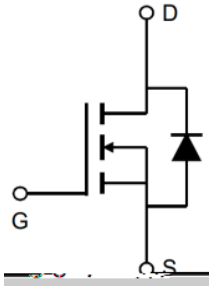
Single P-Channel Enhancement Mode MOSFET

Feature

- **z** -40V/-85A
  $R_{DS(ON)}$= 7.5m (typ.) @ V_{GS} = -10V
  $R_{DS(ON)}$=10.4m (typ.) @ V_{GS} = -4.5
- z 100% Avalanche Tested
- z 100% DVDS
- z Reliable and Rugged
- z Halogen- Free Devices Available
- z (RoHS Compliant)

Pin Description



Applications

- **z** High Frequency Point-of-Load Synchronous Buck Converter
- z Power Tool Application
- z Networking DC-DC Power System

Ordering and Marking Information

C2 HYG090P04 XYMXXXXXX	Package Code C2: PDFN8L(5 × 6) Date Code XYMXXXXXX

Note: HUAYI lead-free products contain molding

Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
Common Ratings (Tc=25°C Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage		-40	V
V_{GSS}	Gate-Source Voltage		+20 / -20	V
T_J	Maximum Junction Temperature		-55 to175	℃
T_{STG}	Storage Temperature Range		-55 to175	℃
I_S	Source Current-Continuous(Body Diode)	Tc=25°C	-85	A
Mounted on Large Heat Sink				
I_{DM}	Pulsed Drain Current *	Tc=25°C	-320	A
I_D	Continuous Drain Current	Tc=25°C	-85	A
		Tc=100°C	-60	A
P_D	Maximum Power Dissipation	Tc=25°C	115	W
		Tc=100°C	57.7	W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case		1.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient **		53	°C/W
E_{AS}	SinglePulsed-Avalanche Energy ***	L=0.3mH	215	mJ

Note: * Repetitive rating pulse width limited by max.junction temperature.
** Surface mounted on FR-4 board.
*** Limited by $T_J$max , starting T_J=25°C, L = 0.3mH, V_{DS} =-32V., V_{GS} =-10V.

Electrical Characteristics(Tc =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG090P04LQ1			Unit
			Min	Typ.	Max	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V,I_{DS}=250 A	-40	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	V_{DS}=-40V,V_{GS}=0V	-	-	-1	A
		T_J=100°C	-	-	-50	A
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250 A	-1.0	-1.6	-3.0	V
I_{GSS}	Gate-Source Leakage Current	V_{GS}= ± 20V,V_{DS}=0V	-	-	± 100	nA
$R_{DS(ON)}$*	Drain-Source On-State Resistance	V_{GS}=-10V,I_{DS}=-20A	-	7.5	9	mΩ
		V_{GS}=-4.5V,I_{DS}=-20A	-	10.4	16	mΩ
Diode Characteristics						
V_{SD}*	Diode Forward Voltage	I_{SD}=-20A,V_{GS}=0V	-	-0.85	-1.3	V
t_{rr}	Reverse Recovery Time	I_{SD}=-20A,dI_{SD}/dt=100A/	-	16.2	-	

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

Symbol	Parameter	Test Conditions	HYG090P04LQ1			Unit
			Min	Typ.	Max	
Dynamic Characteristics						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	-	4.7	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-25V, Frequency=1MHz	-	3310	-	pF
C_{oss}	Output Capacitance		-	310	-	
C_{rss}	Reverse Transfer Capacitance		-	284	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=-20V,R_G=2.5 I_{DS}=-20A,V_{GS}=-10V	-	10	-	ns
T_r	Turn-on Rise Time		-	50	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	97	-	
T_f	Turn-off Fall Time		-	69	-	

Gate Ch2 65.92 1 18.482 re-e me 7(18.482 rea)-9(cteriETstTQ EMC P <<MCID 22Lang (en1-US)>BC 42 654.94

Typical Operating Characteristics

Figure 1: Power Dissipation

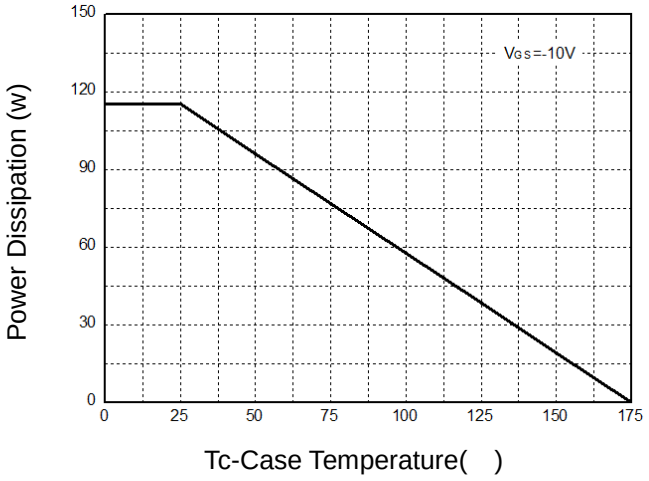


Figure 2: Drain Current

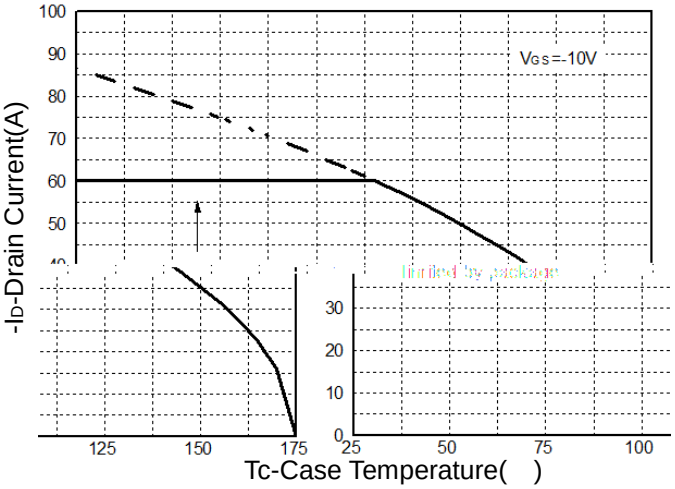


Figure 3: Safe Operation Area

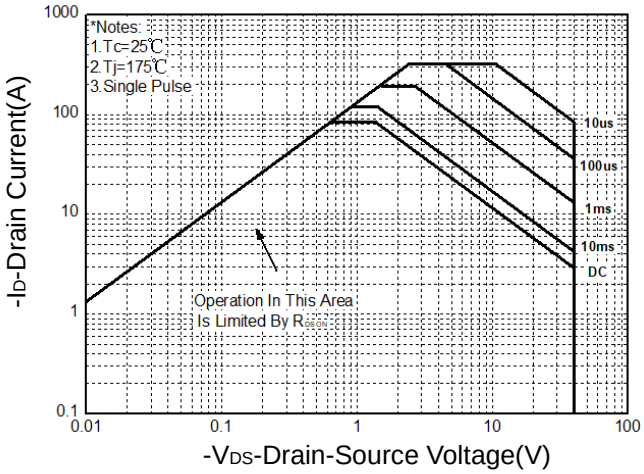


Figure 4: Thermal Transient Impedance

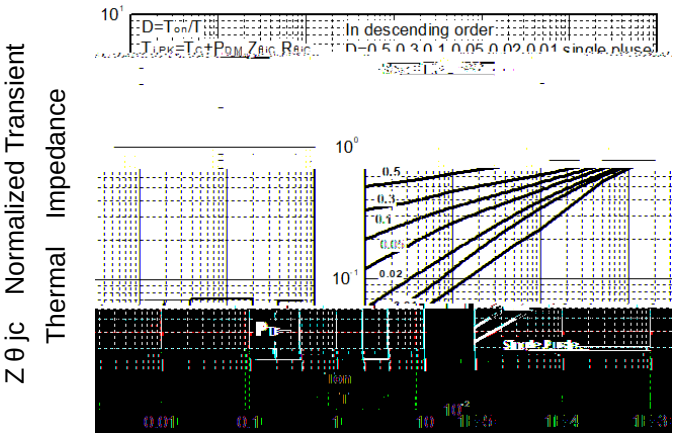


Figure 5: Output Characteristics

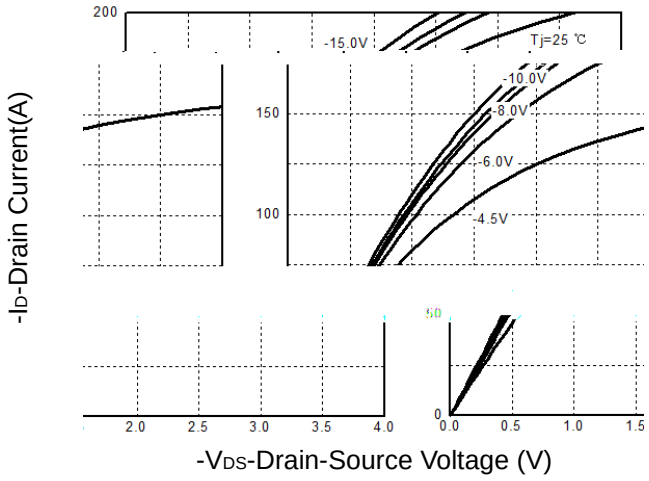
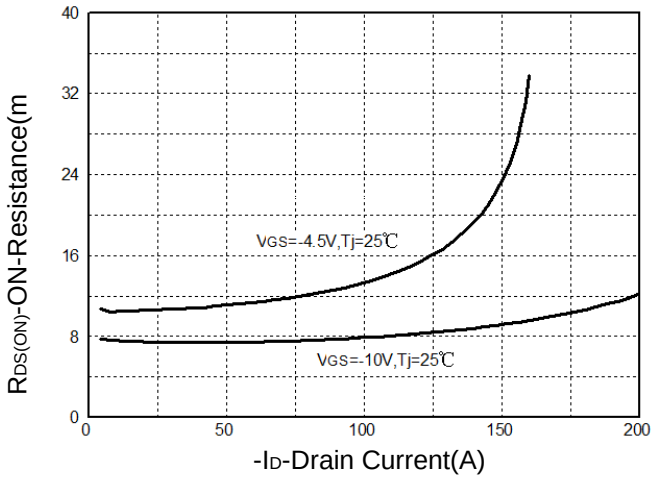


Figure 6: Drain-Source On Resistance



Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

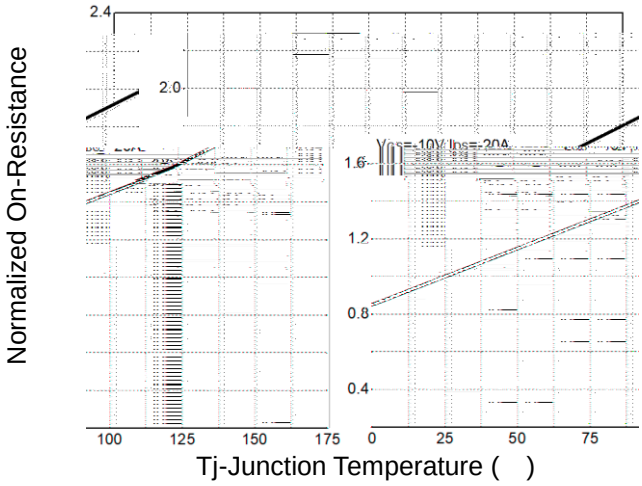


Figure 8: Source-Drain Diode Forward

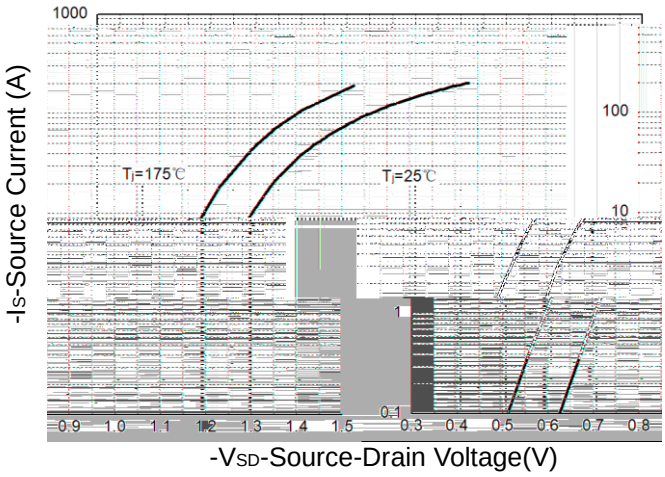
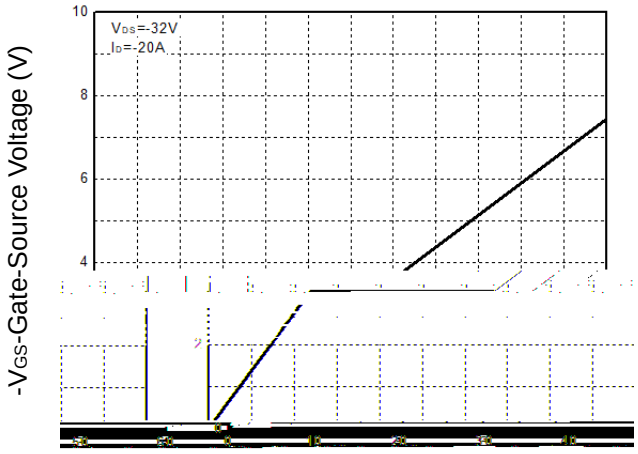


Figure 9: Capacitance Characteristics

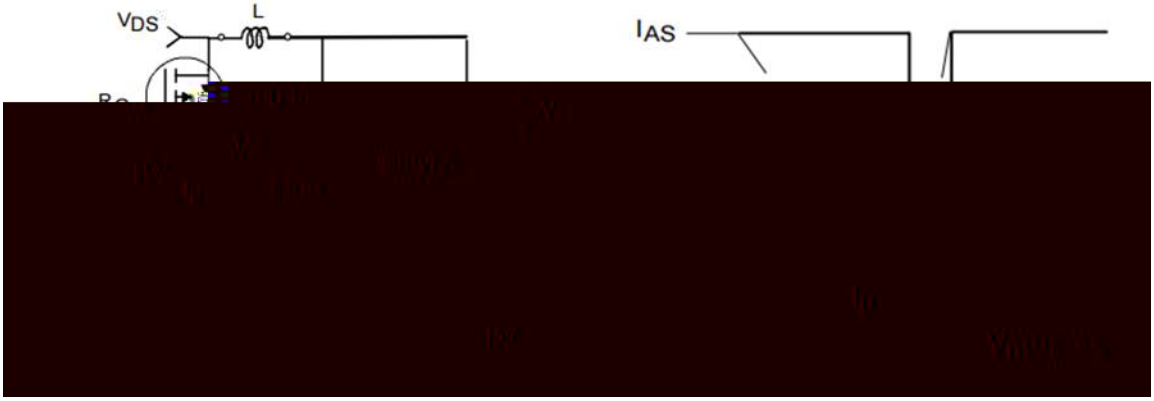
C-Capacitance(F)

-VDS-Drain-Source Voltage (V)

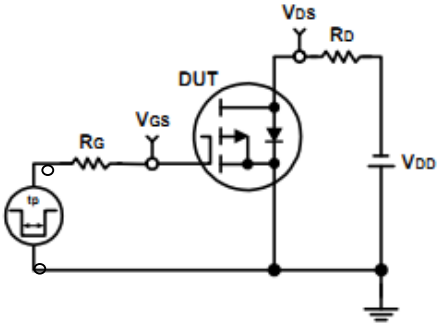
Figure 10: Gate Charge Characteristics

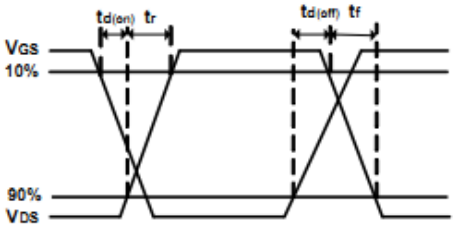


Avalanche Test Circuit and Waveforms

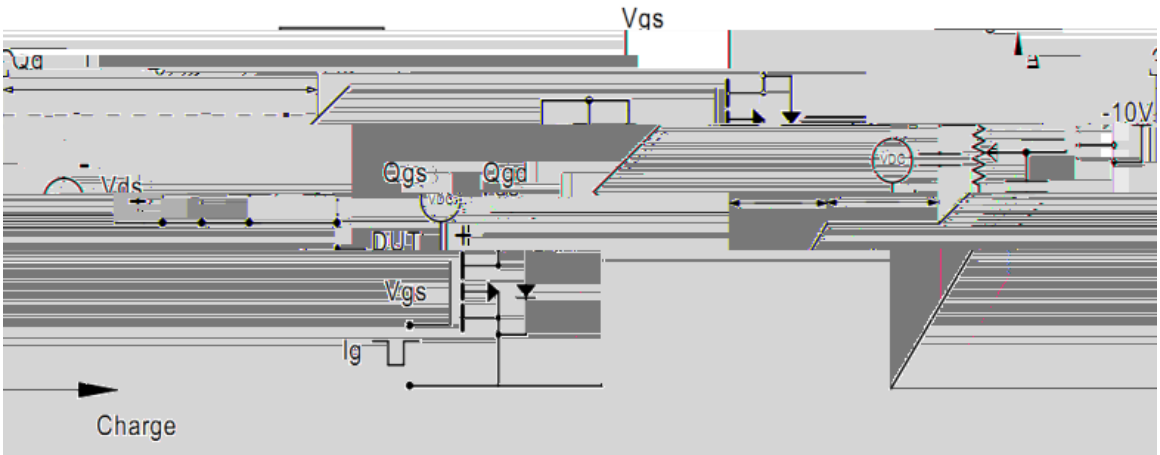


Switching Time Test Circuit and Waveforms





Gate Charge Test Circuit and Waveforms

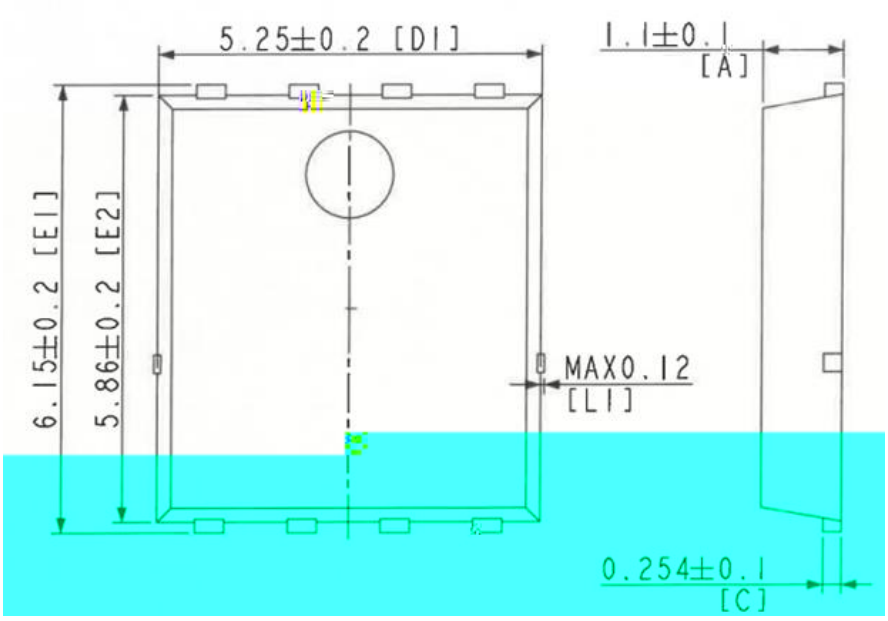


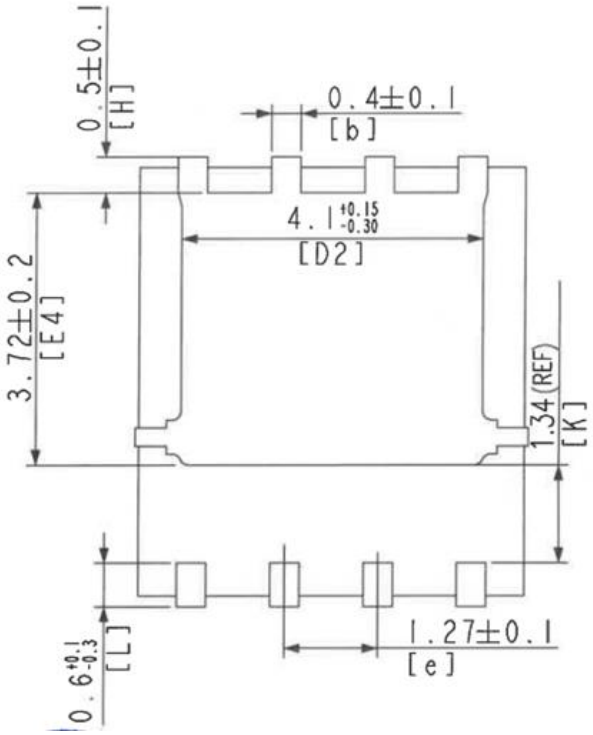
Device Per Unit

Package Type	Unit	Quantity
PDFN8L(5 × 6)	Reel	5000

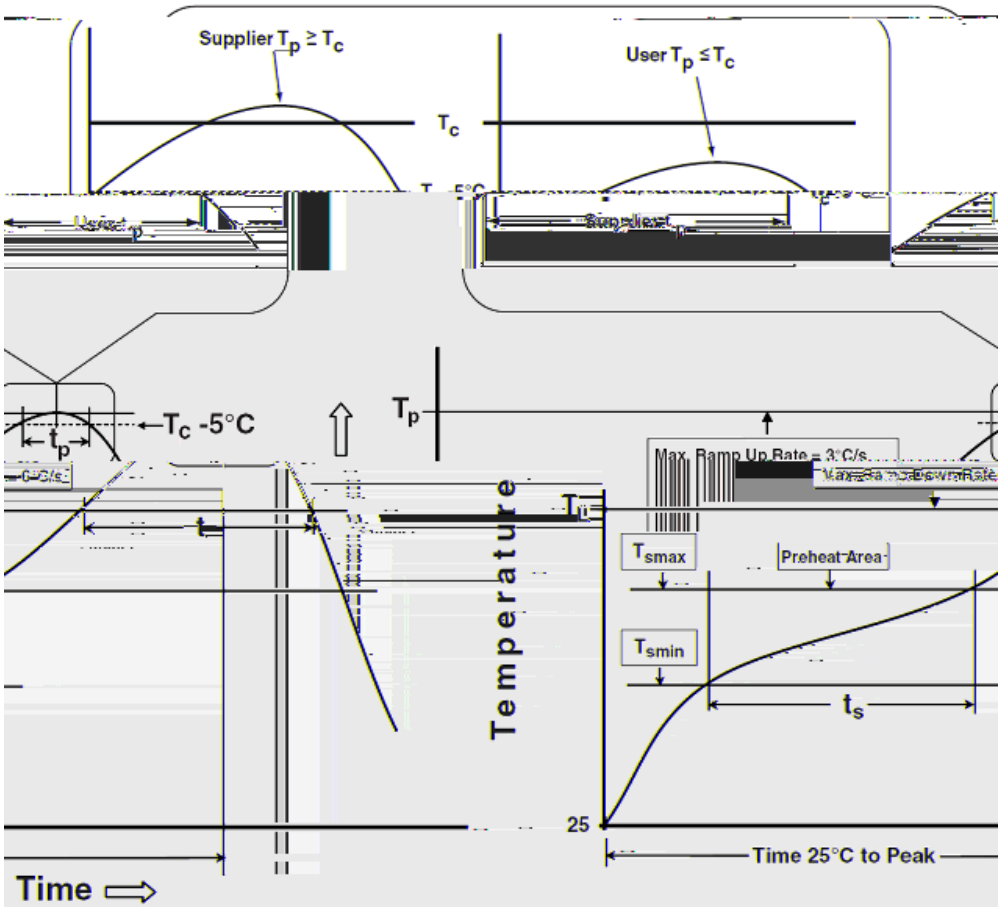
Package Information

PDFN8L(5 × 6)





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 (Tsmin to Tsmax) (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	SeeClassification Tempin 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 mm³ <350	Volume mm³ ≥ 350
2.5 mm	235 °C	220 °C
	220 °C	220 °C

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

Package Thickness	Volume mm³ <350	Volume mm³ 350-2000	Volume mm³ ≥ 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
PRECON	JESD-22, A113	30°C/60%/192Hrs
HTRB	JESD-22, A108	168Hrs//500Hrs/1000Hrs, Bias @ 150°C
HTGB	JESD-22, A108	168 Hrs/500Hrs/1000Hrs, V_{gs}100% @ 150°C
PCT	JESD-22, A102	96 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -55°C~150°C

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