



650V Super-junction Power MOSFET

Description

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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

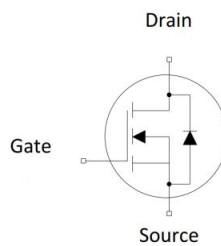
TO-263



TO-220



TO-247



Device Marking and Package Information

Device	Package	Marking
TPB65R075DFD	TO-263	65R075DFD
TPP65R075DFD	TO-220	65R075DFD
TPW65R075DFD	TO-247	65R075DFD

Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	700	V
$R_{DS(on),max}$	0.075	Ω
$Q_{g,typ}$	81	nC
I_D	45	A
$I_{D,pulse}$	135	A
$E_{OSS} @ 400V$	10.29	μJ
t_{rr}	176	ns
Q_{rr}	1.4	μC
I_{rrm}	16	A



Absolute Maximum Ratings $T_C = 25^{\circ}\text{C}$, unless otherwise noted				
Parameter		Symbol	Values	Unit
Continuous Drain Current	$T_C = 25^{\circ}\text{C}$	I_D	45	A
	$T_C = 100^{\circ}\text{C}$		27	
Pulsed Drain Current (note1)		$I_{D,pulse}$	135	A
Gate-Source Voltage		V_{GSS}	$\pm 30\text{V}$	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, $V_{DS} = 0 \dots 650\text{V}$		dv/dt	50	V/ns
Power Dissipation For TO-263,TO-220,TO-247		P_D	312	W
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}	$-55 \sim +150$	$^{\circ}\text{C}$

Thermal Resistance For TO-263,TO-220,TO-247			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	0.4	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	



Electrical Characteristics T _J = 25°C, 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	650	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650V, V _{GS} = 0V, T _J = 25°C	--	--	10	μA
		V _{DS} = 650V, V _{GS} = 0V, T _J = 150°C	--	--	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 = 22A	--	0.058	0.075	Ω
Gate Resistance	R _G	f = 1.0MHz open drain	--	1	--	Ω
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{GS} = 0V, V _{DS} = 100V, f = 1.0MHz	--	4640	--	pF
Output Capacitance	C _{oss}		--	123	--	
Reverse Transfer Capacitance	C _{rss}		--	3.55	--	
Total Gate Charge	Q _g	V _{DD} = 400V, I _D = 22A, V _{GS} = 10V	--	81	--	nC
Gate-Source Charge	Q _{gs}		--	25	--	
Gate-Drain Charge	Q _{gd}		--	24	--	
Turn-on Delay Time	t _{d(on)}	V _{DD} = 400V, I _D = 22A, R _G = 25Ω	--	107	--	ns
Turn-on Rise Time	t _r		--	80	--	
Turn-off Delay Time	t _{d(off)}		--	164	--	
Turn-off Fall Time	t _f		--	52	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V _{SD}	T _J = 25°C, 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	--	176	--	ns
Reverse Recovery Charge	Q _{rr}		--	1.4	--	μC
Peak Reverse Recovery Current	I _{rrm}		--	16	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_D = 10A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Identical low side and high side switch with identical R_G



Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 1. Output Characteristics

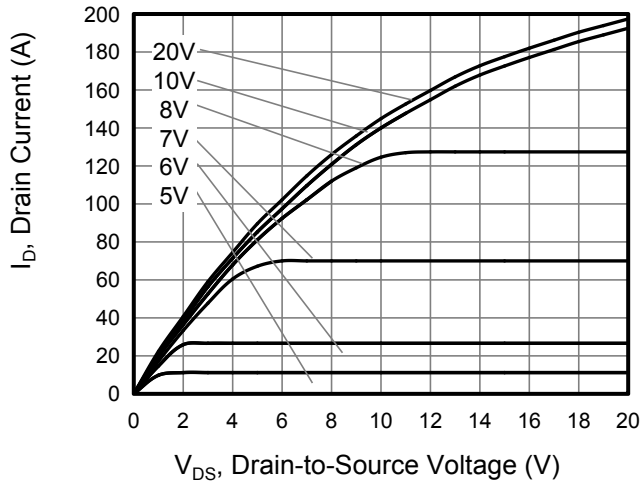


Figure 2. Transfer Characteristics

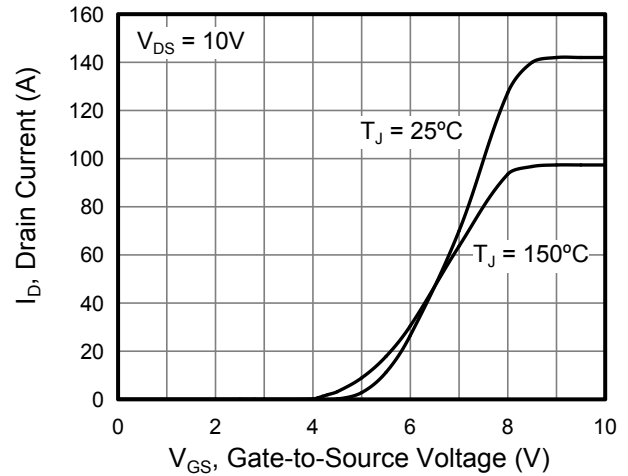


Figure 3. On-Resistance vs. Drain Current

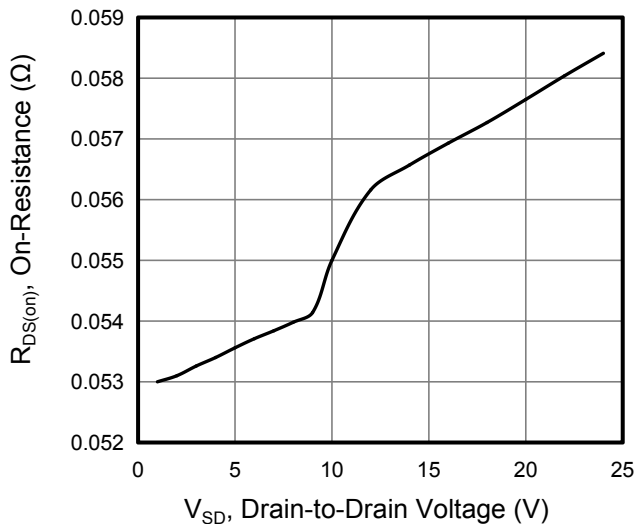


Figure 4. Capacitance

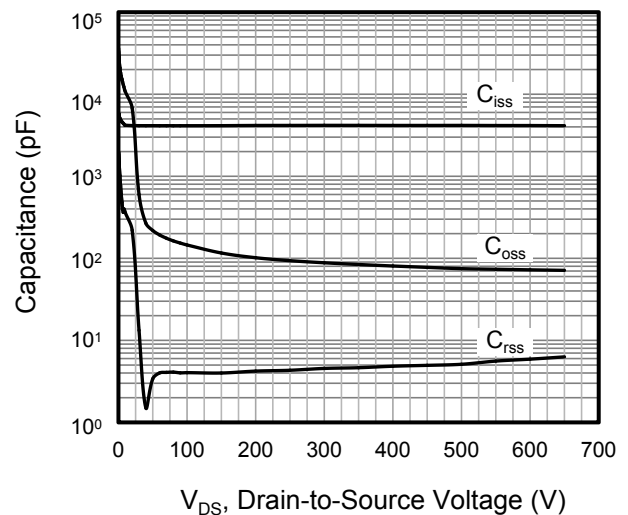


Figure 5. Gate Charge

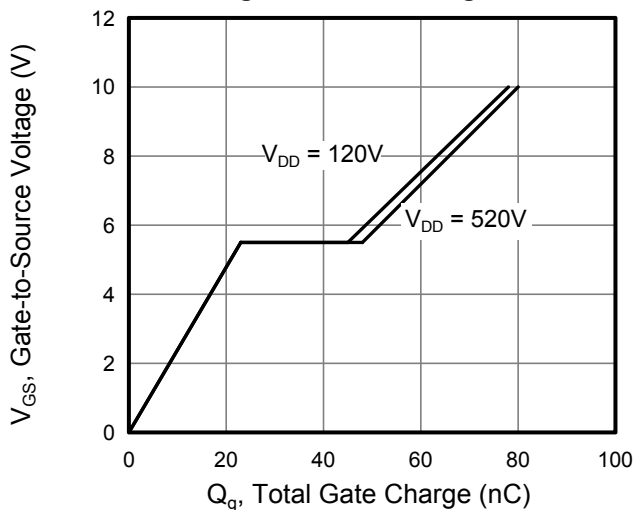
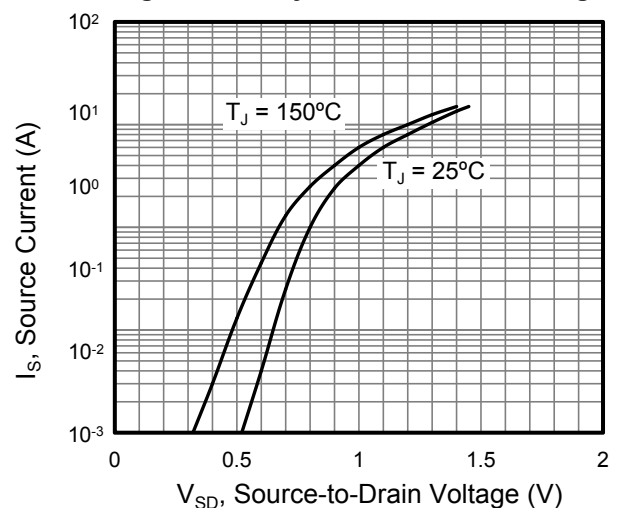


Figure 6. Body Diode Forward Voltage



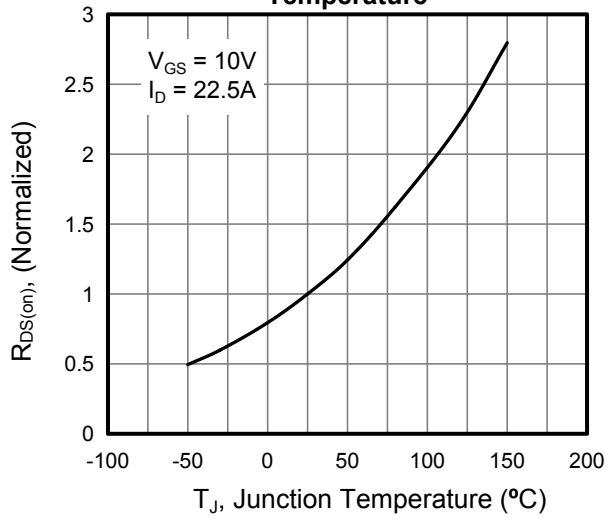
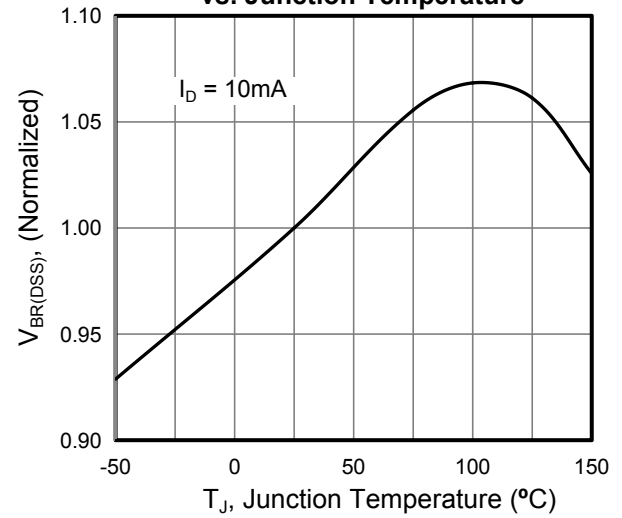
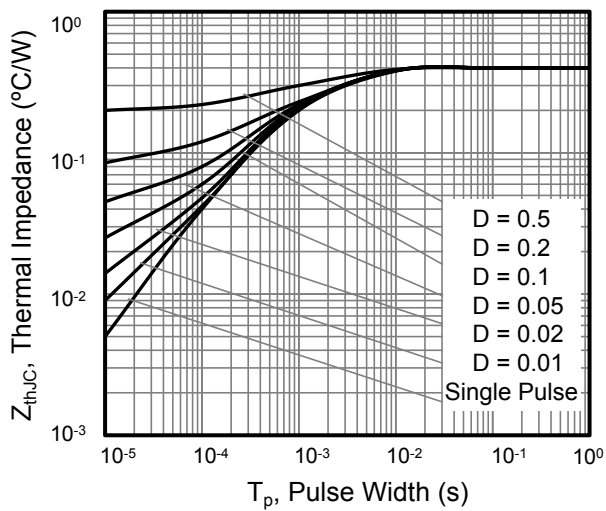
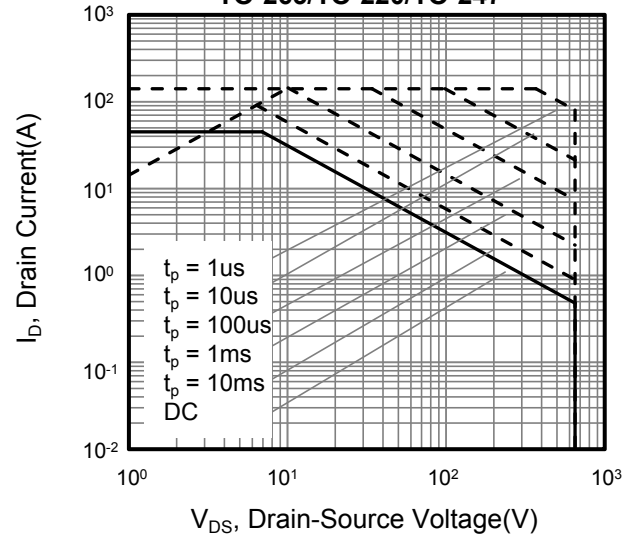
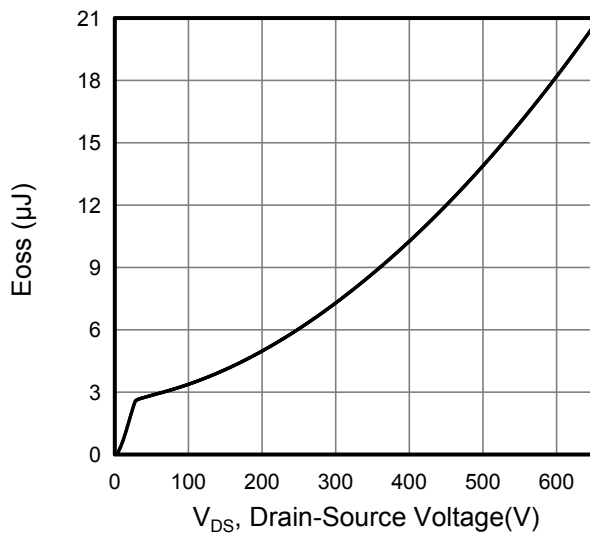
**Figure 7. On-Resistance vs. Temperature****Figure 8. Breakdown voltage vs. Junction Temperature****Figure 9. Transient Thermal Impedance For TO-263/TO-220/TO-247****Figure 10. Safe Operation Area For TO-263/TO-220/TO-247****Figure 11. Typ. Coss Stored Energy**



Figure A: Gate Charge Test Circuit and Waveform

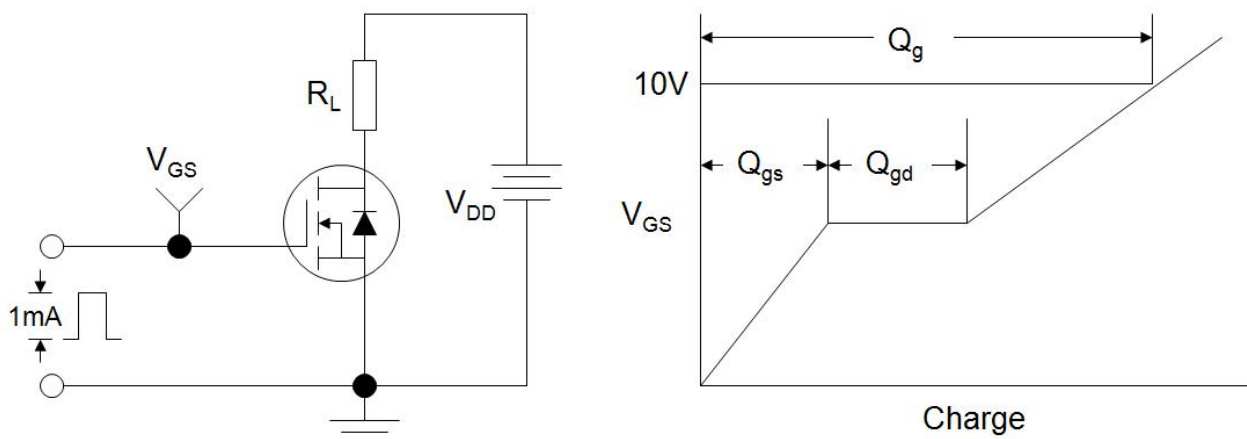


Figure B: Resistive Switching Test Circuit and Waveform

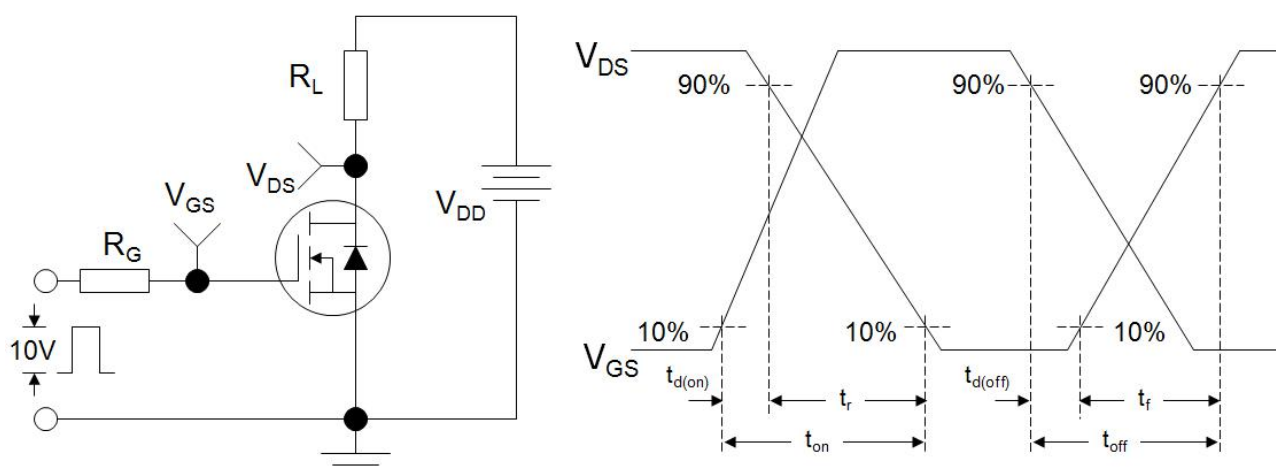
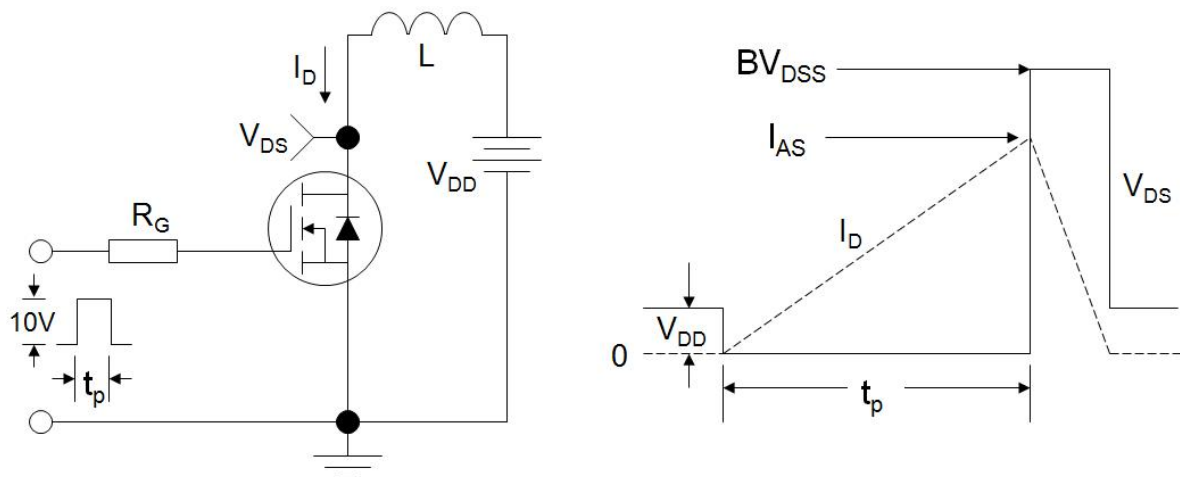
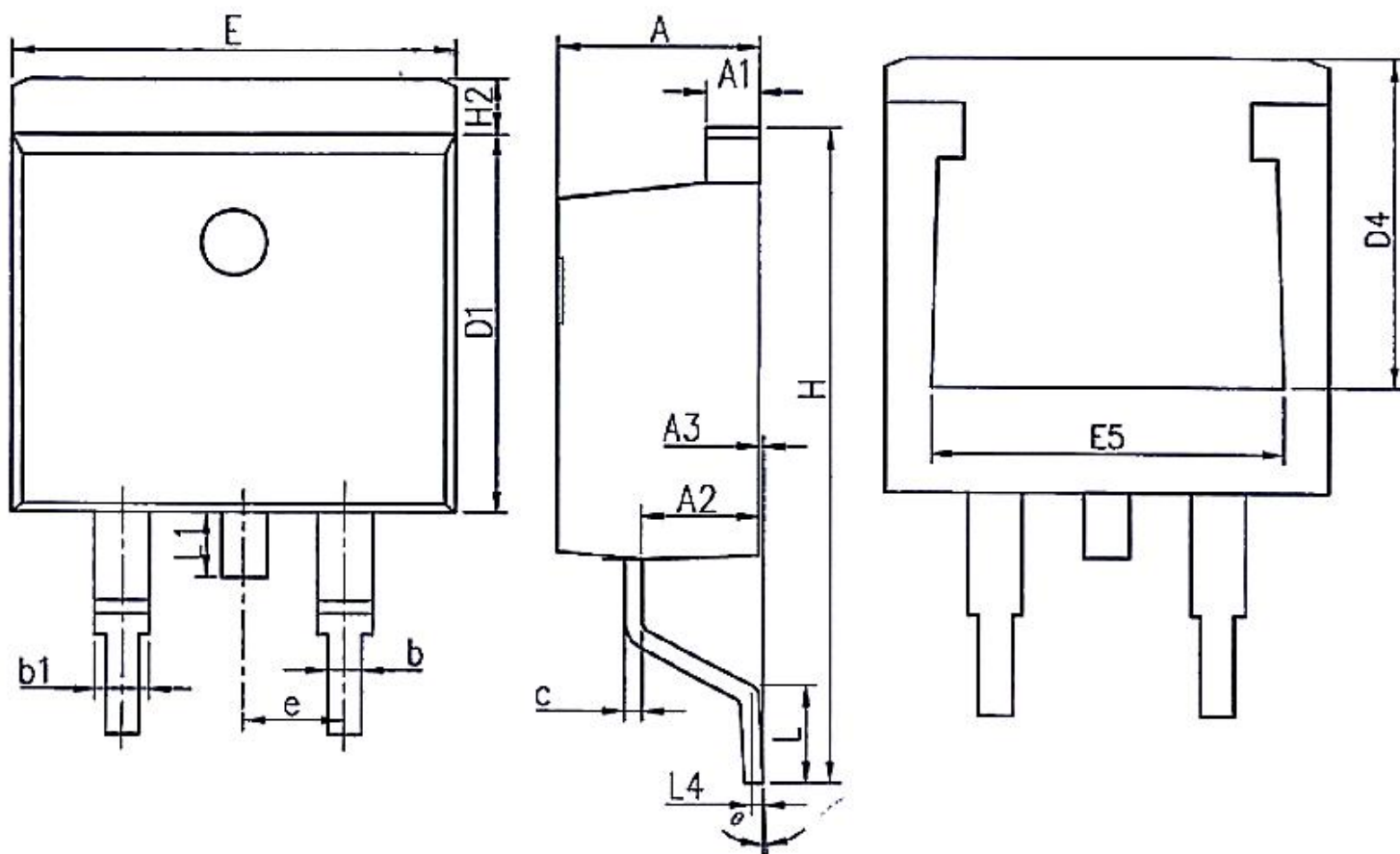


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





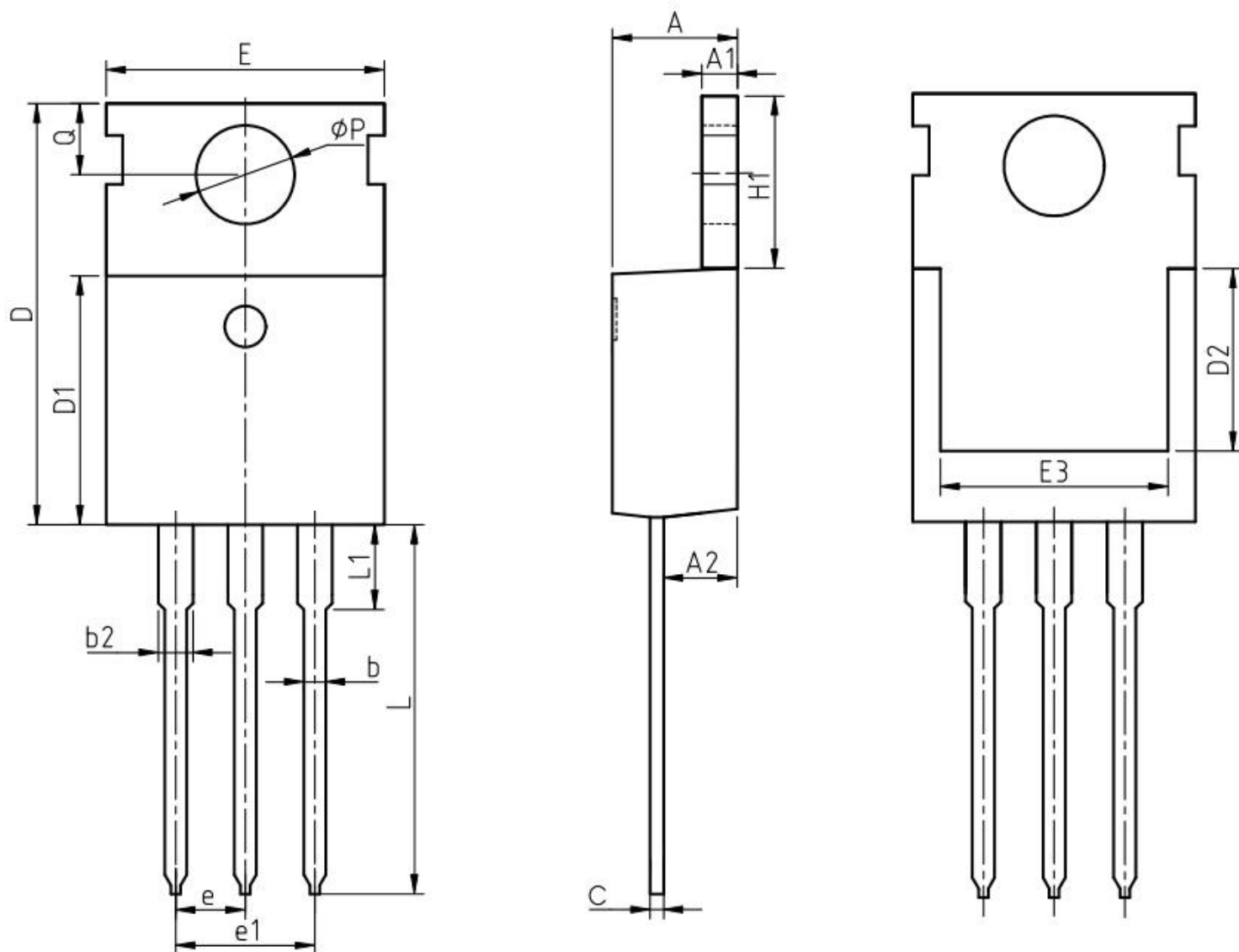
TO-263



Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77	E	9.86	10.16	10.36
A1	1.22	1.27	1.42	E5	7.06	-	-
A2	2.49	2.69	2.89	e	2.54BSC		
A3	0.00	0.13	0.25	H	14.70	15.10	15.50
b	0.70	0.81	0.96	H2	1.07	1.27	1.47
b1	1.17	1.27	1.47	L	2.00	2.30	2.60
c	0.30	0.38	0.53	L1	1.40	1.55	1.70
D1	8.50	8.70	8.90	L4	0.25BSC		
D4	6.60	-	-	θ	0°	5°	9°



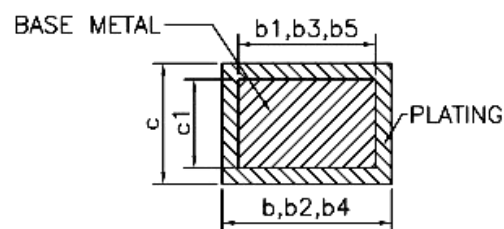
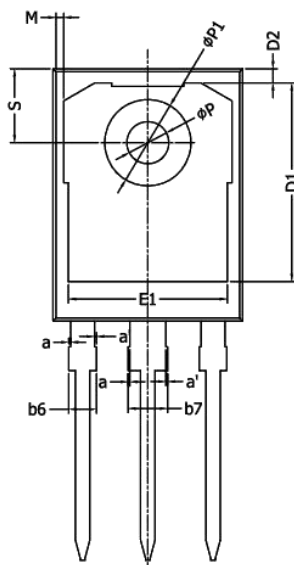
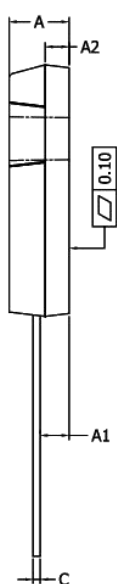
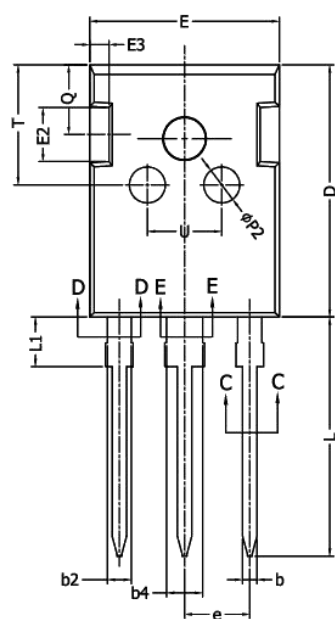
TO-220



Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77	E	9.70	10.00	10.30
A1	1.25	1.30	1.40	E3	7.00	-	-
A2	2.20	2.40	2.60	e	2.54 BSC		
b	0.70	0.80	0.95	e1	5.08 BSC		
b2	1.17	1.27	1.47	H1	6.25	6.50	6.85
c	0.45	0.50	0.60	L	12.75	13.50	13.80
D	15.10	15.60	16.10	L1	-	3.10	3.40
D1	8.80	9.10	9.40	ϕP	3.40	3.60	3.80
D2	5.50	-	-	Q	2.60	2.80	3.00



TO-247



SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2.00	2.02
b4	2.96	---	3.06
b5	2.96	3.00	3.02
b6	---	---	2.25
b7	---	---	3.25
c	0.59	---	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.40	4.50	4.60
E3	2.40	2.50	2.60
e	5.436 BSC		
L	19.80	19.92	20.10
L1	---	---	4.30
M	0.35	---	0.95
P	3.40	3.50	3.60
P1	7.00	---	7.40
P2	2.40	2.50	2.60
Q	5.60	---	6.00
S	6.05	6.15	6.25
T	9.80	---	10.20
U	6.00	---	6.40



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