

N-Channel Enhancement Mode MOSFET

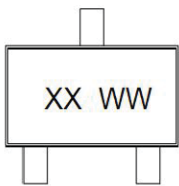
Feature

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

Applications

- Networking
- Switching application
- Hand-held Instruments

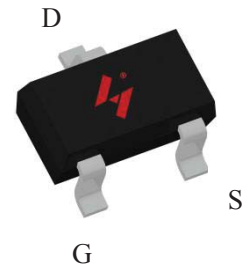
Ordering and Marking Information

	Product type XX Date Code WW
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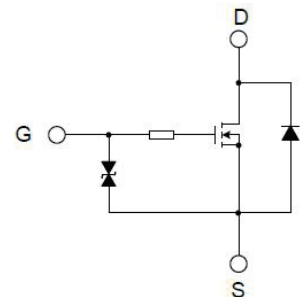
Note: HUAYI lead-free products contain molding compounds/die attach materials and 100% matte tin plate Termination finish; which are fully compliant with RoHS. HUAYI lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020 for MSL classification at lead-free peak reflow temperature. 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 product and/or to this document at any time without notice.

Pin Description



SOT-23-3L



N-Channel MOSFET

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 _{θJA}	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	V _{DS} =60V,V _{GS} =0V, T _J =25° C	-	-	1	uA
		V _{DS} =48V,V _{GS} =0V , T _J =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
C _{iss}	Input Capacitance	V _{GS} =0V,	-	14	-	pF
C _{oss}	Output Capacitance	V _{DS} =10V,	-	8	-	
C _{rss}	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						
Q _g	Total Gate Charge	V _{DS} = 30V, V _{GS} = 4.5V, I _D = 0.2A,	-	0.3	-	nC
Q _{gs}	Gate-Source Charge		-	0.12	-	
Q _{gd}	Gate-Drain Charge		-	0.08	-	

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

Typical Operating Characteristics

Figure 1: Power Dissipation

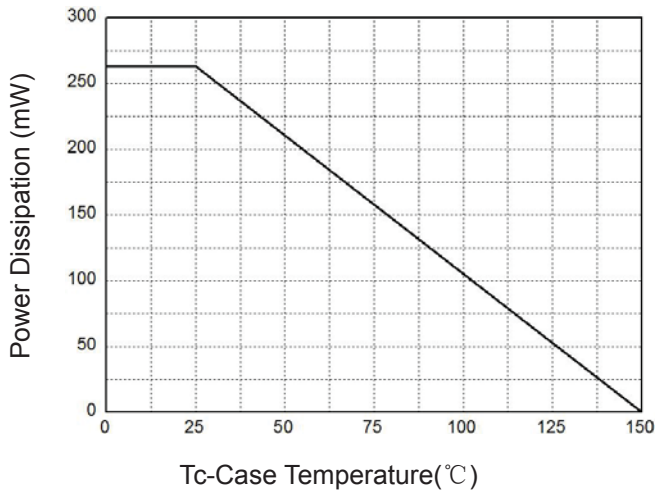


Figure 2: Drain Current

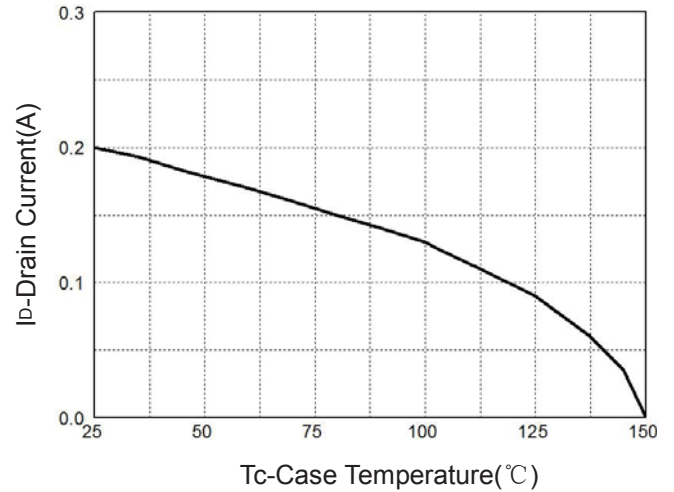


Figure 3: Safe Operation Area

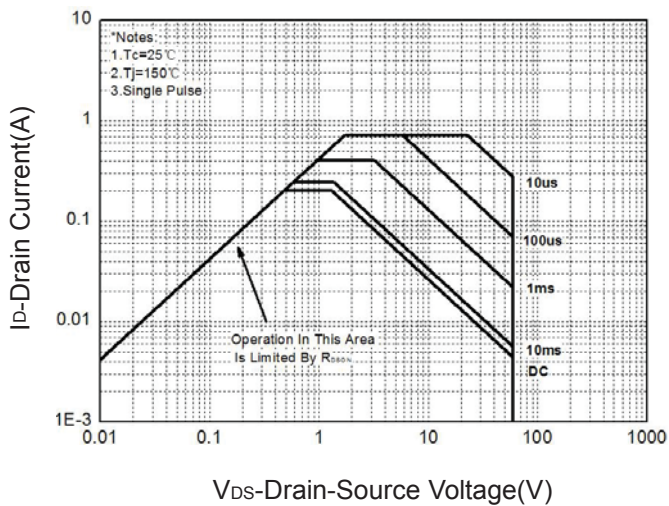


Figure 4: Thermal Transient Impedance

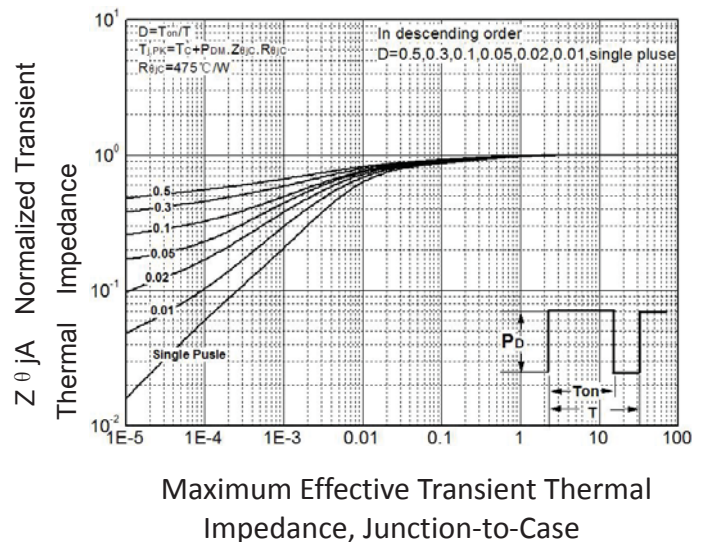


Figure 5: Output Characteristics

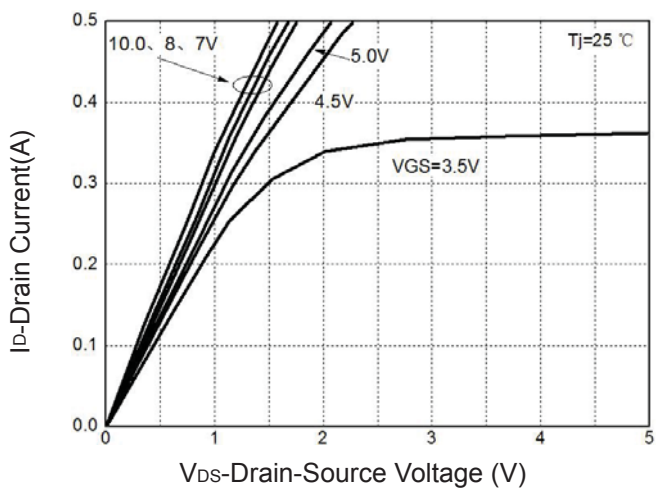
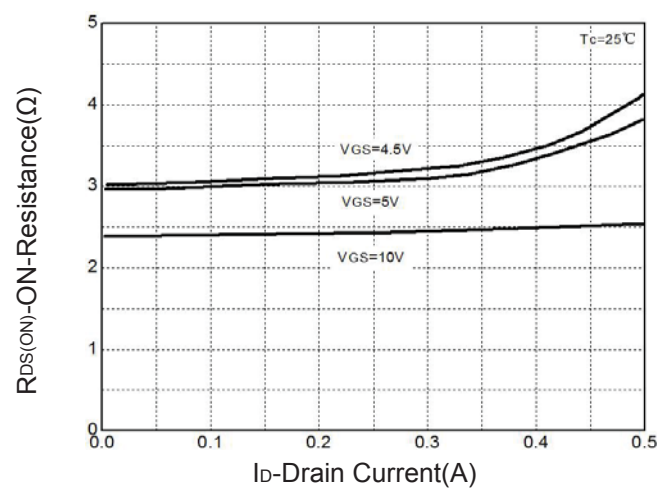


Figure 6: Drain-Source On Resistance



Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

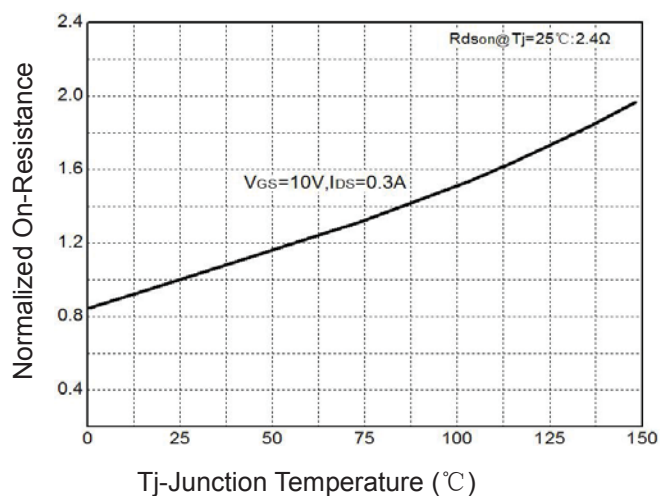


Figure 8: Source-Drain Diode Forward

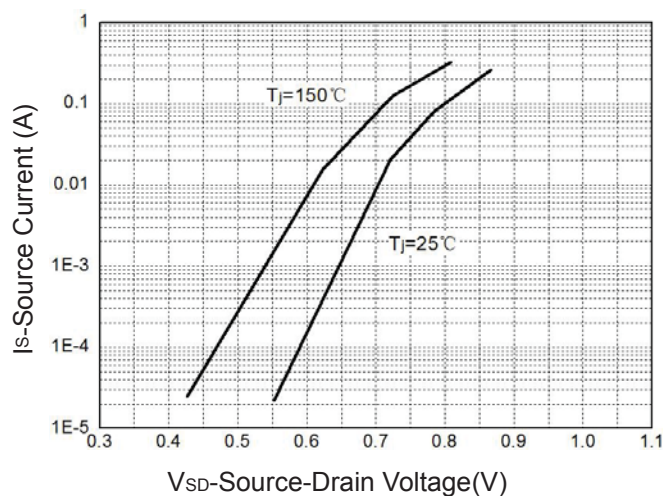


Figure 9: Capacitance Characteristics

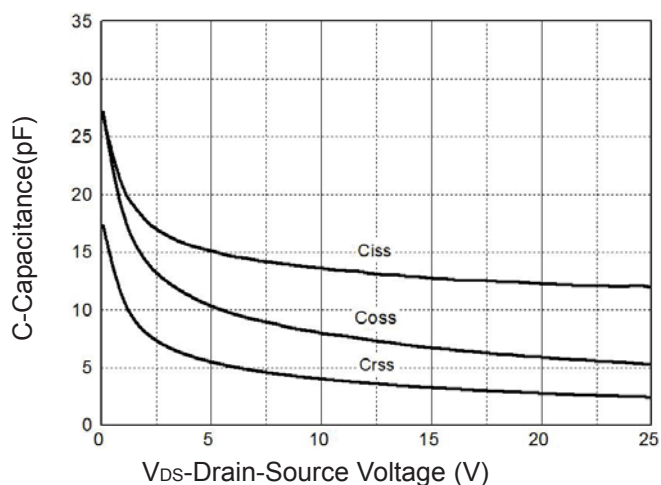
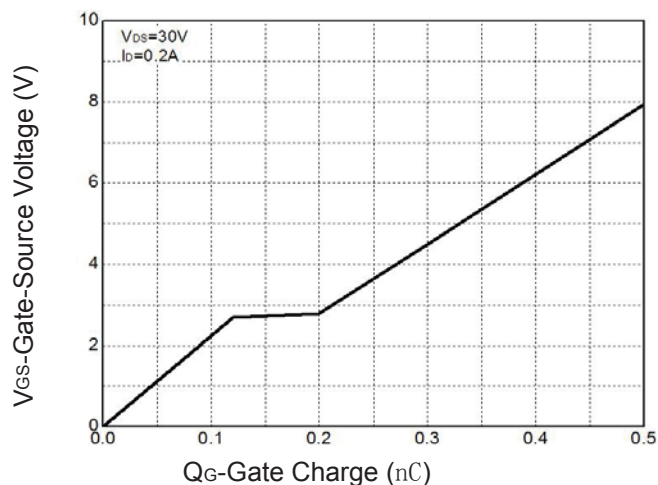
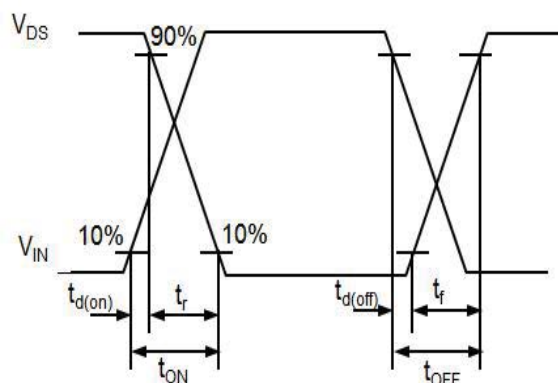
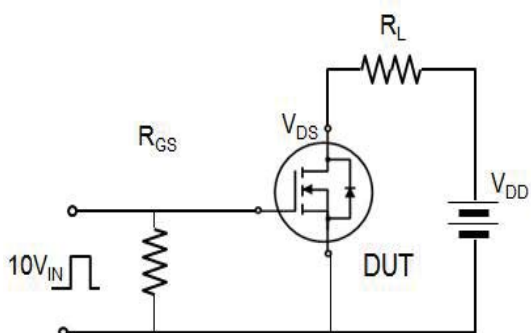


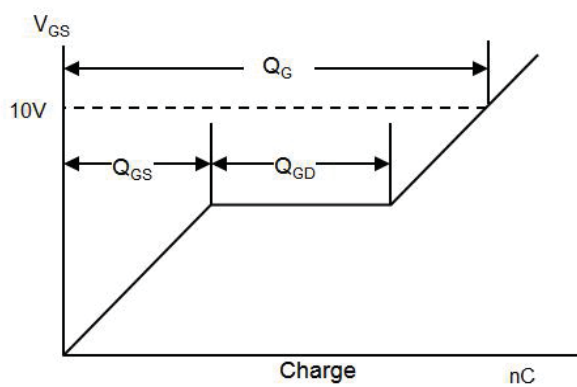
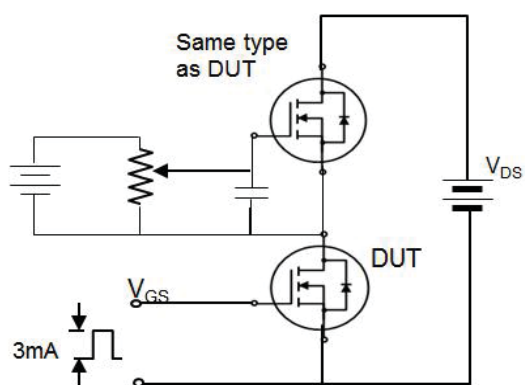
Figure 10: Gate Charge Characteristics



Switching Time Test Circuit



Gate Charge Test Circuit



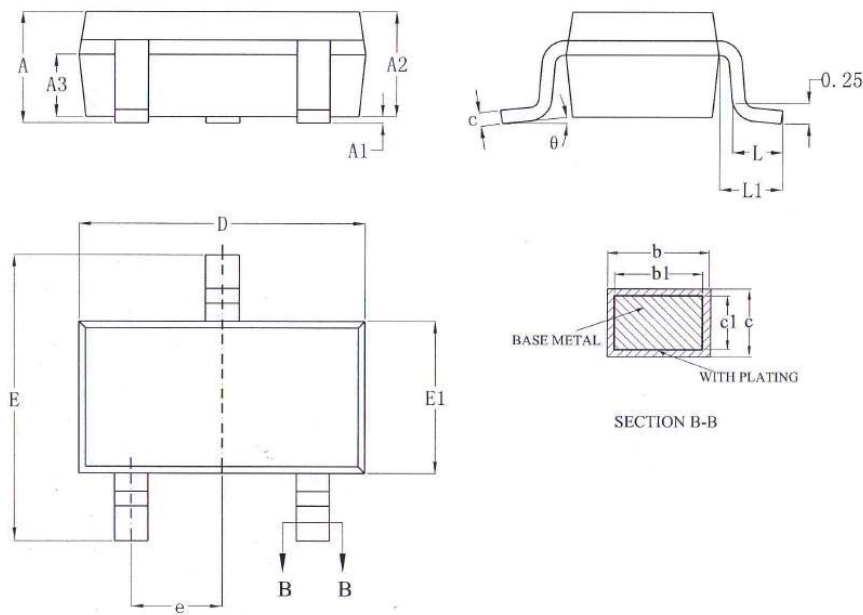
HY2N7002E

Device Per Unit

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

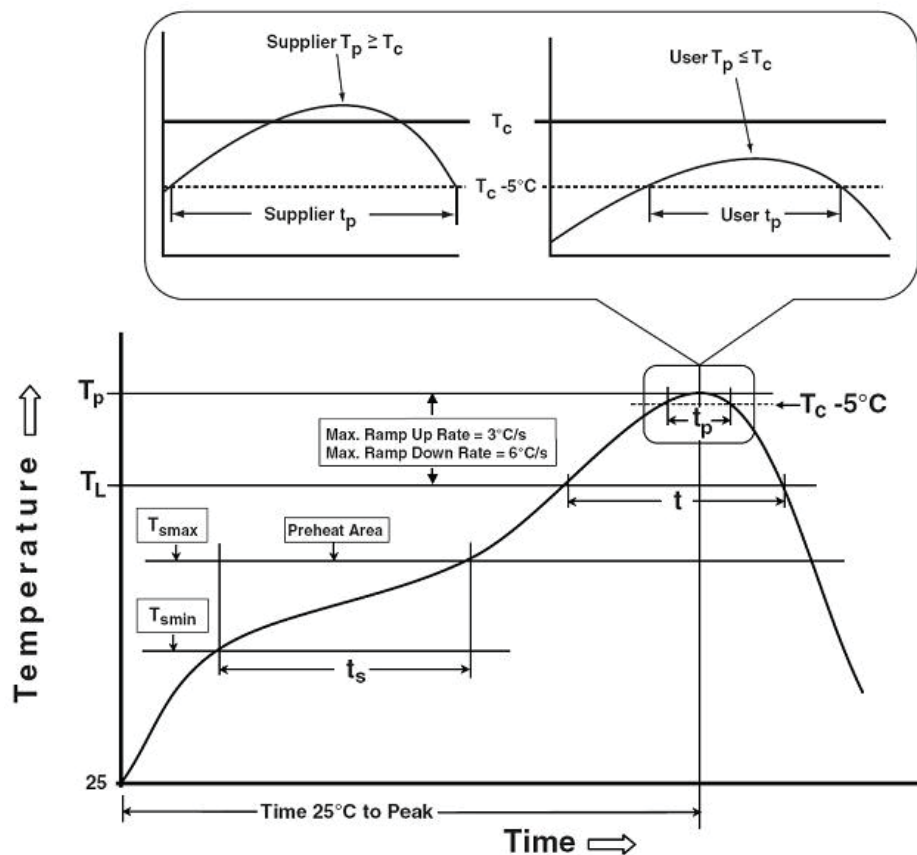
Package Information

SOT-23-3L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	---	---	1.25
A1	0.04	---	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	---	0.41
b1	0.32	0.35	0.38
c	0.15	---	0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
L	0.30	---	0.60
L1	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})	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 ³ <350	Volume mm ³ ≥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 mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ ≥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

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