

Applications

For Soft Switching Boost PFC switch, HB or AHB or LLC half bridge and full bridge topologies.

Such as phase-shift-bridge(ZVS),LLC Application-Server Power, Telecom Power, EV Charging, Solar inverter.

Features

Low drain-source on-resistance: $R_{DS(ON)} = 0.031\Omega$ (typ.)

Easy to control Gate switching

Enhancement mode: $V_{th} = 3$ to 5 V

TO247

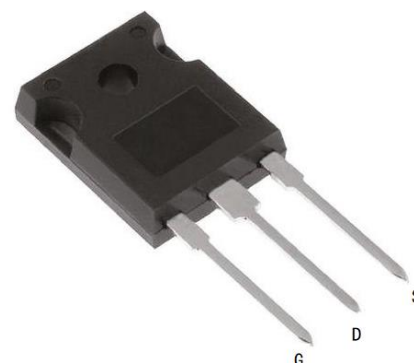
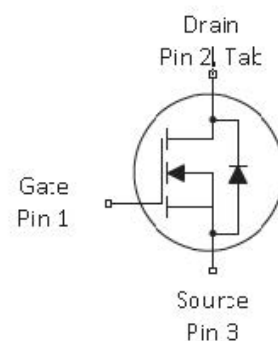


Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	35	m Ω
$Q_{g,typ}$	158.2	nC
I_D	90	A
Body diode dv/dt	50	V/ns



Packaging and Internal Circuit

Part Name	Package	Marking
WTM90N65FMP	TO247	WPM 90N65FMP XXX YYWW

Thermal characteristics

Table 2 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.205	$^{\circ}\text{C/W}$	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	$^{\circ}\text{C/W}$	device on PCB, minimal footprint

Maximum ratings

at $T_j = 25^\circ\text{C}$, unless otherwise specified

Table 3 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D		-	90	A	$T_C=25^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	240	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}	-	-	2560	mJ	$T_C=25^\circ\text{C}, V_{DD}=50\text{V}, L=20\text{mH}$, $R_G=25\Omega$
Avalanche current, single pulse	I_{AR}	-	-	16	A	$T_C=25^\circ\text{C}, V_{DD}=50\text{V}, L=20\text{mH}$, $R_G=25\Omega$
MOSFET dv/dt ruggedness	dv/dt	-	-	26	V/ns	$V_{DS}=0\dots150\text{V}$
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC ($f>1\text{ Hz}$)
Power dissipation	P_{tot}	-	-	500	W	$T_C=25^\circ\text{C}$
Storage temperature	T_{stg}	-55	-	150	$^\circ\text{C}$	
Operating junction temperature	T_j	-55	-	150	$^\circ\text{C}$	
Soldering Temperature Distance of 1.6mm from case for	T_L			260	$^\circ\text{C}$	
^{10s} Reverse diode dv/dt ³⁾	dv/dt	-	-	50	V/ns	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq 48\text{A}$, $T_j=25^\circ\text{C}$ see table 8

¹⁾Limited by $T_{j,max}$. Maximum Duty Cycle $D =$

²⁾0.50 Pulse width t_p limited by $T_{j,max}$

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

Table 4 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.61	-	V	$V_{GS}=0\text{V}$, $I_F=1\text{A}$, $T_j=25^\circ\text{C}$
Reverse recovery time	t_{rr}	-	173.5	-	ns	$V_r=400\text{V}$, $I_F=44.2\text{A}$, $di/dt=100\text{A/us}$ see table 8
Reverse recovery charge	Q_{rr}	-	1.19	-	μC	$V_r=400\text{V}$, $I_F=44.2\text{A}$, $di/dt=100\text{A/us}$ see table 8
Peak reverse recovery current	I_{rrm}	-	12.7	-	A	$V_r=400\text{V}$, $I_F=44.2\text{A}$, $di/dt=100\text{A/us}$ see table 8

Electrical characteristics

at $T_j=25^{\circ}\text{C}$, unless otherwise specified

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	655	-	-	V	$V_{GS}=0V$, $I_D=250\mu A$
Gate threshold voltage	$V_{(GS)th}$	3		5	V	$V_{DS}=V_{GS}$, $I_D=250\mu A$
Zero gate voltage drain current	I_{DSS}	-	-	5	μA	$V_{DS}=650V$, $V_{GS}=0V$, $T_j=25^{\circ}\text{C}$
Gate-source leakage current	I_{GSS}	-	-	100	nA	$V_{GS}=30V$, $V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.031	0.035	Ω	$V_{GS}=10V$, $I_D=28A$, $T_j=25^{\circ}\text{C}$
Gate resistance (Intrinsic)	R_G	-	1.2	-	Ω	$f=1\text{MHz}$, open drain

Table 6 Dynamic characteristics

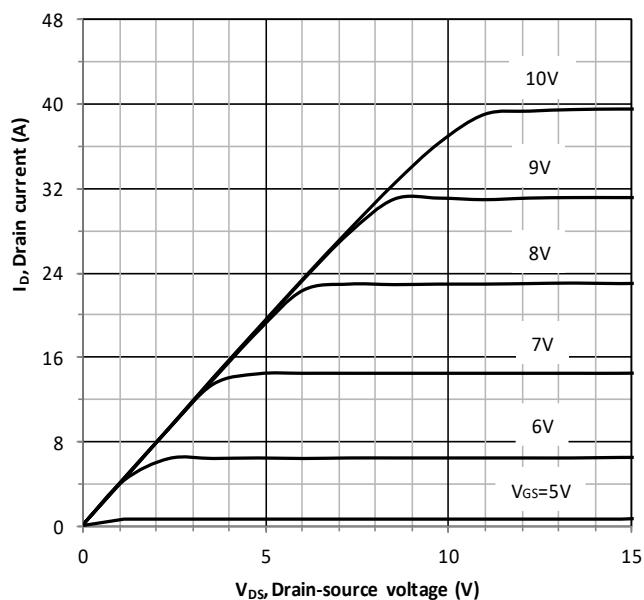
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	6033	-	pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=1\text{MHz}$
Output capacitance	C_{oss}	-	169	-	pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=1\text{MHz}$
Reverse transfer capacitance	C_{rss}	-	12.1	-	pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=1\text{MHz}$
Turn-on delay time	$t_{d(on)}$	-	67.6	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=44.2A$ $R_G=1.8\Omega$; see table 9
Rise time	t_r	-	29.8	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=44.2A$ $R_G=1.8\Omega$; see table 9
Turn-off delay time	$t_{d(off)}$	-	30	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=44.2A$ $R_G=1.8\Omega$; see table 9
Fall time	t_f	-	325.4	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=44.2A$ $R_G=1.8\Omega$; see table 9

Table 7 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	45	-	nC	$V_{DD}=480V$, $I_D=44.2A$, $V_{GS}=10V$
Gate to drain charge	Q_{gd}	-	61	-	nC	$V_{DD}=480V$, $I_D=44.2A$, $V_{GS}=10V$
Gate charge total	Q_g	-	158.2	-	nC	$V_{DD}=480V$, $I_D=44.2A$, $V_{GS}=10V$
Gate plateau voltage	$V_{plateau}$	-	6.14	-	V	$V_{DD}=480V$, $I_D=44.2A$, $V_{GS}=10V$

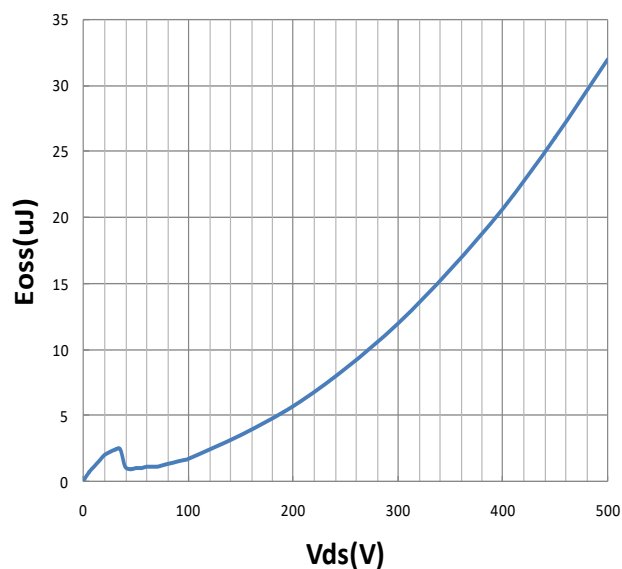
Electrical characteristics diagram

Diagram 1: Typ. output characteristics



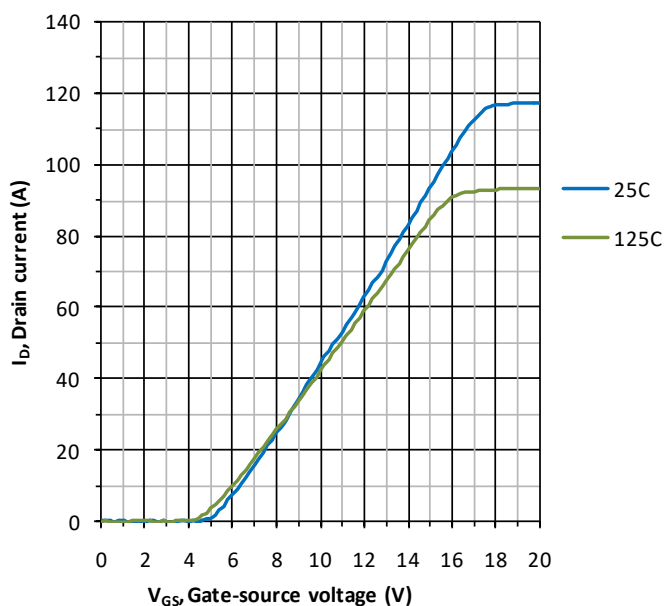
$I_D = f(V_{DS})$; $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 2: Typ. Coss stored energy



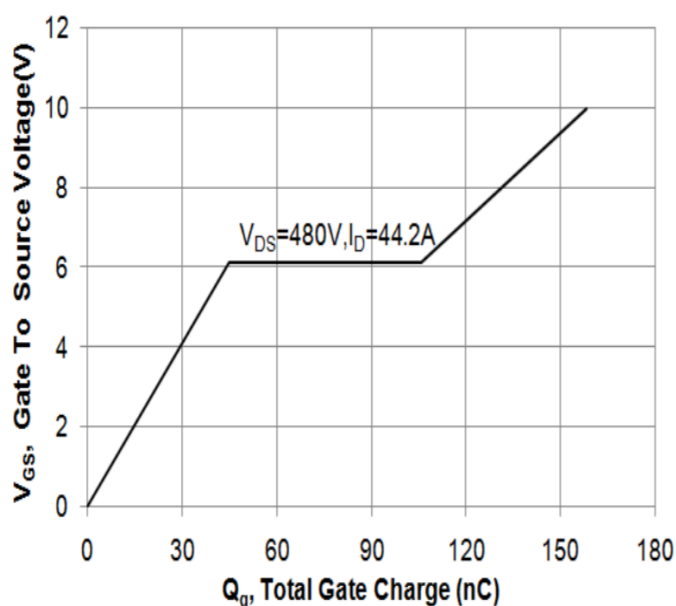
$E_{oss} = f(V_{DS})$

Diagram 3: Typ. transfer characteristics



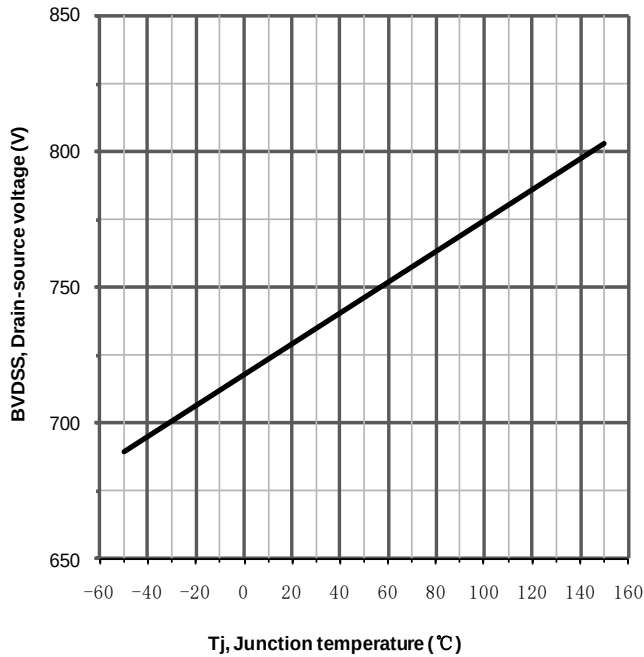
$I_D = f(V_{GS})$; parameter: T_j

Diagram 4: Typ. gate charge



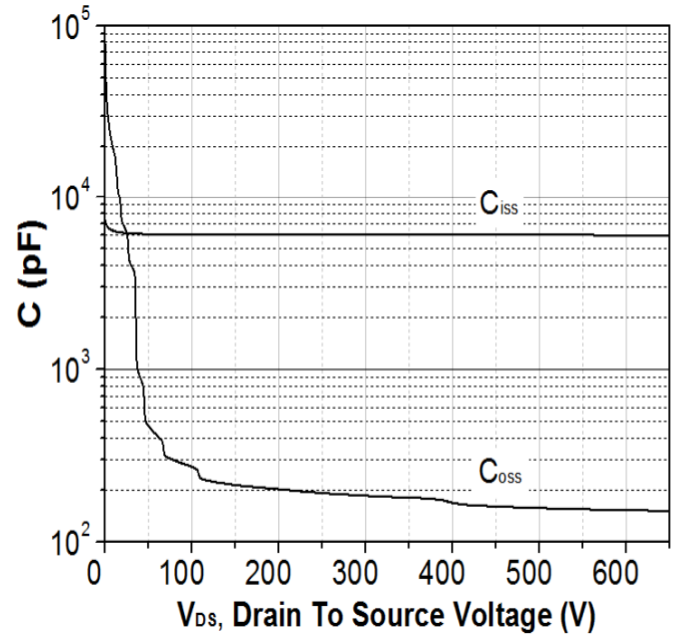
$V_{GS} = f(Q_{gate})$; $I_D = 44.2\text{A}$ pulsed; parameter: V_{DD}

Diagram 5: Drain-source breakdown voltage



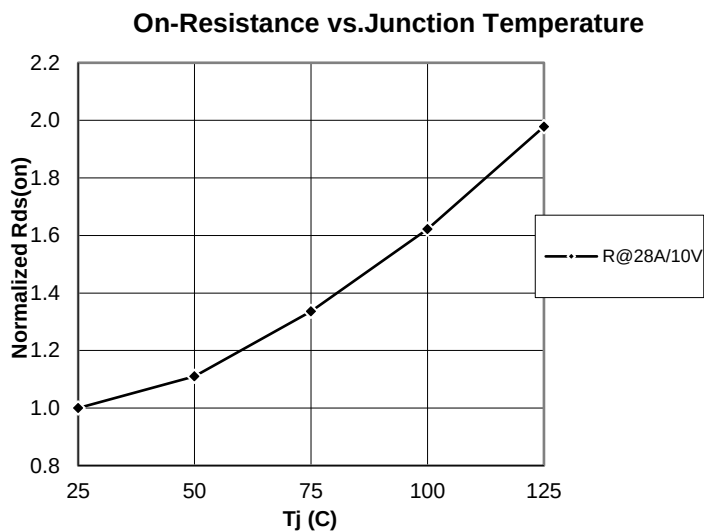
$$V_{BR(DSS)} = f(T_j); I_D = 10\text{mA}$$

Diagram 6: Typ. capacitances



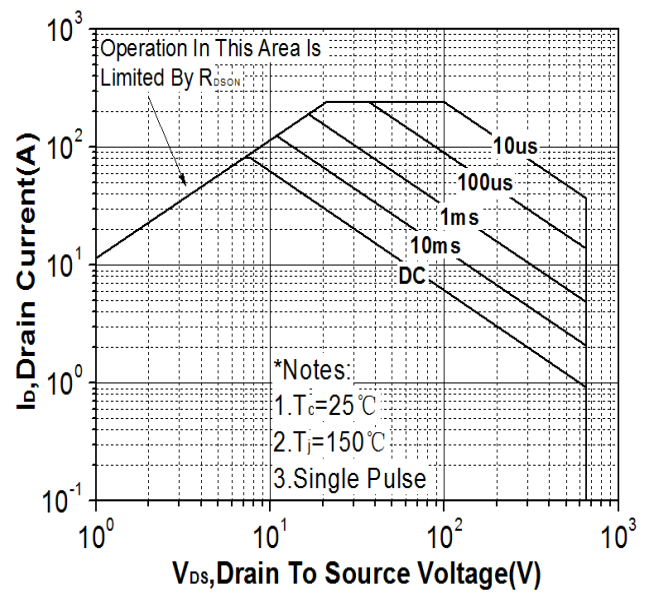
$$C = f(V_{DS}); V_{GS} = 0\text{V}; f = 10\text{ kHz}$$

Diagram7:Typ. On-Resistance vs. Junction Temperature



$$R_{ds(on)} = f(T_j); V_{GS} = 10\text{V}; I_D = 28\text{A}$$

Diagram 8: Safe operating area Tc=25 °C, TO247



$$I_D = f(V_{DS}); T_C = 25\text{ °C}; V_{GS} > 7\text{V}; D = 0; \text{parameter } t_p$$

Test Circuits

Table 8 Diode characteristics

Test circuit for diode characteristics	Diode recovery waveform
$R_{G1} = R_{G2}$	

Table 9 Switching times

Switching times test circuit for inductive load	Switching times waveform

Table10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform

Package Outlines

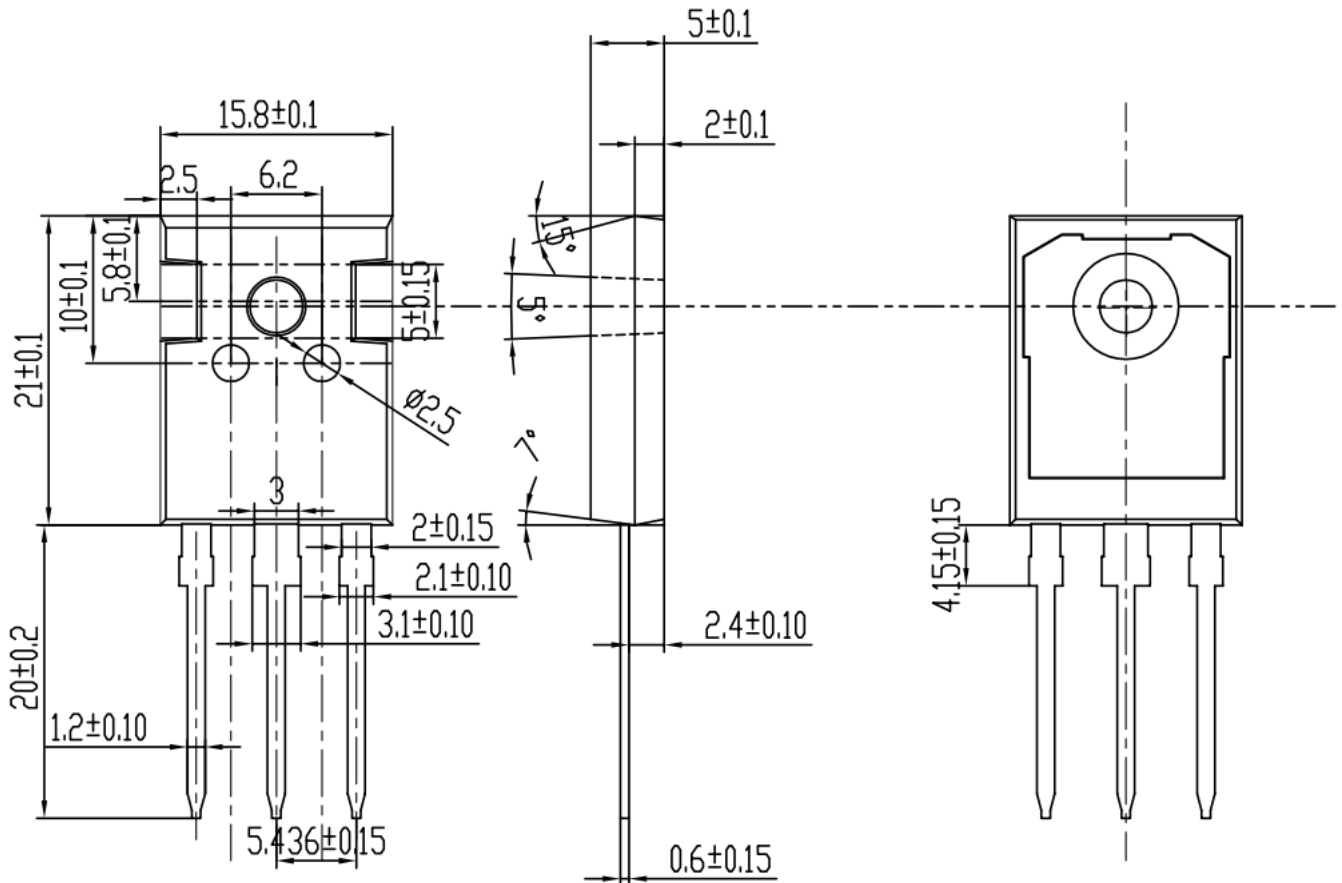
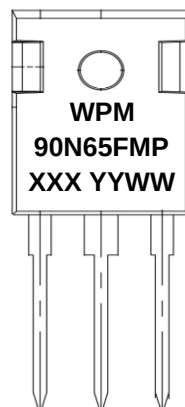


Figure: Outline TO247

Marking



WPM=WPMtek's Logo
90N65FMP=Marking
XXX YYWW=Date Code

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