300mA,Ultra-low noise, Small Package Ultra-Fast CMOS LDO Regulator

General Description

The BL9169 is designed for portable RF and wireless applications with demanding performance and space requirements. The BL9169 performance is optimized for battery-powered systems to deliver ultra low noise and low quiescent current. The BL9169 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices.

The BL9169 has fast turn-on time less than 50μs. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio. It is available in the 5-lead of SOT23-5 and TSOT23-5 packages.

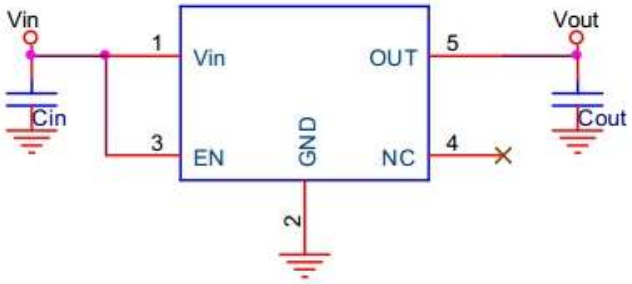
Features

- Ultra-Low-Noise for RF Application
- 2.5V- 5.5V Input Voltage Range
- Low Dropout : 220mV @ 300mA
- 1.2V, 1.5V, 1.8V, 2.5V, 2.8V,3.0V,3.3V, 3.6V and 5V Fixed
- 300mA Output Current, 550mA Peak Current
- High PSSR:-76dB at 1KHz
- 0.01uA Standby Current When Shutdown
- TTL-Logic-Controlled Shutdown Input
- Ultra-Fast Response in Line/Load transient
- Current Limiting and Thermal Shutdown Protection
- Quick start-up (typically 50uS)
- Available in SOT23-5 and TSOT23-5 Package

Applications

- Portable Media Players/MP3 players
- Cellular and Smart mobile phone
- LCD
- DSC Sensor
- Wireless Card

Typical Application Circuit



Ordering Information

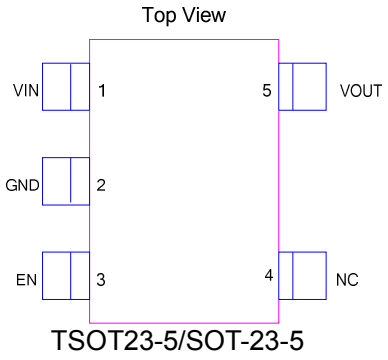
BL9169 □ □ □ □ □

F: Pb-Free

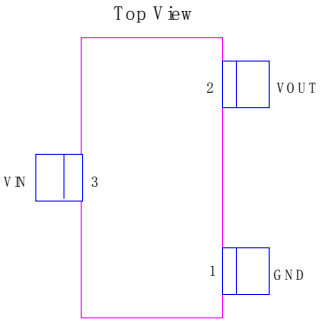
Package Type
B3: SOT23-3
B5: SOT23-5
J5: TSOT23-5

Output Voltage Type
12: 1.2V
15: 1.5V
18: 1.8V
25: 2.5V
28: 2.8V
30: 3.0V
33: 3.3V
36: 3.6V
50: 5.0V

Pin Configurations



TSOT23-5/SOT-23-5

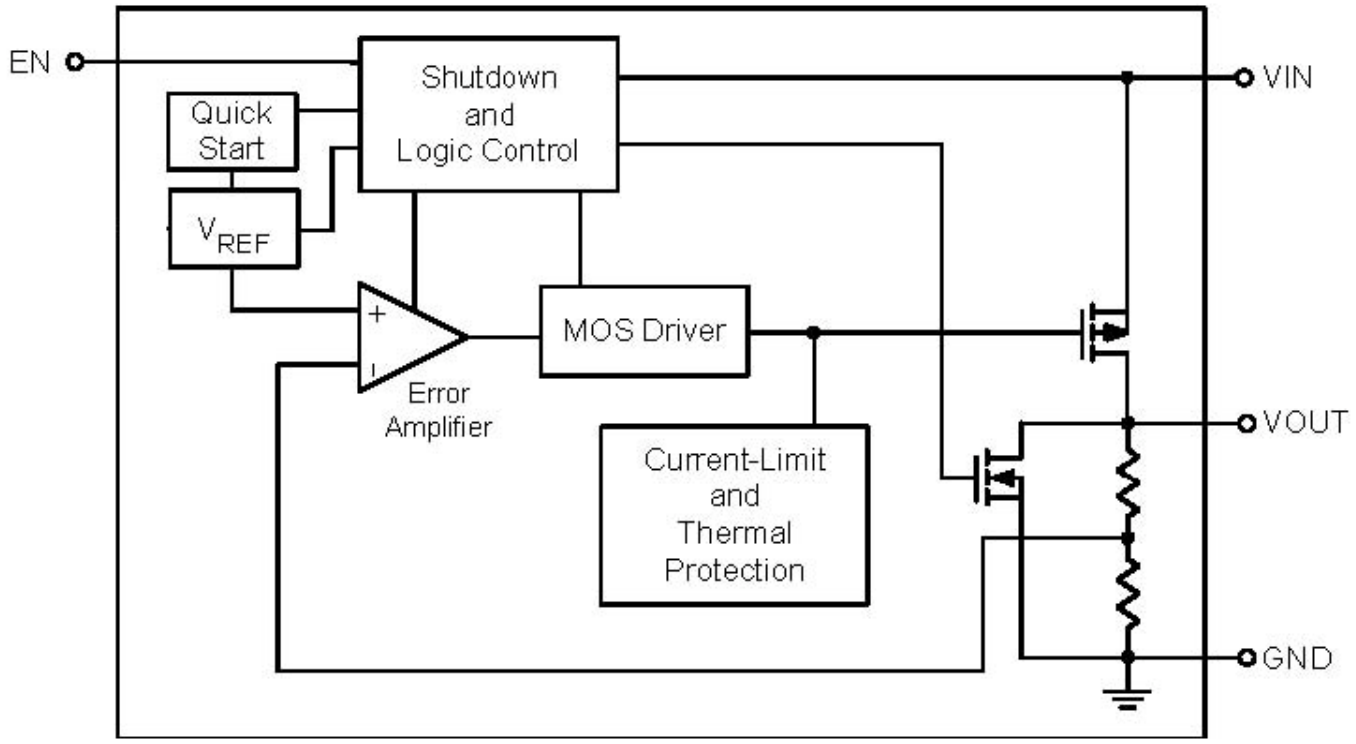


SOT-23-3

Functional Pin Description

SOT23-5	SOT23-3	Pin Name	Pin Function
1	3	VIN	Power Input Voltage.
2	1	GND	Ground.
3		EN	Chip Enable (Active High). Note that this pin is high impedance. There is an integrated pull low 2MΩ resistor connected to GND when the control signal is floating.
4		NC	No Connection.
5	2	VOUT	Output Voltage.

Function Block Diagram



Absolute Maximum Ratings

Supply Input Voltage---------- 6.5V
Other Pin Voltage---------- -0.3V to VIN+0.3V

Power Dissipation, PD @ TA = 25° C
SOT23-5 ----------450mW
SOT23-3 ----------450mW

Package Thermal Resistance
SOT23-5, θJA ----------250°C/W
SOT23-3, θJA ----------250°C/W
Lead Temperature (Soldering, 10 sec.) ----------260°C
Storage Temperature Range ---------- −65°C to 150°C

ESD Susceptibility
HBM (Human Body Mode) ----------2kV
MM(Machine-Mode)----------200V

Recommended Operating Conditions
Supply Input Voltage---------- 2.5V to 5.5V
EN Input Voltage ---------- 0V to 5.5V
Operation Junction Temperature Range ---------- −40°C to 125°C
Operation Ambient Temperature Range---------- −40°C to 85°C

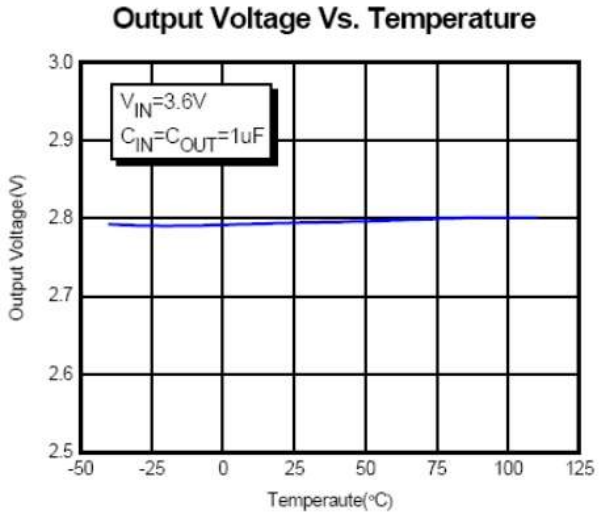
Electrical Characteristics

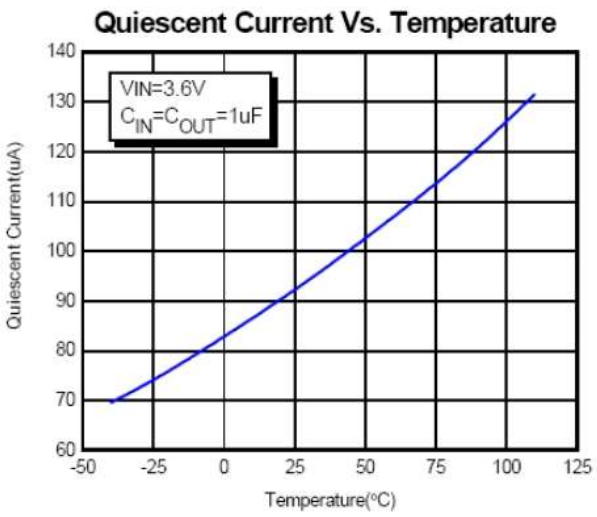
(VIN = VOUT + 1V, CIN = COUT = 1μF, TA = 25° C, unless otherwise specified)

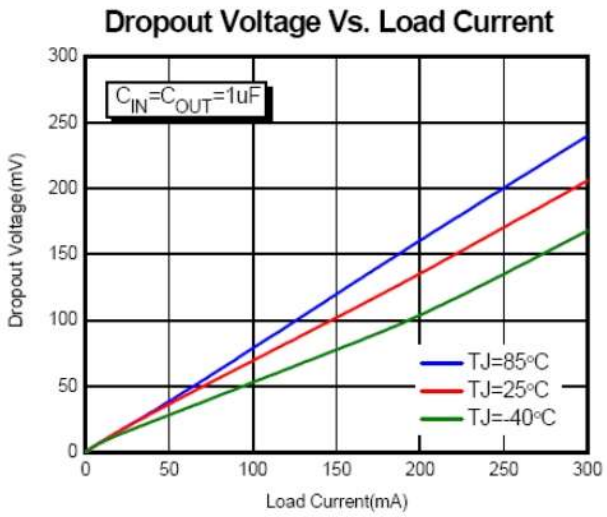
Parameter		Symbol	Test Conditions	Min	Typ.	Max	Units
Output Voltage Accuracy		ΔVOUT	IOUT = 1mA	-2	--	+3	%
Output Loading Current		I_{LOAD}	VEN=VIN,VIN>2.5V		300		mA
Current Limit		ILIM	RLOAD = 1Ω	420	450		mA
Quiescent Current		IQ	VEN ≥ 1.2V, IOUT = 0mA		100	130	μA
Dropout Voltage		VDROP	IOUT = 200mA, VOUT > 2.8V		130	200	mV
			IOUT = 300mA, VOUT > 2.8V		220	300	
Line Regulation		ΔVLINE	VIN = (VOUT + 1V) to 5.5V, IOUT = 1mA			0.2	%/V
Load Regulation		ΔLOAD	1mA < IOUT < 300mA			2	%/A
Standby Current		ISTBY	VEN = GND, Shutdown		0.01	1	μA
EN Input Bias Current		IIBSD	VEN = 3V		1.5	2	μA
EN Threshold	Logic-Low Voltage	VIL	VIN = 3V to 5.5V, Shutdown			0.4	V

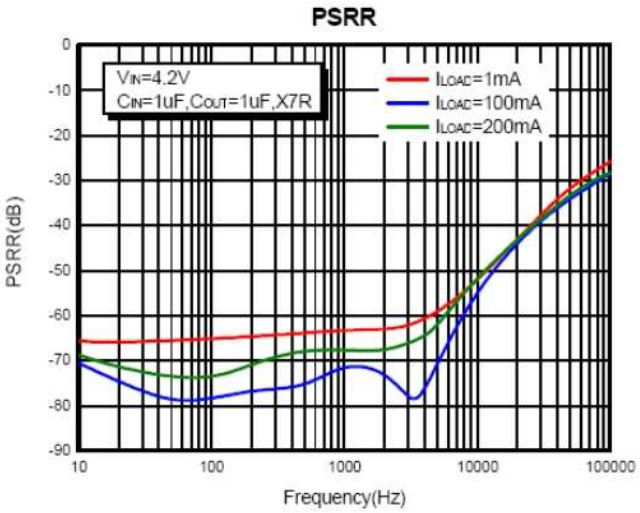
	Logic-High Voltage	VIH	VIN = 3V to 5.5V, Start-Up	1.4		VIN+ 0.3	
Output Noise Voltage			10Hz to 100kHz, IOUT = 200mA, COUT = 1μF		300		uVRMS
Power Supply Rejection Rate	f = 1kHz		COUT = 1μF, IOUT = 100mA		-76		dB
	f = 10kHz				-65		
Thermal Shutdown Temperature		TSD			150		° C

Typical Operating Characteristics

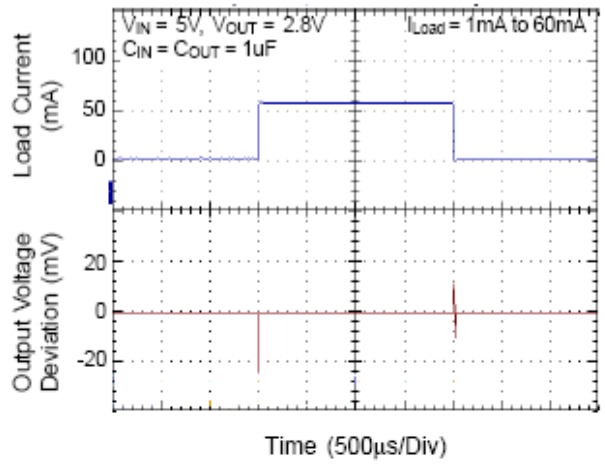




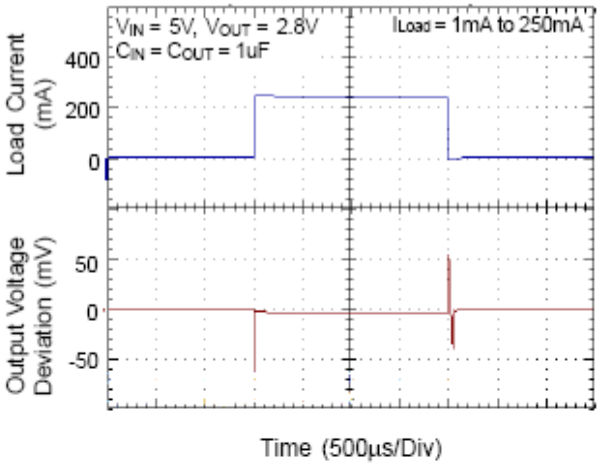




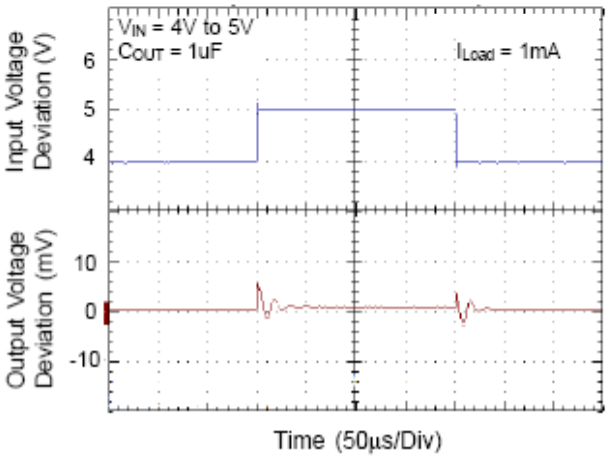
Load Transient Response



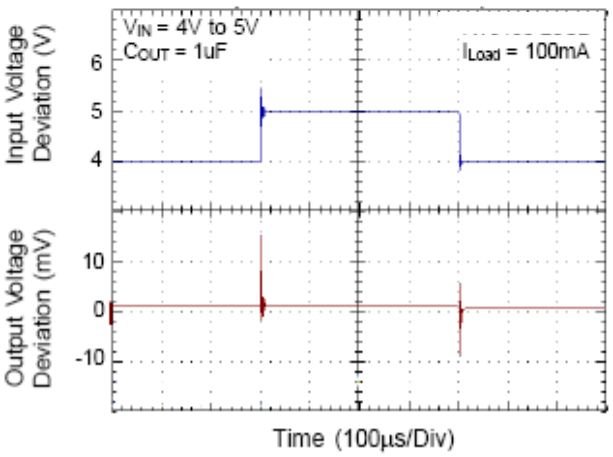
Load Transient Response



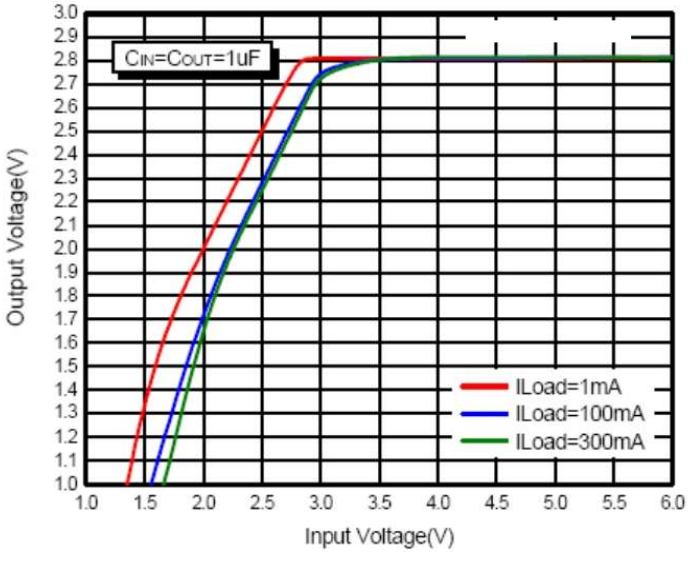
Line Transient Response



Line Transient Response



VOUT Vs. VIN



Applications Information

Like any low-dropout regulator, the external capacitors used with the BL9169 must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1μF on the BL9169 input and the amount of capacitance can be increased without limit. The input capacitor must be located a distance of not more than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response. The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The BL9169 is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least 1μF with ESR is > 25mΩ on the BL9169 output ensures stability. The BL9169 still works well with output capacitor of other types due to the wide stable ESR range. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and PSRR. The output capacitor should be located not more than 0.5 inch from the VOUT pin of the BL9169 and returned to a clean analog ground.

Start-up Function Enable Function

The BL9169 features an LDO regulator enable/disable function. To assure the LDO regulator will switch on, the EN turn on control level must be greater than 1.4 volts. The LDO regulator will go into the shutdown mode when the voltage on the EN pin falls below 0.4 volts. For to protecting the system, the BL9169 have a quick-discharge function. If the enable function is not needed in a specific application, it may be tied to VIN to keep the LDO regulator in a continuously on state.

Thermal Considerations

Thermal protection limits power dissipation in BL9169. When the operation junction temperature exceeds 150°C, the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turns on again after the junction temperature cools by 20°C. For continue operation, do not exceed absolute maximum operation junction temperature 125°C.

The power dissipation definition in device is:

PD = (VIN−VOUT) x IOUT + VIN x IQ

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient.

The maximum power dissipation can be calculated by following formula:

PD(MAX) = (TJ(MAX) − TA) /θJA

Where

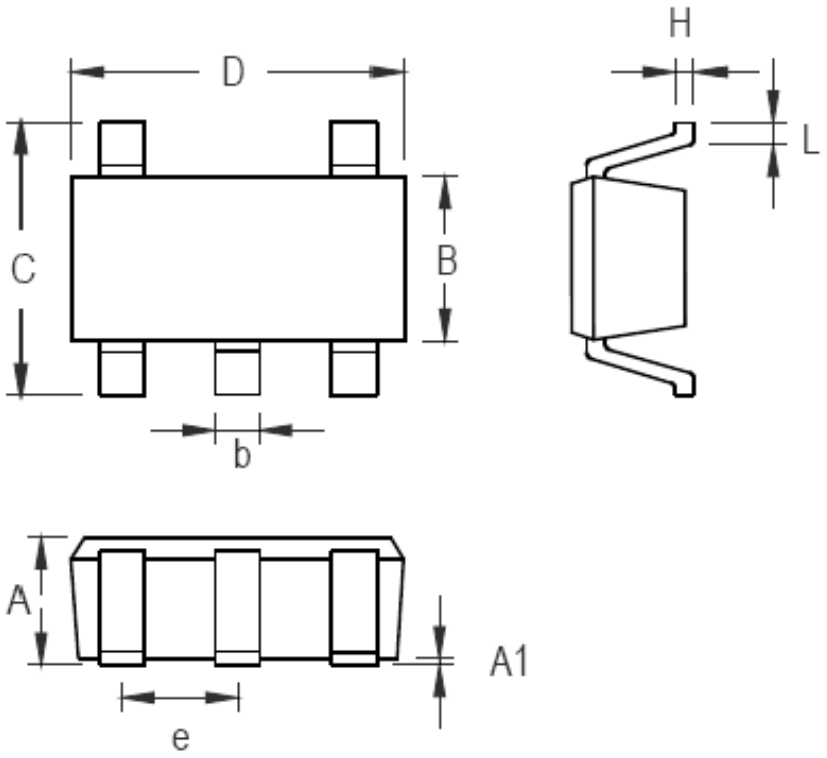
TJ(MAX) is the maximum operation junction temperature 125°C, TA is the ambient temperature and the θJA is the junction to ambient thermal resistance. For recommended operating conditions specification of BL9169, where TJ(MAX) is the maximum junction temperature of the die (125°C) and TA is the maximum ambient temperature. The junction to ambient thermal resistance (θJA is layout dependent) for SOT23-5 package is 250°C/W.

PD(MAX) = (125°C−25°C) / 250 = 400mW (SOT23-5)

The maximum power dissipation depends on operating ambient temperature for fixed TJ(MAX) and thermal resistance θJA.

Packaging Information

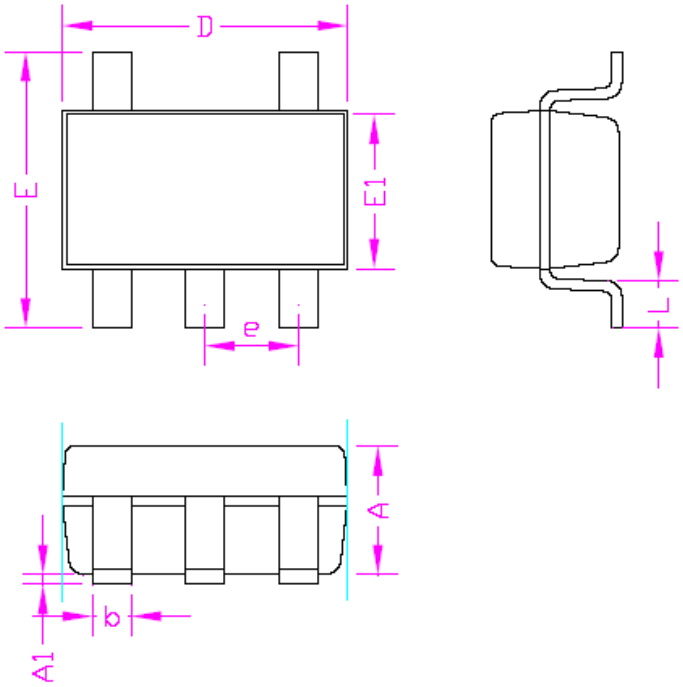
SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

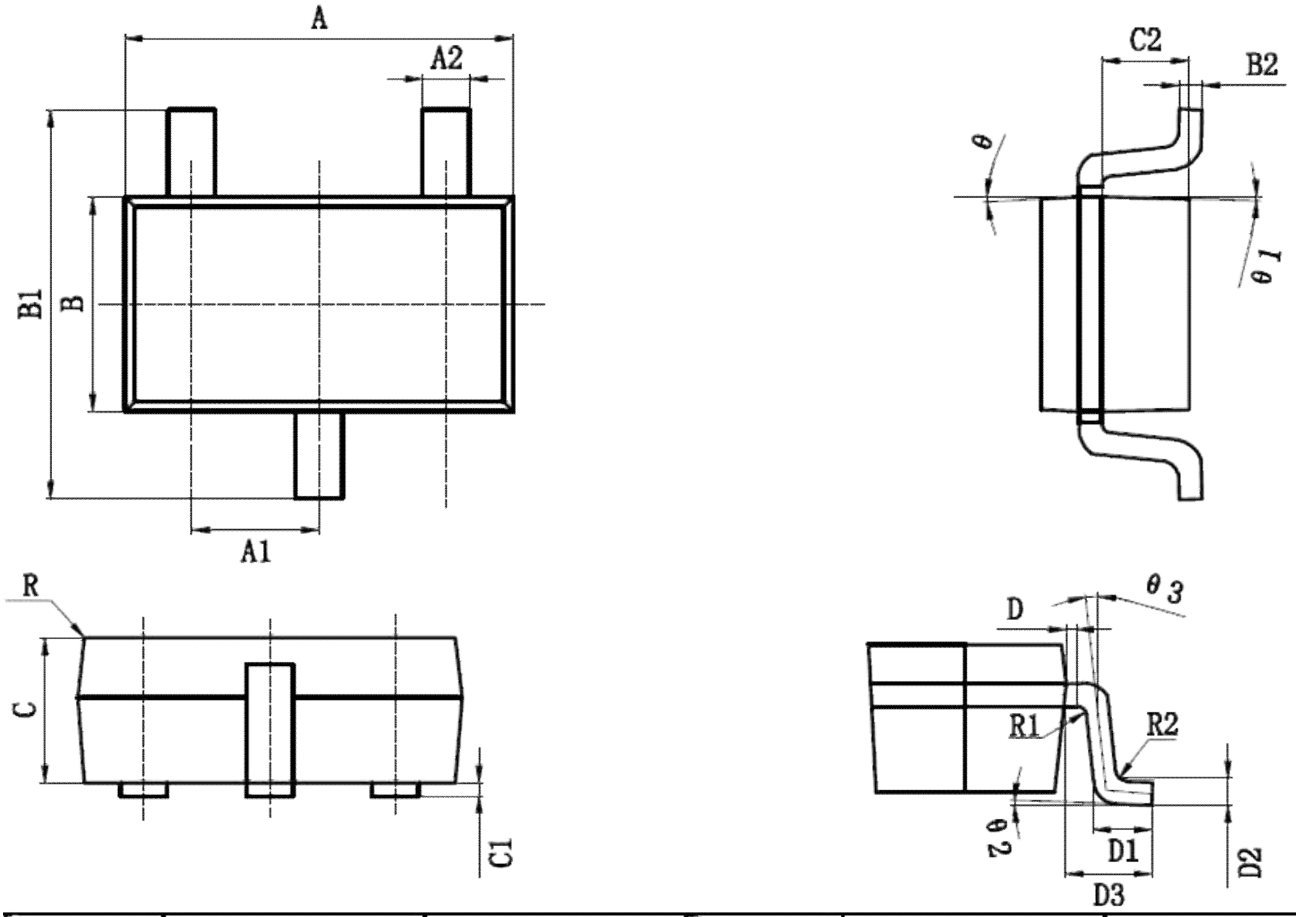
SOT-23-5 Surface Mount Package

TSOT23-5



SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	-	1.00	-	0.039
A1	0.00	0.15	0.000	0.006
D	2.90		0.114	
E1	1.60		0.063	
E	2.60	3.00	0.102	0.118
L	0.30	0.60	0.012	0.024
b	0.30	0.50	0.012	0.020
e	0.95		0.037	

SOT23-3



Symbol	MIN(mm)	MAX(mm)	Symbol	MIN(mm)	MAX(mm)
A	2.82	3.02	D1	0.40	0.50
A1	0.90	1.00	**D2**	0.254TYP	
A2	0.35	0.45	**D3**	**0.60**	**0.70**
B	1.52	1.72	**θ**	9° TYP4	
B1	2.80	3.00	**θ1**	10° TYP4	
B2	0.119	0.135	**θ2**	0° ~ 8°	
C	1.05	1.15	**θ3**	6° TYP	
C1	0.03	0.13	R	<0.2TYP4	
C2	0.60	0.70	R1	0.08TYP	
D	0.03	0.13	R2	0.08TYP	