



OCTOBER 2001

## FDS6898A

### Dual N-Channel Logic Level PWM Optimized PowerTrench<sup>®</sup> MOSFET

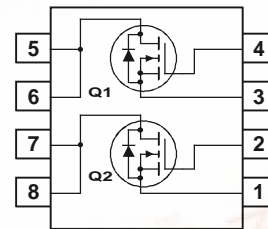
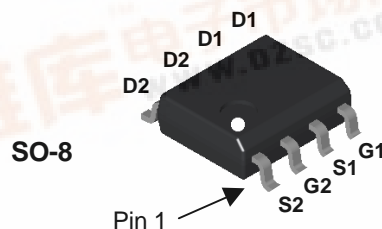
#### General Description

These N-Channel Logic Level MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

#### Features

- 9.4 A, 20 V  $R_{DS(ON)} = 14 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$   
 $R_{DS(ON)} = 18 \text{ m}\Omega @ V_{GS} = 2.5 \text{ V}$
- Low gate charge (16 nC typical)
- 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	20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Drain Current – Continuous (Note 1a)	9.4	A
	– Pulsed	38	
$P_D$	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 $+150$	$^\circ\text{C}$

#### 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	Reel Size	Tape width	Quantity
FDS6898A	FDS6898A	13"	12mm	2500 units



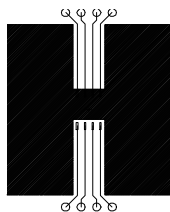
## Electrical Characteristics

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

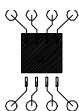
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
$BV_{DSS}$	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		21		mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$			1	μA
$I_{GSSF}$	Gate–Body Leakage, Forward	$V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate–Body Leakage, Reverse	$V_{GS} = -12\text{ V}, V_{DS} = 0\text{ V}$			–100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.5	1	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		–3.5		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 4.5\text{ V}, I_D = 9.4\text{ A}$ $V_{GS} = 2.5\text{ V}, I_D = 8.3\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 9.4\text{ A}, T_J = 125^\circ\text{C}$		10 13 14	14 18 21	mΩ
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$	19			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 9.4\text{ A}$		47		S
Dynamic Characteristics						
$C_{iss}$	Input Capacitance	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		1821		pF
$C_{oss}$	Output Capacitance			440		pF
$C_{rss}$	Reverse Transfer Capacitance			208		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = 10\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$		10	20	ns
$t_r$	Turn–On Rise Time			15	27	ns
$t_{d(off)}$	Turn–Off Delay Time			34	55	ns
$t_f$	Turn–Off Fall Time			16	29	ns
$Q_g$	Total Gate Charge	$V_{DS} = 10\text{ V}, I_D = 9.4\text{ A},$ $V_{GS} = 4.5\text{ V}$		16	23	nC
$Q_{gs}$	Gate–Source Charge			3		nC
$Q_{gd}$	Gate–Drain Charge			4		nC
Drain–Source Diode Characteristics and Maximum Ratings						
$I_S$	Maximum Continuous Drain–Source Diode Forward Current				1.3	A
$V_{SD}$	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2)		0.7	1.2	V

### Notes:

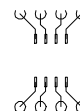
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



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



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



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

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%

3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied

# Typical Characteristics

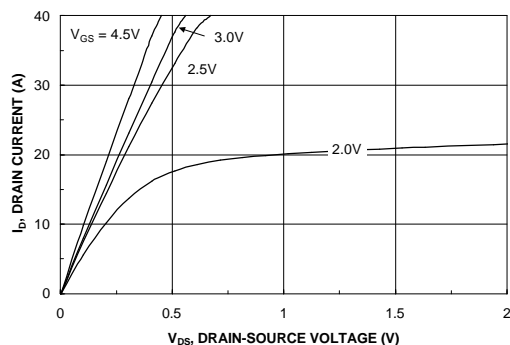


Figure 1. On-Region Characteristics.

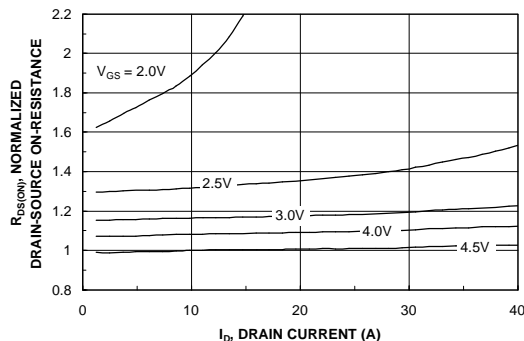


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

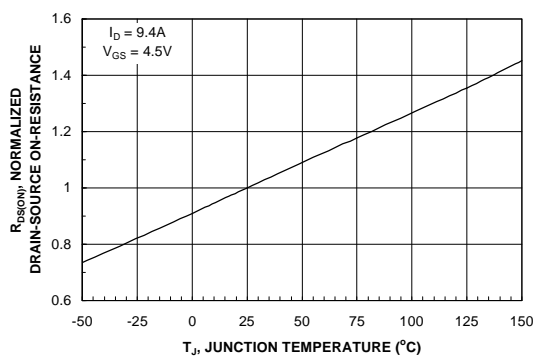


Figure 3. On-Resistance Variation with Temperature.

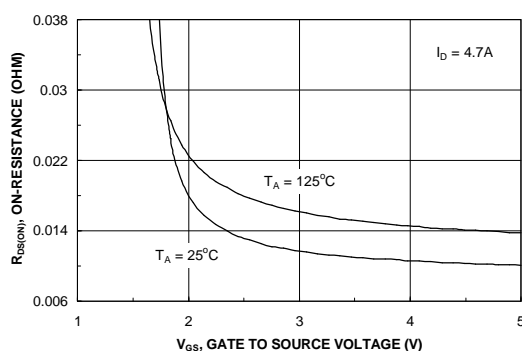


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

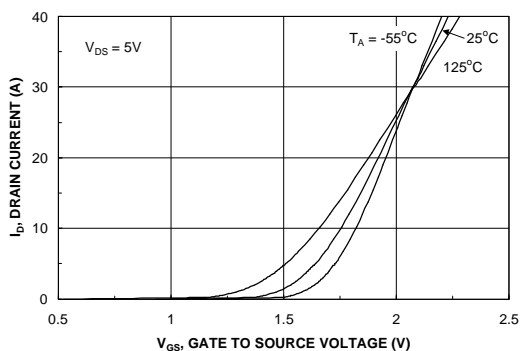


Figure 5. Transfer Characteristics.

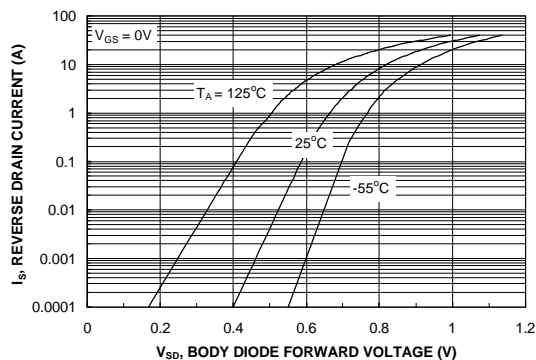


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

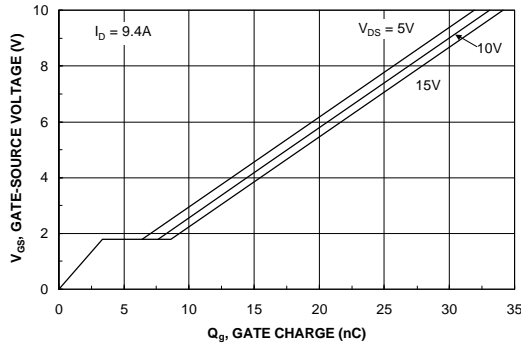


Figure 7. Gate Charge Characteristics.

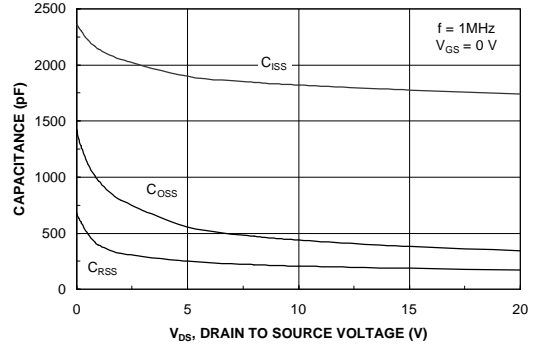


Figure 8. Capacitance Characteristics.

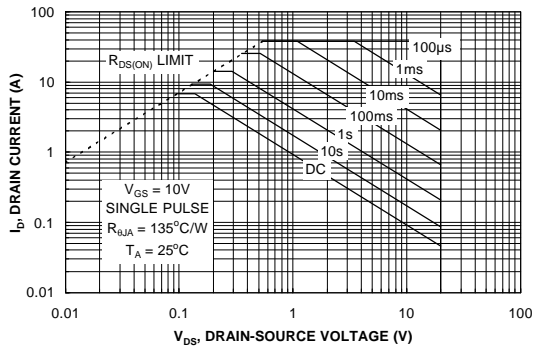


Figure 9. Maximum Safe Operating Area.

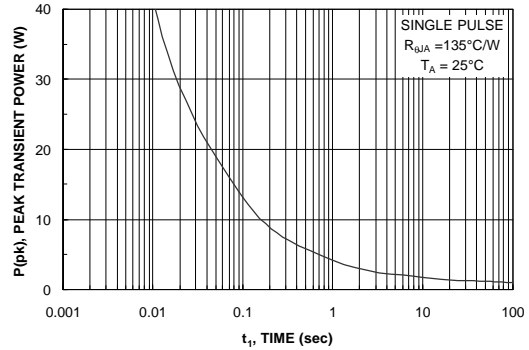


Figure 10. Single Pulse Maximum Power Dissipation.

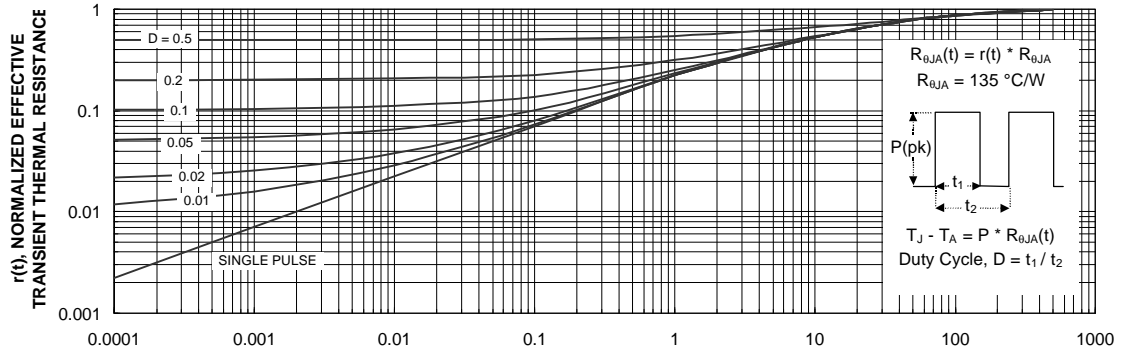


Figure 11. Transient Thermal Response Curve.

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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