FAIRCHILD SEMICONDUCTOR™

April 2001

Si6923DQ

P-Channel 2.5V Specified PowerTrench® MOSFET with Schottky Diode

General Description

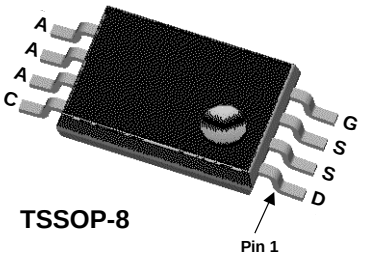
This P-Channel 2.5V specified MOSFET is a rugged gate version of Fairchild Semiconductor's advanced PowerTrench process. It is combined with a low forward drop Schottky diode which is isolated from the MOSFET, providing a compact power solution for asynchronous DC/DC converter applications.

Applications

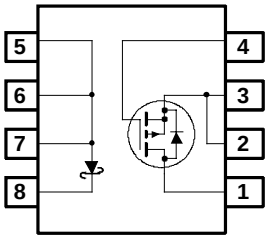
- DC/DC conversion

Features

- –3.5 A, –20 V. $R_{DS(ON)}$ = 0.045 Ω @ V_{GS} = –4.5 V
  $R_{DS(ON)}$ = 0.075 Ω @ V_{GS} = –2.5 V
- V_F < 0.55 V @ 1 A
- High performance trench technology for extremely low $R_{DS(ON)}$
- Low profile TSSOP-8 package



TSSOP-8



MOSFET 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	± 12	V
I_D	Drain Current – Continuous (Note 1)	–3.5	A
	– Pulsed	–30	
P_D	MOSFET Power Dissipation (minimum pad) (Note 1) Schottky Power Dissipation (minimum pad) (Note 1)	1.2 1.0	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Schottky Maximum Ratings

V_{RRM}	Repetitive Peak Reverse Voltage	20	V
I_F	Average Forward Current	1.5	A
I_{FM}	Peak Forward Current	30	A

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (minimum pad) (Note 1)	MOSFET: 115 Schottky: 130	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
6923	Si6923DQ	13''	16mm	3000 units

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 to25°C			–16		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = –16 V, V_{GS} = 0 V				–1	µA
I_{GSSF}	Gate–Body Leakage, Forward	V_{GS} = –12 V, V_{DS} = 0 V				–100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	V_{GS} = 12 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		–0.6	–1.0	–1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = –250 µA, Referenced to25°C			3		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = –4.5 V, I_D = –3.5 A V_{GS} = –2.5 V, I_D = –2.7 A V_{GS}=–4.5 V, I_D =–3.5A, T_J=125°C			36 56 49	45 75 72	mΩ
$I_{D(on)}$	On–State Drain Current	V_{GS} = –4.5 V, V_{DS} = –5 V		–15			A
g_{FS}	Forward Transconductance	V_{DS} = –5 V, I_D = –3.5A			13.2		S
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = –10 V, V_{GS} = 0 V, f = 1.0 MHz			1015		pF
C_{oss}	Output Capacitance				446		pF
C_{rss}	Reverse Transfer Capacitance				118		pF
Switching Characteristics (Note 2)							
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = –5 V, I_D = –1 A, V_{GS} = –4.5 V, R_{GEN} = 6 Ω			11	20	ns
t_r	Turn–On Rise Time				18	32	ns
$t_{d(off)}$	Turn–Off Delay Time				34	55	ns
t_f	Turn–Off Fall Time				34	55	ns
Q_g	Total Gate Charge	V_{DS} = –5V, I_D = –3.5 A, V_{GS} = –4.5 V			9.7	16	nC
Q_{gs}	Gate–Source Charge				2.2		nC
Q_{gd}	Gate–Drain Charge				2.4		nC
Drain–Source Diode Characteristics and Maximum Ratings							
I_S	Maximum Continuous Drain–Source Diode Forward Current					–1.25	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = –1.25 A (Note 2)			–0.6	–1.2	V
I_{GSSR}	Gate–Body Leakage, Reverse	V_{GS} = 12 V, V_{DS} = 0 V				100	nA
Schottky Diode Characteristics							
I_R	Reverse Leakage	V_R = 20V	T_J=25°C		0.6	50	µA
			T_J=125°C		1	8	mA
V_F	Forward Voltage	I_F = 1A	T_J=25°C		0.48	0.55	V
			T_J=125°C		0.42	0.50	V
C_T	Junction Capacitance	V_R = 10V			50		pF

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.

$R_{\theta JA}$ is 115 °C/W for the MOSFET and 130°C/W for the Schottky Diode when mounted on a minimum pad.

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

Typical Characteristics

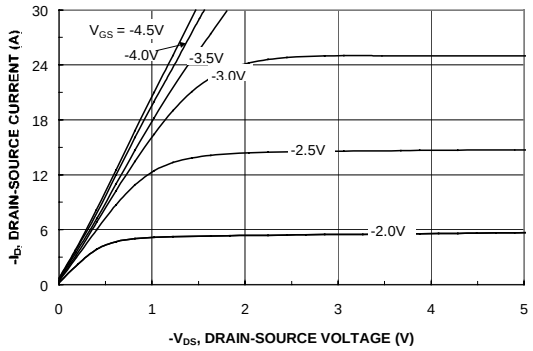


Figure 1. On-Region Characteristics.

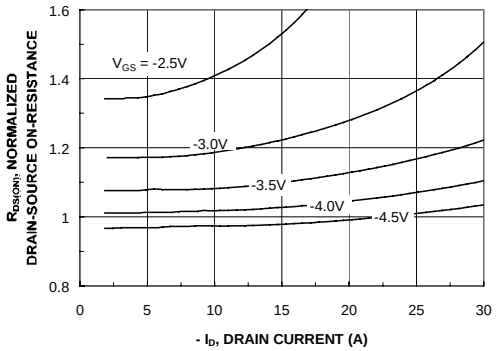


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

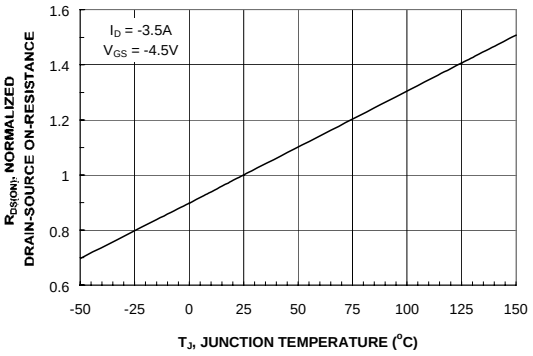


Figure 3. On-Resistance Variation with Temperature.

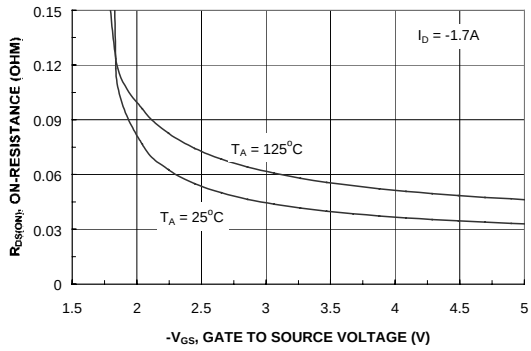


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

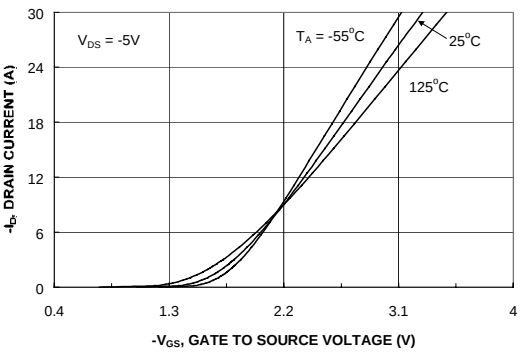


Figure 5. Transfer Characteristics.

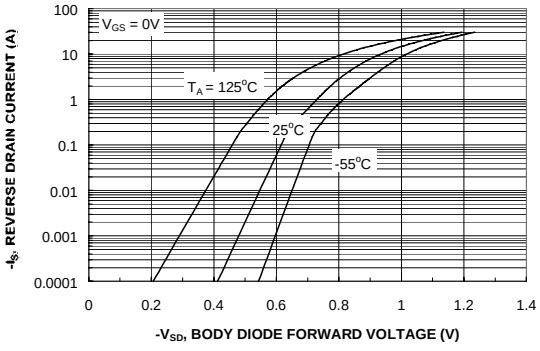


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

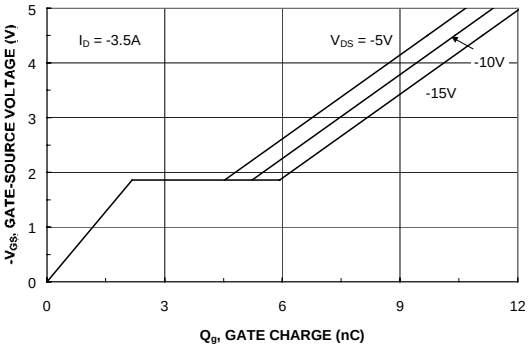


Figure 7. Gate Charge Characteristics.

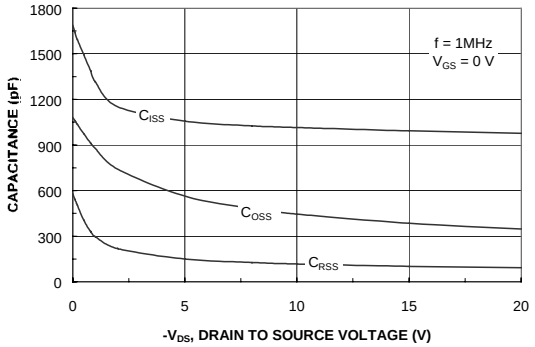


Figure 8. Capacitance Characteristics.

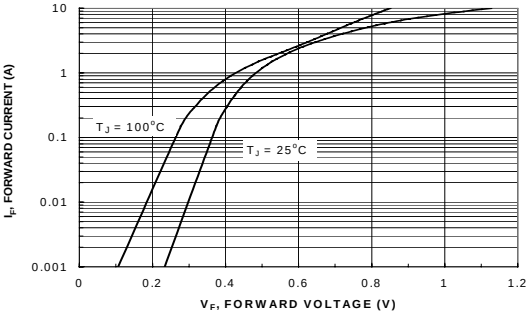


Figure 9. Schottky Diode Forward Voltage.

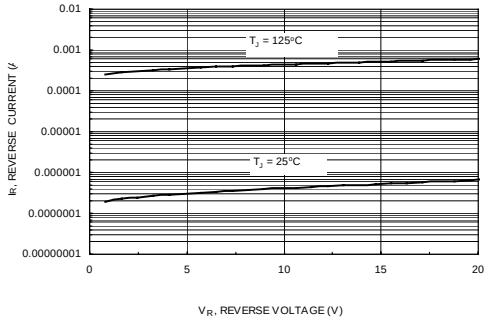


Figure 10. Schottky Diode Reverse Current.

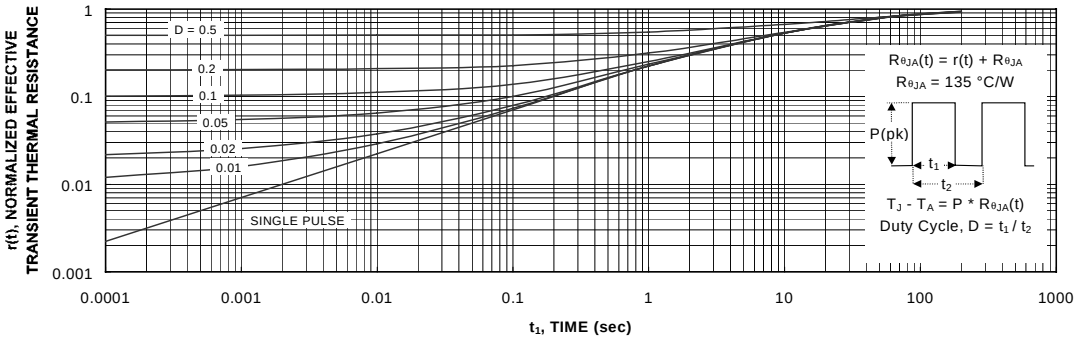


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1.
Transient thermal response will change depending on the circuit board design.