KTH564A1 Series

Sensitivity Adjustable, Linear Hall-effect Sensor

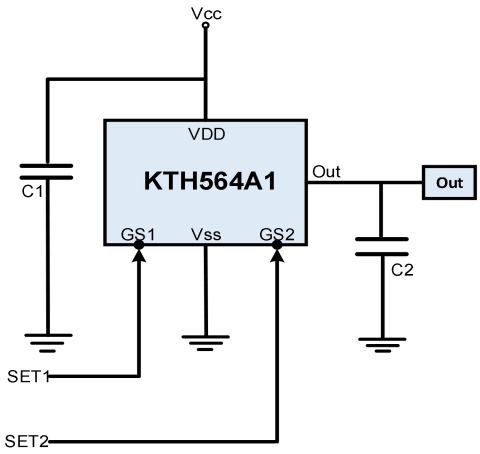
1 Features

- Proportional Linear Hall-effect Magnetic Sensor
- Wide Operating Voltage：2.8V~6.0V
- Low Power Consumption: 3.3mA@5.0V V_{DD}
- Low-Noise Output
- Responds to either positive or negative gauss
- Sensitivity Adjustable: 1.5mV/Gs 2.0mV/Gs 2.5mV/Gs 3.0mV/Gs
- Package: DFN2020-6L, DFN1616-6L
- Operating Temperature：-40℃~125℃
- Robust ESD Performance：HBM 4KV
- RoHS Compliant 2011/65/EU and Halogen Free

2 Applications

- Current sensing
- Motor control
- Position sensing
- Vibration sensing
- Liquid level sensing
- Weight sensing
- Proximity sensing
- Rotary encoder
- Ferrous metal detector

3 Typical Application Circuit



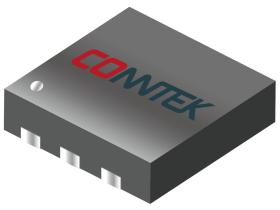
Note：C1： 1nF/10V
C2：10nF/10V

4 Descriptions

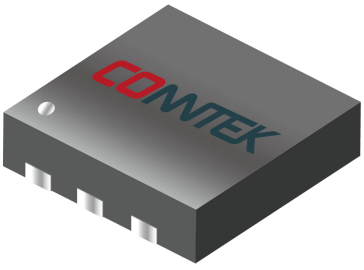
KTH564A1 is a sensitivity adjustable of linear Hall-effect sensor, is composed of Hall sensor, linear amplifier and Totem-Pole output stage. It features low noise output, which use an external capacitance. It also can provide increased temperature stability and accuracy. The linear Hall sensor has a wide operating temperature range of -40℃ to +125℃, appropriate for commercial, consumer, and industrial environments.

The high sensitivity of Hall-effect sensor accurately tracks extremely weak changes in magnetic flux density. The linear sourcing output voltage is set by the supply voltage and in proportion of vary of the magnetic flux density. That is proportional to the applied magnetics and features a null voltage output of half of the applied voltage.

KTH564A1 family provides a variety of package to customers:DFN2020-6L,DFN1616-6L. All packages are RoHS compliant.



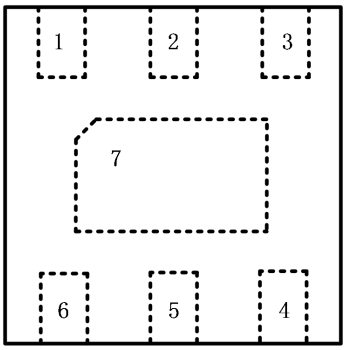
KTH564A1E-DS6

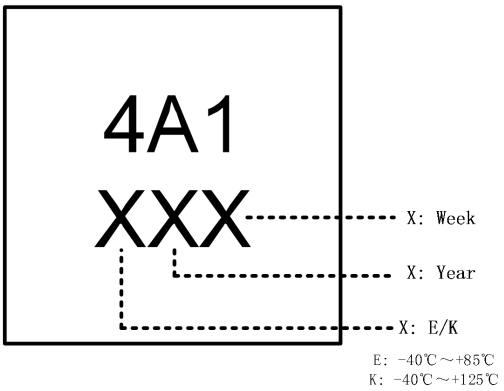


KTH564A1E-DZ6

5 Pin Descriptions

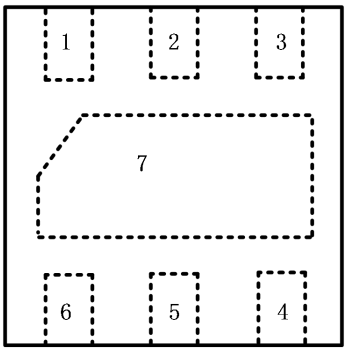
DFN2020-6L

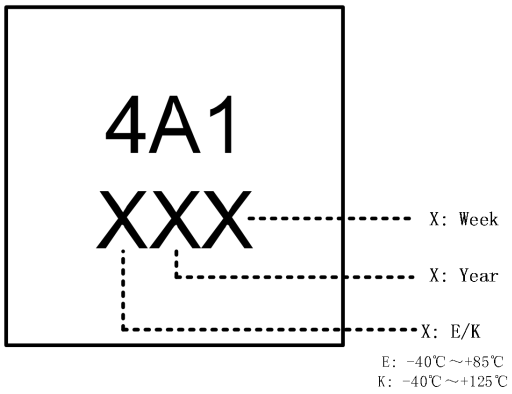




Pin Name	Pin No.	Function
VDD	1	Power Supply Input
NC	2 , 7	NC
OUT	3	Output Pin
GS1	4	
VSS	5	Ground Pin
GS2	6	

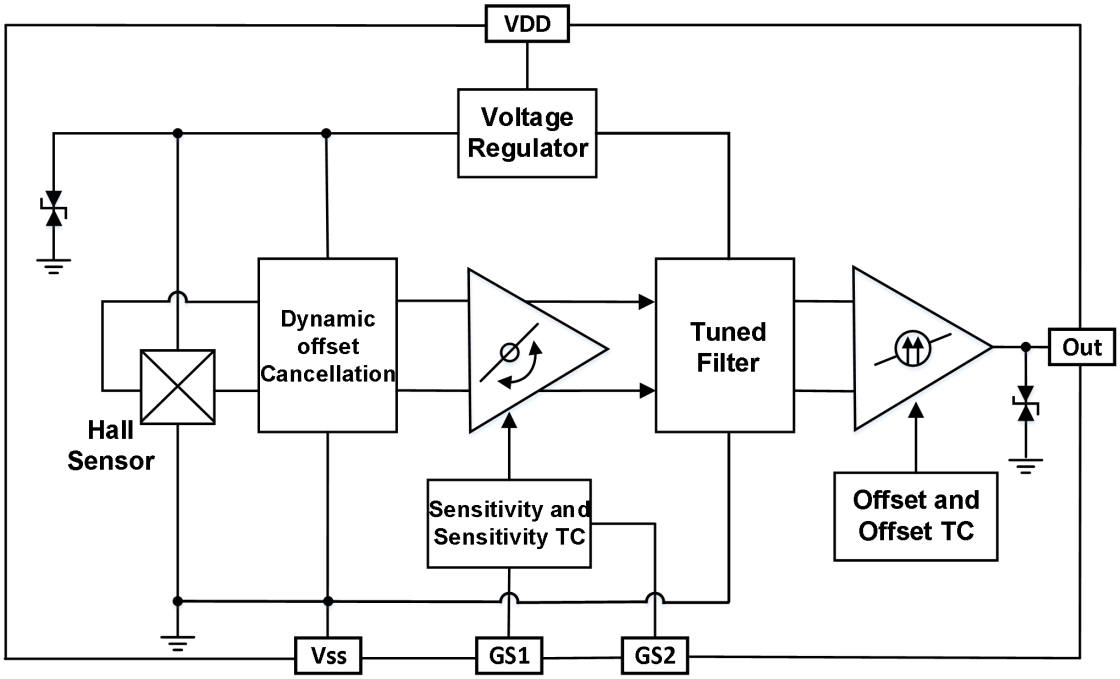
DFN1616-6L





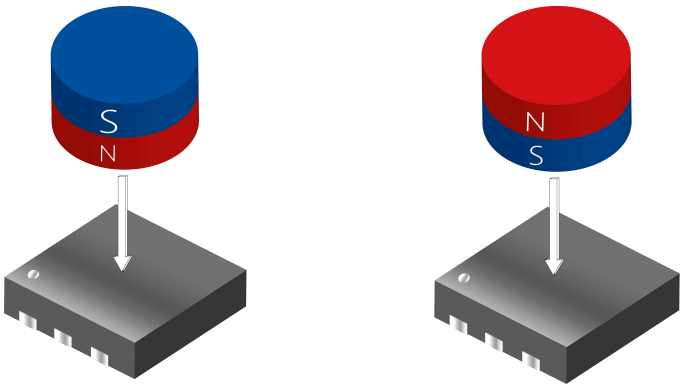
Pin Name	Pin No.	Function
VDD	1	Power Supply Input
NC	2 , 7	NC
OUT	3	Output Pin
GS1	4	
VSS	5	Ground Pin
GS2	6	

6 Block Diagram

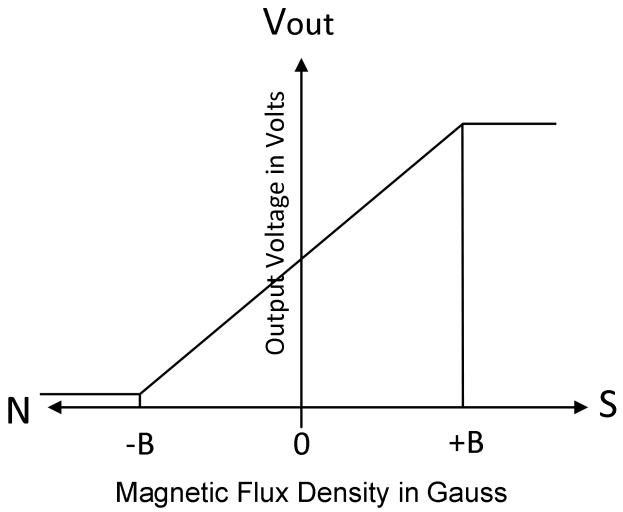


7 Output Characteristics (TA=-40℃~105℃， Vcc=2.8V~6.0V)

Symbol	Conditions	Output
South pole	B>0 Gauss	>V_{NULL}
North pole	B<0 Gauss	<V_{NULL}



B<0 Gauss　　B>0 Gauss



8 Product Name Structure

KTH564A1 X-XXX

Package Abbreviation：DZ6：DFN2020-6L
DS6：DFN1616-6L

Temperature Range Suffix：E: -40℃～+85℃
K: -40℃～+125℃

9 Absolute Maximum Ratings (@TA=+25℃,unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{DD}	Supply Voltage		8	V
V_{DD_REV}	Reverse Voltage		-0.5	V
I_{OUTPUT}	Output current		20	mA
V_{OUTPUT}	Output Voltage		8	V
T_A	Operating Temperature Rang	“E”Class	-40～+85	ºC
		“K”Class	-40～+125	ºC
T_{STG}	Storage temperature Range		-65～+150	ºC
T_J	Maximum Junction Temp		+150	ºC
P_D	Package Power Dissipation	DZ6/DS6	780/500	mW
T_R	Thermal Resistance	(θJA) DZ6/DS6	160/250	ºC/W
		(θJC) DZ6/DS6	35/50	

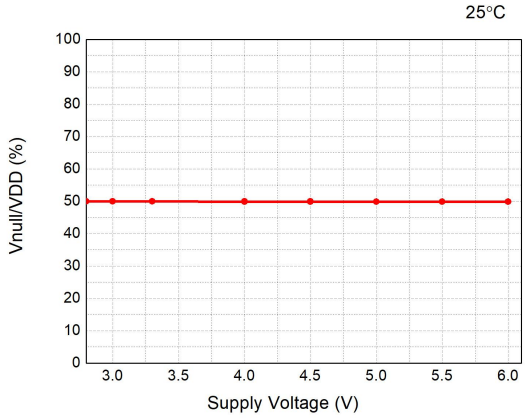
Note: Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum rated conditions for extended periods may affect device reliability.

10 Electronics Characteristics (@TA=+25℃,Vcc=5.0V , unless otherwise specified)

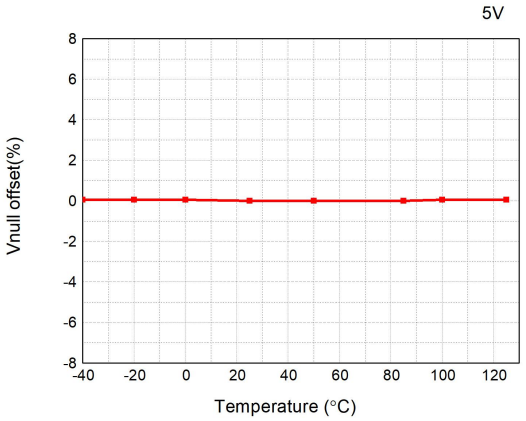
KTH564A1 Series						
Symbol	**Parameter**	**Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
V_{DD}	Supply Voltage	Operating	2.8	—	6.0	V
I_{DD}	Supply Current	B=0 Gs	—	3.3	5.0	mA
I_O	Output Current	V_{DD}>3V	1.0	1.5	—	mA
V_{NULL}	Null Output Voltage	B=0 Gs	2.475	2.5	2.525	V
V_{OH}	High Output Voltage	B> Max Magnetic Gauss	—	4.9	4.99	V
V_{OL}	Low Output Voltage	B> Min Magnetic Gauss	0.01	0.1	—	V
V_{OS}	Output Voltage Span	Operating	—	4.8	—	V
V_{ON}	Output Referred Noise	C_2=10nF	—	—	50	mV
T_P	Power-On Time	Operating	—	—	150	uS
T_{SW}	Output Switch Time	Operating	—	—	150	uS
F_{SW}	Output Switch Frequency	Operating	3	—		kHz
Magnetic Range			±800	—	±1600	Gs
Sensitivity		GS1=Low,GS2=Open	1.38	1.5	1.62	mV/Gs
		GS1=Open,GS2=Open	1.84	2.0	2.16	mV/Gs
		GS1=Low,GS2=Low	2.30	2.5	2.68	mV/Gs
		GS1=Open,GS2=Low	2.76	3.0	3.24	mV/Gs
R_{VON}	Ratiometry Null output error	Operating voltage range relative to 5V	—	±1.5	—	%
R_{SEN}	Ratiometry Sensitivity error	Operating voltage range relative to 5V	—	±1.5	—	%
LIN	Linearity	% of Span	—	±1.5	—	%
TC_{Sens}	Sensitivity Temperature Coefficient	Sens@125℃/Sens@25℃	—	±0.1	—	%/℃
δV_{ON}	Delta null voltage	$\|V_{ON}$@125℃-V_{ON}@25℃$\|$	—	20	—	mV
ESD	Electro-Static Discharge	HBM	4	—	—	kV

11 Characteristic Performance

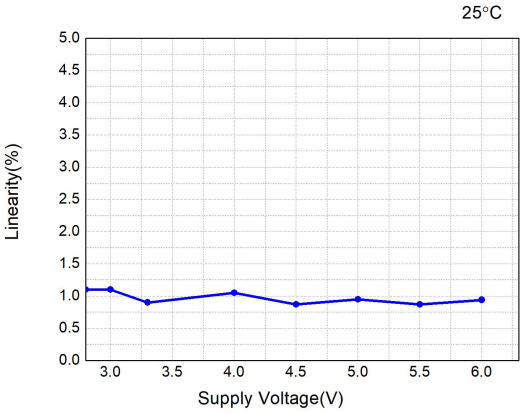
KTH564A1



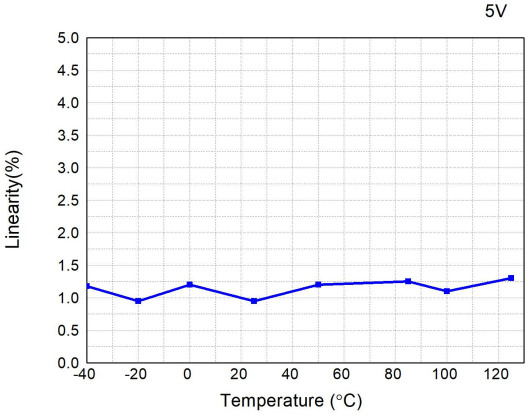
Typical Supply Voltage (V_{DD}) ***VS*** Ratio of V_{NULL} to V_{DD}



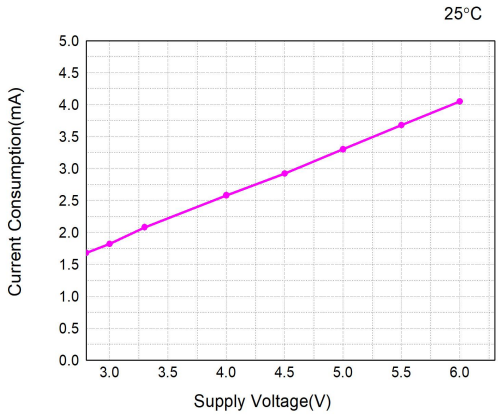
Typical Temperature (TA) ***VS*** V_{NULL} Offset



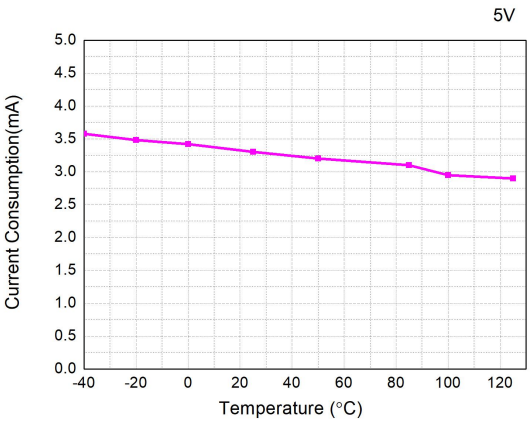
Typical Supply Voltage (V_{DD}) ***VS*** Linearity



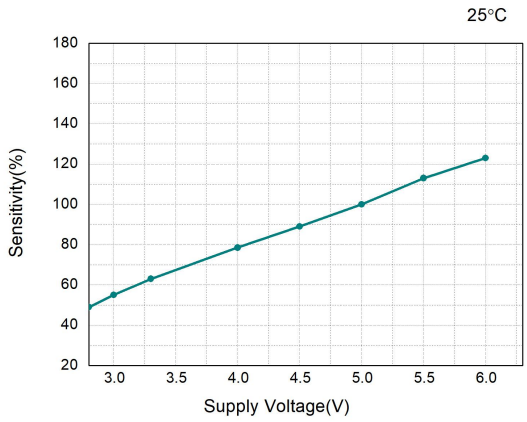
Typical Temperature (TA) ***VS*** Linearity



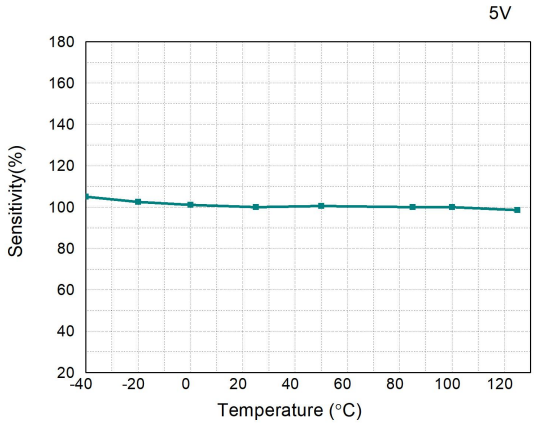
Typical Supply Voltage (V_{DD}) ***VS*** Supply Current (I_{DD})



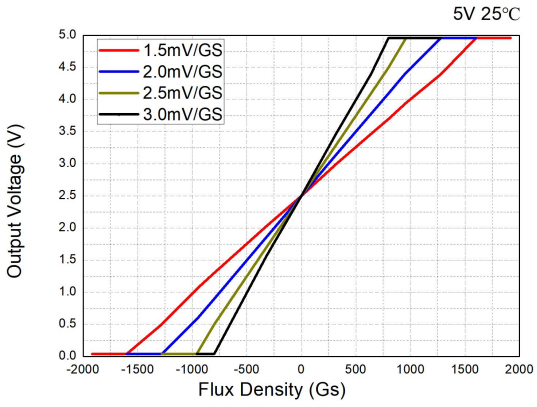
Typical Temperature (TA) ***VS*** Supply Current (I_{DD})



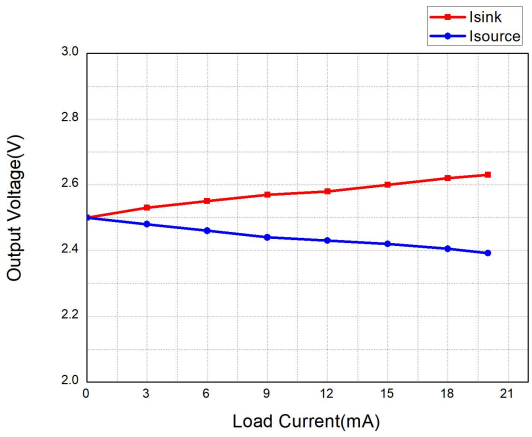
Typical Supply Voltage (V_{DD}) ***VS*** Sensitivity



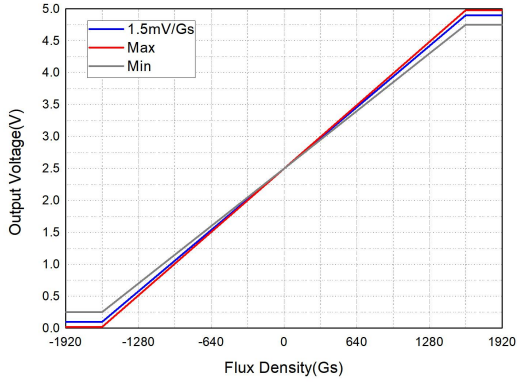
Typical Temperature (TA) ***VS*** Sensitivity



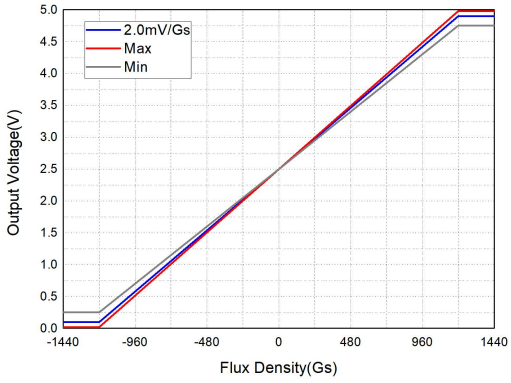
Typical Flux Density ***VS*** Output Voltage



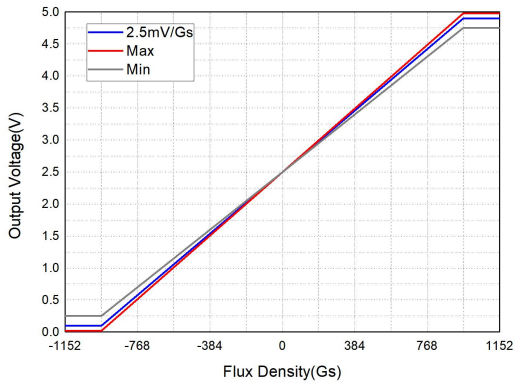
Load Current ***VS*** Output Voltage



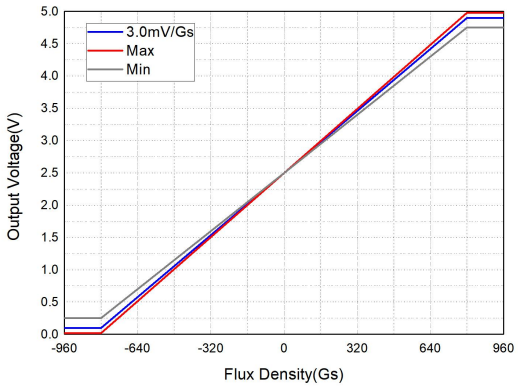
Range of Flux Density ***VS*** Output Voltage



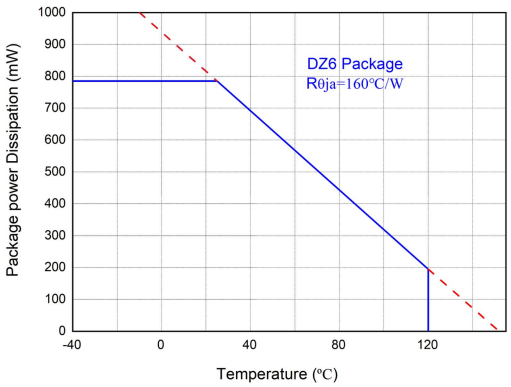
Range of Flux Density ***VS*** Output Voltage



Range of Flux Density ***VS*** Output Voltage



Range of Flux Density ***VS*** Output Voltage



Power Dissipation ***VS*** Temperature (TA)

12 Function Description

（1）V_{DD} Pin

The pin is Supplied power to IC as circuit operation and output transition requirements, and the Supplied voltage must greater than the minimum operating voltage - 2.8V.

（2）V_{SS} Pin

The pin is connected to ground of the supplied power and must to be connected firmly.

（3）Out Pin

The output pin is Totem-Pole type, don't place pull-high resistance. When there is no magnetic field, the output voltage is half of IC's V_{DD}. When the magnetic field is near the marking of IC, and magnetic force is South pole, this pin output state will larger than half of IC's V_{DD}. When the magnetic field is near the marking of IC, and magnetic force is North pole, this pin output state will less than half of IC's V_{DD}. Every time of the output transition must be after T_{SW}.

（4）GS1、GS2 Pin

The GS1 and GS2 input pins are setup sensitivity of the IC. There are four types sensitivities can be selected via change GS1 and GS2 Potential. The typical truth table as below:

GS1	GS2	Sensitivity

Low	Open	1.5 mV/GS
Open	Open	2.0 mV/GS
Low	Low	2.5 mV/GS
Open	Low	3.0 mV/GS

（5）Power on Time

When the applied voltage is into the device, the device output requires a response time to react to the ratiometry magnetic field.

（6）Null Voltage output

In the zero magnetic field state, the output voltage is half of the applied voltage V_{DD}.

（7）Sensitivity

The amount of the output voltage is proportional to the magnetic field's changes. This proportionality is specified as the below:

$$Sens = \frac{V_{OUT(B+)} - V_{OUT(B-)}}{(B+) - (B-)}$$

（8）Linearity

The device is designed to provide linear output in response to a ramping applied magnetic field. Consider two magnetic fields, B1 and B2. Ideally, the sensitivity of a device is the same for both fields, for a given applied voltage and temperature. The Linearity is calculated separately for positive and negative applied magnetic fields.

$$Lin_{B+} = (1 - \frac{Sens_{(B2+)}}{Sens_{(B1+)}}) \times 100\%$$

$$Lin_{B-} = (1 - \frac{Sens_{(B2-)}}{Sens_{(B1-)}}) \times 100\%$$

（9）Ratiometry Error

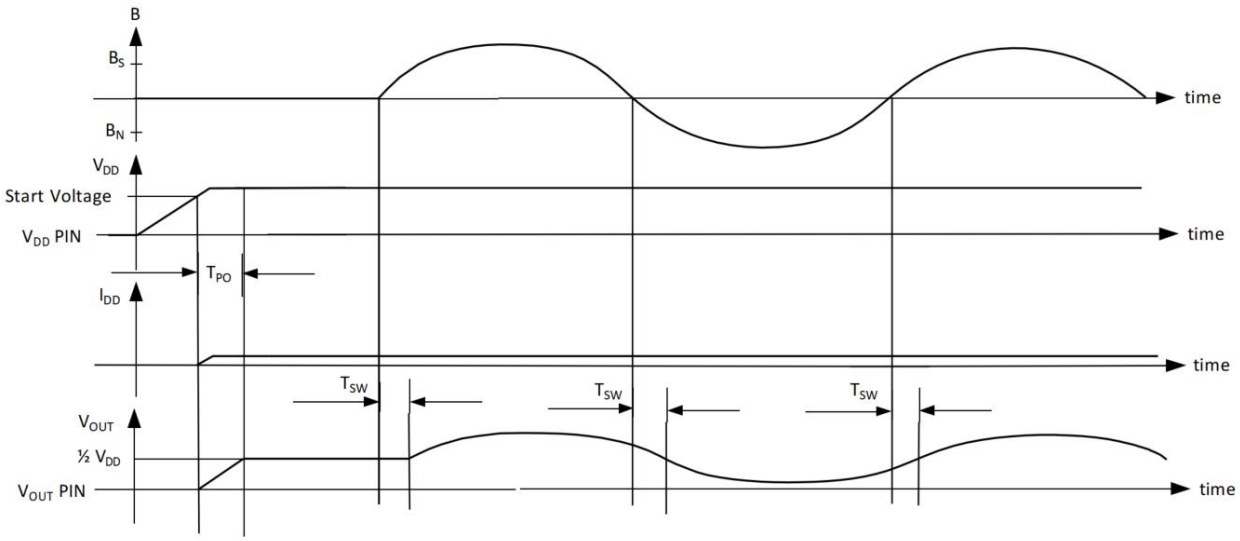
The device provides ratiometric output. The means that Null voltage output, V_{NULL}, and the magnetic sensitivity, Sens, are proportional to the applied voltage, V_{DD}. The ratiometric amount is relative to 5V, and defined as the below:

$$R_{Von} = (1 - \frac{\mathrm{Vnull}_{V_{DD}}/\mathrm{Vnull}_{5V}}{V_{DD}/5V}) \times 100\%$$

$$R_{Sens} = (1 - \frac{Sens_{V_{DD}}/Sens_{5V}}{V_{DD}/5V}) \times 100\%$$

13 Timing Waveform Diagram

Power on timing



● Power-On time (T_{PO}):

When input voltage to VDD of IC, IC can be normal working after Power-On Time (T_{PO}).

● Output switch time(T_{SW}):

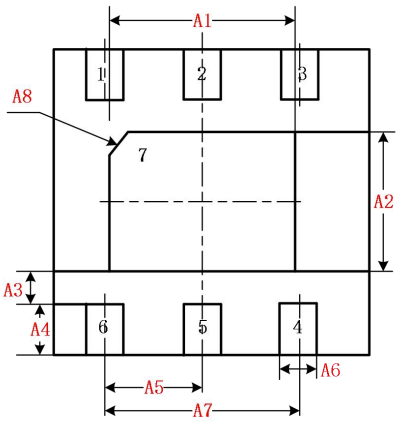
The time from magnetic field change to output signal begin to transit is called output switch time.

14 Order Information

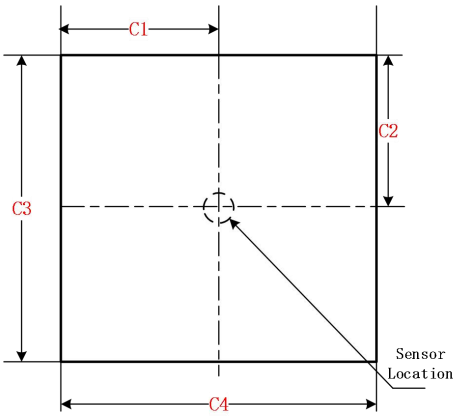
Part Numbers	Package	Number of Pins	Temperature
KTH564A1E-DZ6	DFN2020-6L	6	-40℃～+85℃
KTH564A1E-DS6	DFN1616-6L	6	-40℃～+85℃
KTH564A1K-DZ6	DFN2020-6L	6	-40℃～+125℃
KTH564A1K-DS6	DFN1616-6L	6	-40℃～+125℃

15 Package Outline Dimensions

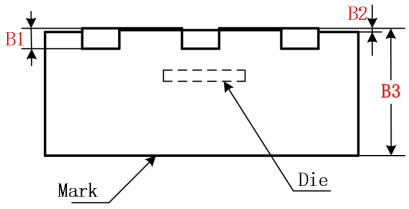
DFN2020-6L



Bottom View

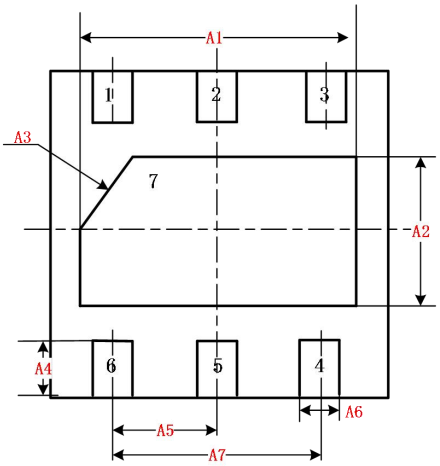


Top View

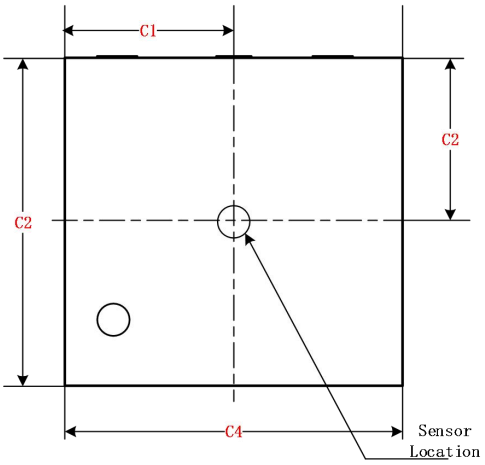


Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A1	1.176	-	-
A2	0.62	-	-
A3	0.21	-	-
A4	0.25	-	0.45
A5	0.60	-	0.70
A6	0.225	-	0.325
A7	-	1.30	-
A8	-	0.25	-
B1	0.15	-	0.25
B2	0.005	-	0.060
B3	0.57	-	0.63
C1	-	1.0	-
C2	-	1.0	-
C3	1.95	-	2.05
C4	1.95	-	2.05

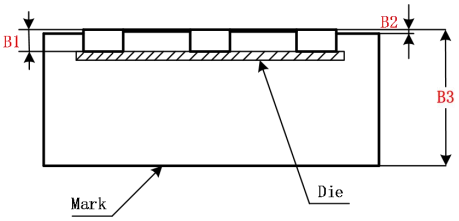
DFN1616-6L



Bottom View



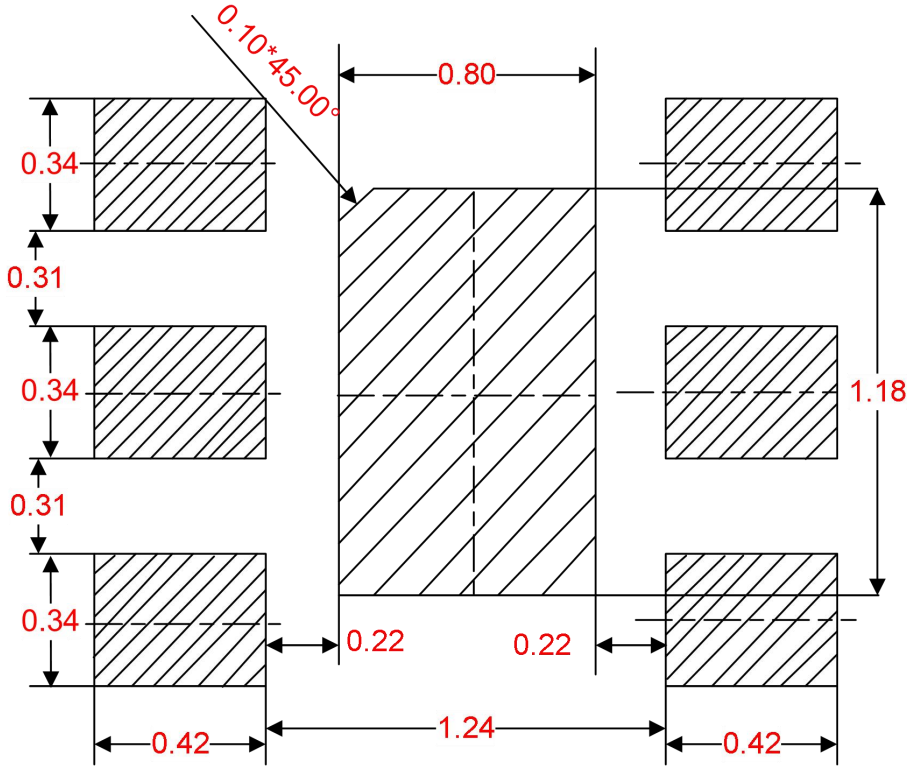
Top View



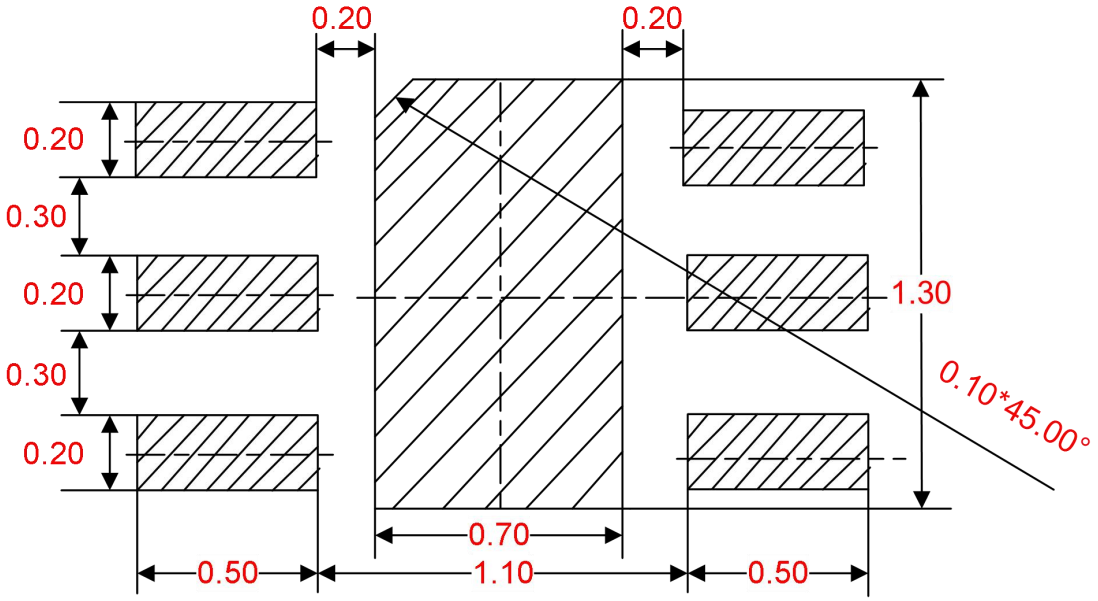
Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A1	1.25	-	1.35
A2	0.65	-	0.75
A3	-	0.1	-
A4	0.20	-	0.30
A5	0.45	0.50	0.55
A6	0.15	-	0.25
A7	-	1.00	-
B1	-	-	0.13
B2	0.00	-	0.04
B3	0.35	-	0.45
C1	-	0.8	-
C2	1.55	-	1.65
C3	-	0.8	-
C4	1.55	-	1.65

Land Pattern (For reference only)

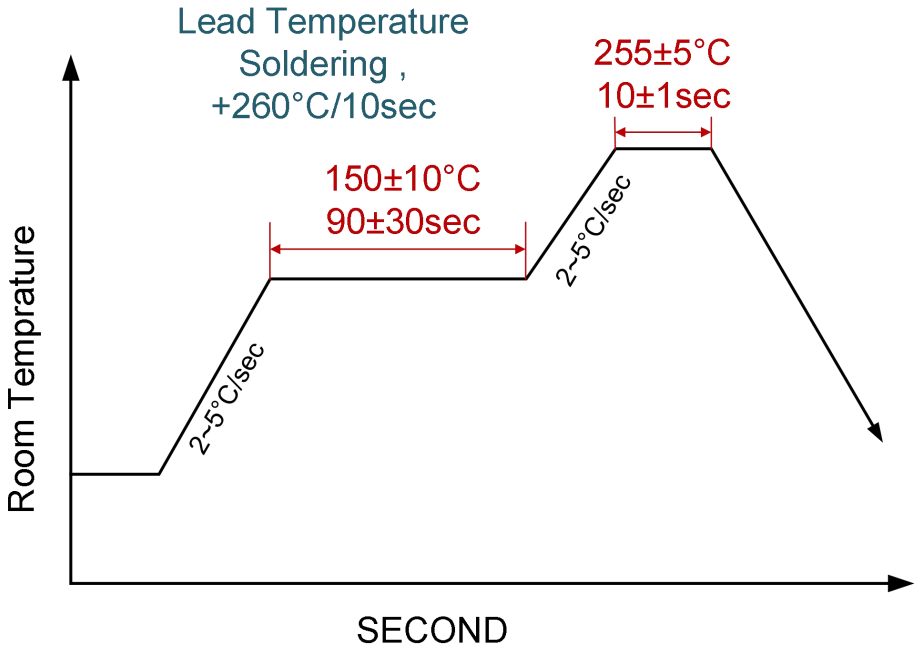
DFN2020-6L



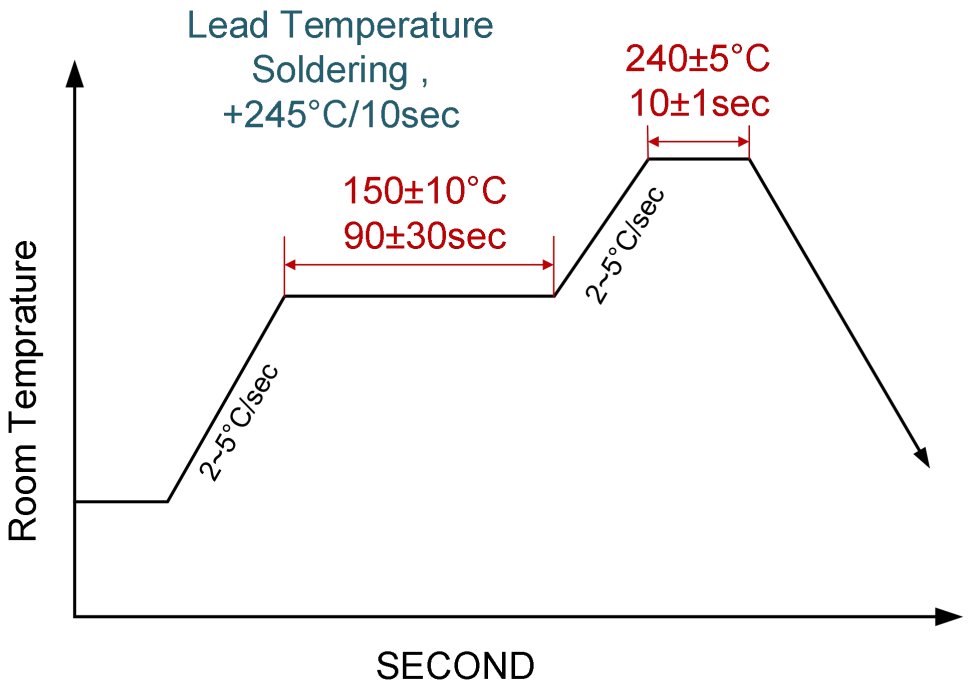
DFN1616-6L



IR Reflow curve



DFN2020-6L Soldering Condition



DFN1616-6L Soldering Condition