APM2804QA

P-Channel Enhancement Mode MOSFET with Schottky Diode

Features

MOSFET

- -20V/-2.6A,
  $R_{DS(ON)}$= 85mΩ(typ.) @ V_{GS}= -4.5V
  $R_{DS(ON)}$= 120mΩ(typ.) @ V_{GS}= -2.5V
- Super High Dense Cell Design
- Reliable and Rugged

SBD

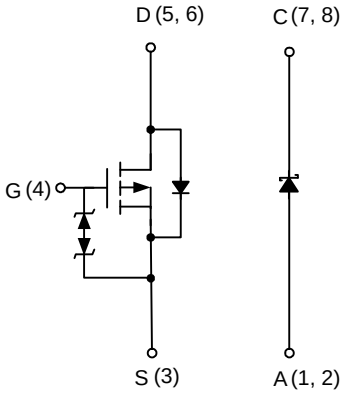
- VF=0.385V (typ.) @ If=500mA.
- Lead Free and Green Devices Available (RoHS Compliant)

Applications

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

Pin Description

Top View of DFN3x2-8



P-Channel SBD

Ordering and Marking Information

APM2804 □□□-□□ □ Assembly Material Handling Code Temperature Range Package Code	Package Code QA : DFN3x2-8 Operating Junction Temperature Range C : -55 to 150 °C Handling Code TR : Tape & Reel Assembly Material G : Halogen and Lead Free Device
APM2804 QA : M2804 XXXXX	XXXXX - Date Code

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-020D 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).

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Symbol	Parameter		Rating	Unit
[MOSFET]				
V_{DSS}	Drain-Source Voltage		-20	V
V_{GSS}	Gate-Source Voltage		±10	
I_D*	Continuous Drain Current	V_{GS}=-4.5V	-2.6	A
I_{DM}*	300µs Pulsed Drain Current		-9	
I_S*	Diode Continuous Forward Current		-1.4	A
T_J	Maximum Junction Temperature		150	°C
T_{STG}	Storage Temperature Range		-55 to 150	
P_D*	Maximum Power Dissipation	T_A=25°C	1.13	W
		T_A=100°C	0.45	
$R_{\theta JA}$*	Thermal Resistance-Junction to Ambient		110	°C/W
[SBD]				
V_{RRM}	Repetitive Peak Reverse Voltage		20	V
V_R	DC Blocking Voltage		20	V
I_F	Average Rectified Forward Current	Steady State	1	A
		t ≦5 s	2	A
$R_{\theta JA}$*	Thermal Resistance-Junction to Ambient	Steady State	130	°C/W
		t ≦5 s	100	°C/W

Note : *Surface Mounted on 1in² pad area, t ≤ 5sec.

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	APM2804QA			Unit
			Min.	Typ.	Max.	
[MOSFET]						
Static Characteristics						
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
		T_J=85°C	-	-	-30	
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=-250µA	-0.45	-0.7	-1	V
I_{GSS}	Gate Leakage Current	V_{GS}=±10V, V_{DS}=0V	-	-	±10	µA
$R_{DS(ON)}$ [a]	Drain-Source On-state Resistance	V_{GS}=-4.5V, I_{DS}=-2.6A	-	85	110	mΩ
		V_{GS}=-2.5V, I_{DS}=-2A	-	120	160	

Electrical Characteristics (Cont.) (T_A = 25°C unless otherwise noted)

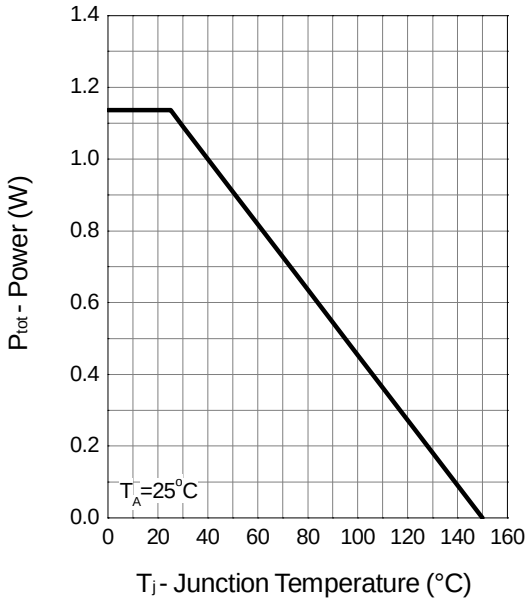
Symbol	Parameter	Test Conditions	APM2804QA			Unit
			Min.	Typ.	Max.	
[MOSFET]						
Diode Characteristics						
V_{SD} [a]	Diode Forward Voltage	I_{SD}=-1.4A, V_{GS}=0V	-	-0.7	-1.3	V
t_{rr}	Reverse Recovery Time	I_{DS}=-2.6A, dI_{SD}/dt=100A/µs	-	13.5	-	ns
Q_{rr}	Reverse Recovery Charge		-	4	-	nC
Dynamic Characteristics [b]						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-10V, Frequency=1.0MHz	-	390	-	pF
C_{oss}	Output Capacitance		-	70	-	
C_{rss}	Reverse Transfer Capacitance		-	50	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=-10V, R_L=10Ω, I_{DS}=-1A, V_{GEN}=-4.5V, R_G=6Ω	-	6	13	ns
T_r	Turn-on Rise Time		-	14	29	
$t_{d(OFF)}$	Turn-off Delay Time		-	28	55	
T_f	Turn-off Fall Time		-	20	39	
Gate Charge Characteristics [b]						
Q_g	Total Gate Charge	V_{DS}=-10V, V_{GS}=-4.5V, I_{DS}=-2.6A	-	4.2	6	nC
Q_{gs}	Gate-Source Charge		-	0.6	-	
Q_{gd}	Gate-Drain Charge		-	1.3	-	
[SBD]						
V_R	Reverse Voltage	I_R=0.5A	20	-	-	V
V_{F1}	Forward Voltage	I_F=500mA	-	0.385	0.455	V
V_{F2}		I_F=500mA, T_A=125°C	-	0.35	0.42	V
V_{F3}		I_F=1000mA	-	0.455	0.55	V
I_{R1}	Reverse Current	V_R=10V	-	2	10	µA
I_{R2}	Reverse Current	V_R=20V	-	10	40	µA
C [b]	Junction Capacitance	V_R=10V, Frequency=1.0MHz	-	40	-	pF

Note a : Pulse test ; pulse width ≤300µs, duty cycle ≤ 2%.
Note b : Guaranteed by design, not subject to production testing.

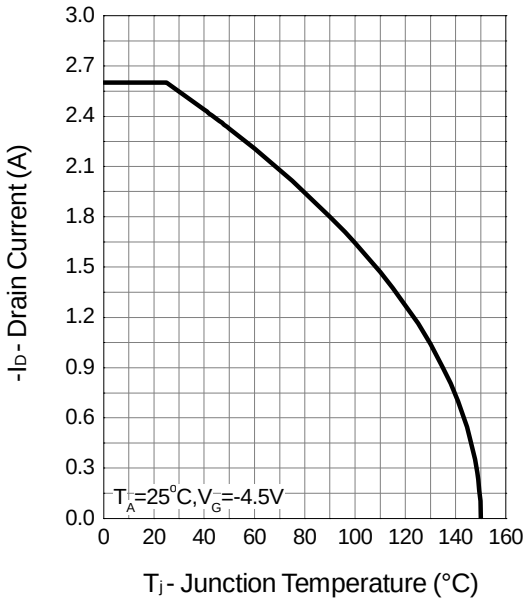
Typical Operating Characteristics

P-Channel

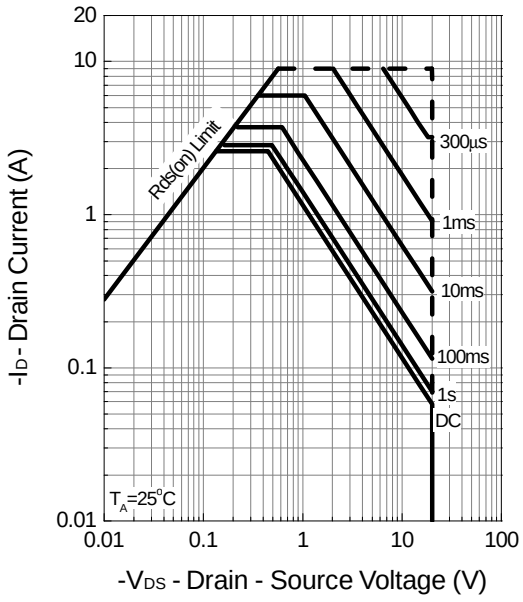
Power Dissipation



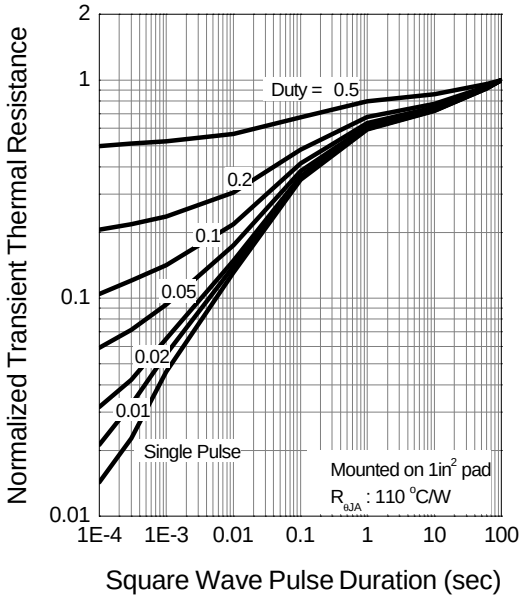
Drain Current



Safe Operation Area



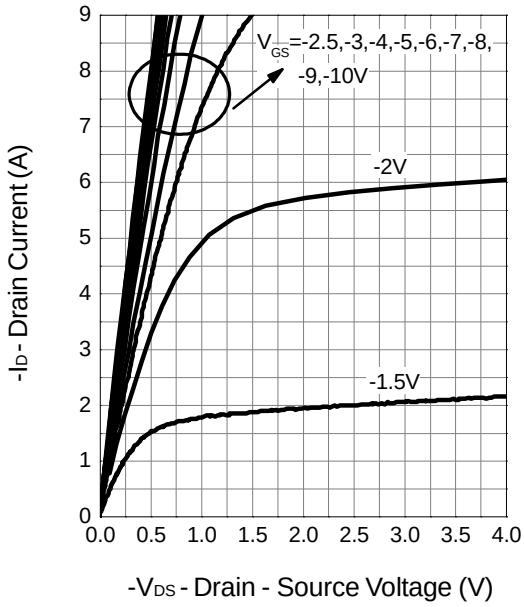
Thermal Transient Impedance



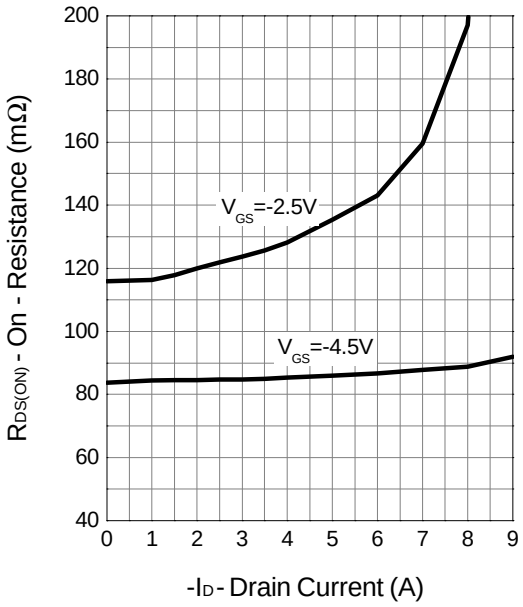
Typical Operating Characteristics (Cont.)

P-Channel

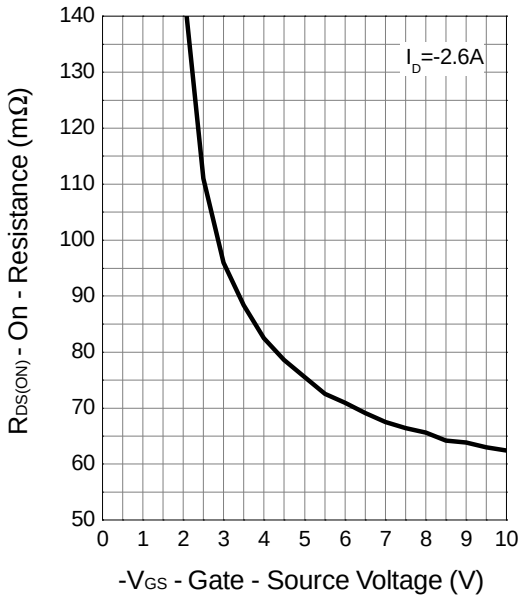
Output Characteristics



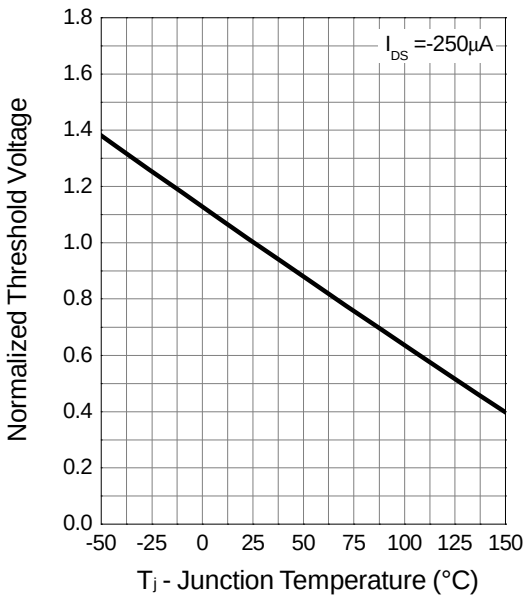
Drain-Source On Resistance



Drain-Source On Resistance



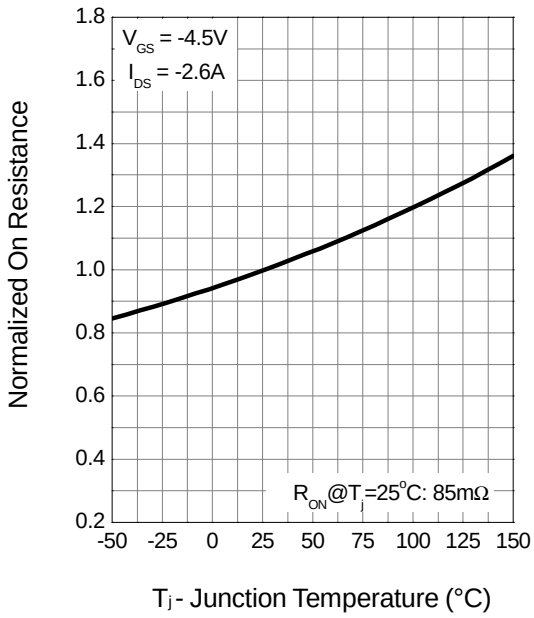
Gate Threshold Voltage



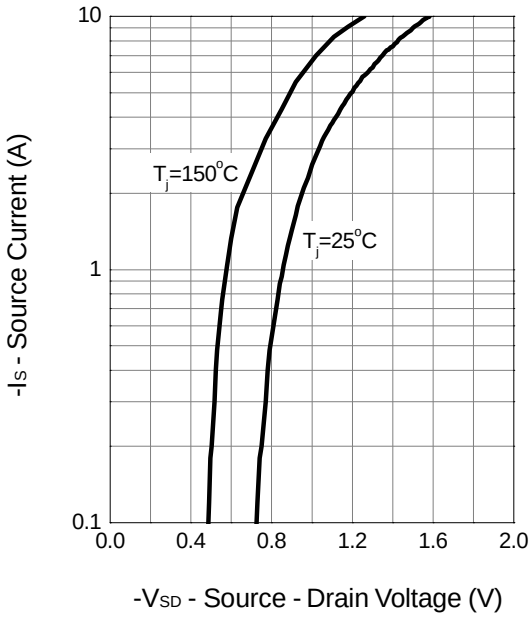
Typical Operating Characteristics (Cont.)

P-Channel

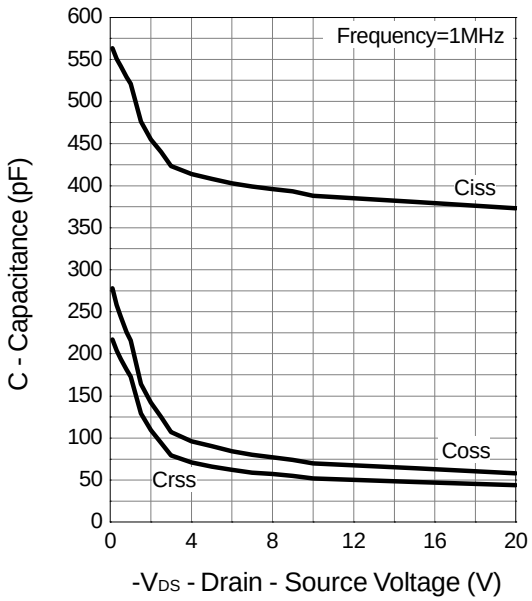
Drain-Source On Resistance



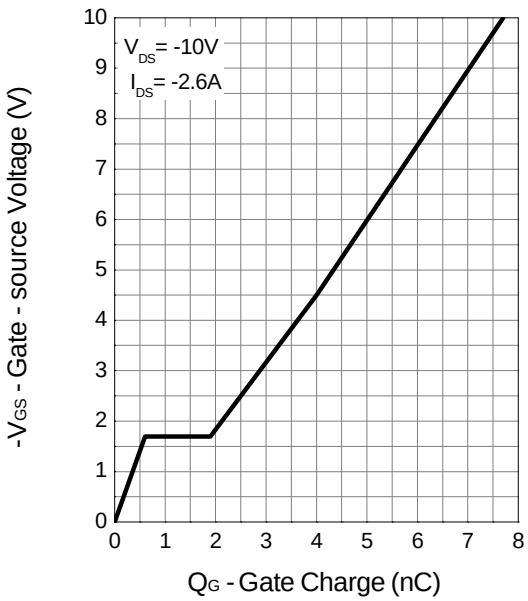
Source-Drain Diode Forward



Capacitance



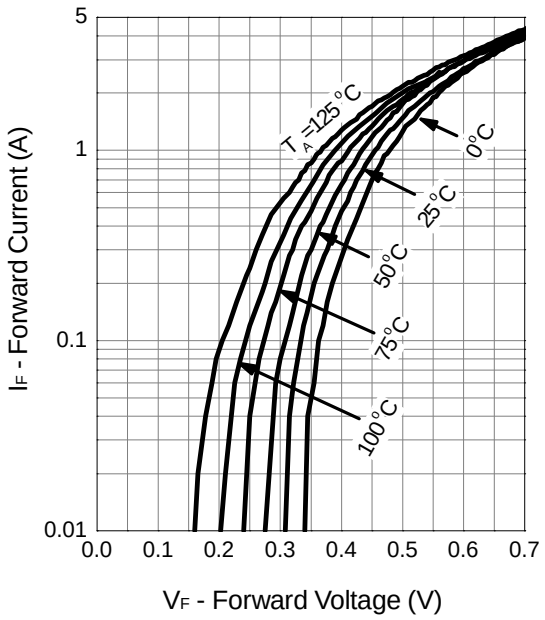
Gate Charge



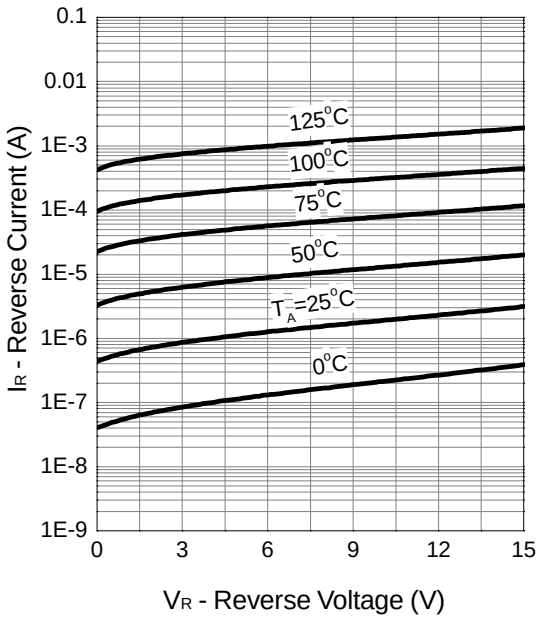
Typical Operating Characteristics (Cont.)

SBD

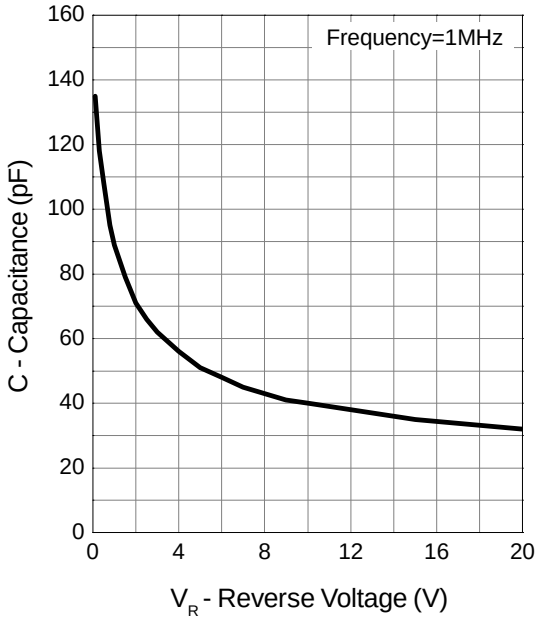
I_F - V_F



I_R - V_R

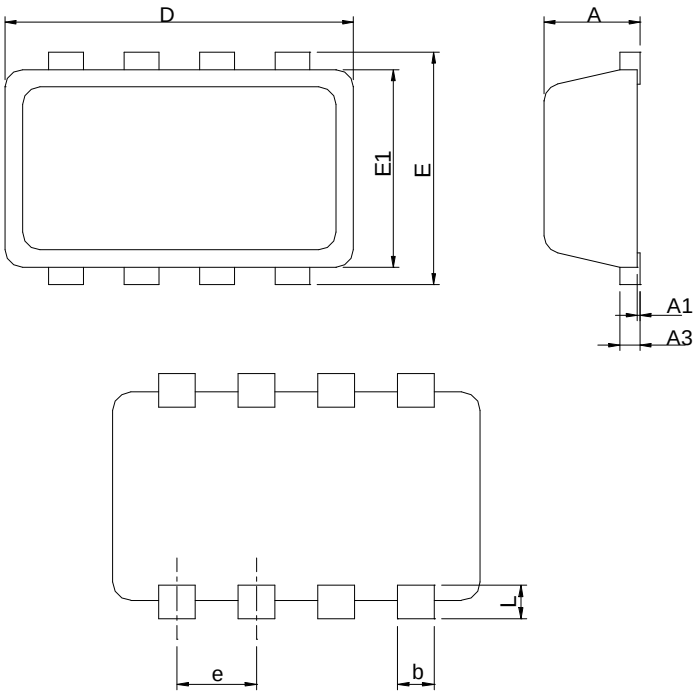


C - V_R



Package Information

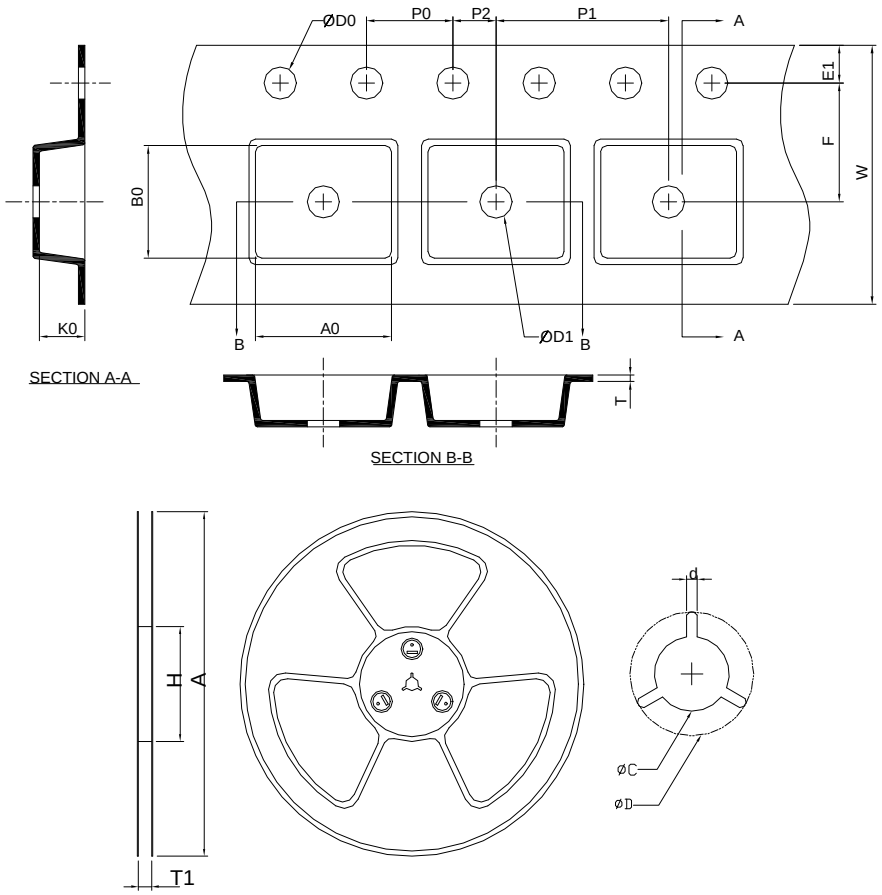
DFN3x2-8



SYMBOL	DFN3x2-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	0.80	1.00	0.031	0.039
A1	0.00	0.05	0.000	0.002
A3	0.08	0.25	0.003	0.010
b	0.24	0.35	0.009	0.014
D	2.90	3.10	0.114	0.122
E	1.90	2.10	0.075	0.083
E1	1.60	1.80	0.063	0.071
e	0.65 BSC		0.026 BSC	
L	0.20	0.40	0.008	0.016

Note : 1. Follow JEDEC MO-229 VECC.

Carrier Tape & Reel Dimensions



Application	A	H	T1	C	d	D	W	E1	F
DFN3x2-8	178.0±2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.05
	P0	**P1**	**P2**	**D0**	**D1**	**T**	**A0**	**B0**	**K0**
	4.0±0.10	8.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	3.30±0.20	3.30±0.20	1.30±0.20

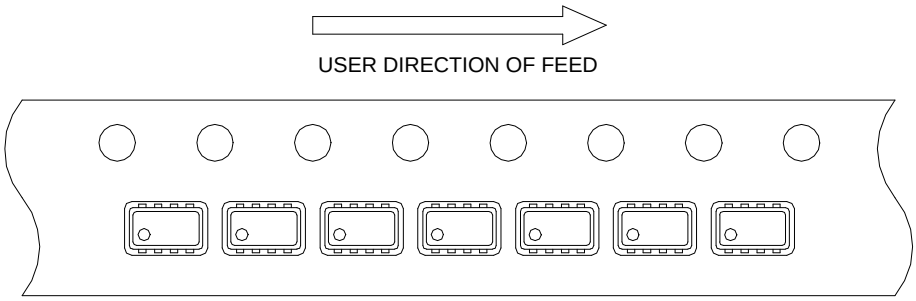
(mm)

Devices Per Unit

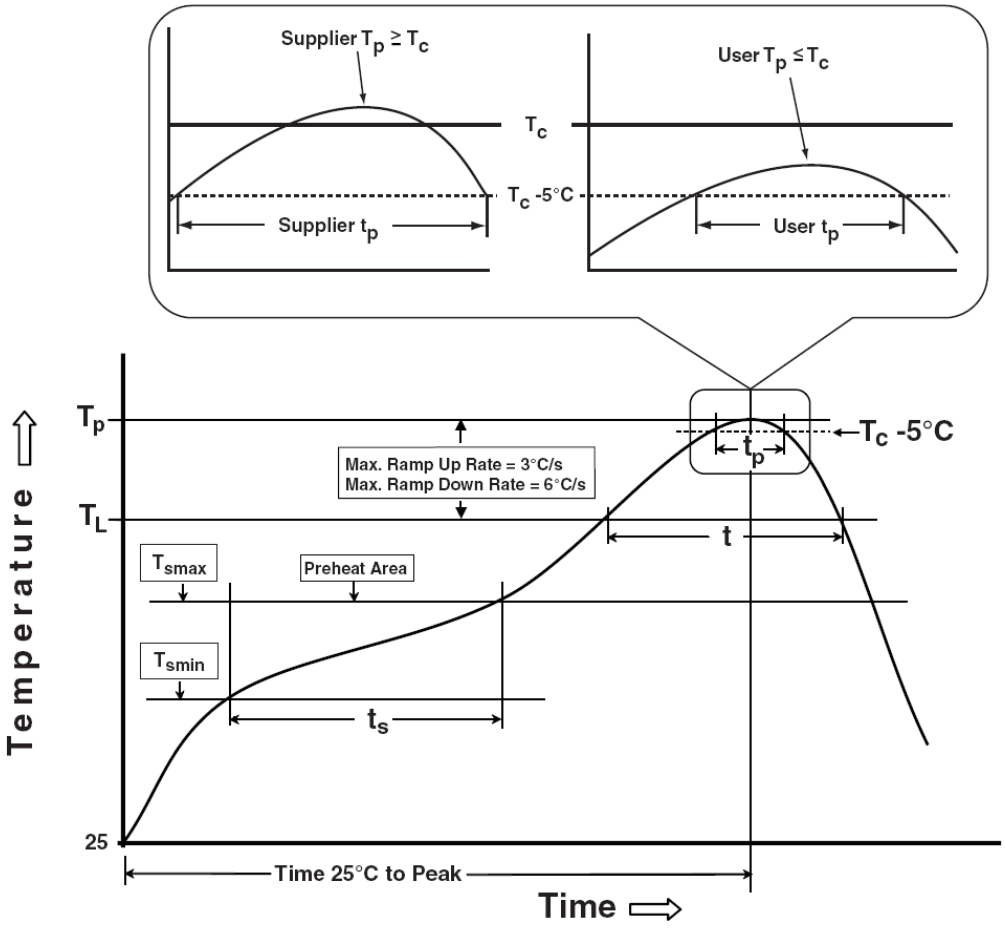
Package Type	Unit	Quantity
DFN3x2-8	Tape & Reel	3000

Taping Direction Information

DFN3x2-8



Classification Profile



Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (T_{smin}) Temperature max (T_{smax}) Time (T_{smin} to T_{smax}) (t_s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate (T_{smax} to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L) Time at liquidous (t_L)	183 °C 60-150 seconds	217 °C 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 (Tc)

Package Thickness	Volume mm^3 <350	Volume mm^3 ³350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

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

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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