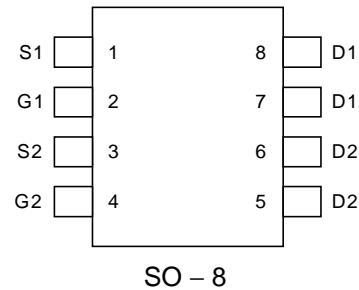


Dual P-Channel Enhancement Mode MOSFET

Features

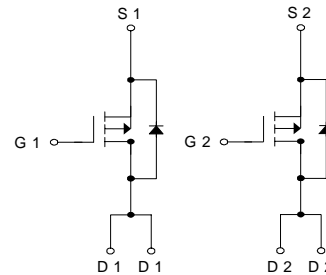
- 20V/-6A, $R_{DS(ON)} = 30m\Omega$ (typ.) @ $V_{GS} = -4.5V$
 $R_{DS(ON)} = 38m\Omega$ (typ.) @ $V_{GS} = -2.5V$
- Super High Dense Cell Design for Extremely Low $R_{DS(ON)}$
- Reliable and Rugged
- SO-8 Package

Pin Description



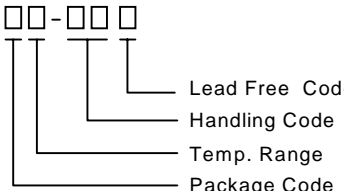
Applications

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



Ordering and Marking Information

P-Channel MOSFET

<p>APM9935</p> 	<p>Package Code K : SO-8 Operation Junction Temp. Range C : -55 to 150°C Handling Code TU : Tube TR : Tape & Reel Lead Free Code L : Lead Free Device Blank : Original Device</p>
<p>APM9935K : APM9935 XXXXX</p>	<p>XXXXX - Date Code</p>

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

Symbol	Parameter	Rating	Unit
V_{DSS}	Drain-Source Voltage	-20	V
V_{GSS}	Gate-Source Voltage	± 12	
I_D	Maximum Drain Current – Continuous	-6	A
I_{DM}	Maximum Drain Current – Pulsed	-20	

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	
$R_{\theta JA}^*$	Thermal Resistance – Junction to Ambient	62.5	$^\circ\text{C/W}$

* Mounted on 1in^2 pad area of PCB.

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

Symbol	Parameter	Test Condition	APM9935			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} =-16V , V _{GS} =0V			-1	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =-250μA	-0.5	-0.7	-1	V
I _{GSS}	Gate Leakage Current	V _{GS} =±12V , V _{DS} =0V			±100	nA
R _{DS(ON)} ^a	Drain-Source On-state Resistance	V _{GS} =-4.5V , I _{DS} =-6A		30	45	mΩ
		V _{GS} =-2.5V , I _{DS} =-5A		38	65	
V _{SD} ^a	Diode Forward Voltage	I _S =-2A , V _{GS} =0V		-0.7	-1.3	V
Dynamic ^b						
Q _g	Total Gate Charge	V _{DS} =-10V , I _{DS} =-6A V _{GS} =-4.5V		17	25	nC
Q _{gs}	Gate-Source Charge			5.2		
Q _{gd}	Gate-Drain Charge			3.6		
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-15V , I _{DS} =-6A , V _{GEN} =-4.5V , R _G =10Ω		12	25	ns
T _r	Turn-on Rise Time			18	35	
t _{d(OFF)}	Turn-off Delay Time			40	80	
T _f	Turn-off Fall Time			20	40	
C _{iss}	Input Capacitance	V _{GS} =0V , V _{DS} =-15V Frequency=1.0MHz		1665		pF
C _{oss}	Output Capacitance			380		
C _{rss}	Reverse Transfer Capacitance			290		

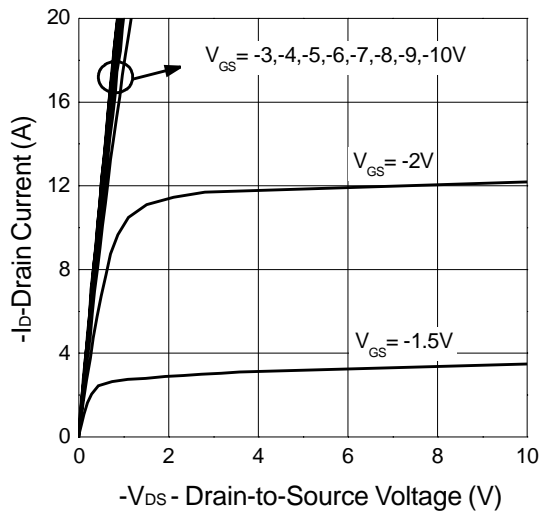
Notes

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

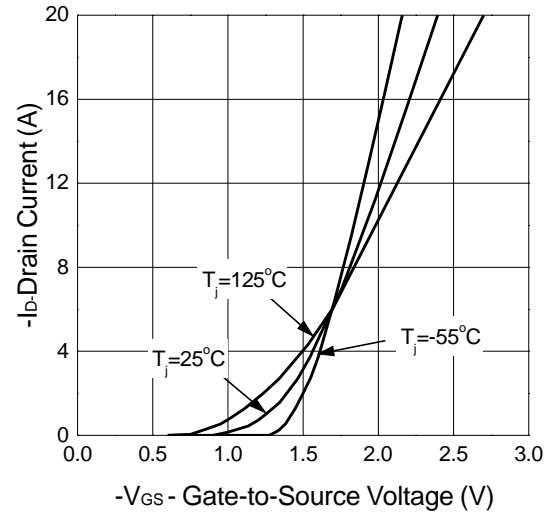
^b : Guaranteed by design, not subject to production testing

Typical Characteristics

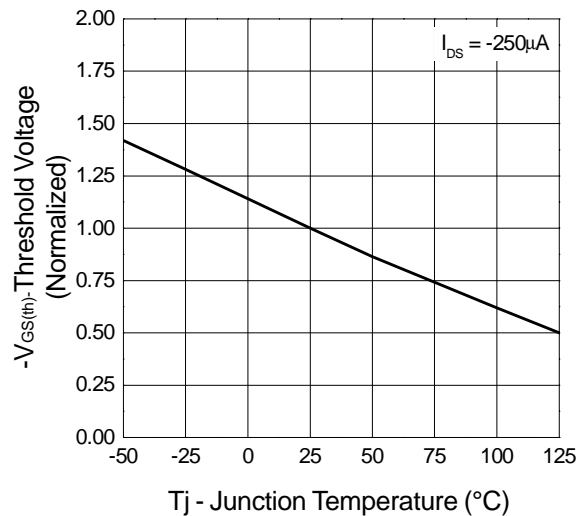
Output Characteristics



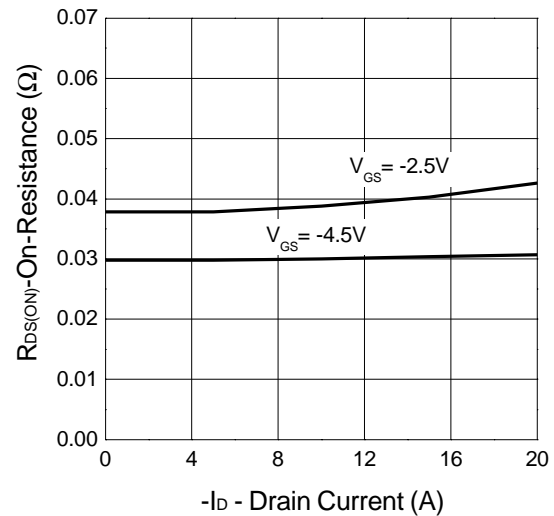
Transfer Characteristics



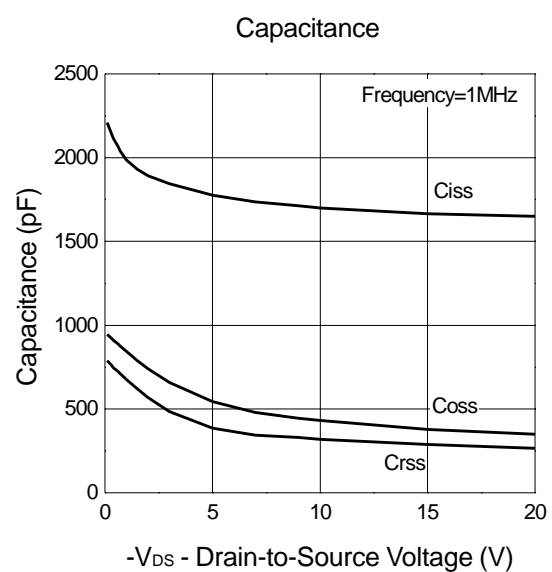
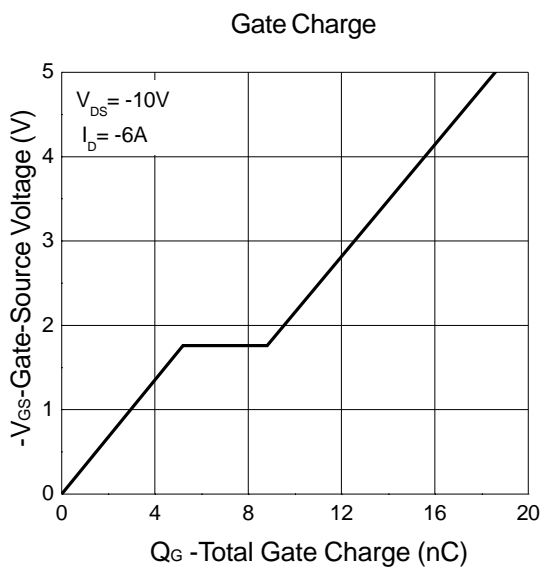
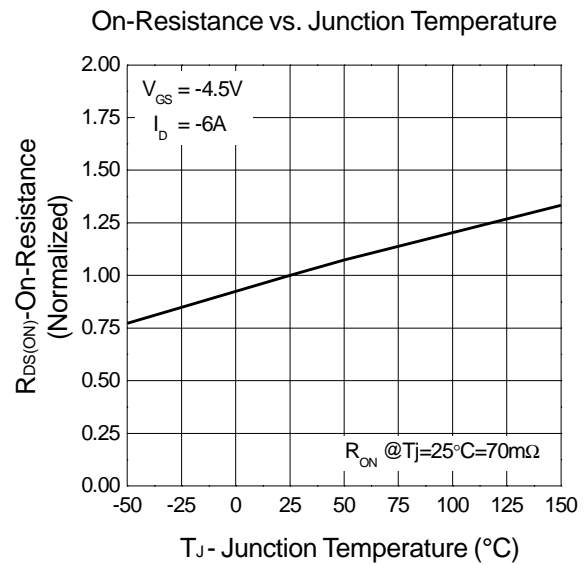
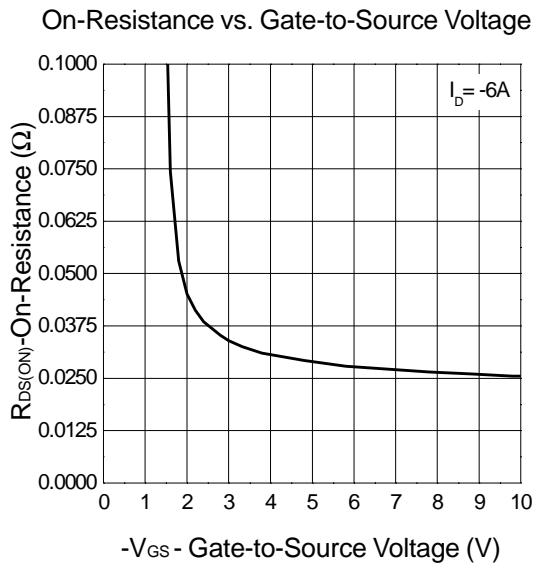
Threshold Voltage vs. Junction Temperature



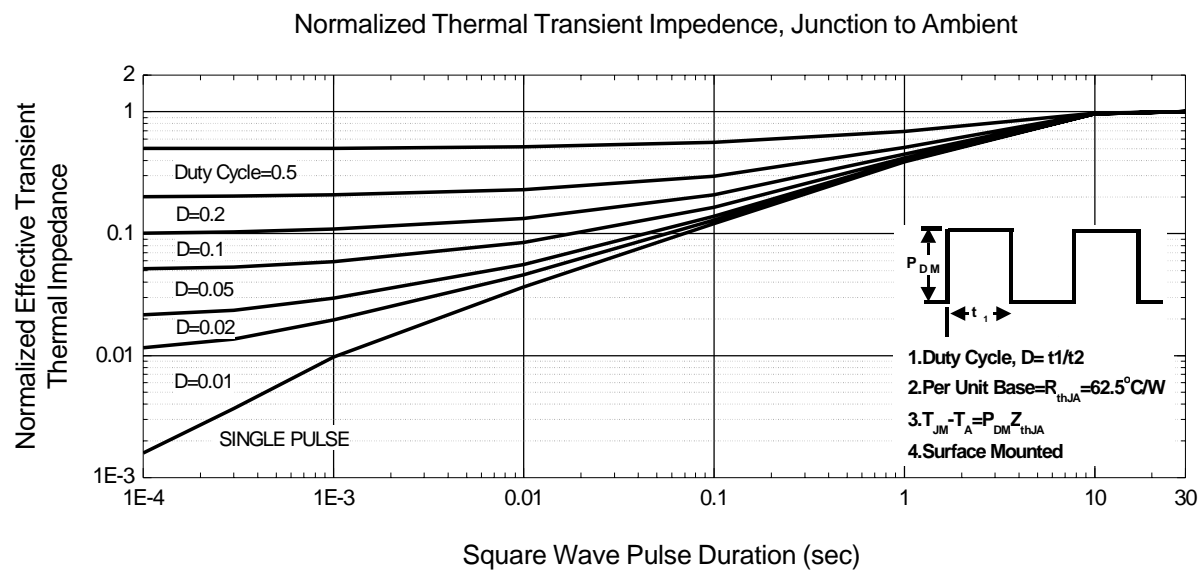
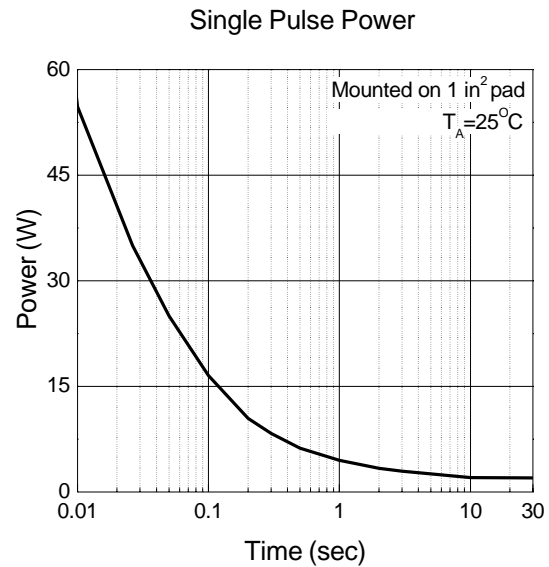
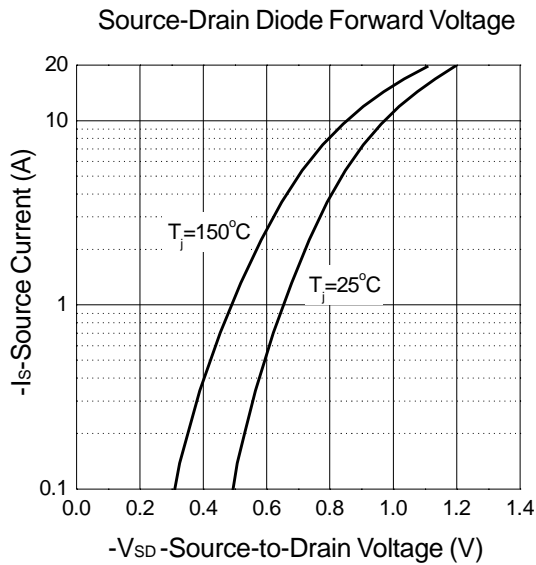
On-Resistance vs. Drain Current



Typical Characteristics (Cont.)

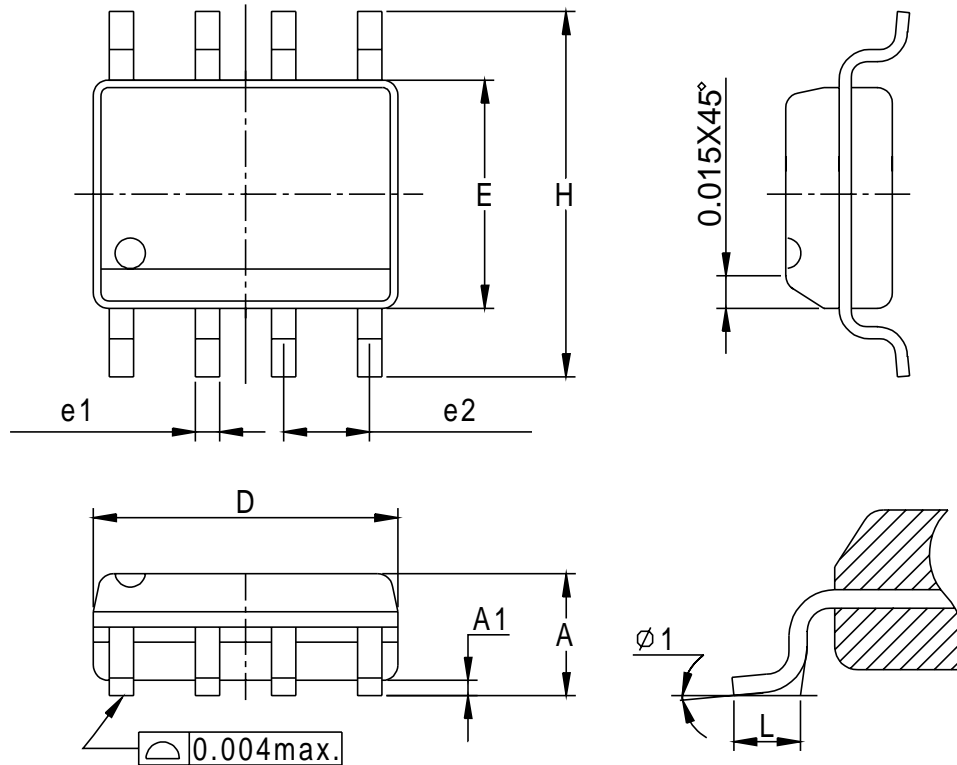


Typical Characteristics (Cont.)



Packaging Information

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

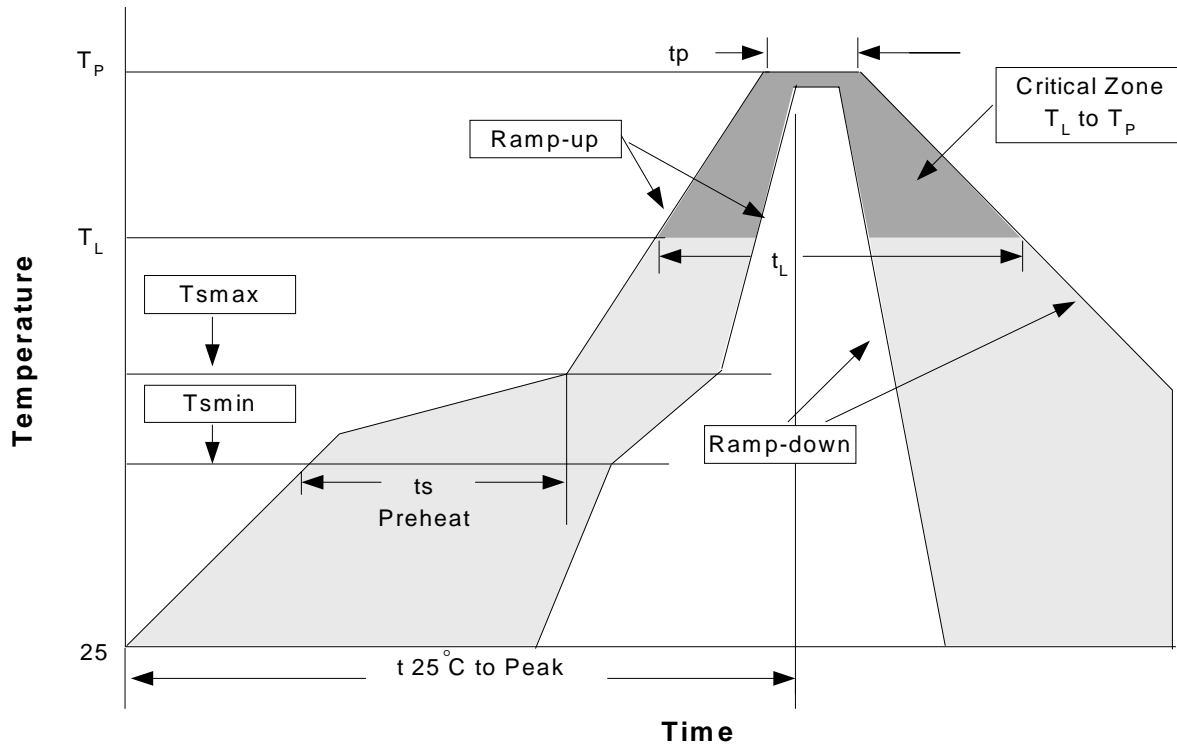


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
Ø 1	8°		8°	

Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RS186-91, ANSI/J-STD-002 Category 3.

Reflow Condition (IR/Convection or VPR Reflow)



Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate (T_L to T_P)	3°C/second max.		3°C/second max.	
Preheat				
- Temperature Min (T_{smin})	100°C		150°C	
- Temperature Mix (T_{smax})	150°C		200°C	
- Time (min to max)(t_s)	60-120 seconds		60-180 seconds	
T_{smax} to T_L			3°C/second max	
- Ramp-up Rate				
T_{smax} to T_L				
- Temperature(T_L)	183°C		217°C	
- Time (t_L)	60-150 seconds		60-150 seconds	
Peak Temperature(T_P)	225 +0/-5°C	240 +0/-5°C	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actual Peak Temperature(t_p)	10-30 seconds	10-30 seconds	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.		6°C/second max.	
Time 25°C to Peak Temperature	6 minutes max.		8 minutes max.	

Note: All temperatures refer to topside of the package. Measured on the body surface.

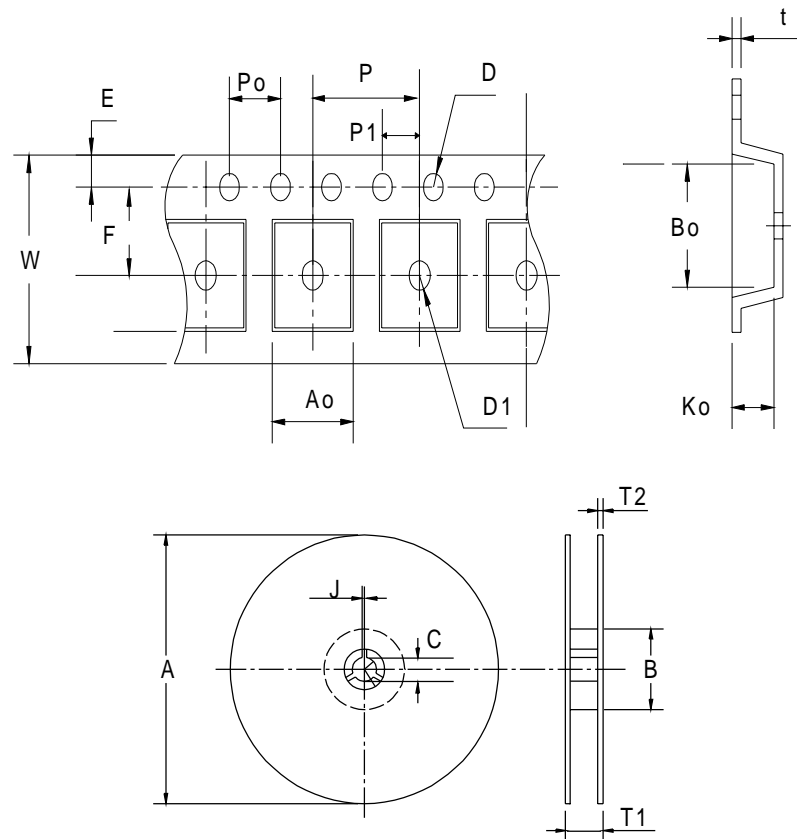
Package Reflow Conditions

pkg. thickness $\geq 2.5\text{mm}$ and all bgas	pkg. thickness $< 2.5\text{mm}$ and pkg. volume $\geq 350\text{mm}^3$	pkg. thickness $< 2.5\text{mm}$ and pkg. volume $< 350\text{mm}^3$
Convection 220 $\pm 5/-0^\circ\text{C}$		Convection 235 $\pm 5/-0^\circ\text{C}$
VPR 215-219 $^\circ\text{C}$		VPR 235 $\pm 5/-0^\circ\text{C}$
IR/Convection 220 $\pm 5/-0^\circ\text{C}$		IR/Convection 235 $\pm 5/-0^\circ\text{C}$

Reliability Test Program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245 $^\circ\text{C}$, 5 SEC
HOLT	MIL-STD 883D-1005.7	1000 Hrs Bias @ 125 $^\circ\text{C}$
PCT	JESD-22-B, A102	168 Hrs, 100% RH, 121 $^\circ\text{C}$
TST	MIL-STD 883D-1011.9	-65 $^\circ\text{C}$ ~ 150 $^\circ\text{C}$, 200 Cycles

Carrier Tape & Reel Dimensions



Carrier Tape & Reel Dimensions

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	.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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