FAIRCHILD

SEMICONDUCTOR ™

Si9424DY

Single P-Channel 2.5V Specified PowerTrench   MOSFET

General Description

This P-Channel 2.5V specified MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize 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.

Applications

- DC/DC converter
- Load switch
- Battery Protection

Features

- -8.0 A, -20 V. $R_{DS(on)} = 0.024\ \Omega$ @ $V_{GS} = -4.5$ V

  $R_{DS(on)} = 0.032\ \Omega$ @ $V_{GS} = -2.5$ V.

- Low gate charge (23nC typical).

- Fast switching speed.

- High performance trench technology for extremely low $R_{DS(ON)}$.

- High power and current handling capability.

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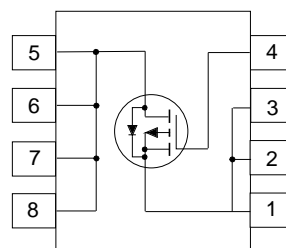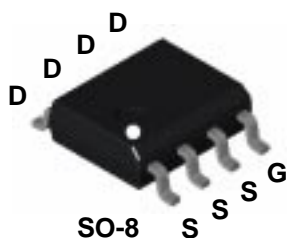
Absolute Maximum Ratings $T_A = 25°C$ unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		-20	V
V_{GSS}	Gate-Source Voltage		± 10	V
I_D	Drain Current - Continuous	(Note 1a)	-8.0	A
	- Pulsed		-50	
P_D	Power Dissipation for Single Operation	(Note 1a)	2.5	W
		(Note 1b)	1.2	
		(Note 1c)	1	
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	°C/W

Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
9424	Si9424DY	13''	12mm	2500 units

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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	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = -250 μA, Referenced to 25°C		-24		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -16 V, V_{GS} = 0 V			-1	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 10 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -10 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	-0.4	-0.8	-1.5	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} = -4.5 V, I_D = -8 A V_{GS} = -4.5 V, I_D = -8 A ,T_J=125°C V_{GS} = -2.5 V, I_D = -7 A		0.019 0.026 0.027	0.024 0.039 0.032	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = -4.5 V, V_{DS} = -5.0 V	-50			A
g_{FS}	Forward Transconductance	V_{DS} = -5 V, I_D = -8 A		28		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = -10 V, V_{GS} = 0 V, f = 1.0 MHz		2260		pF
C_{oss}	Output Capacitance			500		pF
C_{rss}	Reverse Transfer Capacitance			205		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -10 V, I_D = -1 A, V_{GS} = -4.5 V, R_{GEN} = 6 Ω		8	16	ns
t_r	Turn-On Rise Time			15	27	ns
$t_{d(off)}$	Turn-Off Delay Time			98	135	ns
t_f	Turn-Off Fall Time			35	55	ns
Q_g	Total Gate Charge	V_{DS} = -10 V, I_D = -8 A, V_{GS} = -5 V,		23	33	nC
Q_{gs}	Gate-Source Charge			5.5		nC
Q_{gd}	Gate-Drain Charge			4		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				-2.1	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = -2.1 A (Note 2)		-0.75	-1.2	V

Notes:

1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient 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.
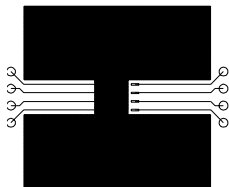
a) 50° C/W when mounted on a 0.5 in² pad of 2 oz. copper.
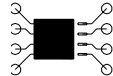
b) 105° C/W when mounted on a 0.02 in² pad of 2 oz. copper.
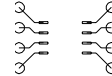
c) 125° C/W when mounted on a 0.003 in² pad of 2 oz. copper.

Scale 1 : 1 on letter size paper

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

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Typical Characteristics
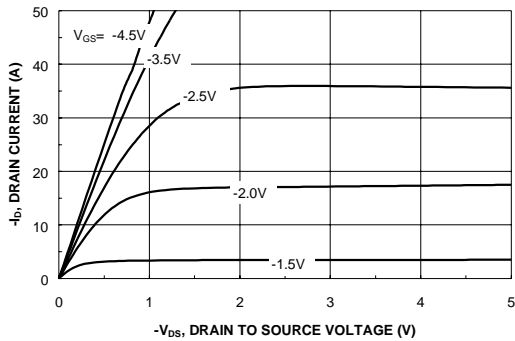
Figure 1. On-Region Characteristics.

V_GS= -4.5V
-3.5V
-2.5V
-2.0V
-1.5V

-I_D, DRAIN CURRENT (A)
-V_DS, DRAIN TO SOURCE VOLTAGE (V)
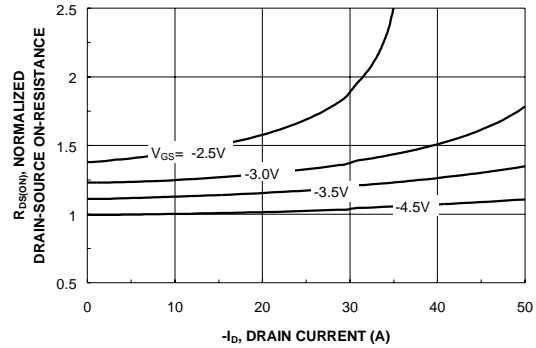
Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

V_GS= -2.5V
-3.0V
-3.5V
-4.5V

R_DS(ON), NORMALIZED DRAIN-SOURCE ON-RESISTANCE
-I_D, DRAIN CURRENT (A)
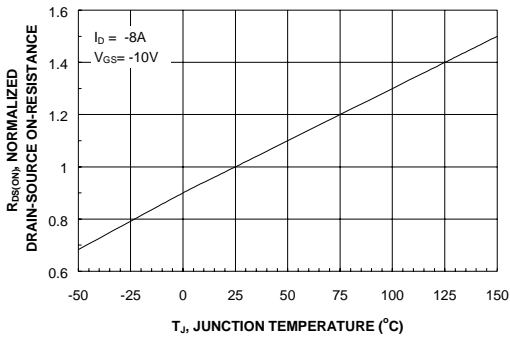
Figure 3. On-Resistance Variation with Temperature.

I_D = -8A
V_GS= -10V

R_DS(ON), NORMALIZED DRAIN-SOURCE ON-RESISTANCE
T_J, JUNCTION TEMPERATURE (°C)
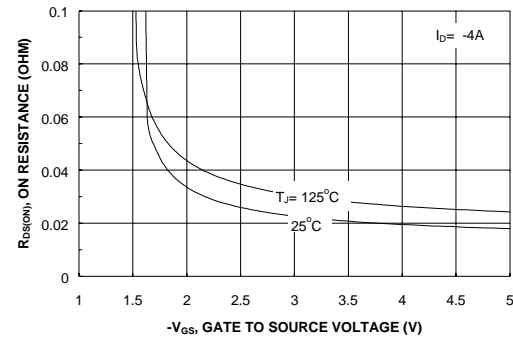
Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

I_D= -4A
T_J= 125°C
25°C

R_DS(ON), ON RESISTANCE (OHM)
-V_GS, GATE TO SOURCE VOLTAGE (V)
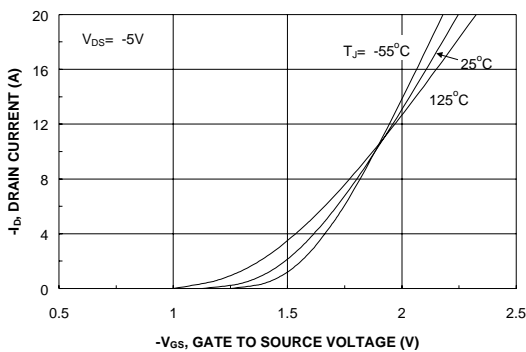
Figure 5. Transfer Characteristics.

V_DS= -5V
T_J= -55°C
25°C
125°C

-I_D, DRAIN CURRENT (A)
-V_GS, GATE TO SOURCE VOLTAGE (V)
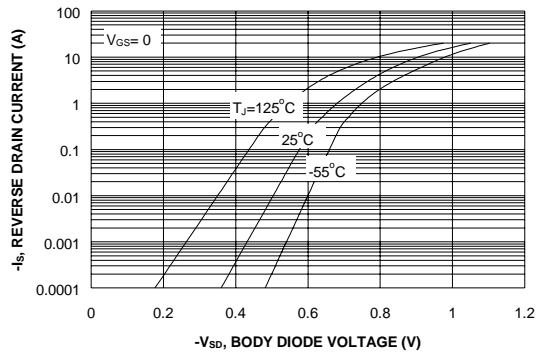
Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

V_GS= 0
T_J=125°C
25°C
-55°C

-I_S, REVERSE DRAIN CURRENT (A)
-V_SD, BODY DIODE VOLTAGE (V)

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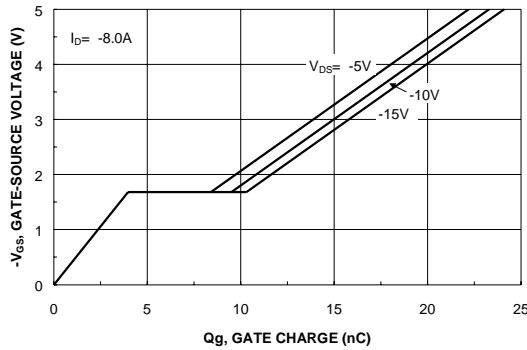## Typical Characteristics (continued)

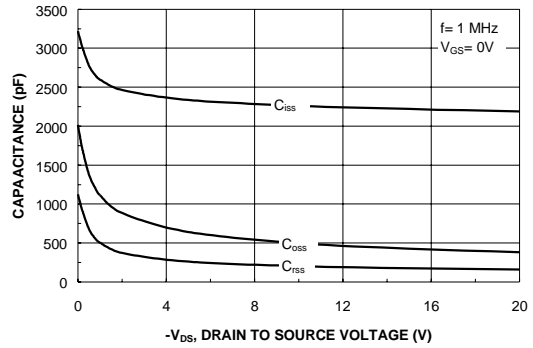**Figure 7. Gate Charge Characteristics.**

Figure 8. Capacitance Characteristics.
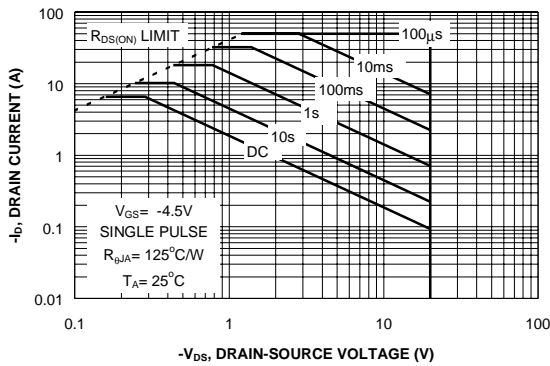

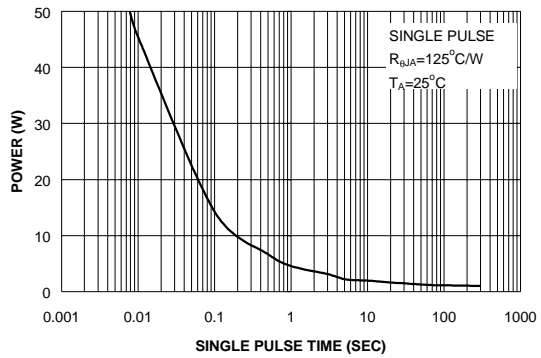**Figure 9. Maximum Safe Operating Area.**

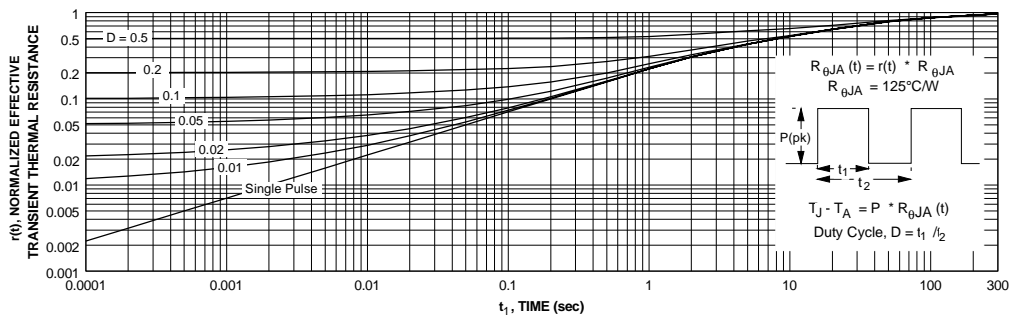**Figure 10. Single Pulse Maximum Power Dissipation.**

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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E²CMOS™	MICROWIRE™	SILENT SWITCHER ®	
EnSigna™	OPTOLOGIC™	SMART START™	
FACT™	OPTOPLANAR™	SuperSOT™-3	
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