

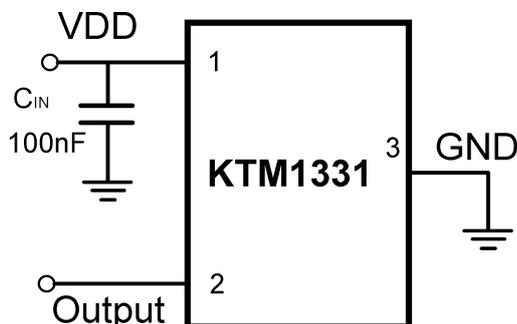
### Features

- TMR+CMOS monolithic structure
- Low power Consumption
  - 50Hz Version: 160nA@3.0V (typical)
  - 1.6KHz Version: 600nA@3.0V (typical)
  - Continuous Version: 1.9uA@3.0V (typical)
- Supply Voltage: 1.8V~5.5V
- High Magnetic Sensitivity
  - $B_{OP}=45Gs$   $B_{RP}=-45Gs$
  - $B_{OP}=30Gs$   $B_{RP}=-30Gs$
  - $B_{OP}=17Gs$   $B_{RP}=-17Gs$
  - $B_{OP}=9Gs$   $B_{RP}=-9Gs$
  - $B_{OP}=5Gs$   $B_{RP}=-5Gs$
- Latch TMR Switch
- Push-pull Output Mode
- Package: SOT-23-3L (MSL1) TO-92S
- Operating Temperature:  $-40^{\circ}C \sim 125^{\circ}C$
- High ESD Rating: HBM 8KV
- RoHS Compliant

### Application

- Water, electric and gas utility meters
- Door, Lids and Tray Position Switches
- Level, proximity and position switches
- Speed Detection

### Typical Application Circuit

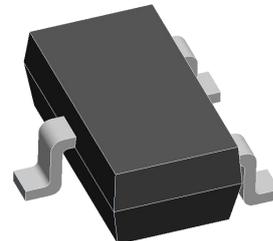


Note: C<sub>IN</sub> is for stabilization and to strengthen the noise immunity, the recommended capacitance is 100nF typical and should be placed as close to the supply pin as possible.

### Descriptions

The KTM1331 is a digital-latch magnetic switch integrated with Tunneling Magnetoresistance (TMR) technology and CMOS process for use in industrial and consumer switch applications. The IC internally includes a TMR bridge, a voltage regulator for operation with supply voltage from 1.8V to 5.5V, digital logic control module, threshold adjustment module, Schmitt trigger and a push-pull output. If the magnetic flux density parallel to the part marking surface is larger than operating point (BOP), the output will be turned on; if it is less than releasing point (BRP), the output will be turned off. The device operates in the latch mode.

The KTM1331 family provides a variety of package to customers: SOT-23-3L for surface mount and TO-92S flat for through-hole mount. All package are RoHS compliant.



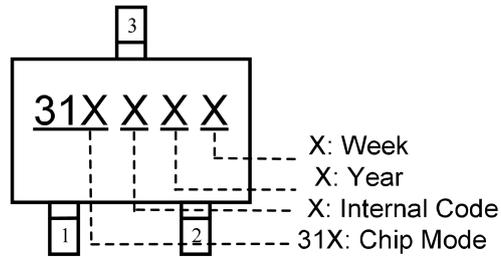
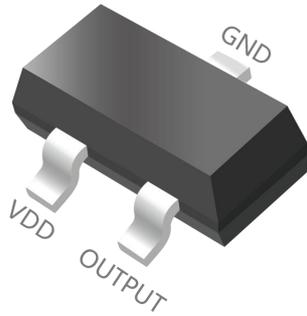
SOT-23-3L



TO-92S

**Pin Descriptions**

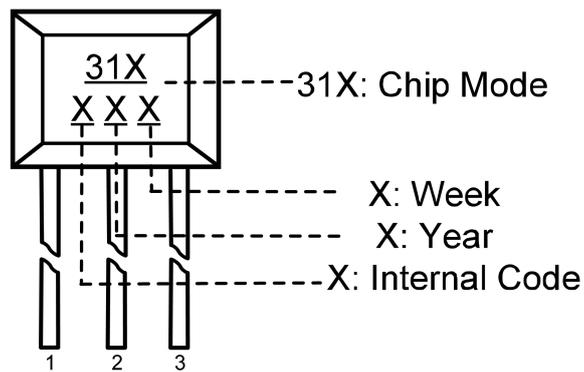
SOT-23-3L



Top view

Pin Name	Pin Number	Function
VDD	1	Power Supply Input
OUTPUT	2	Output Ground Pin
GND	3	Ground Pin

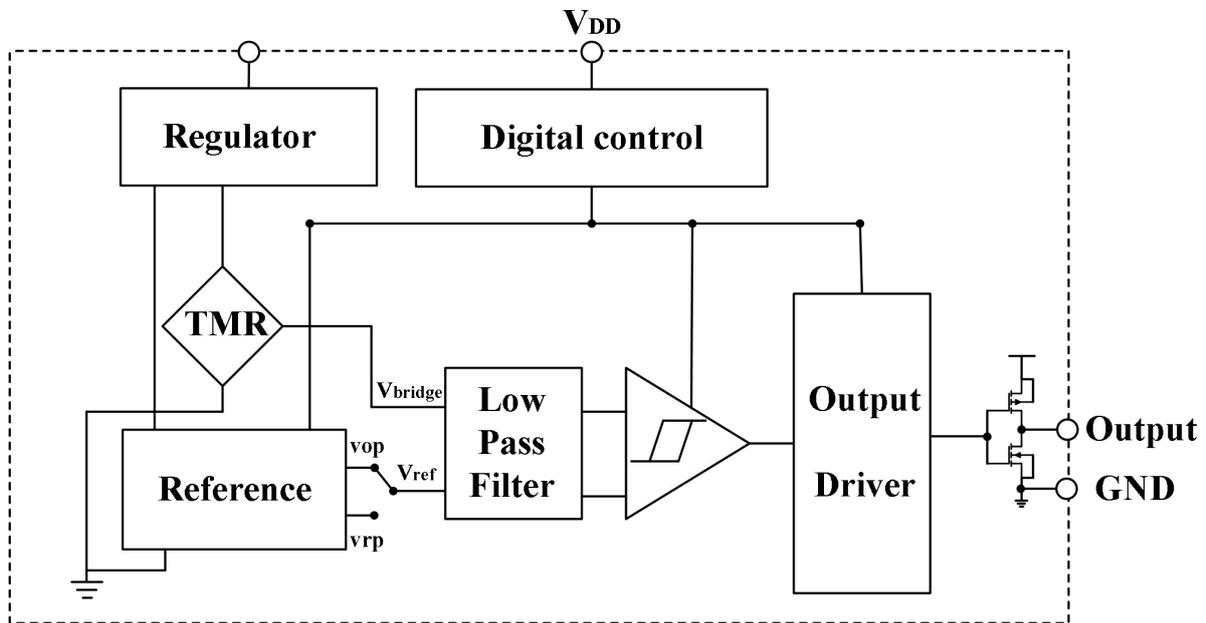
TO-92S



Top view

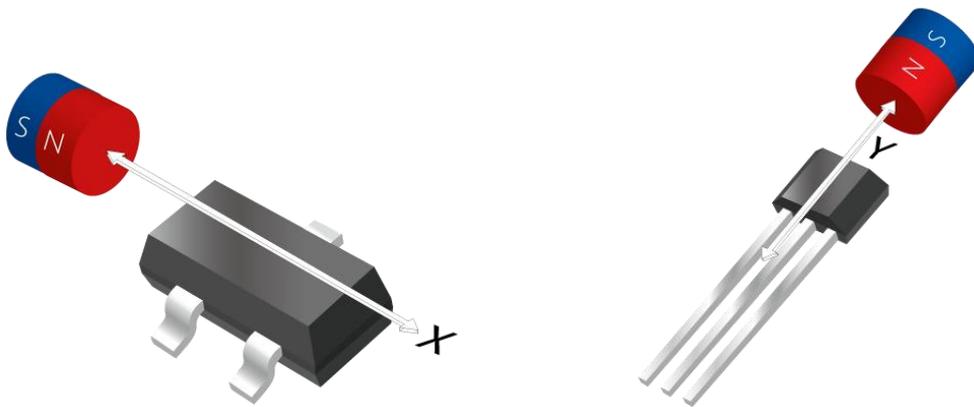
Pin Name	Pin Number	Function
VDD	3	Power Supply Input
GND	2	Ground Pin
OUTPUT	1	Output Pin

**Block Diagram**

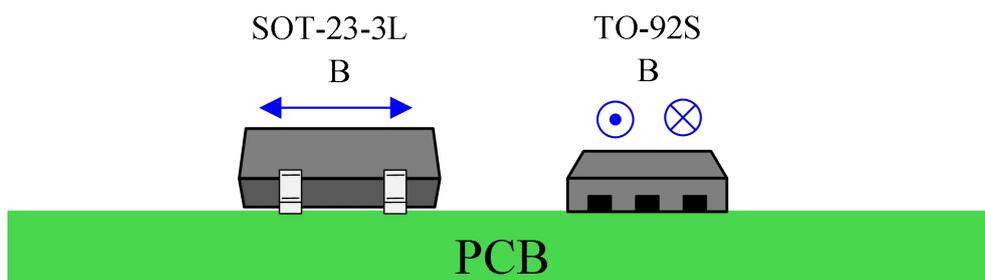


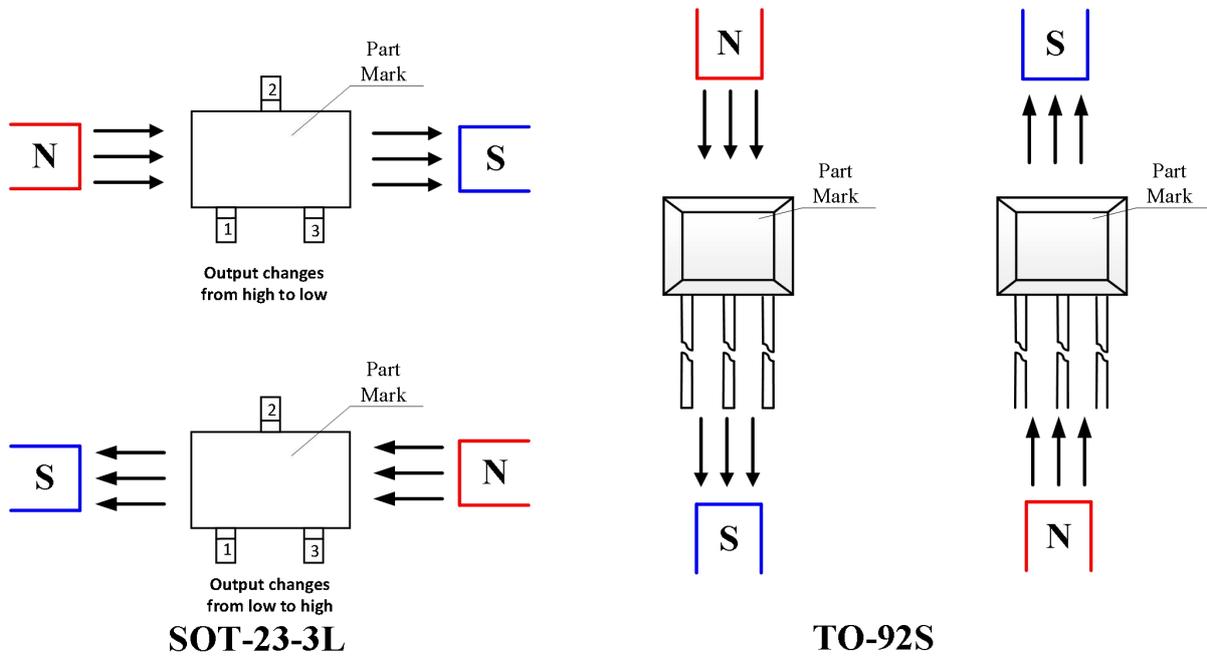
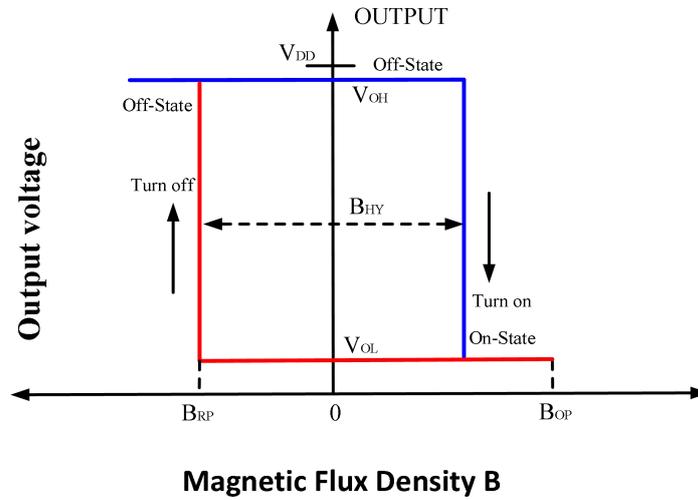
**Output Switching Characteristics**

To operate the TMR switch, the magnetic field should be applied to the sensor with sufficient magnetic flux density and correct direction.

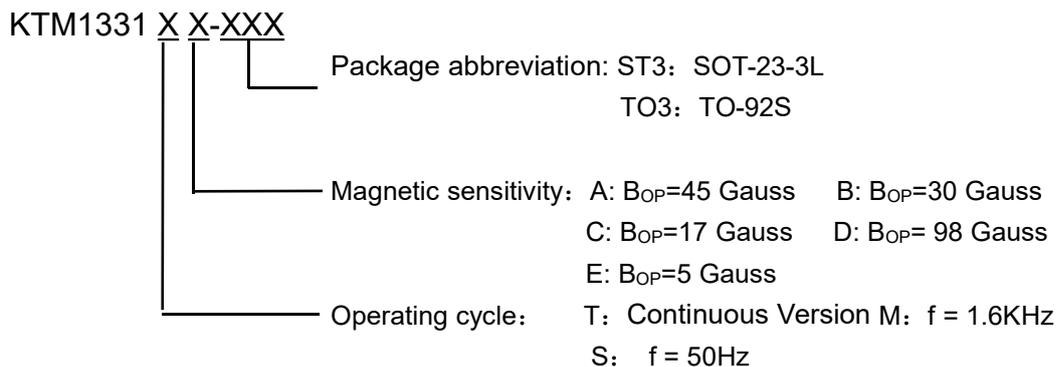


As shown in the figure below, a horizontal magnetic field parallel to the package can be detected.





**Product Name Structure**



**Absolute Maximum Ratings** (@T<sub>A</sub>=+25°C, unless otherwise specified)

Symbol	Parameter	Value	Unit
V <sub>DD</sub>	Supply Voltage Dissipation	6	V
V <sub>DD_REV</sub>	Reverse voltage (VDD)	-0.3	V
I <sub>OUTPUT</sub>	Output Current	5	mA
B	Magnetic Flux Density	3000@<5min	Gauss
T <sub>STG</sub>	Maximum Junction Temperature	-50~+150	°C
T <sub>J</sub>	Human Body Model ESD Capability	+150	°C
ESD HBM	Supply Voltage Dissipation	8000	V
T reflow	Reflow Temperature (MAX)	+260	°C

Note: Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum rated conditions for extended periods may affect device reliability.

**Recommended Operating Range** (@T<sub>A</sub>=+25°C, unless otherwise specified)

Symbol	Parameter	Conditions	Value	Unit
V <sub>DD</sub>	Supply Voltage	Operating	1.8~5.5	V
T <sub>A</sub>	Operating temperature Range	Operating	-40~125	°C

**Electronics Characteristics** (@T<sub>A</sub>=+25°C, V<sub>DD</sub>=3.0V, unless otherwise specified)

KTM1331SX Series						
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	Operating	1.8	—	5.5	V
V <sub>OL</sub>	Output Low Voltage (On)	I <sub>OUT</sub> =1mA	—	0.008	0.05	V
V <sub>OH</sub>	Output High Voltage (Off)	I <sub>OUT</sub> =1mA	V <sub>DD</sub> -0.05	V <sub>DD</sub> -0.015	—	V
I <sub>DD(AVG)</sub>	Average Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =3.0V	—	160	—	nA
I <sub>DD(Awake)</sub>	Awake Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =3.0V	—	1.9	—	μA
I <sub>DD(Sleep)</sub>	Sleep Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =3.0V	—	148	—	nA
T <sub>AWAKE</sub>	Awake Time	Operating	—	40	—	μs
T <sub>PERIOD</sub>	Period	Operating	—	20	—	ms

KTM1331MX Series						
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
VDD	Supply Voltage	Operating	1.8	—	5.5	V
VOL	Output Low Voltage (On)	I <sub>OUT</sub> =1mA	—	0.008	0.05	V
VOH	Output High Voltage (Off)	I <sub>OUT</sub> =1mA	V <sub>DD</sub> -0.05	V <sub>DD</sub> -0.015	—	V
I <sub>DD(AVG)</sub>	Average Supply Current	T <sub>A</sub> =+25°C, VDD=3.0V	—	600	—	nA
I <sub>DD(Awake)</sub>	Awake Supply Current	T <sub>A</sub> =+25°C, VDD=3.0V	—	1.9	—	μA
I <sub>DD(Sleep)</sub>	Sleep Supply Current	T <sub>A</sub> =+25°C, VDD=3.0V	—	148	—	nA
T <sub>PERIOD</sub>	Period	Operating	—	625	—	μs
F <sub>S</sub>	Sampling Frequency	Operating	—	1600	—	Hz

KTM1331TX Series						
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
VDD	Supply Voltage	Operating	1.8	—	5.5	V
VOL	Output Low Voltage (On)	I <sub>OUT</sub> =1mA	—	0.008	0.05	V
VOH	Output High Voltage (Off)	I <sub>OUT</sub> =1mA	V <sub>DD</sub> -0.05	V <sub>DD</sub> -0.015	—	V
I <sub>DD(AVG)</sub>	Awake Supply Current	T <sub>A</sub> =+25°C, VDD=3.0V	—	1.9	—	μA
F <sub>S</sub>	Sampling Frequency	Operating	—	5000	—	Hz

**Magnetic Characteristics (T<sub>A</sub>=25°C, VDD=3.0V, unless otherwise noted)**

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTM1331XA Series</b>						
B <sub>OP</sub>	Magnetic threshold operate point	T <sub>A</sub> =+25°C, VDD=3.0V	40	45	50	Gauss
B <sub>RP</sub>	Magnetic threshold release point	T <sub>A</sub> =+25°C, VDD=3.0V	-50	-45	-40	
B <sub>HY</sub> ( B <sub>OPX</sub>  - B <sub>RPX</sub>  )	Magnetic hysteresis		-	90	-	

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTM1331XB Series</b>						
B <sub>OP</sub>	Magnetic threshold operate point	TA=+25°C, VDD=3.0V	26	30	36	Gauss
B <sub>RP</sub>	Magnetic threshold release point	TA=+25°C, VDD=3.0V	-36	-30	-26	
B <sub>HY</sub> ( B <sub>OPX</sub>  - B <sub>RPX</sub>  )	Magnetic hysteresis		-	60	-	

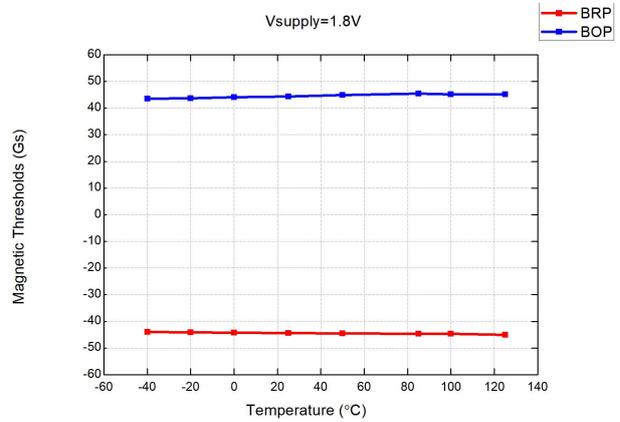
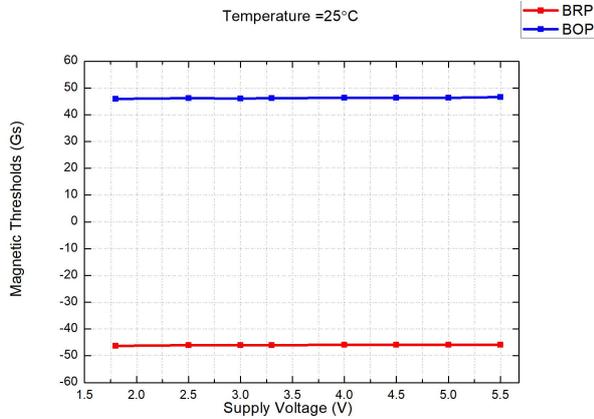
Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTM1331XC Series</b>						
B <sub>OP</sub>	Magnetic threshold operate point	TA=+25°C, VDD=3.0V	12	17	22	Gauss
B <sub>RP</sub>	Magnetic threshold release point	TA=+25°C, VDD=3.0V	-22	-17	-12	
B <sub>HY</sub> ( B <sub>OPX</sub>  - B <sub>RPX</sub>  )	Magnetic hysteresis		-	34	-	

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTM1331XD Series</b>						
B <sub>OPS</sub>	Magnetic threshold operate point	TA=+25°C, VDD=3.0V	7	9	11	Gauss
B <sub>RPN</sub>	Magnetic threshold release point	TA=+25°C, VDD=3.0V	-11	-9	-7	
B <sub>HY</sub> ( B <sub>OPX</sub>  - B <sub>RPX</sub>  )	Magnetic hysteresis		-	18	-	

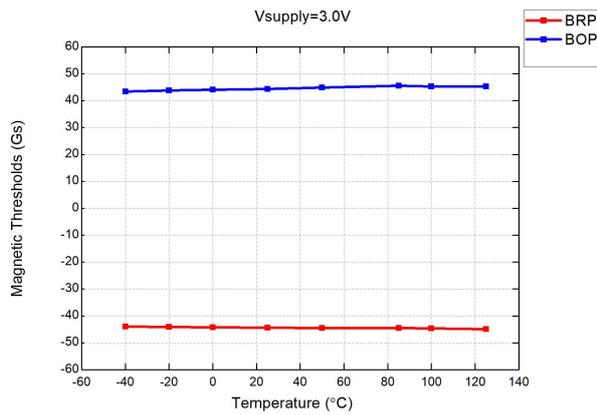
Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTM1331XE Series</b>						
B <sub>OPS</sub>	Magnetic threshold operate point	TA=+25°C, VDD=3.0V	3	5	7	Gauss
B <sub>RPN</sub>	Magnetic threshold release point	TA=+25°C, VDD=3.0V	-7	-5	-3	
B <sub>HY</sub> ( B <sub>OPX</sub>  - B <sub>RPX</sub>  )	Magnetic hysteresis		-	10	-	

**Performance Graphs**

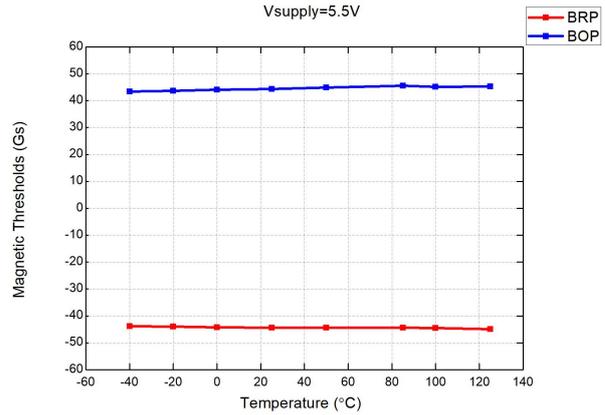
**KTM1331XA Series**



**Magnetic Thresholds vs. Supply Voltage @T<sub>A</sub>=25°C**



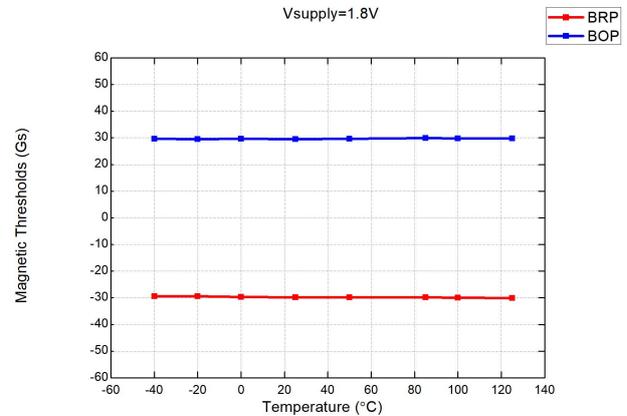
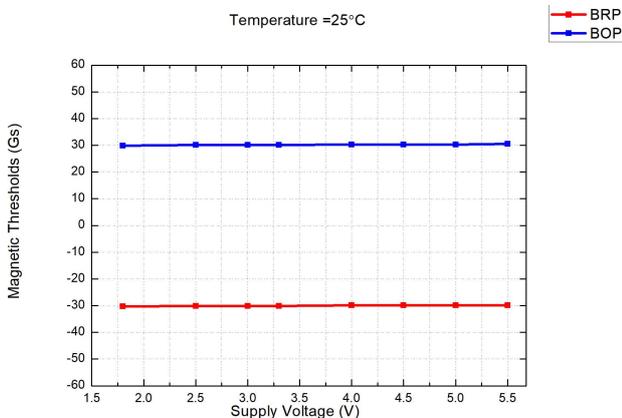
**Magnetic Thresholds vs T<sub>A</sub> @VDD=1.8V**



**Magnetic Thresholds vs T<sub>A</sub> @VDD=3.0V**

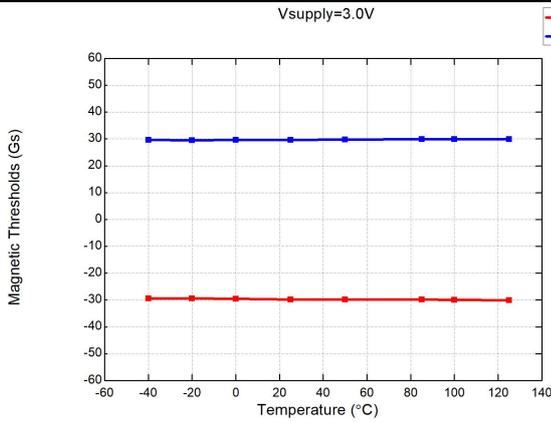
**Magnetic Thresholds vs T<sub>A</sub> @VDD=5.5V**

**KTM1331XB Series**

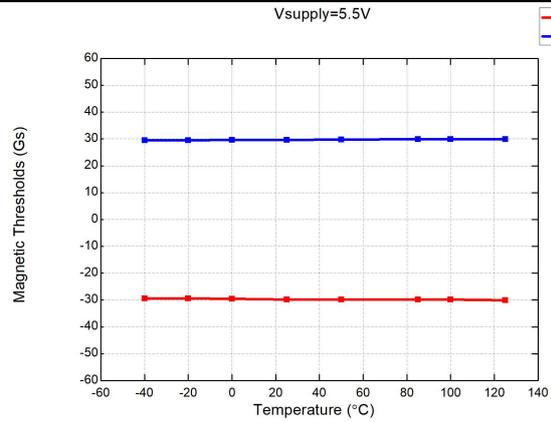


**Magnetic Thresholds vs. Supply Voltage @T<sub>A</sub>=25°C**

**Magnetic Thresholds vs T<sub>A</sub> @VDD=1.8V**

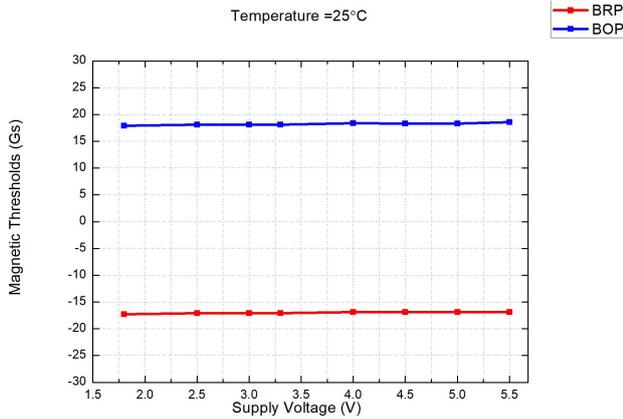


**Magnetic Thresholds vs T<sub>A</sub> @VDD=3.0V**

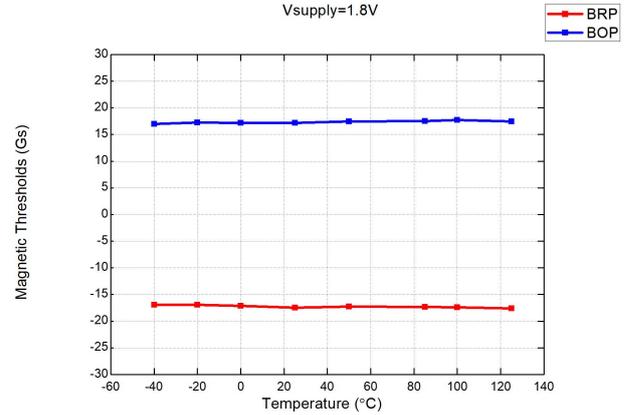


**Magnetic Thresholds vs T<sub>A</sub> @VDD=5.5V**

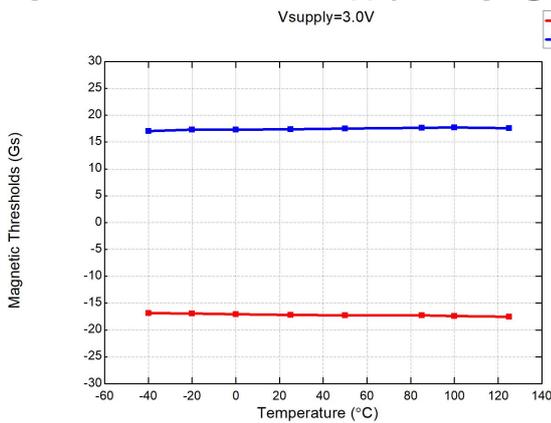
**KTM1331XC Series**



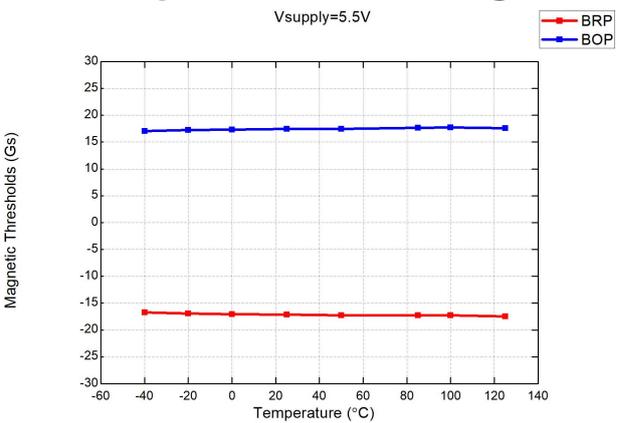
**Magnetic Thresholds vs. Supply Voltage @T<sub>A</sub>=25°C**



**Magnetic Thresholds vs T<sub>A</sub> @VDD=1.8V**

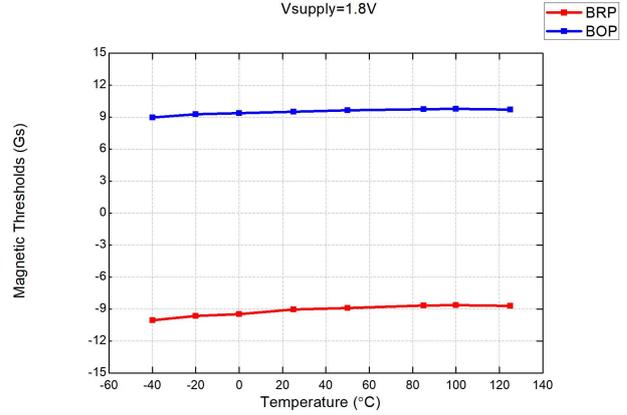
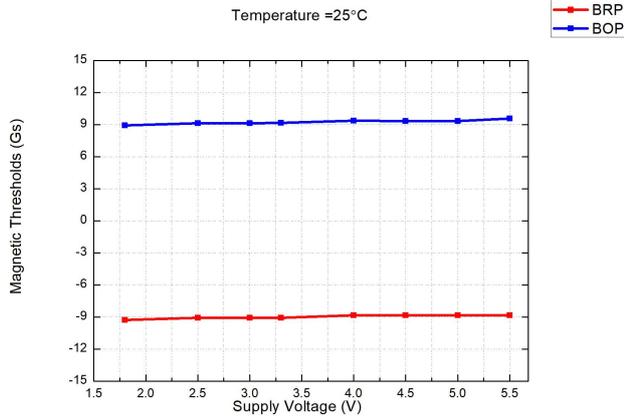


**Magnetic Thresholds vs T<sub>A</sub> @VDD=3.0V**



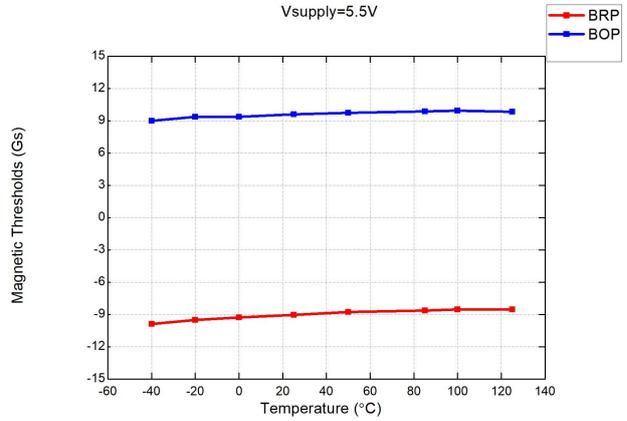
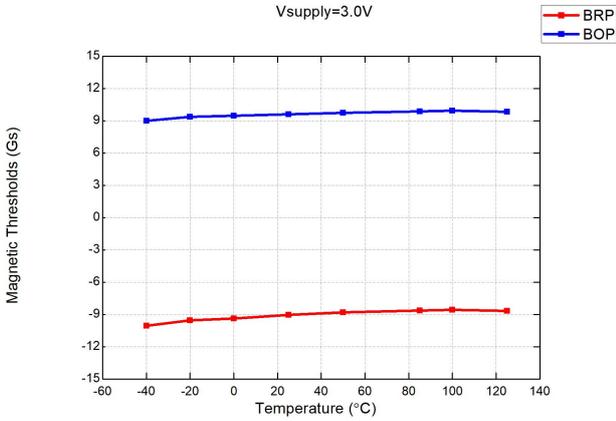
**Magnetic Thresholds vs T<sub>A</sub> @VDD=5.5V**

**KTM1331XD Series**



**Magnetic Thresholds vs. Supply Voltage @T<sub>A</sub>=25°C**

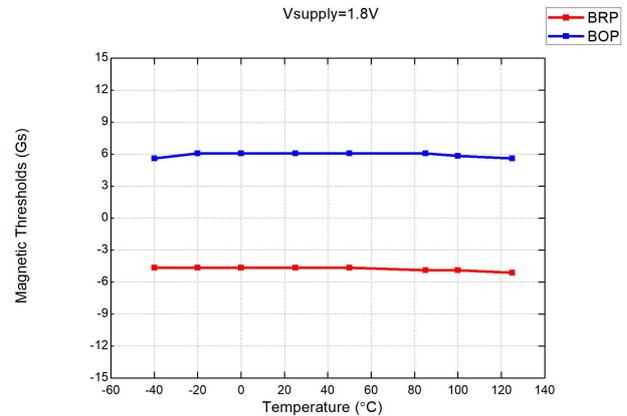
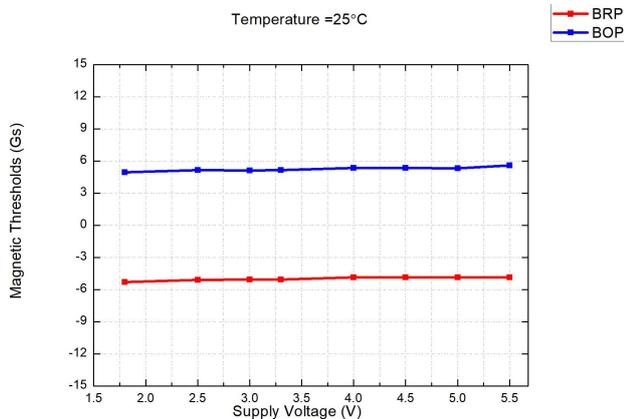
**Magnetic Thresholds vs. T<sub>A</sub> @VDD=1.8V**



**Magnetic Thresholds vs. T<sub>A</sub> @VDD=3.0V**

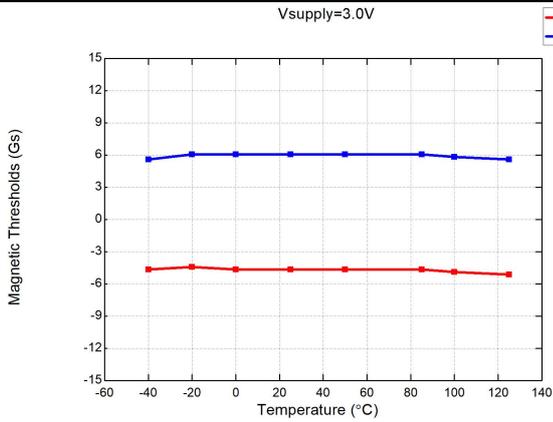
**Magnetic Thresholds vs. T<sub>A</sub> @VDD=5.5V**

**KTM1331XE Series**

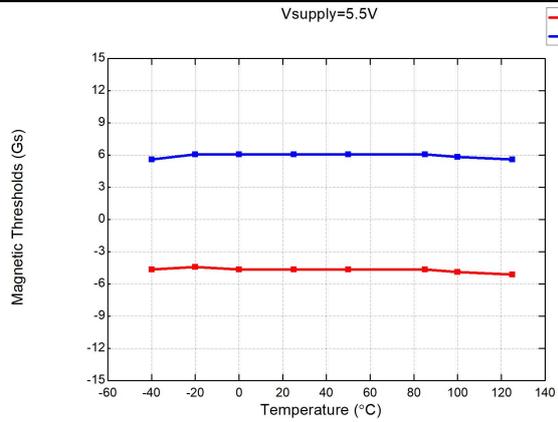


**Magnetic Thresholds vs. Supply Voltage @T<sub>A</sub>=25°C**

**Magnetic Thresholds vs. T<sub>A</sub> @VDD=1.8V**

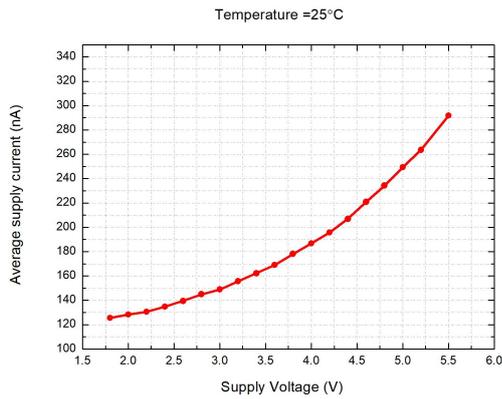


**Magnetic Thresholds vs T<sub>A</sub> @VDD=3.0V**



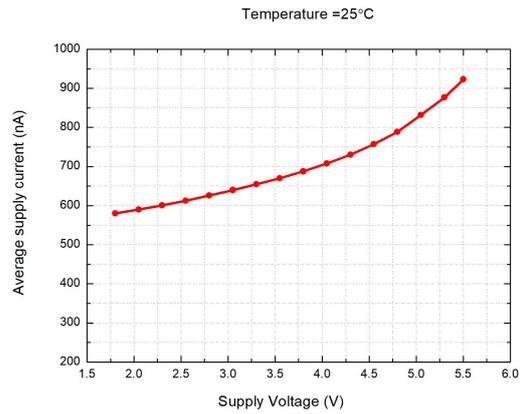
**Magnetic Thresholds vs T<sub>A</sub> @VDD=5.5V**

**KTM1331SX Series (5Hz)**



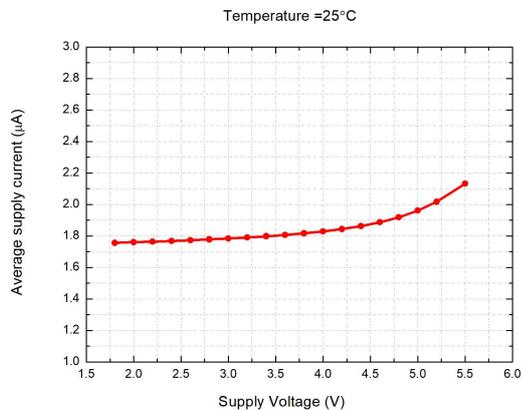
**Current Consumption vs. Supply Voltage @T<sub>A</sub>=25°C**

**KTM1331MX Series (1.6KHz)**



**Current Consumption vs. Supply Voltage @T<sub>A</sub>=25°C**

**KTM1331TX Series (Continuous)**



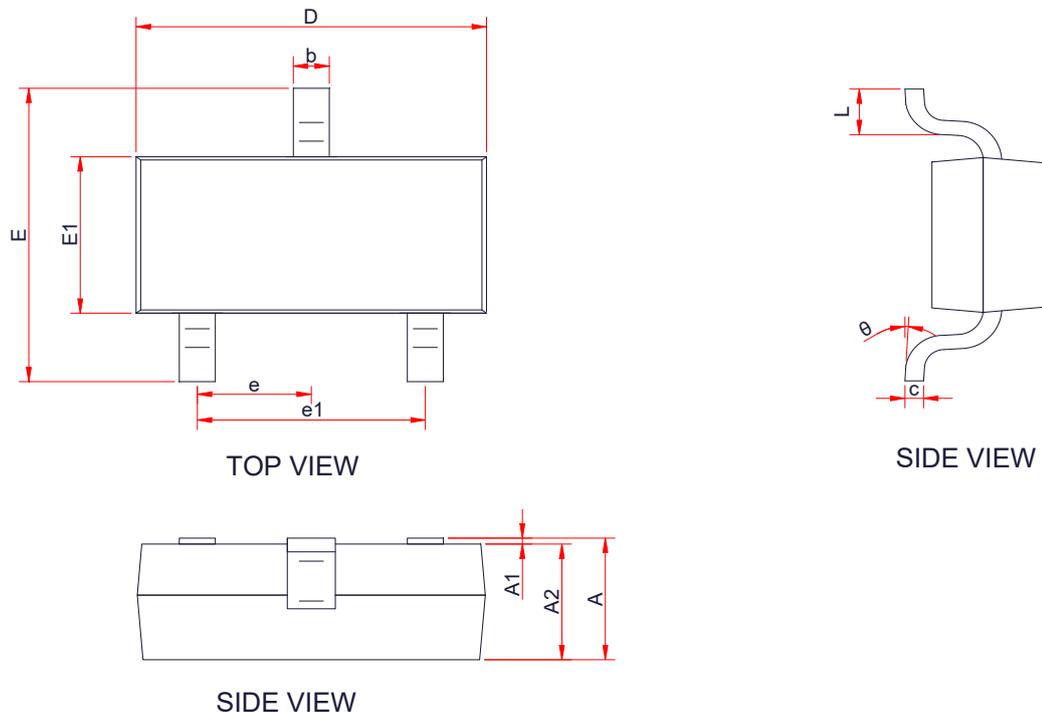
**Current Consumption vs. Supply Voltage @T<sub>A</sub>=25°C**

**Order Information**

Part Numbers	Package	Number of Pins	Bop	Operating Frequency	Temperature
KTM1331TA-ST3	SOT-23-3L	3	45Gauss	Continuous	-40°C~125°C
KTM1331TB-ST3	SOT-23-3L	3	30Gauss	Continuous	-40°C~125°C
KTM1331TC-ST3	SOT-23-3L	3	17Gauss	Continuous	-40°C~125°C
KTM1331TD-ST3	SOT-23-3L	3	9Gauss	Continuous	-40°C~125°C
KTM1331TE-ST3	SOT-23-3L	3	5Gauss	Continuous	-40°C~125°C
KTM1331MA-ST3	SOT-23-3L	3	45Gauss	1600Hz	-40°C~125°C
KTM1331MB-ST3	SOT-23-3L	3	30Gauss	1600Hz	-40°C~125°C
KTM1331MC-ST3	SOT-23-3L	3	17Gauss	1600Hz	-40°C~125°C
KTM1331MD-ST3	SOT-23-3L	3	9Gauss	1600Hz	-40°C~125°C
KTM1331ME-ST3	SOT-23-3L	3	5Gauss	1600Hz	-40°C~125°C
KTM1331SA-ST3	SOT-23-3L	3	45Gauss	50Hz	-40°C~125°C
KTM1331SB-ST3	SOT-23-3L	3	30Gauss	50Hz	-40°C~125°C
KTM1331SC-ST3	SOT-23-3L	3	17Gauss	50Hz	-40°C~125°C
KTM1331SD-ST3	SOT-23-3L	3	9Gauss	50Hz	-40°C~125°C
KTM1331SE-ST3	SOT-23-3L	3	5Gauss	50Hz	-40°C~125°C
KTM1331TA-TO3	TO-92S	3	45Gauss	Continuous	-40°C~125°C
KTM1331TB-TO3	TO-92S	3	30Gauss	Continuous	-40°C~125°C
KTM1331TC-TO3	TO-92S	3	17Gauss	Continuous	-40°C~125°C
KTM1331TD-TO3	TO-92S	3	9Gauss	Continuous	-40°C~125°C
KTM1331TE-TO3	TO-92S	3	5Gauss	Continuous	-40°C~125°C
KTM1331MA-TO3	TO-92S	3	45Gauss	1600Hz	-40°C~125°C
KTM1331MB-TO3	TO-92S	3	30Gauss	1600Hz	-40°C~125°C
KTM1331MC-TO3	TO-92S	3	17Gauss	1600Hz	-40°C~125°C
KTM1331MD-TO3	TO-92S	3	9Gauss	1600Hz	-40°C~125°C
KTM1331ME-TO3	TO-92S	3	5Gauss	1600Hz	-40°C~125°C
KTM1331SA-TO3	TO-92S	3	45Gauss	50Hz	-40°C~125°C
KTM1331SB-TO3	TO-92S	3	30Gauss	50Hz	-40°C~125°C
KTM1331SC-TO3	TO-92S	3	17Gauss	50Hz	-40°C~125°C
KTM1331SD-TO3	TO-92S	3	9Gauss	50Hz	-40°C~125°C
KTM1331SE-TO3	TO-92S	3	5Gauss	50Hz	-40°C~125°C

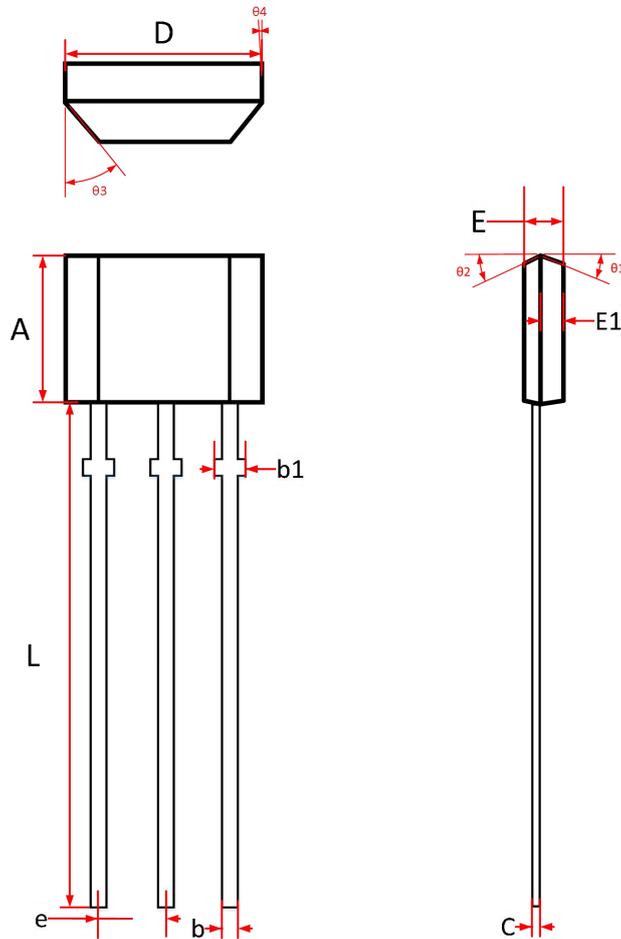
**PACKAGE OUTLINE DIMENSIONS**

**SOT-23-3L**



Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	1.0	-	1.25
A1	0.00	-	0.15
A2	1.00	1.10	1.20
b	0.30	-	0.50
c	0.10	-	0.20
D	2.82	2.95	3.02
E	2.65	2.80	2.95
E1	1.50	1.65	1.70
e	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.30	0.45	0.60
$\theta$	0 °	-	8 °

**TO-92S**



Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	2.90	3.05	3.25
b	0.33	0.415	0.50
b1	0.40	0.44	0.55
C	0.36	0.38	0.45
D	3.90	4.00	4.10
E	1.42	1.52	1.62
E1		0.75	
e	1.27 TYP		
L	13.50	14.50	15.50
$\theta 1$		6°	
$\theta 2$		3°	
$\theta 3$		45°	
$\theta 4$		3°	