# High Input Low $I_Q$ 200mA LDO

## DESCRIPTION

SUM3572 series are the high input low $I_Q$ 200 mA LDO with enable function that operates output 3.3 V, 5.0 V and 12 V, are designed specifically for portable battery-powered applications which require ultra-low quiescent current. The low consumption of type 5 μA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

SUM3572 series are offered SOT89-3 and SOT89-3 (L-Type) packages.

## FEATURES

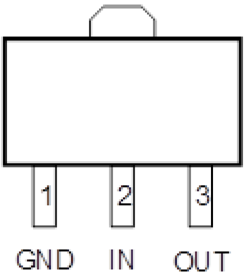
- Wide Input Voltage Range: 3.0 V ~ 40 V
- Up to 200 mA Load Current
- Low $I_Q$ is 5 μA Typical
- Fixed Output Voltage: 3.3 V, 5.0 V, 12 V
- Low Dropout is 600 mV Typical at 100 mA Load @$V_{OUT}$ = 5.0 V
- Excellent Load/Line Transient Response
- Current Limit and Short Protection
- Packages: SOT89-3, SOT89-3 (L-Type)

## ORDER INFORMATION

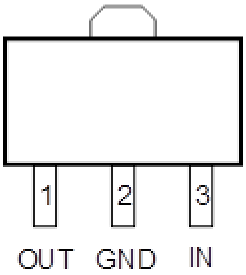
| Model | Package | Ordering Number | Packing Option |
|---|---|---|---|
| SUM3572 | SOT89-3 | SUM3572-XXP | Tape and Reel, 1000 |
| | SOT89-3 (L-Type) | SUM3572-XXPL | Tape and Reel, 1000 |

*XX: When expressed as 33, the output voltage is 3.3 V; when expressed as 50 the output voltage is 5.0 V.

## PIN CONFIGURATION (Top View)



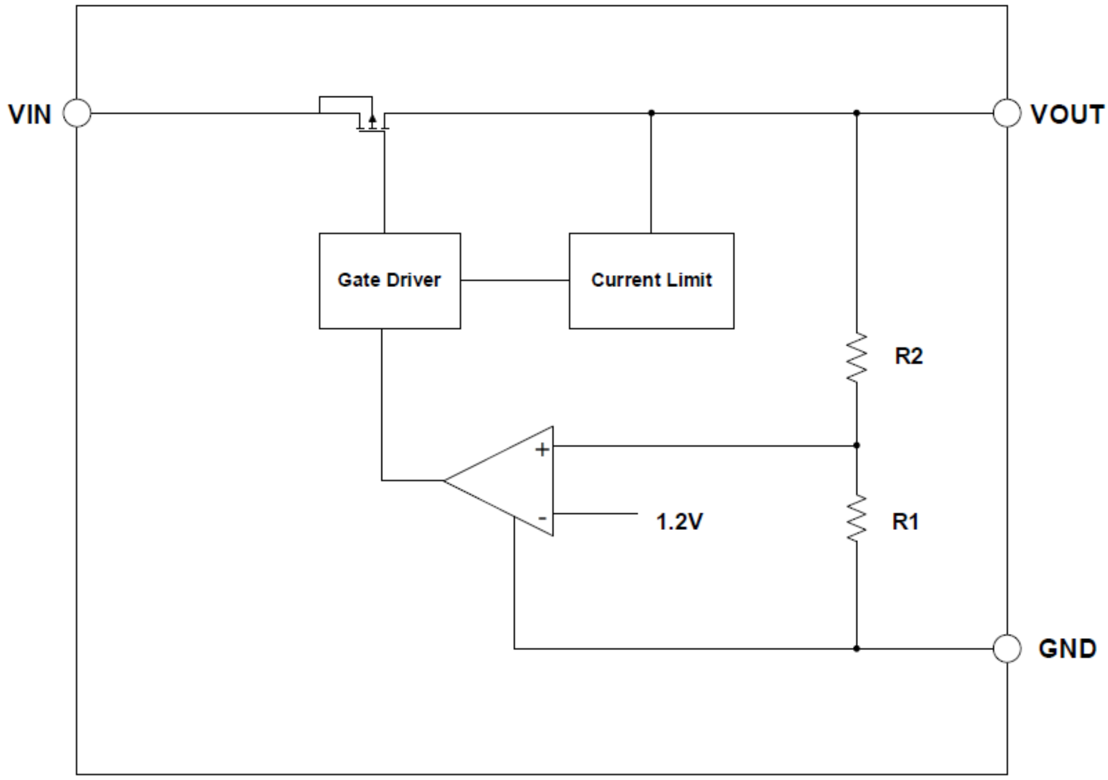

SOT89-3




SOT89-3 (L-Type)

| **Pin** | | **Symbol** | **Description** |
|---|---|---|---|
| SOT89-3 | SOT89-3 (L-Type) | | |
| 3 | 1 | OUT | Output pin. |
| 1 | 2 | GND | Ground. |
| 2 | 3 | IN | Supply input pin. |

## BLOCK DIAGRAM




## FUNCTIONAL DESCRIPTION

### Input Capacitor

A 1 µF ~ 10 µF ceramic capacitor is recommended to connect between $V_{IN}$ and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both $V_{IN}$ and GND.

### Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1 µF to 10 µF, Equivalent Series Resistance (ESR) is from 5 mΩ to 100 mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to $V_{OUT}$ and GND pins.

### Dropout Voltage

The SUM3572 uses a PMOS pass transistor to achieve low dropout. When (VIN – VOUT) is less than the dropout voltage ($V_{DROP}$), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. $V_{DROP}$ scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as ($V_{IN}$ – $V_{OUT}$) approaches dropout operation.

### Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 155°C.Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 125°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the ($V_{IN}$ – $V_{OUT}$) voltage and the load current. For reliable operation, limit junction temperature to 125°C maximum.

### Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula :

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, $T_A$ is the ambient temperature, and $\theta_{JA}$ is the junction to ambient thermal resistance.

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, $\theta_{JA}$.

### Current-Limit Protection

The SUM3572 provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

### Layout Guidelines

- Place input and output capacitors as close to the device as possible.
- Use copper planes for device connections in order to optimize thermal performance.
- Place thermal vias around the device to distribute heat.

## CAUTION

This integrated circuit can be damaged by ESD if you don’t pay attention to ESD protection. SUMSEMI recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

SUMSEMI reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SUMSEMI sales office to get the latest datasheet.

## ABSOLUTE MAXIMUM RATINGS[1]

| Parameter | | Rating | | Unit |
|---|---|---|---|---|
| Input Voltage[2] | | -0.3 to 43 | | V |
| Output Voltage | | -0.3 to 18 | | V |
| Junction to Ambient Thermal Resistance ($\theta_{JA}$),[3] | | SOT89-3 | 135 | ℃/W |
| Power Dissipation@25°C PCB board dimension : 50mm x 50mm (2layer) Copper :1oz | | SOT89-3 | 920 | mW |
| Junction Temperature | | 150 | | ℃ |
| Operating Ambient Temperature | | -40 to 85 | | °C |
| Operating Junction Temperature | | -40 to 125 | | °C |
| Storage Temperature | | -65 to 150 | | ℃ |
| ESD[4] | HBM Capability | ±2000 | | V |
| | CDM Capability | ±1500 | | V |
| Latch Up Current Maximum Rating[4] | | ±200 | | mA |

NOTE:

(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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(2) Refer to Electrical Characteristics and Application Information for Safe Operating Area.

(3) This particular frame decreases the total thermal resistance of the package and increases its ability to dissipate power when an appropriate area of copper on the printed circuit board is available for heat-sinking.

(4) This device series incorporates ESD protection and is tested by the following methods:

ESD HBM tested per EIA/JESD22-A114;ESD CDM tested per JESD22-C101; Latch up tested per JEDEC78.

## ELECTRICAL CHARACTERISTICS

($V_{IN}$ =$V_{OUT}$+2V; $I_{OUT}$ = 10mA, $C_{IN}$ = $C_{OUT}$ = 1.0μF, unless otherwise noted. Typical values are at $T_A$ = +25°C.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IN}$(1) | Operating Input Voltage | | 3.0 | | 40 | V |
| $V_{OUT}$ | Output Voltage | $T_A$ = +25°C | -2% | | +2% | V |
| $I_Q$ | Quiescent Current | $I_{OUT}$ = 0 mA | | 5 | 10 | μA |
| $I_{Q\_OFF}$ | Standby Current | $V_{EN}$ = 0 V, $T_A$ = +25°C | | | 1 | μA |
| $Reg_{Line}$ | Line Regulation | $V_{IN}$ = $V_{OUT}$ +1 V to 40 V, $I_{OUT}$ = 10 mA | | 20 | 60 | mV |
| $V_{DROP}$ (2) | Dropout Voltage $I_{OUT}$ = 100 mA | | | 600 | 1000 | mV |
| $Reg_{LOAD}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 100 mA, $V_{IN}$ = $V_{OUT}$ + 2 V | | 70 | 150 | mV |
| $I_{LMT}$ | Current Limit | $V_{IN}$ = $V_{OUT}$ + 2 V | | 200 | | mA |
| PSRR(3) | Power Supply Rejection Ratio | f = 1 kHz, $V_{IN}$ = $V_{OUT}$ + 2 V $I_{OUT}$ = 20 mA | | 52 | | dB |
| $e_N$(3) | Output Noise Voltage | $V_{IN}$ = $V_{OUT}$ + 2 V, $I_{OUT}$ = 1 mA, f = 10 Hz to 100 KHz, $V_{OUT}$ = 3.3 V,$C_{OUT}$ = 1 μF | | 30*$V_{OUT}$ | | μVrms |
| $T_{ON}$ | Turn-On Time | From assertion of $V_{EN}$ to $V_{OUT}$ = 90%$V_{OUT(NOM)}$ | | 500 | | ms |
| $V_{TRLN}$ | Line transient | $V_{IN}$= $V_{OUT}$ + 2V to $V_{OUT}$+10V in 10 μs, $I_{OUT}$= 1 mA, $T_A$= +25 ºC | | 50 | | mV |
| | | $V_{IN}$= $V_{OUT}$+ 10 V to $V_{OUT}$+2V in 10 μs, $I_{OUT}$=1 mA, $T_A$= +25ºC | | 50 | | mV |
| $V_{TRLD}$ | Load transient | $I_{OUT}$=1mA to 100 mA in 10 μs $V_{IN}$= $V_{OUT}$+ 2 V,$T_A$= +25ºC | | 180 | | mV |
| | | $I_{OUT}$= 100 mA to 1 mA in 10 μs $V_{IN}$= $V_{OUT}$+ 2 V, $T_A$= +25 ºC | | 140 | | mV |
| $T_{TSD}$ (3) | Thermal Shutdown Temperature | Temperature Increasing from $T_A$= +25°C | | 155 | | °C |
| $T_{HYS}$ (3) | Thermal Shutdown Hysteresis | Temperature Falling from $T_{TSD}$ | | 25 | | °C |

Note

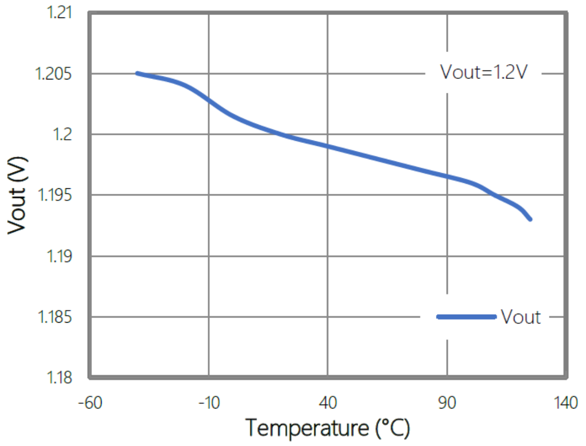
(1). Here $V_{IN}$ means internal circuit can work normal. If $V_{IN}$ < $V_{OUT}$, Output voltage follow $V_{IN}$($I_{OUT}$ = 1 mA), circuit is safety.

(2). $V_{DROP}$ FT test method: test the VOUT voltage at $V_{OUT}$+$V_{DROPMAX}$ with 100 mA output current.

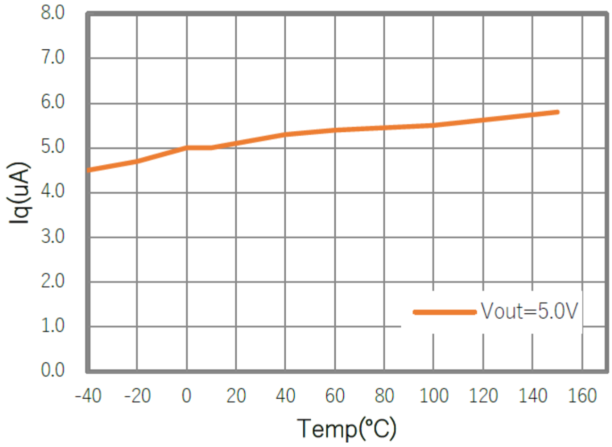
(3). Guaranteed by design and characterization. not a FT item.

## TYPICAL PERFORMANCE CURVES

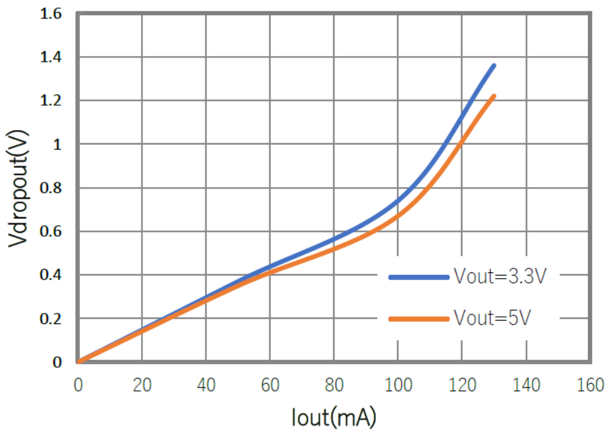
($C_{IN}$ = $C_{OUT}$ = 1.0 µF, unless otherwise noted. Typical values are at $T_A$ = +25°C.)



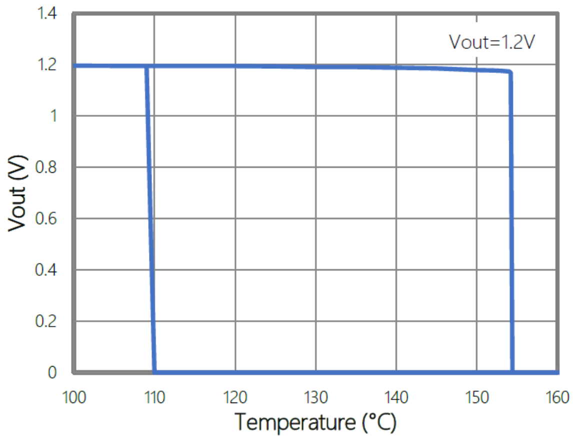
Output Voltage VS Temperature



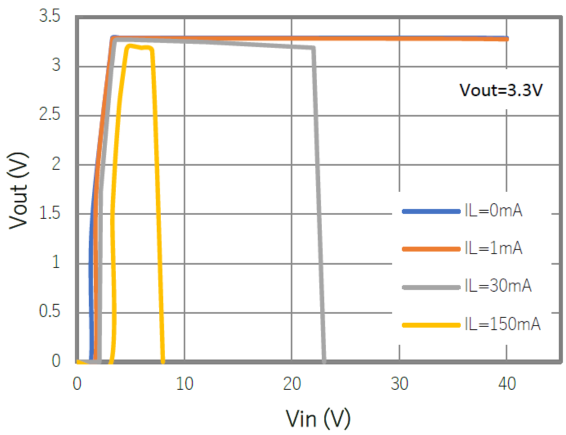
Quiescent Current VS Temperature



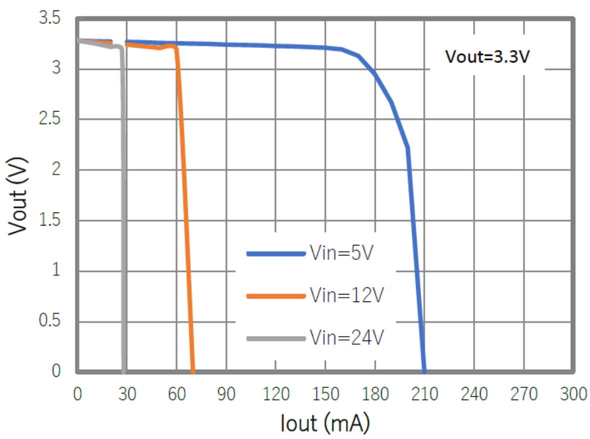
Dropout Voltage VS Output Current



OTP Hysteresis



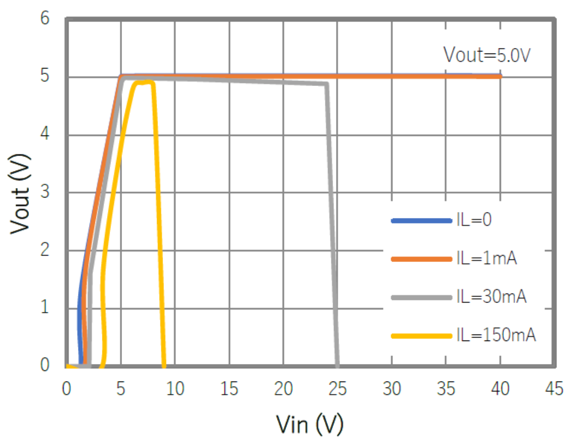
Line Regulation



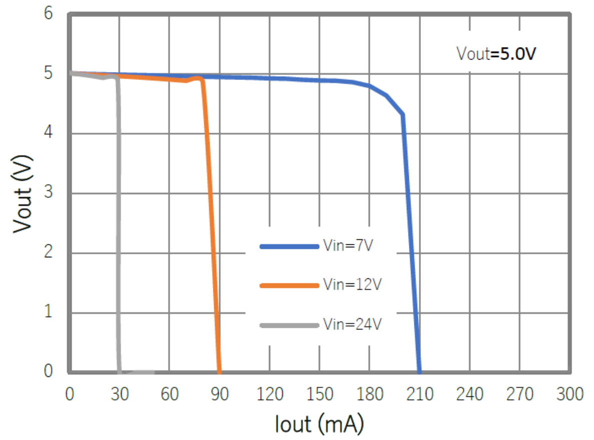
Load Regulation

# TYPICAL PERFORMANCE CURVES

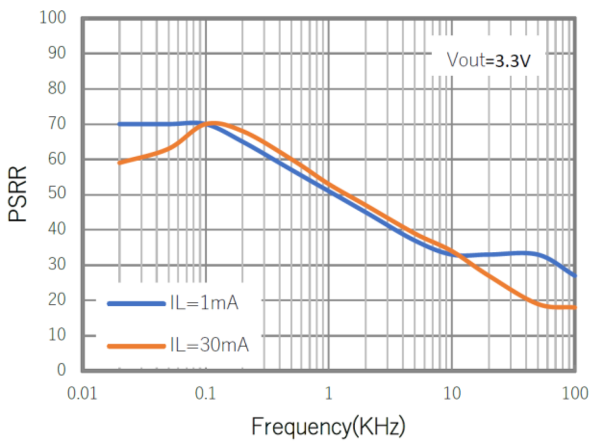
($C_{IN}$ = $C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at $T_A$ = +25°C.)



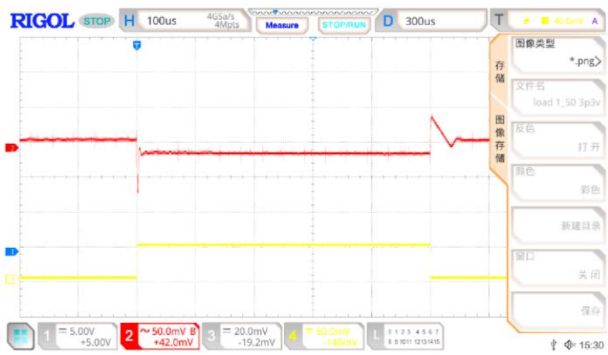

Line Regulation




Load Regulation

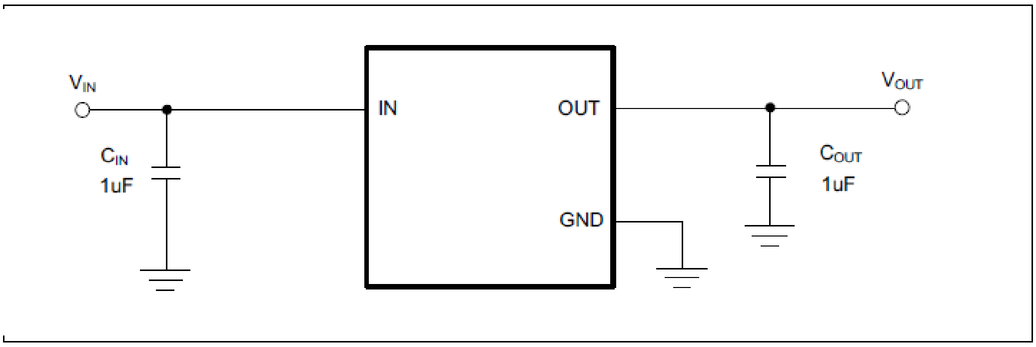



PSRR



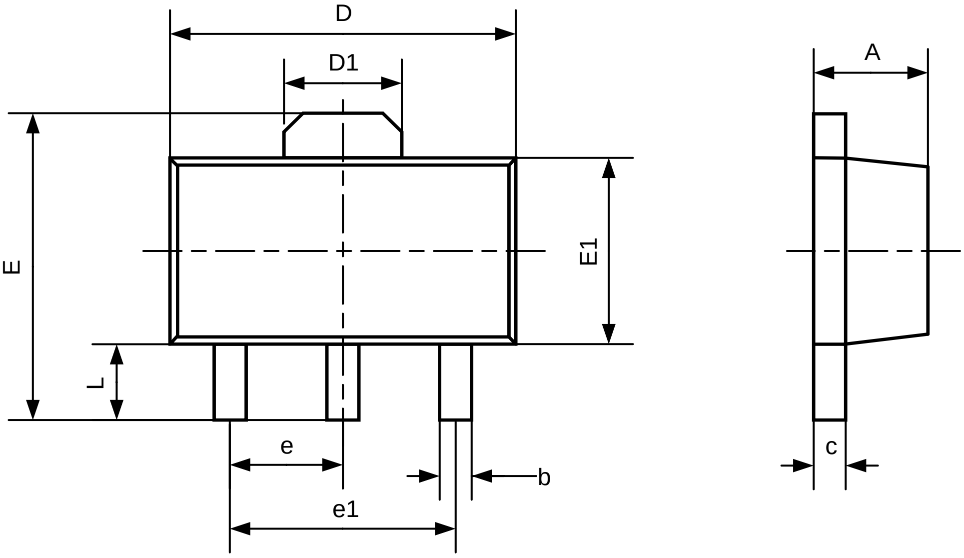

Load Transient($I_{OUT}$=1mA~50mA ,$V_{OUT}$=3.3 V)

## APPLICATION CIRCUITS



## PACKAGE DIMENSION

**SOT89-3**




| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | **Min** | **Max** |
| A | 1.400 | 1.600 |
| b | 0.320 | 0.520 |
| c | 0.350 | 0.440 |
| D | 4.400 | 4.600 |
| D1 | 1.550REF | |
| E | 3.940 | 4.250 |
| E1 | 2.300 | 2.600 |
| e | 1.500BSC | |
| e1 | 3.000BSC | |
| L | 0.900 | 1.200 |