THERMOMETRICS
A COMMITMENT TO EXCELLENCE

Product Data sheet

Datasheet of Digital output thermopile Detector

1. Description

ZTPD-148F is AEC-Q102 qualified digital output IR detector series presents the temperature compensated digital I2C output. Sensing element(thermopile) and signal condition IC(ASIC) integrated into single TO-39 package and provided temperature compensated temperature output. It provides a calibrated output, allowing customers to use the temperature output provided by the sensor directly without the need for additional process.

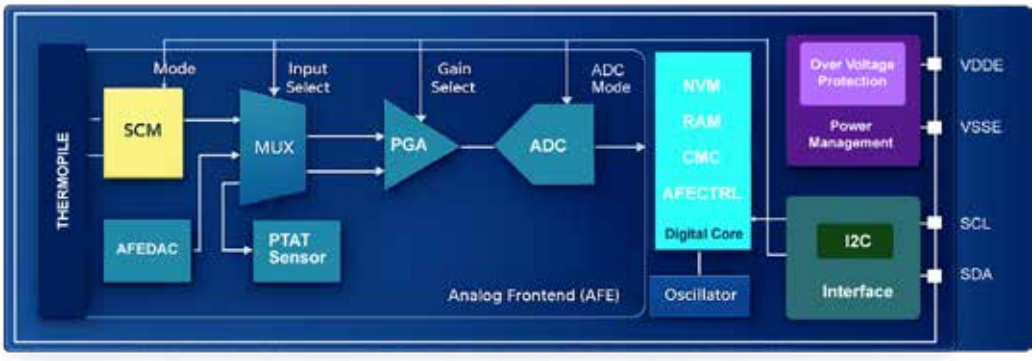
2. Feature of ZTPD-148F

- Wide temperature range
  - Operation(Ambient) temperature range : -40℃ ~ 125℃
  - Target(Object) measurement temperature range : -30℃ ~ 200℃
  - Storage temperature range : -40℃ - 125℃
- Ambient temperature compensation
- Standard I2C Interface
- RoHS and REACH compliance product
- AEC-Q102 qualified

3. Application

- Battery/power inverter temperature sensing
- Non-contact thermometer
- Temperature sensing for automotive and building HVAC system
- Home appliance(Microwave oven, Refrigerator, Coffee machine, etc)

4. Sensor Block Diagram

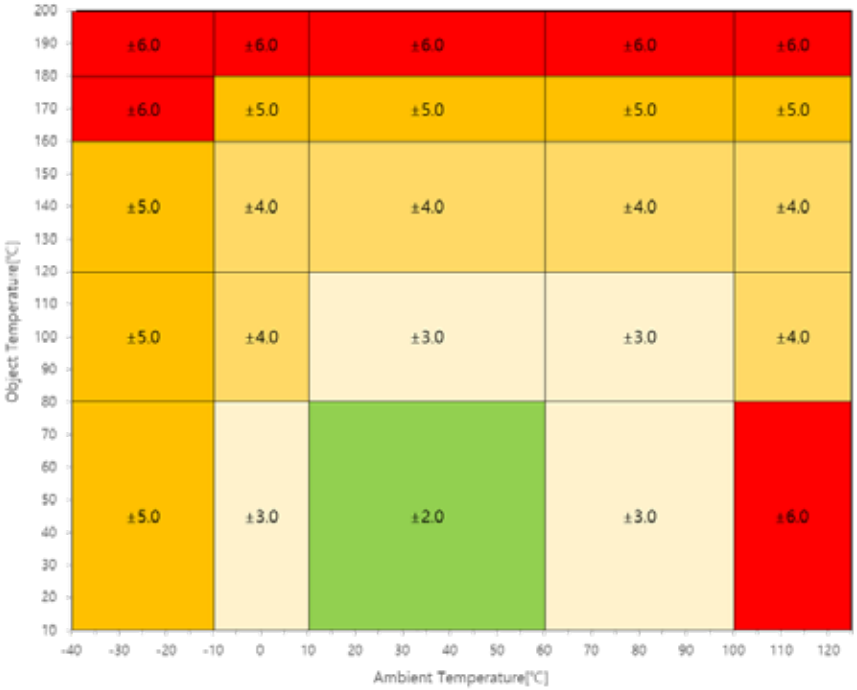


Analog Digital Interface Safety Power

5. Electrical Characteristic

PARAMETER	LIMITS			UNIT	CONDITION
	MIN	TYP	MAX		
Supply Voltage		5.0		V	@25°C
Current Consumption		7	10	mA	
Object Temp. Range	-30		200	°C	
Operating Temp. Range	-40		125	°C	
Storage Temp. Range	-40		125	°C	
Accuracy	See 6. Sensor output accuracy			°C	
ADC Resolution		15		bit	
Oscillator frequency	7.2	8.0	8.8	MHz	Calibrated oscillator frequency.
Startup time			10	msec	
Data retention	15			years	

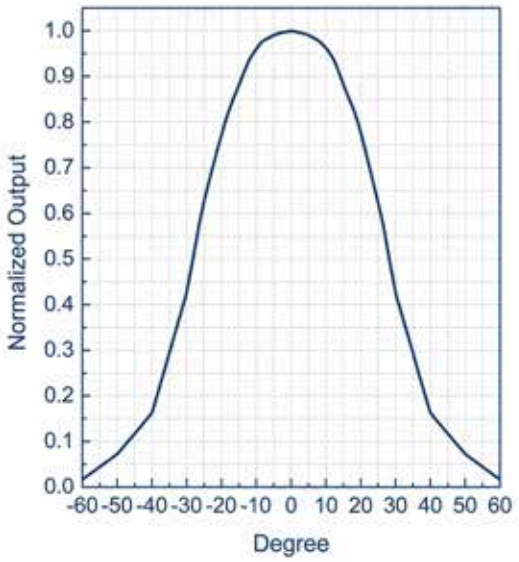
6. Sensor output accuracy



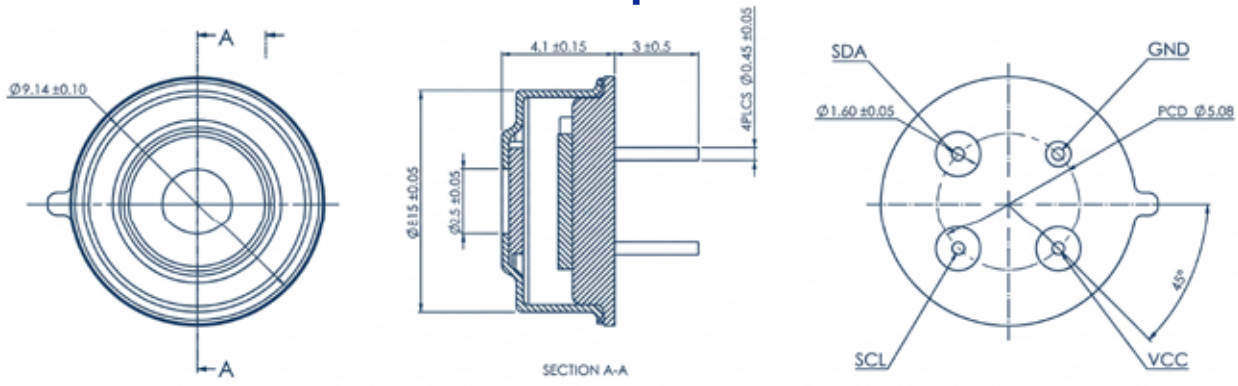
* Remark
- Sensor output accuracy tested at below condition
- Target object : Blackbody source(Emissivity : ε = 0.96)
- Distance between IR sensor and blackbody surface : 30mm

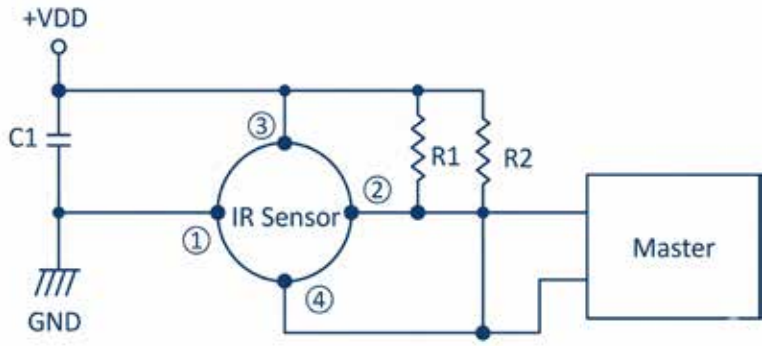
7. Optics characteristic

Parameter	LIMITS			Units	Condition
	Min	Typ	Max		
Field of View		56		Degree	50% of Maximum Output



8. Mechanical dimension and pin connection





Remark
R1, R2(Full up resistor) : 2.2 ~ 10Kohm
C1(Decoupling capacitor) : 100nF

9. I2CI Interface

For I2C communication, a data line (SDA) and a clock line (SCL) are required

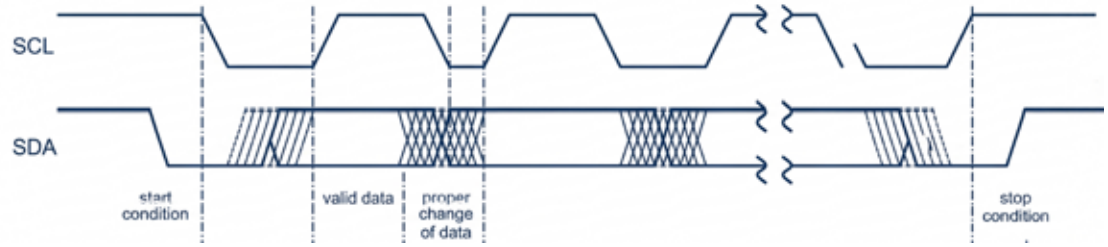


Figure 1 : Principles of I2C Protocol

9.1 Write Operation

An I2C WRITE operation is initiated by the master sending the slave an address byte including a data directionbit set to ‘0’ (WRITE). The address byte is followed by a command byte, and for applicable commands, additional data bytes (optional).

- **I2C Write, Command Byte and 2 DATA Bytes**

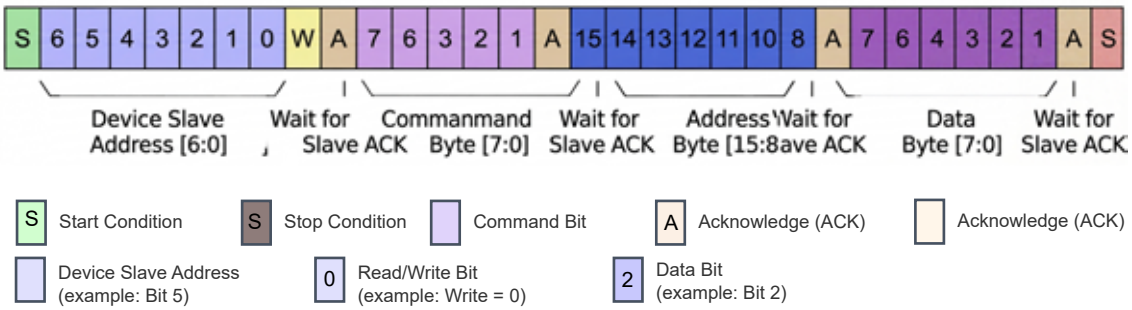


Figure 2 : Write Operation

9.2 Read Operation

A data request from a master to a slave is initiated by sending an address byte including a data direction bit set to ‘1’ (READ). The slave answers by sending data from the interface output registers. The master must generate the transmission clock for the following: SCL, acknowledges after each data byte (except after the last one), and the stop condition at the end.

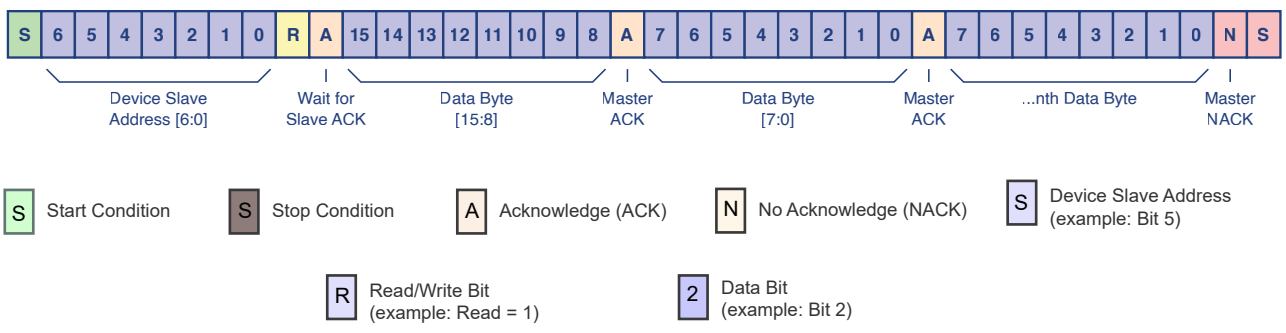


Figure 3 : Read Operation - Data Request

9.3 I2C Timing and interface parameter

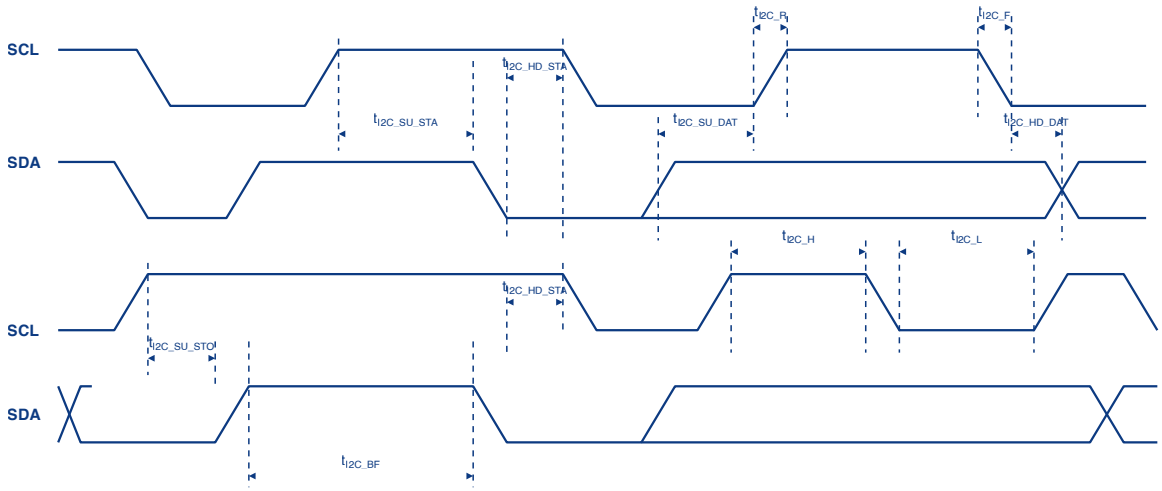


Figure 4 : Timing Protocol

No.	Parameter	Conditions	Min	Typ	Max	Units
1	SCL clock frequency		10		400	KHz
2	Bus free time between start and stop condition		1.3			us
3	Hold time start condition		0.6			us
4	Setup time repeated start condition		0.6			us
5	Input low level voltage		1.3			us
6	High period SCL/SDA		0.6			us
7	Data hold time		0			us
8	Data setup time		0.1			us
9	Rise time SCL/SDA				0.3	us
11	Setup time stop condition		0.6			us
12	Noise interception SDA/SCL	Spike suppression			50	us

9.4 I2C Command

Sensor	Slave Address	Command	Data address	Address
ZTPD-148F	0x28	0x2E	0x06	0x01

9.5 Temperature Calculation

- Send value : 0x28, 0x2E, 0x06, 0x01
- Read : 3 byte read
- Target temperature output calculation

• Object temperature value calculation equation

- Tobj(℃)= A + B1*Tcount + B2*Tcount^2 + B3* Tcount^3 + B4* Tcount^4 + B5* Tcount^5

Parameter	Value
A	-768.84
B1	2164.38
B2	-2302.73
B3	1294.37
B4	-363.12
B5	40.12

• Sensor I2C read : Byte(0): 0x2E, Byte(1): 0x22, Byte(2) : 0x72

Tcount = ((Byte(1)Byte(2))/10,000)

•Temperature conversion

Tcount= ((Byte(1)Byte(2))/10,000)

= (0x2272)/10,000
= 8818/10,000
= 0.8818

Tobj= -768.84 + 2164.38*Tcount -2302.73*Tcount^2 + 1294.37*Tcount^3 -363.12*Tcount^4+40.12*Tcount^5

= 38.5℃

10. Handling and Precautions

10.1 Humidity

IR detector operation should under without condensation condition

10.2 ESD Precautions

IR detector(electronic semiconductor) is Electro static discharge(ESD) device.
Prevent damages, applying precautions necessary for ESD devices.
Do not apply physical force to detector leads and window.
Do not expose detector to aggressive detergents such as freon, trichloroethylene, etc.

10.3 Soldering

Manual soldering and standard wave soldering process may be applied.
(EIA/JEDEC JESD22-B106E : Resistance to Solder Shock for Through-Hole Mounted Devices)
Resistance to soldering temperature for through-hole mounted devices

10.4 Moisture Sensitivity Level(MSL)

MSL rating : Grade 1