Features

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single-clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- Nonvolatile Program and Data Memories
  - 16K Bytes of In-System Self-Programmable Flash
    Endurance: 10,000 Write/Erase Cycles
  - Optional Boot Code Section with Independent Lock Bits
    In-System Programming by On-chip Boot Program
    True Read-While-Write Operation
  - 512 Bytes EEPROM
    Endurance: 100,000 Write/Erase Cycles
  - 1K Byte Internal SRAM
  - 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 Prescalers 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-lead 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 25°C for ATmega16L
  - Active: 1.1 mA
  - Idle Mode: 0.35 mA
  - Power-down Mode: < 1 µA

ATMEL

8-bit AVR® Microcontroller with 16K Bytes In-System Programmable Flash

ATmega16
ATmega16L

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 throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

ADC Conversion Result

After the conversion is complete (ADIF is high), the conversion result can be found in the ADC Result Registers (ADCL, ADCH).

For single ended conversion, the result is

$$ADC = \frac{V_{IN} \cdot 1024}{V_{REF}}$$

National Semiconductor

May 1999

LM567/LM567C
Tone Decoder

General Description

The LM567 and LM567C are general purpose tone decoders designed to provide a saturated transistor switch to ground when an input signal is present within the passband. The circuit consists of an I and Q detector driven by a voltage controlled oscillator which determines the center frequency of the decoder. External components are used to independently set center frequency, bandwidth and output delay.

Features

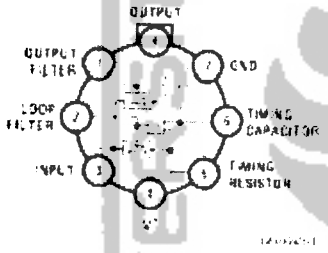
- 20 to 1 frequency range with an external resistor
- Logic compatible output with 100 mA current sinking capability
- Bandwidth adjustable from 0 to 14%
- High rejection of out of band signals and noise
- Immunity to false signals
- Highly stable center frequency
- Center frequency adjustable from 0.01 Hz to 500 kHz

Applications

- Touch tone decoding
- Precision oscillator
- Frequency monitoring and control
- Wide band FSK demodulation
- Ultrasonic controls
- Carrier current remote controls
- Communications paging decoders

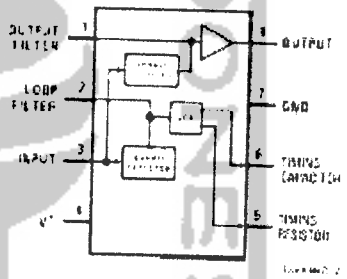
Connection Diagrams

Metal Can Package



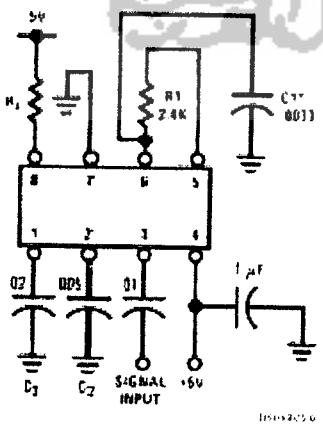
Top View
Order Number LM567H or LM567CH
See NS Package Number H08C

Dual-In-Line and Small Outline Packages



Top View
Order Number LM567CM
See NS Package Number M08A
Order Number LM567CN
See NS Package Number N08E

AC Test Circuit



f_o = 100 kHz + 5V
*Note: Adjust for f_o = 100 kHz

Applications Information

The center frequency of the tone decoder is equal to the free running frequency of the VCO. This is given by

$$f_o \cong \frac{1}{1.1 R_1 C_1}$$

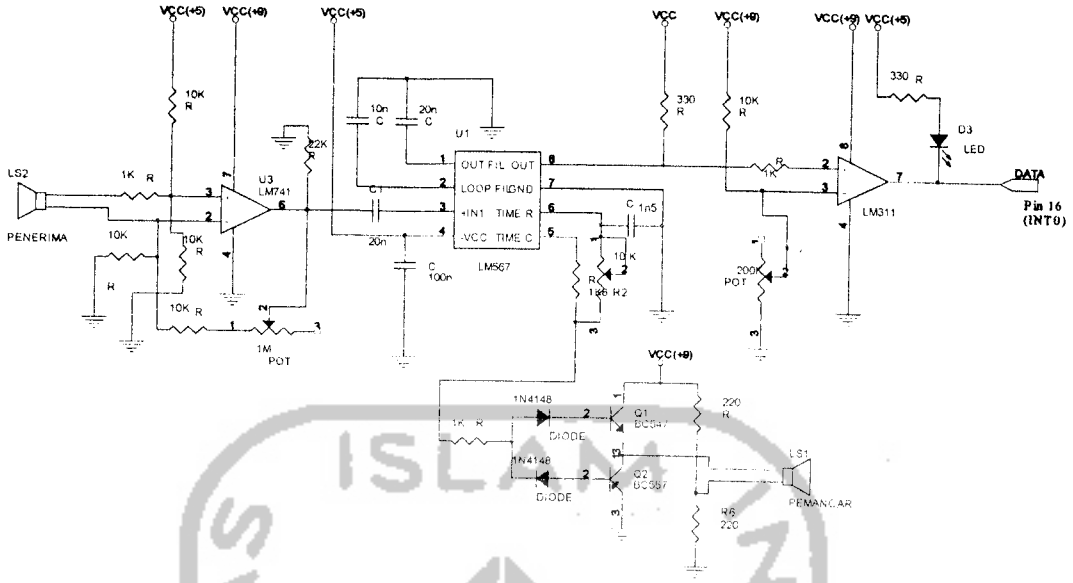
The bandwidth of the filter may be found from the approximation

$$BW = 1070 \sqrt{\frac{V_i}{f_o C_2}} \text{ in \% of } f_o$$

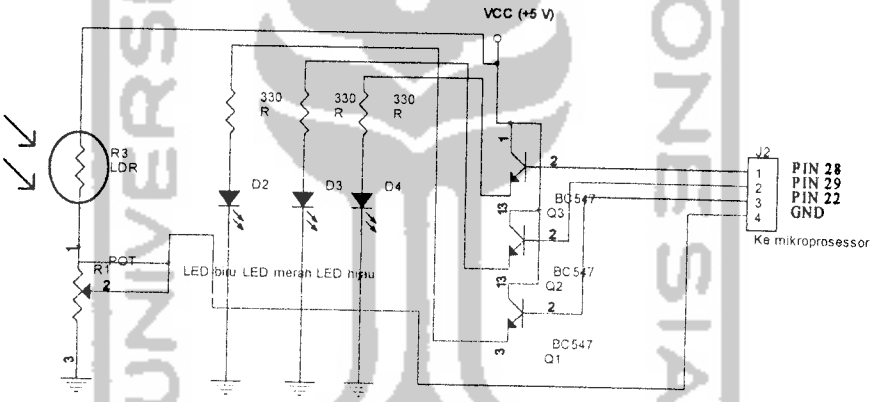
Where:

V_i = input voltage (volts rms), $V_i \leq 200$ mV

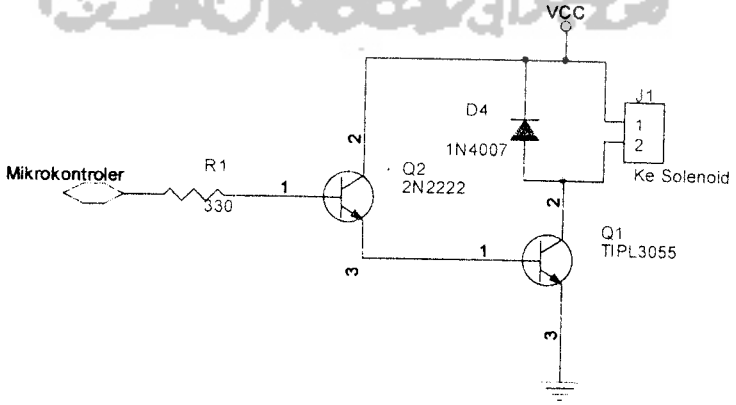
C_2 = Capacitance at Pin 2 (µF)



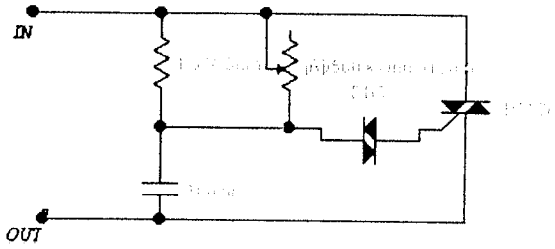
Skema Rangkaian Sensor Ultrasonik



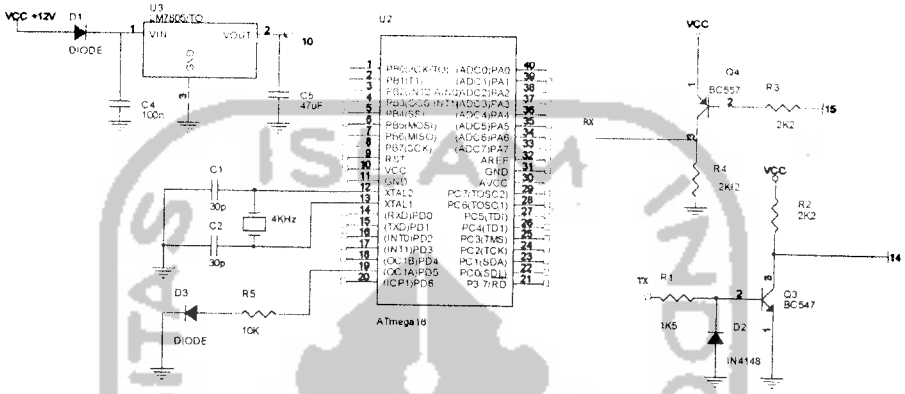
Skema Rangkaian Sensor Warna



Skema Rangkaian *Driver Valve*



Skema Rangkaian Dimmer



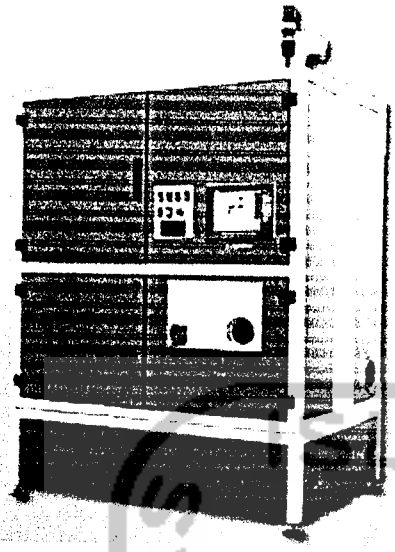
Skema Rangkaian Sistem Minimum ATmega16

```
$regfile = "M16def.dat"
$crystal = 8000000
$baud = 19200
Config Portb = Output
Config Portc = Output
Config Portd = Input
Portb.0 = 0
Red Alias Portc.7
Green Alias Portc.6
Blue Alias Portc.0
Portd = 0

Dim W As Word , Channel As Byte , Total As Integer , Wred As Word
, Wgreen As Word , Wblue As Word
Dim Pred As Long , Pgreen As Long , Pblue As Long
Dim Delay_off1 As Integer , Delay_on1 As Integer
Dim Interupt As Byte , Delay_off2 As Integer ,
Delay_on2 As Integer, Dim Total_min As Integer , Total_max As
Integer , S As Byte

Config Adc = Single , Prescaler = Auto
Channel = 1
Interupt = 0
Start Adc
Config Int0 = Falling
Enable Interrupts
Enable Int0
On Int0 Label2 Nosave
Delay_on1 = 1000
Delay_off1 = 1000
Delay_on2 = 1000
Delay_off2 = 1000
Total_min = 600
Total_max = 1400

Do
   Interupt = 0
   S = Inkey()
   If S = Asc( "S") Or S = Asc( "s") Then Gosub Setting
   Red = 1
   Green = 0
   Blue = 0
   Waitms 20
   Wred = Getadc(channel)
   If Interupt > 0 Then Goto Sele_on
   Red = 0
   Green = 1
   Blue = 0
   Waitms 20
   Wgreen = Getadc(channel)
   If Interupt > 0 Then Goto Sele_on
   Red = 0
   Green = 0
   Blue = 1
   Waitms 20
```

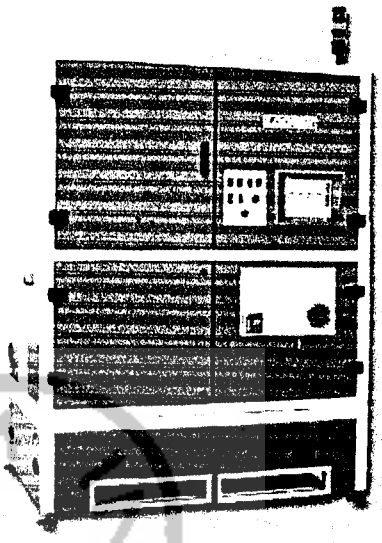
```
    Wblue = Getadc(channel)
    If Interupt > 0 Then Goto Sele_on

Terus:
    Total = Wred + Wgreen
    Total = Total + Wblue
    If Interupt > 0 Then Goto Sele_on
    Print "Total = " ; Total
    If Total < Total_max Then Interupt = 2
    If Total < Total_min Then Interupt = 0
    If Wred < 6 And Wgreen < 6 And Wblue < 6 Then Interupt = 0
    If Interupt > 0 Then Goto Sele_on

Lanjut:
Sele_on:
   If Interupt = 1 Then
      Print "Ultrasonic :"
      Waitms Delay_on1
      Portb.0 = 1
      Print "SELENOID ON"
      Waitms Delay_off1
      Portb.0 = 0
      Interupt = 0
      Print "SELENOID OFF"
   Else
      If Interupt = 2 Then
         Print "Sensor Warna :"
         Waitms Delay_on2
         Portb.0 = 1
         Print "SELENOID ON"
         Waitms Delay_off2
         Portb.0 = 0
         Interupt = 0
         Print "SELENOID OFF"
      End If
   End If
Loop
End

Label2:
  Interupt = 1
Return

Setting:
Dim Value As Integer
Print : Print
Print "Delay on Ultrsonic ";
Input Value
If Value = 0 Then Value = Delay_on1
Delay_on1 = Value
Print
Print "Delay Off Ultrsonic";
Input Value
If Value = 0 Then Value = Delay_off1
Delay_off1 = Value
Print
```

```
Print "Delay on Sensor warna ";
Input Value
If Value = 0 Then Value = Delay_on2
Delay_on2 = Value
Print
Print "Delay Off Sensor warna";
Input Value
If Value = 0 Then Value = Delay_off2
Delay_off2 = Value
Print

Print "Total Min ";
Input Value
Print
If Value = 0 Then Value = Total_min
Total_min = Value
Print "Total Max ";
Input Value
If Value = 0 Then Value = Total_max
Total_max = Value
Print
Print "Delay on  Ultrasonic = " ; Delay_on1
Print "Delay off Ultrasonic = " ; Delay_off1
Print "Total min = " ; Total_min
Print "Total max = " ; Total_max
Input Value
Return
```

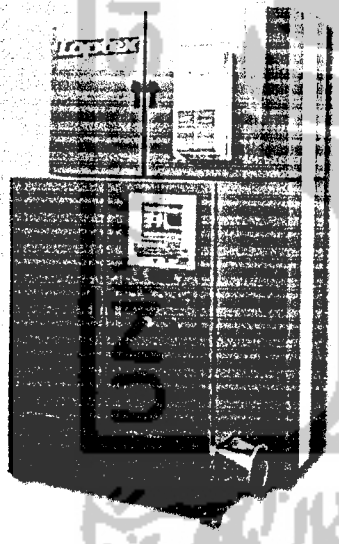
Jenis Mesin Penyortir Kapas



Gambar *single optosonic sorter*



Gambar *tandem optosonic sorter*



Gambar H.P *optosonic sorter*