

FDS6680A Single N-Channel, Logic Level, PowerTrench® MOSFET

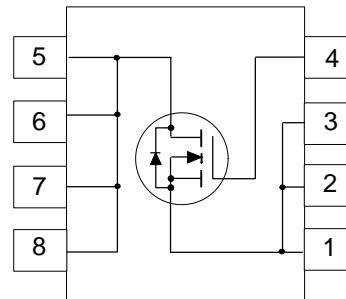
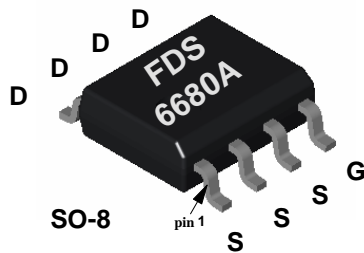
General Description

This N-Channel Logic Level MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the 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.

Features

- 12.5 A, 30 V. $R_{DS(ON)} = 0.0095 \Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 0.013 \Omega @ V_{GS} = 4.5 \text{ V}$.
- Fast switching speed.
- Low gate charge.
- 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	FDS6680A	Units
V_{DSS}	Drain-Source Voltage	30	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current - Continuous (Note 1a)	12.5	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 Temperature Range	-55 to 150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

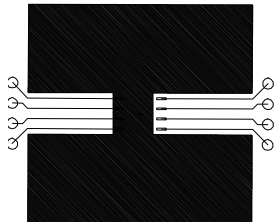
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	25	$^\circ\text{C/W}$

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

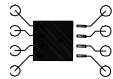
Symbol	Parameter	Conditions	Min	Typ	Max	Units	
OFF CHARACTERISTICS							
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V	
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to $25\text{ }^\circ\text{C}$		33		mV / $^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			1	μA	
					10	μA	
		$T_J = 55\text{ }^\circ\text{C}$					
I_{GSSF}	Gate - Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA	
I_{GSSR}	Gate - Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA	
ON CHARACTERISTICS (Note 2)							
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to $25\text{ }^\circ\text{C}$		-4.5		mV / $^\circ\text{C}$	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		1	1.6	2	V
				0.8	1.3	2.4	
		$T_J = 125\text{ }^\circ\text{C}$					
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 12.5\text{ A}$		0.008	0.0095	Ω	
				0.012	0.016		
				0.0105	0.013		
		$T_J = 125\text{ }^\circ\text{C}$					
		$V_{GS} = 4.5\text{ V}, I_D = 10.5\text{ A}$					
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	25			A	
g_{FS}	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 12.5\text{ A}$		35		S	
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		2180		pF	
C_{oss}	Output Capacitance			500		pF	
C_{rss}	Reverse Transfer Capacitance			255		pF	
SWITCHING CHARACTERISTICS (Note 2)							
$t_{D(on)}$	Turn - On Delay Time	$V_{DS} = 10\text{ V}, I_D = 1\text{ A}$		13	24	ns	
t_r	Turn - On Rise Time		$V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		14	26	ns
$t_{D(off)}$	Turn - Off Delay Time				43	70	ns
t_f	Turn - Off Fall Time			15	27	ns	
Q_g	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 12.5\text{ A},$ $V_{GS} = 5\text{ V}$		23	33	nC	
Q_{gs}	Gate-Source Charge			7		nC	
Q_{gd}	Gate-Drain Charge			11		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)		0.72	1.2	V	

Notes:

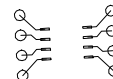
- $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. $50\text{ }^\circ\text{C/W}$ on a 1 in^2 pad of 2oz copper.



b. $105\text{ }^\circ\text{C/W}$ on a 0.04 in^2 pad of 2oz copper.



c. $125\text{ }^\circ\text{C/W}$ on a 0.006 in^2 pad of 2oz copper.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

Typical Electrical Characteristics

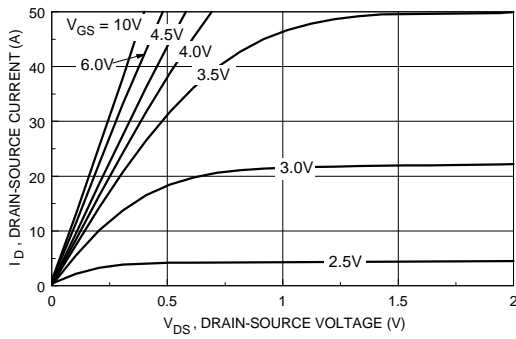


Figure 1. On-Region Characteristics.

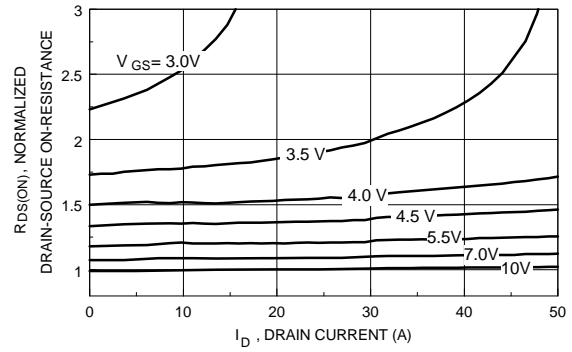


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

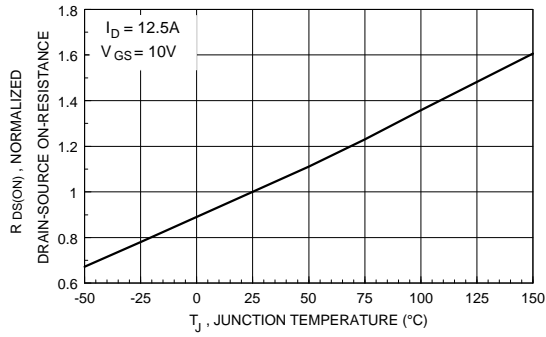


Figure 3. On-Resistance Variation with Temperature.

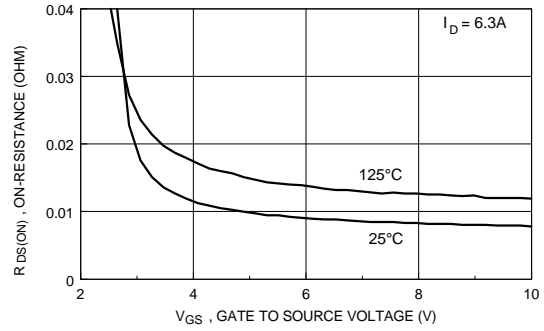


Figure 4. On Resistance Variation with Gate-to-Source Voltage.

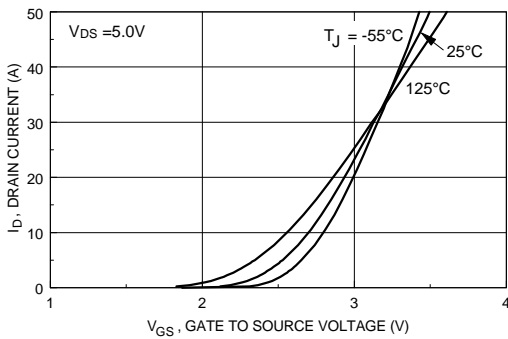


Figure 5. Transfer Characteristics.

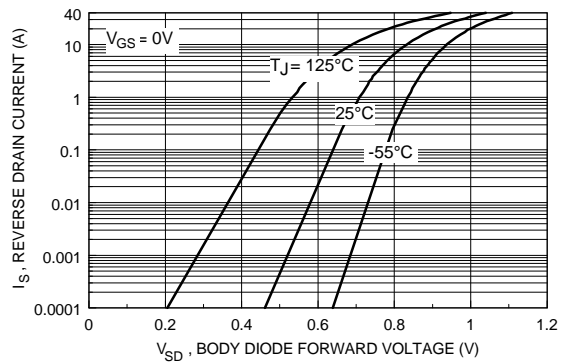


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical And Thermal Characteristics

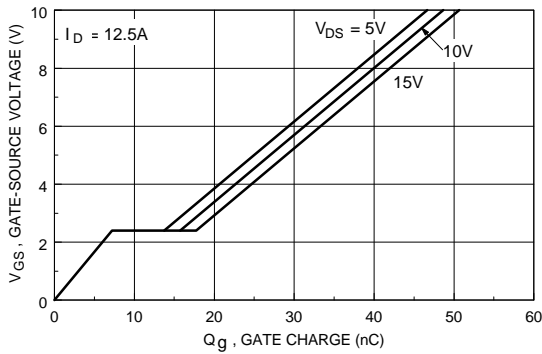


Figure 7. Gate Charge Characteristics.

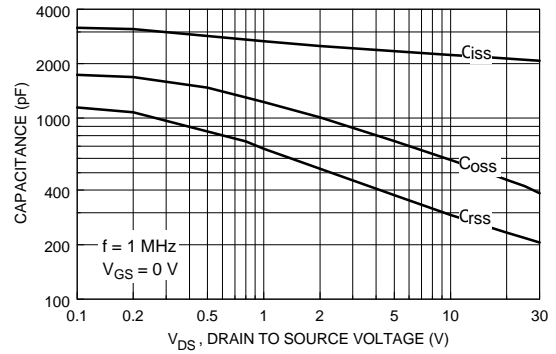


Figure 8. Capacitance Characteristics.

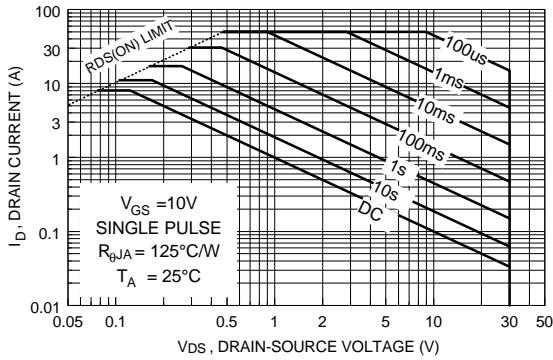


Figure 9. Maximum Safe Operating Area.

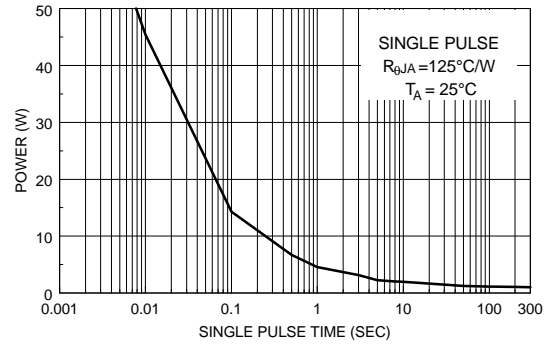


Figure 10. Single Pulse Maximum Power Dissipation.

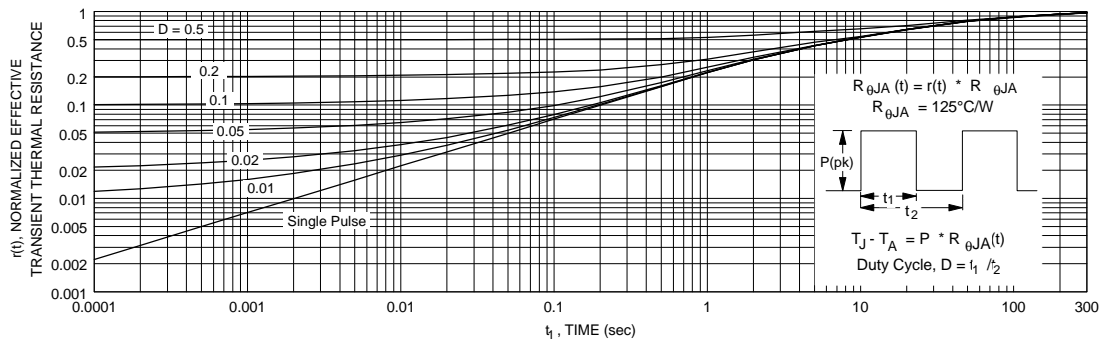


Figure 11. Transient Thermal Response Curve .

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

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE _x TM	FAST [®]	OPTOLOGIC TM	SMART START TM	VCX TM
Bottomless TM	FAST _r TM	OPTOPLANAR TM	STAR*POWER TM	
CoolFET TM	FRFET TM	PACMAN TM	Stealth TM	
CROSSVOLT TM	GlobalOptoisolator TM	POPT TM	SuperSOT TM -3	
DenseTrench TM	GTO TM	Power247 TM	SuperSOT TM -6	
DOMET TM	HiSeC TM	PowerTrench [®]	SuperSOT TM -8	
EcoSPARK TM	ISOPLANAR TM	QFET TM	SyncFET TM	
E ² CMOS TM	LittleFET TM	QST TM	TinyLogic TM	
EnSigna TM	MicroFET TM	QT Optoelectronics TM	TruTranslation TM	
FACT TM	MicroPak TM	Quiet Series TM	UHC TM	
FACT Quiet Series TM	MICROWIRE TM	SILENT SWITCHER [®]	UltraFET [®]	

STAR*POWER is used under license

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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.