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.

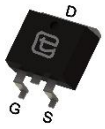
Features

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

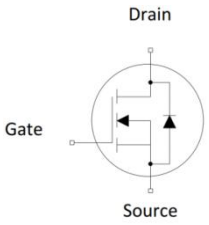
Applications

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

TO-263



TO-247



Device Marking and Package Information

Device	Package	Marking
TPB60R090MFD	TO-263	60R090MFD
TPW60R090MFD	TO-247	60R090MFD

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.09	Ω
$Q_{g,typ}$	78	nC
I_D	47	A
$I_{D,pulse}$	141	A
E_{OSS} @ 400V	11.7	μJ
Body Diode di_F/dt	900	A/μs
t_{rr}	170	ns
Q_{rr}	1.05	μC
I_{rrm}	12.4	A

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Value**	**Unit**
Continuous Drain Current	T_C = 25ºC	I_D	47	A
	T_C = 100ºC		28.2	
Pulsed Drain Current (note1)		$I_{D,pulse}$	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 For TO-263,TO-247		P_D	391	W
Continuous Diode Forward Current		I_S	47	A
Diode Pulsed Current (note1)		$I_{S,pulse}$	141	
Reverse Diode dv/dt (note3)		dv/dt	50	V/ns
Maximum Diode Commutation Speed (note3)		di_f/dt	900	A/μs
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance For TO-263,TO-247			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.32	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	--	--	5	μA
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	3	--	5	V
Drain-Source On-State-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 Characteristics						
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 Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} =24A, V_{GS} = 0V	--	1.0	1.5	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_F = 23A, di_F/dt = 100A/μs	--	170	--	ns
Reverse Recovery Charge	Q_{rr}		--	1.05	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	12.4	--	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

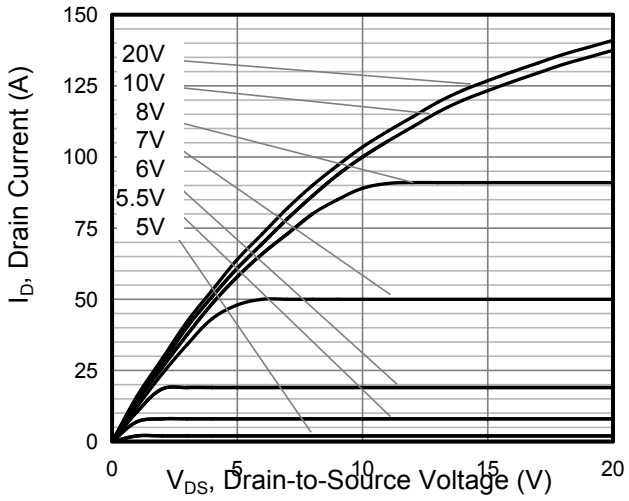


Figure 2. Transfer Characteristics

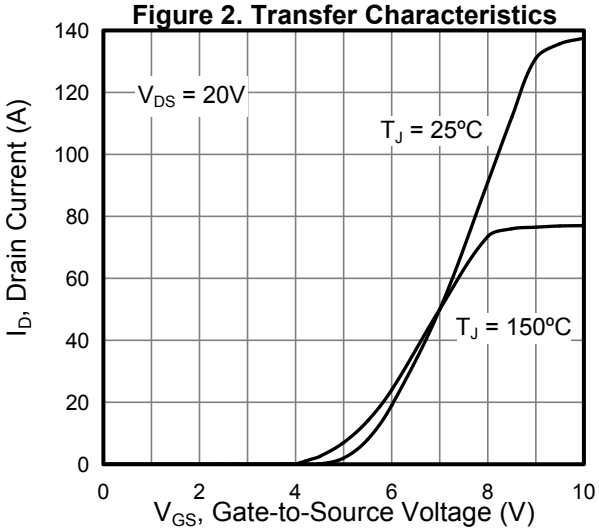


Figure 3. On-Resistance vs. Drain Current

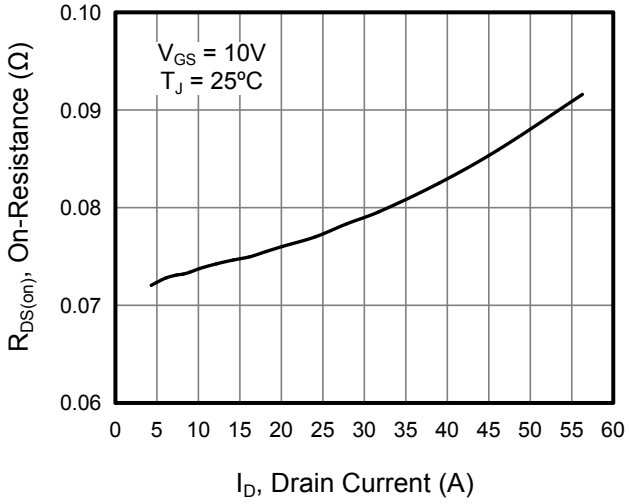


Figure 4. Capacitance

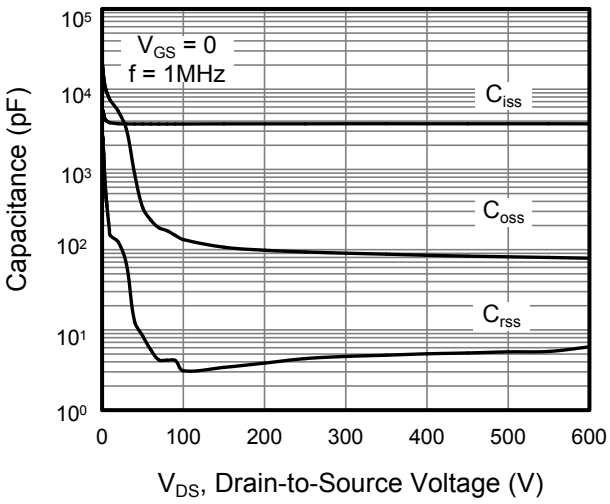


Figure 5. Gate Charge

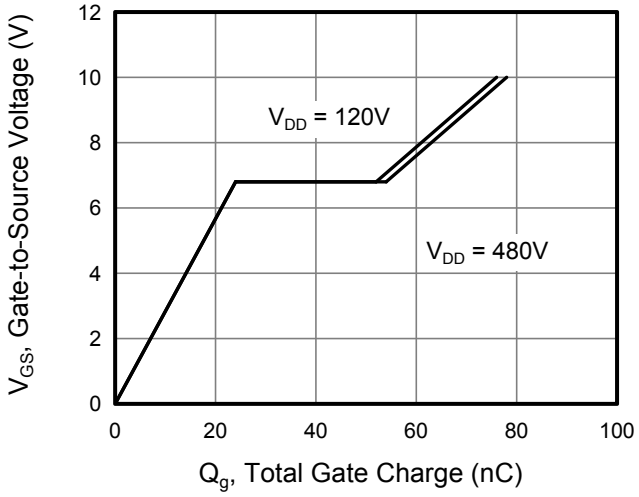
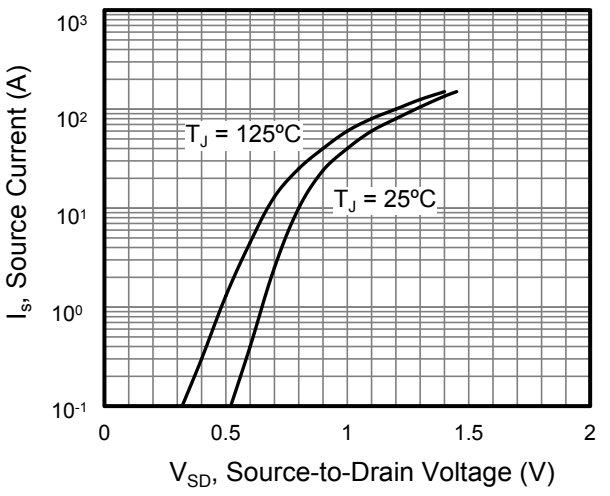


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

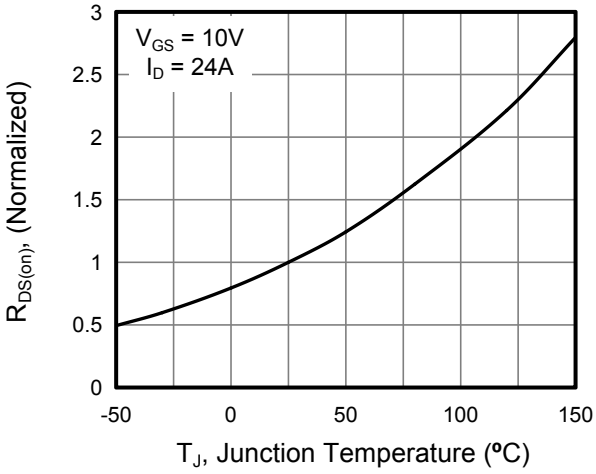


Figure 8. Breakdown voltage vs. Junction Temperature

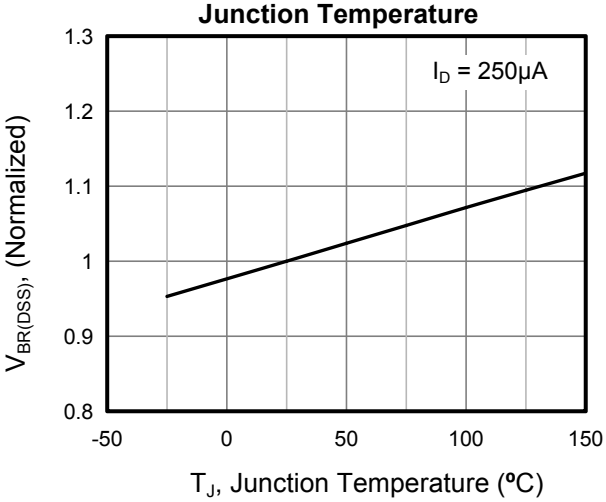


Figure 9. Transient Thermal Impedance For TO-263/TO-247

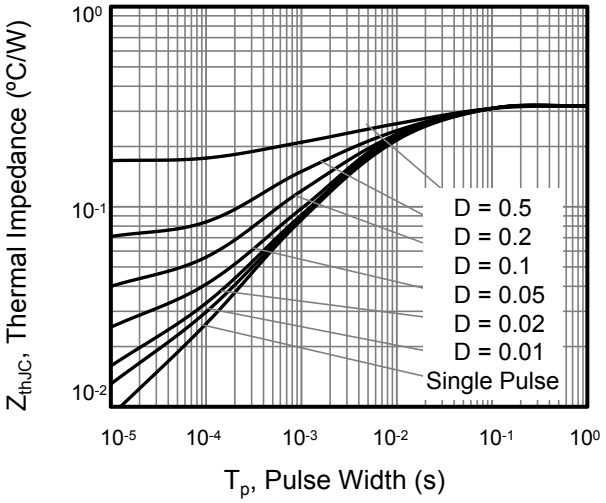


Figure 10. Safe Operation Area For TO-263/TO-247

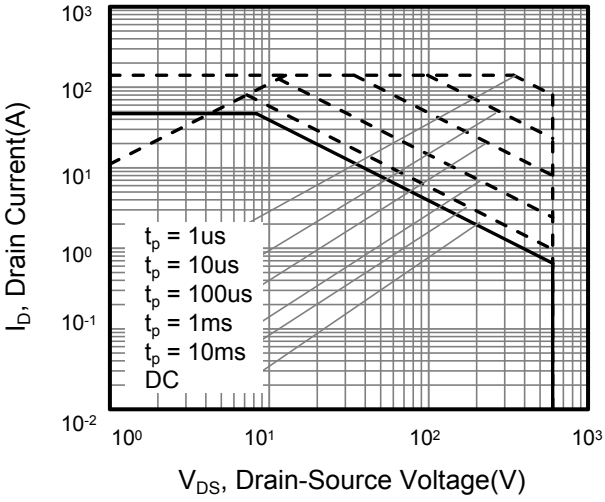


Figure 11. Typ. Coss Stored Energy

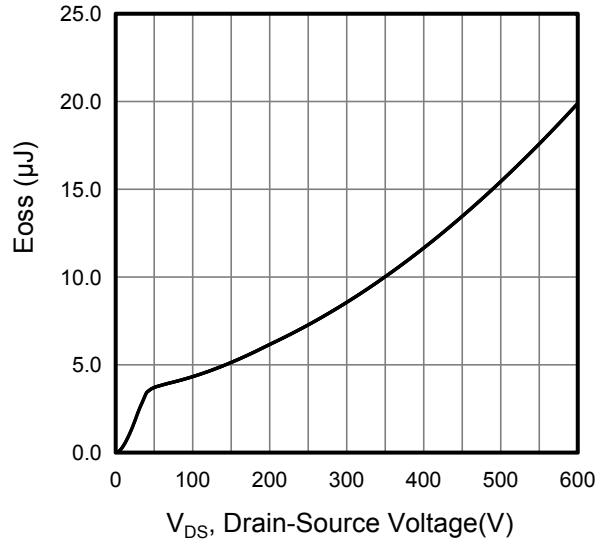


Figure A：Gate Charge Test Circuit and Waveform

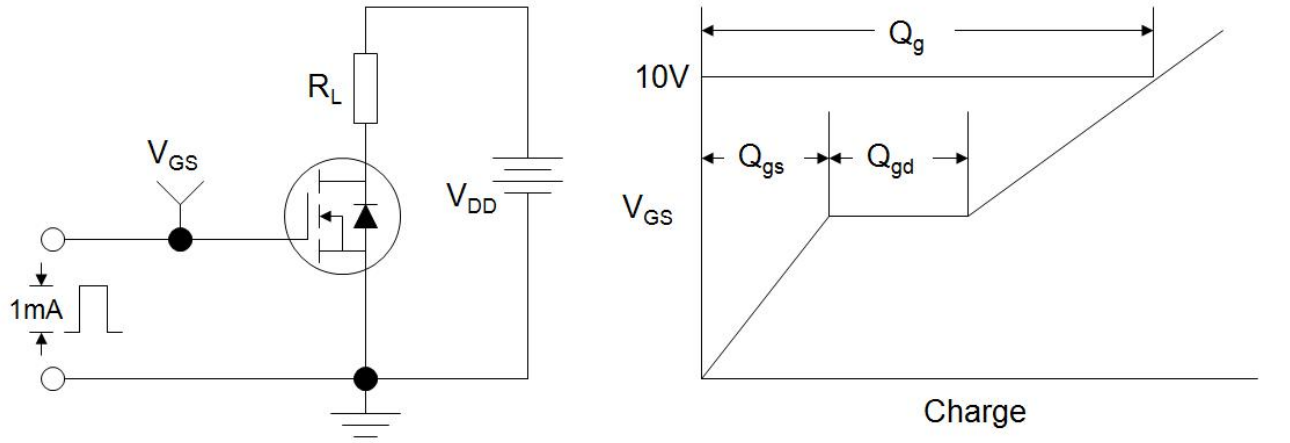


Figure B：Resistive Switching Test Circuit and Waveform

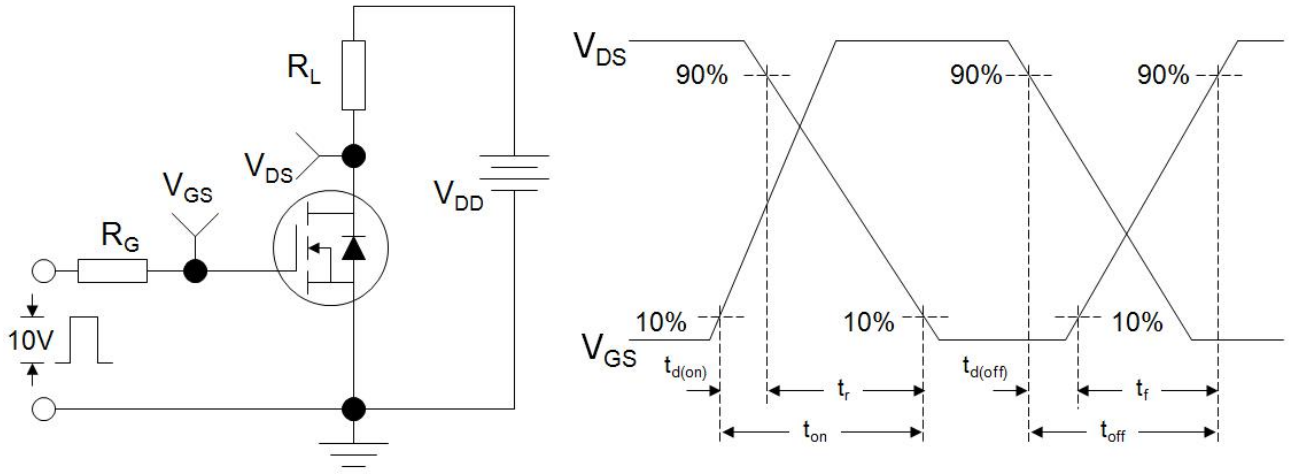
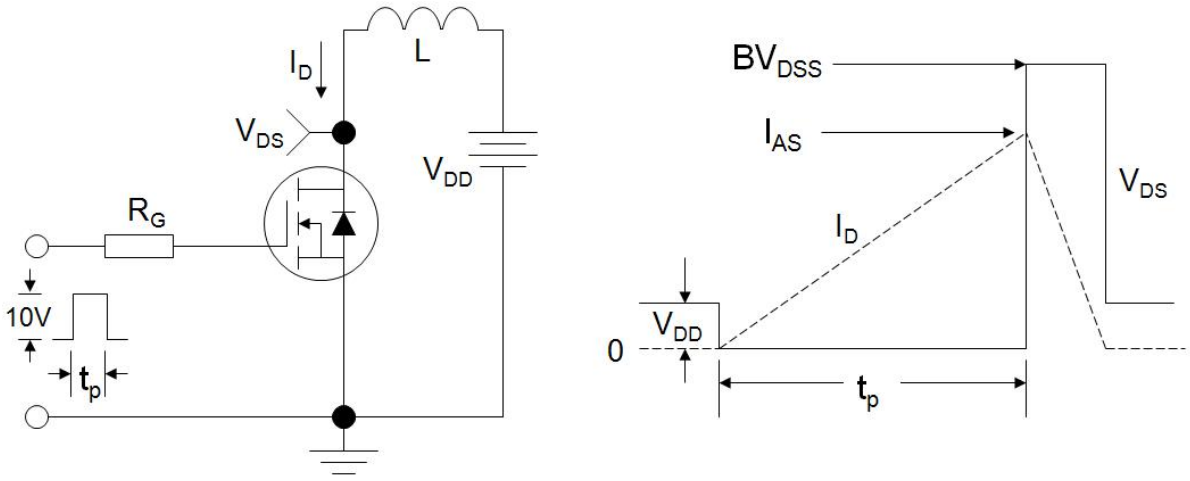
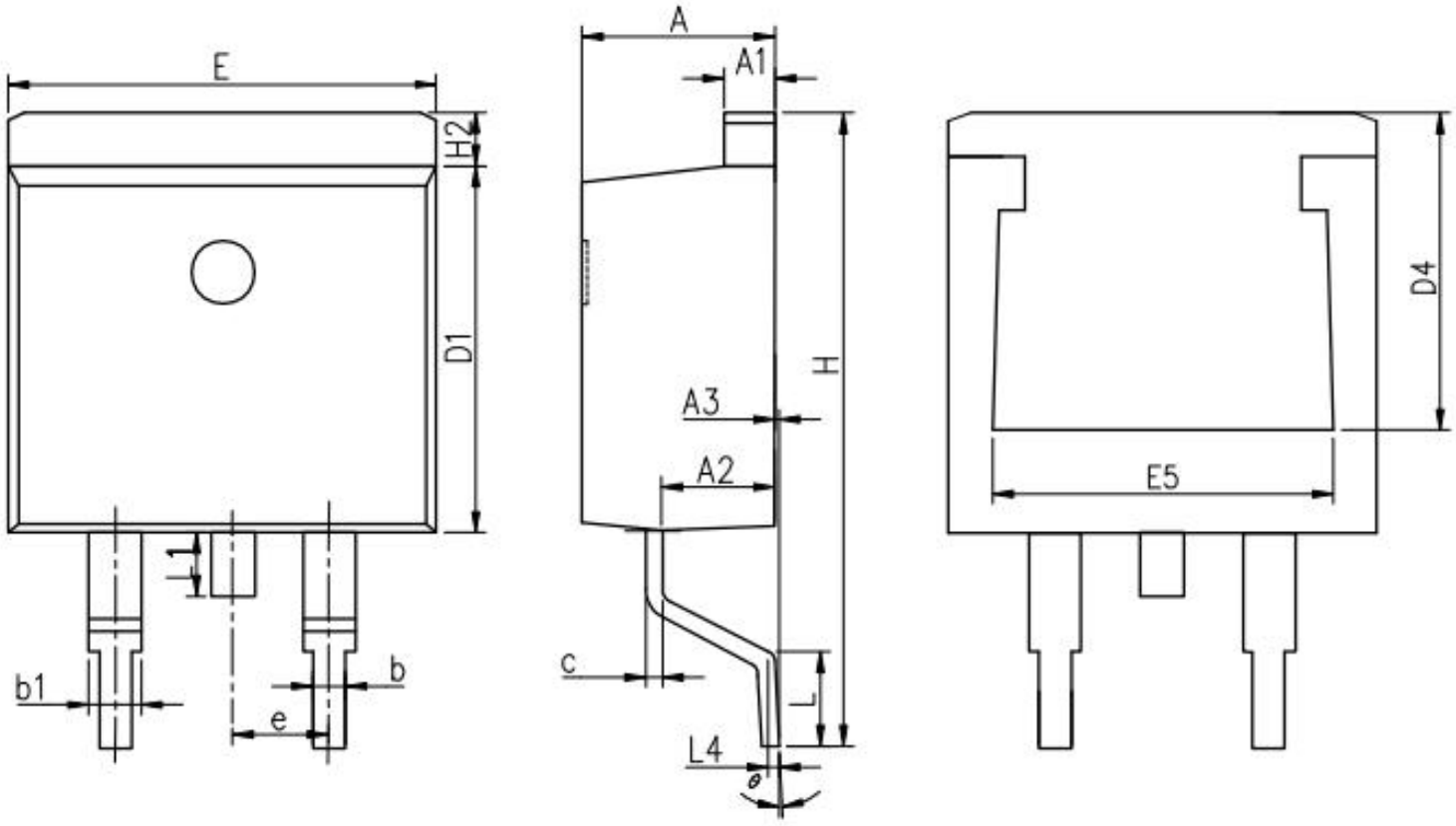


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



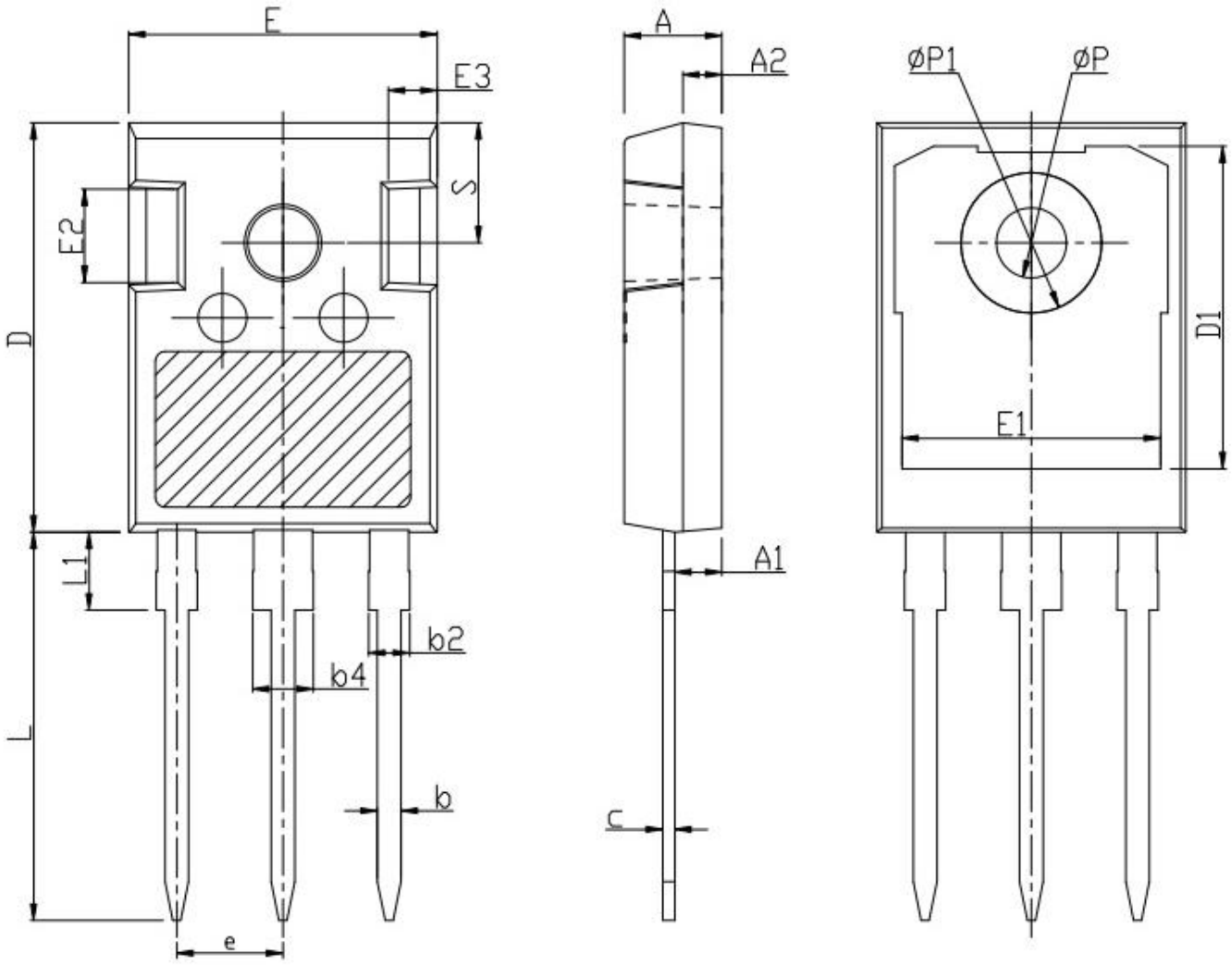
TO-263



Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-

Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54BSC		
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.30	2.60
L1	1.40	1.55	1.70
L4	0.25BSC		
θ	0°	5°	9°

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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