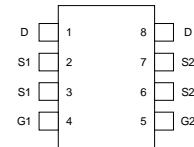


## N-Channel Enhancement Mode MOSFET

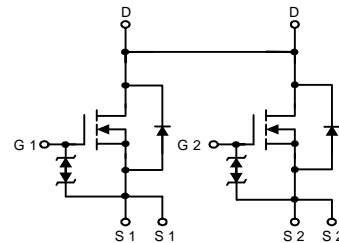
### Features

- 20V/6A ,  $R_{DS(ON)}=16m\Omega(\text{typ.}) @ V_{GS}=4.5V$   
 $R_{DS(ON)}=20m\Omega(\text{typ.}) @ V_{GS}=2.5V$
- Super High Dense Cell Design for Extremely Low  $R_{DS(ON)}$
- Reliable and Rugged
- TSSOP-8 Packages

### Pin Description



TSSOP-8

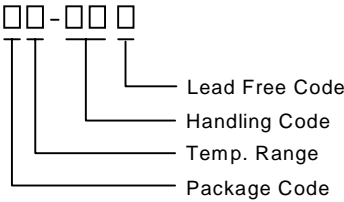


N-Channel MOSFET

### Applications

- Power Management in Notebook Computer , Portable Equipment and Battery Powered Systems.
- Zener Diode Protected Gate Provide Human Body Mode Electrostatic Discharge Protection to 2500 V.

### Ordering and Marking Information

<p>APM9968C □□-□□□</p>  <p>Lead Free Code Handling Code Temp. Range Package Code</p>	<p>Package Code O : TSSOP-8 Temp. Range C : -55 to 150°C Handling Code TR : Tape &amp; Reel Lead Free Code L : Lead Free Device      Blank : Original Device</p>
<p>APM9968C O : <span style="border: 1px solid black; padding: 2px;">APM9968C XXXXX</span></p>	<p>XXXXX - Date Code</p>

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
$V_{DSS}$	Drain-Source Voltage	20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 8$	
$I_D^*$	Maximum Drain Current – Continuous	6	A
$I_{DM}$	Maximum Drain Current – Pulsed	20	
$P_D$	Maximum Power Dissipation	$T_A=25^\circ\text{C}$	W
		$T_A=100^\circ\text{C}$	
$T_J$	Maximum Junction Temperature	150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$R_{\theta JA}^*$	Thermal Resistance – Junction to Ambient	80	$^\circ\text{C/W}$

\* Surface Mounted on FR4 Board,  $t \leq 10$  sec.

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

Symbol	Parameter	Test Condition	APM9968C			Unit
			Min.	Typ.	Max.	
Static						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V , I <sub>DS</sub> =250μA	20			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =16V , V <sub>GS</sub> =0V			1	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	0.6	0.7	1	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±8V , V <sub>DS</sub> =0V			±10	μA
R <sub>DS(ON)</sub> <sup>a</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =4.5V , I <sub>DS</sub> =6A		16	20	mΩ
		V <sub>GS</sub> =2.5V , I <sub>DS</sub> =5.2A		20	25	
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>SD</sub> =0.5A , V <sub>GS</sub> =0V		0.7	1.3	V
Dynamic <sup>b</sup>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =10V , I <sub>DS</sub> = 6A V <sub>GS</sub> =4.5V ,		19	25	nC
Q <sub>gs</sub>	Gate-Source Charge			2		
Q <sub>gd</sub>	Gate-Drain Charge			5		
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =10V , I <sub>DS</sub> =6A , V <sub>GEN</sub> =4.5V , R <sub>G</sub> =6Ω		37	68	ns
T <sub>r</sub>	Turn-on Rise Time			33	62	
t <sub>d(OFF)</sub>	Turn-off Delay Time			100	182	
T <sub>f</sub>	Turn-off Fall Time			54	100	

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

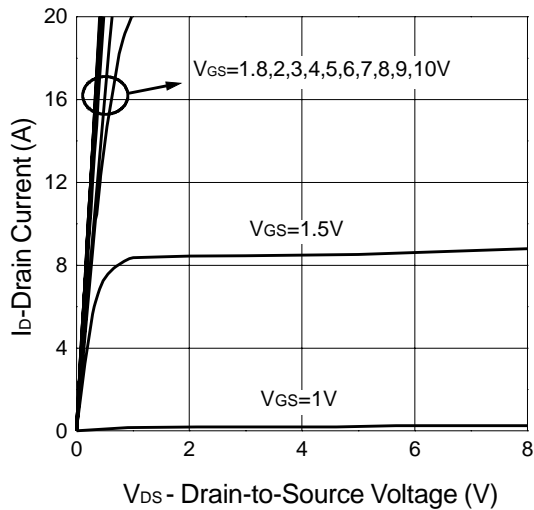
Symbol	Parameter	Test Condition	APM9968C			Unit
			Min.	Typ.	Max.	
$C_{iss}$	Input Capacitance	$V_{GS}=0V$ $V_{DS}=15V$ Frequency=1.0MHz		1253		pF
$C_{oss}$	Output Capacitance			340		
$C_{rss}$	Reverse Transfer Capacitance			260		

## Notes

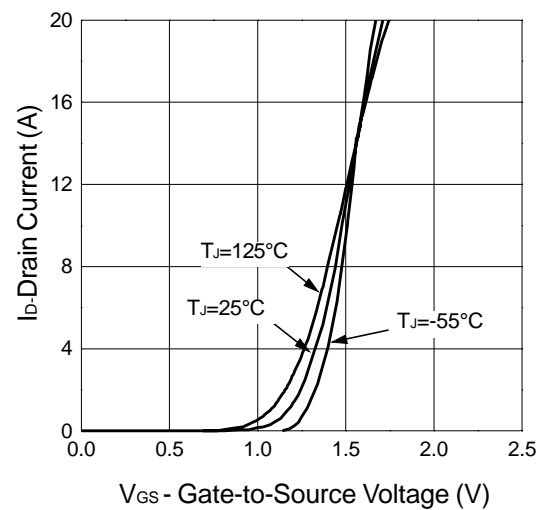
<sup>a</sup> : Pulse test ; pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ <sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

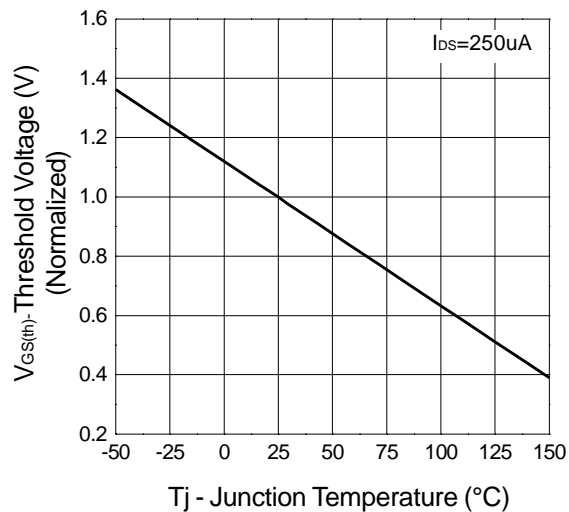
Output Characteristics



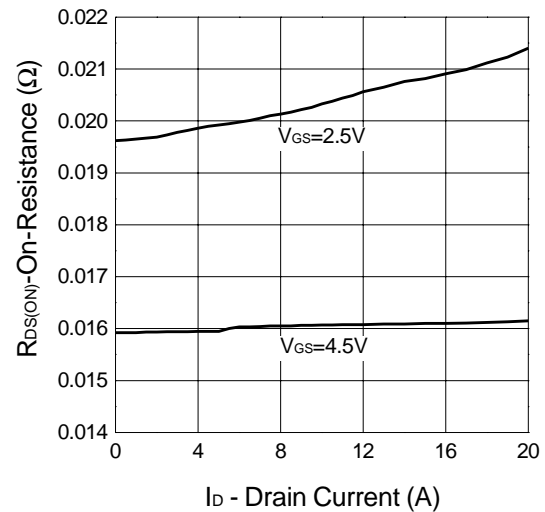
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

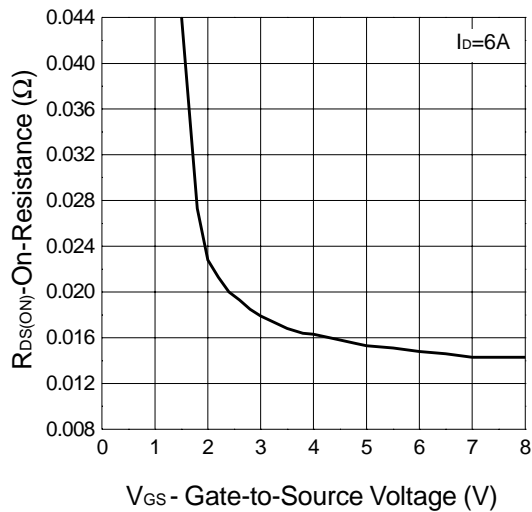


On-Resistance vs. Drain Current

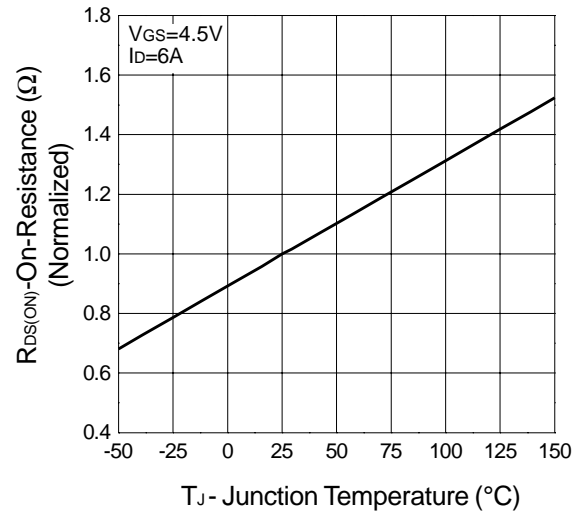


## Typical Characteristics

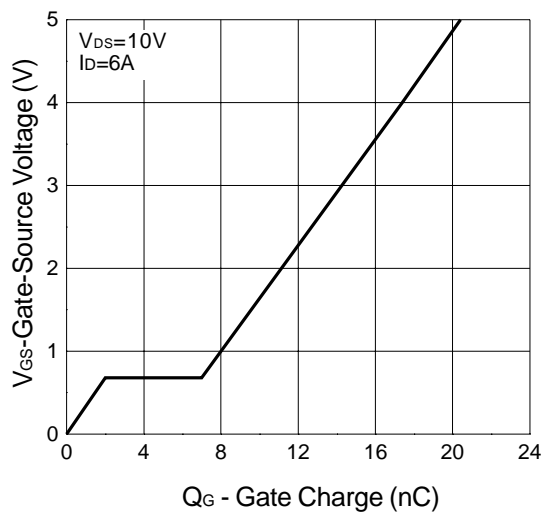
On-Resistance vs. Gate-to-Source Voltage



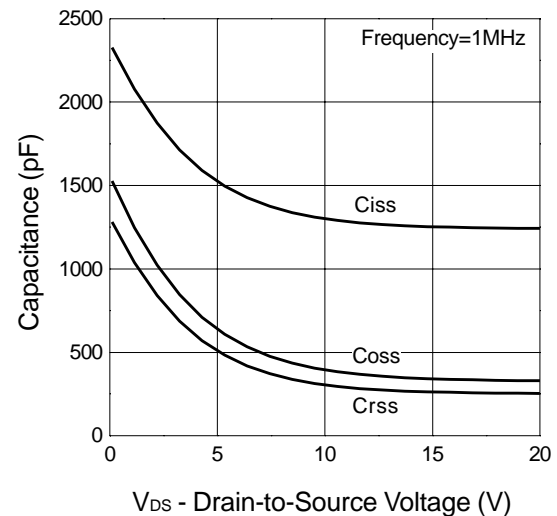
On-Resistance vs. Junction Temperature



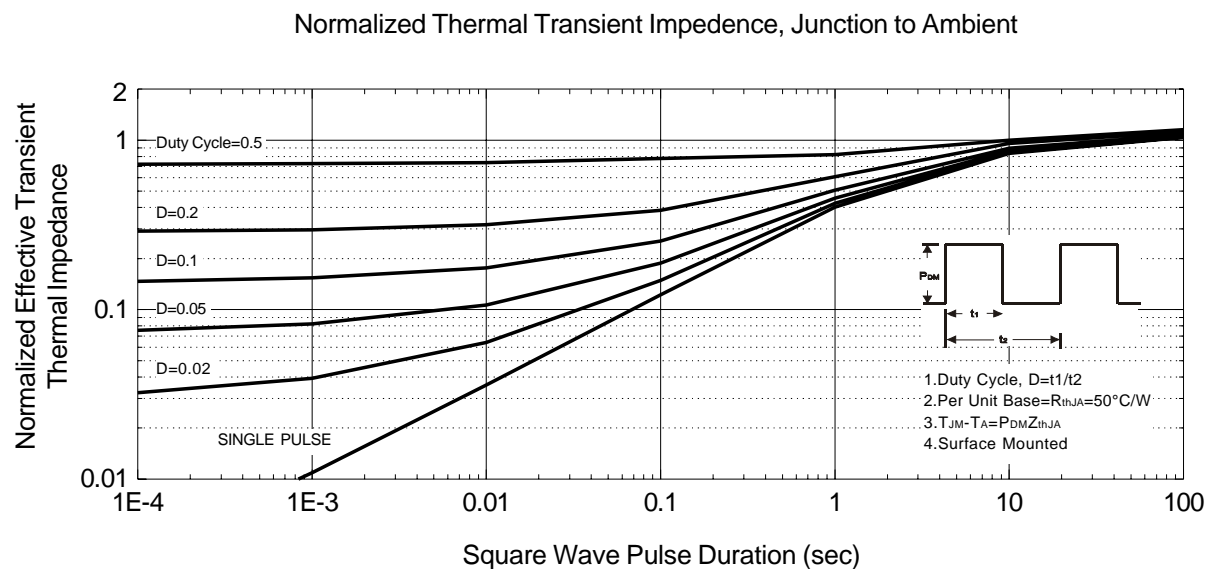
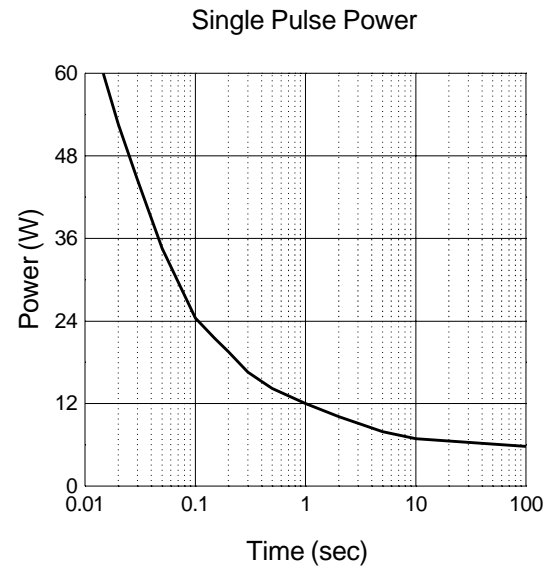
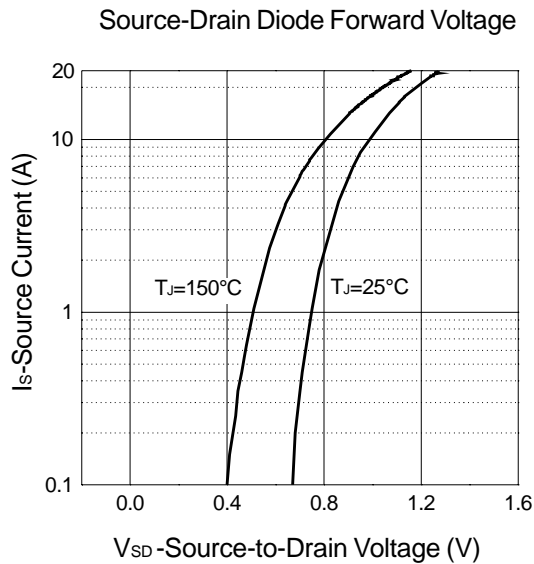
Gate Charge



Capacitance

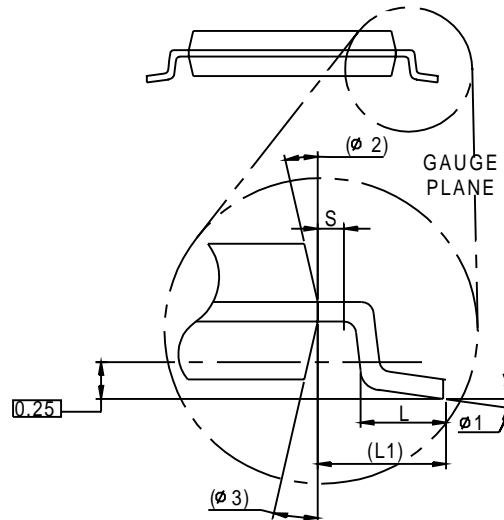
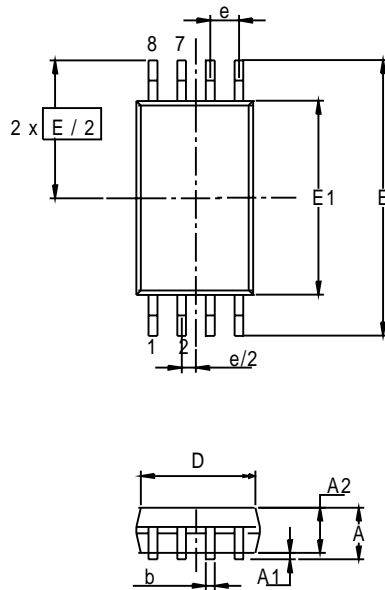


## Typical Characteristics



## Packaging Information

TSSOP-8

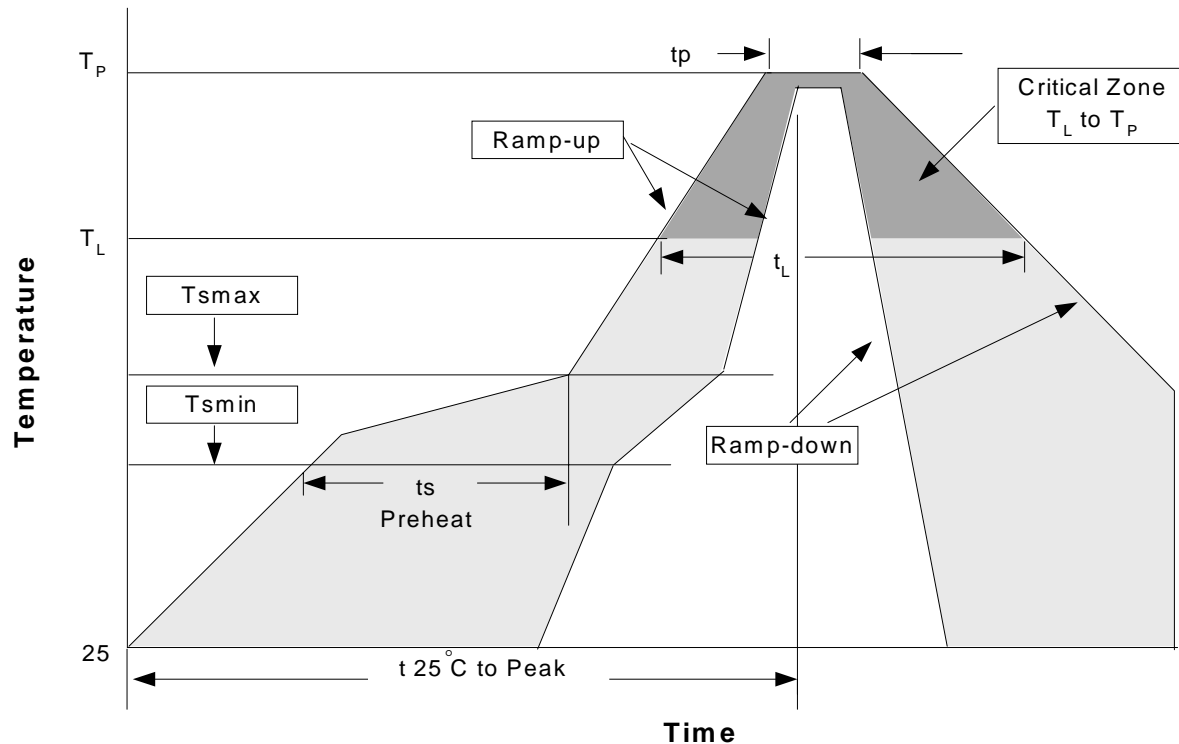


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A		1.2		0.047
A1	0.00	0.15	0.000	0.006
A2	0.80	1.05	0.031	0.041
b	0.19	0.30	0.007	0.012
D	2.9	3.1	0.114	0.122
e	0.65 BSC		0.026 BSC	
E	6.40 BSC		0.252 BSC	
E1	4.30	4.50	0.169	0.177
L	0.45	0.75	0.018	0.030
L1	1.0 REF		0.039 REF	
R	0.09		0.004	
R1	0.09		0.004	
S	0.2		0.008	
ø1	0°	8°	0°	8°
ø2	12° REF		12° REF	
ø3	12° REF		12° REF	

## Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RS186-91, 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	
	Large Body	Small Body	Large Body	Small Body
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 Mix ( $T_{smax}$ )	150°C		200°C	
- Time (min to max)( $t_s$ )	60-120 seconds		60-180 seconds	
$T_{smax}$ to $T_L$			3°C/second max	
- Ramp-up Rate				
$T_{smax}$ to $T_L$				
- Temperature( $T_L$ )	183°C		217°C	
- Time ( $t_L$ )	60-150 seconds		60-150 seconds	
Peak Temperature( $T_P$ )	225 +0/-5°C	240 +0/-5°C	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actual Peak Temperature( $t_p$ )	10-30 seconds	10-30 seconds	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.



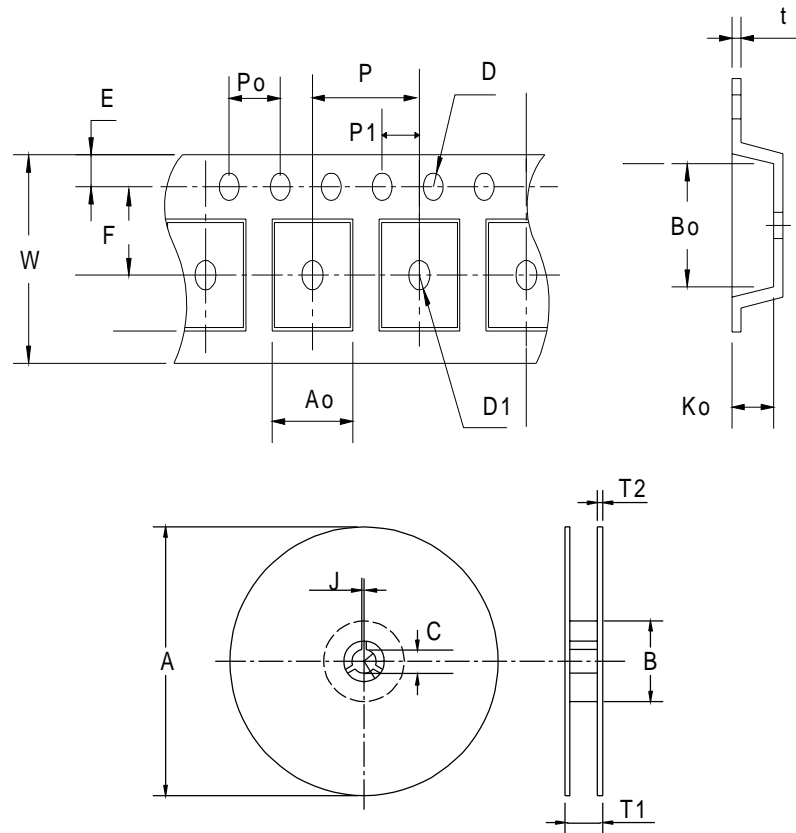
## Package Reflow Conditions

pkg. thickness $\geq 2.5\text{mm}$ and all bgas	pkg. thickness $< 2.5\text{mm}$ and pkg. volume $\geq 350\text{mm}^3$	pkg. thickness $< 2.5\text{mm}$ and pkg. volume $< 350\text{mm}^3$
Convection 220 $\pm 5/-0^\circ\text{C}$		Convection 235 $\pm 5/-0^\circ\text{C}$
VPR 215-219 $^\circ\text{C}$		VPR 235 $\pm 5/-0^\circ\text{C}$
IR/Convection 220 $\pm 5/-0^\circ\text{C}$		IR/Convection 235 $\pm 5/-0^\circ\text{C}$

## Reliability Test Program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245 $^\circ\text{C}$ , 5 SEC
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @ 125 $^\circ\text{C}$
PCT	JESD-22-B,A102	168 Hrs, 100% RH, 121 $^\circ\text{C}$
TST	MIL-STD-883D-1011.9	-65 $^\circ\text{C}$ ~150 $^\circ\text{C}$ , 200 Cycles

## Carrier Tape & Reel Dimensions



## Carrier Tape & Reel Dimensions

Application	A	B	C	J	T1	T2	W	P	E
TSSOP-8	330 ± 1	62 +1.5	12.75+ 0.15	2 + 0.5	12.4 ± 0.2	2 ± 0.2	12± 0.3	8± 0.1	1.75±0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.1	1.5 + 0.1	1.5 + 0.1	4.0 ± 0.1	2.0 ± 0.1	7.0 ± 0.1	3.6 ± 0.3	1.6 ± 0.1	0.3±0.013

## Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
TSSOP- 8	12	9.3	2500

## Customer Service

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