



## 1A LOW DROPOUT LINEAR REGULATOR

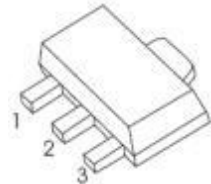
### SZSA1117B-A Series

#### FEATURES

- 🔌 Low Dropout Voltage: 1.3V(typ.) at 0.8A Output Current
- 🔌 Thermal Shutdown
- 🔌 Three-Terminal Adjustable to 1.2V, 1.8V, 2.5V, 3.3V, 5V
- 🔌 Operation Junction Temperature: -40°C to 125°C
- 🔌 Space-saving SOT-89-3L packages

#### SOT-89-3L

- 1. ADJ/GND
- 2. OUTPUT
- 3. IN



#### GENERAL DESCRIPTION

The SZSA1117B-A series is a group of low dropout three-terminal regulators with a dropout of 1.3V(typ.) at 0.8A output current.

The SZSA1117B-A series is available in an adjustable version, which can set the output voltage from 1.25V to 12V with only two external resistors. In addition, it is available in five fixed voltages: 1.2V, 1.5V, 1.8 V, 2.5 V, 3.3 V and 5 V.

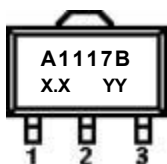
The SZSA1117B-A series offer thermal shutdown protection. Its circuit includes a Zener trimmed bandgap reference to assure output voltage accuracy to within  $\pm 2\%$ .

A minimum of 10 $\mu$ F tantalum capacitor is required at the output to improve the transient response and stability.

#### APPLICATIONS

- 🔌 PC Motherboard
- 🔌 LCD Monitor
- 🔌 Graphic Card
- 🔌 DVD-Video Player
- 🔌 NIC/Switch
- 🔌 Telecom Modem
- 🔌 ADSL Modem
- 🔌 Printer and other peripheral Equipment

#### MARKING



"A1117B": Device serial number.

"X.X": Output voltage, for example, if  $V_{OUT} = 3.0V$ , "X.X" = 3.0.

"YY": A code composed of one uppercase letter and one number, indicates weekly record information of production.

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## MAXIMUM RATINGS

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### ORDERING INFORMATION

| Package   | Operating Junction Temperature Range | Part NO.        |
|-----------|--------------------------------------|-----------------|
| SOT-89-3L | -40 to 125°C                         | SZSA1117B-ADJ-A |
|           |                                      | SZSA1117B-1.2-A |
|           |                                      | SZSA1117B-1.8-A |
|           |                                      | SZSA1117B-2.5-A |
|           |                                      | SZSA1117B-3.3-A |
|           |                                      | SZSA1117B-5.0-A |

### ABSOLUTE MAXIMUM RATINGS ( $T_a=25^\circ\text{C}$ unless otherwise noted)

| Parameter                                   | Symbol                       | Value    | Unit                      |
|---|------------------------------|----------|---------------------------|
| Input Voltage                               | $V_i$                        | 20       | V                         |
| Thermal Resistance from Junction to Ambient | $R_{\theta JA}$              | 250      | $^\circ\text{C}/\text{W}$ |
| Operating Ambient Temperature               | $T_A$                        | -40~+85  | $^\circ\text{C}$          |
| Maximum Junction Temperature                | $T_j$                        | -40~+150 | $^\circ\text{C}$          |
| Storage Temperature                         | $T_{stg}$                    | -40~+150 | $^\circ\text{C}$          |
| Lead Temperature (Soldering, 10s)           | $T_L$                        | 260      | $^\circ\text{C}$          |
| ESD Rating                                  | <b>Human Body Model, HBM</b> | 8        | kV                        |

Note: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

### RECOMMENDED OPERATING CONDITIONS

| Parameter                      | Symbol | Value    | Unit             |
|--------------------------------|--------|----------|------------------|
| Input Voltage                  | $V_i$  | 15       | V                |
| Operating Junction Temperature | $T_j$  | -40~+125 | $^\circ\text{C}$ |

# ELECTRICAL CHARACTERISTICS

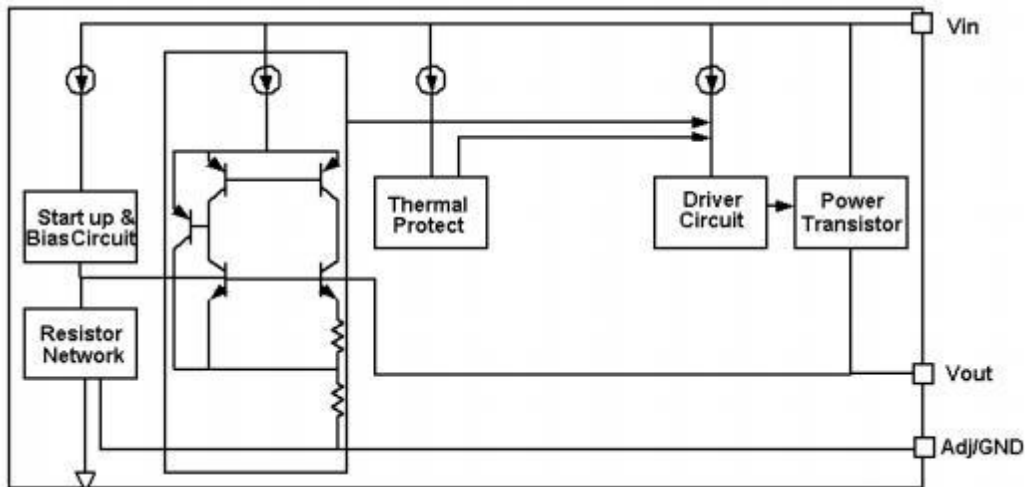
T<sub>J</sub>=25°C unless otherwise specified.

| Parameter               | Symbol   | Part NO.        | Test conditions  | Min   | Typ  | Max   | Unit    |
|-------------------------|--|-----------------|--|-------|------|-------|---------|
| Reference Voltage       | V <sub>IROC</sub>                                    | SZSA1117B-ADJ-A | I <sub>OUT</sub> =10mA, V <sub>IN</sub> =3.25V   | 1.225 | 1.25 | 1.275 | V       |
|                         |  |                 | 10mA≤I <sub>OUT</sub> ≤1A, 2.75V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤12V  | 1.219 | 1.25 | 1.281 |         |
| Output Voltage          | V <sub>O</sub>                                       | SZSA1117B-1.2-A | I <sub>OUT</sub> =10mA, V <sub>IN</sub> =3.2V  | 1.176 | 1.2  | 1.224 | V       |
|                         |  |                 | 10mA≤I <sub>OUT</sub> ≤1A, 2.7V≤V <sub>IN</sub> ≤12V   | 1.170 | 1.2  | 1.230 |         |
|                         |  | SZSA1117B-1.5-A | I <sub>OUT</sub> =10mA, V <sub>IN</sub> =3.5V  | 1.470 | 1.5  | 1.530 |         |
|                         |  |                 | 10mA≤I <sub>OUT</sub> ≤1A, 3V≤V <sub>IN</sub> ≤12V   | 1.463 | 1.5  | 1.537 |         |
|                         |  | SZSA1117B-1.8-A | I <sub>OUT</sub> =10mA, V <sub>IN</sub> =3.8V  | 1.764 | 1.8  | 1.836 |         |
|                         |  |                 | 10mA≤I <sub>OUT</sub> ≤1A, 3.3V≤V <sub>IN</sub> ≤12V   | 1.755 | 1.8  | 1.845 |         |
|                         |  | SZSA1117B-2.5-A | I <sub>OUT</sub> =10mA, V <sub>IN</sub> =4.5V  | 2.450 | 2.5  | 2.550 |         |
|                         |  |                 | 10mA≤I <sub>OUT</sub> ≤1A, 4V≤V <sub>IN</sub> ≤12V   | 2.438 | 2.5  | 2.562 |         |
|                         |  | SZSA1117B-3.3-A | I <sub>OUT</sub> =10mA, V <sub>IN</sub> =5.3V  | 3.234 | 3.3  | 3.366 |         |
|                         |  |                 | 10mA≤I <sub>OUT</sub> ≤1A, 4.8V≤V <sub>IN</sub> ≤12V   | 3.218 | 3.3  | 3.382 |         |
| SZSA1117B-5.0-A         | I <sub>OUT</sub> =10mA, V <sub>IN</sub> =7.0V        | 4.900           | 5.0  | 5.100 |      |       |         |
|                         | 10mA≤I <sub>OUT</sub> ≤1A, 6.5V≤V <sub>IN</sub> ≤12V | 4.875           | 5.0  | 5.125 |      |       |         |
| Line Regulation         | LNR  | SZSA1117B-ADJ-A | I <sub>OUT</sub> =10mA, 1.5V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤10.75V   |       | 0.03 | 0.2   | %<br>%V |
|                         |  | SZSA1117B-1.2-A | I <sub>OUT</sub> =10mA, 1.5V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤8.8V   |       | 0.03 | 0.2   |         |
|                         |  | SZSA1117B-1.5-A | I <sub>OUT</sub> =10mA, 1.5V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤8.5V   |       | 0.03 | 0.2   |         |
|                         |  | SZSA1117B-1.8-A | I <sub>OUT</sub> =10mA, 1.5V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤10.2V  |       | 0.03 | 0.2   |         |
|                         |  | SZSA1117B-2.5-A | I <sub>OUT</sub> =10mA, 1.5V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤9.5V   |       | 0.03 | 0.2   |         |
|                         |  | SZSA1117B-3.3-A | I <sub>OUT</sub> =10mA, 1.5V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤8.7V   |       | 0.03 | 0.2   |         |
|                         |  | SZSA1117B-5.0-A | I <sub>OUT</sub> =10mA, 1.5V≤V <sub>IN</sub> -V <sub>OUT</sub> ≤7V   |       | 0.03 | 0.2   |         |
| Load Regulation         | LDR  | SZSA1117B-ADJ-A | V <sub>IN</sub> -V <sub>OUT</sub> =1.5V, 10mA≤I <sub>OUT</sub> ≤1A   |       | 2    | 8     | mV      |
|                         |  | SZSA1117B-1.2-A |  |       | 2    | 8     |         |
|                         |  | SZSA1117B-1.5-A |  |       | 2    | 8     |         |
|                         |  | SZSA1117B-1.8-A |  |       | 3    | 12    |         |
|                         |  | SZSA1117B-2.5-A |  |       | 4    | 16    |         |
|                         |  | SZSA1117B-3.3-A |  |       | 6    | 24    |         |
|                         |  | SZSA1117B-5.0-A |  |       | 9    | 36    |         |
| Dropout Voltage         | V <sub>D</sub>                                       |                 | I <sub>OUT</sub> =1A   |       | 1.3  | 1.5   | V       |
| Adjust Pin Current      | I <sub>Adj</sub>                                     | SZSA1117B-ADJ-A | V <sub>IN</sub> =5V, I <sub>OUT</sub> =10mA  |       | 55   | 120   | μA      |
|                         |  |                 | V <sub>IN</sub> =5V, I <sub>OUT</sub> =1A  |       | 55   | 120   | μA      |
| I <sub>adj</sub> change | I <sub>change</sub>                                  | SZSA1117B-ADJ-A | V <sub>IN</sub> =5V 10mA≤I <sub>OUT</sub> ≤1A  |       | 0.2  | 10    | μA      |
| Minimum Load Current    | I <sub>L</sub>                                       | SZSA1117B-ADJ-A |  |       | 2    | 10    | mA      |
| Quiescent Current       | I <sub>q</sub>                                       | SZSA1117B-1.2-A | V <sub>IN</sub> =10V   |       | 2    | 5     | mA      |
|                         |  | SZSA1117B-1.5-A | V <sub>IN</sub> =10V   |       | 2    | 5     | mA      |
|                         |  | SZSA1117B-1.8-A | V <sub>IN</sub> =12V   |       | 2    | 5     | mA      |
|                         |  | SZSA1117B-2.5-A | V <sub>IN</sub> =12V   |       | 2    | 5     | mA      |
|                         |  | SZSA1117B-3.3-A | V <sub>IN</sub> =12V   |       | 2    | 5     | mA      |
|                         |  | SZSA1117B-5.0-A | V <sub>IN</sub> =12V   |       | 2    | 5     | mA      |
| Ripple Rejection        | RR   |                 | f=1kHz, C <sub>IN</sub> =10μF/25V, C <sub>OUT</sub> =10μF/25V, V <sub>IN</sub> -V <sub>OUT</sub> =2V, I <sub>OUT</sub> =10mA |       | 60   |       | dB      |

\* With package soldering to copper area over backside ground plane or internal power plane R<sub>θJA</sub> can vary from 46 °C/W to >90°C/W depending on mounting technique and the size of the copper area

# FUNCTIONAL BLOCK and TYPICAL APPLICATION

## FUNCTIONAL BLOCK DIAGRAM



## DETAILED DESCRIPTION

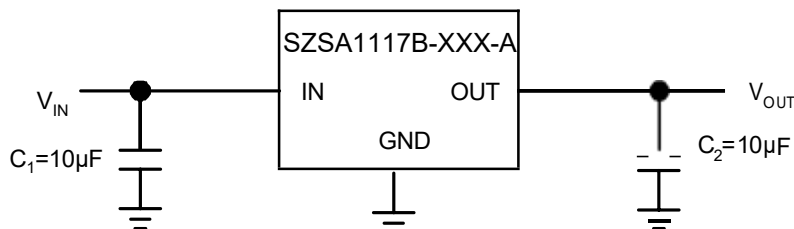
SZSA1117B-XXX-A is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, power transistors and its driver circuit and so on.

The thermal shutdown modules can assure chip and its application system working safety when the junction temperature is larger than  $170^{\circ}\text{C}$ .

The bandgap module provides stable reference voltage, whose temperature coefficient is compensated by careful design considerations. The temperature coefficient is under  $100\text{ ppm}/^{\circ}\text{C}$ . And the accuracy of output voltage is guaranteed by trimming technique.

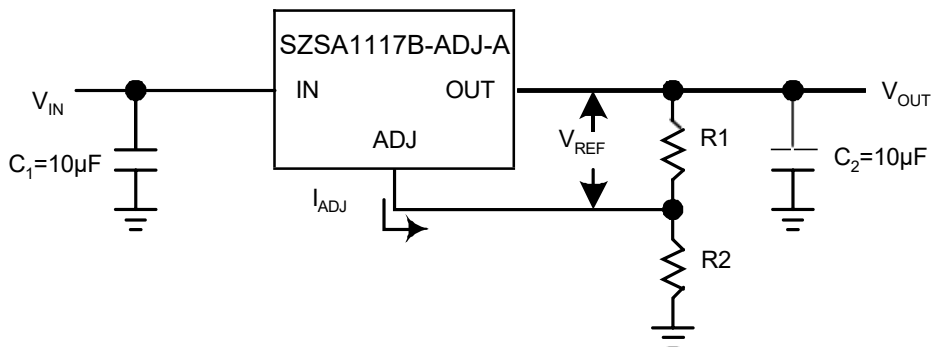
## TYPICAL APPLICATION

### Fixed Output Voltage Version



- 1) Recommend using  $10\mu\text{F}$  tan capacitor as bypass capacitor ( $C_1$ ) for all application circuit.
- 2) Recommend using  $10\mu\text{F}$  tan capacitor to assure circuit stability.

### Adjustable Output Voltage Version



$$V_{OUT} = V_{REF} \times (1 + R2/R1) + I_{ADJ} \times R2$$

The output voltage of adjustable version follows the equation:  $V_{out} = 1.25 \times (1 + R2/R1) + I_{adj} \times R2$ . We can ignore  $I_{adj}$  because  $I_{adj}$  (about 50µA) is much less than the current of  $R1$  (about 2~10mA).

1) To meet the minimum load current (>10mA) requirement,  $R1$  is recommended to be 125ohm or lower. As SZSA1117B-ADJ-A can keep itself stable at load current about 2mA,  $R1$  is not allowed to be higher than 625ohm.

2) Using a bypass capacitor ( $C_{ADJ}$ ) between the ADJ pin and ground can improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. The impedance of  $C_{ADJ}$  should be less than  $R1$  to prevent ripple from being amplified. As  $R1$  is normally in the range of 100Ω~500Ω, the value of  $C_{ADJ}$  should satisfy this equation:  $1/(2\pi \times f_{ripple} \times C_{ADJ}) < R1$ .

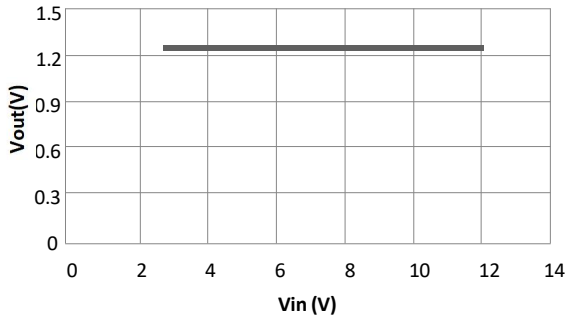
### THERMAL CONSIDERATION

We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by SZSA1117B-ADJ-A is very large. SZSA1117B-ADJ-A series uses SOT-223 package type and its thermal resistance is about 20°C/W. And the copper area of application board can affect the total thermal resistance. If copper area is 5cm\*5cm (two sides), the resistance is about 30°C/W. So the total thermal resistance is about 20°C/W+30°C/W. We can decrease total thermal resistance by increasing copper area in application board. When there is no good heat dissipation copper area in PCB, the total thermal resistance will be as high as 120°C/W, then the power dissipation of SZSA1117B-ADJ-A could allow on itself is less than 1W. And furthermore, SZSA1117B-ADJ-A will work at junction temperature higher than 125°C under such condition and no lifetime is guaranteed.

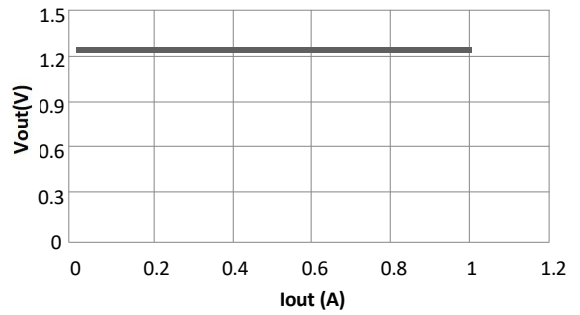
# TYPICAL PERFORMANCE CHARACTERISTICS

TA=25°C, unless otherwise noted.

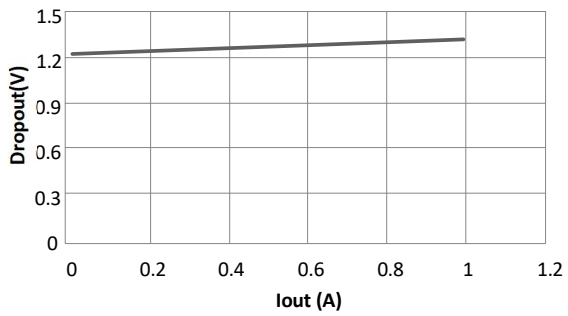
### Line regulation



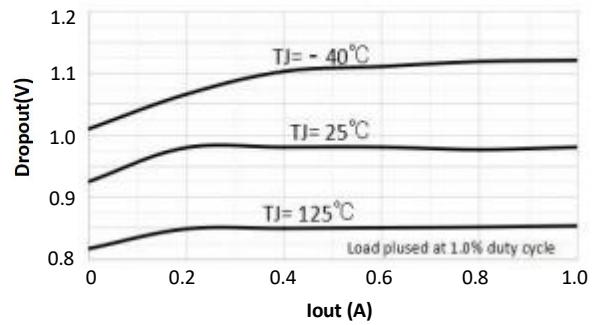
### Load regulation



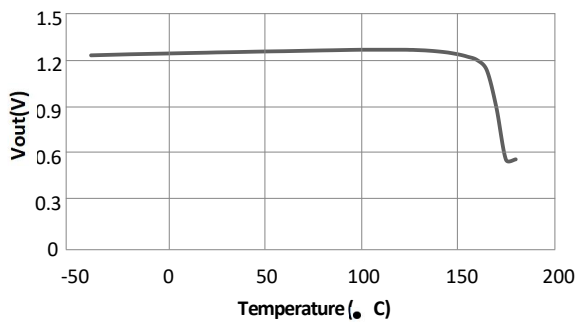
### Dropout Voltage (ADJ Except)



### Dropout Voltage (ADJ Only)



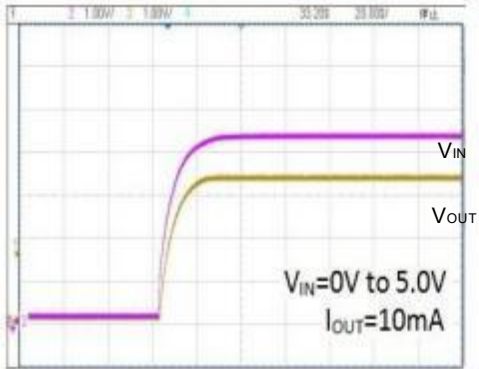
### Thermal performance with OTP



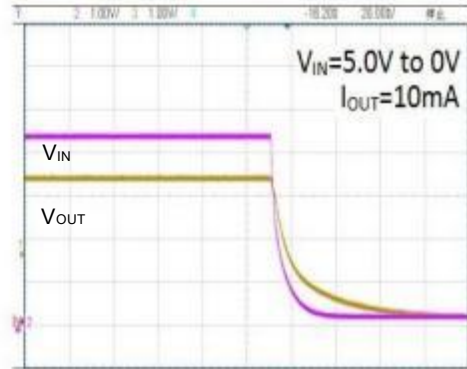
# TYPICAL PERFORMANCE CHARACTERISTICS

TA=25°C, unless otherwise noted.

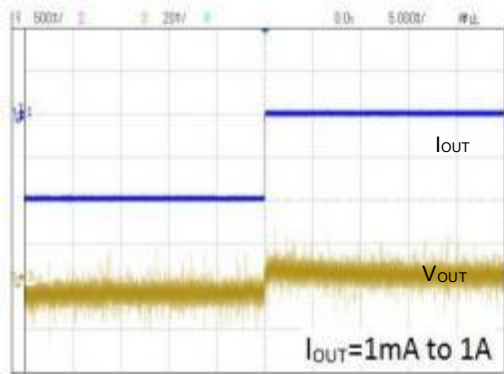
Power ON / OFF



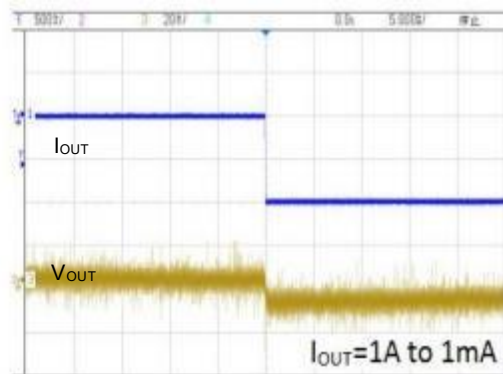
Power ON / OFF



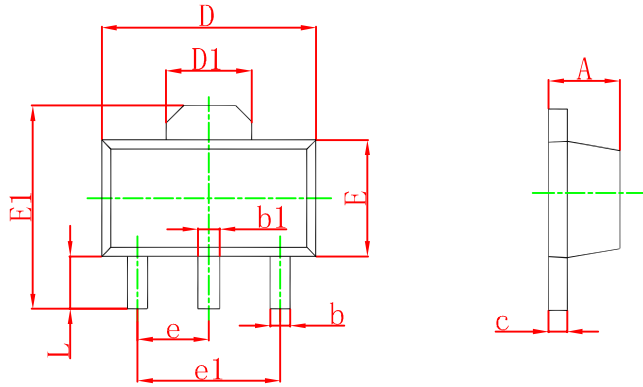
Load Transient Response



Load Transient Response

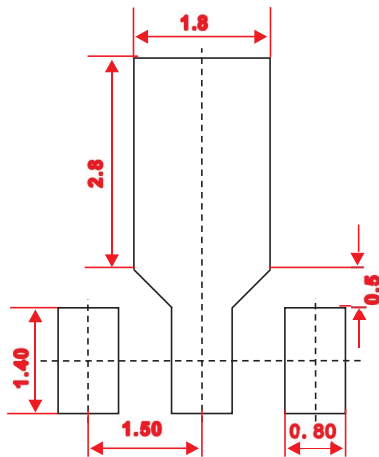


## SOT-89-3L Package Outline Dimensions



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.400                     | 1.600 | 0.055                | 0.063 |
| b      | 0.320                     | 0.520 | 0.013                | 0.020 |
| b1     | 0.400                     | 0.580 | 0.016                | 0.023 |
| c      | 0.350                     | 0.440 | 0.014                | 0.017 |
| D      | 4.400                     | 4.600 | 0.173                | 0.181 |
| D1     | 1.550 REF.                |       | 0.061 REF.           |       |
| E      | 2.300                     | 2.600 | 0.091                | 0.102 |
| E1     | 3.940                     | 4.250 | 0.155                | 0.167 |
| e      | 1.500 TYP.                |       | 0.060 TYP.           |       |
| e1     | 3.000 TYP.                |       | 0.118 TYP.           |       |
| L      | 0.900                     | 1.200 | 0.035                | 0.047 |

## SOT-89-3L Suggested Pad Layout



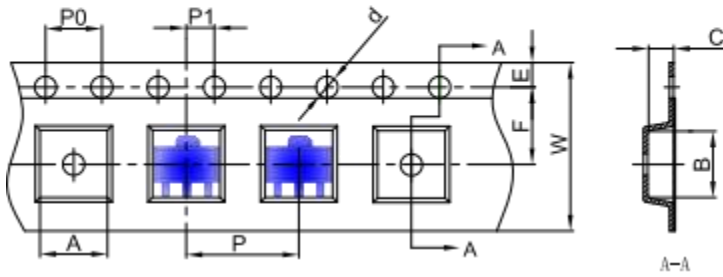
Note:

1. Controlling dimension : in millimeters.
2. General tolerance:  $\pm 0.05\text{mm}$ .
3. The pad layout is for reference purposes only.



# SOT-89-3L Tape and Reel

## SOT-89-3L Embossed Carrier Tape

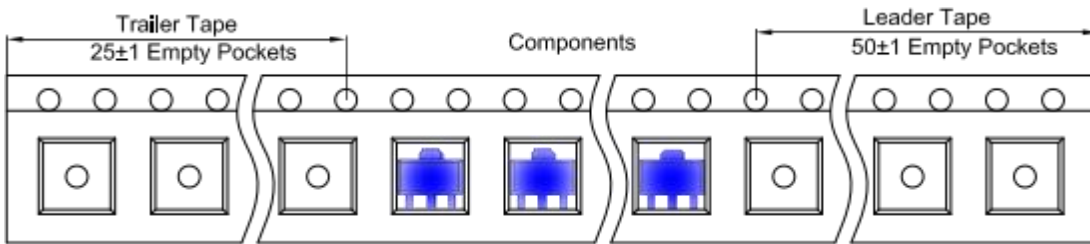


### Packaging Description:

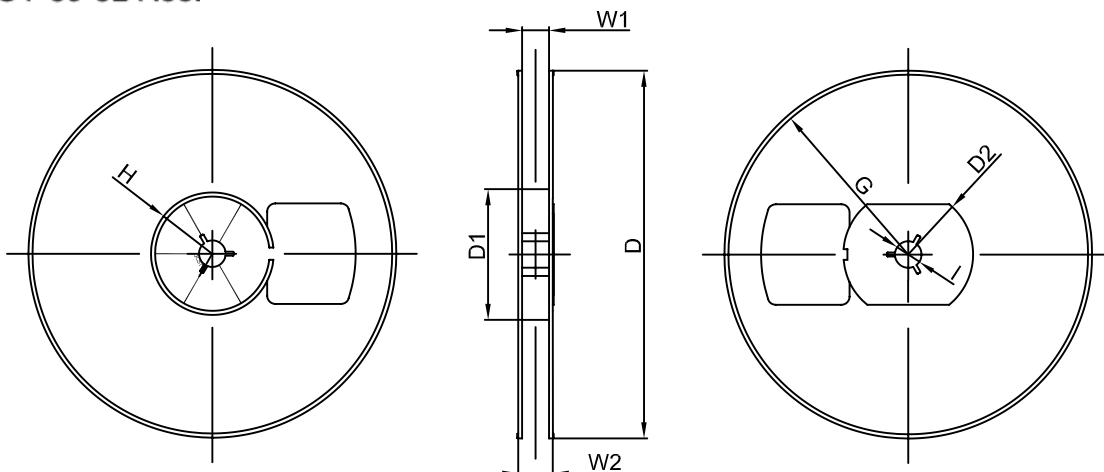
SOT-89-3L parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 1,000 units per 7" or 18.0 cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

| Dimensions are in millimeter |      |      |      |       |      |      |      |      |      |       |
|------------------------------|------|------|------|-------|------|------|------|------|------|-------|
| Pkg type                     | A    | B    | C    | d     | E    | F    | P0   | P    | P1   | W     |
| SOT-89-3L                    | 4.85 | 4.45 | 1.85 | Ø1.50 | 1.75 | 5.50 | 4.00 | 8.00 | 2.00 | 12.00 |

## SOT-89-3L Tape Leader and Trailer



## SOT-89-3L Reel



| Dimensions are in millimeter |         |       |        |        |        |        |       |       |
|------------------------------|---------|-------|--------|--------|--------|--------|-------|-------|
| Reel Option                  | D       | D1    | D2     | G      | H      | I      | W1    | W2    |
| 7" Dia                       | Ø180.00 | 60.00 | R32.00 | R86.50 | R30.00 | Ø13.00 | 13.20 | 16.50 |

| REEL     | Reel Size | Box        | Box Size(mm) | Carton     | Carton Size(mm) | G.W.(kg) |
|----------|-----------|------------|--------------|------------|-----------------|----------|
| 1000 pcs | 7 Inch    | 10,000 pcs | 203×203×195  | 40,000 pcs | 438×438×220     |          |

# DISCLAIMER

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