

Product Overview

The NSM107x series of hall sensors are designed for consumer and industrial applications, which moisture sensitivity level (MSL) are one. They are based on planar hall effect technology and offered in multiple magnetic thresholds, output interfaces, and packages to accommodate various applications.

The micropower version has very low power consumption, which is ideal for battery operated products where minimal current consumption is required.

The general version has milliampere-level power consumption. Its maximum switching frequency is 30kHz.

Typical Applications

- Position, proximity contactless switch in battery powered consumer, home appliances and industrial applications.
- Smart meters
- IOT devices
- Medical devices
- Robot vacuum cleaner

Packages



STD: SOT23-3L



TO: TO-92s

Key Features

- -40°C to +125°C operating temperature
- Industrial level
- 1.65 V to 5.5 V operating Vcc range
- Micropower operation version available:
20 Hz sampling rate, 1.5 µA average current consumption
- General operation version available:
2 mA current consumption
- Magnetic threshold options (typ.): 1.9 mT, 3.6 mT
- Omnipolar/unipolar switch
- Output interface options: open drain, push-pull
- Package options: SOT23-3L, TO-92s

Device Information

Part Number	Package	Body Size
NSM1071	SOT23-3L	2.926(mm)*2.80(mm)
	TO-92s	18.45(mm)*4.00(mm)
NSM1072	SOT23-3L	2.926(mm)*2.80(mm)
	TO-92s	18.45(mm)*4.00(mm)

Functional Block Diagram

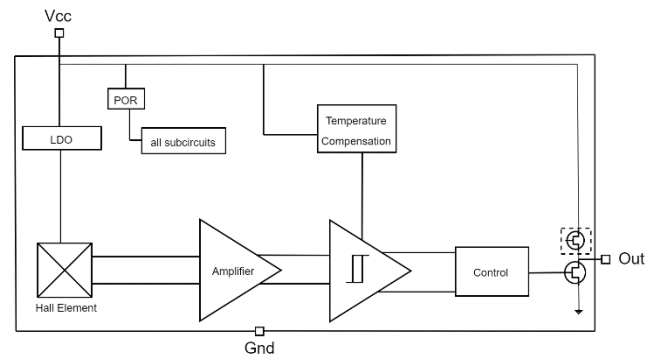


Figure 1 NSM107X Block Diagram

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1. Pin Configuration and Functions

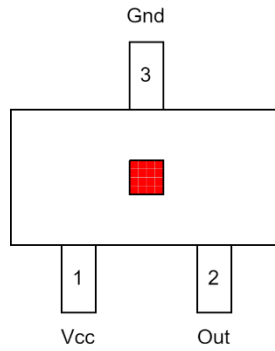


Figure 1.1 SOT23-3L Package

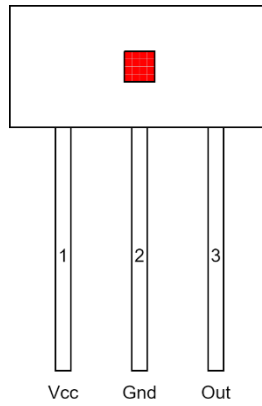


Figure 1.2 TO-92s Package

Table 1.1 NSM107X Pin Configuration and Functions

Symbol	Pin No.		Function
	SOT23-3L	TO-92s	
Vcc	1	1	Power Supply
Gnd	3	2	Ground Reference
Out	2	3	Output

2. Axis of Sensitivity

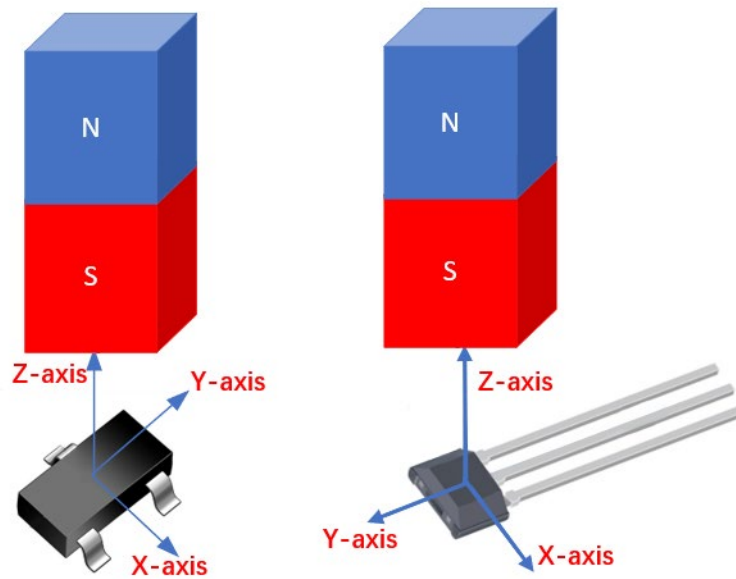


Figure 2.1 Axis of Sensitivity: Z axis

3. Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)

Parameters	Symbol	Min	Typ.	Max	Unit	Comments
Power Supply Voltage	$V_{CC}^{[1]}$	-0.3		6.5	V	
Output Voltage (Open Drain)	V_{OUT_OD}	-0.3		6.5	V	
Output Voltage (Push-pull)	V_{OUT_PP}	-0.3		$V_{CC}+0.3$	V	The maximum voltage must not exceed 6.5V
Output Current	I_O	-5		5	mA	
Magnetic Flux Density	B_{MAX}	Unlimited			mT	
Junction Temperature	T_J			150	°C	
Operating Temperature Range	T_A	-40		125	°C	
Storage Temperature	$T_{STORAGE}$			150	°C	
Lead Soldering Temperature, <10 seconds	$T_{SOLDERING}$			260	°C	

[1]: The maximum junction temperature should not be exceeded

4. ESD Ratings

Characteristic	Symbol	Notes	Rating	Units
ESD Voltage	$V_{ESD(HBM)}$	Human body model (HBM), per ESDA/JEDEC JS-001 ^[1]	±4000	V
	$V_{ESD(CDM)}$	Charged-device model (CDM), per ESDA/JEDEC JS-002 ^[2]	±500	V

[1]: JEDEC document JS-001 that 500-V HBM allows safe manufacturing with a standard ESD control process.

[2]: JEDEC document JS-001 that 250-V CDM allows safe manufacturing with a standard ESD control process.

5. Recommended Operating Conditions

For $V_{CC} = 1.65\text{ V to }5.5\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

Parameters	Symbol	Min	Typ.	Max	Unit	Comments
Power Supply Voltage	V_{CC}	1.65		5.5	V	
Bypass Capacitor	C_{BYP}		100		nF	
Pull-up Resistance (Open Drain)	$R_{PULL-UP}$	1000			Ω	
Load Capacitor	C_{LOAD}		4.7		nF	

6. Thermal Information

Characteristic	Symbol	Test Conditions	Typ.	Units
Package Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	Package STD 1-layer PCB with copper limited to solder pads	290	$^\circ\text{C/W}$
		Package TO 1-layer PCB with copper limited to solder pads	250	$^\circ\text{C/W}$

7. Specifications

7.1. Electrical Characteristics

For $V_{CC} = 1.65\text{ V}$ to 5.5 V , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

Parameters	Symbol	Min	Typ. ^[1]	Max	Unit	Comments	
Supply And Startup							
Average Supply Current	$I_{CC(AVG)}$	General Version		1.4	4	mA	$T \geq 10\text{s}$, no load
		Sleep Hold Current@1.65V		0.2	0.5	μA	
		Micropower Version@1.65V		0.7	1.77	μA	
		Micropower Version@3.3V		1.5	2.91	μA	
		Micropower Version@5.5V		2.6	4.57	μA	
Power-On Time	t_{PO}		500	700	μs	$V_{CC} > 1.65\text{V}$, Output low	
Power-On State	POS		High			$V_{CC} \geq V_{CC(min)}$, $t < t_{PO}$	
Micropower Operation							
Awake Period	t_{AWAKE}		50		ms		
Awake Time	t_{ACTIVE}		27		μs		
Chopper Stabilization							
Chopping Frequency ^[2]	f_C		500		kHz		
Maximum Switching Frequency	f_{SW}	General Version		30		kHz	Sine wave magnetic field with amplitude $> 2 \cdot B_{OP}$
		Micropower Version		20		Hz	
Open Drain Output							
Output Leakage Current	I_{OUTOFF}			1	μA	$V_{PULL-UP} = 3.3\text{ V}$, output off, $V_{CC} \geq V_{CC(min)}$, $t > t_{PO}$	
Output Voltage High	V_{OUTH}	$V_{CC} - 0.0047$		V_{CC}	V	Output off, $R_{PULL-UP} = 4.7\text{ k}\Omega$, no load	
Output Saturation Voltage	V_{OUTSAT}		0.025	0.04	V	Output on, $I_{OUT} = 1\text{ mA}$	
Output Rise Time	t_r		0.5		μs	$C_{LOAD}^{[3]} = 22\text{ pF}$ $R_{PULL-UP} = 4.7\text{ k}\Omega$	

Parameters	Symbol	Min	Typ. [1]	Max	Unit	Comments
Output Fall Time	t_f		0.2		μs	$C_{\text{LOAD}}^{[3]} = 22 \text{ pF}$ $R_{\text{PULL-UP}} = 4.7 \text{ k}\Omega$
PUSH-PULL OUTPUT						
Output Voltage High	V_{OUTH}	$0.9 \cdot V_{\text{CC}}$			V	Output off, $I_{\text{OUT}} = -1 \text{ mA}$
Output Voltage Low	V_{OUTL}			$0.1 \cdot V_{\text{CC}}$	V	Output on, $I_{\text{OUT}} = 1 \text{ mA}$
Output Rise Time	t_r		0.1		μs	$C_{\text{LOAD}}^{[3]} = 22 \text{ pF}$
Output Fall Time	t_f		0.1		μs	$C_{\text{LOAD}}^{[3]} = 22 \text{ pF}$

[1] Typical data is defined at $T_A = 25^\circ\text{C}$ and $V_{\text{CC}} = 3.3\text{V}$ unless otherwise noted.

[2] Guaranteed by device design and characterization.

[3]: C_{LOAD} – measurement probe capacitance.

7.2. Magnetic Characteristics

DC Operating parameters, $T_A = 25^\circ\text{C}$, $V_{\text{CC}} = 1.65\text{V}$ to 5.5V , general version

NSM1071:

Code (Suffix)	Operating Point B_{OP} (mT)			Release Point B_{RP} (mT)			Hysteresis B_{HYS} (mT)		
	Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max
1	1	1.9	3.5	0.5	1.4	2.8	0.3	0.5	0.9
2	2.2	3.6	5.5	1.7	2.6	4.4	0.5	1	1.5

NSM1072:

Code (Suffix)	Operating Point B_{OP} (mT)			Release Point B_{RP} (mT)			Hysteresis B_{HYS} (mT)		
	Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max
1	± 1	± 1.9	± 3.5	± 0.5	± 1.4	± 2.8	0.3	0.5	0.9
2	± 2.2	± 3.6	± 5.5	± 1.7	± 2.6	± 4.4	0.5	1	1.5

DC Operating parameters, $T_A = 25^\circ\text{C}$, micropower version

NSM1071:

Code (Suffix)	Comments	Operating Point B_{OP} (mT)			Release Point B_{RP} (mT)			Hysteresis B_{HYS} (mT)		
		Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max
1	V_{CC} from 1.65V to 5.5V	1.3	2.6	4.5	0.7	2.1	3.5	0.3	0.5	0.9
	$V_{\text{CC}} = 3\text{V}$	2.0	2.6	3.7	1.5	2.1	3.3	0.3	0.5	0.9
2	V_{CC} from 1.65V to 5.5V	3.0	4.2	6.5	2.5	3.4	5.6	0.4	0.8	1.3
	$V_{\text{CC}} = 3\text{V}$	3.5	4.2	5.5	2.7	3.4	4.7	0.4	0.8	1.3

NSM1072:

Code (Suffix)	Comments	Operating Point B_{OP} (mT)			Release Point B_{RP} (mT)			Hysteresis B_{HYS} (mT)		
		Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max
1	Vcc from 1.65V to 5.5V	±1.3	±2.6	±4.5	±0.7	±2.1	±3.5	0.3	0.5	0.9
	Vcc=3V	±2.0	±2.6	±3.7	±1.5	±2.1	±3.3	0.3	0.5	0.9
2	Vcc from 1.65V to 5.5V	±3.0	±4.2	±6.5	±2.5	±3.4	±5.6	0.4	0.8	1.3
	Vcc=3V	±3.5	±4.2	±5.5	±2.7	±3.4	±4.7	0.4	0.8	1.3

8. Function Description

8.1. Overview

NSM107X integrates rotating current Hall plate, Schmitt trigger, open drain & push-pull output, which can convert the changing external magnetic field signal into a digital voltage signal to achieve position detection.

When the applied magnetic flux density (B) perpendicular to the package exceeds the operating point (B_{op}) the output is switched on (pulled low). The output will be turned off when B is lower than the releasing point (B_{rp}). Omnipolar (North and South pole) and unipolar (South or North pole) magnetic responses are available.

The NSM107X is available in two packages: STD is a general-purpose 3-pin SOT-23 package, and TO is a general-purpose TO-92s plug-in package. Both packages are lead (Pb) free and RoHS compliant with 100% tin plated lead frame.

8.2. Function Description

The output state of NSM107X changes when a magnetic field perpendicular to the Hall-effect sensor exceeds the operate point threshold (B_{op}). When the magnetic field is reduced below the release point (B_{rp}), the device output changes to the alternate state. For unipolar an increasing south field is required; In omnipolar mode, the device will switch on and off with either magnetic polarity.

Figure 8.1 Magnetic options shows the output switching behavior relative to increasing and decreasing magnetic field. On the horizontal axis, the $B+$ direction indicates increasing south polarity magnetic field strength.

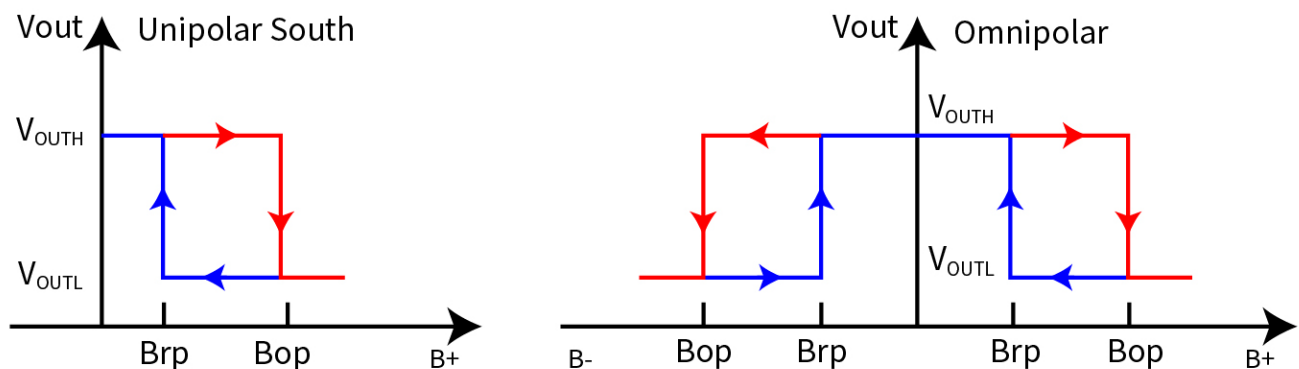


Figure 8.1 Magnetic Options

9. Application Note

Typical Application Circuit

It is strongly recommended that an external bypass capacitor be connected between the supply and ground of the device to guarantee correct performance under harsh environmental conditions and to reduce noise from internal circuitry.

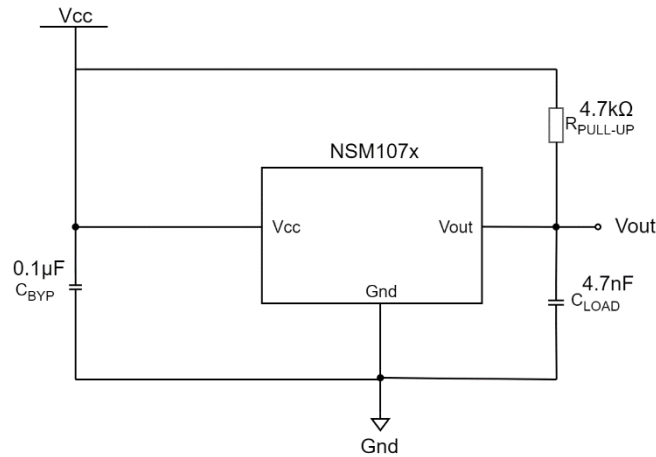


Figure 9.1 Typical Application Circuit for Open Drain Output

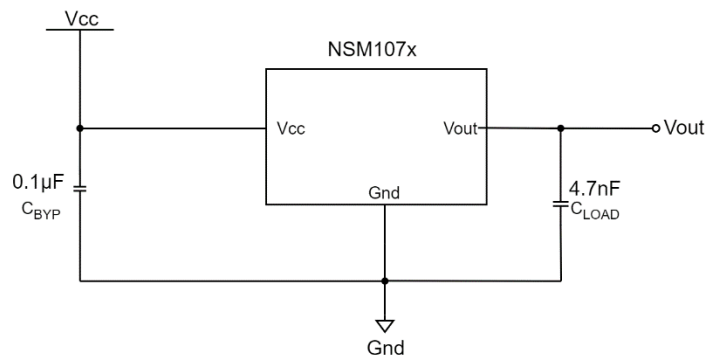
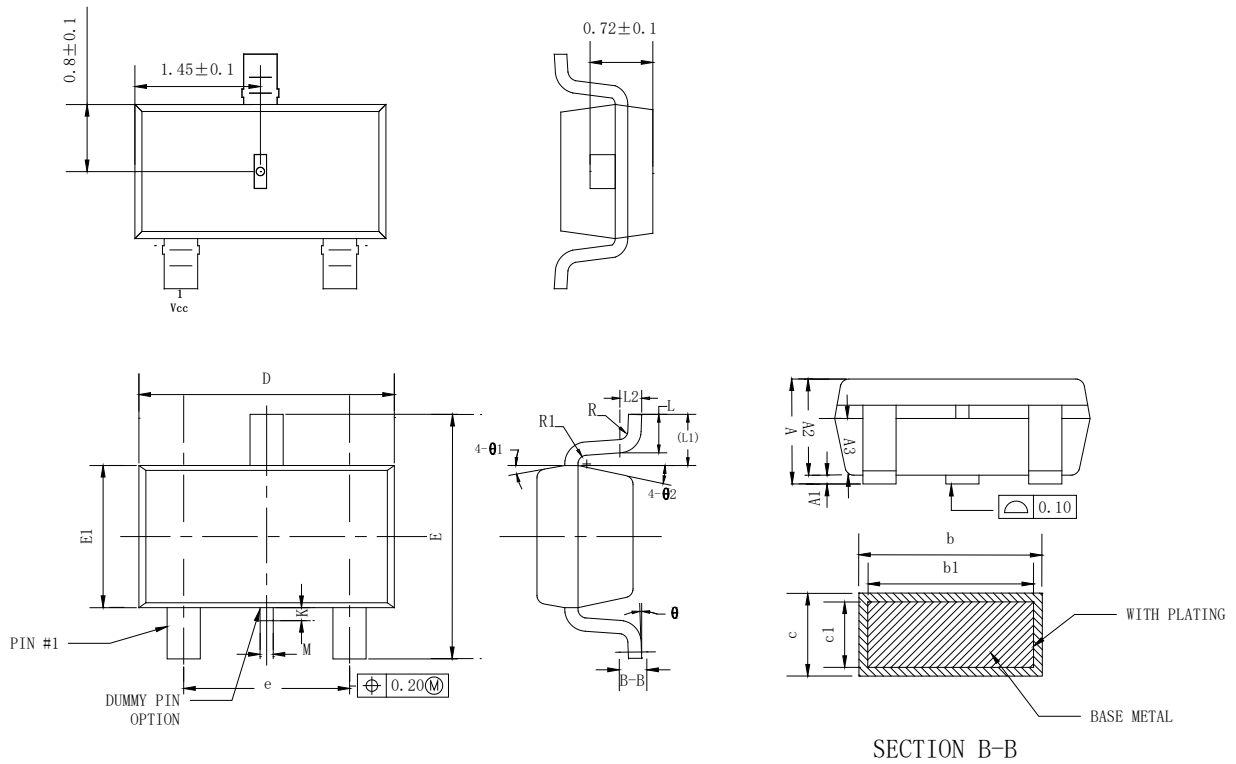


Figure 9.2 Typical Application Circuit for Push-pull Output

10. Package Information

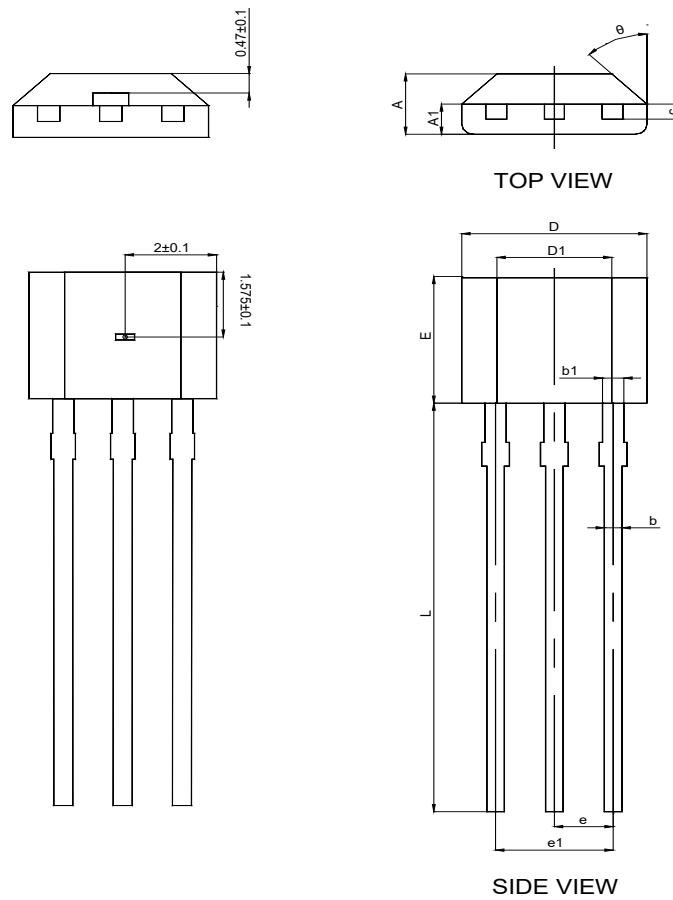
10.1. STD Package



Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	-	-	1.250
A1	0.000	-	0.150
A2	1.000	1.100	1.200
A3	0.600	0.650	0.700
b	0.340	-	0.450
b1	0.340	0.380	0.410
c	0.120	-	0.200
c1	0.120	0.150	0.160
D	2.826	2.926	3.026
E	2.600	2.800	3.000
E1	1.526	1.626	1.700
e	1.800	1.900	2.000
K	0.000	-	0.200
L	0.300	0.400	0.600
L1	0.590REF		
L2	0.250BSC		
M	0.100	0.150	0.200
R	0.050	-	0.200
R1	0.050	-	0.200
θ	0°	-	8°
$\theta1$	8°	10°	12°
$\theta2$	10°	12°	14°

Figure 10.1 SOT23-3L Package Shape and Dimension in Millimeters

10.2. TO Package



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.420	1.620
A1	0.660	0.860
b	0.330	0.480
b1	0.400	0.510
c	0.330	0.510
D	3.900	4.100
D1	2.280	2.680
E	3.050	3.250
e	1.270 TYP.	
e1	2.440	2.640
L	15.100	15.500
θ	45° TYP.	

Figure 10.2 TO-92s Package Shape and Dimension in Millimeters

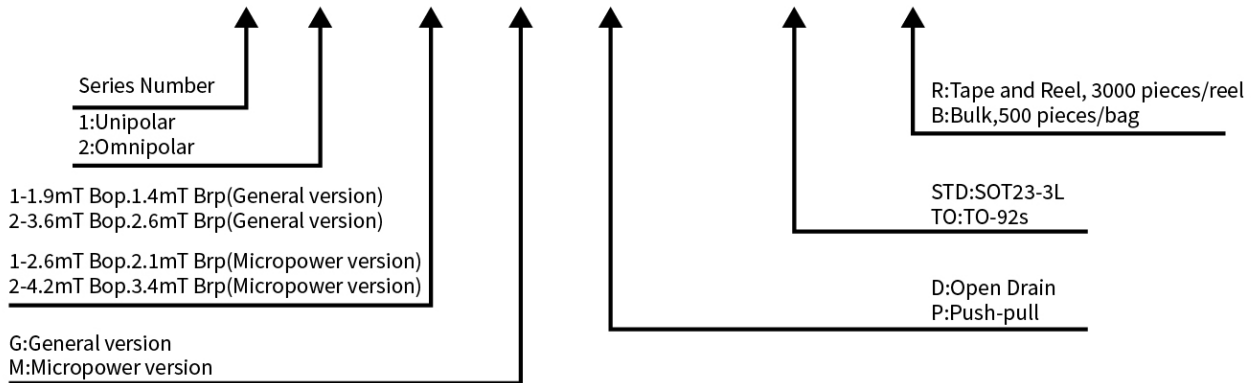
11. Ordering Information

Part Number	Device Switch Threshold Magnitude	Power Mode	Output Interface	Package	Packing
NSM1071-1GD-DSTDR	BOP: 1.9mT; BRP:1.4mT	General Power	Open Drain	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1071-1GP-DSTDR	BOP: 1.9mT; BRP:1.4mT	General Power	Push-pull	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1071-1GD-DTOB	BOP: 1.9mT; BRP:1.4mT	General Power	Open Drain	TO-92s	Bulk, 500 pieces/bag
NSM1071-1GP-DTOB	BOP: 1.9mT; BRP:1.4mT	General Power	Push-pull	TO-92s	Bulk, 500 pieces/bag
NSM1071-1MD-DSTDR	BOP: 2.6mT; BRP:2.1mT	Micropower	Open Drain	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1071-1MP-DSTDR	BOP: 2.6mT; BRP:2.1mT	Micropower	Push-pull	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1071-2GD-DTOB	BOP: 3.6mT; BRP:2.6mT	General Power	Open Drain	TO-92s	Bulk, 500 pieces/bag
NSM1071-2MD-DTOB	BOP: 4.2mT; BRP:3.4mT	Micropower	Open Drain	TO-92s	Bulk, 500 pieces/bag
NSM1071-2MP-DTOB	BOP: 4.2mT; BRP:3.4mT	Micropower	Push-pull	TO-92s	Bulk, 500 pieces/bag
NSM1072-1GD-DSTDR	BOP: 1.9mT; BRP:1.4mT	General Power	Open Drain	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-1GP-DSTDR	BOP: 1.9mT; BRP:1.4mT	General Power	Push-pull	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-1GD-DTOB	BOP: 1.9mT; BRP:1.4mT	General Power	Open Drain	TO-92s	Bulk, 500 pieces/bag
NSM1072-1GP-DTOB	BOP: 1.9mT; BRP:1.4mT	General Power	Push-pull	TO-92s	Bulk, 500 pieces/bag
NSM1072-1MD-DSTDR	BOP: 2.6mT; BRP:2.1mT	Micropower	Open Drain	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-1MP-DSTDR	BOP: 2.6mT; BRP:2.1mT	Micropower	Push-pull	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-1MD-DTOB	BOP: 2.6mT; BRP:2.1mT	Micropower	Open Drain	TO-92s	Bulk, 500 pieces/bag
NSM1072-1MP-DTOB	BOP: 2.6mT; BRP:2.1mT	Micropower	Push-pull	TO-92s	Bulk, 500 pieces/bag

NSM1072-2GD-DSTDR	BOP: 3.6mT; BRP:2.6mT	General Power	Open Drain	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-2GP-DSTDR	BOP: 3.6mT; BRP:2.6mT	General Power	Push-pull	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-2GD-DTOB	BOP: 3.6mT; BRP:2.6mT	General Power	Open Drain	TO-92s	Bulk, 500 pieces/bag
NSM1072-2GP-DTOB	BOP: 3.6mT; BRP:2.6mT	General Power	Push-pull	TO-92s	Bulk, 500 pieces/bag
NSM1072-2MD-DSTDR	BOP: 4.2mT; BRP:3.4mT	Micropower	Open Drain	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-2MP-DSTDR	BOP: 4.2mT; BRP:3.4mT	Micropower	Push-pull	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1072-2MD-DTOB	BOP: 4.2mT; BRP:3.4mT	Micropower	Open Drain	TO-92s	Bulk, 500 pieces/bag
NSM1072-2MP-DTOB	BOP: 4.2mT; BRP:3.4mT	Micropower	Push-pull	TO-92s	Bulk, 500 pieces/bag

Part Number Rule:

NSM107(1) - (1) (M) (D) - D(STD) (R)



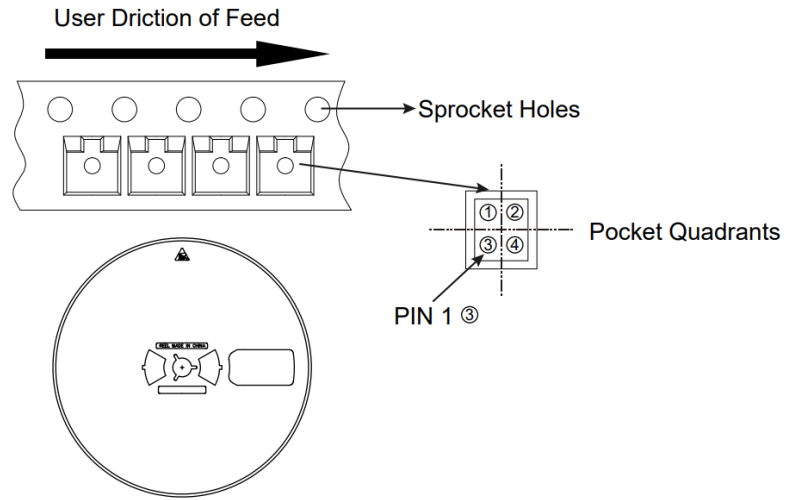


Figure 12.1 Tape and Reel Information of SOT23-3L

Revision History

Revision	Description	Date
1.0	Initial Version	2024/05/15

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