100mA, 4µA Quiescent Current CMOS LDO Regulator

General Description

The RT9169/H series are 100mA ultra-low quiescent current CMOS low dropout (LDO) regulator designed for battery-powered equipments. The output voltages range from 1.2V to 5V with 0.1V per step.

The other features include 4µA ultra-low quiescent, low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio.

Ordering Information

RT9169/H-□□ □ □

- Package Type
  - ZL : TO-92 (L-Type)
  - ZT : TO-92 (T-Type)
  - X : SOT-89
  - V : SOT-23-3
  - VL : SOT-23-3 (L-Type)
  - B : SOT-23-5
- Lead Plating System
  - P : Pb Free
  - G : Green (Halogen Free and Pb Free)
- Output Voltage
  - 12 : 1.2V
  - 13 : 1.3V
  - :
  - 49 : 4.9V
  - 50 : 5.0V
- Chip Enable High (SOT-23-5 Only)
- Chip Enable Low

Note :

1. RT9169H package type is available in SOT-23-5 only.
2. Richtek products are :
   - RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
   - Suitable for use in SnPb or Pb-free soldering processes.

Marking Information

For marking information, contact our sales representative directly or through a Richtek distributor located in your area.

Features

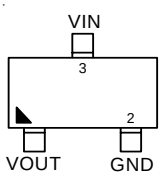
- **Ultra-Low Quiescent Current: 4µA**
- **Low Dropout: 450mV at 100mA**
- **Wide Operating Voltage Ranges: 2V to 6V**
- **Current Limiting Protection**
- **Only 1µF Output Capacitor Required for Stability**
- **High Power Supply Rejection Ratio**
- **RoHS Compliant and 100% Lead (Pb)-Free**

Applications

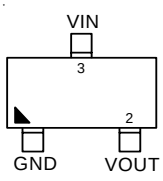
- Battery-Powered Equipment
- Palmtops, Notebook Computers
- Hand-held Instruments
- PCMCIA Cards

Pin Configurations

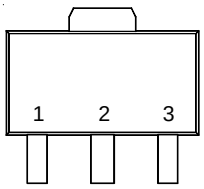
(TOP VIEW)



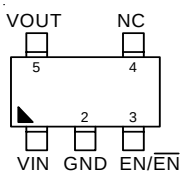
SOT-23-3



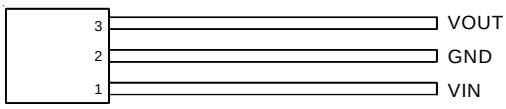
SOT-23-3 (L-Type)



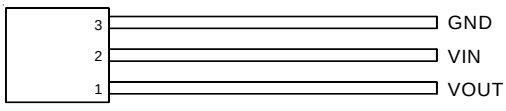
SOT-89



SOT-23-5

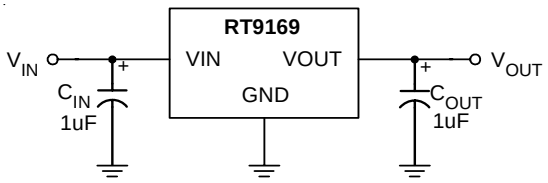


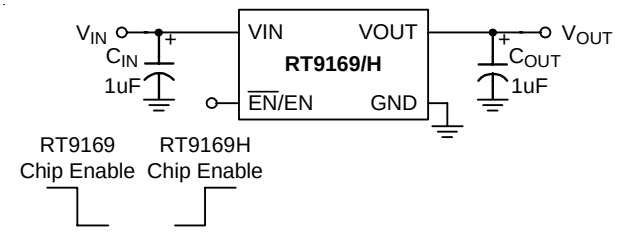
TO-92 (L-Type)



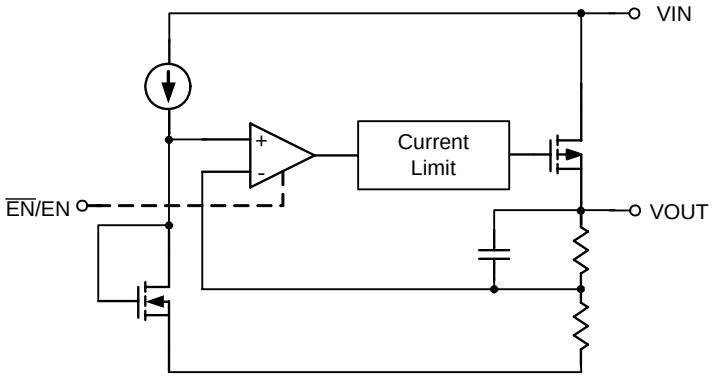
TO-92 (T-Type)

Typical Application Circuit





Function Block Diagram



Functional Pin Description

Pin Name	Pin Function
VIN	Power Input
VOUT	Output Voltage
GND	Ground
EN/EN	Chip Enable Control Input

Absolute Maximum Ratings (Note 1)

- Input Voltage ---------- 7V
- Power Dissipation, P_D @ T_A = 25°C
  - SOT-23-3 ---------- 0.4W
  - SOT-23-5 ---------- 0.4W
  - SOT-89 ---------- 0.571W
  - TO-92 ---------- 0.625W
- Junction Temperature ---------- 150°C
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C
- Storage Temperature Range ---------- –65°C to 150°C
- Package Thermal Resistance (Note 2)
  - SOT-23-3, θ_{JA} ---------- 250°C/W
  - SOT-23-5, θ_{JA} ---------- 250°C/W
  - SOT-89, θ_{JA} ---------- 175°C/W
  - TO-92, θ_{JA} ---------- 160°C/W
- ESD Susceptibility (Note 3)
  - HBM (Human Body Mode) ---------- 2kV
  - MM (Machine Mode) ---------- 200V

Recommended Operating Conditions (Note 4)

- Junction Temperature Range ---------- –40°C to 125°C
- Ambient Temperature Range ---------- –40°C to 85°C

Electrical Characteristics

(V_{IN} = 5.5V, C_{IN} = 1µF, C_{OUT} = 1µF, T_A = 25°C, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range		V_{IN}		2	--	6	V
Output Voltage Accuracy		ΔV_{OUT}	I_L = 1mA	-2	--	+2	%
Maximum Output Current		I_{MAX}	$V_{IN} = V_{OUT}$ + 0.6V, $V_{IN} \geq$ 3.6V	100	--	--	mA
Current Limit		I_{LIM}	I_L = 100mA	150	250	--	mA
GND Pin Current		I_G	No Load	--	4	7	µA
			I_{OUT} = 100mA		4	10	µA
Dropout Voltage		V_{DROP}	I_{OUT} = 1mA, $V_{IN} \geq$ 3.6V	--	4	10	mV
			I_{OUT} = 50mA, $V_{IN} \geq$ 3.6V	--	200	300	
			I_{OUT} = 100mA, $V_{IN} \geq$ 3.6V	--	450	600	
Line Regulation		ΔV_{LINE}	$V_{IN} = (V_{OUT}$ + 0.3V) to 6V, $V_{IN} \geq$ 3.6V, I_{OUT} = 1mA	-0.2	--	+0.2	%/V
Load Regulation		ΔV_{LOAD}	I_{LOUT} = 0mA to 100mA	--	0.01	0.04	%/mA
Output Noise		e_{NO}	BW = 100Hz to 50kHz C_{OUT} = 10µF	--	250	--	µV
Ripple Rejection		PSRR	F = 1kHz, C_{OUT} = 1µF	--	30	--	dB
Standby Current	RT9169/H (SOT-23-5)		$\overline{EN} = V_{IN}$ or EN = 0	--	0.1	1	µA
$\overline{EN}$/EN Threshold	Logic High	V_{IL}		0.6	--	--	V
	Logic Low	V_{IH}		--	--	2	
Thermal Shutdown Protection				125	--	--	°C

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2. θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

Note 3. Devices are ESD sensitive. Handling precaution is highly recommended.

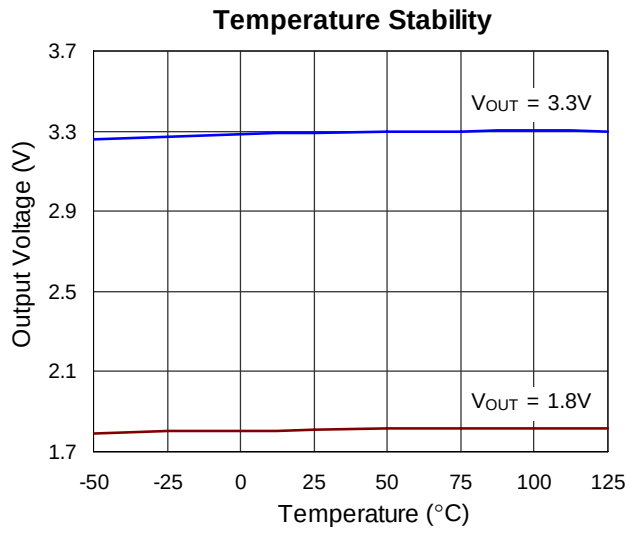
Note 4. The device is not guaranteed to function outside its operating conditions.

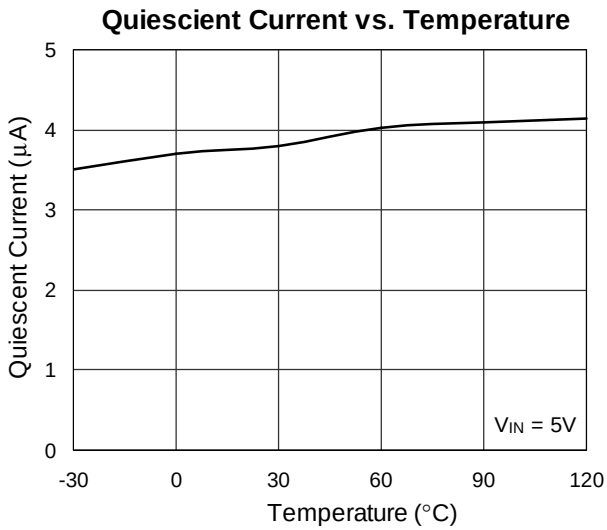
Application Information

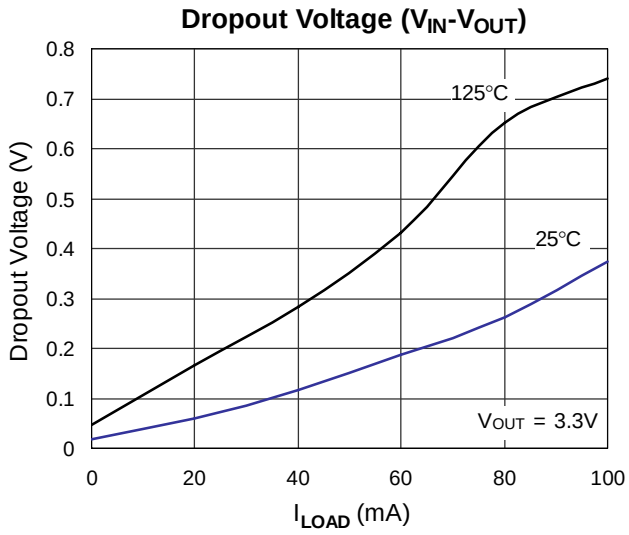
A 1µF (or larger) capacitor is recommended between V_{OUT} and GND for stability. The part may oscillate without the capacitor. Any type of capacitor can be used, but not Aluminum electrolytes when operating below –25°C. The capacitance may be increased without limit.

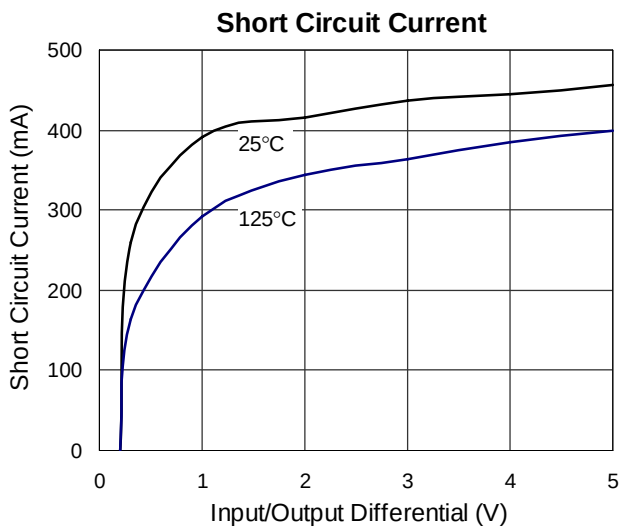
A 1µF capacitor (or larger) should be placed between V_{IN} to GND.

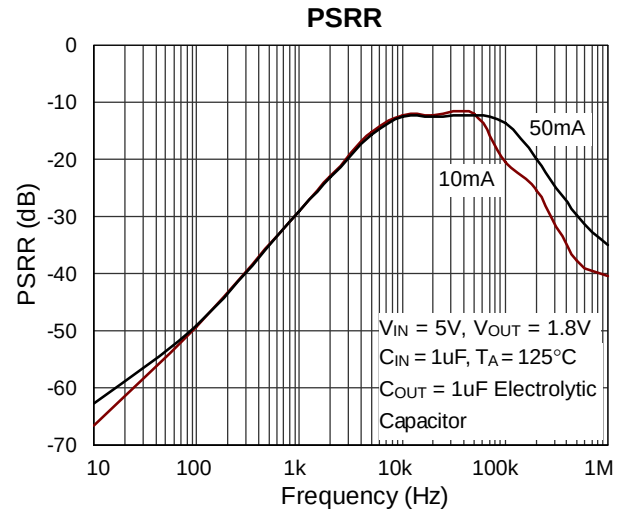
Typical Operating Characteristics

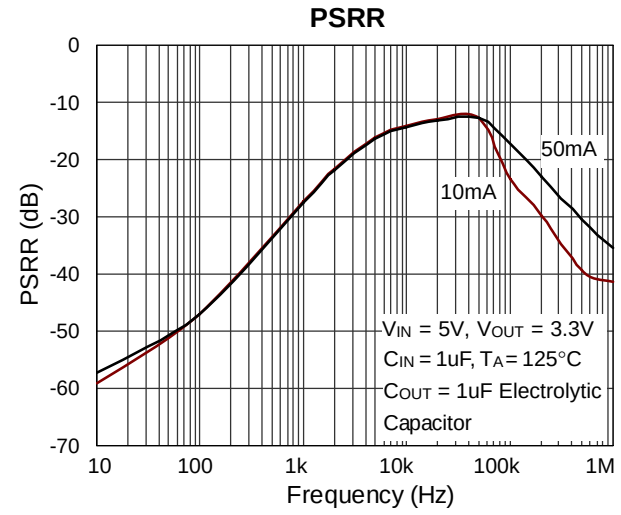




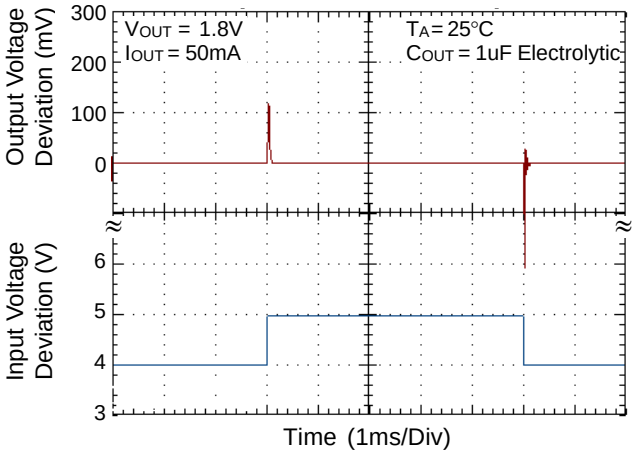




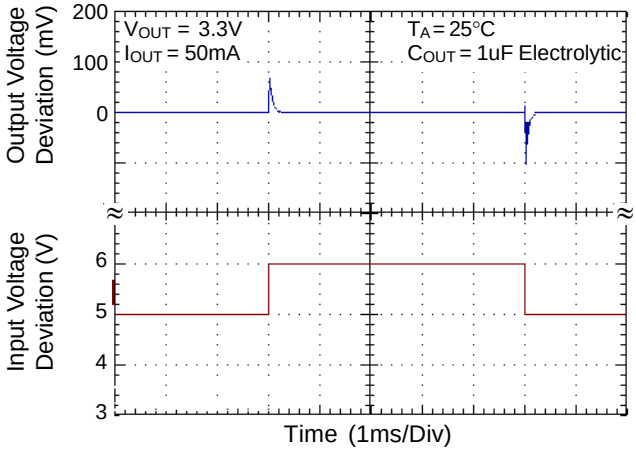




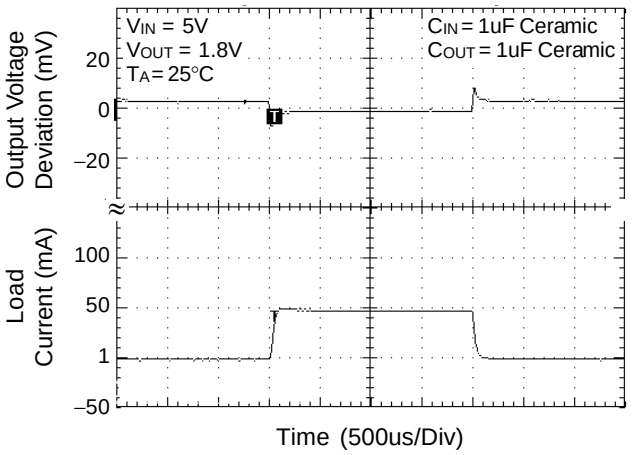
Line Transient Response



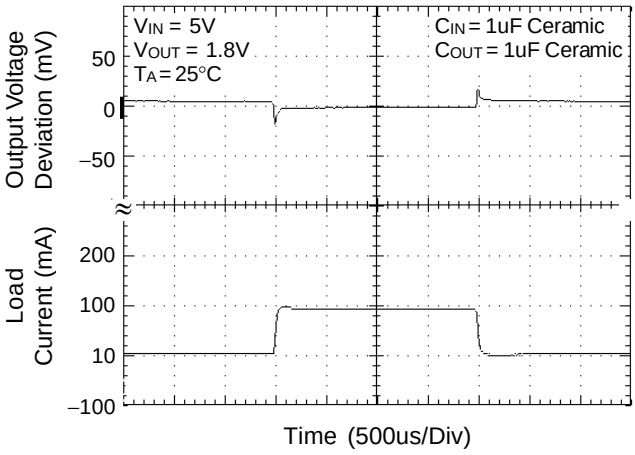
Line Transient Response



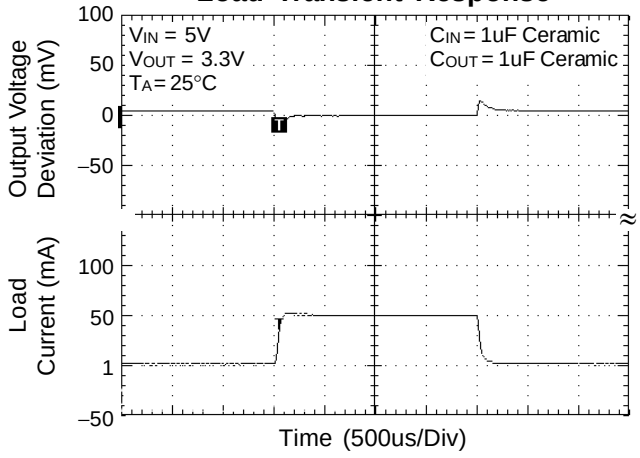
Load Transient Response



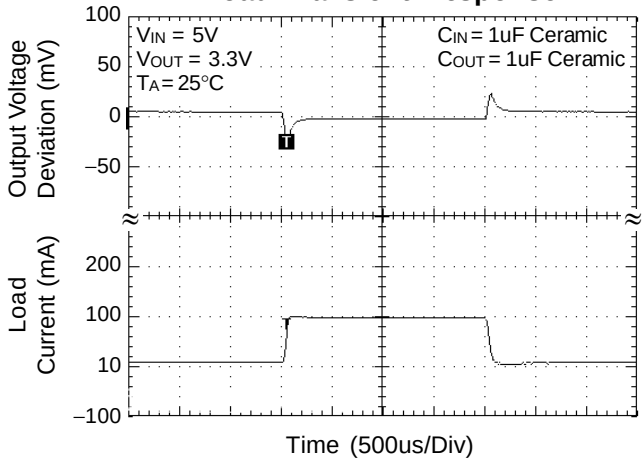
Load Transient Response



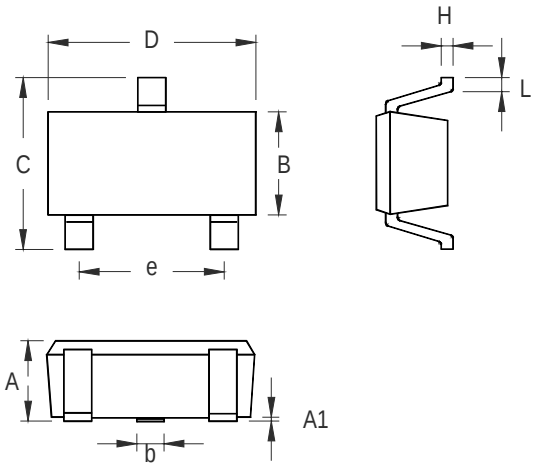
Load Transient Response



Load Transient Response

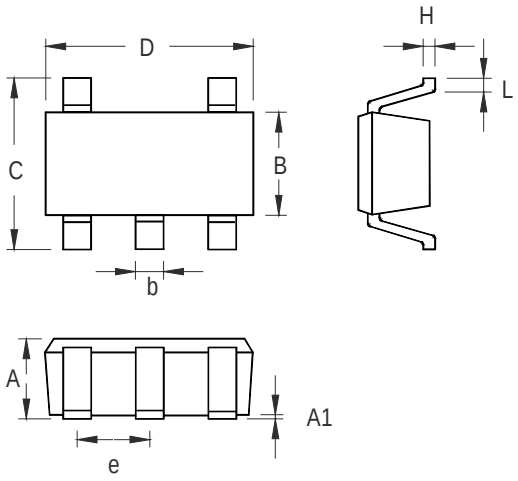


Outline Dimension



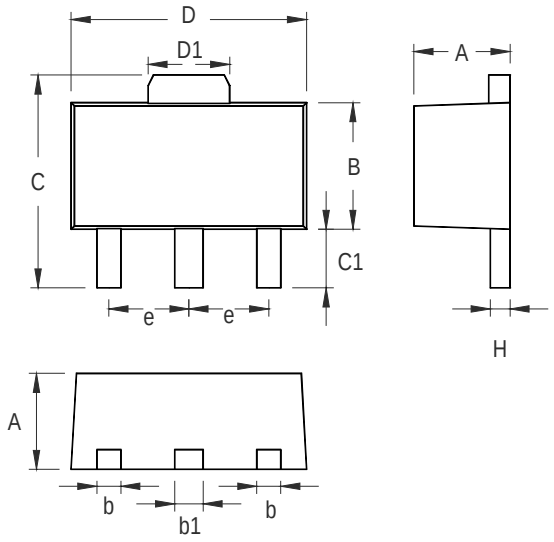
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.508	0.014	0.020
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	1.803	2.007	0.071	0.079
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-3 Surface Mount Package



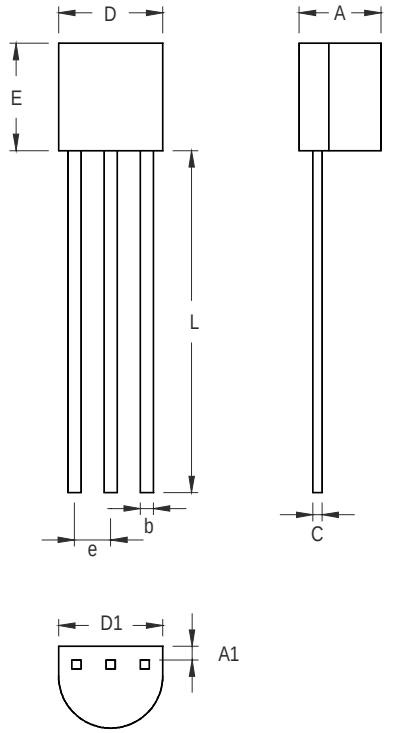
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012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

SOT-23-5 Surface Mount Package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.397	1.600	0.055	0.063
b	0.356	0.483	0.014	0.019
B	2.388	2.591	0.094	0.102
b1	0.406	0.533	0.016	0.021
C	3.937	4.242	0.155	0.167
C1	0.787	1.194	0.031	0.047
D	4.394	4.597	0.173	0.181
D1	1.397	1.753	0.055	0.069
e	1.448	1.549	0.057	0.061
H	0.356	0.432	0.014	0.017

3-Lead SOT-89 Surface Mount Package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.175	4.191	0.125	0.165
A1	1.143	1.372	0.045	0.054
b	0.406	0.533	0.016	0.021
C	0.406	0.533	0.016	0.021
D	4.445	5.207	0.175	0.205
D1	3.429	5.029	0.135	0.198
E	4.318	5.334	0.170	0.210
e	1.143	1.397	0.045	0.055
L	12.700		0.500	

3-Lead TO-92 Plastic Package

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