**FAIRCHILD**

SEMICONDUCTOR®

May 2010

FDD5810_F085

N-Channel Logic Level Trench® MOSFET
60V, 36A, 27mΩ

Features

- $R_{DS(ON)}$ = 22mΩ (Typ.), V_{GS} = 5V, I_D = 29A
- $Q_{g(5)}$ = 13nC (Typ.), V_{GS} = 5V
- Low Miller Charge
- Low Q_{rr} Body Diode
- UIS Capability (Single Pulse / Repetitive Pulse)
- Qualified to AEC Q101
- RoHS Compliant

Applications

- Motor / Body Load Control
- ABS Systems
- Powertrain Management
- Injection System
- DC-DC converters and Off-line UPS
- Distributed Power Architecture and VRMs
- Primary Switch for 12V and 24V systems

LEAD-FREE IMPLEMENTATION

**D-PAK
(TO-252)**
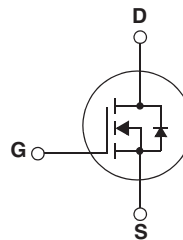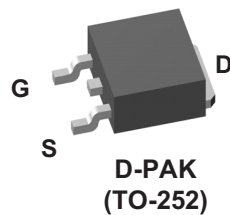
Absolute Maximum Ratings $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current Continuous ($V_{GS} = 10V$)	37	A
	Drain Current Continuous ($V_{GS} = 5V$)	33	A
	Continuous ($T_A = 25°C$, $V_{GS} = 10V$, with $R_{θJA} = 52°C/W$)	7.4	A
	Pulsed	Figure 4	A
E_{AS}	Single Pulse Avalanche Energy (Note 1)	45	mJ
P_D	Power Dissipation	72	W
	Derate above 25°C	0.48	W/°C
T_J, T_{STG}	Operating and Storage Temperature	-55 to 175	°C

Thermal Characteristics

$R_{θJC}$	Maximum Thermal resistance Junction to Case TO-252	2.1	°C/W
$R_{θJA}$	Thermal Resistance Junction to Ambient TO-252, 1in² copper pad area	52	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD5810	FDD5810_F085	TO-252AA	330mm	16mm	2500 units

Electrical Characteristics $T_J = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
B_{VDSS}	Drain to Source Breakdown Voltage	$I_D = 250μA$, $V_{GS} = 0V$		60	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48V$		-	-	1	μA
		$V_{GS} = 0V$	$T_C = 150°C$	-	-	250	
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = ±20V$		-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250μA$	1	1.6	2	V
$R_{DS(ON)}$	Drain to Source On Resistance	$I_D = 32A$, $V_{GS} = 10V$	-	18	22	mΩ
		$I_D = 29A$, $V_{GS} = 5V$	-	22	27	
		$I_D = 32A$, $V_{GS} = 10V$, $T_J = 175°C$	-	43	53	

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1MHz		-	1420	1890	pF
C_{oss}	Output Capacitance			-	150	200	pF
C_{rss}	Reverse Transfer Capacitance			-	65	100	pF
R_G	Gate Resistance	f = 1MHz		-	3.5	-	Ω
Q_g	Total Gate Charge at 10V	$V_{GS} = 0V$ to 10V	$V_{DD} = 30V$ $I_D = 35A$	-	24	34	nC
Q_g	Total Gate Charge at 5V	$V_{GS} = 0V$ to 5V		-	13	18	nC
$Q_{g(th)}$	Threshold Gate Charge	$V_{GS} = 0V$ to 1V		-	1.3	-	nC
Q_{gs}	Gate to Source Gate Charge			-	4.0	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau			-	2.7	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	5.0	-	nC

Switching Characteristics

t_{on}	Turn-On Time		-	-	130	ns
$t_{d(on)}$	Turn-On Delay Time		-	12	-	ns
t_r	Rise Time	$V_{DD} = 30V$, $I_D = 35A$	-	75	-	ns
$t_{d(off)}$	Turn-Off Delay Time	$V_{GS} = 5V$, $R_{GS} = 11\Omega$	-	26	-	ns
t_f	Fall Time		-	34	-	ns
t_{off}	Turn-Off Time		-	-	90	ns

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Voltage	$I_{SD} = 32A$	-	-	1.25	V
		$I_{SD} = 16A$	-	-	1.0	V
t_{rr}	Reverse Recovery Time	$I_F = 35A$, $di/dt = 100A/\mu s$	-	-	39	ns
Q_{rr}	Reverse Recovery Charge	$I_F = 35A$, $di/dt = 100A/\mu s$	-	-	35	nC

Notes:
1: Starting $T_J = 25°C$, $L = 110\mu H$, $I_{AS} = 28A$, $V_{DD} = 54V$, $V_{GS} = 10V$.

Typical Characteristics T_J = 25°C unless otherwise noted

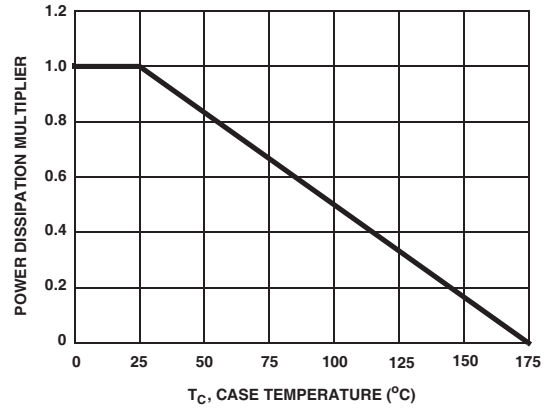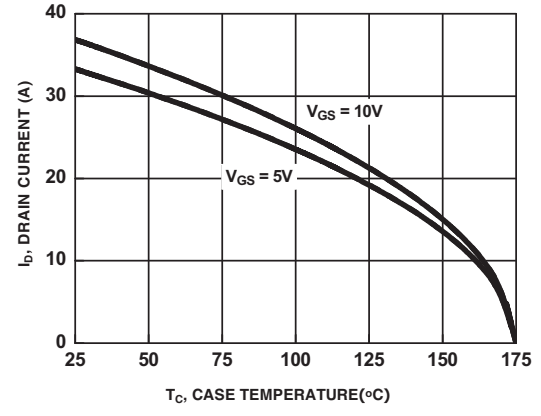**Figure 1. Normalized Power Dissipation vs Case Temperature**

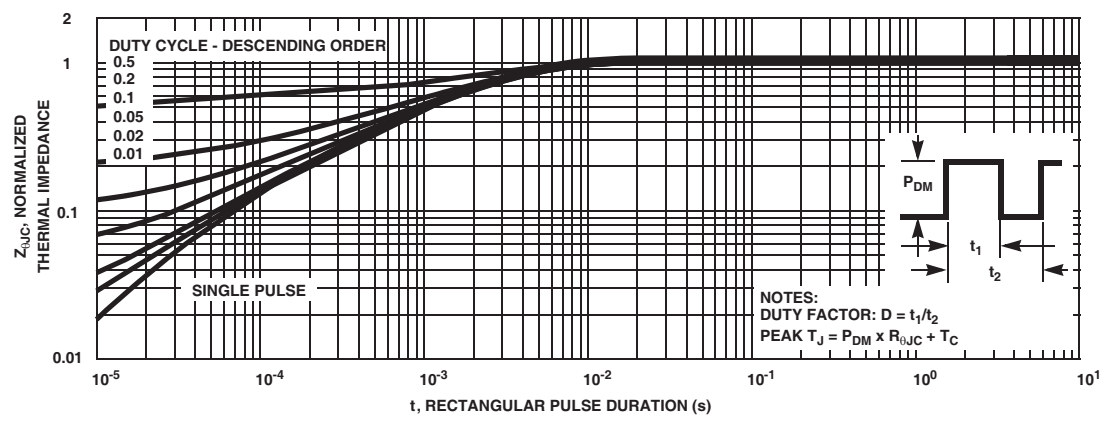**Figure 2. Maximum Continuous Drain Current vs Case Temperature**

NOTES:
DUTY FACTOR: D = t_1/t_2
PEAK T_J = P_{DM} x $R_{\theta JC}$ + T_C

Figure 3. Normalized Maximum Transient Thermal Impedance

T_C = 25°C

FOR TEMPERATURES ABOVE 25°C DERATE PEAK CURRENT AS FOLLOWS:

$$I = I_{25} \left[\sqrt{\frac{175 - T_C}{150}} \right]$$
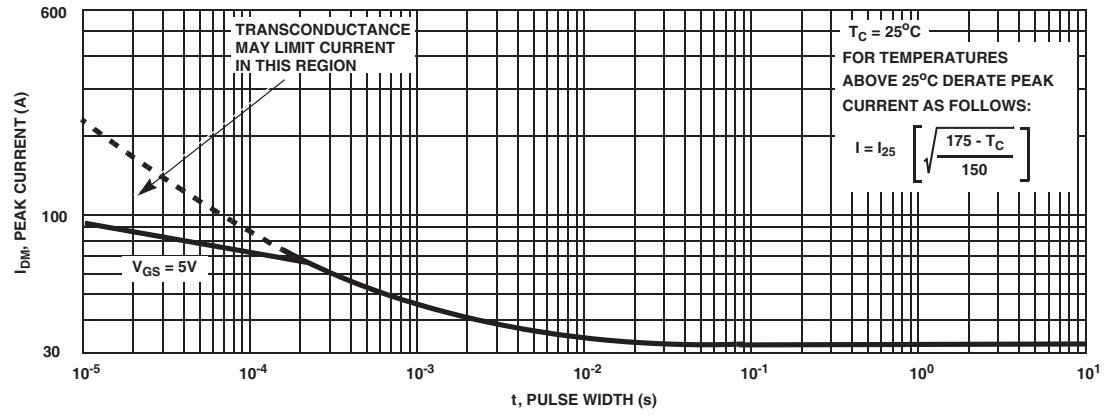
Figure 4. Peak Current Capability

Typical Characteristics $T_J = 25°C$ unless otherwise noted
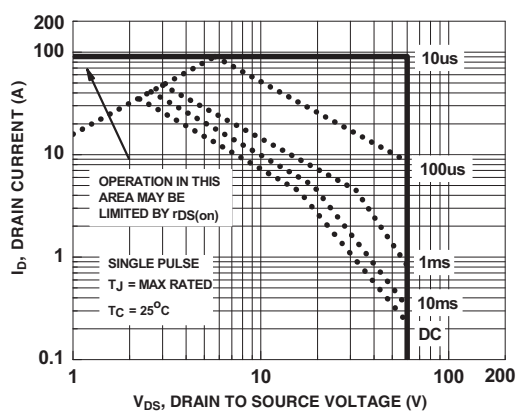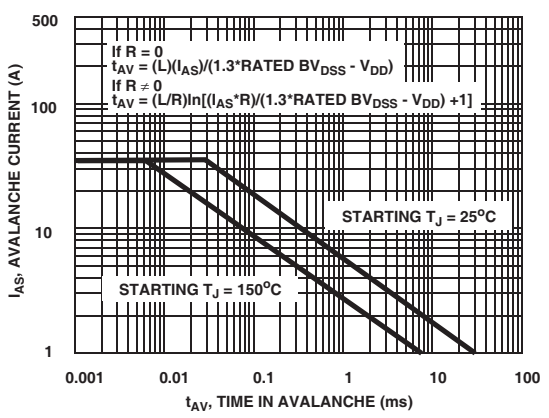

Figure 5. Forward Bias Safe Operating Area

NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

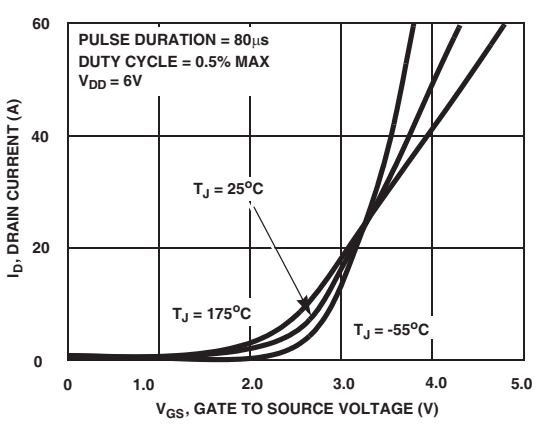**Figure 6. Unclamped Inductive Switching Capability**
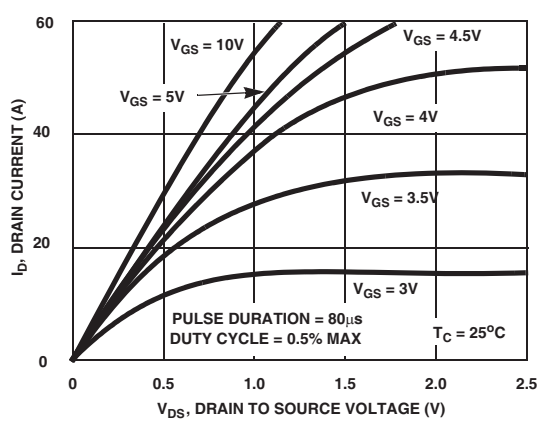

Figure 7. Transfer Characteristics

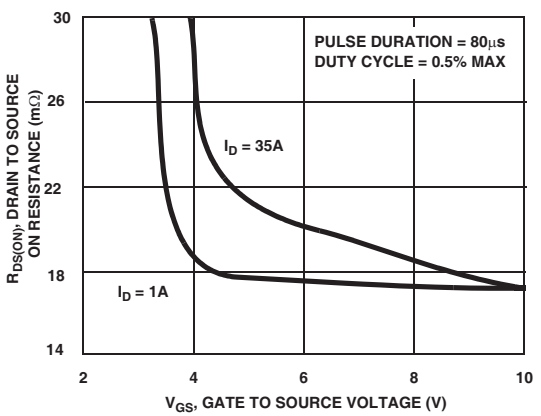**Figure 8. Saturation Characteristics**

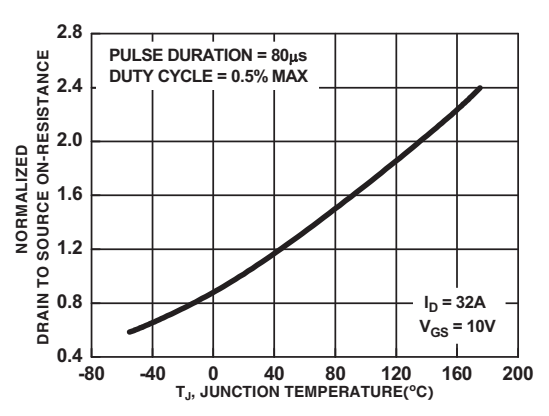**Figure 9. Drain to Source On Resistance vs Gate Voltage and Drain Current**

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

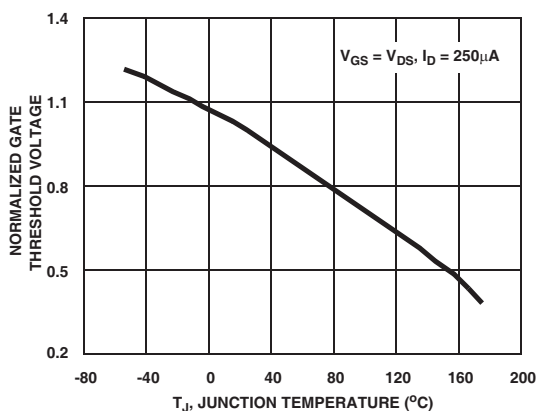**Typical Characteristics** T_J = 25°C unless otherwise noted

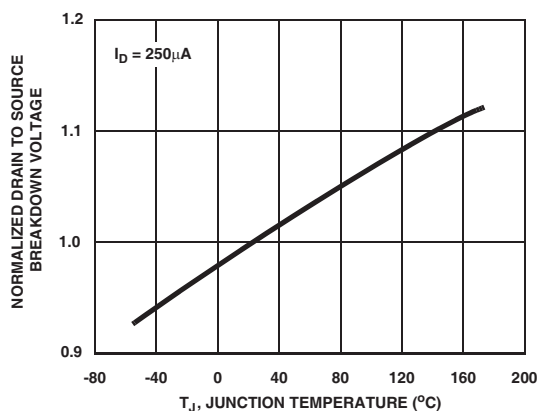**Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature**

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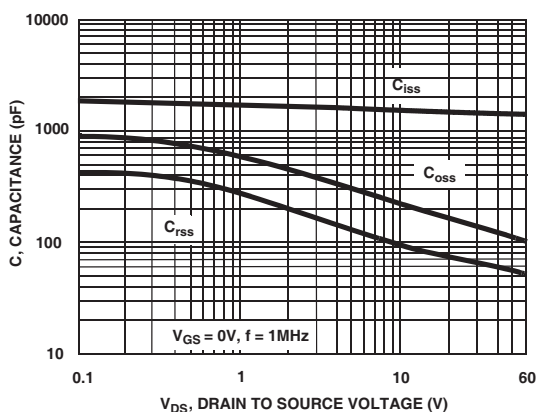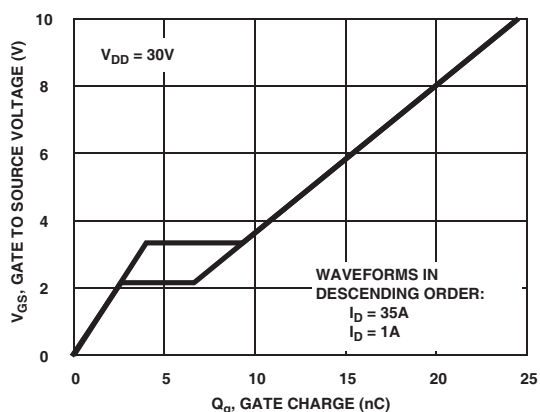

Figure 13. Capacitance vs Drain to Source Voltage

Figure 14. Gate Charge Waveforms for Constant Gate Current

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