

## Omni-polar, Low Power AMR Switch IC

### 1 Product Description

The MT611X family is produced with monolithic technology. Which built AMR sensor & ASIC on one chip. The IC internally includes a Wheatstone bridge with magnetic film, a voltage regulator for operating with supply voltage from 1.8V to 5.5V, a sleep/awake logic for low power consumption requirement, small signal amplifier and Schmitt trigger comparator with dynamic offset cancellation, and an output driver with open-drain output.

When combined with a magnet, it becomes a non-contact switch with low power consumption, high sensitivity and high reliability. A horizontal magnetic field parallel to the electrode of the package can be detected by an arbitrary polarity.

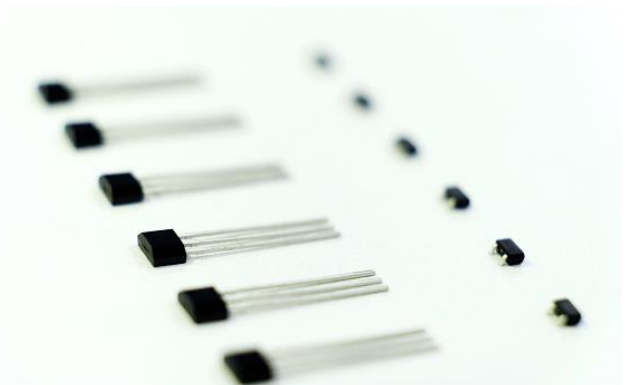
The MT611X family provides a variety of packages to customers: SOT-23 for surface mount and flat TO-92 for through-hole mount. All packages are RoHS compliant.

### 2 Features

- Monolithic Technology
- AMR (Anisotropic Magneto Resistance)
- Omni-polar Switch
- 1.8~5.5V Operating Vcc Range
- -40°C~125°C Operating Temperature
- Package Option:
  - SOT-23
  - Flat TO-92
- Magnetic Sensitivity Option:
  - BOP=±18Gs, BRP=±13Gs
- Open-Drain Output
- Low Power Consumption:
  - Average Supply Current =1.3uA (Typ)
- RoHS Compliant: (EU)2015/863

### 3 Product Overview of MT611X

Part No.	Description
MT6111A	Flat TO-92, bulk packaging (1000pcs/bag)
MT6111AT	SOT-23, tape & reel (3000pcs/bag)



### 4 Application

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

### 5. Pin Configuration and Functions

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

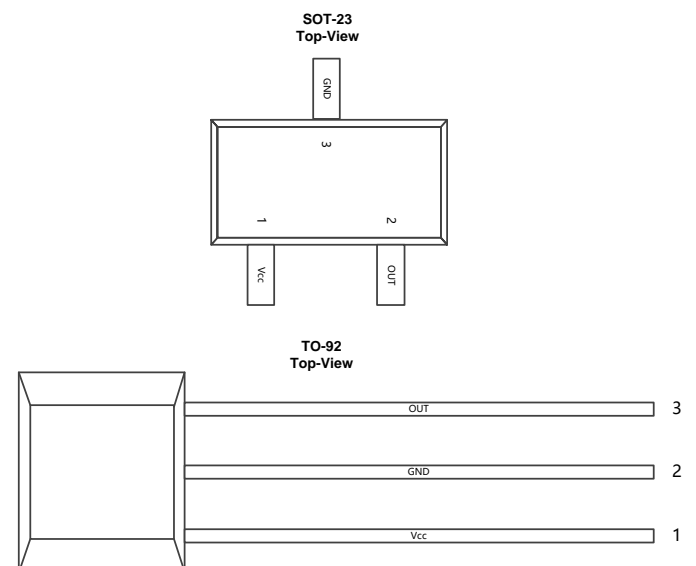


Figure.1 Pin Configuration & Functions

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## Reversion History

1	Originally Version	
2	1.1 Version	Update T <sub>PO</sub> from 100us to 50us
3	1.2 Version	Update the marking spec of SOT-23

## 6 Definition of Switching Function

Figure.2 shows the device functionality and hysteresis

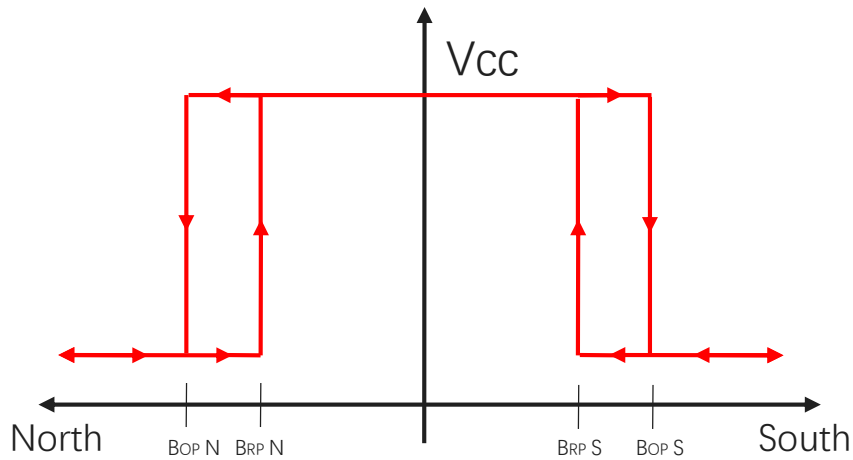


Figure.2 Omni-polar Switching Function

## 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,  $|B_{OP} - B_{RP}|$

## 8 Feature Description

The MT611X device is sensitive to the magnetic field that is parallel to the package

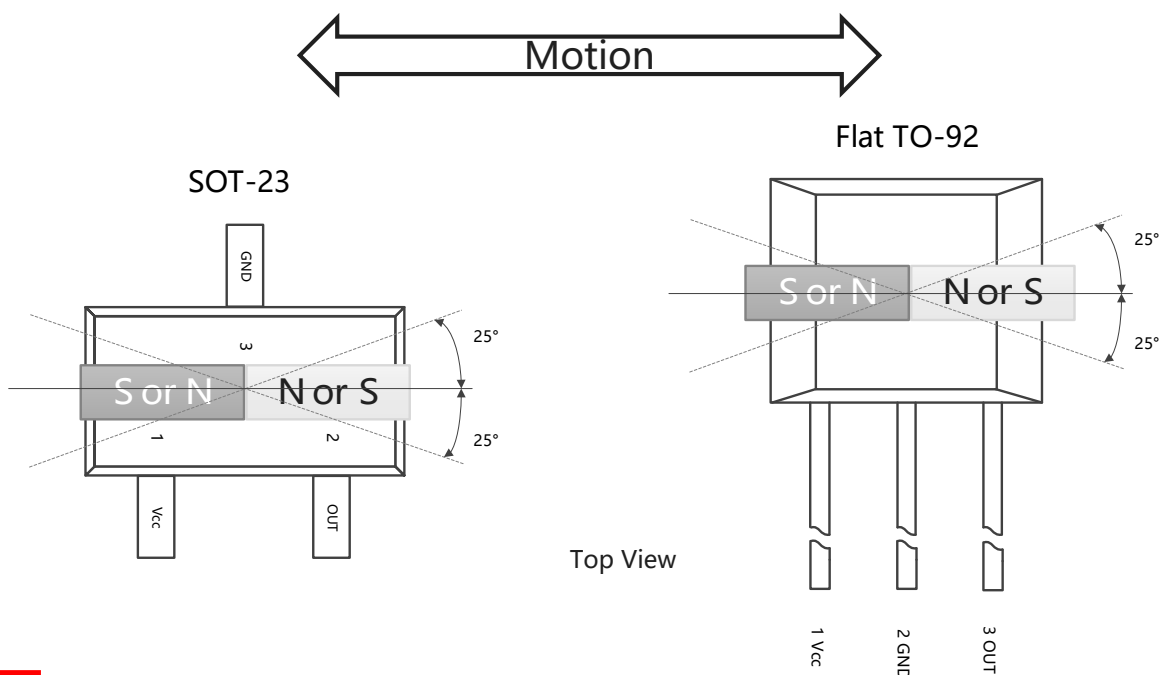


Figure.3 Flux Direction Polarity

## 9 Functional Block Diagram

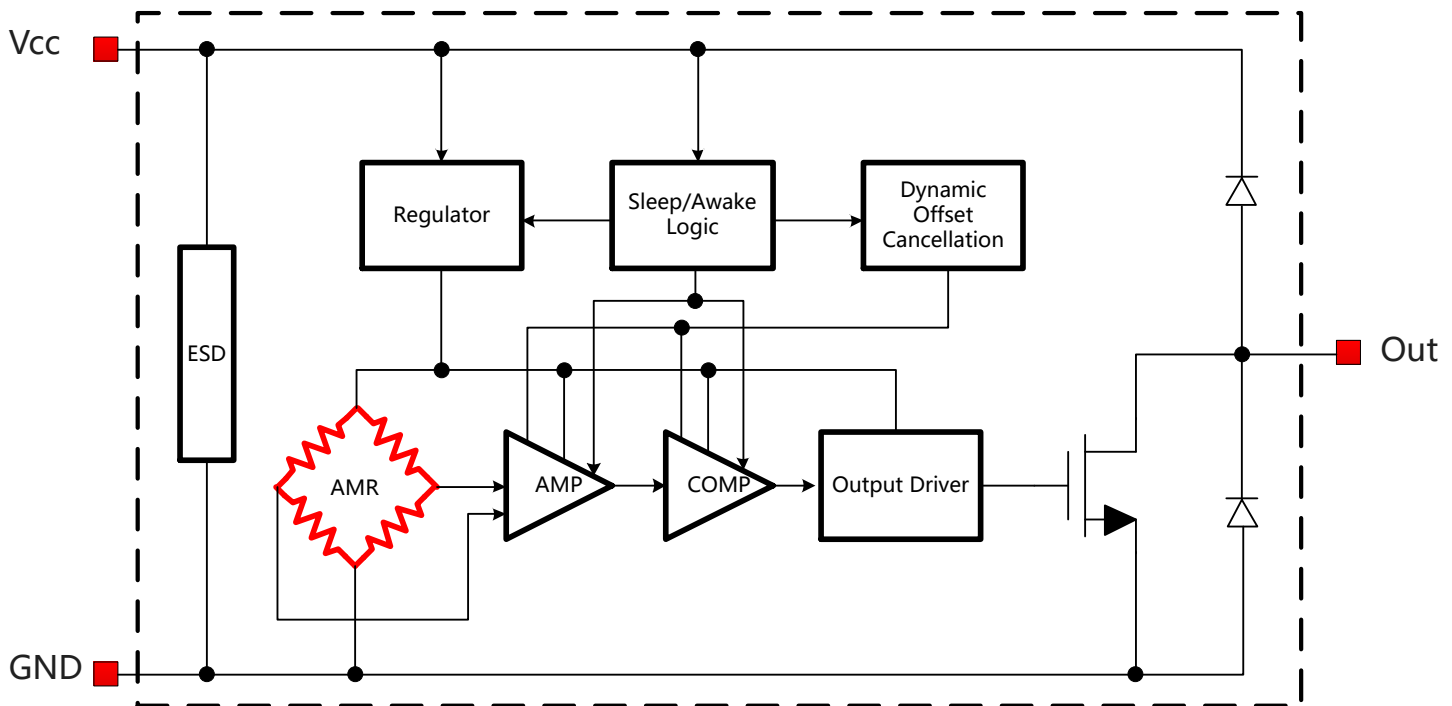


Figure.4 Functional Block Diagram

## 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 <sub>CC</sub>	Supply Voltage	-	7	V
V <sub>RCC</sub>	Reverse Battery Voltage	-0.5	-	V
V <sub>OUT</sub>	Output Voltage	-0.5	7	V
I <sub>OUT</sub>	Continuous Output Current	-	40	mA
T <sub>A</sub>	Operating Ambient Temperature	-40	125	°C
T <sub>S</sub>	Storage Temperature	-50	150	°C
T <sub>J</sub>	Junction Temperature	-	165	°C
B	Magnetic Flux Density		3000	Gs

## 10.2 Electrical Specifications

At  $T_A = -40 \sim 125^\circ\text{C}$ ,  $V_{CC} = 1.8\text{V} \sim 5.5\text{V}$  (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
$V_{CC}$	Supply Voltage	Operating	1.8	-	5.5	V
$I_{CC}$	Supply Current	$V_{CC} = 3.6\text{V}$	-	1.3	2.0	$\mu\text{A}$
$V_{DS(on)}$	Output Saturation Voltage	$V_{CC} \geq 1.8\text{V}$ , $I_{OUT} = 15\text{mA}$ , $ B  >  B_{OP} $ $V_{CC} \geq 3.3\text{V}$ , $I_{OUT} = 30\text{mA}$ , $ B  >  B_{OP} $	-	-	0.4	V
$I_{OFF}$	Output Leakage Current	$V_{OUT} = 5.5\text{V}$ , $ B  <  B_{RP} $	-	-	1	$\mu\text{A}$
$T_{PO}$	Power on Time	$dV_{CC}/dt > 3.6\text{V}/\mu\text{s}$ , $B > B_{OP}(\text{MAX})$	-	-	50	$\mu\text{s}$
$f_{SW}$	Switching Frequency	$V_{CC} = 3.6\text{V}$	-	20	-	Hz
$T_{AW}$	Awake Time	$V_{CC} = 3.6\text{V}$	-	12	-	$\mu\text{s}$
$T_{SL}$	Sleep Time	$V_{CC} = 3.6\text{V}$	-	50	-	ms
D.C.	Duty Cycle	$V_{CC} = 3.6\text{V}$	-	0.02	-	%
$R_{TH}$	Thermal Resistance of SOT-23		-	301	-	$^\circ\text{C}/\text{W}$
	Thermal Resistance of Flat TO-92		-	230	-	$^\circ\text{C}/\text{W}$

## 10.3 Magnetic Characteristics

At  $V_{CC} = 1.8\text{V} \sim 5.5\text{V}$  (unless otherwise specified)

Part No.	Symbol	Min	Typ	Max	Unit
MT6111 Series	$B_{OP}$ , $T_A = 25^\circ\text{C}$	-	$\pm 18$	$\pm 25$	Gs
	$B_{RP}$ , $T_A = 25^\circ\text{C}$	$\pm 3$	$\pm 13$	-	Gs
	$B_{HYST}$ , $T_A = 25^\circ\text{C}$	-	5	-	Gs

## 10.4 ESD Ratings

Symbol	Reference	Values	Unit	
$V_{ESD}$	Human-body model (HBM)	AEC-Q100-002	$\pm 8000$	V
	Charged-device model (CDM)	AEC-Q100-011	$\pm 1000$	V

### 10.5 Characteristic Performance

At  $V_{CC}=3.6V$ ,  $B < B_{RPMIN}$

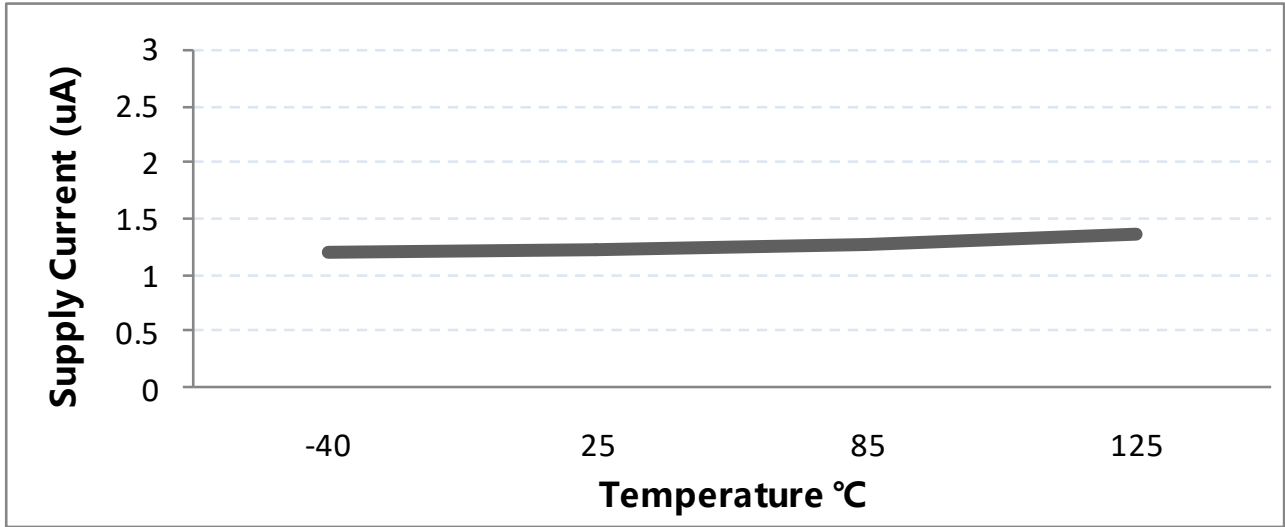


Figure.5 Supply Current vs. Temperature

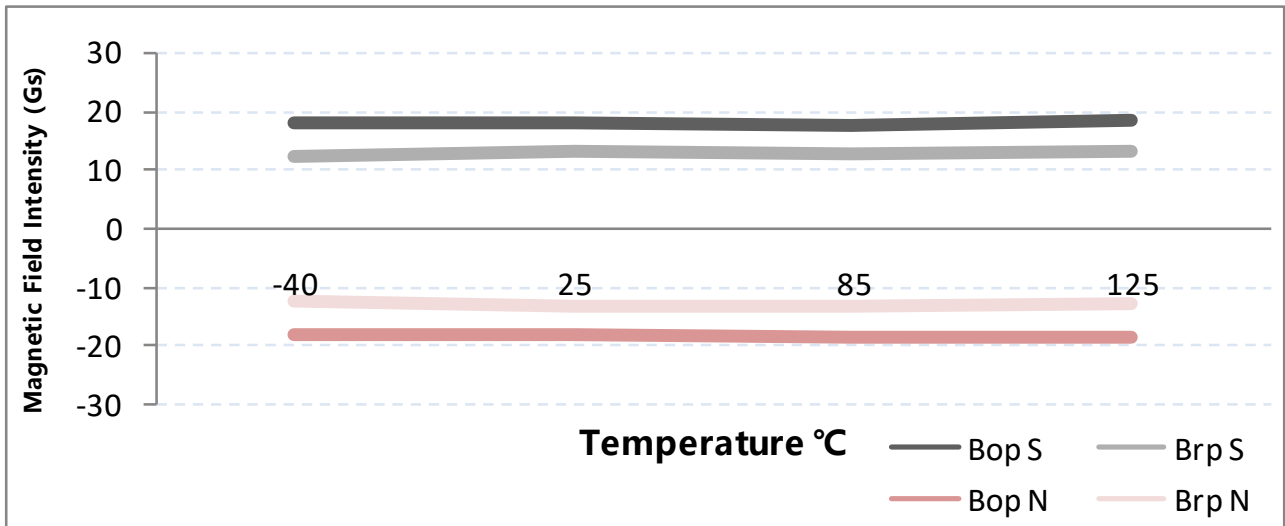


Figure.6 Magnetic Characteristics vs. Temperature (BOP & BRP)

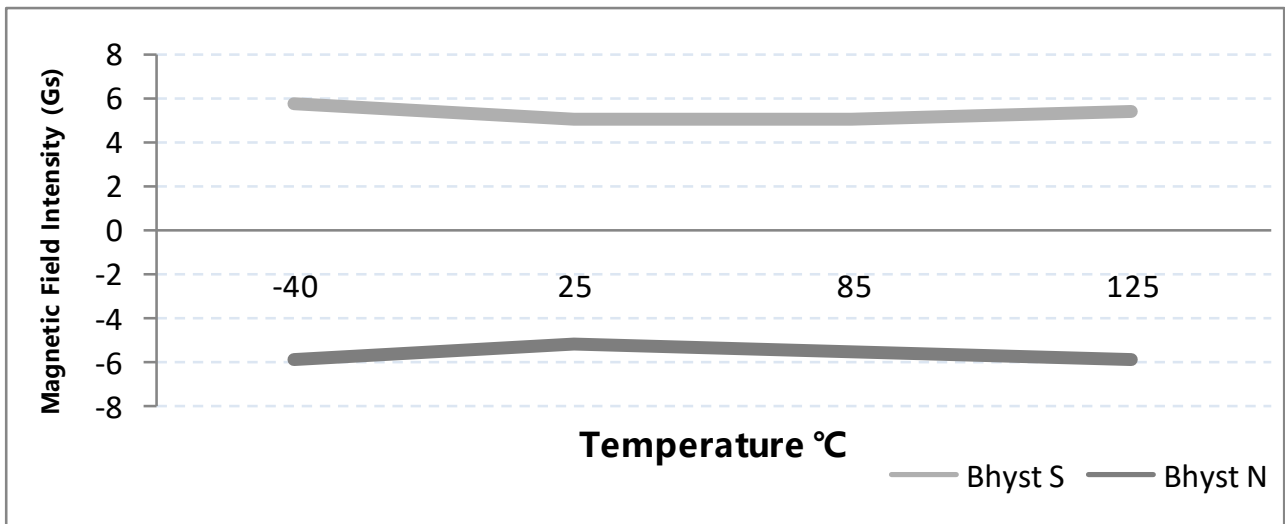


Figure.7 Magnetic Characteristics vs. Temperature (BHYST)

### 10.6 Typical Output Waveform

MT6111A as example

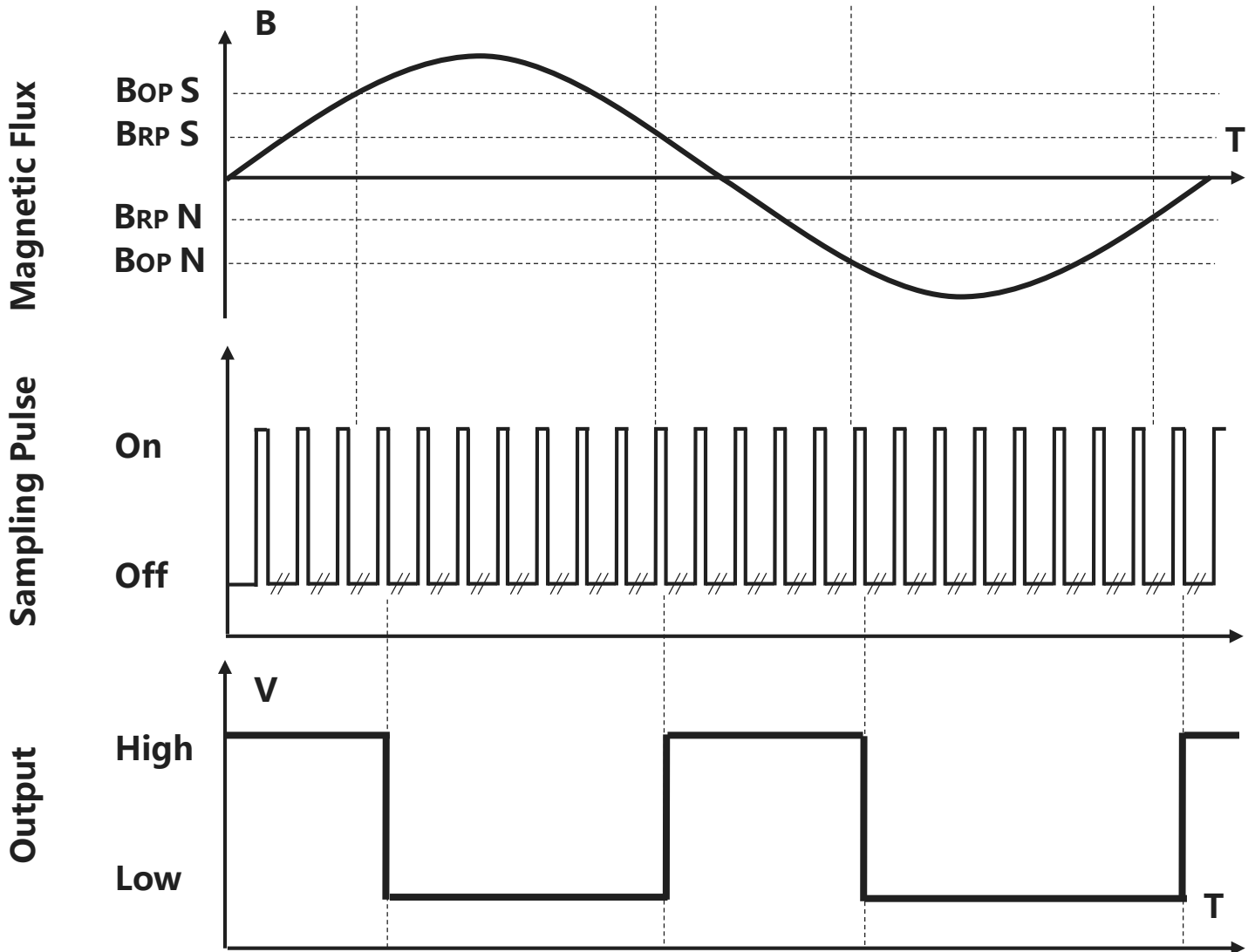


Figure.8 Digital Output vs. Magnetic Flux Density & Sampling Pulse

### 11 Typical Application Circuit

MT6111AT as example

Note: Recommended value for  $R_L$  is 100KOhms

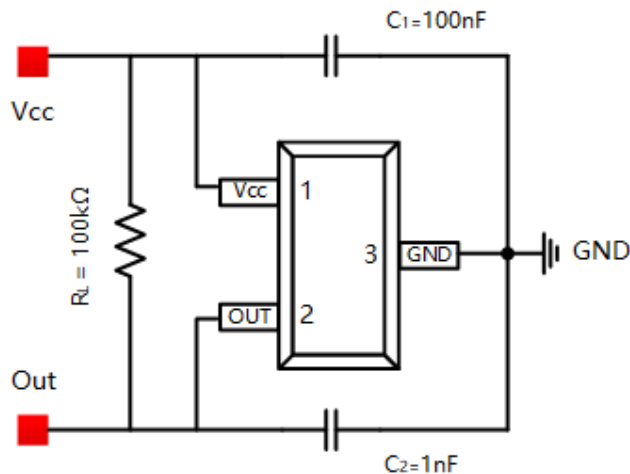


Figure.9 Typical Application Circuit

## 12 Power on Output Waveform

$V_{CC}$  rise time  $< 1\mu s$ ,  $T_{PO}$  is the time from the stable point of  $V_{CC}$  to the valid point of output

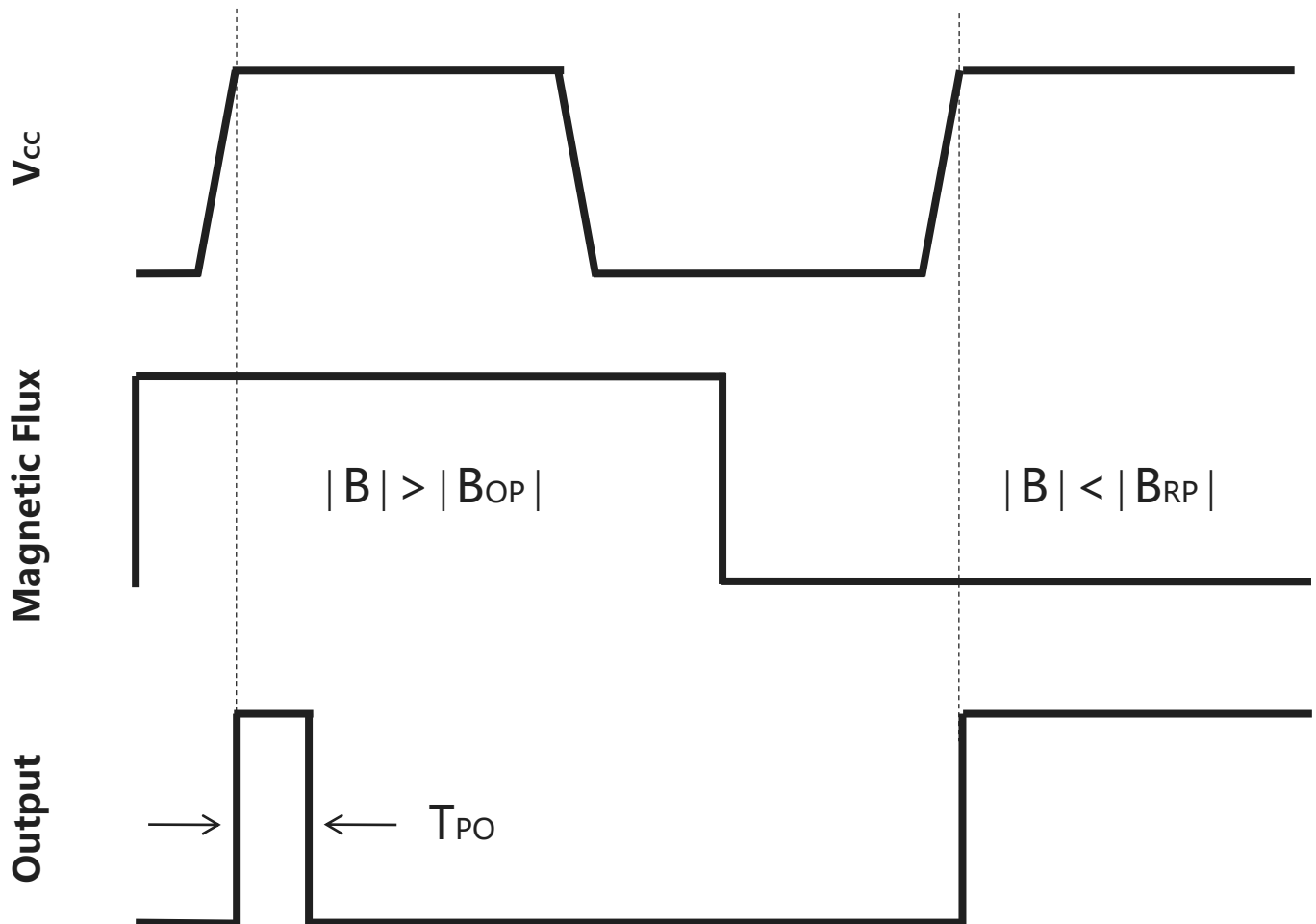


Figure.10 Power on Output Waveform



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

#### 13.1 SOT-23 Package Information

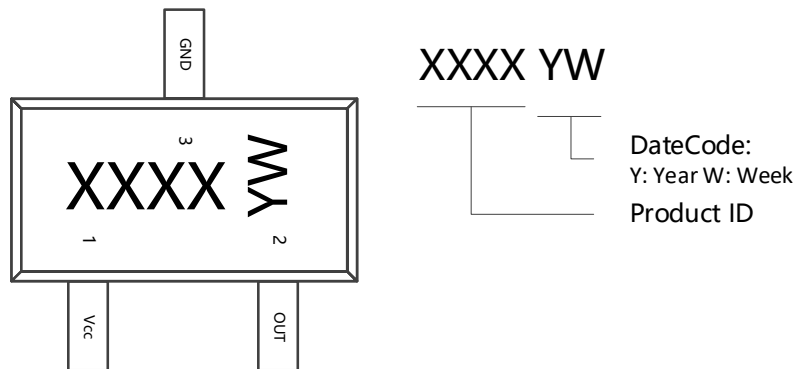


Figure.11 SOT-23 Chip Marking Spec

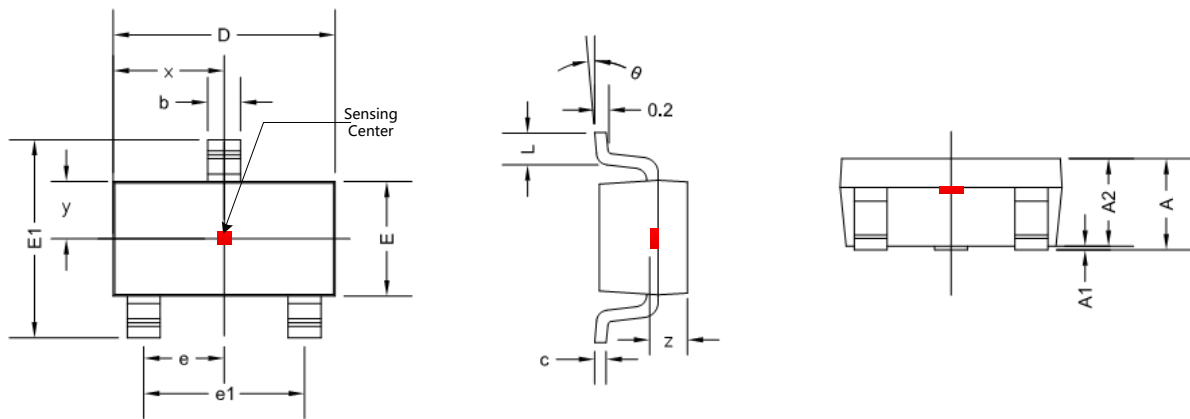


Figure.12 SOT-23 Package Drawing

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	

### 13.2 Flat TO-92 Package Information

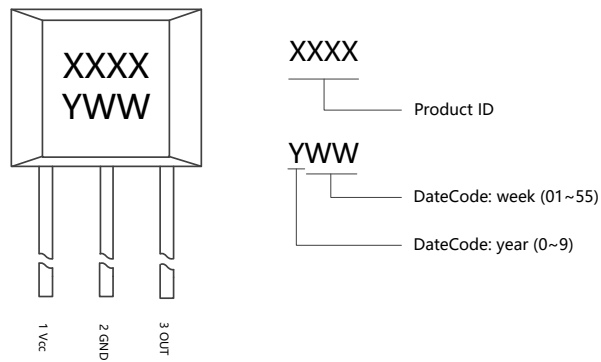


Figure.13 Flat TO-92 Chip Marking Spec

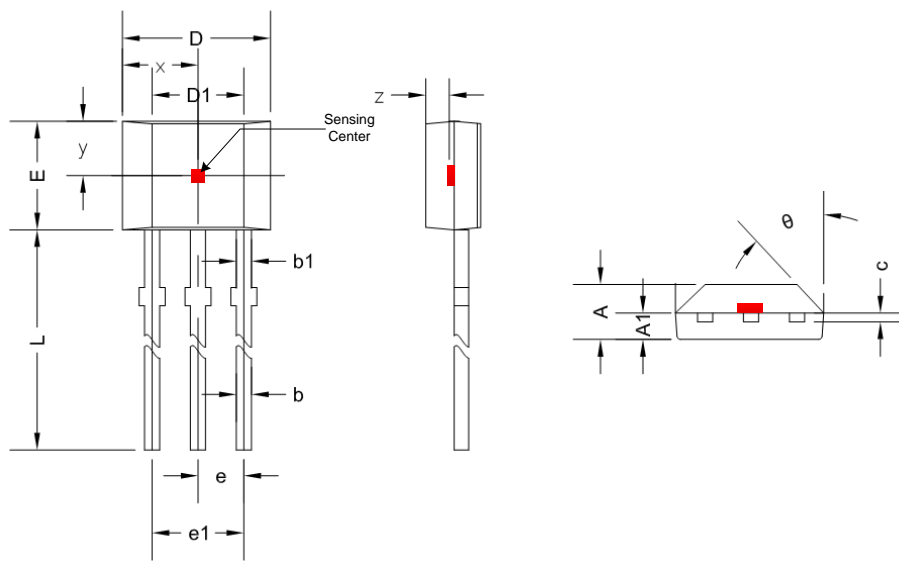


Figure.14 Flat TO-92 Package Drawing

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	

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