

# APM6928

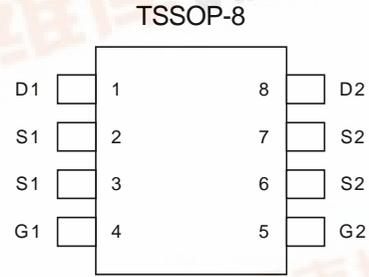


## N-Channel Enhancement Mode MOSFET

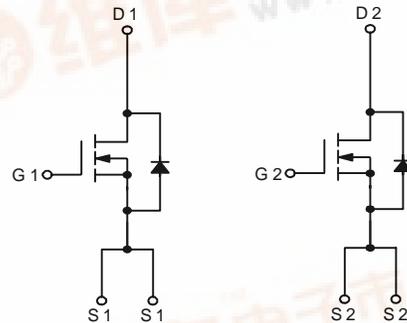
### Features

- 30V/4A,  $R_{DS(ON)}=15m\Omega(\text{typ.}) @ V_{GS}=10V$   
 $R_{DS(ON)}=25m\Omega(\text{typ.}) @ V_{GS}=4.5V$
- Super High Dense Cell Design for Extremely Low  $R_{DS(ON)}$
- Reliable and Rugged
- TSSOP-8 Package

### Pin Description



Top View



### Applications

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

### Ordering and Marking Information

APM6928	 Handling Code Temp. Range Package Code	Package Code O : TSSOP-8 Operation Junction Temp. Range C : -55 to 150°C Handling Code TR : Tape & Reel
APM6928 O :	 APM6928 XXXXX	XXXXX - Date Code

### Absolute Maximum Ratings $(T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Rating	Unit
$V_{DSS}$	Drain-Source Voltage	30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	
$I_D^*$	Maximum Drain Current – Continuous	4	A
$I_{DM}$	Maximum Drain Current – Pulsed	20	

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

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

Symbol	Parameter	Rating	Unit
$P_D$	Maximum Power Dissipation $T_A=25^\circ\text{C}$	1.0	W
$T_J$	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	125	$^\circ\text{C/W}$

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

Symbol	Parameter	Test Condition	APM6928			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu\text{A}$	30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=24V, V_{GS}=0V$			1	$\mu\text{A}$
		$V_{DS}=24V, V_{GS}=0V, T_J=55^\circ\text{C}$			5	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	1		3	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=4A$		20	30	m $\Omega$
		$V_{GS}=4.5V, I_{DS}=3.4A$		35	45	
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=1.25A, V_{GS}=0V$		0.73	1.2	V
<b>Dynamic<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=15V, I_{DS}=10A$ $V_{GS}=5V,$		15	20	nC
$Q_{gs}$	Gate-Source Charge			5.8		
$Q_{gd}$	Gate-Drain Charge			3.8		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=15V, I_{DS}=2A,$ $V_{GEN}=10V, R_G=6\Omega$		11	18	ns
$T_r$	Turn-on Rise Time			17	26	
$t_{d(OFF)}$	Turn-off Delay Time			37	54	
$T_f$	Turn-off Fall Time			20	30	
$C_{iss}$	Input Capacitance	$V_{GS}=0V$		1150		pF
$C_{oss}$	Output Capacitance	$V_{DS}=15V$		230		
$C_{riss}$	Reverse Transfer Capacitance	Frequency=1.0MHz		100		

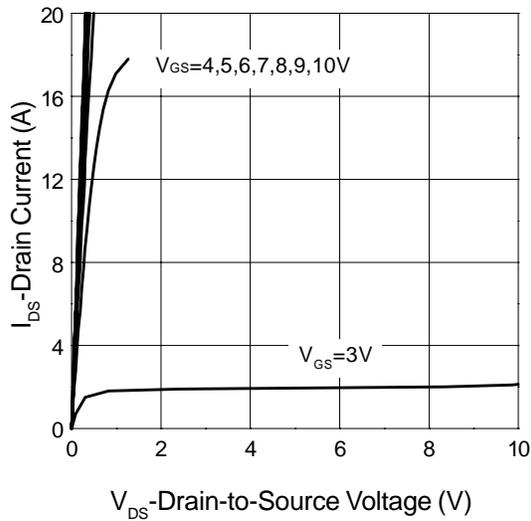
## Notes

<sup>a</sup> : Pulse test ; pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$

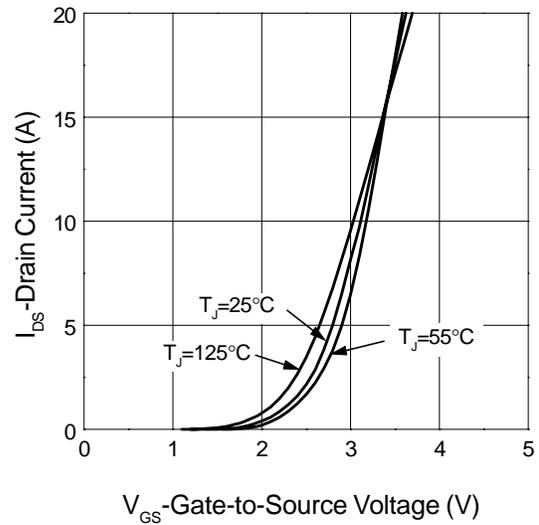
<sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

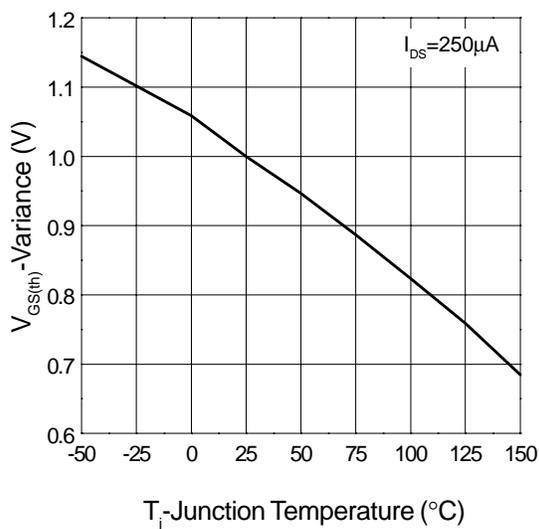
Output Characteristics



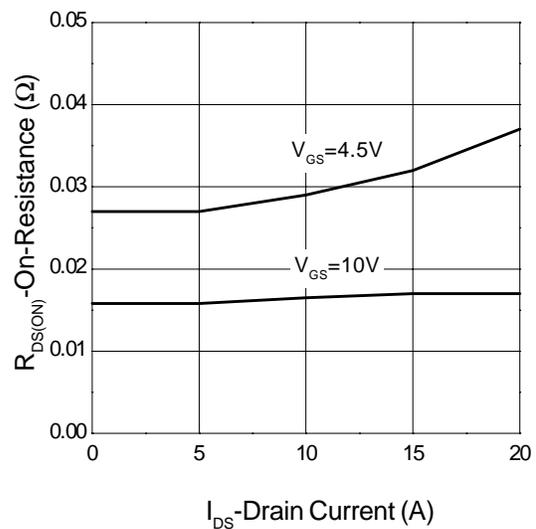
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

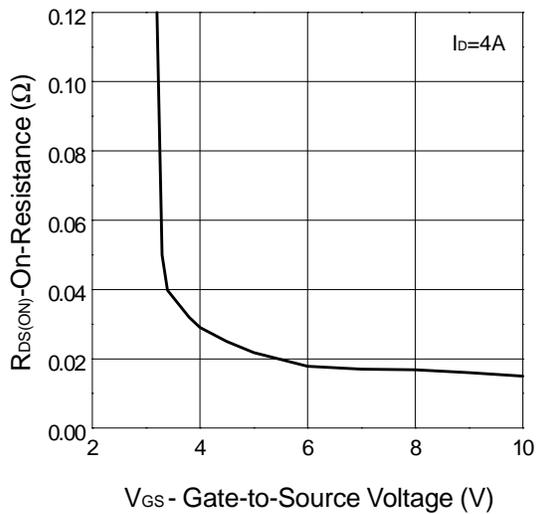


On-Resistance vs. Drain Current

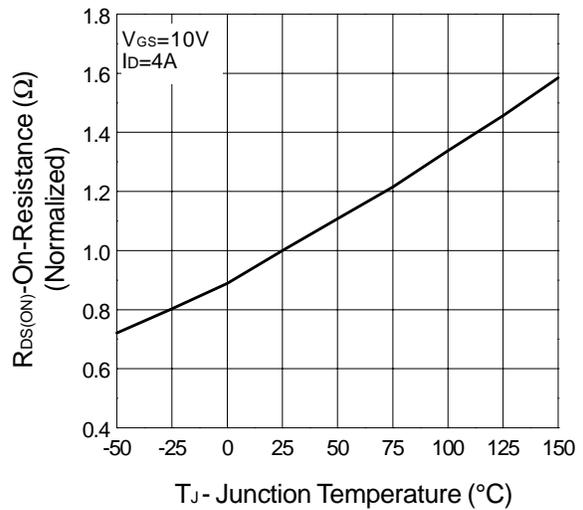


## Typical Characteristics

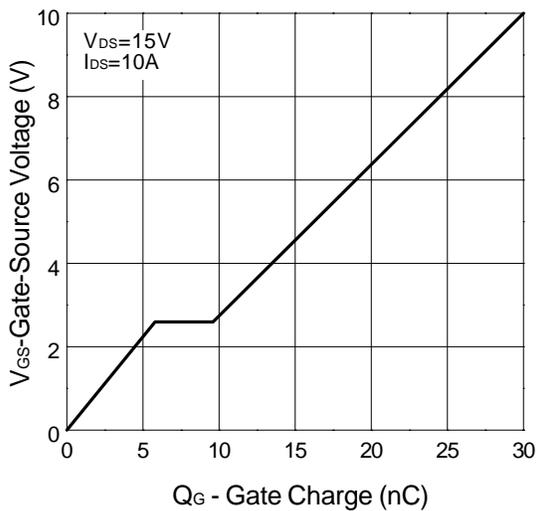
On-Resistance vs. Gate-to-Source Voltage



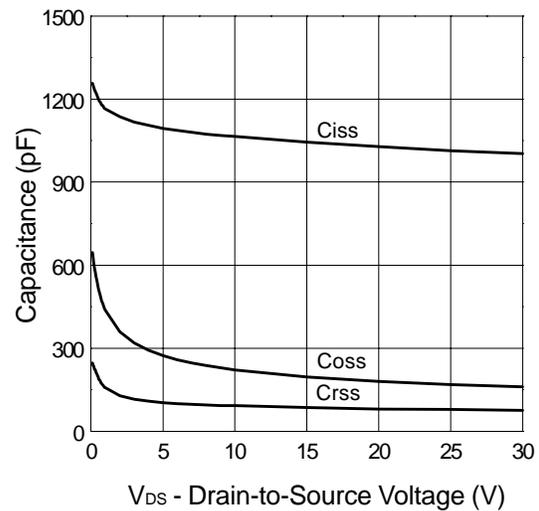
On-Resistance vs. Junction Temperature



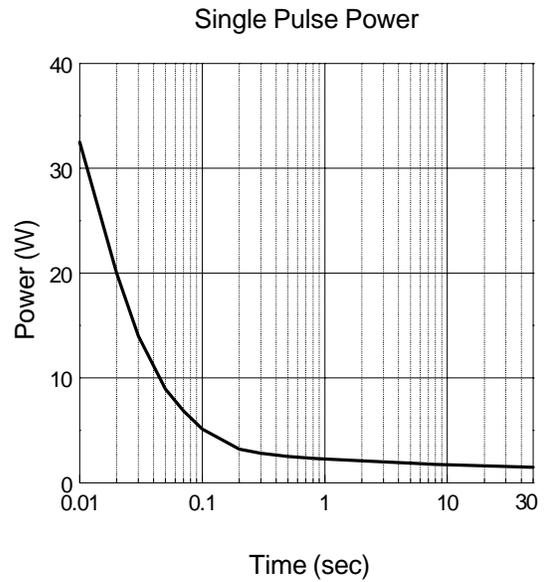
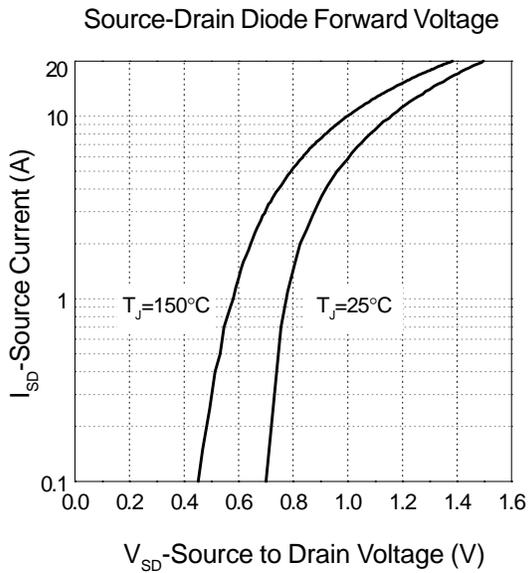
Gate Charge



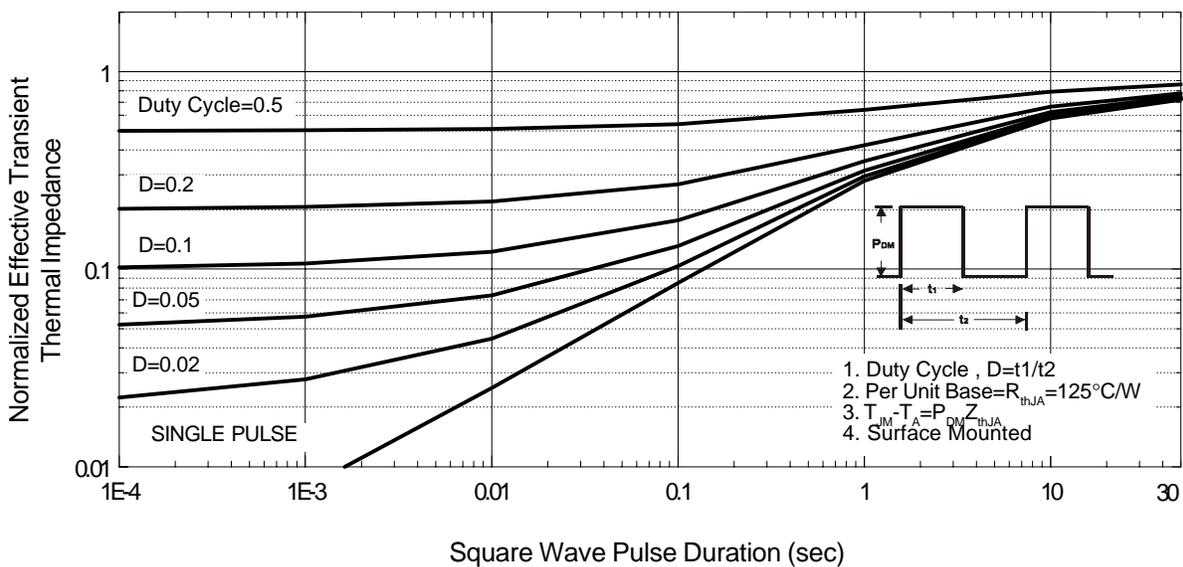
Capacitance



Typical Characteristics Cont.

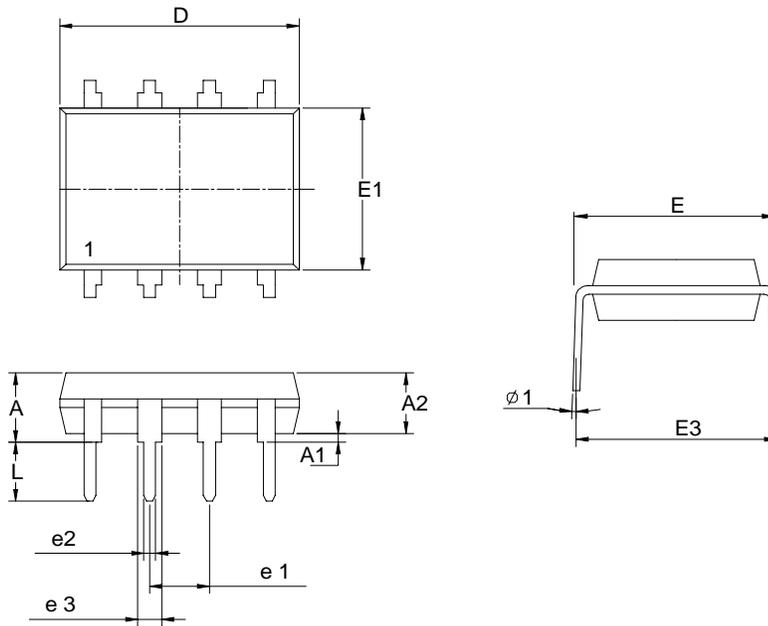


Normalized Transient Thermal Impedance, Junction to Ambient



## Packaging Information

PDIP-8 pin ( Reference JEDEC Registration MS-001)



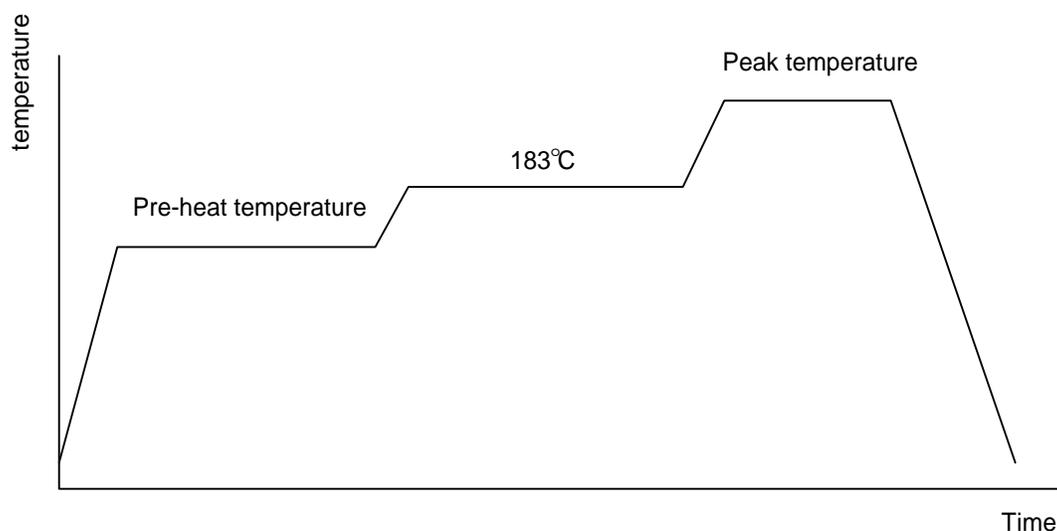
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A		5.33		0.210
A1	0.38		0.015	
A2	2.92	3.68	0.115	0.145
D	9.02	10.16	0.355	0.400
e1	2.54BSC		0.100BSC	
e2	0.36	0.56	0.014	0.022
e3	1.14	1.78	0.045	0.070
E	7.62 BSC		0.300 BSC	
E1	6.10	7.11	0.240	0.280
E3		10.92		0.430
L	2.92	3.81	0.115	0.150
φ 1	15°		15°	

## 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)

Reference JEDEC Standard J-STD-020A APRIL 1999



## 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.	

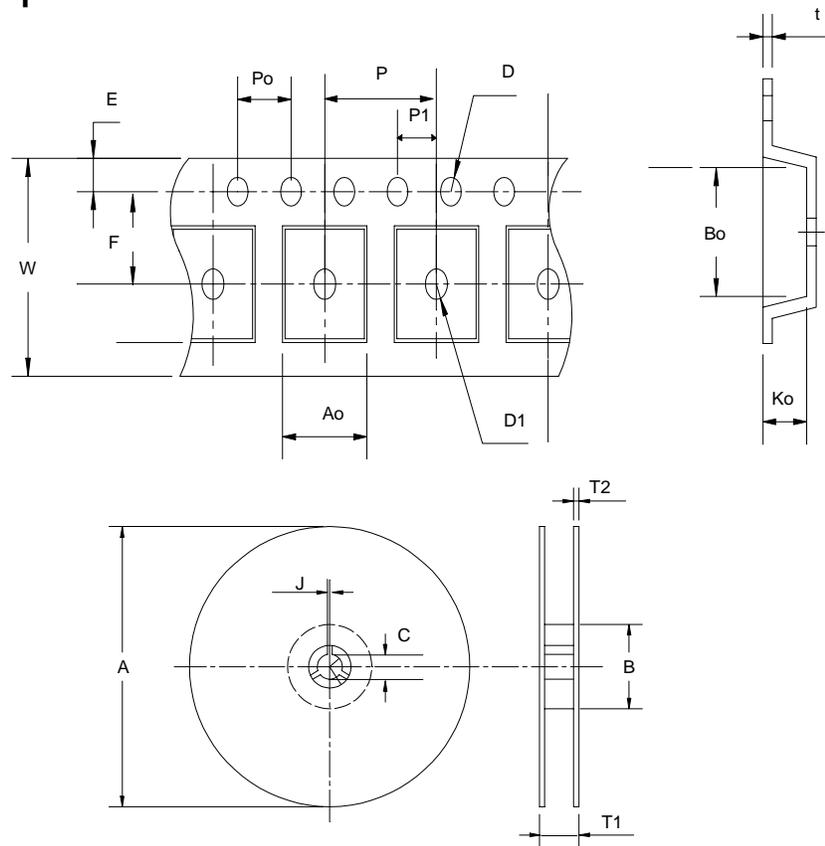
## Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm³	pkg. thickness < 2.5mm and pkg. volume < 350mm³
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



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

(mm)

## Cover Tape Dimensions

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

## Customer Service

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