

## LAMPIRAN

### Program Arduino IDE

```
#include "ThingSpeak.h"
#include "Adafruit_MLX90614.h"
#include <Wire.h>
#include <WiFi.h>
#include <Ticker.h>

// Use this file to store all of the private credentials
// and connection details

#define SECRET_SSID "Pasmadala22" // replace MySSID with your WiFi network
    name
#define SECRET_PASS "Pasmadala22" // replace MyPassword with your WiFi
    password

#define SECRET_CH_ID 811953 // replace 0000000 with your channel number
#define SECRET_WRITE_APIKEY "K8MO36HXY7CU0LZI" // replace XYZ
    with your channel write API Key

Adafruit_MLX90614 mlx1 = Adafruit_MLX90614();
Adafruit_MLX90614 mlx2 = Adafruit_MLX90614(0x2B);

char ssid[] = SECRET_SSID; // your network SSID (name)
char pass[] = SECRET_PASS; // your network password
int keyIndex = 0; // your network key Index number (needed only for WEP)
WiFiClient client;
unsigned long myChannelNumber = SECRET_CH_ID;
const char * myWriteAPIKey = SECRET_WRITE_APIKEY;
float suhu1 = 0.0f;
float suhu2 = 0.0f;
const int warning = 5;
const int sending = 4;
int i;

Ticker ticker_led;
unsigned long previous_millis = 0;

void setup() {
    Serial.begin(9600); //Initialize serial
    pinMode(warning, OUTPUT);
    pinMode(sending, OUTPUT); // start ticker with 0.1
```

```

ticker_led.attach(0.1, tick_led);
mlx1.begin();
mlx2.begin();
WiFi.mode(WIFI_STA);
ThingSpeak.begin(client); // Initialize ThingSpeak
digitalWrite(warning, LOW);
digitalWrite(sending, LOW);
delay(300);
digitalWrite(warning, HIGH);
digitalWrite(sending, HIGH);
}

void loop() {
  wificonnect();
  //digitalWrite(sending, LOW);
  suhu1 = mlx1.readObjectTempC();
  suhu2 = mlx2.readObjectTempC();

  Serial.print("Suhu Bearing Atas:");Serial.print(suhu1, 2);Serial.print("*C\t");
  Serial.print("Suhu Bearing Bawah:");Serial.print(suhu2, 2);Serial.println("*C");
  alarm();
  unsigned long current_millis = millis();
  if(current_millis-previous_millis > 20000){
    kirim();
    previous_millis = current_millis;
  }
}

void wificonnect() {
  // Connect or reconnect to WiFi
  if (WiFi.status() != WL_CONNECTED) {
    Serial.print("Attempting to connect to SSID: ");
    Serial.println(SECRET_SSID);
    while (WiFi.status() != WL_CONNECTED) {
      WiFi.begin(ssid, pass); // Connect to WPA/WPA2 network. Change this line
      if using open or WEP network
      Serial.print(".");
      delay(5000);
    }
    ticker_led.detach();
    digitalWrite(sending, LOW);
    Serial.println("\nConnected.");
    Serial.println("IP address: ");
  }
}

```

```

        Serial.println(WiFi.localIP());
    }
}

void alarm() {
    if (suhu1 > 80.0 || suhu2 > 80.0) {
        //i++;
        digitalWrite(warning, LOW);
        delay(500);
        digitalWrite(warning, HIGH);
        delay(100);
        digitalWrite(warning, LOW);
        delay(500);
        digitalWrite(warning, HIGH);
        delay(100);
        digitalWrite(warning, LOW);
        delay(500);
        digitalWrite(warning, HIGH);
        delay(100);
        digitalWrite(warning, LOW);
        delay(500);
        digitalWrite(warning, HIGH);
        //delay(100);
        kirim();
        delay(20000);
    }
}

void kirim() {
    // start ticker with 0.3
    ticker_led.attach(0.3, tick_led);
    // set the fields with the values
    ThingSpeak.setField(1, suhu1); //masukkan nilai sensor ke field 1
    ThingSpeak.setField(2, suhu2); //masukkan nilai sensor ke field 2

    // write to the ThingSpeak channel
    int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);
    if (x == 200) {
        Serial.println("Channel update successful.");
        Serial.println((float) suhu1);
        Serial.println((float) suhu2);
        ticker_led.detach();
        ledKirim();
    }
}

```

```
    } else {  
        Serial.println("Problem updating channel. HTTP error code " + String(x));  
    }  
}  
  
void ledKirim() {  
    digitalWrite(sending, HIGH);  
    delay(200);  
    digitalWrite(sending, LOW);  
    delay(200);  
    digitalWrite(sending, HIGH);  
    delay(200);  
    digitalWrite(sending, LOW);  
}  
  
void tick_led() {  
    //toggle state  
    int state = digitalRead(sending); // get the current state LED pin  
    digitalWrite(sending, !state); // set pin to the opposite state  
}
```

## DATASHEET ESP-WROOM-32

### 1. Overview

ESP32-WROOM-32 is a powerful, generic Wi-Fi+BT+BLE MCU module that targets a wide variety of applications, ranging from low-power sensor networks to the most demanding tasks, such as voice encoding, music streaming and MP3 decoding.

At the core of this module is the ESP32-D0WDQ6 chip\*. The chip embedded is designed to be scalable and adaptive. There are two CPU cores that can be individually controlled, and the CPU clock frequency is adjustable from 80 MHz to 240 MHz. The user may also power off the CPU and make use of the low-power co-processor to constantly monitor the peripherals for changes or crossing of thresholds. ESP32 integrates a rich set of peripherals, ranging from capacitive touch sensors, Hall sensors, SD card interface, Ethernet, high-speed SPI, UART, I<sup>2</sup>S and I<sup>2</sup>C.

**Note:**

\* For details on the part numbers of the ESP32 family of chips, please refer to the document [ESP32 Datasheet](#).

The integration of Bluetooth, Bluetooth LE and Wi-Fi ensures that a wide range of applications can be targeted, and that the module is all-around: using Wi-Fi allows a large physical range and direct connection to the Internet through a Wi-Fi router, while using Bluetooth allows the user to conveniently connect to the phone or broadcast low energy beacons for its detection. The sleep current of the ESP32 chip is less than 5  $\mu$ A, making it suitable for battery powered and wearable electronics applications. The module supports a data rate of up to 150 Mbps, and 20 dBm output power at the antenna to ensure the widest physical range. As such the module does offer industry-leading specifications and the best performance for electronic integration, range, power consumption, and connectivity.

The operating system chosen for ESP32 is freeRTOS with LwIP; TLS 1.2 with hardware acceleration is built in as well. Secure (encrypted) over the air (OTA) upgrade is also supported, so that users can upgrade their products even after their release, at minimum cost and effort.

Table 1 provides the specifications of ESP32-WROOM-32.

**Table 1: ESP32-WROOM-32 Specifications**

Categories	Items	Specifications
Certification	RF certification	FCC/CE-RED/IC/TELEC/KCC/SRRC/NCC
	Wi-Fi certification	Wi-Fi Alliance
	Bluetooth certification	BQB
	Green certification	RoHS/REACH
Test	Reliability	HTOL/HTSL/uHAST/TCT/ESD
Wi-Fi	Protocols	802.11 b/g/n (802.11n up to 150 Mbps) A-MPDU and A-MSDU aggregation and 0.4 $\mu$ s guard interval support
	Frequency range	2.4 GHz ~ 2.5 GHz
Bluetooth	Protocols	Bluetooth v4.2 BR/EDR and BLE specification
	Radio	NZIF receiver with -97 dBm sensitivity
		Class-1, class-2 and class-3 transmitter
		AFH

## 1. Overview

Categories	Items	Specifications
	Audio	CVSD and SBC
Hardware	Module interfaces	SD card, UART, SPI, SDIO, I <sup>2</sup> C, LED PWM, Motor PWM, I <sup>2</sup> S, IR, pulse counter, GPIO, capacitive touch sensor, ADC, DAC
	On-chip sensor	Hall sensor
	Integrated crystal	40 MHz crystal
	Integrated SPI flash	4 MB
	Operating voltage/Power supply	2.7 V ~ 3.6 V
	Operating current	Average: 80 mA
	Minimum current delivered by power supply	500 mA
	Recommended operating temperature range	-40 °C ~ +85 °C
	Package size	(18.00±0.10) mm × (25.50±0.10) mm × (3.10±0.10) mm

## 2. Pin Definitions

### 2.1 Pin Layout

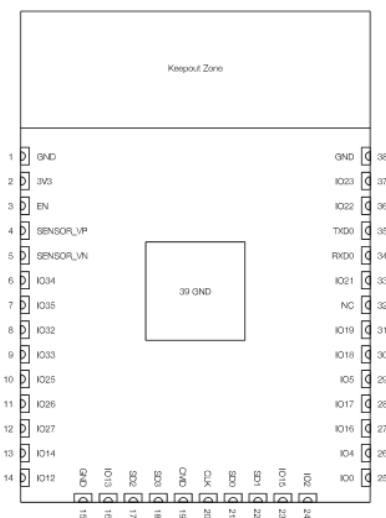


Figure 1: ESP32-WROOM-32 Pin Layout (Top View)

### 2.2 Pin Description

ESP32-WROOM-32 has 38 pins. See pin definitions in Table 2.

Table 2: Pin Definitions

Name	No.	Type	Function
GND	1	P	Ground
3V3	2	P	Power supply
EN	3	I	Module-enable signal. Active high.
SENSOR_VP	4	I	GPIO36, ADC1_CH0, RTC_GPIO0
SENSOR_VN	5	I	GPIO39, ADC1_CH3, RTC_GPIO3
IO34	6	I	GPIO34, ADC1_CH6, RTC_GPIO4
IO35	7	I	GPIO35, ADC1_CH7, RTC_GPIO5
IO32	8	I/O	GPIO32, XTAL_32K_P (32.768 kHz crystal oscillator input), ADC1_CH4, TOUCH9, RTC_GPIO9
IO33	9	I/O	GPIO33, XTAL_32K_N (32.768 kHz crystal oscillator output), ADC1_CH5, TOUCH8, RTC_GPIO8

## 2. Pin Definitions

Name	No.	Type	Function
IO25	10	I/O	GPIO25, DAC_1, ADC2_CH8, RTC_GPIO6, EMAC_RXD0
IO26	11	I/O	GPIO26, DAC_2, ADC2_CH9, RTC_GPIO7, EMAC_RXD1
IO27	12	I/O	GPIO27, ADC2_CH7, TOUCH7, RTC_GPIO17, EMAC_RX_DV
IO14	13	I/O	GPIO14, ADC2_CH6, TOUCH6, RTC_GPIO16, MTMS, HSPICLK, HS2_CLK, SD_CLK, EMAC_TXD2
IO12	14	I/O	GPIO12, ADC2_CH5, TOUCH5, RTC_GPIO15, MTDI, HSPIQ, HS2_DATA2, SD_DATA2, EMAC_TXD3
GND	15	P	Ground
IO13	16	I/O	GPIO13, ADC2_CH4, TOUCH4, RTC_GPIO14, MTCK, HSPID, HS2_DATA3, SD_DATA3, EMAC_RX_ER
SHD/SD2*	17	I/O	GPIO9, SD_DATA2, SPIHD, HS1_DATA2, U1RXD
SWP/SD3*	18	I/O	GPIO10, SD_DATA3, SPIWP, HS1_DATA3, U1TXD
SCS/CMD*	19	I/O	GPIO11, SD_CMD, SPICS0, HS1_CMD, U1RTS
SCK/CLK*	20	I/O	GPIO6, SD_CLK, SPICLK, HS1_CLK, U1CTS
SDO/SD0*	21	I/O	GPIO7, SD_DATA0, SPIQ, HS1_DATA0, U2RTS
SDI/SD1*	22	I/O	GPIO8, SD_DATA1, SPID, HS1_DATA1, U2CTS
IO15	23	I/O	GPIO15, ADC2_CH3, TOUCH3, MTDO, HSPICS0, RTC_GPIO13, HS2_CMD, SD_CMD, EMAC_RXD3
IO2	24	I/O	GPIO2, ADC2_CH2, TOUCH2, RTC_GPIO12, HSPWP, HS2_DATA0, SD_DATA0
IO0	25	I/O	GPIO0, ADC2_CH1, TOUCH1, RTC_GPIO11, CLK_OUT1, EMAC_TX_CLK
IO4	26	I/O	GPIO4, ADC2_CH0, TOUCH0, RTC_GPIO10, HSPHD, HS2_DATA1, SD_DATA1, EMAC_TX_ER
IO16	27	I/O	GPIO16, HS1_DATA4, U2RXD, EMAC_CLK_OUT
IO17	28	I/O	GPIO17, HS1_DATA5, U2TXD, EMAC_CLK_OUT_180
IO5	29	I/O	GPIO5, VSPICS0, HS1_DATA6, EMAC_RX_CLK
IO18	30	I/O	GPIO18, VSPICLK, HS1_DATA7
IO19	31	I/O	GPIO19, VSPIQ, U0CTS, EMAC_TXD0
NC	32	-	-
IO21	33	I/O	GPIO21, VSPIHD, EMAC_TX_EN
RXD0	34	I/O	GPIO3, U0RXD, CLK_OUT2
TXD0	35	I/O	GPIO1, U0TXD, CLK_OUT3, EMAC_RXD2
IO22	36	I/O	GPIO22, VSPIWP, U0RTS, EMAC_TXD1
IO23	37	I/O	GPIO23, VSPID, HS1_STROBE
GND	38	P	Ground

**Notice:**

\* Pins SCK/CLK, SDO/SD0, SDI/SD1, SHD/SD2, SWP/SD3 and SCS/CMD, namely, GPIO6 to GPIO11 are connected to the integrated SPI flash integrated on the module and are not recommended for other uses.

### 2.3 Strapping Pins

ESP32 has five strapping pins, which can be seen in Chapter 6 Schematics:



## 7. Peripheral Schematics

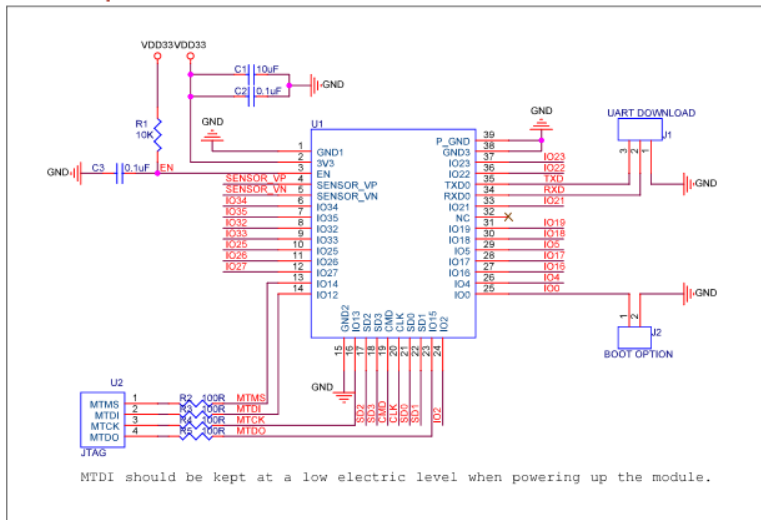


Figure 4: ESP32-WROOM-32 Peripheral Schematics

**Note:**

Soldering Pad 39 to the Ground of the base board is not necessary for a satisfactory thermal performance. If users do want to solder it, they need to ensure that the correct quantity of soldering paste is applied.

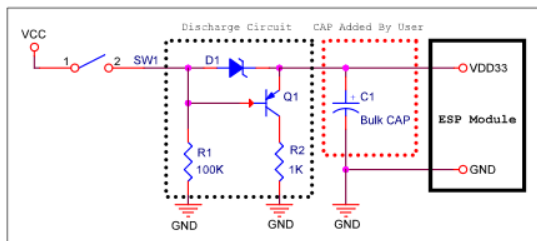


Figure 5: Discharge Circuit for VDD33 Rail

**Note:**

The discharge circuit can be applied in scenarios where ESP32 is powered on and off repeatedly by switching the power rails, and there is a large capacitor on the VDD33 rail. For details, please refer to Section **Power Scheme** in [ESP32 Datasheet](#).

**DATASHEET MLX90614**



**MLX90614 family**  
*Single and Dual Zone*  
**Infra Red Thermometer in TO-39**

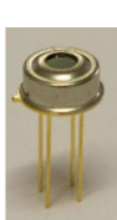
**Features and Benefits**

- Small size, low cost
- Easy to integrate
- Factory calibrated in wide temperature range:
  - 40...+125°C for sensor temperature and
  - 70...+380°C for object temperature.
- High accuracy of 0.5°C in a wide temperature range (0...+50°C for both Ta and To)
- High (medical) accuracy calibration
- Measurement resolution of 0.02°C
- Single and dual zone versions
- SMBus compatible digital interface
- Customizable PWM output for continuous reading
- Available in 3V and 5V versions
- Simple adaptation for 8...16V applications
- Sleep mode for reduced power consumption
- Different package options for applications and measurements versatility
- Automotive grade

**Applications Examples**

- High precision non-contact temperature measurements
- Thermal Comfort sensor for Mobile Air Conditioning control system
- Temperature sensing element for residential, commercial and industrial building air conditioning
- Windshield defogging
- Automotive blind angle detection
- Industrial temperature control of moving parts
- Temperature control in printers and copiers
- Home appliances with temperature control
- Healthcare
- Livestock monitoring
- Movement detection
- Multiple zone temperature control – up to 127 sensors can be read via common 2 wires
- Thermal relay / alert
- Body temperature measurement

**Ordering Information**



Part No.	Temperature Code	Package Code	- Option Code	Standard part	Packing form
MLX90614	E (-40°C...85°C) K (-40°C...125°C)	SF (TO-39)	- X X X (1) (2) (3)	-000	-TU

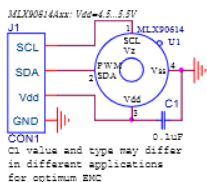
(1) Supply Voltage/ Accuracy  
 A - 5V  
 B - 3V  
 C - Reserved  
 D - 3V medical accuracy

(2) Number of thermopiles:  
 A – single zone  
 B – dual zone  
 C – gradient compensated\*

(3) Package options:  
 A – Standard package  
 B – Reserved  
 C – 35° FOV  
 D/E – Reserved  
 F – 10° FOV  
 G – Reserved  
 H – 12° FOV (refractive lens)  
 I – 5° FOV

**Example:**  
 MLX90614ESF-BAA-000-TU \* : See page 2

**1 Functional diagram**



**MLX90614 connection to SMBus**

**Figure 1: Typical application schematics**

**2 General Description**

The MLX90614 is an Infra Red thermometer for non contact temperature measurements. Both the IR sensitive thermopile detector chip and the signal conditioning ASSP are integrated in the same TO-39 can.

Thanks to its low noise amplifier, 17-bit ADC and powerful DSP unit, a high accuracy and resolution of the thermometer is achieved.

The thermometer comes factory calibrated with a digital PWM and SMBus (System Management Bus) output.

As a standard, the 10-bit PWM is configured to continuously transmit the measured temperature in range of -20...120°C, with an output resolution of 0.14°C.

The factory default POR setting is SMBus.



## MLX90614 family

Single and Dual Zone  
Infra Red Thermometer in TO-39

### General description (continued)

The MLX90614 is built from 2 chips developed and manufactured by Melexis:

- The Infra Red thermopile detector MLX81101
- The signal conditioning ASSP MLX90302, specially designed to process the output of IR sensor.

The device is available in an industry standard TO-39 package.

Thanks to the low noise amplifier, high resolution 17-bit ADC and powerful DSP unit of MLX90302 high accuracy and resolution of the thermometer is achieved. The calculated object and ambient temperatures are available in RAM of MLX90302 with resolution of 0.01°C. They are accessible by 2 wire serial SMBus compatible protocol (0.02°C resolution) or via 10-bit PWM (Pulse Width Modulated) output of the device.

The MLX90614 is factory calibrated in wide temperature ranges: -40...125°C for the ambient temperature and -70...380°C for the object temperature.

The measured value is the average temperature of all objects in the Field Of View of the sensor. The MLX90614 offers a standard accuracy of  $\pm 0.5^\circ\text{C}$  around room temperatures. A special version for medical applications exists offering an accuracy of  $\pm 0.2^\circ\text{C}$  in a limited temperature range around the human body temperature.

It is very important for the application designer to understand that these accuracies are only guaranteed and achievable when the sensor is in thermal equilibrium and under isothermal conditions (there are no temperature differences across the sensor package). The accuracy of the thermometer can be influenced by temperature differences in the package induced by causes like (among others): Hot electronics behind the sensor, heaters/coolers behind or beside the sensor or by a hot/cold object very close to the sensor that not only heats the sensing element in the thermometer but also the thermometer package.

This effect is especially relevant for thermometers with a small FOV like the xxC and xxF as the energy received by the sensor from the object is reduced. Therefore, Melexis has introduced the xCx version of the MLX90614. In these MLX90614xCx, the thermal gradients are measured internally and the measured temperature is compensated for them. In this way, the xCx version of the MLX90614 is much less sensitive to thermal gradients, but the effect is not totally eliminated. It is therefore important to avoid the causes of thermal gradients as much as possible or to shield the sensor from them.

As a standard, the MLX90614 is calibrated for an object emissivity of 1. It can be easily customized by the customer for any other emissivity in the range 0.1...1.0 without the need of recalibration with a black body.

The 10-bit PWM is as a standard configured to transmit continuously the measured object temperature for an object temperature range of -20...120°C with an output resolution of 0.14°C. The PWM can be easily customized for virtually any range desired by the customer by changing the content of 2 EEPROM cells. This has no effect on the factory calibration of the device.

The PWM pin can also be configured to act as a thermal relay (input is To), thus allowing for an easy and cost effective implementation in thermostats or temperature (freezing / boiling) alert applications. The temperature threshold is user programmable. In a SMBus system this feature can act as a processor interrupt that can trigger reading all slaves on the bus and to determine the precise condition.

The thermometer is available in 2 supply voltage options: 5V compatible or 3V (battery) compatible. The 5V can be easily adopted to operate from a higher supply voltage (8...16V, for example) by use of few external components (refer to "Applications information" section for details).

An optical filter (long-wave pass) that cuts off the visible and near infra-red radiant flux is integrated in the package to provide ambient and sunlight immunity. The wavelength pass band of this optical filter is from 5.5 till 14 $\mu\text{m}$  (except for xCH and xCI type of devices which incorporate uncoated silicon lens).



## MLX90614 family

Single and Dual Zone  
Infra Red Thermometer in TO-39

### 4 Glossary of Terms

PTAT	Proportional To Absolute Temperature sensor (package temperature)
POR	Power On Reset
HFO	High Frequency Oscillator (RC type)
DSP	Digital Signal Processing
FIR	Finite Impulse Response. Digital filter
IIR	Infinite Impulse Response. Digital filter
IR	Infra-Red
PWM	Pulse With Modulation
DC	Duty Cycle (of the PWM) ; Direct Current (for settled conditions specifications)
FOV	Field Of View
SDA,SCL	Serial DAta, Serial CLock – SMBus compatible communication pins
T <sub>a</sub>	Ambient Temperature measured from the chip – (the package temperature)
T <sub>o</sub>	Object Temperature, 'seen' from IR sensor
ESD	Electro-Static Discharge
EMC	Electro-Magnetic Compatibility
ASSP	Application Specific Standard Product
TBD	To Be Defined

Note: sometimes the MLX90614xxx is referred as "the module".

### 5 Maximum ratings

Parameter	MLX90614ESF-Axx	MLX90614ESF-Bxx MLX90614ESF-Dxx	MLX90614KSF-Axx
Supply Voltage, V <sub>DD</sub> (over voltage)	7V	5V	7V
Supply Voltage, V <sub>DD</sub> (operating)	5.5 V	3.6V	5.5V
Reverse Voltage	0.4 V		
Operating Temperature Range, T <sub>A</sub>	-40...+85°C		-40...+125°C
Storage Temperature Range, T <sub>S</sub>	-40...+125°C		-40...+125°C
ESD Sensitivity (AEC Q100 002)	2kV		
DC current into SCL / Vz (Vz mode)	2 mA		
DC sink current, SDA / PWM pin	25 mA		
DC source current, SDA / PWM pin	25 mA		
DC clamp current, SDA / PWM pin	25 mA		
DC clamp current, SCL pin	25 mA		

Table 1: Absolute maximum ratings for MLX90614

Exceeding the absolute maximum ratings may cause permanent damage.  
Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.



## MLX90614 family

Single and Dual Zone  
Infra Red Thermometer in TO-39

### 6 Pin definitions and descriptions

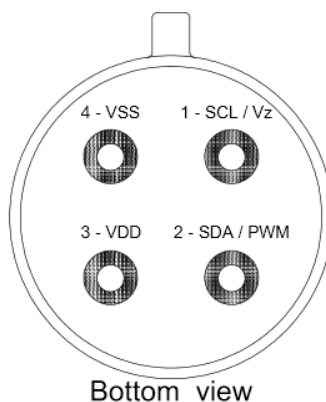


Figure 2: Pin description

Pin Name	Function
SCL / Vz	Serial clock input for 2 wire communications protocol. 5.7V zener is available at this pin for connection of external bipolar transistor to MLX90614Axx to supply the device from external 8 ...16V source.
SDA / PWM	Digital input / output. In normal mode the measured object temperature is available at this pin Pulse Width Modulated. In SMBus compatible mode the pin is automatically configured as open drain NMOS.
VDD	External supply voltage.
VSS	Ground. The metal can is also connected to this pin.

Table 2: Pin description MLX90614

Note: for +12V (+8...+16V) powered operation refer to the Application information section. For EMC and isothermal conditions reasons it is highly recommended not to use any electrical connection to the metal can except by the VSS pin.  
With the SCL / Vz and PWM / SDA pins operated in 2-wire interface mode, the input Schmitt trigger function is automatically enabled.



## MLX90614 family

Single and Dual Zone  
Infra Red Thermometer in TO-39

### 8 Detailed description

#### 8.1 Block diagram

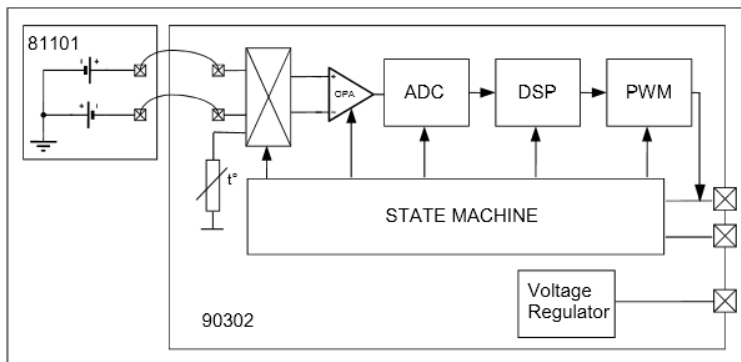


Figure 3: Block diagram

#### 8.2 Signal processing principle

The operation of the MLX90614 is controlled by an internal state machine, which controls the measurements and calculations of the object and ambient temperatures and does the post-processing of the temperatures to output them through the PWM output or the SMBus compatible interface.

The ASSP supports 2 IR sensors (second one not implemented in the MLX90614xAx). The output of the IR sensors is amplified by a low noise low offset chopper amplifier with programmable gain, converted by a Sigma Delta modulator to a single bit stream and fed to a powerful DSP for further processing. The signal is treated by programmable (by means of EEPROM content) FIR and IIR low pass filters for further reduction of the band width of the input signal to achieve the desired noise performance and refresh rate. The output of the IIR filter is the measurement result and is available in the internal RAM. 3 different cells are available: One for the on-board temperature sensor and 2 for the IR sensors.

Based on results of the above measurements, the corresponding ambient temperature  $T_a$  and object temperatures  $T_o$  are calculated. Both calculated temperatures have a resolution of  $0.01^\circ\text{C}$ . The data for  $T_a$  and  $T_o$  can be read in two ways: Reading RAM cells dedicated for this purpose via the 2-wire interface ( $0.02^\circ\text{C}$  resolution, fixed ranges), or through the PWM digital output (10 bit resolution, configurable range).

In the last step of the measurement cycle, the measured  $T_a$  and  $T_o$  are rescaled to the desired output resolution of the PWM and the recalculated data is loaded in the registers of the PWM state machine, which creates a constant frequency with a duty cycle representing the measured data.



## MLX90614 family

Single and Dual Zone  
Infra Red Thermometer in TO-39

### 8.3 Block description

#### 8.3.1 Amplifier

A low noise, low offset amplifier with programmable gain is used for amplifying the IR sensor voltage. By carefully designing the input modulator and balanced input impedance, the max offset of the system is 0.5 $\mu$ V.

#### 8.3.2 Supply regulator and POR

The module can operate from 3 different supplies:

VDD = 5V  $\rightarrow$  MLX90614Axxx

VDD = 3.3V  $\rightarrow$  MLX90614Bxxx (battery or regulated supply)

VDD = 8...16V  $\rightarrow$  MLX90614Axxx few external components are necessary please refer to "Applications

information" section for information about adopting higher voltage supplies.

The Power On Reset (POR) is connected to Vdd supply. The on-chip POR circuit provides an active (high) level of the POR signal when the Vdd voltage rises above approximately 0.5V and holds the entire MLX90614 in reset until the Vdd is higher than the specified POR threshold  $V_{POR}$ . During the time POR is active, the POR signal is available as an open drain at the PWM/SDA pin. After the MLX90614 exits the POR condition, the function programmed in EEPROM takes precedence for that pin.

#### 8.3.3 EEPROM

A limited number of addresses in the EEPROM memory can be changed by the customer. The whole EEPROM can be read through the SMBus interface.

EEPROM (32X16)			
Name	Address	Write access	
To <sub>max</sub>	0x00	Yes	
To <sub>min</sub>	0x01	Yes	
PWMCTRL	0x02	Yes	
Ta range	0x03	Yes	
Emissivity correction coefficient	0x04	Yes	
Config Register1	0x05	Yes	
Melexis reserved	0x06	No	
...	...	...	
Melexis reserved	0x0D	No	
SMBus address (LSByte only)	0x0E	Yes	
Melexis reserved	0x0F	Yes	
Melexis reserved	0x10	No	
...	...	...	
Melexis reserved	0x18	No	
Melexis reserved	0x19	Yes	
Melexis reserved	0x1A	No	
Melexis reserved	0x1B	No	
ID number	0x1C	No	
ID number	0x1D	No	
ID number	0x1E	No	
ID number	0x1F	No	

Table 5: EEPROM table

The addresses To<sub>max</sub>, To<sub>min</sub>, and Ta range are for customer dependent object and ambient temperature ranges. For details see section 8.5.3 below in this document

The address **Emissivity** contains the object emissivity (factory default 1.0 = 0xFFFF), 16 bit.

$$\text{Emissivity} = \text{dec2hex}[\text{round}(65535 \times \epsilon)]$$

Where dec2hex[round(X)] represents decimal to hexadecimal conversion with round-off to nearest value (not truncation). In this case the physical emissivity values are  $\epsilon = 0.1 \dots 1.0$ .

Erase (write 0) must take place before write of desired data is made.

