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December 2014

FCP190N60 / FCPF190N60 N-Channel SuperFET® II MOSFET

600 V, 20.2 A, 199 mΩ

Features

- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 170 m Ω
- Ultra Low Gate Charge (Typ. Q_q = 57 nC)
- Low Effective Output Capacitance (Typ. C_{oss(eff.)} = 160 pF)
- · 100% Avalanche Tested
- · RoHS Compliant

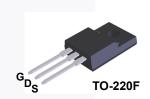
Applications

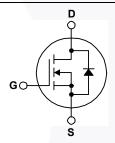
- · LCD / LED / PDP TV Lighting
- · Solar Inverter
- AC-DC Power Supply

Description

SuperFET[®] II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET II MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.







Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol		Parameter		FCP190N60	FCPF190N60	Unit	
V _{DSS}	Drain to Source Voltage			600		V	
V	- DC			±	20	V	
V_{GSS}	Gate to Source Voltage	- AC	(f > 1 Hz)	±	30	V	
	Drain Current	- Continuous (T _C = 25°C)		20.2	20.2*	۸	
I _D	Drain Current	- Continuous (T _C = 100°C)		12.7	12.7*	Α	
I _{DM}	Drain Current	- Pulsed	(Note 1)	60.6	60.6*	Α	
E _{AS}	Single Pulsed Avalanche Energy (Note 2		(Note 2)	400		mJ	
I _{AR}	Avalanche Current		(Note 1)	4.0		Α	
E _{AR}	Repetitive Avalanche Energy (Note 1)		2.1		mJ		
dv/dt	MOSFET dv/dt			100		V/ns	
dv/dt	Peak Diode Recovery dv/dt (Note		(Note 3)	20			
n	Dawer Dissipation	$(T_C = 25^{\circ}C)$		208	39	W	
P_D	Power Dissipation - Derate Above 25°C			1.67	0.31	W/°C	
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to +150		٥С		
T _I	Maximum Lead Temperature	e for Soldering, 1/8" from Case for	5 Seconds	300		٥С	

^{*}Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FCP190N60	FCPF190N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.6	3.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	· C/VV

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP190N60	FCP190N60	TO-220	Tube	N/A	N/A	50 units
FCPF190N60	FCPF190N60	TO-220F	Tube	N/A	N/A	50 units

Test Conditions

Min.

Тур.

Max.

Unit

Electrical Characteristics $T_C = 25^{\circ}C$ unless otherwise noted. Parameter

Off Chara	acteristics					
D\/	Drain to Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 10 \text{ mA}, T_J = 25^{\circ}\text{C}$	600	-	-	V
BV _{DSS}	Diain to Source Breakdown voltage	$V_{GS} = 0 \text{ V}, I_D = 10 \text{ mA}, T_J = 150^{\circ}\text{C}$	650	-	-	, v
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 10 mA, Referenced to 25°C	-	0.67	-	V/°C
BV _{DS}	Drain to Source Avalanche Breakdown Voltage	V _{GS} = 0 V, I _D = 20 A	-	700	-	V
	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V	-	-	1	
IDSS	Zelo Gate Voltage Diam Current	$V_{DS} = 480 \text{ V}, T_{C} = 125^{\circ}\text{C}$	-	1.3	-	μΑ
I _{GSS}	Gate to Body Leakage Current	V _{GS} = ±20 V, V _{DS} = 0 V	-	-	±100	nA

On Characteristics

Symbol

V _{GS(th)}	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu A$	2.5	-	3.5	V
R _{DS(on)}	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 10 \text{ A}$	-	0.17	0.199	Ω
9 _{FS}	Forward Transconductance	$V_{DS} = 20 \text{ V}, I_{D} = 10 \text{ A}$	1	21	-	S

Dynamic Characteristics

-						
C _{iss}	Input Capacitance	V - 25 V V - 0 V	-	2220	2950	pF
C _{oss}	Output Capacitance	V _{DS} = 25 V, V _{GS} = 0 V f = 1 MHz	-	1630	2165	pF
C _{rss}	Reverse Transfer Capacitance	1 - 1 WH12	-	85	128	pF
C _{oss}	Output Capacitance	$V_{DS} = 380 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	42	-	pF
C _{oss(eff.)}	Effective Output Capacitance	$V_{DS} = 0 \text{ V to } 480 \text{ V}, V_{GS} = 0 \text{ V}$	-	160	-	pF
Q _{g(tot)}	Total Gate Charge at 10V	V _{DS} = 380 V, I _D = 10 A,	-	57	74	nC
Q_{gs}	Gate to Source Gate Charge	V _{GS} = 10 V	-	9	-	nC
Q _{gd}	Gate to Drain "Miller" Charge	(Note 4)	- /	21	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-/	1	-	Ω

Switching Characteristics

t _{d(on)}	Turn-On Delay Time		-	20	50	ns
t _r		$V_{DD} = 380 \text{ V}, I_D = 10 \text{ A},$	-	10	30	ns
t _{d(off)}	Turn-Off Delay Time	V_{GS} = 10 V, R_{G} = 4.7 Ω	-	64	138	ns
t _f	Turn-Off Fall Time	(Note 4)	-	5	20	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	20.2	Α
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		- ,	-	60.6	Α
V_{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 10 A	-	-	1.2	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 10 A,	-	320	-	ns
Q _{rr}	Reverse Recovery Charge	$dI_F/dt = 100 A/\mu s$	-	5.1	-	μС

- 1. Repetitive rating: pulse-width limited by maximum junction temperature.
- 2. I_{AS} = 4 A, V_{DD} = 50 V, R_G = 25 Ω , starting T_J = 25°C.
- 3. $I_{SD} \le 10$ A, di/dt ≤ 200 A/ μ s, $V_{DD} \le BV_{DSS}$, starting T_J = 25°C.
- 4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

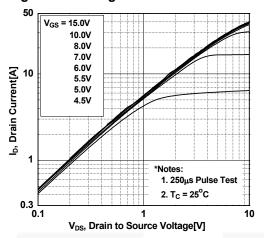


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

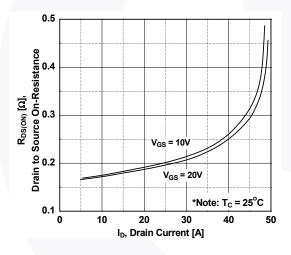


Figure 5. Capacitance Characteristics

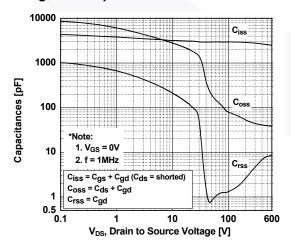


Figure 2. Transfer Characteristics

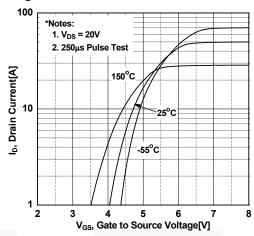


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

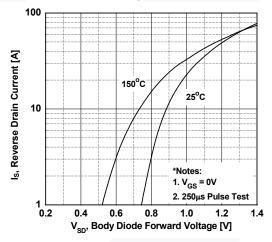
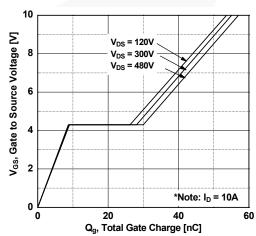


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

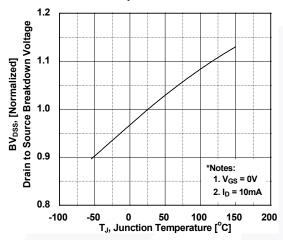


Figure 9. Maximum Safe Operating Area for FCP190N60

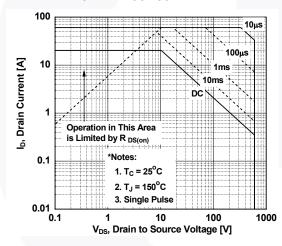


Figure 11. Maximum Drain Current vs. Case Temperature

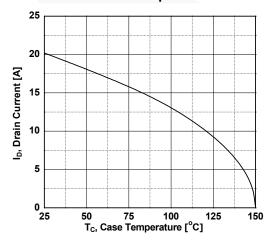


Figure 8. On-Resistance Variation vs. Temperature

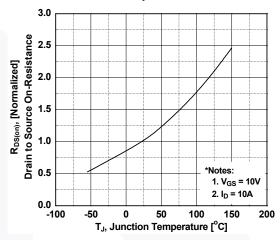


Figure 10. Maximum Safe Operating Area for FCPF190N60

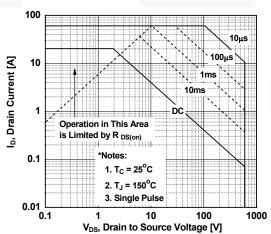
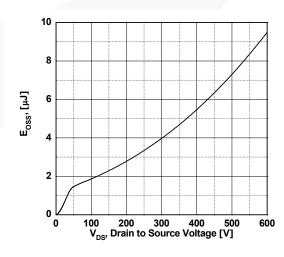


Figure 12. Eoss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve for FCP190N60

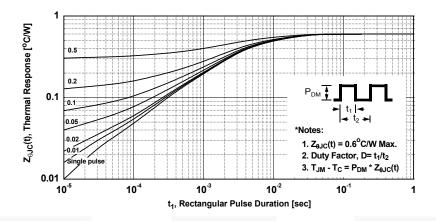
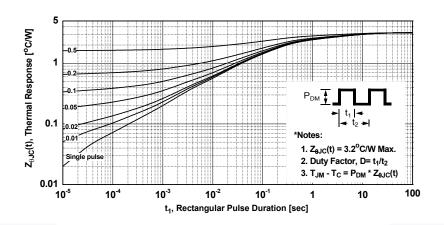


Figure 14. Transient Thermal Response Curve for FCPF190N60



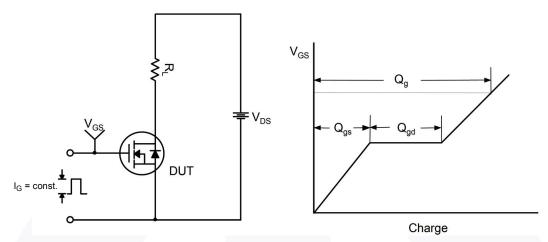


Figure 15. Gate Charge Test Circuit & Waveform

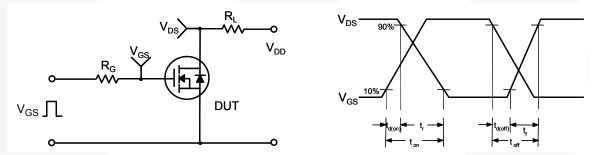


Figure 16. Resistive Switching Test Circuit & Waveforms

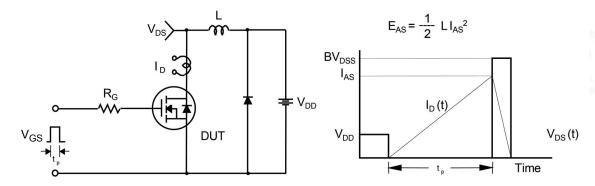


Figure 17. Unclamped Inductive Switching Test Circuit & Waveforms

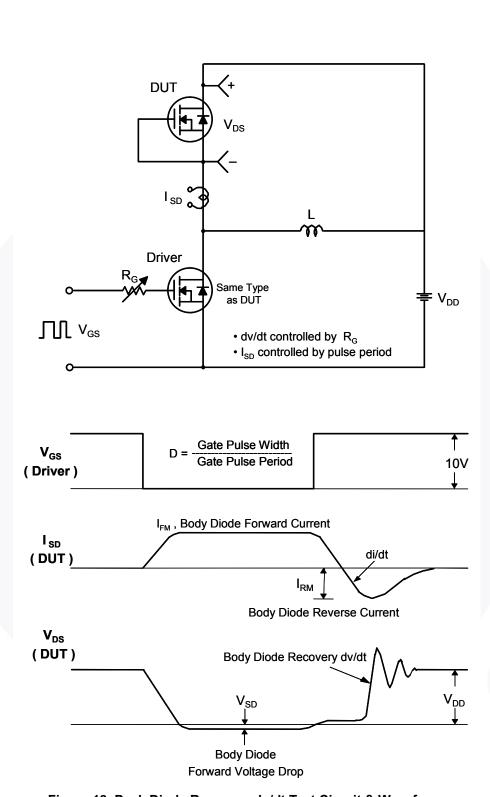
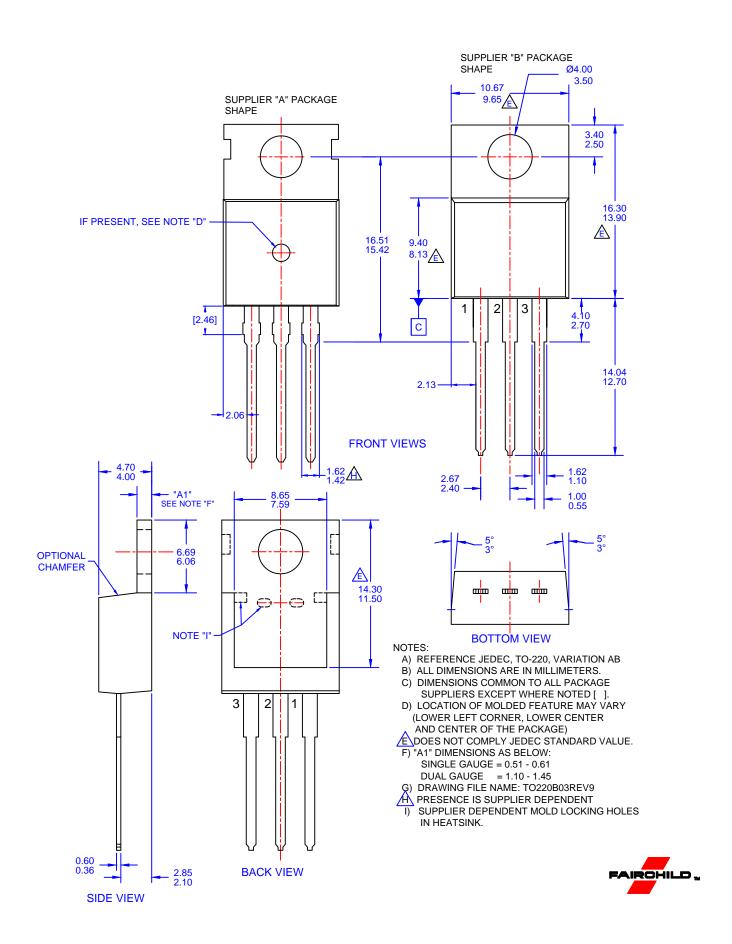
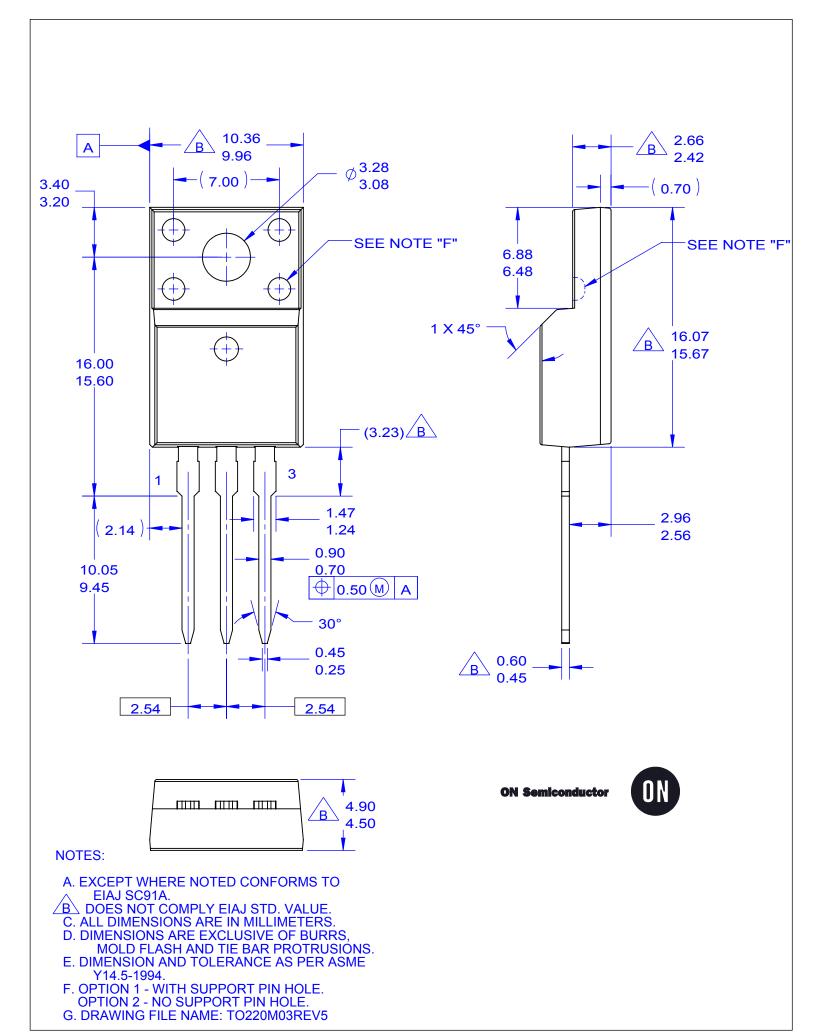


Figure 18. Peak Diode Recovery dv/dt Test Circuit & Waveforms





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