Unipolar Detection High Performance Low Power Hall-Effect Sensor IC

AD1918

General Description

Using low power CMOS process, the AD1918 is designed for low power, high performance unipolar detection hall-effect application, such as cover switch, contactless switch, solid state switch and lid close sensor etc battery operation. The hall IC integrated an on-chip hall voltage generator for magnetic sensing, a comparator that amplifiers the hall voltage, a Chopper amplifier, a Schmitt trigger to provide switching hysteresis for noise rejection, and a complementary output.

The total power consumption of AD1918 is typically less than 1.8uA at 3.3V power supply. AD1918 is designed to respond to alternating South pole. When 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 SOT23-3L, SSOT23-3L, TSOT23-3L, SOT553, SIP-3L, DFN1006-3L and DFN1010-4L Packages and is rated over the -40°C to 85°C. The package is RoHS compliant.

Features

- Input Voltage Range : 1.65V to 5.5V
- Micro-power consumption ideal for battery power applications
- Unipolar Operation, easy to use as output
- Very high sensitivity hall sensor
- Low Power CMOS process technology
- Chopper stabilization amplifier stage
- Magnetic Sensitivity (typical) B_{OP}=±42Gauss, B_{RP}=±25Gauss
- Good RF noise immunity
- No need pull-up resistor
- Small Solution Size
- RoHS & Green Compliant
- SOT23-3L, SSOT23-3L, TSOT23-3L, SOT553, SIP-3L, DFN1006-3L and DFN1010-4L Packages
- -40℃ to +125 ℃ Temperature Range

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 devise
- Magnet proximity sensor for reed switch replacement in low duty cycle applications
- DV, DSC, and White Goods

Ordering Information

AD1918XXX

Package：
S2: SSOT23-3L
ST: SOT23-3L
TW: TSOT23-3L
W: SOT553
D6: DFN1006-3L
D1: DFN1010-4L
M: SIP-3L

Packing：
R:Tape&Reel
B: Blank

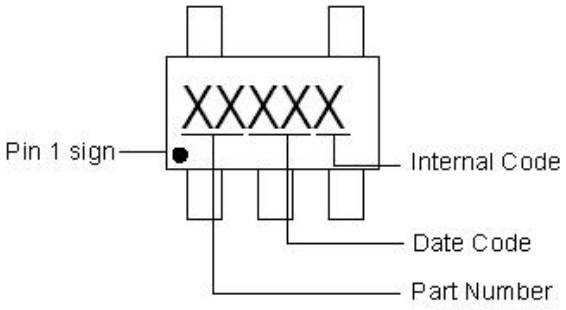
Temperature Grade：
N: -40°C~85°C

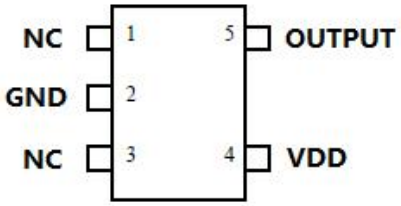
Part Number	B_{OP}(Gauss)	B_{RP} Gauss)	Package Type	Package Qty	Temperature	Eco Plan
AD1918S2RN	-42	-25	SSOT23-3L	7-in reel 3000pcs/reel	-40～85℃	Green
AD1918STRN	-42	-25	SOT23-3L	7-in reel 3000pcs/reel	-40～85℃	Green
AD1918TWRN	-42	-25	TSOT23-3L	7-in reel 3000pcs/reel	-40～85℃	Green
AD1918WRN	+42	+25	SOT553	7-in reel 3000pcs/reel	-40～85℃	Green
AD1918D6RN	+42	+25	DFN1006-3L	7-in reel 10000pcs/reel	-40～85℃	Green
AD1918D1RN	+42	+25	DFN1010-4L	7-in reel 10000pcs/reel	-40～85℃	Green
AD1918MBN	+42	+25	SIP-3L	1000pcs/Package	-40～85℃	Rohs
AD1918NMBN	-42	-25	SIP-3L	1000pcs/Package	-40～85℃	Rohs

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■ Marking & Pin Assignment

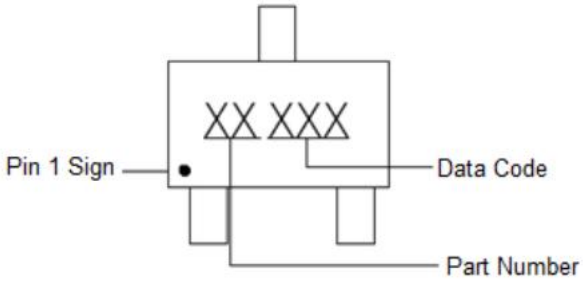
SOT553:

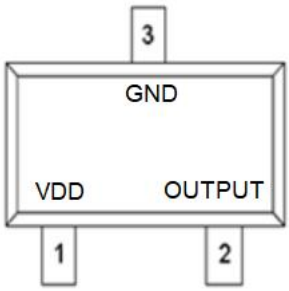




Pin Name	Pin No.	I/O	Pin Function
	SOT553		
VDD	4	P	Input Power Supply
GND	2	P	Ground
NC	1, 3	-	Not Connected
OUTPUT	5	O	Output Pin

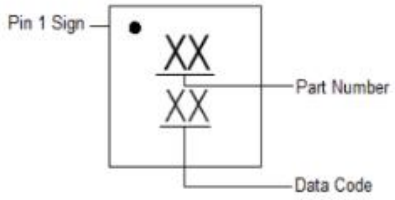
SOT23-3L/SSOT23-3L/TSOT23-3L:

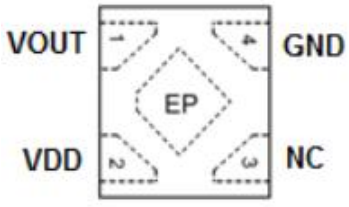




Pin Name	Pin No.	I/O	Pin Function
	SOT23-3L/SSOT23-3L/TSOT23-3L		
VDD	1	P	Input Power Supply
GND	3	P	Ground
OUTPUT	2	O	Output Pin

DFN1010-4L：

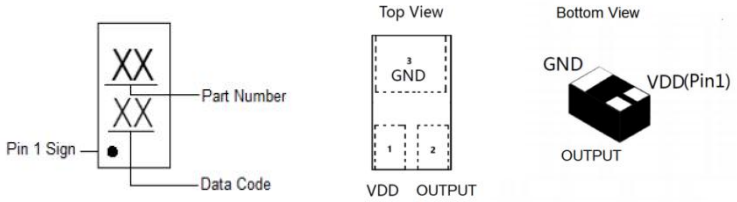




Pin Name	Pin No.	I/O	Pin Function
	DFN1010-4L		
VDD	2	P	Input Power Supply
GND	4	P	Ground
NC	3	-	Not Connected
OUTPUT	1	O	Output Pin

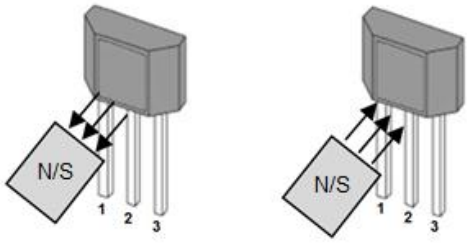
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DFN1006-3L：



Pin Name	Pin No.	I/O	Pin Function
	DFN1006-3L		
VDD	1	P	Input Power Supply
GND	3	P	Ground
OUTPUT	2	O	Output Pin

SIP-3L:



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

■ Typical Application Circuit

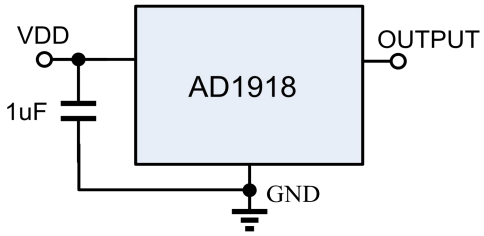


Figure 1, Typical Application Circuit of AD1918

■ Block Diagram

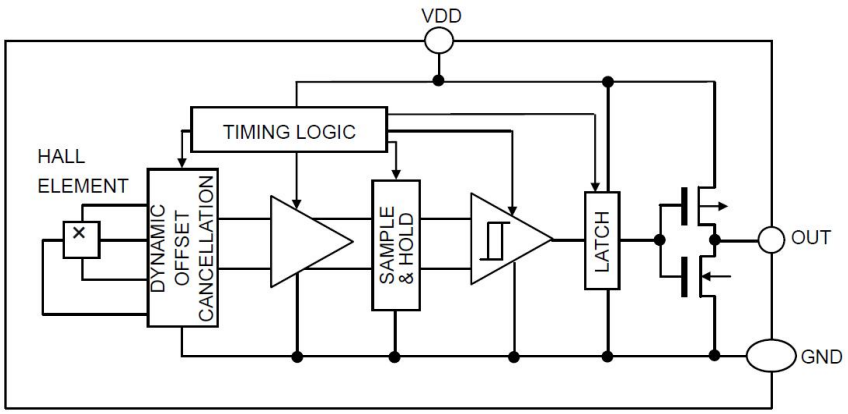


Figure 3, Block Diagram of AD1918

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

Parameter	Symbol	Rating	Unit
V_{DD} Pin to GND	V_{DD}	-0.3 to 5.5	V
Output Pin to GND	V_{OUTPUT}	-0.3 to V_{DD} +0.3	V
Max. Continuous Output Current	I_{OUTMAX}	2.0	mA
Magnetic Flux Density	B	Unlimited	Gauss
ESD (HBM)	ESD	8000	V
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_{DD} Pin to GND	V_{DD}	1.65 to 5.5	V
Continuous Output Current	I_{OUT}	1.0	mA
Operating Temperature Range	T_{OP}	-40 to +85	℃

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.

■ Electrical Characteristics

(T_A = -40 to +85℃ unless otherwise noted. Typical values are at T_A= +25℃, V_{DD} = 3.3V)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Input Voltage		1.65	3.3	5.5	V
I_{DD}(AVG)	Supply Current	Average supply current, T_A =25℃, V_{DD} =3.3V	-	1.8	-	μA
I_{DD}(AVG)		Average supply current, T_A =25℃, V_{DD} =4.4V	-	2.0	-	μA
T_{awake}	Awake Time		-	50	100	μs
T_{period}	Period		-	100	150	ms
D.C.	Duty Cycle		-	0.05	-	%
V_{OH}	Output Off Voltage (High side)	I_{OUT}=+1mA	V_{DD}-0.3	V_{DD}-0.1	V_{DD}+0.3	V
V_{OL}	Output On Voltage (Low side)	I_{OUT}=-1mA	-0.3	0.1	+0.3	V
Magnetic Para. (SOT553, DFN1010-4L and DFN1006-3L)						
B_{OPS}	Magnetic Operating Point		-	+42	+60	Gauss
B_{RPS}	Magnetic Release Point		+10	+25	-	Gauss
B_{HYS}	Hysteresis Window		-	17	-	Gauss
Magnetic Para. (SOT23-3L, SSOT23-3L, TSOT23-3L and SIP-3L)						
B_{OPN}	Magnetic Operating Point		-	-42	-60	Gauss
B_{RPN}	Magnetic Release Point		-10	-25	-	Gauss
B_{HYS}	Hysteresis Window		-	17	-	Gauss

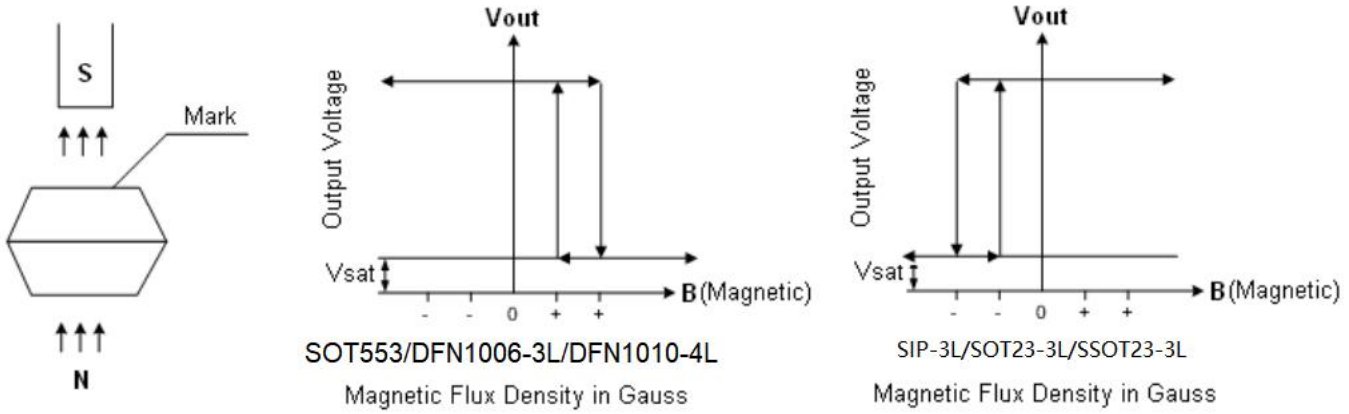
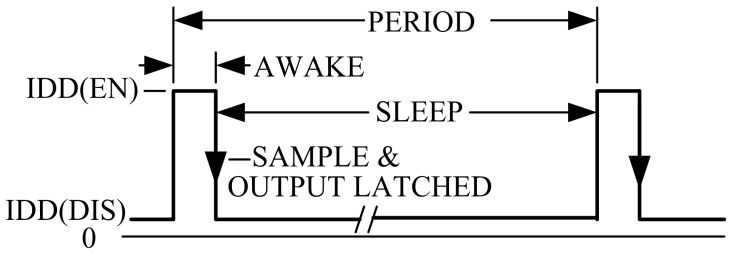


Fig 4, Magnetic Operation Characteristic of AD1918

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■ Function Description



Micro-power Operation

Internal timing circuitry activates the sensor for 50μs and deactivates it for the remainder of the period (100ms). 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

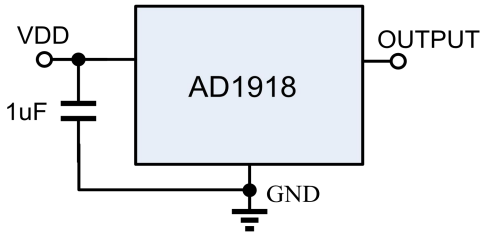
The Hall IC cannot detect magnetic fields that run horizontal to the package top layer. Be certain to configure the Hall IC so that the magnetic field is perpendicular to the top layer.

Operation

The output of this device switches low (turns on) when a magnetic field perpendicular to the Hall sensor exceeds the operate point B_{OP}. 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_{RP}, 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.

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Applications:



AD1918's pole-independent sensing technique allows for operation with north-pole magnet orientation, enhancing the manufacturability of the device.

C1 serves two purposes: minimizing ripples on the input voltage and enhancing immunity from RF transmission noises within close proximity. Recommended values are between 100nF and 1uF. The larger the capacitance, the better the noise immunity is for the AD1918.

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 north pole near the branded surface of the device.

Thermal Considerations

The maximum IC junction temperature should be restricted to 125°C under normal operating conditions. This restriction limits the power dissipation of the AD1918. 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:

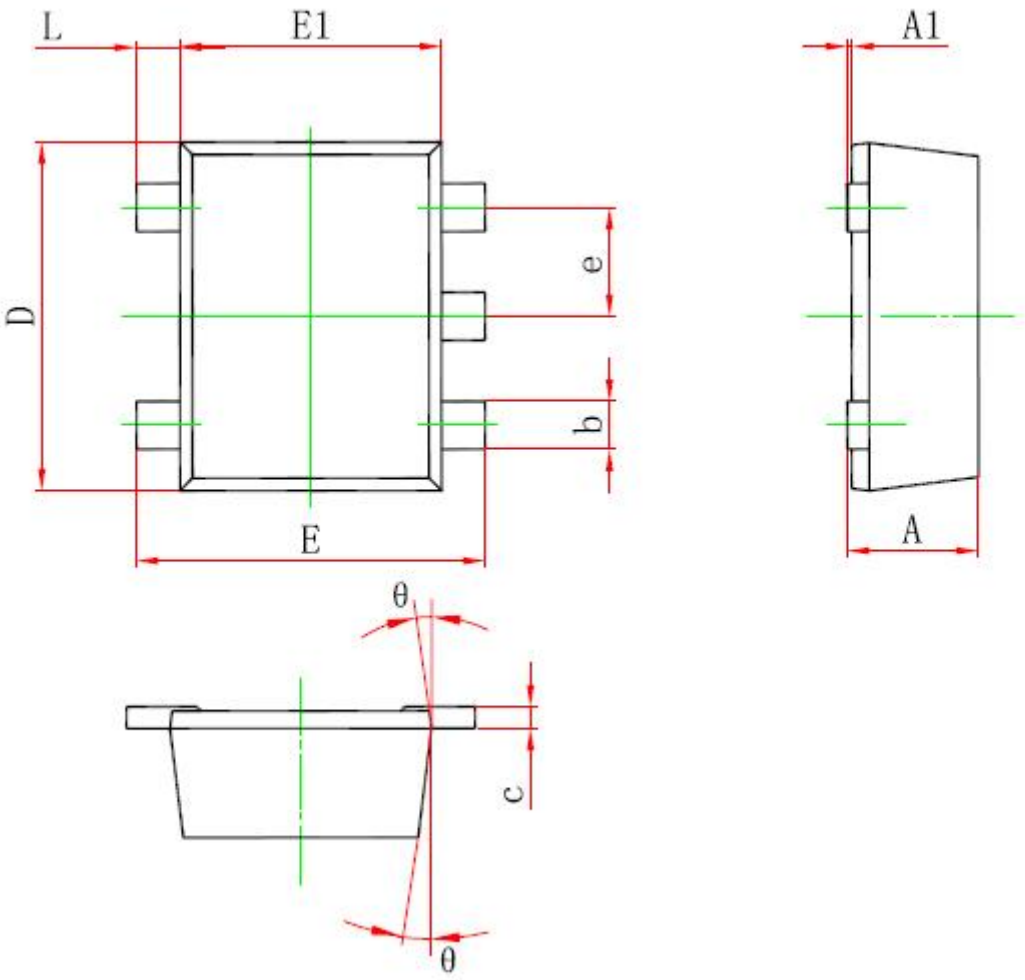
$$P_{D(MAX)} = \frac{125℃ - T_A}{R_{\theta JA}}$$

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.

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■ Package Information

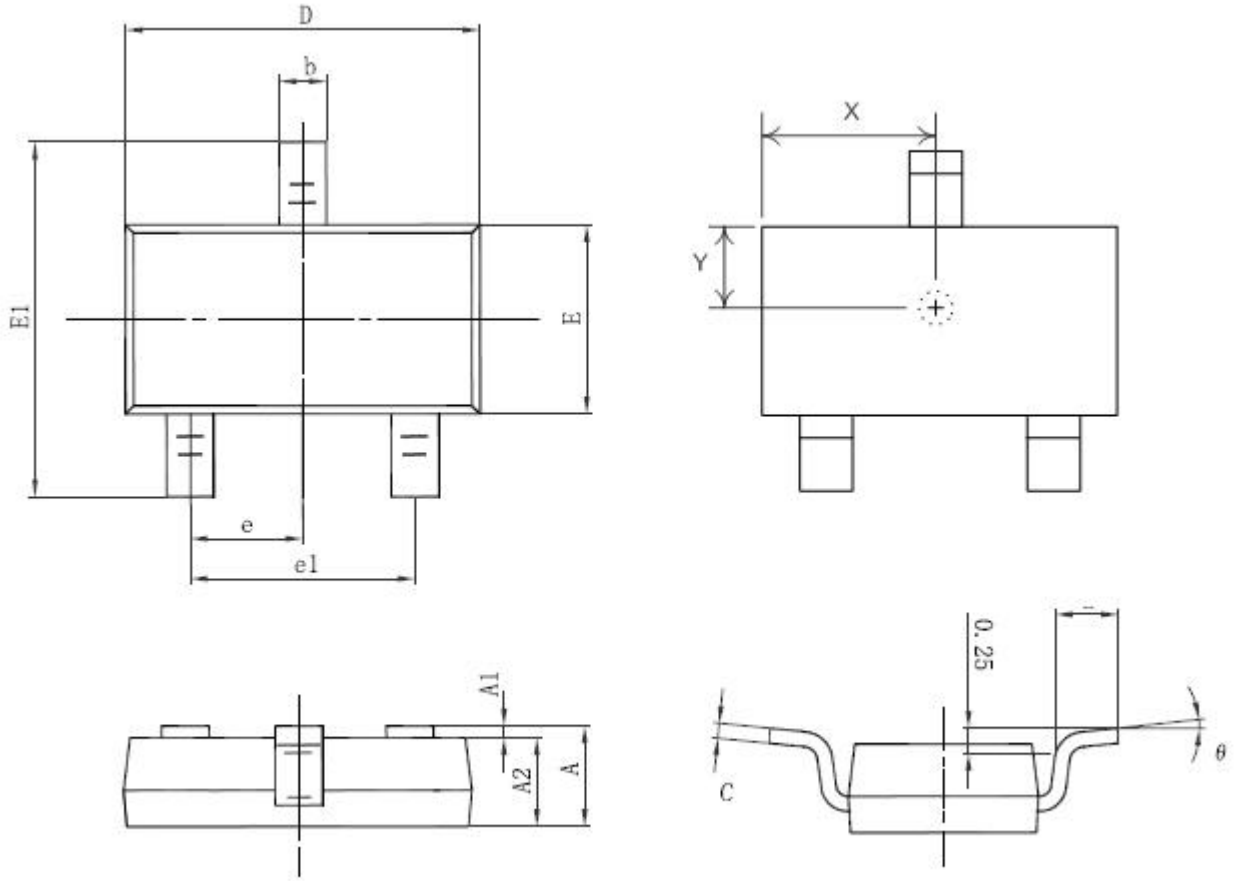
SOT553:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.525	0.600	0.021	0.024
A1	0.000	0.050	0.000	0.002
e	0.450	0.550	0.018	0.022
c	0.090	0.160	0.004	0.006
D	1.500	1.700	0.059	0.067
b	0.170	0.270	0.007	0.011
E1	1.100	1.300	0.043	0.051
E	1.500	1.700	0.059	0.067
θ	7° REF		7° REF	
L	0.100	0.300	0.004	0.012

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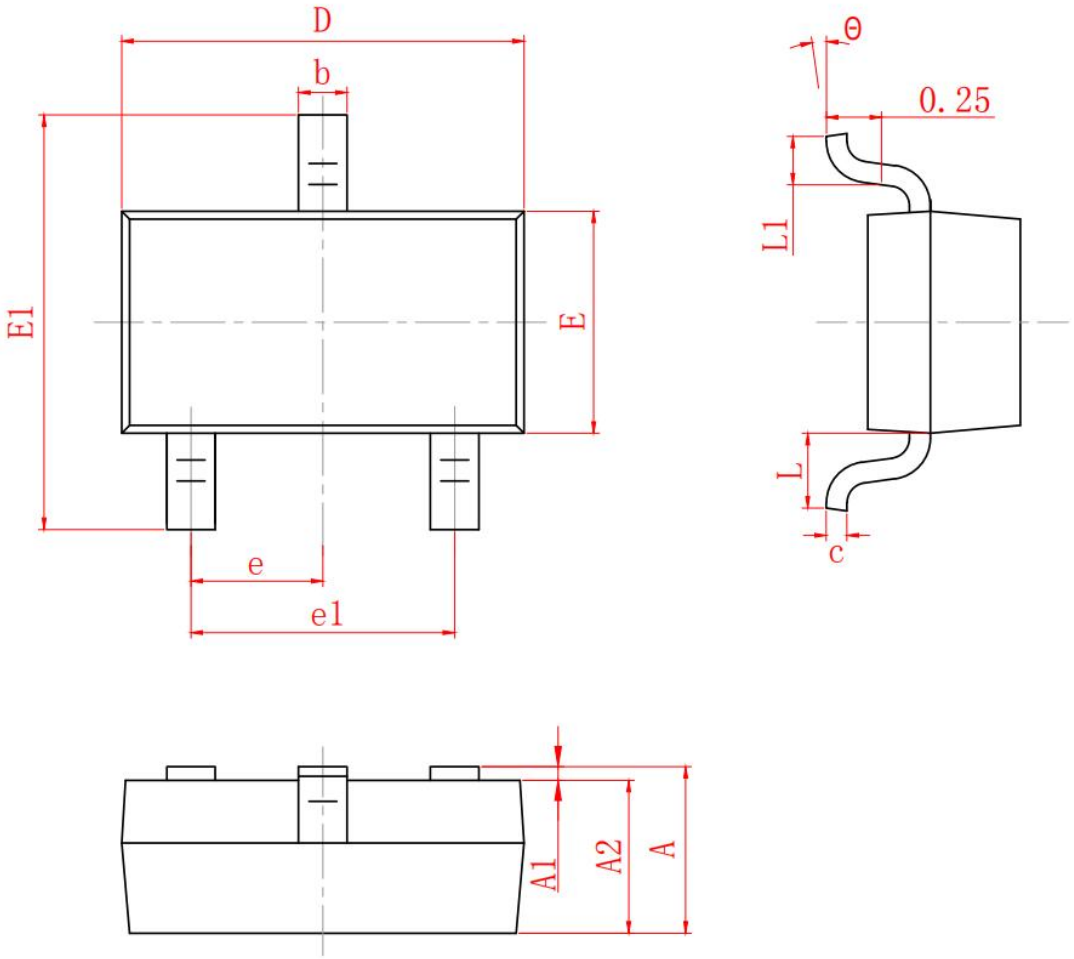
SOT23-3L:



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	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	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

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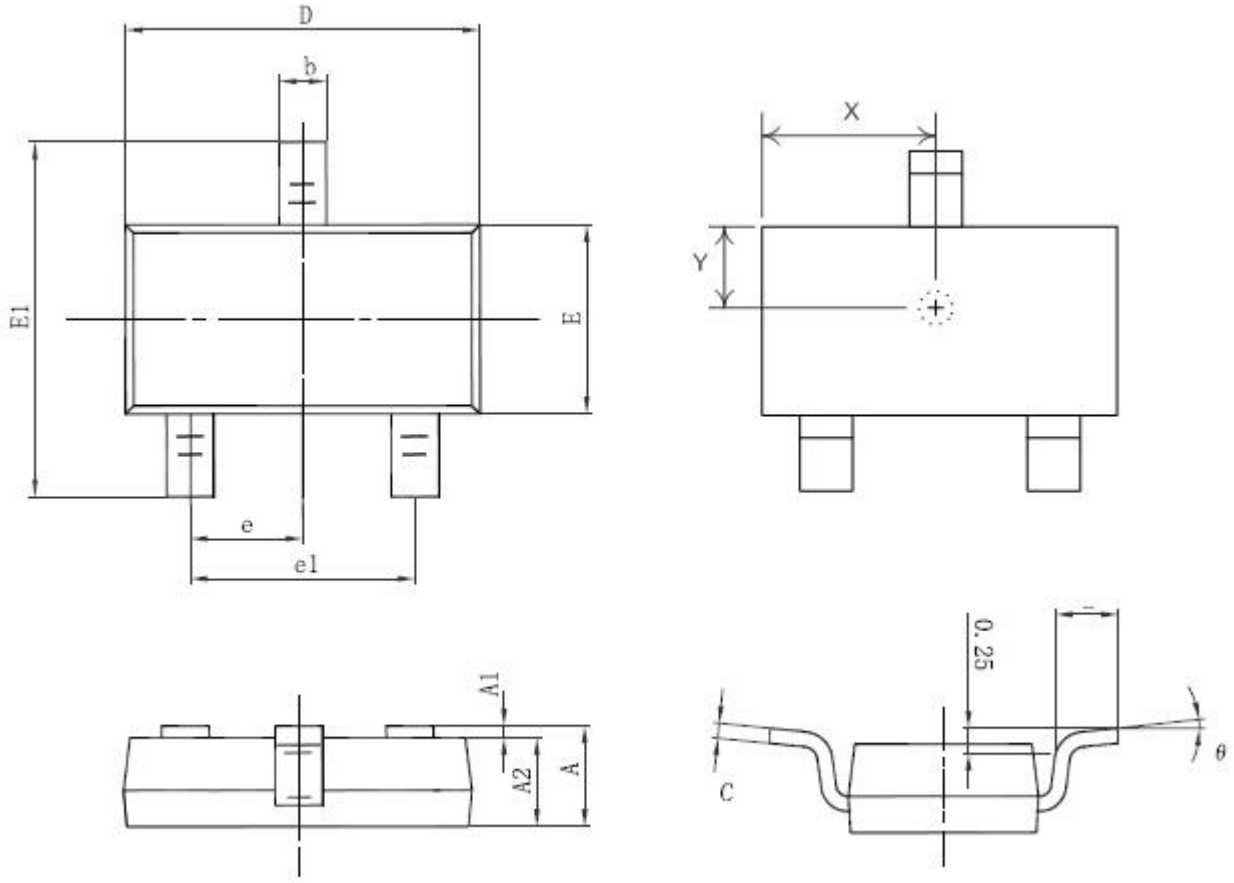
SSOT23-3L:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950(TPY)		0.037（TPY）	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020

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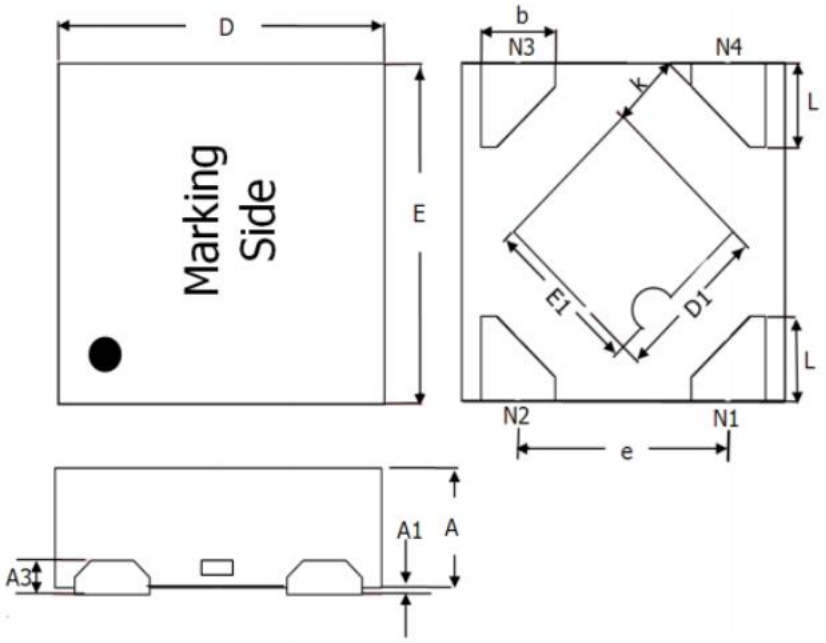
TSOT23-3L:



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

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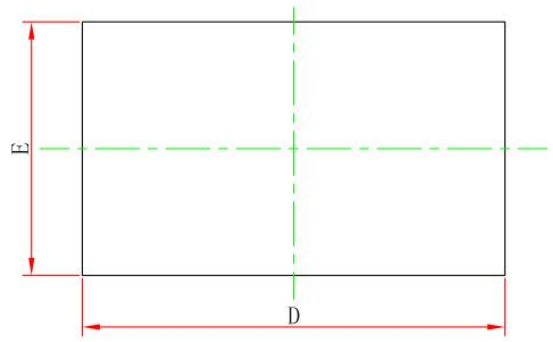
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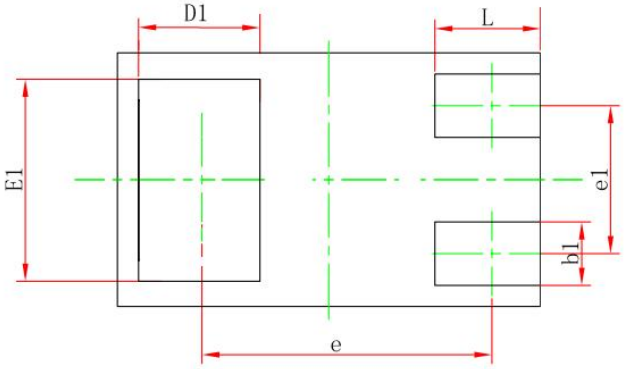
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.340	0.400	0.014	0.016
A1	0.000	0.050	0.000	0.002
A3	0.152 BSC		0.006 BSC	
D	0.950	1.050	0.038	0.042
E	0.950	1.050	0.038	0.042
D1	0.450	0.550	0.018	0.022
E1	0.450	0.550	0.018	0.022
k	0.211 BSC		0.008 BSC	
b	0.180	0.280	0.0072	0.0112
e	0.625 BSC		0.025 BSC	
L	0.200	0.300	0.008	0.012

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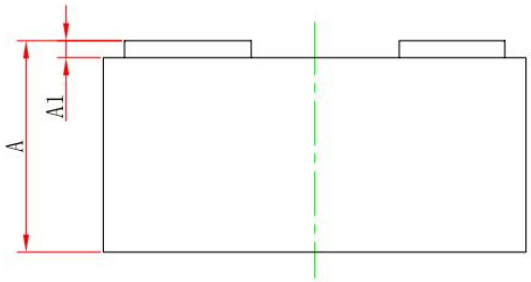
DFN1006-3L:



TOP VIEW



BOTTOM VIEW

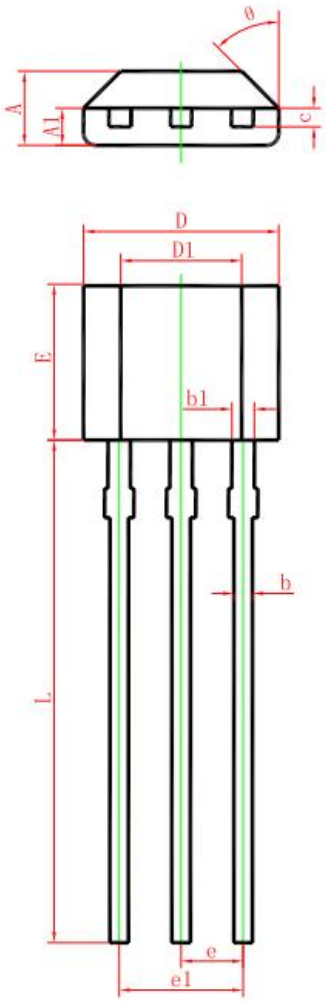


SIDE VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.450	0.550	0.018	0.022
A1	0.000	0.050	0.000	0.002
D	0.950	1.050	0.037	0.041
E	0.550	0.650	0.022	0.026
D1	0.200	0.300	0.008	0.012
E1	0.450	0.550	0.018	0.022
b1	0.100	0.200	0.004	0.008
e1	0.350 BSC		0.014 BSC	
e	0.675 BSC		0.027 BSC	
L	0.250	0.350	0.010	0.014

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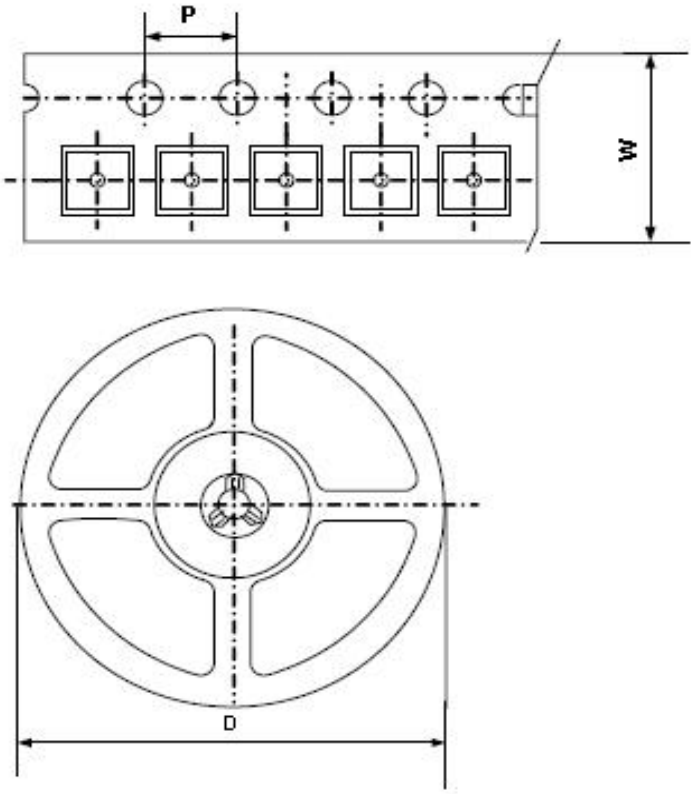
SIP-3L:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.420	1.620	0.056	0.064
A1	0.660	0.860	0.026	0.034
b	0.330	0.480	0.013	0.019
b1	0.400	0.510	0.016	0.020
c	0.330	0.510	0.013	0.020
D	3.900	4.100	0.154	0.161
D1	2.280	2.680	0.090	0.106
E	3.050	3.250	0.120	0.128
e	1.270 TYP.		0.050 TYP.	
e1	2.440	2.640	0.096	0.104
L	14.350	14.750	0.565	0.581
θ	45° TYP.		45° TYP.	

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■ Packing Information



Package Type	Carrier Width(W)	Pitch(P)	Reel Size(D)	Packing Minimum
SSOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs
SOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs
TSOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs
SOT553	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs
DFN1006-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	10000pcs
DFN1010-4L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	10000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum

■ Packing Information

SIP-3L:
1, Packing type: Bulk
2, Packing minimum: 1000pcs

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