

High ESD Performance Hall-Effect Switch IC, Two-Wire

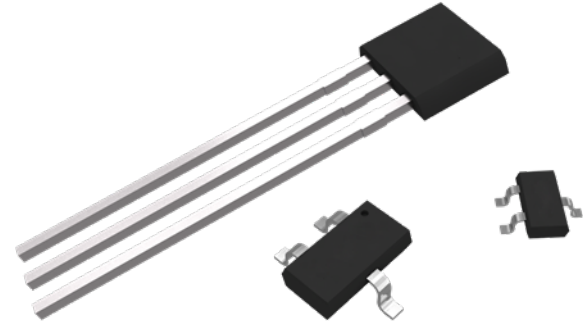
1 Product Description

The MT72xx-xxx 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 from 2.8V to 26V, temperature compensation circuitry, small-signal amplifier, Hall IC with dynamic offset cancellation system and Schmitt.

The MT72xx-xxx using two-wire interface during the application, can saving one wire compared with traditional open-drain output switches.

The MT72xx-xxx 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.



4 Applications

- Automotive, Industry & Consumer
- Seatbelt buckle

2 Features

- AEC-Q100 Automotive Qualified for MT720x-xxx
- BCD Technology
- Latch Switch & Uni-Polar & Omni-Polar
- 2.8~26V Operating Vcc Range
- Package Option:
Flat TO-92 / SOT-23 / SOT-23 (Thin Outline)
- Reversed Current Clamping
- -30V Reversed Power Supply Protection
- Robust ESD Performance (HBM=12kV)
- RoHS Compliant: (EU)2023/863

5. Pin Configuration and Function

	Vcc	GND	GND
SOT-23	1	2	3
SOT-23 (Thin Outline)	1	2	3
Flat TO-92	1	3	2
Description	Power	Ground	Ground

3 Product Overview of MT72xx-xxx

Part No.	Description
MT72xxA-xxx	Flat TO-92, bulk packaging (1000pcs/bag)
MT72xxAT-xxx	SOT-23, tape & reel (3000pcs/bag)
MT72xxET-xxx	SOT-23 (Thin Outline), tape & reel (3000pcs/bag)

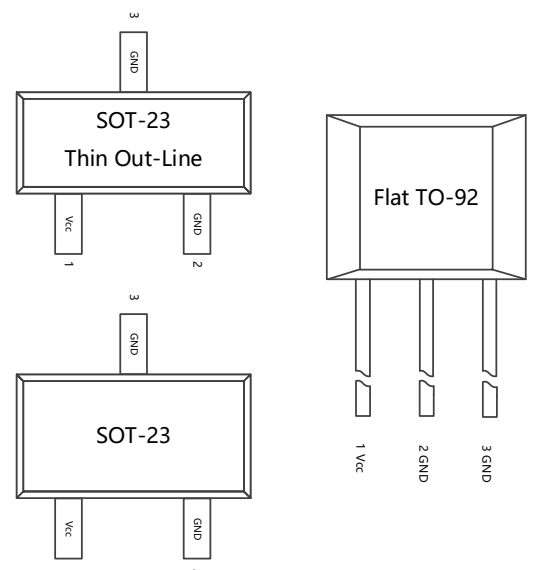


Figure.1 Pin Configuration & Function

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Reversion History

1	1.0 Version	Originally Version
2	1.1 Version	Update TO-92S Package Outline
3	1.2 Version	Update TO-92S Package Outline
4	1.3 Version	Update TO-92S Package Outline
		Update Magnetic Characteristics of MT72X2-XLX & MT72X1-XOX
		Update Electrical Specifications

6 Functional Block Diagram

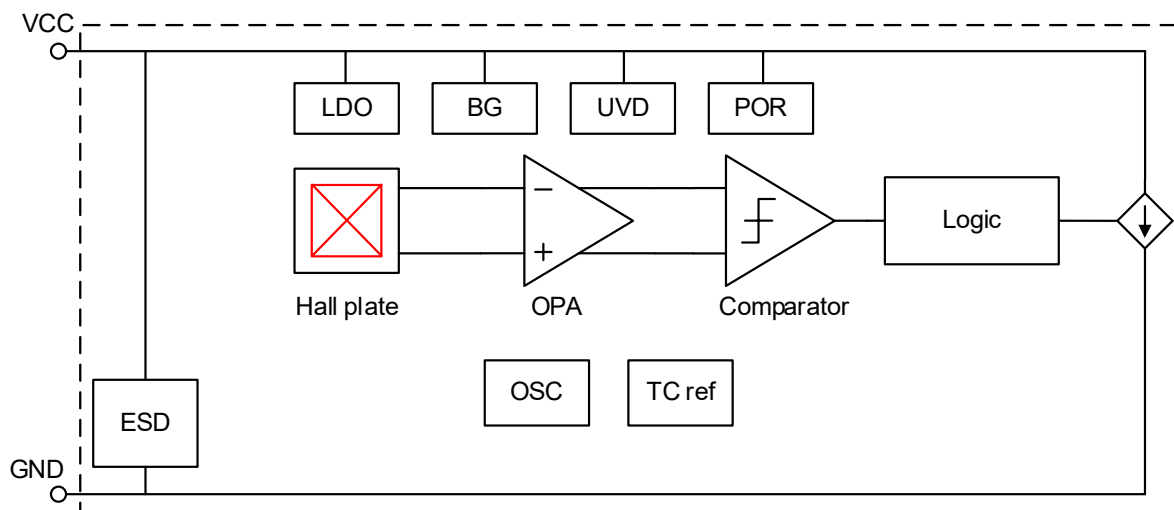


Figure.2 Functional Block Diagram

7 Definition of Product Name

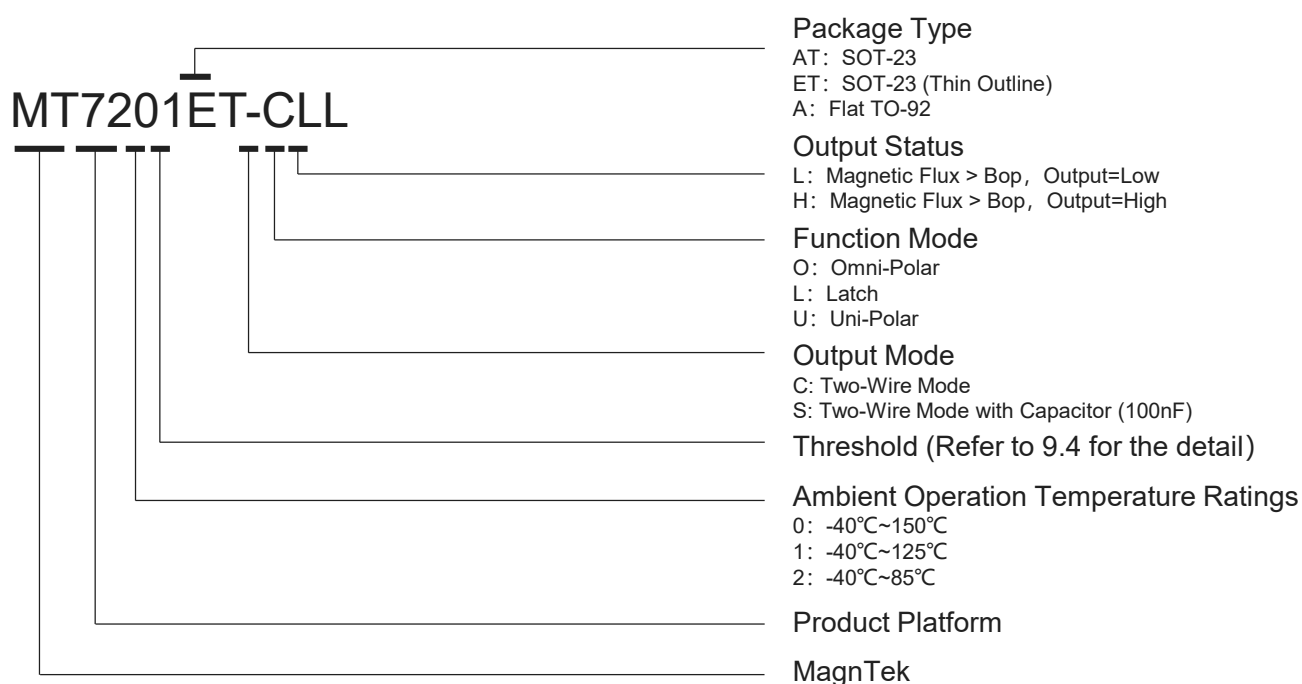


Figure.3 Definition of Product Name

8 Definition of Switching Function

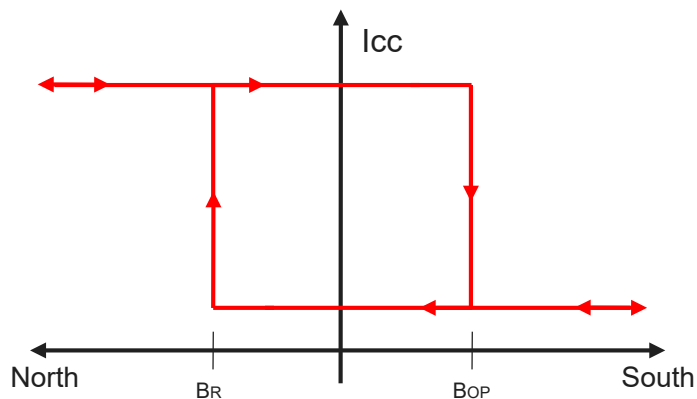


Figure.4 Function of Latch (MT72XXET/A-XLL)

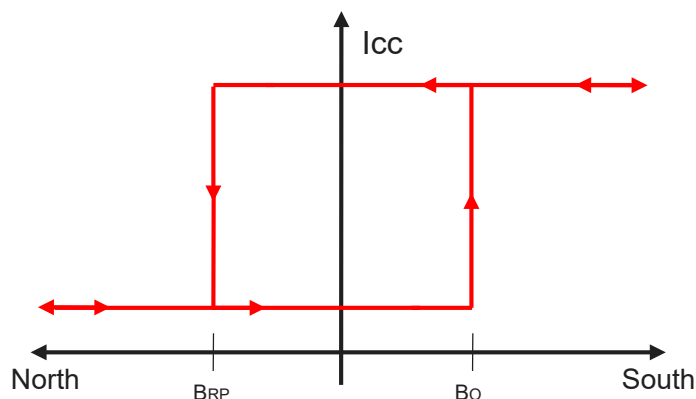


Figure.5 Function of Latch (MT72XXET/A-XLH)

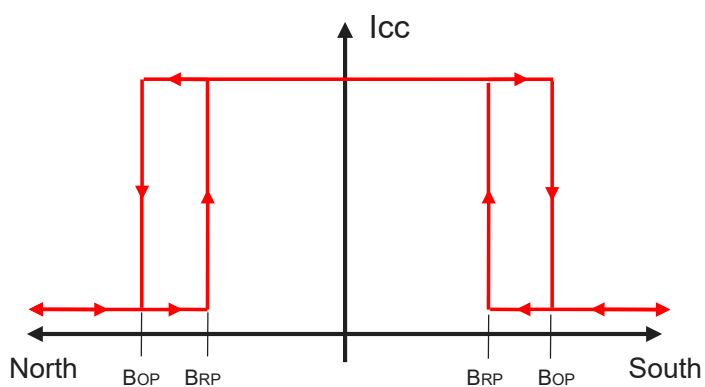


Figure.6 Function of Omni-Polar (MT72XXET/A-XOL)

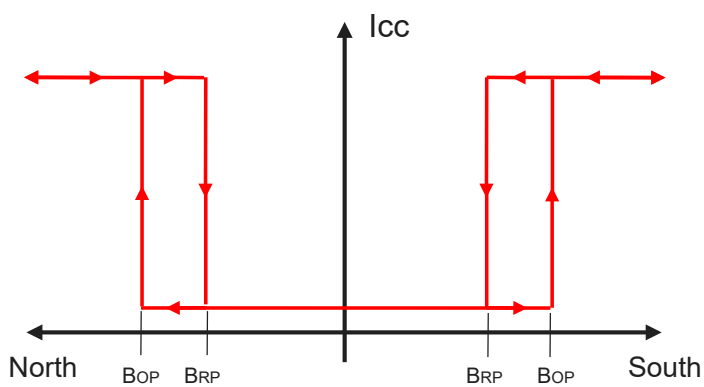


Figure.7 Function of Omni-Polar (MT72XXET/A-XOH)

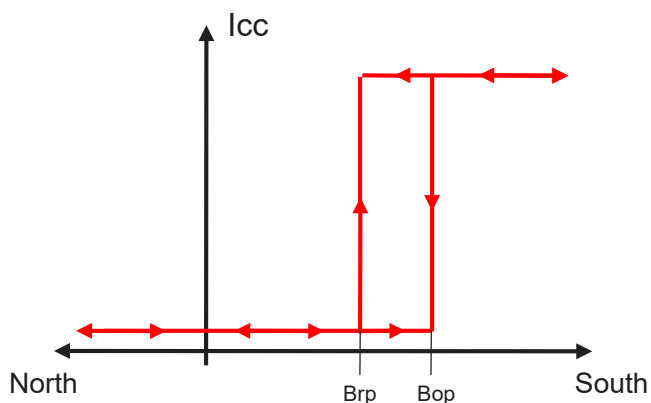


Figure.8 Function Uni-polar (MT72XXET/A-XUH)

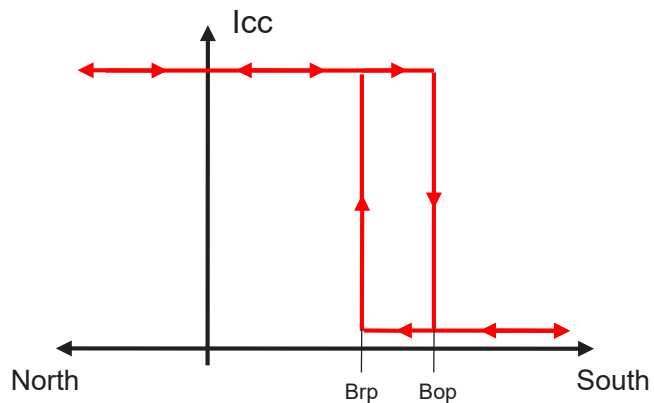


Figure.9 Function of Uni-Polar (MT72XXET/A-XUL)

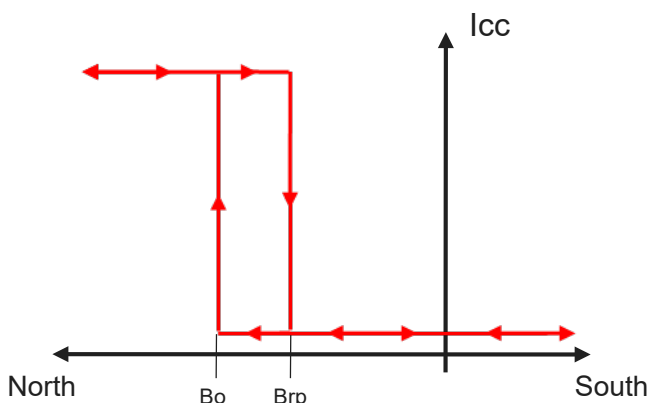


Figure.10 Function Uni-polar (MT72XXAT-CUH)

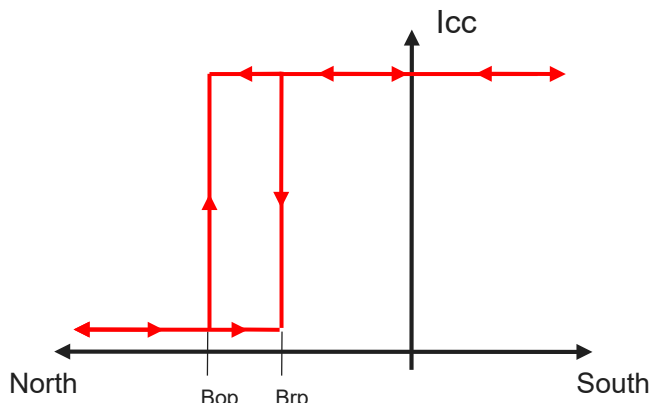


Figure.11 Function of Uni-Polar (MT72XXAT-CUL)

9 Electrical and Magnetic Characteristics

9.1 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	-	30	V
V _{RCC}	Reverse Battery Voltage	-30	-	V
T _A	Operating Ambient Temperature (MT720X-XXX)	-40	150	°C
	Operating Ambient Temperature (MT721X-XXX)	-40	125	°C
	Operating Ambient Temperature (MT722X-XXX)	-40	85	°C
T _S	Storage Temperature	-50	150	°C
T _J	Junction Temperature	-	165	°C
B	Magnetic Flux Density	No Limit		Gs

9.2 Electrical Specifications

V_{CC}=2.8V~26V (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V _{CC}	Supply Voltage	Operating	2.8	-	26	V
I _{CC(L)}	Supply Current-Low Level	MT72XXET-XXL: B>BOP, MT72XXET-XXH: B<BRP 2.8V≤V _{CC} ≤24V	5	- 5.95	6.9	mA
I _{CC(H)}	Supply Current-High Level	MT72XXET-XXL: B<BRP, MT72XXET-XXH: B>BOP 2.8V≤V _{CC} ≤24V	12	- 14.5	17	mA
I _{RCC}	Reverse Supply Current	V _{CC} =-30V	-1	-	-	mA
dI/dT	Current Slew Rate		-	60	-	mA/μS
V _{UDRESET}	Under Voltage Lockout Threshold		-	2.6	-	V
V _{UDRLS}	Under Voltage Release Threshold		-	2.8	-	V
T _{PO}	Power on Time		-	-	50	μs
P _{OS}	Power on State		I _{CC(H)}			-
F _C	Chopping Frequency		-	800	-	KHz
F _S	Sampling Frequency		-	25	-	KHz
R _{TH}	Thermal Resistance of SOT-23		-	301	-	°C/W
	Thermal Resistance of SOT-23 (Thin Outline)		-	301	-	°C/W
	Thermal Resistance of Flat TO-92		-	230	-	°C/W

9.3 ESD Ratings

Symbol		Reference	Values	Unit
V _{ESD}	Human-body model (HBM)	AEC-Q100-002	12000	V
	Charged-device model (CDM)	AEC-Q100-011	1000	V

9.4 Magnetic Characteristics

At V_{cc}=2.8V~26V (unless otherwise specified)

Part No.	Symbol	Min	Typ	Max	Unit
MT72X1-XLX Series	BOP, T _A =25°C	35	50	65	Gs
	BRP, T _A =25°C	-65	-50	-35	Gs
	BHYST, T _A =25°C	70	100	130	Gs
MT72X2-XLX Series	BOP, T _A =25°C	10	20	30	Gs
	BRP, T _A =25°C	-30	-20	-10	Gs
	BHYST, T _A =25°C	20	40	60	Gs
MT72X1-XUX Series	BOP, T _A =25°C	20	35	50	Gs
	BRP, T _A =25°C	10	25	40	Gs
	BHYST, T _A =25°C	3	10	17	Gs
MT72X2-XUX Series	BOP, T _A =25°C	60	85	110	Gs
	BRP, T _A =25°C	25	50	75	Gs
	BHYST, T _A =25°C	20	35	50	Gs
MT72X3-XUX Series	BOP, T _A =25°C	110	140	170	Gs
	BRP, T _A =25°C	75	105	135	Gs
	BHYST, T _A =25°C	20	35	50	Gs
MT72X5-XUX Series	BOP, T _A =25°C	210	255	300	Gs
	BRP, T _A =25°C	165	210	255	Gs
	BHYST, T _A =25°C	30	45	60	Gs
MT72X1-XOX Series	BOP, T _A =25°C	±20	±35	±50	Gs
	BRP, T _A =25°C	±10	±25	±40	Gs
	BHYST, T _A =25°C	3	10	17	Gs
MT72X2-XOX Series	BOP, T _A =25°C	±60	±85	±110	Gs
	BRP, T _A =25°C	±25	±50	±75	Gs
	BHYST, T _A =25°C	20	35	50	Gs
MT72X3-XOX Series	BOP, T _A =25°C	±110	±140	±170	Gs
	BRP, T _A =25°C	±75	±105	±135	Gs
	BHYST, T _A =25°C	20	35	50	Gs

9.5 Power on Status

During power-on, the I_{cc} keeps high level when the V_{cc} reach to the $V_{cc}(\text{Min})$, until the device is ready to respond appropriately to the input magnetic field.

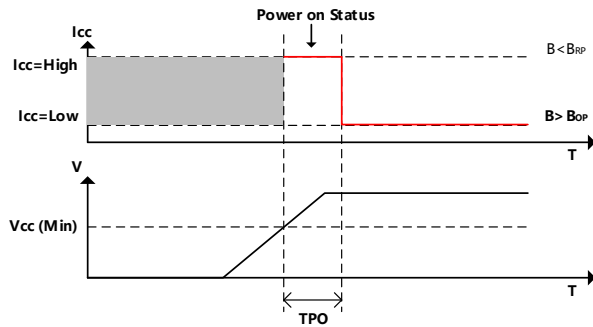


Figure.12 Power on Status (MT72XX-CXL)

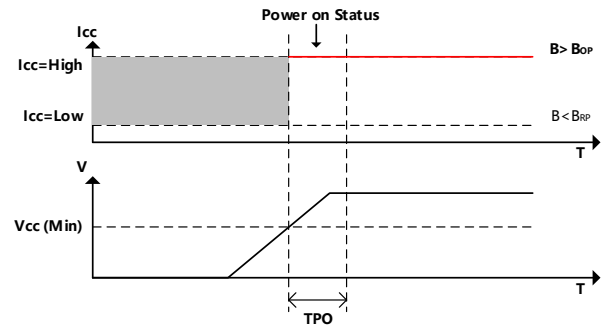


Figure.13 Power on Status (MT72XX-CXH)

9.6 Under Voltage Protection

After power on, when the V_{cc} lower than the $V_{UDRESET}$ which caused by the unstable power supply, the device will jump into the status of under voltage protection, the device will lock the status of I_{cc} & do not reactive to the input magnetic field. Until V_{cc} back to V_{UDRLS}

If the V_{cc} lower than 2.0V after power on, the device will re-start

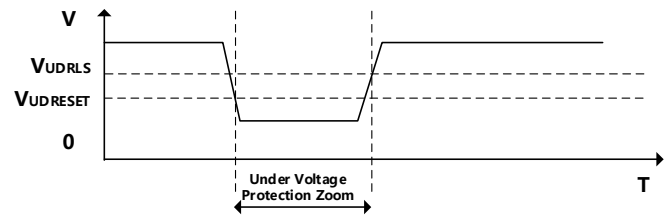


Figure.14 Under Voltage Protection

10 Typical Application Circuit

Note:

The bypass capacitor $C1$ (10nF to 100nF) should be placed as close as possible to the V_{cc} and GND pin

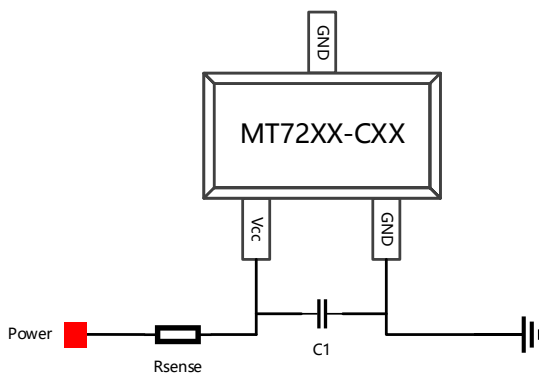


Figure.15 $R_{sense} @ V_{cc}$

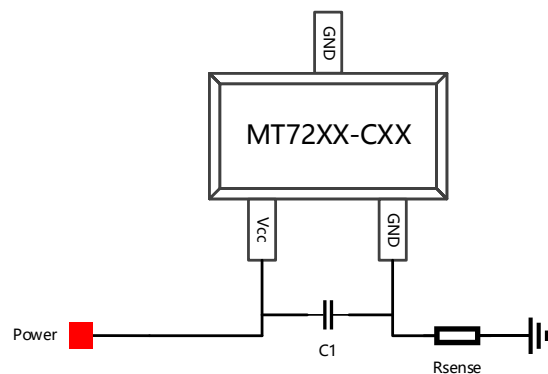


Figure.16 $R_{sense} @ GND$

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

11.1 SOT-23 Package Information

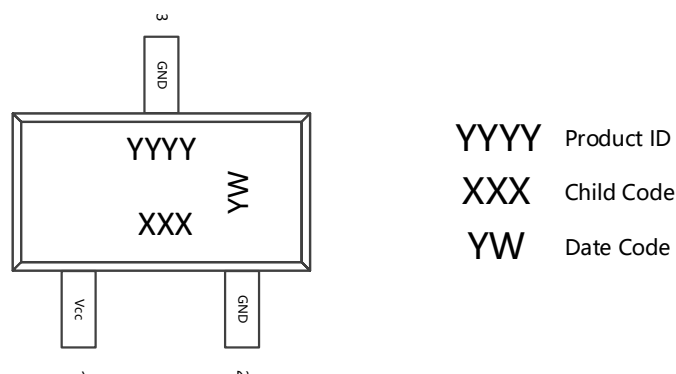


Figure.17 SOT-23 Chip Marking Spec

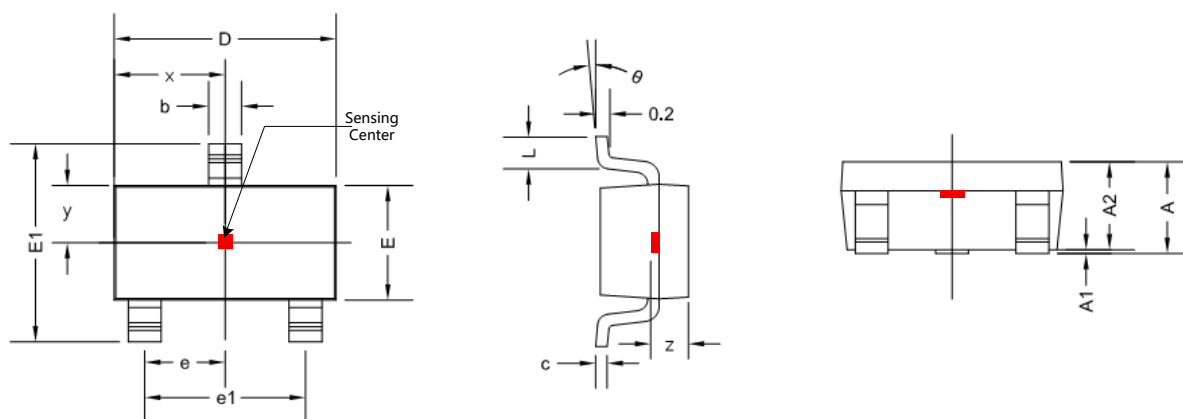


Figure.18 SOT-23 Package Drawing

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	0.700 TYP		0.027 TYP	

11.2 SOT-23 (Thin Outline) Package Information

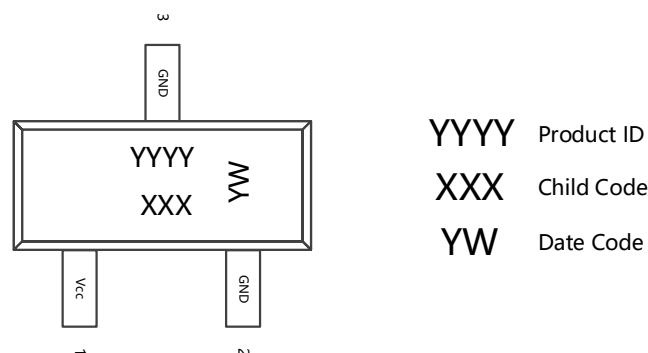


Figure.19 SOT-23 (Thin Outline) Chip Marking Spec

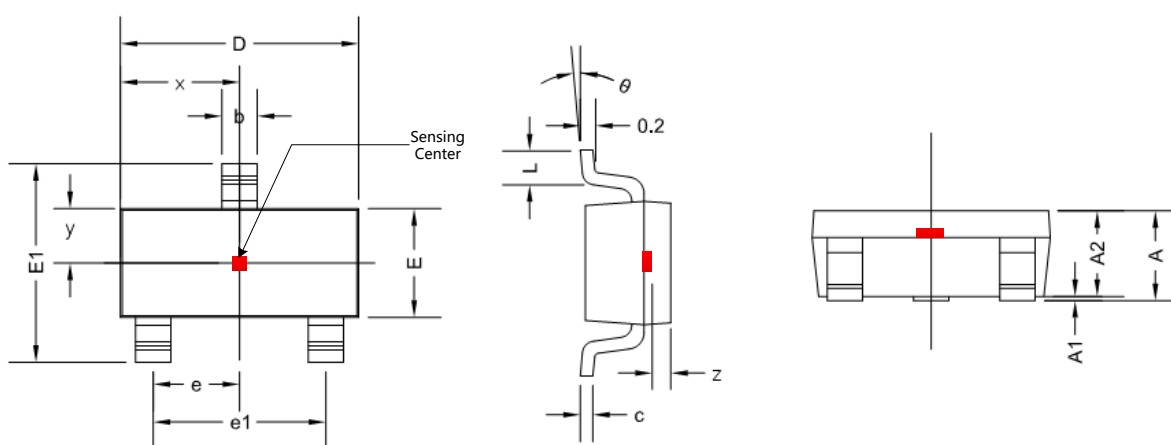


Figure.20 SOT-23 (Thin Outline) Package Drawing

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	1.100	0.035	0.043
b	0.300	0.500	0.012	0.020
c	0.132	0.202	0.005	0.008
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
theta	0 °	8 °	0 °	8 °
x	1.460 TYP		0.057 TYP	
y	0.650 TYP		0.026 TYP	
z	0.190 TYP		0.007 TYP	

11.3 Flat TO-92 Package Information

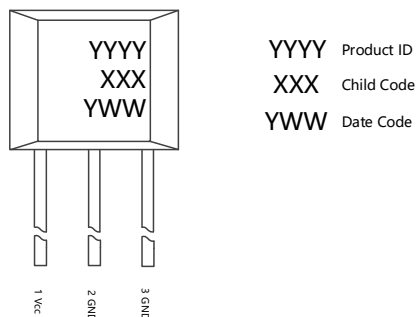


Figure.21 Flat TO-92 Chip Marking Spec

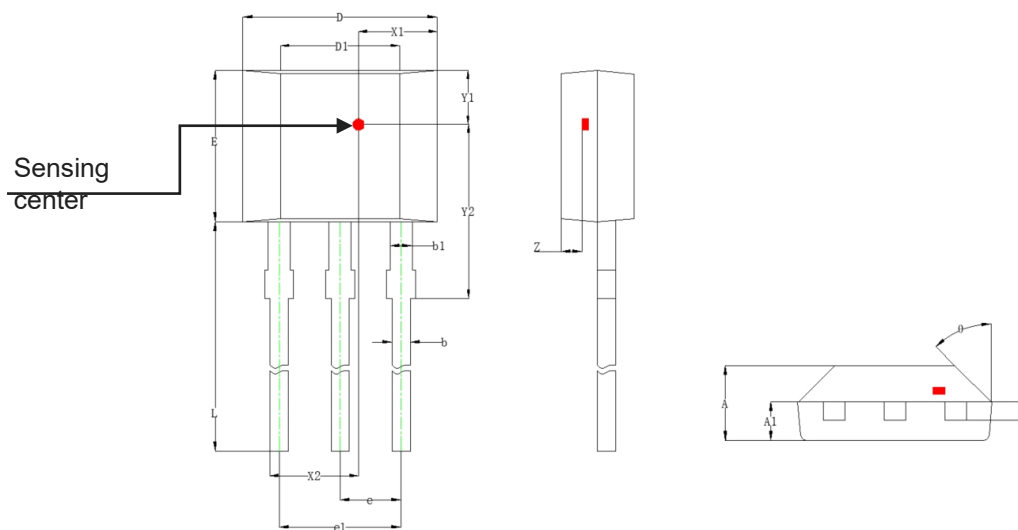


Figure.22 Flat TO-92 Package Drawing

Symbol1,	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	0.330	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	4.000	4.100	0.157	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	15.100	15.500	0.594	0.610
θ	45 ° TYP		45 ° TYP	
X1	1.640 TYP		0.065 TYP	
Y1	1.125 TYP		0.044 TYP	
X2	1.859 TYP		0.073 TYP	
Y2	3.603 TYP		0.142 TYP	
Z	0.440 TYP		0.017 TYP	

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