

ML6101 Series Voltage Monitor

❖ Application

- ◆ *Battery Charger Voltage Monitor*

❖ Features

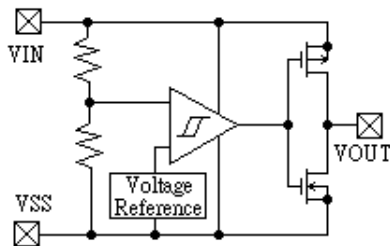
- CMOS Low Power Consumption : Typical 1.0uA at $V_{in}=2.0V$
- Selectable Monitor Voltage : 1.1V to 6.0V in 0.1V increments
- Highly Accurate : Detect Voltage 1.1V to 1.9V $\pm 3\%$
Detect Voltage 2.0V to 6.0V $\pm 2\%$
- Operating Voltage : 0.8V to 10.0V
- Package Available : SOT23 (150mW), SOT89 (500mW) & TO92 (300mW)

❖ General Description

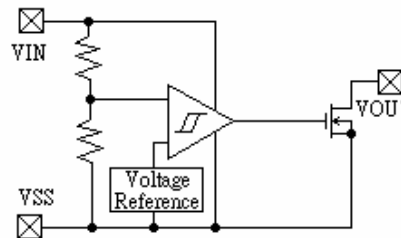
The ML6101 is a group of high-precision and low-power Voltage Monitor. The ML6101 consists of a highly-accurate and low-power reference voltage source, a comparator, a hysteresis circuit, and an output driver. Detect voltage is very accurate and stable with N-channel open drain and CMOS, are available. Output High when the Monitor Voltage goes upto or higher than the user selected Monitor Voltage.

❖ Block Diagram

(1) CMOS Output



(2) N-Channel Open Drain Output



❖ Absolute Maximum Ratings

Parameter	Symbol	Ratings	Units
Input Voltage	V_{IN}	10	V
Output Current	I_{OUT}	50	mA
Output Voltage	V_{OUT}	$V_{SS}-0.3 \sim V_{IN}+0.3$	V
Continuous Total Power Dissipation	SOT-23	150	mW
	SOT-89	500	
	TO-92	300	
Operating Ambient Temperature	T_{opr}	-40 ~ +70	$^{\circ}C$
Storage Temperature	T_{stg}	-40 ~ +70	$^{\circ}C$

❖ Electrical Characteristics

<i>Parameter</i>	<i>Symbol</i>	<i>Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Units</i>
<i>Monitor Voltage</i>	V_{MON}	$V_{MON} = 1.1V \text{ to } 1.9V$	X0.97	V_{MON}	X1.03	V
		$V_{MON} = 2.0V \text{ to } 6.0V$	X0.98	V_{MON}	X1.02	V
<i>Hysteresis Range</i>	V_{HYS}	$V_{MON} = 1.1V \text{ to } 2.9V$	X0.04	V_{MON} X0.05	X0.06	V
		$V_{MON} = 3.0V \text{ to } 6.0V$	X0.015	V_{MON} X0.025	X0.035	V
<i>Supply Current</i>	I_{SS}	$V_{IN} = 1.0V$		0.8	2.0	uA
		$V_{IN} = 2.0V$		1.0	2.5	
		$V_{IN} = 3.0V$		1.3	3.0	
		$V_{IN} = 4.0V$		1.6	3.5	
		$V_{IN} = 5.0V$		2.0	4.0	
<i>Operating Voltage</i>	V_{IN}	$V_{DF} = 1.1 \sim 6.0V$	0.8		10.0	V
<i>Output Current</i>	I_{OUT}	<i>Nch</i> $V_{DS} = 0.5V$ $V_{IN} = 1.0V$ $V_{IN} = 2.0V$ $V_{IN} = 3.0V$ $V_{IN} = 4.0V$ $V_{IN} = 5.0V$		1.0		mA
				3.0		
				5.0		
				11.0		
				13.0		
	<i>Pch</i> $V_{DS} = 2.1V$ $V_{IN} = 8.0V$ (CMOS Output)		-10.0			
<i>Transient Delay Time</i> ($V_{DR} \rightarrow V_{OUT}$ Inversion)	t_{DLY}	<i>While V_{IN} changes from 0.6V to 10V</i>			0.2	ms

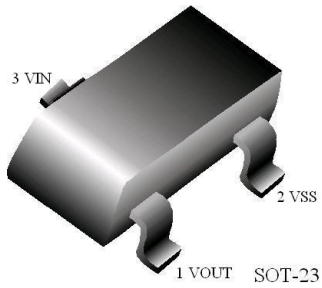
❖ Electrical Characteristics By Detector Threshold

Part Number	Standard Monitor Accuracy	Detector Threshold			Hysteresis Range		Supply Current		
		V _{MON} (V)			V _{HYS} (V)		I _{SS} (uA)		
		MIN.	TYP.	MAX.	MIN.	MAX.	Condition	TYP.	MAX.
ML6101X113XX	3%	1.067	1.100	1.133	V _{MON} x 0.04	V _{MON} x 0.06	V _{IN} = 1.0V	0.8	2.0
ML6101X123XX		1.164	1.200	1.236					
ML6101X133XX		1.261	1.300	1.339					
ML6101X143XX		1.358	1.400	1.442					
ML6101X153XX		1.455	1.500	1.545					
ML6101X163XX		1.552	1.600	1.648					
ML6101X173XX		1.649	1.700	1.751					
ML6101X183XX		1.746	1.800	1.854					
ML6101X193XX		1.843	1.900	1.957					
ML6101X202XX		1.960	2.000	2.040					
ML6101X212XX	2.058	2.100	2.142						
ML6101X222XX	2.156	2.200	2.244						
ML6101X232XX	2.254	2.300	2.346						
ML6101X242XX	2.352	2.400	2.448						
ML6101X252XX	2.450	2.500	2.550						
ML6101X262XX	2.548	2.600	2.652						
ML6101X272XX	2.646	2.700	2.754						
ML6101X282XX	2.744	2.800	2.856						
ML6101X292XX	2.842	2.900	2.958						
ML6101X302XX	2.940	3.000	3.060	V _{IN} = 3.0V	1.3	3.0			
ML6101X312XX	3.038	3.100	3.162						
ML6101X322XX	3.136	3.200	3.264						
ML6101X332XX	3.234	3.300	3.366						
ML6101X342XX	3.332	3.400	3.468						
ML6101X352XX	3.430	3.500	3.570						
ML6101X362XX	3.528	3.600	3.672						
ML6101X372XX	3.626	3.700	3.774						
ML6101X382XX	3.724	3.800	3.876						
ML6101X392XX	3.822	3.900	3.978				V _{IN} = 4.0V	1.6	3.5
ML6101X402XX	3.920	4.000	4.080						
ML6101X412XX	4.018	4.100	4.182						
ML6101X422XX	4.116	4.200	4.284						
ML6101X432XX	4.214	4.300	4.386						
ML6101X442XX	4.312	4.400	4.488						
ML6101X452XX	4.410	4.500	4.590						
ML6101X462XX	4.508	4.600	4.692						
ML6101X472XX	4.606	4.700	4.794						
ML6101X482XX	4.704	4.800	4.896	V _{IN} = 5.0V	2.0	4.0			
ML6101X492XX	4.802	4.900	4.998						
ML6101X502XX	4.900	5.000	5.100						
ML6101X512XX	4.998	5.100	5.202						
ML6101X522XX	5.096	5.200	5.304						
ML6101X532XX	5.194	5.300	5.406						
ML6101X542XX	5.292	5.400	5.508						
ML6101X552XX	5.390	5.500	5.610						
ML6101X562XX	5.488	5.600	5.712						
ML6101X572XX	5.586	5.700	5.814						
ML6101X582XX	5.684	5.800	5.916						
ML6101X592XX	5.782	5.900	6.018						
ML6101X602XX	5.880	6.000	6.120						

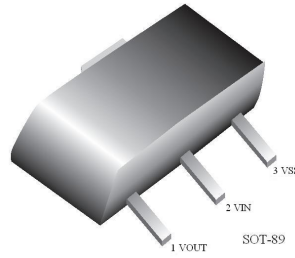
Part Number	Operating Voltage		Pch Output Current		Nch Output Current		Transient Delay Time
	V_{IN} (V)		Pch I_{OUT} (mA)		Nch I_{OUT} (mA)		t_{DLY} (ms)
	MIN.	MAX.	Condition	TYP.	Condition	TYP.	MAX.
ML6101X113XX	0.8V	10V	$V_{DS} = 2.1V$ $V_{IN} = 8.0V$	-10.0	$V_{DS} = 0.5V$ $V_{IN} = 1.0V$	1.0	0.2
ML6101X123XX							
ML6101X133XX							
ML6101X143XX							
ML6101X153XX							
ML6101X163XX							
ML6101X173XX							
ML6101X183XX							
ML6101X193XX							
ML6101X202XX							
ML6101X212XX							
ML6101X222XX							
ML6101X232XX							
ML6101X242XX							
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ML6101X362XX							
ML6101X372XX							
ML6101X382XX							
ML6101X392XX							
ML6101X402XX							
ML6101X412XX							
ML6101X422XX							
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ML6101X442XX							
ML6101X452XX							
ML6101X462XX							
ML6101X472XX							
ML6101X482XX							
ML6101X492XX							
ML6101X502XX							
ML6101X512XX							
ML6101X522XX							
ML6101X532XX							
ML6101X542XX							
ML6101X552XX							
ML6101X562XX							
ML6101X572XX							
ML6101X582XX							
ML6101X592XX							
ML6101X602XX							

❖ *Pin Configuration*

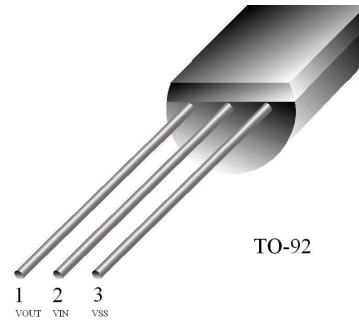
SOT-23-3



SOT-89-3



TO-92



Package Pin Number			Pin Name	Function
SOT-23-3	SOT-89-3	TO-92		
1	1	1	VOUT	Supply Voltage Output
3	2	2	VIN	Supply Voltage Input
2	3	3	VSS	Ground

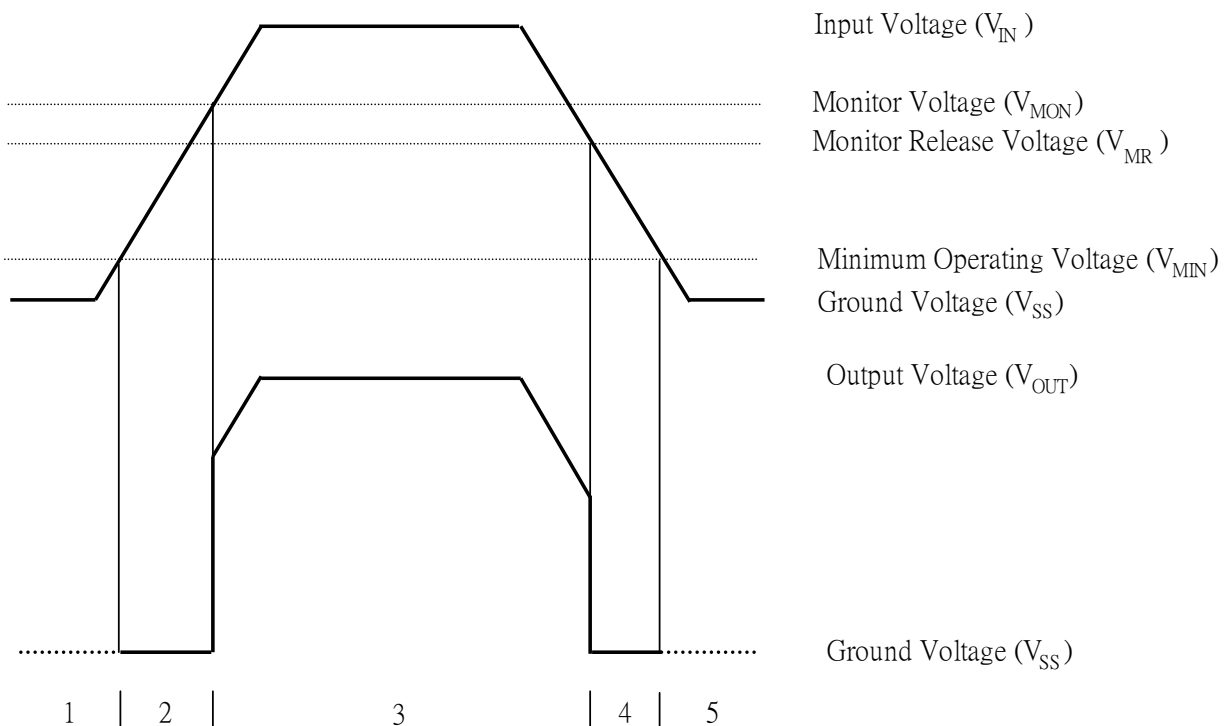
❖ *Functional Description (Refers to CMOS Output)*

1. Firstly, when the Input Voltage (V_{IN}) falls below the Minimum Operating Voltage (V_{MIN}) level, output becomes unstable. In the case of N-channel open drain configuration, as the output pin is generally pulled-up, the output will be equal to the pull-up voltage.
2. When the Input Voltage (V_{IN}) rises, output become stable once the voltage has exceeded V_{MIN} . The Output Voltage (V_{OUT}) will remain equal to the Ground Voltage (V_{SS}) level until the Input Voltage (V_{IN}) reaches the Monitor Voltage (V_{MON}) level.
3. When a voltage higher than the Monitor Voltage (V_{MON}) is applied to the Input Voltage pin (V_{IN}), output at V_{OUT} will be equal to the input at the V_{IN} pin. High impedance exists on the Output pin (V_{OUT}) with the N-channel open drain configuration. If the pin is pulled-up. V_{OUT} will be identical to the pull-up voltage.
4. When the Input Voltage (V_{IN}) falls below the Monitor Release Voltage (V_{MR}) level, output at the Output pin (V_{OUT}) is equal to Ground Voltage (V_{SS}) level until the Input Voltage (V_{IN}) reaches the Minimum Operating Voltage (V_{MIN}) level.
5. When the Input Voltage (V_{IN}) falls below the Minimum Operating Voltage (V_{MIN}) level, output becomes unstable. In the case of N-channel open drain configuration, as the output pin is generally pulled-up, the output will be equal to the pull-up voltage.

Notes :

1. The difference between V_{MR} and V_{MF} represents the Hysteresis Range.

❖ *Timing Diagram*



❖ Ordering Information

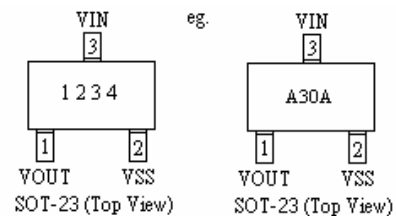
Designator	Description
a	Output Configuration C = CMOS Output N = N-Channel Output
b	Detect Voltage eg. 30=3.0V 50=5.0V
c	Detect Voltage Accuracy 2 = ±2.0% 3 = ±3.0%
d	Package Type M = SOT-23-3 P = SOT-89 T = TO-92
e	Device Orientation R = Embossed Tape (Orientation of Device : Right) L = Embossed Tape (Orientation of Device : Left) B = Bag (TO-92) H = Paper Tape (TO-92)
G	G = Lead Free Part

ML6101 xxxxxxG
 ↑ ↑↑ ↑↑↑
 a b c d e

❖ Marking

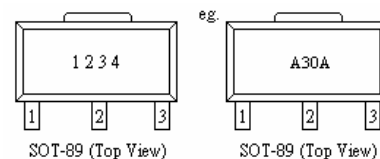
SOT-23-3 :

Designator	Description
1	Type A = Voltage Detector (CMOS Output) B = Voltage Detector (N-channel Output)
2,3	Output Voltage eg. 30 = 3.0V
4	Internal Code



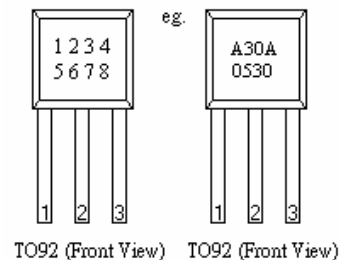
SOT-89 :

Designator	Description
1	Type A = Voltage Detector (CMOS Output) B = Voltage Detector (N-channel Output)
2,3	Output Voltage eg. 30 = 3.0V
4	Internal Code

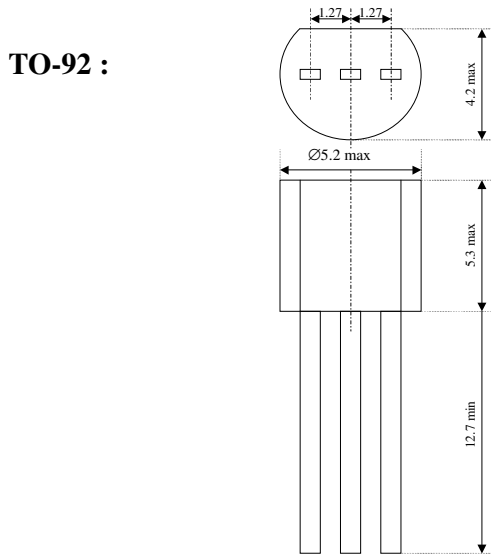
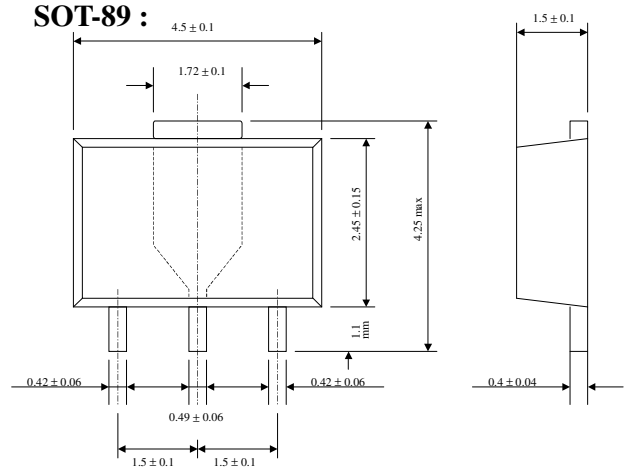
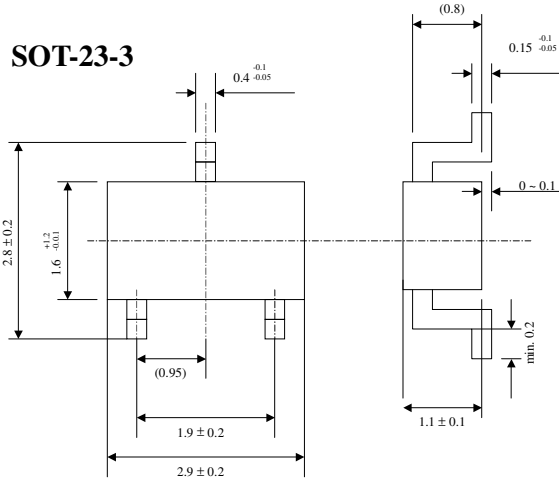


TO-92 :

Designator	Description
1	Type A = Voltage Detector (CMOS Output) B = Voltage Detector (N-channel Output)
2,3	Output Voltage eg. 30 = 3.0V
4	Internal code
5, 6	Year Code eg. 05 = Year 2005
7, 8	Week Code eg. 30 = Week 30



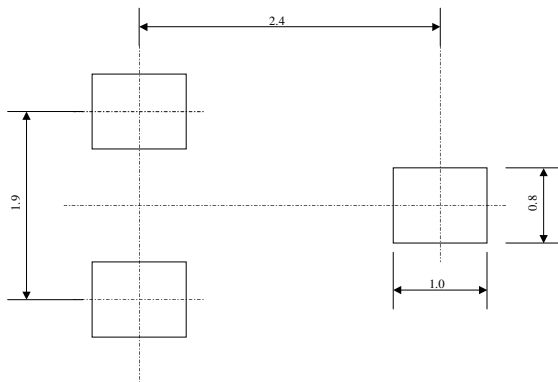
❖ *Packaging Information*



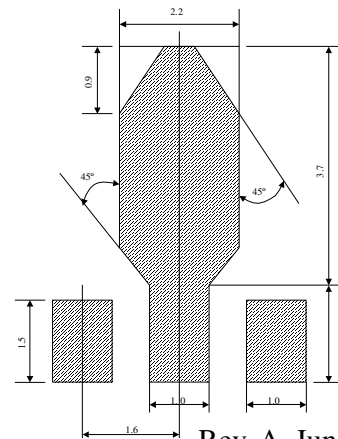
Units : mm

❖ *Recommended Pattern Layout*

SOT-23 :

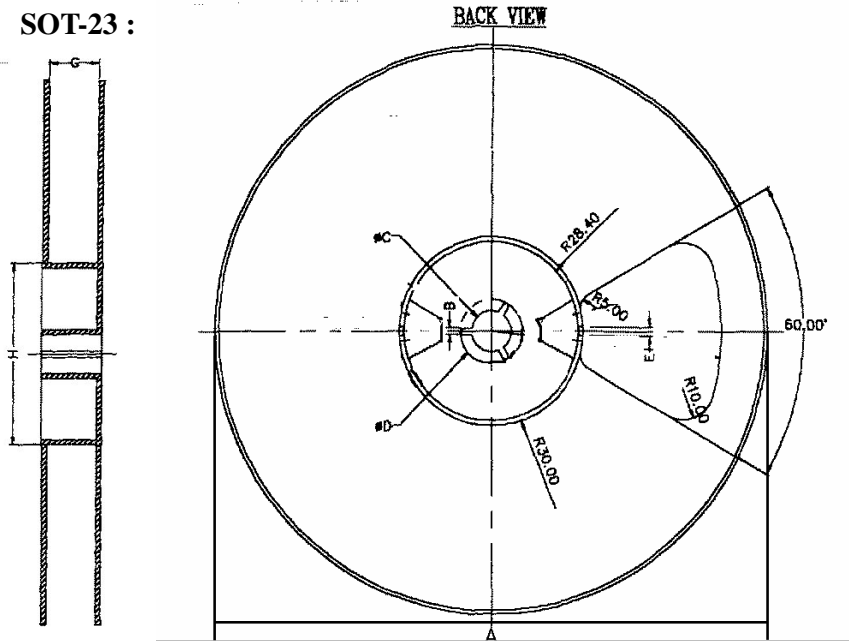


SOT-89



❖ *Tape and Reel Information*

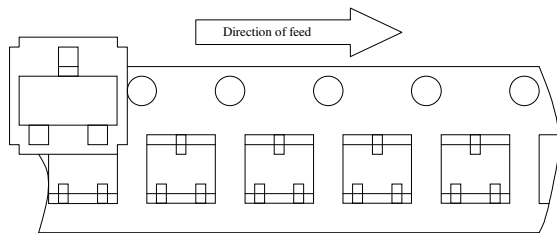
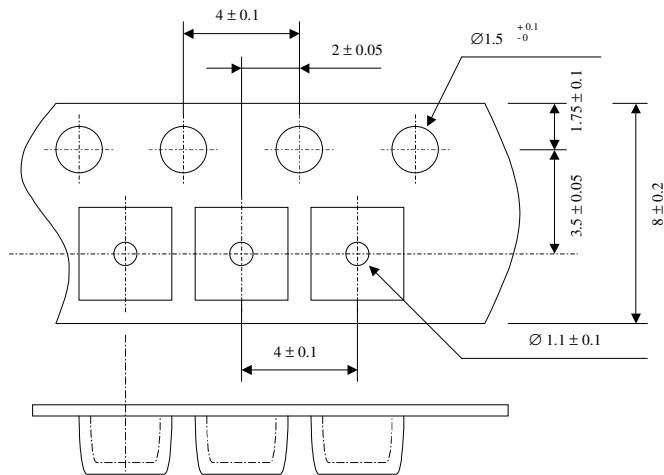
SOT-23 :



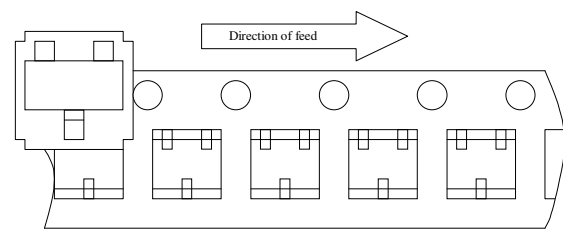
	SIZE (mm)
A	∅ 178 ± 0.8
B	2 ± 0.2
C	∅ 13 ± 0.2
D	∅ 21 ± 0.8
G	8 ± 0.5
H	∅ 60

3,000 pcs / reel

SOT-23 Taping Specifications :

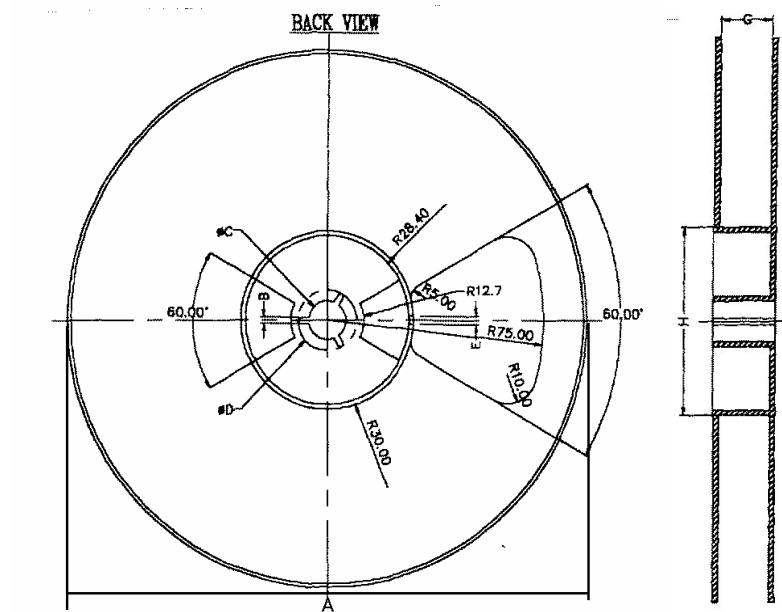


"R" type [Orientation of Device: Right]
Standard Type



"L" type [Orientation of Device: Left]
Reverse Type

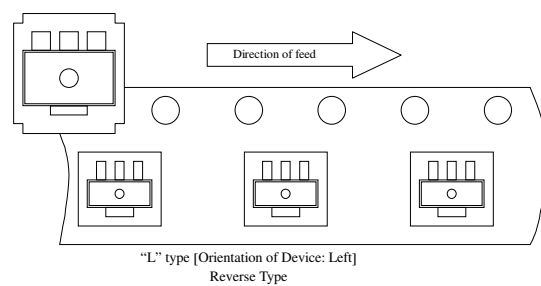
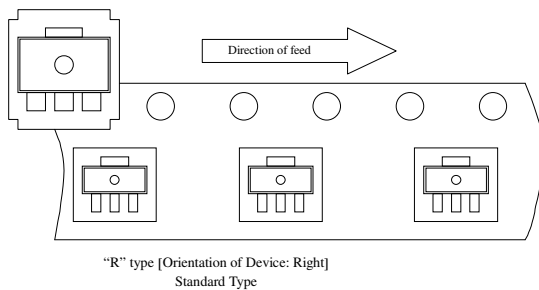
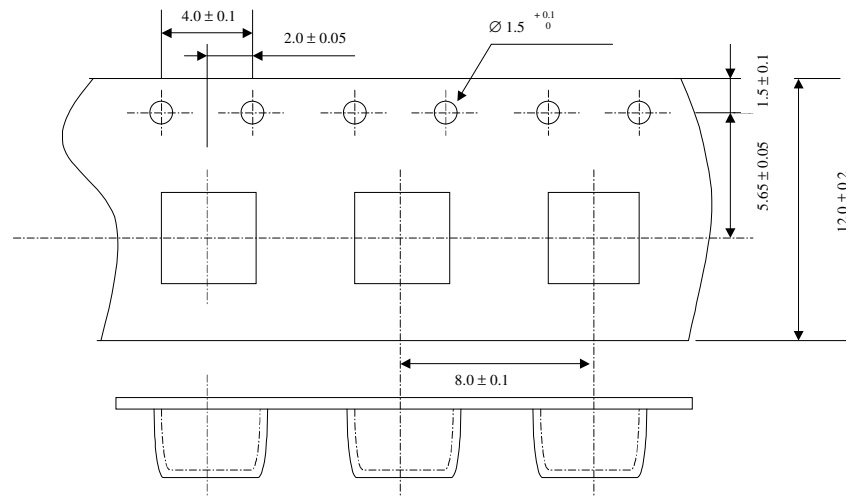
SOT-89 :

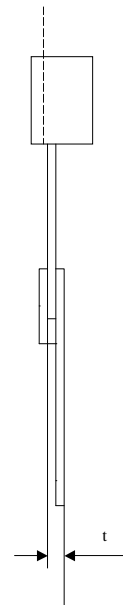
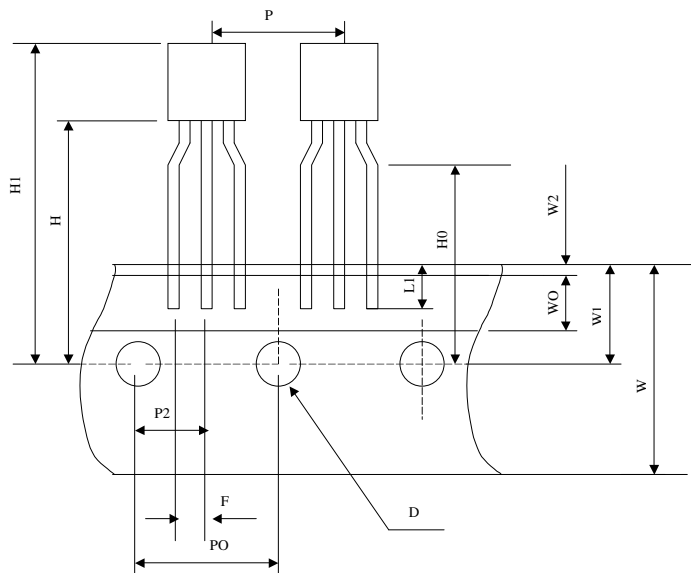


	SIZE (mm)
A	$\varnothing 178 \pm 0.8$
B	2 ± 0.2
C	$\varnothing 13 \pm 0.2$
D	$\varnothing 21 \pm 0.8$
G	12 ± 0.5
H	$\varnothing 60$

1,000 pcs / reel

SOT-89 Taping Specifications :



TO-92 Taping Specifications :


	SIZE (mm)
P	12.7 ± 1.0
PO	12.7 ± 0.3
P2	6.35 ± 0.4
F	2.5 ^{+0.45} _{-0.15}
W	18.0 ± 1.0
W0	6.0 ± 0.3
W1	9.0 ± 0.5
W2	0.5 MAX
H	19.0 ± 0.5
H0	16.0 ± 0.5
H1	32.25 MAX
D	∅ 4.0 ± 0.2
t	0.6 ± 0.2
L1	3.5 MIN

2,000 pcs / box

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