

## FDS6680

### Single N-Channel Logic Level PWM Optimized PowerTrench™ MOSFET

#### General Description

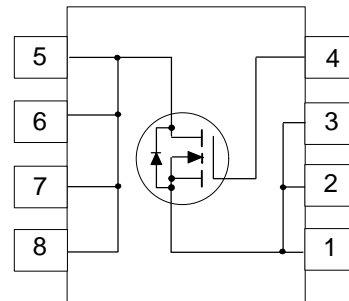
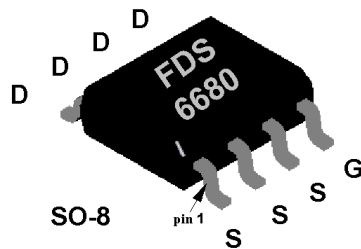
This N-Channel Logic Level MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

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.  $R_{DS(ON)} = 0.010 \Omega$  @  $V_{GS} = 10$  V  
 $R_{DS(ON)} = 0.015 \Omega$  @  $V_{GS} = 4.5$  V.
- Optimized for use in switching DC/DC converters with PWM controllers.
- Very fast switching.
- Low gate charge (typical  $Q_g = 19$  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	$\pm 20$	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
	(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<sub>A</sub> = 25 °C unless otherwise noted )

Symbol	Parameter	Conditions	Min	Typ	Max	Units
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## OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25 °C		23		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V			1	μA
		T <sub>J</sub> = 55°C			10	μA
I <sub>GSSF</sub>	Gate - Body Leakage, Forward	V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V			100	nA
I <sub>GSSR</sub>	Gate - Body Leakage, Reverse	V <sub>GS</sub> = -20 V, V <sub>DS</sub> = 0 V			-100	nA

## ON CHARACTERISTICS (Note 2)

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1	1.7	3	V
ΔV <sub>GS(th)</sub> /ΔT <sub>J</sub>	Gate Threshold Voltage Temp.Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25 °C		-5		mV/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 11.5 A		0.0085	0.01	Ω
		T <sub>J</sub> = 125°C		0.014	0.017	
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 9.5 A		0.0125	0.015	
I <sub>D(ON)</sub>	On-State Drain Current	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 5 V	50			A
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 11.5 A		40		S

## DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz		2070		pF
C <sub>oss</sub>	Output Capacitance			510		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			235		pF

## SWITCHING CHARACTERISTICS (Note 2)

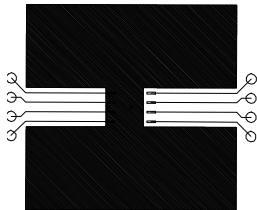
t <sub>D(on)</sub>	Turn - On Delay Time	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 1 A		13	21	ns
t <sub>r</sub>	Turn - On Rise Time	V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω		10	18	ns
t <sub>D(off)</sub>	Turn - Off Delay Time			36	58	ns
t <sub>f</sub>	Turn - Off Fall Time			13	23	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 11.5 A,		19	27	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = 5 V		7		nC
Q <sub>gd</sub>	Gate-Drain Charge			6		nC

## DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

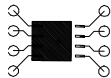
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				2.1	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.1 A (Note 2)			1.2	V

Notes:

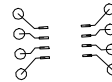
1. R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design.



a. 50°C/W on a 1 in<sup>2</sup> pad of 2oz copper.



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



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

Scale 1 : 1 on letter size paper

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

## Typical Electrical Characteristics

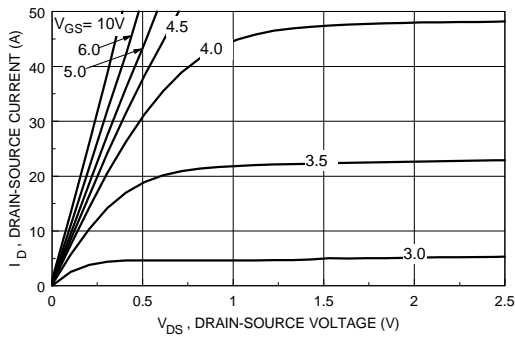


Figure 1. On-Region Characteristics.

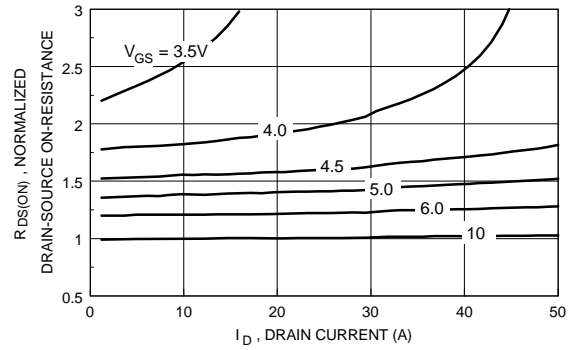


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

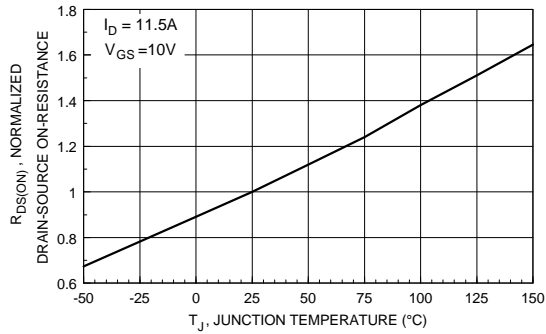


Figure 3. On-Resistance Variation with Temperature.

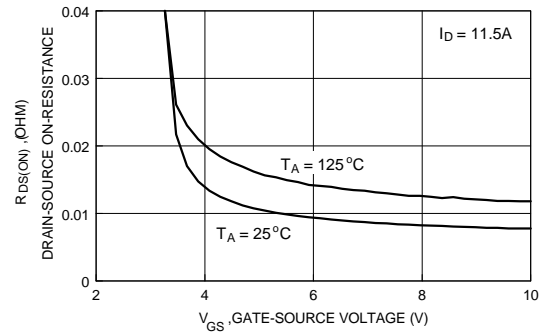


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

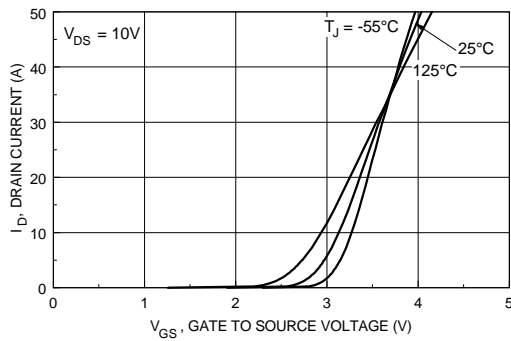


Figure 5. Transfer Characteristics.

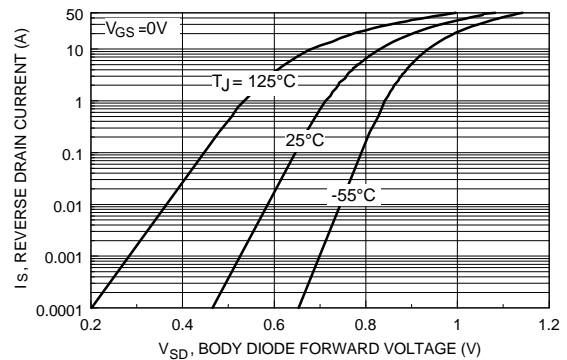


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Electrical And Thermal Characteristics

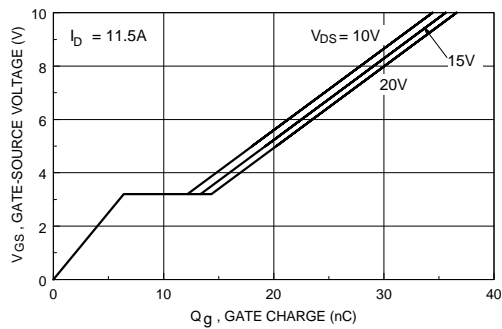


Figure 7. Gate Charge Characteristics.

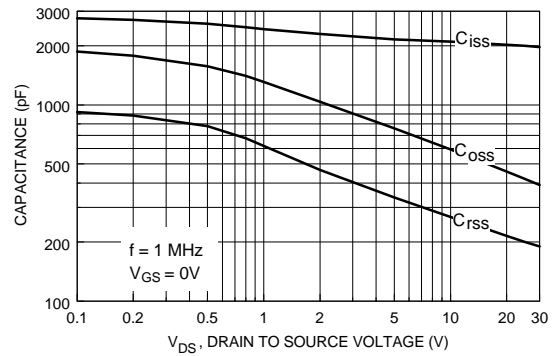


Figure 8. Capacitance Characteristics.

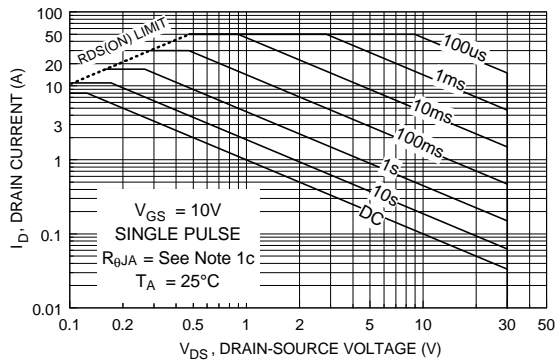


Figure 9. Maximum Safe Operating Area.

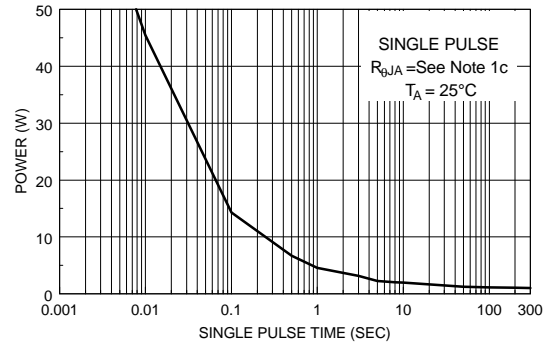


Figure 10. Single Pulse Maximum Power Dissipation.

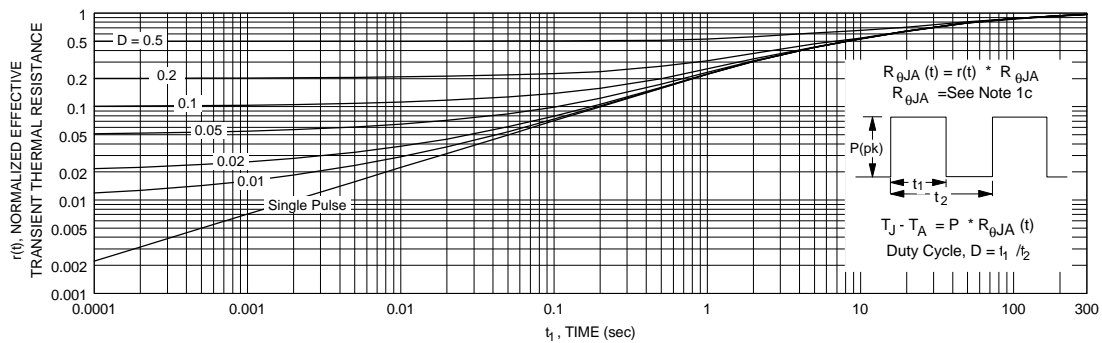


Figure 11. Transient Thermal Response Curve.

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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