

## 3A Low Dropout Fast Response Positive Adjustable Regulator and Fixed 3.3V

### Features

- **Fast Transient Response**
- **Guaranteed Dropout Voltage at Multiple Currents**
- **Load Regulation : 0.05% Typ.**
- **Line Regulation : 0.03% Typ.**
- **Low Dropout Voltage : 1.2V Typ. at  $I_{OUT} = 3A$**
- **Trimmed Current Limit : 3A Typ. at  $T_J = 125^{\circ}C$**
- **On-Chip Thermal Limiting : 150 $^{\circ}C$  Typ.**
- **Standard 3-Pin TO-220, TO-252, and TO-263 Power Package**
- **Lead Free and Green Devices Available (RoHS Compliant)**

### Applications

- **Pentium™ Processor Supplies**
- **Power PC™ Supplies**
- **Low Voltage Logic Supplies**
- **Battery-Powered Circuitry**
- **Post Regulator for Switching Power Supply**

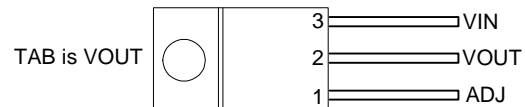
### General Description

The APL1085 is a low dropout three-terminal adjustable regulator with 3A output current capability. In order to obtain lower dropout voltage and faster transient response which is critical for low voltage applications, the APL1085 has been optimized. The output available voltage range of adjustable version is from 1.25 to 5.75V with an input supply below 7V, and the fixed 3.3V output voltage device is also available.

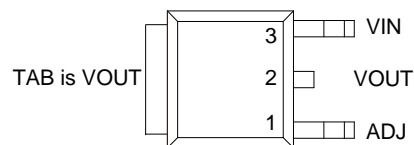
Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload that would create excessive junction temperatures.

The APL1085 is available in both the through-hole and surface mount versions of the industry standard 3-pin TO-220, TO-252, and TO-263 power packages.

### Pin Configuration



Front View APL1085 TO-220 Package



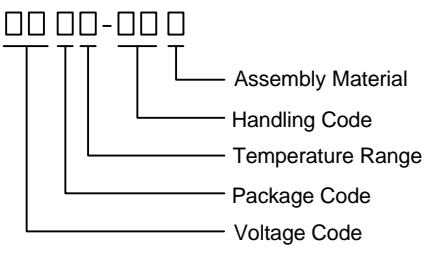


Front View APL1085 TO-252 Package



Front View APL1085 TO-263 Package

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>APL1085 <span style="font-family: monospace;">□□□□-□□□</span></p>  <ul style="list-style-type: none"> <li>— Assembly Material</li> <li>— Handling Code</li> <li>— Temperature Range</li> <li>— Package Code</li> <li>— Voltage Code</li> </ul> | <p>Package Code<br/>G : TO-263-3 U : TO-252-3 F : TO-220-3</p> <p>Temperature Range<br/>C : 0 to 70 °C</p> <p>Handling Code<br/>TR : Tape &amp; Reel TU : Tube</p> <p>Voltage Code :<br/>33 : 3.3V Blank : Adjustable Version</p> <p>Assembly Material<br/>L : Lead Free Device<br/>G : Halogen and Lead Free Device</p> |
| <p>APL1085 U/G/F :  XXXXX</p>   | <p>XXXXX - Date Code</p>   |
| <p>APL1085-33 U/G/F :  XXXXX</p>  | <p>XXXXX - Date Code</p>   |

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020D for MSL classification at lead-free peak reflow temperature. ANPEC defines “Green” to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

## Absolute Maximum Ratings (Note 1, 2)

| Symbol    | Parameter                                      | Rating             | Unit |
|-----------|--|--------------------|------|
| $V_I$     | Input Voltage                                  | 7                  | V    |
| $P_D$     | Power Dissipation                              | Internally Limited | W    |
| $T_J$     | Junction Temperature                           | 150                | °C   |
| $T_{STG}$ | Storage Temperature Range                      | -65 to +150        | °C   |
| $T_L$     | Maximum Lead Soldering Temperature, 10 Seconds | 260                | °C   |

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2: The maximum allowable power dissipation at any  $T_A$  (ambient temperature) is calculated using:  $P_D (max) = (T_J - T_A) / \theta_{JA}$ ;  $T_J = 125^\circ\text{C}$ . Exceeding the maximum allowable power dissipation will result in excessive die temperature.

## Electrical Characteristics

| Symbol       | Parameter         | Test Conditions  | APL1085        |              |                | Unit |
|--------------|-------------------|--|----------------|--------------|----------------|------|
|              |                   |  | Min.           | Typ.         | Max.           |      |
| $V_{REF}$    | Reference Voltage | $1.5V \leq (V_{IN} - V_{OUT}) \leq 5.75V$ ,<br>$10mA \leq I_{OUT} \leq 3A$ , $T_J = 0 \sim 125^\circ\text{C}$  | 1.225<br>(-2%) | 1.250        | 1.275<br>(+2%) | V    |
| $V_{OUT}$    | Output Voltage    | $10mA \leq I_{OUT} \leq 3A$ , $4.75V \leq V_{IN} \leq 7V$ ,<br>$T_J = 0 \sim 125^\circ\text{C}$  | 3.235<br>(-2%) | 3.300        | 3.365<br>(+2%) | V    |
| $REG_{LINE}$ | Line Regulation   | $T_J = 0 \sim 125^\circ\text{C}$ , <sup>(Note 3)</sup><br>APL1085 $2.75V \leq V_{IN} \leq 7V$ , $I_{OUT} = 10mA$ ,<br>APL1085-33 $4.75V \leq V_{IN} \leq 7V$ , $I_{OUT} = 0mA$ | -              | 0.03         | 0.2            | %    |
| $REG_{LOAD}$ | Load Regulation   | $T_J = 25^\circ\text{C}$ , <sup>(Note 3)</sup><br>APL1085 $(V_{IN} - V_{OUT}) = 3V$ , $10mA \leq I_{OUT} \leq 3A$<br>APL1085-33 $V_{IN} = 5V$ , $0mA \leq I_{OUT} \leq 3A$     | -              | 0.05<br>0.05 | 0.3<br>0.5     | %    |

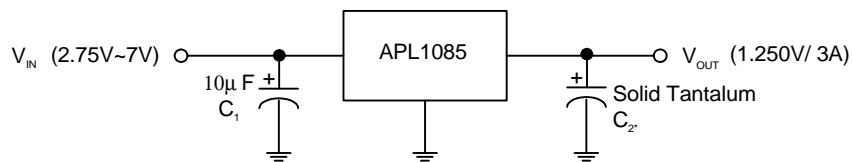
## Electrical Characteristics (Cont.)

| Symbol           | Parameter                            | Test Conditions   | APL1085    |            |      | Unit         |
|------------------|--------------------------------------|---|------------|------------|------|--------------|
|                  |                                      |   | Min.       | Typ.       | Max. |              |
| $V_D$            | Dropout Voltage                      | $\Delta V_{REF}=1\%$ , $I_{OUT}=3A$ ,<br>$T_J=0\sim 125^\circ C$                    | -          | 1.3        | 1.4  | V            |
| $I_{LIMIT}$      | Current Limit                        | $(V_{IN}-V_{OUT})=1.7V$ , $T_J=25^\circ C$<br>$T_J=125^\circ C$                     | 4.5<br>3.5 | 6.0<br>5.0 | -    | A            |
|                  |                                      | $(V_{IN}-V_{OUT})=3V$ , $T_J=25^\circ C$<br>$T_J=125^\circ C$                       | 5.0<br>4.0 | 6.5<br>5.5 | -    |              |
| $I_{ADJ}$        | Adjust Pin Current                   | $(V_{IN}-V_{OUT})=3V$ , $I_{OUT}=10mA$ , $T_J=0\sim 125^\circ C$                    | -          | 60         | 120  | $\mu A$      |
| $\Delta I_{ADJ}$ | Adjust Pin Current Change<br>APL1085 | $1.5V \leq (V_{IN}-V_{OUT}) \leq 5.75V$ , $10mA \leq I_{OUT} \leq 3A$               | -          | 0.2        | 5    | $\mu A$      |
| $I_{LMIN}$       | Minimum Load Current<br>APL1085      | $1.5V \leq (V_{IN}-V_{OUT}) \leq 5.75V$ , $T_J=0\sim 125^\circ C$                   | -          | 2          | 10   | mA           |
| $I_Q$            | Quiescent Current<br>APL1085-33      | $V_{IN}=5V$   | -          | 8          | 13   | mA           |
| PSRR             | Ripple Rejection                     | $F=120Hz$ , $C_{OUT}=22\mu F$ , $T_{ant}$ , $(V_{IN}-V_{OUT})=3V$ ,<br>$I_{OUT}=3A$ | 60         | -          | -    | dB           |
| $L_S$            | Long -Term Stability                 | $T_J=125^\circ C$ , 1000Hrs.  | -          | 0.03       | 1.0  | %            |
| $V_N$            | RMS Output Noise (% of $V_{OUT}$ )   | $T_J=25^\circ C$ , $10Hz \leq F \leq 10kHz$   | -          | 0.003      | -    | %            |
| $\theta_{JC}$    | Thermal Resistance Junction to Case  |   | -          | -          | 3.0  | $^\circ C/W$ |

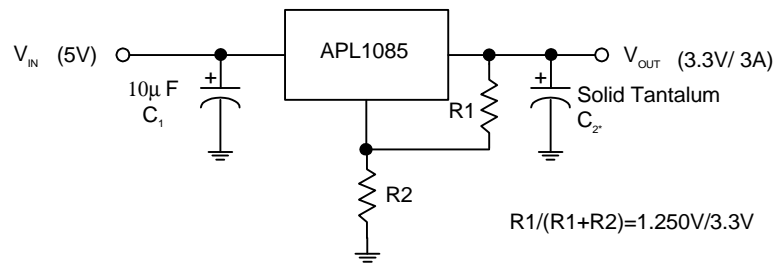
Note 3 : See thermal regulation specifications for changes in output voltage due to heating effects. Load and line regulations are measured at a constant junction temperature by low duty cycle pulse testing.

## Typical Application Circuit

Typical Regulator



5V to 3.3V Regulator



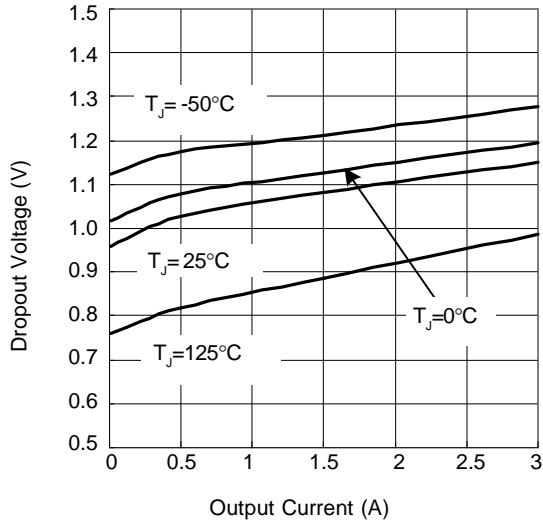
\*Required for stability

APL1085: $C_2=10\mu F$

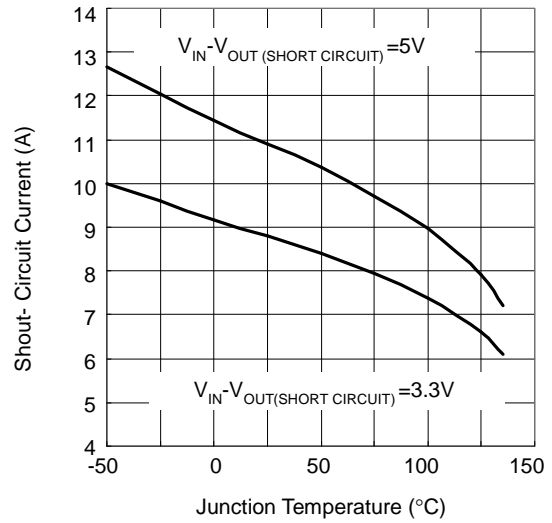
\* R1 is typically in range of 100 $\Omega$  to 120 $\Omega$

## Typical Operating Characteristics

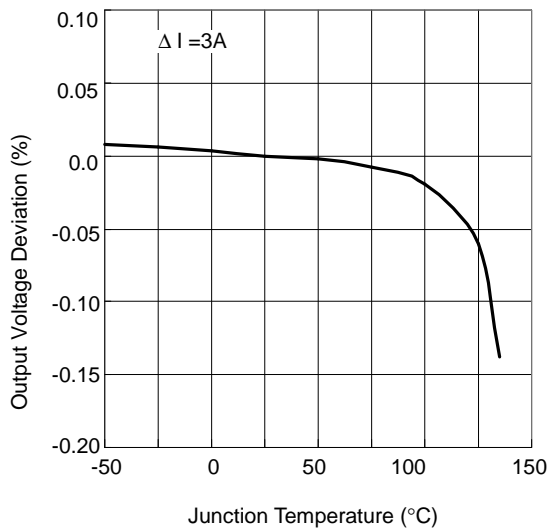
Dropout Voltage vs. Output Current



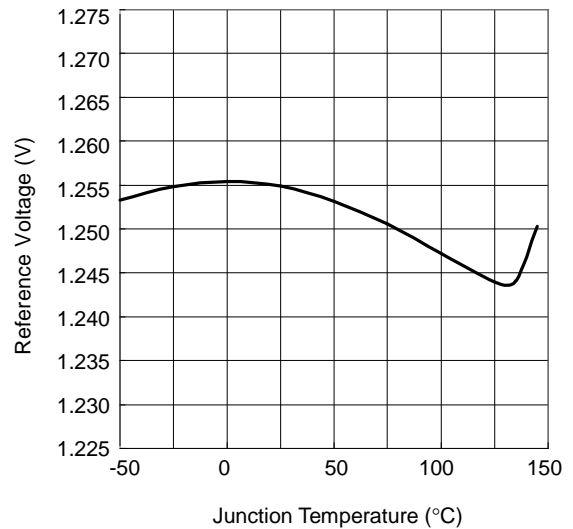
Short-Circuit Current vs. Junction Temperature



Load Regulation vs. Junction Temperature

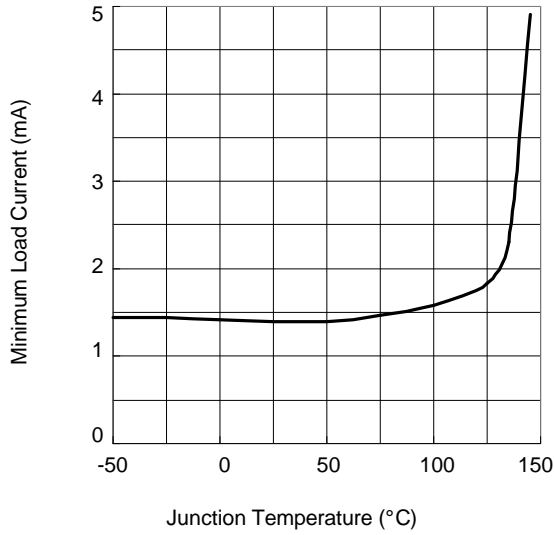


Reference Voltage vs. Junction Temperature

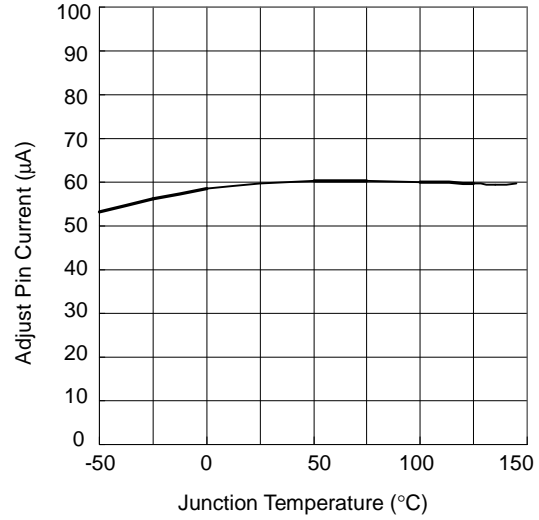


Typical Operating Characteristics (Cont.)

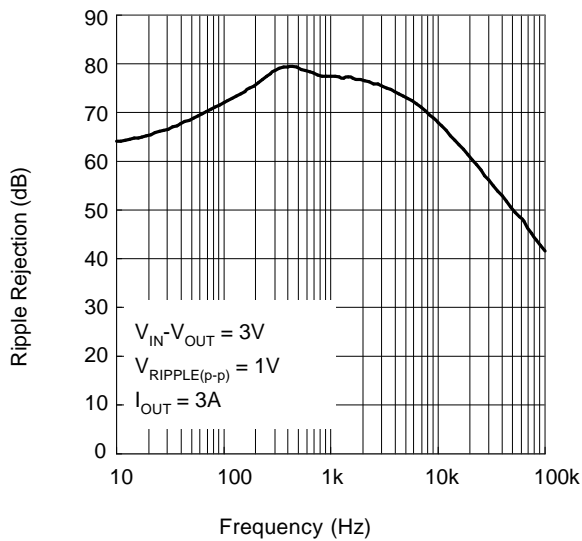
Minimum Load Current vs. Junction Temperature



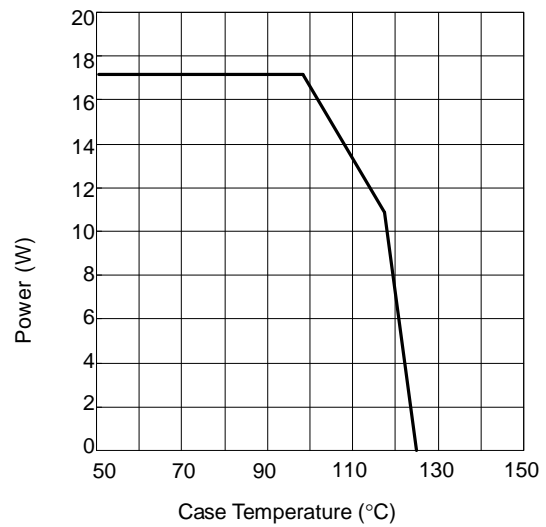
Adjust Pin Current vs. Junction Temperature



Ripple Rejection vs. Frequency



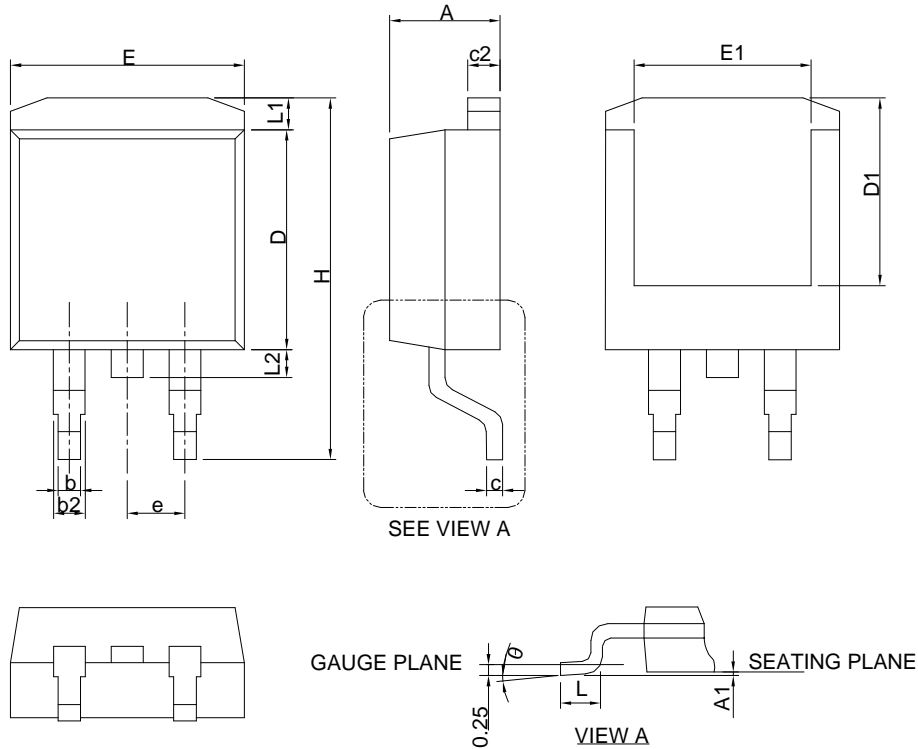
Maximum Power Dissipation\*



\* as Limited by Maximum Jcnction Temperature

Package Information

TO-263-3

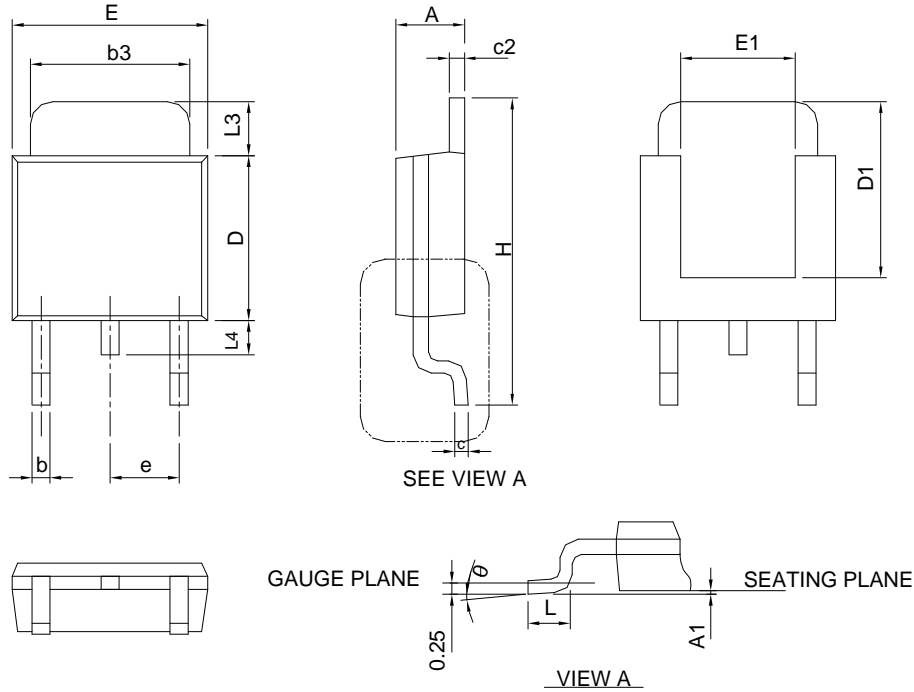


| SYMBOL | TO-263-3    |       |           |       |
|--------|-------------|-------|-----------|-------|
|        | MILLIMETERS |       | INCHES    |       |
|        | MIN.        | MAX.  | MIN.      | MAX.  |
| A      | 4.06        | 4.83  | 0.160     | 0.190 |
| A1     | 0.00        | 0.25  | 0.000     | 0.010 |
| b      | 0.51        | 0.99  | 0.020     | 0.039 |
| b2     | 1.14        | 1.78  | 0.045     | 0.070 |
| c      | 0.38        | 0.74  | 0.015     | 0.029 |
| c2     | 1.14        | 1.65  | 0.045     | 0.065 |
| D      | 8.38        | 9.65  | 0.330     | 0.380 |
| D1     | 6.00        | 9.00  | 0.236     | 0.354 |
| E      | 9.65        | 11.43 | 0.380     | 0.450 |
| E1     | 6.22        | 9.00  | 0.245     | 0.354 |
| e      | 2.54 BSC    |       | 0.100 BSC |       |
| H      | 14.61       | 15.88 | 0.575     | 0.625 |
| L      | 1.78        | 2.79  | 0.070     | 0.110 |
| L1     |             | 1.68  |           | 0.066 |
| L2     |             | 1.78  |           | 0.070 |
| θ      | 0°          | 8°    | 0°        | 8°    |

Note : Follow JEDEC TO-263 AB.

Package Information

TO-252-3 (Package 1)

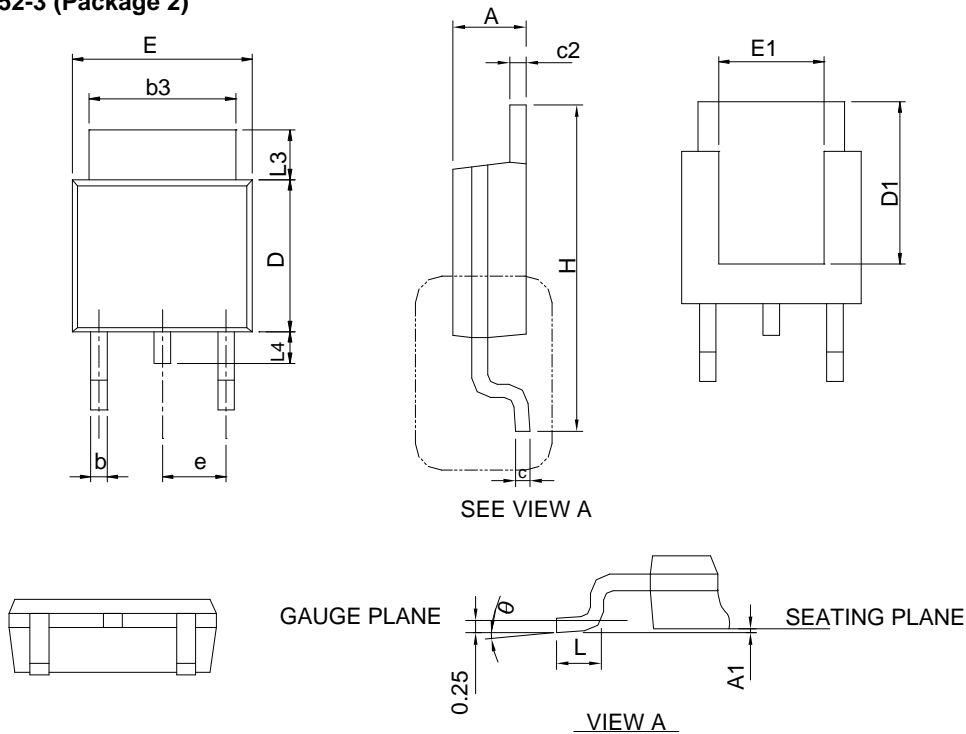


| DIMENSIONS | TO-252-3    |       |           |       |
|------------|-------------|-------|-----------|-------|
|            | MILLIMETERS |       | INCHES    |       |
|            | MIN.        | MAX.  | MIN.      | MAX.  |
| A          | 2.18        | 2.39  | 0.086     | 0.094 |
| A1         |             | 0.13  |           | 0.005 |
| b          | 0.50        | 0.89  | 0.020     | 0.035 |
| b3         | 4.95        | 5.46  | 0.195     | 0.215 |
| c          | 0.46        | 0.61  | 0.018     | 0.024 |
| c2         | 0.46        | 0.89  | 0.018     | 0.035 |
| D          | 5.33        | 6.22  | 0.210     | 0.245 |
| D1         | 4.57        | 6.00  | 0.180     | 0.236 |
| E          | 6.35        | 6.73  | 0.250     | 0.265 |
| E1         | 3.81        | 6.00  | 0.150     | 0.236 |
| e          | 2.29 BSC    |       | 0.090 BSC |       |
| H          | 9.40        | 10.41 | 0.370     | 0.410 |
| L          | 0.90        | 1.78  | 0.035     | 0.070 |
| L3         | 0.89        | 2.03  | 0.035     | 0.080 |
| L4         |             | 1.02  |           | 0.040 |
| θ          | 0°          | 8°    | 0°        | 8°    |

Note : Follow JEDEC TO-252 .

Package Information

TO-252-3 (Package 2)

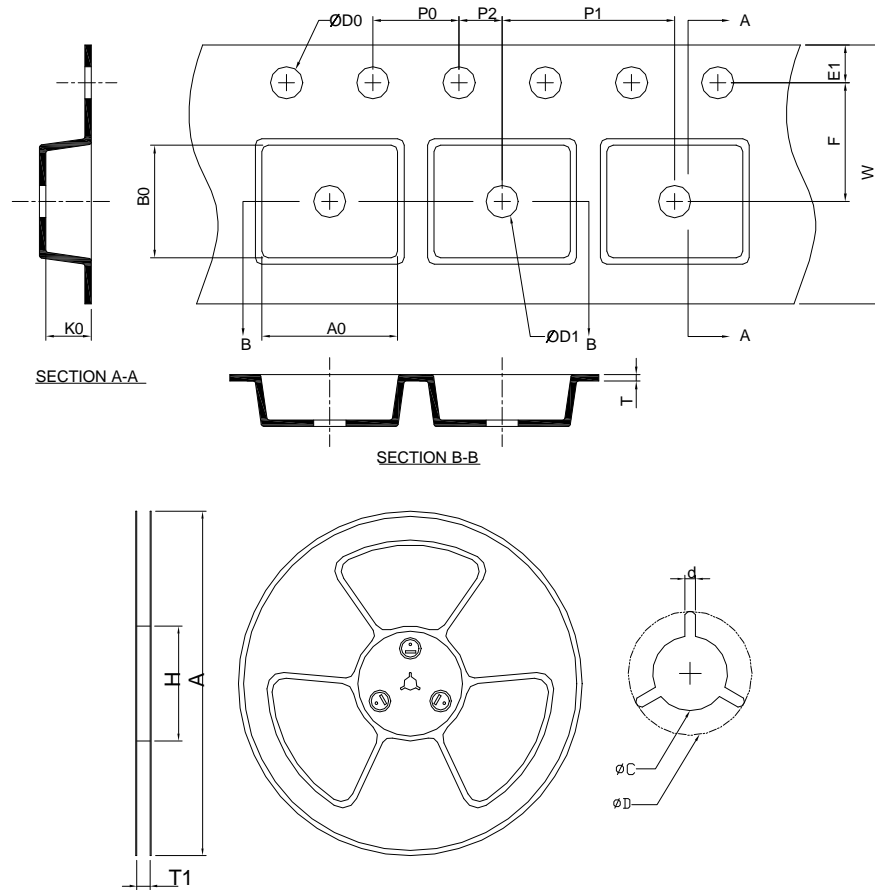


| DIMENSIONS | TO-252-3    |       |           |       |
|------------|-------------|-------|-----------|-------|
|            | MILLIMETERS |       | INCHES    |       |
|            | MIN.        | MAX.  | MIN.      | MAX.  |
| A          | 2.18        | 2.39  | 0.086     | 0.094 |
| A1         |             | 0.13  |           | 0.005 |
| b          | 0.50        | 0.89  | 0.020     | 0.035 |
| b3         | 4.95        | 5.46  | 0.195     | 0.215 |
| c          | 0.46        | 0.61  | 0.018     | 0.024 |
| c2         | 0.46        | 0.89  | 0.018     | 0.035 |
| D          | 5.33        | 6.22  | 0.210     | 0.245 |
| D1         | 4.57        | 6.00  | 0.180     | 0.236 |
| E          | 6.35        | 6.73  | 0.250     | 0.265 |
| E1         | 3.81        | 6.00  | 0.150     | 0.236 |
| e          | 2.29 BSC    |       | 0.090 BSC |       |
| H          | 9.40        | 10.41 | 0.370     | 0.410 |
| L          | 0.90        | 1.78  | 0.035     | 0.070 |
| L3         | 0.89        | 2.03  | 0.035     | 0.080 |
| L4         |             | 1.02  |           | 0.040 |
| θ          | 0°          | 8°    | 0°        | 8°    |

Note : Follow JEDEC TO-252 .



Carrier Tape & Reel Dimensions



| Application | A           | H          | T1                 | C                  | d         | D                 | W          | E1          | F          |
|-------------|-------------|------------|--------------------|--------------------|-----------|-------------------|------------|-------------|------------|
| TO-252-3    | 330.0 ±0.00 | 50 MIN.    | 16.4+2.00<br>-0.00 | 13.0+0.50<br>-0.20 | 1.5 MIN.  | 20.2 MIN.         | 16.0 ±0.30 | 1.75 ±0.10  | 7.50 ±0.05 |
|             | <b>P0</b>   | <b>P1</b>  | <b>P2</b>          | <b>D0</b>          | <b>D1</b> | <b>T</b>          | <b>A0</b>  | <b>B0</b>   | <b>K0</b>  |
|             | 4.0 ±0.10   | 8.0 ±0.10  | 2.0 ±0.05          | 1.5+0.10<br>-0.00  | 1.5 MIN.  | 0.6+0.00<br>-0.40 | 6.80 ±0.20 | 10.40 ±0.20 | 2.50 ±0.20 |
| Application | A           | H          | T1                 | C                  | d         | D                 | W          | E1          | F          |
| TO-263-3    | 330.0 ±0.00 | 50 MIN.    | 24.4+2.00<br>-0.00 | 13.0+0.50<br>-0.20 | 1.5 MIN.  | 20.2 MIN.         | 24.0 ±0.30 | 1.75 ±0.10  | 11.5 ±0.10 |
|             | <b>P0</b>   | <b>P1</b>  | <b>P2</b>          | <b>D0</b>          | <b>D1</b> | <b>T</b>          | <b>A0</b>  | <b>B0</b>   | <b>K0</b>  |
|             | 4.0 ±0.10   | 16.0 ±0.10 | 2.0 ±0.10          | 1.5+0.10<br>-0.00  | 1.5 MIN.  | 0.6+0.00<br>-0.40 | 10.8 ±0.20 | 16.1 ±0.20  | 5.2 ±0.20  |

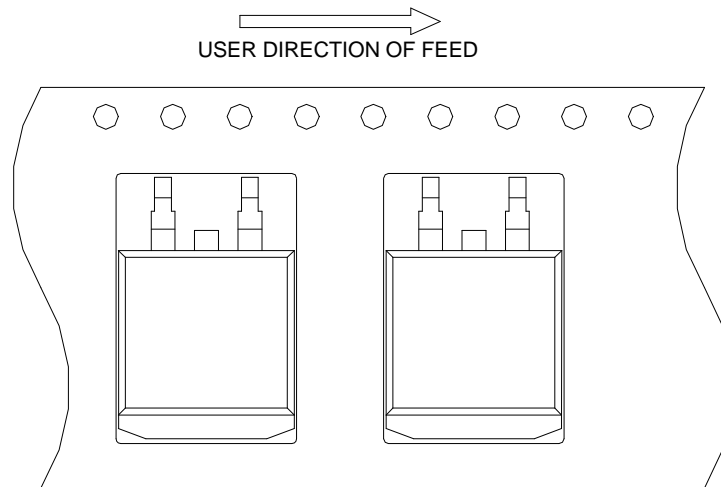
(mm)

## Devices Per Unit

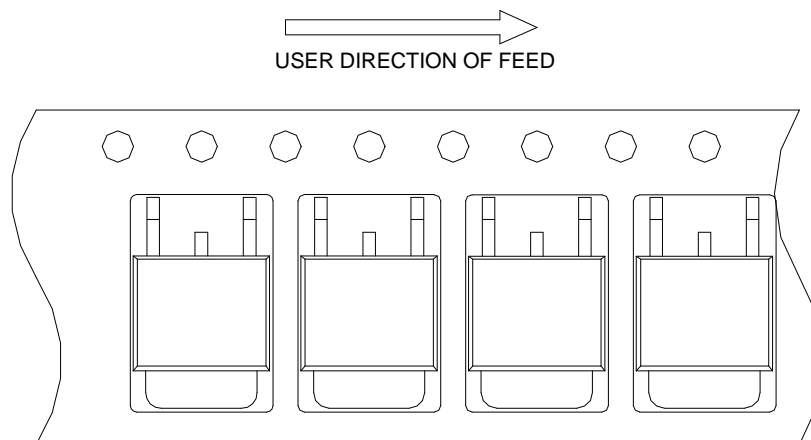
| Package Type | Unit        | Quantity |
|--------------|-------------|----------|
| TO-252-3     | Tape & Reel | 2500     |
| TO-263-3     | Tape & Reel | 800      |

## Taping Direction Information

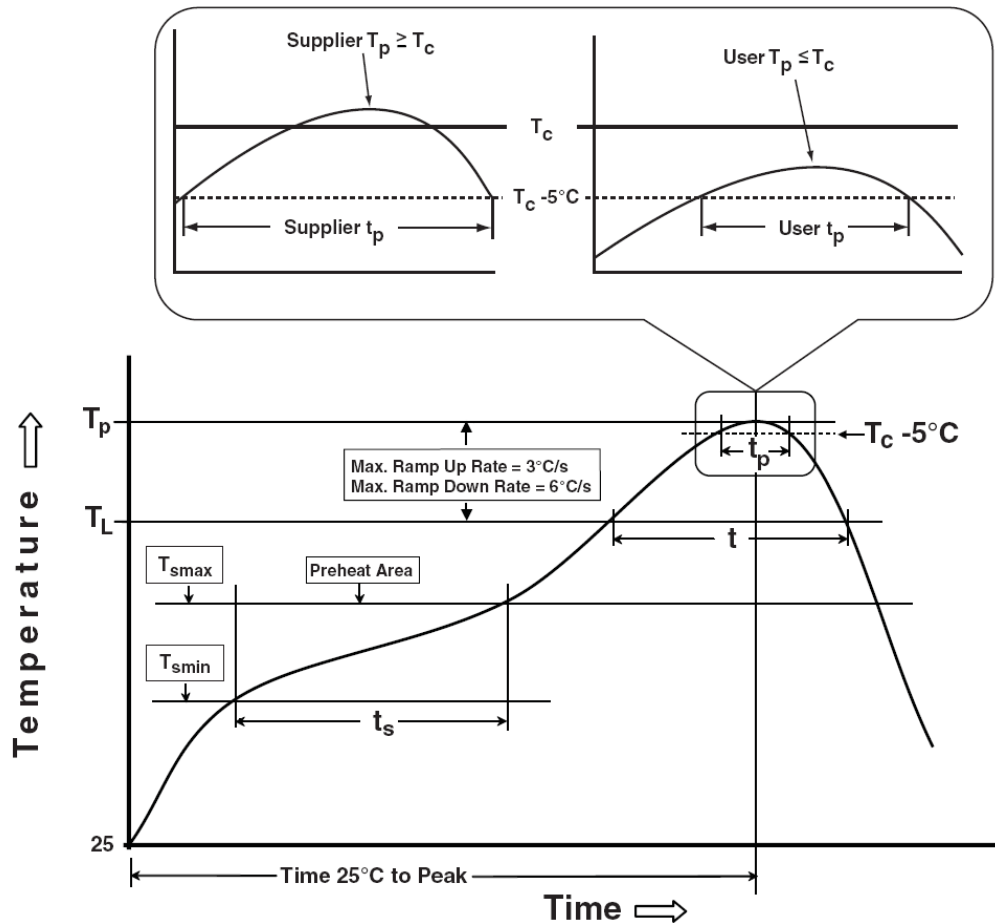
### TO-263-3



### TO-252-3



### Classification Profile



### Classification Reflow Profiles

| Profile Feature   | Sn-Pb Eutectic Assembly            | Pb-Free Assembly                   |
|---|------------------------------------|------------------------------------|
| <b>Preheat &amp; Soak</b>   |                                    |                                    |
| Temperature min ( $T_{smin}$ )  | 100 °C                             | 150 °C                             |
| Temperature max ( $T_{smax}$ )  | 150 °C                             | 200 °C                             |
| Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )                                       | 60-120 seconds                     | 60-120 seconds                     |
| Average ramp-up rate ( $T_{smax}$ to $T_p$ )                                      | 3 °C/second max.                   | 3°C/second max.                    |
| Liquidous temperature ( $T_L$ )   | 183 °C                             | 217 °C                             |
| Time at liquidous ( $t_L$ )   | 60-150 seconds                     | 60-150 seconds                     |
| Peak package body Temperature ( $T_p$ )*  | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ ) | 20** seconds                       | 30** seconds                       |
| Average ramp-down rate ( $T_p$ to $T_{smax}$ )                                    | 6 °C/second max.                   | 6 °C/second max.                   |
| Time 25°C to peak temperature   | 6 minutes max.                     | 8 minutes max.                     |

\* Tolerance for peak profile Temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

\*\* Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.

## Classification Reflow Profiles (Cont.)

Table 1. SnPb Eutectic Process – Classification Temperatures (Tc)

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>≥350 |
|-------------------|--------------------------------|--------------------------------|
| <2.5 mm           | 235 °C                         | 220 °C                         |
| ≥2.5 mm           | 220 °C                         | 220 °C                         |

Table 2. Pb-free Process – Classification Temperatures (Tc)

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>350-2000 | Volume mm <sup>3</sup><br>>2000 |
|-------------------|--------------------------------|------------------------------------|---------------------------------|
| <1.6 mm           | 260 °C                         | 260 °C                             | 260 °C                          |
| 1.6 mm – 2.5 mm   | 260 °C                         | 250 °C                             | 245 °C                          |
| ≥2.5 mm           | 250 °C                         | 245 °C                             | 245 °C                          |

## Reliability Test Program

| Test item     | Method             | Description                            |
|---------------|--------------------|--|
| SOLDERABILITY | JESD-22, B102      | 5 Sec, 245°C                           |
| HOLT          | JESD-22, A108      | 1000 Hrs, Bias @ T <sub>j</sub> =125°C |
| PCT           | JESD-22, A102      | 168 Hrs, 100%RH, 2atm, 121°C           |
| TCT           | JESD-22, A104      | 500 Cycles, -65°C~150°C                |
| ESD           | MIL-STD-883-3015.7 | VHBM 2KV, VMM 200V                     |
| Latch-Up      | JESD 78            | 10ms, 1 <sub>tr</sub> 100mA            |

## Customer Service

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