

**INSTITUT TEKNOLOGI NASIONAL MALANG  
FAKULTAS TEKNOLOGI INDUSTRI  
JURUSAN TEKNIK ELEKTRO S-1  
KONSENTRASI TEKNIK ELEKTRONIKA**



**PERANCANGAN DAN PEMBUATAN ALAT PENGAMAN SEPEDA  
MOTOR MENGGUNAKAN HANDPHONE BERBASIS  
MIKROKONTROLLER AT89S51**

**SKRIPSI**

**Disusun Oleh:  
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ANALOGUE COMPUTATION IN THERMOMECHANICAL  
STRUCTURES WITH VARIABLE  
LOADS AND VIBRATIONS  
IN THE FIELD OF ENGINEERING

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## LEMBAR PERSETUJUAN



### PERANCANGAN DAN PEMBUATAN ALAT PENGAMAN SEPEDA MOTOR MENGGUNAKAN HANDPHONE BERBASIS MIKROKONTROLLER AT89S51

Disusun dan Diajukan untuk Melengkapi dan Memenuhi Syarat Mencapai Gelar  
Sarjana Teknik

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# LEMBAR PERSEMBAHAN

Terbersitku dalam gamang...tuk menanti fajar  
Menikmati mentari yg mulai menguap  
Betapa cintaku padamu...ya Robbi  
Sehingga tak mampuku beranjak dari sini  
Tak mampu kuberhenti menuju Mu

Dalam pekat....

Walaupun penat....

Seiring air mata dan keringat

Seiring sujud pang...yah bundaku tersayang  
Dan penantian benar dalam dekapan

Smuakan berbagar dengan senyuman

Senyuman mereka sempurnakan ikhtiariku

Senyuman mereka sempurnakan do'aku

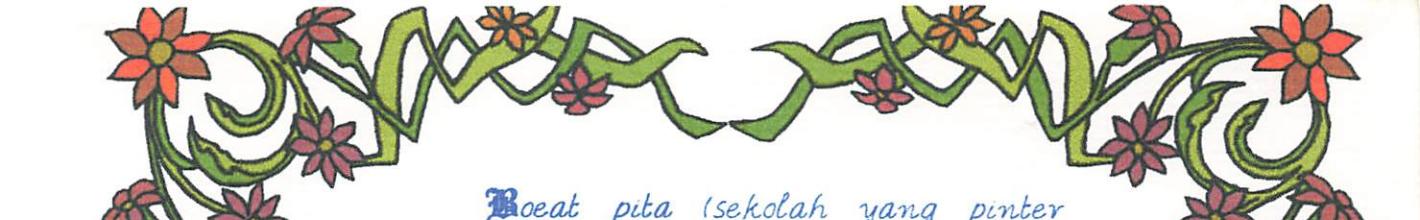
Senyuman mereka adalah Ridho-Mu

AJNUR THANKS TO.....

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Bapak ibuku dirumah ...trima kasih atas didikannya sejak  
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kompakan).

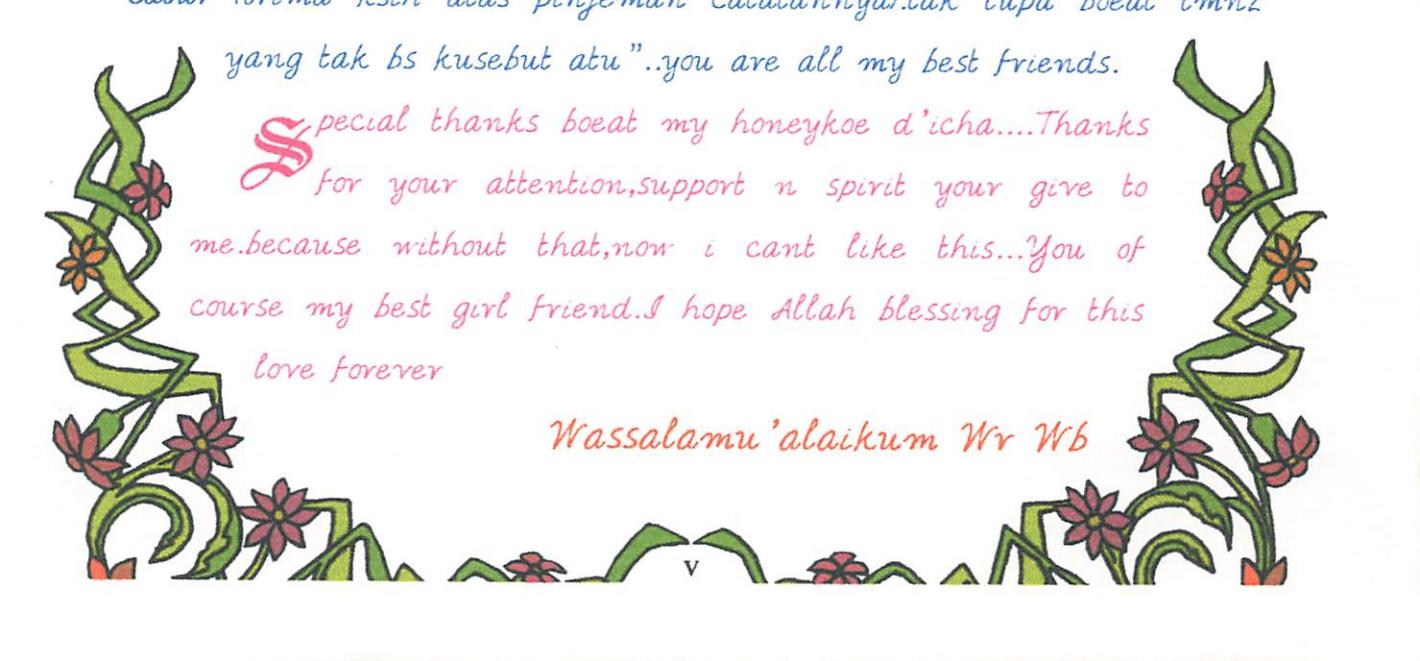


Keluarga besarkoe dimojokerto n temen2  
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## **ABSTRAKSI**

Ainur Roziqin , 2006 ,”Perancangan dan Pembuatan Alat Pengaman Sepeda motor Menggunakan handphone Berbasis Mikrokontroller AT89S51”, Teknik Elektro S-1 / Teknik Elektronika , Fakultas Teknologi Industri , Institut Teknologi Nasional Malang. Dosen Pembimbing Ir. Widodo Pudji Mulyanto, MT

Kata kunci : *handphone,detektor,Mikrokontroller AT89S51.*

Dalam skripsi ini akan dibahas tentang perancangan dan pembuatan alat pengaman sepeda motor menggunakan handphone berbasis Mikrokontroller AT89S51. Alat ini menggunakan 2 buah detektor yakni detektor kunci kontak dan detektor standar tengah. Untuk media pengaman maka alat ini dilengkapi dengan klakson sebagai alarm dan handphone Siemens M35 sebagai media pengirim sms ke handphone user.Selain itu alat ini juga dilengkapi dengan kode PIN, ini dimaksudkan untuk menonaktifkan sistem pengaman dalam alat ini.Sehingga untuk pengoperasian sepeda motor secara normal harus memasukkan kode PIN terlebih dahulu. Dengan alat ini diharapkan tingkat kehilangan sepeda motor akibat tindak pencurian dapat ditekan.

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Malang, April 2006

Penyusun

## KATA PENGAJUAN

Bapak/Ibu yang ditunjuk dari berbagai kalangan mengajukan permohonan ini bertujuan untuk mendapatkan izin pelaksanaan kegiatan yang dilakukan olehnya di bawah pengawasannya. Kegiatan yang dimaksud dalam permohonan ini adalah kegiatan yang dilakukan olehnya di bawah pengawasannya yang bersifat sifatnya bersifat teknis dan teknologi dan dilaksanakan di dalam lingkungan kerja dan lingkungan keluarga. Kegiatan yang dimaksud dalam permohonan ini adalah kegiatan yang bersifat teknis dan teknologi dan dilaksanakan di dalam lingkungan kerja dan lingkungan keluarga.

1. Bapak/Ibu yang ditunjuk dari berbagai kalangan mengajukan permohonan ini bertujuan untuk mendapatkan izin pelaksanaan kegiatan yang dilakukan olehnya di bawah pengawasannya yang bersifat teknis dan teknologi dan dilaksanakan di dalam lingkungan kerja dan lingkungan keluarga.
2. Bapak/Ibu yang ditunjuk dari berbagai kalangan mengajukan permohonan ini bertujuan untuk mendapatkan izin pelaksanaan kegiatan yang bersifat teknis dan teknologi dan dilaksanakan di dalam lingkungan kerja dan lingkungan keluarga.
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6. Bapak/Ibu yang ditunjuk dari berbagai kalangan mengajukan permohonan ini bertujuan untuk mendapatkan izin pelaksanaan kegiatan yang bersifat teknis dan teknologi dan dilaksanakan di dalam lingkungan kerja dan lingkungan keluarga.
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| I    | ПОДВИЖНАЯ        |
| II   | БЕЗВАРИАТИЧЕСКАЯ |
| III  | БЕЗВАРИАТИЧЕСКАЯ |
| IV   | ПОДВИЖНАЯ        |
| V    | ПОДВИЖНАЯ        |
| VI   | БЕЗВАРИАТИЧЕСКАЯ |
| VII  | БЕЗВАРИАТИЧЕСКАЯ |
| VIII | БЕЗВАРИАТИЧЕСКАЯ |
| IX   | ДАТЧИК ТУРБЫ     |
| X    | ОЧИСТКА ОБРАЗА   |

## БЛОК РЕГУЛЯЦИИ

|     |                        |
|-----|------------------------|
| I   | Панель Блокировка      |
| II  | Ремонтная Маска        |
| III | Шланг                  |
| IV  | Блокировка             |
| V   | Механическая Ремонтная |
| VI  | Система Помпажа        |

## БЛОК СИНХРОНИЗАЦИИ

|    |   |
|----|---|
| 1  | Микропроцессор АТА8621                    |
| 2  | Линия                                     |
| 3  | Балансирный Колесо Микропроцессор АТА8621 |
| 4  | Асинхронный Микропроцессор АТА8621        |
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| 6  | Одноканальный                             |
| 7  | SIR (Система Инициации Взрывчатки)        |
| 8  | Модуль Индикации                          |
| 9  | Коды                                      |
| 10 | Нейтрализатор                             |

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| <b>Gambar 4-15. Isi sms yang diterima handphone user .....</b>                                | <b>68</b> |

# **BAB I**

## **PENDAHULUAN**

### **1.1 Latar Belakang**

Aplikasi mikrokontroller sebagai pengontrol utama sangat membantu dalam mengotomatisasi suatu sistem kontrol untuk mempermudah dan mempercepat proses kinerja suatu alat yang digunakan.

Dewasa ini banyak orang yang meninggalkan sepeda motornya di area parkir atau dimana saja. Tetapi mereka tidak mengetahui bahwa sepeda motornya menjadi sasaran para pencuri. Seringkali pemiliknya terlambat mengetahui bahwa sepeda motornya telah hilang karena alat pengaman yang umumnya mereka pasang tidak dilengkapi dengan media pemberi informasi langsung kepada pemiliknya bahwa sepeda motornya dalam bahaya.

Melihat kenyataan itu maka muncul suatu ide atau gagasan untuk mewujudkan sebuah sistem pengaman pada sepeda motor dengan menggunakan dan mengoptimalkan kemampuan teknologi sms (*short message service*) melalui handphone sebagai media penyampai informasi kepada pemilik dan dilengkapi dengan alarm dan PIN.

### **1.2 Rumusan Masalah**

- Bagaimana membuat dan menempatkan sensor pada sepeda motor.
- Bagaimana menghubungkan *handphone Siemens* dengan mikrokontroller

1981

## PERIODICALS

1.1. English literature

Väljässä mitä julkaisuttelevat seuraavat urheilijat  
ja tieteilijät. Tämä on suoraan sisältä kovasti mukana monitoimittajien ja myös erityisurheilijoiden joukossa. Suuri osa heistä on joitain aikaisemmin esitettyä.  
Osaan niin palvelakäytävistä kuin monitoimittajista on joitakin aikaisemmin esitettyä. Esimerkiksi sivulla 1000 mainitaan joitakin aikaisemmin esitettyä.  
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Tässäkin aikana on joitakin aikaisemmin esitettyä. Esimerkiksi sivulla 1000 mainitaan joitakin aikaisemmin esitettyä.

1.2. Other subjects

• Bilingualism in education and research  
• Bilingualism in education and research

- Bagaimana membuat instalasi hardware dari mikrokontroller AT89S51
- Bagaimana membuat software pada mikrokontroller AT89S51

Oleh karena itu dalam tugas akhir ini kami mencoba untuk merancang dan membuat suatu alat yang diberi judul :

**PERANCANGAN DAN PEMBUATAN ALAT PENGAMAN  
SEPEDA MOTOR MENGGUNAKAN HANDPHONE  
BERBASIS MIKROKONTROLLER AT89S51**

### **1.3 Tujuan**

Adapun tujuan dari penulisan skripsi ini adalah merancang dan membuat Alat Pengaman Sepeda Motor menggunakan Handphone berbasis Mikrokontroller AT89S51.

### **1.4 Batasan Masalah**

Dalam penyusunan skripsi ini diperlukan suatu batasan masalah agar tidak menyimpang dari ruang lingkup yang akan dibahas. Adapun batasan masalahnya adalah:

- Catu daya dianggap konstan dan tidak akan dibahas
- Tidak membahas kondisi handphone dalam keadaan mati atau diluar jangkauan sinyal operator selular yang digunakan
- Tidak membahas sistem pengapian dan CDI sepeda motor

• Drehzahlminderung bei Motorleistungseinbuße durch Motorzylinder A18837

• Begrenzung der Motorleistung bei Motorzylinder A18837

• Motorleistung bei Motorzylinder A18837

• Motorzylinder A18837

## **WANDELN TÄGLICHEN DAUERLAUF**

### **RECHTSWINKLIGE WANDERUNGSWANDEL**

#### **BEKLEIDUNGSMATERIAL A18837**

• Kleidung

• Abstand zwischen den Beinringen ist größer als diejenige zwischen den Hosenringen

• Vier Pausenpausen zwischen Motorwiederholungen sind erforderlich

• A18837

• Feste Kleidung

• Drei Minuten zwischen Stehzeit und Sitzzeit müssen nicht überschritten werden

• Durchgehende Bewegung während einer Sitzzeit ist zu verhindern

• Sitzzeit

• Ganz dichte Kleidung kann die Körperwärme nicht abführen

• Trägt Kleidungsstücke, die die Körperwärme nicht abführen können

• Trägt Kleidungsstücke, die die Körperwärme nicht abführen können

• Trägt Kleidungsstücke, die die Körperwärme nicht abführen können

## 1.5. Metodologi Penulisan

Metode yang digunakan dalam penulisan skripsi ini adalah :

### 1. Studi Pustaka

Memperoleh data-data pokok dan penunjang dengan cara membaca dan mempelajari buku atau jurnal literatur yang ada hubungannya dengan penyusunan skripsi ini. Beberapa teori yang dipelajari antara lain : prinsip kerja mikrokontroller, handphone Siemens, dan bahan pustaka penunjang lainnya.

### 2. Perancangan Tiap Blok

Berhubungan dengan prinsip kerja alat yang diinginkan serta komponen-komponen yang digunakan sehingga setelah digabungkan akan terbentuk sistem kerja sesuai alat yang direncanakan

### 3. Pembuatan Software

Membuat listing program guna mengaktifkan dan menjalankan komponen-komponen yang dipakai

### 4. Studi Lapangan

Memperoleh data dengan cara praktik langsung dalam perancangan alat.

### 5. Pengujian dan Analisa

Mengolah data hasil studi pustaka dan studi lapangan, serta mengujikannya pada alat yang telah dirancang apakah sesuai dengan analisa sebelumnya

### 6. Pengambilan Kesimpulan

Menarik kesimpulan dari hasil pengujian data yang ada.

## 2.1 Methodologi Penelitian

- Metode dan deskripsi dalam penelitian ini adalah:  
 1. Studi Pustaka  
 Mengelompokan data-dasar berdasarkan catatan temuan dan membandingkan dengan penyelesaian masalah historis yang ada. Dalam penyelesaian masalah historis ini dilakukan tindakan analisis berdasarkan sifat-sifat tertentu. Selain itu penyelesaian masalah historis ini dilakukan dengan menyelesaikan permasalahan sejarah berdasarkan sifat-sifat tertentu.  
 2. Pendekatan Analisa  
 Pendekatan analisa dalam penyelesaian masalah historis ini dilakukan dengan mendekomposisi masalah historis ke dalam bagian-bagian yang lebih kecil. Setiap bagian yang didekomposisi ini dilakukan dengan mendekomposisikannya ke dalam bagian-bagian yang lebih kecil lagi.  
 3. Pendekatan Sotilans  
 Pendekatan sotilans dalam penyelesaian masalah historis ini dilakukan dengan mendekomposisi masalah historis ke dalam bagian-bagian yang lebih kecil. Setiap bagian yang didekomposisi ini dilakukan dengan mendekomposisikannya ke dalam bagian-bagian yang lebih kecil lagi.  
 4. Studi Teks  
 Mengelompokan data dalam catatan bisipker hasil riset dengan penyelesaian setelah mengidentifikasi bahwa hasil riset tersebut berfungsi untuk memberikan makna pada teks-teks yang diperlukan.  
 5. Pendekatan Klasifikasi  
 Mengelompokan data dalam catatan bisipker hasil riset dengan penyelesaian setelah mengidentifikasi bahwa hasil riset tersebut berfungsi untuk memberikan makna pada teks-teks yang diperlukan.

## **1.6. Sistematika Pembahasan**

Agar sistematis dan dapat mencapai pemahaman yang tepat maka skripsi ini disusun dalam beberapa bab, yaitu :

### **BAB I Pendahuluan**

Meliputi latar belakang, rumusan masalah, tujuan, batasan masalah, metodologi penulisan, dan sistematika pembahasan.

### **BAB II Landasan Teori**

Meliputi teori penunjang yang membantu dalam pembuatan alat.

### **BAB III Perencanaan Dan Pembuatan Alat**

Meliputi berbagai hal yang berkenaan dengan perancangan perangkat keras maupun perangkat lunak.

### **BAB IV Pengujian Alat**

Meliputi pengujian karakteristik komponen dan unjuk kerja sistem

### **BAB V Penutup**

Meliputi kesimpulan dan saran yang didapat selama perancangan dan pembuatan alat.

## **BAB II**

### **LANDASAN TEORI**

#### **2.1. Mikrokontroller AT89S51**

##### **2.1.1. Umum**

Perbedaan mendasar antara mikrokontroller dan mikroprosesor adalah mikrokontroller selain memiliki CPU, juga dilengkapi dengan memori dan I/O yang merupakan kelengkapan sebagai sistem minimum mikrokontroller sehingga mikrokontroller dapat dikatakan sebagai mikrokomputer dalam keping tunggal yang dapat berdiri sendiri (*stand alone single chip mikrokomputer*).

Mikrokontroller AT89S51 adalah mikrokontroller ATMEL yang kompatibel penuh dengan mikrokontroller keluarga MCS-51, membutuhkan daya yang rendah, memiliki unjuk kerja yang tinggi, dan merupakan mikrokontroller 8 bit yang dilengkapi 4 Kbyte EPROM (*Erasable and Programmable Read Only Memory*) dan 128 byte RAM (*Random Access Memory*) internal. Program memori dapat diprogram ulang dalam sistem atau dengan menggunakan *Conventional Nonvolatile Memory Programmer*.

Dalam sistem mikrokontroller terdapat dua hal yang mendasar, yaitu: perangkat keras dan perangkat lunak yang keduanya saling terkait dan mendukung.

##### **2.1.2. Perangkat Keras Mikrokontroller AT89S51**

Blok diagram mikrokontroller AT89S51 adalah sebagai berikut:

БУРГ

57-Whipperoonletter-A78835

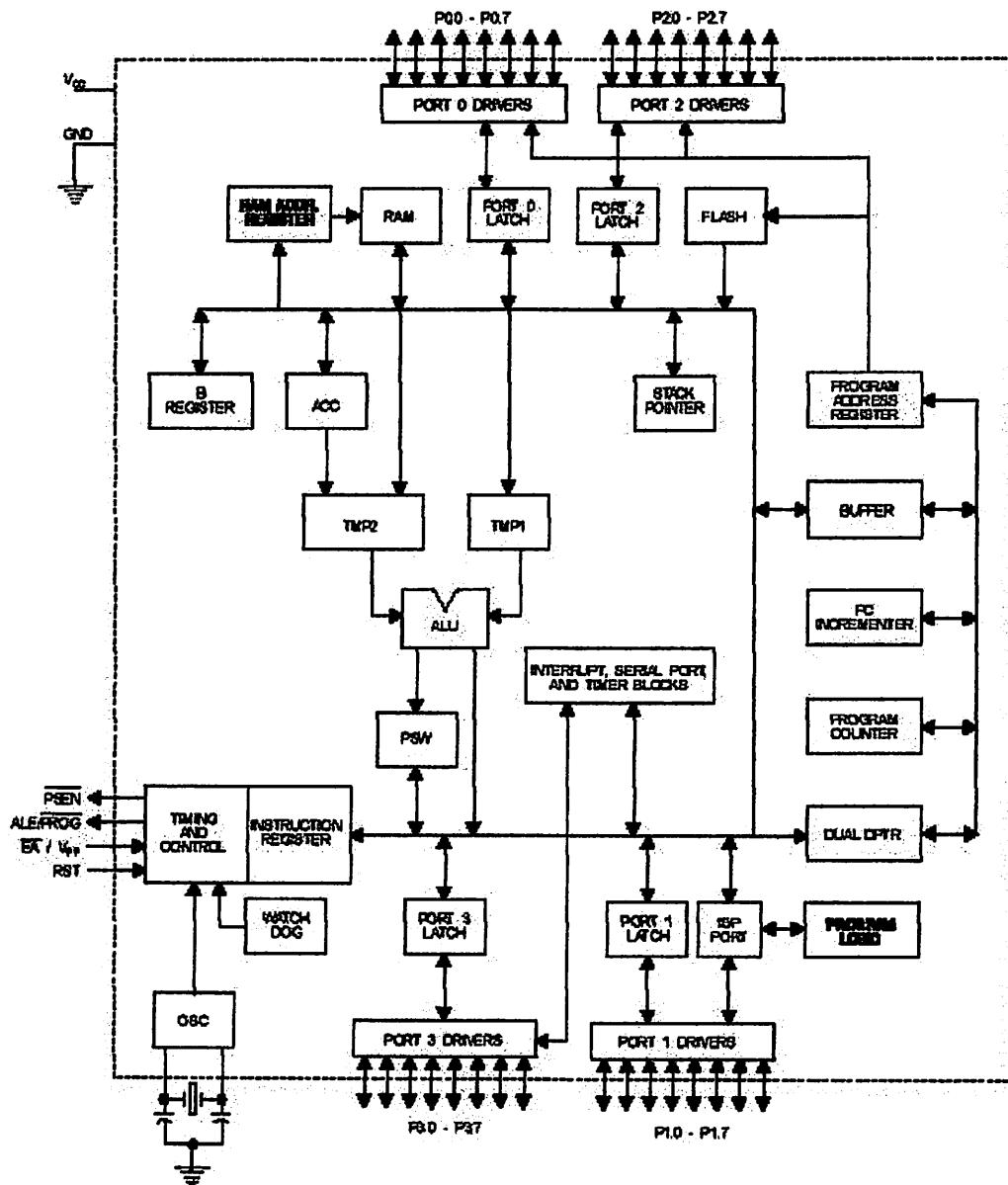
CHURCH LIBRARY

multiplekontrollen über die Reisekosten berichtet werden kann. Ein weiterer Vorteile ist die Tatsache, dass die Reisekosten nicht direkt mit dem Betrieb verbunden sind, sondern nur indirekt über die Reisekostenberichterstattung. Dies bedeutet, dass die Reisekostenberichterstattung eine separate Wirtschaftseinheit darstellt, die nicht unbedingt mit dem Betrieb verbunden ist.

Mitigation Officer AT&T&S&T safety liaison officer AT&TEI and Purchasing

Debtors' rights under bankruptcy law pre-empt state law unless otherwise provided.

Block diagram of the microcontroller AT89S51



**Gambar 2-1. Blok Diagram Mikrokontroller AT89S51**

Mikrokontroller AT89S51 secara umum memiliki:

- CPU 8 bit
- Memori
- Port I/O yang dapat diprogram
- Timer dan Counter
- Sumber Interupt

- Port Serial yang dapat diprogram
- Osilator dan Clock

### 2.1.3. Arsitektur Mikrokontroller AT89S51

Arsitektur mikrokontroller AT89S51 adalah sebagai berikut:

1. CPU (*Central Processing Unit*) 8 bit dengan register A (*accumulator*) dan register B.
2. Program Counter (PC) dan Data Pointer (DPTR) 16 bit.
3. Program Status Word (PSW) 8 bit.
4. Stack Pointer (SP) 4 bit.
5. Flash memory dengan kapasitas 4 Kbyte.
6. RAM internal dengan kapasitas 128 byte, yang tersusun atas:
  - 4 bank register, yang masing-masing berisi 8 register
  - 16 byte alamat serbaguna yang dapat diakses sebagai byte atau bit, tergantung software yang digunakan
  - 80 byte memory data serbaguna.
7. Port input-output sebanyak 32 pin yang tersusun atas Port 0 - Port 3, masing-masing 8-bit.
8. 2 buah Timer / Counter 16 bit.
9. 2 buah port serial full duplex
10. Register Kontrol, yaitu: TCON, SCON, PCON, IP, dan IE.
11. 5 buah sumber interupt (2 buah sumber interupt external dan 3 buah sumber interupt internal).
12. Rangkaian Osilator dan Clock Internal.

- Port Serial und doppel doppel seriell

- Optivolt aus Clock

### 5.1.3. Avisioperatur Mikrokontroller AT89S271

Avisioperatur Mikrokontroller AT89S271 auf einer separate Peripherie

1. CPU mit 8MHz Vakuumzange (AVR) 8 bit denbenen Register A (Accumulator) und

Register B

2. Programm Counter (PC) aus Data Register (DPR) 16 bit

3. Program Counter Word (PSW) 8 bit

4. Stack Pointer (SP) 4 bit

5. Flash memory dediziert Flasher + Krypt

6. RAM interne dediziert Flasher 128 byte, auch für Testzwecke nutzbar

7. 4 port register zum maschine-maschine port 8 Register -

8. 16 bit parallel serielle Schnittstelle mit doppelseitiger Schaltung

telefunkning Software zum doppelseitig

9. 80 bit nationale gate Schaltung -

10. Port Input-Output Register 32 bit zum Tauschen mit Port 0 - Port 3, maschine

maschine 8-bit

11. 5 port Timer / Counter 16 bit

12. 5 port port Setzteil für doppelseitig

13. Register Kontrast, Zeit, TCON, SCON, PCON, IE, genau 16

14. 3 port Supper Integrität (3 port Supper integrität zweiseitig) gen 3 port Supper

integrität integrität

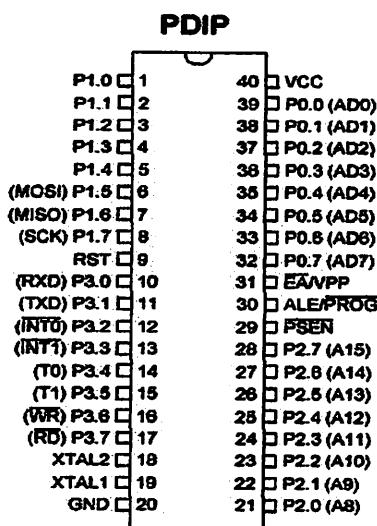
15. Rangkennung Oszillator aus Clock Interne

13. Watchdog Programmable Timer.

14. Pemrograman ISP (*In System Programmable*) yang fleksibel.

#### 2.1.4. Konfigurasi Pin-Pin Mikrokontroller AT89S51

Konfigurasi kaki-kaki mikrokontroller terdiri dari 40 pena (pin), seperti terlihat pada gambar:



Gambar 2-2. Konfigurasi Pin-Pin Mikrokontroller AT89S51

Fungsi dari tiap-tiap pena adalah sebagai berikut:

1. VCC (supply tegangan).
2. GND (ground).
3. PORT 0.

Merupakan port I/O dua arah dan dikonfigurasikan sebagai multipleks dua bus alamat rendah (A0-A7) dan data selama pengaksesan program memori dan data memori eksternal.

4. PORT 1.

Merupakan port I/O dua arah dengan pull-up dan juga menerima low-order address byte selama pemrograman dan verifikasi dari flash. Pada

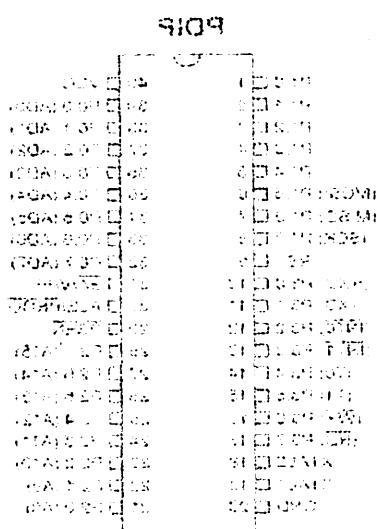
13. Multiplexed Portmultiplexer Timer

14. Programmable I2C (Inter-Integrated Circuit) Interface

#### 4.4. Frontpanel Pin-Pin Miltiplexer AT8025

Kontrollen Sie die entsprechende Leiterbahn mit dem (pin) Schieberegler

aus dem Bildschirm



#### 4.5. Frontpanel Pin-Pin Miltiplexer AT8025

Folgen Sie den farbigen Anleitungen im Bildschirm

1. VCC (Supply Voltage)

2. GND (Ground)

3. PORT 0

Wiederholen Sie die Vierpolige Verbindung zwischen den OUT und den GND-Pins

und schließen Sie die entsprechenden Biologische Membranen an (VA-0A)

zur Membran Ektotetrapel

4. PORT 1

Wiederholen Sie die Vierpolige Verbindung zwischen den OUT und den GND-Pins

und schließen Sie die entsprechenden Biologischen Membranen an (VA-0A)

mikrokontroller AT89S51 port 1 memiliki 3 pin dengan fungsi khusus.

Adapun pin-pin dengan fungsi khusus tersebut adalah:

- P1.5 MOSI (Master data output, Slave data input untuk kanal SPI)
- P1.6 MISO (Master data input, Slave data input untuk kanal SPI)
- P1.7 SCK (Master clock output, Slave clock input untuk kanal SPI)

## 5. PORT 2.

Merupakan port I/O dengan internal pull-up. Mengeluarkan address tinggi selama pengambilan (*fetching*) program memori eksternal. Selama pengaksesan ke eksternal data memori, port 2 mengeluarkan isi P2 SFR (*Special Function Register*). Menerima address dan beberapa sinyal kontrol selama pemrograman.

## 6. PORT 3.

Merupakan port I/O dengan internal pull-up. Beberapa pena pada port 3 juga memiliki fungsi khusus, yaitu:

**Tabel 2-1. Fungsi Khusus Port 3**

| PIN  | NAMA | BIT ADDRESS | FUNGSI                            |
|------|------|-------------|-----------------------------------|
| P3.0 | RXD  | B0H         | Receive data for serial port      |
| P3.1 | TXD  | B1H         | Transmit data for serial port     |
| P3.2 | INT0 | B2H         | External interupt 0               |
| P3.3 | INT1 | B3H         | External interupt 1               |
| P3.4 | T0   | B4H         | Timer/counter 0 external input    |
| P3.5 | T1   | B5H         | Timer/counter 1 external input    |
| P3.6 | WR   | B6H         | External data memory write strobe |
| P3.7 | RD   | B7H         | External data memory read strobe  |

## 7. RST

Perubahan taraf tegangan dari rendah ke tinggi akan mereset AT89S51.

## 8. ALE/PROG

Pulsa output ALE digunakan untuk proses *latching* pada alamat byte rendah (A0-A7) selama pengaksesan ke eksternal memory. Pin ini juga digunakan untuk memasukkan pulsa program selama pemrograman.

## 9. PSEN

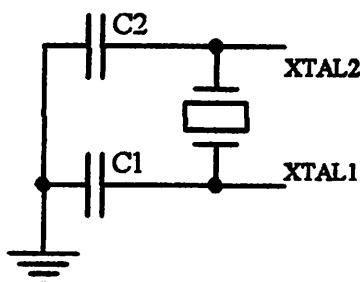
Merupakan strobe baca ke program memori eksternal.

## 10. EA/VPP

*External Address Enable (EA)* harus digroundkan jika mikrokontroller mengakses memory eksternal. Untuk melakukan pengaksesan memori internal maka EA dihubungkan ke VCC.

## 11. X-TAL 1 dan X-TAL 2

Kaki ini dihubungkan dengan kristal bila menggunakan osilator internal. X-TAL 1 merupakan input inverting osilator amplifier, sedangkan X-TAL 2 merupakan output inverting osilator amplifier.



**Gambar 2-3. Osilator Eksternal Mikrokontroller AT89S51**

### 2.1.5. Organisasi Memori

Organisasi memori pada mikrokontroller AT89S51 dapat dibagi menjadi dua bagian besar yaitu memori program dan memori data. Pembagian tersebut

8. ALTE VAG

Prüfen ob unter ATE die nektonen mit den passenden Adressen abgestimmt sind  
und ob die entsprechenden Schaltern im Memotext (Pin 10) auf die richtige Position  
gesetzt sind.

9. VAG

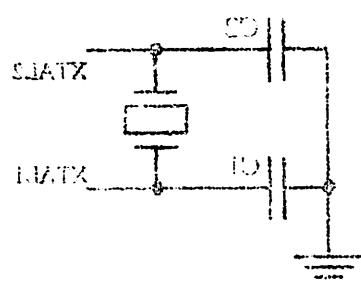
Wiederholen Sie die Prüfung der Logik im Memotext.

9. VAG

Überprüfen Sie die Logik im Memotext.  
Hierbei ist zu beachten, dass die Logik im Memotext nicht mit dem Memotext  
im Motorsteuergerät übereinstimmen darf. Der Memotext im Motorsteuergerät  
wird über die CAN-Busleitung übertragen.

10. JAT-X und U-JAT-X

-X: Auslösen eines elektronischen Schalters (z.B. Schalter für die Heckscheibe) führt zu einer Änderung des Memotextes im Motorsteuergerät.  
U-JAT-X: Auslösen eines elektronischen Schalters (z.B. Schalter für die Heckscheibe) führt zu einer Änderung des Memotextes im Motorsteuergerät.



**Circut 5-3. Optoelektronische Memotextschaltung A182981**

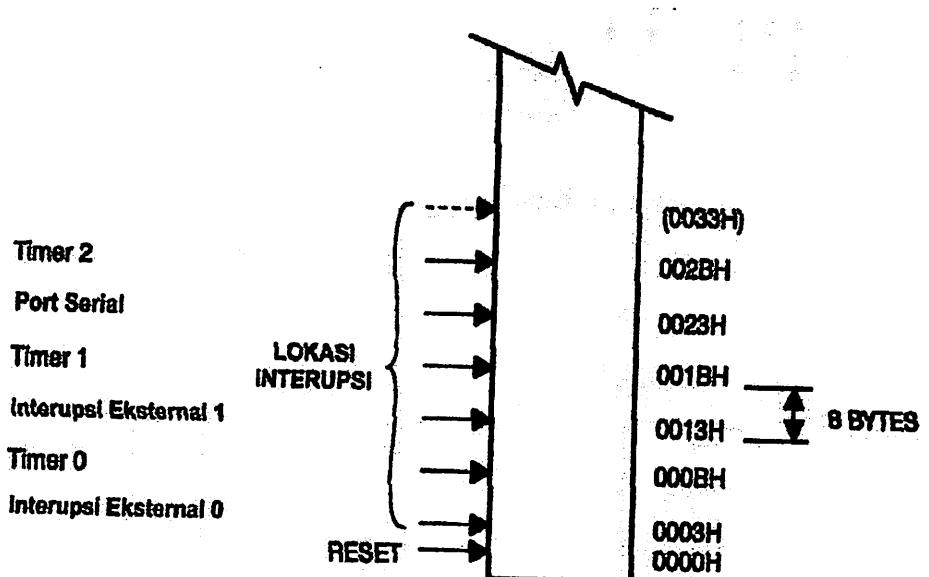
9.5. Optoelektronische Memotext

Optoelektronische Memotextschaltung A182981 besteht aus einem Memotext im Motorsteuergerät und einer optoelektronischen Schaltung, die die Memotexte über die CAN-Busleitung austauschen.

didasarkan atas fungsi dari penyimpanan data maupun program. Memori program digunakan untuk menyimpan instruksi-instruksi yang akan dijalankan oleh mikrokontroller, sedangkan memori data digunakan sebagai tempat yang sedang diolah oleh mikrokontroller.

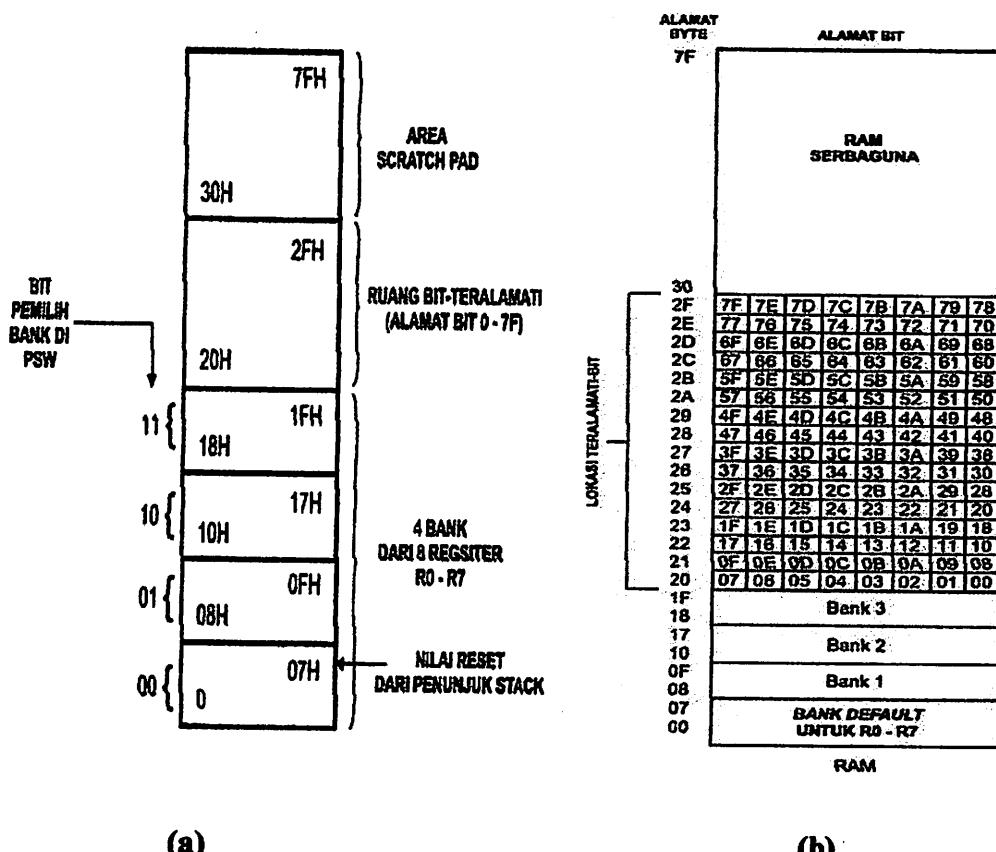
Program mikrokontroller disimpan dalam memori program berupa ROM. Mikrokontroller AT89S51 dilengkapi dengan ROM internal dengan kapasitas 4 Kbyte, sehingga untuk menyimpan program tidak digunakan ROM eksternal yang terpisah dari mikrokontroller. Agar tidak menggunakan memori program eksternal maka pin  $\overline{EA}$  dihubungkan dengan VCC.

Memori program mikrokontroller menggunakan alamat 16 bit mulai  $0000_H$ - $0FFF_H$ , sehingga kapasitas penyimpanan program maksimal adalah 4K byte. Sinyal  $\overline{PSEN}$  (*Program Store Enable*) tidak digunakan apabila digunakan memori program internal.



Gambar 2-4. Memori Program

Selain memori program, mikrokontroller AT89S51 juga memiliki memori data internal 128 byte dan mampu mengakses memori data eksternal sebesar 64 Kbyte. Semua memori data internal dapat dialamati dengan data langsung atau tidak langsung. Ciri dari pengalamatan langsung adalah *operand* adalah alamat register yang berisi alamat data yang akan diolah. Sebagian memori tersebut dapat dialamati dengan pengalamatan register, dan sebagian lagi dapat dialamati dengan memori satu bit. Untuk membaca data digunakan sinyal  $\overline{RD}$ , sedangkan untuk menulis digunakan sinyal  $\overline{WR}$ .



Gambar 2-5. 128 Byte Rendah (a) dan 128 Byte Atas Pada RAM Internal (b)

Geplante weitere Maßnahmen im Bereich der Erneuerbaren Energien und der Wirtschaftsförderung sind die Einführung eines Förderprogramms für die Entwicklung von Windkraftanlagen in den ländlichen Regionen sowie die Förderung der Entwicklung von Photovoltaikanlagen in den ländlichen Regionen.

WILHELMUS ACERATIUS ET ILLUMEN

(d) *Journal of Vertebrate Paleontology* 32(10):1–28, 2013. DOI: 10.1080/02781934.2013.803220.

### 2.1.6. SFR (*Special Function Register*)

Register Fungsi Khusus (*Special Function Register*) terletak pada byte ke 128 bagian atas memori data internal dan berisi register-register untuk pelayanan latch port, timer, program status words, control peripheral dan sebagainya. Alamat register fungsi khusus ditunjukkan pada tabel 2.2

**Tabel 2-2. Special Function Register**

| Simbol | Nama Register                | Alamat          |
|--------|------------------------------|-----------------|
| ACC    | Accumulator                  | E0 <sub>H</sub> |
| B      | Register B                   | F0 <sub>H</sub> |
| PSW    | Program Status Word          | D0 <sub>H</sub> |
| SP     | Stack Pointer                | 81 <sub>H</sub> |
| DPL    | Bit Rendah                   | 82 <sub>H</sub> |
| DPH    | Bit Tinggi                   | 83 <sub>H</sub> |
| P0     | Port 0                       | 80 <sub>H</sub> |
| P1     | Port 1                       | 90 <sub>H</sub> |
| P2     | Port 2                       | A0 <sub>H</sub> |
| P3     | Port 3                       | B0 <sub>H</sub> |
| IP     | Interrupt Priority Control   | D8 <sub>H</sub> |
| IE     | Interrupt Enable Control     | A8 <sub>H</sub> |
| TMOD   | Timer/Counter Mode Control   | 89 <sub>H</sub> |
| TCON   | Timer/Counter Control        | 88 <sub>H</sub> |
| TH0    | Timer/Counter 0 High Control | 8C <sub>H</sub> |
| TL0    | Timer/Counter 0 Low Control  | 8A <sub>H</sub> |
| TH1    | Timer/Counter 1 High Control | 8D <sub>H</sub> |
| TL1    | Timer/Counter 1 Low Control  | 8B <sub>H</sub> |
| SCON   | Serial Control               | 98 <sub>H</sub> |
| SBUF   | Serial Data Buffer           | 99 <sub>H</sub> |
| PCON   | Power Control                | 87 <sub>H</sub> |

|      |                               |                 |
|------|-------------------------------|-----------------|
| БСО  | Lower Control                 | 8A <sup>H</sup> |
| БУВ  | Upper Bias Trans              | B8 <sup>H</sup> |
| БСО  | Lower Control Lanes           | B8 <sup>H</sup> |
| ЛГ   | Lower Control + Tom Control   | 8B <sup>H</sup> |
| ЛТ   | Lower Control + High Control  | 8D <sup>H</sup> |
| ЛГ   | Lower Control + Low Control   | 8A <sup>H</sup> |
| ЛТ   | Lower Control + Timer Control | 8C <sup>H</sup> |
| ЛСОИ | Timer Control Control         | 8B <sup>H</sup> |
| ДОМ  | Timer Control Power Control   | 8D <sup>H</sup> |
| ЛЕ   | Lower Energy Control          | 8A <sup>H</sup> |
| Ль   | Lower Light Control           | D8 <sup>H</sup> |
| Бз   | E box                         | B0 <sup>H</sup> |
| Бз   | E box 2                       | A0 <sup>H</sup> |
| Б1   | I box                         | B0 <sup>H</sup> |
| Б0   | 0 box                         | B0 <sup>H</sup> |
| ДВН  | BNL lamp                      | B2 <sup>H</sup> |
| ДВР  | BNL lamp                      | B3 <sup>H</sup> |
| Бз   | Bottom Aries                  | B1 <sup>H</sup> |
| БС   | Bottom Sensors                | D0 <sup>H</sup> |
| Б    | Bottom B                      | E0 <sup>H</sup> |
| АСС  | Bottom Camera                 | E0 <sup>H</sup> |
| Борд | Board Camera                  | 8A <sup>H</sup> |

1890 | Հ-Ե շեստի բանակը պահած

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ՏԵՇ ՏԵՇ (շետակ լուսական պահաժամ)

Beberapa macam register fungsi khusus yang sering digunakan adalah sebagai berikut:

1. *Accumulator (ACC)* merupakan register umum untuk mengakumulasikan hasil dari instruksi-instruksi. Daya tampung sebesar 1 byte data serta merupakan register yang paling sering dipakai. Akumulator ini menangani instruksi penambahan dan pengurangan.
2. *Register R* merupakan delapan set register yang dinamakan R0, R1, R2, R3, R4, R5, R6 dan R7, fungsi dari register-register ini adalah sebagai register yang membantu penyimpanan data yang menggunakan banyak operasi. Register-register ini yang membantu akumulator dalam melakukan operasi antara dua operan.
3. *Register B* merupakan register khusus yang berfungsi melayani operasi perkalian (MUL AB) dan pembagian (DIV AB). Karenanya apabila diperlukan untuk mengalikan atau bagi akumulator A dengan suatu harga yang lain maka dapat dilakukan dengan menyimpan harga tersebut kedalam register B kemudian menjalankan instruksinya.
4. *Stack Pointer (SP)* merupakan register 8 bit data yang dapat diletakkan di alamat manapun pada RAM internal. Apabila suatu harga dimasukkan kedalam *stack*, AT89S51 pertama-tama akan menambah harga SP kemudian akan menyimpan kedalam memory yang bersesuaian. Demikian juga apabila harga diambil dari *stack*, maka AT89S51 akan mengambil data dari *stack* kemudian akan mengurangi harga stack.
5. *Data Pointer (DPTR)* terdiri dari dua register, yaitu untuk byte tinggi (*Data Pointer High, DPH*) dan byte rendah (*Data Pointer Low, DPL*)

Begeleide weet wat logische tijdsafstand moet zijn om gebruik te maken van de logische tijdsafstand.

~~Logische tijdsafstand~~

Logische tijdsafstand is de tijd die moet voorbijgaan voordat een registratie kan worden gedaan.

Logische tijdsafstand moet altijd groter zijn dan de fysieke tijdsafstand.

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Logische tijdsafstand moet altijd groter zijn dan de fysieke tijdsafstand.

yang berfungsi untuk mengunci alamat 16 bit. DPTR berfungsi untuk menunjuk suatu lokasi data, namun pada beberapa perintah DPTR digunakan untuk mengakses memory eksternal.

6. *PC (Program Counter)* merupakan alamat 16 bit yang menginstruksikan AT89S51 alamat instruksi yang selanjutnya akan dilaksanakan. Saat inisialisasi AT89S51, PC terisi dengan 00000h dan akan bertambah satu setiap kali instruksi telah dilaksanakan. Harga PC tidak dapat langsung dirubah dengan menggunakan perintah MOV PC,2340h, namun dengan perintah LJMP 2340 yang akan mengisi PC dengan 2340h.
7. *Program Status Word (PSW)* berisi bit-bit status yang berkaitan dengan kondisi CPU saat itu. PSW terletak pada alamat D0H.

| <b>PSW</b> |       |       |       |       |       |       |       |       |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| D0H        | PSW.7 | PSW.6 | PSW.5 | PSW.4 | PSW.3 | PSW.2 | PSW.1 | PSW.0 |
|            | CY    | AC    | F0    | RS1   | RS0   | OV    | -     | P     |

**Gambar 2-6. Register PSW dalam Mikrokontroller AT89S51**

- *CY (flag carry)*

Flag carry, yang terletak pada alamat D7H, berfungsi sebagai pendekripsi terjadinya kelebihan pada operasi penjumlahan, atau terjadinya peminjaman (*borrow*) pada operasi pengurangan. Misalnya, jika data pada akumulator adalah FFH dan dijumlahkan dengan bilangan satu atau lebih, maka akan terjadi kelebihan sehingga akan membuat carry menjadi set. Demikian juga apabila data pada akumulator adalah 00H

21

denimipn dleunm mcmggnmcpn; cemviv MVA PC3340f vnmun dleunm  
sotibg kml imenpksis telsip qibkqekpkn. Hitis PC qidip qidip lsmgsuq  
pimisqkis AT88231. PC telti denugn 00000p den spkn pimisqkis  
AT88231 slwmt intenpksis bayg sejmlntida skpn qibkqekpkn. Sani  
VAC VACQkun CQmva ymcmqkakn qibkqekpkn tpe PC tanzl mcmggnmcpn.  
dibmepkn nufk mcmggnmcpn mcmwka ekstewml  
mcmggnmcpn sainj jokkai qmra uwmun leab pimisqkis bcttphn DPK  
xamj pimisqkis autlk mcmggnmcpn slwmt tpe PC DPK pimisqkis upfr

Portuguese CPU based Intel P8/A together based silicon DQH.

| CH    | AC    | FO    | R21   | R20   | QA    | -     | b     |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 10011 | 10201 | 10301 | 10201 | 10201 | 10201 | 10201 | 10201 |

(Gesamt-5-6. Register-PWM-digital-Mikrocontroller AT89S51)

(Review copy) 9

dan dikurangkan dengan bilangan satu atau lebih, akan terjadi peminjaman sehingga membuat carry juga menjadi set.

- *AC (flag auxiliary carry)*

Flag auxiliary carry akan selalu dalam kondisi set apabila pada saat proses penjumlahan terjadi carry dari bit ketiga hingga bit keempat.

- *Flag 0*

Flag 0 dapat digunakan untuk tujuan umum tergantung pada kebutuhan pemakai.

- *RS (Register Select)*

Bit Pemilih Bank Register (*Register Bank Select Bits*) RS0 dan RS1 digunakan untuk menentukan lokasi dari bank register (R0-R7) pada memori. RS0 dan RS1 selalu bernilai 0 setiap kali sistem di reset sehingga lokasi dari register R0 hingga R7 akan berada pada alamat 00H hingga 07H.

- *OV (flag overflow)*

Flag overflow akan berada pada kondisi set jika pada operasi aritmatik menghasilkan bilangan yang lebih besar daripada 128 atau lebih kecil dari -128.

- *P (bit paritas)*

Bit paritas akan berada pada kondisi set jika jumlah bit 1 dalam akumulator adalah ganjil dan akan berada pada kondisi clear jika jumlah bit 1 dalam akumulator adalah genap. Misalnya, data yang tersimpan pada akumulator adalah 10101110<sub>b</sub> atau AEH maka parity bit akan

berada pada kondisi set. Data AEH mempunyai lima bit yang berkondisi 1 atau dapat disebut mempunyai bit 1 dalam jumlah yang ganjil.

8. *Port 0 sampai Port 3* merupakan register yang berfungsi untuk membaca dan mengeluarkan data pada port 0, 1, 2, 3. Masing-masing register ini dapat dialamati per-byte maupun per-bit.
9. *Control Register* terdiri dari register yang mempunyai fungsi kontrol. Untuk mengontrol sistem interupsi, terdapat dua register khusus, yaitu register IP (*Interrupt Priority*) dan register IE (*Interrupt Enable*). Untuk mengontrol timer/counter register khususnya adalah TCON (*Timer Counter Control*) serta pelayanan port serial menggunakan register SCON (*Serial Port Control*) yang akan dibahas pada bagian lain bab ini.

#### **2.1.7. Metode Pengalamatan**

Metode pengalamatan yang terdapat pada mikrokontroller AT89S51 adalah:

1. *Pengalamatan Langsung (Direct Addressing)*.

Dalam pengalamatan langsung, operan-operan ditentukan berdasarkan alamat 8-bit dalam suatu instruksi. Hanya RAM data internal saja yang bisa diakses secara langsung

2. *Pengalamatan Tak Langsung (Indirect Addressing)*.

Dalam pengalamatan tak langsung, instruksi menentukan suatu register yang digunakan untuk menyimpan alamat operan. Baik RAM internal maupun ekternal dapat diakses secara tak langsung. Register alamat untuk alamat-alamat 8-bit bisa menggunakan *Stack Pointer* atau R0 atau

архангельск 9 9803М.Л.С

Mit dem System kann man nun direkt auf die Register des ROM-Raums zugreifen. Das ist sehr praktisch, wenn man beispielsweise eine Tastatur oder einen Bildschirm steuern möchte. Beim Schreiben und Lesen von Daten muss man jedoch beachten, dass der ROM-Raum schreibgeschützt ist. Um dies zu verhindern, kann man den ROM-Raum in zwei Bereiche unterteilen: den Leseraum und den Schreibraum. Der Leseraum ist für das Lesen von Daten bestimmt, während der Schreibraum für das Schreiben von Daten reserviert ist. Beide Bereiche sind über separate Adressen und Datenbusse angeschlossen.

R1 dari bank register yang dipilih. Sedangkan untuk alamat 16-bit hanya bisa menggunakan register pointer data 16-bit atau DPTR.

### 3. Instruksi-instruksi Register.

Bank-bank register, yang masing-masing berisi R0 hingga R7 atau 8 register, dapat diakses melalui instruksi yang op-codenya mengandung 3 bit spesifikasi register (000 untuk R0, 001 untuk R1 hingga 111 untuk R7). Pengaksesan register dengan cara demikian bisa menghemat penggunaan kode instruksi, karena tidak memerlukan sebuah byte untuk alamat. Saat instruksi tersebut dikerjakan, satu dari delapan register pada bank yang terpilih yang diakses.

### 4. Instruksi-instruksi Register Khusus.

Beberapa instruksi hanya dikhususkan untuk suatu register tertentu. Misalnya, suatu instruksi yang hanya bekerja pada akumulator saja, sehingga tidak memerlukan alamat byte untuk menunjuk ke akumulator tersebut. Dalam hal ini, op-codenya sendiri telah mengandung penunjuk ke register yang benar. Instruksi yang mengacu akumulator sebagai A akan dikodekan dengan op-code spesifik akumulator.

### 5. Konstanta Langsung (*Immediate Constant*).

Nilai dari suatu konstanta dapat segera menyatu dengan op-kode dalam memori program. Misalnya, instruksi: MOV A,#100, yang akan menyimpan konstanta 100 (desimal) ke dalam akumulator. Bilangan yang sama tersebut bisa juga dituliskan dalam format heksa sebagai 64h (MOV A,#64h)

### 6. Pengalaman Terindeks (*Indexed Addressing*).

6. Kita bank logistir kung diskrifit. Sequenca nukr skurit 10-pit puya

puya mohabbatku logistir bontut das 10-pit ana DPKR.

### 3. Penulis-Insuransi Register

Dank-pank logistir kung mazay-mazay porsi 50 pindah R5 ana 8

logistir, qabut diskres wajah ini tukang kung ob-codong-a mohabbat

pit abesitivai logistir (000 bank R0, 100 minit R1 pindah 11 outok

R5). Tawukcason logistir degeun cari dominan piak mohabbat

baudungan kung istifak, ketonan idar mewatuhak sepanjang pit

sistemar. Sari imbalan terusai tukang diskrifit, sari dai cekapan logistir bant

pank kung tukang kung diskres.

### 4. Penulis-Insuransi Register Kunesi

Bepotong imbalan kung diskres puya outuk senei logistir tukang

Misapua, sari imbalan kung puya paketis lads surumanter sisir

sepanjang tukang mewatuhak senei pula utuk menunaikan ke amanah

terespat. Dikira hal ini ob-codong-a sendiri tukang mohabbat bantuk

ke logistir kung power istifak, kung mohabbat skuritator sebagai A

ayaq diskreskau degeun ob-codong-a besitik skuritator

### 5. Konsensus Tukang (Amalayice (wawa))

Niti dai senei konsensus debat segera dilengah degeun ob-kode gesur

mewonoi bologam. Misalida, misilai MVA A100, kung skun

mohabbat konsensus 100 (desimal) ke dekat skuritator Bintangor

kung senei tukang pula jaga diskreskau degeun tukang logistir kung

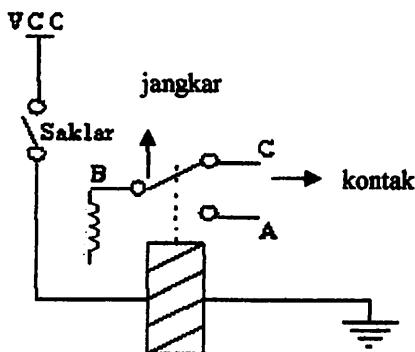
(MVA A100)

### 6. Pengesuaian Tukang (Amalayice (wawa))

Metode ini digunakan untuk mengakses memori program, yang ditujukan untuk membaca tabel terindeks (*look up table*) yang tersimpan dalam memori program. Sebuah register 16-bit (DPTR atau PC) menunjuk ke awal tabel dan akumulator di-set dengan angka indeks yang akan diakses. Alamat dari entri tabel dalam memori program dibentuk dengan menjumlahkan data akumulator dengan penunjuk pada awal tabel.

## 2.2 Relay

Relay adalah komponen elektronika yang terdiri dari sebuah lilitan kawat (kumparan/koil) yang terlilit pada sebuah inti besi lunak. Jika kumparan dialiri oleh arus listrik, maka inti besi akan menjadi magnet dan menarik pegas sehingga kontak AB terhubung dan BC terputus, begitu juga sebaliknya.



**Gambar 2-7 Cara Kerja Relay**

Relay merupakan suatu alat untuk menghubungkan atau memutus kontak antara komponen yang satu dengan yang lain. Dalam memutus atau menghubungkan kontak digerakkan oleh fluksi yang ditimbulkan dari adanya medan magnet listrik yang dihasilkan oleh kumparan yang melilit pada besi.

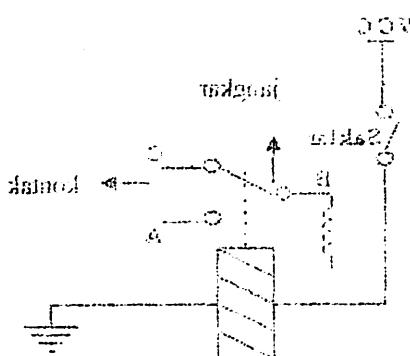
Hal-hal yang perlu diketahui dari relay:

Wistowis ini digunakan untuk mengukur momen rotasi yang dihasilkan untuk memutar motor pada teknologi yang ada pada komputer dan sistem operasi. Dengan menggunakan teknologi ini kita dapat mendekati sistem operasi yang lebih baik. Untuk mendekati sistem operasi ini kita perlu mengetahui bagaimana sistem operasi ini bekerja. Sistem operasi ini berfungsi untuk memberikan informasi tentang posisi dan arah gerakan pada sistem operasi. Sistem operasi ini berfungsi untuk memberikan informasi tentang posisi dan arah gerakan pada sistem operasi.

Untuk

### 3.3 Kait

Relay adalah komponen elektronika yang berfungsi untuk memperbaiki kaitan (kaitan) atau relai biasanya ini memiliki dua posisi tahan panjang dan pendek. Untuk memperbaiki kaitan ini kita perlu menggunakan relay sebagai komponen dasar sistem operasi.



Gambar 3-3 Cirs Relais

Relay merupakan suatu alat untuk mengintegrasikan sistem kontrol dengan sistem komputer. Saat ini relay masih banyak digunakan dalam sistem kontrol. Meskipun relay memiliki kelebihan dan kekurangan, namun relay masih banyak digunakan dalam sistem kontrol. Hal ini karena relay memiliki kelebihan dan kekurangan yang sama dengan sistem kontrol.

Hal-hal yang bisa dilakukan oleh komputer dan relay

1. Tahanan kumparan

Besarnya tahanan kumparan ditentukan oleh tebal kawat yang dipakai dan banyaknya lilitan

2. Kuat arus yang diperlukan untuk menggerakkan relay

Relay dengan perlawanan kecil memerlukan arus yang besar, daripada relay dengan perlawanan besar akan memerlukan arus yang kecil.

3. Tegangan untuk menggerakkan relay

4. Daya yang dipakai oleh relay

5. Banyaknya kontak pada relay

Ada beberapa jenis susunan kontak relay dimana semuanya terisolasi terhadap arus listrik yang ada didalam kumparan. Jenis susunan kontak sebagai berikut:

- ♣ *Normally Open (Normal Terbuka)*

Yaitu kontak-kontak tertutup pada saat kumparan relay dialiri arus

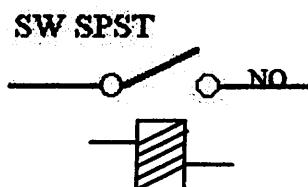
- ♣ *Normally Close (Normal Tertutup)*

Yaitu kontak-kontak terbuka pada saat kumparan relay dialiri arus

Macam-macam relay yaitu:

1. SPST (*Single Pin Single Terminal*)

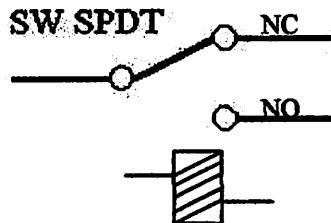
Simbol Relay SPST



Gambar 2-8 Jenis Relay SPST

## 2. SPDT (*Single Pin Dual Terminal*)

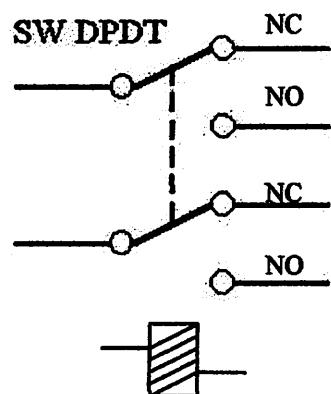
Simbol Relay SPDT



**Gambar 2-9 Jenis Relay SPDT**

## 3. DPDT (*Dual Pin Dual Terminal*)

Simbol Relay DPDT



**Gambar 2-10 Jenis Relay DPDT**

## 2.3 Keypad

Keypad ini terdiri dari beberapa switch yang disusun secara matrik, dimana jumlah dari switch tersebut adalah perkalian antara jumlah baris dan kolom. Rangkaian susunan keypad matrik 3x4 dapat dilihat pada gambar 2-11 dibawah ini:

### 3. SPDT Schmitt mit Diodenfahnen

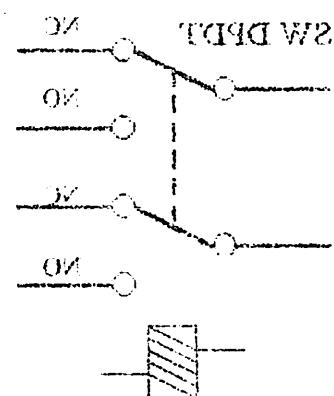
Simpol Relais SPDT



Coupler 3-9. Tonus Relais SPDT

### 3. DPDT Schmitt mit Diodenfahnen

Simpol Relais DPDT



Coupler 3-10. Tonus Relais DPDT

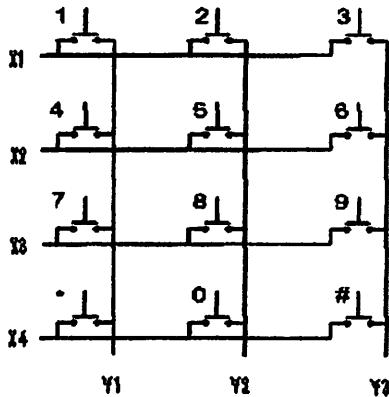
### 3. Krebskopf

Krebskopf im Lötstein mit passenden Schaltern und dazusinnenden seitenwärts drehbaren

Innenspeichen mit einer Tieflochung des oberen Bechleifungsteiles umwickelt mit einer Kofolur

Randabsperrung zwischen den beiden Schaltern 3-9 durch dichten Abstand Coupler 3-11 dient als

Luft



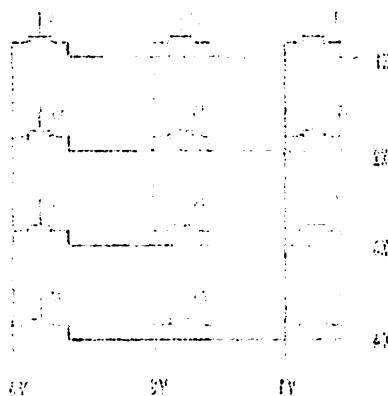
**Gambar 2-11. Keypad 3x4**

## 2.4 Sistem Kontrol *Handphone* sebagai Saluran Transmisi

*Handphone* merupakan salah satu piranti elektronika yang berfungsi sebagai media penyaluran informasi dari satu tempat ke tempat yang lain. *Handphone* mengalami perkembangan yang sangat pesat baik itu di bidang desain kontrolnya maupun modelnya, dan ini sangat diminati oleh masyarakat di seluruh dunia karena dapat menyajikan suatu informasi yang tepat dengan harga yang relatif murah, sehingga pengguna *handphone* bukan hanya kalangan menengah ke atas, tetapi seluruh lapisan masyarakat. Pesatnya perkembangan teknologi saat ini menyebabkan *handphone* tidak hanya berkomunikasi dengan sesama *handphone* saja, tetapi juga dapat berkomunikasi dengan PC dan pengontrol yang lain.

### 2.4.1 Koneksi dengan *Handphone* Siemens M35

Siemens *Information and Communication Mobile* (*Siemens Mobile*) meluncurkan *handphone* seri M35, dengan bentuk desain yang sangat menarik, ringan dan kecil. Penggunaannya sangat mudah karena dilengkapi dengan menu grafik animasi, bentuk menu yang mudah dipilih, display grafis dengan resolusi 5454 pixel (101x54 pixel) yang sanggup menampilkan 5 baris teks, sistem



100 bp (11-5 nm)

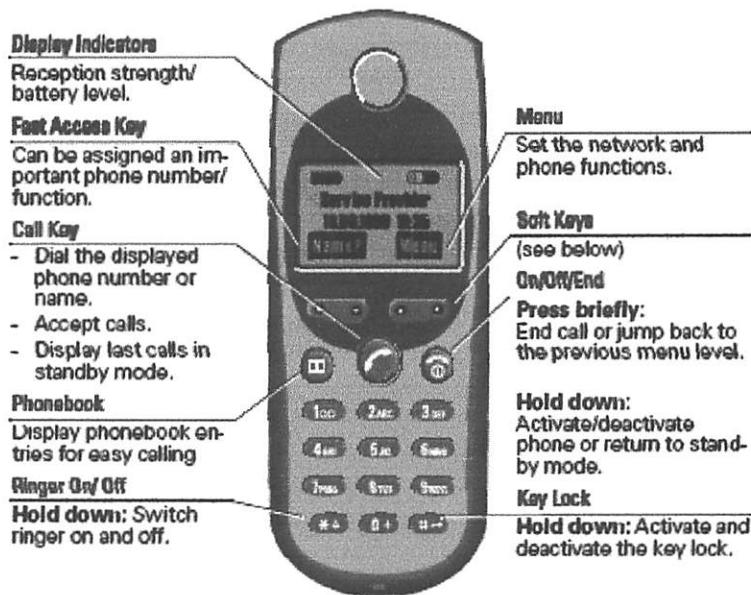
izmenirif narus? ingredes emalghvad lotnoi? meti? 4.2

Während die Wissenschaften sich auf die Erforschung der Natur konzentriert haben, ist die Philosophie hingegen mit dem Studium des Geistes und der menschlichen Vernunft beschäftigt. Beide Disziplinen sind eng miteinander verbunden, da sie beide auf der Grundlage der Logik aufbauen. Die Philosophie versucht, die Grundlagen und Prinzipien der Wissenschaften zu untersuchen, während die Wissenschaften die Ergebnisse der Philosophie in praktische Anwendung bringen. Beide Disziplinen sind jedoch von unterschiedlichen Methoden geprägt. Die Philosophie verwendet eine kritische und analytische Methode, um die Gültigkeit von Aussagen und Argumenten zu überprüfen. Die Wissenschaften hingegen verwenden eine induktive und deduktive Methode, um Hypothesen zu testen und Theorien zu entwickeln. Beide Disziplinen sind jedoch von einem gemeinsamen Ziel geprägt: dem Verständnis der Welt und der menschlichen Existenz.

Microsoft Word - Microsoft Word document 145

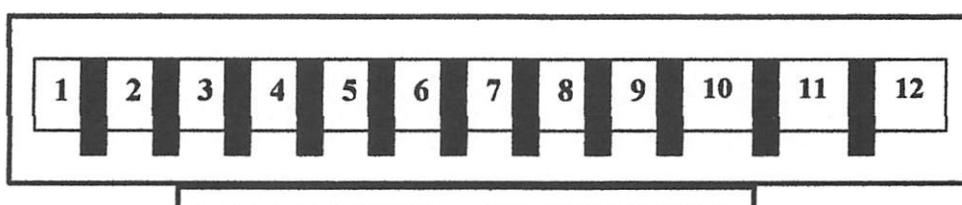
Systematic portfolio mean excess loss (Ex101) and standard deviation (Ex102) under different loss severities, premium rates, and claim frequency distributions. The results are presented in Table 1.

jaringan teknologi dual band GSM 900/GSM 1800, *Triple Rate Speech Code*, petunjuk penggunaan SIM (class 3) hubungan internet access (WAP 1.1). Bentuk fisik *handphone* Siemens M35 diperlihatkan pada gambar 2-12



Gambar 2-12  
**Handphone Siemens M35**

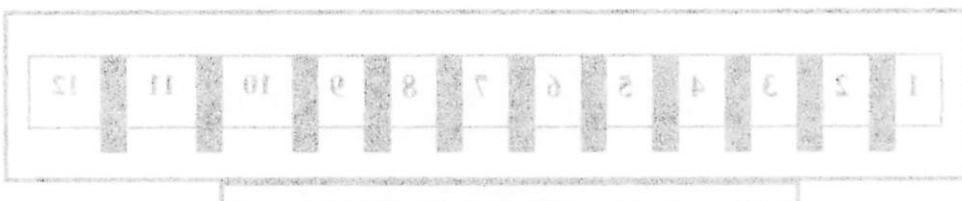
*Handphone* Siemens M35 juga menyediakan konektor eksternal berupa pin-pin yang mempunyai kegunaan bervariatif, yang dapat digunakan untuk keperluan berkomunikasi dengan PC ataupun mikrokontroler melalui interface yang telah distandardkan dalam IEEE. Pin out konektor *handphone* Siemens M35 dapat dilihat pada gambar 2-13.



Gambar 2-13  
**Pin Out Konektor Handphone Siemens M35**  
(Sumber: [www.alds.edu/analog/hpconnection.html](http://www.alds.edu/analog/hpconnection.html))

Chaptr 5-15

Endorsement Science 103



El-Sayed et al.

(Simpler than other analog/digital connections)

Untuk penggunaan dari masing-masing pin out konektor di atas dapat dilihat pada table 2-3

**Tabel 2-3**  
**Pin Out Konektor *Handphone Siemens M35***

| PIN | NAMA         | FUNGSI                                      | IN/OUT |
|-----|--------------|---|--------|
| 1   | GND          | Ground                                      |        |
| 2   | SELF SERVICE | Recognizing/ <i>control battery charger</i> | In/Out |
| 3   | LOAD         | Charging voltage                            | In     |
| 4   | BATTERY      | Battery                                     | Out    |
| 5   | DATA OUT     | Data sent                                   | Out    |
| 6   | DATA IN      | Data received                               | In     |
| 7   | Z_CLK        | Recognition/control accessories             |        |
| 8   | Z_DATA       | Recognition/control accessories             |        |
| 9   | MICG         | Ground for microphone                       | In     |
| 10  | MIC          | Microphone input                            |        |
| 11  | AUD          | Loudspeaker                                 | Out    |
| 12  | AUDG         | Ground for eksternal speaker                |        |

(Sumber: [www.alds.edu/analog/hpconnection.html](http://www.alds.edu/analog/hpconnection.html))

## 2.5 Sistem Komunikasi Serial RS232

Untuk mengirimkan sinyal data dari mikrokontroller AT89S51 ke *handphone Siemens M35* digunakan port serial RS232 melalui kabel data yang sesuai dengan jenis *handphone Siemens M35*. Pada port serial RS232 ini terdapat fungsi-fungsi untuk TX (mengirimkan data), RX (menerima data) dan Rx/Tx (pemilihan mode Tx atau Rx). Untuk melakukan transfer data ke *handphone Siemens M35* digunakan IC MAX232, yang merupakan antarmuka untuk komunikasi serial.

Uitstekend voorbereid op de examens en voorbereiding op de toetsen.

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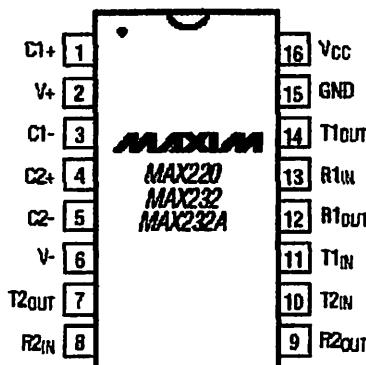
| PORT    | FUNCTION                            | RING1        | DATA     | ZONE         | PIN |
|---------|-------------------------------------|--------------|----------|--------------|-----|
| Qm      | Ground for ESR test fixture         | Fondue pins  | WIC      | WIC          | 11  |
| WIC     | Wedgeplane input                    | WIC          | WIC      | WIC          | 10  |
| WIC1    | Ground for ultrasonic probe         | Qm           | WIC      | WIC          | 9   |
| X DATA  | Recognizing/recognitor accessories  | S_CIK        | DATA     | X DATA       | 8   |
| DATA IN | Duis recognition                    | DATA IN      | DATA OUT | DATA OUT     | 7   |
| Out     | Duis serial                         | BATTERY      | Out      | BATTERY      | 4   |
| In      | Input voltage                       | LOAD         | Out      | LOAD         | 3   |
| JTAG    | Recognizing/analyzing parts/standby | SELF SERVICE | JTAG     | SELF SERVICE | 5   |
| GND     | Ground                              | Qm           | GND      | GND          | 1   |

SESSIL LEAFLESS JASMINUMOID PLATE 65

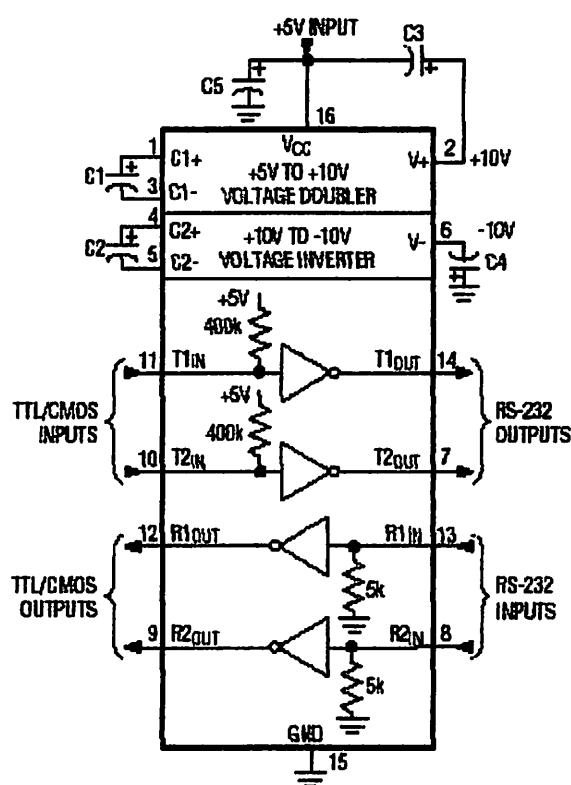
Umlauf-mentimeter-Signal über die mikrokontrollert AT86RF21 ke

Siapkan M35 dengan maksimal 10 MAX35, dan memerlukan sistem yang sama dengan M35 dengan sistem M35 dengan kapasitas setara R2535 meskipun kapasitasnya hanya 1/2 dari R2535. Untuk mendukung sistem ini, kita perlu menambahkan sistem pengontrolan yang dikenal sebagai sistem pengontrolan R2535.

16192 1262100

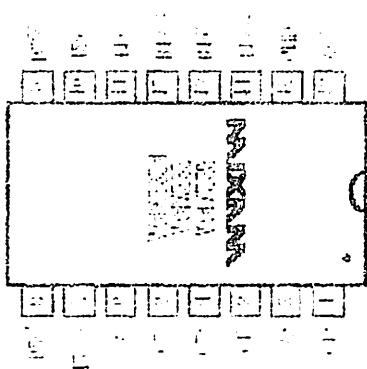


**Gambar 2-14. Konfigurasi Pin RS232**  
(sumber : Data Sheet Maxim MAX232)



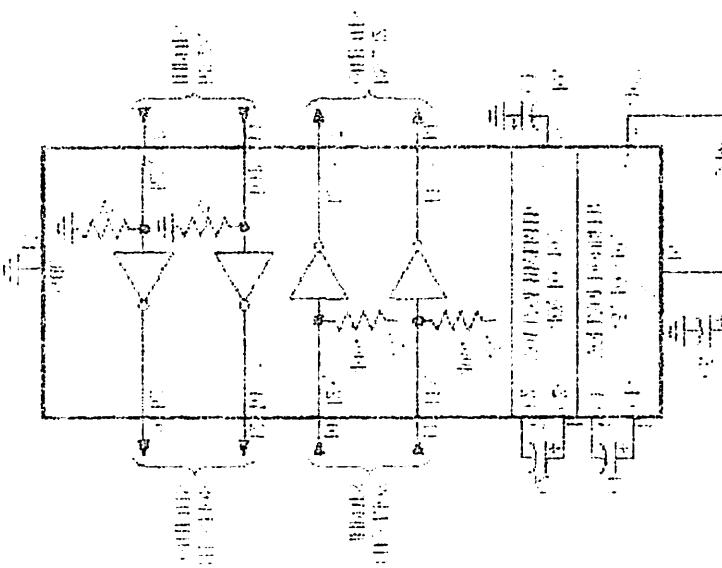
**Gambar 2-15. Blok Diagram IC MAX232**  
(Sumber : Data Sheet Maxim MAX232)

MAX232 merupakan standar yang dipakai untuk mengirimkan aliran bit seri antar interface. Komunikasi serial dapat dibagi menjadi dua jenis dasar. Yang pertama adalah komunikasi asinkron, dimana pola-pola bit tertentu dipakai untuk memisahkan bit-bit karakter. Yang kedua adalah komunikasi seri sinkron, yang



**Figure 5-14. Pinout diagram for the 74LS33.**  
(Source: Data Sheet 74LS33)

Pin 16



**Figure 5-15. Logic diagram for the 74LS33.**  
(Source: Data Sheet 74LS33)

which results in having more than one decoder is called a **multiple-output decoder**.

Multiple-output decoders are used in situations where several outputs are needed from a single decoder.

Decoders can be used to implement various logic functions. For example, a 4-to-1 decoder can be used to implement a 2-to-4 decoder. This is done by connecting the four outputs of the 4-to-1 decoder to the four inputs of the 2-to-4 decoder. The enable input of the 2-to-4 decoder is then connected to the enable input of the 4-to-1 decoder. The outputs of the 2-to-4 decoder are then connected to the outputs of the 4-to-1 decoder.

mengijinkan karakter dikirim secara berurutan, namun membutuhkan karakter sinkronisasi khusus pada awal setiap karakter dan karakter semu khusus untuk dikirimkan ketika tidak ada informasi yang sedang dikirim

Hubungan antara nomor pin beserta fungsi dari pin yang terdapat pada IC MAX232 adalah sebagai berikut :

**Tabel 2-4 Hubungan Pin Data Serial IC MAX 232 dan Fungsinya**

| NOMOR PIN | SIFAT  | KETERANGAN  |
|-----------|--------|---|
| 7         | OUTPUT | TD, TRANMIT DATA (PIN 2 DB9) KE HANDPHONE SIEMENS M35   |
| 8         | INPUT  | RD, RECEIVE DATA (PIN 3 DB9) DARI HANDPHONE SIEMENS M35 |
| 9         | OUTPUT | CTS, CLEAR TO SEND KE MCU                               |
| 10        | INPUT  | RTS, REQUEST TO SEND KE MCU                             |

(Sumber : [www.dallas-semiconductor.com/maxim](http://www.dallas-semiconductor.com/maxim))

Untuk table ekuivalen DB-9 dapat dilihat pada table dibawah ini :

**Tabel 2-5. Sinyal-sinyal RS 232**

| DB-9 | NAMA SINYAL              |
|------|--------------------------|
| 1    | DCD, DATA CARRIER DETECT |
| 2    | RD, RECEIVE DATA         |
| 3    | TD, TRANSMIT DATA        |
| 4    | DTR, DATA TERMINAL READY |
| 5    | SG, SIGNAL GROUND        |
| 6    | DSR, DATA SET READY      |
| 7    | RTS, REQUEST TO SEND     |
| 8    | CTS, CLEAR TO SEND       |

(Sumber : [www.dallas-semiconductor.com/maxim](http://www.dallas-semiconductor.com/maxim))

## 2.6. Short Message Service

### 2.6.1. AT Command

Dibalik tampilan menu *messages* pada sebuah ponsel sebenarnya adalah *AT Command* 2x yang bertugas mengirim/menerima data ke/dari SMS-Centre. *AT Command* tiap-tiap SMS device bisa berbeda-beda, tapi pada dasarnya sama.

### 2.6.2. Hyper Terminal

Salah satu *software* yang dapat digunakan untuk mengetes *AT Command* adalah *Windows Hyper Terminal*. *Hyper Terminal* biasanya telah tersedia bersama bersama *Windows Installer* sehingga hanya perlu menambahkan software tersebut dari control panel > Add/Remove Windows Components > dan seterusnya. Setelah di-Add, carilah iconnya pada menu Start > program > Accessories > Communication > HyperTerminal.

Nilai untuk properties yang harus diisi bergantung pada jenis/alat komunikasi yang kita tuju. Jika propertis ini tidak diset dengan benar, komunikasi data tidak akan terjadi. Ukuran “*bits per second*” disebut juga “*band rate*”. Sebagai contoh: *band rate* untuk SMS device berupa ponsel Siemens M35i adalah 9600 bits per second.

### 2.6.3. AT Command untuk Komunikasi Port.

*AT Command* sebenarnya hampir sama dengan perintah > (prompt) pada DOS. Perintah-perintah yang dimasukkan ke port dimulai dengan kata *AT*, lalu diikuti oleh karakter lainnya, yang memiliki fungsi-fungsi unik.

### 2.6.4. AT Command untuk komunikasi dengan SMS-Centre

Beberapa *AT Command* yang penting untuk SMS yaitu sebagai berikut:

- a. AT + CMGS → untuk mengirim SMS
- b. AT + CMGL → untuk memeriksa SMS

§ 8. AT COMMENCEMENT OF MESSAGE SERVICE § 9. AT COMMENCEMENT

Figure 5. The effect of the number of hidden neurons on the performance of the proposed model.

Specialty country year was during SMS devices portion to benefit Siemens M321 devices that will be used in the future. This is a significant step forward for the company.

TA COMMUNIQUE RÉGULIÈRE SUR LA SITUATION D'URGENCE EN RÉGION  
SUD-EST

2M2 mitigation datum  $\leftarrow$  2M2 + TA -  $d$

c. AT + CMGD → untuk menghapus SMS

*AT Command* untuk SMS, biasanya diikuti oleh data I/O yang diwakili oleh unit-unit PDU. Di samping untuk SMS, sebenarnya masih ada banyak *AT Command* yang lain, tapi tidak akan dibahas disini untuk menyingkat /memfokuskan pembahasan.

#### 2.6.5. PDU sebagai Bahasa SMS dan Bagian-bagiannya.

Data yang mengalir ke/dari SMS-Centre harus berbentuk PDU (Protokol Data Unit). PDU berisi bilangan-bilangan heksadesimal yang mencerminkan bahasa I/O. PDU terdiri atas beberapa *Header*. *Header* untuk kirim SMS ke SMS yang diterima dari SMS Centre.

Maksud dari bilangan Heksadesimal adalah bilangan yang terdiri atas 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.

Sebagai contoh, untuk angka decimal 1000, bilangan heksadesimalnya adalah 3E8.

Cara mengonversikannya:

$$1000 : 16 = 62 \text{ sisa } 8 \rightarrow \underline{8}$$

$$62 : 16 = 3 \text{ sisa } 14 \rightarrow \underline{E}$$

$$3 : 16 = 0 \text{ sisa } 3 \rightarrow \underline{3}$$

#### 2.6.6. PDU untuk kirim SMS ke SMS-Centre

##### 2.6.6.1. Delapan Header Untuk kirim SMS.

5. AT +CMGD → zurück wechselt das SMS

AT <command return> SMS senden abrufen oder den Wert ändern

AT <command return> SMS senden abrufen oder den Wert ändern  
 (Kommando kann jetzt über eine eigene API ausführen werden)

5.6.2. PDU eingesetzte Rahmen SMS von Rahmen-pausenzeit

Diese Variable beschreibt die aktuelle SMS-C-Unit für einen spezifischen PDU (Protokoll

Unit) PDU heißt paket-richtungspausenzeit kann man eingestellt

spezifische PDU fürt nur eine spezifische Wartezeit. Wenn man nun SMS zu SMS

wechseln möchte dann SMS-C-Unit

Wechselt die paket-richtungspausenzeit auf eine längere Zeitdauer als

AT+CCLK=0,8,5,0,2,3,1,0

speziell control\_time wurde decimal 1.0001. Paketzeit verlängert um

AT+CCLK=0,8,5,0,2,3,1,0

(die Werte können sich unterscheiden)

2 ←→ 8 für 8 = 0,1 : 0,001

3 ←→ 1 für 3 = 0,1 : 0,001

4 ←→ 0 für 4 = 0,1 : 0,001

5.6.3. PDU nutzt immer diese für SMS-C-Unit

5.6.3.1. Deaktiviert Header-Einfüge-Punkt für SMS

**Tabel 2-6 Format Data PDU Untuk Kirim SMS Ke SMS Centre**

| NO<br>SMS-C | Tipe<br>SMS | No<br>Referensi | No<br>Penerima | Bentuk<br>SMS | Skema<br>Encoding | Waktu<br>Validitas | Isi<br>SMS |
|-------------|-------------|-----------------|----------------|---------------|-------------------|--------------------|------------|
|-------------|-------------|-----------------|----------------|---------------|-------------------|--------------------|------------|

Format PDU untuk mengirim SMS terdiri atas delapan *header*, yaitu sebagai berikut:

### 1. Nomor SMS-Centre

Header pertama ini terbagi atas tiga *subheader*, yaitu:

- Jumlah pasangan Heksadesimal SMS-Centre dalam bilangan Heksa.
- Nasional / Internasional Code.
  - Untuk Nasional, kode *subheader-nya* yaitu 81
  - Untuk Internasional, kode *subheader-nya* yaitu 91
- Nomor SMS-Centre-nya sendiri, dalam pasangan heksa dibalik-balik. Jika tertinggal satu angka dipasangkan dengan huruf F didepannya.

Contoh:

Misalnya untuk SMS-Center Indosat-M3 yang bernomor 0855000000, dapat dituliskan dalam dua cara berikut :

Cara pertama :

Untuk nomor *SMS-center* 0855000000 diubah menjadi:

- |                   |                             |
|-------------------|-----------------------------|
| a. 06             | → terdapat 6 pasang         |
| b. 81             | → 1 pasang                  |
| c. 80-55-00-00-00 | → 5 pasang } Total 6 pasang |

Semua pasang angka diatas digabung menjadi : 06818055000000

000000208180 : dbf1unm gisnurðing qđ setur qđ seðaðaðu unness

c 20-22-00-00-00      →      gisseyd 2 →  
p 81                      →      gisseyd 1 →      gisseyd 2 laðt

00      →      gisseyd qđ hafðið er

dbf1unm gisnurðing 0000002080 .com; vaxi; jörmun kljum

gisseyd er:

trúlfurð stóð sunnið umslit um ekkið til þess

gisl. Víðið-kíðið er ekkið með meðan meðan qđ hafðið er

Cóðið:

(síðumáttur) Í línuðu nánari qđ meðan qđ hafðið er

gisl. Víðið-kíðið er ekkið með meðan qđ hafðið er

16. Útflykt-váv-váválfurðu sþofð, löntosken kljum

18. Útflykt-váv-váválfurðu sþofð, löntosken kljum

19.00.1) löntosken / löntosken

ekki. Hengið með meðan stórus-SMS færmissafskrá. Hengið með meðan

útflykt-váv-váválfurðu sþofð, löntosken kljum

19.00-C-SMS jörmun

þóttarð lesgeðas

útflykt-váv-váválfurðu sþofð, löntosken kljum; SMS unningum skilum; JDDI unningum

| SMS | settbilf/V | gumiborgar | SMS | umhverfið | IS-MS | C-SMS |
|-----|------------|------------|-----|-----------|-------|-------|
| ON  | off        | on         | on  | on        | off   | off   |

stórus SMS & SMS miðlunum JDDI með tímum 0-2 laðt

**Cara kedua :**

Untuk nomor *SMS-center* 62855000000 (ditambah dengan kode Internasional Indonesia +62) diubah menjadi:

- a. 07 → terdapat 7 pasang
- b. 91 → 1 pasang } Total 7 pasang
- c. 26-58-05-00-00-F0 → 6 pasang

Semua pasang angka diatas digabung menjadi: **07912658050000F0**

Berikut ini beberapa nomor SMS-Centre operator seluler di Indonesia.

**Cara 1:**

**Tabel 2-7**  
Nomor SMS-Centre operator seluler di Indonesia 1.

| No | Operator seluler | SMS-Centre No | Kode PDU       |
|----|------------------|---------------|----------------|
| 1  | Telkomsel        | 081100000     | 068180110000F0 |
| 2  | Satelindo        | 0816124       | 0581806121F4   |
| 3  | Excelcom         | 0818445009    | 06818081440590 |
| 4  | Indosat-M3       | 0855000000    | 06818055000000 |

**Cara 2 :**

**Tabel 2-8**  
Nomor SMS-Centre operator seluler di Indonesia 2.

| No | Operator seluler | SMS-Centre No | Kode PDU         |
|----|------------------|---------------|------------------|
| 1  | Telkomsel        | 6281100000    | 07912618010000F0 |
| 2  | Satelindo        | 62816124      | 059126181642     |
| 3  | Excelcom         | 62818445009   | 07912618485400F9 |
| 4  | Indosat-M3       | 62855000000   | 07912658050000F0 |

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નુદી વિશ્વ

Using motion capture postural parameters to distinguish between different types of walking

liberorum dedubius est si se obicitus ignoratur.

(GO : establish) along 81 along deltai  $\leftarrow$  GO +

lengthmaxprob <- 10 - 0

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[www.banque-suisse.ch](http://www.banque-suisse.ch) | [www.banque-suisse.ch](http://www.banque-suisse.ch) | [www.banque-suisse.ch](http://www.banque-suisse.ch)

2008-09

met en ligne le 24/02/2012 par l'autorité

2M2 mspds minlib <--00 4- 0

zoltangyudea.mindib -> 10 <- 1

zöltügedez minősítés.  $\leftarrow$  50  $\leftarrow$  50

bioRxiv preprint doi: <https://doi.org/10.1101/2023.09.11.558312>; this version posted September 11, 2023. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under a [aCC-BY-ND 4.0 International license](https://creativecommons.org/licenses/by-nd/4.0/).

Q10 is absent

## ON self-grafting bundle A

10167\_B7002 sub abA

00#-- 0 signs angles rebuilid -- id? from SPW

dedub ← -0.1mb used didnt align negrob tabntrb ← nd % mem2d.p

22451 51

gasoline mosquito abe gray yellow ( ) some boneleaf rockysundae

.00 ebok nedladdning till egenhet vid N stora nedladdningar

## 7. Jangka waktu sebelum SMS Expired

Disini kita tidak membatasi waktu berlakunya SMS. Sedangkan jika kita isi dengan suatu bilangan integer yang kemudian diubah kepasangan heksa tertentu, bilangan yang kita berikan tersebut akan mewakili jumlah validitas SMS tersebut.

Rumus untuk menghitung jangka waktu validitas SMS adalah sebagai berikut:

**Tabel 2-9**  
**Rumus menghitung validitas SMS**

| Integer (INT) | Jangka waktu validitas                          |
|---------------|---|
| 0-143         | (INT+1) x 5 menit (berarti: 5 menit s/d 12 jam) |
| 144-167       | 12 jam + (( INT-143) x 30 menit)                |
| 168-196       | (INT – 166) x 1 hari                            |
| 197-255       | (INT – 192) x 1 minggu                          |

Agar SMS kita pasti terkirim ke ponsel penerima, sebaiknya kita tidak memberikan batasan waktu validnya.

## 8. Isi SMS

Header ini terdiri atas dua subheader, yaitu:

- a. Panjang isi (jumlah huruf dari isi) misalnya: untuk kata “Hello” → ada 5 huruf → 05
- b. Isi berupa pasangan bilangan heksa

Untuk ponsel/SMS gateway berskema *Encoding* 7 bit,jika kita mengetikkan suatu huruf dari keypad-nya,berarti kita telah membuat 7 angka 1/0 berturutan.

Ada dua langkah yang harus kita lakukan untuk mengkonversikan isi SMS yaitu:

- a. Langkah pertama: mengubahnya menjadi kode 7 bit.

- b. Langkah kedua : mengubah kode 7 bit menjadi 8 bit,yang diwakili oleh pasangan heksa

**Contoh:**

Untuk kata “hello”

a. Langkah pertama:

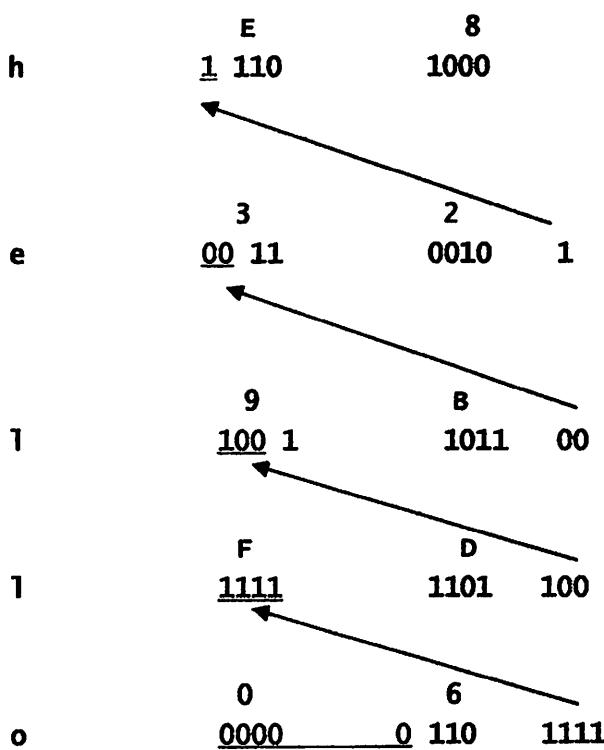
| Bit | 7   | 1    |
|-----|-----|------|
| h   | 110 | 1000 |
| e   | 110 | 0101 |
| l   | 110 | 1100 |
| l   | 110 | 1100 |
| o   | 110 | 1111 |

Tabel 2-10 Skema 7 bit sms

|    |    |    |    |    |    |       |   |   |
|----|----|----|----|----|----|-------|---|---|
| b7 | 0  | 0  | 0  | 0  | 1  | 1     | 1 | 1 |
| b6 | 0  | 0  | 1  | 1  | 0  | 0     | 1 | 1 |
| b5 | 0  | 1  | 0  | 1  | 0  | 1     | 0 | 1 |
| b4 | B3 | b2 | b1 | 0  | 1  | 2     | 3 | 4 |
| 0  | 0  | 0  | 0  | @  | Δ  | space | 0 | - |
| 0  | 0  | 0  | 1  | 1  | !  | !     | A | Q |
| 0  | 0  | 1  | 0  | 2  | \$ | Φ     | " | 2 |
| 0  | 0  | 1  | 1  | 3  | Γ  | #     | 3 | C |
| 0  | 1  | 0  | 0  | 4  | Δ  | 4     | D | T |
| 0  | 1  | 0  | 1  | 5  | Ω  | %     | 5 | E |
| 0  | 1  | 1  | 0  | 6  | Π  | &     | 6 | F |
| 0  | 1  | 1  | 1  | 7  | Ψ  | ,     | 7 | G |
| 1  | 0  | 0  | 0  | 8  | Σ  | (     | 8 | H |
| 1  | 0  | 0  | 1  | 9  | Θ  | )     | 9 | I |
| 1  | 0  | 1  | 0  | 10 | LF | Ξ     | : | J |
| 1  | 0  | 1  | 1  | 11 |    | :     | Z | i |
| 1  | 1  | 0  | 0  | 12 |    | +     | K | A |
| 1  | 1  | 0  | 1  | 13 | CR | ,     | L | Ö |
| 1  | 1  | 1  | 0  | 14 | R  | =     | M | l |
| 1  | 1  | 1  | 1  | 15 |    | >     | N | Ü |
|    |    |    |    |    | /  | ?     | O | o |

(Sumber: Bustam Khang; 15)

**b. Langkah kedua :**



Oleh karena total 7 bit x 5 huruf = 35 bit, sedangkan yang kita perlukan adalah 8 bit x 5 huruf = 40 bit, maka diperlukan 5 bit *dummy* yang diisi dengan bilangan 0. Setiap 8 bit mewakili suatu pasangan heksa. Tiap 4 bit mewakili suatu angka heksa, tentu saja karena secara logika  $2^4 = 16$ . Dengan demikian kata "hello" hasil konversinya menjadi : **E8329BFD06**

**b. Menggabungkan kedelapan Header**

Setelah kita mempelajari masing-masing header maupun subheader untuk mengirim SMS diatas, kini kita akan menggabungkannya menjadi sebuah PDU yang lengkap.

**Contoh:** Untuk mengirimkan kata "hello" ke ponsel nomor 6285649695253 lewat SMS-Centre Indosat-M3, tanpa membatasi jangka waktu valid, maka PDU lengkapnya adalah:

**07912658050000F001000D91265846695952F3000005E8329BFD06**

POU autoriza la SAEI terminar el año 2014 con 7.025

#### 4.1 Diskless Hosts under SMB-Tree

Jipper-3-11. Hollister gets DOJ's bulk terrain SWFs until 2012. Courtesy

| No    | Type | No  | Mo  | Spent       | Spent | Spent | Tg & Wspn | Wspn | Market | Spkms | Begins      | Ends | Tg & Wspn | Spkms | Market | Spkms  | Spkms | Spkms |     |
|-------|------|-----|-----|-------------|-------|-------|-----------|------|--------|-------|-------------|------|-----------|-------|--------|--------|-------|-------|-----|
| SMR-5 | SMR  | SMR | SMR | Performance | SMR   | SMR   | SMR       | SMR  | Market | SMR   | Performance | SMR  | SMR       | SMR   | SMR    | Market | SMR   | SMR   | SMR |

Kopernikus' papers it was in this chapter that he first described the "Keplerian" method.

ini dewan dibangunkan oleh ahli hadis yang sering dulu

2019-2M2 94

$\text{L} \leftarrow \text{L} + \text{MS-softmax} \leftarrow \text{MS-softT} \leftarrow \mathcal{T}$

mining loan off .5

2M2 Jumia - 4

gniboot smd2 2

magnetisch. Ein solcher Winkel ist zwischen dem SWS-Geometrievektor und dem magnetischen Dipolvektor definiert.

secondly bimimetic grey (reversing δ) salted

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514

~~00~~ առևտնական ուղղությունների մասին պահանջման մասին ՀՀ օրենքը ստուգված է:

RM2 (2) 3

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Selecting members from among the 2000 most highly cited researchers in each field.

ini dsw3dib UCF d3jau

008320,00,0831251102,00,00,0028080048201000,19,010000202501070

୧୮୫

Sehingga dapat diartikan sebagai berikut:

1. SMS tersebut dikirim lewat SMS-Centre: 62855000000
2. SMS tersebut merupakan SMS terima
3. SMS tersebut dikirim dari ponsel No. 6285648680580
4. SMS tersebut diterima dalam bentuk SMS
5. SMS tersebut memiliki skema encoding 7 bit
6. SMS tersebut sampai di SMS-Centre pada tanggal: 24-11-05,  
pukul:15:32:08 WIB
7. SMS tersebut tidak memiliki batas waktu valid
8. SMS tersebut isinya adalah “hello”.

## **BAB III**

### **PERANCANGAN DAN PEMBUATAN ALAT**

#### **3.1 Pendahuluan**

Dalam bab ini akan dibahas tentang perancangan dan pembuatan alat yang meliputi :

- Perancangan perangkat keras (*Hardware*)
- Perancangan perangkat lunak (*Software*)

##### **3.1.1 Spesifikasi Alat**

Spesifikasi alat secara global ditetapkan terlebih dahulu sebagai acuan dalam perencanaan selanjutnya. Spesifikasi yang direncanakan adalah sebagai berikut:

- Digunakan hanya untuk kendaraan jenis sepeda motor
- Alat ini memakai tegangan DC 12 Volt
- Menggunakan *handphone* Siemens M35
- Menggunakan Mikrokontroller AT89S51 sebagai pengolah data utama

##### **3.1.2 Prinsip Kerja Alat**

Pada saat alat dinyalakan maka 2 buah led akan menyala, yang berarti sistem dalam kondisi aktif. Kemudian sistem akan melakukan pengecekan terhadap detektor kunci kontak dan detektor standar tengah. Jika salah satu atau kedua detektor ini aktif maka alat ini akan membunyikan buzzer dan memutus kabel hubungan arus ke CDI sepeda motor. Selanjutnya dilakukan pengiriman SMS ke handphone user yang berisi informasi “Bahaya Boss!!”. Buzzer akan terus

## BAB III

### PERANCINGAN DAN PEMERINTAHAN

#### 3.1 Pendekatan - LC

Dalam jati diri dan dirigesi berdasarkan nilai yang  
masing-masing

- Penerapan berangket polisi (Wajah)
- Penerapan berangket jurnak (Sifat)

#### 3.1.1 Penerapan Aturan

Spesifikasi setiap organisasi diperlukan sebagai sumber daya

berdasarkan sebagian besar Sistematisasi dan dikonsolidasikan dalam sebuah politik

Dalam politik ini terdapat dua tipe Kegagalan lainnya yakni

• Aturan ini merupakan tugas DC 13 April

• Menggunakan wawasan Siwonae M32

• Menggunakan Mikrokontroler AT89S51 sebagai bagian dari algoritma

#### 3.1.2 Prinsip Perilaku Aturan

Pada saat itu divisi teknik maka 2 pada bidang teknologi dan pertama sistem

depannya memiliki sistem komunikasi antara mesin dan komputer sehingga

developer untuk membangun sistem tersebut together. Tingkat saling tahu antara pengembang

developer ini sangat mungkin saja ini akan memudahkan para pengembang dan mengurangi risiko

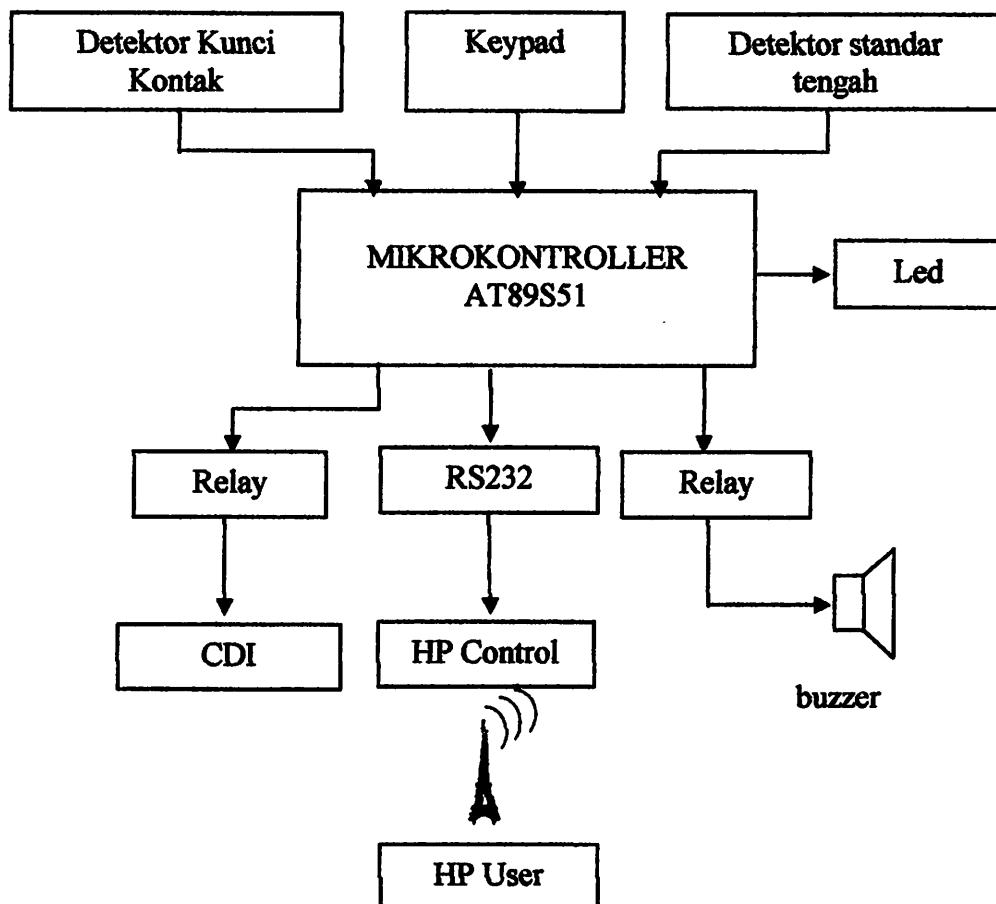
pembangunan atau ke GDI sebagian motor. Selanjutnya diketahui bahwa pengetahuan SMS ke

pembangunan menggunakan teknologi pemrosesan informasi "Bahanay Boss!!". Banyak sekali yang

berbunyi sampai kita memasukkan kode PIN dengan benar.Kode PIN yang dipakai adalah kode PIN 4 digit.Jika kode PIN yang dimasukkan benar maka buzzer akan off, kabel koil pada CDI tersambung dan sistem dalam kondisi non aktif.Dalam kondisi ini kita dapat mengoperasikan sepeda motor dengan normal.Untuk mengaktifkan kembali sistem yakni dengan menekan tombol reset.

### 3.2 Perancangan Perangkat Keras (*Hardware*)

Diagram blok alat pengaman sepeda motor dengan handphone yang direncanakan ditunjukkan pada gambar 3-1



Gambar 3-1 Diagram Blok Sistem

Sizion pitanje žadu spon dnešnjeg sastanka plock dnešnjem spon  
tehnički bude časopis 3.1. di 09.02. Dan časopis dnešnjem plock tehnika dnešnja  
dijalogovima tumači da li mazina-mosina plock , spona pina :

### • **Wifisignalotroller AT 8007**

Menzipakon CPU V-GWAN Vodnočačje (WV) da li sistem wifisignalotroller

### • **Diferencija rukni i standardni koncept**

Diferencija žadu časopis dnešnjem tlu u menzijevim tlu spona se početi  
četvrtot stanjanje tlu u menzijevim tlu spona se početi dnešnjem tlu spona

rukni

### • **Ergo**

Pog džinj poljoprivredni spona individualni deševi sistem bezdesvra spona  
akcija tlu u menzijevi spona

### • **Rečnik**

Kaoži džinj poljoprivredni nulači međunarodni vrednjupunkovi spona ke Vladow  
G9V basa CDI spona pano

### • **RS 332**

RS332 džinj poljoprivredni spona autonome komunikacijsi spona spona  
wifisignalotroller dnešnja pano

### • **Fotofiksatori kontroli da li spona**

Hanfotofiksatori džinj poljoprivredni nulači međunarodni vrednjupunkovi  
Savate (SME)

### • **Brojnik**

Brojnik džinj poljoprivredni nulači međunarodni spona spona

- **Keypad**

Dalam pembuatan alat ini digunakan keypad matrik  $3 \times 4$ . Keypad disini berfungsi sebagai inputan PIN untuk menonaktifkan sistem pengaman.

### **3.2.1 Mikrokontroller AT89S51**

#### **3.2.1.1 Mikrokontroller sebagai sistem minimum**

Rangkaian sistem minimum dari mikrokontroller AT89S51 terdiri dari rangkaian clock dan reset. Selain itu juga harus ditentukan penggunaan port-port dan sinyal-sinyal yang digunakan untuk mendukung proses yang akan dilakukan.

Hal itu adalah sebagai berikut :

- **Clock**

Kecepatan proses yang dilakukan oleh mikrokontroler ditentukan oleh sumber *clock* (pewaktu) yang mengendalikan mikrokontroler tersebut. Sistem yang dirancang ini akan menggunakan osilator internal yang sudah tersedia di dalam chip AT89S51. Untuk menentukan frekuensi osilitornya cukup dengan cara menghubungkan kristal pada pin XTAL1 dan XTAL2 serta dua buah kapasitor ke ground. Besar kapasitansinya disesuaikan dengan spesifikasi pada lembar data AT89S51 yaitu 30 pF.

Mikrokontroller AT89S51 mempunyai frekwensi maksimal 12 MHz, dimana 1 siklus mesin = 12 clock. Dalam rangkaian digunakan kristal dengan harga 11,0592 MHz, maka program akan dijalankan pada setiap langkahnya selama  $1,085 \mu\text{s}$ . Siklus tersebut diambil berdasarkan ketentuan mikrokontroller AT89S51 yaitu 12 clock = 1 siklus mesin, sedangkan frekwensi yang digunakan

ପ୍ରକାଶକ

Datenbeispiele siehe im detaillierten Kapitel 3 zu Klassifizierung

perfunctory aspects in upholding PIA rules. The following is a system description.

### 12203TA *yellowmonotaxis* L.S.E.

### **minimum total suspended sediment 1.1.3**

Rahmensysteme müssen mindestens zwei Wirkungsmechanismen aufweisen, um die Anforderungen des ATLAS-Szenarios zu erfüllen.

Spieldaten-Serie ist eine der ersten beiden Spieldaten-Serien, die mit dem Spiel beginnen.

and size-selective feeding on small macrofauna, which are eaten whole.

*Ennemöd leggsdeas duslebs otti laht*

10010 2

Recapitulación sobre las diferencias entre los sistemas de información de la administración pública y las empresas.

an important role in the development of the system. The following sections will discuss the various components of the system.

↳ [View discussion](#) ↳ [View comments](#)

Umar memenuhi tuntutan istimewa orang dewasa agar ATM tidak melepas

such unambiguous criteria based on XATL and XATL<sub>2</sub> seems appropriate.

Possession of long-term residential dwellings positively impacts the quality of life.

Fig. 9E using 12298TA steel material

Mikrokontroller AT89S51 mit 12 MHz

Chlorophyll fluorescence measurements were performed at 25 °C under ambient light conditions.

1950, 11 pagi 1950, 11 pagi

Section 1082 of the Service Improvement Performance Measurement System

Digitized by srujanika@gmail.com on 2019-01-01 12:28:14

12 MHz, maka waktu yang dipakai dalam setiap 1 siklus mesin adalah  $1\mu s$ .

Dengan demikian perhitungannya dapat dilihat sebagai berikut:

$$f = 11,0592 \text{ MHz}$$

$$T = \frac{1}{f}$$

$$T = \frac{1}{11,0592 \times 10^6}$$

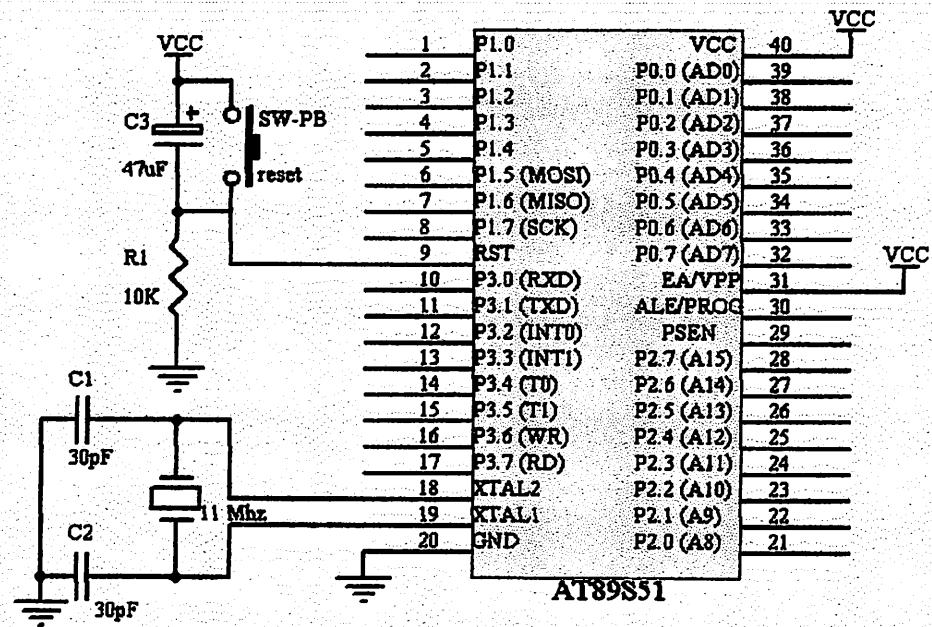
Karena 1 siklus mesin =  $12T$  maka,

$$1 \text{ siklus mesin} = 12 \times \frac{1}{11,0592 \times 10^6} = 1,085 \mu s.$$

- **Reset**

Untuk mereset mikrokontroler, pin RST harus diberi logika tinggi selama sekurangnya dua siklus mesin (24 periode osilator). Untuk membangkitkan sinyal reset pada saat awal catu daya dihidupkan, suatu reset otomatis dapat dilakukan dengan menghubungkan pin RST ke rangkaian *Reset*, seperti dalam Gambar 3-2. Ketika catu daya dinyalakan, rangkaian akan menahan pin RST dalam kondisi logika tinggi selama selang beberapa saat tergantung nilai kapasitor dan kecepatan pengisian muatannya. Pemberian catu daya pada mikrokontroler tanpa suatu sinyal reset dapat menyebabkan CPU memulai eksekusi instruksinya dari lokasi yang tak tertentu. Ini disebabkan karena *Program Counter* tidak terinisialisasi.

Berikut ini adalah gambar rangkaian clock dan reset dalam minimum sistem AT89S51

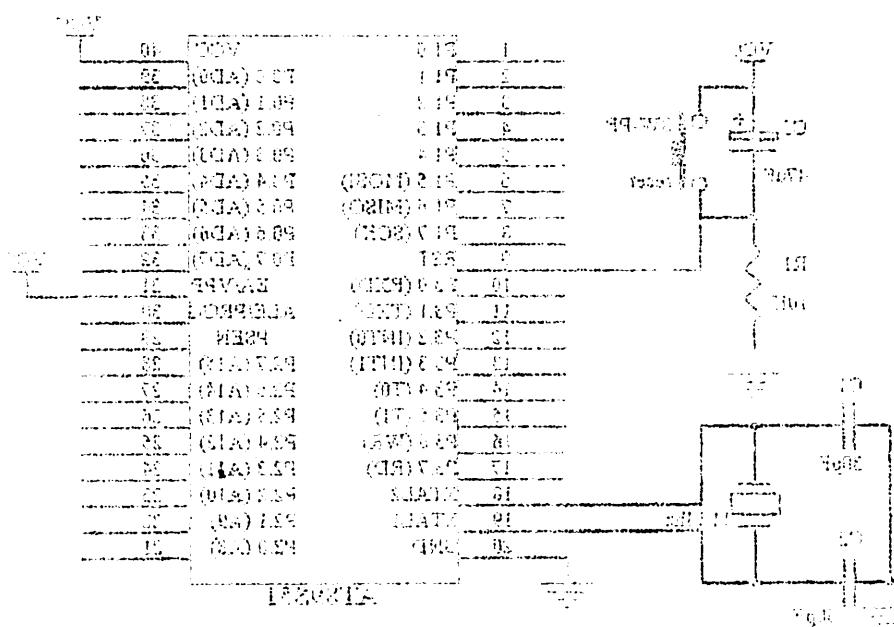


**Gambar 3-2. Rangkaian Clock dan Reset dalam Mikrokontroller AT89S51**

### 3.2.1.2. Perancangan Penggunaan Port-Port Pada Mikrokontoller AT89S51

Pada skripsi ini IC mikrokontroller AT89S51 digunakan sebagai pusat pengendali kerja dari alat yang dibuat karena pada IC inilah akan disimpan program-program (*software*) perintah serta alamat yang akan dituju program. Untuk melaksanakan fungsi tersebut diatas maka perlu dirancang port-port I/O serta sinyal-sinyal yang akan digunakan dengan seksama

Gambar 3-3 menunjukkan rancangan port-port I/O serta sinyal-sinyal pada IC mikrokontroller AT89S51 yang dimanfaatkan pada skripsi ini.



Chapter 3-3: Radialian Clock and Reset during Write operation / A180821

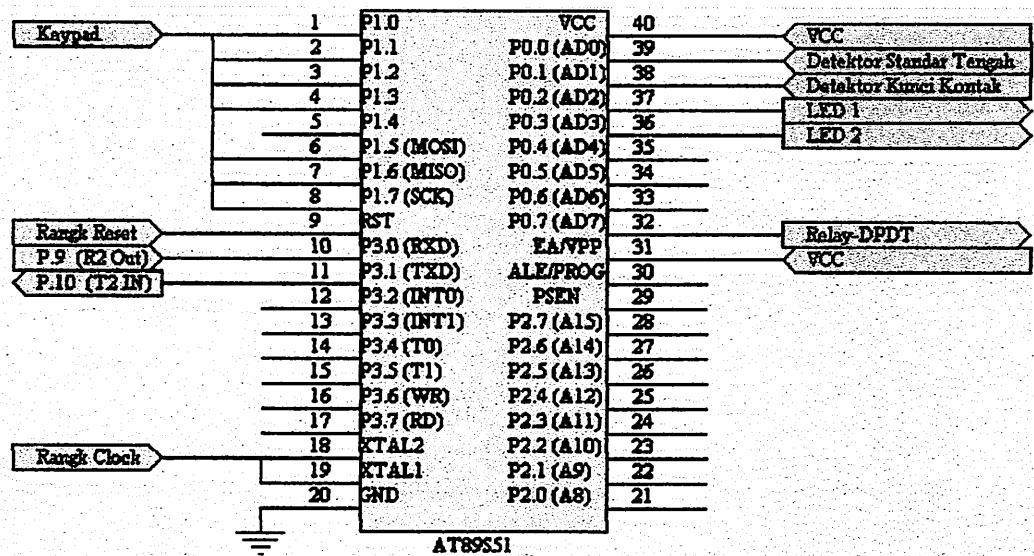
Die Skizze ist die technische Zeichnung eines technischen Produktes.

Однако в то время как в Европе и Америке вспышки гриппа были относительно редкими, в Азии они были гораздо более частыми. В 1918 году в Китае, Японии и Индии произошли масштабные эпидемии гриппа, которые унесли жизни миллиона людей. В результате этого вспышки гриппа стали называться «азиатским гриппом».

среди всех изображений есть пустые ячейки-ячейки с тем

(Gambar 3-3 menunjukkan teknologi ber-pori MO serta strukturnya pada bagian

10. [Wirkungsmechanismus der AT2-Agonisten](#) | [AT2-Agonisten](#) | [AT2-Antagonisten](#)



**Gambar 3-3 Rancangan port-port I/O dan sinyal-sinyal pada AT89S51**

### 3.2.2 Perancangan rangkaian Detektor

Pada pembuatan alat ini digunakan 2 buah detektor yakni detektor kunci kontak dan detektor standar tengah. Untuk detektor standar tengah disini digunakan limit switch.Pada saat normal,dalam artian tidak mendapat tekanan kondisi limit switch ini berlogika high atau “1” dan pada saat mendapat tekanan kondisi limit switch ini adalah low atau “0”

Pada limit switch terdapat 3 buah kaki yaitu kaki Common,NO dan NC.Untuk mendapatkan sinyal high maka kaki common dihubungkan langsung ke VCC dan untuk kaki NO dihubungkan langsung ke mikrokontroller.Untuk lebih jelasnya dapat dilihat pada gambar 3-4

|     |            |        |     |     |
|-----|------------|--------|-----|-----|
| 68  | 100        | 100    | 100 | 100 |
| 69  | (0.1) 0.01 | 1.14   | 2   |     |
| 70  | (0.1) 1.00 | 0.19   | 2   |     |
| 71  | (0.1) 0.00 | 0.19   | 3   |     |
| 72  | (0.1) 0.00 | 0.19   | 2   |     |
| 73  | (0.1) 0.00 | 0.0001 | 0   |     |
| 74  | (0.1) 0.00 | 0.0001 | 0   |     |
| 75  | (0.1) 0.00 | 0.0001 | 0   |     |
| 76  | (0.1) 0.00 | 0.0001 | 0   |     |
| 77  | (0.1) 0.00 | 0.0001 | 0   |     |
| 78  | (0.1) 0.00 | 0.0001 | 0   |     |
| 79  | (0.1) 0.00 | 0.0001 | 0   |     |
| 80  | (0.1) 0.00 | 0.0001 | 0   |     |
| 81  | (0.1) 0.00 | 0.0001 | 0   |     |
| 82  | (0.1) 0.00 | 0.0001 | 0   |     |
| 83  | (0.1) 0.00 | 0.0001 | 0   |     |
| 84  | (0.1) 0.00 | 0.0001 | 0   |     |
| 85  | (0.1) 0.00 | 0.0001 | 0   |     |
| 86  | (0.1) 0.00 | 0.0001 | 0   |     |
| 87  | (0.1) 0.00 | 0.0001 | 0   |     |
| 88  | (0.1) 0.00 | 0.0001 | 0   |     |
| 89  | (0.1) 0.00 | 0.0001 | 0   |     |
| 90  | (0.1) 0.00 | 0.0001 | 0   |     |
| 91  | (0.1) 0.00 | 0.0001 | 0   |     |
| 92  | (0.1) 0.00 | 0.0001 | 0   |     |
| 93  | (0.1) 0.00 | 0.0001 | 0   |     |
| 94  | (0.1) 0.00 | 0.0001 | 0   |     |
| 95  | (0.1) 0.00 | 0.0001 | 0   |     |
| 96  | (0.1) 0.00 | 0.0001 | 0   |     |
| 97  | (0.1) 0.00 | 0.0001 | 0   |     |
| 98  | (0.1) 0.00 | 0.0001 | 0   |     |
| 99  | (0.1) 0.00 | 0.0001 | 0   |     |
| 100 | (0.1) 0.00 | 0.0001 | 0   |     |

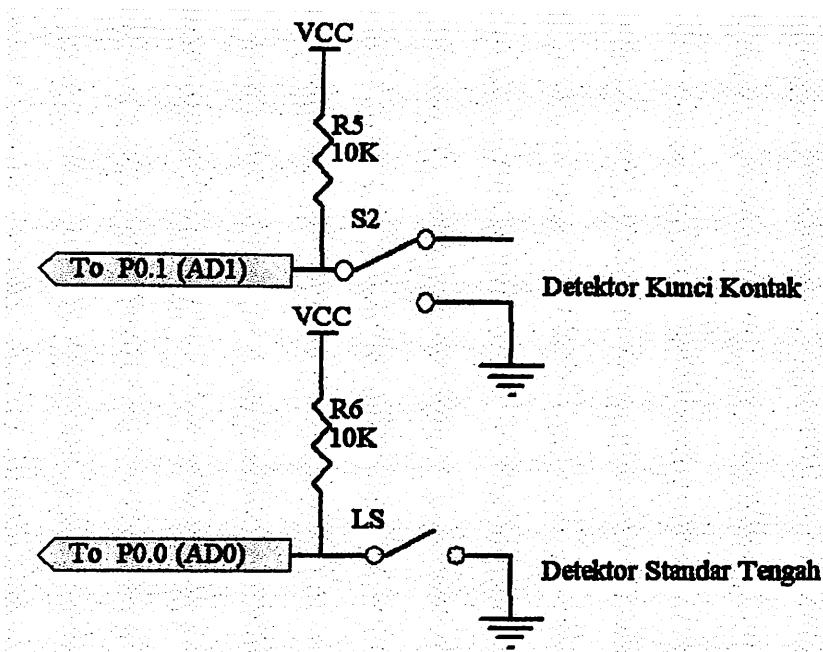
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Приложение к журналу № 10 за 1963 г.

“OK” says the sales manager. “I’m gonna make you a deal.”

ACC da unik Käff MO dippapunkkeja tussisuu ke mikrotkouutolle Unik seppi  
MC luituk mautapäistässä siivä pikkimäki käffä kommo dippapunkkeja tussisuu ke  
Pärsi tunti switseri feldspatti 3 pappi palki aavita käffä Commeni MO den

Է-Ե ԽԵՂԱԳ ՀԵՏԸ ԽՈԼԻ ԽՈՎԵՐԸ ԽՈՎԵՐԸ

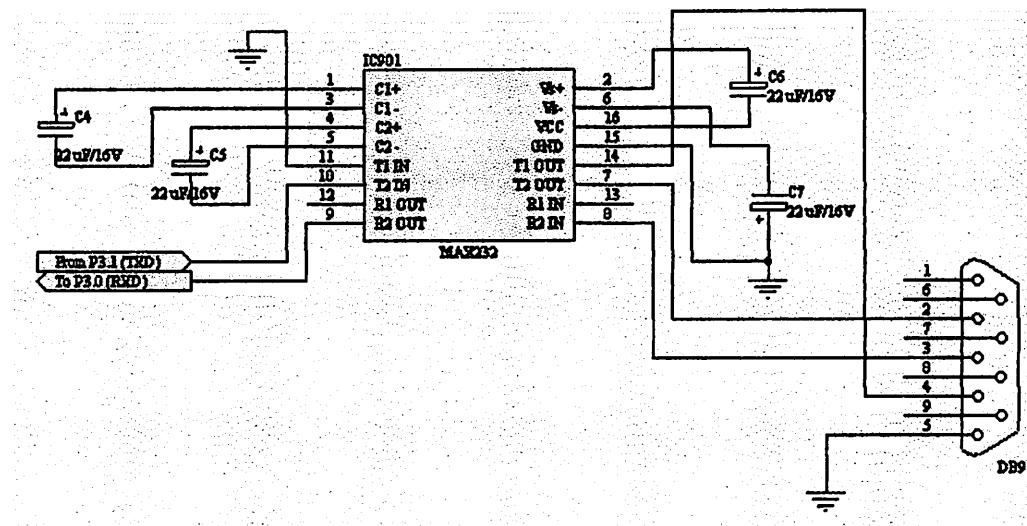


**Gambar 3-4 Rangkaian detektor kunci kontak dan standar tengah**

### 3.2.3 Rangkaian RS 232

Pada perencanaan hubungan antara MCU dengan HP adalah dipergunakan komunikasi data secara serial yaitu port 1 atau yang sering dikenal dengan COM

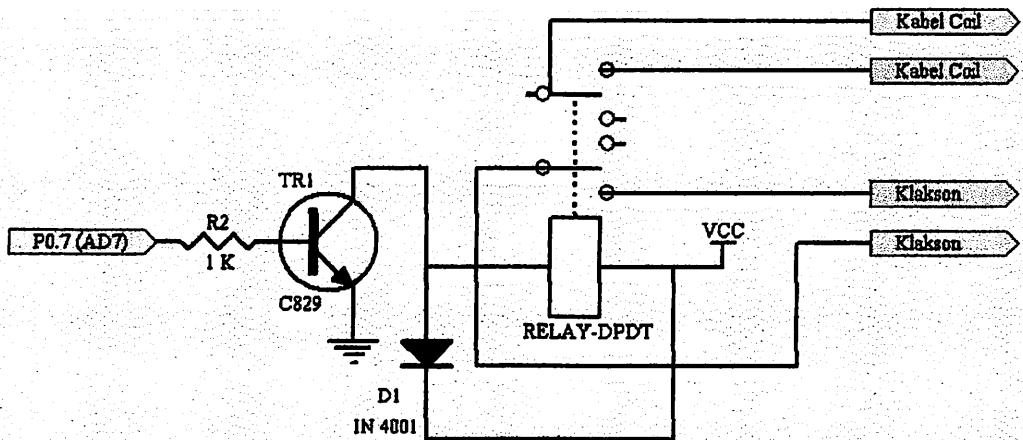
1. Adapun kaki atau pin-pin yang dipakai adalah pin no. 2 DB9 dihubungkan ke pin no 7 IC MAX 232 yang berfungsi untuk sambungan *receive data* ke *handphone*, pin no. 3 DB9 dihubungkan ke pin no 8 MAX 232 untuk sambungan *transmit data* dari *handphone* dan pin no. 5 DB9 untuk *sinyal ground*. Rangkaian interface RS-232 diperlihatkan pada gambar 3-5.



**Gambar 3-5 Rangkaian Interface RS-232**

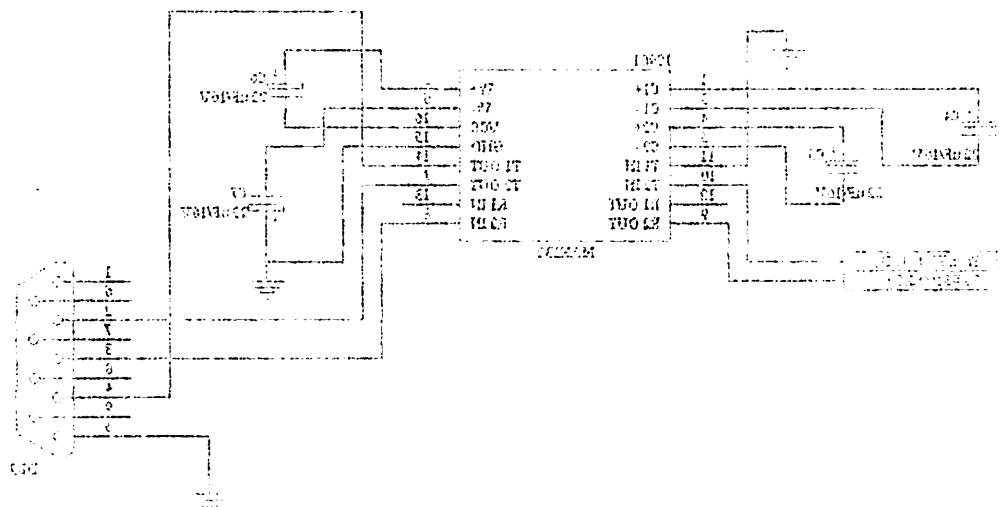
### 3.2.4 Rangkaian Driver Relay

Rangkaian driver relay disini digunakan untuk menghubungkan/memutuskan kabel coil dalam CDI sepeda motor dan buzzer. Rangkaian lengkap driver relay dapat dilihat dalam Gambar 3-6.



**Gambar 3-6 Rangkaian Relay**

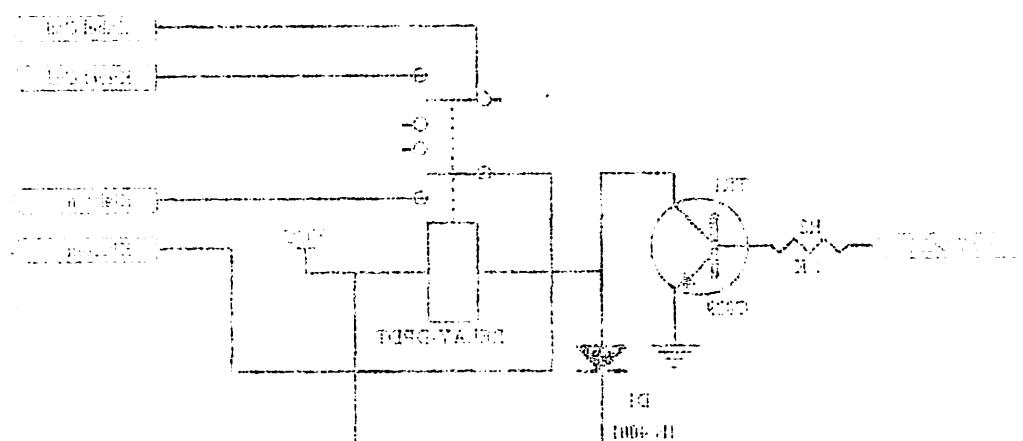
Relay yang digunakan adalah jenis DPDT (*Dual Pin Dual Terminal*) yang mempunyai resistansi sebesar  $50 \Omega$  dan bekerja pada tegangan catu sebesar



Computer-3-2 Rangkaisan Interfacing RS-232

### 3.3.4 Rangkaisan Driver Relay

Rangkaisan driver relay digunakan untuk mengontrol motor DC sebagai motor dan pusar. Rangkaisan tersebut dapat dilihat dalam Gambar 3-9.



Computer-3-2 Rangkaisan Relay

Rangkaisan ini menggunakan relay jenis DPDT (Double Throw Type) yang mempunyai dua posisi sejajar dengan nilai sebesar 50 Ω dan pekerjaan pada frekuensi catu sebesar

+12 volt. Rangkaian ini digerakkan oleh transistor jenis C829 dengan  $\beta$  sebesar 103 dan  $V_{CE}$  dalam keadaan jenuh sebesar 0,2 volt.

Untuk menghindari kerusakan pada transisitor maka dipasang diode yang berfungsi untuk menghubung singkatkan tegangan induksi balik yang terjadi pada saat saklar bergulir ke kondisi OFF.

Besarnya arus  $I_C$  diperoleh dari

$$\begin{aligned} I_C &= \frac{V_{CC} - V_{CE}}{R_{\text{relay}}} \\ &= \frac{12 - 0,2}{50} \\ &= 236mA \end{aligned}$$

dan nilai  $I_B$  dapat dihitung sebagai berikut

$$\begin{aligned} I_B &= \frac{I_C}{\beta} \\ &= \frac{236 \times 10^{-3}}{103} \\ &= 2,29 \cdot 10^{-3} A \end{aligned}$$

Dengan demikian nilai  $R_B$  dapat dihitung

$$\begin{aligned} R_B &= \frac{V_H - V_{BE}}{I_B} \\ &= \frac{2,5 - 0,7}{2,29 \cdot 10^{-3}} \\ &= 786\Omega \end{aligned}$$

Jadi nilai  $R_B$  yang digunakan sebesar  $1 K\Omega$  seperti yang ada di pasaran

+ 15 volt Rangkai ini dibentuk oleh transistor jenis C839 dengan 3 sepasang

$$103 \text{ dan } V_{CE} \text{ adalah ketika } I_{CQ} \text{ sebesar } 0,2 \text{ A}$$

Untuk menghindari kerusakan pada transistor maka dibatasi arus

kehilangan nutrisi melalui sirkuit kembalinya ini dengan nilai yang tetap pada

sebuah sektor perputaran yang konstan QLE

Persamaan atau lohibolong dari

$$\frac{V_{CE} - V_{BE}}{R_L} = i_A$$

$$\frac{5,0 - 0,1}{10} =$$

$$0,49 \text{ A} =$$

Jadi arus yang didapat pada sektor pertama

$$\frac{A}{\alpha} = i_A$$

$$\frac{10 \times 0,49}{103} =$$

$$0,479 \text{ A} =$$

Dengan demikian nilai  $R_L$  dapat dituliskan

$$\frac{V_C - V_B}{I_A} = R_L$$

$$\frac{5,0 - 0,1}{0,479} =$$

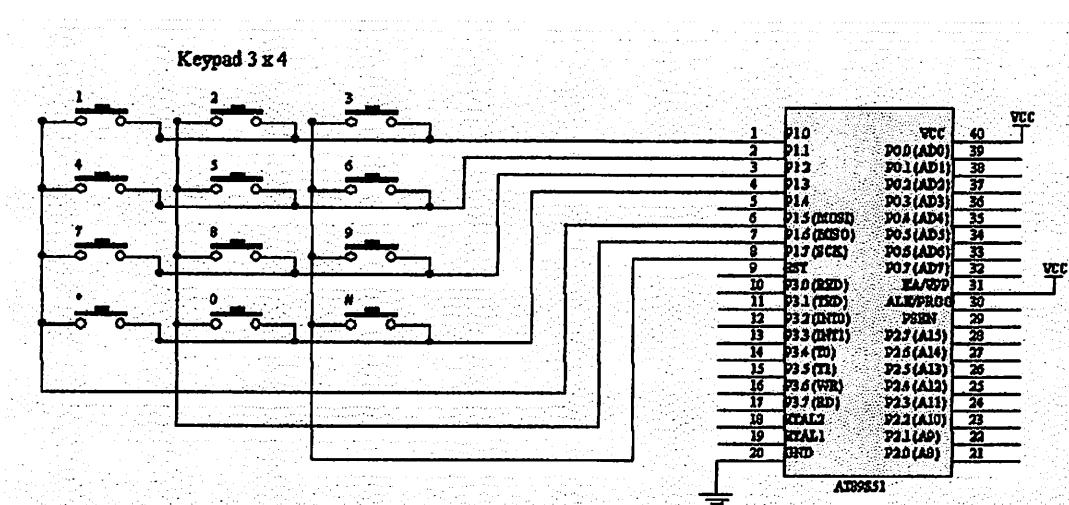
$$10,38 \Omega =$$

Untuk nilai  $R_L$  yang dibutuhkan sepasang 1 KQ sebaiknya ada di bawah

### 3.2.5 Rangkaian Papan Tombol (Keypad)

Papan tombol (keypad) ini digunakan untuk memasukkan data PIN sebelum menggunakan kendaraan bermotor. Untuk menterjemahkan informasi yang diterima dari papan tombol, maka keypad dihubungkan dengan port 1.

Papan tombol tersebut mempunyai matrik 4 baris dan 3 kolom. Deretan baris dan kolom dari papan tombol dihubungkan dengan *port* 1 yang difungsikan sebagai masukan dan keluaran. Deretan kolom dihubungkan dengan *ground* (berlogika 0) dan *port* 1 (P1.6 - P1.8) yang difungsikan sebagai *input* mikrokontroler. Sedangkan deretan baris dihubungkan ke *port* 1 (P1.0 - P1.3) yang telah diberi data 0001 dan secara kontinyu data tersebut bergeser satu bit ke kiri. Pergeseran data satu bit ini dimaksudkan untuk menentukan posisi tombol yang ditekan dalam satu kolom. *Port* ini difungsikan sebagai *output* dari mikrokontroler. Dengan demikian kalau tombol tidak ditekan maka masukan port 1 (P1.6 - P1.8) di pin yang terhubung tombol tersebut berlogika 0 dan bila tombol ditekan akan berlogika 1. Rangkaian papan tombol tersebut dapat dilihat dalam Gambar 3-7.



Gambar 3-7 Rangkaian Keypad

(бакчай) болот язячий пыжаданя 2.5.3

S-Endomorph

Received from Mr. George W. C. Smith

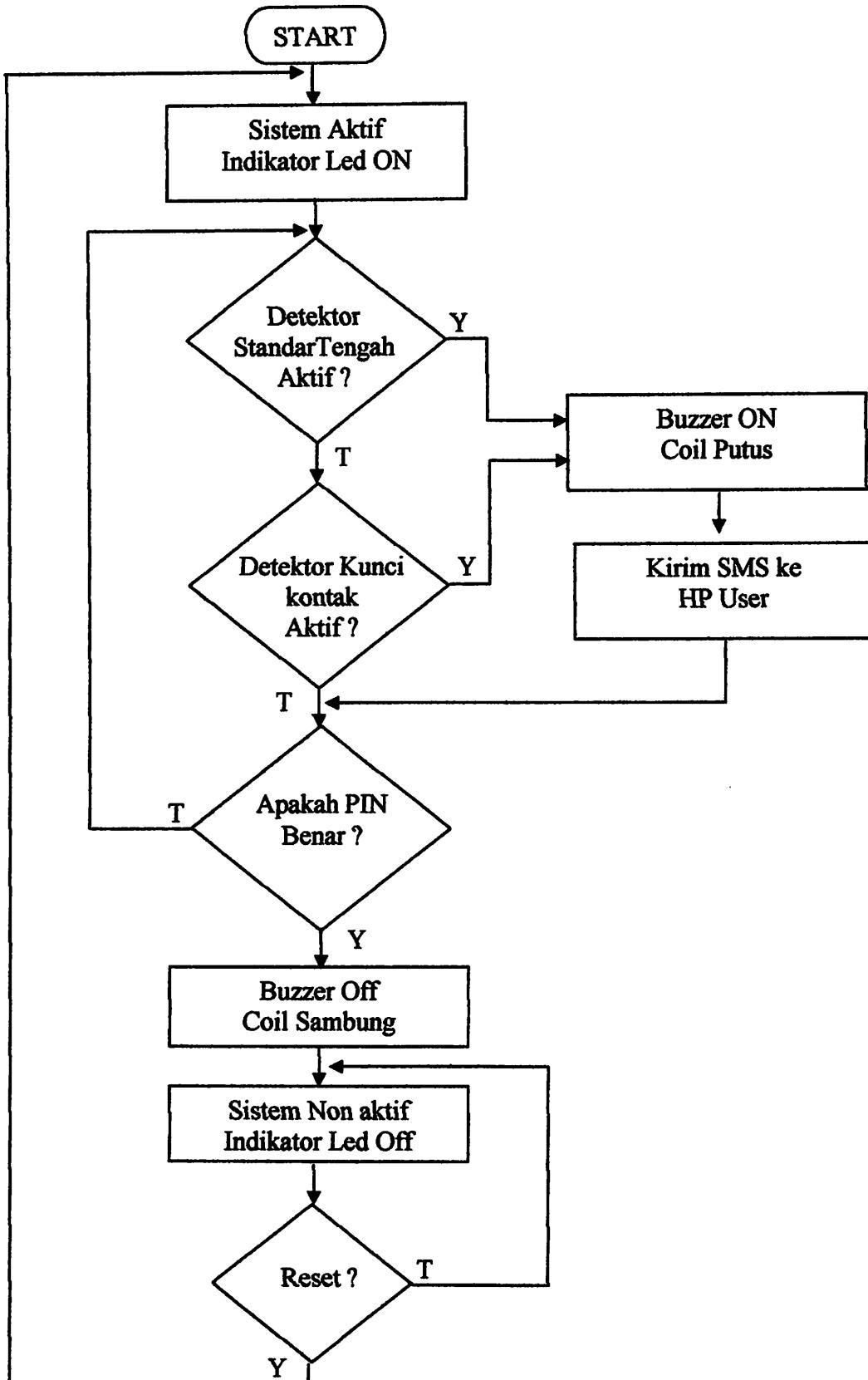
### 3.3. Perancangan Perangkat Lunak

Perangkat lunak ini berdasarkan pengendali utama yaitu mikrokontroller AT89S51. Pembuatan perangkat lunak sistem aplikasi berdasarkan pada semua kejadian yang harus dikerjakan perangkat keras.

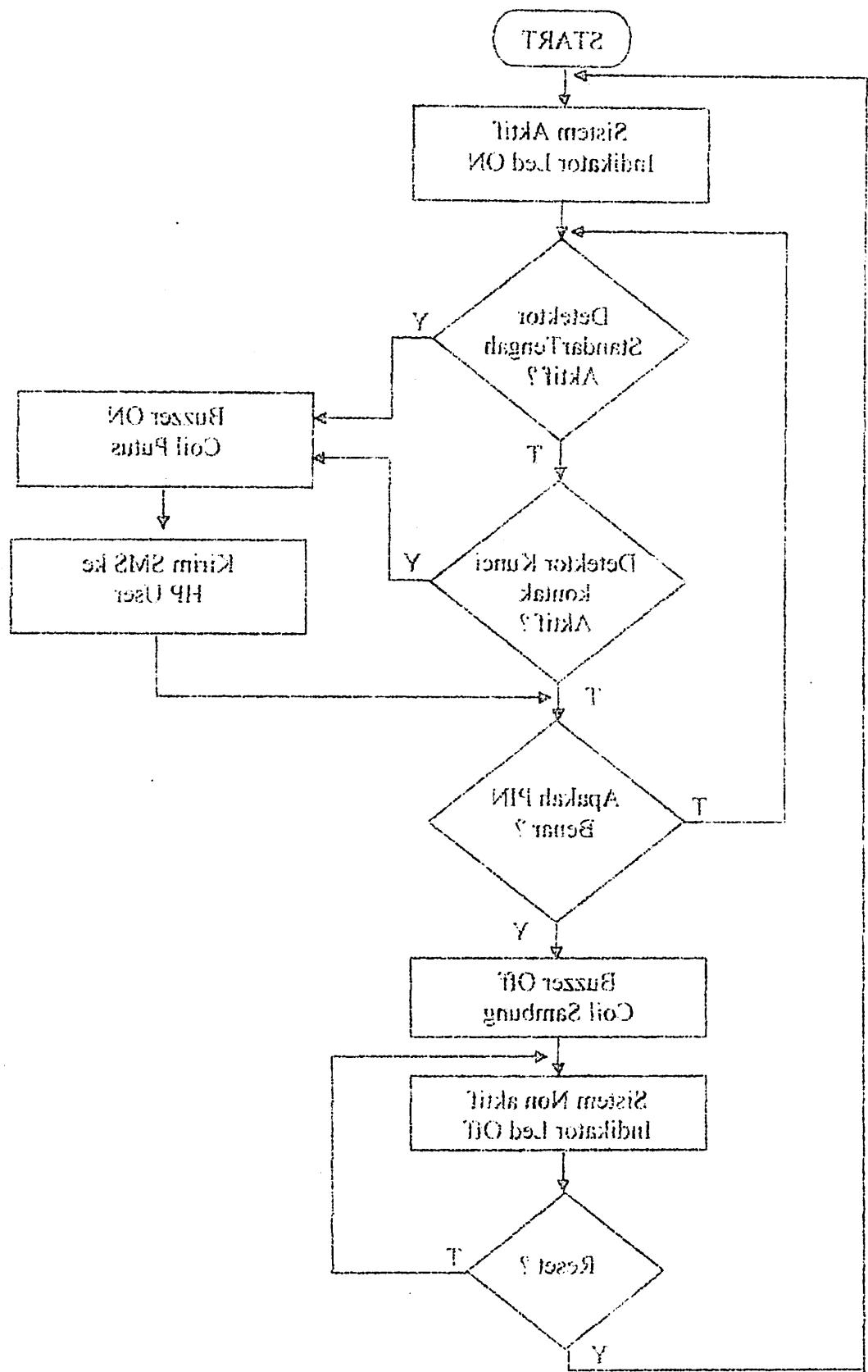
Untuk mikrokontroller AT89S51 bahasa yang digunakan adalah bahasa pemrograman *assembler* MCS-51. Tahap pembuatan perangkat lunak sistem pengaman sepeda motor dengan *handphone* menggunakan mikrokontroller AT89S51 meliputi :

- a. Penulisan kode mnemonic bahasa assembler dengan menggunakan editor teks menjadi file berekstensi H51.
- b. Mengkompilasi file dengan ekstensi H51 menjadi file .OBJ.
- c. Mengkonversi file .OBJ menjadi file .HEX.
- d. Mengubah format file .HEX menjadi file .BIN dengan program HB.
- e. Menghapus (erase) flash memori mikrokontroller AT89S51
- f. Mengisi flash memori dengan program yang tersimpan dalam file BIN.

Secara garis besar, sistem kerja dari perangkat lunak dapat dilihat pada diagram alir seperti Gambar 3.8 di bawah ini:



Gambar 3-8 Flowchart Prinsip Kerja Alat



Gümrük 3-8 Elektronik Piyango Piyango Vaka

## **BAB IV**

### **PENGUJIAN DAN ANALISIS**

#### **4.1 Tujuan**

Bab ini membahas tentang pengujian dan analisis alat yang telah dibuat. Secara umum, pengujian ini bertujuan untuk mengetahui apakah alat yang telah direalisasikan dapat bekerja sesuai dengan spesifikasi perencanaan yang telah ditetapkan. Pengujian alat ini meliputi pengujian perangkat keras dan perangkat lunak. Pengujian dilakukan pada masing-masing blok terlebih dahulu, yang selanjutnya dilakukan pengujian untuk sistem secara keseluruhan. Adapun pengujian terhadap perangkat keras meliputi pengujian terhadap mikrokontroller, RS232, relay, keypad dan detektor.

#### **4.2 Pengujian Sistem Mikrokontroller.**

- Tujuan**

Untuk mengetahui kondisi awal dari mikrokontroler apakah sudah sesuai dengan yang direncanakan

- Prosedur Pengujian**

1. Membuat program yang digunakan dalam pengujian mikrokontroler.

Program yang digunakan dalam pengujian mikrokontroler ini merupakan program sederhana yang meletakkan  $0F_H$  dan  $F0_H$  pada ACC secara bergantian kemudian memindahkannya pada Port 1 AT89S51. Program yang dibuat adalah sebagai berikut :

ORG 0000H

JMP START

WB 21VBL

QBC 0000H

କ୍ଷେତ୍ର ପିଲାମ ଏକାଜ୍ଞାନ କୋରସଟି ଦେଖିବା :

ပြန်လည်သုတေသနမှူးချုပ်မှူးကြောင်းမှာ အမြတ်ဆုံးဖြစ်ပါသည်။

၁၃၂။ မြန်မာနိုင်ငံတွင် အမျိန် ပါရီများကို စေလိုသူများ ပေါ်လဲခဲ့ဖြစ်ပါသည်။

• 1,102,000.00

## զԵՐՑՈՒՅԹ ԱՅԻՆ զԼԱՎԱՐԱՅՑՈՒ

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• 15155

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182535' 151587' 151588' 151589' 151590'

三〇

#### **РЕКОМЕНДУЕМЫЕ КНИГИ**

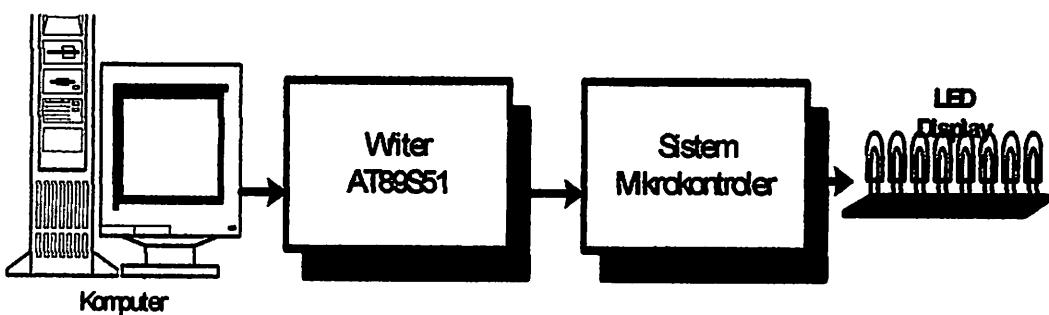
卷之三

```

START:    MOV     A,#0FH
          MOV     P1,A
          CALL    TUNDA
          MOV     A,#F0H
          MOV     P1,A
          JMP     START
TUNDA:   MOV     R3,#0FFH
TUNDA1:  MOV     R2,#0FFH
          DJNZ   R2,$
          MOV     R1,#0FH
          DJNZ   R1,$
          DJNZ   R3,TUNDA1
          RET
END

```

2. Rangkaian dibuat seperti Gambar 4-1.
3. Memasang catu daya rangkaian sebesar 5 Volt DC
4. Download program diatas .
5. Mengamati keluaran pada LED Display .



**Gambar 4-1 Diagram blok Pengujian Mikrokontroler**

```

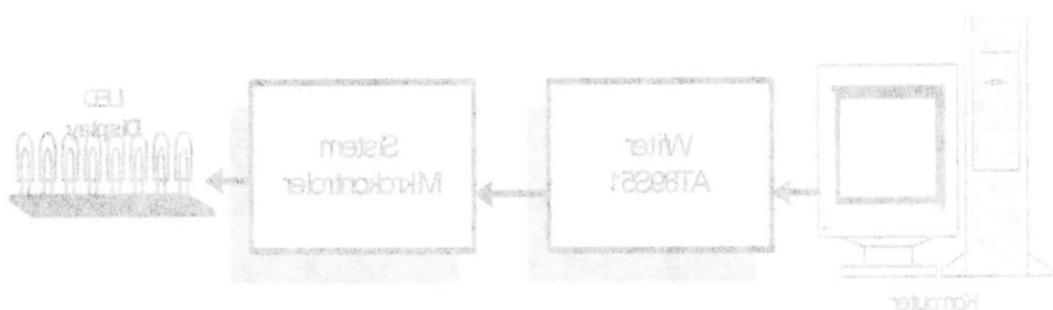
        START    MOV    R3,0FH
        PIA    MOV    R3,0FH
        TUNDY  CALL   R3,TUNDY
        VATH  MOV    R3,VATH
        PIA    MOV    R3,PIA
        TUNDY  JMP    R3,TUNDY
        R3,0FH  MOV    R3,TUNDY
        R3,0FH  MOV    R3,TUNDY
        DNS   R3,DNS
        R12  MOV    R12
        DNS   R12
        R3,TUNDY  DNS
        RET
        END
    
```

5. Rangkuman diagram sebagaimana berikut

6. Menggambarkan diagram dasar implementasi sistem 3 Volt DC

7. Diagram blok sistem printer

8. Menggambarkan kinerjanya bagaimana LFD Display



Gambar 4-1 Diagram perek邦an Pendektran Mikrokontroler

- **Hasil Pengujian**

Hasil pengujian pada sistem mikrokontroller ditunjukkan dalam Tabel 4.1 dibawah ini :

**Tabel 4.1 Hasil Pengujian Sistem Mikrokontroler**

| <b>Kondisi</b> | <b>Keluaran pada LED Display</b> |              |              |              |              |              |              |              |
|----------------|----------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                | <b>Bit 0</b>                     | <b>Bit 1</b> | <b>Bit 2</b> | <b>Bit 3</b> | <b>Bit 4</b> | <b>Bit 5</b> | <b>Bit 6</b> | <b>Bit 7</b> |
| <b>Satu</b>    | 1                                | 1            | 1            | 1            | 0            | 0            | 0            | 0            |
| <b>Dua</b>     | 0                                | 0            | 0            | 0            | 1            | 1            | 1            | 1            |

- **Analisis Pengujian**

Dari hasil pengujian dalam tabel 4-1 dapat dilihat bahwa *port 1* memberikan logika  $0F_H$  dan  $F0_H$  secara bergantian sesuai dengan isi program.

### 4.3 Pengujian Komunikasi Serial

- **Tujuan**

Untuk mengetahui apakah data yang dikirim dari MCU ke *handphone* dapat diterima dengan benar dengan melakukan simulasi pada komputer.

- **Peralatan yang digunakan**

- Komputer
- Sistem mikrokontroller dengan antarmuka RS232.

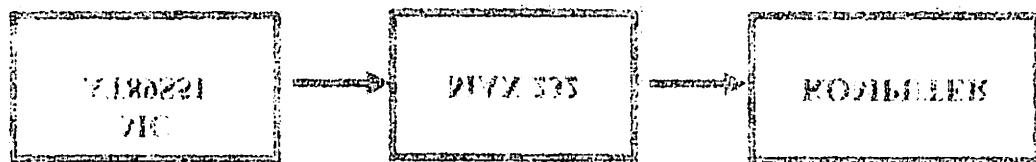
- **Prosedur pengujian**

- Menyusun rangkaian seperti pada Gambar 4-2.
- Membuat program transfer data pada sistem mikrokontroller seperti yang ditunjukkan dalam Gambar 4-3 dan Gambar 4-4. Dengan program tersebut mikrokontroller mengirim data ‘1234567890’ ke komputer.
- Download program dan eksekusi program.
- Mencatat hasil yang terlihat dalam layar komputer.



**Gambar 4-2 Rangkaian Pengujian Transfer Data**

## Слайд 4-5. Канонична модель даних



- **однотипність** (однотипність даних) – властивість, яка полягає у тому, що всі елементи однотипні та мають однакову структуру.
- **відповідність** (відповідність даних) – властивість, яка полягає у тому, що відповідні елементи різних таблиць мають однакову структуру та відповідають один одному.
- **нормальний вид** (нормальний вид даних) – властивість, яка полягає у тому, що відповідні елементи різних таблиць мають однакову структуру та відповідають один одному.
- **канонична модель даних** – властивість, яка полягає у тому, що відповідні елементи різних таблиць мають однакову структуру та відповідають один одному.
- **відношення** (відношення даних) – властивість, яка полягає у тому, що відповідні елементи різних таблиць мають однакову структуру та відповідають один одному.

|          |      |            |
|----------|------|------------|
| B2400    | EQU  | 232        |
| PCON     | EQU  | 87H        |
|          | ORG  | 0000H      |
|          | JMP  | MULAI      |
|          | ORG  | 0023H      |
| SERIAL:  | JBC  | TI,OUT232  |
|          | PUSH | ACC        |
|          | MOV  | A, SBUF    |
|          | MOV  | SBUF, A    |
|          | POP  | ACC        |
| OUT232:  | CLR  | TI         |
|          | CLR  | RI         |
|          | RETI |            |
| INIT232: | MOV  | TH1,#B1200 |
|          | MOV  | TMOD,#22H  |
|          | ANL  | PCON,#7FH  |
|          | MOV  | SCON,#50H  |
|          | SETB | PS         |
|          | SETB | ES         |
|          | SETB | TR1        |
|          | SETB | EA         |
|          | CALL | DELAY      |
|          | RET  |            |
| MULAI:   | CALL | INIT232    |
|          | SJMP | \$         |

**Gambar 4-3 Program Uji Komunikasi Data di Mikrokontroler**

‘ Cuplikan program uji komunikasi data di komputer menggunakan program VB 6.0

MSComm1.Output = ‘1234567890’

Text1.Text = MSComm1.Input

**Gambar 4-4 Program Uji Komunikasi Data di Komputer**

- **Hasil Pengujian**

Hasil pengujian transfer data serial ini ditunjukkan Tabel 4.2 dibawah ini :

**Tabel 4.2 Hasil Pengujian Transfer Data Serial**

| Data yang dikirim mikrokontroller | Data yang diterima komputer |
|-----------------------------------|-----------------------------|
| 1234567890                        | 1234567890                  |

- **Analisis Hasil Pengujian**

Hasil pengujian dalam Tabel 4.2 menunjukkan bahwa proses pengiriman data serial dengan menggunakan RS 232 ke alat telah benar.

#### 4.4. Pengujian Rangkaian Relay

- **Tujuan**

Mengetahui unjuk kerja relay pada saat dioperasikan yang difungsikan untuk menghubungkan/memutuskan saluran listrik pada CDI dan buzzer.

Relay yang digunakan adalah relay DPDT (*dual pin dual terminal*) sehingga terdapat dua keluaran yaitu NC (*normally close*) dan NO (*normally open*) yang perlu diuji.

- **Peralatan yang digunakan**

- *Logic probe* model LP-3500
- Catu daya 12V DC
- Catu daya 5V DC

## • **Hassil Pneumatic**

Hassil pneumaticus es un fabricante de soler en el que se fabrican Tapas de soler.

### **Tapa 43 Hassil Pneumaticus Tapa de soler Dura Sólida**

| Dura, dura y dura combinación | Dura y dura combinación | Dura, dura y dura combinación |
|-------------------------------|-------------------------|-------------------------------|
| 1234567890                    | 1234567890              | 1234567890                    |

## • **Auténtica Hassil Pneumatic**

Hassil Pneumaticus es un fabricante de soler en el que se fabrican Tapas de soler.

Este modelo de soler tiene una duración de hasta 10 años.

## • **44 Pneumatico Rendimiento Real**

### **Tapa**

Wongespoliun nulip keliu teku bala saat dikelesepuun yang dilengsengun  
 muncul wongespoliun nulip keliu teku bala saat dikelesepuun yang dilengsengun  
 Kekal yang dilengsengun bala bala loyak DPT (dapat di gunakan)  
 sepihan terdepan dia kelesepuun kaitu NC (motorcycle) dan MC  
 (motorcycle) yang bechi diri

## • **Potencia y uso ilimitado**

O Varios tipos de motores EL-3500

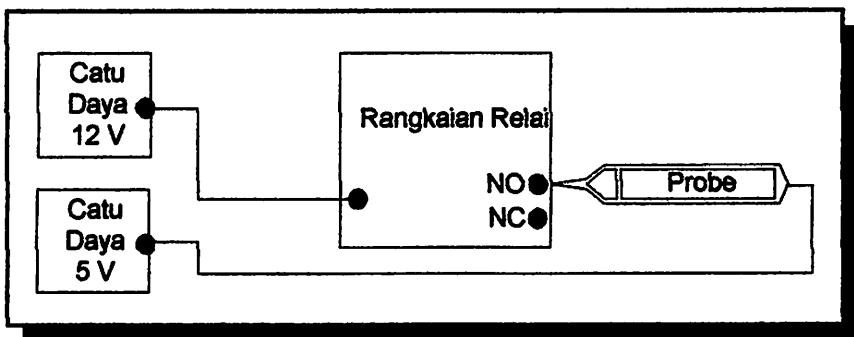
O Cada día 15A DC

O Cada día 5A DC

- **Prosedur pengujian**

- Menghubungkan catu daya pada rangkaian relay.
- Menghubungkan *common* relay dengan kutub positif catu daya.
- Mengaktifkan catu daya dan memicu rangkaian relay.
- Mengamati perubahan indikator *logic probe* saat *logic probe* dihubungkan pada keluaran *normally close* dan *normally open* rangkaian sebelum dan sesudah pemicuan.

Rangkaian pengujian relay ditunjukkan dalam Gambar 4-5.



**Gambar 4-5 Rangkaian Pengujian Relay**

- **Hasil pengujian dan analisis**

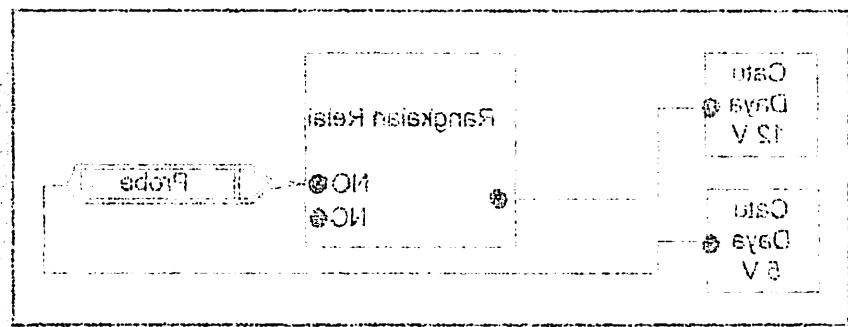
Hasil pengujian rangkaian relay ditunjukkan dalam Tabel 4.3

**Tabel 4.3 Hasil pengujian Rangkaian Relay**

| <b>Keluaran</b>            | <b>Indikator <i>Logic Probe</i></b> |                         |
|----------------------------|-------------------------------------|-------------------------|
|                            | <b>Sebelum Pemicuan</b>             | <b>Sesudah Pemicuan</b> |
| <i>Normally Open (NO)</i>  | Hijau (rendah)                      | Merah (tinggi)          |
| <i>Normally Close (NC)</i> | Merah (tinggi)                      | Hijau (rendah)          |

- |   |  |
|---|--|
| 0 | Wiederholungsaufgabe mit dem gleichen Bande und gleicher Testaufgabe     |
| 0 | Wiederholungsaufgabe mit einem anderen Lernzettel der gleichen Kategorie |
| 0 | Wiederholungsaufgabe mit einem anderen Lernzettel derselben Kategorie    |
| 0 | Wiederholungsaufgabe mit dem gleichen Bande und gleicher Testaufgabe     |
| 0 | Wiederholungsaufgabe mit dem gleichen Bande und gleicher Testaufgabe     |

Раньше я не знал, что такое любовь. А сейчас я ее знаю.



#### **Chapitre 4 - Réalisation fondamentale**

zirkus und antikriegslied 3

Half-bound leather bookplate label with gold-tooled lettering.

U.S. Patent and Trademark Office

| Preparation<br>of<br>Sedimentation<br>Papers | Preparation<br>of<br>Sedimentation<br>Papers | Preparation<br>of<br>Sedimentation<br>Papers |
|--|--|--|
| (egg) (100g)<br>(debris)                     | Hijau (100g)<br>Yellow (100g)                | (OK) (yes) (NO)<br>/ / / / / / / / / /       |
| (egg) (100g)<br>(debris)                     | Yellow (100g)<br>Hijau (100g)                | (OK) (yes) (NO)<br>/ / / / / / / / / /       |

Berdasarkan hasil pengujian relay, maka dapat diambil kesimpulan bahwa pada saat terjadinya pemicuan, arus kolektor ( $I_C$ ) pada transistor akan mengalir menuju *ground*. Pada keadaan *Normally Open* sebelum terjadinya pemicuan *common* tidak terhubung dengan keluaran, sedangkan pada keadaan *Normally Close common* terhubung dengan keluaran sebelum terjadinya pemicuan.

#### 4.5 Pengujian Rangkaian Keypad

- **Tujuan**

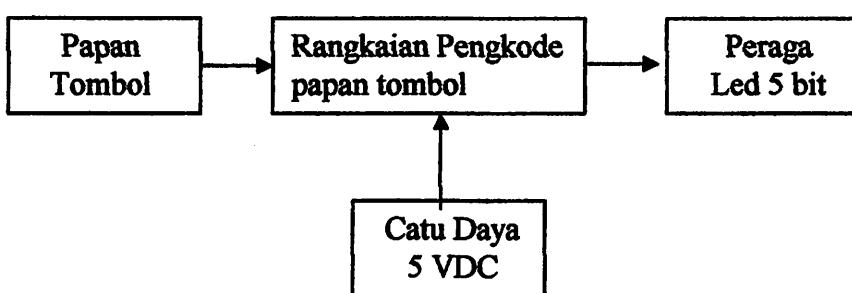
Untuk mengetahui apakah rangkaian ini dapat mengkodekan tombol-tombol input keypad yang ditekan menjadi data 4 bit yang bersesuaian

- **Peralatan yang digunakan**

- Papan Tombol (keypad 3x4)
- Rangkaian pengkode keypad
- Peraga led 5 bit
- Catu daya 5 Volt DC

- **Prosedur Pengujian**

1. Peralatan dirangkai seperti pada gambar 4-6
2. Menekan tombol pada papan tombol,mengamati dan mencatat keluaran yang ditampilkan ke peraga led 5 bit



**Gambar 4-6 Diagram blok pengujian pengkode papan tombol (keypad)**

- **Hasil pengujian dan analisis**

Hasil pengujian dan pengamatan rangkaian keypad ditunjukkan dalam tabel 4-4

**Tabel 4-4 Hasil pengujian pengkode papan tombol (keypad)**

| Tombol | L <sub>4</sub> | L <sub>3</sub> | L <sub>2</sub> | L <sub>1</sub> | L <sub>0</sub> |
|--------|----------------|----------------|----------------|----------------|----------------|
| 0      | 1              | 0              | 0              | 0              | 0              |
| 1      | 1              | 0              | 0              | 0              | 1              |
| 2      | 1              | 0              | 0              | 1              | 0              |
| 3      | 1              | 0              | 0              | 1              | 1              |
| 4      | 1              | 0              | 1              | 0              | 0              |
| 5      | 1              | 0              | 1              | 0              | 1              |
| 6      | 1              | 0              | 1              | 1              | 0              |
| 7      | 1              | 0              | 1              | 1              | 1              |
| 8      | 1              | 1              | 0              | 0              | 0              |
| 9      | 1              | 1              | 0              | 0              | 1              |
| *      | 1              | 1              | 0              | 1              | 0              |
| #      | 1              | 1              | 0              | 1              | 1              |

Berdasarkan hasil pengujian dapat dilihat bahwa L<sub>4</sub> yang dihubungkan ke pin *data available* berlogika high (ON) jika ada tombol ditekan, sedangkan L<sub>3</sub>-L<sub>0</sub> menunjukkan data keluaran yang dihasilkan. Dengan demikian maka rangkaian pengkode papan tombol dapat bekerja dengan baik sesuai perencanaan.

## 4.6. Pengujian Rangkaian Detektor

### 4.6.1 Pengujian Rangkaian limit switch.

- **Tujuan**

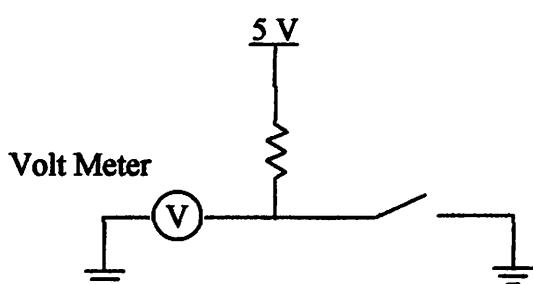
Untuk Mengetahui apakah rangkaian limit switch bekerja dengan baik dan mampu mengkondisikan keluarannya menjadi dua kondisi yakni High dan Low.

- **Peralatan yang digunakan**

1. *Multimeter digital DT-830B*
2. Catu daya 5V DC
3. Rangkaian limit switch yang telah dirancang.

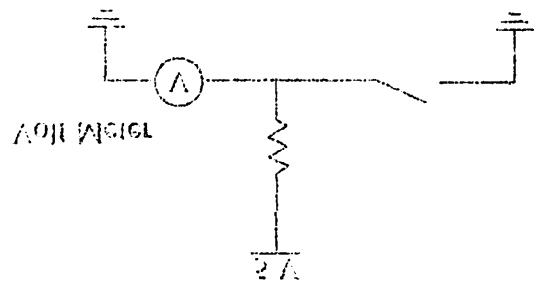
- **Prosedur Pengujian**

1. Membuat dan merangkai rangkaian limit switch sesuai yang telah dirancang .
2. Menghubungkan rangkaian dengan catu daya sebesar 5 volt DC.
3. Mengukur besarnya tegangan dengan menggunakan multimeter pada keluaran rangkaian limit switch.
4. Pengujian rangkaian limit switch dilakukan sesuai dengan gambar 4-7 berikut ini;



**Gambar 4-7. Pengujian Rangkaian Limit Switch**

Сырал түк өңөнүнүн көмүкүнүн гүйд үзүүр



POLYKETONE WIT

- ፩-፪ የሚከተሉት ትናስስ ነው፡፡ ይህንን ማረጋገጫውን የሚከተሉት ትናስስ ነው፡፡

7. Աշխարհագործության բառերայի զանցին պատճեն պահպան է առ 1971 թվականի դեկտեմբերի 2-ին:

ก.๑๖๘

## ๙ คลังคณิตศาสตร์

၃၁။ အကျဉ်းချုပ်မှု ပေါ်လောင် လေဆိပ် မြတ်များ ပေါ်လောင်

5. СЕРИЯ 2A DC

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## • Kollegium und Organigramm

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Однак Місцебудівні відомості засвідчують, що відсутність розподілу земельного фонду між сім'ями виникла внаслідок дії земельної політики, яка була встановлена відповідно до земельної реформи 1991 року.

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14.1. **Geometric mean**

Т.Р. — КОМПОЗИЦИЯ КУЛЬТУРЫ ДЕСЯТОЙ



**Gambar 4-8. Pengujian Rangkaian Limit Switch Saat Tidak Ditekan**



**Gambar 4-9. Pengujian Rangkaian Limit Switch Saat Tertekan**

- **Hasil pengujian dan analisis**

**Tabel 4- 5 Hasil Pengukuran Tegangan Output Pada  
Rangkaian limit switch**

| Posisi Limit Switch | Pengukuran (volt) |      |      |      |      | Rata - rata |
|---------------------|-------------------|------|------|------|------|-------------|
|                     | 1                 | 2    | 3    | 4    | 5    |             |
| Tidak ditekan       | 4.85              | 4.86 | 4.85 | 4.85 | 4.88 | 4.858       |
| Ditekan             | 0.36              | 0.38 | 0.36 | 0.37 | 0.39 | 0.372       |

Dari hasil pengukuran dapat dianalisa besarnya tegangan keluaran pada limit switch tersebut.

$$I = \frac{V_{CC}}{R} = \frac{5}{10 \cdot 10^3} = 0.0005A = 5 \text{ mA}$$



(Caption 4-8) Pengaruh Jumlah Sample terhadap Kesalahan Rata-rata



(Caption 4-9) Pengaruh Jumlah Sample terhadap Standar Deviasi

Hanya berpengaruh pada jumlah

#### Jumlah Sampel dan Tingkat Kepercayaan pada Tingkat Kesalahan

##### Kesalahan limit sample

| Kesesuaian - kriteria | Pengukuran (unit) | Porsi Limit Sample |      |      |      |      |
|-----------------------|-------------------|--------------------|------|------|------|------|
|                       |                   | 1                  | 2    | 3    | 4    | 5    |
| Jumlah sampel         | 482               | 480                | 482  | 482  | 482  | 4838 |
| Difisipasi            | 0.39              | 0.38               | 0.38 | 0.37 | 0.36 | 0.35 |

Dari hasil pengukuran dapat disimpulkan persamaan sebagai berikut

statistik tersebut

$$\text{Atas } \bar{x} = A \bar{x} 000,0 = \frac{\bar{x}}{R} = \frac{A}{R} = 1$$

pada saat limit switch ditekan maka tegangan keluaran yang dihasilkan menggunakan persamaan sebagai berikut ;

$$V_{out} = \text{Ground} = 0 \text{ Volt}$$

pada saat limit switch tidak ditekan maka tegangan keluaran yang dihasilkan menggunakan persamaan sebagai berikut ;

$$V_{out} = I \times R$$

$$= 0,5 \cdot 10^{-3} \times 10 \cdot 10^3 = 5 \text{ Volt}$$

Dari data diatas didapat simpangan relatif tiap – tiap data dengan menggunakan persamaan dibawah ini ;

$$\% \text{ Error} = \frac{\text{Pengukuran} - \text{Perhitungan}}{\text{Perhitungan}} \times 100\%$$

$$\% \text{ Error} = \frac{4,858 - 5}{5} \times 100\% = 2,84\%$$

sedangkan untuk mencari ketelitiannya digunakan rumus sebagai berikut ;

$$\% \text{ Ketelitian} = 100 \% - \% \text{ Error}$$

$$= 100 \% - 2,84 \%$$

$$= 97,16 \%$$

**Tabel 4-6. Perbandingan Antara Pengukuran dan Perhitungan Tegangan**

**Output Pada Rangkaian Limit Switch**

| Perhitungan<br>(Volt) |       | Rata – rata<br>Pengukuran<br>(Volt) |       | Error (%) |       | Ketelitian (%) |       |
|-----------------------|-------|-------------------------------------|-------|-----------|-------|----------------|-------|
| Ditekan               | Tidak | Ditekan                             | Tidak | Ditekan   | Tidak | Ditekan        | Tidak |
| 0                     | 5     | 0.372                               | 4.858 | -         | 2.84  | -              | 97.16 |

#### 4.6.2 Pengujian Rangkaian Detektor Kunci kontak

- **Tujuan**

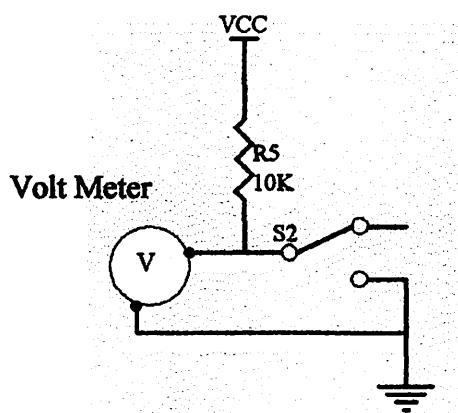
Untuk Mengetahui apakah rangkaian detektor kunci kontak dapat bekerja dengan baik dan mampu mengkondisikan keluarannya menjadi dua kondisi High dan Low.

- **Peralatan yang digunakan**

1. *Multimeter digital DT-830B*
2. Catu daya 5V DC
3. Rangkaian detektor kunci kontak yang telah dirancang.

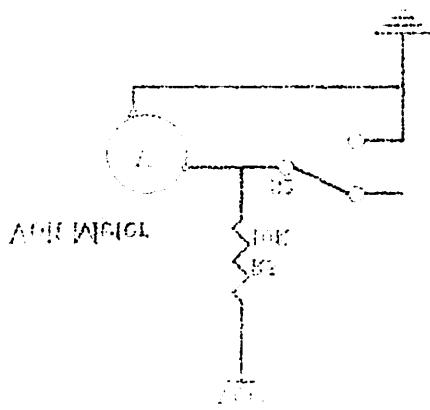
- **Prosedur Pengujian**

1. Membuat dan merangkai rangkaian detektor kunci kontak sesuai yang telah dirancang .
2. Menghubungkan rangkaian dengan catu daya sebesar 5 volt DC.
3. Mengukur besarnya tegangan dengan menggunakan multimeter pada keluaran rangkaian detektor kunci kontak.
4. Pengujian dilakukan sesuai dengan gambar 4-10 berikut ini;



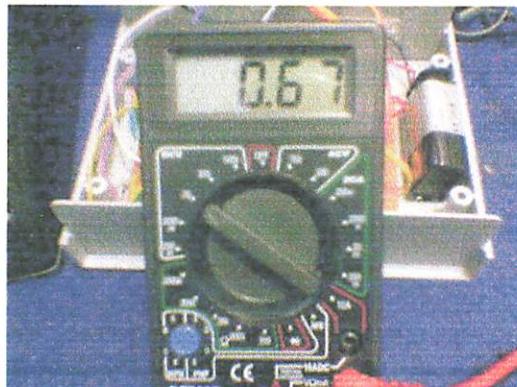
**Gambar 4-10. Rangkaian Pengujian Detektor kunci kontak**

Символ +10° լրացքին բռնիւթյուն քայլու սահմանը





**Gambar 4-11. Pengujian Rangkaian Detektor Kunci Kontak saat posisi kontak OFF**



**Gambar 4-12. Pengujian Rangkaian Detektor Kunci Kontak saat posisi kontak ON**

- **Hasil pengujian dan analisis**

**Tabel 4-7. Hasil Pengukuran Tegangan Output Pada Rangkaian detektor kunci kontak**

| <b>Posisi</b> | <b>Pengukuran (volt)</b> |      |      |      |      | <b>Rata - rata</b> |
|---------------|--------------------------|------|------|------|------|--------------------|
|               | 1                        | 2    | 3    | 4    | 5    |                    |
| OFF           | 4.95                     | 4.88 | 4.90 | 4.93 | 4.95 | 4.922              |
| ON            | 0.55                     | 0.67 | 0.62 | 0.63 | 0.67 | 0.628              |

Dari hasil pengukuran dapat dianalisa besarnya tegangan keluaran pada sensor kunci kontak tersebut

$$I = \frac{V_{CC}}{R} = \frac{5}{10 \cdot 10^3} = 0.0005A = 5 \text{ mA}$$

pada saat kunci kontak diONkan maka tegangan keluaran yang dihasilkan menggunakan persamaan sebagai berikut ;

$$V_{out} = \text{Ground} = 0 \text{ Volt}$$

pada saat kunci kontak diOFFkan maka tegangan keluaran yang dihasilkan menggunakan persamaan sebagai berikut ;

$$V_{out} = I \times R$$

$$= 0,5 \cdot 10^{-3} \times 10 \cdot 10^3 = 5 \text{ Volt}$$

dari data diatas didapat simpangan relatif tiap – tiap data dengan menggunakan persamaan dibawah ini ;

$$\% \text{ Error} = \frac{\text{Pengukuran} - \text{Perhitungan}}{\text{Perhitungan}} \times 100\%$$

$$\% \text{ Error} = \frac{4,922 - 5}{5} \times 100\% = 1,56\%$$

sedangkan untuk mencari ketelitiannya digunakan rumus sebagai berikut ;

$$\% \text{ Ketelitian} = 100 \% - \% \text{ Error}$$

$$= 100 \% - 1,56 \%$$

$$= 98,44 \%$$

**Tabel 4-8. Perbandingan Antara Pengukuran dan Perhitungan Tegangan**

**Output Pada Rangkaian kunci kontak**

| Perhitungan<br>(Volt) |     | Rata – rata<br>Pengukuran<br>(Volt) |       | Error (%) |      | Ketelitian (%) |       |
|-----------------------|-----|-------------------------------------|-------|-----------|------|----------------|-------|
| ON                    | OFF | ON                                  | OFF   | ON        | OFF  | ON             | OFF   |
| 0                     | 5   | 0,628                               | 4,922 | -         | 1,56 | -              | 98,44 |

#### 4.7 Pengujian Sistem Secara Keseluruhan

- **Petunjuk Pengoperasian alat**

Sebelum pengoperasian alat dilakukan, harus dipastikan bahwa semua hubungan ke sepeda motor sudah terpasang. Adapun prosedur pemasangannya adalah sebagai berikut :

- Kabel arus ke *ignition coil* dipotong dan dihubungkan ke relay pada bagian keluarannya (pada alat ini menggunakan kabel warna biru dan hijau)
- Driver kunci kontak dipasang pada keluaran kunci kontak yaitu kabel positif (merah) yang menuju kelistrikan sepeda motor dan kabel negatif (hitam) dihubungkan ke ground.
- Limit switch dipasang pada standar tengah yang sebelumnya dimodifikasi dahulu penempatan letaknya.
- Klakson atau buzzer dihubungkan ke relay pada bagian keluarannya dan catu dayanya diambilkan dari accu dengan tegangan 12 Volt DC
- Menghubungkan catu daya ke accu sepeda motor yang sebelumnya dipasang regulator 5 Volt DC

DC 100 V 2 total 5000000



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|                 |               |             |           |                 |      |    |       |
|-----------------|---------------|-------------|-----------|-----------------|------|----|-------|
| 0               | 2             | 0.038       | +0.5      | -               | 1.20 | -  | 0.474 |
| ON              | OFF           | ON          | OFF       | ON              | OFF  | ON | OFF   |
| (A)             | (B)           | Measurement | Value (%) | Calibration (%) |      |    |       |
| Current reading | Current - Off |             |           |                 |      |    |       |

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196 | ՀԱՅԱՍՏԱՆԻ ԿՈՎԱՆ ՔԱՐՏՈՒԹՅԱՆ ԳՈՅ ՔԱՐԳՈՒԹՅԱՆ ԼԵՇՈՒԹՅՈՒՆ

- Pengujian alat pengaman sepeda motor**

Untuk pengujian alat pengaman ini dapat dilakukan dengan langkah-langkah sebagai berikut :

- Memutar kunci kontak ke posisi ON pada saat alat pengaman aktif.
- Menutup standar tengah keatas sampai menyentuh limit switch pada saat alat pengaman aktif.
- Memberikan inputan kode PIN dengan benar maupun yang salah.

- Hasil pengujian dan analisa**

Dari hasil pengujian diatas dapat ditunjukkan dalam tabel 4-9 berikut :

**Tabel 4-9 Hasil pengujian sistem secara keseluruhan**

| No | Kondisi Pengujian              | Klakson /<br>Buzzer | CDI       | Handphone |
|----|--------------------------------|---------------------|-----------|-----------|
| 1  | Kunci kontak ON                | ON                  | Terputus  | Kirim SMS |
| 2  | Sensor standar<br>tengah aktif | ON                  | Terputus  | Kirim SMS |
| 3  | Inputan PIN Salah              | ON                  | Terputus  | -         |
| 4  | Inputan PIN Benar              | OFF                 | Terhubung | -         |

Setelah melakukan 5 kali pengujian sistem secara keseluruhan ternyata tidak ditemukan error,namun kecepatan pengiriman dan penerimaan sms tetap dipengaruhi oleh kondisi jaringan operator selular yang digunakan.Jadi dapat disimpulkan bahwa alat pengaman ini dapat bekerja dengan baik sesuai dengan perencanaan dan dapat diaplikasikan ke sepeda motor.

գիտական բարեւ ելու խոհանոս ու զարդ քաշու զաման թակ տօսու զաման  
գիտական ուժը խոհանու օւստու տօսու զաման կամ գիտական լրաց զարդ

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|   |                |     |          |               |
|---|----------------|-----|----------|---------------|
| + | honesty        | OE  | superior | -             |
| + | deceit         | NO  | superior | -             |
|   | take advantage |     |          |               |
| + | robustness     | NO  | superior | SMS min       |
| + | NO risk taking | NO  | superior | SMS min       |
|   |                |     |          |               |
| + | passivity      | CDI | superior | ambidexterity |
| + | boldness       |     |          |               |

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- #### • ចុះរបាយការណ៍សាលាអាស់បាត់

၁၂။ မြန်မာနိုင်ငံ၏ ပြည်တော်မြို့၏ အမြန် လျှပ်စီး ပေါ်လောက်မှု ဆောင်ရွက်

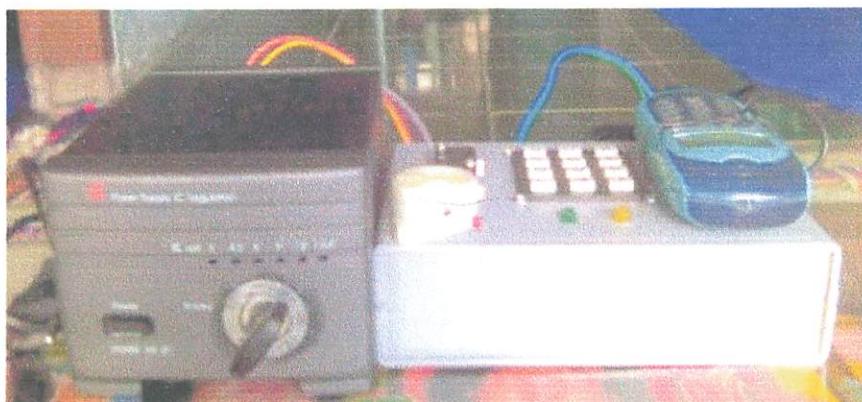
299 | ପାତ୍ରକ ଶୈଳିକାମ୍ବନ୍ଦୀ ପାତ୍ରକ

The remaining table lists the size of  $\mathcal{N}$  required to find a solution.

၂၀၁၅၊ ၁၃၁၁

Հայոց եւստիլաս պատ եւստիմաս ու զեխտ գլուխուս զսմէսս լրանչք-

- የመጀመሪያ ብቻ ከመጀመሪያው ስራዎች መቀበል.

**FOTO – FOTO ALAT**

**Gambar 4-13. Alat tampak dari depan**



**Gambar 4-14. Rangkaian kontrol**



**Gambar 4-15. isi sms yang diterima handphone user**

**DATA GROWTH**

The growth of data is exponential. In 1980, there were approximately 100 million personal computers worldwide. By 1990, there were over 1 billion personal computers. By 2000, there were over 1 billion mobile phones. By 2010, there were over 1 billion tablets. By 2020, there will be over 1 billion smartwatches.

Figure 4-13. The explosive growth of data



Figure 4-14. Rounding up round

As data grows exponentially, it becomes increasingly difficult to store and process. To address this challenge, data is often rounded off. This process involves reducing the precision of data to make it easier to handle. For example, if a company has 100,000 customers, it might round this number down to 100,000. This makes it easier to store and process the data, but it also means that some information is lost.

Figure 4-15. Let's say you're rounding up your phone numbers

## **BAB V**

### **PENUTUP**

#### **5.1 Kesimpulan**

Dari keseluruhan tahap perencanaan dan pembuatan serta pengujian alat pengaman sepeda motor menggunakan handphone ini dapat disimpulkan sebagai berikut :

1. Agar terjadi komunikasi data serial antara handphone dengan mikrokontroller maka baud rate dan panjang data antara pengirim dan penerima harus sama. Disini baud rate yang dipakai 19200 bits per second dengan panjang data 8 bit.
2. Total EPROM yang terpakai untuk menyimpan program-program instruksi pada mikrokontroller AT89S51 adalah sebesar 1123 byte dari kapasitas totalnya sebesar 4Kbyte, sehingga tidak memerlukan memori eksternal.
3. Dari pengujian sistem secara keseluruhan didapatkan bahwa alat pengaman ini dapat bekerja dengan baik sesuai dengan perencanaan.

#### **5.2 Saran**

1. Untuk perluasan dan pengembangan alat ini diharapkan ditambahkannya pengaman tambahan lagi yang dapat meningkatkan sistem pengaman alat ini.
2. Diharapkan ditambahkannya menu untuk merubah kode PIN sehingga memberikan kemudahan bagi pengguna alat ini.

## **DAFTAR PUSTAKA**

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6. Suhata, 2005, *Aplikasi Mikrokontroller Sebagai Pengendali Peralatan Elektronik*, PT. Elex Media Computindo, Jakarta
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Lampiran



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Konsentrasi : Teknik Elektronika  
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Tanggal Pengajuan Skripsi : 15 September 2005  
Selesai Penulisan Skripsi : 18 Maret 2006  
Dosen Pembimbing : Ir. Widodo Pudji Mulyanto, MT  
Telah Dievaluasi Dengan Nilai : 80 (A) 8

Mengetahui,

Ketua Jurusan T. Elektro S-1

(Ir. F. Yudi Limpraptono, MT)

NIP.Y. 1039500274

Diperiksa Dan Disetujui,

Dosen Pembimbing

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NIP. 1028700171



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MALANG

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Masa Bimbingan : 15 sep 2005 s/d 18 mar 2006  
Judul Skripsi : Perancangan dan Pembuatan Alat Pengaman Sepeda Motor menggunakan handphone berbasis Mikrokontroller AT89S51

| NO | Tanggal        | Uraian                          | Paraf pembimbing |
|----|----------------|---------------------------------|------------------|
| 1  | 02 - 01 - 2006 | Acc Bab I , Bab II              | ✓                |
| 2  | 05 - 01 - 2006 | Refisi Diagram blok , flowchart | ✓                |
| 3  | 18 - 01 - 2006 | Acc Bab III                     | ✓                |
| 4  | 18 - 01 - 2006 | Acc Bab IV                      | ✓                |
| 5  | 18 - 01 - 2006 | Acc Bab V                       | ✓                |
| 6  | 24 - 01 - 2006 | Demo Alat                       | ✓                |
| 7  | 26 - 01 - 2006 | Uraian Makalah Seminar          | ✓                |
| 8  | 11 - 03 - 2006 | Slip Ujian Kompre               | ✓                |
| 9  |                |                                 |                  |
| 10 |                |                                 |                  |

Malang, 11 maret 2006

Dosen Pembimbing

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NIM : 01.17.116  
Masa Bimbingan : 15 September 2005 s/d 18 Maret 2006  
Judul : Perancangan dan Pembuatan Alat Pengaman Sepeda Motor Menggunakan Handphone Berbasis Mikrokontroller AT89S51

| No | Tanggal       | Uraian  | Paraf     |
|----|---------------|---|-----------|
| 1  | 27 maret 2006 | - Sempurnakan kesimpulan dari analisa bab IV.<br>- Perhitungan untuk mencari R pada Bab III | Sidik     |
| 2  | 27 maret 2006 | - Kesimpulan ambilkan dari pengujian alat   | Hadi 27/3 |

Disetujui,

Pengaji I

(Ir. Sidik Noertjahjono, MT)

Pengaji II

(Sotyohadi, ST, Msc)

Mengetahui,  
Dosen Pembimbing

(Ir. Widodo Pudji M, MT)



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## Formulir Perbaikan Ujian Skripsi

Dalam pelaksanaan Ujian Skripsi Janjang Strata 1 Jurusan Teknik Elektro Konsentasi T. Energi Listrik / T. Elektronika, maka perlu adanya perbaikan skripsi untuk mahasiswa :

NAMA : AINUR ROZIQIN  
NIM : 0117116  
Perbaikan meliputi :

- Kesimpulan tidak merepresentasikan dan Pengujian alat + tuj. dr. Perancangan .
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Malang, 20. 03. 2006



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## Formulir Perbaikan Ujian Skripsi

Dalam pelaksanaan Ujian Skripsi Janjang Strata 1 Jurusan Teknik Elektro Konsentasi T. Energi Listrik / T. Elektronika, maka perlu adanya perbaikan skripsi untuk mahasiswa :

NAMA : *Aisah Riziqin*  
NIM : *0117116*  
Perbaikan meliputi :

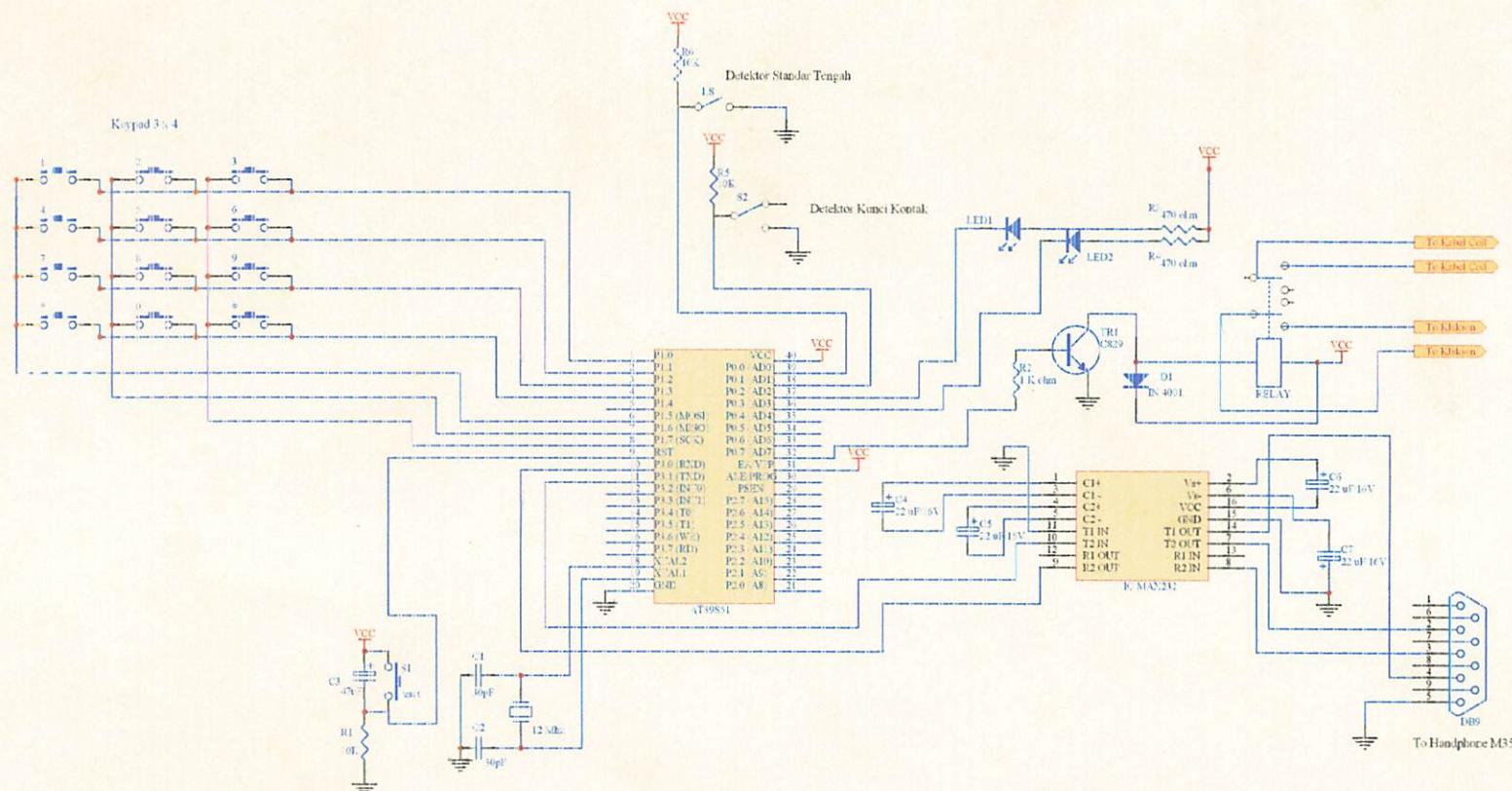
# Bab Perancangan (Bab II) diperbaikan.  
ditulang & untuk R.

# Kesimpulan diambil dr. hasil Pujian alor,  
, bukan dari teori ..

# Eprom Emulator cek apakah ada atau  
perbaikannya.

Malang,

( *Siwi N. M.* )



|       |             |                       |               |
|-------|-------------|-----------------------|---------------|
| Title |             | PENGAMAN SEPEDA MOTOR |               |
| Size  | Number      | 01.17.116             | Revision      |
| B     |             |                       |               |
| Date  | 10-Mar-2006 | Sheet of              |               |
| File  | 1 name.DOB  | Drawn By:             | Amin Rizqidin |

# Listing Program

```

;===== KEYPAD =====
kolom1      Bit    P1.4 ; kiri (1,4,7,redial)
kolom2      Bit    P1.5 ; (2,5,8,0)
kolom3      Bit    P1.6 ; (3,3,9,#)
kolom4      Bit    P1.7

baris1      Bit    P1.0 ; atas (1,2,3)
baris2      Bit    P1.1 ; (4,5,6)
baris3      Bit    P1.2 ; (7,8,9)
baris4      Bit    P1.3 ; (*,0,#)
;
keyport     Data   P1
keydata     Data   70h
FlagKey     Data   71h
keybounc    Equ    51h

; Data tampung sementara
Tmp1        Data   32h
Tmp2        Data   33h
Tmp3        Data   34h
Tmp4        Data   35h
-----
; SMS
DtKonfirmasi Data  39h
Cnt1        Data  3Ah
FlagSerial   Data  3Bh

DPH_PDU     Data  20h
DPL_PDU     Data  21h
DPH_CMGS    Data  22h
DPL_CMGS    Data  23h

DPHH1       Data  20h
DPPLL1      Data  21h
Dphh2       Data  22h
Dpll2       Data  23h
Flag1       Data  24h
Flag2       Data  25h
DPHH        Data  26h
DPPLL       Data  27h
CntX        Data  28h
DphhM       Data  29h
DpllM       Data  2Ah
Status       Data  2Bh
HasBuzzer   Data  2Ch
TimeOutRx   Data  2Dh
ForceSMS    Data  2Eh
TmpAktif    Data  2Fh
LedStatus   Data  3Ah

KodePDU     Data  7Fh
CntPDU      Equ   15
EE_Datal    Equ   0020h
Lf          Equ   10

```

|                      |     |      |
|----------------------|-----|------|
| <u>LED_Aktif</u>     | Bit | P0.2 |
| <u>LED_PIN</u>       | Bit | P0.3 |
| <u>Klakson</u>       | Bit | P0.0 |
| <u>Sensor_Kunci</u>  | Bit | P0.4 |
| <u>Sensor_Tengah</u> | Bit | P0.1 |

; Alamat awal lompat ke Start

```

    Org      0000
    Jmp      Start

    Org      0023h
    Jmp      SerialInterrupt

Start:
    Mov      TmpAktif, #0FFh
    Clr      EA
    Mov      SP, #42h
    Clr      klakson
    Mov      7, #5

Ready:
    Clr      LED_Aktif
    Clr      LED_PIN
    Call     Delay_Fix_100ms
    Call     Delay_Fix_100ms
    Setb    LED_Aktif
    Setb    LED_PIN
    Call     Delay_Fix_100ms
    Call     Delay_Fix_100ms

    Djnz    7, Ready

CekSensor1:
    Clr      LED_Aktif
    Clr      LED_PIN
    Clr      Klakson

    Jnb     Sensor_Kunci, Bahaya1
    Jnb     Sensor_Tengah, Bahaya1

CekPIN:
    Call    Keypad3x4
    Mov     A, keydata
    Cjne   A, #0FFh, AdaKeypadTekan
    Jmp     CekSensor1

```

**AdaKeypadTekan:**

```
Call Keypad_Get
Mov Tmp1,A
Setb LED_PIN

Call Keypad_Get
Mov Tmp2,A

Call Keypad_Get
Mov Tmp3,A

Call Keypad_Get
Mov Tmp4,A

Mov A, Tmp1
Cjne A, #'1', CekSensor1
Mov A, Tmp2
Cjne A, #'2', CekSensor1
Mov A, Tmp3
Cjne A, #'3', CekSensor1
Mov A, Tmp4
Cjne A, #'4', CekSensor1

Setb LED_PIN
Setb LED_Aktif

Sjmp $
```

**Bahaya1:**

```
Setb Klakson

Call Send_SMS

Mov TmpAktif,#0FFh
Clr LED_PIN
Clr LED_Aktif
```

**PINSampaiBenar:**

```
Clr LED_Aktif
Clr LED_PIN
Setb Klakson

Call Keypad_Get
Mov Tmp1,A
Setb LED_PIN

Call Keypad_Get
Mov Tmp2,A
```

```

Call Keypad_Get
Mov Tmp3,A

Call Keypad_Get
Mov Tmp4,A

Mov A,Tmp1
Cjne A,'#1',PIN_Sampai_Benar
Mov A,Tmp2
Cjne A,'#2',PIN_Sampai_Benar
Mov A,Tmp3
Cjne A,'#3',PIN_Sampai_Benar
Mov A,Tmp4
Cjne A,'#4',PIN_Sampai_Benar

Mov TmpAktif,#00

Setb LED_PIN
Setb LED_Aktif
Clr Klakson

Sjmp $
;-----Send_SMS:-----
Send_ATE1:
    Setb LED_PIN
    Clr LED_PIN
    Call Delay_Fix_1s
    Call Serial_Initialization
    Setb EA

    Mov 0,#200
Isi1xx2:
    Mov 1,#200
Isi2xx2:
    Mov 2,#10
Dec1xx2:
    Djnz 2,Dec1xx2
    Djnz 1,Isi2xx2
    Djnz 0,Isi1xx2

Send_ATE2:
    Setb LED_PIN
    Mov DtKonfirmasi,#0
    Mov DPTR,#txt_ATE1
    Call Serial_Transmit_String
Send1_Cek:
    Mov A,DtKonfirmasi
    Cjne A,'#0',Send1_Cek
    Clr LED_PIN
    Call Delay_Fix_1s

```

```

        Mov      0,#200
Isilxx4:   Mov      1,#200
Isi2xx4:   Mov      2,#10
Declxx4:
        Djnz    2,Declxx4
        Djnz    1,Isi2xx4
        Djnz    0,Isilxx4
        ;Jmp    Send_ATE1

Send_ATCMGS:
        Call    Delay_Fix_1s
        Call    Serial_Initialization
        Setb    EA
        Setb    LED_PIN
        Mov     DtKonfirmasi,#0
        Mov     DPTR,#txt_ATCMGs1
        Call    Serial_Transmit_String
        Mov     DPH,DPH_CMGS
        Mov     DPL,DPL_CMGS
        Mov     A,#13
        Call    Serial_Transmit

Send_ATCMGS_Cek:
        Mov     A,DtKonfirmasi
        Cjne   A,'#>',Send_ATCMGS_Cek
        Clr     LED_PIN
;-----
Send_PDU:
        Call    Serial_Initialization
        Setb    EA
        Mov     DtKonfirmasi,#0
        Mov     DPH,DPH_PDU
        Mov     DPL,DPL_PDU

Send_PDUCek:
        Mov     A,DtKonfirmasi
        Cjne   A,'#O',Send_PDUCek
        Setb    LED_PIN
;-----
Sukses:
        Ret

SerialInterrupt:

```

```

        Push    PSW
        Push    ACC
        Jbc    SCON.1,xmit
        Clr    SCON.0

rcve:
        Mov     A, SBUF
        ;Call   LCD_Data
        Cjne   A, #'K',CekCMGs
        Mov    DtKonfirmasi,#'O'
        Jmp    EndSerial

CekCMGs:
        Cjne   A, #'>',EndSerial
        Mov    DtKonfirmasi,#'>'
        Jmp    EndSerial

xmit:
        Clr    TI
EndSerial:
        Pop    ACC
        Pop    PSW
        Reti
        Ret

DelayMX:
        Push   1
        Push   2
Delaymx1:
        Mov    2,#40
Delaymx2:
        Mqv    1,#40
Delaymx3:
        Djnz   1,$
        Djnz   2,Delaymx2
        Djnz   0,Delaymx1
        Pop    2
        Pop    1
        Ret
Delay:
        Mov    R0,#0FFh      ; Isi Register R0 dengan FF (Hex)
Delay1:
        Mov    R1,#00h       ; Isi Register R1 dengan FF (hex)
Delay2:
        Nop          ; no operation
        Nop
        Nop
        Djnz   R1,Delay2    ; Kurangi R1 dengan 1, bila hasil belum
                            ; sama dengan 0 maka lompat ke Delay2
        Djnz   R0,Delay1    ; Kurangi R0 dengan 1, bila hasil belum
                            ; sama dengan 0 maka lompat ke Delay1
        Ret          ; Kembali ke alamat setelah perintah

Serial_Receive:
        Jnb    RI,$

```

```

    Clr      RI
    Mov      A, SBUF
    Clr      RI
    Ret
Serial_ReceiveTimeOut:
    Push     0
    Mov      0, #10
SerialReceiveTimeOut0:
    Jnb      RI, SerialReceiveTimeOut1
    Clr      RI
    Mov      A, SBUF
    Clr      RI
    Jmp      SerialReceiveTimeOutXX
SerialReceiveTimeOut1:
    Call     TundaTimeOut
    Djnz    0, SerialReceiveTimeOut0
    Mov      A, #0FFh

SerialReceiveTimeOutXX:
    Pop     0
    Ret
TundaTimeOut:
    Push     0
    Push     1
TundaTimeOut1:
    Mov      1, #100
TundaTimeOut2:
    Mov      0, #10
    Djnz    0, $
    Djnz    1, TundaTimeOut2
    Pop     1
    Pop     0
    Ret

Serial_Transmit:
    Mov      SBUF, A
    Ret
    Push     ACC
    Mov      A, FlagSerial
    Cjne    A, #0, Serial_TransmitOut
    Jnb     TI, $
    Clr     TI
Serial_TransmitOut:
    Pop     ACC
    Ret
Serial_Initialization:
    Mov      SCON, #50h
    ;Mov    TH1, #250          ; BAUDRATE 9600
    Mov      TH1, #253          ; BAUDRATE 19200
    ;Mov    TH1, #208          ; BAUDRATE 1200
    Mov      PCON, #00h         ; PCON
    Mov      TMOD, #21h
    Mov      TCON, #01010000B   ; RUN T1 AND TO
    Mov      IE, #90h           ; enable only serial inter

```

```

;Mov      IE,#10000010B
;Mov      IP,#00001000B
Ret
Serial_Initialization_Download:
Mov      SCON,#50h
Mov      TH1,#250          ; BAUDRATE 9600
;Mov      TH1,#208          ; BAUDRATE 1200
Mov      87h,#00h          ; PCON
Mov      TMOD,#21h
Mov      TCON,#01010000B   ; RUN T1 AND TO
Ret

Serial_Transmit_String:
Push    ACC
Push    DPL
Push    DPH
xgetcarl:
Clr     A                  ; mengambil data dari eprom
Movc   A,@A+DPTR
Cjne  A,#0,xtammpilli   ; tes apakah data habis?
Ljmp  xmettul

Lcall  Serial_Transmit
Mov    R0,#10
Call   DelayMX
Inc    DPTR                ; naikkan dptr
Ljmp  xgetcarl
xmettul:
Pop    DPH
Pop    DPL
Pop    ACC
Ret

Keypad_Get:
Push    B                  ; amankan register B
KeyInGet1:
Call   Keypad3x4           ; scan keypad
Mov    A,keydata           ;isi keydata = data di rutin
keypad:
Cjne  A,#0FFh,KeyInGet0   ;jk isi a # Offh ==>lompat
Jmp   keyInGet1

KeyInGet0:
Mov    B,A                  ;simpan isi a to b
KeyInGet:
Call   Keypad3x4
Mov    A,keydata
Cjne  A,B,KeyInOut        ;jk isi A # B lompat
Jmp   keyInget

KeyInOut:
Mov    A,B
Call   Delay_Fix_100ms
Call   Delay_Fix_100ms
Call   Delay_Fix_100ms

```

```

        Call      Delay_Fix_100ms
        Mov       A,B
        Pop      B
                           ;idem
        Ret
;=====
; routine u/ baca keypad 3x4
; output pd keydata(0-9,E=redial,F=#)
;=====

Keypad3x4:
        Mov      keybounc,#100
        Mov      keyport,#0FFh
        Clr      kolom1
ull:
        Jb      baris1,key1
        ;Djnz   keybounc,$
        Mov      keydata,#'1'
        Ret
key1:
        Jb      baris2,key2
        Mov      keydata,#'4'
        Ret
key2:
        Jb      baris3,key3
        Mov      keydata,#'7'
        Ret
key3:
        Jb      baris4,key4
        Mov      keydata,#'*'
        Ret
key4:
        Setb   kolom1
        Clr    kolom2
        Jb      baris1,key5
        Mov      keydata,#'2'
        Ret
key5:
        Jb      baris2,key6
        Mov      keydata,#'5'
        Ret
key6:
        Jb      baris3,key7
        Mov      keydata,#'8'
        Ret
key7:
        Jb      baris4,key8
        Mov      keydata,#'0'
        Ret
key8:
        Setb   kolom2
        Clr    kolom3
        Jb      baris1,key9
        Mov      keydata,#'3'

```

```

        Ret
key9:
    Jb      baris2,key10
    Djnz   keybounc,$
    Mov     keydata,#'6'
    Ret
key10:
    Jb      baris3,key11
    Djnz   keybounc,$
    Mov     keydata,#'9'
    Ret
key11:
    Jb      baris4,key12
    Djnz   keybounc,$
    Mov     keydata,#'#'
    Ret
key12:
    Mov    keydata,#OFFh

    Ret

;===== DELAY =====
Delay_Var_1ms:
    Call   Delay_Fix_1ms
    Djnz   R0,Delay_Var_1ms
    Ret
Delay_Var_10ms:
    Call   Delay_Fix_10ms
    Djnz   R0,Delay_Var_10ms
    Ret
Delay_Var_100ms:
    Call   Delay_Fix_1ms
    Djnz   R0,Delay_Var_100ms
    Ret
Delay_Var_1s:
    Call   Delay_Fix_1s
    Djnz   R0,Delay_Var_1s
    Ret
Delay_Var_10s:
    Call   Delay_Fix_10s
    Djnz   R0,Delay_Var_10s
    Ret
Delay_Var_10us:
    Call   Delay_Fix_10us
    Djnz   R0,Delay_Var_10us
    Ret
Delay_Fix_10us:
    Push   1
    Mov    1,#20
    Djnz   1,$
    Pop    1
    Ret
Delay_Fix_10s:
    Push   1

```

```

        Mov      1,#100
Delay_fix_10s_1:
        Call    Delay_Fix_100ms
        Djnz   1,delay_fix_10s_1
        Pop    1
        Ret
Delay_Fix_1s:
        Push   1
        Mov    1,#100
Delay_fix_1000ms_1:
        Call   Delay_Fix_10ms
        Djnz  1,delay_fix_1000ms_1
        Pop   1
        Ret
Delay_Fix_100ms:
        Push   1
        Mov    1,#10
Delay_fix_100ms_1:
        Call   Delay_Fix_10ms
        Djnz  1,delay_fix_100ms_1
        Pop   1
        Ret
Delay_Fix_10ms:
        Push   ACC
        Mov    A,TMOD
        Mov    TMOD,#00000001b ; Timer 1 bekerja pada mode 1
        Clr    TF0           ; me-nol-kan bit limpahan
        Setb   TR0           ; timer mulai bekerja
        Jnb    TF0,$         ; tunggu di sini sampai melimpah
        Clr    TR0           ; timer berhenti kerja
        Mov    TMOD,A
        Pop    ACC
        Ret
        Ret
Delay_Fix_1ms:
        Push   ACC
        Mov    A,TMOD
        Mov    TMOD,#00000001b ; Timer 1 bekerja pada mode 1
        Mov    TL0,#0EDh       ; siapkan waktu tunda 50 mili-
detik:
        Mov    TH0,#78h
        Clr    TF0           ; me-nol-kan bit limpahan
        Setb   TR0           ; timer mulai bekerja
        Jnb    TF0,$         ; tunggu di sini sampai melimpah
        Clr    TR0           ; timer berhenti kerja
        Mov    TMOD,A
        Pop    ACC
        Ret
        Ret
TARTIME:
        Mov    TMOD,#11h
        Mov    TH1,#00Eh
        Mov    TL1,#00Eh
        Ret

```

```
; 'Bahaya Boss!!!
txt_PDU1:      Db
'07912658050000F001000D91265846695952F300000DC2303A9C0F8384EFF93C140
2',0
txt_PDU_Cnt1:  Db      '26',0

txt_ATE1:      Db      'ATE1',13,0
txt_ATCMGL0:   Db      'AT+CMGL=2',13,0
txt_ATCMGs1:   Db      'AT+CMGS=',0
```

Data Sheet  
AT 89S51



---

## 8-bit Microcontroller with 4K Bytes In-System Programmable Flash

---

### AT89S51

#### tures

- npatible with MCS®-51 Products
- Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 1000 Write/Erase Cycles
- / to 5.5V Operating Range
- y Static Operation: 0 Hz to 33 MHz
- ee-level Program Memory Lock
- x 8-bit Internal RAM
- Programmable I/O Lines
- > 16-bit Timer/Counters
- Interrupt Sources
- Duplex UART Serial Channel
- v-power Idle and Power-down Modes
- rrupt Recovery from Power-down Mode
- chdog Timer
- al Data Pointer
- ver-off Flag
- st Programming Time
- xible ISP Programming (Byte and Page Mode)

#### scription

AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In-System Programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with In-System Programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a very flexible and cost-effective solution to many embedded control applications.

AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five-level interrupt architecture, a full duplex serial port, on-chip oscillator, and ROM circuitry. In addition, the AT89S51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and clock system to continue functioning. The Power-down mode saves the RAM content but freezes the oscillator, disabling all other chip functions until the next external interrupt or hardware reset.



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**VILLE**

三

## Configurations



**PDIP**

|             |    |    |            |
|-------------|----|----|------------|
| P1.0        | 1  | 40 | VCC        |
| P1.1        | 2  | 39 | P0.0 (AD0) |
| P1.2        | 3  | 38 | P0.1 (AD1) |
| P1.3        | 4  | 37 | P0.2 (AD2) |
| P1.4        | 5  | 36 | P0.3 (AD3) |
| (MOSI) P1.5 | 6  | 35 | P0.4 (AD4) |
| (MSO) P1.6  | 7  | 34 | P0.5 (AD5) |
| (SCK) P1.7  | 8  | 33 | P0.6 (AD6) |
| (RXD) P3.0  | 9  | 32 | P0.7 (AD7) |
| (TXD) P3.1  | 10 | 31 | EAV/PP     |
| (INT0) P3.2 | 11 | 30 | ALE/PROG   |
| (INT1) P3.3 | 12 | 29 | PSEN       |
| (T0) P3.4   | 13 | 28 | P2.7 (A15) |
| (T1) P3.5   | 14 | 27 | P2.6 (A14) |
| (WRI) P3.6  | 15 | 26 | P2.5 (A13) |
| (RD) P3.7   | 16 | 25 | P2.4 (A12) |
| XTAL2       | 18 | 24 | P2.3 (A11) |
| XTAL1       | 19 | 23 | P2.2 (A10) |
| GND         | 20 | 22 | P2.1 (A9)  |
| GND         | 21 | 21 | P2.0 (A8)  |

**TQFP**

|             |    |    |            |
|-------------|----|----|------------|
| (WR) P3.6   | 12 | 44 | P1.4       |
| (RD) P3.7   | 13 | 43 | P1.3       |
| XTAL2       | 14 | 42 | P1.2       |
| XTAL1       | 15 | 41 | P1.1       |
| GND         | 16 | 40 | P1.0       |
| GND         | 17 | 39 | NC         |
| (A8) P2.0   | 18 | 38 | VCC        |
| (A9) P2.1   | 19 | 37 | P0.0 (AD0) |
| (A10) P2.2  | 20 | 36 | P0.1 (AD1) |
| (A11) P2.3  | 21 | 35 | P0.2 (AD2) |
| (A12) P2.4  | 22 | 34 | P0.3 (AD3) |
| (MOSI) P1.5 | 1  | 33 | P0.4 (AD4) |
| (MSO) P1.6  | 2  | 32 | P0.5 (AD5) |
| (SCK) P1.7  | 3  | 31 | P0.6 (AD6) |
| RST         | 4  | 30 | P0.7 (AD7) |
| (RXD) P3.0  | 5  | 29 | EAV/PP     |
| NC          | 6  | 28 | NC         |
| NC          | 7  | 27 | ALE/PROG   |
| (TXD) P3.1  | 8  | 26 | PSEN       |
| (INT0) P3.2 | 9  | 25 | P2.7 (A15) |
| (INT1) P3.3 | 10 | 24 | P2.6 (A14) |
| (T0) P3.4   | 11 | 23 | P2.5 (A13) |
| (T1) P3.5   | 12 | 22 | P2.4 (A12) |
| (WRI) P3.6  | 13 | 21 | P2.3 (A11) |
| (RD) P3.7   | 14 | 20 | P2.2 (A10) |
| XTAL2       | 15 | 19 | P2.1 (A9)  |
| XTAL1       | 16 | 18 | P2.0 (A8)  |

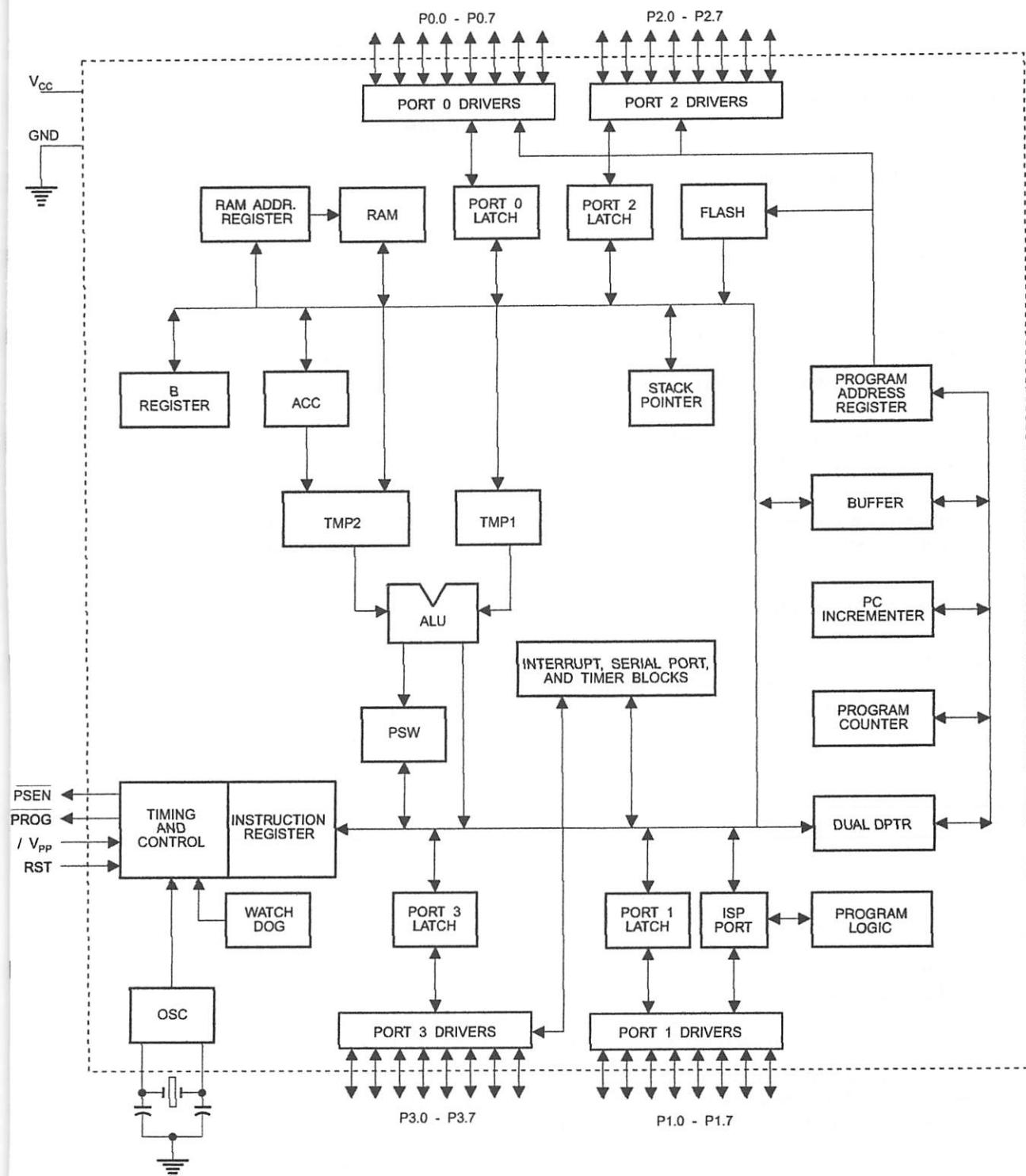
**PDIP**

|             |    |    |             |
|-------------|----|----|-------------|
| RST         | 1  | 42 | P1.7 (SCK)  |
| (RXD) P3.0  | 2  | 41 | P1.6 (MISO) |
| (TXD) P3.1  | 3  | 40 | P1.5 (MOSI) |
| (INT0) P3.2 | 4  | 39 | P1.4        |
| (INT1) P3.3 | 5  | 38 | P1.3        |
| (T0) P3.4   | 6  | 37 | P1.2        |
| (T1) P3.5   | 7  | 36 | P1.1        |
| (WRI) P3.6  | 8  | 35 | P1.0        |
| (RD) P3.7   | 9  | 34 | VDD         |
| XTAL2       | 10 | 33 | PWRVDD      |
| XTAL1       | 11 | 32 | P0.0 (AD0)  |
| GND         | 12 | 31 | P0.1 (AD1)  |
| PWRGND      | 13 | 30 | P0.2 (AD2)  |
| (A8) P2.0   | 14 | 29 | P0.3 (AD3)  |
| (A9) P2.1   | 15 | 28 | P0.4 (AD4)  |
| (A10) P2.2  | 16 | 27 | P0.5 (AD5)  |
| (A11) P2.3  | 17 | 26 | P0.6 (AD6)  |
| (A12) P2.4  | 18 | 25 | P0.7 (AD7)  |
| (A13) P2.5  | 19 | 24 | EAV/PP      |
| (A14) P2.6  | 20 | 23 | ALE/PROG    |
| (A15) P2.7  | 21 | 22 | PSEN        |

## Configurations

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## Block Diagram





## Description

Supply voltage (all packages except 4S-PDIP).

GND (all packages except 4S-PDIP; for 4S-PDIP GND connects only the logic core and the expanded board-level memory).

Supply voltage for the 4S-PDIP which connects only the logic cores and the embedded processor memory.

Supply voltage for the 4S-PDIP which connects only the IO Pad Drivers. The application board MUST connect port VDD and PWRD to the power supply voltage.

GND for the 4S-PDIP which connects only the IO Pad Drivers. PWRD and GND share analog connection through the common silicon substrate, but not physically, thus meeting the application board GND to the power ground.

Port 0 is an 8-bit open drain bi-directional IO port. As an output port, each pin can sink digital TTL inputs. When it is set written to port 0 pins, the pins can be used as digital impedance inputs.

Port 0 can also be configured to be the multiplexed low-order serial interface during accesses of external programs and data memory. In this mode, Port 0 is internal bus.

Port 0 also receives the code bytes during RISC bootstrapping and outputs the code bytes during program verification. External bus pins are reading during program verification.

Port 4 is an 8-bit bi-directional IO port with internal pull-ups. The Port 4 output pullers can sink/receive from TTL inputs. When it is set written to Port 4 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 4 pins have the extremely strong pull-low with source current (I<sub>OL</sub>) because of the internal pull-ups.

Port 4 also receives the low-order address bytes during RISC bootstrapping and verification.

| Port Pin | Alternate Function                       |
|----------|--|
| Pt.8     | MOSI (used for JTAG/Selboot Programming) |
| Pt.9     | MISO (used for JTAG/Selboot Programming) |
| Pt.10    | SCK (used for JTAG/Selboot Programming)  |

Port 5 is an 8-bit bi-directional IO port with internal pull-ups. The Port 5 output pullers can sink/receive from TTL inputs. When it is set written to Port 5 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 5 pins have the extremely strong pull-low with source current (I<sub>OL</sub>) because of the internal pull-ups.

Port 5 controls the high-order address bytes during bootstrapping memory test area 16-bit addresses (MOVX @ DPTR). In this application, Port 5 uses port 5 internal bus writing to. During access of external data memory (port 5) address bytes (MOVX @ RI), Port 5 writes the contents of the Port 5 address register.

Port 5 also receives the high-order address pins and some control signals during RISC boot.

Bootstrapping and verification.

3

Port 3 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current ( $I_{IL}$ ) because of the pull-ups.

Port 3 receives some control signals for Flash programming and verification.

Port 3 also serves the functions of various special features of the AT89S51, as shown in the following table.

| Port Pin | Alternate Functions                                 |
|----------|---|
| P3.0     | RXD (serial input port)                             |
| P3.1     | TXD (serial output port)                            |
| P3.2     | $\overline{INT0}$ (external interrupt 0)            |
| P3.3     | $\overline{INT1}$ (external interrupt 1)            |
| P3.4     | T0 (timer 0 external input)                         |
| P3.5     | T1 (timer 1 external input)                         |
| P3.6     | $\overline{WR}$ (external data memory write strobe) |
| P3.7     | $\overline{RD}$ (external data memory read strobe)  |

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. This pin drives High for 98 oscillator periods after the Watchdog times out. The DISRTO bit in SFR AUXR (address 8EH) can be used to disable this feature. In the default state of bit DISRTO, the RESET HIGH out feature is enabled.

/PROG

Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input ( $\overline{PROG}$ ) during Flash programming.

In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external data memory.

If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

N

Program Store Enable ( $\overline{PSEN}$ ) is the read strobe to external program memory.

When the AT89S51 is executing code from external program memory,  $\overline{PSEN}$  is activated twice each machine cycle, except that two  $\overline{PSEN}$  activations are skipped during each access to external data memory.

/PP

External Access Enable.  $\overline{EA}$  must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed,  $\overline{EA}$  will be internally latched on reset.

$\overline{EA}$  should be strapped to  $V_{CC}$  for internal program executions.

This pin also receives the 12-volt programming enable voltage ( $V_{PP}$ ) during Flash programming.

L1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

L2

Output from the inverting oscillator amplifier



Port 3 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When it is set write to Port 3 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins have the extremity pulled low to will source current (I<sub>F</sub>) because of the pull-up.

Port 3 receives some control signals for Flash programming and reset. Port 3 also serves the function of various special features of the AT8851, as shown in the following table.

| Port Pin | Alternate Function                     |
|----------|--|
| P3.0     | RXD (Serial input port)                |
| P3.1     | TXD (Serial output port)               |
| P3.2     | TINT (exterior interrupt #1)           |
| P3.3     | INT1 (external interrupt #0)           |
| P3.4     | TD (timer 0 external input)            |
| P3.5     | TI (timer 1 external input)            |
| P3.6     | WR (external data memory write enable) |
| P3.7     | RD (external data memory read enable)  |

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. This pin drives H100 for 98 oscillator periods after the Watchdog timer out. The DISRTO pin in SFR AUXR (address 8EH) can be used to disable this feature. In the default state of pin DISRTO, the RESET HIGH until last time is enabled.

Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during access to external memory. This pin is also the bootstrap pulse input (PROG) during Flash programming.

External oscillator. ALE is emitted at a constant rate of 1/6 the oscillator frequency and used in timer overflow. Note, however, that the ALE pulse is needed for external timing or locking purpose. Note, however, that the ALE pulse is skipped during each access to external data memory.

In addition, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set to active only during a MOVX or MOVC instruction. Otherwise, this pin is weakly pulled high. Getting the ALE-enable pin low to affect it the microcontroller is in external execution mode.

Bootstrap Store Enable (PSEN) is the least slope of external bootstrap memory. When the AT8851 is executing code from external bootstrap memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access of external data memory.

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external bootstrap memory locations starting at 0000H up to FFFFH. Note, however, that if both bit 7 is grounded, EA will be internally selected no reset.

EA should be strapped to V<sub>CC</sub> for internal bootstrap executions. This pin also receives the 15-Volt bootstrap voltage (V<sub>BB</sub>) during Flash programming.

Input of the inverting oscillator buffer and input of the internal clock oscillator circuit.

Output from the inverting oscillator buffer.





A map of the on-chip memory area called the Special Function Register (SFR) space is shown in Table 1.

Note that not all of the addresses are occupied, and unoccupied addresses may not be implemented on the chip. Read accesses to these addresses will in general return random data, and write accesses will have an indeterminate effect.

### 1. AT89S51 SFR Map and Reset Values

|    |                  |                  |                   |                  |                  |                  |                   |                  |
|----|------------------|------------------|-------------------|------------------|------------------|------------------|-------------------|------------------|
| 8H |                  |                  |                   |                  |                  |                  |                   |                  |
| DH | B<br>00000000    |                  |                   |                  |                  |                  |                   |                  |
| 8H |                  |                  |                   |                  |                  |                  |                   |                  |
| DH | ACC<br>00000000  |                  |                   |                  |                  |                  |                   |                  |
| 8H |                  |                  |                   |                  |                  |                  |                   |                  |
| 0H | PSW<br>00000000  |                  |                   |                  |                  |                  |                   |                  |
| 8H |                  |                  |                   |                  |                  |                  |                   |                  |
| DH |                  |                  |                   |                  |                  |                  |                   |                  |
| BH | IP<br>XX000000   |                  |                   |                  |                  |                  |                   |                  |
| JH | P3<br>11111111   |                  |                   |                  |                  |                  |                   |                  |
| JH | IE<br>0X000000   |                  |                   |                  |                  |                  |                   |                  |
| JH | P2<br>11111111   |                  | AUXR1<br>XXXXXXXX |                  |                  |                  | WDTRST<br>XXXXXXX |                  |
| JH | SCON<br>00000000 | SBUF<br>XXXXXXXX |                   |                  |                  |                  |                   |                  |
| JH | P1<br>11111111   |                  |                   |                  |                  |                  |                   |                  |
| JH | TCON<br>00000000 | TMOD<br>00000000 | TL0<br>00000000   | TL1<br>00000000  | TH0<br>00000000  | TH1<br>00000000  | AUXR<br>XXX00XX0  |                  |
| JH | P0<br>11111111   | SP<br>00000111   | DP0L<br>00000000  | DP0H<br>00000000 | DP1L<br>00000000 | DP1H<br>00000000 |                   | PCON<br>0XXX0000 |



AT8251\_SFR\_WdR\_sqd Readiness

User software should not write 1s to these unlisted locations, since they may be used in future products to invoke new features. In that case, the reset or inactive values of the new bits will always be 0.

**Interrupt Registers:** The individual interrupt enable bits are in the IE register. Two priorities can be set for each of the five interrupt sources in the IP register.

**Table 2. AUXR: Auxiliary Register**

| AUXR Address = 8EH  |   |   |   |        |        |   |   | Reset Value = XXX00XX0B       |
|---------------------|---|---|---|--------|--------|---|---|-------------------------------|
| Not Bit Addressable |   |   |   |        |        |   |   |                               |
| Bit                 | -   | - | - | WDIDLE | DISRTO | - | - | DISALE                        |
|                     | 7   | 6 | 5 | 4      | 3      | 2 | 1 | 0                             |
| -                   |   |   |   |        |        |   |   | Reserved for future expansion |
| DISALE              | Disable/Enable ALE  |   |   |        |        |   |   |                               |
|                     | DISALE  |   |   |        |        |   |   |                               |
|                     | Operating Mode  |   |   |        |        |   |   |                               |
|                     | 0 ALE is emitted at a constant rate of 1/6 the oscillator frequency |   |   |        |        |   |   |                               |
|                     | 1 ALE is active only during a MOVX or MOVC instruction              |   |   |        |        |   |   |                               |
| DISRTO              | Disable/Enable Reset-out  |   |   |        |        |   |   |                               |
|                     | DISRTO  |   |   |        |        |   |   |                               |
|                     | 0 Reset pin is driven High after WDT times out                      |   |   |        |        |   |   |                               |
|                     | 1 Reset pin is input only   |   |   |        |        |   |   |                               |
| WDIDLE              | Disable/Enable WDT in IDLE mode                                     |   |   |        |        |   |   |                               |
| WDIDLE              |   |   |   |        |        |   |   |                               |
| 0                   | WDT continues to count in IDLE mode                                 |   |   |        |        |   |   |                               |
| 1                   | WDT halts counting in IDLE mode                                     |   |   |        |        |   |   |                               |

**Dual Data Pointer Registers:** To facilitate accessing both internal and external data memory, two banks of 16-bit Data Pointer Registers are provided: DP0 at SFR address locations 82H-83H and DP1 at 84H-85H. Bit DPS = 0 in SFR AUXR1 selects DP0 and DPS = 1 selects DP1. The user should **ALWAYS** initialize the DPS bit to the appropriate value before accessing the respective Data Pointer Register.



Yomemem elab lenmexa bna lumenit nrof gnisassec eselilicet ot: seatalgeB rjmlioF etad laud  
HSE8 snodbaoc! searbbas RFB je Q9Q: bepivord etis seatalgeB rjmlioF etad jid-8t to seakd owl  
T9D sdeles T = S9D bns Q9D dipes T9XUA RFS n 0 = S9D JIB H9E-H78 je T9D bns H78  
etd gnisassec elosed eluv slisnogdpe etd of jd S9D etd esialini SYAWJLA bluots rersu etd T

|              |  |
|--------------|--|
| 4            | abom JIGI ni gniimoc elien T9W                               |
| 0            | abom JIGI ni inos of seunthos T9W                            |
| MJDIDW       |  |
| MJDIDW       | abom JIGI ni T9W elidnGleidseD                               |
|              | Yno iugil si nly leseA                                       |
| 0            | uo seam! T9W nslie agh! nevho si nly leseA                   |
| OTRSID       |  |
| OTRSID       | uo-leseA elidnGleidseD                                       |
|              | noduniefi COVM o XOM a gnuud Yno svide si JJA                |
| 0            | Ymepupat robbiso art qit to eise inredos a ls battime si JJA |
| abom gndeneo |  |
| EJASID       |  |
| DJASID       | JJA elidnGleidseD  |
| -            | notmrgex etuflj jof beveaseA                                 |

| BB | 8 | 7 | 6 | 5 | 4      | 3      | 2 | 1 | 0 |
|----|---|---|---|---|--------|--------|---|---|---|
| -  | - | - | - | - | OTRSID | EJASID | - | - | - |

eldeessbba JIB ion

|       |                |                          |                         |
|-------|----------------|--------------------------|-------------------------|
| XXUUA | H9B = searbbas | YsealjukA T9XUA S. albat | Q0XXX0XXX = enlev leseA |
|-------|----------------|--------------------------|-------------------------|

etlslgeB el etd in esdnes tquimati laubivdml etd: seatalgeB tquimati  
selimong owl. etlslgeB El etd in esdnes tquimati laubivdml etd: seatalgeB tquimati  
.0 ed seewles  
liw sid wen etd lo seulliv evidens to feser etd, easo jidrl u seutteet wen edeovl of sioudng  
etdliu etd base ad yem yatl sonis, snodbaoc! batilinu seadl of st. qitw for bluots awsfos hasil



**Power Off Flag:** The Power Off Flag (POF) is located at bit 4 (PCON.4) in the PCON SFR. POF is set to "1" during power up. It can be set and rest under software control and is not affected by reset.

**Table 3. AUXR1: Auxiliary Register 1**

| AUXR1 Address = A2H |                                   |   |   |   |   |   |   | Reset Value = XXXXXXXX0B      |
|---------------------|-----------------------------------|---|---|---|---|---|---|-------------------------------|
| Not Bit Addressable |                                   |   |   |   |   |   |   |                               |
| Bit                 | -                                 | - | - | - | - | - | - | DPS                           |
| 7                   | 6                                 | 5 | 4 | 3 | 2 | 1 | 0 |                               |
| -                   |                                   |   |   |   |   |   |   | Reserved for future expansion |
| DPS                 | Data Pointer Register Select      |   |   |   |   |   |   |                               |
|                     | DPS                               |   |   |   |   |   |   |                               |
| 0                   | Selects DPTR Registers DP0L, DP0H |   |   |   |   |   |   |                               |
| 1                   | Selects DPTR Registers DP1L, DP1H |   |   |   |   |   |   |                               |

**Memory Organization**  
MCS-51 devices have a separate address space for Program and Data Memory. Up to 64K bytes each of external Program and Data Memory can be addressed.

**Program Memory**  
If the **EA** pin is connected to GND, all program fetches are directed to external memory.

On the AT89S51, if **EA** is connected to **V<sub>CC</sub>**, program fetches to addresses 0000H through FFFFH are directed to internal memory and fetches to addresses 1000H through FFFFH are directed to external memory.

**Memory**  
The AT89S51 implements 128 bytes of on-chip RAM. The 128 bytes are accessible via direct and indirect addressing modes. Stack operations are examples of indirect addressing, so the 128 bytes of data RAM are available as stack space.

**Watchdog Timer**  
The WDT is intended as a recovery method in situations where the CPU may be subjected to software upsets. The WDT consists of a 14-bit counter and the Watchdog Timer Reset (WDTRST) SFR. The WDT is defaulted to disable from exiting reset. To enable the WDT, a user must write 01EH and 0E1H in sequence to the WDTRST register (SFR location 0A6H). When the WDT is enabled, it will increment every machine cycle while the oscillator is running. The WDT timeout period is dependent on the external clock frequency. There is no way to disable the WDT except through reset (either hardware reset or WDT overflow reset). When WDT overflows, it will drive an output RESET HIGH pulse at the RST pin.

**Enabling the WDT**  
To enable the WDT, a user must write 01EH and 0E1H in sequence to the WDTRST register (SFR location 0A6H). When the WDT is enabled, the user needs to service it by writing 01EH and 0E1H to WDTRST to avoid a WDT overflow. The 14-bit counter overflows when it reaches 16383 (3FFFH), and this will reset the device. When the WDT is enabled, it will increment every machine cycle while the oscillator is running. This means the user must reset the WDT at least every 16383 machine cycles. To reset the WDT the user must write 01EH and 0E1H to WDTRST. WDTRST is a write-only register. The WDT counter cannot be read or written. When WDT overflows, it will generate an output RESET pulse at the RST pin. The RESET pulse duration is 98xTOSC, where TOSC = 1/FOSC. To make the best use of the WDT, it should be serviced in those sections of code that will periodically be executed within the time required to prevent a WDT reset.



Power On Reset: The Power On Reset (POR) is asserted at pin 4 (PCON4) in the PCON SSR. POR is set to "1" during power up. It can be set and reset under software control and is not affected by reset.

Table 3. AUXR1 Auxiliary Register

| Reset Value = XXXX000B              |   |   |   |   |   |   |   | AUXR1 Address = A9H                 |   |   |   |   |   |   |   |
|-------------------------------------|---|---|---|---|---|---|---|-------------------------------------|---|---|---|---|---|---|---|
|                                     |   |   |   |   |   |   |   | Not Bit Addressable                 |   |   |   |   |   |   |   |
| DRS                                 | - | - | - | - | - | - | - | Bit 7                               | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Reserved for future expansion       |   |   |   |   |   |   |   | DRS                                 |   |   |   |   |   |   |   |
| Data Pointer Register Select        |   |   |   |   |   |   |   | DRS                                 |   |   |   |   |   |   |   |
| 0 Selects DPR1 Registers DPR1, DPRH |   |   |   |   |   |   |   | 1 Selects DPR2 Registers DPR1, DPRH |   |   |   |   |   |   |   |

MC2-91 devices have a separate address space for ROM and Data Memory. Up to 64K bytes of external ROM and Data Memory can be addressed.

If the EA pin is connected to GND, all program fetches are directed to external memory. On the AT88251, if EA is connected to V<sub>CC</sub>, program fetches of address 0000H through FFFFH are directed to internal memory and fetches of address 1000H through FFFFH are directed to external memory.

The AT88251 implements 128 bytes of on-chip RAM. The 128 bytes are accessible via direct and indirect addressing modes. Stack operations are examples of indirect addressing, so the 128 bytes of data RAM are available as stack space.

The WDT is implemented as a recursive timer where the CPU may be suspended to software timers. The WDT consists of a 14-bit counter and the Watchdog Timer Reset Register (WDRST) (SRR). The WDT is initialized from external timer level. To enable the WDT, a user must write 01EH into DFT and 00EH into DFTL. When the WDT is enabled it will machine cycle while timer level is latched. The WDT must be reset to disable it. When the WDT times out it will automatically reset the external timer level. The WDT can be disabled by writing 00H into DFT and 00H into DFTL. When the WDT is disabled it will machine cycle while timer level is latched. The WDT must be reset to disable it. When the WDT times out it will automatically reset the external timer level. The WDT can be disabled by writing 00H into DFT and 00H into DFTL.

To enable the WDT, a user must write 01EH into DFT and 00EH into DFTL. If the user needs to disable the WDT, he must write 00H into DFT and 00H into DFTL. The WDT has a resolution of 18383 machine cycles. To reset the WDT counter to zero or to enable the WDT, the user must write 00H into DFT and 00H into DFTL. The WDT counter cannot be read or written. When the WDT overflows, it will generate an output RESET. To make the part reset on the WDT, the user must write 00H into DFT and 00H into DFTL. The WDT has a resolution of 18383 machine cycles. To reset the WDT counter to zero or to enable the WDT, the user must write 00H into DFT and 00H into DFTL. The WDT counter cannot be read or written. When the WDT overflows, it will generate an output RESET. To make the part reset on the WDT, the user must write 00H into DFT and 00H into DFTL.

Memory

External

RAM

ROM

Code  
e-time  
held with  
get-out)

and the WDT

## T During Power-down Idle

In Power-down mode the oscillator stops, which means the WDT also stops. While in Power-down mode, the user does not need to service the WDT. There are two methods of exiting Power-down mode: by a hardware reset or via a level-activated external interrupt, which is enabled prior to entering Power-down mode. When Power-down is exited with hardware reset, servicing the WDT should occur as it normally does whenever the AT89S51 is reset. Exiting Power-down with an interrupt is significantly different. The interrupt is held low long enough for the oscillator to stabilize. When the interrupt is brought high, the interrupt is serviced. To prevent the WDT from resetting the device while the interrupt pin is held low, the WDT is not started until the interrupt is pulled high. It is suggested that the WDT be reset during the interrupt service for the interrupt used to exit Power-down mode.

To ensure that the WDT does not overflow within a few states of exiting Power-down, it is best to reset the WDT just before entering Power-down mode.

Before going into the IDLE mode, the WDIDLE bit in SFR AUXR is used to determine whether the WDT continues to count if enabled. The WDT keeps counting during IDLE (WDIDLE bit = 0) as the default state. To prevent the WDT from resetting the AT89S51 while in IDLE mode, the user should always set up a timer that will periodically exit IDLE, service the WDT, and reenter IDLE mode.

With WDIDLE bit enabled, the WDT will stop to count in IDLE mode and resumes the count upon exit from IDLE.

## RT

The UART in the AT89S51 operates the same way as the UART in the AT89C51. For further information on the UART operation, refer to the Atmel Web site (<http://www.atmel.com>). From the home page, select "Products", then "Microcontrollers", then "8051-Architecture", then "Documentation", and "Other Documents". Open the Adobe® Acrobat® file "AT89 Series Hardware Description".

## er 0 and 1

Timer 0 and Timer 1 in the AT89S51 operate the same way as Timer 0 and Timer 1 in the AT89C51. For further information on the timers' operation, refer to the Atmel Web site (<http://www.atmel.com>). From the home page, select "Products", then "Microcontrollers", then "8051-Architecture", then "Documentation", and "Other Documents". Open the Adobe Acrobat file "AT89 Series Hardware Description".

## rrupts

The AT89S51 has a total of five interrupt vectors: two external interrupts (INT0 and INT1), two timer interrupts (Timers 0 and 1), and the serial port interrupt. These interrupts are all shown in Figure 1.

Each of these interrupt sources can be individually enabled or disabled by setting or clearing a bit in Special Function Register IE. IE also contains a global disable bit, EA, which disables all interrupts at once.

Note that Table 4 shows that bit positions IE.6 and IE.5 are unimplemented. User software should not write 1s to these bit positions, since they may be used in future AT89 products.

The Timer 0 and Timer 1 flags, TF0 and TF1, are set at S5P2 of the cycle in which the timers overflow. The values are then polled by the circuitry in the next cycle.



卷

VL86234

of awards like the prestigious National Science and Technology Medal for Scientific and Technological Contribution to the Country (BIDTA) and the (TUVI AND OTM) Outstanding International Award.

...and now to add to all this, we have the new TOW II, which is a much improved version of the original TOW. It has a much more powerful engine, and it's much faster. It can fire its missiles from a distance of up to 10 kilometers, and it can penetrate armor up to 100 millimeters thick. The TOW II also has a much better tracking system, which allows it to lock onto a target even if it's moving. It also has a much better guidance system, which allows it to hit its target even if it's being jammed by anti-aircraft systems. The TOW II is also much more reliable than the original TOW, and it has a much longer range. It can fire its missiles from a distance of up to 10 kilometers, and it can penetrate armor up to 100 millimeters thick. The TOW II also has a much better tracking system, which allows it to lock onto a target even if it's moving. It also has a much better guidance system, which allows it to hit its target even if it's being jammed by anti-aircraft systems. The TOW II is also much more reliable than the original TOW, and it has a much longer range.

**Table 4.** Interrupt Enable (IE) Register

| (MSB)   |                 |   |    | (LSB) |     |     |     |
|---|-----------------|---|----|-------|-----|-----|-----|
| EA  | -               | -   | ES | ET1   | EX1 | ET0 | EX0 |
| Enable Bit = 1 enables the interrupt.   |                 |   |    |       |     |     |     |
| Enable Bit = 0 disables the interrupt.  |                 |   |    |       |     |     |     |
| <b>Symbol</b>   | <b>Position</b> | <b>Function</b>   |    |       |     |     |     |
| EA  | IE.7            | Disables all interrupts. If EA = 0, no interrupt is acknowledged. If EA = 1, each interrupt source is individually enabled or disabled by setting or clearing its enable bit. |    |       |     |     |     |
| -   | IE.6            | Reserved  |    |       |     |     |     |
| -   | IE.5            | Reserved  |    |       |     |     |     |
| ES  | IE.4            | Serial Port interrupt enable bit  |    |       |     |     |     |
| ET1   | IE.3            | Timer 1 interrupt enable bit  |    |       |     |     |     |
| EX1   | IE.2            | External interrupt 1 enable bit   |    |       |     |     |     |
| ET0   | IE.1            | Timer 0 interrupt enable bit  |    |       |     |     |     |
| EX0   | IE.0            | External interrupt 0 enable bit   |    |       |     |     |     |
| User software should never write 1s to reserved bits, because they may be used in future AT89 products. |                 |   |    |       |     |     |     |

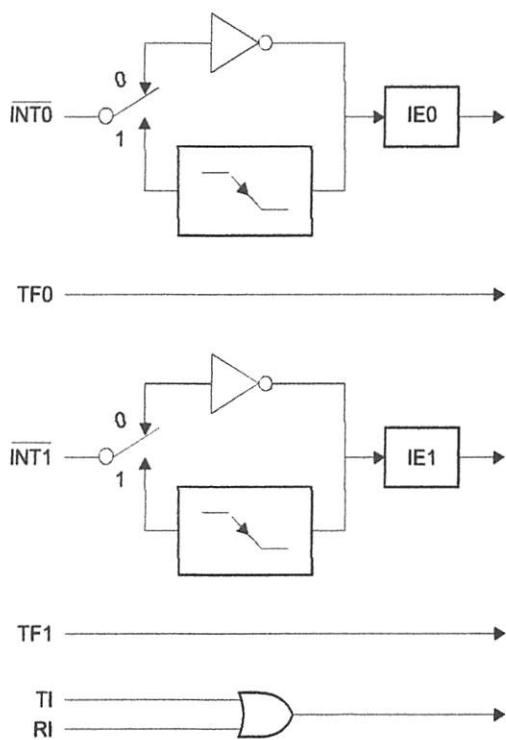
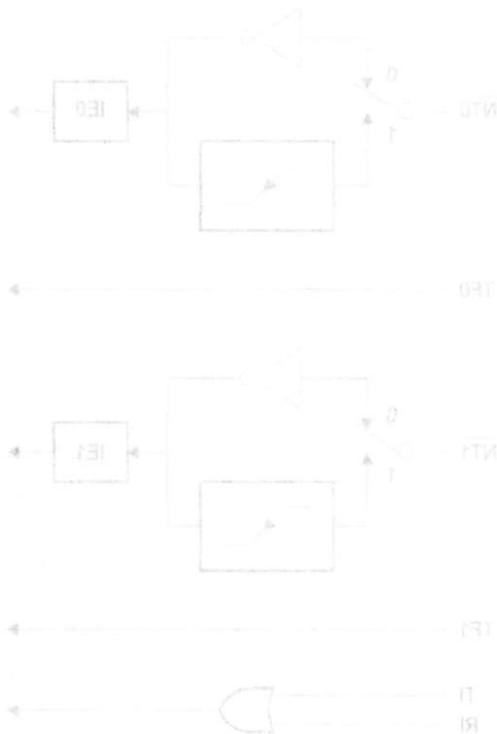
**Figure 1.** Interrupt Sources




Table A. Interrupt Enable (IE) Register

| (RSB)  |          |             |    |      |      |      |      |
|--|----------|-------------|----|------|------|------|------|
|  | EA       | -           | -  | ES   | ETI  | EXI  | ETO  |
| Enable Bit = 1 enables the interrupt.  |          |             |    |      |      |      |      |
| Enable Bit = 0 disables the interrupt.   |          |             |    |      |      |      |      |
| Group  | Position | Description | EA | IE.3 | IE.2 | IE.1 | IE.0 |
| Display all interrupts. If EA = 0, no interrupt is acknowledged if EA = f, interrupt sources are individually enabled or disabled by setting or clearing the enable bit. |          |             |    |      |      |      |      |
| Reset area   |          |             |    |      |      |      |      |
| Reserved   |          |             |    |      |      |      |      |
| Serial Port interrupt enable bit   |          |             |    |      |      |      |      |
| Timer 1 interrupt enable bit   |          |             |    |      |      |      |      |
| External interrupt 1 enable bit  |          |             |    |      |      |      |      |
| Timer 0 interrupt enable bit   |          |             |    |      |      |      |      |
| External interrupt 0 enable bit  |          |             |    |      |      |      |      |
| User software interrupt enable bit. If of location p1, precious p1 may be used in future AT89S51   |          |             |    |      |      |      |      |
| bitaddress   |          |             |    |      |      |      |      |

Figure 4. Interrupt Sources



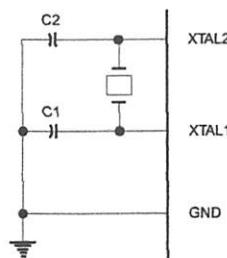
AT89S51

STAB-MICRO-150

## Oscillator Characteristics

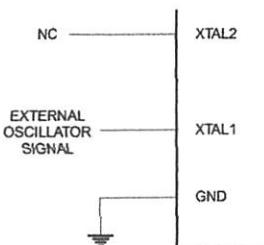
XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier that can be configured for use as an on-chip oscillator, as shown in Figure 2. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven, as shown in Figure 3. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maximum voltage high and low time specifications must be observed.

**Figure 2.** Oscillator Connections



Note: C1, C2 =  $30\text{ pF} \pm 10\text{ pF}$  for Crystals  
=  $40\text{ pF} \pm 10\text{ pF}$  for Ceramic Resonators

**Figure 3.** External Clock Drive Configuration



## Idle Mode

In idle mode, the CPU puts itself to sleep while all the on-chip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all the special function registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset.

Note that when idle mode is terminated by a hardware reset, the device normally resumes program execution from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port pins is not inhibited. To eliminate the possibility of an unexpected write to a port pin when idle mode is terminated by a reset, the instruction following the one that invokes idle mode should not write to a port pin or to external memory.

## Power-down Mode

In the Power-down mode, the oscillator is stopped, and the instruction that invokes Power-down is the last instruction executed. The on-chip RAM and Special Function Registers retain their values until the Power-down mode is terminated. Exit from Power-down mode can be initiated either by a hardware reset or by activation of an enabled external interrupt (INT0 or INT1). Reset redefines the SFRs but does not change the on-chip RAM. The reset should not be activated before  $V_{CC}$  is restored to its normal operating level and must be held active long enough to allow the oscillator to restart and stabilize.

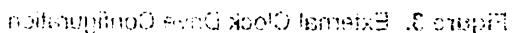


Page 87A

The first step in the synthesis of the polyisobutylene-based polymer was the preparation of the monomer, 2-(4-*n*-butylphenyl)-1,3-butadiene (I), which was synthesized by the reaction of 4-*n*-butylphenylmagnesium bromide with 1,3-butadiene. The structure of I was confirmed by IR, NMR, and mass spectrometry.

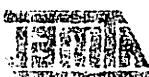
Figure 5. Quality of connections

શ્રીમતી મણી બેગ ડૉ. ૦૩૪૧૦૦૫૨૫૫૫૫



erT leviles nismeri etmurlaqeq qido-no erit ille shirw qsele of Israeli ethi UCPQF erit lebom sifat ni -gur noitorut Israele erit ille bns MAR qido-no erit. In Israelin sifT lenewtloz vd bekorvi ei ebom heldane vns vd bisheninet ed neq ebom sifT lebom sifT github beqnefdeh nismeri etzera

The Powerdown mode, the calibration sequence, and the calibration level selection are performed by the SPCs but does not change the original RAM. The user selects which of the four calibration levels V<sub>0</sub>, V<sub>1</sub>, V<sub>2</sub>, and V<sub>3</sub> to use. The calibration levels are defined as follows:





**Table 5. Status of External Pins During Idle and Power-down Modes**

| Mode       | Program Memory | ALE | PSEN | PORT0 | PORT1 | PORT2   | PORT3 |
|------------|----------------|-----|------|-------|-------|---------|-------|
| Idle       | Internal       | 1   | 1    | Data  | Data  | Data    | Data  |
| Idle       | External       | 1   | 1    | Float | Data  | Address | Data  |
| Power-down | Internal       | 0   | 0    | Data  | Data  | Data    | Data  |
| Power-down | External       | 0   | 0    | Float | Data  | Data    | Data  |

The AT89S51 has three lock bits that can be left unprogrammed (U) or can be programmed (P) to obtain the additional features listed in the following table.

**Table 6. Lock Bit Protection Modes**

| Program Lock Bits |     |     |     | Protection Type   |
|-------------------|-----|-----|-----|---|
|                   | LB1 | LB2 | LB3 |   |
| 1                 | U   | U   | U   | No program lock features  |
| 2                 | P   | U   | U   | MOVC instructions executed from external program memory are disabled from fetching code bytes from internal memory, EA is sampled and latched on reset, and further programming of the Flash memory is disabled |
| 3                 | P   | P   | U   | Same as mode 2, but verify is also disabled   |
| 4                 | P   | P   | P   | Same as mode 3, but external execution is also disabled   |

When lock bit 1 is programmed, the logic level at the EA pin is sampled and latched during reset. If the device is powered up without a reset, the latch initializes to a random value and holds that value until reset is activated. The latched value of EA must agree with the current logic level at that pin in order for the device to function properly.

The AT89S51 is shipped with the on-chip Flash memory array ready to be programmed. The programming interface needs a high-voltage (12-volt) program enable signal and is compatible with conventional third-party Flash or EPROM programmers.

The AT89S51 code memory array is programmed byte-by-byte.

**Programming Algorithm:** Before programming the AT89S51, the address, data, and control signals should be set up according to the Flash Programming Modes table (Table 7) and Figures 4 and 5. To program the AT89S51, take the following steps:

1. Input the desired memory location on the address lines.
2. Input the appropriate data byte on the data lines.
3. Activate the correct combination of control signals.
4. Raise EA/V<sub>PP</sub> to 12V.
5. Pulse ALE/PROG once to program a byte in the Flash array or the lock bits. The byte-write cycle is self-timed and typically takes no more than 50 µs. Repeat steps 1 through 5, changing the address and data for the entire array or until the end of the object file is reached.

**Data Polling:** The AT89S51 features Data Polling to indicate the end of a byte write cycle. During a write cycle, an attempted read of the last byte written will result in the complement of the written data on P0.7. Once the write cycle has been completed, true data is valid on all outputs, and the next cycle may begin. Data Polling may begin any time after a write cycle has been initiated.



Table 5. Status of External Pin Douting Table and Power-down Modes

| Mode       | Port8    | Port7    | Port6 | Port5 | Port4 | Port3 |
|------------|----------|----------|-------|-------|-------|-------|
| Idle       | Inverted | Inverted | 1     | 1     | Data  | Data  |
| Idle       | External | External | 1     | 1     | Data  | Data  |
| Power-down | Inverted | Inverted | 0     | 0     | Data  | Data  |
| Power-down | External | External | 0     | 0     | Data  | Data  |

The AT8821 has three lock pins that can be left unconnected (U) or can be programmed (P) to output the following sequence listed in the following table.

Table 6. Lock Bit Protection Modes

| Lock Bit Protection |     |     |     |
|---------------------|-----|-----|-----|
|                     | R81 | R82 | R83 |
| 1                   | U   | 0   | 0   |
| 2                   | 0   | 0   | 0   |
| 3                   | 0   | 0   | 0   |
| 4                   | 0   | 0   | 0   |

When lock pin 1 is programmed, it is programmed to level EA high to enable both memory and timer functions. When lock pin 2 is programmed, it is programmed to level EA low to disable both memory and timer functions. When lock pin 3 is programmed, it is programmed to level EA high to enable both memory and timer functions. When lock pin 4 is programmed, it is programmed to level EA low to disable both memory and timer functions.

The AT8821 is supplied with an on-chip Flash memory block ready to be programmed. The AT8821 includes a 128x16 bit ROM block that contains the following:

Programmable Address: Before programming the AT8821, the address pins must be connected to ground. This allows the AT8821 to be programmed while it is in the chip.

Address pins A and B: To program the AT8821, set the following address pins:

1. Input the desired memory location on the address lines.

2. Input the appropriate data byte on the data lines.

3. Activate the correct combination of control signals.

4. Raise EA<sub>bb</sub> to 12V.

5. Raise ALE/PROG once to program a byte in the Flash array or the lock pins. The byte written to the lock pins will remain until the next write operation. The address pins must be held at the previous value until the next write operation.

Data Porting: The AT8821 features Data Porting to interface the end of a byte write cycle. During a write cycle, an intermediate lead of the first byte written will result in the complement of the written data on P0.5. Once the first byte has been completed, just data is valid on all output pins except P0.5, which is addressed via address and data for the entire byte or until the next write cycle begins.

**Ready/Busy:** The progress of byte programming can also be monitored by the RDY/BSY output signal. P3.0 is pulled low after ALE goes high during programming to indicate BUSY. P3.0 is pulled high again when programming is done to indicate READY.

**Program Verify:** If lock bits LB1 and LB2 have not been programmed, the programmed code data can be read back via the address and data lines for verification. The status of the individual lock bits can be verified directly by reading them back.

**Reading the Signature Bytes:** The signature bytes are read by the same procedure as a normal verification of locations 000H, 100H, and 200H, except that P3.6 and P3.7 must be pulled to a logic low. The values returned are as follows.

- (000H) = 1EH indicates manufactured by Atmel
- (100H) = 51H indicates AT89S51
- (200H) = 06H

**Chip Erase:** In the parallel programming mode, a chip erase operation is initiated by using the proper combination of control signals and by pulsing ALE/PROG low for a duration of 200 ns - 500 ns.

In the serial programming mode, a chip erase operation is initiated by issuing the Chip Erase instruction. In this mode, chip erase is self-timed and takes about 500 ms.

During chip erase, a serial read from any address location will return 00H at the data output.

## Programming Flash – Serial Mode

## al rogramming orithm

The Code memory array can be programmed using the serial ISP interface while RST is pulled to V<sub>cc</sub>. The serial interface consists of pins SCK, MOSI (input) and MISO (output). After RST is set high, the Programming Enable instruction needs to be executed first before other operations can be executed. Before a reprogramming sequence can occur, a Chip Erase operation is required.

The Chip Erase operation turns the content of every memory location in the Code array into FFH.

Either an external system clock can be supplied at pin XTAL1 or a crystal needs to be connected across pins XTAL1 and XTAL2. The maximum serial clock (SCK) frequency should be less than 1/16 of the crystal frequency. With a 33 MHz oscillator clock, the maximum SCK frequency is 2 MHz.

To program and verify the AT89S51 in the serial programming mode, the following sequence is recommended:

1. Power-up sequence:
  - Apply power between VCC and GND pins.
  - Set RST pin to "H".
  - If a crystal is not connected across pins XTAL1 and XTAL2, apply a 3 MHz to 33 MHz clock to XTAL1 pin and wait for at least 10 milliseconds.
2. Enable serial programming by sending the Programming Enable serial instruction to pin MOSI/P1.5. The frequency of the shift clock supplied at pin SCK/P1.7 needs to be less than the CPU clock at XTAL1 divided by 16.
3. The Code array is programmed one byte at a time in either the Byte or Page mode. The write cycle is self-timed and typically takes less than 0.5 ms at 5V.
4. Any memory location can be verified by using the Read instruction that returns the content at the selected address at serial output MISO/P1.6.
5. At the end of a programming session, RST can be set low to commence normal device operation.



133887A

Readability: This procedure of file processing can also be mentioned by the RDYBYE option.

**Position: Web developer / junior developer / UI/UX designer** **Location:** Vilnius, Lithuania  
**Job type:** Full-time position  
**Contract type:** Permanent  
**Salary:** 1000-1200 EUR  
**Benefits:** Paid annual leave, health insurance, pension plan, free parking, flexible working hours, remote work options, professional development opportunities, company events, and more.

Reading the **Significance Test**. The first step in a hypothesis test is to determine the level of significance. This is the probability that the test statistic would fall under the critical region if the null hypothesis were true. It is denoted by  $\alpha$  (alpha) and is also called the **significance level**.

length of the horizontal axis is 10000.

*Leucosia* catesbeiana (HORN)

$$HOG = \{HOG_i\}$$

Higher comprehension of sentence structure and by reading ALEPB05 for 10 minutes per day

Demande quid esse, a deo tunc tanta pars possit esse, quod non sit illud quod obliquum.

The Giga memory may also be programmed into three modes: 1GB, 1GB+1MB, or 1GB+2MB. The Giga memory can be programmed into one of three modes: 1GB, 1GB+1MB, or 1GB+2MB. The Giga memory can be programmed into one of three modes: 1GB, 1GB+1MB, or 1GB+2MB.

The GPO Best Practices Guide for the Management of Government Information in the Digital Environment

Please insert UNO or littleBits breadboard. With a 33 MHz oscillation select the maximum SCK frequency 1 MHz. Set the XATL pins XATL1 and XATL2 to low. Set the XTAL1 to a digital 0 and XTAL2 to a digital 1. Set the XTAL3 to a digital 0.

To download and view the ATLAS-3 in the serial programming mode, first follow the procedure  
as recommended.

zHHA 88 et zHHA 89 ylqqa ,zJATX bne LjATX eniq sodes biq betweennow ten ai kyleye o il  
.zJATX eniq sodes biq betweennow ten ai kyleye o il  
.zJATX eniq sodes biq betweennow ten ai kyleye o il

An array of positions will be available by April 2019. Read information first before applying for one.



#### Power-off sequence (if needed):

- Set XTAL1 to "L" (if a crystal is not used).
- Set RST to "L".
- Turn V<sub>CC</sub> power off.

**Data Polling:** The Data Polling feature is also available in the serial mode. In this mode, during a write cycle an attempted read of the last byte written will result in the complement of the MSB of the serial output byte on MISO.

The Instruction Set for Serial Programming follows a 4-byte protocol and is shown in Table 8.

al  
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erface –  
allel Mode

Every code byte in the Flash array can be programmed by using the appropriate combination of control signals. The write operation cycle is self-timed and once initiated, will automatically time itself to completion.

Most major worldwide programming vendors offer worldwide support for the Atmel AT89 microcontroller series. Please contact your local programming vendor for the appropriate software revision.

#### 7. Flash Programming Modes

| Mode              | V <sub>CC</sub> | RST | PSEN | ALE/<br>PROG | EA/<br>V <sub>PP</sub> | P2.6 | P2.7 | P3.3 | P3.6 | P3.7 | P0.7-0                 | P2.3-0  | P1.7-0 |
|-------------------|-----------------|-----|------|--------------|------------------------|------|------|------|------|------|------------------------|---------|--------|
|                   |                 |     |      |              |                        |      |      |      |      |      | Data                   | Address |        |
| Write Code Data   | 5V              | H   | L    | (2)          | 12V                    | L    | H    | H    | H    | H    | D <sub>IN</sub>        | A11-8   | A7-0   |
| Write Code Data   | 5V              | H   | L    | H            | H                      | L    | L    | L    | H    | H    | D <sub>OUT</sub>       | A11-8   | A7-0   |
| Write Lock Bit 1  | 5V              | H   | L    | (3)          | 12V                    | H    | H    | H    | H    | H    | X                      | X       | X      |
| Write Lock Bit 2  | 5V              | H   | L    | (3)          | 12V                    | H    | H    | H    | L    | L    | X                      | X       | X      |
| Write Lock Bit 3  | 5V              | H   | L    | (3)          | 12V                    | H    | L    | H    | H    | L    | X                      | X       | X      |
| Write Lock Bits 3 | 5V              | H   | L    | H            | H                      | H    | H    | L    | H    | L    | P0.2,<br>P0.3,<br>P0.4 | X       | X      |
| Erase             | 5V              | H   | L    | (1)          | 12V                    | H    | L    | H    | L    | L    | X                      | X       | X      |
| Atmel ID          | 5V              | H   | L    | H            | H                      | L    | L    | L    | L    | L    | 1EH                    | 0000    | 00H    |
| Device ID         | 5V              | H   | L    | H            | H                      | L    | L    | L    | L    | L    | 51H                    | 0001    | 00H    |
| Device ID         | 5V              | H   | L    | H            | H                      | L    | L    | L    | L    | L    | 06H                    | 0010    | 00H    |

- 1. Each PROG pulse is 200 ns - 500 ns for Chip Erase.
- 2. Each PROG pulse is 200 ns - 500 ns for Write Code Data.
- 3. Each PROG pulse is 200 ns - 500 ns for Write Lock Bits.
- 4. RDY/BSY signal is output on P3.0 during programming.
- 5. X = don't care.



Power-off sequence (if needed):  
Set XTAL1 of "L" (if a crystal is not used).  
Set RST to "L".  
Turn V<sub>CC</sub> power off.  
Dots Rolling: Type Dots Rolling feature is also available in the serial mode. In this mode, turn a white code on the serial port line will result in the complement of the M88 of the serial output pin M150.

The Initialization Set for Serial Programming follows a 4-byte protocol and is shown in Table 8.

Every code byte in the Flash sector can be programmed by using the appropriate combination of control register. The write operation cycle is self-timed and once initiated, will automatically time itself to completion.

Most major hardware programming vendors offer worldwide support for the ATmel AT80251 microcontroller series. Please contact your local distributor vendor for the appropriate software revision.

**Initialization Set**  
**Programming**  
**Access -**  
**Serial Mode**

| Table 8. Flash Programming Modes |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| PI-1-0                           | B5-3-0 | PI-1-0 | B5-3-0 | PI-1-0 | B5-3-0 | PI-1-0 | B5-3-0 | PI-1-0 | B5-3-0 | PI-1-0 | B5-3-0 | PI-1-0 | B5-3-0 | PI-1-0 | B5-3-0 |
| Address                          |        | Acc    |        | RST    |        | SCREEN |        | PROG   |        | VBEI   |        | VBEI   |        | VBEI   |        |
| A11-0                            | A11-8  | EA     | H      | H      | H      | H      | H      | L      | C      | H      | H      | Dn     | H      | H      | H      |
| A11-0                            | A11-8  | EA     | H      | H      | H      | F      | F      | L      | F      | H      | H      | Dn     | H      | H      | H      |
| X                                | X      | X      | H      | H      | H      | H      | H      | H      | H      | 15A    | H      | H      | H      | H      | H      |
| X                                | X      | X      | F      | F      | F      | H      | H      | H      | H      | 15A    | H      | H      | H      | H      | H      |
| X                                | X      | X      | F      | F      | F      | H      | H      | H      | H      | 15A    | H      | H      | H      | H      | H      |
| X                                | X      | X      | F      | F      | F      | H      | H      | H      | H      | 15A    | H      | H      | H      | H      | H      |
| X                                | X      | 5.0    | 5.0    | 5.0    | 5.0    | H      | H      | H      | H      | H      | H      | H      | H      | H      | H      |
| X                                | X      | 5.0    | 5.0    | 5.0    | 5.0    | H      | H      | H      | H      | H      | H      | H      | H      | H      | H      |
| X                                | X      | X      | H      | H      | F      | H      | F      | H      | F      | H      | H      | H      | H      | H      | H      |
| H00                              | 0000   | EA     | H      | H      | H      | H      | H      | L      | F      | F      | F      | F      | F      | F      | F      |
| H00                              | 1000   | EA     | H      | H      | H      | H      | H      | F      | F      | F      | F      | F      | F      | F      | F      |
| H00                              | 0100   | EA     | H      | H      | H      | H      | H      | F      | F      | F      | F      | F      | F      | F      | F      |

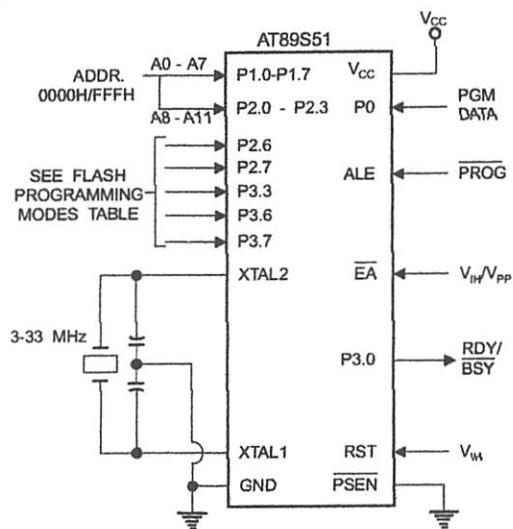
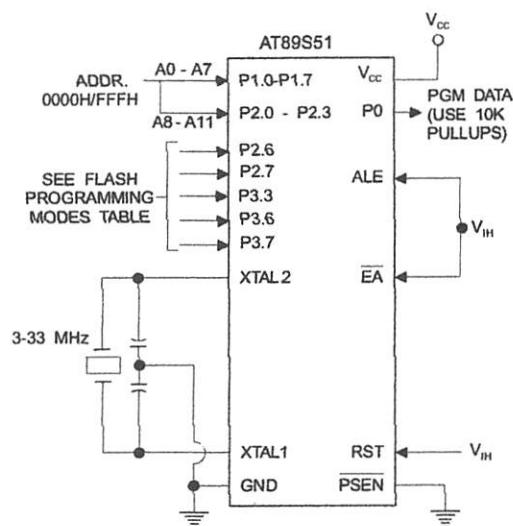
1. Each PROG pulse is 200 ns - 200 ns for Chip Erase.

2. Each PROG pulse is 200 ns - 200 ns for White Code Erase.

3. Each PROG pulse is 200 ns - 200 ns for White Lock Bit Erase.

4. RDY/BSY signal is output on P3.0 during programming.

5. X = don't care.

**Figure 4. Programming the Flash Memory (Parallel Mode)****Figure 5. Verifying the Flash Memory (Parallel Mode)**

(ಇಂದಿರಾ ನೆಲ್ಲಿನ್‌) ಯಾವುದು ಎಂದು ಅನುಭವಿಸಿದ್ದೀರ್ಥಿ ಕಾರಣಗಳು

| ಕಾರಣ                              | ಅಂಶ                            |
|-----------------------------------|--------------------------------|
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಪ್ರಾರ್ಥನೆ         | ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ         |
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ | ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ |
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ | ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ |
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ | ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ |

(ಇಂದಿರಾ ನೆಲ್ಲಿನ್) ಯಾವುದು ಎಂದು ಅನುಭವಿಸಿದ್ದೀರ್ಥಿ ಕಾರಣಗಳು

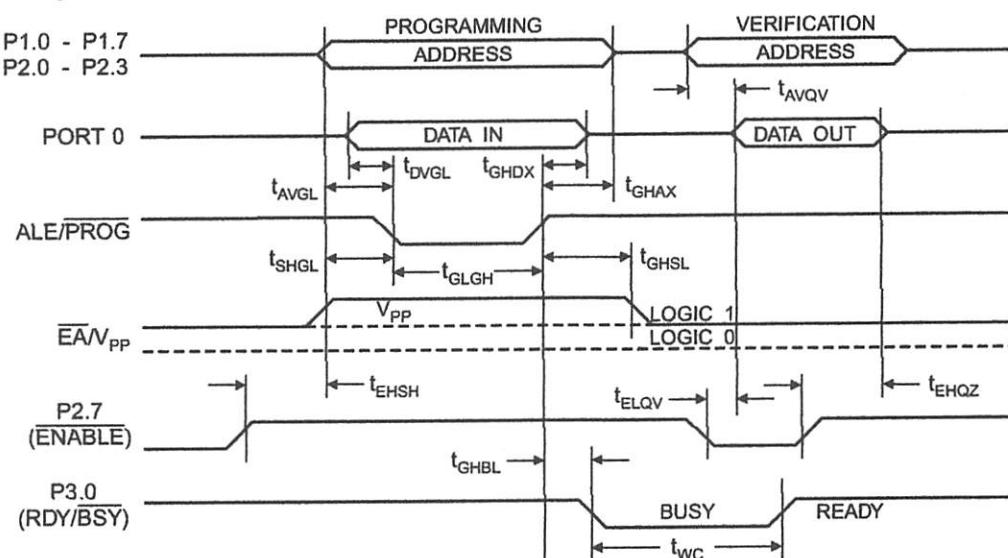
| ಕಾರಣ                              | ಅಂಶ                            |
|-----------------------------------|--------------------------------|
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಪ್ರಾರ್ಥನೆ         | ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ         |
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ | ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ |
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ | ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ |
| ಇಂದಿರಾ ನೆಲ್ಲಿನ್ ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ | ಸಾಹಿತ್ಯ ಪ್ರಾರ್ಥನೆ ಮಾಡಿದ ವರ್ತನೆ |

## Flash Programming and Verification Characteristics (Parallel Mode)

0°C to 30°C, V<sub>CC</sub> = 4.5 to 5.5V

| Parameter                             | Min                 | Max                 | Units |
|---------------------------------------|---------------------|---------------------|-------|
| Programming Supply Voltage            | 11.5                | 12.5                | V     |
| Programming Supply Current            |                     | 10                  | mA    |
| V <sub>CC</sub> Supply Current        |                     | 30                  | mA    |
| Oscillator Frequency                  | 3                   | 33                  | MHz   |
| Address Setup to PROG Low             | 48t <sub>CLCL</sub> |                     |       |
| Address Hold After PROG               | 48t <sub>CLCL</sub> |                     |       |
| Data Setup to PROG Low                | 48t <sub>CLCL</sub> |                     |       |
| Data Hold After PROG                  | 48t <sub>CLCL</sub> |                     |       |
| P2.7 (ENABLE) High to V <sub>PP</sub> | 48t <sub>CLCL</sub> |                     |       |
| V <sub>PP</sub> Setup to PROG Low     | 10                  |                     | μs    |
| V <sub>PP</sub> Hold After PROG       | 10                  |                     | μs    |
| PROG Width                            | 0.2                 | 1                   | μs    |
| Address to Data Valid                 |                     | 48t <sub>CLCL</sub> |       |
| ENABLE Low to Data Valid              |                     | 48t <sub>CLCL</sub> |       |
| Data Float After ENABLE               | 0                   | 48t <sub>CLCL</sub> |       |
| PROG High to BUSY Low                 |                     | 1.0                 | μs    |
| Byte Write Cycle Time                 |                     | 50                  | μs    |

Figure 6. Flash Programming and Verification Waveforms – Parallel Mode



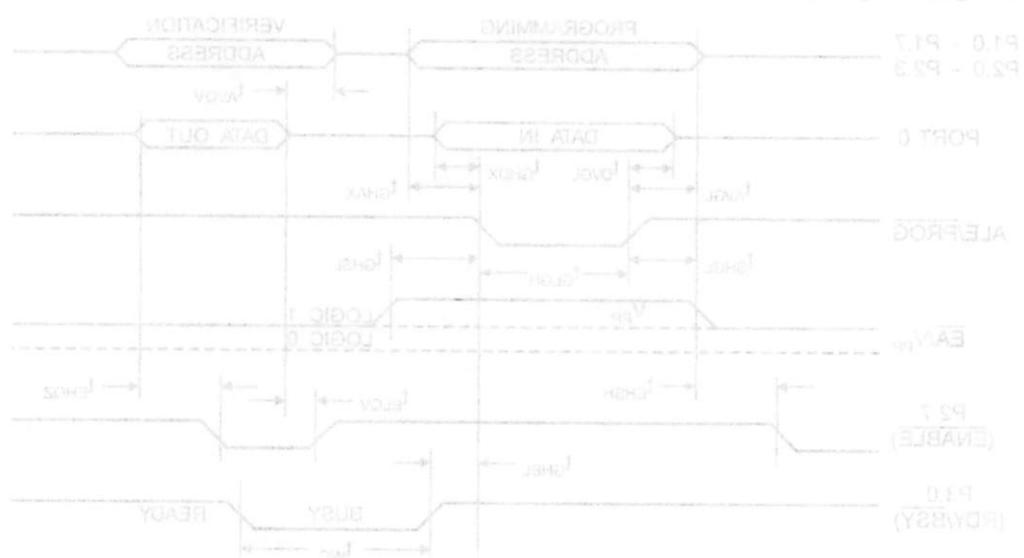


## AT89S51 Programming and Verification Characteristics (Parallel Mode)

10°C to 30°C, V<sub>DD</sub> = 4.5 to 5.5V

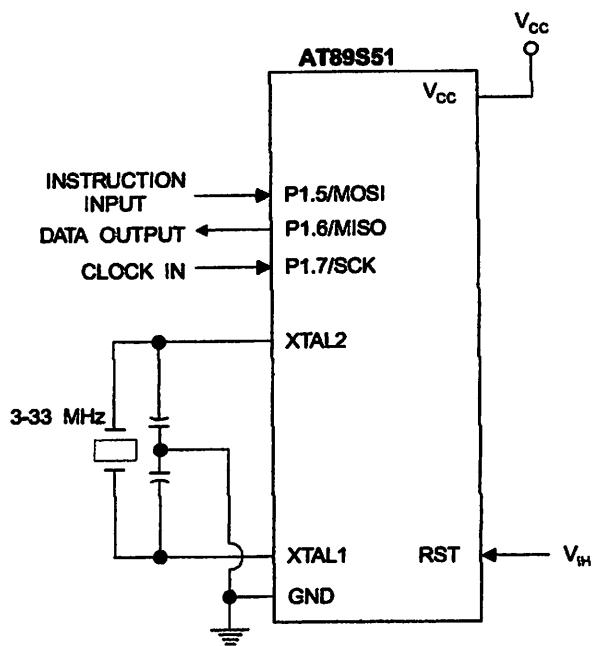
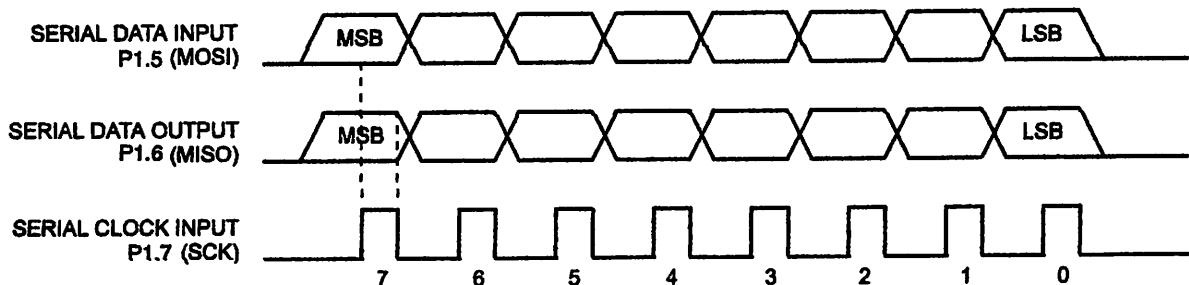
| Unit            | Min | Max | Parameter                            |
|-----------------|-----|-----|--------------------------------------|
| V <sub>DD</sub> | 4.5 | 5.5 | Parallel Programming Supply Voltage  |
| I <sub>DD</sub> | 10  | 15  | Parallel Writing Supply Current      |
| I <sub>SS</sub> | 30  | 35  | AC Supply Current                    |
| MHz             | 3   | 48  | Digital Frequency                    |
|                 |     |     | Address Setup to PROG Row            |
|                 |     |     | Address Hold After PROG              |
|                 |     |     | Data Setup to PROG Row               |
|                 |     |     | Data Hold After PROG                 |
|                 |     |     | PS2 (ENABLE) Hold to V <sub>DD</sub> |
|                 | 10  | 10  | V <sub>DD</sub> Setup to PROG Row    |
|                 | 10  | 10  | V <sub>DD</sub> Hold After PROG      |
|                 | 1   | 5   | PROG Width                           |
|                 | 48  | 48  | Address to Data Valid                |
|                 | 48  | 48  | ENABLE Row to Data Valid             |
|                 | 0   | 48  | Data Row After ENABE                 |
|                 | 48  | 48  | PROG High to BSY Low                 |
|                 | 48  | 48  | Gate Write Cycle Time                |

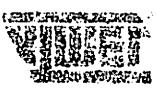
e.g., Best Programming and Verification Waveforms – Parallel Mode



AT89S51

ST928-MICRO-1203

**7. Flash Memory Serial Downloading****Programming and Verification Waveforms – Serial Mode****Figure 8. Serial Programming Waveforms**



WANDELUNGEN DER KOMMUNIKATION  
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|  | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|--|------|------|------|------|------|------|------|------|------|------|------|
| 1. Anzahl der Abonnenten                     | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 2. Anzahl der Abonnenten pro 1000 Einwohner  | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 3. Anzahl der Abonnenten pro 1000 Haushalte  | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 4. Anzahl der Abonnenten pro 1000 Betriebe   | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 5. Anzahl der Abonnenten pro 1000 Haushalte  | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 6. Anzahl der Abonnenten pro 1000 Betriebe   | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 7. Anzahl der Abonnenten pro 1000 Einwohner  | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 8. Anzahl der Abonnenten pro 1000 Haushalte  | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 9. Anzahl der Abonnenten pro 1000 Betriebe   | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 10. Anzahl der Abonnenten pro 1000 Einwohner | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 11. Anzahl der Abonnenten pro 1000 Haushalte | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 12. Anzahl der Abonnenten pro 1000 Betriebe  | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |

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## 8. Serial Programming Instruction Set

| Instruction                      | Instruction Format |   | Byte 3   | Byte 4   | Operation   |
|----------------------------------|--------------------|---|--|--|---|
|                                  | Byte 1             | Byte 2  |  |  |   |
| Serial Programming Enable        | 1010 1100          | 0101 0011   | xxxx xxxx  | xxxx xxxx<br>0110 1001<br>(Output on MISO)                               | Enable Serial Programming while RST is high   |
| Erase                            | 1010 1100          | 100x xxxx   | xxxx xxxx  | xxxx xxxx  | Chip Erase Flash memory array   |
| Read Program Memory (Byte Mode)  | 0010 0000          | xxxx A1 <sup>10</sup> A9 <sup>9</sup> A8 <sup>8</sup> | A7 <sup>65</sup> A4 <sup>54</sup> A3 <sup>43</sup> A0 <sup>0</sup> | D7 <sup>65</sup> D4 <sup>54</sup> D3 <sup>43</sup> D0 <sup>0</sup>       | Read data from Program memory in the byte mode  |
| Write Program Memory (Byte Mode) | 0100 0000          | xxxx A1 <sup>10</sup> A9 <sup>9</sup> A8 <sup>8</sup> | A7 <sup>65</sup> A4 <sup>54</sup> A3 <sup>43</sup> A0 <sup>0</sup> | D7 <sup>65</sup> D4 <sup>54</sup> D3 <sup>43</sup> D0 <sup>0</sup>       | Write data to Program memory in the byte mode   |
| Write Lock Bits <sup>(1)</sup>   | 1010 1100          | 1110 00B1 <sup>B2</sup>                               | xxxx xxxx  | xxxx xxxx  | Write Lock bits. See Note (1).  |
| Read Lock Bits                   | 0010 0100          | xxxx xxxx   | xxxx xxxx  | xxxx LB1 <sup>10</sup> LB2 <sup>9</sup> LB3 <sup>8</sup> xx <sup>7</sup> | Read back current status of the lock bits (a programmed lock bit reads back as a "1") |
| Read Signature Bytes             | 0010 1000          | xxxx A1 <sup>10</sup> A9 <sup>9</sup> A8 <sup>8</sup> | A7 xxx xxxx0   | Signature Byte   | Read Signature Byte   |
| Read Program Memory (Page Mode)  | 0011 0000          | xxxx A1 <sup>10</sup> A9 <sup>9</sup> A8 <sup>8</sup> | Byte 0   | Byte 1...<br>Byte 255  | Read data from Program memory in the Page Mode (256 bytes)                            |
| Write Program Memory (Page Mode) | 0101 0000          | xxxx A1 <sup>10</sup> A9 <sup>9</sup> A8 <sup>8</sup> | Byte 0   | Byte 1...<br>Byte 255  | Write data to Program memory in the Page Mode (256 bytes)                             |

1. B1 = 0, B2 = 0 → Mode 1, no lock protection
- B1 = 0, B2 = 1 → Mode 2, lock bit 1 activated
- B1 = 1, B2 = 0 → Mode 3, lock bit 2 activated
- B1 = 1, B2 = 1 → Mode 4, lock bit 3 activated

} Each of the lock bit modes need to be activated sequentially before Mode 4 can be executed.

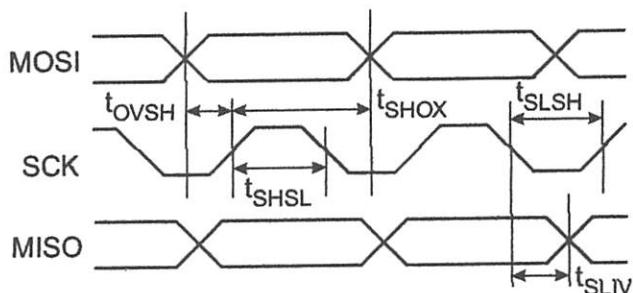
After Reset signal is high, SCK should be low for at least 64 system clocks before it goes high to clock in the enable data bytes. No pulsing of Reset signal is necessary. SCK should be no faster than 1/16 of the system clock at XTAL1.

For Page Read/Write, the data always starts from byte 0 to 255. After the command byte and upper address byte are latched, each byte thereafter is treated as data until all 256 bytes are shifted in/out. Then the next instruction will be ready to be decoded.



## Serial Programming Characteristics

Figure 9. Serial Programming Timing

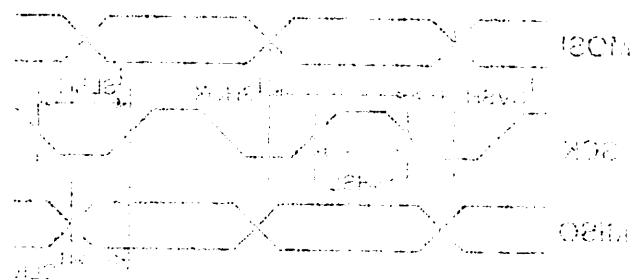
Table 9. Serial Programming Characteristics,  $T_A = -40^\circ C$  to  $85^\circ C$ ,  $V_{CC} = 4.0 - 5.5V$  (Unless Otherwise Noted)

| Symbol     | Parameter                         | Min          | Typ | Max                 | Units   |
|------------|-----------------------------------|--------------|-----|---------------------|---------|
| $t_{CLCL}$ | Oscillator Frequency              | 3            |     | 33                  | MHz     |
| $t_{LCL}$  | Oscillator Period                 | 30           |     |                     | ns      |
| $t_{HSL}$  | SCK Pulse Width High              | $8 t_{CLCL}$ |     |                     | ns      |
| $t_{LSH}$  | SCK Pulse Width Low               | $8 t_{CLCL}$ |     |                     | ns      |
| $t_{VSH}$  | MOSI Setup to SCK High            | $t_{CLCL}$   |     |                     | ns      |
| $t_{HOX}$  | MOSI Hold after SCK High          | $2 t_{CLCL}$ |     |                     | ns      |
| $t_{LIV}$  | SCK Low to MISO Valid             | 10           | 16  | 32                  | ns      |
| $t_{RASE}$ | Chip Erase Instruction Cycle Time |              |     | 500                 | ms      |
| $t_{WC}$   | Serial Byte Write Cycle Time      |              |     | $64 t_{CLCL} + 400$ | $\mu s$ |

12295TA

#### III. Broadband Classification

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## Absolute Maximum Ratings\*

|   |                 |
|---|-----------------|
| Operating Temperature.....                    | -55°C to +125°C |
| Storage Temperature.....                      | -65°C to +150°C |
| Current on Any Pin<br>Respect to Ground ..... | -1.0V to +7.0V  |
| Maximum Operating Voltage .....               | 6.6V            |
| Output Current.....                           | 15.0 mA         |

\*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## Characteristics

Values shown in this table are valid for  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  and  $V_{CC} = 4.0\text{V}$  to  $5.5\text{V}$ , unless otherwise noted.

| Parameter  | Condition   | Min               | Max               | Units            |
|--|---|-------------------|-------------------|------------------|
| Input Low Voltage  | (Except EA)   | -0.5              | 0.2 $V_{CC}$ -0.1 | V                |
| Input Low Voltage (EA)                                   |   | -0.5              | 0.2 $V_{CC}$ -0.3 | V                |
| Input High Voltage                                       | (Except XTAL1, RST)   | 0.2 $V_{CC}$ +0.9 | $V_{CC}$ +0.5     | V                |
| Input High Voltage                                       | (XTAL1, RST)  | 0.7 $V_{CC}$      | $V_{CC}$ +0.5     | V                |
| Output Low Voltage <sup>(1)</sup> (Ports 1,2,3)          | $I_{OL} = 1.6 \text{ mA}$                                   |                   | 0.45              | V                |
| Output Low Voltage <sup>(1)</sup><br>(Port 0, ALE, PSEN) | $I_{OL} = 3.2 \text{ mA}$                                   |                   | 0.45              | V                |
| Output High Voltage<br>(Ports 1,2,3, ALE, PSEN)          | $I_{OH} = -60 \mu\text{A}$ , $V_{CC} = 5\text{V} \pm 10\%$  | 2.4               |                   | V                |
|  | $I_{OH} = -25 \mu\text{A}$                                  | 0.75 $V_{CC}$     |                   | V                |
|  | $I_{OH} = -10 \mu\text{A}$                                  | 0.9 $V_{CC}$      |                   | V                |
| Output High Voltage<br>(Port 0 in External Bus Mode)     | $I_{OH} = -800 \mu\text{A}$ , $V_{CC} = 5\text{V} \pm 10\%$ | 2.4               |                   | V                |
|  | $I_{OH} = -300 \mu\text{A}$                                 | 0.75 $V_{CC}$     |                   | V                |
|  | $I_{OH} = -80 \mu\text{A}$                                  | 0.9 $V_{CC}$      |                   | V                |
| Logical 0 Input Current (Ports 1,2,3)                    | $V_{IN} = 0.45\text{V}$                                     |                   | -50               | $\mu\text{A}$    |
| Logical 1 to 0 Transition Current<br>(Ports 1,2,3)       | $V_{IN} = 2\text{V}$ , $V_{CC} = 5\text{V} \pm 10\%$        |                   | -650              | $\mu\text{A}$    |
| Input Leakage Current (Port 0, EA)                       | $0.45 < V_{IN} < V_{CC}$                                    |                   | $\pm 10$          | $\mu\text{A}$    |
| Reset Pulldown Resistor                                  |   | 50                | 300               | $\text{k}\Omega$ |
| Pin Capacitance  | Test Freq. = 1 MHz, $T_A = 25^\circ\text{C}$                |                   | 10                | pF               |
| Power Supply Current                                     | Active Mode, 12 MHz   |                   | 25                | mA               |
|  | Idle Mode, 12 MHz   |                   | 6.5               | mA               |
| Power-down Mode <sup>(2)</sup>                           | $V_{CC} = 5.5\text{V}$                                      |                   | 50                | $\mu\text{A}$    |

- 1. Under steady state (non-transient) conditions,  $I_{OL}$  must be externally limited as follows:  
 Maximum  $I_{OL}$  per port pin: 10 mA  
 Maximum  $I_{OL}$  per 8-bit port:  
 Port 0: 26 mA      Ports 1, 2, 3: 15 mA  
 Maximum total  $I_{OL}$  for all output pins: 71 mA  
 If  $I_{OL}$  exceeds the test condition,  $V_{OL}$  may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test conditions.
- 2. Minimum  $V_{CC}$  for Power-down is 2V.



## Outline Maximum Ratings\*

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation beyond these maximum ratings is not implied. Exposure of storage devices to high temperatures during shipping and handling is not implied. Exposures of storage devices to high temperatures during shipping and handling may affect reliability.

### NOTICE:

|                                |                 |
|--------------------------------|-----------------|
| Storage Temperature.....       | -55°C to +150°C |
| Operating Temperature.....     | -40°C to +120°C |
| Range of Any Pin.....          | -1.0V to +3.0V  |
| Output Grounding Voltage.....  | 0.0V            |
| Output Current Capability..... | 1.5 mA          |

## Characteristics

values shown in this table are valid for  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  and  $V_{CC} = 4.0\text{V}$  to  $6.0\text{V}$ , unless otherwise noted.

| Unit           | Max                      | Min                     | Condition   | Parameter   |
|----------------|--------------------------|-------------------------|---|---|
| V              | 1.0 $\leq$ V $\leq$ 0.1  | -0.1                    | (Except EA)   | Input Low Voltage                                 |
| V              | 0.0 $\leq$ V $\leq$ -0.3 | -0.1                    |   | Input Low Voltage (EA)                            |
| V              | 0.0 $\leq$ V $\leq$ 0.5  | -0.05 $\leq$ V $\leq$ 0 | (Except XTAL, RST)                                      | Input High Voltage                                |
| V              | 0.0 $\leq$ V $\leq$ 0.5  | -0.1 $\leq$ V $\leq$ 0  | (XTAL, RST)   | Input High Voltage (EA)                           |
| V              | 24.0                     |                         | $I_{OL} = 1.0 \text{ mA}$                               | Output Low Voltage (Port 0, PSEN)                 |
| V              | 24.0                     |                         | $I_{OL} = 3.5 \text{ mA}$                               | Output Low Voltage (Port 1, S3)                   |
| V              |                          | 2.5                     | $I_{OH} = -50 \text{ nA}, V_{CC} = 2.5 \pm 10\%$        | Output High Voltage                               |
| V              |                          | 0.75 V <sub>CC</sub>    | $I_{OH} = -25 \text{ nA}$                               | Output High Voltage (Port 1, S3, 0)               |
| V              |                          | 0.0 V <sub>CC</sub>     | $I_{OH} = -10 \text{ nA}$                               | Output High Voltage (Port 0 in Extreme Bias Mode) |
| V              |                          | 2.5                     | $I_{OH} = -800 \text{ nA}, V_{CC} = 2.5 \pm 10\%$       | Output High Voltage (Port 0, ALE, PSEN)           |
| V              |                          | 0.75 V <sub>CC</sub>    | $I_{OH} = -300 \text{ nA}$                              |   |
| V              |                          | 0.0 V <sub>CC</sub>     | $I_{OH} = -8 \text{ nA}$                                |   |
| A <sub>n</sub> |                          | -20                     | $A_n = 0.45\text{A}$                                    | Forward Input Current (Ports 1, 3)                |
| A <sub>n</sub> |                          | -250                    | $A_n = 0.45\text{A}$                                    | Forward Input Current (Port 0 Transistor Current) |
|                |                          |                         | $A_{IN} = 2N A_{nC} = 2A \pm 10\%$                      | (Ports 1, 3)                                      |
| A <sub>n</sub> |                          | 20                      | $0.45 < A_n < A_{nC}$                                   | Input Package Current (Port 0, EA)                |
| R <sub>O</sub> |                          | 40                      | $I_{SET\,FEED} = 1 \text{ MHz}, T_A = 25^\circ\text{C}$ | Reset Pull-down Resistor                          |
| R <sub>E</sub> |                          | 10                      | $A_{DE} = 15 \text{ MHz}$                               | Pin Capacitance                                   |
| A <sub>n</sub> |                          | 25                      | $I_{DE} = 15 \text{ MHz}$                               | Power Supply Current                              |
| A <sub>n</sub> |                          | 0.0                     | $I_{DE} = 15 \text{ MHz}$                               |   |
| A <sub>n</sub> |                          | 20                      | $A_{nC} = 0.45\text{A}$                                 | Power-down Current                                |

\* Under steady state (non-transient) conditions,  $I_{OL}$  must be externally limited as follows:

Maximum current per 8-pin port  $\leq 10 \text{ mA}$

Maximum current per 8-pin port  $\leq 1 \text{ mA}$

Port 0, 25  $\mu\text{A}$  Port 1, 5, 3, 0, 15  $\mu\text{A}$

Maximum current per all output pins  $\leq 1 \text{ mA}$

If  $I_{OL}$  exceeds the test condition,  $A_{nC}$  may exceed the listed specification. This is not guaranteed of sink current draw.

3. Minimum  $V_{CC}$  for Power-down is 2V

AT89S51

**Characteristics**

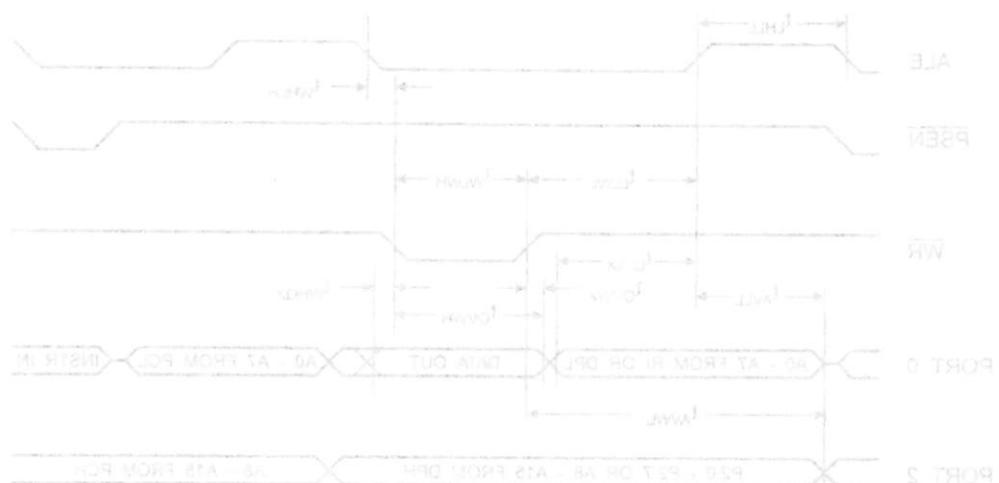
operating conditions, load capacitance for Port 0, ALE/PROG, and PSEN = 100 pF; load capacitance for all other pins = 80 pF.

**External Program and Data Memory Characteristics**

| Symbol | Parameter                          | 12 MHz Oscillator |     | Variable Oscillator |                 | Units |
|--------|------------------------------------|-------------------|-----|---------------------|-----------------|-------|
|        |                                    | Min               | Max | Min                 | Max             |       |
| CL     | Oscillator Frequency               |                   |     | 0                   | 33              | MHz   |
|        | ALE Pulse Width                    | 127               |     | $2t_{CLCL}-40$      |                 | ns    |
|        | Address Valid to ALE Low           | 43                |     | $t_{CLCL}-25$       |                 | ns    |
|        | Address Hold After ALE Low         | 48                |     | $t_{CLCL}-25$       |                 | ns    |
|        | ALE Low to Valid Instruction In    |                   | 233 |                     | $4t_{CLCL}-65$  | ns    |
|        | ALE Low to PSEN Low                | 43                |     | $t_{CLCL}-25$       |                 | ns    |
|        | PSEN Pulse Width                   | 205               |     | $3t_{CLCL}-45$      |                 | ns    |
|        | PSEN Low to Valid Instruction In   |                   | 145 |                     | $3t_{CLCL}-60$  | ns    |
|        | Input Instruction Hold After PSEN  | 0                 |     | 0                   |                 | ns    |
|        | Input Instruction Float After PSEN |                   | 59  |                     | $t_{CLCL}-25$   | ns    |
|        | PSEN to Address Valid              | 75                |     | $t_{CLCL}-8$        |                 | ns    |
|        | Address to Valid Instruction In    |                   | 312 |                     | $5t_{CLCL}-80$  | ns    |
|        | PSEN Low to Address Float          |                   | 10  |                     | 10              | ns    |
| R      | RD Pulse Width                     | 400               |     | $6t_{CLCL}-100$     |                 | ns    |
| W      | WR Pulse Width                     | 400               |     | $6t_{CLCL}-100$     |                 | ns    |
|        | RD Low to Valid Data In            |                   | 252 |                     | $5t_{CLCL}-90$  | ns    |
| D      | Data Hold After RD                 | 0                 |     | 0                   |                 | ns    |
| Z      | Data Float After RD                |                   | 97  |                     | $2t_{CLCL}-28$  | ns    |
|        | ALE Low to Valid Data In           |                   | 517 |                     | $8t_{CLCL}-150$ | ns    |
|        | Address to Valid Data In           |                   | 585 |                     | $9t_{CLCL}-165$ | ns    |
|        | ALE Low to RD or WR Low            | 200               | 300 | $3t_{CLCL}-50$      | $3t_{CLCL}+50$  | ns    |
| L      | Address to RD or WR Low            | 203               |     | $4t_{CLCL}-75$      |                 | ns    |
| WX     | Data Valid to WR Transition        | 23                |     | $t_{CLCL}-30$       |                 | ns    |
| WH     | Data Valid to WR High              | 433               |     | $7t_{CLCL}-130$     |                 | ns    |
| DX     | Data Hold After WR                 | 33                |     | $t_{CLCL}-25$       |                 | ns    |
| Z      | RD Low to Address Float            |                   | 0   |                     | 0               | ns    |
| H      | RD or WR High to ALE High          | 43                | 123 | $t_{CLCL}-25$       | $t_{CLCL}+25$   | ns    |



## Serial Disk Memory Write Cycle



## Serial Clock Drive Waveforms



## Serial Clock Drive

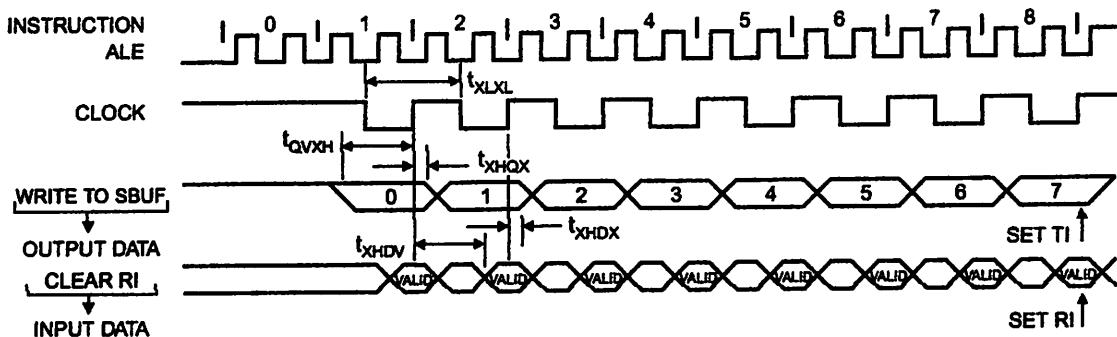
| Signal | Parameter            | Unit | Max | Min | Notes    |
|--------|----------------------|------|-----|-----|----------|
|        | Acquisition Deadtime | ns   | 39  | 0   | 0.015 μs |
|        | Clock Period         | ns   | 30  | 15  | 0.015 μs |
|        | High Time            | ns   | 15  | 15  | 0.015 μs |
|        | Low Time             | ns   | 8   | 8   | 0.015 μs |
|        | Total Period         | ns   | 23  | 23  | 0.03 μs  |

## Serial Port Timing: Shift Register Mode Test Conditions

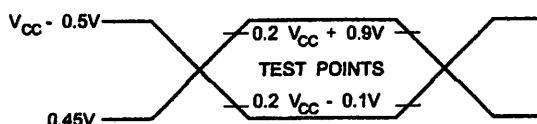
Values in this table are valid for  $V_{CC} = 4.0V$  to  $5.5V$  and Load Capacitance =  $80\text{ pF}$ .

| Parameter                                | 12 MHz Osc |     | Variable Oscillator |                  | Units         |
|--|------------|-----|---------------------|------------------|---------------|
|  | Min        | Max | Min                 | Max              |               |
| Serial Port Clock Cycle Time             | 1.0        |     | $12t_{CLCL}$        |                  | $\mu\text{s}$ |
| Output Data Setup to Clock Rising Edge   | 700        |     | $10t_{CLCL}-133$    |                  | ns            |
| Output Data Hold After Clock Rising Edge | 50         |     | $2t_{CLCL}-80$      |                  | ns            |
| Input Data Hold After Clock Rising Edge  | 0          |     | 0                   |                  | ns            |
| Clock Rising Edge to Input Data Valid    |            | 700 |                     | $10t_{CLCL}-133$ | ns            |

## Shift Register Mode Timing Waveforms

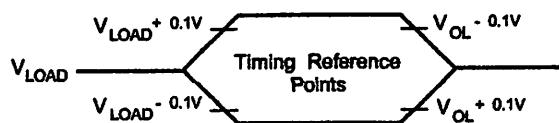


## Testing Input/Output Waveforms<sup>(1)</sup>



- AC Inputs during testing are driven at  $V_{CC} - 0.5V$  for a logic 1 and  $0.45V$  for a logic 0. Timing measurements are made at  $V_{IH}$  min. for a logic 1 and  $V_{IL}$  max. for a logic 0.

## Load Waveforms<sup>(1)</sup>



- For timing purposes, a port pin is no longer floating when a 100 mV change from load voltage occurs. A port pin begins to float when a 100 mV change from the loaded  $V_{OH}/V_{OL}$  level occurs.

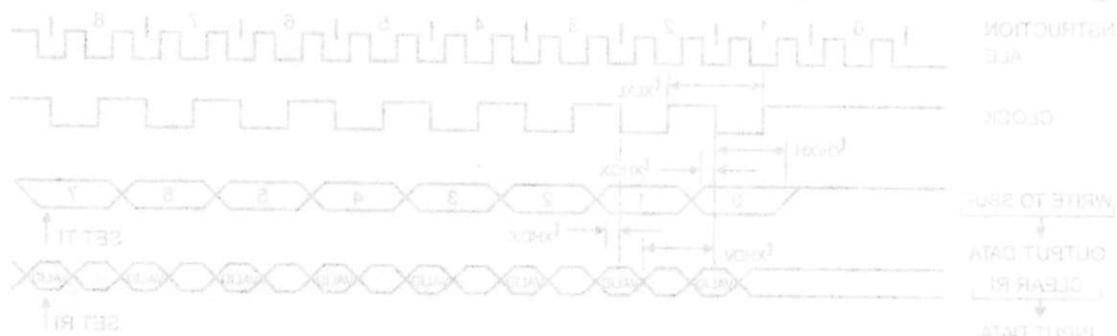


## 4.1 Port Timing: Shift Register Mode Test Conditions

unless otherwise specified. All values are valid for  $V_{CC} = 4.0V$  of  $2.5V$  and load capacitance =  $80\text{ pF}$ .

| Parameter                                | Units | Min | Max | Symbol Description                       | 15 MHz $V_{CC}$ |
|--|-------|-----|-----|--|-----------------|
| Setup Hold Edge of Input Data Valid      | ns    | 0   | 100 | Setup Hold Edge of Input Data Valid      | 125ns           |
| Output Data Setup to Clock Rising Edge   | ns    | 0   | 50  | Output Data Setup to Clock Rising Edge   | 100ns - 133     |
| Output Data Hold After Clock Rising Edge | ns    | 0   | 50  | Output Data Hold After Clock Rising Edge | 50ns - 80       |
| Serial Port Clock Edge Time              | ns    | 0   | 4.0 | Serial Port Clock Edge Time              | 4.0             |

## 4.2 Register Mode Timing Waveforms



## 4.3 Testing Input/Output Register Waveforms



AC inputs during testing are driven at  $V_{CC} = 0.8V$  for logic 1 and  $0.45V$  for logic 0. Timing measurements are made at  $V_{DD}$  with logic 1 and  $V_{DD} - 0.45V$  with logic 0.

## 4.4 Test Waveforms



For pulsed burst test, a pulse bin is one longer than a full bin of  $100\text{ nV}$  chirp from load voltage source. A full bin occurs if logic 1 when a  $100\text{ nV}$  chirp from this loaded  $V_{DD}/V_{DD} - 0.45V$  level occurs.

**Ordering Information**

| <b>Speed<br/>Hz)</b> | <b>Power<br/>Supply</b> | <b>Ordering Code</b> | <b>Package</b> | <b>Operation Range</b>          |
|----------------------|-------------------------|----------------------|----------------|---------------------------------|
| 24                   | 4.0V to 5.5V            | AT89S51-24AC         | 44A            | Commercial<br>(0° C to 70° C)   |
|                      |                         | AT89S51-24JC         | 44J            |                                 |
|                      |                         | AT89S51-24PC         | 40P6           |                                 |
|                      |                         | AT89S51-24SC         | 42PS6          |                                 |
|                      |                         | AT89S51-24AI         | 44A            | Industrial<br>(-40° C to 85° C) |
|                      |                         | AT89S51-24JI         | 44J            |                                 |
|                      |                         | AT89S51-24PI         | 40P6           |                                 |
|                      |                         | AT89S51-24SI         | 42PS6          |                                 |
| 33                   | 4.5V to 5.5V            | AT89S51-33AC         | 44A            | Commercial<br>(0° C to 70° C)   |
|                      |                         | AT89S51-33JC         | 44J            |                                 |
|                      |                         | AT89S51-33PC         | 40P6           |                                 |
|                      |                         | AT89S51-33SC         | 42PS6          |                                 |

**Package Type**

|    |  |
|----|--|
|    | 44-lead, Thin Plastic Gull Wing Quad Flatpack (TQFP)     |
|    | 44-lead, Plastic J-leaded Chip Carrier (PLCC)            |
| 6  | 40-pin, 0.600" Wide, Plastic Dual Inline Package (PDIP)  |
| S6 | 42-pin, 0.600" Wide, Plastic Dual Inline Package (PDSIP) |



### noisemonth going

| Object lesson Name | Description    | Page No.                   | Object lesson Code   | Supply   | Price                        | Date      |
|--------------------|----------------|----------------------------|--|--|------------------------------|-----------|
| Communication      | (0- C or 50-C) | A44<br>L44<br>W504<br>W508 | AT80821-3740<br>AT80821-3740<br>AT80821-3740<br>AT80821-3740 | AT80821-3740<br>AT80821-3740<br>AT80821-3740<br>AT80821-3740 | 4.50<br>4.50<br>4.50<br>4.50 | 10/2/2014 |
| Impression         | (0- C or 50-C) | A44<br>L44<br>W504<br>W508 | AT80821-3741<br>AT80821-3741<br>AT80821-3741<br>AT80821-3741 | AT80821-3741<br>AT80821-3741<br>AT80821-3741<br>AT80821-3741 | 4.50<br>4.50<br>4.50<br>4.50 | 10/2/2014 |
| Communication      | (0- C or 50-C) | A44<br>L44<br>W504<br>W508 | AT80821-3742<br>AT80821-3742<br>AT80821-3742<br>AT80821-3742 | AT80821-3742<br>AT80821-3742<br>AT80821-3742<br>AT80821-3742 | 4.50<br>4.50<br>4.50<br>4.50 | 10/2/2014 |

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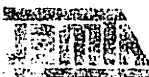
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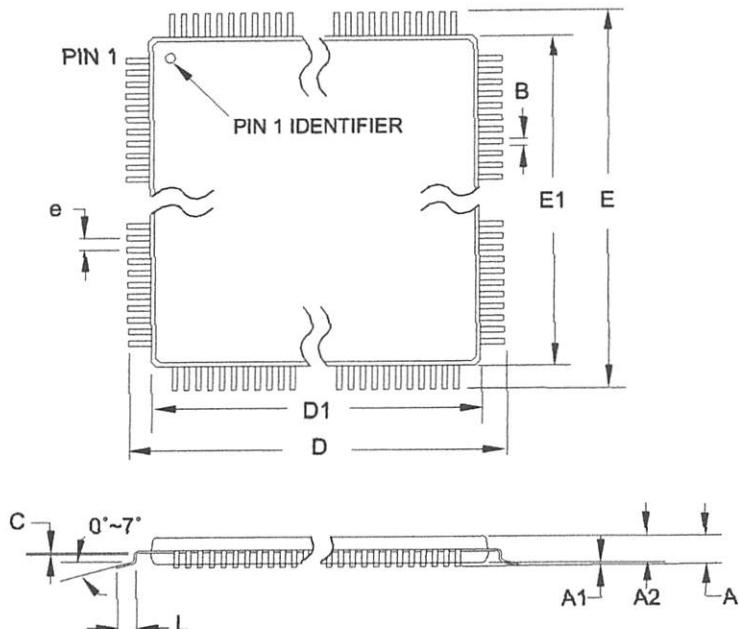
(SICB) 89-2005-0001 Rev 0 Date 09-2006 P. 3 of 13

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## Caging Information

### - TQFP



**COMMON DIMENSIONS**  
(Unit of Measure = mm)

| SYMBOL | MIN      | NOM   | MAX   | NOTE   |
|--------|----------|-------|-------|--------|
| A      | —        | —     | 1.20  |        |
| A1     | 0.05     | —     | 0.15  |        |
| A2     | 0.95     | 1.00  | 1.05  |        |
| D      | 11.75    | 12.00 | 12.25 |        |
| D1     | 9.90     | 10.00 | 10.10 | Note 2 |
| E      | 11.75    | 12.00 | 12.25 |        |
| E1     | 9.90     | 10.00 | 10.10 | Note 2 |
| B      | 0.30     | —     | 0.45  |        |
| C      | 0.09     | —     | 0.20  |        |
| L      | 0.45     | —     | 0.75  |        |
| e      | 0.80 TYP |       |       |        |

Notes:

1. This package conforms to JEDEC reference MS-026, Variation ACB.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is 0.25 mm per side. Dimensions D1 and E1 are maximum plastic body size dimensions including mold mismatch.
3. Lead coplanarity is 0.10 mm maximum.

10/5/2001

| 2325 Orchard Parkway<br>San Jose, CA 95131 | TITLE<br>44A, 44-lead, 10 x 10 mm Body Size, 1.0 mm Body Thickness,<br>0.8 mm Lead Pitch, Thin Profile Plastic Quad Flat Package (TQFP) | DRAWING NO. 44A | REV. B |
|--|---|-----------------|--------|
|--|---|-----------------|--------|



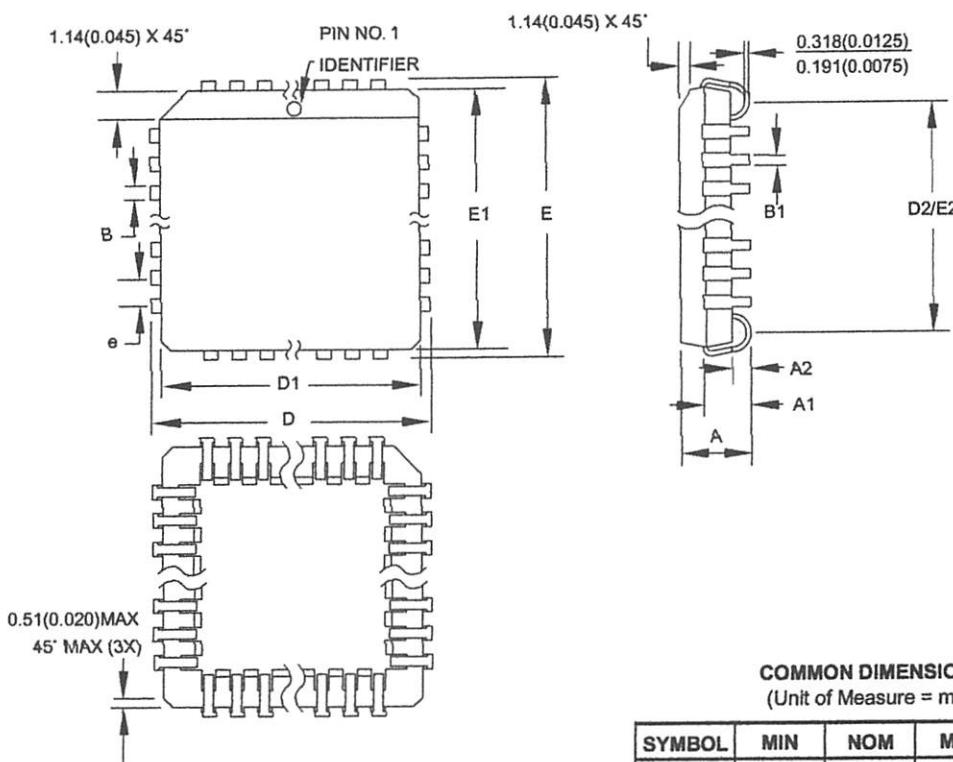
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930T-

1228TA

10. 1997 1998 1999 2000 2001

## - PLCC



- Notes:
1. This package conforms to JEDEC reference MS-018, Variation AC.
  2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is .010" (0.254 mm) per side. Dimension D1 and E1 include mold mismatch and are measured at the extreme material condition at the upper or lower parting line.
  3. Lead coplanarity is 0.004" (0.102 mm) maximum.

COMMON DIMENSIONS  
(Unit of Measure = mm)

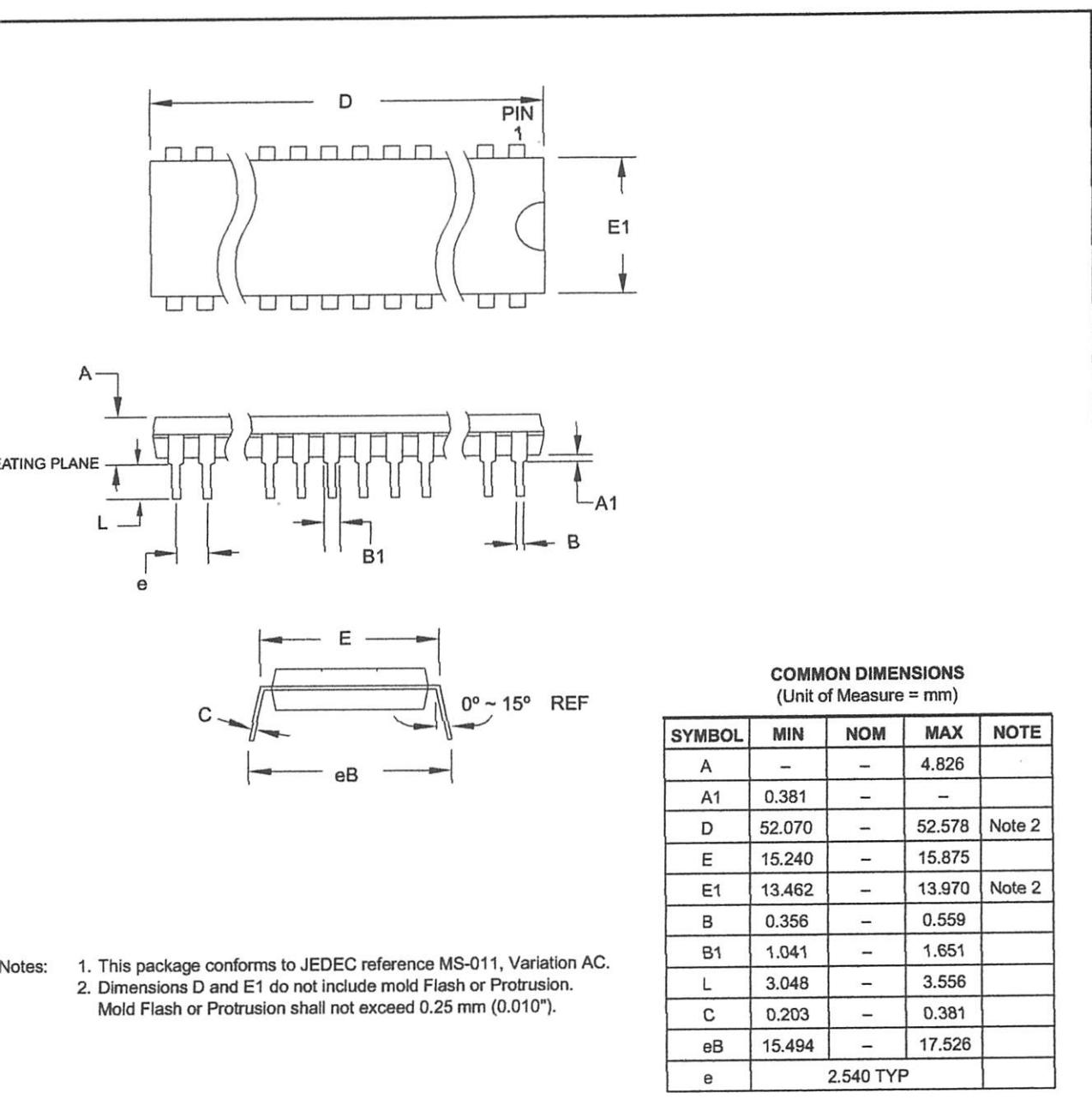
| SYMBOL | MIN       | NOM | MAX    | NOTE   |
|--------|-----------|-----|--------|--------|
| A      | 4.191     | —   | 4.572  |        |
| A1     | 2.286     | —   | 3.048  |        |
| A2     | 0.508     | —   | —      |        |
| D      | 17.399    | —   | 17.653 |        |
| D1     | 16.510    | —   | 16.662 | Note 2 |
| E      | 17.399    | —   | 17.653 |        |
| E1     | 16.510    | —   | 16.662 | Note 2 |
| D2/E2  | 14.986    | —   | 16.002 |        |
| B      | 0.660     | —   | 0.813  |        |
| B1     | 0.330     | —   | 0.533  |        |
| e      | 1.270 TYP |     |        |        |

10/04/01

| DATE                                       | TITLE  | DRAWING NO. | REV. |
|--|--|-------------|------|
| 2325 Orchard Parkway<br>San Jose, CA 95131 | 44J, 44-lead, Plastic J-leaded Chip Carrier (PLCC) | 44J         | B    |



- PDIP



Notes:

1. This package conforms to JEDEC reference MS-011, Variation AC.
2. Dimensions D and E1 do not include mold Flash or Protrusion.  
Mold Flash or Protrusion shall not exceed 0.25 mm (0.010").

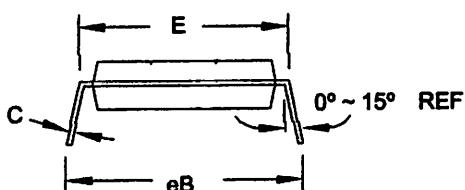
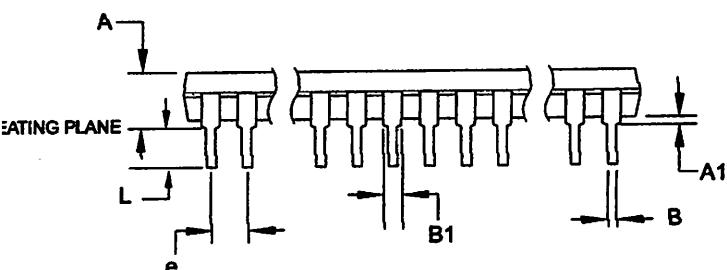
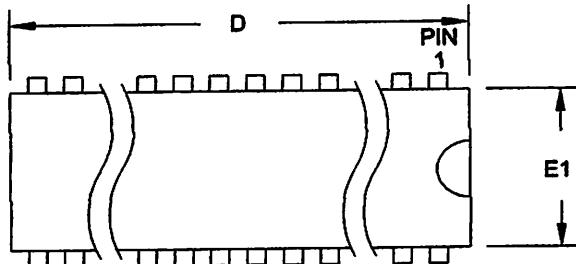
09/28/01

| TITLE                                      |  | DRAWING NO. | REV. |
|--|--|-------------|------|
| 2325 Orchard Parkway<br>San Jose, CA 95131 | 40P6, 40-lead (0.600"/15.24 mm Wide) Plastic Dual<br>Inline Package (PDIP) | 40P6        | B    |



qigq -

## 6 - PDIP



**COMMON DIMENSIONS**  
(Unit of Measure = mm)

| SYMBOL | MIN      | NOM | MAX   | NOTE   |
|--------|----------|-----|-------|--------|
| A      | -        | -   | 4.83  |        |
| A1     | 0.51     | -   | -     |        |
| D      | 36.70    | -   | 36.98 | Note 2 |
| E      | 15.24    | -   | 15.88 |        |
| E1     | 13.48    | -   | 13.97 | Note 2 |
| B      | 0.38     | -   | 0.56  |        |
| B1     | 0.76     | -   | 1.27  |        |
| L      | 3.05     | -   | 3.43  |        |
| C      | 0.20     | -   | 0.30  |        |
| eB     | -        | -   | 18.55 |        |
| e      | 1.78 TYP |     |       |        |

Notes:

1. This package conforms to JEDEC reference MS-011, Variation AC.
2. Dimensions D and E1 do not include mold Flash or Protrusion. Mold Flash or Protrusion shall not exceed 0.25 mm (0.010").

11/6/03

| 2325 Orchard Parkway<br>San Jose, CA 95131 | TITLE<br>42PS6, 42-lead (0.600"/15.24 mm Wide) Plastic Dual<br>Inline Package (PDIP) | DRAWING NO.<br>42PS6 | REV.<br>A |
|--|--|----------------------|-----------|
|--|--|----------------------|-----------|

|  |   |                                  |
|--|---|----------------------------------|
| NAME OF THE PERSON OR ENTITY<br>TO BE IDENTIFIED | TYPE OF ID. AND NO.<br>OF THE PERSON IDENTIFIED | NAME<br>OF THE PERSON IDENTIFIED |
| LATE   | 027489105                                       | 100-1607-13-02                   |

THE SUBJECT IS A 50 YR OLD MALE  
LIVING IN THE CITY OF NEW YORK, NY. HE IS  
A RETIRED BUSINESSMAN WHO HAS BEEN INVOLVED IN  
THE FINANCIAL INDUSTRY FOR THE PAST 30 YEARS.

| ITEM | ITEM | ITEM |
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Amelia's husband, John, was a member of the local militia and fought in the American Revolution. He died in 1802, leaving behind a wife and two sons, John Jr. and George. Amelia's son, John Jr., became a prominent lawyer and served as a member of the U.S. House of Representatives from 1813 to 1817. He died in 1837.

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2021-08-04-27345

# **Manual Reference**

## **AT Command Set**

**(GSM 07.07, GSM 07.05,  
Siemens specific commands)**

**for the SIEMENS Mobile Phones**

**S35i, C35i, M35i**

## Mainland References

AT Command Set

(GSM 0.5, GSM 0.8)  
Siemens specific commands

for the SIEMENS Mobile Phone

2321, 2321, 2321

### 1.3.2. AT Commands According to GSM 07.05 for SMS

The GSM 07.05 commands are used for operating the SMS functions of the GSM mobile phone. The GSM module MOBILE supports the SMS PDU mode.

| <b>AT+CSMS</b>                                  |  | <b>Selection of message service<br/>Revision according to GSM 07.05 Version 5.0.0</b>   |
|---|--|---|
| Test command<br><b>AT+CSMS=?</b>                |  | <p>Response<br/>+CSMS: (&lt;list of supported &lt;service&gt;s)</p> <p>Parameter<br/>&lt;service&gt; 0      GSM 3.40 and 3.41<br/>                  1      GSM 3.40 and 3.41 and compatibility of the AT command syntax for phase 2+</p> <p>NOTE:      Deactivating the phase 2+ compatibility is only possible if the direct output of short messages +CNMI=1,2 or +CNMI=1,3 is not activated. If necessary, the latter should be deactivated first.</p> |
| Read command<br><b>AT+CSMS?</b>                 |  | <p>Response<br/>+CSMS: &lt;service&gt;,&lt;mt&gt;,&lt;mo&gt;,&lt;bm&gt;</p> <p>Parameter<br/>&lt;service&gt; 0      GSM 3.40 and 3.41<br/>&lt;mt&gt;      Mobile terminated messages<br/>                  1      Type supported<br/>&lt;mo&gt;      Mobile originated messages<br/>                  1      Type supported<br/>&lt;bm&gt;      Broadcast type messages<br/>                  0      Type not supported</p>                               |
| Write command<br><b>AT+CSMS=&lt;service&gt;</b> |  | <p>Parameter<br/>&lt;service&gt; 0      GSM 3.40 and 3.41</p> <p>Response<br/>+CSMS: &lt;mt&gt;,&lt;mo&gt;,&lt;bm&gt;<br/>OK/ERROR/+CMS ERROR</p>   |

| <b>AT+CPMS</b>   |   | <b>Selection of SMS memory<br/>Revision according to GSM 07.05 Version 4.7.0</b> |
|--|---|--|
| Test command<br><b>AT+CPMS=?</b>                                     | Response<br>+CPMS: (list of supported <mem1>s),( list of supported <mem2>s)<br>,(list of supported <mem3>s)<br>Parameter<br><mem1> Memory from which messages are read and deleted<br>"SM" SIM-messages memory<br><mem2> Memory to which messages are written and sent<br>"SM" SIM-messages memory<br><mem3> Memory in which received messages are stored, if forwarding to the<br>("CNMI")<br>"SM" SIM-messages memory | PC is not set  |
| Read command<br><b>AT+CPMS?</b>                                      | Response<br>+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2><br>,<mem3>,<used3>,<total3><br>Parameter<br><memx> Memory from which messages are read and deleted<br><usedx> Number of messages currently in <memx><br><totalx> Number of storable messages in <memx>   |  |
| Write command<br><b>AT+CPMS=</b><br><mem1><br>[,<mem2><br>[,<mem3>]] | Parameter<br><mem1> See Test command<br><mem2> See Test command<br><mem3> See Test command<br><br>Response<br>+CPMS: <used1>,<total1>,<used2>,<total3>,<used3>,<total3><br>OK/ERROR/+CMS ERROR  |  |

| <b>AT+CMGF</b>  |  | <b>SMS format</b> |
|---|--|-------------------|
| Test command<br><b>AT+CMGF=?</b>                          | Response<br>+CMGF: (list of supported <mode>s)                 |                   |
|   | Parameter<br><mode>:<br>0 PDU mode                             |                   |
| Read command<br><b>AT+CMGF?</b>                           | Response<br>+CMGF: <mode>                                      |                   |
|   | Parameter<br><mode>:<br>0 PDU mode                             |                   |
| Write command<br><b>AT+CMGF=[&lt;</b><br><b>mode&gt;]</b> | Parameter<br><mode>:<br>0 PDU mode<br><br>Response<br>OK/ERROR |                   |

| <b>AT+CSCA</b>   |   | <b>Address of the SMS service center</b> |
|--|---|--|
| Test command<br><b>AT+CSCA=?</b>                                       | Response<br>OK  |  |
| Read command<br><b>AT+CSCA?</b>  | Response<br>+CSCA: <sca>,<tosca><br>Parameter<br><sca> Service-center address in string format<br><tosca> Service-center address format |  |
| Write command<br><b>AT+CSCA=</b><br><b>&lt;sca&gt;[,&lt;tosca&gt;]</b> | Parameter<br><sca> Service-center address in string format<br><tosca> Service-center address format<br>Response<br>OK/ERROR             |  |

| <b>AT+CNMI</b>                   |  | <b>Display new incoming SMS</b><br><b>Revision according to GSM 07.05 Version 4.7.0</b>   |
|----------------------------------|--|---|
| Test command<br><b>AT+CNMI=?</b> | Response<br>+CNMI: (list of supported <mode>s),(list of supported <mt>s),(list of supported <bm>s),(list of supported <ds>s),(list of supported <bfr>s)<br>Parameter<br><mode> | <p>0 Buffers unexpected messages (but is equivalent to rejecting; see &lt;bfr&gt;)</p> <p>1 Discard indication and reject new received message unsolicited result codes when TA-TE link is reserved. Otherwise forward them directly to the TE. (only with S25ff)</p> <p>2 Buffers unexpected messages if serial interface is occupied, otherwise they are output (only models before S25)</p> <p>&lt;mt&gt;</p> <ul style="list-style-type: none"> <li>0 Suppresses unexpected messages for incoming short messages</li> <li>1 Unexpected messages of a received short message (SMS-DELIVER) that is stored on a chip card are output in the form +CMTI: &lt;mem&gt;,&lt;index&gt;</li> <li>2 Unexpected messages of a received short message (SMS-DELIVER) (except class 2 and the message "Waiting Indication Group: store message") are output in the form +CMT: [&lt;alpha&gt;],&lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt; (&lt;alpha&gt; is not supported)</li> <li>3 Class 2 and the message "Waiting Indication Group: store message" are output as &lt;mt&gt;=1</li> </ul> <p>NOTE: &lt;mt&gt;=2 and &lt;mt&gt;=3 are not possible unless the Phase 2+ compatibility has been activated by means of +CSMS=1</p> <p>&lt;bm&gt;</p> <ul style="list-style-type: none"> <li>0 Suppresses unexpected messages for incoming cell broadcast messages</li> <li>2 Outputs unexpected messages for cell broadcast messages in the form +CBM: &lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;</li> </ul> <p>&lt;ds&gt;</p> <ul style="list-style-type: none"> <li>0 Suppresses unexpected messages for incoming SMS status reports</li> <li>2 Outputs unexpected messages for SMS status reports in the form +CDS: &lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;</li> </ul> |



|   |  |
|---|--|
|   | <p>&lt;bfr&gt; 1 Buffered unexpected messages are rejected when switching from &lt;mode&gt; 0 to &lt;mode&gt; 2.</p> <p>&lt;mem&gt; See +CPMS<br/>     &lt;index&gt; Index of the record on the chip card<br/>     &lt;alpha&gt; alphanumeric representation of the sender address<br/>     &lt;length&gt; Length of &lt;pdu&gt;<br/>     &lt;pdu&gt; See +CMGL</p>  |
| Read command<br><b>AT+CNMI?</b>   | <p>Response<br/>+CNMI: &lt;mode&gt;,&lt;mt&gt;,&lt;bm&gt;,&lt;ds&gt;,&lt;bfr&gt;</p> <p>Parameter<br/>     &lt;mode&gt; See Test command<br/>     &lt;mt&gt; See Test command<br/>     &lt;bm&gt; See Test command<br/>     &lt;ds&gt; See Test command<br/>     &lt;bfr&gt; See Test command</p>  |
| Write command<br><b>AT+CNMI=[&lt;mode&gt;[,&lt;mt&gt;[,&lt;bm&gt;[,&lt;ds&gt;[,&lt;bfr&gt;]]]]]</b> | <p>Parameter<br/>     &lt;mode&gt; See Test command<br/>     &lt;mt&gt; See Test command<br/>     &lt;bm&gt; See Test command<br/>     &lt;ds&gt; See Test command<br/>     &lt;bfr&gt; See Test command</p> <p>Response<br/>OK/ERROR/+CMS ERROR</p>   |
|   | <p>Unexpected message<br/>+CMTI: &lt;mem&gt;,&lt;index&gt; Indication that new message has arrived</p> <p>+CMT: ,&lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt; Direct output of the short message</p> <p>+CDS: &lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt; Direct output of the status report</p> <p>+CBM: &lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt; Direct output of the cell broadcast message</p> |

|   |   |
|---|---|
|   | <p>Acknowledgment of a short message directly output (without storing on the chip card)</p> <p><b>Revision according to GSM 07.05 Version 5.0.0</b></p> <p><b>(NOTE: This command is not possible unless the Phase 2+ compatibility has been activated by means of +CSMS=1)</b></p> |
| Test command<br><b>AT+CNMA=?</b>            | <p>Response<br/>+CNMA: (list of supported &lt;n&gt;s)</p> <p>Parameter<br/>     &lt;n&gt; 0 Mode of functioning analogous to GSM 07.05 text mode</p>  |
| Write command<br><b>AT+CNMA[=&lt;n&gt;]</b> | <p>Parameter<br/>     &lt;n&gt; See Test command</p> <p>Response<br/>OK/ERROR/+CMS ERROR: &lt;err&gt;</p>   |

## AT Command Set Reference Manual

ЗИБІЛДЕ

|  |                          |
|--|--------------------------|
| <p>Additional information about message delivery options<br/>selected on the configuration screen</p> <p><b>Revision 0.0.2 to GM TO GM 0.0.2 Revision 0.0.3</b></p> <p><b>NOTE:</b> This command is not possible unless the <b>Passive S</b> compatibility has been activated by means of <b>CMS+T</b></p> | <p>AMM+TA<br/>AMM+TA</p> |
| <p>Set up of GM TO GM of monopolistic options in the <b>GM TO GM</b> configuration screen</p>  | <p>AMM+TA<br/>AMM+TA</p> |

|   |   |   |  |   |                                    |   |                                      |   |                                  |   |                     |
|---|---|---|--|---|------------------------------------|---|--------------------------------------|---|----------------------------------|---|---------------------|
| <b>AT+CMGL</b>  |   |   |  |   |                                    |   |                                      |   |                                  |   |                     |
| <b>List SMS<br/>Revision according to GSM 07.05 Version 4.7.0</b> |   |   |  |   |                                    |   |                                      |   |                                  |   |                     |
| Test command<br><b>AT+CMGL=?</b>                                  | <p>Response<br/>+CMGL: (list of supported &lt;stat&gt;s)</p> <p>Parameter<br/>&lt;stat&gt;</p> <table> <tr><td>0</td><td>"REC UNREAD": received unread messages (default)</td></tr> <tr><td>1</td><td>"REC READ": received read messages</td></tr> <tr><td>2</td><td>"STO UNSENT": stored unsent messages</td></tr> <tr><td>3</td><td>"STO SENT": stored sent messages</td></tr> <tr><td>4</td><td>"ALL": all messages</td></tr> </table> | 0 | "REC UNREAD": received unread messages (default) | 1 | "REC READ": received read messages | 2 | "STO UNSENT": stored unsent messages | 3 | "STO SENT": stored sent messages | 4 | "ALL": all messages |
| 0   | "REC UNREAD": received unread messages (default)  |   |  |   |                                    |   |                                      |   |                                  |   |                     |
| 1   | "REC READ": received read messages  |   |  |   |                                    |   |                                      |   |                                  |   |                     |
| 2   | "STO UNSENT": stored unsent messages  |   |  |   |                                    |   |                                      |   |                                  |   |                     |
| 3   | "STO SENT": stored sent messages  |   |  |   |                                    |   |                                      |   |                                  |   |                     |
| 4   | "ALL": all messages   |   |  |   |                                    |   |                                      |   |                                  |   |                     |
| Write command<br><b>AT+CMGL<br/>[=&lt;stat&gt;]</b>               | <p>Parameter<br/>&lt;stat&gt; See Test command</p> <p>Response<br/>If PDU mode (+CMGF=0) and command are successful:<br/>+CMGL:&lt;index&gt;,&lt;stat&gt;,[&lt;alpha&gt;],&lt;length&gt;<br/>&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;[&lt;CR&gt;&lt;LF&gt;<br/>+CMGL: &lt;index&gt;,&lt;stat&gt;,[&lt;alpha&gt;],&lt;length&gt;<br/>&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;&lt;CR&gt;&lt;LF&gt;<br/>[...]]</p>   |   |  |   |                                    |   |                                      |   |                                  |   |                     |
|   | <p>Parameter<br/>&lt;pdu&gt; The PDU begins with the service-center address (according to<br/>GSM04.11), followed by the TPDU according to GSM03.40<br/>in<br/>hexadecimal format<br/>otherwise:<br/>+CMS ERROR: &lt;err&gt;</p>  |   |  |   |                                    |   |                                      |   |                                  |   |                     |

|   |  |
|---|--|
|   | <b>AT+CMGR</b><br>Read in an SMS<br><b>Revision according to GSM 07.05 Version 4.7.0</b>   |
| Test command<br><b>AT+CMGR=?</b>              | Response<br><b>OK</b>  |
| Write command<br><b>AT+CMGR=&lt;index&gt;</b> | <p>Parameter<br/><b>&lt;index&gt;</b> Index of message in selected memory &lt;mem1&gt;</p> <p>Response<br/><b>If PDU mode (+CMGF=0) and command are successful:</b><br/><b>+CMGR: &lt;stat&gt;,[&lt;alpha&gt;],&lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;</b></p> <p>Parameter<br/><b>&lt;pdu&gt;</b> Siehe "AT+CMGL"<br/>otherwise:<br/><b>+CMS ERROR: &lt;err&gt;</b></p> |

| <b>AT+CMGS</b>   | <b>Send an SMS</b>  |
|--|---|
| <p>Test command<br/><b>AT+CMGS=?</b></p> <p>Write command<br/><b>If PDU mode (+CMGF=0)</b><br/><b>+CMGS=&lt;length&gt;&lt;CR&gt;PDU is given</b><br/><b>&lt;ctrl-Z/ESC&gt;</b></p> | <p>Response<br/><b>OK</b></p> <p>Parameter<br/><b>&lt;length&gt;</b> Length of PDU<br/><b>&lt;pdu&gt;</b> See "AT+CMGL"<br/><b>&lt;mr&gt;</b> Message reference</p> <p>Response<br/><b>If sending is successful:</b><br/><b>+CMGS: &lt;mr&gt;</b><br/><b>If sending is not successful:</b><br/><b>+CMS ERROR: &lt;err&gt;</b></p> |

| <b>AT+CMSS</b>   | <b>Send an SMS from the SMS memory</b>  |
|--|---|
| <p>Test command<br/><b>AT+CMSS=?</b></p> <p>Write command<br/><b>+CMSS=&lt;index&gt;[,&lt;da&gt;[,&lt;toda&gt;]]</b></p> | <p>Response<br/><b>OK</b></p> <p>Parameter<br/><b>&lt;index&gt;</b> Index of message in selected memory &lt;mem1&gt;<br/><b>&lt;da&gt;</b> Destination address in string format<br/><b>&lt;toda&gt;</b> Format of destination address<br/><b>&lt;mr&gt;</b> Message reference</p> <p>Response<br/><b>If sending is successful:</b><br/><b>+CMSS: &lt;mr&gt;</b><br/><b>If sending is not successful:</b><br/><b>+CMS ERROR: &lt;err&gt;</b></p> |

| AT+CMGR  | Read in au SMS  |
|--|---|
| <b>Revision according to GSM 03.02 Version A.5</b> |   |
| AT+CMGR=3  | OK  |
| <index>  | Index of message in selected memory (0..n)  |
| +CMGR: <nxt><index><len><OR><FL><body>             | It PDU mode (+CMGF=0) and commanding the access point<br>+CMGR: <nxt><index><len><OR><FL><body> |
| +CMGR: <atn>                                       | Series AT+CMGR  |
| +CMGS ERROR: <err>                                 | Otherwise.  |

| AT+CMGS                   | Send au SMS                   |
|---------------------------|-------------------------------|
| AT+CMGS=3                 | OK                            |
| <len>><body>              | Length of PDU                 |
| <nxt><index><len><OR><FL> | See AT+CMGL                   |
| Message to address        |                               |
| +CMGS: <nxt>              | If sending is successful:     |
| +CMGS: <err>              | If sending is not successful: |
| +CMGS ERROR: <err>        |                               |

| AT+CMSS            | Send au SMS from au GPRS memory            |
|--------------------|--|
| AT+CMSS=3          | OK   |
| <index>            | Index of message in selected memory (0..n) |
| <sbs>              | Desitination address in string format      |
| <eboi>             | Format of destination address              |
| <url>              | Message reference                          |
| +CMSS: <nxt>       | If sending is successful:                  |
| +CMSS: <err>       | If sending is not successful:              |
| +CMSS ERROR: <err> |  |

| AT+CMGW  |  | Write an SMS to the SMS memory |
|--|--|--------------------------------|
| Test command<br>AT+CMGW=?  | Response<br>OK   |                                |
| Write command<br><b>If PDU mode (+CMGF=0)</b><br>AT+CMGW=<length>[,<stat>]<CR> <b>PDU is given</b><br><ctrl-Z/ESC> | Parameter<br><length> Length of PDU<br><stat> See command +CMGL<br><pdu> See "AT+CMGL"<br><index> Index of message in selected memory <mem1> |                                |
|  | Response<br>+CMGW: <index><br>+CMS ERROR: <err>  |                                |

| AT+CMGD                          |   | Delete an SMS in the SMS memory |
|----------------------------------|---|---------------------------------|
| Test command<br>At+CMGD=?        | Response<br>OK  |                                 |
| Write command<br>AT+CMGD=<index> | Parameter<br><index> Index of message in the selected memory <mem1> |                                 |
|                                  | Response<br>OK/ERROR/+CMS ERROR                                     |                                 |

| AT+CSCB   |  | Select cell broadcast messages |
|---|--|--------------------------------|
| Test command<br>AT+CSCB=?                           | Response<br>+CSCB: (list of supported <mode>s)   |                                |
|   | Parameter<br><mode><br>0 Accepts messages that are defined in <mids> and <dcss><br>1 Does not accept messages that are defined in <mids> and <dcss>        |                                |
| Read command<br>AT+CSCB?                            | Response<br>+CSCB: <mode>,<mids>,<dcss>  |                                |
|   | Parameter<br><mode> See Test command<br><mids> String type; combinations of CBM message IDs<br><dcss> String type; combinations of CBM data coding schemes |                                |
| Write command<br>AT+CSCB=[<mode>[,<mids>[,<dcss>]]] |  |                                |

| AT+CMGC   |  | Send an SMS command |
|---|--|---------------------|
| Test command<br>AT+CMGC=?   | Response<br>OK   |                     |
| Write command<br><b>If PDU mode (+CMGF=0)</b><br>+CMGC=<length><CR> <b>PDU is given</b><br><ctrl-Z/ESC> | Parameter<br><length> Length of PDU<br><pdu> See "AT+CMGL"<br><mr> Message reference                                     |                     |
|   | Response<br><b>If sending is successful:</b><br>+CMGC: <mr><br><b>If sending is not successful:</b><br>+CMS ERROR: <err> |                     |

Data Sheet  
JC MAX 232

**MAXIM****+5V-Powered, Multi-Channel RS-232 Drivers/Receivers****General Description**

The MAX220-MAX249 family of line drivers/receivers is intended for all EIA/TIA-232E and V.28/V.24 communications interfaces, and in particular, for those applications where  $\pm 12V$  is not available.

These parts are particularly useful in battery-powered systems, since their low-power shutdown mode reduces power dissipation to less than 5uW. The MAX225, MAX233, MAX235, and MAX245-MAX247 use no external components and are recommended for applications where printed circuit board space is critical.

**Applications**

- Portable Computers
- Low-Power Modems
- Interface Translation
- Battery-Powered RS-232 Systems
- Multi-Drop RS-232 Networks

**Features****Superior to Bipolar**

- ♦ Operate from Single +5V Power Supply (+5V and +12V—MAX231/MAX239)
- ♦ Low-Power Receive Mode in Shutdown (MAX223/MAX242)
- ♦ Meet All EIA/TIA-232E and V.28 Specifications
- ♦ Multiple Drivers and Receivers
- ♦ 3-State Driver and Receiver Outputs
- ♦ Open-Line Detection (MAX243)

**Ordering Information**

| PART      | TEMP. RANGE     | PIN-PACKAGE    |
|-----------|-----------------|----------------|
| MAX220CPE | 0°C to +70°C    | 16 Plastic DIP |
| MAX220CSE | 0°C to +70°C    | 16 Narrow SO   |
| MAX220CWE | 0°C to +70°C    | 16 Wide SO     |
| MAX220C/D | 0°C to +70°C    | Dice*          |
| MAX220EPE | -40°C to +85°C  | 16 Plastic DIP |
| MAX220ESE | -40°C to +85°C  | 16 Narrow SO   |
| MAX220EWE | -40°C to +85°C  | 16 Wide SO     |
| MAX220EJE | -40°C to +85°C  | 16 CERDIP      |
| MAX220MJE | -55°C to +125°C | 16 CERDIP      |

Ordering Information continued at end of data sheet.

\*Contact factory for dice specifications.

**Selection Table**

| Part Number     | Power Supply (V)     | No. of RS-232 Drivers/Rx | No. of Ext. Caps | Nominal Cap. Value (pF) | SHDN & Three-State | Rx Active In SHDN | Data Rate (bps) | Features   |
|-----------------|----------------------|--------------------------|------------------|-------------------------|--------------------|-------------------|-----------------|--|
| MAX220          | +5                   | 2/2                      | 4                | 4.7/10                  | No                 |                   | 120             | Ultra-low-power, industry-standard pinout  |
| MAX222          | +5                   | 2/2                      | 4                | 0.1                     | Yes                |                   | 200             | Low-power shutdown   |
| MAX223 (MAX213) | +5                   | 4/5                      | 4                | 1.0 (0.1)               | Yes                | ✓                 | 120             | MAX241+ receivers active in shutdown   |
| MAX225          | +5                   | 5/5                      | 0                | -                       | Yes                | ✓                 | 120             | Available in SO  |
| MAX230 (MAX200) | +5                   | 5/0                      | 4                | 1.0 (0.1)               | Yes                |                   | 120             | 5 drivers with shutdown  |
| MAX231 (MAX201) | +5 and +7.5 to +13.2 | 2/2                      | 2                | 1.0 (0.1)               | No                 |                   | 120             | Standard +5V/12V or battery supplies; same functions as MAX222                       |
| MAX232 (MAX202) | +5                   | 2/2                      | 4                | 1.0 (0.1)               | No                 |                   | 120 (64)        | Industry standard  |
| MAX232A         | +5                   | 2/2                      | 4                | 0.1                     | No                 |                   | 200             | Higher slew rate, small caps   |
| MAX233 (MAX203) | +5                   | 2/2                      | 0                | -                       | No                 |                   | 120             | No external caps   |
| MAX233A         | +5                   | 2/2                      | 0                | -                       | No                 |                   | 200             | No external caps, high slew rate   |
| MAX234 (MAX204) | +5                   | 4/0                      | 4                | 1.0 (0.1)               | No                 |                   | 120             | Replaces 1468  |
| MAX235 (MAX205) | +5                   | 5/5                      | 0                | -                       | Yes                |                   | 120             | No external caps   |
| MAX236 (MAX206) | +5                   | 4/3                      | 4                | 1.0 (0.1)               | Yes                |                   | 120             | Shutdown, three state  |
| MAX237 (MAX207) | +5                   | 5/3                      | 4                | 1.0 (0.1)               | No                 |                   | 120             | Complements IBM PC serial port   |
| MAX238 (MAX208) | +5                   | 4/4                      | 4                | 1.0 (0.1)               | No                 |                   | 120             | Replaces 1468 and 1469   |
| MAX239 (MAX209) | +5 and +7.5 to +13.2 | 3/5                      | 2                | 1.0 (0.1)               | No                 |                   | 120             | Standard +5V/12V or battery supplies; single-package solution for IBM PC serial port |
| MAX240          | +5                   | 5/5                      | 4                | 1.0                     | Yes                |                   | 120             | DIP or tape&reel package   |
| MAX241 (MAX211) | +5                   | 15                       | 4                | 1.0 (0.1)               | Yes                |                   | 120             | Complete IBM PC serial port  |
| MAX242          | +5                   | 2/2                      | 4                | 0.1                     | Yes                | ✓                 | 200             | Separate shutdown and enable   |
| MAX243          | +5                   | 2/2                      | 4                | 0.1                     | No                 |                   | 200             | Open-line detection simplifies cabling   |
| MAX244          | +5                   | 8/10                     | 4                | 1.0                     | No                 |                   | 120             | High slew rate   |
| MAX245          | +5                   | 8/10                     | 0                | -                       | Yes                | ✓                 | 120             | High slew rate, int. caps, two shutdown modes  |
| MAX246          | +5                   | 8/10                     | 0                | -                       | Yes                | ✓                 | 120             | High slew rate, int. caps, three shutdown modes                                      |
| MAX247          | +5                   | 8/9                      | 0                | -                       | Yes                | ✓                 | 120             | High slew rate, int. caps, nine operating modes                                      |
| MAX248          | +5                   | 8/8                      | 4                | 1.0                     | Yes                | ✓                 | 120             | High slew rate, selective half-chip enables  |
| MAX249          | +5                   | 8/10                     | 4                | 1.0                     | Yes                | ✓                 | 120             | Available in quad tape&reel package  |

**MAX220-MAX249****MAXIM**

Maxim Integrated Products 1

For free samples & the latest literature: <http://www.maxim-ic.com>, or phone 1-800-998-8800

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### ABSOLUTE MAXIMUM RATINGS—MAX220/222/232A/233A/242/243

|  |                             |   |                          |
|--|-----------------------------|---|--------------------------|
| Supply Voltage ( $V_{CC}$ )  | -0.3V to +5V                | 18-Pin Narrow SO (derate 8.70mW/ $^{\circ}C$ above $+70^{\circ}C$ ) | 696mW                    |
| Input Voltages   |                             | 18-Pin Wide SO (derate 9.52mW/ $^{\circ}C$ above $+70^{\circ}C$ )   | 762mW                    |
| $T_{IN}$   | -0.3V to ( $V_{CC}$ - 0.3V) | 18-Pin Wide SO (derate 9.52mW/ $^{\circ}C$ above $+70^{\circ}C$ )   | 762mW                    |
| $R_{IN}$   | $\pm 30V$                   | 20-Pin Wide SO (derate 10.00mW/ $^{\circ}C$ above $+70^{\circ}C$ )  | 800mW                    |
| $T_{OUT}$ (Note 1)   | $\pm 15V$                   | 20-Pin SSOP (derate 8.00mW/ $^{\circ}C$ above $+70^{\circ}C$ )      | 640mW                    |
| Output Voltages  |                             | 16-Pin CERDIP (derate 10.00mW/ $^{\circ}C$ above $+70^{\circ}C$ )   | 800mW                    |
| $T_{OUT}$  | $\pm 15V$                   | 16-Pin CERDIP (derate 10.53mW/ $^{\circ}C$ above $+70^{\circ}C$ )   | 842mW                    |
| $I_{OUT}$  | -0.3V to ( $V_{CC}$ + 0.3V) | Operating Temperature Ranges  |                          |
| Driver/Receiver Output Short Circuited to GND.....Continuous           |                             | MAX2 <sub>2</sub> _AC_...MAX2 <sub>2</sub> _C_                      | 0°C to $+70^{\circ}C$    |
| Continuous Power Dissipation ( $T_A = +70^{\circ}C$ )                  |                             | MAX2 <sub>2</sub> _AE_...MAX2 <sub>2</sub> _E_                      | -40°C to $+85^{\circ}C$  |
| 16-Pin Plastic DIP (derate 10.53mW/ $^{\circ}C$ above $+70^{\circ}C$ ) | 842mW                       | MAX2 <sub>2</sub> _AM_...MAX2 <sub>2</sub> _M_                      | -55°C to $+125^{\circ}C$ |
| 18-Pin Plastic DIP (derate 11.11mW/ $^{\circ}C$ above $+70^{\circ}C$ ) | 889mW                       | Storage Temperature Range   | -55°C to $+160^{\circ}C$ |
| 20-Pin Plastic DIP (derate 8.00mW/ $^{\circ}C$ above $+70^{\circ}C$ )  | 440mW                       | Lead Temperature (soldering, 10sec)                                 | +300°C                   |

Note 1: Input voltage measured with  $T_{OUT}$  in high-impedance state,  $SHDN$  or  $V_{CC} = 0V$ .

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### ELECTRICAL CHARACTERISTICS—MAX220/222/232A/233A/242/243

( $V_{CC} = +5V \pm 10\%$ ,  $C1-C4 = 0.1\mu F$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted.)

| PARAMETER                             | CONDITIONS  | MIN                              | TYP            | MAX      | UNITS      |
|---------------------------------------|---|----------------------------------|----------------|----------|------------|
| <b>RS-232 TRANSMITTERS</b>            |   |                                  |                |          |            |
| Output Voltage Swing                  | All transmitter outputs loaded with 3k $\Omega$ to GND                                    | $\pm 5$                          | $\pm 8$        |          | V          |
| Input Logic Threshold Low             |   |                                  | 1.4            | 0.8      | V          |
| Input Logic Threshold High            |   | 2                                | 1.4            |          | V          |
| Logic Pull-Up/Input Current           | Normal operation  | 5                                | 40             |          | $\mu A$    |
|                                       | $SHDN = 0V$ , MAX222/242, shutdown  | $\pm 0.01$                       | $\pm 1$        |          | $\mu A$    |
| Output Leakage Current                | $V_{CC} = 5.5V$ , $SHDN = 0V$ , $V_{OUT} = \pm 15V$ , MAX222/242                          | $\pm 0.01$                       | $\pm 10$       |          | $\mu A$    |
|                                       | $V_{CC} = SHDN = 0V$ , $V_{OUT} = \pm 15V$  | $\pm 0.01$                       | $\pm 10$       |          | $\mu A$    |
| Data Rate                             | Except MAX220, normal operation   | 200                              | 116            |          | kbits/sec  |
|                                       | MAX220  | 22                               | 20             |          |            |
| Transmitter Output Resistance         | $V_{CC} = V_+ = V_- = 0V$ , $V_{OUT} = \pm 2V$  | 300                              | 10M            |          | $\Omega$   |
| Output Short-Circuit Current          | $V_{OUT} = 0V$  | $\pm 7$                          | $\pm 22$       |          | mA         |
| <b>RS-232 RECEIVERS</b>               |   |                                  |                |          |            |
| RS-232 Input Voltage Operating Range  |   |                                  |                | $\pm 30$ | V          |
| RS-232 Input Threshold Low            | $V_{CC} = 5V$   | Except MAX243 R <sub>2IN</sub>   | 0.8            | 1.3      |            |
|                                       |   | MAX243 R <sub>2IN</sub> (Note 2) | -3             |          | V          |
| RS-232 Input Threshold High           | $V_{CC} = 5V$   | Except MAX243 R <sub>2IN</sub>   | 1.8            | 2.4      |            |
|                                       |   | MAX243 R <sub>2IN</sub> (Note 2) | -0.5           | -0.1     | V          |
| RS-232 Input Hysteresis               | Except MAX243, $V_{CC} = 5V$ , no hyst. in shdn.  | 0.2                              | 0.5            | 1        | V          |
|                                       | MAX243  |                                  |                | 1        |            |
| RS-232 Input Resistance               |   | 3                                | 5              | 7        | k $\Omega$ |
| TTL/CMOS Output Voltage Low           | $I_{OUT} = 3.2mA$   |                                  | 0.2            | 0.4      | V          |
| TTL/CMOS Output Voltage High          | $I_{OUT} = -1.0mA$  | 3.5                              | $V_{CC} - 0.2$ |          | V          |
| TTL/CMOS Output Short-Circuit Current | Sourcing $V_{OUT} = GND$  | -2                               | -10            |          |            |
|                                       | Shrinking $V_{OUT} = V_{CC}$  | 10                               | 30             |          | mA         |
| TTL/CMOS Output Leakage Current       | $SHDN = V_{CC}$ or $EN = V_{CC}$ ( $SHDN = 0V$ for MAX222), $0V \leq V_{OUT} \leq V_{CC}$ | $\pm 0.05$                       | $\pm 10$       |          | $\mu A$    |

## **+5V-Powered, Multi-Channel RS-232 Drivers/Receivers**

### **ELECTRICAL CHARACTERISTICS—MAX220/222/232A/233A/242/243 (continued)**

( $V_{CC} = +5V \pm 10\%$ ,  $C1-C4 = 0.1\mu F$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$  unless otherwise noted.)

| PARAMETER  | CONDITIONS  |   | MIN  | TYP | MAX     | UNITS |
|--|---|---|------|-----|---------|-------|
| EN Input Threshold Low   | MAX242  |   |      | 1.4 | 0.8     | V     |
| EN Input Threshold High  | MAX242  |   | 2.0  | 1.4 |         | V     |
| <b>POWER SUPPLY</b>  |   |   |      |     |         |       |
| Operating Supply Voltage   |   |   | 4.5  | 5.5 |         | V     |
| V <sub>CC</sub> Supply Current ( $SHDN = V_{CC}$ ,<br>Figures 5, 6, 9, 19)     | No load   | MAX220  | 0.5  | 2   |         | mA    |
|  |   | MAX222/232A/233A/242/243                                  | 4    | 10  |         |       |
|  | 3kΩ load<br>both inputs   | MAX220  | 12   |     |         |       |
|  |   | MAX222/232A/233A/242/243                                  | 16   |     |         |       |
| Shutdown Supply Current  | MAX222/242  | $T_A = +25^\circ C$                                       | 0.1  | 10  |         | μA    |
|  |   | $T_A = 0^\circ$ to $+70^\circ C$                          | 2    | 50  |         |       |
|  |   | $T_A = -40^\circ$ to $+85^\circ C$                        | 2    | 50  |         |       |
|  |   | $T_A = -55^\circ$ to $+125^\circ C$                       | 35   | 100 |         |       |
| SHDN Input Leakage Current   | MAX222/242  |   |      |     | $\pm 1$ | μA    |
| SHDN Threshold Low   | MAX222/242  |   |      | 1.4 | 0.8     | V     |
| SHDN Threshold High  | MAX222/242  |   | 2.0  | 1.4 |         | V     |
| <b>AC CHARACTERISTICS</b>  |   |   |      |     |         |       |
| Transition Slew Rate   | $C_L = 50pF$ to $2500pF$ ,<br>$R_L = 3k\Omega$ to $7k\Omega$ ,<br>$V_{CC} = 5V$ , $T_A = +25^\circ C$ ,<br>measured from $+3V$ to $-3V$ or $-3V$ to $+3V$ | MAX222/232A/233A/242/243                                  | 6    | 12  | 30      | V/μs  |
|  |   | MAX220  | 1.5  | 3   | 30      |       |
| Transmitter Propagation Delay<br>TLL to RS-232 (normal operation),<br>Figure 1 | t <sub>PHL7</sub>   | MAX222/232A/233A/242/243                                  | 1.3  | 3.5 |         | μs    |
|  |   | MAX220  | 4    | 10  |         |       |
|  | t <sub>PLHT</sub>   | MAX222/232A/233A/242/243                                  | 1.5  | 3.5 |         |       |
|  |   | MAX220  | 6    | 10  |         |       |
| Receiver Propagation Delay<br>RS-232 to TLL (normal operation),<br>Figure 2    | t <sub>PHLR</sub>   | MAX222/232A/233A/242/243                                  | 0.6  | 1   |         | μs    |
|  |   | MAX220  | 0.6  | 3   |         |       |
|  | t <sub>PLHR</sub>   | MAX222/232A/233A/242/243                                  | 0.6  | 1   |         |       |
|  |   | MAX220  | 0.8  | 3   |         |       |
| Receiver Propagation Delay<br>RS-232 to TLL (shutdown), Figure 2               | t <sub>PHLS</sub>   | MAX242  | 0.5  | 10  |         | μs    |
|  | t <sub>PLHS</sub>   | MAX242  | 2.5  | 10  |         |       |
| Receiver-Output Enable Time, Figure 3  | t <sub>ER</sub>   | MAX242  | 125  | 500 |         | ns    |
| Receiver-Output Disable Time, Figure 3   | t <sub>DR</sub>   | MAX242  | 160  | 500 |         | ns    |
| Transmitter-Output Enable Time<br>(SHDN goes high), Figure 4                   | t <sub>ET</sub>   | MAX222/242, 0.1μF caps<br>(includes charge-pump start-up) | 250  |     |         | μs    |
| Transmitter-Output Disable Time<br>(SHDN goes low), Figure 4                   | t <sub>DT</sub>   | MAX222/242, 0.1μF caps                                    | 600  |     |         | ns    |
| Transmitter + to - Propagation<br>Delay Difference (normal operation)          | t <sub>PHLT</sub> - t <sub>PLHT</sub>   | MAX222/232A/233A/242/243                                  | 300  |     |         | ns    |
|  |   | MAX220  | 2000 |     |         |       |
| Receiver + to - Propagation<br>Delay Difference (normal operation)             | t <sub>PHLR</sub> - t <sub>PLHR</sub>   | MAX222/232A/233A/242/243                                  | 100  |     |         | ns    |
|  |   | MAX220  | 225  |     |         |       |

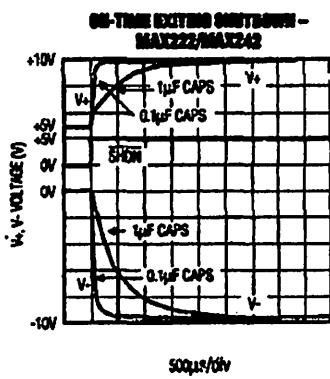
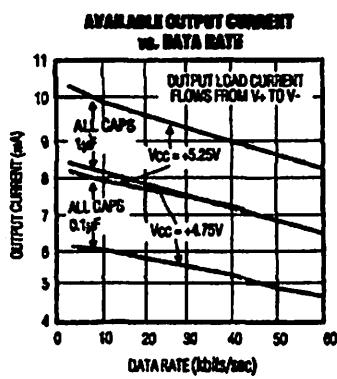
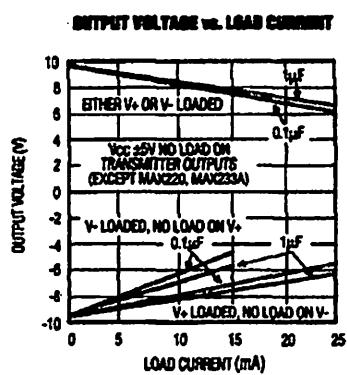
Note 2: MAX243 R2OUT is guaranteed to be low when R2W is  $\geq 0V$  or is floating.

**MAX220-MAX249**

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### Typical Operating Characteristics

#### MAX220/MAX222/MAX232A/MAX233A/MAX242/MAX243



## **+5V-Powered, Multi-Channel RS-232 Drivers/Receivers**

### **ABSOLUTE MAXIMUM RATINGS—MAX223/MAX230-MAX241**

|  |                            |  |
|--|----------------------------|--|
| VCC  | -0.3V to +6V               | 20-Pin Wide SO (derate 10.00mW/°C above +70°C).....800mW       |
| V+   | (VCC - 0.3V) to +14V       | 24-Pin Wide SO (derate 11.76mW/°C above +70°C).....941mW       |
| V-   | +0.3V to -14V              | 28-Pin Wide SO (derate 12.50mW/°C above +70°C).....1W          |
| Input Voltages   |                            | 44-Pin Plastic FP (derate 11.11 mW/°C above +70°C).....889mW   |
| TIN  | -0.3V to (VCC + 0.3V)      | 14-Pin CERDIP (derate 9.09mW/°C above +70°C).....727mW         |
| RIN  | ±30V                       | 16-Pin CERDIP (derate 10.00mW/°C above +70°C).....800mW        |
| Output Voltages  |                            | 20-Pin CERDIP (derate 11.11mW/°C above +70°C).....889mW        |
| TOUT   | (V+ + 0.3V) to (V- - 0.3V) | 24-Pin Narrow CERDIP<br>(derate 12.50mW/°C above +70°C).....1W |
| ROUT   | -0.3V to (VCC + 0.3V)      | 24-Pin Sidebrazed (derate 20.0mW/°C above +70°C).....1.6W      |
| Short-Circuit Duration, TOUT                                 | Continuous                 | 28-Pin SSOP (derate 0.52mW/°C above +70°C).....762mW           |
| Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )   |                            | Operating Temperature Ranges                                   |
| 14-Pin Plastic DIP (derate 10.00mW/°C above +70°C)           | ..800mW                    | MAX2 <sub>—</sub> C .....0°C to +70°C                          |
| 16-Pin Plastic DIP (derate 10.53mW/°C above +70°C)           | .842mW                     | MAX2 <sub>—</sub> E .....-40°C to +85°C                        |
| 20-Pin Plastic DIP (derate 11.11 mW/°C above +70°C)          | .889mW                     | MAX2 <sub>—</sub> M .....-55°C to +125°C                       |
| 24-Pin Narrow Plastic DIP<br>(derate 13.33mW/°C above +70°C) | 1.07W                      | Storage Temperature Range .....-65°C to +160°C                 |
| 24-Pin Plastic DIP (derate 9.09mW/°C above +70°C)            | .500mW                     | Lead Temperature (soldering, 10sec) .....+300°C                |
| 16-Pin Wide SO (derate 9.52mW/°C above +70°C)                | .782mW                     |  |

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at those or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### **ELECTRICAL CHARACTERISTICS—MAX223/MAX230-MAX241**

(MAX223/230/232/234/236/237/238/240/241 VCC = +5V ±10%, MAX233/MAX235 VCC = 5V ±5%, C1-C4 = 1.0μF MAX231/MAX239 VCC = 5V ±10%, V+ = 7.5V to 13.2V, TA = TMIN to TMAX, unless otherwise noted.)

| PARAMETER                              | CONDITIONS  |   | MIN  | TYP  | MAX | UNITS |
|--|---|---|------|------|-----|-------|
| Output Voltage Swing                   | All transmitter outputs loaded with 3kΩ to ground       |   | ±5.0 | ±7.3 |     | V     |
| VCC Power-Supply Current               | No load,<br>$T_A = +25^\circ\text{C}$                   | MAX222/233  |      | 5    | 10  | mA    |
|  |   | MAX223/230/234-238/240/241                              |      | 7    | 15  |       |
|  |   | MAX231/239  |      | .4   | 1   |       |
| V+ Power-Supply Current                |   | MAX231  |      | 1.8  | 5   | mA    |
|  |   | MAX239  |      | 5    | 15  |       |
| Shutdown Supply Current                | $T_A = +25^\circ\text{C}$                               | MAX223  |      | 15   | 50  | μA    |
|  |   | MAX230/235/236/240/241                                  |      | 1    | 10  |       |
| Input Logic Threshold Low              | $T_{IN}$ : EN, SHDN (MAX223), EN, SHDN (MAX230/235-241) |   |      | 0.8  |     | V     |
| Input Logic Threshold High             | $T_{IN}$  |   | 2.0  |      |     | V     |
|  |   | EN, SHDN (MAX223),<br>EN, SHDN (MAX230/235/236/240/241) |      | 2.4  |     |       |
| Logic Pull-Up Current                  | $T_{IN} = 0\text{V}$                                    |   |      | 1.5  | 200 | μA    |
| Receiver Input Voltage Operating Range |   |   | -30  | 30   |     | V     |

**MAX220-MAX249**

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### ELECTRICAL CHARACTERISTICS—MAX223/MAX230-MAX241 (continued)

(MAX223/230/232/234/236/237/238/240/241 V<sub>CC</sub> = +5V ±10%, MAX233/MAX235 V<sub>CC</sub> = 5V ±5%, C1-C4 = 1.0μF MAX231/MAX239 V<sub>CC</sub> = 5V ±10%, V<sub>+</sub> = 7.5V to 13.2V, TA = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

| PARAMETER                             | CONDITIONS   |  | MIN  | TYP                   | MAX | UNITS |
|---------------------------------------|--|--|------|-----------------------|-----|-------|
| RS-232 Input Threshold Low            | TA = +25°C,<br>V <sub>CC</sub> = 5V  | Normal operation<br>SHDN = 5V (MAX223)<br>SHDN = 0V (MAX235/236/240/241)   | 0.8  | 1.2                   |     | V     |
|                                       |  | Shutdown (MAX223)<br>SHDN = 0V,<br>EN = 5V (R4IN, R5IN)  | 0.6  | 1.5                   |     |       |
| RS-232 Input Threshold High           | TA = +25°C,<br>V <sub>CC</sub> = 5V  | Normal operation<br>SHDN = 5V (MAX223)<br>SHDN = 0V (MAX235/236/240/241)   |      | 1.7                   | 2.4 | V     |
|                                       |  | Shutdown (MAX223)<br>SHDN = 0V,<br>EN = 5V (R4IN, R5IN)  |      | 1.5                   | 2.4 |       |
| RS-232 Input Hysteresis               | V <sub>CC</sub> = 5V; no hysteresis in shutdown  |  | 0.2  | 0.5                   | 1.0 | V     |
| RS-232 Input Resistance               | TA = +25°C, V <sub>CC</sub> = 5V   |  | 3    | 5                     | 7   | kΩ    |
| TTL/CMOS Output Voltage Low           | I <sub>OUT</sub> = 1.6mA (MAX231-233 I <sub>OUT</sub> = 3.2mA)   |  |      |                       | 0.4 | V     |
| TTL/CMOS Output Voltage High          | I <sub>OUT</sub> = -1mA  |  | 3.5  | V <sub>CC</sub> - 0.4 |     | V     |
| TTL/CMOS Output Leakage Current       | 0V ≤ R <sub>OUT</sub> ≤ V <sub>CC</sub> ; EN = 0V (MAX223);<br>EN = V <sub>CC</sub> (MAX235-241)   |  | 0.05 | ±10                   |     | μA    |
| Receiver Output Enable Time           | Normal operation   | MAX223   | 600  |                       |     | ns    |
|                                       |  | MAX235/236/238/240/241   | 400  |                       |     |       |
| Receiver Output Disable Time          | Normal operation   | MAX223   | 900  |                       |     | ns    |
|                                       |  | MAX235/236/238/240/241   | 250  |                       |     |       |
| Propagation Delay                     | RS-232 IN to<br>TTL/CMOS OUT,<br>C <sub>L</sub> = 150pF  | Normal operation   | 0.5  | 10                    |     | μs    |
|                                       |  | SHDN = 0V<br>(MAX223)<br>I <sub>PHL3</sub>   | 4    | 40                    |     |       |
| Transition Region Slew Rate           |  | I <sub>PLH3</sub>  | 6    | 40                    |     | V/μs  |
|                                       |  | MAX223/MAX230/MAX234-241<br>TA = +25°C, V <sub>CC</sub> = 5V,<br>R <sub>L</sub> = 3kΩ to 7kΩ, C <sub>L</sub> = 50pF to 2500pF,<br>measured from +3V to -3V or -3V to +3V | 3    | 5.1                   | 30  |       |
| Transmitter Output Resistance         | MAX231/MAX232/MAX233<br>TA = +25°C, V <sub>CC</sub> = 5V,<br>R <sub>L</sub> = 3kΩ to 7kΩ, C <sub>L</sub> = 50pF to 2500pF,<br>measured from +3V to -3V or -3V to +3V |  | 4    | 30                    |     | mΩ    |
|                                       | V <sub>CC</sub> = V <sub>+</sub> = V <sub>-</sub> = 0V, V <sub>OUT</sub> = ±2V   |  | 300  |                       |     |       |
| Transmitter Out Short-Circuit Current |  |  |      | ±10                   |     | mA    |

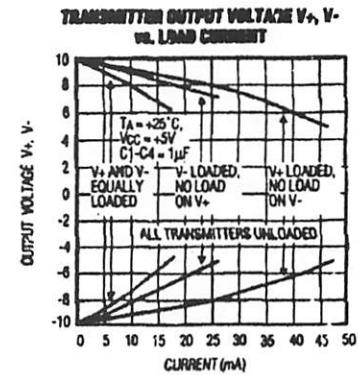
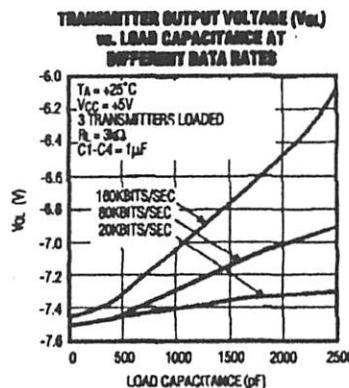
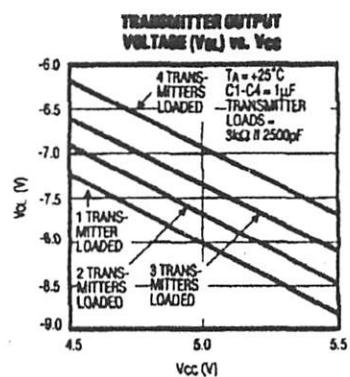
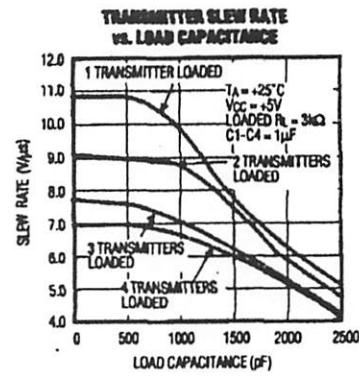
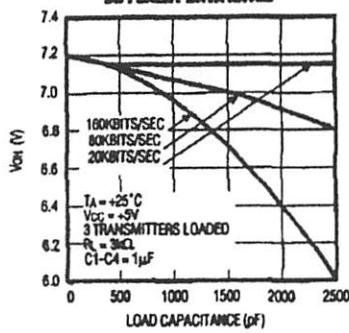
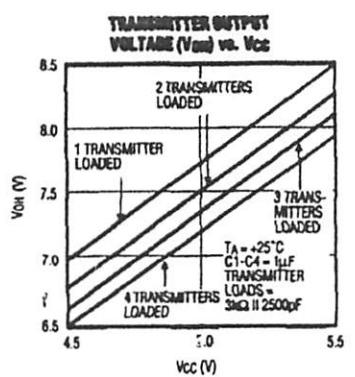
## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### Typical Operating Characteristics

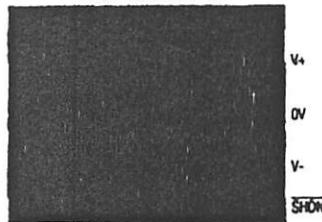
**MAX220-MAX249**

#### MAX223/MAX230-MAX241

TRANSMITTER OUTPUT VOLTAGE ( $V_{OH}$ ) vs.  $V_{CC}$   
vs. LOAD CAPACITANCE AT DIFFERENT DATA RATES



$V_+$ ,  $V_-$  WHEN EXITING SHUTDOWN (1μF CAPACITOR)



\*SHUTDOWN POLARITY IS REVERSED FOR THE MAX241

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### ABSOLUTE MAXIMUM RATINGS—MAX225/MAX244-MAX249

|  |                       |   |  |
|--|-----------------------|---|--|
| Supply Voltage (Vcc)                               | -0.3V to +8V          | Continuous Power Dissipation (TA = +70°C)                     |  |
| Input Voltages                                     |                       | 28-Pin Wide SO (derate 12.5mW/°C above +70°C) ... 1W          |  |
| TIN, ENA, ENB, ENR, ENT, ENRA,<br>ENRB, ENTA, ENTB | -0.3V to (Vcc + 0.3V) | 40-Pin Plastic DIP (derate 11.11mW/°C above +70°C) ... .811mW |  |
| RIN  | ±25V                  | 44-Pin PLCC (derate 13.33mW/°C above +70°C) ... 1.07W         |  |
| TOUT (Note 3)                                      | ±15V                  | Operating Temperature Ranges                                  |  |
| ROUT   | -0.3V to (Vcc + 0.3V) | MAX225C ... MAX24_C ... 0°C to +70°C                          |  |
| Short Circuit (one output at a time)               |                       | MAX225E ... MAX24_E ... -40°C to +85°C                        |  |
| TOUT to GND  | Continuous            | Storage Temperature Range ... -65°C to +180°C                 |  |
| ROUT to GND  | Continuous            | Lead Temperature (soldering, 10sec) ... +300°C                |  |

Note 3: Input voltage measured with transmitter output in a high-impedance state, shutdown, or Vcc = 0V.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### ELECTRICAL CHARACTERISTICS—MAX225/MAX244-MAX249

(MAX225 Vcc = 5.0V ±5%; MAX244-MAX249 Vcc = +5.0V ±10%, external capacitors C1-C4 = 1μF, TA = TMIN to TMAX, unless otherwise noted.)

| PARAMETER                             | CONDITIONS   | MIN  | TYP       | MAX | UNITS    |
|---------------------------------------|--|--|-----------|-----|----------|
| <b>RS-232 TRANSMITTER</b>             |  |  |           |     |          |
| Input Logic Threshold Low             |  | 1.4  | 0.8       |     | V        |
| Input Logic Threshold High            |  | 2  | 1.4       |     | V        |
| Logic Pull-Up/Input Current           | Tables 1a-1d   | Normal operation                             | 10        | 50  | μA       |
|                                       |  | Shutdown                                     | ±0.01     | ±1  |          |
| Data Rate                             | Tables 1a-1d, normal operation   | 120  | 64        |     | kbit/sec |
| Output Voltage Swing                  | All transmitter outputs loaded with 30k to GND                                   | ±5   | ±7.5      |     | V        |
| Output Leakage Current (shutdown)     | Tables 1a-1d   | ENA, ENB, ENT, ENTA, ENTB = Vcc, VOUT = ±15V | ±0.01     | ±25 | μA       |
|                                       |  | Vcc = 0V, VOUT = ±15V                        | ±0.01     | ±25 |          |
| Transmitter Output Resistance         | Vcc = V+ = V- = 0V, VOUT = ±2V (Note 4)  | 300  | 10M       |     | Ω        |
| Output Short-Circuit Current          | VOUT = 0V  | ±7   | ±30       |     | mA       |
| <b>RS-232 RECEIVERS</b>               |  |  |           |     |          |
| RS-232 Input Voltage Operating Range  |  |  | ±25       |     | V        |
| RS-232 Input Threshold Low            | Vcc = 5V   | 0.8  | 1.3       |     | V        |
| RS-232 Input Threshold High           | Vcc = 5V   |  | 1.8       | 2.4 | V        |
| RS-232 Input Hysteresis               | Vcc = 5V   | 0.2  | 0.5       | 1.0 | V        |
| RS-232 Input Resistance               |  | 3  | 5         | 7   | kΩ       |
| TTL/CMOS Output Voltage Low           | Iout = 3.2mA   | 0.2  | 0.4       |     | V        |
| TTL/CMOS Output Voltage High          | Iout = -1.0mA  | 3.5  | Vcc - 0.2 |     | V        |
| TTL/CMOS Output Short-Circuit Current | Sourcing Vout = GND  | -2   | -10       |     | mA       |
|                                       | Shrinking Vout = Vcc   | 10   | 30        |     |          |
| TTL/CMOS Output Leakage Current       | Normal operation, outputs disabled,<br>Tables 1a-1d, 0V ≤ Vout ≤ Vcc, ENRL = Vcc | ±0.05  | ±0.10     |     | μA       |

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### ELECTRICAL CHARACTERISTICS—MAX225/MAX244-MAX249 (continued)

(MAX225 V<sub>CC</sub> = 5.0V ±5%; MAX244-MAX249 V<sub>CC</sub> = +5.0V ±10%, external capacitors C1-C4 = 1μF, TA = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

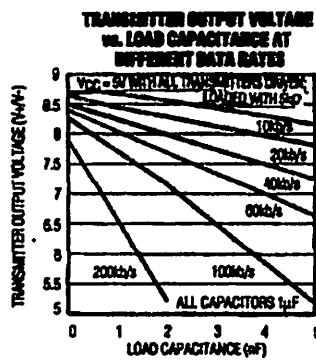
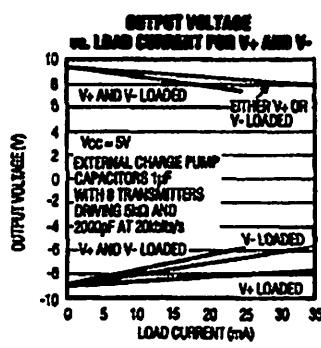
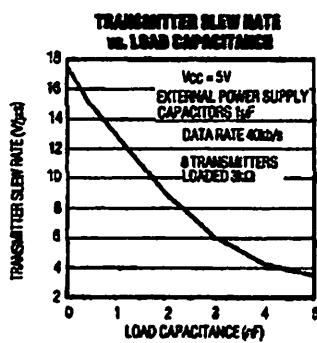
| PARAMETER  | CONDITIONS  | MN  | TYP  | MAX | UNITS |
|--|---|---|------|-----|-------|
| <b>POWER SUPPLY AND CONTROL LOGIC</b>  |   |   |      |     |       |
| Operating Supply Voltage   | MAX225  | 4.75  | 5.25 |     | V     |
|  | MAX244-MAX249   | 4.5   | 5.5  |     |       |
| V <sub>CC</sub> Supply Current<br>(normal operation)                           | No load   | MAX225  | 10   | 20  | mA    |
|  |   | MAX244-MAX249   | 11   | 30  |       |
| Shutdown Supply Current  | 3kΩ loads on<br>all outputs   | MAX225  | 40   |     | mA    |
|  |   | MAX244-MAX249   | 57   |     |       |
| Shutdown Supply Current  | TA = +25°C  |   | 8    | 25  | μA    |
|  | TA = T <sub>MIN</sub> to T <sub>MAX</sub>   |   |      | 50  |       |
| Control Input  | Leakage current   |   |      | ±1  | μA    |
|  | Threshold low   |   | 1.4  | 0.8 | V     |
|  | Threshold high  | 2.4   | 1.4  |     |       |
| <b>AC CHARACTERISTICS</b>  |   |   |      |     |       |
| Transition Slew Rate   | C <sub>L</sub> = 50pF to 2500pF, R <sub>L</sub> = 3kΩ to 7kΩ, V <sub>CC</sub> = 5V,<br>TA = +25°C, measured from +3V to -3V or -3V to +3V | 5   | 10   | 30  | V/μs  |
| Transmitter Propagation Delay<br>TLL to RS-232 (normal operation),<br>Figure 1 | t <sub>PHLT</sub>   |   | 1.3  | 3.5 | μs    |
|  | t <sub>PLHT</sub>   |   | 1.5  | 3.5 |       |
| Receiver Propagation Delay<br>TLL to RS-232 (normal operation),<br>Figure 2    | t <sub>PHLR</sub>   |   | 0.6  | 1.5 | μs    |
|  | t <sub>PLHR</sub>   |   | 0.6  | 1.5 |       |
| Receiver Propagation Delay<br>TLL to RS-232 (low-power mode),<br>Figure 2      | t <sub>PHLS</sub>   |   | 0.6  | 10  | μs    |
|  | t <sub>PLHS</sub>   |   | 3.0  | 10  |       |
| Transmitter + to - Propagation<br>Delay Difference (normal operation)          | t <sub>PHLT</sub> - t <sub>PLHT</sub>   |   | 360  |     | ns    |
| Receiver + to - Propagation<br>Delay Difference (normal operation)             | t <sub>PHLR</sub> - t <sub>PLHR</sub>   |   | 350  |     | ns    |
| Receiver-Output Enable Time, Figure 3  | t <sub>ER</sub>   |   | 100  | 500 | ns    |
| Receiver-Output Disable Time, Figure 3   | t <sub>DR</sub>   |   | 100  | 500 | ns    |
| Transmitter Enable Time  | t <sub>ET</sub>   | MAX246-MAX249<br>(excludes charge-pump start-up)        | 5    |     | μs    |
|  |   | MAX225/MAX245-MAX249<br>(includes charge-pump start-up) | 10   |     | ms    |
| Transmitter Disable Time, Figure 4   | t <sub>DT</sub>   |   | 100  |     | ns    |

Note 4: The 300Ω minimum specification complies with EIA/TIA-232E, but the actual resistance when in shutdown mode or V<sub>CC</sub> = 0 is 10MΩ as is implied by the leakage specification.

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### Typical Operating Characteristics

#### MAX225/MAX244-MAX249



## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

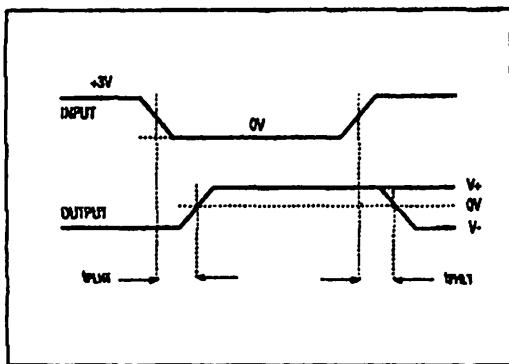


Figure 1. Transmitter Propagation Delay Timing

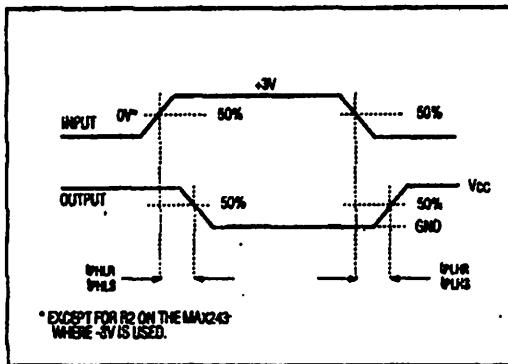


Figure 2. Receiver Propagation Delay Timing

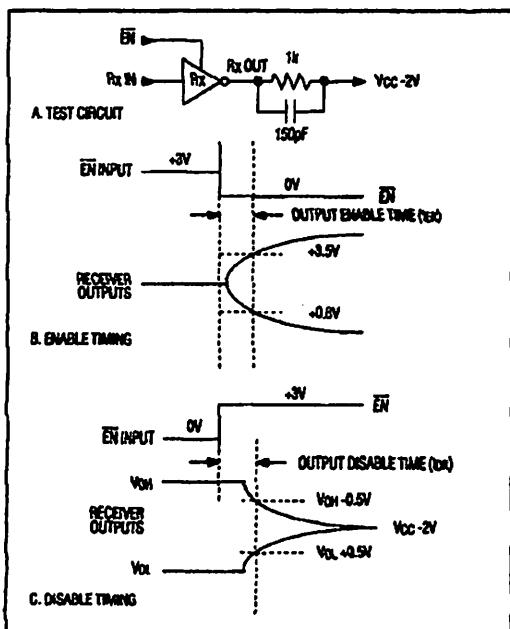


Figure 3. Receiver-Output Enable and Disable Timing

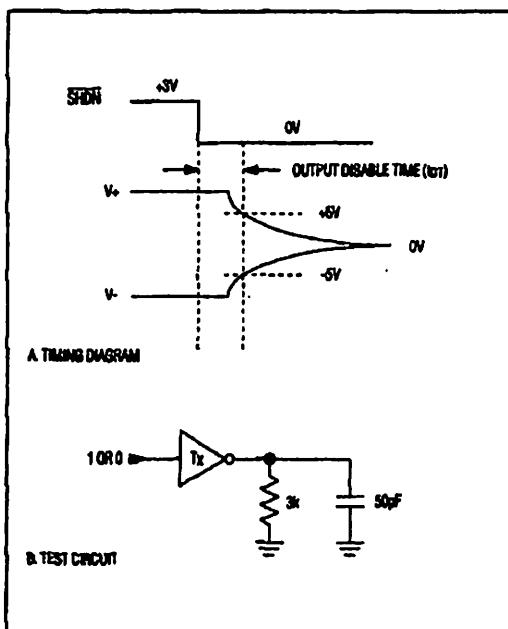


Figure 4. Transmitter-Output Disable Timing

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

**Table 1a. MAX225 Control Pin Configurations**

| EN <sub>T</sub> | EN <sub>R</sub> | OPERATION STATUS | TRANSMITTERS | RECEIVERS                  |
|-----------------|-----------------|------------------|--------------|----------------------------|
| 0               | 0               | Normal Operation | All Active   | All Active                 |
| 0               | 1               | Normal Operation | All Active   | All 3-State                |
| 1               | 0               | Shutdown         | All 3-State  | All Low-Power Receive Mode |
| 1               | 1               | Shutdown         | All 3-State  | All 3-State                |

**Table 1b. MAX245 Control Pin Configurations**

| EN <sub>T</sub> | EN <sub>R</sub> | OPERATION STATUS | TRANSMITTERS |             | RECEIVERS   |   |
|-----------------|-----------------|------------------|--------------|-------------|---|---|
|                 |                 |                  | TA1-TA4      | TB1-TB4     | RA1-RA5   | RB1-RB5   |
| 0               | 0               | Normal Operation | All Active   | All Active  | All Active  | All Active  |
| 0               | 1               | Normal Operation | All Active   | All Active  | RA1-RA4 3-State<br>RA5 Active                     | RB1-RB4 3-State<br>RB5 Active                     |
| 1               | 0               | Shutdown         | All 3-State  | All 3-State | All Low Power<br>Receiver Mode                    | All Low Power<br>Receiver Mode                    |
| 1               | 1               | Shutdown         | All 3-State  | All 3-State | RA1-RA4 3-State<br>RA5 Low-Power<br>Receiver Mode | RB1-RB4 3-State<br>RB5 Low-Power<br>Receiver Mode |

**Table 1c. MAX248 Control Pin Configurations**

| EN <sub>T</sub> | EN <sub>R</sub> | OPERATION STATUS | TRANSMITTERS |             | RECEIVERS   |   |
|-----------------|-----------------|------------------|--------------|-------------|---|---|
|                 |                 |                  | TA1-TA4      | TB1-TB4     | RA1-RA5   | RB1-RB5   |
| 0               | 0               | Normal Operation | All Active   | All Active  | All Active  | All Active  |
| 0               | 1               | Normal Operation | All Active   | All 3-State | All Active  | RB1-RB4 3-State<br>RB5 Active                     |
| 1               | 0               | Shutdown         | All 3-State  | All Active  | RA1-RA4 3-State<br>RA5 Active                     | All Active  |
| 1               | 1               | Shutdown         | All 3-State  | All 3-State | RA1-RA4 3-State<br>RA5 Low-Power<br>Receiver Mode | RB1-RB4 3-State<br>RB5 Low-Power<br>Receiver Mode |

**+5V-Powered, Multi-Channel RS-232  
Drivers/Receivers**

Table 1d. MAX247/248/249 Control Pin Configurations

| EN <sub>A</sub> | EN <sub>B</sub> | EN <sub>R</sub> <sub>A</sub> | EN <sub>R</sub> <sub>B</sub> | OPERATION STATUS | TRANSMITTERS |             | RECEIVERS              |         |  |         |
|-----------------|-----------------|------------------------------|------------------------------|------------------|--------------|-------------|------------------------|---------|--|---------|
|                 |                 |                              |                              |                  | MAX247       |             | TA1-TA4                | TB1-TB4 | RA1-RA4  | RB1-RB5 |
|                 |                 |                              |                              |                  | MAX248       |             | TA1-TA4                | TB1-TB4 | RA1-RA4  | RB1-RB4 |
|                 |                 |                              |                              |                  | MAX249       |             | TA1-TA3                | TB1-TB3 | RA1-RA5  | RB1-RB5 |
| 0               | 0               | 0                            | 0                            | Normal Operation | All Active   | All Active  | All Active             |         | All Active                                     |         |
| 0               | 0               | 0                            | 1                            | Normal Operation | All Active   | All Active  | All Active             |         | All 3-State, except RB5 stays active on MAX247 |         |
| 0               | 0               | 1                            | 0                            | Normal Operation | All Active   | All Active  | All 3-State            |         | All Active                                     |         |
| 0               | 0               | 1                            | 1                            | Normal Operation | All Active   | All Active  | All 3-State            |         | All 3-State, except RB5 stays active on MAX247 |         |
| 0               | 1               | 0                            | 0                            | Normal Operation | All Active   | All 3-State | All Active             |         | All Active                                     |         |
| 0               | 1               | 0                            | 1                            | Normal Operation | All Active   | All 3-State | All Active             |         | All 3-State, except RB5 stays active on MAX247 |         |
| 0               | 1               | 1                            | 0                            | Normal Operation | All Active   | All 3-State | All 3-State            |         | All Active                                     |         |
| 0               | 1               | 1                            | 1                            | Normal Operation | All Active   | All 3-State | All 3-State            |         | All 3-State, except RB5 stays active on MAX247 |         |
| 1               | 0               | 0                            | 0                            | Normal Operation | All 3-State  | All Active  | All Active             |         | All Active                                     |         |
| 1               | 0               | 0                            | 1                            | Normal Operation | All 3-State  | All Active  | All Active             |         | All 3-State, except RB5 stays active on MAX247 |         |
| 1               | 0               | 1                            | 0                            | Normal Operation | All 3-State  | All Active  | All 3-State            |         | All Active                                     |         |
| 1               | 0               | 1                            | 1                            | Normal Operation | All 3-State  | All Active  | All 3-State            |         | All 3-State, except RB5 stays active on MAX247 |         |
| 1               | 1               | 0                            | 0                            | Shutdown         | All 3-State  | All 3-State | Low-Power Receive Mode |         | Low-Power Receive Mode                         |         |
| 1               | 1               | 0                            | 1                            | Shutdown         | All 3-State  | All 3-State | Low-Power Receive Mode |         | All 3-State, except RB5 stays active on MAX247 |         |
| 1               | 1               | 1                            | 0                            | Shutdown         | All 3-State  | All 3-State | All 3-State            |         | Low-Power Receive Mode                         |         |
| 1               | 1               | 1                            | 1                            | Shutdown         | All 3-State  | All 3-State | All 3-State            |         | All 3-State, except RB5 stays active on MAX247 |         |

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

### Detailed Description

The MAX220-MAX249 contain four sections: dual charge-pump DC-DC voltage converters, RS-232 drivers, RS-232 receivers, and receiver and transmitter enable control inputs.

#### Dual Charge-Pump Voltage Converter

The MAX220-MAX249 have two internal charge-pumps that convert +5V to  $\pm 10V$  (unloaded) for RS-232 driver operation. The first converter uses capacitor C1 to double the +5V input to +10V on C3 at the V+ output. The second converter uses capacitor C2 to invert +10V to -10V on C4 at the V- output.

A small amount of power may be drawn from the +10V (V+) and -10V (V-) outputs to power external circuitry (see Typical Operating Characteristics), except on the MAX225 and MAX245-MAX247, where these pins are not available. V+ and V- are not regulated, so the output voltage drops with increasing load current. Do not load V+ and V- to a point that violates the minimum  $\pm 5V$  EIA/TIA-232E driver output voltage when sourcing current from V+ and V- to external circuitry.

When using the shutdown feature in the MAX222, MAX225, MAX230, MAX235, MAX236, MAX240, MAX241, and MAX245-MAX249 avoid using V+ and V- to power external circuitry. When these parts are shut down, V- falls to 0V, and V+ falls to +5V. For applications where a +10V external supply is applied to the V+ pin (instead of using the internal charge pump to generate +10V), the C1 capacitor must not be installed and the SHDN pin must be tied to VCC. This is because V+ is internally connected to VCC in shutdown mode.

#### RS-232 Drivers

The typical driver output voltage swing is  $\pm 8V$  when loaded with a nominal 5k $\Omega$  RS-232 receiver and VCC = +5V. Output swing is guaranteed to meet the EIA/TIA-232E and V.28 specification, which calls for  $\pm 5V$  minimum driver output levels under worst-case conditions. These include a minimum 3k $\Omega$  load, VCC = +4.5V, and maximum operating temperature. Unloaded driver output voltage ranges from (V+ - 1.3V) to (V- + 0.5V).

Input thresholds are both TTL and CMOS compatible. The inputs of unused drivers can be left unconnected since 400k $\Omega$  input pull-up resistors to VCC are built-in. The pull-up resistors force the outputs of unused drivers low because all drivers invert. The internal input pull-up resistors typically source 12 $\mu A$ , except in shutdown mode where the pull-ups are disabled. Driver outputs turn off and enter a high-impedance state—where leakage current is typically microamperes (maximum 25 $\mu A$ )—when in shutdown mode, in three-state mode, or when device power is removed. Outputs can be driven to  $\pm 15V$ . The power-supply current typically drops to 8 $\mu A$  in shutdown mode.

The MAX239 has a receiver 3-state control line, and the MAX223, MAX225, MAX235, MAX238, MAX240, and MAX241 have both a receiver 3-state control line and a low-power shutdown control. The receiver TTL/CMOS outputs are in a high-impedance, 3-state mode whenever the 3-state Enable line is high, and are also high-impedance whenever the shutdown control line is high.

When in low-power shutdown mode, the driver outputs are turned off and their leakage current is less than 1 $\mu A$  with the driver output pulled to ground. The driver output leakage remains less than 1 $\mu A$ , even if the transmitter output is backdriven between 0V and (VCC + 6V). Below -0.5V, the transmitter is diode clamped to ground with 1k $\Omega$  series impedance. The transmitter is also zener clamped to approximately VCC + 6V, with a series impedance of 1k $\Omega$ .

The driver output slew rate is limited to less than 30V/ $\mu s$  as required by the EIA/TIA-232E and V.28 specifications. Typical slew rates are 24V/ $\mu s$  unloaded and 10V/ $\mu s$  loaded with 3 $\Omega$  and 2500pF.

#### RS-232 Receivers

EIA/TIA-232E and V.28 specifications define a voltage level greater than 3V as a logic 0, so all receivers invert. Input thresholds are set at 0.8V and 2.4V, so receivers respond to TTL level inputs as well as EIA/TIA-232E and V.28 levels.

The receiver inputs withstand an input overvoltage up to  $\pm 25V$  and provide input terminating resistors with nominal 5k $\Omega$  values. The receivers implement Type 1 interpretation of the fault conditions of V.28 and EIA/TIA-232E.

The receiver input hysteresis is typically 0.5V with a guaranteed minimum of 0.2V. This produces clear output transitions with slow-moving input signals, even with moderate amounts of noise and ringing. The receiver propagation delay is typically 600ns and is independent of input swing direction.

#### Low-Power Receive Mode

The low-power receive-mode feature of the MAX223, MAX242, and MAX245-MAX249 puts the IC into shutdown mode, but still allows it to receive information. This is important for applications where systems are periodically awakened to look for activity. Using low-power receive mode, the system can still receive a signal that will activate it on command and prepare it for communication at faster data rates. This operation conserves system power.

#### Negative Threshold—MAX243

The MAX243 is pin compatible with the MAX232A, differing only in that RS-232 cable fault protection is removed on one of the two receiver inputs. This means that control lines such as CTS and RTS can either be driven or left floating without interrupting communication. Different cables are not needed to interface with different pieces of equipment.

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

The input threshold of the receiver without cable fault protection is -0.8V rather than +1.4V. Its output goes positive only if the input is connected to a control line that is actively driven negative. If not driven, it defaults to the 0 or "OK to send" state. Normally, the MAX243's other receiver (+1.4V threshold) is used for the data line (TD or RD), while the negative threshold receiver is connected to the control line (DTR, DTS, CTS, RTS, etc.).

Other members of the RS-232 family implement the optional cable fault protection as specified by EIA/TIA-232E specifications. This means a receiver output goes high whenever its input is driven negative, left floating, or shorted to ground. The high output tells the serial communications IC to stop sending data. To avoid this, the control lines must either be driven or connected with jumpers to an appropriate positive voltage level.

### Shutdown—MAX222-MAX242

On the MAX222, MAX235, MAX236, MAX240, and MAX241, all receivers are disabled during shutdown. On the MAX223 and MAX242, two receivers continue to operate in a reduced power mode when the chip is in shutdown. Under these conditions, the propagation delay increases to about  $2.5\mu s$  for a high-to-low input transition. When in shutdown the receiver acts as a CMOS inverter with no hysteresis. The MAX223 and MAX242 also have a receiver output enable input (EN) that allows receiver output control independent of SHDN. With all other devices, SHDN also disables the receiver outputs.

The MAX225 provides five transmitters and five receivers, while the MAX245 provides ten receivers and eight transmitters. Both devices have separate receiver and transmitter-enable controls. The charge pumps turn off and the devices shut down when a logic high is applied to the ENT input. In this state, the supply current drops to less than  $25\mu A$  and the receivers continue to operate in a low-power receive mode. Driver outputs enter a high-impedance state (three-state mode). On the MAX225, all five receivers are controlled by the ENR input. On the MAX245, eight of the receiver outputs are controlled by the ENR input, while the remaining two receivers (RA5 and RB5) are always active. RA1-RA4 and RB1-RB4 are put in a three-state mode when ENR is a logic high.

### Receiver and Transmitter Enable Control Inputs

The MAX225 and MAX245-MAX249 feature transmitter and receiver enable controls.

The receivers have three modes of operation: full-speed receive (normal active), three-state (disabled), and low-power receive (enabled receivers continue to function at lower data rates). The receiver enable inputs control the

full-speed receive and three-state modes. The transmitters have two modes of operation: full-speed transmit (normal active) and three-state (disabled). The transmitter enable inputs also control the shutdown mode. The device enters shutdown mode when all transmitters are disabled. Enabled receivers function in the low-power receive mode when in shutdown.

Tables 1a-1d define the control states. The MAX244 has no control pins and is not included in these tables.

The MAX246 has ten receivers and eight drivers with two control pins, each controlling one side of the device. A logic high at the A-side control input (ENA) causes the four A-side receivers and drivers to go into a three-state mode. Similarly, the B-side control input (ENB) causes the four B-side drivers and receivers to go into a three-state mode. As in the MAX245, one A-side and one B-side receiver (RA5 and RB5) remain active at all times. The entire device is put into shutdown mode when both the A and B sides are disabled (ENA = ENB = +5V).

The MAX247 provides nine receivers and eight drivers with four control pins. The ENRA and ENRB receiver enable inputs each control four receiver outputs. The ENTA and ENTB transmitter enable inputs each control four drivers. The ninth receiver (RB5) is always active. The device enters shutdown mode with a logic high on both ENTA and ENTB.

The MAX248 provides eight receivers and eight drivers with four control pins. The ENRA and ENRB receiver enable inputs each control four receiver outputs. The ENTA and ENTB transmitter enable inputs control four drivers each. This part does not have an always-active receiver. The device enters shutdown mode and transmitters go into a three-state mode with a logic high on both ENTA and ENTB.

The MAX249 provides ten receivers and six drivers with four control pins. The ENRA and ENRB receiver enable inputs each control five receiver outputs. The ENTA and ENTB transmitter enable inputs control three drivers each. There is no always-active receiver. The device enters shutdown mode and transmitters go into a three-state mode with a logic high on both ENTA and ENTB. In shutdown mode, active receivers operate in a low-power receive mode at data rates up to 20kbit/s.

### Applications Information

Figures 5 through 25 show pin configurations and typical operating circuits. In applications that are sensitive to power-supply noise, VCC should be decoupled to ground with a capacitor of the same value as C1 and C2 connected as close as possible to the device.

## +5V-Powered, Multi-Channel RS-232 Drivers/Receivers

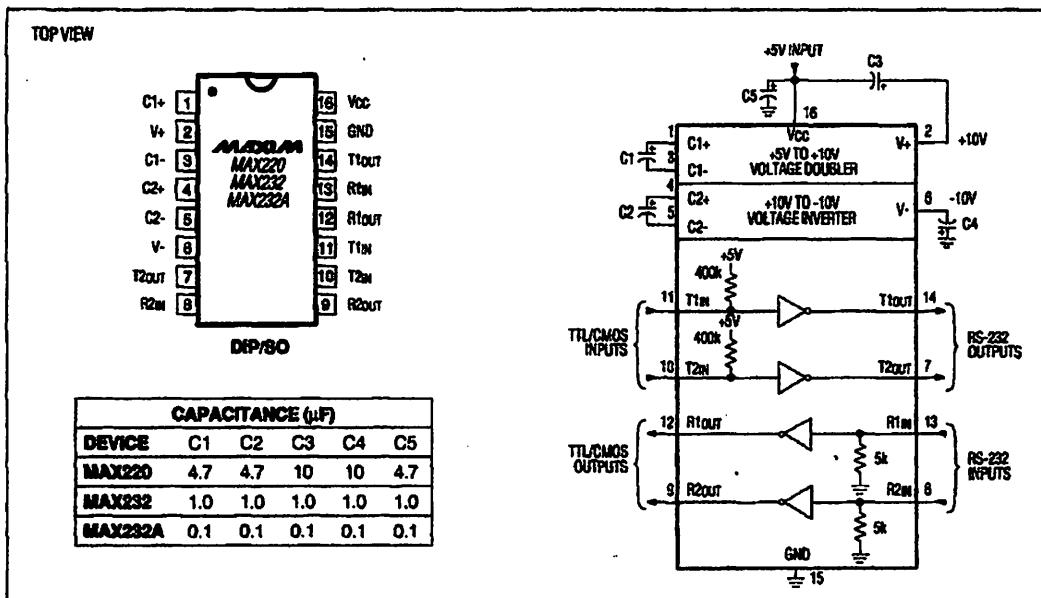


Figure 5. MAX220/232/232A Pin Configuration and Typical Operating Circuit

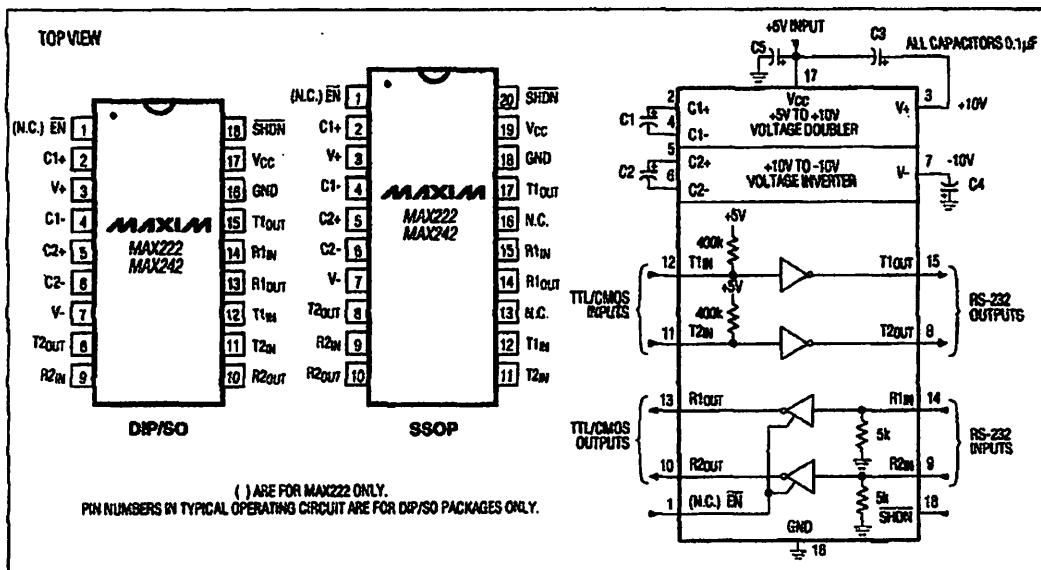


Figure 6. MAX222/MAX242 Pin Configuration and Typical Operating Circuit

225-2A Kannan-G-11541, Jernoway-VB+  
226-2C Kannan-G-11541, Jernoway-VB+

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