

## FEATURES

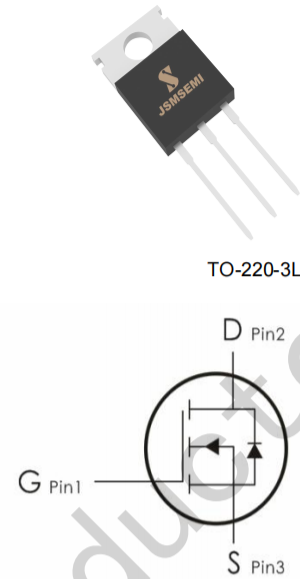
- Proprietary New Planar Technology
- $R_{DS(ON),typ.}=50m\ \Omega@V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

## APPLICATIONS

- DC-DC Converters
- DC-AC Inverters for UPS
- SMPS and Motor controls

### Device Marking and Package Information

Device	Package	Marking
IRFB38N20DPBF	TO-220-3L	IRFB38N20D



### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , unless otherwise noted

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	220	V
Continuous Drain Current	$I_D$	45	A
Pulsed Drain Current (note1)	$I_{DM}$	200	A
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
Single Pulse Avalanche Energy (note1)	$E_{AS}$	191	mJ
Avalanche Current (note1)	$I_{AS}$	31	A
Repetitive Avalanche Energy (note1)	$E_{AR}$	124	mJ
Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$	400	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	$^\circ\text{C}$

### Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{thJC}$	1.2	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	60	

Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	220	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 220V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	$\mu A$
		$V_{DS} = 220V, V_{GS} = 0V, T_J = 125^\circ\text{C}$	--	--	100	
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	--	4.0	V
Drain-Source On-Resistance (Note4)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 20A$	--	0.05	0.06	$\Omega$
Forward Transconductance (Note4)	gfs	$V_{DS} = 25V, I_D = 20A$	--	16	--	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V, V_{DS} = 25V, f = 1.0\text{MHz}$	--	2800	--	$\mu F$
Output Capacitance	$C_{oss}$		--	355	--	
Reverse Transfer Capacitance	$C_{rss}$		--	101	--	
Total Gate Charge	$Q_g$	$V_{DD} = 160V, I_D = 40A,$	--	154	--	nC
Gate-Source Charge	$Q_{gs}$		--	13	--	
Gate-Drain Charge	$Q_{gd}$		--	58	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 160V, I_D = 40A, V_{GS} = 15V, R_G = 25\Omega$	--	46	--	ns
Turn-on Rise Time	$t_r$		--	54	--	
Turn-off Delay Time	$t_{d(off)}$		--	360	--	
Turn-off Fall Time	$t_f$		--	96	--	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source Current	$I_{SD}$	Integral PN-diode in MOSFET	--	--	45	A
Pulsed Source Current	$I_{SM}$		--	--	200	
Body Forward Voltage	$V_{SD}$	$I_S = 20A, V_{GS} = 0V$	--	--	1.4	V
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0V, I_F = 10A, di_F/dt = 100A/\mu s$	--	152	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	1	--	$\mu C$

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 1\text{mH}, V_{DD} = 30V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 1\%$

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

Figure 1. Output Characteristics ( $T_J = 25^\circ\text{C}$ )

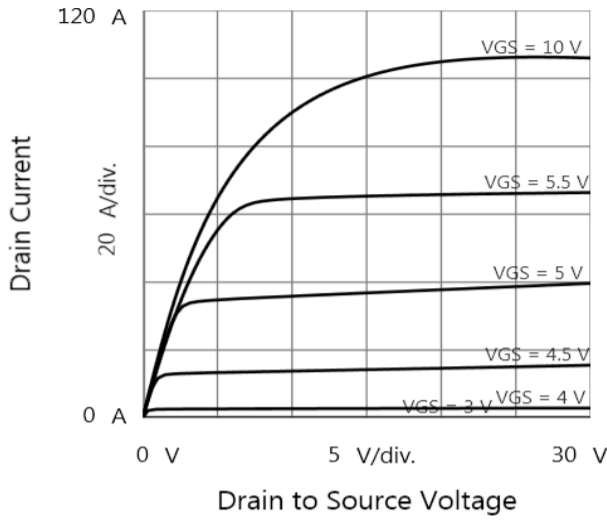


Figure 2. Transfer Characteristics

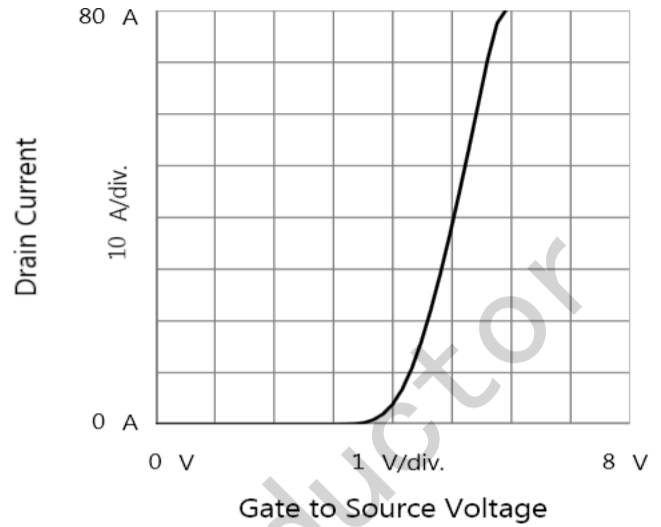


Figure 3. Drain to Source Resistance vs. Drain Current

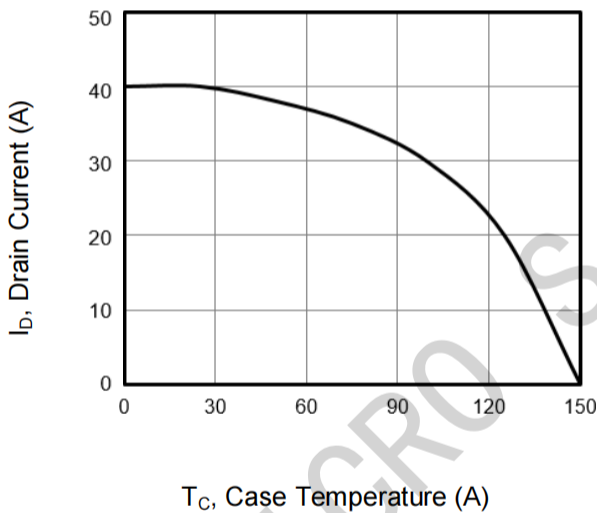


Figure 4.  $BV_{DSS}$  Variation vs. Temperature

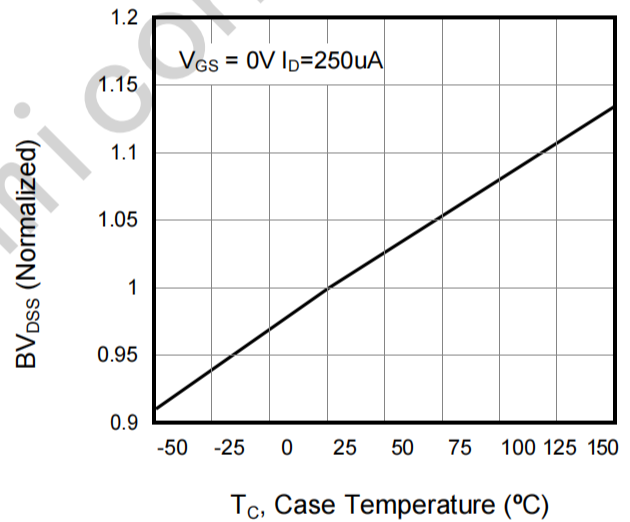


Figure 5. Drain to Source Voltage vs. Gate to Source Voltage

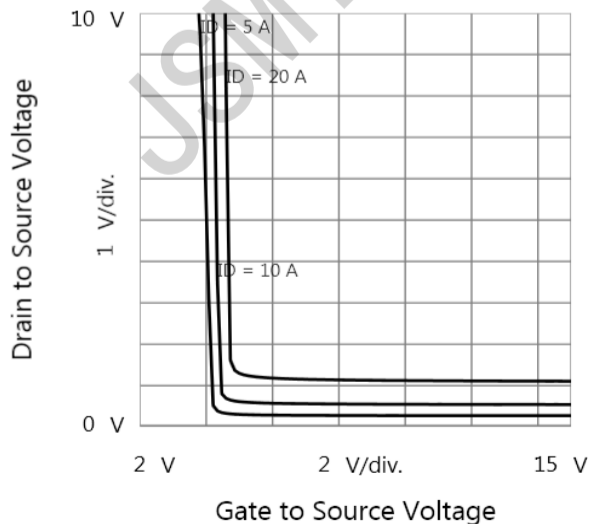
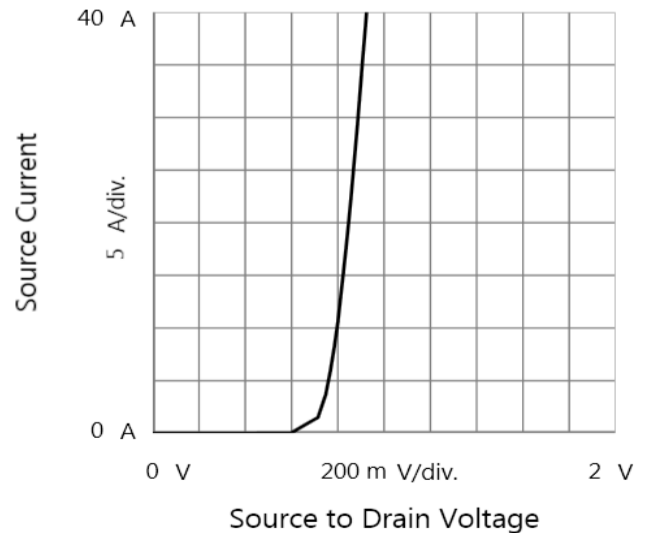


Figure 6. Body Diode Forward Characteristics



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

Figure 7. Capacitance

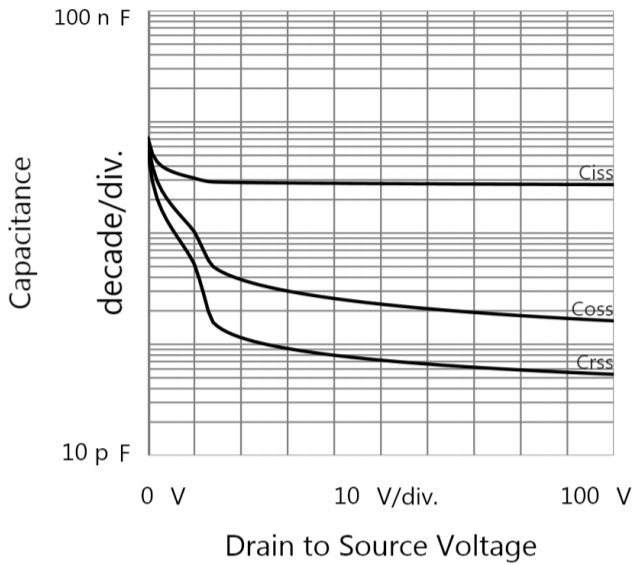


Figure 8. Gate Charge

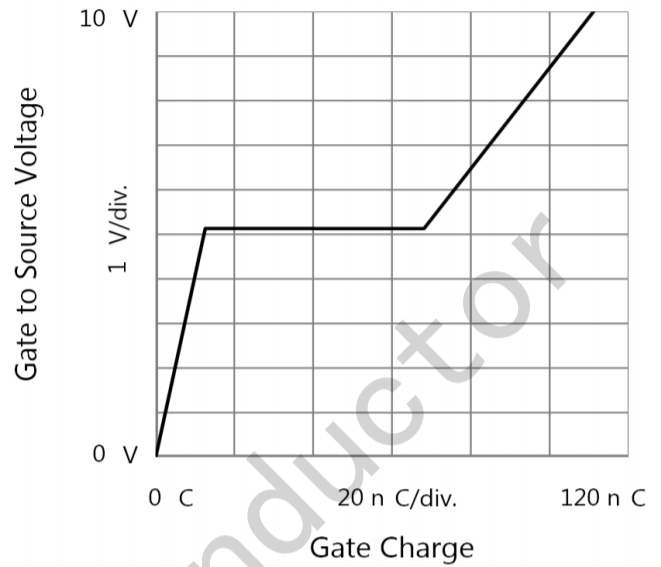
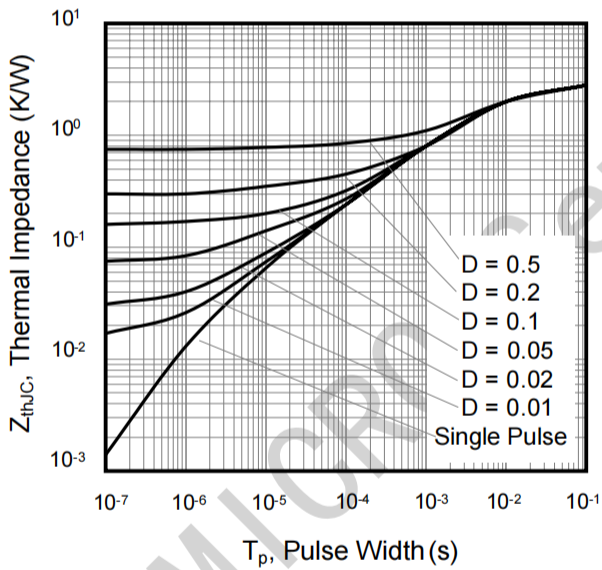
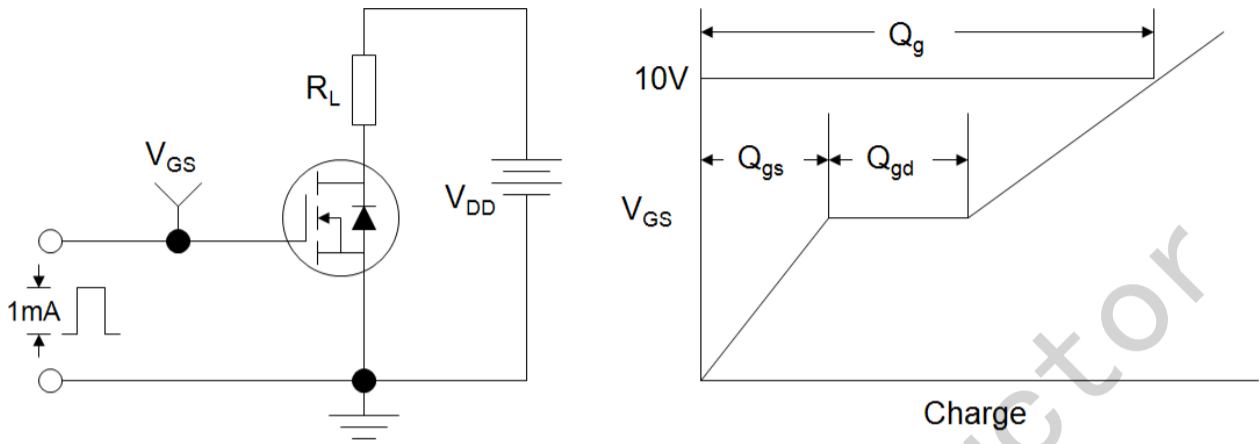


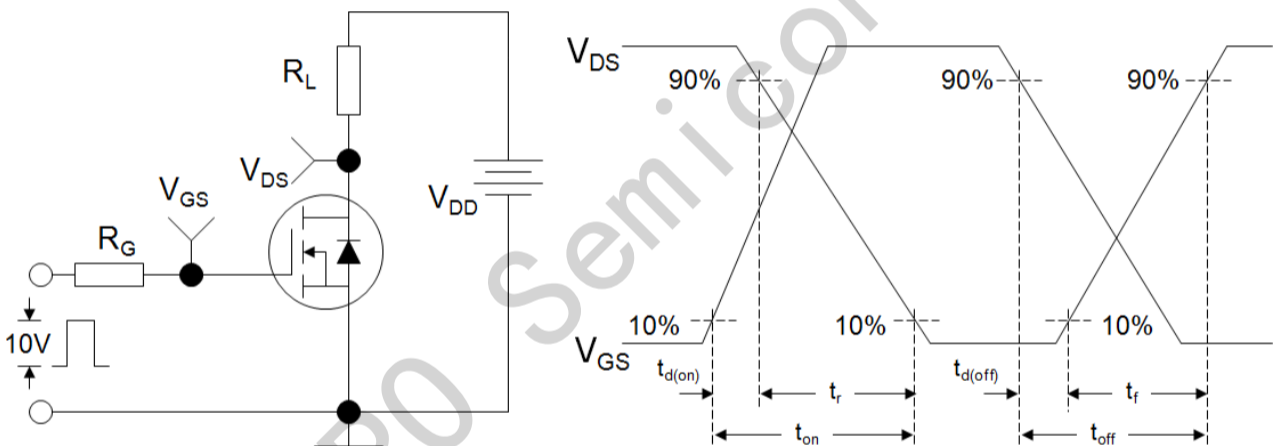
Figure 9. Transient Thermal Impedance



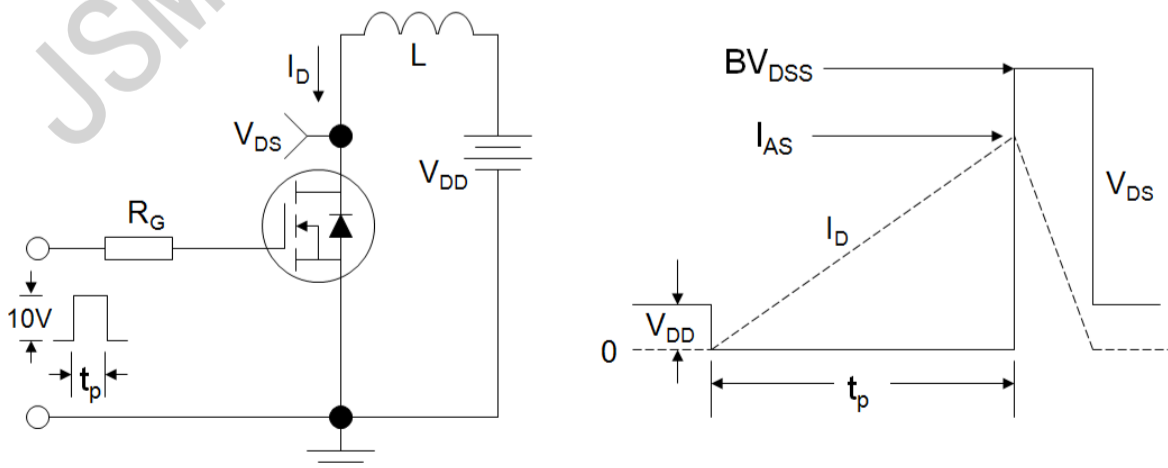
**Figure A: Gate Charge Test Circuit and Waveform**



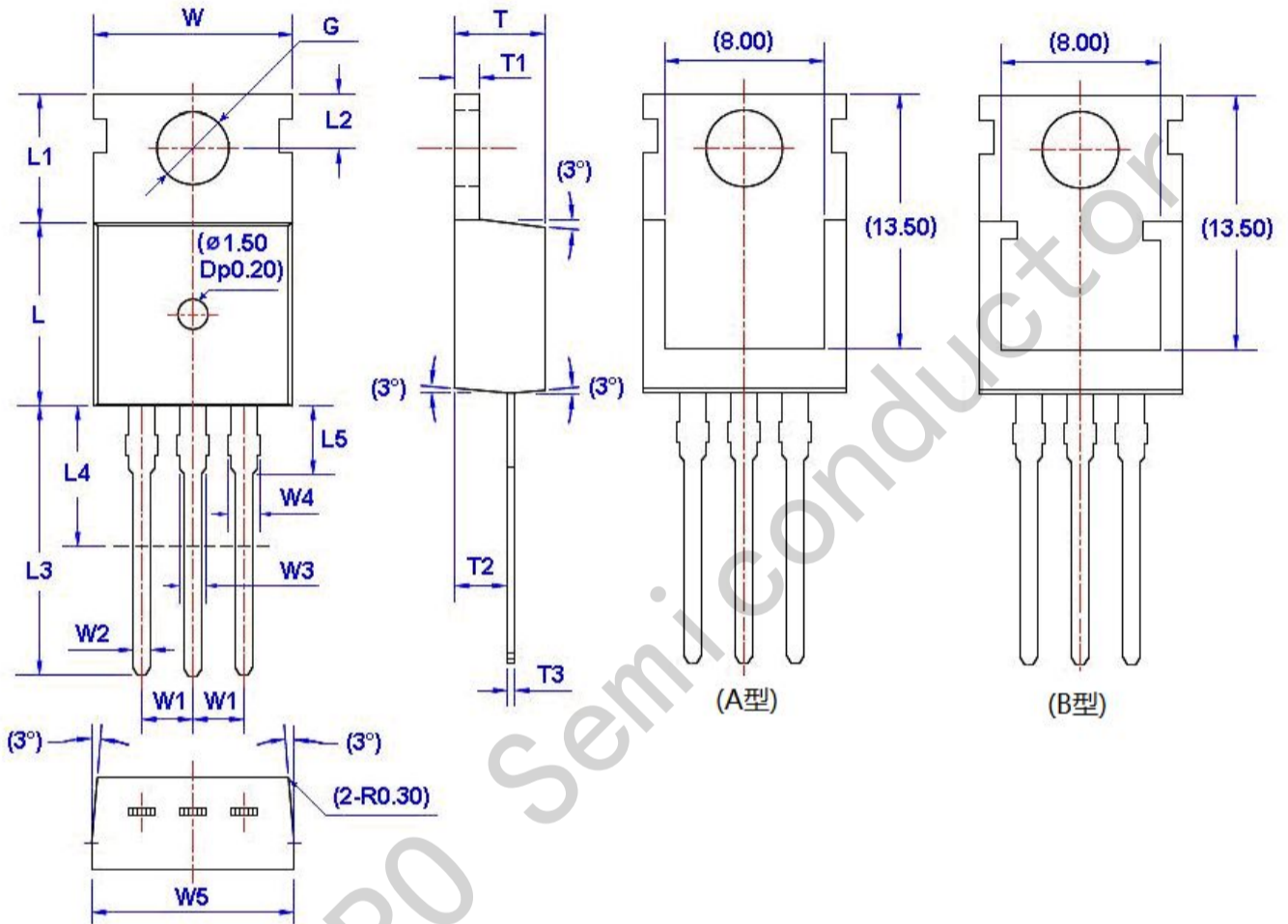
**Figure B: Resistive Switching Test Circuit and Waveform**



**Figure C: Unclamped Inductive Switching Test Circuit and Waveform**



Package Outline: TO-220



Unit: mm

Symbol	Size		Symbol	Size		Symbol	Size		Symbol	Size	
	Min	Max		Min	Max		Min	Max		Min	Max
W	9.66	10.28	W5	9.80	10.20	L4**	6.20	6.60	T3	0.45	0.60
W1	2.54 (TYP)		L	9.00	9.40	L5	2.79	3.30	G( $\Phi$ )	3.50	3.70
W2	0.70	0.95	L1	6.40	6.80	T	4.30	4.70			
W3	1.17	1.37	L2	2.70	2.90	T1	1.15	1.40			
W4*	1.32	1.72	L3	12.70	14.27	T2	2.20	2.60			