



## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit	
<b>Common Ratings</b> ( $T_A=25^{\circ}\text{C}$ Unless Otherwise Noted)				
$V_{\text{DSS}}$	Drain-Source Voltage	25	V	
$V_{\text{GSS}}$	Gate-Source Voltage	$\pm 20$		
$T_J$	Maximum Junction Temperature	150	$^{\circ}\text{C}$	
$T_{\text{STG}}$	Storage Temperature Range	-55 to 150	$^{\circ}\text{C}$	
$I_S$	Diode Continuous Forward Current	$T_C=25^{\circ}\text{C}$ 30	A	
<b>Mounted on Large Heat Sink</b>				
$I_{\text{DP}}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_C=25^{\circ}\text{C}$	100	A
		$T_C=100^{\circ}\text{C}$	65	
$I_D$	Continuous Drain Current	$T_C=25^{\circ}\text{C}$	50*	A
		$T_C=100^{\circ}\text{C}$	38	
$P_D$	Maximum Power Dissipation	$T_C=25^{\circ}\text{C}$	50	W
		$T_C=100^{\circ}\text{C}$	20	
$R_{\theta\text{JC}}$	Thermal Resistance-Junction to Case	2.5	$^{\circ}\text{C}/\text{W}$	
<b>Mounted on PCB of Minimum Footprint</b>				
$I_{\text{DP}}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_A=25^{\circ}\text{C}$	100	A
		$T_A=100^{\circ}\text{C}$	65	
$I_D$	Continuous Drain Current	$T_A=25^{\circ}\text{C}$	9.5	A
		$T_A=100^{\circ}\text{C}$	4	
$P_D$	Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$	1.25	W
		$T_A=100^{\circ}\text{C}$	0.25	
$R_{\theta\text{JA}}$	Thermal Resistance-Junction to Ambient	100	$^{\circ}\text{C}/\text{W}$	

Note:

\* Current limited by bond wire.

## Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	APM2509NUB			Unit
			Min.	Typ.	Max.	
<b>Drain-Source Avalanche Ratings</b>						
E <sub>AS</sub>	Avalanche Energy, Single Pulsed	I <sub>D</sub> =15A, L=0.5mH			50	mJ
<b>Static Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	25			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V T <sub>J</sub> =85°C			1 30	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1.3	1.8	2.5	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V			±100	nA
R <sub>DS(ON)</sub> <sup>a</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V, I <sub>DS</sub> =30A V <sub>GS</sub> =4.5V, I <sub>DS</sub> =15A		7.5	9 18	mΩ
<b>Diode Characteristics</b>						
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>SD</sub> =10A, V <sub>GS</sub> =0V		0.9	1.1	V
t <sub>rr</sub> <sup>b</sup>	Reverse Recovery Time	I <sub>SD</sub> =10A, di <sub>SD</sub> /dt =100A/μs		17		ns
Q <sub>rr</sub> <sup>b</sup>	Reverse Recovery Charge			6		nC
<b>Dynamic Characteristics<sup>b</sup></b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz		1.8		Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, Frequency=1.0MHz		1560		pF
C <sub>oss</sub>	Output Capacitance			345		
C <sub>rss</sub>	Reverse Transfer Capacitance			245		
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω, I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V, R <sub>G</sub> =6Ω		17		ns
T <sub>r</sub>	Turn-on Rise Time			18		
t <sub>d(OFF)</sub>	Turn-off Delay Time			41		
T <sub>f</sub>	Turn-off Fall Time			16		
<b>Gate Charge Characteristics<sup>b</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =30A		17.5	26	nC
Q <sub>gs</sub>	Gate-Source Charge			5		
Q <sub>gd</sub>	Gate-Drain Charge			11		

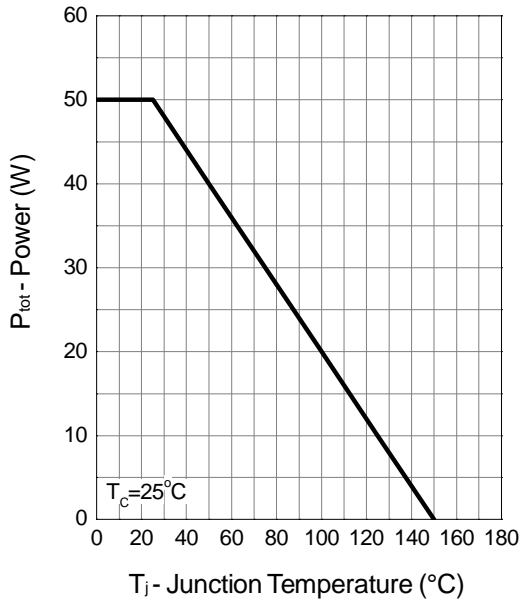
Notes:

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

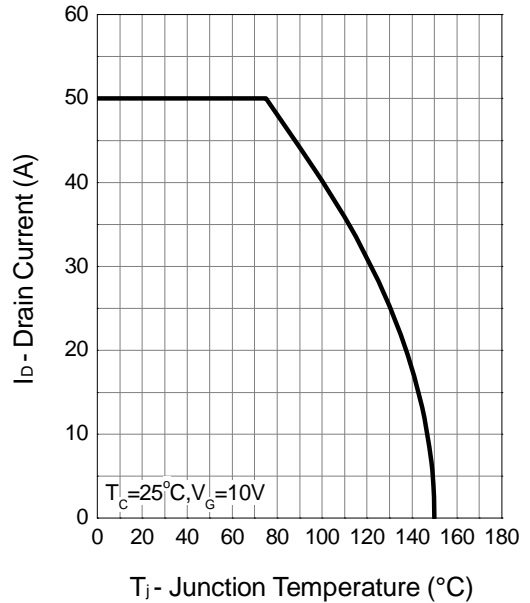
b : Guaranteed by design, not subject to production testing.

Typical Characteristics

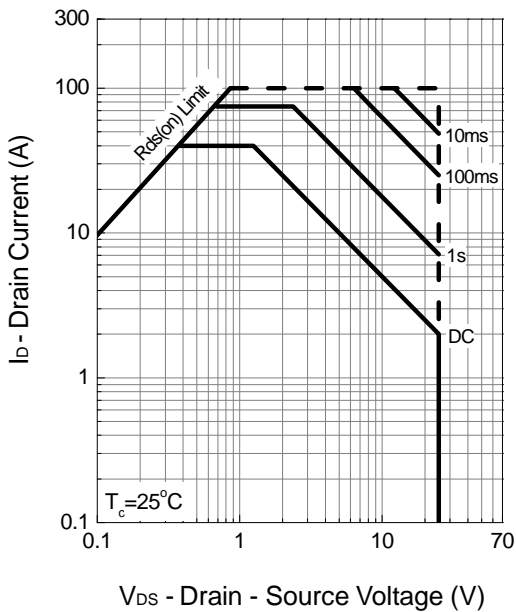
Power Dissipation



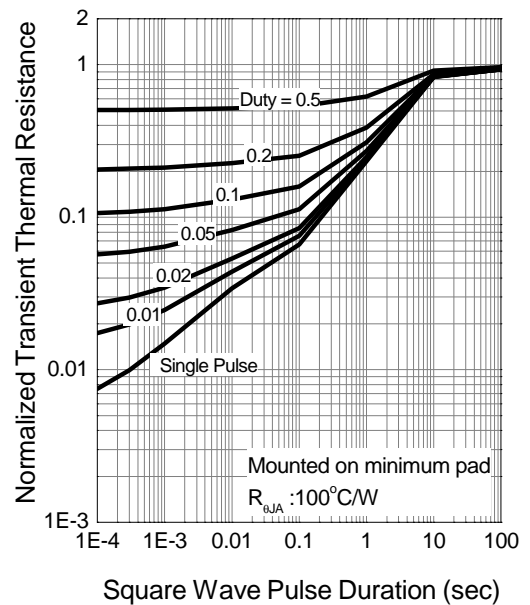
Drain Current



Safe Operation Area

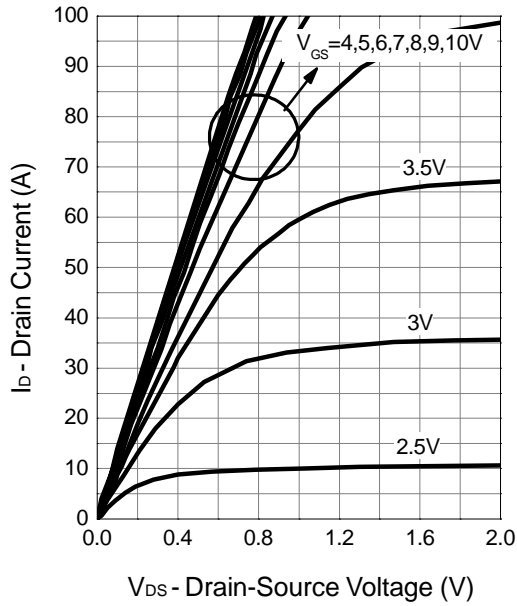


Thermal Transient Impedance

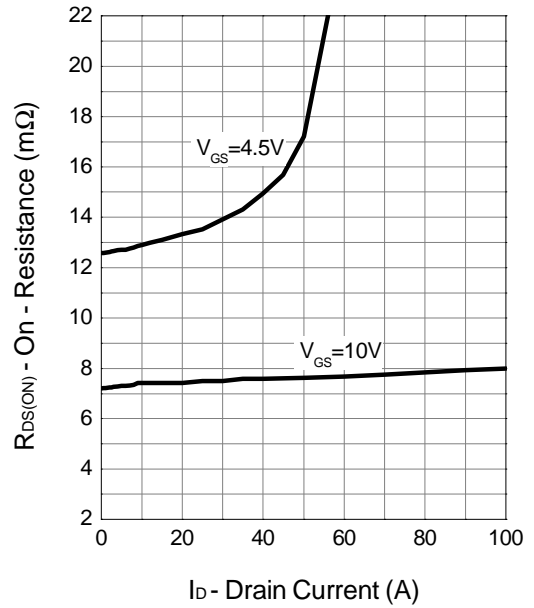


Typical Characteristics (Cont.)

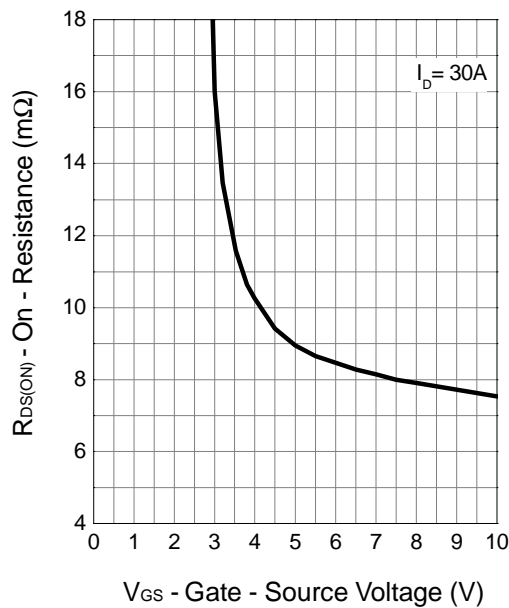
Output Characteristics



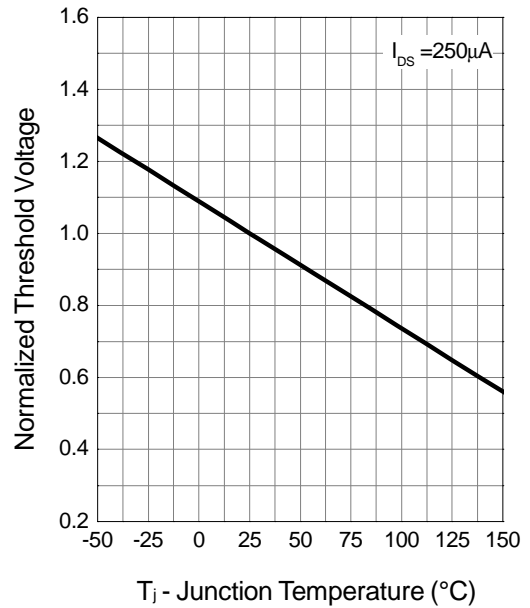
Drain-Source On Resistance



Drain-Source On Resistance

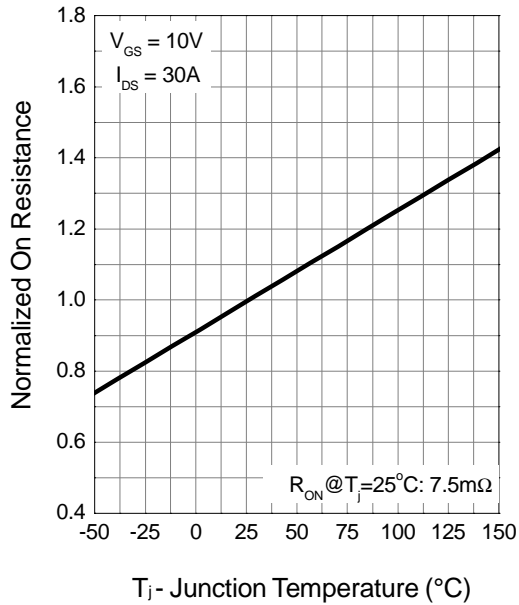


Gate Threshold Voltage

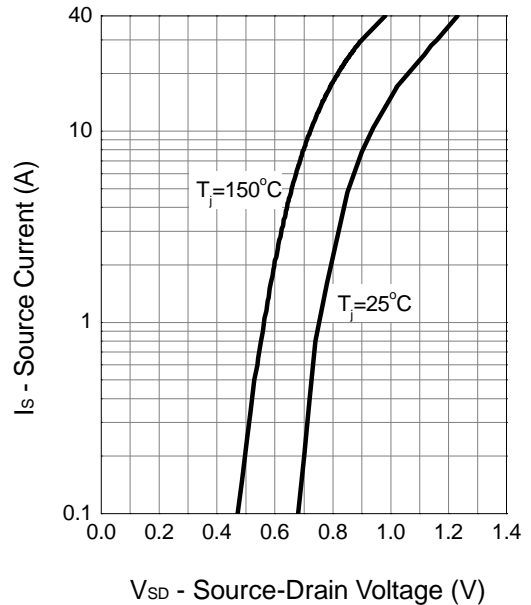


Typical Characteristics (Cont.)

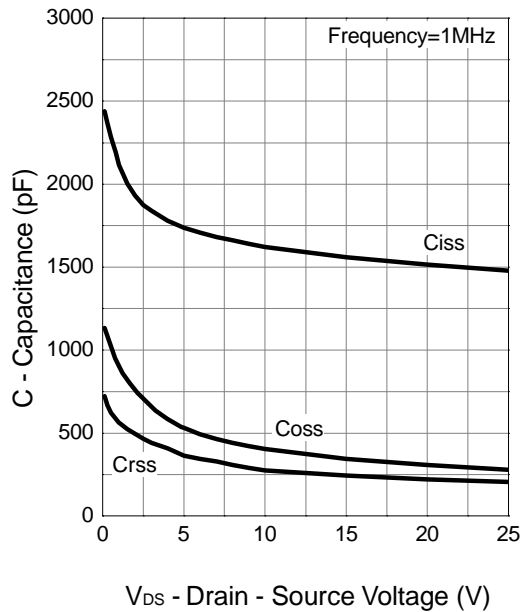
Drain-Source On Resistance



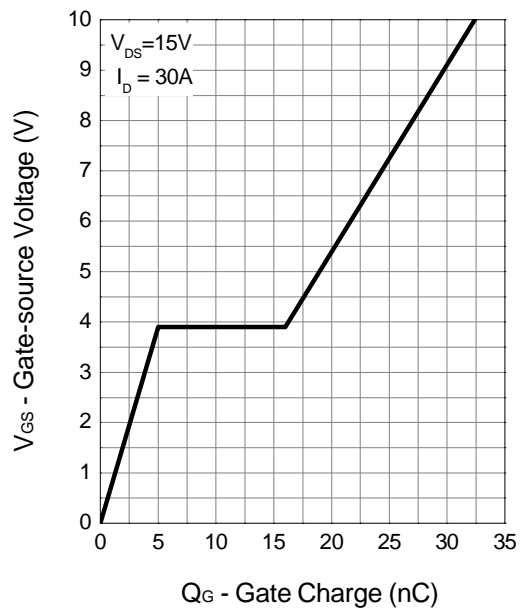
Source-Drain Diode Forward



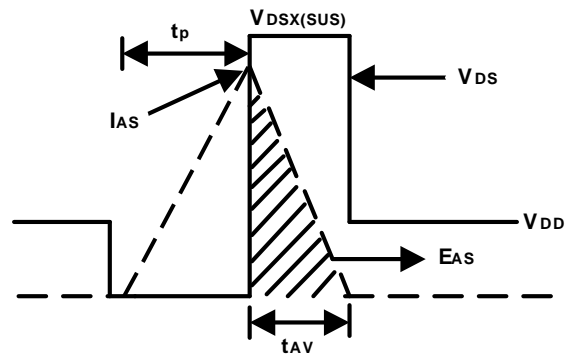
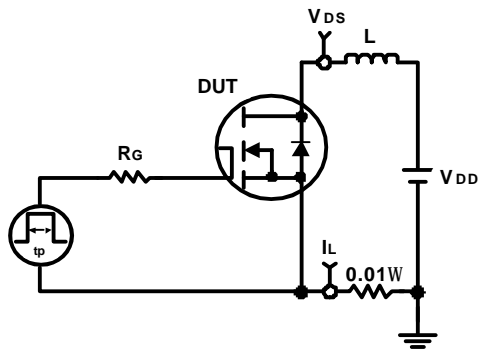
Capacitance



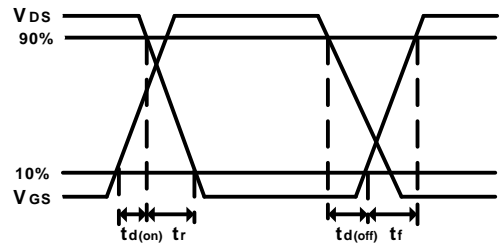
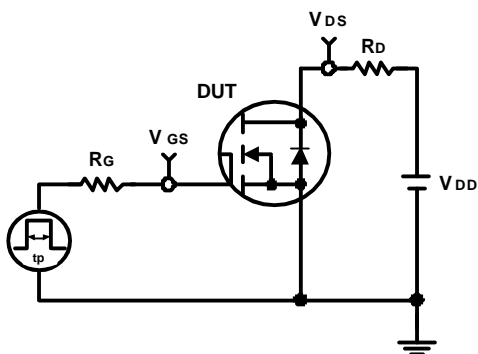
Gate Charge



## Avalanche Test Circuit and Waveforms

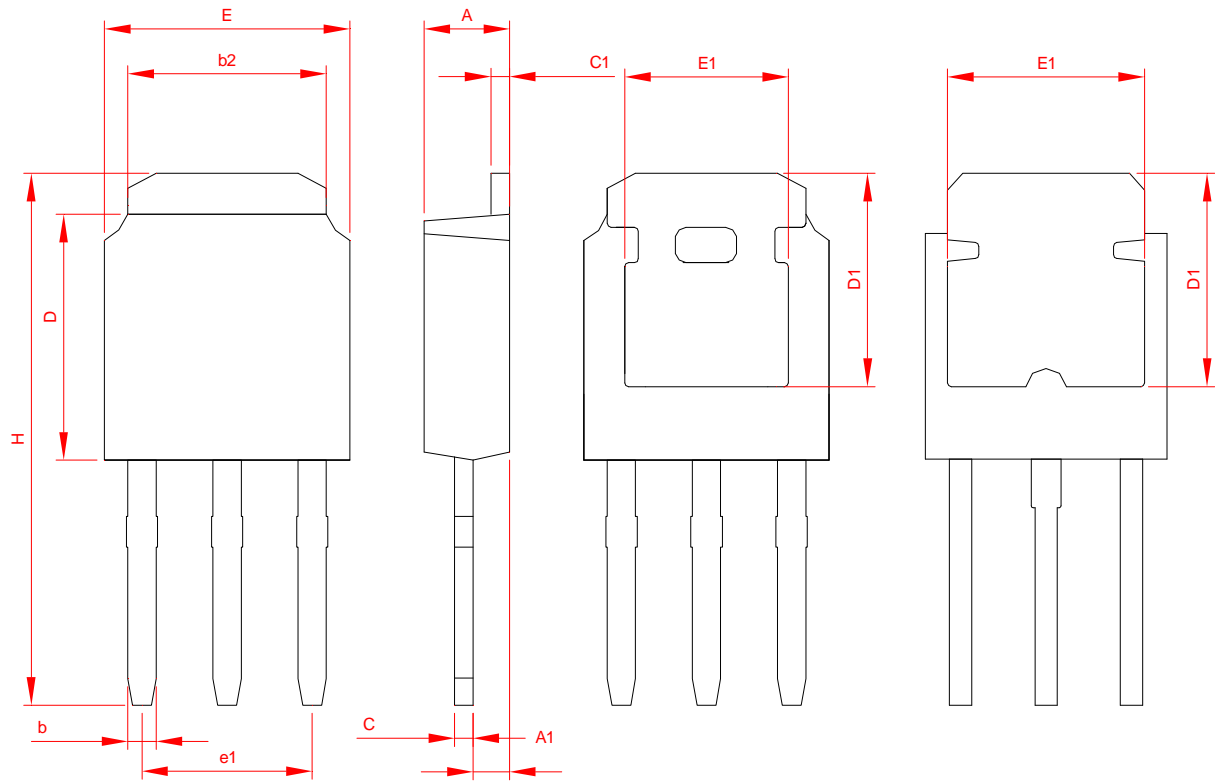


## Switching Time Test Circuit and Waveforms



Packaging Information

TO-251



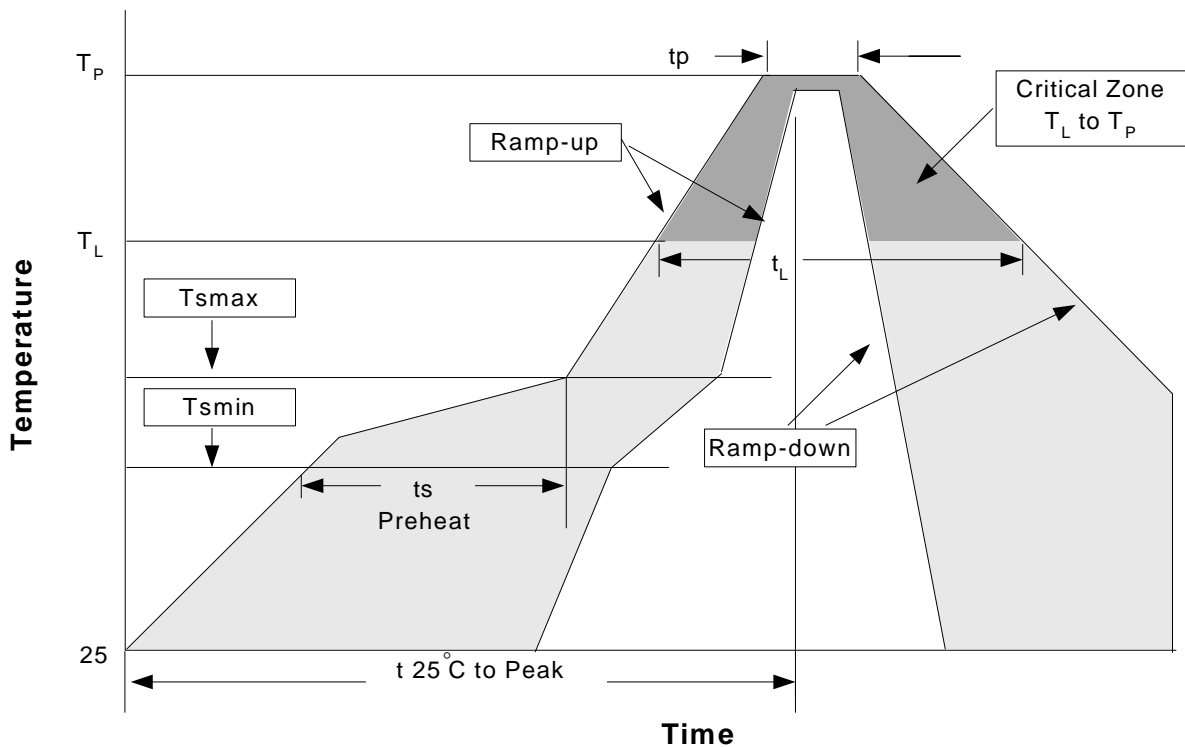
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.40	0.087	0.094
A1	1.02	1.27	0.040	0.050
b	0.50	0.88	0.020	0.035
b2	5.20	5.46	0.205	0.215
C	0.40	0.60	0.016	0.024
C1	0.40	0.60	0.016	0.024
D	5.40	6.20	0.213	0.244
D1	5.30	--	0.209	--
E	6.35	6.70	0.250	0.264
E1	4.40	5.40	0.173	0.213
e1	4.50	4.70	0.177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



### 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		
- Temperature Min ( $T_{smin}$ )	100°C	150°C
- Temperature Max ( $T_{smax}$ )	150°C	200°C
- Time (min to max) ( $t_s$ )	60-120 seconds	60-180 seconds
Time maintained above:		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60-150 seconds	60-150 seconds
Peak/Classification Temperature ( $T_p$ )	See table 1	See table 2
Time within 5°C of actual Peak Temperature ( $t_p$ )	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 Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥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 <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >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

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