GYMCU90640 Module User Manual V1.0

I. Overview

GYMCU90640 is a low-cost non-contact infrared dot matrix temperature measurement module. Working voltage 3-5v, small size.

Its working principle is the law of blackbody radiation. The higher the temperature of the object, the infrared radiation emitted.

The stronger the capability, the temperature data is obtained through chip processing.

This module has two ways to read data, ie Serial port (TTL level) or I2C (chip itself) communication method. The baud rate of the serial port is 9600, 115200 and 460800 bps.

The product has a large number of temperature measuring lattices. Can distinguish the human body type in the general environment.

There are two ways of continuous output and query output, which can adapt to different working environments. Connect to all microcontrollers and computers.

The module retains the I2C interface of the MLX90640 chip itself, and the module PS is connected to the GND in SET point. The MCU of the module itself does not work, and the MLX90640 can be directly operated by the I2C.

II Features

- Small size
- Large number of lattices
- Serial communication port
- I2C self communication

Technical Parameters

name	parameter
Range	-40º ~ 300º
Resolution	0.1º
Accuracy	±2º
Repeatability	±2º [1]
Response frequency	8 Hz（460800bps）
Operating Voltage	3~5 V
Working current	42mA
Operating temperature	-20º ~ 85º
Storage temperature	-40º ~ 125º

[1] Please refer to the chip manual on page 47

size	15.5mm×25mm

III Product application

- non-contact temperature measurement
- moving object temperature measurement
- visual graphic temperature measurement
- personnel presence testing
- robot

III Pin description

Pin1	VCC	Power + (3v-5v)
Pin 2	GND	Power ground
Pin3	RX	Serial data reception
Pin 4	TX	Serial data transmission
Pin 5	SCL	MLX90640 SCL
Pin 6	SDA	MLX90640 SDA
Pin 7	B0	Internal use, no connection, dangling
Pin 8	PS	Module function switching

IV Serial port communication protocol:

1. Serial communication parameters (default baud rate value 115200 bps, can be set by software):

Baud rate: 9600 bps	Check digit: N	Data bits: 8	Stop bit: 1
Baud rate: 115200 bps	Check digit: N	Data bits: 8	Stop bit: 1
Baud rate: 460800 bps	Check digit: N	Data bits: 8	Stop bit: 1

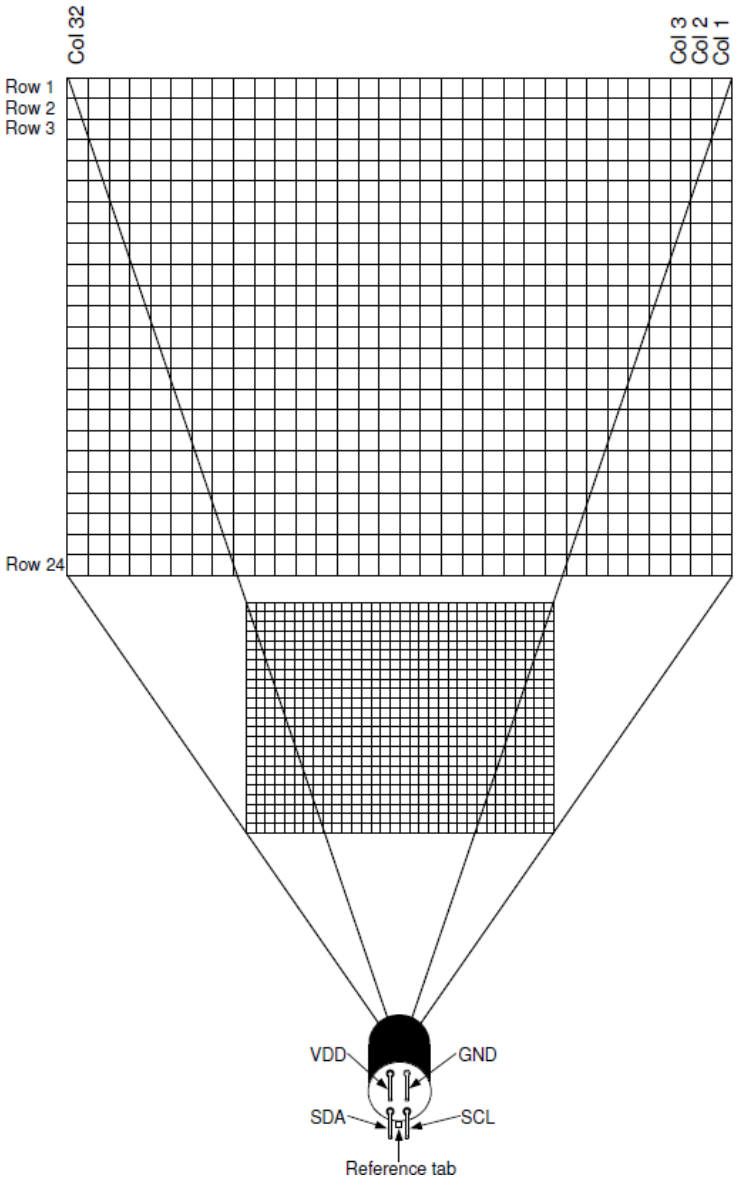
2. Module output format, each frame contains 1544 bytes (hexadecimal):

1. Byte 0:	0x5A	Frame header flag
2. Byte 1:	0x5A	Frame header flag
3. Byte 2:	0x02	Low data volume 8 digits
4. Byte 3:	0x06	High data volume 8 digits
5. Byte 4:	0x00~0xFF	Target temperature data 1 low 8 digits
6. Byte 5:	0x00~0xFF	Target temperature data 1 high 8 digits
7. Byte 6:	0x00~0xFF	Target temperature data 2 low 8 bits
8. Byte 7:	0x00~0xFF	Target temperature data 2 high 8 digits
9.Byte xx:	0x00~0xFF	Target temperature data xx lower 8 bits
10. Byte xx:	0x00~0xFF	Target temperature data xx high 8 bits
11. Byte1540:	0x00~0xFF	MLX90640 has a low temperature of 8 bits
12. Byte1541:	0x00~0xFF	MLX90640 has a high temperature of 8 bits
13. Byte1542:	0x00~0xFF	Checksum low 8 bits
14. Byte1543:	0x00~0xFF	Inspection and high 8 digits

The meaning of the byte representation:

byte0~byte1	Frame header
byte2~byte3	The data amount of this frame = byte3*256+byte2 (a)
byte4~ byte1539	Temperature dot matrix, target object 768 points temperature, one for every two bytes Temperature, which is 100 times the actual temperature; For example: temperature of point 1 = (byte5 * 256 + byte 4) / 100 (°C) Point temperature of 768 = (byte1539 * 256 + byte 1538) / 100 (°C)
byte1540~byte1541	The MLX90640 is 100 times its own temperature. It can also be used as an ambient temperature. TA = (byte1541*256+ byte1540)/100(°C)
byte1542~byte1543	The cumulative sum of the first 771 words, retaining 16 bits. See below for details

3. Data calculation method



Data magnification:
The temperature is amplified by 100 times and output; data analysis:

For example, one data frame: <5A5A-0206-6E0E-690E-5A0E-XXXX-050E-8D0E-D540>

Byte0~ Byte1---0x5A0x5A represents the frame header;

Byte2~ Byte3---0x0206 indicates data volume = 0x06 * 256 + 0x02 = 1538 temperature data (including target data and MLX90640 own temperature data)

Byte4~ Byte1539---indicates the temperature data of 768 points in the above figure.
The output order is once (Col 1, Row 1) → (Col 32, Row 1) → (Col 1, Row 2) → (Col 32, Row 2) → (Col 1, Row XX) → (Col 1, Row XX) → (Col 1, Row 24) → (Col 32, Row 24)

Note: (Col 1, Row 1) starts in the upper right corner of the above image.

Example data calculation: one frame of data:

<5A5A-0206-6E0E-690E-5A0E-XXXX-050E-8D0E-D540>

$$T_{\text{Col 1,Row 1}} = \frac{0x0E * 256 + 0x6E}{100} = 36.94\ ^{\circ}\text{C}$$

$$T_{\text{Col 2,Row 1}} = \frac{0x0E * 256 + 0x69}{100} = 36.89\ ^{\circ}\text{C}$$

$$\vdots$$

$$T_{\text{Col 32,Row24}} = \frac{0x0E * 256 + 0x50}{100} = 36.64\ ^{\circ}\text{C}$$

Byte1540--- Byte1541 represents the MLX90640's own temperature data.

$$\text{TA} = \frac{0x0E * 256 + 0x8D}{100} = 37.25\ ^{\circ}\text{C}$$

Byte1542--- Byte1543 represents the cumulative sum of the first 771 words, each word is 16bit. Word 1=0x5A5A
Word 2 = 0x0602 (i.e. the amount of data)
Word 3 = 0x0E6E (i.e. the temperature data of point 1)
⋮
Word 770 = 0x0E05 (i.e. temperature data at point 768)
Word 771 = 0x0E8D (i.e. temperature data of MLX90640)
Checksum = word 1 + word 2+ word 3 + word XX + word 700 + word 771 = Byte1543 * 256 + Byte 1542
See the attached routine for details.

4. Instruction byte, sent by the external controller to the module (hexadecimal)

The instructions sent to the module are four bytes:

Baud rate setting command:
9600 setting instruction ----------0xA5+0x15+0x01+0xBB
115200 setting instructions -------0xA5+0x15+0x02+0xBC
460800 setting instruction ---------0xA5+0x15+0x03+0xBD

Module update frequency setting command:
0.5hz setting instruction ----0xA5+0x25+0x00+0xCA
1hz setting instruction ------0xA5+0x25+0x01+0xCB
2hz setting instruction ------0xA5+0x25+0x02+0xCC
4hz setting command -------0xA5+0x25+0x03+0xCD
8hz setting command -------0xA5+0x25+0x04+0xCE

Automatic / Query Setup Instructions:
Query output data command -------0xA5+0x35+0x01+0xDB
Automatic output data command -------0xA5+0x35+0x02+0xDC

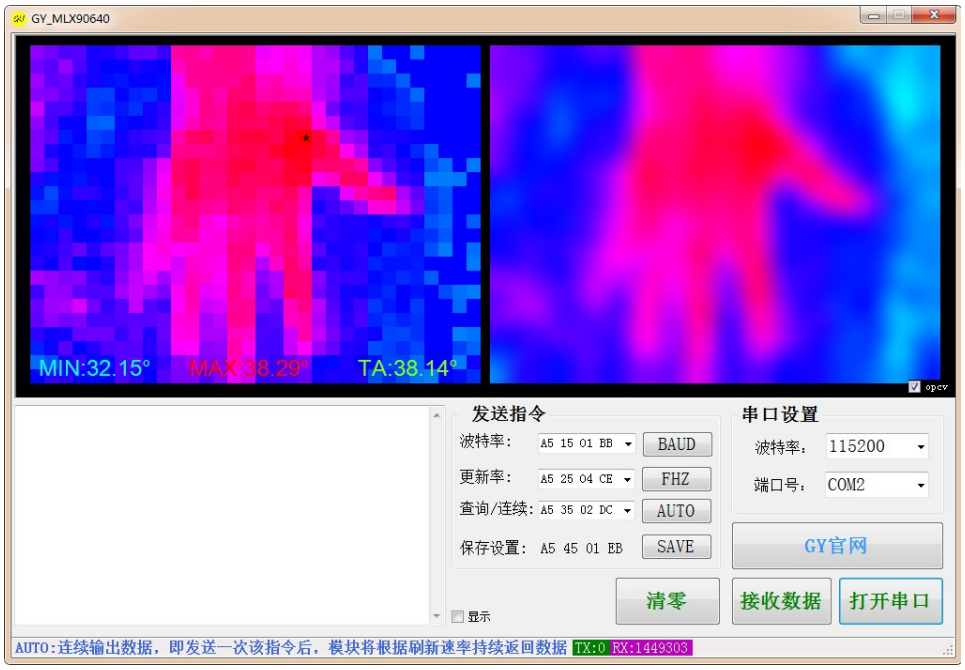
Emissivity setting command: 0xA5 +0x45 +0xXX+sum (8bit checksum)
For example, the emissivity of the human body is generally 0.95, 0xXX is 100 times 0.95, that is, 95=0x5f, then the order is: 0xA5+0x45+0x5F+0x49;
Note: The emissivity is up to 1; that is, 0xXX is max. 100=0x64; after launch, the module immediately calculates the target temperature according to the set emissivity. If you want to save in flash, please send a save command;

Emissivity query command: 0xA5 +0x55+ 0x01+0xFB
Module return frame: 0x5A + 0x5A + 0xXX + sum (8bit checksum) 0xXX is the emissivity of the module;
For example, if [5A5A5F13] is returned, then 0xXX=0x5F=95, that is, the emissivity is 95/100=0.95;

Save the setup command:
Save setting command ----------0xA5+0x65+0x01+0x0B
Save Setup Command: Indicates that the current baud rate setting, module update frequency setting, auto/query and emissivity settings are saved to flash, and restarted and then run according to the saved settings.

I2C mode:
When the module PS is connected to the GND or SET point, the function is read by the user. MLX90640 chip data, it is recommended that the memory RAM is greater than 20k and above.

Host computer:



After the computer is connected to the module via FT232, the upper computer uses the steps (as shown in the figure above):

1. After selecting the corresponding port number and baud rate, open the serial port. The module powers up by default and outputs continuously.

2. After sending the baud rate, update rate and query/continuous commands, the save command must be sent at the end. The module is powered off and the power is turned on again.

V. The end

1. Then the PS pin is grounded, after the power is turned off and restarted, the module enters the IIC mode. The customer can operate the sensor by himself. The module MCU does not perform any operation on the sensor, and the MCU does not consume current.
2. Module I / O is TTL level, can be directly connected to the serial port of the microcontroller, can be directly connected with the chip, such as CH340, FT232, but can not to be directly connected with the computer nine-pin serial port.