OncQue™

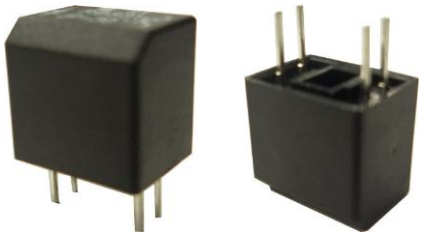
OncQue Corporation

SENSOR SWITCH 大日科技股份有限公司

| Item.# | RBS3111 Series | Description | ROLL BALL SWITCH | Version | V101.6 |
|---|---|---|---|---|---|
| Page | 1 of 17 | | Date | Sep. 14, 2012 | |

## FUNCTIONS

1. Tilt Detecting within a 360° radius
2. Slight Vibration Detecting



## APPLICATIONS

1. Automatically shut off for home appliances
2. Automatically shut off for Sporting equipment
3. Automatically shut off for motorbike
4. Alarm system
5. Anti-theft / Anti-tamper devices
6. Being motion detection (personal locator)
7. Wake up systems for power saving, such like remote controllers
8. Earthquake Detecting

## FEATURES

1. Housing made of high insulation plastic material, free from electric conduction and rust problem.
2. Detecting with photo transistors, generating highly reliable and stable signals.
3. All plastic materials subject to industrial purpose, resist high temperature and meet fireproof function.
4. Simple ON and OFF signals, easy for design.
5. Suitable to vertical PCB.
6. Tilt Angles: 15°, 20°, 30°, and 45° within a 360° radius.
7. RoHS compliance, an ideal substitute for mercury switch.
8. A more economical tilt and vibration detection option than IC design solution.
9. All made in Taiwan and examined before shipment.

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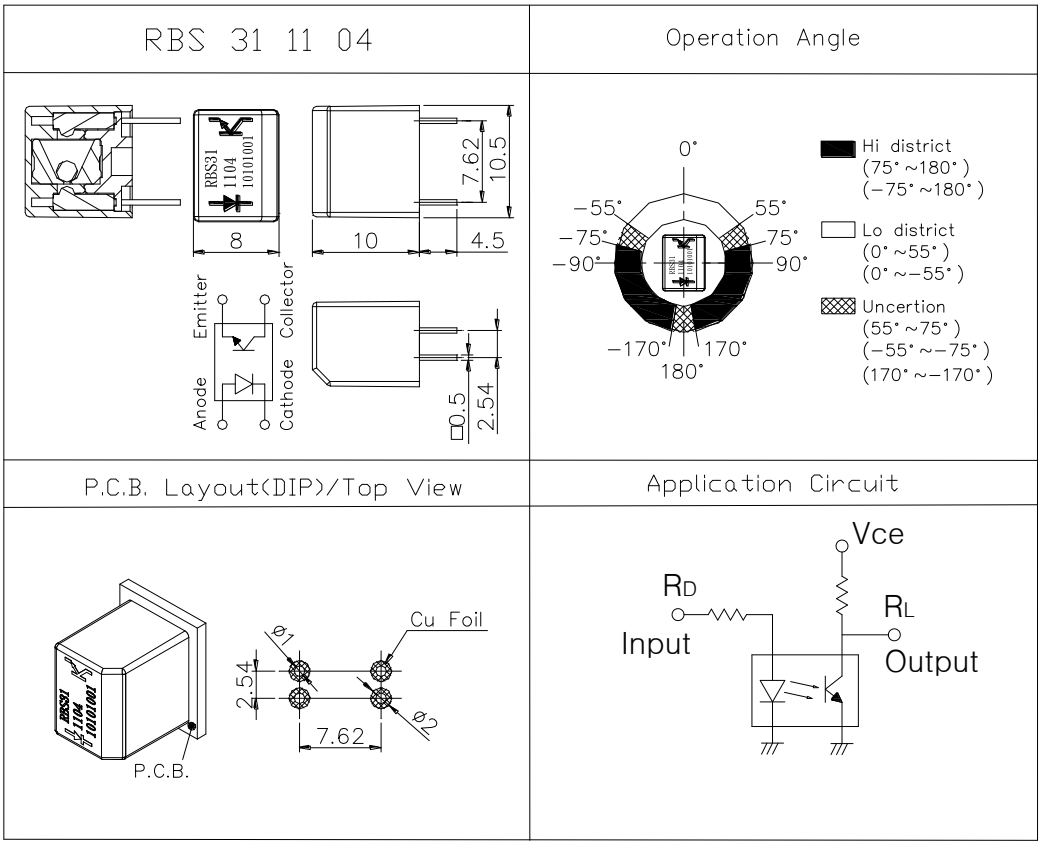
- PATENTS
  1. Taiwan Patent No. I 310952
  2. Taiwan Patent No. 181431
  3. USA Patent No. US 6,800,841 B1
  4. USA Patent No. US 7,402,791 B2
  5. China Patent No. ZL 200610083013.5
  6. China Patent No. ZL 200820126206.9
  7. Japan Patent No. 4384217
  8. Japan Patent No. 3148127

- DIMENSIONS / OPERATION / P.C.B. LAYOUT (Unit: mm, Tolerance: ±0.25mm)



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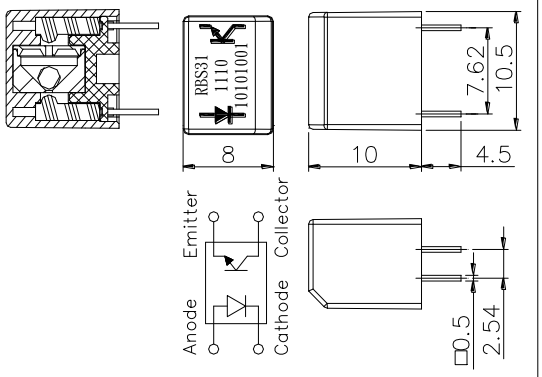
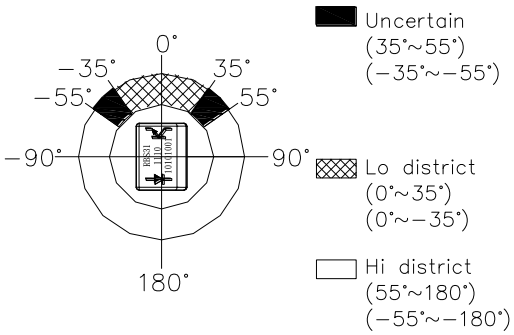
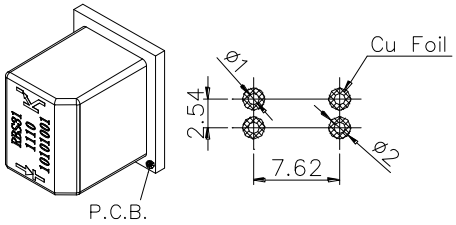


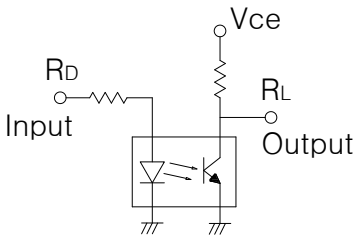

Operation Angle




P.C.B. Layout(DIP)/Top View




Application Circuit

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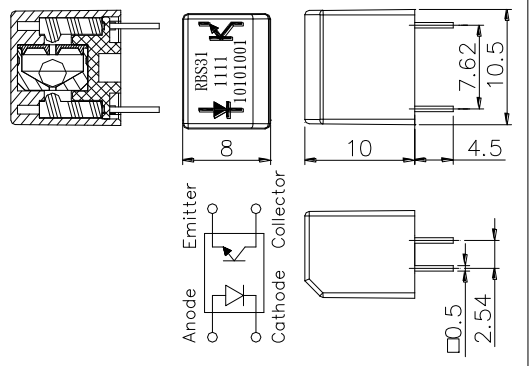
RBS 31 11 11

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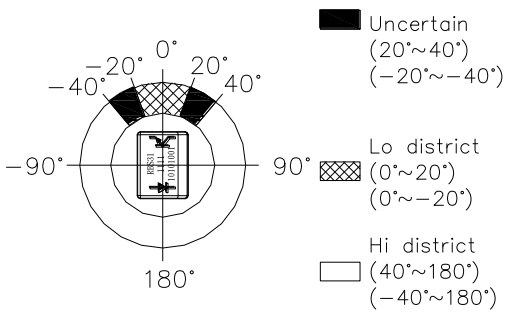


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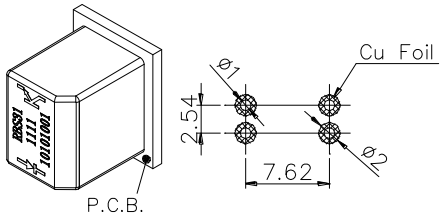
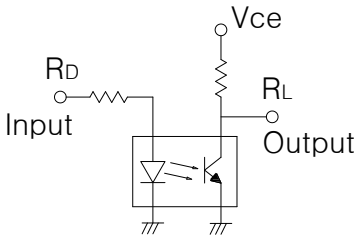



Application Circuit



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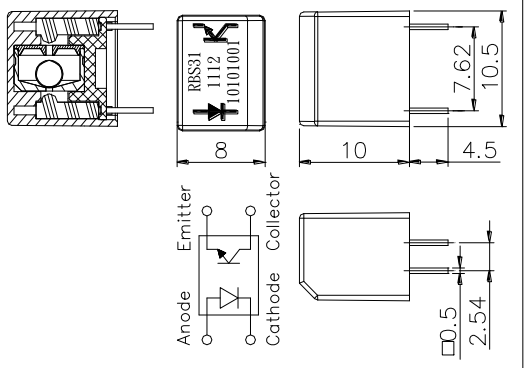
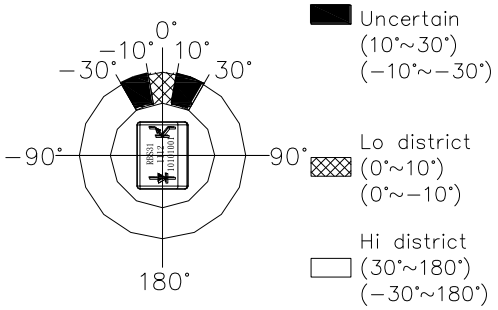



Operation Angle

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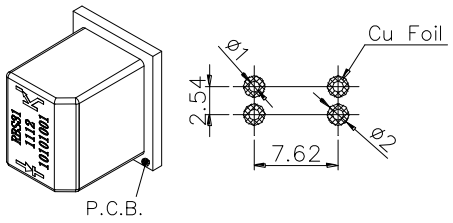
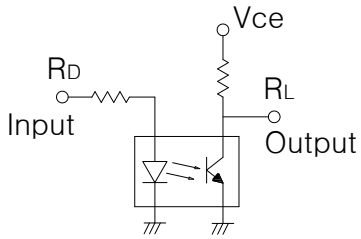



Application Circuit

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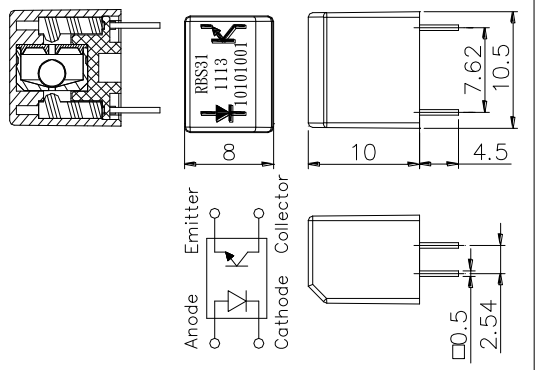
RBS 31 11 13

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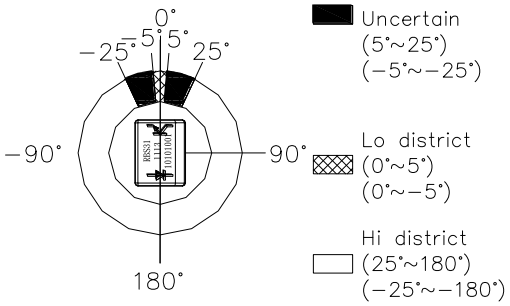


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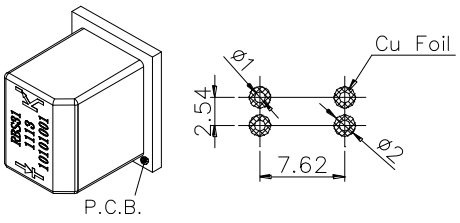
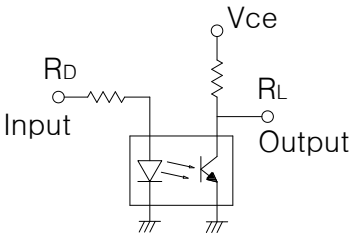



Application Circuit

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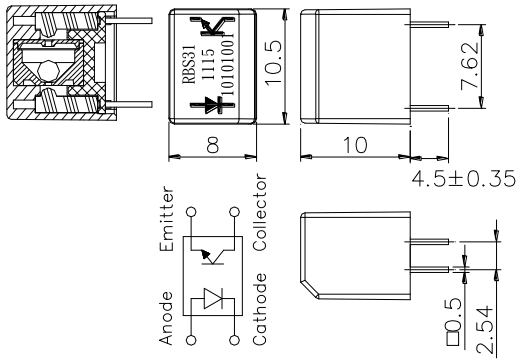
RBS 31 11 15

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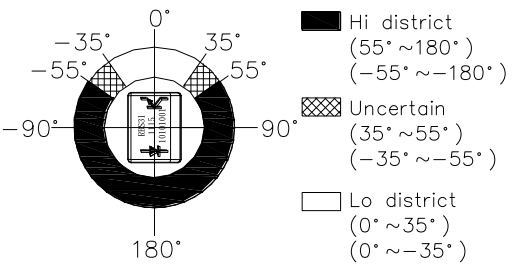


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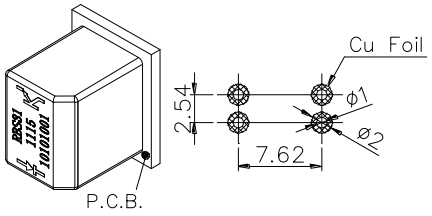
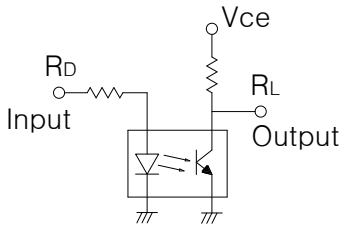
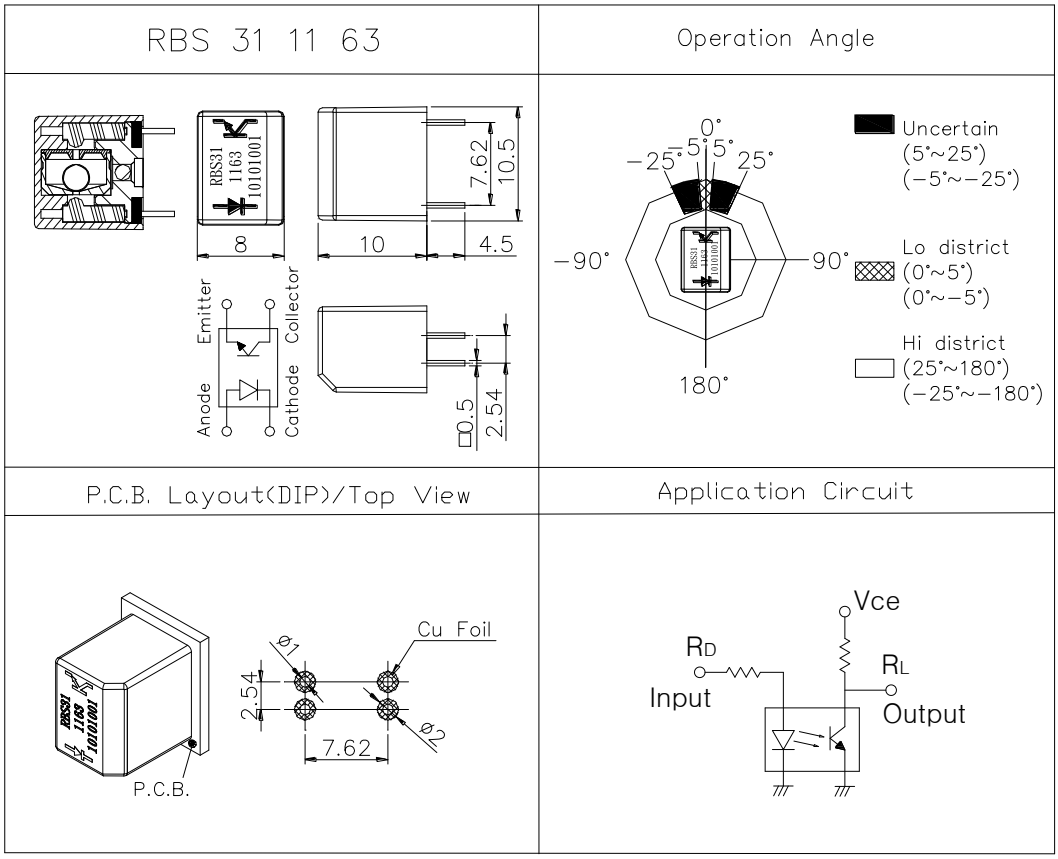



Application Circuit






● Current/Voltage Suggested

| Input Current (mA) | Operating Voltage (V) | Conditions |
|---|---|---|
| 10 | 5 | Vce=5V<br>RD=470ohn<br>RL=33Kohn |

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● Absolute Maximum Rating （Ta=25℃）

| Item | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Input | Power Dissipation | Pd | 75 | mW |
| | Reverse Voltage | Vr | 5 | V |
| | Forward Current | IF | 50 | mA |
| | Peak Forward Current (*1) | IFP | 1 | A |
| Output | Collector Power Dissipation | Pc | 100 | mW |
| | Collector Current | Ic | 20 | mA |
| | C-E Voltage | VCEO | 30 | V |
| | E-C Voltage | VECO | 5 | V |
| Operating Temperature | | Topr | -25~+85 | ℃ |
| Storage Temperature | | Tstg | -40~+100 | ℃ |
| Soldering Temperature (*2) | | Tsol | 260 | ℃ |

(*1) tw=100 uSec.、T=10 mSec.　　(*2) t=5 Sec

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● Electrical Optical Characteristics (Ta=25℃)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage | $V_F$ | $I_F$=20mA | — | — | 1.5 | V |
| Reverse Current | $I_R$ | $V_R$=5V | — | — | 10 | μA |
| Peak Wavelength | λp | $I_F$=10mA | | 940 | | nm |
| Dark Current | $I_D$ | $V_{CE}$=10V | — | — | 2 | μA |
| C-E Saturation Voltage | $V_{CE\ (sat)}$ | $I_C$=0.25mA<br>$I_F$=20mA | — | — | 0.4 | V |
| Light Current | $I_L$ | $V_{CE}$=5V<br>$I_F$=20mA | 0.5 | 5 | — | mA |
| Rise Time | Tr | $I_C$=0.8mA<br>Vcc=30v<br>$R_L$=1KΩ | — | 5 | — | μsec |
| Fall Time | Tf | | — | 5 | — | μsec |

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● Typical Electrical / Optical Characteristics Curves (Ta=25℃)

Fig.1 Power Dissipation vs. Ambient Temperature

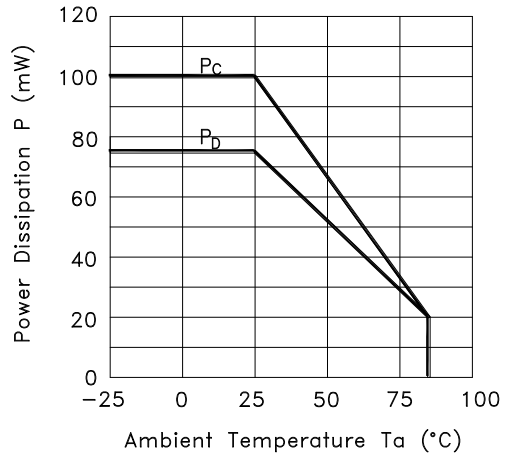


Fig.2 Forward Current vs. Forward Voltage

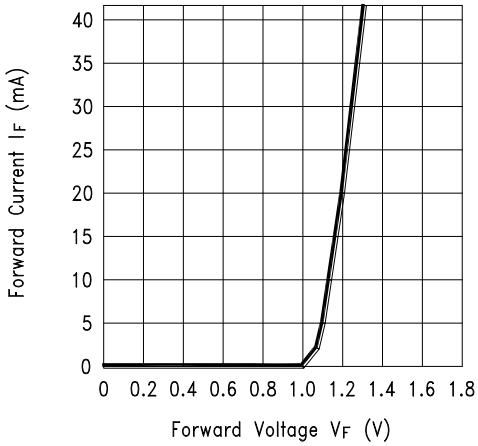


Fig.3 Collector Current vs. Collector−emitter Voltage

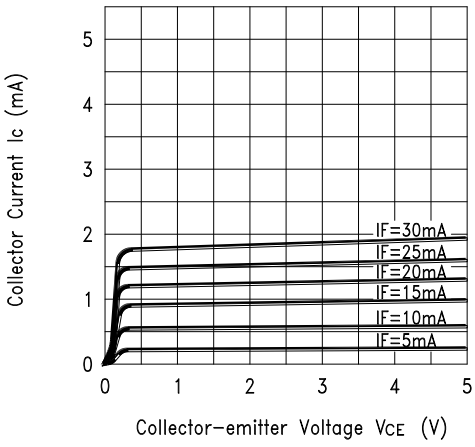


Fig.4 Collector Current vs. Ambient Temperature

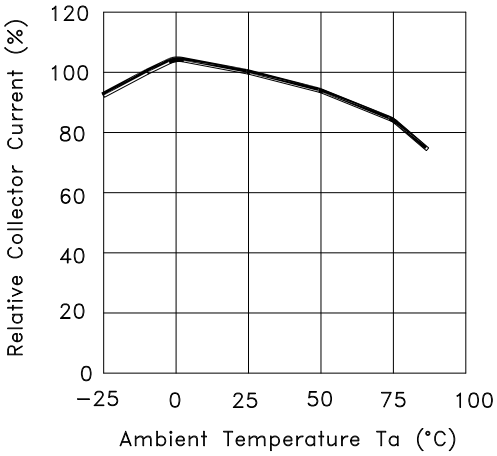


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Fig.5 Collector-emitter Saturation Voltage vs. Ambient Temperature

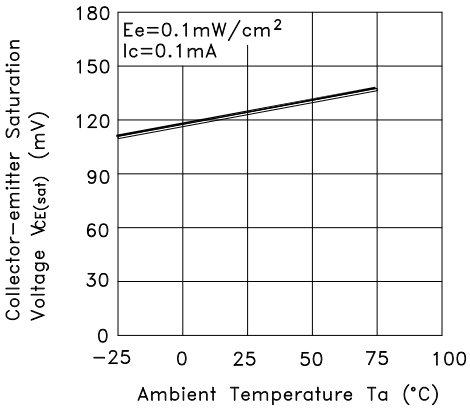



Fig.6 Response Time vs. Load Resistance

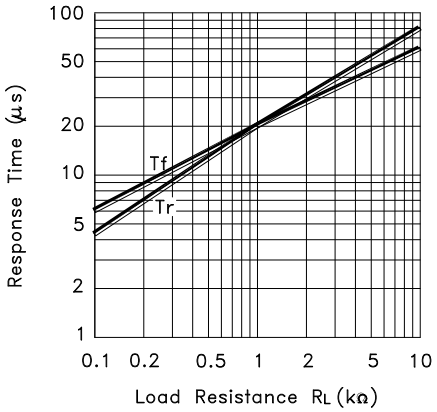
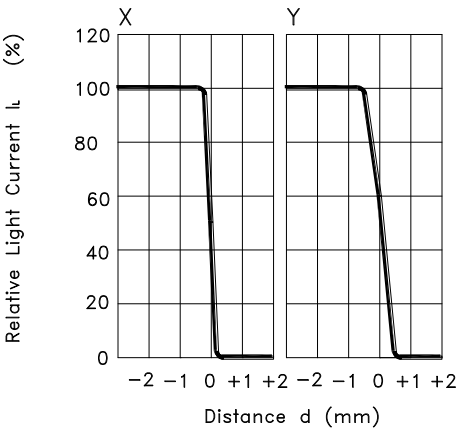
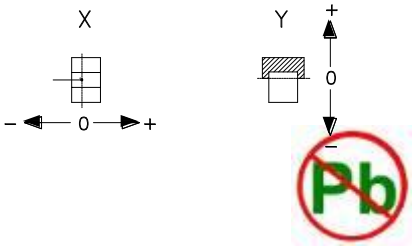


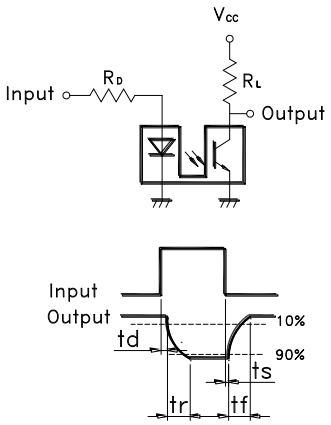

Fig.7 Sensing Position Characteristics (Typical)




(Center of Optical axis)




Test Circuit for Response Time

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● ELECTRICAL CHARACTERISTICS

| | | |
|---|---|---|
| 1 | Contact Rating | -- |
| 2 | Contact Resistance | -- |
| 3 | Angle Tolerance | Please see above illustration |
| 4 | Insulation Resistance | -- |
| 5 | Dielectric Strength | -- |
| 6 | Capacitance | -- |

● Reliable Test Items

| Test Item | Standard | Contents |
|---|---|---|
| IR Reflow | MIL-STD-202G, TEST METHOD 210F、IPC/JEDEC J-STD-020D | Peak temp.=255~260℃ *3times |
| Operating Temperature | MIL-STD-202G, TEST METHOD 107G, TEST A | -25°C~85°C |
| Storage Temperature | MIL-STD-202G, TEST METHOD 107G, TEST A | -40℃~85℃ |
| Humidity | MIL-STD-202G, TEST METHOD 103B | 40℃/95%RH |
| Mechanical Life | -- | 2Hz horizontal/1,000,000 times |
| Electrical Life | MIL-STD-883E:1016 | IF=20 mA VCE=5 V TIME:1,000 hrs |
| Pull Force of Terminal | -- | 500 GF，1 minutes |

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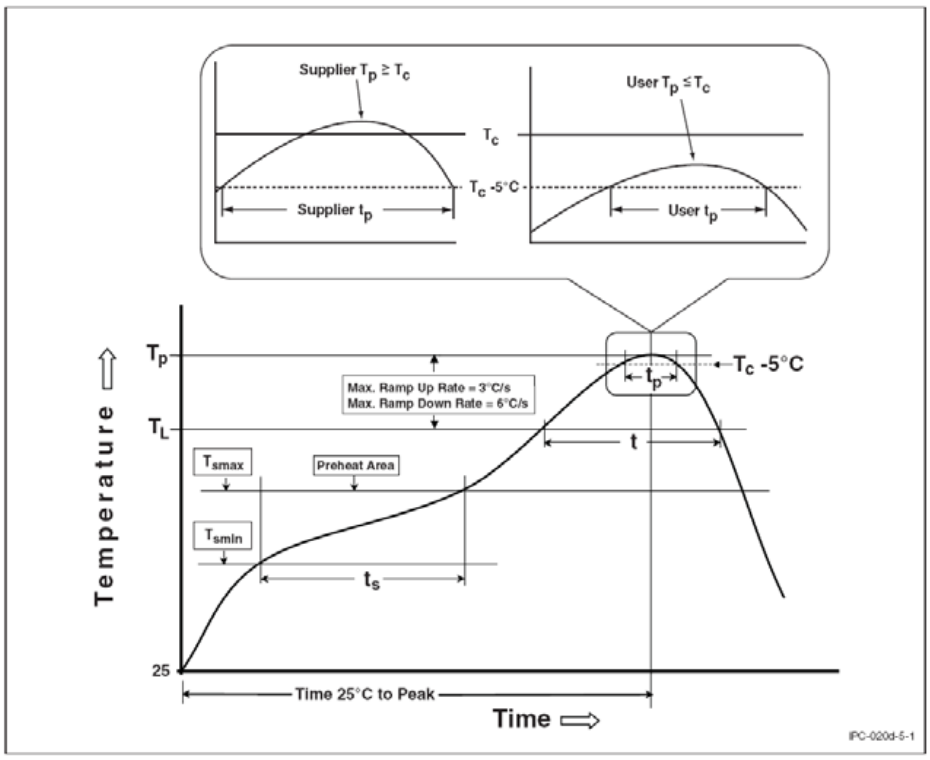
- IR Reflow Reference Profile (For SMT Type)

  Following reflow information is for reference only, we suggest users to process as per the recommendation of soldering flux manufacturer.



< Table of classification Reflow profile>

| Item | Pb process | Pb free process |
|---|---|---|
| Pre-heat and Soak<br>Temperature min.(Tsmin)<br>Temperature max.(Tsmax)<br>Time (Tsmin to Tsmax)(ts) | <br>100 °C<br>150 °C<br>60-120 seconds | <br>150 °C<br>200 °C<br>60-120 seconds |
| Average ram-up Rate<br>(Tsmax to Tp) | 3 °C/second max. | 3 °C/second max. |
| Liquidous Temperature (TL)<br>Time at Liquidous (tL) | 183 °C<br><br>60-150 seconds | 217 °C<br><br>60-150 seconds |
| Peak package body Temperature<br>(Tp)* | 230 °C ~235 °C * | 255 °C ~260 °C * |
| Classification temperature(Tc) | 235 °C | 260 °C |
| Time(tp)** within 5 °C of the specified classification temperature (Tc) | 20** seconds | 30** seconds |
| Average ram-down Rate<br>(Tp toTsmax) | 6 °C/second max. | 6 °C/second max. |
| Time 25 °C to peak temperature | 6 minutes max. | 8 minutes max. |
| * Tolerance for peak profile temperature (Tp) is defined as a supplier minimum and a user maximum.<br>** Tolerance for time at peak profile temperature (tp) is defined as a supplier minimum and a user maximum. | | |

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|---|---|---|---|---|---|
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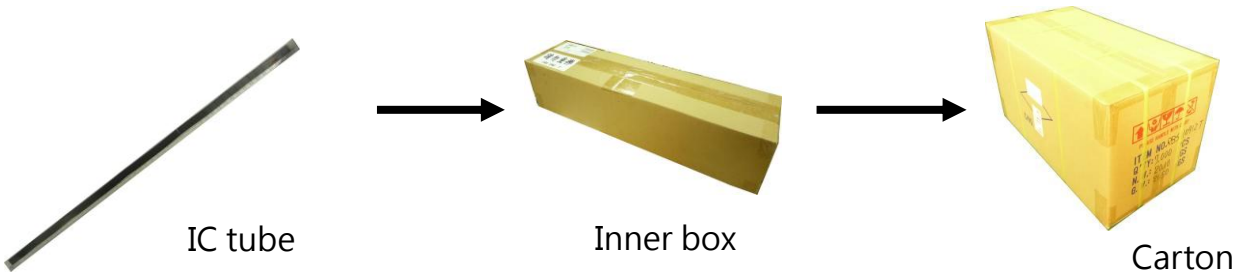
| Condition / Soldering Method | Soldering Temperature | Times for Soldering |
|---|---|---|
| Manual Soldering | 260 ± 5°C | < 5 Sec. Max |
| Wave Soldering | 260 ± 5°C | < 5 Sec. Max |

● PACKAGE

| | Part Number | Package | Quantity | Total | Dimension |
|---|---|---|---|---|---|
| 1. | RBS311104<br>RBS311110<br>RBS311111<br>RBS311112<br>RBS311113<br>RBS311115<br>RBS311163 | IC tube | 48 pcs | 48 pcs | 525L*10W*17.5H |
| | | Inner box | 84 tubes | 4,032 pcs | 539L*130W*130H |
| | | Outer carton | 4 boxes | 16,128 pcs | 551L*285W*288H |

※ Package shown as below for reference.

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- NOTES
  1. Suggestion for usage：For vibration usage or application，we suggest to add hysteresis for IC.
  2. For the continued product improvement as one of the company policy, specifications may change or update without notice. The latest information can be obtained through our sales offices. Normally, all products are supplied under our standard conditions.

- PRECAUTIONS FOR USE
  1. If the products is intended to be used for other endurance equipment requiring higher safety and reliability such as life support system, space and aviation devices, disaster and safety system, it's necessary to make verification of conformity or contact us for the details before using.
  2. Do not try to clean the switch with a solvent or similar substance after the soldering process.
  3. Use water-soluble flux may damage the switch.
  4. When the soldering temperature exceeds specifications, the switch may fall apart.
  5. Do not use switch in the environment of high humidity，because such an environment may cause the leakage current between the terminals.
  6. More than the rated load may cause fire, so do not use more than the load
  7. In the circuit，switch should not be near or directly connected with the magnetic component solder joints (for example: relays, transformers, etc.).

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