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FDS6680

Single N-Channel Logic Level PWM Optimized PowerTrench™ MOSFET

General Description

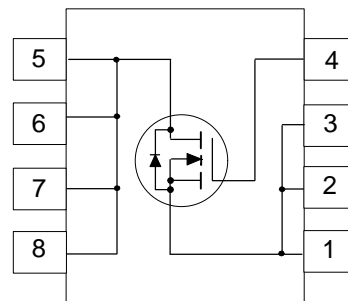
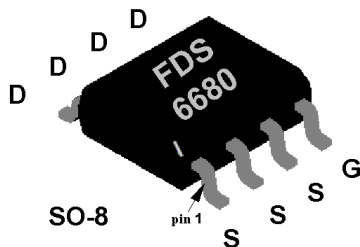
This N-Channel Logic Level MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

The MOSFET features 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

- 11.5 A, 30 V. $R_{DS(ON)} = 0.010 \Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 0.015 \Omega @ V_{GS} = 4.5 \text{ V}$.
- Optimized for use in switching DC/DC converters with PWM controllers.
- Very fast switching.
- Low gate charge (typical $Q_g = 19 \text{ nC}$).



Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	FDS6680	Units
V_{DSS}	Drain-Source Voltage	30	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current - Continuous (Note 1a)	11.5	A
	- Pulsed	50	
P_D	Power Dissipation for Single Operation (Note 1a)	2.5	W
		1.2	
		1	
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

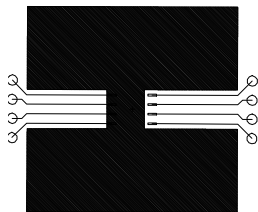
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	25	$^\circ\text{C/W}$

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

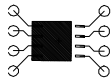
Symbol	Parameter	Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		23		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$ $T_J = 55^\circ\text{C}$			1	μA
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)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1	1.7	3	V
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		-5		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 11.5\text{ A}$ $T_J = 125^\circ\text{C}$ $V_{GS} = 4.5\text{ V}, I_D = 9.5\text{ A}$		0.0085 0.014 0.0125	0.01 0.017 0.015	Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	50			A
g_{FS}	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 11.5\text{ A}$		40		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		2070		pF
C_{oss}	Output Capacitance			510		pF
C_{rss}	Reverse Transfer Capacitance			235		pF
SWITCHING CHARACTERISTICS (Note 2)						
$t_{D(on)}$	Turn - On Delay Time	$V_{DS} = 15\text{ V}, I_D = 1\text{ A}$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		13	21	ns
t_r	Turn - On Rise Time			10	18	ns
$t_{D(off)}$	Turn - Off Delay Time			36	58	ns
t_f	Turn - Off Fall Time			13	23	ns
Q_g	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 11.5\text{ A},$ $V_{GS} = 5\text{ V}$		19	27	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			6		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)			1.2	V

Notes:

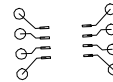
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. 50°C/W on a 1 in^2 pad of 2oz copper.



b. 105°C/W on a 0.04 in^2 pad of 2oz copper.



c. 125°C/W on a 0.006 in^2 pad of 2oz copper.

Scale 1 : 1 on letter size paper

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

Typical Electrical Characteristics

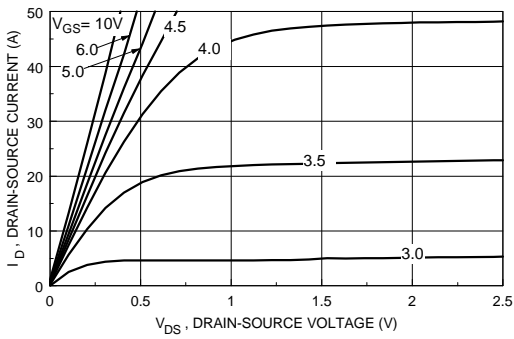


Figure 1. On-Region Characteristics.

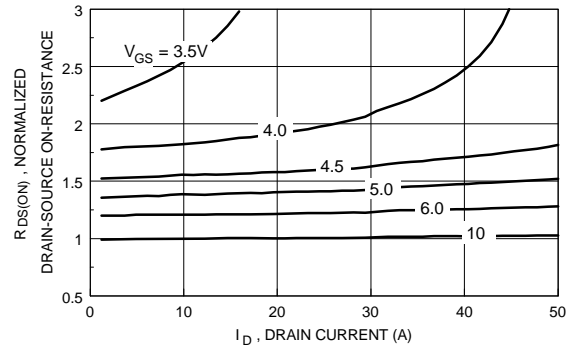


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

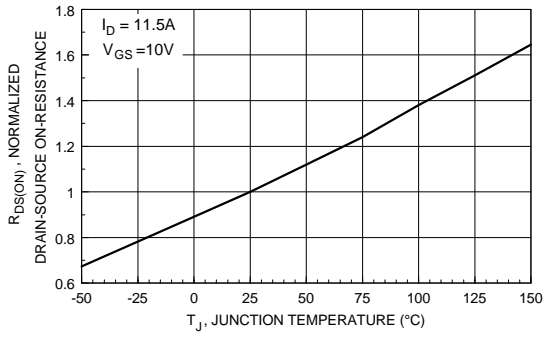


Figure 3. On-Resistance Variation with Temperature.

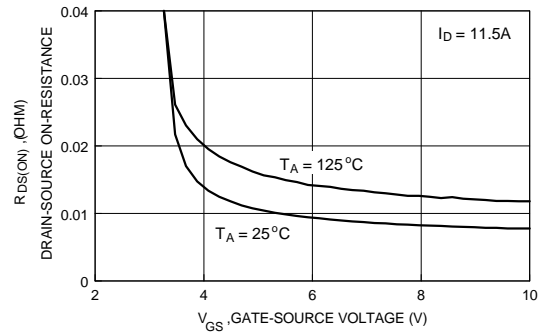


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

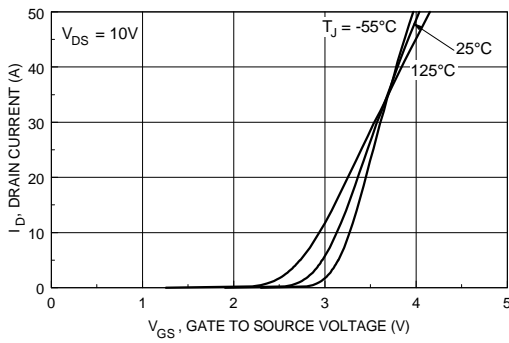


Figure 5. Transfer Characteristics.

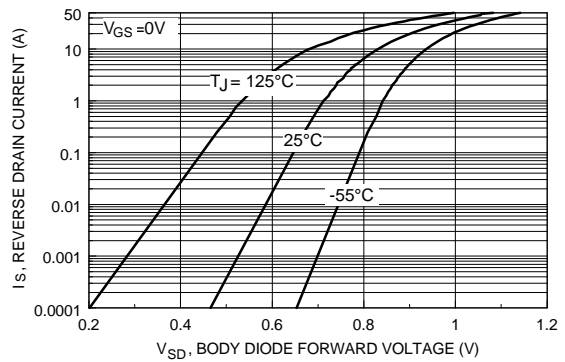


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical And Thermal Characteristics

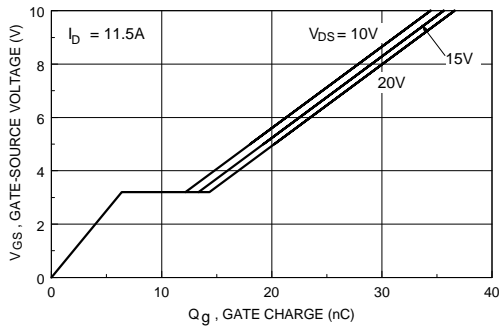


Figure 7. Gate Charge Characteristics.

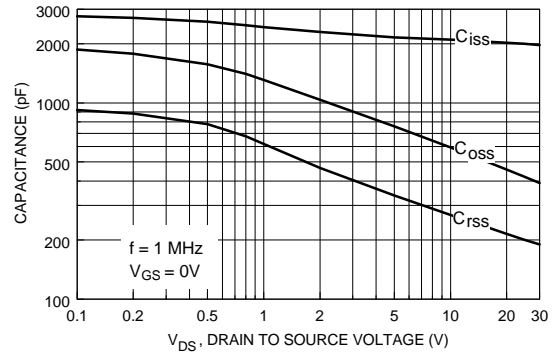


Figure 8. Capacitance Characteristics.

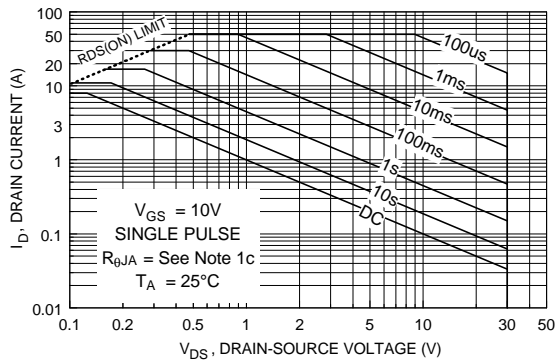


Figure 9. Maximum Safe Operating Area.

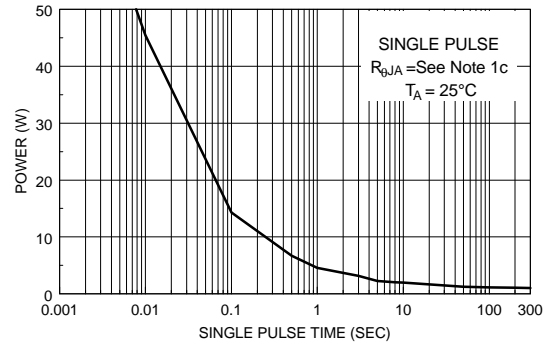


Figure 10. Single Pulse Maximum Power Dissipation.

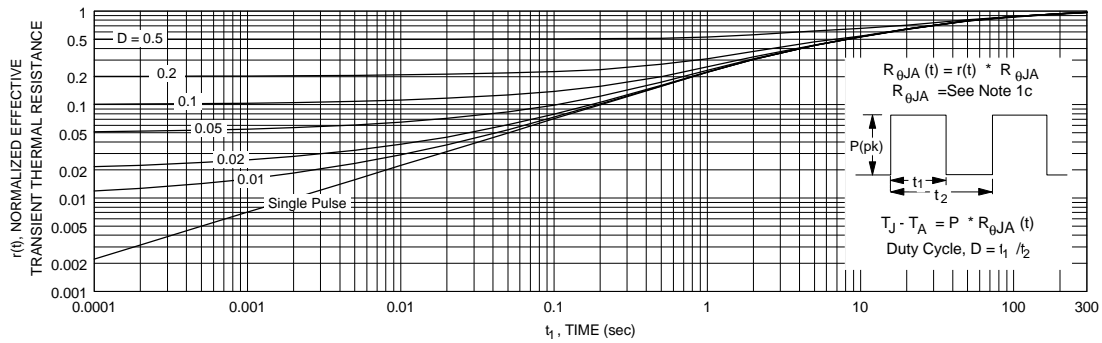


Figure 11. Transient Thermal Response Curve.

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

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