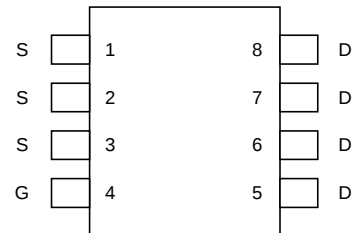


N-Channel Enhancement Mode MOSFET

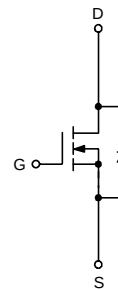
Features

- 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

APM4408 □□-□□ Handling Code Temp. Range Package Code	Package Code K : SO-8 Operation Junction Temp. Range C : -55 to 125°C Handling Code TU : Tube TR : Tape & Reel
APM4408 K : APM4408 XXXXXX	XXXXXX - Date Code

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	± 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	$T_A=25^\circ\text{C}$	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	$^\circ\text{C/W}$

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

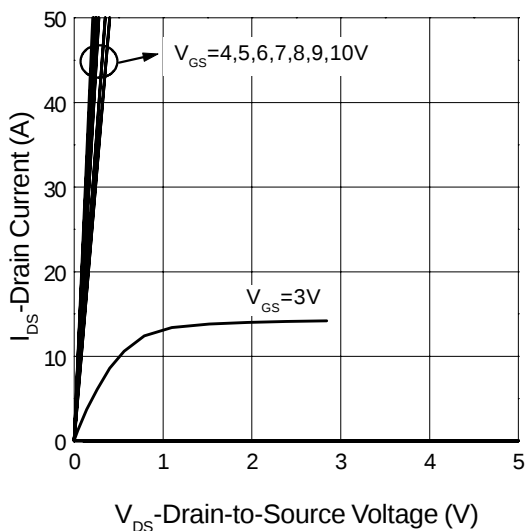
Symbol	Parameter	Test Condition	APM4408			Unit
			Min.	Typ.	Max.	
Static						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V , I _{DS} =250μA	20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =18V , V _{GS} =0V			1	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	0.8		1.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±16V , V _{DS} =0V			±100	nA
R _{DS(ON)} ^a	Drain-Source On-state Resistance	V _{GS} =10V , I _{DS} =21A		3.5	4.5	mΩ
		V _{GS} =4.5V , I _{DS} =17A		5	6	
		V _{GS} =2.5V , I _{DS} =10A		8	10	
V _{SD} ^a	Diode Forward Voltage	I _{SD} =2.9A , V _{GS} =0V	0.6		1.3	V
Dynamic ^b						
Q _g	Total Gate Charge	V _{DS} =10V , I _{DS} = 21A V _{GS} =4.5V ,		45	65	nC
Q _{gs}	Gate-Source Charge			20		
Q _{gd}	Gate-Drain Charge			17		
t _{d(ON)}	Turn-on Delay Time	V _{DD} =10V , I _{DS} =1A , V _{GEN} =4.5V , R _G =6Ω		35	50	ns
T _r	Turn-on Rise Time			19	28	
t _{d(OFF)}	Turn-off Delay Time			110	170	
T _f	Turn-off Fall Time			60	75	
C _{iss}	Input Capacitance	V _{GS} =0V		5300		pF
C _{oss}	Output Capacitance	V _{DS} =15V		1000		
C _{rss}	Reverse Transfer Capacitance	Frequency=1.0MHz		300		

Notes
^a : Guaranteed by design, not subject to production testing

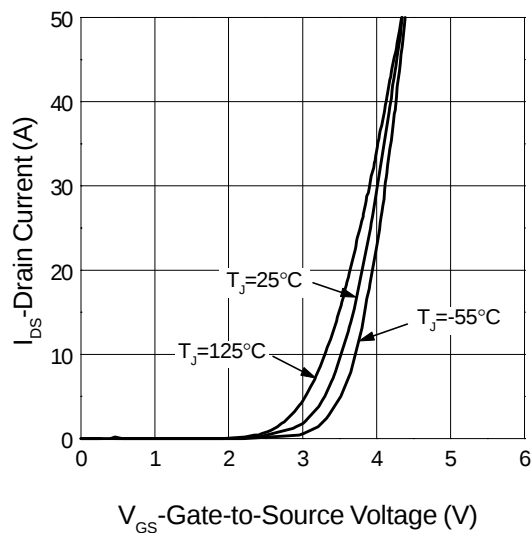
^b : Pulse test ; pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$

Typical Characteristics

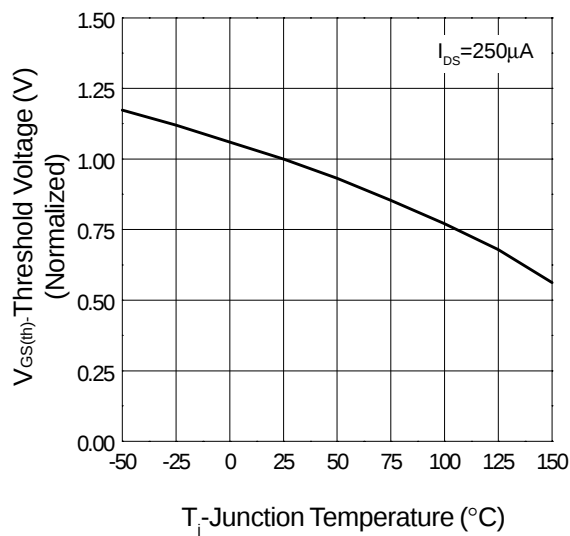
Output Characteristics



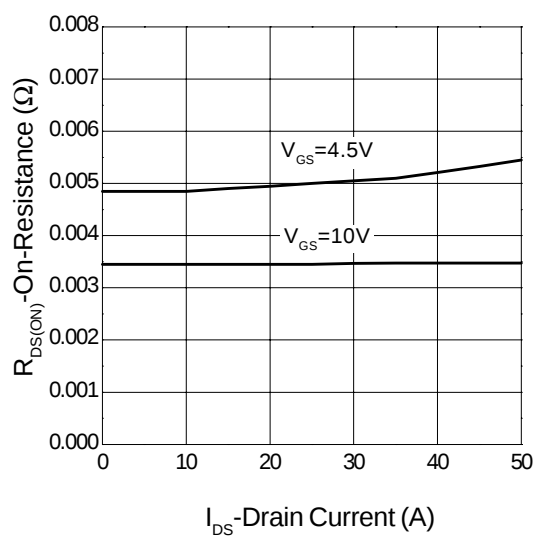
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

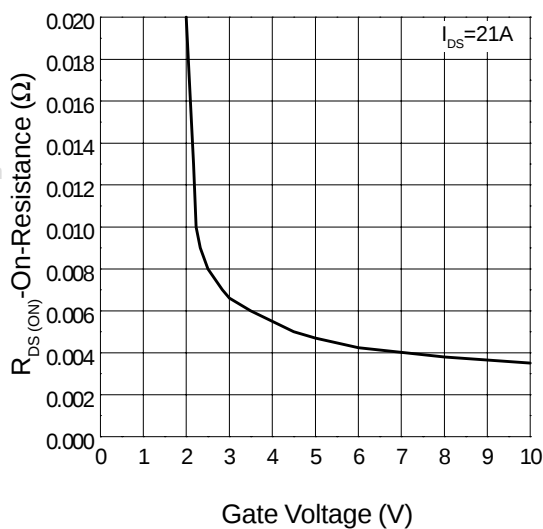


On-Resistance vs. Drain Current

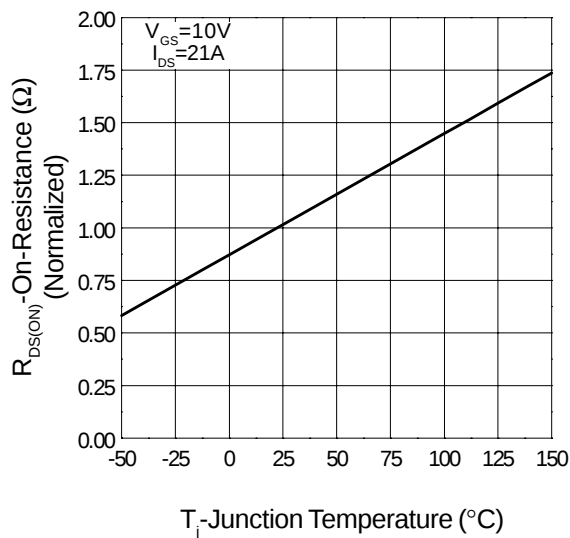


Typical Characteristics Cont.

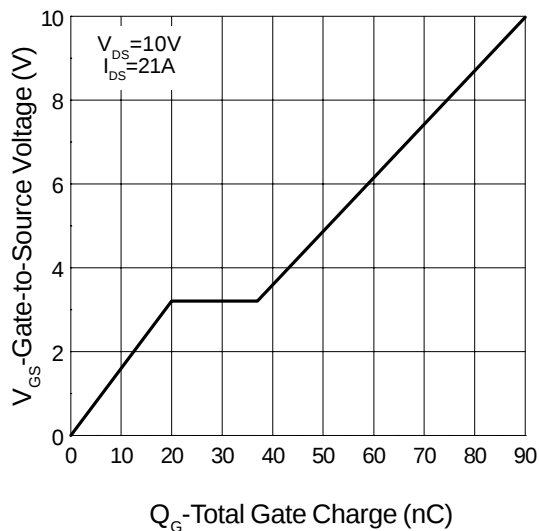
On-Resistance vs. Gate-to-Source Voltage



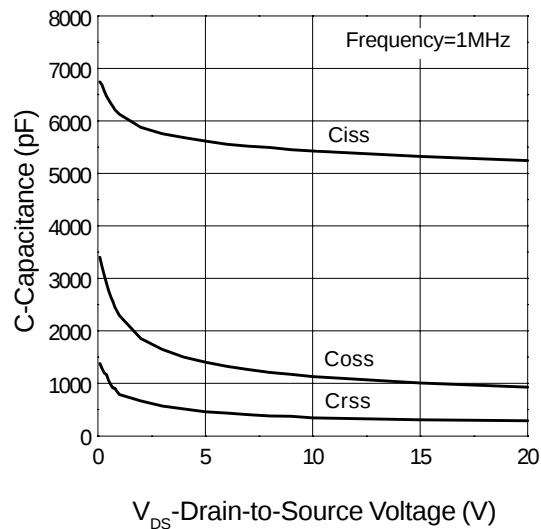
On-Resistance vs. Junction Temperature



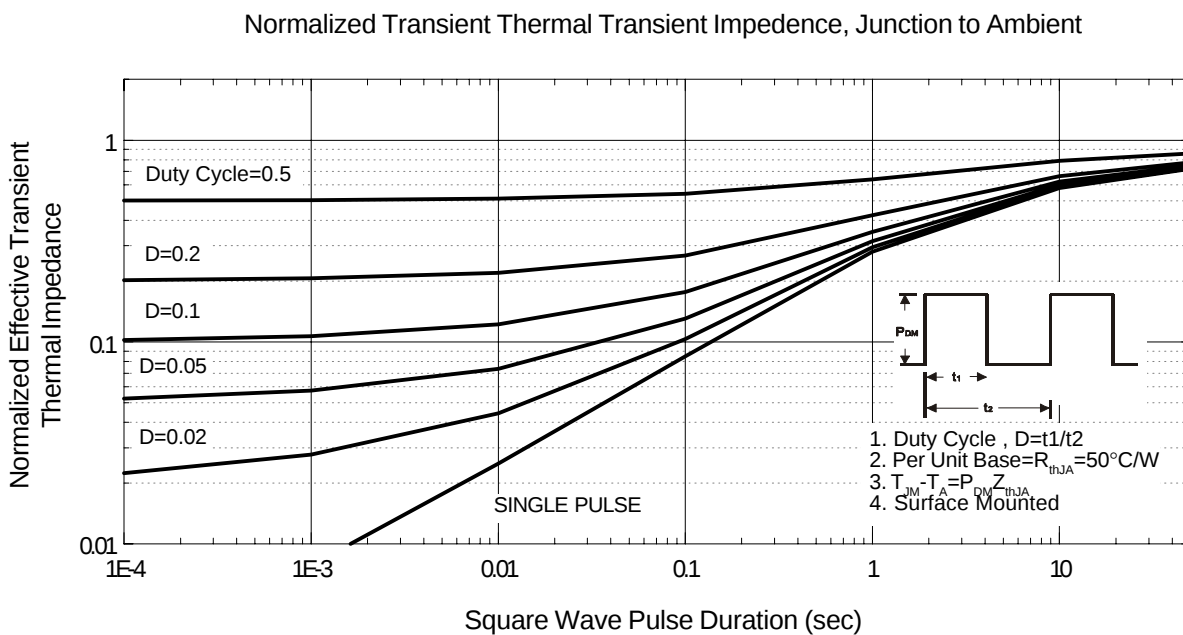
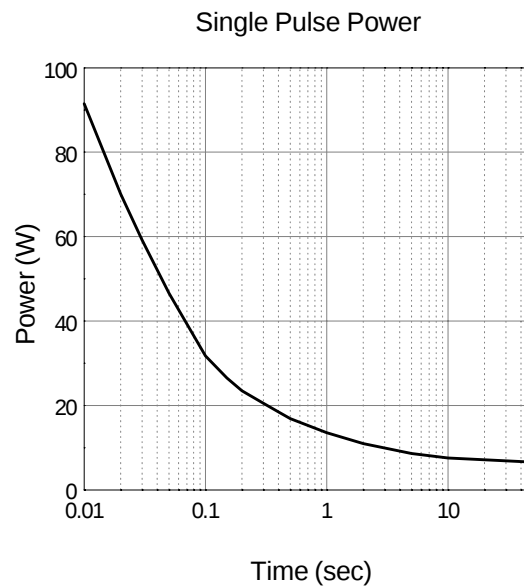
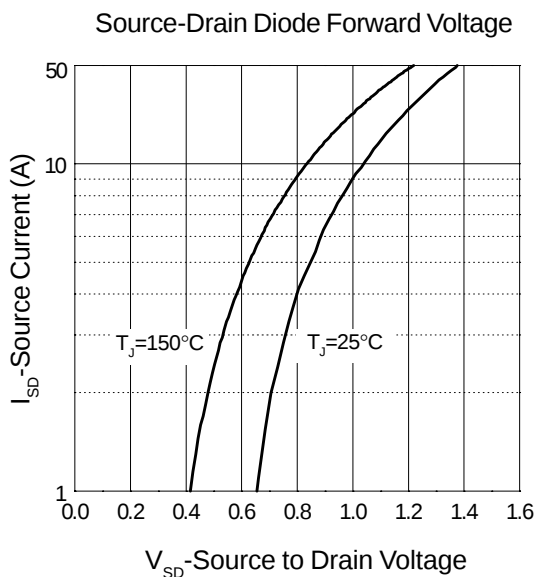
Gate Charge



Capacitance Characteristics



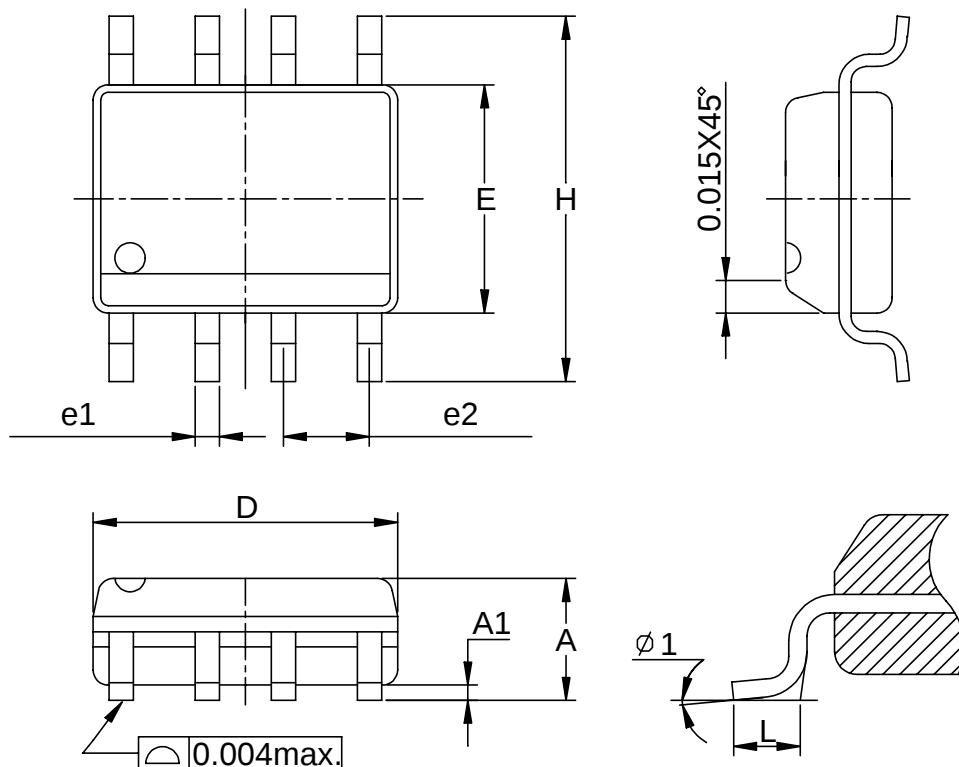
Typical Characteristics Cont.



Packaging Information

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

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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	
$\phi 1$	8°		8°	

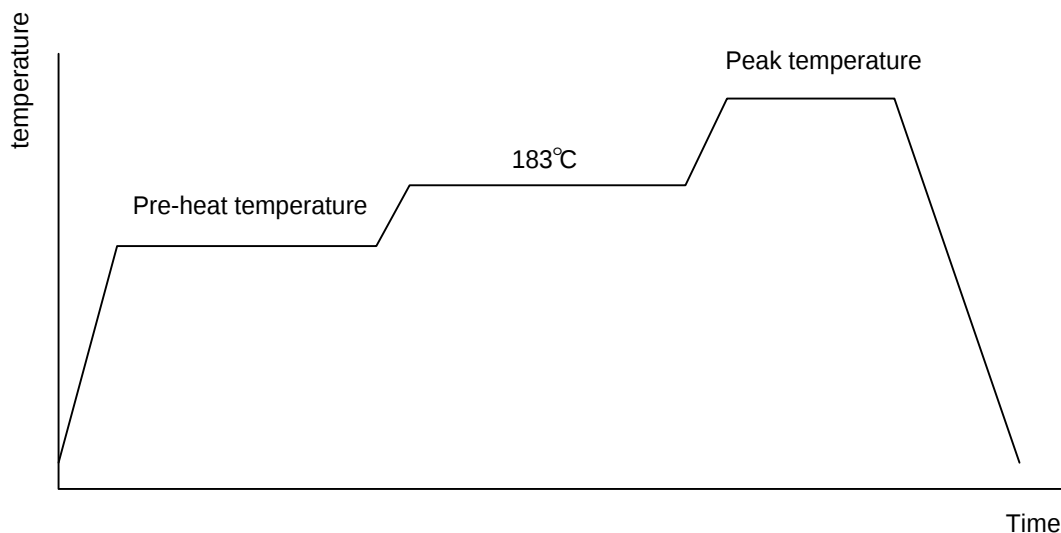
Physical Specifications

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

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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.	

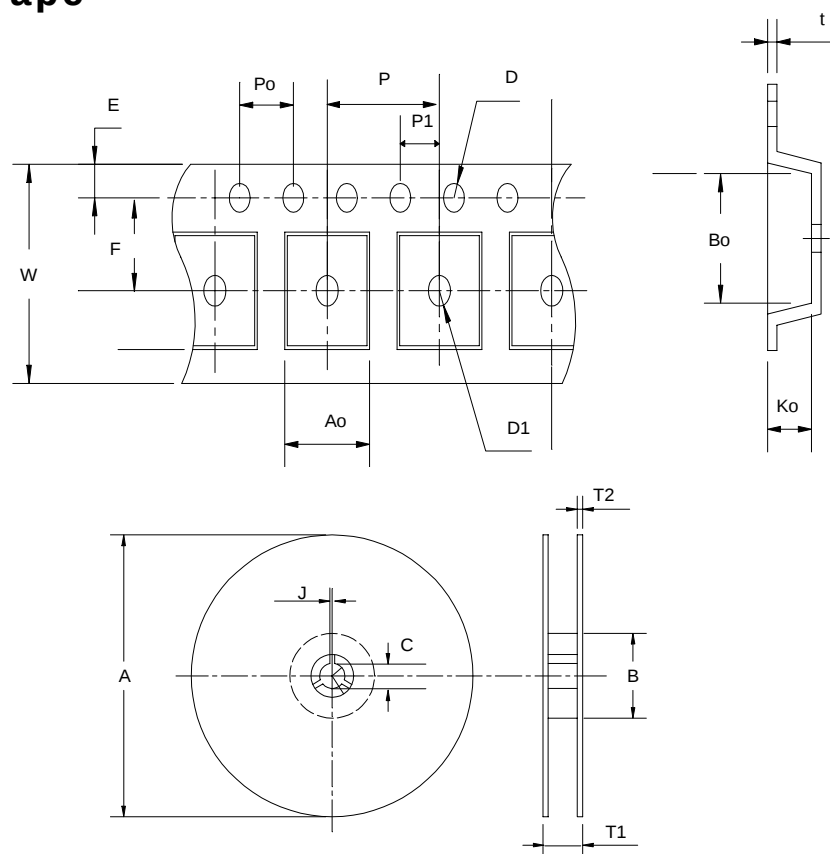
Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm ³	pkg. thickness < 2.5mm and pkg. volume < 350mm ³
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 _{tr} > 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

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