



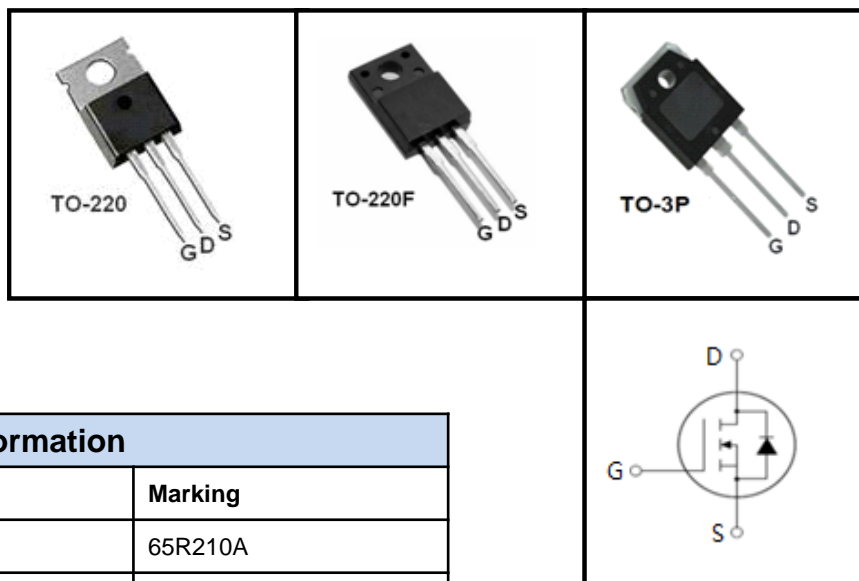
650V Super-Junction Power MOSFET

FEATURES

- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



Device Marking and Package Information		
Device	Package	Marking
TPP65R210A	TO-220	65R210A
TPA65R210A	TO-220F	65R210A
TPV65R210A	TO-3P	65R210A

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted					
Parameter	Symbol	Value			Unit
		TO-220	TO-3P	TO-220F	
Drain-Source Voltage ($V_{GS} = 0\text{V}$)	V_{DSS}	650			V
Continuous Drain Current	I_D	18.8			A
Pulsed Drain Current (note1)	I_{DM}	55			A
Gate-Source Voltage	V_{GSS}	± 30			V
Single Pulse Avalanche Energy (note2)	E_{AS}	500			mJ
Avalanche Current (note1)	I_{AR}	18			A
Repetitive Avalanche Energy (note1)	E_{AR}	1			mJ
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	208		34.5	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150			$^\circ\text{C}$

Thermal Resistance					
Parameter	Symbol	Value			Unit
		TO-220	TO-3P	TO-220F	
Thermal Resistance, Junction-to-Case	R_{thJC}	0.6		3.6	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62		80	



Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = 650V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5	--	3.5	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$	--	0.19	0.21	Ω
Forward Transconductance (Note3)	g_{fs}	$V_{DS} = 10V, I_D = 18A$	--	18.8	--	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 50V,$ $f = 1.0\text{MHz}$	--	2140	--	μF
Output Capacitance	C_{oss}		--	300	--	
Reverse Transfer Capacitance	C_{rss}		--	18	--	
Total Gate Charge	Q_g	$V_{DD} = 480V, I_D = 18A,$ $V_{GS} = 10V$	--	54	--	nC
Gate-Source Charge	Q_{gs}		--	10	--	
Gate-Drain Charge	Q_{gd}		--	20	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 300V, I_D = 18A,$ $R_G = 25\Omega$	--	48	104	ns
Turn-on Rise Time	t_r		--	108	220	
Turn-off Delay Time	$t_{d(off)}$		--	176	360	
Turn-off Fall Time	t_f		--	50	108	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	18	A
Pulsed Diode Forward Current	I_{SM}		--	--	55	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 18A, V_{GS} = 0V$	--	0.95	1.2	V
Reverse Recovery Time	t_{rr}	$V_R = 480V, I_F = I_S,$ $di_F/dt = 100A/\mu s$	--	440	--	ns
Reverse Recovery Charge	Q_{rr}		--	5	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	24	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 10A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width $\leq 300\mu s, \text{Duty Cycle } \leq 1\%$



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

Figure 1. Output Characteristics

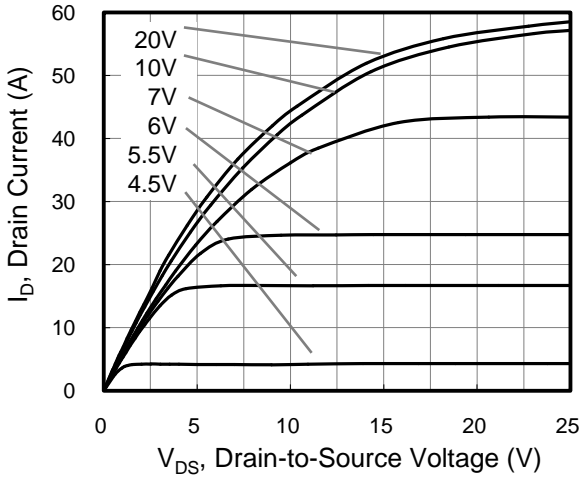


Figure 2. Transfer Characteristics

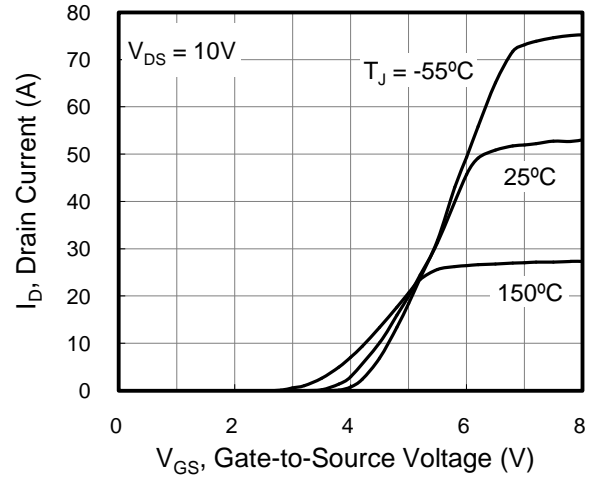


Figure 3. On-Resistance vs. Drain Current

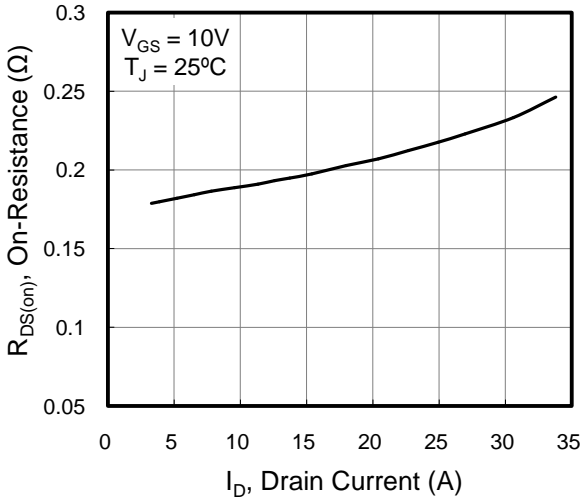


Figure 4. Capacitance

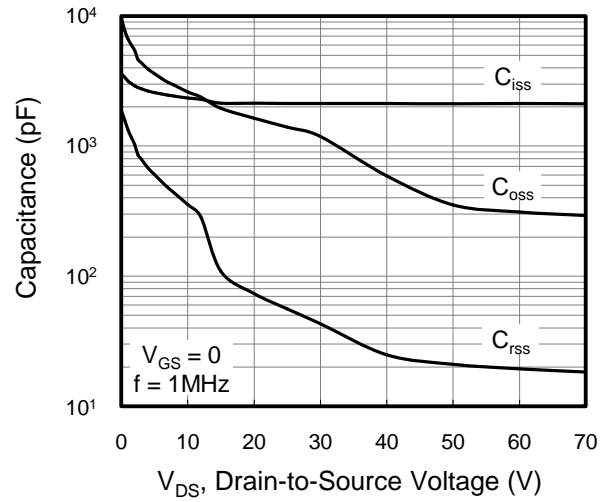


Figure 5. Gate Charge

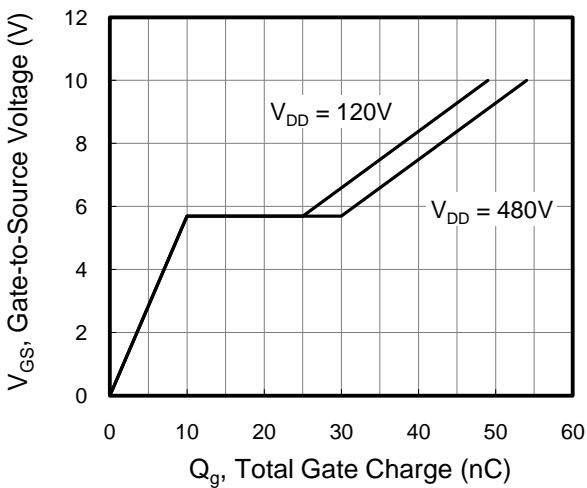
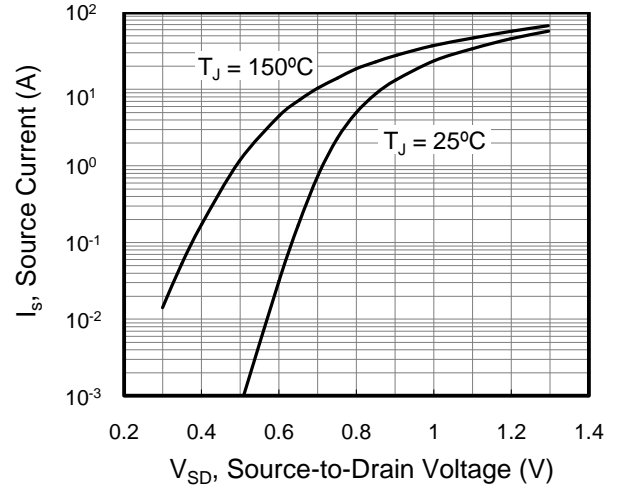


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs. Junction Temperature

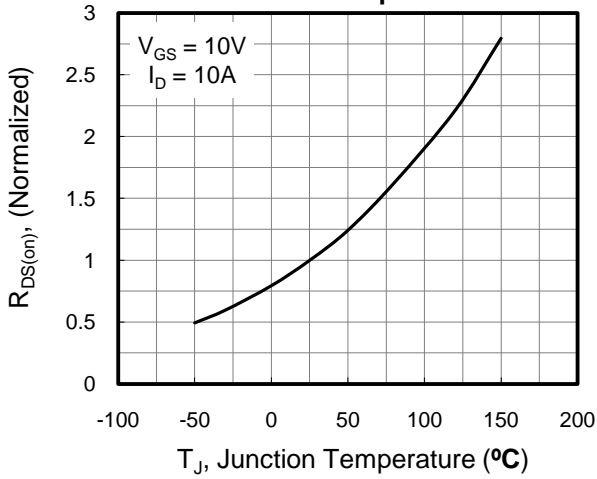


Figure 8. Threshold Voltage vs. Junction Temperature

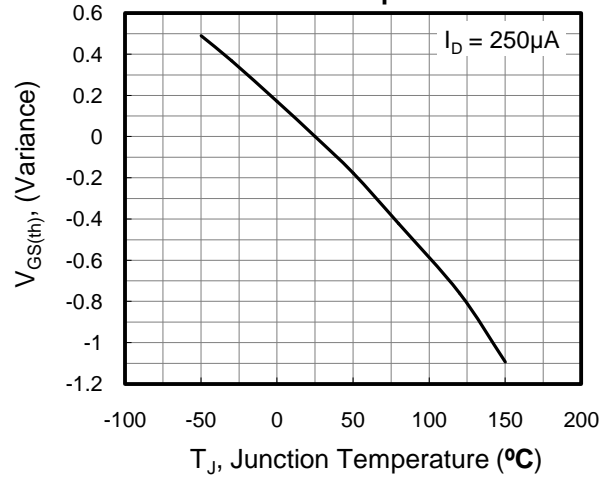


Figure 9. Transient Thermal Impedance TO-220/TO-3P

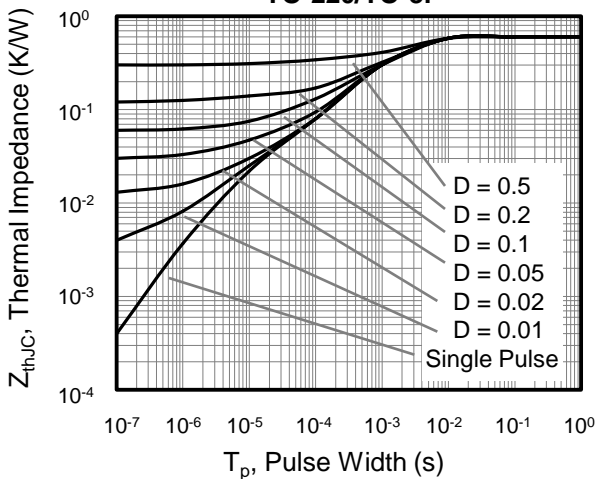


Figure 10. Transient Thermal Impedance TO-220F

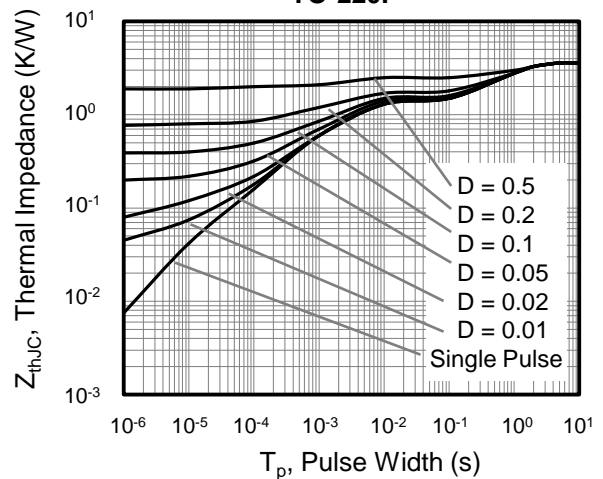


Figure 11. Safe Operating Area TO-220/TO-3P

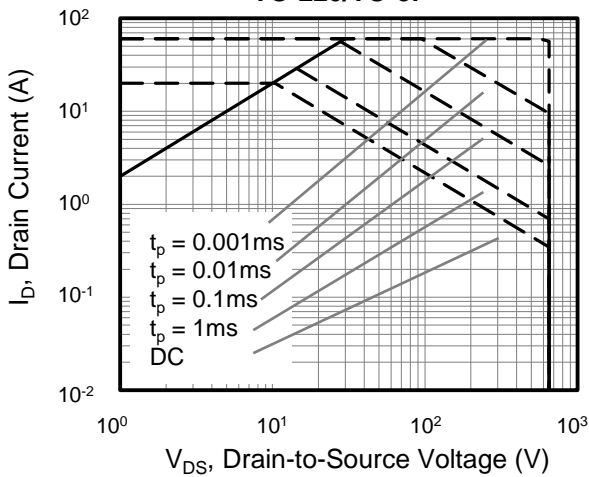


Figure 12. Safe Operating Area TO-220F

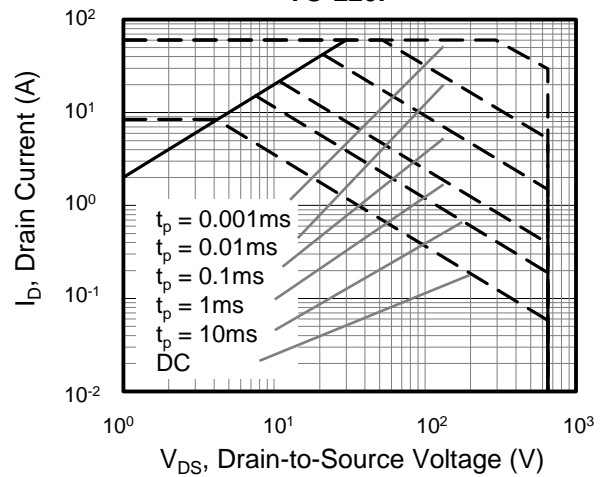




Figure A: Gate Charge Test Circuit and Waveform

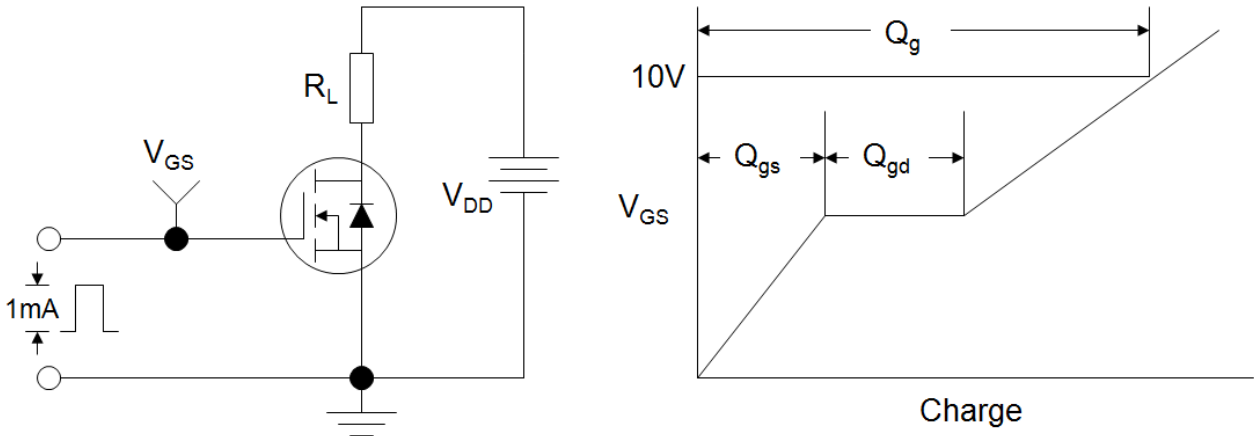


Figure B: Resistive Switching Test Circuit and Waveform

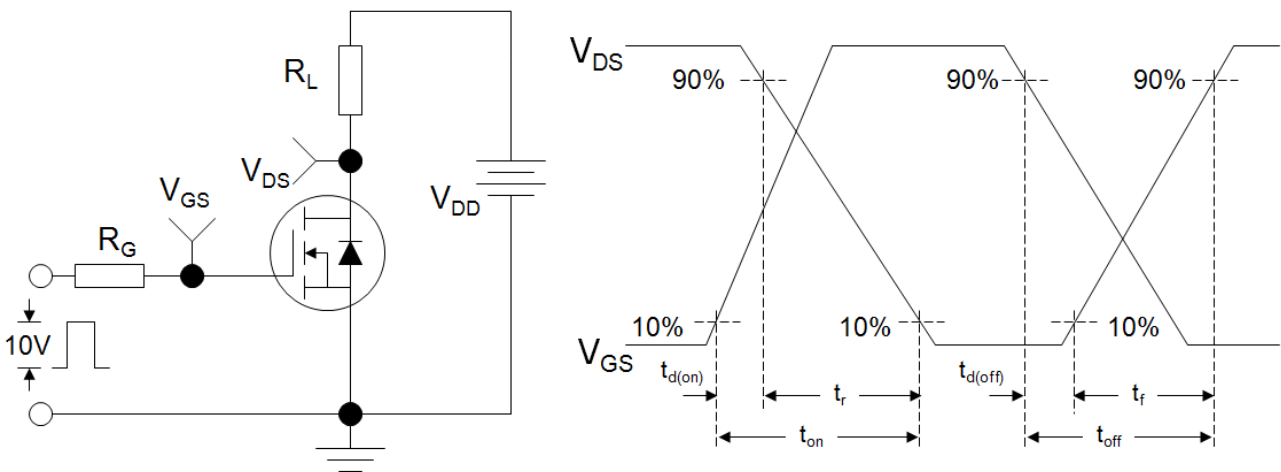
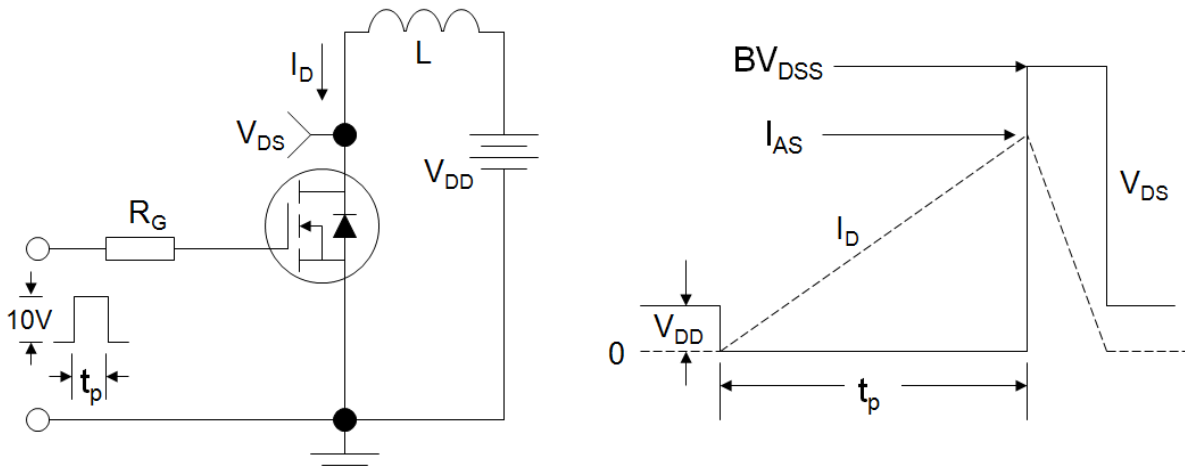
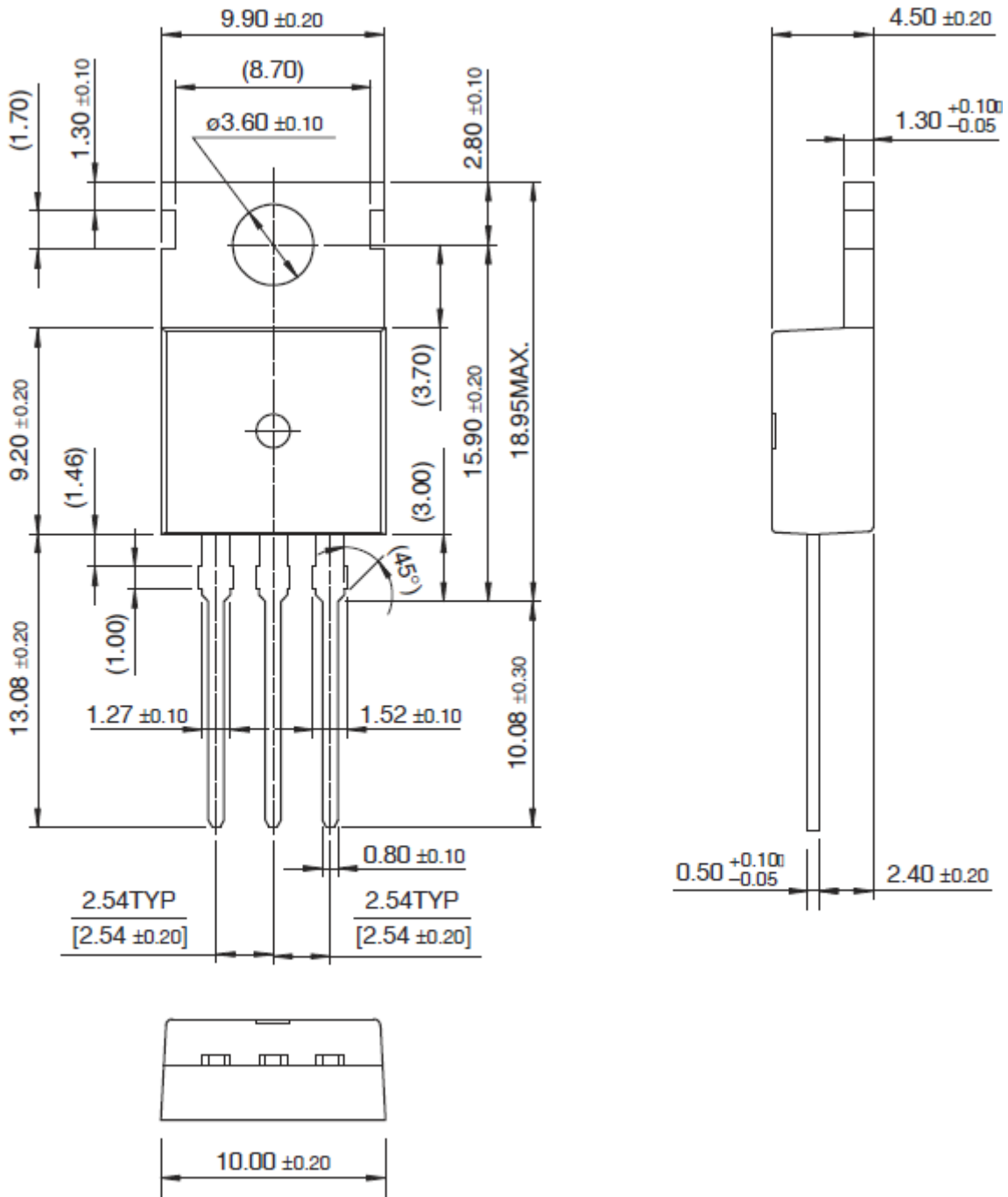


Figure C: Unclamped Inductive Switching Test Circuit and Waveform



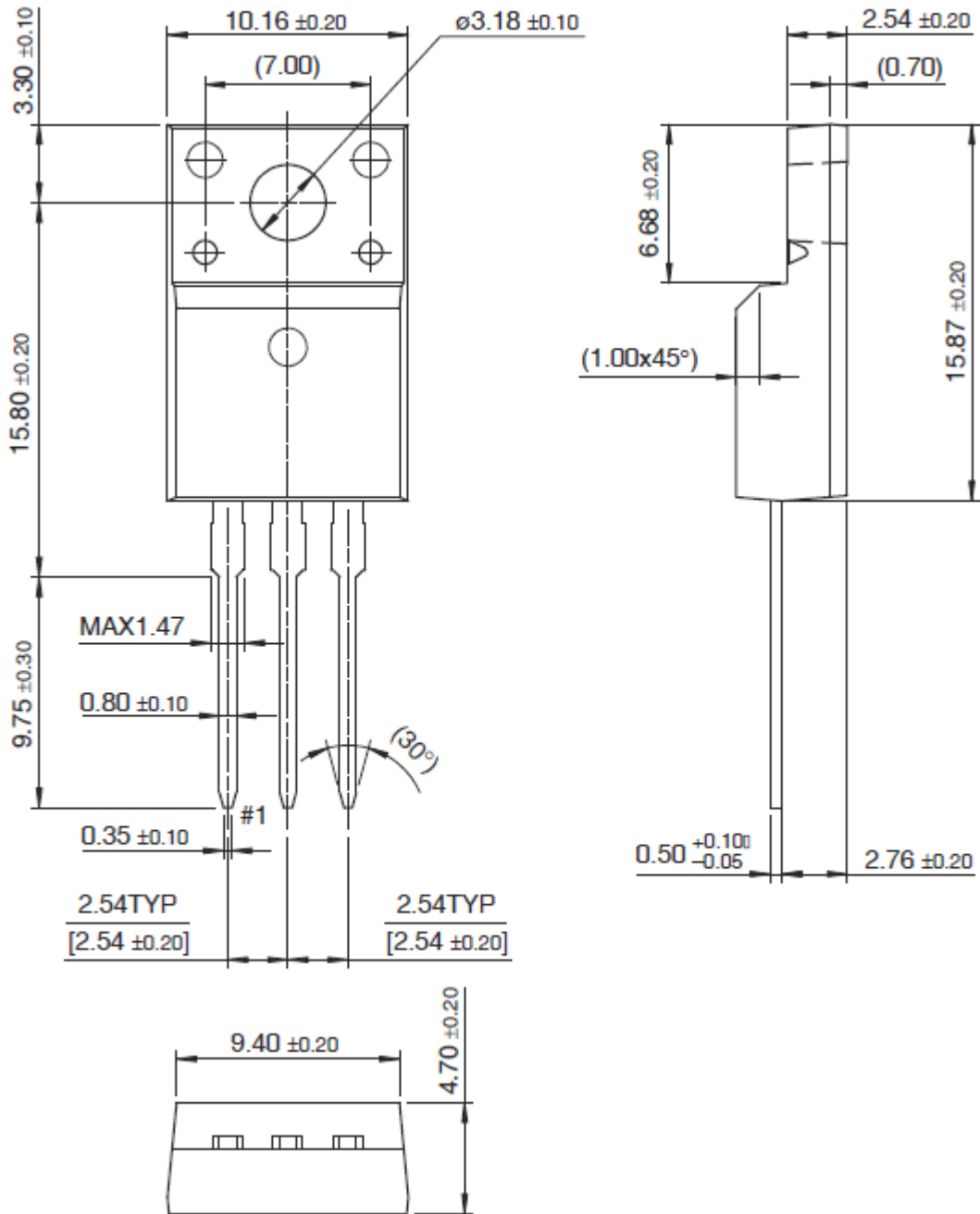


TO-220



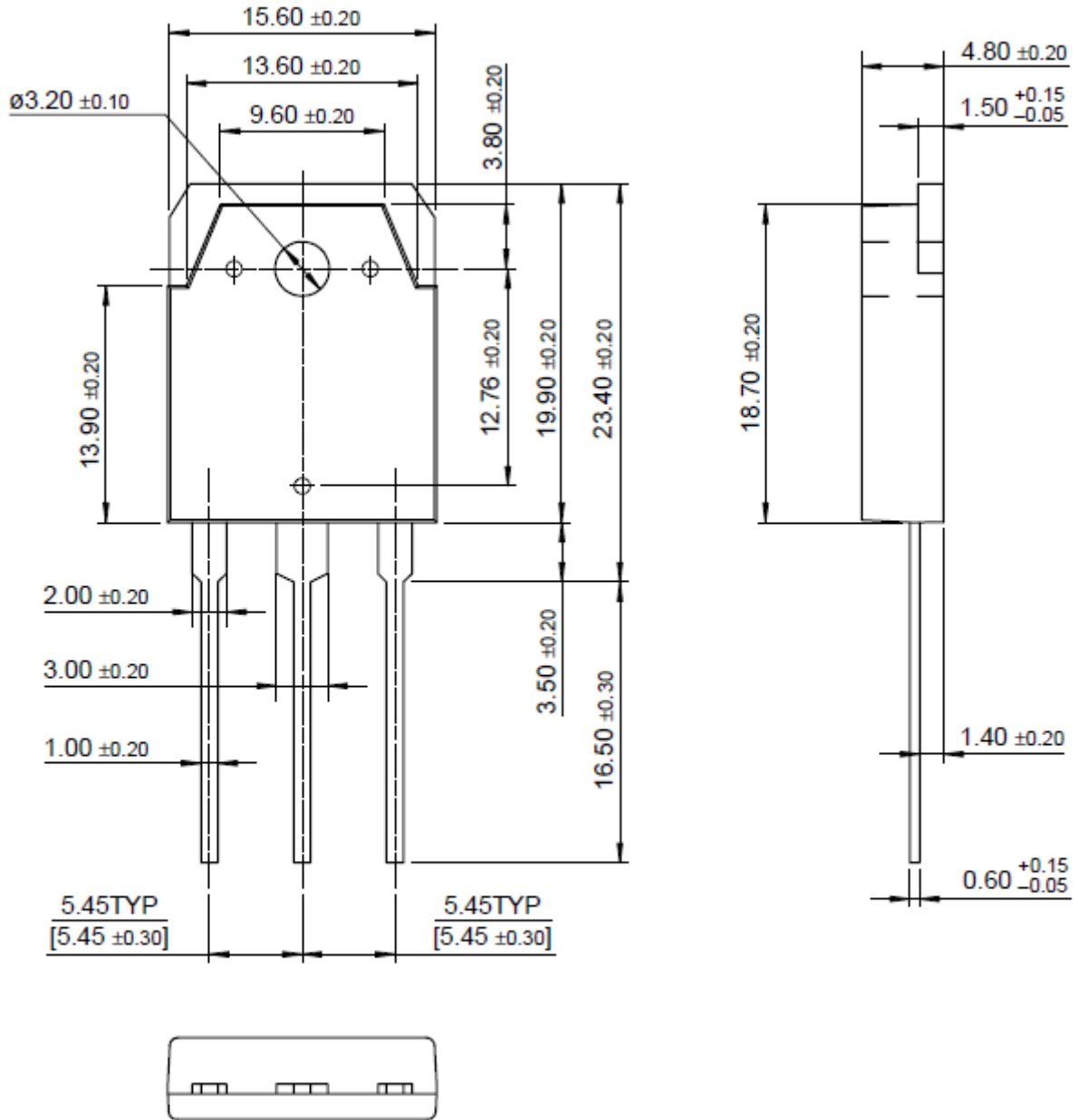


TO-220F





TO-3P





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