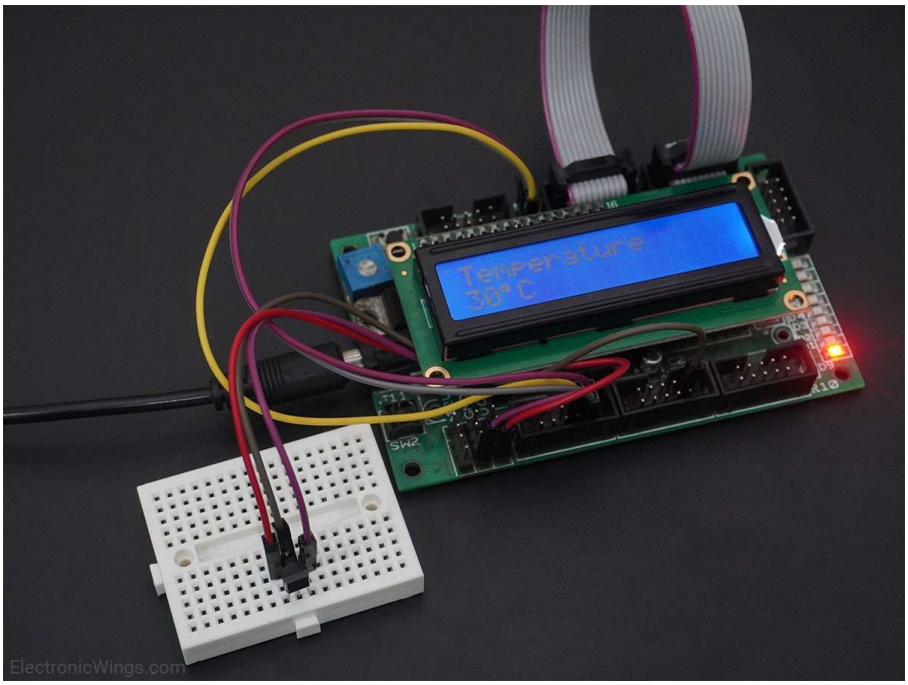
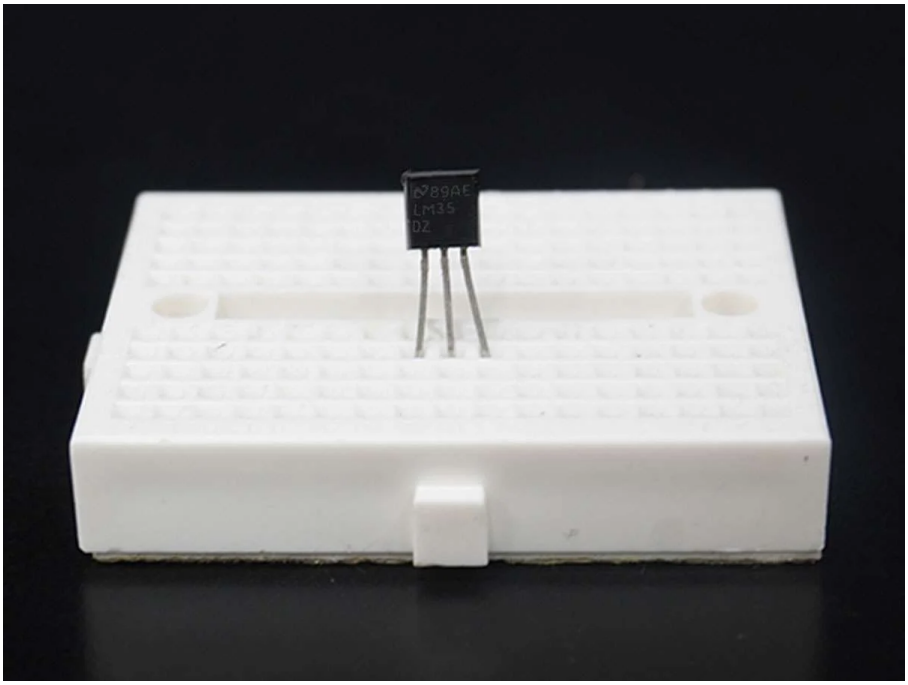
LM35 Temperature Sensor Interfacing with AVR ATmega16/ATmega32



Overview of LM35



LM35 Temperature Sensor

LM35 is a temperature sensor that can measure temperature in the range of -55°C to 150°C.

It is a 3-terminal device that provides an analog voltage proportional to the temperature. The higher the temperature, the higher is the output voltage.

The output analog voltage can be converted to digital form using ADC so that a microcontroller can process it.

For more information about LM35 and how to use it, refer to the topic **LM35 Temperature Sensor** (http://electronicwings.com/sensors-modules/lm35-temperature-sensor) in the sensors and modules section.

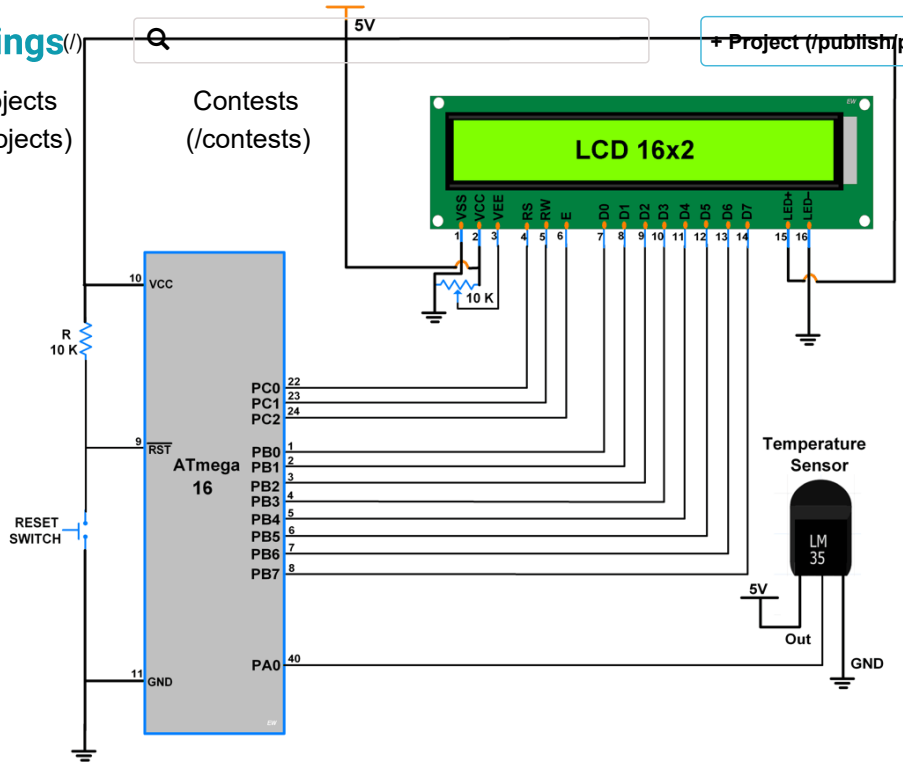
For information about ADC in AVR ATmega16/ATmega32 and how to use it, refer the topic **ADC in AVR ATmega16/ATmega32** (http://electronicwings.com/avr-atmega/atmega1632-adc) in the ATmega inside section.

Measure Temperature using LM35 With Atmega16/32 Microcontroller

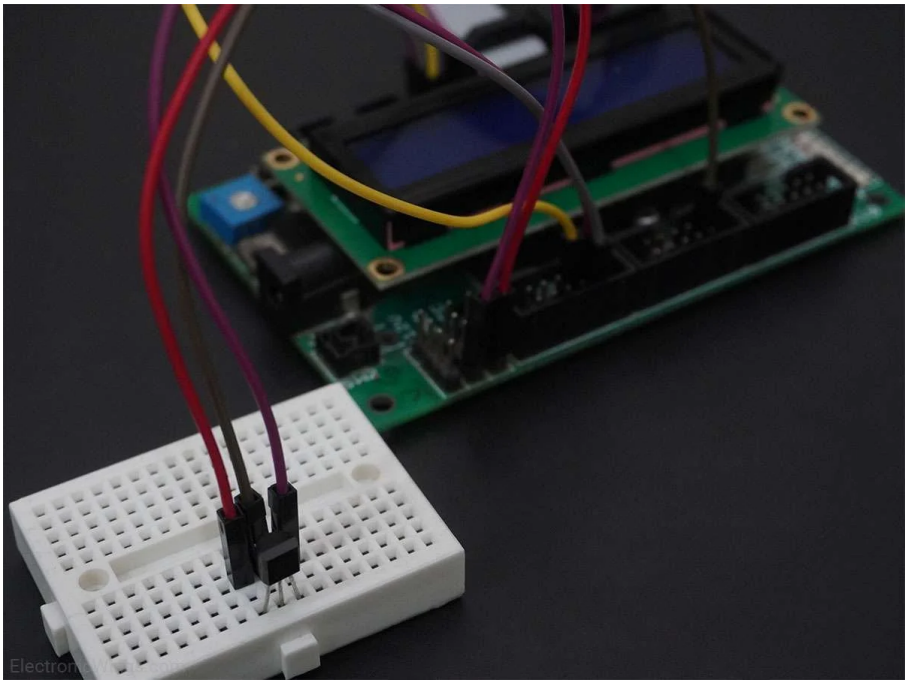
Let's interface the LM35 temperature sensor with ATmega16 and display the surrounding temperature on the LCD16x2 display.

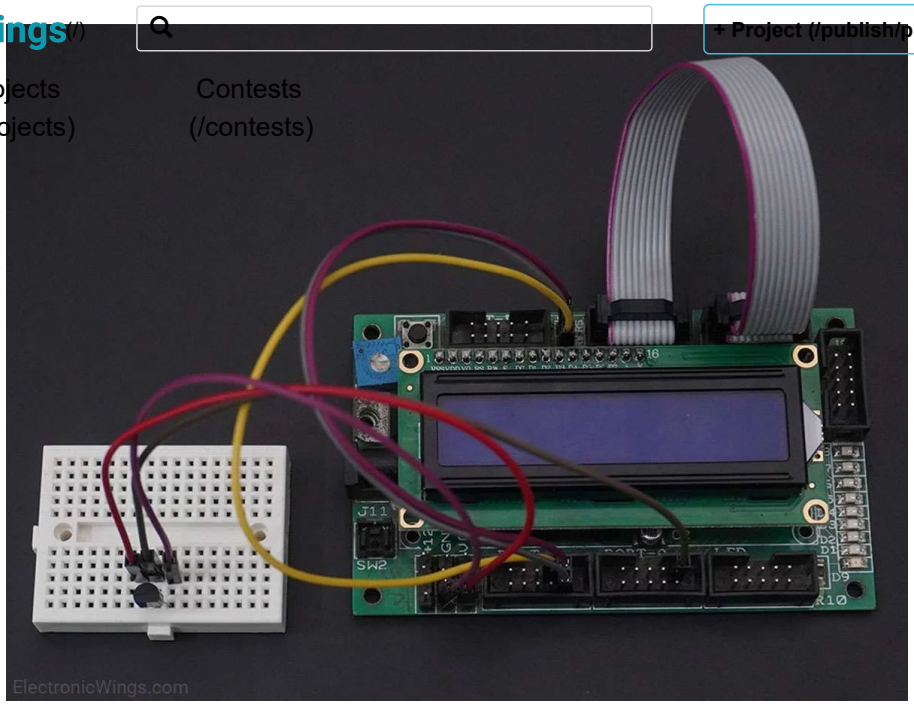
LM35 gives output in the analog form so connect out pin of a sensor to one of the ADC channels of ATmega16/ATmega32.

Connection Diagram of LM35 with ATmega16/32



LM35 Temperature Sensor Interfacing with ATmega16/ATmega32





LM35 Code for ATmega16/32

```
/*
     LM35 Interfacing with ATmega16/32
     http://www.electronicwings.com
 */

#define F_CPU 8000000UL
#include <avr/io.h>
#include <util/delay.h>
#include <string.h>
#include <stdio.h>
#include "LCD_16x2_H_file.h"

#define degree_sysmbol 0xdf

void ADC_Init(){
        DDRA = 0x00;            /* Make ADC port as input */
        ADCSRA = 0x87;          /* Enable ADC, with freq/128  */
        ADMUX = 0x40;           /* Vref: Avcc, ADC channel: 0 */
}

int ADC_Read(char channel)
{
```

Components Used

ATmega 16 ATmega 16	X 1	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA16L-8PU?qs=%2Fha2pyFaduiGCJtTvs2wv8fVZbVAalLu7Iq%2FglTS0tALAx6fMenLvg%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega-16/1/datasheet)
Atmega32 Atmega32	X 1	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA32-16PU?qs=aqrrBurbvGdpkmgj7RWmsQ%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega32/1/datasheet)

Components Used

LCD16x2 Display LCD16x2 Display	X 1	(https://www.mouser.com/ProductDetail/Adafruit/1447?qs=XAKlUOoRPe6AClmsjw7y7g%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)
LM35 Temperature Sensor LM35 is a sensor which is used to measure tempe...	X 1	(https://www.mouser.com/ProductDetail/Texas-Instruments/LM35DZ-NOPB?qs=QbsRYf82W3F5RpWTxhXHxA%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/lm35-temperature-sensor/1/datasheet)

Downloads

ATmega16 Interfacing LM35 Project File	Dow nloa d (/api/download/platform-attachment/246)

Downloads

LM35 Datasheet

Dow nloa d (/api/download/platform-attachment/247)

Comments

Comment

mehdiprht
(/users/mehdiprht/profile)
2018-11-11 07:39:17

Hi
are you sure about the .hex file ?
i think didn't work
Reply Like

faces666
(/users/faces666/profile)
2019-01-30 15:21:24 • Edited

Hello, you set the fusebit? The processor works on an internal 8MHz oscillator.
For the internal clock of 8MHz bits: CKSEL3..0 = "0100".
Setting all bits for the 8MHz oscillator:
http://mirley.firlej.org/files/ART_fuseM16_04B.gif
Reply Like

authorized
(/users/authorized/profile)
2019-01-31 17:14:34 • Edited

i think it may using internal clock.
as per datasheet
The device is shipped with default CKSEL = “0001” (Calibrated Internal RC Oscillator). you need to change it. e.g. for 8MHz CKSEL = "0100" .
in above program
#define F_CPU 8000000UL line says it using clock of 8MHz.
Reply Like

trojanhorsedigital
(/users/trojanhorsedigital/profile)
2019-03-17 16:44:53 • Edited

After Reading your adc_read() function i can say this wrong , bcz i read in data sheet the conversation result save in ADCL and ADCH, WHERE you have to read low bit first and after that high bit, in your code u dint use both resistors. Am i write sir ???
Reply Like

lokeshc
(/users/lokeshc/profile)
2019-05-01 15:36:38

Yes you are right. But here ADCW register is used which is 16-bit adc register.
Reply Like

senafitra5

(/users/senafitra5/profile)
2019-05-01 04:26:21
(/)
i have written a code about this lm35. and it includes a threshold too. pls check if it has wrong code.

```
#include <avr/io.h>
#include <util/delay.h>
#include "lcd-routines.h"
#include<stdio.h>
char buffer1[5];
//char buffer2[5];
char buffer3[5];

//int WertADC()
//{
// PIN
// ADMUX = 0x01;
// ADCSRA |= (1<<ADSC);
// while( ADCSRA&(1<<ADSC))
//ADSCRA = (1<<ADIF);
// return (ADC);
//}
int main()
{
DDRC=0;
_delay_ms(50);
ADCSRA = (1<<ADEN)|(1<<ADIE)|(1<<ADPS0)|(1<<ADPS1)|(1<<ADPS2);
ADMUX = (1<<REFS1)|(1<<REFS0);
ADMUX = 0x00;
int16_t Temp = 0;
char SHOWA[3];
int max = 70;
int min = 0;
lcd_init();
lcd_clear();
ADCSRA |= (1<<ADSC);
//ADC_init();
while(1)
{
Temp = ADC/4;
Temp = Temp * 0.48828125;
lcd_string("AKT:");
lcd_setcursor(8,1);
lcd_string("Max");
sprintf(buffer1,"%i",max);
lcd_string(buffer1);
lcd_setcursor(14,1);
lcd_string("°C");
lcd_setcursor(0,2);
lcd_string("TMP:");
itoa(Temp,SHOWA,10);
lcd_string(SHOWA);
//sprintf(buffer2,"%d",Temp);
//lcd_string(buffer2);
lcd_setcursor(8,2);
lcd_string("°C");
lcd_setcursor(10,2)
lcd_string("Min");
sprintf(buffer3,"%i",min);
lcd_string(buffer3);
lcd_setcursor(14,1);
lcd_string("°C");
```

```
if(Temp>max)
{ PORTB = 0x01; }
if (Temp<min)
{ PORTB = 0x02;}
else {PORTB = 0x04;}
_delay_ms(20);

lcd_clear();

}
return (0);
}
```

Reply Like

FaiqMunshi
(/users/FaiqMunshi/profile)
2023-11-07 13:52:04

You check it ?

Reply Like

shani0tnt
(/users/shani0tnt/profile)
2020-05-05 01:46:09

i am using the same code... i added little bit.. i want that when my temp is going to up(40'C) led shound be off and when temp is going low (30'C) then led should be again on.. My code is ..but am not getting result which i want

```
if ((int) celsius==40)
   {
LCD_Command(0x90);
LCD_String(" Led Off");
PORTD=0b0000000; // led off
if ((int) celsius==30) // if again temp getting low then ...
{
LCD_Command(0x99);
LCD_String("On");
PORTD=0b00000000; // led off
}
```

Reply Like

HarshGupta
(/users/HarshGupta/profile)
2021-01-09 20:37:01 • Edited

Did you got any solution

Reply Like

HarshRusia
(/users/HarshRusia/profile)
2021-01-11 11:09:27

you have to add. what it is doing in between 30 to 40'c

Reply Like

nandintsetseg
(/users/nandintsetseg/profile)
2020-11-24 12:31:31

Hi, is there another record that worked on the temperature sensor's atmega32? If so, please help

Reply Like