Magnetic Sensor ICs

Omnipolar High Performance Hall-Effect Sensor IC

AS1846A

General Description

Using BiCMOS process, the AS1846A is designed for high performance Omnipolar detection hall-effect application, such as automotive, industrial, electric tools, home appliances, rotor position sensing, brushless DC motor etc. The hall IC integrated an on-chip hall voltage generator for magnetic sensing, a comparator that amplifiers the hall voltage, hall sensor with dynamic offset cancellation system, an pull-up resistance, and a Schmitt trigger to provide switching hysteresis for noise rejection, and a voltage regulator for operation with supply voltage of 2.5V to 24V.

AS1846A is designed to respond to alternating North and South poles. White the magnetic flux density (B) is larger than operate point (B_{OP}), the output will be turned on (low), the output is held until the magnetic flux density (B) is lower than release point (B_{RP}), then turn off (high).

The device is available in SIP-3L and SOT23-3L Packages and is rated over the -40°C to 150°C. the package is RoHS compliant.

Features

- High Performance BiCMOS Process Tech.
- Input Voltage Range : 2.5V to 24V
- Resistant to physical stress
- Omnipolar Operation
- High Sensitivity Hall Sensor
- High Chopping Frequency
- Magnetic Sensitivity (typical)
  B_{OP}=±18Gauss, B_{RP}=±12Gauss
- Small Solution Size
- RoHS Compliant
- SIP-3L and SOT23-3L Packages
- -40℃ to +150 ℃ Temperature Range

Applications

- Docking Detection
- Door Open and Close Detection
- Valve Positioning
- Pulse Counting
- Electric Tools
- Rotor Position Sensing and Flow Meters
- Valve and Solenoid Status
- Proximity Sensing
- Tachometers
- Magnetic Encoder

Ordering Information

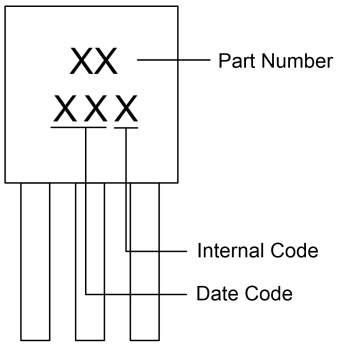
AS1846AXXX

Package:	Packing:	Temperature Grade:
M:SIP-3L	B: Bulk	Y: -40°C~125°C
W: SOT23-3L	R: Tape&Reel	Z: -40°C~150°C

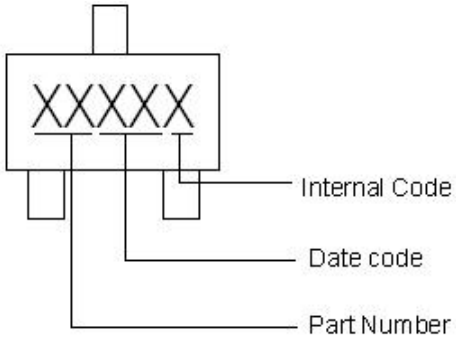
Part Number	B_{OP}(Gauss)	B_{RP} (Gauss)	Package Type	Package Qty	Temperature	Eco Plan
AS1846AMBY	±18	±12	SIP-3L	1K/Package	-40～125℃	RoHS
AS1846AWRY	±18	±12	SOT23-3L	7-in reel 3000pcs/reel	-40～125℃	RoHS
AS1846AMBZ	±18	±12	SIP-3L	1K/Package	-40～150℃	RoHS
AS1846AWRZ	±18	±12	SOT23-3L	7-in reel 3000pcs/reel	-40～150℃	RoHS

■ Marking Information

SIP-3L



SOT23-3L



■ Typical Application Circuit

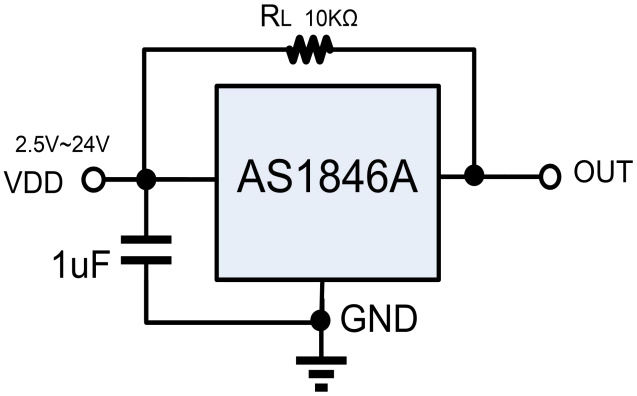
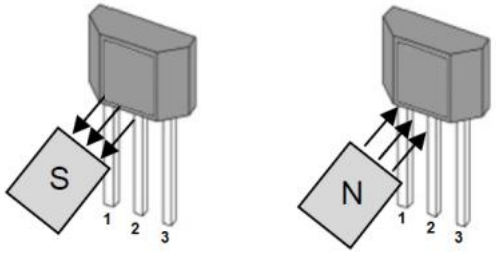


Figure 1, Typical Application Circuit of AS1846A

■ Pin Configuration

SIP-3L (Top View)



SOT23-3L (Top View)

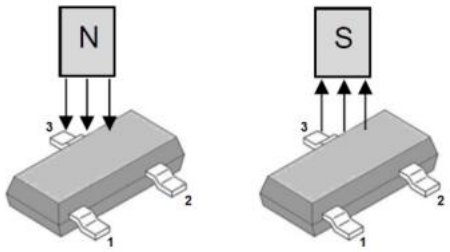


Figure 2, Pin Assignments of AS1846A

Pin Name	Pin No.		I/O	Pin Function
	SIP-3L	SOT23-3L		
VCC	1	1	P	Input Power Supply
GND	2	3	P	Ground
OUTPUT	3	2	O	Open Collector Output

■ Block Diagram

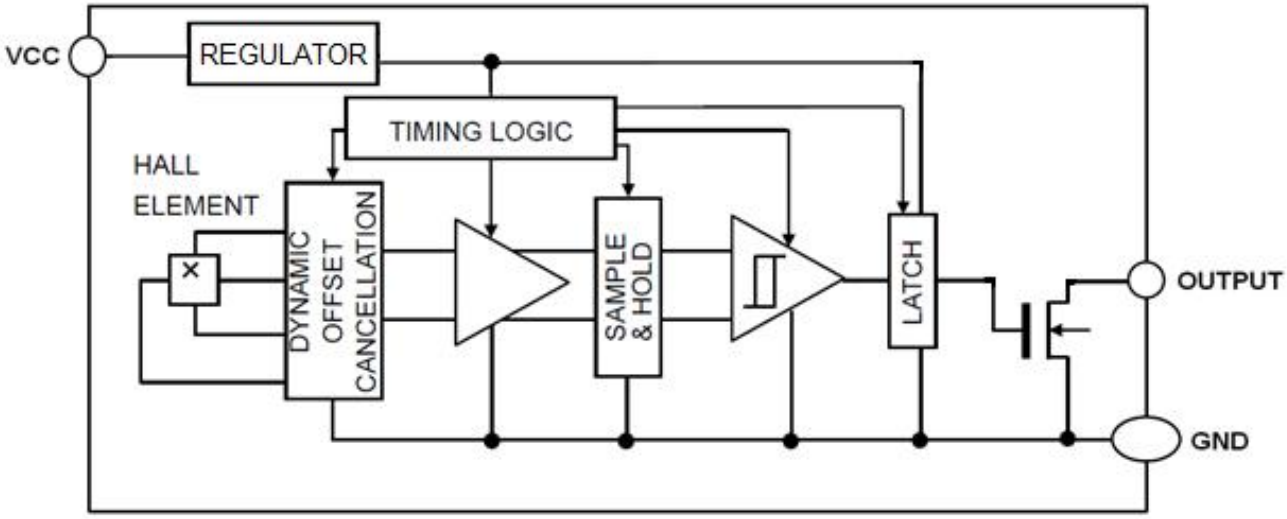


Figure 3, Block Diagram of AS1846A

■ Absolute Maximum Ratings[1] (T_A=25°C, unless otherwise noted)

Parameter		Symbol	Rating	Unit
V_{CC} Pin to GND		V_{CC}	-24 to 30	V
Output Pin to GND		V_{OUTPUT}	-0.3 to 30	V
Max. Continuous Output Current		I_{OUTMAX}	30	mA
Thermal Resistance	SIP-3L	T_{JA}	230	℃/W
	SOT23-3L		310	
Human Body Mode		HBM	6000	V
Storage Temperature Range		T_S	-55 to +150	℃
Operating Junction Temperature Range		T_{OP}	-40 to +150	℃
Maximum Soldering Temperature (at leads, 10 sec)		T_{LEAD}	300	℃

■ Recommended Operating Conditions[2]

Parameter	Symbol	Rating	Unit
V_{CC} Pin to GND	V_{CC}	2.5 to 24	V
Continuous Output Current	I_{OUT}	30	mA
Operating Temperature Range	T_{OP}	-40 to +150	℃

■ Electrical Characteristics

(T_A = -40 to +150℃ unless otherwise noted. Typical values are at T_A = +25℃, V_{CC} = 2.5V to 24V)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Input Voltage		2.5	-	24	V
I_Q	Supply Current		-	3.5	5.0	mA
t_{ON}	Power On Time		-	35	50	uS
V_{SON}	Output Saturation Voltage	V_{CC} = 5V, I_{OUT}=10mA	-	0.2	0.4	V
I_{OFF}	Off-state Leakage Current	Output Hi-Z	-	-	1.0	uA
$R_{DS(ON)}$	Output On Resistance	V_{CC} = 5V, I_{OUT}=10mA	-	20	-	Ω
T_R	Output Rise Time	R_L=1K, C_L=50pF	-	-	0.5	uS
T_F	Output Fall Time	R_L=1K, C_L=50pF	-	-	0.2	uS
T_D	Output Delay Time	B=B_{RP}-100Gs to B_{OP}+100Gs	-	15	25	uS
f_{BW}	Operation Bandwidth		20	-	-	KHz
B_{OP}	Magnetic Operating Point	T_A = +25℃	±8	±18	±28	Gauss
B_{RP}	Magnetic Release Point	T_A = +25℃	±5	±12	±24	Gauss
B_{HYS}	Hysteresis Window	T_A = +25℃	-	6	-	Gauss

Note: 1: Stresses above those listed in absolute maximum ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one absolute maximum rating should be applied at any one time. 2: The device is not guaranteed to function outside of its operating conditions.

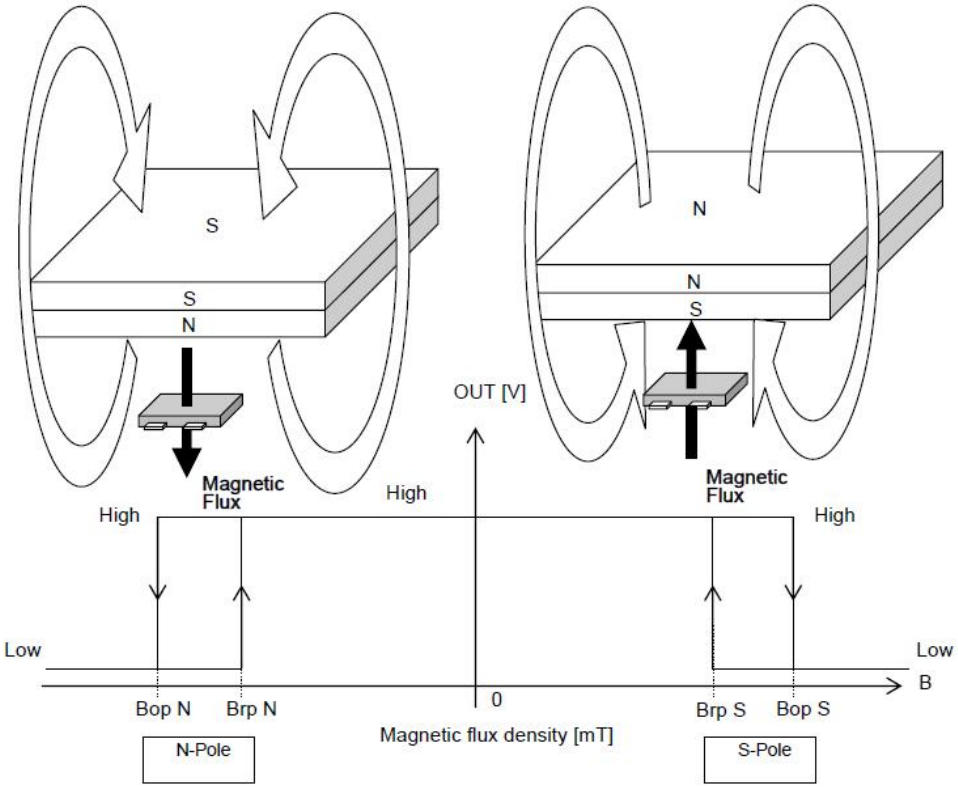
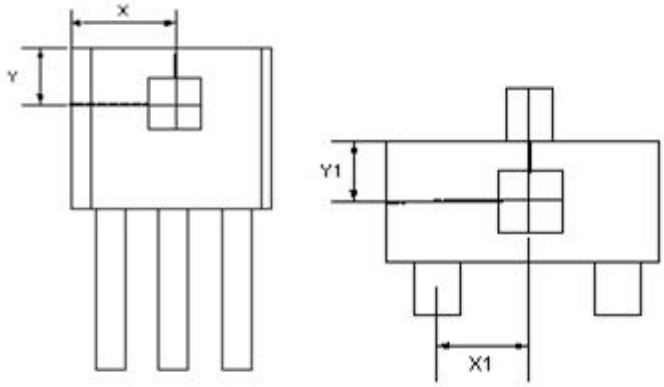


Fig 4, Magnetic Operation Characteristic of AS1846A

■ Hall Sensor Location

The Fig 5 is hall sensor location, where marks the IC number.

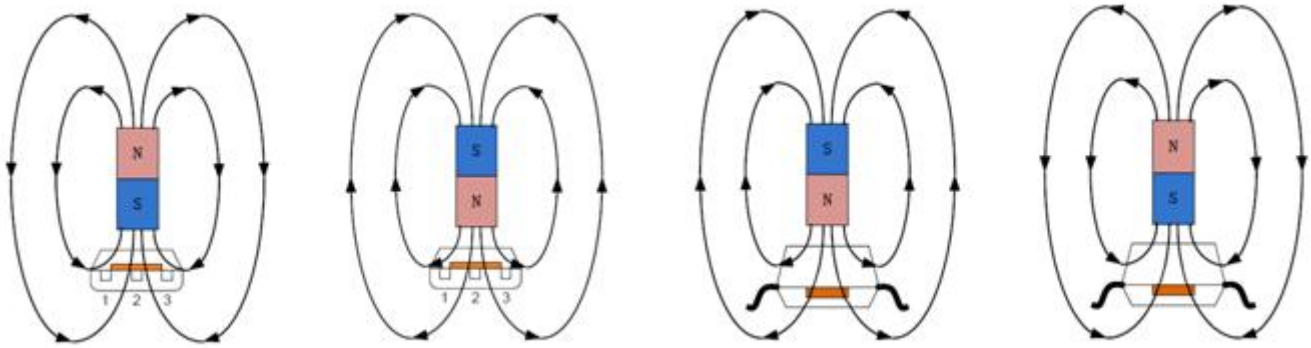


		unit
X	2.00	mm
Y	1.755	mm
X1	0.95	mm
Y1	0.8±0.05	mm

Fig 5, AS1846A Hall Sensor Location

■ Hall Sensor Location

A positive magnetic field is defined as a south pole near the marked side of the package.



If the device is powered on with a magnetic field strength between BRP and BOP, then the device output is determinate High. For SIP-3L/SOT23-3L package, if the field strength is greater than BOP, then the output is pulled low. If the field strength is less than BRP, the output is released.

■ Function Description

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.

Operation

The output of this device switches low (turns on) when a magnetic field perpendicular to the Hall sensor exceeds the operate point B_{OPS} (or is less than B_{OPN}). After turn-on, the output is capable of sinking up to 1mA and the output voltage is V_{OUT}(ON). When the magnetic field is reduced below the release point B_{RPS} (or increased above B_{RPN}), the device output switches high (turns off). The difference between the magnetic operates and release points are the hysteresis (Bhys) of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise.

Thermal Considerations

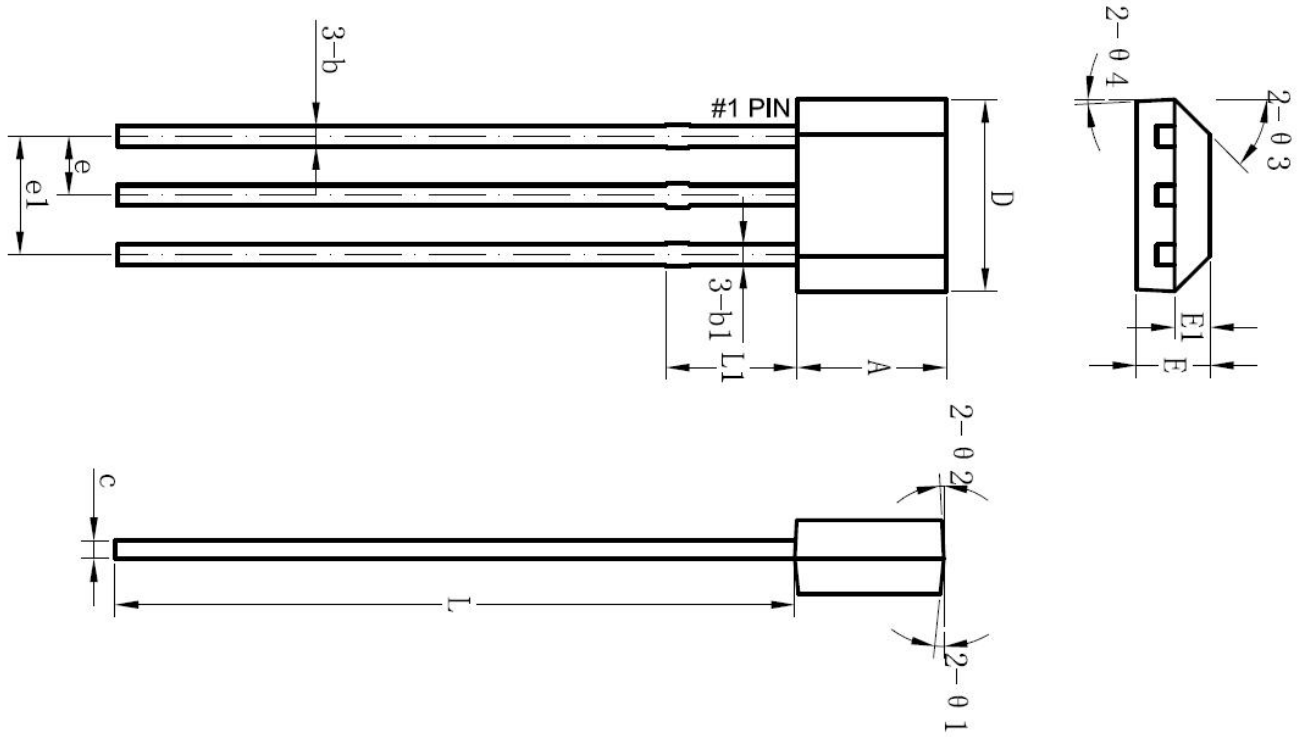
The maximum IC junction temperature should be restricted to 150°C under normal operating conditions. This restriction limits the power dissipation of the AS1846A. Calculate the maximum allowable dissipation, $P_{D(max)}$, and keep the actual dissipation less than or equal to $P_{D(max)}$. The maximum-power-dissipation limit is determined using following equation:

$$P_{D(MAX)} = \frac{150℃ - T_A}{R_{\theta JA}}$$

Where, T_A is the maximum ambient temperature for the application. $R_{\theta JA}$ is the thermal resistance junction-to-ambient given in Power Dissipation Table.

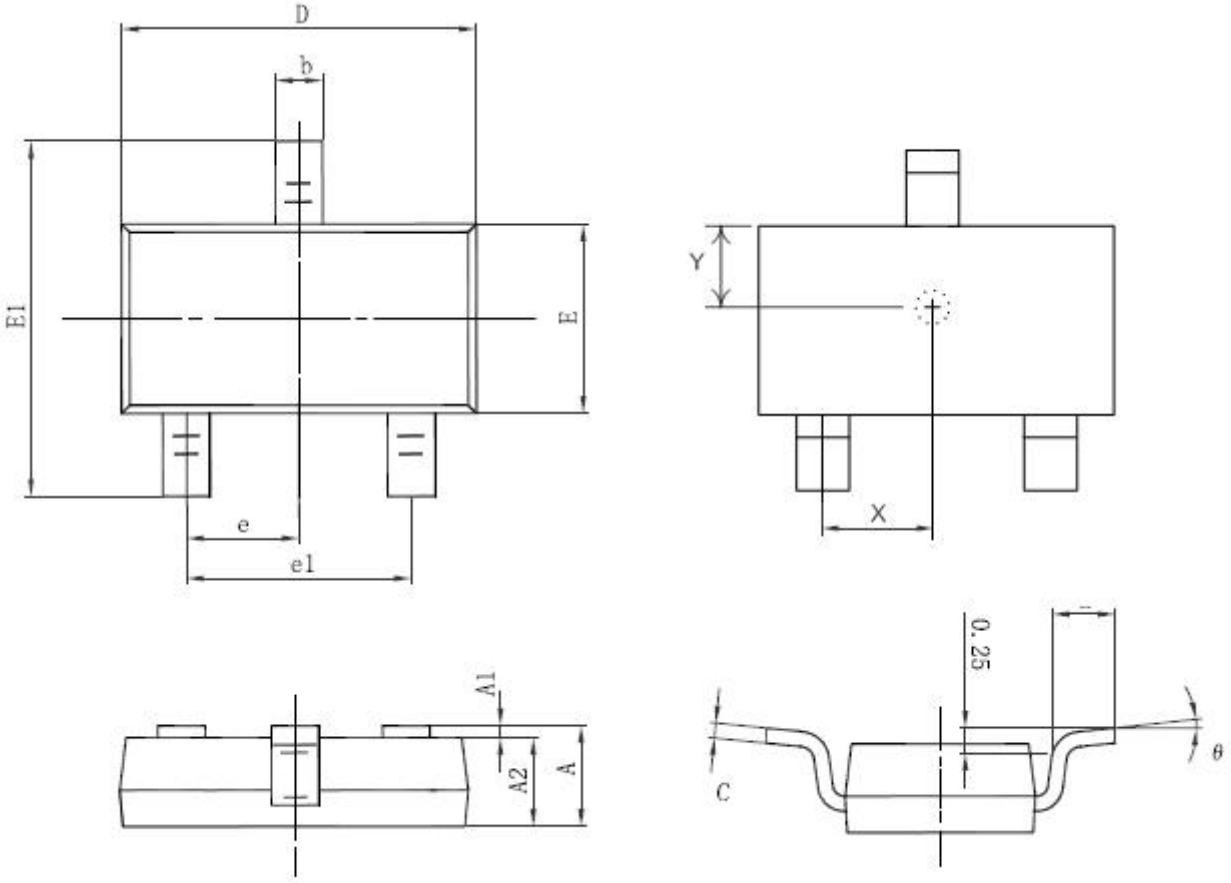
■ Package Information

SIP-3L:



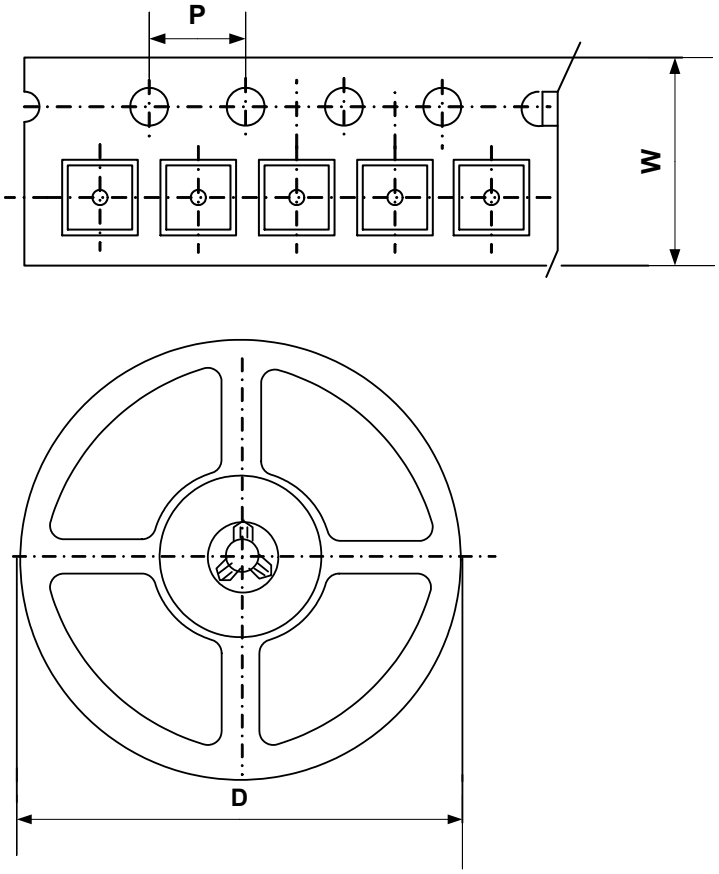
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.900	3.000	3.100	0.114	0.118	0.122
b	0.350	0.390	0.560	0.014	0.015	0.022
b1	-	0.440	-	-	0.017	-
C	0.360	0.380	0.510	0.014	0.015	0.020
D	3.900	4.000	4.100	0.153	0.157	0.161
E	1.420	1.520	1.620	0.056	0.060	0.064
E1	-	0.750	-	-	0.030	-
E	-	1.270	-	-	0.050	-
e1	-	2.540	-	-	0.100	-
L	13.50	14.50	15.50	0.531	0.571	0.610
L1	-	1.600	-	-	0.063	-
θ 1	-	6°	-	-	6°	-
θ 2	-	3°	-	-	3°	-
θ 3	-	45°	-	-	45°	-
θ 4	-	3°	-	-	3°	-

SOT23-3L:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
B	0.300	0.500	0.012	0.020
C	0.100	0.200	0.004	0.008
D	2.82	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.95	0.104	0.116
e	0.950(BSC)		0.037（BSC）	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°
X	0.950(BSC)		0.037(BSC)	
Y	0.750	0.850	0.030	0.033

■ Packing Information



Package Type	Carrier Width (W)	Pitch (P)	Reel Size(D)	Packing Minimum
SOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum

■ Packing Information

1. Packing type: Bulk
2. Packing minimum: 1000pcs