

**FAIRCHILD**  
SEMICONDUCTOR®

May 2007

# FDS8984

## N-Channel PowerTrench® MOSFET

30V, 7A, 23mΩ

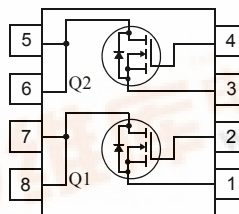
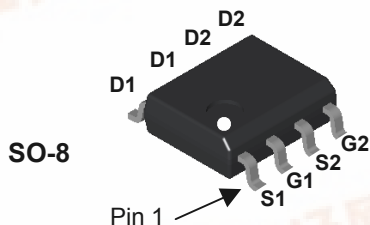
### General Description

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. It has been optimized for low gate charge, low  $r_{DS(ON)}$  and fast switching speed.



### Features

- Max  $r_{DS(on)}$  = 23mΩ,  $V_{GS}$  = 10V,  $I_D$  = 7A
- Max  $r_{DS(on)}$  = 30mΩ,  $V_{GS}$  = 4.5V,  $I_D$  = 6A
- Low gate charge
- 100%  $R_G$  tested
- RoHS Compliant



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current Continuous (Note 1a)	7	A
	Pulsed	30	A
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	32	mJ
$P_D$	Power Dissipation for Single Operation	1.6	W
	Derate above $25^\circ\text{C}$	13	mW/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature	-55 to 150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	78	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	40	$^\circ\text{C/W}$

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS8984	FDS8984	SO-8	330mm	12mm	2500 units

FDS8984 N-Channel PowerTrench® MOSFET

**Electrical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		23		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}$ $V_{GS} = 0\text{V}$ $T_J = 125^\circ\text{C}$			1 250	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$			$\pm 100$	nA

**On Characteristics (Note 3)**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	1.2	1.7	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		- 4.3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{V}$ , $I_D = 7\text{A}$		19	23	m $\Omega$
		$V_{GS} = 4.5\text{V}$ , $I_D = 6\text{A}$		24	30	
		$V_{GS} = 10\text{V}$ , $I_D = 7\text{A}$ , $T_J = 125^\circ\text{C}$		26	32	

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ , $f = 1.0\text{MHz}$		475	635	pF
$C_{oss}$	Output Capacitance			100	135	pF
$C_{rss}$	Reverse Transfer Capacitance			65	100	pF
$R_G$	Gate Resistance	$f = 1\text{MHz}$		0.9	1.6	$\Omega$

**Switching Characteristics (Note 3)**

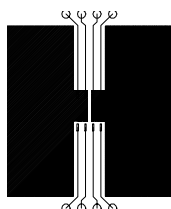
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{V}$ , $I_D = 7\text{A}$ $V_{GS} = 10\text{V}$ , $R_{GS} = 33\Omega$		5	10	ns
$t_r$	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			42	68	ns
$t_f$	Fall Time			21	34	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{V}$ , $V_{GS} = 10\text{V}$ , $I_D = 7\text{A}$		9.2	13	nC
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{V}$ , $V_{GS} = 5\text{V}$ , $I_D = 7\text{A}$		5.0	7	nC
$Q_{gs}$	Gate to Source Gate Charge	$I_D = 7\text{A}$		1.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2.0		nC

**Drain-Source Diode Characteristics**

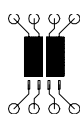
$V_{SD}$	Source to Drain Diode Voltage	$I_{SD} = 7\text{A}$		0.9	1.25	V
		$I_{SD} = 2.1\text{A}$		0.8	1.0	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 7\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$			33	ns
$Q_{rr}$	Diode Reverse Recovery Charge				20	nC

**Notes:**

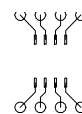
1:  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $78^\circ\text{C}/\text{W}$  when mounted on a  $0.5\text{in}^2$  pad of 2 oz copper



b)  $125^\circ\text{C}/\text{W}$  when mounted on a  $0.02\text{in}^2$  pad of 1 oz copper



c)  $135^\circ\text{C}/\text{W}$  when mounted on a minimum pad

Scale 1 : 1 on letter size paper

2: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1\text{mH}$ ,  $I_{AS} = 8\text{A}$ ,  $V_{DD} = 27\text{V}$ ,  $V_{GS} = 10\text{V}$ .  
3: Pulse Test: Pulse Width  $< 300\mu\text{s}$ , Duty Cycle  $< 2\%$ .

## Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

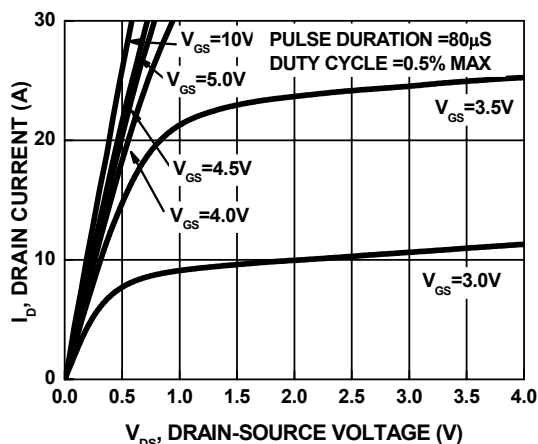


Figure 1. On Region Characteristics

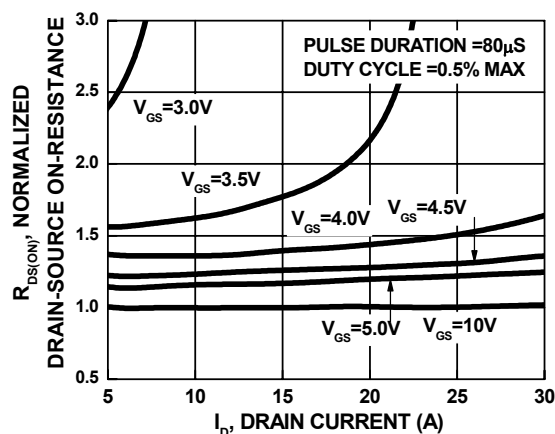


Figure 2. On-Resistance vs Drain Current and Gate Voltage

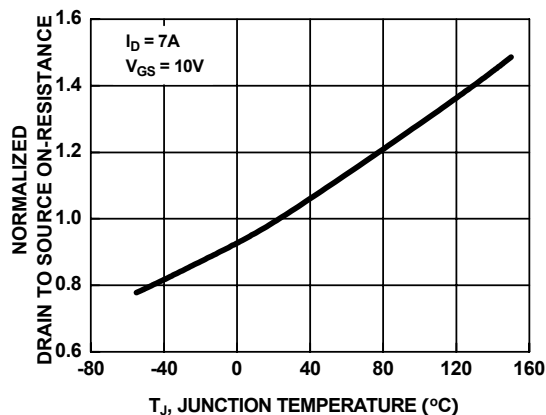


Figure 3. On Resistance vs Temperature

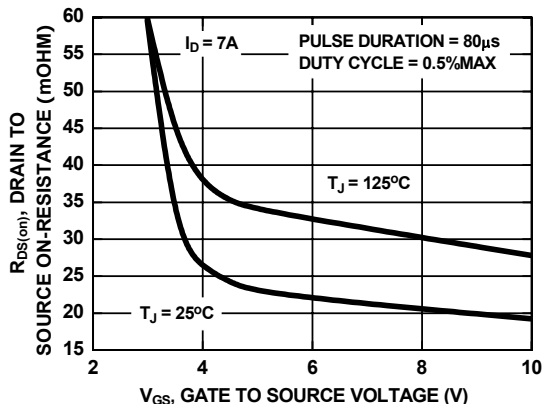


Figure 4. On-Resistance vs Gate to Source Voltage

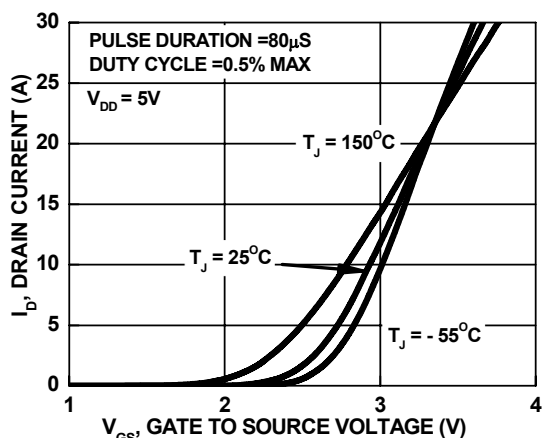


Figure 5. Transfer Characteristics

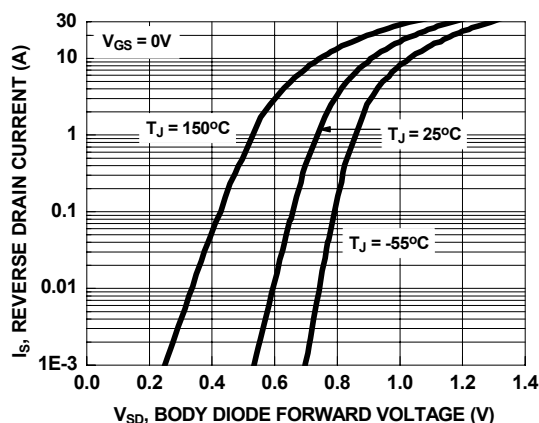


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

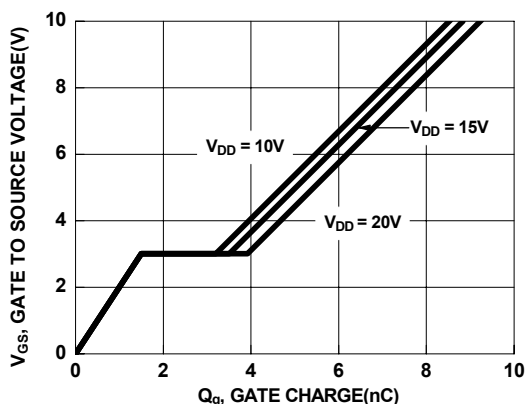


Figure 7. Gate Charge Characteristics

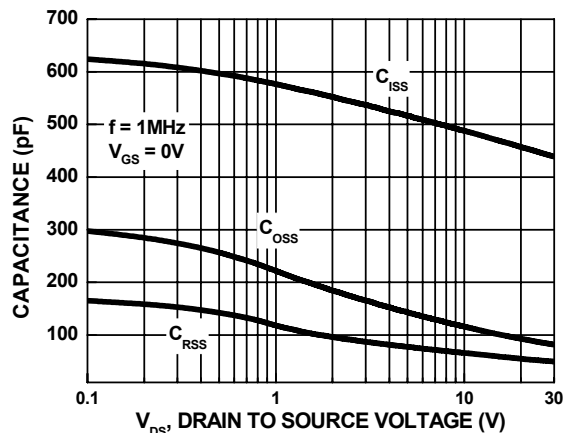


Figure 8. Capacitance vs Drain to Source Voltage

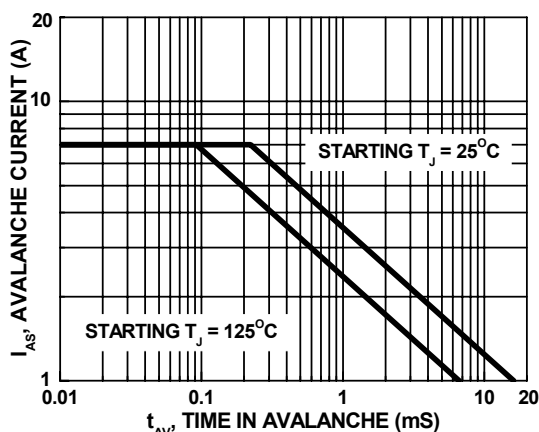


Figure 9. Unclamped Inductive Switching Capability

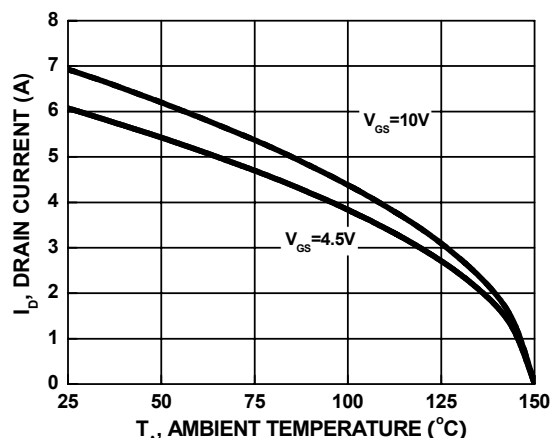


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

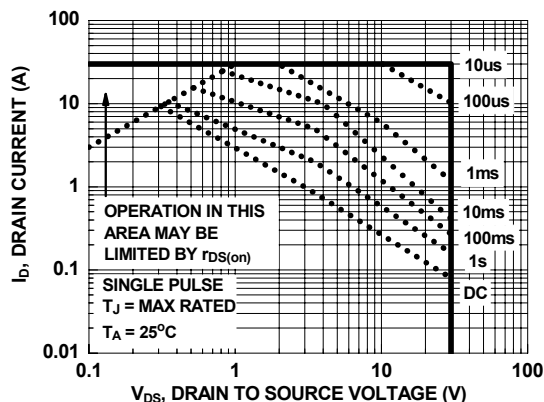


Figure 11. Forward Bias Safe Operating Area

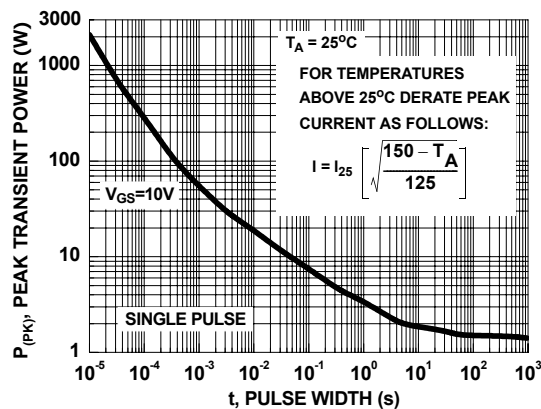


Figure 12. Single Pulse Maximum Power Dissipation

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

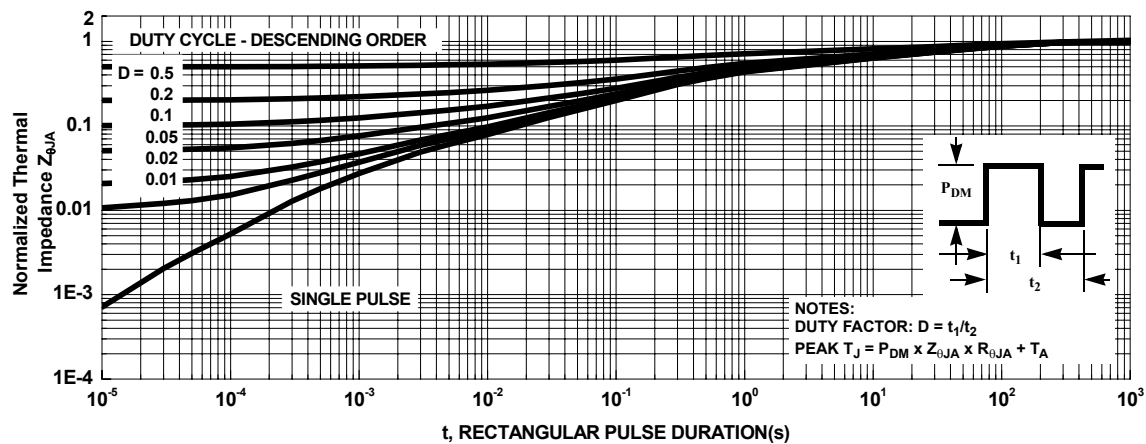


Figure 13. Transient Thermal Response Curve



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