FAIRCHILD SEMICONDUCTOR™

March 2001

FDD5612

60V N-Channel PowerTrench® MOSFET

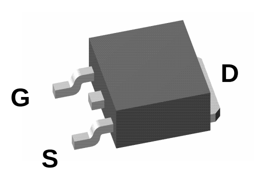
General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(ON)}$ specifications. The result is a MOSFET that is easy and safer to drive (even at very high frequencies), and DC/DC power supply designs with higher overall efficiency.

Features

- 18 A, 60 V. $R_{DS(ON)}$ = 55 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 64 mΩ @ V_{GS} = 6 V
- Optimized for use in high frequency DC/DC converters.
- Low gade charge.
- Very fast switching.



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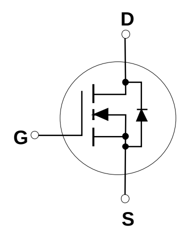


Absolute Maximum Ratings

T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		60	V
V_{GSS}	Gate-Source Voltage		±20	V
I_D	Drain Current – Continuous	(Note 1)	18	A
		(Note 1a)	5.4	
	Drain Current – Pulsed		100	
P_D	Maximum Power Dissipation	(Note 1)	42	W
		(Note 1a)	3.8	
		(Note 1b)	1.6	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +175	°C

Thermal Characteristics

$R_{θJC}$	Thermal Resistance, Junction-to-Case	(Note 1)	3.5	°C/W
$R_{θJA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	40	°C/W
		(Note 1b)	96	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD5612	FDD5612	13''	16mm	2500 units

Electrical Characteristics

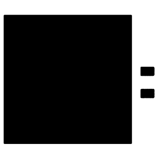
T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 1)						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 30 V, I_D = 5.4 A			90	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				5.4	A
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		62		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 48 V, V_{GS} = 0 V			1	μA
I_{GSSF}	Gate–Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	V_{GS} = –20 V V_{DS} = 0 V			–100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_D = 250 μA	1	2.4	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		–6		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 5.4 A V_{GS} = 6 V, I_D = 5 A V_{GS} = 10 V, I_D = 5.4 A, T_J = 125°C		36 42 64	55 64 103	mΩ
$I_{D(on)}$	On–State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	20			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 5.4 A		15		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 30 V, V_{GS} = 0 V, f = 1.0 MHz		660		pF
C_{oss}	Output Capacitance			79		pF
C_{rss}	Reverse Transfer Capacitance			36		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 30 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		8	16	ns
t_r	Turn–On Rise Time			4	8	ns
$t_{d(off)}$	Turn–Off Delay Time			24	38	ns
t_f	Turn–Off Fall Time			4	8	ns
Q_g	Total Gate Charge	V_{DS} = 30 V, I_D = 5.4 A, V_{GS} = 10 V		7.5	11	nC
Q_{gs}	Gate–Source Charge			2.5		nC
Q_{gd}	Gate–Drain Charge			3		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				2.7	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.7 A (Note 2)		0.8	1.2	V

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 drain tab.

$R_{\theta JA}$ is the guaranteed design while $R_{\theta JA}$ is determined by the user's design. $R_{\theta JA}$ has been used to determine some of the maximum ratings.



a) $R_{\theta JA}$= 40°C/W when mounted on a 1in^2 pad of 2oz copper.

b) $R_{\theta JA}$= 96°C/W when mounted on a 0.076 in^2 pad of 2oz copper.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300μs, Duty Cycle ≤ 2.0%

Typical Characteristics

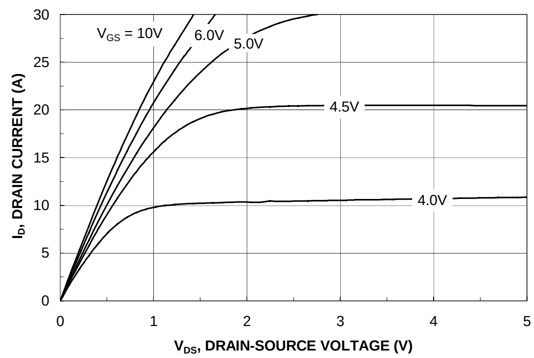


Figure 1. On-Region Characteristics.

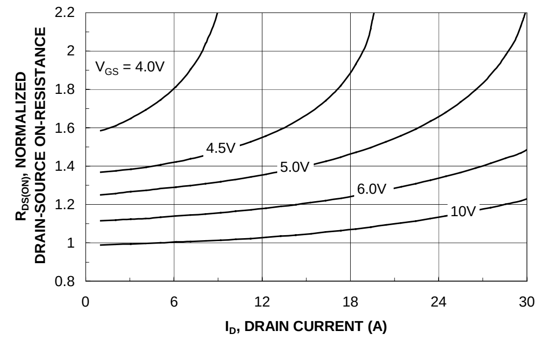


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

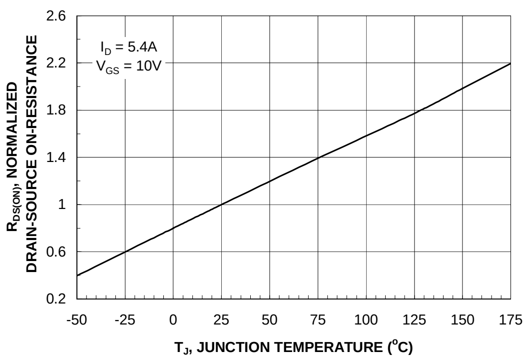


Figure 3. On-Resistance Variation with Temperature.

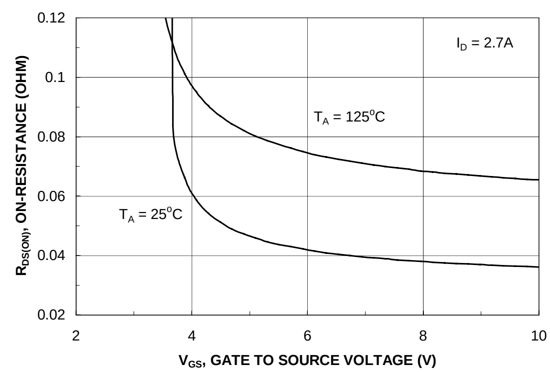


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

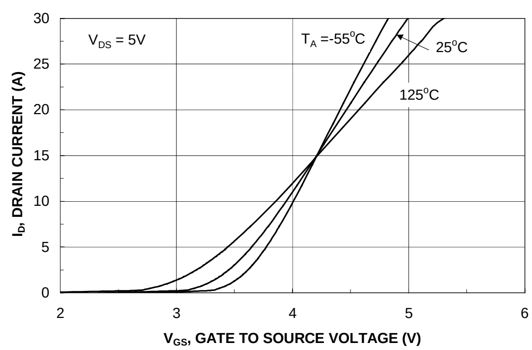


Figure 5. Transfer Characteristics.

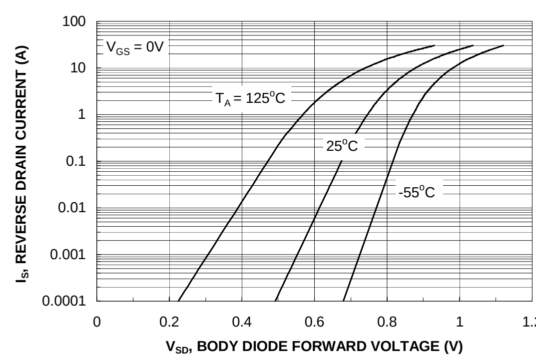


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

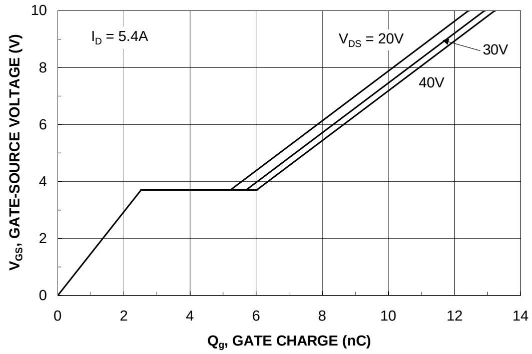


Figure 7. Gate Charge Characteristics.

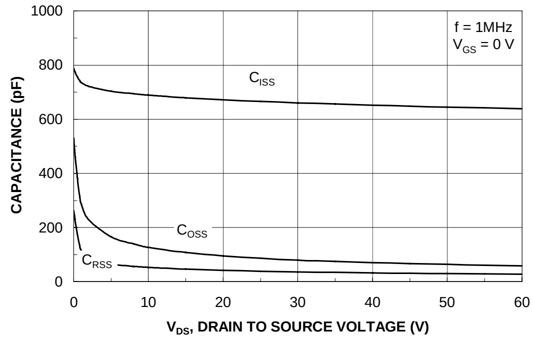


Figure 8. Capacitance Characteristics.

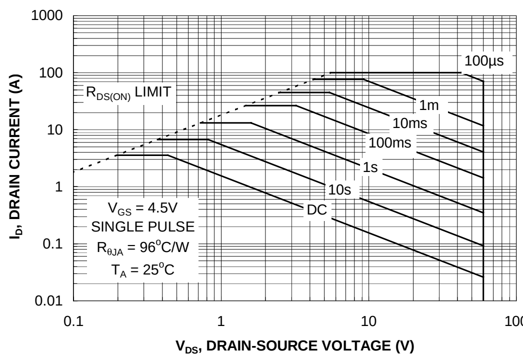


Figure 9. Maximum Safe Operating Area.

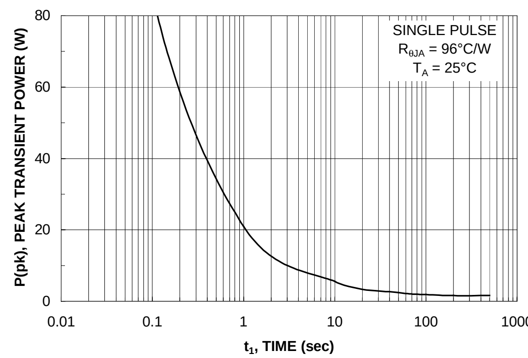


Figure 10. Single Pulse Maximum Power Dissipation.

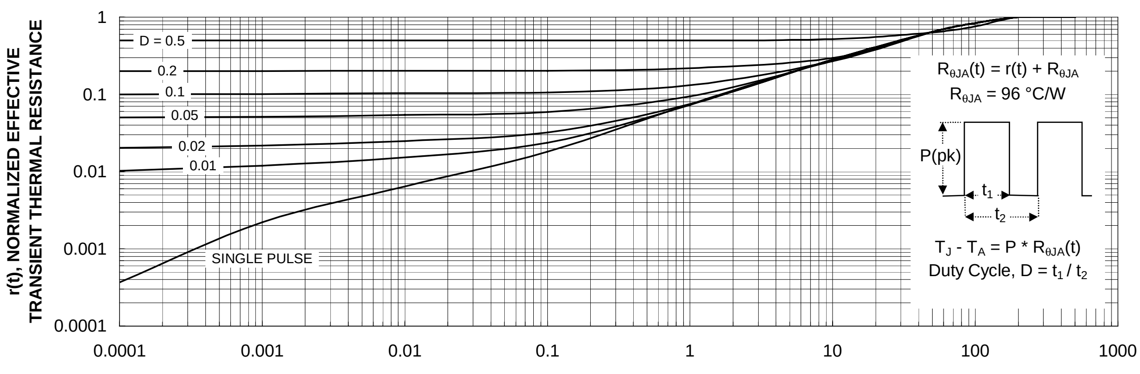


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.

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