N-Channel Enhancement Mode MOSFET

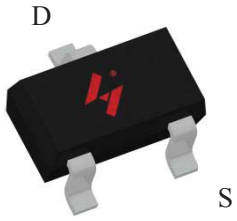
Feature

- 60V/200mA
  $R_{DS(ON)}$= 2.4Ω(typ.) @V_{GS} = 10V
  $R_{DS(ON)}$= 3.0Ω(typ.) @V_{GS} = 5V
  $R_{DS(ON)}$= 3.1Ω(typ.) @V_{GS} = 4.5V
- Avalanche Rated
- Lead Free Devices Available
- Reliable and Rugged
- ESD Protected
- HBM：＞1KV

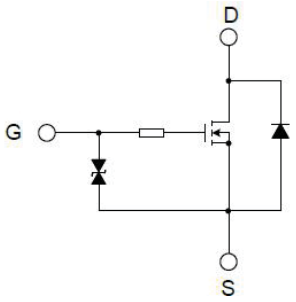
Applications

- Networking
- Switching application
- Hand-held Instruments

Pin Description

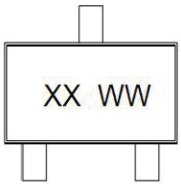


SOT-23-3L



N-Channel MOSFET

Ordering and Marking Information

	Product type XX Date Code WW

Note: HUAYI lead-free products contain molding compounds/die attach materials and 100% matte tin plateTermi-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 Otherwis Noted)				
V_{DSS}	Drain-Source Voltage		60	V
V_{GSS}	Gate-Source Voltage		±20	V
T_J	Operating Junction Temperture Range		-55 to 150	°C
T_{STG}	Storage Temperture Range		-55 to 150	°C
I_S	Drain Current-Continuous	Tc=25°C	200	mA
Mounted on Large Heat Sink				
I_{DM}	Pulsed Drain Current *	Tc=25°C	720	mA
I_D	Continuous Drain Current	Tc=25°C	200	mA
		Tc=100°C	130	mA
P_D	Maximum Power Dissipation	T_A=25°C	263	mW
		T_A=100°C	105	mW
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient **		475	°C/W

Note: * Repetitive rating;pulse width limited by max.junction temperature.
** Surface mounted on FR-4 board.

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

Symbol	Parameter	Test Conditions	HY2N7002			Unit
			Min	Typ	Max	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V,I_{DS}=250uA	60	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	VDS=60V,VGS=0V, TJ=25° C	-	-	1	uA
		VDS=48V,VGS=0V , TJ=125°C	-	-	100	uA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250uA	1.0	1.5	2.5	V
I_{GSS}	Gate-Source Leakage Current	V_{GS}=±20V,V_{DS}=0V	-	-	±10	uA
$R_{DS(ON)}$*	Drain-Source On-state Resistance	V_{GS}=10V,I_{DS}=0.3A	-	2.4	2.9	Ω
$R_{DS(ON)}$*	Drain-Source On-state Resistance	V_{GS}=5V,I_{DS}=0.1A	-	3.0	4.5	Ω
$R_{DS(ON)}$*	Drain-Source On-state Resistance	V_{GS}=4.5V,I_{DS}=0.1A	-	3.1	4.7	Ω
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_{SD}=0.1A,V_{GS}=0V	-	0.8	1	V

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

Symbol	Parameter	Test Conditions	HY2N7002			Unit
			Min	Typ	Max	
Dynamic Characteristics						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V, F=1MHz	-	860	-	Ω
Ciss	Input Capacitance	V_{GS}=0V,	-	14	-	pF
Coss	Output Capacitance	V_{DS}=10V,	-	8	-	
Crss	Reverse Transfer Capacitance	Frequency=1.0MHz	-	4	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=30V,R_G=6Ω, I_{DS}=0.2A,V_{GS}=10V	-	2	-	ns
T_r	Turn-on Rise Time		-	3	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	10	-	
T_f	Turn-off Fall Time		-	6	-	
Gate Charge Characteristics						
Qg	Total Gate Charge	V_{DS} = 30V, V_{GS} = 4.5V, I_D = 0.2A,	-	0.3	-	nC
Qgs	Gate-Source Charge		-	0.12	-	
Qgd	Gate-Drain Charge		-	0.08	-	

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

Typical Operating Characteristics

Figure 1: Power Dissipation

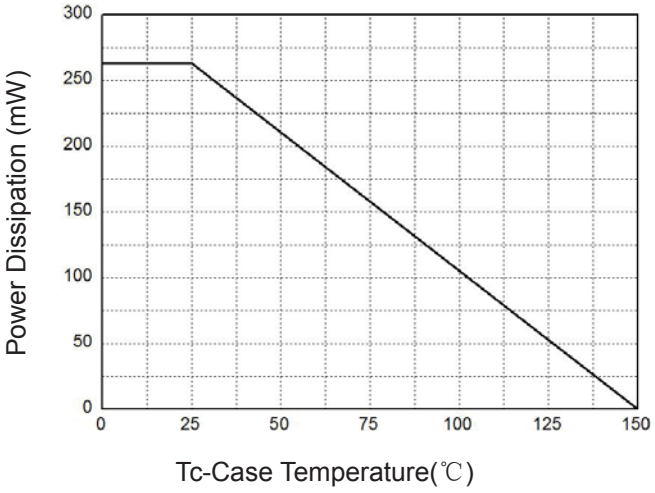


Figure 2: Drain Current

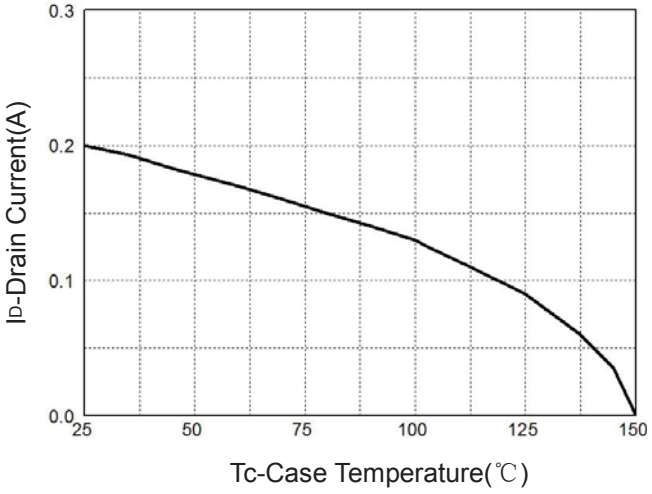


Figure 3: Safe Operation Area

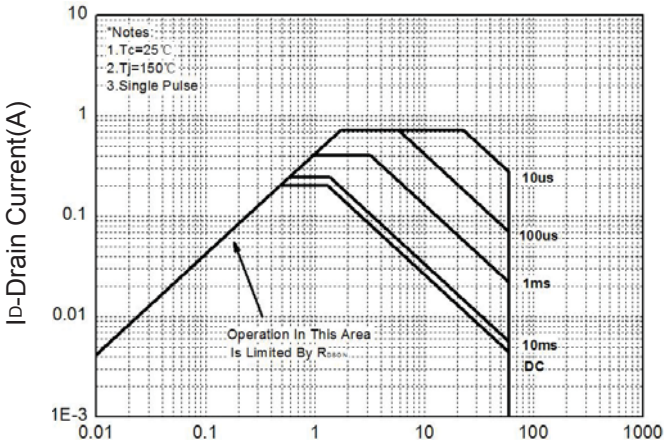
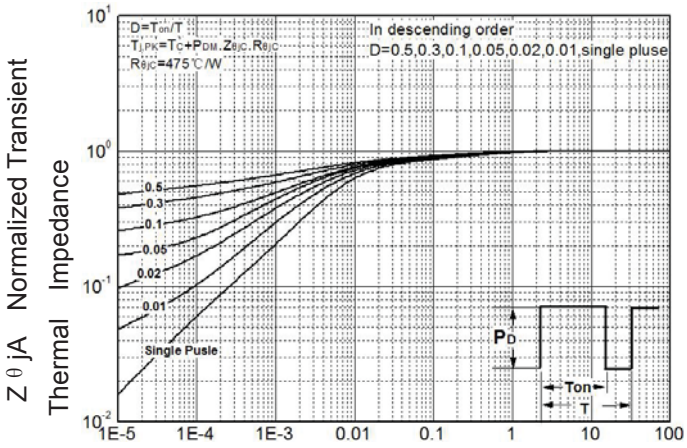


Figure 4: Thermal Transient Impedance



Maximum Effective Transient Thermal Impedance, Junction-to-Case

Figure 5: Output Characteristics

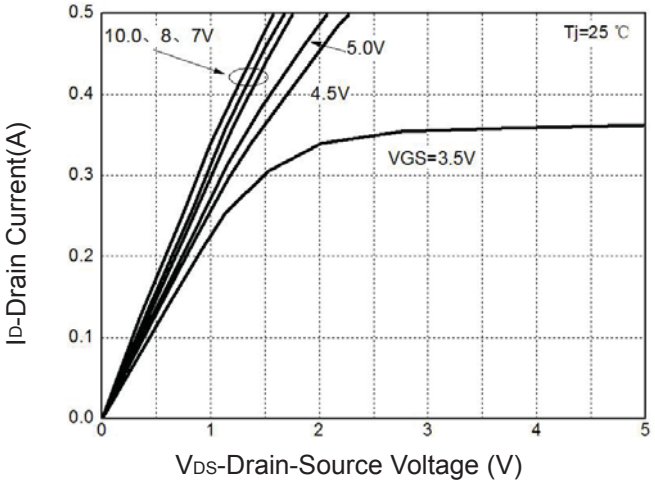
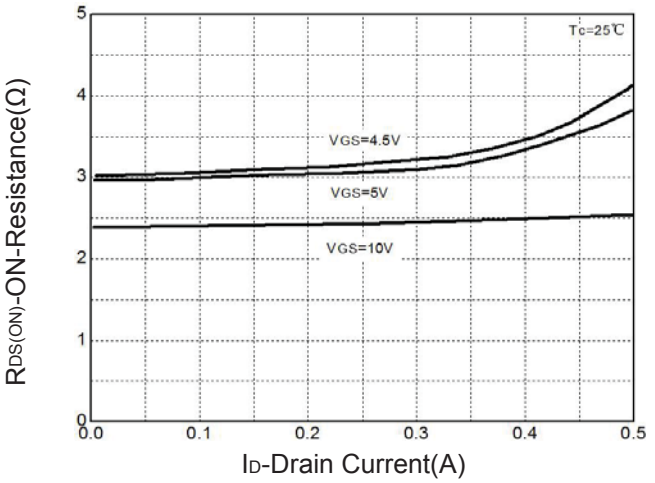


Figure 6: Drain-Source On Resistance



Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

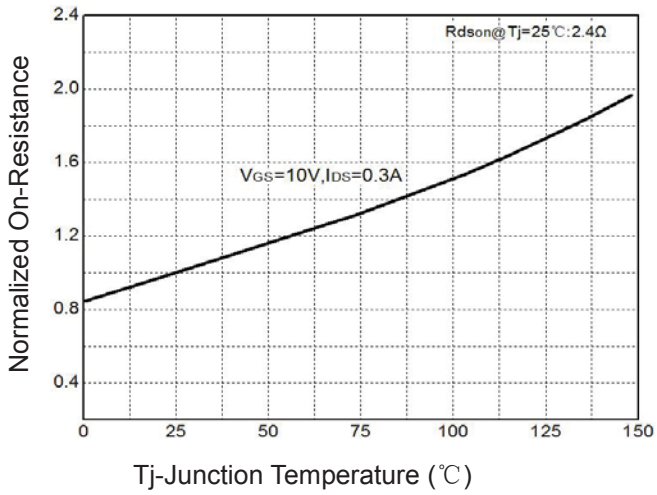


Figure 8: Source-Drain Diode Forward

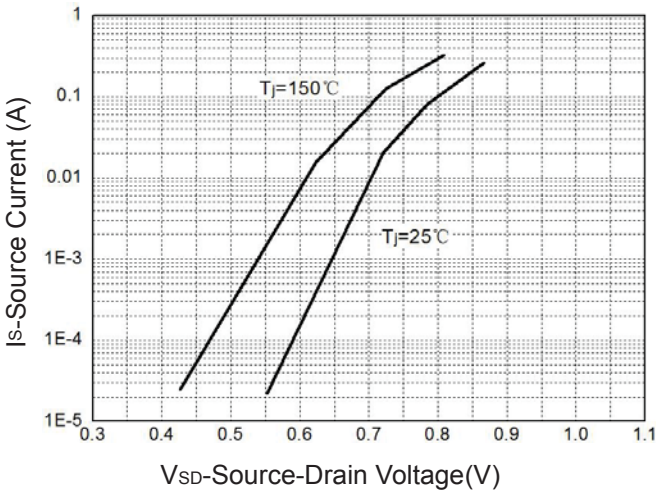


Figure 9: Capacitance Characteristics

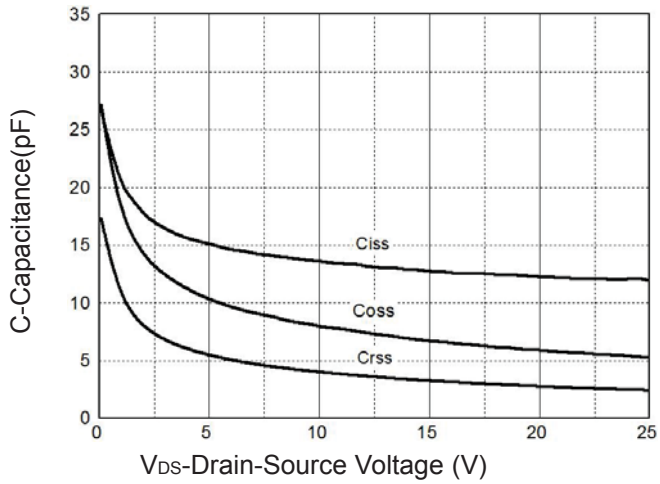
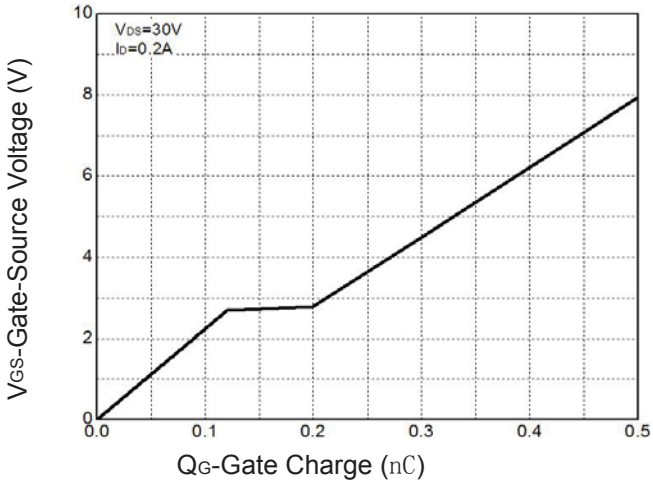
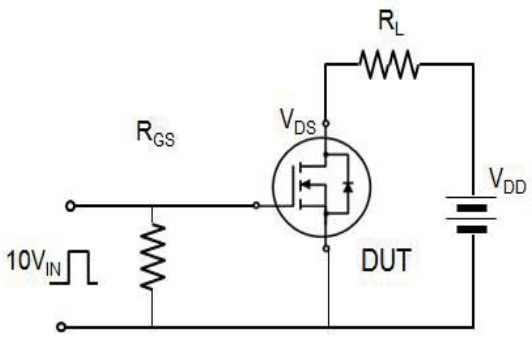
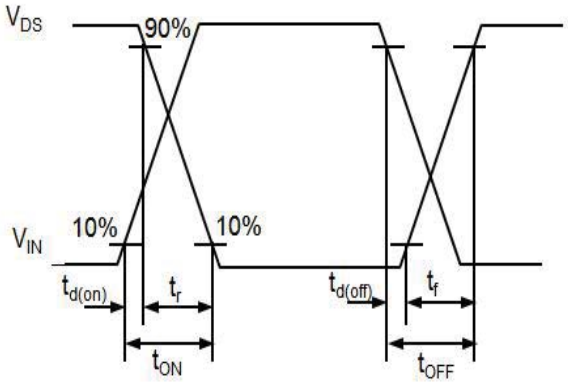


Figure 10: Gate Charge Characteristics

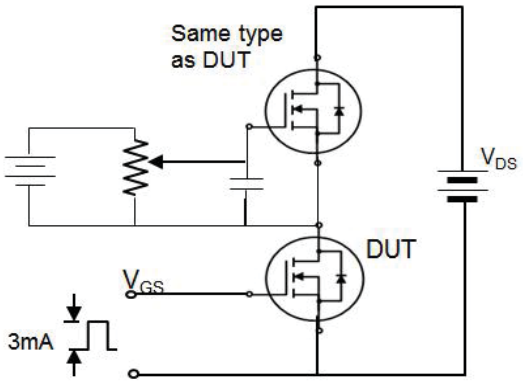


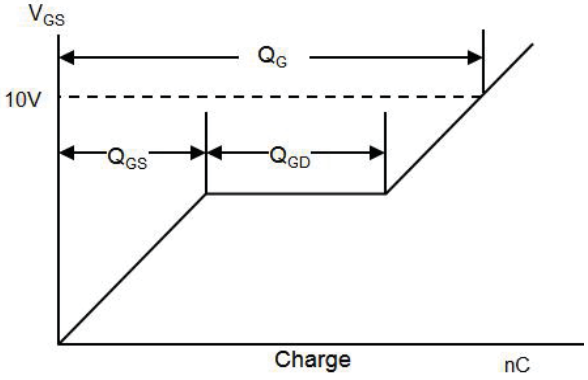
Switching Time Test Circuit





Gate Charge Test Circuit



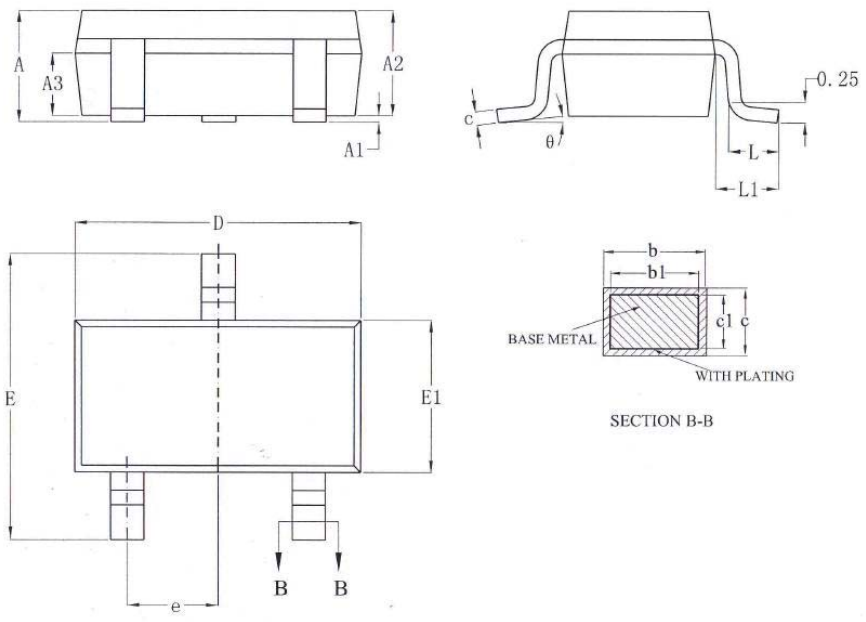


Device Per Unit

Package Type	Unit	Quantity
SOT-23-3L	Reel	3000

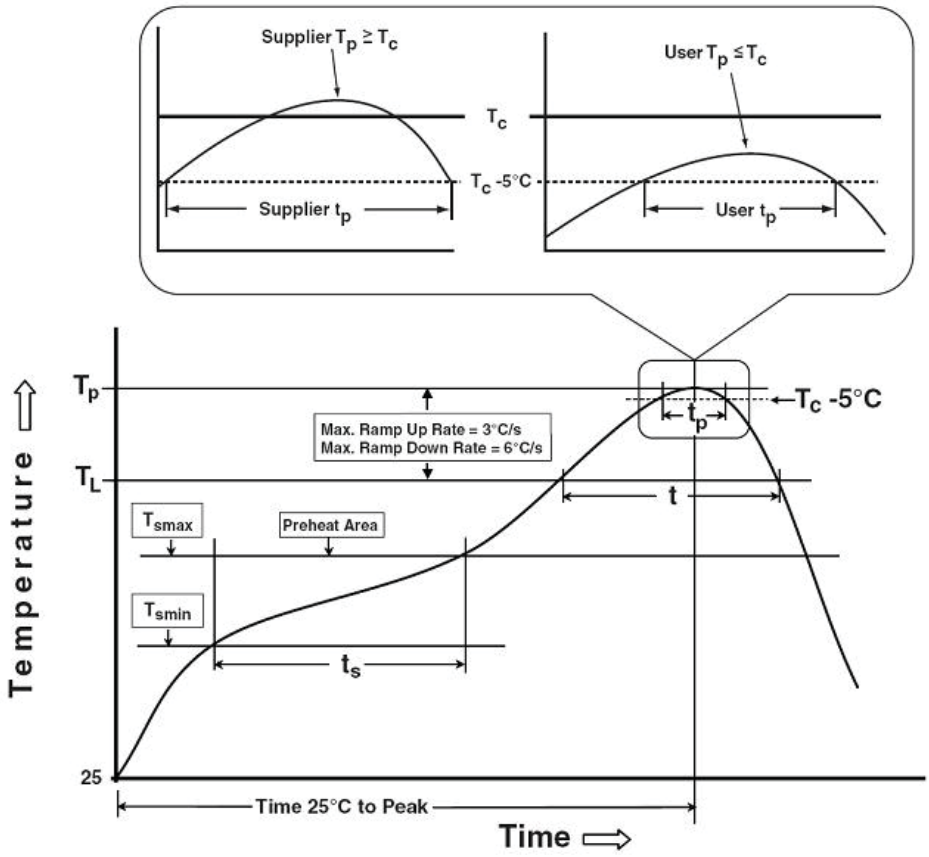
Package Information

SOT-23-3L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	---	---	1.25
Al	0.04	---	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	---	0.41
b 1	0.32	0.35	0.38
c	0.15	---	0. 19
cl	0.14	0. 15	0.16
D	2.82	2.92	3.02
E	2 .60	2.80	3.00
E 1	1.50	1.60	1.70
e	0.95BSC		
L	0.30	---	0.60
L 1	0.60REF		
θ	0	---	80

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	30°C/60%/192Hrs
HTRB	JESD-22, A108	168/500/1000 Hrs, Bias @ 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
Xi'an 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