December 2002

FAIRCHILD SEMICONDUCTOR™

FDD5690

60V N-Channel PowerTrench® MOSFET

General Description

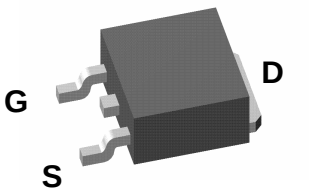
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

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

- 30 A, 60 V. $R_{DS(ON)}$ = 0.027Ω @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 0.032 Ω @ V_{GS} = 6 V.
- Low gate charge (23nC typical).
- Fast switching speed.
- High performance trench technology for extremely low $R_{DS(ON)}$.



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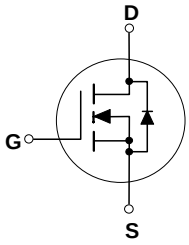

Absolute Maximum Ratings

T_C=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	Maximum Drain Current -Continuous	(Note 1)	30	A
		(Note 1a)	9	
	Maximum Drain Current -Pulsed		100	
P_D	Maximum Power Dissipation @ T_C = 25°C	(Note 1)	50	W
	T_A = 25°C	(Note 1a)	3.2	
	T_A = 25°C	(Note 1b)	1.3	
T_J, T_{stg}	Operating and Storage Junction Temperature Range		-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to- Case	(Note 1)	2.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to- Ambient	(Note 1a)	40	°C/W
		(Note 1b)	96	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD5690	FDD5690	13''	16mm	2500

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 30 V, I_D = 30 A			90	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				30	A
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 = 250µA, Referenced to 25°C		57		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 48 V, V_{GS} = 0 V			1	µA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 20V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate-Body Leakage Current, 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	2	2.5	4	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 = 9 A V_{GS} = 10 V, I_D = 9 A, T_J = 125°C V_{GS} = 6 V, I_D = 8 A		0.023 0.032 0.026	0.027 0.048 0.032	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	25			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 9 A		24		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V f = 1.0 MHz		1110		pF
C_{oss}	Output Capacitance			150		pF
C_{rss}	Reverse Transfer Capacitance			75		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		10	18	ns
t_r	Turn-On Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			24	39	ns
t_f	Turn-Off Fall Time			10	18	ns
Q_g	Total Gate Charge	V_{DS} = 30 V, I_D = 9 A V_{GS} = 10 V,		23	32	nC
Q_{gs}	Gate-Source Charge			4		nC
Q_{gd}	Gate-Drain Charge			6.8		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				2.3	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.3 A (Note 2)		0.75	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. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

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

b) $R_{\theta JA}$= 96°C/W on a minimum mounting pad.

Scale 1 : 1 on letter size paper

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

Typical Characteristics

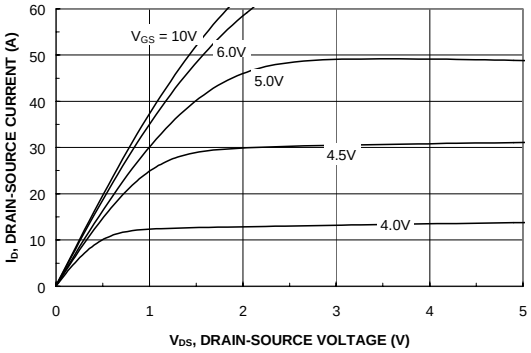

Figure 1. On-Region Characteristics.

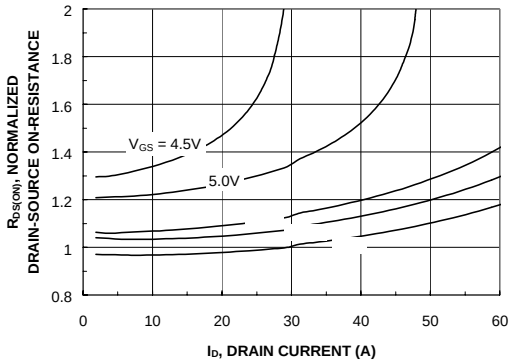

Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

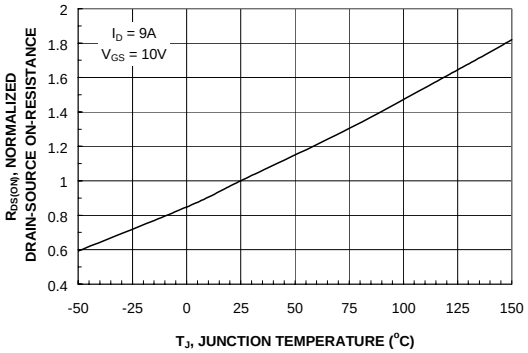

Figure 3. On-Resistance Variation with Temperature.

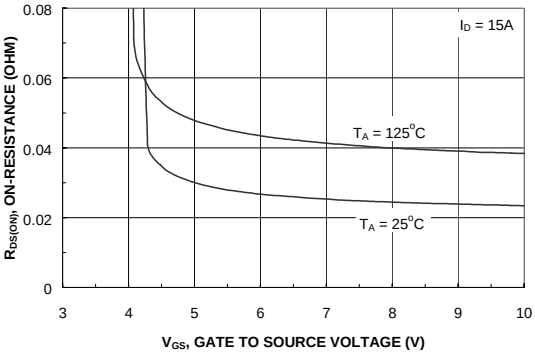

Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

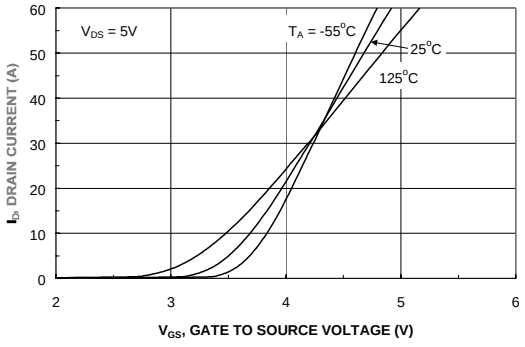

Figure 5. Transfer Characteristics.

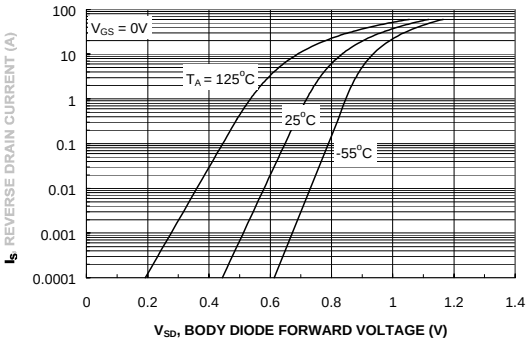

Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

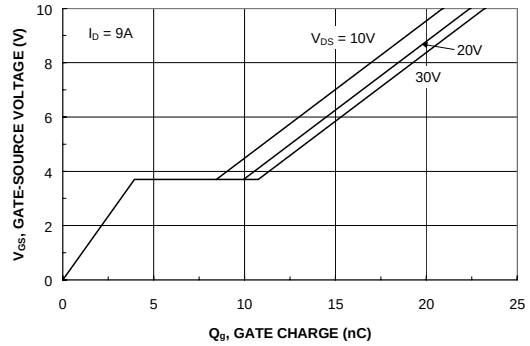

Figure 7. Gate-Charge Characteristics.

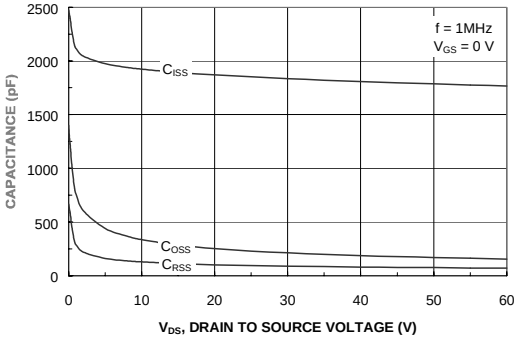

Figure 8. Capacitance Characteristics.

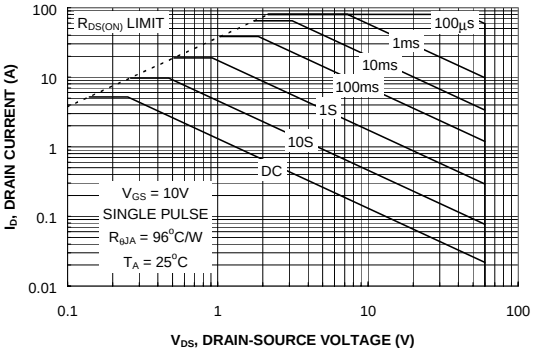

Figure 9. Maximum Safe Operating Area.

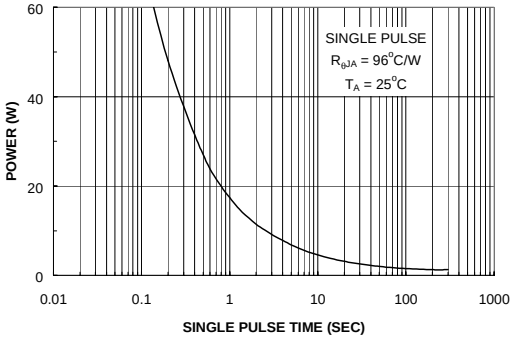

Figure 10. Single Pulse Maximum Power Dissipation.

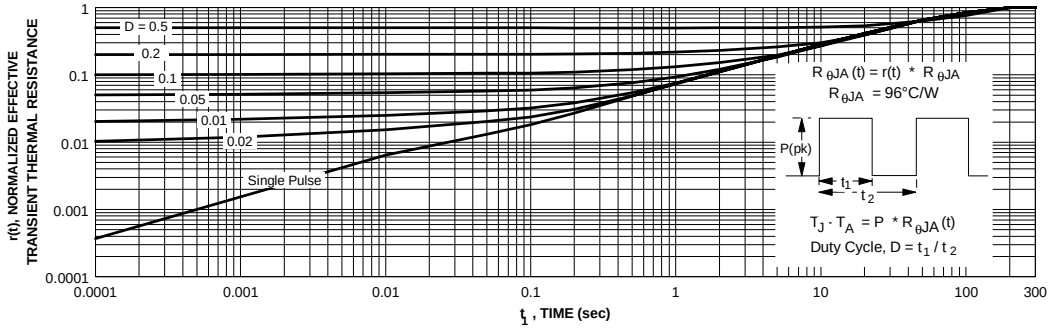

Figure 11. Transient Thermal Response Curve.

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

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