

APM2509NU



N-Channel Enhancement Mode MOSFET

Features

- 25V/50A ,
 $R_{DS(ON)} = 7.5m\Omega (typ.) @ V_{GS} = 10V$
 $R_{DS(ON)} = 13m\Omega (typ.) @ V_{GS} = 4.5V$
- Super High Dense Cell Design
- Avalanche Rated
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

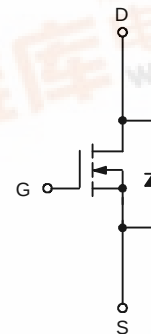
Applications

- Power Management in Desktop Computer or DC/DC Converters

Pin Description



Top View of TO-252



N-Channel MOSFET

Ordering and Marking Information

APM2509N □□-□□ □ Lead Free Code Handling Code Temp. Range Package Code	Package Code U : TO-252 Operating Junction Temp. Range C : -55 to 150°C Handling Code TU : Tube TR : Tape & Reel Lead Free Code L : Lead Free Device Blank : Original Device
APM2509N U : APM2509N 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 soldering 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.

Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
Common Ratings ($T_A=25^{\circ}\text{C}$ Unless Otherwise Noted)			
V_{DSS}	Drain-Source Voltage	25	V
V_{GSS}	Gate-Source Voltage	± 20	
T_J	Maximum Junction Temperature	150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-55 to 150	$^{\circ}\text{C}$
I_S	Diode Continuous Forward Current	$T_C=25^{\circ}\text{C}$ 30	A
Mounted on Large Heat Sink			
I_{DP}	300 μs 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	$^{\circ}\text{C/W}$
Mounted on PCB of 1in² Pad Area			
I_{DP}	300 μs Pulse Drain Current Tested	$T_A=25^{\circ}\text{C}$ 100	A
		$T_A=100^{\circ}\text{C}$ 65	
I_D	Continuous Drain Current	$T_A=25^{\circ}\text{C}$ 13	A
		$T_A=100^{\circ}\text{C}$ 8	
P_D	Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$ 2.5	W
		$T_A=100^{\circ}\text{C}$ 1	
$R_{\theta\text{JA}}$	Thermal Resistance-Junction to Ambient	50	$^{\circ}\text{C/W}$
Mounted on PCB of Minimum Footprint			
I_{DP}	300 μs Pulse Drain Current Tested	$T_A=25^{\circ}\text{C}$ 100	A
		$T_A=100^{\circ}\text{C}$ 65	
I_D	Continuous Drain Current	$T_A=25^{\circ}\text{C}$ 10.5	A
		$T_A=100^{\circ}\text{C}$ 6	
P_D	Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$ 1.6	W
		$T_A=100^{\circ}\text{C}$ 0.6	
$R_{\theta\text{JA}}$	Thermal Resistance-Junction to Ambient	75	$^{\circ}\text{C/W}$

Note:

* Current limited by bond wire.

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

Symbol	Parameter	Test Condition	APM2509NU			Unit
			Min.	Typ.	Max.	
Drain-Source Avalanche Ratings						
E _{AS}	Avalanche Energy, Single Pulsed	I _D =15A, L=0.5mH			50	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
		T _J =85°C			30	
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} =30A		7.5	9	mΩ
		V _{GS} =4.5V, I _{DS} =15A		13	18	
Diode Characteristics						
V _{SD} ^a	Diode Forward Voltage	I _{SD} =10A, V _{GS} =0V		0.9	1.1	V
t _{rr} ^b	Reverse Recovery Time	I _{SD} =10A, dI _{SD} /dt =100A/μs		17		ns
Q _{rr} ^b	Reverse Recovery Charge			6		nC
Dynamic Characteristics ^b						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz		1.8		Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, Frequency=1.0MHz		1560		pF
C _{oss}	Output Capacitance			345		
C _{rss}	Reverse Transfer Capacitance			245		
t _{d(ON)}	Turn-on Delay Time	V _{DD} =15V, R _L =15Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω		17		ns
T _r	Turn-on Rise Time			18		
t _{d(OFF)}	Turn-off Delay Time			41		
T _f	Turn-off Fall Time			16		
Gate Charge Characteristics ^b						
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =4.5V, I _{DS} =30A		17.5		nC
Q _{gs}	Gate-Source Charge			5		
Q _{gd}	Gate-Drain Charge			11		

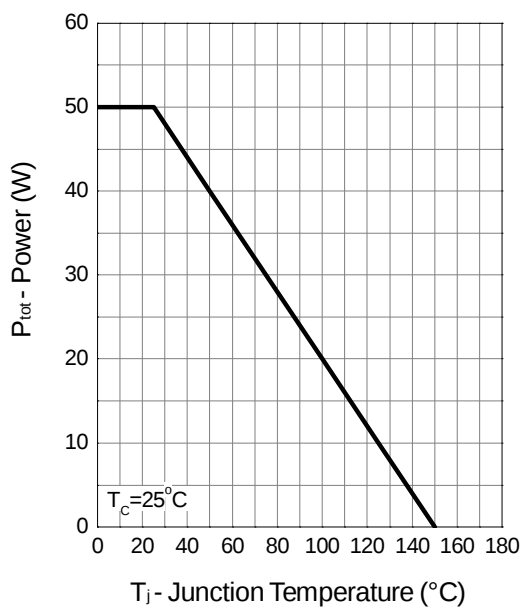
Notes:

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

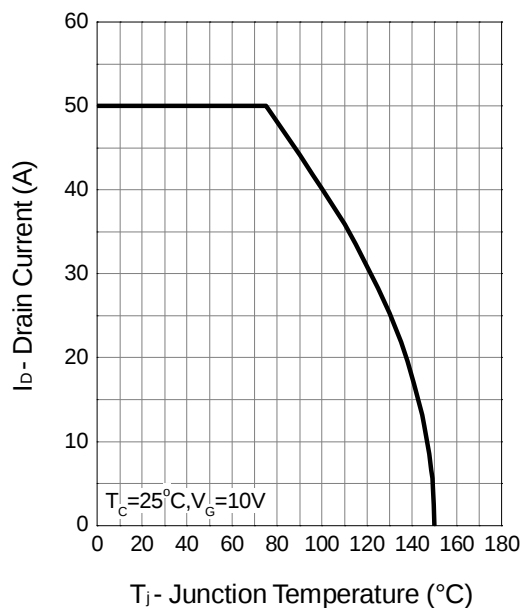
b : Guaranteed by design, not subject to production testing.

Typical Characteristics

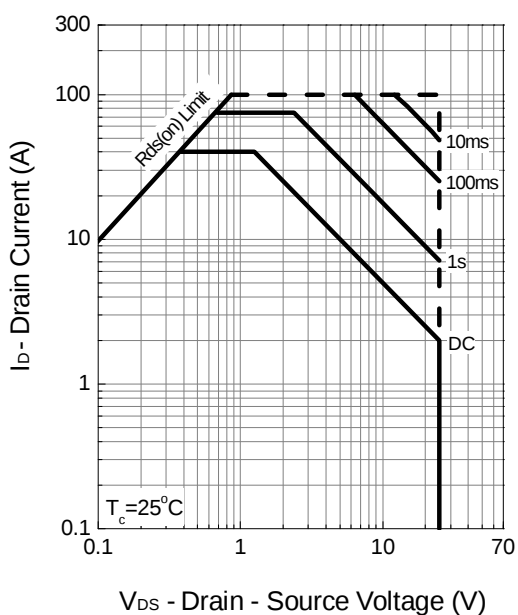
Power Dissipation



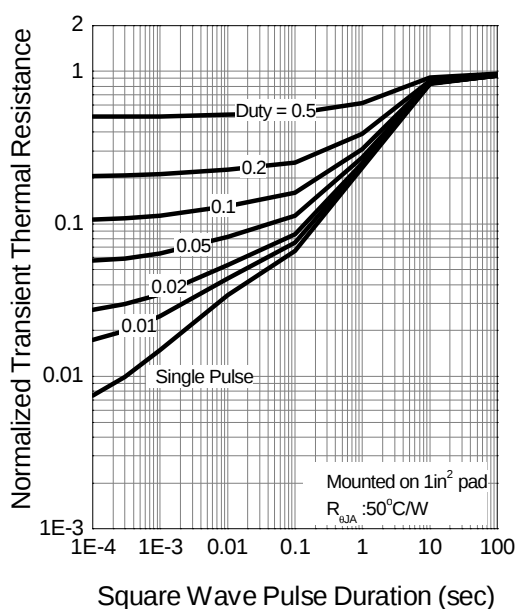
Drain Current



Safe Operation Area

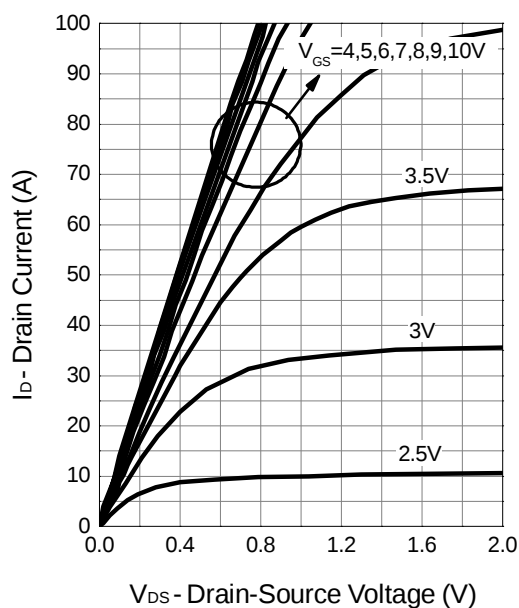


Thermal Transient Impedance

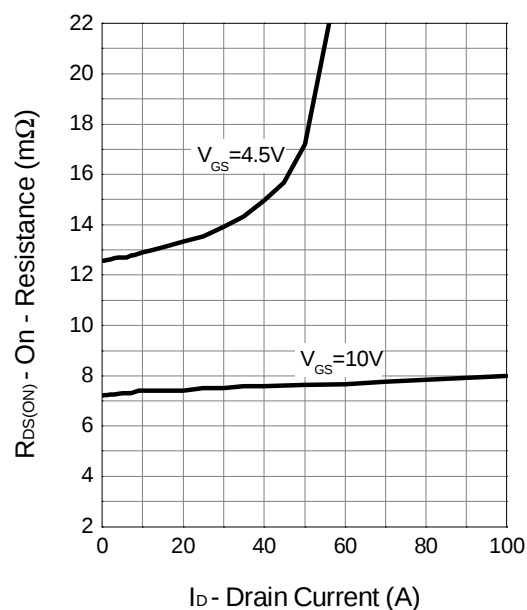


Typical Characteristics (Cont.)

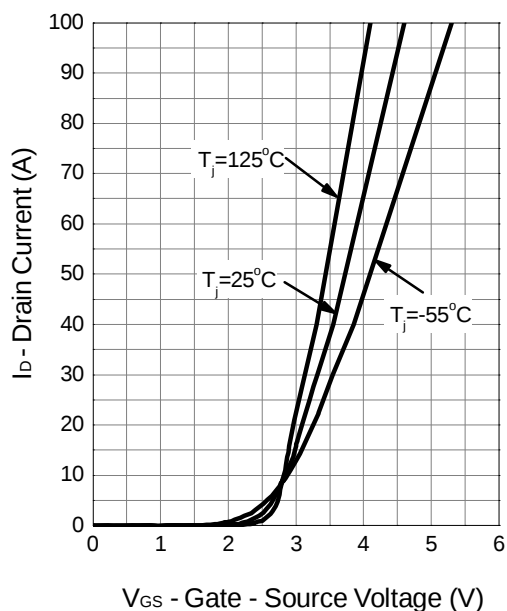
Output Characteristics



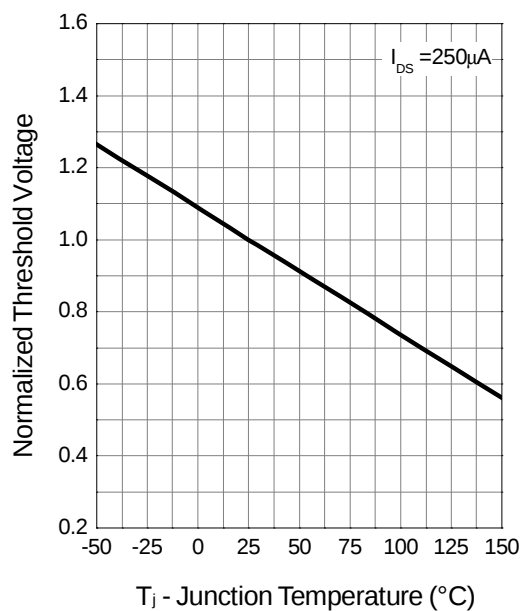
Drain-Source On Resistance



Transfer Characteristics

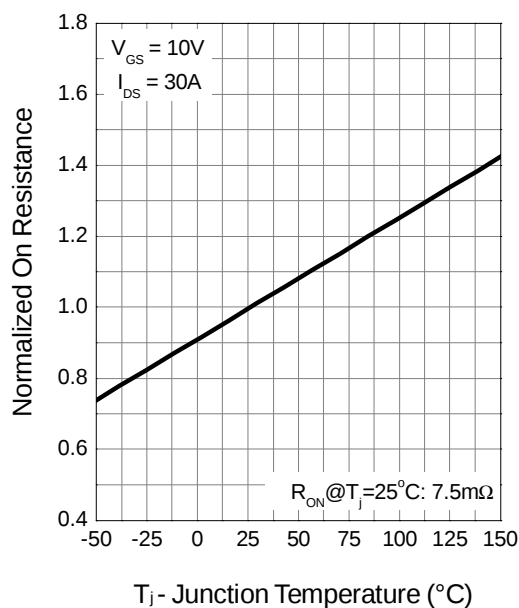


Gate Threshold Voltage

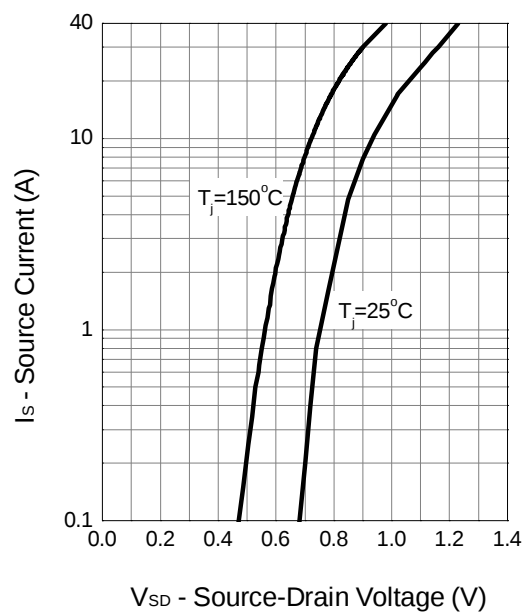


Typical Characteristics (Cont.)

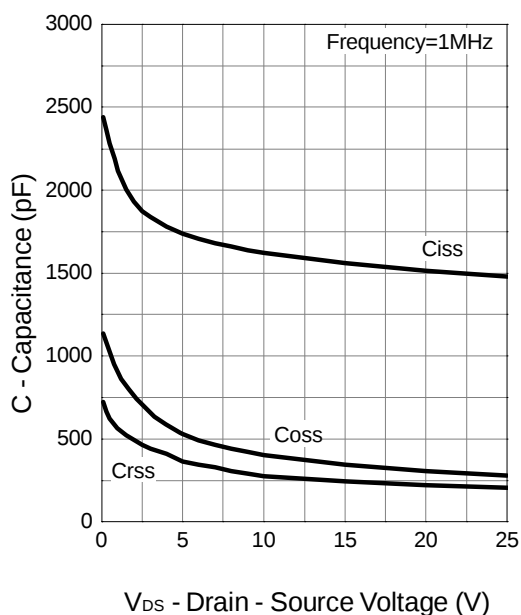
Drain-Source On Resistance



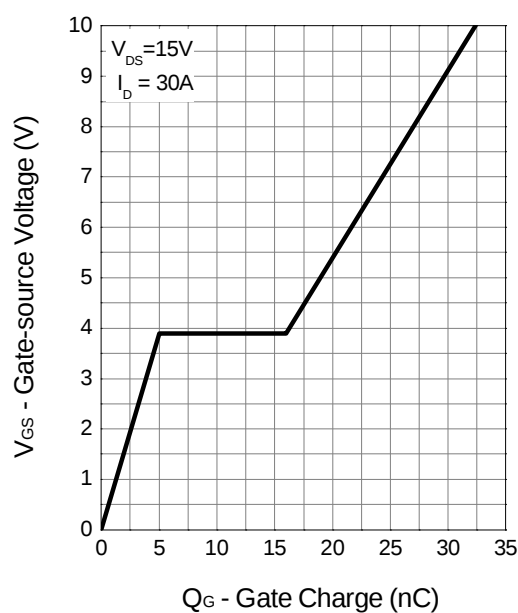
Source-Drain Diode Forward



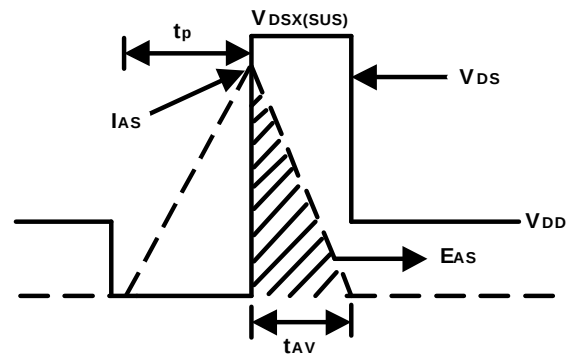
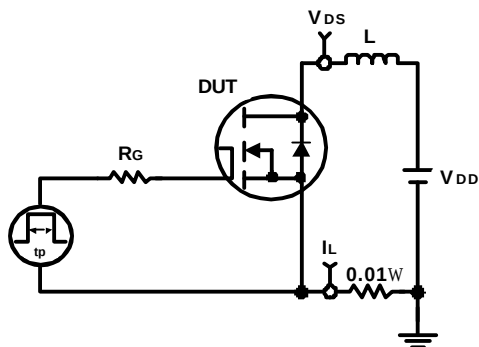
Capacitance



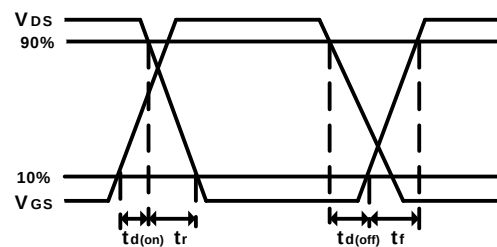
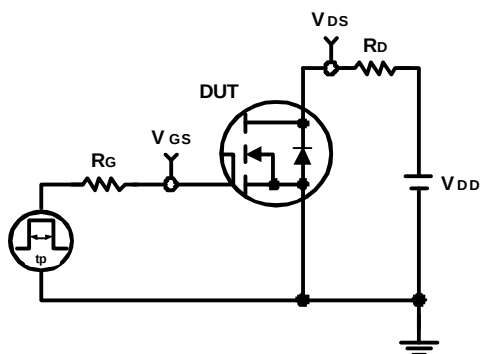
Gate Charge



Avalanche Test Circuit and Waveforms

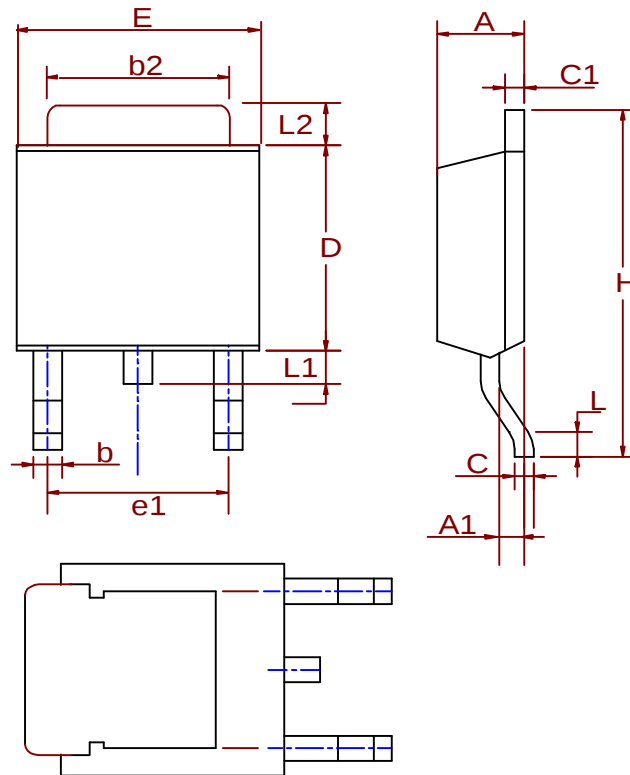


Switching Time Test Circuit and Waveforms



Packaging Information

TO-252(Reference JEDEC Registration TO-252)

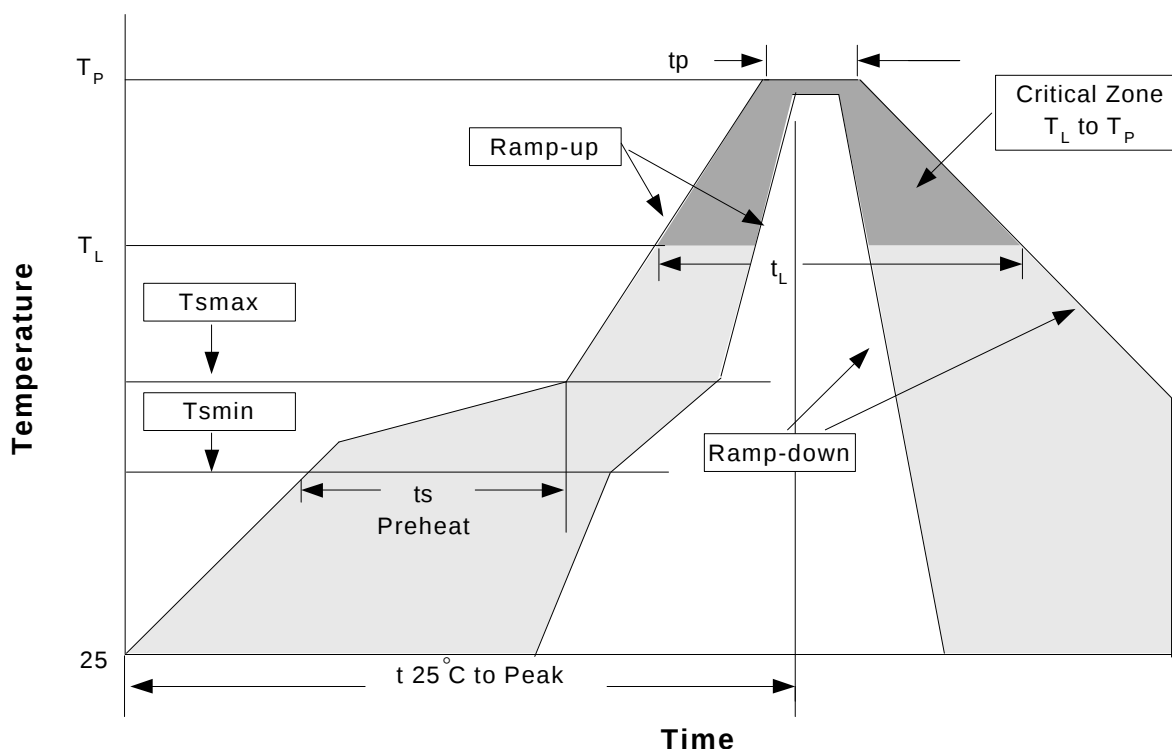


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.18	2.39	0.086	0.094
A1	0.89	1.27	0.035	0.050
b	0.508	0.89	0.020	0.035
b2	5.207	5.461	0.205	0.215
C	0.46	0.58	0.018	0.023
C1	0.46	0.58	0.018	0.023
D	5.334	6.22	0.210	0.245
E	6.35	6.73	0.250	0.265
e1	3.96	5.18	0.156	0.204
H	9.398	10.41	0.370	0.410
L	0.51		0.020	
L1	0.64	1.02	0.025	0.040
L2	0.89	2.032	0.035	0.080

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}) - Temperature Max (T_{smax}) - Time (min to max) (t_s)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	183°C 60-150 seconds	217°C 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 ³ <350	Volume mm 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

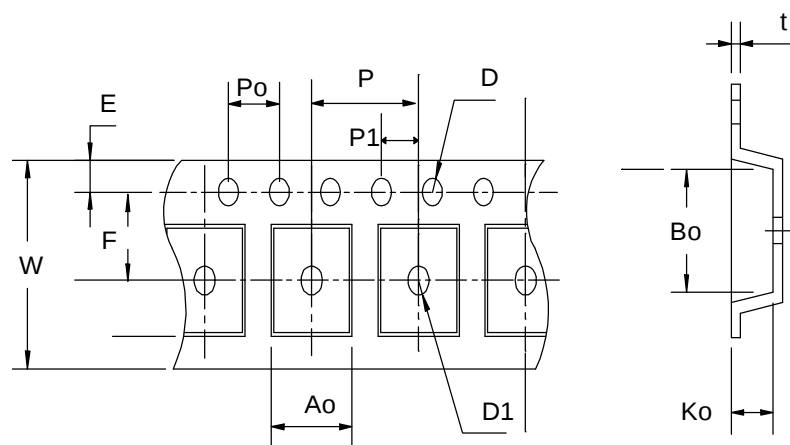
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

*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.

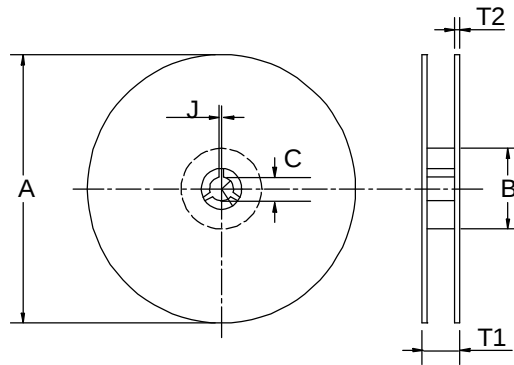
Reliability Test Program

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

Carrier Tape & Reel Dimensions



Carrier Tape & Reel Dimensions(Cont.)



Application	A	B	C	J	T1	T2	W	P	E
TO-252	330 ± 3	100 ± 2	13 ± 0.5	2 ± 0.5	$16.4 + 0.3 - 0.2$	2.5 ± 0.5	$16 + 0.3 - 0.1$	8 ± 0.1	1.75 ± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	7.5 ± 0.1	1.5 ± 0.1	1.5 ± 0.25	4.0 ± 0.1	2.0 ± 0.1	6.8 ± 0.1	10.4 ± 0.1	2.5 ± 0.1	0.3 ± 0.05

(mm)

Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
TO- 252	16	13.3	2500

Customer Service

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