



# Murata Touts 'True' SMD Pyroelectric Infrared Sensor

*The company has resolved temperature, encapsulation, noise resistance and heat insulation issues to come up with such product fit for reflow soldering.*

**P**yroelectric infrared sensors have been used for crime-prevention security systems for some time now. Recently, the use of pyroelectric infrared sensors has been increasing and expanding for example, as a sensor light, which can be referred to as a simple crime prevention security device. Environmentally friendly illumination systems that use pyroelectric infrared sensors to light up only the required locations in buildings are also becoming widespread.

Over the years, pyroelectric infrared sensor characteristics such as resistance to noise and external light interference have been improved to enhance the performance of these devices. At the same time, prices of the products have gone down as this market continues to expand.

There has been little improvement, however, in the packaging of pyroelectric infrared sensors. Most pyroelectric infrared sensors still use can cases with hermetic sealing like the TO-5 package that were used for transistors in the past. In contrast, most transistors today are available as surface-mountable device (SMD) in mini-mold packages, following the plastic-mold lead surface mount package. With improved packaging, the transistor's footprint for volume and mounting has been dramatically reduced. Furthermore, numerous IC packages with higher density integration and

improved mounting efficiency, as well as bare chip mounting have also emerged in the market. Chip packages have been more common for other electronic components like capacitors, resistors, and coils, and size reduction has progressed further for these devices as well. Nowadays, it has become harder to find lead mount components.

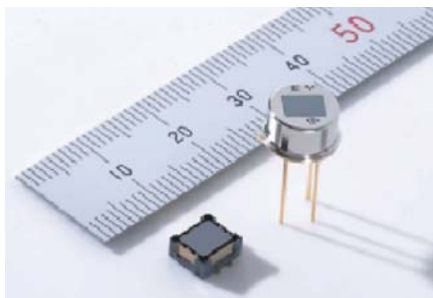
Electronic components that have adopted the SMD package can be mounted using the reflow soldering method. This is in contrast with the presently used pyroelectric infrared sensors that require



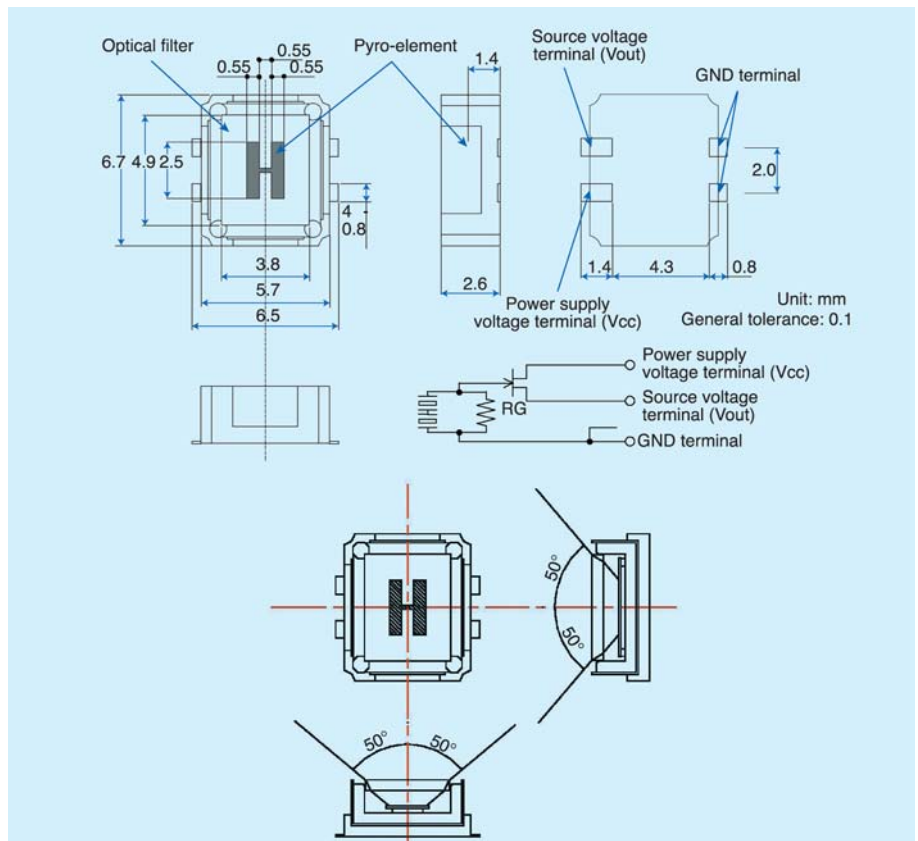
**IRS-A200ST01**

hand solder mounting, which is extremely inconvenient for board manufacturers. In some cases, the existing packaging of pyroelectric infrared sensors also becomes a constraint and makes it difficult for users to reduce the size of their products. In fact,

many electronic component manufacturers have tried to use SMD packaging for pyroelectric infrared sensors. Some were able to manufacture these sensors in an SMD package as far as external appearances are concerned. No company, however, has been able to manufacture pyroelectric infrared sensors using SMD pack-



**Murata's IRS-A200ST01 surface-mounted pyroelectric infrared sensor**



**Fig. 1: Dimensional outline and circuit diagram of IRS-A200ST01**

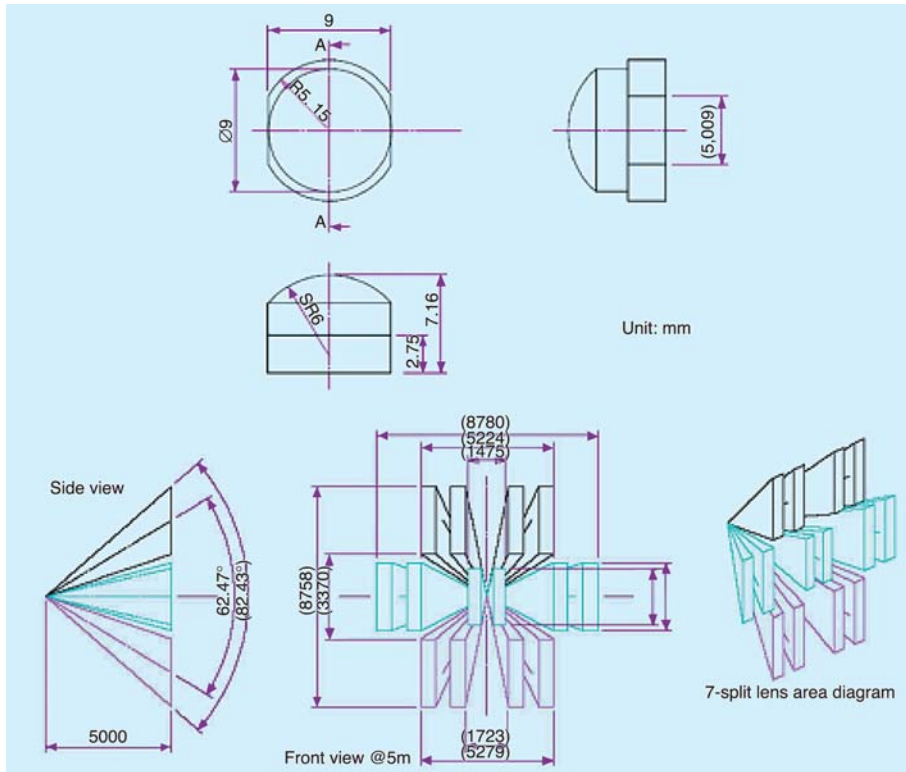


Fig. 2: Dimensional outline and light distribution pattern of the dedicated lens

ages that can actually be used for the reflow soldering process. To manufacture 'true' SMD pyroelectric infrared sensors, it is necessary to resolve four issues as described below.

Believed to be the first surface-mounted pyroelectric infrared sensor, the IRS-A200ST01 Series has been introduced by Murata Manufacturing Co., Ltd., and has also started marketing the IML-0658, a cap type, dedicated Fresnel lens for this sensor.

### Improvement of Heat Resistance

To manufacture SMD pyroelectric infrared sensors for reflow soldering process, it is necessary to develop pyroelectric material that can withstand the reflow temperature. Normally, when the pyroelectric coefficient or sensitivity of a material is higher, the Curie point becomes lower. Materials with such characteristics are not suitable for reflow soldering. Manufacturers tend to put more importance on the sensitivity characteristics of conventionally used pyroelectric materials, and therefore adopt materials with a low Curie point.

Murata has introduced a new material that was developed by using the company's original ceramic technologies to maximum advantage. This new material satisfies the

contradictory requirements of a higher temperature for the Curie point to enable reflow soldering, while maintaining the same pyroelectric coefficient level as in conventional materials. Murata has adopted this newly developed material for its SMD pyroelectric infrared sensors.

### Hermetic Sealing Performance of Package

The temperature of ceramics used for pyroelectric infrared sensors changes through the heat radiated from the human body by about 10<sup>6</sup>°C, and the ceramics generate an electrical charge in the order of femto ampere (fA). This extremely weak electrical charge is input to an impedance of several tens of gigaohms and is converted into voltage. Because the impedance is too high as it is, pyroelectric infrared sensors are equipped with a field effect transistor (FET) for impedance conversion. To prevent invasive humidity from causing the impedance of the charge-to-voltage conversion block from deteriorating, the package is encapsulated with nitrogen gas to assure airtightness.

To meet such requirements, Murata has developed a package with superior sealing performance, while having insert mold terminals for connection and internal circuit

configuration using an insert molding system originally developed by the company.

### Electromagnetic Shield

Pyroelectric ceramics are categorized as capacitors in terms of electrical circuits. Therefore, changes in the neighborhood electrical fields are directly output as noise. The electromagnetic shield performance of the package plays a significant role in preventing such noise.

Murata's IRS-A200ST01 pyroelectric infrared sensor achieves a high electromagnetic shield performance by adopting a case structure with insert mold terminals that are provided with a shielding effect by using the company's fully original insert mold resin molding system. This sensor ceramics package provides the shield network without loopholes by applying a structure that uses an optical filter as a part of the shield.

### Heat Insulation

SMD pyroelectric infrared sensors use the general dual-element design, which has a structural characteristic that enables it to cancel the output when energy simultaneously enters two photoreceptors (equivalent to changes in the temperature of an object). Pyroelectric infrared sensors with high resistance to external temperature changes can be manufactured by adopting a structure that enables the heat, which is transmitted to the pyroelectric element through a package, to be transmitted simultaneously to two photoreceptors.

Conventional can cases achieve a uniform heat transmission quality due to the high thermal conductivity of the can case metal and the large heat capacity of the stem portion. For SMD pyroelectric infrared sensors, on the other hand, an SMD package with high resistance to external heat fluctuations has been developed through optimal implementation of a heat propagation characteristic that utilizes the metal terminal used for the insert mold package as a heat pipe, and a heat insulation characteristic that is produced by using the mild heat transmission characteristic of resin.

### New Sensor Features

The IRS-A200ST01 SMD pyroelectric infrared sensor developed by Murata after resolving the above technological issues feature high sensitivity and low noise;

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are suitable for reflow surface-mount process; have low-profile size of  $6.7 \times 5.7 \times 2.6$ mm; have superior immunity to noise, and complies with the RoHS Directive.

Murata's SMD pyroelectric infrared sensors can be used for security equipment; automatic switching of lighting appliances; Web cameras or Internet Protocol (IP) cameras; automatic toilet seat with warm water washing function; and other

automatic switches like switches for liquid crystal monitors, air conditioners, air cleaners, ventilation fans and TVs.

Murata has also developed a dedicated Fresnel lens that takes full advantage of the downsizing feature of the SMD pyroelectric infrared sensors. In the near future, the company plans to introduce lenses with various light distribution patterns.

### Conclusion

Today, there is a large demand for elec-

tronic equipment that is environmentally friendly and highly energy efficient. Murata intends to introduce smaller SMD pyroelectric infrared sensors that target broader range of applications with the use of the dedicated lenses, in a bid to improve contributions to the global environmental and the ecosystem.

### About This Article:

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