

SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	1 of 14		Date	Jan. 27, 2016	

● **FUNCTIONS**

Omni-directional Vibration Detecting

● **APPLICATIONS**

1. Wake up systems for power saving,
Such like remote controllers
2. GPS starting system
3. Alarm system
4. Anti-theft \ Anti-tampered devices.
5. Automatically flashing for bike lamp
6. Subsidiary night lamp flashing for car
7. Outsole of sporting shoes flashing
8. Toys



● **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. Both suitable for vertical and horizontal PCB.
6. RoHS compliance, an ideal substitute for mercury switch.
7. A more economical vibration detection option than IC design solution.
8. All made in Taiwan and examined before shipment.

● **PATENTS**

1. TAIWAN Patent No. I 226467
2. U.S.A. Patent No. US 6,740,867 B2
3. CHINA Patent No. ZL 02 1 46662.9



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	2 of 14		Date	Jan. 27, 2016	

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

Table 1

VBS 04 02 00 T	Operation Angle
P.C.B. Layout(SMT)/Top View	
TAPE & REEL	



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	3 of 14		Date	Jan. 27, 2016	

● Absolute Maximum Rating (Ta=25°C)

Item		Symbol	Rating	Unit
Input	Power Dissipation	Pd	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
Storage Temperature		Tstg	-40~+85	°C
Soldering Temperature (*2)		Tsol	260	°C

(*1) tw=100 μSec. ∙ T=10 mSec.

(*2) t=5 Sec



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	4 of 14		Date	Jan. 27, 2016	

● 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
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	22	mA
The variation of light current when vibration	ΔI_C	$V_{CE}=5V$ $I_F=20mA$	-	0.2	-	mA
Rise Time	T_r	$I_C=0.8mA$ $V_{CC}=30V$	-	5	-	μsec
Fall Time	T_f	$R_L=1K\Omega$	-	5	-	μsec



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	5 of 14		Date	Jan. 27, 2016	

● Schematic Design

In schematic design, we suggest the design current equal to the half of rated current, we get VBS04,

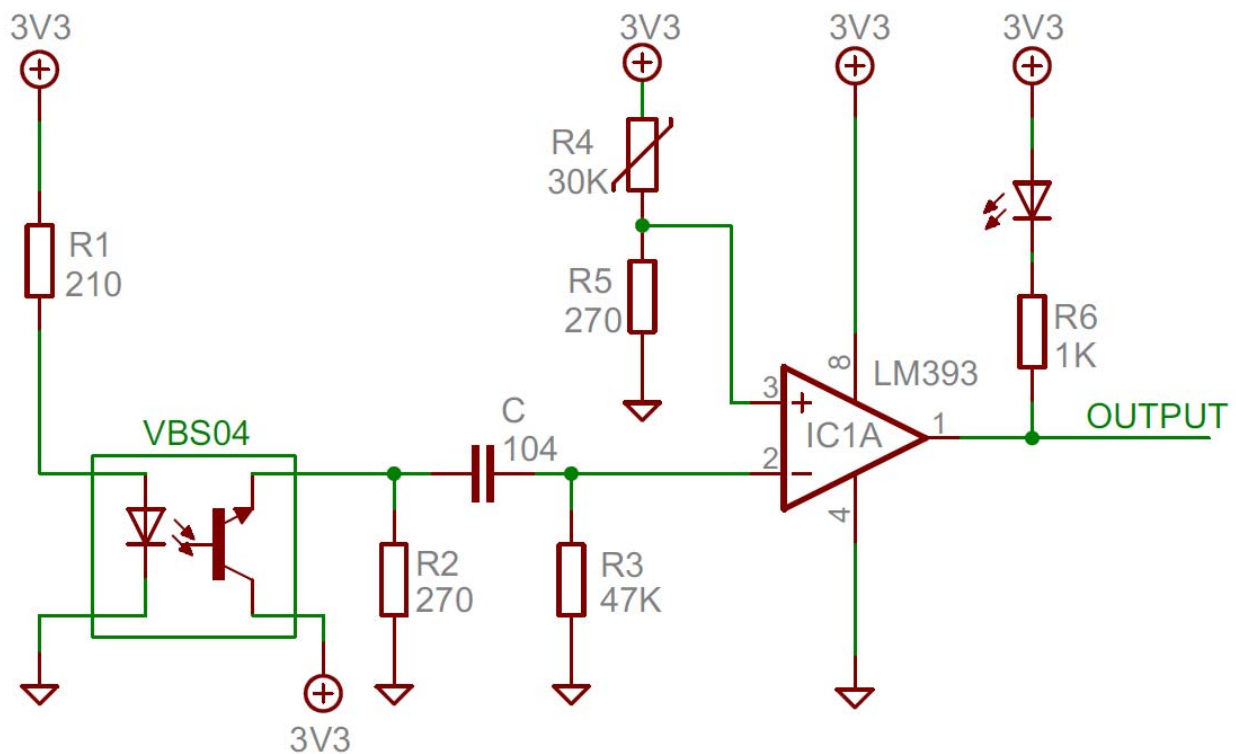
Current of Emitter (IR) $I_F = 10 \text{ mA}$

Current of Receiver (PT) $I_c = 0.25 \sim 11.0 \text{ mA}$

When vibration, the varied current at Receiver (PT) $\Delta I_c \approx 0.1 \text{ mA}$

Adjustment of the input divided voltage of LM393 (pin3), the sensitivity is adjusted.

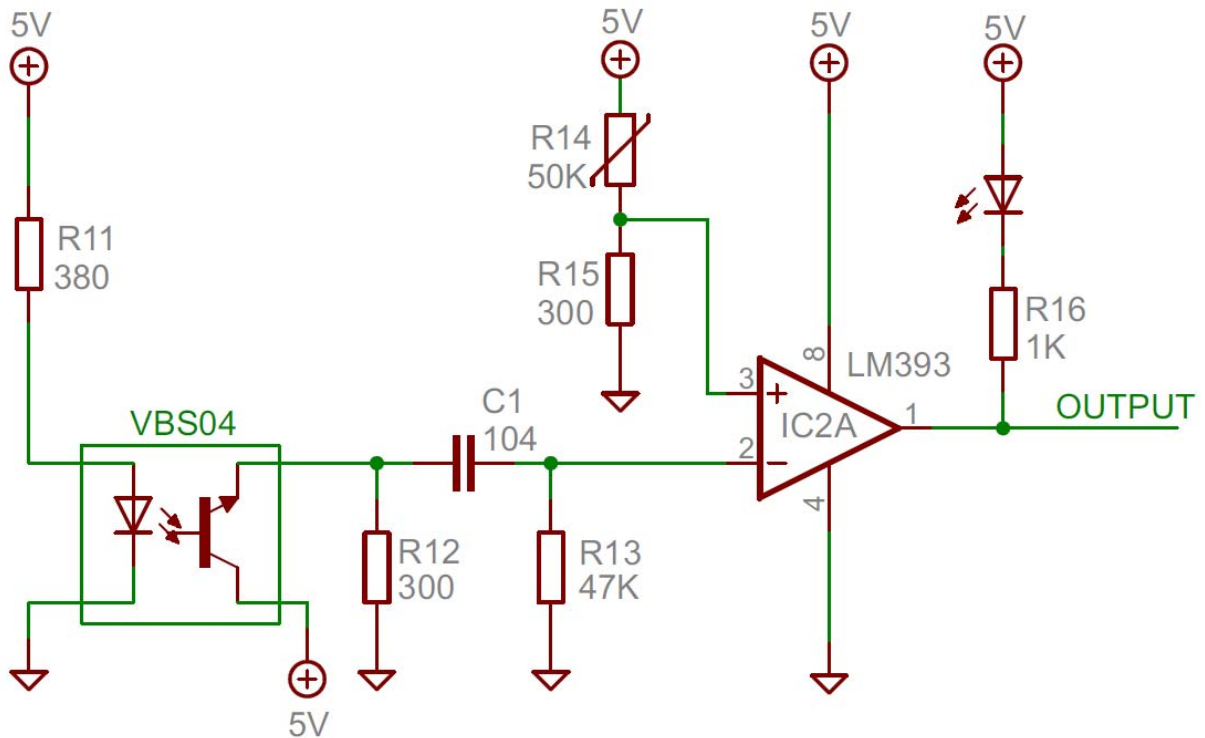
● Schematic 1 (Power supply for 3.3V)



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	6 of 14		Date	Jan. 27, 2016	

● Schematic 2 (Power supply for 5V)



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	7 of 14		Date	Jan. 27, 2016	

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

Fig.1 Power Dissipation vs. Ambient Temperature

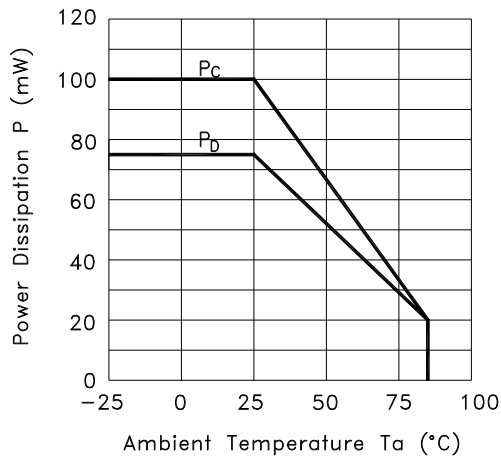


Fig.2 Forward Current vs. Forward Voltage

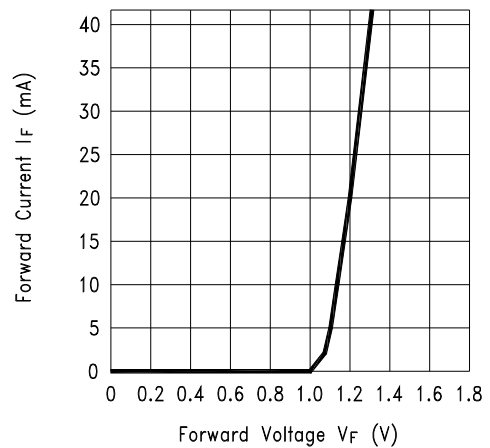


Fig.3 Collector Current vs. Collector-emitter Voltage

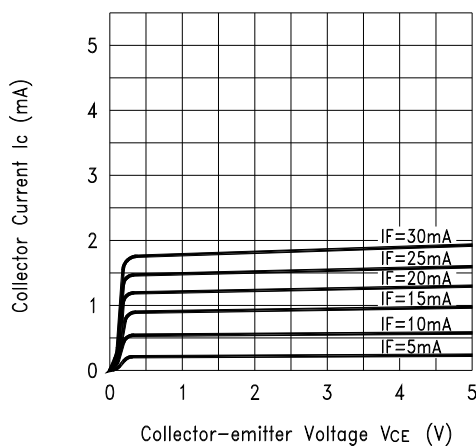
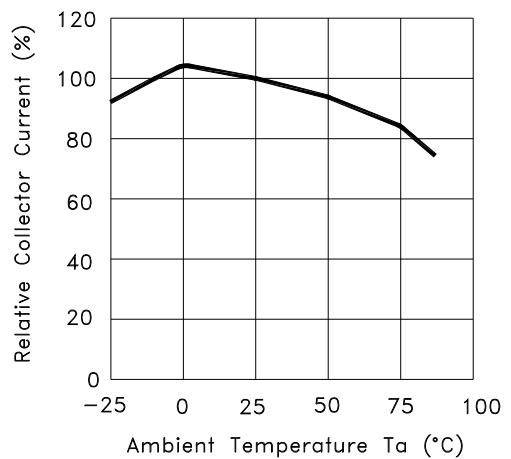


Fig.4 Collector Current vs. Ambient Temperature



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	8 of 14		Date	Jan. 27, 2016	

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

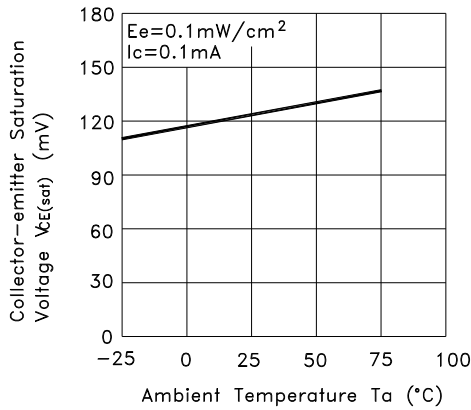


Fig.6 Response Time vs. Load Resistance

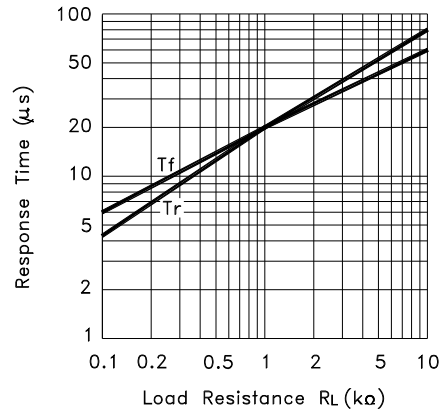
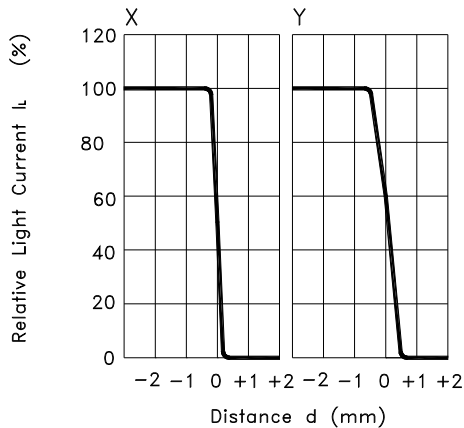
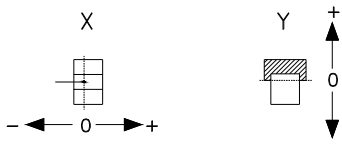


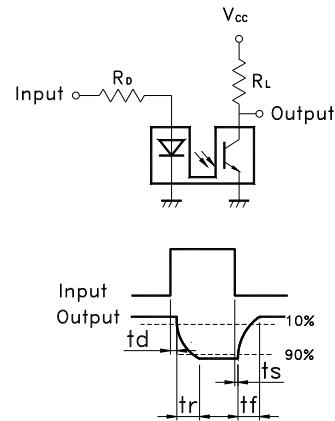
Fig.7 Sensing Position Characteristics (Typical)



(Center of Optical axis)



Test Circuit for Response Time



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	9 of 14		Date	Jan. 27, 2016	

● ELECTRICAL CHARACTERISTICS

1	Contact Rating	--
2	Contact Resistance	--
3	Angle Tolerance	Refer to Table 1
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°C*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°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



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	10 of 14		Date	Jan. 27, 2016	

● **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 Table 2		-	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



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	11 of 14		Date	Jan. 27, 2016	

< Table of classification Reflow profile >

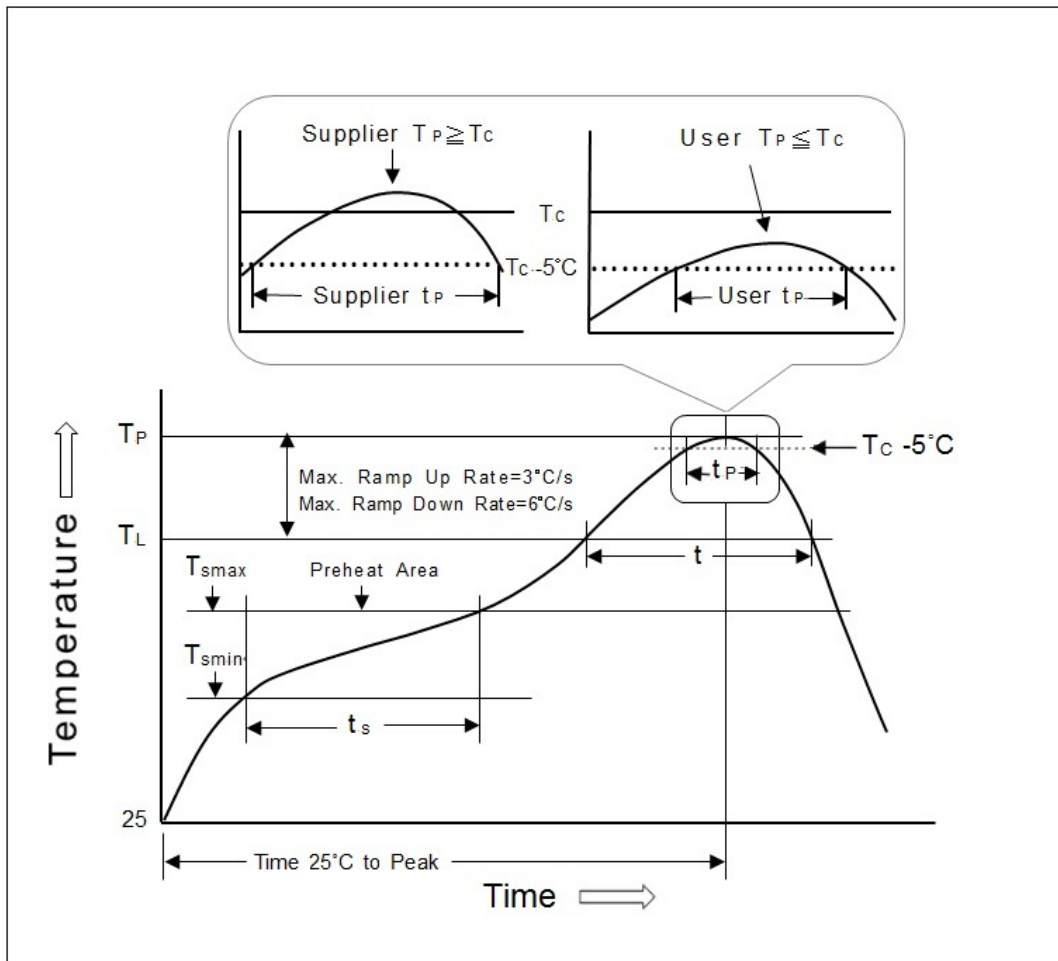
Item	Pb process	Pb free process
Pre-heat and Soak		
Temperature min.(T _{min})	100 °C	150 °C
Temperature max.(T _{max})	150 °C	200 °C
Time (T _{min} to T _{max})(t _s)	60-120 seconds	60-120 seconds
Average ram-up Rate (T _{max} to T _p)	3 °C/second max.	3 °C/second max.
Liquidous Temperature (TL)	183 °C	217 °C
Time at Liquidous (t _L)	60-150 seconds	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.		



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	12 of 14		Date	Jan. 27, 2016	

Table 2



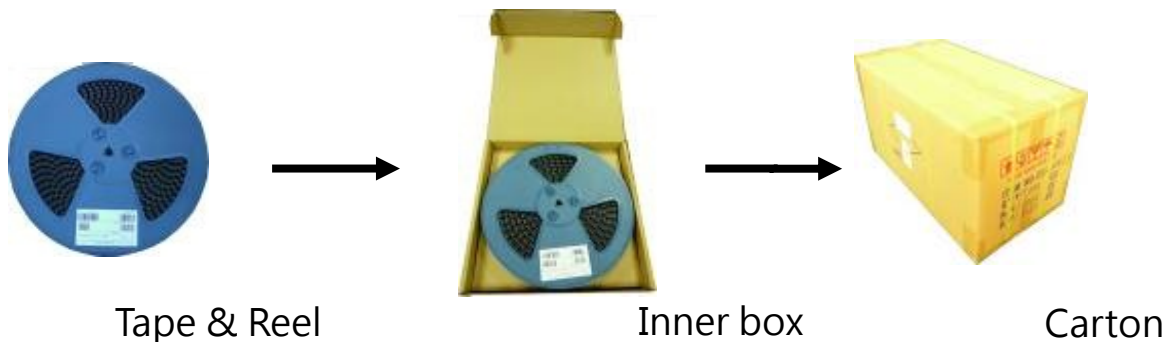
SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	13 of 14		Date	Jan. 27, 2016	

● PACKAGE

	Part Number	Package	Quantity	Total	Dimension(mm)
1.	VBS040200T	Tape & reel	350 pcs	350 pcs	φ330*25H
		Inner box	2 Reels	700 pcs	355L*340W*68H
		Carton	10 boxes	7,000 pcs	705L*365W*375H

※ Package shown as below for reference.



SENSOR SWITCH

Item No.	VBS040200T	Description	ROLL BALL SWITCH	Version	8
Page	14 of 14		Date	Jan. 27, 2016	

● **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.

