

800mA Low Dropout Fast Response Positive Adjustable Regulator and Fixed 1.8V, 2.5V and 3.3V

Features

- Guaranteed Output Voltage Accuracy within 2%
- Fast Transient Response
- Guaranteed Dropout Voltage at Multiple Currents
- Load Regulation : 0.6% Typ.
- Line Regulation : 0.03% Typ.
- Low Dropout Voltage : 1.3V Typ. at $I_{OUT} = 500\text{mA}$
- Current Limit : 0.8A Min. at $T_j = 125^\circ\text{C}$
- On-Chip Thermal Limiting : 150 $^\circ\text{C}$ Typ.
- Adjustable Output : 1.25~7.15V
- Standard 3-pin SOT-89 and TO-92 Power Packages.

Applications

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

General Description

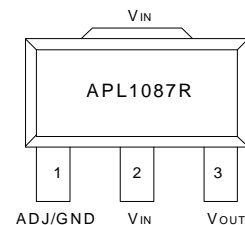
The APL1087R is a low dropout three-terminal adjustable regulators with 0.8A output current capability. In order to obtain lower dropout voltage and faster transient response, which is critical for low voltage applications, the APL1087R has been optimized.

The device is available in an adjustable version and fixed output voltages of 1.8V, 2.5V and 3.3V, the output available voltage range is from 1.25~7.15V with an input supply below 9V. Dropout voltage is guaranteed at a maximum of 1.45V at 0.5A.

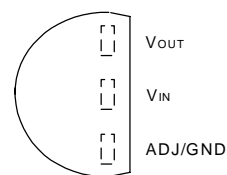
Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload that would create excessive junction temperatures.

The APL1087R is available in the industry standard 3-pin SOT-89 and TO-92 power packages.

Pin Description



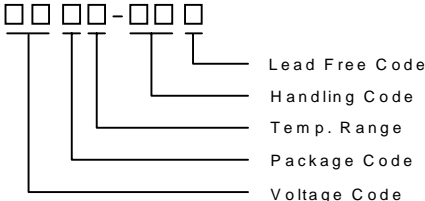
SOT-89 (Front View)



TO-92 (Top View)

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

Ordering and Marking Information

| | | |
|---|--|---------------------|
| <p>APL1087R- □□□□-□□□</p>  <p>Lead Free Code Handling Code Temp. Range Package Code Voltage Code</p> | <p>Package Code D : SOT-89 E : TO-92</p> <p>Temp. Range C : 0 to 70 °C</p> <p>Handling Code TU : Tube TR : Tape & Reel</p> <p>Voltage Code 18 : 1.8V 25 : 2.5V 33 : 3.3V</p> <p>Blank : Adjustable Version</p> <p>Lead Free Device L : Lead Free Device Blank : Original Device</p> | |
| APL1087R D/E : | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 2px;">APL1087R XXXXX</td> </tr> </table> XXXXX - Date Code | APL1087R XXXXX |
| APL1087R XXXXX | | |
| APL1087R-18D/E : | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 2px;">APL1087R XXXXX18</td> </tr> </table> XXXXX - Date Code | APL1087R XXXXX18 |
| APL1087R XXXXX18 | | |
| APL1087R-25D/E : | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 2px;">APL1087R XXXXX25</td> </tr> </table> XXXXX - Date Code | APL1087R XXXXX25 |
| APL1087R XXXXX25 | | |
| APL1087R-33D/E : | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 2px;">APL1087R XXXXX33</td> </tr> </table> XXXXX - Date Code | APL1087R XXXXX33 |
| APL1087R XXXXX33 | | |

Absolute Maximum Ratings

| Symbol | Parameter | Rating | Unit |
|---------------|---|-------------|------|
| V_I | Input Voltage | 9 | V |
| T_J | Operating Junction Temperature Range | | °C |
| | Control Section | 0 to 125 | |
| | Power Transistor | 0 to 150 | |
| T_{STG} | Storage Temperature Range | -65 to +150 | °C |
| T_L | Lead Temperature (Soldering, 10 second) | 260 | °C |
| θ_{JA} | Thermal Resistance from Junction to Ambient in Free Air | | °C/W |
| | SOT-89 | 180 | |
| | TO-92 | 180 | |

Electrical Characteristics

| Symbol | Parameter | Test Conditions | APL1087R | | | Unit |
|------------------|---------------------------|--|----------|-------|-------|------------|
| | | | Min. | Typ. | Max. | |
| V_{REF} | Reference Voltage | $10mA \leq I_{OUT} \leq 0.5A$, $3.1V \leq V_{IN} \leq 9V$, $T_J = 0 \sim 125^\circ C$ | 1.225 | 1.250 | 1.275 | V |
| V_{OUT} | Output Voltage | $T_J = 0 \sim 125^\circ C$, | | | | V |
| | APL1087R-18 | $0 \leq I_{OUT} \leq 0.5A$, $3.25V \leq V_{IN} \leq 9V$, | 1.764 | 1.800 | 1.836 | |
| | APL1087R-25 | $0 \leq I_{OUT} \leq 0.5A$, $3.95V \leq V_{IN} \leq 9V$, | 2.450 | 2.500 | 2.550 | |
| | APL1087R-33 | $0 \leq I_{OUT} \leq 0.5A$, $4.75V \leq V_{IN} \leq 9V$, | 3.235 | 3.300 | 3.365 | |
| REG_{LINE} | Line Regulation | $T_J = 0 \sim 125^\circ C$ | | | | % mV |
| | APL1087R | $I_{OUT} = 10mA$, $3.1V \leq V_{IN} \leq 9V$, (note 1) | | 0.03 | 0.2 | |
| | APL1087R-18 | $I_{OUT} = 0mA$, $3.25V \leq V_{IN} \leq 9V$, (note 1) | | 1 | 6 | |
| | APL1087R-25 | $I_{OUT} = 0A$, $3.95V \leq V_{IN} \leq 9V$, (note 1) | | 1 | 6 | |
| | APL1087R-33 | $I_{OUT} = 0A$, $4.75V \leq V_{IN} \leq 9V$, (note 1) | | 1 | 6 | |
| REG_{LOAD} | Load Regulation | $T_J = 0 \sim 125^\circ C$ | | | | % |
| | APL1087R | $(V_{IN} - V_{OUT}) = 3V$, $0 \leq I_{OUT} \leq 0.5A$, (note 1) | | 0.4 | 0.6 | |
| | APL1087R-18 | $V_{IN} = 3.25V$, $0 \leq I_{OUT} \leq 0.5A$, (note 1) | | | | |
| | APL1087R-25 | $V_{IN} = 3.95V$, $0 \leq I_{OUT} \leq 0.5A$, (note 1) | | | | |
| | APL1087R-33 | $V_{IN} = 4.75V$, $0 \leq I_{OUT} \leq 0.5A$, (note 1) | | | | |
| V_D | Dropout Voltage | $I_{OUT} = 0.5A$, $T_J = 0 \sim 125^\circ C$ | | 1.3 | 1.45 | V |
| I_{LIMIT} | Current Limit | $(V_{IN} - V_{OUT}) = 5V$, $T_J = 25^\circ C$ | 800 | | | mA |
| I_{ADJ} | Adjust Pin Current | $(V_{IN} - V_{OUT}) = 3V$, $I_{OUT} = 10mA$, $T_J = 0 \sim 125^\circ C$ | | 60 | 120 | μA |
| ΔI_{ADJ} | Adjust Pin Current Change | $T_J = 0 \sim 125^\circ C$, $10mA \leq I_{OUT} \leq 0.5A$, $1.45V \leq V_{IN} - V_{OUT} \leq 7.55V$ | | 0.2 | 5 | μA |
| I_O | Minimum Load Current | $T_J = 0 \sim 125^\circ C$, $V_{IN} = 9V$, (note 3) | | 1.7 | | mA |
| PSRR | Ripple Rejection | $F_{RIPPLE} = 120Hz$, $V_{RIPPLE} = 1V_{P-P}$, $(V_{IN} - V_{OUT}) = 3V$, $T_J = 0 \sim 125^\circ C$ | 60 | 75 | | dB |
| T_R | Thermal Regulation | $T_J = 25^\circ C$, 30ms Pulse | | 0.01 | 0.02 | %/W |
| T_S | Temperature Stability | | | 0.5 | | % |
| L_S | Long -Term Stability | $T_J = 125^\circ C$, 1000Hrs. | | 0.3 | | % |
| V_N | RMS Output Noise | $T_J = 25^\circ C$, $10Hz \leq F \leq 10kHz$, (% of V_{OUT}) | | 0.003 | | % |
| OT | Over Temperature Point | | | 150 | | $^\circ C$ |
| | Quiescent Current | $T_J = 0 \sim 125^\circ C$, | | | | mA |
| | APL1087R-18 | $V_{IN} \leq 9V$ | | 5.5 | 10 | |
| | APL1087R-25 | $V_{IN} \leq 9V$ | | 5.5 | 10 | |
| | APL1087R-33 | $V_{IN} \leq 9V$ | | 5.5 | 10 | |

Electrical Characteristics (Cont.)

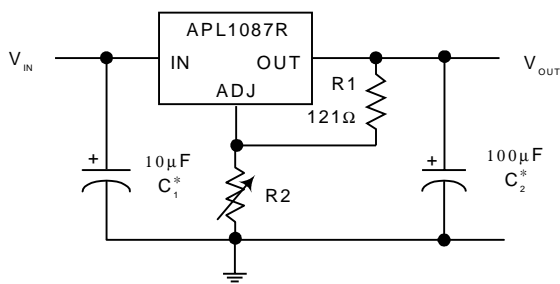
Note 1: See thermal regulation specifications for changes in output voltage due to heating effects. Load line regulations are measured at a constant junction temperature by low duty cycle pulse testing.

Note 2: Dropout voltage is specified over the full output current range of the device. Dropout voltage is defined as the minimum input/output differential measured at the specified output current. Test points and limits are also shown on the Dropout Voltage curve.

Note 3: Minimum load current is defined as the minimum output current required to maintain regulation.

Application Circuits

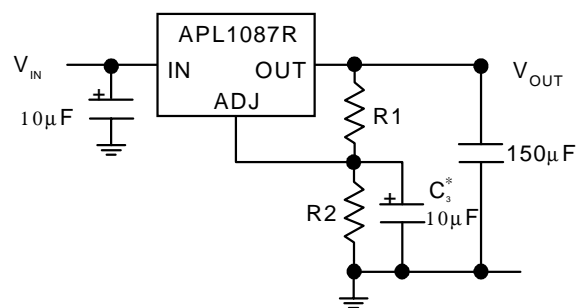
1.25V to 7.15V Adjustable Regulator



* Needed if device is far from filter capacitors

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

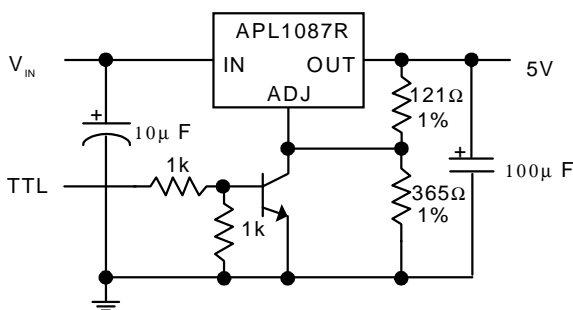
Improving Ripple Rejection



* C₃ improves ripple rejection.

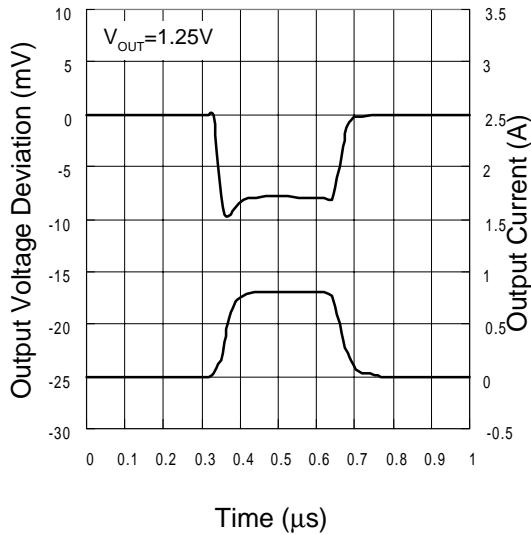
X_C should be approximately equal to R₁ at ripple frequency

5V Regulator with Shutdown

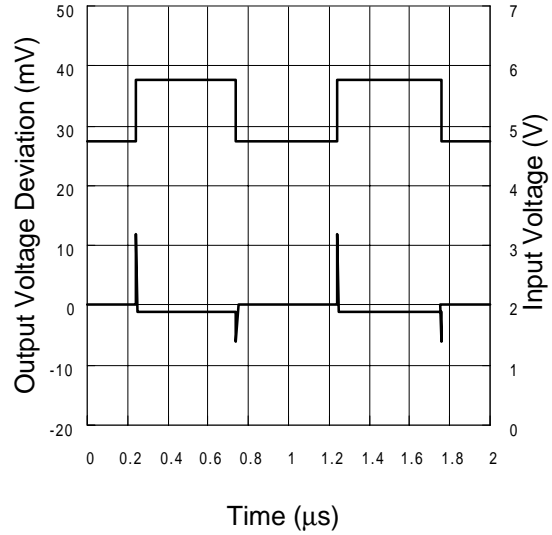


Typical Characteristics

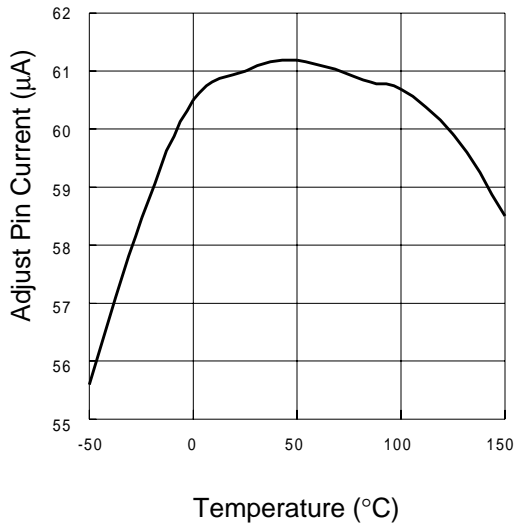
Load Transient Response



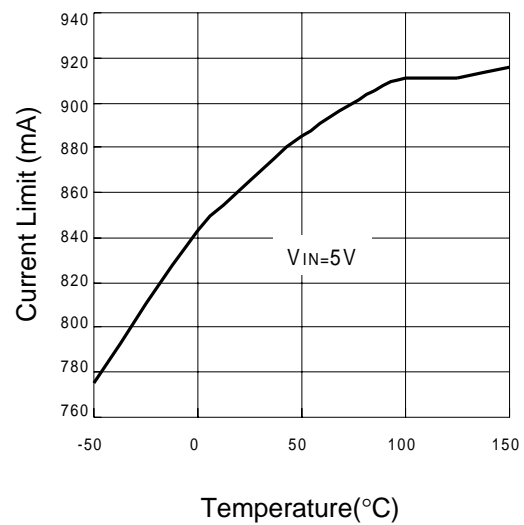
Line Transient Response



Adjust Pin Current vs. Temperature

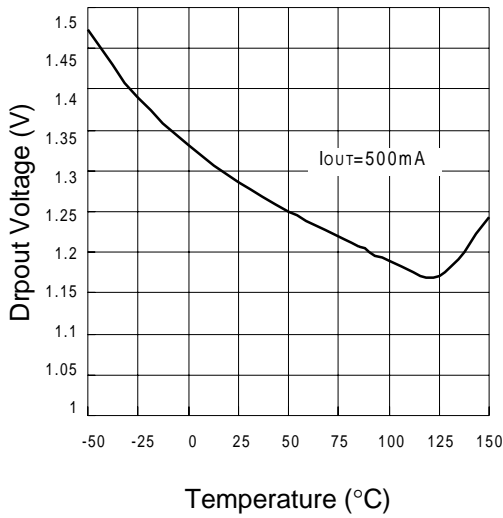


Current Limit vs. Temperature

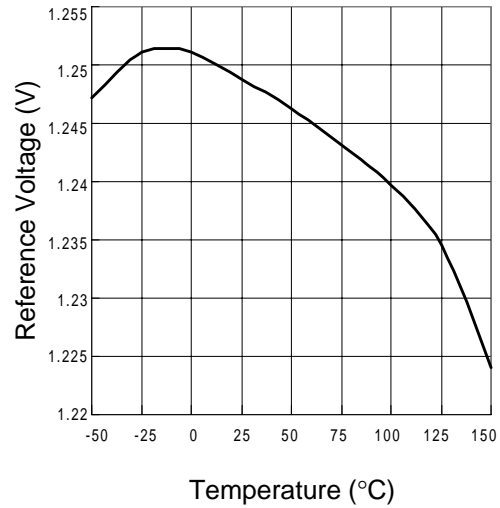


Typical Characteristics (Cont.)

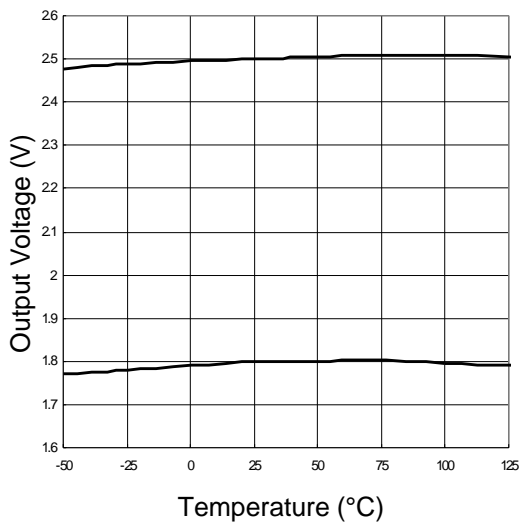
Dropout Voltage vs. Temperature



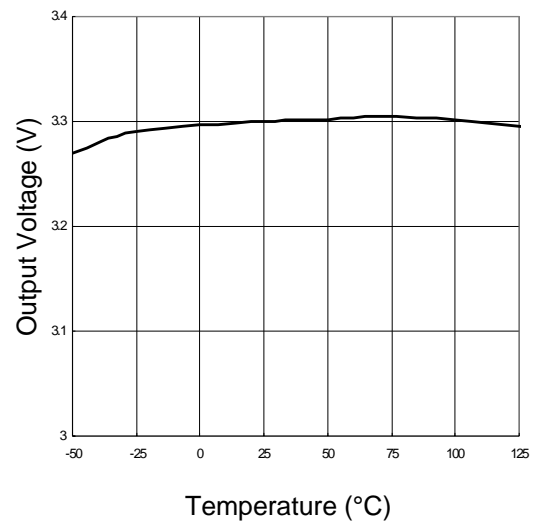
Reference Voltage vs. Temperature



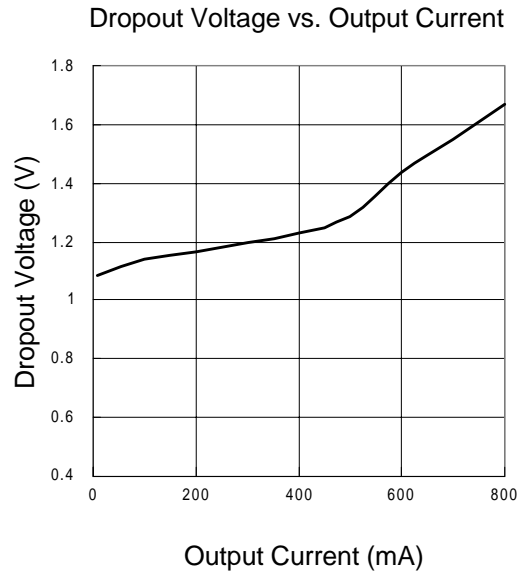
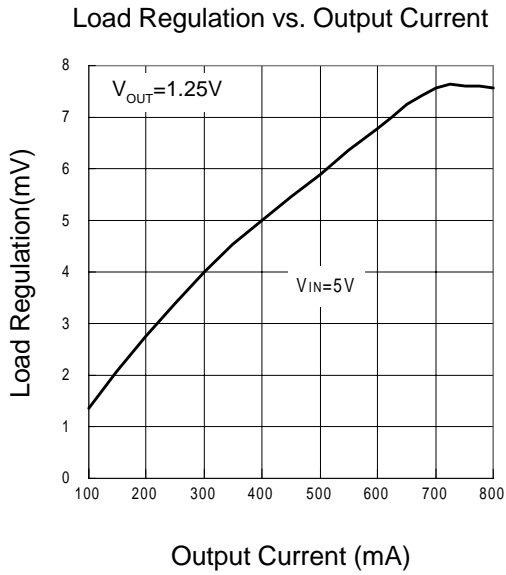
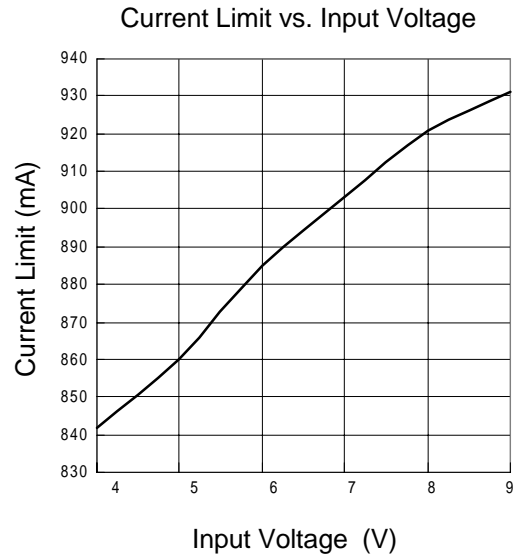
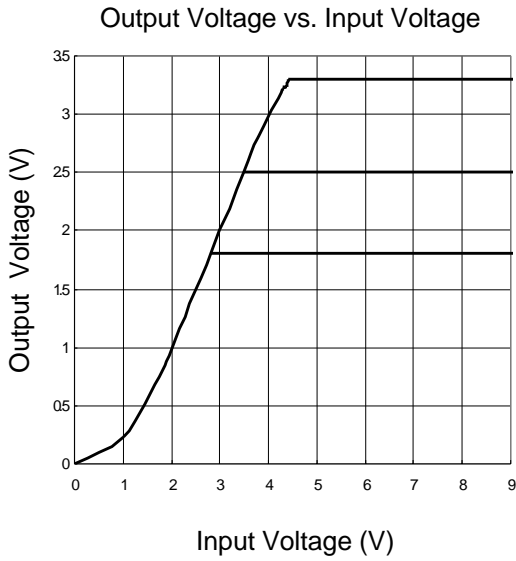
Output Voltage vs. Temperature



Output Voltage vs. Temperature

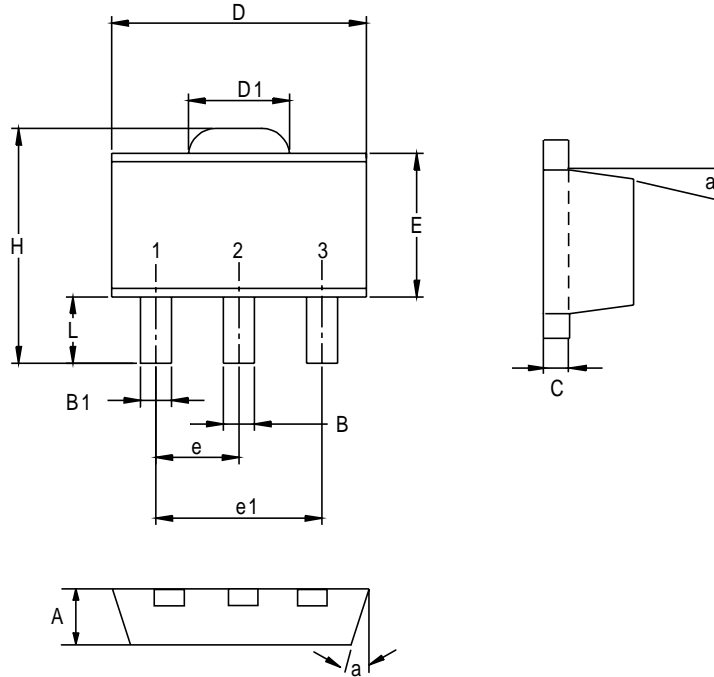


Typical Characteristics (Cont.)



Package Information

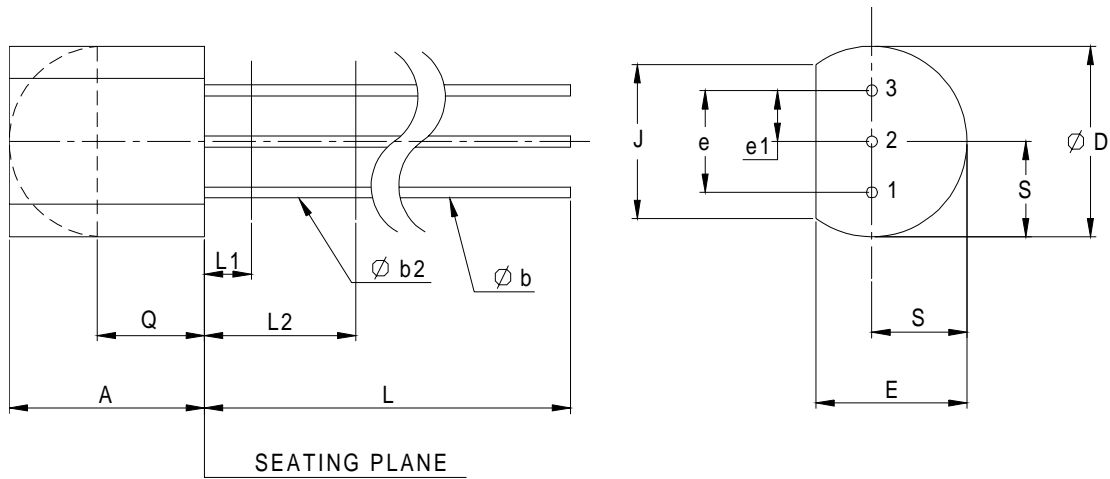
SOT-89 (Reference EIAJ ED-7500A Registration SC-62)



| 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° |

Package Information

TO-92

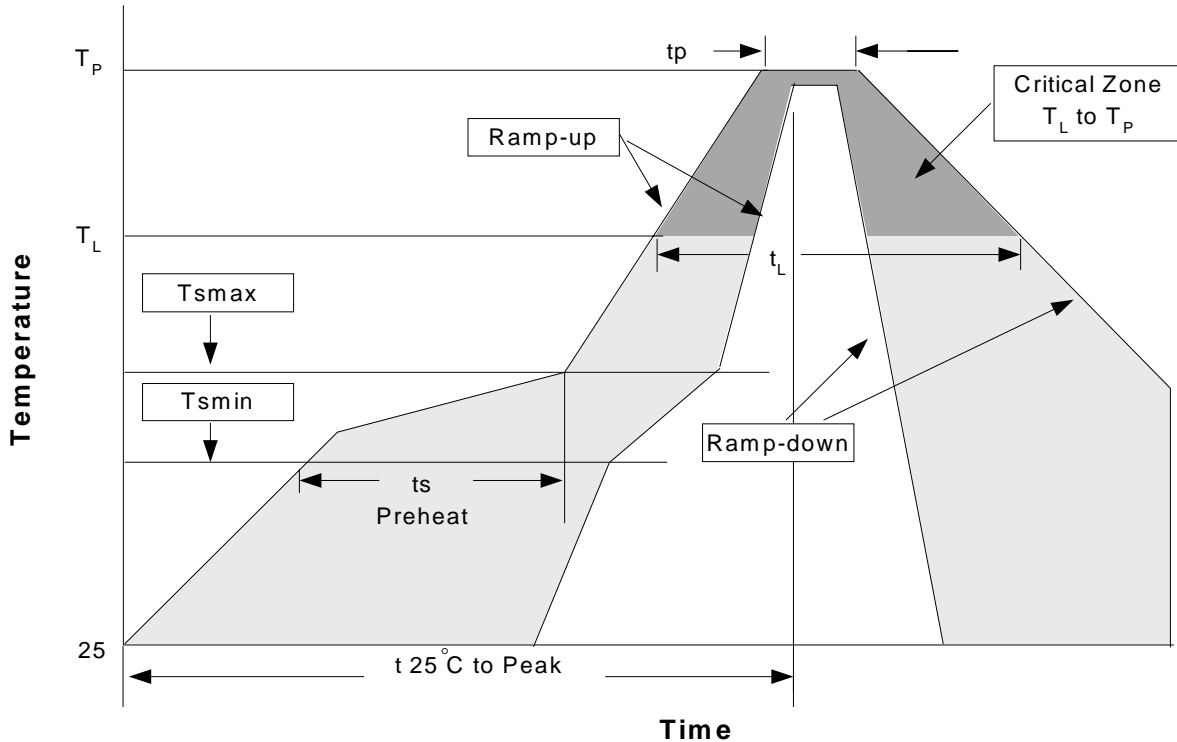


| Dim | Millimeters | | Inches | |
|------|-------------|------|--------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.58 | 5.33 | 0.170 | 0.210 |
| φ b | 0.41 | 0.53 | 0.160 | 0.021 |
| φ b2 | 0.41 | 0.48 | 0.160 | 0.019 |
| φ D | 4.96 | 5.20 | 0.175 | 0.205 |
| E | 3.94 | 4.19 | 0.125 | 0.165 |
| 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 |

Physical Specifications

| | |
|--------------------|--|
| Terminal Material | Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn |
| Lead Solderability | Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3. |

Reflow Condition (IR/Convection or VPR Reflow)



Classification Reflow Profiles

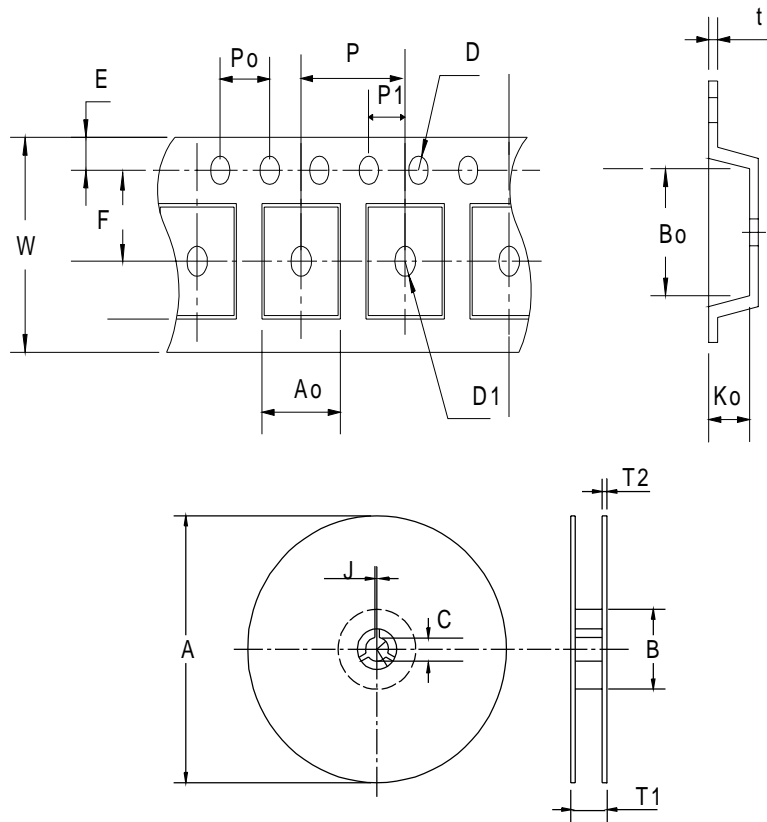
| Profile Feature | Sn-Pb Eutectic Assembly | | Pb-Free Assembly | |
|---|-------------------------|---------------|------------------|---------------|
| | Large Body | Small Body | Large Body | Small Body |
| Average ramp-up rate (T _L to T _P) | 3°C/second max. | | 3°C/second max. | |
| Preheat | | | | |
| - Temperature Min (T _{smin}) | 100°C | | 150°C | |
| - Temperature Mix (T _{smax}) | 150°C | | 200°C | |
| - Time (min to max)(t _s) | 60-120 seconds | | 60-180 seconds | |
| T _{smax} to T _L | | | | |
| - Ramp-up Rate | | | 3°C/second max | |
| T _{smax} to T _L | | | | |
| - Temperature(T _L) | 183°C | | 217°C | |
| - Time (t _L) | 60-150 seconds | | 60-150 seconds | |
| Peak Temperature(T _p) | 225 +0/-5°C | 240 +0/-5°C | 245 +0/-5°C | 250 +0/-5°C |
| Time within 5°C of actual Peak Temperature(t _p) | 10-30 seconds | 10-30 seconds | 10-30 seconds | 20-40 seconds |
| Ramp-down Rate | 6°C/second max. | | 6°C/second max. | |
| Time 25°C to Peak Temperature | 6 minutes max. | | 8 minutes max. | |

Note: All temperatures refer to topside of the package. Measured on the body surface.

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, $1_{tr} > 100mA$ |

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 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