

SI3948DV

Dual N-Channel Logic Level PowerTrench MOSFET

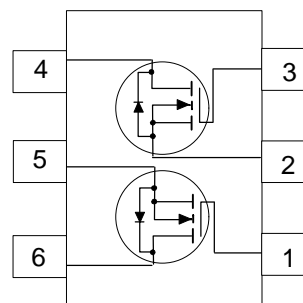
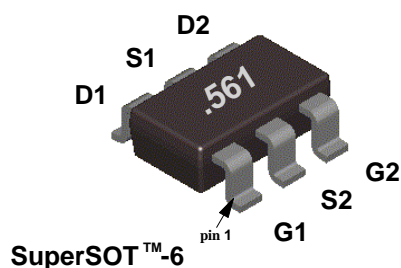
General Description

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 low gate charge for superior switching performance.

These devices are well suited for all applications where small size is desirable but especially low cost DC/DC conversion in battery powered systems.

Features

- 2.5 A, 30 V. $R_{DS(ON)} = 0.095 \Omega$ @ $V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 0.145 \Omega$ @ $V_{GS} = 4.5 \text{ V}$
- Very fast switching.
- Low gate charge (2.1nC typical).
- SuperSOT™-6 package: small footprint (72% smaller than standard SO-8); low profile (1mm thick).



Absolute Maximum Ratings

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

Symbol	Parameter	Ratings	Units
V_{DS}	Drain-Source Voltage	30	V
V_{GS}	Gate-Source Voltage - Continuous	± 20	V
I_D	Drain Current - Continuous - Pulsed	2.5	A
		10	
P_D	Maximum Power Dissipation (Note 1a) (Note 1b) (Note 1c)	0.96	W
		0.9	
		0.7	
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	130	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	60	$^\circ\text{C/W}$

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		23.6		$\text{mV}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$T_J = 55^\circ\text{C}$			10	μA
I_{GSSF}	Gate - Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

ON CHARACTERISTICS (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1	1.8	3	V
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		-4		$\text{mV}/^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$		0.082	0.095	Ω
		$T_J = 125^\circ\text{C}$		0.122	0.152	
		$V_{GS} = 4.5\text{ V}, I_D = 2.0\text{ A}$		0.113	0.145	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	10			A
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 2.5\text{ A}$		5		S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		220		pF
C_{oss}	Output Capacitance			50		pF
C_{rss}	Reverse Transfer Capacitance			25		pF

SWITCHING CHARACTERISTICS (Note 2)

$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = 5\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		6	12	ns
t_r	Turn - On Rise Time			10	18	ns
$t_{D(off)}$	Turn - Off Delay Time			12	22	ns
t_f	Turn - Off Fall Time			2	6	ns
Q_g	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 2.5\text{ A}$ $V_{GS} = 5\text{ V}$		2.3	3.2	nC
Q_{gs}	Gate-Source Charge			0.7	1	nC
Q_{gd}	Gate-Drain Charge			0.9	1.3	nC

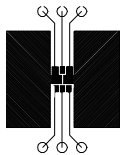
DRAIN-SOURCE DIODE CHARACTERISTICS

I_S	Continuous Source Diode Current				0.75	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 0.75\text{ A}$ (Note 2)		0.78	1.2	V

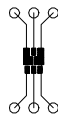
Notes:

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 $R_{\theta JA}$ is determined by the user's board design.

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



a. $130^\circ\text{C}/\text{W}$ on a 0.125 in^2 pad of 2oz copper.



b. $140^\circ\text{C}/\text{W}$ on a 0.005 in^2 pad of 2oz copper.



c. $180^\circ\text{C}/\text{W}$ on a minimum pad.

Typical Electrical Characteristics

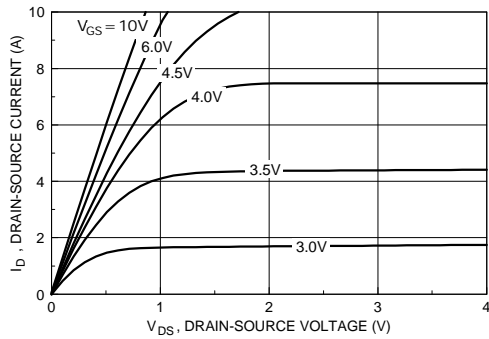


Figure 1. On-Region Characteristics.

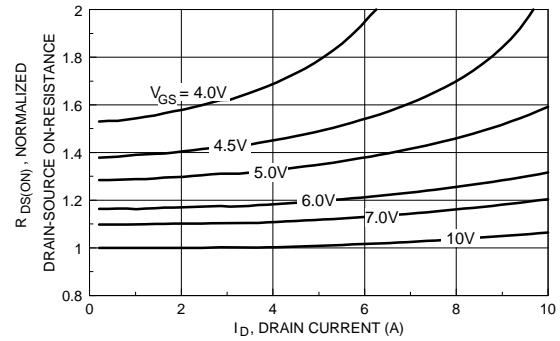


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

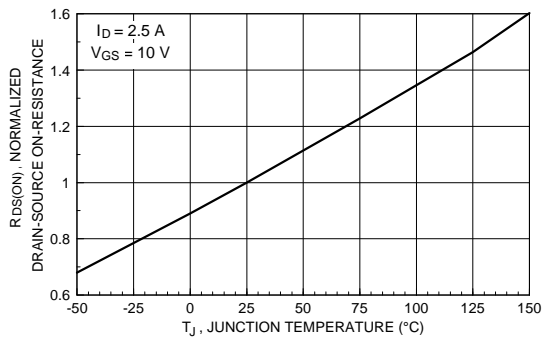


Figure 3. On-Resistance Variation with Temperature.

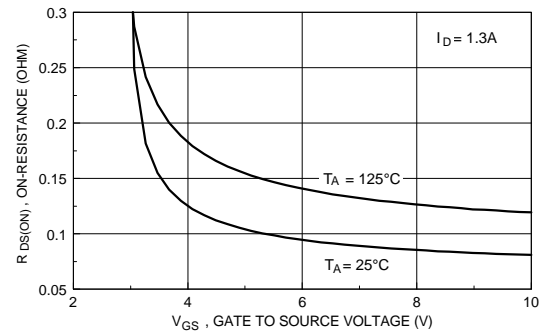


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

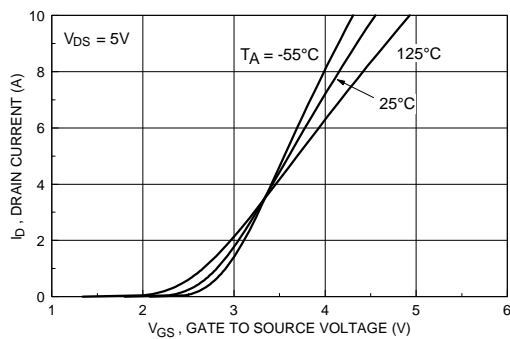


Figure 5. Transfer Characteristics.

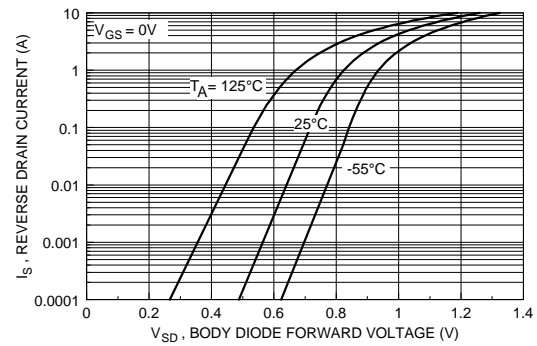


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics (continued)

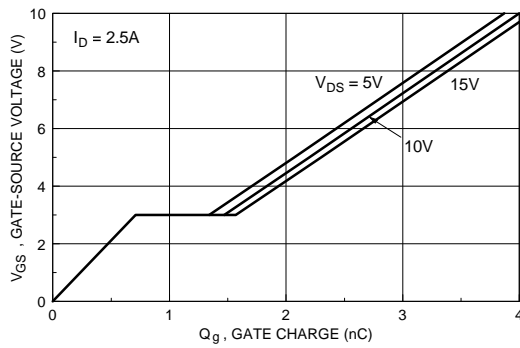


Figure 7. Gate Charge Characteristics.

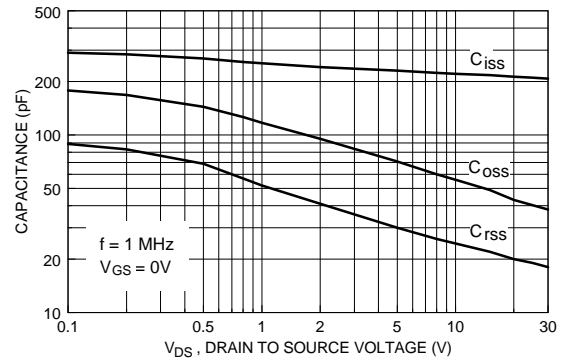


Figure 8. Capacitance Characteristics.

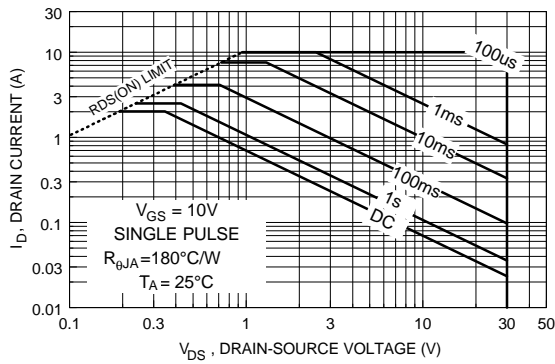


Figure 9. Maximum Safe Operating Area.

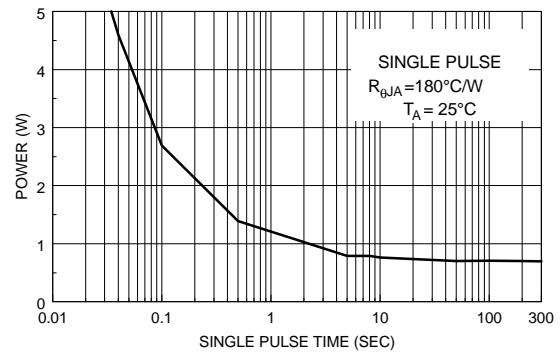


Figure 10. Single Pulse Maximum Power Dissipation.

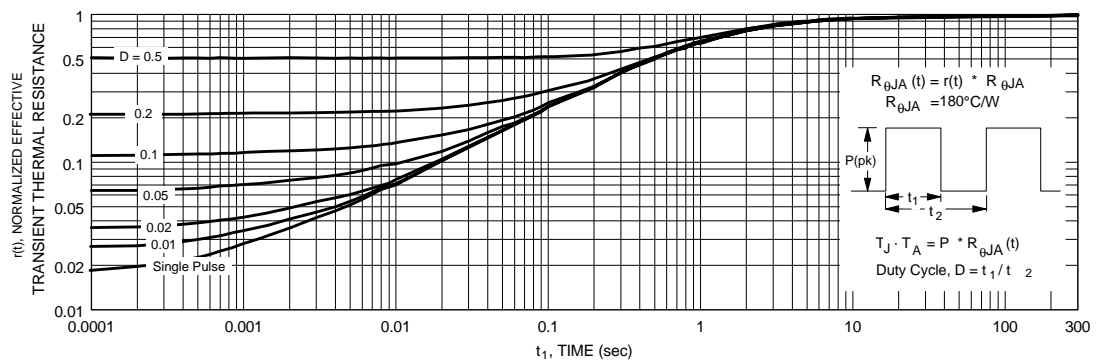


Figure 11. Transient Thermal Response Curve.

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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