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FAIRCHILD SEMICONDUCTOR®

November 2005

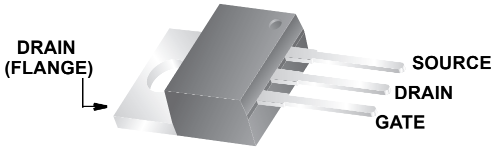
FDP8878
N-Channel Logic Level PowerTrench® MOSFET
30V, 40A, 15mΩ

General Descriptions

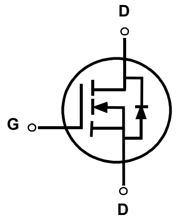
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(ON)}$ and fast switching speed.

Features

- $r_{DS(ON)} = 15m\Omega$, $V_{GS} = 10V$, $I_D = 40A$
- $r_{DS(ON)} = 19m\Omega$, $V_{GS} = 4.5V$, $I_D = 36A$
- High performance trench technology for extremely low $r_{DS(ON)}$
- Low gate charge
- High power and current handling capability
- RoHS Compliant



TO-220AB
FDP SERIES



MOSFET Maximum Ratings $T_A = 25°C$ unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain to Source Voltage		30	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current			
	Continuous ($T_C = 25^oC$, $V_{GS} = 10V$)		40	A
	Continuous ($T_C = 25^oC$, $V_{GS} = 4.5V$)		36	A
	Pulsed (Note 4)		141	A
E_{AS}	Single Pulse Avalanche Energy (Note 1)	$L = 1mH$, $I_{AS} = 11A$	60	mJ
		$L = 43\mu H$, $I_{AS} = 32A$	22	
P_D	Power dissipation		40.5	W
T_J, T_{STG}	Operating and Storage Temperature		-55 to 175	^oC

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 2)	3.7	$^oC/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient at 1000 seconds (Note 3)	43	$^oC/W$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8878	FDP8878	TO-220	Tube	n/a	45 units

Electrical Characteristics T_A = 25°C unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = 250µA, V_{GS} = 0V	30	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temp. Coefficient	I_D = 250µA, Referenced to 25°C		21		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24V	-	-	1	µA
		V_{GS} = 0V, T_A = 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	1.2	1.7	2.5	V
$\frac{\Delta V_{GS(TH)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250µA, Referenced to 25°C		-5		mV/°C
$r_{DS(ON)}$	Drain to Source On Resistance	I_D = 40A, V_{GS} = 10V	-	12	15	mΩ
		I_D = 36A, V_{GS} = 4.5V	-	16	19	
		I_D = 40, V_{GS} = 10V, T_A = 175°C	-	20	25	

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{ISS}	Input Capacitance	V_{DS} = 15V, V_{GS} = 0V, f = 1MHz	-	927	1235	pF
C_{OSS}	Output Capacitance		-	188	250	pF
C_{RSS}	Reverse Transfer Capacitance		-	1130	175	pF
R_G	Gate Resistance	f = 1MHz		3.0		Ω
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{GS} = 0V to 10V V_{DD} = 15V I_D = 40A I_g = 1.0mA	-	17.1	23	nC
$Q_{g(5)}$	Total Gate Charge at 5V	V_{GS} = 0V to 5V	-	9.2	12	nC
Q_{gs}	Gate to Source Gate Charge		-	2.6	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau		-	1.7	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	3.7	-	nC

Switching Characteristics (V_{GS} = 10V)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t_{ON}	Turn-On Time	V_{DD} = 15V, I_D = 40A V_{GS} = 10V, R_{GS} = 16Ω	-	255	383	ns
$t_{d(ON)}$	Turn-On Delay Time		-	11.1		ns
t_r	Rise Time		-	244		ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	14.8		ns
t_f	Fall Time		-	35.3		ns
t_{OFF}	Turn-Off Time		-	50	75	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 40A	-	1.1	1.25	V
		I_{SD} = 3.2A	-	0.85	1.2	V
t_{rr}	Reverse Recovery Time	I_{SD} = 40A, dI_{SD}/dt=100A/µs	-	14.4	18.8	ns
Q_{RR}	Reverse Recovered Charge	I_{SD} = 40A, dI_{SD}/dt=100A/µs	-	5.1	6.7	nC

Notes:

1: Starting T_J = 25°C, V_{DD} = 30V, V_{GS} = 10V

2: $R_{\theta JA}$ 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 $R_{\theta JA}$ is determined by the user's board design.

3: $R_{\theta JA}$ is measured with 1.0 in^2 copper on FR-4 board

4: Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%

Typical Characteristics T_A = 25°C unless otherwise noted

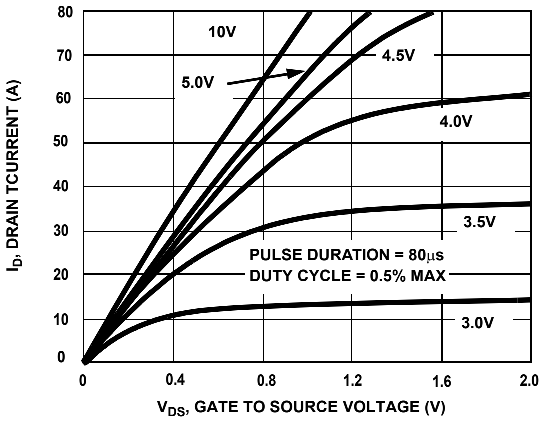


Figure 1. On Region Characteristics

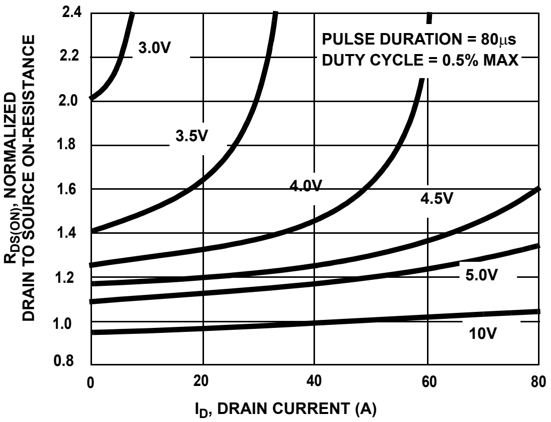


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

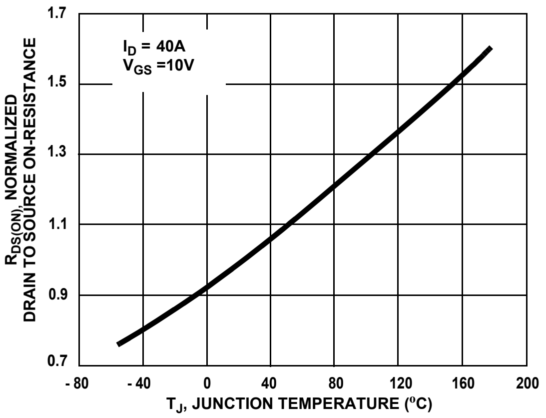


Figure 3. On Resistance Variation with Temperature

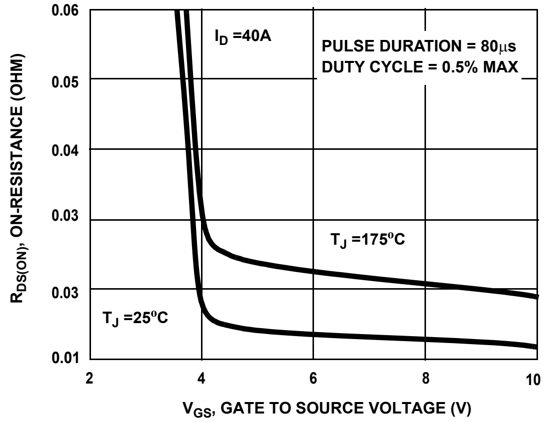


Figure 4. On-Resistance Variation with Gate-to-Source Votlage

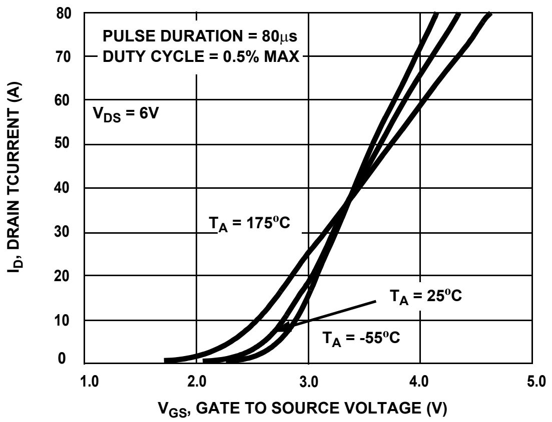


Figure 5. Transfer Characteristics

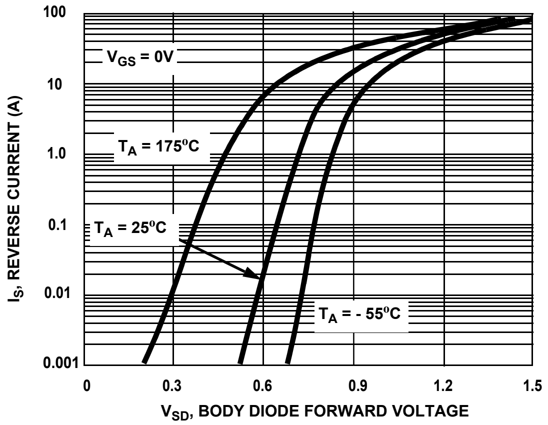


Figure 6. Body Diode Forward Voltage Variation With Source Current and Temperature

Typical Characteristics T_A = 25°C unless otherwise noted

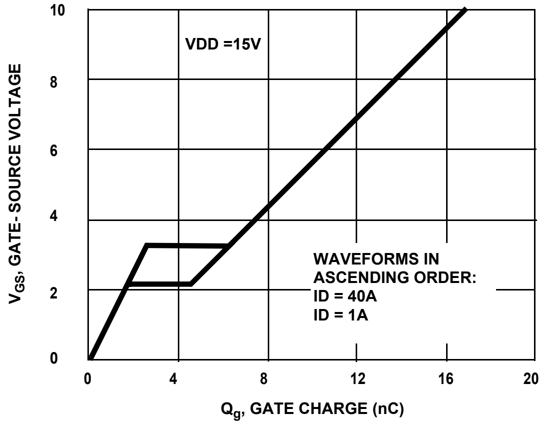


Figure 7. Gate Charge Characteristics

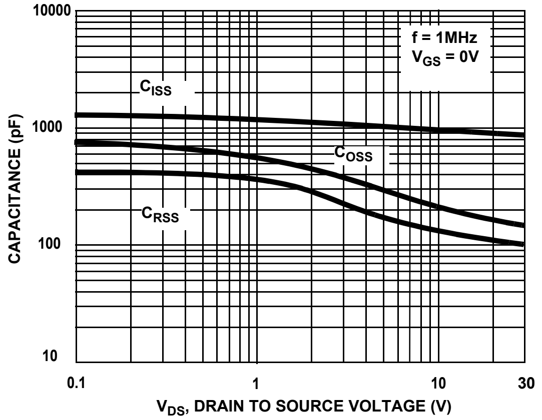


Figure 8. Capacitance Characteristics

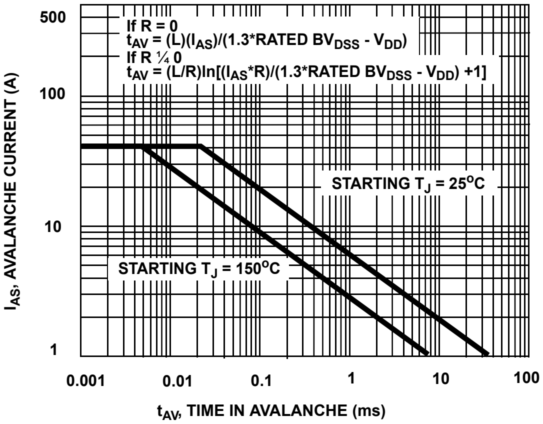


Figure 9. Unclamped Inductive Switching Capability

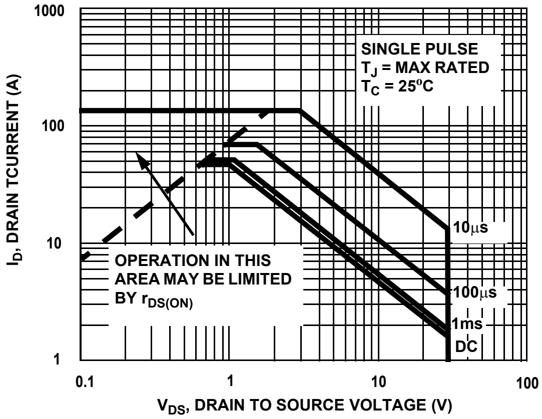


Figure 10. Safe Operating Area

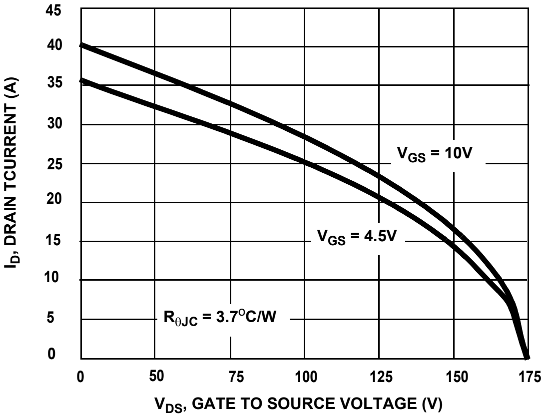


Figure 11. Maximum Continuous Drain Current vs Case Temperature

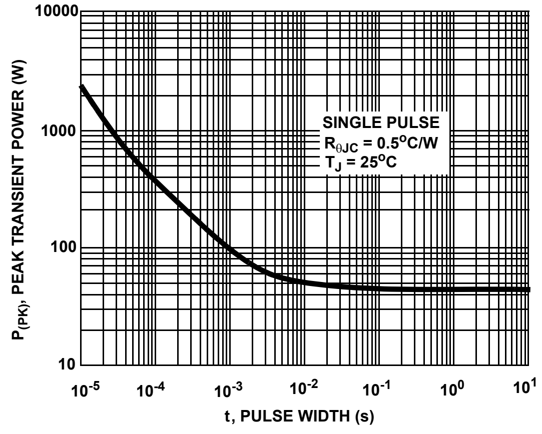


Figure 12. Single Pulse Maximum Power Dissipation

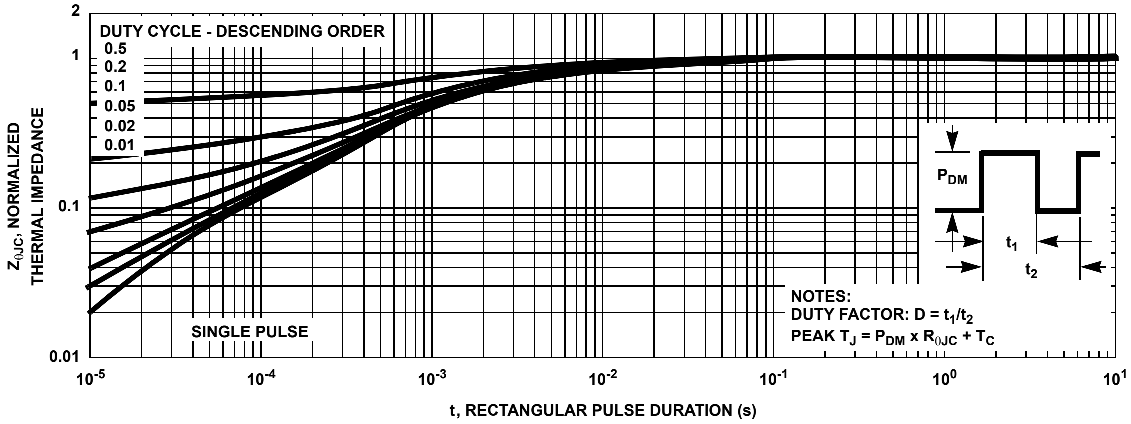


Figure 13. Transient Thermal Response Curve

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