# APM2506NUB

N-Channel Enhancement Mode MOSFET

## Features

- 25V/60A ,
  $R_{DS(ON)}$=4.8mΩ(typ.) @ $V_{GS}$=10V
  $R_{DS(ON)}$=7mΩ(typ.) @ $V_{GS}$=4.5V
- Super High Dense Cell Design
- Avalanche Rated
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

## Applications

- Power Management in Desktop Computer or DC/DC Converters

## Pin Description

1 2 3

G D S

Top View of TO-251

D

G

S

N-Channel MOSFET

## Ordering and Marking Information

| APM2506N □□-□□ □ — Lead Free Code; Handling Code; Temp. Range; Package Code | Package Code<br>UB : TO-251<br>Operating Junction Temp. Range<br>C : -55 to 150° C<br>Handling Code<br>PB : Plastic Bag<br>Lead Free Code<br>L : Lead Free Device Blank : Original Device |
|---|---|
| APM2506N UB : APM2506N XXXXX | XXXXX - Date Code |

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldiering operations. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

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.

## Absolute Maximum Ratings

| Symbol | Parameter | | Rating | Unit |
|---|---|---|---|---|
| **Common Ratings** ($T_A$ = 25°C Unless Otherwise Noted) | | | | |
| $V_{DSS}$ | Drain-Source Voltage | | 25 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±20 | V |
| $T_J$ | Maximum Junction Temperature | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | °C |
| $I_S$ | Diode Continuous Forward Current | $T_C$=25°C | 40 | A |
| **Mounted on Large Heat Sink** | | | | |
| $I_{DP}$ | 300µs Pulse Drain Current Tested | $T_C$=25°C | 150 | A |
| | | $T_C$=100°C | 80 | |
| $I_D$ | Continuous Drain Current | $T_C$=25°C | 60* | A |
| | | $T_C$=100°C | 50 | |
| $P_D$ | Maximum Power Dissipation | $T_C$=25°C | 50 | W |
| | | $T_C$=100°C | 20 | |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | | 2.5 | °C/W |
| **Mounted on PCB of Minimum Footprint** | | | | |
| $I_{DP}$ | 300µs Pulse Drain Current Tested | $T_A$=25°C | 150 | A |
| | | $T_A$=100°C | 80 | |
| $I_D$ | Continuous Drain Current | $T_A$=25°C | 12 | A |
| | | $T_A$=100°C | 5.5 | |
| $P_D$ | Maximum Power Dissipation | $T_A$=25°C | 1.25 | W |
| | | $T_A$=100°C | 0.25 | |
| $R_{\theta JA}$ | Thermal Resistance-Junction to Ambient | | 100 | °C/W |

Note:
* Current limited by bond wire.

Copyright © ANPEC Electronics Corp.

## Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

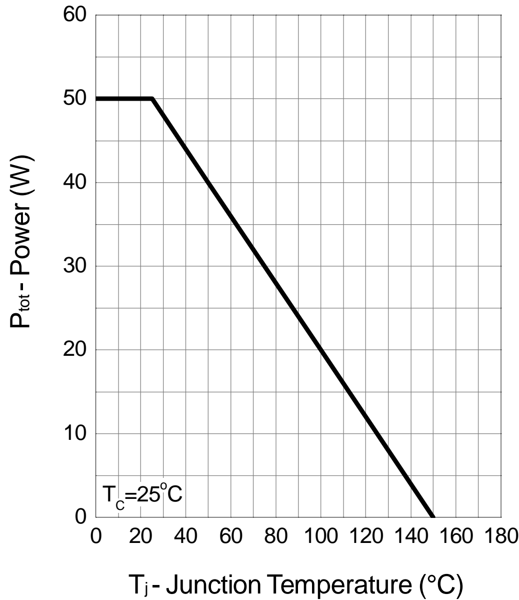
| Symbol | Parameter | Test Condition | APM2506NUB | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Drain-Source Avalanche Ratings** | | | | | | |
| $E_{AS}$ | Drain-Source Avalanche Energy | $I_D$=20A, L=0.5mH | | | 100 | mJ |
| **Static Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_{DS}$=250μA | 25 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=20V, $V_{GS}$=0V | | | 1 | μA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_{DS}$=250μA | 1.3 | 1.8 | 2.5 | V |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | | | ±100 | nA |
| $R_{DS(ON)}$ [a] | Drain-Source On-state Resistance | $V_{GS}$=10V, $I_{DS}$=40A | | 4.8 | 6 | mΩ |
| | | $V_{GS}$=4.5V, $I_{DS}$=20A | | 7 | 9 | |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ [a] | Diode Forward Voltage | $I_{SD}$=20A, $V_{GS}$=0V | | 0.7 | 1.1 | V |
| $t_{rr}$ [b] | Reverse Recovery Time | $I_{SD}$=10A, $dI_{SD}/dt$ =100A/μs | | 30 | | ns |
| $Q_{rr}$ [b] | Reverse Recovery Charge | | | 14 | | nC |
| **Dynamic Characteristics** [b] | | | | | | |
| $R_G$ | Gate Resistance | $V_{GS}$=0V,$V_{DS}$=0V,F=1MHz | | 1.0 | 2.1 | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, Frequency=1.0MHz | | 3100 | | pF |
| $C_{oss}$ | Output Capacitance | | | 680 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 520 | | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}$=15V, $R_L$=15Ω, $I_{DS}$=1A, $V_{GEN}$=10V, $R_G$=6Ω | | 19 | | ns |
| $T_r$ | Turn-on Rise Time | | | 20 | | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | | 62 | | |
| $T_f$ | Turn-off Fall Time | | | 43 | | |
| **Gate Charge Characteristics** [b] | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $V_{GS}$=4.5V, $I_{DS}$=40A | | 37.5 | 56 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 9.4 | | |
| $Q_{gd}$ | Gate-Drain Charge | | | 21 | | |

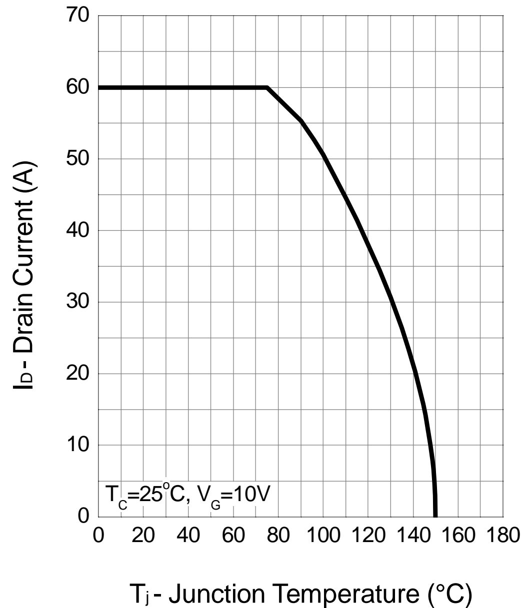
Notes:

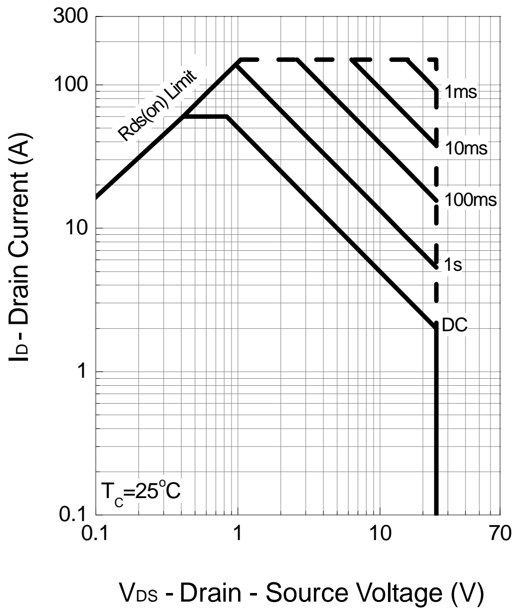
a : Pulse test ; pulse width ≤300μs, duty cycle ≤ 2%.

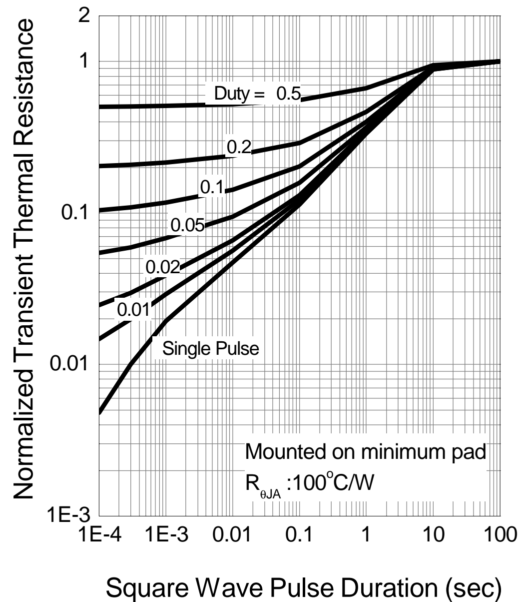
b : Guaranteed by design, not subject to production testing.

## Typical Characteristics

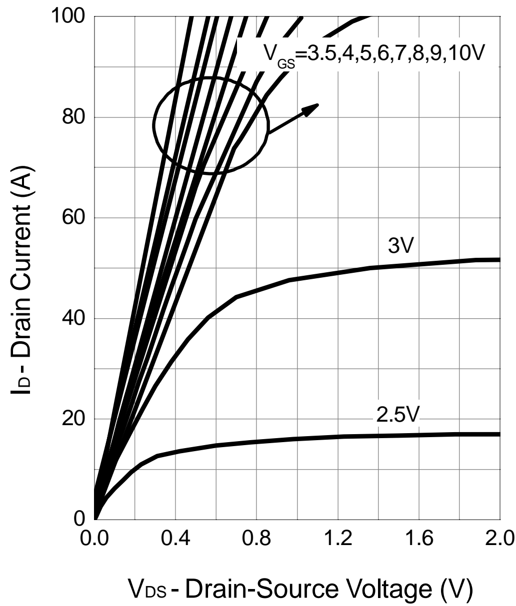


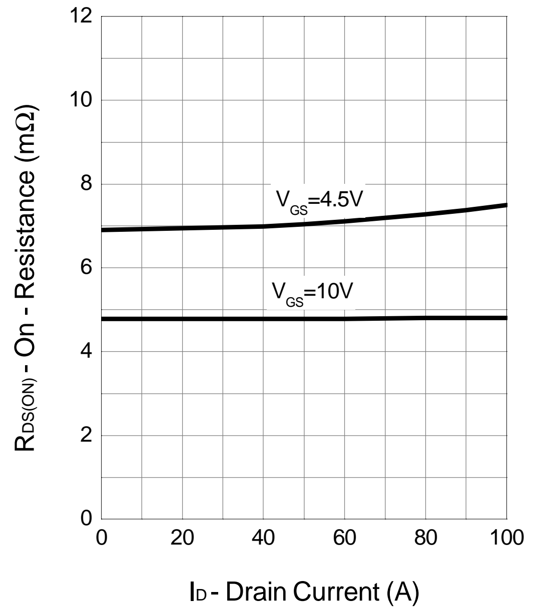



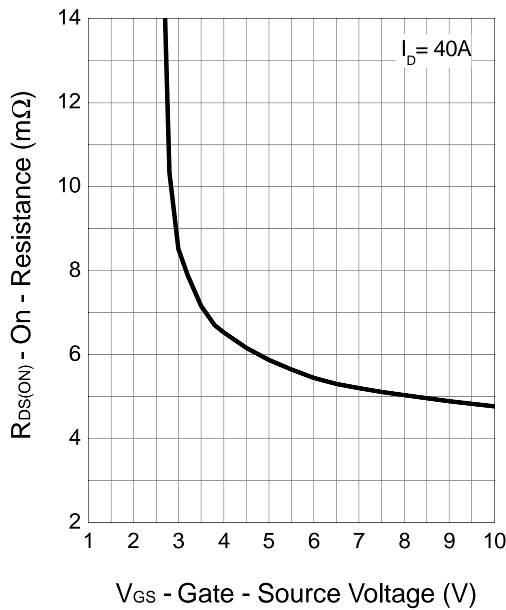



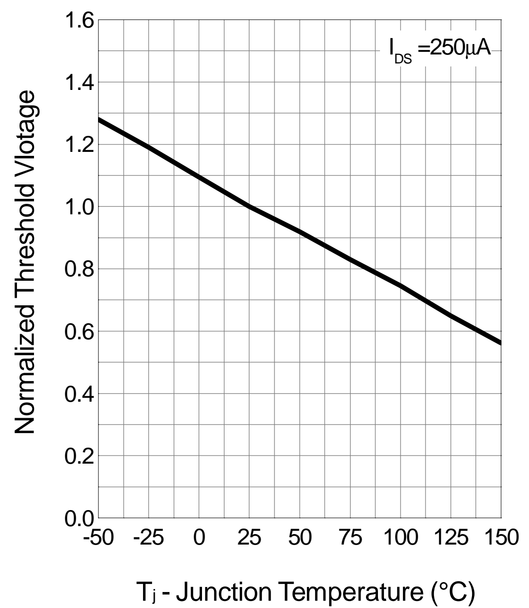



## Typical Characteristics (Cont.)



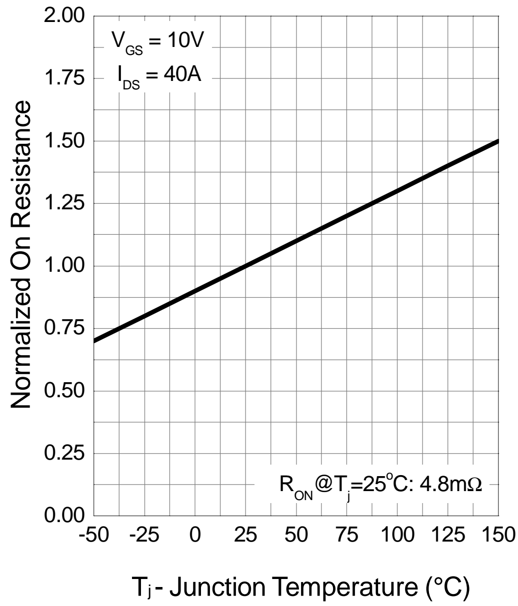



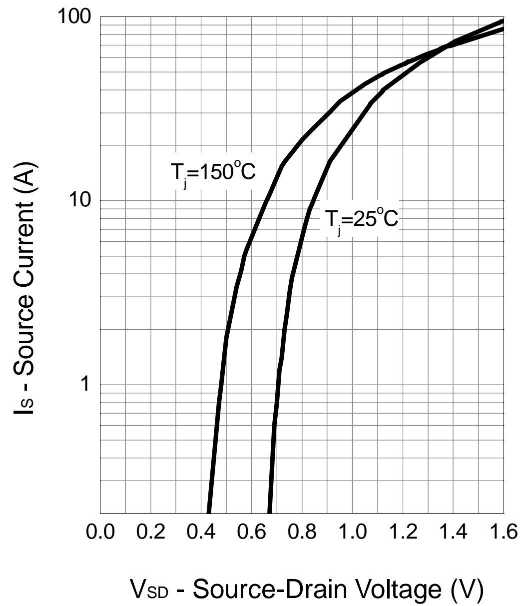



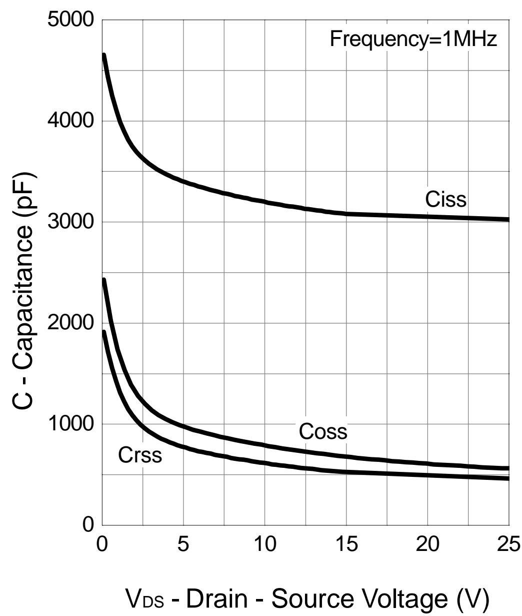



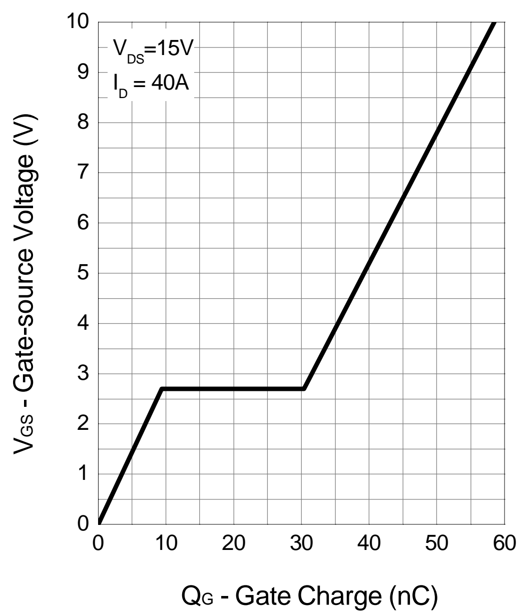

Copyright © ANPEC Electronics Corp.

## Typical Characteristics (Cont.)



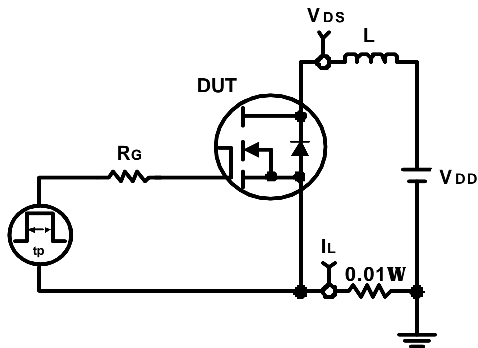



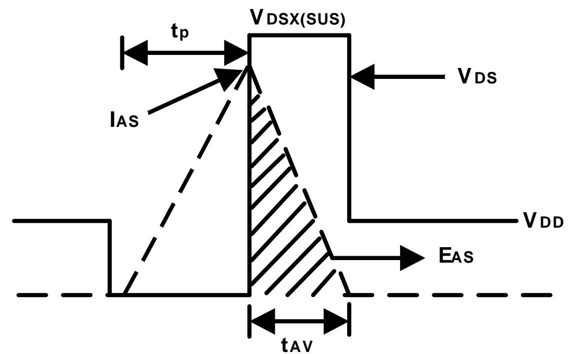



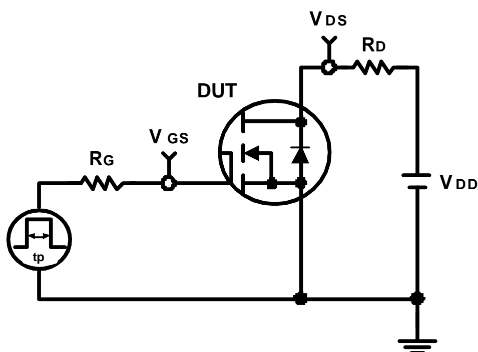

Copyright © ANPEC Electronics Corp.

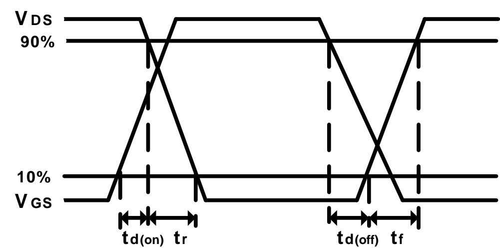
## Avalanche Test Circuit and Waveforms




## Switching Time Test Circuit and Waveforms

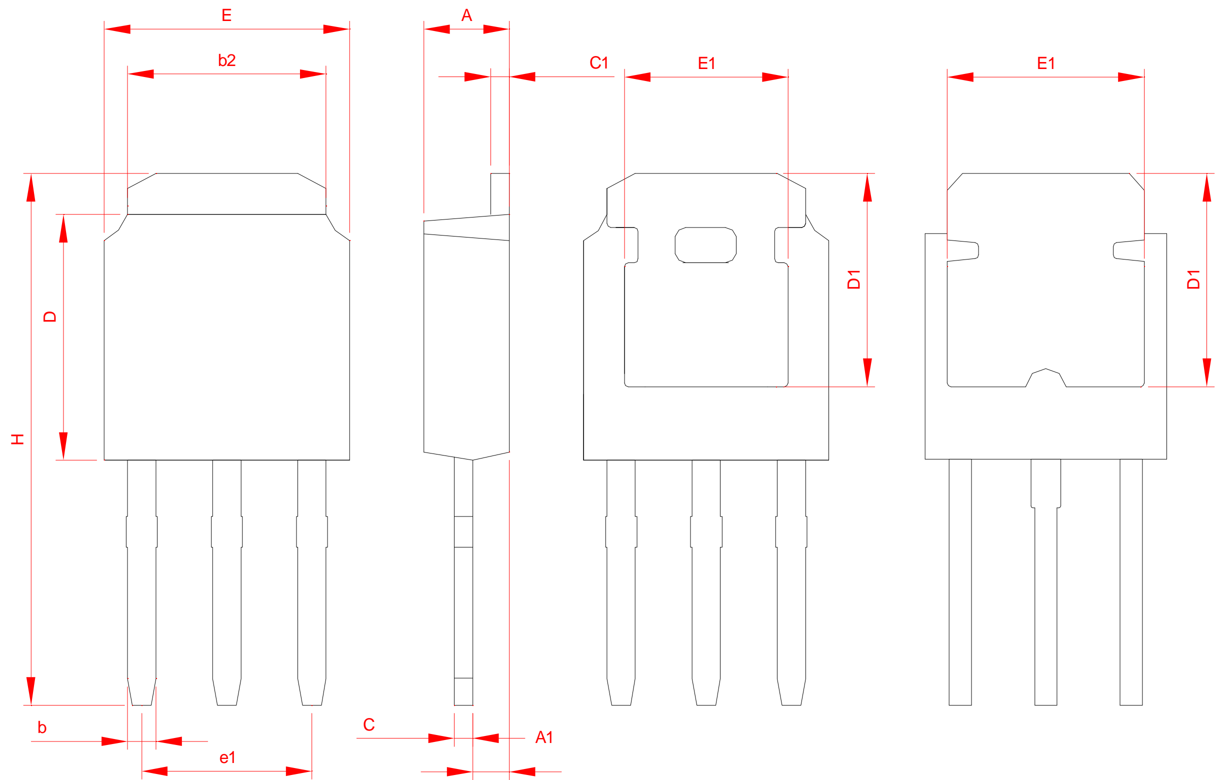



Copyright © ANPEC Electronics Corp.

## Packaging Information

TO-251



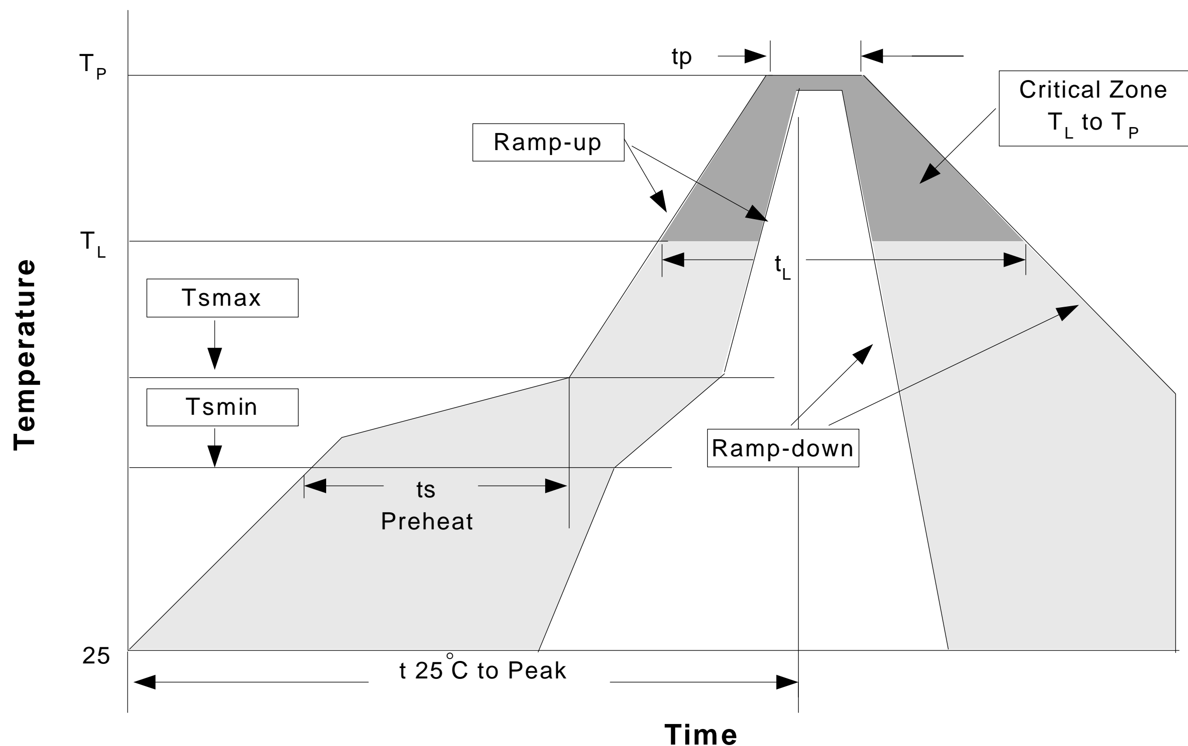

| Dim | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.20 | 2.40 | 0.087 | 0.094 |
| A1 | 1.02 | 1.27 | 0.040 | 0.050 |
| b | 0.50 | 0.88 | 0.020 | 0.035 |
| b2 | 5.20 | 5.46 | 0.205 | 0.215 |
| C | 0.40 | 0.60 | 0.016 | 0.024 |
| C1 | 0.40 | 0.60 | 0.016 | 0.024 |
| D | 5.40 | 6.20 | 0.213 | 0.244 |
| D1 | 5.30 | -- | 0.209 | -- |
| E | 6.35 | 6.70 | 0.250 | 0.264 |
| E1 | 4.40 | 5.40 | 0.173 | 0.213 |
| e1 | 4.50 | 4.70 | 0.177 | 0.185 |
| H | 12.90 | 15.25 | 0.508 | 0.600 |

Copyright © ANPEC Electronics Corp.

## 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 |
|---|---|---|
| Average ramp-up rate ($T_L$ to $T_P$) | 3°C/second max. | 3°C/second max. |
| Preheat<br>- Temperature Min (Tsmin)<br>- Temperature Max (Tsmax)<br>- Time (min to max) (ts) | 100°C<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>- Temperature ($T_L$)<br>- Time ($t_L$) | 183°C<br>60-150 seconds | 217°C<br>60-150 seconds |
| Peak/Classificatioon Temperature (Tp) | See table 1 | See table 2 |
| Time within 5°C of actual Peak Temperature (tp) | 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. |

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

## Classification Reflow Profiles(Cont.)

Table 1. SnPb Entectic Process – Package Peak Reflow Temperatures

| Package Thickness | Volume mm$^3$ <350 | Volume mm$^3$ $^3$350 |
|---|---|---|
| <2.5 mm | 240 +0/-5°C | 225 +0/-5°C |
| ≥2.5 mm | 225 +0/-5°C | 225 +0/-5°C |

Table 2. Pb-free Process – Package Classification Reflow Temperatures

| Package Thickness | Volume mm$^3$ <350 | Volume mm$^3$ 350-2000 | Volume mm$^3$ >2000 |
|---|---|---|---|
| <1.6 mm | 260 +0°C* | 260 +0°C* | 260 +0°C* |
| 1.6 mm – 2.5 mm | 260 +0°C* | 250 +0°C* | 245 +0°C* |
| ≥2.5 mm | 250 +0°C* | 245 +0°C* | 245 +0°C* |

*Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

## 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 |

## Customer Service

**Anpec Electronics Corp.**

Head Office :

No.6, Dusing 1st 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