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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

July 2015

FCD5N60_F085

N-Channel SuperFET® MOSFET

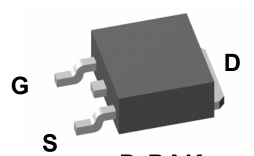
600 V, 4.6 A, 1.1 Ω

Features

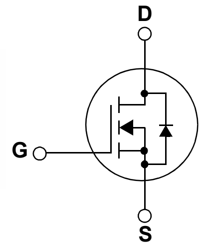
- 600V, 4.6A, typ. $R_{ds(on)}$=860mΩ@V_{GS}=10V
- Ultra Low Gate Charge (Typ. Q_g = 16 nC)
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101

Applications

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



D-PAK
(TO-252)



For current package drawing, please refer to the Fairchild website at http://www.fairchildsemi.com/package-drawings/TO/TO252A03.pdf.

Description

SuperFETTM 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.

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	4.6	A
	Pulsed Drain Current	T_C = 25°C	See Figure 4	
E_{AS}	Single Pulse Avalanche Energy	(Note 1)	29	mJ
P_D	Power Dissipation		54	W
	Derate Above 25°C		1.56	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to + 150	°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case		2.3	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	(Note 2)	83	°C/W

Notes:
1: Starting T_J = 25°C, L = 10mH, I_{AS} = 2.4A, V_{DD} = 100V during inductor charging and V_{DD} = 0V during time in avalanche.
2: $R_{\theta JA}$ 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 board design. The maximum rating presented here is based on mounting on a 1 in^2 pad of 2oz copper.

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCD5N60	FCD5N60_F085	D-PAK(TO-252)	13”	16mm	2500units

Electrical Characteristics T_J = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units

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,	T_J = 25°C	-	-	1	μA
		V_{GS} = 0V	T_J = 150°C (Note 4)	-	-	10	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	-	5.0	V
$R_{DS(on)}$	Drain to Source On Resistance	I_D = 4.6A,	T_J = 25°C	-	0.86	1.1	Ω
		V_{GS}= 10V	T_J = 150°C (Note 4)	-	2.5	3.2	Ω

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	570	-	pF
C_{oss}	Output Capacitance			-	280	-	pF
C_{rss}	Reverse Transfer Capacitance			-	20	-	pF
R_g	Gate Resistance	f = 1MHz		-	1.9	-	Ω
$Q_{g(ToT)}$	Total Gate Charge	V_{GS} = 0 to 10V	V_{DD} = 480V, I_D = 4.6A	-	16	21	nC
$Q_{g(th)}$	Threshold Gate Charge	V_{GS} = 0 to 2V		-	1.0	-	nC
Q_{gs}	Gate-to-Source Gate Charge			-	3.2	-	nC
Q_{gd}	Gate-to-Drain “Miller“ Charge			-	7.6	-	nC

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
t_{on}	Turn-On Time	V_{DD} = 300V, I_D = 4.6A, V_{GS} = 10V, R_{GEN} = 25Ω	-	-	84	ns
$t_{d(on)}$	Turn-On Delay		-	18	-	ns
t_r	Rise Time		-	19	-	ns
$t_{d(off)}$	Turn-Off Delay		-	48	-	ns
t_f	Fall Time		-	13	-	ns
t_{off}	Turn-Off Time		-	-	178	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{SD}	Source-to-Drain Diode Voltage	I_{SD} = 4.6A, V_{GS} = 0V	-	-	1.25	V
t_{rr}	Reverse-Recovery Time	V_{DD} = 480V, I_F = 4.6A, dI_{SD}/dt = 100A/μs	-	190	250	ns
Q_{rr}	Reverse-Recovery Charge		-	1.7	2.2	μC

Note:

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

Typical Characteristics

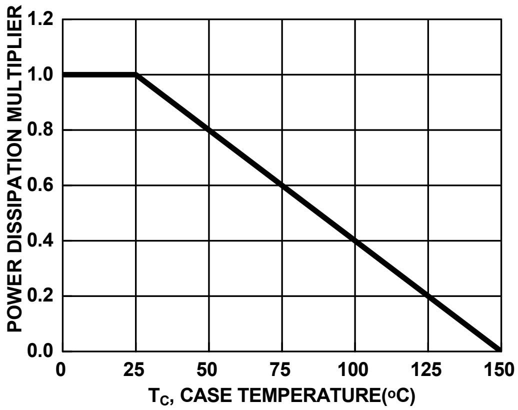


Figure 1. Normalized Power Dissipation vs. Case Temperature

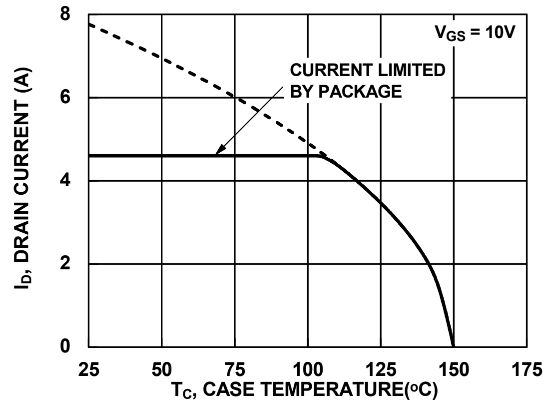


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

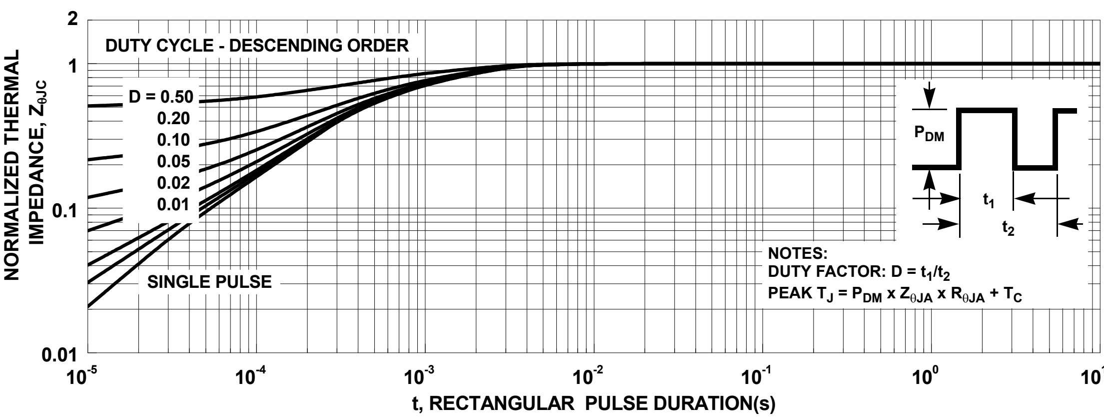


Figure 3. Normalized Maximum Transient Thermal Impedance

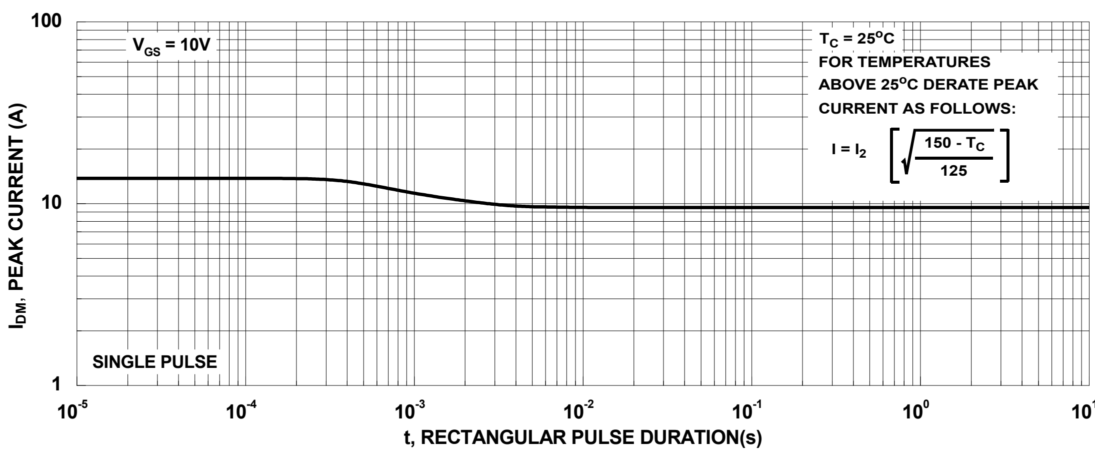


Figure 4. Peak Current Capability

Typical Characteristics

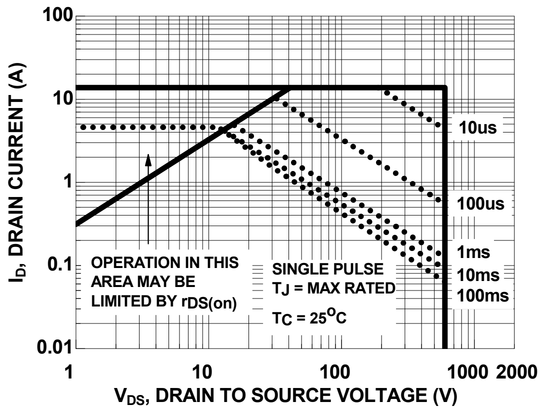


Figure 5. Forward Bias Safe Operating Area

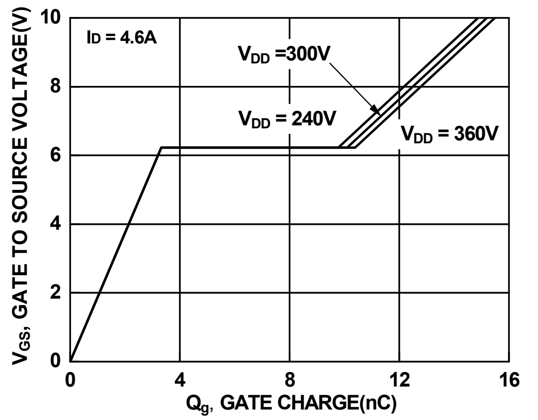


Figure 6. Gate Charge vs. Gate to Source Voltage

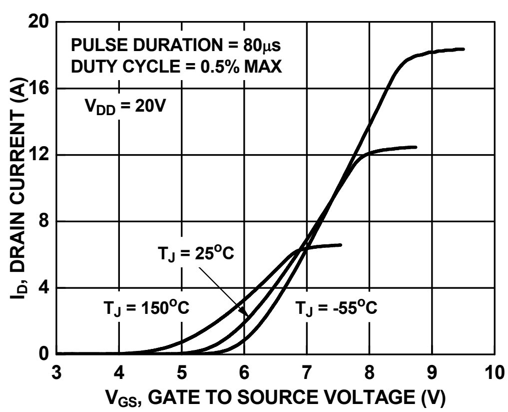


Figure 7. Transfer Characteristics

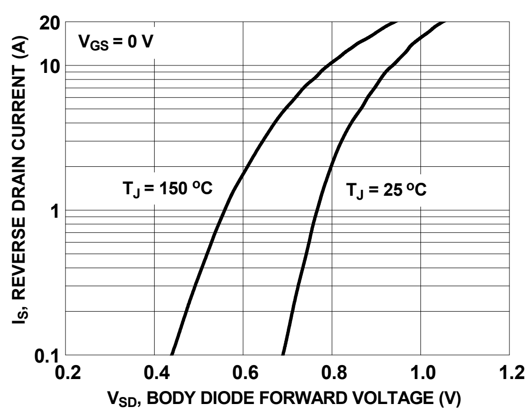


Figure 8. Forward Diode Characteristics

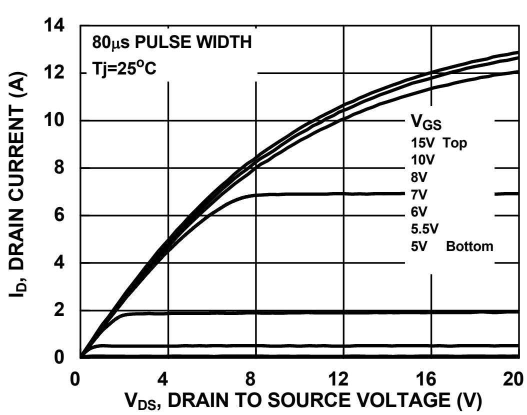


Figure 9. Saturation Characteristics

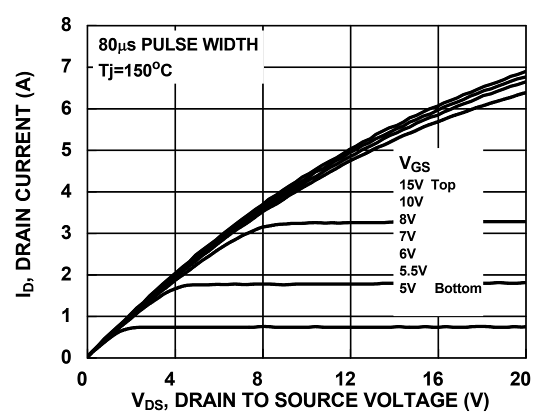


Figure 10. Saturation Characteristics

Typical Characteristics

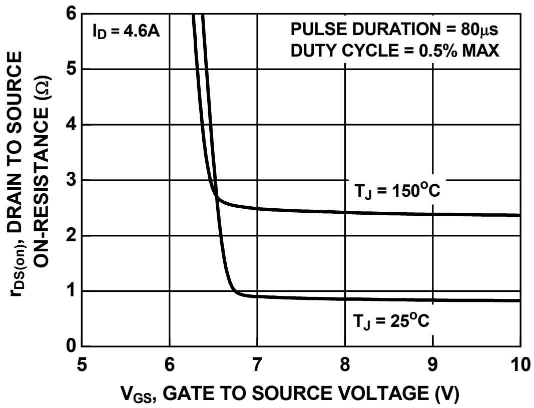


Figure 11. R_{DSON} vs. Gate Voltage

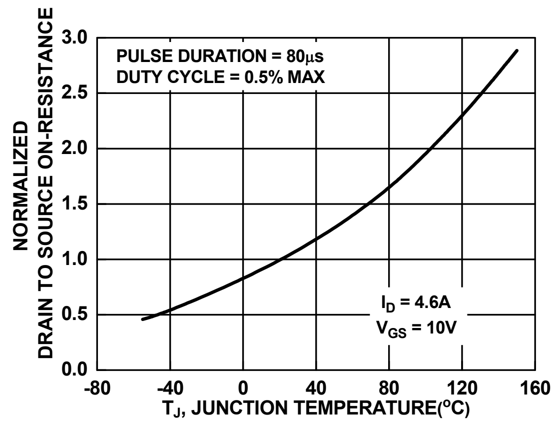


Figure 12. Normalized R_{DSON} vs. Junction Temperature

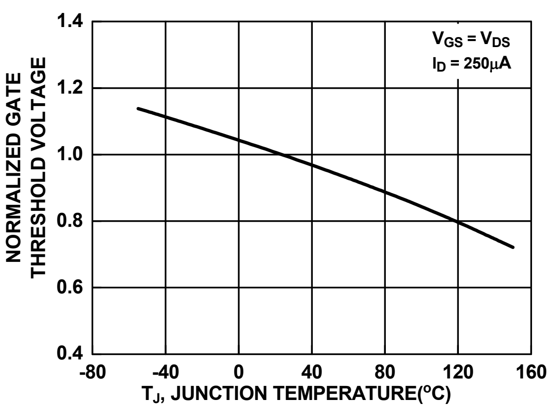


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

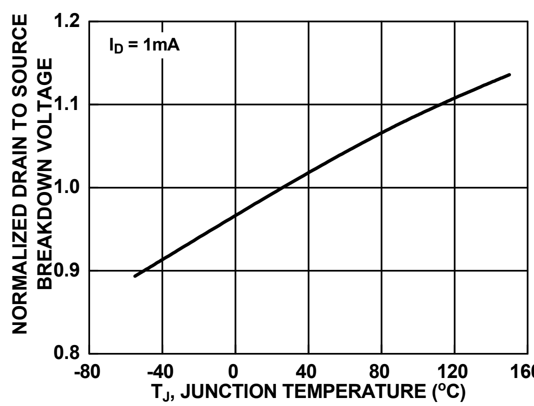


Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

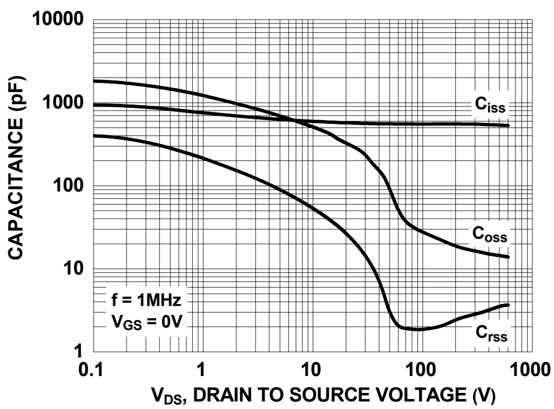


Figure 15. Capacitance vs. Drain to Source Voltage

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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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