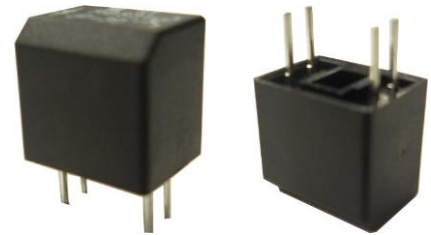


SENSOR SWITCH

Item No.	RBS3111 Series	Description	ROLL BALL SWITCH	Version	9
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● **FUNCTIONS**

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



● **APPLICATIONS**

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



SENSOR SWITCH

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● 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 for 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.

● PATENTS

1. Taiwan Patent No. I 310952
2. Taiwan Patent No. M 450817
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. China Patent No. ZL 201220539712.7
8. Japan Patent No. 4384217
9. Japan Patent No. 3148127

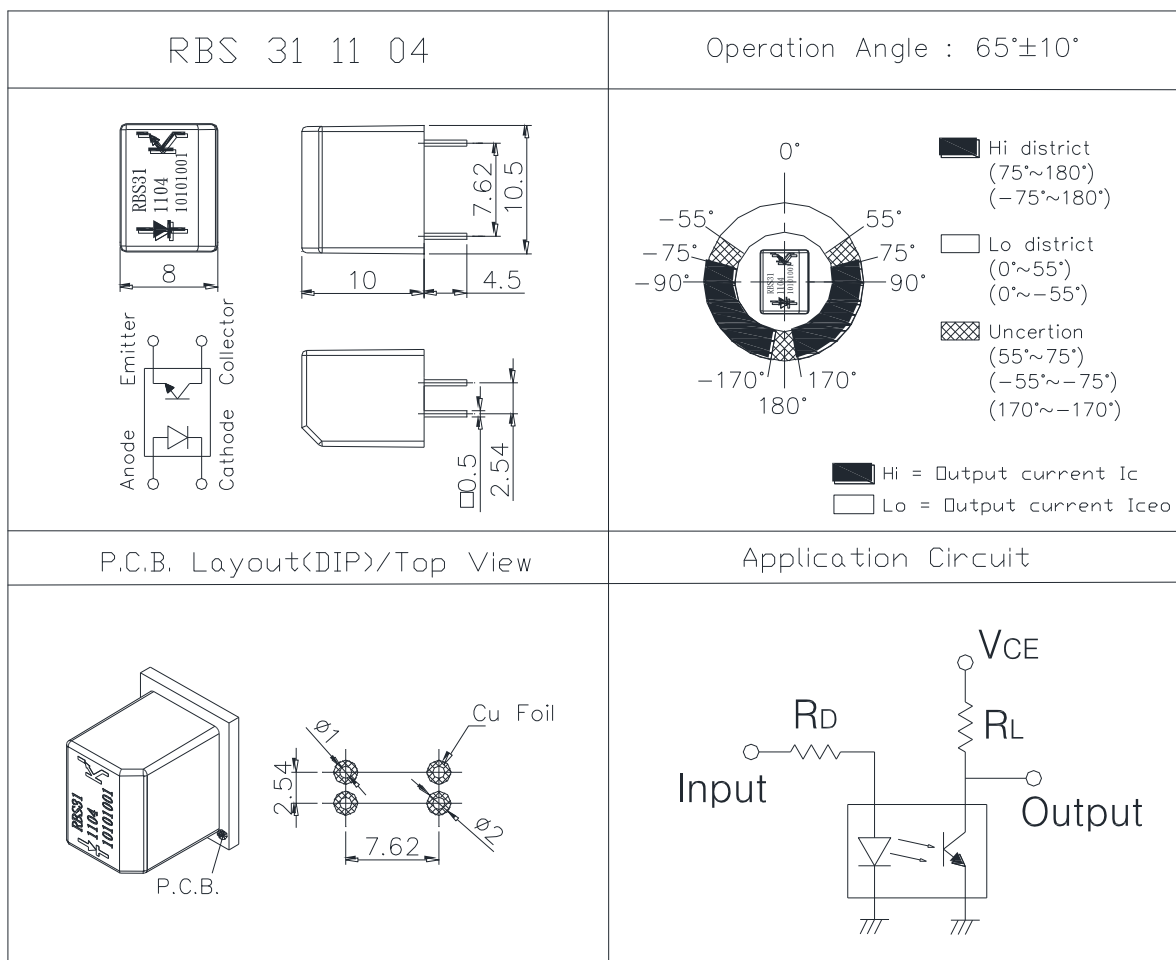


SENSOR SWITCH

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

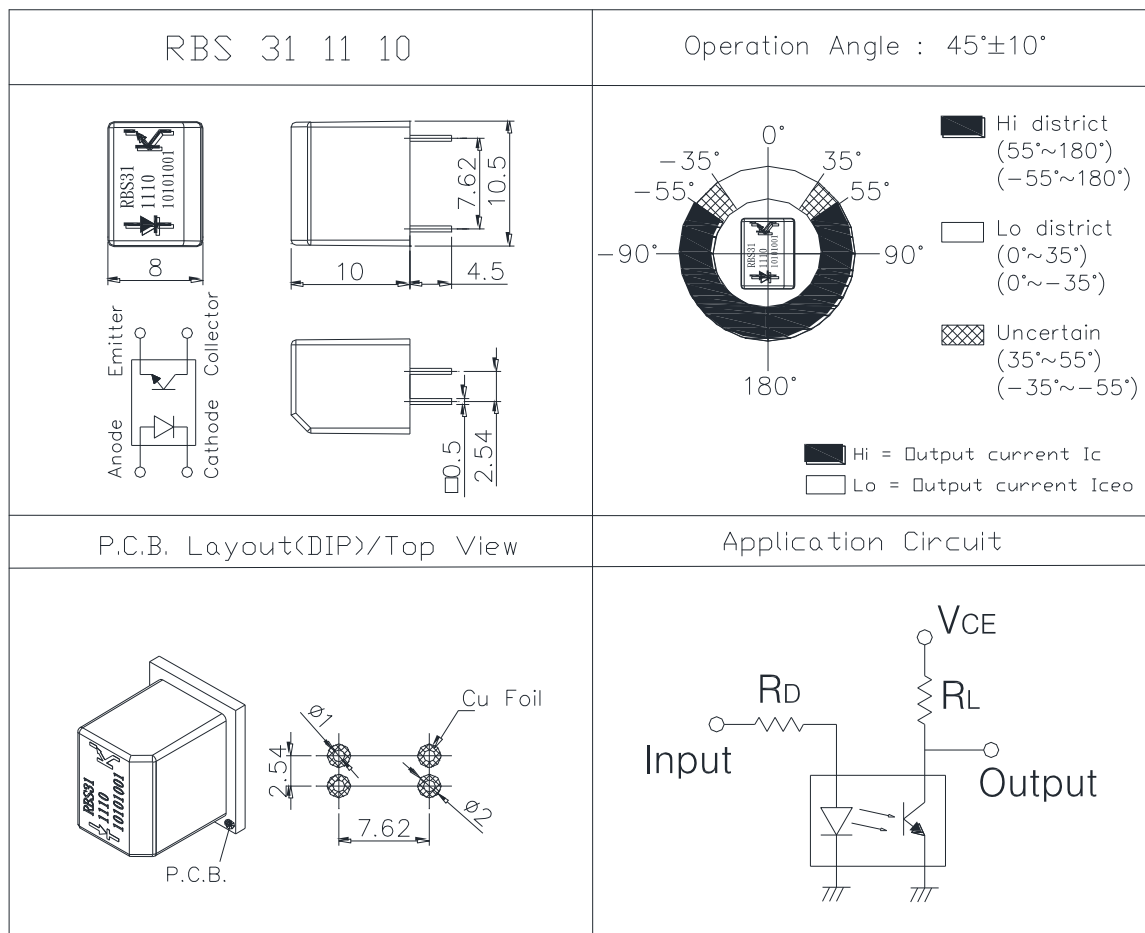
Fig. 1



SENSOR SWITCH

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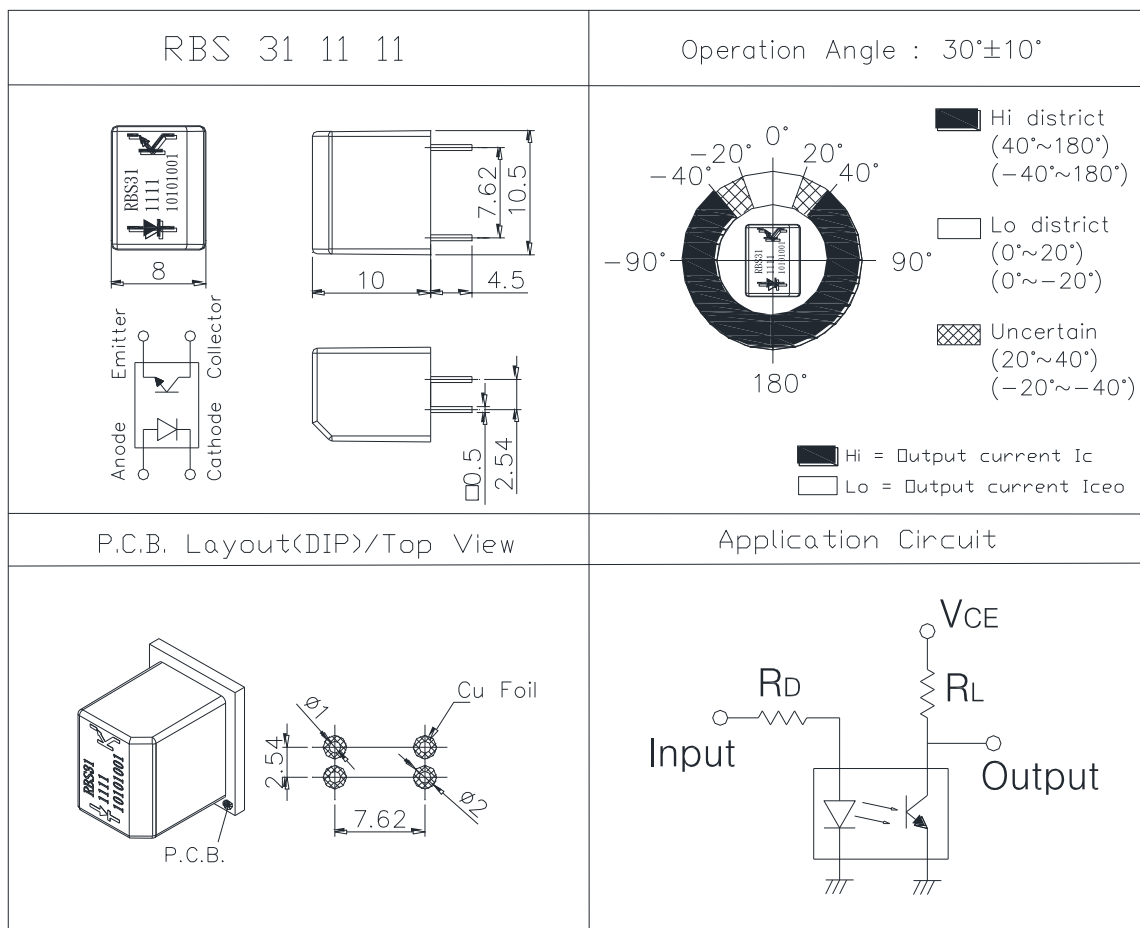
Fig. 2



SENSOR SWITCH

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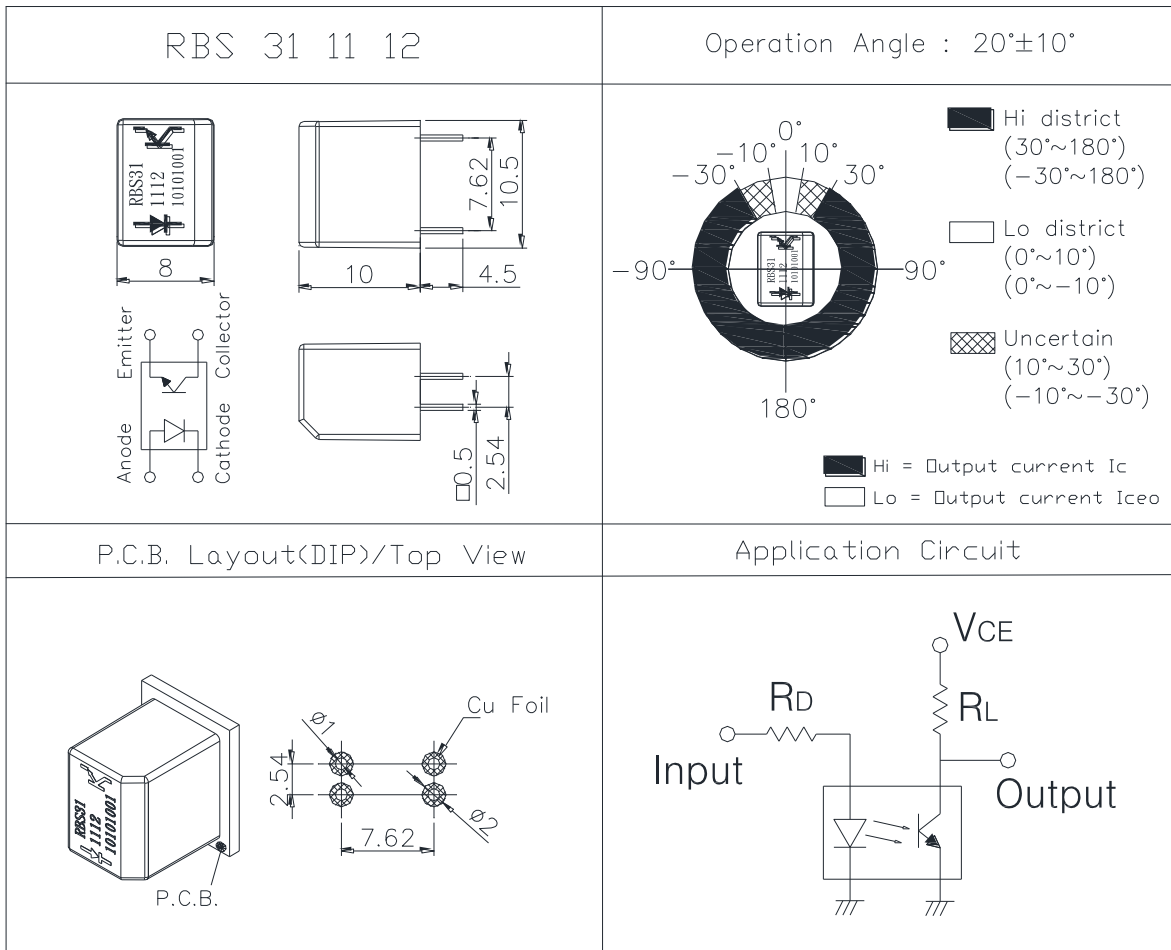
Fig. 3



SENSOR SWITCH

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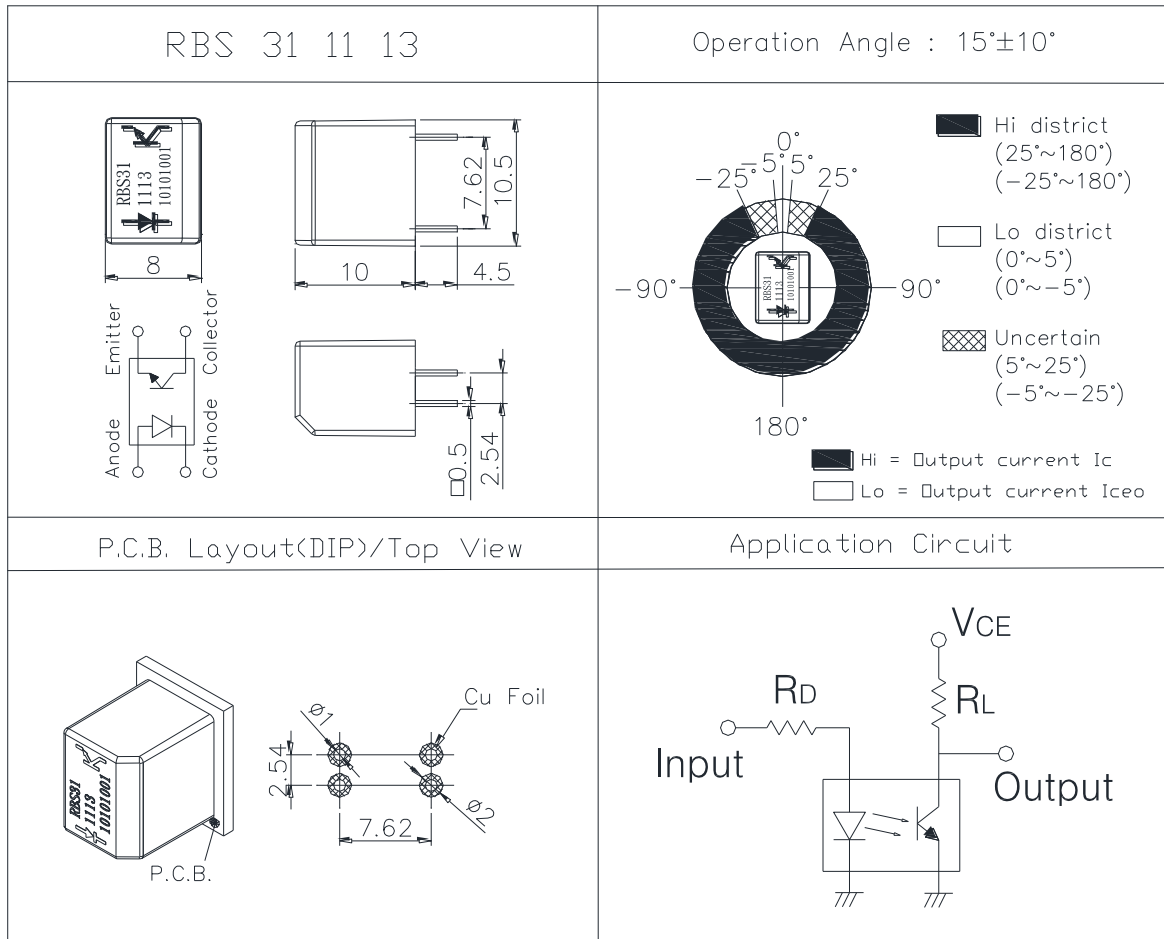
Fig. 4



SENSOR SWITCH

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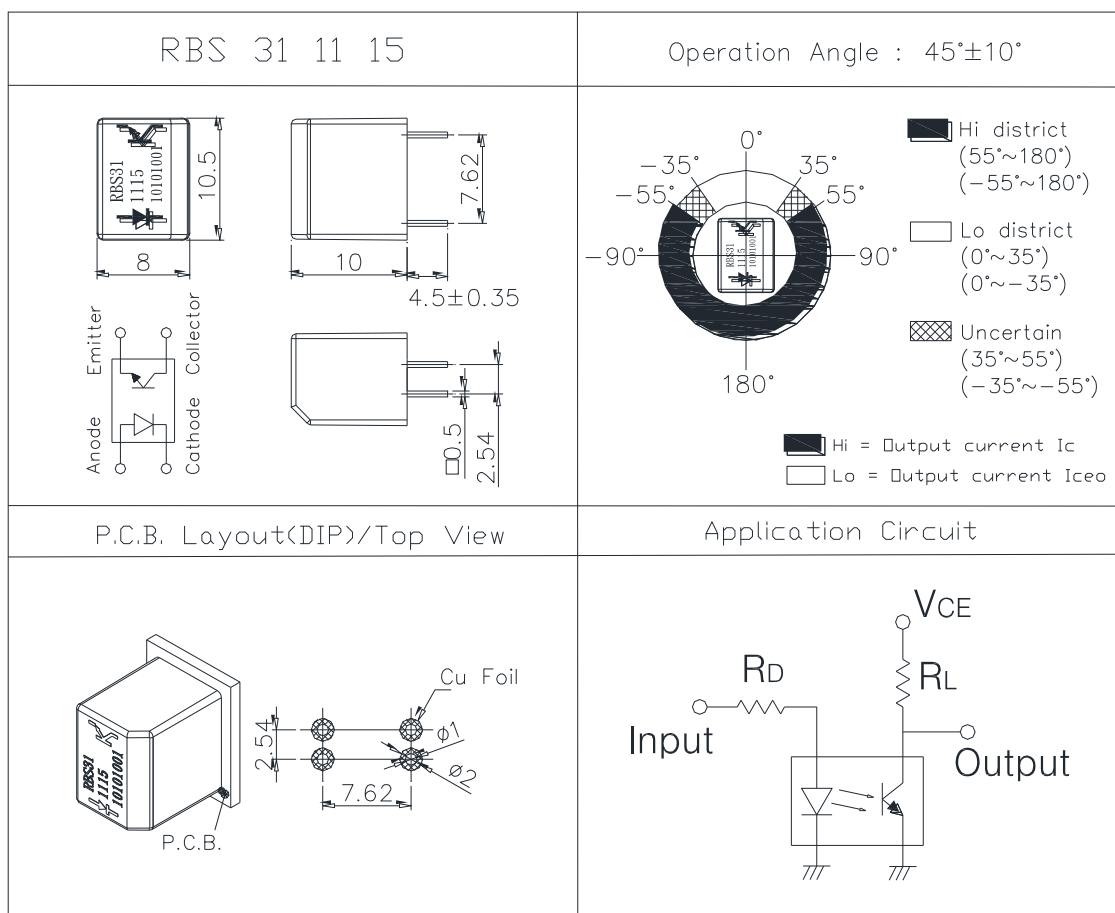
Fig. 5



SENSOR SWITCH

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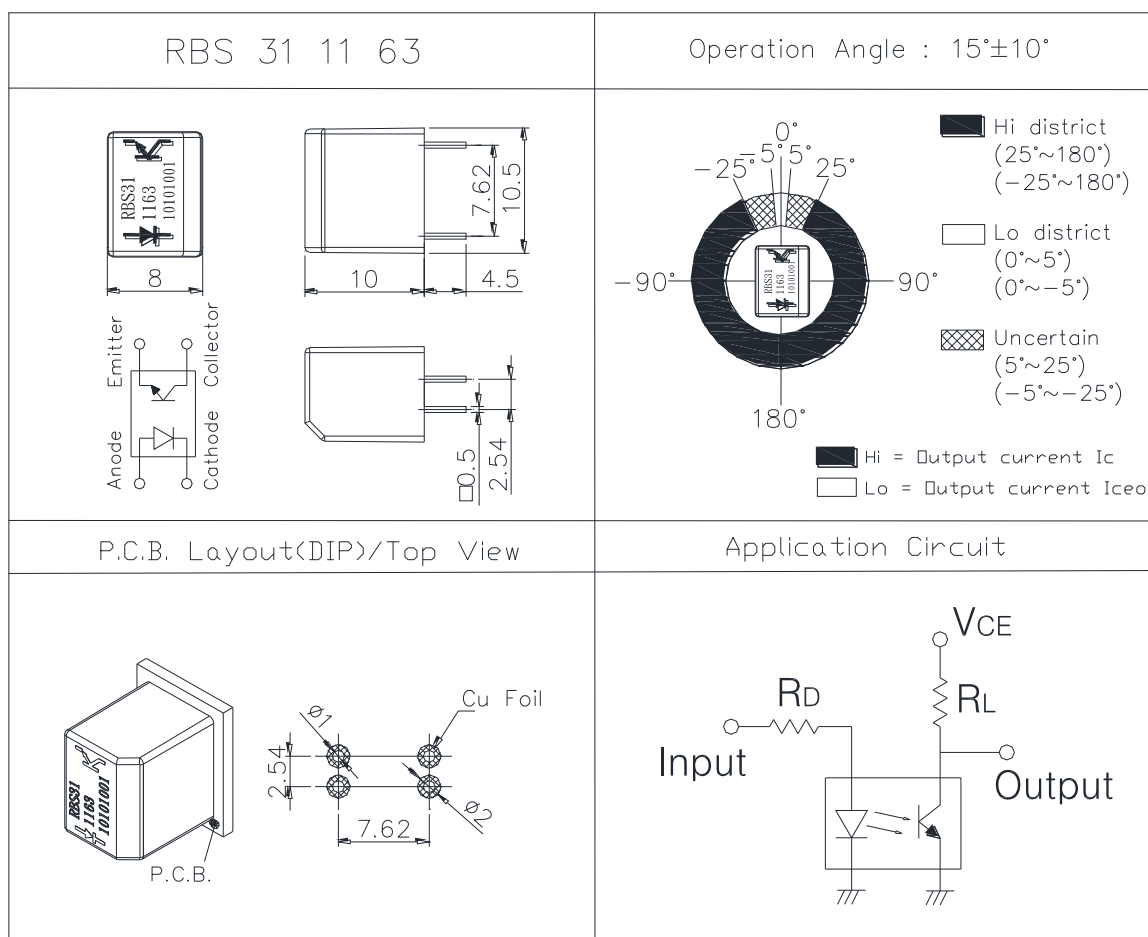
Fig. 6



SENSOR SWITCH

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Fig. 7



SENSOR SWITCH

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● Current/Voltage Suggested

Input Current (mA)	Operating Voltage (V)	Conditions
10	5	V _{CE} =5V R _D =470 ohm R _L =33K ohm

● Absolute Maximum Rating (Ta=25°C)

Item		Symbol	Rating	Unit
Input	Power Dissipation	P _d	75	mW
	Reverse Voltage	V _R	5	V
	Forward Current	I _F	50	mA
	Peak Forward Current (*1)	I _{FP}	1	A
Output	Collector Power Dissipation	P _C	100	mW
	Collector Current	I _C	20	mA
	C-E Voltage	V _{CEO}	30	V
	E-C Voltage	V _{ECO}	5	V
Operating Temperature		Topr	-25~+85	°C
Operating Temperature (RBS311163)		Topr	-40~+85	°C
Storage Temperature		Tstg	-40~+85	°C
Soldering Temperature (*2)		Tsol	260	°C

(*1) tw=100 μSec. ∙ T=10 mSec.

(*2) t=5 Sec



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SENSOR SWITCH

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● Electrical Optical Characteristics (Ta=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_F	$I_F=20mA$	-	1.2	1.5	V
Reverse Current	I_R	$V_R=5V$	-	-	10	μA
Peak Wavelength	λ_p	$I_F=10mA$		940		nm
Dark Current	I_{ceo}	$V_{CE}=10V$	-	-	2	μA
C-E Saturation Voltage	$V_{CE(sat)}$	$I_C=0.25mA$ $I_F=20mA$	-	-	0.4	V
Light Current	I_C	$V_{CE}=5V$ $I_F=20mA$	0.5	5	-	mA
Rise Time	T_r	$I_C=0.8mA$ $V_{CC}=30V$ $R_L=1K\Omega$	-	5	-	μsec
Fall Time	T_f		-	5	-	μsec



SENSOR SWITCH

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

Fig.1 Power Dissipation vs. Ambient Temperature

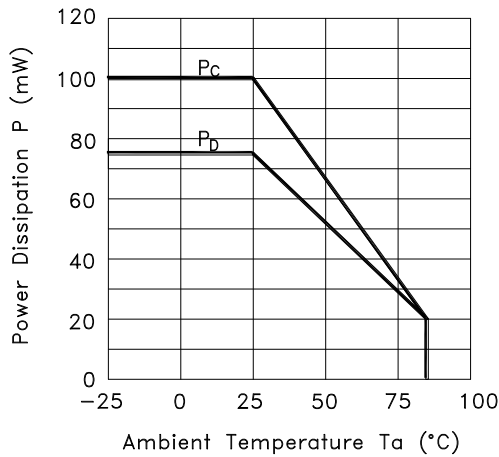


Fig.2 Forward Current vs. Forward Voltage

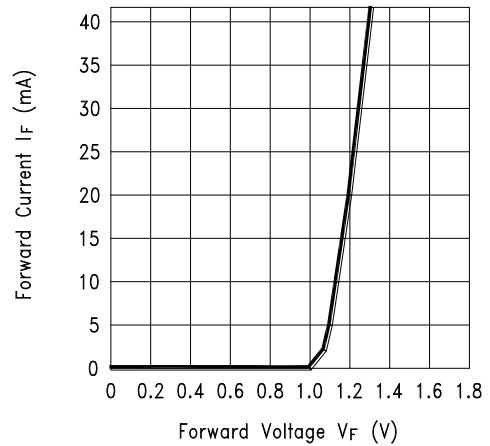


Fig.3 Collector Current vs. Collector-emitter Voltage

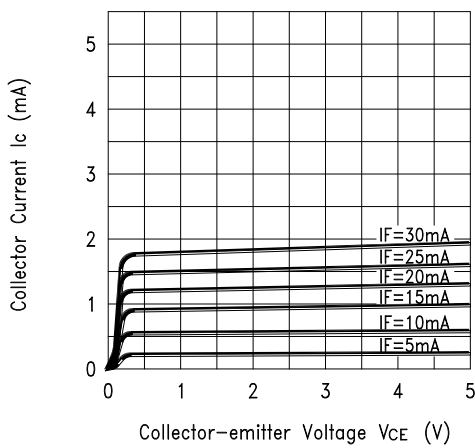
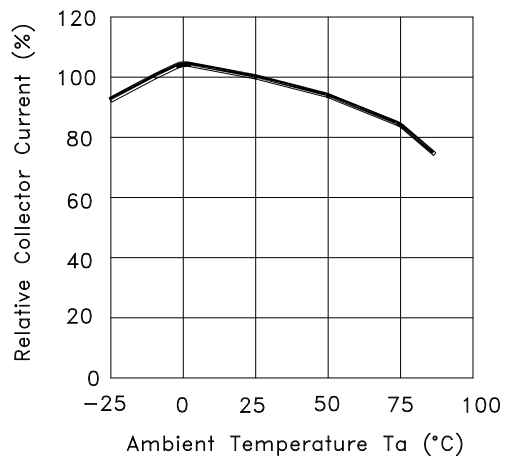


Fig.4 Collector Current vs. Ambient Temperature



SENSOR SWITCH

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

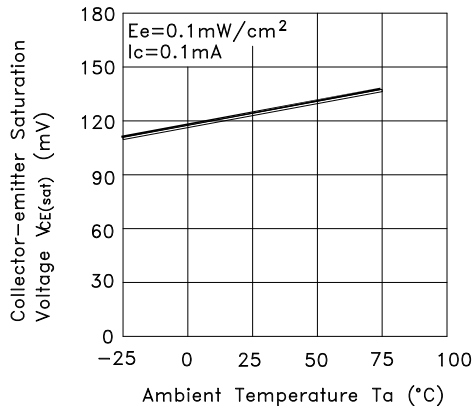


Fig.6 Response Time vs. Load Resistance

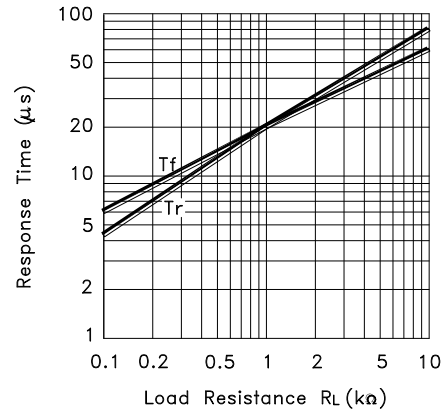
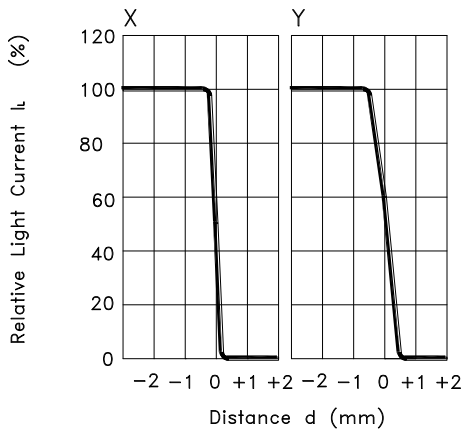
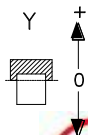
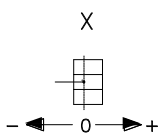


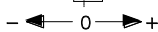
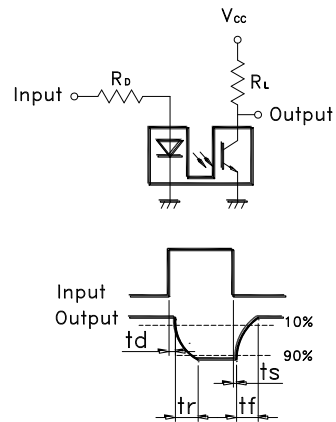
Fig.7 Sensing Position Characteristics (Typical)



(Center of Optical axis)



Test Circuit for Response Time



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● ELECTRICAL CHARACTERISTICS

1	Contact Rating	--
2	Contact Resistance	--
3	Angle Tolerance	Refer to Fig. 1~Fig. 7
4	Insulation Resistance	--
5	Dielectric Strength	--
6	Capacitance	--

● RELIABLE TEST ITEMS

Test Item	Standard	Test Content
IR Reflow	--	--
Operation Temperature	MIL-STD-202G, TEST METHOD 107G, TEST A	-25°C~85°C
Storage Temperature	MIL-STD-202G, TEST METHOD 107G, TEST A	-40°C ~85°C
Humidity	MIL-STD-202G, TEST METHOD 103B	40°C/95%RH
Mechanical Life	--	2Hz, horizontal 1,000,000 times
Electrical Life	MIL-STD-883E:1016	I _F =20 mA, V _{CE} =5 V TIME: 30,000 hrs



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● SOLDERING CONDITION

Following soldering conditions are for reference only, please use soldering information that solder paste manufacturer recommends.

Condition Operation Method	Soldering Temperature	Soldering Time	Wattage of Manual Soldering	Suitable Production Process
IR Reflow	Please refer to following < Table of classification Reflow profile > and Fig. 8		-	SMT
Wave Soldering	260±5°C	< 5 seconds max.	-	DIP
Manual Soldering	260±5°C	< 5 seconds max.	20W or Temperature-controlled manual soldering	DIP、SMT



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< Table of classification Reflow profile >

Item	Pb process	Pb free process
Pre-heat and Soak Temperature min.(T _{min}) Temperature max.(T _{max}) Time (T _{min} to T _{max})(t _s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ram-up Rate (T _{max} to T _p)	3 °C/second max.	3 °C/second max.
Liquidous Temperature (TL) Time at Liquidous (tL)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body Temperature (T _p)*	230 °C ~235 °C *	255 °C ~260 °C *
Classification temperature(T _c)	235 °C	260 °C
Time(tp)** within 5 °C of the specified classification temperature (T _c)	20** seconds	30** seconds
Average ram-down Rate (T _p to T _{max})	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 (T _p) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (tp) is defined as a supplier minimum and a user maximum.		



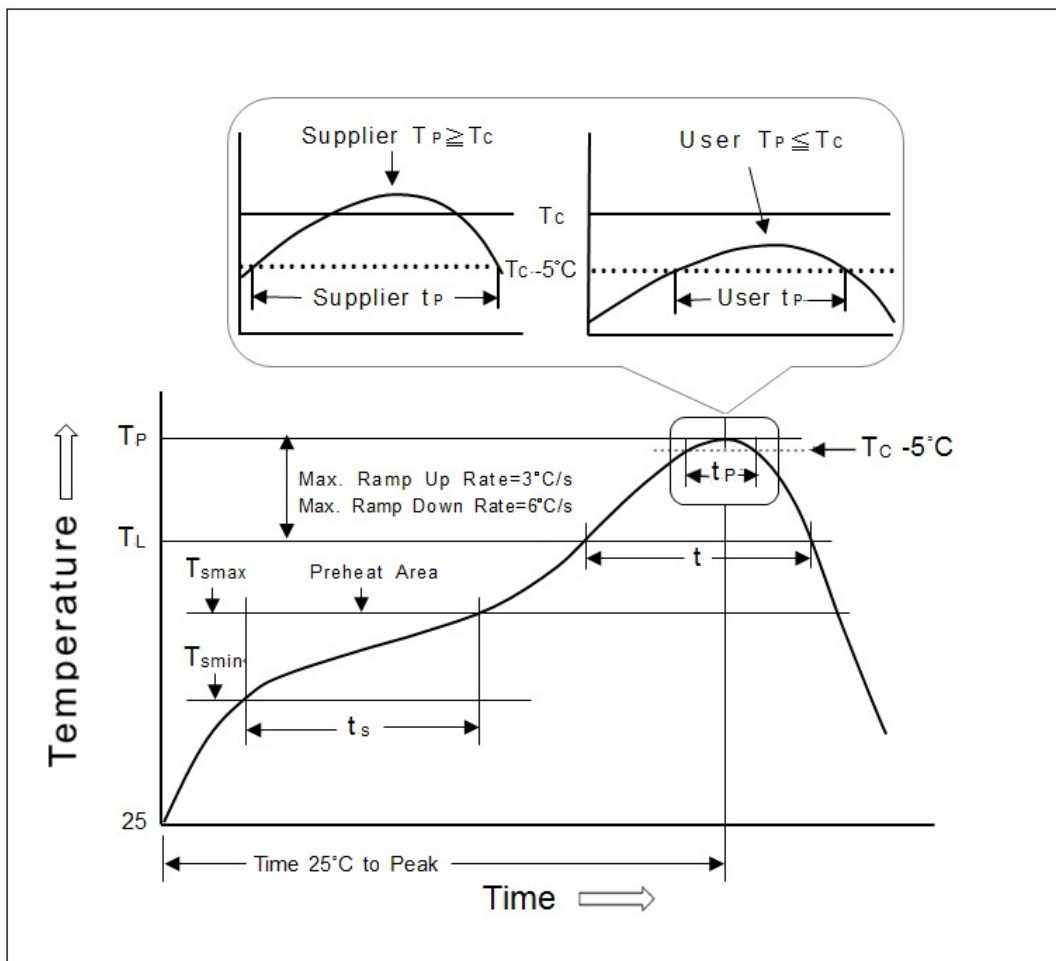
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Fig. 8



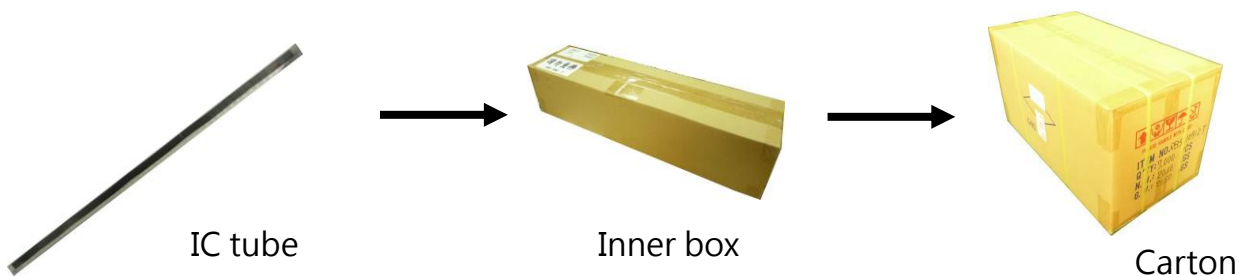
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● PACKAGE

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

※ 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.).
8. To prevent damaging IR and PT, please make electrostatic protective treatment, for example: wearing a conductive wrist strap or antistatic gloves during production process · grounding machinery etc.

