

•General Description

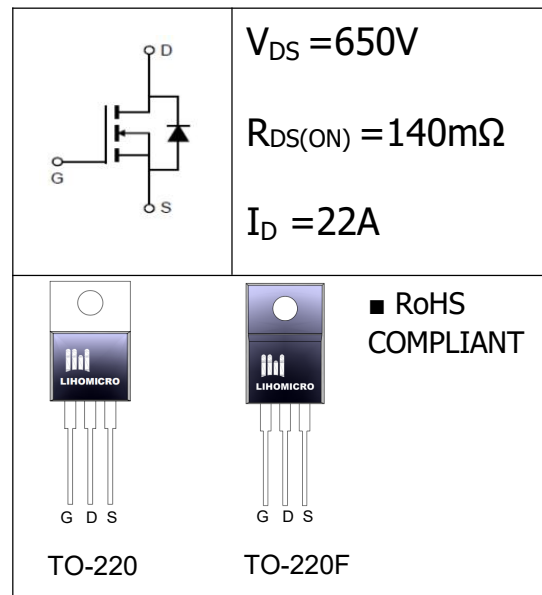
The SJ MOSFET LH65R140 has the low $R_{DS(on)}$, low gate charge, fast switching and excellent avalanche characteristics. This device offers extremely fast and robust body diode, and is suitable for telecom and power supplies.

•Features

- Low Power Loss By High Speed Switching
- Low On-Resistance

•Application

- DC-DC Converter
- UPS-Micro Inverter System
- PFC Power Supply



•Ordering Information:

Part number	LH65R140	LH65R140
Package	TO-220	TO-220F
Basic ordering unit (pcs)	1000	1000
Normal Package Material Ordering Code	LH65R140T-TO220-TU	LH65R140F-TO220F-TU
Halogen Free Ordering Code	LH65R140T-TO220-TU-HF	LH65R140F-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}	±30	V
Continuous Drain Current	TC = 25°C	I_D	22	A
	TC = 100°C		14	
Pulsed drain current (TC = 25°C, tp limited by Tjmax) ¹		I_D pulse	66	A
Single Pulse Avalanche Energy ¹		I_{AR}	4.2	A
Single Pulse Avalanche Energy ²		E_{AS}	484	mJ
Repetitive Avalanche Energy ¹		E_{AR}	0.7	mJ
Power Dissipation (TC=25°C)		P_D	TO-220:151 TO-220F:34	W
Operating Temperature and Storage Temperature Range		T_J/T_{STG}	-55~+150	°C
Reverse Diode dv/dt ³		dv/dt	50	V/ns
Maximum Diode Commutation Speed ³		di/dt	900	A/ns

●Electronic Characteristics

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650	--	--	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5	--	4.5	V
Drain-source On Resistance ³	$R_{DS(ON)}$	$V_{GS}=10V, I_D=7.5A$	--	0.12	0.14	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}	$V_{GS}=0V,$ $V_{DS}=100V$ $f=1.0MHz$	--	1834	--	pF
Output Capacitance	C_{oss}		--	57	--	
Reverse transfer Capacitance	C_{rss}		--	1.7	--	
Turn-on delay time	$T_d(on)$	$V_{DD}=400V,$ $I_D=20A$ $R_G=25\Omega$	--	34	--	nS
Rise time	T_r		--	72	--	
Turn -Off Delay Time	$T_d(off)$		--	114	--	
Fall time	T_f		--	41	--	
Total Gate Charge	Q_g	$I_D=20A,$ $V_{DS}=520V$ $V_{GS}=10V$	--	42	---	nC
Gate-to-Source Charge	Q_{gs}		--	10	--	
Gate-to-Drain Charge	Q_{gd}		--	17	---	
Continuous Diode Forward Current	I_S		--	--	20	A
Pulsed Diode Forward Current	I_{SM}		--	--	60	A
Diode Forward Voltage	V_{SD}	$T_J=25^\circ C, I_S=20A$ $V_{GS}=0V$	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	$V_{RR}=400V,$ $I_f=I_S$ $di_F/dt=100A/\mu s$	--	198	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.54	--	μC
Peak Reverse Recovery Current	I_{RRM}		--	60	--	A

●Thermal Characteristics

PARAMETER	SYMBOL	MAX		UNIT
		TO-220	TO-220F	
Thermal Resistance Junction-case	R_{thJC}	0.83	3.7	$^\circ C/W$
Thermal Resistance Junction-ambient	R_{thJA}	62	80	$^\circ C/W$

Notes:

- 1.Repetitive Rating: Pulse width limited by maximum junction temperature.
2. $I_{AS}=4.2A, V_{DD}=50V, R_G=25\Omega$, 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

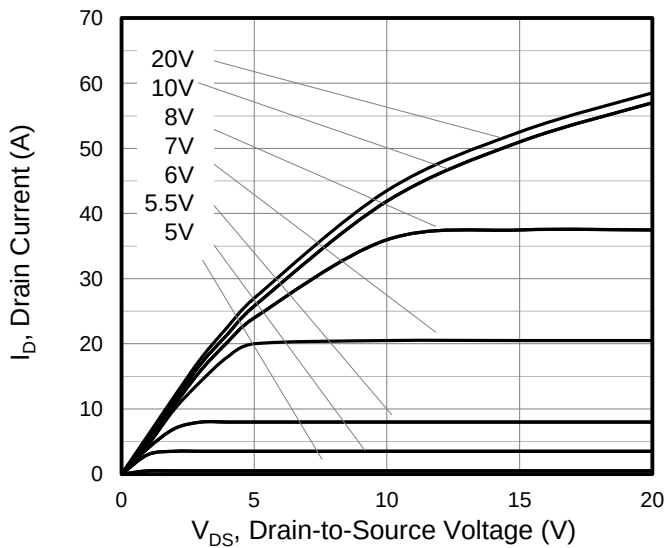


Figure 2. Transfer Characteristics

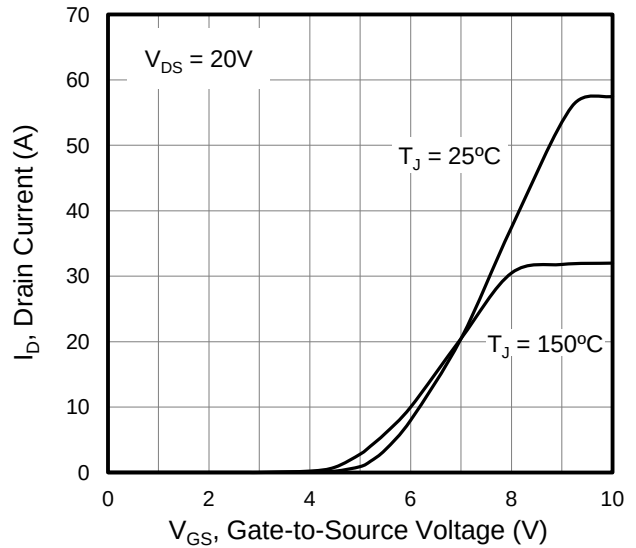


Figure 3. On-Resistance vs. Drain Current

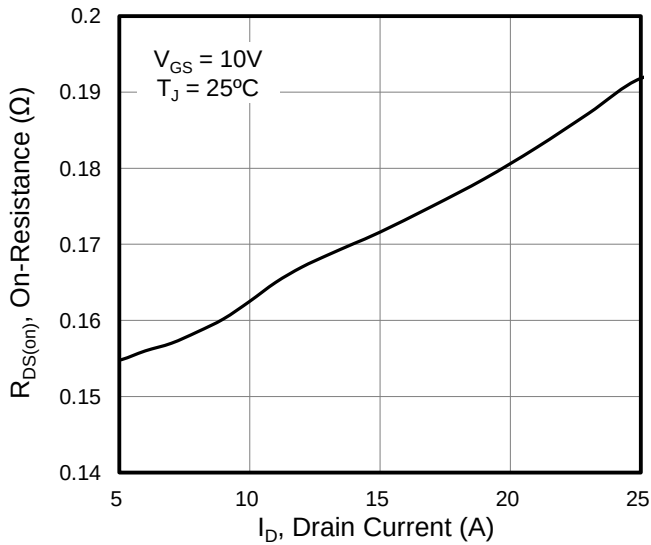


Figure 4. Capacitance

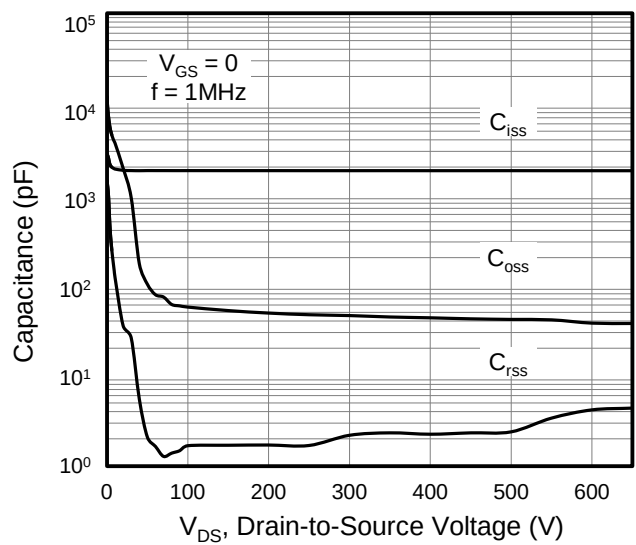


Figure 5. Gate Charge

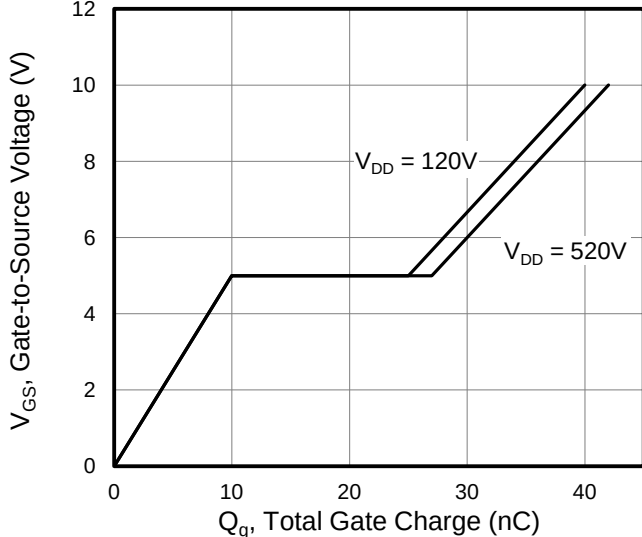
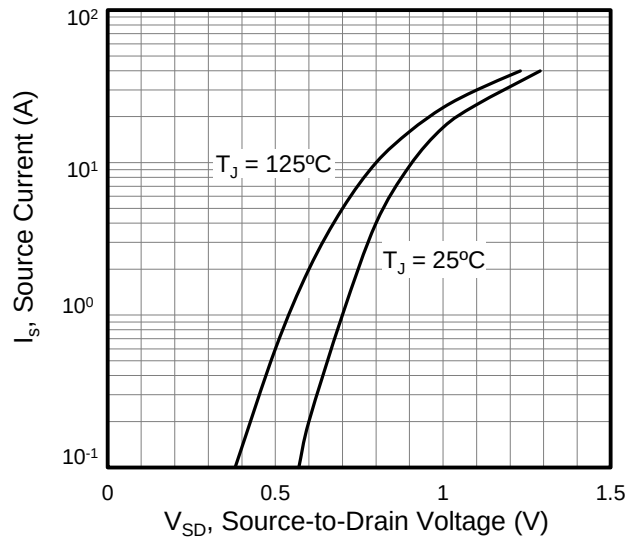


Figure 6. Body Diode Forward Voltage



•Typical Characteristics(Cont.)

Figure 7. On-Resistance vs. Junction Temperature

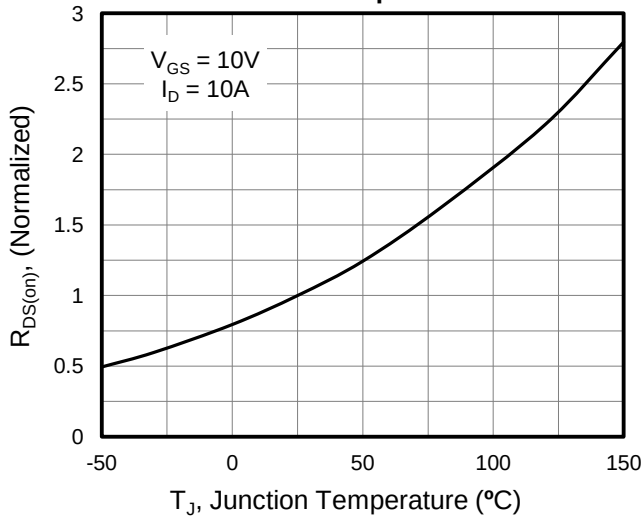


Figure 8. Breakdown voltage vs. Junction Temperature

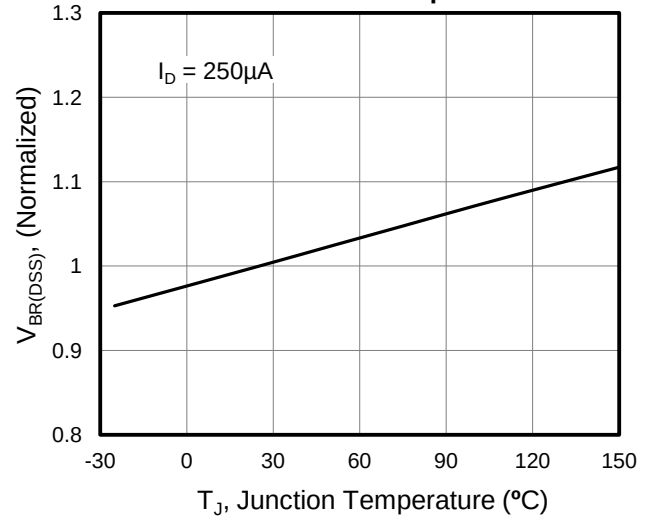


Figure9 . Transient Thermal Impedance

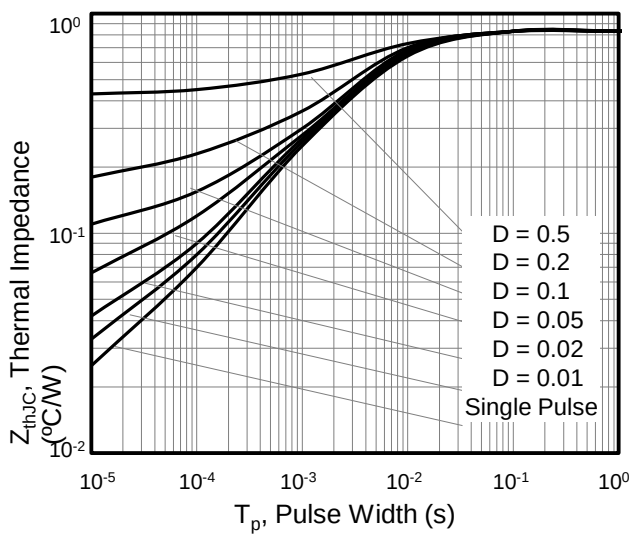
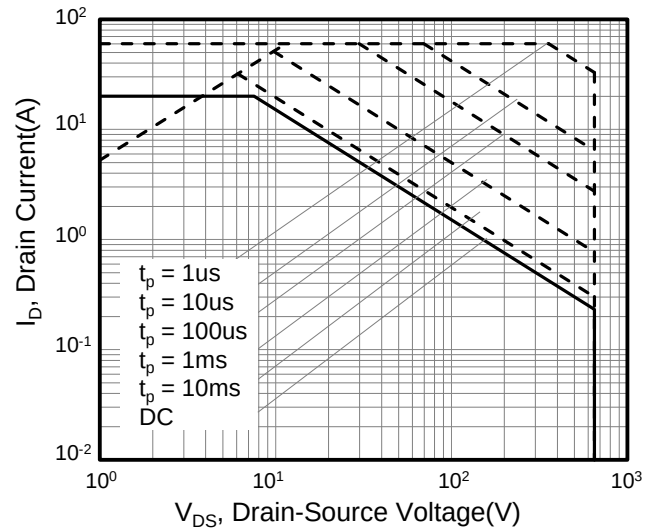


Figure 10. Safe operation area



● **Test Circuit and Waveforms**

Figure A: Gate Charge Test Circuit and Waveform

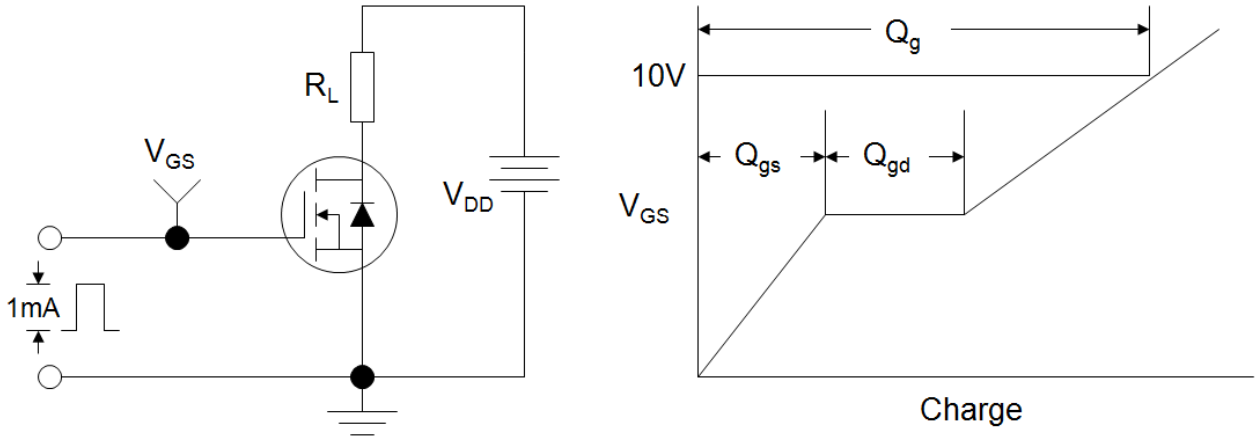


Figure B: Resistive Switching Test Circuit and Waveform

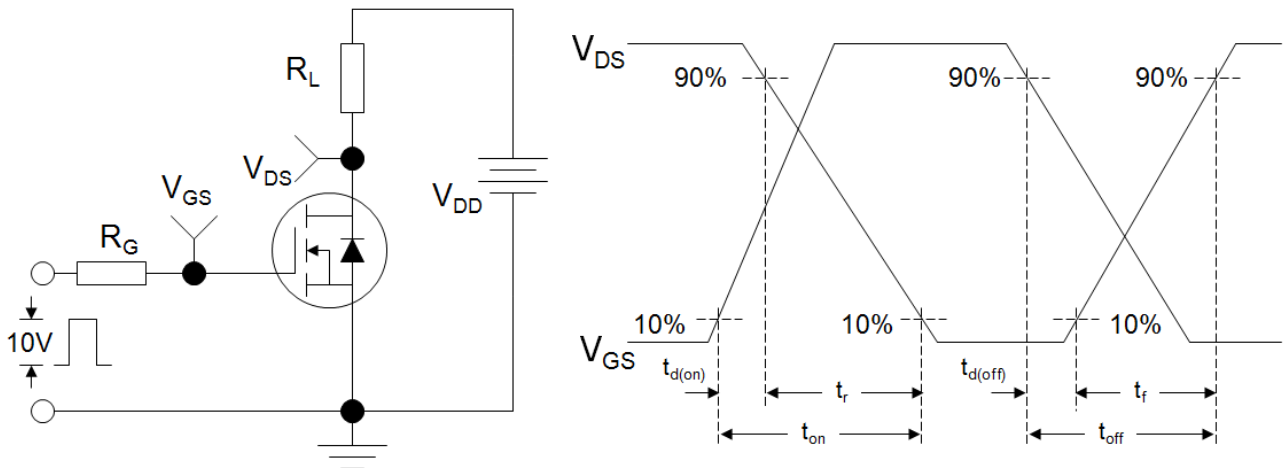
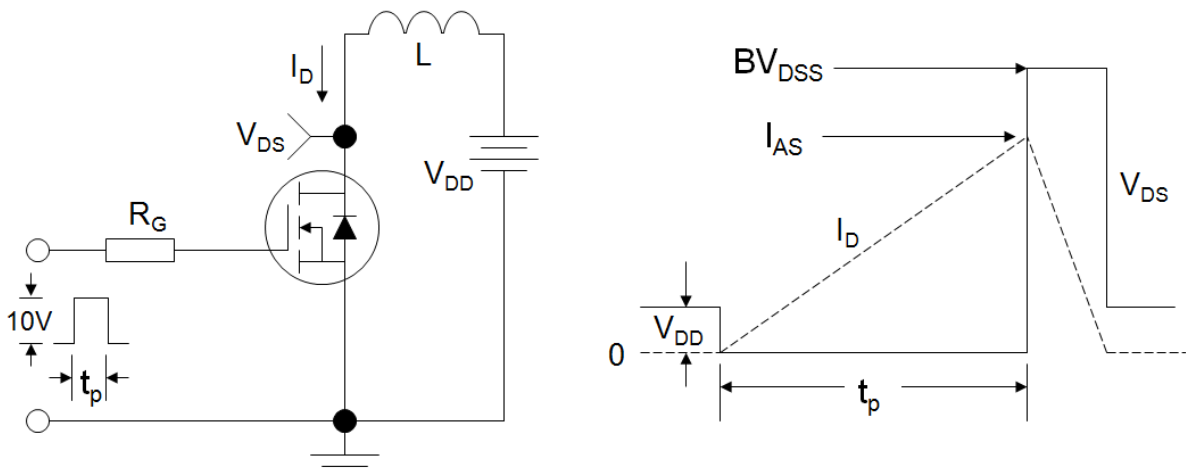


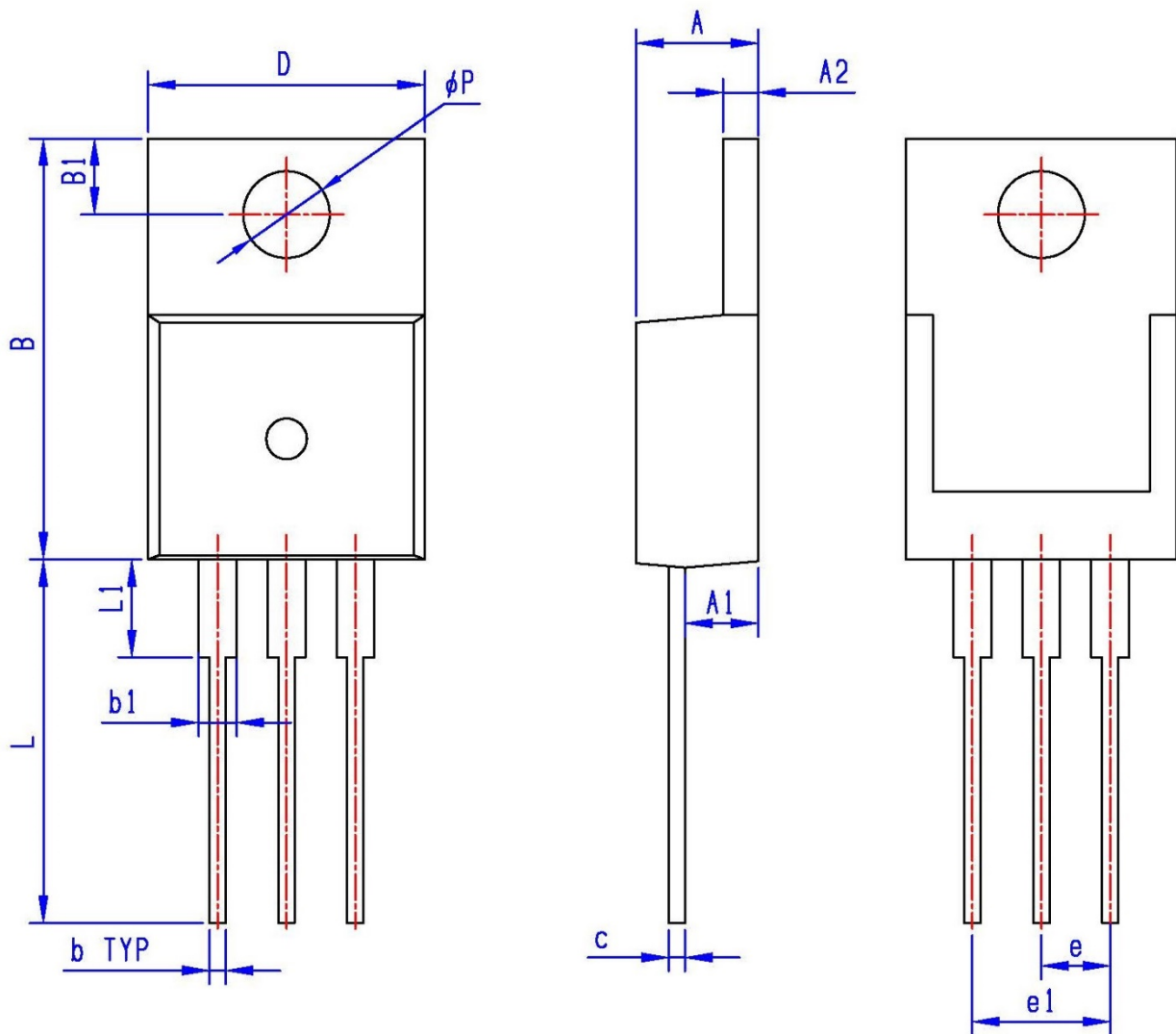
Figure C: Unclamped Inductive Switching Test Circuit and Waveform



●Dimensions (TO-220)

UNIT:mm

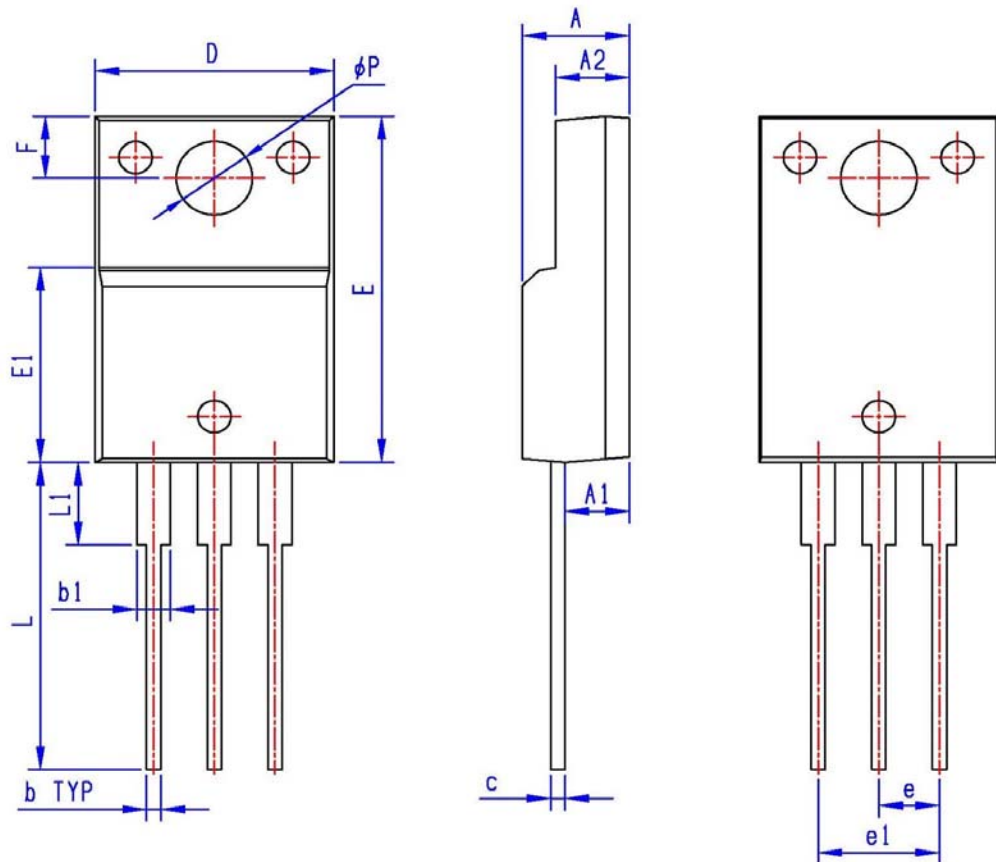
SYMBOL	min	max	SYMBOL	min	max
A	4.25	4.85	B1	2.60	3.00
A1	2.30	3.00	e	2.40	2.70
A2	1.20	1.40	e1	4.95	5.25
b	0.60	0.90	L	12.60	14.40
b1	1.10	1.70	L1	2.40	4.00
c	0.40	0.70	øP	3.50	3.90
D	9.80	10.60			
B	15.20	16.20			



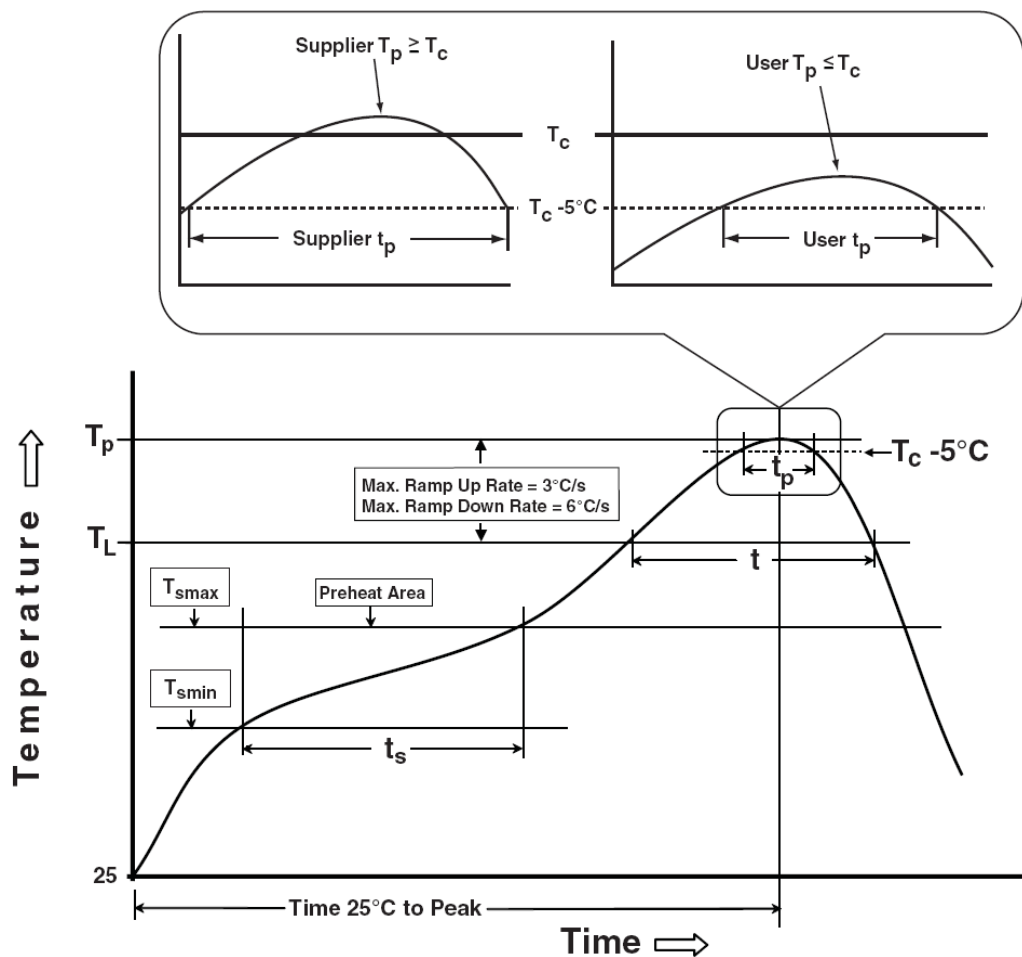
●Dimensions (TO-220F)

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
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 (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