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

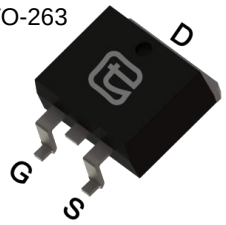
- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

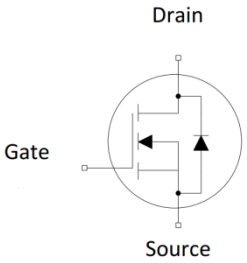
APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

TO-220

TO-263





RoHS

Device Marking and Package Information

Device	Package	Marking
TPB65R070D	TO-263	65R070D
TPP65R070D	TO-220	65R070D

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.07	Ω
I_D	45	A
$Q_{g,typ}$	80	nC
I_{DM}	135	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	45	A
	T_C = 100ºC		27	
Pulsed Drain Current (note1)		I_{DM}	135	A
Gate-Source Voltage		V_{GSS}	±30	V
Single Pulse Avalanche Energy (note2)		E_{AS}	180	mJ
Avalanche Current		I_{AS}	6	A
Power Dissipation		P_D	312	W
Continuous Body Diode Current		I_S	45	A
Pulsed Diode Forward Current (note1)		I_{SM}	135	
MOSFET dv/dt ruggedness, V_{DS} = 0...650V		dv/dt	50	V/ns
Reverse diode dv/dt, V_{DS} = 0…650V, $I_{SD} \le I_D$		dv/dt	5	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}	0.4	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	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 650V, V_{GS} = 0V, T_J = 150ºC	--	--	100	
Gate-Source Leakage	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-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 22A	--	0.055	0.07	Ω
Forward Transconductance (Note3)	g_{fs}	V_{DS} = 10V, I_D = 22A	--	10	--	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 100V, f = 1.0MHz	--	4134	--	pF
Output Capacitance	C_{oss}		--	160	--	
Reverse Transfer Capacitance	C_{rss}		--	4	--	
Total Gate Charge	Q_g	V_{DD} = 400V, I_D = 22A, V_{GS} = 10V	--	80	--	nC
Gate-Source Charge	Q_{gs}		--	24	--	
Gate-Drain Charge	Q_{gd}		--	24	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 22A, R_G = 25Ω	--	51	--	ns
Turn-on Rise Time	t_r		--	71	--	
Turn-off Delay Time	$t_{d(off)}$		--	154	--	
Turn-off Fall Time	t_f		--	67	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 22A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_S=22A, di_F/dt = 100A/μs	--	354	--	ns
Reverse Recovery Charge	Q_{rr}		--	4.2	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	24	--	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

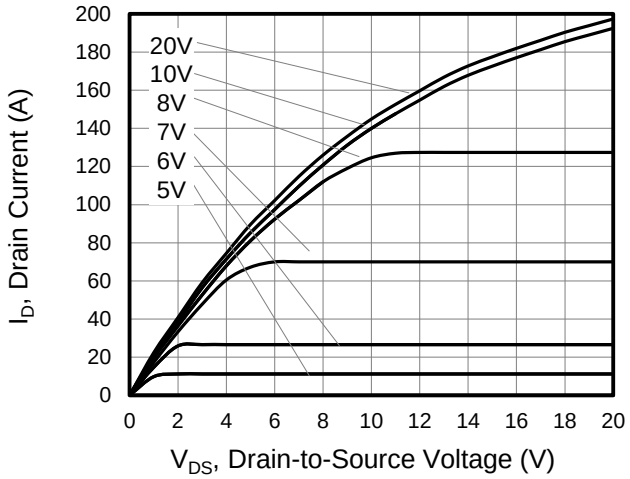


Figure 2. Transfer Characteristics

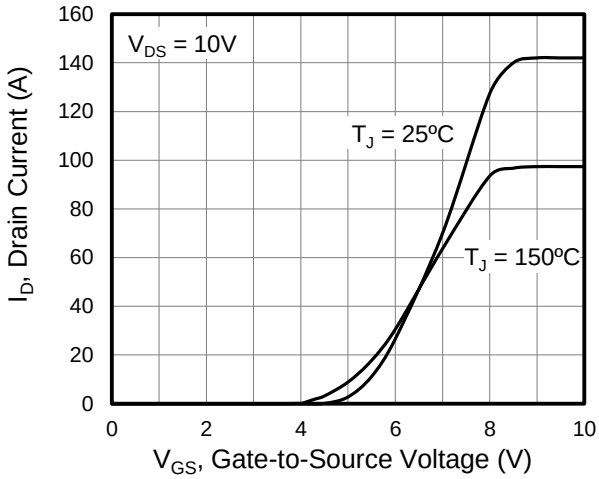


Figure 3 . Body Diode Forward Voltage

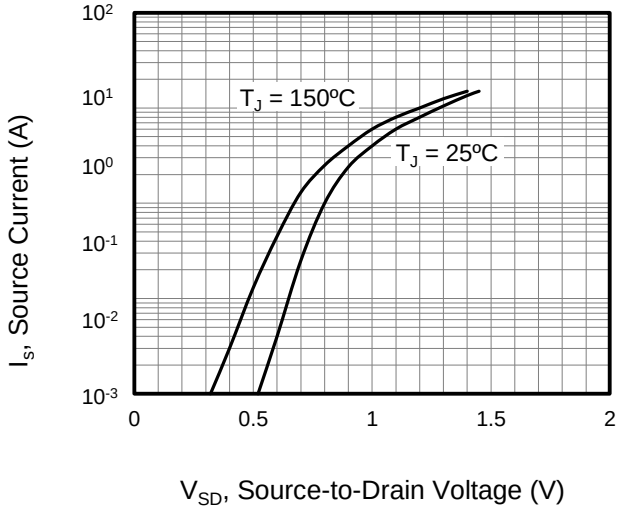


Figure 4. Capacitance

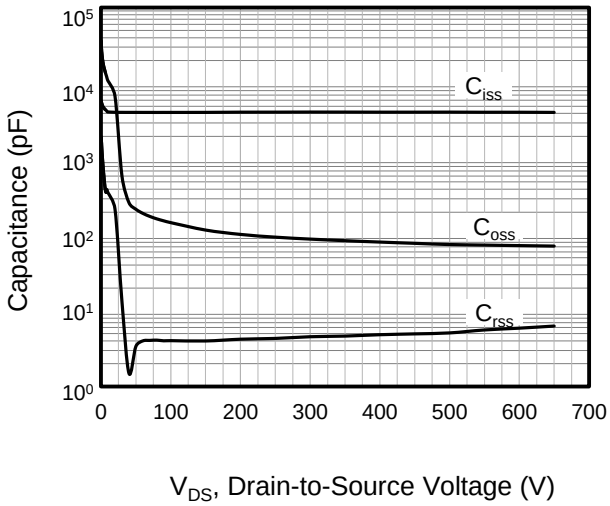


Figure 5. Gate Charge

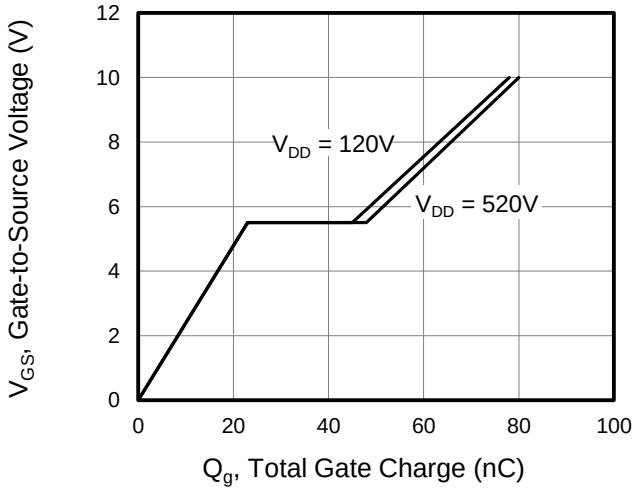


Figure 6. On-Resistance vs. Junction Temperature

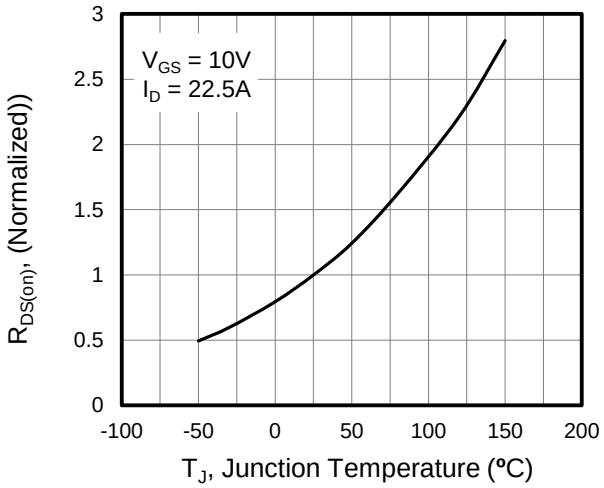


Figure 7. Breakdown voltage vs. Junction Temperature

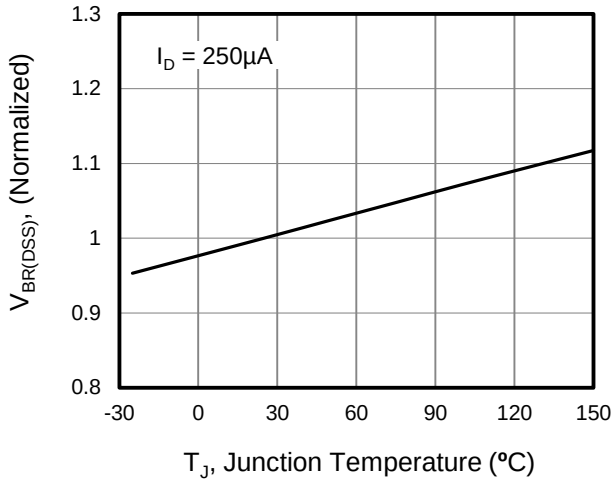


Figure 8. Threshold Voltage vs. Junction Temperature

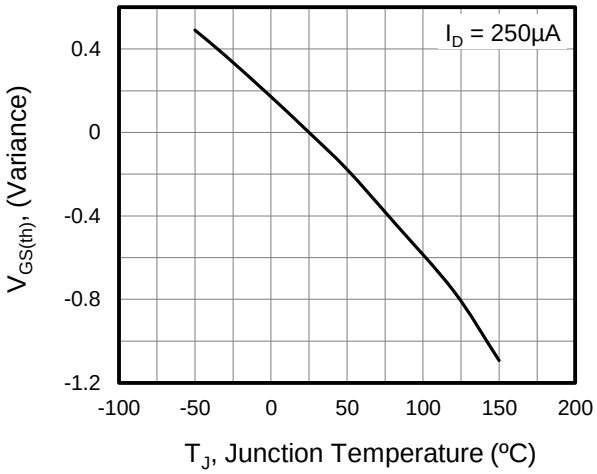


Figure9 . Transient Thermal Impedance for TO-220

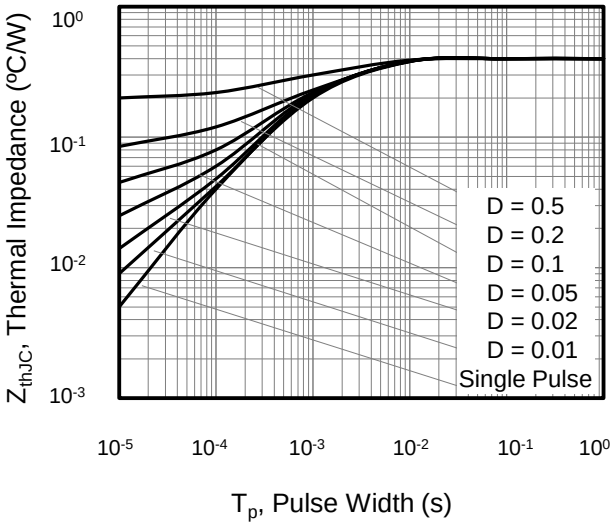


Figure 10. Safe operation area for TO-220

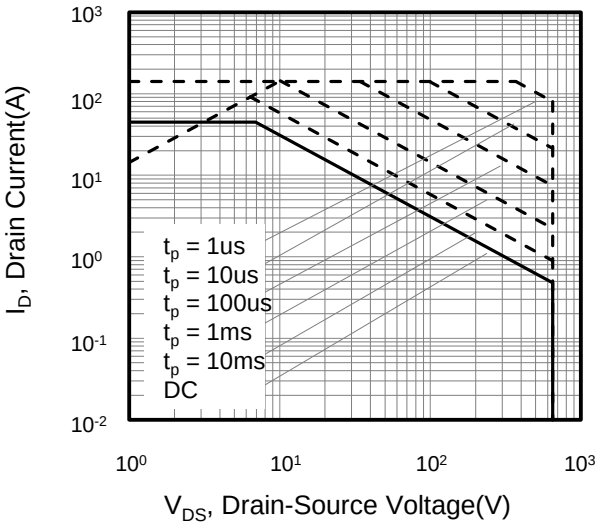


Figure A：Gate Charge Test Circuit and Waveform

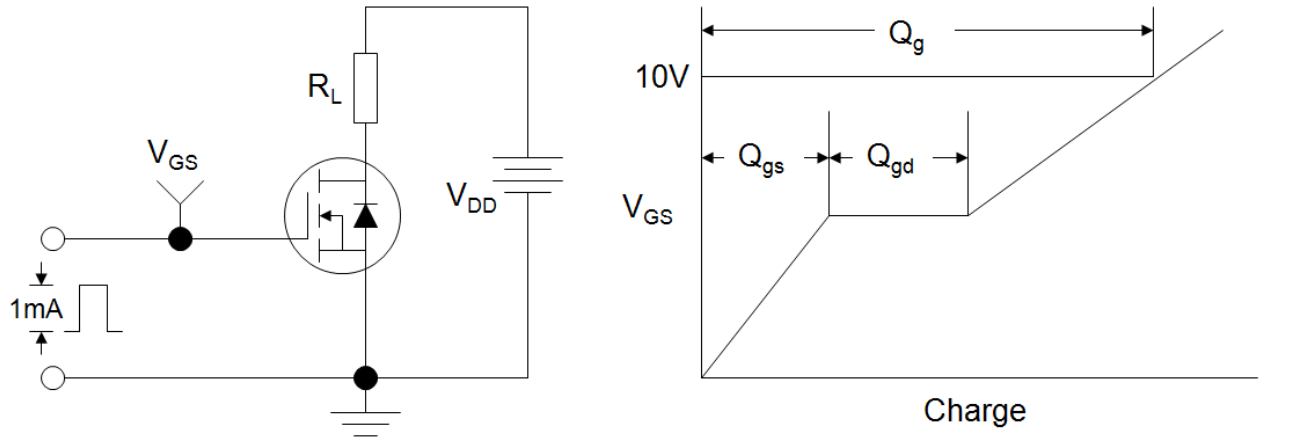


Figure B：Resistive Switching Test Circuit and Waveform

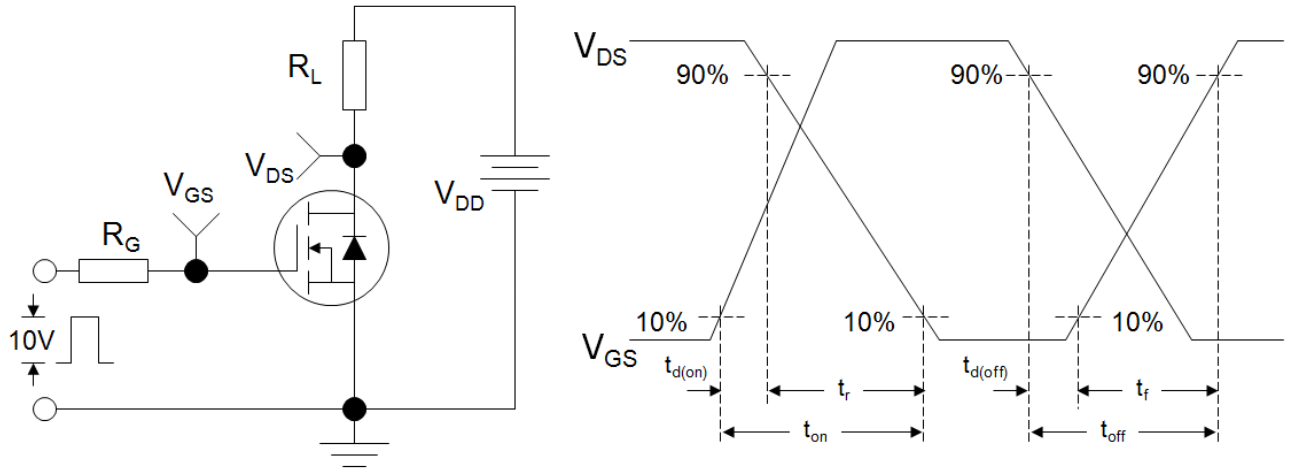
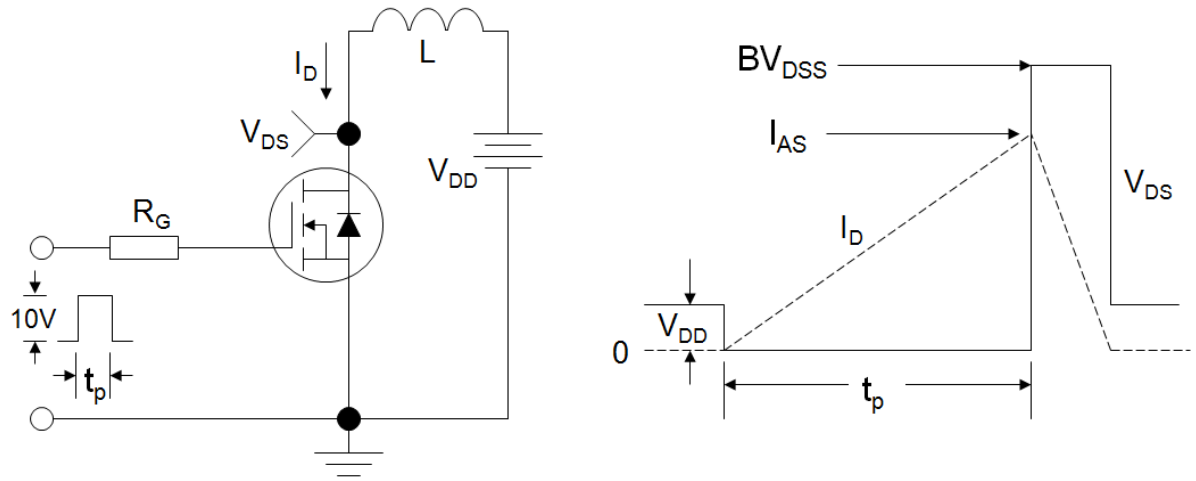
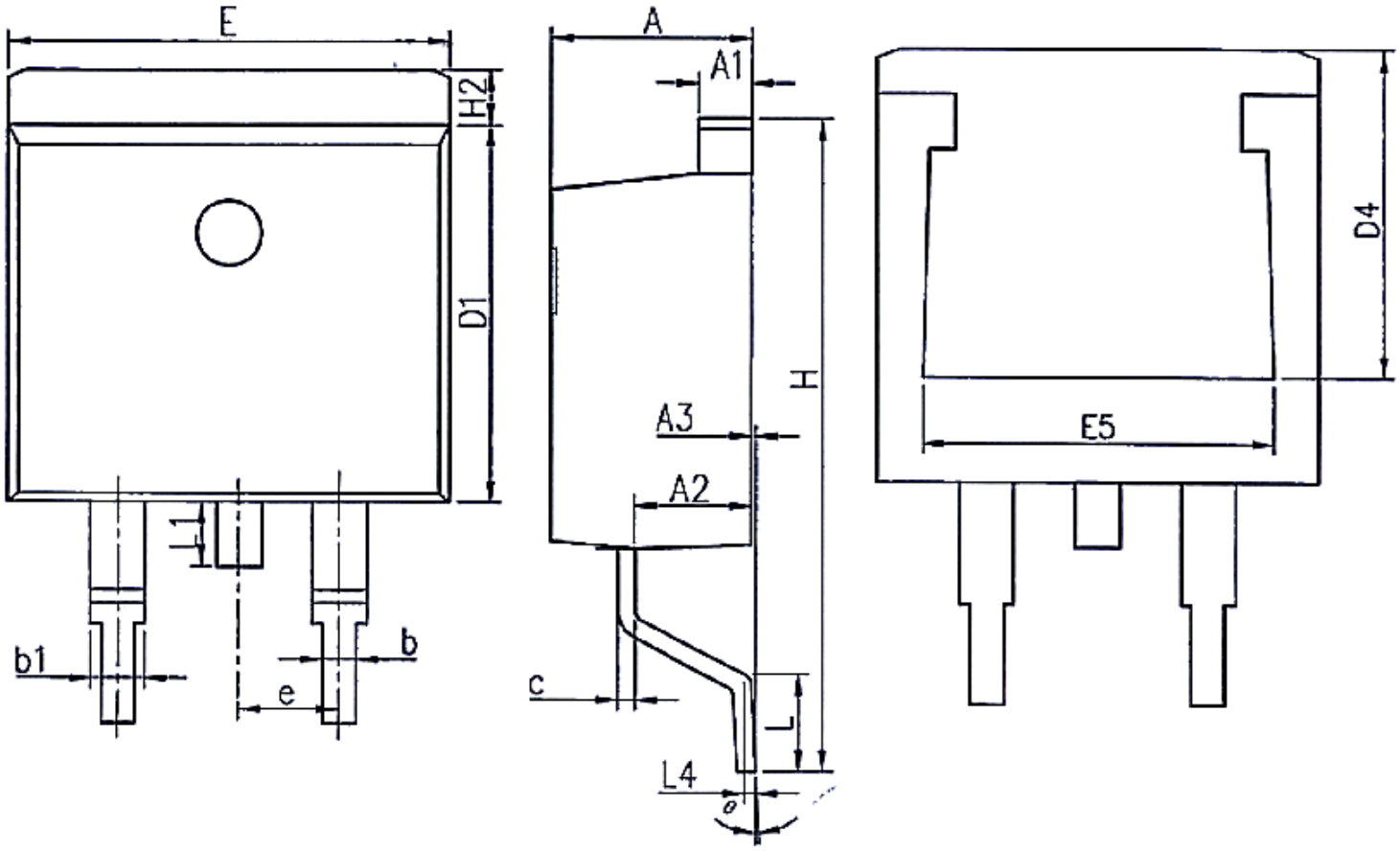


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



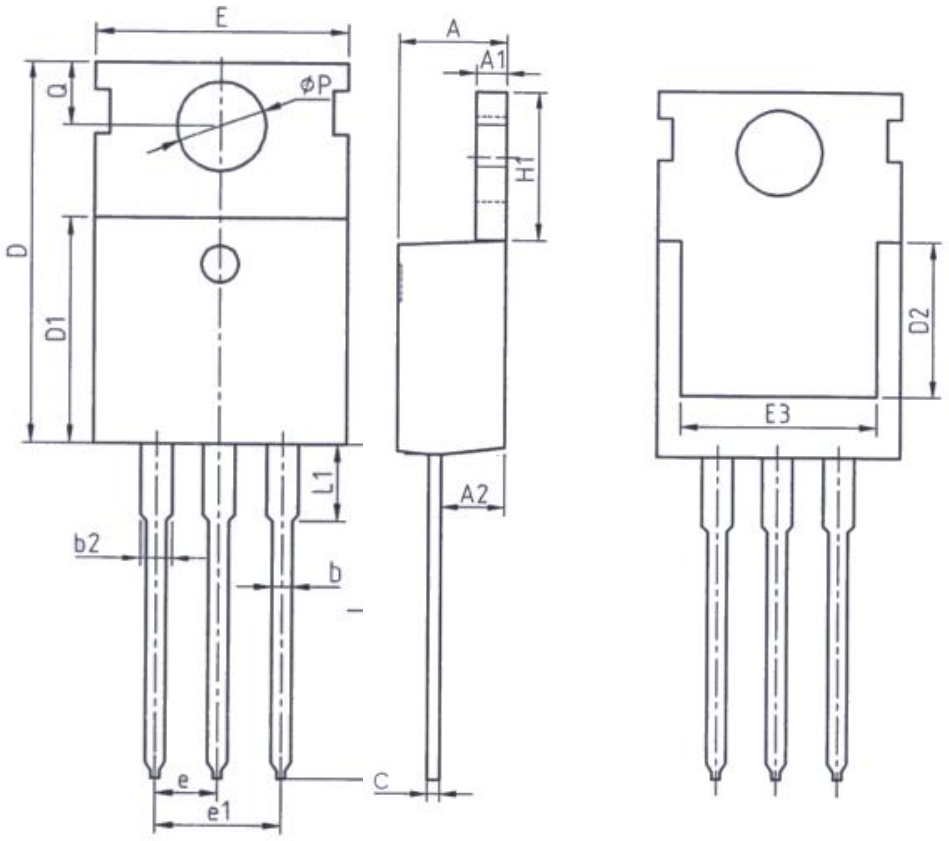
TO-263



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-220



Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.25	1.45
A2	2.20	2.60
b	0.70	0.95
b2	1.17	1.47
c	0.40	0.65
D	15.10	16.10
D1	8.80	9.40
D2	5.50	–

Unit: mm		
Symbol	Min.	Max.
E	9.70	10.30
E3	7.00	–
e	2.54BSC	
e1	5.08BSC	
H1	6.25	6.85
L	12.75	13.80
L1	–	3.40
P	3.40	3.80
Q	2.60	3.00

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