MSU115N06G

N-Channel Enhancement Mode MOSFET

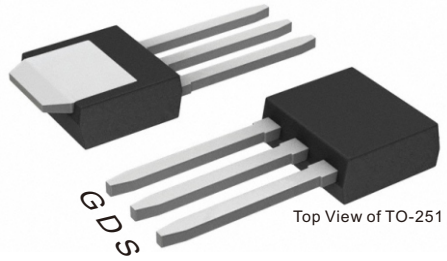
■ Features

- 60V/58A
  $R_{DS(ON)}$ = 11.5mΩ (max.) @ V_{GS}= 10V
  $R_{DS(ON)}$ = 14.5mΩ (max.) @ V_{GS}= 4.5V
- Reliable and Rugged.
- Lead free and green device available (RoHS compliant).
- 100% UIS + R_g Tested

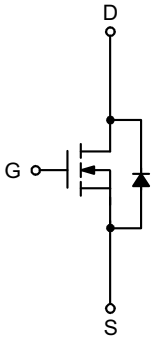
■ Application

- DC-DC converter.
- Power Load Switching Application.

■ Pin Description



Top View of TO-251



■ Absolute Maximum Ratings (T_A = 25°C unless otherwise specified)

PARAMETER	CONDITIONS	Symbol	MSU115N06G	UNIT
Drain-Source Voltage		V_{DSS}	60	V
Continuous Drain Current	T_C = 25°C	I_D	58	A
	T_C = 100°C		37	
Pulsed Drain Current(Note:1)	T_C = 25°C	I_{DM}	230	
Gate-Source Voltage		V_{GSS}	±20	V
Diode Continuous Forward Current	T_C = 25°C	I_S	30	A
Avalanche Current, single pulse (Note:2)	L=0.5mH	I_{AS}	20	A
Avalanche Energy, single pulse (Note:2)	L=0.5mH	E_{AS}	100	mJ
Maximum Power Dissipation	T_C = 25°C	P_D	83	W
	T_C = 100°C		33	
Thermal Resistance-Junction to Ambient(Note:3)	Steady State	$R_{\theta JA}$	50	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 ~ +150	°C
Maximum Power Dissipation	T_A = 25°C	P_D	2.5	W
	T_A = 70°C		1.6	
Continuous Drain Current	T_A = 25°C	I_D	10	A
	T_A = 70°C		8	
Thermal Resistance-Junction to Case(Note:3)	Steady State	$R_{\theta JC}$	1.5	°C/W

NOTE : 1.Repetitive rating; pulse width limited by maximum junction temperature.
2.UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature T_J =25°C).
3.surface mounted on 1 inch per square pad area.

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■ Electrical characteristics(T_A = 25°C unless otherwise specified)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_{DS} = 250μA	BV_{DSS}	60			V
Gate Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = 250μA	$V_{GS(th)}$	1	2	3	V
Zero Gate Voltage Drain Current	V_{DS} = 48V, V_{GS} = 0V	I_{DSS}			1	μA
	V_{DS} = 48V, V_{GS} = 0V, T_J = 85°C				30	
Gate Leakage Current	V_{GS} = ±20V, V_{DS} = 0V	I_{GSS}			±100	nA
Drain-Source On-state Resistance(Note:4)	V_{GS} = 10V, I_{DS} = 25A	$R_{DS(on)}$		9.5	11.5	mΩ
	V_{GS} = 4.5V, I_{DS} = 25A			11	14.5	

■ Diode Characteristics

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Diode Forward Voltage(Note:4)	I_{SD} = 25A, V_{GS} = 0V	V_{SD}		0.8	1.3	V
Reverse Recovery Time	I_{SD} = 25A, dI_{SD}/dt = 100A/μs	t_{RR}		28		ns
Reverse Recovery Charge		Q_{RR}		30		nC

■ Dynamic Characteristics(Note:5)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Gate Resistance	V_{GS} = 0V, V_{DS} = 0V f = 1.0MHz	R_G		1		Ω
Input Capacitance	V_{DS} = 30V, V_{GS} = 0V, f = 1.0MHz	C_{iss}		2500	3500	pF
Output Capacitance		C_{oss}		215		
Reverse Transfer Capacitance		C_{rss}		105		
Turn on Delay Time	V_{DD} = 30V, R_L = 30Ω, I_{DS} = 1A V_{GEN}=10V R_G = 6Ω	$t_{d(on)}$		20	36	ns
Turn on Rise Time		t_r		9	16	
Turn off Delay Time		$t_{d(off)}$		55	99	
Turn off Fall Time		t_f		20	36	

■ Gate-Charge Characteristics(Note:5)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Total Gate Charge	V_{DS} = 30V, V_{GS}=4.5V, I_{DS} = 25A	Q_g		20		nC
Total Gate Charge	V_{DS} = 30V, V_{GS}=10V, I_{DS} =25A	Q_g		45	65	
Gate-Source Charge		Q_{gs}		9		
Gate-Drain Charge		Q_{gd}		8.5		

NOTE : 4.Pulse test; pulse width ≤ 300μs, duty cycle ≤ 2%.
5.Guranteed by design, not subject to production testing.

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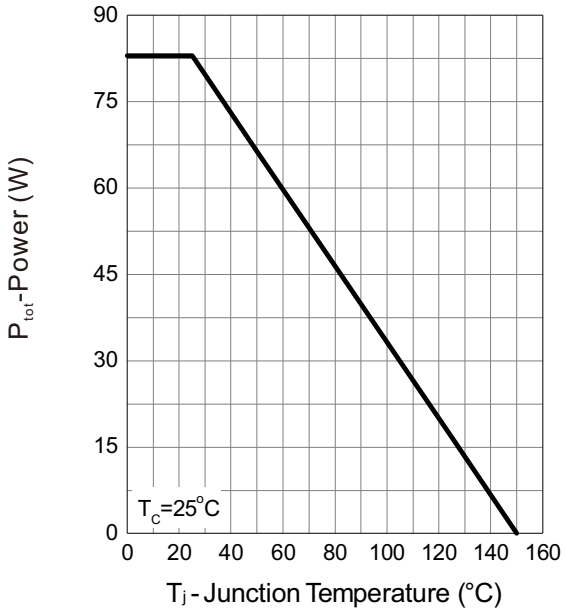
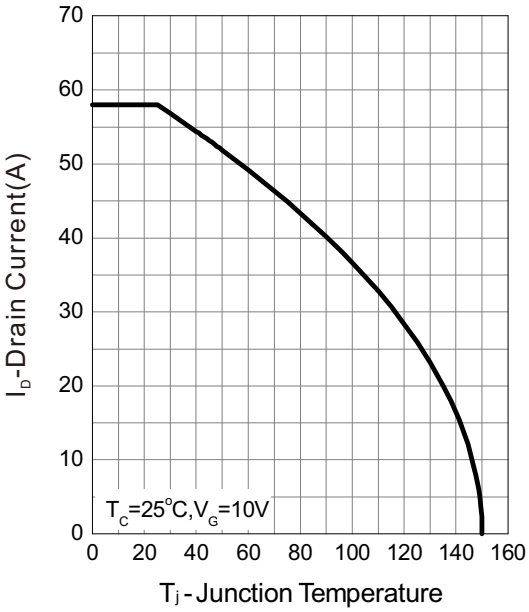
■ Rating and characteristic curves

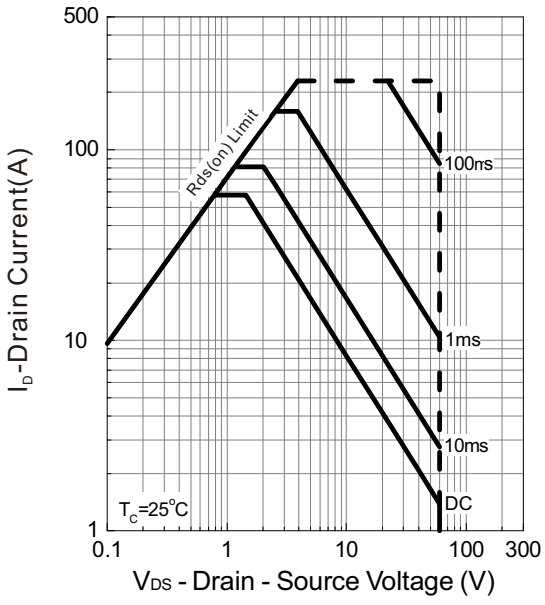
Power Dissipation



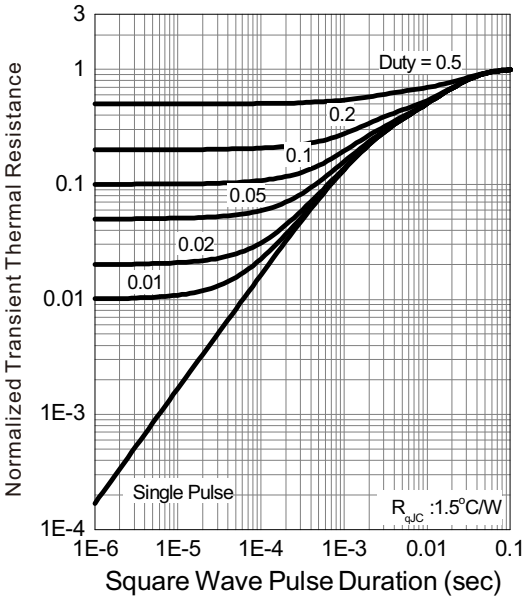
Drain Current



Safe Operation Area



Thermal Transient Impedance



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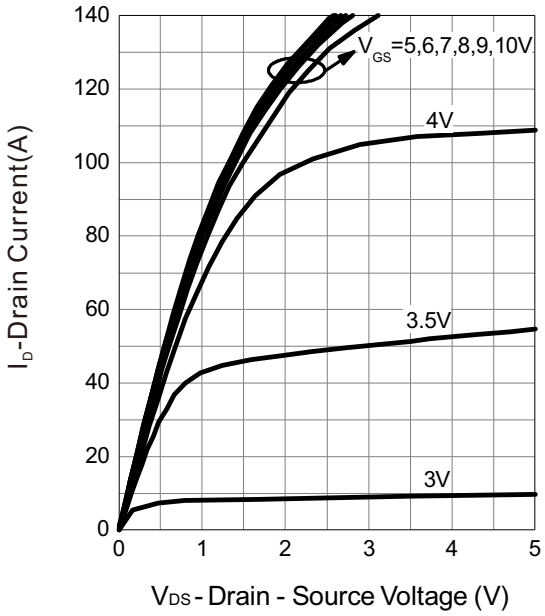
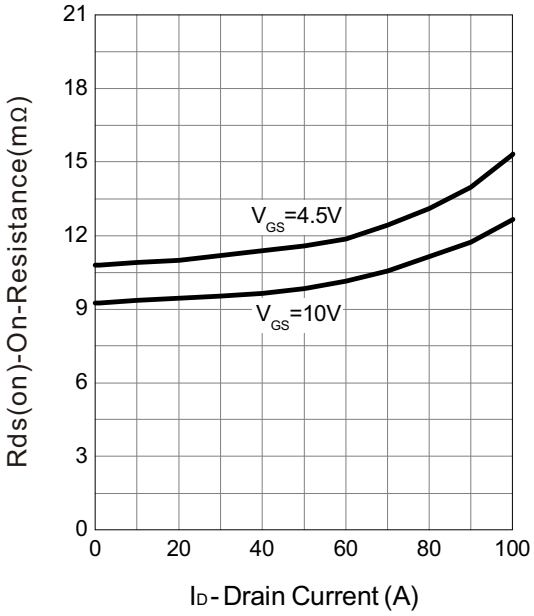
■ Rating and characteristic curves

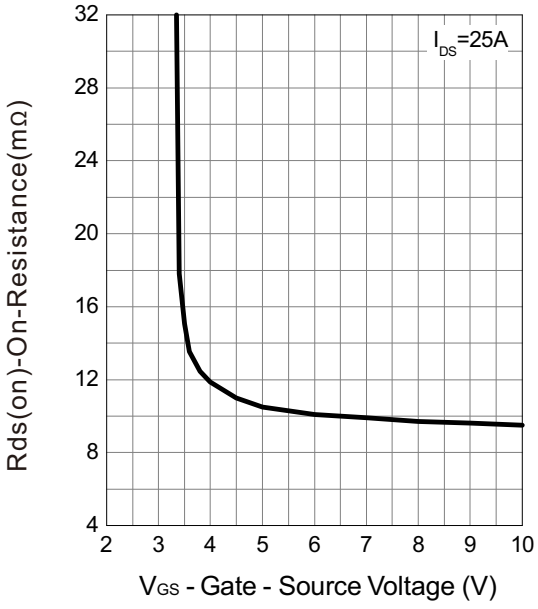
Output Characteristics



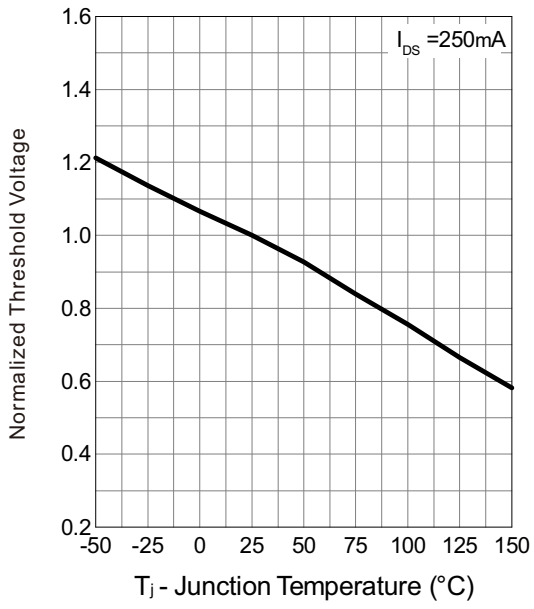
Drain-Source On Resistance



Gate-Source On Resistance



Gate Threshold Voltage



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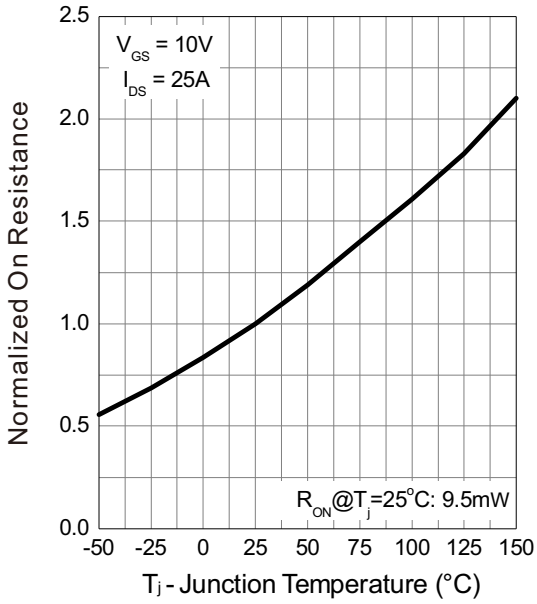
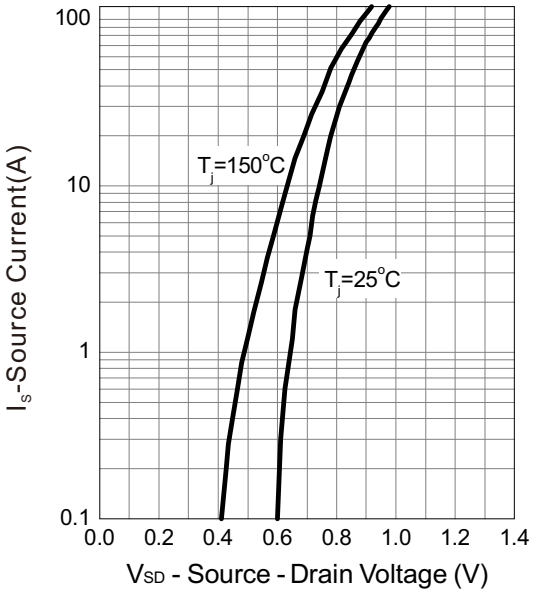
■ Rating and characteristic curves

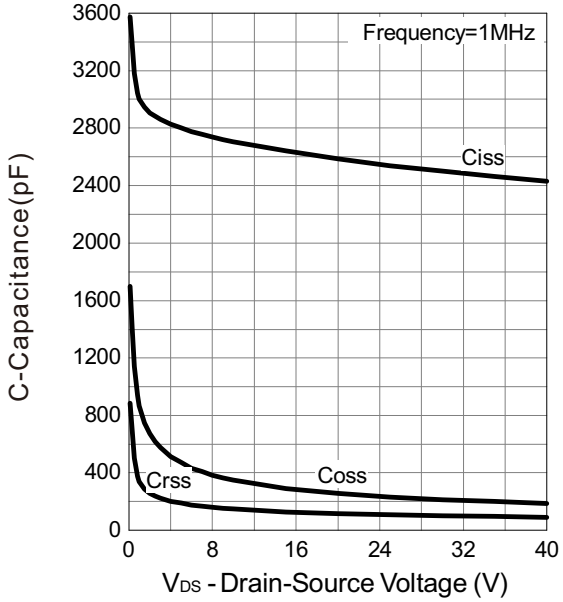
Drain-Source On Resistance



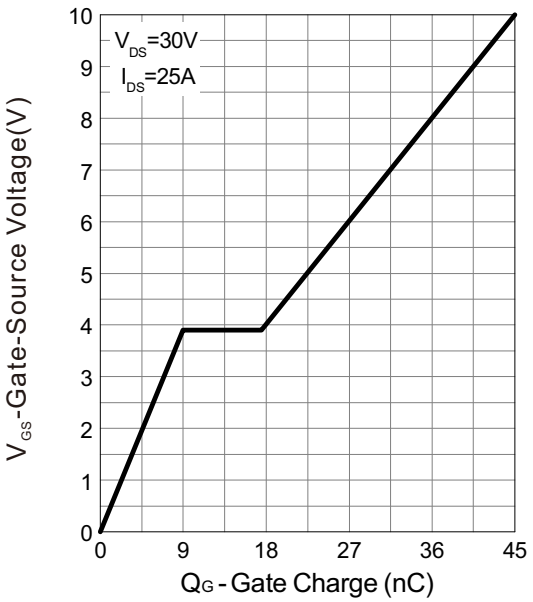
Source-Drain Diode Forward



Capacitance



Gate Charge



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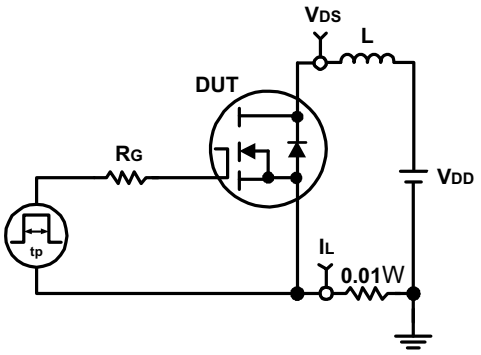
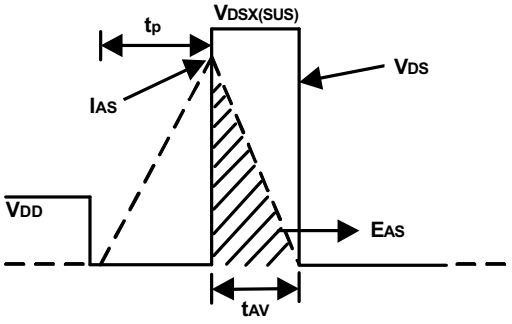
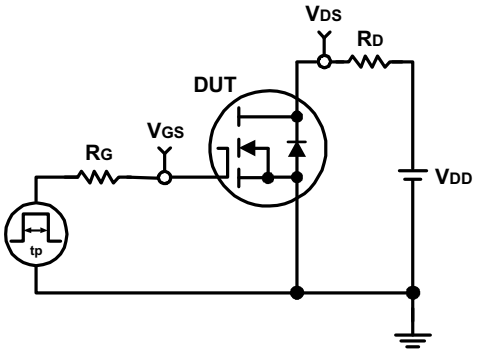
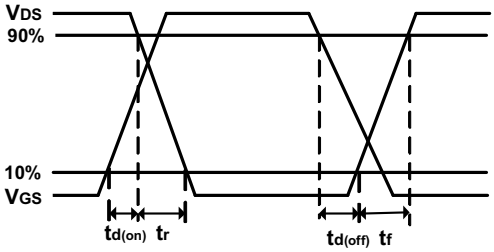
■ Test circuit and waveform









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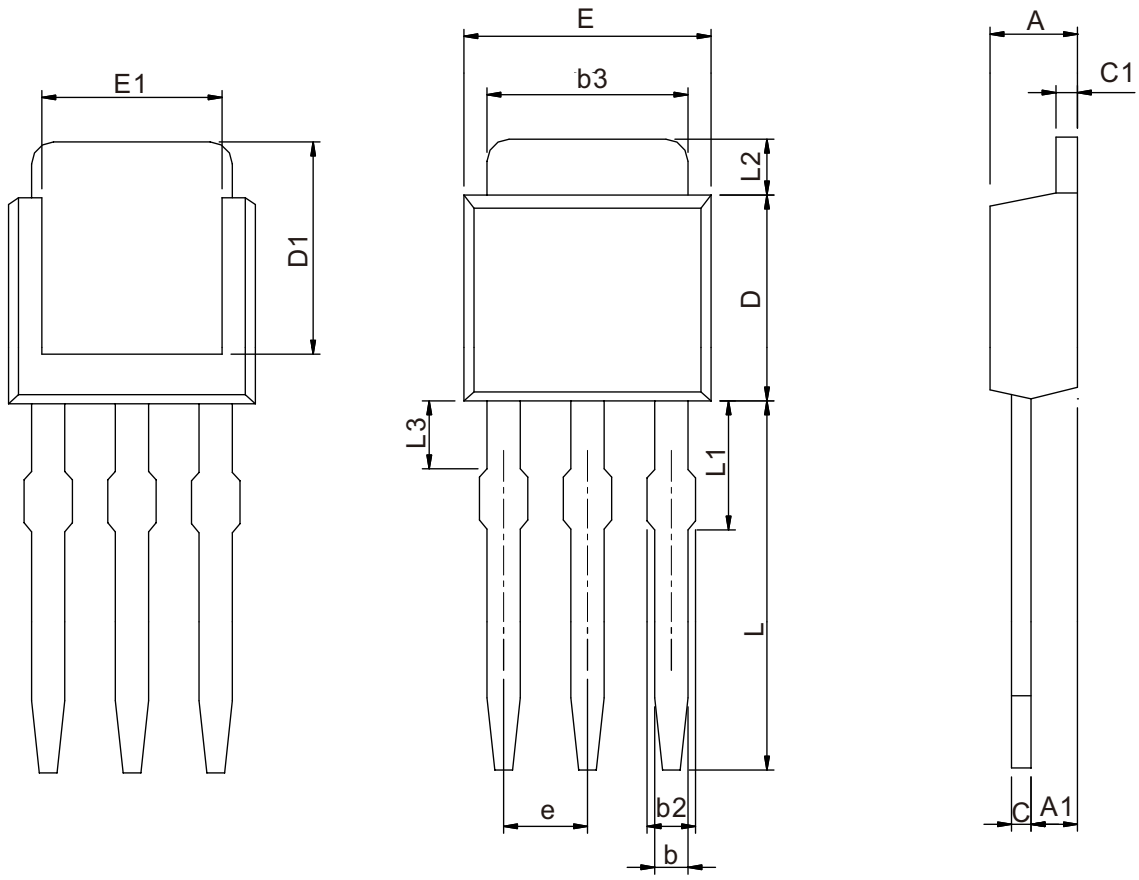
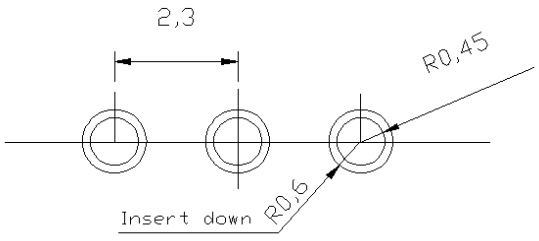
■ Package Information



SYMBOL	TO-251			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.184	2.388	0.086	0.094
A1	0.890	1.143	0.035	0.045
b	0.635	0.890	0.025	0.035
b2	0.910	1.143	0.036	0.045
b3	4.953	5.460	0.195	0.215
c	0.457	0.610	0.018	0.024
c1	0.457	0.890	0.018	0.035
D	5.334	6.223	0.210	0.245
D1	5.207	-	0.205	-
E	6.350	6.730	0.250	0.265
E1	4.320	-	0.170	-
e	2.29BSC		0.090BSC	
L	7.000	9.650	0.280	0.380
L1	1.905	2.290	0.075	0.090
L2	0.890	1.270	0.035	0.050
L3	1.143	1.520	0.045	0.060

RECOMMENDED LAND PATTERN



UNIT: mm

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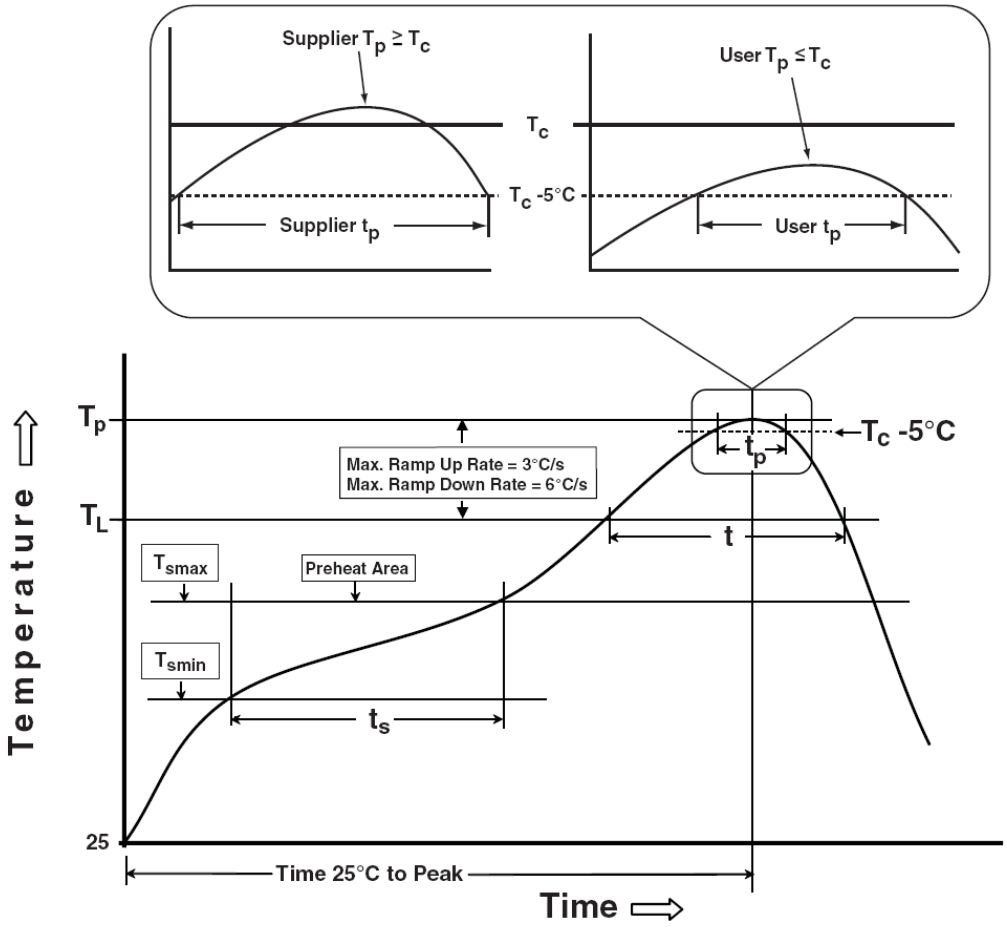
■ Classification Profile



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■ Classification Reflow Profile

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (T_{smin}) Temperature max (T_{smax}) Time (T_{smin} to T_{smax}) (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	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
HTRB	JESD-22, A108	1000 Hrs, 80% of VDS max @ Tjmax
HTGB	JESD-22, A108	1000 Hrs, 100% of VGS max @ Tjmax
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C

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