MT869X

Uni-polar, Nano Power Hall-Effect Switch IC

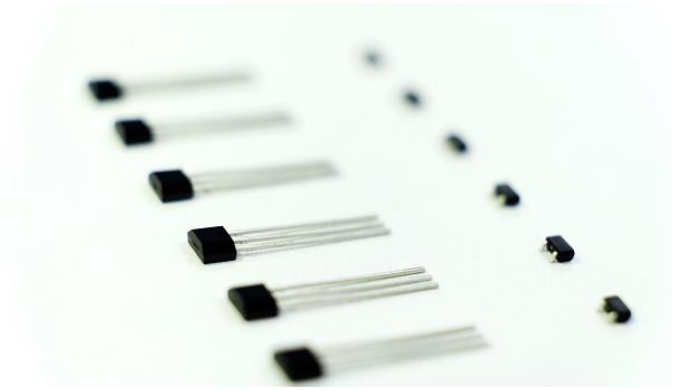
MagnTek

1 Product Description

The MT869X family is produced with CMOS technology. The Hall IC internally includes high sensitivity horizontal hall plates, sleep/awake logics for mode control, a low-power on-chip oscillator, low noise analog signal chain with dynamic offset cancellation, hysteresis comparators and an output driver.

The product responds to North pole or South pole magnetic fields. The output will be turned on (Low) when the magnetic flux density (B) is larger than the operating point (B_{OP}), and be turned off (High) when the magnetic flux density (B) is lower than the releasing point (B_{RP}).

The MT869X family provides a variety of packages to customers: DFN & SOT-23 for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.



2 Features

- CMOS Technology
- Uni-polar Switch
- 2.0～5.5V Operating Vcc Range
- -40℃~125℃ Operating Temperature
- Package Option:
  SOT-23
  Flat TO-92
  DFN1608
  DFN1616
- Magnetic Sensitivity Option:
  B_{OP}=35Gs, B_{RP}=25Gs
- Push Pull Output
- Nano Power Consumption:
  Average Supply Current =600nA (Vcc=2.0V)
- RoHS Compliant: (EU)2015/863

3 Product Overview of MT869X

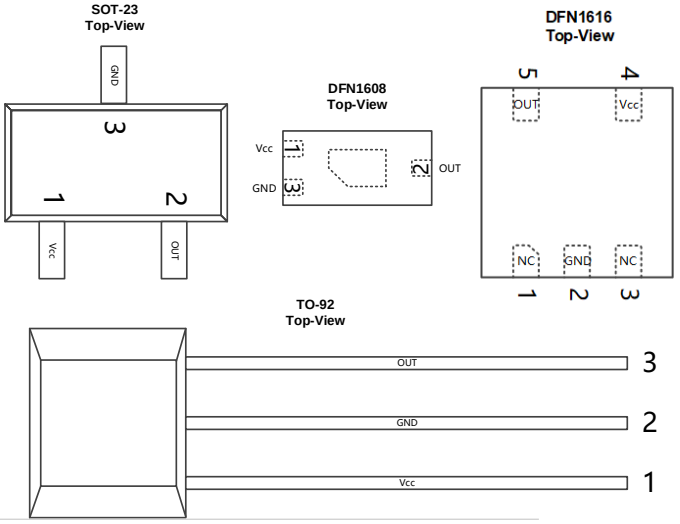
Part No.	Description
MT8691A	Flat TO-92, bulk packaging (1000pcs/bag)
MT8691AT	SOT-23, tape & reel (3000pcs/bag)
MT8691DT-1608	DFN1608, tape & reel (10000pcs/bag)
MT8691DT-1616	DFN1616, tape & reel (3000pcs/bag)

4 Applications

- Home appliances, Industrial
- Position Detection
- Solid-State Switch
- Proximity Switch
- Smart Meter
- Handheld Device
- Consumer Device

5. Pin Configuration and Functions

	Vcc	Out	GND
SOT-23	1	2	3
Flat TO-92	1	3	2
DFN1608	1	2	3
DFN1616	4	5	2
Description	Power	Output Push Pull	Ground



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Reversion History

1	Originally Version	
2	1.1 Version	Update the I_{AW} max spec from 4mA to 5mA
3	1.2 Version	Update the marking spec of SOT-23
4	1.3 Version	Update DFN1616

6 Definition of Switching Function

Figure.2 & Figure.3 shows the device functionality and hysteresis

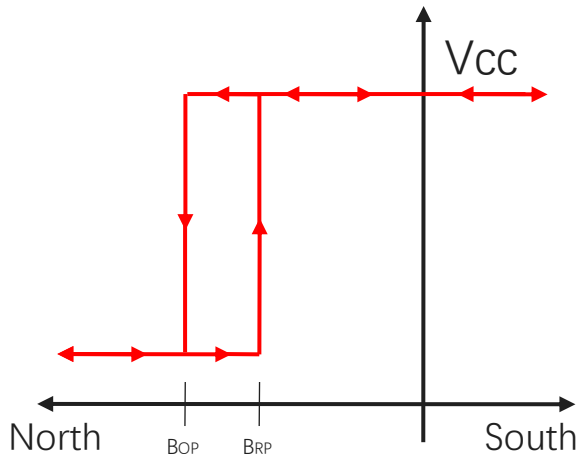


Figure.2 Switching Function Uni-polar (North)
SOT-23

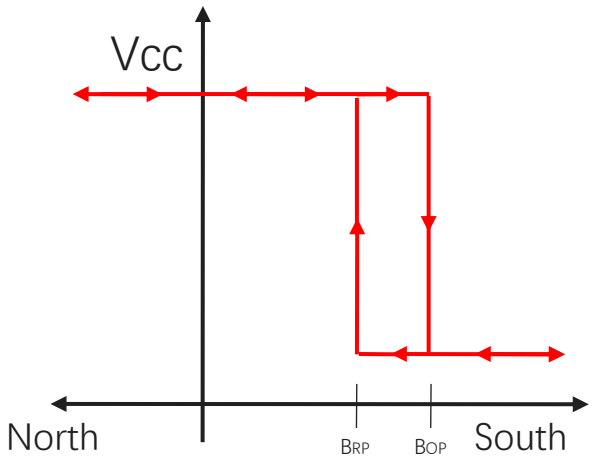


Figure.3 Switching Function Uni-polar (South)
Flat TO-92 / DFN1608 / DFN1616

7 Function Description

B_{OP}: Operating Point, Magnetic flux density applied on the branded side of the package which turns the output driver ON (V_{OUT}=Low)

B_{RP}: Releasing Point, Magnetic flux density applied on the branded side of the package which turns the output driver OFF (V_{OUT}=High)

B_{HYST}: Hysteresis Window, $|B_{OP} - B_{RP}|$
Devices that have a lower magnetic threshold (V_{OUT}=High) detect magnets at a farther distance. Higher thresholds (V_{OUT}=Low) generally require a closer distance or larger magnet.

8 Feature Description

The MT869X device is sensitive to the magnetic field component that is perpendicular to the top of the package

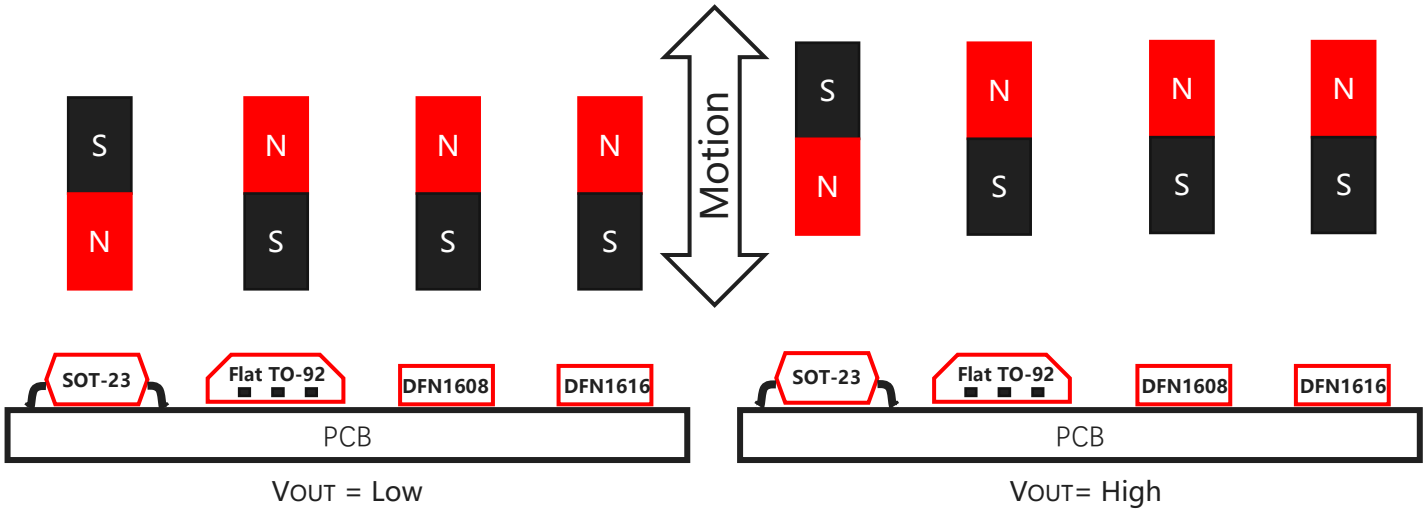


Figure.4 Flux Direction Polarity

9 Functional Block Diagram

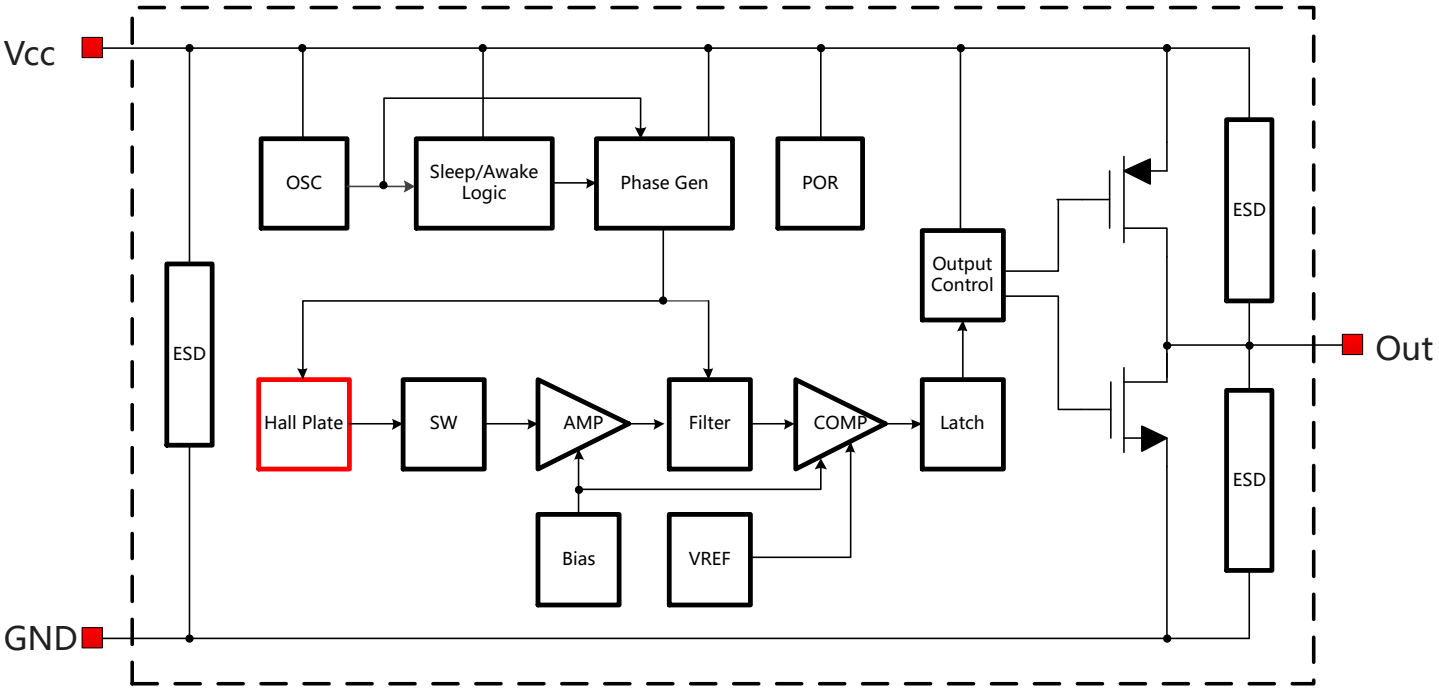


Figure.5 Functional Block Diagram

10 Electrical and Magnetic Characteristics

10.1 Absolute Maximum Ratings

Absolute maximum ratings are limited values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

Symbol	Parameters	Min	Max	Units
V_{CC}	Supply Voltage	-	7	V
V_{RCC}	Reverse Battery Voltage	-0.5	-	V
V_{OUT}	Output Voltage	-	7	V
I_{OUT}	Continuous Output Current	-	8	mA
T_A	Operating Ambient Temperature	-40	125	℃
T_S	Storage Temperature	-50	150	℃
T_J	Junction Temperature	-	165	℃
B	Magnetic Flux Density	No Limit		Gs

10.2 Electrical Specifications

At T_A=-40~125℃, V_{CC}=2.0V~5.5V (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	2.0	3.6	5.5	V
I_{CC}	Supply Current	V_{CC}=3.6V	-	1.2	2.0	uA
		V_{CC}=2.0V	-	600	-	nA
I_{AW}	Awake Current	V_{CC}=3.6V	-	3.0	5.0	mA
I_{SL}	Sleep Current	V_{CC}=3.6V	-	0.6	1.4	uA
V_{OL}	Output Low Voltage	I_{OUT}=5mA, |B| > |B_{OP}|	-	-	0.4	V
V_{OH}	Output High Voltage	I_{OUT}=5mA, |B| < |B_{RP}|	V_{CC}-0.4	-	-	V
F_{SW}	Switching Frequency	V_{CC}=3.6V	10	20	40	Hz
T_{AW}	Awake Time	V_{CC}=2.0V to 5.5V	4	10	16	us
T_{SL}	Sleep Time	V_{CC}=2.0V to 5.5V	25	50	100	ms
D.C.	Duty Cycle	V_{CC}=2.0V to 5.5V	-	0.02	-	%
T_{PO}	Power on Time	dVcc/dt>5V/us, |B| > |B_{OP}|	-	-	120	us
R_{TH}	Thermal Resistance of SOT-23		-	301	-	℃/W
	Thermal Resistance of DFN		-	301	-	℃/W
	Thermal Resistance of Flat TO-92		-	230	-	℃/W

10.3 Magnetic Characteristics

At V_{CC}=2.0V~5.5V (unless otherwise specified)

Part No.	Symbol	Min	Typ	Max	Unit
MT8691 Series	B_{OP}, T_A =25℃	15	35	55	Gs
	B_{RP}, T_A =25℃	10	25	40	Gs
	B_{HYST}, T_A =25℃	-	10	-	Gs

10.4 ESD Ratings

Symbol		Reference	Values	Unit
V_{ESD}	Human-body model (HBM)	AEC-Q100-002	±5000	V
	Charged-device model (CDM)	AEC-Q100-011	±1000	V

10.5 Characteristic Performance

At Vcc=3.6V

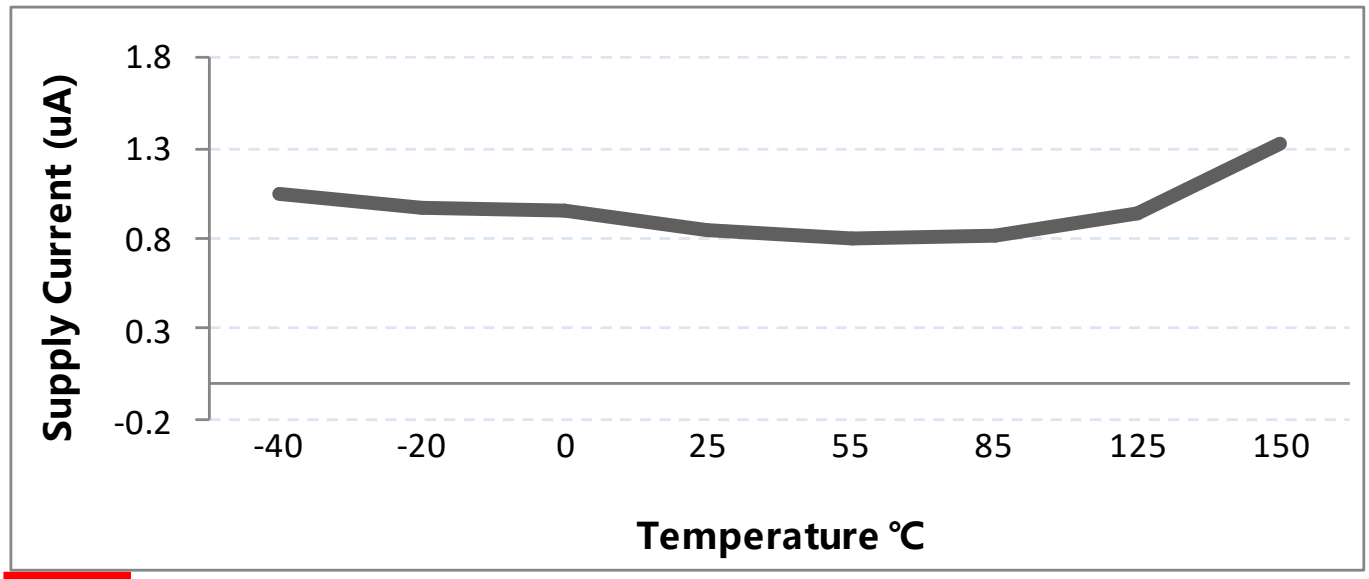


Figure.6 Supply Current vs. Temperature

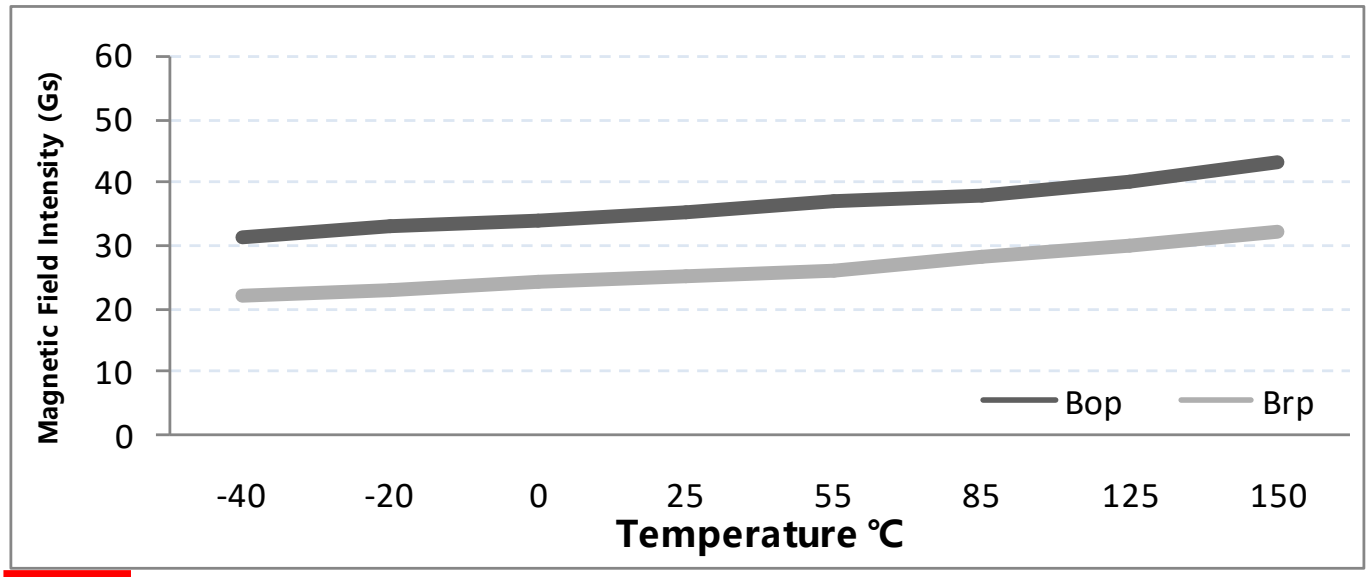


Figure.7 Magnetic Characteristics vs. Temperature (BOP & BRP)

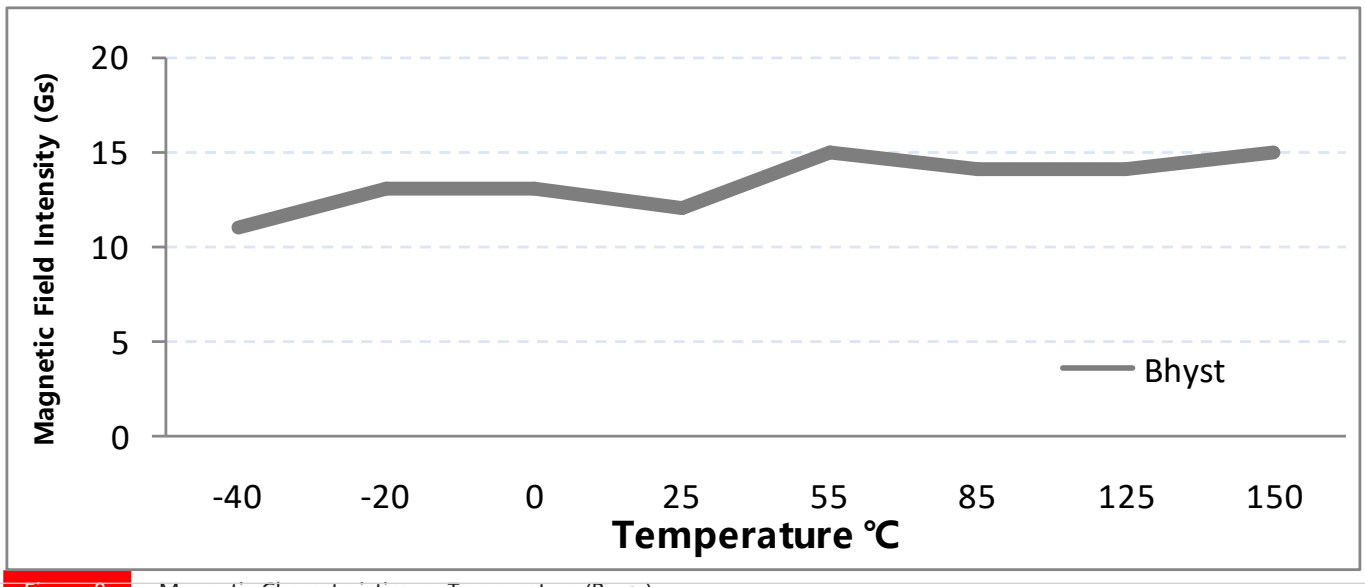


Figure.8 Magnetic Characteristics vs. Temperature (BHYST)

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10.6 Typical Output Waveform

MT8691A as example

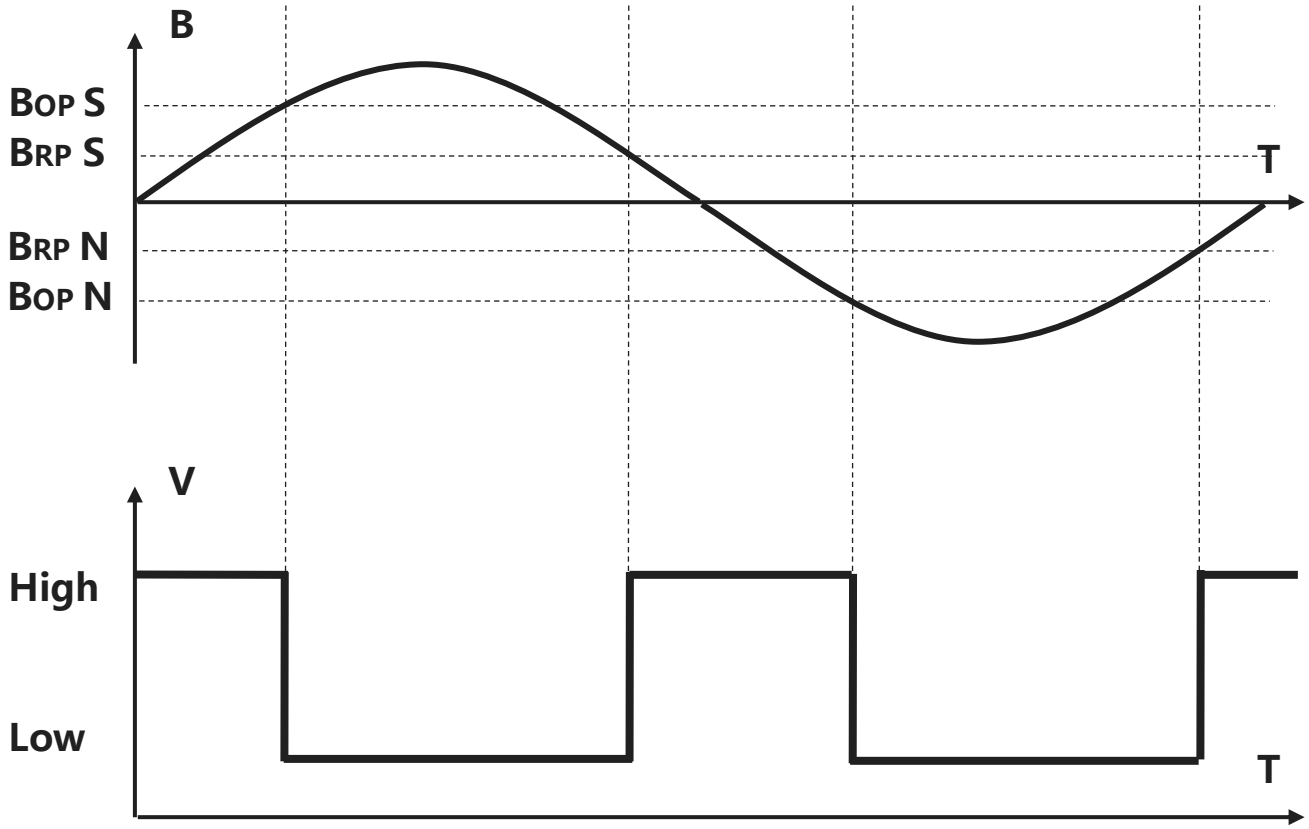


Figure.9 Digital Output vs. Magnetic Flux Density

11 Typical Application Circuit

MT8691AT as example

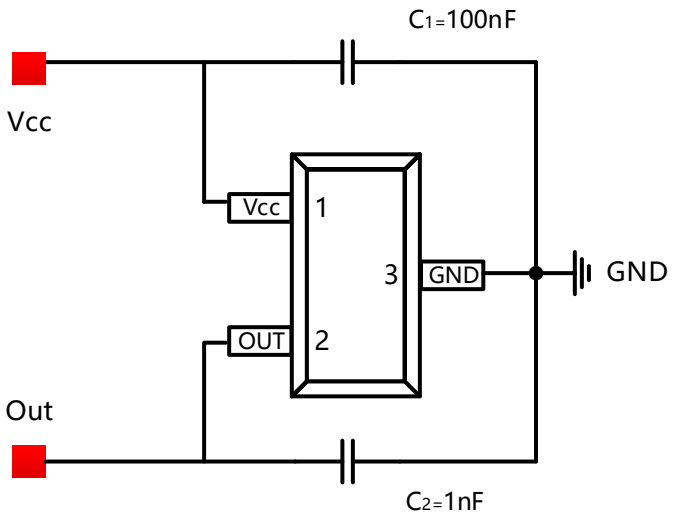


Figure.10 Typical Application Circuit

12 Package Material Information (For Reference Only – Not for Tooling Use)

12.1 SOT-23 Package Information

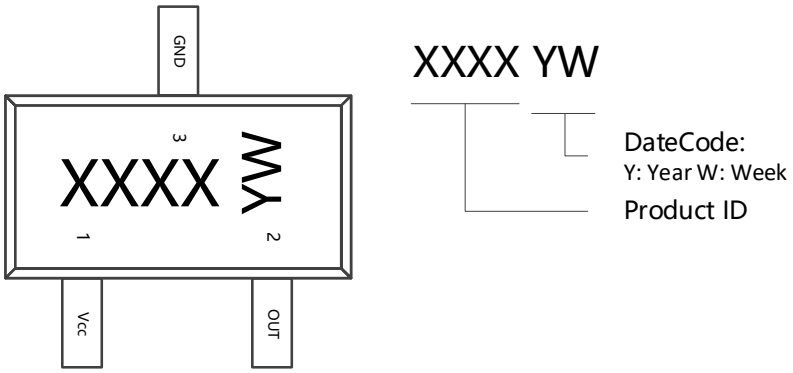


Figure.11 SOT-23 Chip Marking Spec

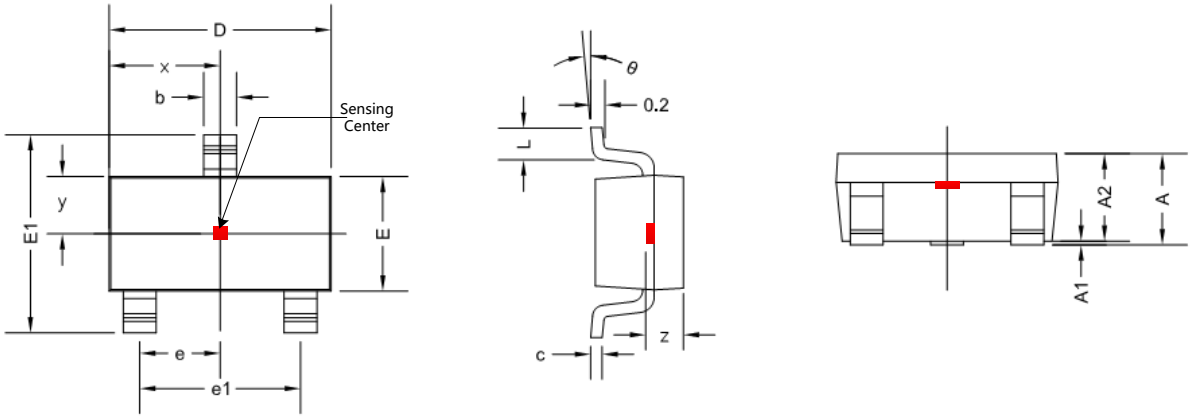


Figure.12 SOT-23 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	-	1.300	-	0.0512
A1	0.000	0.150	0.0000	0.0059
A2	1.000	1.200	0.0394	0.0472
b	0.300	0.500	0.0118	0.0197
c	0.080	0.220	0.0031	0.0087
D	2.800	3.000	0.1102	0.1181
E	1.500	1.700	0.0591	0.0669
E1	2.600	3.000	0.1024	0.1181
e	0.870	1.030	0.0343	0.0406
e1	1.820	1.980	0.0717	0.0780
L	0.300	0.600	0.0118	0.0236
θ	0 °	8 °	0 °	8 °
x	1.450 TYP		0.057 TYP	
y	0.800 TYP		0.032 TYP	
z	0.600 TYP		0.024 TYP	

12.2 Flat TO-92 Package Information

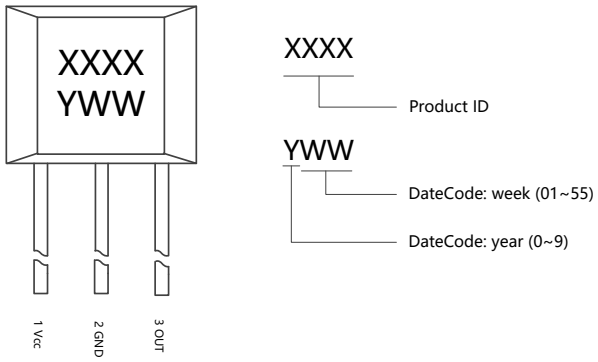


Figure.13 Flat TO-92 Chip Marking Spec

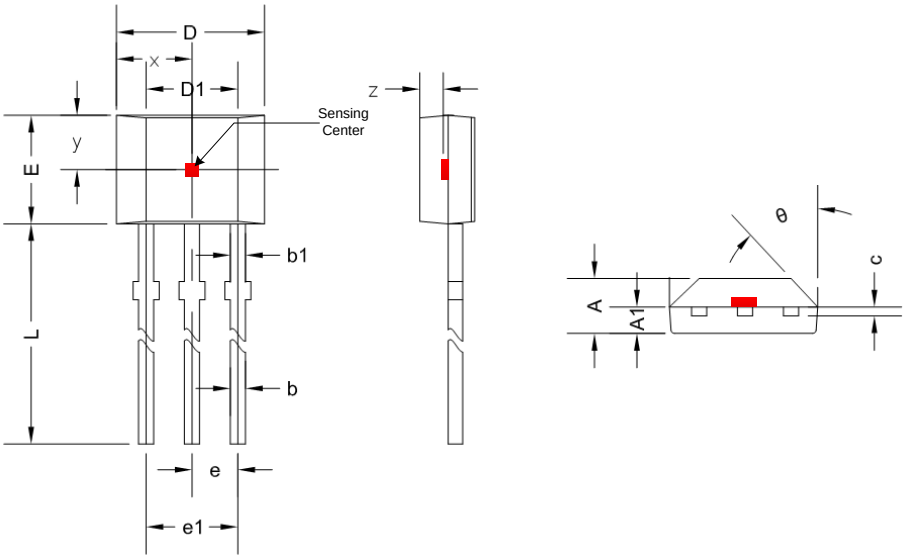


Figure.14 Flat TO-92 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.620	0.056	0.064
A1	0.660	0.860	0.026	0.034
b	0.350	0.480	0.013	0.019
b1	0.400	0.510	0.016	0.020
c	0.330	0.510	0.013	0.020
D	3.900	4.100	0.154	0.161
D1	2.280	2.680	0.090	0.106
E	3.050	3.250	0.120	0.128
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.350	14.750	0.565	0.581
θ	45 ° TYP		45 ° TYP	
x	2.025 TYP		0.080 TYP	
y	1.545 TYP		0.061 TYP	
z	0.500 TYP		0.020 TYP	

12.3 DFN1608 Package Information

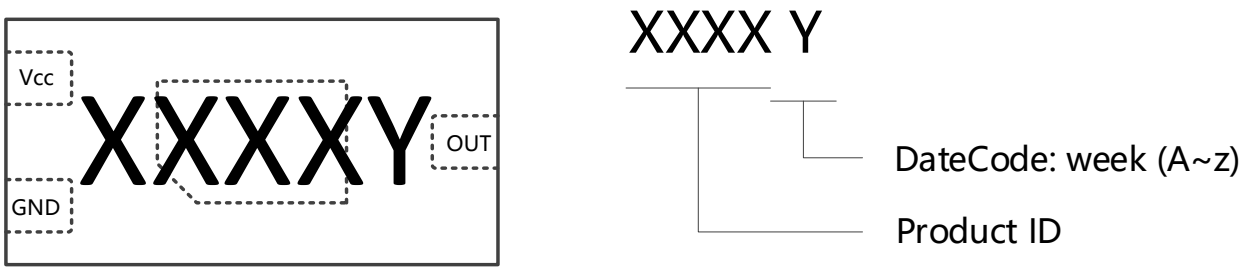


Figure.15 DFN1608 Chip Marking Spec

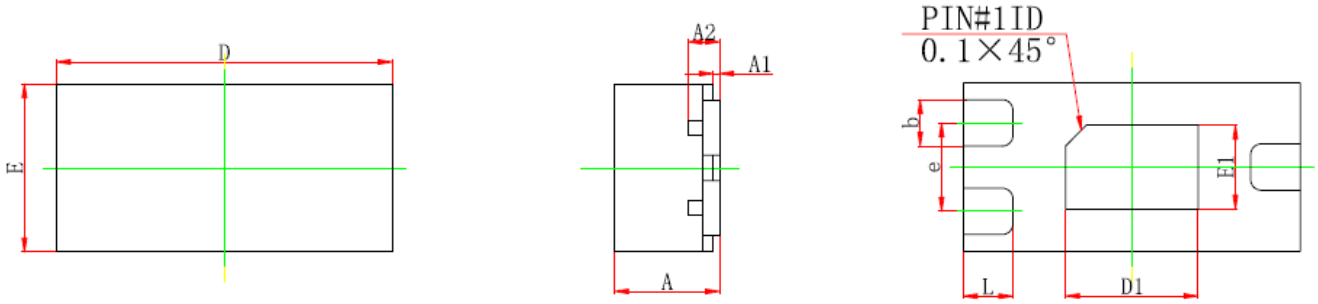


Figure.16 DFN1608 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.450	0.550	0.018	0.022
A1	0.000	0.050	0.000	0.002
A2		0.150 TYP		0.006 TYP
D	1.550	1.650	0.061	0.065
E	0.750	0.850	0.030	0.033
D1	0.580	0.680	0.023	0.027
E1	0.350	0.450	0.014	0.018
b	0.170	0.270	0.007	0.011
e		0.420 TYP		0.017 TYP
L	0.185	0.285	0.007	0.011

12.4 DFN1616 Package Information

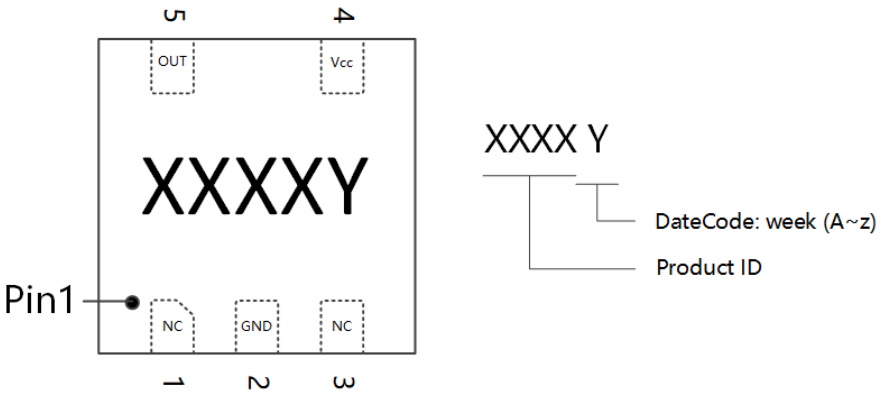


Figure.17 DFN1616 Chip Marking Spec

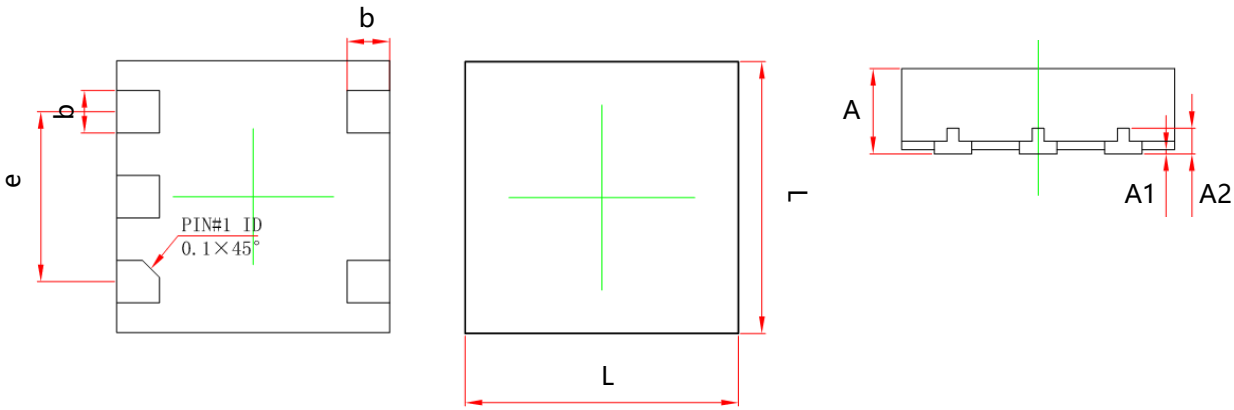


Figure.18 DFN1616 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.450	0.550	0.018	0.022
A1	0.000	0.050	0.000	0.002
A2		0.150 TYP		0.006 TYP
L	1.550	1.650	0.061	0.065
b	0.200	0.300	0.008	0.012
e		1.000 TYP		0.039 TYP

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