Datasheet Atmega 16

Features

- High-performance, Low-power Atmel® 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
- High Endurance Non-volatile Memory segments
  - 16 Kbytes of In-System Self-programmable Flash program memory
  - 512 Bytes EEPROM
  - 1 Kbyte Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    In-System Programming by On-chip Boot Program
    True Read-While-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 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
  - 2.7V - 5.5V for ATmega16L
  - 4.5V - 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

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

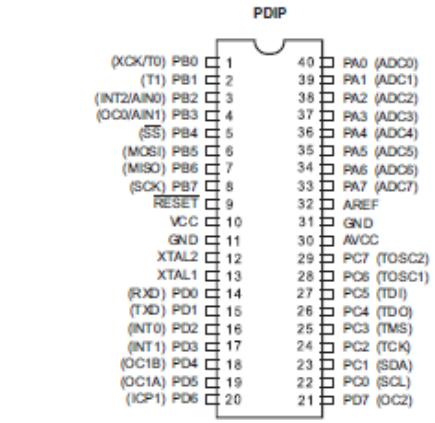
ATmega16
ATmega16L

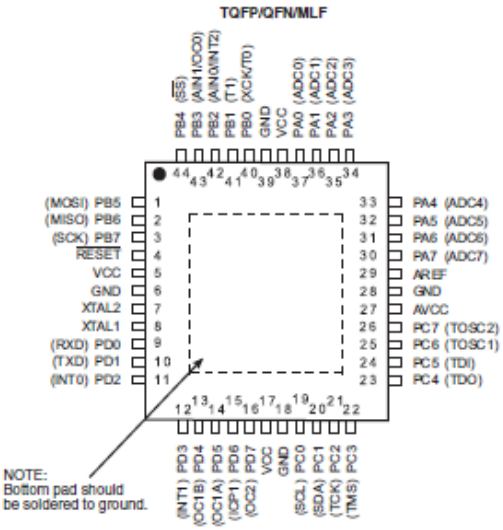
Rev. 2466T–AVR–07/10

Konfigurasi PIN Atmega 16

Pin Configurations

Figure 1. Pinout ATmega16





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.

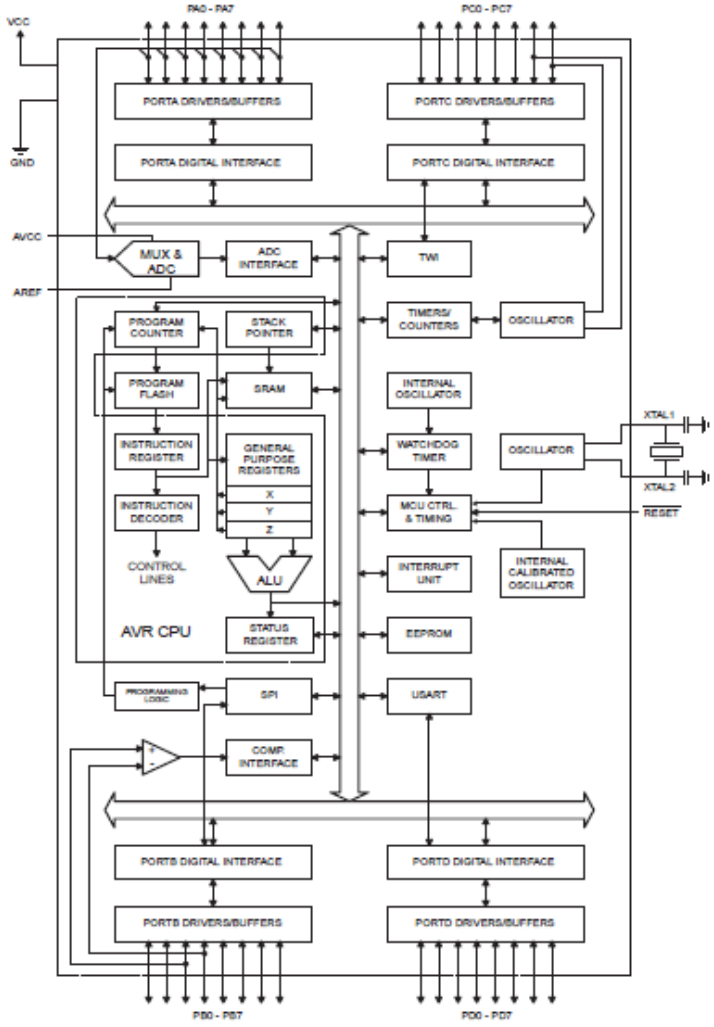
Blok Diagram Atmega 16

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.

Block Diagram

Figure 2. Block Diagram



Deskripsi PIN Atmega 16

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 throughputs 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, 1 Kbyte 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 (TQFP 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 modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator 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 On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel 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 debugger/simulators, in-circuit emulators, and evaluation kits.

Pin Descriptions

VCC Digital supply voltage.

GND Ground.

Port A (PA7..PA0) Port A serves as the analog inputs to the A/D Converter.

Port A also serves as an 8-bit bi-directional 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 PA0 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.

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.

$\overline{\text{RESET}}$

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 V_{CC}, even if the ADC is not used. If the ADC is used, it should be connected to V_{CC} through a low-pass filter.

AREF

AREF is the analog reference pin for the A/D Converter.

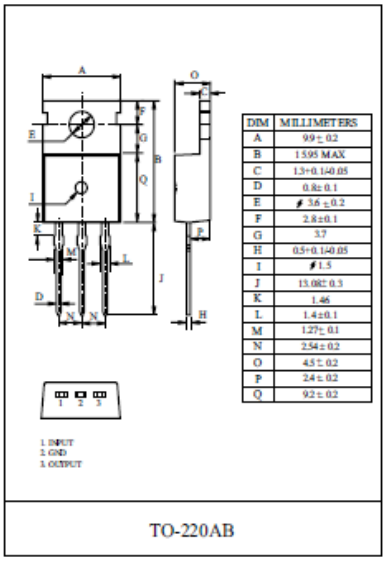
Datasheet IC Regulator 7805

KEC SEMICONDUCTOR TECHNICAL DATA

KIA7805AP~KIA7824AP

BIPOLAR LINEAR INTEGRATED CIRCUIT

THREE TERMINAL POSITIVE VOLTAGE REGULATORS
5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V.



DIM	MILLIMETERS
A	9.9± 0.2
B	1.595 MAX
C	1.3+0.1/-0.05
D	0.8± 0.1
E	∮ 3.6 ± 0.2
F	2.8±0.1
G	3.7
H	0.5+0.1/-0.05
I	∮1.5
J	13.08± 0.3
K	1.46
L	1.4±0.1
M	1.27± 0.1
N	2.54± 0.2
O	4.5± 0.2
P	2.4± 0.2
Q	9.2± 0.2

TO-220AB

FEATURES

- Internal Thermal Overload Protection.
- Internal Short Circuit Current Limiting.
- Output Current up to 1.5A.
- Satisfies IEC-65 Specification. (International Electronical Commission).
- Package is TO-220AB

LINE-UP

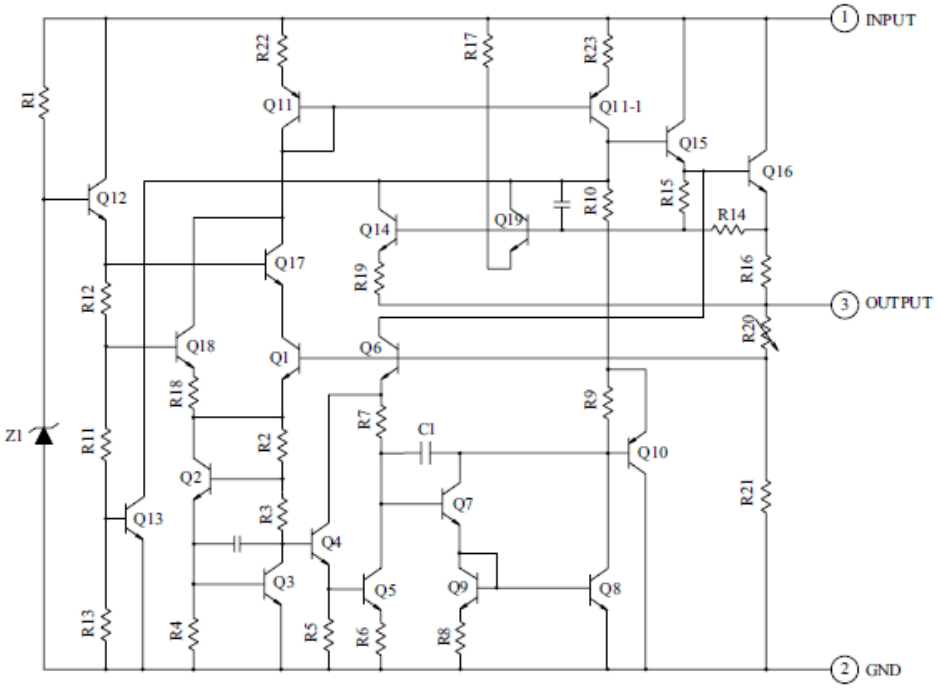
ITEM	OUTPUT VOLTAGE (Typ.)	UNIT
KIA7805AP	5	V
KIA7806AP	6	
KIA7807AP	7	
KIA7808AP	8	
KIA7809AP	9	
KIA7810AP	10	
KIA7812AP	12	
KIA7815AP	15	
KIA7818AP	18	
KIA7820AP	20	
KIA7824AP	24	

MAXIMUM RATINGS (Ta=25℃)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	KIA7805 ~ KIA7815	V_{IN}	35	V
	KIA7818 ~ KIA7824		40	
Power Dissipation-1 (No Heatsink)	AP	P_{D2}	1.9	W
Power Dissipation-2 (Infinite Heatsink)	AP	P_{D2}	30	
Operating Junction Temperature		T_j	-40 ~150	℃
Storage Temperature		T_{stg}	-55 ~150	℃
Maximum Junction Tamperature		$T_{j(max)}$	150	℃

KIA7805AP~KIA7824AP

EQUIVALENT CIRCUIT



KIA7805AP~KIA7824AP

KIA7805AP

ELECTRICAL CHARACTERISTICS (V_{IN}=10V, I_{OUT}=500mA, 0℃ ≤T_j ≤125℃)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	Fig. 1	T_j=25℃, I_{OUT}=100mA		4.8	5.0	5.2	V
Input Regulation	Reg line	Fig. 1	T_j=25℃	7.0V ≤V_{IN} ≤25V	-	3	100	mV
				8.0V ≤V_{IN} ≤12V	-	1	50	
Load Regulation	Reg load	Fig. 1	T_j=25℃	5mA ≤I_{OUT} ≤1.5A	-	15	100	mV
				250mA ≤I_{OUT} ≤750mA	-	5	50	
Output Voltage	V_{OUT}	Fig. 1	7.0V ≤V_{IN} ≤20V		4.75	-	5.25	V
Quiescent Current	I_B	Fig. 1	T_j=25℃, I_{OUT}=5mA		-	4.2	8.0	mA
Quiescent Current Change	ΔI_B	Fig. 1	7.0V ≤V_{IN} ≤25V		-	-	1.3	mA
Output Noise Voltage	V_{NO}	Fig. 2	Ta=25 ℃, 10Hz ≤f ≤100kHz		-	50	-	μV_{rms}
Ripple Rejection Ratio	RR	Fig. 3	f=120Hz, 8.0V ≤V_{IN} ≤18V,		62	78	-	dB
Dropout Voltage	V_D	Fig. 1	I_{OUT}=1.0A, T_j=25℃		-	2.0	-	V
Short Circuit Current Limit	I_{SC}	Fig. 1	T_j=25℃		-	1.6	-	A
Average Temperature Coefficient of Output Voltage	TC_{VO}	Fig. 1	I_{OUT}=5mA, 0℃ ≤T_j ≤125℃		-	-0.6	-	mV/℃

Datasheet Transistor BC517

NPN Darlington transistor BC517

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V)
- Very high DC current gain (min. 30000).

APPLICATIONS

- Where very high amplification is required.

DESCRIPTION

NPN Darlington transistor in a TO-92; SOT54 plastic package. PNP complement: BC516.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

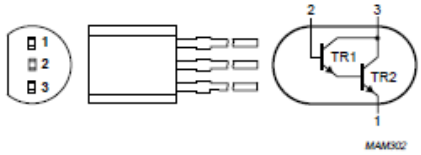


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	800	mA
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 2 V; see Fig.2	30000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 10 mA; V_{CE} = 5 V	–	–	1.4	V
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 100 MHz	–	220	–	MHz

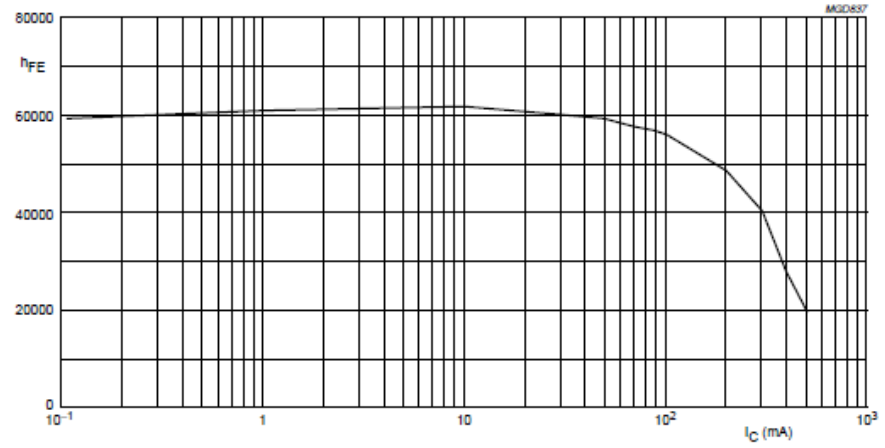
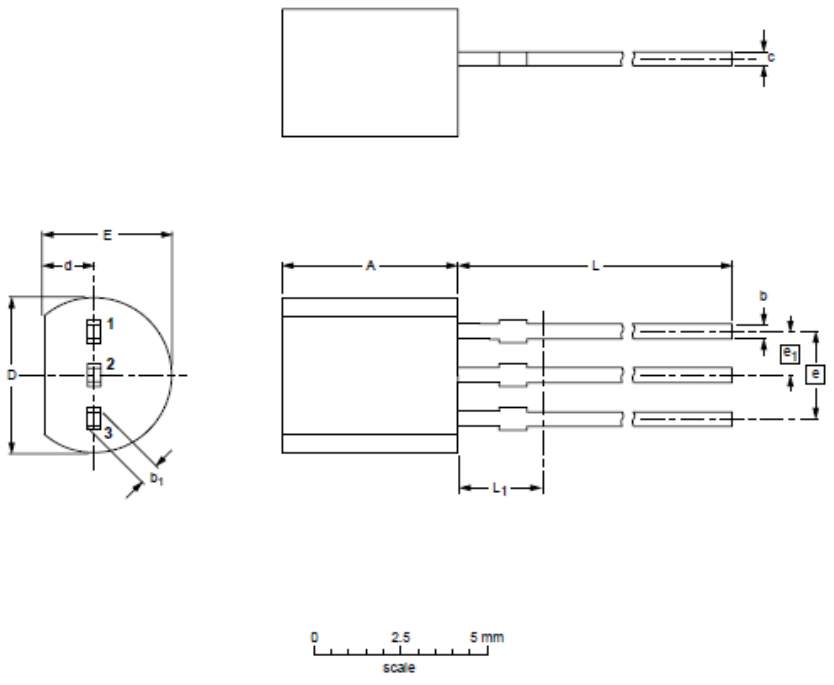


Fig.2 DC current gain; typical values.

PACKAGE OUTLINE

Plastic single-ended leaded (through hole) package; 3 leads **SOT54**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b_1	c	D	d	E	e	e_1	L	L_1 (1)
mm	5.2 5.0	0.48 0.40	0.66 0.56	0.45 0.40	4.8 4.4	1.7 1.4	4.2 3.6	2.54	1.27	14.5 12.7	2.5

Note

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT54		TO-92	SC-43			97-02-28

Datasheet Sensor PIR (*Passive Infrared*)

PARALLAX

Web Site: www.parallax.com
Forums: forums.parallax.com
Sales: sales@parallax.com
Technical: support@parallax.com

Office: (916) 624-8333
Fax: (916) 624-8003
Sales: (888) 512-1024
Tech Support: (888) 997-8267

PIR Sensor (#555-28027)

General Description

The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin.

Features

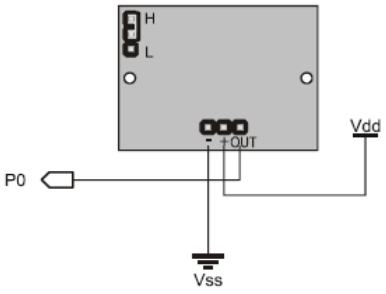
- Single bit output
- Small size makes it easy to conceal
- Compatible with all Parallax microcontrollers
- 3.3V & 5V operation with <100uA current draw

Application Ideas

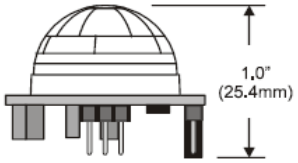
- Alarm Systems
- Halloween Props

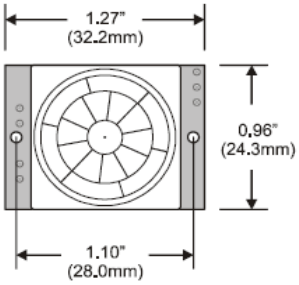
Quick Start Circuit

Note: The sensor is active high when the jumper (shown in the upper left) is in either position.



Module Dimensions





Theory of Operation

Pyroelectric devices, such as the PIR sensor, have elements made of a crystalline material that generates an electric charge when exposed to infrared radiation. The changes in the amount of infrared striking the element change the voltages generated, which are measured by an on-board amplifier. The device contains a special filter called a Fresnel lens, which focuses the infrared signals onto the element. As the ambient infrared signals change rapidly, the on-board amplifier trips the output to indicate motion.

Pin Definitions and Ratings

Pin	Name	Function
-	GND	Connects to Ground or Vss
+	V+	Connects to Vdd (3.3V to 5V) @ ~100uA
OUT	Output	Connects to an I/O pin set to INPUT mode (or transistor/MOSFET)

Jumper Setting

Position	Mode	Description
H	Retrigger	Output remains HIGH when sensor is retriggered repeatedly. Output is LOW when idle (not triggered).
L	Normal	Output goes HIGH then LOW when triggered. Continuous motion results in repeated HIGH/LOW pulses. Output is LOW when idle.

Connecting and Testing

Connect the 3-pin header to your circuit so that the minus (-) pin connects to ground or Vss, the plus (+) pin connects to Vdd and the OUT pin connects to your microcontroller's I/O pin. One easy way to do this would be to use a standard servo/LCD extension cable, available separately from Parallax (#805-00002). This cable makes it easy to plug sensor into the servo headers on our Board Of Education or Professional Development Board. If you use the Board Of Education, be sure the servo voltage jumper (located between the 2 servo header blocks) is in the Vdd position, not Vin. If you do not have this jumper on your board you should manually connect to Vdd through the breadboard. You may also plug the sensor directly into the edge of the breadboard and connect the signals from there. Remember the position of the pins when you plug the sensor into the breadboard.

Calibration

The PIR Sensor requires a 'warm-up' time in order to function properly. This is due to the settling time involved in 'learning' its environment. This could be anywhere from 10-60 seconds. During this time there should be as little motion as possible in the sensors field of view.

Sensitivity

The PIR Sensor has a range of approximately 20 feet. This can vary with environmental conditions. The sensor is designed to adjust to slowly changing conditions that would happen normally as the day progresses and the environmental conditions change, but responds by making its output high when sudden changes occur, such as when there is motion.

Resources and Downloads

Check out the PIR Sensor product page for example programs and more:

http://www.parallax.com/detail.asp?product_id=555-28027

Listing Program Keseluruhan

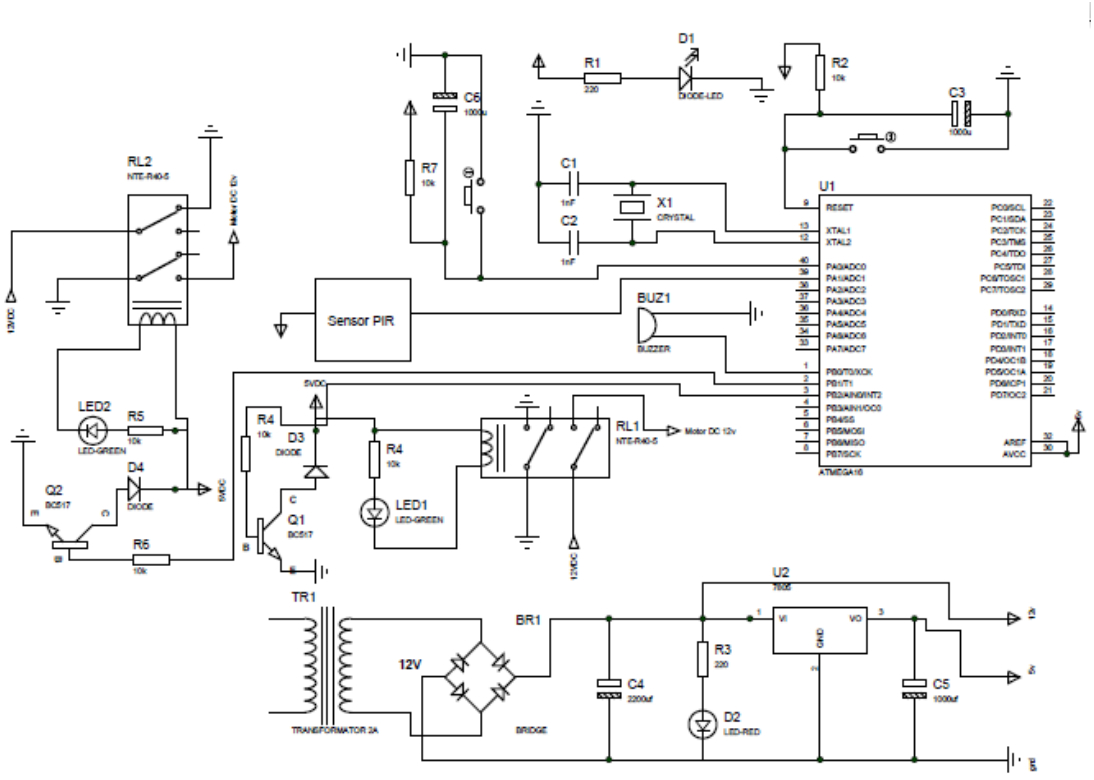
```
/*****************************************************
This program was produced by the
CodeWizardAVR V2.05.0 Professional
Automatic Program Generator
© Copyright 1998-2010 Pavel Haiduc, HP InfoTech s.r.l.
http://www.hpinfotech.com

Project :
Version :
Date : 6/20/2016
Author : NeVaDa
Company :
Comments :


Chip type : ATmega16
Program type : Application
AVR Core Clock frequency : 12.000000 MHz
Memory model : Small
External RAM size : 0
Data Stack size : 256
*****************************************************/

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

// 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=Out Func6=Out Func5=Out Func4=Out Func3=Out Func2=Out Func1=Out
Func0=Out
```

```
// State7=0 State6=0 State5=0 State4=0 State3=0 State2=0 State1=0 State0=0
   PORTB=0x00;
   DDRB=0xFF;

// 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=0xFF
// OC0 output: Disconnected
   TCCR0=0x00;
   TCNT0=0x00;
   OCR0=0x00;

// Timer/Counter 1 initialization
// Clock source: System Clock
// Clock value: Timer1 Stopped
// Mode: Normal top=0xFFFF
// OC1A output: Discon.
// OC1B output: Discon.
// Noise Canceler: Off
// Input Capture on Falling Edge
// Timer1 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: Timer2 Stopped
// Mode: Normal top=0xFF
// 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;

// USART initialization
// USART disabled
   UCSRB=0x00;

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

// ADC initialization
// ADC disabled
   ADCSRA=0x00;

// SPI initialization
// SPI disabled
   SPCR=0x00;

// TWI initialization
// TWI disabled
   TWCR=0x00;
```

```
while (1)
{
PORTB=0;
// Place your code here
if(PORTA.0==0)
{
PORTB.1=1;
delay_ms(500);
}
if(PORTA.1==0)
{
PORTB.2=1;
delay_ms(500);
}
}
}
```

Skema Rangkaian Keseluruhan



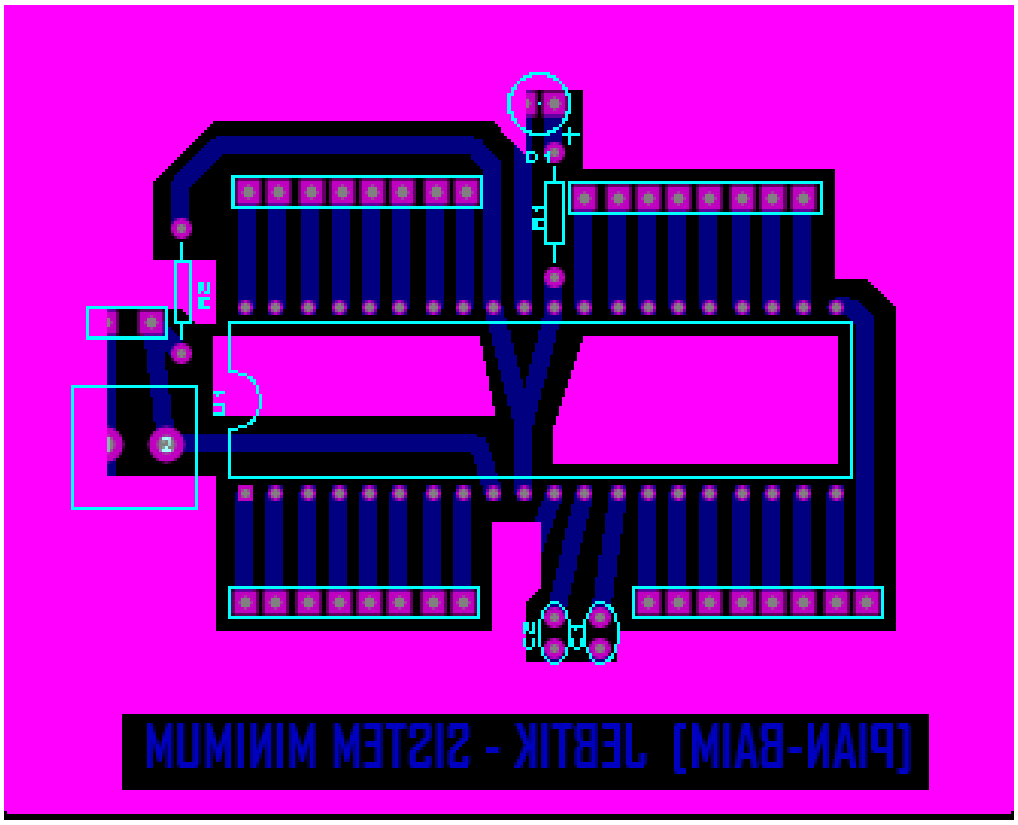
DAFTAR KOMPONEN DAN DAFTAR HARGA

Nama Komponen	Jumlah	Harga Satuan	Total
Resistor 220Ω	7 buah	Rp. 100	Rp. 700
Resistor 1KΩ	1 buah	Rp. 100	Rp. 100
Resistor 10KΩ	3 buah	Rp. 100	Rp. 300
Trimpot 10KΩ	1 buah	Rp. 3.000	Rp. 3.000
Kapasitor Keramik 22p	2 buah	Rp. 100	Rp. 200
Kapasitor MKN 100 np	1 buah	Rp. 2.500	Rp. 2.500
Elco 2200 µf / 25V	1 buah	Rp. 2.000	Rp. 2.000
Elco 100 µf / 25V	1 buah	Rp. 1.000	Rp. 1.000
Dioda bridge 2A	1 buah	Rp. 2.000	Rp. 2.000
Dioda IN4002	2 buah	Rp. 200	Rp. 400
LED 3mm	4 buah	Rp. 500	Rp. 2.000
LED 5mm	1 buah	Rp. 500	Rp. 500
Transistor BC517	2 buah	Rp. 500	Rp. 1.000
Kristal 12 Mhz	1 buah	Rp. 2.500	Rp. 2.500
IC Regulator 7805	1 buah	Rp. 2.500	Rp. 2.500
Atmega 16	1 buah	Rp. 55.000	Rp. 55.000
Soket IC 40 PIN	1 buah	Rp. 1.500	Rp. 1.500
Buzzer 12VDC	1 buah	Rp. 5.000	Rp. 5.000
Relay DPDT 5V	2 buah	Rp. 8.000	Rp. 16.000
Tulang Ikan	2 strip	Rp. 2.000	Rp. 4.000
Black Housing 3 pin	1 buah	Rp. 800	Rp. 800
Black Housing 4 pin	1 buah	Rp. 1.000	Rp. 1.000
Black Housing 8 pin	2 buah	Rp. 2.000	Rp. 4.000
Female Header	1 buah	Rp. 3.500	Rp. 3.500
Molex 2 pin kecil	13 buah	Rp. 1.000	Rp. 13.000
Molex 2 pin besar	1 buah	Rp. 1.000	Rp. 1.000
TBLOCK 3 pin	4 buah	Rp. 2.500	Rp. 10.000
TBLOCK 2 pin	1 buah	Rp. 2.000	Rp. 2.000
PCB Fiber	2 buah	Rp. 10.000	Rp. 20.000
Push On	1 buah	Rp. 3.000	Rp. 3.000
Push button	1 buah	Rp. 500	Rp. 500
Skun kabel	1 buah	Rp. 500	Rp. 500
Transformator 2A	1 buah	Rp. 38.000	Rp. 38.000
Kabel AC	1 buah	Rp. 10.000	Rp. 10.000
Soket kabel AC	1 buah	Rp. 2.000	Rp. 2.000
Switch AC	1 buah	Rp. 3.000	Rp. 3.000
Baud Spicer kecil	17 buah	Rp. 1.000	Rp. 17.000
Kabel Pelangi	2 meter	Rp. 5.000	Rp. 10.000
Kabel Merah Hitam	1 meter	Rp. 4.000	Rp. 4.000

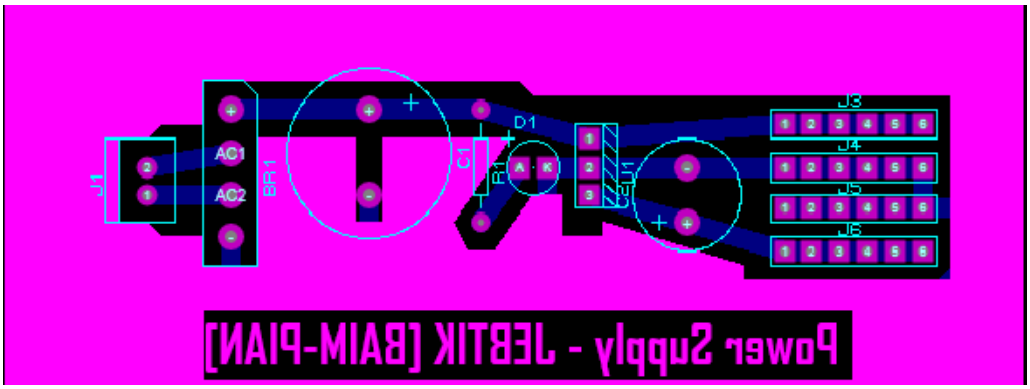
Kabel Kuning Hitam	1 meter	Rp. 4.000	Rp. 4.000
Motor DC	1 buah	Rp. 5.000	Rp. 5.000
Sensor PIR	1 buah	Rp. 26.000	Rp. 26.000
Karet Tape	1 buah	Rp. 1000	Rp. 1000
JUMLAH TOTAL			**Rp. 281.500**

PCB LAYOUT

1. LAYOUT PCB SISTEM MINIMUM



2. LAYOUT PCB POWER SUPPLY



3. LAYOUT PCB DRIVER RELAY

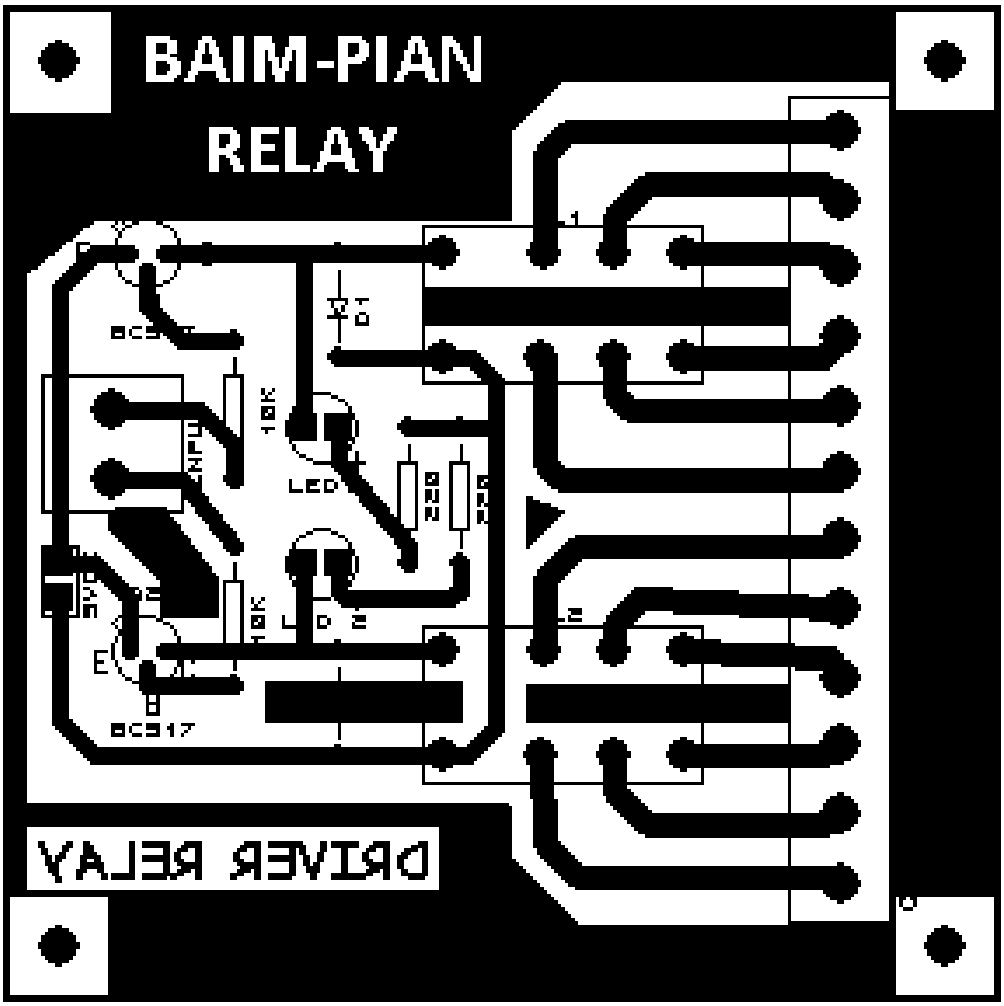


Foto Alat Keseluruhan

Foto Tampak Bagian Samping

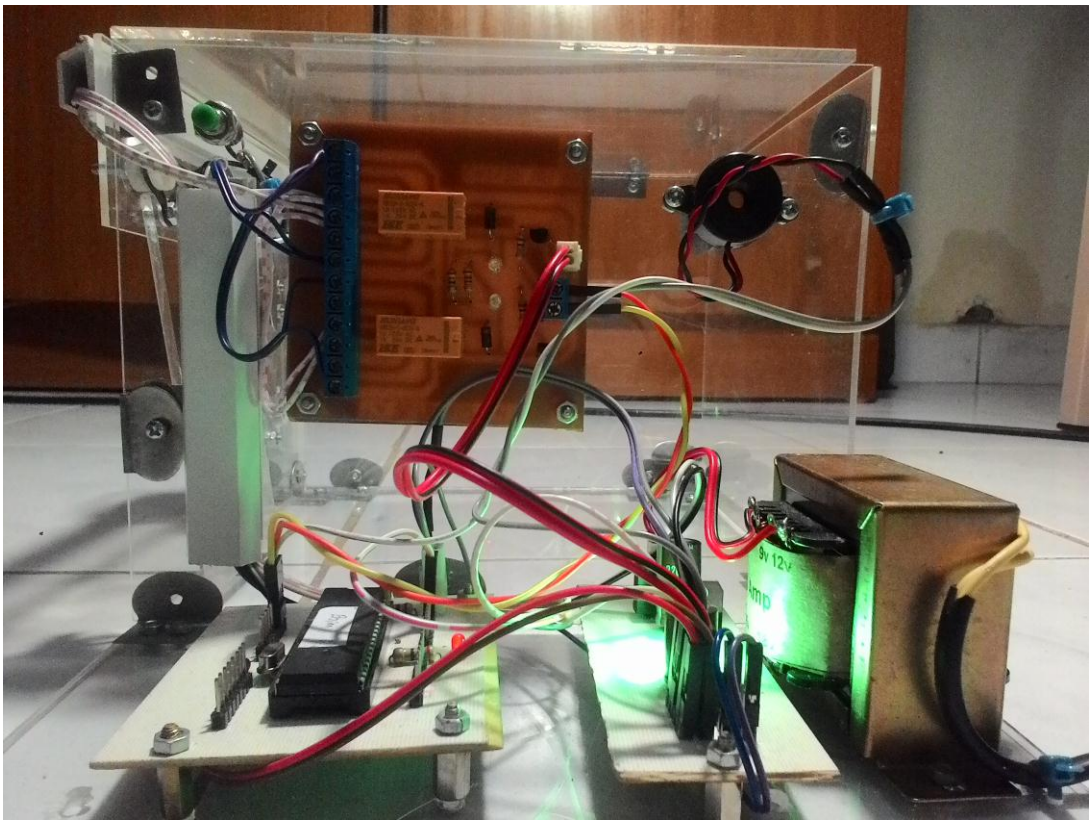


Foto Tampak Bagian Depan

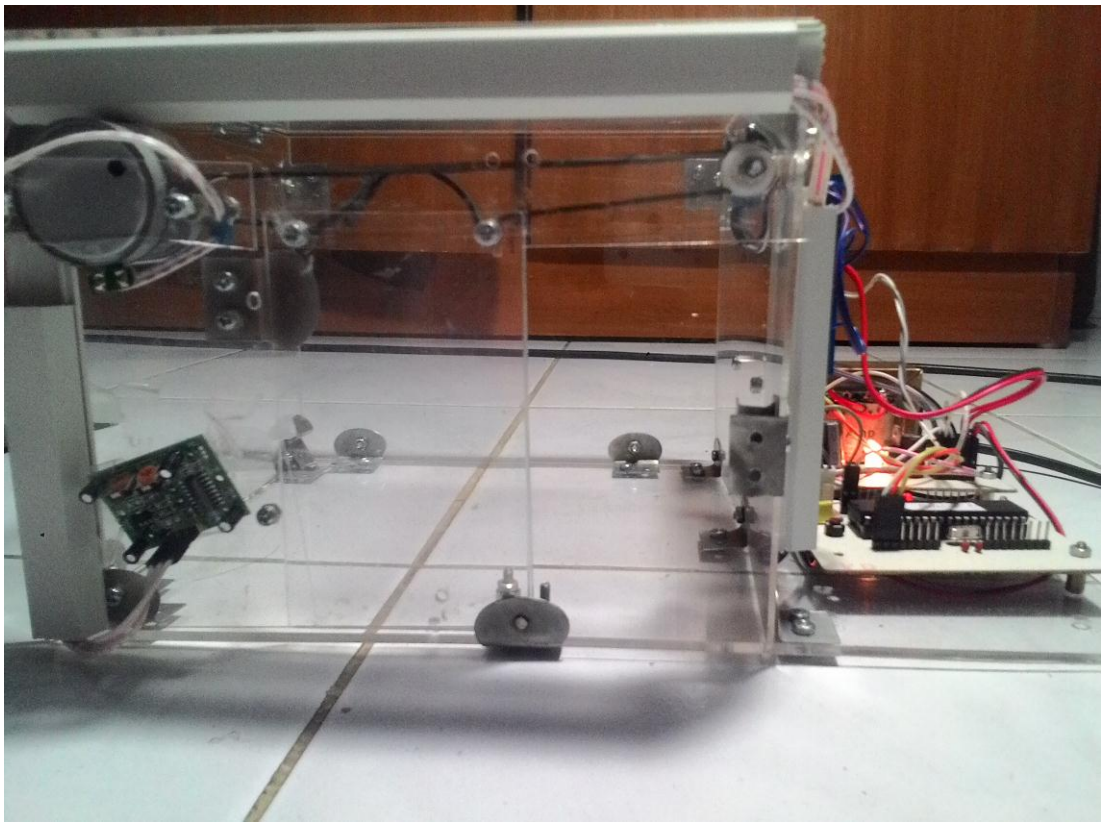


Foto Tampak Bagian Atas