Wuxi Unigroup Microelectronics Co.,Ltd

600V Super-Junction Power MOSFET

DESCRIPTION

600V super-junction Power MOSFET

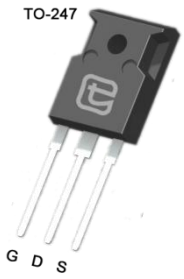
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The SJ MOSFET is a price-performance optimized product enabling to target cost sensitive applications in Consumer and Lighting markets, designed by Wuxi Unigroup Microelectronics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

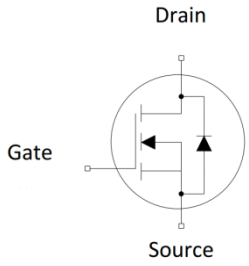
FEATURES

- 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
TPW60R090MFD	TO-247	60R090MFD

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	600	V
$R_{DS(on),max}$	0.09	Ω
I_D	47	A
$Q_{g,typ}$	78	nC
I_{DM}	141	A
t_{rr}	145	ns
Q_{rr}	0.87	μC
I_{rrm}	12.0	A

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Value**	**Unit**
Drain-Source Voltage (V_{GS} = 0V)		V_{DSS}	600	V
Continuous Drain Current	T_C = 25ºC	I_D	47	A
	TC = 100ºC		28.2	
Pulsed Drain Current (note1)		I_{DM}	141	A
Gate-Source Voltage		V_{GSS}	±30	V
Single Pulse Avalanche Energy (note2)		E_{AS}	1160	mJ
Repetitive Avalanche Energy (note2)		E_{AR}	1.76	mJ
Avalanche Current		I_{AR}	8.7	A
MOSFET dv/dt ruggedness, V_{DS} = 0...480V		dv/dt	50	V/ns
Power Dissipation		P_D	391	W
Continuous Body Diode Current		I_S	40	A
Pulsed Diode Forward Current (note1)		I_{SM}	141	
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}	0.32	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	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	--	--	5	μA
		V_{DS} = 600V, V_{GS} = 0V, T_J = 150ºC	--	--	5000	
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 = 24A	--	0.077	0.09	Ω
Gate resistance	R_G	f = 1.0MHz open drain	--	0.8	--	Ω
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 100V, f = 1.0MHz	--	3685	--	pF
Output Capacitance	C_{oss}		--	134	--	
Reverse Transfer Capacitance	C_{rss}		--	3.1	--	
Total Gate Charge	Q_g	V_{DD} = 480V, I_D = 47A, V_{GS} = 10V	--	78	--	nC
Gate-Source Charge	Q_{gs}		--	24	--	
Gate-Drain Charge	Q_{gd}		--	30	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 47A, R_G = 25Ω	--	49	--	ns
Turn-on Rise Time	t_r		--	123	--	
Turn-off Delay Time	$t_{d(off)}$		--	105	--	
Turn-off Fall Time	t_f		--	49	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 47A, V_{GS} = 0V	--	1.0	1.5	V
Reverse Recovery Time	t_{rr}	V_R = 480V, I_F = 23A, di_F/dt = 100A/μs	--	145	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.87	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	12.0	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 8.7A, 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

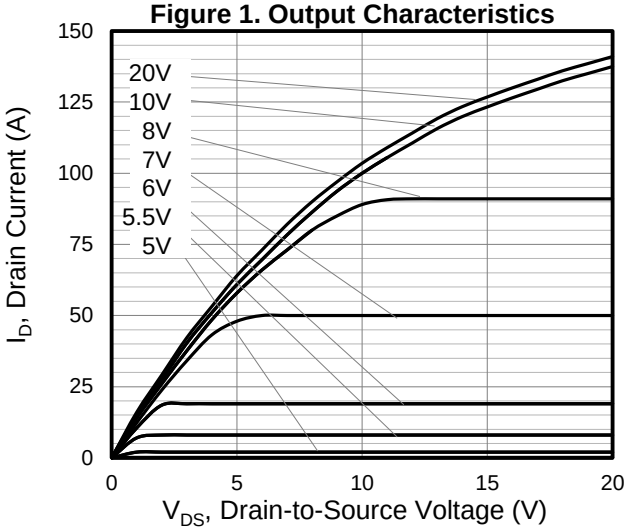


Figure 2. Transfer Characteristics

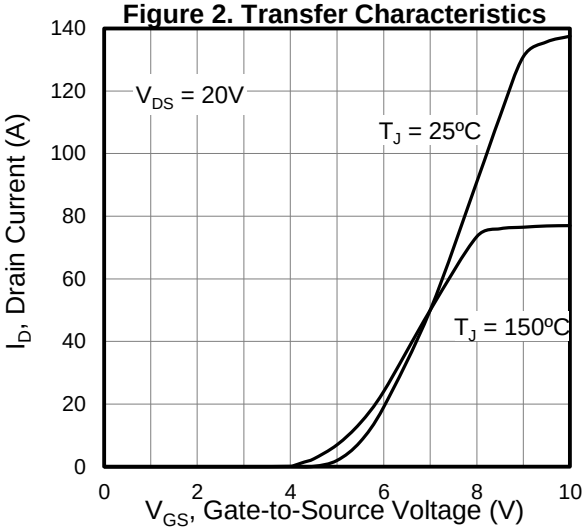


Figure 3. On-Resistance vs. Drain Current

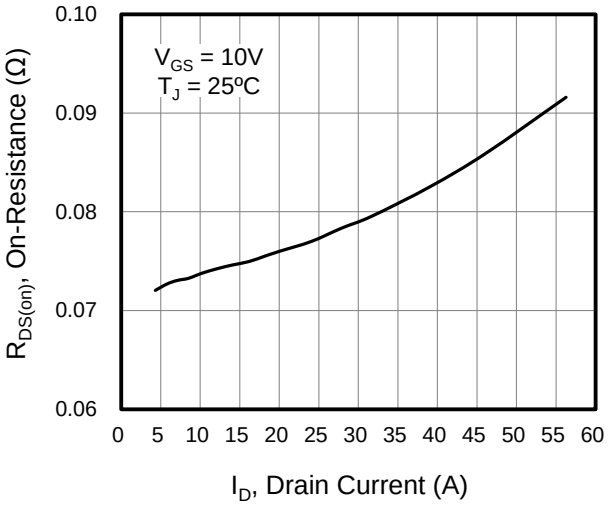


Figure 4. Capacitance

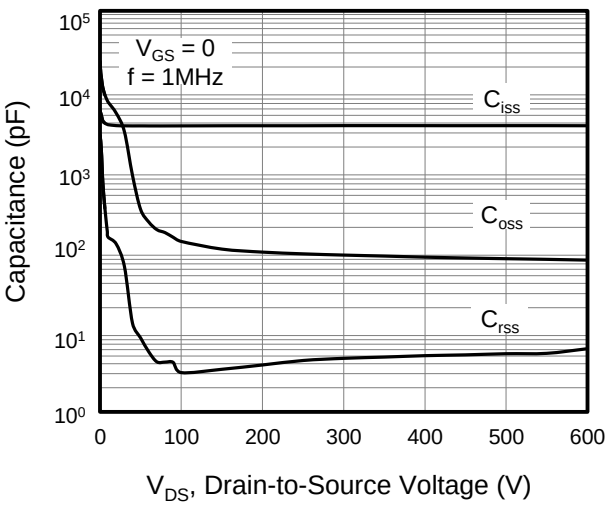


Figure 5. Gate Charge

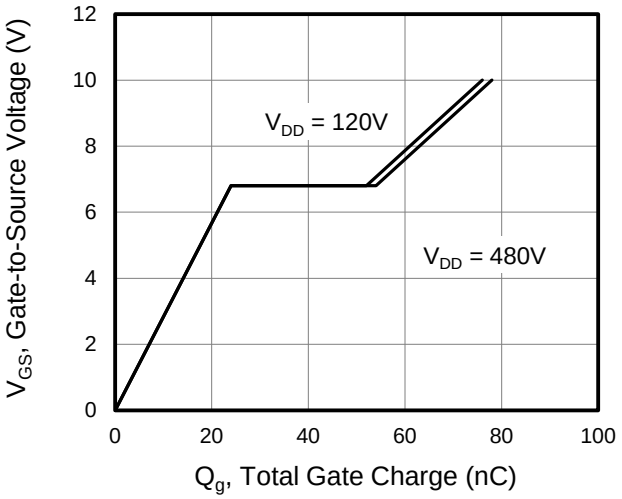
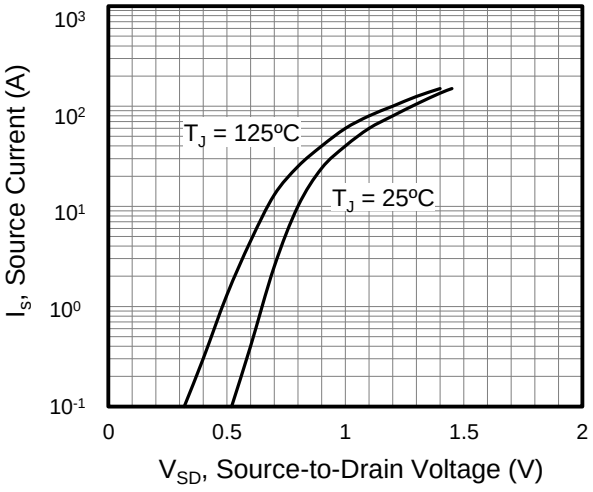


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

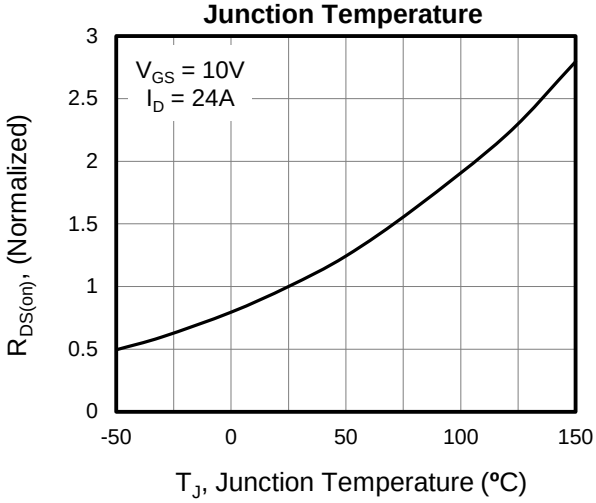


Figure 8. Breakdown voltage vs. Junction Temperature

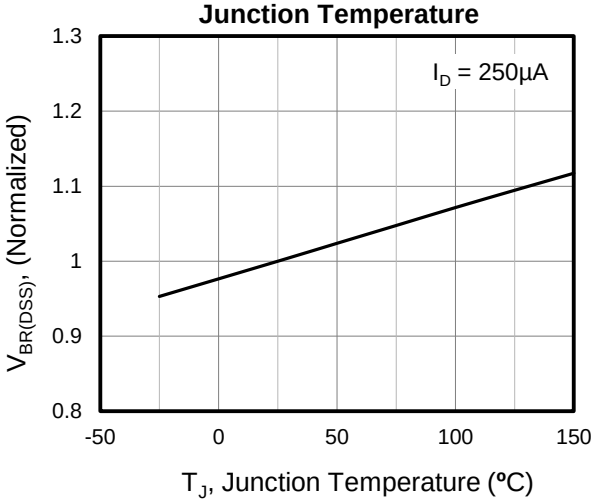


Figure 9. Transient Thermal Impedance for TO-247

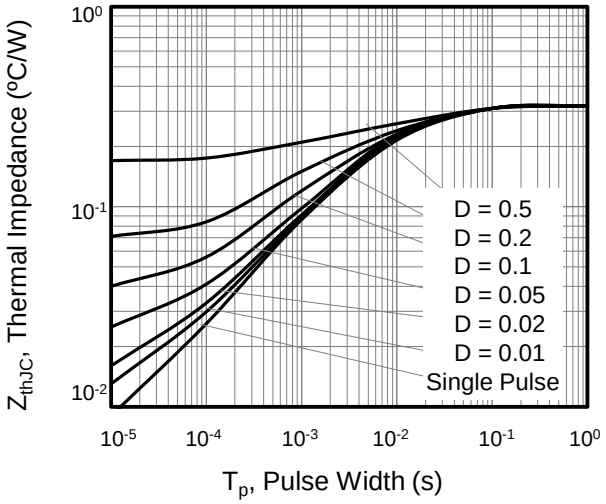


Figure 10. Safe operation area for TO-247

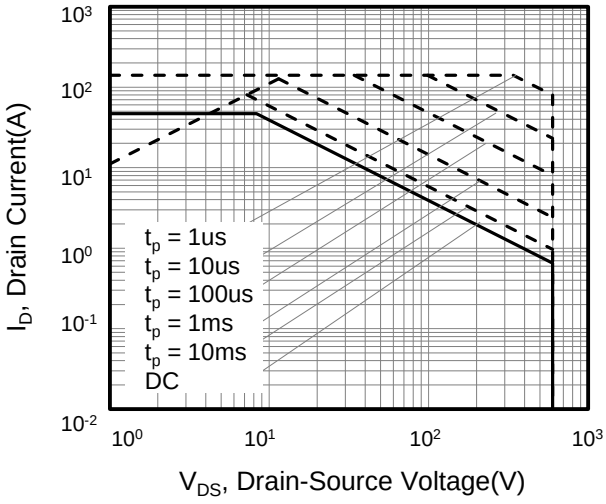


Figure A：Gate Charge Test Circuit and Waveform

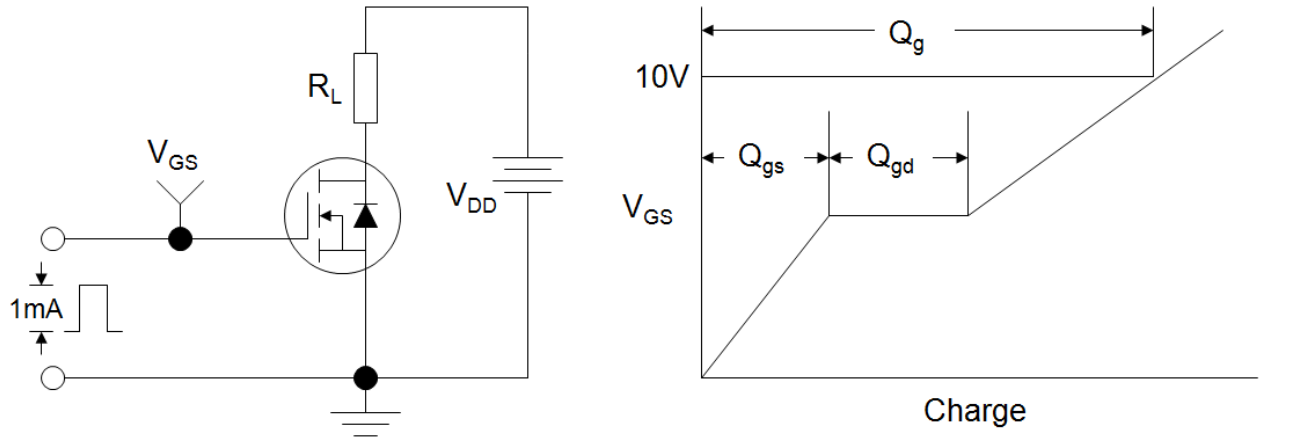


Figure B：Resistive Switching Test Circuit and Waveform

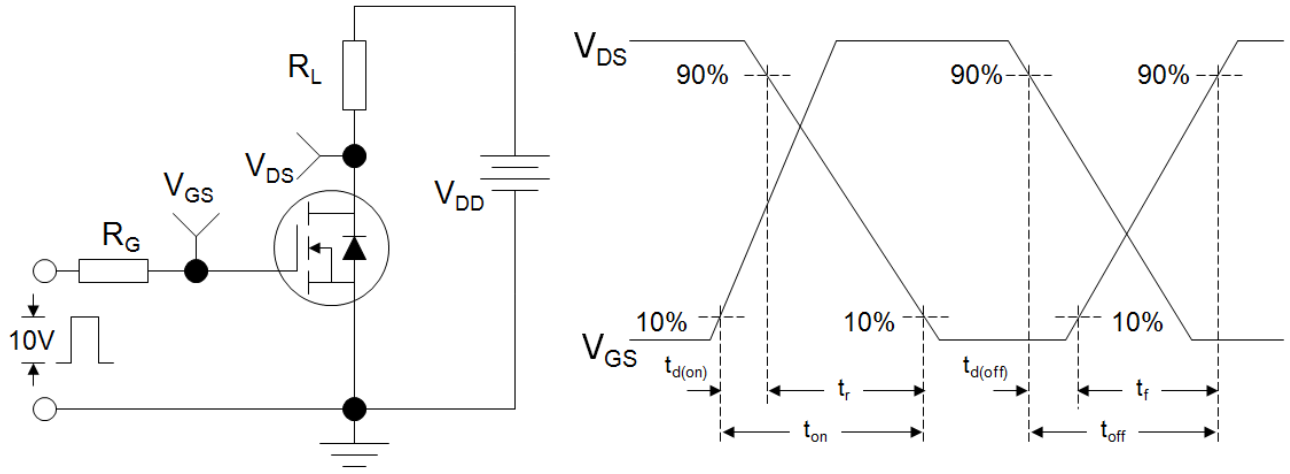
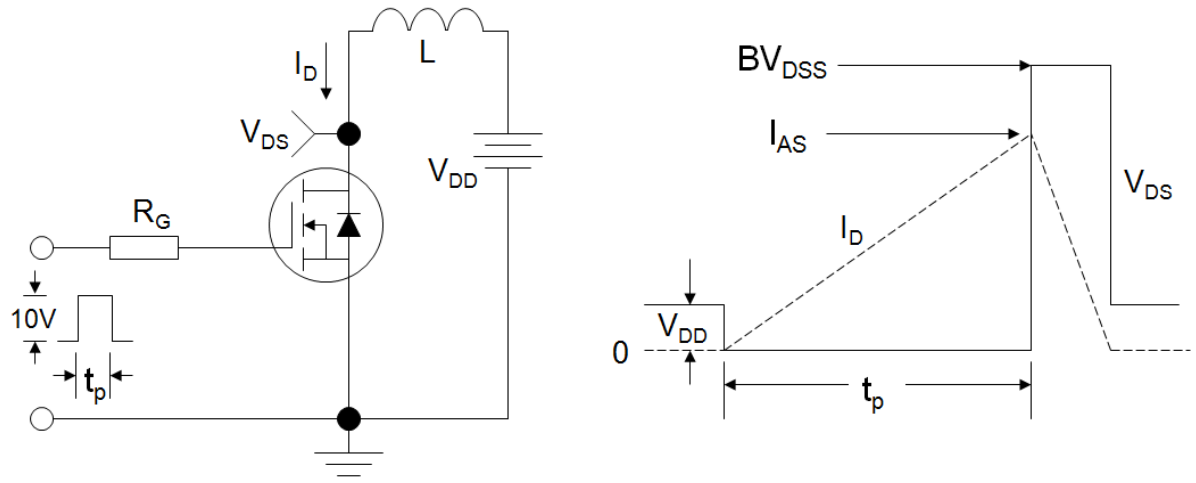
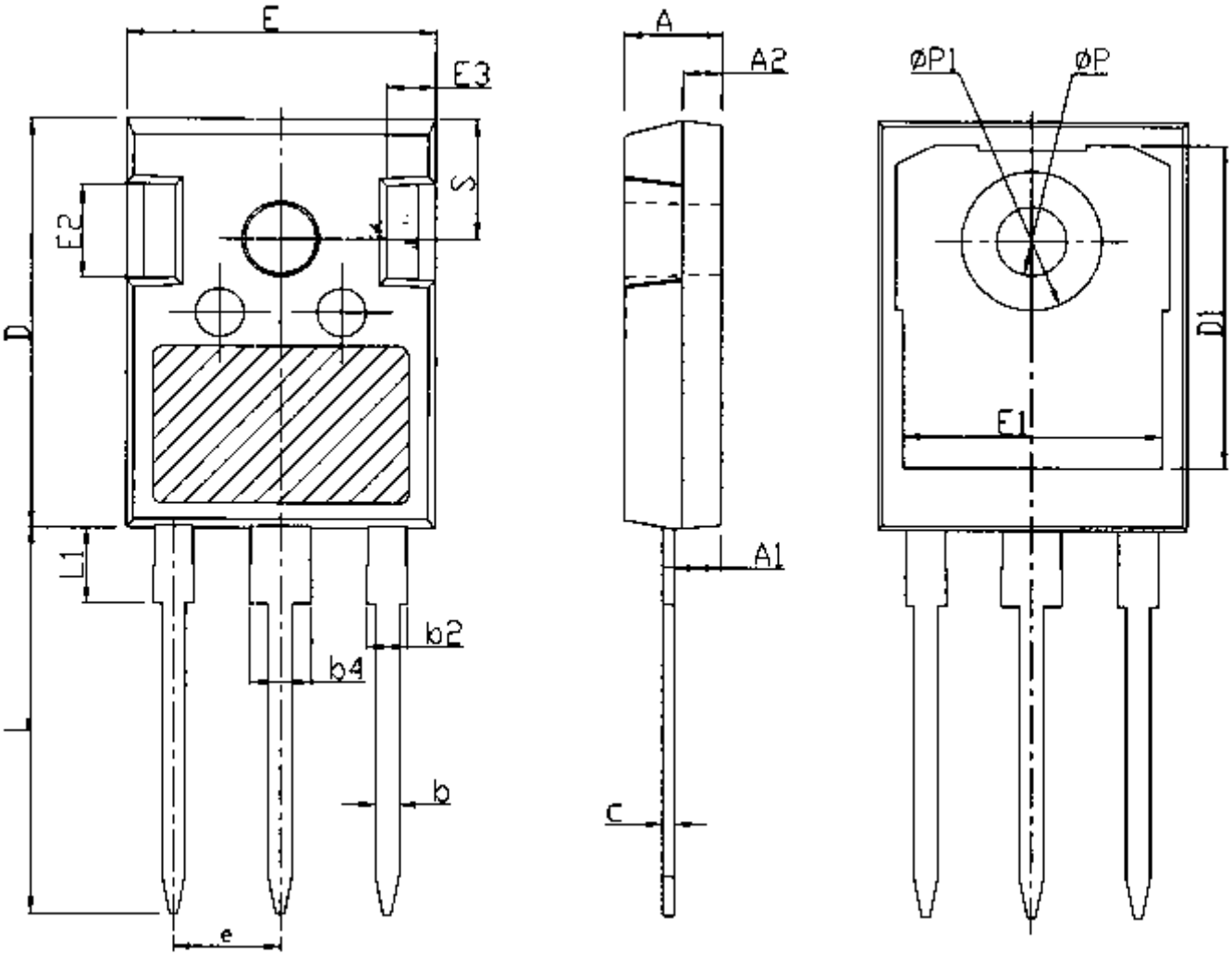


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



TO-247



Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85

Unit:mm			
Symbol	**Min.**	**Nom.**	**Max.**
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		

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