

## Uni-polar, Hall-Effect Switch IC

### 1 Product Description

The MT871X family is produced by BCD technology with both high performance and high reliability. The Hall IC internally includes an on-chip Hall voltage generator, a voltage regulator for operation with supply voltage of 2.4V to 24V, temperature compensation circuitry, small-signal amplifier, Hall IC with dynamic offset cancellation system, Schmitt trigger and an open collector output. It also includes an clamp diode at output and reversed power supply protection enhances the robustness of Hall IC.

The Hall IC designed to respond to a single poles. While the magnetic flux density(B) is larger than operating point (BOP), the output will be turned on (Low), the output is held until the magnetic flux density(B) is lower than releasing point (BRP), then turn off (High).

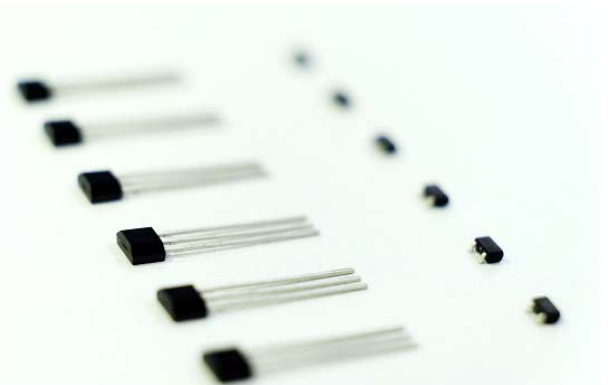
The MT871X family provides a variety of packages to customers: SOT-23/SOT-23 (Thin Outline) for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.

### 2 Features

- BCD Technology
- Uni-polar Switch
- 2.4~24V Operating Vcc Range
- -40°C~150°C Operating Temperature
- Package Option:
  - Flat TO-92
  - SOT-23
  - SOT-23 (Thin Outline)
- Magnetic Sensitivity Option:
  - MT8711 (BOP=85Gs, BRP=55Gs)
  - MT8712 (BOP=130Gs, BRP=100Gs)
  - MT8713 (BOP=30Gs, BRP=20Gs)
- Open Drain Output
- -27V Reversed Power Supply Protection
- Output Limiting Current Protection
- RoHS Compliant: (EU)2015/863

### 3 Product Overview of MT871X

Part No.	Description
MT871XA	Flat TO-92, bulk packaging (1000pcs/bag)
MT871XAT	SOT-23, tape & reel (3000pcs/bag)
MT871XET	SOT-23 (thin outline), tape & reel (3000pcs/bag)



### 4 Applications

- Home appliances
- DC Fan, Electric tools
- Industrial
- Magnetic Encoder

### 5. Pin Configuration and Functions

	Vcc	Out	GND
SOT-23	1	2	3
SOT-23 Thin Outline	1	2	3
Flat TO-92	1	3	2
Description	Power	Output Open-Drain	Ground

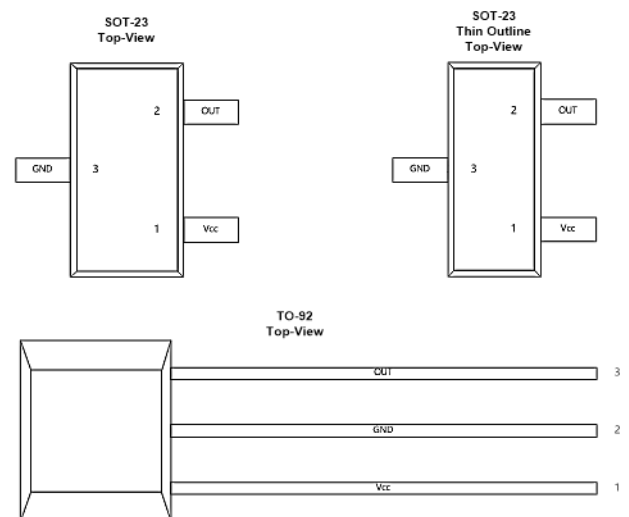


Figure.1 Pin Configuration & Functions

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## Reversion History

- Rev1.0 Originally Version
- Rev1.1 Update Supply Current
- Rev1.2 Update Small SOT-23 Package Outline Dimensions

## 6 Definition of Switching Function

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

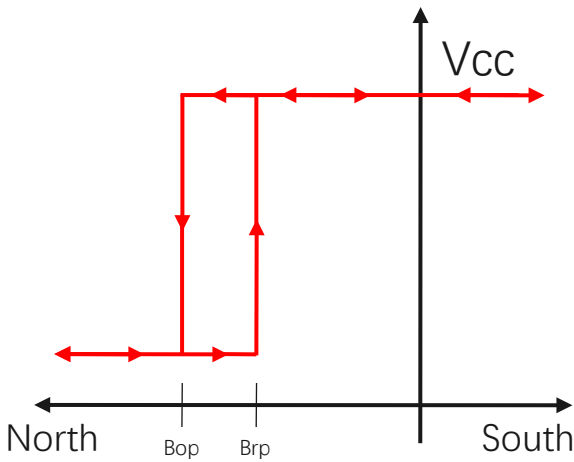


Figure.2 Switching Function Uni-polar (North)  
SOT-23

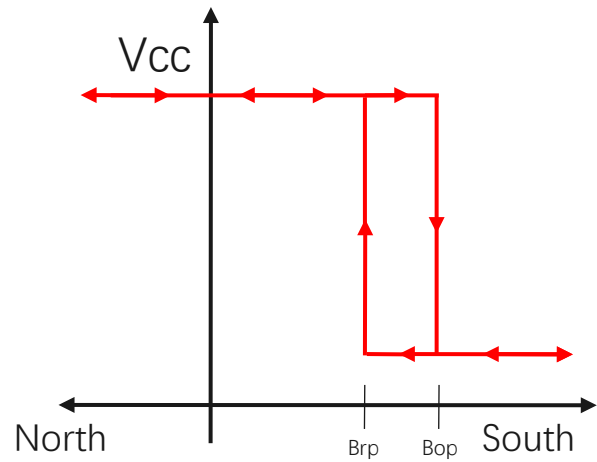


Figure.3 Switching Function Uni-polar (South)  
Flat TO-92 / SOT-23 (Thin Outline)

## 7 Function Description

**B<sub>OP</sub>:** Operating Point, Magnetic flux density applied on the branded side of the package which turns the output driver ON ( $V_{OUT}=Low$ )

**B<sub>RP</sub>:** Releasing Point, Magnetic flux density applied on the branded side of the package which turns the output driver OFF ( $V_{OUT}=High$ )

**B<sub>HYST</sub>:** 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 MT871X device is sensitive to the magnetic field component that is perpendicular to the top of the package

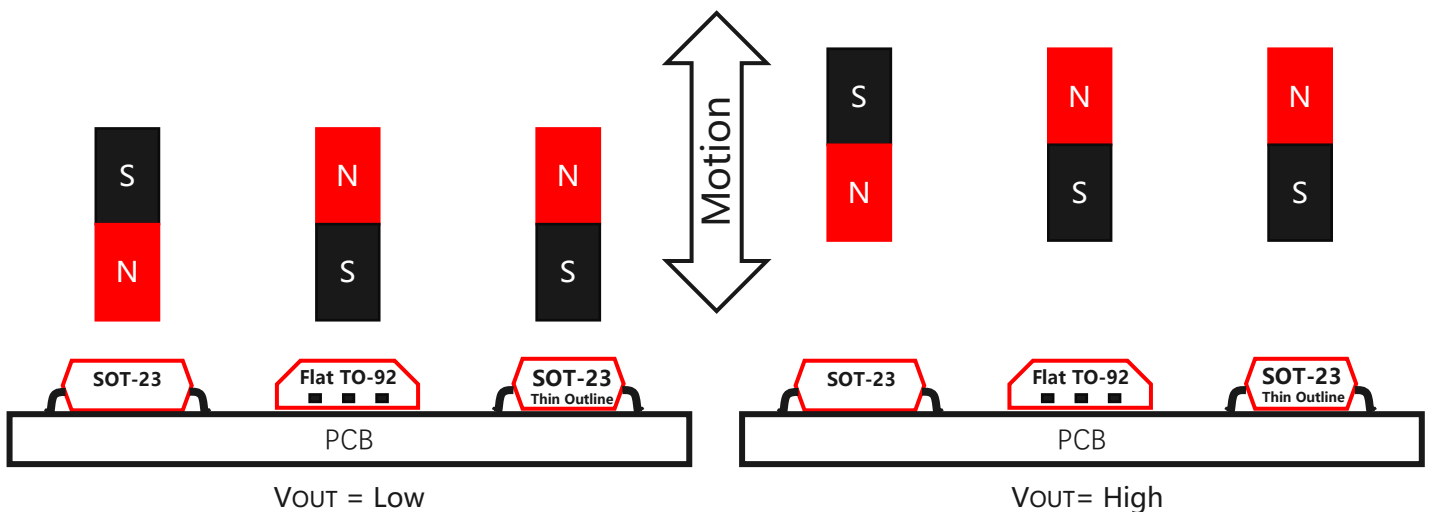
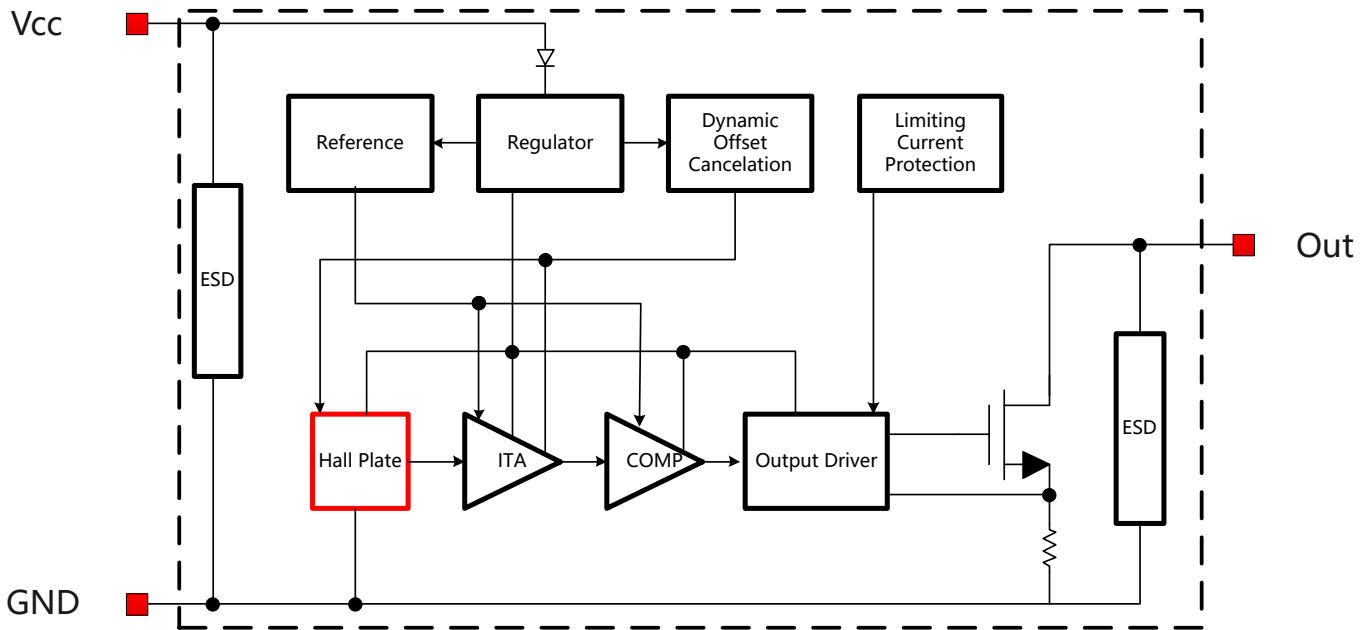


Figure.4 Flux Direction Polarity

## 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
VCC	Supply Voltage	-	27	V
V <sub>RCC</sub>	Reversed Power Supply Protection	-27	-	V
V <sub>OUT</sub>	Output Voltage	-	27	V
I <sub>OUT</sub>	Continuous Output Current	-	25	mA
T <sub>A</sub>	Operating Ambient Temperature	-40	150	°C
T <sub>S</sub>	Storage Temperature	-50	150	°C
T <sub>J</sub>	Junction Temperature	-	165	°C
B	Magnetic Flux Density	No Limit		Gs

## 10.2 Electrical Specifications

At  $T_A = -40 \sim 150^\circ\text{C}$ ,  $V_{CC} = 2.4\text{V} \sim 24\text{V}$  (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
$V_{CC}$	Supply Voltage	Operating	2.4	-	24	V
$I_{CC}$	Supply Current	$V_{CC} = 5\text{V}$	-	0.6	-	mA
$I_{AW}$	Awake Current	$V_{CC} = 5\text{V}$	-	1.2	-	mA
$V_{OL}$	Output Low Voltage	$I_{OUT} = 10\text{mA}$ , $ B  >  B_{OP} $	-	-	0.4	V
$F_{SW}$	Sampling Frequency	$V_{CC} = 5\text{V}$	-	15	-	KHz
$T_{PO}$	Power on Time	$dV_{CC}/dt > 5\text{V}/\mu\text{s}$ , $ B  >  B_{OP} $	-	-	25	$\mu\text{s}$
$R_{TH}$	Thermal Resistance of SOT-23		-	301	-	$^\circ\text{C}/\text{W}$
	Thermal Resistance of SOT-23 (Thin Outline)		-	301	-	$^\circ\text{C}/\text{W}$
	Thermal Resistance of TO-92		-	230	-	$^\circ\text{C}/\text{W}$

## 10.3 Magnetic Characteristics

At  $V_{CC} = 2.4\text{V} \sim 24\text{V}$  (unless otherwise specified)

Part No.	Symbol	Min	Typ	Max	Unit
MT8711 Series	BOP, $T_A = 25^\circ\text{C}$	65	85	105	Gs
	BRP, $T_A = 25^\circ\text{C}$	35	55	75	Gs
	BHYST, $T_A = 25^\circ\text{C}$	20	30	40	Gs
MT8712 Series	BOP, $T_A = 25^\circ\text{C}$	110	130	150	Gs
	BRP, $T_A = 25^\circ\text{C}$	80	100	120	Gs
	BHYST, $T_A = 25^\circ\text{C}$	20	30	40	Gs
MT8713 Series	BOP, $T_A = 25^\circ\text{C}$	20	30	40	Gs
	BRP, $T_A = 25^\circ\text{C}$	10	20	30	Gs
	BHYST, $T_A = 25^\circ\text{C}$	3	10	17	Gs

## 10.4 ESD Ratings

Symbol	Reference	Values	Unit	
$V_{ESD}$	Human-body model (HBM)	AEC-Q100-002	$\pm 6000$	V
	Charged-device model (CDM)	AEC-Q100-011	$\pm 1000$	V

### 10.5 Characteristic Performance

At  $V_{CC}=5V$

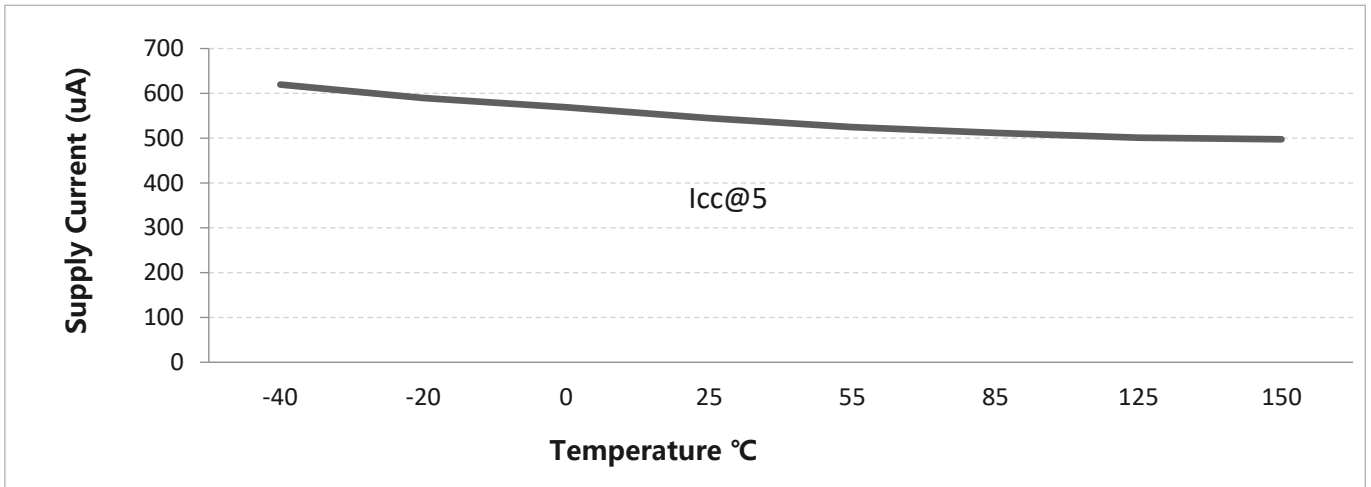


Figure.6 Supply Current vs. Temperature

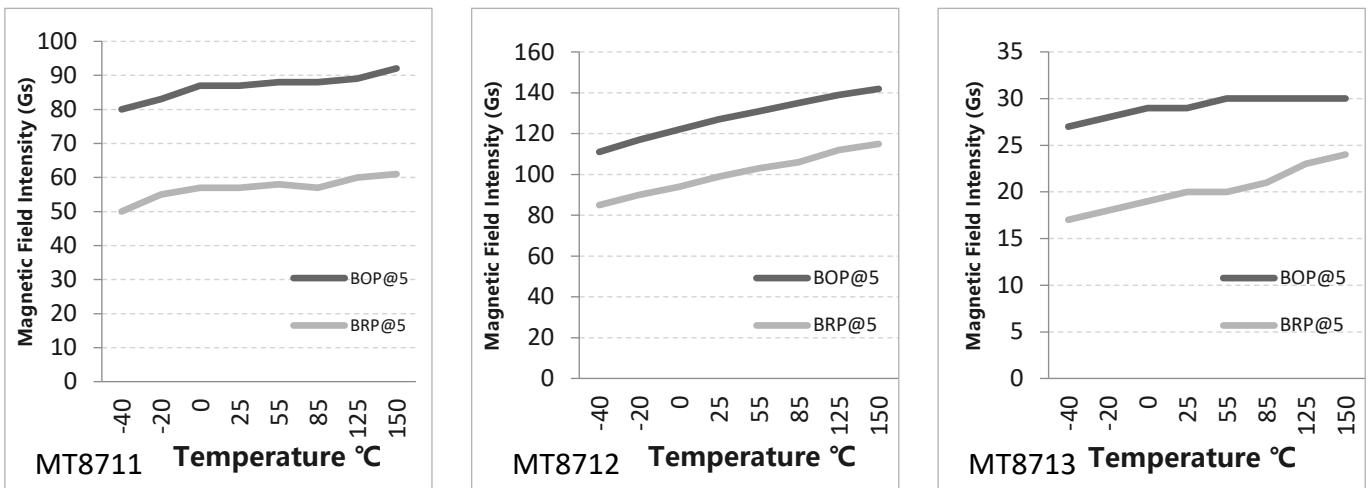


Figure.7 Magnetic Characteristics vs. Temperature (BOP & BRP)

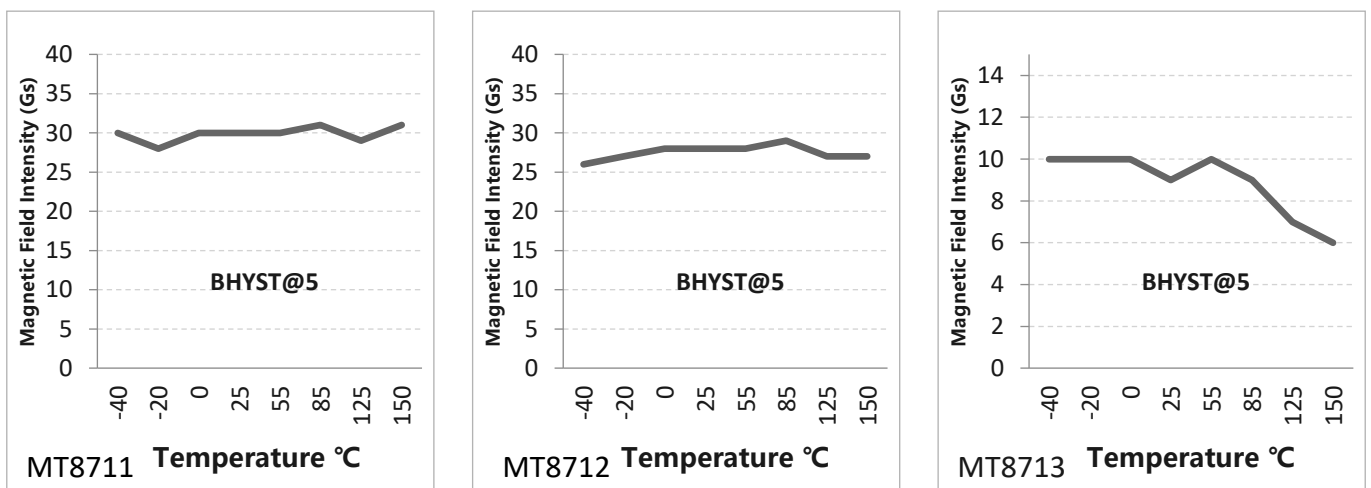


Figure.8 Magnetic Characteristics vs. Temperature (BHYST)

### 10.6 Typical Output Waveform

MT871XA as example

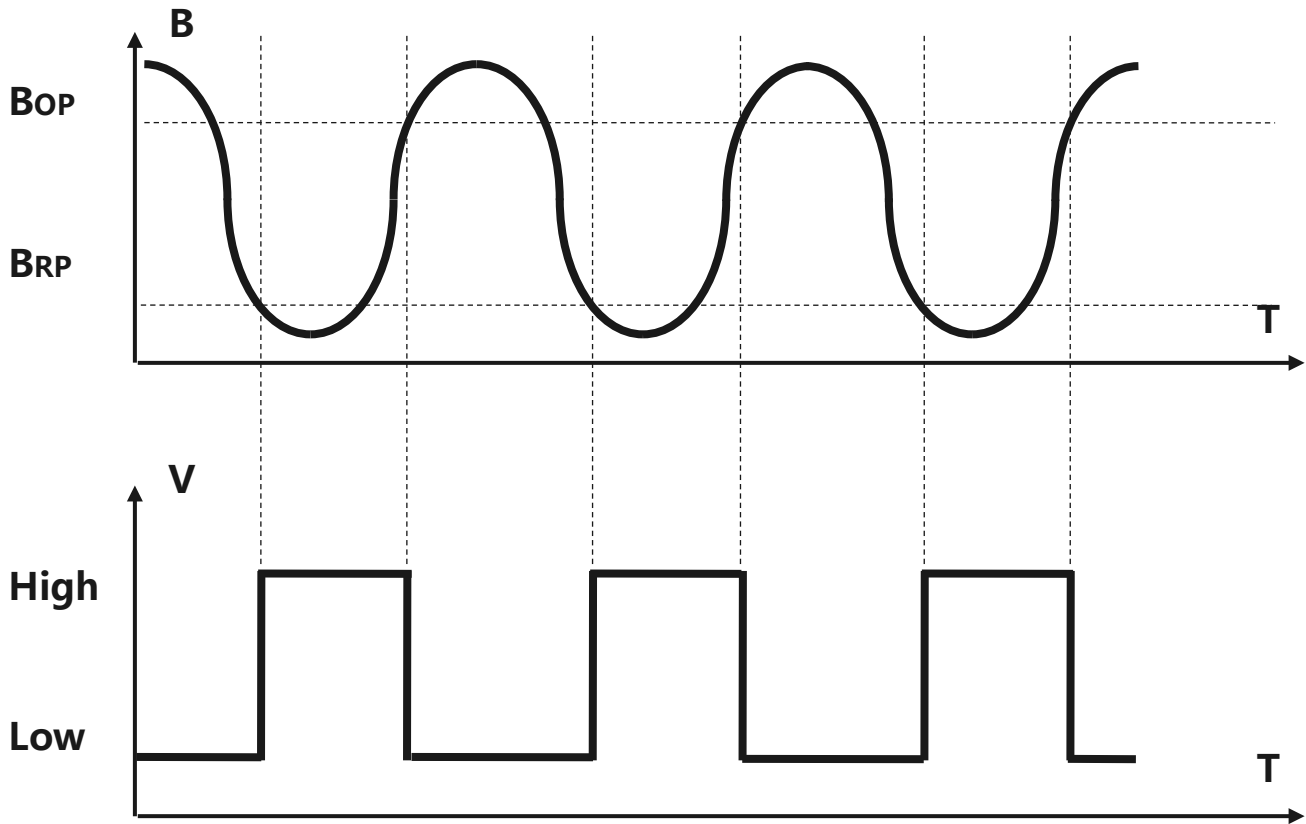


Figure.9 Digital Output vs. Magnetic Flux Density

### 11 Typical Application Circuit

MT871XAT as example

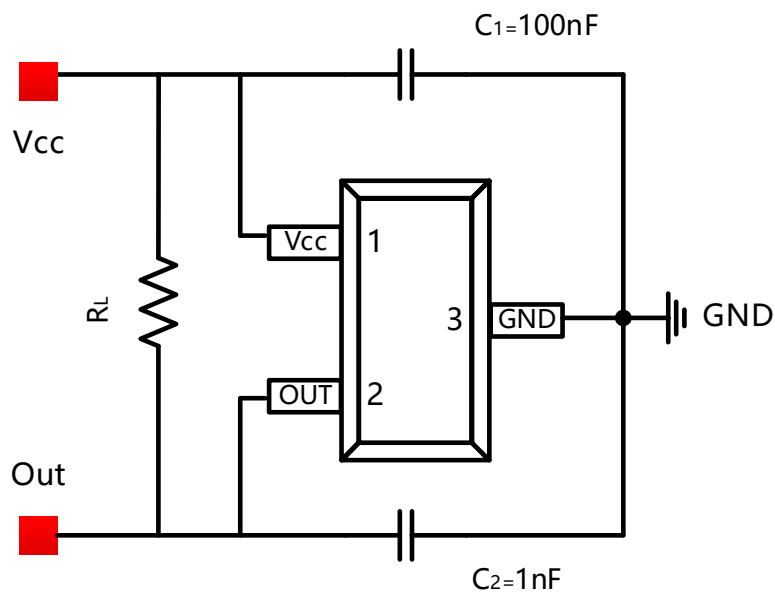
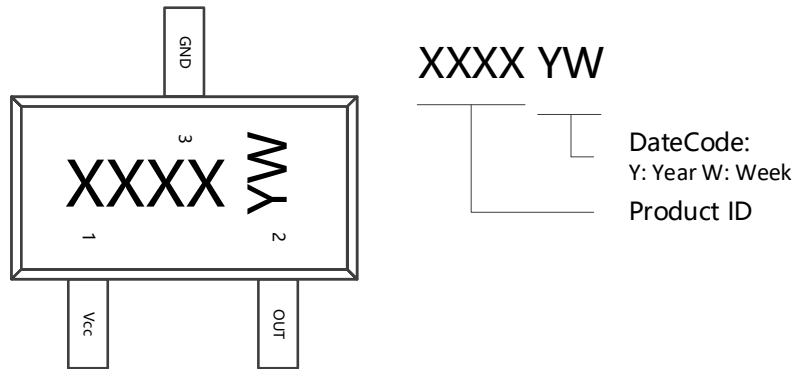


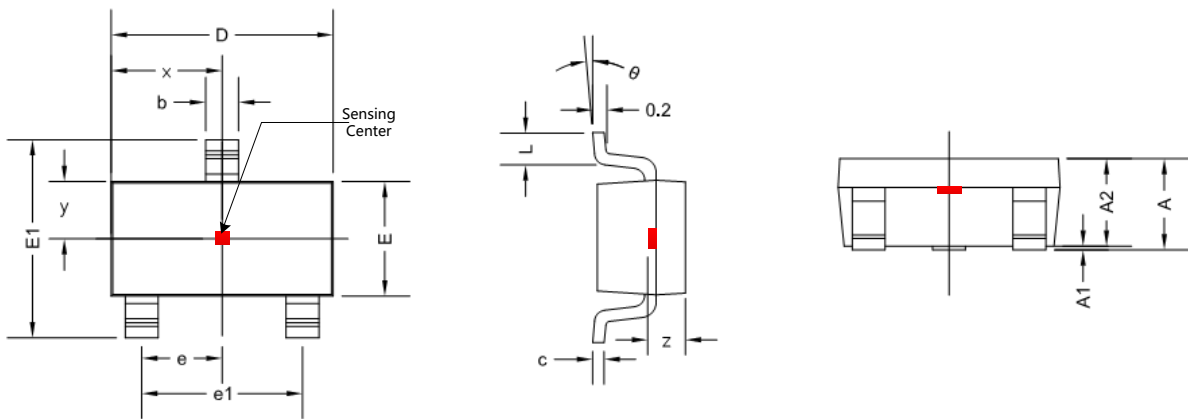
Figure.10 Typical Application Circuit

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

### 12.1 SOT-23 Package Information



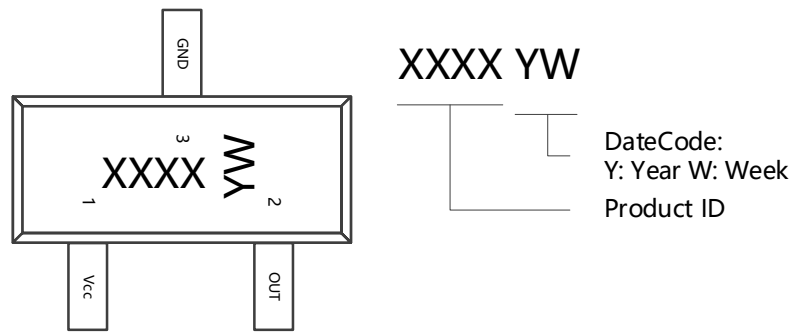
**Figure.11** SOT-23 Chip Marking Spec



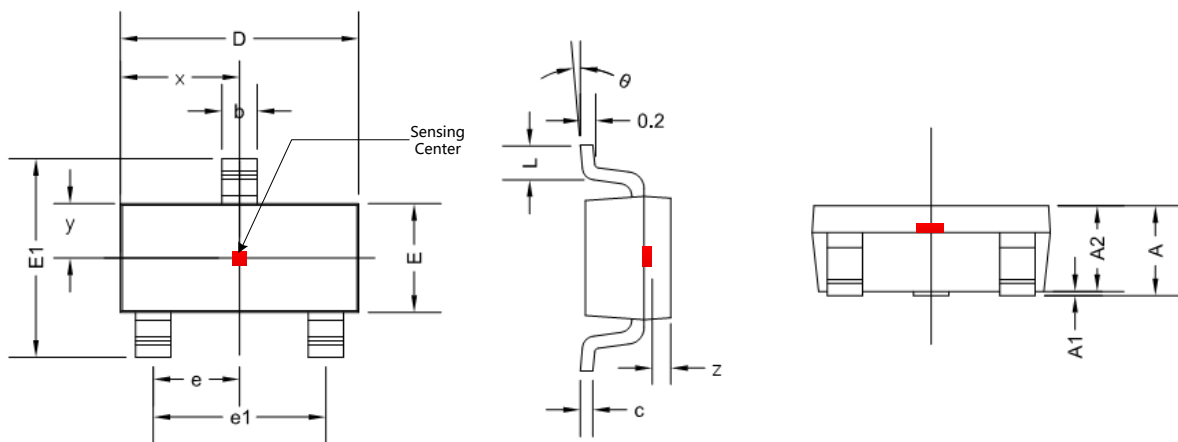
**Figure.12** SOT-23 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.050	1.300	0.041	0.051
A1	0.000	0.150	0.000	0.006
A2	1.000	1.200	0.039	0.047
b	0.300	0.500	0.012	0.020
c	0.080	0.220	0.003	0.009
D	2.800	3.020	0.110	0.119
E	1.500	1.700	0.059	0.067
E1	2.600	3.000	0.102	0.118
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
$\theta$	0 °	8 °	0 °	8 °
x	1.460 TYP		0.057 TYP	
y	0.800 TYP		0.032 TYP	
z	0.600 TYP		0.024 TYP	

## 12.2 SOT-23 (Thin Outline) Package Information



**Figure.13** SOT-23 (Thin Outline) Chip Marking Spec



**Figure.14** SOT-23 (Thin Outline) Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.890	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.880	1.100	0.035	0.043
b	0.300	0.500	0.012	0.020
c	0.080	0.202	0.003	0.008
D	2.800	3.040	0.110	0.120
E1	2.100	2.640	0.083	0.104
E	1.200	1.400	0.048	0.055
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.236
L1	0.540	0.550	0.021	0.022
$\theta$	0°	8°	0°	8°
x	1.460 TYP		0.057 TYP	
y	0.650 TYP		0.026 TYP	
z	0.500 TYP		0.020 TYP	

## 12.2 Flat TO-92 Package Information

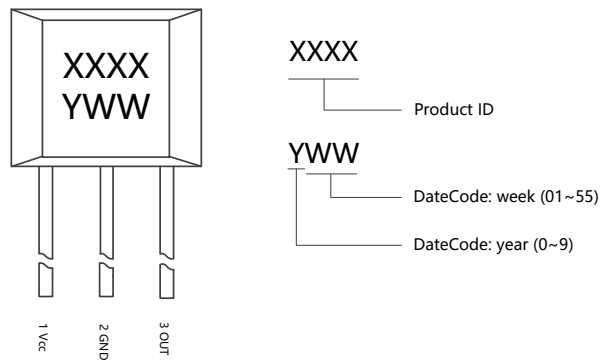


Figure.13 Flat TO-92 Chip Marking Spec

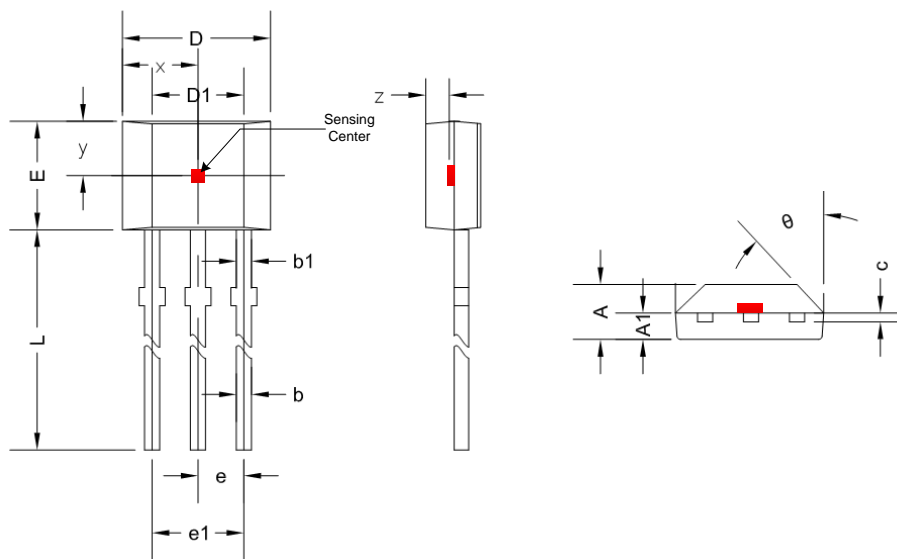


Figure.14 Flat TO-92 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.620	0.056	0.064
A1	0.660	0.910	0.026	0.036
b	0.330	0.560	0.013	0.022
b1	0.400	0.510	0.016	0.020
c	0.330	0.510	0.013	0.020
D	3.900	4.200	0.154	0.165
D1	2.280	2.680	0.090	0.106
E	2.900	3.280	0.114	0.128
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	13.500	16.200	0.531	0.638
$\theta$	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	

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