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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™

May 2016

FDMS86381_F085

## N-Channel PowerTrench® MOSFET

80 V, 30 A, 22 mΩ

Features

- Typical $R_{DS(on)}$ = 17.2 mΩ at V_{GS} = 10V, I_D = 30 A
- Typical $Q_{g(tot)}$ = 14 nC at V_{GS} = 10V, I_D = 30 A
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101

Applications

- Automotive Engine Control
- PowerTrain Management
- Solenoid and Motor Drivers
- Electronic Steering
- Integrated Starter/Alternator
- Distributed Power Architectures and VRM
- Primary Switch for 12V Systems

Top   Bottom   Pin 1

Power 56

100% RoHS COMPLIANT
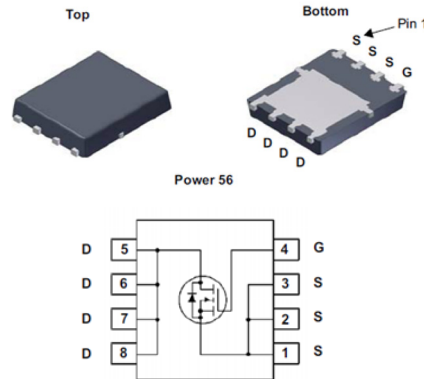
For current package drawing, please refer to the Fairchild website at https://www.fairchildsemi.com/package-drawings/PQ/PQFN08M.pdf

MOSFET Maximum Ratings T_J = 25°C unless otherwise noted.

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-to-Source Voltage		80	V
V_{GS}	Gate-to-Source Voltage		±20	V
I_D	Drain Current - Continuous (V_{GS}=10) (Note 1)	T_C = 25°C	30	A
	Pulsed Drain Current	T_C = 25°C	See Figure 4	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	11.5	mJ
P_D	Power Dissipation		50	W
	Derate Above 25°C		0.33	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to + 175	°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case		3	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	(Note 3)	50	°C/W

Notes:
1: Current is limited by bondwire configuration.
2: Starting T_J = 25°C, L = 40uH, I_{AS} = 24A, V_{DD} = 80V 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 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
FDMS86381	FDMS86381_F085	Power56	13"	12mm	3000units

Electrical Characteristics T_J = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
Off Characteristics							
B_{VDSS}	Drain-to-Source Breakdown Voltage	$I_D = 250\mu A$, $V_{GS} = 0V$		80	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	$V_{DS}=80V$, $V_{GS} = 0V$	$T_J = 25^oC$	-	-	1	μA
			$T_J = 175^oC$ (Note 4)	-	-	1	mA
I_{GSS}	Gate-to-Source Leakage Current	$V_{GS} = \pm20V$		-	-	±100	nA
On Characteristics							
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu A$		2.0	2.9	4.0	V
$R_{DS(on)}$	Drain to Source On Resistance	$I_D = 30A$, $V_{GS}= 10V$	$T_J = 25^oC$	-	17.2	22.0	mΩ
			$T_J = 175^oC$ (Note 4)	-	37.7	48.2	mΩ
Dynamic Characteristics							
C_{iss}	Input Capacitance	$V_{DS} = 40V$, $V_{GS} = 0V$, f = 1MHz		-	866	-	pF
C_{oss}	Output Capacitance			-	176	-	pF
C_{rss}	Reverse Transfer Capacitance			-	7	-	pF
R_g	Gate Resistance	f = 1MHz		-	2.3	-	Ω
$Q_{g(ToT)}$	Total Gate Charge	$V_{GS} = 0$ to 10V	$V_{DD} = 40V$ $I_D = 30A$	-	14	21	nC
$Q_{g(th)}$	Threshold Gate Charge	$V_{GS} = 0$ to 2V		-	1.7	-	nC
Q_{gs}	Gate-to-Source Gate Charge			-	5.1	-	nC
Q_{gd}	Gate-to-Drain "Miller" Charge			-	3.8	-	nC
Switching Characteristics							
t_{on}	Turn-On Time	$V_{DD} = 40V$, $I_D = 30A$, $V_{GS} = 10V$, $R_{GEN} = 6\Omega$		-	-	23	ns
$t_{d(on)}$	Turn-On Delay			-	9	-	ns
t_r	Rise Time			-	6	-	ns
$t_{d(off)}$	Turn-Off Delay			-	14	-	ns
t_f	Fall Time			-	5	-	ns
t_{off}	Turn-Off Time			-	-	28	ns
Drain-Source Diode Characteristics							
V_{SD}	Source-to-Drain Diode Voltage	$I_{SD} =30A$, $V_{GS} = 0V$		-	-	1.25	V
		$I_{SD} = 15A$, $V_{GS} = 0V$		-	-	1.2	V
t_{rr}	Reverse-Recovery Time	$I_F = 30A$, $dI_{SD}/dt = 100A/\mu s$ $V_{DD} = 64V$		-	34	50	ns
Q_{rr}	Reverse-Recovery Charge			-	27	40	nC

Note:

4: The maximum value is specified by design at T_J = 175°C. Product is not tested to this condition in production.

Typical Characteristics

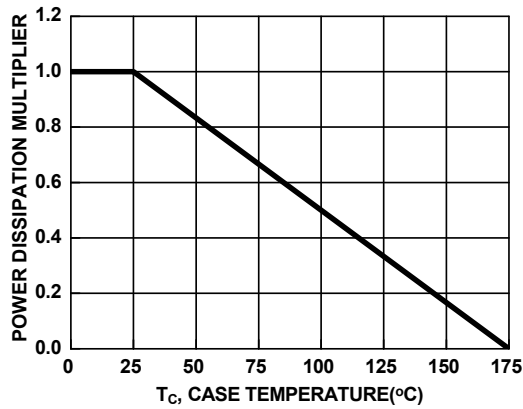**Figure 1. Normalized Power Dissipation vs. Case Temperature**
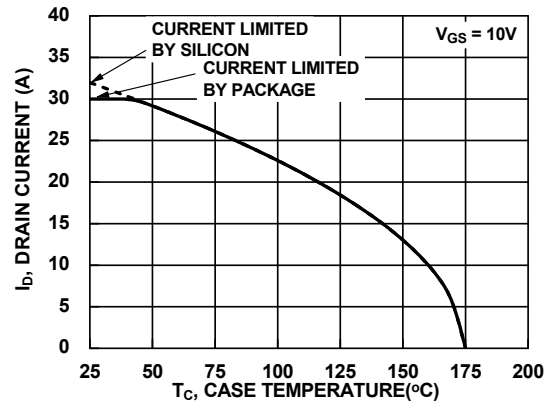
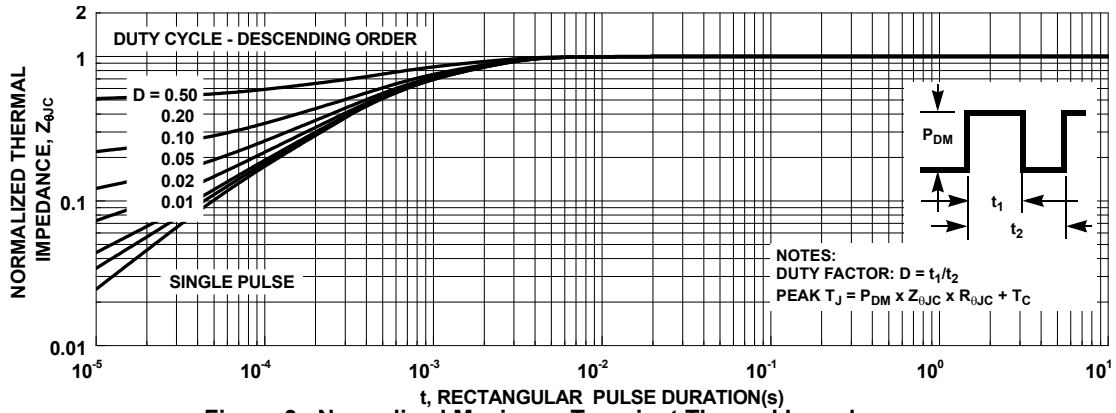**Figure 2. Maximum Continuous Drain Current vs. Case Temperature**

NOTES:
DUTY FACTOR: D = t_1/t_2
PEAK T_J = P_{DM} x $Z_{\theta JC}$ x $R_{\theta JC}$ + T_C

Figure 3. Normalized Maximum Transient Thermal Impedance

$T_C = 25^oC$
FOR TEMPERATURES ABOVE 25°C DERATE PEAK CURRENT AS FOLLOWS:

$$I = I_{25} \left[\sqrt{\frac{175 - T_C}{150}} \right]$$
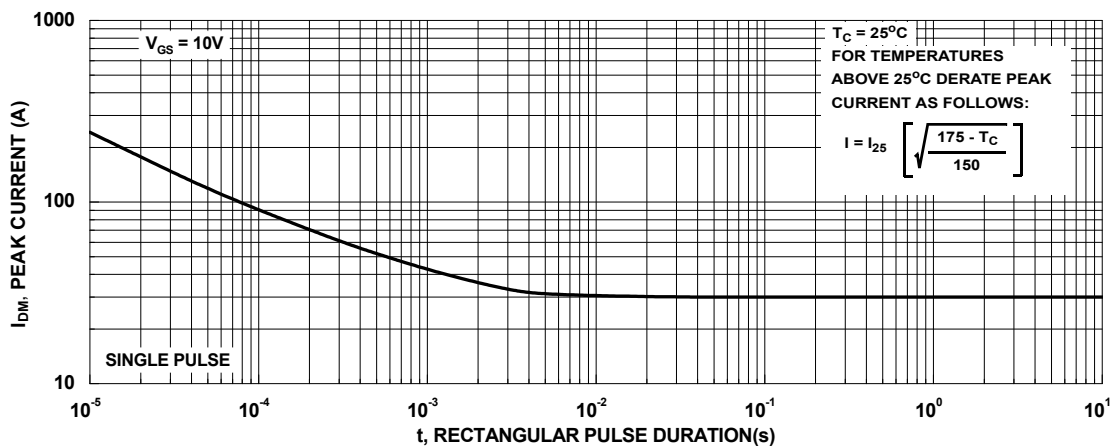
Figure 4. Peak Current Capability

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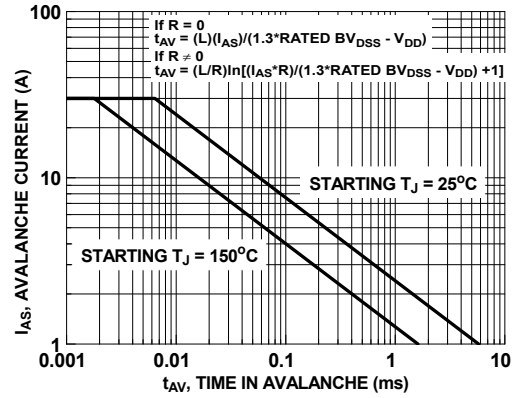FDMS86381_F085 Rev. 1.0

Typical Characteristics
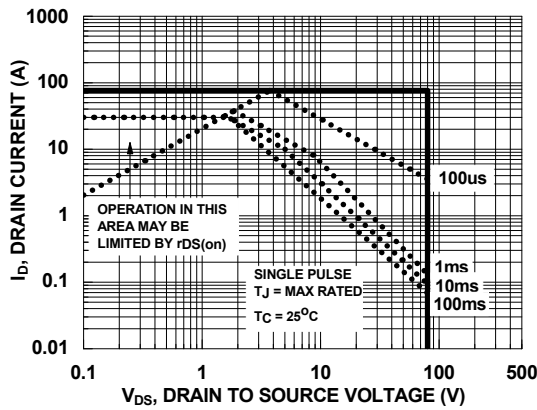
Figure 5. Forward Bias Safe Operating Area

NOTE: Refer to Fairchild Application Notes AN7514 and AN7515
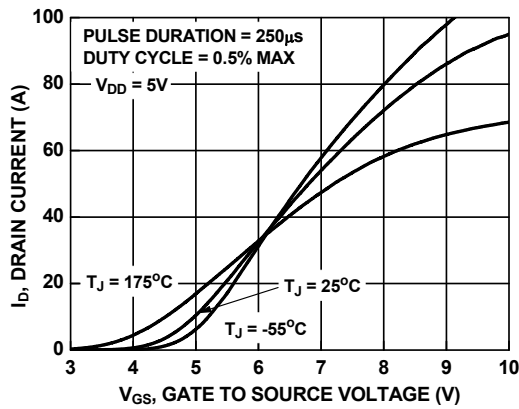
Figure 6. Unclamped Inductive Switching Capability
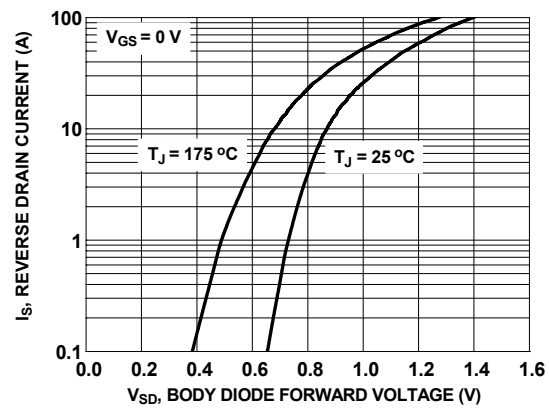

Figure 7. Transfer Characteristics
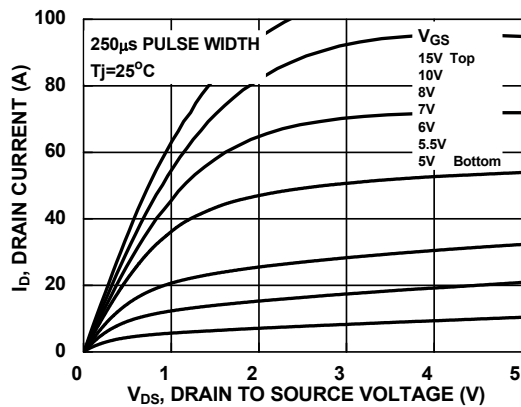

Figure 8. Forward Diode Characteristics

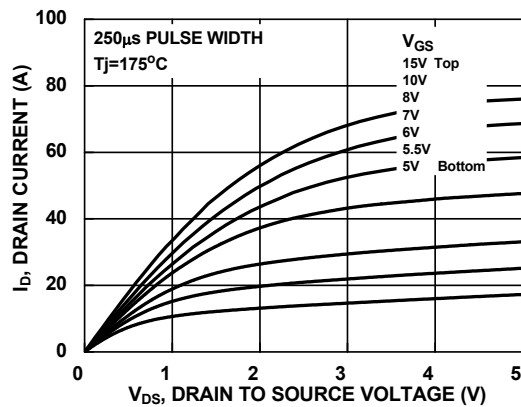**Figure 9. Saturation Characteristics**

Figure 10. Saturation Characteristics

Typical Characteristics
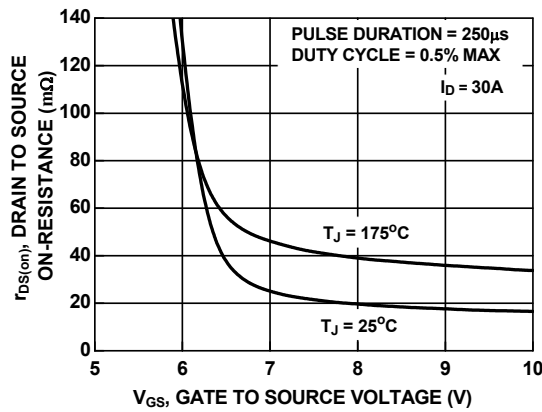

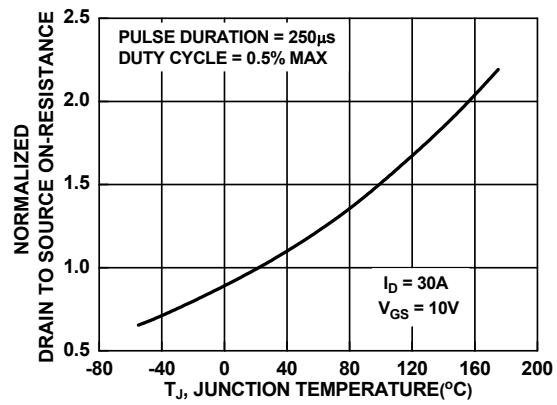
Figure 11. R_{DSON} vs. Gate Voltage

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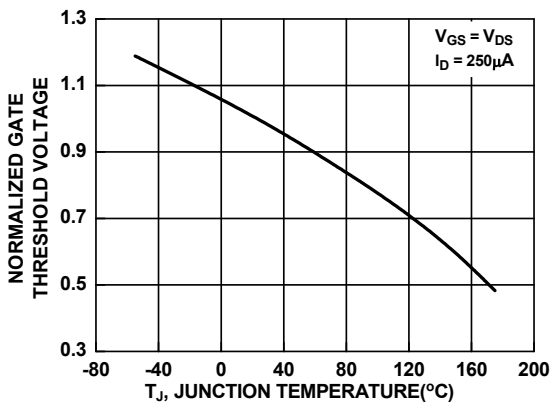

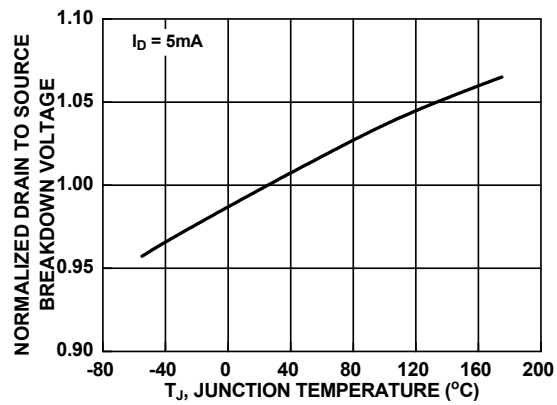Figure 13. Normalized Gate Threshold Voltage vs. Temperature

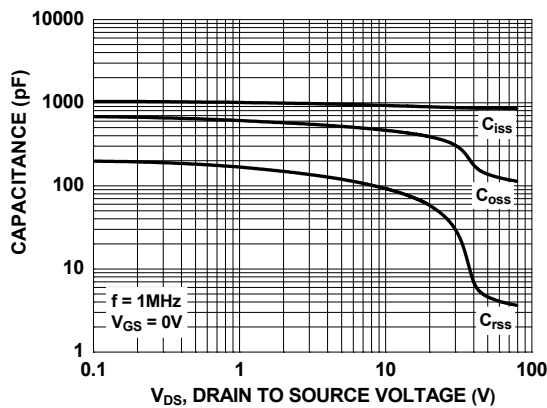Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

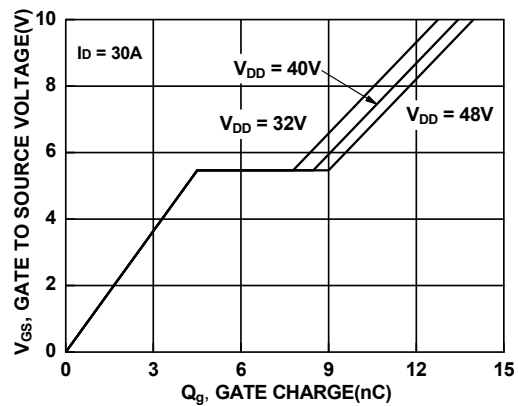Figure 15. Capacitance vs. Drain to Source Voltage

Figure 16. 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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