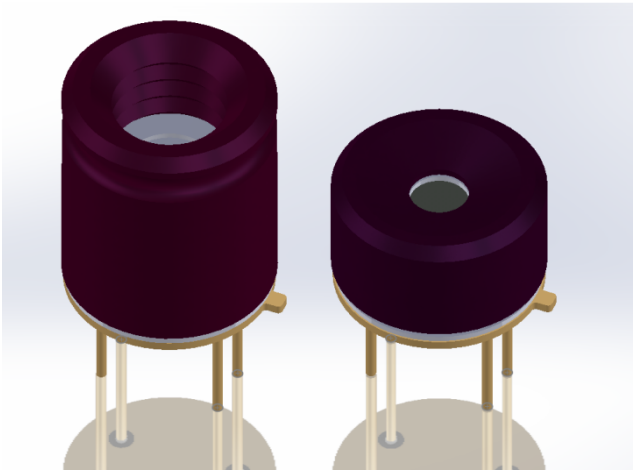
MLX90640 32x24 IR array

Short form Datasheet

1. Features and Benefits

- Small size, low cost 32x24 pixels IR array
- Easy to integrate
- Industry standard four lead TO39 package
- Factory calibrated
- I^2C compatible digital interface
- Programmable frame rate 0,5Hz…32Hz
- 3V supply voltage
- 2 FOV options – 55°x35° and 110°x75°
- Operating temperature -40°C ÷ 85°C
- Target temperature -40°C ÷ 300°C
- Complies with RoHS regulations



2. Application Examples

- Temperature sensing in residential, industrial and commercial air conditioning
- Home appliances with temperature control
- Thermal Comfort sensor in automotive Air Conditioning control systems
- Passenger detection and classification
- Microwave ovens
- Industrial temperature control
- Identifying thermal leaks in homes
- Security / safety gates
- Presence detection / Person localization

3. Description

The MLX90640 is a fully calibrated 32x24 pixels IR array in an industry standard 4-lead TO39 package with digital interface

The MLX90640 contains 768 FIR pixels. An ambient sensor is integrated to measure the ambient temperature of the chip and supply sensor to measure the VDD. The outputs of all sensors IR, Ta and VDD are stored in internal RAM and are accessible through I^2C.

Contents

4. Ordering Information

Product	Temperature	Package	Option Code	Custom Configuration	Packing Form	Definition
MLX90640	E	SF	BAA	000	TU	32x24 IR array
MLX90640	E	SF	BAB	000	TU	32x24 IR array

Legend:

Temperature Code:	**E: -40°C to 85°C**
Package Code:	"SF" for TO39 package
Option Code:	BAA – FOV = 110°x75° BAB – FOV = 50°x35°
Custom configuration	000 – standard product
Packing Form:	"TU" - Tubes
Ordering Example:	"MLX90640ESF-BAA-000-TU"

Table 1 Ordering information

5. Glossary of Terms

TC	**T**emperature **C**oefficient (in ppm/°C)
POR	**P**ower **O**n **R**eset
IR	**I**nfra-**R**ed
Ta	**A**mbient **T**emperature – the temperature of the TO39 package
IR data	**I**nfrared **d**ata (raw data from ADC proportional to IR energy received by the sensor)
ADC	**A**nalog To **D**igital **C**onverter
TGC	**T**emperature **G**radient **C**oefficient
FOV	**F**ield **O**f **V**iew
nFOV	**F**ield **O**f **V**iew of the N-th pixel
I^2C	**I**nter-**I**ntegrated **C**ircuit communication protocol
SDA	**S**erial **Da**ta
SCL	**S**erial **Cl**ock
LSB	**L**east **S**ignificant **B**it
MSB	**M**ost **S**ignificant **B**it
Fps	**F**rames **p**er **S**econd – data refresh rate
MD	**M**aster **D**evice
SD	**S**lave **D**evice
ASP	**A**nalog **S**ignal **P**rocessing
DSP	**D**igital **S**ignal **P**rocessing
ESD	**E**lectro **S**tatic **D**ischarge
EMC	**E**lectro **M**agnetic **C**ompatibility
NC	**N**ot **C**onnected
NA	**N**ot **A**pplicable

Table 2 Glosarry of terms

6. Pin Definitions and Descriptions

6.1. Pin Definition

Pin #	Name	Description
1	SDA	I^2C serial data (input / output)
2	V_{DD}	Positive supply
3	GND	Negative supply (Ground)
4	SCL	I^2C serial clock (input only)

Table 3 Pin definition

6.2. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage (over voltage)	V_{DD}			5	V	
Supply Voltage (operating max voltage)	V_{DD}			3.6		
Reverse Voltage (each pin)				-0.3	V	
Operating Temperature	T_{AMB}	-40		+85	°C	
Storage Temperature	T_{ST}	-40		+125	°C	
ESD sensitivity (AEC Q100 002)		2			kV	
SDA DC sink current				40	mA	

Table 4 Absolute maximum ratings

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

7. Detailed General Description

7.1. Pixel position

The array consists of 768 IR sensors (also called pixels). Each pixel is identified with its row and column position as Pix(*i*,*j*) where ***i*** is its row number (from 1 to 24) and ***j*** is its column number (from 1 to 32)

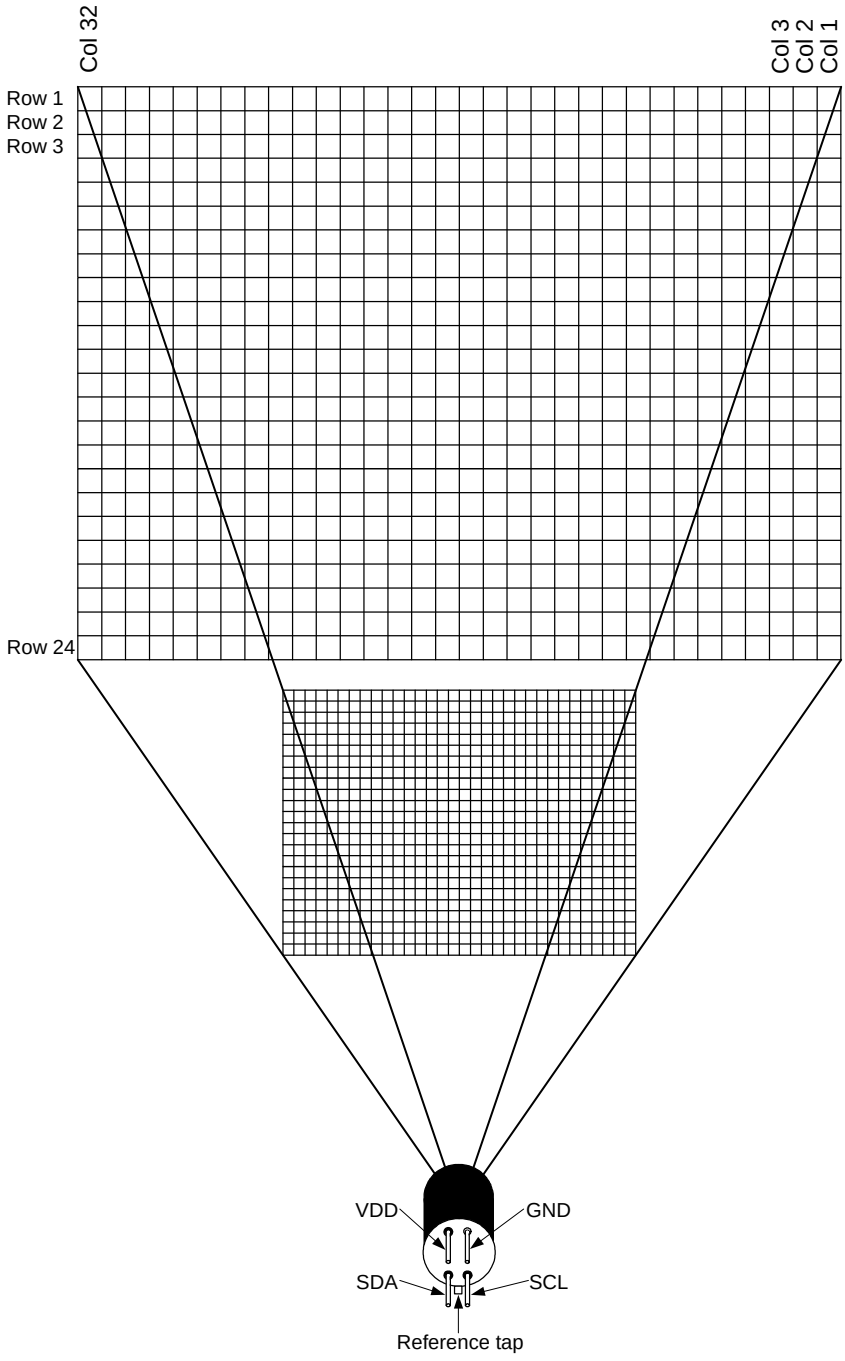


Figure 1 Pixel in the whole FOV

7.2. Communication protocol

Low level

Start / Stop conditions

Each communication session is initiated by a START condition and ends with a STOP condition. A START condition is initiated by a HIGH to LOW transition of the SDA while a STOP is generated by a LOW to HIGH transition. Both changes must be done while the SCL is HIGH.

Device addressing

The master is addressing the slave device by sending a 7-bit slave address after the START condition. The first seven bits are dedicated for the address and the 8th is Read/Write (R/W) bit. This bit indicates the direction of the transfer:

- Read (HIGH) means that the master will read the data from the slave
- Write (LOW) means that the master will send data to the slave

Acknowledge

During the 9th clock following every byte transfer the transmitter releases the SDA line. The receiver acknowledges (ACK) receiving the byte by pulling SDA line to low or does not acknowledge (NoACK) by letting the SDA 'HIGH'.

I²C command format

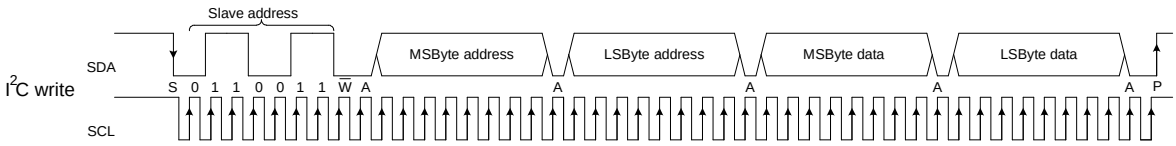


Figure 2 I²C write command format (default SA=0x33 is used)

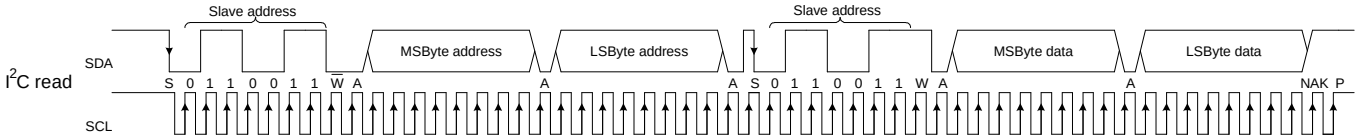


Figure 3 I²C read command format (default SA=0x33 is used)

7.3. Device modes

The device can operate in following modes:

- Normal mode
- Step mode

Normal mode

In this mode the measurements are constantly running. Depending on the selected frame rate Fps in the control register, the data for IR pixels and Ta will be updated in the RAM each 1/Fps seconds. In this mode the external microcontroller has full access to the internal registers and memories of the device.

Step mode

This mode is foreseen for single measurements triggered by an external device (microcontroller). Entering this mode is possible by writing the appropriate code in the configuration register. A measurement is triggered by setting the start measurement bit to 1 in status register.

The measurement time is $\frac{1}{F_{ps}}$

A flag bit in Status register (bit 0x03) is dedicated in order to be able to check whenever the measurement is done.

8. General Electrical Specifications

Electrical Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply Voltage	V_{DD}	2.9	3	3.6	V	
Supply Current	I_{DD}	8	10	14	mA	
POR level up digital	V_{POR_UP}	0.9		2.0	V	VDD rising
POR level down digital	V_{POR_DOWN}			1.95	V	VDD falling
POR level up analog	V_{POR_UP}	2.2		2.6	V	VDD rising
POR level down analog	V_{POR_DOWN}			2.55	V	VDD falling
POR hysteresis	V_{POR_hys}		50		mV	
Input high voltage (SDA, SCL)	V_{IH}	$0.7*V_{DD}$			V	Over Ta and V_{DD}
Input low voltage (SDA, SCL)	V_{LOW}			$0.3*V_{DD}$	V	Over Ta and V_{DD}
SDA output low voltage	V_{OL}			0.4	V	Over Ta and V_{DD} I_{SINK}=3mA
SDA leakage	I_{SDA_leak}			±10	µA	V_{SDA}=3.6V, Ta=125°C
SCL leakage	I_{SCL_leak}			±10	µA	V_{SCL}=3.6V, Ta=125°C
SDA capacitance	C_{SDA}			10	pF	
SCL capacitance	C_{SCL}			10	pF	
Acknowledge setup time	$T_{SUAC(MD)}$			0.45	µs	
Acknowledge hold time	$T_{DUAC(MD)}$			0.45	µs	
Acknowledge setup time	$T_{SUAC(SD)}$			0.45	µs	
Acknowledge hold time	$T_{DUAC(SD)}$			0.45	µs	
I^2C clock frequency	F_{I2C}			1	MHz	
Erase/write cycles		TBD			times	Ta=25°C
Erase/write cycles		TBD			times	Ta=125°C, erase/write at high temperature must be checked, avoid
Write cell time	T_{WRITE}			5	ms	

Table 5 Electrical specification

9. Mechanical drawings

FOV 55°

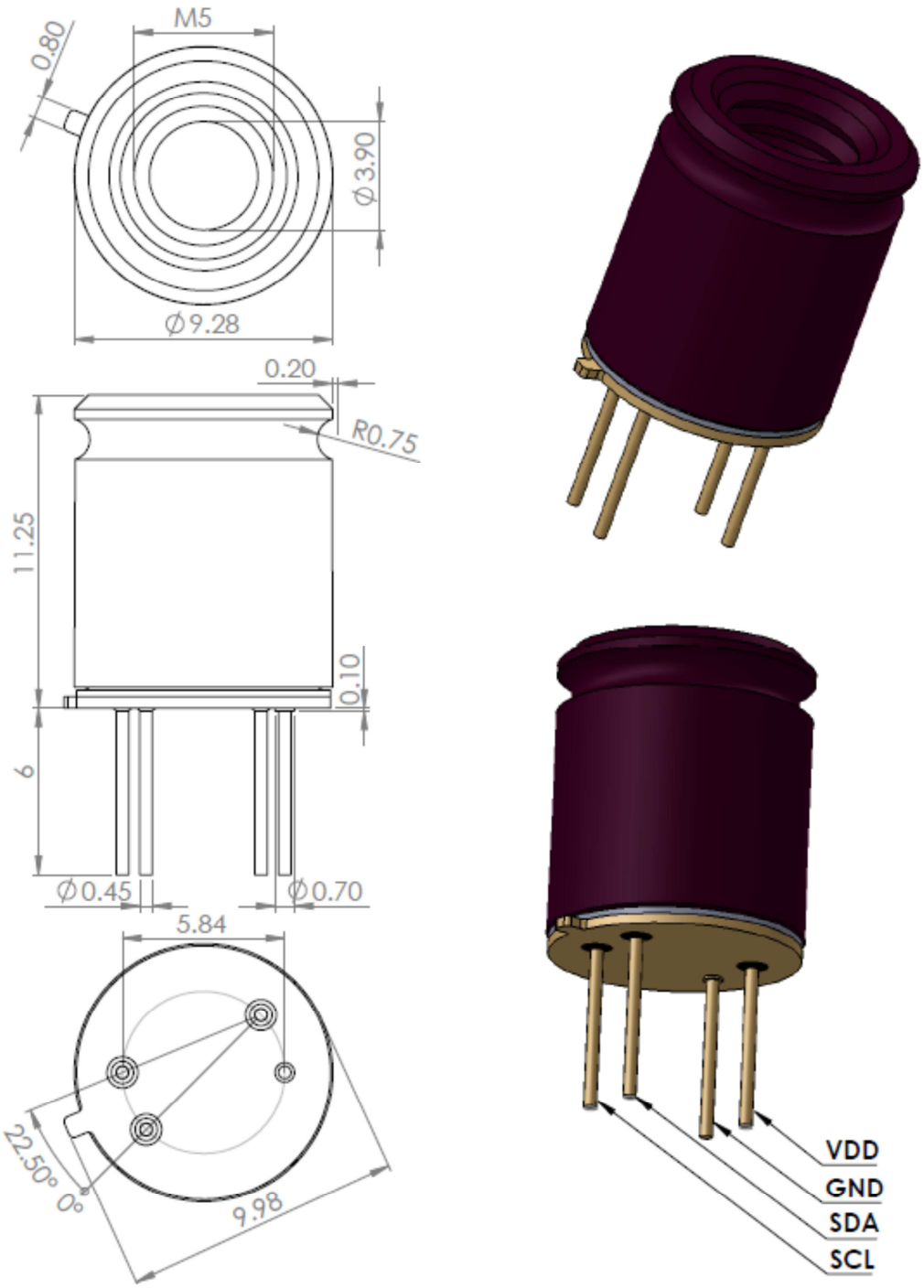


Figure 4 Mechanical drawing of 55° FOV device

FOV 110°

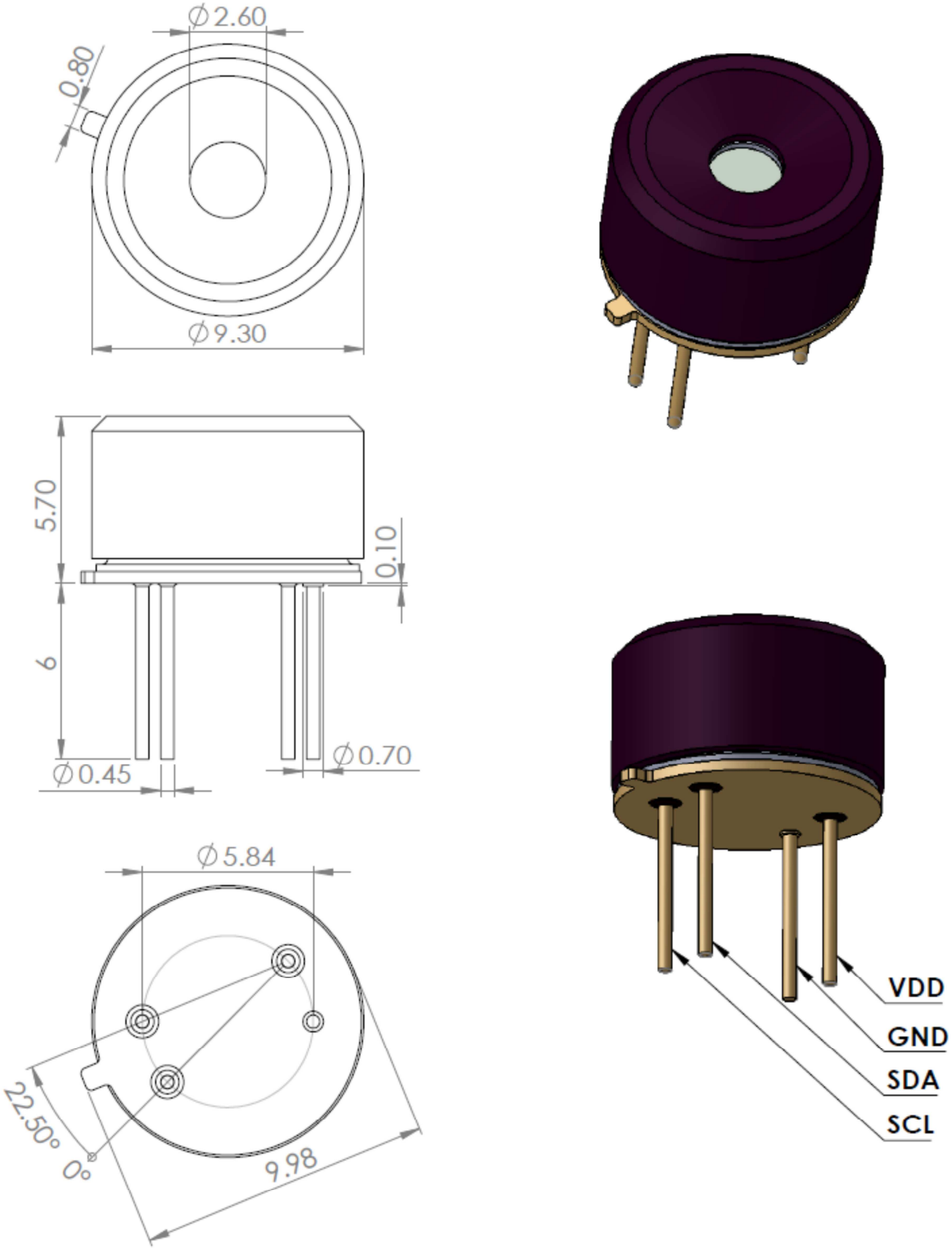


Figure 5 Mechanical drawing of 110° FOV device

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