

ON Semiconductor

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ON Semiconductor®

FDS5670

60V N-Channel PowerTrench™ MOSFET

General Description

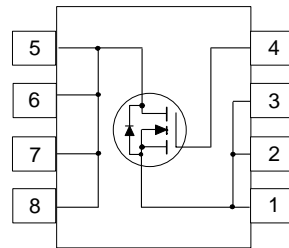
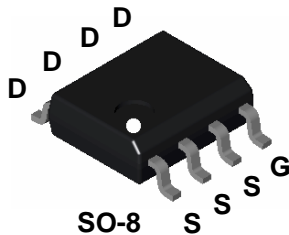
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

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

- 10 A, 60 V. $R_{DS(ON)} = 0.014 \Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 0.017 \Omega @ V_{GS} = 6 \text{ V}$.
- Low gate charge.
- 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) - Pulsed	10	A
		50	
P_D	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	2.5	W
		1.2	
		1	
T_J, T_{stg}	Operating and Storage Junction 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	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDS5670	FDS5670	13"	12mm	2500 units

Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		58		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)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2	2.4	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		6.8		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 10\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}, I_D = 9\text{ A}$		0.012 0.019 0.014	0.014 0.027 0.017	Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	25			A
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 10\text{ A}$		39		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}$ $f = 1.0\text{ MHz}$		2900		pF
C_{oss}	Output Capacitance			685		pF
C_{rss}	Reverse Transfer Capacitance			180		pF

Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_D = 1\text{ A}$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		16	29	ns
t_r	Turn-On Rise Time			10	20	ns
$t_{d(off)}$	Turn-Off Delay Time			50	80	ns
t_f	Turn-Off Fall Time			23	42	ns
Q_g	Total Gate Charge	$V_{DS} = 20\text{ V}, I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$		49	70	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			10.4		nC

Drain-Source Diode Characteristics and Maximum Ratings

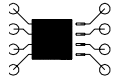
I_S	Maximum Continuous Drain-Source Diode Forward Current			2.1		A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.1\text{ A}$ (Note 2)		0.72	1.2	V

Notes:

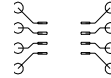
- $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.



a) 50° C/W when mounted on a 0.5 in^2 pad of 2 oz. copper.



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



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

Scale 1 : 1 on letter size paper

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

Typical Characteristics

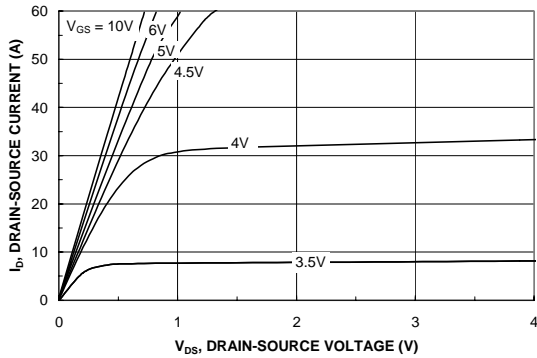


Figure 1. On-Region Characteristics.

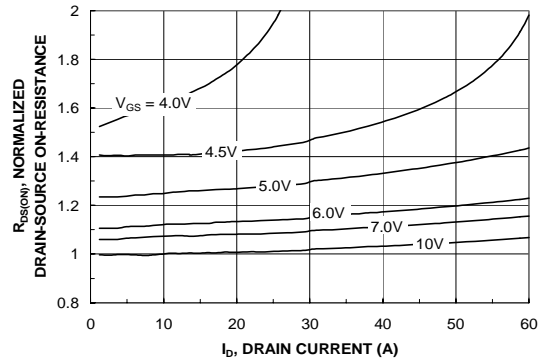


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

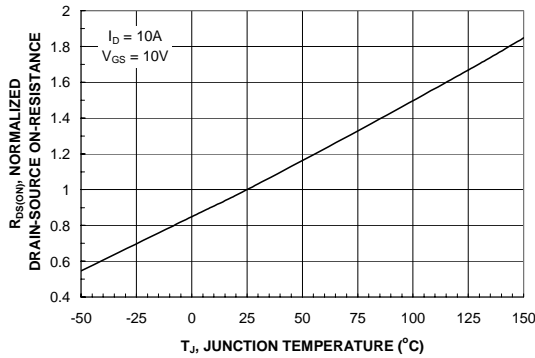


Figure 3. On-Resistance Variation with Temperature.

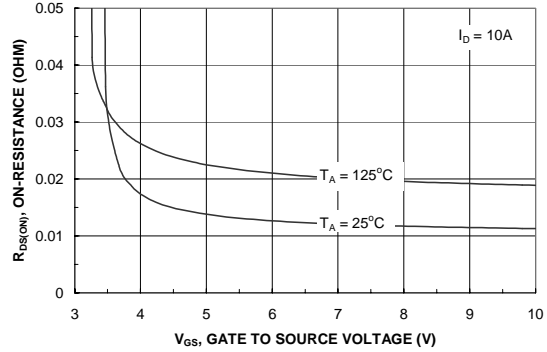


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

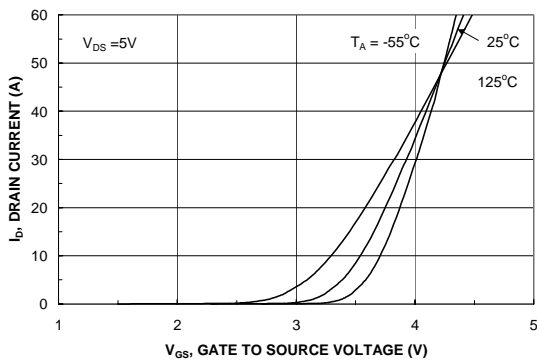


Figure 5. Transfer Characteristics.

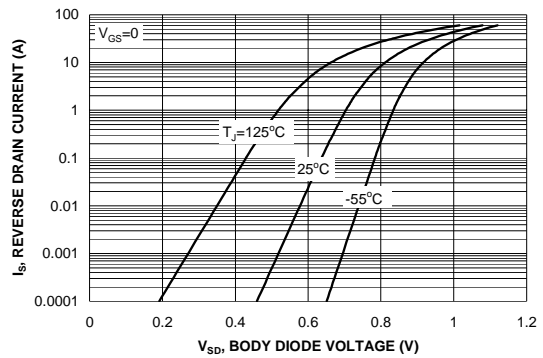


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

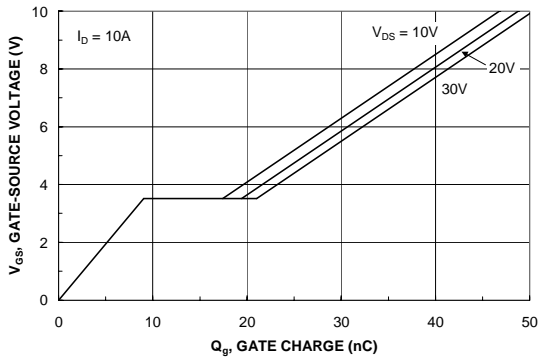


Figure 7. Gate-Charge Characteristics.

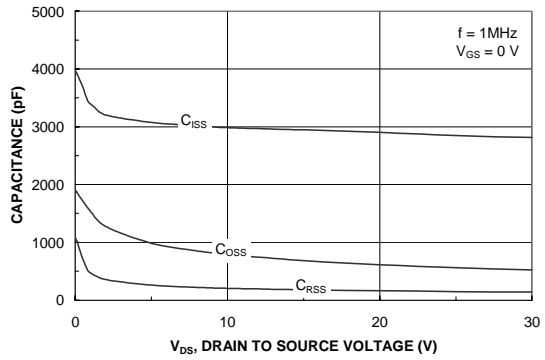


Figure 8. Capacitance Characteristics.

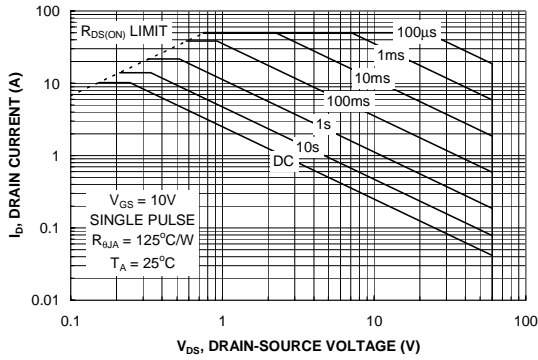


Figure 9. Maximum Safe Operating Area.

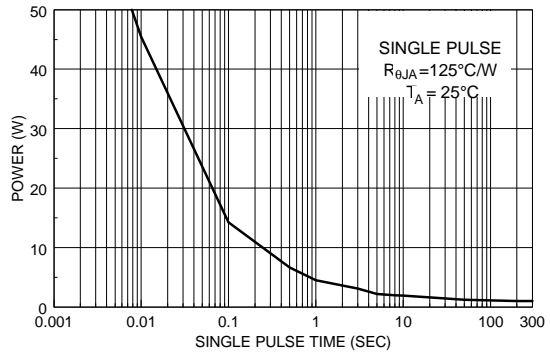


Figure 10. Single Pulse Maximum Power Dissipation.

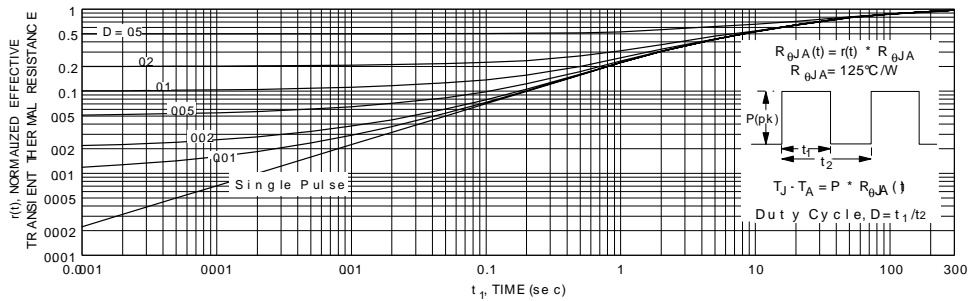


Figure 11. Transient Thermal Response Curve.

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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