



**THE DATASHEET OF  
FDP8878**



# FDP8878

## N-Channel Logic Level PowerTrench® MOSFET

30V, 40A, 15mΩ

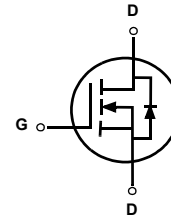
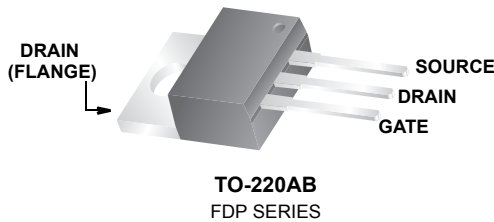
### General Descriptions

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



### MOSFET Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units	
$V_{DSS}$	Drain to Source Voltage	30	V	
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V	
$I_D$	Drain Current			
	Continuous ( $T_C = 25^\circ C, V_{GS} = 10V$ )	40	A	
	Continuous ( $T_C = 25^\circ C, V_{GS} = 4.5V$ )	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	$^\circ C$	

### Thermal Characteristics

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

### 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**  $T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$B_{VDSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	30	-	-	V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temp. Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$		21		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}$ $V_{GS} = 0\text{V}$ $T_A = 150^\circ\text{C}$	-	-	1 250	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA

**On Characteristics**

$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	1.2	1.7	2.5	V
$\frac{\Delta V_{GS(TH)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$		-5		mV/ $^\circ\text{C}$
$r_{DS(ON)}$	Drain to Source On Resistance	$I_D = 40\text{A}, V_{GS} = 10\text{V}$	-	12	15	m $\Omega$
		$I_D = 36\text{A}, V_{GS} = 4.5\text{V}$	-	16	19	
		$I_D = 40\text{A}, V_{GS} = 10\text{V}$ , $T_A = 175^\circ\text{C}$	-	20	25	

**Dynamic Characteristics**

$C_{ISS}$	Input Capacitance	$V_{DS} = 15\text{V}, V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$	-	927	1235	pF	
$C_{OSS}$	Output Capacitance		-	188	250	pF	
$C_{RSS}$	Reverse Transfer Capacitance		-	1130	175	pF	
$R_G$	Gate Resistance	$f = 1\text{MHz}$		3.0		$\Omega$	
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0\text{V}$ to 10V	$V_{DD} = 15\text{V}$ $I_D = 40\text{A}$ $I_g = 1.0\text{mA}$	-	17.1	23	nC
$Q_{g(5)}$	Total Gate Charge at 5V	$V_{GS} = 0\text{V}$ 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** ( $V_{GS} = 10\text{V}$ )

$t_{ON}$	Turn-On Time	$V_{DD} = 15\text{V}, I_D = 40\text{A}$ $V_{GS} = 10\text{V}, R_{GS} = 16\Omega$	-	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**

$V_{SD}$	Source to Drain Diode Voltage	$I_{SD} = 40\text{A}$	-	1.1	1.25	V
		$I_{SD} = 3.2\text{A}$	-	0.85	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 40\text{A}, dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	14.4	18.8	ns
$Q_{RR}$	Reverse Recovered Charge	$I_{SD} = 40\text{A}, dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	5.1	6.7	nC

**Notes:**

- Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 30\text{V}$ ,  $V_{GS} = 10\text{V}$
- $R_{\theta JA}$  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.
- $R_{\theta JA}$  is measured with 1.0 in<sup>2</sup> copper on FR-4 board
- Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%

**Typical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

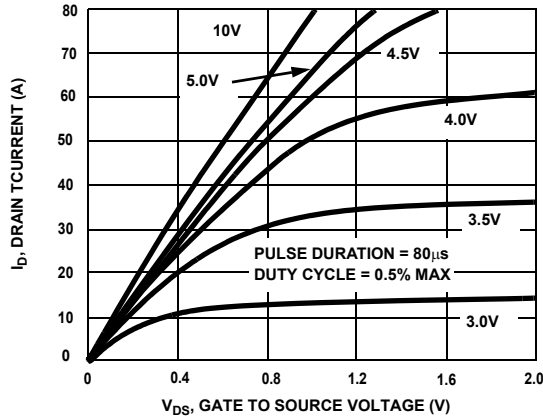


Figure 1. On Region Characteristics

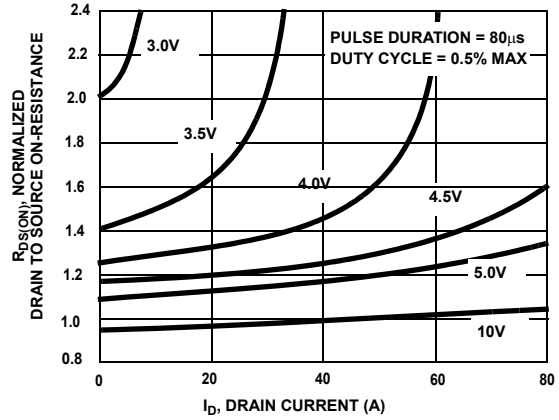


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

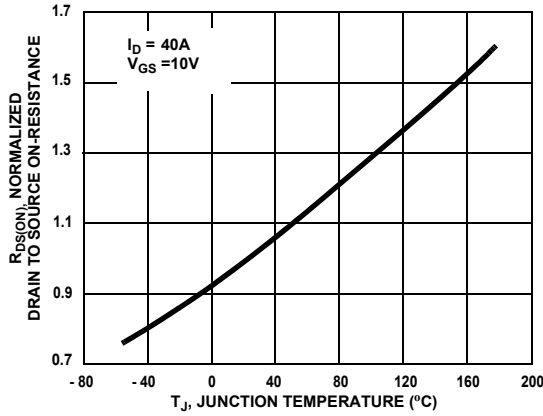


Figure 3. On Resistance Variation with Temperature

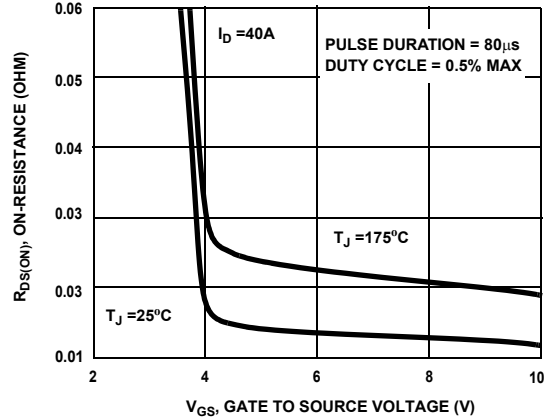


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

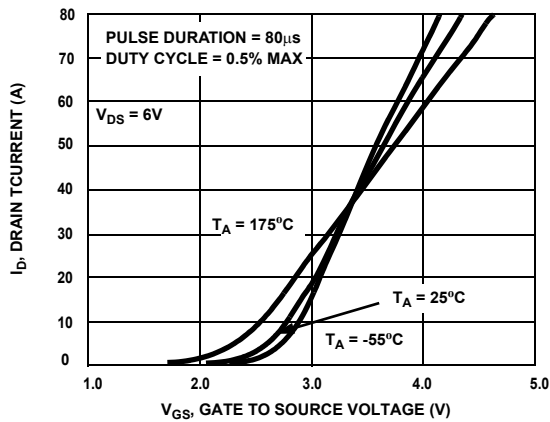


Figure 5. Transfer Characteristics

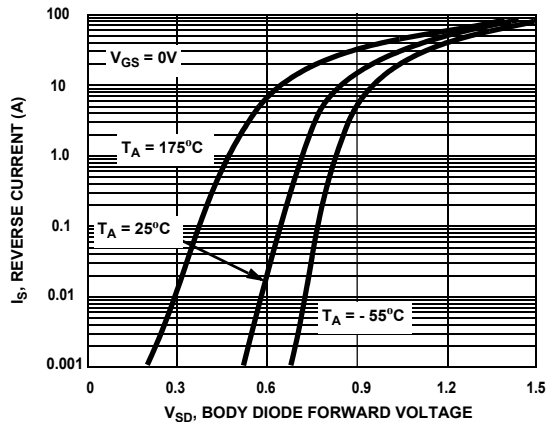


Figure 6. Body Diode Forward Voltage Variation With Source Current and Temperature

**Typical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

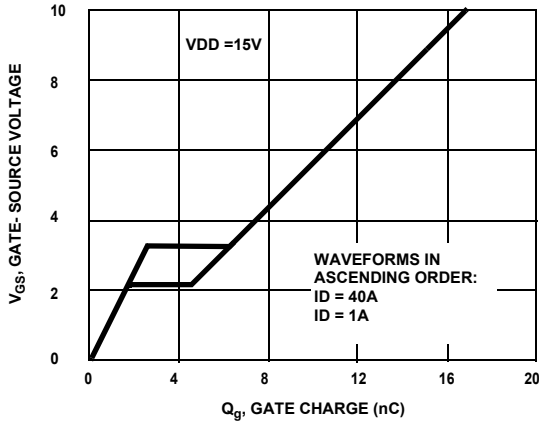


Figure 7. Gate Charge Characteristics

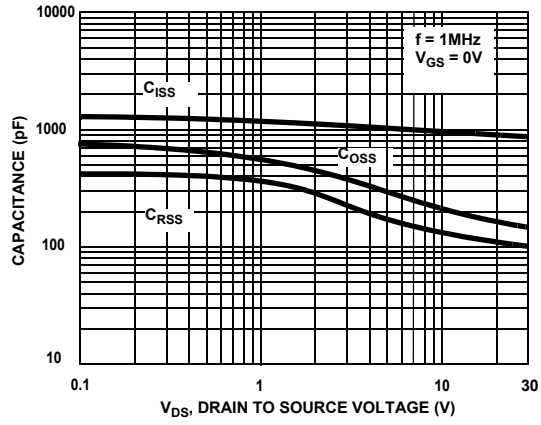


Figure 8. Capacitance Characteristics

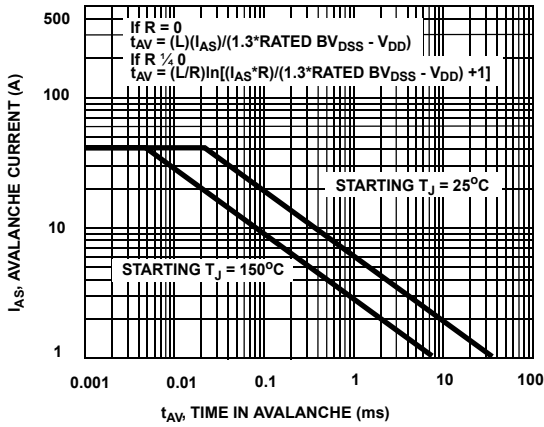


Figure 9. Unclamped Inductive Switching Capability

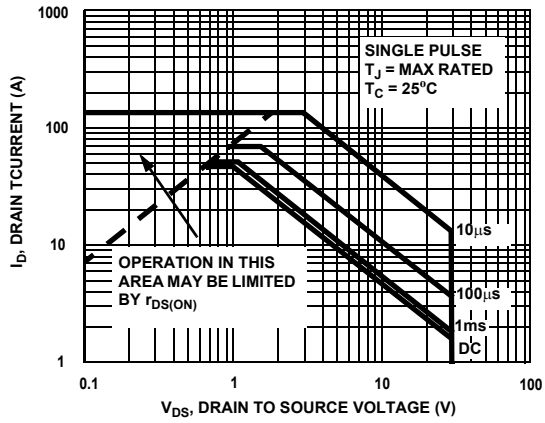


Figure 10. Safe Operating Area

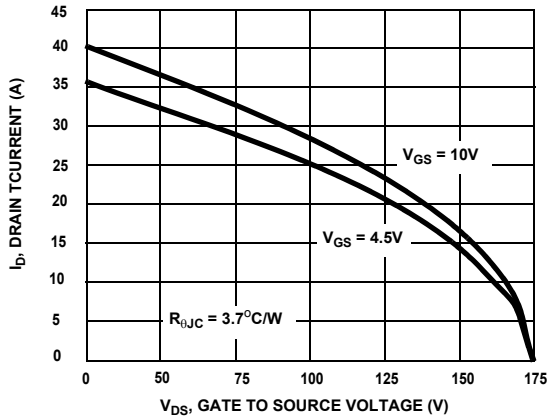


Figure 11. Maximum Continuous Drain Current vs Case Temperature

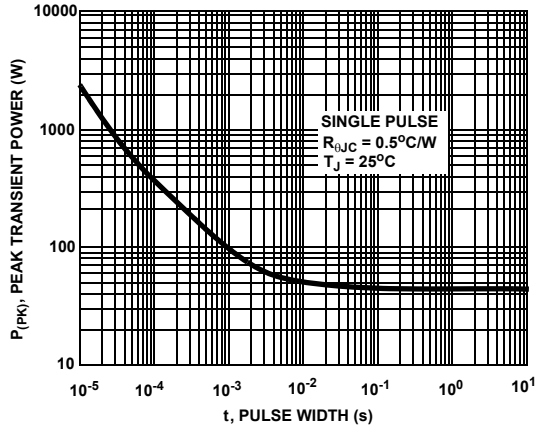


Figure 12. Single Pulse Maximum Power Dissipation

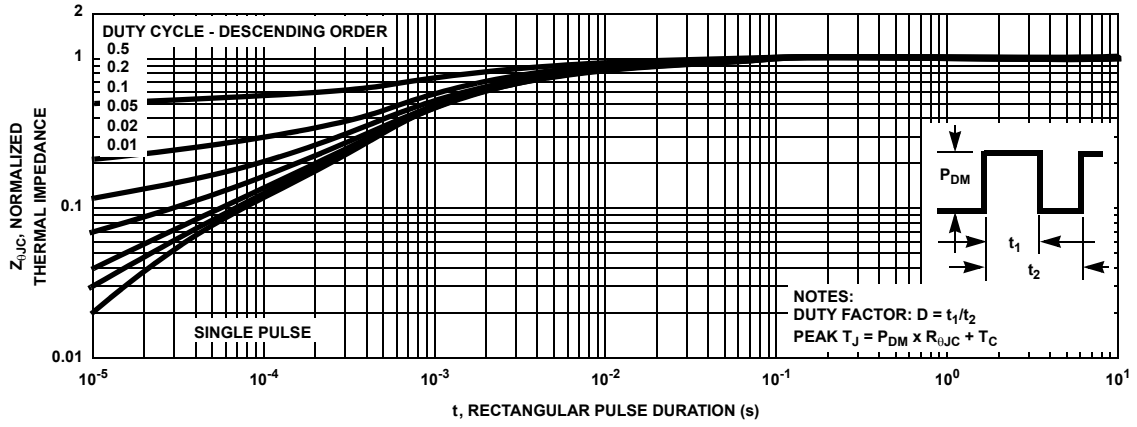


Figure 13. Transient Thermal Response Curve

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