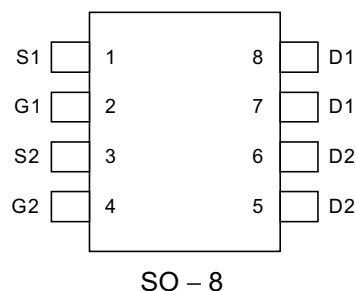


## Dual P-Channel Enhancement Mode MOSFET

### Features

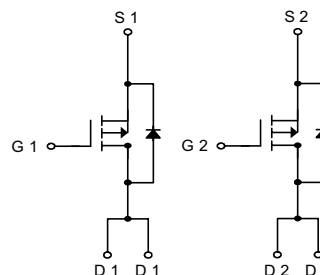
- 20V/-6A,  $R_{DS(ON)} = 45m\Omega(max.) @ V_{GS} = -4.5V$   
 $R_{DS(ON)} = 65m\Omega(max.) @ V_{GS} = -2.5V$
- Super High Dense Cell Design for Extremely Low  $R_{DS(ON)}$
- Reliable and Rugged
- SO-8 Package

### Pin Description



### Applications

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



### Ordering and Marking Information

P-Channel MOSFET

<p>APM9935    □□-□□□</p> <p>Lead Free Code</p> <p>Handling Code</p> <p>Temp. Range</p> <p>Package Code</p>	<p>Package Code K : SO-8</p> <p>Operation Junction Temp. Range C : -55 to 150°C</p> <p>Handling Code TU : Tube    TR : Tape &amp; Reel</p> <p>Lead Free Code L : Lead Free Device    Blank : Original Device</p>
<p>APM9935K :    <span style="border: 1px solid black; padding: 2px;">APM9935 XXXXX</span></p>	<p>XXXXX - Date Code</p>

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

Symbol	Parameter	Rating	Unit
$V_{DSS}$	Drain-Source Voltage	-20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 12$	
$I_D^*$	Maximum Drain Current – Continuous	-6	A
$I_{DM}$	Maximum Drain Current – Pulsed	-10	

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	50	$^\circ\text{C/W}$

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

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

Symbol	Parameter	Test Condition	APM9935			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	-0.5	-0.7	-1	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±12V , V <sub>DS</sub> =0V			±100	nA
R <sub>DS(ON)</sub> <sup>a</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =-4.5V , I <sub>DS</sub> =-6A			45	mΩ
		V <sub>GS</sub> =-2.5V , I <sub>DS</sub> =-5A			65	
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>S</sub> =-2A , 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> =-4V , I <sub>DS</sub> =-6A V <sub>GS</sub> =-4.5V		17	22	nC
Q <sub>gs</sub>	Gate-Source Charge			4.1		
Q <sub>gd</sub>	Gate-Drain Charge			1.6		
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =-4V , I <sub>DS</sub> =-6A , V <sub>GEN</sub> =-4.5V , R <sub>G</sub> =10Ω		23	45	ns
T <sub>r</sub>	Turn-on Rise Time			45	80	
t <sub>d(OFF)</sub>	Turn-off Delay Time			45	90	
T <sub>f</sub>	Turn-off Fall Time			32	55	
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V , V <sub>DS</sub> =-15V Frequency=1.0MHz		1242		pF
C <sub>oss</sub>	Output Capacitance			341		
C <sub>rss</sub>	Reverse Transfer Capacitance			217		

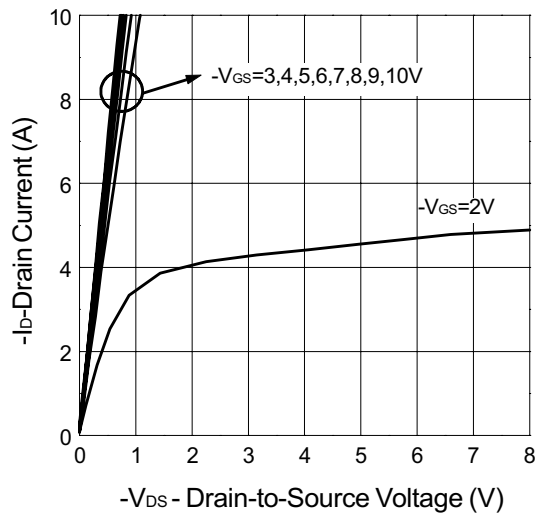
### Notes

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

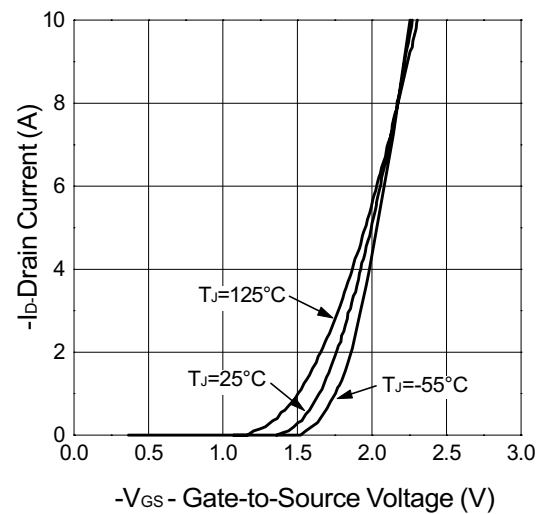
<sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

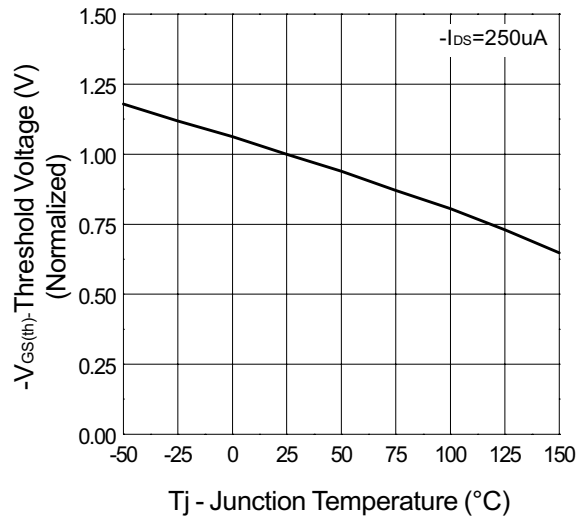
Output Characteristics



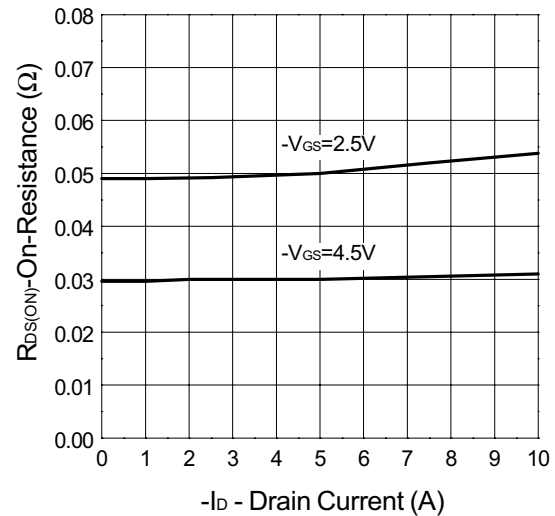
Transfer Characteristics



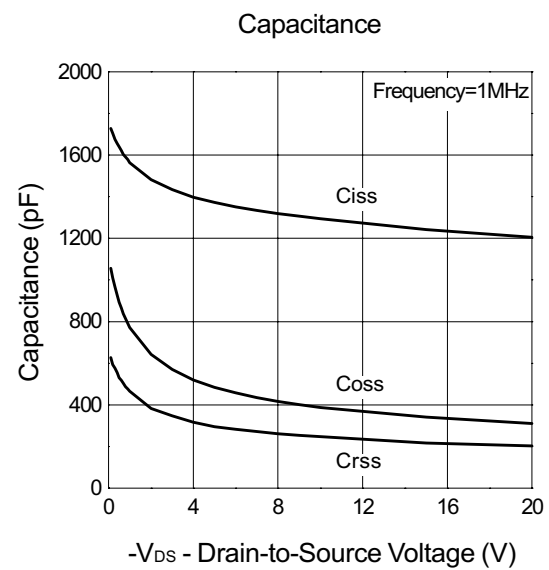
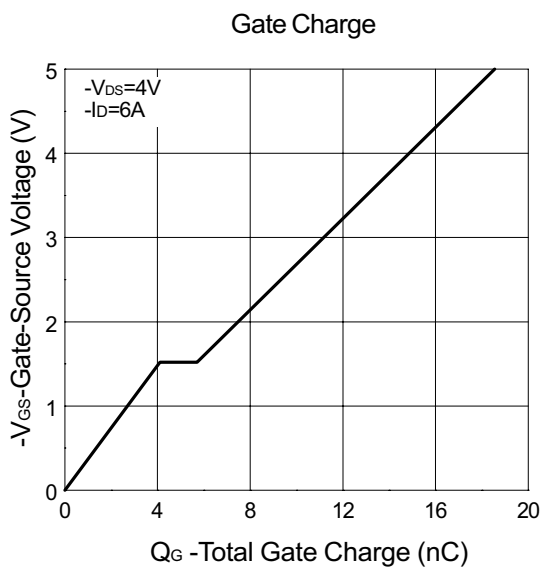
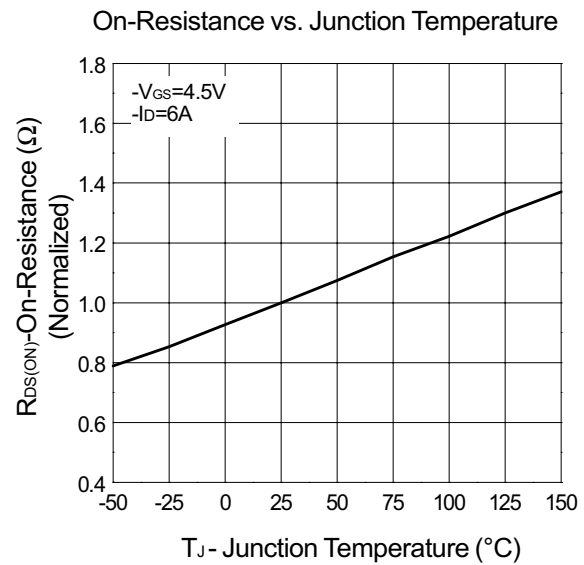
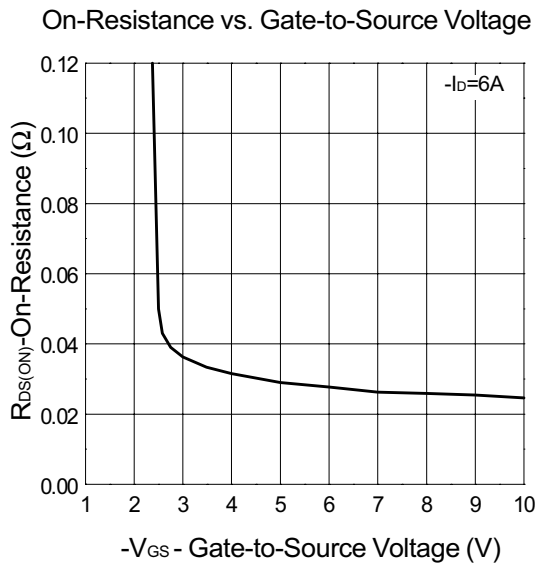
Threshold Voltage vs. Junction Temperature



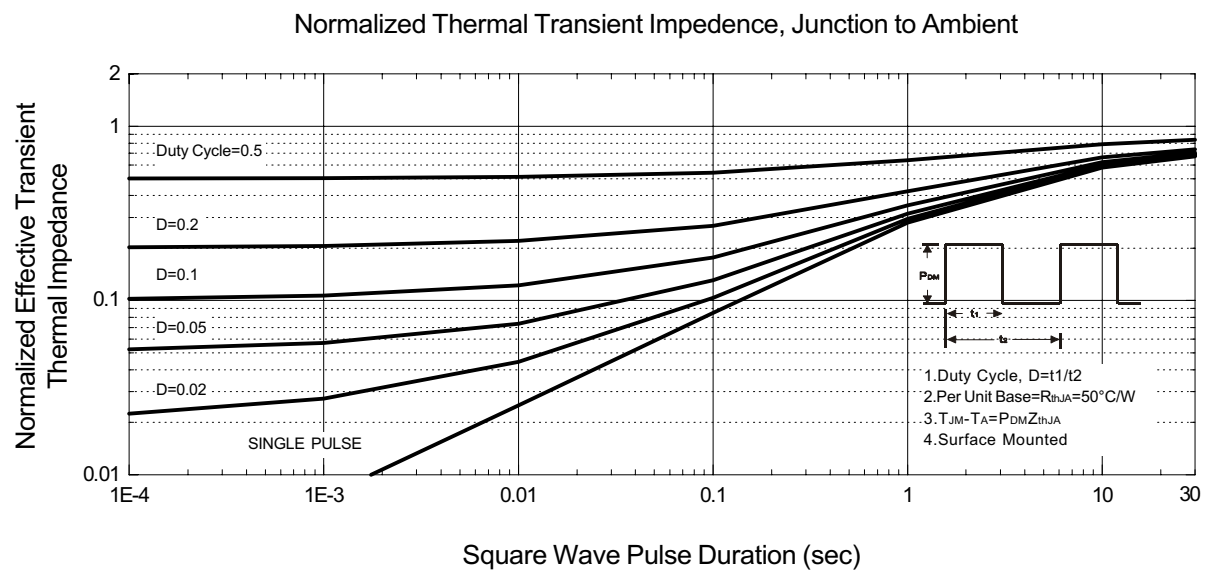
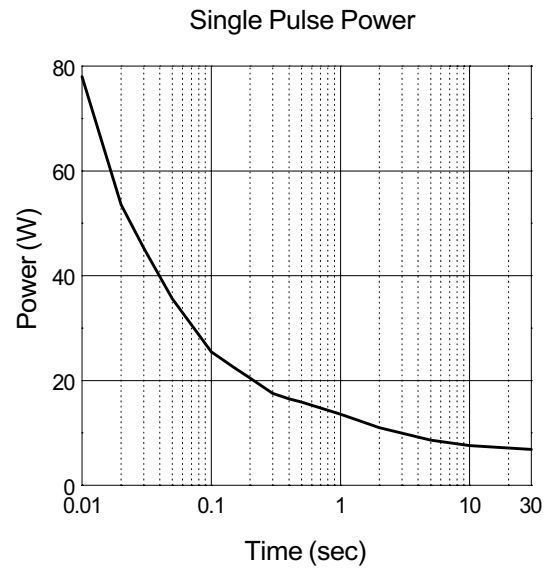
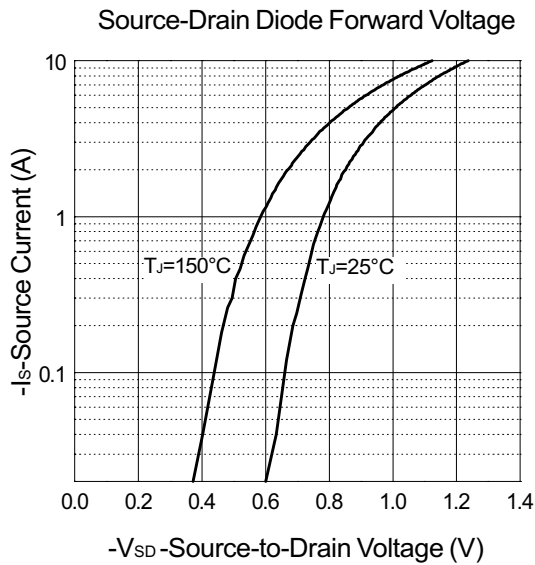
On-Resistance vs. Drain Current



## Typical Characteristics (Cont.)

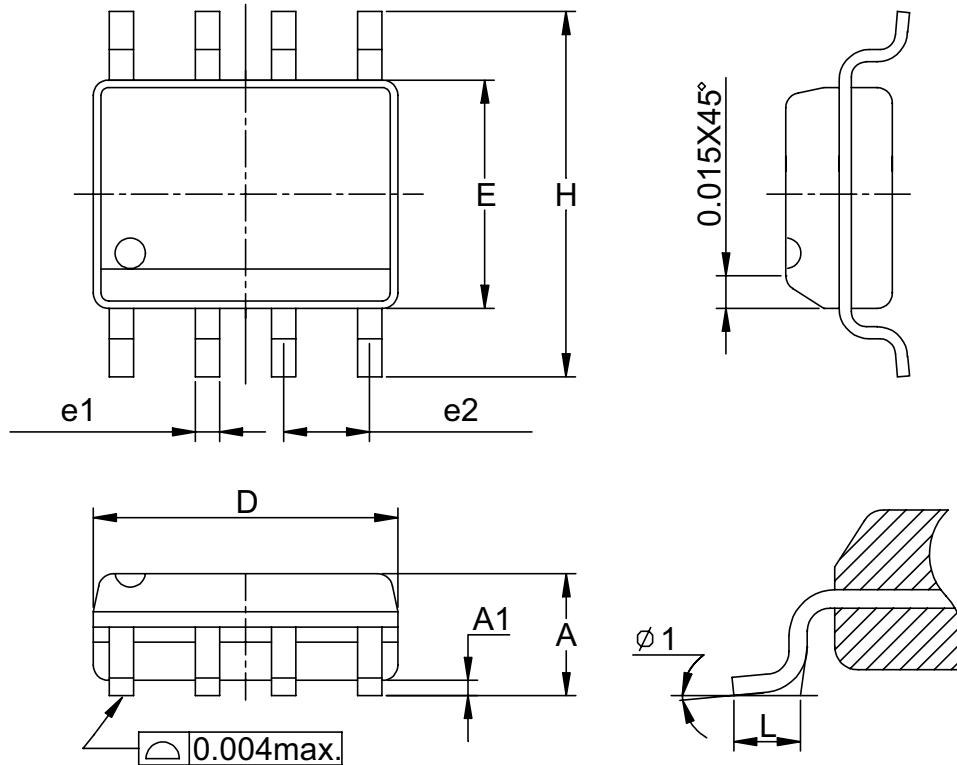


## Typical Characteristics (Cont.)



## Packaging Information

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



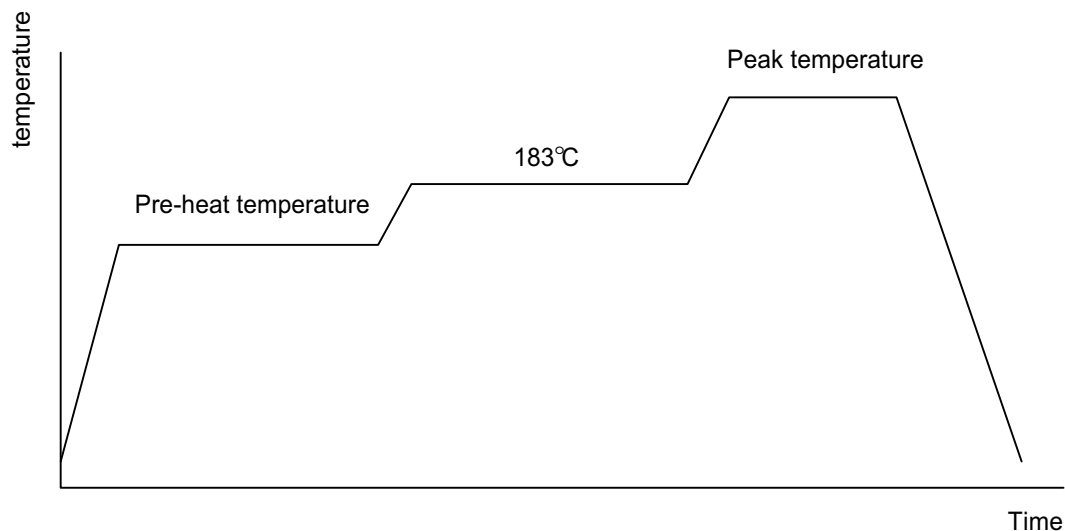
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
$\phi 1$	8°		8°	

## 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 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.	

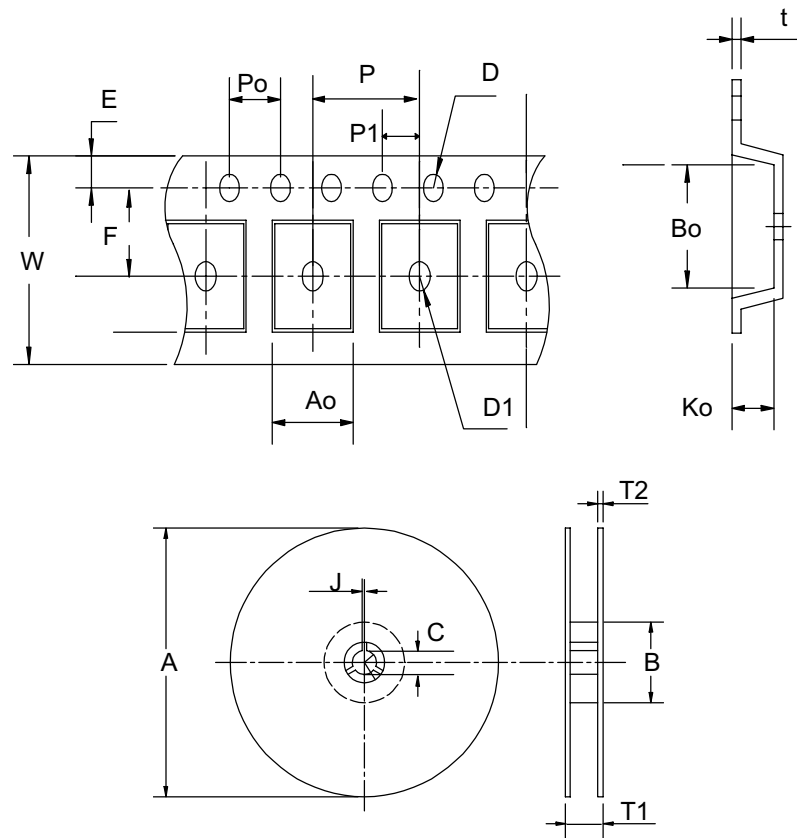
## Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 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
SOP- 8	$330 \pm 1$	$62 +1.5$	$12.75+0.15$	$2 \pm 0.5$	$12.4 \pm 0.2$	$2 \pm 0.2$	$12 \pm 0.3$	$8 \pm 0.1$	$1.75 \pm 0.1$
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	$5.5 \pm 1$	$1.55 +0.1$	$1.55+0.25$	$4.0 \pm 0.1$	$2.0 \pm 0.1$	$6.4 \pm 0.1$	$5.2 \pm 0.1$	$2.1 \pm 0.1$	$0.3 \pm 0.013$

## Cover Tape Dimensions

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

## Customer Service

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