

PRODUCT DATASHEET



SCA10H

Doc. No. 1322 Rev. 3

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1 Features and benefits

- Contactless measurement enables continuous monitoring without disturbing the patient.
- Ultra low noise and narrow noise bandwidth SCA61T 3D MEMS accelerometer and analog signal conditioning.
- Embedded heart and respiration rate signal processing with 1 Hz output rate.
- Low power and only tens of bytes per second communication bandwidth requirement.
- Easy to use
 - UART-interface
 - Solderable PCB-module

2 Target Applications

- Hospitals, elderly care, assisted living
- Heart and respiration rate detection
- Cardiac output estimation
- Bed occupancy
- Stress and relaxation index
- Sleep quality monitoring

3 Product code

| Product code | Quantity | SW version |
|-------------------|----------|------------|
| SCA10H-D01-Sample | 1 | 1 |
| SCA10H-D01-112 | 112 | 1 |

4 Block diagram

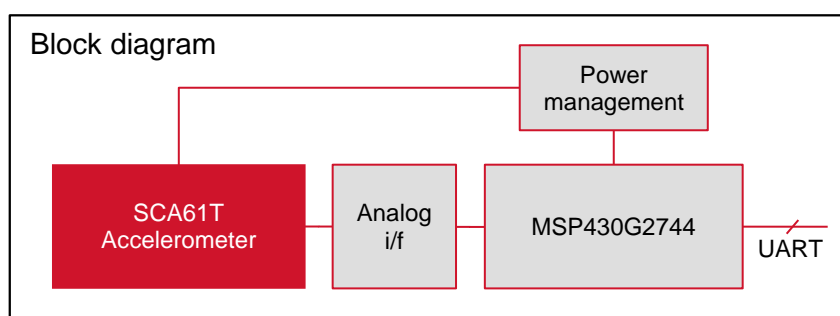


Figure 1 Functional block diagram

5 Dimensions, Measurement Direction, Terminal Configurations and Land Pattern

5.1 Dimensions

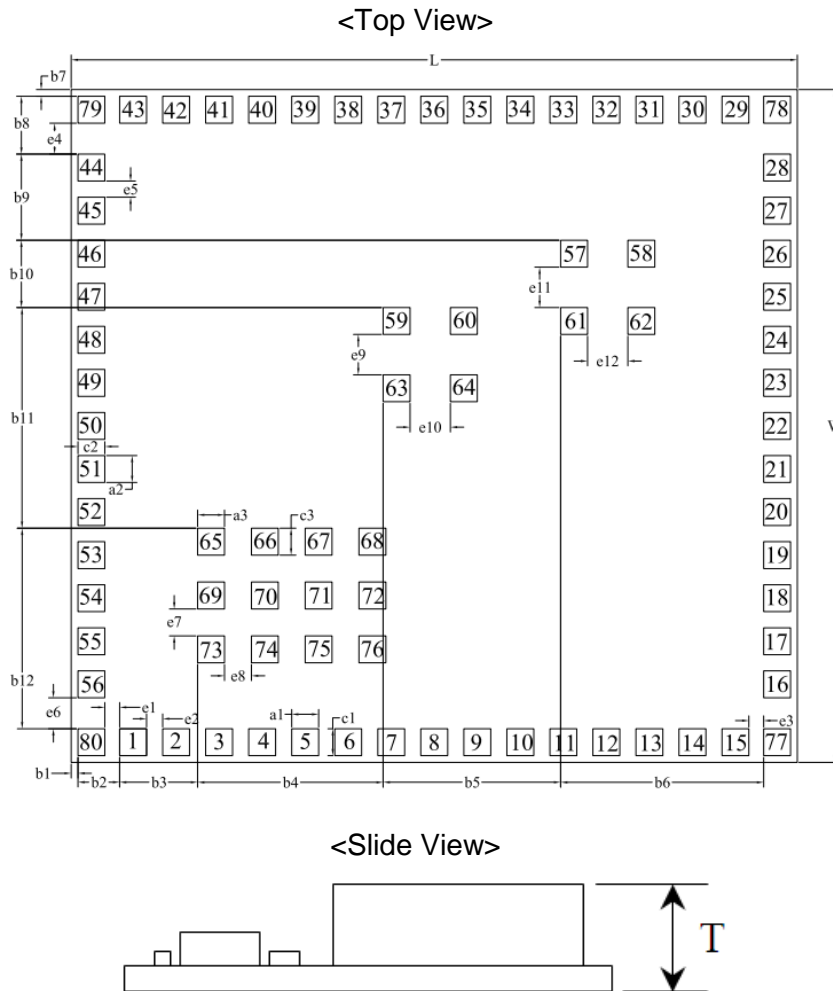


Figure 2 Module dimensions

Table 1 Dimensions (unit: mm)

| Mark | Dimension | Mark | Dimension | Mark | Dimension |
|------|-----------|------|-----------|------|-----------|
| L | 27.6±0.25 | W | 25.6±0.25 | T | 6.6max |
| a1 | 1.0±0.1 | a2 | 1.0±0.1 | a3 | 1.0±0.1 |
| b1 | 0.55±0.15 | b2 | 1.55±0.15 | b3 | 2.9±0.15 |
| b4 | 6.9±0.15 | b5 | 6.6±0.15 | b6 | 7.55±0.15 |
| b7 | 0.55±0.15 | b8 | 2.15±0.15 | b9 | 3.2±0.15 |
| b10 | 2.5±0.15 | b11 | 8.2±0.15 | b12 | 7.45±0.15 |
| c1 | 1.0±0.1 | c2 | 1.0±0.1 | c3 | 1.0±0.1 |
| e1 | 0.55±0.1 | e2 | 0.6±0.1 | e3 | 0.55±0.1 |
| e4 | 1.15±0.1 | e5 | 0.6±0.1 | e6 | 1.15±0.1 |
| e7 | 1.0±0.1 | e8 | 1.0±0.1 | e9 | 1.5±0.1 |
| e10 | 1.5±0.1 | e11 | 1.5±0.1 | e12 | 1.5±0.1 |

5.2 Measurement Direction

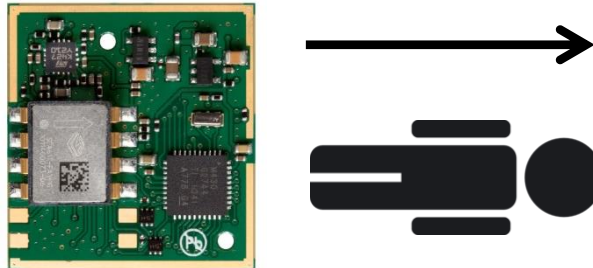


Figure 3 Measurement direction

5.3 Terminal Configurations

Table 2 Pin names and descriptions

| Pin no | Name | Description | MSP430G2744 pin ⁽¹⁾ |
|--------|-------------------|-------------------------------|--------------------------------|
| 1 | P1.2/TA1 | P1.2/TA1 | P1.2/TA1 |
| 2 | P1.3/TA2 | P1.3/TA2 | P1.3/TA2 |
| 3 | P1.4/SMCLK/TCK | JTAG Interface | P1.4/SMCLK/TCK |
| 4 | P1.5/TA0/TMS | JTAG Interface | P1.5/TA0/TMS |
| 5 | P1.6/TA1/TDI/TCLK | JTAG Interface | P1.6/TA1/TDI/TCLK |
| 6 | P1.7/TA2/TDO/TDI | JTAG Interface | P1.7/TA2/TDO/TDI |
| 7 | GND | Ground | |
| 8 | GND | Ground | |
| 9 | TEST/SBWTCK | TEST/SBWTCK | TEST/SBWTCK |
| 10 | JTAG_TCK | NC | |
| 11 | INT_IN | Interrupt from host to module | P2.5/ROSC |
| 12 | MCU_VDD | NC | DVCC |
| 13 | GND | Ground | |
| 14 | GND | Ground | |
| 15 | GND | Ground | |
| 16 | GND | Ground | |
| 17 | RST_n/SBWTIO | Reset | RST/NMI/SBWTIO |
| 18 | VIN | Power Supply voltage | |
| 19 | GND | Ground | GND |
| 20 | BSL_RX | BSL_RX | P2.2/TA0/A2 |
| 21 | P3.0/CS_n | SPI Chip Select | P3.0/UCB0STE/UCA0CLK/A5 |
| 22 | P3.1/SDA/MOSI | I2C data / SPI MOSI | P3.1/UCB0SIMO/UCB0SDA |
| 23 | P3.2/SCL/MISO | I2C clk / SPI MISO | P3.2/UCB0SOMI/UCB0SCL |
| 24 | P3.3/CLK | SPI CLK | P3.3/UCB0CLK/UCA0STE |
| 25 | GND | Ground | |
| 26 | GND | Ground | |
| 27 | GND | Ground | |
| 28 | GND | Ground | |
| 29 | GND | Ground | |
| 30 | GND | Ground | |
| 31 | GND | Ground | |
| 32 | GND | Ground | |

| Pin no | Name | Description | MSP430G2744 pin ⁽¹⁾ |
|--------|-----------------|-------------------------------|--------------------------------|
| 33 | GND | Ground | |
| 34 | SPI_SCK_SCA61T | NC | |
| 35 | GND | Ground | |
| 36 | SPI_MISO_SCA61T | NC | |
| 37 | SPI_MOSI_SCA61T | NC | |
| 38 | SPI_MOSI_SCA10X | NC | |
| 39 | P4.0/TB0 | P4.0/TB0 | P4.0/TB0 |
| 40 | P4.1/TB1 | P4.1/TB1 | P4.1/TB1 |
| 41 | P4.2/TB2 | P4.2/TB2 | P4.2/TB2 |
| 42 | GND | | |
| 43 | GND | | |
| 44 | GND | | |
| 45 | GND | | |
| 46 | SPI_CSB_SCA61T | NC | |
| 47 | SPI_CSB_SCA10X | NC | |
| 48 | ST1 | NC | |
| 49 | ST2 | NC | |
| 50 | INT_OUT | Interrupt from module to host | P4.6/TBOUTH/A15 |
| 51 | UART_TX | UART_TX | P3.4/UCA0TXD/UCA0SIMO |
| 52 | UART_RX | UART_RX | P3.5/UCA0RXD/UCA0SOMI |
| 53 | XTRA1 | NC | P3.6/A6 |
| 54 | XTRA2 | NC | P3.7/A7 |
| 55 | P1.0 | P1.0/TACLK/ADC10CLK | P1.0/TACLK/ADC10CLK |
| 56 | BSL_TX | BSL_TX | P1.1/TA0 |
| 57~80 | GND | Ground | |

¹⁾ Please refer to TI's MSP430G2744 datasheet for digital I/O DC and timing parameters. The used processor's supply voltage is 3.3V +/- 5%.

5.4 Recommended Land Pattern

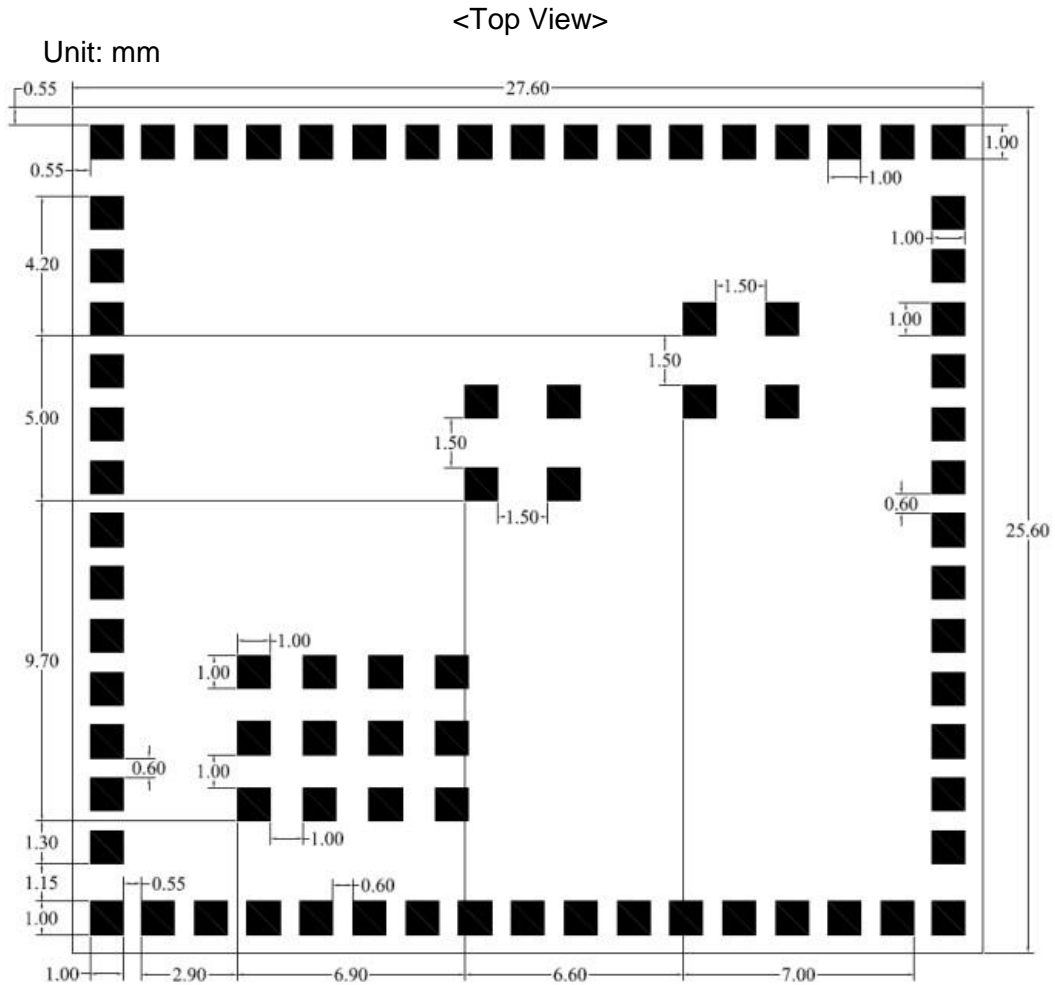


Figure 4 Recommended Land Pattern

Note: The recommended stencil mask thickness for above land pattern is 120 μ m. The stencil mask area is 0.9mm x 0.9mm, and the position is on the center of each land.

6 Maximum absolute ratings

Table 3 Maximum ratings

| Parameter | Min | Max | Unit |
|--------------------------------|------|------|------|
| Storage temperature | -40 | 85 | °C |
| Vin | -0.1 | 20 | V |
| Voltage on any IO-pin, Vin=9 V | -0.1 | 3.4 | V |
| Voltage on any IO-pin, Vin=0 V | -0.1 | 0.1 | V |
| ESD (Human Body Model) | | 3 | kV |
| Mechanical shock ^{**} | | 1000 | g |

* When the supply voltage Vin is 9V

** 1 m drop on concrete may cause >> 1000 g shock.

7 Electrical specification

Table 4 Electrical specification parameters

| Parameter | Min | Typ | Max | Unit |
|---|-----|-----|-----|---------|
| Module's supply voltage V_{in} | 8 | | 10 | V |
| Temperature range | 0 | | 80 | °C |
| Current consumption | | 8 | | mA |
| Acceleration raw data noise level ⁽¹⁾ | | 1.3 | | LSB RMS |
| Acceleration sensor sensitivity ⁽²⁾ | | 427 | | LSB/g |
| Acceleration sensor's step response gain ⁽³⁾ | 1 | | | |

⁽¹⁾ RMS-noise within the application bandwidth measured on stone table in raw data mode without any external vibration or noise.

⁽²⁾ Sensitivity measurement by tilting the module in test mode

⁽³⁾ BCG- and inclination channel gain ratio $G = \text{BCG-channel step response gain} / \text{inclination channel step response gain}$ when sensor's self-test is activated

8 Serial port configuration

Table 5 Serial port configuration

| Parameter | |
|--------------|-------------|
| Baud rate | 230400 baud |
| Data bits | 8 |
| Parity | None |
| Stop bits | 1 |
| Flow control | None |

9 Functional specification

Table 6 Functional specification parameters

| Parameter | Min | Typ | Max | Unit |
|---|-----|-----|-----|------|
| Pulse detection range | 40 | | 120 | BPM |
| Steady state pulse rate for test input ⁽¹⁾ | 48 | | 52 | BPM |

⁽¹⁾ Accelerometer is disconnected from the circuit. Pre-defined test signal is injected to the output node of the accelerometer V_{out} . With default BCG-parameters steady state output HR is 50 ± 2 BPM. Test setup is according to Figure 5 below and example measurement and simulation is in Figure 6.

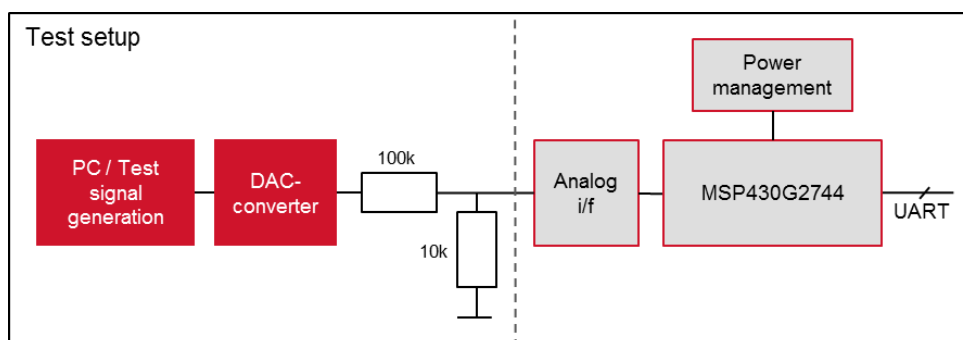


Figure 5 Functional test setup

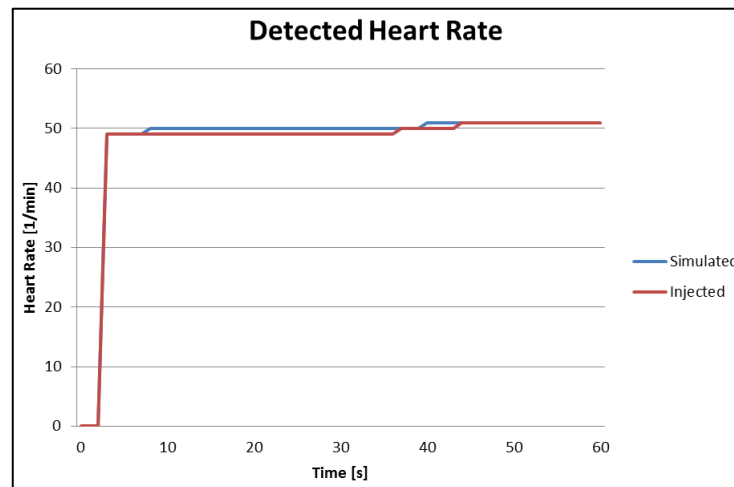
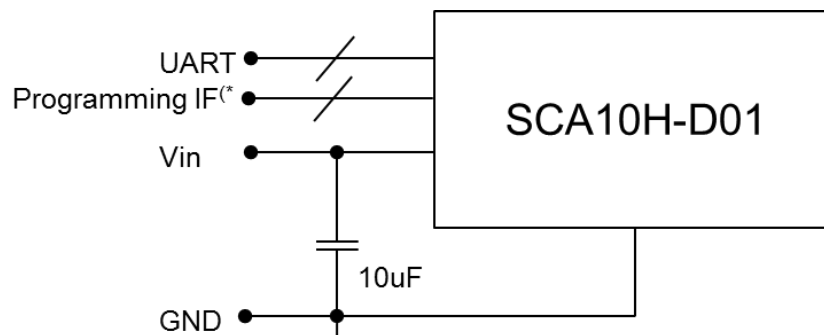


Figure 6 Injected vs simulated output with test signal using default BCG-parameters

10 Application schematic

SCA10H should be considered as a noise sensitive analog component. Due to sampled system, high frequency supply noise may alias to the signal bandwidth. Thus the power supply circuitry and layout must be designed carefully following good design practices and verified with measurements.



*) See section firmware update

Figure 7 Application schematic

11 Communication

Communication protocol is discussed in *Product Specification 1327 SCA10H binary protocol specification*.

12 Firmware update

Programming IF includes pins
 #17 RST_n/SBWDIO
 #20 BSL_RX
 #56 BSL_TX
 GND

With FW version 1.5.0.1 and later, modules FW can be updated according to the *Product Specification 1326 SCA10H FW upgrade specification*.

13 Reliability

SCA10H-D01 has been verified against the following test conditions:

Table 7 Test items and conditions

| Test item | Test condition |
|--|---|
| 1. Temperature humidity bake (THB) | - 85RH/85°C - 9V biased - 500h - N=12 |
| 2. Low temperature storage life (LTSL) | - -40°C - 500 h - N=12 |
| 3. Temperature cycling test (TCY) | - -40°C...+85°C - 30 min dwell time - 200 cycles (c) - N=12 |
| 4. Mixed gas test | - IEC60068-2-60 method 2 - 14 days - N=5 |
| 5. Vibration test | - 10<f<2000Hz, log sweep, A=20 G - 10 cycles/1 ax, 15min/cycle - 2.5hrs/axis, total 7.5hrs |
| 6. Drop test | - 2 directional drops on each 6 sides (=12 drops) on concrete - Module attached to a jig - Drop height 1 m - N=6 |
| 7. ESD (HBM) | - 3 kV - N=5 |
| 8. ESD (MM) | - 200 V - N=5 |
| 9. ESD (CDM) | - 600 V - N=5 |

14 Storage

Please use this product within 6 months after receipt.

- The product shall be stored without opening the packing under the ambient temperature from 5 to 35 °C and humidity from 20 to 70 %RH. (Packing materials, in particular, may be deformed at the temperature over 40 °C)
- The product shall be stored in non-corrosive gas (Cl₂, NH₃, SO₂, NO_x, etc.).
- Any excess mechanical shock including, but not limited to, sticking the packing materials by sharp object and dropping the product, shall not be applied in order not to damage the packing materials.

This product is applicable to MSL3 (Based on JEDEC Standard J-STD-020)

- After the packing opened, the product shall be stored at <30deg.C / <60%RH and the product shall be used within 168hours.

- When the color of the indicator in the packing changed, the product shall be baked before soldering.
- Baking condition : 125 +5/-0deg.C, 24hours, 1time

The products shall be baked on the heat-resistant tray. Please note that the packaging materials are not heat-resistant.

15 Handling

Be careful in handling or transporting products because excessive stress or mechanical shock may break products due to the nature of PWB structure.

Handle with care. If products have cracks or damages on their terminals, the characteristics of products may change.

Ensure cleanliness when handling. Pad contamination may affect solderability.

16 Standard PCB Design (Land Pattern and Dimensions)

All the ground terminals should be connected to the ground patterns. Furthermore, the ground pattern should be provided between IN and OUT terminals. Please refer to the specifications for the standard land dimensions.

The recommended land pattern and dimensions is as Murata's standard. The characteristics of products may vary depending on the pattern drawing method, grounding method, land dimensions, land forming method of the NC terminals and the PCB material and thickness. Therefore, be sure to verify the characteristics in the actual set. When using non-standard land pattern, please contact Murata beforehand.

17 Notice for Chip Placer

When placing products on the PCB, products may be stressed and broken by uneven forces from a worn-out chucking locating claw or a suction nozzle. To prevent products from damages, be sure to follow the specifications for the maintenance of the chip placer being used. For the positioning of products on the PCB, be aware that mechanical chucking may damage products.

18 Soldering Conditions

Carefully perform preheating so that the temperature difference (ΔT) between the solder and products surface should be in the following range. When products are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100 °C.

Soldering must be carried out by the above mentioned conditions to prevent products from damage. Contact Murata before use if concerning other soldering conditions.

Table 8 Soldering methods

| Soldering Method | Temperature |
|-----------------------|---|
| Soldering iron method | $\Delta T < 130 \text{ }^\circ\text{C/s}$ |
| Reflow method | |

- Soldering iron method conditions are indicated below.

Table 9 Soldering iron conditions

| Soldering iron conditions | |
|---------------------------|-----------------------------------|
| Soldering iron power | $\leq 18\text{W}$ |
| Temperature of iron tip | $\leq 350 \text{ }^\circ\text{C}$ |
| Iron contact time | within 3s |

- Diameter of iron-tip: max 3.0 mm.
- Do not allow the iron-tip to directly touch the ceramic element.

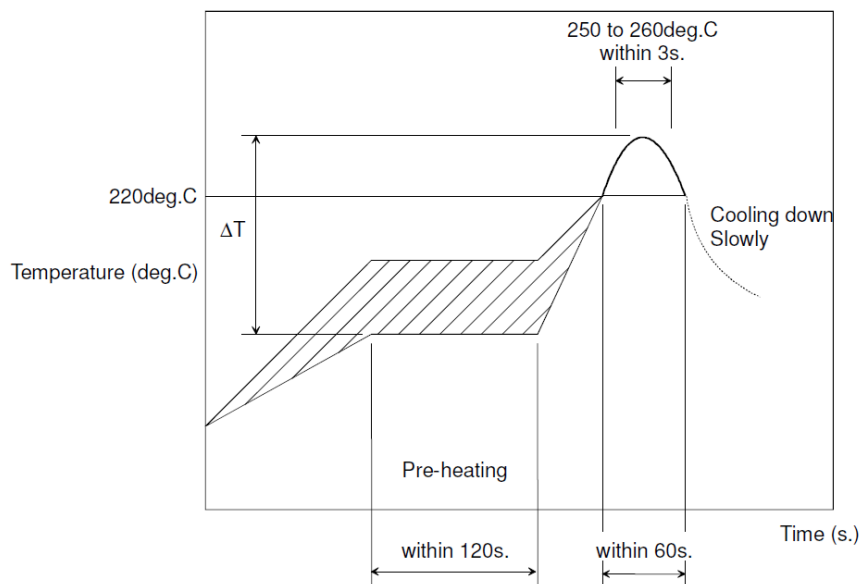


Figure 8 Example reflow soldering standard conditions

19 Cleaning

Any cleaning of this product is not permitted.

20 Potting

Potting the product is not recommended. Potting material may get between the sensor and circuit board resulting in mechanical damages due to thermal expansion.

21 Operational Environment Conditions

Products are designed to work for electronic products under normal environmental conditions (ambient temperature, humidity and pressure). Therefore, products have no problems to be used under the similar conditions to the above-mentioned. However, if

products are used under the following circumstances, it may damage products and leakage of electricity and abnormal temperature may occur.

- In an atmosphere containing corrosive gas (Cl₂, NH₃, SO_x, NO_x etc.)
- In an atmosphere containing combustible and volatile gases
- Dusty place
- Direct sunlight place
- Water splashing place
- Humid place where water condenses
- Freezing place

If there are possibilities for products to be used under the preceding clause, consult with Murata before actual use.

As it might be a cause of degradation or destruction to apply static electricity to products, do not apply static electricity or excessive voltage while assembling and measuring.

22 Packaging

22.1 Tray

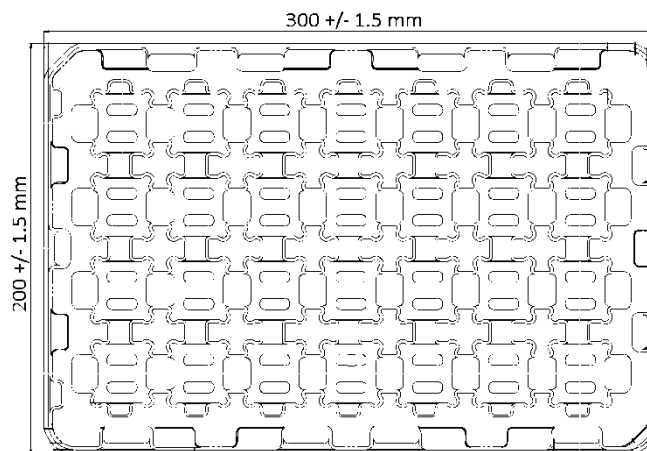


Figure 9 Product tray 28 pcs

22.2 Inner Box

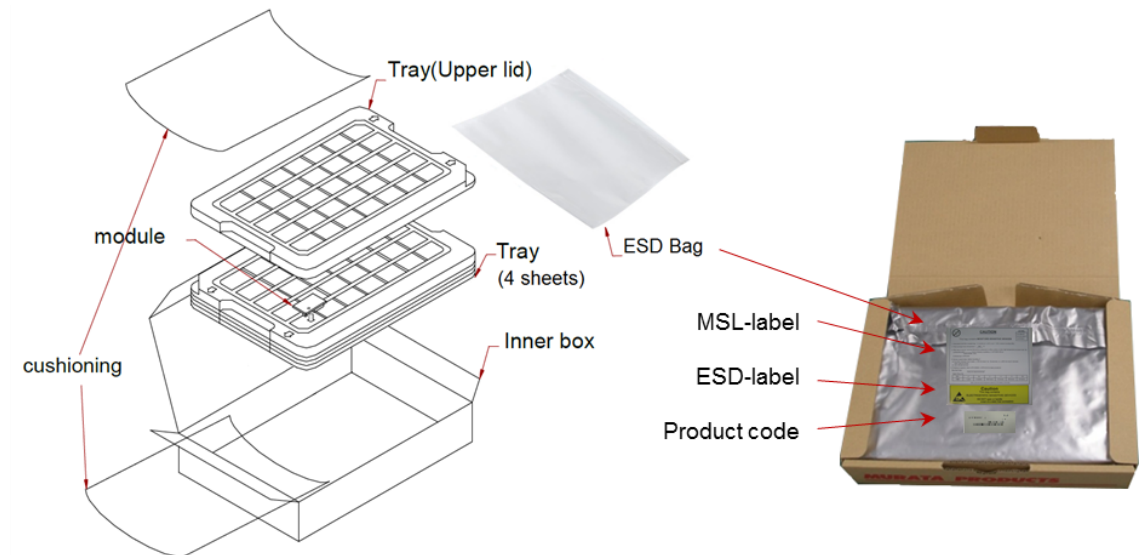


Figure 10 Inner box 112 pcs

22.3 Outer Box

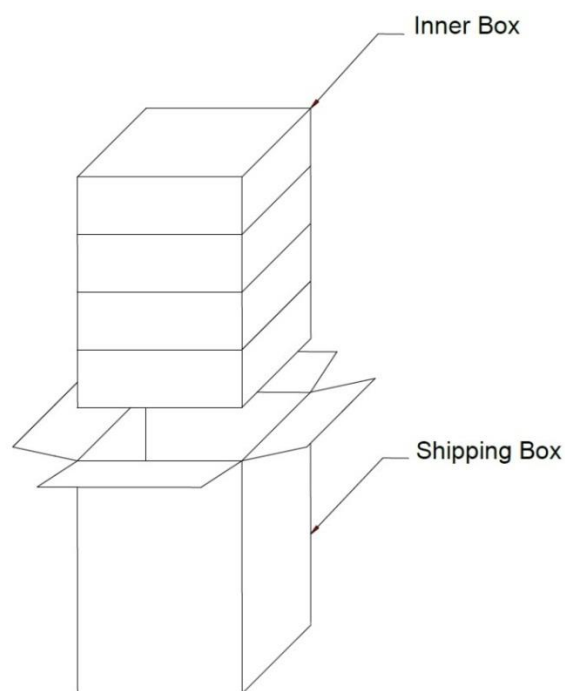


Figure 11 Outer box 448 pcs

- Outer box contains 4 inner boxes. One or more inner boxes can be dummies depending on the actual delivery quantity.
- Please don't stack more than 5 shipping boxes.

23 Note

Please make sure that our product SCA10H has been evaluated and confirmed against your specifications. Please also note that our product SCA10H has not been qualified for medical or similar use where it might directly or indirectly cause damage to the third party's life, body or property.

All the items and parameters in this product specification have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment agreed upon between you and us. You are requested not to use our product deviating from such agreement.

We consider it is not appropriate to include other terms and conditions for transaction warranty in your product specifications, drawings or other technical documents. Therefore, even if your original part of this product specification includes such terms and conditions as warranty clause, product liability clause, or intellectual property infringement liability clause, we are not able to accept such terms and conditions in our product specification unless they are based on the governmental regulation and we have agreed in a separate contract. We would like you to discuss them when negotiating the contract.

24 Change control

| Rev. | Date | Change Description |
|------|-----------|---|
| 1 | 09-Sep-15 | Document moved to new control system and template, section 8 added, document references in section 11 and 12 updated. |
| 2 | 18-May-16 | Figure 10 updated, storage conditions clarified |
| 3 | 26-Aug-16 | Section 10 updated |
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