QMS Pyroelectric Infrared Motion Sensors, I²C-SMD

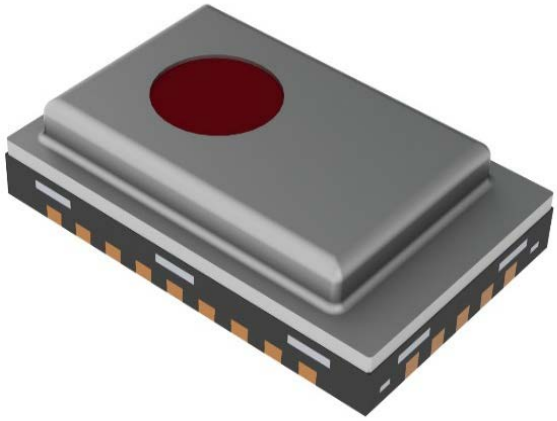
Overview

KEMET's QMS thin film digital pyroelectric IR sensors combine high sensitivity with fast response times to ensure rapid and accurate motion detection, and high dynamic range to allow motion detection nearby or over larger distances. The 2x2 pixel version of this device allows users to determine direction of motion.

These high quality sensors, in their small SMD package, integrate a digital, current mode read-out. Industry standard I²C communication enables plug-and-play connectivity to microcontrollers and allows easy tuning. Programmable gain and filtering offer maximum flexibility in system design, and various low power modes, including a wake-up by motion feature, are also available. These sensors can be connected toegther in linear series to allow synchronized sampling across devices.

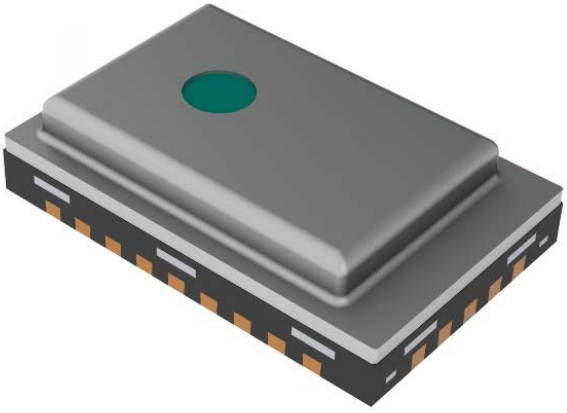
Applications

- Contactless switching
- Office automation equipment
- Home applicances
- Lighting
- Display products
- Air-conditioners
- TV
- PC monitors
- Rice cookers
- Smart toilets



Benefits

- High sensitivity with fast response time
- High dynamic range
- Small SMD package
- I²C communication
- Digital output
- Programmable gain and filltering
- Various pixel and aperture configurations
- Ultra-low power comsumption and standby modes, motion triggered wake-up



Ordering Information

USE	QMS	E	A	0116	8	0
Product Family	Series	Sensor Type	Mounting Type	Specification	Packaging	Version
Sensors	QMS = SMD IR Motion Sensors	E = Serial output M = Serial module K = Evaluation kit	A = Sensor only 1 = Module type 1 or kit type 1 L = Lens S = Small lens	0116 = 1x1 pixel, 1.65 aperture, 5.0 µm Long Pass 2216 = 2x2 pixel, 1.65 aperture, 5.0 µm Long Pass 2209 = 2x2 pixel, 0.9 aperture, 5.0 µm Long Pass	0 = Bulk 8 = 7" Tape & Reel	0

Environmental Compliance

All KEMET Motion Sensors are RoHS and REACH Compliant.

Article 33(1) of the REACH Regulation states that manufacturers and importers of articles (products) are required to notify their customers of the presence of any Substances of Very High Concern (SVHC) in their products exceeding 0.1% by weight and provide instructions on safe use of the product.

KEMET Corporation reports regarding the Article 33(1) of REACH Regulation as follows:

1. Applicable Product: Motion Sensors (QMS series)

2. Report for the content of REACH SVHC list:
The product(s) above contains a substance by more than 0.1wt% per product weight that was published in the 8th update of the REACH SVHC substances (December 19, 2012).

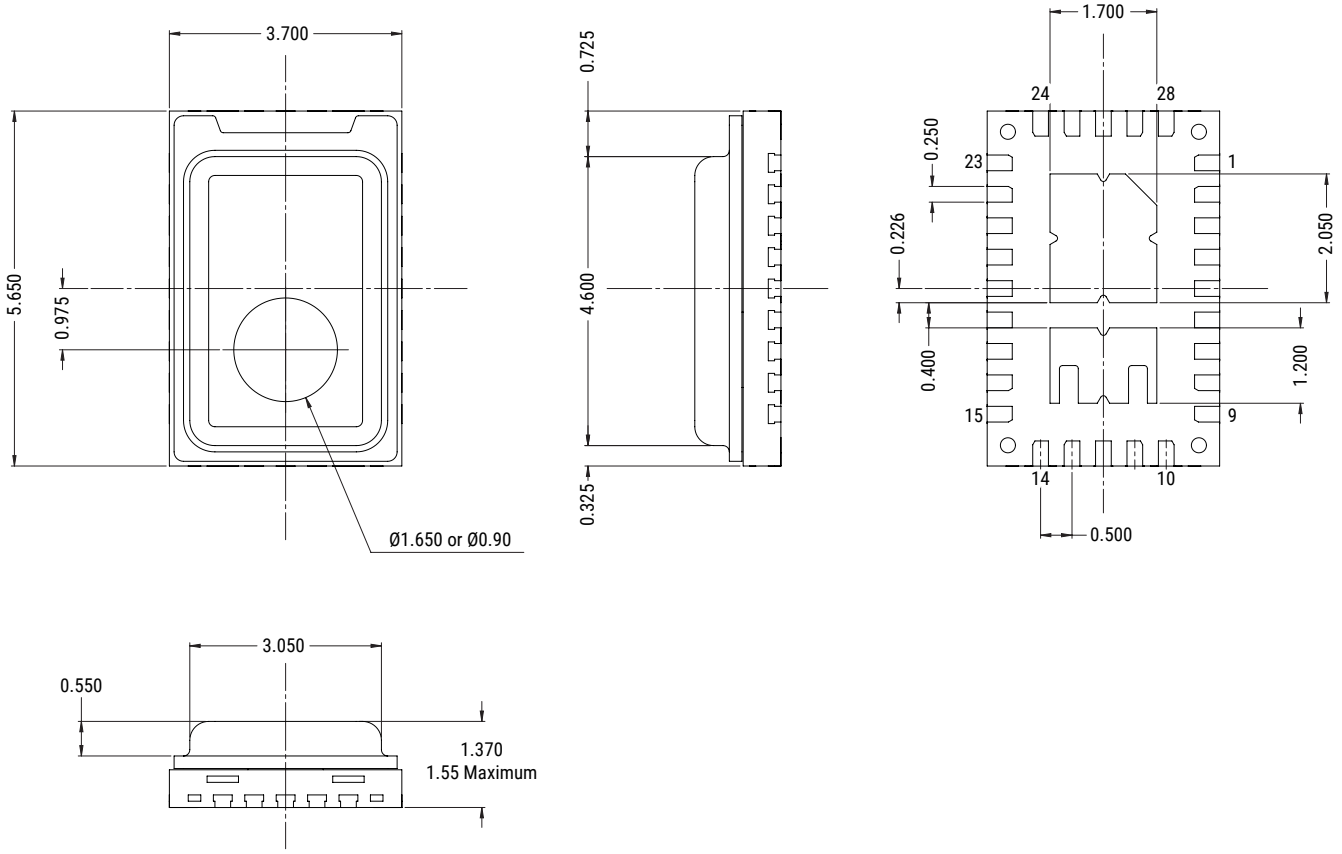
3. Regarding the safety of the motion sensors (Piezoceramic products):
The Piezoceramic that is used in this product becomes ceramic by sintering powder containing PZT as the main ingredient. It is chemically stable, with minimum risks toward the human body or environment within the intended use of the product. Please note that risks could occur in the case of inhalation or accidental oral uptake of powder ceramics.

4. Technical product information on the motion sensors (Piezoceramic products):
The manufacturing technique of the "piezoceramic products" whose main ingredient is Lead Titanium Zirconium Oxide (PZT) has been established, and there is no alternative material that can exhibit superior performance than PZT at this moment. Please note that the piezoceramic is listed as an exempt on RoHS (2011/65/EU) AnnexIII (7c.1).

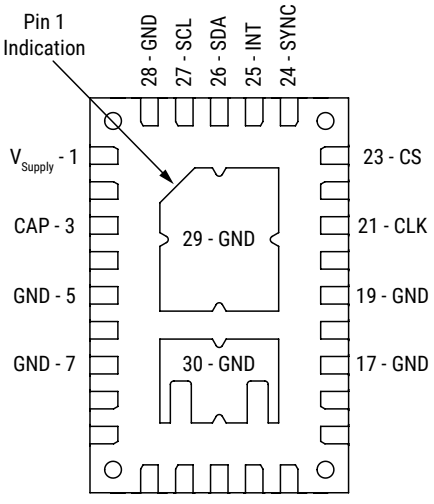
5. The responsibility of piezoceramic manufacturers:
Piezoceramic manufacturers report information regarding PZT containment in their products to the customers to obey the article 33 of the REACH regulation

Dimensions – Millimeters

Sensor



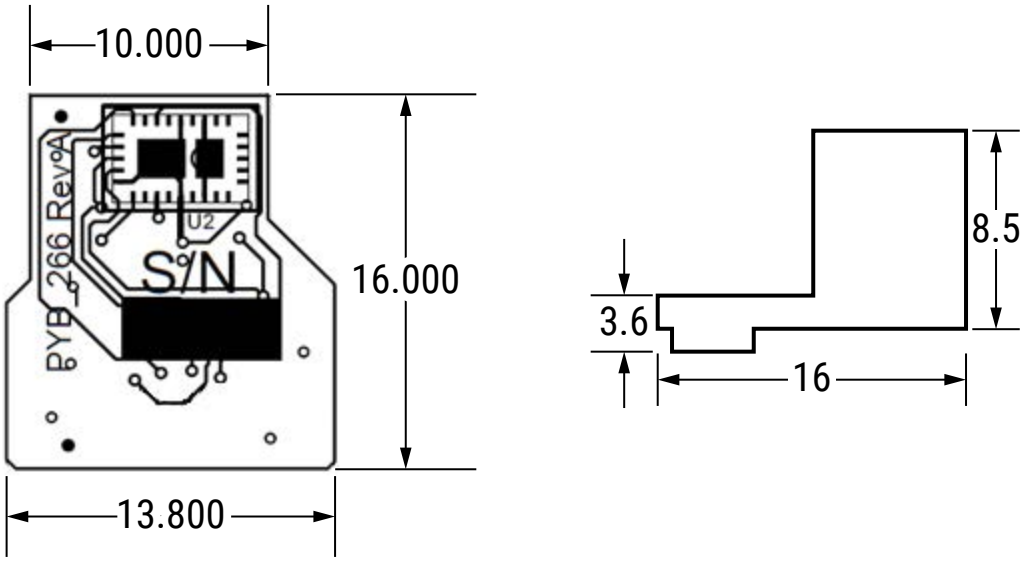
Pin Configuration of Sensor



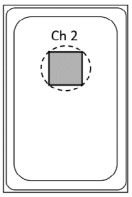
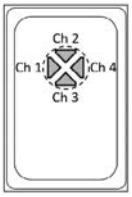
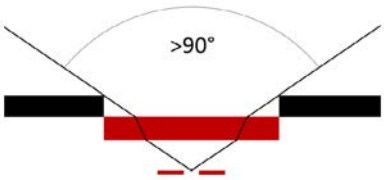
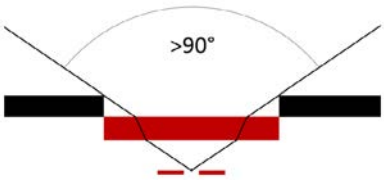
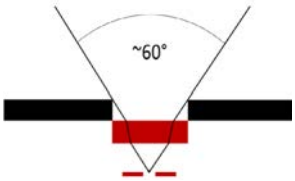
TRANSPARENT TOP VIEW

Dimensions – Millimeters cont.

Module



Field of View

	Single Element	2x2 Array
Sensor Element		
Pixel Mapping		
Field of View		 Large Aperture  Small Aperture

Performance Characteristics

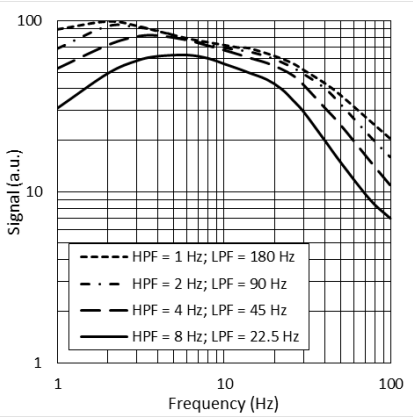
Signal Filtering & Power Modes

Power Mode (base sample rate)	High Pass Filter – Analog (Hz)					Fixed Analog Low Pass Filter (Hz)	Fixed Digital Low Pass Filter (Hz)	Digital Low Pass Filter (Hz)				Maximum ADC Sampling Rate (sps)
Normal Power Mode	Off	1.0	2.0	4.0	8.0	600	250	180.0	90.0	45.0	22.5	1,000
Low Power Mode	Off	0.17	0.33	0.66	1.30	100	42	30.00	15.00	7.50	3.75	166

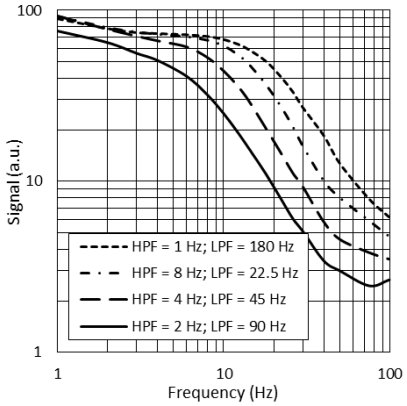
Item	Mode	Description	Typical Current Consumption (1.8 V, room temperature)
Power consumption	Normal Power Mode	Normal power consumption, 1 kHz maximum sample rate	22 µA
	Low Power Mode	Low power consumption, 166 Hz maximum sample rate	3.5 µA
Operational state	Normal Operation Mode	Sensor signal readout over I²C	22 µA
	Sleep Mode	Hardware interrupt on infrared trigger	21 µA (Normal Power Mode) 3.5 µA (Low Power Mode)
	Power Down Mode	Sensor is disabled	1.1 µA

Infrared Frequency Characteristics

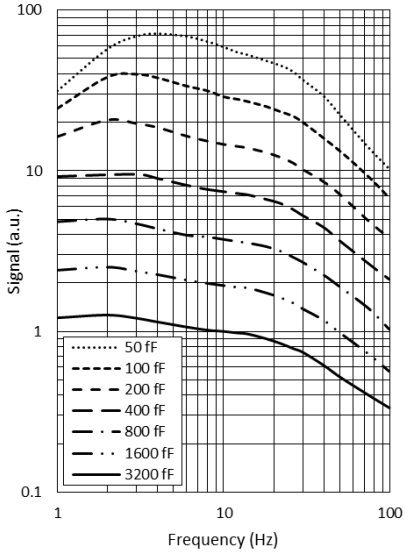
Typical Frequency Response in Normal Power Mode



Typical Frequency Response in Low Power Mode



Typical Frequency Response at Different Gain Settings



Part Number Specifications

Electrical Characteristics

Supply Voltage (V)	Supply Current (µA) Typical	Digital I/O	ΔΣ ADC at 1 ksp	Operating Temperature Range (°C)	Storage Temperature Range (°C)	Sensor Read-out	Configurable
1.75 to 3.60	1 to 23	I²C (FM+ compatible)	15 bit	−40 to +85	−40 to +110	Current mode	Gain Digital filtering Sampling rate Power modes

Part Number (Sensor)

Part Number	Filter Aperture (mm)	Element Size (mm²)	SMD Package (mm)	D*[1] (cm√Hz/W) Typical	NEP[1] (W/√Hz) Typical	Time Constant (ms) at 10–20 Hz peak	Filter	Weight (gr)
USEQMSEA011680	φ 1.65	0.410 (1 pixel)	5.65 x 3.70 x 1.55	2.5×10^{8}	2.7×10^{-10}	~10	5.0 µm Long Pass	0.07
USEQMSEA221680	φ 1.65	4 x 0.057 (4 pixel)		5.5×10^{8}	0.4×10^{-10}			0.07
USEQMSEA220980	φ 0.90	4 x 0.057 (4 pixel)						0.07

[1] 10 Hz, 500 K, room temperature, without window and optics.

Part Number (Module)

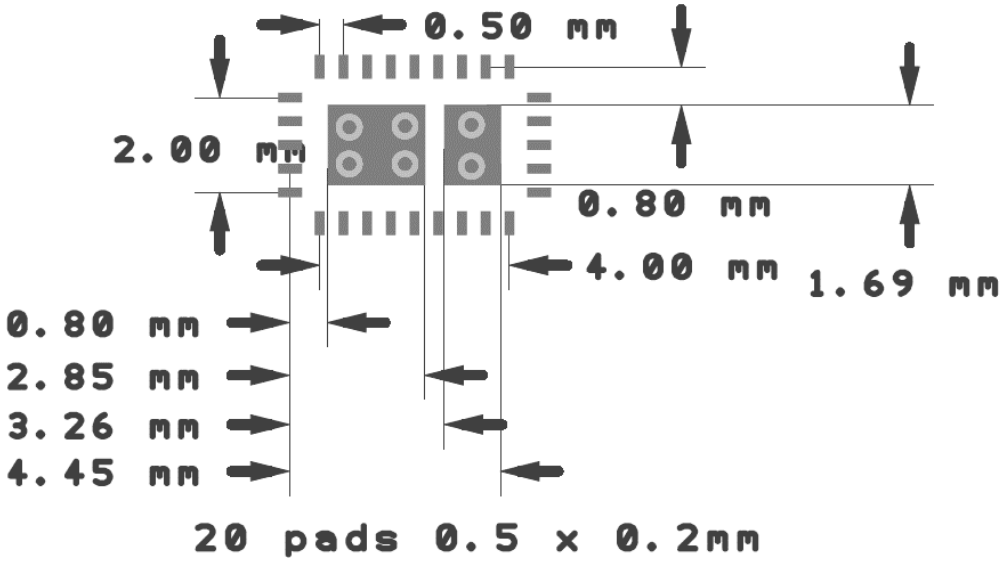
Part Number	Comment	Weight (gr)
USEQMSM1011600	Includes sensor: USEQMSEA011680	5.40
USEQMSM1221600	Includes sensor: USEQMSEA221680	5.40
USEQMSM1220900	Includes sensor: USEQMSEA220980	5.40

Part Number (Evaluation Kit)

Part Number	Comment	Weight (gr)
USEQMSKL011600	Includes sensor: USEQMSEA011680, motion sensing, with Fresnel lens	300
USEQMSKL221600	Includes sensor: USEQMSEA221680, motion and motion direction sensing, with Fresnel lens	300
USEQMSKS221600	Includes sensor: USEQMSEA221680, long range, with Fresnel lens	300
USEQMSK1220900	Includes sensor: USEQMSEA220980, medium range, no optics	300
USEQCSK0000000	Control board for modules, maximum 4 modules can be connected on one control board	250

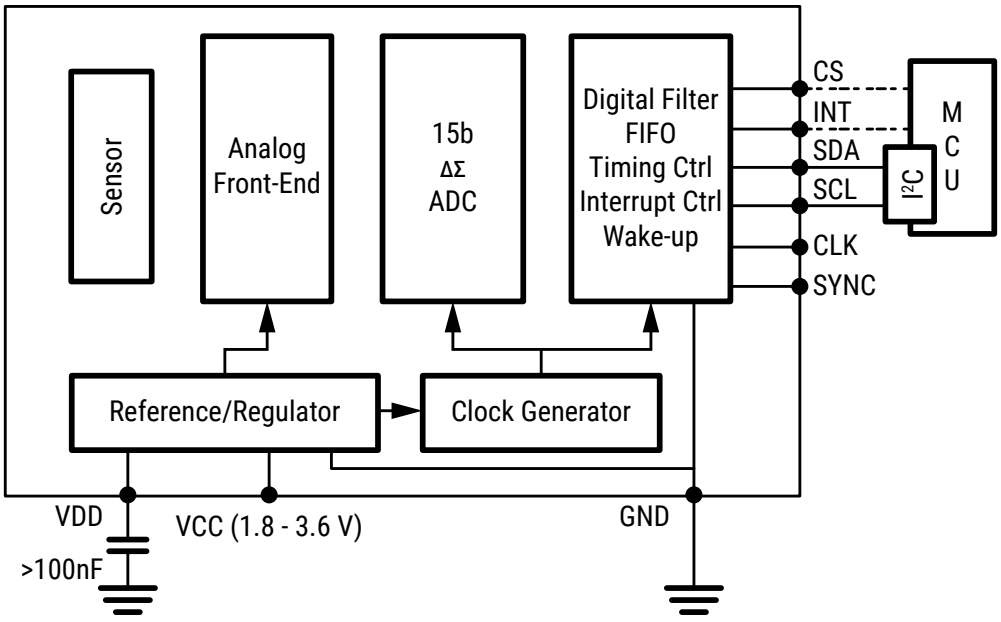
Landing Pattern

Recommended PCB Landing Pattern



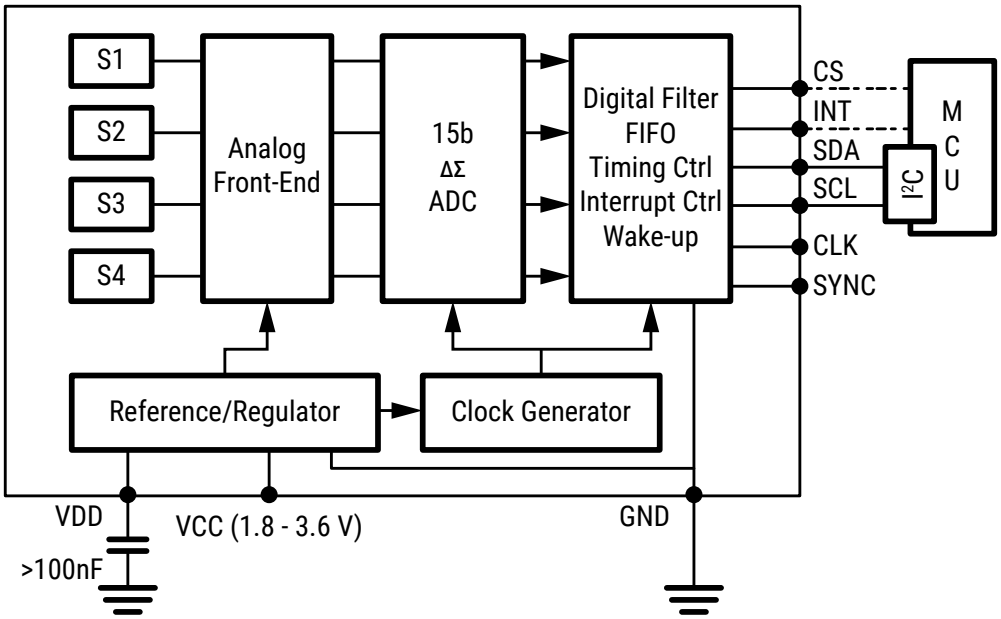
Part Schematic

Block Diagram - Single Element



Part Schematic cont.

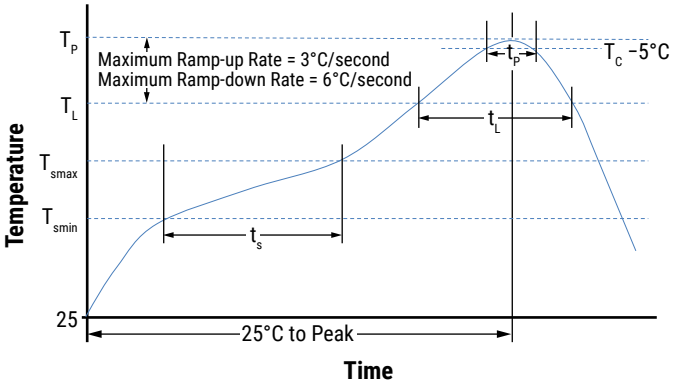
Block Diagram - 2 x 2 Pixel



Soldering Process

Recommended Reflow Soldering Profile

Profile Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Minimum (T_{Smin})	150°C
Temperature Maximum (T_{Smax})	200°C
Time (t_s) from T_{smin} to T_{smax}	60 – 120 seconds
Ramp-Up Rate (T_L to T_P)	3°C/second maximum
Liquidous Temperature (T_L)	217°C
Time Above Liquidous (t_L)	60 – 150 seconds
Peak Temperature (T_P)	260°C
Time within 5°C of Maximum Peak Temperature (t_P)[1]	30 seconds maximum
Ramp-Down Rate (T_P to T_L)	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum

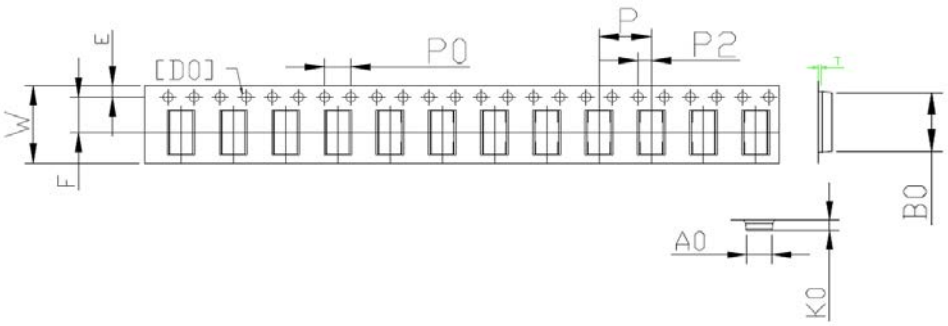


[1] *Tolerance for peak profile temperature (TP) is defined as a supplier minimum and as a user maximum.*

Packaging

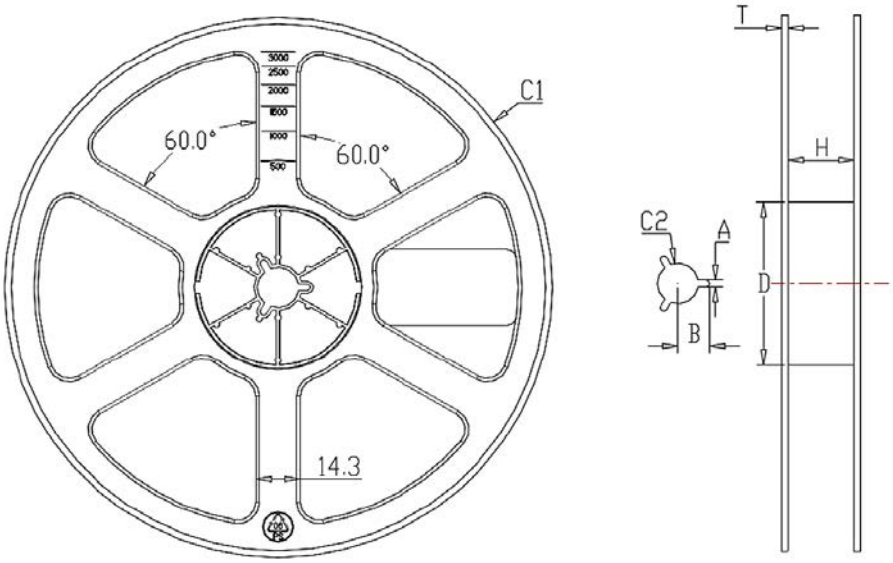
Series	Packaging Type	Pieces per Reel
QMS	7" Tape & Reel	800

Taping Specification



	Dimensions (mm)										
	P0	P	T	P2	W	A0	B0	K0	E	F	D0
Minimum	3.90	7.90	0.25	1.90	11.70	3.90	5.85	1.65	1.65	5.40	1.50
Typical	4.00	8.00	0.30	2.00	12.00	4.00	5.95	1.75	1.75	5.50	1.50
Maximum	4.10	8.10	0.35	2.10	12.30	4.10	6.05	1.85	1.85	5.60	1.60

Reel Specification



	Dimensions (mm)						
	C1	C2	A	B	H	T	D
Tolerance	±1.0	±0.2	±0.2	±0.2	±0.5	±0.2	±0.5
Nominal	Ø178	13.5	2.3	10.4	12.5	1.6	Ø54

Handling Precautions

Pyroelectric Infrared Sensors should be kept away from indirect and direct sunlight, the headlights of cars, wind, and exposure to strong vibration and strong shock.
Do not use in water, alcohol ETA, corrosive gas or under sea breeze.
Do not expose to corrosive substances.
Do not drop or apply any mechanical stress.

The performance of this device can be affected by ESD. Precautions should be used when handling and installing the sensor. Precision devices such as this sensor can be damaged or caused not to meet published specification due to ESD. Please note that there is limited ESD protection built-in as the device is optimised for low power consumption and low noise operation. Human Body Model (HBM), per JS-001: 2,000 V.

The sensor is classed as Moisture Sensitivity Level 3 (MSL-3). The package should be handled according to IPC/JEDEC J-STD-20.

Pyroelectric Infrared Sensors should be stored in normal working environments.
Solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long-term storage.

KEMET recommends that ambient storage conditions are < 30°C and < 60% relative humidity and that maximum storage temperature does not exceed 110°C. Atmospheres should be free of chlorine and sulfur-bearing compounds.
Temperature fluctuations should be minimized to avoid condensation on the parts.
For optimized solderability sensors stock should be used promptly, preferably within 24 months of receipt.

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