

## P-Channel Enhancement Mode MOSFET

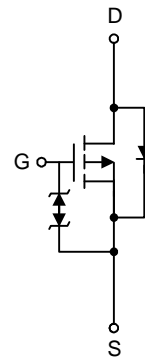
### Features

- -20V/-8A,  
 $R_{DS(ON)}=125m\Omega$  (typ.) @  $V_{GS}=-4.5V$   
 $R_{DS(ON)}=160m\Omega$  (typ.) @  $V_{GS}=-2.5V$
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free and Green Devices Available  
 (RoHS Compliant)

### Pin Description



Top View of TO-252-3



P-Channel MOSFET

### Applications

- Power Management in Desktop Computer or DC/DC Converters

### Ordering and Marking Information

<p>APM2150P <span style="font-family: monospace;">□□-□□□</span></p> <div style="margin-left: 20px;"> <p>└─ Assembly Material</p> <p>└─ Handling Code</p> <p>└─ Temperature Range</p> <p>└─ Package Code</p> </div>	<p>Package Code                  U : TO-252-3</p> <p>Operating Junction Temperature Range                  C : -55 to 150 °C</p> <p>Handling Code                  TR : Tape &amp; Reel</p> <p>Assembly Material                  G : Halogen and Lead Free Device</p>
<p>APM2150P U :</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 10px;"> <p style="margin: 0; font-size: 8px;">APM2150P XXXXX</p> </div>	<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-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	-20	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 12$		
$T_J$	Maximum Junction Temperature	150	$^{\circ}\text{C}$	
$T_{STG}$	Storage Temperature Range	-55 to 150	$^{\circ}\text{C}$	
$I_S$	Diode Continuous Forward Current	$T_A=25^{\circ}\text{C}$ -1	A	
<b>Mounted on Large Heat Sink</b>				
$I_{DP}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_C=25^{\circ}\text{C}$	-20	A
		$T_C=100^{\circ}\text{C}$	-12	
$I_D$	Continuous Drain Current	$T_C=25^{\circ}\text{C}$	-8*	A
		$T_C=100^{\circ}\text{C}$	-5	
$P_D$	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	$^{\circ}\text{C/W}$	
<b>Mounted on PCB of 1in<sup>2</sup> Pad Area</b>				
$I_{DP}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_A=25^{\circ}\text{C}$	-20	A
		$T_A=100^{\circ}\text{C}$	-12	
$I_D$	Continuous Drain Current	$T_A=25^{\circ}\text{C}$	-3	A
		$T_A=100^{\circ}\text{C}$	-2	
$P_D$	Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$	1.6	W
		$T_A=100^{\circ}\text{C}$	0.6	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	75	$^{\circ}\text{C/W}$	
<b>Mounted on PCB of Minimum Footprint</b>				
$I_{DP}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_A=25^{\circ}\text{C}$	-20	A
		$T_A=100^{\circ}\text{C}$	-12	
$I_D$	Continuous Drain Current	$T_A=25^{\circ}\text{C}$	-2	A
		$T_A=100^{\circ}\text{C}$	-1	
$P_D$	Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$	1	W
		$T_A=100^{\circ}\text{C}$	0.4	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	115	$^{\circ}\text{C/W}$	

Note : \* Current limited by bond wire.

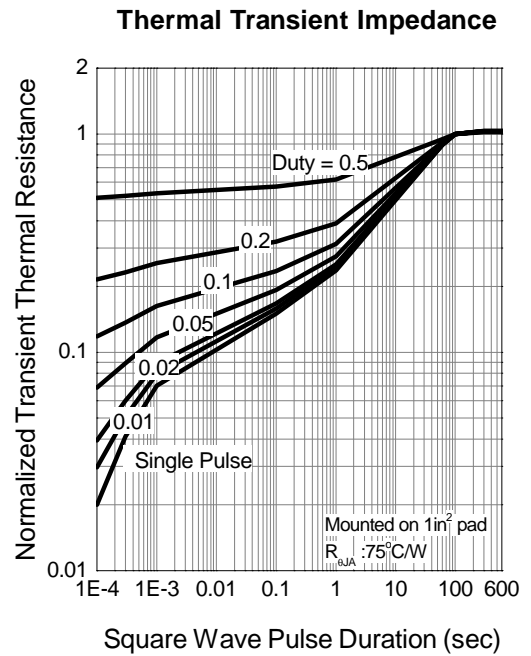
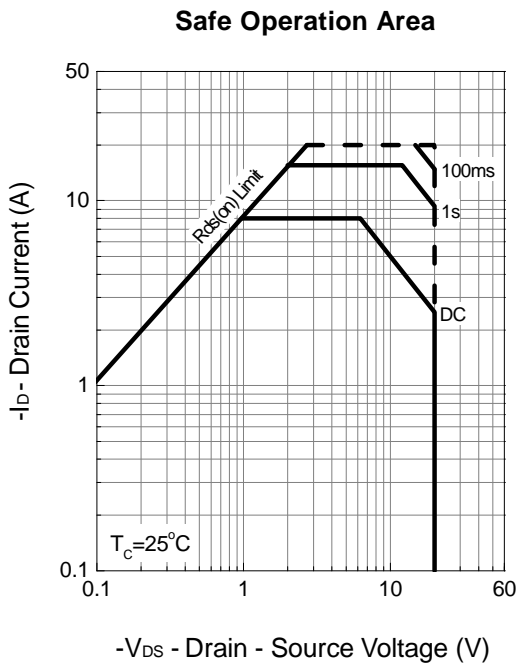
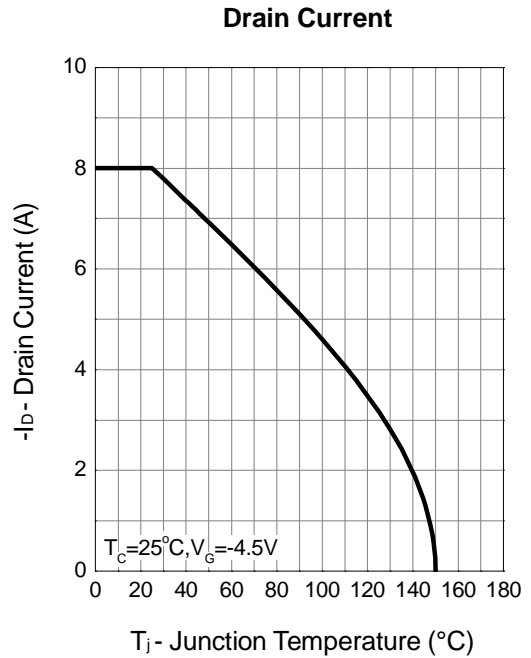
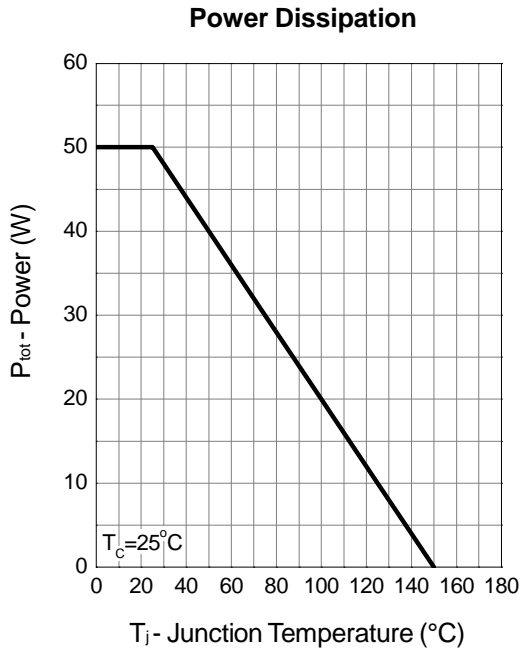
## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	APM2150PU			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=-250\mu A$	-20	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-16V, V_{GS}=0V$	-	-	-1	$\mu A$
		$T_J=85^\circ\text{C}$	-	-	-30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=-250\mu A$	-0.45	-0.6	-1	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 10V, V_{DS}=0V$	-	-	$\pm 10$	$\mu A$
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=-4.5V, I_{DS}=-2.9A$	-	125	150	m $\Omega$
		$V_{GS}=-2.5V, I_{DS}=-2.6A$	-	160	200	
<b>Diode Characteristics</b>						
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=-1A, V_{GS}=0V$	-	-0.8	-1.3	V
<b>Dynamic Characteristics<sup>b</sup></b>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	-	11	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=-15V,$ Frequency=1.0MHz	-	330	-	pF
$C_{oss}$	Output Capacitance		-	50	-	
$C_{riss}$	Reverse Transfer Capacitance		-	25	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=-10V, R_L=10\Omega,$ $I_{DS}=-1A, V_{GEN}=-4.5V,$ $R_G=6\Omega$	-	6	12	ns
$T_r$	Turn-on Rise Time		-	8	15	
$t_{d(OFF)}$	Turn-off Delay Time		-	10	19	
$T_f$	Turn-off Fall Time		-	5	10	
<b>Gate Charge Characteristics<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=-10V, V_{GS}=-4.5V,$ $I_{DS}=-2.9A$	-	7	10	nC
$Q_{gs}$	Gate-Source Charge		-	1	-	
$Q_{gd}$	Gate-Drain Charge		-	1	-	

Note a : Pulse test ; pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ .

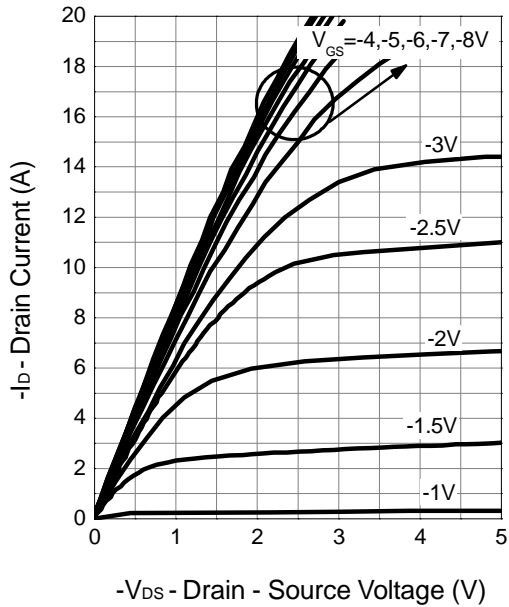
Note b : Guaranteed by design, not subject to production testing.

Typical Operating Characteristics

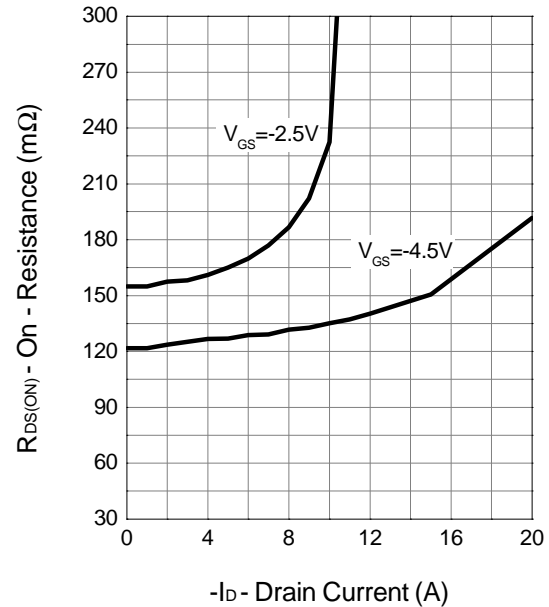


Typical Operating Characteristics (Cont.)

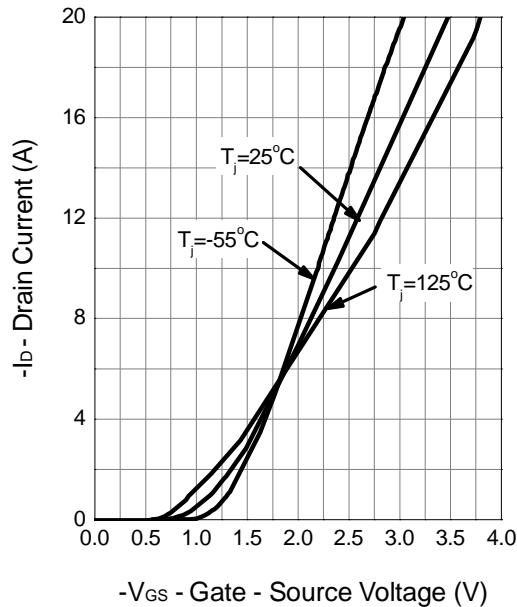
Output Characteristics



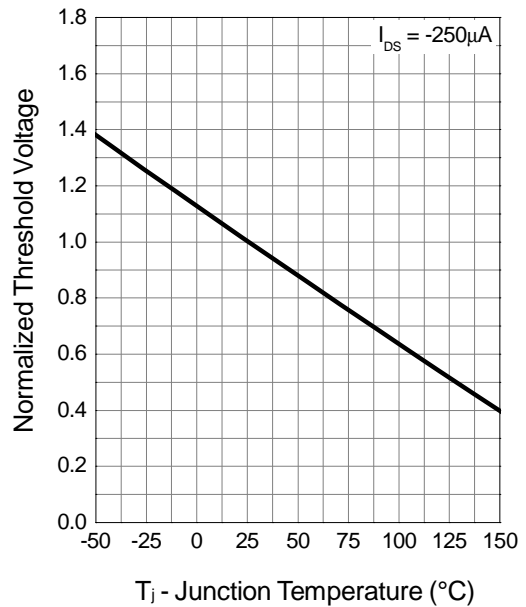
Drain-Source On Resistance



Transfer Characteristics

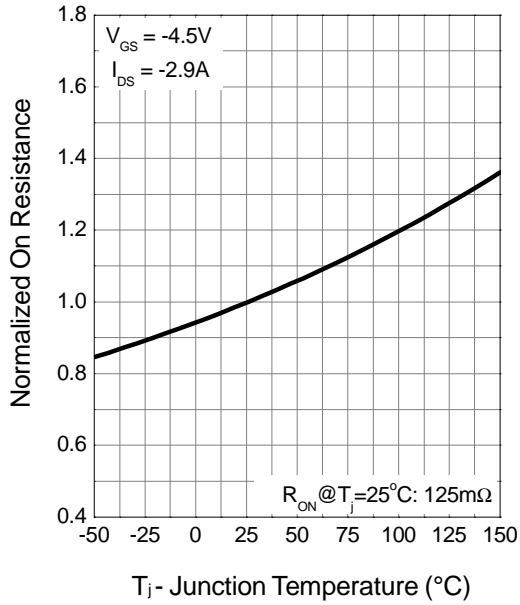


Gate Threshold Voltage

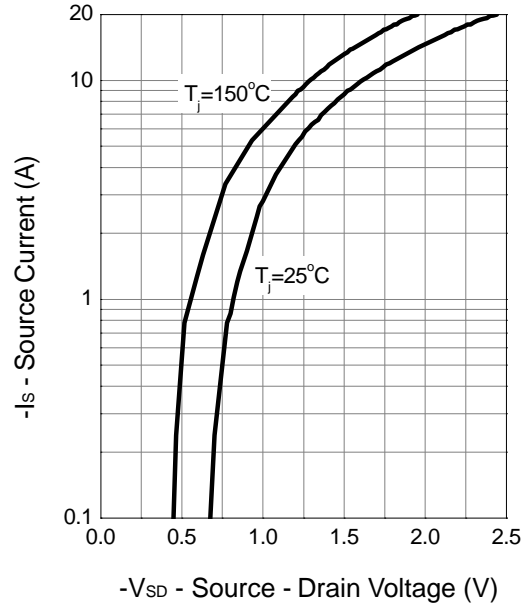


Typical Operating Characteristics (Cont.)

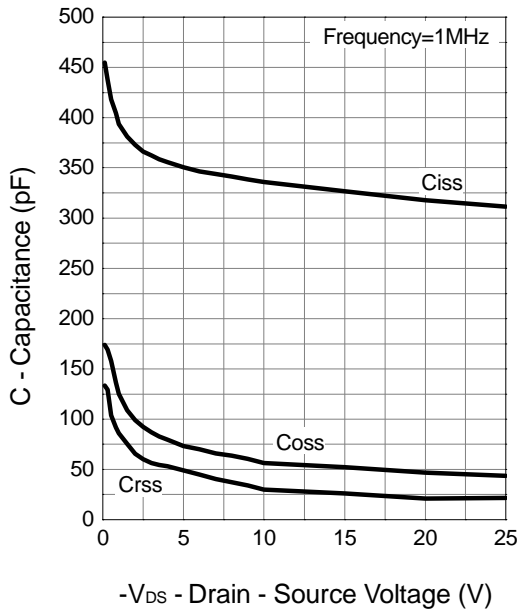
Drain-Source On Resistance



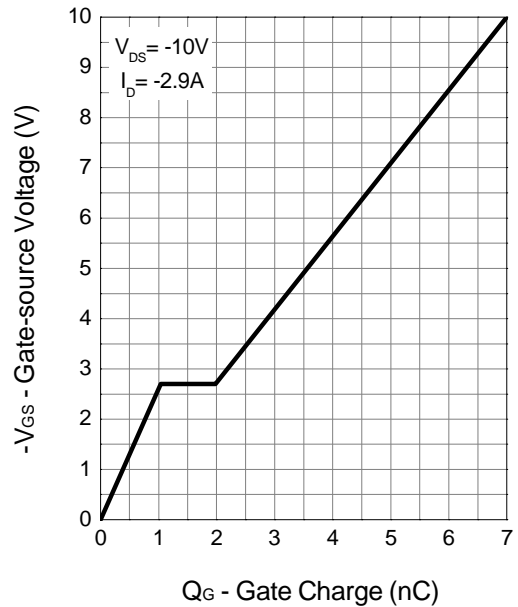
Source-Drain Diode Forward



Capacitance

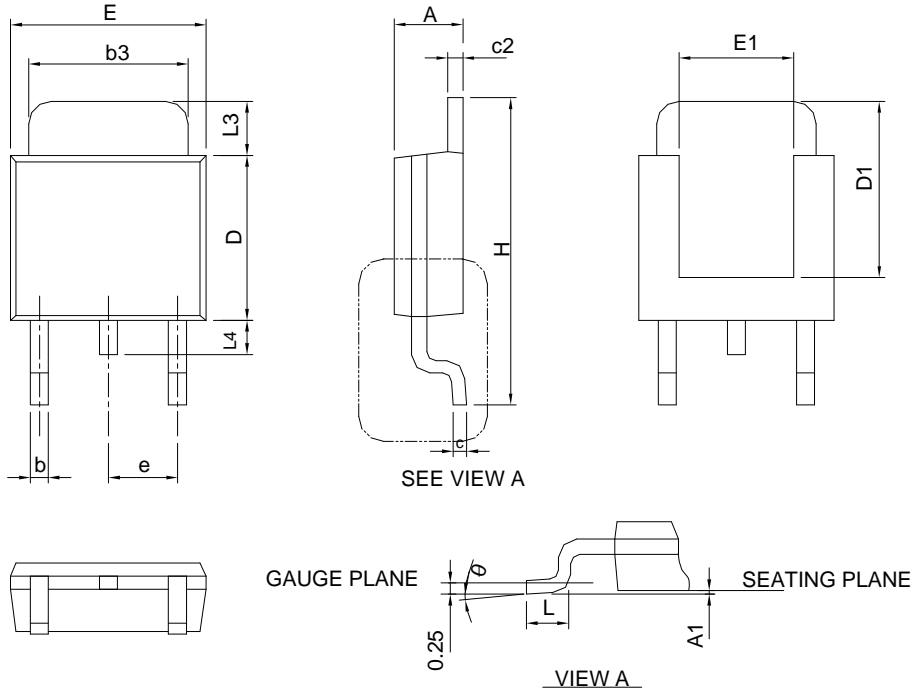


Gate Charge



Package Information

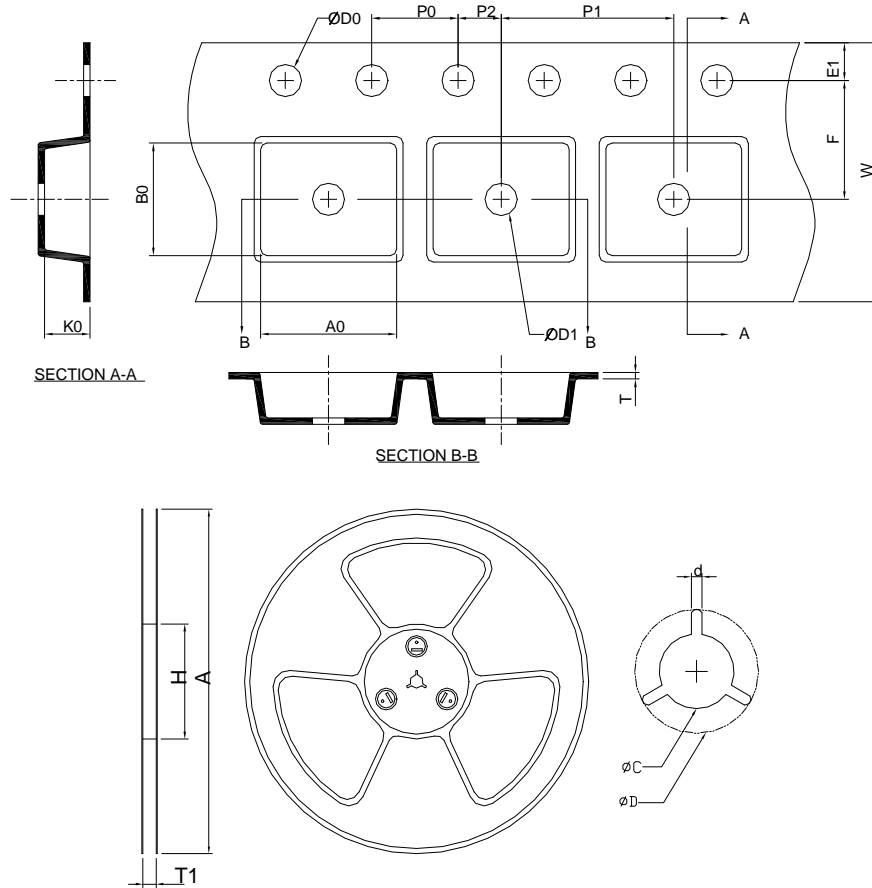
TO-252-3



SYMBOL	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 ±2.00	50 MIN.	16.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	16.0 ±0.30	1.75 ±0.10	7.50 ±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	8.0 ±0.10	2.0 ±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.80 ±0.20	10.40 ±0.20	2.50 ±0.20

(mm)

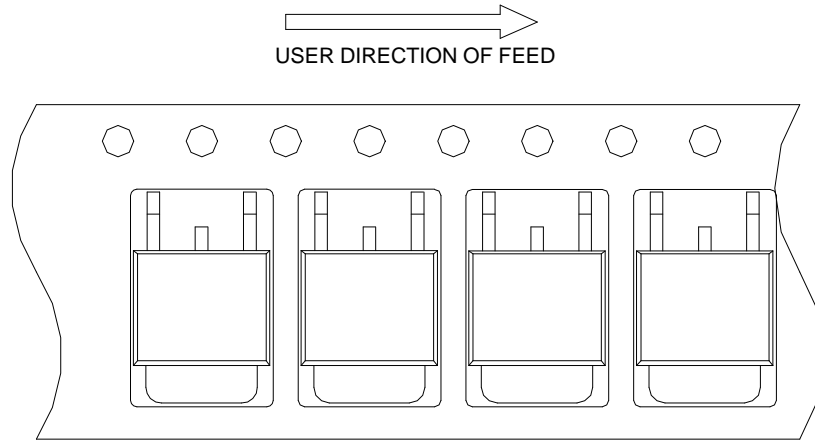
### Devices Per Unit

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

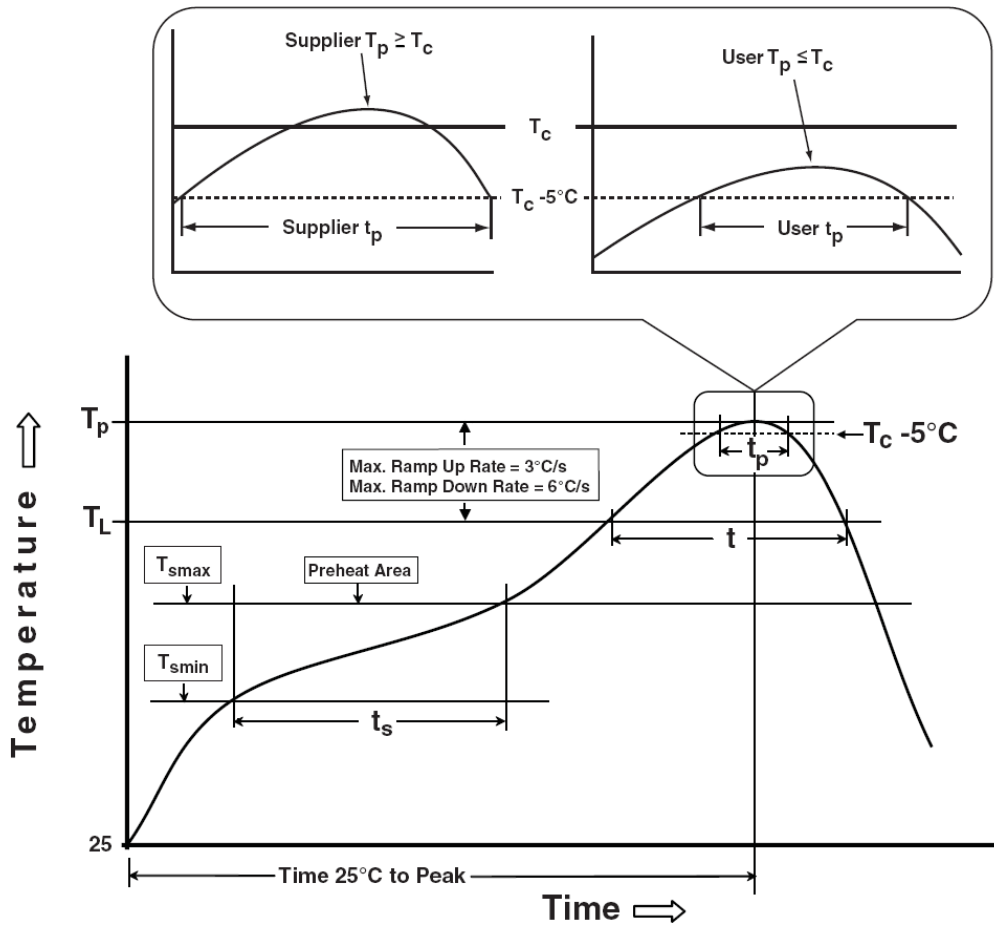


## Taping Direction Information

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.		

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

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

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

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 °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 @ 125°C
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C

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## 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 :

2F, No. 11, Lane 218, Sec 2 Jhongsing Rd.,

Sindain City, Taipei County 23146, Taiwan

Tel : 886-2-2910-3838

Fax : 886-2-2917-3838