Dual N-Channel Enhancement Mode MOSFET

Feature

- 40V/33A
  $R_{DS(ON)}$= 17mΩ(typ.) @VGS = 10V
  $R_{DS(ON)}$= 20 mΩ(typ.) @VGS = 4.5V
- 100% Avalanche Tested
- 100% DVDS
- Reliable and Rugged
- Halogen Free and Green Devices Available
  (RoHS Compliant)

Pin Description

Applications

- DC-DC
- Motor control

Ordering and Marking Information

C2 HYG190ND04 XYMXXXXXX	Package Code C2: PDFN8L(5x6) Date Code XYMXXXXXX

Note: HUAYI halogen free products contain molding compounds/die attach materials and 100% matte tin plate Termi-Nation finish;which are fully compliant with RoHS. HUAYI halogen

Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
Common Ratings (Tc=25℃ Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage		40	V
V_{GSS}	Gate-Source Voltage		±20	V
T_J	Junction Temperature Range		-55 to 175	℃
T_{STG}	Storage Temperature Range			℃
I_S	Source Current-Continuous(Body Diode)	Tc=25°C	33	A
Mounted on Large Heat Sink				
I_{DM}	Pulsed Drain Current *	Tc=25°C	99	A
I_D	Continuous Drain Current	Tc=25°C	33	A
		Tc=100°C	23	A
P_D	Maximum Power Dissipation	Tc=25°C	40	W
		Tc=100°C	20	W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case		3.79	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient **		80	°C/W
E_{AS}	Single Pulsed-Avalanche Energy ***	L=0.1mH	20	mJ

Note: * Repetitive rating; pulse width limited by max.junction temperature.
** Surface mounted on 1in2 FR-4 board.
*** Limited by $T_J$max , starting T_J=25°C, L = 0.1mH, R_G= 25Ω, V_{GS} =10V.

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

Symbol	Parameter	Test Conditions	HYG190ND04LR1			Unit
			Min	Typ.	Max	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V,I_{DS}=250μA	40	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	V_{DS}=40V,V_{GS}=0V	-	-	1	μA
		T_J=125°C	-	-	50	μA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250μA	1	1.7	3	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}=10A	-	17	20	mΩ
$R_{DS(ON)}$	Drain-Source On-State Resistance	V_{GS}=4.5V,I_{DS}=10A	-	20	26	mΩ
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_{SD}=10A,V_{GS}=0V	-	0.86	1.20	V
t_{rr}	Reverse Recovery Time	I_{SD}=10A,dI_{SD}/dt=100A/μs	-	8	-	ns
Q_{rr}	Reverse Recovery Charge		-	4	-	nC

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

Symbol	Parameter	Test Conditions	HYG190ND04LR1			Unit
			Min	Typ.	Max	
Dynamic Characteristics						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	-	2.1	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V,	-	566	-	pF
C_{oss}	Output Capacitance	V_{DS}=25V,	-	63	-	
C_{rss}	Reverse Transfer Capacitance	Frequency=1MHz	-	51	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=20V,R_G=2.5Ω, I_{DS}=10A,V_{GS}=10V	-	7	-	ns
T_r	Turn-on Rise Time		-	3	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	17	-	
T_f	Turn-off Fall Time		-	2	-	
Gate Charge Characteristics						
Q_g	Total Gate Charge(V_{GS}=10V)	V_{DS}=32V, I_{DS}=10A	-	14	-	nC
Q_g	Total Gate Charge(V_{GS}=4.5V)			7		
Q_{gs}	Gate-Source Charge		-	2	-	
Q_{gd}	Gate-Drain Charge		-	4	-	
$V_{plateau}$	Gate plateau voltage		-	3.4	-	V

Note: *Pulse test，pulse width ≤ 300us，duty cycle ≤ 2%

Typical Operating Characteristics

Figure 1: Power Dissipation

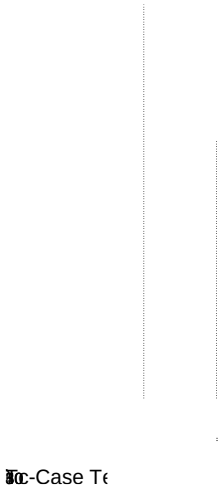


Figure 2: Drain Current

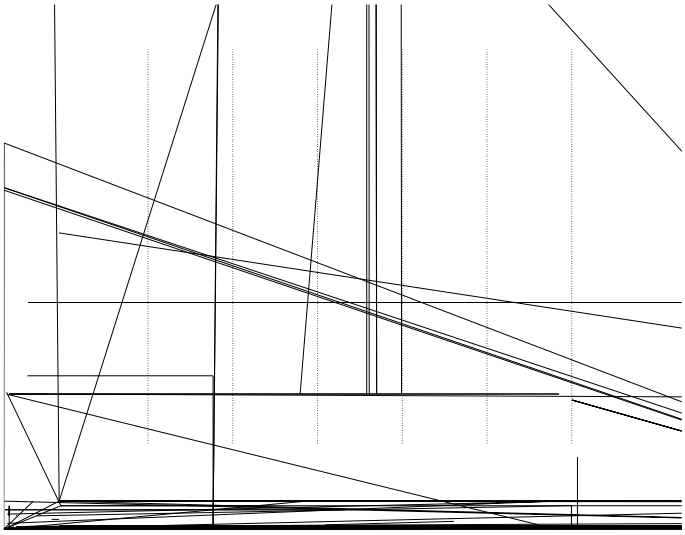


Figure 3: Safe Operation Area

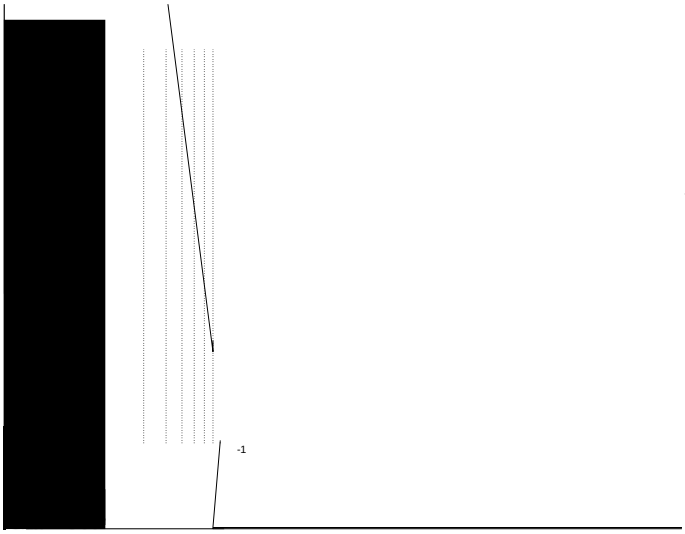


Figure 4: Thermal Transient Impedance

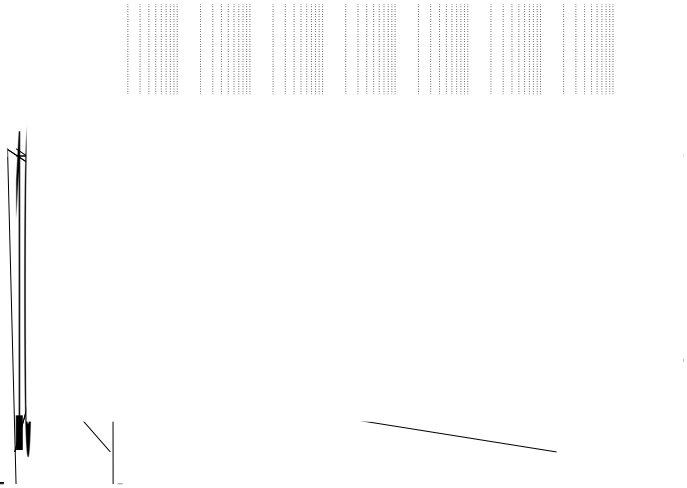
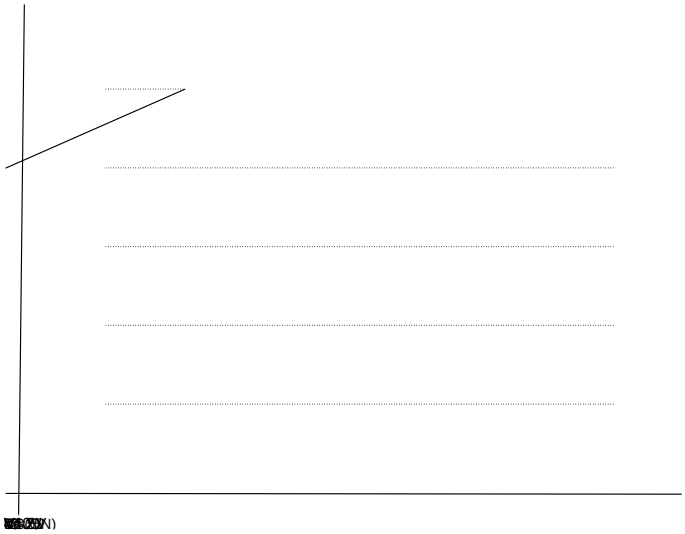


Figure 5: Output Characteristics

Figure 6: Drain-Source On Resistance



Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

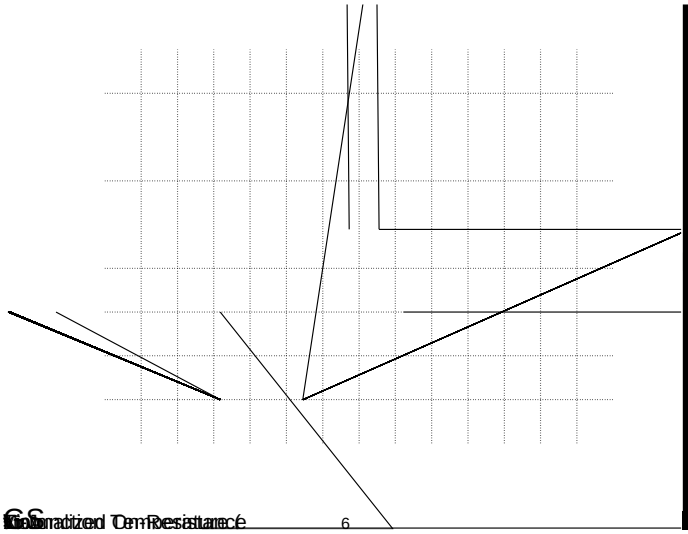


Figure 8: Source-Drain Diode Forward

Figure 9: Capacitance Characteristics

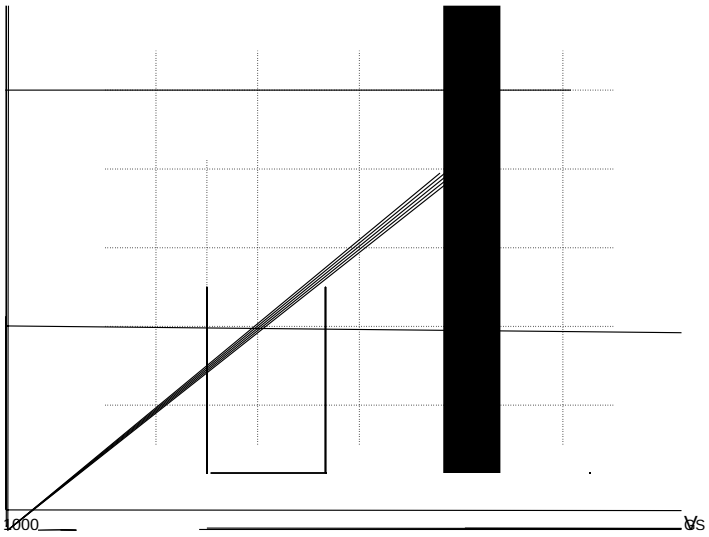
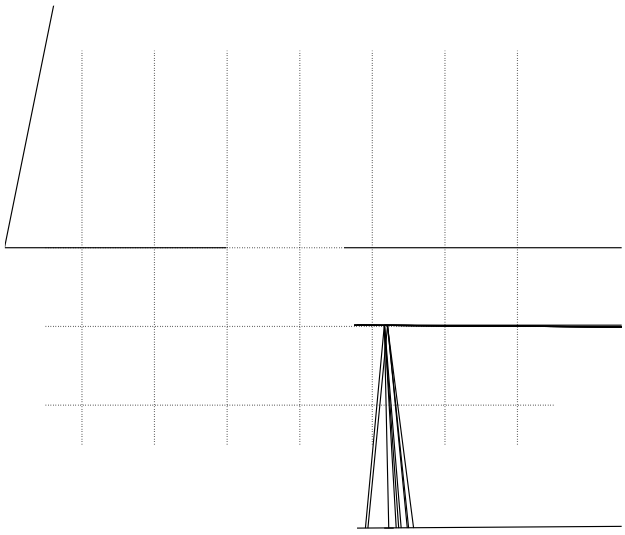
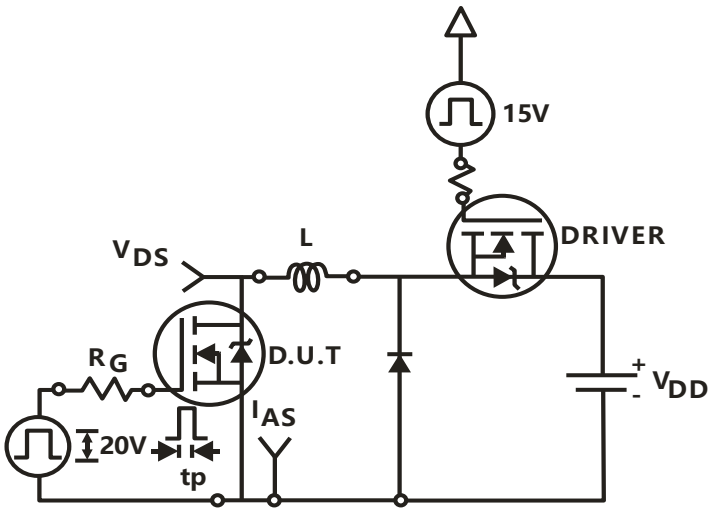


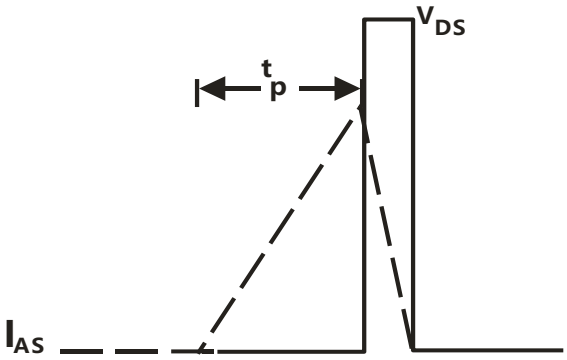
Figure 10: Gate Charge Characteristics



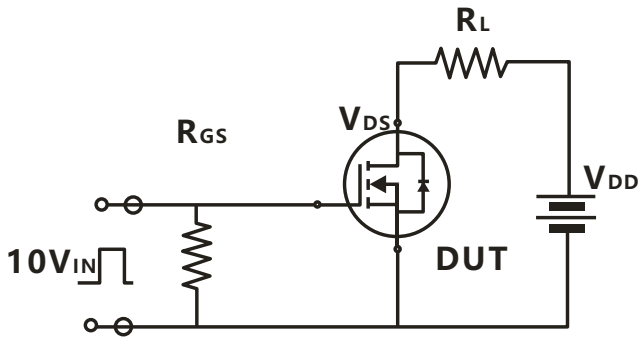
Avalanche Test Circuit

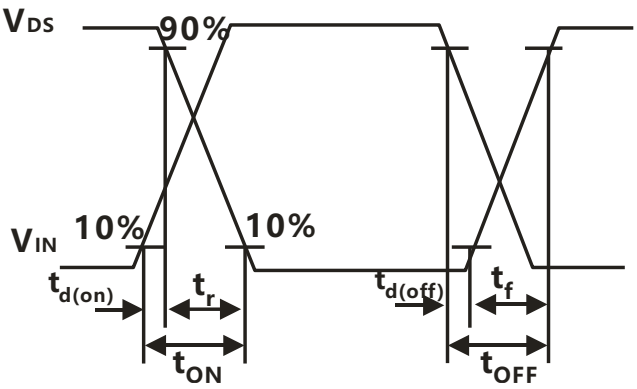


$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

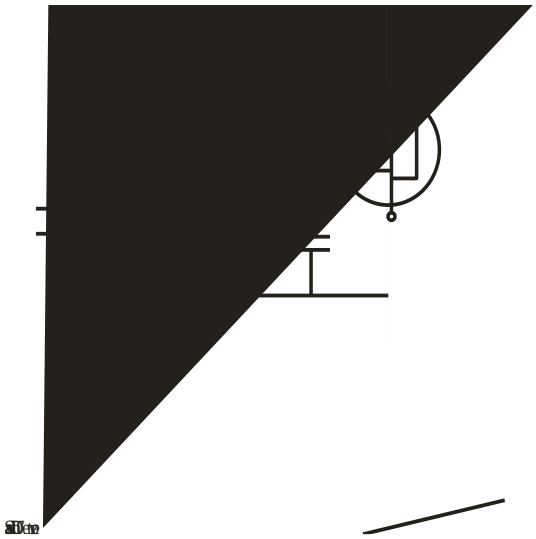


Switching Time Test Circuit





Gate Charge Test Circuit

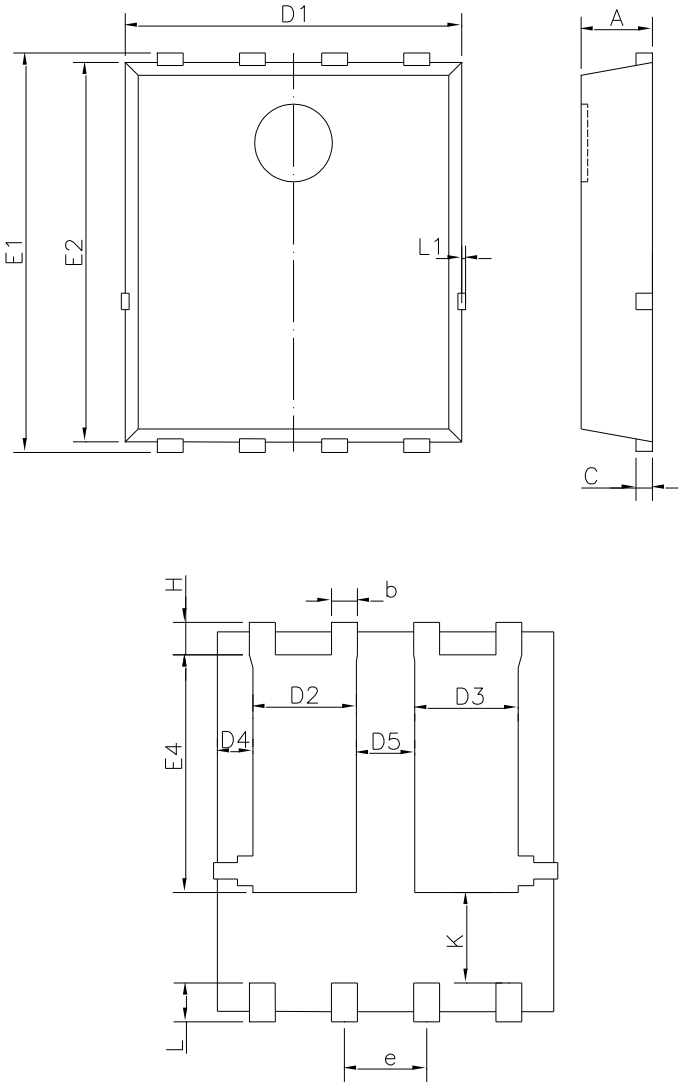


Device Per Unit

Package Type	Unit	Quantity
PDFN8L(5x6)	Reel	5000

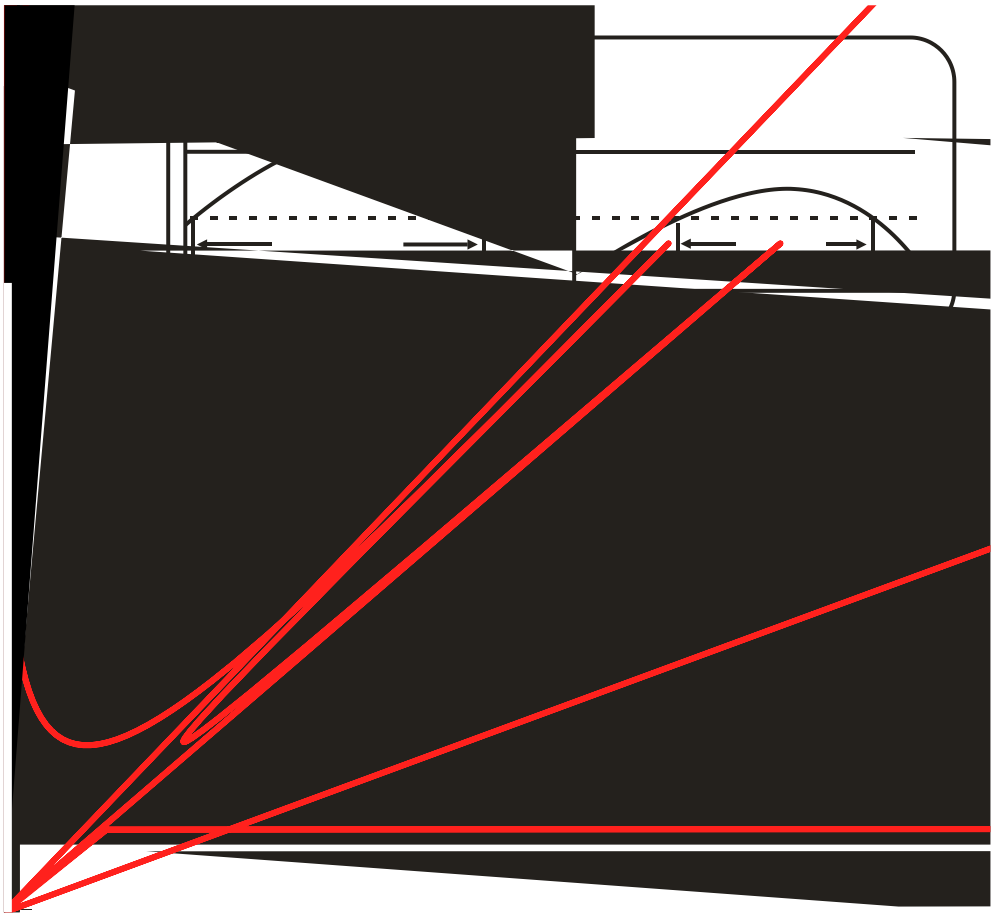
Package Information

PDFN8L(5x6）



COMMON DIMENSIONS			
SYMBOL	mm		
	MIN	NOM	MAX
A	1.00	1.10	1.20
b	0.30	0.40	0.50
c	0.154	0.254	0.354
D1	5.00	5.20	5.40
D2	1.40	1.60	1.80
D3	1.40	1.60	1.80
D4	0.45	0.55	0.65
D5	0.70	0.90	1.10
e	1.27BSC		
E1	5.95	6.15	6.35
E2	5.66	5.86	6.06
E4	3.47	3.67	3.87
H	0.40	0.50	0.60
K	1.23	1.38	1.53
L	0.30	0.60	0.70
L1	\	\	0.12
*Not specified			

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
≥2.5 mm	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