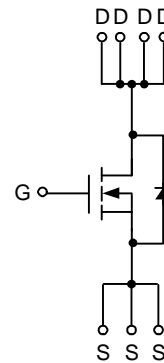
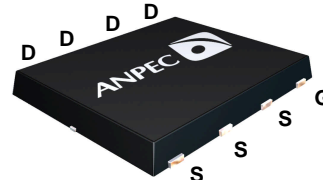


## N-Channel Enhancement Mode MOSFET

### Features

- 30V/60A,  
 $R_{DS(ON)} = 7.5m\Omega$  (typ.) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 11.5m\Omega$  (typ.) @  $V_{GS} = 4.5V$
- Super High Dense Cell Design
- Avalanche Rated
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

### Pin Description




N-Channel MOSFET

### Applications

- Power Management in Notebook Computer, or Decktop Computer.

### Ordering and Marking Information

<p>APM4350 □□□-□□□</p> <ul style="list-style-type: none"> <li>□□□ — Assembly Material</li> <li>□□ — Handling Code</li> <li>□ — Temperature Range</li> <li>□ — Package Code</li> </ul>	<p>Package Code                  KP : KPAK                  Operating Junction Temperature Range                  C : -55 to 150 °C                  Handling Code                  TR : Tape &amp; Reel                  Assembly Material                  L : Lead Free Device                  G : Halogen and Lead Free Device</p>
<p>APM4350 KP :</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; text-align: center;">                   APM4350                  XXXXX             </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 ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Rating	Unit	
<b>Common Ratings</b> ( $T_A = 25^\circ\text{C}$ Unless Otherwise Noted)				
$V_{DSS}$	Drain-Source Voltage	30	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	$T_C = 25^\circ\text{C}$	50	A
$I_{DP}$	300 $\mu\text{s}$ Pulse Drain Current Tested	$T_C = 25^\circ\text{C}$	140	A
		$T_C = 100^\circ\text{C}$	80	
<b>Mounted on Large Heat Sink</b>				
$I_D$	Continuous Drain Current	$T_C = 25^\circ\text{C}$	60	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	$^\circ\text{C/W}$	
<b>Mounted on PCB of 1in<sup>2</sup> pad area</b>				
$I_D$	Continuous Drain Current	$T_A = 25^\circ\text{C}$	13.5	A
		$T_A = 100^\circ\text{C}$	8.5	
$P_D$	Maximum Power Dissipation	$T_A = 25^\circ\text{C}$	2.5	W
		$T_A = 100^\circ\text{C}$	1	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	50	$^\circ\text{C/W}$	
<b>Mounted on PCB of Minimum Footprint</b>				
$I_D$	Continuous Drain Current	$T_A = 25^\circ\text{C}$	10	A
		$T_A = 100^\circ\text{C}$	6	
$P_D$	Maximum Power Dissipation	$T_A = 25^\circ\text{C}$	1.5	W
		$T_A = 100^\circ\text{C}$	0.5	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	75	$^\circ\text{C/W}$	

## Electrical Characteristics (T<sub>A</sub> = 25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	APM4350KP			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =24V, 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 11.5	9 14.5	mΩ
<b>Diode Characteristics</b>						
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>SD</sub> =15A, V <sub>GS</sub> =0V		0.75	1.1	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>DS</sub> =15A, di <sub>SD</sub> /dt=100A/μs		11		ns
Q <sub>rr</sub>	Reverse Recovery Charge			3		nC
<b>Gate Charge Characteristics<sup>b</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, V <sub>GS</sub> =10V, I <sub>DS</sub> =30A		28	39	nC
Q <sub>gs</sub>	Gate-Source Charge			4		
Q <sub>gd</sub>	Gate-Drain Charge			9		
<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		1.6		Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, Frequency=1.0MHz		1660		pF
C <sub>oss</sub>	Output Capacitance			260		
C <sub>riss</sub>	Reverse Transfer Capacitance			170		
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		18	33	ns
t <sub>r</sub>	Turn-on Rise Time			15	28	
t <sub>d(OFF)</sub>	Turn-off Delay Time			47	86	
t <sub>f</sub>	Turn-off Fall Time			22	41	

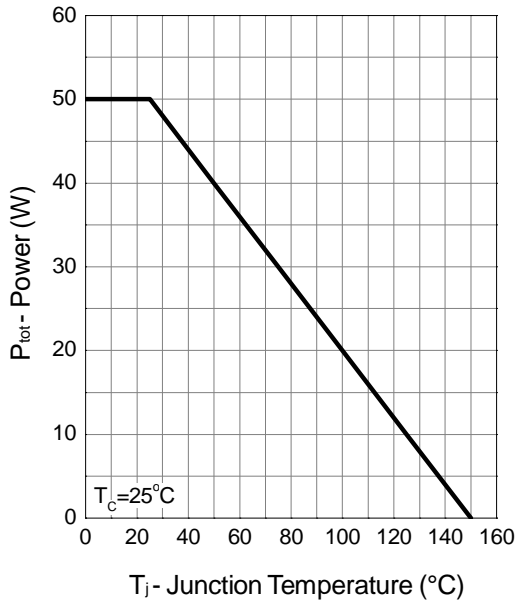
Note :

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

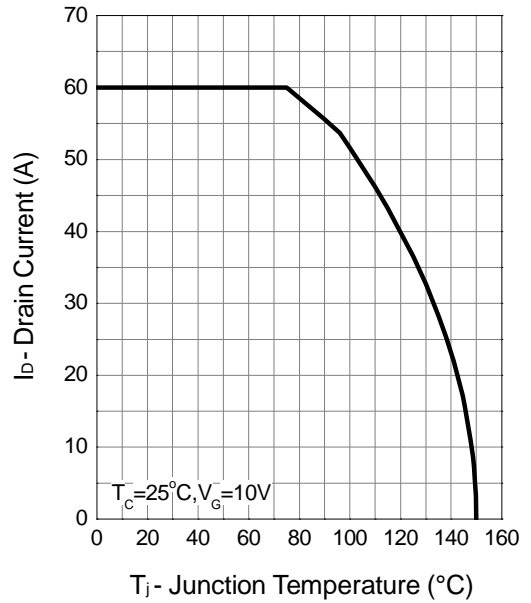
b : Guaranteed by design, not subject to production testing.

Typical Characteristics

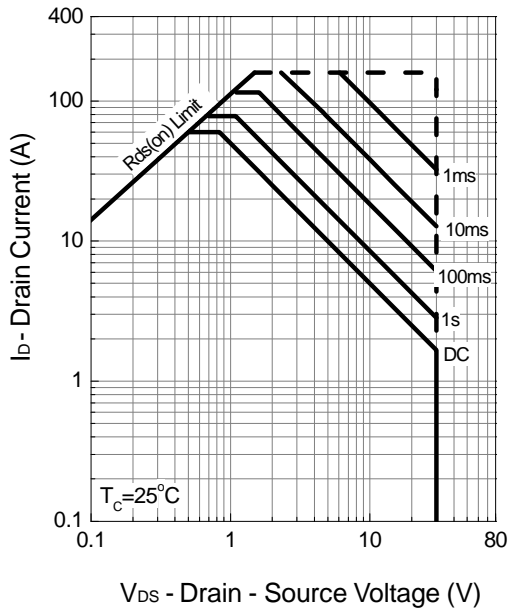
Power Dissipation



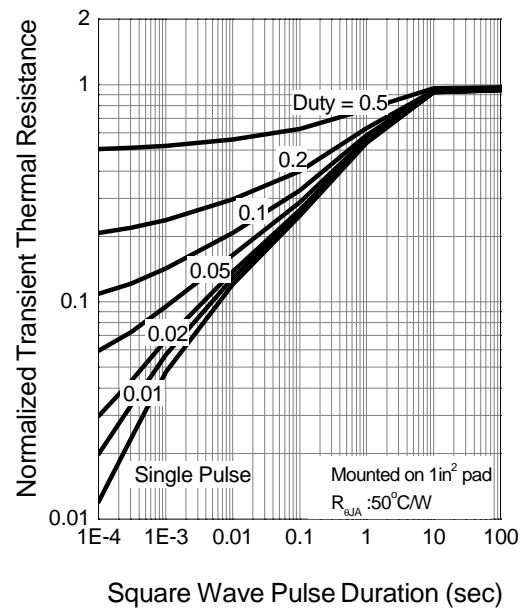
Drain Current



Safe Operation Area

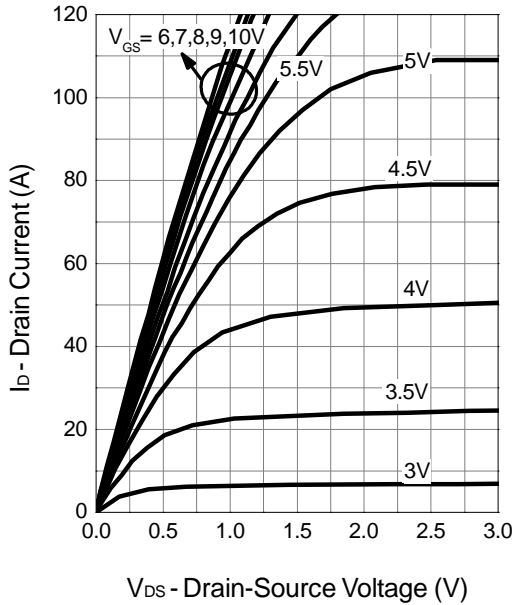


Thermal Transient Impedance

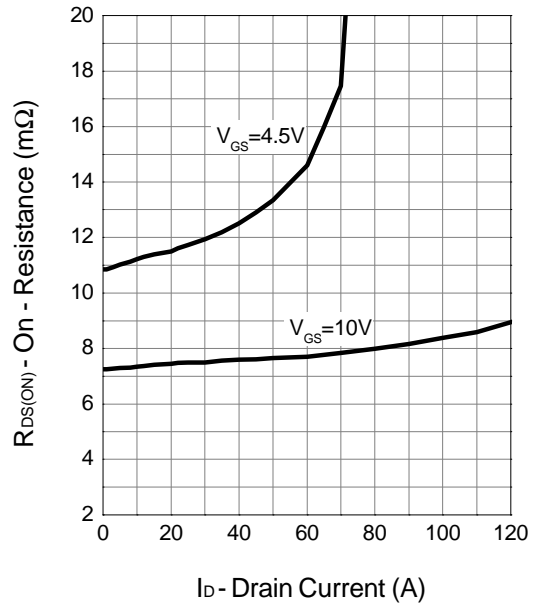


Typical Characteristics (Cont.)

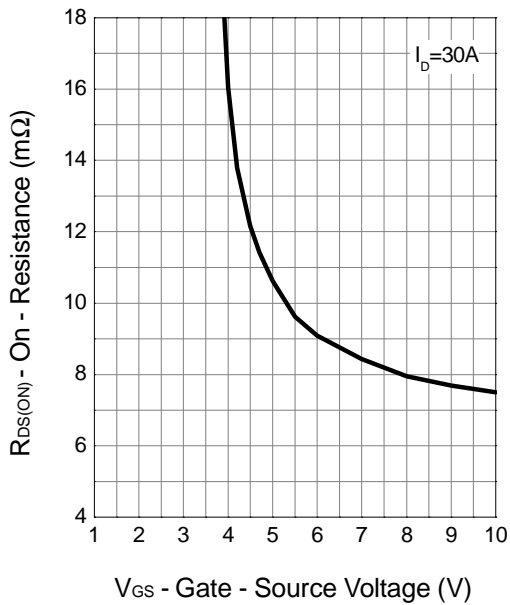
Output Characteristics



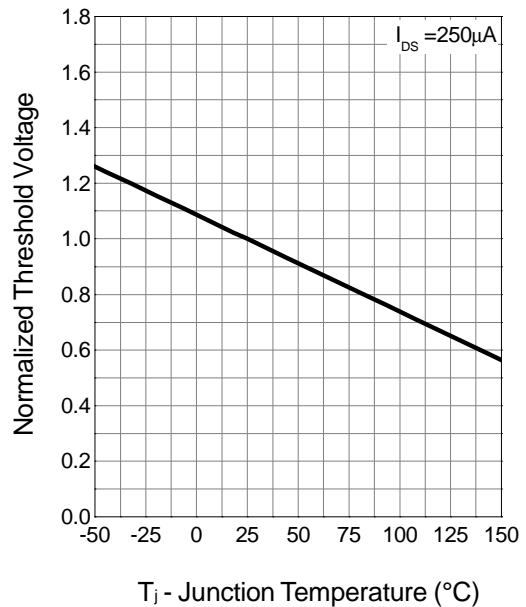
Drain-Source On Resistance



Gate-Source On Resistance

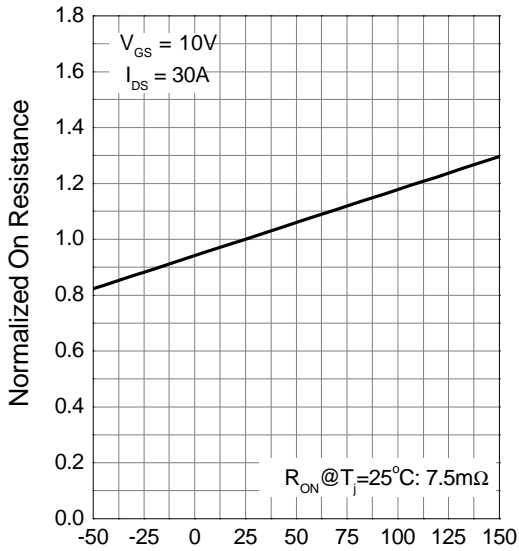


Gate Threshold Voltage



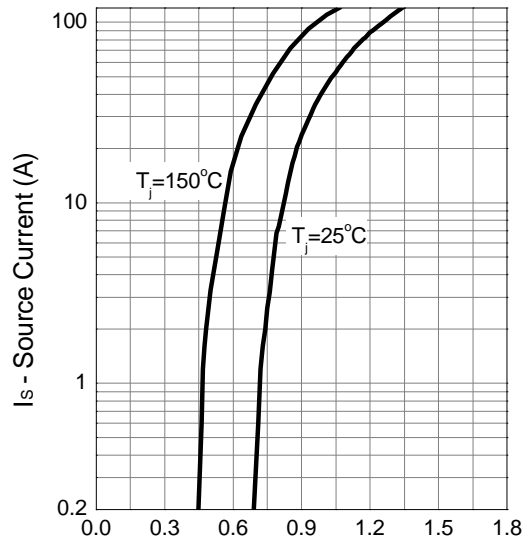
Typical Characteristics (Cont.)

Drain-Source On Resistance



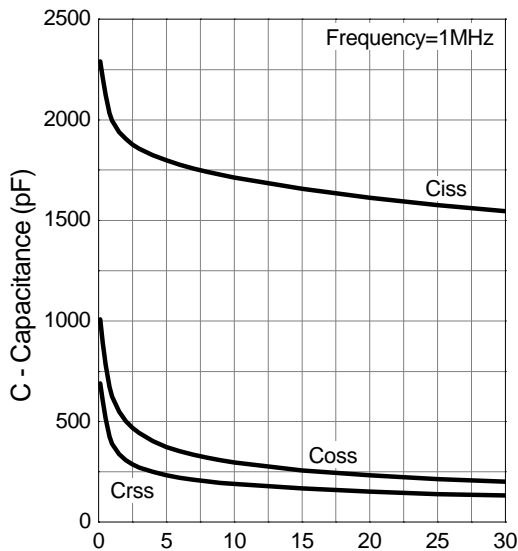
$T_j$  - Junction Temperature ( $^{\circ}\text{C}$ )

Source-Drain Diode Forward



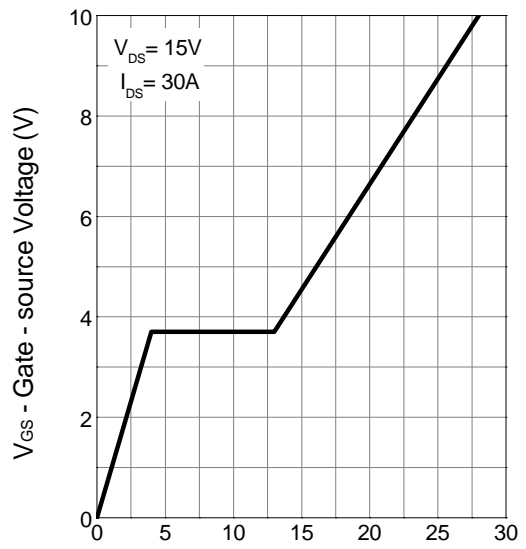
$V_{SD}$  - Source - Drain Voltage (V)

Capacitance



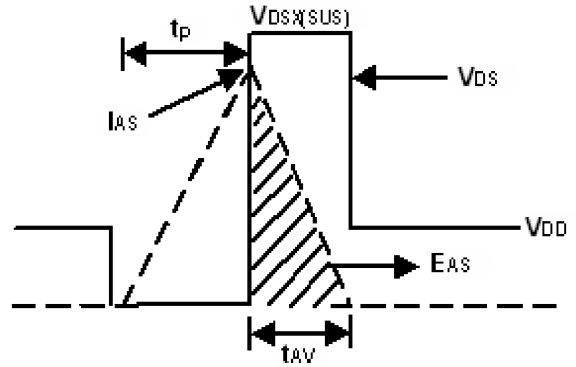
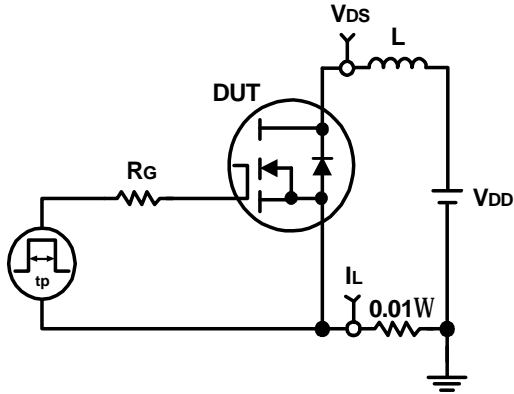
$V_{DS}$  - Drain - Source Voltage (V)

Gate Charge

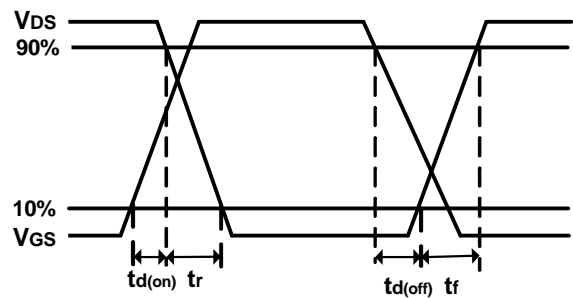
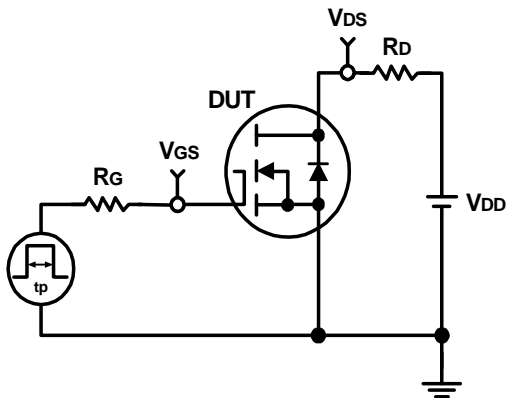


$Q_G$  - Gate Charge (nC)

### Avalanche Test Circuit and Waveforms

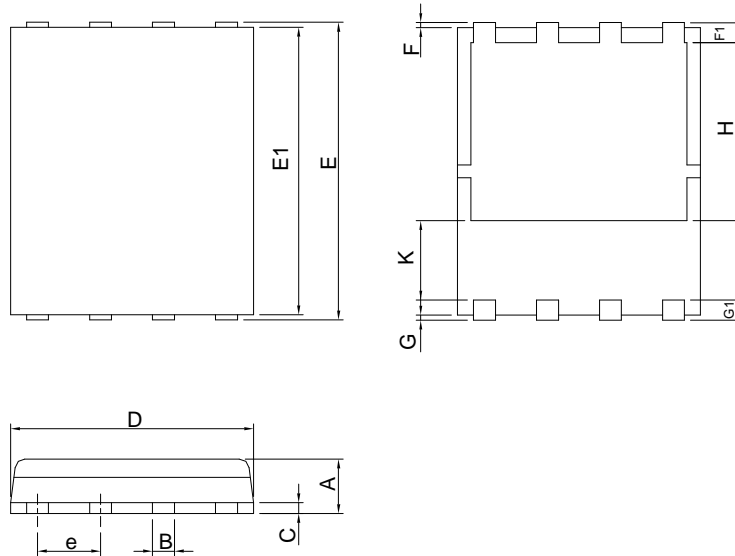


### Switching Time Test Circuit and Waveforms



Package Information

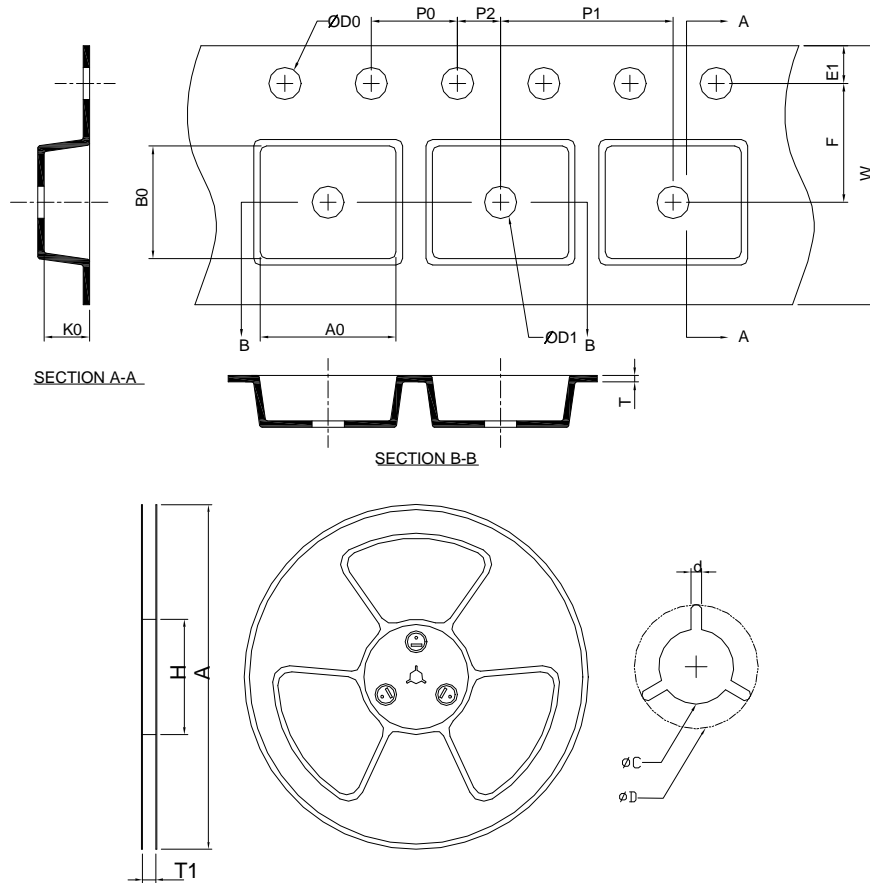
KPAK



SYMBOL	KPAK			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	1.00	1.20	0.039	0.047
B	0.38	0.51	0.015	0.020
C	0.19	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.90	6.10	0.232	0.240
E1	5.70	5.80	0.224	0.228
e	1.27 BSC		0.050 BSC	
F	0.05	0.15	0.002	0.006
F1	0.35	0.45	0.014	0.018
G	0.05	0.15	0.002	0.006
G1	0.35	0.45	0.014	0.018
H	3.49	3.69	0.137	0.145
K	1.60		0.063	



### Carrier Tape & Reel Dimensions



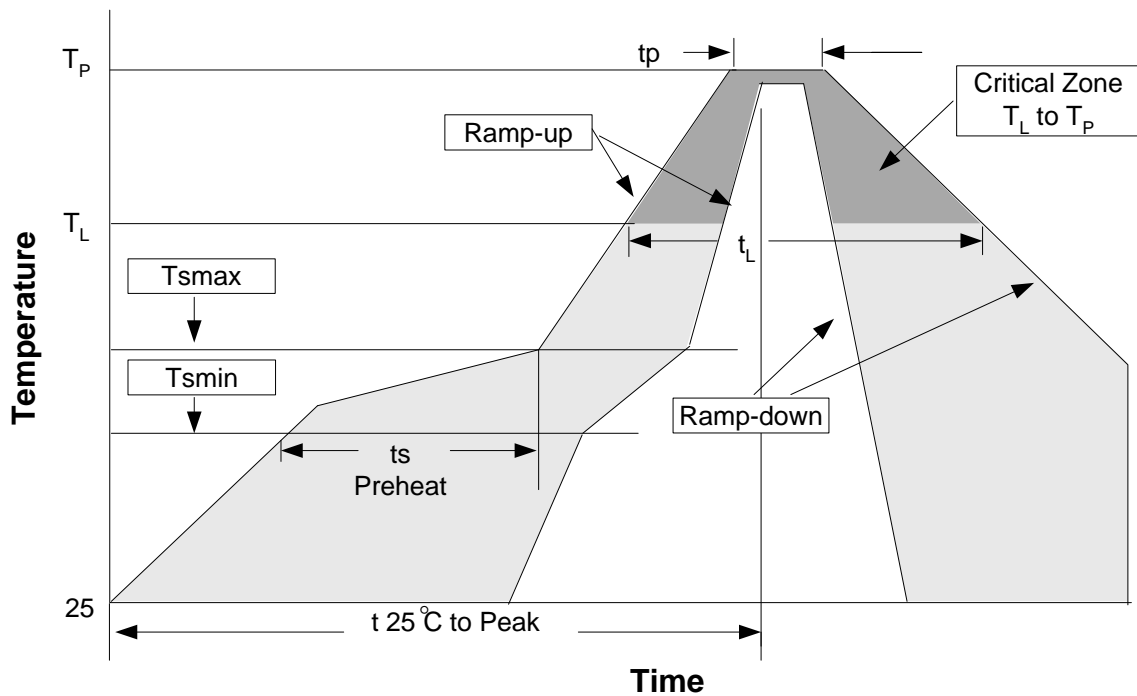
Application	A	H	T1	C	d	D	W	E1	F
KPAK	$330.0 \pm 2.00$	50 MIN.	$12.4+2.00$ $-0.00$	$13.0+0.50$ $-0.20$	1.5 MIN.	20.2 MIN.	$12.0 \pm 0.30$	$1.75 \pm 0.10$	$5.5 \pm 0.10$
	P0	P1	P2	D0	D1	T	A0	B0	K0
	$4.0 \pm 0.10$	$8.0 \pm 0.10$	$2.0 \pm 0.10$	$1.5+0.10$ $-0.00$	1.5 MIN.	$0.3 \pm 0.05$	$6.5 \pm 0.10$	$5.3 \pm 0.10$	$1.4 \pm 0.10$

(mm)

### Devices Per Unit

Package Type	Unit	Quantity
KPAK	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 ( $T_L$ 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.

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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