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ON Semiconductor®

FCD5N60-F085**N-Channel SuperFET® MOSFET****600 V, 4.6 A, 1.1 Ω****Features**

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

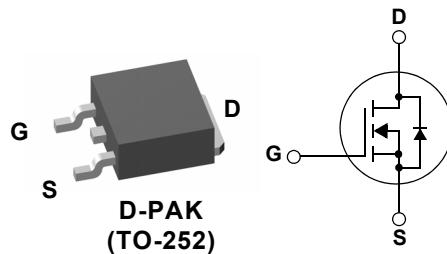
**Applications**

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

Description

SuperFET™ is ON Semiconductor 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 $T_J = 25^\circ\text{C}$ 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 ($V_{GS}=10$) (<i>Note 1</i>)	4.6	A
	Pulsed Drain Current	See Figure 4	
E_{AS}	Single Pulse Avalanche Energy	(<i>Note 1</i>)	mJ
P_D	Power Dissipation	54	W
	Derate Above 25°C	1.56	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature	-55 to + 150	$^\circ\text{C}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	2.3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	(<i>Note 2</i>)	$^\circ\text{C}/\text{W}$

Notes:

1: Starting $T_J = 25^\circ\text{C}$, $L = 10\text{mH}$, $I_{AS} = 2.4\text{A}$, $V_{DD} = 100\text{V}$ during inductor charging and $V_{DD} = 0\text{V}$ 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 in² 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 $T_J = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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Off Characteristics

B_{VDSS}	Drain-to-Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	600	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	$V_{DS} = 600\text{V}, T_J = 25^\circ\text{C}$ $V_{GS} = 0\text{V}, T_J = 150^\circ\text{C}$ (Note 4)	-	-	1	μA
I_{GSS}	Gate-to-Source Leakage Current	$V_{GS} = \pm 30\text{V}$	-	-	10	μA
			-	-	± 100	nA

On Characteristics

$V_{GS(\text{th})}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3.0	-	5.0	V
$R_{DS(\text{on})}$	Drain to Source On Resistance	$I_D = 4.6\text{A}, T_J = 25^\circ\text{C}$ $V_{GS} = 10\text{V}, T_J = 150^\circ\text{C}$ (Note 4)	-	0.86	1.1	Ω
			-	2.5	3.2	Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	570	-	pF	
C_{oss}	Output Capacitance		-	280	-	pF	
C_{rss}	Reverse Transfer Capacitance		-	20	-	pF	
R_g	Gate Resistance	$f = 1\text{MHz}$	-	1.9	-	Ω	
$Q_{g(\text{ToT})}$	Total Gate Charge	$V_{GS} = 0$ to 10V	$V_{DD} = 480\text{V}$	-	16	21	nC
$Q_{g(\text{th})}$	Threshold Gate Charge	$V_{GS} = 0$ to 2V	$I_D = 4.6\text{A}$	-	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

t_{on}	Turn-On Time	$V_{DD} = 300\text{V}, I_D = 4.6\text{A}, V_{GS} = 10\text{V}, R_{\text{GEN}} = 25\Omega$	-	-	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

V_{SD}	Source-to-Drain Diode Voltage	$I_{SD} = 4.6\text{A}, V_{GS} = 0\text{V}$	-	-	1.25	V
t_{rr}	Reverse-Recovery Time	$V_{DD} = 480\text{V}, I_F = 4.6\text{A}, dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	190	250	ns
Q_{rr}	Reverse-Recovery Charge		-	1.7	2.2	μC

Note:

4: The maximum value is specified by design at $T_J = 150^\circ\text{C}$. Product is not tested to this condition in production.

Typical Characteristics

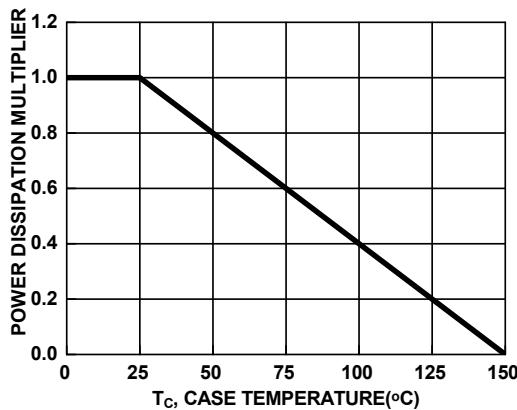


Figure 1. Normalized Power Dissipation vs. Case Temperature

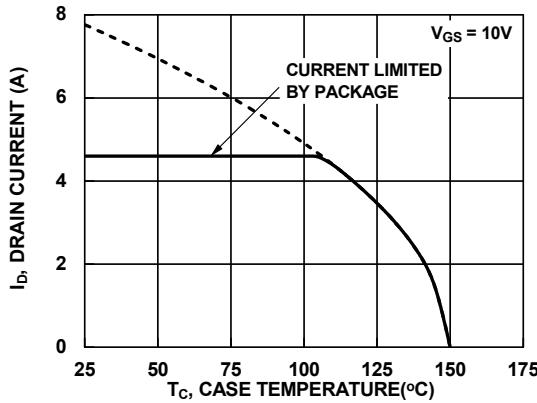


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

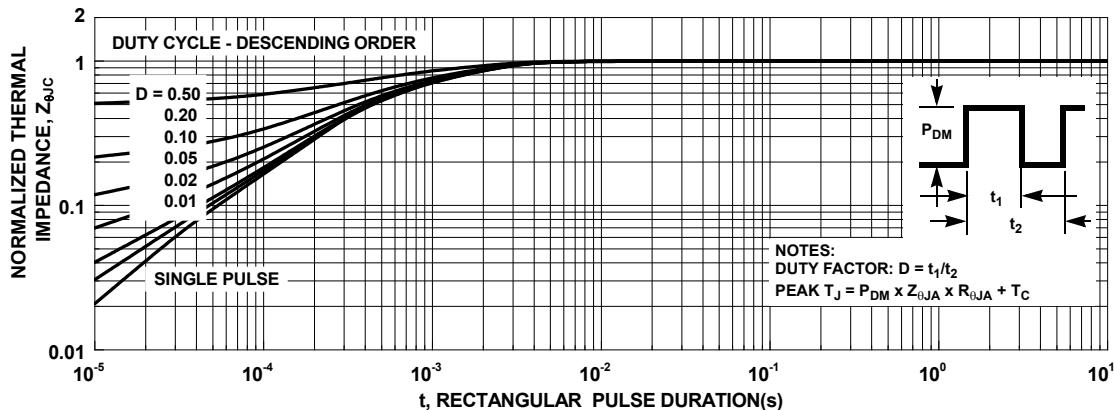


Figure 3. Normalized Maximum Transient Thermal Impedance

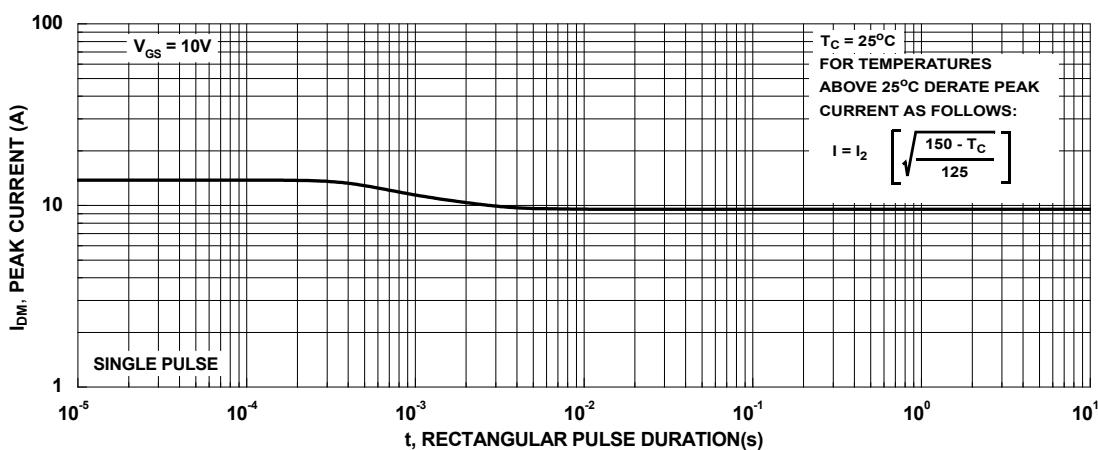


Figure 4. Peak Current Capability

Typical Characteristics

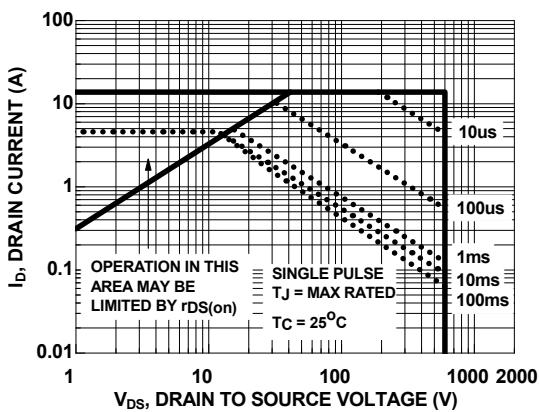


Figure 5. Forward Bias Safe Operating Area

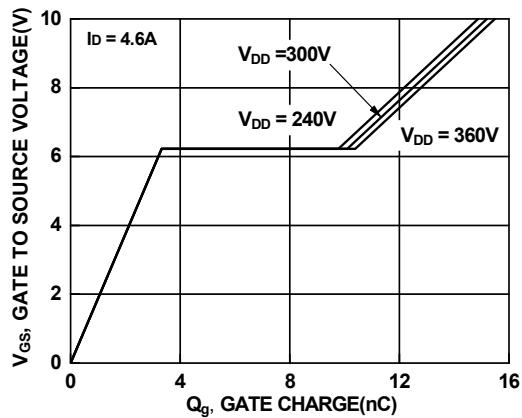


Figure 6. Gate Charge vs. Gate-to-Source Voltage

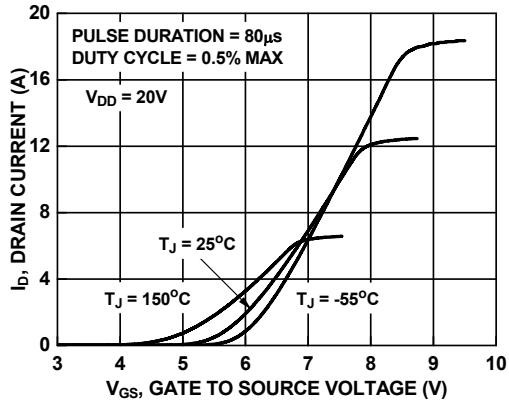


Figure 7. Transfer Characteristics

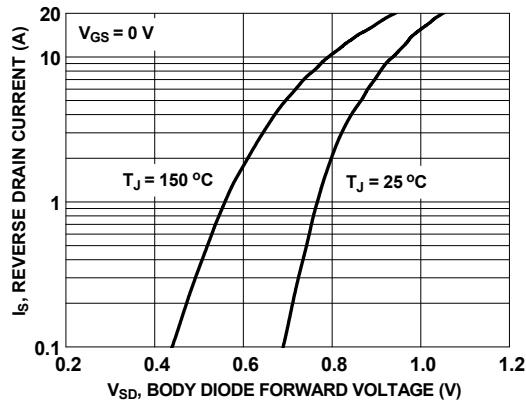


Figure 8. Forward Diode Characteristics

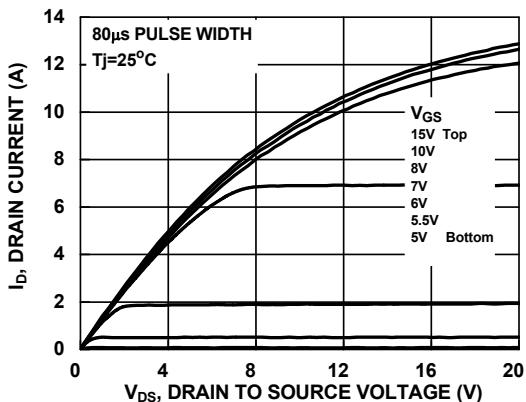


Figure 9. Saturation Characteristics

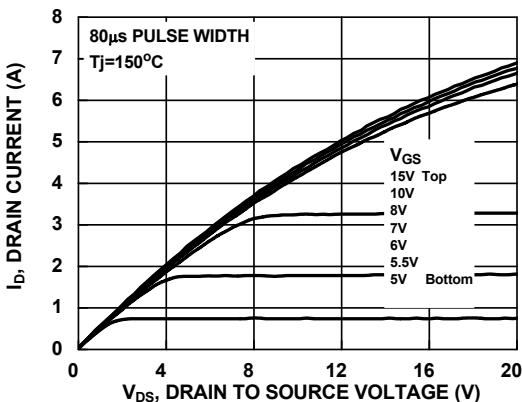


Figure 10. Saturation Characteristics

Typical Characteristics

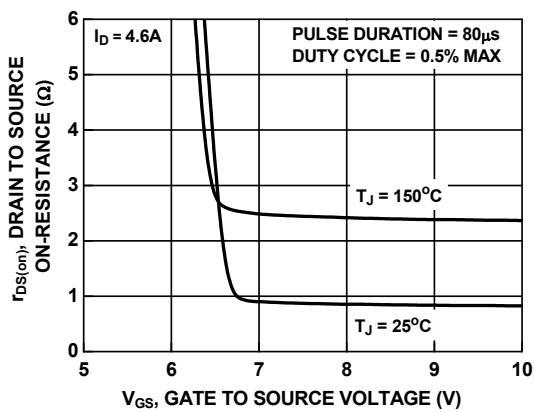


Figure 11. $R_{DS(on)}$ vs. Gate Voltage

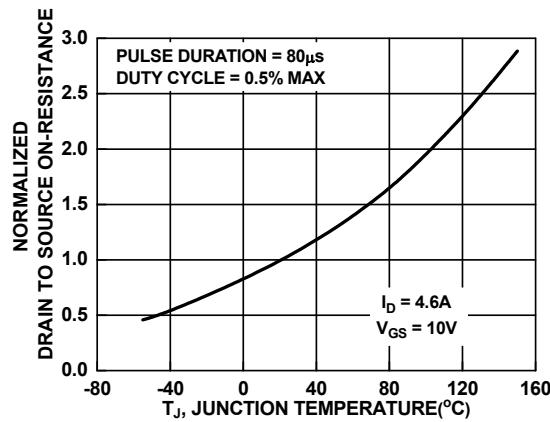


Figure 12. Normalized $R_{DS(on)}$ vs. Junction Temperature

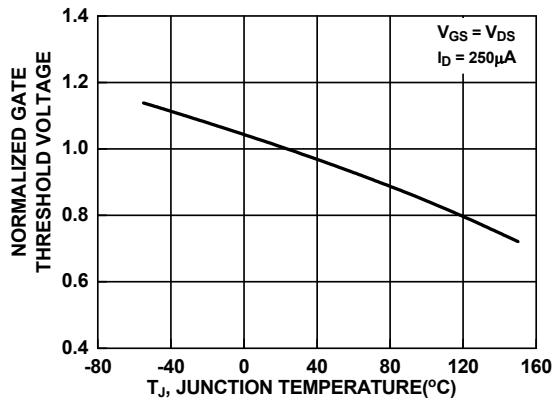


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

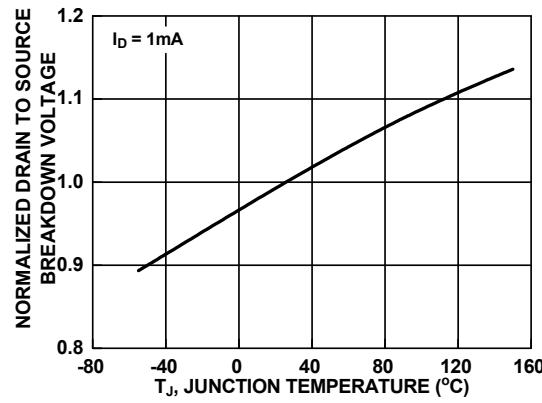


Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

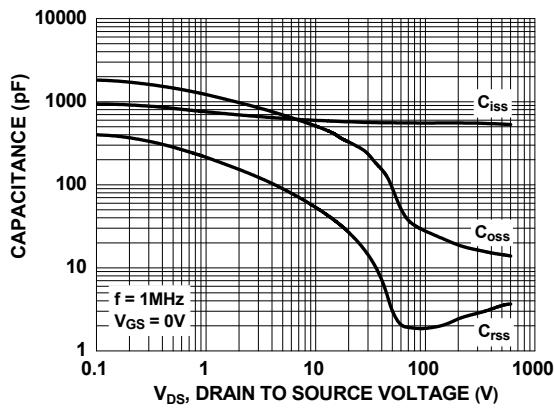


Figure 15. Capacitance vs. Drain to Source Voltage

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