

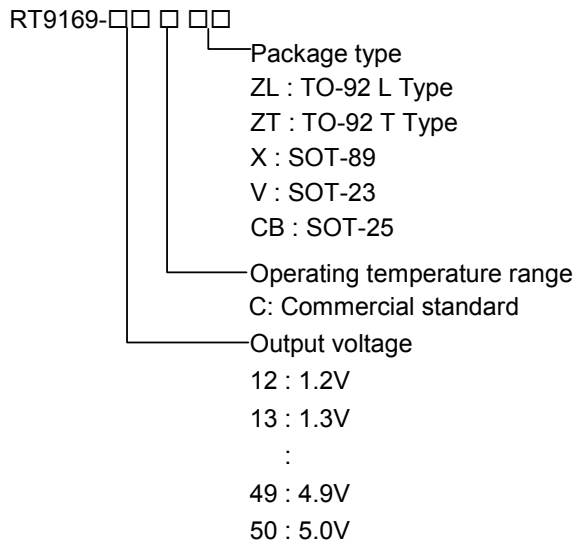
# 100mA, 4μA Quiescent Current CMOS LDO Regulator

## General Description

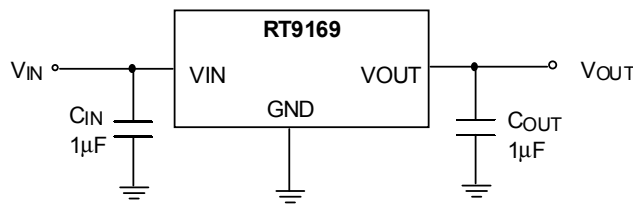
The RT9169 series are 100mA ultra-low quiescent current CMOS low dropout (LDO) regulator designed for battery-powered equipments. The output voltages range from 1.2V to 5V with 0.1V per step.

The other features include 4μA 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: 4μA**
- **Low Dropout: 450mV at 100mA**
- **Wide Operating Voltage Ranges: 2V~6V**
- **Current Limiting Protection**
- **Only 1μF 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<br>(Plastic TO-92) |                    | TOP VIEW<br>1. VIN<br>2. GND<br>3. VOUT                   |
| RT9169-□□CZT<br>(Plastic TO-92) |                    | TOP VIEW<br>1. VOUT<br>2. VIN<br>3. GND                   |
| RT9169-□□CX<br>(Plastic SOT-89) |                    | TOP VIEW<br>1. GND<br>2. VIN (TAB)<br>3. VOUT             |
| RT9169-□□CV<br>(Plastic SOT-23) |                    | TOP VIEW<br>1. VOUT<br>2. GND<br>3. VIN                   |
| RT9169-□□CB<br>(Plastic SOT-25) |                    | TOP VIEW<br>1. VIN<br>2. GND<br>3. EN<br>4. NC<br>5. VOUT |

## 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 | RTEd    |
| 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      |

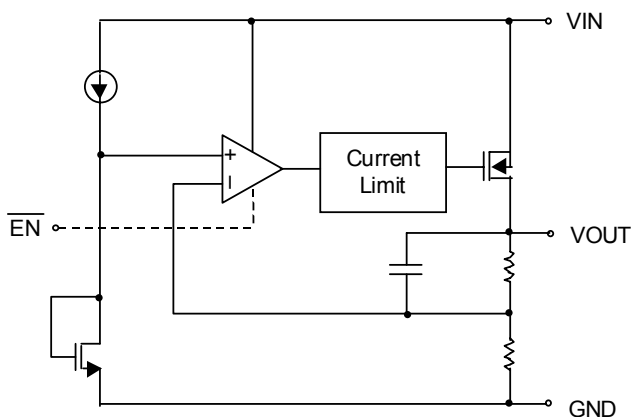
| Part Number | Marking |
|-------------|---------|
| RT9169-41CV | BX      |
| RT9169-42CV | BY      |
| RT9169-43CV | BZ      |
| RT9169-44CV | CT      |
| RT9169-45CV | CU      |
| RT9169-46CV | CV      |

| 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)

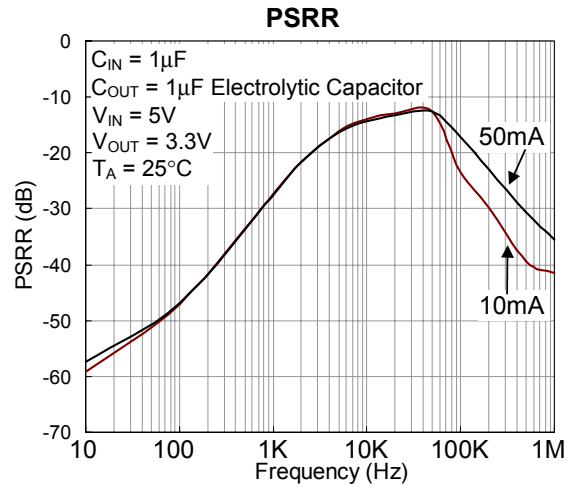
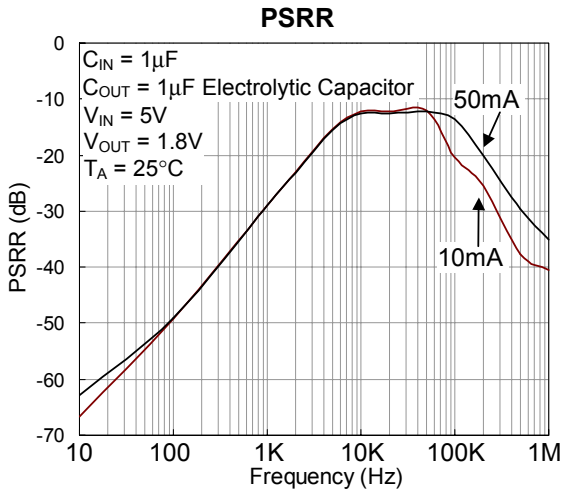
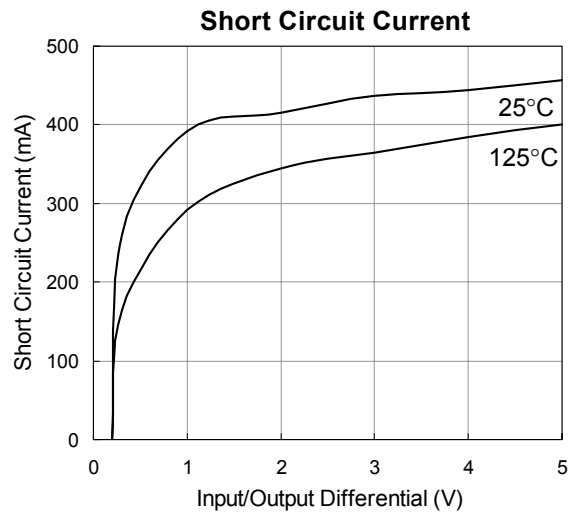
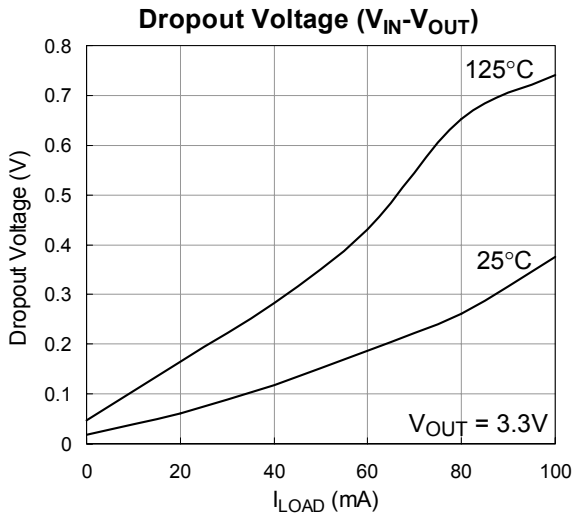
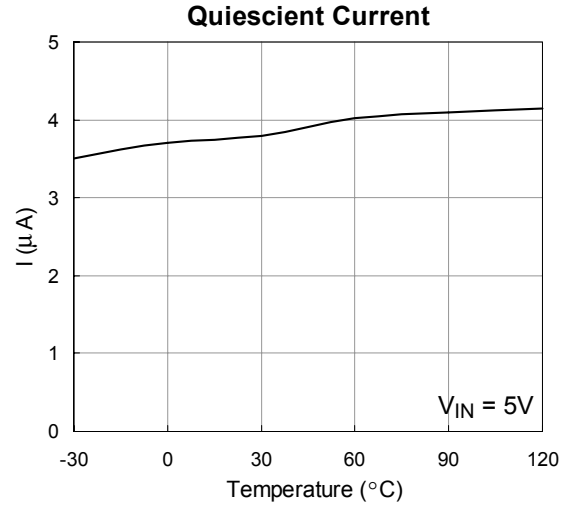
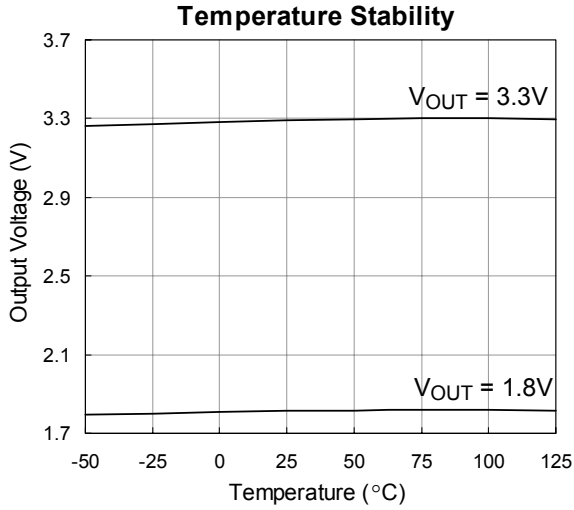
| Parameter                 | Symbol            | Test Conditions   | Min  | Typ  | Max  | Units   |
|---------------------------|-------------------|---|------|------|------|---------|
| Input Voltage Range       | $V_{IN}$          |   | 2    | --   | 6    | V       |
| Output Voltage Accuracy   | $\Delta V_{OUT}$  | $I_L = 1mA$   | -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 $6V$ ,<br>$V_{IN} \geq 3.6V$ , $I_{OUT} = 1mA$ | -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<br>$C_{OUT} = 10\mu F$                                    | --   | 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

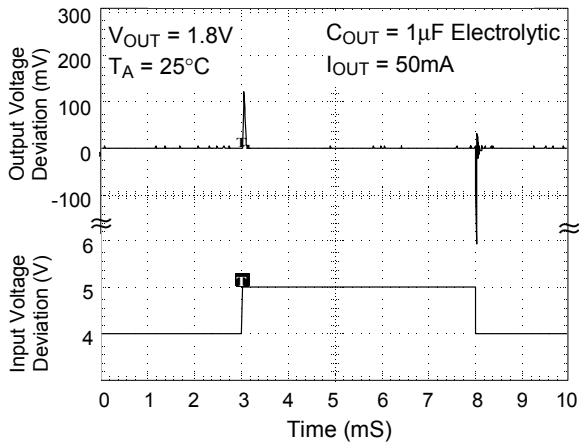
A  $1\mu F$  (or larger) capacitor is recommended between  $V_{OUT}$  and GND for stability. The part may oscillate without the capacitor. Any type of capacitor can be used, but not Aluminum electrolytes when operating below  $-25^\circ C$ . The capacitance may be increased without limit.

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

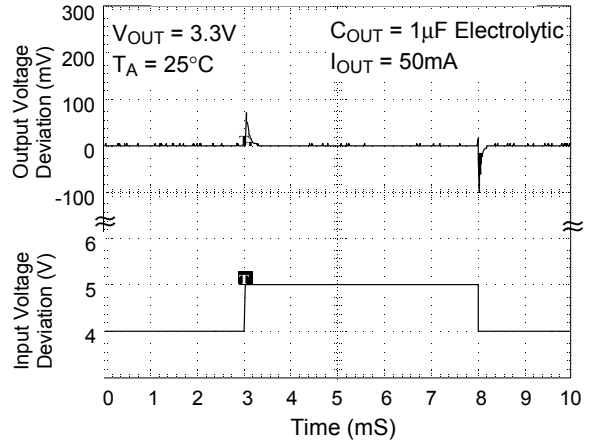
Typical Operating Characteristics



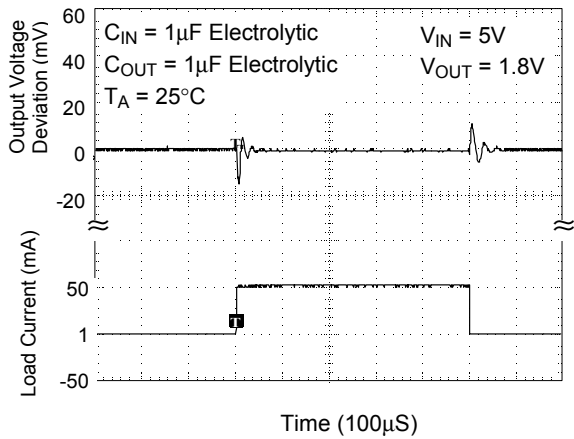
**Line Transient Response**



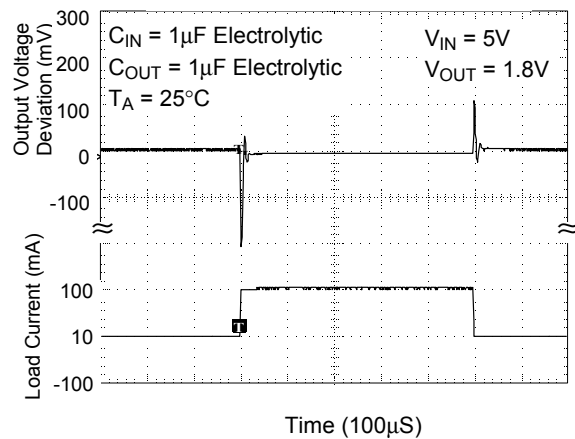
**Line Transient Response**



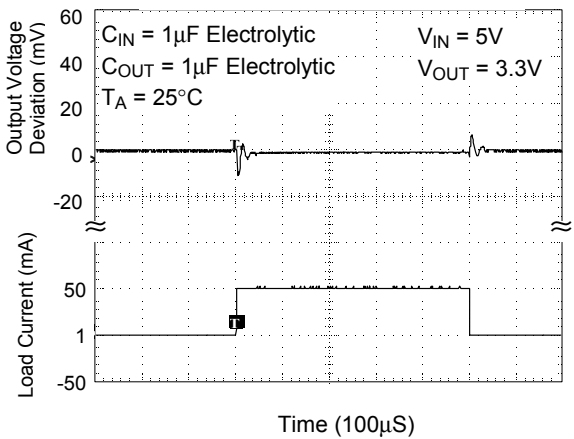
**Load Transient Response**



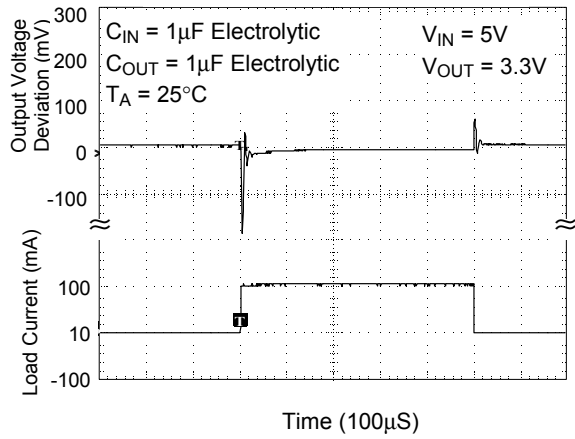
**Load Transient Response**



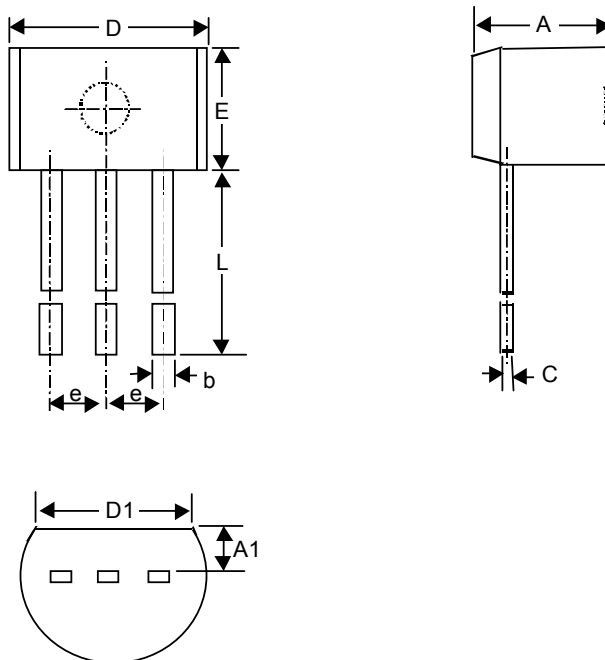
**Load Transient Response**



**Load Transient Response**



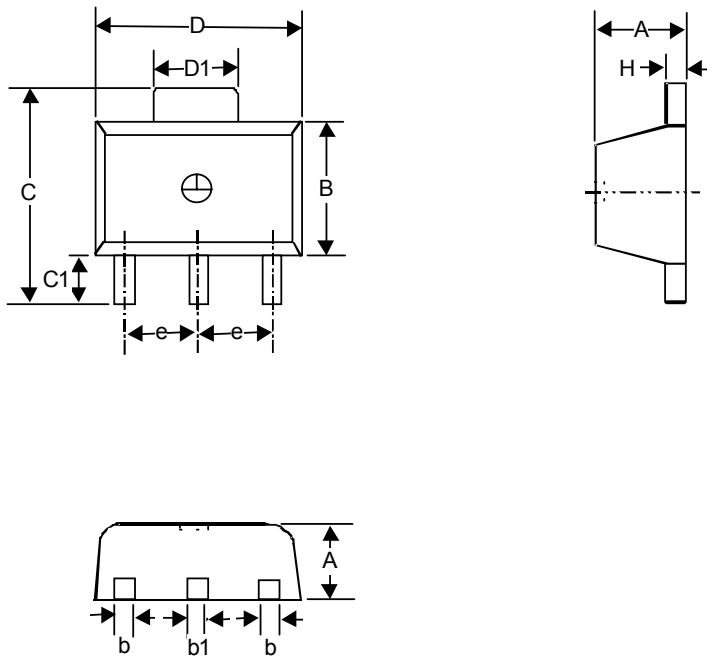
Package Information



| 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                | --    |

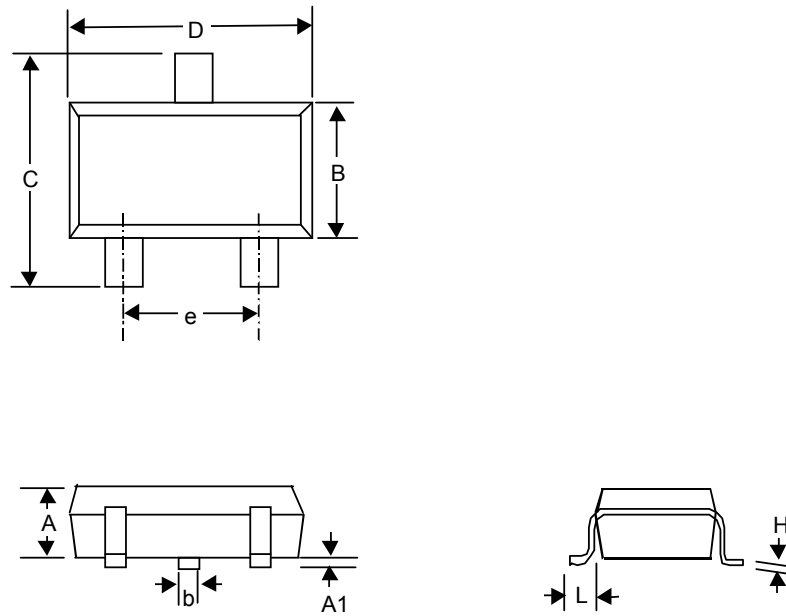
3-Lead TO-92 Package





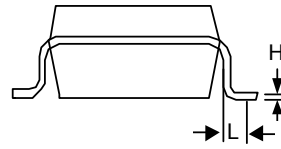
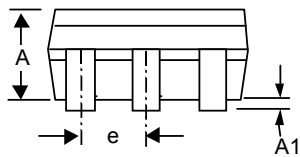
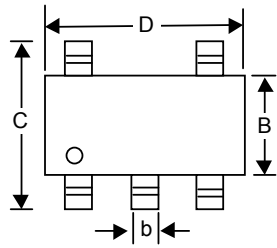
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.397                     | 1.600 | 0.055                | 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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