December 2001

FAIRCHILD

SEMICONDUCTOR®

FDN306P

P-Channel 1.8V Specified PowerTrench® MOSFET

General Description

This P-Channel 1.8V specified MOSFET uses Fairchild's advanced low voltage PowerTrench process. It has been optimized for battery power management applications.

Applications

- Battery management
- Load switch
- Battery protection

Features

- -2.6 A, -12 V. $R_{DS(ON)} = 40$ mΩ @ $V_{GS} = -4.5$ V

  $R_{DS(ON)} = 50$ mΩ @ $V_{GS} = -2.5$ V

  $R_{DS(ON)} = 80$ mΩ @ $V_{GS} = -1.8$ V

- Fast switching speed

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

- SuperSOT™ -3 provides low $R_{DS(ON)}$ and 30% higher power handling capability than SOT23 in the same footprint

SuperSOT™-3
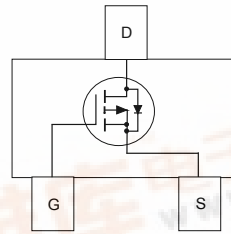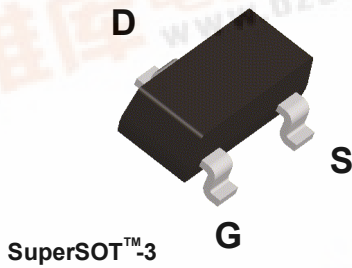
Absolute Maximum Ratings $T_A = 25^\circ$C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		-12	V
V_{GSS}	Gate-Source Voltage		± 8	V
I_D	Drain Current – Continuous	(Note 1a)	-2.6	A
	– Pulsed		-10	
P_D	Maximum Power Dissipation	(Note 1a)	0.5	W
		(Note 1b)	0.46	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		-55 to $+150$	$^\circ$C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	250	$^\circ$C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	75	$^\circ$C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
306	FDN306P	7''	8mm	3000 units

FDN306P Rev D (W)

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	–12			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250$ μA, Referenced to 25°C		–3		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -10$ V, $V_{GS} = 0$ V			–1	μA
I_{GSSF}	Gate–Body Leakage, Forward	$V_{GS} = 8$ V, $V_{DS} = 0$ V			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	$V_{GS} = -8$ 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	–0.6	–1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250$ μA, Referenced to 25°C		2.5		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = -4.5$ V, $I_D = -2.6$ A $V_{GS} = -2.5$ V, $I_D = -2.3$ A $V_{GS} = -1.8$V, $I_D = -1.8$ A $V_{GS} = -4.5$ V, $I_D = -2.6$A , T_J=125°C		30 39 54 40	40 50 80 54	mΩ
$I_{D(on)}$	On–State Drain Current	$V_{GS} = -4.5$ V, $V_{DS} = -5$ V	–10			A
g_{FS}	Forward Transconductance	$V_{DS} = -5$ V, $I_D = -2.6$ A		10		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = -6$ V, $V_{GS} = 0$ V,		1138		pF
C_{oss}	Output Capacitance	f = 1.0 MHz		454		pF
C_{rss}	Reverse Transfer Capacitance			302		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = -6$ V, $I_D = -1$ A,		11	20	ns
t_r	Turn–On Rise Time	$V_{GS} = -4.5$ V, $R_{GEN} = 6$ Ω		10	20	ns
$t_{d(off)}$	Turn–Off Delay Time			38	61	ns
t_f	Turn–Off Fall Time			35	56	ns
Q_g	Total Gate Charge	$V_{DS} = -6$ V, $I_D = -2.6$ A,		12	17	nC
Q_{gs}	Gate–Source Charge	$V_{GS} = -4.5$ V		2		nC
Q_{gd}	Gate–Drain Charge			3		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				–0.42	A
V_{SD}	Drain–Source Diode Forward Voltage	$V_{GS} = 0$ V, $I_S = -0.42$ (Note 2)		–0.6	–1.2	V

Notes:

1. $R_{θJA}$ 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. $R_{θJC}$ is guaranteed by design while $R_{θCA}$ is determined by the user's board design.

a) 250°C/W when mounted on a 0.02 in² pad of 2 oz. copper.

b) 270°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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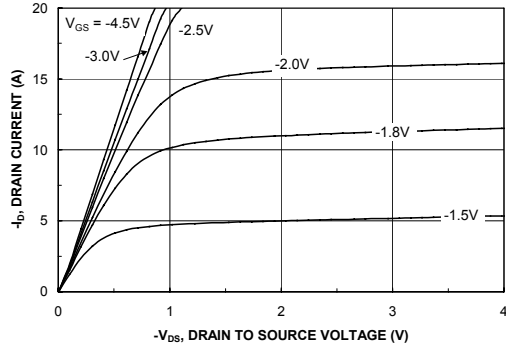
Typical Characteristics

Figure 1. On-Region Characteristics.
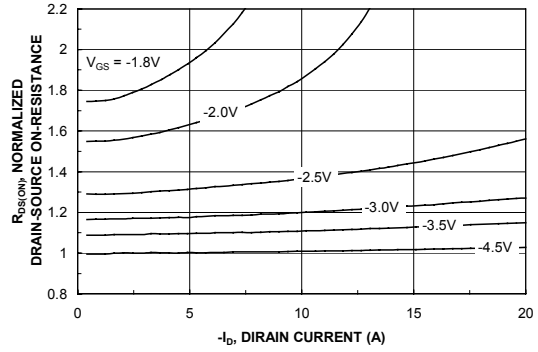

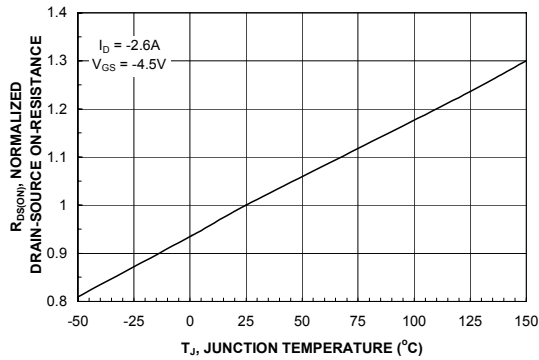**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

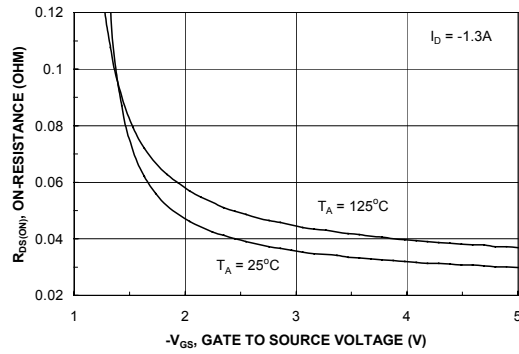**Figure 3. On-Resistance Variation with Temperature.**

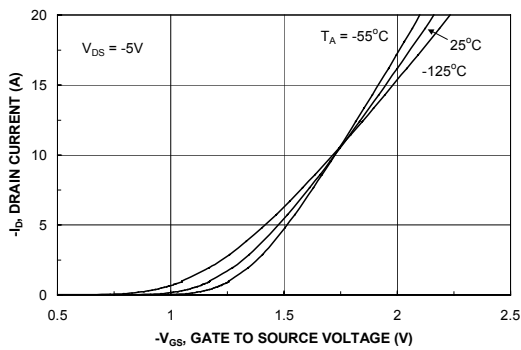**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

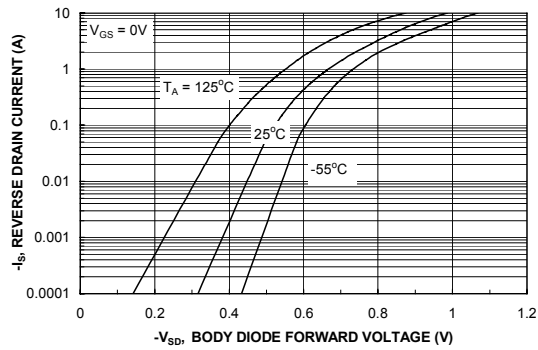**Figure 5. Transfer Characteristics.**

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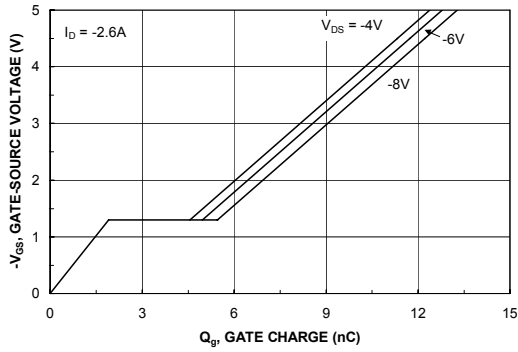
Typical Characteristics
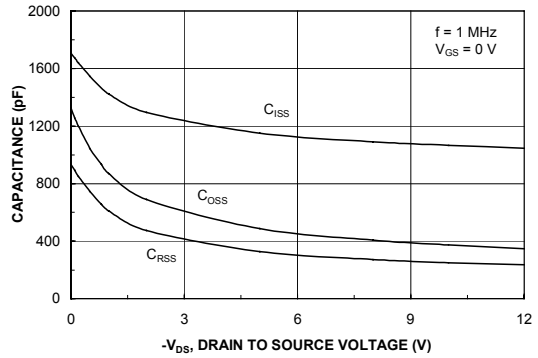

Figure 7. Gate Charge Characteristics.

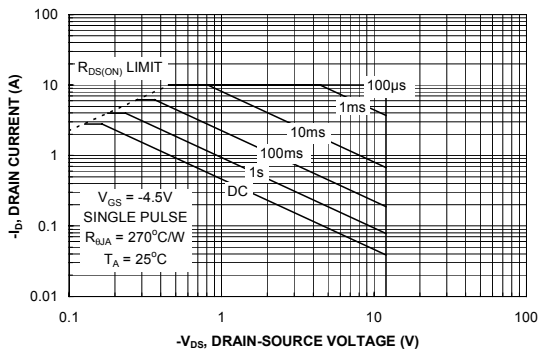Figure 8. Capacitance Characteristics.
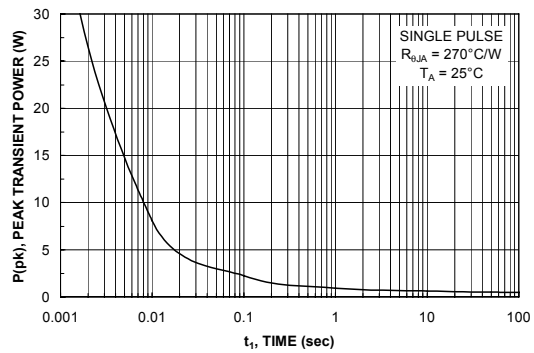

Figure 9. Maximum Safe Operating Area.

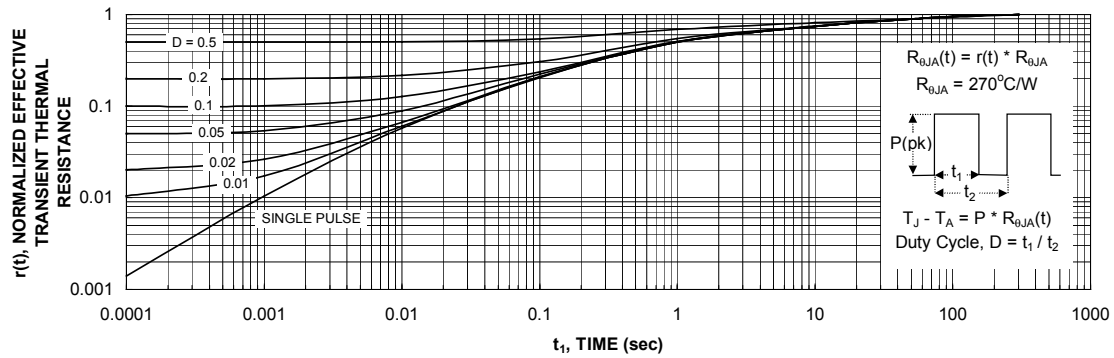Figure 10. Single Pulse Maximum
Power Dissipation.

Figure 11. Transient Thermal Response Curve.

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

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