FAIRCHILD

SEMICONDUCTOR®

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FDS9412A
N-Channel PowerTrench® MOSFET
**30V, 8A, 21mΩ**

General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switiching PWM controllers. It has been optimized for low gate charge ,low $r_{DS(on)}$ and fast switching speed.

Application

■ DC/DC converters

Features

■ Max $r_{DS(on)} = 21$mΩ at $V_{GS} = 10$V, $I_D = 8$A

■ Max $r_{DS(on)} = 25$mΩ at $V_{GS} = 4.5$V, $I_D = 6.6$A

■ Low gate charge

■ RoHS Compliant

SO-8
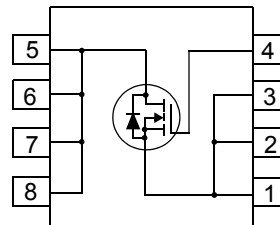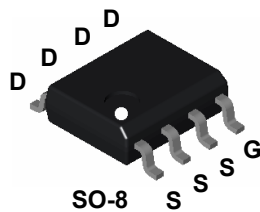
MOSFET Maximum Ratings $T_A = 25$°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous ($T_A = 25$°C, $V_{GS} = 10$V, $R_{\theta JA} = 50$°C/W)	8	A
	-Continuous ($T_A = 25$°C, $V_{GS} = 4.5$V, $R_{\theta JA} = 50$°C/W)	6.6	
	-Pulsed	30	A
E_{AS}	Single Pulse Avalanche Energy (Note 3)	54	mJ
P_D	Power dissipation	2.5	W
T_J, T_{STG}	Operating and Storage Temperature	-55 to 150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance , Junction to Case	(Note 1)	25	°C/W
$R_{\theta JA}$	Thermal Resistance , Junction to Ambient	(Note 1a)	50	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS9412A	FDS9412A	SO-8	330mm	12mm	2500 units

Electrical Characteristics T_J = 25°C unless otherwise noted

| Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Off Characteristics							
BV$_{DSS}$	Drain to Source Breakdown Voltage	I_D = 250µA, V_{GS} = 0V		30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250µA, referenced to 25°C			22		mV/°C
I$_{DSS}$	Zero Gate Voltage Drain Current	V_{DS} = 24V, V_{GS} = 0V				1	µA
			T_J = 150°C			250	
I$_{GSS}$	Gate to Source Leakage Current	V_{GS} = ±20V				±100	µA
On Characteristics (Note 2)							
V$_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250µA		1.2	1.9	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250µA, referenced to 25°C			-5.8		mV/°C
r$_{DS(on)}$	Drain to Source On Resistance	V_{GS} =10V , I_D = 8A			14	21	mΩ
		V_{GS} = 4.5V, I_D = 6.6A			18	25	
		V_{GS} = 10V, I_D = 8A T_J = 150°C			20	30	
Dynamic Characteristics							
C$_{iss}$	Input Capacitance	V_{DS} =15V, V_{GS} = 0V, f = 1MHz			740	985	pF
C$_{oss}$	Output Capacitance				150	200	pF
C$_{rss}$	Reverse Transfer Capacitance				95	145	pF
R$_G$	Gate Resistance	f = 1MHz			3		Ω
Switching Characteristics (Note 2)							
t$_{d(on)}$	Turn-On Delay Time	V_{DD} = 15V, I_D = 1A V_{GS} = 10V, R_{GS} = 6Ω			5	10	ns
t$_r$	Rise Time				13	23	ns
t$_{d(off)}$	Turn-Off Delay Time				13	24	ns
t$_f$	Fall Time				12	22	ns
Q$_g$	Total Gate Charge at 10V	V_{GS} = 0V to 10V	V_{DD} = 15V I_D = 8A I_G = 1.0mA		14	20	nC
Q$_g$	Total Gate Charge at 5V	V_{GS} = 0V to 5V			8	12	nC
Q$_{gs}$	Gate to Source Gate Charge				2.3		nC
Q$_{gd}$	Gate to Drain "Miller" Charge				3.0		nC
Drain-Source Diode Characteristics							
V$_{SD}$	Source to Drain Diode Voltage	V_{GS} = 0V, I_S = 8A			0.85	1.25	V
		V_{GS} = 0V, I_S = 2.1A			0.76	1.0	V
t$_{rr}$	Reverse Recovery Time	I_F = 8A, di/dt = 100A/µs			18	27	ns
Q$_{rr}$	Reverse Recovery Charge	I_F = 8A, di/dt = 100A/µs			9.6	14	nC

Notes:

1: $R_{\theta JA}$ 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 $R_{\theta CA}$ is determined by the user's board design.
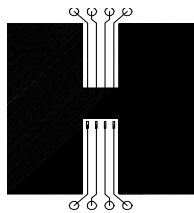
a) 50°C/W when mounted on a 1 in^2 pad of 2 oz copper
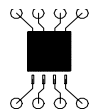
b)105°C/W when mounted on a .04 in^2 pad of 2 oz copper
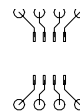
c) 125°C/W when mounted on a minimun pad

Scale 1 : 1 on letter size paper

2: Pulse Test:Pulse Width <300µs, Duty Cycle <2.0%.
3: Starting T_J = 25°C, L = 3mH, I_{AS} = 6A, V_{DD} = 30V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted
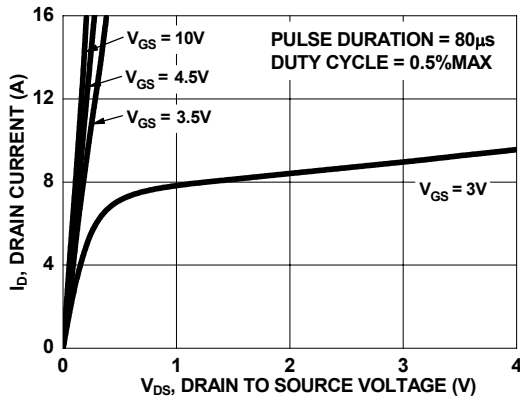

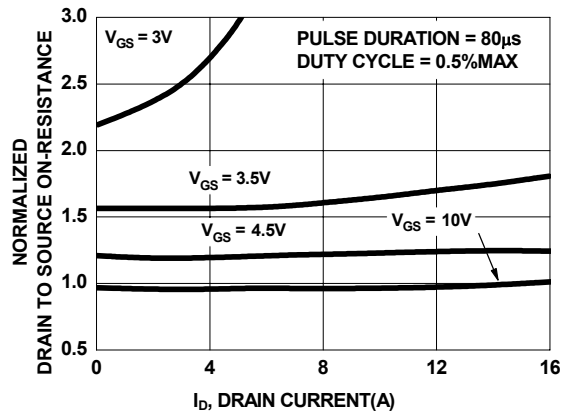**Figure 1. On Region Characteristics**

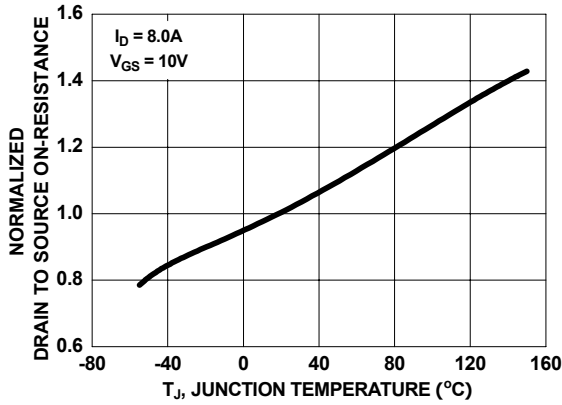**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

Figure 3. Normalized On Resistance vs Junction Temperature
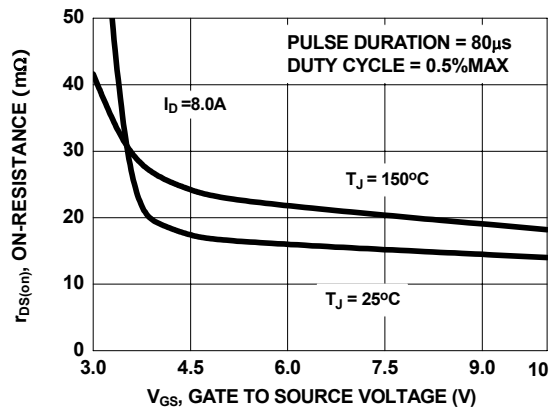

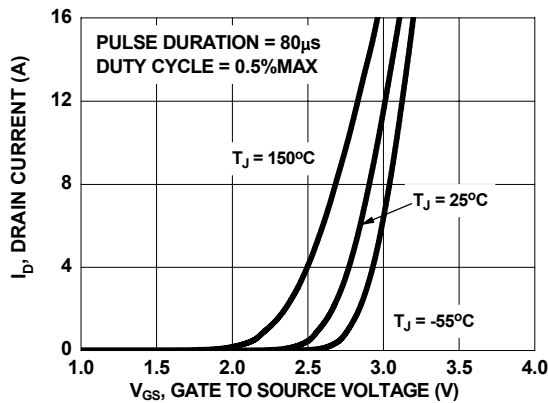**Figure 4. On-Resistance vs Gate to Source Voltage**
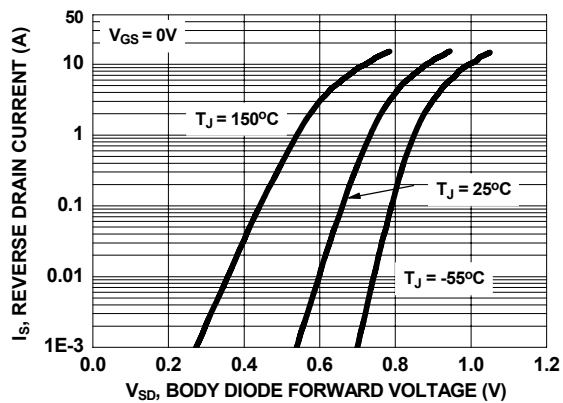

Figure 5. Transfer Characteristics

Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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Typical Characteristics T_J = 25°C unless otherwise noted
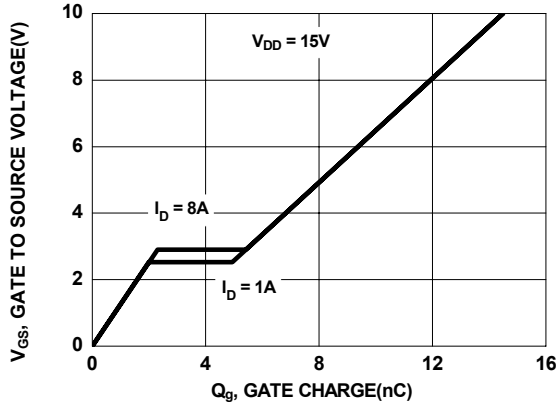
Figure 7. Gate Charge Characteristics
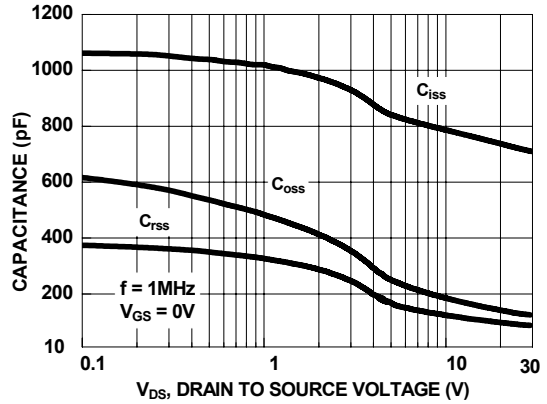
Figure 8. Capacitance vs Drain to Source Voltage
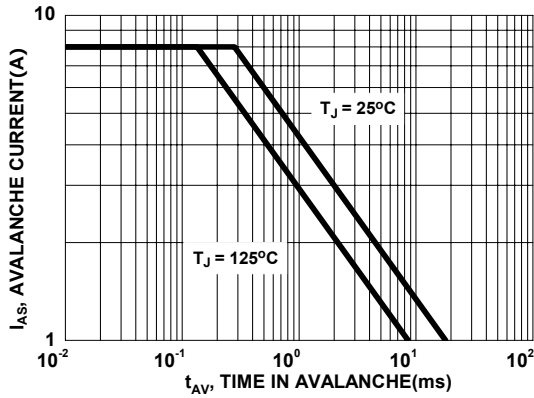
Figure 9. Unclamped Inductive Switching Capability
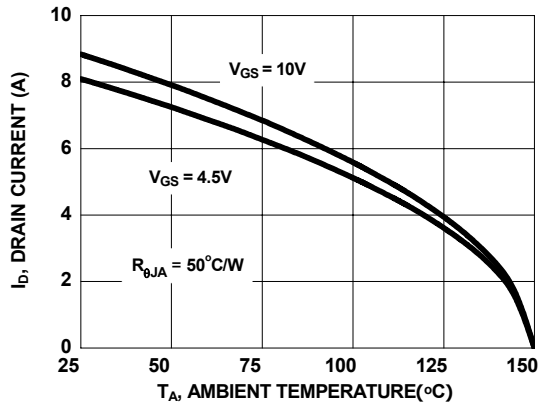
Figure 10. Maximum Continuous Drain Current vs Ambient Temperature
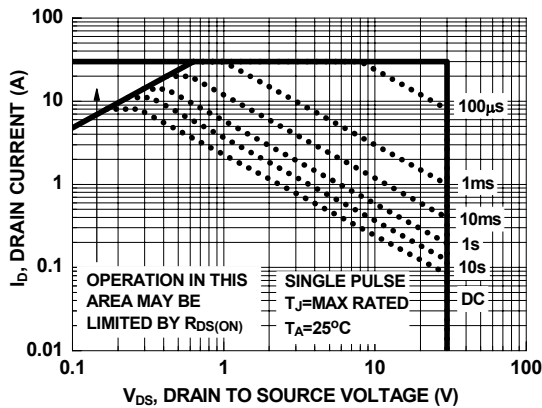
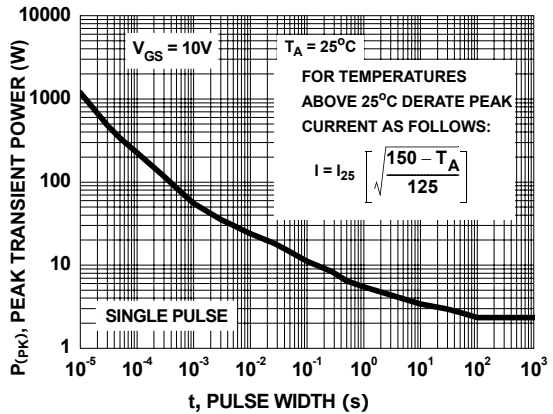**Figure 11. Forward Bias Safe Operating Area**

Figure 12. Single Pulse Maximum Power Dissipation

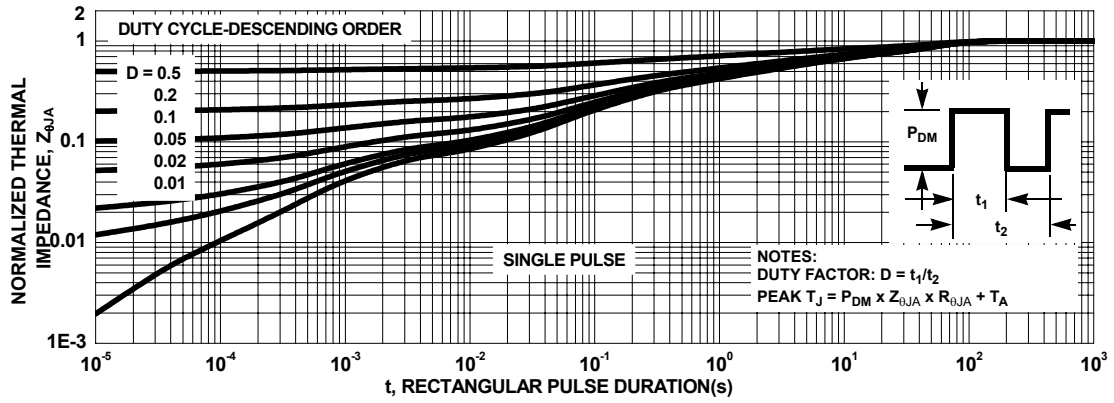## Typical Characteristics T_J = 25°C unless otherwise noted

DUTY CYCLE-DESCENDING ORDER

D = 0.5
0.2
0.1
0.05
0.02
0.01

SINGLE PULSE

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

t, RECTANGULAR PULSE DURATION(s)

NORMALIZED THERMAL IMPEDANCE, $Z_{\theta JA}$

Figure 13. Transient Thermal Response Curve

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TRADEMARKS

DISCLAIMER

LIFE SUPPORT POLICY

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.