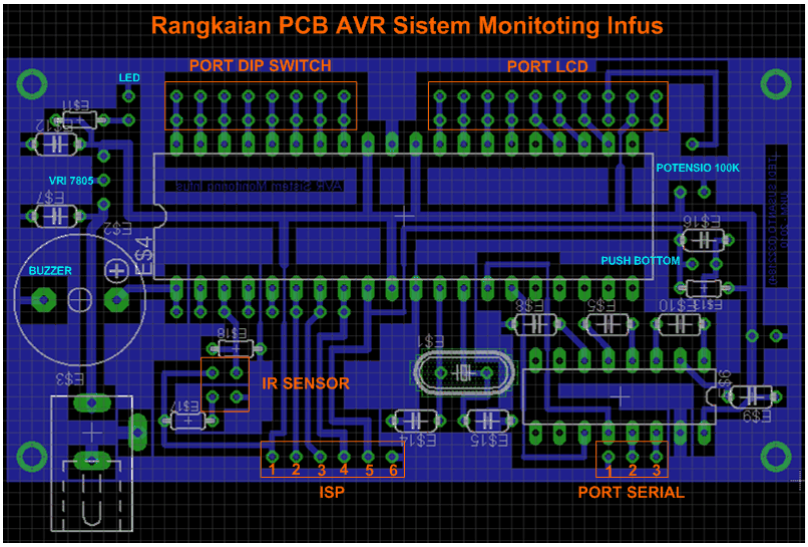
# LAMPIRAN A

Foto Alat

# Photo Alat Sistem Monitoring Infus

# Photo Alat Sistem Monitoring Infus

Rangkaian Skematik PCB Sistem Monitoring Infus



# LAMPIRAN B

## PROGRAM UTAMA

```
/*****************************************************
This program was produced by the
CodeWizardAVR V1.25.3 Standard
Automatic Program Generator
© Copyright 1998-2007 Pavel Haiduc, HP InfoTech s.r.l.
http://www.hpinfotech.com

Project :
Version :
Date    : 8/30/2010
Author  : F4CG
Company : F4CG
Comments:


Chip type           : ATmega16
Program type        : Application
Clock frequency     : 11.059200 MHz
Memory model        : Small
External SRAM size  : 0
Data Stack size     : 256
*****************************************************/

#include <mega16.h>
#include <stdlib.h>
#include <delay.h>


// Alphanumeric LCD Module functions
#asm
   .equ __lcd_port=0x15 ;PORTC
#endasm
#include <lcd.h>

// Standard Input/Output functions
#include <stdio.h>
int a,count,detik,kon1,kon2,kon3,Rs;
char hasil[18];
char hasil1[18];
char hasil2[5];

// Timer 1 overflow interrupt service routine
interrupt [TIM1_OVF] void timer1_ovf_isr(void)
{
```

```
// Reinitialize Timer 1 value
TCNT1H=0xD5;
TCNT1L=0xD0;
// Place your code here
detik=detik+1;
if(detik==60)

{
detik=0;
a=count-a;
if(a!=kon1)
{
PORTB.0=1;
delay_ms(100);
PORTB.0=0;
}
if(a==0)
{
PORTB.0=0x01;
}
lcd_clear();
lcd_gotoxy(0,0);
lcd_puts(hasil);
sprintf(hasil1,"tetes/mnt=%d",a);
sprintf(hasil2,"%d",a);
lcd_gotoxy(0,1);
lcd_puts(hasil1);
puts(hasil2);
a=count;
}

}

// Declare your global variables here

void main(void)
{
// Declare your local variables here

// Input/Output Ports initialization
// Port A initialization
// Func7=In Func6=In Func5=In Func4=In Func3=In Func2=In Func1=In
Func0=In
// State7=P State6=P State5=P State4=P State3=P State2=P State1=P State0=P
PORTA=0xFF;
DDRA=0x00;
```

```
// Port B initialization
// Func7=In Func6=In Func5=In Func4=In Func3=In Func2=In Func1=In Func0=Out
// State7=P State6=P State5=P State4=P State3=P State2=P State1=P State0=1
PORTB=0xFE;
DDRB=0x01;

// Port C initialization
// Func7=In Func6=In Func5=In Func4=In Func3=In Func2=In Func1=In Func0=In
// State7=T State6=T State5=T State4=T State3=T State2=T State1=T State0=T
PORTC=0x00;
DDRC=0x00;

// Port D initialization
// Func7=In Func6=In Func5=In Func4=In Func3=In Func2=In Func1=In Func0=In
// State7=T State6=T State5=T State4=T State3=T State2=T State1=T State0=T
PORTD=0x00;
DDRD=0x00;

// Timer/Counter 0 initialization
// Clock source: System Clock
// Clock value: Timer 0 Stopped
// Mode: Normal top=FFh
// OC0 output: Disconnected
TCCR0=0x00;
TCNT0=0x00;
OCR0=0x00;

// Timer/Counter 1 initialization
// Clock source: System Clock
// Clock value: 10.800 kHz
// Mode: Normal top=FFFFh
// OC1A output: Discon.
// OC1B output: Discon.
// Noise Canceler: Off
// Input Capture on Falling Edge
// Timer 1 Overflow Interrupt: On
// Input Capture Interrupt: Off
// Compare A Match Interrupt: Off
// Compare B Match Interrupt: Off
TCCR1A=0x00;
TCCR1B=0x05;
TCNT1H=0xD5;
```

```
TCNT1L=0xD0;
ICR1H=0x00;
ICR1L=0x00;
OCR1AH=0x00;
OCR1AL=0x00;
OCR1BH=0x00;
OCR1BL=0x00;

// Timer/Counter 2 initialization
// Clock source: System Clock
// Clock value: Timer 2 Stopped
// Mode: Normal top=FFh
// OC2 output: Disconnected
ASSR=0x00;
TCCR2=0x00;
TCNT2=0x00;
OCR2=0x00;

// External Interrupt(s) initialization
// INT0: Off
// INT1: Off
// INT2: Off
MCUCR=0x00;
MCUCSR=0x00;

// Timer(s)/Counter(s) Interrupt(s) initialization
TIMSK=0x04;

// USART initialization
// Communication Parameters: 8 Data, 1 Stop, No Parity
// USART Receiver: On
// USART Transmitter: On
// USART Mode: Asynchronous
// USART Baud rate: 9600
UCSRA=0x00;
UCSRB=0x18;
UCSRC=0x86;
UBRRH=0x00;
UBRRL=0x47;

// Analog Comparator initialization
// Analog Comparator: Off
// Analog Comparator Input Capture by Timer/Counter 1: Off
ACSR=0x80;
SFIOR=0x00;
```

```
// LCD module initialization
lcd_init(16);
count=0;
detik=0;
a=0;

ulang:
if(PINA.0==0 && PINA.1==1 && PINA.2==1 && PINA.3==1 && PINA.4==0
&& PINA.5==1 && PINA.6==0 && PINA.7==1)
{
    kon1=20;
    kon2=500;
    kon3=60;
    goto lanjut;
}

if(PINA.0==0 && PINA.1==1 && PINA.2==1 && PINA.3==1 && PINA.4==0
&& PINA.5==1 && PINA.6==1 && PINA.7==0)
{
    kon1=20;
    kon2=500;
    kon3=20;
    goto lanjut;
}

if(PINA.0==0 && PINA.1==1 && PINA.2==1 && PINA.3==1 && PINA.4==1
&& PINA.5==0 && PINA.6==0 && PINA.7==1)
{
    kon1=20;
    kon2=1000;
    kon3=60;
    goto lanjut;
}

if(PINA.0==0 && PINA.1==1 && PINA.2==1 && PINA.3==1 && PINA.4==1
&& PINA.5==0 && PINA.6==1 && PINA.7==0)
{
    kon1=20;
    kon2=1000;
    kon3=20;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==0 && PINA.2==1 && PINA.3==1 && PINA.4==0
&& PINA.5==1 && PINA.6==0 && PINA.7==1)
{
```

```
    kon1=30;
    kon2=500;
    kon3=60;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==0 && PINA.2==1 && PINA.3==1 && PINA.4==0
&& PINA.5==1 && PINA.6==1 && PINA.7==0)
{
    kon1=30;
    kon2=500;
    kon3=20;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==0 && PINA.2==1 && PINA.3==1 && PINA.4==1
&& PINA.5==0 && PINA.6==0 && PINA.7==1)
{
    kon1=30;
    kon2=1000;
    kon3=60;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==0 && PINA.2==1 && PINA.3==1 && PINA.4==1
&& PINA.5==0 && PINA.6==1 && PINA.7==0)
{
    kon1=30;
    kon2=1000;
    kon3=20;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==0 && PINA.3==1 && PINA.4==0
&& PINA.5==1 && PINA.6==0 && PINA.7==1)
{
    kon1=40;
    kon2=500;
    kon3=60;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==0 && PINA.3==1 && PINA.4==0
&& PINA.5==1 && PINA.6==1 && PINA.7==0)
{
    kon1=40;
```

```
    kon2=500;
    kon3=20;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==0 && PINA.3==1 && PINA.4==1
&& PINA.5==0 && PINA.6==0 && PINA.7==1)
{
    kon1=40;
    kon2=1000;
    kon3=60;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==0 && PINA.3==1 && PINA.4==1
&& PINA.5==0 && PINA.6==1 && PINA.7==0)
{
    kon1=40;
    kon2=1000;
    kon3=20;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==1 && PINA.3==0 && PINA.4==0
&& PINA.5==1 && PINA.6==0 && PINA.7==1)
{
    kon1=50;
    kon2=500;
    kon3=60;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==1 && PINA.3==0 && PINA.4==0
&& PINA.5==1 && PINA.6==1 && PINA.7==0)
{
    kon1=50;
    kon2=500;
    kon3=20;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==1 && PINA.3==0 && PINA.4==1
&& PINA.5==0 && PINA.6==0 && PINA.7==1)
{
    kon1=50;
    kon2=1000;
```

```
    kon3=60;
    goto lanjut;
}

if(PINA.0==1 && PINA.1==1 && PINA.2==1 && PINA.3==0 && PINA.4==1
&& PINA.5==0 && PINA.6==1 && PINA.7==0)
{
    kon1=50;
    kon2=1000;
    kon3=20;
    goto lanjut;
}


goto ulang;

lanjut:
Rs=kon2*kon3-300;


// Global enable interrupts
#asm("sei")

while (1)
    {
    // Place your code here
    while(PINB.2==1);
    while(PINB.2==0);
    count=count+1;
    if(count>=Rs)
    {
    PORTB.0=0x01;
    }
    sprintf(hasil,"tetes=%d",count);
    lcd_gotoxy(0,0);
    lcd_puts(hasil);

    };
}
```

## LISTING PROGRAM BORLAN DELPHI 7.0

```
unit Unit1;

interface

uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,
  Dialogs, StdCtrls, ExtCtrls, CPort;

type
  TForm1 = class(TForm)
    Label1: TLabel;
    Label6: TLabel;
    GroupBox1: TGroupBox;
    GroupBox2: TGroupBox;
    GroupBox4: TGroupBox;
    RadioButton1: TRadioButton;
    RadioButton2: TRadioButton;
    RadioButton3: TRadioButton;
    RadioButton4: TRadioButton;
    GroupBox5: TGroupBox;
    RadioButton5: TRadioButton;
    RadioButton6: TRadioButton;
    GroupBox6: TGroupBox;
    RadioButton7: TRadioButton;
    RadioButton8: TRadioButton;
    GroupBox3: TGroupBox;
    Label7: TLabel;
    GroupBox7: TGroupBox;
    Label2: TLabel;
    Label3: TLabel;
    Label4: TLabel;
    Label5: TLabel;
    Button1: TButton;
    Button2: TButton;
    Edit1: TEdit;
    Edit2: TEdit;
    Edit3: TEdit;
    Edit4: TEdit;
    Edit5: TEdit;
    Label8: TLabel;
    Label10: TLabel;
    ComPort1: TComPort;
    Timer1: TTimer;
    Label11: TLabel;
```

```
    GroupBox8: TGroupBox;
    GroupBox9: TGroupBox;
    Label9: TLabel;
    Edit6: TEdit;
    Edit7: TEdit;
    Label12: TLabel;
    procedure FormCreate(Sender: TObject);
    procedure Button2Click(Sender: TObject);
    procedure Button1Click(Sender: TObject);
  private
    { Private declarations }
  public
    { Public declarations }
  end;

var
  Form1: TForm1;

implementation

{$R *.dfm}
procedure TForm1.FormCreate(Sender: TObject);
var total:integer;
begin
comport1.Connected:=true;
total:=0;
edit2.Text:=inttostr(total);
end;

procedure TForm1.Button2Click(Sender: TObject);
begin
 close;
end;

procedure TForm1.Button1Click(Sender: TObject);
var data,a,b,c,h1,h2,h3:string;
var konv,i,total,jumlah_tetesMenit:integer;
var asupan,jumlah_tetes,jenis_selang,volume_infus,indikator_level,waktu:real;

label ulang;
begin
timer1.Enabled:=true;
if (radiobutton5.Checked=true)then
begin
jumlah_tetes:=strtoint(edit2.Text);
jenis_selang:=20;
```

```
asupan:=jumlah_tetes/jenis_selang;
edit3.Text:=floattostr(asupan);
end;
if (radiobutton6.Checked=true)then
begin
jumlah_tetes:=strtoint(edit2.Text);
jenis_selang:=60;
asupan:=jumlah_tetes/jenis_selang;
edit3.Text:=floattostr(asupan);
end;

if (radiobutton7.Checked=true)then
begin
volume_infus:=500;
indikator_level:=volume_infus-asupan;
edit4.Text:=floattostr(indikator_level);
end;

if (radiobutton8.Checked=true)then
begin
volume_infus:=1000;
indikator_level:=volume_infus-asupan;
edit4.Text:=floattostr(indikator_level);
end;


comport1.ReadStr(data,3);
if (data='') then goto ulang;
edit1.Text:=data;
a:=copy(edit1.Text,1,1);
if(a='0') or (a='1') or (a='2') or (a='3') or (a='4')or(a='5')or(a='6')or(a='7')
or(a='8')or(a='9') then h1:=a else  h1:='';
b:=copy(edit1.Text,2,1);
if(b='0') or (b='1') or (b='2') or (b='3') or (b='4')or(b='5')or(b='6')or(b='7')
or(b='8')or(b='9') then h2:=b else h2:='';
a:=copy(edit1.Text,3,1);
if(c='0') or (c='1') or (c='2') or (c='3') or (c='4')or(c='5')or(c='6')or(c='7')
or(c='8')or(c='9') then h3:=c else h3:='';

edit1.Text:=h1+h2+h3;
konv:=strtoint(edit1.Text);
total:=strtoint(edit2.Text);
total:=total+konv;
edit2.Text:=inttostr(total);

if (radiobutton1.Checked=true)then
```

```
begin
if(konv=20)then edit5.text:='Deteksi Sesuai' else edit5.text:='Error Deteksi';
end;

if (radiobutton2.Checked=true)then
begin
if(konv=30)then edit5.text:= 'Deteksi Sesuai'else edit5.text:= 'Error Deteksi';
end;

if (radiobutton3.Checked=true)then
begin
if(konv=40)then edit5.text:= 'Deteksi Sesuai' else edit5.text:= 'Error Deteksi'
end;

if (radiobutton4.Checked=true)then
begin
if(konv=60)then edit5.text:= 'Deteksi Sesuai'else edit5.text:= 'Error Deteksi';
end;

begin
waktu:=(jenis_selang*indikator_level)-300;
if(volume_infus>=waktu)then edit6.text:='Mohon segera ganti cairan infus' else
edit6.text:='Cairan infus belum saatnya diganti';
end;

begin
edit7.text:=TIMETOSTR(NOW);
end;

ulang:

end;

end.
```

# LAMPIRAN C

# DATASHEET

### Function Tables

EACH DRIVER

| INPUT TIN | OUTPUT TOUT |
|---|---|
| L | H |
| H | L |

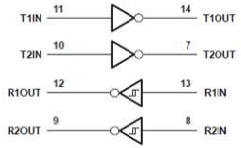
H = high level, L = low level

EACH RECEIVER

| INPUT RIN | OUTPUT ROUT |
|---|---|
| L | H |
| H | L |

H = high level, L = low level

### logic diagram (positive logic)



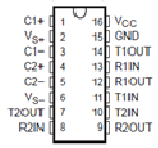



TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265



- Meets or Exceeds TIA/EIA-232-F and ITU Recommendation V.28
- Operates From a Single 5-V Power Supply With 1.0-μF Charge-Pump Capacitors
- Operates Up To 120 kbit/s
- Two Drivers and Two Receivers
- ±30-V Input Levels
- Low Supply Current . . . 8 mA Typical
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
- Upgrade With Improved ESD (15-kV HBM) and 0.1-μF Charge-Pump Capacitors is Available With the MAX202
- Applications
  - TIA/EIA-232-F, Battery-Powered Systems, Terminals, Modems, and Computers

MAX232 . . . D, DW, N, OR NS PACKAGE
MAX232I . . . D, DW, OR N PACKAGE
(TOP VIEW)




### description/ordering information

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels. The driver, receiver, and voltage-generator functions are available as cells in the Texas Instruments LinASIC™ library.

ORDERING INFORMATION

| $T_A$ | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| 0°C to 70°C | PDIP (N) | Tube of 25 | MAX232N | MAX232N |
| | SOIC (D) | Tube of 40 | MAX232D | MAX232 |
| | | Reel of 2500 | MAX232DR | |
| | SOIC (DW) | Tube of 40 | MAX232DW | MAX232 |
| | | Reel of 2000 | MAX232DWR | |
| | SOP (NS) | Reel of 2000 | MAX232NSR | MAX232 |
| −40°C to 85°C | PDIP (N) | Tube of 25 | MAX232IN | MAX232IN |
| | SOIC (D) | Tube of 40 | MAX232ID | MAX232I |
| | | Reel of 2500 | MAX232IDR | |
| | SOIC (DW) | Tube of 40 | MAX232IDW | MAX232I |
| | | Reel of 2000 | MAX232IDWR | |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

## DRIVER SECTION

### electrical characteristics over recommended ranges of supply voltage and operating free-air temperature range (see Note 4)

| PARAMETER | | | TEST CONDITIONS | | MIN | TYP† | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{OH}$ | High-level output voltage | T1OUT, T2OUT | $R_L$ = 3 kΩ to GND | | 5 | 7 | | V |
| $V_{OL}$ | Low-level output voltage‡ | T1OUT, T2OUT | $R_L$ = 3 kΩ to GND | | | −7 | −5 | V |
| $r_o$ | Output resistance | T1OUT, T2OUT | $V_{S+}$ = $V_{S-}$ = 0, | $V_O$ = ±2 V | 300 | | | Ω |
| $I_{OS}$§ | Short-circuit output current | T1OUT, T2OUT | $V_{CC}$ = 5.5 V, | $V_O$ = 0 | | ±10 | | mA |
| $I_{IS}$ | Short-circuit input current | T1IN, T2IN | $V_I$ = 0 | | | | 200 | µA |

† All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
‡ The algebraic convention, in which the least-positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels only.
§ Not more than one output should be shorted at a time.
NOTE 4: Test conditions are C1–C4 = 1 µF at $V_{CC}$ = 5 V ± 0.5 V.

### switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C (see Note 4)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| SR | Driver slew rate | $R_L$ = 3 kΩ to 7 kΩ, See Figure 2 | | | 30 | V/µs |
| SR(t) | Driver transition region slew rate | See Figure 3 | | 3 | | V/µs |
| | Data rate | One TOUT switching | | 120 | | kbit/s |

NOTE 4: Test conditions are C1–C4 = 1 µF at $V_{CC}$ = 5 V ± 0.5 V.

## RECEIVER SECTION

### electrical characteristics over recommended ranges of supply voltage and operating free-air temperature range (see Note 4)

| PARAMETER | | | TEST CONDITIONS | | MIN | TYP† | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{OH}$ | High-level output voltage | R1OUT, R2OUT | $I_{OH}$ = −1 mA | | 3.5 | | | V |
| $V_{OL}$ | Low-level output voltage‡ | R1OUT, R2OUT | $I_{OL}$ = 3.2 mA | | | | 0.4 | V |
| $V_{IT+}$ | Receiver positive-going input threshold voltage | R1IN, R2IN | $V_{CC}$ = 5 V, | $T_A$ = 25°C | | 1.7 | 2.4 | V |
| $V_{IT-}$ | Receiver negative-going input threshold voltage | R1IN, R2IN | $V_{CC}$ = 5 V, | $T_A$ = 25°C | 0.8 | 1.2 | | V |
| $V_{hys}$ | Input hysteresis voltage | R1IN, R2IN | $V_{CC}$ = 5 V | | 0.2 | 0.5 | 1 | V |
| $r_i$ | Receiver input resistance | R1IN, R2IN | $V_{CC}$ = 5, | $T_A$ = 25°C | 3 | 5 | 7 | kΩ |

† All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
‡ The algebraic convention, in which the least-positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels only.
NOTE 4: Test conditions are C1–C4 = 1 µF at $V_{CC}$ = 5 V ± 0.5 V.

### switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C (see Note 4 and Figure 1)

| PARAMETER | | TYP | UNIT |
|---|---|---|---|
| $t_{PLH(R)}$ | Receiver propagation delay time, low- to high-level output | 500 | ns |
| $t_{PHL(R)}$ | Receiver propagation delay time, high- to low-level output | 500 | ns |

NOTE 4: Test conditions are C1–C4 = 1 µF at $V_{CC}$ = 5 V ± 0.5 V.





### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Input supply voltage range, $V_{CC}$ (see Note 1) . . . −0.3 V to 6 V
Positive output supply voltage range, $V_{S+}$ . . . $V_{CC}$ − 0.3 V to 15 V
Negative output supply voltage range, $V_{S-}$ . . . −0.3 V to −15 V
Input voltage range, $V_I$: Driver . . . −0.3 V to $V_{CC}$ + 0.3 V
Receiver . . . ±30 V
Output voltage range, $V_O$: T1OUT, T2OUT . . . $V_{S-}$ − 0.3 V to $V_{S+}$ + 0.3 V
R1OUT, R2OUT . . . −0.3 V to $V_{CC}$ + 0.3 V
Short-circuit duration: T1OUT, T2OUT . . . Unlimited
Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): D package . . . 73°C/W
DW package . . . 57°C/W
N package . . . 67°C/W
NS package . . . 64°C/W
Operating virtual junction temperature, $T_J$ . . . 150°C
Storage temperature range, $T_{stg}$ . . . −65°C to 150°C

† 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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
NOTES: 1. All voltages are with respect to network GND.
2. Maximum power dissipation is a function of $T_J$(max), $\theta_{JA}$, and $T_A$. The maximum allowable power dissipation at any allowable ambient temperature is $P_D$ = ($T_J$(max) − $T_A$)/$\theta_{JA}$. Operating at the absolute maximum $T_J$ of 150°C can affect reliability.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions

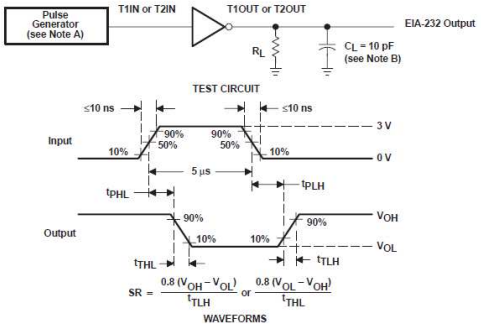
| | | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 4.5 | 5 | 5.5 | V |
| $V_{IH}$ | High-level input voltage (T1IN,T2IN) | | 2 | | | V |
| $V_{IL}$ | Low-level input voltage (T1IN, T2IN) | | | | 0.8 | V |
| R1IN, R2IN | Receiver input voltage | | | | ±30 | V |
| $T_A$ | Operating free-air temperature | MAX232 | 0 | | 70 | °C |
| | | MAX232I | −40 | | 85 | |

### electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP‡ | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply current | $V_{CC}$ = 5.5 V, $T_A$ = 25°C | All outputs open, | | 8 | 10 | mA |

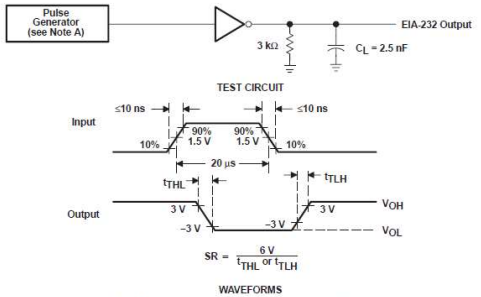
‡ All typical values are at $V_{CC}$ = 5 V and $T_A$ = 25°C.
NOTE 4: Test conditions are C1–C4 = 1 µF at $V_{CC}$ = 5 V ± 0.5 V.

## PARAMETER MEASUREMENT INFORMATION




NOTES: A. The pulse generator has the following characteristics: $Z_O$ = 50 Ω, duty cycle ≤ 50%.
B. $C_L$ includes probe and jig capacitance.

**Figure 2. Driver Test Circuit and Waveforms for $t_{PHL}$ and $t_{PLH}$ Measurements (5-µs Input)**



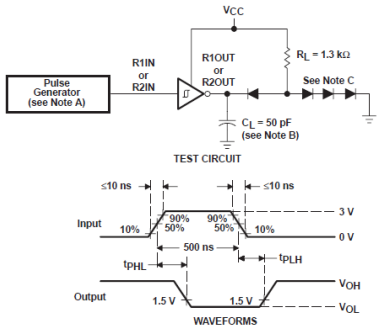

NOTE A: The pulse generator has the following characteristics: $Z_O$ = 50 Ω, duty cycle ≤ 50%.

**Figure 3. Test Circuit and Waveforms for $t_{THL}$ and $t_{TLH}$ Measurements (20-µs Input)**





## PARAMETER MEASUREMENT INFORMATION

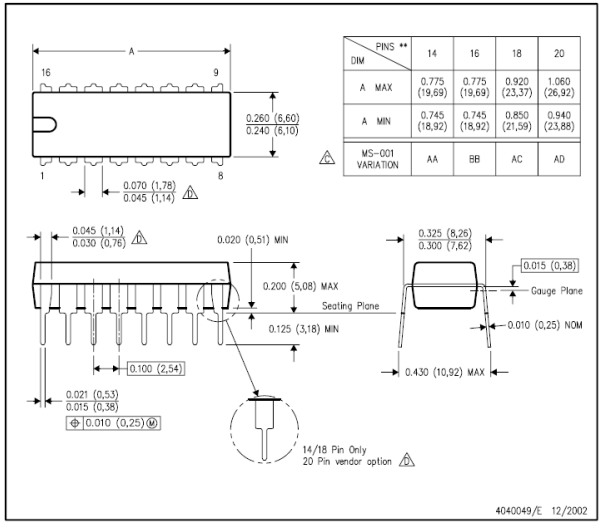



NOTES: A. The pulse generator has the following characteristics: $Z_O$ = 50 Ω, duty cycle ≤ 50%.
B. $C_L$ includes probe and jig capacitance.
C. All diodes are 1N3064 or equivalent.

**Figure 1. Receiver Test Circuit and Waveforms for $t_{PHL}$ and $t_{PLH}$ Measurements**

N (R–PDIP–T**) PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



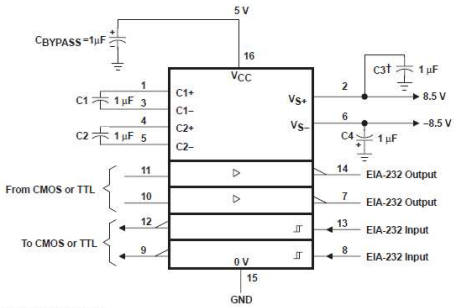

| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS–001 VARIATION | AA | BB | AC | AD |

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.





APPLICATION INFORMATION




† C3 can be connected to $V_{CC}$ or GND.

NOTES: A. Resistor values shown are nominal.
B. Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown. In addition to the 1-µF capacitors shown, the MAX202 can operate with 0.1-µF capacitors.

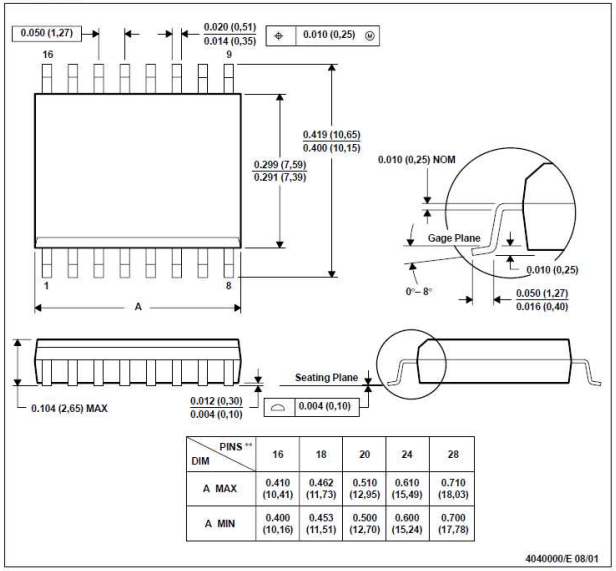
**Figure 4. Typical Operating Circuit**

## MECHANICAL DATA

MSOI003E – JANUARY 1995 – REVISED SEPTEMBER 2001

**DW (R-PDSO-G**)** PLASTIC SMALL-OUTLINE PACKAGE

**16 PINS SHOWN**




| DIM \ PINS ** | 16 | 18 | 20 | 24 | 28 |
|---|---|---|---|---|---|
| A MAX | 0.410 (10,41) | 0.462 (11,73) | 0.510 (12,95) | 0.610 (15,49) | 0.710 (18,03) |
| A MIN | 0.400 (10,16) | 0.453 (11,51) | 0.500 (12,70) | 0.600 (15,24) | 0.700 (17,78) |

4040000/E 08/01

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013

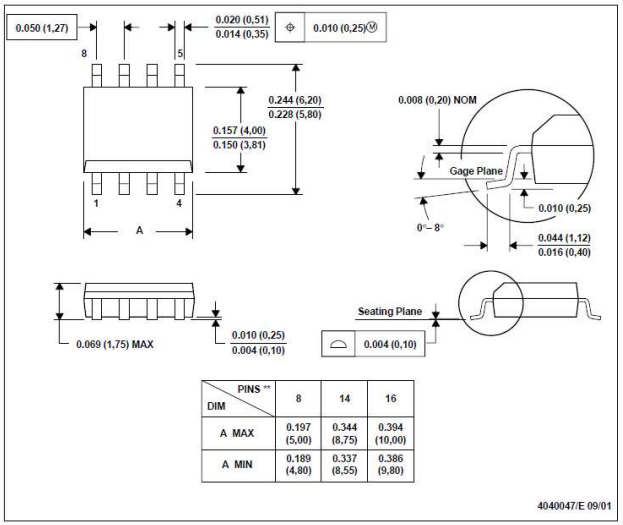


## MECHANICAL DATA

MSOI002B – JANUARY 1995 – REVISED SEPTEMBER 2001

**D (R-PDSO-G**)** PLASTIC SMALL-OUTLINE PACKAGE

**8 PINS SHOWN**




| DIM \ PINS ** | 8 | 14 | 16 |
|---|---|---|---|
| A MAX | 0.197 (5,00) | 0.344 (8,75) | 0.394 (10,00) |
| A MIN | 0.189 (4,80) | 0.337 (8,55) | 0.386 (9,80) |

4040047/E 09/01

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-012

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| Products | | Applications | |
|---|---|---|---|
| Amplifiers | amplifier.ti.com | Audio | www.ti.com/audio |
| Data Converters | dataconverter.ti.com | Automotive | www.ti.com/automotive |
| DSP | dsp.ti.com | Broadband | www.ti.com/broadband |
| Interface | interface.ti.com | Digital Control | www.ti.com/digitalcontrol |
| Logic | logic.ti.com | Military | www.ti.com/military |
| Power Mgmt | power.ti.com | Optical Networking | www.ti.com/opticalnetwork |
| Microcontrollers | microcontroller.ti.com | Security | www.ti.com/security |
| | | Telephony | www.ti.com/telephony |
| | | Video & Imaging | www.ti.com/video |
| | | Wireless | www.ti.com/wireless |

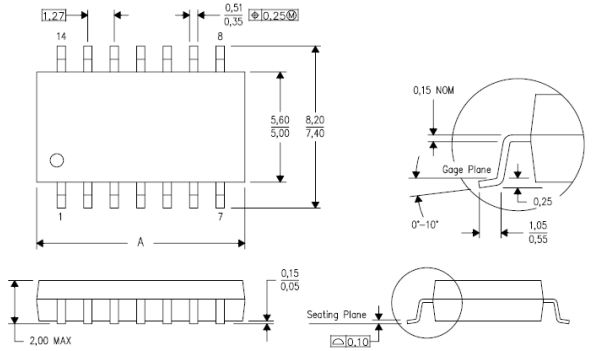
Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265



## MECHANICAL DATA

**NS (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**




| DIM \ PINS ** | 14 | 16 | 20 | 24 |
|---|---|---|---|---|
| A MAX | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN | 9,90 | 9,90 | 12,30 | 14,70 |

4040062/C 03/03

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

TEXAS INSTRUMENTS
www.ti.com