

February 2010

# FDP2710\_F085

# N-Channel PowerTrench<sup>®</sup> MOSFET 250V, 50A, 47m $\Omega$

#### **Features**

- Typ  $r_{DS(on)}$  = 38m $\Omega$  at  $V_{GS}$  = 10V,  $I_D$  = 50A
- Typ  $Q_{g(TOT)}$  = 78nC at  $V_{GS}$  = 10V
- Fast switching speed
- Low gate charge
- High performance trench technology for extremely low RDS(on)
- High power and current handling capability
- Qualified to AEC Q101
- RoHS Compliant

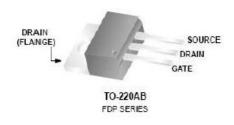
#### **General Description**

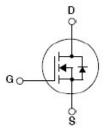
This N-Channel MOSFET is produced using Fairchil Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

#### **Applications**

- PDP application
- Hybrid Electric Vehicle DC/DC converters







Units

### **MOSFET Maximum Ratings** $T_C = 25^{\circ}C$ unless otherwise noted

Symbol	Parameter		Ratings	Units
$V_{DSS}$	Drain to Source Voltage		250	V
$V_{GS}$	Gate to Source Voltage		±30	V
	Drain Current Continuous (T <sub>C</sub> < 50°C, V <sub>GS</sub> = 10V)		50	
$I_D$	Continuous ( $T_{amb} = 25^{\circ}C$ , $V_{GS} = 10V$ , with $R_{\theta JA} = 62^{\circ}C/W$ )		4	Α
	Pulsed		See Figure 4	
E <sub>AS</sub>	Single Pulse Avalanche Energy	(Note 1)	483	mJ
П	Power Dissipation		403	W
$P_{D}$	Derate above 25°C		3.2	W/°C
$T_J$ , $T_{STG}$	Operating and Storage Temperature		-55 to +150	°C

#### **Thermal Characteristics**

R	θЈС	Maximum Thermal Resistance Junction to Case		0.31	°C/W
R	θЈΑ	Maximum Thermal Resistance Junction to Ambient	(Note 2)	62	°C/W

### **Package Marking and Ordering Information**

**Parameter** 

De	vice Marking	Device	Package	Reel Size	Tape Width	Quantity
	FDP2710	FDP2710_F085	TO220	Tube	NA	50 units

# Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

Off Characteristics						
B <sub>VDSS</sub>	Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V$	250	-	-	V
$\Delta BV_{DSS}$ $/\Delta T_{J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	-	0.25	-	V/°C
		$V_{PQ} = 250 V$	_	_	1	

**Test Conditions** 

Min

Тур

#### 

### On Characteristics

Symbol

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	3	3.9	5	V
	$I_D = 50A, V_{GS} = 10V,$	-	38	47		
	$I_D = 50A, V_{GS} = 10V,$ $T_J = 150^{\circ}C$	-	104	129	mΩ	
9 <sub>FS</sub>	Forward Transconductance	I <sub>D</sub> = 25A, V <sub>DS</sub> = 10V	-	63	-	S

#### **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz		-	5690	-	pF
C <sub>oss</sub>	Output Capacitance			-	425	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			-	115	-	pF
$Q_{g(TOT)}$	Total Gate Charge at 20V	V <sub>GS</sub> = 0 to 10V	\/ - 405\/	-	78	101	nC
Q <sub>gs</sub>	Gate to Source Gate Charge	$V_{DD} = 125V$ $I_{D} = 50A$		-	31	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge			-	20	-	nC

# **Electrical Characteristics** $T_C = 25^{\circ}C$ unless otherwise noted

	Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Cuitabina Characteristics							

### Switching Characteristics

t <sub>d(on)</sub>	Turn-On Delay Time	., ,,,,,	-	85	-	ns
t <sub>r</sub>	Rise Time	$V_{DD} = 125V, I_D = 50A$	-	183	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS}$ = 10V, $R_{GEN}$ = 25 $\Omega$	-	140	-	ns
t <sub>f</sub>	Fall Time		1	121	1	ns

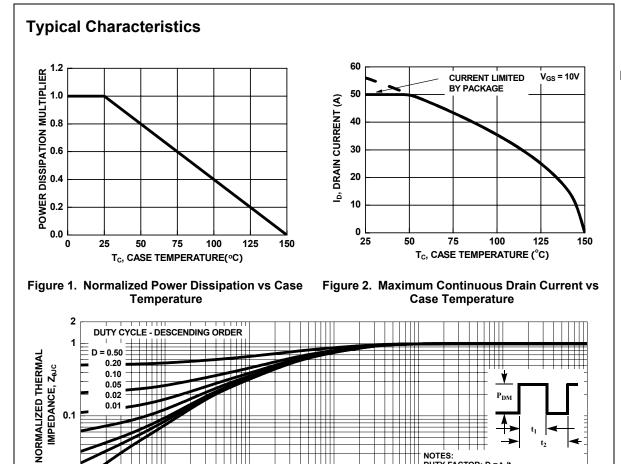
#### **Drain-Source Diode Characteristics**

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-	50	Α
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		-	-	150	Α
$V_{SD}$	Source to Drain Diode Voltage	I <sub>SD</sub> = 50A	-	0.9	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	L = 500 dl /dt = 1000/	-	166	216	ns
Q <sub>rr</sub>	Reverse Recovery Charge	$I_{SD} = 50A$ , $dI_{SD}/dt = 100A/\mu s$	-	1	1.3	uC

- Starting T<sub>J</sub> = 25°C, L = 1.68mH, I<sub>AS</sub> = 24A.
   Pulse width 100s

This product has been designed to meet the extreme test conditions and environment demanded by the automotive industry. For a copy of the requirements, see AEC Q101 at: http://www.aecouncil.com/
All Fairchild Semiconductor products are manufactured, assembled and tested under ISO9000 and QS9000 quality systems certification.

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t, RECTANGULAR PULSE DURATION(s) Figure 3. Normalized Maximum Transient Thermal Impedance

10<sup>-2</sup>

10<sup>-3</sup>

SINGLE PULSE

0.01 10<sup>-5</sup> NOTES:

DUTY FACTOR: D =  $t_1/t_2$ PEAK T<sub>J</sub> =  $P_{DM}$  x  $Z_{\theta JC}$  x  $R_{\theta JC}$  +  $T_{C}$ 

10°

10<sup>1</sup>

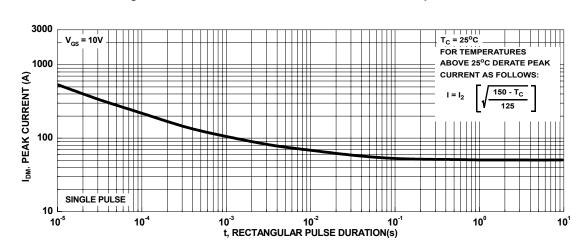


Figure 4. Peak Current Capability

### **Typical Characteristics**

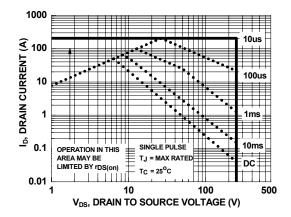


Figure 5. Forward Bias Safe Operating Area

If R = 0 t<sub>AV</sub> = (L)(I<sub>AS</sub>)/(1.3\*RATED BV<sub>DSS</sub> - V<sub>DD</sub>)

STARTING T<sub>J</sub> = 125°C

0.1

 $t_{AV} = (L/R) \ln[(I_{AS}*R)/(1.3*RATED BV_{DSS} - V_{DD})]$ 

STARTING T<sub>J</sub> = 25°C

10

100

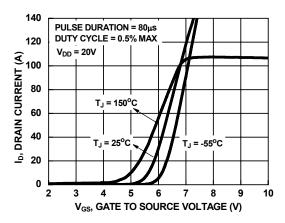
100

IAS, AVALANCHE CURRENT (A)

0.01

t<sub>AV</sub>, TIME IN AVALANCHE (ms) NOTE: Refer to Fairchild Application Notes AN7514 and AN7515 Figure 6. Unclamped Inductive Switching

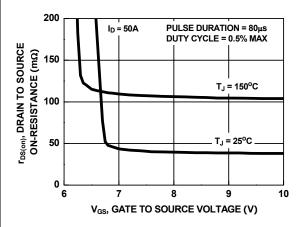
Capability



140 120 PULSE DURATION = 80 µs DRAIN CURRENT (A) DUTY CYCLE = 0.5% MAX 100  $V_{GS} = 10V$ 80  $V_{GS} = 6.5V$ 60 40 ئے  $V_{GS} = 6V$ 20  $V_{GS} = 5.5V$ 0 12 0 15 V<sub>DS</sub>, DRAIN TO SOURCE VOLTAGE (V)

Figure 7. Transfer Characteristics

Figure 8. Saturation Characteristics



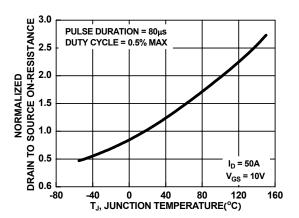


Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

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### **Typical Characteristics**

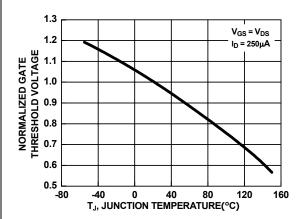


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

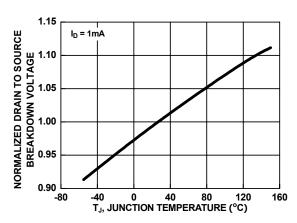


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

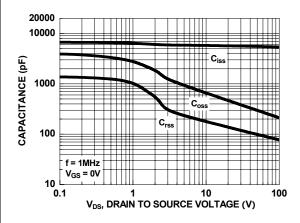


Figure 13. Capacitance vs Drain to Source Voltage

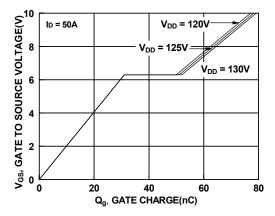


Figure 14. Gate Charge vs Gate to Source Voltage





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