FAIRCHILD

SEMICONDUCTOR®

FDD5810

N-Channel PowerTrench® MOSFET
60V, 35A, 27mΩ

Features

- $R_{DS(ON)}$ = 20.5mΩ (Typ.), V_{GS} = 5V, I_D = 35A
- $Q_{g(5)}$ = 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)

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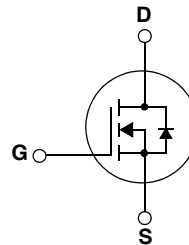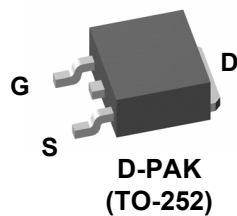
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

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, T_C = 52°C)	(Note 1)	35	A
	Drain Current Continuous (V_{GS} = 5V, T_C = 42°C)	(Note 1)	35	A
	Continuous (T_A = 25°C, V_{GS} = 10V, with $R_{\theta JA}$ = 52°C/W)		7.7	A
	Pulsed		Figure 4	A
E_{AS}	Single Pulse Avalanche Energy (Note 2)		45	mJ
P_D	Power Dissipation		88	W
	Derate above 25°C		0.59	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to 175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case TO-252		1.7	°C/W
$R_{\theta JA}$	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	TO-252AA	13"	12mm	2500 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Off Characteristics							
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							
$V_{GS(TH)}$	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 = 35A, V_{GS} = 10V		-	16.5	20	mΩ
		I_D = 35A, V_{GS} = 5V		-	20.5	27	
		I_D = 35A, V_{GS} = 10V, T_J = 175°C		-	39	48	
Dynamic Characteristics							
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} = 11Ω	-	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} = 35A	-	-	1.25	V
		I_{SD} = 16A	-	-	1.0	V
t_{rr}	Reverse Recovery Time	I_F = 35A, di/dt = 100A/μs	-	-	39	ns
Q_{rr}	Reverse Recovery Charge	I_F = 35A, di/dt = 100A/μs	-	-	35	nC

Notes:
1: Package Limitation is 35A.
2: Starting T_J = 25°C, L = 110μH, I_{AS} = 28A, V_{DD} = 54V, V_{GS} = 10V.

FDD5810 N-Channel PowerTrench® MOSFET

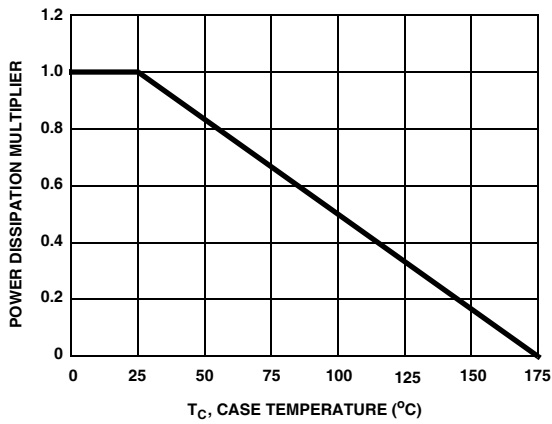**Typical Characteristics** $T_J = 25°C$ unless otherwise noted

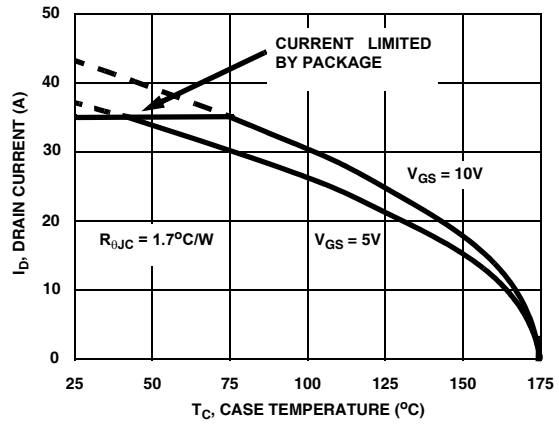**Figure 1. Normalized Power Dissipation vs Case Temperature**

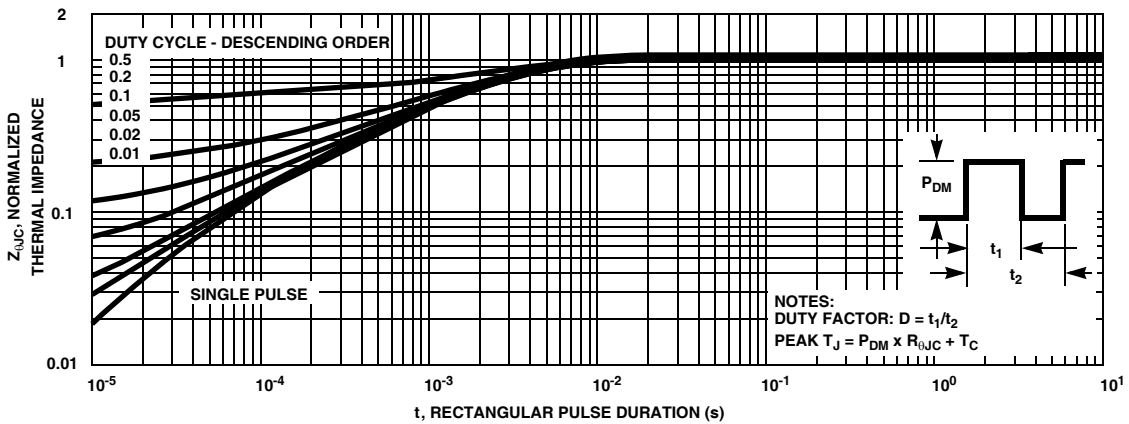**Figure 2. Maximum Continuous Drain Current vs Case Temperature**

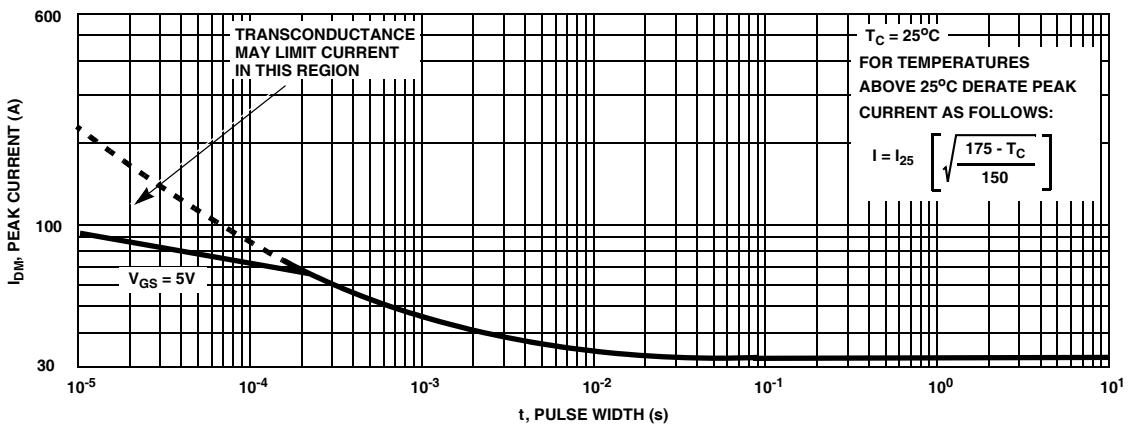

Figure 3. Normalized Maximum Transient Thermal Impedance

Figure 4. Peak Current Capability

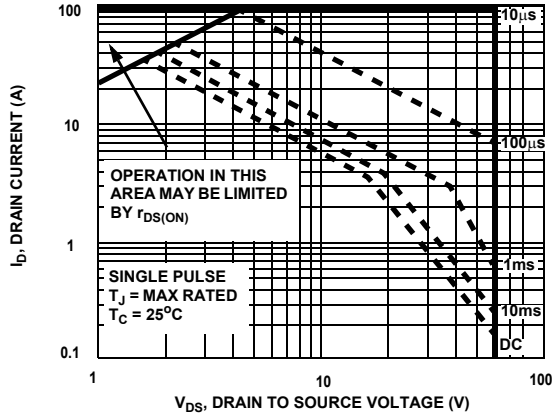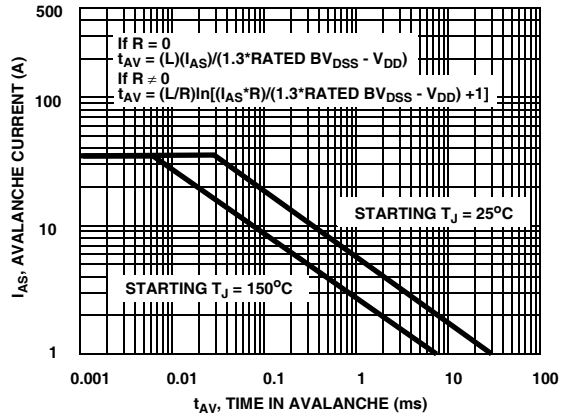## Typical Characteristics $T_J = 25°C$ unless otherwise noted

OPERATION IN THIS AREA MAY BE LIMITED BY $r_{DS(ON)}$

SINGLE PULSE
T_J = MAX RATED
$T_C = 25°C$

10μs
100μs
1ms
10ms
DC

I_D, DRAIN CURRENT (A)
V_{DS}, DRAIN TO SOURCE VOLTAGE (V)

Figure 5. Forward Bias Safe Operating Area

If R = 0
$t_{AV} = (L)(I_{AS})/(1.3*RATED\ BV_{DSS} - V_{DD})$
If R ≠ 0
$t_{AV} = (L/R)ln[(I_{AS}*R)/(1.3*RATED\ BV_{DSS} - V_{DD}) +1]$

STARTING T_J = 25°C
STARTING T_J = 150°C

I_{AS}, AVALANCHE CURRENT (A)
t_{AV}, TIME IN AVALANCHE (ms)

NOTE: Refer to Fairchild Application Notes AN7514 and AN7515
Figure 6. Unclamped Inductive Switching Capability

PULSE DURATION = 80μs
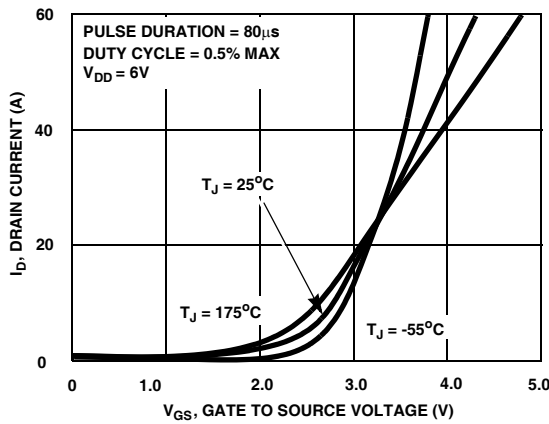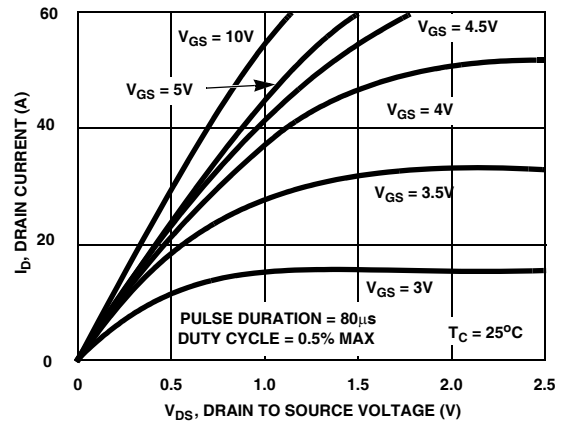DUTY CYCLE = 0.5% MAX
V_{DD} = 6V

$T_J = 25°C$
$T_J = 175°C$
$T_J = -55°C$

I_D, DRAIN CURRENT (A)
V_{GS}, GATE TO SOURCE VOLTAGE (V)

Figure 7. Transfer Characteristics

V_{GS} = 10V
V_{GS} = 5V
V_{GS} = 4.5V
V_{GS} = 4V
V_{GS} = 3.5V
V_{GS} = 3V

PULSE DURATION = 80μs
DUTY CYCLE = 0.5% MAX
$T_C = 25°C$

I_D, DRAIN CURRENT (A)
V_{DS}, DRAIN TO SOURCE VOLTAGE (V)

Figure 8. Saturation Characteristics

PULSE DURATION = 80μs
DUTY CYCLE = 0.5% MAX

I_D = 35A
I_D = 1A

$R_{DS(ON)}$, DRAIN TO SOURCE ON RESISTANCE (mΩ)
V_{GS}, GATE TO SOURCE VOLTAGE (V)
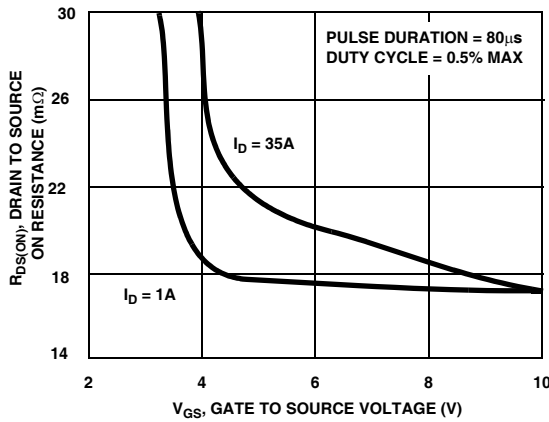
Figure 9. Drain to Source On Resistance vs Gate Voltage and Drain Current

PULSE DURATION = 80μs
DUTY CYCLE = 0.5% MAX

V_{GS} = 5V, I_D = 35A

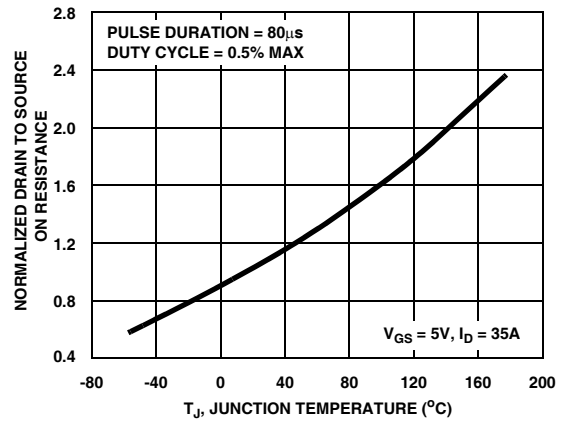NORMALIZED DRAIN TO SOURCE ON RESISTANCE
T_J, JUNCTION TEMPERATURE (°C)

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

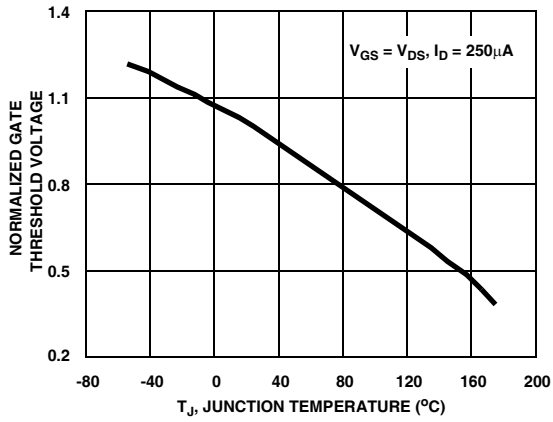## Typical Characteristics T_J = 25°C unless otherwise noted

Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature
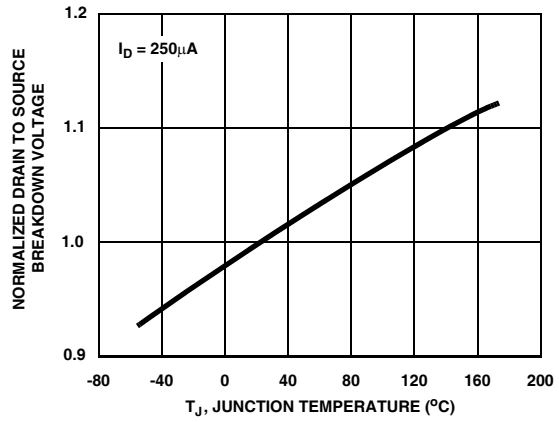

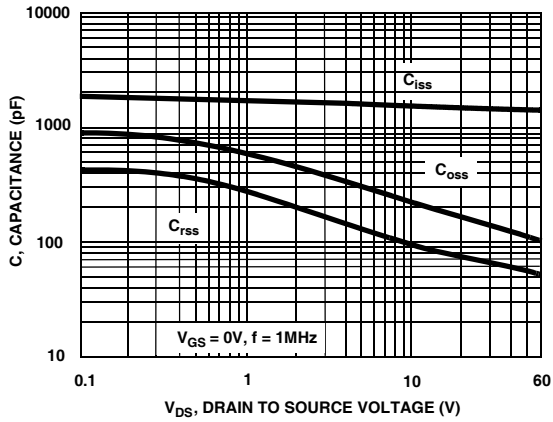**Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature**

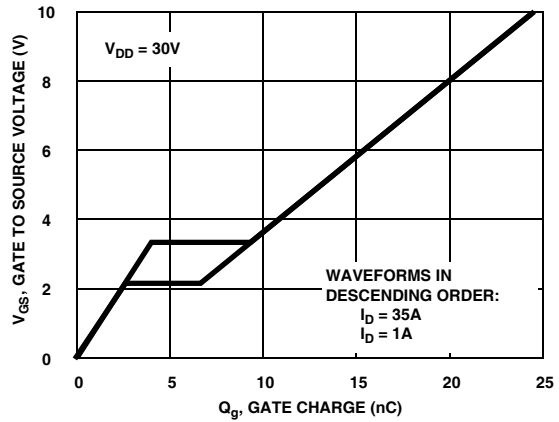**Figure 13. Capacitance vs Drain to Source Voltage**

Figure 14. Gate Charge Waveforms for Constant Gate Current

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