600V Super-junction Power MOSFET

DESCRIPTION

600V Super-junction Power MOSFET

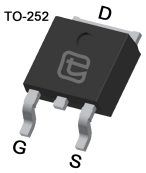
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs，designed according to the SJ principle and pioneered. The Multi-EPI SJ MOSFET provide an extremely fast and robust body diode. Also provide an extremely low switching, communication and conduction losses device with highest robustness make especially resonant switching applications more reliable, more efficient, lighter and cooler, designed by Wuxi Unigroup Microelectronics Company.

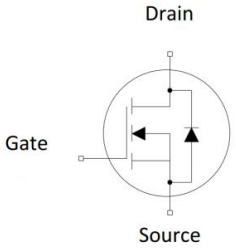
FEATURES

- Ultra-fast body diode
- Very low FOM $R_{DS(on)} \times Q_g$
- Easy to use/drive
- 100% avalanche tested
- RoHS compliant

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- LLC Half-bridge
- Charger





Device Marking and Package Information

Device	Package	Marking
TPA60R600MFD	TO-220F	60R600MFD
TPD60R600MFD	TO-252	60R600MFD

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	600	V
$R_{DS(on),max}$	0.6	Ω
I_D	7	A
$Q_{g,typ}$	14.2	nC
I_{DM}	21	A
t_{rr}	129	ns
Q_{rr}	0.71	μC
I_{rrm}	11	A

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted					
Parameter		**Symbol**	**Value**		**Unit**
			TO-220F	**TO-252**	
Drain-Source Voltage (V_{GS} = 0V)		V_{DSS}	600		V
Continuous Drain Current	T_C = 25ºC	I_D	7		A
	TC = 100ºC		4.2		
Pulsed Drain Current (note1)		I_{DM}	21		A
Gate-Source Voltage		V_{GSS}	±30		V
Single Pulse Avalanche Energy (note2)		E_{AS}	142		mJ
Repetitive Avalanche Energy (note2)		E_{AR}	0.21		mJ
Avalanche Current		I_{AR}	1.3		A
MOSFET dv/dt ruggedness, V_{DS} = 0...480V		dv/dt	50		V/ns
Power Dissipation		P_D	28	63	W
Continuous Body Diode Current		I_S	6		A
Pulsed Diode Forward Current (note1)		I_{SM}	21		
Reverse diode dv/dt (note3)		dv/dt	15		V/ns
Maximum diode commutation speed (note3)		di_f/dt	500		A/us
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150		ºC

Thermal Resistance			
Parameter	**Symbol**	**Value**	**Unit**
		TO-220F	**TO-252**	
Thermal Resistance, Junction-to-Case	R_{thJC}	4.5	2.0	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	62	

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	600	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 600V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
Gate-Source Leakage	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 3.5A	--	0.53	0.6	Ω
Gate resistance	R_G	f = 1.0MHz open drain	--	7	--	Ω
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 100V, f = 1.0MHz	--	573	--	pF
Output Capacitance	C_{oss}		--	29	--	
Reverse Transfer Capacitance	C_{rss}		--	2.3	--	
Total Gate Charge	Q_g	V_{DD} = 480V, I_D = 7A, V_{GS} = 10V	--	14.2	--	nC
Gate-Source Charge	Q_{gs}		--	4.2	--	
Gate-Drain Charge	Q_{gd}		--	5.8	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 7A, R_G = 25Ω	--	61	--	ns
Turn-on Rise Time	t_r		--	61	--	
Turn-off Delay Time	$t_{d(off)}$		--	84	--	
Turn-off Fall Time	t_f		--	47	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} =3.5 A, V_{GS} = 0V	--	1.0	1.5	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_F = 7A, di_F/dt = 100A/μs	--	129	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.71	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	11	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 2.4A, 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

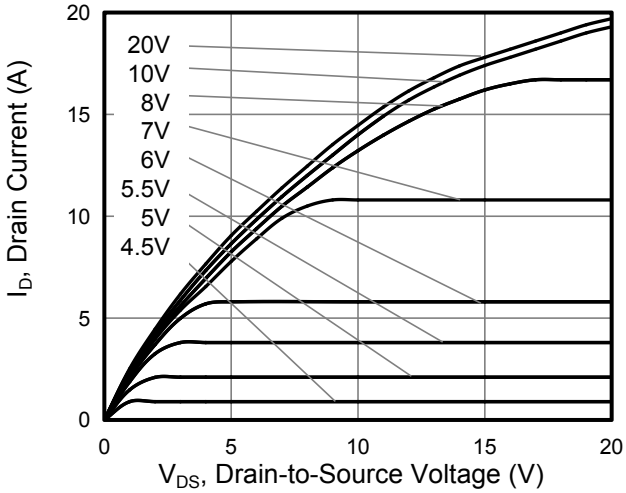


Figure 2. Transfer Characteristics

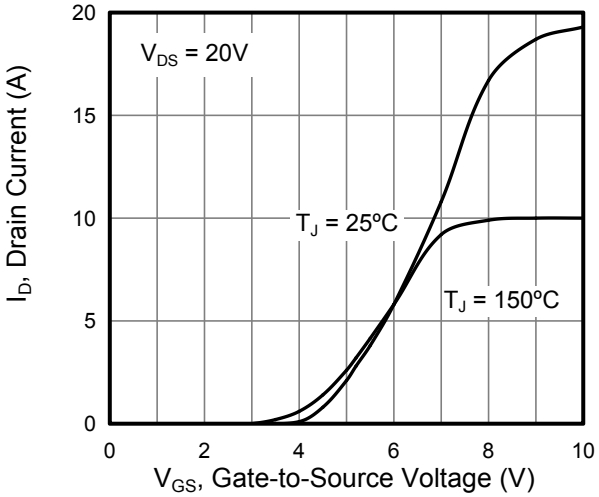


Figure 3. On-Resistance vs. Drain Current

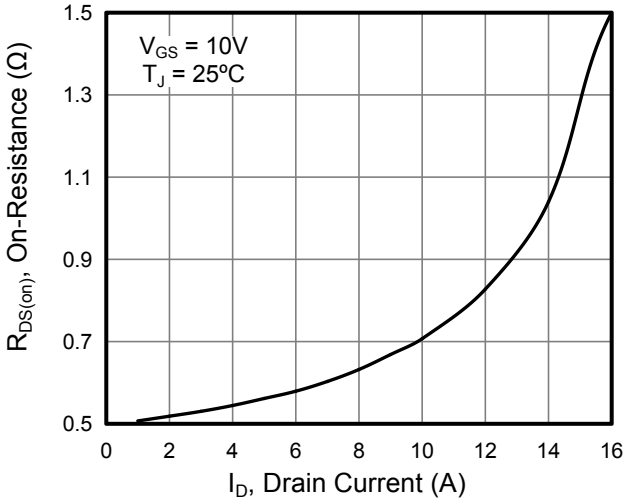


Figure 4. Capacitance

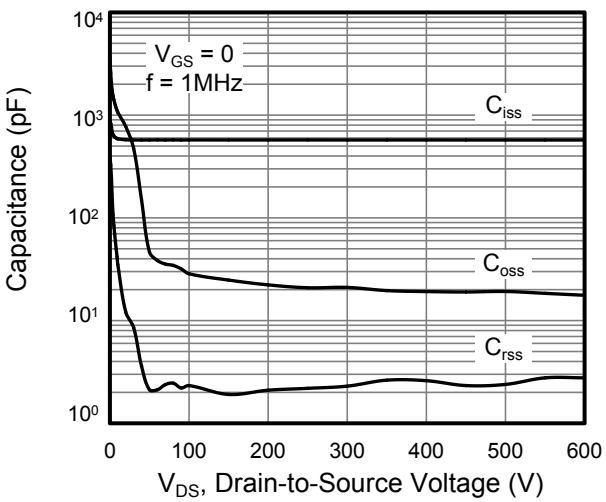


Figure 5. Gate Charge

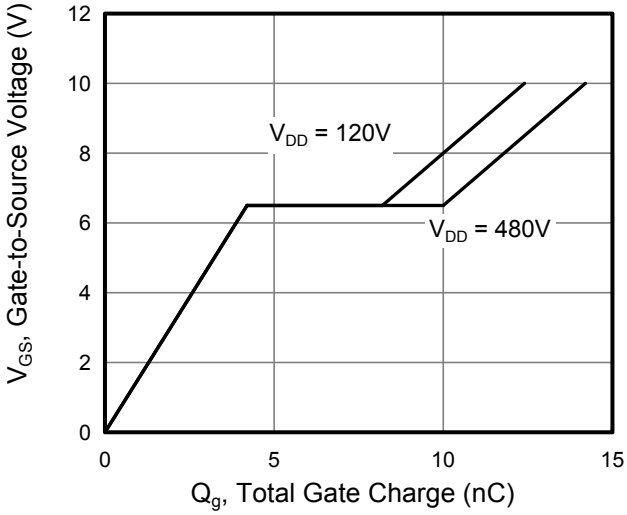
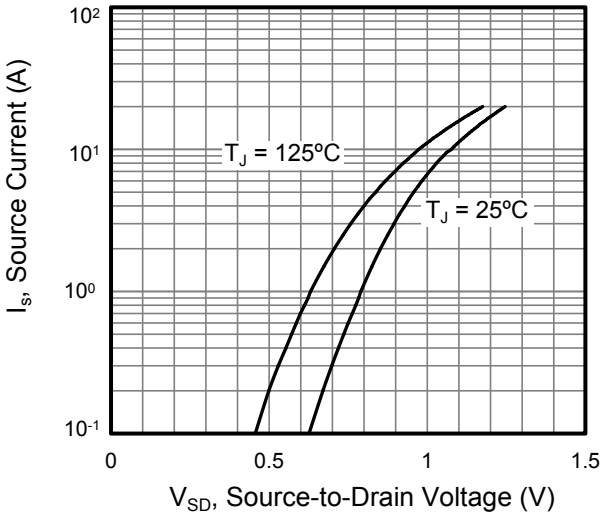


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

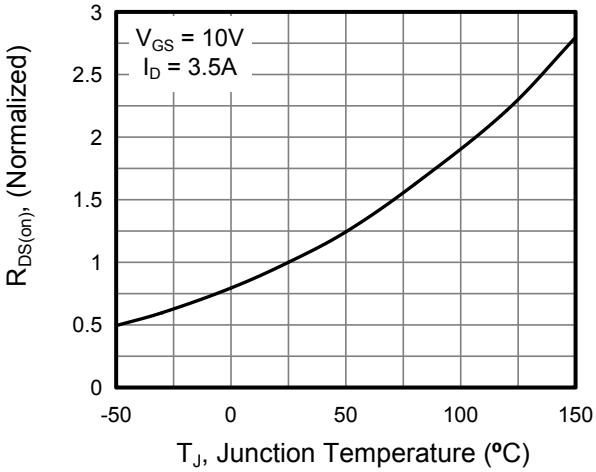


Figure 8.Breakdown voltage vs. Junction Temperature

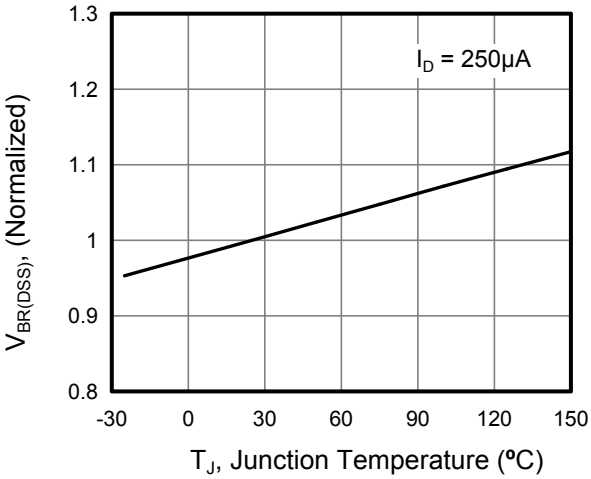


Figure 9. Transient Thermal Impedance TO-220F

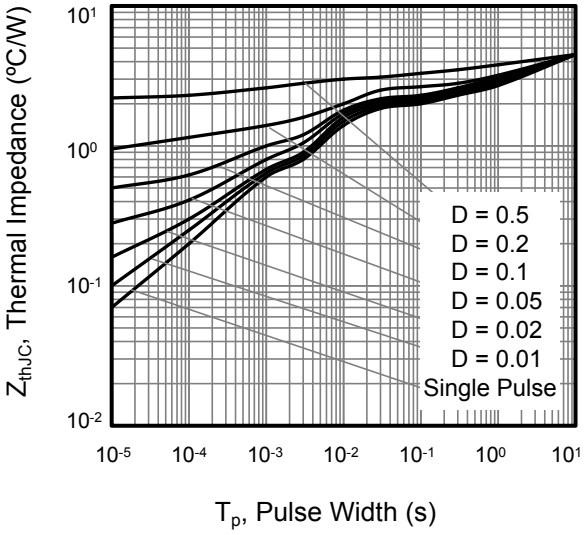


Figure 10. Safe operation area for TO-220F

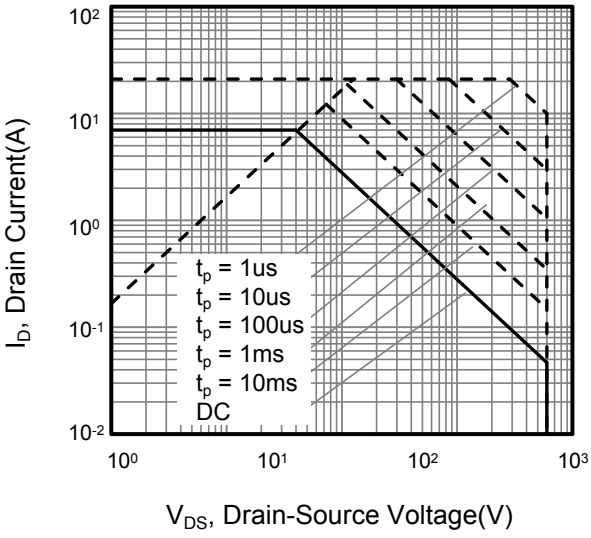


Figure 11. Transient Thermal Impedance TO-252

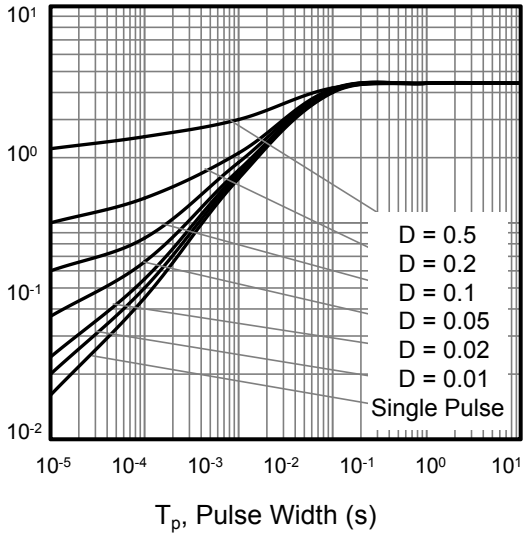


Figure 12. Safe operation area for TO-252

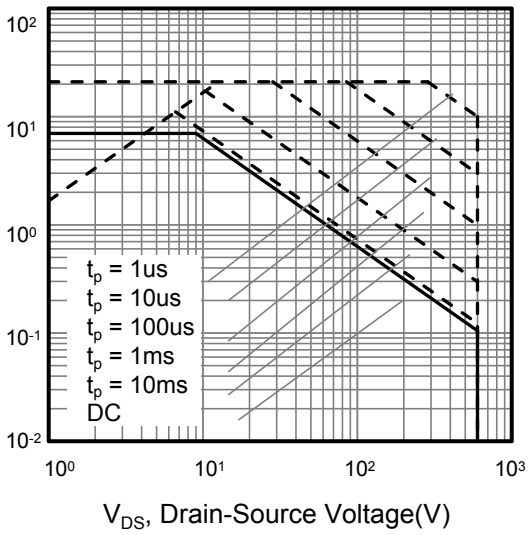


Figure A：Gate Charge Test Circuit and Waveform

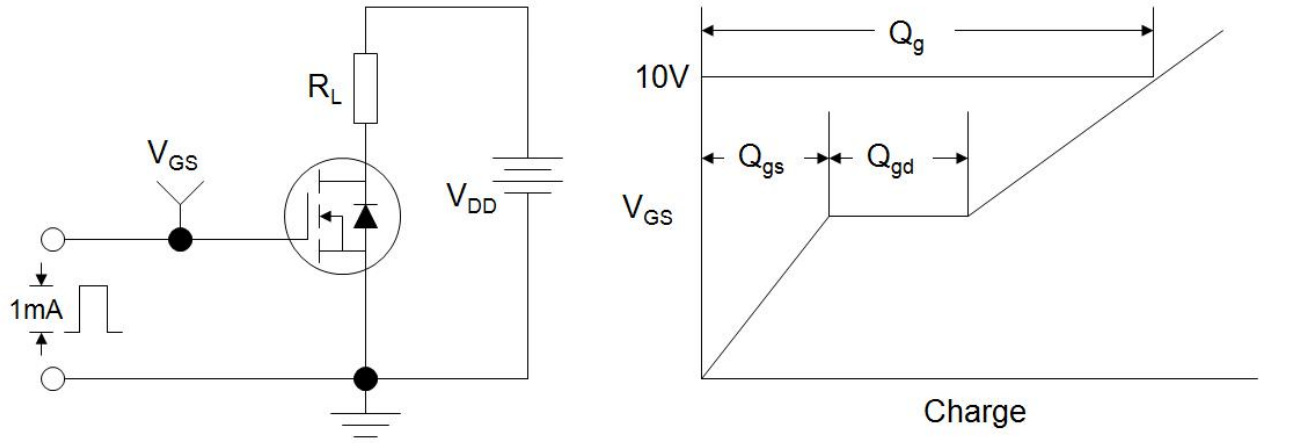


Figure B：Resistive Switching Test Circuit and Waveform

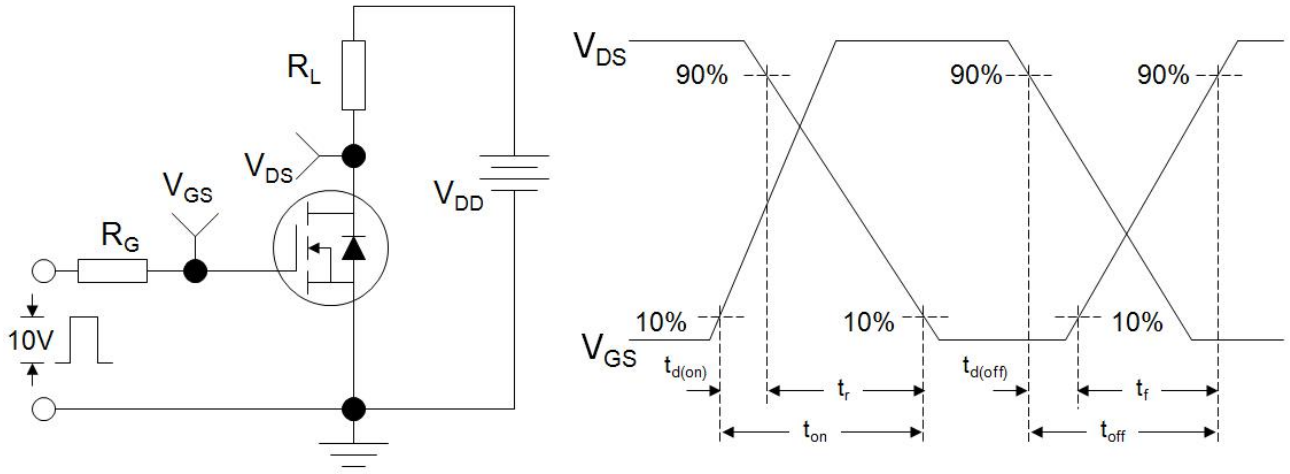
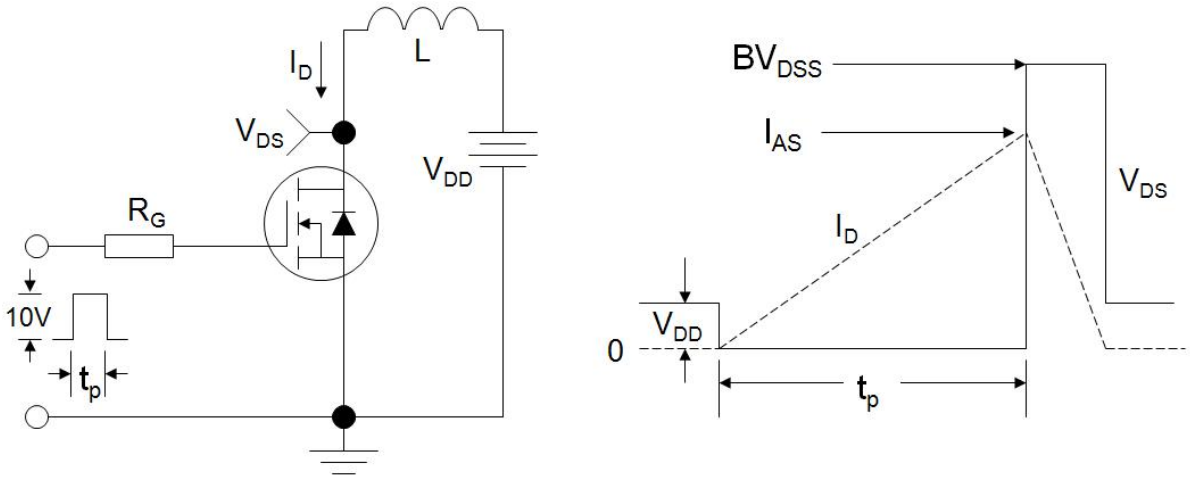
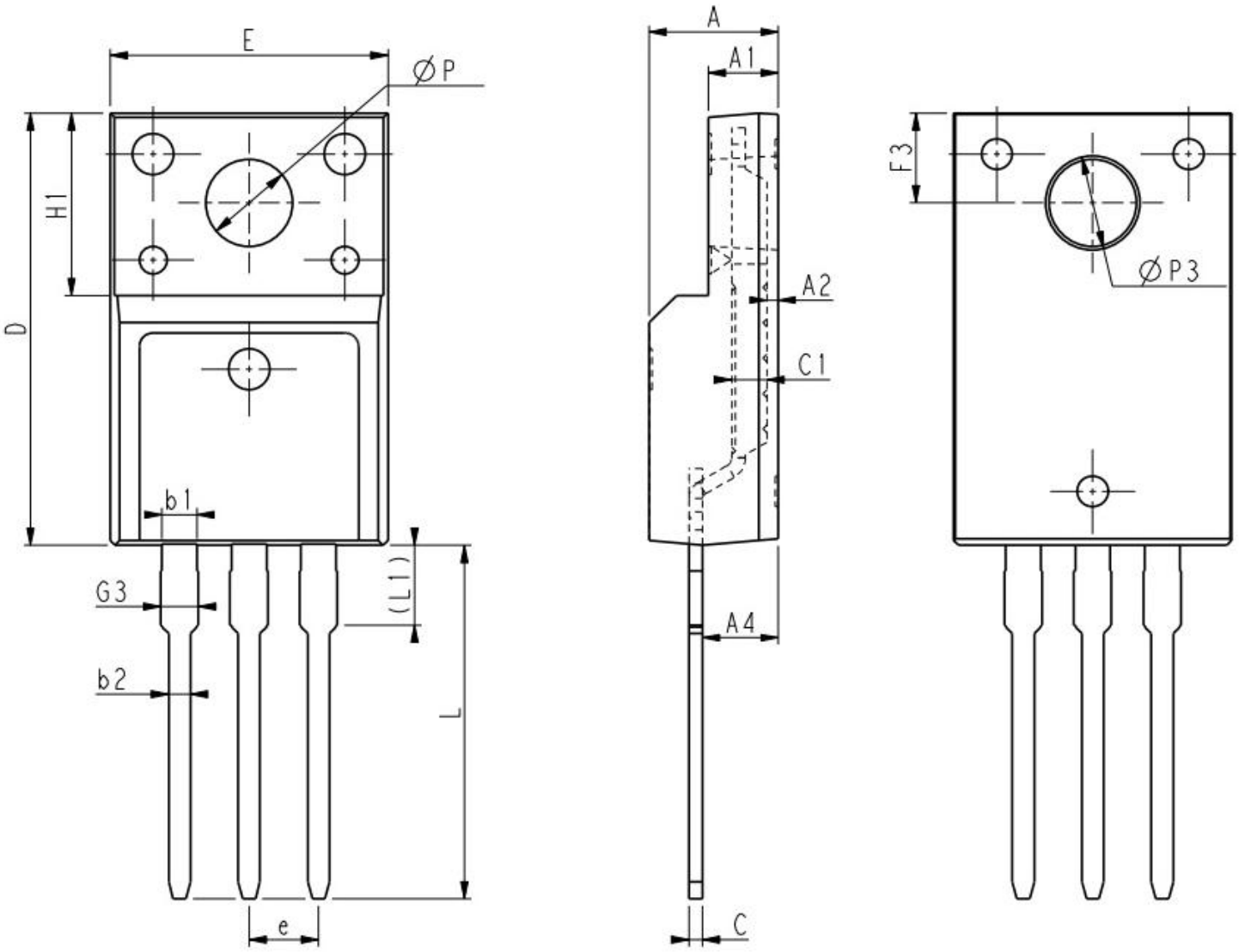


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



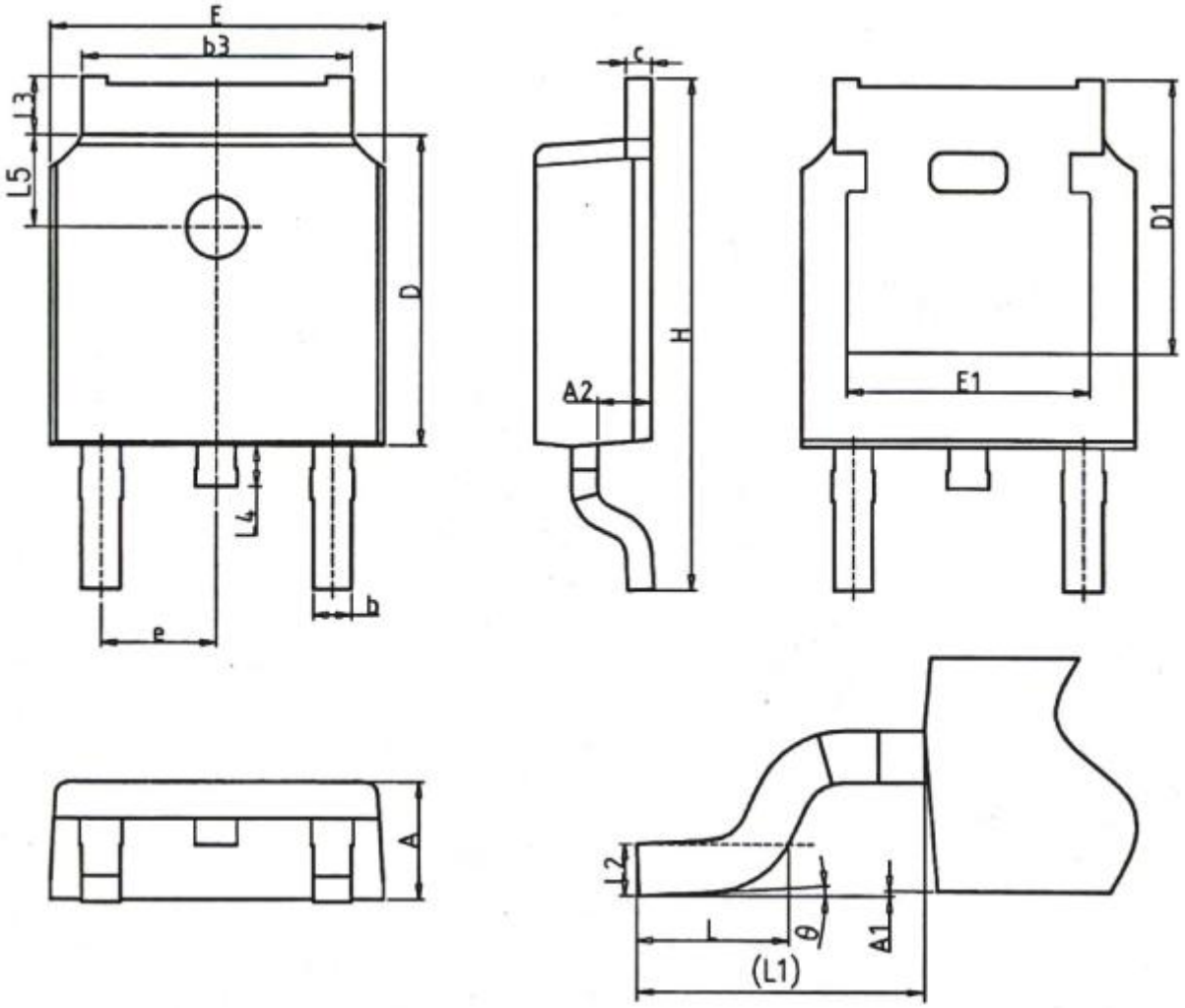
TO-220F



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	2.93	3.03	3.13
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

TO-252



Unit:mm			
Symbol	Min.	Nom	Max.
A	2.20	2.30	2.40
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30 REF		
E	6.40	6.60	6.80
E1	4.63	-	-

Unit:mm			
Symbol	Min.	Nom	Max.
e	2.286 BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90 REF		
L2	0.51 BSC		
L3	0.88	-	1.28
L4	-	-	1.00
L5	1.65	1.80	1.95
θ	0°	-	8°

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