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FDS5680

60V N-Channel PowerTrench™ MOSFET

General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

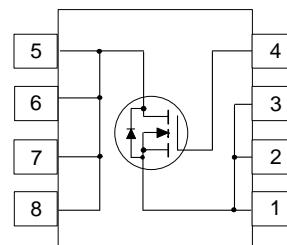
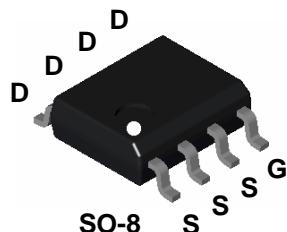
These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

Applications

- DC/DC converter
- Load switch
- Motor drives

Features

- 8 A, 60 V. $R_{DS(ON)} = 0.020 \Omega$ @ $V_{GS} = 10$ V
 $R_{DS(ON)} = 0.025 \Omega$ @ $V_{GS} = 6$ V.
- Low gate charge (30nC typical).
- Fast switching speed.
- High performance trench technology for extremely low $R_{DS(ON)}$.
- High power and current handling capability.



Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ 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 1a)	8	A
	- Pulsed	50	
P_D	Power Dissipation for Single Operation (Note 1a)	2.5	W
	(Note 1b)	1.2	
	(Note 1c)	1	
T_J, T_{stg}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

R_{pJA}	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	°C/W
R_{pJC}	Thermal Resistance, Junction-to-Case (Note 1)	25	°C/W

Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDS5680	FDS5680	13"	12mm	2500 units

Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	60			V
ΔBV_{DSS} ΔT_J	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		27		$\text{mV/}^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}$, $V_{GS} = 0\text{ V}$			1	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$			100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}$, $V_{DS} = 0\text{ V}$			-100	nA

On Characteristics (Note 2)

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2	2.5	4	V
$\Delta V_{GS(\text{th})}$ ΔT_J	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		-4.5		$\text{mV/}^\circ\text{C}$
$R_{DS(\text{on})}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}$, $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 8\text{ A}$, $T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}$, $I_D = 7.5\text{ A}$	0.017 0.027 0.019	0.020 0.032 0.025		Ω
$I_{D(\text{on})}$	On-State Drain Current	$V_{GS} = 10\text{ V}$, $V_{DS} = 5\text{ V}$	25			A
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}$, $I_D = 8\text{ A}$		28		mS

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$ $f = 1.0\text{ MHz}$		1850		pF
C_{oss}	Output Capacitance			290		pF
C_{rss}	Reverse Transfer Capacitance			100		pF

Switching Characteristics (Note 2)

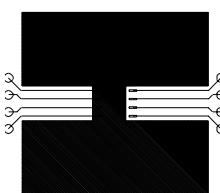
$t_{d(\text{on})}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}$, $I_D = 1\text{ A}$ $V_{GS} = 10\text{ V}$, $R_{\text{GEN}} = 6\text{ }\Omega$		13	24	ns
t_r	Turn-On Rise Time			8	16	ns
$t_{d(\text{off})}$	Turn-Off Delay Time			16	26	ns
t_f	Turn-Off Fall Time			32	50	ns
Q_g	Total Gate Charge	$V_{DS} = 15\text{ V}$, $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$,		30	42	nC
Q_{gs}	Gate-Source Charge			8.5		nC
Q_{gd}	Gate-Drain Charge			5.5		nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current			2.1	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$, $I_S = 2.1\text{ A}$	(Note 2)	0.74	1.2	V

Notes:

1: $R_{\theta_{JA}}$ is the sum of the junction-to-case and case-to-ambient 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 0.5 in² pad of 2 oz. copper.

b) 105° C/W when mounted on a 0.02 in² pad of 2 oz. copper.

c) 125° C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

Typical Characteristics

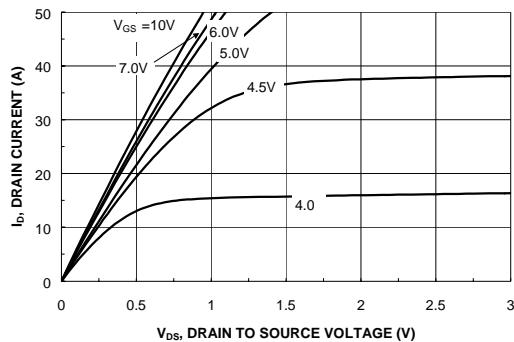


Figure 1. On-Region Characteristics.

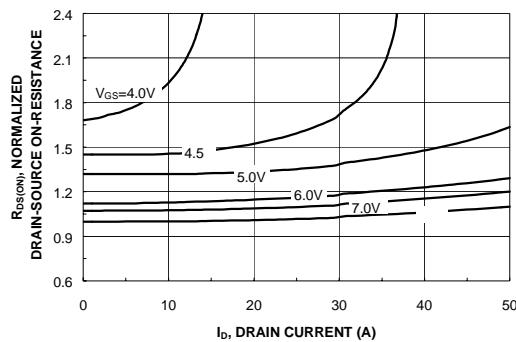


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

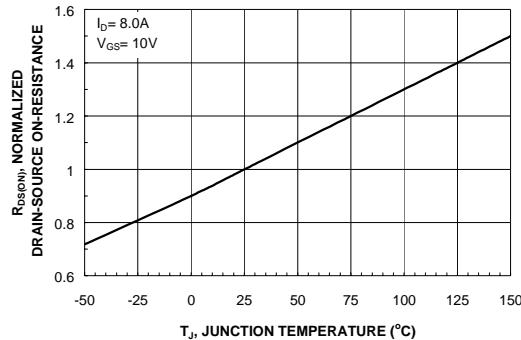


Figure 3. On-Resistance Variation with Temperature.

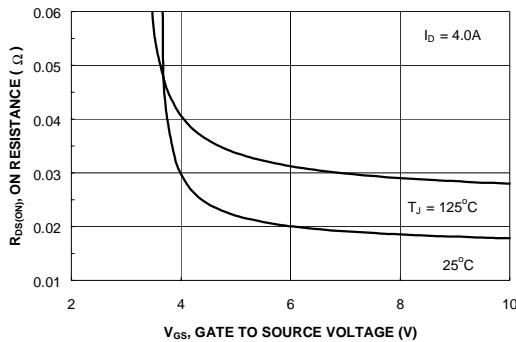


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

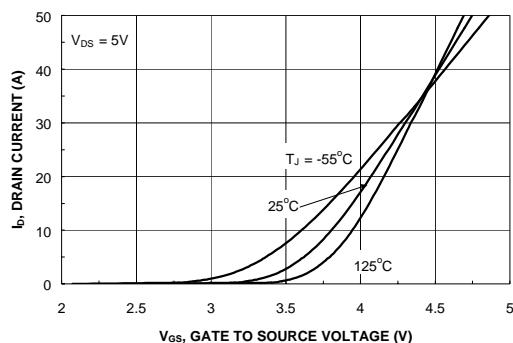


Figure 5. Transfer Characteristics.

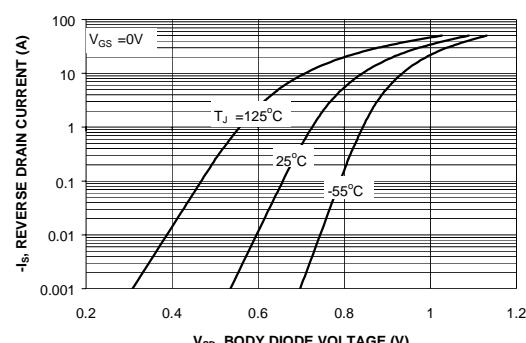


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

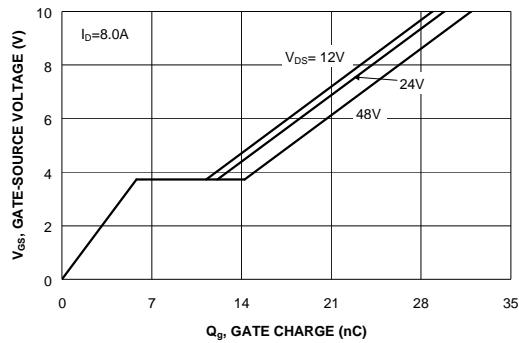


Figure 7. Gate Charge Characteristics.

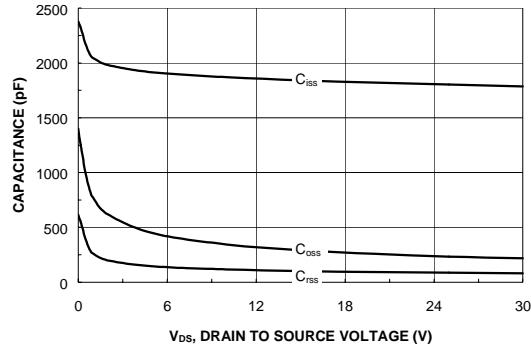


Figure 8. Capacitance Characteristics.

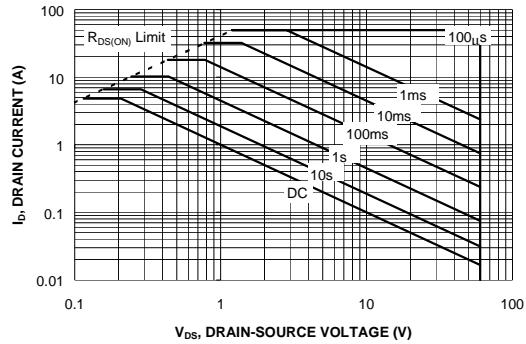


Figure 9. Maximum Safe Operating Area.

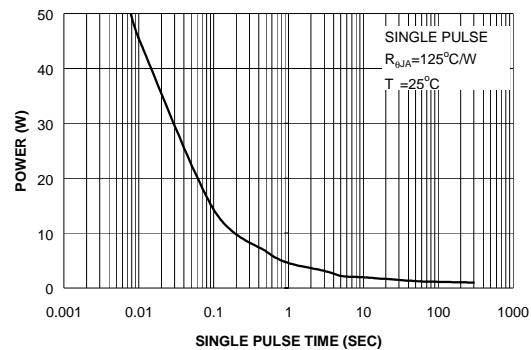


Figure 10. Single Pulse Maximum Power Dissipation.

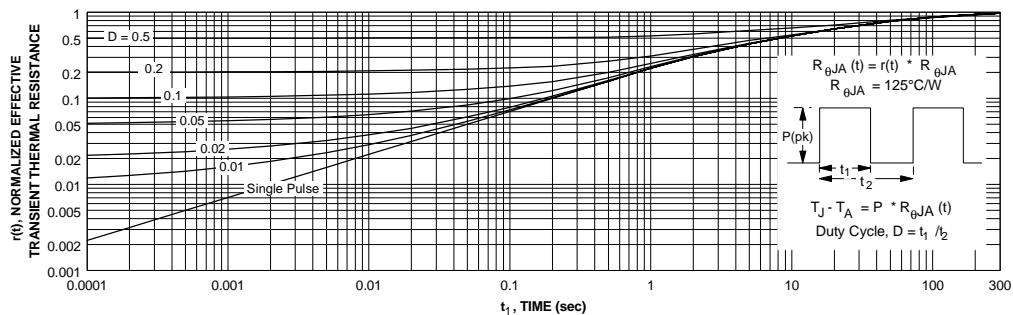


Figure 11. Transient Thermal Response Curve.

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

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