

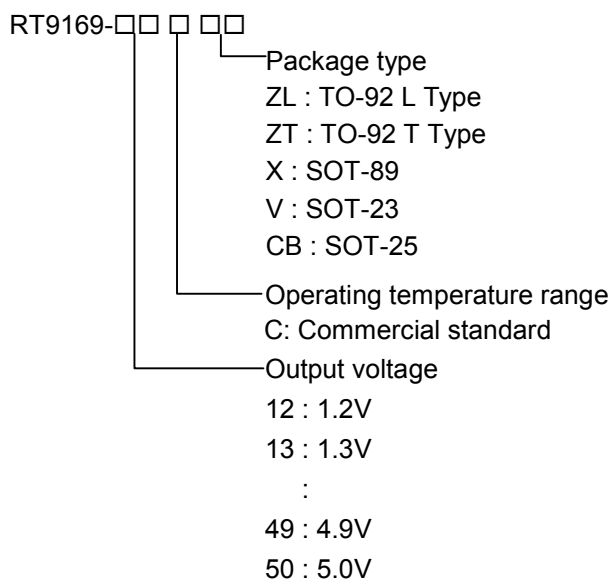
# 100mA, 4 $\mu$ A Quiescent Current CMOS LDO Regulator

## General Description

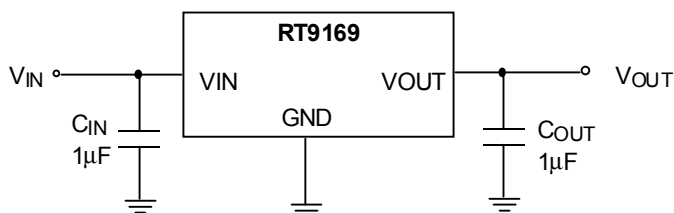
The RT9169 series are 100mA ultra-low quiescent current CMOS low dropout (LDO) regulator designed for battery-powered equipments. The output voltages range from 1.2V to 5V with 0.1V per step.

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

## Ordering Information



## Typical Application Circuit



## Features

- **Ultra-Low Quiescent Current: 4 $\mu$ A**
- **Low Dropout: 450mV at 100mA**
- **Wide Operating Voltage Ranges: 2V~6V**
- **Current Limiting Protection**
- **Only 1 $\mu$ F Output Capacitor Required for Stability**
- **High Power Supply Rejection Ratio**

## Applications

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

## Pin Configurations

Part Number	Pin Configurations
RT9169-□□CZL (Plastic TO-92)	<p>TOP VIEW</p> <ol style="list-style-type: none"> <li>1. VIN</li> <li>2. GND</li> <li>3. VOUT</li> </ol>
RT9169-□□CZT (Plastic TO-92)	<p>TOP VIEW</p> <ol style="list-style-type: none"> <li>1. VOUT</li> <li>2. VIN</li> <li>3. GND</li> </ol>
RT9169-□□CX (Plastic SOT-89)	<p>TOP VIEW</p> <ol style="list-style-type: none"> <li>1. GND</li> <li>2. VIN (TAB)</li> <li>3. VOUT</li> </ol>
RT9169-□□CV (Plastic SOT-23)	<p>TOP VIEW</p> <ol style="list-style-type: none"> <li>1. VOUT</li> <li>2. GND</li> <li>3. VIN</li> </ol>
RT9169-□□CB (Plastic SOT-25)	<p>TOP VIEW</p> <ol style="list-style-type: none"> <li>1. VIN</li> <li>2. GND</li> <li>3. EN</li> <li>4. NC</li> <li>5. VOUT</li> </ol>

## Marking Information

Part Number	Marking
RT9169-12CX	B1
RT9169-13CX	B2
RT9169-14CX	B3
RT9169-15CX	B4
RT9169-16CX	B5
RT9169-17CX	B6
RT9169-18CX	B7
RT9169-19CX	B8
RT9169-20CX	B9
RT9169-21CX	BA
RT9169-22CX	BB
RT9169-23CX	BC
RT9169-24CX	BD
RT9169-25CX	BE
RT9169-26CX	BF
RT9169-27CX	BG
RT9169-28CX	BH
RT9169-29CX	BJ
RT9169-30CX	BK
RT9169-31CX	BL
RT9169-32CX	BM
RT9169-33CX	BN
RT9169-34CX	BP
RT9169-35CX	BQ
RT9169-36CX	BR
RT9169-37CX	BS
RT9169-38CX	BT
RT9169-39CX	BU
RT9169-40CX	BV
RT9169-41CX	BW
RT9169-42CX	BX
RT9169-43CX	BY
RT9169-44CX	BZ
RT9169-45CX	C1
RT9169-46CX	C2
RT9169-47CX	C3

Part Number	Marking
RT9169-48CX	C4
RT9169-49CX	C5
RT9169-50CX	C6
RT9169-12CZL	RTD1
RT9169-13CZL	RTD2
RT9169-14CZL	RTD3
RT9169-15CZL	RTD4
RT9169-16CZL	RTD5
RT9169-17CZL	RTD6
RT9169-18CZL	RTD7
RT9169-19CZL	RTD8
RT9169-20CZL	RTD9
RT9169-21CZL	RTDA
RT9169-22CZL	RTDB
RT9169-23CZL	RTDC
RT9169-24CZL	RTDD
RT9169-25CZL	RTDE
RT9169-26CZL	RTDF
RT9169-27CZL	RTDG
RT9169-28CZL	RTDH
RT9169-29CZL	RTDJ
RT9169-30CZL	RTDK
RT9169-31CZL	RTDL
RT9169-32CZL	RTDM
RT9169-33CZL	RTDN
RT9169-34CZL	RTDP
RT9169-35CZL	RTDQ
RT9169-36CZL	RTDR
RT9169-37CZL	RTDS
RT9169-38CZL	RTDT
RT9169-39CZL	RTDU
RT9169-40CZL	RTDV
RT9169-41CZL	RTDW
RT9169-42CZL	RTDX
RT9169-43CZL	RTDY
RT9169-44CZL	RTDZ

Part Number	Marking
RT9169-45CZL	RTC1
RT9169-46CZL	RTC2
RT9169-47CZL	RTC3
RT9169-48CZL	RTC4
RT9169-49CZL	RTC5
RT9169-50CZL	RTC6
RT9169-12CZT	RTE1
RT9169-13CZT	RTE2
RT9169-14CZT	RTE3
RT9169-15CZT	RTE4
RT9169-16CZT	RTE5
RT9169-17CZT	RTE6
RT9169-18CZT	RTE7
RT9169-19CZT	RTE8
RT9169-20CZT	RTE9
RT9169-21CZT	RTEA
RT9169-22CZT	RTEB
RT9169-23CZT	RTEC
RT9169-24CZT	RTE D
RT9169-25CZT	RTEE
RT9169-26CZT	RTEF
RT9169-27CZT	RTEG
RT9169-28CZT	RTEH
RT9169-29CZT	RTEJ
RT9169-30CZT	RTEK
RT9169-31CZT	RTEL
RT9169-32CZT	RTEM
RT9169-33CZT	RTEN
RT9169-34CZT	RTEP
RT9169-35CZT	RTEQ
RT9169-36CZT	RTER
RT9169-37CZT	RTES
RT9169-38CZT	RTET
RT9169-39CZT	RTEU
RT9169-40CZT	RTEV
RT9169-41CZT	RTEW
RT9169-42CZT	RTEX

Part Number	Marking
RT9169-43CZT	RTEY
RT9169-44CZT	RTEZ
RT9169-45CZT	RTC7
RT9169-46CZT	RTC8
RT9169-47CZT	RTC9
RT9169-48CZT	RTCA
RT9169-49CZT	RTCB
RT9169-50CZT	RTCC
RT9169-12CV	B1
RT9169-13CV	B2
RT9169-14CV	B3
RT9169-15CV	B4
RT9169-16CV	B5
RT9169-17CV	B6
RT9169-18CV	B7
RT9169-19CV	B8
RT9169-20CV	B9
RT9169-21CV	BA
RT9169-22CV	BB
RT9169-23CV	BC
RT9169-24CV	BD
RT9169-25CV	BE
RT9169-26CV	BF
RT9169-27CV	BG
RT9169-28CV	BH
RT9169-29CV	BJ
RT9169-30CV	BK
RT9169-31CV	BL
RT9169-32CV	BM
RT9169-33CV	BN
RT9169-34CV	BQ
RT9169-35CV	BR
RT9169-36CV	BS
RT9169-37CV	BT
RT9169-38CV	BU
RT9169-39CV	BV
RT9169-40CV	BW

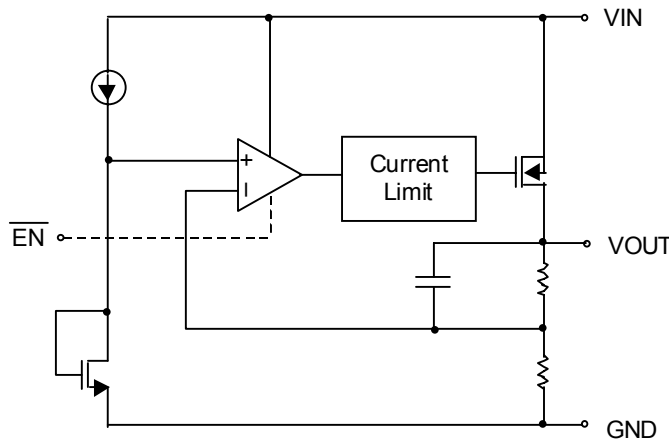
Part Number	Marking
RT9169-41CV	BX
RT9169-42CV	BY
RT9169-43CV	BZ
RT9169-44CV	CT
RT9169-45CV	CU
RT9169-46CV	CV

Part Number	Marking
RT9169-47CV	CW
RT9169-48CV	CX
RT9169-49CV	CY
RT9169-50CV	CZ
RT9169-25CB	C1
RT9169-28CB	C2

## Pin Description

Pin Name	Pin Function
VIN	Power Input
VOUT	Output Voltage
GND	Ground
$\overline{\text{EN}}$	Chip Enable Control Input

## Function Block Diagram



## Absolute Maximum Ratings

- Input Voltage ..... 7V
- Power Dissipation,  $P_D @ T_A = 25^\circ \text{C}$ 
  - TO-92 ..... 0.6W
  - SOT-89 ..... 0.5W
  - SOT-23 ..... 0.25W
  - SOT-25 ..... 0.25W
- Operating Junction Temperature Range .....  $-40^\circ \text{C}$  to  $125^\circ \text{C}$
- Storage Range .....  $-65^\circ \text{C}$  to  $150^\circ \text{C}$
- Package Thermal Resistance
  - TO-92,  $\theta_{JA}$  .....  $160^\circ \text{C/W}$
  - SOT-89,  $\theta_{JC}$  .....  $100^\circ \text{C/W}$
  - SOT-89,  $\theta_{JA}$  .....  $300^\circ \text{C/W}$
  - SOT-23,  $\theta_{JA}$  .....  $250^\circ \text{C/W}$
  - SOT-25,  $\theta_{JA}$  .....  $250^\circ \text{C/W}$

## Electrical Characteristics

( $V_{IN} = 5.5V$ ,  $C_{IN} = 1\mu F$ ,  $C_{OUT} = 1\mu F$ ,  $T_A = 25^\circ C$ , unless otherwise specified)

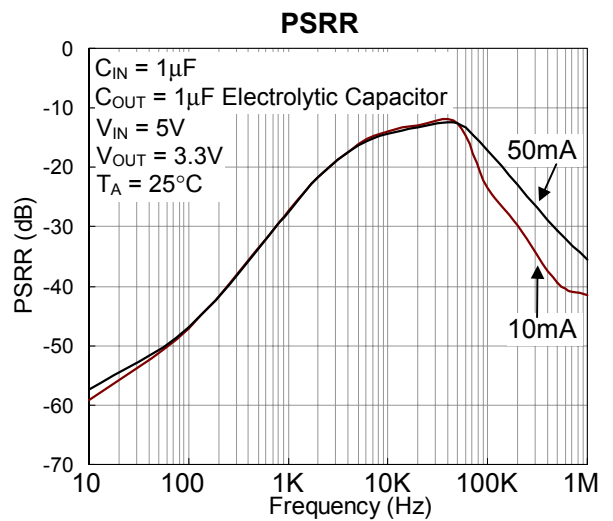
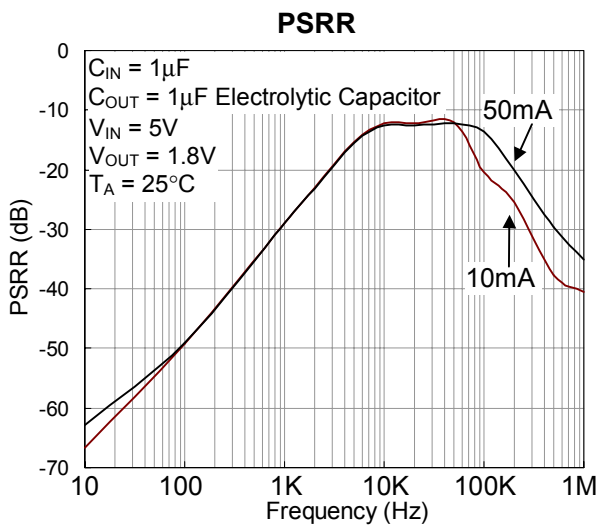
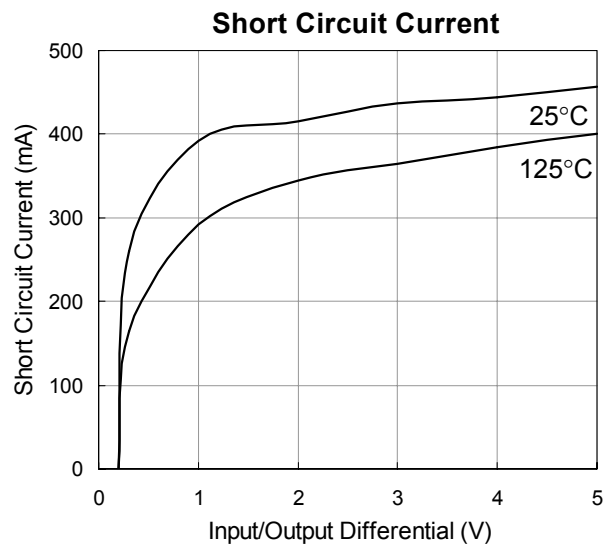
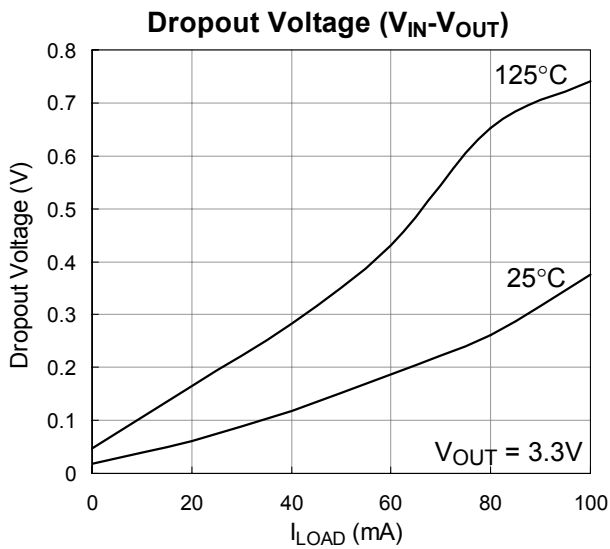
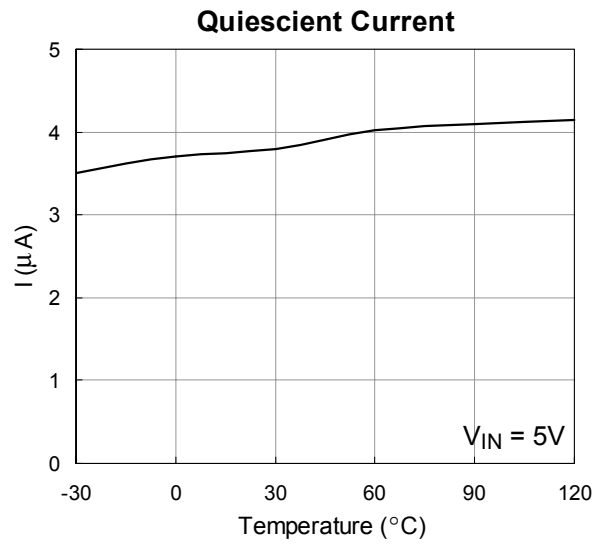
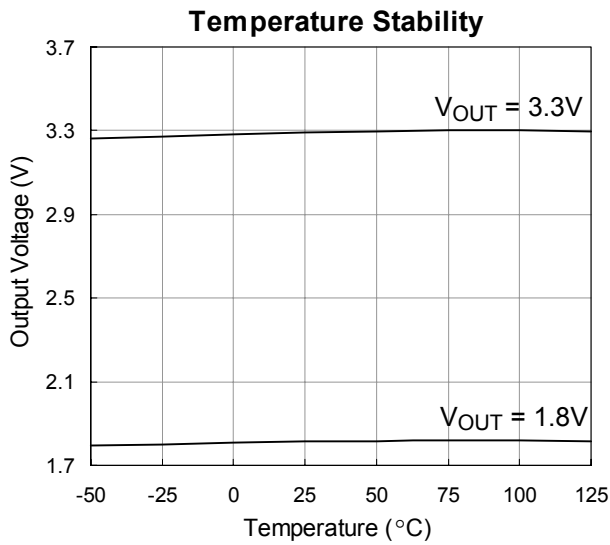
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Input Voltage Range	$V_{IN}$		2	--	6	V
Output Voltage Accuracy	$\Delta V_{OUT}$	$I_L = 1mA$	-2	--	+2	%
Maximum Output Current	$I_{MAX}$	$V_{IN} = V_{OUT} + 0.6V$ , $V_{IN} \geq 3.6V$	100	--	--	mA
Current Limit	$I_{LIMIT}$	$R_{LOAD} = 1\Omega$	--	250	--	mA
GND Pin Current	$I_G$	No Load	--	4	7	$\mu A$
		$I_{OUT} = 100mA$		4	10	$\mu A$
Dropout Voltage	$V_{DROP}$	$I_{OUT} = 1mA$ , $V_{IN} \geq 3.6V$	--	4	--	mV
		$I_{OUT} = 50mA$ , $V_{IN} \geq 3.6V$	--	200	--	
		$I_{OUT} = 100mA$ , $V_{IN} \geq 3.6V$	--	450	--	
Line Regulation	$\Delta V_{LINE}$	$V_{IN} = (V_{OUT} + 0.3V)$ to $6V$ , $V_{IN} \geq 3.6V$ , $I_{OUT} = 1mA$	-0.2	--	+0.2	%/V
Load Regulation	$\Delta V_{LOAD}$	$I_{LOAD} = 0mA$ to $100mA$	--	0.01	0.04	%/mA
Output Noise	$e_{NO}$	BW = 100Hz to 50KHz $C_{OUT} = 10\mu F$	--	250	--	$\mu V$
Ripple Rejection	PSRR	$F = 1KHz$ , $C_{OUT} = 10\mu F$	--	50	--	DB
Standby Current	RT9169-CB	$\overline{EN} = V_{IN}$	--	0.1	1	$\mu A$
$\overline{EN}$ Threshold			0.6	1	2	V

## Application Information

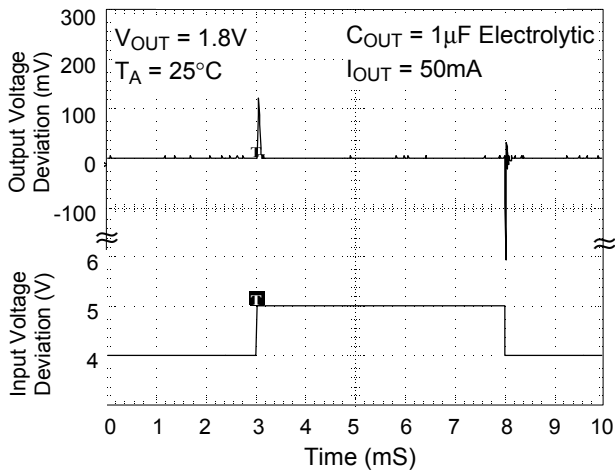
A  $1\mu F$  (or larger) capacitor is recommended between  $V_{OUT}$  and GND for stability. The part may oscillate without the capacitor. Any type of capacitor can be used, but not Aluminum electrolytes when operating below  $-25^\circ C$ . The capacitance may be increased without limit.

A  $1\mu F$  capacitor (or larger) should be placed between  $V_{IN}$  to GND.

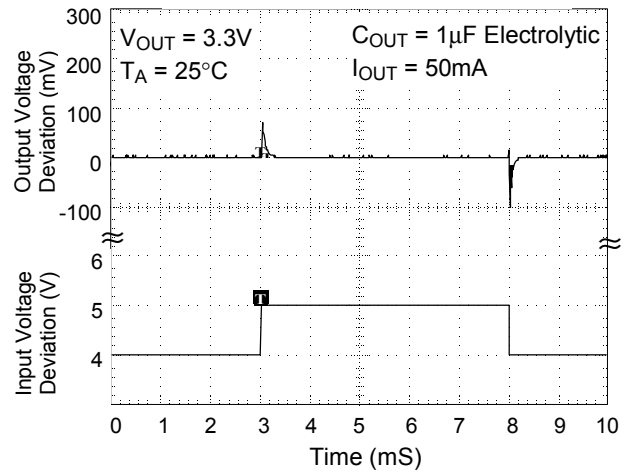
Typical Operating Characteristics



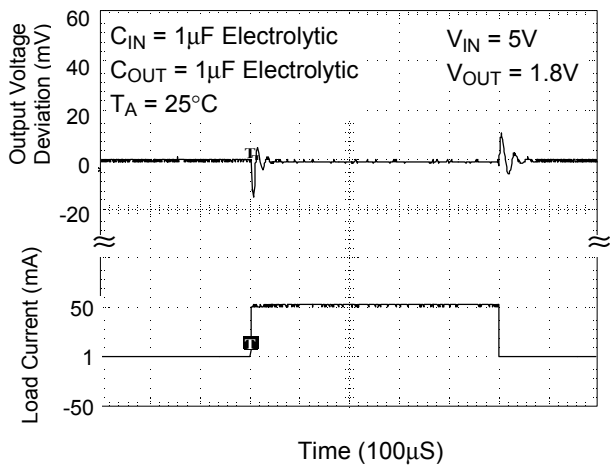
**Line Transient Response**



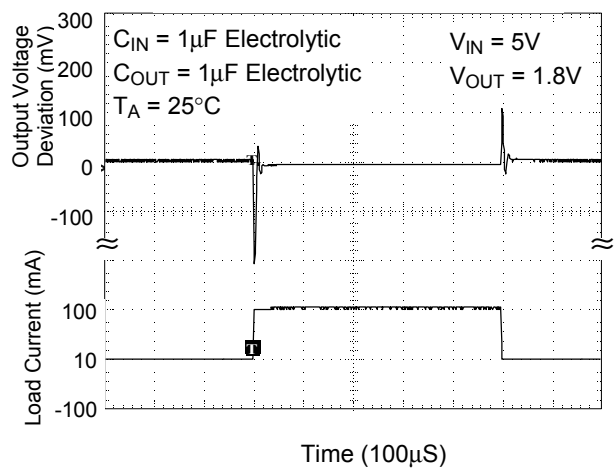
**Line Transient Response**



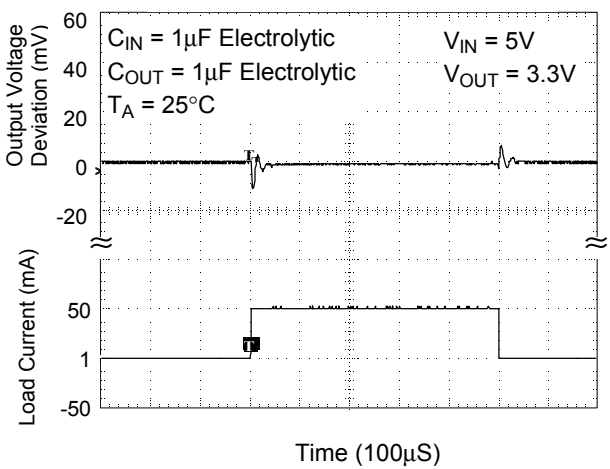
**Load Transient Response**



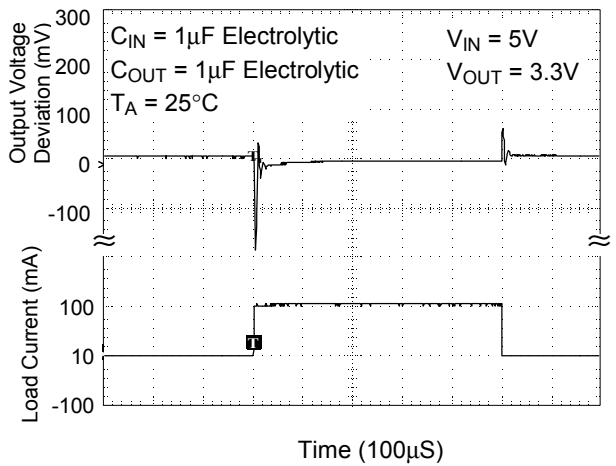
**Load Transient Response**



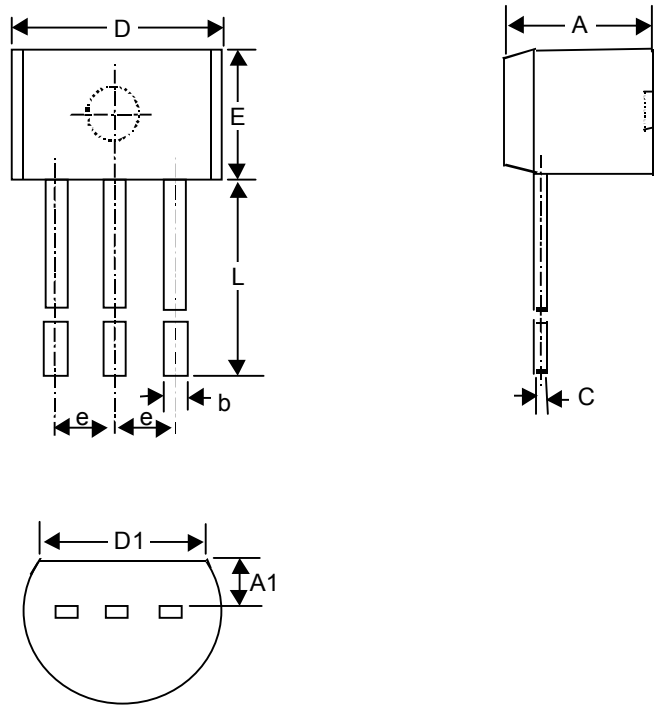
**Load Transient Response**



**Load Transient Response**



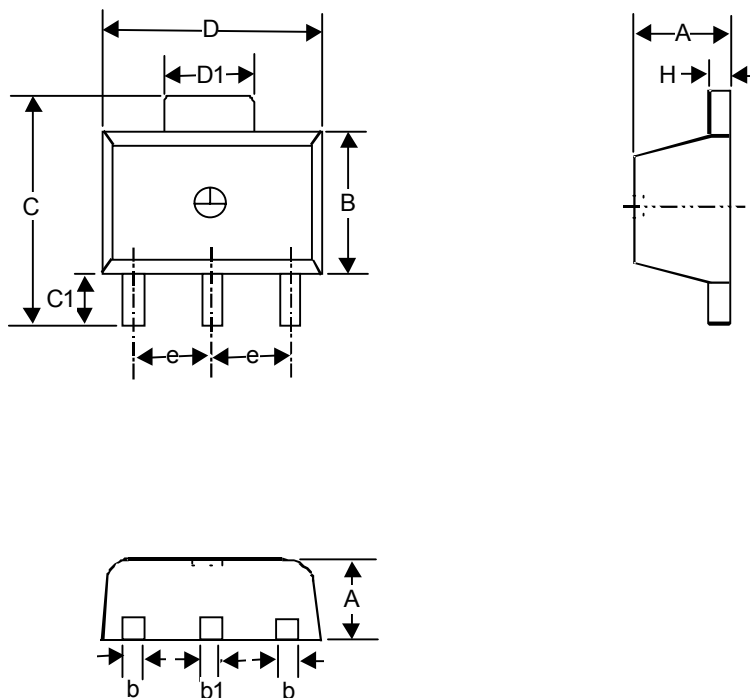
Package Information



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	--	0.135	--
E	4.318	5.334	0.170	0.210
e	1.143	1.397	0.045	0.055
L	12.700	--	0.500	--

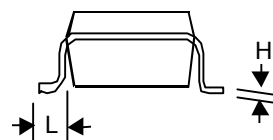
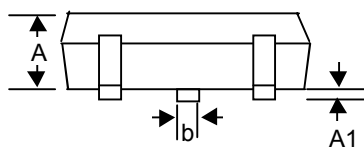
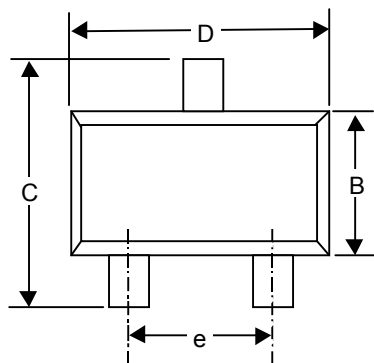
3-Lead TO-92 Package





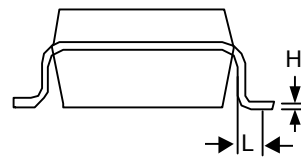
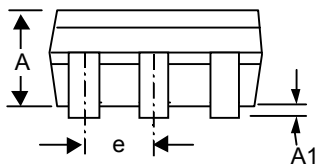
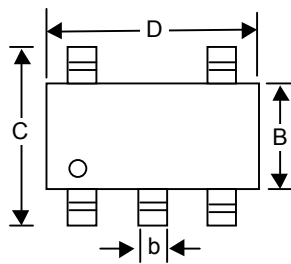
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.397	1.600	0.055	0.063
b	0.356	0.483	0.014	0.019
B	2.388	2.591	0.094	0.102
b1	0.406	0.533	0.016	0.021
C	--	4.242	--	0.167
C1	0.787	1.194	0.031	0.047
D	4.394	4.597	0.173	0.181
D1	1.397	1.753	0.055	0.069
e	1.448	1.549	0.057	0.061
H	0.381	0.432	0.015	0.017

**3-Lead SOT-89 Surface Mount**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	--	0.152	--	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	0.102	0.254	0.004	0.010
L	0.356	0.610	0.014	0.024

**SOT-23 Plastic Surface Mount**



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	0.102	0.254	0.004	0.010
L	0.356	0.610	0.014	0.024

**SOT- 25 Surface Mount Package**

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