

N-Channel Enhancement Mode MOSFET


Features

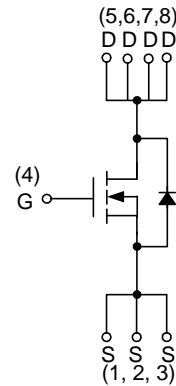
- 25V/16A,
 $R_{DS(ON)}=7.5m\Omega(\text{typ.}) @ V_{GS}=10V$
 $R_{DS(ON)}=10m\Omega(\text{typ.}) @ V_{GS}=4.5V$
- Super High Dense Cell Design
- Avalanche Rated
- Reliable and Rugged
- Thermal Pad Exposed with Standard SOP-8 Outline
- Lead Free and Green Devices Available (RoHS Compliant)

Pin Description



SOP-8 Exposed

 = Thermal Pad (connected to Drain plane for better heat dissipation)



N-Channel MOSFET

Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems

Ordering and Marking Information

<p>APM4220 □□□-□□□</p> <div style="margin-left: 20px;"> <p>└─ Assembly Material</p> <p>└─ Handling Code</p> <p>└─ Temp. Range</p> <p>└─ Package Code</p> </div>	<p>Package Code KA : SOP-8P</p> <p>Operating Junction Temp. Range C : -55 to 150°C</p> <p>Handling Code TR : Tape & Reel</p> <p>Assembly Material L : Lead Free Device G : Halogen and Lead Free Device</p>
<p>APM4220 KA : APM4220 XXXXX</p>	<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

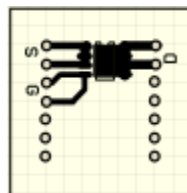
Symbol	Parameter	Rating	Unit	
Common Ratings ($T_A=25^{\circ}\text{C}$ Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage	25	V	
V_{GSS}	Gate-Source Voltage	± 20		
T_J	Maximum Junction Temperature	150	$^{\circ}\text{C}$	
T_{STG}	Storage Temperature Range	-55 to 150	$^{\circ}\text{C}$	
Mounted on Large Heat Sink				
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	$^{\circ}\text{C/W}$	
Mounted on PCB of 1in² Pad Area^j				
I_{DP}	300 μs Pulse Drain Current Tested	$T_A=25^{\circ}\text{C}$	50	A
		$T_A=100^{\circ}\text{C}$	25	
I_D	Continuous Drain Current	$T_A=25^{\circ}\text{C}$	16	A
		$T_A=100^{\circ}\text{C}$	8	
P_D	Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$	3	W
		$T_A=100^{\circ}\text{C}$	1.2	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	40	$^{\circ}\text{C/W}$	
Mounted on PCB of Minimum Footprint^k				
I_{DP}	300 μs Pulse Drain Current Tested	$T_A=25^{\circ}\text{C}$	50	A
		$T_A=100^{\circ}\text{C}$	25	
I_D	Continuous Drain Current	$T_A=25^{\circ}\text{C}$	13	A
		$T_A=100^{\circ}\text{C}$	6	
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 Minimum Footprint	50	$^{\circ}\text{C/W}$	

Notes:

j . The value of $R_{\theta JA}$ is when the device mounted on 1in² pad with 2oz. Copper, $t \leq 10\text{s}$.



k . The value of $R_{\theta JA}$ is when the device mounted on minimum pad with 2oz. Copper, $t \leq 10\text{s}$.



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

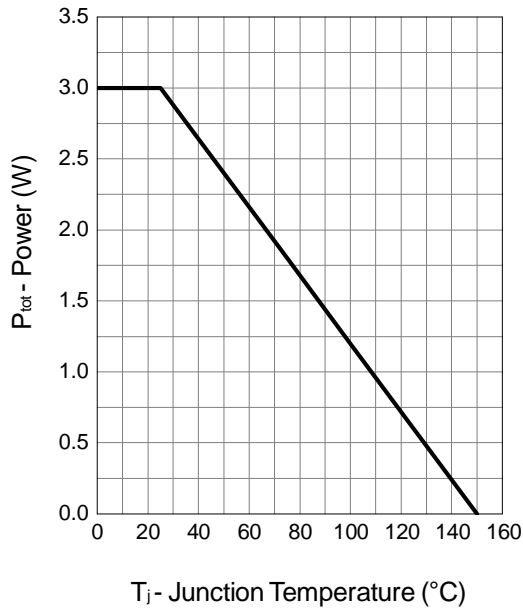
Symbol	Parameter	Test Condition	APM4220KA			Unit
			Min.	Typ.	Max.	
Drain-Source Avalanche Ratings						
E_{AS}	Avalanche Energy, Single Pulsed	$I_D=15\text{A}, V_{DD}=15\text{V}$			50	mJ
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$	25			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=20\text{V}, V_{GS}=0\text{V}$			1	μA
		$V_{DS}=20\text{V}, V_{GS}=0\text{V}$ $T_A=25^\circ\text{C}$			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	$V_{GS}=\pm 20\text{V}, V_{DS}=0\text{V}$			± 100	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10\text{V}, I_{DS}=16\text{A}$		7.5	9	m Ω
		$V_{GS}=4.5\text{V}, I_{DS}=14\text{A}$		10	12	
V_{SD}^a	Diode Forward Voltage	$I_{SD}=3\text{A}, V_{GS}=0\text{V}$		0.8	1.3	V
Gate Charge Characteristics^b						
Q_g	Total Gate Charge	$V_{DS}=10\text{V}, V_{GS}=4.5\text{V},$ $I_{DS}=12\text{A}$		20	26	nC
Q_{gs}	Gate-Source Charge			4.8		
Q_{gd}	Gate-Drain Charge			8.4		
Dynamic Characteristics^b						
R_G	Gate Resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$		2		Ω
C_{iss}	Input Capacitance	$V_{GS}=0\text{V},$ $V_{DS}=15\text{V},$ Frequency=1.0MHz		1785		pF
C_{oss}	Output Capacitance			500		
C_{riss}	Reverse Transfer Capacitance			300		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=15\text{V}, R_L=15\Omega,$ $I_{DS}=1\text{A}, V_{GEN}=10\text{V},$ $R_G=6\Omega$		10	19	ns
T_r	Turn-on Rise Time			7	13	
$t_{d(OFF)}$	Turn-off Delay Time			69	95	
T_f	Turn-off Fall Time			32	46	

Notes:

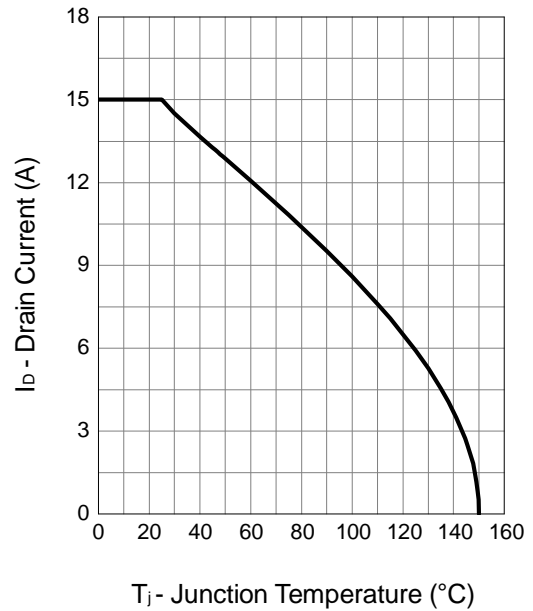
- a: Pulse test ; pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
- b: Guaranteed by design, not subject to production testing.

Typical Characteristics

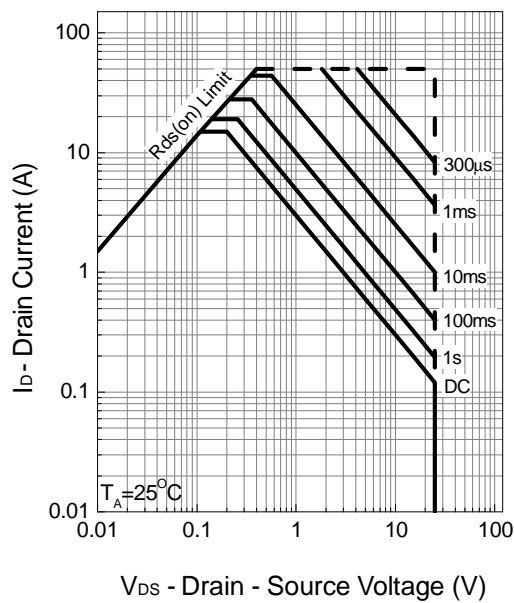
Power Dissipation



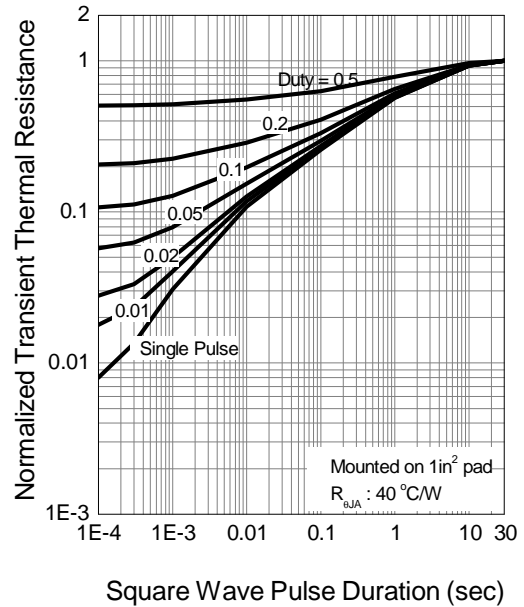
Drain Current



Safe Operation Area

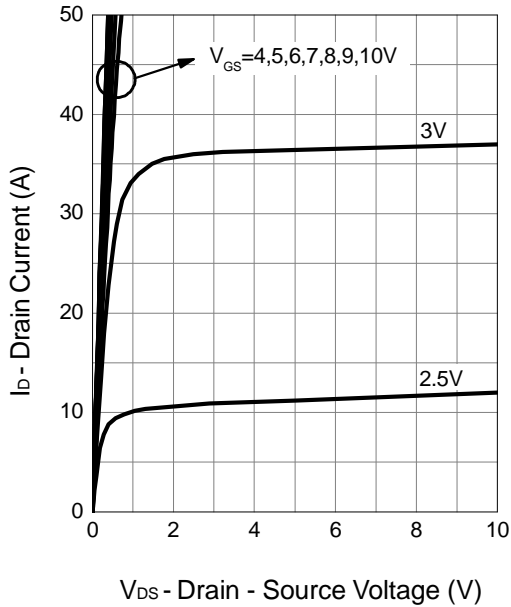


Thermal Transient Impedance

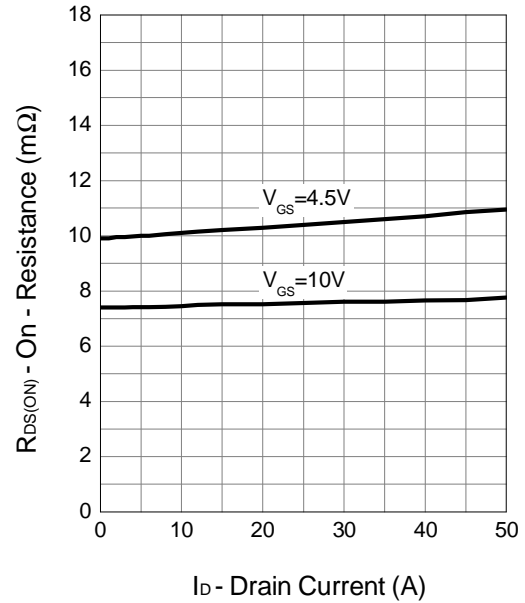


Typical Characteristics (Cont.)

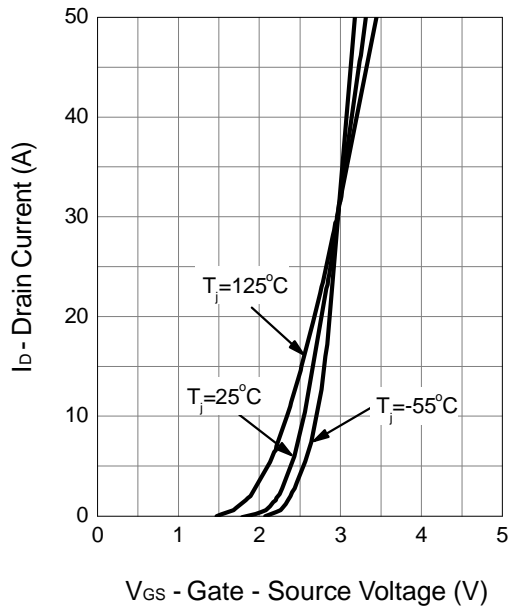
Output Characteristics



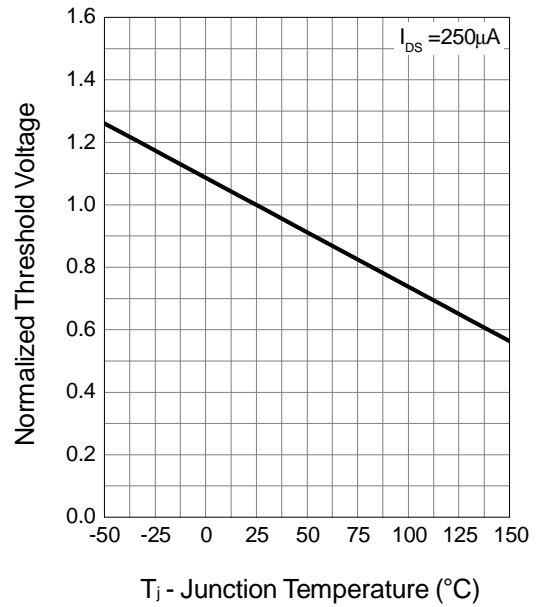
Drain-Source On Resistance



Transfer Characteristics

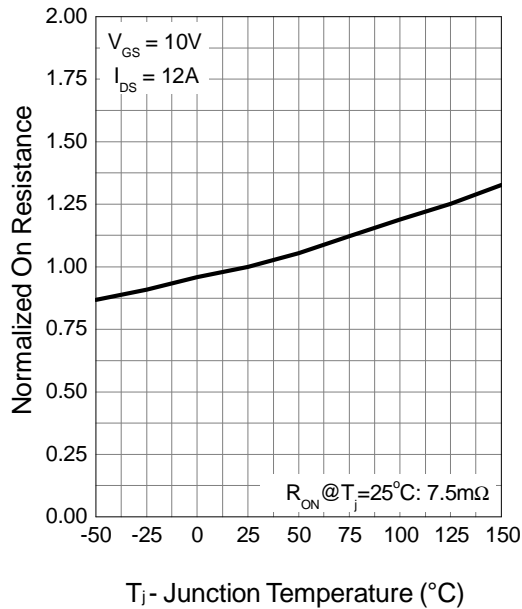


Gate Threshold Voltage

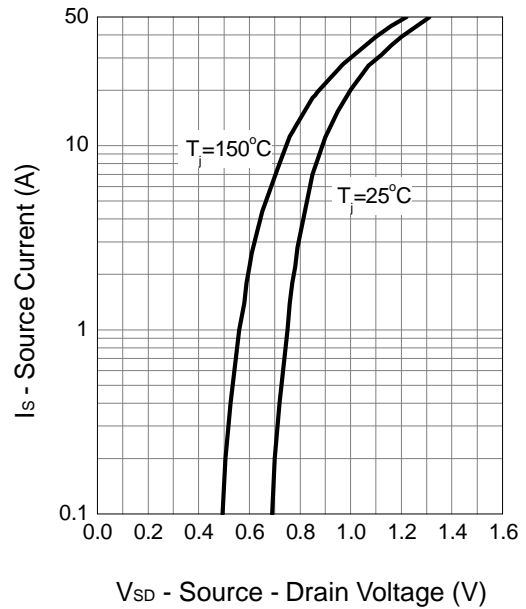


Typical Characteristics (Cont.)

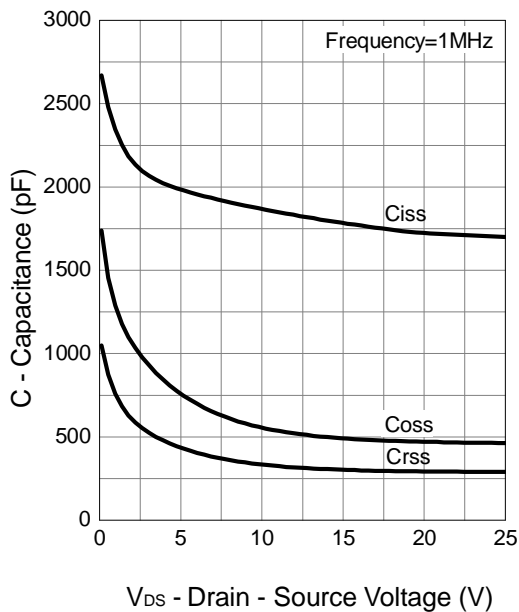
Drain-Source On Resistance



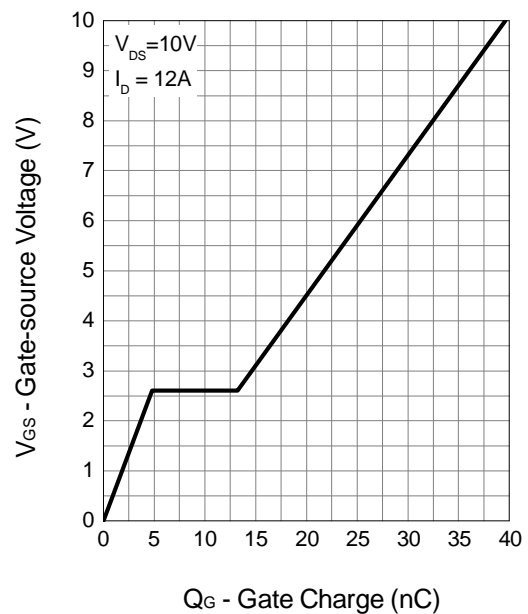
Source-Drain Diode Forward



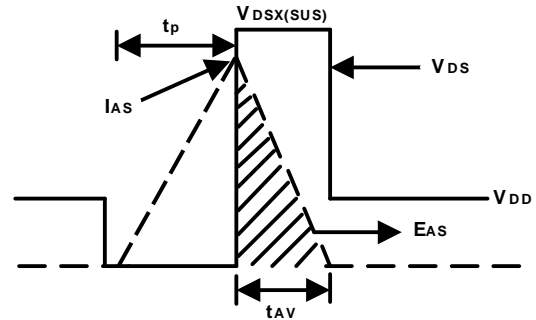
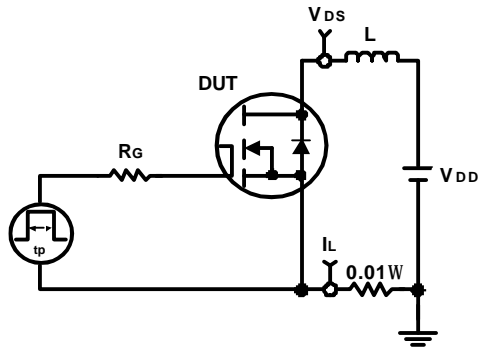
Capacitance



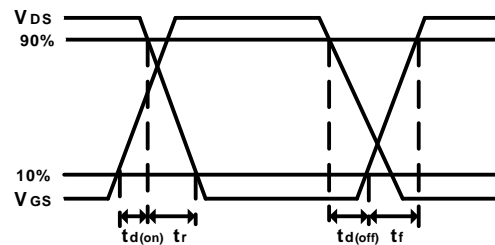
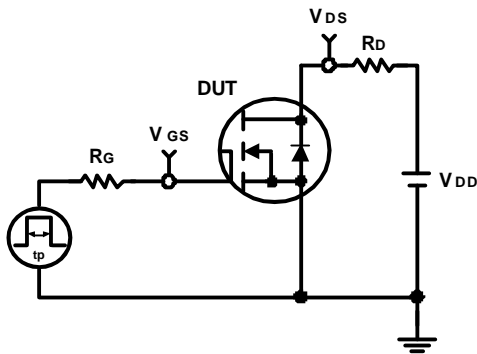
Gate Charge



Avalanche Test Circuit and Waveforms

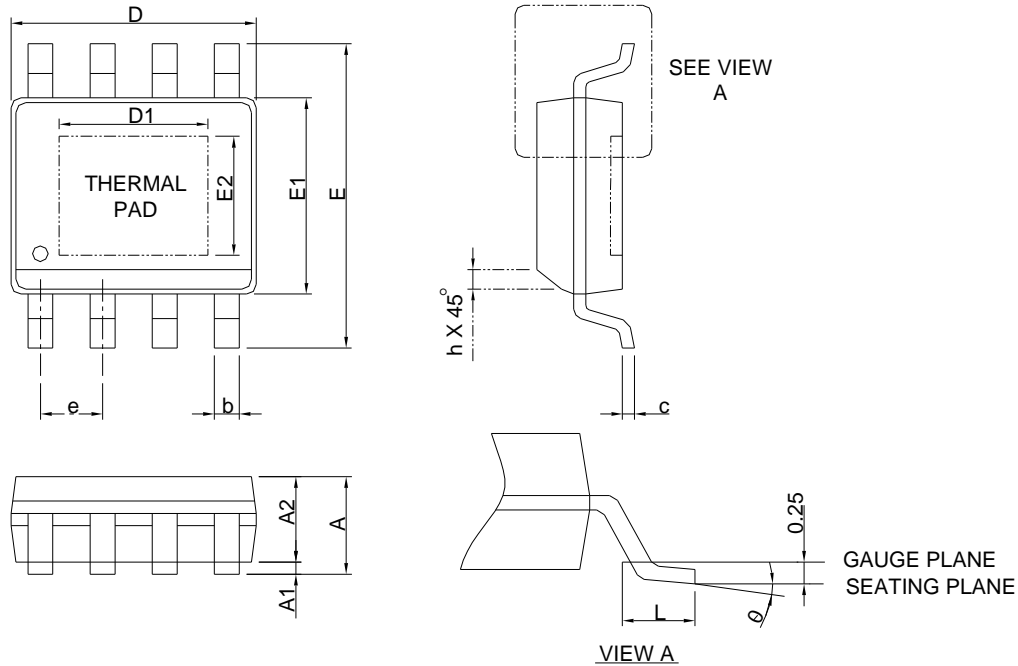


Switching Time Test Circuit and Waveforms



Package Information

SOP-8P



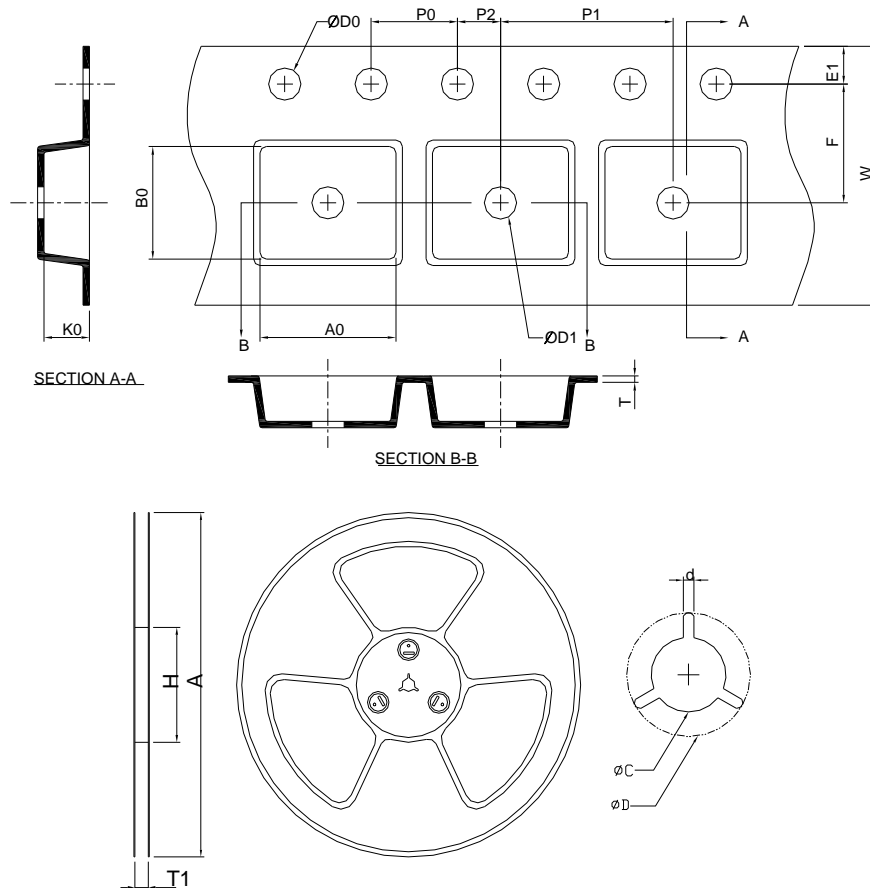
SYMBOL	SOP-8P			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.60		0.063
A1	0.00	0.15	0.000	0.006
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
D1	2.25	3.50	0.098	0.138
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
E2	2.00	3.00	0.079	0.118
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

Note : 1. Follow JEDEC MS-012 BA.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .

3. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.

Carrier Tape & Reel Dimensions



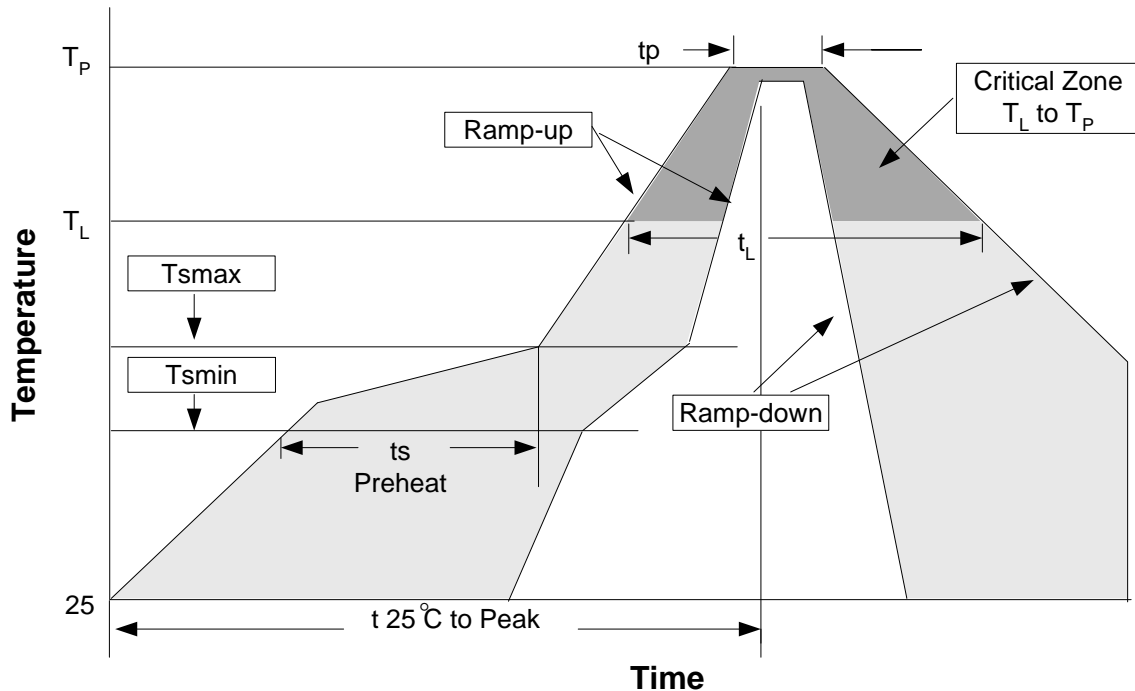
Application	A	H	T1	C	d	D	W	E1	F
SOP-8P	330.0±2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0±0.10	8.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.40±0.20	5.20±0.20	2.10±0.20

(mm)

Devices Per Unit

Package Type	Unit	Quantity
SOP-8P	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 _{min})	100°C	150°C
- Temperature Max (T _{max})	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 (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.

Customer Service

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