FAIRCHILD

SEMICONDUCTOR®

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FDP8876
## N-Channel PowerTrench® MOSFET
30V, 71A, 8.5mΩ

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

■ $r_{DS(ON)}$ = 8.5mΩ, V_{GS} = 10V, I_D = 40A

■ $r_{DS(ON)}$ = 10.3mΩ, V_{GS} = 4.5V, I_D = 40A

■ High performance trench technology for extremely low $r_{DS(ON)}$

■ Low gate charge

■ High power and current handling capability

■ RoHS Compliant

DRAIN (FLANGE)   **SOURCE**   **DRAIN**   **GATE**

TO-220AB
FDP SERIES

D   **G**   **S**
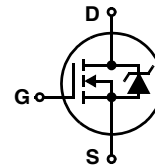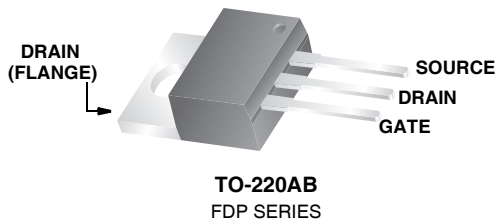
MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

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°C, V_{GS} = 10V)	70	A
	Continuous (T_C = 25°C, V_{GS} = 4.5V)	64	A
	Pulsed	Figure 4	A
E_{AS}	Single Pulse Avalanche Energy (Note 1)	180	mJ
P_D	Power dissipation	70	W
T_J, T_{STG}	Operating and Storage Temperature	-55 to 175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case TO-263	2.14	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-263,1in^{2}copper pad area	62	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8876	FDP8876	TO-220AB	Tube	N/A	50 units

Electrical Characteristics T_A = 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		30	-	-	V
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							
$V_{GS(TH)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA		1.2	-	2.5	V
$r_{DS(ON)}$	Drain to Source On Resistance	I_D = 40A, V_{GS} = 10V		-	6.1	8.7	mΩ
		I_D = 40A, V_{GS} = 4.5V		-	7.7	10.5	
		I_D = 40, V_{GS} = 10V, T_A = 175°C		-	11	14	
Dynamic Characteristics							
C_{ISS}	Input Capacitance	V_{DS} = 15V, V_{GS} = 0V, f = 1MHz		-	1700	-	pF
C_{OSS}	Output Capacitance			-	340	-	pF
C_{RSS}	Reverse Transfer Capacitance			-	210	-	pF
R_G	Gate Resistance	V_{GS}=0.5V, f = 1MHz		-	2.3	-	Ω
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{GS} = 0V to 10V	V_{DD} = 15V	-	32	45	nC
$Q_{g(5)}$	Total Gate Charge at 5V	V_{GS} = 0V to 5V	I_D = 40A	-	17	24	nC
$Q_{g(TH)}$	Threshold Gate Charge	V_{GS} = 0V to 1V	I_g = 1.0mA	-	1.6	2.4	nC
Q_{gs}	Gate to Sourse Gate Charge			-	4.7	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau			-	3.1	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	7.0	-	nC
Switching Characteristics (V_{GS} = 10V)							
t_{ON}	Turn-On Time	V_{DD} = 15V, I_D = 40A V_{GS} = 10V, R_{GS} = 10Ω		-	-	189	ns
$t_{d(ON)}$	Turn-On Delay Time			-	9	-	ns
t_r	Rise Time			-	97	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time			-	51	-	ns
t_f	Fall Time			-	39	-	ns
t_{OFF}	Turn-Off Time			-	-	135	ns
Drain-Source Diode Characteristic							
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 40A		-	-	1.25	V
		I_{SD} = 3.2A		-	-	1.0	V
t_{rr}	Reverse Recovery Time	I_{SD} = 40A, dI_{SD}/dt=100A/μs		-	-	22	ns
Q_{RR}	Reverse Recovered Charge	I_{SD} = 40A, dI_{SD}/dt=100A/μs		-	-	9	nC

Notes:

1: Starting T_J=25°C, L=1mH, I_{AS}=19A, V_{DD}=27V, V_{GS}=10V

2: Pulse width=100s

FDP8876 N-Channel PowerTrench® MOSFET

Typical Characteristics T_A = 25°C unless otherwise noted
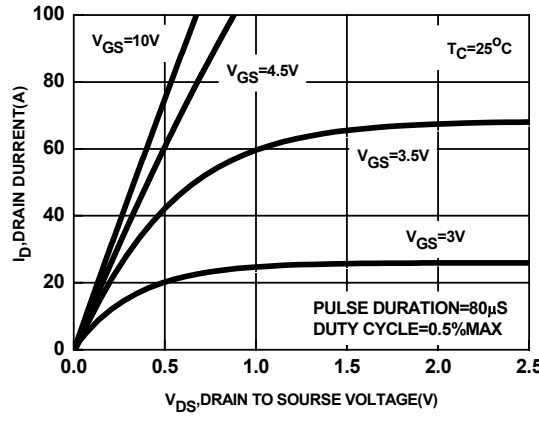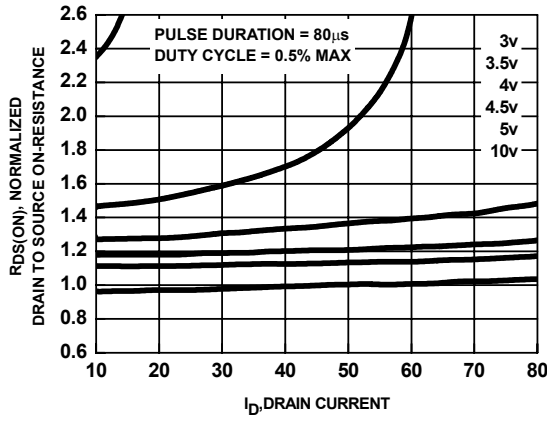
Figure 1. On Region Characteristics

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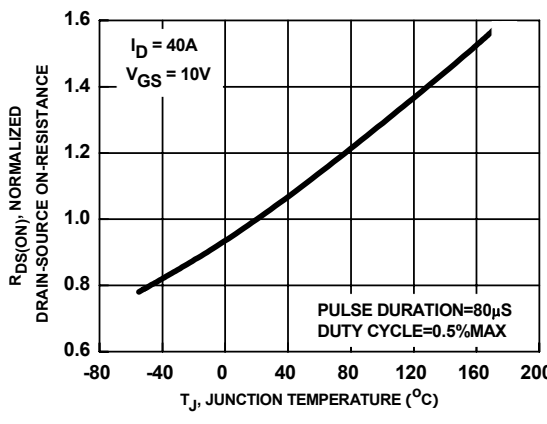Current and Gate Voltage
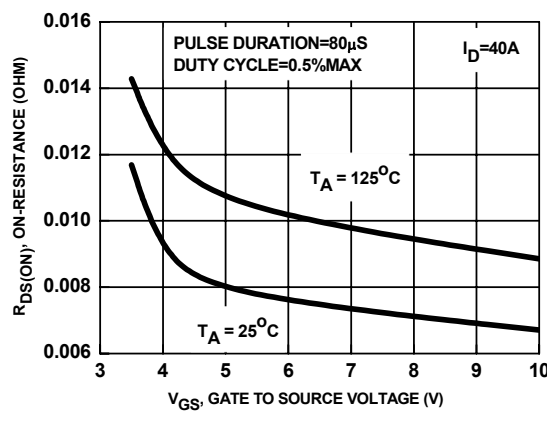

Figure 3. On Resistance Variation with
Temperature

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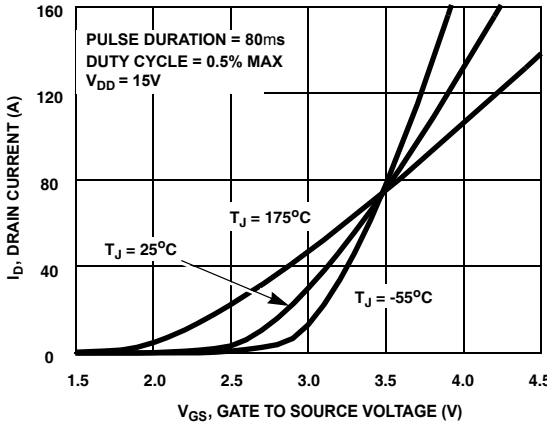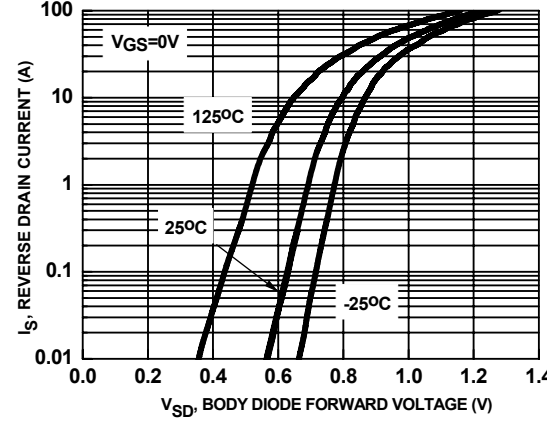Gate-to-Source Votlage

Figure 5. Transfer Characteristics

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

FDP8876 Rev. A

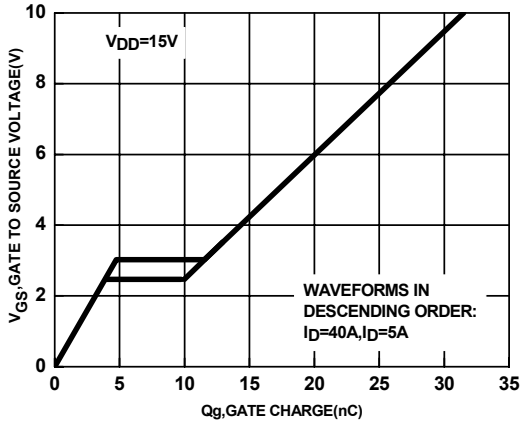## Typical Characteristics T_A = 25°C unless otherwise noted

V_{DD}=15V

WAVEFORMS IN
DESCENDING ORDER:
I_D=40A,I_D=5A

V_{GS},GATE TO SOURCE VOLTAGE(V)

Qg,GATE CHARGE(nC)

Figure 7. Gate Charge characteristics

$C_{ISS} = C_{GS} + C_{GD}$

$C_{OSS} \cong C_{DS} + C_{GD}$

$C_{RSS} = C_{GD}$

V_{GS} = 0V, f = 1MHz

C, CAPACITANCE (pF)

V_{DS}, DRAIN TO SOURCE VOLTAGE (V)
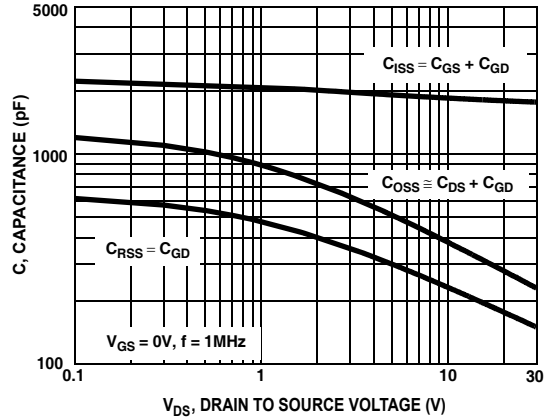
Figure 8. Saturation characteristics

I_{AS}, AVALANCHE CURRENT (A)

STARTING T_J = 25°C

STARTING T_J = 150°C

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]

t_{AV}, TIME IN AVALANCHE (ms)
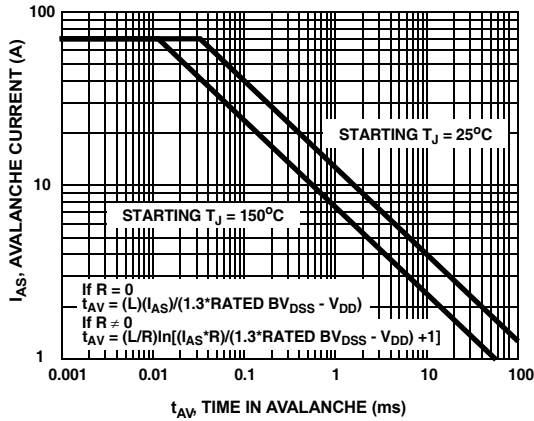
Figure 9. Unclamped Inductive Switching Capability

I_D, DRAIN CURRENT (A)

10μs
100μs
1ms
10ms
DC

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

SINGLE PULSE
T_J = MAX RATED
T_C = 25°C

V_{DS}, DRAIN TO SOURCE VOLTAGE (V)
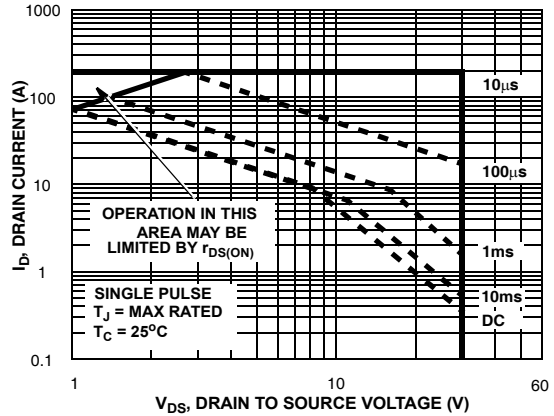
Figure 10. Safe Operating Area

I_D, DRAIN CURRENT (A)

V_{GS} = 10V

V_{GS} = 4.5V

T_C, CASE TEMPERATURE (°C)
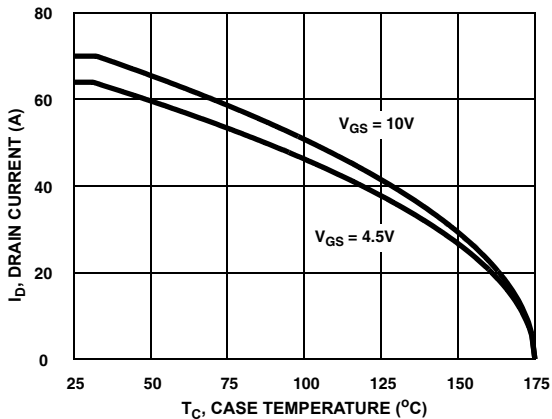
Figure 11. Maximum Continuous Drain Current vs Case Temperature

$P_{(PK)}$, PEAK TRANSIENT POWER (W)

SINGLE PULSE
$R_{\theta JC}$ = 2.14°C/W
T_J = 25°C

t, PULSE WIDTH (s)

Figure 12. Normalized Drain to Source Breake Down Voltage vs Junction Temperature

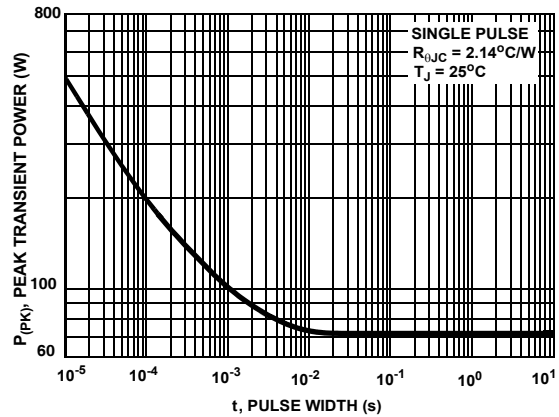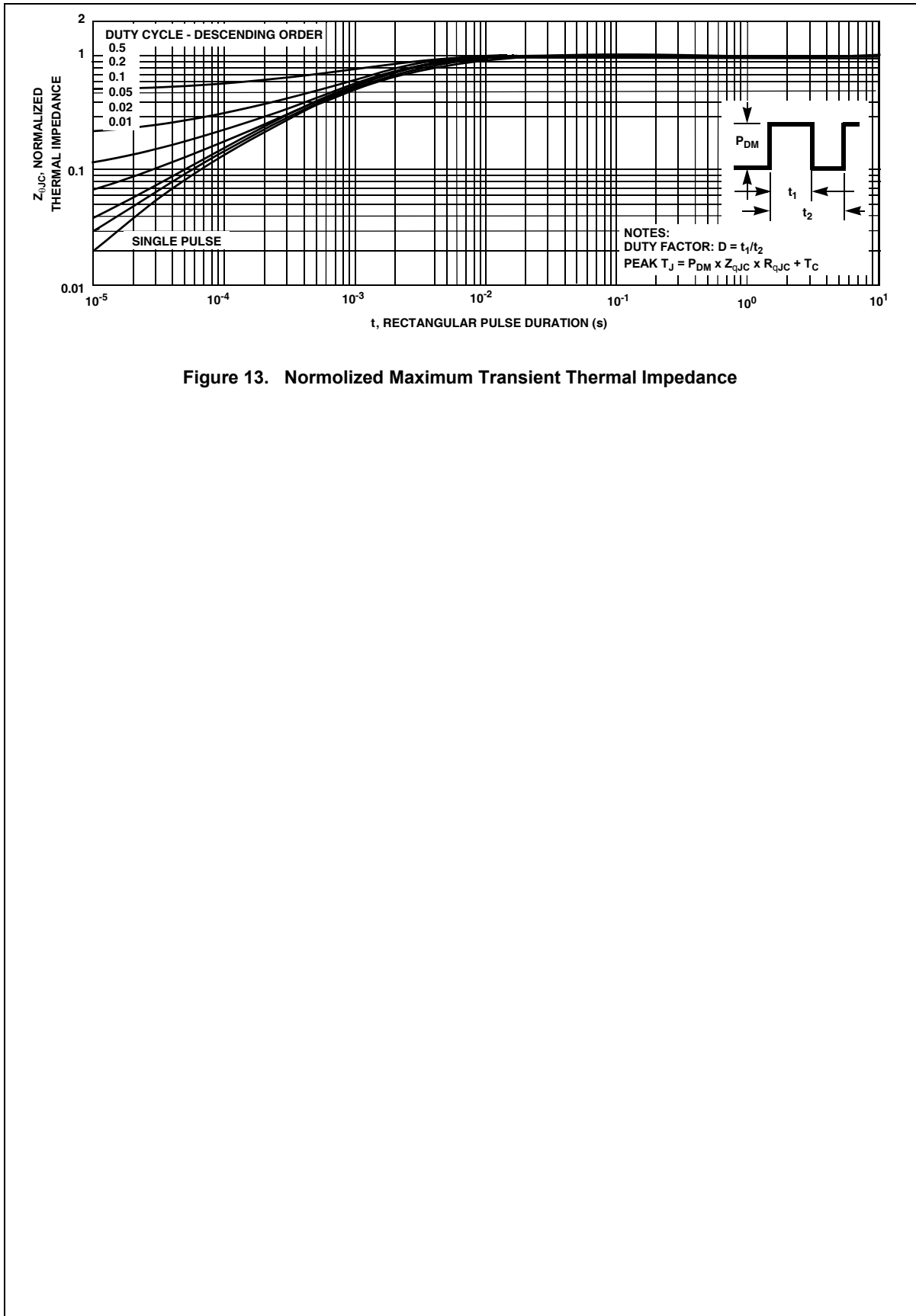**Typical Characteristics** T_A = 25°C unless otherwise noted

Figure 13.   Normolized Maximum Transient Thermal Impedance

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