LAMPIRAN
A
#include <mega16.h>
#include<delay.h>
#include<stdio.h>

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

// Declare your global variables here
int count,deteksi1,deteksi2,deteksi3,deteksi4,deteksi5,deteksi6,deteksi7,deteksi8;
int data1,data2,data3,data4,data5,data6,data7,data8;
int start;
int index,j;

unsigned char password[6];

void Pintu_Tutup()
{
    PORTB=1;
delay_ms(50);
    //PORTB=3;
    //delay_ms(50);
    PORTB=2;
delay_ms(50);
    //PORTB=6;
    //delay_ms(50);
    PORTB=4;
delay_ms(50);
    //PORTB=12;
    //delay_ms(50);
PORTB=8;
delay_ms(50);
//PORTB=9;
//delay_ms(50);
}

void Pintu_Buka()
{
//PORTB=9;
//delay_ms(50);
PORTB=8;
delay_ms(50);
//PORTB=12;
//delay_ms(50);
PORTB=4;
delay_ms(50);
//PORTB=6;
//delay_ms(50);
PORTB=2;
delay_ms(50);
//PORTB=3;
//delay_ms(50);
PORTB=1;
delay_ms(50);
}

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=T State6=T State5=T State4=T State2=T State1=T State0=P
PORTA=0x31;
DDRA=0x00;

// Port B initialization
// Func7=In Func6=In Func5=In Func4=Out Func3=Out Func2=Out Func1=Out Func0=Out
// State7=T State6=T State5=T State4=T State2=0 State1=0 State0=0
PORTB=0x00;
DDRB=0x0F;
// 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: Timer 1 Stopped
// Mode: Normal top=FFFFh
// OC1A output: Discon.
// OC1B output: Discon.
// Noise Canceler: Off
// Input Capture on Falling Edge
// Timer 1 Overflow Interrupt: Off
// Input Capture Interrupt: Off
// Compare A Match Interrupt: Off
// Compare B Match Interrupt: Off
TCCR1A=0x00;
TCCR1B=0x00;
TCNT1H=0x00;
TCNT1L=0x00;
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=0x00;

// 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);
j=0;
lcd_gotoxy(0,0);
lcd_putsf("Password=");

while (1)
{
   // Place your code here
   while (PINA.0==1) {
   }
   while (PINA.0==0)
   {
      delay_us(100);
      count++;
   }
}
start=count;
count=0;
if (start>=24 && start<=27)
{
  while (PINA.0==1) {}
  while (PINA.0==0)
  {
    delay_us(100);
    count++;
  }
  deteksi1=count;
count=0;
  while (PINA.0==1) {}
  while (PINA.0==0)
  {
    delay_us(100);
    count++;
  }
  deteksi2=count;
count=0;
  while (PINA.0==1) {}
  while (PINA.0==0)
  {
    delay_us(100);
    count++;
  }
  deteksi3=count;
count=0;
  while (PINA.0==1) {}
  while (PINA.0==0)
  {
    delay_us(100);
    count++;
  }
  deteksi4=count;
count=0;
  while (PINA.0==1) {}
  while (PINA.0==0)
  {
    delay_us(100);
    count++;
  }
  deteksi5=count;
count=0;
  while (PINA.0==1) {}
  while (PINA.0==0)
\{
  delay_us(100);
  count++;
};
deteksi6=count;
count=0;
while (PINA.0==1) {};
while (PINA.0==0)
{
  delay_us(100);
  count++;
};
deteksi7=count;
count=0;
while (PINA.0==1) {};
while (PINA.0==0)
{
  delay_us(100);
  count++;
};
deteksi8=count;
count=0;

//=================================CEK 8 DATA=================================
  data1=((deteksi1/5)-1)*1;//data hasil deteksi pulsa dibagi 5 dikurangi 1
  data2=((deteksi2/5)-1)*2;//jika datanya 6 maka outputnya akan = 0
  data3=((deteksi3/5)-1)*4;//sedangkan jika datanya 12 maka outputnya = 1
  data4=((deteksi4/5)-1)*8;//lalu hasil tersebut dikalikan dengan nilai2 bit
  data5=((deteksi5/5)-1)*16;
  data6=((deteksi6/5)-1)*32;
  data7=((deteksi7/5)-1)*64;
  data8=((deteksi8/5)-1)*128;

//==================================PENJUMLAHAN 8 DATA============================
  index=data8+data7+data6+data5+data4+data3+data2+data1;
  if(index==128) //tombol 1
  {
    password[j]='1';
    lcd_gotoxy(0,0);
    lcd_putsf("Password=");
    lcd_gotoxy(j+9,0);
    lcd_putchar('*');
    delay_ms(600);
  }
if(index==129) //tombol 2
{
    password[j]='2';
    lcd_gotoxy(0,0);
    lcd_putsf("Password=");
    lcd_gotoxy(j+9,0);
    lcd_putchar('*');
    delay_ms(600);
}
if(index==130) //tombol 3
{
    password[j]='3';
    lcd_gotoxy(0,0);
    lcd_putsf("Password=");
    lcd_gotoxy(j+9,0);
    lcd_putchar('*');
    delay_ms(600);
}
if(index==131) //tombol 4
{
    password[j]='4';
    lcd_gotoxy(0,0);
    lcd_putsf("Password=");
    lcd_gotoxy(j+9,0);
    lcd_putchar('*');
    delay_ms(600);
}
if(index==132) //tombol 5
{
    password[j]='5';
    lcd_gotoxy(0,0);
    lcd_putsf("Password=");
    lcd_gotoxy(j+9,0);
    lcd_putchar('*');
    delay_ms(600);
}
if(index==133) //tombol 6
{
    password[j]='6';
    lcd_gotoxy(0,0);
    lcd_putsf("Password=");
    lcd_gotoxy(j+9,0);
    lcd_putchar('*');
    delay_ms(600);
}
if(index==134)   //tombol 7
{
  password[j]='7';
  lcd_gotoxy(0,0);
  lcd_putsf("Password=");
  lcd_gotoxy(j+9,0);
  lcd_putchar('*');
  delay_ms(600);
}
if(index==135)   //tombol 8
{
  password[j]='8';
  lcd_gotoxy(0,0);
  lcd_putsf("Password=");
  lcd_gotoxy(j+9,0);
  lcd_putchar('*');
  delay_ms(600);
}
if(index==136)   //tombol 9
{
  password[j]='9';
  lcd_gotoxy(0,0);
  lcd_putsf("Password=");
  lcd_gotoxy(j+9,0);
  lcd_putchar('*');
  delay_ms(600);
}
if(index==137)   //tombol 0
{
  password[j]='0';
  lcd_gotoxy(0,0);
  lcd_putsf("Password=");
  lcd_gotoxy(j+9,0);
  lcd_putchar('*');
  delay_ms(600);
}
j++;
if (j==4)
{
        password[3]=='4')
    {
        lcd_clear();
        lcd_gotoxy(0,0);
        lcd_putsf("Password=");
        lcd_gotoxy(0,1);
        lcd_putsf("Pintu Buka");
        while (PINA.4==1)
        {
            Pintu_Buka();
        }
    }
             password[3]=='1')
    {
        lcd_clear();
        lcd_gotoxy(0,0);
        lcd_putsf("Password=");
        lcd_gotoxy(0,1);
        lcd_putsf("Pintu Tutup");
        while(PINA.5==1)
        {
            Pintu_Tutup();
        }
    }
    else
    {
        lcd_clear();
        lcd_gotoxy(0,0);
        lcd_putsf("Password=");
        lcd_gotoxy(0,1);
        lcd_putsf("Password Salah");
    }
    j=0;
    password[0]='';
    password[1]='';
    password[2]='';
    password[3]='';
}

};

}
LAMPIRAN

B
Features
- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions — Most Single-cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 96 MIPS Throughput at 16 MHz
- On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
  - 16K Bytes of In-system Self-programmable Flash program memory
  - 512 Bytes EEPROM
  - 1K Byte Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C
- Optional Boot Code Section with Independent Lock Bits
- In-System Programming by On-chip Boot Program
  - True Read-Write Operation
  - Programming Lock for Software Security
  - JTAG IEEE std. 1149.1 Compliant Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescaler and Compare Modes
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four PWM Channels
  - 8-channel, 10-bit ADC
  - 8 Single-ended Channels
    - 7 Differential Channels in TQFP Package Only
    - 2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
  - 40-pin PDIP, 44-pad TQFP, and 44-pad QFN MLF
- Operating Voltages
  - 2.7 — 5.5V for ATmega16L
  - 4.5 — 5.5V for ATmega16
- Speed Grades
  - 0 — 8 MHz for ATmega16L
  - 0 — 16 MHz for ATmega16
- Power Consumption @ 1 MHz, 3V, and 26°C for ATmega16L
  - Active: 1.1 mA
  - Idle Mode: 0.36 mA
  - Power-down Mode: < 1 µA

Note: Not recommended for new designs.
Figure 1. Pinout ATmega16

Pin Configurations

Disclaimer

Typical values contained in this datasheet are based on simulations and characterization of other AVR microcontrollers manufactured on the same process technology. Min and Max values will be available after the device is characterized.

2 ATmega16(L)
ATmega16(L)

Overview

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughput approaching 1 MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed.

Block Diagram

Figure 2. Block Diagram
The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughput up to ten times faster than conventional CISC microcontrollers.

The ATmega16 provides the following features: 16 Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 512 bytes EEPROM, 1K byte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-Wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TCPG package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next external interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O except Asynchronous Timer and ADC to minimize switching noise during ADC conversions. In Standby mode, the crystal Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The device is manufactured using Atmel's high density nonvolatile memory technology. The In-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the ATmega16 is a powerful microcontroller that provides a highly flexible and cost-effective solution to many embedded control applications.

The ATmega16 AVR is supported with a full suite of program and system development tools including C Compilers, macro assemblers, program debuggers/simulators, in-circuit emulators, and evaluation kits.

<table>
<thead>
<tr>
<th>Pin Descriptions</th>
<th>Digital supply voltage.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC</td>
<td>Ground</td>
</tr>
<tr>
<td>Port A (PA7..PA0)</td>
<td>Port A serves as the analog inputs to the A/D Converter. Port A 2 pin serves as a 8-bit bidirectional I/O port. If the A/D Converter is not used, Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA6 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.</td>
</tr>
</tbody>
</table>
Port B (PB7..PB0)  Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B also serves the functions of various special features of the ATmega16 as listed on page 58.

Port C (PC7..PC0)  Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs.

Port C also serves the functions of the JTAG interface and other special features of the ATmega16 as listed on page 61.

Port D (PD7..PD0)  Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port D also serves the functions of various special features of the ATmega16 as listed on page 63.

RESET  Reset input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The minimum pulse length is given in Table 15 on page 38. Shorter pulses are not guaranteed to generate a reset.

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

XTAL2  Output from the inverting Oscillator amplifier.

AVCC  AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

AREF  AREF is the analog reference pin for the A/D Converter.
LAMPIRAN C
EIGHT DARLINGTON ARRAYS

- EIGHT DARLINGTONS WITH COMMON EMITTERS
- OUTPUT CURRENT TO 500 mA
- OUTPUT VOLTAGE TO 60 V
- INTEGRAL SUPPRESSION DIODES
- VERSIONS FOR ALL POPULAR LOGIC FAMILIES
- OUTPUT CAN BE PARALLELED
- INPUTS PINNED OPPOSITE OUTPUTS TO SIMPLIFY BOARD LAYOUT

DESCRIPTION
The ULN2801A-ULN2805A each contain eight darlington transistors with common emitters and integral suppression diodes for inductive loads. Each darlington features a peak load current rating of 600mA (500mA continuous) and can withstand at least 50V in the off state. Outputs may be paralleled for higher current capability.

Five versions are available to simplify interfacing to standard logic families; the ULN2801A is designed for general purpose applications with a current limit resistor; the ULN2802A has a 10.5kΩ input resistor and zener for 14-25V PMOS; the ULN2803A has a 2.7kΩ input resistor for 5V TTL and CMOS; the ULN2804A has a 10.5kΩ input resistor for 6-15V CMOS and the ULN2805A is designed to sink a minimum of 350mA for standard and Schottky TTL where higher output current is required.

All types are supplied in a 18-lead plastic DIP with a copperlead from and feature the convenientinput-opposite-outputpinout to simplify board layout.

September 1997
SCHEMATIC DIAGRAM AND ORDER CODES

For ULN2801A (each driver for PMOS-CMOS)

For ULN2803A (each driver for 5 V, TTL/CMOS)

For ULN2805A (each driver for high out TTL)

For ULN2802A (each driver for 14-15 V PMOS)

For ULN2804A (each driver for 6-15 V CMOS/PMOS)
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{cc}$</td>
<td>Output Voltage</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td>$V_i$</td>
<td>Input Voltage</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>for ULN2802A, ULN2803A, ULN2804A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for ULN2805A</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>$I_{c}$</td>
<td>Continuous Collector Current</td>
<td>500</td>
<td>mA</td>
</tr>
<tr>
<td>$I_s$</td>
<td>Continuous Base Current</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>Power Dissipation</td>
<td>1.0</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>(one Darlington pair)</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(total package)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{amb}$</td>
<td>Operating Ambient Temperature Range</td>
<td>-20 to 65</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{esc}$</td>
<td>Storage Temperature Range</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_j$</td>
<td>Junction Temperature Range</td>
<td>-20 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

### Thermal Data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{θJA}$</td>
<td>Thermal Resistance Junction-ambient</td>
<td>55</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

### Electrical Characteristics

#### Test Conditions: $T_{amb} = 25°C$ unless otherwise specified.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
<th>Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{cex}$</td>
<td>Output Leakage Current</td>
<td>$V_{cc} = 50V$</td>
<td>50</td>
<td>µA</td>
<td>1a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_{amb} = 70°C, V_{cc} = 50V$</td>
<td>100</td>
<td>µA</td>
<td>1a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_{esc} = 70°C$ for ULN2802A</td>
<td>500</td>
<td>µA</td>
<td>1b</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{cc} = 50V, V_i = 6V$ for ULN2803A</td>
<td>500</td>
<td>µA</td>
<td>1b</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{cc} = 50V, V_i = 1V$ for ULN2804A</td>
<td>500</td>
<td>µA</td>
<td>1b</td>
<td></td>
</tr>
<tr>
<td>$V_{CE(max)}$</td>
<td>Collector-emitter Saturation Voltage</td>
<td>$I_c = 100mA, I_b = 250mA$</td>
<td>0.9</td>
<td>1.1</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 200mA, I_b = 500mA$</td>
<td>1.1</td>
<td>1.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 350mA, I_b = 500mA$</td>
<td>1.3</td>
<td>1.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$I_{on}$</td>
<td>Input Current</td>
<td>$V_{cc} = 50V, V_i = 17V$ for ULN2802A</td>
<td>0.82</td>
<td>1.25</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{cc} = 50V, V_i = 3.0V$ for ULN2803A</td>
<td>0.93</td>
<td>1.30</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{cc} = 50V, V_i = 5V$ for ULN2804A</td>
<td>0.35</td>
<td>0.5</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{cc} = 12V$ for ULN2805A</td>
<td>1</td>
<td>1.45</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>$I_{off}$</td>
<td>Input Current</td>
<td>$T_{esc} = 70°C, I_c = 500mA$</td>
<td>1.5</td>
<td>2.4</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>$V_{ccp}$</td>
<td>Input Voltage</td>
<td>$V_{cc} = 2V$ for ULN2802A</td>
<td>13</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 300mA$ for ULN2803A</td>
<td>2.4</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 200mA$ for ULN2804A</td>
<td>2.7</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 125mA$ for ULN2805A</td>
<td>3</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 200mA$</td>
<td>5</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 275mA$</td>
<td>7</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_c = 350mA$</td>
<td>8</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$N_{F}$</td>
<td>DC Forward Current Gain</td>
<td>$V_{cc} = 2V, I_c = 350mA$ for ULN2801A</td>
<td>1000</td>
<td></td>
<td>$-2$</td>
<td></td>
</tr>
<tr>
<td>$C_{l}$</td>
<td>Input Capacitance</td>
<td></td>
<td>15</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{on}$</td>
<td>Turn-on Delay Time</td>
<td>$0.5 \cdot V_i$ to $0.5 \cdot V_o$</td>
<td>0.25</td>
<td>1</td>
<td>µs</td>
<td></td>
</tr>
<tr>
<td>$t_{off}$</td>
<td>Turn-off Delay Time</td>
<td>$0.5 \cdot V_i$ to $0.5 \cdot V_o$</td>
<td>0.25</td>
<td>1</td>
<td>µs</td>
<td></td>
</tr>
<tr>
<td>$I_{DL}$</td>
<td>Clamp Diode Leakage Current</td>
<td>$V_{cc} = 50V$</td>
<td>50</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_{esc} = 70°C, V_{cc} = 50V$</td>
<td>100</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{cc}$</td>
<td>Clamp Diode Forward Voltage</td>
<td>$I_b = 350mA$</td>
<td>1.7</td>
<td>2</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

**SOS-THOMSON**
TEST CIRCUITS

Figure 1a.

Figure 1b.

Figure 2.

Figure 3.

Figure 4.

Figure 5.

Figure 6.

Figure 7.
Figure 8: Collector Current as a Function of Saturation Voltage.

Figure 9: Collector Current as a Function of Input Current.

Figure 10: Allowable Average Power Dissipation as a Function of Ambient Temperature.

Figure 11: Peak Collector Current as a Function of Duty Cycle.

Figure 12: Peak Collector Current as a Function of Duty.

Figure 13: Input Current as a Function of Input Voltage (for ULN2802A).
<table>
<thead>
<tr>
<th>DIM.</th>
<th>mm</th>
<th>inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>a1</td>
<td>0.234</td>
<td>0.010</td>
</tr>
<tr>
<td>B</td>
<td>1.39</td>
<td>0.055</td>
</tr>
<tr>
<td>b</td>
<td>0.46</td>
<td>0.018</td>
</tr>
<tr>
<td>b/1</td>
<td>0.25</td>
<td>0.010</td>
</tr>
<tr>
<td>D</td>
<td>23.24</td>
<td>0.915</td>
</tr>
<tr>
<td>E</td>
<td>8.3</td>
<td>0.333</td>
</tr>
<tr>
<td>e</td>
<td>2.54</td>
<td>0.100</td>
</tr>
<tr>
<td>e3</td>
<td>20.32</td>
<td>0.800</td>
</tr>
<tr>
<td>F</td>
<td>7.1</td>
<td>0.280</td>
</tr>
<tr>
<td>L</td>
<td>3.3</td>
<td>0.139</td>
</tr>
<tr>
<td>Z</td>
<td>1.27</td>
<td>0.050</td>
</tr>
</tbody>
</table>

**OUTLINE AND MECHANICAL DATA**

DIP18
NOTES:

1. This drawing measure is a standard value. All dimensions are in millimeter.
2. In case of designation is tolerance ± 0.3mm.
3. Lead spacing is measured where the lead emerge from the package.
4. Above specification may be changed without notice. EVERLIGHT will reserve authority on material change for above specification.
5. These specification sheets include materials protected under copyright of EVERLIGHT corporation. Please don't reproduce or cause anyone to reproduce them without EVERLIGHT consent.
6. When using this produce, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets. EVERLIGHT assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets.
Description:
1. The module is a small type infrared remote control system receiver which has been
developed and designed by utilizing the latest hybrid technology.
2. This single unit type module incorporates a photo diode and a receiving preamplifier IC.
3. The demodulated output signal can directly be decoded by a microprocessor.

Feature:
1. High protection ability to EMI and metal case can be customized.
2. Mold type and metal case type to meet the design of front panel.
3. Elliptic lens to improve the characteristic against
4. Line-up for various center carrier frequencies.
5. Low voltage and low power consumption.
6. High immunity against ambient light.
7. Photodiode with integrated circuit.
8. TTL and CMOS compatibility.

Application:
1. Optical switch
2. Light detecting portion of remote control
   • AV instruments such as Audio, TV, VCR, CD, MD, etc.
   • Home appliances such as Air-conditioner, Fan, etc.
   • The other equipments with wireless remote control.
   • CATV set top boxes
   • Multi-media Equipment
### Absolute maximum ratings:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Ratings</th>
<th>Unit</th>
<th>Notice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>Vcc</td>
<td>4.3–5.7</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>Topr</td>
<td>-10–+60</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>Tstg</td>
<td>-20–+70</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Soldering Temperature</td>
<td>Tsol</td>
<td>260</td>
<td>°C</td>
<td>4 mm from mold body less than 5 seconds</td>
</tr>
</tbody>
</table>

### Electro Optical Characteristics:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>Vcc</td>
<td>4.7</td>
<td>5</td>
<td>5.3</td>
<td>V</td>
<td>DC voltage</td>
</tr>
<tr>
<td>Supply Current</td>
<td>Icc</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>mA</td>
<td>No signal input</td>
</tr>
<tr>
<td>B.P.F Center Frequency</td>
<td>fo</td>
<td>-</td>
<td>37.9</td>
<td>-</td>
<td>KHz</td>
<td></td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>λp</td>
<td>-</td>
<td>940</td>
<td>-</td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Transmission Distance</td>
<td>L₀</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td>At the ray axis *1</td>
</tr>
<tr>
<td></td>
<td>L₄₅</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>Half Angle</td>
<td>θ</td>
<td>-</td>
<td>45</td>
<td>-</td>
<td>deg</td>
<td></td>
</tr>
<tr>
<td>High Level Pulse Width</td>
<td>T₇₇</td>
<td>400</td>
<td>-</td>
<td>800</td>
<td>μs</td>
<td>At the ray axis *2</td>
</tr>
<tr>
<td>Low Level Pulse Width</td>
<td>T₉₇</td>
<td>400</td>
<td>-</td>
<td>800</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>High Level Output Voltage</td>
<td>V₇₇</td>
<td>4.5</td>
<td>-</td>
<td>-</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Low Level Output Voltage</td>
<td>V₉₇</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

*1: The ray receiving surface at a vertex and relation to the ray axis in the range of θ= 0° and θ=45°.
*2: A range from 30cm to the arrival distance. Average value of 50 pulses.
TEST METHOD:
The specified electro-optical characteristics is satisfied under the following Conditions at the controllable distance.

①Measurement place
A place that is nothing of extreme light reflected in the room.

②External light
Project the light of ordinary white fluorescent lamps which are not high Frequency lamps and must be less than 10 Lux at the module surface.
(£E ≤ 10Lux)

③Standard transmitter
A transmitter whose output is so adjusted as to Vo=400mVp-p and the output Wave form shown in Fig.-1. According to the measurement method shown in Fig.-2 the standard transmitter is specified. However, the infrared photodiode to be used for the transmitter should be λp=940nm, Δλ=50nm. Also, photo diode is used of PD438B (Vr=5V).
(Standard light / Light source temperature 2856 °K).

④Measuring system
According to the measuring system shown in Fig.-3

D-5
Fig. 1 Transmitter Wave Form

Carrier frequency is adjusted to center frequency of each product.

Fig. 2 Measuring Method

Fig. 3 Measuring System

\[ \theta : \text{Angle Of Horizontal & Vertical Direction} \]
TYPICAL ELECTRICAL/OPTICAL/CHARACTERISTICS CURVES

Fig. 4 Relative Spectral Sensitivity vs. Wavelength

Fig. 5 Relative Transmission Distance vs. Direction

Fig. 6 Output Pulse Length vs. Arrival Distance

Fig. 7 Arrival Distance vs. Supply Voltage

Fig. 8 Relative Transmission Distance vs. Center Carrier Frequency

Fig. 9 Arrival Distance vs. Ambient Temperature
Packing Specifications

1. Plastic Case

2. Box

3. Carton

CPN: Customer's Production Number
P/N: Production Number
QTY: Packing Quantity
CAT: Ranks
HUE: Peak Wavelength
REF: Reference
LOT NO: Lot Number
MADE IN TAIWAN: Production place

Packing Quantity Specification

1. 40 Pcs/1 Plastic Case, 4 Plastic Cases/1 Box
2. 10 Boxes/1 Carton