ACE5024D

Ultra Fast High PSRR Low Noise CMOS Voltage Regulator

Description

The ACE5024D series are a group of positive voltage regulators manufactured by CMOS technologies with high ripple rejection, ultra low noise, low power consumption and low dropout voltage, which can prolong battery life in portable electronics. The ACE5024D series work with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications. The ACE5024D series consume less than 0.1μA in shutdown mode and have fast turn-on time less than 50μS.The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

Features

- Low Output Noise：40μV_{RMS} (10Hz~100kHz)
- Low Dropout Voltage：50mV@100mA，Vout=3.3V
- Low Dropout Voltage：230mV@300mA，Vout=1.8V
- Low Dropout Voltage：360mV@500mA，Vout=1.8V
- Low Quiescent Current：50μA
- High Ripple Rejection：80dB@10kHz
- Excellent Line and Load Transient Response
- Operating Voltage Range：1.8V～6.0V
- Output Voltage Range：1.05V ~ 5.0V
- High Accuracy：±2%（Typ.）
- Built-in Current Limiter, Short-Circuit Protection
- TTL- Logic-Controlled Shutdown Input

Application

- Cellular and Smart Phones
- Laptop, Palmtops and PDA
- Digital Still and Video Cameras
- Portable Audio Video Equipments
- Radio control systems
- Battery-Powered Equipments

Absolute Maximum Ratings

Parameter		Symbol	Ratings	Unit
Input Voltage(2)		V_{IN}	-0.3~ 7	V
Output Voltage(2)		V_{OUT}	-0.3~V_{IN}+0.3	V
Output Current		I_{OUT}	700	mA
Power Dissipation	SOT-23-3	P_D	0.25	W
	SOT-23-5		0.25	W
	DFN1X1-4		0.4	W
	SOT-89-3		0.6	W
	SOT-89-5		0.6	W
Operating free air temperature range		T_A	-40~85	°C
Operating Junction Temperature Range(3)		T_j	-40~125	°C
Storage Temperature		T_{stg}	-40~125	°C
Lead Temperature(Soldering, 10 sec)		T_{solder}	260	°C
ESD rating(4)		Human Body Model -(HBM)	4	kV
		Machine Model- (MM)	200	V

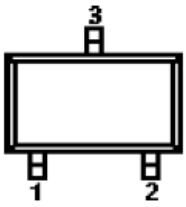
1. Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods my affect device reliability.
2. All voltages are with respect to network ground terminal.
3. This IC includes over temperature protection that is intended to protect the device during momentary overload. Junction temperature will exceed 125°C when over temperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.
4. ESD testing is performed according to the respective JESD22 JEDEC standard.
   The human body model is a 100 pF capacitor discharged through a 1.5kΩ resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

Recommended Operating Conditions

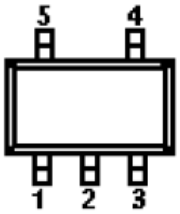
Parameter	Min.	Max.	Units
Supply voltage at V_{IN}	1.8	6	V
Operating junction temperature range, T_j	0	125	°C
Operating free air temperature range, T_A	0	85	°C

Packaging Type

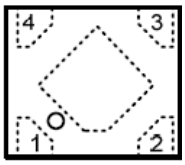
SOT-23-3



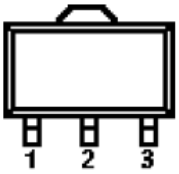
SOT-23-5/SC-70-5



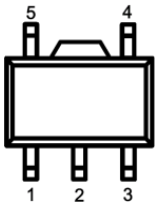
DFN1*1-4



SOT-89-3



SOT-89-5



Pin Configuration

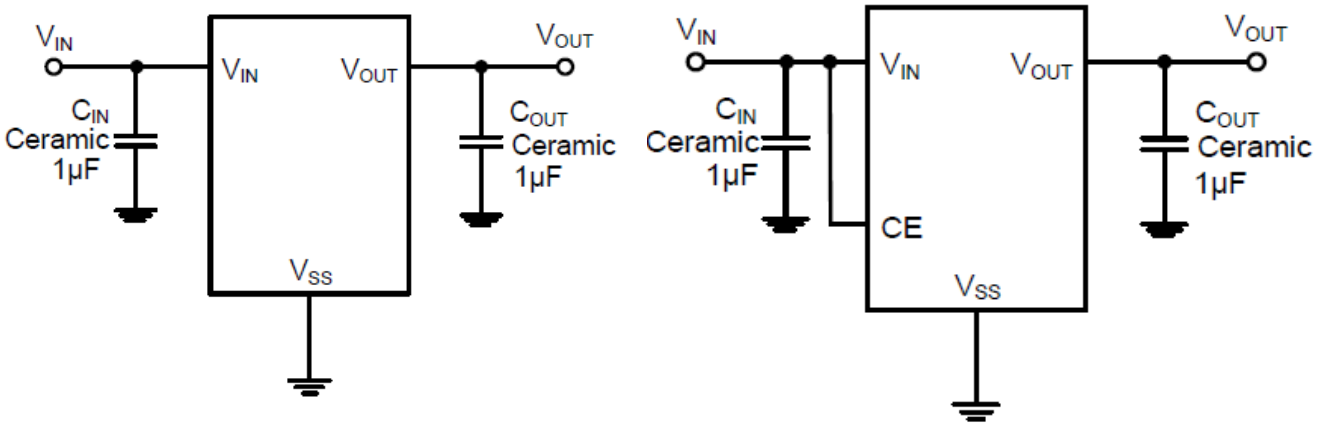
SOT-23-3				SOT-23-5			DFN1*1-4	SOT-89-3		SOT-89-5	Symbol	Function
A	B	C	D	A	B	C		A	B			
1	2	3	3	2	2	2	2	1	2	2	V_{SS}	Ground
2	1	2	1	5	5	4	1	3	1	1	V_{OUT}	Output
3	3	1	2	1	1	5	4	2	3	5	V_{IN}	Power Input Pin
				3		1	3			4	CE	Chip Enable Pin
				4	3/4	3				3	NC	No Connection

Ordering information

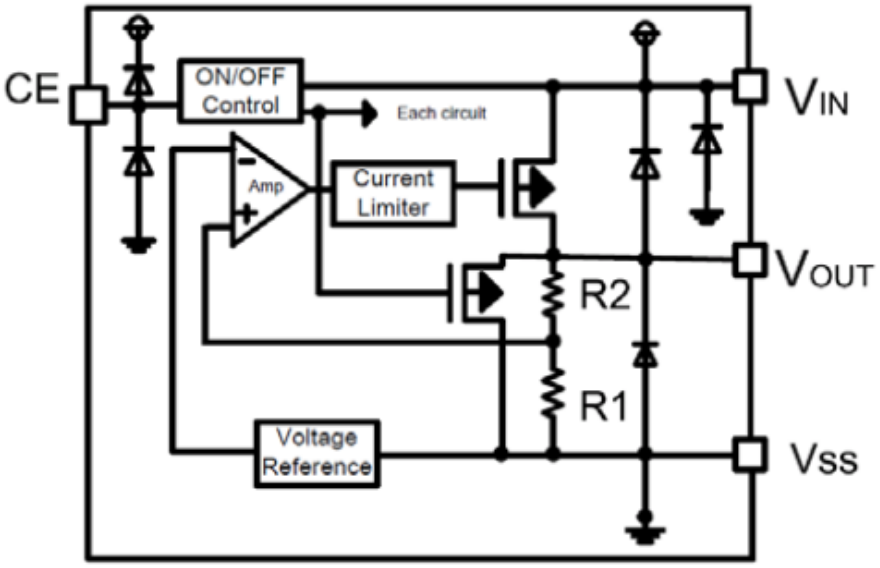
ACE5024D XX XX + H

- H: Halogen - free
- +: Pb - free
- XX (SOT-23-3 / SOT-23-5 / SOT-89-3 / SOT-89-5 / DFN1*1-4):
  - BMA：SOT-23-3A
  - BMB：SOT-23-3B
  - BMC：SOT-23-3C
  - BMD：SOT-23-3D
  - BNA：SOT-23-5A
  - BNB：SOT-23-5B
  - BNC：SOT-23-5C
  - IN：DFN1*1-4
  - AMA：SOT-89-3A
  - AMB：SOT-89-3B
  - AN：SOT-89-5
- XX (Output Voltage)：1.05V/1.8V/……/5.0V

Typical Operating Circuit



Block Diagram



Electrical Characteristics

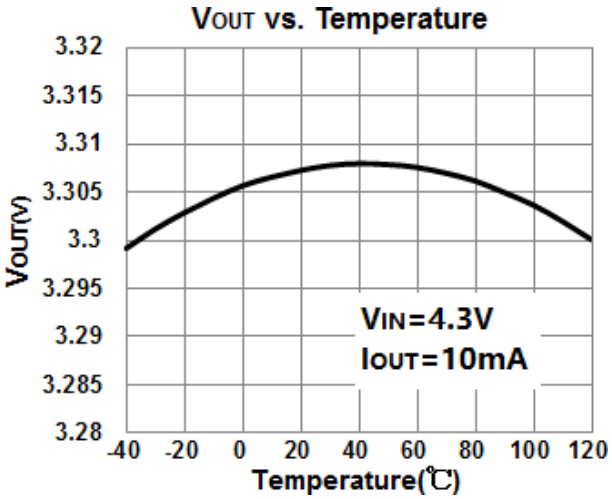
(V_{IN}=V_{OUT}+1V, C_{IN}=C_{OUT}=1μF , T_A=25℃,unless otherwise specified)

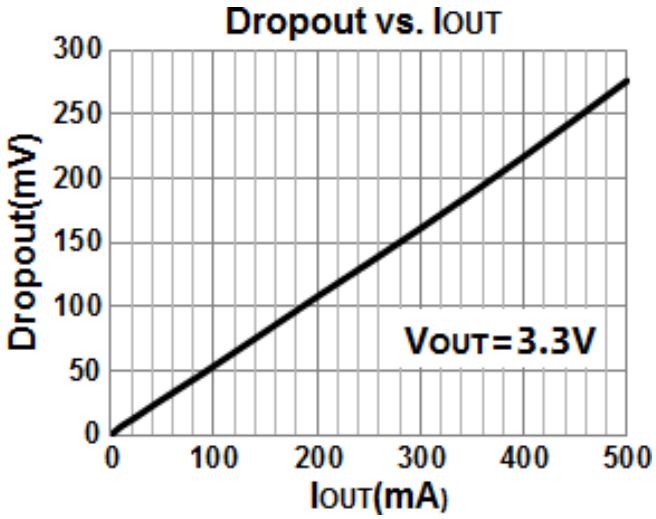
Parameter		Symbol	Conditions	Min	Typ(1)	Max	Unit
Output Voltage		$V_{OUT}(E)$ (2)	I_{OUT}=1mA	V_{OUT}(3)*0.98	V_{OUT}(3)	V_{OUT}(3)*1.02	V
Supply Current		I_{SS}	I_{OUT}=0		50	100	μA
Standby Current		I_{STBY}	CE = V_{SS}		0.1	1	μA
Output Current		I_{OUT}		500			mA
Dropout Voltage		V_{DO} (4)	I_{OUT} =100mA V_{OUT}≥3.3V		50		mV
Load Regulation		ΔV_{OUT}	V_{IN}= V_{OUT} +1V, 1mA≤I_{OUT}≤100mA		1		mV
Line Regulation		$\frac{\Delta V_{OUT}}{\Delta V_{IN}} \frac{V_{OUT}}{}$	I_{OUT} =10mA V_{OUT} +1V≤V_{IN}≤6V		0.01	0.2	%/V
Output Voltage Temperature Characteristics		$\frac{\Delta V_{OUT}}{\Delta T \times V_{OUT}}$	I_{OUT} =10mA -40≤T≤+85		30		ppm
Short Current		I_{Short}	V_{OUT} =V_{SS}		50		mA
Input Voltage		V_{IN}		1.8		6.0	V
Power Supply Rejection Rate	100Hz	PSRR	I_{OUT}=50mA		75		dB
	1kHz				80		
	10kHz				80		
CE "High" Voltage		V_{CE}"H"		1.5		V_{IN}	V
CE "Low" Voltage		V_{CE}"L"				0.3	V
C_{OUT} Auto-Discharge Resistance		$R_{DISCHRG}$	V_{IN}=5V, V_{OUT}=3.0V, V_{CE}=V_{SS}		60		Ω

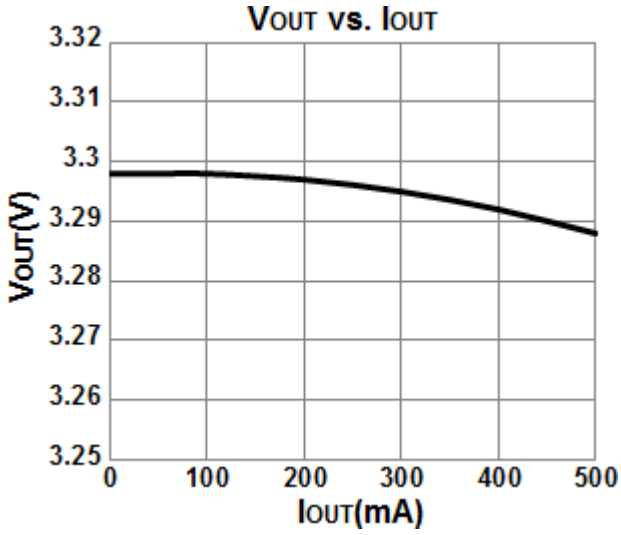
1. Typical numbers are at 25°C and represent the most likely norm.
2. V_{OUT} (E): Effective Output Voltage (Ie. The output voltage when VIN = (V_{OUT} +1.0V) and maintain a certain I_{OUT} Value).
3. V_{OUT}: Specified Output Voltage.
4. V_{DO}: The Difference Of Output Voltage And Input Voltage When Input Voltage Is Decreased Gradually Till Output Voltage Equals To 98% Of V_{OUT} (E).

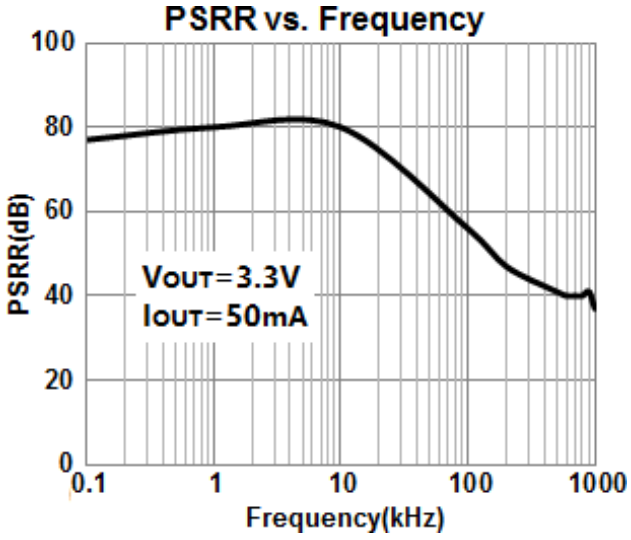
Typical Performance Characteristics

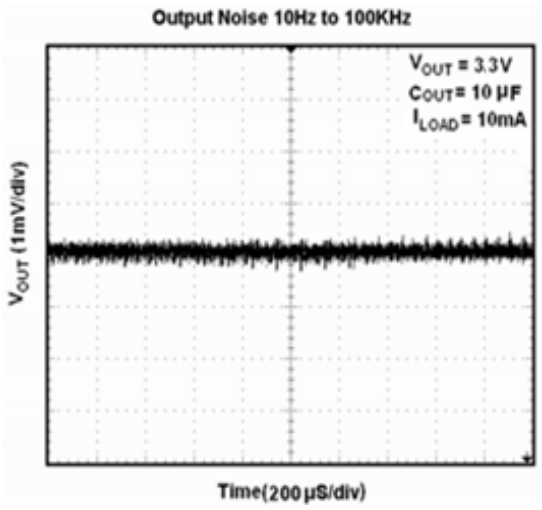
(V_{CE}=V_{IN}=V_{OUT}+1V, C_{IN}=C_{OUT}=1μF，T_A=25℃,unless otherwise specified)

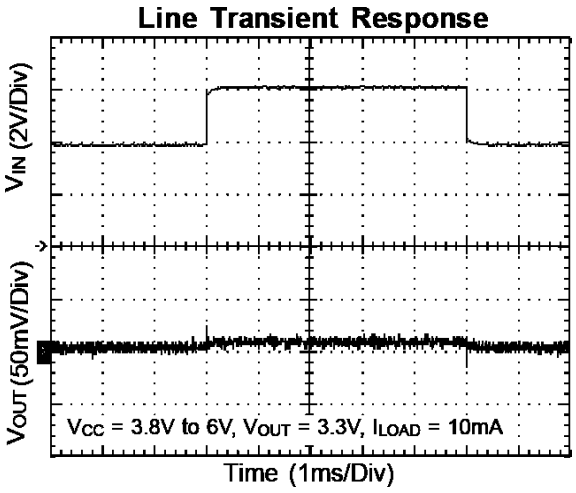


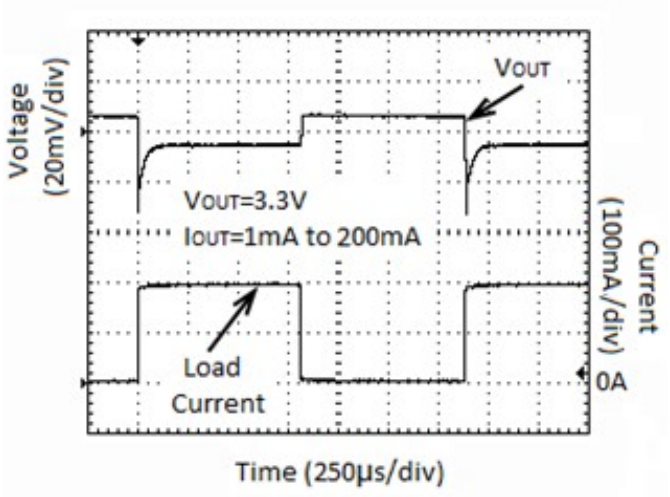


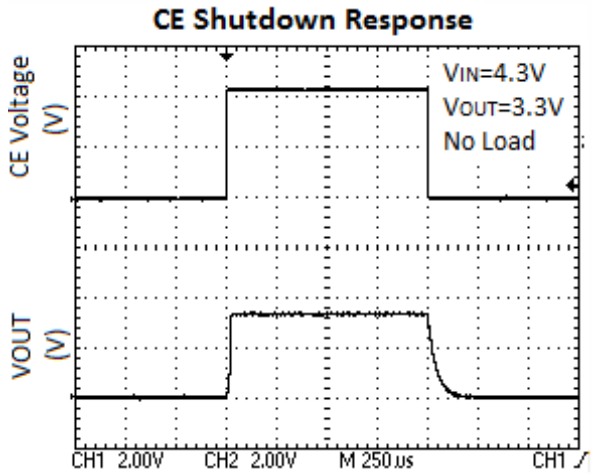












C_{OUT} Auto-Discharge Function

ACE5024D series can discharge the electric charge in the output capacitor (C_{OUT}), when a low signal to the CE pin, which enables a whole IC circuit turn off, is inputted via the

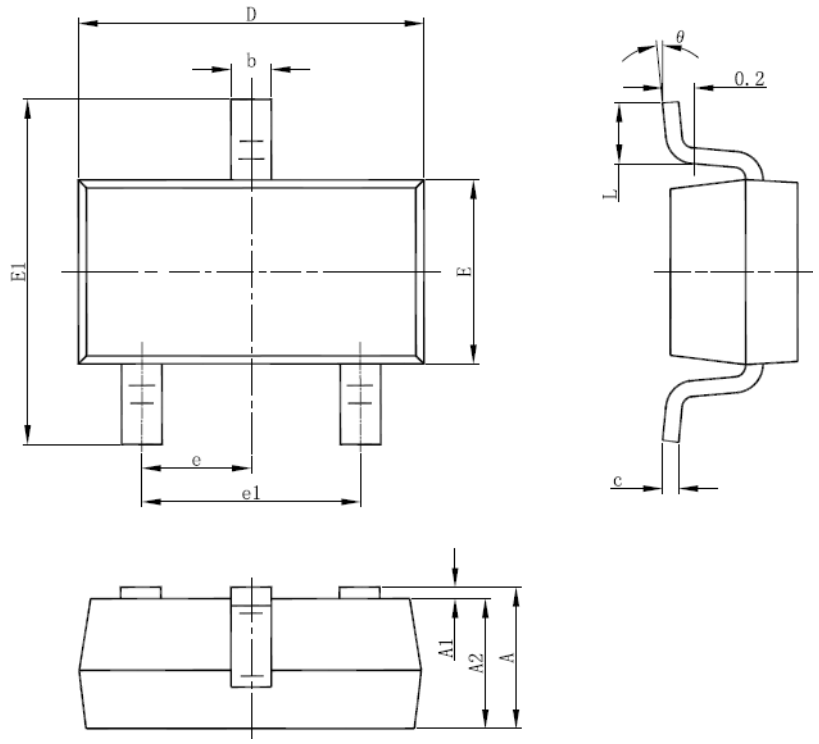
N-channel transistor located between the V_{OUT} pin and the V_{SS} pin (cf. Block Diagram). The C_{OUT} auto-discharge resistance value is set at 60Ω (V_{OUT}=3.0V @ V_{IN}=5.0V at typical). The discharge time of the output capacitor (C_{OUT}) is set by the C_{OUT} auto-discharge resistance (R) and the output capacitor (C_{OUT}). By setting time constant of a C_{OUT} auto-discharge resistance value [$R_{DISCHRG}$] and an output capacitor value (C_{OUT}) as τ (τ=C x $R_{DISCHRG}$), the output voltage after discharge via the N-channel transistor is calculated by the following formulas.

$$V = V_{OUT(E)} \times e^{-t/\tau},\ or\ t=\tau ln\ (\ V / V_{OUT(E)}\ )$$

(V : Output voltage after discharge, $V_{OUT(E)}$: Output voltage, t: Discharge time,τ: C_{OUT} auto-discharge resistance $R_{DISCHRG}$×Output capacitor (C_{OUT}) value C)

Packing Information

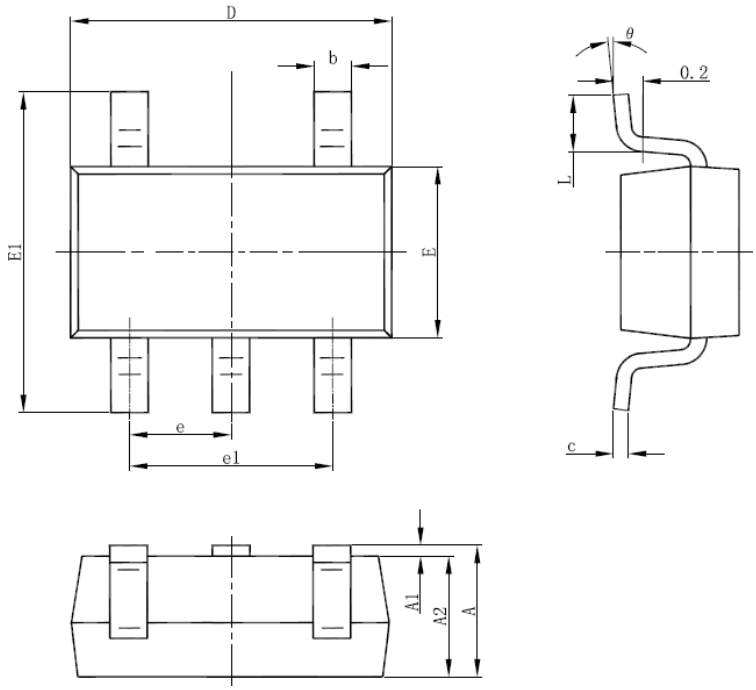
SOT-23-3



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°

Packing Information

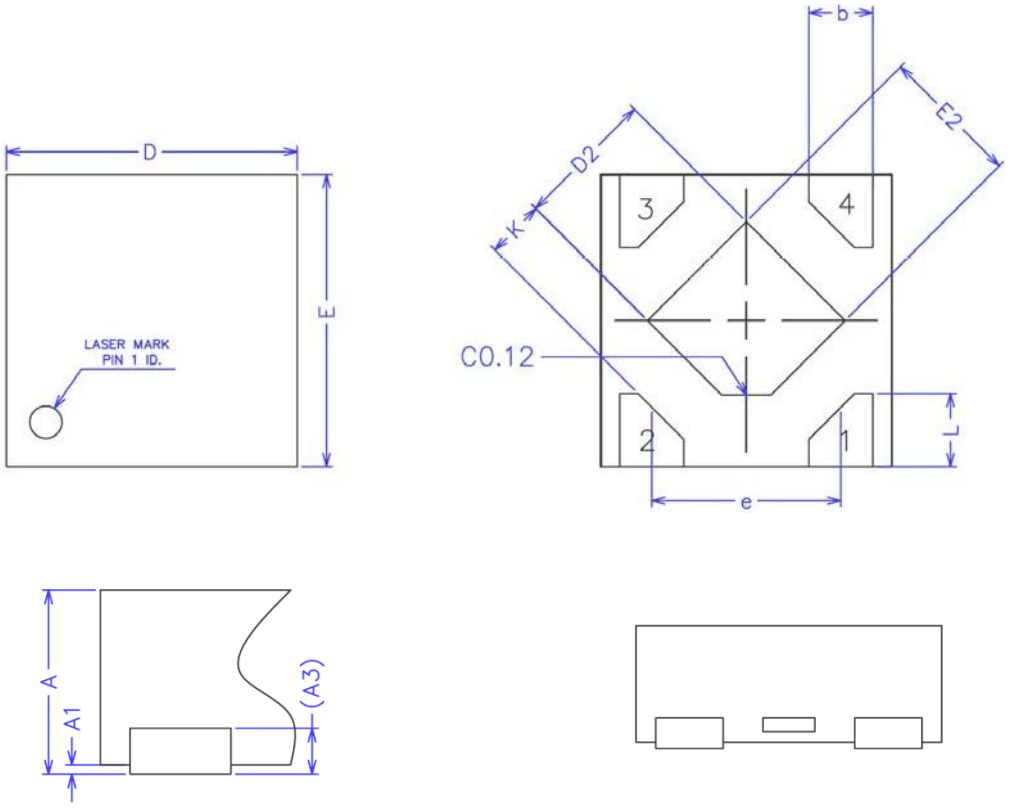
SOT-23-5



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°

Packing Information

DFN1*1-4

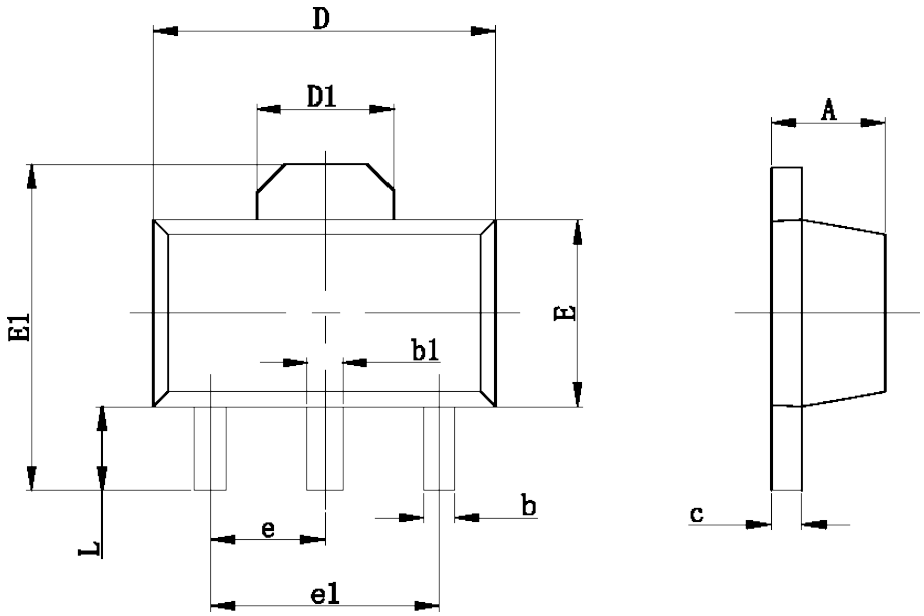


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.34	0.37	0.40
A1	0.00	0.02	0.05
A3		0.100REF	
b	0.17	0.22	0.27
D	0.95	1.00	1.05
E	0.95	1.00	1.05
D2	0.43	0.48	0.53
E2	0.43	0.48	0.53
L	0.20	0.25	0.30
e	–	0.65	–
K	0.15	–	–

Packing Information

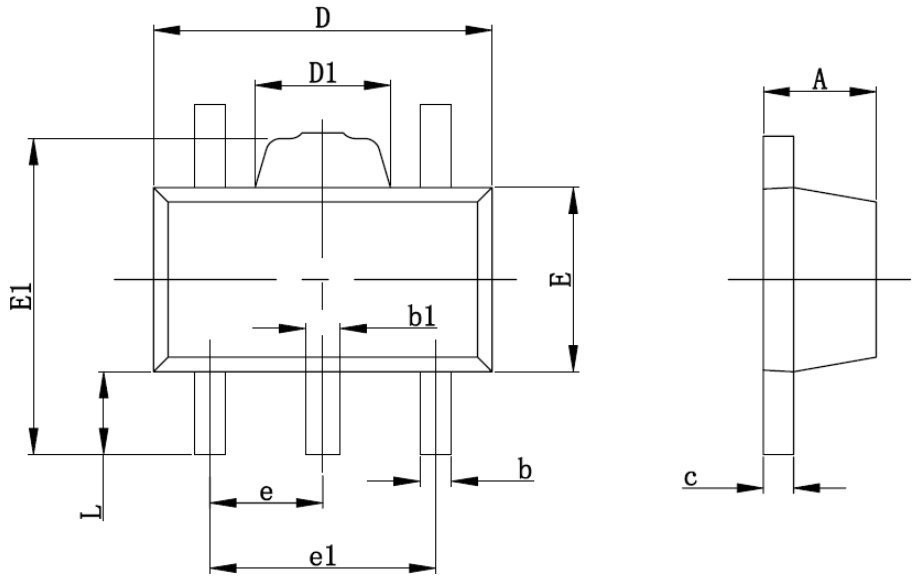
SOT-89-3



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

Packing Information

SOT-89-5



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

Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.