MT831X

AEC Qualified

Uni-polar, High Voltage Hall-Effect Switch IC

MagnTek

1 Product Description

The MT831X 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 3.8V to 60V, 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 (B_{OP}), the output will be turned on (Low), the output is held until the magnetic flux density(B) is lower than releasing point (B_{RP}), then turn off (High).

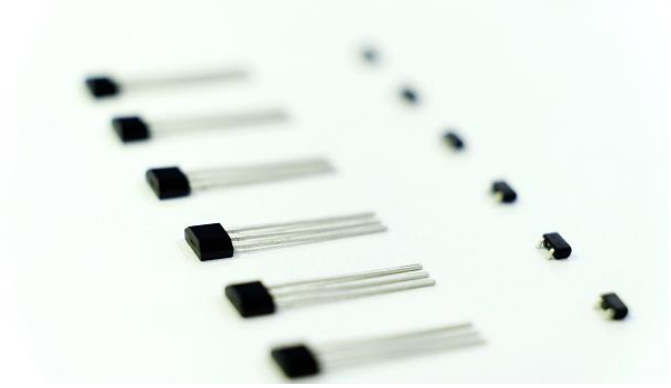
The MT831X family provides a variety of packages to customers: SOT-23/SOT-23 (Thin Outline)/SOT-89B for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.

2 Features

- AEC-Q100 Automotive Qualified
  MT831XAT & MT831XET
- Uni-polar Switch
- 3.8~60V Operating Vcc Range
- -40℃~150℃ Operating Temperature
- Package Option:
  Flat TO-92 / Flat TO-92 (Radial Lead) / SOT-23 / SOT-23 (Thin Outline) / SOT-89B
- Magnetic Sensitivity Option:
  MT8311 (B_{OP}=140Gs, B_{RP}=105Gs)
  MT8312 (B_{OP}=255Gs, B_{RP}=210Gs)
  MT8313 (B_{OP}=85Gs, B_{RP}=50Gs)
  MT8315 (B_{OP}=30Gs, B_{RP}=20Gs)
- Open-Drain Output
- -20V Reversed Power Supply Protection
- Output Limiting Current Protection
- RoHS Compliant: (EU)2015/863

3 Product Overview of MT831X

Part No.	Description
MT831XA	Flat TO-92, bulk packaging (1000pcs/bag)
MT831XA-T	Flat TO-92, radial lead, bulk packaging (1000pcs/bag)
MT831XAT	SOT-23, tape & reel (3000pcs/bag)
MT831XET	SOT-23 (Thin Outline), tape & reel (3000pcs/bag)

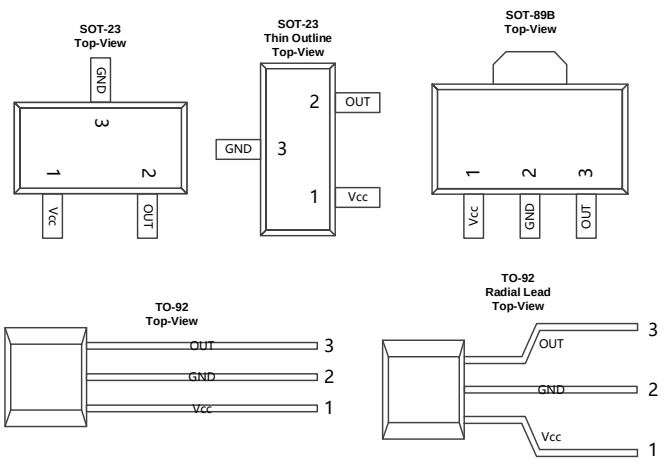


4 Applications

- Automotive, Home appliances, Industrial
- Speed Detection
- Position Detection
- Magnetic Encoder
- Solid-State Switch
- Proximity Switch

5. Pin Configuration and Functions

	Vcc	Out	GND
SOT-23	1	2	3
SOT-23 (Thin Outline)	1	2	3
Flat TO-92 (Radial Lead)	1	3	2
Flat TO-92	1	3	2
SOT-89B	1	3	2
Description	Power	Output Open-Drain	Ground



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Reversion History

1	Originally Version	
2	1.1 Version	Update MT8312 & MT8313 Series Update SOT-23 (Thin Outline) Package
3	1.2 Version	Update Flat TO-92 (Radial Lead) Package
4	1.3 Version	Update AEC-Q100 Automotive on MT831XAT
5	1.4 Version	Update RoHS compliant to (EU)2015/863
6	1.5 Version	Update AEC-Q100 Logo Update Copy Rights and Disclaimer
7	1.6 Version	Update AEC-Q100 Automotive on MT831XET
8	1.7 Version	Update MT8315 Series
9	1.8 Version	Update the marking spec of SOT-23 & SOT-23 (Thin Outline)

6 Definition of Switching Function

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

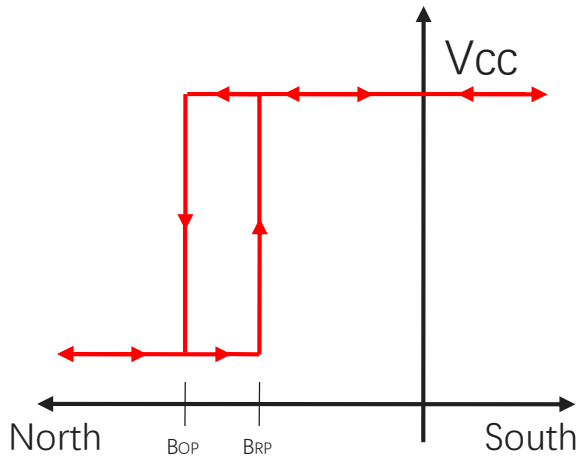


Figure.2 Switching Function Uni-polar (North)
SOT-23

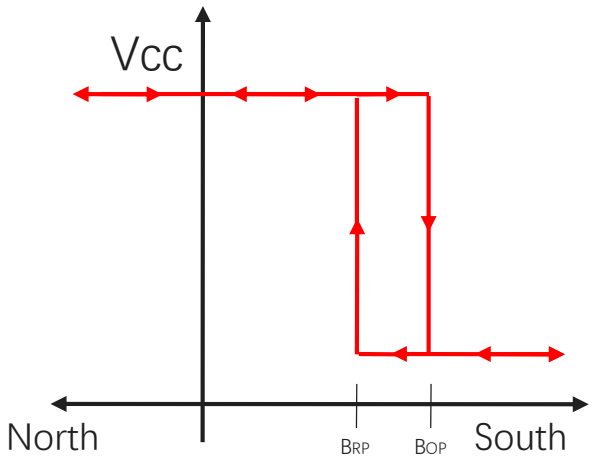


Figure.3 Switching Function Uni-polar (South)
SOT-23 (Thin Outline) / Flat TO-92 / SOT-89B

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 MT831X device is sensitive to the magnetic field component that is perpendicular to the top of the package

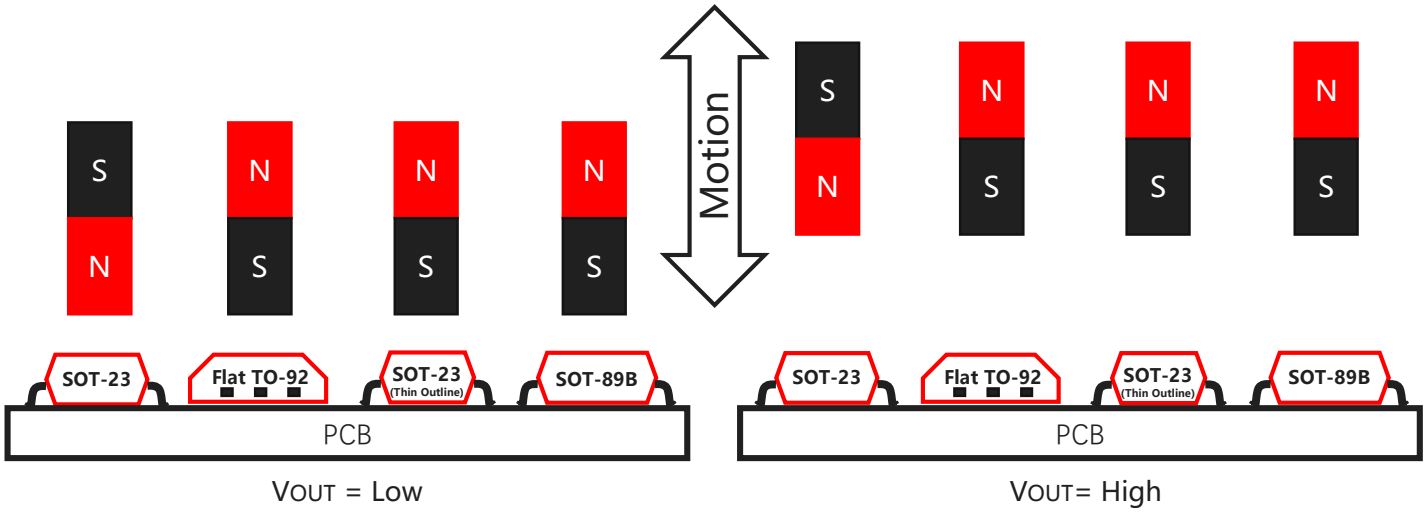


Figure.4 Flux Direction Polarity

9 Functional Block Diagram

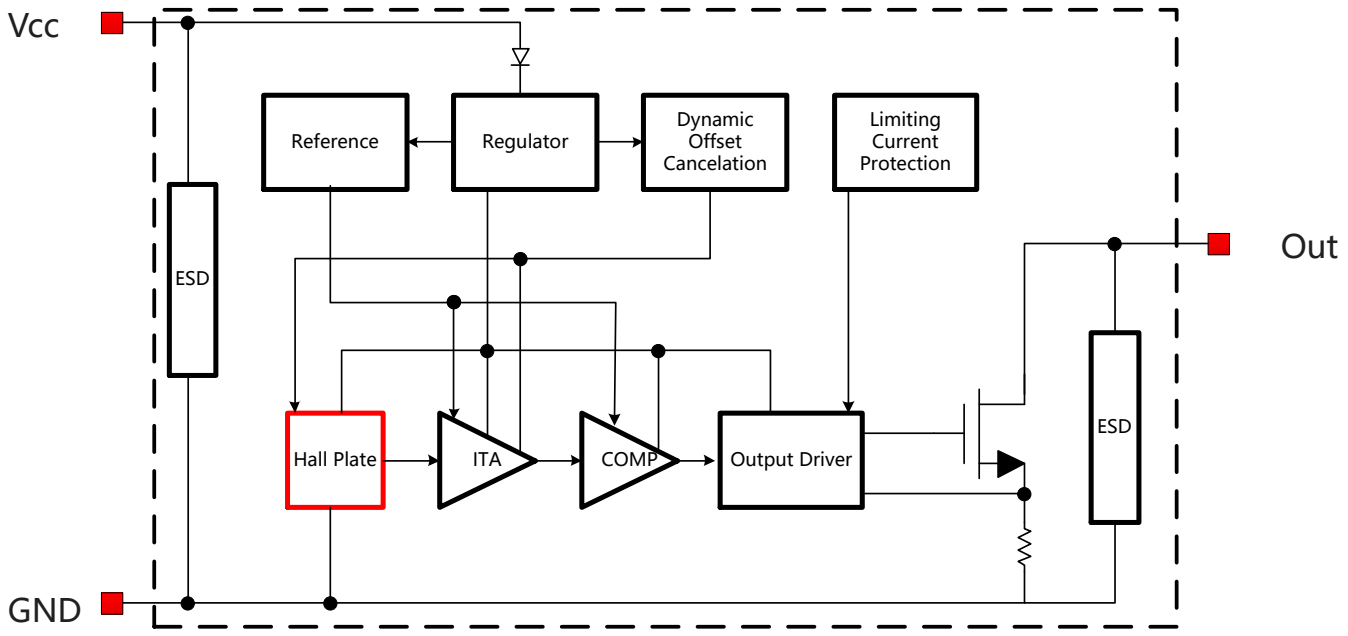


Figure.5 Functional Block Diagram

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	-	65	V
V_{RCC}	Reverse Battery Voltage	-20	-	V
V_{OUT}	Output Voltage	-	65	V
I_{OUT}	Continuous Output Current	-	40	mA
T_A	Operating Ambient Temperature	-40	150	℃
T_S	Storage Temperature	-50	150	℃
T_J	Junction Temperature	-	165	℃
B	Magnetic Flux Density	No Limit		Gs

10.2 ESD Ratings

Symbol		Reference	Values	Unit
V_{ESD}	Human-body model (HBM)	AEC-Q100-002	Class II	Grade
	Charged-device model (CDM)	AEC-Q100-011	Class C6	Grade

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10.3 Electrical Specifications

At T_A=-40~150 ℃, Vcc=3.8V~60V (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	3.8	-	60	V
I_{CC}	Supply Current	B<B_{RP}	-	4	6	mA
I_{OCP}	Short Circuit Protection Current	B>B_{OP}, V_{OUT}=V_{CC}	-	50	-	mA
V_{DSON}	Output Saturation Voltage	I_{OUT}=15mA, B>B_{OP}	-	-	0.4	V
I_{OFF}	Output Leakage Current	V_{OUT}=24V, |B|<|B_{RP}|	-	-	10	uA
T_R	Output Rise Time	R_L=1KOhm, C_L=20pF	-	-	1.0	us
T_F	Output Fall Time	R_L=1KOhm, C_L=20pF	-	-	1.0	us
T_{PO}	Power on Time	dV_{CC}/dt>5V/uS B>$B_{OP(MAX)}$	-	-	10	us
F_C	Chopping Frequency		-	800	-	KHz
F_S	Sampling Frequency		-	200	-	KHz
R_{TH}	Thermal Resistance of SOT-23		-	301	-	℃/W
	Thermal Resistance of SOT-23 (Thin Outline)		-	301	-	℃/W
	Thermal Resistance of TO-92		-	230	-	℃/W
	Thermal Resistance of SOT-89B		-	230	-	℃/W

10.4 Magnetic Characteristics

At V_{CC}=3.8V~60V (unless otherwise specified)

Part No.	Symbol	Min	Typ	Max	Unit
MT8311 Series	B_{OP}, T_A =25℃	110	140	170	Gs
	B_{RP}, T_A =25℃	75	105	135	Gs
	B_{HYST}, T_A =25℃	20	35	50	Gs
MT8312 Series	B_{OP}, T_A =25℃	210	255	300	Gs
	B_{RP}, T_A =25℃	165	210	255	Gs
	B_{HYST}, T_A =25℃	30	45	60	Gs
MT8313 Series	B_{OP}, T_A =25℃	60	85	110	Gs
	B_{RP}, T_A =25℃	25	50	75	Gs
	B_{HYST}, T_A =25℃	20	35	50	Gs
MT8315 Series	B_{OP}, T_A =25℃	20	30	40	Gs
	B_{RP}, T_A =25℃	10	20	30	Gs
	B_{HYST}, T_A =25℃	3	10	17	Gs

10.5 Characteristic Performance

At Vcc=5V

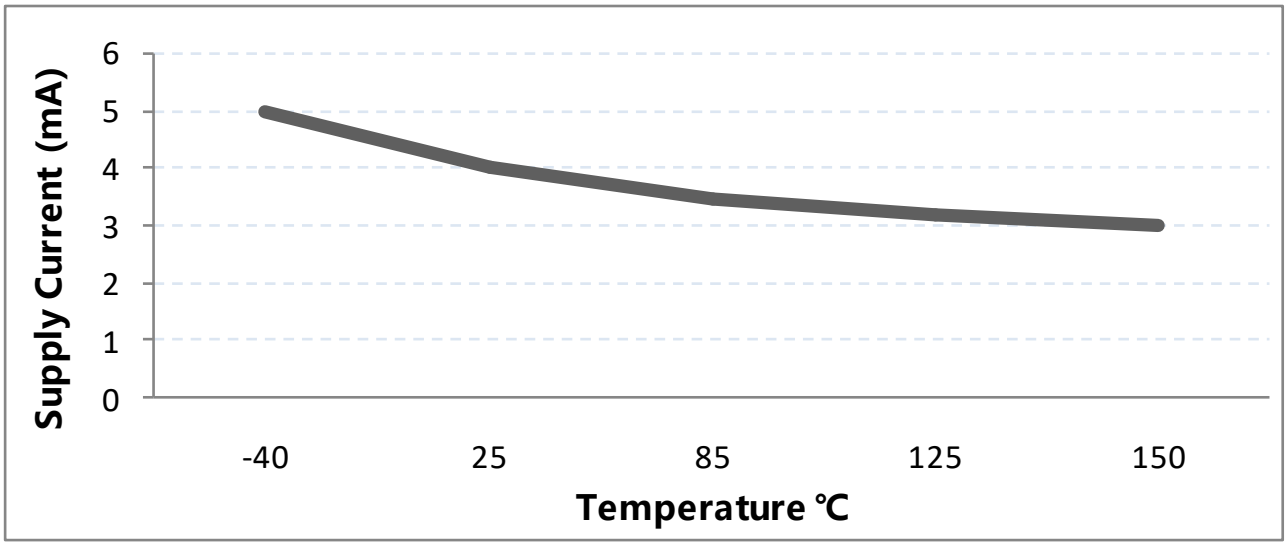


Figure.6 Supply Current vs. Temperature

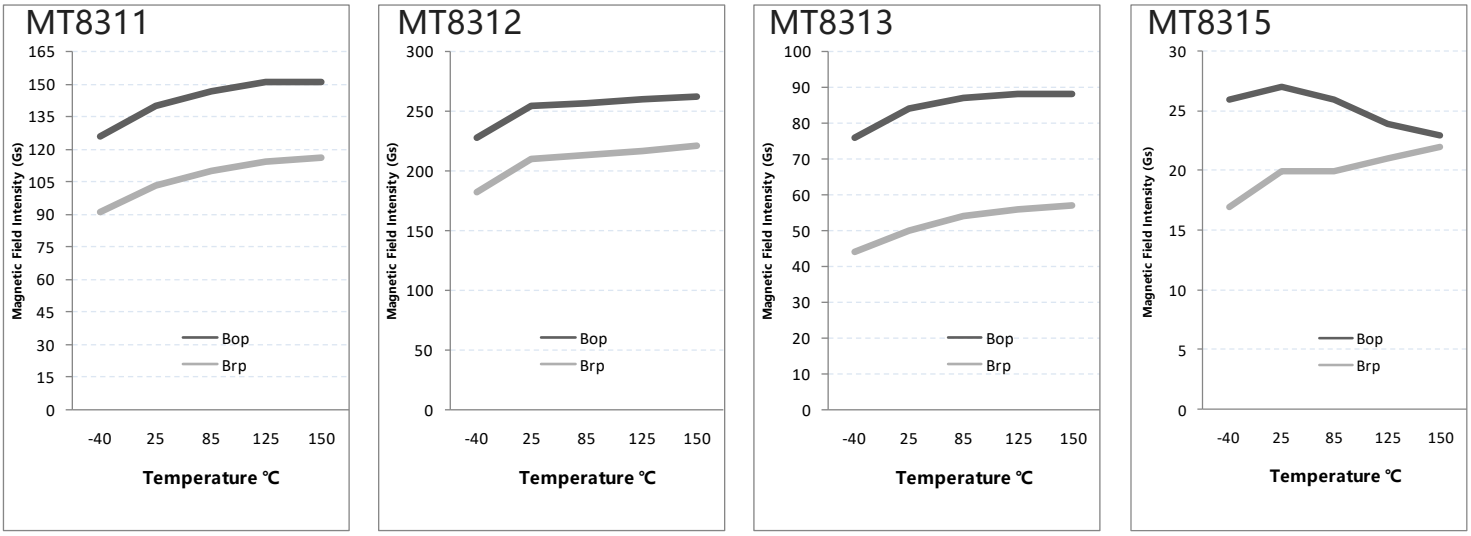


Figure.7 Magnetic Characteristics vs. Temperature (BOP & BRP)

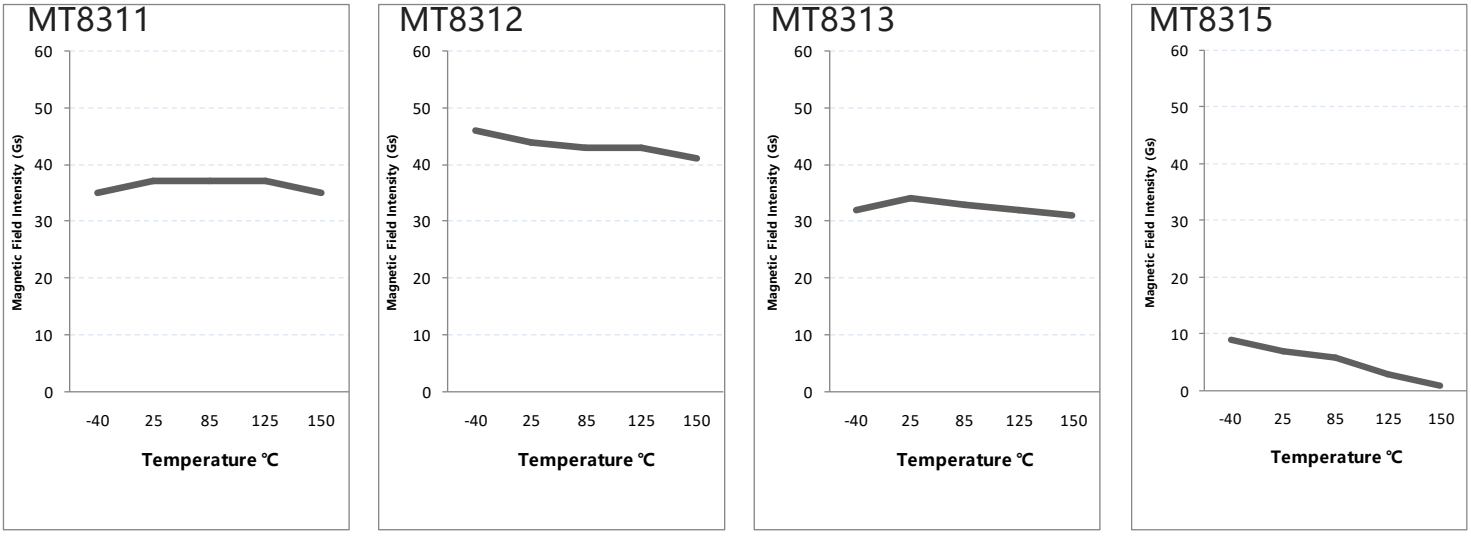


Figure.8 Magnetic Characteristics vs. Temperature (BHYST)

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10.6 Typical Output Waveform

MT8311A as example

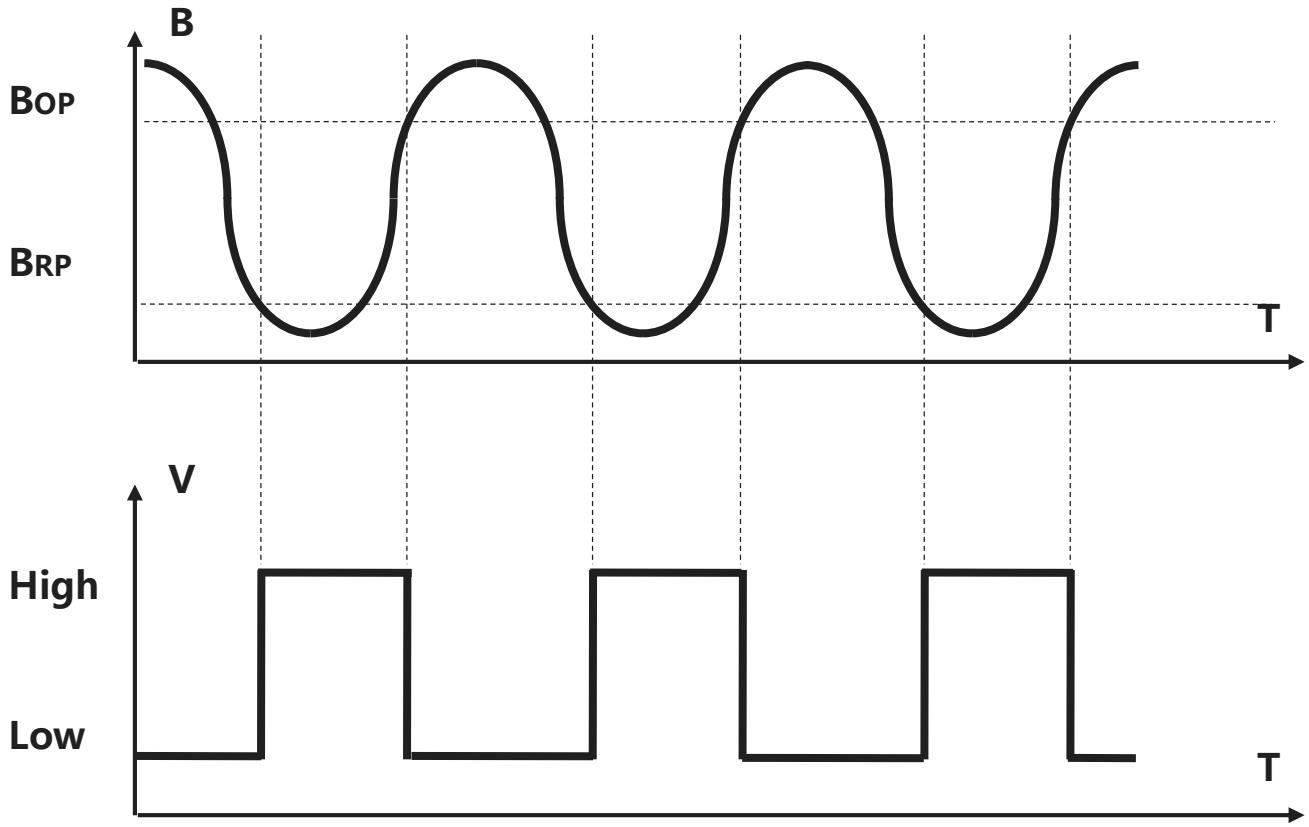


Figure.9 Digital Output vs. Magnetic Flux Density

11 Typical Application Circuit

MT8311AT as example
Note: Recommended value for R_L is 1KOhms to 10KOhms

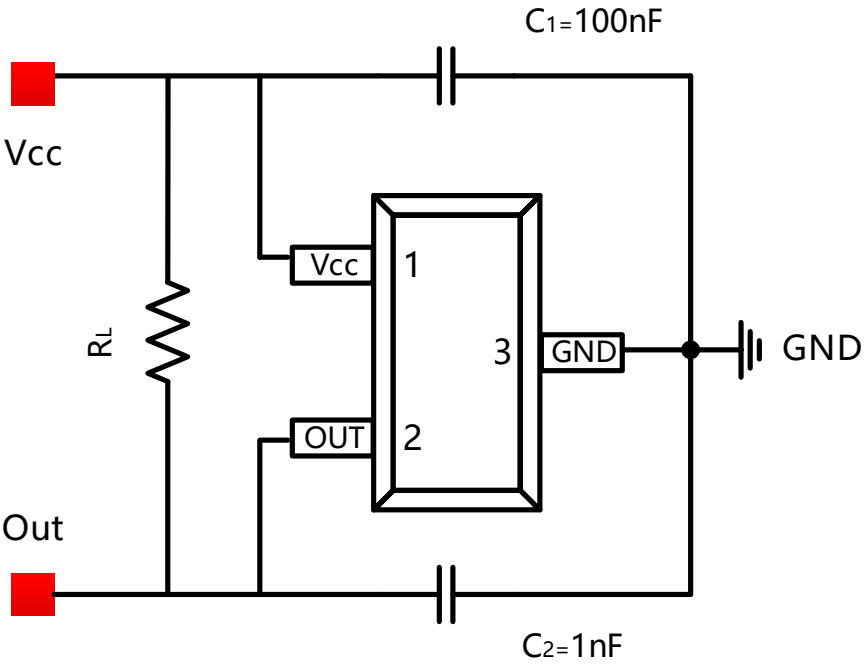


Figure.10 Typical Application Circuit

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

12.1 SOT-23 Package Information

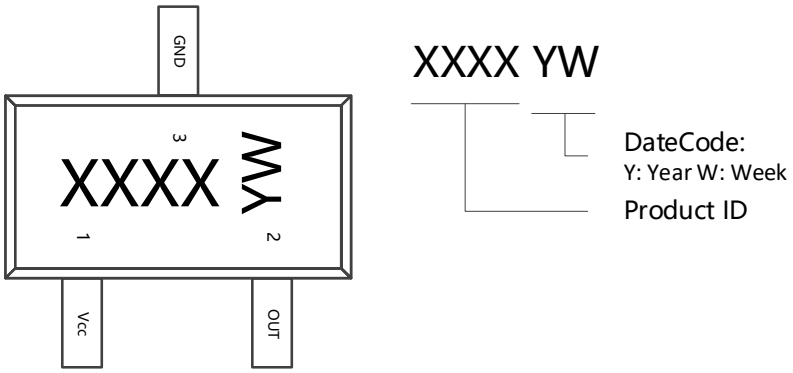


Figure.11 SOT-23 Chip Marking Spec

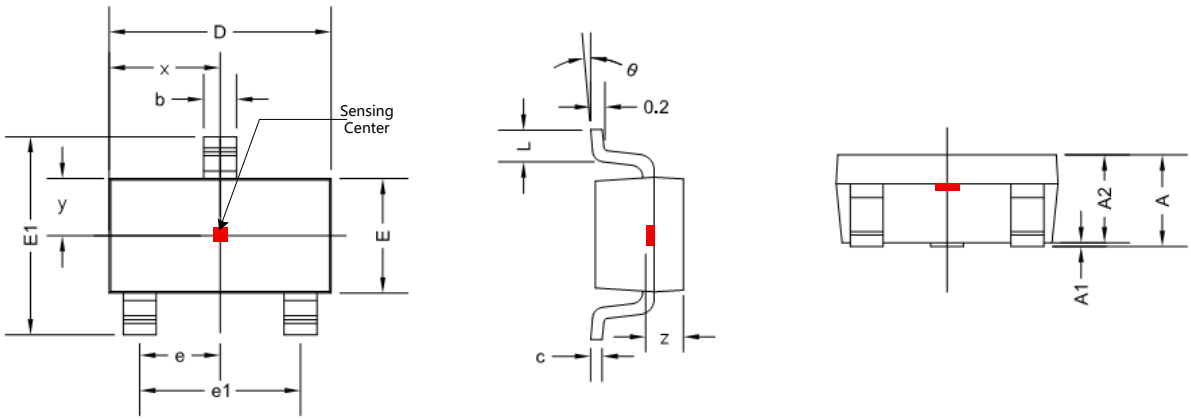


Figure.12 SOT-23 Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
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

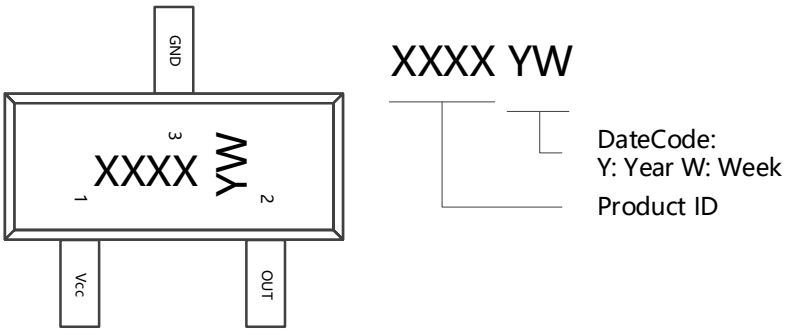


Figure.13 SOT-23 (Thin Outline) Chip Marking Spec

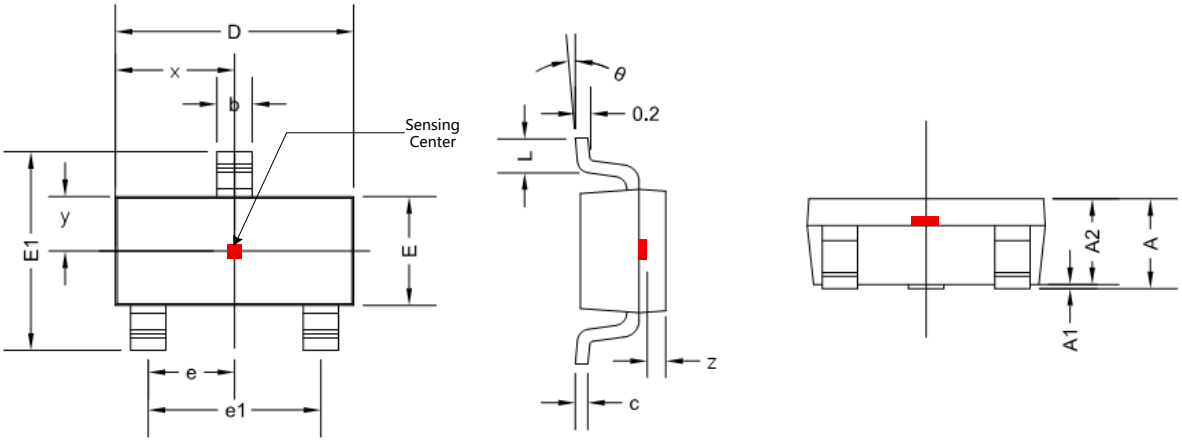


Figure.14 SOT-23 (Thin Outline) Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e		0.950 TYP		0.037 TYP
e1	1.800	2.000	0.071	0.079
L		0.550 REF		0.022 REF
L1	0.300	0.500	0.012	0.020
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

12.3 Flat TO-92 Package Information

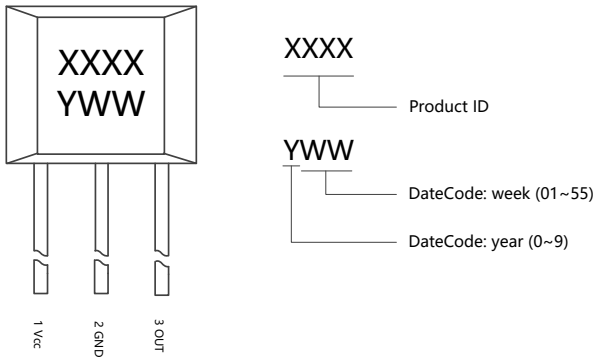


Figure.15 Flat TO-92 Chip Marking Spec

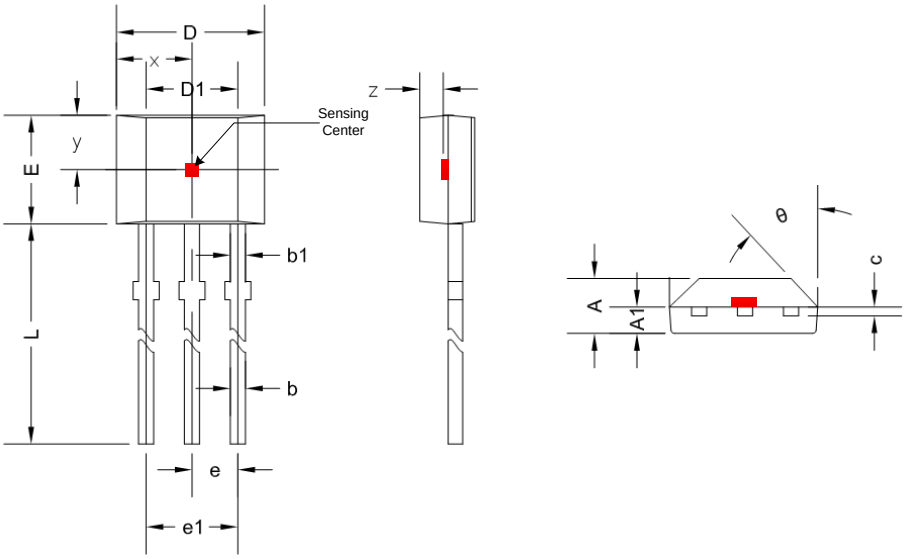


Figure.16 Flat TO-92 Package Drawing

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	

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12.4 Flat TO-92 Package Information (Radial Lead)

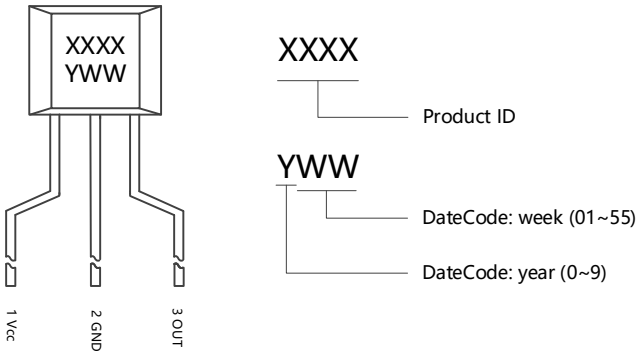


Figure.17 Flat TO-92 (Radial Lead) Chip Marking Spec

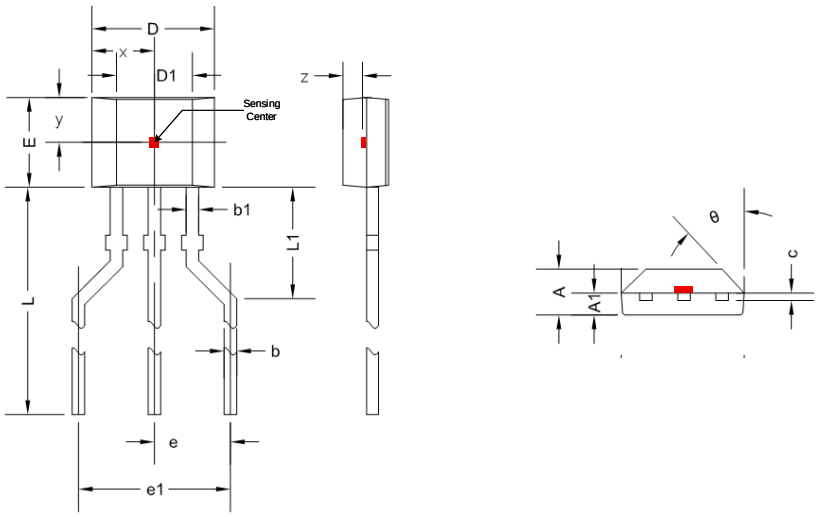


Figure.18 Flat TO-92 (Radial Lead) Package Drawing

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	2.540 TYP		0.100 TYP	
e1	5.000 TYP		0.197 TYP	
L1	2.000 TYP		0.079 TYP	
L	13.88 TYP		0.546 TYP	
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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12.5 SOT-89B Package Information

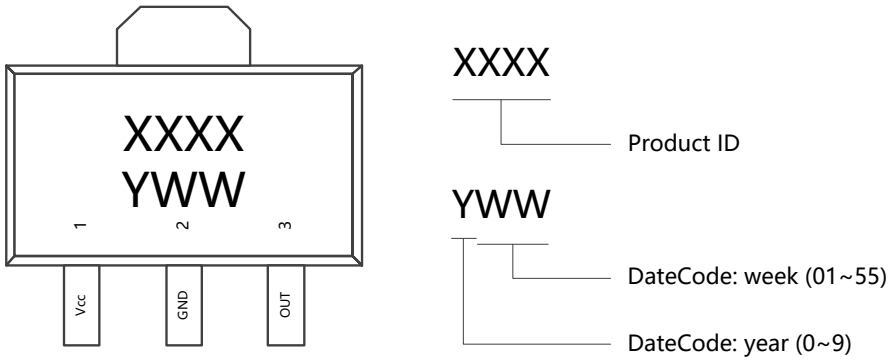


Figure.19 SOT-89B Chip Marking Spec

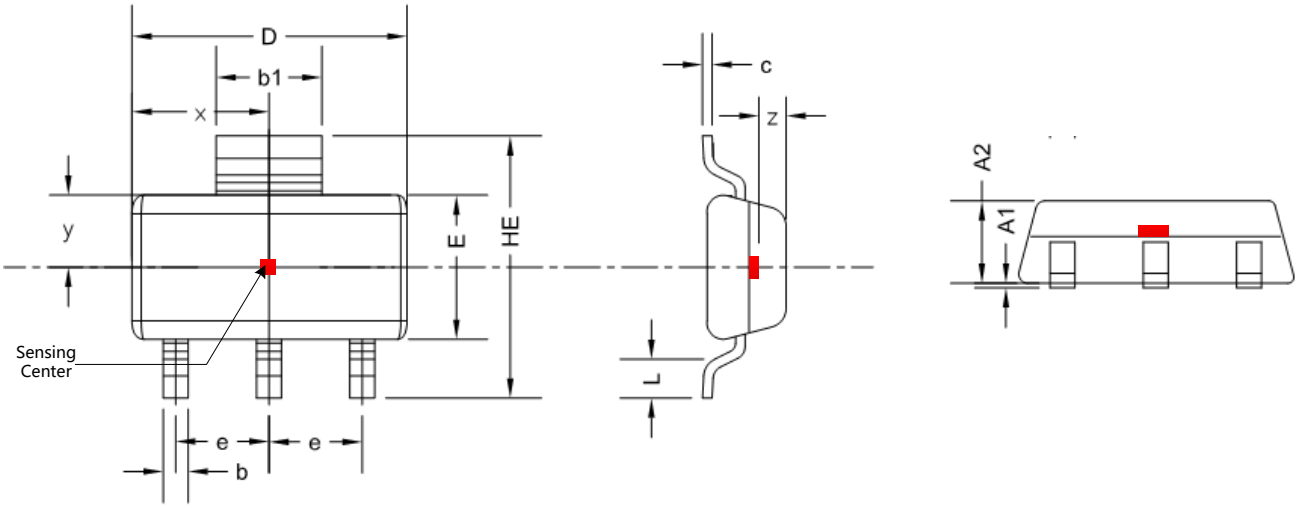


Figure.20 SOT-89B Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A2	1.220	1.420	0.048	0.056
A1	0.000	0.100	0.000	0.004
b	0.300	0.500	0.012	0.020
c	0.052	0.252	0.002	0.010
D	4.400	4.600	0.173	0.181
b1	1.600	1.800	0.063	0.071
E	2.400	2.600	0.094	0.102
HE	4.000	4.400	0.157	0.173
e	1.400	1.600	0.055	0.063
L	0.350	0.550	0.014	0.022
x	2.250 TYP		0.089 TYP	
y	1.250 TYP		0.049 TYP	
z	0.300 TYP		0.012 TYP	

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