

P-Channel Enhancement Mode MOSFET

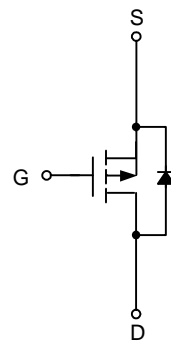
Features

- 100V/-90A,
 $R_{DS(ON)}=15m\Omega$ (Typ.) @ $V_{GS}=-10V$
 $R_{DS(ON)}=18m\Omega$ (Typ.) @ $V_{GS}=-4.5V$
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

Pin Description



Top View of TO-263-3




P-Channel MOSFET

Applications

- Power Management in DC/DC Converters and Battery Powered System

Ordering and Marking Information

<p>APM1104P □□-□□□</p> <div style="margin-left: 20px;"> <p>└─ Assembly Material</p> <p>└─ Handling Code</p> <p>└─ Temperature Range</p> <p>└─ Package Code</p> </div>	<p>Package Code G : TO-263-3</p> <p>Operating Junction Temperature Range C : -55 to 175 °C</p> <p>Handling Code TR : Tape & Reel</p> <p>Assembly Material G : Halogen and Lead Free Device</p>
<p>APM1104P G :</p> <div style="display: inline-block; border: 1px solid black; padding: 2px; margin-left: 10px;">  APM1104P XXXXX </div>	<p>XXXXX - Date Code</p>

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020C for MSL classification at lead-free peak reflow temperature. ANPEC defines “Green” to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

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

Symbol	Parameter	Rating	Unit	
Common Ratings ($T_A=25^\circ\text{C}$ Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage	-100	V	
V_{GSS}	Gate-Source Voltage	± 25		
T_J	Maximum Junction Temperature	175	$^\circ\text{C}$	
T_{STG}	Storage Temperature Range	-55 to 175		
I_S	Diode Continuous Forward Current	-20	A	
I_{DP}	300 μs Pulse Drain Current Tested	$T_C=25^\circ\text{C}$		-160
		$T_C=100^\circ\text{C}$		-110
I_D	Continuous Drain Current	$T_C=25^\circ\text{C}$		-90
		$T_C=100^\circ\text{C}$		-64
P_D	Maximum Power Dissipation	$T_C=25^\circ\text{C}$	300	
		$T_C=100^\circ\text{C}$	150	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	0.5	$^\circ\text{C/W}$	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	45		
E_{AS}	Avalanche Energy, Single Pulsed	L=0.5mH	300	mJ

Electrical Characteristics ($T_A = 25^\circ\text{C}$ Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	APM1104PG			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=-250\mu\text{A}$	-100	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-80V, V_{GS}=0V$ $T_J=85^\circ\text{C}$	-	-	-1	μA
			-	-	-30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=-250\mu\text{A}$	-1	-2	-3	V
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 25V, V_{DS}=0V$	-	-	± 100	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=-10V, I_{DS}=-20A$	-	15	18	m Ω
		$V_{GS}=-4.5V, I_{DS}=-15A$	-	18	22.5	
Diode Characteristics						
V_{SD}^a	Diode Forward Voltage	$I_{SD}=-20A, V_{GS}=0V$	-	-0.8	-1.1	V
t_{rr}	Reverse Recovery Time	$I_{DS}=-20A, di_{SD}/dt=100A/\mu\text{s}$	-	48	-	ns
Q _{rr}	Reverse Recovery Charge		-	82	-	nC

Electrical Characteristics (Cont.) (T_A = 25°C Unless Otherwise Noted)

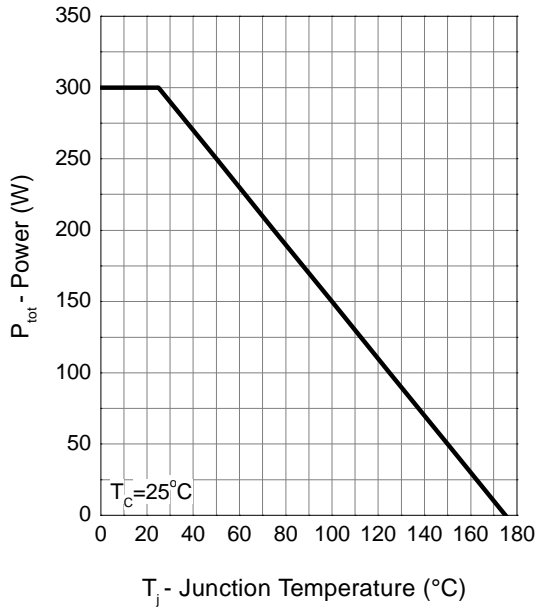
Symbol	Parameter	Test Conditions	APM1104PG			Unit
			Min.	Typ.	Max.	
Dynamic Characteristics ^b						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	1.8	-	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-30V, Frequency=1.0MHz	-	6600	-	pF
C _{oss}	Output Capacitance		-	670	-	
C _{rss}	Reverse Transfer Capacitance		-	380	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-30V, R _L =30Ω, I _{DS} =-1A, V _{GEN} =-10V, R _G =6Ω	-	23	42	ns
t _r	Turn-on Rise Time		-	15	28	
t _{d(OFF)}	Turn-off Delay Time		-	165	298	
t _f	Turn-off Fall Time		-	55	100	
Gate Charge Characteristics ^b						
Q _g	Total Gate Charge	V _{DS} =-50V, V _{GS} =-10V, I _{DS} =-20A	-	156	218	nC
Q _{gs}	Gate-Source Charge		-	28	-	
Q _{gd}	Gate-Drain Charge		-	34	-	

Note a : Pulse test ; pulse width ≤ 300μs, duty cycle ≤ 2%.

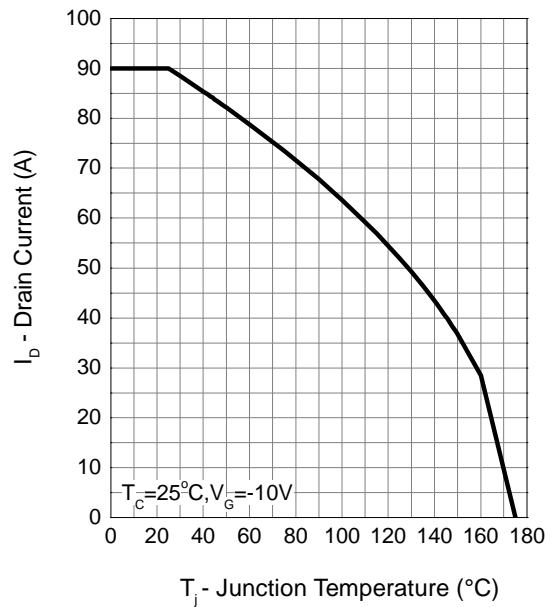
Note b : Guaranteed by design, not subject to production testing.

Typical Operating Characteristics

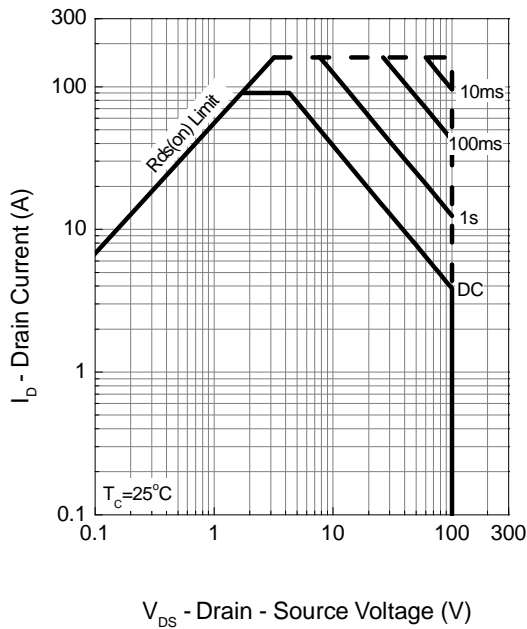
Power Dissipation



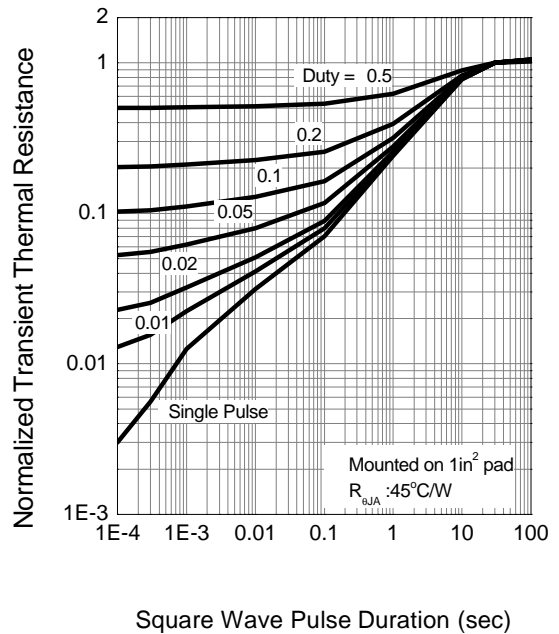
Drain Current



Safe Operation Area

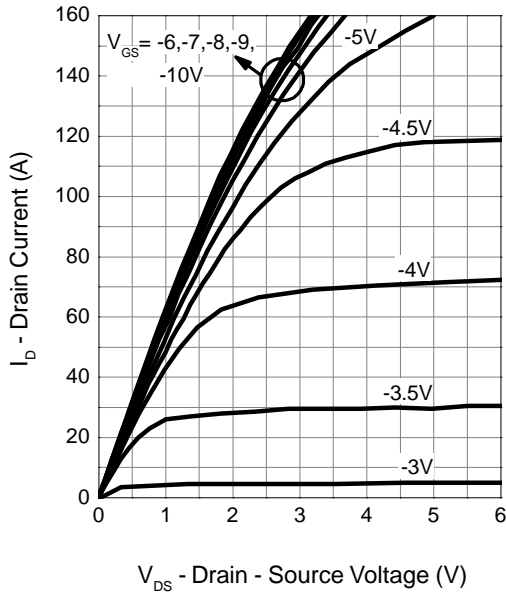


Thermal Transient Impedance

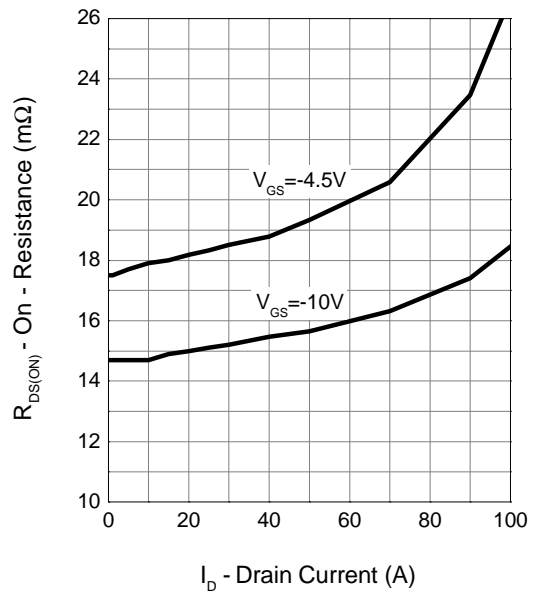


Typical Operating Characteristics (Cont.)

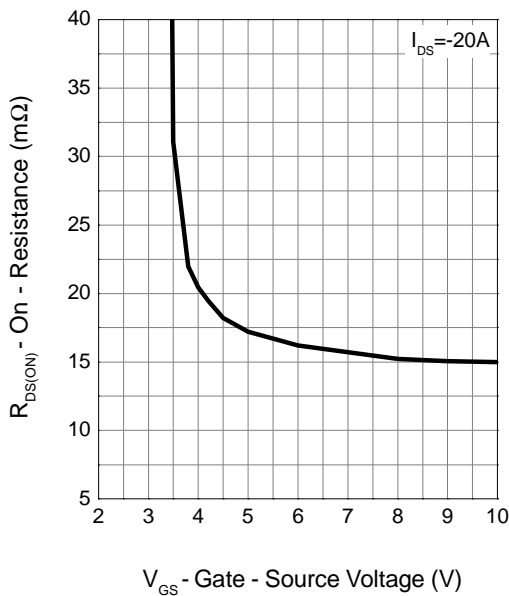
Output Characteristics



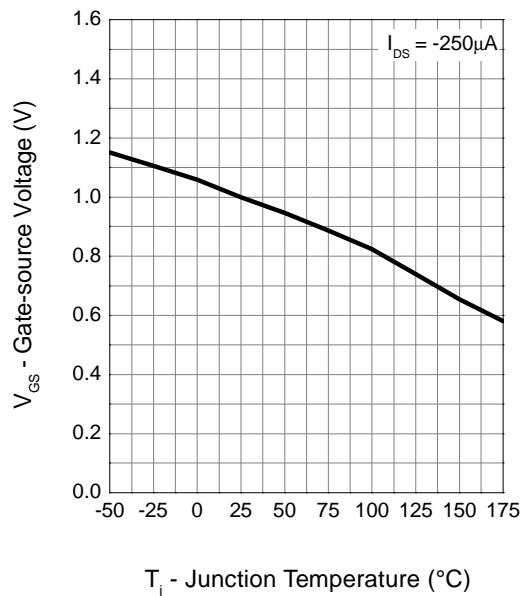
Drain-Source On Resistance



Gate-Source On Resistance

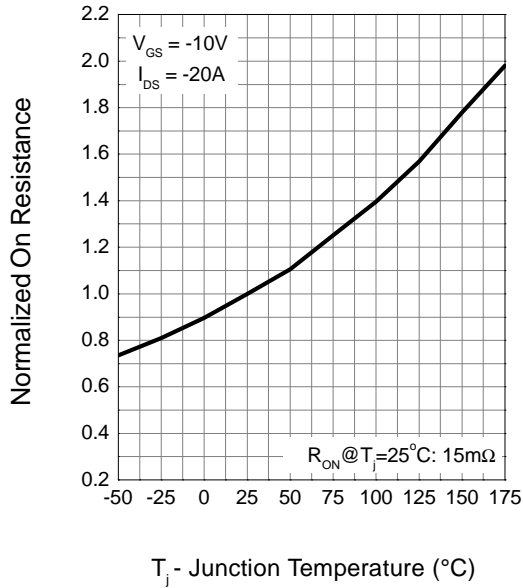


Gate Threshold Voltage

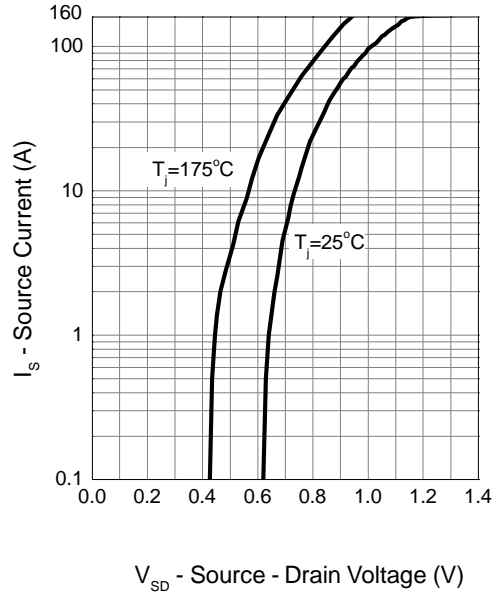


Typical Operating Characteristics (Cont.)

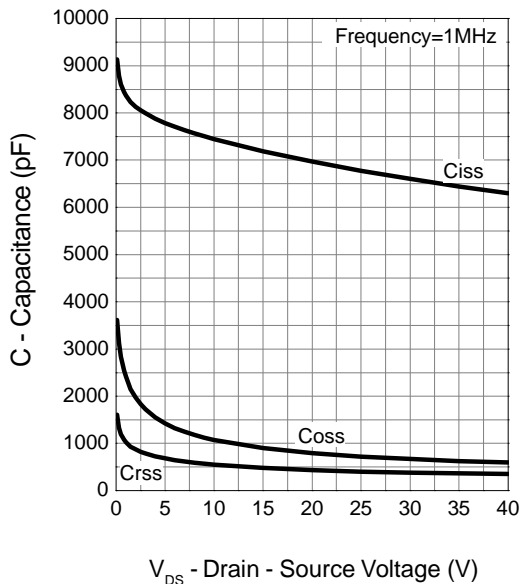
Drain-Source On Resistance



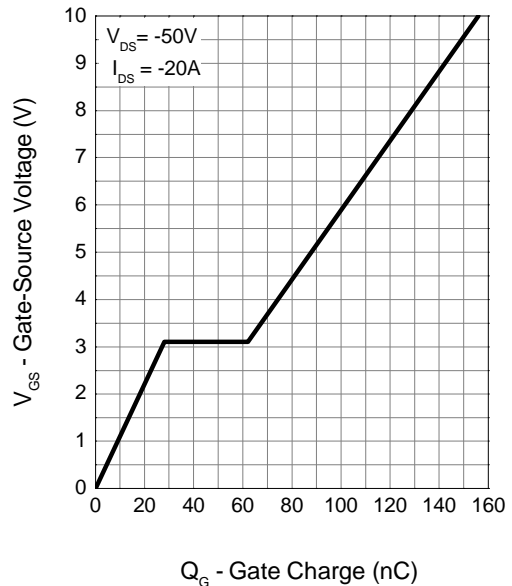
Source-Drain Diode Forward



Capacitance

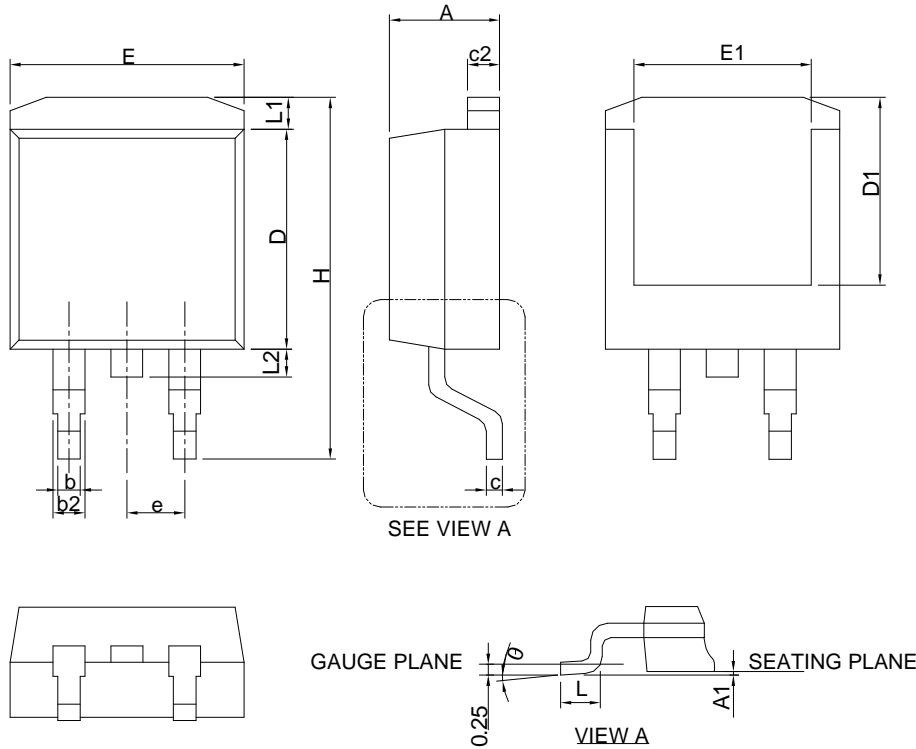


Gate Charge



Package Information

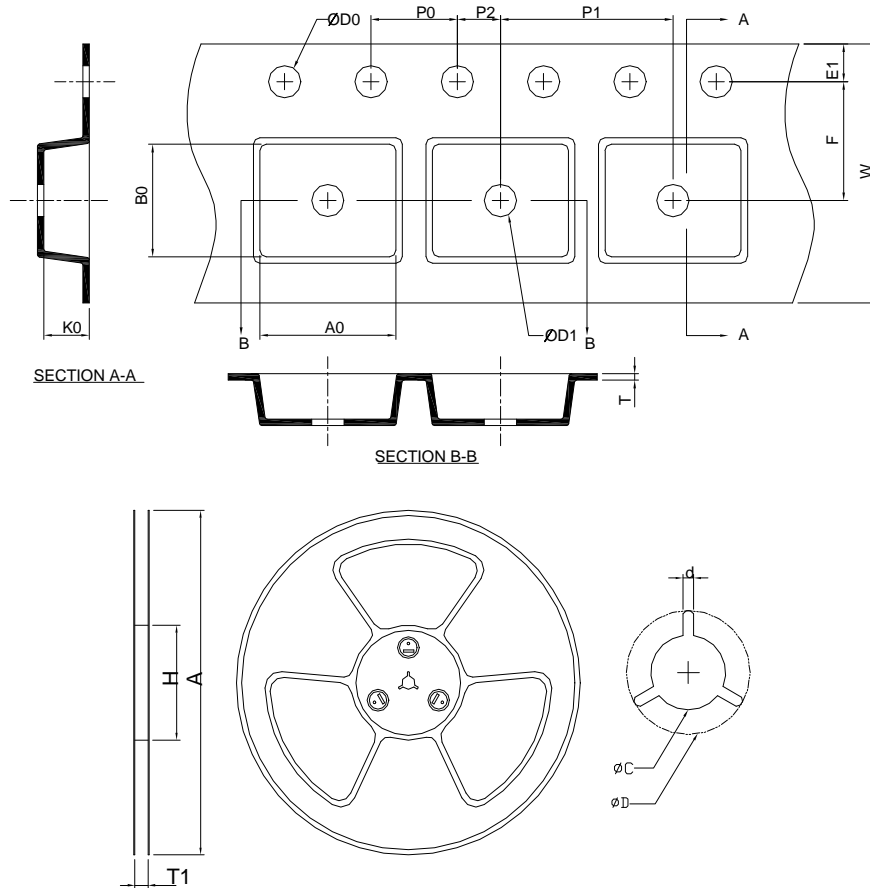
TO-263-3



SYMBOL	TO-263-3			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b2	1.14	1.78	0.045	0.070
c	0.38	0.74	0.015	0.029
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380
D1	6.00	9.00	0.236	0.354
E	9.65	11.43	0.380	0.450
E1	6.22	9.00	0.245	0.354
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1		1.68		0.066
L2		1.78		0.070
θ	0°	8°	0°	8°

Note : Follow JEDEC TO-263 AB.

Carrier Tape & Reel Dimensions



Application	A	H	T1	C	d	D	W	E1	F
TO-263-3	330.0 ±2.00	50 MIN.	24.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	24.0 ±0.30	1.75 ±0.10	11.5 ±0.10
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	16.0 ±0.10	2.0 ±0.10	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	10.8 ±0.20	16.1 ±0.20	5.2 ±0.20

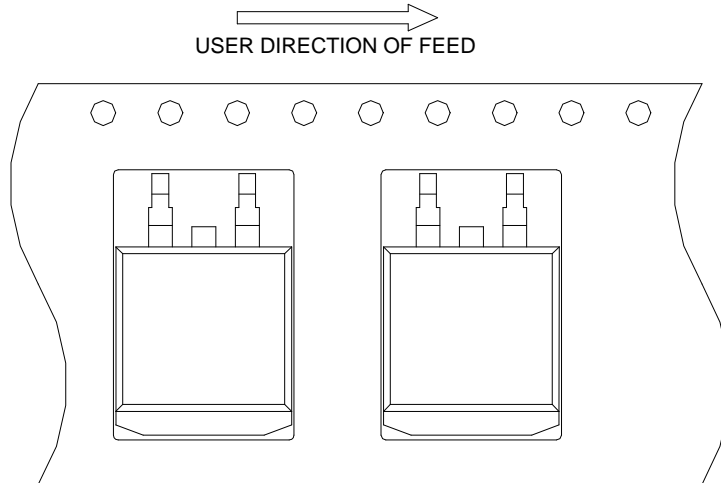
(mm)

Devices Per Unit

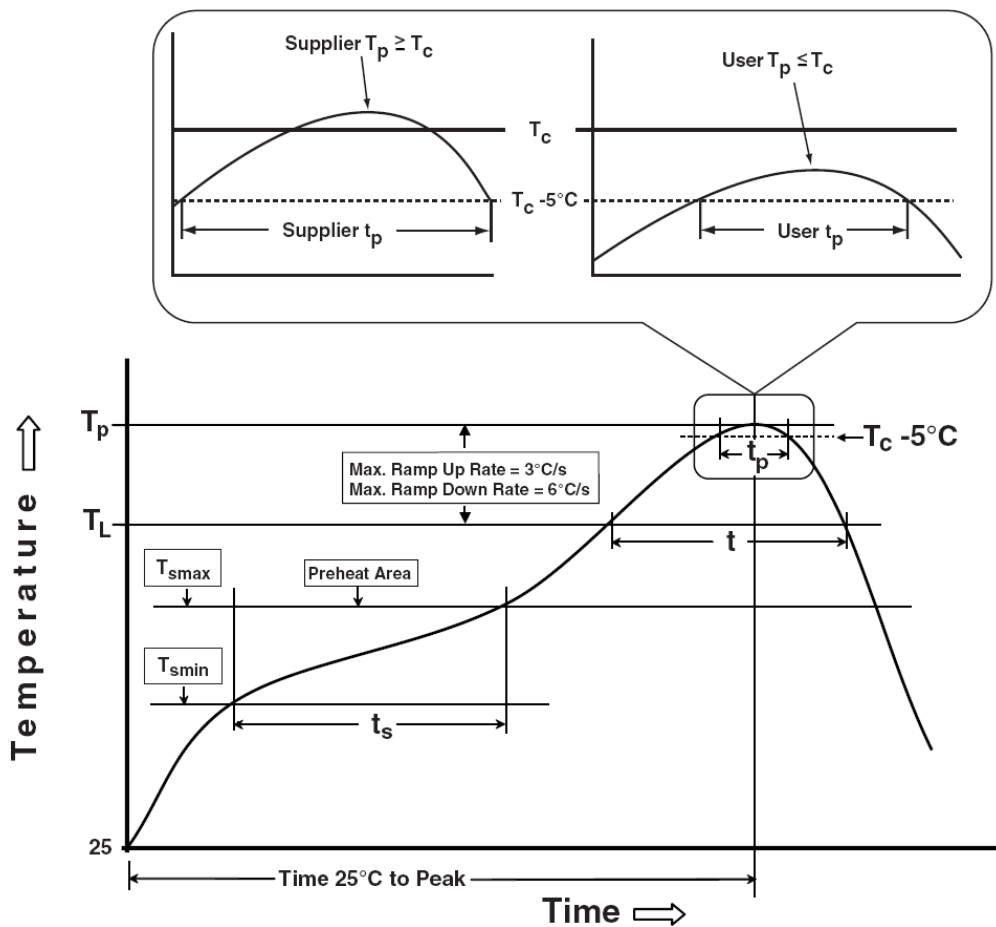
Package Type	Unit	Quantity
TO- 263-3	Tape & Reel	800

Taping Direction Information

TO-263-3



Classification Profile



Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T_{smin})	100 °C	150 °C
Temperature max (T_{smax})	150 °C	200 °C
Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T_{smax} to T_p)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L)	183 °C	217 °C
Time at liquidous (t_L)	60-150 seconds	60-150 seconds
Peak package body Temperature (T_p)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (t_p)** within 5°C of the specified classification temperature (T_c)	20** seconds	30** seconds
Average ramp-down rate (T_p to T_{smax})	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature (T_p) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.		

Table 1. SnPb Eutectic Process – Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245°C
HOLT	JESD-22, A108	1000 Hrs, Bias @ 125°C
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C

Customer Service

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