

## Single P-Channel Enhancement Mode MOSFET

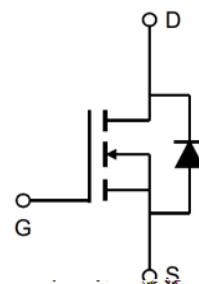
### Feature

### Pin Description

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

### Applications

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



### Ordering and Marking Information

C2 HYG090P04 XYMXXXXXX	Package Code C2: PDFN8L(5× 6)  Date Code XYMXXXXXX
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Note: HUAYI lead-free products contain molding

## Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
<b>Common Ratings</b> (Tc=25°C Unless Otherwise Noted)				
V <sub>DSS</sub>	Drain-Source Voltage		-40	V
V <sub>GSS</sub>	Gate-Source Voltage		+20 / -20	V
T <sub>J</sub>	Maximum Junction Temperature		-55 to 175	°C
T <sub>STG</sub>	Storage Temperature Range		-55 to 175	°C
I <sub>S</sub>	Source Current-Continuous(Body Diode)	Tc=25°C	-85	A
<b>Mounted on Large Heat Sink</b>				
I <sub>DM</sub>	Pulsed Drain Current *	Tc=25°C	-320	A
I <sub>D</sub>	Continuous Drain Current	Tc=25°C	-85	A
		Tc=100°C	-60	A
P <sub>D</sub>	Maximum Power Dissipation	Tc=25°C	115	W
		Tc=100°C	57.7	W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case		1.3	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient **		53	°C/W
E <sub>AS</sub>	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<sub>Jmax</sub>, starting T<sub>J</sub>=25°C, L = 0.3mH, V<sub>DS</sub> = -32V., V<sub>GS</sub> = -10V.

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

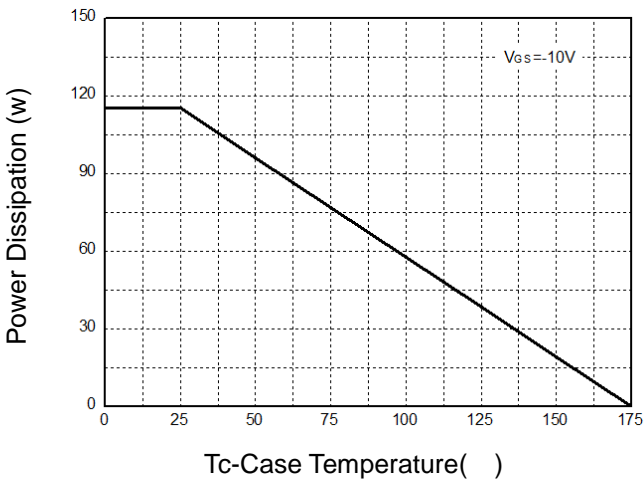
Symbol	Parameter	Test Conditions	HYG090P04LQ1			Unit
			Min	Typ.	Max	
<b>Static Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250 A	-40	-	-	V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V	-	-	-1	A
		T <sub>J</sub> =100°C	-	-	-50	A
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250 A	-1.0	-1.6	-3.0	V
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =± 20V, V <sub>DS</sub> =0V	-	-	± 100	nA
R <sub>DS(ON)*</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> =-10V, I <sub>DS</sub> =-20A	-	7.5	9	m
		V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-20A	-	10.4	16	m
<b>Diode Characteristics</b>						
V <sub>SD*</sub>	Diode Forward Voltage	I <sub>SD</sub> =-20A, V <sub>GS</sub> =0V	-	-0.85	-1.3	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>SD</sub> =-20A, dI <sub>SD</sub> /dt=100A/	-	16.2	-	

**Electrical Characteristics (Cont.)** (T<sub>c</sub> =25°C Unless Otherwise Noted)

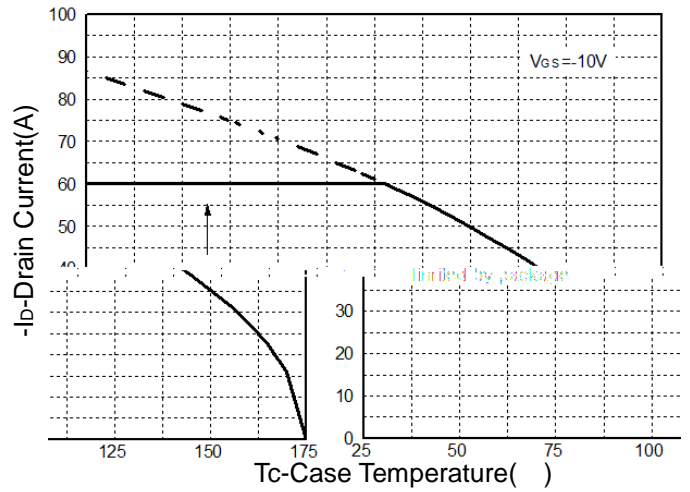
Symbol	Parameter	Test Conditions	HYG090P04LQ1			Unit
			Min	Typ.	Max	
<b>Dynamic Characteristics</b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz	-	4.7	-	
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-25V, Frequency=1MHz	-	3310	-	pF
C <sub>oss</sub>	Output Capacitance		-	310	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	284	-	
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =-20V, R <sub>G</sub> =2.5 I <sub>DS</sub> =-20A, V <sub>GS</sub> =-10V	-	10	-	ns
T <sub>r</sub>	Turn-on Rise Time		-	50	-	
t <sub>d(OFF)</sub>	Turn-off Delay Time		-	97	-	
T <sub>f</sub>	Turn-off Fall Time		-	69	-	

**Typical Operating Characteristics**

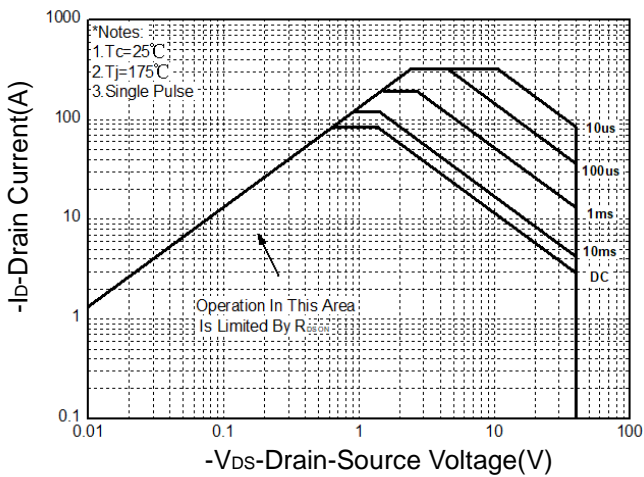
**Figure 1: Power Dissipation**



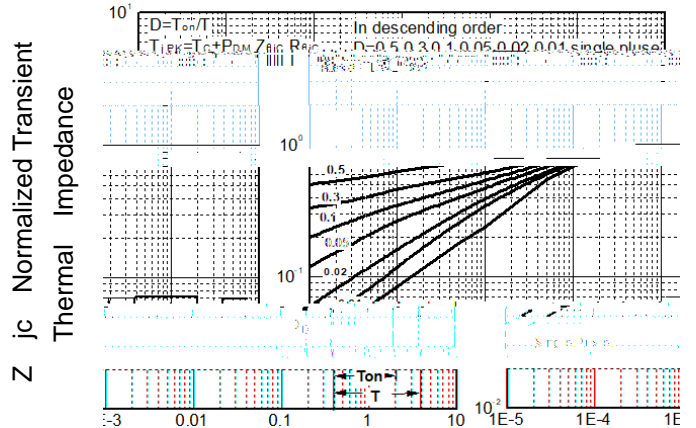
**Figure 2: Drain Current**



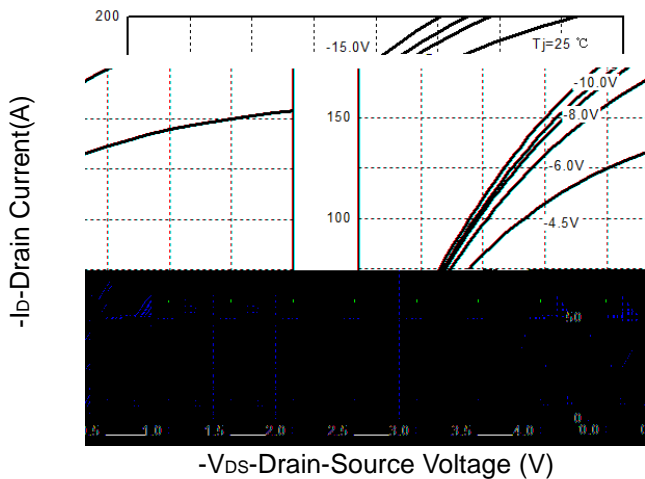
**Figure 3: Safe Operation Area**



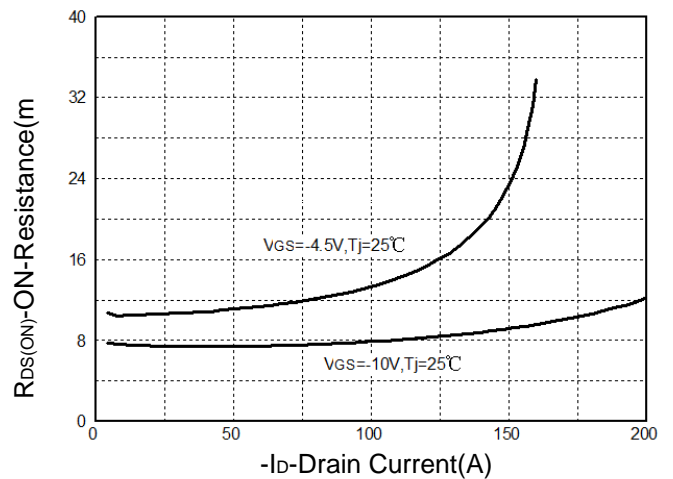
**Figure 4: Thermal Transient Impedance**



**Figure 5: Output Characteristics**

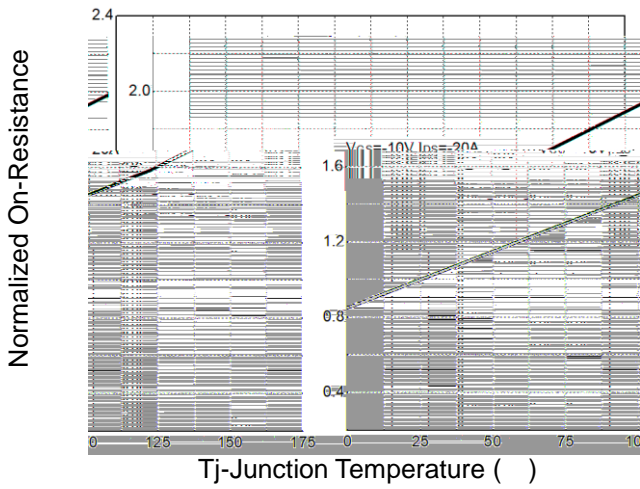


**Figure 6: Drain-Source On Resistance**

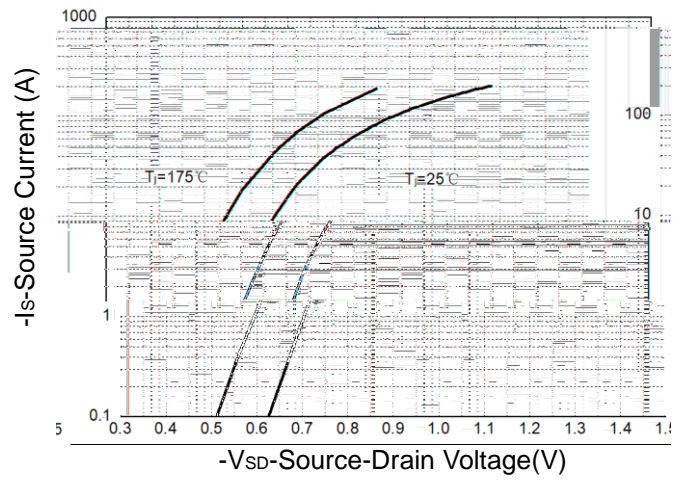


**Typical Operating Characteristics(Cont.)**

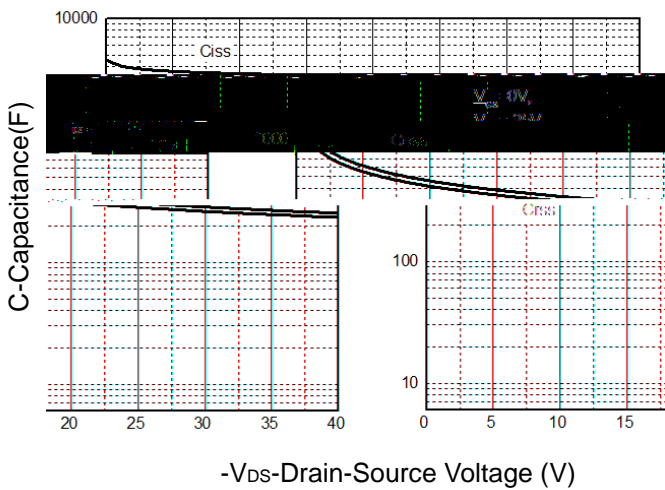
**Figure 7: On-Resistance vs. Temperature**



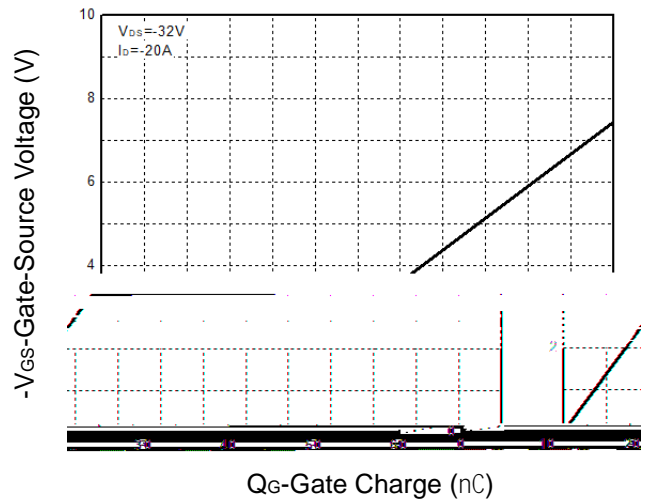
**Figure 8: Source-Drain Diode Forward**



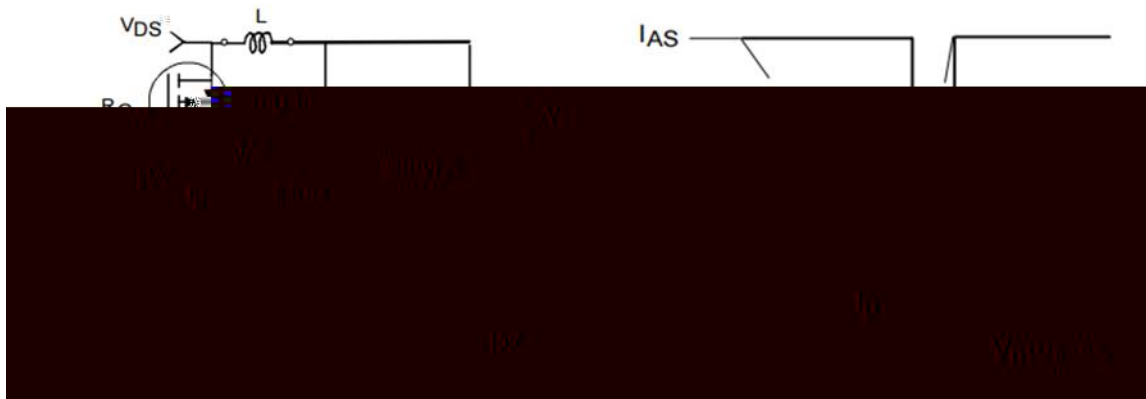
**Figure 9: Capacitance Characteristics**



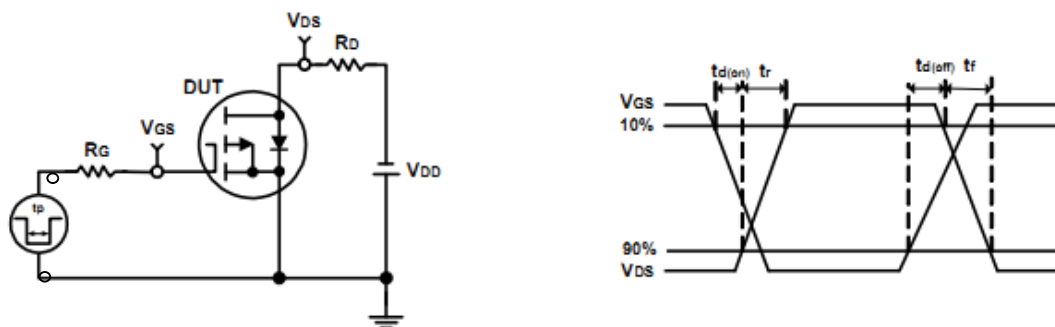
**Figure 10: Gate Charge Characteristics**



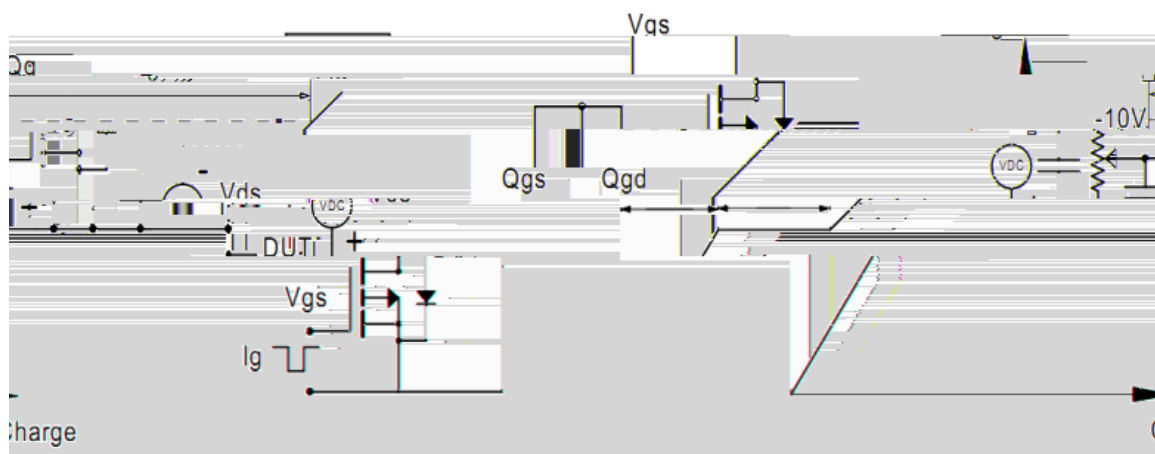
## Avalanche Test Circuit and Waveforms



## Switching Time Test Circuit and Waveforms



## Gate Charge Test Circuit and Waveforms

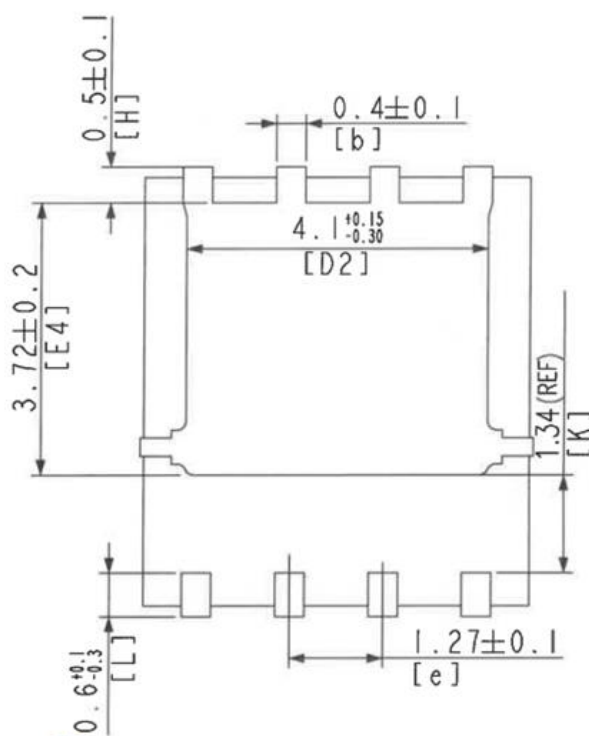
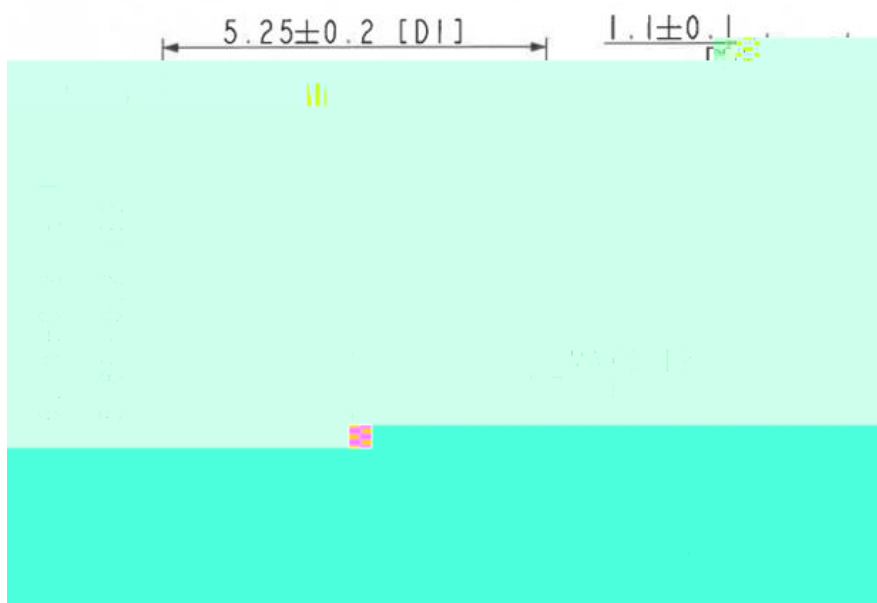


## Device Per Unit

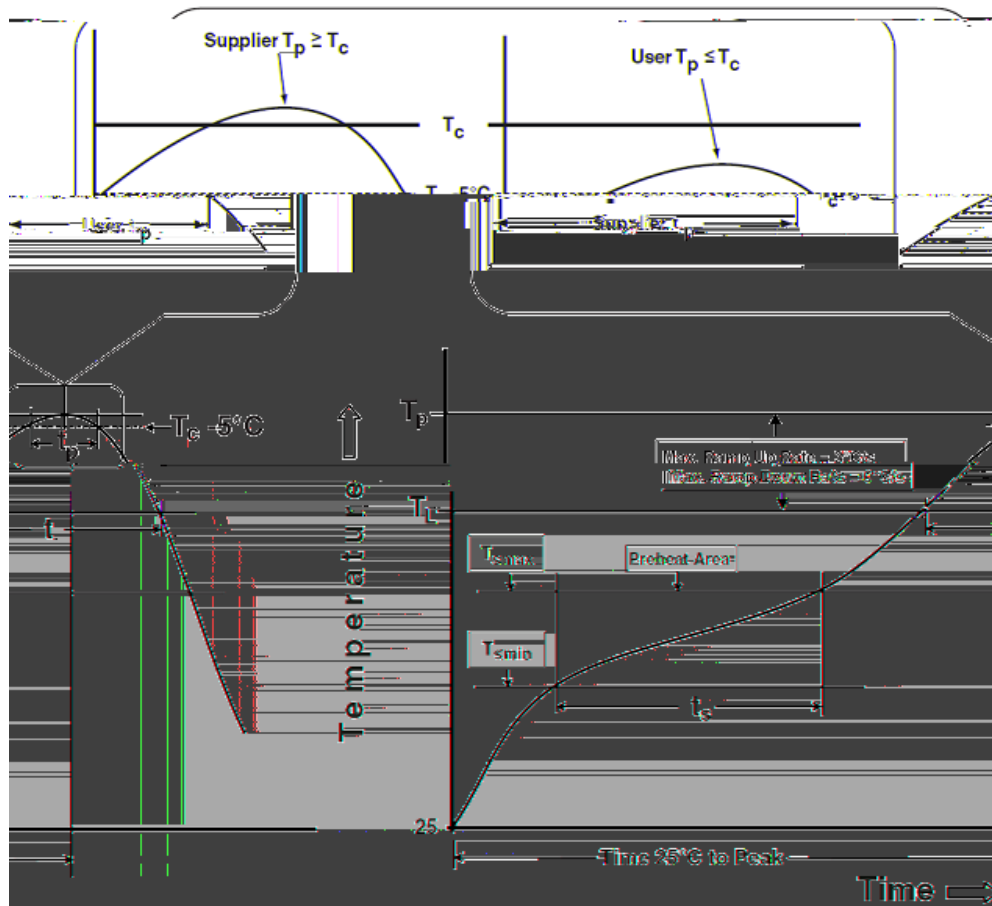
Package Type	Unit	Quantity
PDFN8L(5× 6)	Reel	5000

## Package Information

PDFN8L(5× 6)



**Classification Profile**



**Classification Reflow Profiles**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b>		
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 (Tc)

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350
2.5 mm	235 °C	220 °C
	220 °C	220 °C

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

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> 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 <sub>gs</sub> 100% @ 150°C
PCT	JESD-22, A102	96 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -55°C~150°C

### Customer Service

Worldwide Sales and Service: sales@hymexa.com

Technical Support: Technology@hymexa.com

Huayi Microelectronics Co., Ltd.

No.8928,Shangji Road,Economic and Technological Development Zone,Xi'an,China

TEL: (86-029) 86685706

FAX: (86-029) 86685705

E-mail: sales@hymexa.com

Web net: www.hymexa.com