

**450mA Low Dropout Linear Regulator of Adjustable and Fixed Voltages****Features**

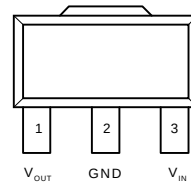
- Low Dropout Voltage of 1.3V at 450mA
- Output Voltage Accuracy  $\pm 2.0\%$
- Line Regulation - 3mV (typ.)
- Load Regulation - 13mV (typ.)
- Input Voltage Range up to 9V
- Internal Current Limiting and Thermal Shutdown Protections
- Available Output Voltages -ADJ, 1.8V, 2.5V, 2.6V, 2.7V, 2.8V, 3.3V
- Various SOT-89 and TO-92 Packages Available

**Applications**

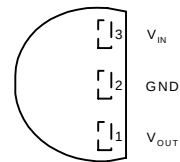
- Voltage Regulator for CD-ROM Drivers
- Voltage Regulator for LAN Cards
- Wireless Communication Systems
- Portable Instrument
- Portable Consumer Equipment
- Low Voltage Systems

**General Description**

The APL5835 is a 3-pin low dropout linear regulator with 2.0% accuracy of output voltage over line, load and temperature variations. Dropout voltage at 450mA output current is less than 1.3V. Both output current limiting and thermal shutdown are built in to provide maximal protection to the APL5835 against fault conditions. The over current and thermal shutdown circuits become active when the current exceed 450mA, or the junction temperature reach 150°C. Normal operation is recovered when junction temperature drops below 130°C.

**Pin Description**

SOT-89 (Top View)

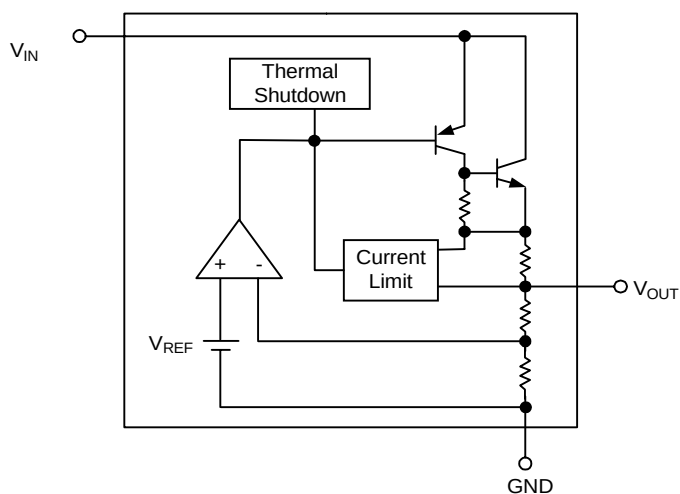


TO-92 (Top View)

## Ordering and Marking Information

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>APL5835 - <span style="border: 1px solid black; padding: 2px;">  </span> <span style="border: 1px solid black; padding: 2px;">  </span> <span style="border: 1px solid black; padding: 2px;">  </span> <span style="border: 1px solid black; padding: 2px;">  </span> - <span style="border: 1px solid black; padding: 2px;">  </span> <span style="border: 1px solid black; padding: 2px;">  </span></p> <p>Handling Code<br/>Temp. Range<br/>Package Code<br/>Voltage Code</p> | <p>Package Code<br/>D : SOT-89<br/>Temp. Range<br/>C : 0 to 70 °C<br/>Handling Code<br/>TU : Tube<br/>Voltage Code<br/>18 : 1.8V<br/>25 : 2.5V<br/>26 : 2.6V<br/>27 : 2.7V<br/>28 : 2.8V<br/>33 : 3.3V<br/>Blank : Adjustable Version</p> <p>E : TO-92<br/>TR : Tape &amp; Reel</p> |
| <p>APL5835 D : <span style="border: 1px solid black; padding: 2px;">APL5835<br/>XXXXX</span> XXXXX - Date Code</p>                                                                                                                                                                                                                                                                                                                                                                  | <p>APL5835 E : <span style="border: 1px solid black; padding: 2px;">APL<br/>5835<br/>XXXXX</span> XXXXX - Date Code</p>                                                                                                                                                             |
| <p>APL5835 -18 D : <span style="border: 1px solid black; padding: 2px;">APL5835<br/>XXXXX18</span> XXXXX - Date Code</p>                                                                                                                                                                                                                                                                                                                                                            | <p>APL5835 -18 E : <span style="border: 1px solid black; padding: 2px;">APL<br/>5835<br/>XXXXX18</span> XXXXX - Date Code</p>                                                                                                                                                       |
| <p>APL5835 -25 D : <span style="border: 1px solid black; padding: 2px;">APL5835<br/>XXXXX25</span> XXXXX - Date Code</p>                                                                                                                                                                                                                                                                                                                                                            | <p>APL5835 -25 E : <span style="border: 1px solid black; padding: 2px;">APL<br/>5835<br/>XXXXX25</span> XXXXX - Date Code</p>                                                                                                                                                       |
| <p>APL5835 -26 D : <span style="border: 1px solid black; padding: 2px;">APL5835<br/>XXXXX26</span> XXXXX - Date Code</p>                                                                                                                                                                                                                                                                                                                                                            | <p>APL5835 -26 E : <span style="border: 1px solid black; padding: 2px;">APL<br/>5835<br/>XXXXX26</span> XXXXX - Date Code</p>                                                                                                                                                       |
| <p>APL5835 -27 D : <span style="border: 1px solid black; padding: 2px;">APL5835<br/>XXXXX27</span> XXXXX - Date Code</p>                                                                                                                                                                                                                                                                                                                                                            | <p>APL5835 -27 E : <span style="border: 1px solid black; padding: 2px;">APL<br/>5835<br/>XXXXX27</span> XXXXX - Date Code</p>                                                                                                                                                       |
| <p>APL5835 -28 D : <span style="border: 1px solid black; padding: 2px;">APL5835<br/>XXXXX28</span> XXXXX - Date Code</p>                                                                                                                                                                                                                                                                                                                                                            | <p>APL5835 -28 E : <span style="border: 1px solid black; padding: 2px;">APL<br/>5835<br/>XXXXX28</span> XXXXX - Date Code</p>                                                                                                                                                       |
| <p>APL5835 -33 D : <span style="border: 1px solid black; padding: 2px;">APL5835<br/>XXXXX33</span> XXXXX - Date Code</p>                                                                                                                                                                                                                                                                                                                                                            | <p>APL5835 -33 E : <span style="border: 1px solid black; padding: 2px;">APL<br/>5835<br/>XXXXX33</span> XXXXX - Date Code</p>                                                                                                                                                       |

## Block Diagram



## Absolute Maximum Ratings

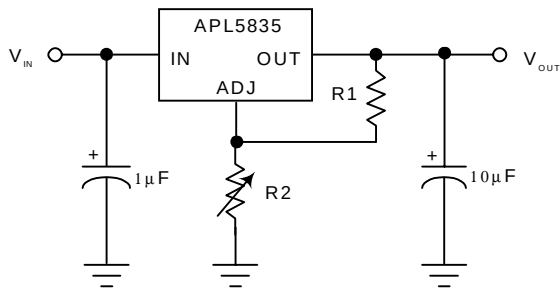
| Symbol        | Parameter                           | Rating           | Unit   |
|---------------|-------------------------------------|------------------|--------|
| $V_{IN}$      | Input Voltage                       | 9                | V      |
| $I_{OUT}$     | Output Current                      | 450              | mA     |
| $T_A$         | Operating Ambient Temperature Range | 0 to 70          | °C     |
| $T_J$         | Operating Ambient Temperature Range | -40 to +150      | °C     |
| $T_{STG}$     | Storage Temperature Range           | -65 to +150      | °C     |
| $P_D$         | Power Dissipation Package           | Interanl Limited |        |
| $\theta_{JA}$ | Thermal Resistance                  | SOT-89           | 180    |
|               |                                     | TO-92            | 180    |
|               |                                     |                  | °C / W |

## Electrical Characteristics cont. ( $T_A=25^\circ\text{C}$ , unless otherwise noted)

| Symbol              | Parameter                              | Test Condition                                      | APL5835           |      |                | Unit          |
|---------------------|----------------------------------------|-----------------------------------------------------|-------------------|------|----------------|---------------|
|                     |                                        |                                                     | Min.              | Typ. | Max.           |               |
| $V_N$               | Input Voltage                          |                                                     | $V_{OUT} + 1.45V$ |      | 8              | V             |
| $V_{OUT}$           | Output Voltage                         | $I_{OUT}=10mA$                                      | $0.9 V_{OUT}$     |      | $1.02 V_{OUT}$ | V             |
| $I_{OUT}$           | Output Current Capability              | $\Delta V_{OUT}=2\%$                                | 450               |      |                | mA            |
| $I_{SC}$            | Short Circuit Current                  | $V_{OUT}<0.4V$                                      |                   | 600  |                | mA            |
| $I_Q$               | Quiescent Current                      | $V_N=5V$ , No Load                                  |                   | 6    | 10             | mA            |
| REG <sub>LINE</sub> | Line Regulation                        | $T_J=0\sim 125^\circ\text{C}$                       |                   |      |                |               |
|                     | APL5835                                | $I_{OUT}=10mA$ , $V_{OUT}+1.7V\leq V_{IN}\leq 8V$   |                   |      |                |               |
|                     | APL5835-18                             | $I_{OUT}=0A$ , $3.5V\leq V_{IN}\leq 8V$             |                   |      |                |               |
|                     | APL5835-25                             | $I_{OUT}=0A$ , $4.2V\leq V_{IN}\leq 8V$             |                   |      |                |               |
|                     | APL5835-26                             | $I_{OUT}=0A$ , $4.3V\leq V_{IN}\leq 8V$             |                   |      |                |               |
|                     | APL5835-27                             | $I_{OUT}=0A$ , $4.4V\leq V_{IN}\leq 8V$             |                   |      |                |               |
|                     | APL5835-28                             | $I_{OUT}=0A$ , $4.5V\leq V_{IN}\leq 8V$             |                   |      |                |               |
|                     | APL5835-33                             | $I_{OUT}=0A$ , $5V\leq V_{IN}\leq 8V$               |                   |      |                |               |
| REG <sub>LOAD</sub> | Load Regulation                        | $T_J=0\sim 125^\circ\text{C}$                       |                   |      |                |               |
|                     | APL5835                                | $(V_{IN}-V_{OUT})=1.7V$ , $0\leq I_{OUT}\leq 0.45A$ |                   |      |                |               |
|                     | APL5835-18                             | $V_{IN}=3.5V$ , $0\leq I_{OUT}\leq 0.45A$           |                   |      |                |               |
|                     | APL5835-25                             | $V_{IN}=4.2V$ , $0\leq I_{OUT}\leq 0.45A$           |                   |      |                |               |
|                     | APL5835-26                             | $V_{IN}=4.5V$ , $0\leq I_{OUT}\leq 0.45A$           |                   |      |                |               |
|                     | APL5835-27                             | $V_{IN}=4.4V$ , $0\leq I_{OUT}\leq 0.45A$           |                   |      |                |               |
|                     | APL5835-28                             | $V_{IN}=4.5V$ , $0\leq I_{OUT}\leq 0.45A$           |                   |      |                |               |
|                     | APL5835-33                             | $V_{IN}=5V$ , $0\leq I_{OUT}\leq 0.45A$             |                   |      |                |               |
| $V_{DROPOUT}$       | Dropout Voltage                        | $I_{OUT}=450mA$ , $\Delta V_{OUT}=1\%$              |                   | 1300 | 1450           | mV            |
| PSRR                | Power Supply Rejection Ratio           | at 1kHz                                             |                   | 55   |                | dB            |
| OTS                 | Over Temperature Shutdown              |                                                     |                   | 150  |                | °C            |
| $E_N$               | Output Noise                           |                                                     |                   | 100  |                | $\mu V_{rms}$ |
| TC                  | Output Voltage Temperature Coefficient |                                                     |                   | 100  |                | ppm/°C        |

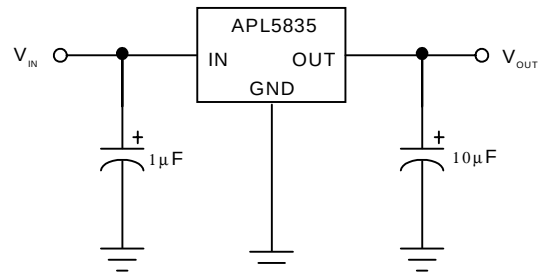
## Application Schematic

1.25V to 7V Adjustable Regulator



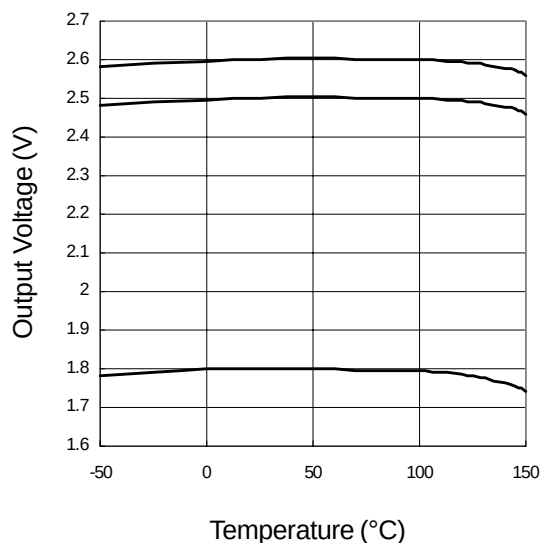
$$V_{OUT} = 1.250V \times \frac{R1 + R2}{R1}$$

Fixed 1.8V, 2.5V, 2.6V, 2.7V, 2.8V and 3.3V Regulator

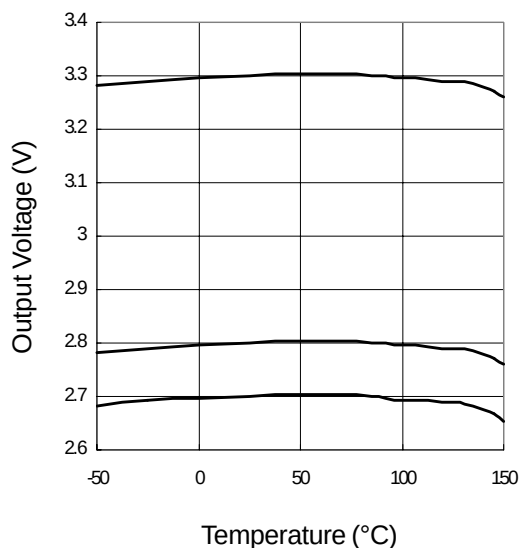


## Typical Characteristics

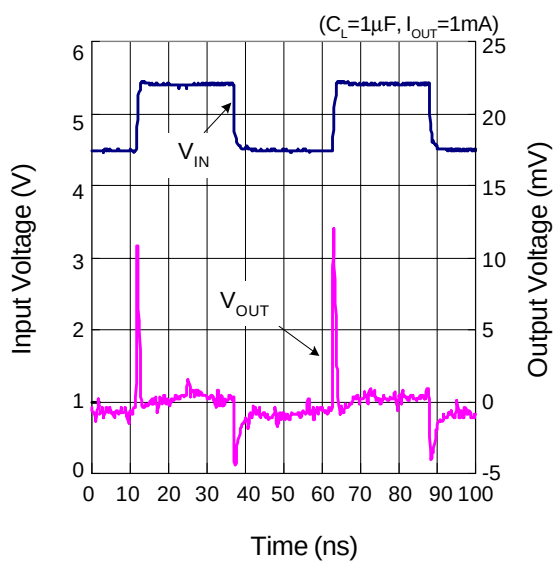
Output Voltage vs. Temperature



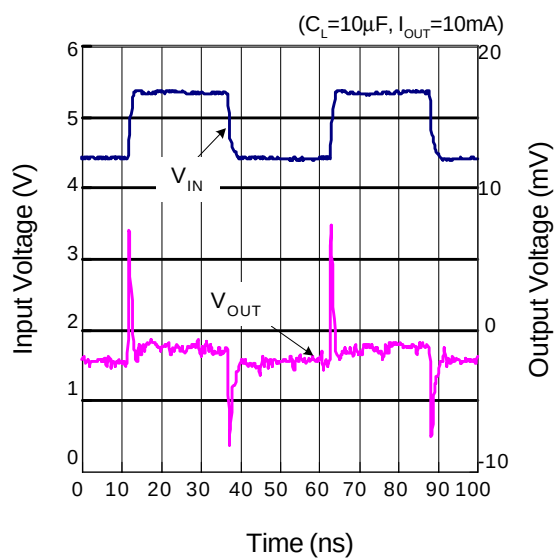
Output Voltage vs. Temperature



Line Transient Response

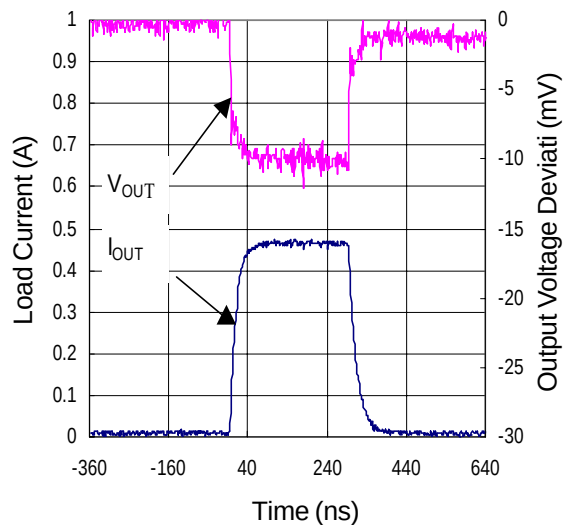


Line Transient Response

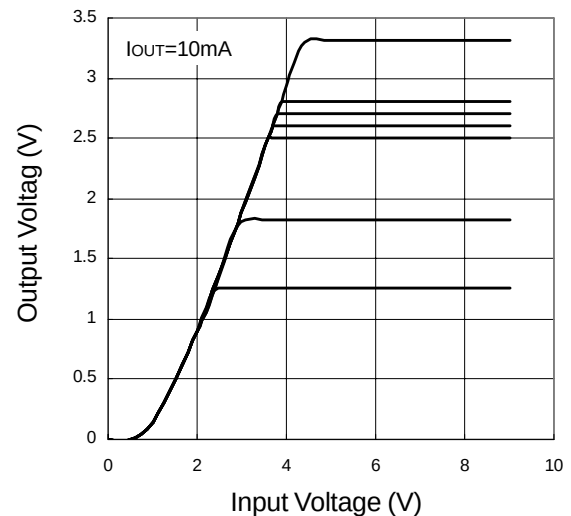


## Typical Characteristics

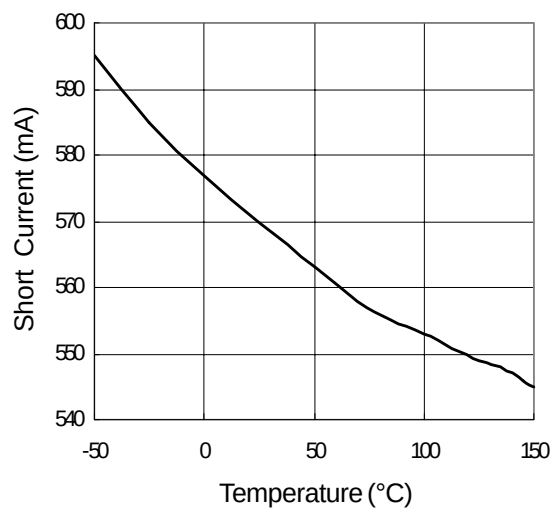
Load Transient Response



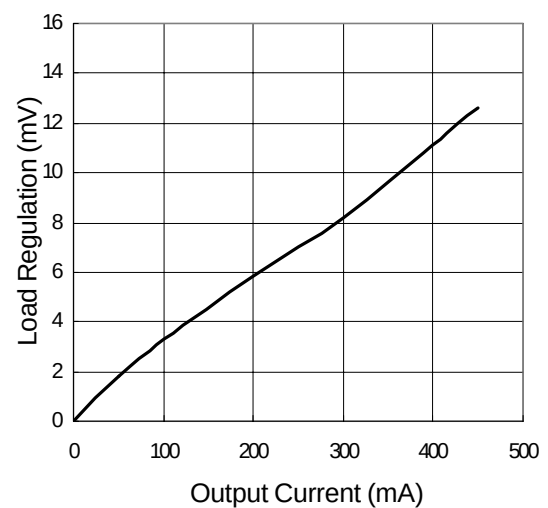
Output Voltage vs. Input Voltage



Short Current vs. Temperature

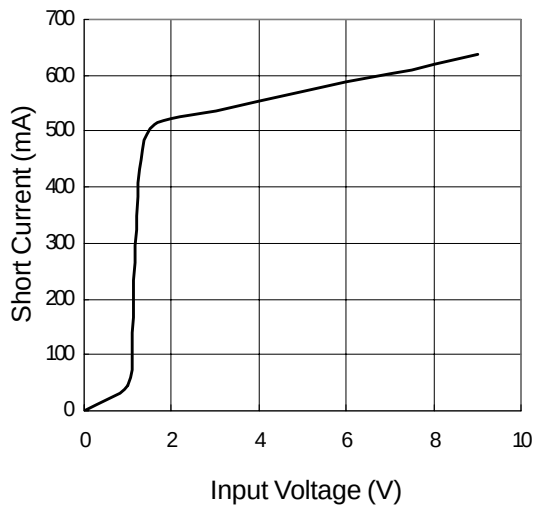


Output Current vs. Load Regulation

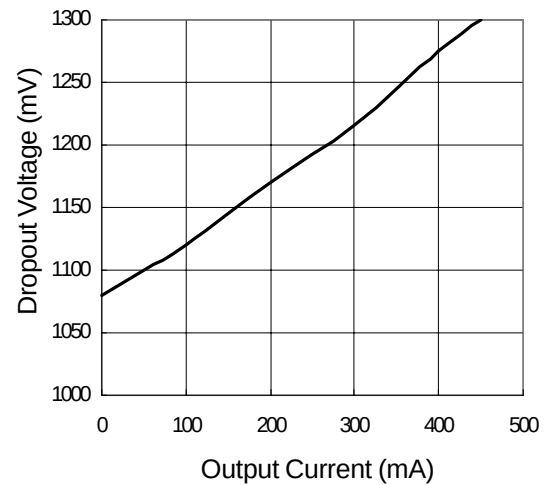


## Typical Characteristics Cont.

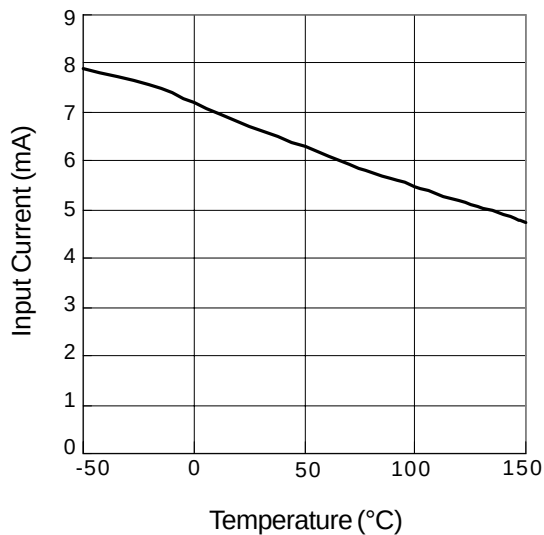
Short Current vs. Input Voltage



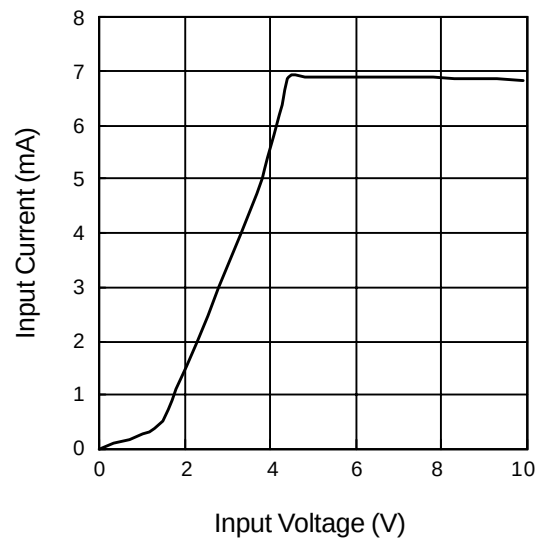
Output Current vs. Dropout Voltage



Input Current vs. Temperature

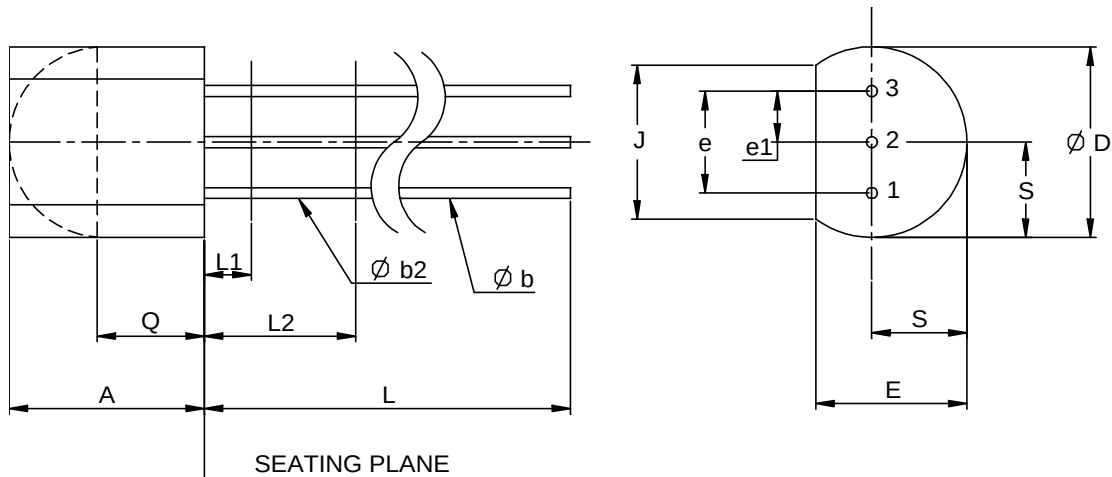


Input Current vs. Input Voltage



## Packaging Ingormation

TO-92

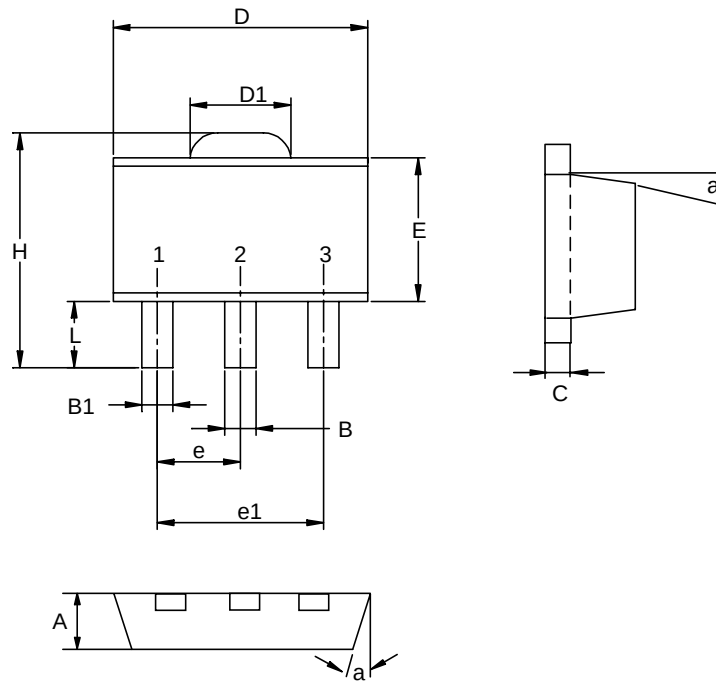


| Dim       | Millimeters |      | Inches |       |
|-----------|-------------|------|--------|-------|
|           | Min.        | Max. | Min.   | Max.  |
| A         | 4.58        | 5.33 | 0.170  | 0.210 |
| $\phi b$  | 0.41        | 0.53 | 0.160  | 0.021 |
| $\phi b2$ | 0.41        | 0.48 | 0.160  | 0.019 |
| $\phi D$  | 4.96        | 5.20 | 0.175  | 0.205 |
| E         | 3.94        | 4.19 | 0.125  | 0.165 |
| e         | 2.42        | 2.66 | 0.095  | 0.105 |
| e1        | 1.15        | 1.39 | 0.045  | 0.055 |
| J         | 3.43        |      | 0.135  |       |
| L         | 12.70       |      | 0.500  |       |
| L1        |             | 1.27 |        | 0.050 |
| L2        | 6.35        |      | 0.250  |       |
| Q         | 2.93        |      | 0.115  |       |
| S         | 2.42        | 2.66 | 0.080  | 0.105 |



## Packaging Information

SOT-89 (Reference EIAJ ED-7500A Registration SC-62)



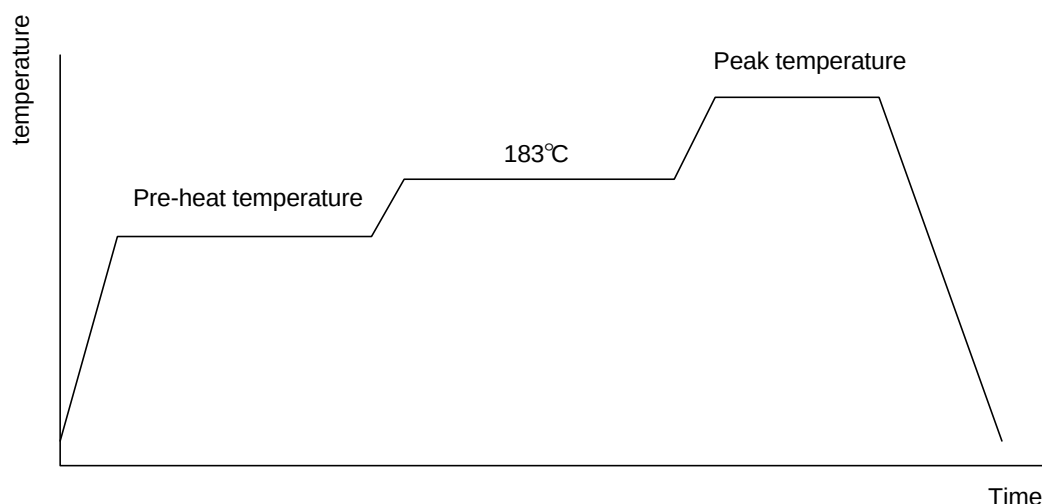
| Dim | Millimeters |      | Inches    |       |
|-----|-------------|------|-----------|-------|
|     | Min.        | Max. | Min.      | Max.  |
| A   | 1.40        | 1.60 | 0.055     | 0.063 |
| B   | 0.40        | 0.56 | 0.016     | 0.022 |
| B1  | 0.35        | 0.48 | 0.014     | 0.019 |
| C   | 0.35        | 0.44 | 0.014     | 0.017 |
| D   | 4.40        | 4.60 | 0.173     | 0.181 |
| D1  | 1.35        | 1.83 | 0.053     | 0.072 |
| e   | 1.50 BSC    |      | 0.059 BSC |       |
| e1  | 3.00 BSC    |      | 0.118 BSC |       |
| E   | 2.29        | 2.60 | 0.090     | 0.102 |
| H   | 3.75        | 4.25 | 0.148     | 0.167 |
| L   | 0.80        | 1.20 | 0.031     | 0.047 |
| α   |             | 10°  |           | 10°   |

## Physical Specifications

|                    |                                                              |
|--------------------|--------------------------------------------------------------|
| Terminal Material  | Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb) |
| Lead Solderability | Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3. |

## Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A APRIL 1999



## Classification Reflow Profiles

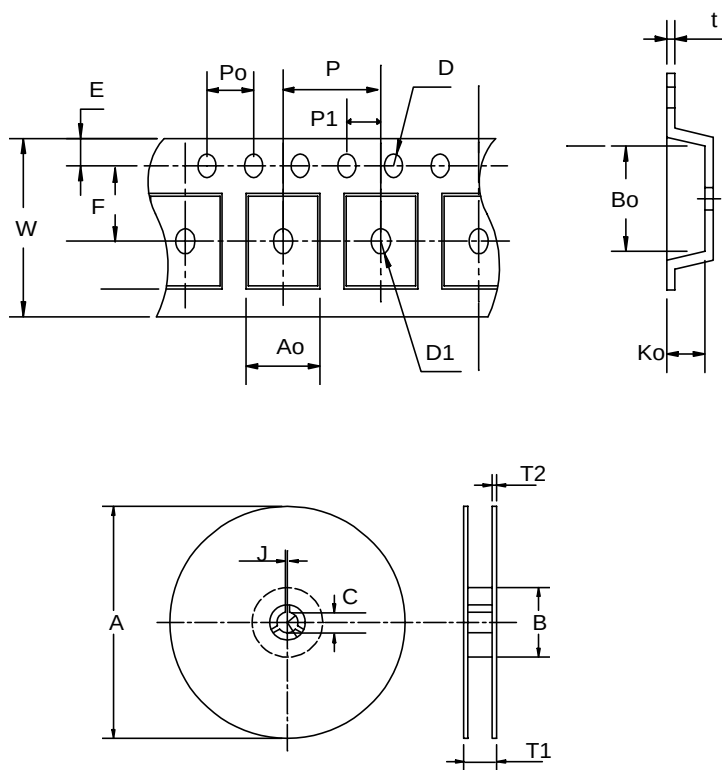
|                                             | Convection or IR/<br>Convection | VPR                        |
|---------------------------------------------|---------------------------------|----------------------------|
| Average ramp-up rate(183°C to Peak)         | 3°C/second max.                 | 10°C /second max.          |
| Preheat temperature 125 ± 25°C)             | 120 seconds max.                |                            |
| Temperature maintained above 183°C          | 60 ~ 150 seconds                |                            |
| Time within 5 °C of actual peak temperature | 10 ~ 20 seconds                 | 60 seconds                 |
| Peak temperature range                      | 220 +5/-0°C or 235 +5/-0°C      | 215~ 219°C or 235 +5/-0 °C |
| Ramp-down rate                              | 6°C /second max.                | 10°C /second max.          |
| Time 25 °C to peak temperature              | 6 minutes max.                  |                            |

| pkg. thickness ≥ 2.5mm<br>and all bags | pkg. thickness < 2.5mm and<br>pkg. volume ≥ 350 mm | pkg. thickness < 2.5mm and pkg.<br>volume < |
|----------------------------------------|----------------------------------------------------|---------------------------------------------|
| Convection 220 +5/-0°C                 |                                                    | Convection 235 +5/-0°C                      |
| VPR 215-219°C                          |                                                    | VPR 235 +5/-0°C                             |
| IR/Convection 220 +5/-0°C              |                                                    | IR/Convection 235 +5/-0°C                   |

## Reliability test Program

| Test item     | Method              | Description                  |
|---------------|---------------------|------------------------------|
| SOLDERABILITY | MIL-STD-883D-2003   | 245° C , 5 SEC               |
| HOLT          | MIL-STD-883D-1005.7 | 1000 Hrs Bias @ 125 °C       |
| PCT           | JESD-22-B, A102     | 168 Hrs, 100 % RH , 121 °C   |
| TST           | MIL-STD-883D-1011.9 | -65° C ~ 150° C , 200 Cycles |
| ESD           | MIL-STD-883D-3015.7 | VHBM > 2KV, VMM > 200V       |
| Latch-Up      | JESD 78             | 10ms , $I_{tr} > 100mA$      |

## Carrier Tape & Reel Dimensions



| Application | A          | B         | C           | J         | T1        | T2        | W                    | P          | E           |
|-------------|------------|-----------|-------------|-----------|-----------|-----------|----------------------|------------|-------------|
| SOT-89      | 178 ± 1    | 70 ± 2    | 13.5 ± 0.15 | 3 ± 0.15  | 14 ± 2    | 1.3 ± 0.3 | 12 + 0.3<br>12 - 0.1 | 8 ± 0.1    | 1.75 ± 0.1  |
| Application | F          | D         | D1          | Po        | P1        | Ao        | Bo                   | Ko         | t           |
| SOT-89      | 5.5 ± 0.05 | 1.5 ± 0.1 | 1.5 ± 0.1   | 4.0 ± 0.1 | 2.0 ± 0.1 | 4.8 ± 0.1 | 4.5 ± 0.1            | 1.80 ± 0.1 | 0.3 ± 0.013 |

(mm)

## Cover Tape Dimensions

| Application | Carrier Width | Cover Tape Width | Devices Per Reel |
|-------------|---------------|------------------|------------------|
| SOT- 89     | 12            | 9.3              | 1000             |

## Customer Service

**Anpec Electronics Corp.**

Head Office :

5F, No. 2 Li-Hsin Road, SBIP,  
Hsin-Chu, Taiwan, R.O.C.

Tel : 886-3-5642000

Fax : 886-3-5642050

Taipei Branch :

7F, No. 137, Lane 235, Pac Chiao Rd.,  
Hsin Tien City, Taipei Hsien, Taiwan, R. O. C.

Tel : 886-2-89191368

Fax : 886-2-89191369