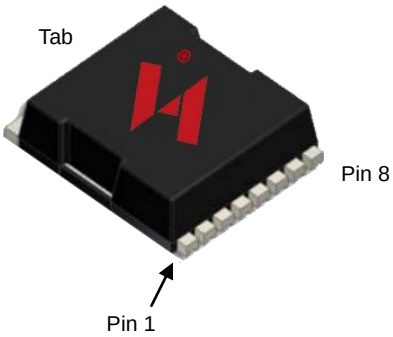
N-Channel Enhancement Mode MOSFET

Feature

- 80V/420A
  $R_{DS(ON)}$=0.9 mΩ(typ.)@V_{GS} = 10V
- 100% Avalanche Tested
- Reliable and Rugged
- Halogen-Free Devices Available
  (RoHS Compliant)

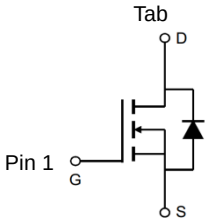
Pin Description



TOLL

Applications

- Switching application
- Power management for inverter systems
- Battery management



Pin 2,3,4,5,6,7,8

N-Channel MOSFET

Ordering and Marking Information

TA G012N08 XYMXXXXXX	Package Code TA:TOLL Date Code XYMXXXXXX

Note: HUAYI lead-free products contain molding compounds/die attach materials and 100% matte tin plate Termi-Nation finish;which are fully compliant with RoHS. HUAYI lead-free products meet or exceed the lead-Free require-ments of IPC/JEDEC J-STD-020 for MSL classification at lead-free peak reflow temperature. HUAYI 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).

HUAYI reserves the right to make changes, corrections, enhancements, modifications, and improvements to this pr-oduct and/or to this document at any time without notice.

Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
Common Ratings (Tc=25°C Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage		80	V
V_{GSS}	Gate-Source Voltage		±20	V
T_J	Junction Temperature Range		-55 to 175	℃
T_{STG}	Storage Temperature Range		-55 to 175	℃
I_S	Source Current-Continuous(Body Diode)	Tc=25°C	420	A
Mounted on Large Heat Sink				
I_{DM}	Pulsed Drain Current *	Tc=25°C	1500	A
I_D	Continuous Drain Current	Tc=25°C	420	A
		Tc=100°C	297	A
P_D	Maximum Power Dissipation	Tc=25°C	428.5	W
		Tc=100°C	214.3	W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case		0.35	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient **		45	°C/W
E_{AS}	SinglePulsed-Avalanche Energy ***	L=0.3mH	1150	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 = 0.3mH, R_G= 25Ω, V_{GS} =10V.

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

Symbol	Parameter	Test Conditions	HYG012N08NS1			Unit
			Min	Typ.	Max	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V,I_{DS}= 250μA	80	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	V_{DS}=80V,V_{GS}=0V	-	-	1	μA
		T_J=125°C	-	-	50	μA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250μA	2	3	4	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}=100A	-	0.9	1.2	mΩ
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_{SD}=100A,V_{GS}=0V	-	0.82	1.2	V
t_{rr}	Reverse Recovery Time	I_{SD}=100A,dI_{SD}/dt=100A/μs	-	113	-	ns
Q_{rr}	Reverse Recovery Charge		-	205	-	nC

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

Symbol	Parameter	Test Conditions	HYG012N08NS1			Unit
			Min	Typ.	Max	
Dynamic Characteristics						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	-	1.0	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V,	-	12217	-	pF
C_{oss}	Output Capacitance	V_{DS}=25V,	-	6886	-	
C_{rss}	Reverse Transfer Capacitance	Frequency=1.0MHz	-	470	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=40V,R_G=4.0Ω, I_{DS}= 100A,V_{GS}= 10V	-	45	-	ns
T_r	Turn-on Rise Time		-	126	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	135	-	
T_f	Turn-off Fall Time		-	136	-	
Gate Charge Characteristics						
Q_g	Total Gate Charge	V_{DS} =64V,V_{GS}=10V,I_{DS}=100A	-	240	-	nC
Q_{gs}	Gate-Source Charge		-	62	-	
Q_{gd}	Gate-Drain Charge		-	79	-	

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

Typical Operating Characteristics

Figure 1: Power Dissipation

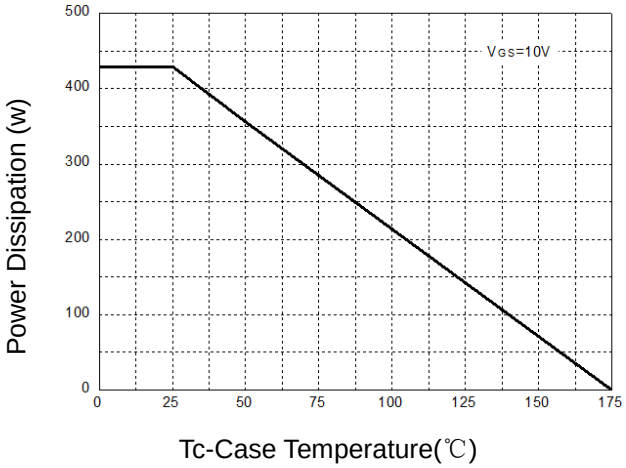


Figure 2: Drain Current

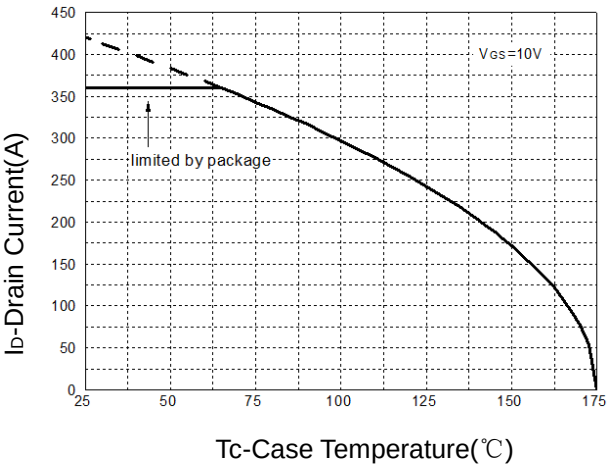


Figure 3: Safe Operation Area

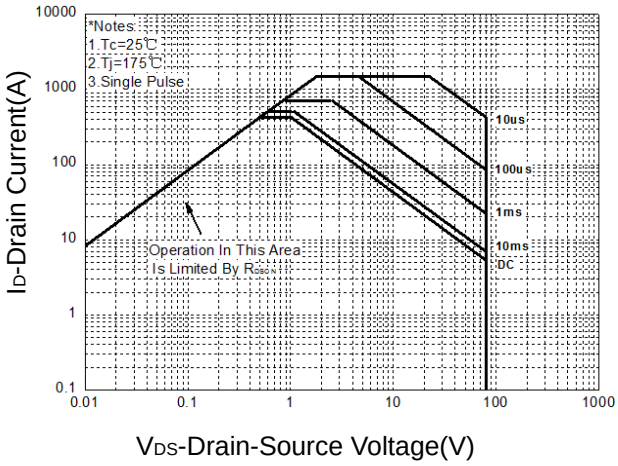


Figure 4: Thermal Transient Impedance

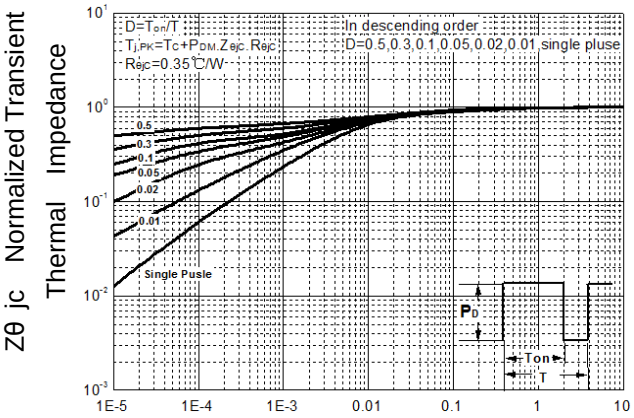


Figure 5: Output Characteristics

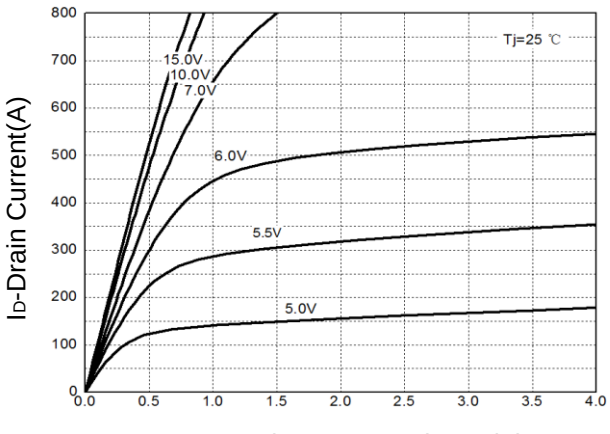
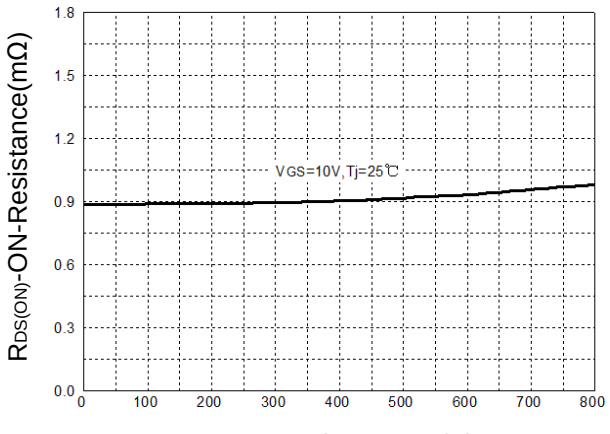
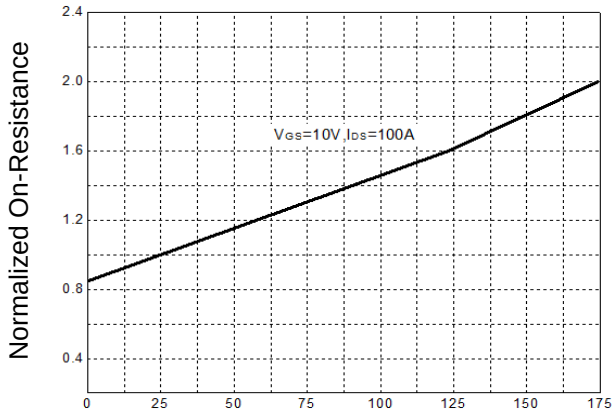


Figure 6: Drain-Source On Resistance



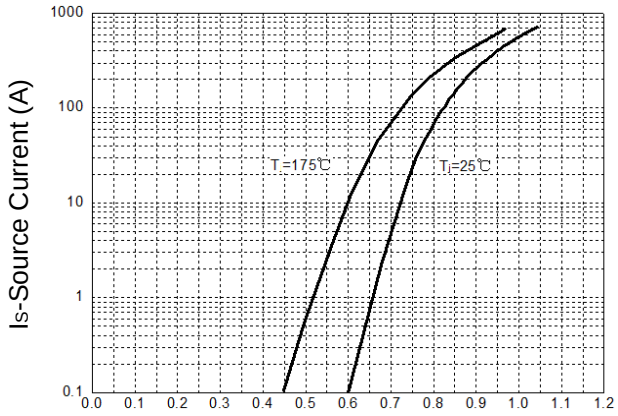
Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature



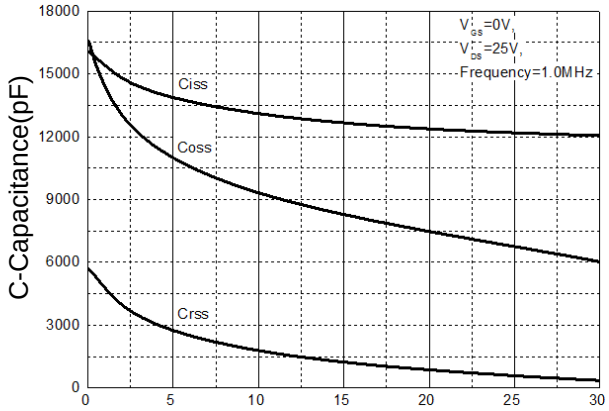
Tj-Junction Temperature (℃)

Figure 8: Source-Drain Diode Forward



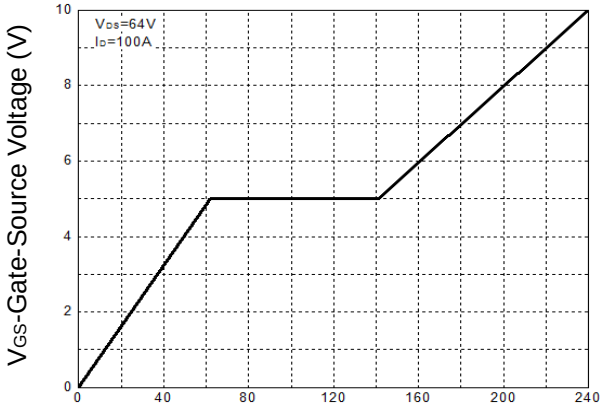
VSD-Source-Drain Voltage(V)

Figure 9: Capacitance Characteristics



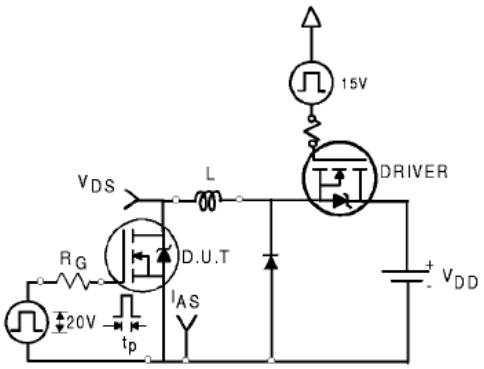
VDS-Drain-Source Voltage (V)

Figure 10: Gate Charge Characteristics

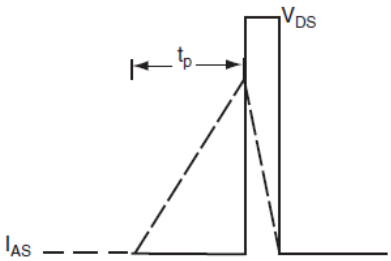


QG-Gate Charge (nC)

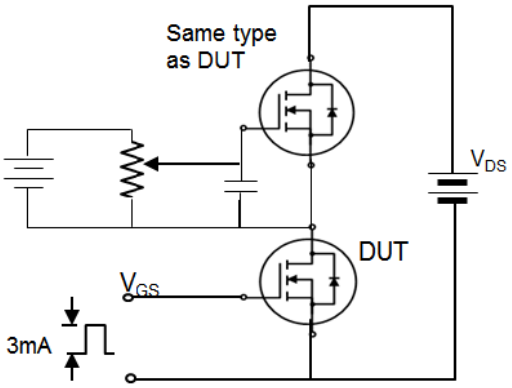
Avalanche Test Circuit

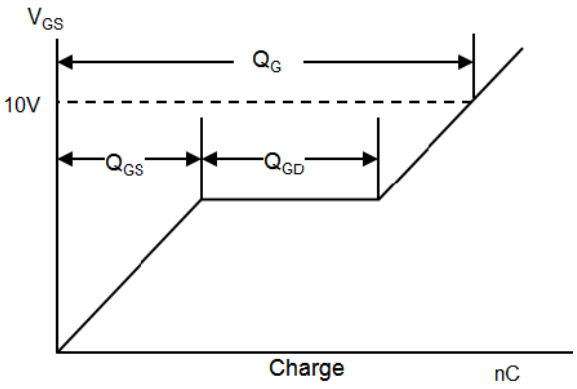


$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

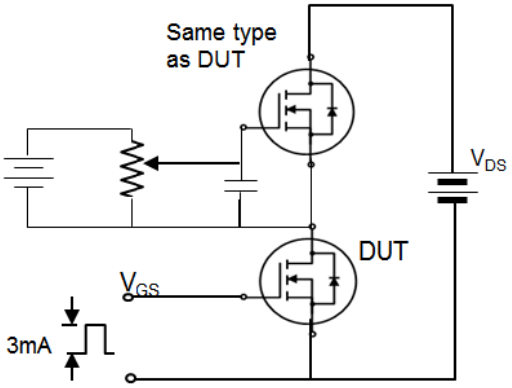


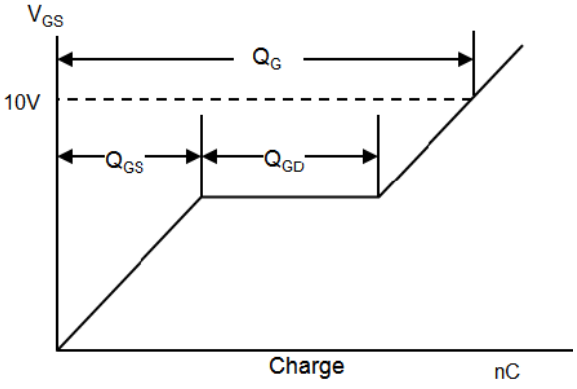
Switching Time Test Circuit





Gate Charge Test Circuit



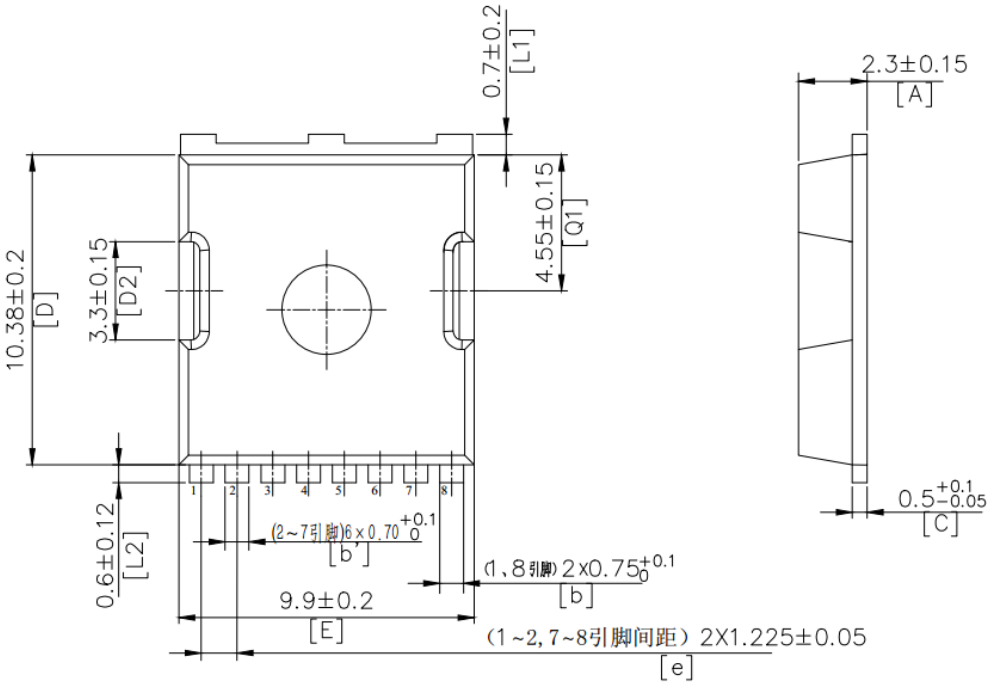


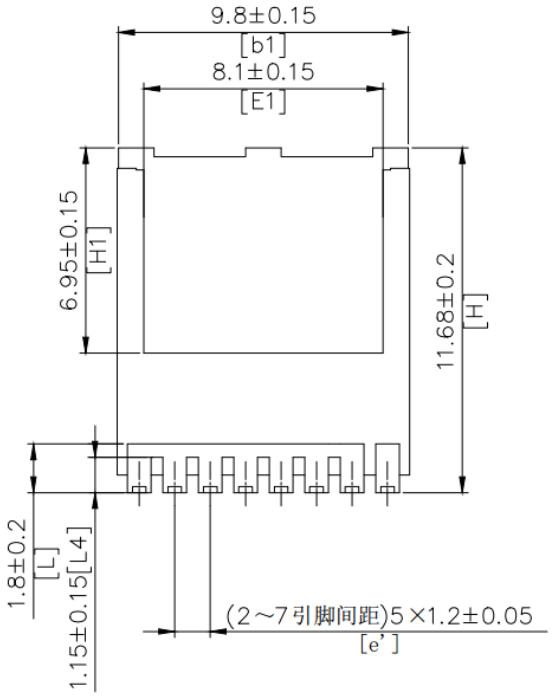
Device Per Unit

Package Type	Unit	Quantity
TOLL	Reel	1200

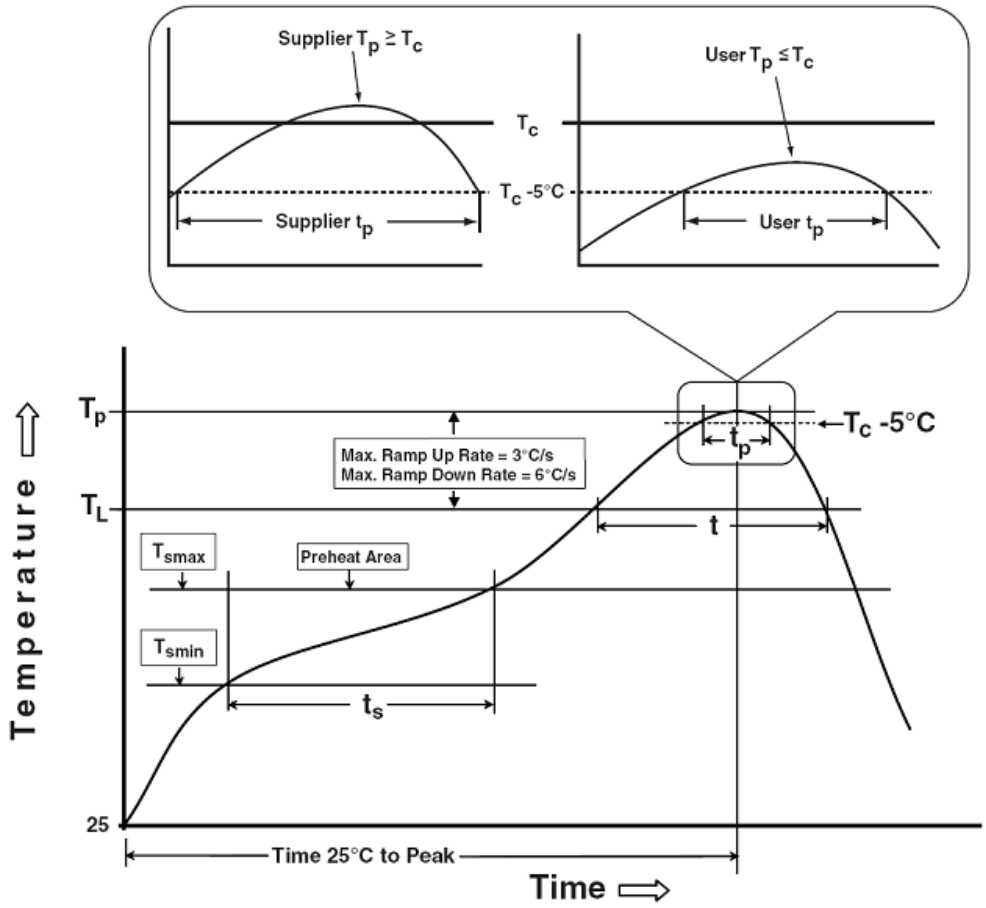
Package Information

TOLL





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
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	85°C/85%RH，168Hrs
HTRB	JESD-22, A108	168/500/1000 Hrs, Bias @ 150°C
HTGB	JESD-22, A108	168 /500/1000Hrs, V_{GS}100% @ 150°C
PCT	JESD-22, A102	96 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	250/500/1000 Cycles, -55°C~150°C

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HYG016N04LS1W HYG016N04NR1P HYG050N08NS1P HY1904B HY4306W HYG020N04NR1B HYG045P03LQ1C2 HYG065N07NS1D HYG090ND06LS1C2 HY4903B6 HYG023N04NR1P HYG190C04LA1S HYG006N04LS1TA HYG014N03LR1P HYG025N06LS1D HYG180N10LS1S HY5110W HYG025N06LS1C2 HYG035N08NS2C2 HYG190P13NA1P HY1906B HYG022N10NS1TA HYG020N04NR1P HYG065N03LR1C2 HYG170C03LR1S HYG200N12NS1P HY1904D HY3810B6 HY5012W HY5208W