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FDB8878
N-Channel Logic Level PowerTrench® MOSFET
**30V, 48A, 14mΩ**

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

- $r_{DS(ON)}$ = 14mΩ, V_{GS} = 10V, I_D = 40A

- $r_{DS(ON)}$ = 18mΩ, 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

GATE

SOURCE

DRAIN
(FLANGE)

TO-263AB
FDB SERIES

D

G

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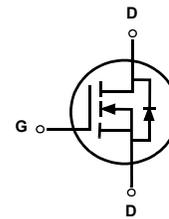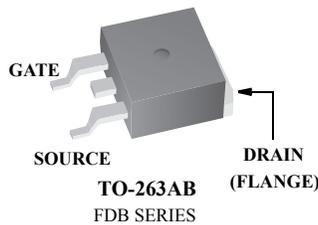
MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

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)		48	A
	Continuous (T_C = 25°C, V_{GS} = 4.5V)		42	A
	Pulsed (Note 4)		170	A
E_{AS}	Single Pulse Avalanche Energy (Note 1)	L = 1mH, I_{AS} = 11A	60	mJ
		L = 0.03mH, I_{AS} = 38A	21	
P_D	Power dissipation		47.3	W
T_J, T_{STG}	Operating and Storage Temperature		-55 to 175	°C

Thermal Characteristics

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

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDB8878	FDB8878	TO-263	13"	24mm	800 units

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Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
BV_{DSS}	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	14	mΩ
		I_D = 36A, V_{GS} = 4.5V		-	15	18	
		I_D = 40, V_{GS} = 10V, T_A = 175°C		-	19	21	

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			-	117	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	-	17.1	23	nC
$Q_{g(5)}$	Total Gate Charge at 5V	V_{GS} = 0V to 5V	I_D = 40A	-	9.2	12	nC
Q_{gs}	Gate to Source Gate Charge		I_g = 1.0mA	-	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		-	255	383	ns
$t_{d(ON)}$	Turn-On Delay Time		-	11.1		ns
t_r	Rise Time	V_{DD} = 15V, I_D = 40A	-	244		ns
$t_{d(OFF)}$	Turn-Off Delay Time	V_{GS} = 10V, R_{GS} = 16Ω	-	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
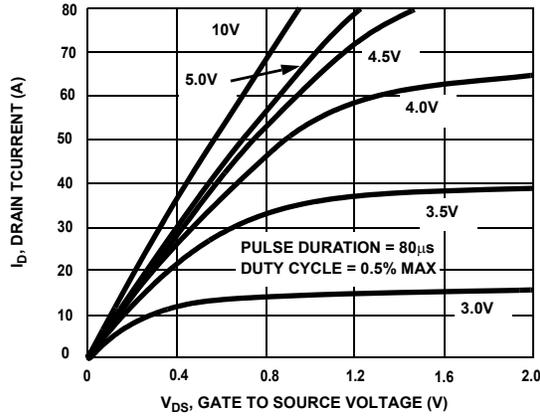

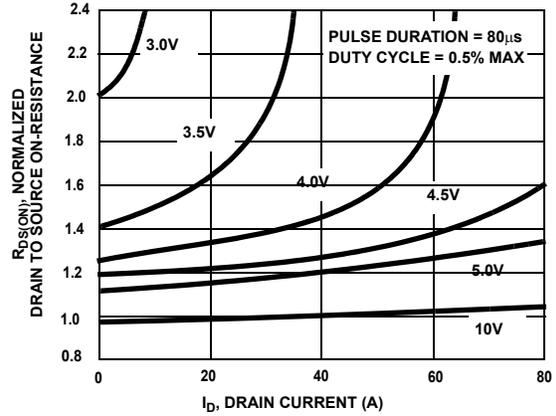**Figure 1. On Region Characteristics**

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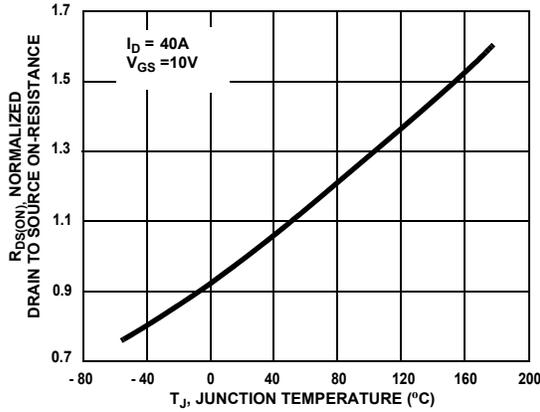

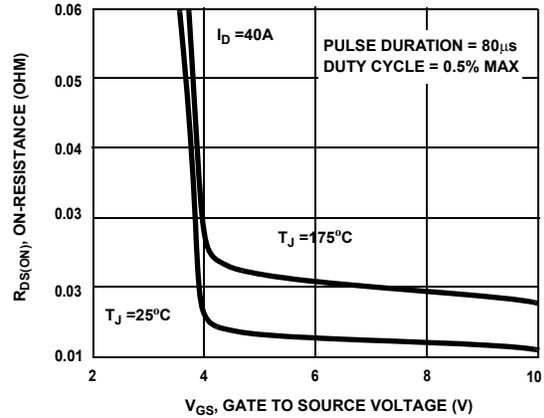**Figure 3. On Resistance Variation with Temperature**

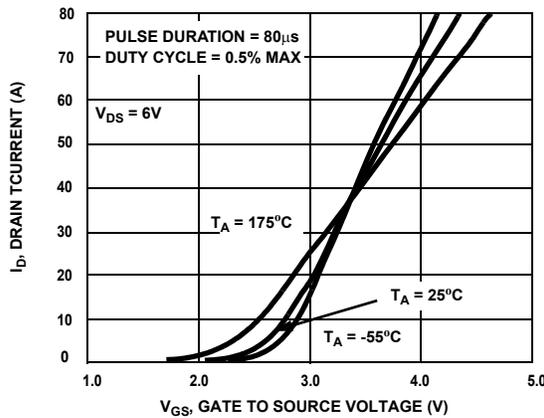**Figure 4. On-Resistance Variation with Gate-to-Source Votlage**
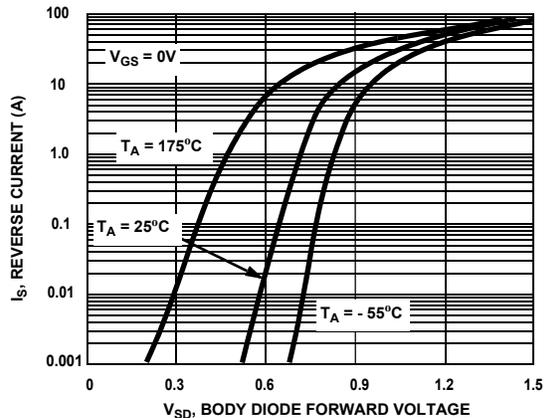

Figure 5. Transfer Characteristics

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

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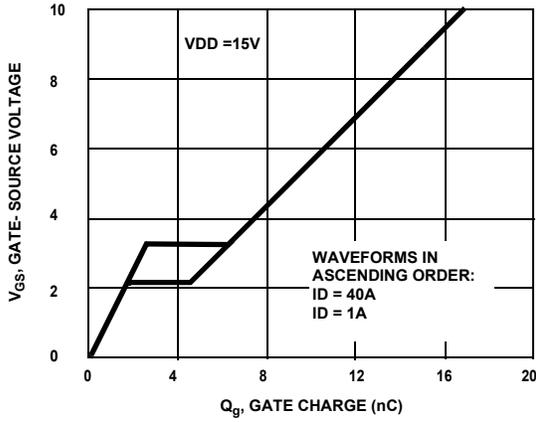## Typical Characteristics T_A = 25°C unless otherwise noted

VDD =15V

WAVEFORMS IN ASCENDING ORDER:
ID = 40A
ID = 1A

V_{GS}, GATE- SOURCE VOLTAGE

Q_g, GATE CHARGE (nC)

Figure 7. Gate Charge Characteristics

f = 1MHz
V_{GS} = 0V

C_{ISS}
C_{OSS}
C_{RSS}

CAPACITANCE (pF)

V_{DS}, DRAIN TO SOURCE VOLTAGE (V)
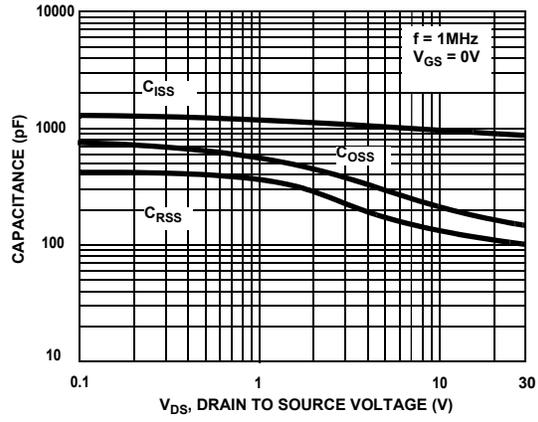
Figure 8. Capacitance Characteristics

If R = 0
$t_{AV} = (L)(I_{AS})/(1.3*RATED~BV_{DSS} - V_{DD})$
If R ¼ 0
$t_{AV} = (L/R)In[(I_{AS}*R)/(1.3*RATED~BV_{DSS} - V_{DD}) +1]$

STARTING T_J = 25°C

STARTING T_J = 150°C

I_{AS}, AVALANCHE CURRENT (A)

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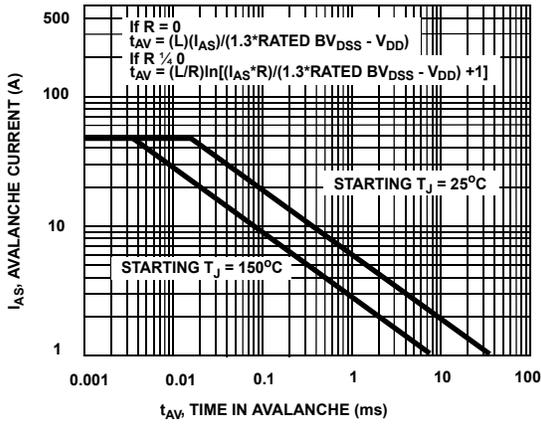
Figure 9. Unclamped Inductive Switching Capability

SINGLE PULSE
T_J = MAX RATED
T_C = 25°C

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

10μs
100μs
1ms
DC

I_D, DRAIN TCURRENT (A)

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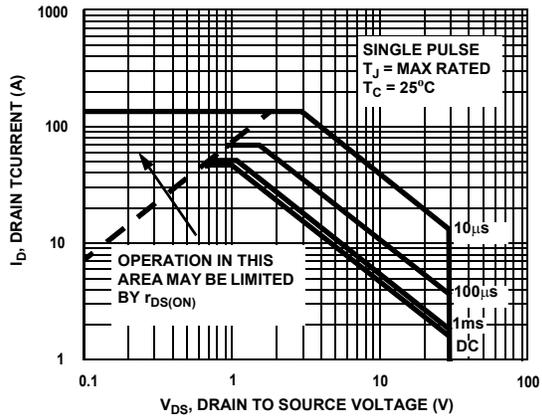
Figure 10. Safe Operating Area

V_{GS} = 10V
V_{GS} = 4.5V
$R_{\theta JC}$ = 3.17°C/W

I_D, DRAIN TCURRENT (A)

V_{DS}, GATE TO SOURCE VOLTAGE (V)
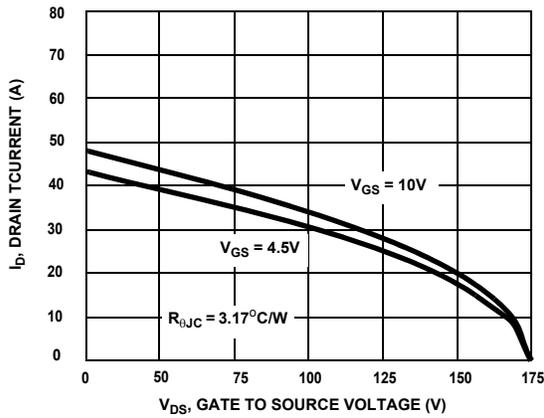
Figure 11. Maximum Continuous Drain Current vs Case Temperature

SINGLE PULSE
$R_{\theta JC}$ = 0.5°C/W
T_J = 25°C

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

t, PULSE WIDTH (s)
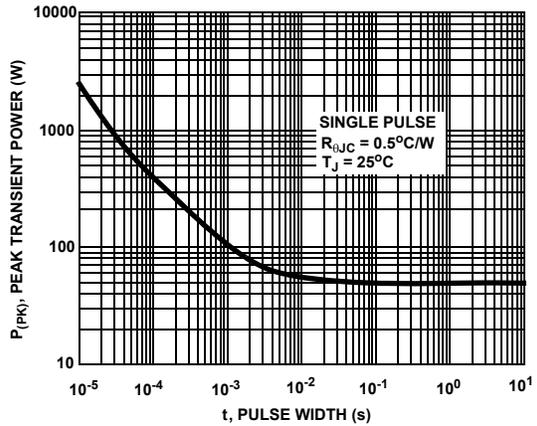
Figure 12. Single Pulse Maximum Power Dissipation

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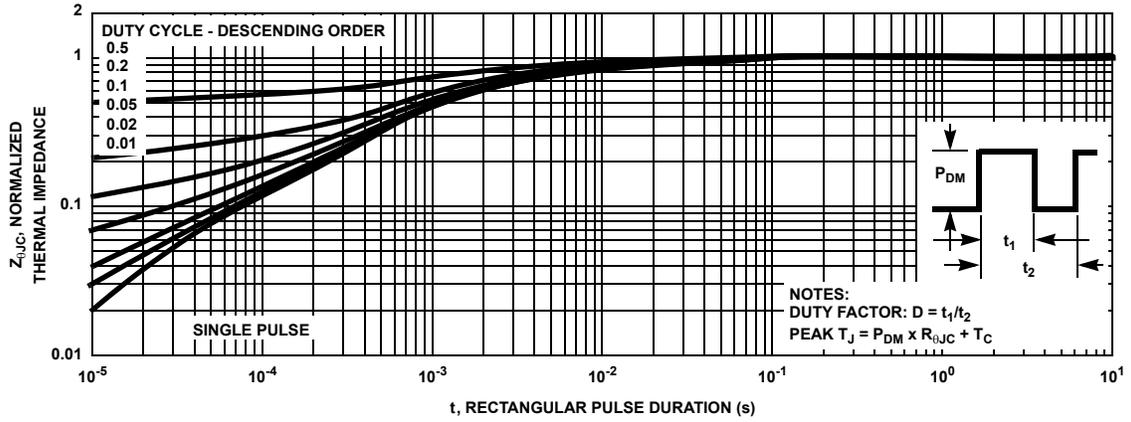
Figure 13. Transient Thermal Response Curve

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