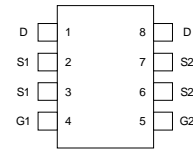


## N-Channel Enhancement Mode MOSFET

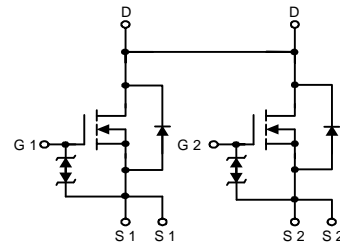
### Features

- 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 <span style="border: 1px solid black; padding: 2px;">□□-□□</span></p> <div style="margin-left: 20px;"> <p>└─── Handling Code</p> <p>└─── Temp. Range</p> <p>└─── Package Code</p> </div>	<p>Package Code O : TSSOP-8</p> <p>Temp. Range C : -55 to 150°C</p> <p>Handling Code TR : Tape &amp; Reel</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	$T_A=25^\circ\text{C}$	1	W
		$T_A=100^\circ\text{C}$	0.4	
$T_J$	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.	
<b>Static</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu\text{A}$	20			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=16V, V_{GS}=0V$			1	$\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	0.6	0.7	1	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 8V, V_{DS}=0V$			$\pm 10$	$\mu\text{A}$
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=4.5V, I_{DS}=6A$		16	20	m $\Omega$
		$V_{GS}=2.5V, I_{DS}=5.2A$		20	25	
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=0.5A, V_{GS}=0V$		0.7	1.3	V
<b>Dynamic<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=10V, I_{DS}=6A$ $V_{GS}=4.5V,$		19	25	nC
$Q_{gs}$	Gate-Source Charge			2		
$Q_{gd}$	Gate-Drain Charge			5		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=10V, I_{DS}=6A,$ $V_{GEN}=4.5V, R_G=6\Omega$		37	68	ns
$T_r$	Turn-on Rise Time			33	62	
$t_{d(OFF)}$	Turn-off Delay Time			100	182	
$T_f$	Turn-off Fall Time			54	100	

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

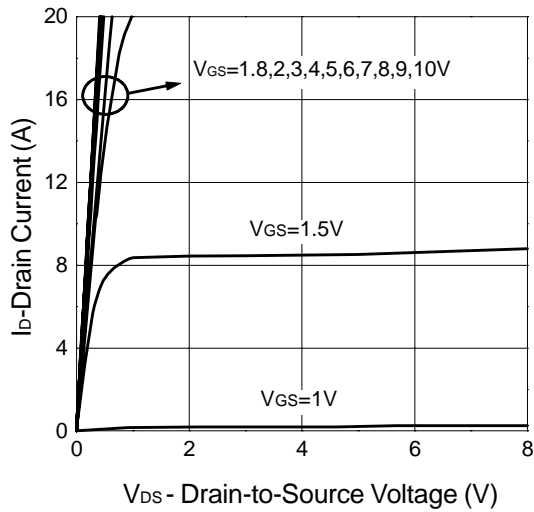
Symbol	Parameter	Test Condition	APM9968C			Unit
			Min.	Typ.	Max.	
$C_{iss}$	Input Capacitance	$V_{GS}=0V$ $V_{DS}=15V$ Frequency=1.0MHz		1253		pF
$C_{oss}$	Output Capacitance			340		
$C_{rss}$	Reverse Transfer Capacitance			260		

## Notes

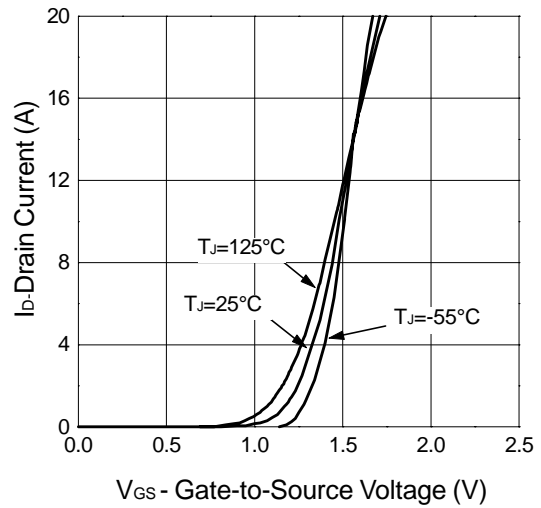
- <sup>a</sup> : Pulse test ; pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$   
<sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

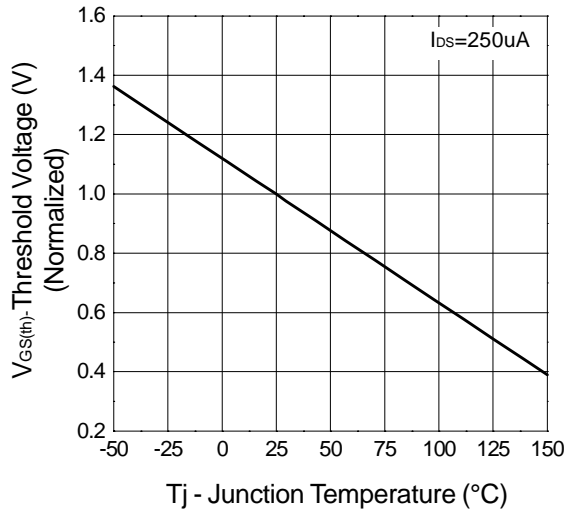
Output Characteristics



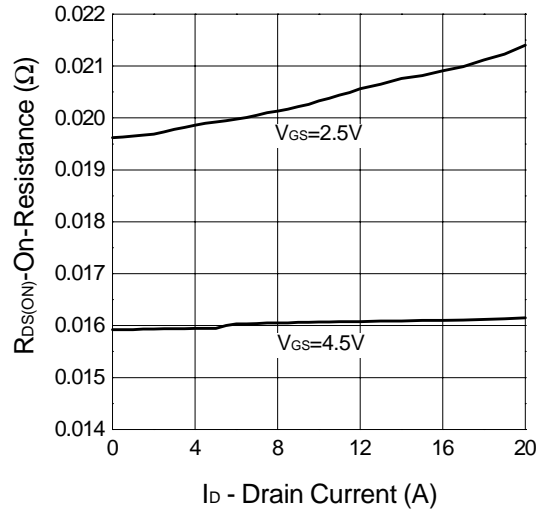
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

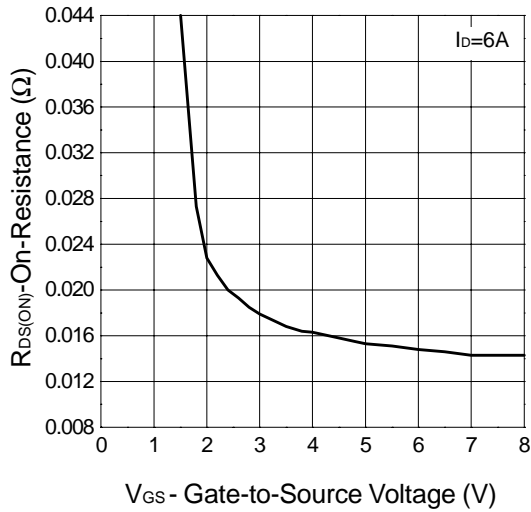


On-Resistance vs. Drain Current

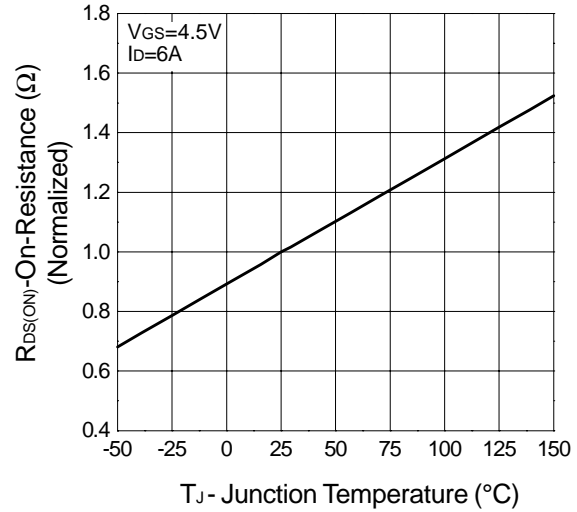


## Typical Characteristics

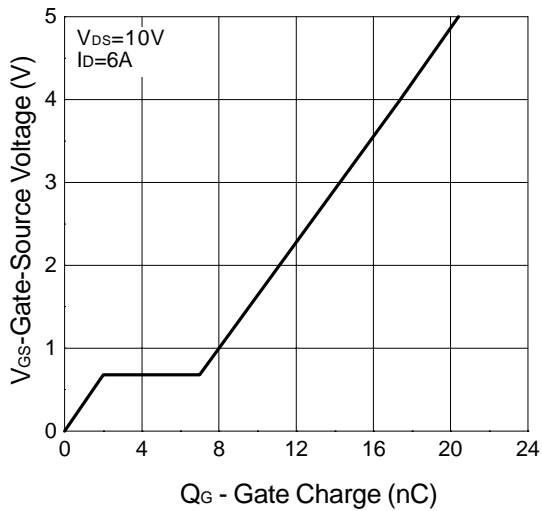
On-Resistance vs. Gate-to-Source Voltage



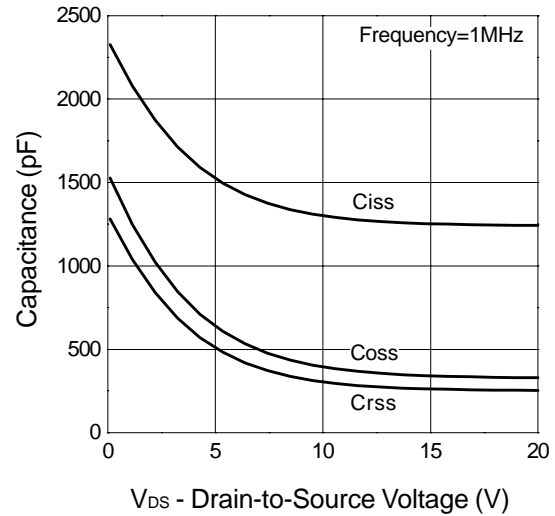
On-Resistance vs. Junction Temperature



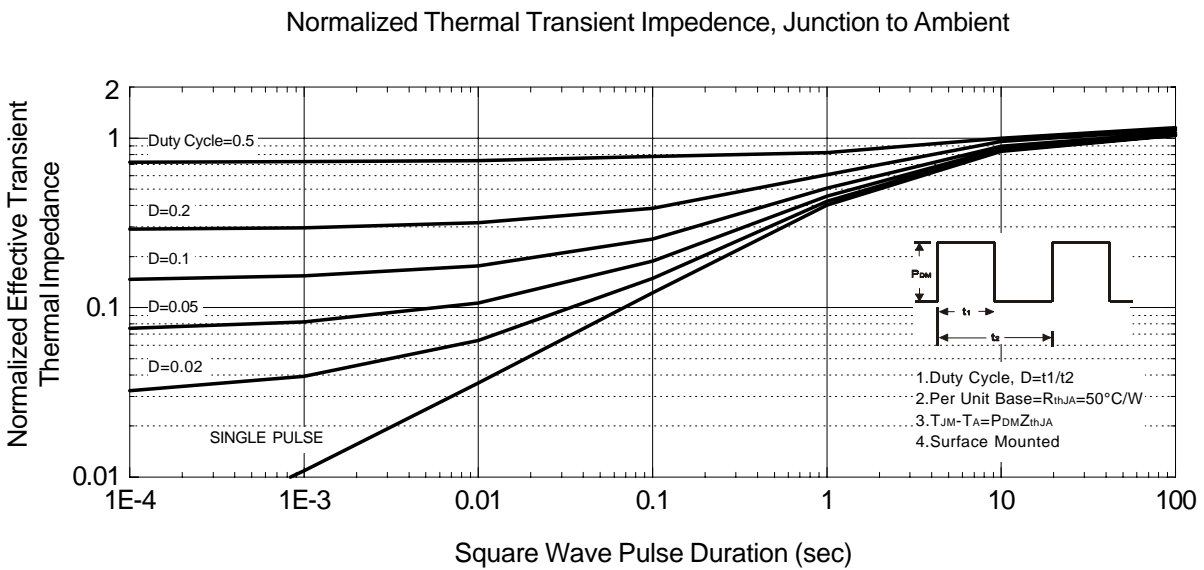
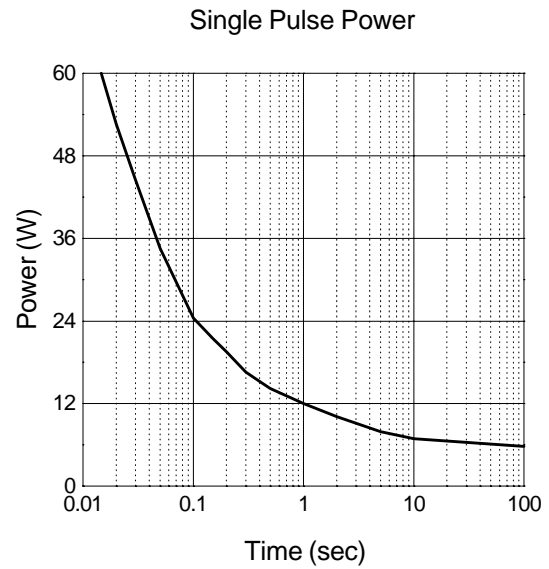
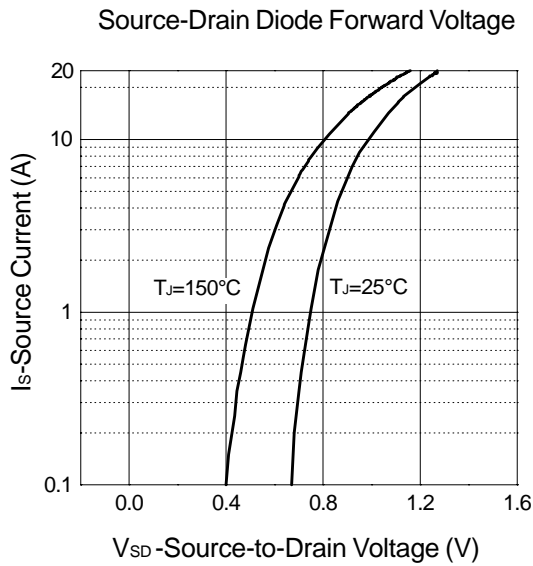
Gate Charge



Capacitance

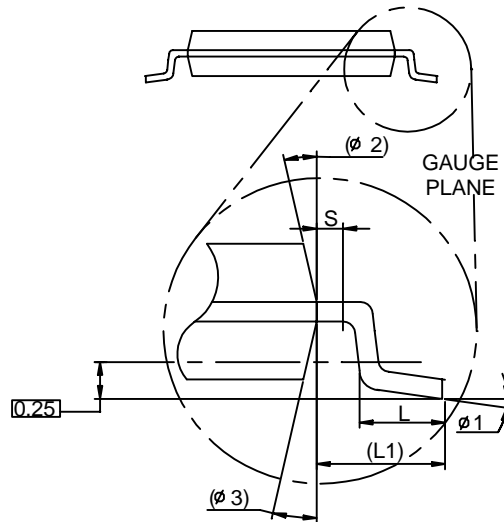
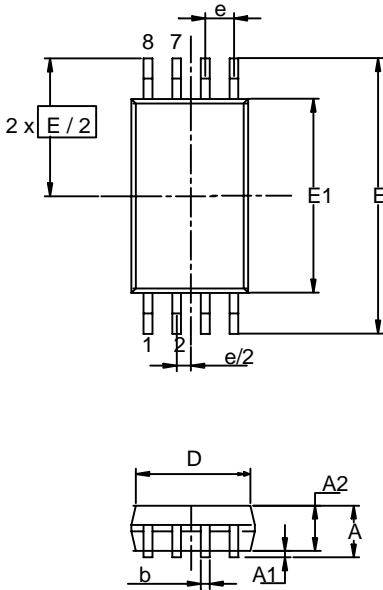


## Typical Characteristics



## Packaging Information

TSSOP-8

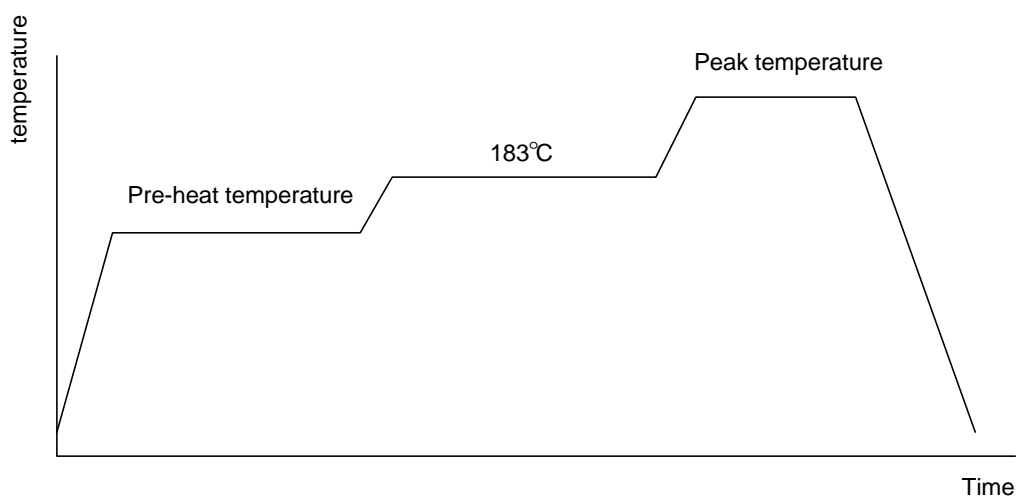


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A		1.2		0.047
A1	0.00	0.15	0.000	0.006
A2	0.80	1.05	0.031	0.041
b	0.19	0.30	0.007	0.012
D	2.9	3.1	0.114	0.122
e	0.65 BSC		0.026 BSC	
E	6.40 BSC		0.252 BSC	
E1	4.30	4.50	0.169	0.177
L	0.45	0.75	0.018	0.030
L1	1.0 REF		0.039 REF	
R	0.09		0.004	
R1	0.09		0.004	
S	0.2		0.008	
phi 1	0°	8°	0°	8°
phi 2	12° REF		12° REF	
phi 3	12° REF		12° REF	

## Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb)
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.

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



## Classification Reflow Profiles

	Convection or IR/ Convection	VPR
Average ramp-up rate(183°C to Peak)	3°C/second max.	10 °C /second max.
Preheat temperature 125 ± 25°C)	120 seconds max	
Temperature maintained above 183°C	60 – 150 seconds	
Time within 5°C of actual peak temperature	10 –20 seconds	60 seconds
Peak temperature range	220 +5/-0°C or 235 +5/-0°C	215-219°C or 235 +5/-0°C
Ramp-down rate	6 °C /second max.	10 °C /second max.
Time 25°C to peak temperature	6 minutes max.	

## Package Reflow Conditions

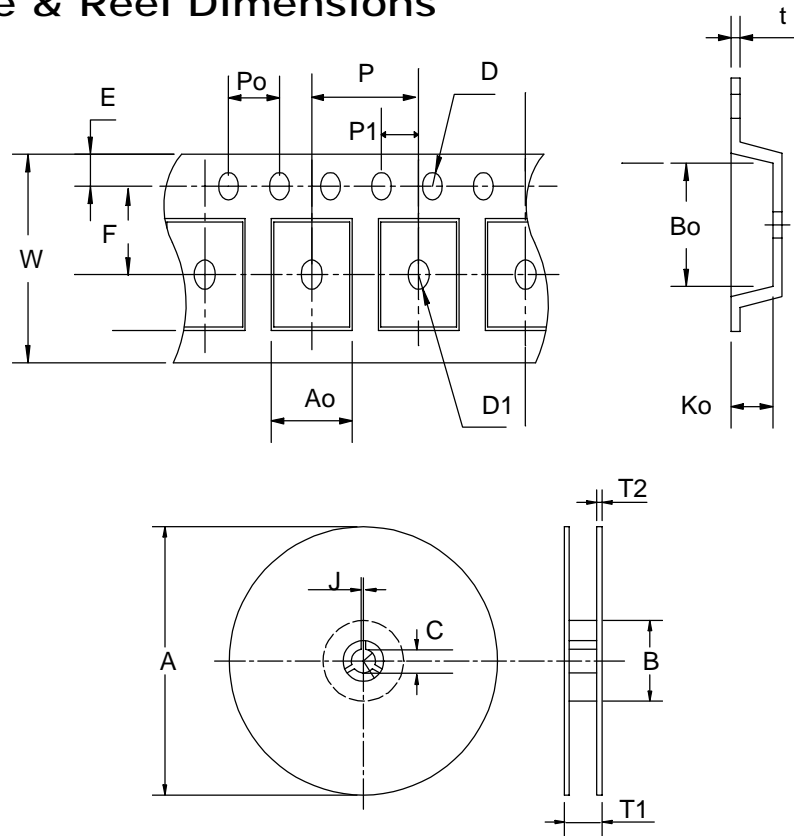
pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm <sup>3</sup>	pkg. thickness < 2.5mm and pkg. volume < 350mm <sup>3</sup>
Convection 220 +5/-0 °C		Convection 235 +5/-0 °C
VPR 215-219 °C		VPR 235 +5/-0 °C
IR/Convection 220 +5/-0 °C		IR/Convection 235 +5/-0 °C



## 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

## 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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