

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).

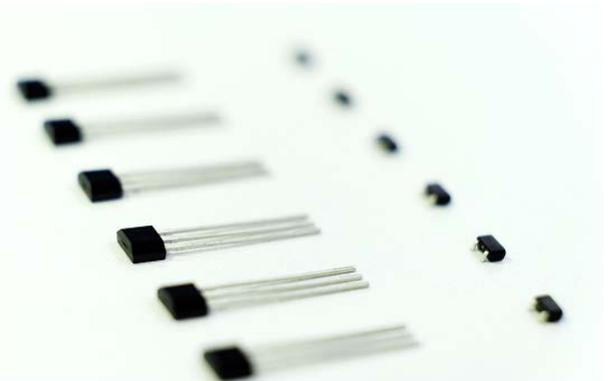
The MT871X family provides a variety of packages to customers: SOT-23/SOT-23 (Thin Outline) for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.

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 |

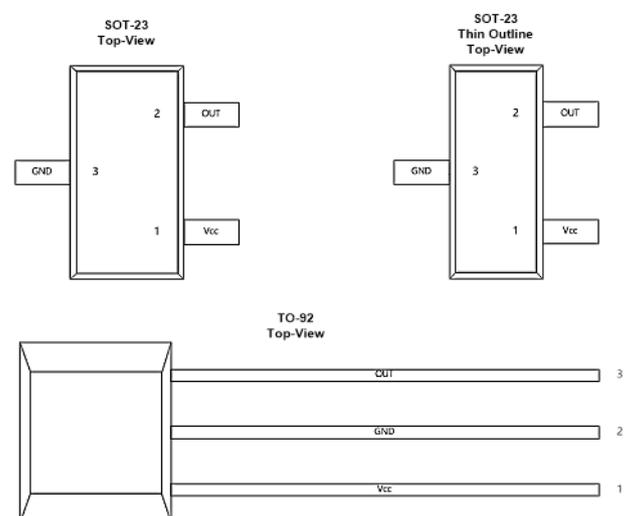


Figure.1 Pin Configuration & Functions

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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

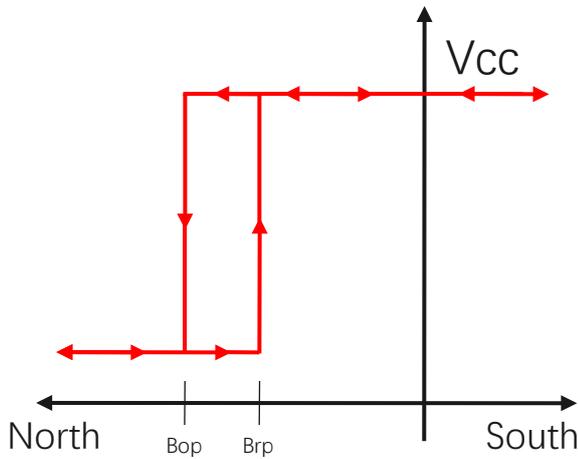


Figure.2 Switching Function Uni-polar (North)
SOT-23

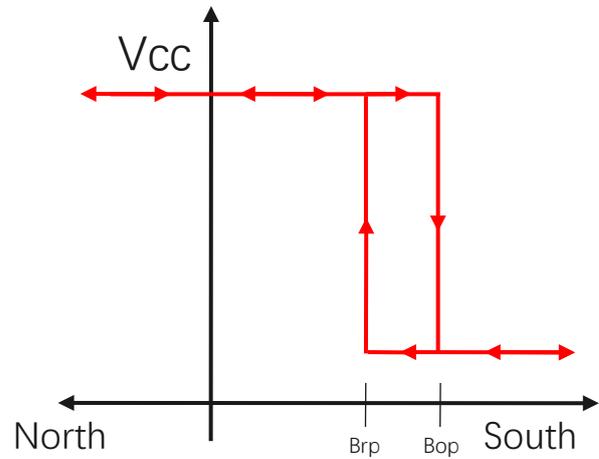


Figure.3 Switching Function Uni-polar (South)
Flat TO-92 / SOT-23 (Thin Outline)

7 Function Description

B_{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 MT871X device is sensitive to the magnetic field component that is perpendicular to the top of the package

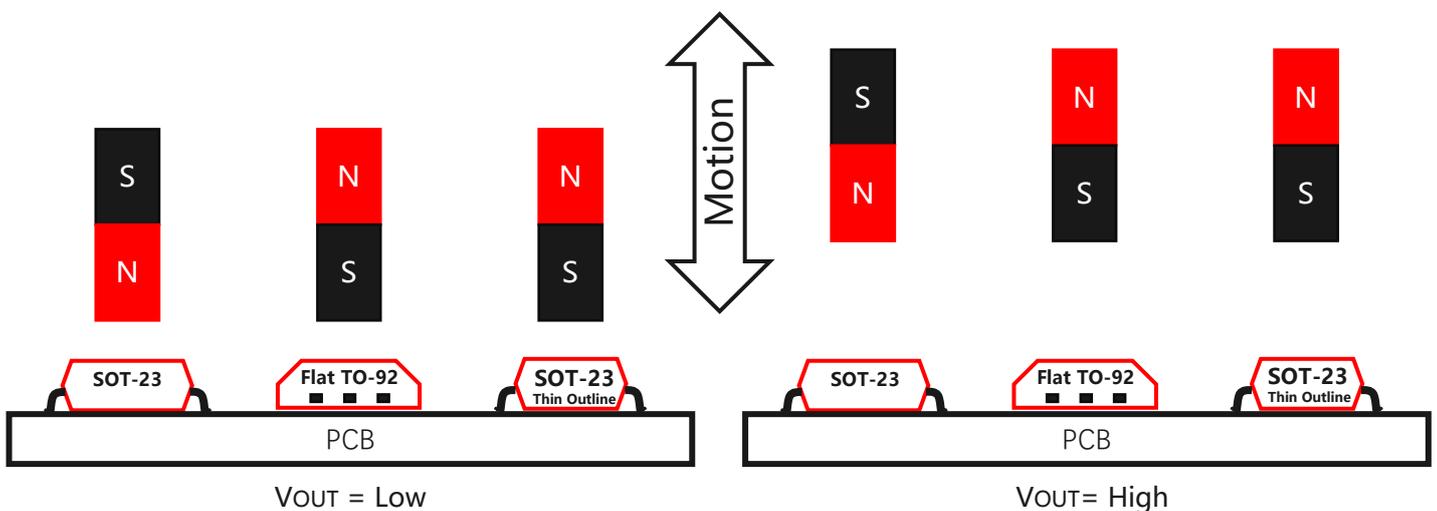


Figure.4 Flux Direction Polarity

9 Functional Block Diagram

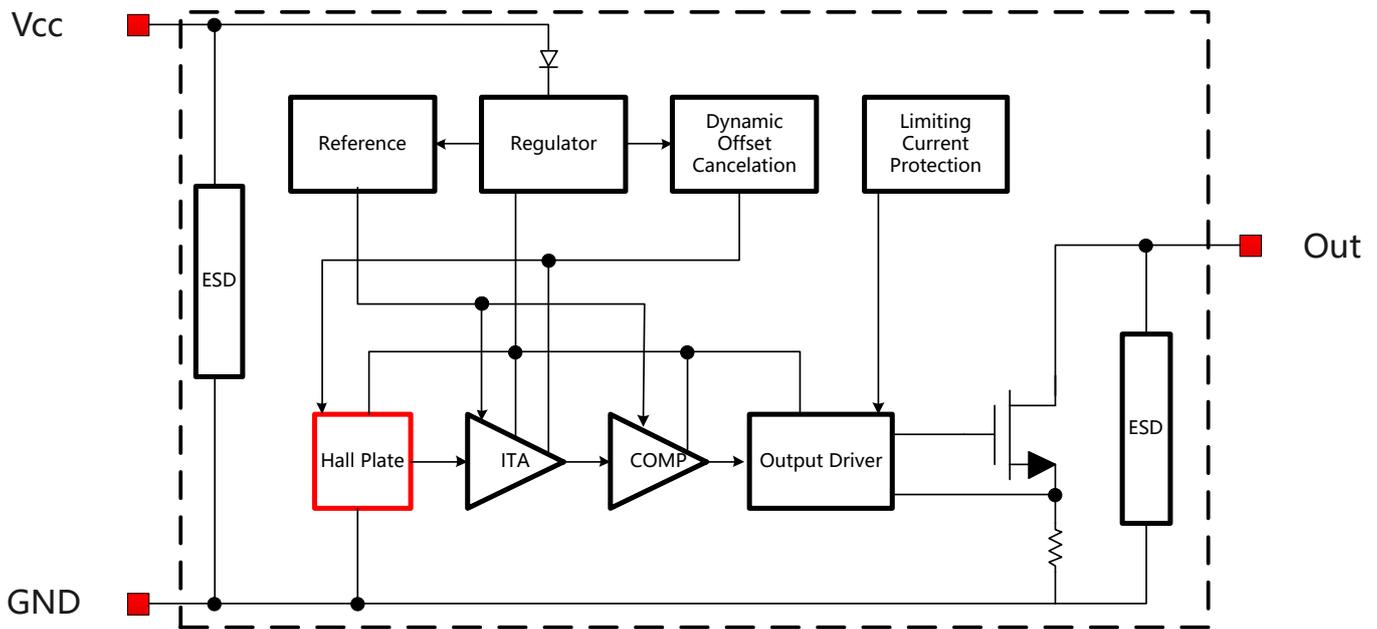


Figure.5 Functional Block Diagram

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 _{RCC} | Reversed Power Supply Protection | -27 | - | V |
| V _{OUT} | Output Voltage | - | 27 | V |
| I _{OUT} | Continuous Output Current | - | 25 | mA |
| T _A | Operating Ambient Temperature | -40 | 150 | °C |
| T _S | Storage Temperature | -50 | 150 | °C |
| T _J | 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 | μs |
| 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 | ± 6000 | V |
| | Charged-device model (CDM) | AEC-Q100-011 | ± 1000 | V |

10.5 Characteristic Performance

At $V_{CC}=5V$

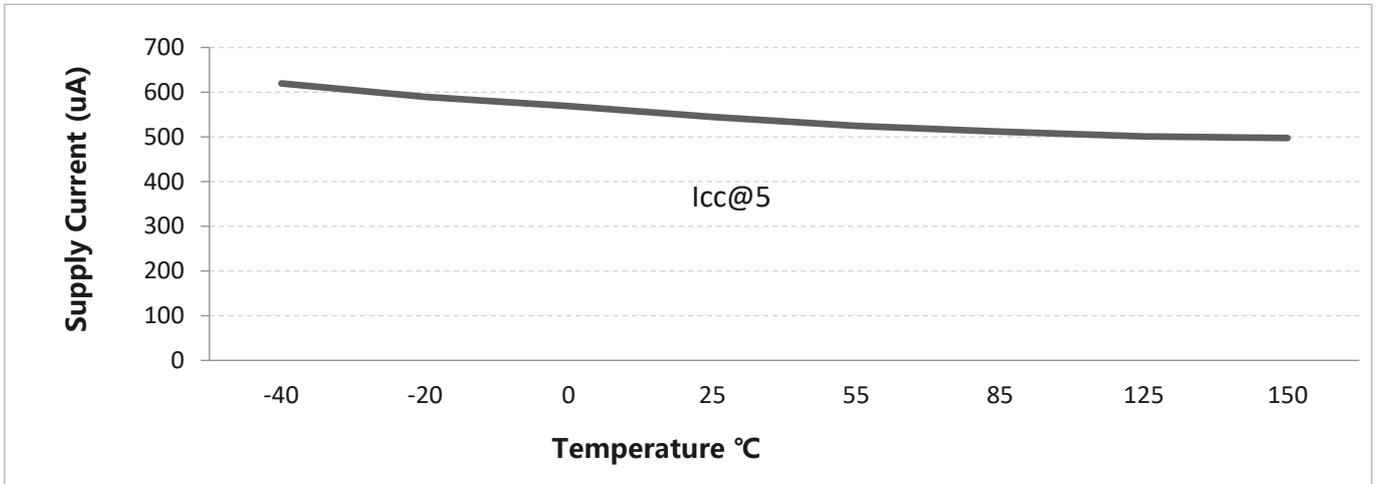


Figure.6 Supply Current vs. Temperature

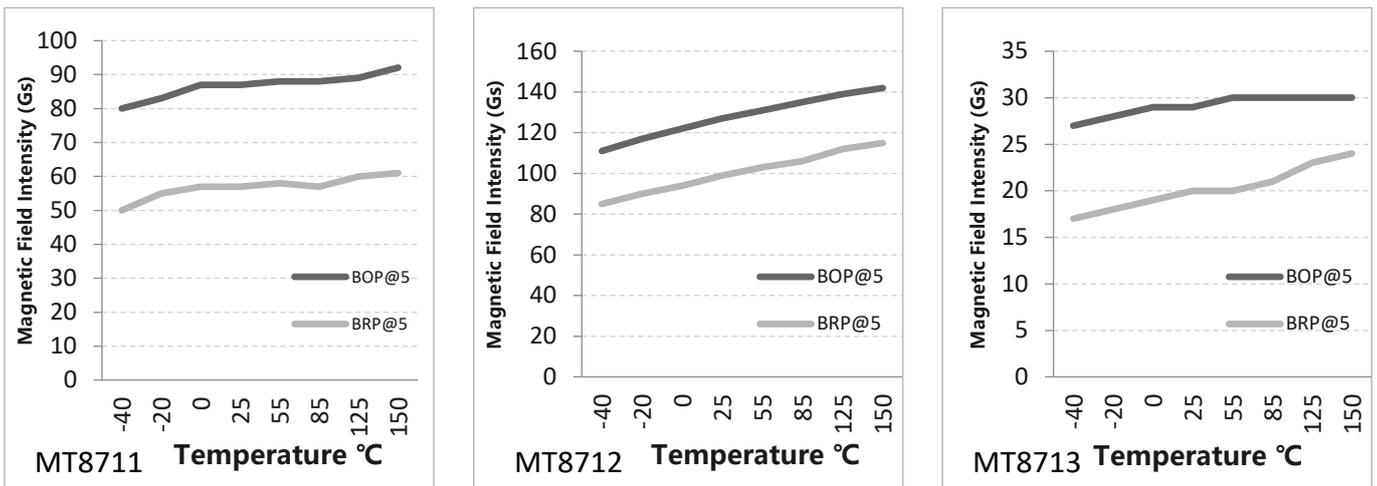


Figure.7 Magnetic Characteristics vs. Temperature (BOP & BRP)

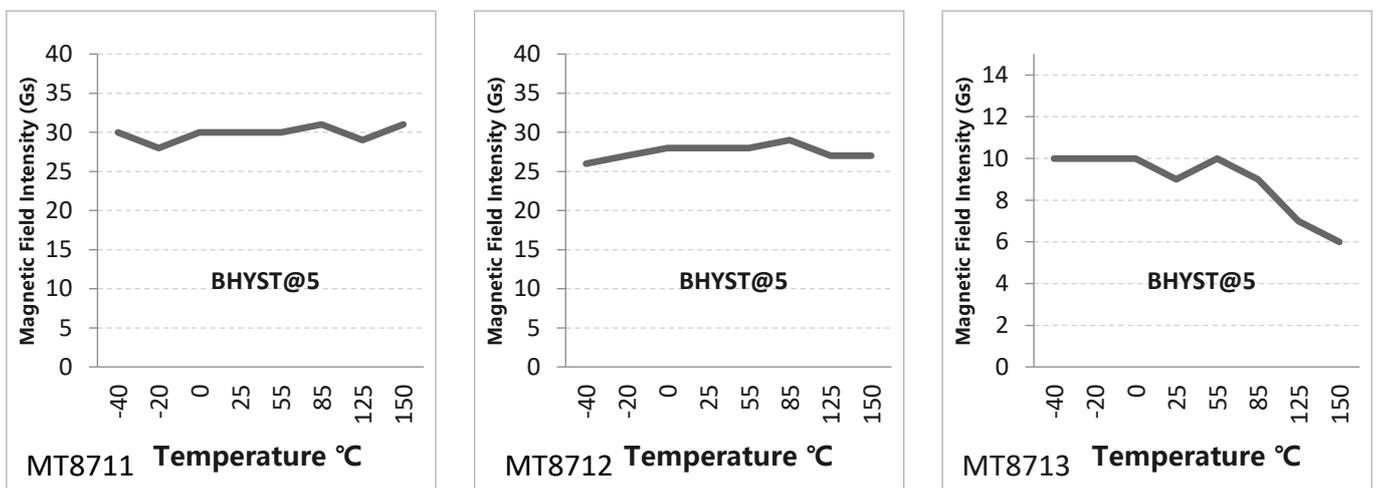


Figure.8 Magnetic Characteristics vs. Temperature (BHYST)

10.6 Typical Output Waveform

MT871XA as example

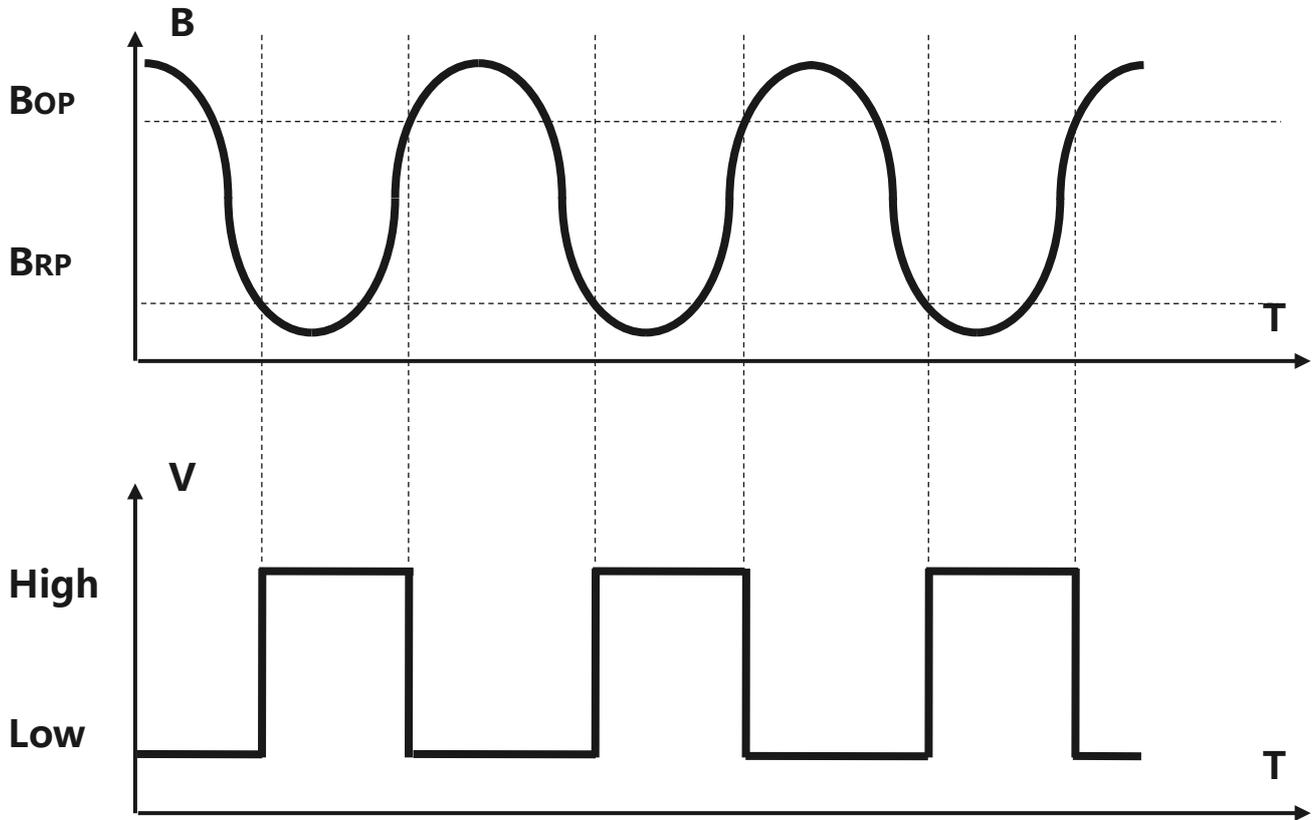


Figure.9 Digital Output vs. Magnetic Flux Density

11 Typical Application Circuit

MT871XAT as example

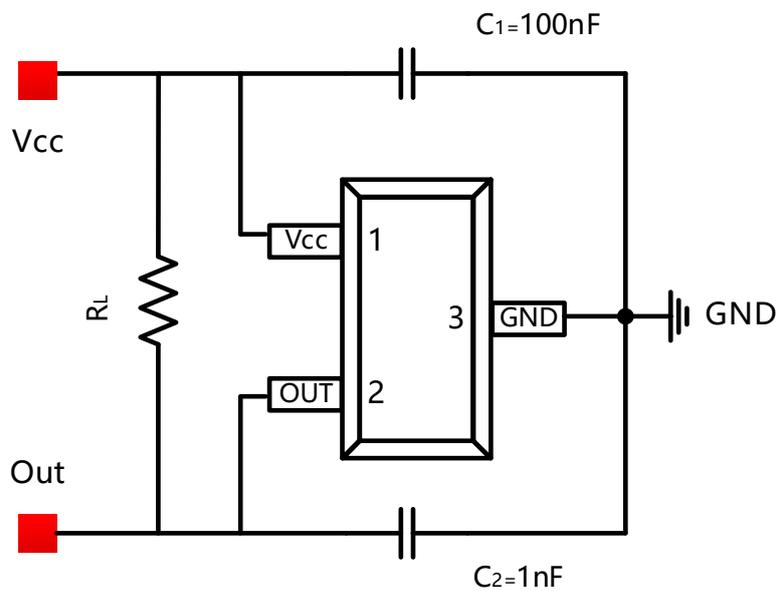


Figure.10 Typical Application Circuit

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

12.1 SOT-23 Package Information

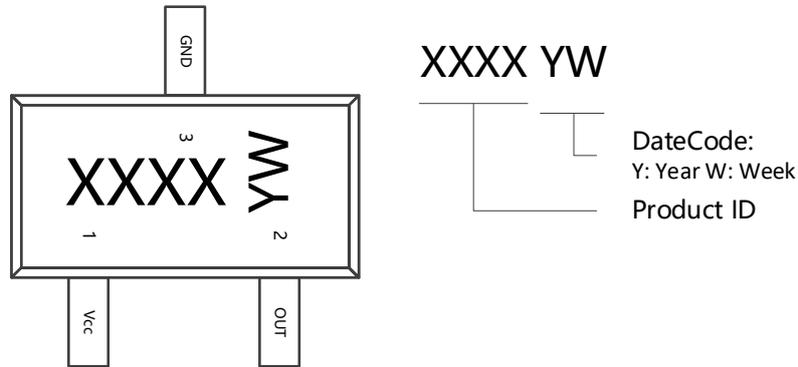


Figure.11 SOT-23 Chip Marking Spec

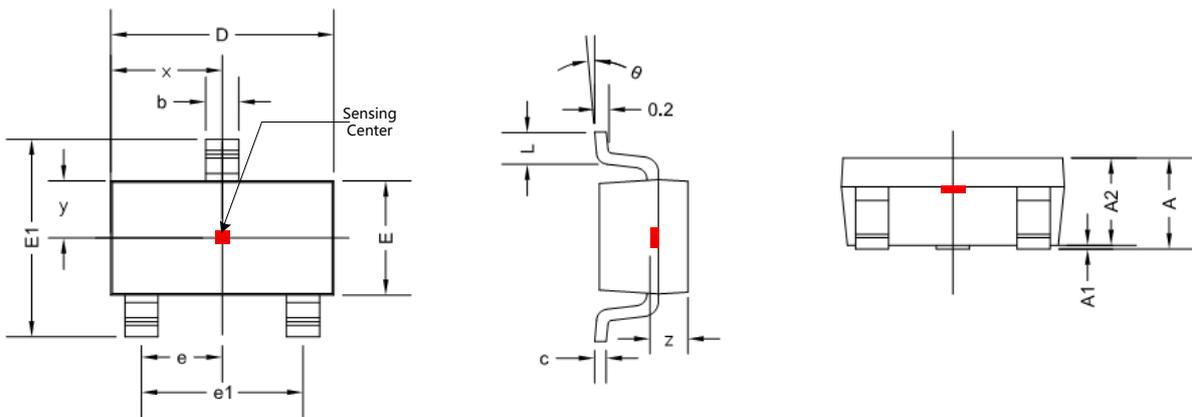


Figure.12 SOT-23 Package Drawing

| 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 |
| θ | 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

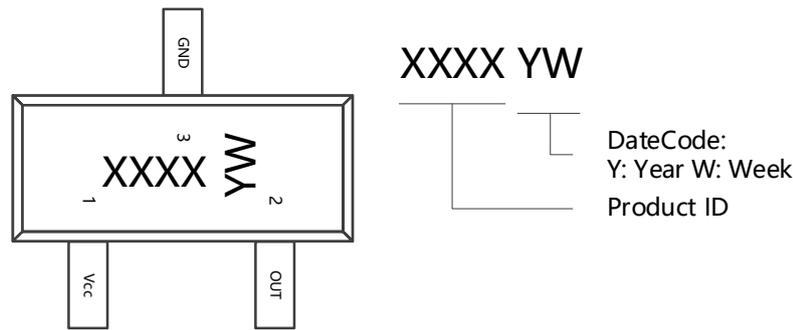


Figure.13 SOT-23 (Thin Outline) Chip Marking Spec

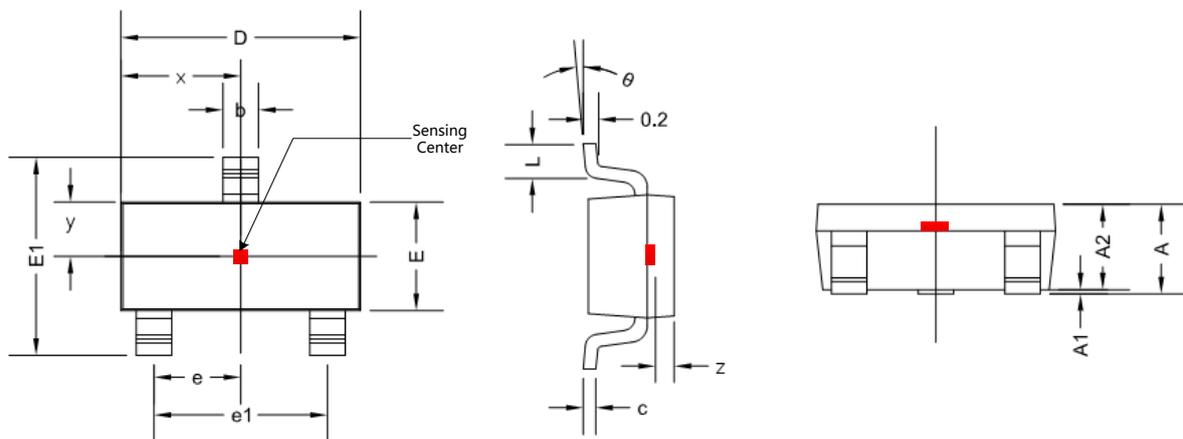


Figure.14 SOT-23 (Thin Outline) Package Drawing

| 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 |
| θ | 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

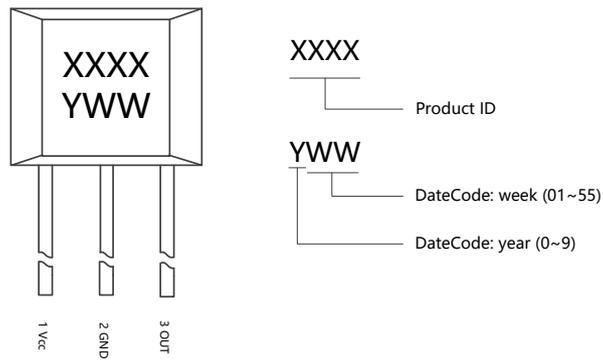


Figure.13 Flat TO-92 Chip Marking Spec

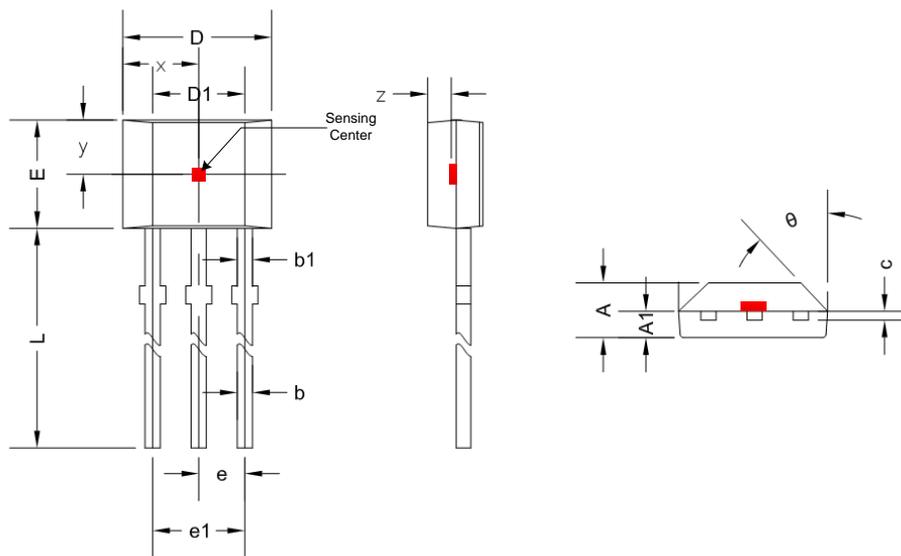


Figure.14 Flat TO-92 Package Drawing

| 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 |
| 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 | |

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