MOSFET – Power, N-Channel, SUPERFET III, Easy Drive

650 V, 12 A, 250 mΩ

Description

SUPERFET III MOSFET is ON 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 advanced technology is tailored to minimize conduction loss, provides superior switching performance, and withstand extreme dv/dt rate. Consequently, SUPERFET III MOSFET Easy drive series helps manage EMI issues and allows for easier design implementation.

Features

- 700 V @ T_J = 150°C
- Typ. $R_{DS(on)} = 210 \text{ m}\Omega$
- Ultra Low Gate Charge (Typ. Q_g = 24 nC)
- Low Effective Output Capacitance (Typ. Coss(eff.) = 248 pF)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

Applications

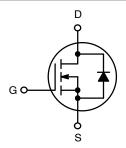
- Computing / Display Power Supplies
- Telecom / Server Power Supplies
- Industrial Power Supplies
- Lighting / Charger / Adapter



ON Semiconductor®

www.onsemi.com

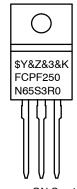
V _{DSS}	R _{DS(ON)} MAX	I _D MAX
650 V	250 m Ω @ 10 V	12 A



POWER MOSFET



MARKING DIAGRAM



\$Y = ON Semiconductor Logo &Z = Assembly Plant Code &3 = Data Code (Year & Week)

&K = Lot

FCPF250N65S3R0 = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^{\circ}C$, Unless otherwise noted)

Symbol	Parameter		Value	Unit	
V_{DSS}	Drain to Source Voltage	urce Voltage		V	
V_{GSS}	Gate to Source Voltage	- DC	±30	V	
		- AC (f > 1 Hz)	±30		
I _D	Drain Current	– Continuous (T _C = 25°C)	12*	Α	
		– Continuous (T _C = 100°C)	7.6*	1	
I _{DM}	Drain Current	- Pulsed (Note 1)	30*	Α	
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		57	mJ	
I _{AS}	Avalanche Current (Note 2)	2.3	А		
E _{AR}	Repetitive Avalanche Energy (Note 1)	0.31	mJ		
dv/dt	dv/dt MOSFET dv/dt		100	V/ns	
	Peak Diode Recovery dv/dt (Note 3)	20			
P_{D}	Power Dissipation	(T _C = 25°C)	31	W	
		- Derate Above 25°C	0.25	W/°C	
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to +150	°C	
TL	Maximum Lead Temperature for Soldering, 1/8"	300	°C		

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
*Drain current limited by maximum junction temperature.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{ heta JC}$	Thermal Resistance, Junction to Case, Max.	4.07	°C/W
$R_{ hetaJA}$	R _{0,JA} Thermal Resistance, Junction to Ambient, Max.		

PACKAGE MARKING AND ORDERING INFORMATION

I	Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
	FCPF250N65S3R0L	FCPF250N65S3R0	TO-220F	Tube	N/A	N/A	50 Units

^{1.} Repetitive rating: pulse–width limited by maximum junction temperature. 2. $I_{AS} = 2.3 \text{ A}$, $R_G = 25 \Omega$, starting $T_J = 25^{\circ}\text{C}$. 3. $I_{SD} \le 6 \text{ A}$, di/dt $\le 200 \text{ A}/\mu\text{s}$, $V_{DD} \le 400 \text{ V}$, starting $T_J = 25^{\circ}\text{C}$.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

		Test Conditions	Min.	Тур.	Max.	Unit
OFF CHARACT	ERISTICS	•	•	•		
BV _{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 1 \text{ mA}, T_J = 25^{\circ}\text{C}$	650			V
		V _{GS} = 0 V, I _D = 1 mA, T _J = 150°C	700			V
$\Delta BV_{DSS}/\Delta T_{J}$	Breakdown Voltage Temperature Coefficient	I _D = 1 mA, Referenced to 25°C		0.67		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V			1	μΑ
		V _{DS} = 520 V, T _C = 125°C		0.77		
I _{GSS}	Gate to Body Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V			±100	nA
ON CHARACTE	RISTICS	-				
V _{GS(th)}	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 0.29 \text{ mA}$	2.5		4.5	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 6 A		210	250	mΩ
9 _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 6 A		7.4		S
YNAMIC CHA	RACTERISTICS	•	•	•		
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		1010		pF
C _{oss}	Output Capacitance	1		25		pF
C _{oss(eff.)}	Effective Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		248		pF
C _{oss(er.)}	Energy Related Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		33		pF
Q _{g(tot)}	Total Gate Charge at 10 V	$V_{DS} = 400 \text{ V}, I_D = 6 \text{ A}, V_{GS} = 10 \text{ V}$ (Note 4)		24		nC
Q _{gs}	Gate to Source Gate Charge			6.1		nC
Q _{gd}	Gate to Drain "Miller" Charge	1		9.7		nC
ESR	Equivalent Series Resistance	f = 1 MHz		1.1		Ω
WITCHING CH	IARACTERISTICS					
t _{d(on)}	Turn-On Delay Time	$V_{DD} = 400 \text{ V}, I_D = 6 \text{ A}, V_{GS} = 10 \text{ V},$		15		ns
t _r	Turn-On Rise Time	$R_g = 4.7 \Omega$ (Note 4)		13		ns
t _{d(off)}	Turn-Off Delay Time	1`		40		ns
t _f	Turn-Off Fall Time	1		7.2		ns
OURCE-DRAII	N DIODE CHARACTERISTICS	•	•			
I _S	Maximum Continuous Source to Drain Diode Forward Current				12	Α
I _{SM}	Maximum Pulsed Source to Drain Diode Forward Current				30	Α
V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 6 A			1.2	V
	Reverse Recovery Time	V _{DD} = 400 V, I _{SD} = 6 A,		251		ns
t _{rr}	Therefore Hedderery Time	$dI_{\rm F}/dt = 100 \text{A/us}$				

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

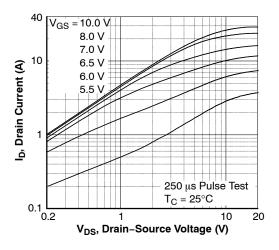


Figure 1. On-Region Characteristics

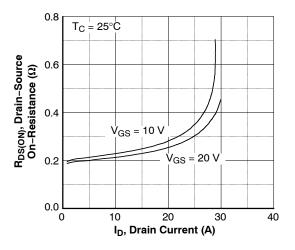


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

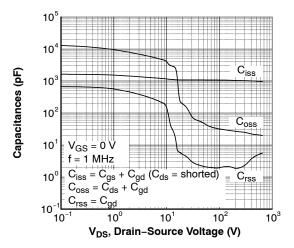


Figure 5. Capacitance Characteristics

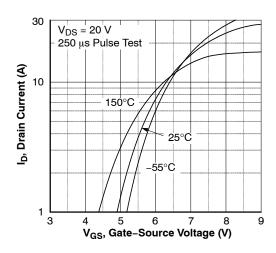


Figure 2. Transfer Characteristics

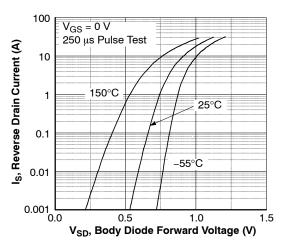


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

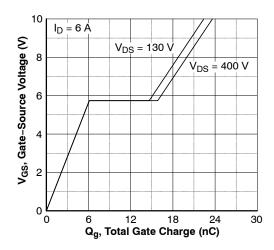


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

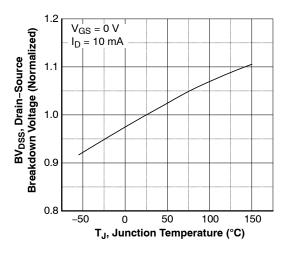


Figure 7. Breakdown Voltage Variation vs. Temperature

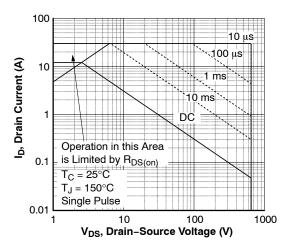


Figure 9. Maximum Safe Operating Area

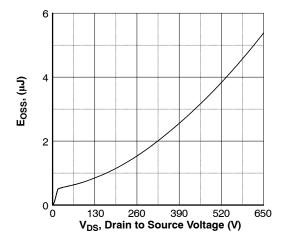


Figure 11. $E_{\mbox{\scriptsize OSS}}$ vs. Drain to Source Voltage

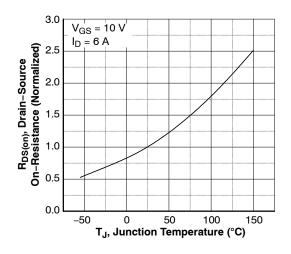


Figure 8. On–Resistance Variation vs. Temperature

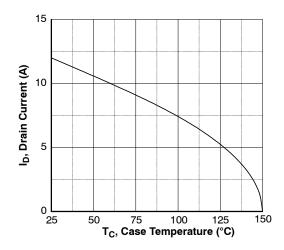


Figure 10. Maximum Drain Current vs. Case Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

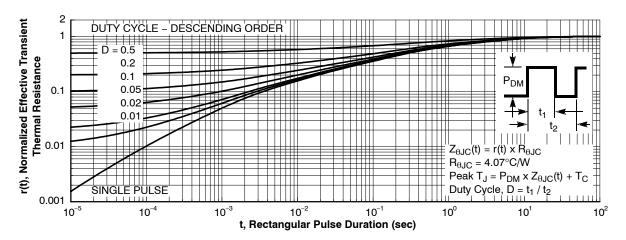


Figure 12. Transient Thermal Response Curve

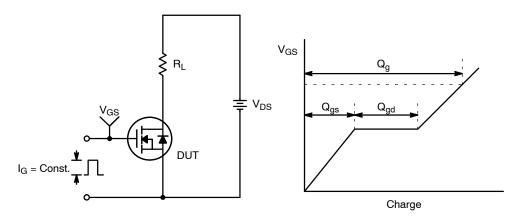


Figure 13. Gate Charge Test Circuit & Waveform

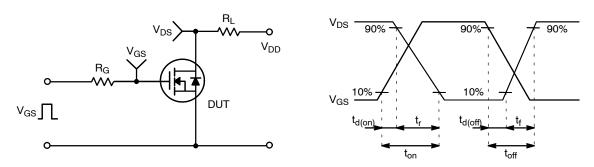


Figure 14. Resistive Switching Test Circuit & Waveforms

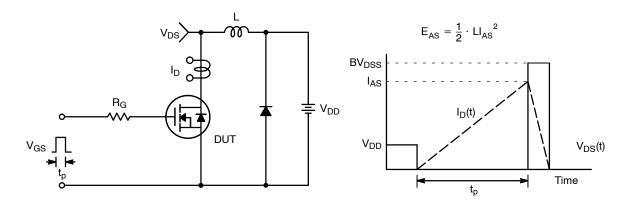


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

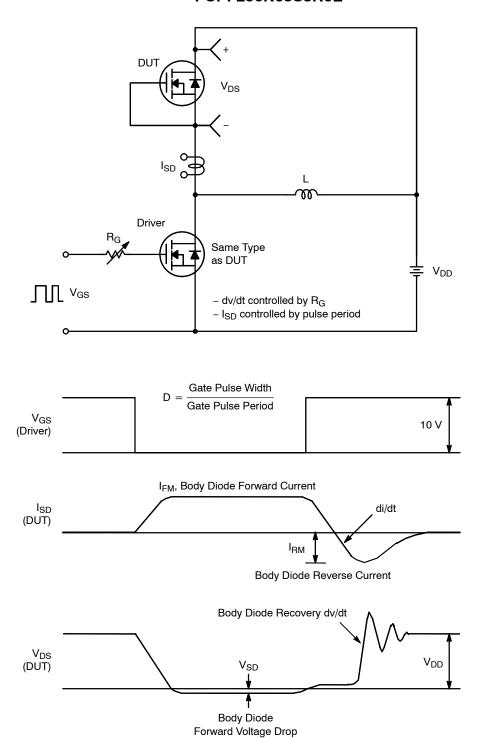
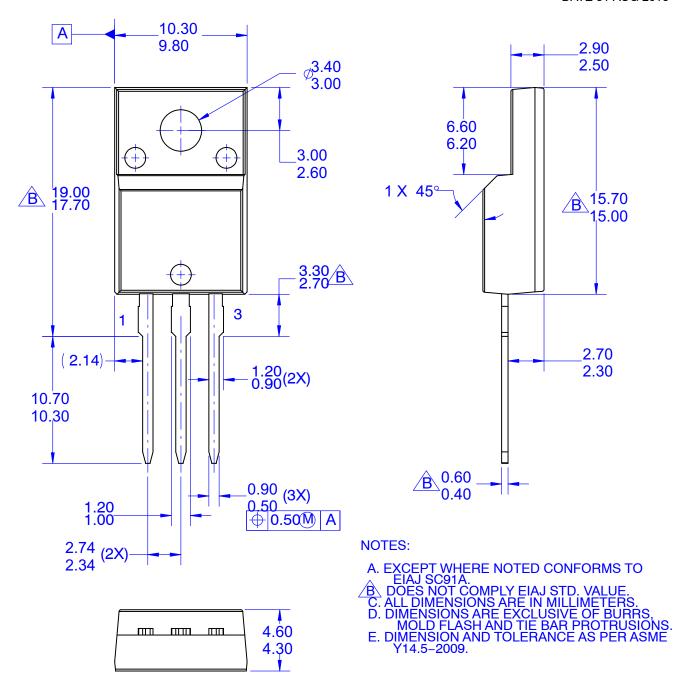


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

SUPERFET is a registered trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.

TO-220 FULLPAK 3LD CASE 340BF ISSUE O

DATE 31 AUG 2016



DOCUMENT NUMBER:	98AON13839G	Electronic versions are uncontrolled except when accessed directly from the Document Repositor Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	TO-220 FULLPAK 3LD		PAGE 1 OF 1

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

onsemi, Onsemi, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. Onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA class 3 medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

 $\textbf{Technical Library:} \ \underline{www.onsemi.com/design/resources/technical-documentation}$

onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales