FAIRCHILD SEMICONDUCTOR®

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FDS8670

30V N-Channel PowerTrench® MOSFET

General Description

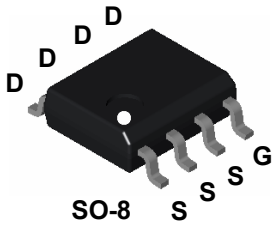
This device has been designed specifically to improve the efficiency of DC-DC converters. Using new techniques in MOSFET construction, the various components of gate charge and capacitance have been optimized to reduce switching losses. Low gate resistance and very low Miller charge enable excellent performance with both adaptive and fixed dead time gate drive circuits. Very low Rds(on) has been maintained to provide an extremely versatile device.

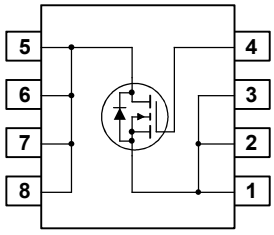
Applications

- High Efficiency DC-DC Converters:
  - Notebook Vcore Power Supply
  - Telecom Brick Synchronous Rectifier
  - Multi purpose Point Of Load

Features

- 21 A, 30 V Max $R_{DS(ON)}$ = 3.7 mΩ @ V_{GS} = 10 V
  Max $R_{DS(ON)}$ = 5.0 mΩ @ V_{GS} = 4.5 V
- High performance trench technology for extremely low $R_{DS(ON)}$ and gate charge
- Minimal Qgd (5.5 nC typical)
- 100% R_G tested (0.9 Ω typical)
- 100% UIL tested
- RoHS Compliant





Absolute Maximum Ratings

T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		30	V
V_{GSS}	Gate-Source Voltage		±20	V
I_D	Drain Current – Continuous	(Note 1a)	21	A
	– Pulsed		105	
P_D	Power Dissipation	(Note 1a)	2.5	W
		(Note 1b)	1.2	
		(Note 1c)	1	
E_{AS}	Single Pulse Avalanche Energy	(Note 3)	433	mJ
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C

Thermal Characteristics

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

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS8670	FDS8670	13”	12mm	2500 units

Electrical Characteristics

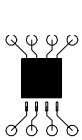
T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		39		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	µA
I_{GSS}	Gate–Body Leakage	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.4	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		–5		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 21 A V_{GS} = 4.5 V, I_D = 18 A V_{GS}=10 V, I_D =21 A, T_J=125°C		3.3 4.2 4.4	3.7 5.0 5.5	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 21 A		118		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		4040		pF
C_{oss}	Output Capacitance			1730		pF
C_{rss}	Reverse Transfer Capacitance			160		pF
R_G	Gate Resistance	f = 1.0 MHz	0.2	0.9	1.5	Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		12	21	ns
t_r	Turn–On Rise Time			11	20	ns
$t_{d(off)}$	Turn–Off Delay Time			56	90	ns
t_f	Turn–Off Fall Time			68	108	ns
$Q_{g(TOT)}$	Total Gate Charge at V_{GS} = 10V	V_{DD} = 15 V, I_D = 21 A		58.5	82	nC
$Q_{g(TOT)}$	Total Gate Charge at V_{GS} = 5V			30	42	nC
Q_{gs}	Gate–Source Charge			9.5		nC
Q_{gd}	Gate–Drain Charge			5.5		nC
Drain–Source Diode Characteristics and Maximum Ratings						
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.1 A (Note 2)		0.7	1.2	V
t_{rr}	Diode Reverse Recovery Time	I_F = 21 A, dI_F/dt = 100 A/µs		51		ns
I_{RM}	Diode Reverse Recovery Current			1.5		A
Q_{rr}	Diode Reverse Recovery Charge			37		nC

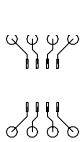
Notes:

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°/W when mounted on a 1 in^2 pad of 2 oz copper



b) 105°/W when mounted on a .04 in^2 pad of 2 oz copper



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

Scale 1 : 1 on letter size paper

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

3. Starting T_J = 25°C, L = 3mH, I_{AS} = 17A, V_{DD} = 30V, V_{GS} = 10V

Typical Characteristics

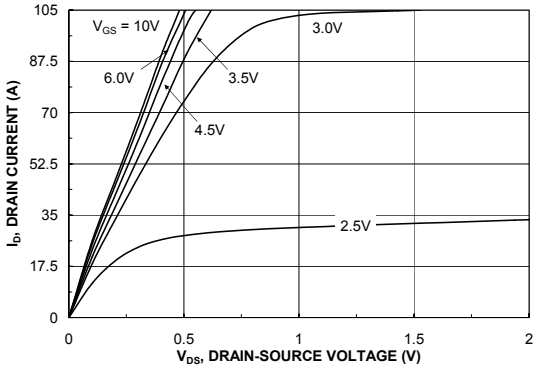


Figure 1. On-Region Characteristics.

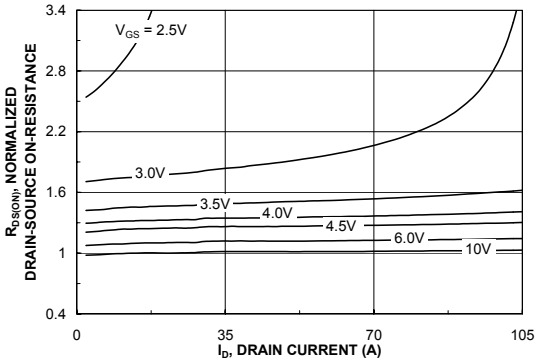


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

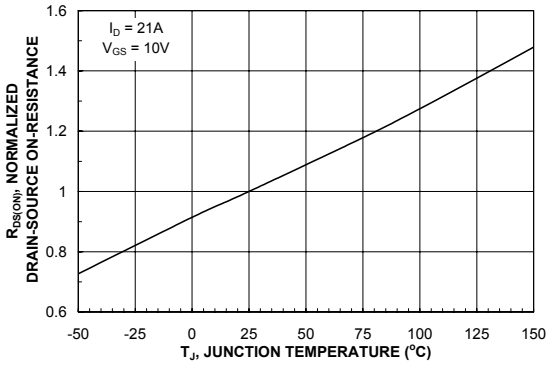


Figure 3. On-Resistance Variation with Temperature.

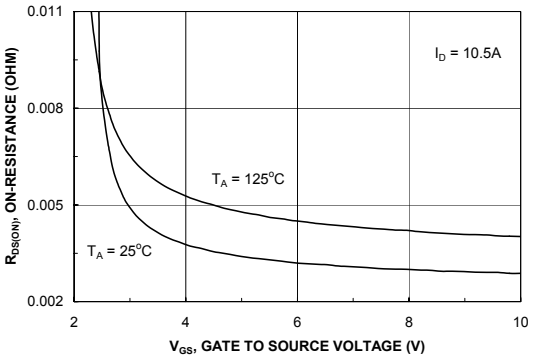


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

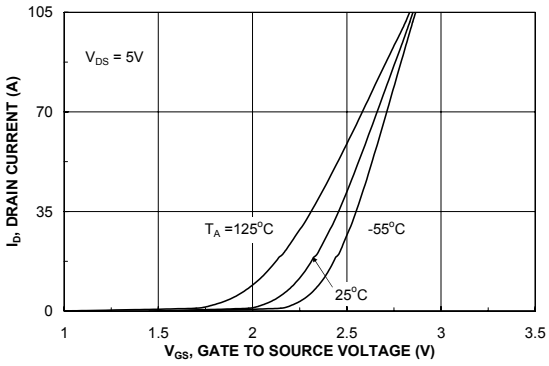


Figure 5. Transfer Characteristics.

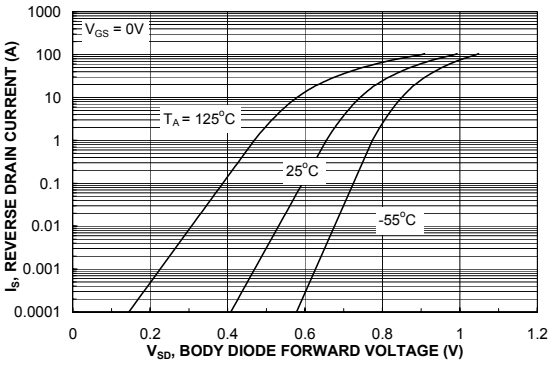


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

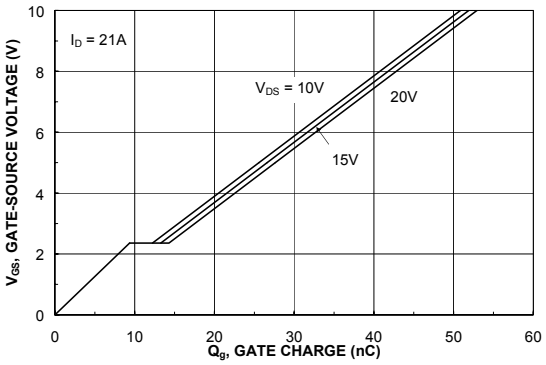


Figure 7. Gate Charge Characteristics.

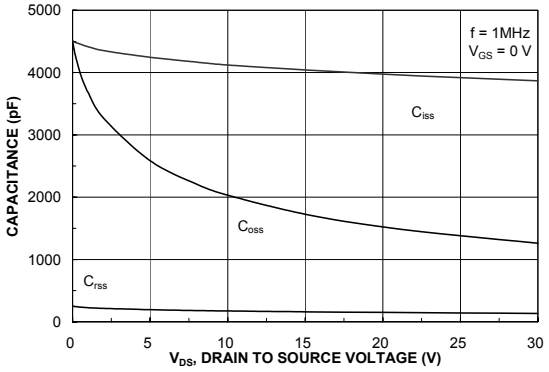


Figure 8. Capacitance Characteristics.

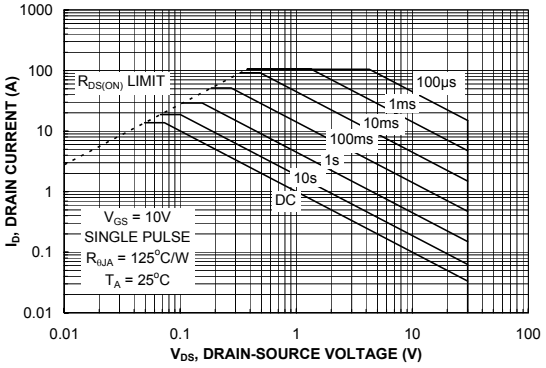


Figure 9. Maximum Safe Operating Area.

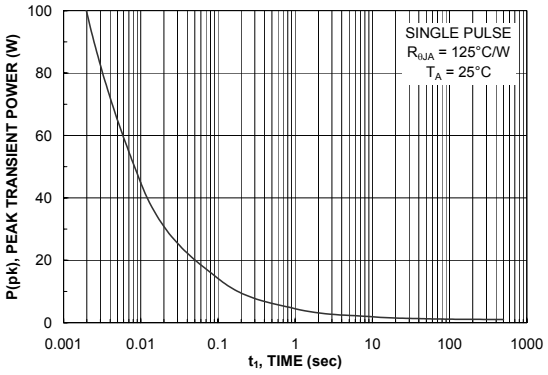


Figure 10. Single Pulse Maximum Power Dissipation.

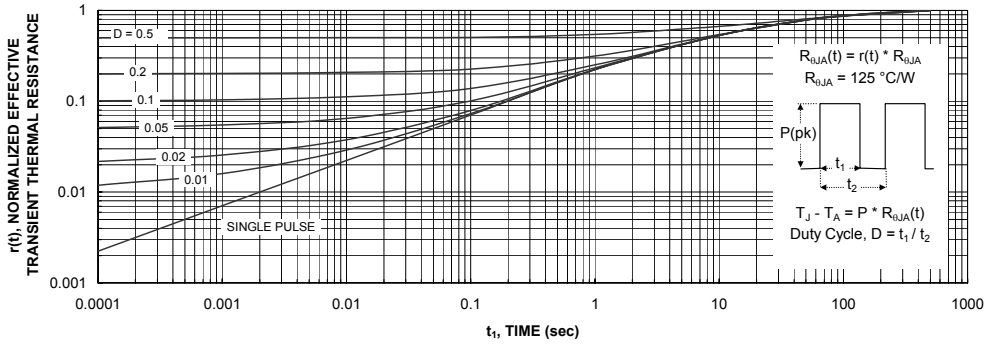


Figure 11. Transient Thermal Response Curve.

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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