FAIRCHILD SEMICONDUCTOR TM

June 1999

FDS6982

Dual N-Channel, Notebook Power Supply MOSFET

General Description

This part is designed to replace two single SO-8 MOSFETs in synchronous DC:DC power supplies that provide the various peripheral voltage rails required in notebook computers and other battery powered electronic devices. FDS6982 contains two unique 30V, N-channel, logic level, PowerTrench® MOSFETs designed to maximize power conversion efficiency.

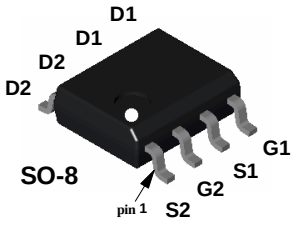
The high-side switch (Q1) is designed with specific emphasis on reducing switching losses while the low-side switch (Q2) is optimized for low conduction losses (less than 20mΩ at V_{GS} = 4.5V).

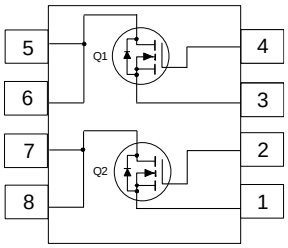
Applications

- Battery powered synchronous DC:DC converters.
- Embedded DC:DC conversion.

Features

- Q2: 8.6A, 30V. $R_{DS(on)}$ = 0.015 Ω @ V_{GS} = 10V
  $R_{DS(on)}$ = 0.020 Ω @ V_{GS} = 4.5V
- Q1: 6.3A, 30V. $R_{DS(on)}$ = 0.028 Ω @ V_{GS} = 10V
  $R_{DS(on)}$ = 0.035 Ω @ V_{GS} = 4.5V
- Fast switching speed.
- High performance trench technology for extremely low $R_{DS(ON)}$.





Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter		Q2	Q1	Units
V_{DSS}	Drain-Source Voltage		30	30	V
V_{GSS}	Gate-Source Voltage		±20	±20	V
I_D	Drain Current - Continuous	(Note 1a)	8.6	6.3	A
	- Pulsed		30	20	
P_D	Power Dissipation for Dual Operation		2		W
	Power Dissipation for Single Operation	(Note 1a)	1.6		
		(Note 1b)	1		
		(Note 1c)	0.9		
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)	78	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDS6982	FDS6982	13”	12mm	2500 units

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Electrical Characteristics

T_A = 25°C unless otherwise noted

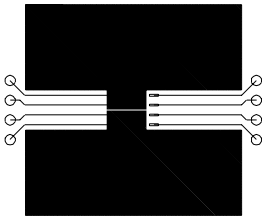
Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
Off Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	Q2 Q1	30 30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	Q2 Q1		27 26		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V	All			1	µA
I_{GSSF}	Gate-Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V	All			100	nA
I_{GSSR}	Gate-Body Leakage, Reverse	V_{GS} = -20 V, V_{DS} = 0 V	All			-100	nA
On Characteristics (Note 2)							
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	Q2 Q1	1 1	2.2 1.6	3 3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	Q2 Q1		-5 -4		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 8.6 A V_{GS} = 10 V, I_D = 8.6 A, T_J = 125°C V_{GS} = 4.5 V, I_D = 7.5 A	Q2		0.012 0.018 0.016	0.015 0.024 0.020	Ω
		V_{GS} = 10 V, I_D = 6.3 A V_{GS} = 10 V, I_D = 6.3 A, T_J = 125°C V_{GS} = 4.5 V, I_D = 5.6 A	Q1		0.021 0.038 0.028	0.028 0.047 0.035	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	Q2 Q1	30 20			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 8.6 A V_{DS} = 5 V, I_D = 6.3 A	Q2 Q1		50 40		S
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1.0 MHz	Q2 Q1		2085 760		pF
C_{oss}	Output Capacitance		Q2 Q1		420 160		pF
C_{rss}	Reverse Transfer Capacitance		Q2 Q1		160 70		pF

Electrical Characteristics (continued) T_A = 25°C unless otherwise noted

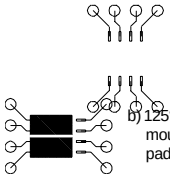
Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
Switching Characteristics (Note 2)							
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10V, R_{GEN} = 6 Ω	Q2 Q1		15 10	27 18	ns
t_r	Turn-On Rise Time		Q2 Q1		11 14	20 25	ns
$t_{d(off)}$	Turn-Off Delay Time		Q2 Q1		36 21	58 34	ns
t_f	Turn-Off Fall Time		Q2 Q1		18 7	29 14	ns
Q_g	Total Gate Charge	Q2 V_{DS} = 15 V, I_D = 8.6 A, V_{GS} = 5 V	Q2 Q1		18.5 8.5	26 12	nC
Q_{gs}	Gate-Source Charge	Q1	Q2 Q1		7.3 2.4		nC
Q_{gd}	Gate-Drain Charge	V_{DS} = 15 V, I_D = 6.3 A,V_{GS} = 5 V	Q2 Q1		6.2 3.1		nC
Drain-Source Diode Characteristics and Maximum Ratings							
I_S	Maximum Continuous Drain-Source Diode Forward Current		Q2 Q1			1.3 1.3	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 1.3 A (Note 2) V_{GS} = 0 V, I_S = 1.3 A (Note 2)	Q2 Q1		0.72 0.74	1.2 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.Thermal rating based on independant single device opperation.



a) 78° C/W when mounted on a 0.5 in^2 pad of 2 oz. copper.



b) 125° C/W when mounted on a 0.02 in^2 pad of 2 oz. copper.

c) 135° C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

Typical Characteristics: Q2

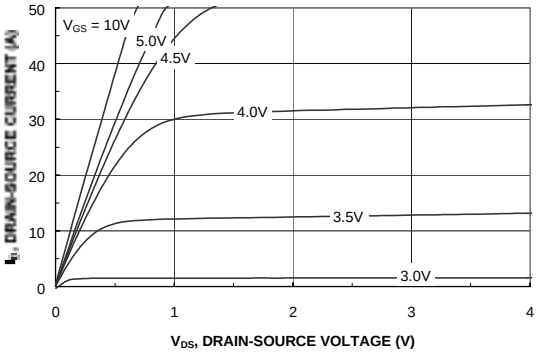


Figure 1. On-Region Characteristics.

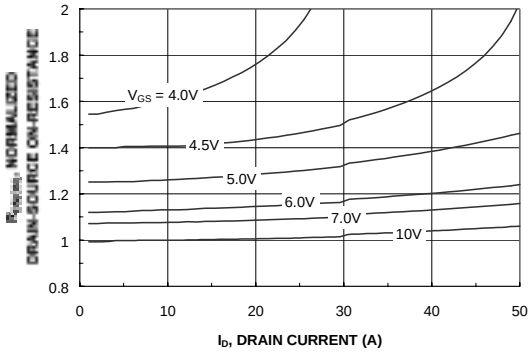


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

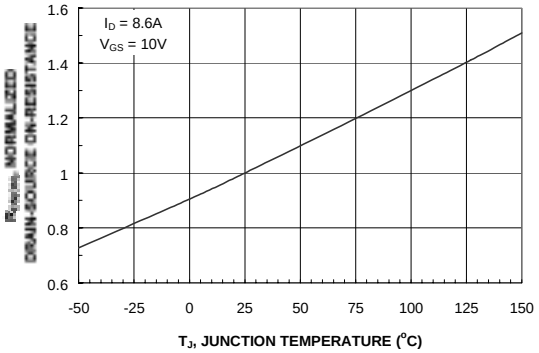


Figure 3. On-Resistance Variation with Temperature.

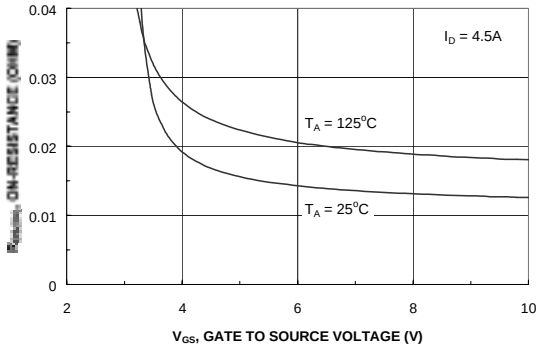


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

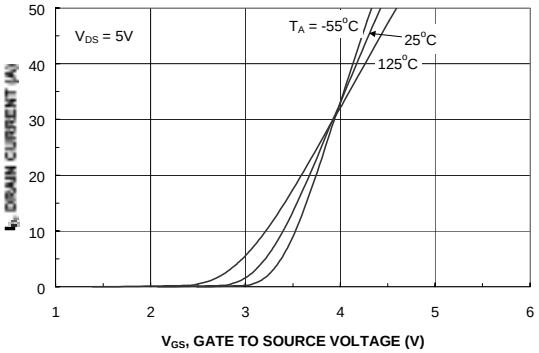


Figure 5. Transfer Characteristics.

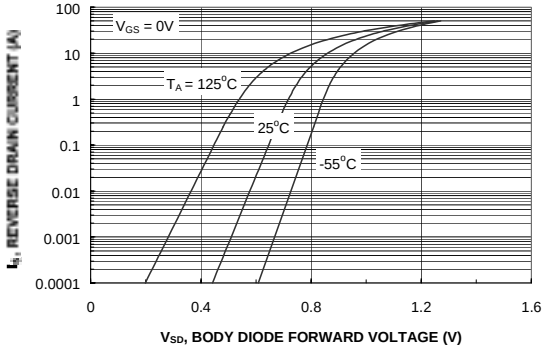


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: Q2 (continued)

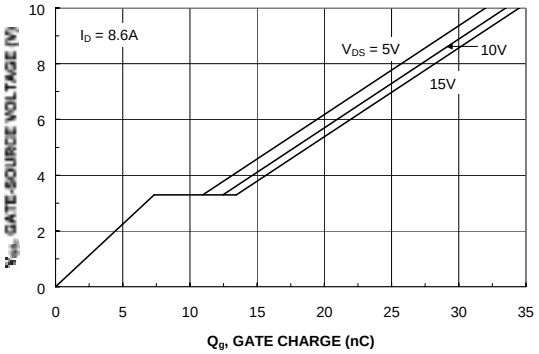


Figure 7. Gate-Charge Characteristics.

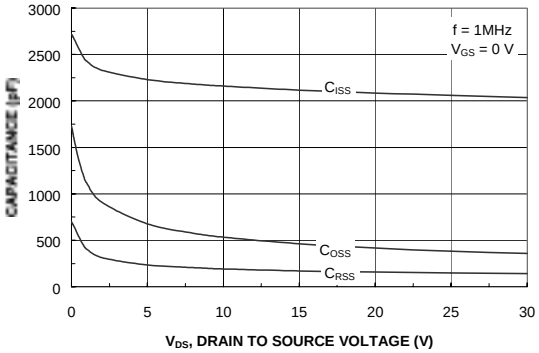


Figure 8. Capacitance Characteristics.

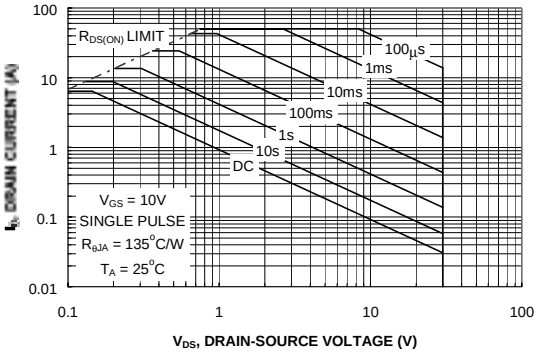


Figure 9. Maximum Safe Operating Area.

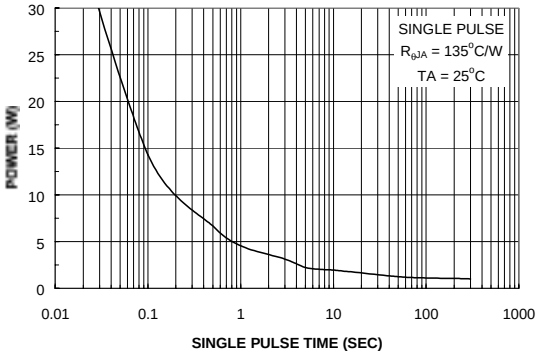


Figure 10. Single Pulse Maximum Power Dissipation.

Typical Characteristics: Q1

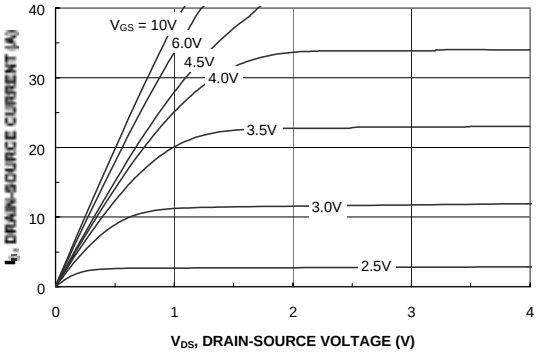


Figure 11. On-Region Characteristics.

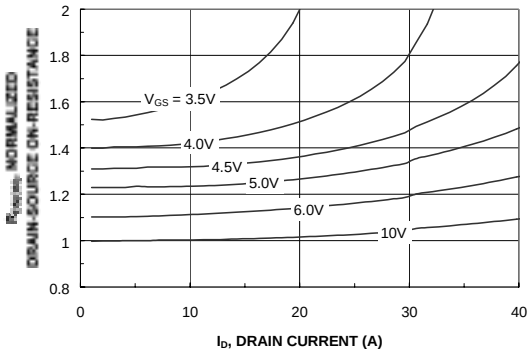


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

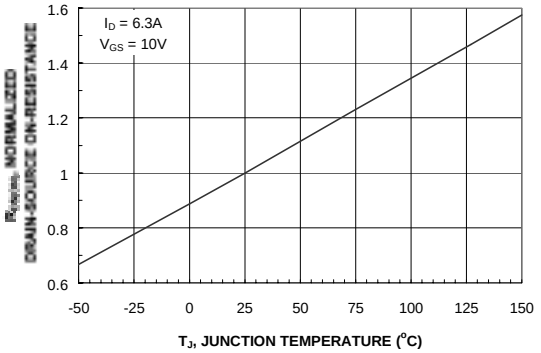


Figure 13. On-Resistance Variation with Temperature.

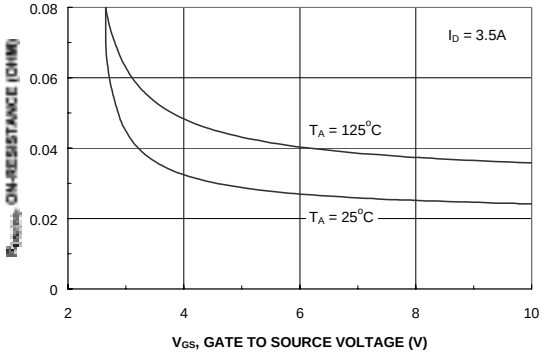


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

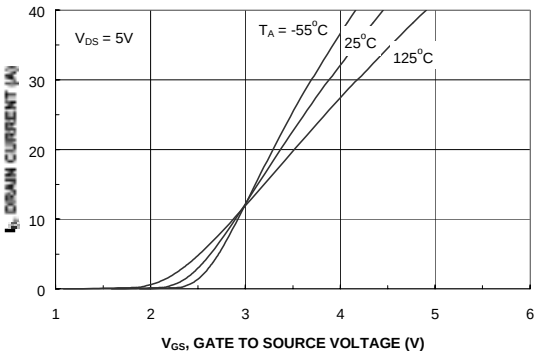


Figure 15. Transfer Characteristics.

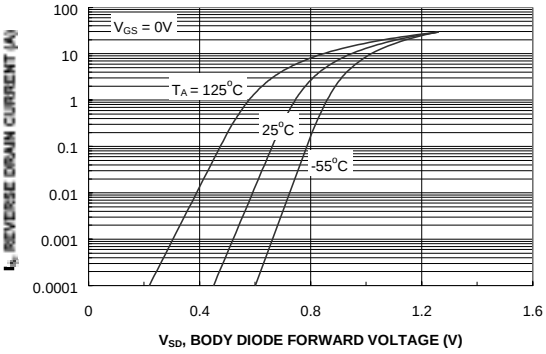


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: Q1 (continued)

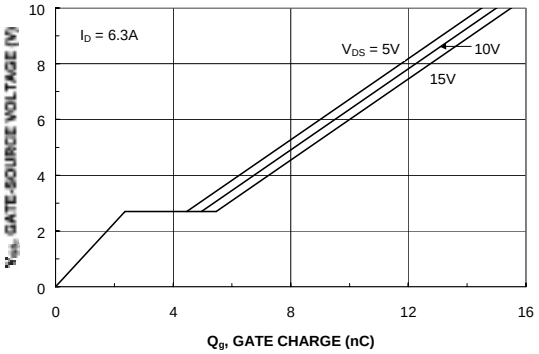


Figure 17. Gate-Charge Characteristics.

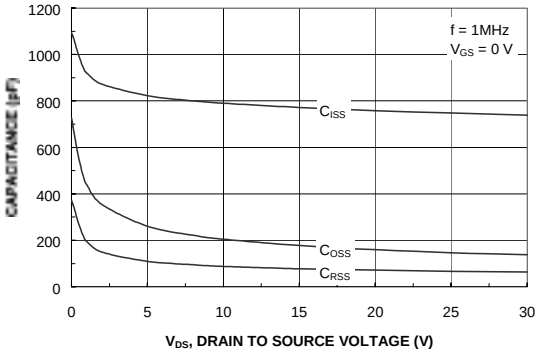


Figure 18. Capacitance Characteristics.

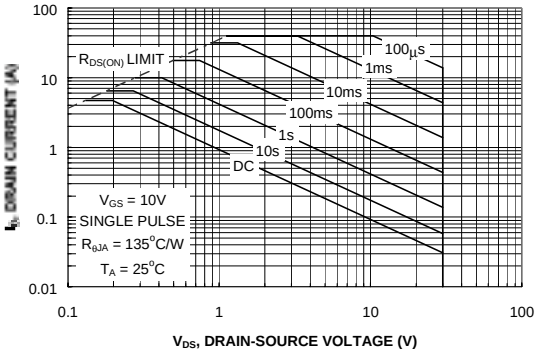


Figure 19. Maximum Safe Operating Area.

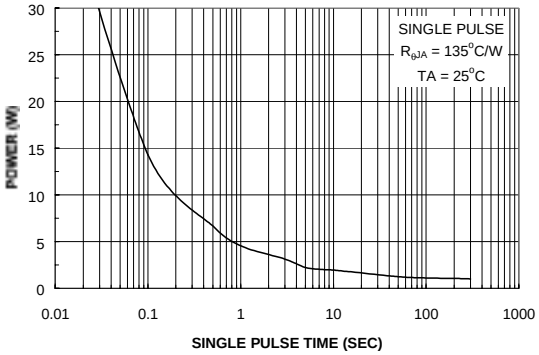


Figure 20. Single Pulse Maximum Power Dissipation.

Typical Characteristics: Q1 & Q2 (continued)

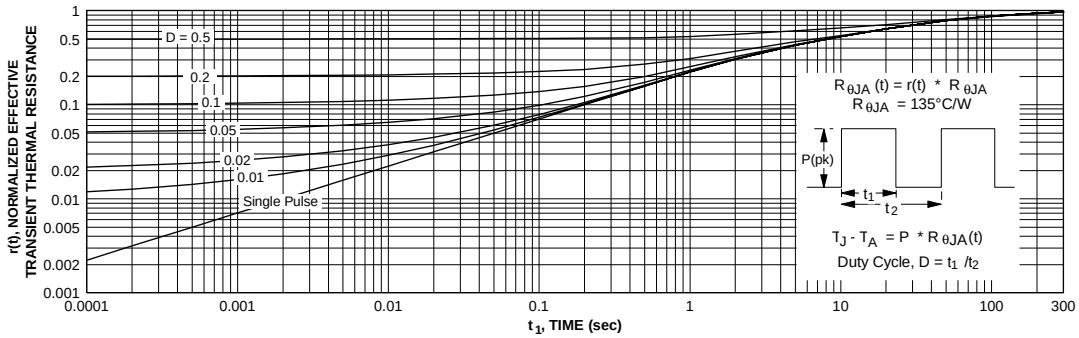


Figure 21. Transient Thermal Response Curve.

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