Wuxi Unigroup Microelectronics Co.,Ltd

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 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
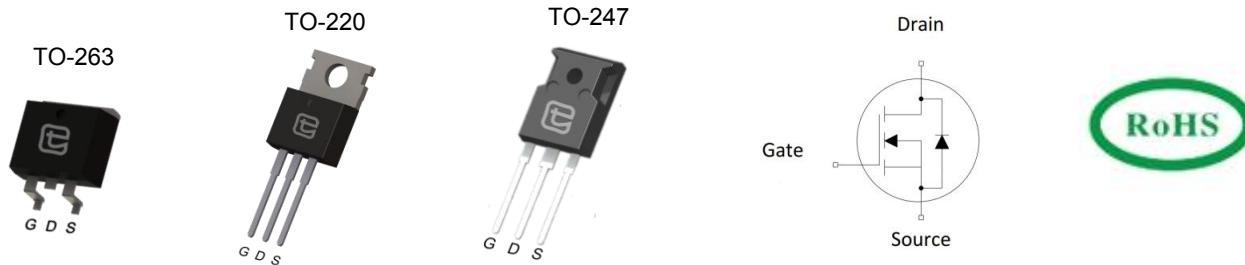
Device Marking and Package Information

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 $T_C = 25ºC$, unless otherwise noted

Parameter		Symbol	Values	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}	±30V	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, $V_{DS} = 0...650V$		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~+150	ºC

Thermal Resistance For TO-263,TO-220,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	Min.	Typ.	Max.	Unit
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 = 25ºC	--	--	10	µA
		V_{DS} = 650V, 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 = 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 = 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	--	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 = 25Ω, Starting T_J = 25°C

3. Identical low side and high side switch with identical R_G

Typical Characteristics T_J = 25**º**C, unless otherwise noted

**Figure 1. Output Characteristics**
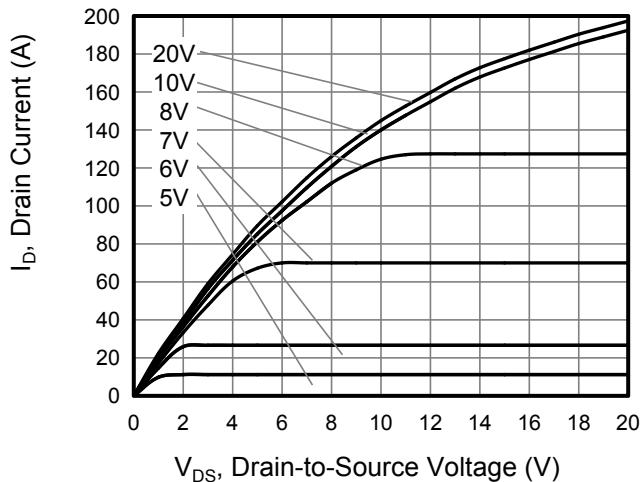

Figure 2. Transfer Characteristics
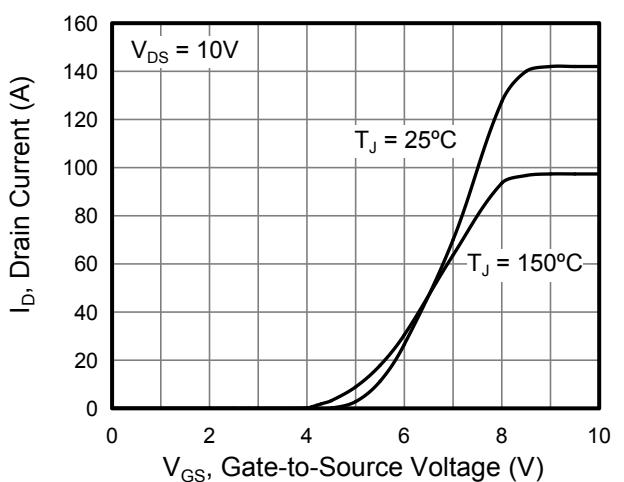

Figure 3 .On-Resistance vs. Drain Current
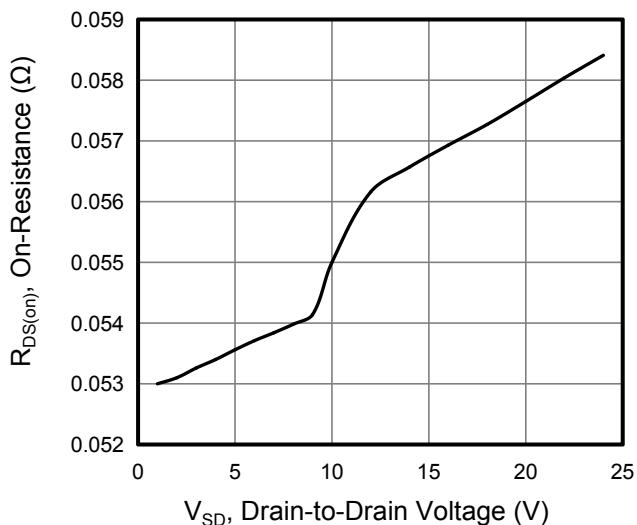


Figure 4. Capacitance
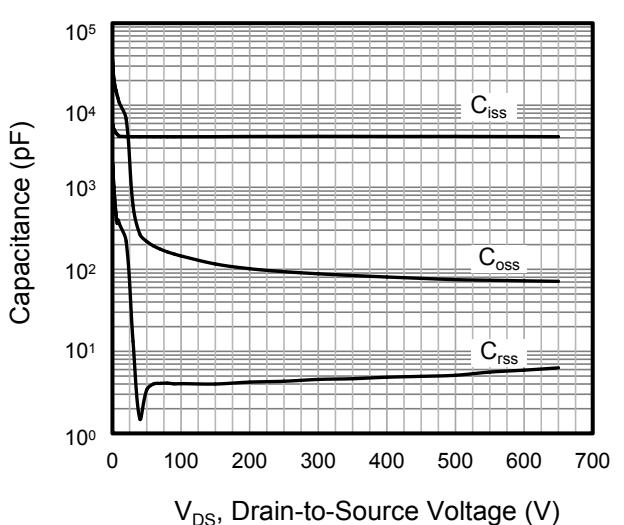
Figure 5. Gate Charge
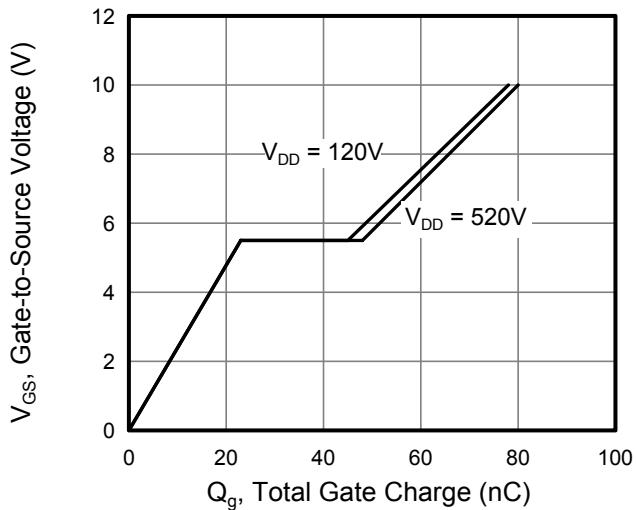
Figure 6. Body Diode Forward Voltage
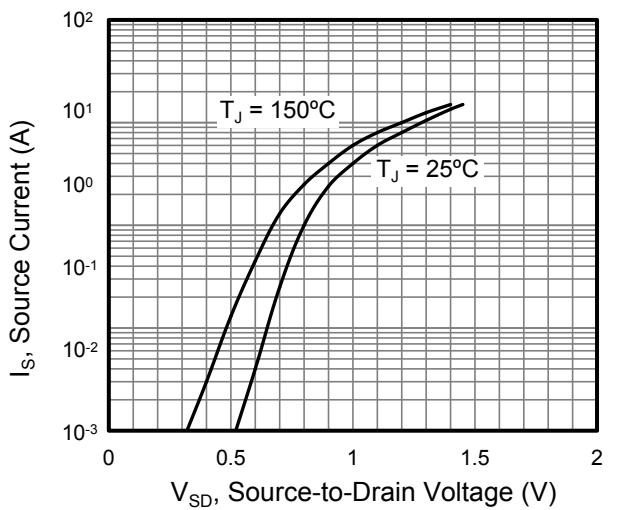
Figure 7. On-Resistance vs. Temperature

V_{GS} = 10V
I_D = 2A

$R_{DS(on)}$, (Normalized)

T_J, Junction Temperature (°C)
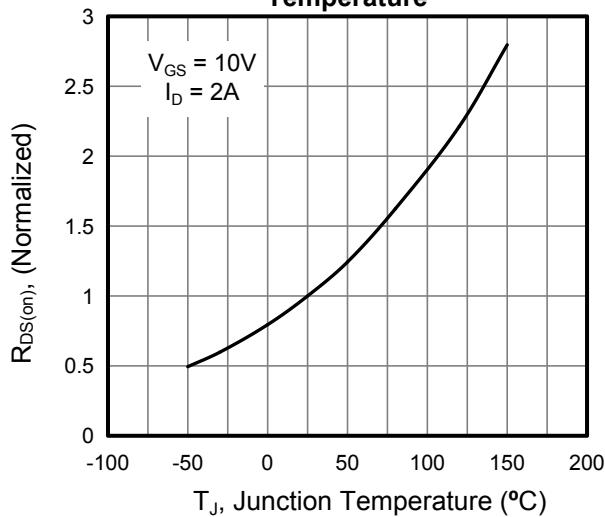
Figure 8. Breakdown voltage vs. Junction Temperature

I_D = 10mA

$V_{BR(DSS)}$, (Normalized)

T_J, Junction Temperature (°C)
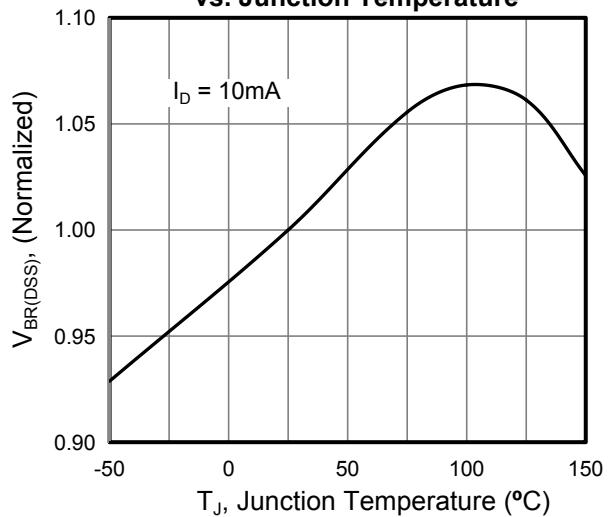
Figure 9. Transient Thermal Impedance For TO-263/TO-220/TO-247

Z_{thJC}, Thermal Impedance (°C/W)

D = 0.5
D = 0.2
D = 0.1
D = 0.05
D = 0.02
D = 0.01
Single Pulse

T_p, Pulse Width (s)
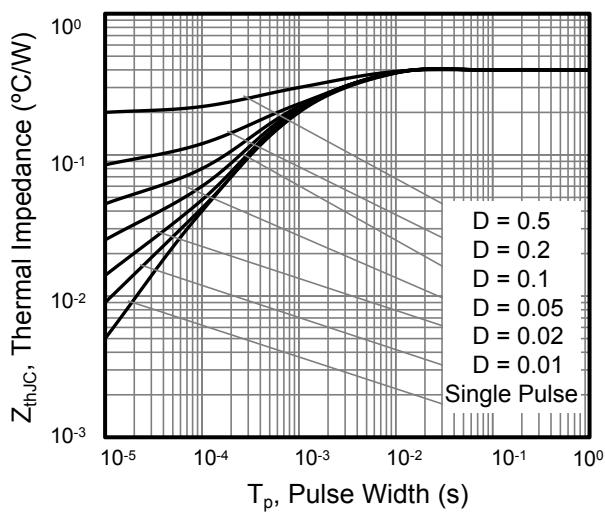
Figure 10. Safe Operation Area For TO-263/TO-220/TO-247

I_D, Drain Current(A)

t_p = 1us
t_p = 10us
t_p = 100us
t_p = 1ms
t_p = 10ms
DC

V_{DS}, Drain-Source Voltage(V)
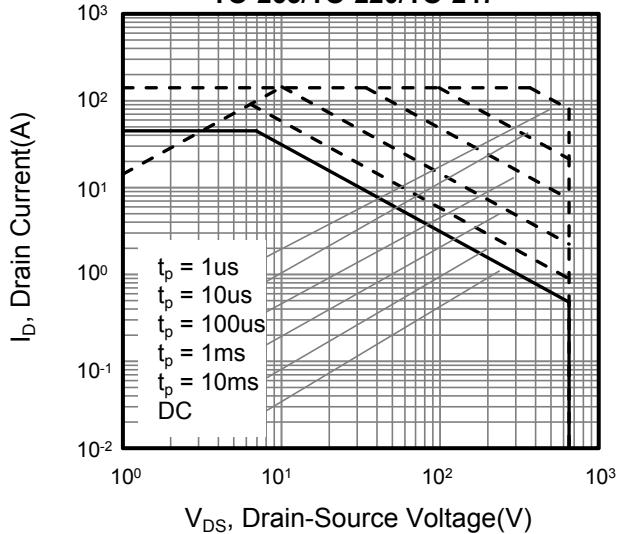
Figure 11. Typ. Coss Stored Energy

Eoss (μJ)

V_{DS}, Drain-Source Voltage(V)
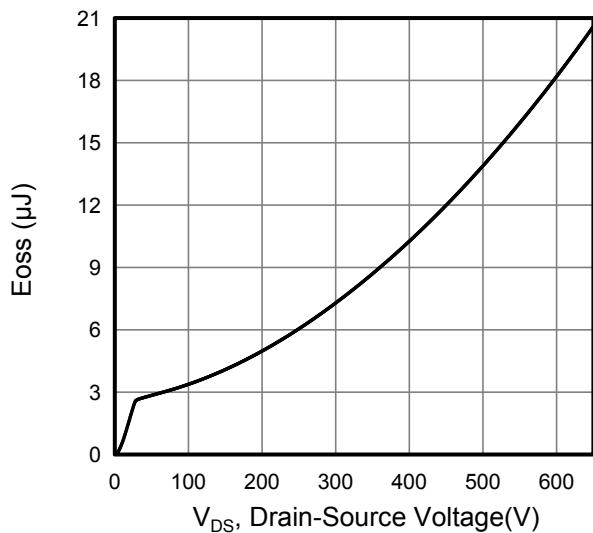
Figure A：Gate Charge Test Circuit and Waveform
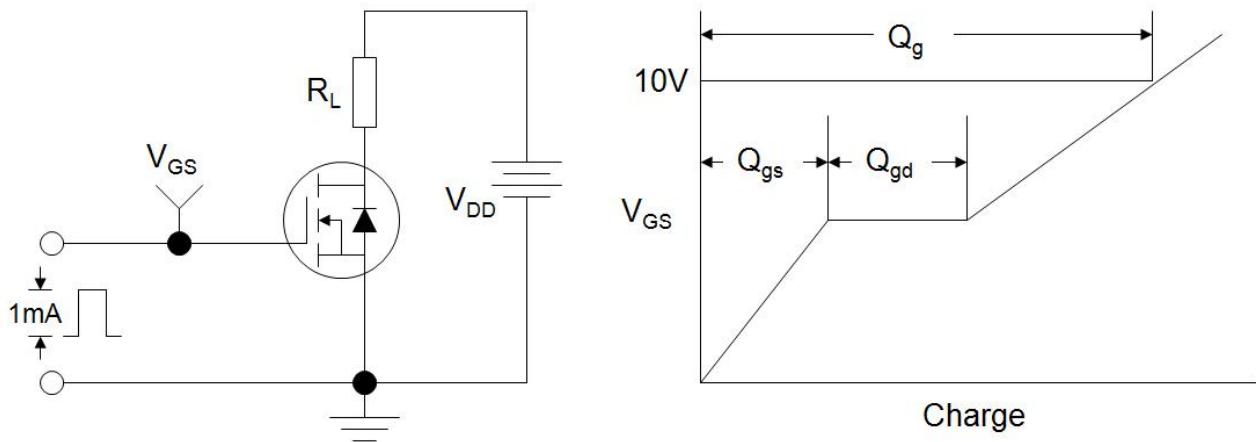
Figure B：Resistive Switching Test Circuit and Waveform
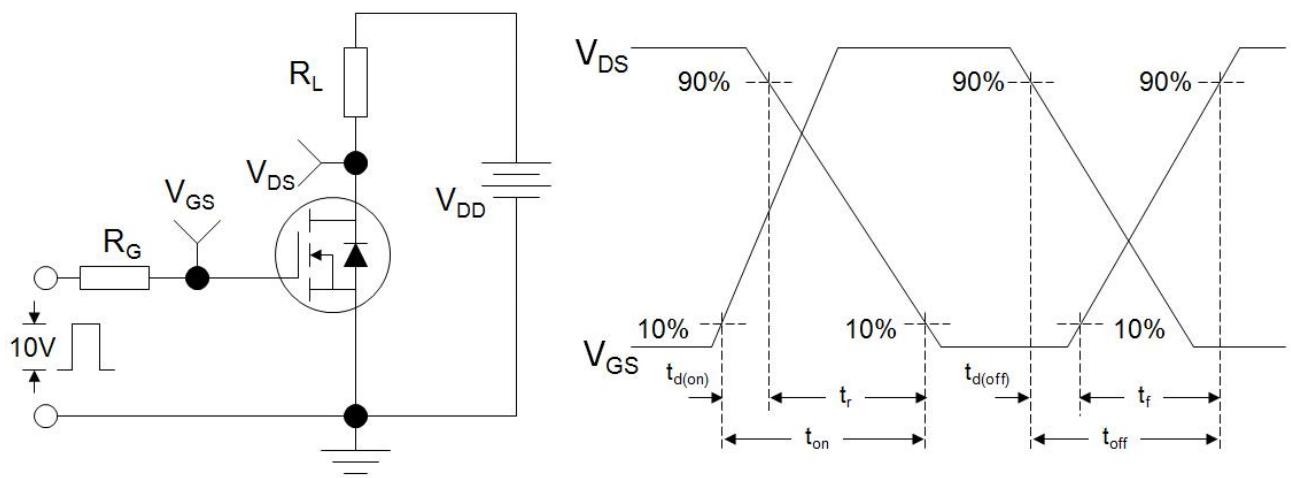
**Figure C：Unclamped Inductive Switching Test Circuit and Waveform**
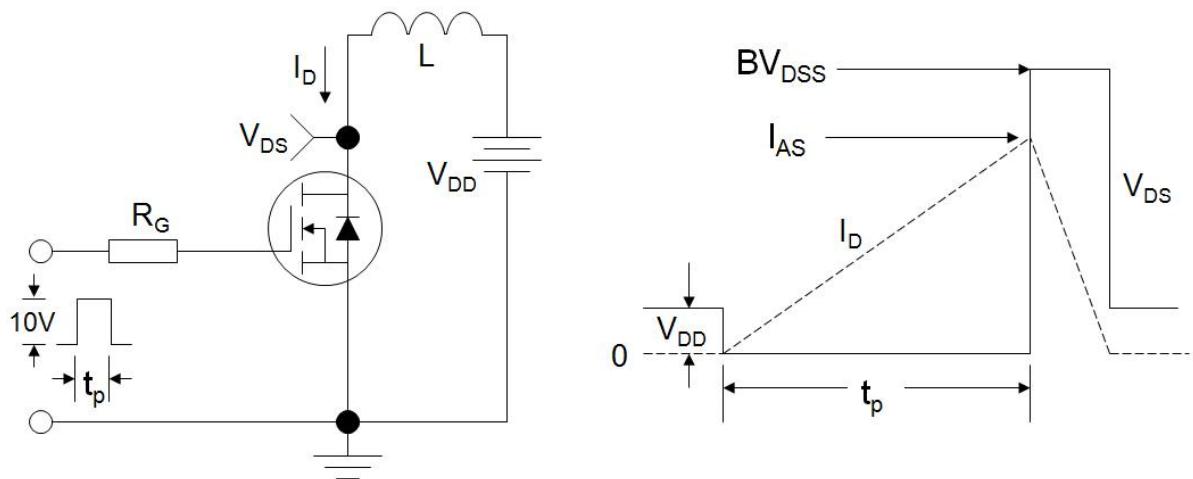
TO-263
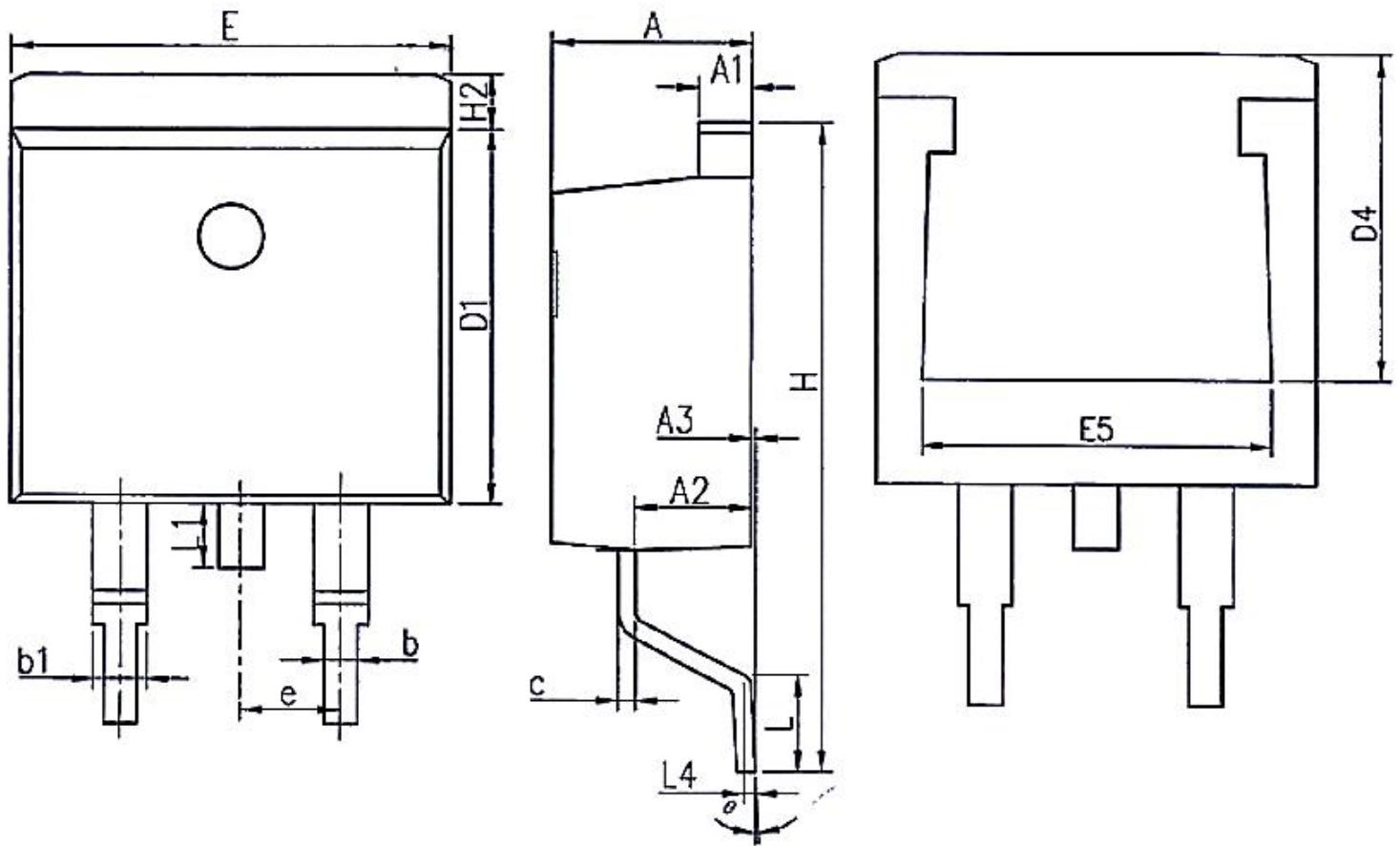

Unit:mm			
Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-

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
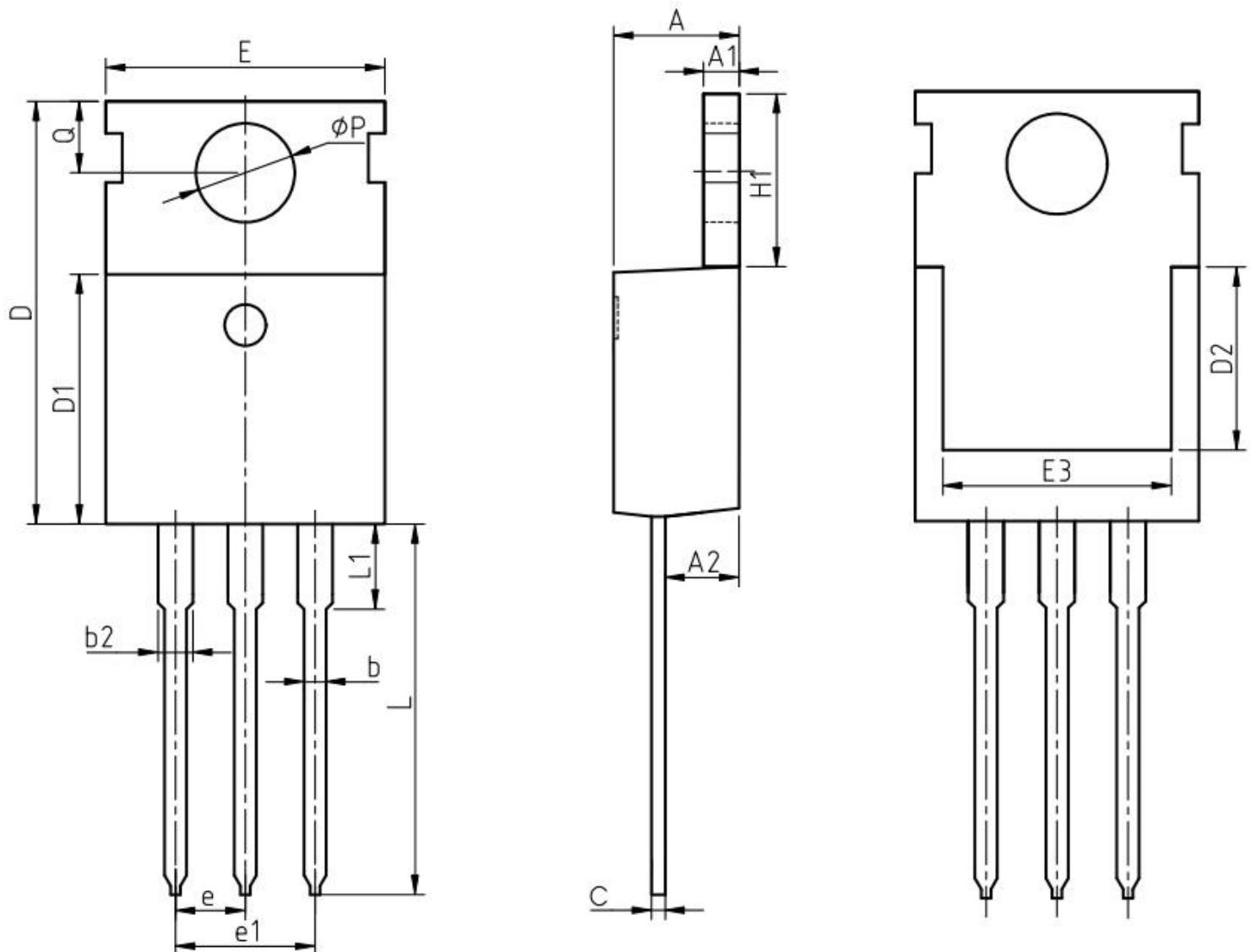
Unit:mm			
Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-

Unit:mm			
Symbol	Min.	Nom	Max.
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00

TO-247
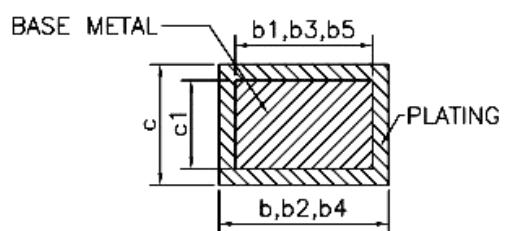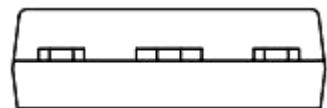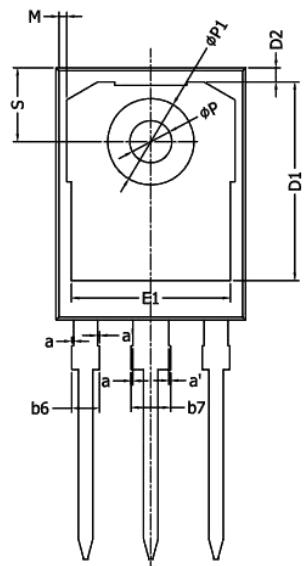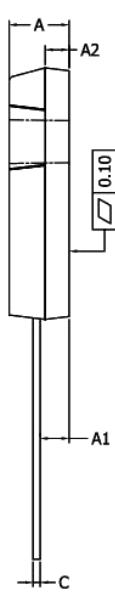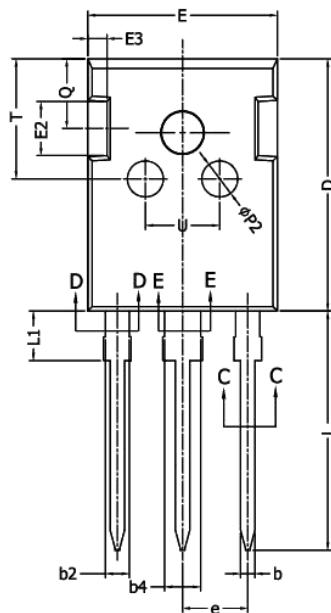
SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2.00	2.02
b4	2.96	---	3.06
b5	2.96	3.00	3.02
b6	---	---	2.25
b7	---	---	3.25
c	0.59	---	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	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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