ML6101 Series Voltage Monitor

❖ *Application*

◆ *Battery Charger Voltage Monitor*

❖ *Features*

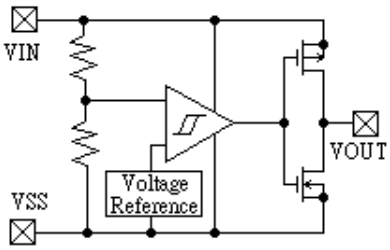
- CMOS Low Power Consumption : Typical 1.0uA at Vin=2.0V
- Selectable Monitor Voltage : 1.1V to 6.0V in 0.1V increments
- Highly Accurate : Detect Voltage 1.1V to 1.9V ± 3%
  Detect Voltage 2.0V to 6.0V ± 2%
- Operating Voltage : 0.8V to 10.0V
- Package Available : SOT23 (150mW), SOT89 (500mW) & TO92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

❖ *General Description*

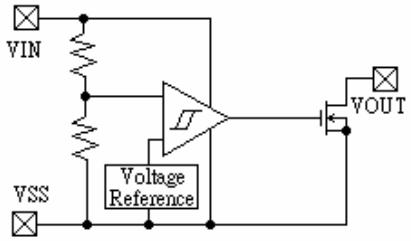
The ML6101 is a group of high-precision and low-power Voltage Monitor. The ML6101 consists of a highly-accurate and low-power reference voltage source, a comparator, a hysteresis circuit, and an output driver. Detect voltage is very accurate and stable with N-channel open drain and CMOS, are available. 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 ~V_{IN}+0.3	V
Continuous Total Power Dissipation	SOT-23	P_d	150	mW
	SOT-89		500	
	TO-92		300	
Operating Ambient Temperature		T_{opr}	-40 ~ +70	°C
Storage Temperature		T_{stg}	-40 ~ +70	°C

❖ *Electrical Characteristics*

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

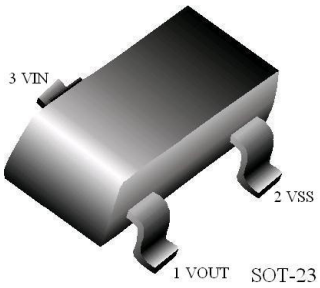
❖ *Electrical Characteristics By Detector Threshold*

Part Number	Standard Monitor Accuracy	Detector Threshold V_{MON} (V)			Hysteresis Range V_{HYS} (V)		Supply Current 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	2%	1.960	2.000	2.040			V_{IN} = 2.0V	1.0	2.5
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_{MON} x 0.015	V_{MON} x 0.035	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					
ML6101X402XX		3.920	4.000	4.080			V_{IN} = 4.0V	1.6	3.5
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					
ML6101X492XX		4.802	4.900	4.998					
ML6101X502XX		4.900	5.000	5.100			V_{IN} = 5.0V	2.0	4.0
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					

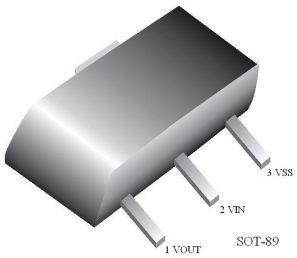
Part Number	Operating Voltage V_{IN} (V)		Pch Output Current Pch I_{OUT} (mA)		Nch Output Current Nch I_{OUT} (mA)		Transient Delay Time t_{DLY} (ms)
	MIN.	MAX.	Condition	TYP.	Condition	TYP.	MAX.
ML6101X113XX	0.8V	10V	V_{DS} = 2.1V V_{IN} = 8.0V	-10.0	V_{DS} = 0.5V V_{IN} = 1.0V	1.0	0.2
ML6101X123XX							
ML6101X133XX							
ML6101X143XX							
ML6101X153XX							
ML6101X163XX							
ML6101X173XX							
ML6101X183XX							
ML6101X193XX							
ML6101X202XX							
ML6101X212XX					V_{DS} = 0.5V V_{IN} = 2.0V	3.0	
ML6101X222XX							
ML6101X232XX							
ML6101X242XX							
ML6101X252XX							
ML6101X262XX							
ML6101X272XX							
ML6101X282XX							
ML6101X292XX							
ML6101X302XX							
ML6101X312XX					V_{DS} = 0.5V V_{IN} = 3.0V	5.0	
ML6101X322XX							
ML6101X332XX							
ML6101X342XX							
ML6101X352XX							
ML6101X362XX							
ML6101X372XX							
ML6101X382XX							
ML6101X392XX							
ML6101X402XX							
ML6101X412XX					V_{DS} = 0.5V V_{IN} = 4.0V	11.0	
ML6101X422XX							
ML6101X432XX							
ML6101X442XX							
ML6101X452XX							
ML6101X462XX							
ML6101X472XX							
ML6101X482XX							
ML6101X492XX							
ML6101X502XX							
ML6101X512XX					V_{DS} = 0.5V V_{IN} = 5.0V	13.0	
ML6101X522XX							
ML6101X532XX							
ML6101X542XX							
ML6101X552XX							
ML6101X562XX							
ML6101X572XX							
ML6101X582XX							
ML6101X592XX							
ML6101X602XX							

❖ *Pin Configuration*

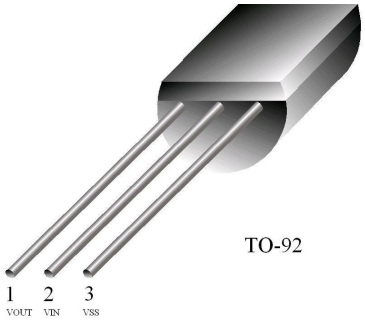
SOT-23-3



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

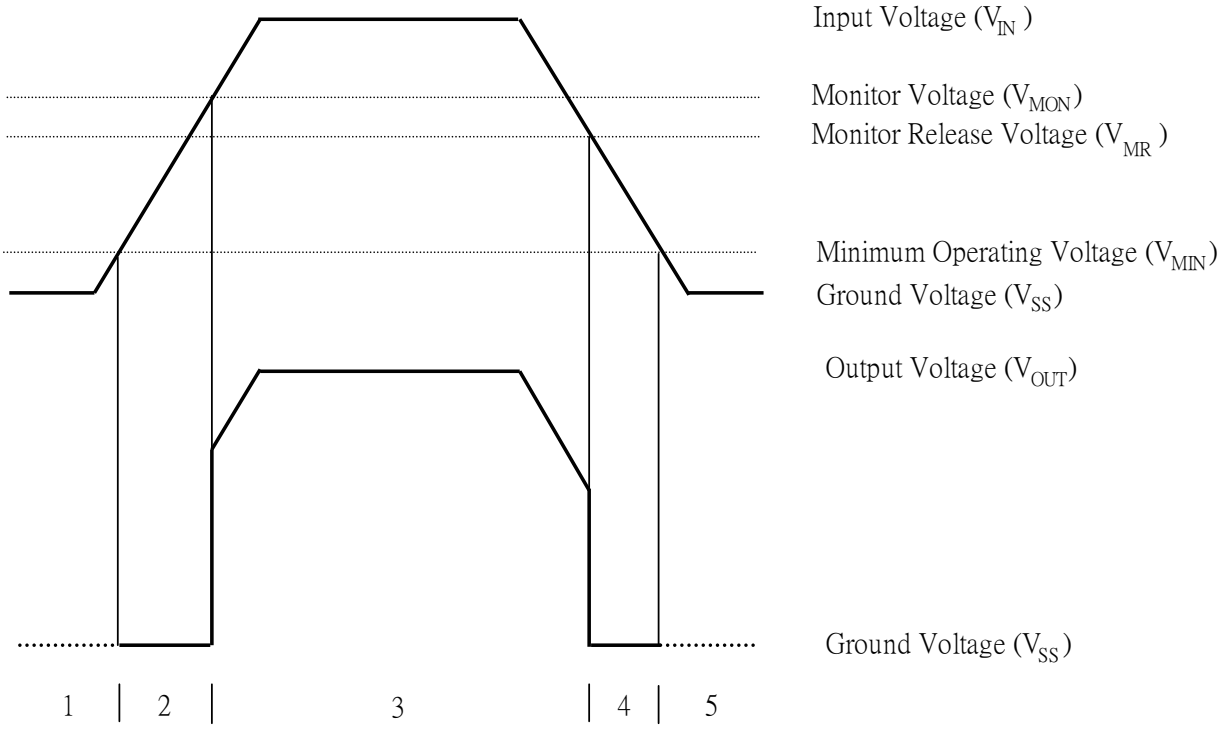
❖ *Functional Description (Refers to CMOS Output)*

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*

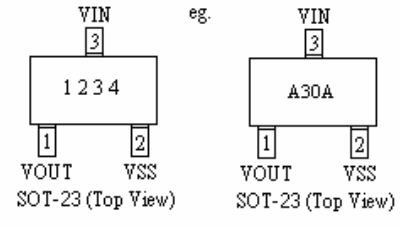
Designator	Description
a	**Output Configuration** C = CMOS Output N = N-Channel Output
b	**Detect Voltage** eg. 30=3.0V 50=5.0V
c	**Detect Voltage Accuracy** 2 = ±2.0% 3 = ±3.0%
d	**Package Type** M = SOT-23-3 P = SOT-89 T = TO-92
e	**Device Orientation** R = Embossed Tape (Orientation of Device : Right)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

ML6101 x x x x x x G
a b c d e

❖ *Marking*

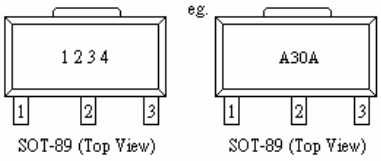
SOT-23-3 :

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**



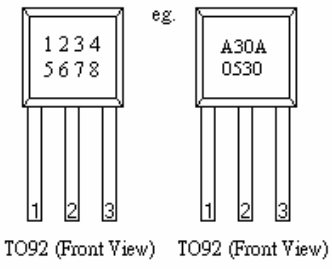
SOT-89 :

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**



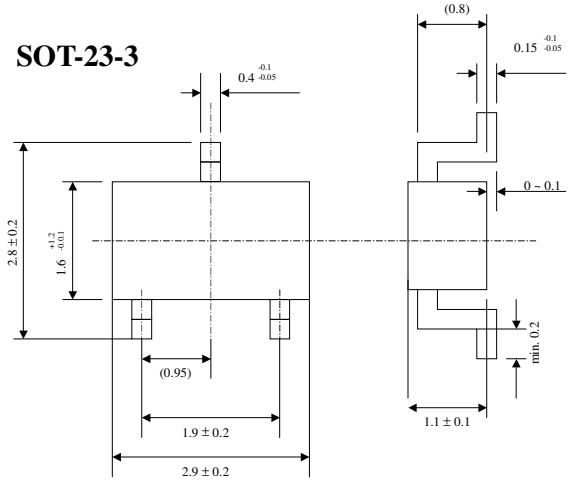
TO-92 :

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

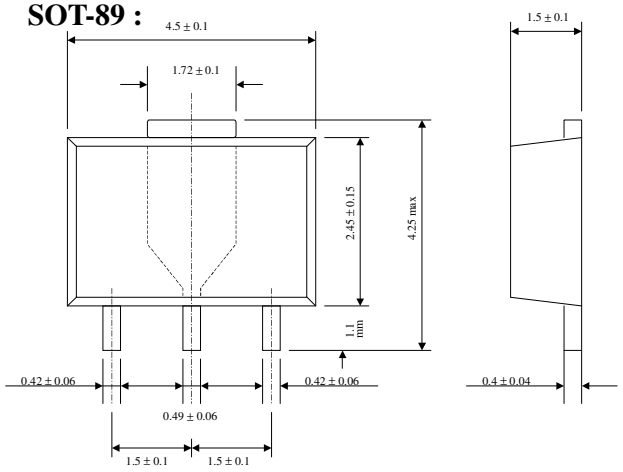


❖ *Packaging Information*

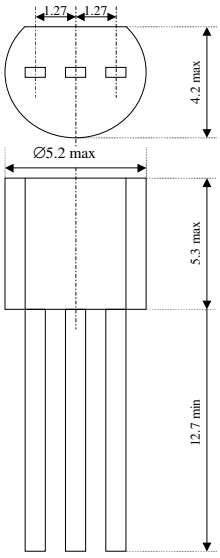
SOT-23-3



SOT-89 :



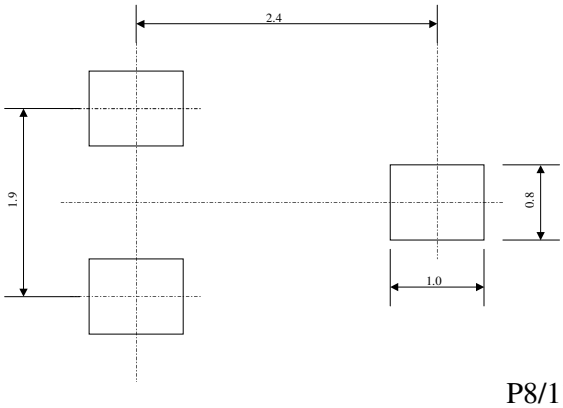
TO-92 :



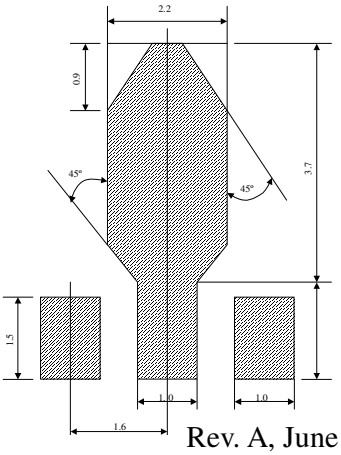
Units : mm

❖ *Recommended Pattern Layout*

SOT-23 :

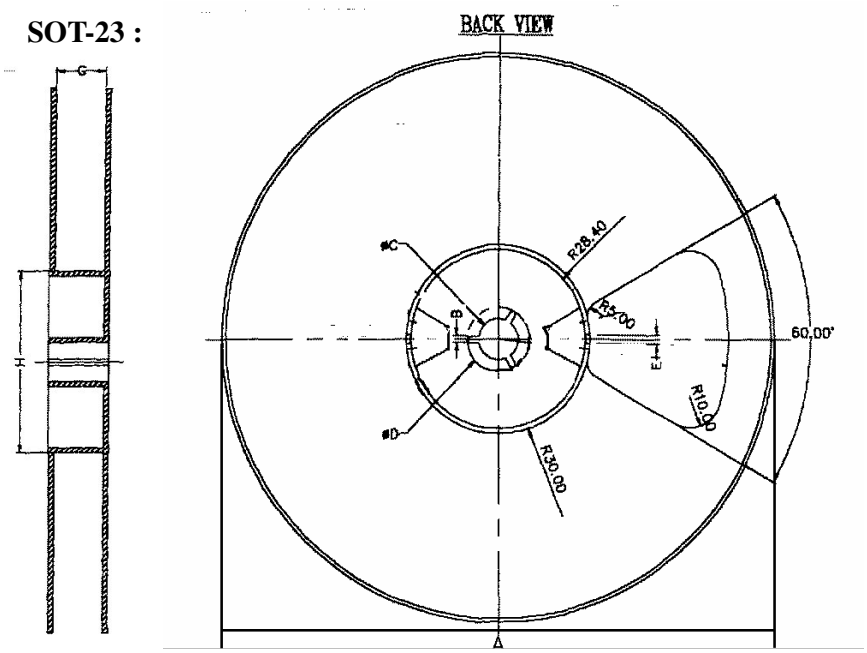


SOT-89



❖ *Tape and Reel Information*

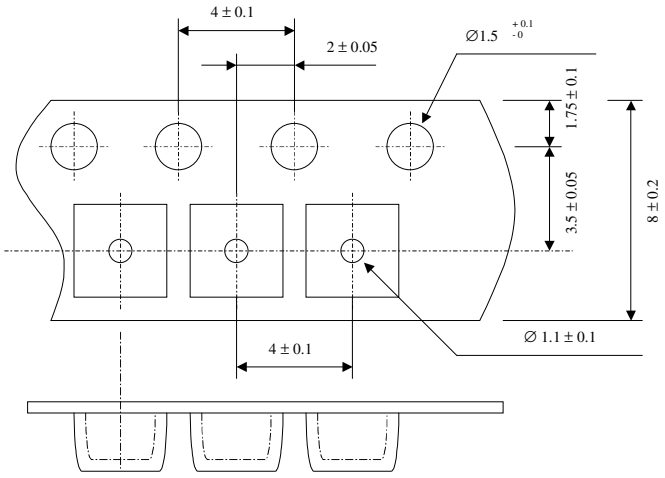
SOT-23 :

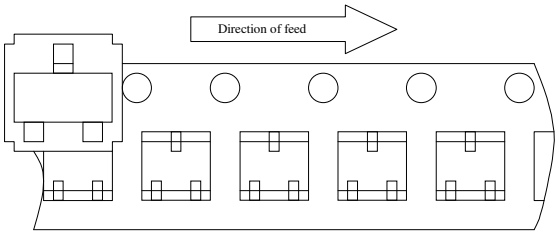


	SIZE (mm)
A	∅ 178 ± 0.8
B	2 ± 0.2
C	∅ 13 ± 0.2
D	∅ 21 ± 0.8
G	8 ± 0.5
H	∅ 60

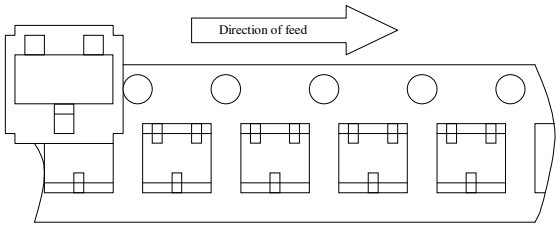
3,000 pcs / reel

SOT-23 Taping Specifications :



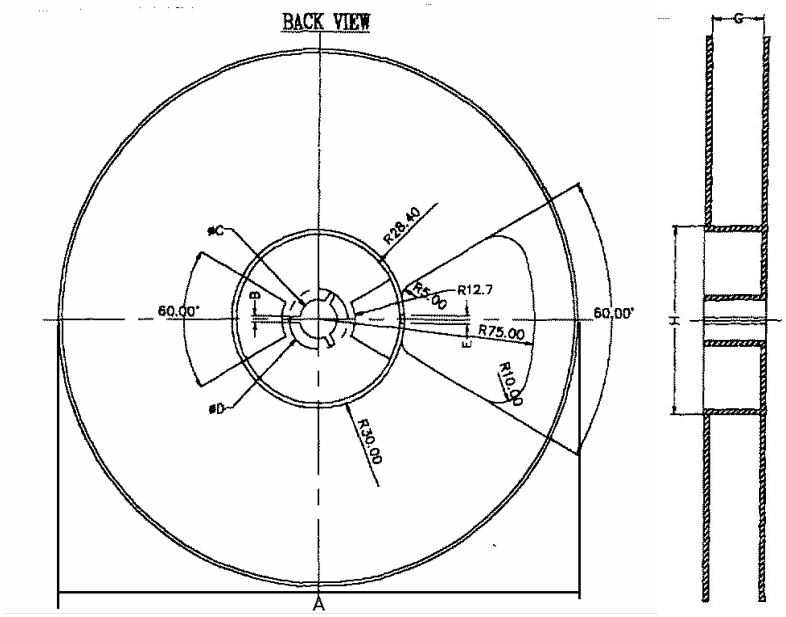


"R" type [Orientation of Device: Right]
Standard Type



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

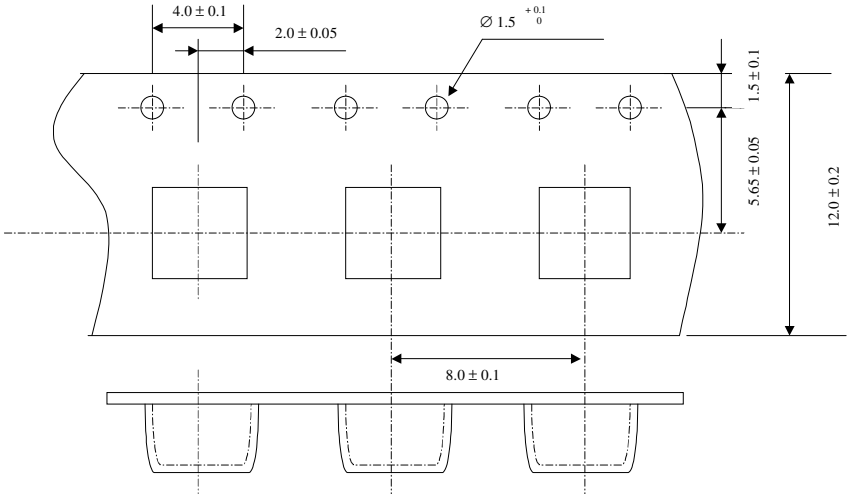
SOT-89 :

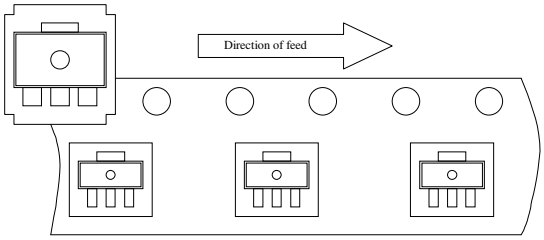


	SIZE (mm)
A	∅ 178 ± 0.8
B	2 ± 0.2
C	∅ 13 ± 0.2
D	∅ 21 ± 0.8
G	12 ± 0.5
H	∅ 60

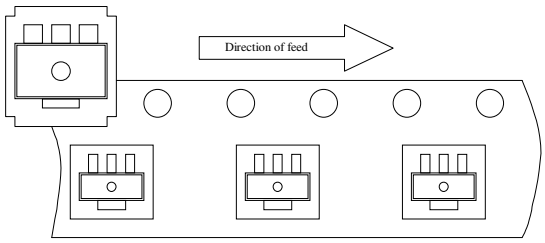
1,000 pcs / reel

SOT-89 Taping Specifications :



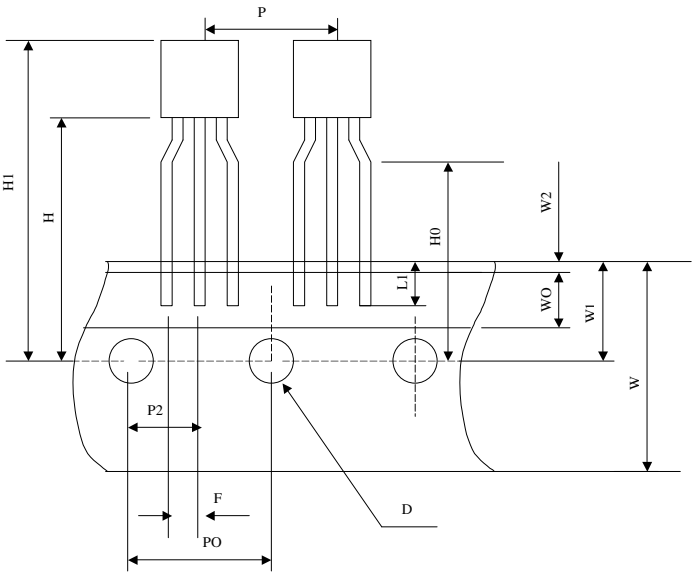


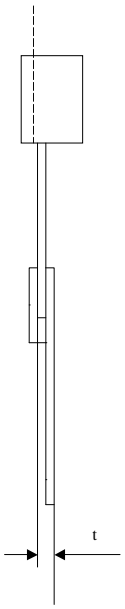
"R" type [Orientation of Device: Right]
Standard Type



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

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
WO	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