

Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
Common Ratings (Tc=25°C Unless Otherwise Noted)				
V _{DSS}	Drain-Source Voltage		-125	V
V _{GSS}	Gate-Source Voltage		±20	V
T _J	Maximum Junction Temperature		-55 to 175	°C
T _{STG}	Storage Temperature Range		-55 to 175	°C
I _S	Source Current-Continuous(Body Diode)	Tc=25°C	-72	A
Mounted on Large Heat Sink				
I _{DM}	Pulsed Drain Current *	Tc=25°C	-290	A
I _D	Continuous Drain Current	Tc=25°C	-72	A
		Tc=100°C	-51	A
P _D	Maximum Power Dissipation	Tc=25°C	230	W
		Tc=100°C	115	W
R _{θJC}	Thermal Resistance, Junction-to-Case		0.65	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient **		62.5	°C/W
E _{AS}	SinglePulsed-Avalanche Energy ***	L=0.3mH	579.5	mJ

Note: * Repetitive rating pulse width limited by max.junction temperature.
 ** Surface mounted on 1in2 FR-4 board.
 *** Limited by T_{Jmax}, starting T_J=25°C, L = 0.3mH, R_C= 25 , V_{GS} = -10V.

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

Symbol	Parameter	Test Conditions	HYG190P13NA1			Unit
			Min	Typ.	Max	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} = -250μA	-125	-	-	V
I _{DSS}	Drain-to-Source Leakage Current	V _{DS} = -125V, V _{GS} =0V	-	-	-1	μA
		T _J =125°C	-	-	-50	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} = -250μA	-1.5	-2.5	-3.5	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} = -35A	-	18	24	m
Diode Characteristics						
V _{SD} *	Diode Forward Voltage	I _{SD} = -35A, V _{GS} =0V	-	-0.83	-1.3	V
t _{rr}	Reverse Recovery Time	I _{SD} =-35A, dI _{SD} /dt=100A/μs	-	44.6	-	ns
Q _{rr}	Reverse Recovery Charge		-	86.2	-	nC

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

Symbol	Parameter	Test Conditions	HYG190P13NA1			Unit
			Min	Typ.	Max	
Dynamic Characteristics						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	1.8	-	
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} = -25V, Frequency=1.0MHz	-	8348	-	pF
C _{oss}	Output Capacitance		-	572	-	
C _{rss}	Reverse Transfer Capacitance		-	430	-	
t _{d(ON)}	Turn-on Delay Time		V _{DD} = -65V, R _G =2.5 , I _{DS} = -35A, V _{GS} = -10V	-	23	-
T _r	Turn-on Rise Time	-		60.2	-	
t _{d(OFF)}	Turn-off Delay Time	-		76.9	-	
T _f	Turn-off Fall Time	-		102.5	-	
Gate Charge Characteristics						
Q _g	Total Gate Charge	V _{DS} = -65V, V _{GS} = -10V, I _D = -35A	-	160	-	nC
Q _{gs}	Gate-Source Charge		-	23	-	nC
Q _{gd}	Gate-Drain Charge		-	67	-	

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

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Typical Operating Characteristics

Figure 1: Power Dissipation

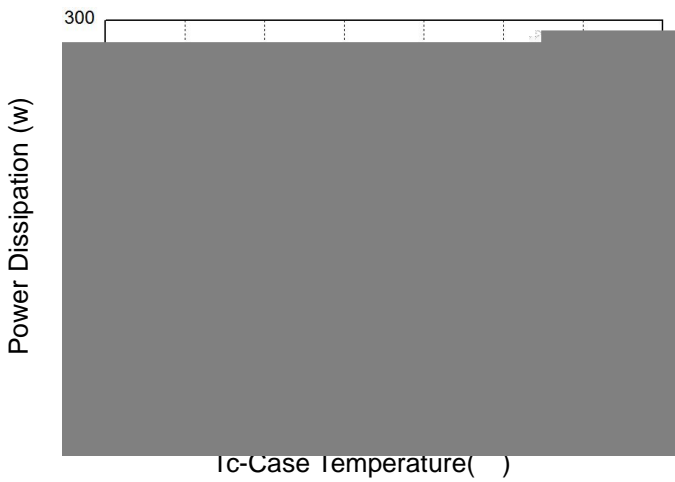


Figure 2: Drain Current

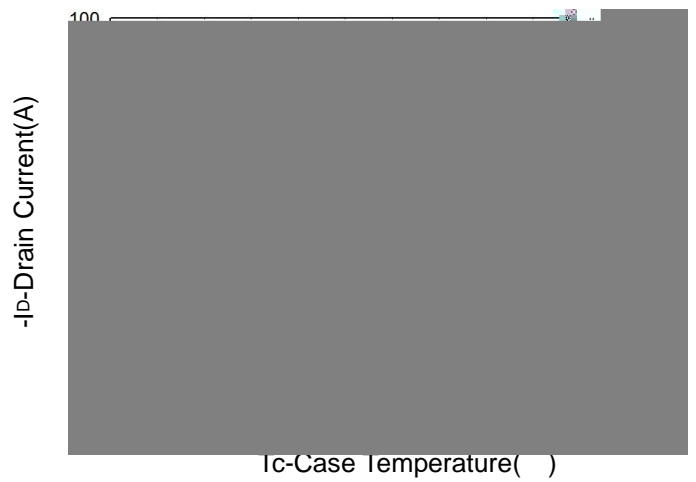


Figure 3: Safe Operation Area

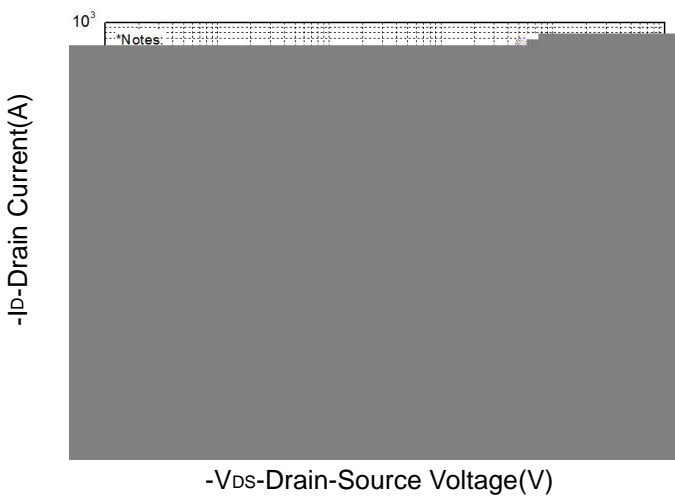


Figure 4: Thermal Transient Impedance

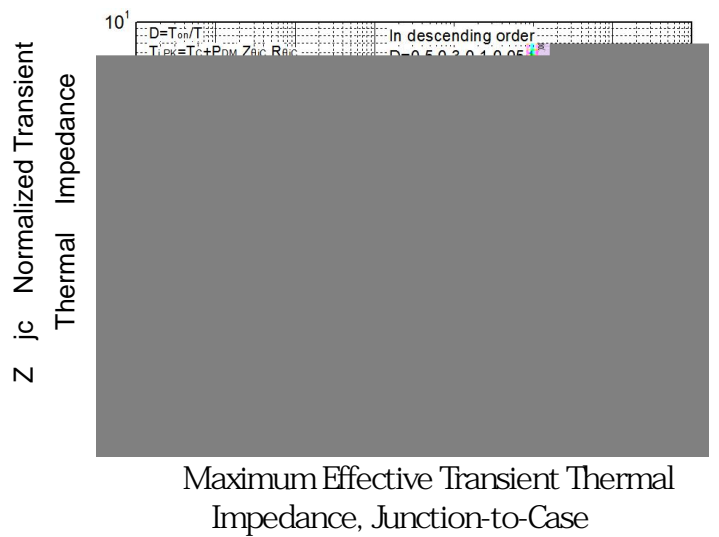


Figure 5: Output Characteristics

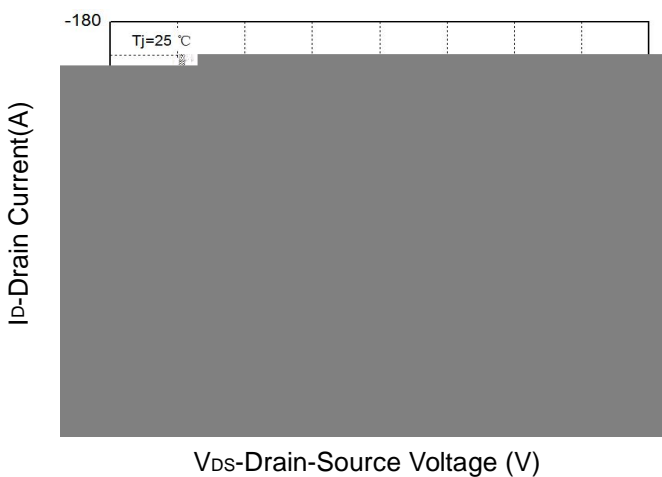
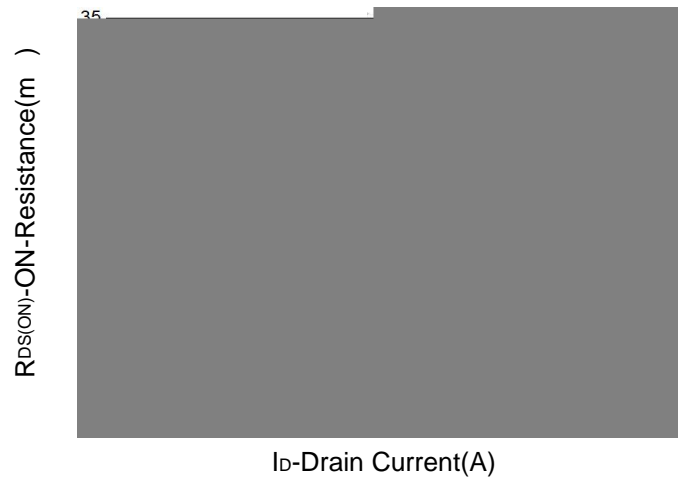


Figure 6: Drain-Source On Resistance



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Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

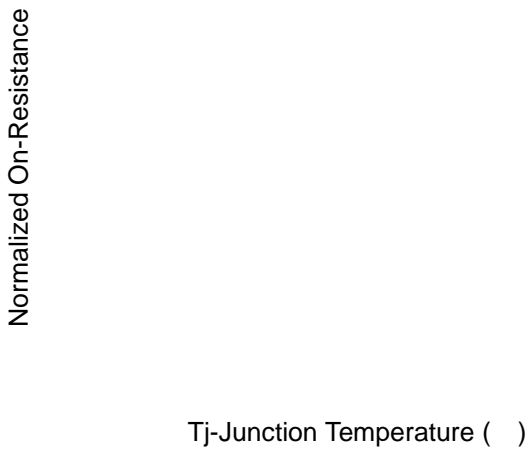


Figure 8: Source-Drain Diode Forward

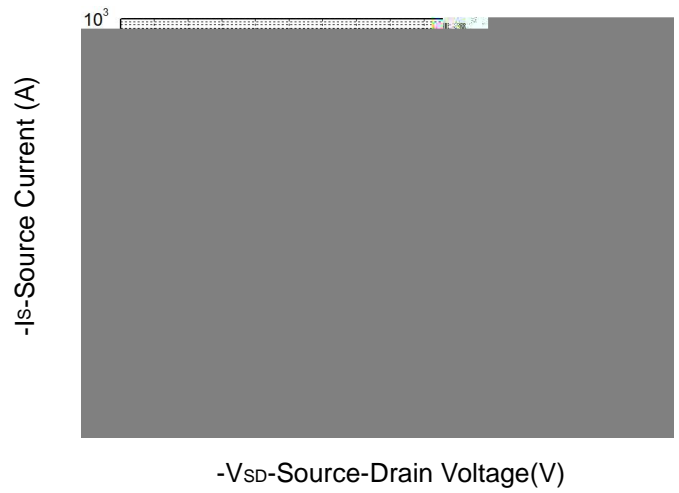


Figure 9: Capacitance Characteristics

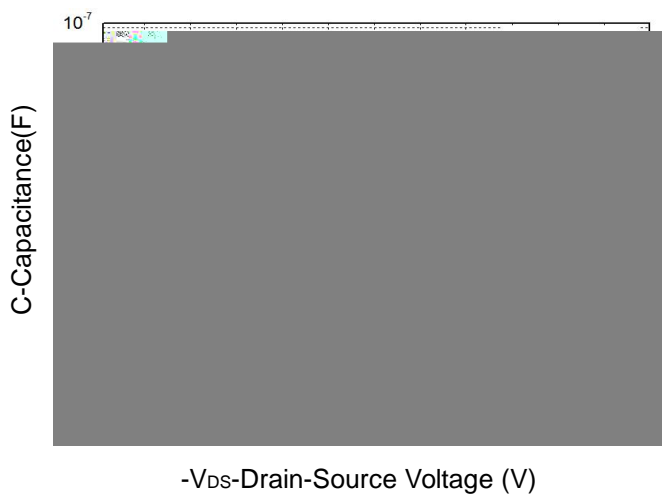
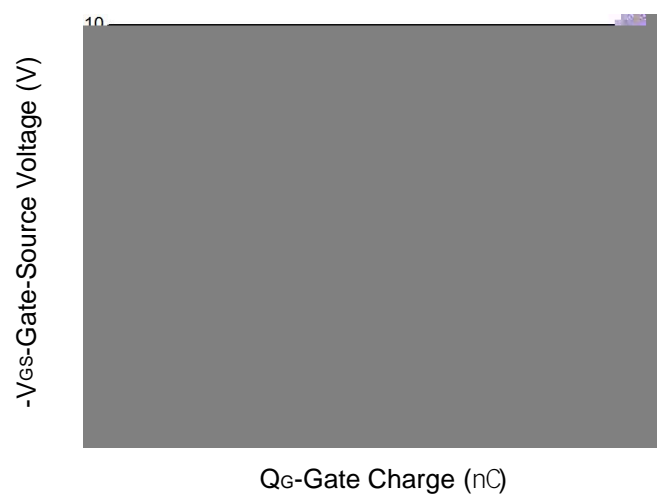
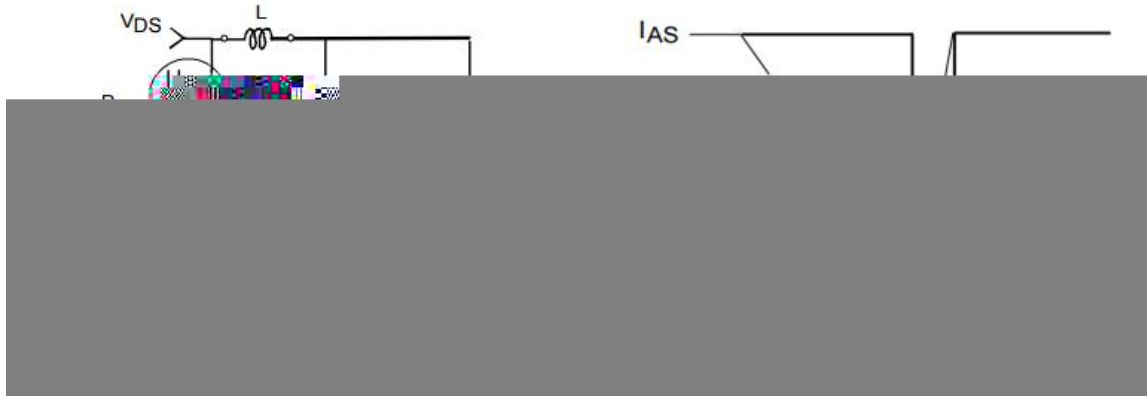


Figure 10: Gate Charge Characteristics



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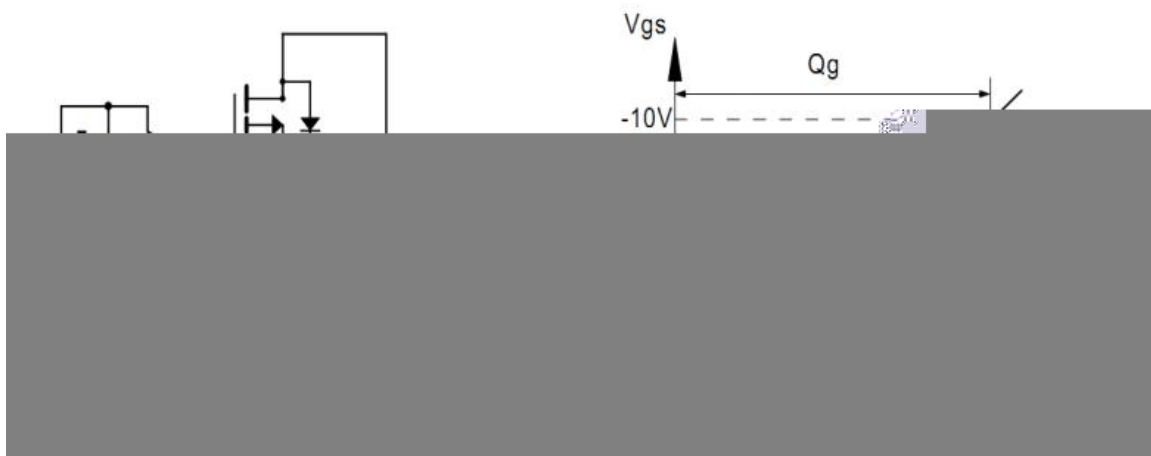
Avalanche Test Circuit and Waveforms



Switching Time Test Circuit and Waveforms



Gate Charge Test Circuit and Waveforms



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Device Per Unit

Package Type	Unit	Quantity
TO-220FB-3L	Tube	50
TO-263-2L	Tube	50
TO-263-2L	Reel	800

Package Information

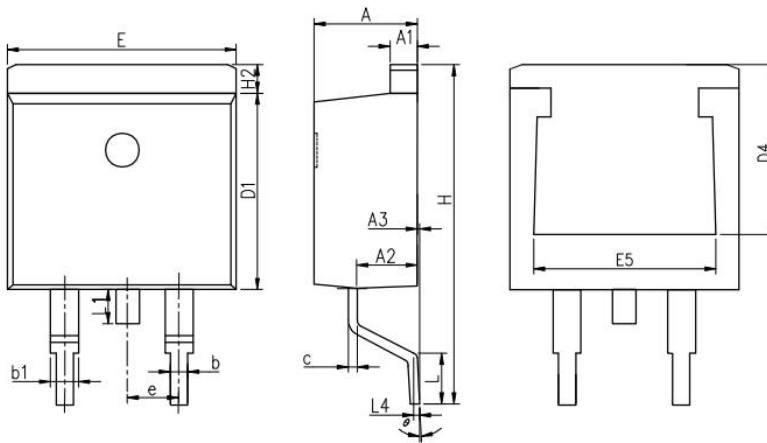
TO-220FB-3L



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.25	1.30	1.45
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.40	0.50	0.65
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
P	3.40	3.60	3.80
Q	2.60	2.80	3.00

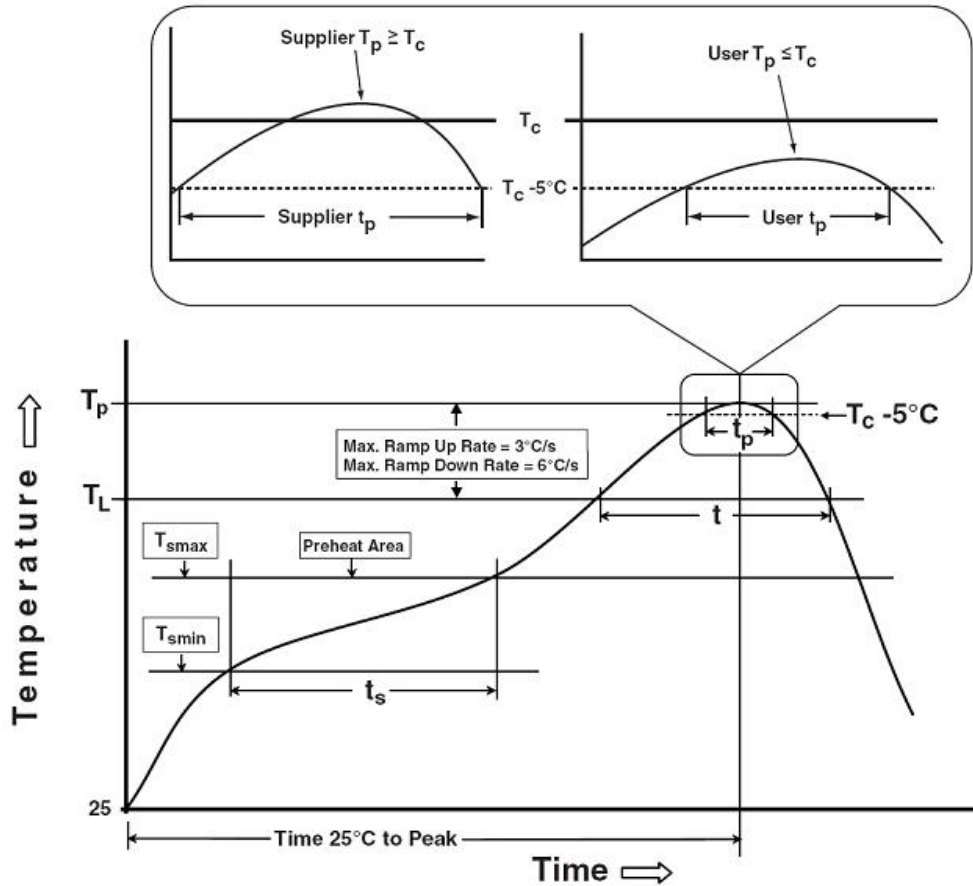
TO-263-2L



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0	0.13	0.25
b	0.7	0.81	0.96
b1	1.17	1.27	1.47
c	0.3	0.38	0.53
D1	8.5	8.7	8.9
D4	6.6	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54 BSC		
H	14.7	15.1	15.5
H2	1.07	1.27	1.47
L	2	2.3	2.6
L1	1.4	1.55	1.7
L4	0.25 BSC		
	0°	5°	9°

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	

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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 Hrs/500hr/1000hr, Bias @ 150°C
HTGB	JESD-22, A108	168 Hrs/500hr/1000hr, V _{gs} 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

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