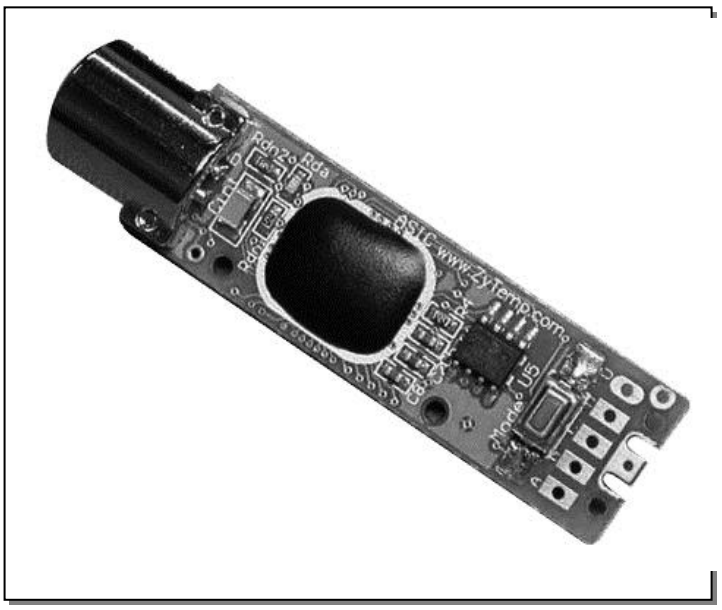
TN0pm2 Infrared Thermometer Module

User Manual



ZyTemp
A new way to measure temperature

Contents

1 General Description

Edition July 2006

Limited Warranty:
This data sheet contains information specific to products manufactured at the time of its publication, Contents herein do not constitute a warranty.

Trademark Acknowledgements:
All trademarks are the property of their respective owners.

2 Theory of Operation

2.1 Principles of Operation

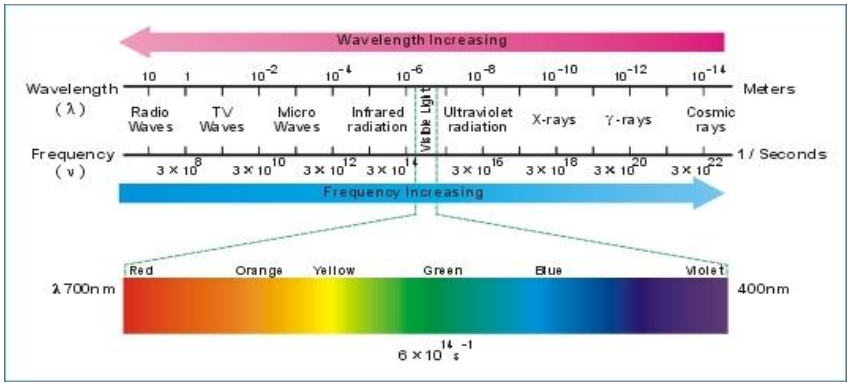


Fig 1. the Infrared Radiation Spectreum

Infrared, just like any light ray, is an Electromagnetic Radiation, with lower frequency (or longer wavelength) than visual light. Anything above absolute zero (-273.15 degrees Celsius or 0 degrees Kelvin), radiates in the infrared. Even ice cube, snow, your refrigerator emit infrared.

The **Stefan-Boltzmann Law**, where the total radiation energy is proportional to the fourth power of the absolute temperature and **Wien Displacement Law**, the product of the peak wavelength and the temperature is found to be a constant, are implemented in the TNm infrared thermometer module. The infrared radiation of measure target is collected by a infrared mirror through a IR filter of 5 or 8um cut in frequency to the infrared thermopile detector. The detector signal will be amplified and digitalize by the low noise and high linearity OP and AD convertor. The ambient temperature sensor(usually included in the same package as the thermopile detector) is set in the space near the optical system to detect the fast change of the ambient temperature. The signal processing section receives the signals from these temperature sensors to calculate the target surface temperature by a mathematical algorithm.

2.2 Features of Design

The TNm infrared thermometer module is specially designed for a high sensitivity, high accuracy, low noise and low power consumption. A number of design features contribute to the performance:

- MEMS thermopile detector and a high accurate ambient temperature compensation technics care used for the TNm infrared thermometer module.
- ZyTemp has developed a proprietary Infrared-System-On-Chip device that integrates all hardware items onto one IC. Using this innovative SoC technology, TNm infrared thermometer module has become a highly affordable and compact product.
- ZyTemp's products can faithfully withstand a thermal shock of 10degC/18degF. Our products are adept in maintaining accuracies under widely changing environmental conditions. For example, the errors from environmental changes of older IRTs can reach 1.6degC, requiring up to 30 minutes to stabilize, while ZyTemp's TNm error differential is only 0.7degC, needing only 7 minutes to restabilize.
- TNm products operate from a 3 Volt power supply, while many other older IRTs still require a 9 Volt supply.
- ZyTemp has maintained a NIST or National Measurement Laboratory traceable Temperature Primary Standard. All the TNm products are calibrated under traceable infrared standard sources. The calibration data and serial number are saved in a EEPROM on the module.

2.3 Field of View

What is D:S = 1:1
This device has a D:S = 1:1
Distance : Spot = 1:1

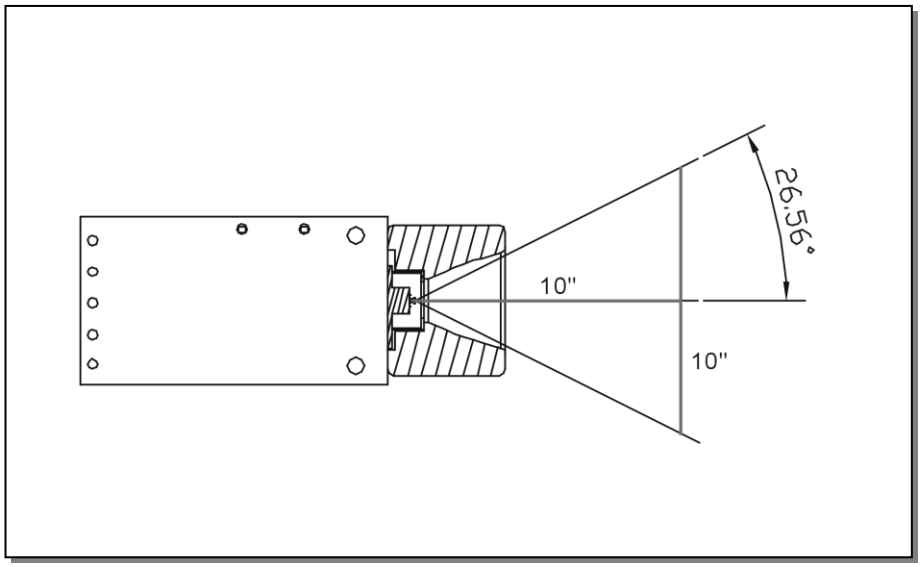


Fig 2. Field of View

When the Distance is 10 inch, then the measurement spot size is also 10 inch.
When the Distance is 20 inch, then the measurement spot size is also 20 inch.
In other words, the FOV(Field of View) is 26.6 x 2 = 53.2 degree

Beware the Vignette
Good Design, No Vignette

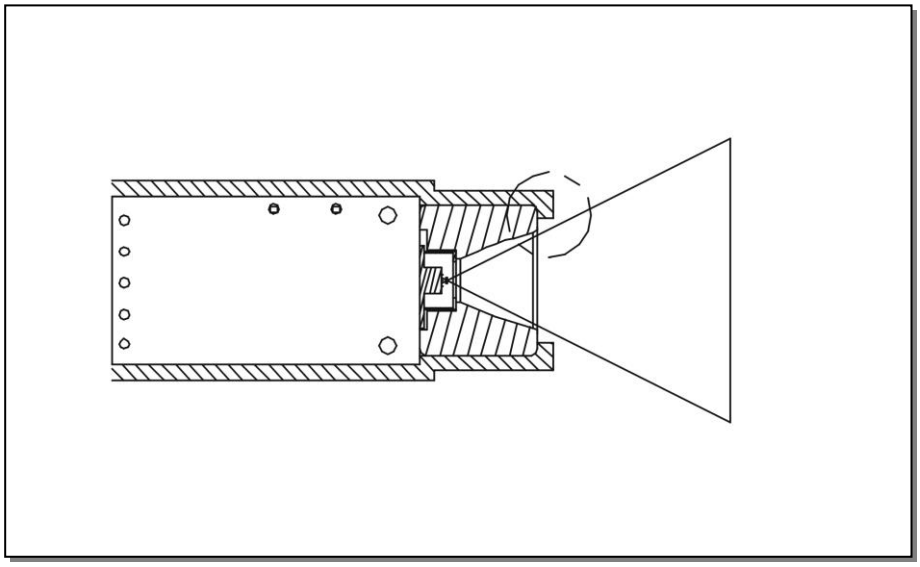


Fig 3. Good Design Field of View

Bad Design Vignette
The Sensor “see” the edge of the housing
So the measurement in fact is the averaging of the real target and the edge of housing.

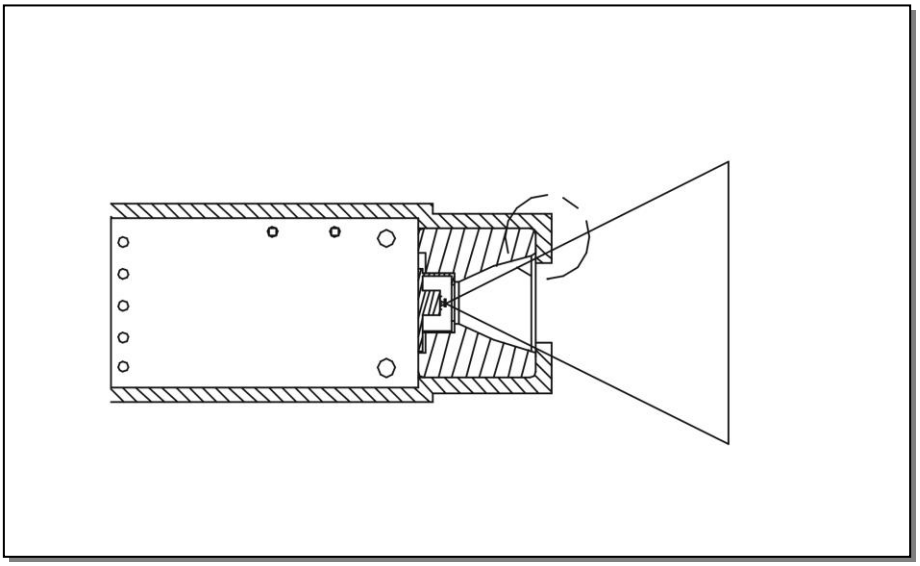


Fig 4. Bad Design Field of View

2.4 Emissivity

Understanding an object's emissivity, or its characteristic "radiance" is a critical component in the proper handling of infrared measurements. Concisely, emissivity is the ratio of radiation emitted by a surface or blackbody and its theoretical radiation predicted from **Planck's law**. A material's surface emissivity is measured by the amount of energy emitted when the surface is directly observed. There are many variables that affect a specific object's emissivity, such as the wavelength of interest, field of view, the geometric shape of the blackbody, and temperature. However, for the purposes and applications of the infrared thermometer user, a comprehensive table showing the emissivity at corresponding temperatures of various surfaces and objects is displayed.
Please visit ZyTemp’s website: http://www.zytemp.com/infrared/emissivity.asp to check the emissivity of the materials of interested.

3 Specification

3.1 Absolute Maximum Rating

Characteristics	Symbol	Ratings
DC Supply Voltage	V_+	<7.0V
Input Voltage Range	V_{IN}	-0.5V to V_+ + 0.5V

Note: Stresses beyond those given in the Absolute Maximum Rating table may cause operational errors or damage to the device. For normal operational conditions see AC/DC Electrical Characteristics.

3.2 DC Characteristics

(VDD = 3.0V, T_A = 25℃)

Characteristics	Symbol	Limit			Unit	Test condition
		Min	Typ.	Max		
Operating Voltage	VDD	2.5	-	3.6	V	
Operating Current	I_{OP}	-	4	6	mA	VDD = 3.0V, F_{CPU} = 600KHz
Standby Current	I_{STBY}	-	2	3	μA	VDD = 3.0V
Input High Level	V_{IH}	2.0	-	-	V	VDD = 3.0V
Input Low Level	V_{IL}	-	-	0.8	V	VDD = 3.0V
Output High I	I_{OH}	-	-2.0	-	mA	VDD = 3.0V, V_{OH} = 2.4V
Output Sink I	I_{OL}	-	2.5	-	mA	VDD = 3.0V, V_{OH} = 0.8V

3.3 Measurement Specification

Measurement Range	-33~220°C / -27~428°F
Operating Range	-10~50°C / 14~122°F
Accuracy Tobj=15~35°C, Tamb=25°C	+/-0.6°C
Full Range Accuracy, Tamb=23+/-3°C	+/-2.5%, 2.5°C
Resolution	0.1°C/0.1°F
Response Time (90%)	1sec
D:S	1:1
Emissivity	0.95 Fixed
Update Frequency	1.4Hz
Dimension	12x1.5x58mm
Wave Length	5um-14um
Weight	4.25 g
Power Supply	3V

3.4 Pin Assignment of TN0,TN9

Warning: The Dimension in this drawing is for reference only.
For actual dimension, please contact us: Market234@ZyTemp.com

V: Vdd **G**: GND
A: Action Pin (***pull low*** to measure, ***floating*** while to Write Data into the IRT)
Note: TN0; TN9 has the same pin assignment.

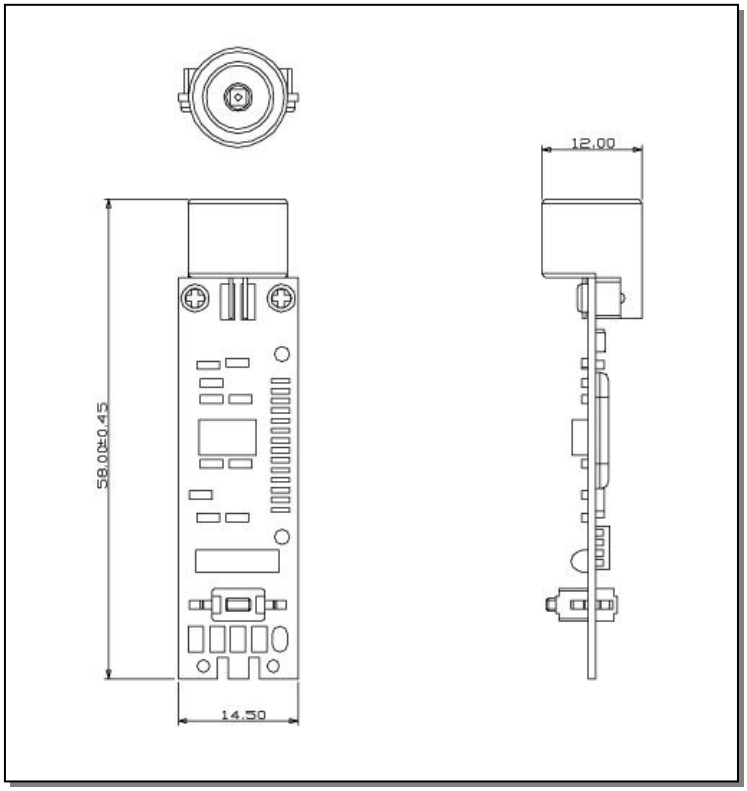


Fig 5. the Module External Drawing

3.5 Typical Diagram(pin D and C have no function)

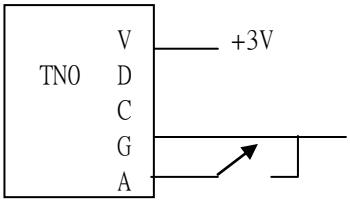


Fig 6. Typical Diagram

3.6 LCD Pin Assignment of TN0,TN9

Please check with RD for the detail LCD drawing and connection design.