

•General Description

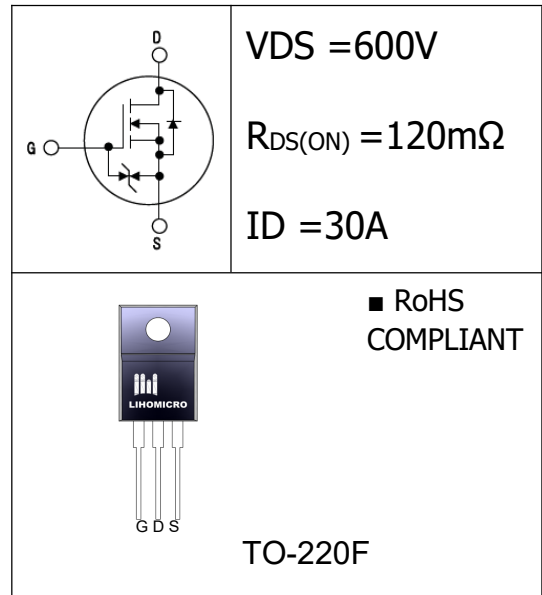
The SJ MOSFET LH60R120 has the low $R_{DS(on)}$, low gate charge, fast switching and excellent avalanche characteristics. This device offers extremely fast and robust body diode, and is suitable for telecom and power supplies.

•Features

- Much lower R_{on} *A performance for On-state efficiency
- Much lower FOM for fast switching efficiency

•Application

- LED/LCD/PDP TV and monitor Lighting
- Solar/Renewable/UPS-Micro Inverter System
- Power Supplies


•Ordering Information:

Part number	LH60R120
Package	TO-220F
Basic ordering unit (pcs)	1000
Normal Package Material Ordering Code	LH60R120F-TO220F-TU
Halogen Free Ordering Code	LH60R120F-TO220F-TU-HF

•Absolute Maximum Ratings (TC = 25°C)

PARAMETER		SYMBOL	Value	UNIT
Drain-Source Breakdown Voltage		BV_{DSS}	600	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current	TC = 25°C	I_D	30	A
	TC = 100°C		25	
Pulsed drain current (TC = 25°C, tp limited by Tjmax) ¹		I_D pulse	65	A
Single Pulse Avalanche Energy ¹		I_{AR}	5.5	A
Single Pulse Avalanche Energy ²		E_{AS}	520	mJ
Repetitive Avalanche Energy ¹		E_{AR}	0.7	mJ
Power Dissipation(TC=25°C)		P_D	34	W
Operating Temperature and Storage Temperature Range		T_J/T_{STG}	-55~+150	°C
MOSFET dv/dt ruggedness, $V_{DS}=0\sim480V$		dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0\sim480V, I_{SD}\leq I_D$		dv/dt	15	V/ns

●Electronic Characteristics

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	600	--	--	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 ³	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 7.5A$	--	0.10	0.12	Ω
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}	$V_{GS} = \pm 30$	--	--	± 100	nA
Forward Transconductance ³	R_G	$f = 1.0MHz$ open drain	--	--	12	Ω
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 100V$ $f = 1.0MHz$	--	1724	--	pF
Output Capacitance	C_{oss}		--	61	--	
Reverse transfer Capacitance	C_{rss}		--	6	--	
Turn-on delay time	$T_d(on)$	$I_D = 25A,$ $V_{DD} = 400V$ $R_G = 25\Omega$	--	15	--	nS
Rise time	T_r		--	59	--	
Turn -Off Delay Time	$T_d(off)$		--	121	--	
Fall time	T_f		--	44	--	
Total Gate Charge	Q_g	$I_D = 25A,$ $V_{DS} = 520V$ $V_{GS} = 10V$	--	38.5	---	nC
Gate-to-Source Charge	Q_{gs}		--	8	--	
Gate-to-Drain Charge	Q_{gd}		--	15	---	
Continuous Diode Forward Current	I_S		--	--	25	A
Pulsed Diode Forward Current	I_{SM}		--	--	60	A
Diode Forward Voltage	V_{SD}	$T_J = 25^\circ C, I_S = 5A$ $V_{GS} = 0V$	--	0.9	1.35	V
Reverse Recovery Time	t_{rr}	$V_{RR} = 400V,$ $I_f = I_S$ $di_F/dt = 100A/\mu s$	--	223	--	ns
Reverse Recovery Charge	Q_{rr}		--	4.3	--	μC

●Thermal Characteristics

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

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.

2. $I_{AS} = 5.5A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ C$

3. 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. Output Characteristics

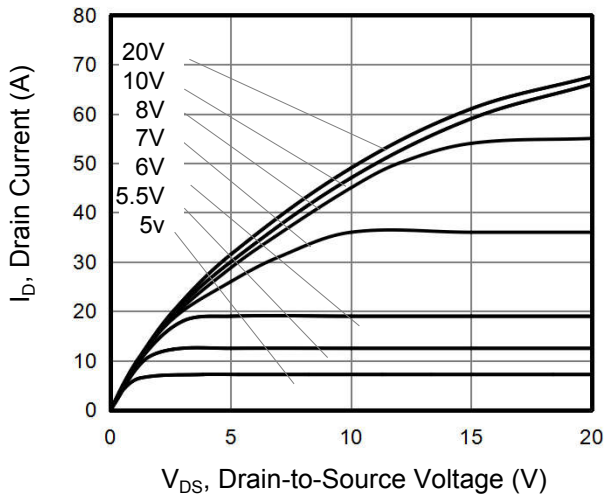


Figure 2. Transfer Characteristics

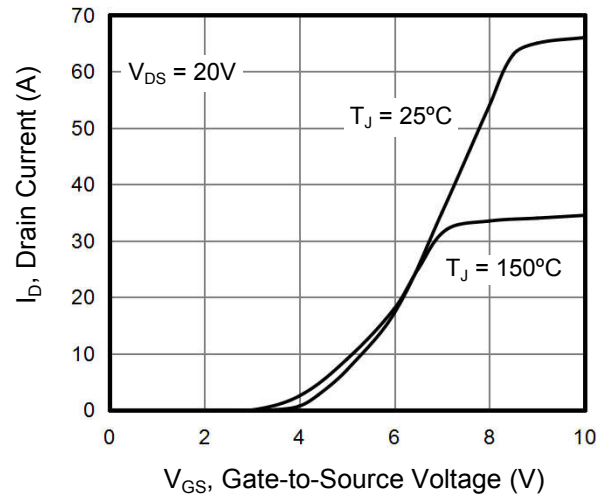


Figure 3. On-Resistance vs. Drain Current

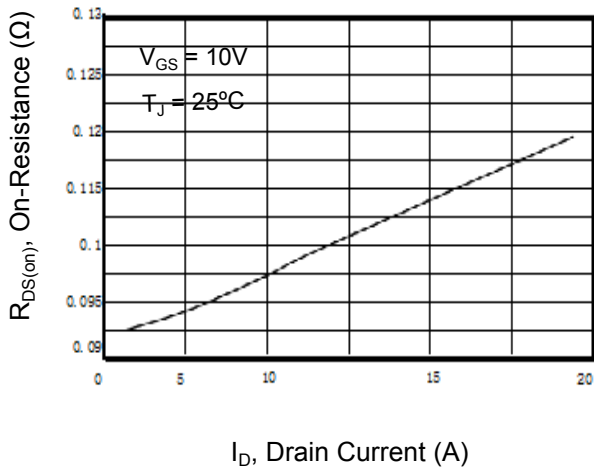


Figure 4. Capacitance

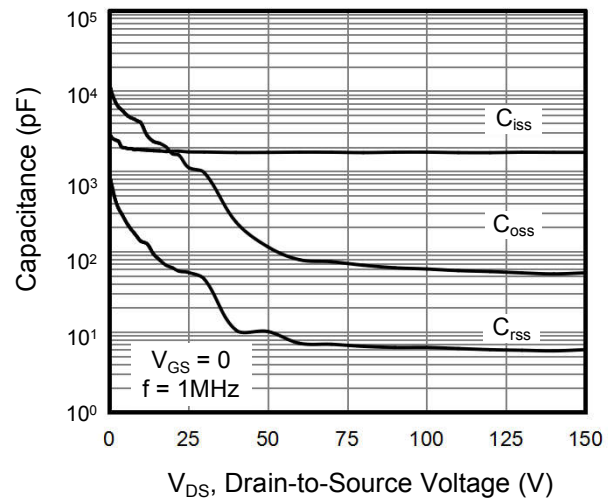


Figure 5. Gate Charge

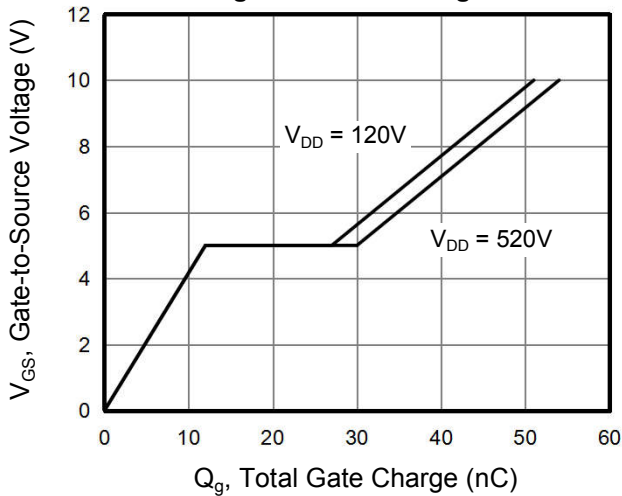
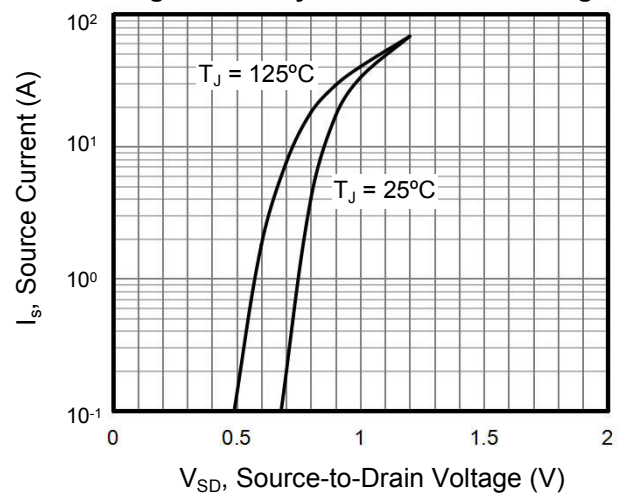


Figure 6. Body Diode Forward Voltage



• **Typical Characteristics** (Cont.)

Figure 7. On-Resistance vs. Junction Temperature

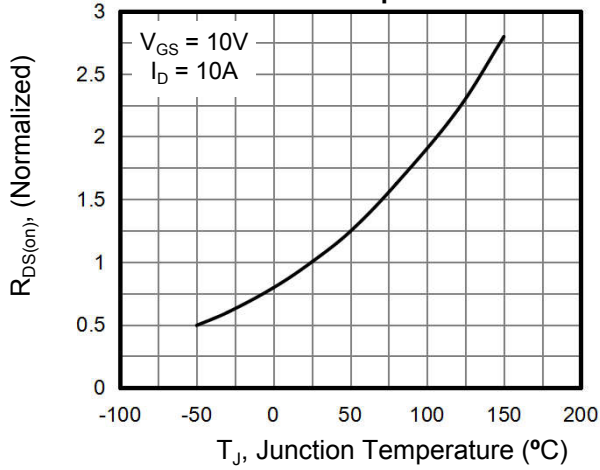


Figure 8. Threshold Voltage vs. Junction Temperature

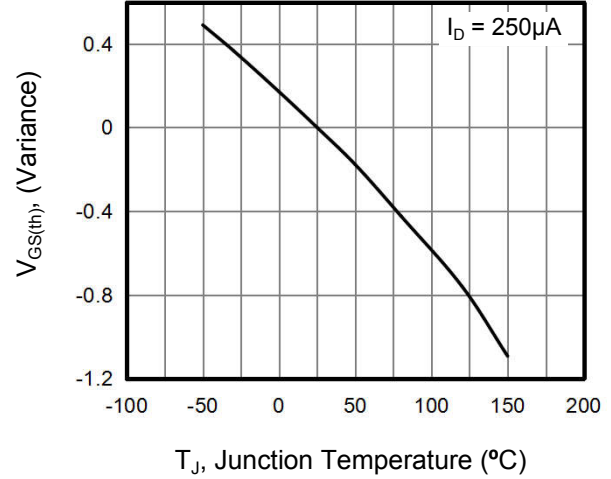


Figure 9. Safe operation area

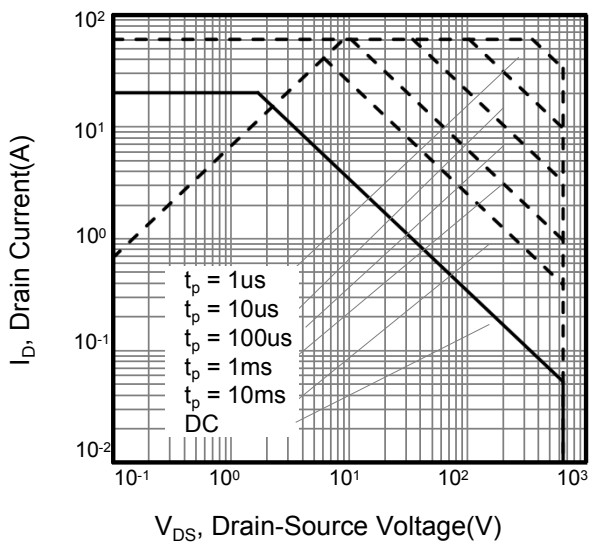
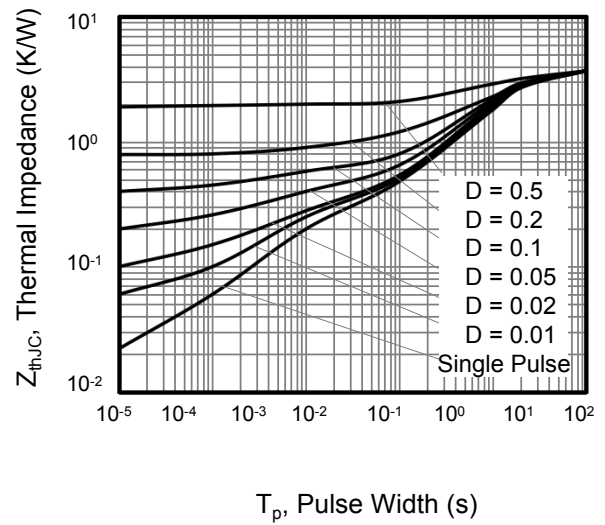


Figure 10. Transient Thermal Impedance



• **Test Circuit and Waveforms**

Figure A: Gate Charge Test Circuit and Waveform

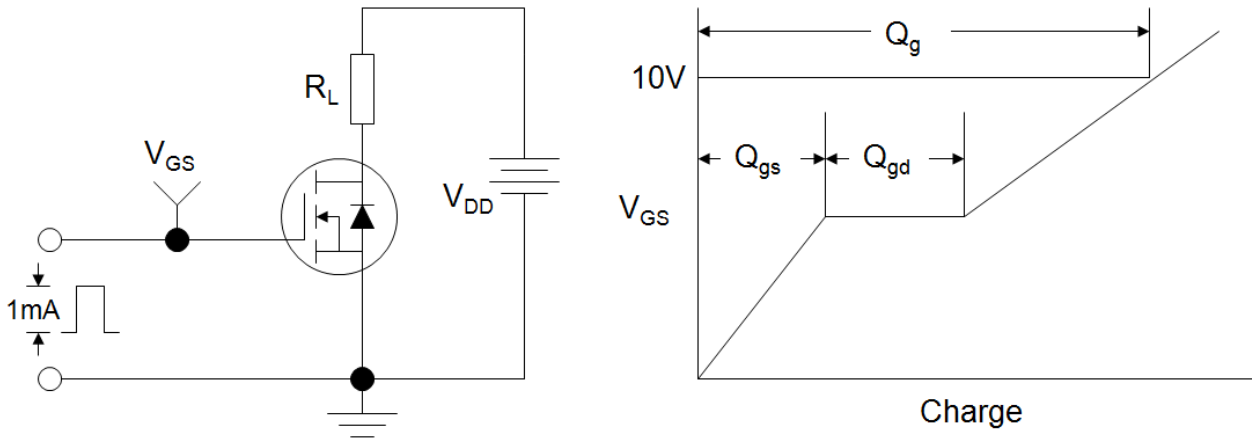


Figure B: Resistive Switching Test Circuit and Waveform

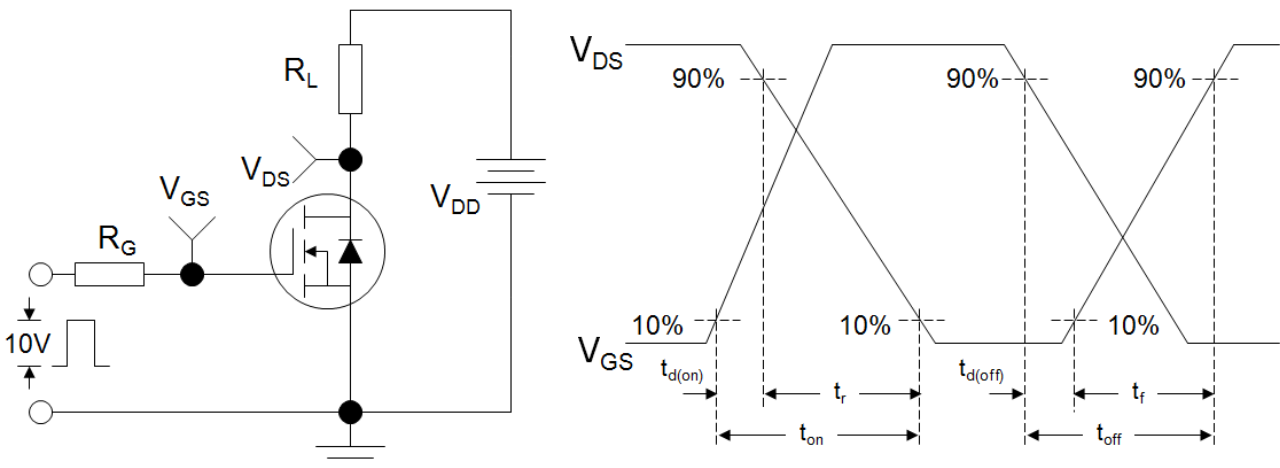
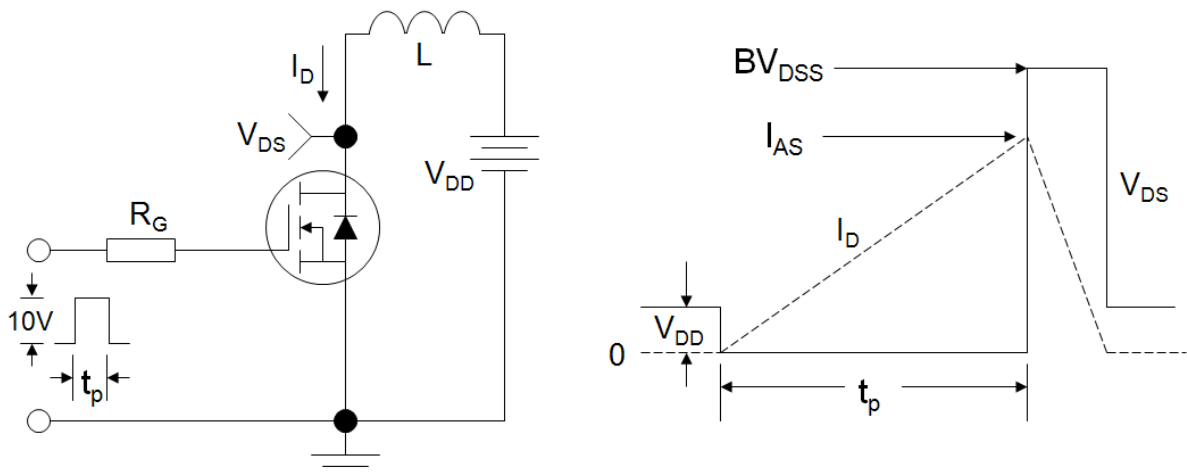


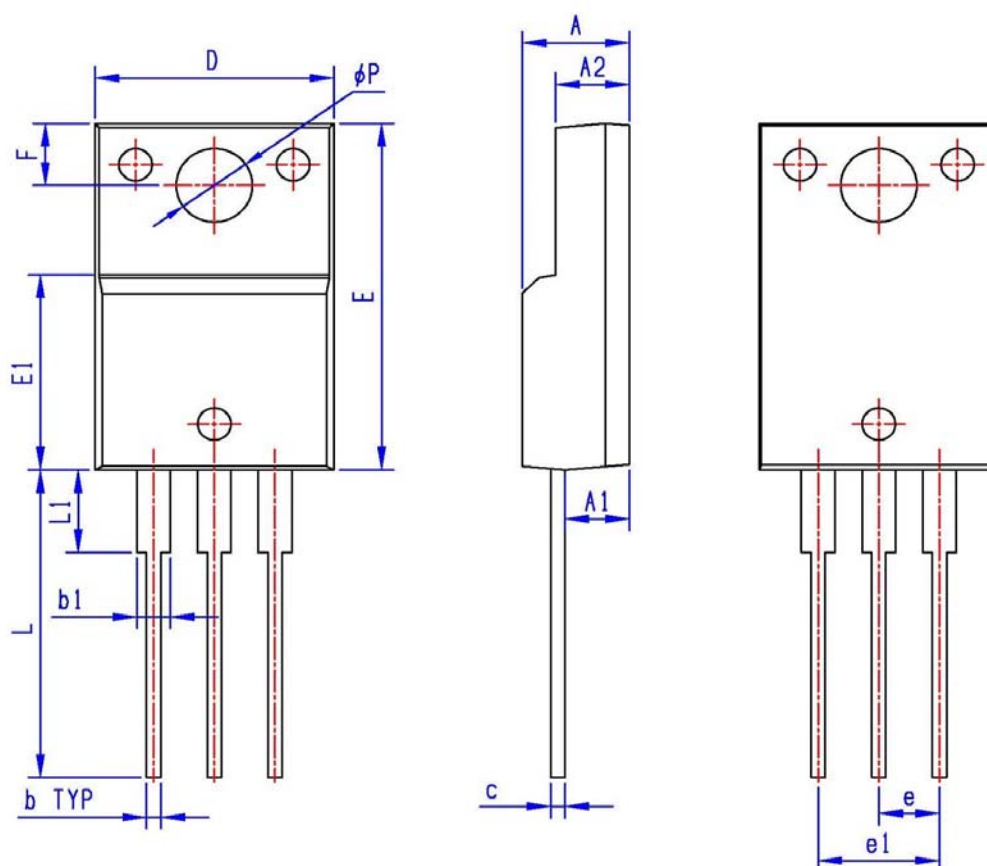
Figure C: Unclamped Inductive Switching Test Circuit and Waveform



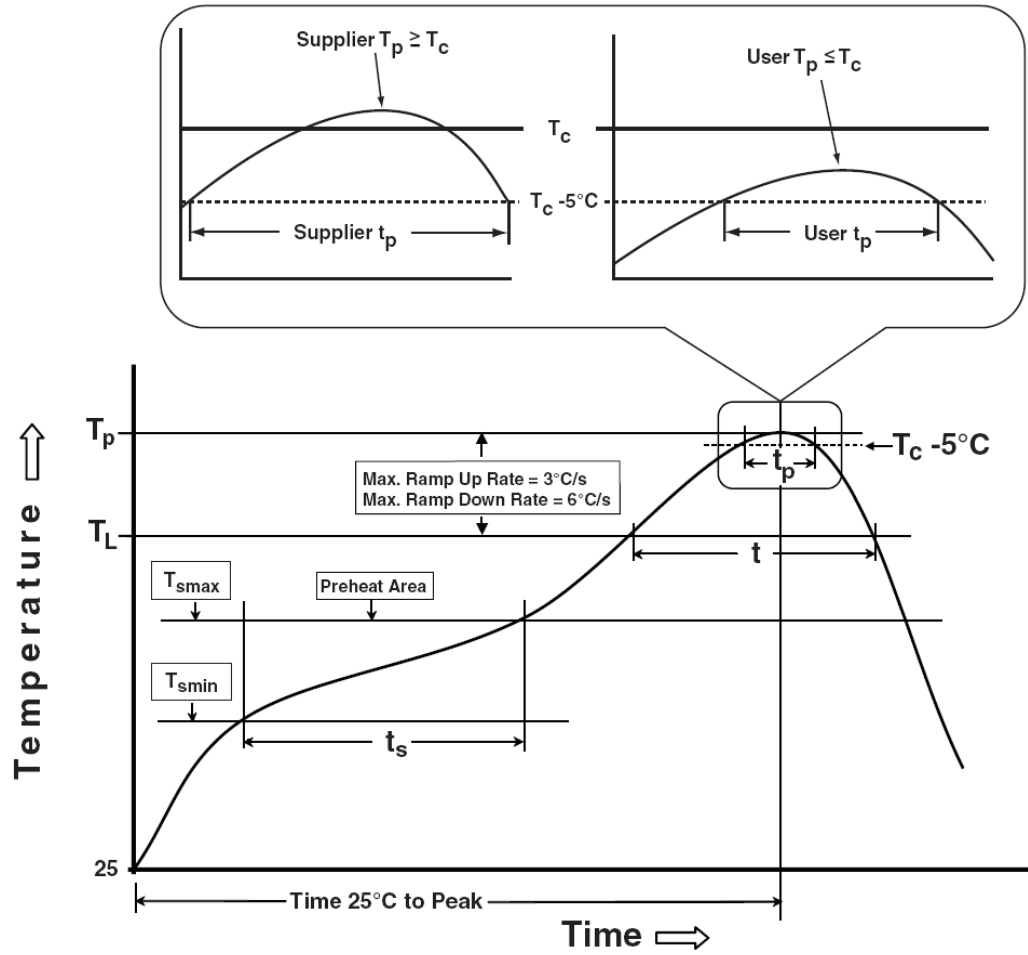
•Dimensions (TO-220F)

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
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 (T_c)

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 (T_c)

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
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