650V Super-Junction Power MOSFET

DESCRIPTION

650V super-junction Power MOSFET

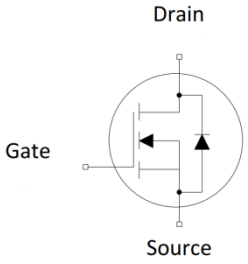
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The SJ MOSFET is a price-performance optimized product enabling to target cost sensitive applications in Consumer and Lighting markets, designed by Wuxi Unigroup Microelectronics Company.

FEATURES

- Ultra-fast body diode
- 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)



RoHS

Device Marking and Package Information

Device	Package	Marking
TPA65R190MFD	TO-220F	65R190MFD

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.19	Ω
I_D	20	A
$Q_{g,typ}$	42	nC
I_{DM}	60	A
t_{rr}	112	ns
Q_{rr}	0.54	μC
I_{rrm}	9.6	A

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Value**	**Unit**
Drain-Source Voltage (V_{GS} = 0V)		V_{DSS}	650	V
Continuous Drain Current	T_C = 25ºC	I_D	20	A
	TC = 100ºC		12	
Pulsed Drain Current (note1)		I_{DM}	60	A
Gate-Source Voltage		V_{GSS}	±30	V
Single Pulse Avalanche Energy (note2)		E_{AS}	484	mJ
Repetitive Avalanche Energy (note2)		E_{AR}	0.7	mJ
Avalanche Current		I_{AR}	3.5	A
MOSFET dv/dt ruggedness, V_{DS} = 0...480V		dv/dt	50	V/ns
Power Dissipation		P_D	34	W
Continuous Body Diode Current		I_S	17	A
Pulsed Diode Forward Current (note1)		I_{SM}	60	
Reverse diode dv/dt (note3)		dv/dt	50	V/ns
Maximum diode commutation speed (note3)		di_f/dt	900	A/us
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	3.7	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Specifications T_J = 25ºC, 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 = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V, T_J = 25ºC	--	--	5	μA
		V_{DS} = 650V, V_{GS} = 0V, T_J = 150ºC	--	--	2500	
Gate-Source Leakage	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	3	--	5	V
Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 10A	--	0.17	0.19	Ω
Gate resistance	R_G	f = 1.0MHz open drain	--	12	--	Ω
Dynamic						
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	--	
Total Gate Charge	Q_g	V_{DD} = 520V, I_D = 20A, V_{GS} = 10V	--	42	--	nC
Gate-Source Charge	Q_{gs}		--	10	--	
Gate-Drain Charge	Q_{gd}		--	17	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 20A, R_G = 25Ω	--	34	--	ns
Turn-on Rise Time	t_r		--	72	--	
Turn-off Delay Time	$t_{d(off)}$		--	114	--	
Turn-off Fall Time	t_f		--	41	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 10A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_F = I_S, di_F/dt = 100A/μs	--	112	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.54	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	9.6	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 3.5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. Identical low side and high side switch with identical R_G

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics

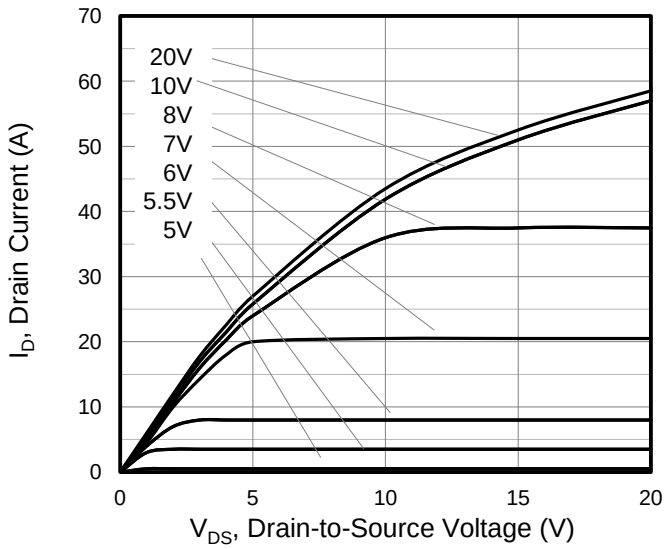


Figure 2. Transfer Characteristics

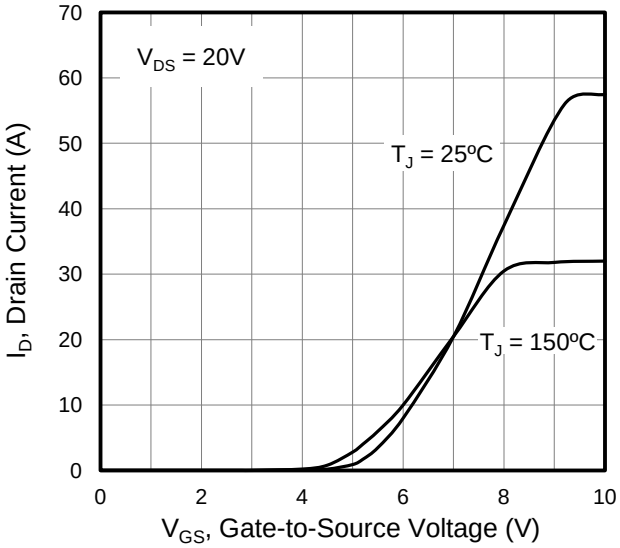


Figure 3. On-Resistance vs. Drain Current

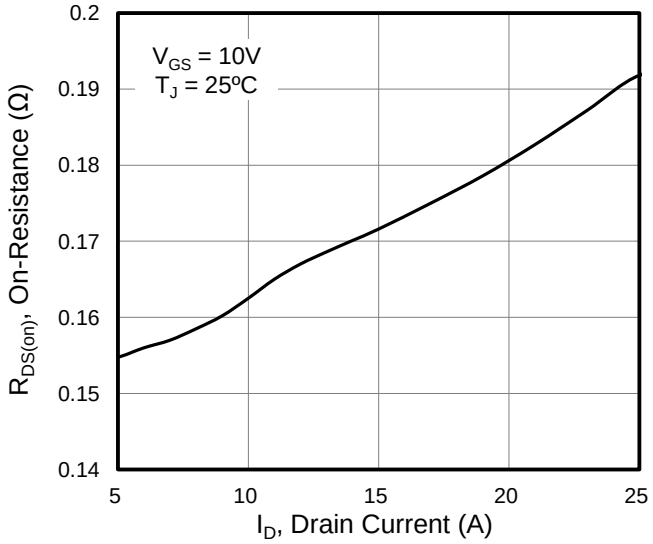


Figure 4. Capacitance

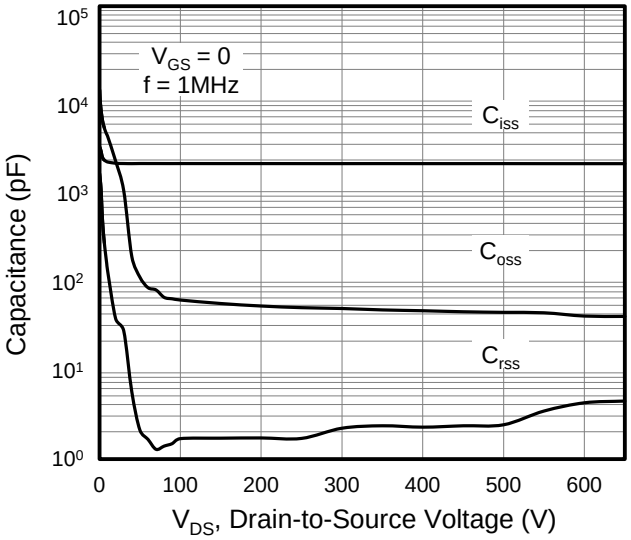


Figure 5. Gate Charge

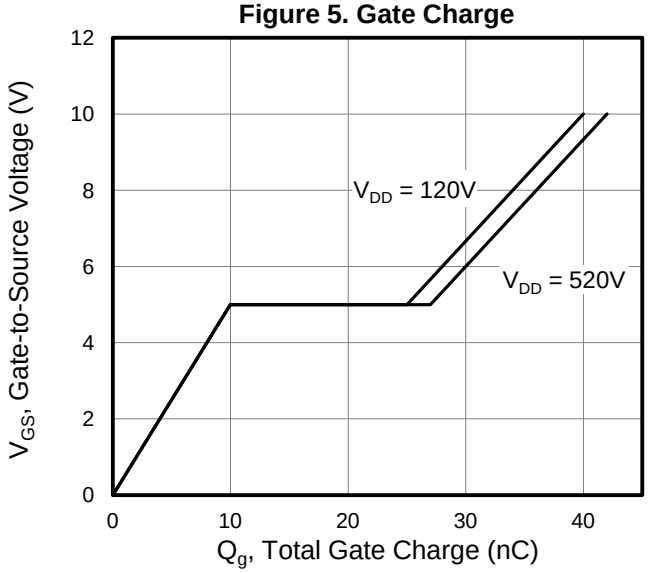
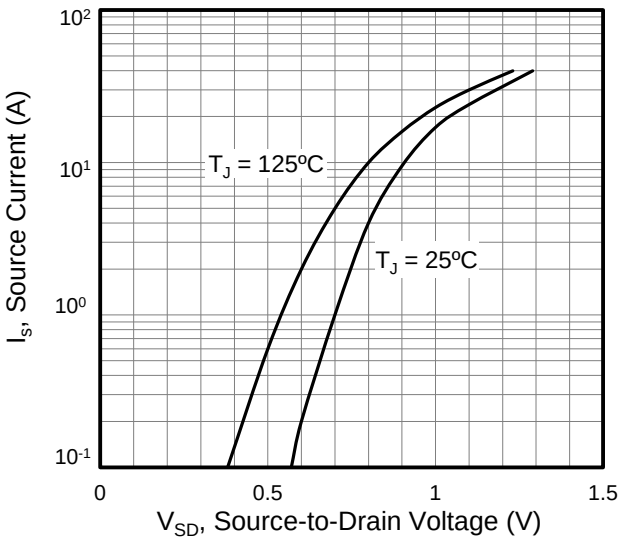


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

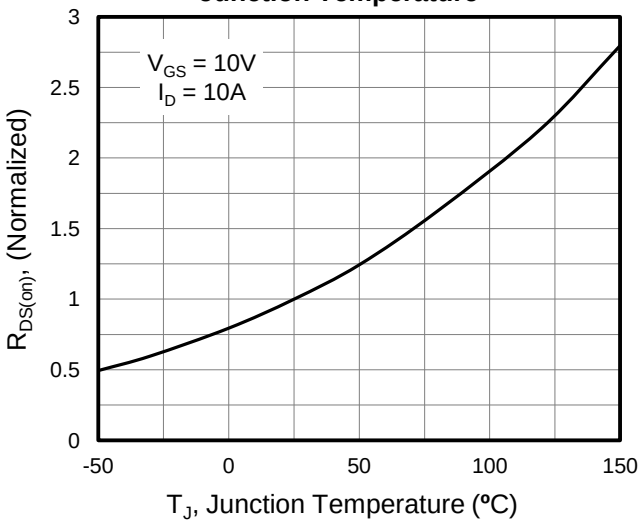


Figure 8. Breakdown voltage vs. Junction Temperature

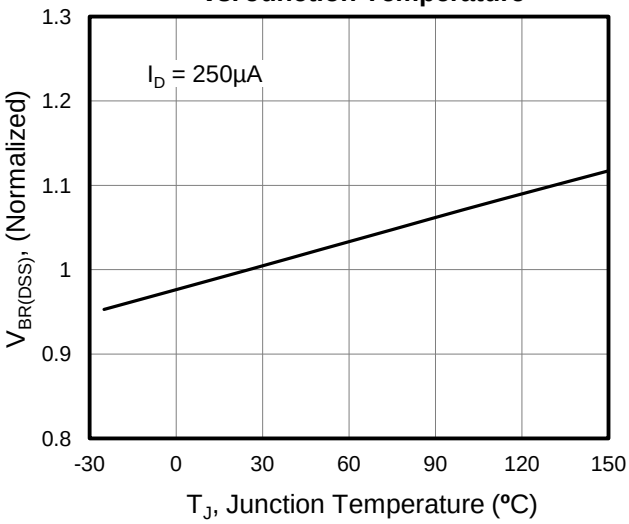


Figure9 . Transient Thermal Impedance for TO-220F

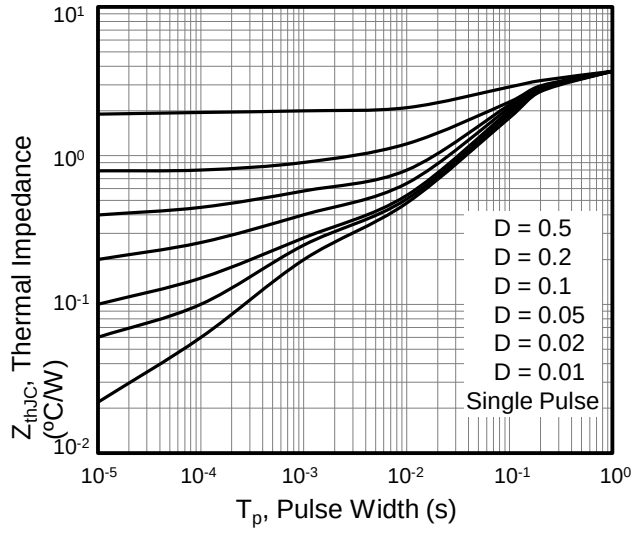


Figure 10. Safe operation area for TO-220F

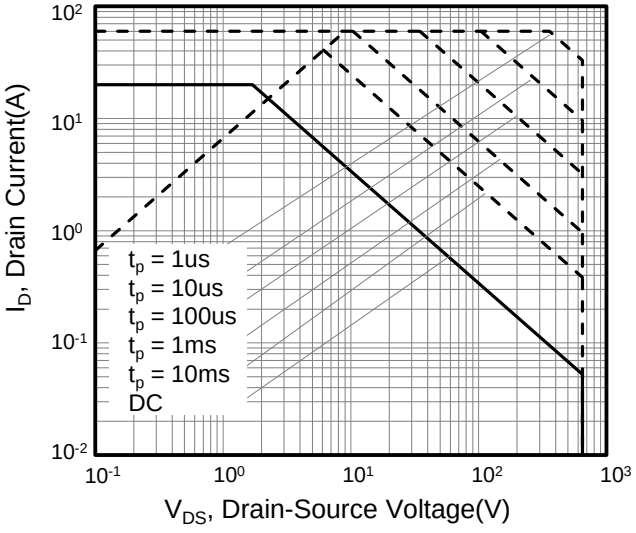


Figure A：Gate Charge Test Circuit and Waveform

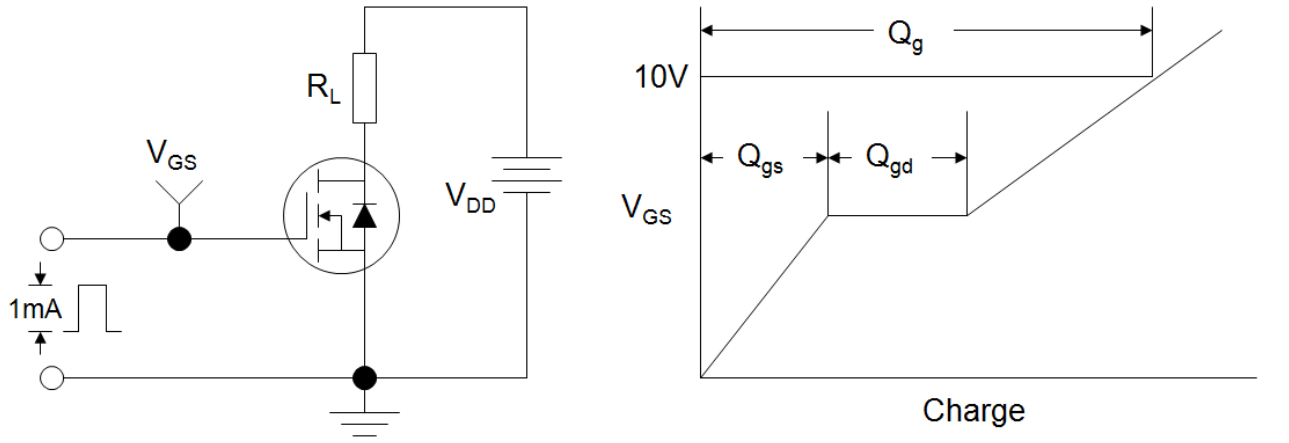


Figure B：Resistive Switching Test Circuit and Waveform

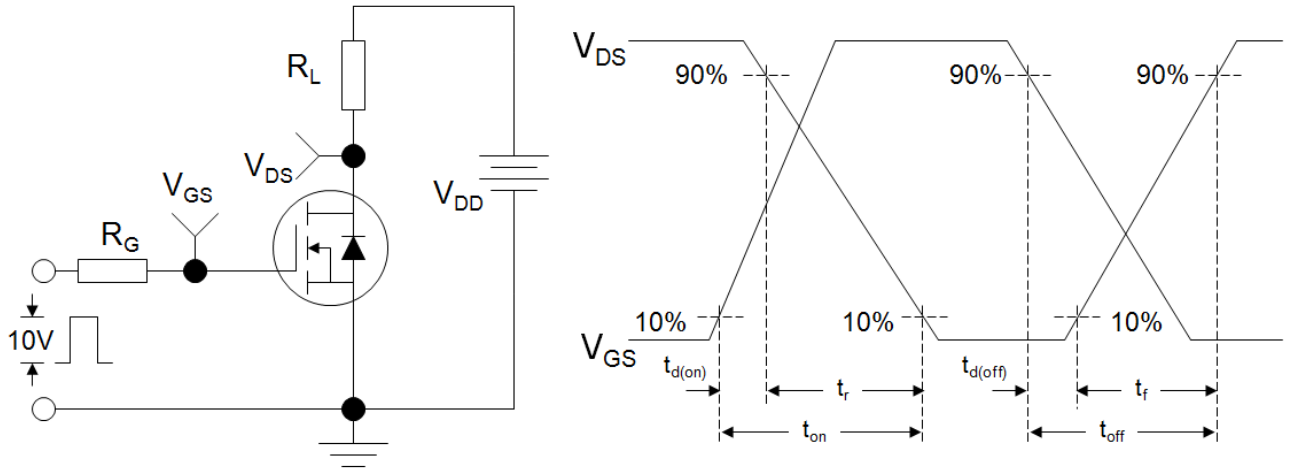
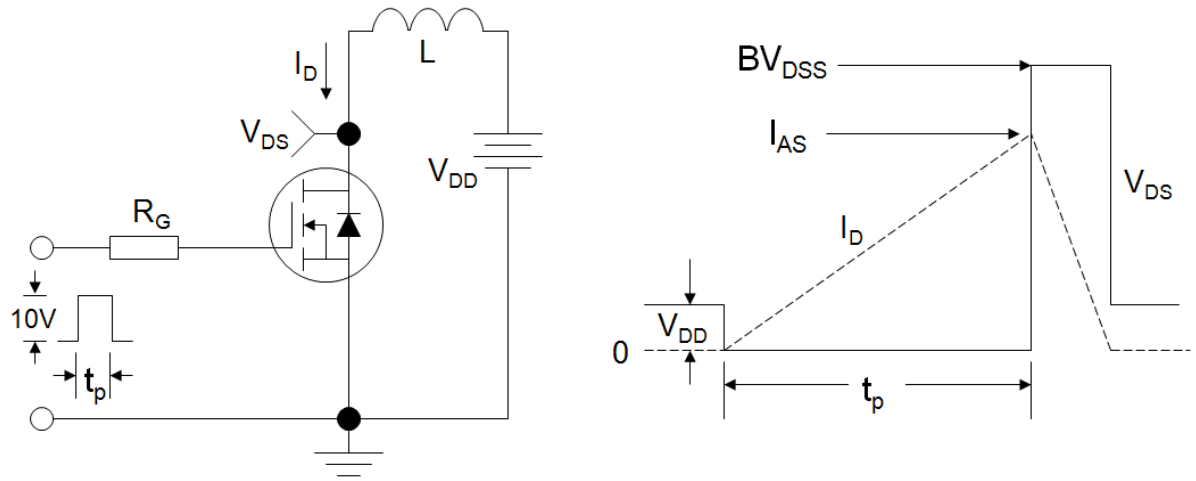
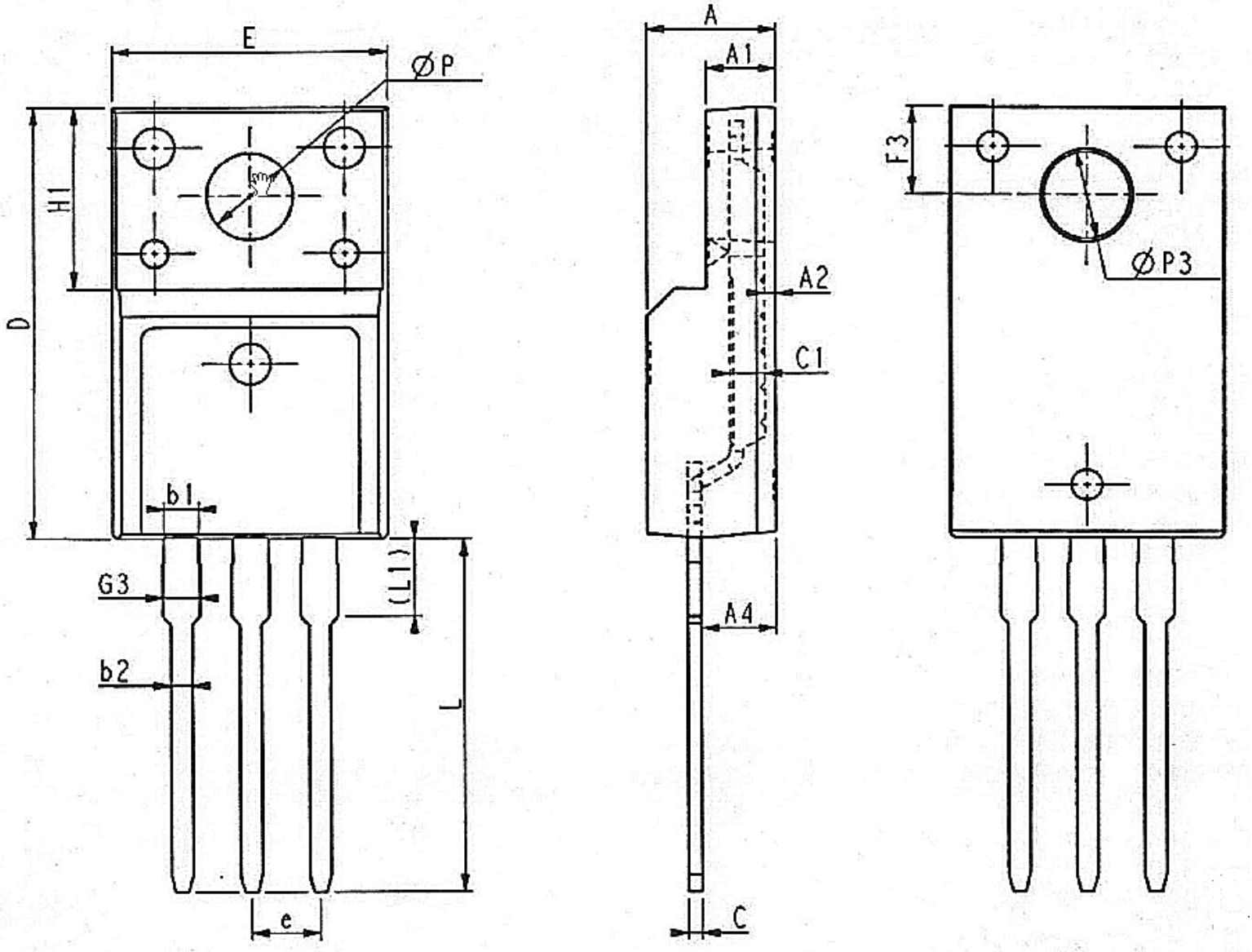


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



TO-220F



Unit:mm			
Symbol	Min.	Nom	Max.
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.30	0.45	0.60
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
c1	1.20	1.30	1.35
D	15.57	15.87	16.17
H1	6.70REF		

Unit:mm			
Symbol	Min.	Nom	Max.
e	2.54BSC		
L	12.68	12.98	13.28
L1	2.88	3.03	3.18
ΦP	3.03	3.18	3.38
ΦP3	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95

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