

# FDW6923

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

### General Description

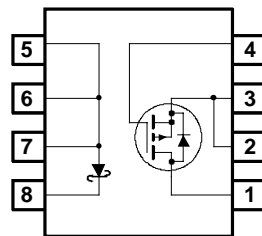
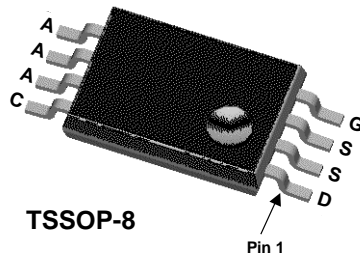
This P-Channel 2.5V specified MOSFET is a rugged gate version of Fairchild Semiconductor's advanced PowerTrench process. It is combined with a low forward drop Schottky diode which is isolated from the MOSFET, providing a compact power solution for asynchronous DC/DC converter applications.

### Applications

- DC/DC conversion

### Features

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



### MOSFET Absolute Maximum Ratings $T_A=25^\circ C$ 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 1)	-3.5	A
	– Pulsed	-30	
$P_D$	MOSFET Power Dissipation (minimum pad) (Note 1)	1.2	W
	Schottky Power Dissipation (minimum pad) (Note 1)	1.0	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ C$

### 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	$^\circ C/W$
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### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
6923	FDW6923	13"	16mm	2500 units

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

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

$BV_{DSS}$	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-16		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	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	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.6	-1.0	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		3		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}$ $V_{GS} = -2.5\text{ V}, I_D = -2.7\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}, T_J = 125^\circ\text{C}$		36 56 49	45 75 72	m $\Omega$
$I_{D(on)}$	On–State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-15			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -3.5\text{ A}$		13.2		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}$		1030		pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{ MHz}$		280		pF
$C_{riss}$	Reverse Transfer Capacitance			120		pF

**Switching Characteristics (Note 2)**

$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = -5\text{ V}, I_D = -1\text{ A}$		11	20	ns
$t_r$	Turn–On Rise Time	$V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		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	$V_{DS} = -5\text{ V}, I_D = -3.5\text{ A}$		9.7	16	nC
$Q_{gs}$	Gate–Source Charge	$V_{GS} = -4.5\text{ V}$		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	$V_{GS} = 0\text{ V}, I_S = -1.25\text{ A}$ (Note 2)	-0.6		-1.2	V
$I_{GSSR}$	Gate–Body Leakage, Reverse	$V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$			100	nA

**Schottky Diode Characteristics**

$I_R$	Reverse Leakage	$V_R = 20\text{ V}$	$T_J = 25^\circ\text{C}$	0.6	50	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$	1	8	mA
$V_F$	Forward Voltage	$I_F = 1\text{ A}$	$T_J = 25^\circ\text{C}$	0.48	0.55	V
			$T_J = 125^\circ\text{C}$	0.42	0.50	V
$C_T$	Junction Capacitance	$V_R = 10\text{ V}$		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  $^\circ\text{C}/\text{W}$  for the MOSFET and 130  $^\circ\text{C}/\text{W}$  for the Schottky Diode when mounted on a minimum pad.

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

## Typical Characteristics

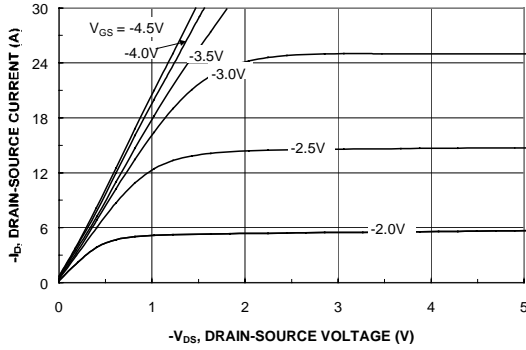


Figure 1. On-Region Characteristics.

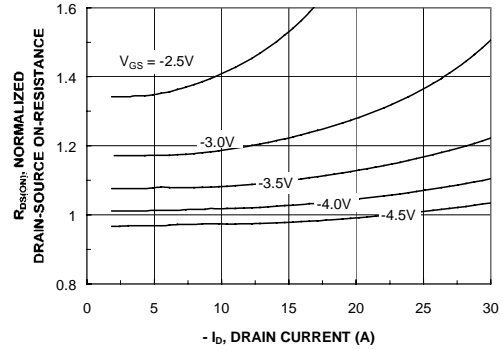


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

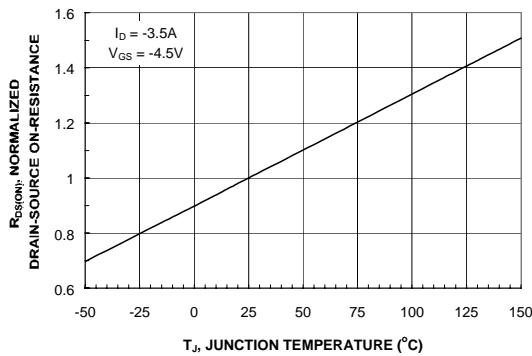


Figure 3. On-Resistance Variation with Temperature.

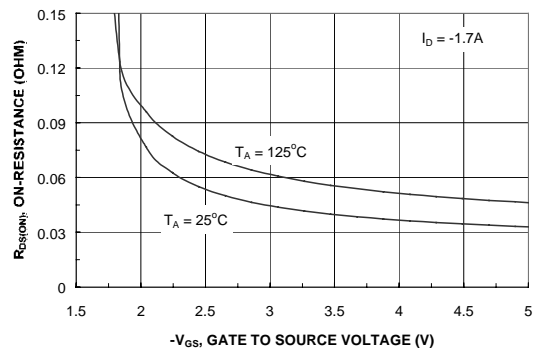


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

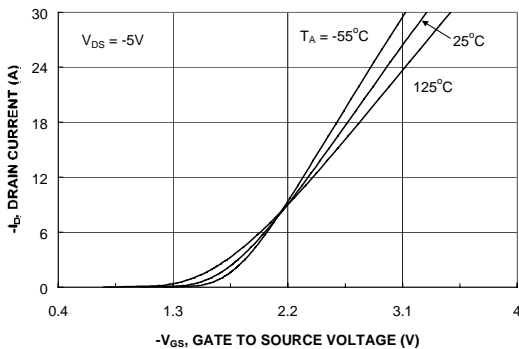


Figure 5. Transfer Characteristics.

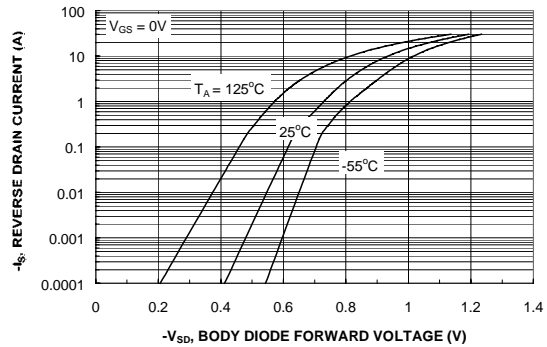


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

### Typical Characteristics

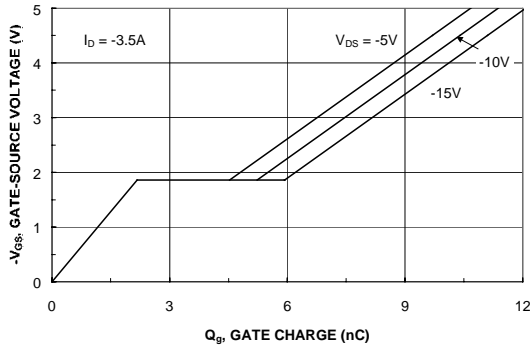


Figure 7. Gate Charge Characteristics.

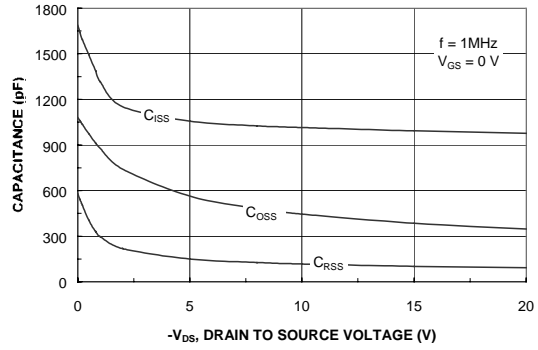


Figure 8. Capacitance Characteristics.

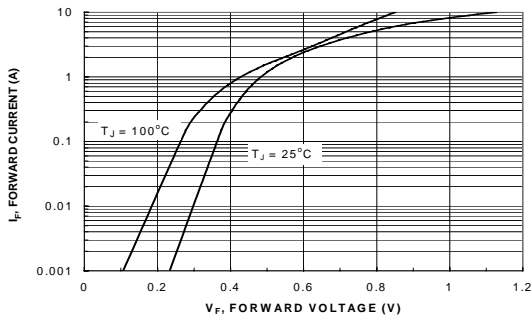


Figure 9. Schottky Diode Forward Voltage.

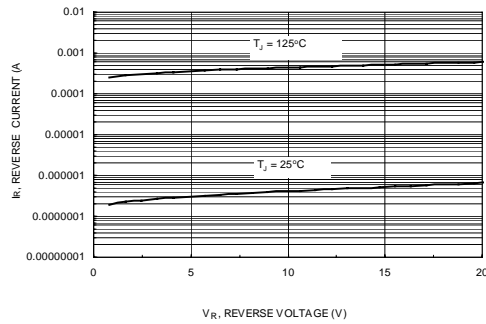


Figure 10. Schottky Diode Reverse Current.

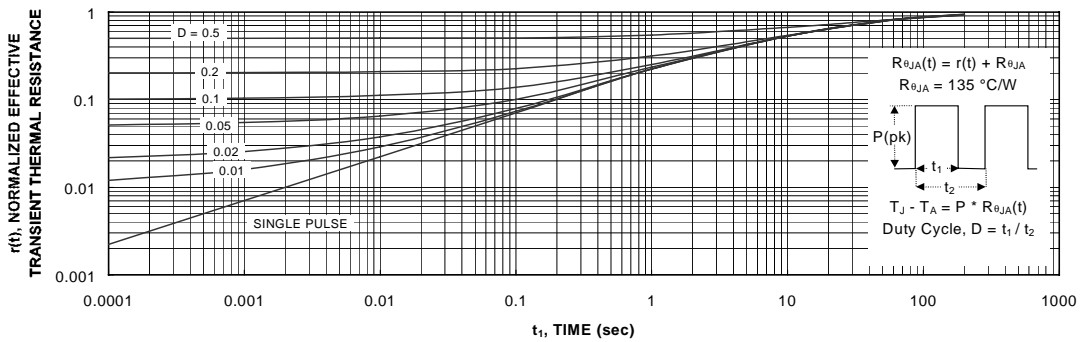


Figure 11. Transient Thermal Response Curve.

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



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