



## General Description

The HEX-45 Unipolar Hall effect sensor IC is fabricated from mixed signal CMOS technology. It is comprised of one Hall plate and a CMOS output driver, mainly designed for battery-operation, hand-held equipment (such as Cellular and Cordless Phone, PAD). The total power consumption in normal operation is typically 21 $\mu$ W with a 3V power source. South poles of sufficient strength will turn the output on. The output will be turned off under no magnetic field. While the magnetic flux density (B) is larger than operating point (BOP), the output will be turned on (low), the output is held until B is lower than release point (BRP), and then turned off.

The HEX-45 is available in TSOT23-3L Package. Operating temperature range of the HEX-45 is from -40°C to 85°C.

To minimize the BOM cost, capacitors of the MLCC type are supported, and only one external component is needed to complete the application circuit.

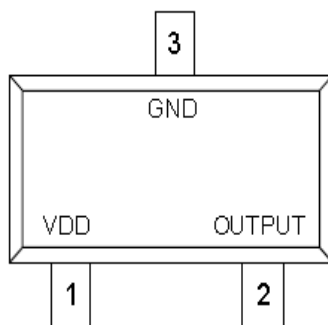
- Micro power consumption ideal for battery-powered applications
- Input Voltage Range: 2.5V to 3.65V
- Very High Sensitivity Hall Sensor
- Chopper stabilized amplifier stage
- Good RF noise immunity
- TSOT23-3L package
- Not need the push-high resistance

## Applications

- Cover switch in clam-shell cellular phones
- Cover switch in Notebook PC/PAD
- Contact-less switch in consumer products
- Solid State Switch
- Handheld Wireless Handset Awake Switch
- Lid close sensor for battery-powered device
- Magnet proximity sensor for reed switch replacement in low duty cycle applications

## Pin Configuration

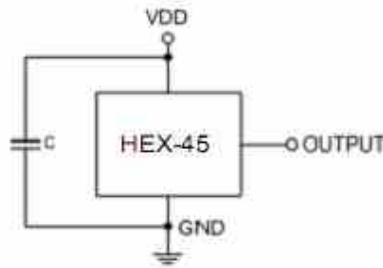
TSOT23-3L (Top View)



Pin Name	Pin No.	Pin Function
	TSOT23-3L	
VDD	1	Power Supply Input
GND	3	Ground
OUTPUT	2	Output Pin

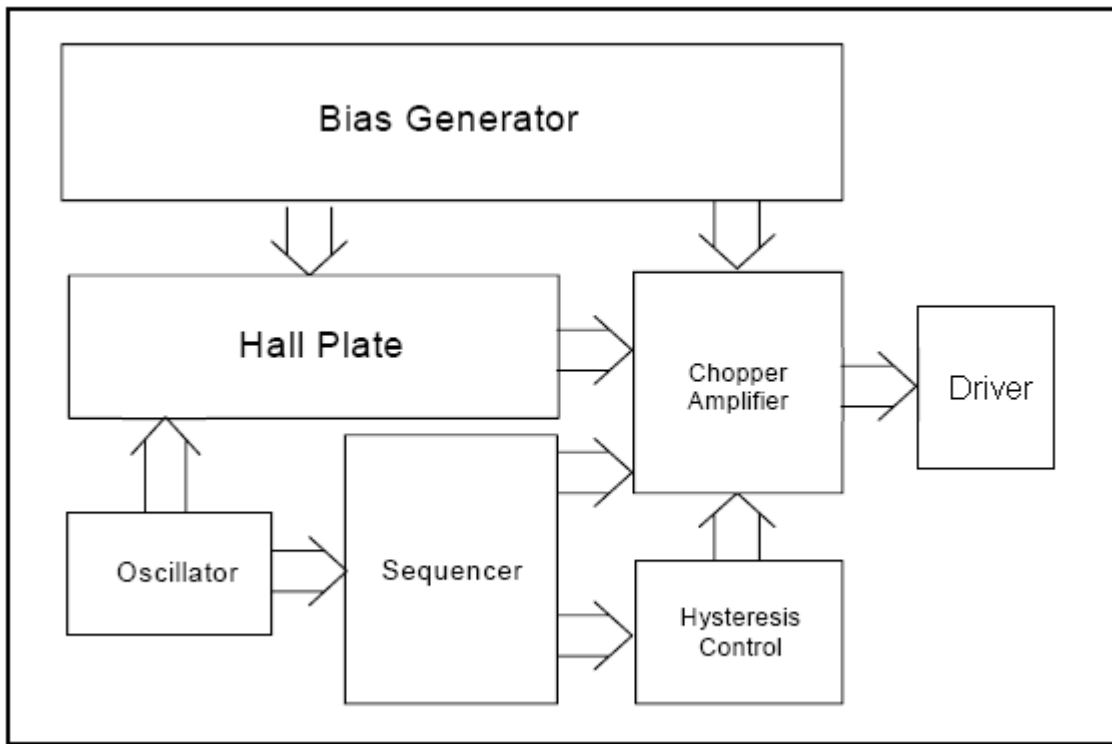


■ Typical Application Circuit



Note: C is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF~100nF.

■ Block Diagram



■ Absolute Maximum Ratings<sup>1</sup> (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Rating	Unit
VDD to GND	V <sub>DD</sub>	-0.3 to 4.5	V
Magnetic Flux Density	B	Unlimited	
Storage Temperature Range	T <sub>S</sub>	-55 to +150	°C
Operating Junction Temperature Range	T <sub>J</sub>	-40 to 150	°C
Package Power Dissipation	TSOT23-3L P <sub>D</sub>	400	mW

■ Recommended Operating Conditions (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	V <sub>DD</sub>	Operating	2.5 ~ 3.65	V
Operating Temperature Range	T <sub>A</sub>	Operating	-40 ~ +85	°C



### Electrical Characteristics

(Unless otherwise noted, typical values are at  $T_A=25^\circ\text{C}$ ,  $V_{DD}=3\text{V}$ )

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{OH}$	Output On Voltage (High side)	$I_{OUT}=+1\text{mA}$	$V_{DD}-0.3$	$V_{DD}-0.1$	$V_{DD}+0.3$	V
$V_{OL}$	Output On Voltage (Low side)	$I_{OUT}=-1\text{mA}$	-0.3	0.1	0.3	V
$I_{OFF}$	Output Leakage Current	$V_{OUT}=3.65\text{V}$ , Output off	-	<0.1	1	$\mu\text{A}$
$I_{DD}(\text{EN})$	Supply Current	Chip enable, $T_A=25^\circ\text{C}$ , $V_{DD}=3\text{V}$	-	1.7	5.0	mA
$I_{DD}(\text{EN})$		Chip enable, $T_A=-40\sim 85^\circ\text{C}$ , $V_{DD}=2.5\sim 3.65\text{V}$	-	1.7	5.5	mA
$I_{DD}(\text{DIS})$		Chip disable, $T_A=25^\circ\text{C}$ , $V_{DD}=3\text{V}$	-	12	17	$\mu\text{A}$
$I_{DD}(\text{DIS})$		Chip disable, $T_A=-40\sim 85^\circ\text{C}$ , $V_{DD}=2.5\sim 3.65\text{V}$	-	12	20	$\mu\text{A}$
$I_{DD}(\text{AVG})$		Average supply current, $T_A=25^\circ\text{C}$ , $V_{DD}=3\text{V}$	-	13	18	$\mu\text{A}$
$I_{DD}(\text{AVG})$		Average supply current, $T_A=-40\sim 85^\circ\text{C}$ , $V_{DD}=2.5\sim 3.65\text{V}$	-	13	20	$\mu\text{A}$
$T_{\text{awake}}$		Awake Time	-	-	40	90
$T_{\text{period}}$	Period	-	-	40	90	ms
D.C.	Duty Cycle	-	-	0.1	-	%

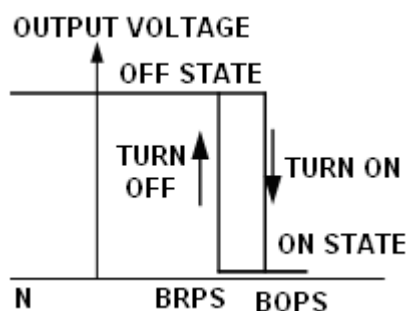
### Magnetic Characteristics

(Unless otherwise noted, typical values are at  $T_A=25^\circ\text{C}$ ,  $V_{DD}=3\text{V}$ )

(1mT=10Gauss)

Symbol	Parameter	Min.	Typ.	Max.	Unit
BOPS (south pole to brand side)	Operate Point	8	11.5	15	mT
BRPS (south pole to brand side)	Release Point	5	7.5	10	
BHY ( BOPX-BRPX )	Hysteresis	-	4	-	

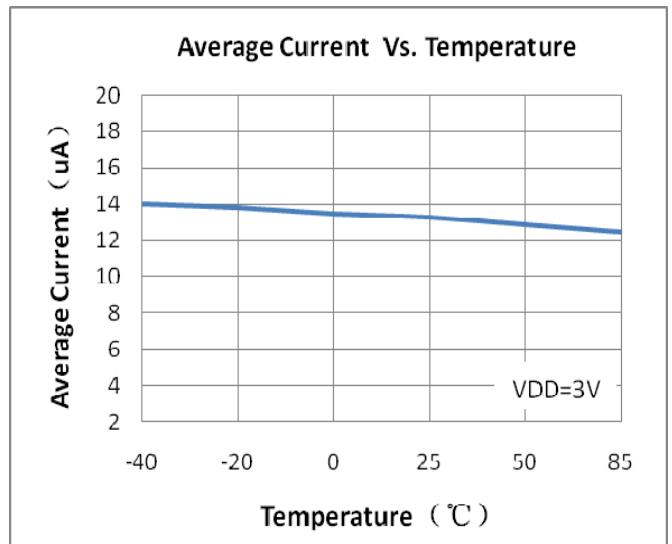
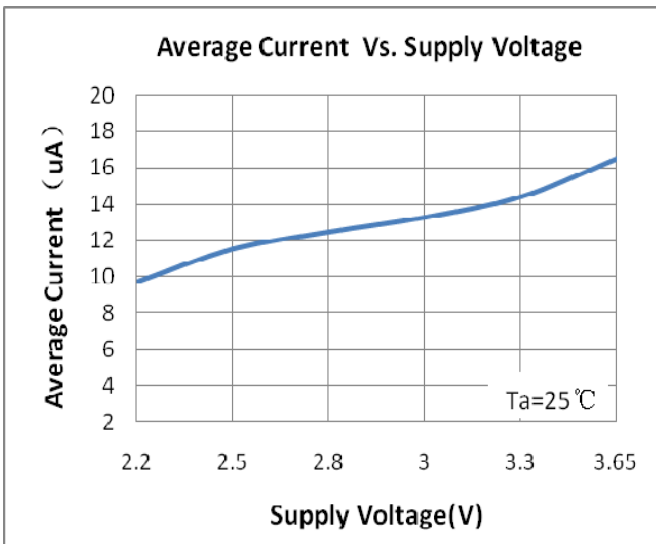
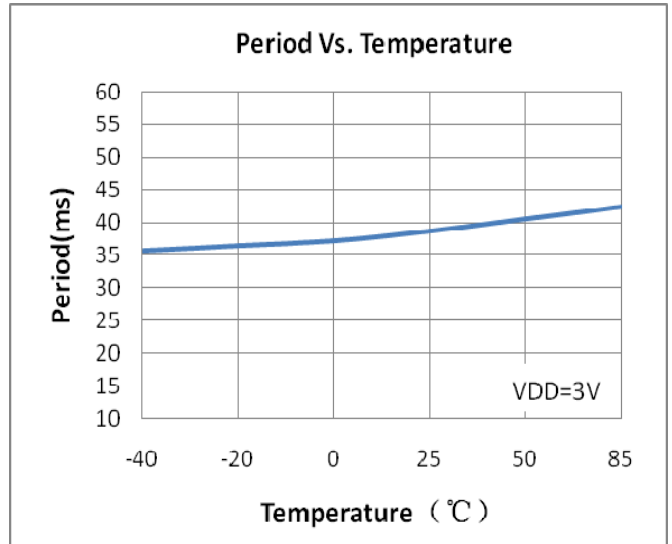
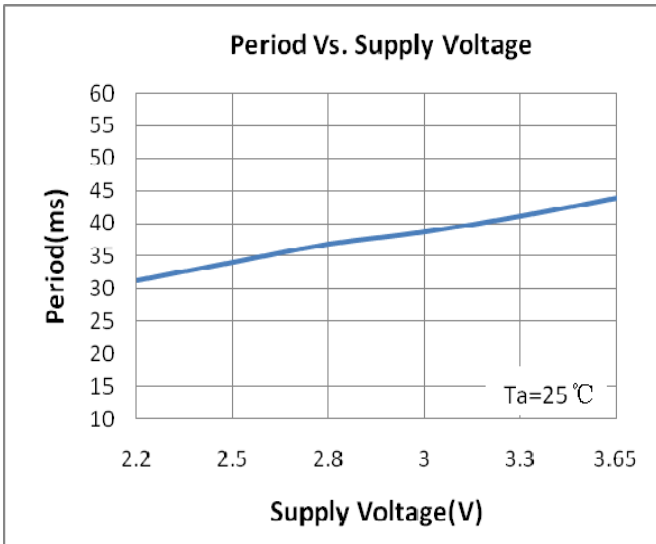
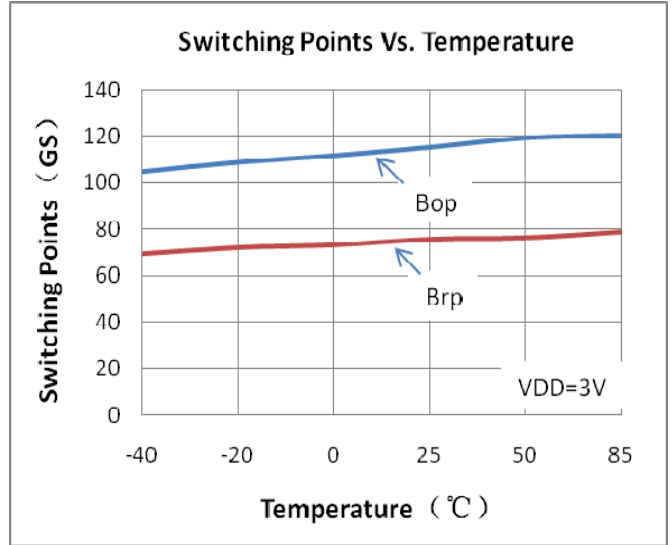
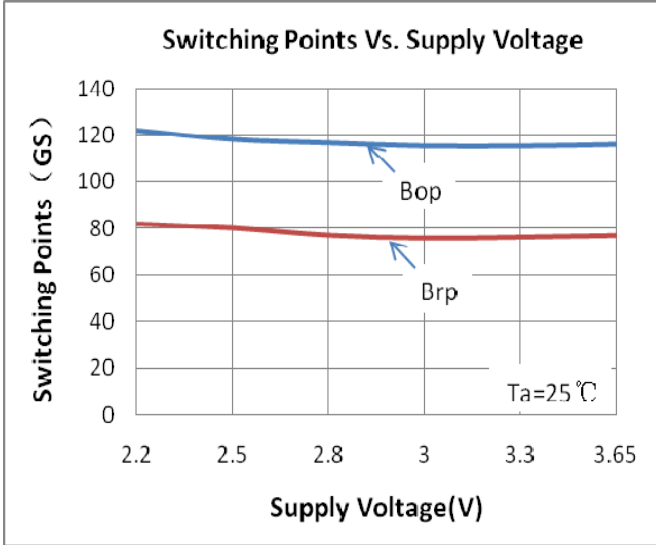
Notes: Operating point and release point will vary with supply voltage and operating temperature.





■ Typical Characteristics— HEX-45

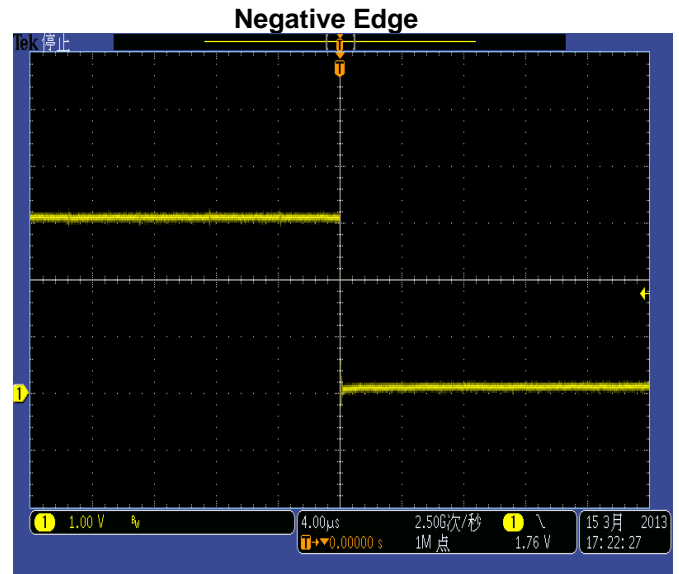
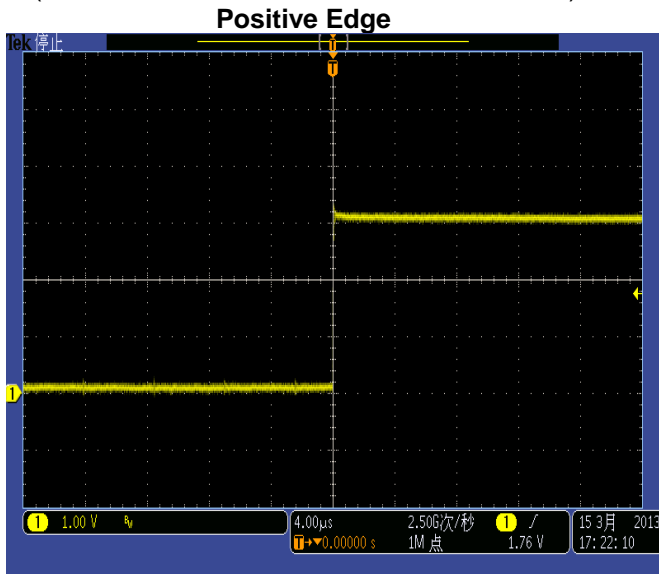
(Unless otherwise noted,  $V_{DD} = 3V$ ,  $T_A = 25^\circ C$ )





### ■ Typical Characteristics— HEX-45

(Unless otherwise noted,  $V_{DD} = 3V$ ,  $T_A = 25^\circ C$ )

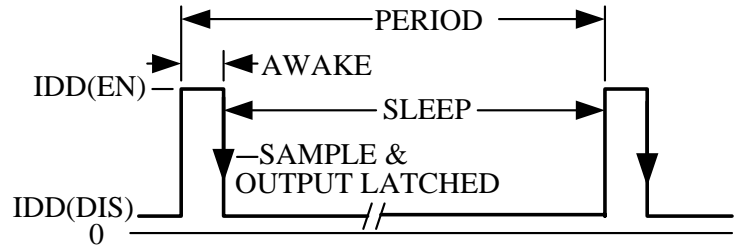




### Functional Description

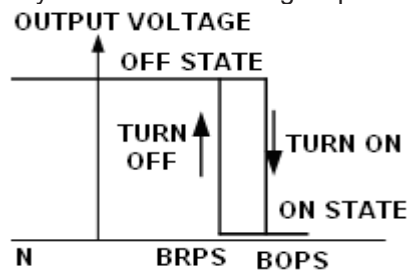
#### Low Average Power

Internal timing circuitry activates the sensor for 40µs and deactivates it for the remainder of the period (40ms). A short "awake" time allows for stabilization prior to the sensor sampling and data latching on the falling edge of the timing pulse. The output during the "sleep" time is latched in the last sampled state. The supply current is not affected by the output state.



#### Chopper-Stabilized Technique

The Hall element can be considered as a resistor array similar to a Wheatstone bridge. A large portion of the offset is a result of the mismatching of these resistors. These devices use a proprietary dynamic offset cancellation technique, with an internal high-frequency clock to reduce the residual offset voltage of the Hall element that is normally caused by device over-molding, temperature dependencies, and thermal stress. The chopper-stabilizing technique cancels the mismatching of the resistor circuit by changing the direction of the current flowing through the Hall plate using CMOS switches and Hall voltage measurement taps, while maintains the Hall voltage signal that is induced by the external magnetic flux. The signal is then captured by a sample-and-hold circuit and further processed using low-offset bipolar circuitry. This technique produces devices that have an extremely stable quiescent Hall output voltage, are immune to thermal stress, and have precise recoverability after temperature cycling. A relatively high sampling frequency is used for faster signal processing capability can be processed.



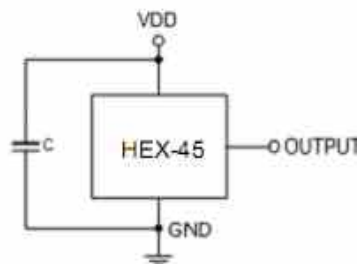
#### Magnetic Field Detection Mechanism

The Hall IC cannot detect magnetic fields that run horizontal to the package top layer. Be certain to configure the Hall IC so that the magnetic field is perpendicular to the top layer.

#### Operation

The output of this device switches low (turns on) when a magnetic field perpendicular to the Hall sensor exceeds the operate point BOPS. After turn-on, the output is capable of sinking up to 1mA and the output voltage is V<sub>OUT</sub> (ON). When the magnetic field is reduced below the release point BRPS, the device output switches high (turns off). The difference between the magnetic operates and release points are the hysteresis (B<sub>hys</sub>) of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise.

#### Applications:



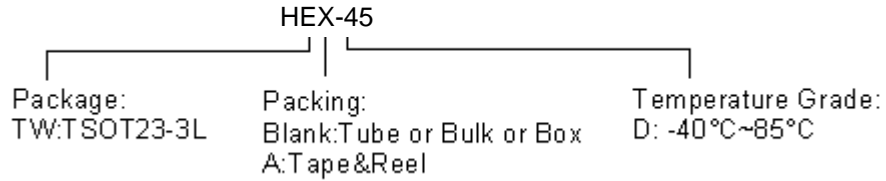
HEX-45's pole-independent sensing technique allows for operation with either a north or south poles magnet orientation, enhancing the manufacturability of the device. The state-of-the-art technology provides the same output polarity for either pole face.



C1 serves two purposes: minimizing ripples on the input voltage and enhancing immunity from RF transmission noises within close proximity. Recommended values are between 10nF and 100nF. The larger the capacitance, the better the noise immunity is for the HEX-45.

It is strongly recommended that an external bypass capacitor be connected (in close proximity to the Hall sensor) between the supply and ground of the device to reduce both external noise and noise generated by the chopper-stabilization technique. This is especially true due to the relatively high impedance of battery supplies. The simplest form of magnet that will operate these devices is a bar magnet with either pole near the branded surface of the device.

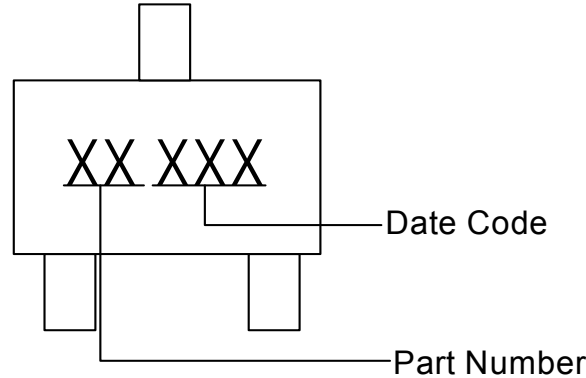
Ordering Information



Part Number	Package Type	Package Qty	B <sub>RPS</sub> (Gauss)	B <sub>OPS</sub> (Gauss)	Temperature	Eco Plan	Lead
HEX-45	TSOT23-3L	7-in reel 3000pcs/reel	50 ~ 100	80 ~ 150	-40~85°C	Green	Cu

Marking Information

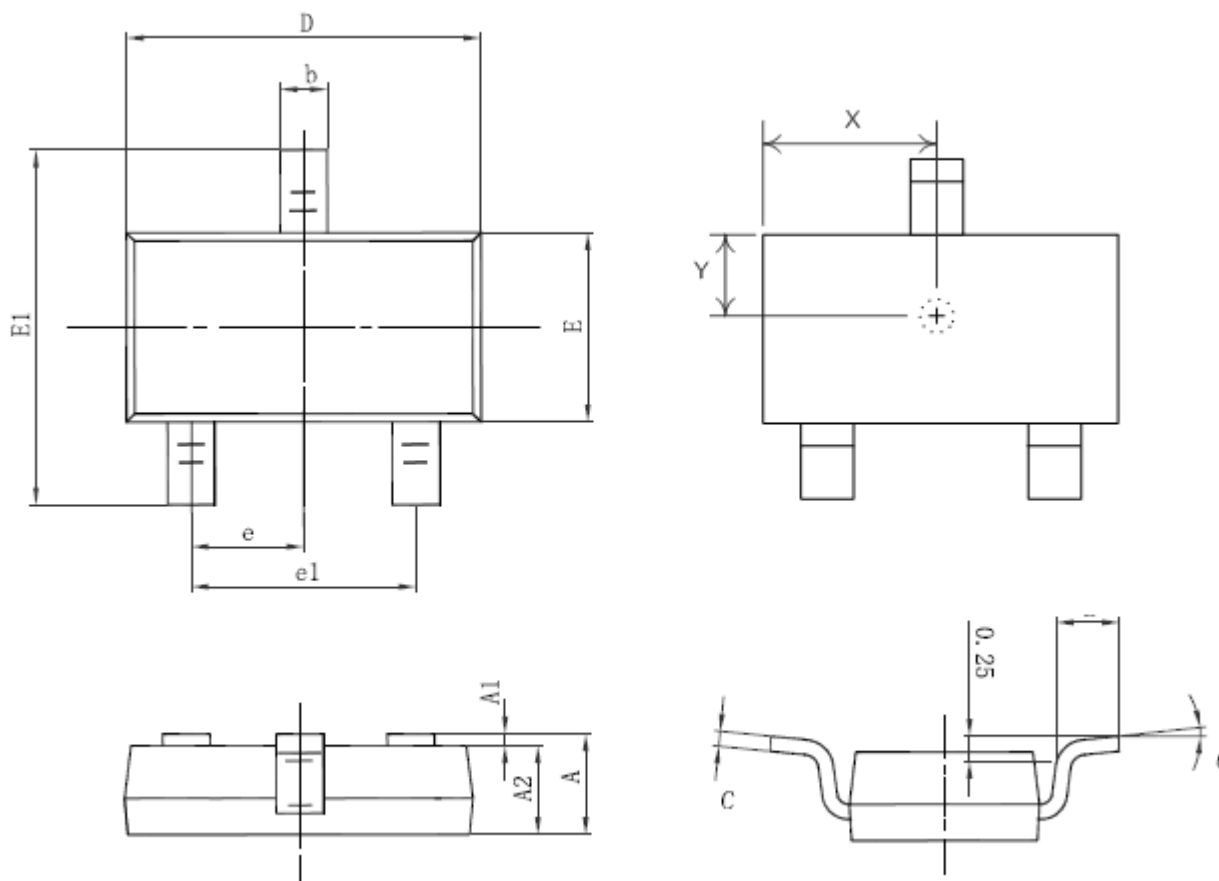
TSOT23-3L





## ■ Package Information

### TSOT23-3L

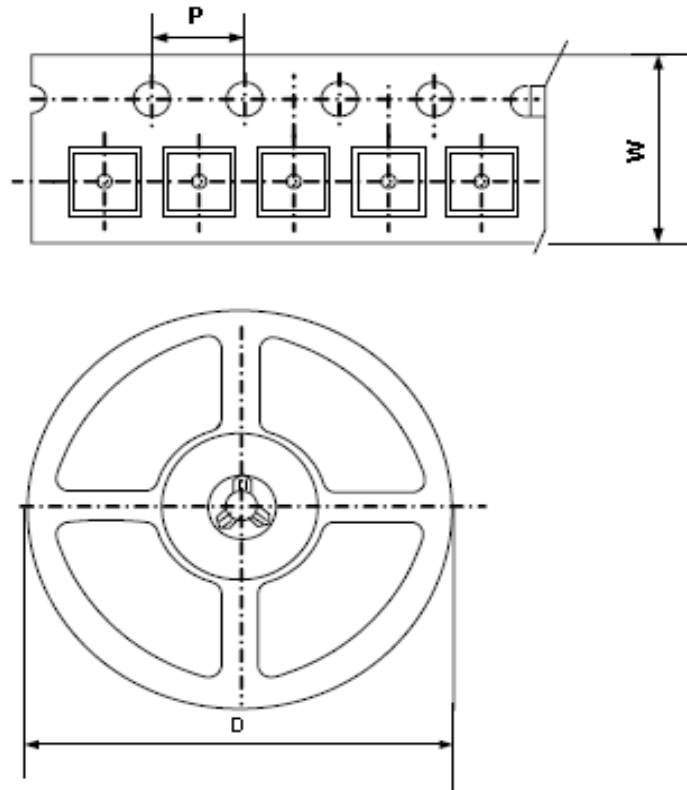


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.900	0.028	0.035
A1	0.000	0.100	0.000	0.004
A2	0.700	0.800	0.028	0.031
b	0.350	0.500	0.014	0.020
c	0.080	0.200	0.003	0.008
D	2.820	3.020	0.111	0.119
E	1.600	1.700	0.063	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.900(BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°
X	1.410	1.510	0.056	0.059
Y	0.800	0.850	0.031	0.033





## ■ Packing information



Package Type	Carrier Width(W)	Pitch(P)	Reel Size(D)	Packing Minimum
TSOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum