

as possible.

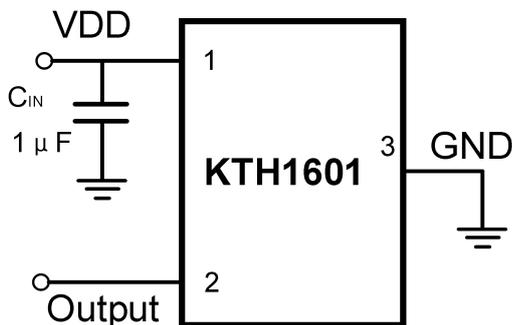
### Features

- Low power Consumption
  - 5Hz Version: 1.6uA@1.8V (typical)
  - 20Hz Version: 3.3uA@1.8V (typical)
- Supply Voltage: 1.6V~5.5V
- High Magnetic Sensitivity
  - $B_{OP} = \pm 22Gs$   $B_{RP} = \pm 16GS$
  - $B_{OP} = \pm 33Gs$   $B_{RP} = \pm 23GS$
  - $B_{OP} = \pm 46Gs$   $B_{RP} = \pm 34GS$
- Magnetic Type: Omni-polar
- No External Pull-up Resistors Required
- Package: SOT-23-3L  
SOT-553  
TO-92S
- Operating Temperature:  $-40^{\circ}C \sim 85^{\circ}C$
- High ESD Rating: HBM 8KV
- RoHS Compliant

### Application

- Cover switch in notebook PC/PAD
- TWS Earphones
- Door, Lids and Tray Position Switches
- Water, electric and gas utility meters
- Level, proximity and position switches

### Typical Application Circuit

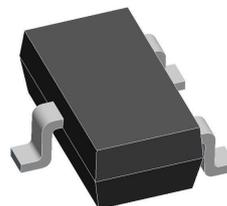


Note:  $C_{IN}$  is for stabilization and to strengthen the noise immunity, the recommended capacitance is  $1 \mu F$  typical and should be placed as close to the supply pin

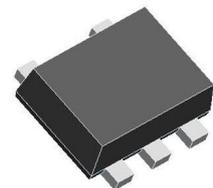
### Descriptions

The KTH1601 is a miniature micropower magnetic Hall effect switch IC with single output. The temperature compensation circuitry improves stability of magnetic switch points over the whole operating range. If the magnetic flux density perpendicular 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. Designed for battery powered consumer equipment, home applications and industrial applications, the average supply current is only  $1.6\mu A$  at 1.8V. To support portable equipment the KTH1601 can operate over the supply range of 1.6V to 5.5V.

The KTH1601 family provides a variety of package to customers: SOT-23-3L, SOT-553 for surface mount and TO-92S flat for through-hole mount. All package are RoHS compliant.



SOT-23-3L



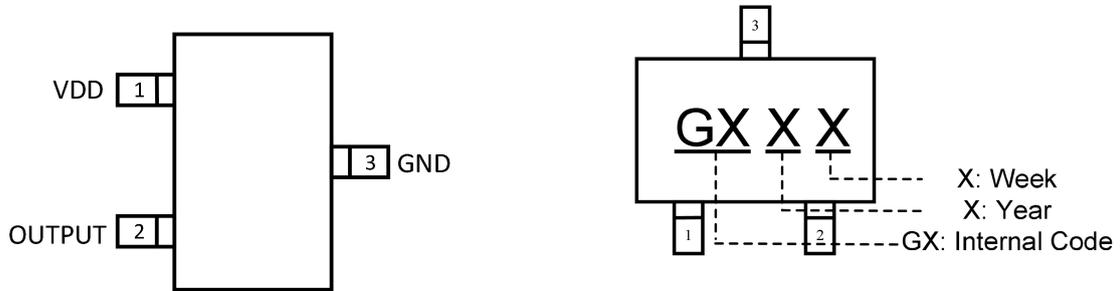
SOT-553



TO-92S

### Pin Descriptions

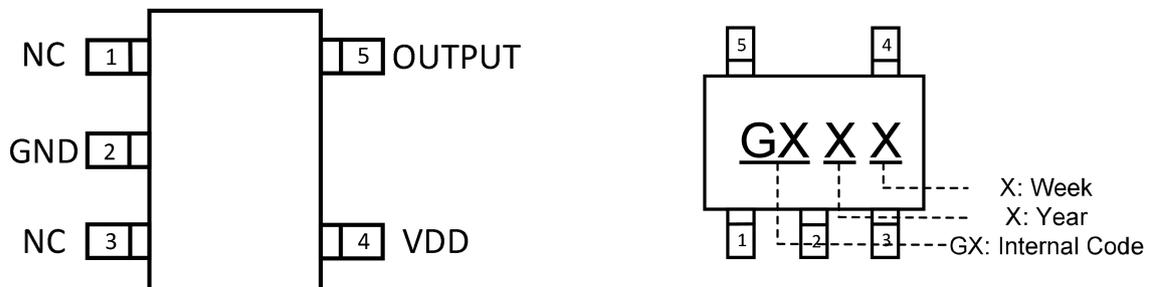
SOT-23-3L



Top view

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

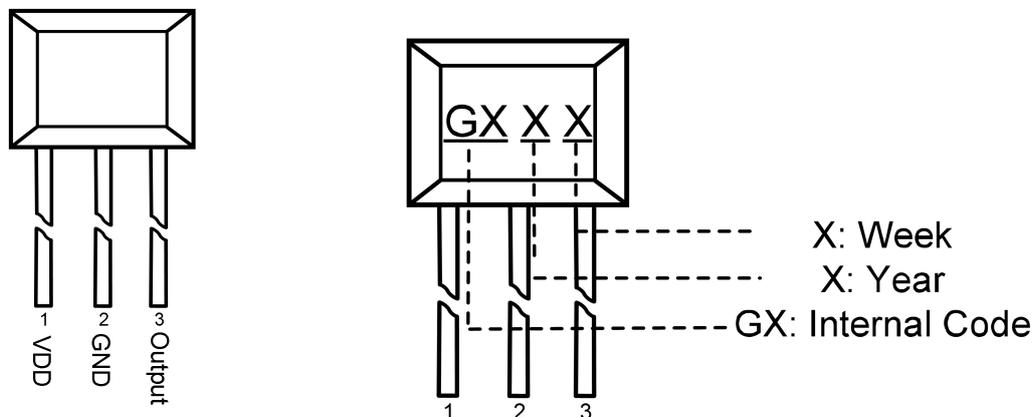
SOT-553



Top view

Pin Name	Pin Number	Function
VDD	4	Power Supply Input
OUTPUT	5	Output Pin
GND	2	Ground Pin
NC	1, 3	NA

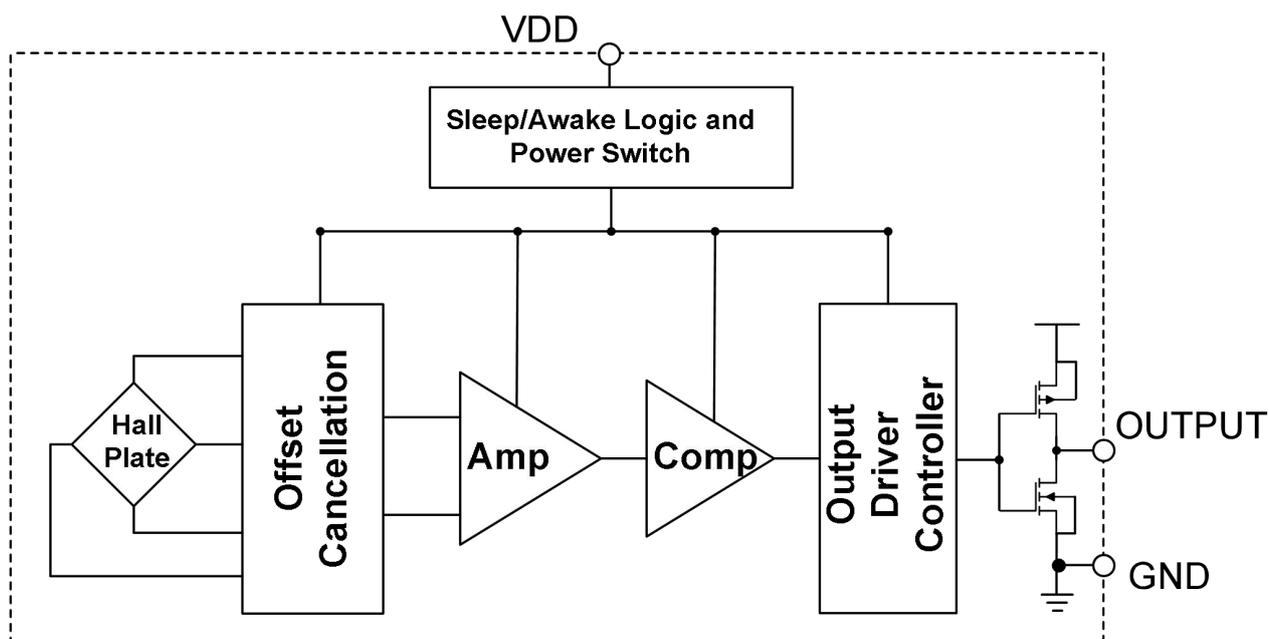
TO-92S



Top view

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

### Block Diagram

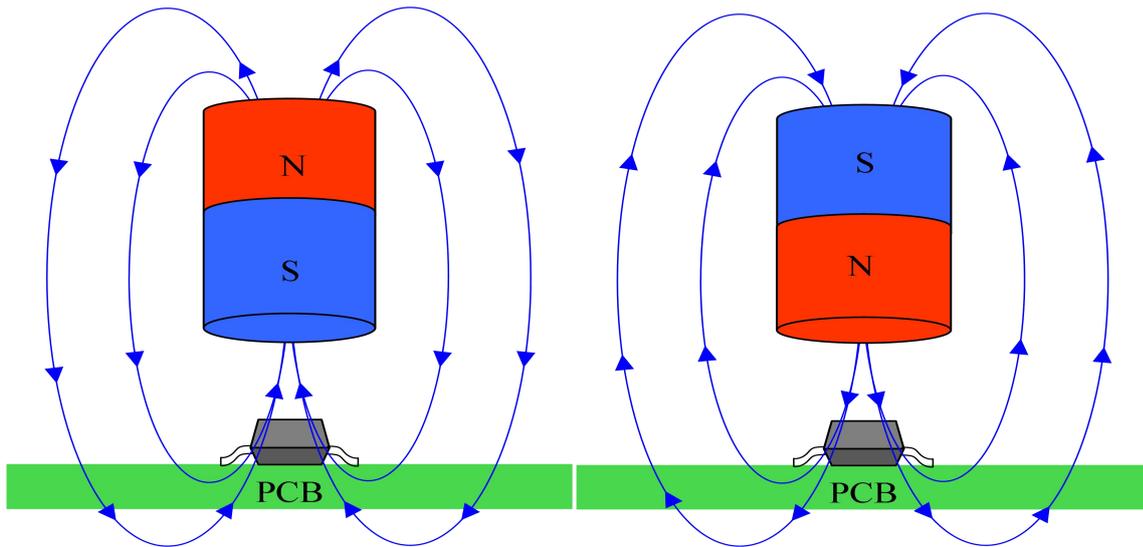




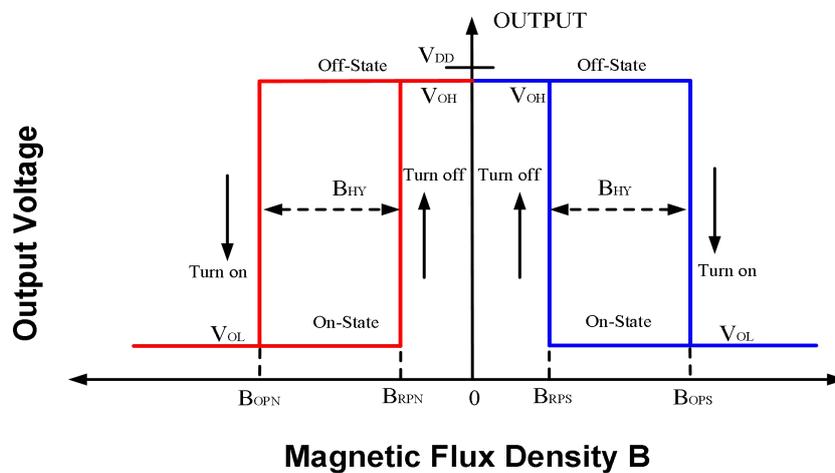
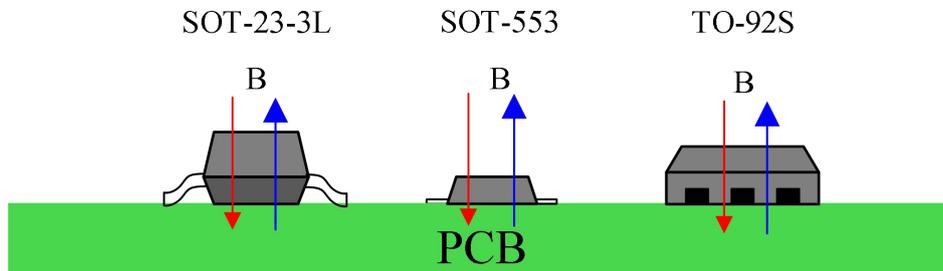
## High sensitivity, Low Power, Omni-polar Hall Switch

### Output Switching Characteristics

As shown in the figure below, when the South Pole of the magnet is near the top of the chip, the magnetic induction line passes from the bottom of the chip to the top. It is considered that the magnetic induction intensity  $B$  is positive at this time. When the North Pole of the magnet is near the top of the chip, the magnetic induction line passes from the top of the chip to the bottom, and the magnetic induction intensity  $B$  is considered to be negative.



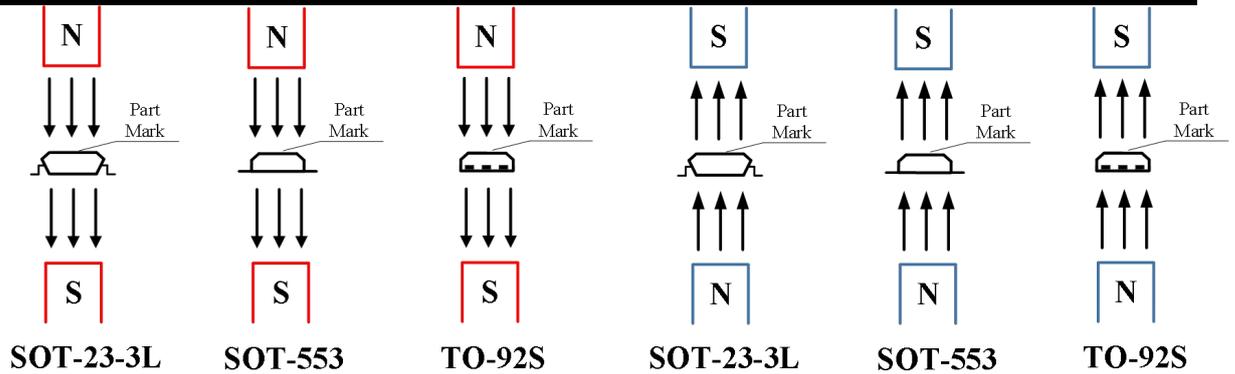
As shown in the figure below, KTH1601 can detect the magnetic fields of the South Pole and the North Pole.



# KTH1601 Series

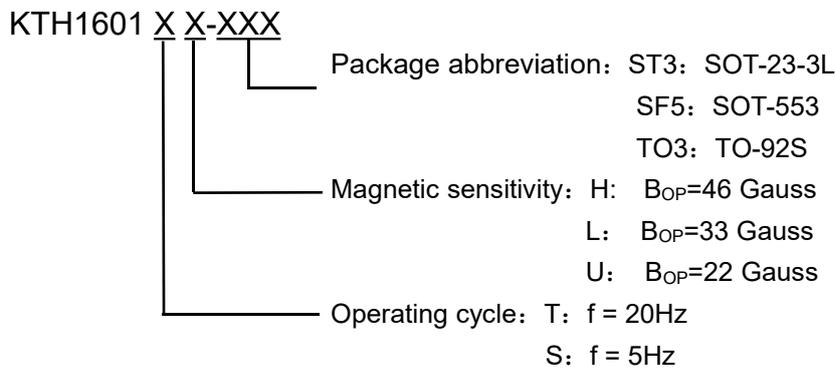


## High sensitivity, Low Power, Omni-polar Hall Switch



Magnetic Field Directions for Omnipolar Mode Operation

### Product Name Structure



### Absolute Maximum Ratings (@ $T_A=+25^\circ\text{C}$ , unless otherwise specified)

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage Dissipation	6	V
$V_{DD\_REV}$	$V_{IN}$ Range	-0.3	V
$I_{OUTPUT}$	Output Current	5	mA
B	Magnetic Flux Density	Unlimited	Gauss
$T_{STG}$	Storage Temperature Range	-50~+150	$^\circ\text{C}$
$T_J$	Maximum Junction Temperature	+150	$^\circ\text{C}$
ESD HBM	Human Body Model ESD Capability	8000	V

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

# KTH1601 Series



## High sensitivity, Low Power, Omni-polar Hall Switch

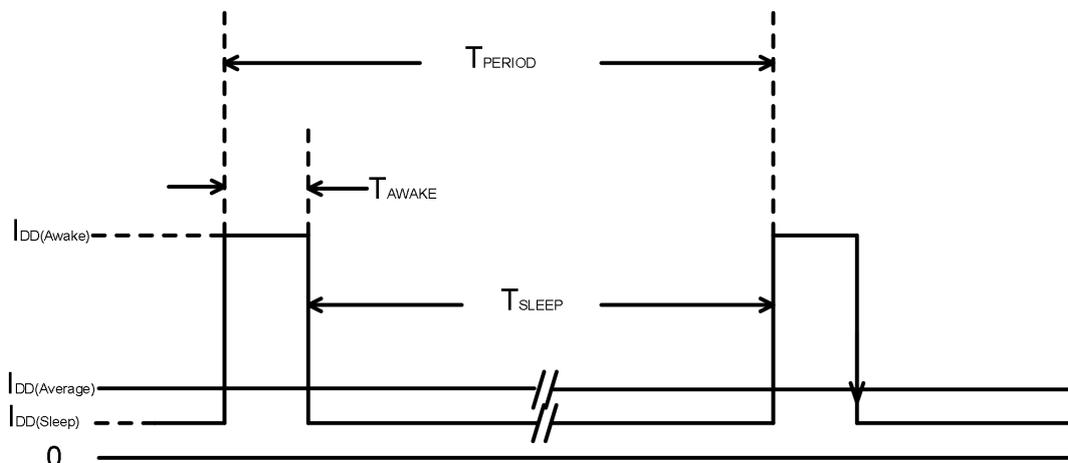
### Recommended Operating Range (@T<sub>A</sub>=+25°C, unless otherwise specified)

Symbol	Parameter	Conditions	Value	Unit
V <sub>DD</sub>	Supply Voltage	Operating	1.6~5.5	V
T <sub>A</sub>	Operating temperature Range	Operating	-40~85	°C

### Electronics Characteristics (@T<sub>A</sub>=+25°C, V<sub>DD</sub>=1.8V, unless otherwise specified)

KTH1601TX Series						
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	Operating	1.6	—	5.5	V
V <sub>OL</sub>	Output Low Voltage (On)	I <sub>OUT</sub> =1mA	—	0.05	0.15	V
V <sub>OH</sub>	Output High Voltage (Off)	I <sub>OUT</sub> =1mA	V <sub>DD</sub> -0.15	V <sub>DD</sub> -0.05	—	V
I <sub>DD(AVG)</sub>	Average Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =1.8V	—	3.30	—	uA
I <sub>DD(Awake)</sub>	Awake Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =1.8V	—	2.0	—	mA
I <sub>DD(Sleep)</sub>	Sleep Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =1.8V	—	1.00	—	uA
T <sub>AWAKE</sub>	Awake Time	Operating	—	50	—	μs
T <sub>PERIOD</sub>	Period	Operating	—	50	—	ms
KTH1601SX Series						
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	Operating	1.6	—	5.5	V
V <sub>OL</sub>	Output Low Voltage (On)	I <sub>OUT</sub> =1mA	—	0.05	0.15	V
V <sub>OH</sub>	Output High Voltage (Off)	I <sub>OUT</sub> =1mA	V <sub>DD</sub> -0.15	V <sub>DD</sub> -0.05	—	V
I <sub>DD(AVG)</sub>	Average Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =1.8V	—	1.6	—	uA
I <sub>DD(Awake)</sub>	Awake Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =1.8V	—	2.0	—	mA
I <sub>DD(Sleep)</sub>	Sleep Supply Current	T <sub>A</sub> =+25°C, V <sub>DD</sub> =1.8V	—	1.0	—	uA
T <sub>AWAKE</sub>	Awake Time	Operating	—	50	—	μs
T <sub>PERIOD</sub>	Period	Operating	—	200	—	ms

Note: When the power is initially turned on, the operating V<sub>DD</sub> (1.6V to 5.5V) must be applied to guaranteed the output sampling. The output state is valid after the first operating cycle.



### Magnetic Characteristics ( $T_A=25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$ , unless otherwise noted )

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTH1601X H Series</b>						
$B_{OPS}$	Output Operation Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	40	46	56	Gauss
$B_{RPS}$	Output Operation Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	26	34	40	
$B_{OPN}$	Output Release Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	-56	-46	-40	
$B_{RPN}$	Output Release Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	-40	-34	-26	
$B_{HY}$ ( $ B_{OPX}  -  B_{RPX} $ )	Hysteresis		-	12	-	

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTH1601X L Series</b>						
$B_{OPS}$	Output Operation Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	26	33	38	Gauss
$B_{RPS}$	Output Operation Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	16	23	28	
$B_{OPN}$	Output Release Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	-38	-33	-26	
$B_{RPN}$	Output Release Point	$T_A=+25^\circ\text{C}$ , $V_{DD}=1.8\text{V}$	-28	-23	-16	
$B_{HY}$ ( $ B_{OPX}  -  B_{RPX} $ )	Hysteresis		-	10	-	



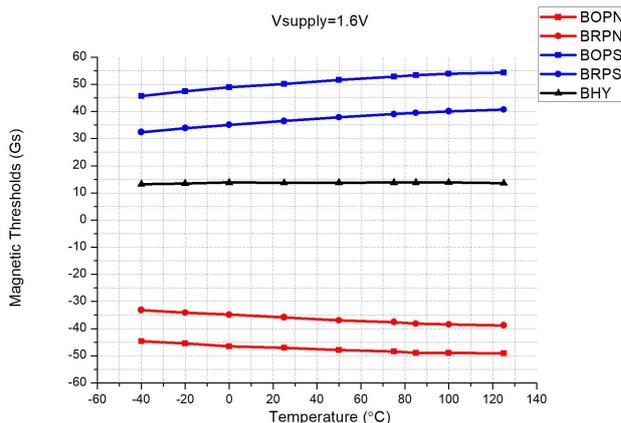
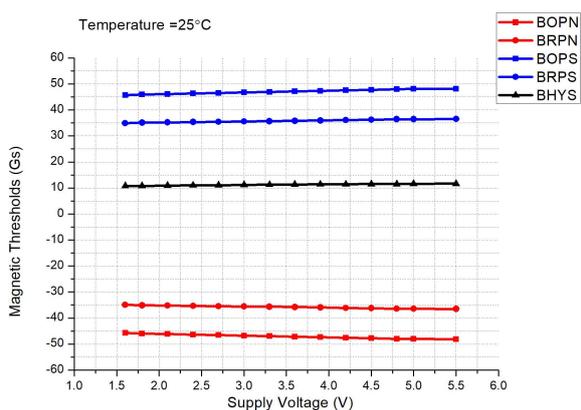
# KTH1601 Series

## High sensitivity, Low Power, Omni-polar Hall Switch

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
<b>KTH1601X U Series</b>						
B <sub>OPS</sub>	Output Operation Point	T <sub>A</sub> =+25°C, VDD=1.8V	14	22	30	Gauss
B <sub>RPS</sub>	Output Operation Point	T <sub>A</sub> =+25°C, VDD=1.8V	8	16	24	
B <sub>OPN</sub>	Output Release Point	T <sub>A</sub> =+25°C, VDD=1.8V	-30	-22	-14	
B <sub>RPN</sub>	Output Release Point	T <sub>A</sub> =+25°C, VDD=1.8V	-24	-16	-8	
B <sub>HY</sub> ( B <sub>OPX</sub>  - B <sub>RPN</sub>  )	Hysteresis		-	6	-	

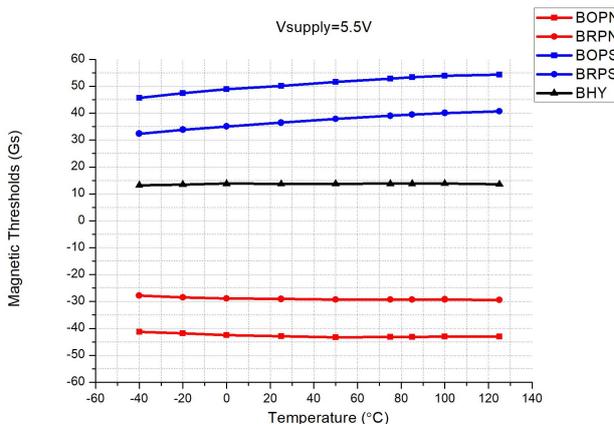
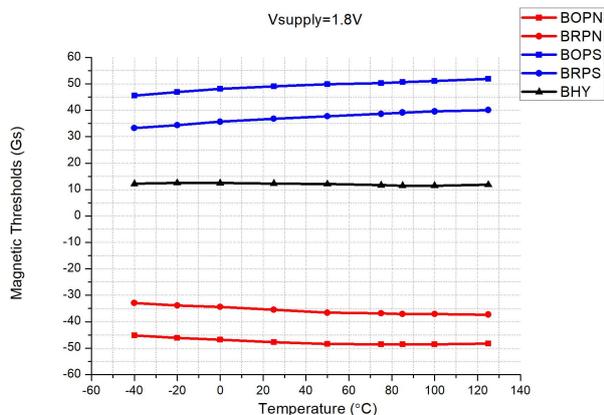
### Performance Graphs

KTH1601XH Series (B<sub>OP</sub>=46Gs)



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

Magnetic Thresholds vs T<sub>A</sub> @VDD=1.6V



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

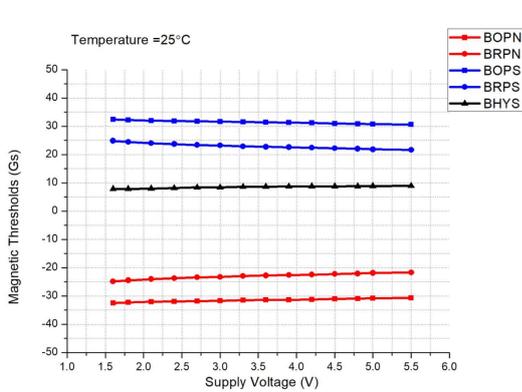
Magnetic Thresholds vs T<sub>A</sub> @VDD=5.5V

# KTH1601 Series

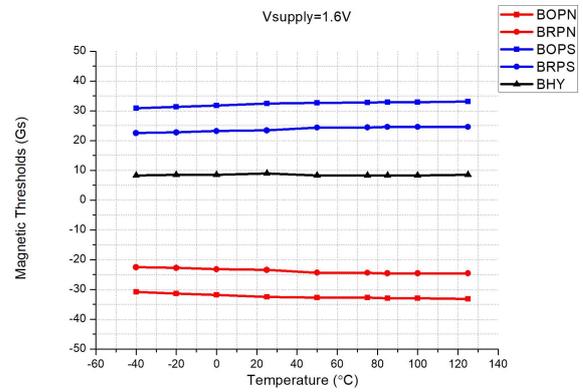


## High sensitivity, Low Power, Omni-polar Hall Switch

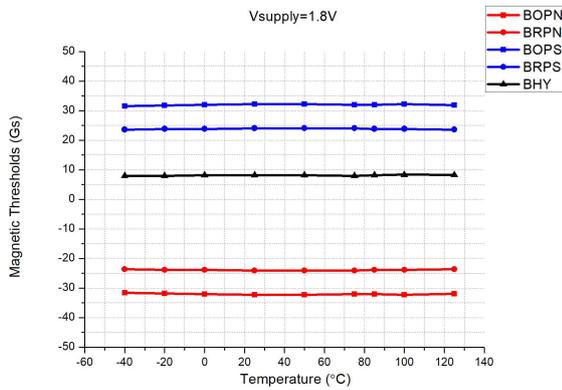
KTH1601XL Series ( $B_{OP}=33Gs$ )



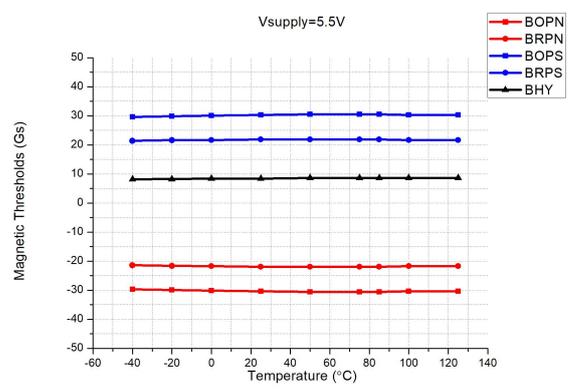
Magnetic Thresholds vs. Supply Voltage @ $T_A=25^\circ C$



Magnetic Thresholds vs  $T_A$  @ $V_{DD}=1.6V$

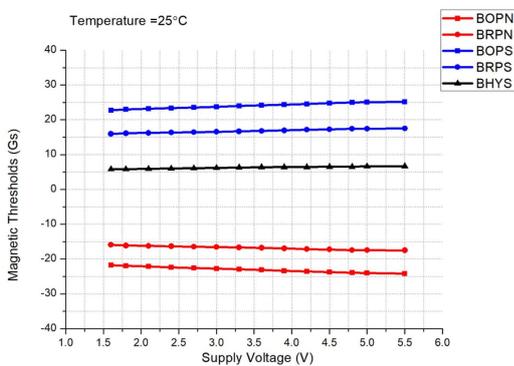


Magnetic Thresholds vs  $T_A$  @ $V_{DD}=1.8V$

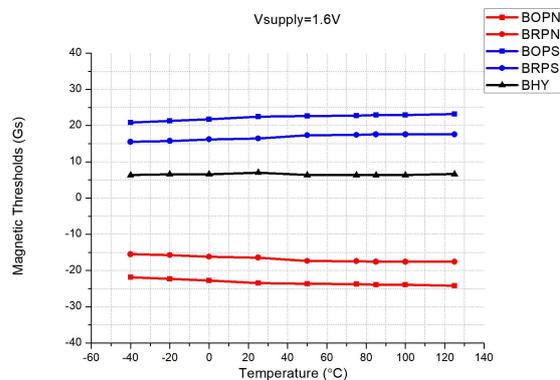


Magnetic Thresholds vs  $T_A$  @ $V_{DD}=5.5V$

KTH1601XU Series ( $B_{OP}=22Gs$ )



Magnetic Thresholds vs. Supply Voltage @ $T_A=25^\circ C$

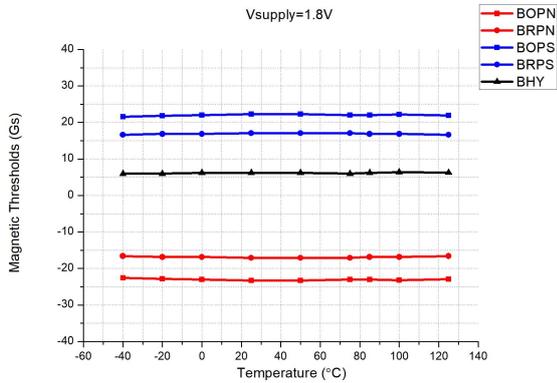


Magnetic Thresholds vs  $T_A$  @ $V_{DD}=1.6V$

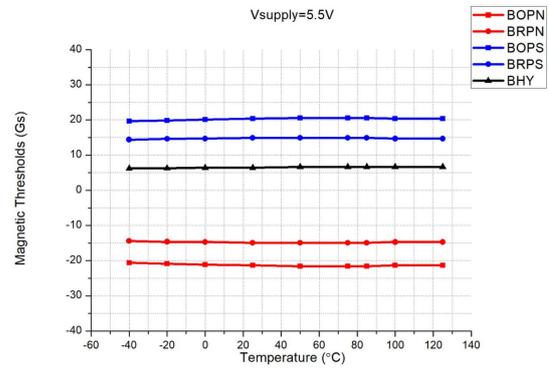


# KTH1601 Series

## High sensitivity, Low Power, Omni-polar Hall Switch

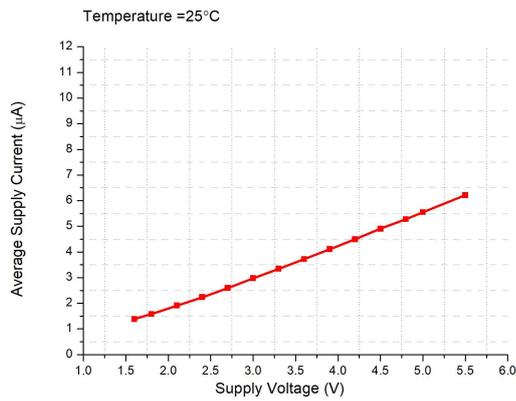


Magnetic Thresholds vs T<sub>A</sub> @VDD=1.8V



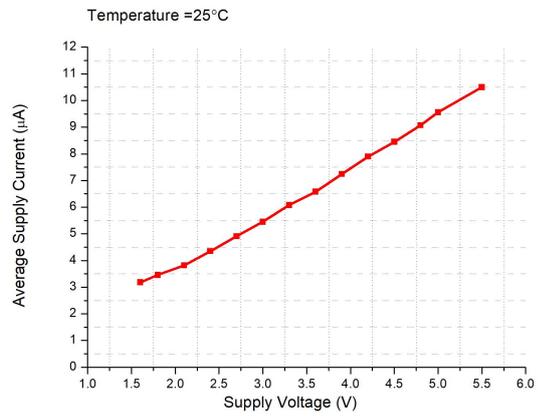
Magnetic Thresholds vs T<sub>A</sub> @VDD=5.5V

### KTH1601SX Series (t<sub>CYCLE</sub>=200ms)



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

### KTH1601T X Series (t<sub>CYCLE</sub>=50ms)



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

## KTH1601 Series



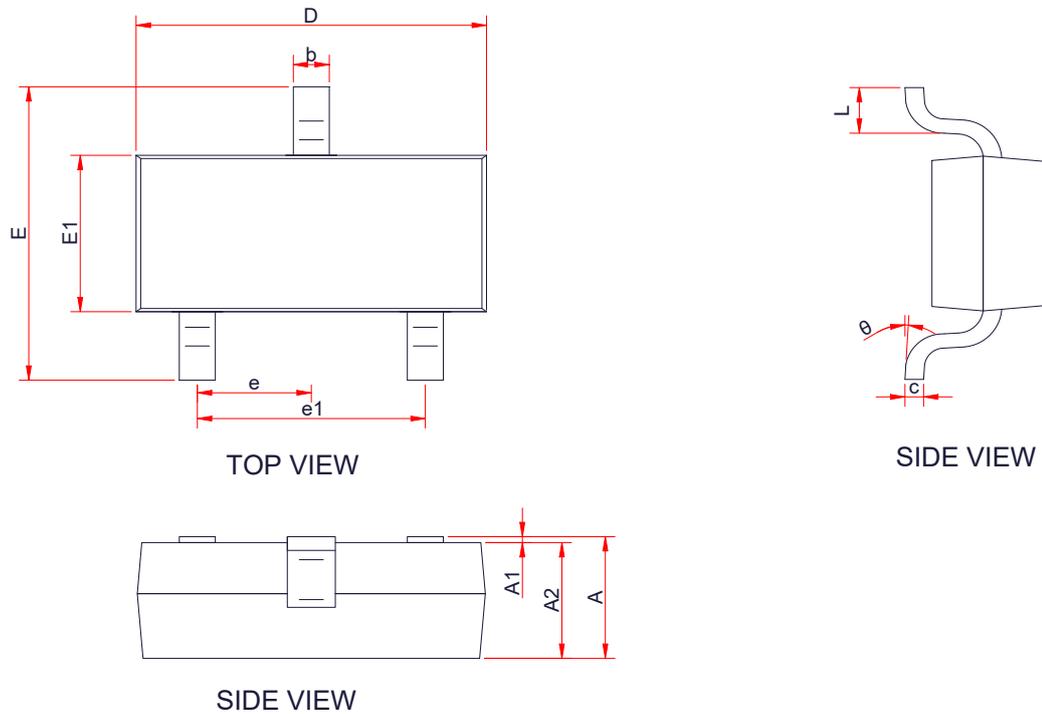
High sensitivity, Low Power, Omni-polar Hall Switch

### Order Information

Part Numbers	Package	Number of Pins	Bop	Operating Frequency	Temperature
KTH1601TH-ST3	SOT-23-3L	3	46Gauss	20Hz	-40°C~85°C
KTH1601TL-ST3	SOT-23-3L	3	33Gauss	20Hz	-40°C~85°C
KTH1601TU-ST3	SOT-23-3L	3	22Gauss	20Hz	-40°C~85°C
KTH1601SH-ST3	SOT-23-3L	3	46Gauss	5Hz	-40°C~85°C
KTH1601SL-ST3	SOT-23-3L	3	33Gauss	5Hz	-40°C~85°C
KTH1601SU-ST3	SOT-23-3L	3	22Gauss	5Hz	-40°C~85°C
KTH1601TH-SF5	SOT-553	5	46Gauss	20Hz	-40°C~85°C
KTH1601TL-SF5	SOT-553	5	33Gauss	20Hz	-40°C~85°C
KTH1601TU-SF5	SOT-553	5	22Gauss	20Hz	-40°C~85°C
KTH1601SH-SF5	SOT-553	5	46Gauss	5Hz	-40°C~85°C
KTH1601SL-SF5	SOT-553	5	33Gauss	5Hz	-40°C~85°C
KTH1601SU-SF5	SOT-553	5	22Gauss	5Hz	-40°C~85°C
KTH1601TH-TO3	TO-92S	3	46Gauss	20Hz	-40°C~85°C
KTH1601TL-TO3	TO-92S	3	33Gauss	20Hz	-40°C~85°C
KTH1601TU-TO3	TO-92S	3	22Gauss	20Hz	-40°C~85°C
KTH1601SH-TO3	TO-92S	3	46Gauss	5Hz	-40°C~85°C
KTH1601SL-TO3	TO-92S	3	33Gauss	5Hz	-40°C~85°C
KTH1601SU-TO3	TO-92S	3	22Gauss	5Hz	-40°C~85°C

### PACKAGE OUTLINE DIMENSIONS

#### SOT-23-3L



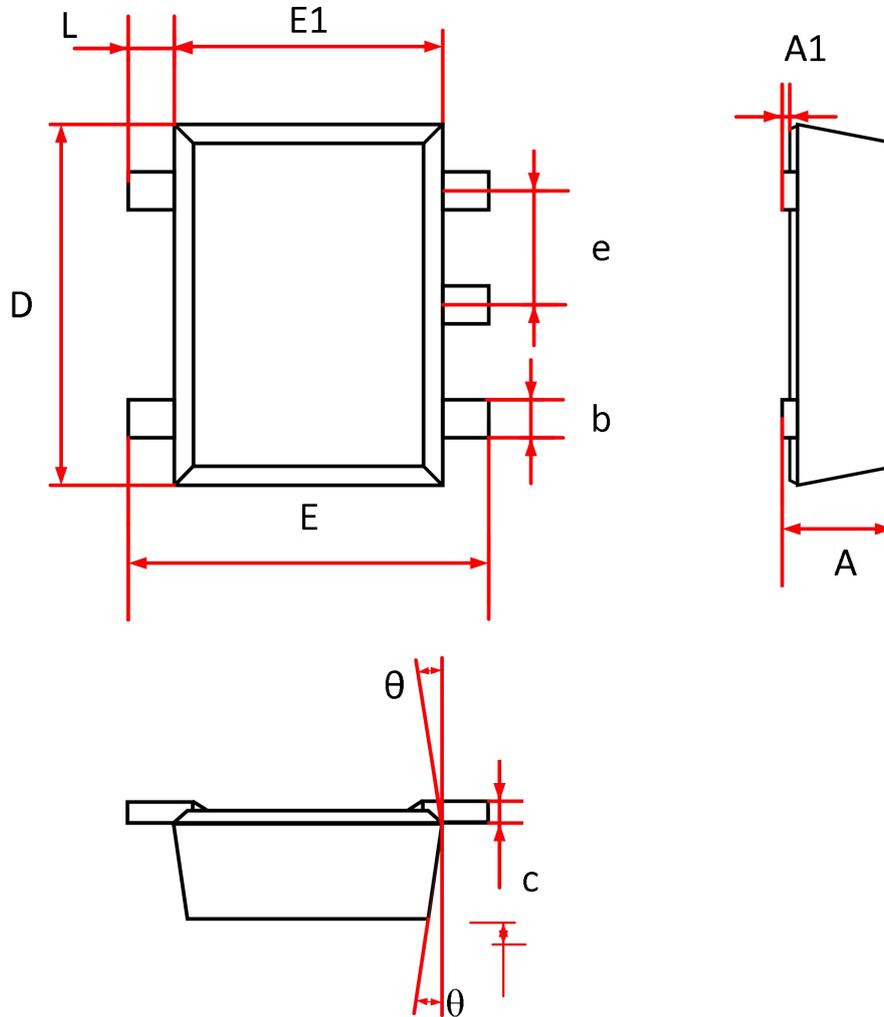
Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	-	-	1.25
A1	0.00	-	0.1
A2	1.00	1.10	1.15
b	0.30	-	0.50
c	0.10	-	0.20
D	2.82	2.95	3.02
E	2.65	2.80	2.95
E1	1.50	1.65	1.70
e	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.30	0.45	0.60
$\theta$	0 °	-	8 °

# KTH1601 Series



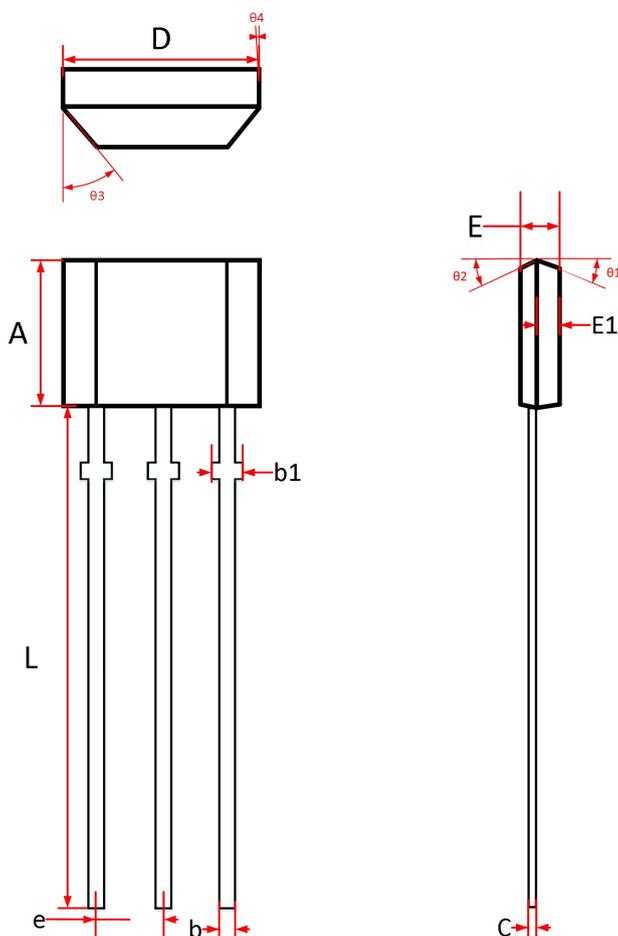
High sensitivity, Low Power, Omni-polar Hall Switch

SOT-553



Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.45	0.60
A1	0.00	0.05
b	0.17	0.27
c	0.09	0.16
e	0.45	0.55
D	1.50	1.70
E	1.50	1.70
E1	1.10	1.30
L	0.10	0.30
θ	7° REF	

### TO-92S



Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	2.90	3.00	3.10
b	0.35	0.39	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°	