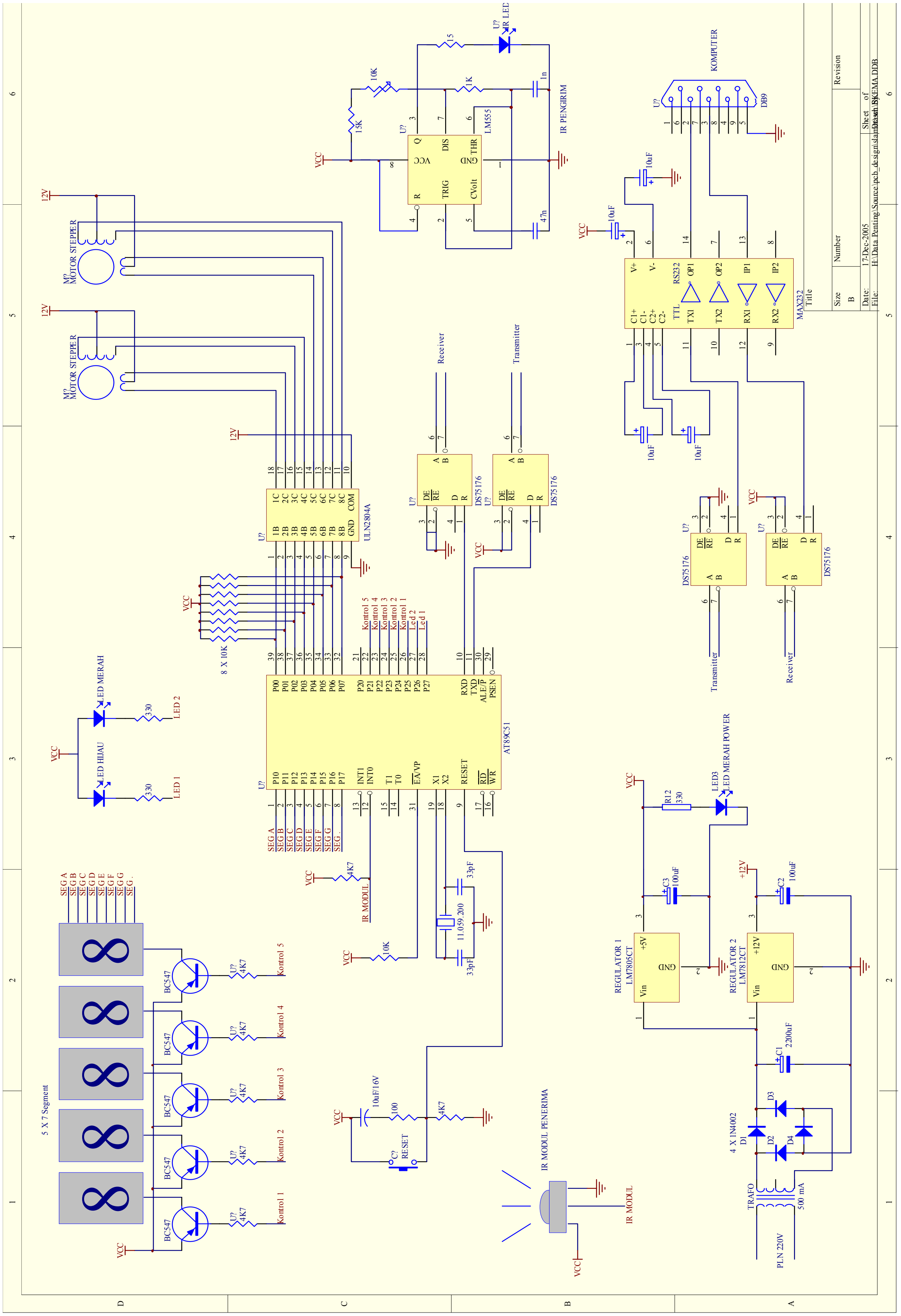
LAMPIRAN A

SKEMA RANGKAIAN



5 X 7 Segment
BC547
Kontrol 1
Kontrol 2
Kontrol 3
Kontrol 4
Kontrol 5
LED HIJAU
LED MERAH
LED 1
LED 2
8 X 10K
AT89C51
ULN2804A
MOTOR STEPPER
DS75176
Receiver
Transmitter
LM555
IR LED
IR PENGIRIM
MAX232
KOMPUTER
DB9
RS232
TTL
LED MERAH POWER
REGULATOR 1
LM7805CT
REGULATOR 2
LM7812CT
4 X 1N4002
TRAFO
500 mA
PLN 220V
IR MODUL PENERIMA
IR MODUL
RESET
11.059.200
33pF
10uF/16V
2200uF
100uF
VCC
12V
Title
Size
B
Number
Revision
Date: 17-Dec-2005
Sheet of

LAMPIRAN B

PERANGKAT LUNAK

```
#INCLUDE        "8051.H"

PORTSTEPPER     .EQU    P0
DATA7SEG        .EQU    P1
LEDMERAH        .EQU    P2.0
LEDHIJAU        .EQU    P2.1
SL1             .EQU    P2.2
SL2             .EQU    P2.3
SL3             .EQU    P2.4
SL4             .EQU    P2.5
SL5             .EQU    P2.6
INPUTINFRA      .EQU    P3.2

                .ORG    $50
BUF1            .BLOCK  1
BUF2            .BLOCK  1
BUF3            .BLOCK  1
BUF4            .BLOCK  1
BUF5            .BLOCK  1
STLOK1          .BLOCK  1
STLOK2          .BLOCK  1
STLOK3          .BLOCK  1
STLOK4          .BLOCK  1
STLOK5          .BLOCK  1
STLOK6          .BLOCK  1
STLOK7          .BLOCK  1
STLOK8          .BLOCK  1
STLOK9          .BLOCK  1
STLOK10         .BLOCK  1
JUMMOBIL        .BLOCK  1
```

```
        .ORG    $0
        LJMP    MULAI

        .ORG    $100
MULAI:  MOV     SP,#$20
        LCALL   INITSERIAL
        MOV     STLOK1,#$30
        MOV     STLOK2,#$30
        MOV     STLOK3,#$30
        MOV     STLOK4,#$30
        MOV     STLOK5,#$30
        MOV     STLOK6,#$30
        MOV     STLOK7,#$30
        MOV     STLOK8,#$30
        MOV     STLOK9,#$30
        MOV     STLOK10,#$30
        MOV     BUF1,#$C0
        MOV     BUF2,#$C0
        MOV     BUF3,#$C0
        MOV     BUF4,#$C0
        MOV     BUF5,#$C0
        SETB    LEDMERAH
        CLR     LEDHIJAU
        MOV     R3,#$0A



LOOP:   MOV     SP,#$20
        MOV     R4,#$FF
```

```
            LCALL   CEKJUMMOBIL
SCANLAGI1:
            LCALL   SCANNING
            DJNZ    R4,SCANLAGI1
;---------------------------------------------------
; SCANNING POSISI MOBIL DAN MENCATATNYA
;---------------------------------------------------
            MOV     R3,#$0A
            MOV     R4,#$4F
SCANMOBIL1:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL1
            JB      INPUTINFRA,SCANMOBIL2
            MOV     STLOK1,#$31
            DEC     R3
            LJMP    SCANMOBIL21
SCANMOBIL2:    MOV     STLOK1,#$30

SCANMOBIL21:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
SCANMOBIL22:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL22
            JB      INPUTINFRA,SCANMOBIL3
            MOV     STLOK2,#$31
            DEC     R3
            LJMP    SCANMOBIL31
SCANMOBIL3:    MOV     STLOK2,#$30
SCANMOBIL31:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
```

```
SCANMOBIL32:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL32
            JB      INPUTINFRA,SCANMOBIL4
            MOV     STLOK3,#$31
            DEC     R3
            LJMP    SCANMOBIL41
SCANMOBIL4:    MOV     STLOK3,#$30
SCANMOBIL41:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
SCANMOBIL42:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL42
            JB      INPUTINFRA,SCANMOBIL5
            MOV     STLOK4,#$31
            DEC     R3
            LJMP    SCANMOBIL51
SCANMOBIL5:    MOV     STLOK4,#$30
SCANMOBIL51:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
SCANMOBIL52:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL52
            JB      INPUTINFRA,SCANMOBIL6
            MOV     STLOK5,#$31
            DEC     R3
            LJMP    SCANMOBIL61
SCANMOBIL6:    MOV     STLOK5,#$30
SCANMOBIL61:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
```

```
SCANMOBIL62:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL62
            JB      INPUTINFRA,SCANMOBIL7
            MOV     STLOK6,#$31
            DEC     R3
            LJMP    SCANMOBIL71
SCANMOBIL7:    MOV     STLOK6,#$30
SCANMOBIL71:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
SCANMOBIL72:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL72
            JB      INPUTINFRA,SCANMOBIL8
            MOV     STLOK7,#$31
            DEC     R3
            LJMP    SCANMOBIL81
SCANMOBIL8:    MOV     STLOK7,#$30
SCANMOBIL81:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
SCANMOBIL82:
            LCALL   PUTARMOTORKR
            DJNZ    R4,SCANMOBIL82
            JB      INPUTINFRA,SCANMOBIL9
            MOV     STLOK8,#$31
            DEC     R3
            LJMP    SCANMOBIL91
SCANMOBIL9:    MOV     STLOK8,#$30
SCANMOBIL91:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
```

```
SCANMOBIL92:
        LCALL   PUTARMOTORKR
        DJNZ    R4,SCANMOBIL92
        JB      INPUTINFRA,SCANMOBIL10
        MOV     STLOK9,#$31
        DEC     R3
        LJMP    SCANMOBIL101
SCANMOBIL10:    MOV     STLOK9,#$30
SCANMOBIL101:   LCALL   PENGIRIMANDATA
        MOV     R4,#$4F
SCANMOBIL102:
        LCALL   PUTARMOTORKR
        DJNZ    R4,SCANMOBIL102
        JB      INPUTINFRA,SCANMOBILEND
        MOV     STLOK10,#$31
        DEC     R3
        LJMP    SCANMOBILEND1
SCANMOBILEND:   MOV     STLOK10,#$30
SCANMOBILEND1:  LCALL   PENGIRIMANDATA

;------------- SCANNING PERTAMA SELESAI ---------------
        MOV     R4,#$FF
        LCALL   CEKJUMMOBIL
SCANLAGI2:      LCALL   SCANNING
        DJNZ    R4,SCANLAGI2
;------------- SCANNING BALIK -------------------------
        MOV     R3,#$0A
        JB      INPUTINFRA,BSCANMOBIL90
        MOV     STLOK10,#$31
        LJMP    BSCANMOBIL91
```

```
BSCANMOBIL90:   MOV     STLOK10,#$30
BSCANMOBIL91:   LCALL   PENGIRIMANDATA
                MOV     R4,#$4F
BSCANMOBIL9:
                LCALL   PUTARMOTORKN
                DJNZ    R4,BSCANMOBIL9
                JB      INPUTINFRA,BSCANMOBIL8
                MOV     STLOK9,#$31
                DEC     R3
                LJMP    BSCANMOBIL81
BSCANMOBIL8:    MOV     STLOK9,#$30
BSCANMOBIL81:   LCALL   PENGIRIMANDATA
                MOV     R4,#$4F
BSCANMOBIL82:
                LCALL   PUTARMOTORKN
                DJNZ    R4,BSCANMOBIL82
                JB      INPUTINFRA,BSCANMOBIL7
                MOV     STLOK8,#$31
                DEC     R3
                LJMP    BSCANMOBIL71
BSCANMOBIL7:    MOV     STLOK8,#$30
BSCANMOBIL71:   LCALL   PENGIRIMANDATA
                MOV     R4,#$4F
BSCANMOBIL72:
                LCALL   PUTARMOTORKN
                DJNZ    R4,BSCANMOBIL72
                JB      INPUTINFRA,BSCANMOBIL6
                MOV     STLOK7,#$31
                DEC     R3
                LJMP    BSCANMOBIL61
```

```
BSCANMOBIL6:    MOV     STLOK7,#$30
BSCANMOBIL61:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
BSCANMOBIL62:
            LCALL   PUTARMOTORKN
            DJNZ    R4,BSCANMOBIL62
            JB      INPUTINFRA,BSCANMOBIL5
            MOV     STLOK6,#$31
            DEC     R3
            LJMP    BSCANMOBIL51
BSCANMOBIL5:    MOV     STLOK6,#$30
BSCANMOBIL51:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
BSCANMOBIL52:
            LCALL   PUTARMOTORKN
            DJNZ    R4,BSCANMOBIL52
            JB      INPUTINFRA,BSCANMOBIL4
            MOV     STLOK5,#$31
            DEC     R3
            LJMP    BSCANMOBIL41
BSCANMOBIL4:    MOV     STLOK5,#$30
BSCANMOBIL41:   LCALL   PENGIRIMANDATA
            MOV     R4,#$4F
BSCANMOBIL42:
            LCALL   PUTARMOTORKN
            DJNZ    R4,BSCANMOBIL42
            JB      INPUTINFRA,BSCANMOBIL3
            MOV     STLOK4,#$31
            DEC     R3
            LJMP    BSCANMOBIL31
```

```
BSCANMOBIL3:    MOV     STLOK4,#$30
BSCANMOBIL31:   LCALL   PENGIRIMANDATA
                MOV     R4,#$4F
BSCANMOBIL32:
                LCALL   PUTARMOTORKN
                DJNZ    R4,BSCANMOBIL32
                JB      INPUTINFRA,BSCANMOBIL2
                MOV     STLOK3,#$31
                DEC     R3
                LJMP    BSCANMOBIL21
BSCANMOBIL2:    MOV     STLOK3,#$30
BSCANMOBIL21:   LCALL   PENGIRIMANDATA
                MOV     R4,#$4F
BSCANMOBIL22:
                LCALL   PUTARMOTORKN
                DJNZ    R4,BSCANMOBIL22
                JB      INPUTINFRA,BSCANMOBIL1
                MOV     STLOK2,#$31
                DEC     R3
                LJMP    BSCANMOBIL11
BSCANMOBIL1:    MOV     STLOK2,#$30
BSCANMOBIL11:   LCALL   PENGIRIMANDATA
                MOV     R4,#$4F
BSCANMOBIL12:
                LCALL   PUTARMOTORKN
                DJNZ    R4,BSCANMOBIL12
                JB      INPUTINFRA,BSCANMOBIL10
                MOV     STLOK1,#$31
                DEC     R3
                LJMP    BSCANMOBIL101
```

```
BSCANMOBIL10:   MOV     STLOK1,#$30
BSCANMOBIL101:  LCALL   PENGIRIMANDATA
            LCALL   PUTARMOTORKN
            LJMP    LOOP




;---------------------------------------------
; PEMUTARAN STEPPER MOTOR
;---------------------------------------------
PUTARMOTORKN:   MOV     DPTR,#DATASTEPPER1
PUTARMOTORKN1:  CLR     A
            MOVC    A,@A+DPTR
            CJNE    A,#0,PUTARMOTORKN2
            RET
PUTARMOTORKN2:  MOV     PORTSTEPPER,A
            LCALL   DELAYMOTOR
            NOP
            NOP
            NOP
            INC     DPTR
            LJMP    PUTARMOTORKN1

PUTARMOTORKR:   MOV     DPTR,#DATASTEPPER2
PUTARMOTORKR1:  CLR     A
            MOVC    A,@A+DPTR
            CJNE    A,#0,PUTARMOTORKR2
            RET
PUTARMOTORKR2:  MOV     PORTSTEPPER,A
            LCALL   DELAYMOTOR
```

```
        NOP
        NOP
        NOP
        INC     DPTR
        LJMP    PUTARMOTORKR1

;--------------------------------------------
;PENGIRIMAN DATA KE KOMPUTER
;--------------------------------------------
PENGIRIMANDATA:
        MOV     A,STLOK1
        LCALL   SENDCHR
        MOV     A,STLOK2
        LCALL   SENDCHR
        MOV     A,STLOK3
        LCALL   SENDCHR
        MOV     A,STLOK4
        LCALL   SENDCHR
        MOV     A,STLOK5
        LCALL   SENDCHR
        MOV     A,STLOK6
        LCALL   SENDCHR
        MOV     A,STLOK7
        LCALL   SENDCHR
        MOV     A,STLOK8
        LCALL   SENDCHR
        MOV     A,STLOK9
        LCALL   SENDCHR
        MOV     A,STLOK10
        LCALL   SENDCHR
```

```
        MOV     A,#$0D          ;ENDOFFDATA
        LCALL   SENDCHR
        RET


;--------------------------------------------------
;RUTIN MENJALANAN STEPPER MOTOR
;--------------------------------------------------
JALANKANMOTOR:
        MOV     DPTR,#DATASTEPPER1
PUTARKAN1:
        CLR     A
        MOVC    A,@A+DPTR
        CJNE    A,#0,PUTARKAN2
        RET

PUTARKAN2:      MOV     PORTSTEPPER,A
        LJMP    PUTARKAN1



CEKJUMMOBIL:
        MOV     A,R3
        JNZ     TTG1
        MOV     BUF1,#$8C
        MOV     BUF2,#$86
        MOV     BUF3,#$C8
        MOV     BUF4,#$C1
        MOV     BUF5,#$89
        CLR     LEDMERAH
        SETB    LEDHIJAU
```

```
        RET

TTG1:   SETB    LEDMERAH
        CLR     LEDHIJAU
        MOV     BUF1,#$C0
        MOV     BUF2,#$C0
        MOV     BUF3,#$C0
        CJNE    R3,#$01,TTG2
        MOV     BUF4,#$C0
        MOV     BUF5,#$F9
        RET
TTG2:   CJNE    R3,#$02,TTG3
        MOV     BUF4,#$C0
        MOV     BUF5,#$A4
        RET
TTG3:   CJNE    R3,#$03,TTG4
        MOV     BUF4,#$C0
        MOV     BUF5,#$B0
        RET
TTG4:   CJNE    R3,#$04,TTG5
        MOV     BUF4,#$C0
        MOV     BUF5,#$99
        RET
TTG5:   CJNE    R3,#$05,TTG6
        MOV     BUF4,#$C0
        MOV     BUF5,#$92
        RET
TTG6:   CJNE    R3,#$06,TTG7
        MOV     BUF4,#$C0
        MOV     BUF5,#$82
```

```
        RET
TTG7:     CJNE   R3,#$07,TTG8
        MOV    BUF4,#$C0
        MOV    BUF5,#$F8
        RET
TTG8:     CJNE   R3,#$08,TTG9
        MOV    BUF4,#$C0
        MOV    BUF5,#$80
        RET
TTG9:     CJNE   R3,#$09,TTG10
        MOV    BUF4,#$C0
        MOV    BUF5,#$90
        RET
TTG10:    CJNE   R3,#$0A,TTG2
        MOV    BUF4,#$F9
        MOV    BUF5,#$C0
        RET



;--------------------------------------------------
; RUTIN SCANNING DISPLAY
;--------------------------------------------------
SCANNING:
SCANW1:    MOV    DATA7SEG,BUF1
        CLR    SL1
        SETB   SL2
        SETB   SL3
        SETB   SL4
        SETB   SL5
```

```
        LCALL   DELAYDISPONW
        MOV     DATA7SEG,#$FF
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
SCANW2:         MOV     DATA7SEG,BUF2
        SETB    SL1
        CLR     SL2
        SETB    SL3
        SETB    SL4
        SETB    SL5
        LCALL   DELAYDISPONW
        MOV     DATA7SEG,#$FF
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
```

```
SCANW3:     MOV     DATA7SEG,BUF3
            SETB    SL1
            SETB    SL2
            CLR     SL3
            SETB    SL4
            SETB    SL5
            LCALL   DELAYDISPONW
            MOV     DATA7SEG,#$FF
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP

SCANW4:     MOV     DATA7SEG,BUF4
            SETB    SL1
            SETB    SL2
            SETB    SL3
            CLR     SL4
            SETB    SL5
            LCALL   DELAYDISPONW
            MOV     DATA7SEG,#$FF
            NOP
            NOP
            NOP
```

```
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
SCANW5:     MOV     DATA7SEG,BUF5
            SETB    SL1
            SETB    SL2
            SETB    SL3
            SETB    SL4
            CLR     SL5
            LCALL   DELAYDISPONW
            MOV     DATA7SEG,#$FF
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP
            NOP

            RET

;-----------------------------------------------
; PROC RUTIN SERIAL UNTUK KIRIM DATA
```

```
;-----------------------------------------------
SENDCHR:        CLR     ES
            CLR     TI
            MOV     SBUF,A
TXLOOP:
            JNB     TI,TXLOOP
            CLR     TI
            SETB    ES
            RET

;----------------------------------------
; INISIALISASI KOMUNIKASI SERIAL 9600BPS
;----------------------------------------
INITSERIAL:
            MOV     TMOD,#20H
            MOV     TCON,#41H
            MOV     TH1,#0FDH
            MOV     SCON,#50H
            SETB    TR1
            RET


;------ ROUTINE KONVERSI ANGKA KE DALAM FORMAT 7 SEGMENT ---
-
CONV7SEG:
            MOV     DPTR,#SEG
LOAD:       MOVC    A,@A+DPTR
            RET
```

```
DELAYDISPONW:
            MOV     R6,#$02
DELAY0ONW:      MOV     R7,#$FF
DELAY1ONW:      DJNZ    R7,DELAY1ONW
            DJNZ    R6,DELAY0ONW
            RET

DELAYMOTOR:     MOV     R6,#$0F         ;2f     ;4F
DELAYMOTOR1:    MOV     R7,#$FF
DELAYMOTOR2:    DJNZ    R7,DELAYMOTOR2
            DJNZ    R6,DELAYMOTOR1
            RET


;                   0   1   2   3   4   5   6   7   8   9
SEG:        .BYTE   $C0,$F9,$A4,$B0,$99,$92,$82,$F8,$80,$90,$C0,$BF,$BF
KATAPENUH       .BYTE   $8C,$86,$C8,$C1,$89
DATASTEPPER1    .BYTE   $11,$22,$44,$88,$0

DATASTEPPER2    .BYTE   $88,$44,$22,$11,$0
            .END
```

```
unit FUTAMA;

interface

uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,
  Dialogs, StdCtrls, ExtCtrls, Buttons, QCCom32,printers, Grids, DBGrids,
  DB, DBTables;

type
  TForm1 = class(TForm)
    Panel1: TPanel;
    pmobil1: TPanel;
    pmobil2: TPanel;
    pmobil3: TPanel;
    pmobil4: TPanel;
    pmobil5: TPanel;
    pmobil6: TPanel;
    pmobil7: TPanel;
    pmobil8: TPanel;
    pmobil9: TPanel;
    pmobil10: TPanel;
    Label1: TLabel;
    Label2: TLabel;
    Enomor: TEdit;
    Label3: TLabel;
    Label4: TLabel;
    Label5: TLabel;
    Label6: TLabel;
    Label7: TLabel;
```

```
    Label8: TLabel;
    Label9: TLabel;
    Label10: TLabel;
    Label11: TLabel;
    Label12: TLabel;
    Bmasuk: TBitBtn;
    Panel2: TPanel;
    Timer1: TTimer;
    Com: TQCCom32;
    PLOKASI: TPanel;
    Label13: TLabel;
    Label14: TLabel;
    Table1: TTable;
    DataSource1: TDataSource;
    ptanggal: TPanel;
    pjam: TPanel;
    BitBtn2: TBitBtn;
    Label15: TLabel;
    Label16: TLabel;
    Panel3: TPanel;
    Panel4: TPanel;
    Panel5: TPanel;
    DBGrid1: TDBGrid;
    Label17: TLabel;
    procedure Timer1Timer(Sender: TObject);
    procedure FormCreate(Sender: TObject);
    procedure BmasukClick(Sender: TObject);
  private
    { Private declarations }
  public
```

```
    { Public declarations }
  end;

var
  Form1: TForm1;
  datars232:string;
  stlok1,
  stlok2,
  stlok3,
  stlok4,
  stlok5,
  stlok6,
  stlok7,
  stlok8,
  stlok9,
  stlok10       :boolean;
  stisi:boolean;
  lokasiparkir:integer;
implementation

{$R *.dfm}

procedure TForm1.Timer1Timer(Sender: TObject);

begin
 ptanggal.caption:=formatdatetime('dd/mm/yyyy',DATE);
 pjam.caption:=formatdatetime('hh:mm:ss',time);

 datars232:=com.read;
 if length(datars232)>10 then
```

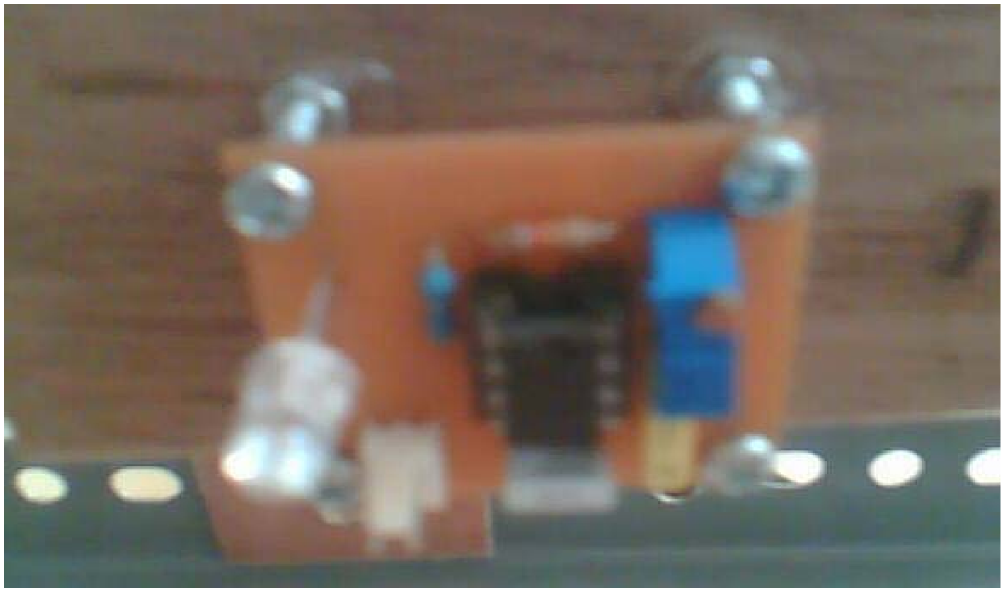
```
 begin
   if copy(datars232,1,1)='1' then stlok1:=true else stlok1:=false;
   if copy(datars232,2,1)='1' then stlok2:=true else stlok2:=false;
   if copy(datars232,3,1)='1' then stlok3:=true else stlok3:=false;
   if copy(datars232,4,1)='1' then stlok4:=true else stlok4:=false;
   if copy(datars232,5,1)='1' then stlok5:=true else stlok5:=false;
   if copy(datars232,6,1)='1' then stlok6:=true else stlok6:=false;
   if copy(datars232,7,1)='1' then stlok7:=true else stlok7:=false;
   if copy(datars232,8,1)='1' then stlok8:=true else stlok8:=false;
   if copy(datars232,9,1)='1' then stlok9:=true else stlok9:=false;
   if copy(datars232,10,1)='1' then stlok10:=true else stlok10:=false;
 end;

 if stlok1 then pmobil1.color:=clred else pmobil1.Color:=clteal;
 if stlok2 then pmobil2.color:=clred else pmobil2.Color:=clteal;
 if stlok3 then pmobil3.color:=clred else pmobil3.Color:=clteal;
 if stlok4 then pmobil4.color:=clred else pmobil4.Color:=clteal;
 if stlok5 then pmobil5.color:=clred else pmobil5.Color:=clteal;
 if stlok6 then pmobil6.color:=clred else pmobil6.Color:=clteal;
 if stlok7 then pmobil7.color:=clred else pmobil7.Color:=clteal;
 if stlok8 then pmobil8.color:=clred else pmobil8.Color:=clteal;
 if stlok9 then pmobil9.color:=clred else pmobil9.Color:=clteal;
 if stlok10 then pmobil10.color:=clred else pmobil10.Color:=clteal;
end;

procedure TForm1.FormCreate(Sender: TObject);
begin
 stlok1:=false;
 stlok2:=false;
 stlok3:=false;
```

```
 stlok4:=false;
 stlok5:=false;
 stlok6:=false;
 stlok7:=false;
 stlok8:=false;
 stlok9:=false;
 stlok10:=false;
 lokasiparkir:=0;
 stisi:=true;

end;

procedure TForm1.BmasukClick(Sender: TObject);
begin

if (not STLOK1) and stisi then begin lokasiparkir:=1;stisi:=false;end;
if (not STLOK2) and stisi then begin lokasiparkir:=2;stisi:=false;end;
if (not STLOK3) and stisi then begin lokasiparkir:=3;stisi:=false;end;
if (not STLOK4) and stisi then begin lokasiparkir:=4;stisi:=false;end;
if (not STLOK5) and stisi then begin lokasiparkir:=5;stisi:=false;end;
if (not STLOK6) and stisi then begin lokasiparkir:=6;stisi:=false;end;
if (not STLOK7) and stisi then begin lokasiparkir:=7;stisi:=false;end;
if (not STLOK8) and stisi then begin lokasiparkir:=8;stisi:=false;end;
if (not STLOK9) and stisi then begin lokasiparkir:=9;stisi:=false;end;
if (not STLOK10) and stisi then begin lokasiparkir:=10;stisi:=false;end;

stisi:=true;

plokasi.caption:=inttostr(lokasiparkir);
```

```
table1.Refresh;
table1.Last;
with table1 do
begin
 Insert;
 fieldbyname('tanggal').asstring:=ptanggal.caption;
 fieldbyname('jam').asstring:=pjam.caption;
 fieldbyname('no_polisi').asstring:=enomor.Text;
 fieldbyname('lok_parkir').AsString:=inttostr(lokasiparkir);
end;

 with Printer do
    begin
      BeginDoc;
       canvas.Textout(320,10, '====PARKING SYSTEM====');
       canvas.textout(320,80, '---------------------------------------------');
       canvas.TextOut(320,150, 'Tanggal:   '+ptanggal.caption);
       canvas.TextOut(320,220,'Jam        :   '+pjam.caption);
       canvas.TextOut(320,290,'No Kendaraan:  '+enomor.text);
       canvas.TextOut(320,360,'Lokasi Parkir:     '+inttostr(lokasiparkir));
       canvas.textout(320,430,'***********************************');
       canvas.textout(320,500,'            Terima kasih');
      EndDoc;
  end;

end;

end.
```

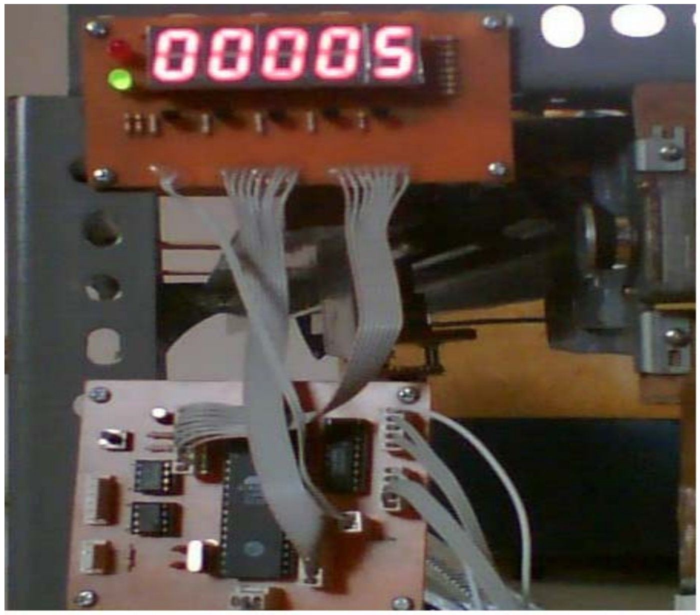
LAMPIRAN C

FOTO ALAT



Gambar 1 Sensor TX

Gambar 2 Sensor RX



Gambar 3 Bagian Pengontrol

Gambar 4 Proses Scanning

LAMPIRAN D

DATA KOMPONEN

Features

- Compatible with MCS-51™ Products
- 4K Bytes of In-System Reprogrammable Flash Memory
  - Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three-Level Program Memory Lock
- 128 x 8-Bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-Bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel
- Low Power Idle and Power Down Modes

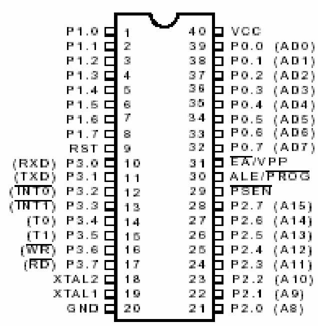
Description

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash Programmable and Erasable Read Only Memory (PEROM). The device is manufactured using Atmel's high density nonvolatile memory technology and is compatible with the industry standard MCS-51™ 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 Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications.

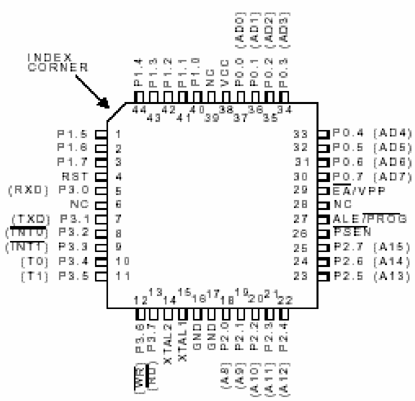
(continued)

Pin Configurations

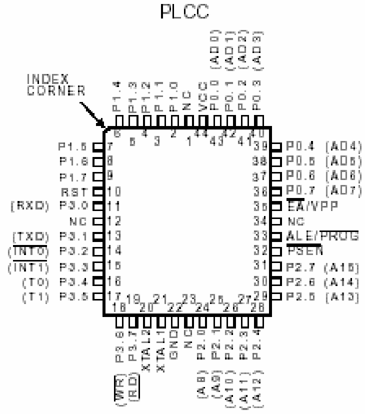
PDIP



PQFP/TQFP



PLCC

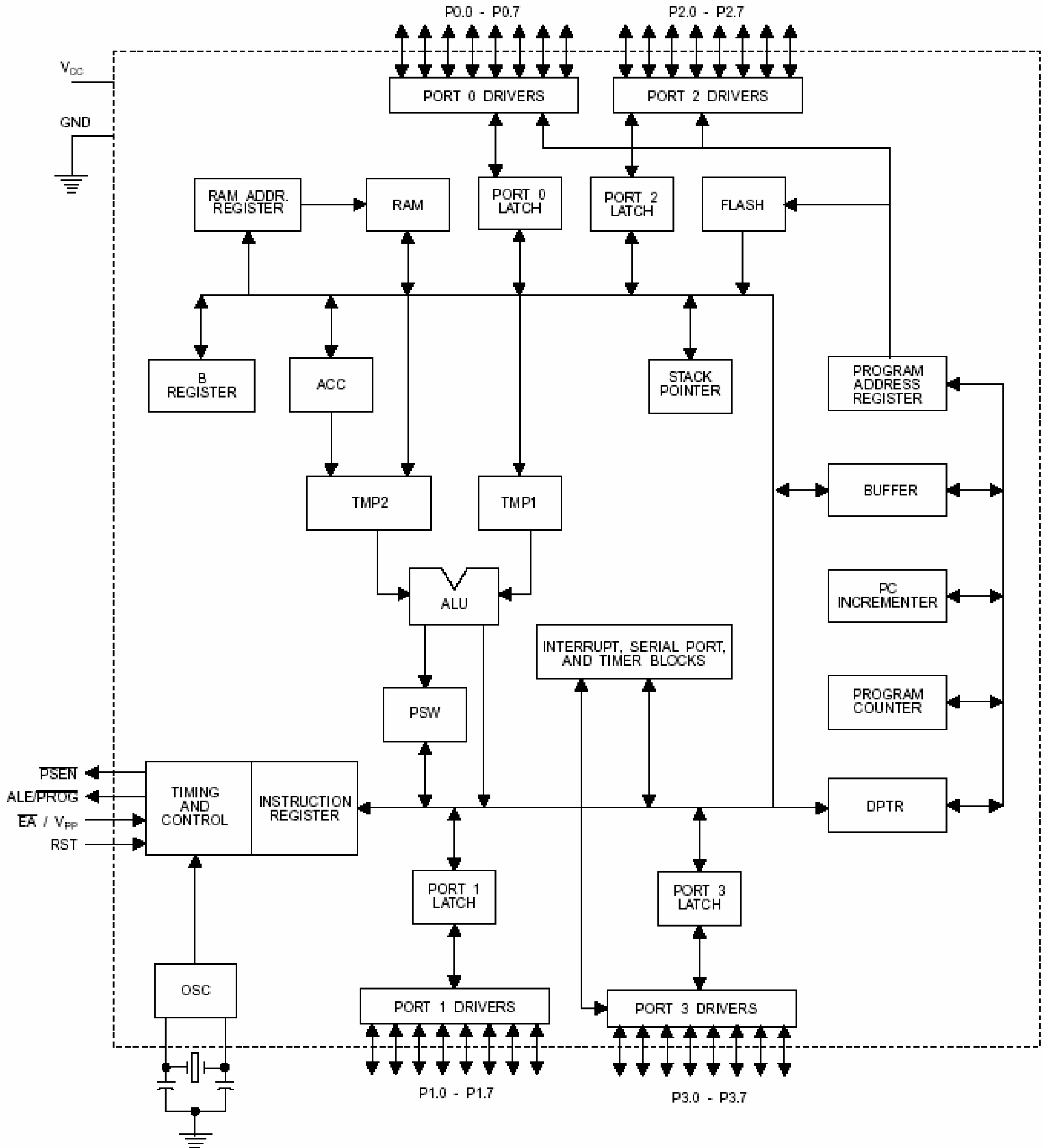


8-Bit Microcontroller with 4K Bytes Flash

AT89C51

0265F-A–12/97

Block Diagram



The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power Down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

Pin Description

V_{CC}

Supply voltage.

GND

Ground.

Port 0

Port 0 is an 8-bit open drain bidirectional I/O port. As an output port each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high-impedance inputs.

Port 0 may also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode P0 has internal pullups.

Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pullups are required during program verification.

Port 1

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

Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2

Port 2 is an 8-bit bidirectional I/O port with internal pullups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pullups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (I_{IL}) because of the internal pullups.

Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVX @ DPTR). In this application it uses strong internal pullups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register.

Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

Port 3

Port 3 is an 8-bit bidirectional I/O port with internal pullups. 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 pullups 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 pullups.

Port 3 also serves the functions of various special features of the AT89C51 as listed below:

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)

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

RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

ALE/$\overline{PROG}$

Address Latch Enable 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.

$\overline{PSEN}$

Program Store Enable is the read strobe to external program memory.

When the AT89C51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/V_{PP}
External Access Enable. 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, EA will be internally latched on reset.

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, for parts that require 12-volt V_{PP}.

XTAL1
Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2
Output from the inverting oscillator amplifier.

Oscillator Characteristics

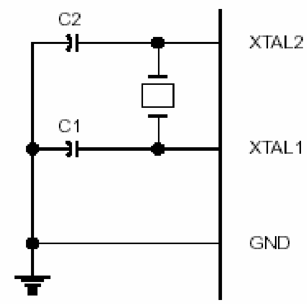
XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier which can be configured for use as an on-chip oscillator, as shown in Figure 1. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven as shown in Figure 2. 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.

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 functions registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset.

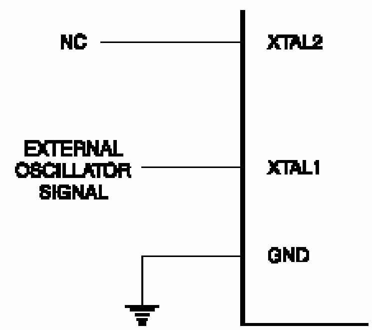
It should be noted that when idle is terminated by a hard ware reset, the device normally resumes program execution, from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port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

Figure 1. Oscillator Connections



Note: C1, C2 = 30 pF ± 10 pF for Crystals
= 40 pF ± 10 pF for Ceramic Resonators

Figure 2. External Clock Drive Configuration



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

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. The only exit from power down is a hardware reset. 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.

Program Memory Lock Bits

On the chip are three lock bits which can be left unprogrammed (U) or can be programmed (P) to obtain the additional features listed in the table below:

When lock bit 1 is programmed, the logic level at the $\overline{EA}$ 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. It is necessary that the latched value of $\overline{EA}$ be in agreement with the current logic level at that pin in order for the device to function properly.

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, $\overline{EA}$ is sampled and latched on reset, and further programming of the Flash is disabled.
3	P	P	U	Same as mode 2, also verify is disabled.
4	P	P	P	Same as mode 3, also external execution is disabled.

Programming the Flash

The AT89C51 is normally shipped with the on-chip Flash memory array in the erased state (that is, contents = FFH) and ready to be programmed. The programming interface accepts either a high-voltage (12-volt) or a low-voltage (V_{CC}) program enable signal. The low voltage programming mode provides a convenient way to program the AT89C51 inside the user's system, while the high-voltage programming mode is compatible with conventional third party Flash or EPROM programmers.

The AT89C51 is shipped with either the high-voltage or low-voltage programming mode enabled. The respective top-side marking and device signature codes are listed in the following table.

	V_{PP} = 12V	V_{PP} = 5V
Top-Side Mark	AT89C51 xxxx yyww	AT89C51 xxxx-5 yyww
Signature	(030H)=1EH (031H)=51H (032H)=FFH	(030H)=1EH (031H)=51H (032H)=05H

The AT89C51 code memory array is programmed byte-by-byte in either programming mode. *To program any non-blank byte in the on-chip Flash Memory, the entire memory must be erased using the Chip Erase Mode.*

Programming Algorithm: Before programming the AT89C51, the address, data and control signals should be set up according to the Flash programming mode table and Figures 3 and 4. To program the AT89C51, 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 $\overline{EA}/V_{PP}$ to 12V for the high-voltage programming mode.
5. Pulse ALE/$\overline{PROG}$ 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 1.5 ms. Repeat steps 1 through 5, changing the address and data for the entire array or until the end of the object file is reached.

$\overline{\text{Data}}$ Polling: The AT89C51 features $\overline{\text{Data}}$ Polling to indicate the end of a write cycle. During a write cycle, an attempted read of the last byte written will result in the complement of the written datum on PO.7. Once the write cycle has been completed, true data are valid on all outputs, and the next cycle may begin. $\overline{\text{Data}}$ Polling may begin any time after a write cycle has been initiated.

Ready/$\overline{\text{Busy}}$: The progress of byte programming can also be monitored by the RDY/$\overline{BSY}$ output signal. P3.4 is pulled low after ALE goes high during programming to indicate BUSY. P3.4 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 lock bits cannot be verified directly. Verification of the lock bits is achieved by observing that their features are enabled.

Chip Erase: The entire Flash array is erased electrically by using the proper combination of control signals and by holding ALE/$\overline{PROG}$ low for 10 ms. The code array is written with all "1"s. The chip erase operation must be executed before the code memory can be re-programmed.

Reading the Signature Bytes: The signature bytes are read by the same procedure as a normal verification of locations 030H,

031H, and 032H, except that P3.6 and P3.7 must be pulled to a logic low. The values returned are as follows.

(030H) = 1EH indicates manufactured by Atmel
(031H) = 51H indicates 89C51
(032H) = FFH indicates 12V programming
(032H) = 05H indicates 5V programming

Programming Interface

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

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

Flash Programming Modes

Mode		RST	$\overline{PSEN}$	ALE/$\overline{PROG}$	$\overline{EA}/V_{PP}$	P2.6	P2.7	P3.6	P3.7
Write Code Data		H	L		H/12V	L	H	H	H
Read Code Data		H	L	H	H	L	L	H	H
Write Lock	Bit - 1	H	L		H/12V	H	H	H	H
	Bit - 2	H	L		H/12V	H	H	L	L
	Bit - 3	H	L		H/12V	H	L	H	L
Chip Erase		H	L	(1)	H/12V	H	L	L	L
Read Signature Byte		H	L	H	H	L	L	L	L

Note: 1. Chip Erase requires a 10-ms $\overline{PROG}$ pulse.

Figure 3. Programming the Flash

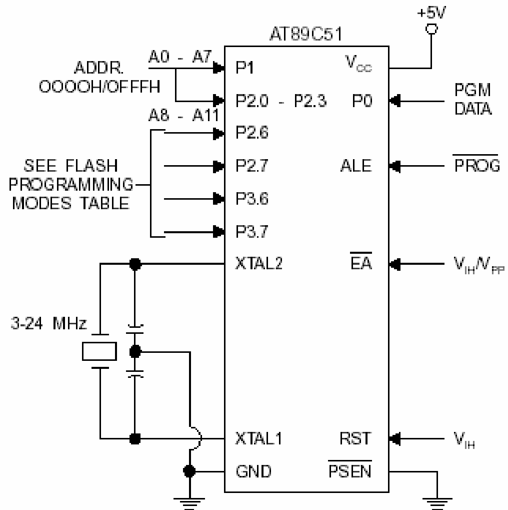
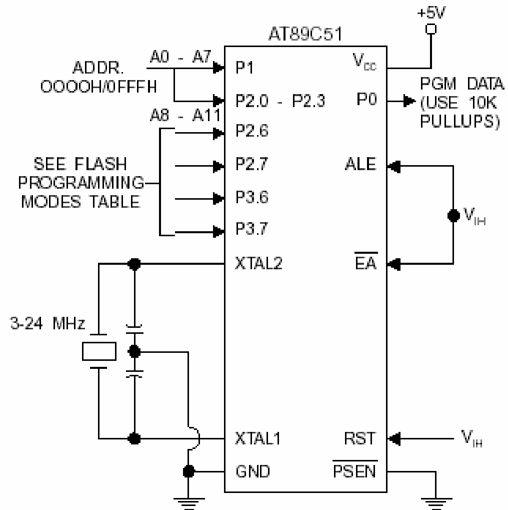


Figure 4. Verifying the Flash



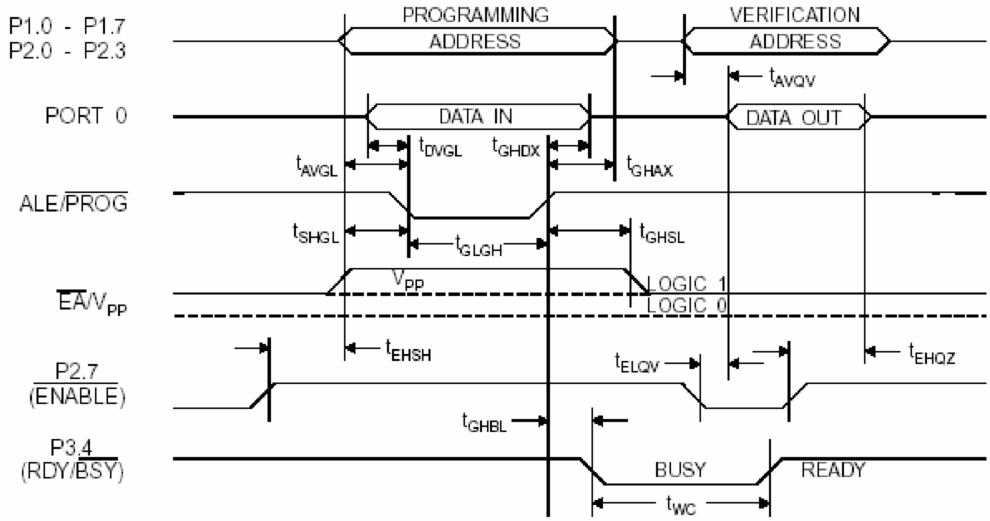
Flash Programming and Verification Characteristics

T_A = 0°C to 70°C, V_{CC} = 5.0 ± 10%

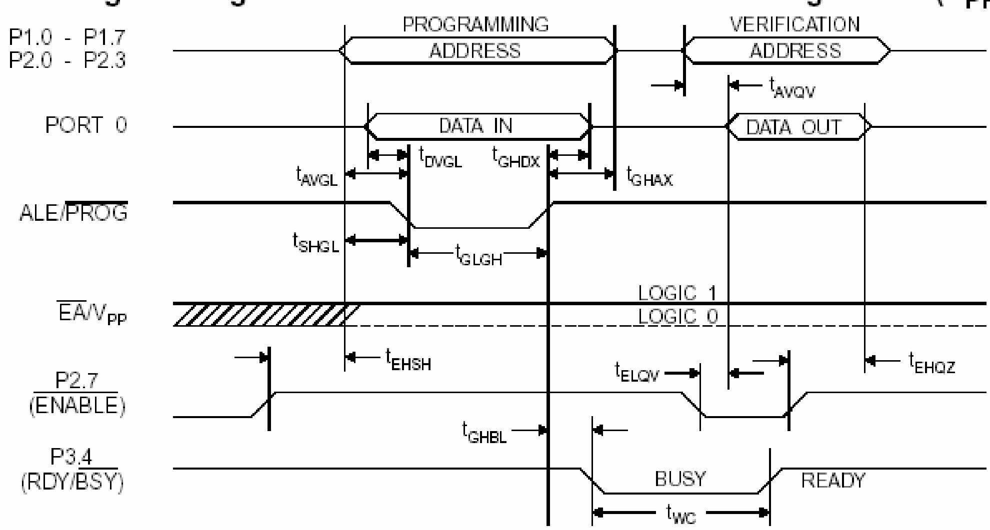
Symbol	Parameter	Min	Max	Units
V_{PP}(1)	Programming Enable Voltage	11.5	12.5	V
I_{PP}(1)	Programming Enable Current		1.0	mA
$1/t_{CLCL}$	Oscillator Frequency	3	24	MHz
t_{AVGL}	Address Setup to $\overline{PROG}$ Low	$48t_{CLCL}$		
t_{GHAX}	Address Hold After $\overline{PROG}$	$48t_{CLCL}$		
t_{DVGL}	Data Setup to $\overline{PROG}$ Low	$48t_{CLCL}$		
t_{GHDX}	Data Hold After $\overline{PROG}$	$48t_{CLCL}$		
t_{EHSH}	P2.7 ($\overline{ENABLE}$) High to V_{PP}	$48t_{CLCL}$		
t_{SHGL}	V_{PP} Setup to $\overline{PROG}$ Low	10		µs
t_{GHSL}(1)	V_{PP} Hold After $\overline{PROG}$	10		µs
t_{GLGH}	$\overline{PROG}$ Width	1	110	µs
t_{AVQV}	Address to Data Valid		$48t_{CLCL}$	
t_{ELQV}	$\overline{ENABLE}$ Low to Data Valid		$48t_{CLCL}$	
t_{EHQZ}	Data Float After $\overline{ENABLE}$	0	$48t_{CLCL}$	
t_{GHBL}	$\overline{PROG}$ High to $\overline{BUSY}$ Low		1.0	µs
t_{WC}	Byte Write Cycle Time		2.0	ms

Note: 1. Only used in 12-volt programming mode.

Flash Programming and Verification Waveforms - High Voltage Mode (V_{PP} = 12V)



Flash Programming and Verification Waveforms - Low Voltage Mode (V_{PP} = 5V)



Absolute Maximum Ratings*

Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on Any Pin with Respect to Ground	-1.0V to +7.0V
Maximum Operating Voltage	6.6V
DC 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.

DC Characteristics

T_A = -40°C to 85°C, V_{CC} = 5.0V ± 20% (unless otherwise noted)

Symbol	Parameter	Condition	Min	Max	Units
V_{IL}	Input Low Voltage	(Except $\overline{EA}$)	-0.5	0.2 V_{CC} - 0.1	V
V_{IL1}	Input Low Voltage ($\overline{EA}$)		-0.5	0.2 V_{CC} - 0.3	V
V_{IH}	Input High Voltage	(Except XTAL1, RST)	0.2 V_{CC} + 0.9	V_{CC} + 0.5	V
V_{IH1}	Input High Voltage	(XTAL1, RST)	0.7 V_{CC}	V_{CC} + 0.5	V
V_{OL}	Output Low Voltage(1) (Ports 1,2,3)	I_{OL} = 1.6 mA		0.45	V
V_{OL1}	Output Low Voltage(1) (Port 0, ALE, $\overline{PSEN}$)	I_{OL} = 3.2 mA		0.45	V
V_{OH}	Output High Voltage (Ports 1,2,3, ALE, $\overline{PSEN}$)	I_{OH} = -60 µA, V_{CC} = 5V ± 10%	2.4		V
		I_{OH} = -25 µA	0.75 V_{CC}		V
		I_{OH} = -10 µA	0.9 V_{CC}		V
V_{OH1}	Output High Voltage (Port 0 in External Bus Mode)	I_{OH} = -800 µA, V_{CC} = 5V ± 10%	2.4		V
		I_{OH} = -300 µA	0.75 V_{CC}		V
		I_{OH} = -80 µA	0.9 V_{CC}		V
I_{IL}	Logical 0 Input Current (Ports 1,2,3)	V_{IN} = 0.45V		-50	µA
I_{TL}	Logical 1 to 0 Transition Current (Ports 1,2,3)	V_{IN} = 2V, VCC = 5V ± 10%		-650	µA
I_{LI}	Input Leakage Current (Port 0, $\overline{EA}$)	0.45 < V_{IN} < V_{CC}		±10	µA
RRST	Reset Pulldown Resistor		50	300	KΩ
C_{IO}	Pin Capacitance	Test Freq. = 1 MHz, T_A = 25°C		10	pF
I_{CC}	Power Supply Current	Active Mode, 12 MHz		20	mA
		Idle Mode, 12 MHz		5	mA
	Power Down Mode(2)	V_{CC} = 6V		100	µA
		V_{CC} = 3V		40	µA

Notes: 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.

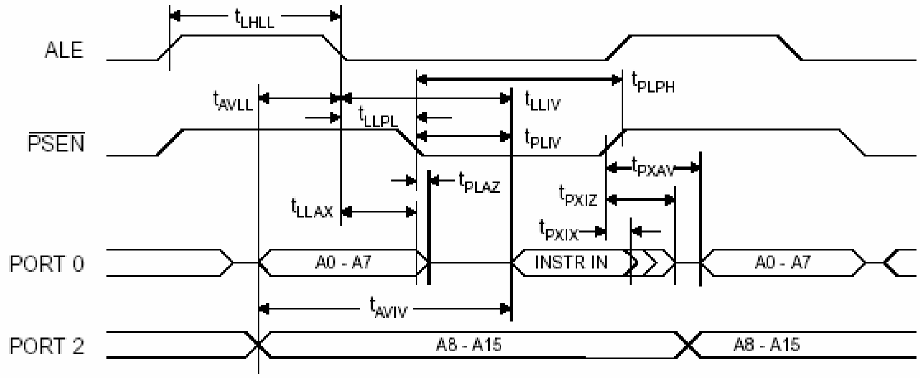
AC Characteristics

(Under Operating Conditions; Load Capacitance for Port 0, ALE/$\overline{PROG}$, and $\overline{PSEN}$ = 100 pF; Load Capacitance for all other outputs = 80 pF)

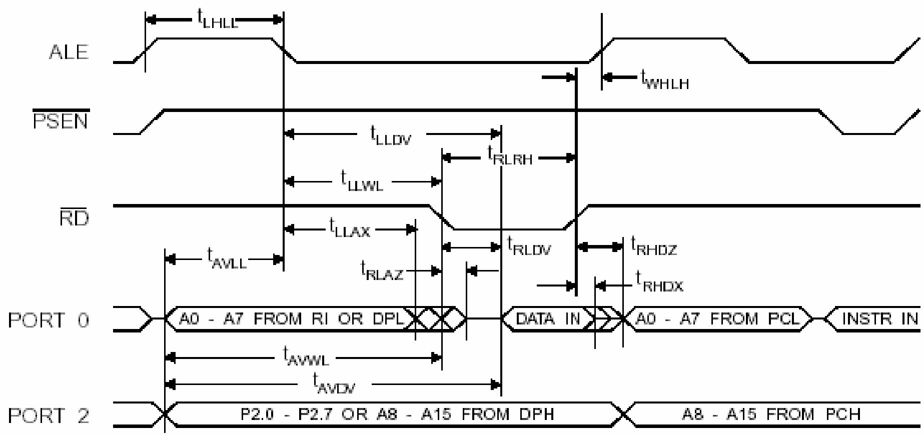
External Program and Data Memory Characteristics

Symbol	Parameter	12 MHz Oscillator		16 to 24 MHz Oscillator		Units
		Min	Max	Min	Max	
$1/t_{CLCL}$	Oscillator Frequency			0	24	MHz
t_{LHLL}	ALE Pulse Width	127		$2t_{CLCL}$-40		ns
t_{AVLL}	Address Valid to ALE Low	43		t_{CLCL}-13		ns
t_{LLAX}	Address Hold After ALE Low	48		t_{CLCL}-20		ns
t_{LLIV}	ALE Low to Valid Instruction In		233		$4t_{CLCL}$-65	ns
t_{LLPL}	ALE Low to $\overline{PSEN}$ Low	43		t_{CLCL}-13		ns
t_{PLPH}	$\overline{PSEN}$ Pulse Width	205		$3t_{CLCL}$-20		ns
t_{PLIV}	$\overline{PSEN}$ Low to Valid Instruction In		145		$3t_{CLCL}$-45	ns
t_{PXIX}	Input Instruction Hold After $\overline{PSEN}$	0		0		ns
t_{PXIZ}	Input Instruction Float After $\overline{PSEN}$		59		t_{CLCL}-10	ns
t_{PXAV}	$\overline{PSEN}$ to Address Valid	75		t_{CLCL}-8		ns
t_{AVIV}	Address to Valid Instruction In		312		$5t_{CLCL}$-55	ns
t_{PLAZ}	$\overline{PSEN}$ Low to Address Float		10		10	ns
t_{RLRH}	$\overline{RD}$ Pulse Width	400		$6t_{CLCL}$-100		ns
t_{WLWH}	$\overline{WR}$ Pulse Width	400		$6t_{CLCL}$-100		ns
t_{RLDV}	$\overline{RD}$ Low to Valid Data In		252		$5t_{CLCL}$-90	ns
t_{RHDX}	Data Hold After $\overline{RD}$	0		0		ns
t_{RHDZ}	Data Float After $\overline{RD}$		97		$2t_{CLCL}$-28	ns
t_{LLDV}	ALE Low to Valid Data In		517		$8t_{CLCL}$-150	ns
t_{AVDV}	Address to Valid Data In		585		$9t_{CLCL}$-165	ns
t_{LLWL}	ALE Low to $\overline{RD}$ or $\overline{WR}$ Low	200	300	$3t_{CLCL}$-50	$3t_{CLCL}$+50	ns
t_{AVWL}	Address to $\overline{RD}$ or $\overline{WR}$ Low	203		$4t_{CLCL}$-75		ns
t_{QVWX}	Data Valid to $\overline{WR}$ Transition	23		t_{CLCL}-20		ns
t_{QVWH}	Data Valid to $\overline{WR}$ High	433		$7t_{CLCL}$-120		ns
t_{WHQX}	Data Hold After $\overline{WR}$	33		t_{CLCL}-20		ns
t_{RLAZ}	$\overline{RD}$ Low to Address Float		0		0	ns
t_{WHLH}	$\overline{RD}$ or $\overline{WR}$ High to ALE High	43	123	t_{CLCL}-20	t_{CLCL}+25	ns

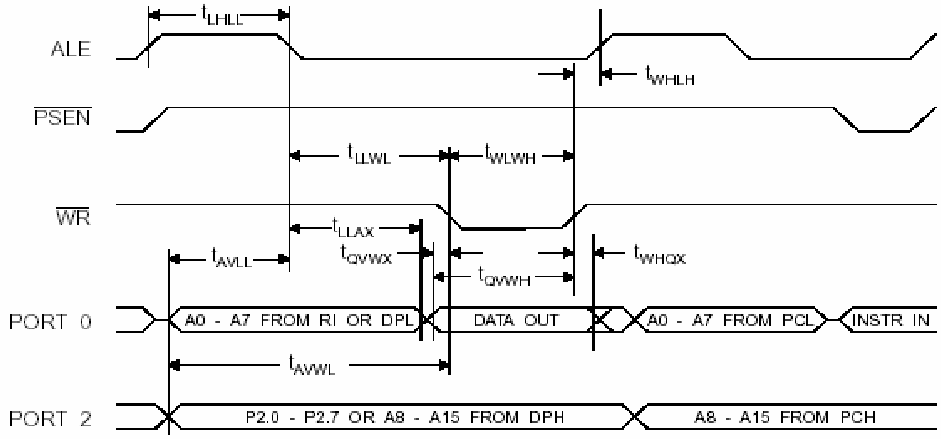
External Program Memory Read Cycle



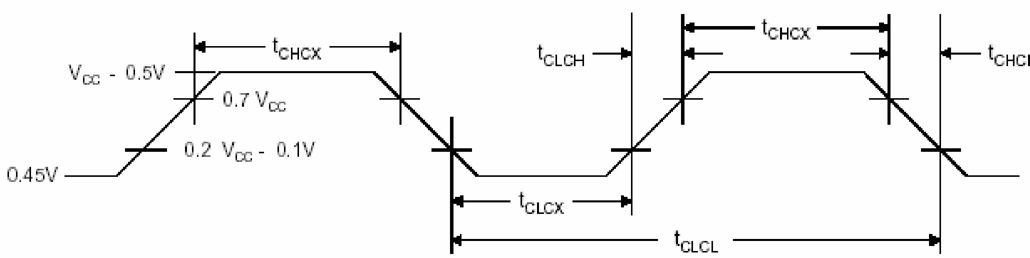
External Data Memory Read Cycle



External Data Memory Write Cycle



External Clock Drive Waveforms



External Clock Drive

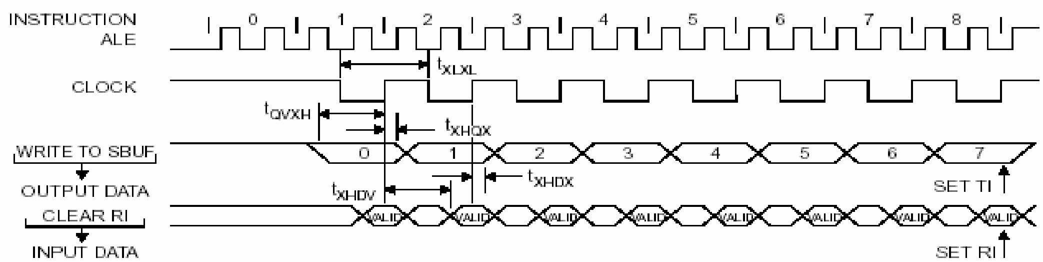
Symbol	Parameter	Min	Max	Units
$1/t_{CLCL}$	Oscillator Frequency	0	24	MHz
t_{CLCL}	Clock Period	41.6		ns
t_{CHCX}	High Time	15		ns
t_{CLCX}	Low Time	15		ns
t_{CLCH}	Rise Time		20	ns
t_{CHCL}	Fall Time		20	ns

Serial Port Timing: Shift Register Mode Test Conditions

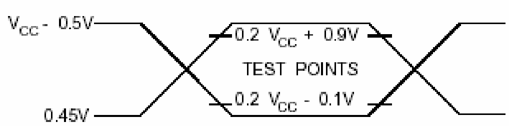
(V_{CC} = 5.0 V ± 20%; Load Capacitance = 80 pF)

Symbol	Parameter	12 MHz Osc		Variable Oscillator		Units
		Min	Max	Min	Max	
t_{XLXL}	Serial Port Clock Cycle Time	1.0		$12t_{CLCL}$		μs
t_{QVXH}	Output Data Setup to Clock Rising Edge	700		$10t_{CLCL}$-133		ns
t_{XHQX}	Output Data Hold After Clock Rising Edge	50		$2t_{CLCL}$-117		ns
t_{XHDX}	Input Data Hold After Clock Rising Edge	0		0		ns
t_{XHDV}	Clock Rising Edge to Input Data Valid		700		$10t_{CLCL}$-133	ns

Shift Register Mode Timing Waveforms

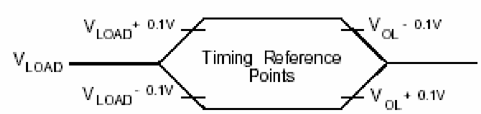


AC Testing Input/Output Waveforms(1)



Note: 1. 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.

Float Waveforms(1)



Note: 1. 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 100 mV change from the loaded V_{OH}/V_{OL} level occurs.

Ordering Information

Speed (MHz)	Power Supply	Ordering Code	Package	Operation Range
12	5V ± 20%	AT89C51-12AC	44A	Commercial
		AT89C51-12JC	44J	(0°C to 70°C)
		AT89C51-12PC	40P6	
		AT89C51-12QC	44Q	
		AT89C51-12AI	44A	Industrial
		AT89C51-12JI	44J	(-40°C to 85°C)
		AT89C51-12PI	40P6	
		AT89C51-12QI	44Q	
		AT89C51-12AA	44A	Automotive
		AT89C51-12JA	44J	(-40°C to 105°C)
		AT89C51-12PA	40P6	
		AT89C51-12QA	44Q	
16	5V ± 20%	AT89C51-16AC	44A	Commercial
		AT89C51-16JC	44J	(0°C to 70°C)
		AT89C51-16PC	40P6	
		AT89C51-16QC	44Q	
		AT89C51-16AI	44A	Industrial
		AT89C51-16JI	44J	(-40°C to 85°C)
		AT89C51-16PI	40P6	
		AT89C51-16QI	44Q	
		AT89C51-16AA	44A	Automotive
		AT89C51-16JA	44J	(-40°C to 105°C)
		AT89C51-16PA	40P6	
		AT89C51-16QA	44Q	
20	5V ± 20%	AT89C51-20AC	44A	Commercial
		AT89C51-20JC	44J	(0°C to 70°C)
		AT89C51-20PC	40P6	
		AT89C51-20QC	44Q	
		AT89C51-20AI	44A	Industrial
		AT89C51-20JI	44J	(-40°C to 85°C)
		AT89C51-20PI	40P6	
		AT89C51-20QI	44Q	

Ordering Information

Speed (MHz)	Power Supply	Ordering Code	Package	Operation Range
24	5V ± 20%	AT89C51-24AC	44A	Commercial
		AT89C51-24JC	44J	(0°C to 70°C)
		AT89C51-24PC	44P6	
		AT89C51-24QC	44Q	
		AT89C51-24AI	44A	Industrial
		AT89C51-24JI	44J	(-40°C to 85°C)
		AT89C51-24PI	44P6	
		AT89C51-24QI	44Q	

Package Type	
44A	44 Lead, Thin Plastic Gull Wing Quad Flatpack (TQFP)
44J	44 Lead, Plastic J-Leaded Chip Carrier (PLCC)
40P6	40 Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)
44Q	44 Lead, Plastic Gull Wing Quad Flatpack (PQFP)

National Semiconductor

July 1998

DS75176B/DS75176BT Multipoint RS-485/RS-422 Transceivers

General Description

The DS75176B is a high speed differential TRI-STATE® bus/line transceiver designed to meet the requirements of EIA standard RS485 with extended common mode range (+12V to −7V), for multipoint data transmission. In addition, it is compatible with RS-422.

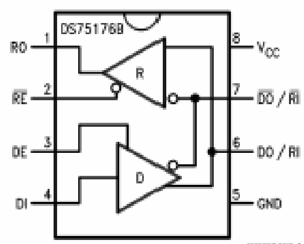
The driver and receiver outputs feature TRI-STATE capability, for the driver outputs over the entire common mode range of +12V to −7V. Bus contention or fault situations that cause excessive power dissipation within the device are handled by a thermal shutdown circuit, which forces the driver outputs into the high impedance state.

DC specifications are guaranteed over the 0 to 70°C temperature and 4.75V to 5.25V supply voltage range.

Features

- Meets EIA standard RS485 for multipoint bus transmission and is compatible with RS-422.
- Small Outline (SO) Package option available for minimum board space.
- 22 ns driver propagation delays.
- Single +5V supply.
- −7V to +12V bus common mode range permits ±7V ground difference between devices on the bus.
- Thermal shutdown protection.
- High impedance to bus with driver in TRI-STATE or with power off, over the entire common mode range allows the unused devices on the bus to be powered down.
- Pin out compatible with DS3695/A and SN75176A/B.
- Combined impedance of a driver output and receiver input is less than one RS485 unit load, allowing up to 32 transceivers on the bus.
- 70 mV typical receiver hysteresis.

Connection and Logic Diagram



DS008759-1

Top View

Order Number DS75176BN, DS75176BTN, DS75176BM or DS75176BTM

See NS Package Number N08E or M08A

TRI-STATE® is a registered trademark of National Semiconductor Corp.

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage, V_{CC}	7V
Control Input Voltages	7V
Driver Input Voltage	7V
Driver Output Voltages	+15V/ −10V
Receiver Input Voltages (DS75176B)	+15V/ −10V
Receiver Output Voltage	5.5V
Continuous Power Dissipation @ 25°C	
for M Package	675 mW (Note 5)
for N Package	900 mW (Note 4)
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 4 seconds)	260°C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage, V_{CC}	4.75	5.25	V
Voltage at Any Bus Terminal (Separate or Common Mode)	−7	+12	V
Operating Free Air Temperature T_A			
DS75176B	0	+70	°C
DS75176BT	−40	+85	°C
Differential Input Voltage, VID (Note 6)	−12	+12	V

Electrical Characteristics (Notes 2, 3)

$0°C \leq T_A \leq 70°C$, $4.75V < V_{CC} < 5.25V$ unless otherwise specified

Symbol	Parameter		Conditions		Min	Typ	Max	Units
V_{OD1}	Differential Driver Output Voltage (Unloaded)		$I_O = 0$				5	V
V_{OD2}	Differential Driver Output Voltage (with Load)		(*Figure 1*)	R = 50Ω; (RS-422) (Note 7)	2			V
				R = 27Ω; (RS-485)	1.5			V
ΔV_{OD}	Change in Magnitude of Driver Differential Output Voltage For Complementary Output States		(*Figure 1*)	R = 27Ω			0.2	V
V_{OC}	Driver Common Mode Output Voltage		(*Figure 1*)	R = 27Ω			3.0	V
$\Delta\|V_{OC}\|$	Change in Magnitude of Driver Common Mode Output Voltage For Complementary Output States		(*Figure 1*)	R = 27Ω			0.2	V
V_{IH}	Input High Voltage	DI, DE, $\overline{RE}$, E			2			V
V_{IL}	Input Low Voltage	DI, DE, $\overline{RE}$, E					0.8	
V_{CL}	Input Clamp Voltage	DI, DE, $\overline{RE}$, E		$I_{IN} = -18$ mA			−1.5	
I_{IL}	Input Low Current	DI, DE, $\overline{RE}$, E		$V_{IL} = 0.4V$			−200	µA
I_{IH}	Input High Current	DI, DE, $\overline{RE}$, E		$V_{IH} = 2.4V$			20	µA
I_{IN}	Input Current	DO/RI, $\overline{DO/RI}$	V_{CC} = 0V or 5.25V DE = 0V	$V_{IN} = 12V$			+1.0	mA
				$V_{IN} = -7V$			−0.8	mA
V_{TH}	Differential Input Threshold Voltage for Receiver		$-7V \leq V_{CM} \leq +12V$		−0.2		+0.2	V
ΔV_{TH}	Receiver Input Hysteresis		$V_{CM} = 0V$			70		mV
V_{OH}	Receiver Output High Voltage		$I_{OH} = -400$ µA		2.7			V
V_{OL}	Output Low Voltage	RO	I_{OL} = 16 mA (Note 7)				0.5	V
I_{OZR}	OFF-State (High Impedance) Output Current at Receiver		V_{CC} = Max $0.4V \leq V_O \leq 2.4V$				±20	µA
R_{IN}	Receiver Input Resistance		$-7V \leq V_{CM} \leq +12V$		12			kΩ
I_{CC}	Supply Current		No Load (Note 7)	Driver Outputs Enabled			55	mA
				Driver Outputs Disabled			35	mA
I_{OSD}	Driver Short-Circuit Output Current		$V_O = -7V$ (Note 7)				−250	mA
			$V_O = +12V$ (Note 7)				+250	mA

Electrical Characteristics (Notes 2, 3) (Continued)

$0^{\circ}C \leq T_A \leq 70^{\circ}C$, $4.75V < V_{CC} < 5.25V$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{OSR}	Receiver Short-Circuit Output Current	$V_O = 0V$	−15		−85	mA

Note 1: "Absolute Maximum Ratings" are those beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

Note 2: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to device ground unless otherwise specified.

Note 3: All typicals are given for $V_{CC} = 5V$ and $T_A = 25^{\circ}C$.

Note 4: Derate linearly at 5.56 mW/°C to 650 mW at 70°C.

Note 5: Derate linearly 6.11 mW/°C to 400 mW at 70°C.

Note 6: Differential - Input/Output bus voltage is measured at the noninverting terminal A with respect to the inverting terminal B.

Note 7: All worst case parameters for which note 7 is applied, must be increased by 10% for DS75176BT. The other parameters remain valid for $-40^{\circ}C < T_A < +85^{\circ}C$.

Switching Characteristics

$V_{CC} = 5.0V$, $T_A = 25^{\circ}C$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PLH}	Driver Input to Output	$R_{LDIFF} = 60\Omega$		12	22	ns
t_{PHL}	Driver Input to Output	$C_{L1} = C_{L2} = 100$ pF		17	22	ns
t_r	Driver Rise Time	$R_{LDIFF} = 60\Omega$			18	ns
t_f	Driver Fall Time	$C_{L1} = C_{L2} = 100$ pF (*Figure 3* and *Figure 5*)			18	ns
t_{ZH}	Driver Enable to Output High	$C_L = 100$ pF (*Figure 4* and *Figure 6*) S1 Open		29	100	ns
t_{ZL}	Driver Enable to Output Low	$C_L = 100$ pF (*Figure 4* and *Figure 6*) S2 Open		31	60	ns
t_{LZ}	Driver Disable Time from Low	$C_L = 15$ pF (*Figure 4* and *Figure 6*) S2 Open		13	30	ns
t_{HZ}	Driver Disable Time from High	$C_L = 15$ pF (*Figure 4* and *Figure 6*) S1 Open		19	200	ns
t_{PLH}	Receiver Input to Output	$C_L = 15$ pF (*Figure 2* and *Figure 7*)		30	37	ns
t_{PHL}	Receiver Input to Output	S1 and S2 Closed		32	37	ns
t_{ZL}	Receiver Enable to Output Low	$C_L = 15$ pF (*Figure 2* and *Figure 8*) S2 Open		15	20	ns
t_{ZH}	Receiver Enable to Output High	$C_L = 15$ pF (*Figure 2* and *Figure 8*) S1 Open		11	20	ns
t_{LZ}	Receiver Disable from Low	$C_L = 15$ pF (*Figure 2* and *Figure 8*) S2 Open		28	32	ns
t_{HZ}	Receiver Disable from High	$C_L = 15$ pF (*Figure 2* and *Figure 8*) S1 Open		13	35	ns

AC Test Circuits

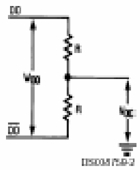
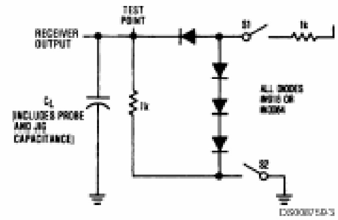


FIGURE 1.



Note: S1 and S2 of load circuit are closed except as otherwise mentioned.

FIGURE 2.

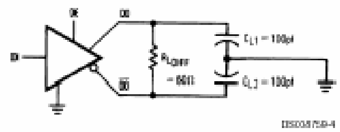
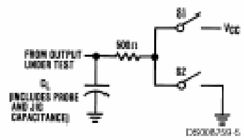


FIGURE 3.



Note: Unless otherwise specified the switches are closed.

FIGURE 4.

Switching Time Waveforms

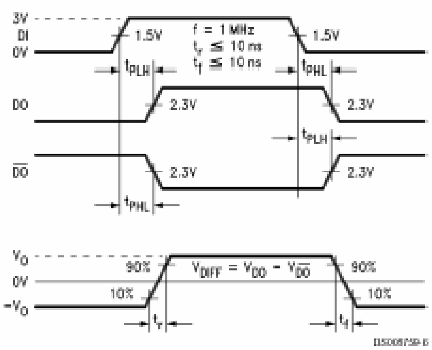


FIGURE 5. Driver Propagation Delays and Transition Times

Switching Time Waveforms (Continued)

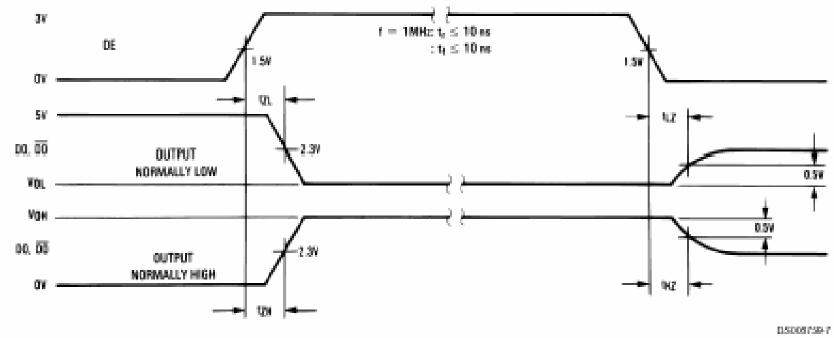
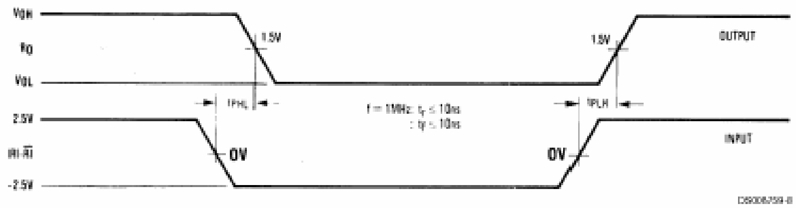


FIGURE 6. Driver Enable and Disable Times



Note: Differential input voltage may may be realized by grounding $\overline{RI}$ and pulsing RI between +2.5V and −2.5V

FIGURE 7. Receiver Propagation Delays

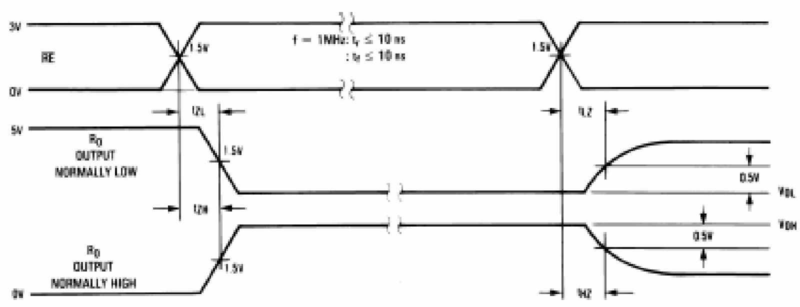


FIGURE 8. Receiver Enable and Disable Times

Function Tables

DS75176B Transmitting

Inputs			Line	Outputs	
$\overline{RE}$	DE	DI	Condition	$\overline{DO}$	DO
X	1	1	No Fault	0	1
X	1	0	No Fault	1	0
X	0	X	X	Z	Z
X	1	X	Fault	Z	Z

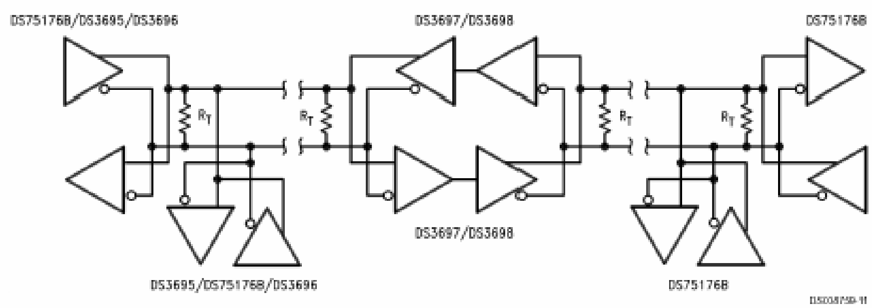
Function Tables (Continued)

DS75176B Receiving

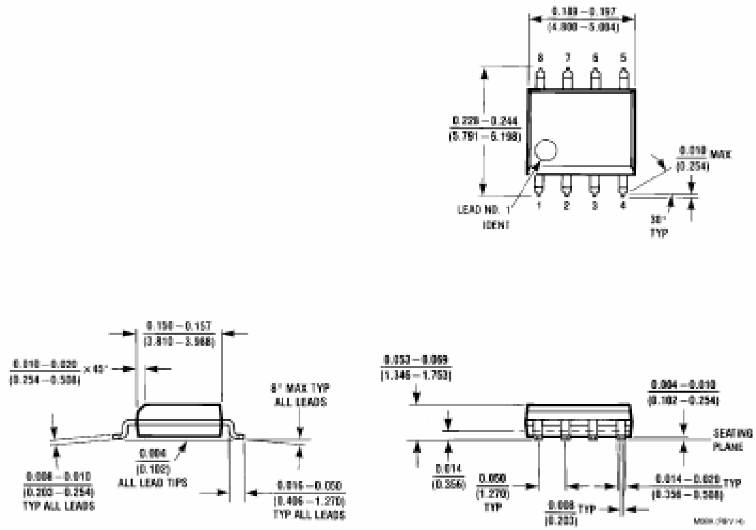
Inputs			Outputs
$\overline{RE}$	DE	RI-$\overline{RI}$	RO
0	0	≥ +0.2V	1
0	0	≤ −0.2V	0
0	0	Inputs Open**	1
1	0	X	Z

X — Don't care condition
Z — High impedance state
Fault — Improper line conditons causing excessive power dissipation in the driver, such as shorts or bus contention situations
**This is a fail safe condition

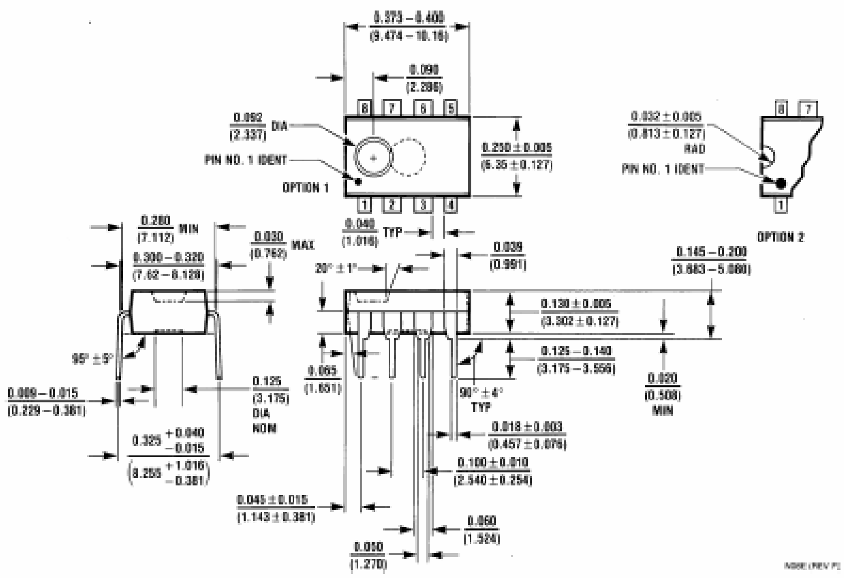
Typical Application



Physical Dimensions inches (millimeters) unless otherwise noted



Lit. # 103669



Molded Dual-In-Line Package (N)
Order Number DS75176BN or DS75176BTN
NS Package Number N08E

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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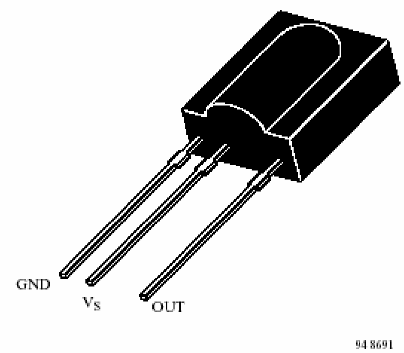
Photo Modules for PCM Remote Control Systems

Available types for different carrier frequencies

Type	fo	Type	fo
TSOP1730	30 kHz	TSOP1733	33 kHz
TSOP1736	36 kHz	TSOP1737	36.7 kHz
TSOP1738	38 kHz	TSOP1740	40 kHz
TSOP1756	56 kHz		

Description

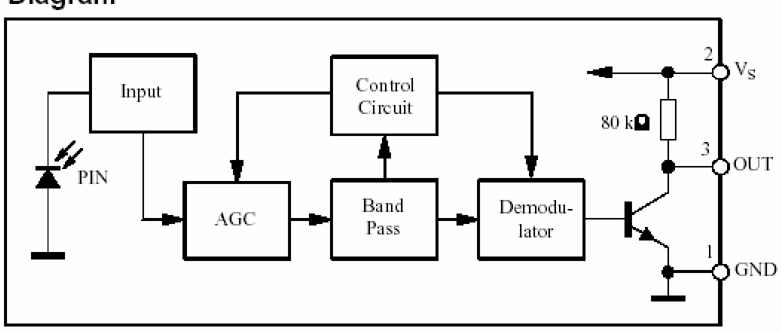
The TSOP17.. – series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter.
The demodulated output signal can directly be decoded by a microprocessor. TSOP17.. is the standard IR remote control receiver series, supporting all major transmission codes.



Features

- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against electrical field disturbance
- TTL and CMOS compatibility
- Output active low
- Low power consumption
- High immunity against ambient light
- Continuous data transmission possible (up to 2400 bps)
- Suitable burst length ≥10 cycles/burst

Block Diagram



Absolute Maximum Ratings

T_{amb} = 25°C

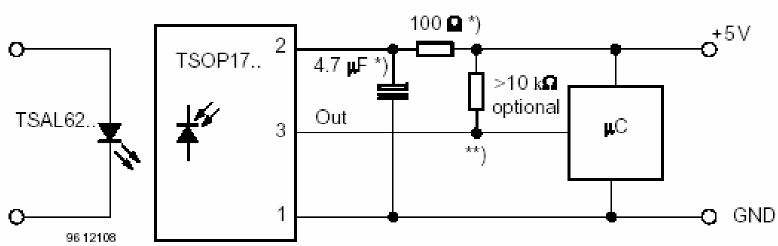
Parameter	Test Conditions	Symbol	Value	Unit
Supply Voltage	(Pin 2)	V_S	–0.3...6.0	V
Supply Current	(Pin 2)	I_S	5	mA
Output Voltage	(Pin 3)	V_O	–0.3...6.0	V
Output Current	(Pin 3)	I_O	5	mA
Junction Temperature		T_j	100	°C
Storage Temperature Range		T_{stg}	–25...+85	°C
Operating Temperature Range		T_{amb}	–25...+85	°C
Power Consumption	(T_{amb} ≤ 85 °C)	P_{tot}	50	mW
Soldering Temperature	t ≤ 10 s, 1 mm from case	T_{sd}	260	°C

Basic Characteristics

T_{amb} = 25°C

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Supply Current (Pin 2)	V_S = 5 V, E_v = 0	I_{SD}	0.4	0.6	1.5	mA
	V_S = 5 V, E_v = 40 klx, sunlight	I_{SH}		1.0		mA
Supply Voltage (Pin 2)		V_S	4.5		5.5	V
Transmission Distance	E_v = 0, test signal see fig.7, IR diode TSAL6200, I_F = 400 mA	d		35		m
Output Voltage Low (Pin 3)	I_{OSL} = 0.5 mA, E_e = 0.7 mW/m², f = f_o, t_p/T = 0.4	V_{OSL}			250	mV
Irradiance (30 – 40 kHz)	Pulse width tolerance: $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal (see fig.7)	$E_{e\,min}$		0.35	0.5	mW/m²
Irradiance (56 kHz)	Pulse width tolerance: $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal (see fig.7)	$E_{e\,min}$		0.4	0.6	mW/m²
Irradiance	$t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$	$E_{e\,max}$	30			W/m²
Directivity	Angle of half transmission distance	$\varphi_{1/2}$		±45		deg

Application Circuit



*) recommended to suppress power supply disturbances

**) The output voltage should not be hold continuously at a voltage below 3.3V by the external circuit.

Suitable Data Format

The circuit of the TSOP17.. is designed in that way that unexpected output pulses due to noise or disturbance signals are avoided. A bandpassfilter, an integrator stage and an automatic gain control are used to suppress such disturbances.
The distinguishing mark between data signal and disturbance signal are carrier frequency, burst length and duty cycle.

The data signal should fullfill the following condition:

- Carrier frequency should be close to center frequency of the bandpass (e.g. 38kHz).
- Burst length should be 10 cycles/burst or longer.
- After each burst which is between 10 cycles and 70 cycles a gap time of at least 14 cycles is neccessary.
- For each burst which is longer than 1.8ms a corresponding gap time is necessary at some time in the data stream. This gap time should have at least same length as the burst.
- Up to 1400 short bursts per second can be received continuously.

Some examples for suitable data format are:
NEC Code, Toshiba Micom Format, Sharp Code, RC5 Code, RC6 Code, R–2000 Code, Sony Format (SIRCS).

When a disturbance signal is applied to the TSOP17.. it can still receive the data signal. However the sensitivity is reduced to that level that no unexpected pulses will occure.

Some examples for such disturbance signals which are suppressed by the TSOP17.. are:

- DC light (e.g. from tungsten bulb or sunlight)
- Continuous signal at 38kHz or at any other frequency
- Signals from fluorescent lamps with electronic ballast (an example of the signal modulation is in the figure below).

Typical Characteristics (T_{amb} = 25°C unless otherwise specified)

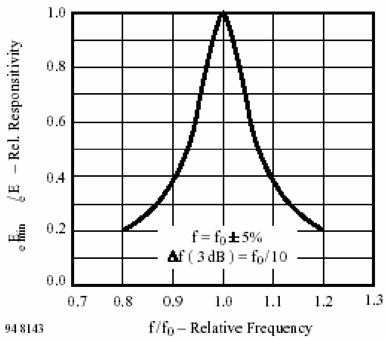


Figure 1. Frequency Dependence of Responsivity

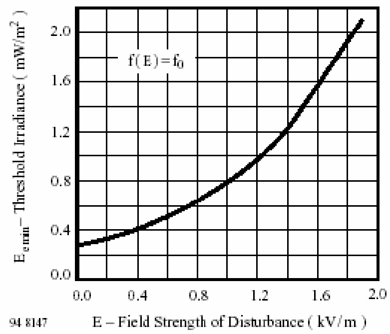


Figure 4. Sensitivity vs. Electric Field Disturbances

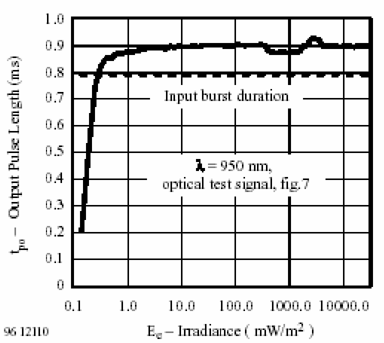


Figure 2. Sensitivity in Dark Ambient

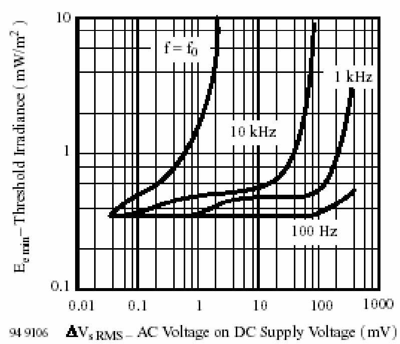


Figure 5. Sensitivity vs. Supply Voltage Disturbances

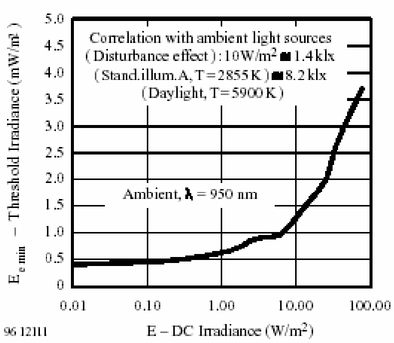


Figure 3. Sensitivity in Bright Ambient

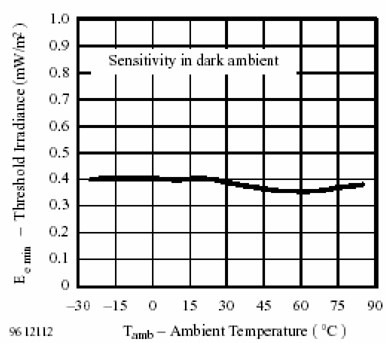


Figure 6. Sensitivity vs. Ambient Temperature

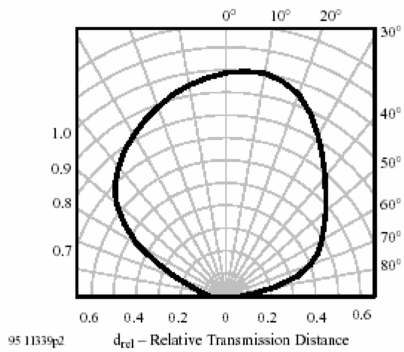


Figure 13. Vertical Directivity φ_y

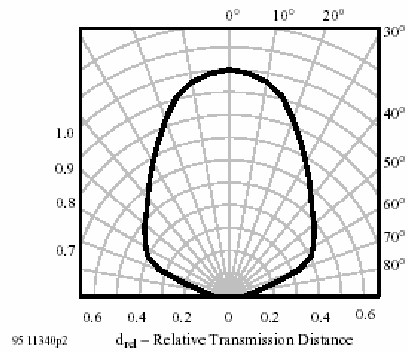
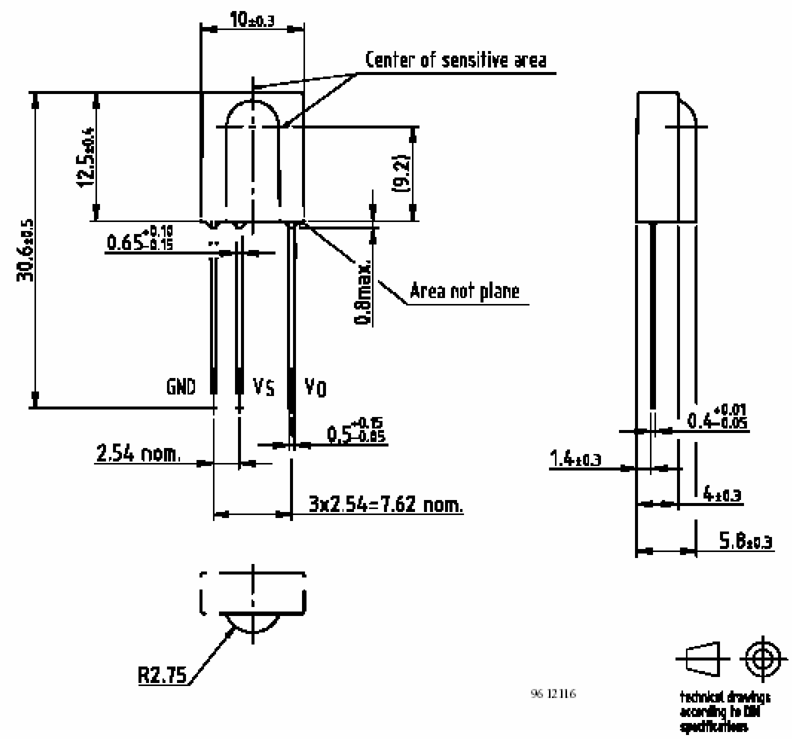


Figure 14. Horizontal Directivity φ_x

Dimensions in mm



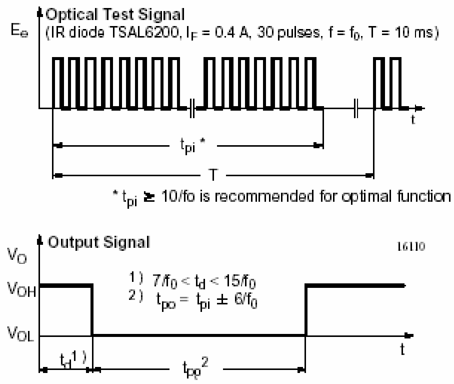


Figure 7. Output Function

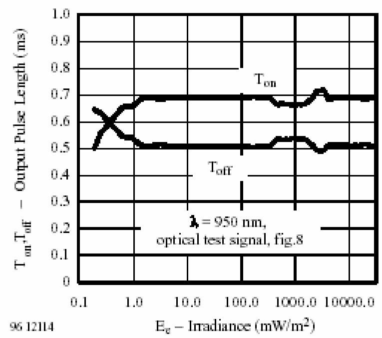


Figure 10. Output Pulse Diagram

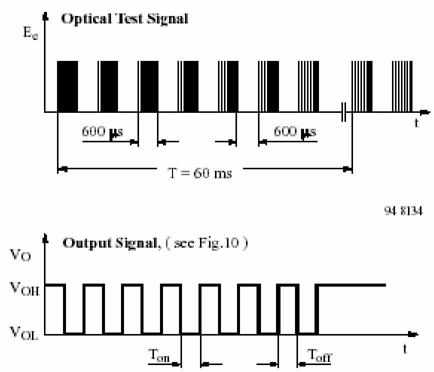


Figure 8. Output Function

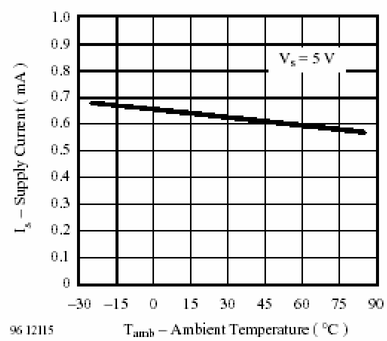


Figure 11. Supply Current vs. Ambient Temperature

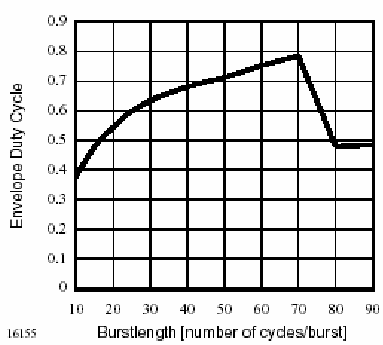


Figure 9. Max. Envelope Duty Cycle vs. Burstlength

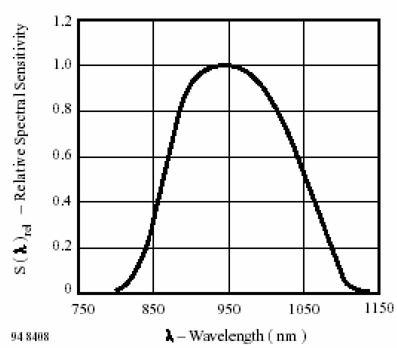


Figure 12. Relative Spectral Sensitivity vs. Wavelength

Ozone Depleting Substances Policy Statement

It is the policy of **Vishay Semiconductor GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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