KTH1604 Series

High sensitivity, Low Power, Dual outputs Unipolar Hall Switch

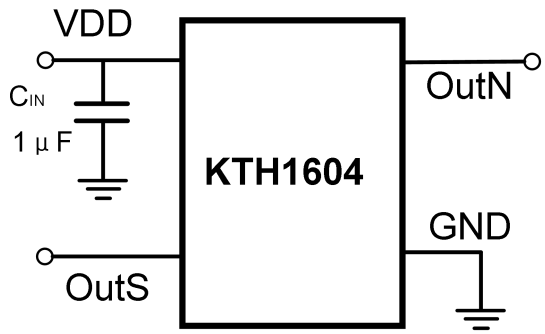
Features

- 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}=±22Gs B_{RP}=±16GS
  - B_{OP}=±33Gs B_{RP}=±23GS
  - B_{OP}=±46Gs B_{RP}=±34GS
- Two Monolithic Unipolar Hall Switches
- CMOS Push-pull Output
- 8KV ESD on Supply and Output Pins
- Small Low Profile HFBP1010-4L
- Operating Temperature -40 ~ +85 °C
- 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 μ F typical and should be placed as close to the supply pin as possible.

Descriptions

The KTH1604 is a miniature micropower magnetic Unipolar Hall effect switch IC with dual outputs, produced with CMOS technology. The temperature compensation circuitry improves stability of magnetic switch points over the whole operating range.

The OutN will turn on with a north pole of sufficient strength and the OutS will turn on with a south pole of sufficient strength. If the magnetic flux density perpendicular to the part marking surface is larger than north field operating point (BOPN), the OutN will be turned on; if it is less than north field releasing point (BRPN), the OutN will be turned off. Similarly, the OutS will turn on when B to the part marking surface is larger than south field operate point (BOPS) and is turned off until B falls below the South field release point (BRPS).

The KTH1604 are available in HFBP1010-4L packages. Standard products are Pb-free and Halogen free products.

FBP1010-4

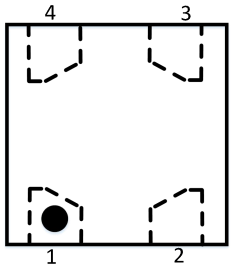
Product Name Structure

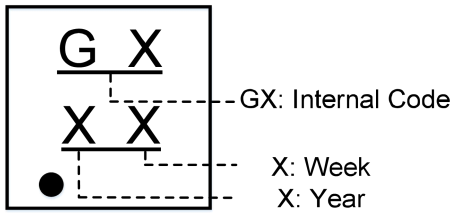
KTH1604 X X-FP4

- X-FP4: Package abbreviation
  - FP4：HFBP1010-4L
- X: Magnetic sensitivity：
  - H: B_{OP}=46 Gauss
  - L:B_{OP}=33 Gauss
  - U:B_{OP}=22Gauss
- X: Operating cycle：
  - T： f = 20Hz
  - S： f = 5Hz

Pin Descriptions

HFBP1010-4L

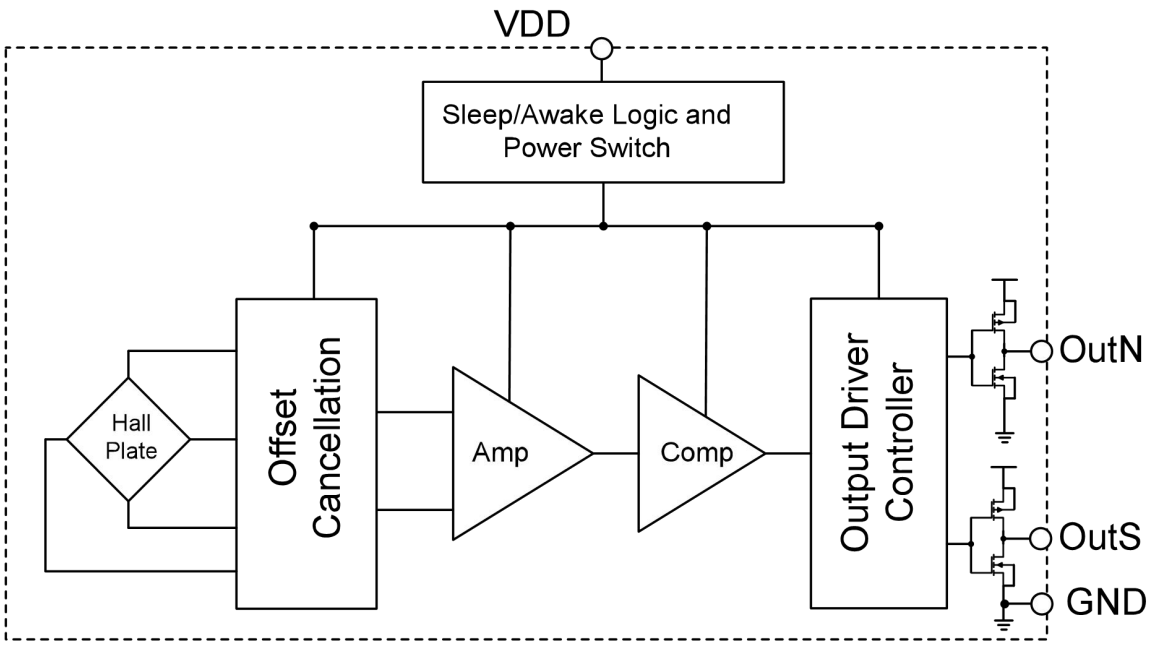




Top view

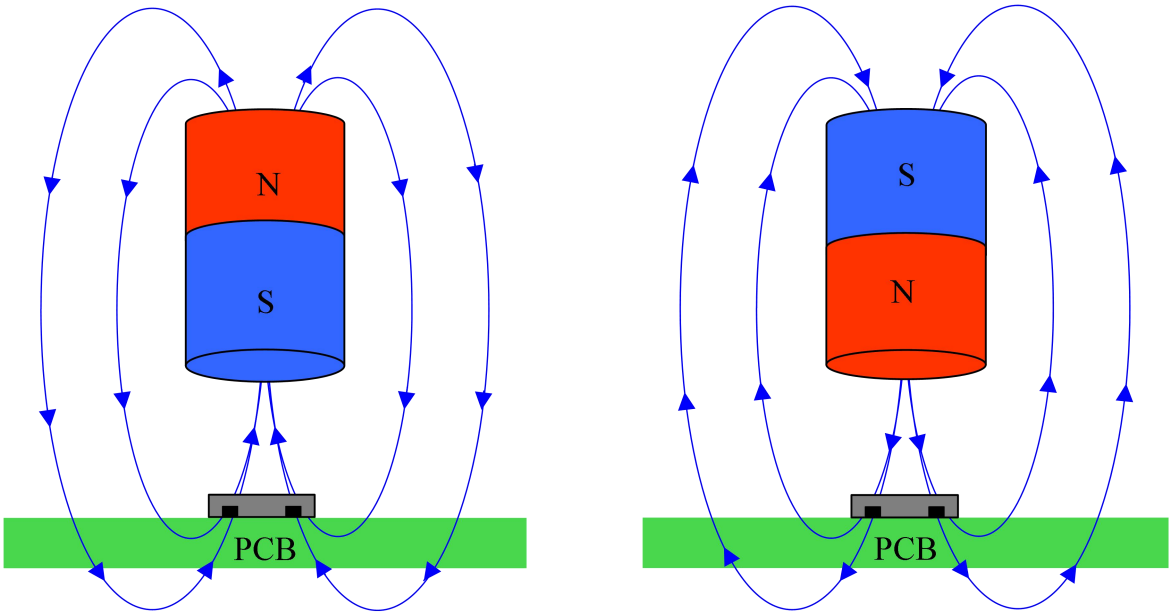
Pin Name	Pin Number	Function
OutS	1	Output S Pin
VDD	2	Power Supply Input
OutN	3	Output N Pin
GND	4	Ground Pin

Block Diagram

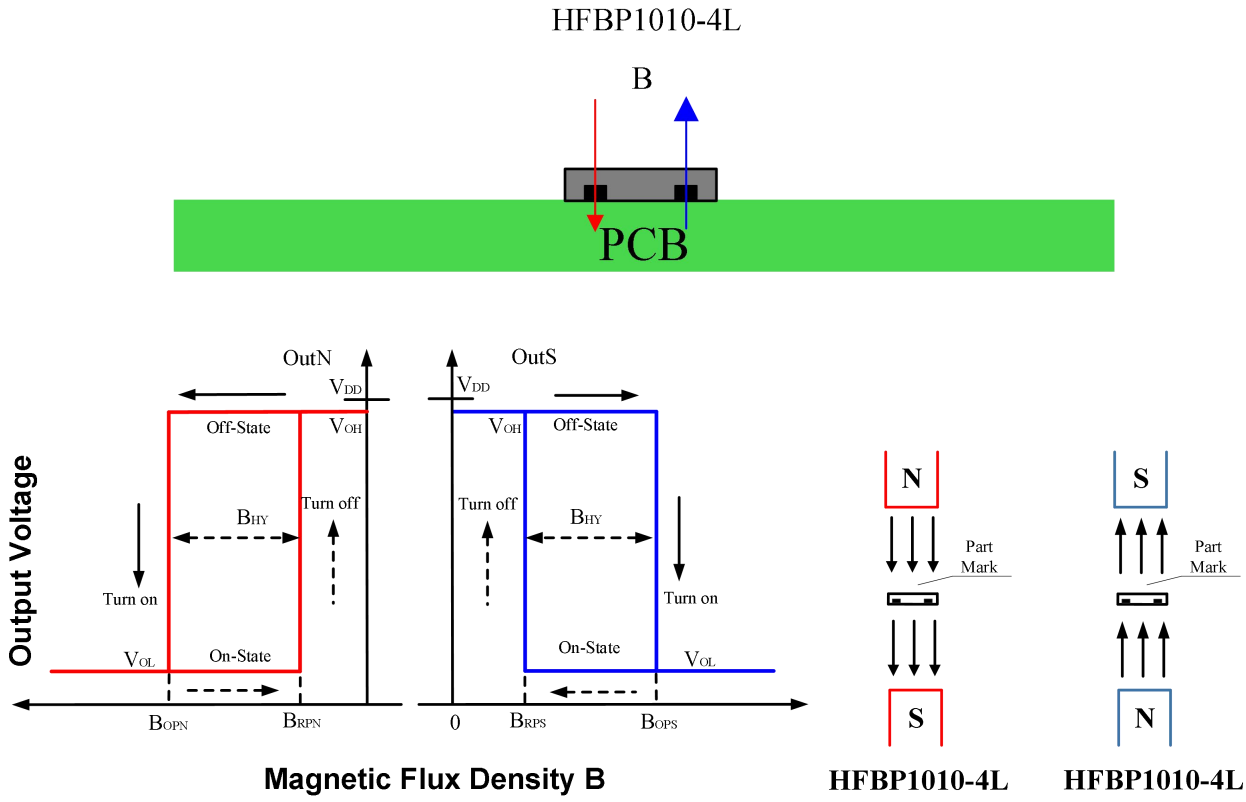


Output Switching Characteristics

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.



Absolute Maximum Ratings （@T_A=+25℃, 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
P_D	Package Power Dissipation	230	mW
T_{STG}	Storage Temperature Range	-50～+150	ºC
T_J	Maximum Junction Temperature	+150	ºC
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.

Recommended Operating Range （@T_A=+25℃, unless otherwise specified）

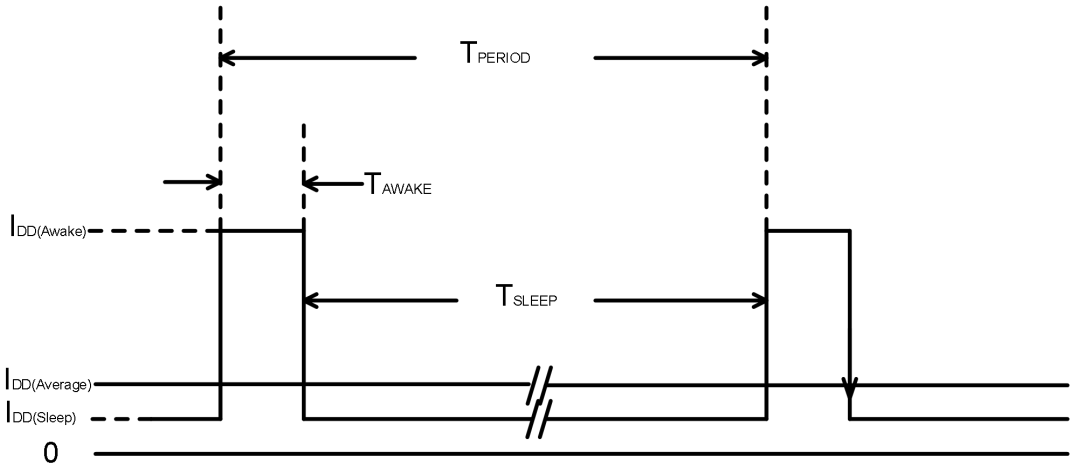
Symbol	Parameter	Conditions	Value	Unit
V_{DD}	Supply Voltage	Operating	1.6～5.5	V
T_A	Operating temperature Range	Operating	-40～85	ºC

Electronics Characteristics （@T_A=+25℃, V_{DD}=1.8V, unless otherwise specified）

KTH1604TX Series						
Symbol	**Parameter**	**Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
VDD	Supply Voltage	Operating	1.6	—	5.5	V
VOL	Output Low Voltage (On)	I_{OUT}=1mA	—	0.05	0.15	V
VOH	Output High Voltage (Off)	I_{OUT}=1mA	V_{DD}-0.15	V_{DD}-0.05	—	V
$I_{DD(AVG)}$	Average Supply Current	TA=+25℃， VDD=1.8V	—	3.30	—	uA
$I_{DD(Awake)}$	Awake Supply Current	TA=+25℃， VDD=1.8V	—	2.0	—	mA
$I_{DD(Sleep)}$	Sleep Supply Current	TA=+25℃， VDD=1.8V	—	1.00		uA
T_{AWAKE}	Awake Time	Operating	—	50	—	μs
T_{PERIOD}	Period	Operating	—	50	—	ms

KTH1604SX Series						
Symbol	**Parameter**	**Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
VDD	Supply Voltage	Operating	1.6	—	5.5	V
VOL	Output Low Voltage (On)	I_{OUT}=1mA	—	0.05	0.15	V
VOH	Output High Voltage (Off)	I_{OUT}=1mA	V_{DD}-0.15	V_{DD}-0.05	—	V
$I_{DD(AVG)}$	Average Supply Current	TA=+25℃， VDD=1.8V	—	1.6	—	uA
$I_{DD(Awake)}$	Awake Supply Current	TA=+25℃， VDD=1.8V	—	2.0	—	mA
$I_{DD(Sleep)}$	Sleep Supply Current	TA=+25℃， VDD=1.8V	—	1.0		uA
T_{AWAKE}	Awake Time	Operating	—	50	—	μs
T_{PERIOD}	Period	Operating	—	200	—	ms

Note: When the power is initially turned on, the operating VDD (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℃, VDD=1.8V, unless otherwise noted）

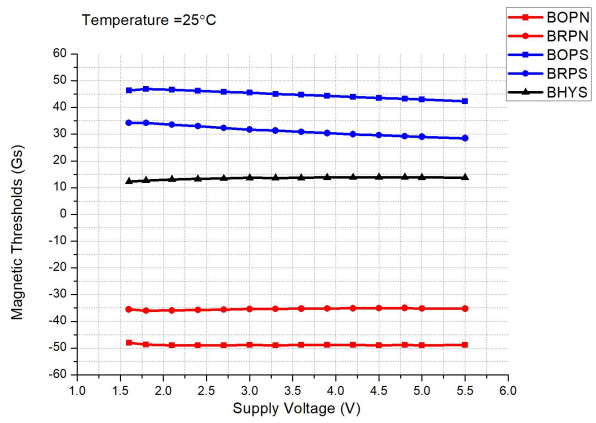
Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
KTH1604X H Series						
B_{OPS}	Output Operation Point	TA=+25℃， VDD=1.8V	40	46	52	Gauss
B_{RPS}	Output Operation Point	TA=+25℃， VDD=1.8V	26	34	38	
B_{OPN}	Output Release Point	TA=+25℃， VDD=1.8V	-52	-46	-40	
B_{RPN}	Output Release Point	TA=+25℃， VDD=1.8V	-38	-34	-26	
B_{HY} ($\|B_{OPX}\|$-$\|B_{RPX}\|$)	Hysteresis		-	12	-	

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
KTH1604X L Series						
B_{OPS}	Output Operation Point	TA=+25℃， VDD=1.8V	26	33	38	Gauss
B_{RPS}	Output Operation Point	TA=+25℃， VDD=1.8V	16	23	28	
B_{OPN}	Output Release Point	TA=+25℃， VDD=1.8V	-38	-33	-28	
B_{RPN}	Output Release Point	TA=+25℃， VDD=1.8V	-28	-23	-16	
B_{HY} ($\|B_{OPX}\|$-$\|B_{RPX}\|$)	Hysteresis		-	10	-	

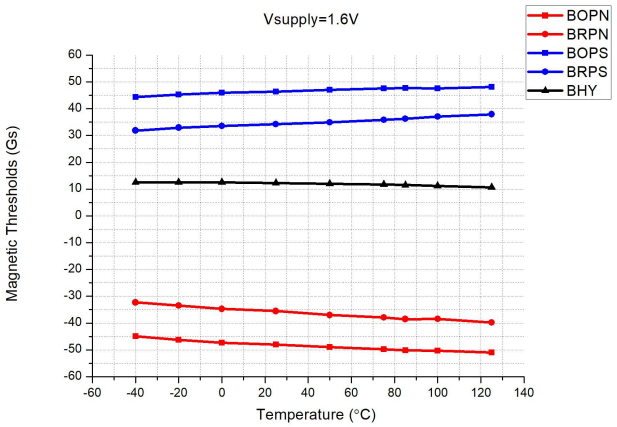
项目	参数说明	工作条件	最小值.	典型值	最大值	单位
KTH1604X U Series						
B_{OPS}	Output Operation Point	TA=+25℃， VDD=1.8V	14	22	30	Gauss
B_{RPS}	Output Operation Point	TA=+25℃， VDD=1.8V	8	16	24	
B_{OPN}	Output Release Point	TA=+25℃， VDD=1.8V	-30	-22	-14	
B_{RPN}	Output Release Point	TA=+25℃， VDD=1.8V	-24	-16	-8	
B_{HY} ($\|B_{OPX}\|$-$\|B_{RPX}\|$)	Hysteresis		-	6	-	

Performance Graphs

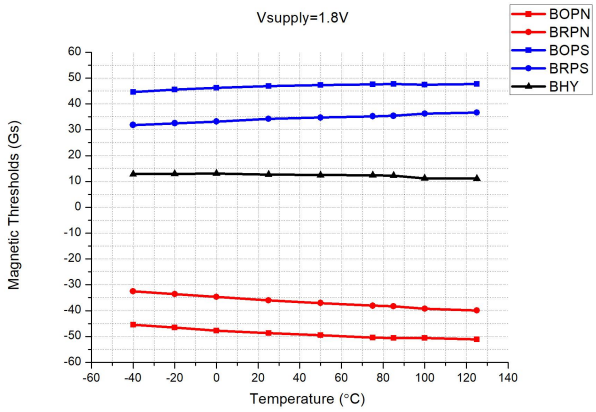
KTH1604XH Series（B_{OP}=46Gs）



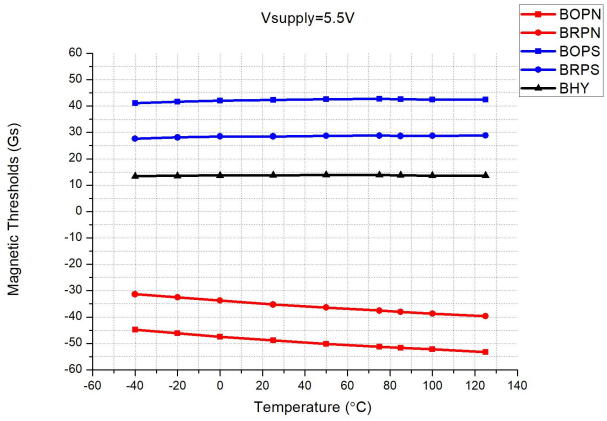
Magnetic Thresholds vs. Supply Voltage @T_A=25℃



Magnetic Thresholds vs T_A @VDD=1.6V

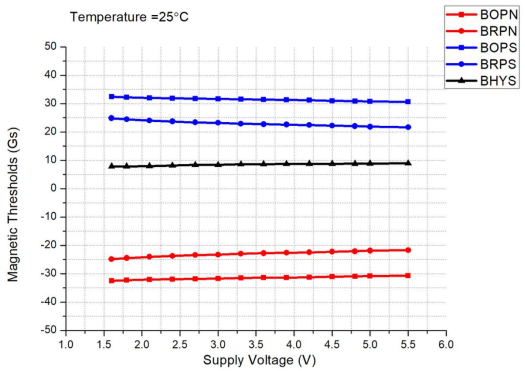


Magnetic Thresholds vs T_A @VDD=1.8V

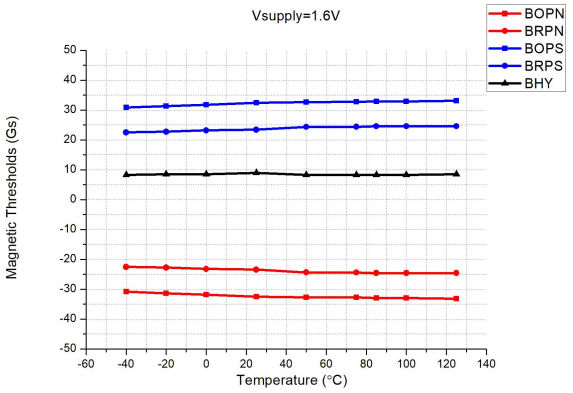


Magnetic Thresholds vs T_A @VDD=5.5V

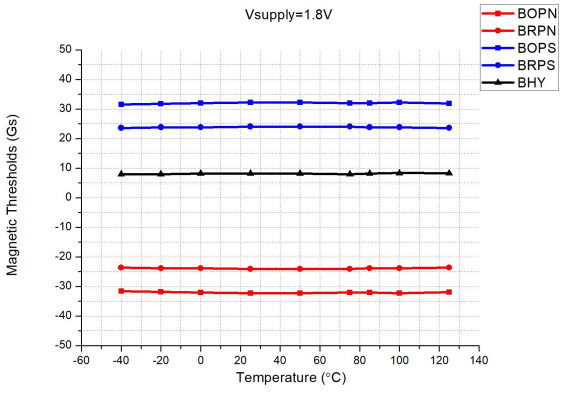
KTH1604XL Series（B_{OP}=33Gs）



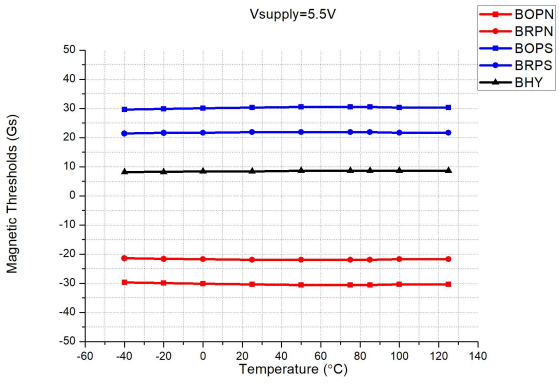
Magnetic Thresholds vs. Supply Voltage @T_A=25℃



Magnetic Thresholds vs T_A @VDD=1.6

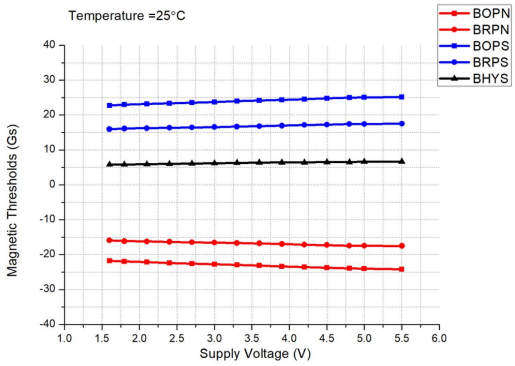


Magnetic Thresholds vs T_A @VDD=1.8V

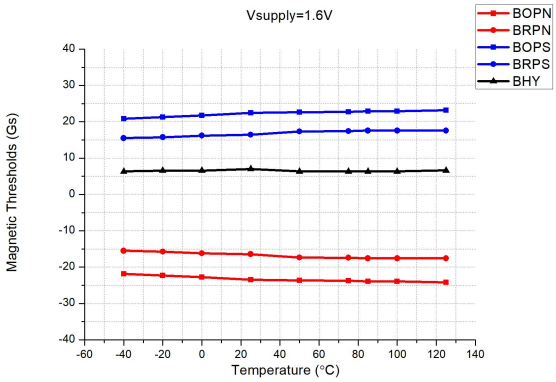


Magnetic Thresholds vs T_A @VDD=5.5V

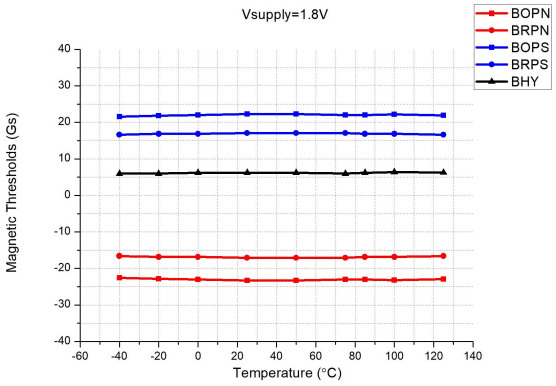
KTH1604XU Series（B_{OP}=22Gs）



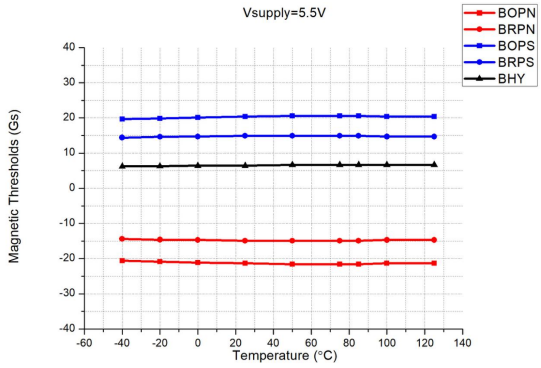
Magnetic Thresholds vs. Supply Voltage @T_A=25℃



Magnetic Thresholds vs T_A @VDD=1.6

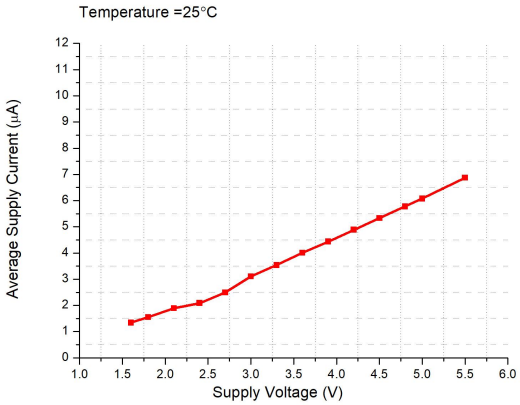


Magnetic Thresholds vs T_A @VDD=1.8V



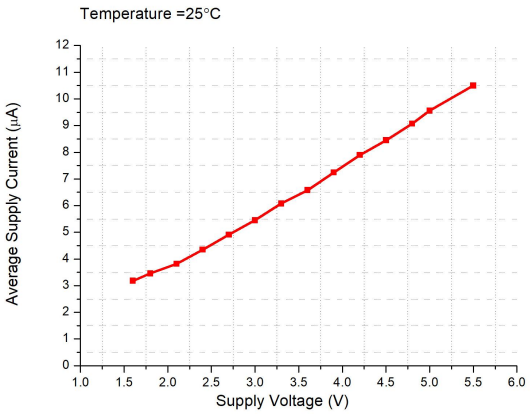
Magnetic Thresholds vs T_A @VDD=5.5V

KTH1604SX Series （t_{CYCLE}=200ms）



Current Consumption vs. Supply Voltage @T_A=25℃

KTH1604T X Series（t_{CYCLE}=50ms）



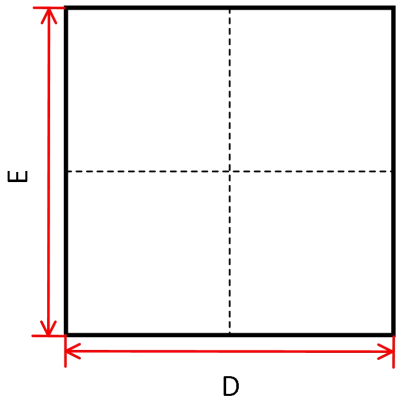
Current Consumption vs. Supply Voltage @T_A=25℃

Order Information

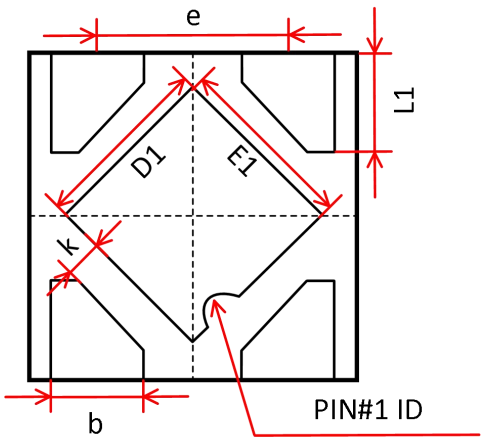
Part Numbers	Package	Number of Pins	Bop	Operating Frequency	Temperature
KTH1604TH-FP4	FBP1010-4L	4	46Gauss	20Hz	-40℃~85℃
KTH1604TL-FP4	FBP1010-4L	4	33Gauss	20Hz	-40℃~85℃
KTH1604TU-FP4	FBP1010-4L	4	22Gauss	20Hz	-40℃~85℃
KTH1604SH-FP4	FBP1010-4L	4	46Gauss	5Hz	-40℃~85℃
KTH1604SL-FP4	FBP1010-4L	4	33Gauss	5Hz	-40℃~85℃
KTH1604SU-FP4	FBP1010-4L	4	22Gauss	5Hz	-40℃~85℃

PACKAGE OUTLINE DIMENSIONS

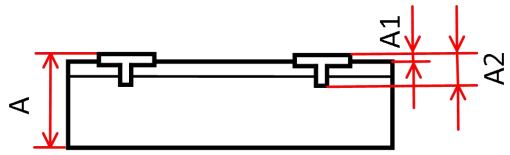
HFBP1010-4L



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.335	0.405
A1	0.000	0.050
A2	0.100REF	
D	0.950	1.050
E	0.950	1.050
D1	0.450	0.550
E1	0.450	0.550
k	0.195REF	
b	0.175	0.275
e	0.575	0.675
L1	0.200	0.300

Layout Guidelines