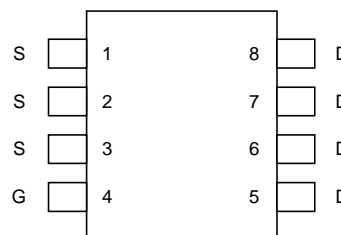


## N-Channel Enhancement Mode MOSFET

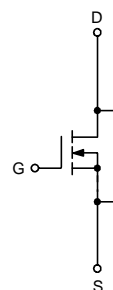
### Features

- 20V/21A,  $R_{DS(ON)} = 3.5m\Omega(\text{typ.}) @ V_{GS} = 10V$   
 $R_{DS(ON)} = 5m\Omega(\text{typ.}) @ V_{GS} = 4.5V$   
 $R_{DS(ON)} = 8m\Omega(\text{typ.}) @ V_{GS} = 2.5V$
- High Density Cell Design
- Reliable and Rugged
- SO-8 Package

### Pin Description



SO – 8

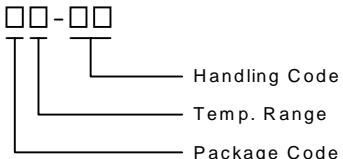


N-Channel MOSFET

### Applications

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

### Ordering and Marking Information

<p>APM4408 □□-□□</p>  <p style="margin-left: 100px;">Handling Code</p> <p style="margin-left: 100px;">Temp. Range</p> <p style="margin-left: 100px;">Package Code</p>	<p>Package Code K : SO-8</p> <p>Operation Junction Temp. Range C : -55 to 125°C</p> <p>Handling Code TU : Tube TR : Tape &amp; Reel</p>
<p>APM4408 K : <span style="border: 1px solid black; padding: 2px 5px;">APM4408 XXXXXX</span></p>	<p>XXXXXX - Date Code</p>

### 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	$\pm 16$	
$I_D^*$	Maximum Drain Current – Continuous	21	A
$I_{DM}$	Maximum Drain Current – Pulsed	60	

\* 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	$T_A=25^\circ\text{C}$	1.6
		$T_A=100^\circ\text{C}$	0.625
$T_J$	Maximum Junction Temperature	150	$^\circ\text{C}$
$T_{\text{STG}}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$R_{\theta\text{JA}}$	Thermal Resistance – Junction to Ambient	80	$^\circ\text{C/W}$

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

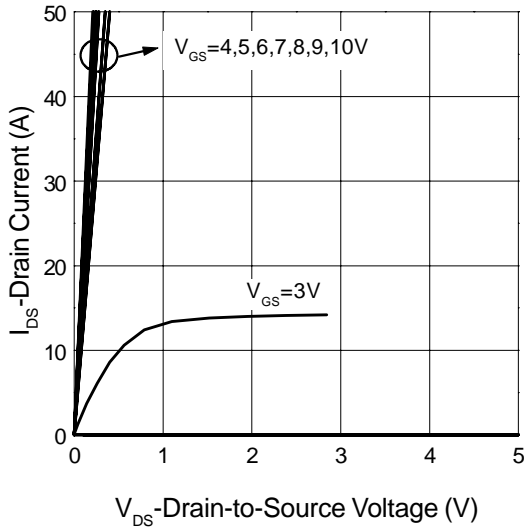
Symbol	Parameter	Test Condition	APM4408			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
$BV_{\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{\text{GS}}=0\text{V}$ , $I_{\text{DS}}=250\mu\text{A}$	20			V
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}}=18\text{V}$ , $V_{\text{GS}}=0\text{V}$			1	$\mu\text{A}$
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}}=V_{\text{GS}}$ , $I_{\text{DS}}=250\mu\text{A}$	0.8		1.5	V
$I_{\text{GSS}}$	Gate Leakage Current	$V_{\text{GS}}=\pm 16\text{V}$ , $V_{\text{DS}}=0\text{V}$			$\pm 100$	nA
$R_{\text{DS(ON)}}^{\text{a}}$	Drain-Source On-state Resistance	$V_{\text{GS}}=10\text{V}$ , $I_{\text{DS}}=21\text{A}$		3.5	4.5	m $\Omega$
		$V_{\text{GS}}=4.5\text{V}$ , $I_{\text{DS}}=17\text{A}$		5	6	
		$V_{\text{GS}}=2.5\text{V}$ , $I_{\text{DS}}=10\text{A}$		8	10	
$V_{\text{SD}}^{\text{a}}$	Diode Forward Voltage	$I_{\text{SD}}=2.9\text{A}$ , $V_{\text{GS}}=0\text{V}$	0.6		1.3	V
<b>Dynamic<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{\text{DS}}=10\text{V}$ , $I_{\text{DS}}=21\text{A}$ $V_{\text{GS}}=4.5\text{V}$ ,		45	65	nC
$Q_{\text{gs}}$	Gate-Source Charge			20		
$Q_{\text{gd}}$	Gate-Drain Charge			17		
$t_{\text{d(ON)}}$	Turn-on Delay Time	$V_{\text{DD}}=10\text{V}$ , $I_{\text{DS}}=1\text{A}$ , $V_{\text{GEN}}=4.5\text{V}$ , $R_G=6\Omega$		35	50	ns
$T_r$	Turn-on Rise Time			19	28	
$t_{\text{d(OFF)}}$	Turn-off Delay Time			110	170	
$T_f$	Turn-off Fall Time			60	75	
$C_{\text{iss}}$	Input Capacitance	$V_{\text{GS}}=0\text{V}$		5300		pF
$C_{\text{oss}}$	Output Capacitance	$V_{\text{DS}}=15\text{V}$		1000		
$C_{\text{rss}}$	Reverse Transfer Capacitance	Frequency=1.0MHz		300		

**Notes**
<sup>a</sup> : Guaranteed by design, not subject to production testing

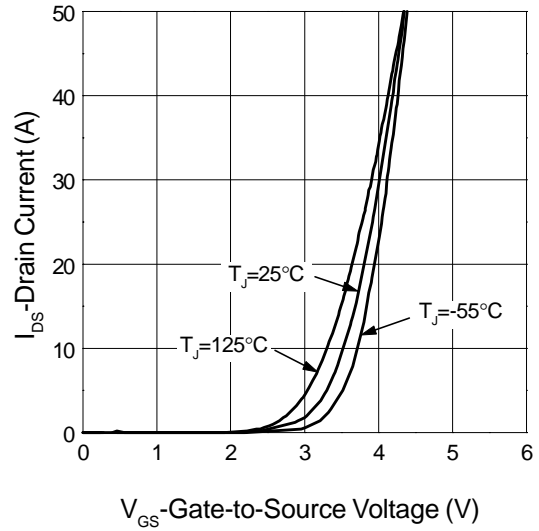
<sup>b</sup> : Pulse test ; pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$

## Typical Characteristics

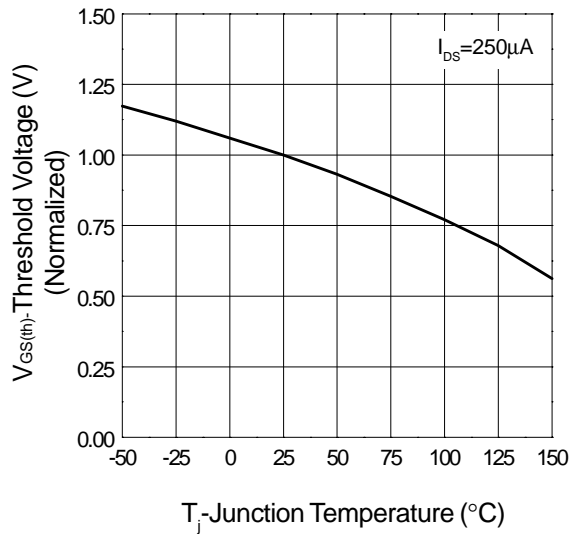
Output Characteristics



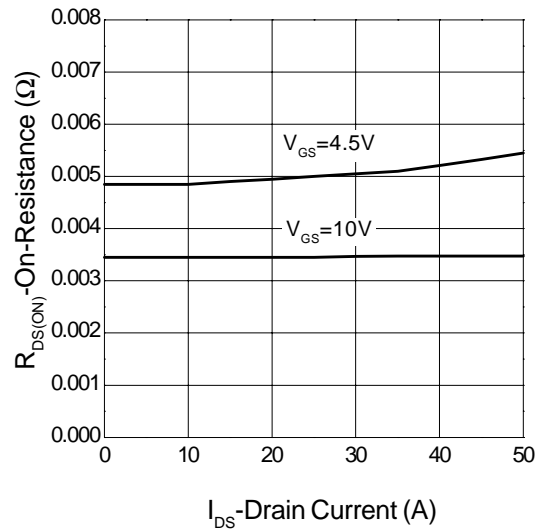
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

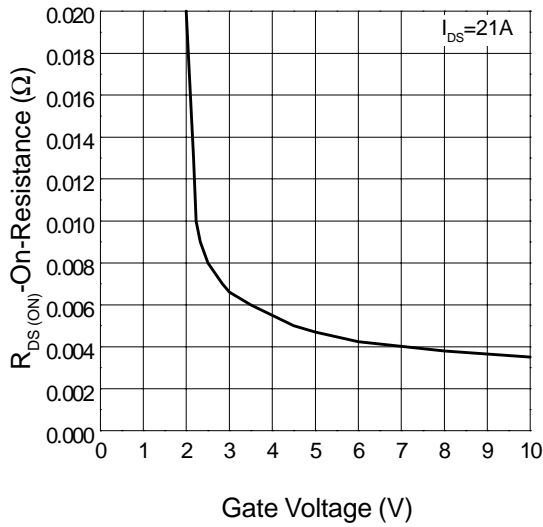


On-Resistance vs. Drain Current

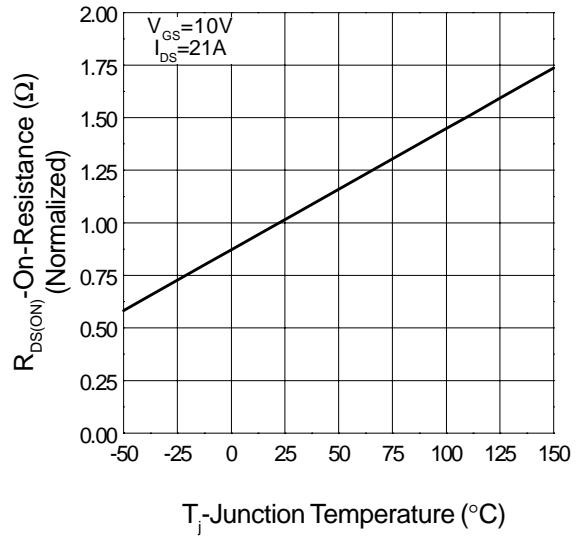


Typical Characteristics Cont.

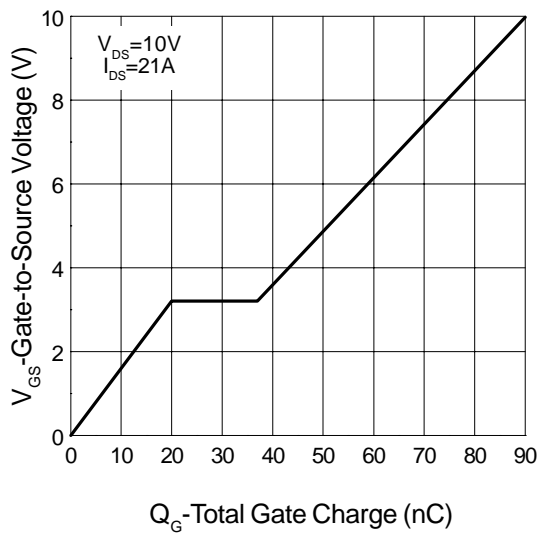
On-Resistance vs. Gate-to-Source Voltage



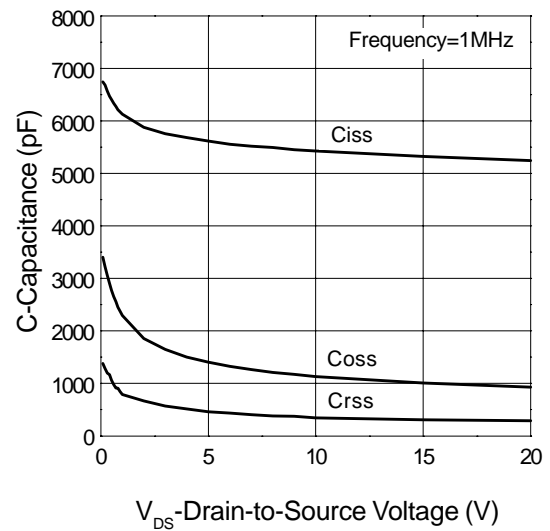
On-Resistance vs. Junction Temperature



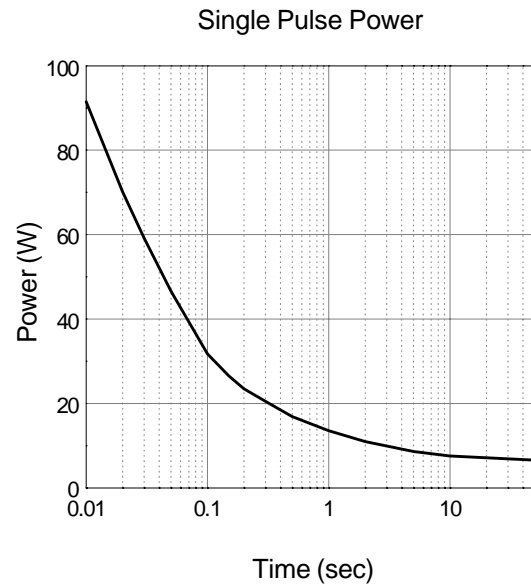
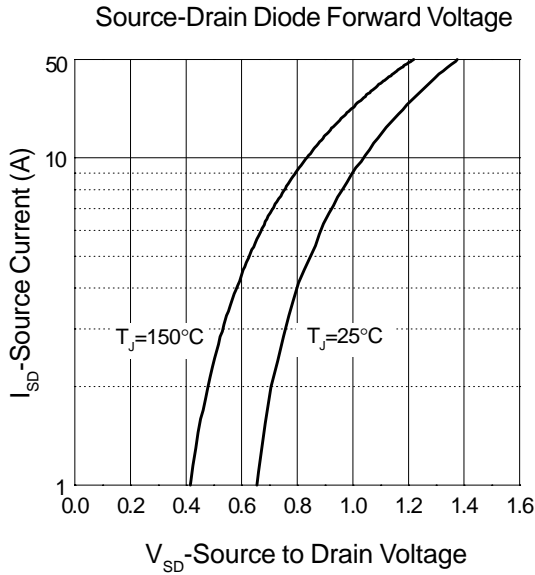
Gate Charge



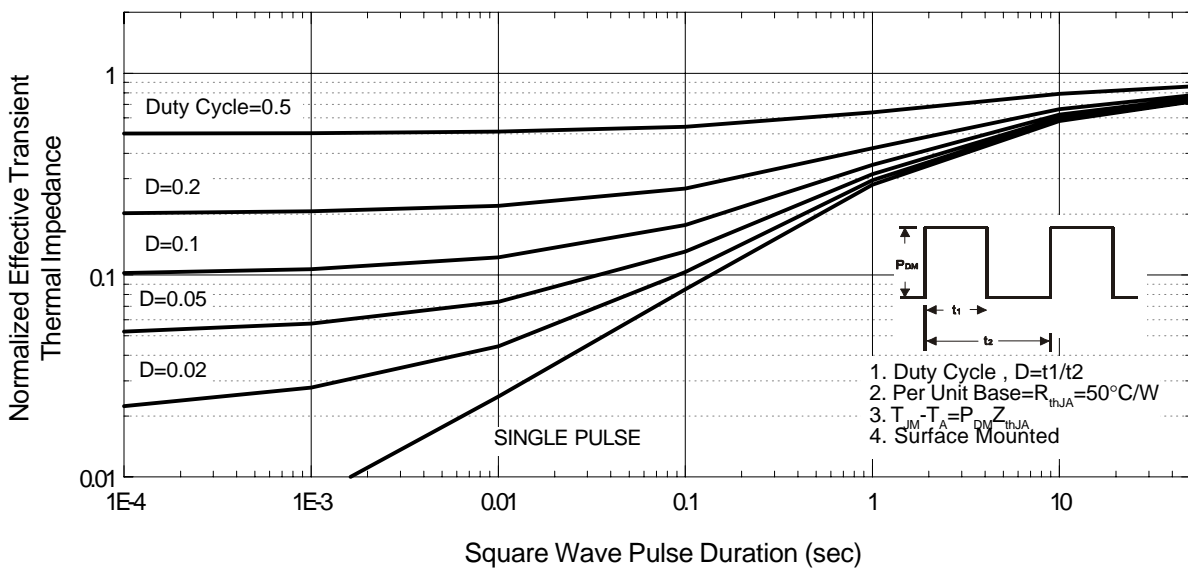
Capacitance Characteristics



Typical Characteristics Cont.

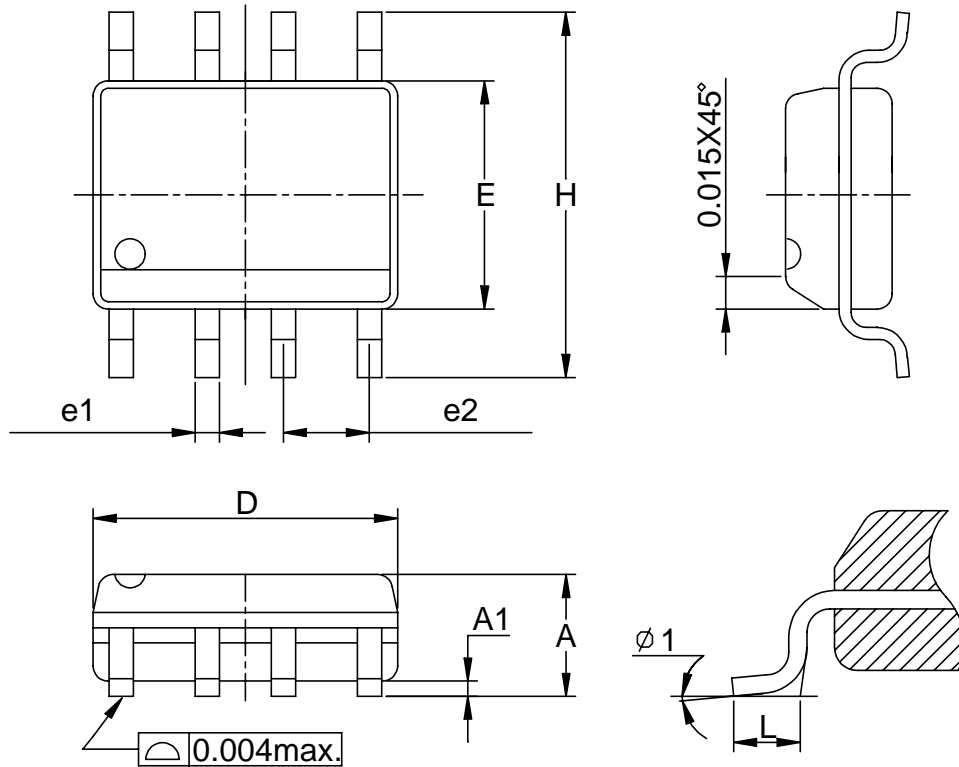


Normalized Transient Thermal Impedance, Junction to Ambient



## Packaging Information

SOP-8 pin ( Reference JEDEC Registration MS-012)



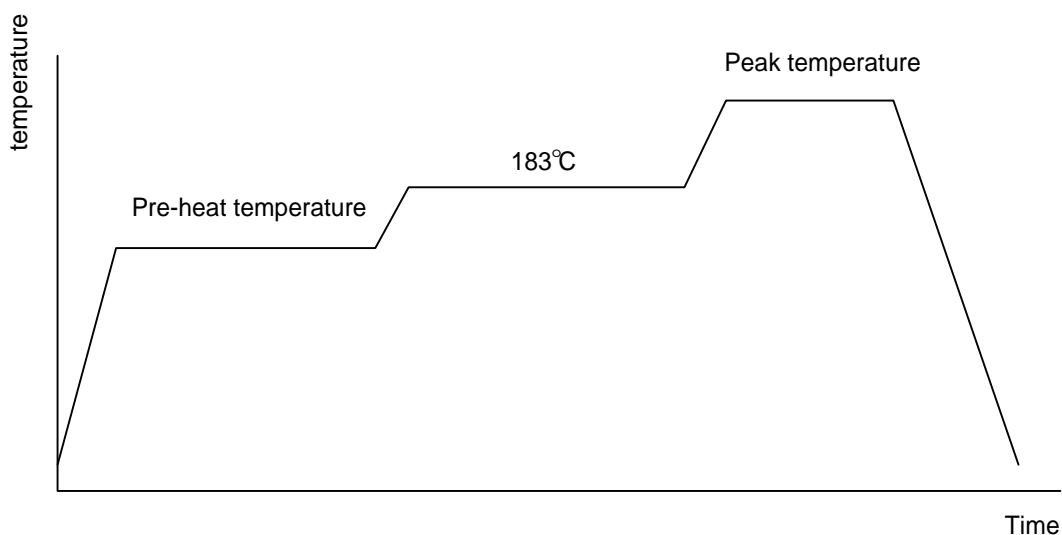
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
φ 1	8°		8°	

## 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)

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.	

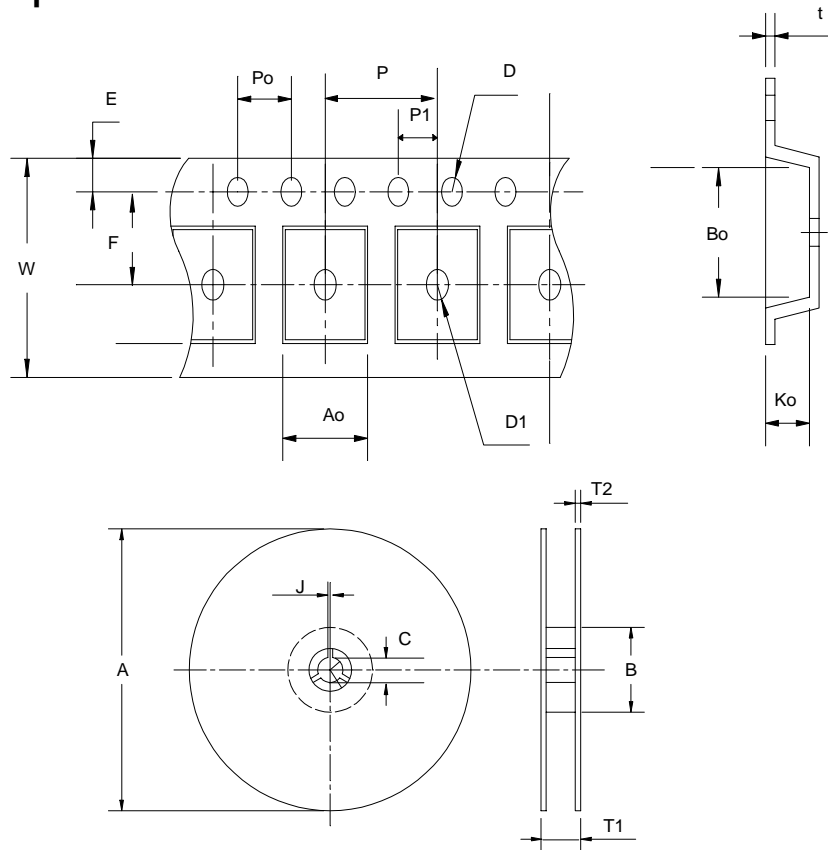
## Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 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
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms , I <sub>tr</sub> > 100mA

### Carrier Tape



Application	A	B	C	J	T1	T2	W	P	E
SOP- 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± 1	1.55 +0.1	1.55+ 0.25	4.0 ± 0.1	2.0 ± 0.1	6.4 ± 0.1	5.2± 0.1	2.1± 0.1	0.3±0.013



## Cover Tape Dimensions

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

## Customer Service

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