Description

WTM65R090FMP/F/T is an N-channel power MOSFET designed according to super junction technology. This device has very low on-resistance and hard ruggedness for switching applications. It's very low conduction loss and fast switching can make applications more efficient and faster.

Features

- Low gate charge
- Low $R_{DS(on)}$ per chip area(Low FOM)
- Very low switching and conduction loss
- Extremely high commutation ruggedness
- Ultra fast body diode
- 100% avalanche tested

Applications

- TV and PC Power
- Adopter and Lighting
- Telecom and UPS(Uninterruptible Power Supply)

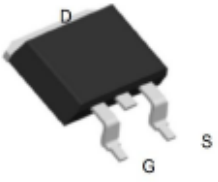
Package & Internal circuit



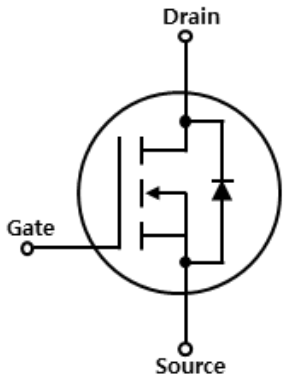
TO-247



TO-220F



TO-263



Key parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$Q_{g,typ}$	52	nC
I_D	31	A
$R_{DS(on),max}$	90	mΩ

Ordering Information

Ordering Code	Package	Marking	Packing type
WTM65R090FMP	TO-247	WPM 65R090FMP XXX YYWW	Tube
WTM65R090FF	TO-220F	WPM 65R090FF XXX YYWW	Tube
WTM65R090FT	TO-263	WPM 65R090FT XXX YYWW	Tube

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Absolute maximum ratings at T_C=25ºC unless otherwise specified

Symbol	Parameter	Value	Unit	Test condition
V_{DS}	Drain-source voltage	650	V	-
V_{GS}	Gate-source voltage	±30	V	-
I_D(1)	Continuous drain current	31	A	T_C = 25˚C
	Continuous drain current	19.6	A	T_C = 100˚C
I_{DM}(2)	Pulsed drain current	93	A	T_C = 25˚C
E_{AS}	Single pulsed avalanche energy	139	mJ	Starting T_j = 25˚C, I_{AS} = 5.3A V_{DD} = 50V, I_D = I_{AR}
P_{tot}	Total power dissipation	147	W	T_C = 25˚C
dv/dt	MOSFET dv/dt ruggedness	50	V/ns	V_{DS} = 0…400V
dv/dt	Reverse diode dv/dt	15	V/ns	V_{DS} = 0…400V, T_j = 25˚C, I_{SD}≤I_D
T_{stg}	Storage temperature	-55 to 150	˚C	-
T_j	Operating junction temperature	-55 to 150	˚C	-

1. limited by $T_{j,max}$, Maximum duty cycle D=0.5
2. Pulse width limited by $T_{j,max}$

Thermal characteristics

Symbol	Parameter	Value	Unit	Test condition
R_{thJC}	Thermal resistance, junction - case	0.85	˚C/W	-
R_{thJA}	Thermal resistance, junction - ambient	62.5	˚C/W	-

Static characteristics at T_C=25ºC unless otherwise specified

Symbol	Parameter	Maximum value			Unit	Test condition
		Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-source breakdown voltage	650	-	-	V	V_{GS} = 0V, I_D = 0.25mA
$V_{GS(th)}$	Gate threshold voltage	3	4	5	V	V_{GS} = V_{DS}, I_D = 0.25mA
I_{GSS}	Gate-body leakage current	-	-	100	nA	V_{GS} = ±30V, T_j = 25ºC
I_{DSS}	Zero gate voltage drain current	-	-	5	uA	V_{DS} = 650V, V_{GS} = 0V, T_j = 25˚C
$R_{DS(on)}$	Drain-source on-resistance	-	87	90	mΩ	V_{GS} = 10V, I_D = 15.5A

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Dynamic characteristics

Symbol	Parameter	Values			Unit	Test condition
		Min.	Typ.	Max.		
C_{iss}	Input capacitance	-	2416	-	pF	V_{DS} = 400V, V_{GS} = 0V, f = 250kHz
C_{oss}	Output capacitance	-	38.6	-	pF	
C_{rss}	Reverse transfer capacitance	-	5.21	-	pF	
$C_{o(er)}$ (3)	Effective output capacitance, energy related	-	70.1	-	pF	V_{GS} =10V, V_{DS} = 0…400V
$C_{o(tr)}$ (4)	Effective output capacitance, time related	-	581	-	pF	V_{GS} =10V, V_{DS} = 0…400V
$t_{d(on)}$	Turn-on delay time	-	66	-	ns	V_{DD} = 400V, I_D = 15.5A, V_{GS} =10V, R_G =20Ω
t_r	Rise time	-	94	-	ns	
$t_{d(off)}$	Turn-off delay time	-	129	-	ns	
t_f	Fall time	-	22	-	ns	
R_G	Gate resistance	-	3.8	-	Ω	f = 1MHz, I_D = 0A
Q_g	Total gate charge	-	52	-	nC	V_{DD} = 400V, V_{GS} = 10V, I_D = 15.5A
Q_{gs}	Gate-source charge	-	13.9	-	nC	
Q_{gd}	Gate-drain charge	-	20.8	-	nC	

3. $C_{o(er)}$is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V
4. $C_{o(tr)}$is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400V

Reverse diode characteristics

Symbol	Parameter	Values			Unit	Test condition
		Min.	Typ.	Max.		
V_{SD}	Diode forward voltage	-	-	1.4	V	V_{GS} = 0V, I_{SD} = 15.5A, T_j = 25˚C
I_{SD}	Continuous Diode forward current	-	-	31	A	-
t_{rr}	Reverse recovery time	-	173.6	-	ns	I_{SD} = 15.5A, V_{DS} = 400V, di/dt = 100A/us
I_{rr}	Reverse recovery current	-	13.4	-	A	
Q_{rr}	Reverse recovery charge	-	1.16	-	uC	

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Characteristic Graph

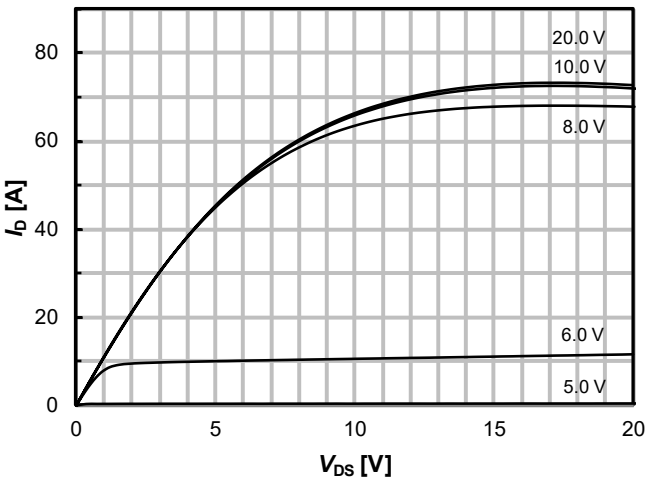


Fig. 1 Output Characteristics

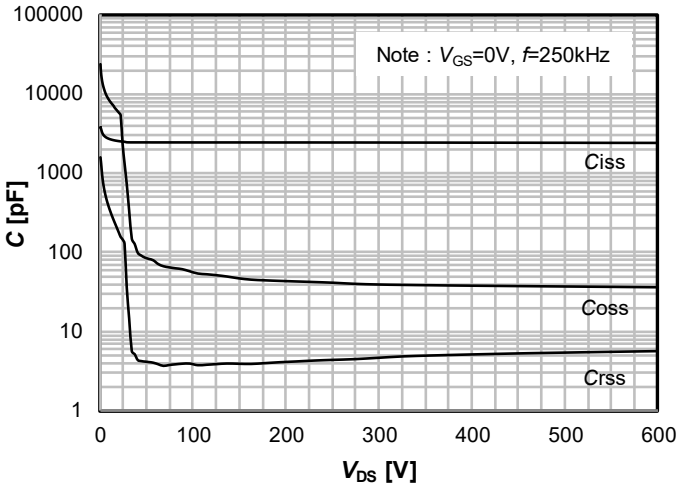


Fig. 2 Capacitances

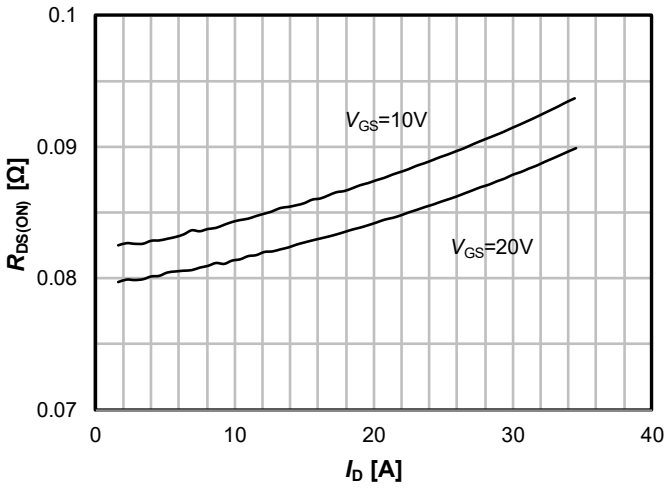


Fig. 3 On-state Resistance

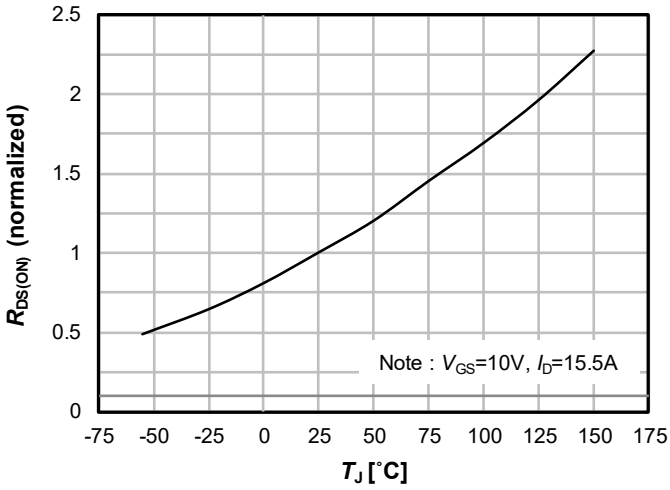


Fig. 4 On-state Resistance with Temperature

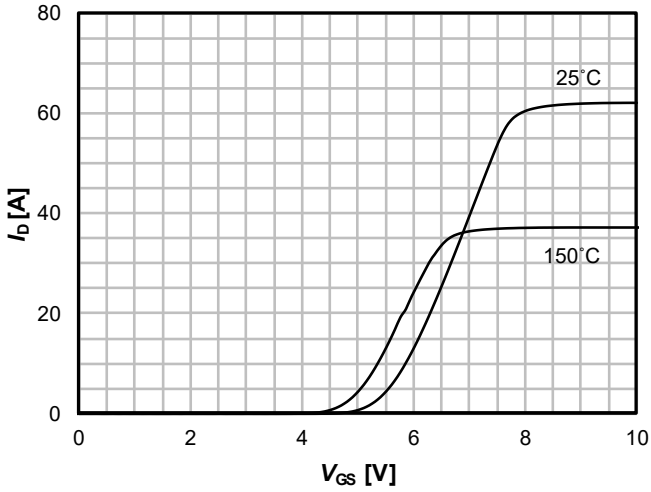


Fig. 5 Transfer Characteristics

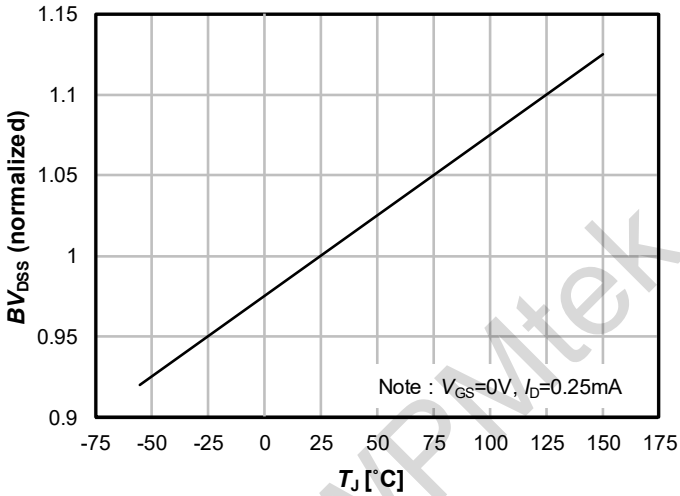


Fig. 6 Breakdown Voltage with Temperature

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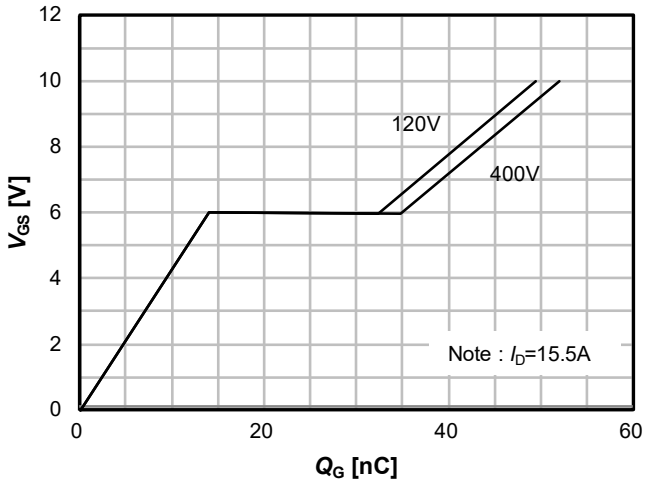


Fig. 7 Gate Charge

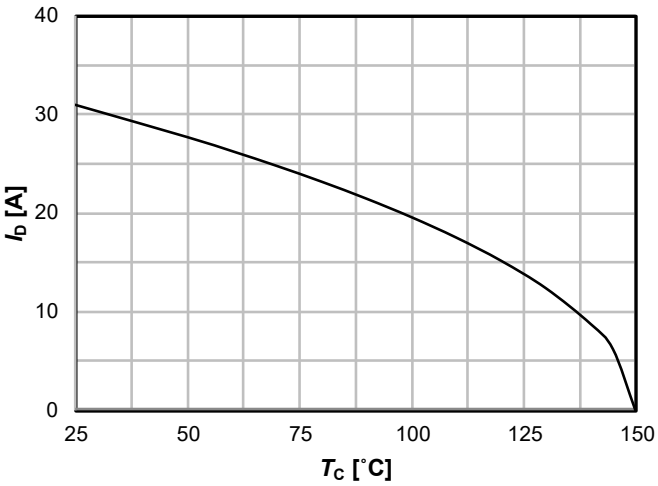


Fig. 8 Maximum Drain Current

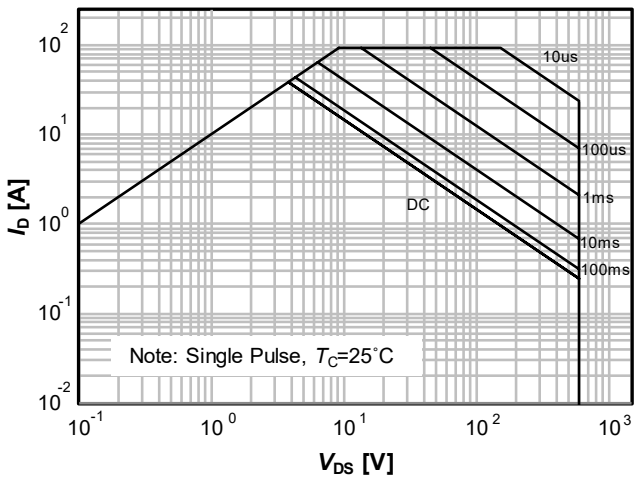


Fig. 9 Safe Operating Area

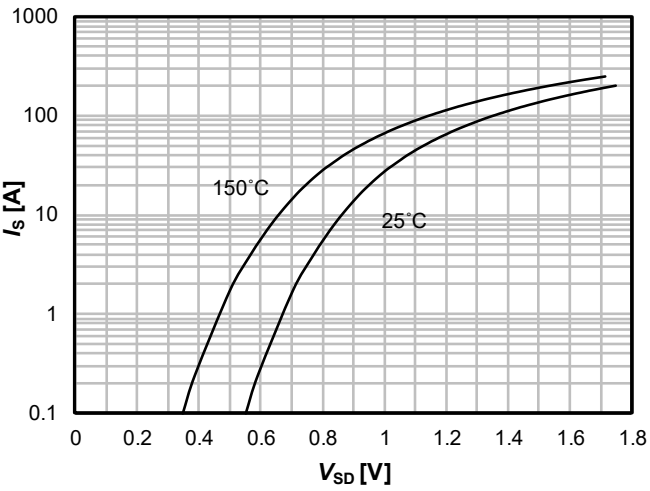


Fig. 10 Body Diode Characteristics

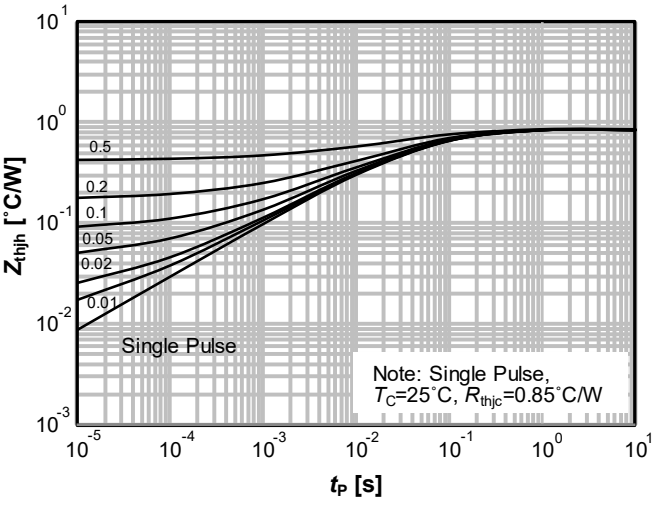


Fig. 11 Maximum Transient Thermal Characteristics

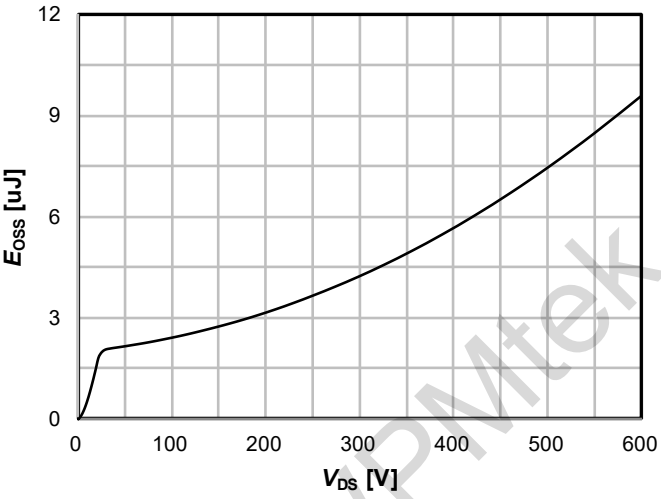


Fig. 12 C_{oss} Stored Energy

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Test Circuits

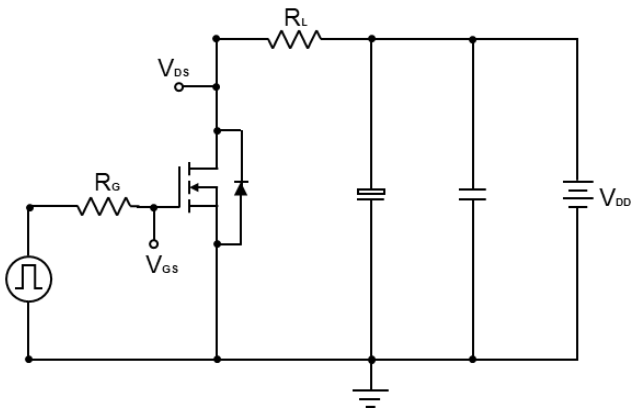


Fig. 13 Test circuit for resistive load switching times

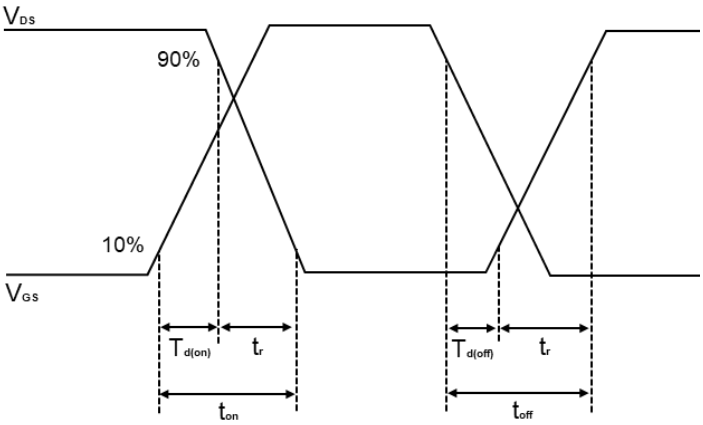


Fig. 14 Switching times waveform

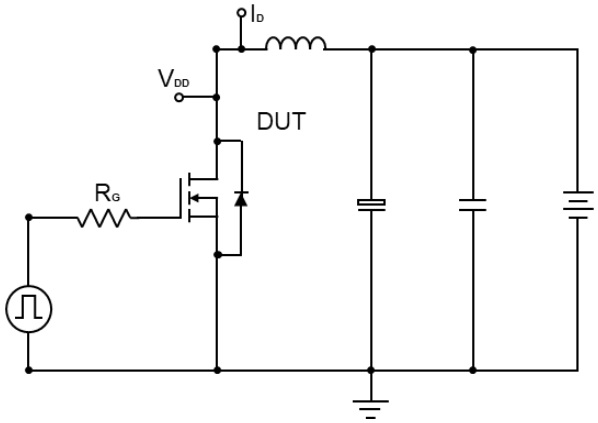


Fig. 15 Test circuit for unclamped inductive load

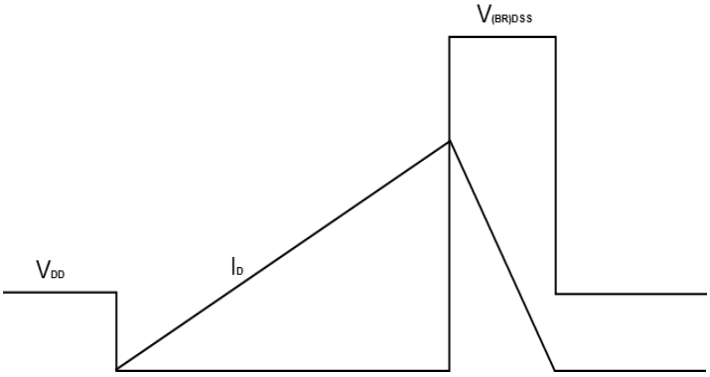


Fig. 16 Unclamped inductive waveform

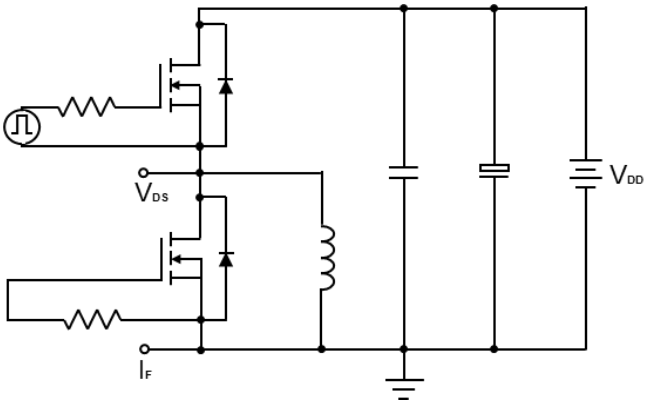


Fig. 17 Test circuit for diode characteristics

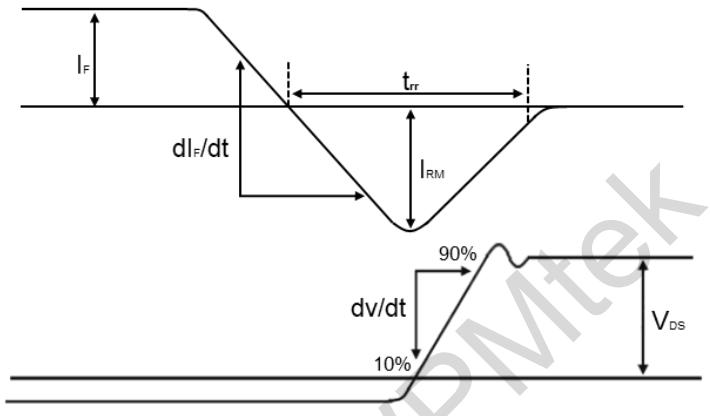
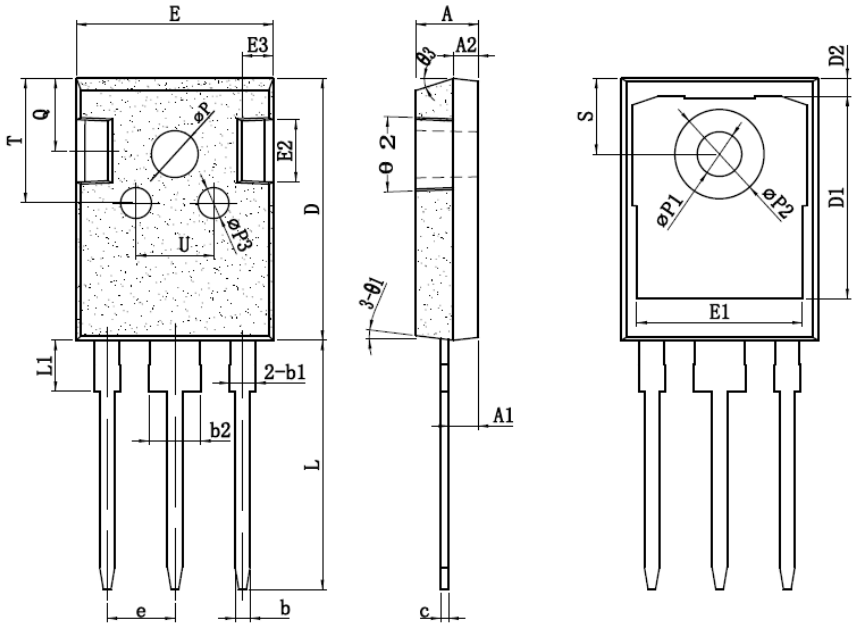


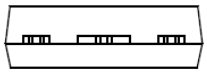
Fig. 18 Diode recovery waveform

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Package Information

TO-247 Package Outline

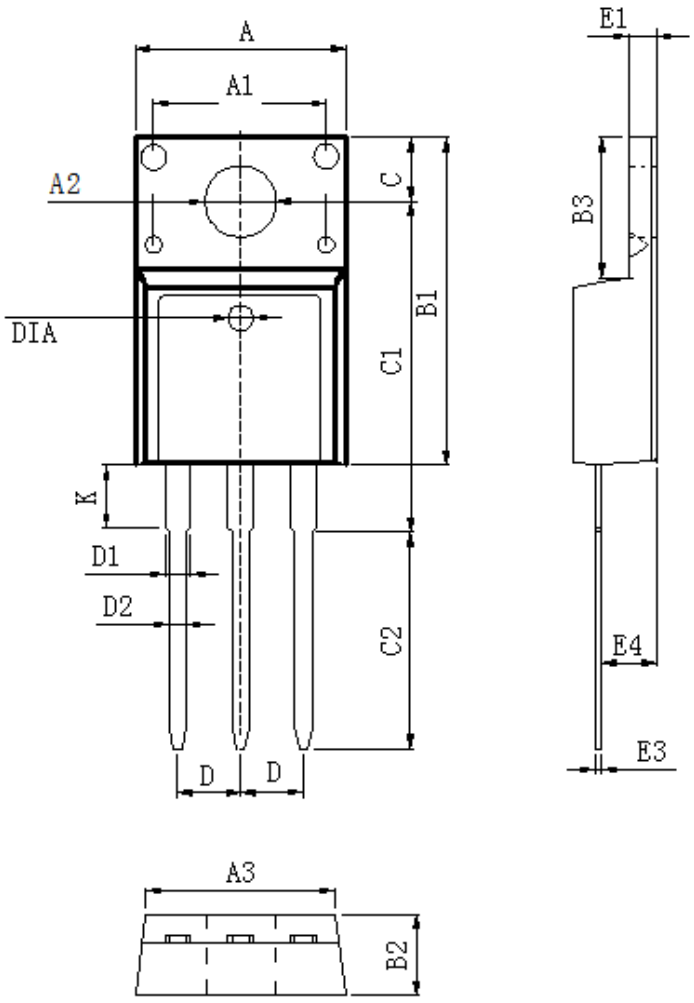




SYMBOL	mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35
*E	15.70	15.80	15.90
E1	13.10	13.25	13.40
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
*e	5.40	5.44	5.48
*L	19.80	19.98	20.15
*L1	–	–	4.30
*ΦP	3.60	3.70	3.80
*ΦP1	3.45	3.55	3.65
ΦP2	7.03	7.18	7.33
ΦP3	2.40	2.50	2.60
Q	5.60	5.80	6.00
*S	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	13°	15°	17°

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TO-220F

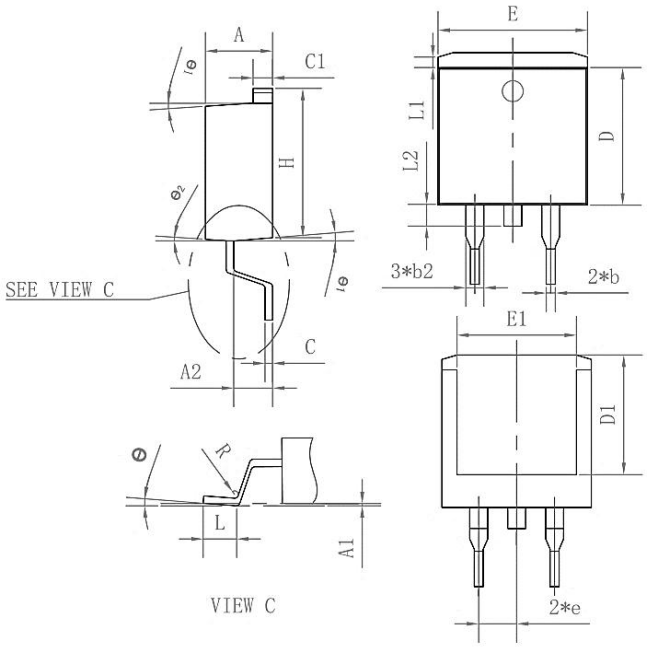


DIM	MILLIMETERS
A	10.16±0.3
A1	7.00±0.1
A2	3.3±0.2
A3	9.5±0.2
B1	15.87±0.3
B2	4.7±0.2
B3	6.68±0.4
C	3.3±0.2
C1	12.57±0.3
C2	10.02±0.5
D	2.54±0.05
D1	1.28±0.2
D2	0.8±0.1
K	3.1±0.3
E1	2.54±0.1
E3	0.5±0.1
E4	2.76±0.2
DIA	⊙1.5(deep 0.2)

Unit :mm

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Package Mechanical Data-TO-263-3L-SLK



Symbol	Common		
	mm		
	Mim	Nom	Max
A	4.35	4.47	4.60
A1	0.09	0.10	0.11
A2	2.30	2.40	2.70
b	0.70	0.80	1.00
b2	1.25	1.36	1.50
C	0.45	0.50	0.55
C1	1.29	1.30	9.40
D	9.10	9.20	9.30
D1	7.90	8.00	8.10
E	9.85	10.00	10.20
E1	7.90	8.00	8.10
H	15.30	15.50	15.70
e	-	2.54	-
L	2.34	2.54	2.74
L1	1.00	1.10	1.20
L2	1.30	1.40	1.50
R	0.24	0.25	0.26
θ	0°	4°	8°
Θ1	4°	7°	10°
Θ2	0°	3°	6°

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