

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 μ A 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

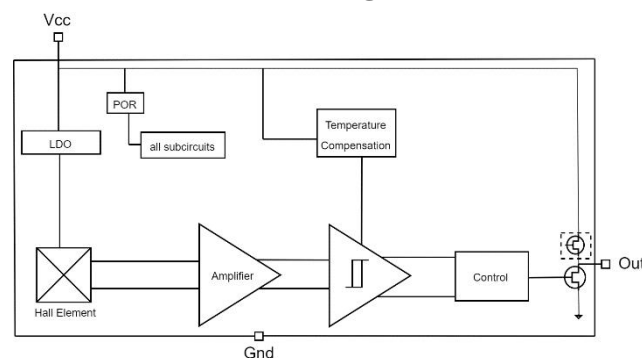


Figure 1 NSM107X Block Diagram

INDEX

1. PIN CONFIGURATION AND FUNCTIONS 3

2. AXIS OF SENSITIVITY 4

3. ABSOLUTE MAXIMUM RATINGS 4

4. ESD RATINGS 5

5. RECOMMENDED OPERATING CONDITIONS 5

6. THERMAL INFORMATION 5

7. SPECIFICATIONS 6

 7.1. ELECTRICAL CHARACTERISTICS 6

 7.2. MAGNETIC CHARACTERISTICS 7

8. FUNCTION DESCRIPTION 8

 8.1. OVERVIEW 8

 8.2. FUNCTION DESCRIPTION 8

9. APPLICATION NOTE 9

 TYPICAL APPLICATION CIRCUIT 9

10. PACKAGE INFORMATION 10

 10.1. STD PACKAGE 10

 10.2. TO PACKAGE 11

11. ORDERING INFORMATION 12

12. TAPE AND REEL INFORMATION 14

REVISION HISTORY 16

1. Pin Configuration and Functions

Figure 1.1 SOT23-3L Package

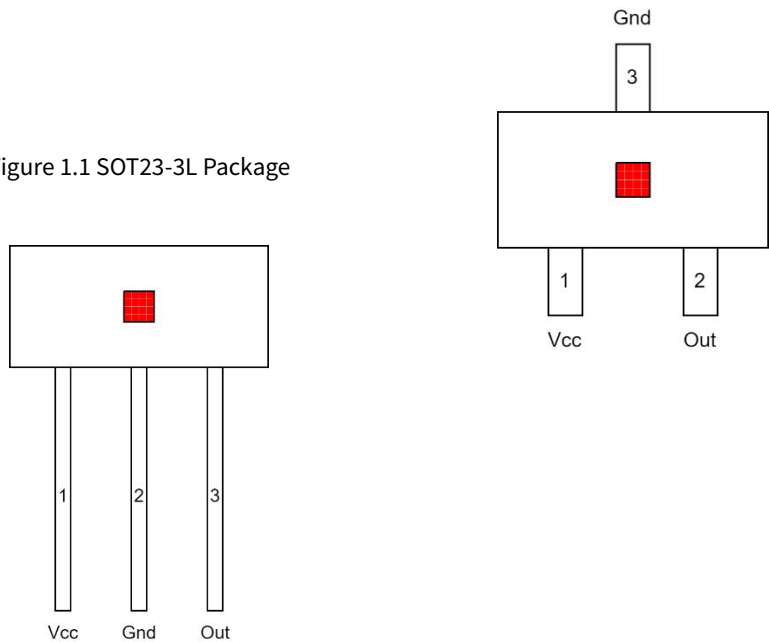


Figure 1.2 TO-92s Package

Table 1.1 NSM107X Pin Configuration and Functions

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

2. Axis of Sensitivity

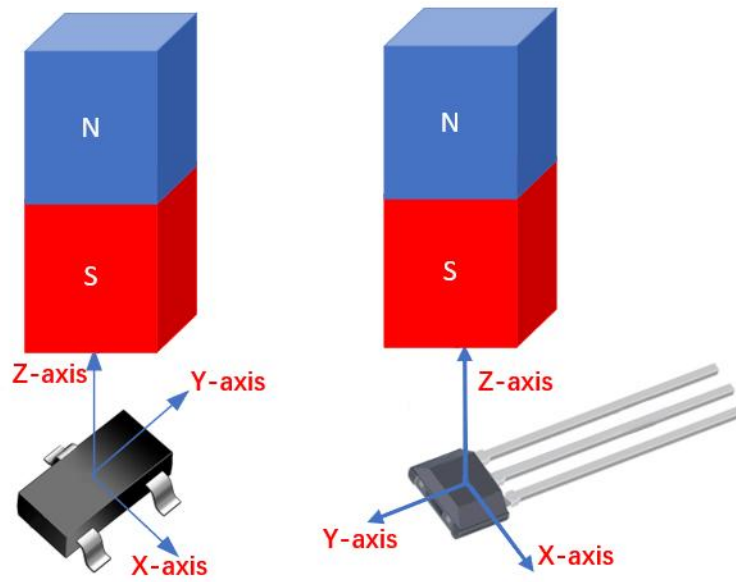


Figure 2.1 Axis of Sensitivity: Z axis

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 V to 5.5 V, T_A =25°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	°C/W
		Package TO 1-layer PCB with copper limited to solder pads	250	°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≥10s, 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} >1.65V, Output low
Power-On State	POS		High				V _{CC} ≥ 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*B _{OP}
		Micropower Version		20		Hz	
Open Drain Output							
Output Leakage Current	I _{OUTOFF}				1	μA	V _{PULL-UP} = 3.3 V, output off, V _{CC} ≥ 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 kΩ, no load
Output Saturation Voltage	V _{OUTSAT}			0.025	0.04	V	Output on, I _{OUT} = 1 mA
Output Rise Time	t _r			0.5		μs	C _{LOAD} ^[3] = 22 pF R _{PULL-UP} = 4.7 kΩ

Parameters	Symbol		Min	Typ. ^[1]	Max	Unit	Comments
Output Fall Time	t _f			0.2		μs	C _{LOAD} ^[3] = 22 pF R _{PULL-UP} = 4.7 kΩ
PUSH-PULL OUTPUT							
Output Voltage High	V _{OUTH}		0.9*Vcc			V	Output off, I _{OUT} = -1 mA
Output Voltage Low	V _{OUTL}				0.1*Vcc	V	Output on, I _{OUT} = 1 mA
Output Rise Time	t _r			0.1		μs	C _{LOAD} ^[3] = 22 pF
Output Fall Time	t _f			0.1		μs	C _{LOAD} ^[3] = 22 pF

[1] Typical data is defined at TA=25°C and Vcc=3.3V 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°C, Vcc = 1.65V 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°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	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

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.

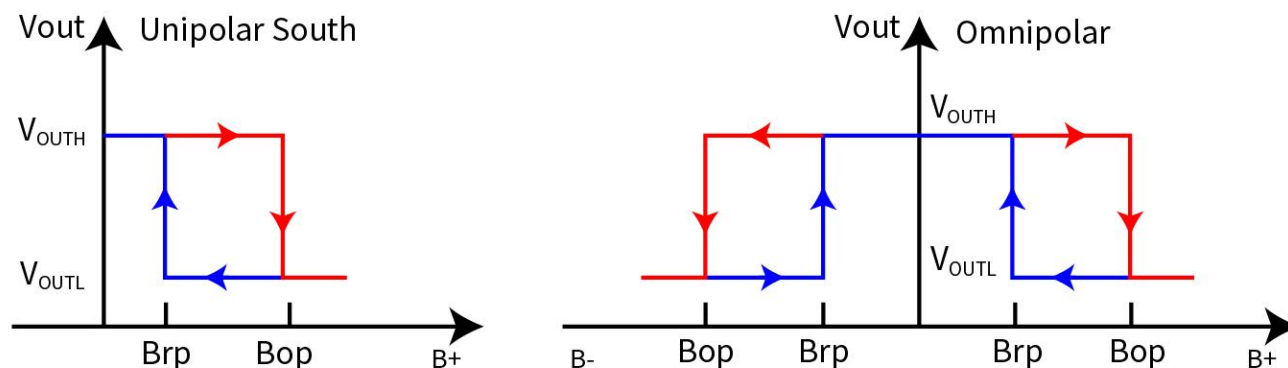


Figure 8.1 Magnetic Options

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.

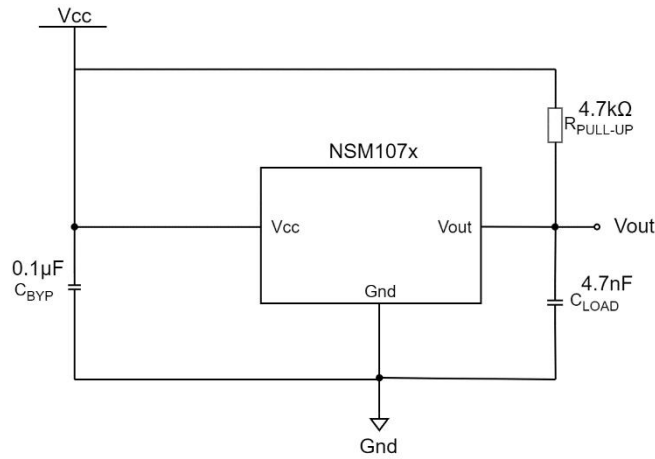


Figure 9.1 Typical Application Circuit for Open Drain Output

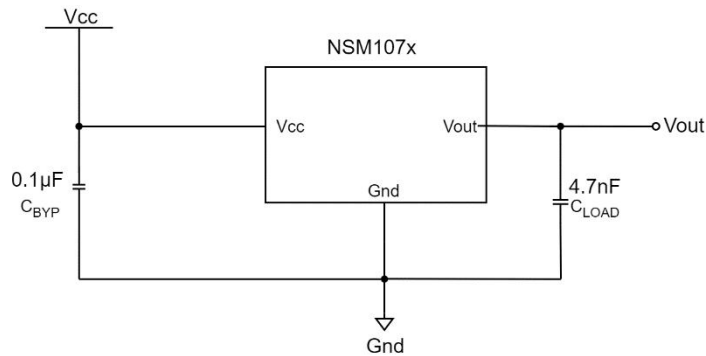
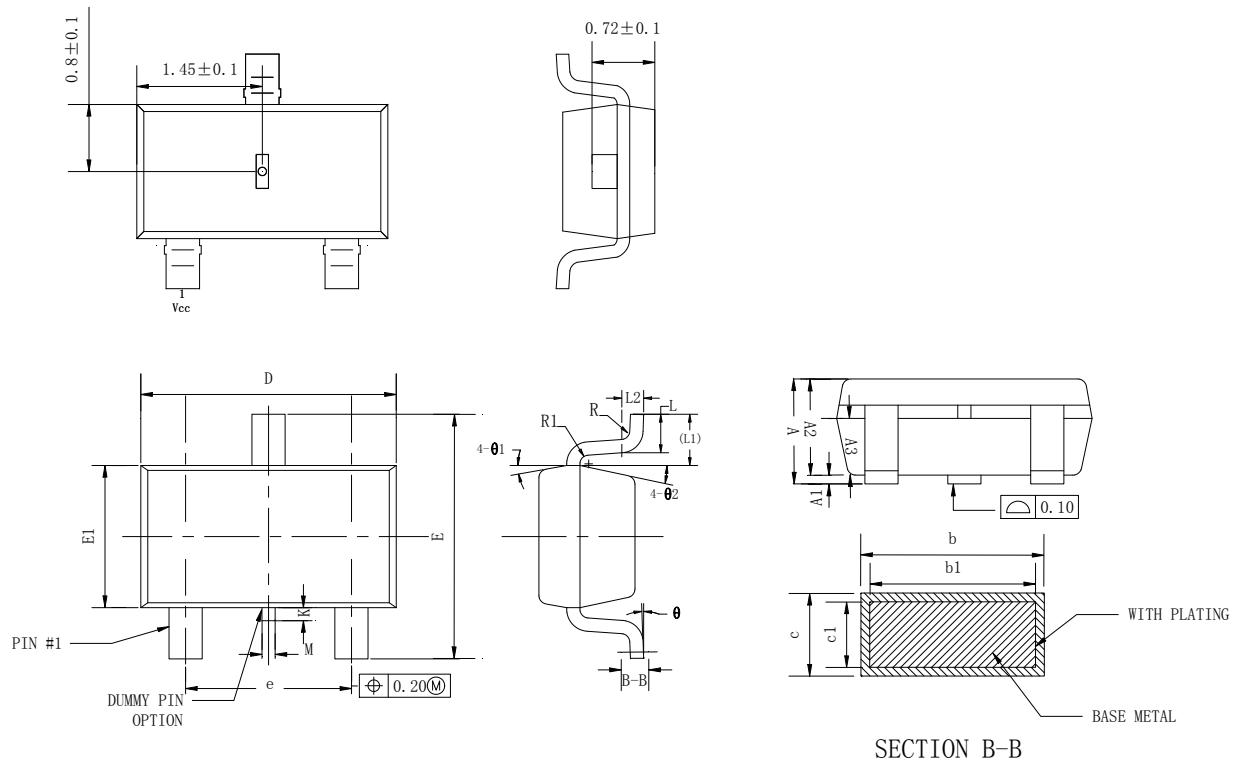


Figure 9.2 Typical Application Circuit for Push-pull Output

10. Package Information

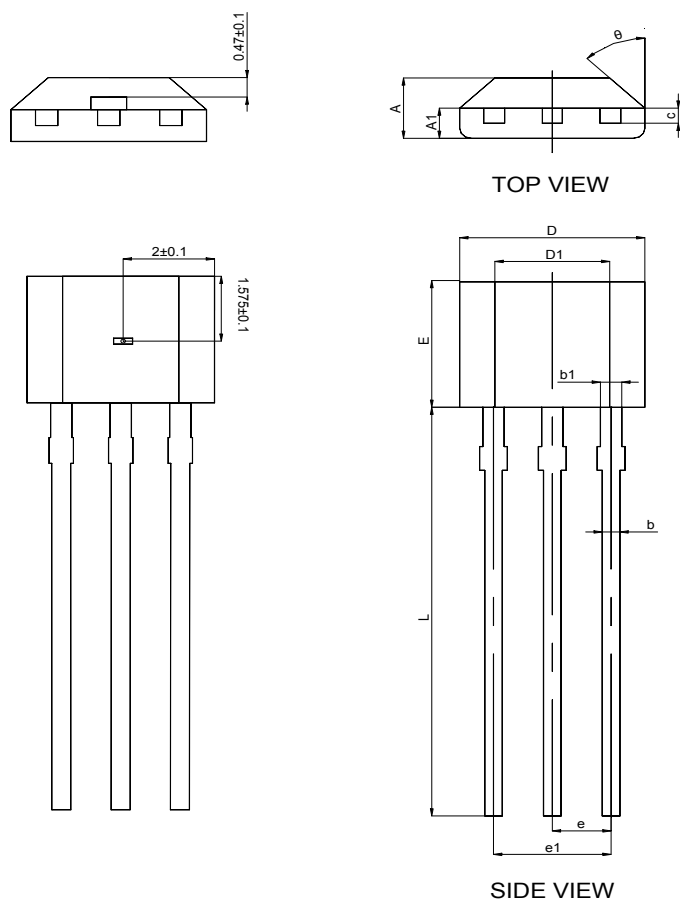
10.1. STD Package



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°
θ1	8°	10°	12°
θ2	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.	

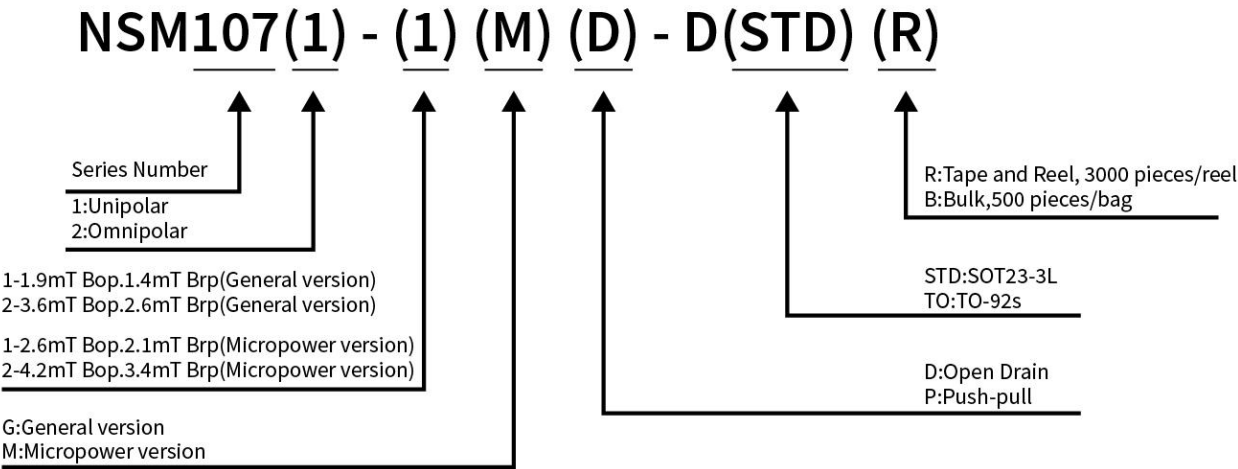
Figure 10.2 TO-92s Package Shape and Dimension in Millimeters

11. Ordering Information

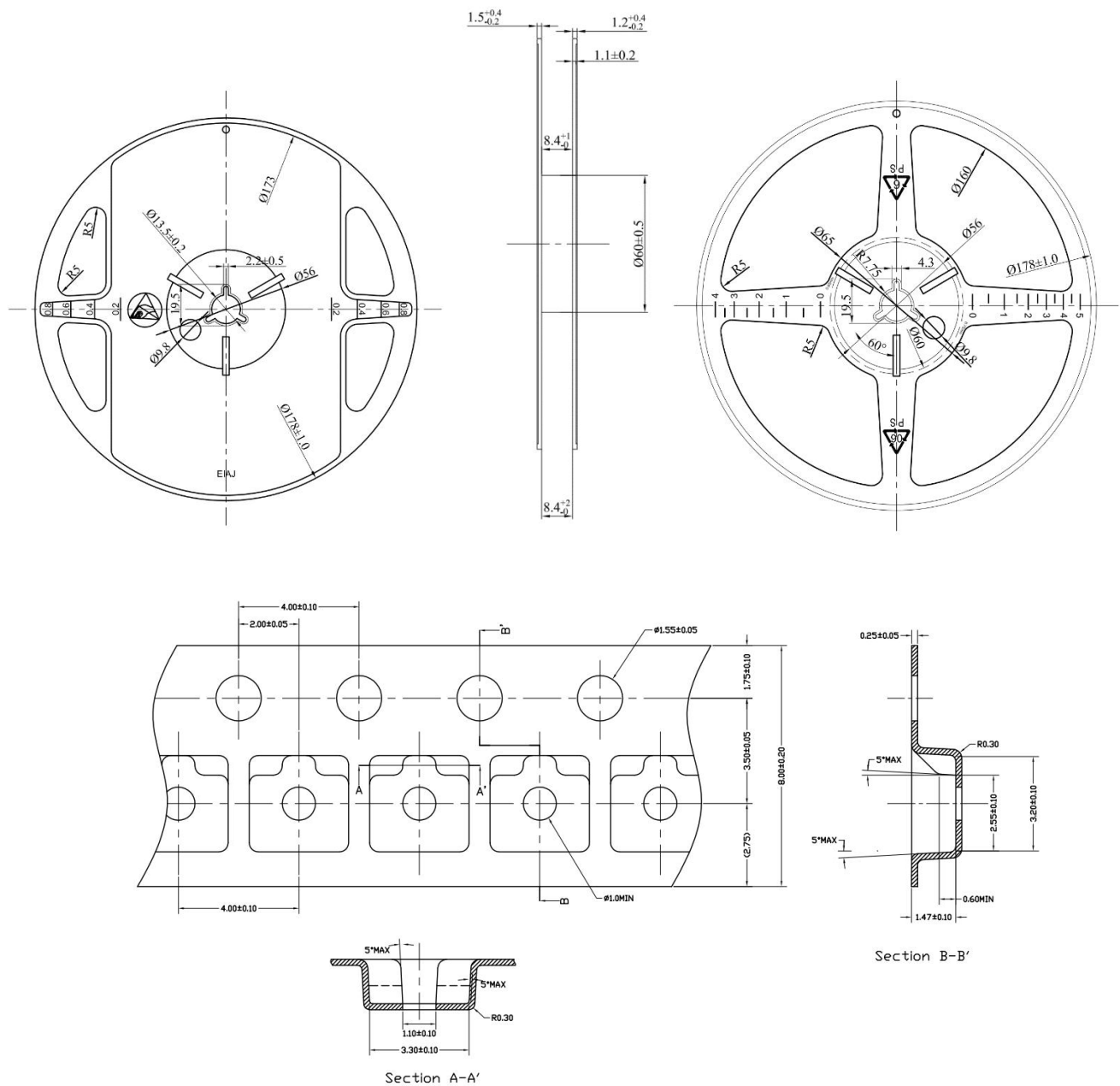
Part Number	Device Switch Threshold Magnitude	Power Mode	Output Interface	Package	Packing
NSM1071-1GD-DSTDR	BOP: 1.9mT; BRP:1.4mT	General Power	Open Drain	SOT23-3L	Tape and Reel, 3000 pieces/reel
NSM1071-1GP-DSTDR	BOP: 1.9mT; BRP:1.4mT	General Power	Push-pull	SOT23-3L	Tape and Reel, 3000 pieces/reel
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:



12. Tape and Reel Information



NOTES:

- 1.MATERIAL:CONDUCTIVE PS
- 2.ALL DIMS IN MM
- 3.There must not be foreign body adhesion and the state of the surface must be excellent
- 4.A permissible difference of the accumulation pitch of the sending hole is assumed to be ± 0.2 up to 10 pitches
- 5.17" PAPER-Reel, 125000pockets
- 6.Surface resistance $1 \times 10^5 \sim 1 \times 10^9$ OHMS/SQ

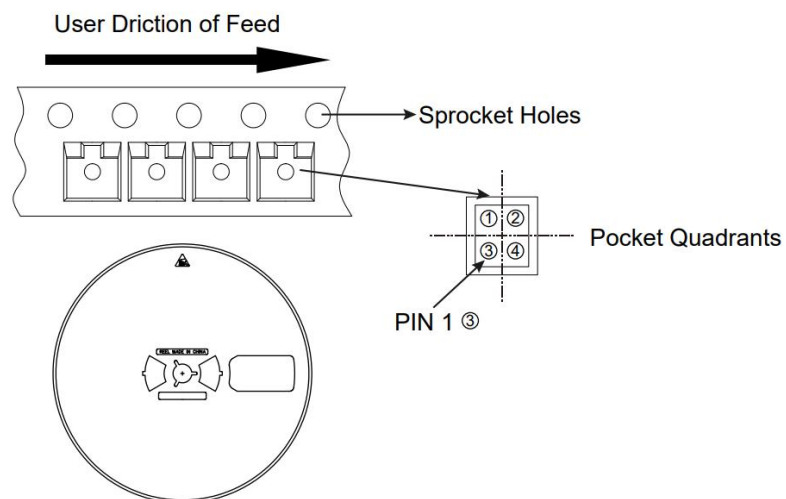


Figure 12.1 Tape and Reel Information of SOT23-3L

Revision History

Revision	Description	Date
1.0	Initial Version	2024/05/15

IMPORTANT NOTICE

The information given in this document (the “Document”) shall in no event be regarded as any warranty or authorization of, express or implied, including but not limited to accuracy, completeness, merchantability, fitness for a particular purpose or infringement of any third party’s intellectual property rights.

Users of this Document shall be solely responsible for the use of NOVOSENSE’s products and applications, and for the safety thereof. Users shall comply with all laws, regulations and requirements related to NOVOSENSE’s products and applications, although information or support related to any application may still be provided by NOVOSENSE.

This Document is provided on an “AS IS” basis, and is intended only for skilled developers designing with NOVOSENSE’ products. NOVOSENSE reserves the rights to make corrections, modifications, enhancements, improvements or other changes to the products and services provided without notice. NOVOSENSE authorizes users to use this Document exclusively for the development of relevant applications or systems designed to integrate NOVOSENSE’s products. No license to any intellectual property rights of NOVOSENSE is granted by implication or otherwise. Using this Document for any other purpose, or any unauthorized reproduction or display of this Document is strictly prohibited. In no event shall NOVOSENSE be liable for any claims, damages, costs, losses or liabilities arising out of or in connection with this Document or the use of this Document.

For further information on applications, products and technologies, please contact NOVOSENSE (www.novosns.com).

Suzhou NOVOSENSE Microelectronics Co., Ltd