ANGSEMI **Datasheet**

Magnetic Sensor IC

Continuous-Time Ratio-metric Linear Hall-Effect Sensor IC

Pb Free RoHS
ANGSemi Microelectronics Components Directive Compliance

AS1243

● General Description

The AS1243 is small, versatile linear Hall effect devices which are operated by the magnetic field from a permanent magnet or an electromagnet. They are optimized to accurately provide a voltage output that is proportional to an applied magnetic field. These devices have a quiescent output voltage that is about 2.5V voltage at 5V supply.

The Hall-effect integrated circuit included in each device includes a Hall sensing element, a linear amplifier, and a Class AB output structure. Integrating the Hall sensing element and the amplifier on a single chip minimizes many of the problems normally associated with low voltage level analog signals.

High precision in output levels is obtained by internal gain and offset trim adjustments made at end-of-line during the manufacturing process.

The integrated circuitry provides increased temperature stability and sensitivity, for both linear target motion and rotational motion. These linear position sensors have an operating temperature range of -40°C to +150°C, appropriate for industrial environments. They respond to either positive or negative gauss, monitoring either or both magnetic poles. The quad Hall sensing element minimizes the effects of mechanical or thermal stress on the output. The positive temperature coefficient of the sensitivity helps compensate for the negative temperature coefficients of low cost magnets, providing a robust design over a wide temperature range.

The AS1243 is available in SOT89-3L, SIP-3L and TO94-3L packages, and is rated over the -40°C to +150°C. These packages are available in a lead (Pb) free version.

● Features

- Input Voltage Range : 3.0V to 10.5V
- Fast Power-on Time
- Power consumption of 4.5mA/5V
- Single Current Sinking or Current Sourcing Output
- Linear Output For Circuit Design Flexibility
- Ratio-metric Output for A/D Interface
- Sensitivity: 3.125mV (typ.)/Gauss
- Rail to Rail Operation Provides More Useable Signal For Higher Accuracy
- Temperature Stable Quiescent Output Voltage
- Quad Hall Sensing Element For Stable Output
- Responds to Either Positive or Negative Gauss
- Robust EMC Protection
- Small Solution Size
- RoHS Compliant
- SOT89-3L, SIP-3L and TO94-3L Packages
- -40℃ to +150 ℃ Temperature Range

● Applications

- Angular Position
- Current Sensing / Over-current Detection
- Motor Control
- Linear Position Sensing
- Magnetic Code Reading
- Rotary Position Sensing
- Ferrous Metal Detector
- Vibration Sensing
- BLDC motor current monitoring
- Weigh and liquid level sensing

■ Ordering Information

AS1243XXX

Package:
M:SIP-3L
Y: SOT89-3L
T: TO94-3L

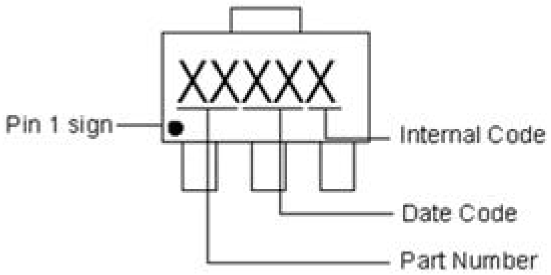
Packing:
R:Tape&Reel
B: Blank/Package

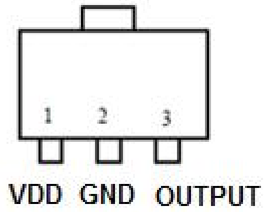
Temperature Grade:
Z: -40°C~150°C

Part Number	Sensitivity (Typ.)	Package Type	Package Qty	Temperature	Eco Plan
AS1243YRZ	3.125mV/Gauss	SOT89-3L	7-in reel 1000pcs/reel	-40～150℃	Rohs
AS1243MBZ	3.125mV/Gauss	SIP-3L	1000pcs/package	-40～150℃	Rohs
AS1243TBZ	3.125mV/Gauss	TO94-3L	1000pcs/package	-40～150℃	Rohs

■ Marking & Pin Assignment

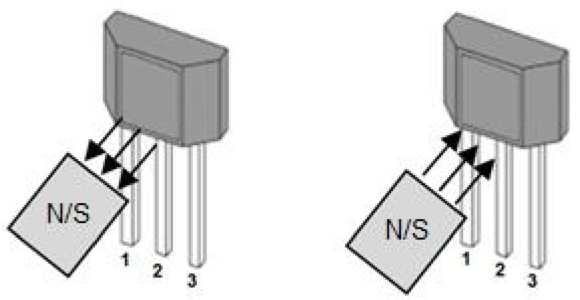
SOT89-3L



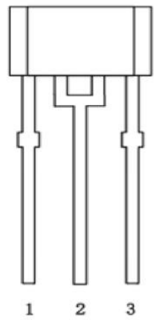


Pin Name	Pin No.	I/O	Pin Function
	SOT89-3L		
VDD	1	P	Input Power Supply
GND	2	P	Ground
OUTPUT	3	O	Output Pin

SIP-3L:



TO94-3L:



Pin Name	Pin No.		I/O	Pin Function
	SIP-3L	TO94-3L		
VDD	1	1	P	Input Power Supply
GND	2	2	P	Ground
OUTPUT	3	3	O	Output Pin.

■ Typical Application Circuit

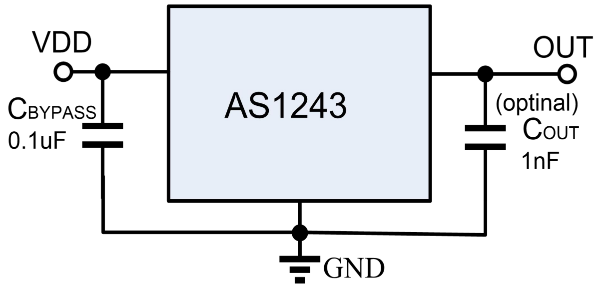


Figure 1, Typical Application Circuit of AS1243

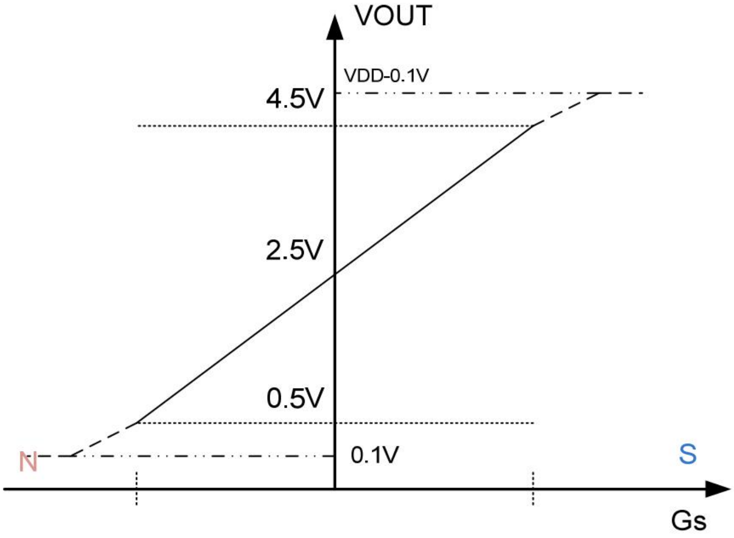


Figure 2, Output Voltage vs Magnetic Field Range of AS1243 (VDD=5V)

■ Block Diagram

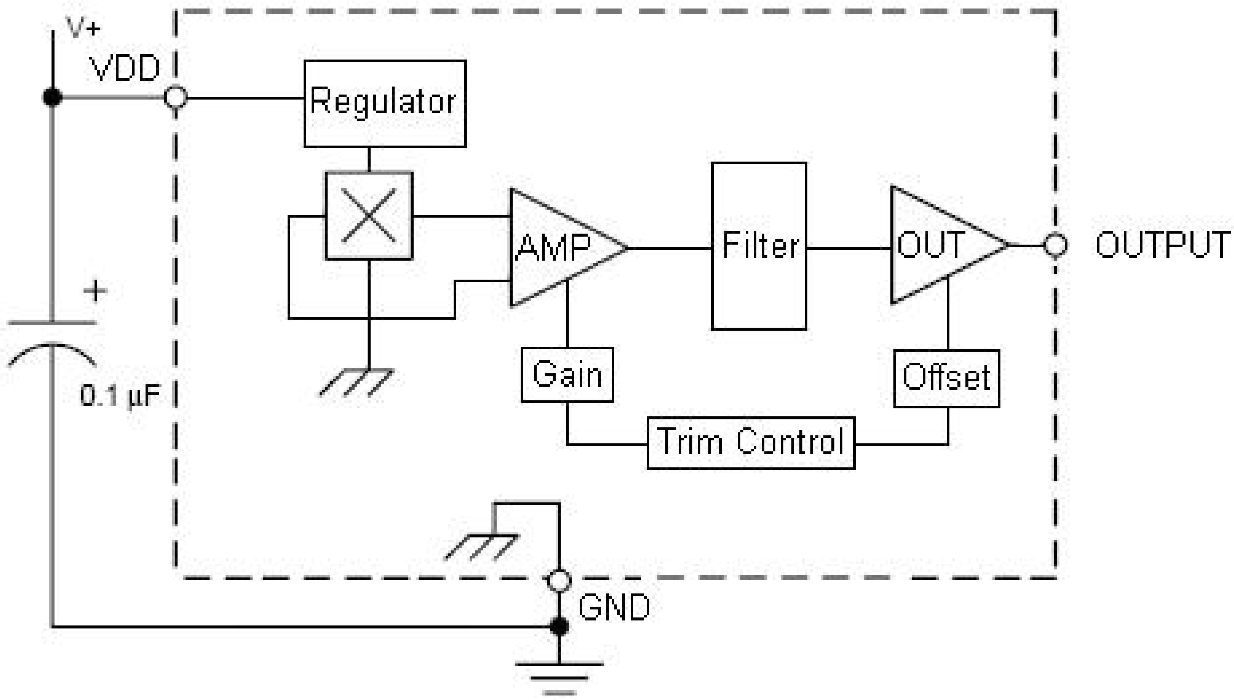


Figure 3, Block Diagram of AS1243

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 30.0	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
Package Power Dissipation	SIP-3L	P_D	430	mW
	SOT89-3L	P_D	600	
ESD (HBM)		ESD	4000	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}	260	℃

Recommended Operating Conditions[2]

Parameter	Symbol	Rating	Unit
V_{DD} Pin to GND	V_{DD}	3.0 to 10.5	V
Continuous Output Current	I_{OUT}	1.0	mA
Operating Temperature Range	T_{OP}	-40 to +150	℃

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

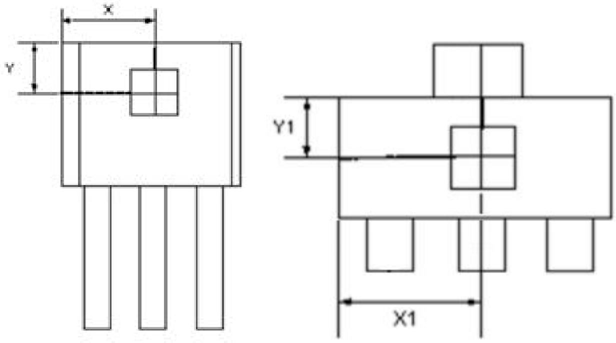
(T_A = -40 to +150℃ unless otherwise noted. Typical values are at T_A = +25℃, V_{DD} = 5.0V)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
General Supply						
V_{DD}	Power supply		3.0	5.0	10.5	V
I_Q	Quiescent Current		2.5	4.5	10.0	mA
T_{PO}	Power On Time[1]		-	3.0	5.0	uS
Gauss Sensitivity						
A_{SEN}	Sensitivity	V_{DD}=5V	2.75	3.125	3.50	mV/Gauss
		V_{DD}=3.3V	-	2.100	-	
MGR	Measureable Gauss Range		-	±730	±820	Gauss
Ratiometry						
$\triangle V_{OQ(\triangle V)}$	Output Voltage Error with Respect to $\triangle V_{DD}$[1]	0 Gauss	-	1.5	-	%
$\triangle S_{EN(\triangle V)}$	Magnetic Sensitivity Error with Respect to $\triangle V_{DD}$[1]		-	1.0	-	%
Output Stage						
V_{OQ}	0 Gauss Output Voltage	V_{DD}=5V	2.30	2.50	2.70	V
		V_{DD}=3.3V	1.50	1.65	1.80	V
Line	Output Voltage Linearity[1]		-	-	±1.0	%
Sym.	Symmetry[1]		-	-	±3.0	%
V_{OH}	Output Maximum Voltage	1000 Gauss	4.80	4.90	-	V
V_{OL}	Output Minimum Voltage	-1000 Gauss	0	0.10	0.20	V
R_{OH}	Output Load Resistance	OUT to VDD	2.0	-	-	KΩ
R_{OL}	Output Load Resistance	OUT to GND	2.0	-	-	KΩ
V_{OUTN}	Wide Band Output Noise[1]		-	150	-	uV
I_{SINK}	Output Current Capability	4.5V < V_{DD}	-	1.0	-	mA
I_{SOURCE}	Output Source Capability	4.5V < V_{DD}	-	1.0	-	mA
t_{RESP}	Response Time	Delay the output signal reaching 90%	-	1.0	-	uS

1) Guaranteed by design, not tested.

Hall Sensor Location

The Fig 4 is hall sensor location, where marks the IC number.



	Center	unit
X	2.00	mm
Y	1.50	mm
X1	1.10	mm
Y1	2.20	mm

Fig 4, AS1243 Hall Sensor Location

Applications

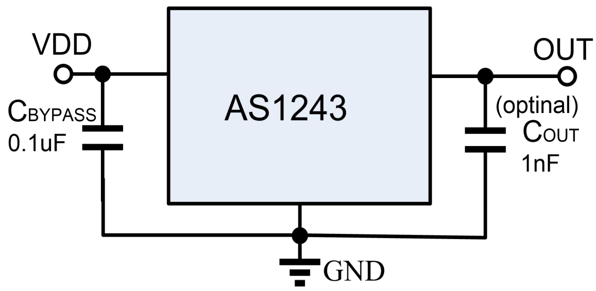


Figure 5, Typical Application Circuit of AS1243

In the quiescent state (that is, with no significant magnetic field: B=0), the output, $V_{OUT(Q)}$, equals to half of the supply voltage, V_{DD}, throughout the entire operating range of V_{DD}. The presence of a South-polarity magnetic field perpendicular to the branded surface of the package increases the output voltage from its quiescent value toward the supply voltage rail. The amount of the output voltage increase is proportional to the magnitude of the magnetic field applied. Conversely, the application of a North polarity field will decrease the output voltage from its quiescent value. This proportionality is specified as the magnetic sensitivity, Sens (mV/Gs), of the device.

The output capacitor is optional, if a fast output response is required, the output capacitors need to be removed. you could cancel the output capacitor. If a low-noise output signal is desired, the output capacitor is required.

Quiescent Voltage Output:

In the quiescent state (no magnetic field), the output equals about 2.5V (5V Power Supply) over the operating voltage range and the operating temperature range. Due to internal component tolerances and thermal considerations, there is a tolerance on the quiescent voltage output both as a function of supply voltage and as a function of ambient temperature. For purposes of specification, the quiescent voltage output as a function of temperature is defined in terms of magnetic flux density, B, as:

$$\Delta V_{OQ(\Delta T)} = \frac{V_{OQ(TA)} - V_{OQ(25^{\circ}C)}}{V_{OQ(25^{\circ}C)}} * 100\%$$

This calculation yields the device's equivalent accuracy, over the operating temperature range, in gauss (G).

Sensitivity:

The presence of a south-pole magnetic field perpendicular to the package face (the branded surface) increases the output voltage from its quiescent value toward the supply voltage rail by an amount proportional to the magnetic field applied. Conversely, the application of a north pole will decrease the output voltage from its quiescent value. This proportionality is specified as the sensitivity of the device and is defined as:

$$A_{SEN} = \frac{V_{OUT(-B)} - V_{OUT(+B)}}{2B}$$

The stability of sensitivity as a function of temperature is defined as:

$$\Delta A_{SEN(\Delta T)} = \frac{A_{SEN(TA)} - A_{SEN(25^{\circ}C)}}{A_{SEN(25^{\circ}C)}} * 100\%$$

Ratio-metric:

The AS1243 family features a ratio-metric output. The quiescent voltage output and sensitivity are proportional to the supply voltage (ratio-metric). The percent ratio-metric change in the quiescent voltage output is defined as:

$$\Delta V_{OQ(\Delta V)} = \frac{V_{OQ(VDD)} / V_{OQ(5V)}}{V_{DD} / 5V} * 100\%$$

and the percent ratio-metric change in sensitivity is defined as:

$$\Delta A_{SEN(\Delta V)} = \frac{A_{SEN(VDD)} / A_{SEN(5V)}}{V_{DD} / 5V} * 100\%$$

Linearity and Symmetry:

The on-chip output stage is designed to provide a linear output with a supply voltage of 5V. Although application of very high magnetic fields will not damage these devices, it will force the output into a non-linear region. Linearity in percent is measured and defined as:

$$Linear+ = \frac{V_{OUT(+B)} - V_{OQ}}{2(V_{OUT(+B/2)} - V_{OQ})} * 100\%$$

$$Linear- = \frac{V_{OUT(-B)} - V_{OQ}}{2(V_{OUT(-B/2)} - V_{OQ})} * 100\%$$

and output symmetry as:

$$Sym = \frac{V_{OUT(+B)} - V_{OQ}}{V_{OQ} - V_{OUT(-B)}} * 100\%$$

Thermal Considerations

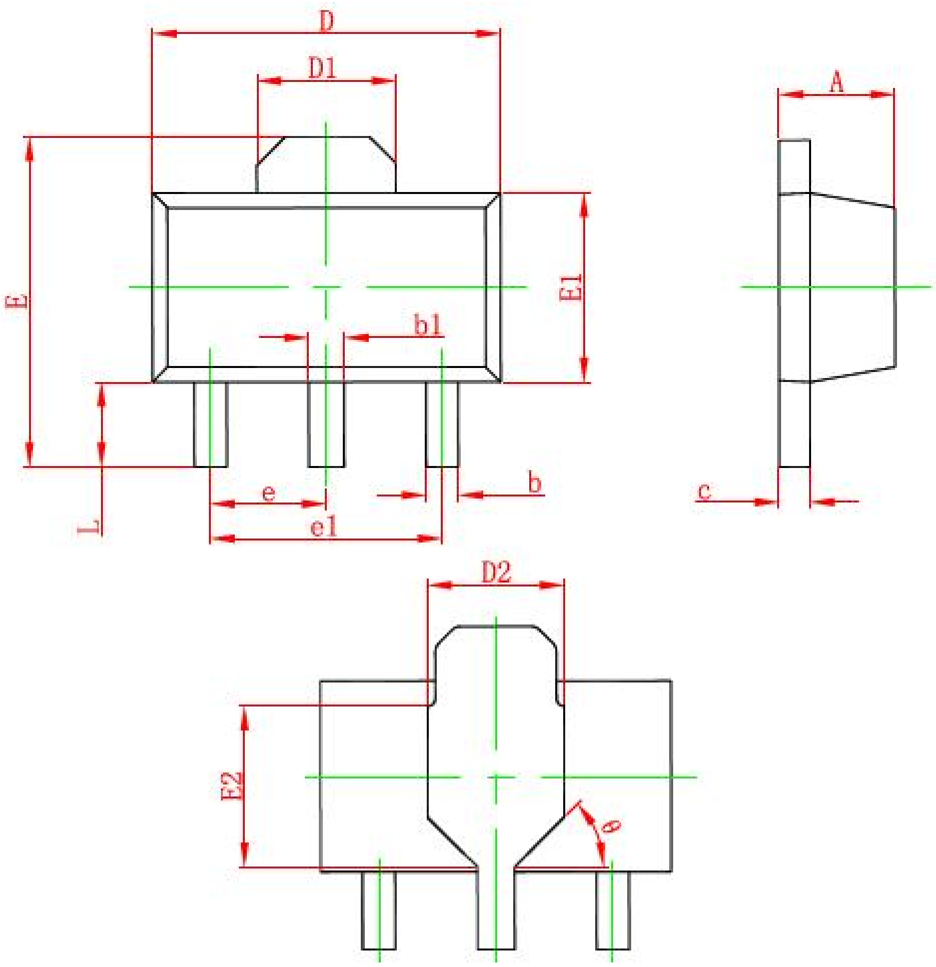
The maximum IC junction temperature should be restricted to 125°C under normal operating conditions. This restriction limits the power dissipation of the AS1243. Calculate the maximum allowable dissipation, $P_{D(max)}$, and keep the actual dissipation less than or equal to $P_{D(max)}$. The maximum-power-dissipation limit is determined using following equation:

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

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.

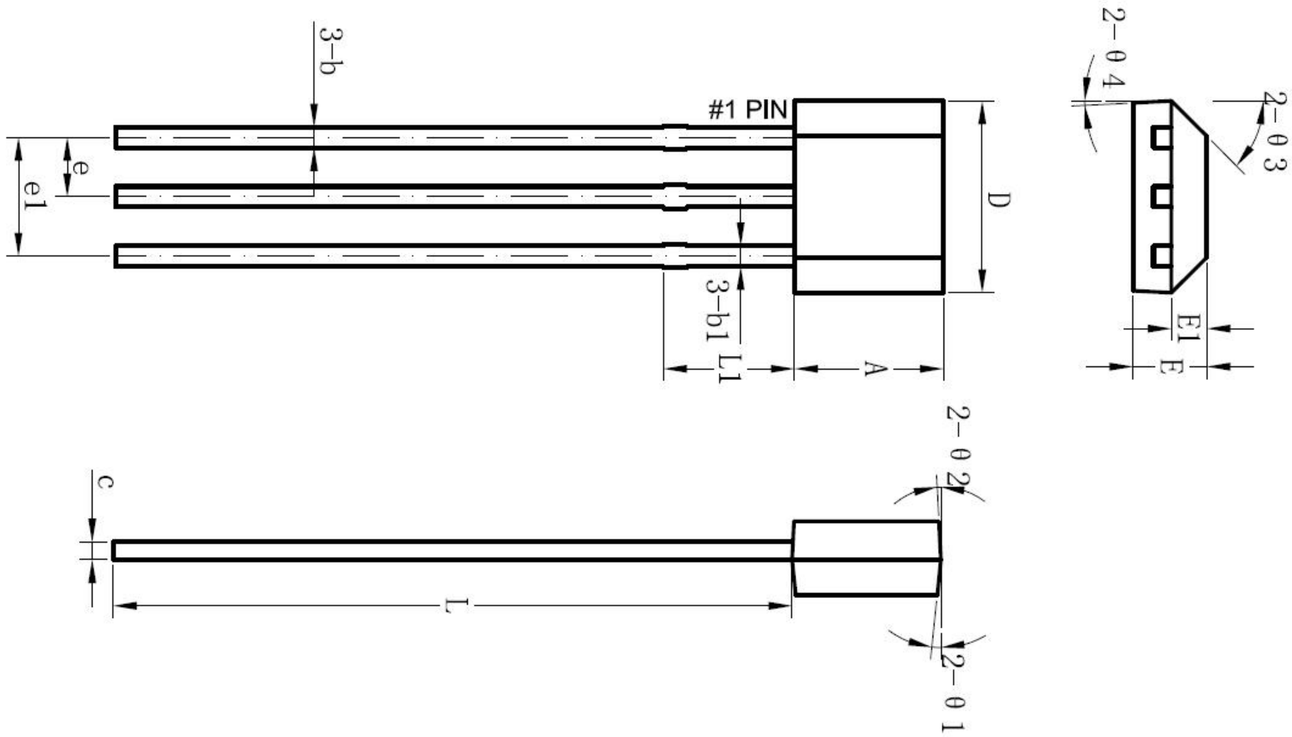
Package Information

SOT89-3L:



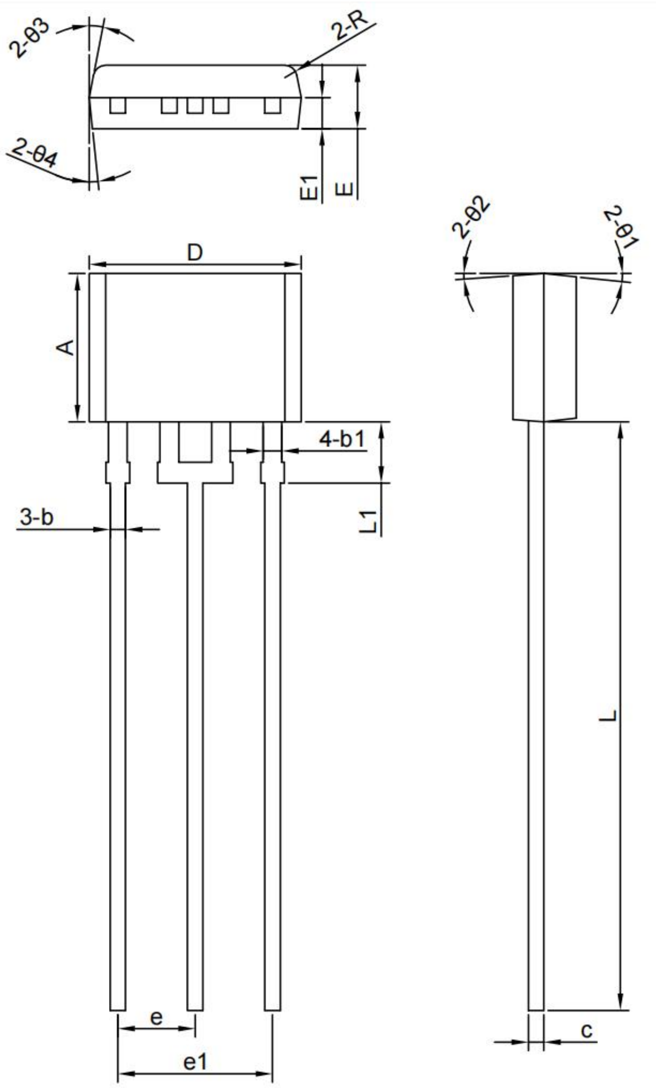
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.380	0.580	0.015	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF	
D2	1.750 REF.		0.069 REF	
E	3.940	4.250	0.155	0.167
E1	2.300	2.600	0.091	0.102
E2	1.900 REF.		0.075 REF	
e	1.500 Typ.		0.060 Typ.	
e1	3.000 Typ.		0.118 Typ.	
L	0.900	1.200	0.035	0.047
θ	45°		45°	

SIP-3L:



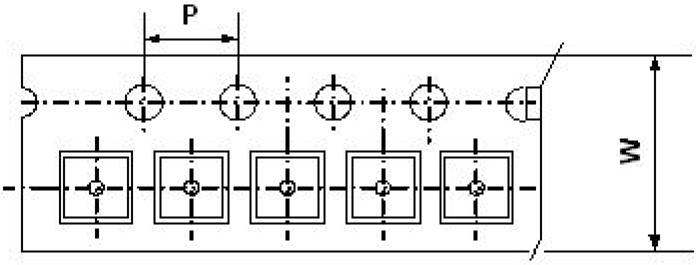
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.900	3.000	3.100	0.114	0.118	0.122
b	0.350	0.390	0.560	0.014	0.015	0.022
b1	-	0.440	-	-	0.017	-
C	0.360	0.380	0.510	0.014	0.015	0.020
D	3.900	4.000	4.100	0.153	0.157	0.161
E	1.420	1.520	1.620	0.056	0.060	0.064
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	-
θ1	-	6°	-	-	6°	-
θ2	-	3°	-	-	3°	-
θ3	-	45°	-	-	45°	-
θ4	-	3°	-	-	3°	-

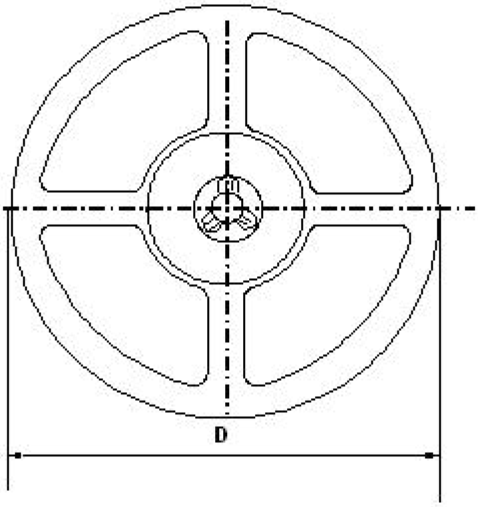
TO94-3L:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
D	5.120	5.320	0.202	0.209
A	3.550	3.750	0.140	0.148
E	1.460	1.660	0.057	0.065
E1	0.760 TYP.		0.300 TYP.	
L	13.500	15.500	0.531	0.610
L1	1.200	1.700	0.047	0.067
b	0.350	0.500	0.014	0.020
c	0.360	0.450	0.014	0.018
b1	0.450 TYP.		0.018 TYP.	
R	0.300 TYP.		0.012 TYP.	
e	1.905 TYP.		0.075 TYP.	
e1	3.810 TYP.		0.150 TYP.	
Θ1	6°		6°	
Θ2	4°		4°	
Θ3	11°		11°	
Θ4	6°		6°	

Packing Information





Package Type	Carrier Width(W)	Pitch(P)	Reel Size(D)	Packing Minimum
SOT89-3L	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

SIP-3L/TO94-3L:

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