Ultra low Power Consumption Low Dropout CMOS Voltage Regulators

■ General Description

The LN1121 series are precise, low power consumption, high voltage; positive voltage regulators manufactured using CMOS and laser trimming technologies. The series provides large currents with a significantly small dropout voltage. The LN1121 consists of a current limiter circuit, a driver transistor, a precision reference voltage and an error correction circuit. The series is compatible with low ESR ceramic capacitors. The current limiter's feedback circuit also operates as a short protect for the output current limiter and the output pin. Output voltage can be set internally by laser trimming technologies. It is selectable in 100mV increments within a range of 1.2V to 5.0V. SOT-89-3L, SOT-23-3L, SOT-353 and SOT-23-3B packages are available.
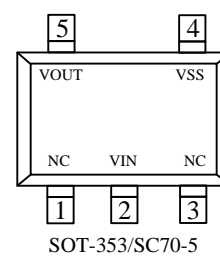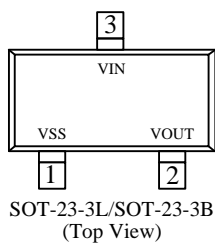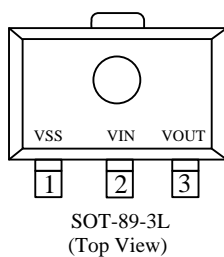
■ Applications

- Battery powered equipment
- Reference voltage sources
- Cameras, Video cameras
- Mobile phones
- Communication tools

■ Features

- Output Voltage Range: 1.2V to 5.0V (selectable in 100mV steps)
- Highly Accurate: 2%
- Dropout Voltage: 160mV @ 100mA (3.0V type)
- Low Power Consumption: 1µA (TYP.)
- Maximum Output Current : 250mA (Vin≥Vout+1V)
- Internal protector: current limiter and short protector
- Small packages

■ Package

- SOT-89-3L
- SOT-353/SC70-5
- SOT-23-3L,SOT-23-3B

■ Ordering Information

LN1121P ①②③④⑤

Designator	Symbol	Description	Designator	Symbol	Description
① ②	Integer	Output Voltage: e.g. ① =3, ② =0 ⇨ 3.0V	④	K	SOT353(SC70-5)
				V	SOT-23-3B
③	2	Accuracy: within ±2%	⑤	R	Embossed Tape: Standard Feed
④	M	SOT-23-3L		L	Embossed Tape: Reverse Feed
	P	SOT89-3L			

■ Pin Configuration

SOT-89-3L
(Top View)

SOT-23-3L/SOT-23-3B
(Top View)

SOT-353/SC70-5

■ Pin Assignment

Pin Number			Pin Name	Function
SOT-353/SC70-5	**SOT-23-3L/B**	**SOT-89-3L**		
2	3	2	VIN	Supply Power
4	1	1	VSS	Ground
1,3	-	-	NC	No Connection
5	2	3	VOUT	Voltage Output

■ Marking Rule

● SOT-89-3L,SOT-353,SOT-23-3L/B

SOT-89-3L
(Top View)

SOT-353/SC70-5

SOT-23-3L/SOT-23-3B
(Top View)
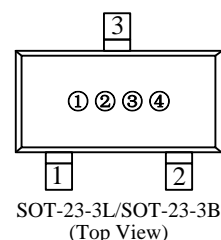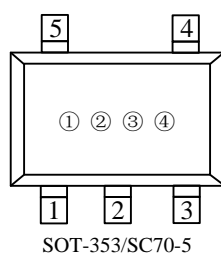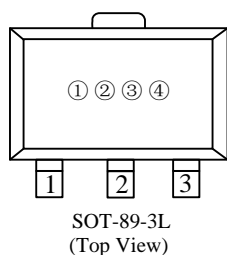
① Represents the product name

Symbol	Product Name
6/9/S	LN1121P◆◆◆◆◆

② Represents the range of output voltage

Output Voltage Range（V）	0.1～3.0	3.1～6.0	6.1～9.0
Symbol	5	6	7

③ Represents the Output Voltage

Symbol	Output Voltage（V）			Symbol	Output Voltage（V）		
0	-	3.1	-	F	1.6	4.6	-
1	-	3.2	-	H	1.7	4.7	-
2	-	3.3	-	K	1.8	4.8	-
3	-	3.4	-	L	1.9	4.9	-
4	-	3.5	-	M	2	5.0	-
5	-	3.6	-	N	2.1	5.1	-
6	-	3.7	-	P	2.2	5.2	-
7	-	3.8	-	R	2.3	5.3	-
8	-	3.9	-	S	2.4	5.4	-
9	-	4	-	T	2.5	5.5	-
A	-	4.1	-	U	2.6	5.6	-
B	1.2	4.2	-	V	2.7	5.7	-
C	1.3	4.3	-	X	2.8	5.8	-

Symbol	Output Voltage（V）			Symbol	Output Voltage（V）		
D	1.4	4.4	-	Y	2.9	5.9	-
E	1.5	4.5	-	Z	3	6.0	-

④ **Represents the assembly lot no.**

0~9, A~Z repeated (G, I, J, O, Q, W excepted)

■ Function Block Diagram
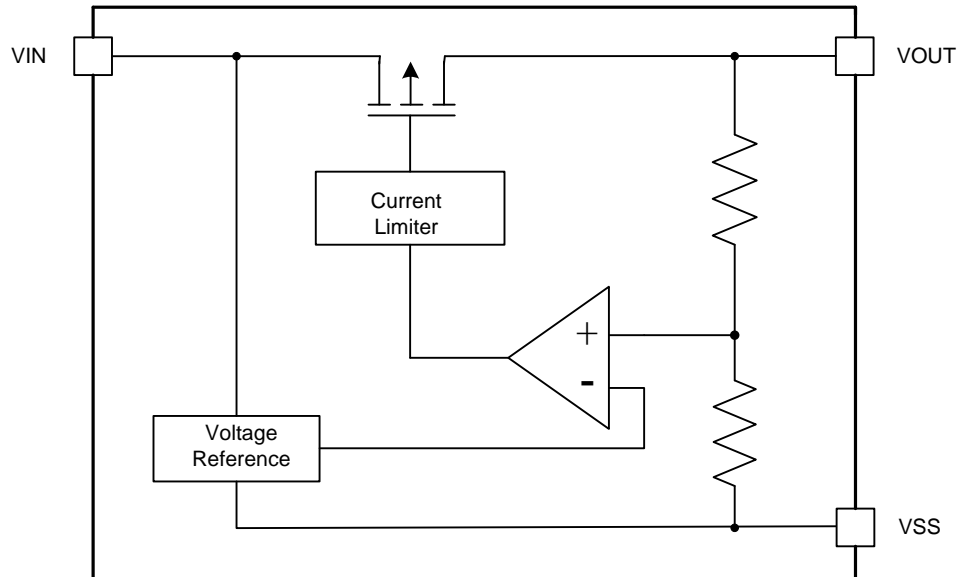
■ Absolute Maximum Ratings

| Parameter	Symbol	Maximum Rating		Unit
Input Voltage	V_{IN}	V_{SS}-0.3～V_{SS}+6		V
Output Current	V_{OUT}	V_{SS}-0.3～V_{IN}+0.3		
Power Dissipation	P_D	SOT-23-3L, SOT-23-3LB	250	mW
		SOT353	250	
		SOT-89-3L	500	
Operating Ambient Temperature	Topr	-40～+85		℃
Storage Temperature	Tstg	-40～+125		

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

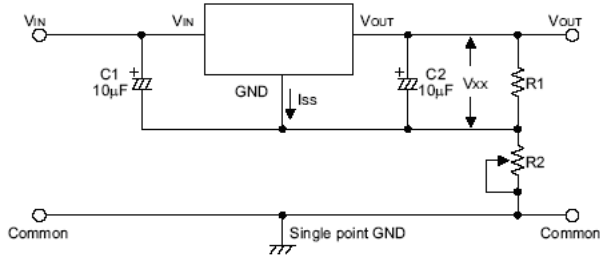## ■ Typical Application Circuit

1、Basic circuit
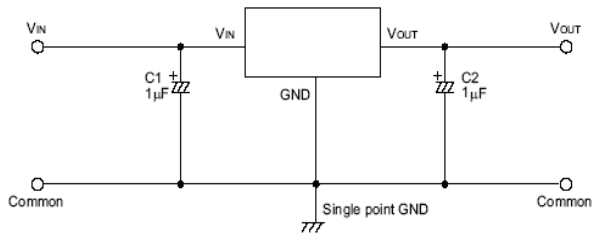
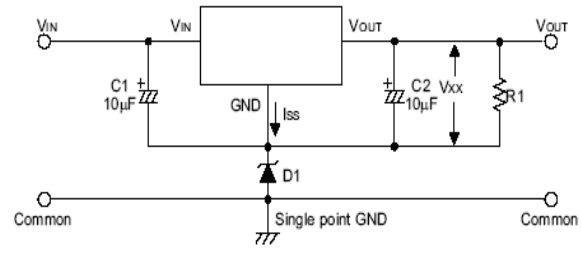**2、High output current positive voltage regulator**
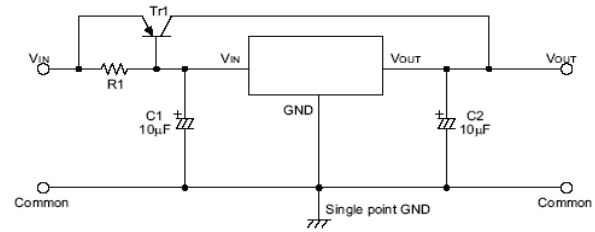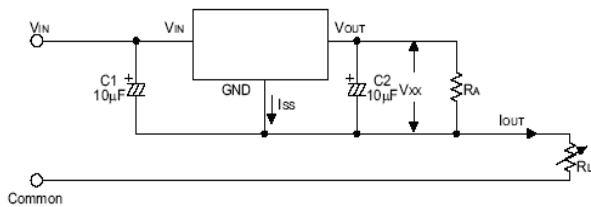

3、Circuit for increasing output voltage

$$V_{OUT} = V_{XX}\left(1 + \frac{R2}{R1}\right) + I_{SS}\,R2$$
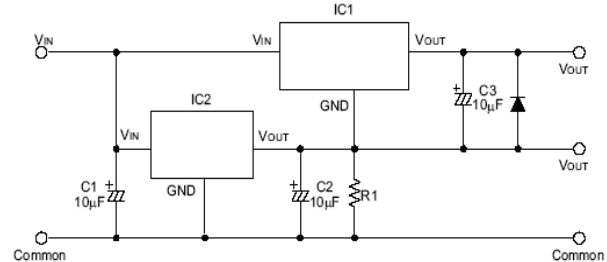
4、Circuit for increasing output voltage

$$V_{OUT} = V_{XX} + V_{D1}$$

5、Constant current regulator

$$I_{OUT} = \frac{V_{XX}}{R_A} + I_{SS}$$

6、Dual supply

Caution ：The above connection diagram and constant will not guarantee successful operation. Perform thorough evaluation using the actual application to set the constant.
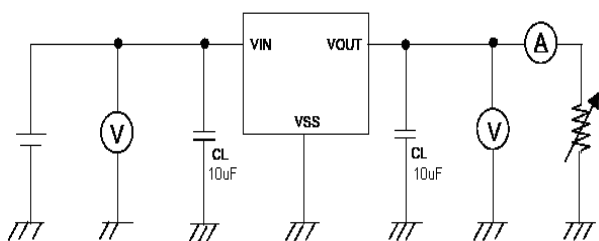
■ Application Conditions

Input capacitor (CIN): 1.0μF or more

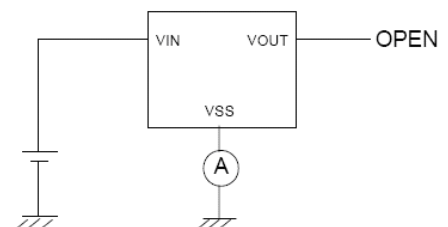Output capacitor (CL): .01μF or more (tantalum capacitor)

Caution A general series regulator may oscillate, depending on the external components selected. Check that no oscillation occurs with the application using the above capacitor.

## ■ Test Circuits

Circuit ①

Circuit ②

■ Electrical Characteristics

| Item	Symbol	Condition		Min	Typ	Max	Unit	Circuit
Output Voltage	$V_{OUT(E)1}$	$V_{IN}=V_{OUT(S)}+1.0$ V, $I_{OUT}=10$ mA		$V_{OUT(S)}$ ×0.98	$V_{OUT(S)}$	$V_{OUT(S)}$ ×1.02	V	1
Output Current	I_{OUT}	$V_{IN}≥V_{OUT(S)}+1.0$ V		280 [*1]	—	—	mA	1
Dropout Voltage	V_{drop}	$I_{OUT}=40$ mA	1.5 V ≤$V_{OUT(S)}$≤2.5 V	—	0.18	0.24	V	1
			2.6 V ≤$V_{OUT(S)}$≤3.3 V	—	0.12	0.20		
			3.4 V ≤$V_{OUT(S)}$≤5.0 V	—	0.08	0.16		
Line Regulations	$\dfrac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	$V_{OUT(S)}+0.5$ V ≤V_{IN}≤5.5 V $I_{OUT}=10$ mA		—	0.05	0.2	%/V	1
Input Voltage	ΔV_{OUT2}	$V_{IN}=V_{OUT(S)}+1.0$ V 1.0 mA ≤I_{OUT} ≤50 mA		—	20	40	mV	
Output Voltage Temperature Characteristics	$\dfrac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}$	$V_{IN}=V_{OUT(S)}+1.0$ V, $I_{OUT}=10$ mA -40°C ≤Ta ≤85°C		—	±100	—	ppm/℃	
Supply Current	I_{SS1}	$V_{IN}=V_{OUT(S)}+1.0$ V		0.8	1	2	µA	2
Input Voltage	V_{IN}	——		1.8	—	6	V	—
Ripple-Rejection	$|RR|$	$V_{IN}=V_{OUT(S)}+1.0$ V，f=1.0 kHz Vrip=0.5 Vrms, $I_{OUT}=30$ mA		—	40	—	dB	1
Short current	I_{short}	$V_{IN}=V_{OUT(S)}+1.5$ V,		—	15	—	mA	1
Current Limiter	I_{lim}	$V_{IN}=V_{OUT(S)}+1.5$ V,		—	380	—	mA	1

Note1: Lower input voltage and the output voltage, maximum output current will decrease. Example:
IOUT (max)=150mA @(VIN=2.5V,VOUT=1.5V)

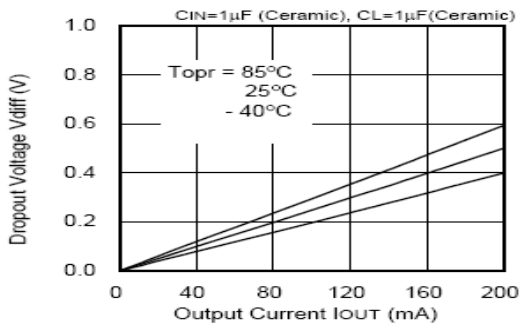## ■ Typical Performance Characteristics （3.0V output）

1、Output Voltage vs. Output Current
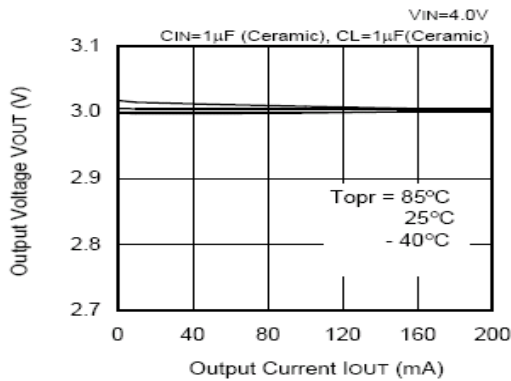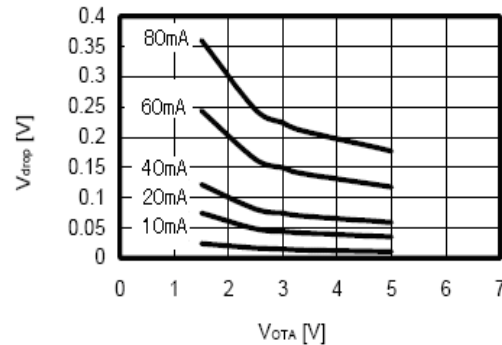

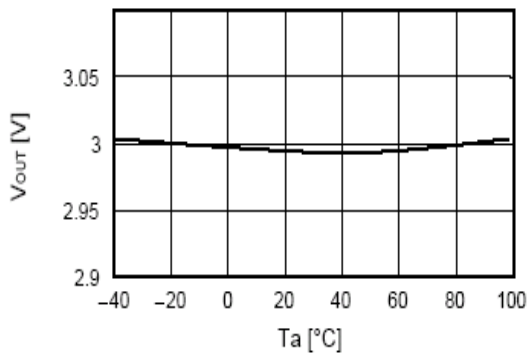### 2、Output Voltage vs. Input Voltage
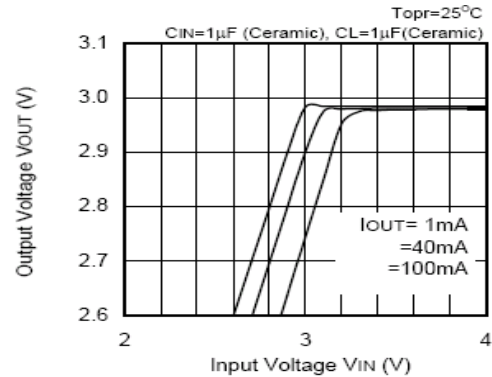
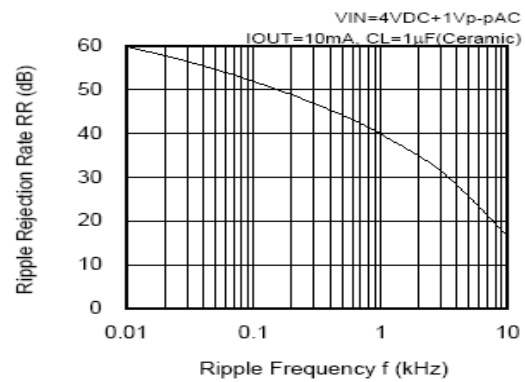### 3、Dropout Voltage vs. Output Current

4、Dropout Voltage vs. Output Voltage
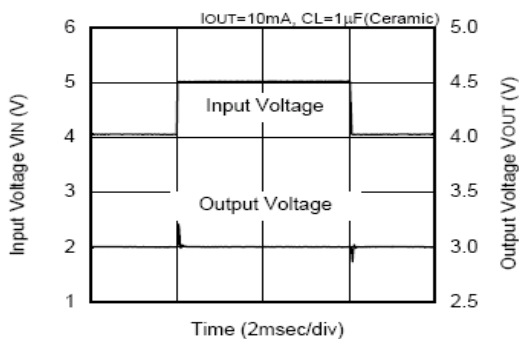

5、Output Voltage vs. Ambient Temperature
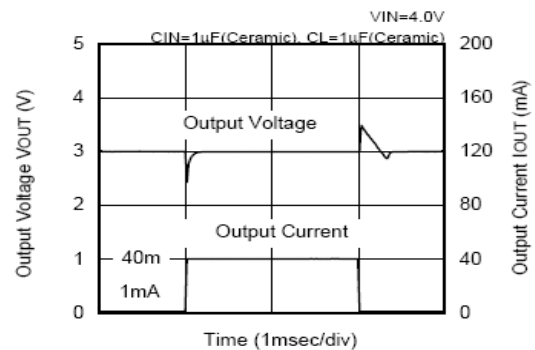

6、Ripple Rejection Rate

7、Transient Response

Input Transient Response

Load Transient Response

■ Package Information

● **SOT-89-3L**
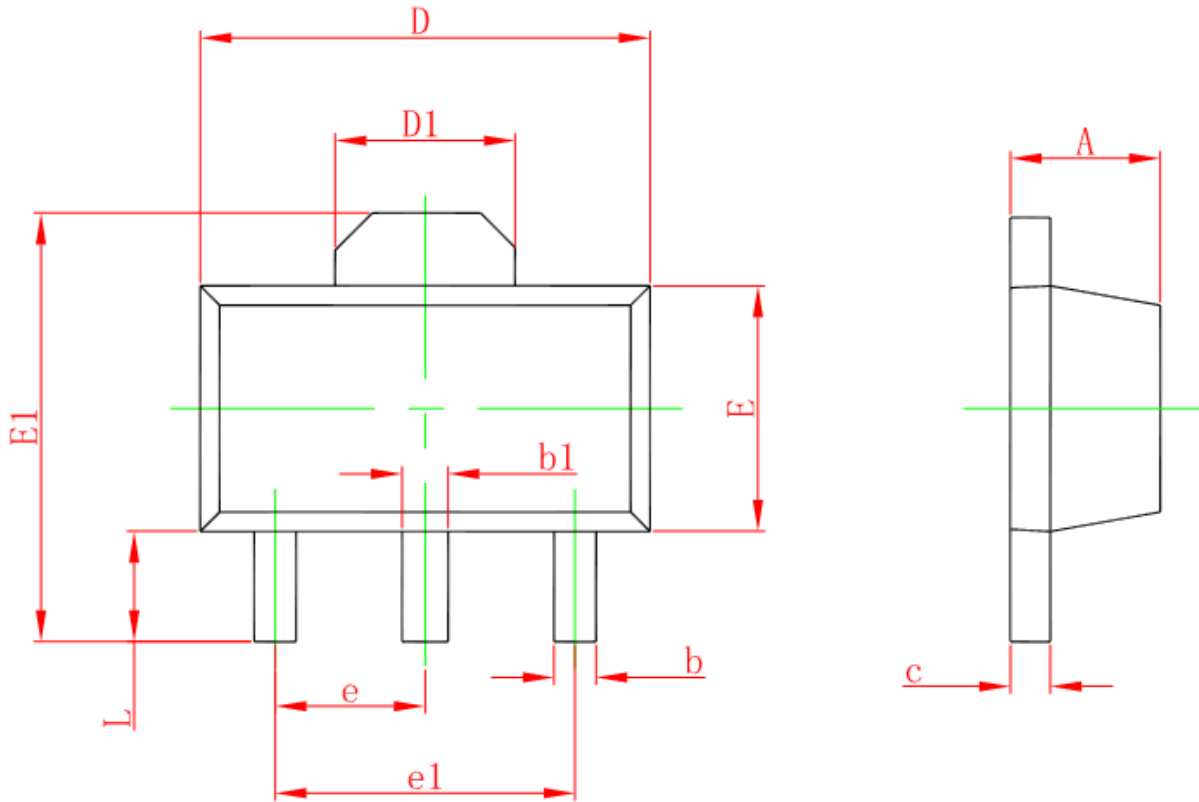
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047

● SOT-353/SC70-5
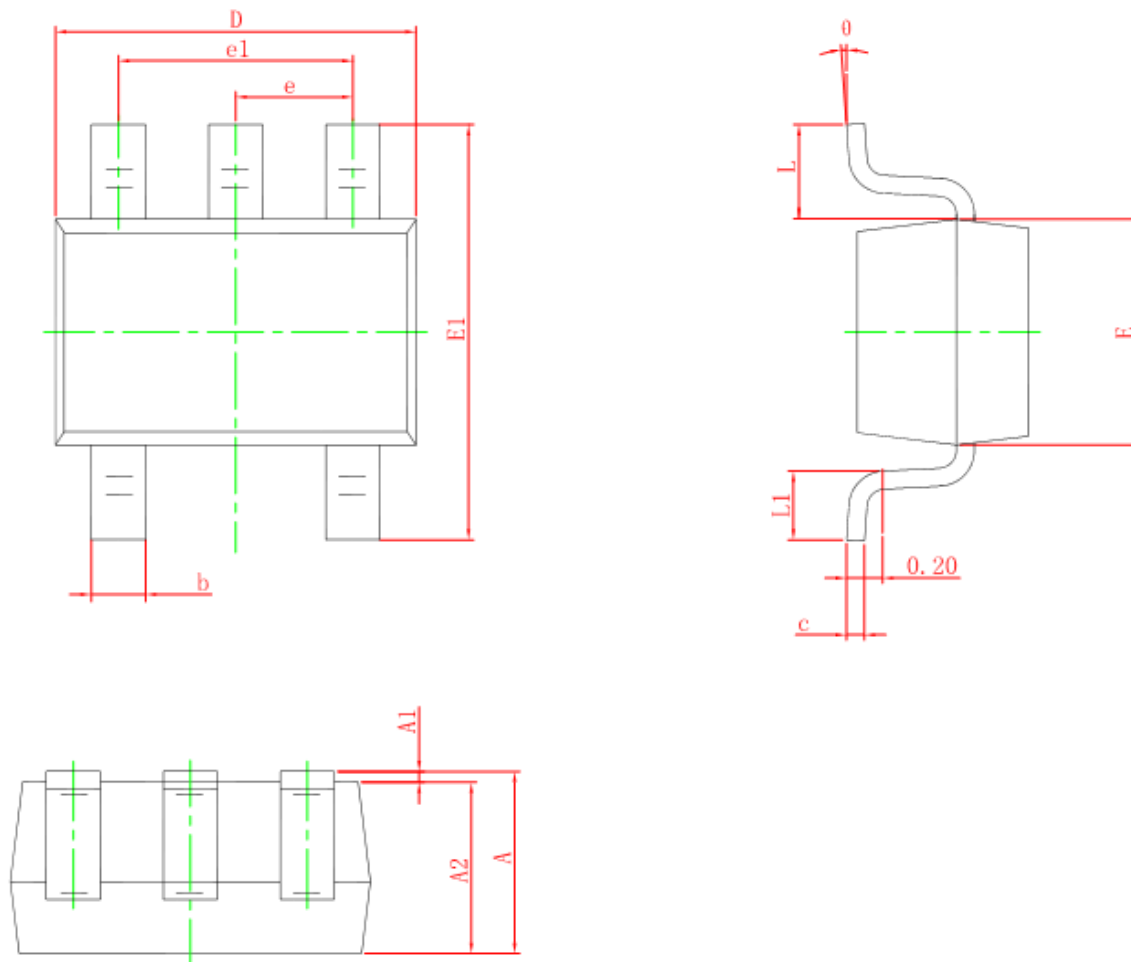
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

● **SOT-23-3L**
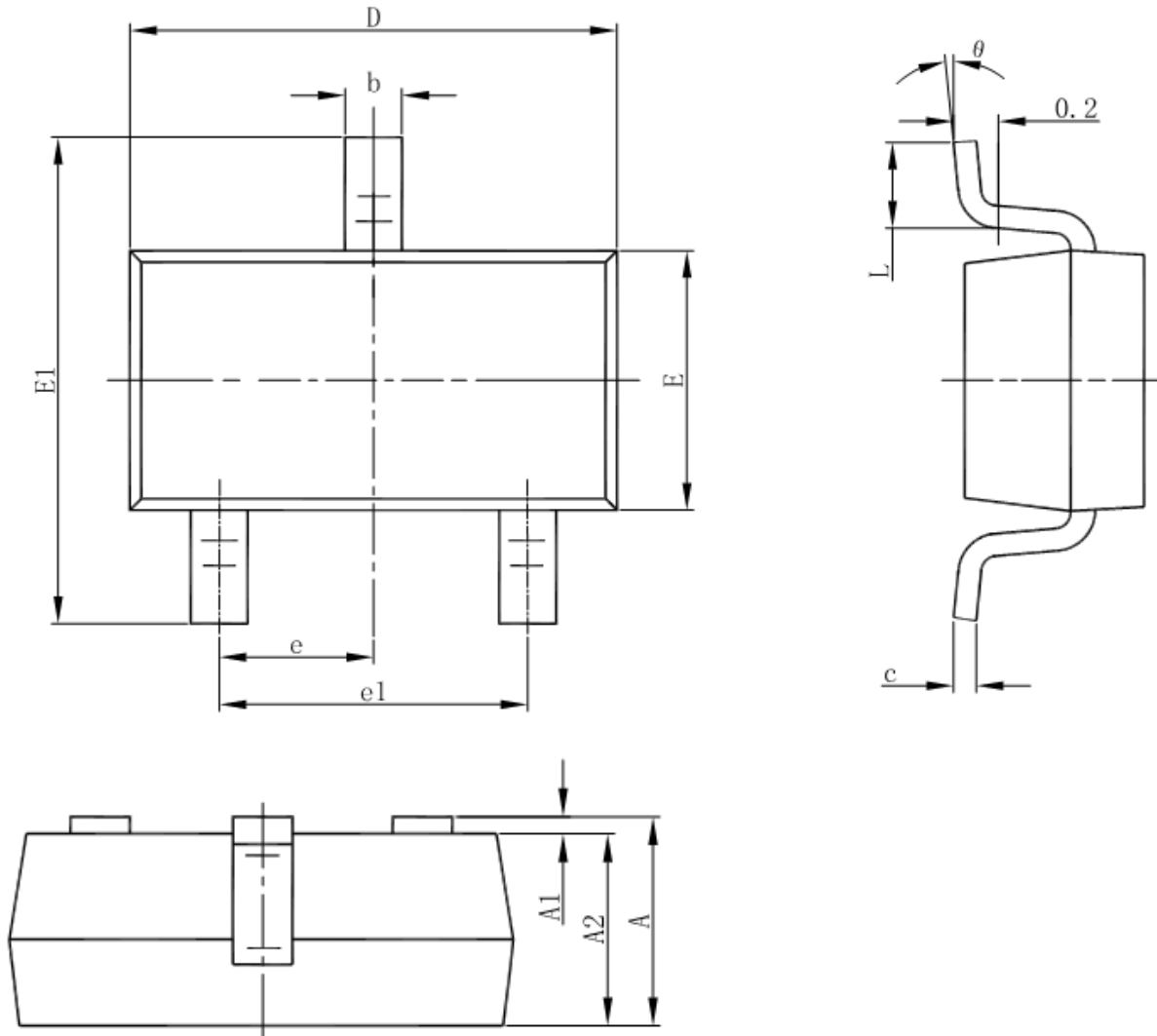
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

● **SOT-23-3B**
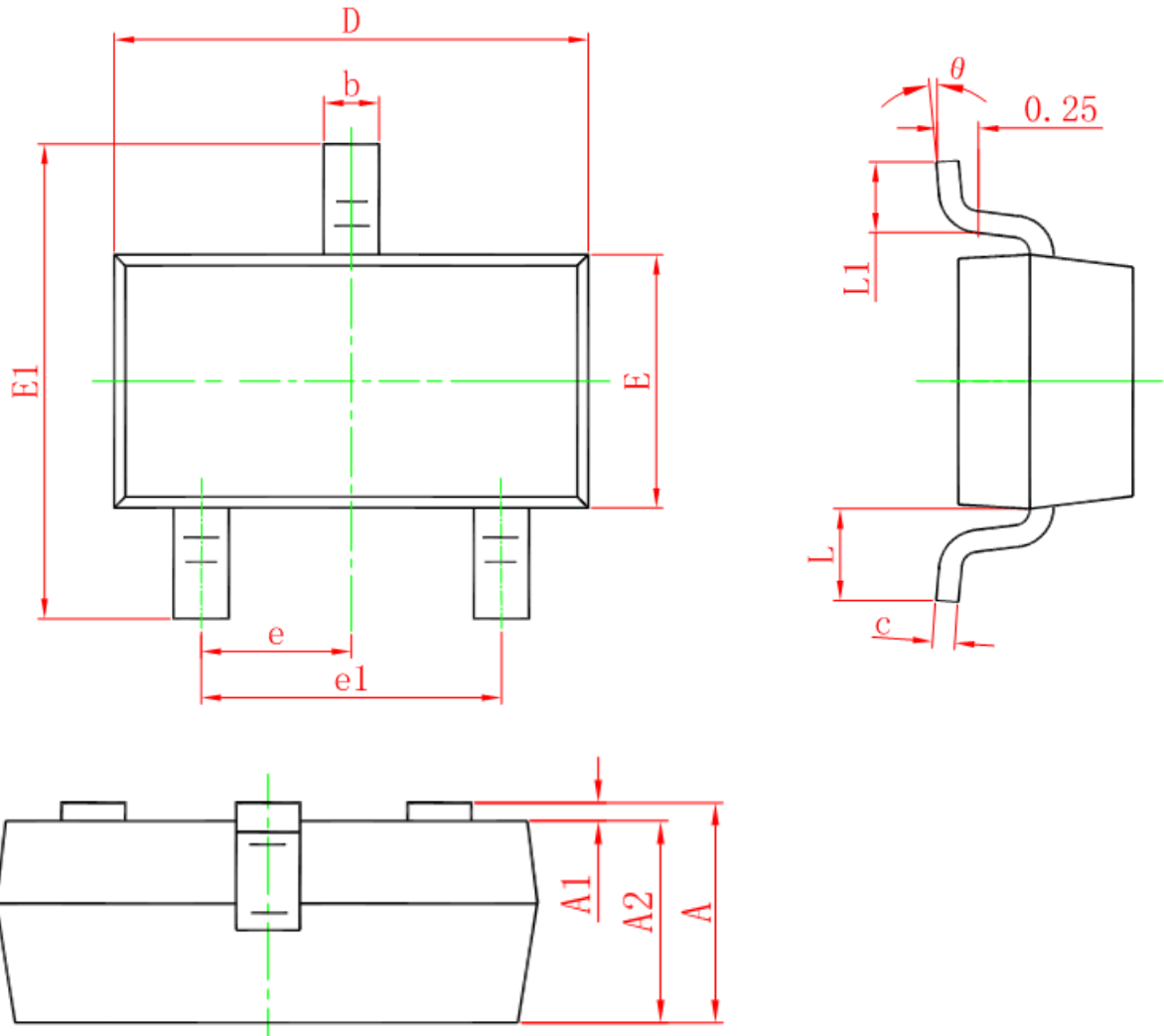
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°