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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

December 2013

FCB20N60F_F085

N-Channel MOSFET

600V, 20A, 190mΩ

Features

- Typ $r_{DS(on)}$ = 171mΩ at V_{GS} = 10V, I_D = 20A
- Typ $Q_{g(tot)}$ = 78nC at V_{GS} = 10V, I_D = 20A
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101

Description

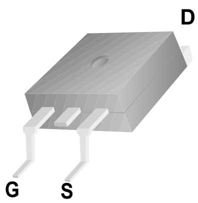
SuperFET™ is Fairchild's proprietary new generation of high voltage MOSFETs utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.

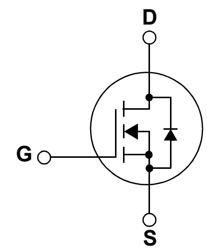
This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy.

Consequently, SuperFET is suitable for various automotive DC/DC power conversion.

Applications

- Automotive On Board Charger
- Automotive DC/DC converter for HEV





For current package drawing, please refer to the Fairchild website at www.fairchildsemi.com/packaging

100% RoHS COMPLIANT

MOSFET Maximum Ratings T_J = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain to Source Voltage		600	V
V_{GS}	Gate to Source Voltage		±30	V
I_D	Drain Current - Continuous (V_{GS}=10) (Note 1)	T_C = 25°C	20	A
	Pulsed Drain Current	T_C = 25°C	See Figure4	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	217.8	mJ
P_D	Power Dissipation		405	W
	Derate above 25°C		2.7	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to + 150	°C
$R_{\theta JC}$	Thermal Resistance Junction to Case		0.37	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance Junction to Ambient	(Note 3)	43	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCB20N60F	FCB20N60F_F085	TO-263AB	330mm	24mm	800 units

Notes:
1: Current is limited by bondwire configuration.
2: Starting T_J = 25°C, L = 10mH, I_{AS} = 6.6A, V_{DD} = 100V during inductor charging and V_{DD} = 0V during time in avalanche
3: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design. The maximum rating presented here is based on mounting on a 1 in^2 pad of 2oz copper.

Electrical Characteristics T_J = 25°C unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V		600	-	-	V
I_{DSS}	Drain to Source Leakage Current	V_{DS}=600V, V_{GS} = 0V	T_J = 25°C	-	-	10	μA
			T_J = 150°C(Note 4)	-	-	500	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±30V		-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA		3.0	4.3	5.0	V
$r_{DS(on)}$	Drain to Source On Resistance	I_D = 20A, V_{GS}= 10V	T_J = 25°C	-	171	195	mΩ
			T_J = 150°C(Note 4)	-	444	511	mΩ

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	2305	-	pF
C_{oss}	Output Capacitance			-	1310	-	pF
C_{rss}	Reverse Transfer Capacitance			-	105	-	pF
R_g	Gate Resistance	f = 1MHz		-	0.95	-	Ω
$Q_{g(ToT)}$	Total Gate Charge at 10V	V_{GS} = 0 to 10V	V_{DD} = 300V, I_D = 20A	-	78	102	nC
$Q_{g(th)}$	Threshold Gate Charge	V_{GS} = 0 to 2V		-	6.6	8.6	nC
Q_{gs}	Gate to Source Gate Charge			-	13.8	-	nC
Q_{gd}	Gate to Drain “Miller“ Charge			-	41.5	-	nC

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t_{on}	Turn-On Time	V_{DD} = 300V, I_D = 20A, V_{GS} = 10V, R_G = 25Ω	-	-	176	ns
$t_{d(on)}$	Turn-On Delay Time		-	43	-	ns
t_r	Rise Time		-	66	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	211	-	ns
t_f	Fall Time		-	42	-	ns
t_{off}	Turn-Off Time		-	-	403	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 20A, V_{GS} = 0V	-	-	1.4	V
T_{rr}	Reverse Recovery Time	I_F = 20A, dI_{SD}/dt = 100A/μs, V_{DD}=480V	-	163	-	ns
Q_{rr}	Reverse Recovery Charge		-	1285	-	nC

Notes:

4: The maximum value is specified by design at T_J = 150°C. Product is not tested to this condition in production.

Typical Characteristics

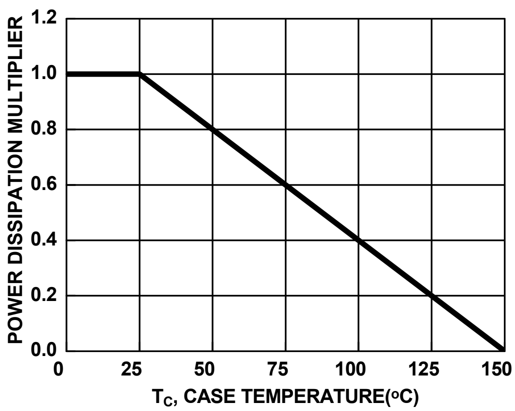


Figure 1. Normalized Power Dissipation vs Case Temperature

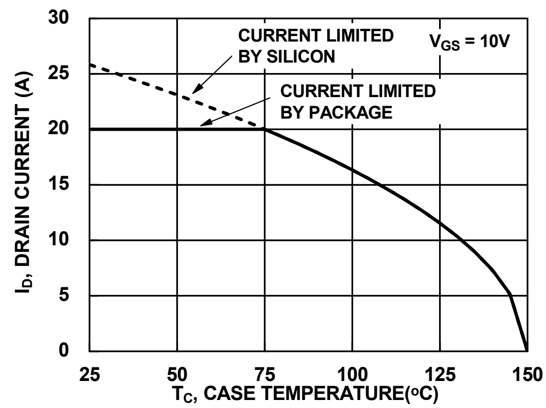


Figure 2. Maximum Continuous Drain Current vs Case Temperature

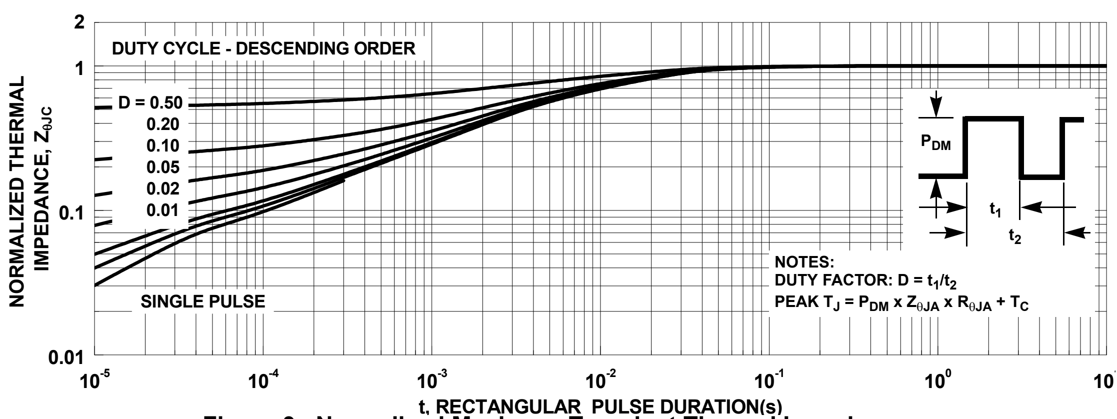


Figure 3. Normalized Maximum Transient Thermal Impedance

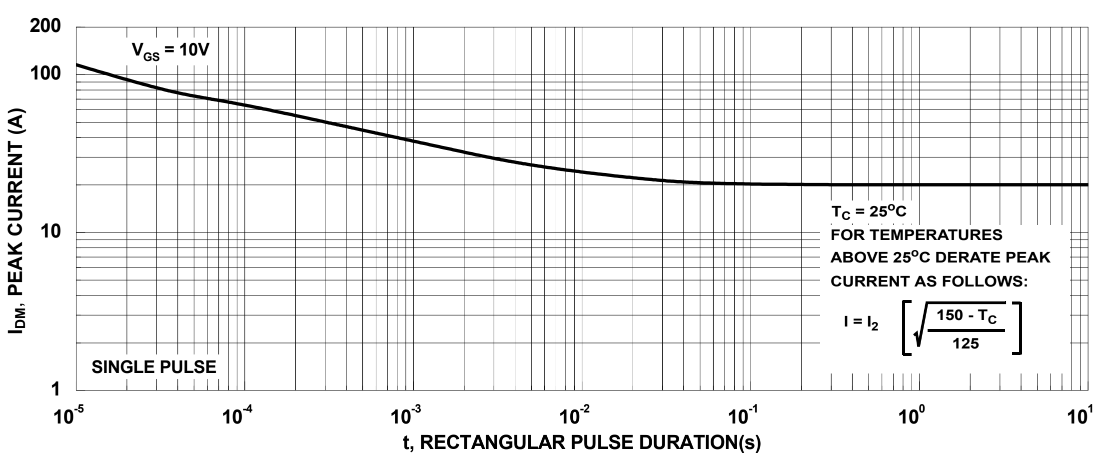


Figure 4. Peak Current Capability

Typical Characteristics

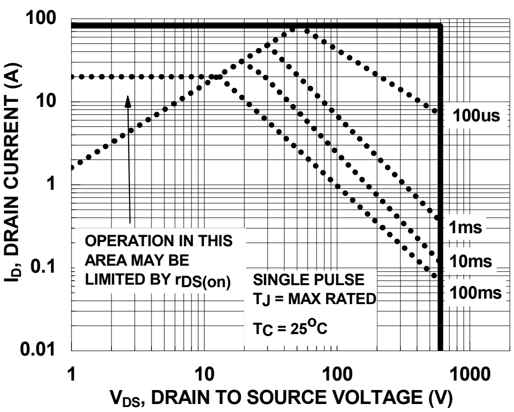


Figure 5. Forward Bias Safe Operating Area

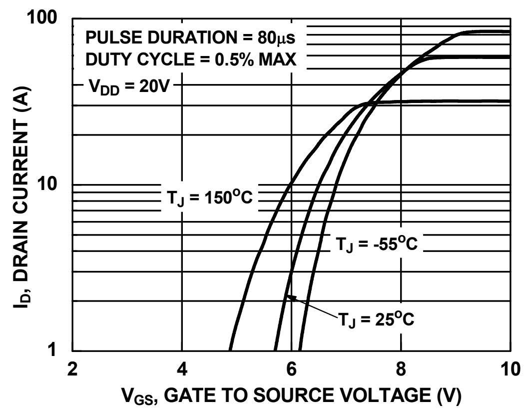


Figure 6. Transfer Characteristics

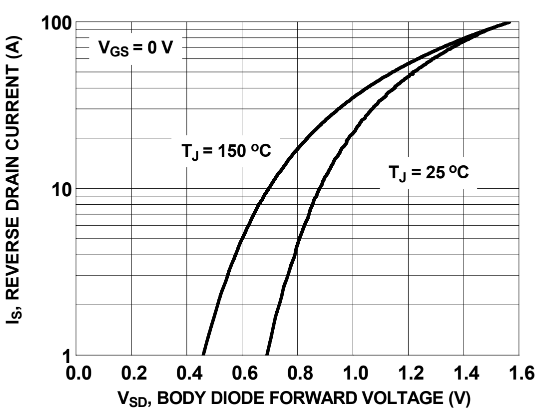


Figure 7. Forward Diode Characteristics

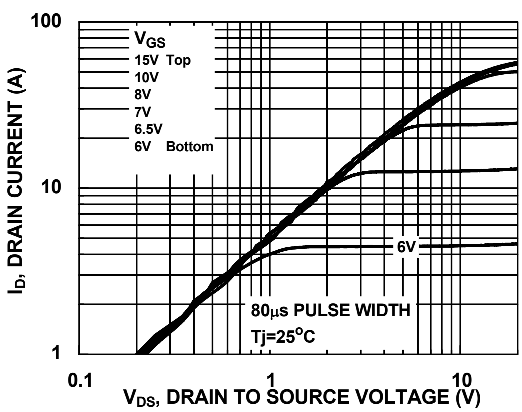


Figure 8. Saturation Characteristics

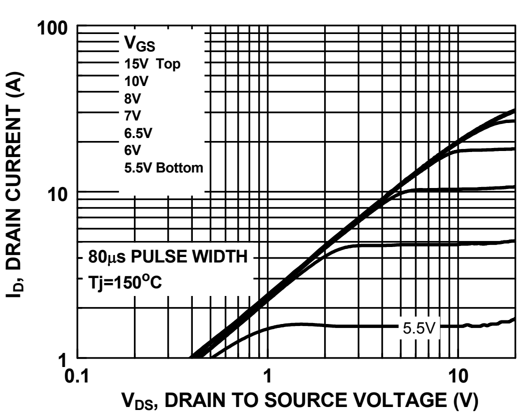


Figure 9. Saturation Characteristics

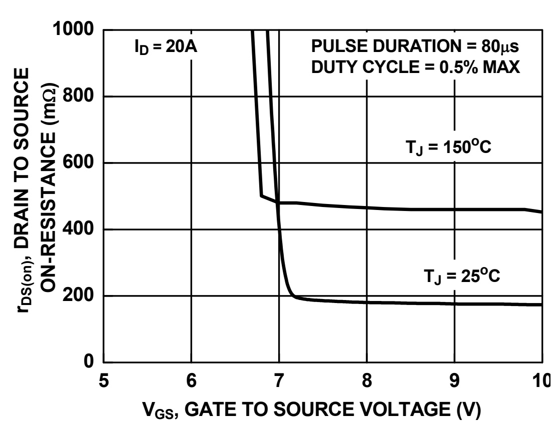


Figure 10. Rdson vs Gate Voltage

Typical Characteristics

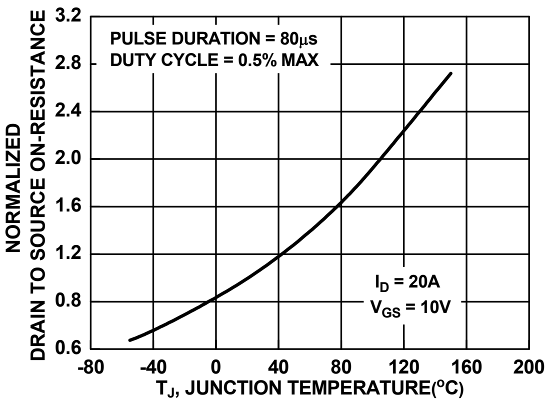


Figure 11. Normalized Rdson vs Junction Temperature

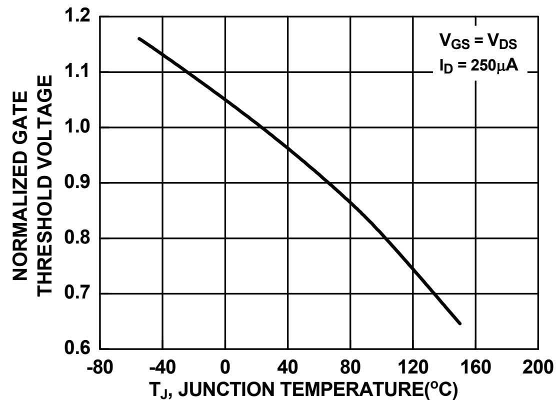


Figure 12. Normalized Gate Threshold Voltage vs Temperature

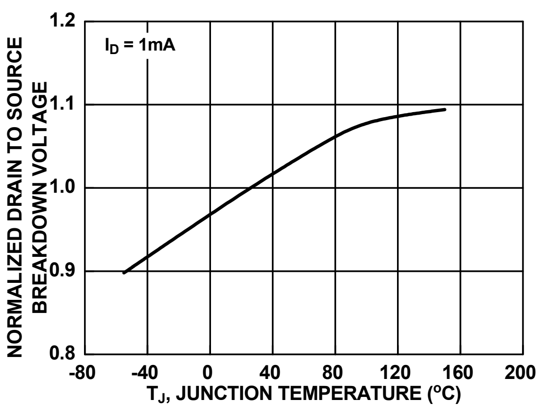


Figure 13. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

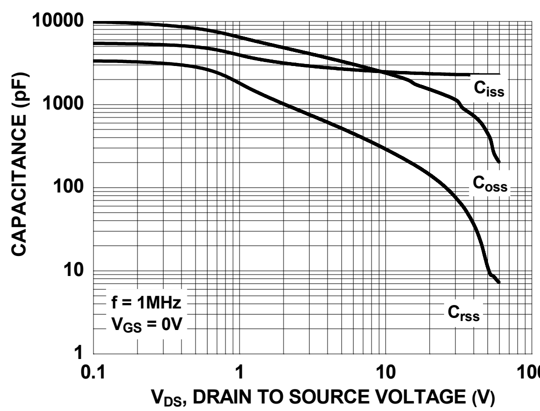


Figure 14. Capacitance vs Drain to Source Voltage

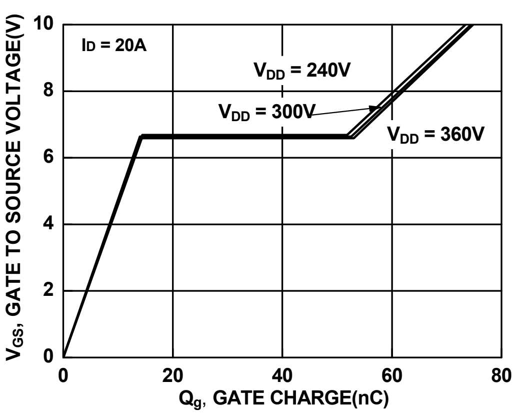


Figure 15. Gate Charge vs Gate to Source Voltage

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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