

## N-Channel Enhancement Mode MOSFET

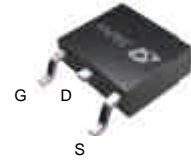
### Features

- 25V/50A,  
 $R_{DS(ON)} = 8.5m\Omega$  (typ.) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 15m\Omega$  (typ.) @  $V_{GS} = 4.5V$
- Super High Dense Cell Design
- Avalanche Rated
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

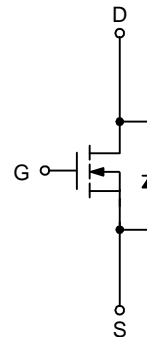
### Applications

- Power Management in Desktop Computer or DC/DC Converters

### Pin Description

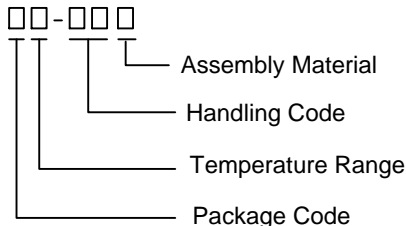
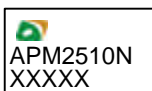


Top View of TO-252



N-Channel MOSFET

### Ordering and Marking Information

APM2510N		Package Code U : TO-252 Operating Junction Temperature Range C : -55 to 150°C Handling Code TR : Tape & Reel Assembly Material L : Lead Free Device G : Halogen and Lead Free Device
APM2510N U :		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. 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 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).

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	
<b>Common Ratings</b> ( $T_A=25^\circ\text{C}$ Unless Otherwise Noted)				
$V_{DSS}$	Drain-Source Voltage	25	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 20$		
$T_J$	Maximum Junction Temperature	150	$^\circ\text{C}$	
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$	
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$	A	
$I_{DP}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_C=25^\circ\text{C}$	120	A
		$T_C=100^\circ\text{C}$	80	
$I_D$	Continuous Drain Current	$T_C=25^\circ\text{C}$	50*	A
		$T_C=100^\circ\text{C}$	35	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ\text{C}$	50	W
		$T_C=100^\circ\text{C}$	20	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	2.5	$^\circ\text{C}/\text{W}$	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	50	$^\circ\text{C}/\text{W}$	
$E_{AS}$	Drain-Source Avalanche Energy, $L=0.5\text{mH}$	100	mJ	

Notes:

\* Current limited by bond wire.

## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Test Conditions	APM2510NU			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$	25			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=20\text{V}, V_{GS}=0\text{V}$ $T_J=85^\circ\text{C}$			1	$\mu\text{A}$
					30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	1.3	1.8	2.5	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20\text{V}, V_{DS}=0\text{V}$			$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10\text{V}, I_{DS}=30\text{A}$		8.5	10	m $\Omega$
		$V_{GS}=4.5\text{V}, I_{DS}=15\text{A}$		15	20	
<b>Diode Characteristics</b>						
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=15\text{A}, V_{GS}=0\text{V}$		0.8	1.1	V
$t_{rr}$	Reverse Recovery Time	$I_{DS}=30\text{A}, dI_{SD}/dt=100\text{A}/\mu\text{s}$		20		ns
$Q_{rr}$	Reverse Recovery Charge			10		nC

## Electrical Characteristics (Cont.) ( $T_A = 25^\circ\text{C}$ )

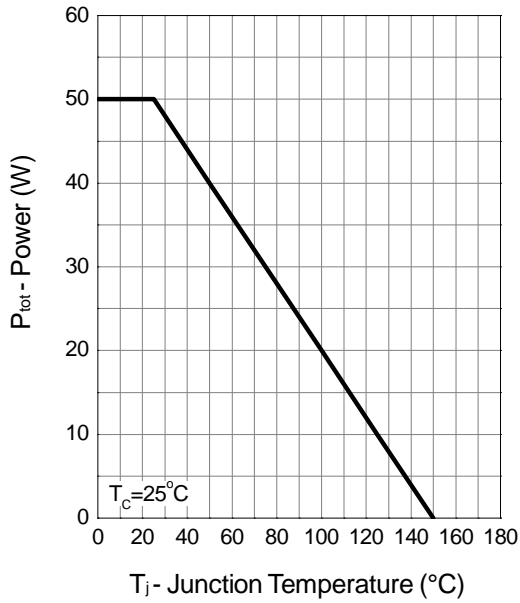
Symbol	Parameter	Test Conditions	APM2510NU			Unit
			Min.	Typ.	Max.	
<b>Dynamic Characteristics<sup>b</sup></b>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	1	1.9	3.9	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=15V,$ Frequency=1.0MHz		960	1250	pF
$C_{oss}$	Output Capacitance			230		
$C_{rss}$	Reverse Transfer Capacitance			185		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=15V, R_L=15\Omega,$ $I_{DS}=1A, V_{GEN}=10V,$ $R_G=6\Omega$		11	21	ns
$t_r$	Turn-on Rise Time			13	24	
$t_{d(OFF)}$	Turn-off Delay Time			29	53	
$t_f$	Turn-off Fall Time			10	19	
<b>Gate Charge Characteristics<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=15V, V_{GS}=10V,$ $I_{DS}=30A$		24	33	nC
$Q_{gs}$	Gate-Source Charge			3.8		
$Q_{gd}$	Gate-Drain Charge			8.2		

Notes:

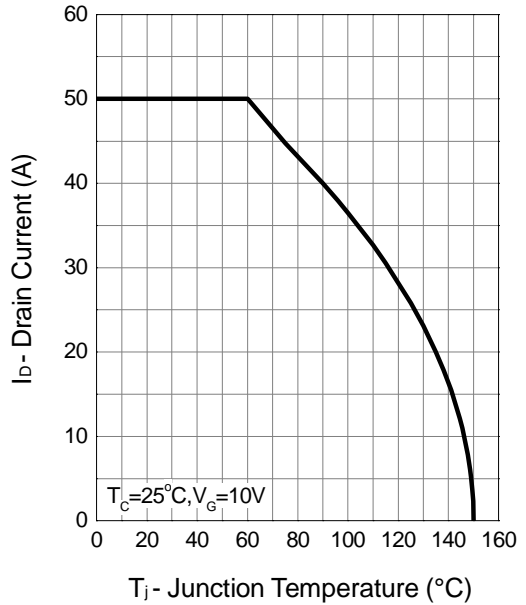
- a : Pulse test ; pulse width $\leq 300\mu\text{s}$ , duty cycle $\leq 2\%$ .
- b : Guaranteed by design, not subject to production testing.

Typical Characteristics

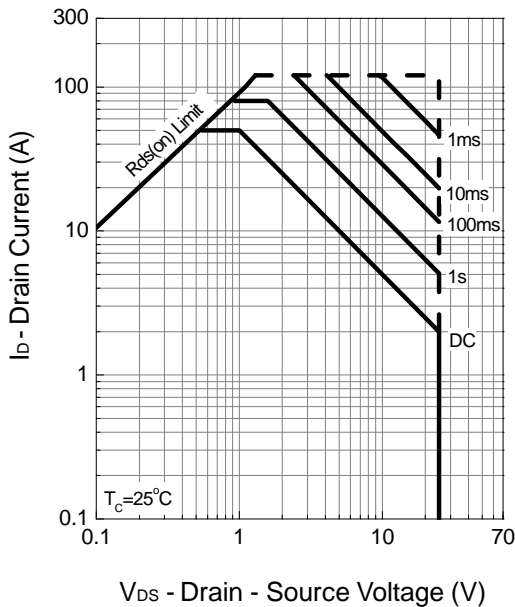
Power Dissipation



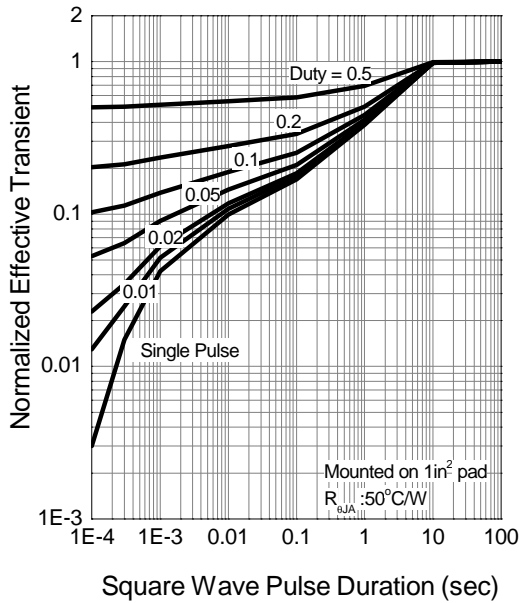
Drain Current



Safe Operation Area

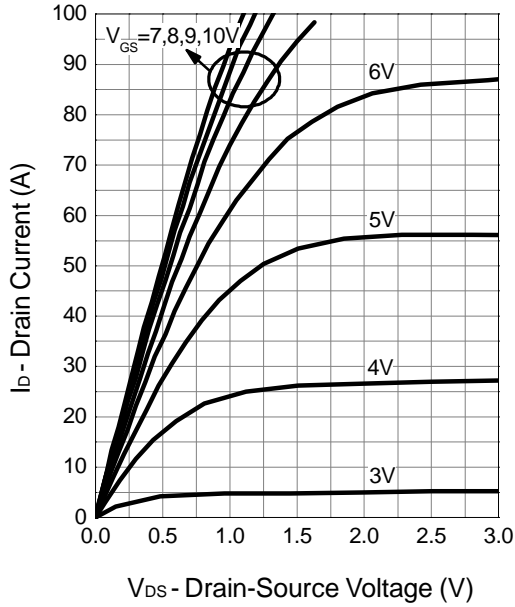


Thermal Transient Impedance

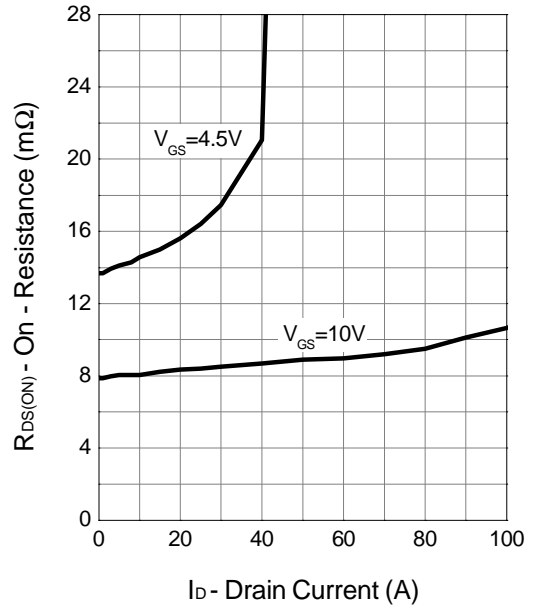


Typical Characteristics (Cont.)

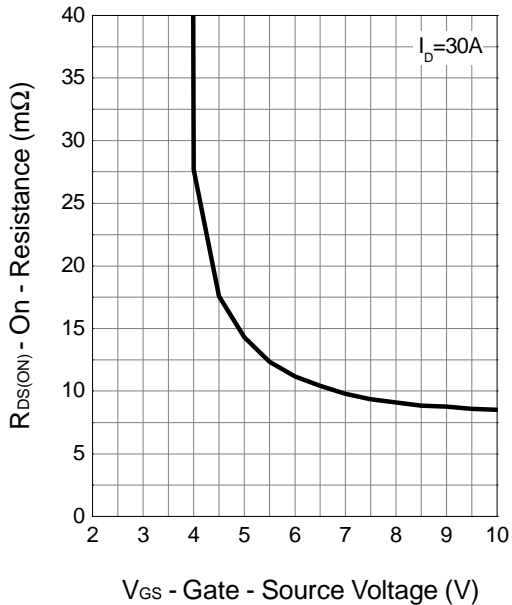
Output Characteristics



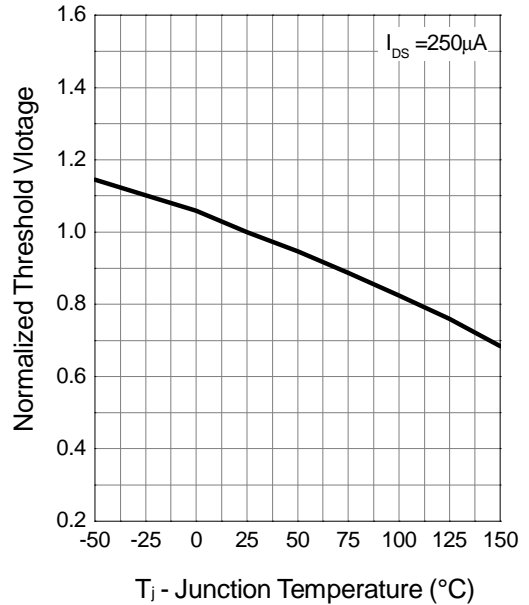
Drain-Source On Resistance



Drain-Source On Resistance

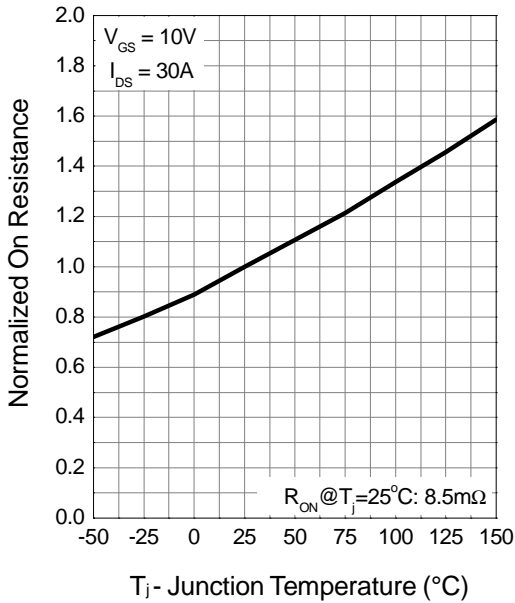


Gate Threshold Voltage

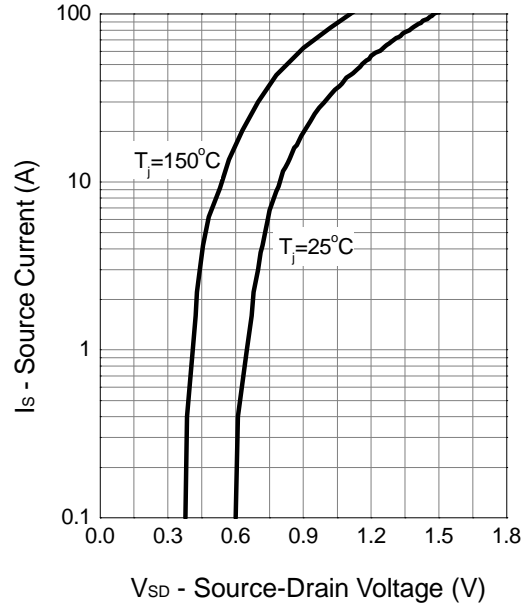


Typical Characteristics (Cont.)

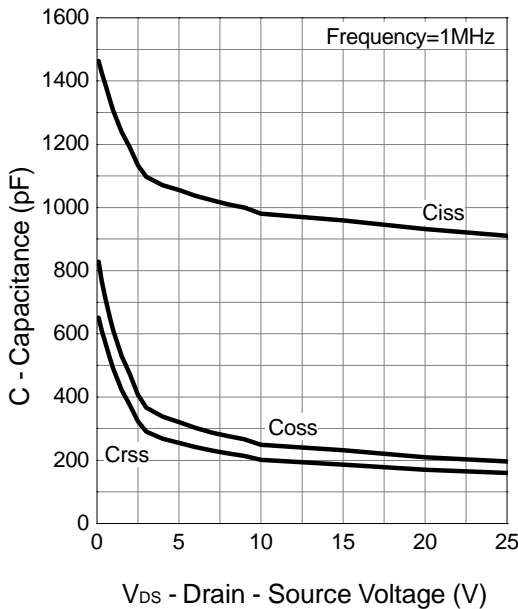
Drain-Source On Resistance



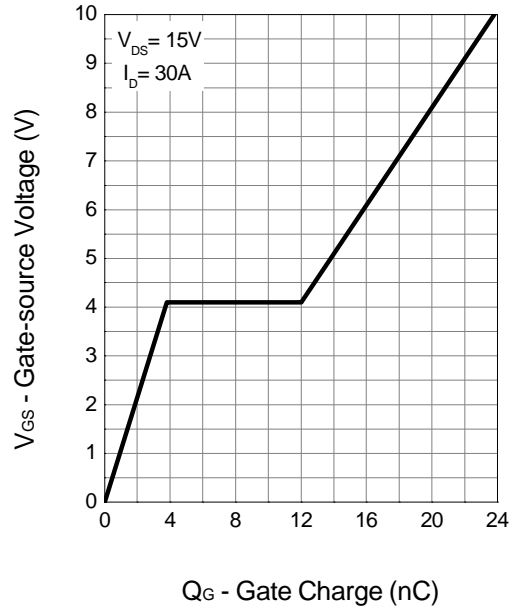
Source-Drain Diode Forward



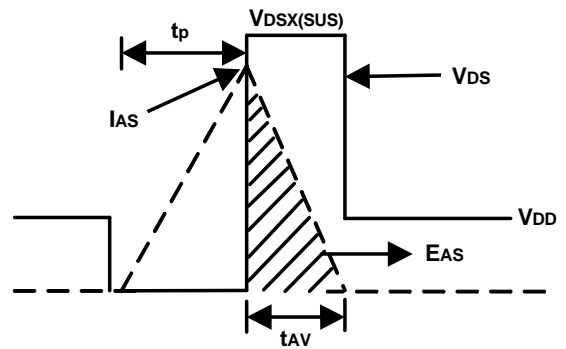
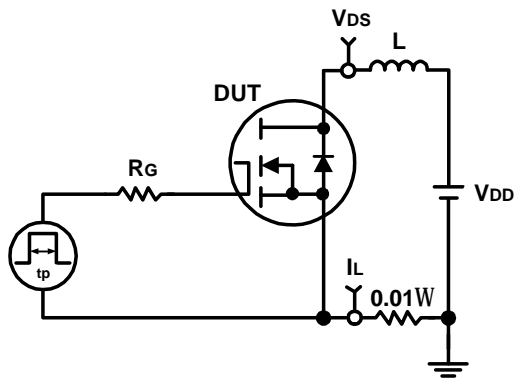
Capacitance



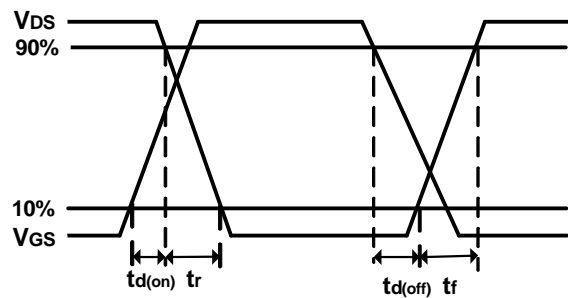
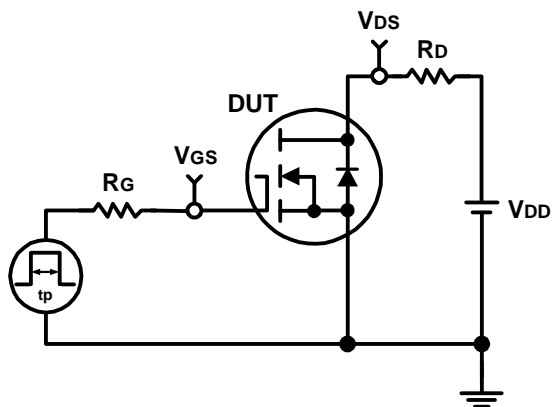
Gate Charge



Avalanche Test Circuit and Waveforms

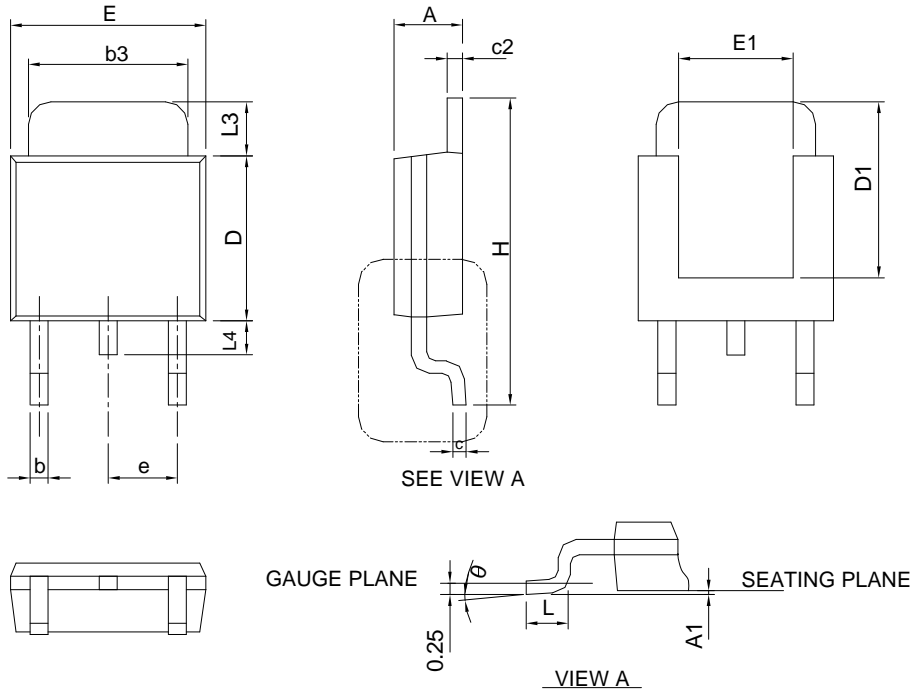


Avalanche Test Circuit and Waveforms



## Package Information

TO-252

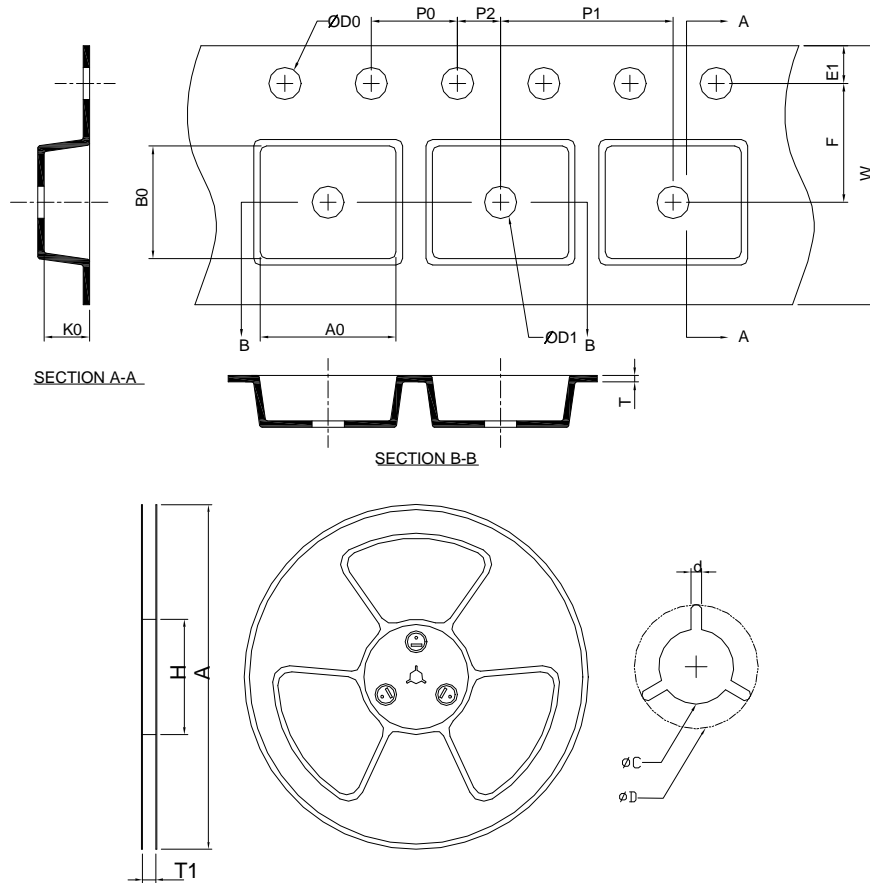


SYMBOL	TO-252			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1		0.13		0.005
b	0.50	0.89	0.020	0.035
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	2.29 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
$\theta$	0°	8°	0°	8°

Note : Follow JEDEC TO-252 .



Carrier Tape & Reel Dimensions



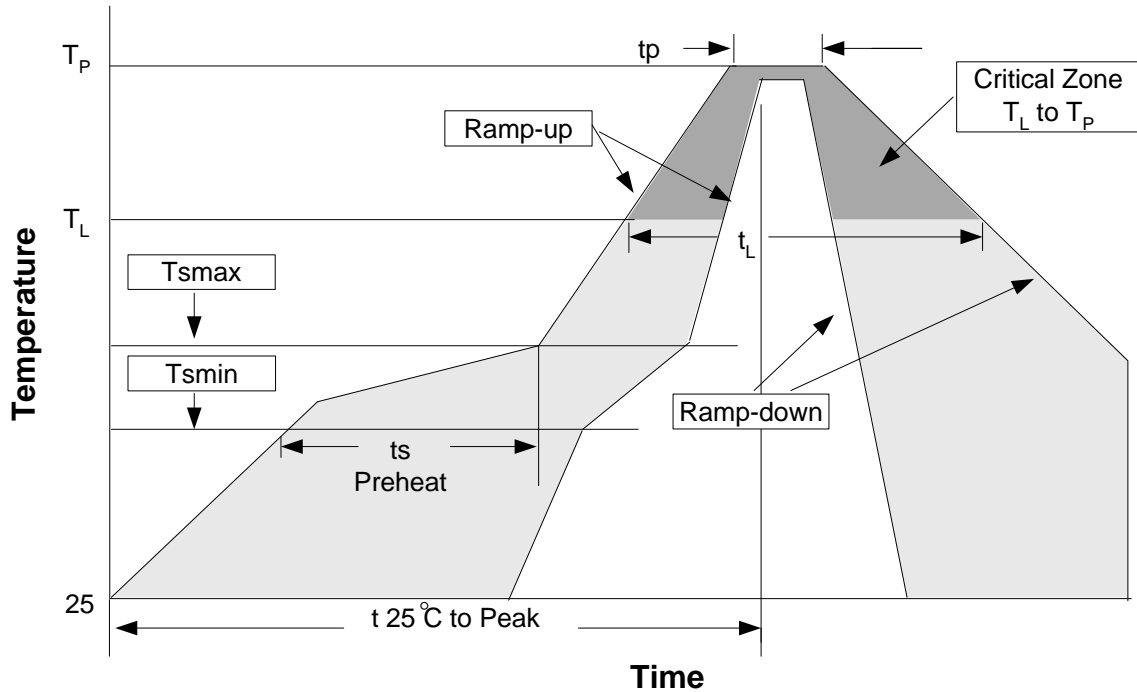
Application	A	H	T1	C	d	D	W	E1	F
TO-252	$330.0 \pm 2.00$	50 MIN.	$16.4+2.00$ $-0.00$	$13.0+0.50$ $-0.20$	1.5 MIN.	20.2 MIN.	$16.0 \pm 0.30$	$1.75 \pm 0.10$	$7.50 \pm 0.05$
	P0	P1	P2	D0	D1	T	A0	B0	K0
	$4.0 \pm 0.10$	$8.0 \pm 0.10$	$2.0 \pm 0.05$	$1.5+0.10$ $-0.00$	1.5 MIN.	$0.6+0.00$ $-0.40$	$6.80 \pm 0.20$	$10.40 \pm 0.20$	$2.50 \pm 0.20$

(mm)

Devices Per Unit

Package Type	Unit	Quantity
TO-252	Tape & Reel	2500

**Reflow Condition (IR/Convection or VPR Reflow)**



**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

**Classification Reflow Profiles**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T <sub>L</sub> to T <sub>P</sub> )	3°C/second max.	3°C/second max.
Preheat		
- Temperature Min (T <sub>min</sub> )	100°C	150°C
- Temperature Max (T <sub>max</sub> )	150°C	200°C
- Time (min to max) (t <sub>s</sub> )	60-120 seconds	60-180 seconds
Time maintained above:		
- Temperature (T <sub>L</sub> )	183°C	217°C
- Time (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak/Classification Temperature (T <sub>p</sub> )	See table 1	See table 2
Time within 5°C of actual Peak Temperature (t <sub>p</sub> )	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.

**Classification Reflow Profiles (Con.)**

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.

**Customer Service**

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