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. The deep trench SJ MOSFET 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

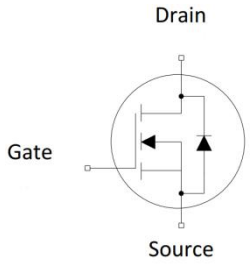
- Ultra-fast body diode
- Very low FOM $R_{DS(on)} \times Q_g$
- Easy to use/drive
- 100% avalanche tested
- RoHS compliant

Applications

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

TO-220F

TO-247



Device Marking and Package Information

Device	Package	Marking
TPA60R070DFD	TO-220F	60R070DFD
TPW60R070DFD	TO-247	60R070DFD

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.07	Ω
$Q_{g,typ}$	83	nC
I_D	45	A
$I_{D,pulse}$	135	A
E_{OSS} @ 400V	10.5	μJ
t_{rr}	171.2	ns
Q_{rr}	1.48	μC
I_{rrm}	16	A

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Value**	**Unit**
Continuous Drain Current	T_C = 25ºC	I_D	45	A
	T_C = 100ºC		27	
Pulsed Drain Current (note1)		$I_{D,pulse}$	135	A
Gate-Source Voltage		V_{GSS}	±30	V
Single Pulse Avalanche Energy (note2)		E_{AS}	180	mJ
Repetitive Avalanche Energy (note2)		E_{AR}	144	mJ
Avalanche Current		I_{AR}	6	A
MOSFET dv/dt Ruggedness, V_{DS} = 0...600V		dv/dt	50	V/ns
Power Dissipation For TO-220F		P_D	53	W
Power Dissipation For TO-247			312	
Continuous Diode Forward Current		I_S	45	A
Diode Pulsed Current (note1)		$I_{S,pulse}$	135	
Reverse Diode dv/dt (note3)		dv/dt	50	V/ns
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance For TO-220F			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	2.35	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-247			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.4	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	

Electrical Characteristics T_J = 25ºC, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Value**			**Unit**
			Min.	**Typ.**	**Max.**	
Static Characteristics						
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
		V_{DS} = 600V, V_{GS} = 0V, T_J = 150ºC	--	--	5000	
Gate-Source Leakage Current	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	2.5	--	4.5	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 22.5A	--	0.055	0.07	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 100V, f = 1.0MHz	--	4702	--	pF
Output Capacitance	C_{oss}		--	123.5	--	
Reverse Transfer Capacitance	C_{rss}		--	3.52	--	
Total Gate Charge	Q_g	V_{DD} = 480V, I_D = 45A, V_{GS} = 10V	--	40.2	--	nC
Gate-Source Charge	Q_{gs}		--	7.8	--	
Gate-Drain Charge	Q_{gd}		--	16.7	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 45A, R_G = 25Ω	--	58.15	--	ns
Turn-on Rise Time	t_r		--	69.5	--	
Turn-off Delay Time	$t_{d(off)}$		--	134.9	--	
Turn-off Fall Time	t_f		--	87.85	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 22.5A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_S=22.5A, di_F/dt = 100A/μs	--	171.2	--	ns
Reverse Recovery Charge	Q_{rr}		--	1.48	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	16	--	A

Notes

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2. V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1%

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics

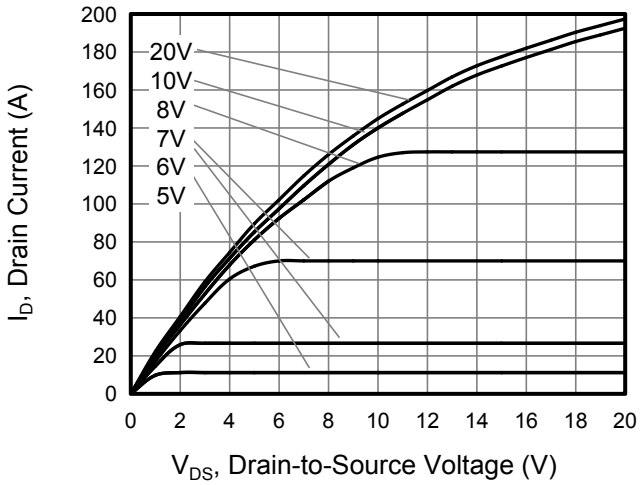


Figure 2. Transfer Characteristics

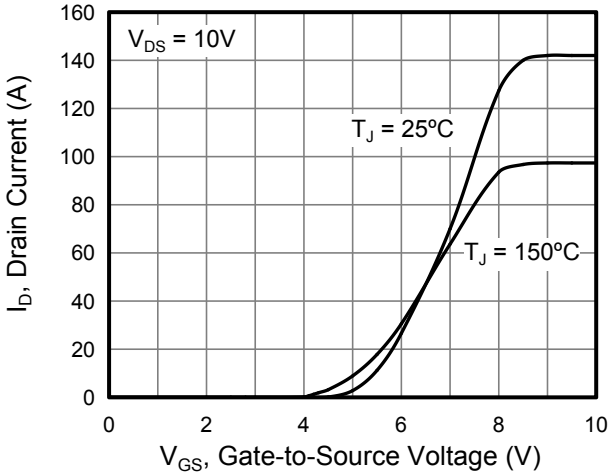


Figure 3 .On-Resistance vs. Drain Current

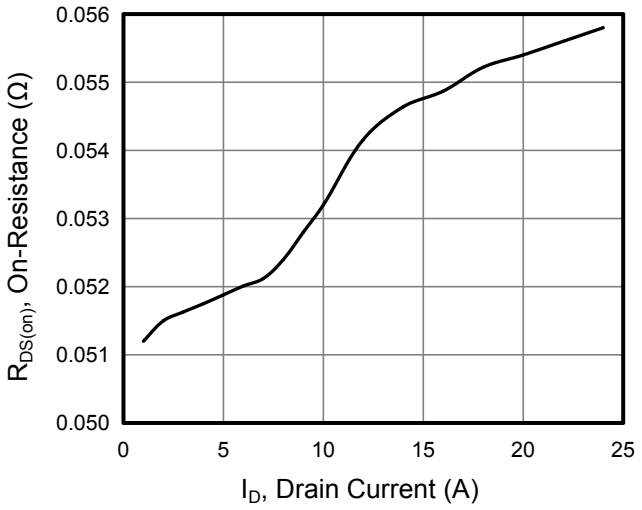


Figure 4. Capacitance

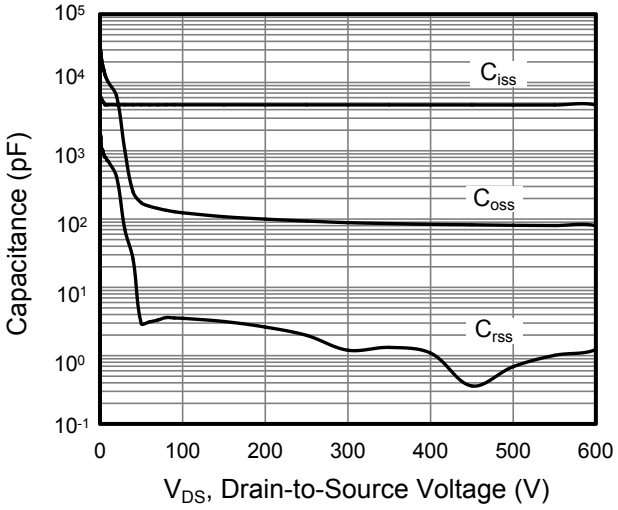


Figure 5. Gate Charge

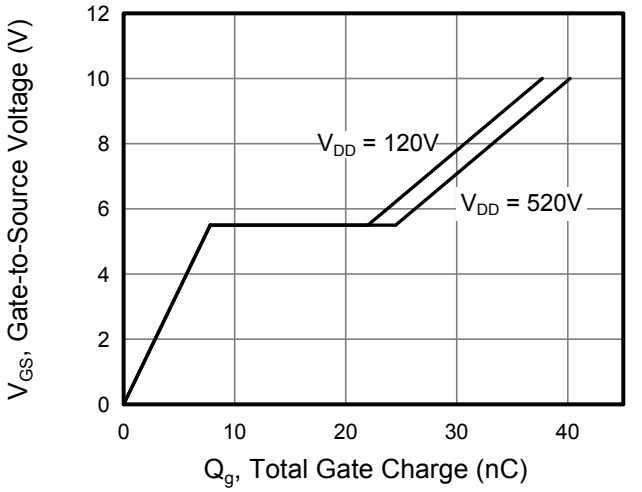


Figure 6. Body Diode Forward Voltage

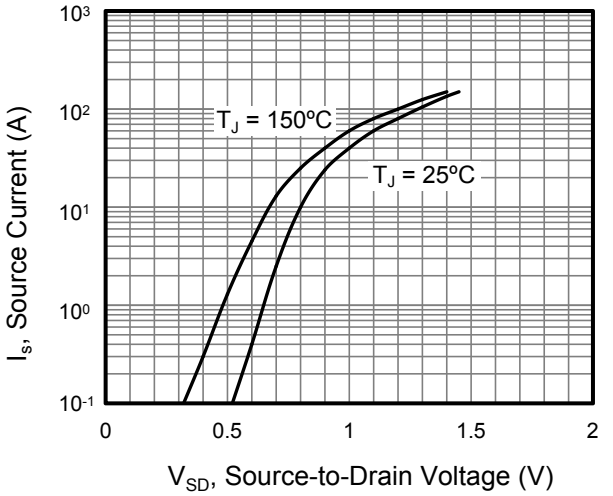


Figure 7. On-Resistance vs. Junction Temperature

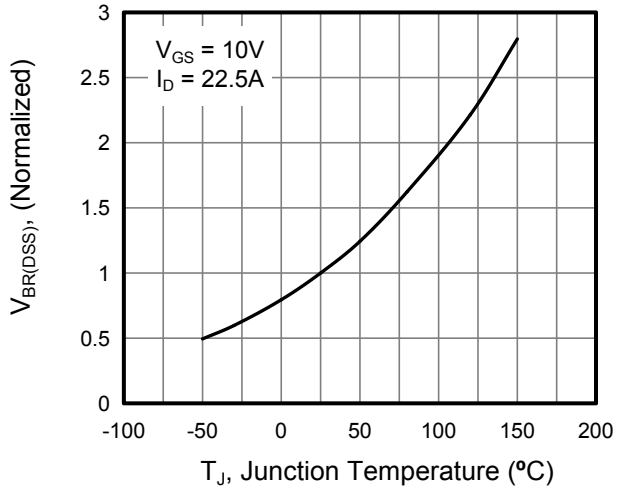


Figure 8. Breakdown voltage vs. Junction Temperature

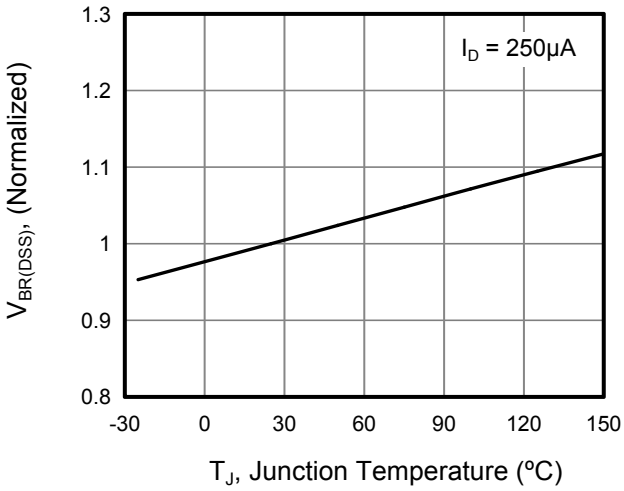


Figure 9. Transient Thermal Impedance For TO-220F

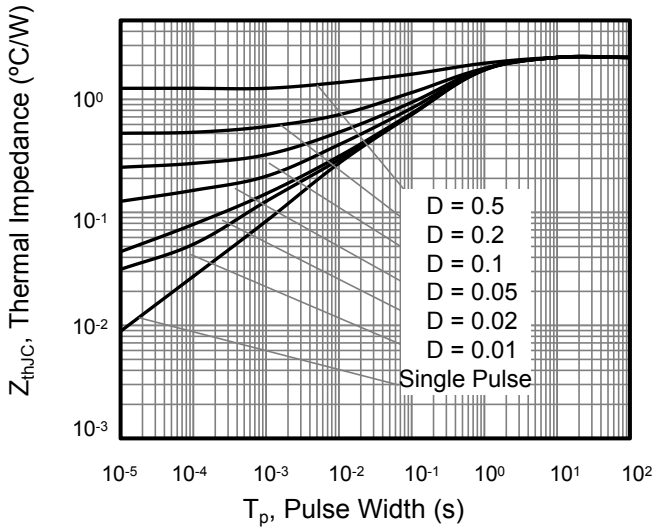


Figure 10 . Transient Thermal Impedance For TO-247

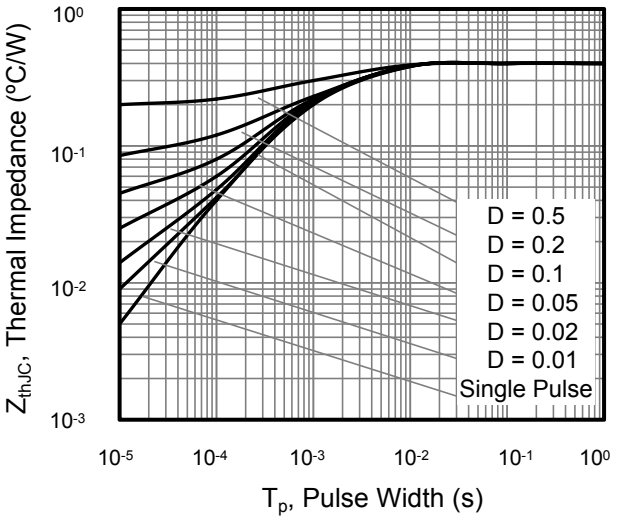


Figure 11. Safe Operation Area For TO-220F

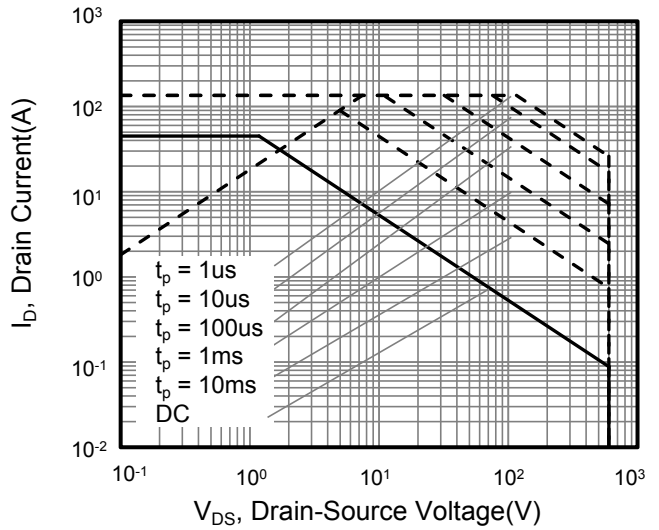
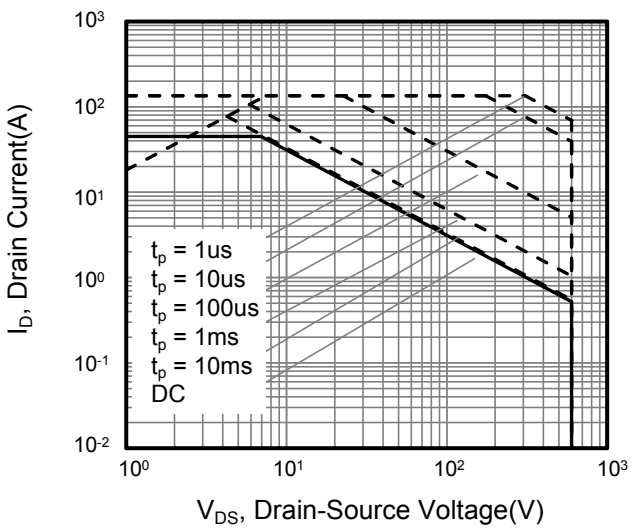


Figure 12. Safe Operation Area For TO-247



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 13. Typ. Coss Stored Energy

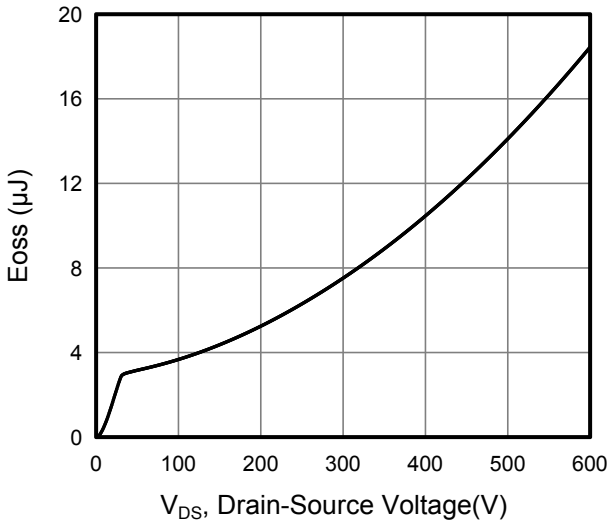


Figure A：Gate Charge Test Circuit and Waveform

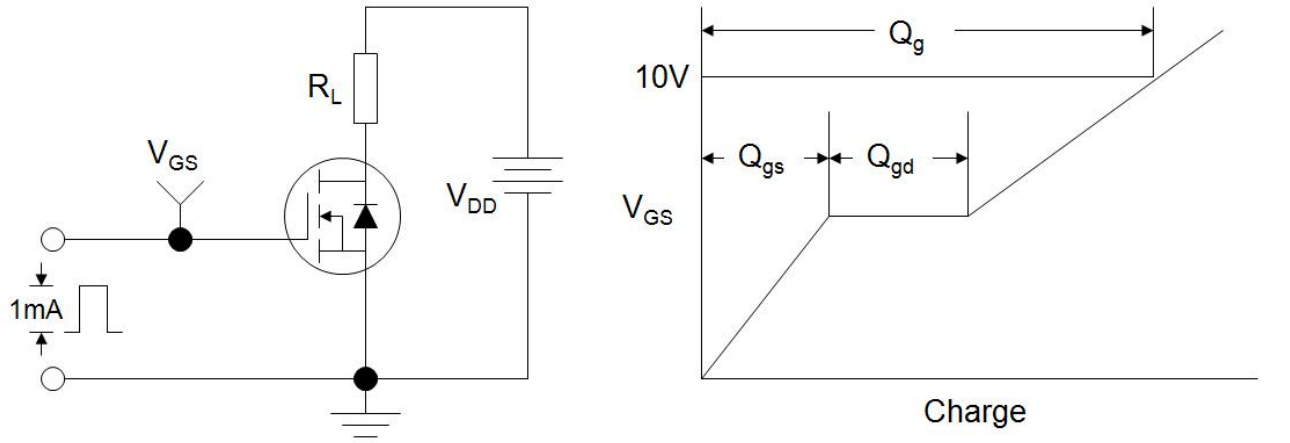


Figure B：Resistive Switching Test Circuit and Waveform

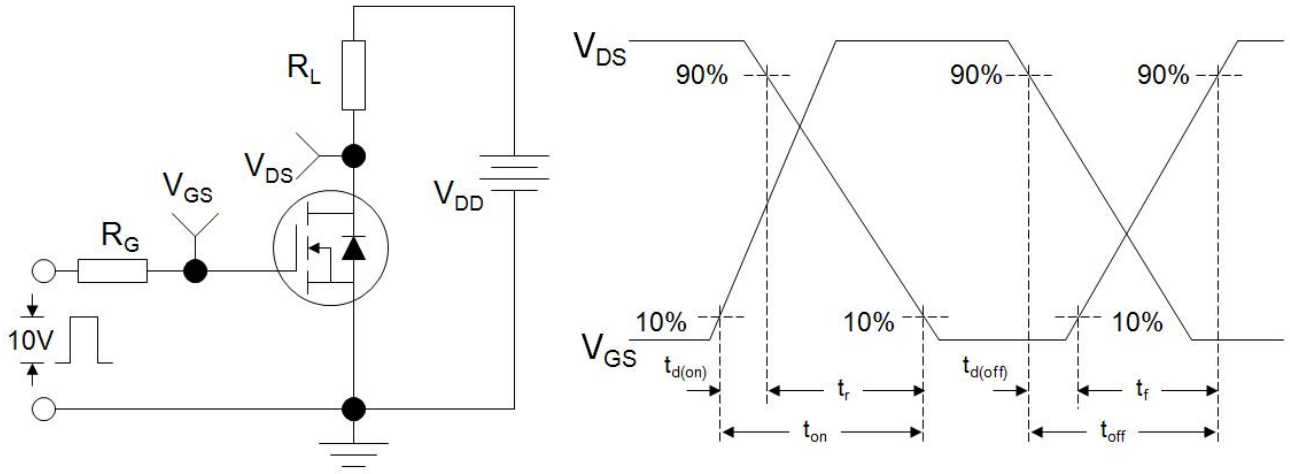
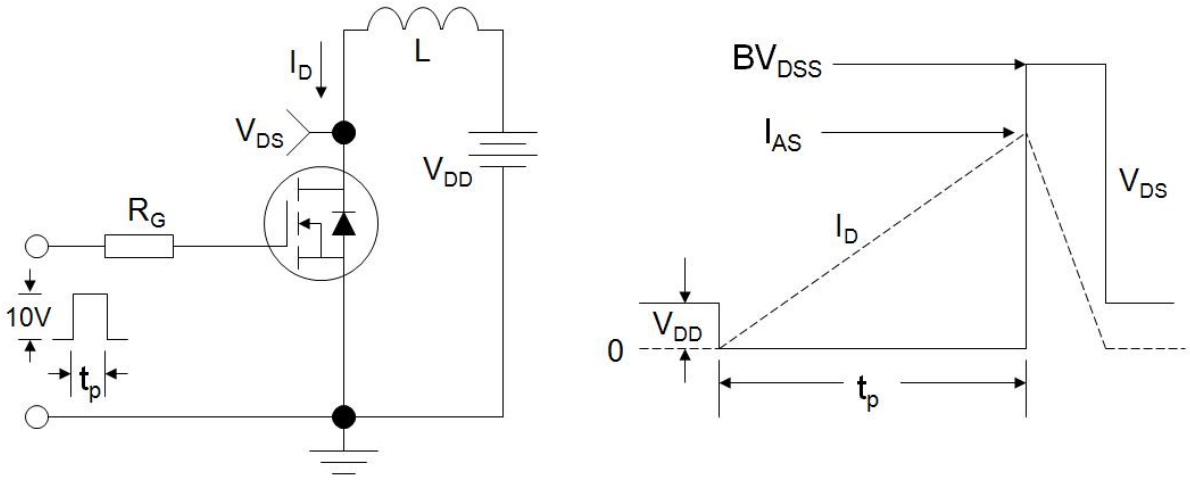
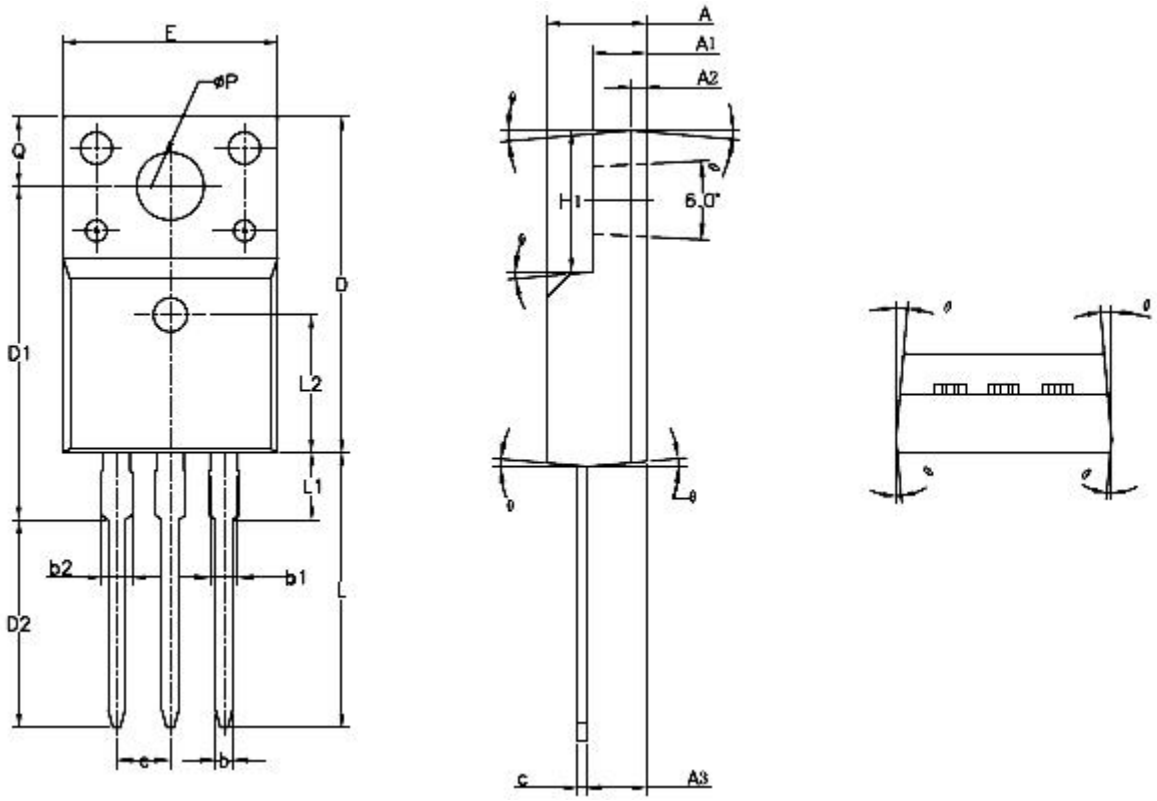


Figure C：Unclamped Inductive Switching Test Circuit and Waveform

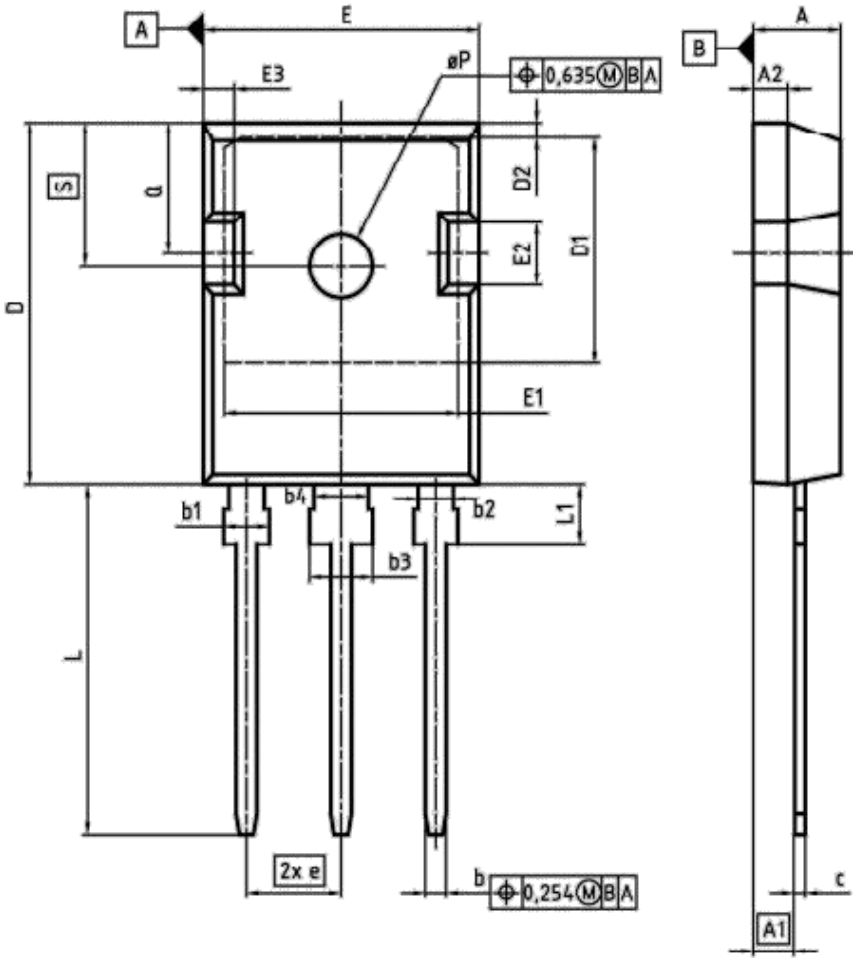


TO-220F（封装厂 I）



SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2		0.70 REF	
A3	2.56	2.76	2.93
b	0.70	–	0.90
b1	1.18	–	1.38
b2	–	–	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e		2.54BSC	
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	–	–	3.50
L2		6.50REF	
øP	3.08	3.18	3.28
Q	3.20	–	3.40
θ1	1°	3°	5°

TO-247（封装厂 E）



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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