

# KTH4603 Series

Ultra-Low Power, High-Sensitivity  
3D Hall Switch

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# 1 Product Features

- Low Power Consumption
  - 2.5 Hz version:  $4.5 \mu A @ 2.5 V$
  - 5.0 Hz version:  $7.1 \mu A @ 2.5 V$
- Wide Operating Voltage Range:  $2.5 V \sim 5.5 V$
- Magnetic Field Threshold ( $B_{OP}$ ): 25 Gs
- Omnipolar Magnetic Field Detection
- NMOS Open-Drain Output
- Package: SOT-23-3L, SOT-23-6L
- Operating Temperature Range:  $-40^{\circ}C \sim 125^{\circ}C$
- Superior ESD Performance: HBM 6 kV
- RoHS Compliant

# 2 Typical Applications

- 3D Magnetic Field Switch Detection
- Anti-Tampering Detection for Meters (Electricity/Water/Gas)
- Intelligent Door and Window Detection
- Electric Garage Door Detection

# 3 Overview

The KTH4603 series is a low-power Hall effect switch sensor with 3D omnipolar detection. The chip offers multiple switching frequencies and packaging options to suit various applications.

When the applied south or north magnetic flux density exceeds the operating point ( $B_{OP}$ ), the chip outputs a low level and maintains it until the flux density drops below the release point ( $B_{RP}$ ). The chip incorporates X, Y, Z ultra-sensitive low-offset Hall plates, multiplexer analog switches, differential amplifiers, Schmitt triggers, and NMOS open-drain output circuits. Advanced SPIN and digital filtering technology, as well as optimized clock control technology, ensure stable operating points and switching frequencies.

The KTH4603 series operates within a supply voltage range of 2.5 V to 5.5 V and is available in standard SOT-23-3L and SOT-23-6L packages.

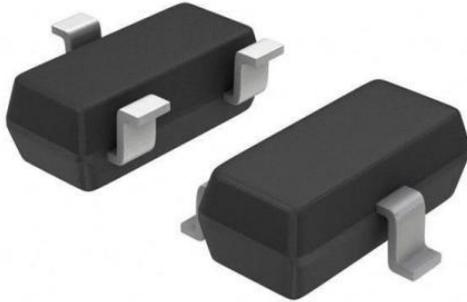


Figure 1: SOT-23-3L

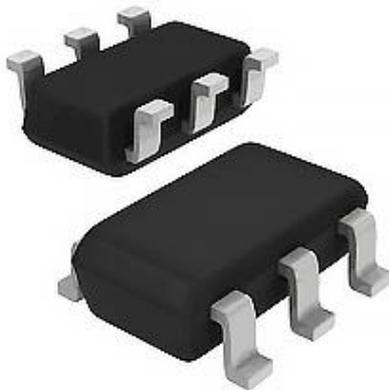


Figure 2: SOT-23-6L

# 4 Pin Definitions and Marking Information

## 4.1 SOT-23-3L

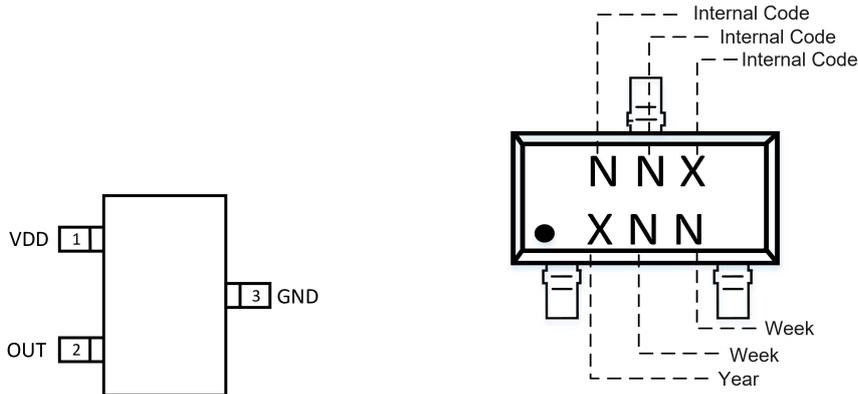


Figure 3: SOT-23-3L Pinout Top View

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

## 4.2 SOT-23-6L

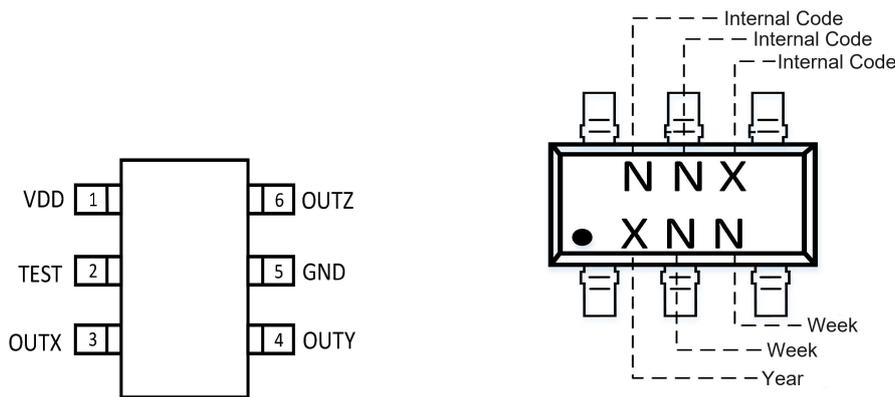


Figure 4: SOT-23-6L Pinout Top View

Pin Name	Pin Number	Function Description
VDD	1	Power Supply Input
TEST	2	Ground
OUTX	3	X-Axis Output
OUTY	4	Y-Axis Output
GND	5	Ground
OUTZ	6	Z-Axis Output

## 5 Functional Block Diagram

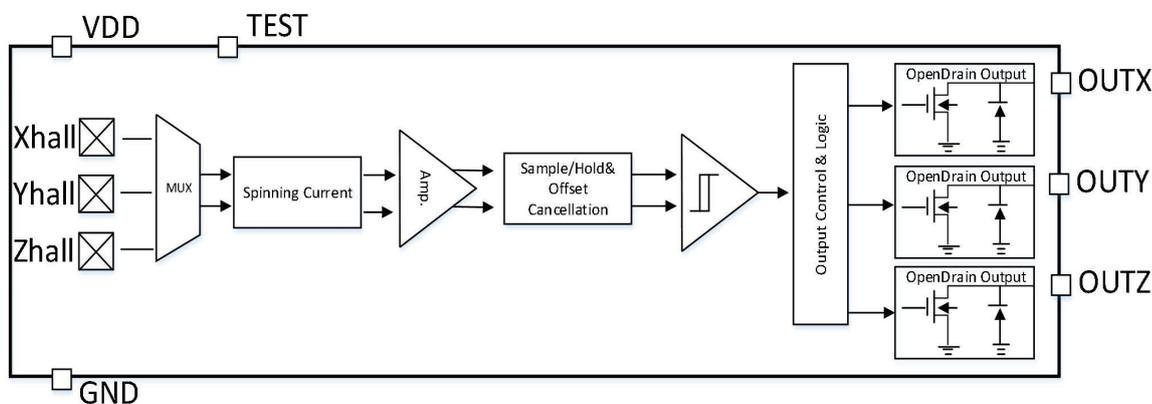


Figure 5: Functional Block Diagram

## 6 Output Characteristics

For the single output option of KTH4603XX-ST3, when a magnetic field perpendicular to any of the Hall sensors (X, Y, or Z direction) exceeds the  $B_{OPS}$  (or falls below  $B_{OPN}$ ), the chip outputs a low level (switch closed). The KTH4603XX-ST6 has three separate outputs (X, Y, or Z). When a magnetic field is applied to the Hall chip, and the magnetic flux density in the corresponding direction exceeds the operating point  $B_{OPS}$  (or falls below  $B_{OPN}$ ), the corresponding output pin outputs a low level (switch closed). When the magnetic flux density drops below the release point  $B_{RPS}$  (or rises above  $B_{RPN}$ ), the corresponding output pin outputs a high level (switch open). The difference between the operating point and release point flux density is the hysteresis ( $B_{HY}$ ). This built-in hysteresis ensures stable output unaffected by mechanical vibration and magnetic noise. When powered on, if the magnetic flux density is between  $B_{OP}$  and  $B_{RP}$ , the

output is in an indeterminate state. The confirmed output state is determined by the first magnetic field that exceeds  $B_{OP}$  or  $B_{RP}$ .

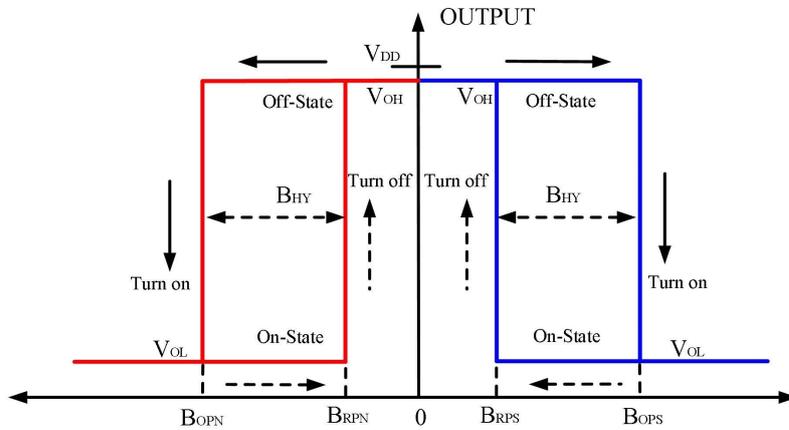
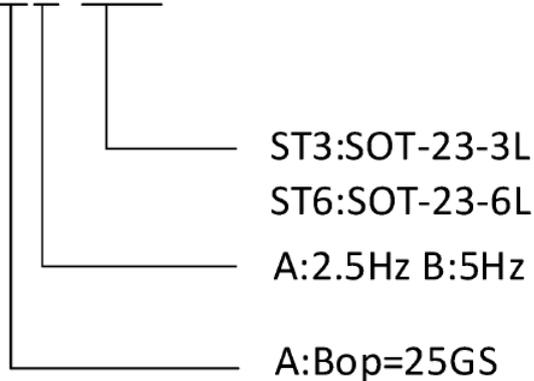


Figure 6: Output Characteristics

## 7 Product Model Name Structure

KTH4603 X X - XXX



## 8 Absolute Maximum Ratings

$T_A=25^\circ\text{C}$  (unless otherwise specified) All voltages are referenced to GND.

Item	Parameter Description	Min	Max	Unit
$V_{DD}$	Supply Voltage	-0.3	6	V
$I_{OUTPUT}$	Output Drive Current	-	30	mA
B	Magnetic Flux Density	No Limit	-	Gs
$T_{STG}$	Storage Temperature Range	-50	150	°C
$T_J$	Junction Maximum Temperature	-	150	°C
ESD	HBM ESD Capability	-6000	6000	V

**Note:** Exceeding the absolute maximum ratings may cause permanent damage. Prolonged operation at the absolute maximum ratings may affect the reliability of the chip.

## 9 Operating Conditions

$T_A = 25\text{ °C}$  (unless otherwise specified)

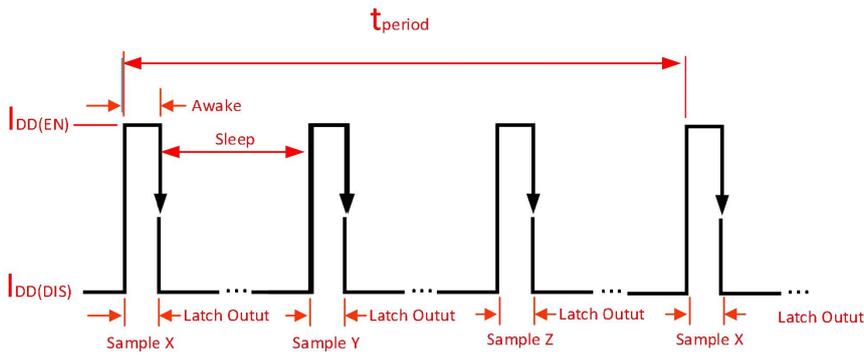
Item	Parameter Description	Operating Condition	Value	Unit
$V_{DD}$	Supply Voltage Range	Operating Voltage	2.5 ~ 5.5	V
$T_A$	Operating Temperature Range	Operating Temperature	-40 ~ 125	°C

## 10 Electrical Parameters

$T_A=25\text{ °C}$ ,  $V_{DD}=3.3\text{ V}$  (unless otherwise specified)

Parameter Symbol	Parameter Description	Test Conditions	Min	Typ	Max	Unit
$V_{DD}$	Supply Voltage	-	2.5	3.3	5.5	V
$I_{DD}$	Wake-Up Current	$V_{DD}=2.5\text{ V}, T_A=25\text{ }^\circ\text{C}$	-	2.7	-	mA
	Sleep Current	$V_{DD}=2.5\text{ V}, T_A=25\text{ }^\circ\text{C}$	-	2.5	-	$\mu\text{A}$
	Average Current (KTH4603AA)	$V_{DD}=2.5\text{ V}, T_A=25\text{ }^\circ\text{C}$	-	4.5	-	$\mu\text{A}$
	Average Current (KTH4603AA)	$V_{DD}=5.0\text{ V}, T_A=25\text{ }^\circ\text{C}$	-	6	-	$\mu\text{A}$
	Average Current (KTH4603AB)	$V_{DD}=2.5\text{ V}, T_A=25\text{ }^\circ\text{C}$	-	7.1	-	$\mu\text{A}$
	Average Current (KTH4603AB)	$V_{DD}=5.0\text{ V}, T_A=25\text{ }^\circ\text{C}$	-	9	-	$\mu\text{A}$
$I_{OUTOFF}$	Output Leakage Current	$ B  <  B_{RP} $	-	-	10	$\mu\text{A}$
$V_{OUT}$	Output Voltage	$I_{OUT}=2\text{ mA}, B>B_{OP}$	-	20	-	mV
$T_{AWAKE}$	Wake-Up Time		-	405	-	$\mu\text{s}$
$T_{PERIOD}$	Period	KTH4603AA Series	-	408	-	ms
		KTH4603AB Series	-	205	-	ms

**Note:** To maintain the chip's low average power consumption, the internal sampling circuit periodically switches between Awake and Sleep states. Each axis of the sensor is powered on for 135  $\mu\text{s}$  before entering a low-power Sleep mode. This Awake and Sleep cycle occurs three times in each period, allowing the X, Y, and Z axes to be sampled during their respective cycles. During the brief Awake time, the chip samples and holds the magnetic field data, outputs the corresponding result, and locks the data at the end of each cycle. During each Sleep cycle, the output state remains in the current determined state, and the high/low output level does not affect the chip's operating current.



## 11 Magnetic Parameters

$T_A=25\text{ }^\circ\text{C}$ ,  $V_{DD}=3.3\text{ V}$  (unless otherwise specified)

Parameter Symbol	Parameter Description	Test Conditions	Min	Typ	Max	Unit
$B_{OPS}$	Operating Point (South Pole)	South pole to the left, bottom or side with printed markings. Refer to Figure 7	-	25	40	Gs
$B_{OPN}$	Operating Point (North Pole)	North pole to the left, bottom or side with printed markings. Refer to Figure 7	-40	-25	-	Gs
$B_{RPS}$	Release Point (South Pole)	South pole to the left, bottom or side with printed markings. Refer to Figure 7	5	15	-	Gs
$B_{RPN}$	Release Point (North Pole)	North pole to the left, bottom or side with printed markings. Refer to Figure 7	-	-15	-5	Gs
$B_{HY}$	Hysteresis	$B_{HY}= B_{OP} - B_{RP} $	-	10	-	Gs

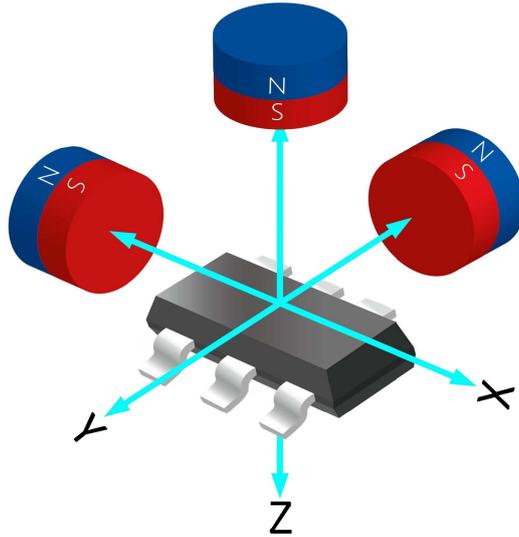


Figure 7: Three-Dimensional Magnetic Field Orientation

## 12 Performance Curves

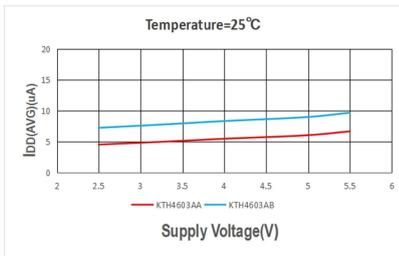


Figure 8: Average Power Consumption VS Supply Voltage @TA=25°C

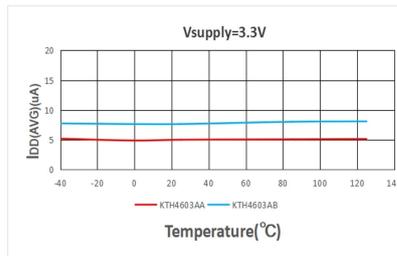


Figure 9: Average Power Consumption VS Operating Temperature @VDD=3.3V

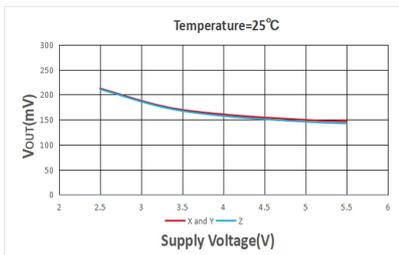


Figure 10: Low Output Voltage VS Supply Voltage @TA=25°C, I<sub>OUT</sub> = 20mA

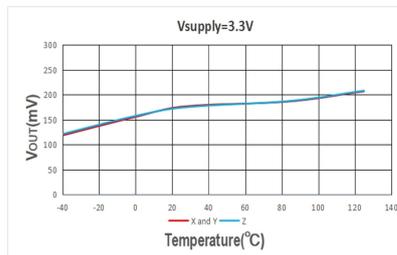


Figure 11: Low Output Voltage VS Operating Temperature @VDD=3.3V, I<sub>OUT</sub> = 20mA

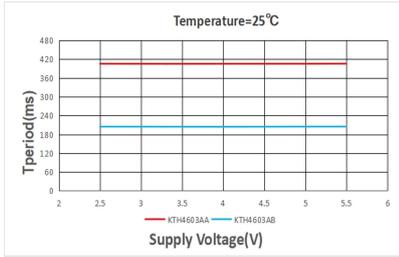


Figure 12: Operating Period VS Supply Voltage @TA=25°C

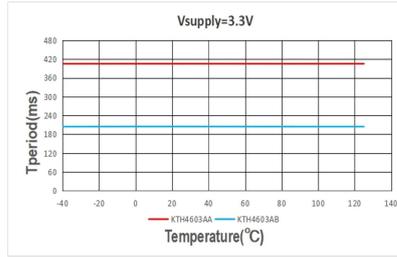


Figure 13: Operating Period VS Operating Temperature @VDD=3.3V

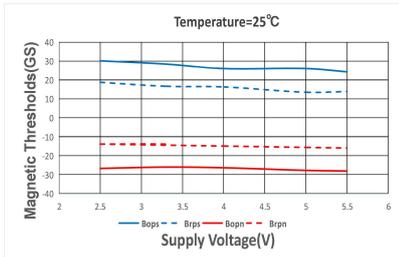


Figure 14: X-Axis Magnetic Threshold VS Supply Voltage @TA=25°C

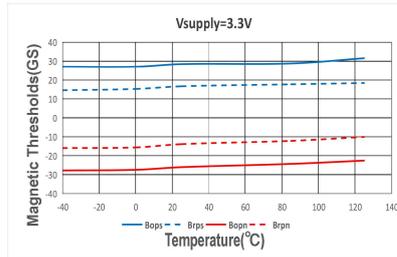


Figure 15: X-Axis Magnetic Threshold VS Operating Temperature @VDD=3.3V

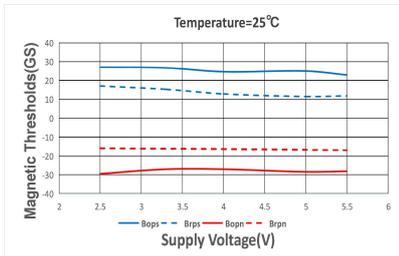


Figure 16: Y-Axis Magnetic Threshold VS Supply Voltage @TA=25°C

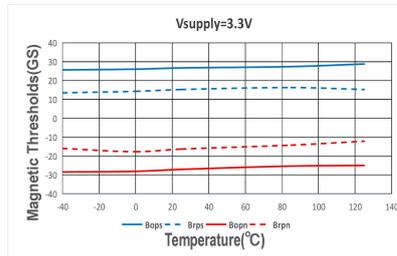


Figure 17: Y-Axis Magnetic Threshold VS Operating Temperature @VDD=3.3V

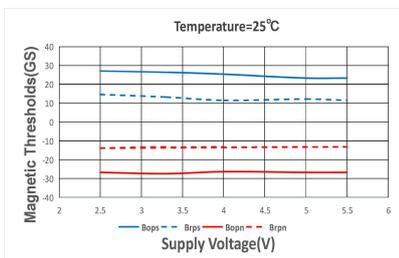


Figure 18: Z-Axis Magnetic Threshold VS Supply Voltage @TA=25°C

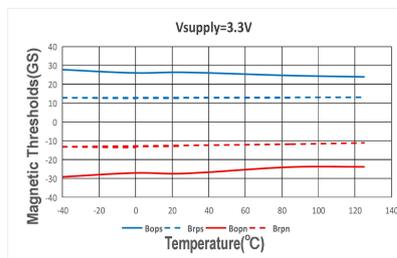


Figure 19: Z-Axis Magnetic Threshold VS Operating Temperature @VDD=3.3V

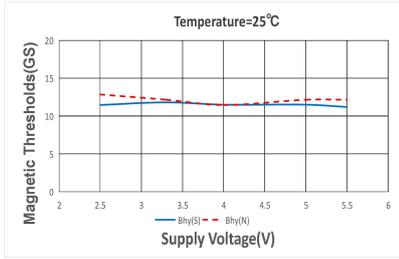


Figure 20: X-Axis Magnetic Hysteresis VS Supply Voltage @TA=25°C

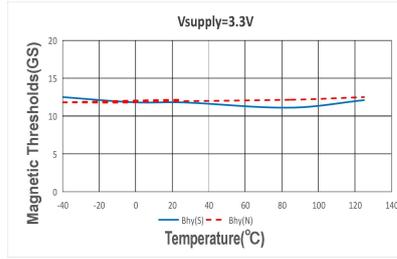


Figure 21: X-Axis Magnetic Hysteresis VS Operating Temperature @VDD=3.3V

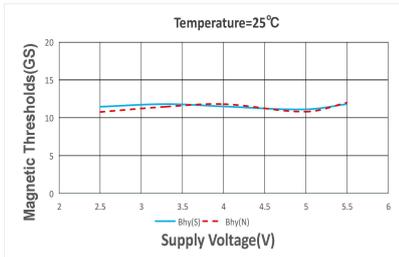


Figure 22: Y-Axis Magnetic Hysteresis VS Supply Voltage @TA=25°C

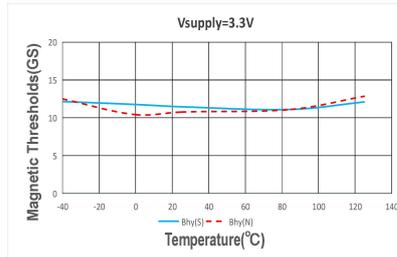


Figure 23: Y-Axis Magnetic Hysteresis VS Operating Temperature @VDD=3.3V

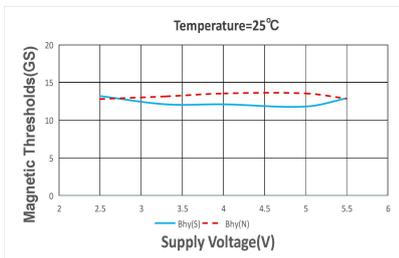


Figure 24: Z-Axis Magnetic Hysteresis VS Supply Voltage @TA=25°C

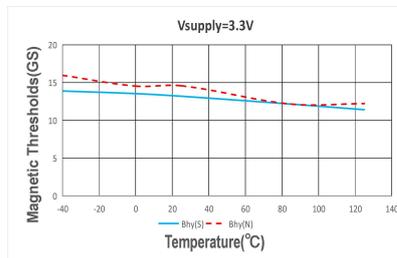


Figure 25: Z-Axis Magnetic Hysteresis VS Operating Temperature @VDD=3.3V

## 13 Ordering Information

Model	Package Type	Number of Pins of	Magnetic Threshold (B <sub>OP</sub> )	Switching Frequency	Temperature
KTH4603AA-ST3	SOT-23-3L	3	25Gauss	2.5Hz	-40°C ~ 125°C
KTH4603AB-ST3	SOT-23-3L	3	25Gauss	5Hz	-40°C ~ 125°C
KTH4603AA-ST6	SOT-23-6L	6	25Gauss	2.5Hz	-40°C ~ 125°C
KTH4603AB-ST6	SOT-23-6L	6	25Gauss	5Hz	-40°C ~ 125°C

## 14 Typical Applications

The KTH4603XX operates within an input voltage range of 2.5 V to 5.5 V. To filter noise at the chip’s power terminal, a filtering capacitor between the power supply and ground is recommended. This capacitor should be 1  $\mu F$  and placed as close to the VDD pin as possible. Typically, the use of a PCB copper layer below the KTH4603XX device does not affect the magnetic flux density or interfere with the device’s performance since copper is not ferromagnetic. However, if nearby system components contain iron or nickel, they may unpredictably alter the magnetic flux density.

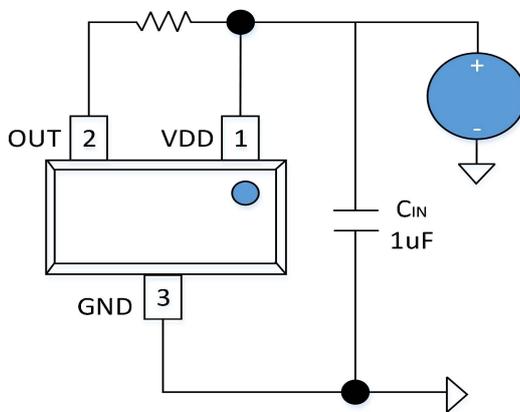


Figure 26: Typical Application of KTH4603XX-ST3

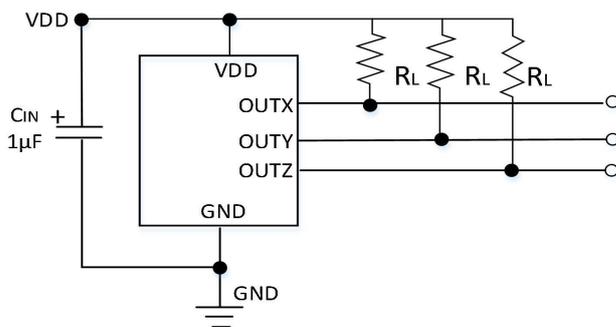


Figure 27: Typical Application of KTH4603XX-ST6

## 15 Package Information

### 15.1 SOT-23-3L Package Information

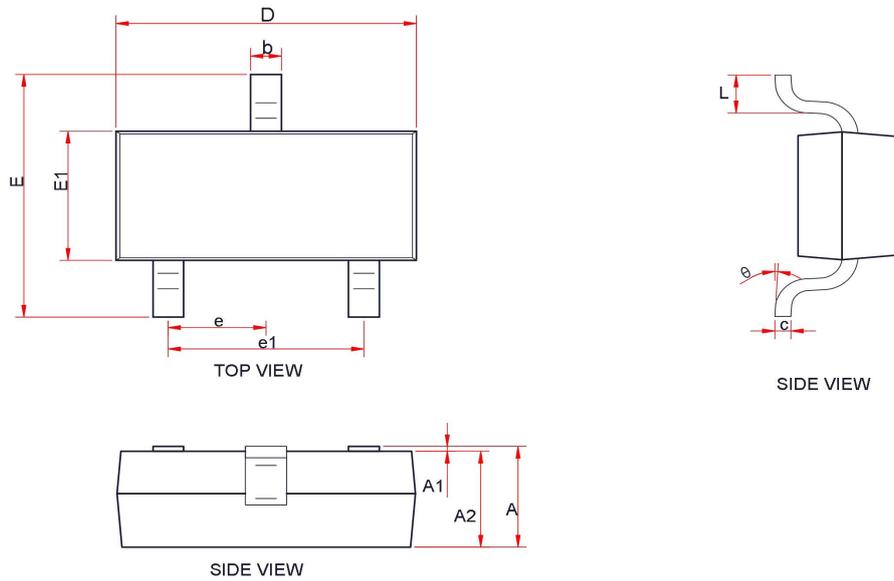


Figure 28: Package dimension of SOT-23-3L

Symbol	Min (mm)	Typ (mm)	Max (mm)
A	-	-	1.25
A1	0.00	-	0.1
A2	1.00	1.10	1.15
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°

### 15.2 SOT-23-6L Package Information

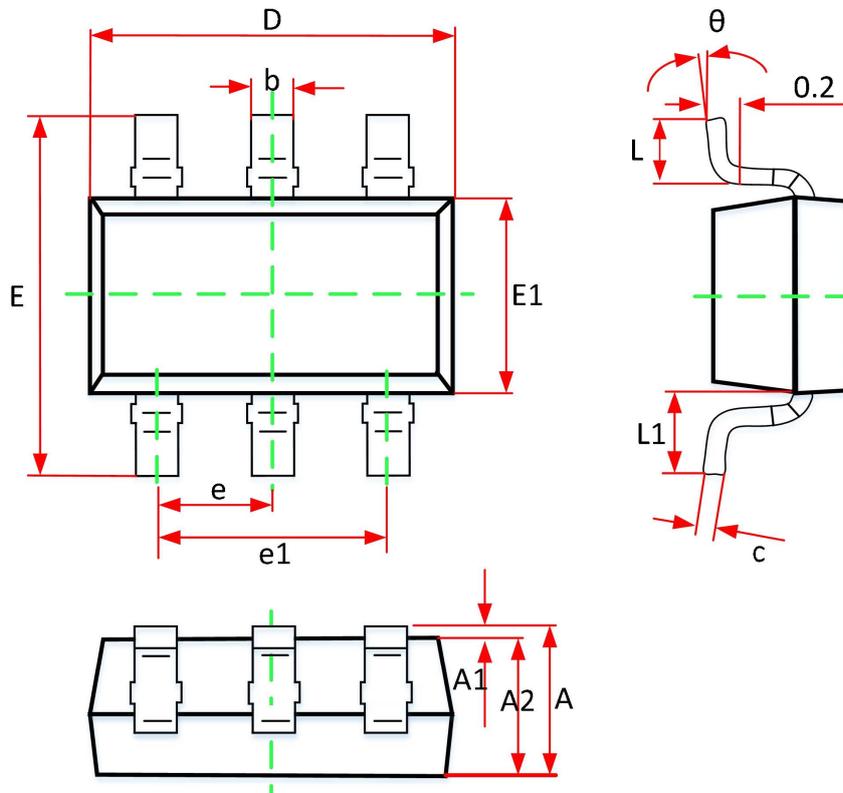


Figure 29: Package dimension of SOT-23-6L

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.280	0.041	0.050
A1	0.000	0.130	0.000	0.005
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
E1	1.500	1.720	0.059	0.068
E	2.650	3.000	0.104	0.118
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
L1		0.600 (REF)		0.024 (REF)
$\theta$	0°	8°	0°	8°