

## Low Dropout Voltage

## 250mA CMOS LDO Regulator

## CE6209 Series

### ■ INTRODUCTION

The CE6209 Series are a group of positive voltage regulators manufactured by CMOS technologies with high ripple rejection, extremely low power consumption (3.0 $\mu$ A Typ.) and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. Thus the CE6209 series are very suitable for the battery-powered equipments, such as portable/palm computers, portable consumer equipments, industry equipments and so on, which want to prolong the using life of the battery.

### ■ APPLICATIONS

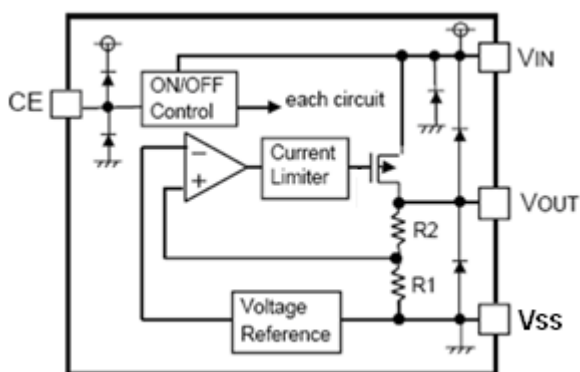
- Battery powered systems
- Portable instrumentations
- Radio control systems

### ■ FEATURES

- Standby Current: <0.1 $\mu$ A
- Output Current: 250mA
- Output Voltage Range: 1.4V ~ 5.0V,(selectable in 0.1V steps)
- High Accuracy:  $\pm 2\%$ (Typ.)
- Low Dropout Voltage: 160mV@100mA (3.0V Typ.)
- Excellent Line Regulation: 0.1%/V
- High Ripple Rejection: 60dB @1KHz
- Built-in Current Limiter
- Built-in Short Circuit Protection
- Static safety: 2KV@HBM
- TC: 100ppm/ $^{\circ}$ C
- Ceramic Capacitor Compatible

- Portable consumer equipments
- Portable/Palm computers
- Reference Voltage Sources

### ■ BLOCK DIAGRAM

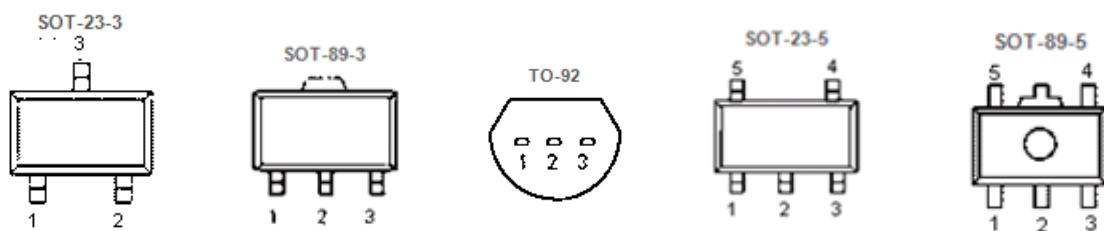


### ■ ORDER INFORMATION

#### CE6209①②③④

DESIGNATOR	SYMBOL	DESCRIPTION
①	A	Standard
	B	With Shutdown Function
②③	Integer	Output Voltage (0.9~5V) e.g:3.0V=②:3, ③:0
④	M	Package:SOT-23-3/5
	P	Package:SOT-89-3/5
	T	Package:TO-92

■ **PIN CONFIGURATION**(Pin output sequence can be ordered by customer)



PIN NUMBER							PIN NAME	FUNCTION
SOT-23-3				SOT-89-3		TO-92		
M	MA	MC	MY	P	PT	T		
1	2	3	3	1	2	1	V <sub>SS</sub>	Ground
2	1	2	1	3	1	3	V <sub>OUT</sub>	Output
3	3	1	2	2	3	2	V <sub>IN</sub>	Power input

**SOT-23-5**

PIN NUMBER	SYMBOL	FUNCTION
1	V <sub>IN</sub>	Power Input Pin
2	V <sub>SS</sub>	Ground
3	CE	Chip Enable Pin
4	NC	No Connection
5	V <sub>OUT</sub>	Output Pin

**SOT-89-5**

PIN NUMBER	SYMBOL	FUNCTION
1	V <sub>OUT</sub>	Output Pin
2	V <sub>SS</sub>	Ground
3	NC	No Connection
4	CE	Chip Enable Pin
5	V <sub>IN</sub>	Power Input Pin

■ **ABSOLUTE MAXIMUM RATINGS**

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V <sub>IN</sub>	V <sub>SS</sub> -0.3~V <sub>SS</sub> +8	V
Output Current		I <sub>OUT</sub>	500	mA
Output Voltage		V <sub>OUT</sub>	V <sub>SS</sub> -0.3~V <sub>IN</sub> +0.3	V
Power Dissipation	SOT-23	P <sub>d</sub>	250	mW
	SOT-89	P <sub>d</sub>	500	mW
	TO-92	P <sub>d</sub>	500	mW
Operating Temperature		T <sub>opr</sub>	-40~+85	°C
Storage Temperature		T <sub>stg</sub>	-40~+125	°C
Soldering Temperature & Time		T <sub>solder</sub>	260°C, 10s	

## ■ ELECTRICAL CHARACTERISTICS

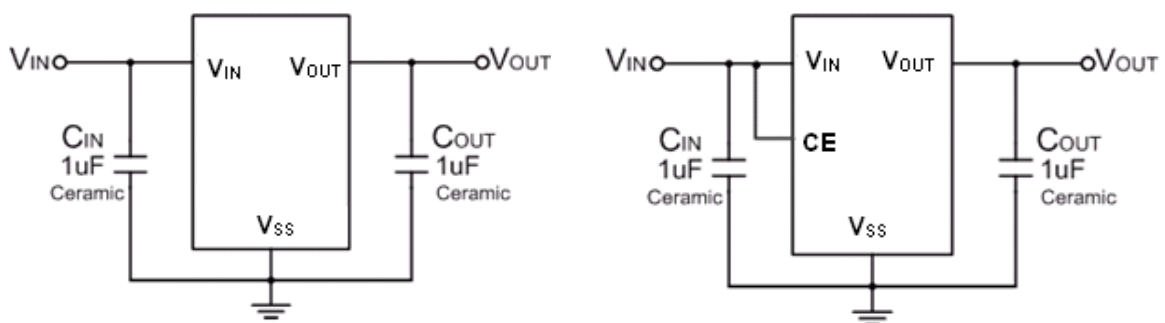
CE6209 Series ( $V_{IN}=V_{OUT}+1V$ ,  $C_{IN}=C_{OUT}=1\mu F$ ,  $T_a=25^\circ C$ , unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT(E)}$ (Note 2)	$I_{OUT}=40mA$ $V_{IN}=V_{OUT}+1V$	$V_{OUT}$ *0.98	$V_{OUT}$ (Note 1)	$V_{OUT}$ *1.02	V
Supply Current	$I_{SS}$	$V_{CE}=V_{IN}=V_{OUT}+1V$		3		$\mu A$
Shutdown Current	$I_{SHDN}$	$V_{CE}=V_{SS}$		0.1	1.0	$\mu A$
Output Current	$I_{OUT}$	$V_{IN}\geq 2.4V$ , $V_{IN}=V_{OUT}+1V$	250			mA
Dropout Voltage (Note 3)	$V_{dif1}$	$I_{OUT}=40mA$		80		mV
	$V_{dif2}$	$I_{OUT}=100mA$		160		mV
Load Regulation	$\Delta V_{OUT}$	$V_{IN}=V_{OUT}+1V$ , $1mA\leq I_{OUT}\leq 100mA$		15	40	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} * V_{OUT}}$	$I_{OUT}=40mA$ $V_{OUT}+1V\leq V_{IN}\leq 6V$		0.1	0.2	%/V
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T * V_{OUT}}$	$I_{OUT}=40mA$ $-40\leq T\leq +85$		100		ppm/ $^\circ C$
Short Current	$I_{Short}$	$V_{OUT}=V_{SS}$		50		mA
Input Voltage	$V_{IN}$	—	2.4		6.0	V
CE "High" Voltage	$V_{CE}$ "H"	—	1.5		$V_{IN}$	V
CE "Low" Voltage	$V_{CE}$ "L"				0.3	V

### NOTE:

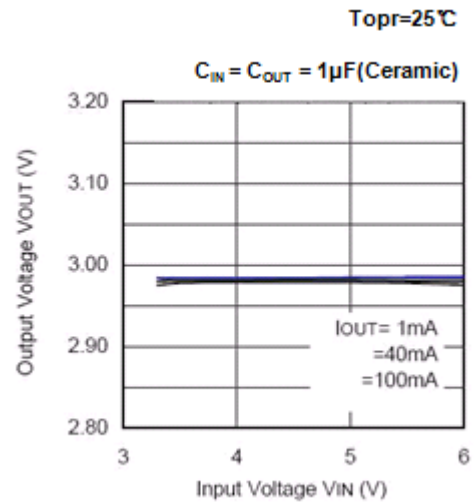
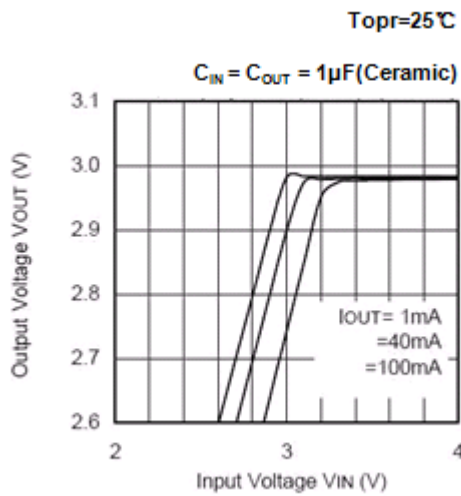
1.  $V_{OUT}$ : Specified Output Voltage.
2.  $V_{OUT(E)}$ : Effective Output Voltage ( I.e. The Output Voltage When  $V_{IN} = (V_{OUT} + 1.0V)$  And Maintain A Certain  $I_{OUT}$  Value).
3.  $V_{dif}$ : The Difference Of Output Voltage And Input Voltage When Input Voltage Is Decreased Gradually Till Output Voltage Equals 98% Of  $V_{OUT(E)}$ ; When  $V_{OUT}<2.4V$ ,  $V_{IN}\geq 2.4V$  Should be Guaranteed.

## ■ TYPICAL APPLICATION CIRCUIT

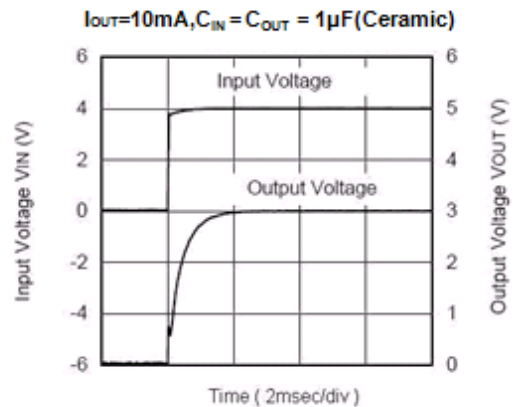
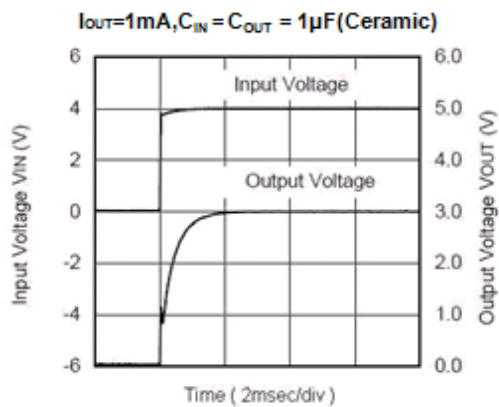


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (CE6209A30P, for instance)

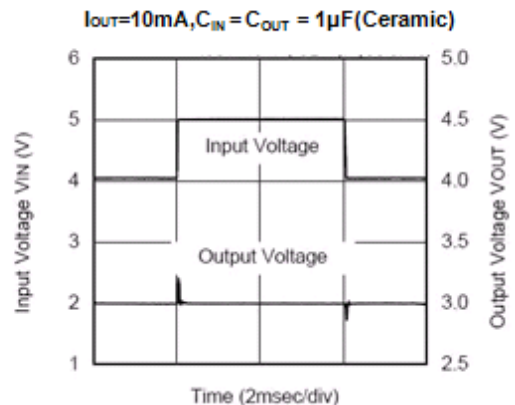
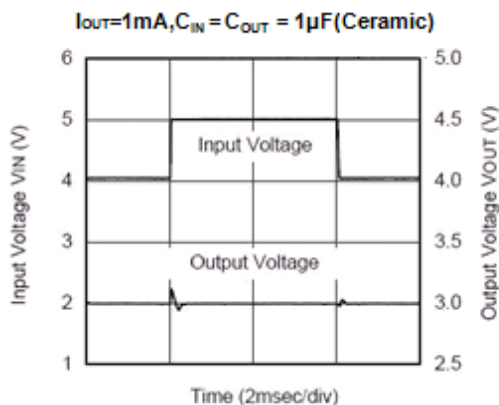
### (1) Output Voltage vs. Input Voltage



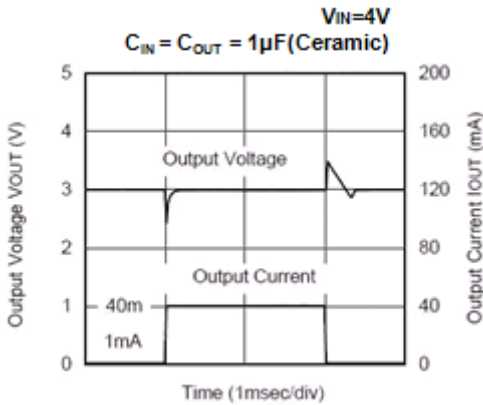
### (2) Input Transient Response 1



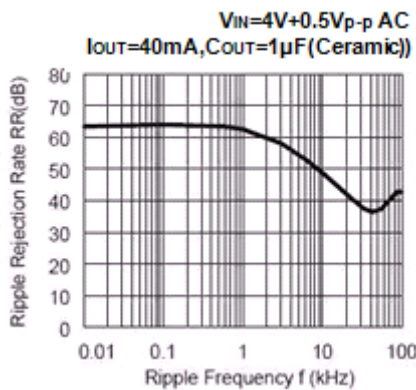
### (3) Input Transient Response 2



(4) Load Transient Response

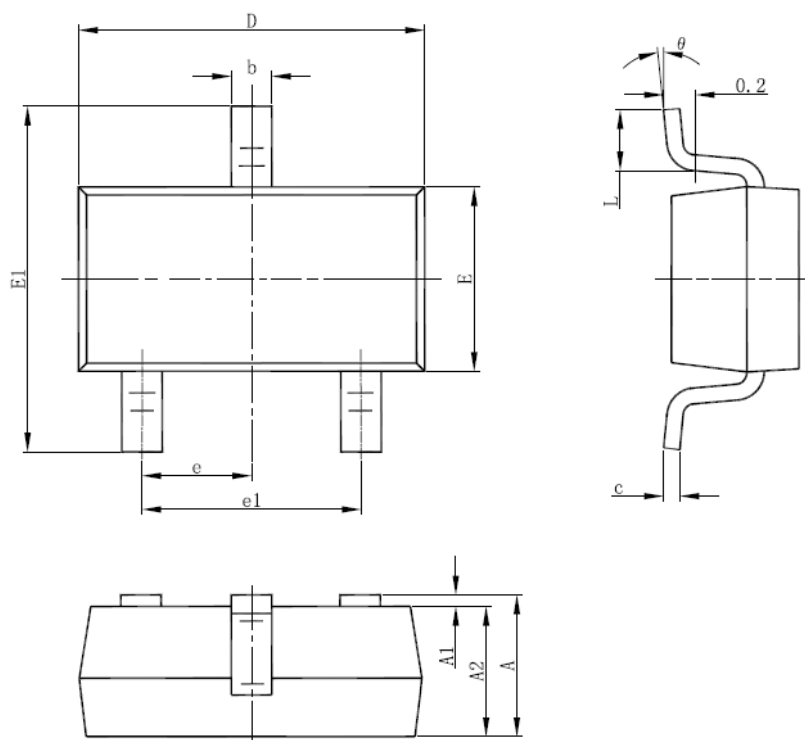


(5) Ripple Rejection Rate



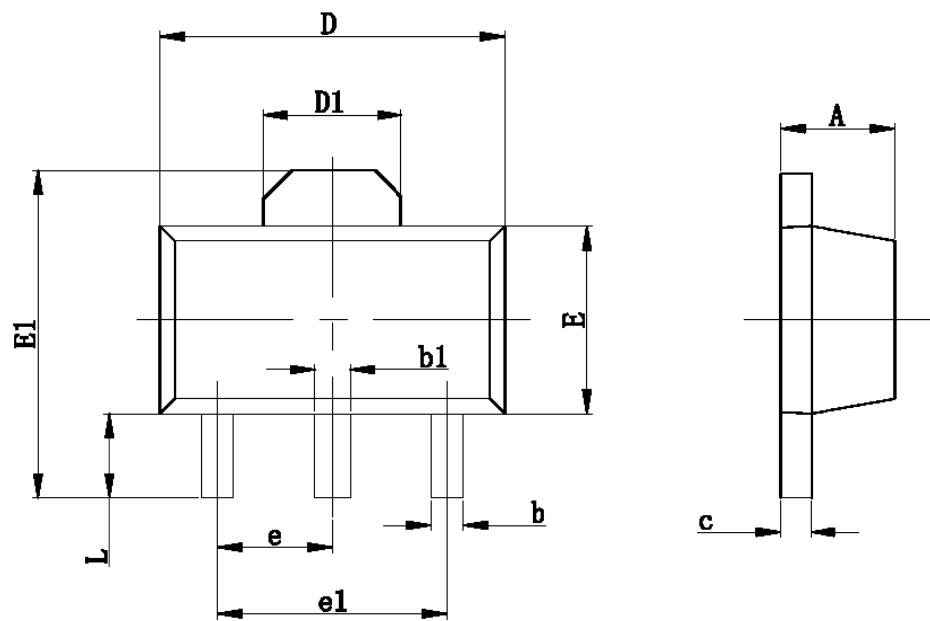
# **■ PACKAGING INFORMATION**

## **● SOT-23-3 PACKAGE OUTLINE DIMENSIONS**



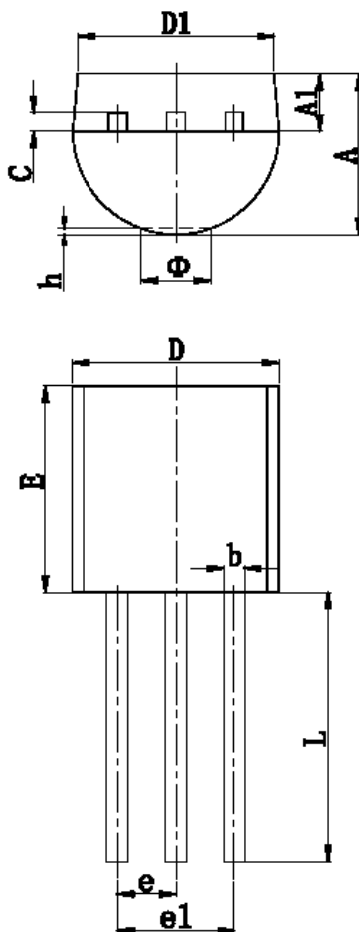
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)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

● SOT-89-3 PACKAGE OUTLINE DIMENSIONS



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	0.197
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		0.060TYP	
e1	3.000 TYP		0.118TYP	
L	0.900	1.200	0.035	0.047

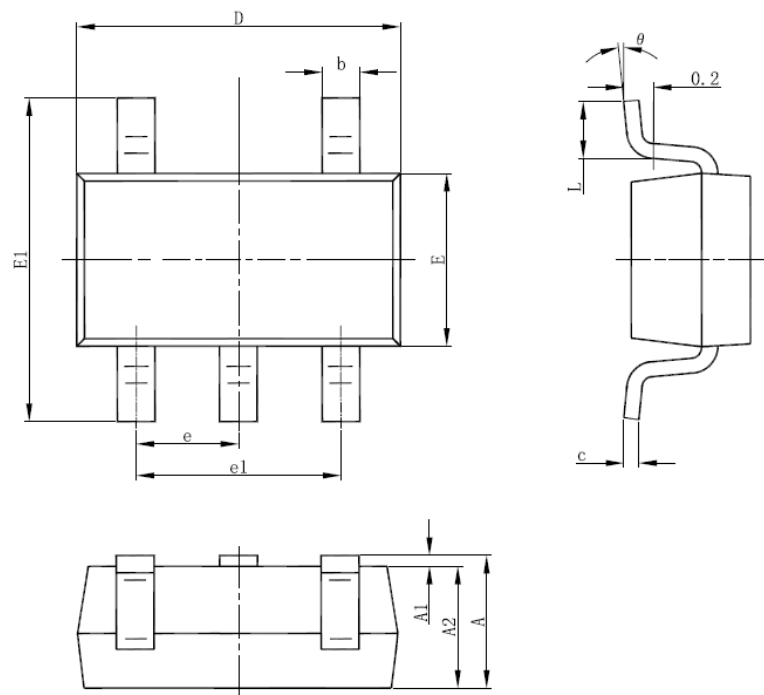
● TO-92 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
$\Phi$		1.600		0.063
h	0.000	0.380	0.000	0.015

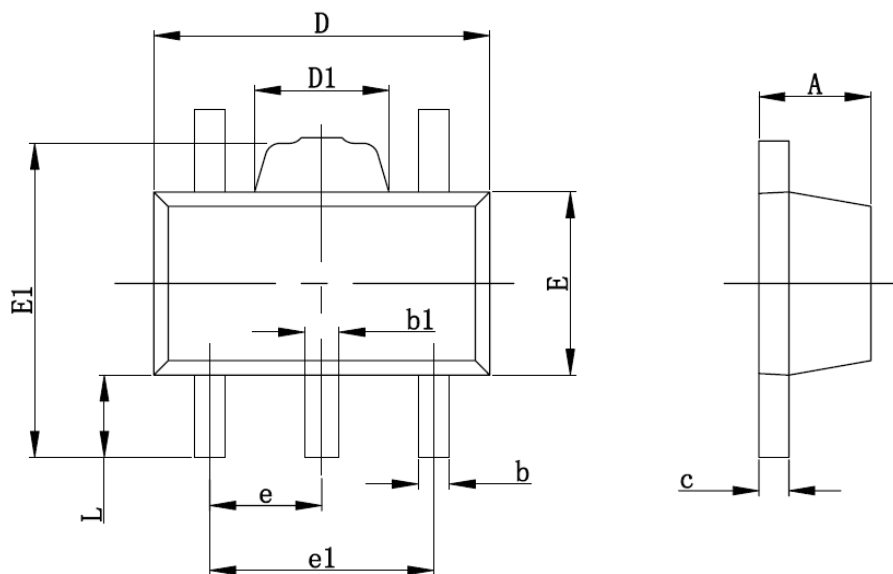


● SOT-23-5 PACKAGE OUTLINE DIMENSIONS



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-89-5 PACKAGE OUTLINE DIMENSIONS



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	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043

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