

**•General Description**

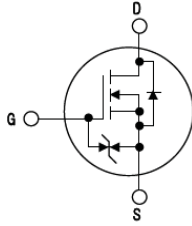


The SJ MOSFET LH65R130 has the low  $R_{DS(on)}$ , low gate charge, fast switching and excellent avalanche characteristics. This device offers extremely fast and robust body diode, and is suitable for telecom and power supplies.

**•Features**

- Excellent stability and uniformity
- Much lower FOM for fast switching efficiency
- Build-in ESD Diode

**•Application**

- LED/LCD/PDP TV and monitor Lighting
- Power Supplies

	<b><math>V_{DS} = 650V</math></b>  <b><math>R_{DS(ON)} = 130m\Omega</math></b>  <b><math>I_D = 25A</math></b>
 TO-220F	 TO-220

■ RoHS COMPLIANT

**•Ordering Information:**

Part number	LH65R130	LH65R130
Package	TO-220	TO-220F
Basic ordering unit (pcs)	1000	1000
Normal Package Material Ordering Code	LH65R130T-TO220-TU	LH65R130F-TO220F-TU
Halogen Free Ordering Code	LH65R130T-TO220-TU-HF	LH65R130F-TO220F-TU-HF

**•Absolute Maximum Ratings (TC = 25°C)**

PARAMETER	SYMBOL	Value	UNIT
Drain-Source Breakdown Voltage	$BV_{DSS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	TC = 25°C	25
		TC = 100°C	15.8
Pulsed drain current (TC = 25°C, tp limited by Tjmax) <sup>1</sup>	$I_D$ pulse	75	A
Single Pulse Avalanche Energy <sup>1</sup>	$E_{AR}$	3.3	A
Single Pulse Avalanche Energy <sup>2</sup>	$E_{AS}$	470	mJ
Repetitive Avalanche Energy <sup>1</sup>	$E_{AR}$	0.7	mJ
Power Dissipation(TC=25°C)	$P_D$	34	W
Gate Sourced ESD(HMB-C=100pF,R=1.5KΩ)	$V_{ESD(G-S)}$	2000	V
MOSFET dv/dt ruggedness, $V_{DS}=0 \dots 480V$	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0 \dots 480V, I_{SD} \leq I_D$	dv/dt	15	V/ns
Operating Temperature and Storage Temperature Range	$T_J/T_{STG}$	-55~+150	°C

**●Electronic Characteristics**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	--	--	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	--	4.0	V
Drain-source On Resistance <sup>3</sup>	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 7A$	--	115	130	mΩ
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ C$	--	--	1	μA
		$V_{DS} = 650V, V_{GS} = 0V, T_J = 125^\circ C$	--	--	100	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS} = 20V$	--	--	1	μA
		$V_{GS} = -20V$	--	--	-1	μA
Input Capacitance	$C_{iss}$	$V_{GS} = 0V, V_{DS} = 400V, f = 1.0MHz$	--	2840	--	pF
Output Capacitance	$C_{oss}$		--	61	--	
Reverse transfer Capacitance	$C_{rss}$		--	3.8	--	
Turn-on delay time	$T_d(on)$	$I_D = 14A, V_{DD} = 320V, R_G = 25\Omega$	--	56	--	nS
Rise time	$T_r$		--	31	--	
Turn -Off Delay Time	$T_d(off)$		--	250	--	
Fall time	$T_f$		--	20	--	
Total Gate Charge	$Q_g$	$I_D = 14A, V_{DS} = 520V, V_{GS} = 10V$	--	65	---	nC
Gate-to-Source Charge	$Q_{gs}$		--	12	--	
Gate-to-Drain Charge	$Q_{gd}$		--	19	---	
Continuous Diode Forward Current	$I_S$		--	--	25	A
Pulsed Diode Forward Current	$I_{SM}$		--	--	75	A
Diode Forward Voltage	$V_{SD}$	$T_J = 25^\circ C, I_S = 14.3A, V_{GS} = 0V$	--	--	1.3	V
Reverse Recovery Time	$t_{rr}$	$V_{RR} = 400V, I_f = I_S, di_f/dt = 100A/\mu s$	--	450	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	7.8	--	μC
Peak Reverse Recovery Current	$I_{RRM}$		--	25	--	A

**●Thermal Characteristics**

PARAMETER	SYMBOL	MAX	UNIT
Thermal Resistance Junction-case	$R_{thJC}$	3.7	°C/W
Thermal Resistance Junction-ambient	$R_{thJA}$	80	°C/W

Notes:

<sup>1</sup> Repetitive Rating: Pulse width limited by maximum junction temperature.

<sup>2</sup>  $I_{AS} = 3.3A, V_{DD} = 100V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$ 
<sup>3</sup> Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

• Typical Characteristics  $T_J=25^\circ\text{C}$ , unless otherwise noted

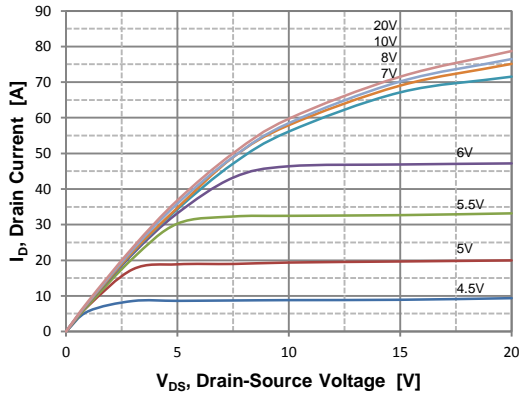


Figure 1. On Region Characteristics

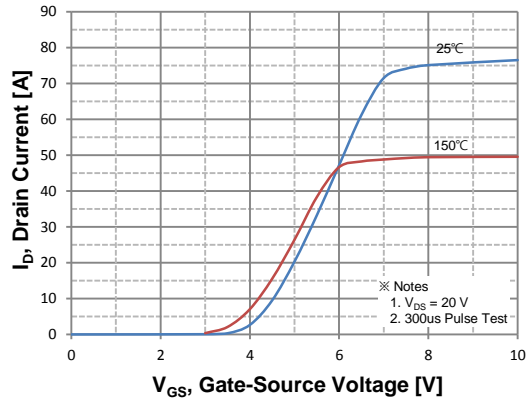


Figure 2. Transfer Characteristics

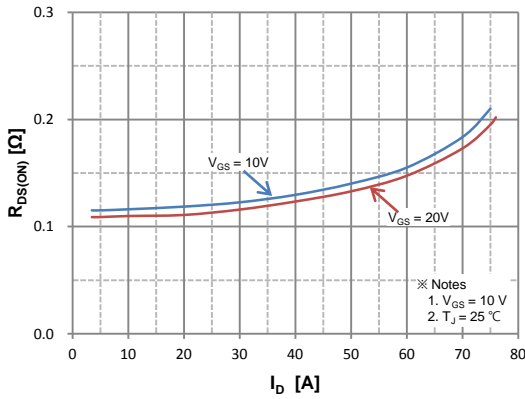


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

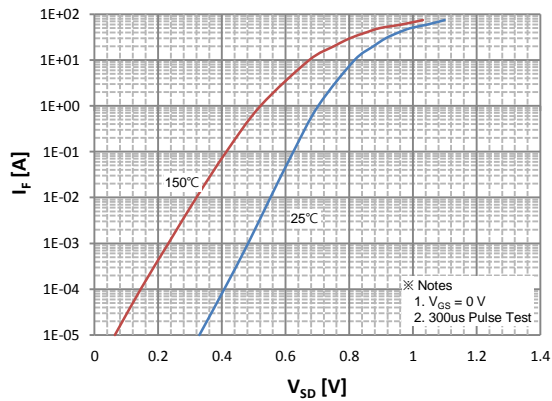


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

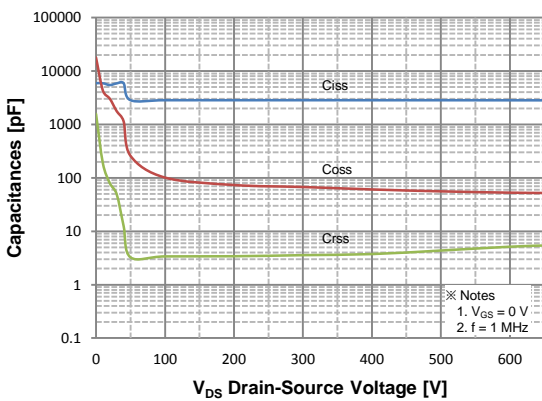


Figure 5. Capacitance Characteristics

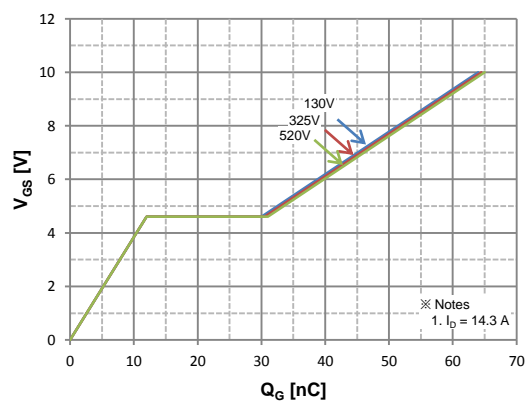
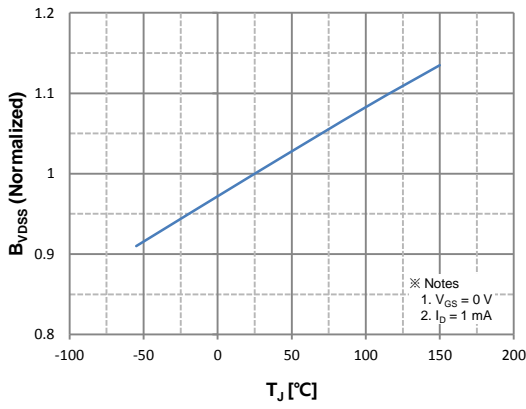
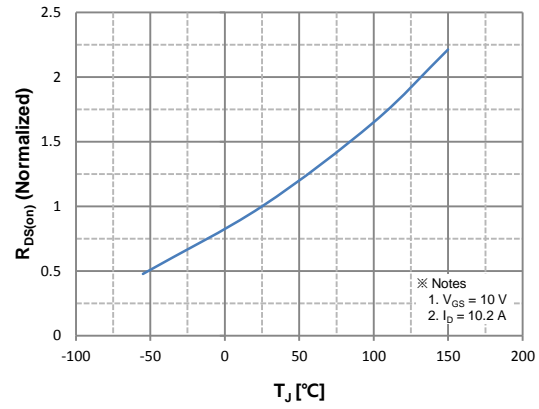


Figure 6. Gate Charge Characteristics

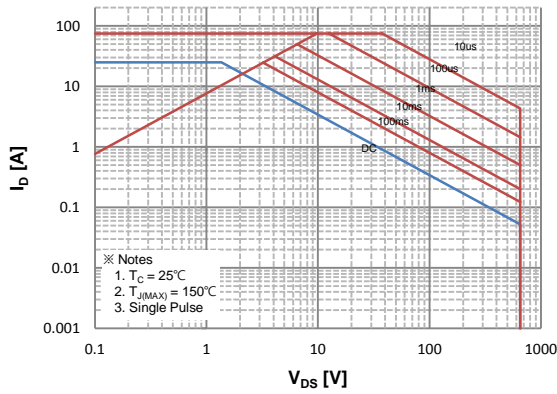
● **Typical Characteristics** (Cont.)



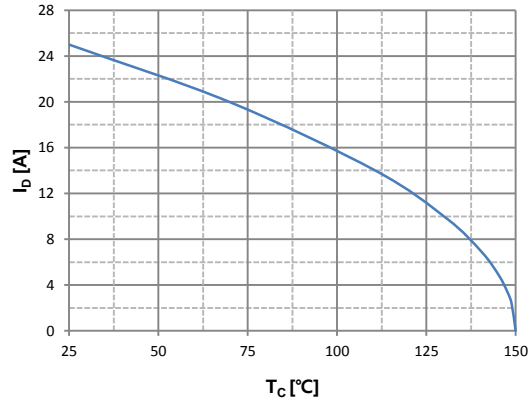
**Figure 7. Breakdown Voltage Variation vs. Temperature**



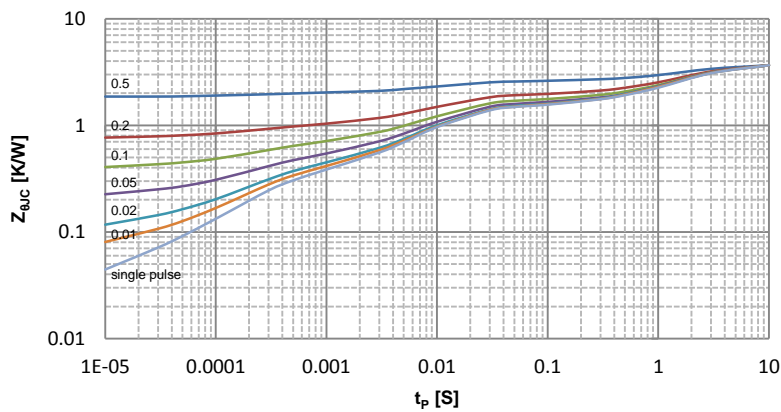
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**

• Test Circuits and Waveforms

Fig 1. Gate Charge Test Circuit & Waveform

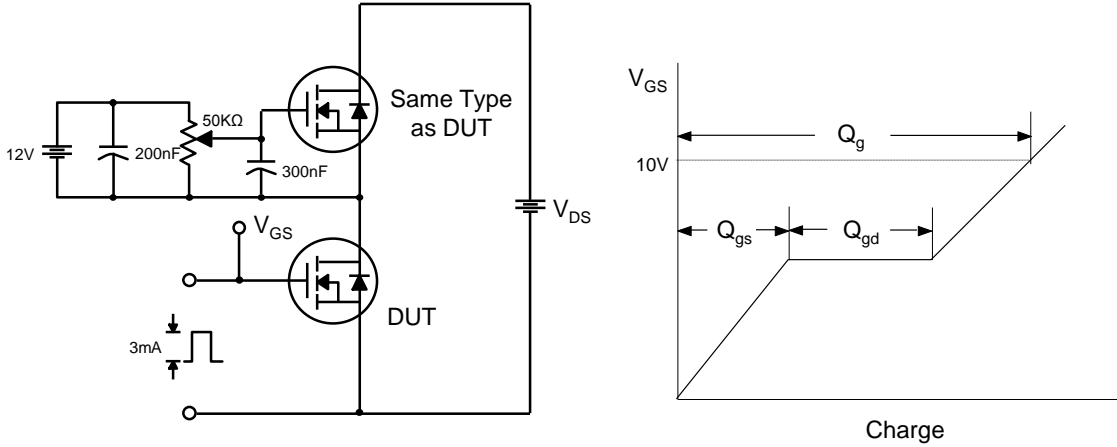


Fig 2. Resistive Switching Test Circuit & Waveforms

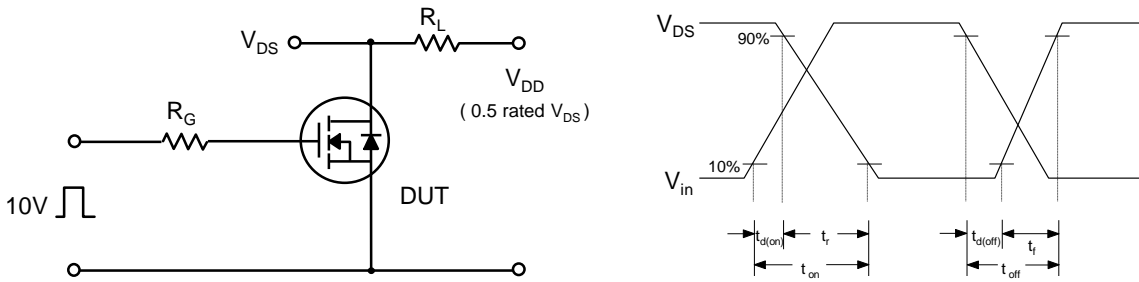
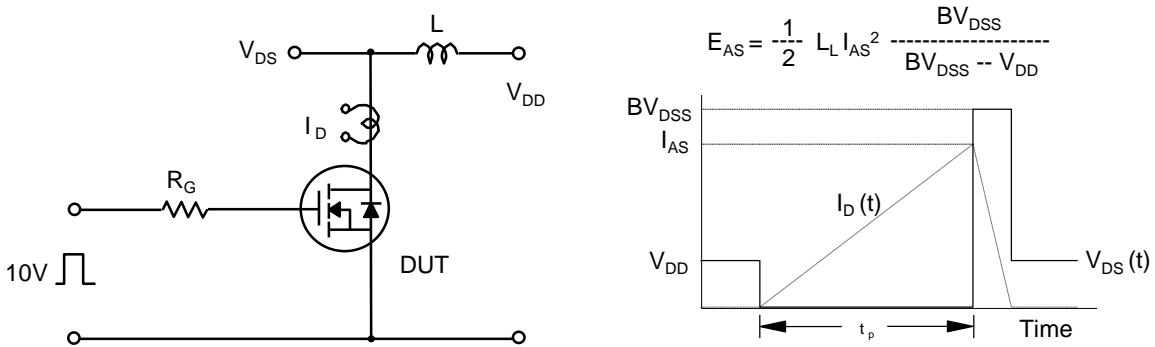
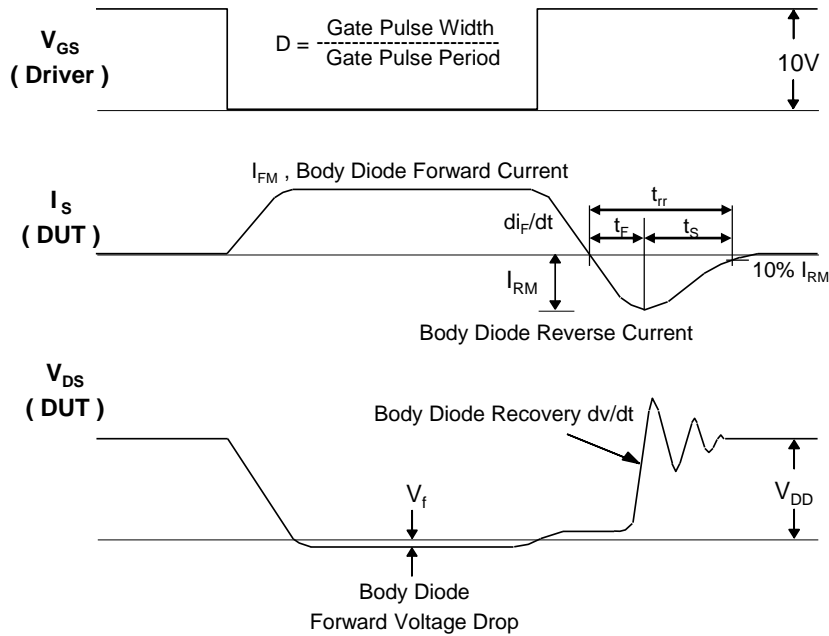
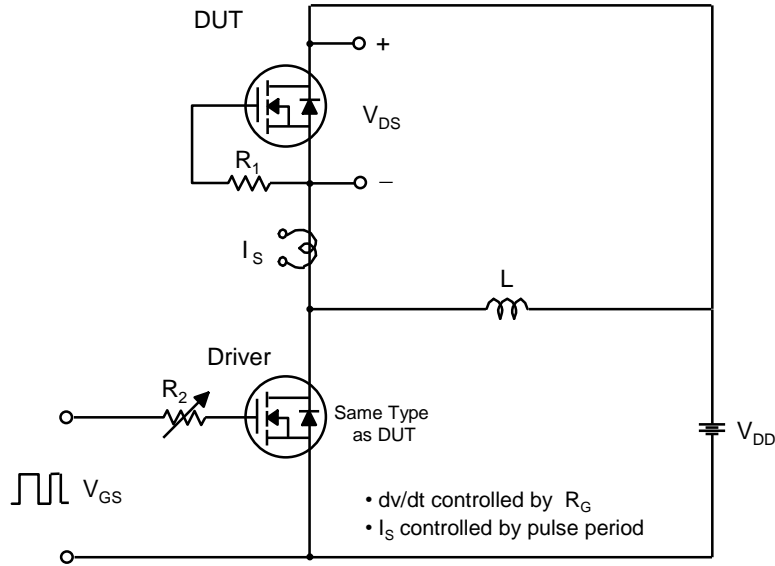


Fig 3. Unclamped Inductive Switching Test Circuit & Waveforms



• Test Circuits and Waveforms

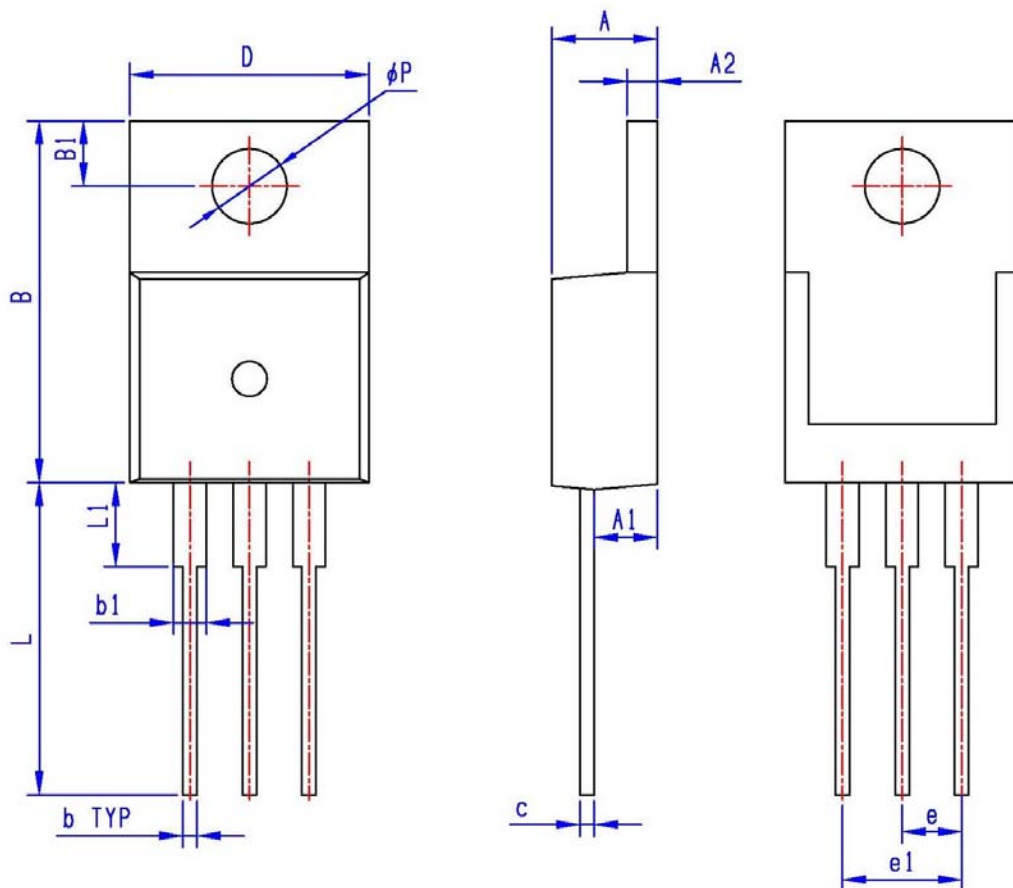
Fig 4. Peak Diode Recovery dv/dt Test Circuit & Waveforms



**●Dimensions (TO-220)**

UNIT:mm

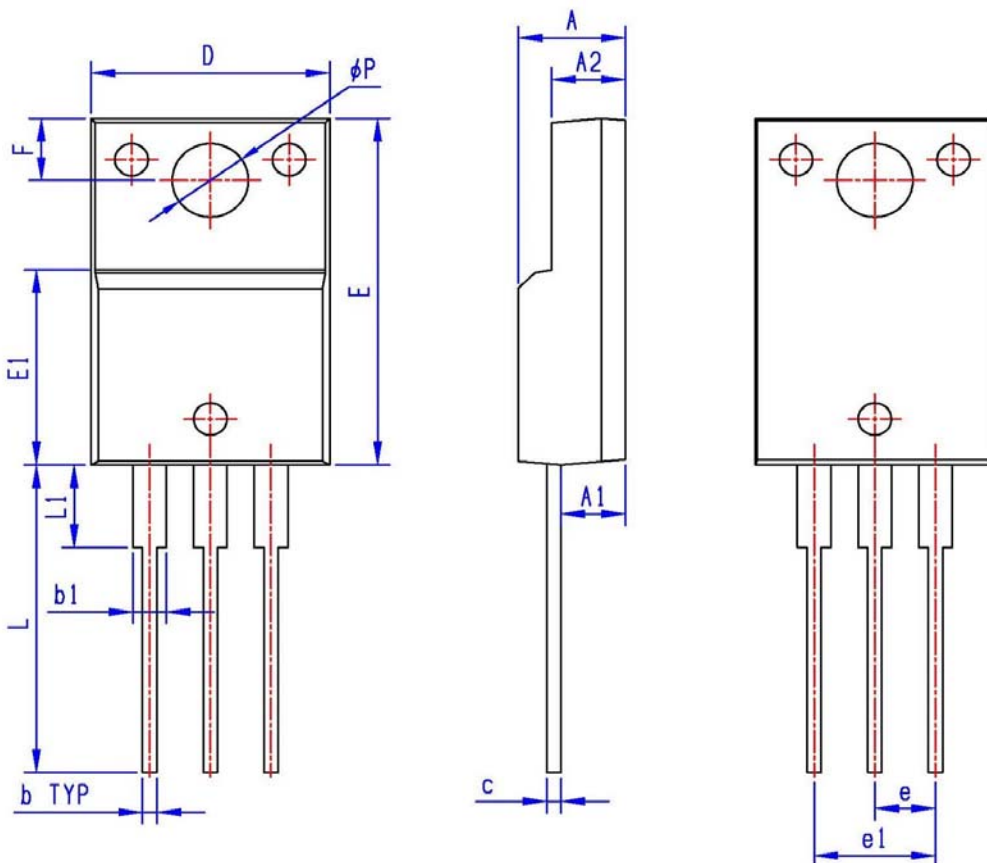
SYMBOL	min	max	SYMBOL	min	max
A	4.25	4.85	B1	2.60	3.00
A1	2.30	3.00	e	2.40	2.70
A2	1.20	1.40	e1	4.95	5.25
b	0.60	0.90	L	12.60	14.40
b1	1.10	1.70	L1	2.40	4.00
c	0.40	0.70	∅P	3.50	3.90
D	9.80	10.60			
B	15.20	16.20			



●Dimensions (TO-220F)

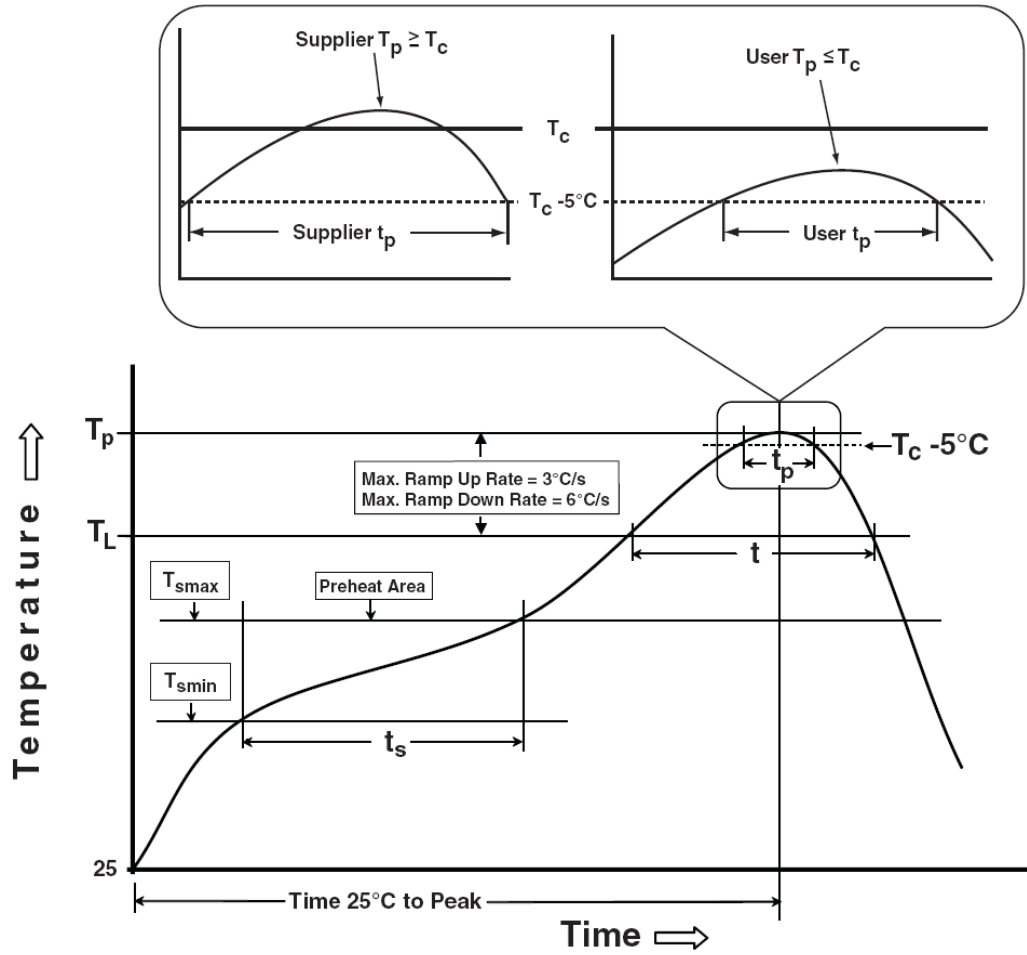
UNIT:mm

SYMBOL	min	max	SYMBOL	min	max
A	4.20	4.80	E1	8.30	8.70
A1	2.50	2.90	e	2.40	2.70
A2	2.90	3.30	e1	4.95	5.25
b	0.40	0.80	F	2.50	2.90
b1	1.10	1.50	L	13.00	14.00
c	0.50	0.70	L1	3.00	4.00
D	9.80	10.60	∅P	2.90	3.50
E	14.60	15.60			





● Classification Profile



**● Classification Reflow Profiles**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b> 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 ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

 Table 2. Pb-free Process – Classification Temperatures ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >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
Solder ability	JESD-22, B012	5 SEC., 245°C
HOLT	JESD-22, A108	1000 HRs, Bias@125°C
PCT	JESD-22, A102	168 HRs, 100% RH, 2ATM, 121°C
TCT	JESD-22, A104	500 Cycles, -65 ~ 150°C