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# FDP8878

## N-Channel Logic Level PowerTrench® MOSFET

30V, 40A, 15mΩ

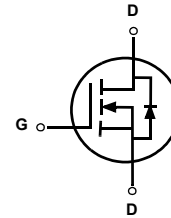
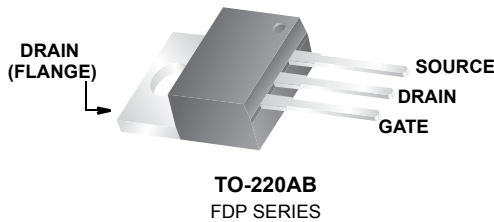
### General Descriptions

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
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temp. Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$		21		mV/°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/°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:**

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

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

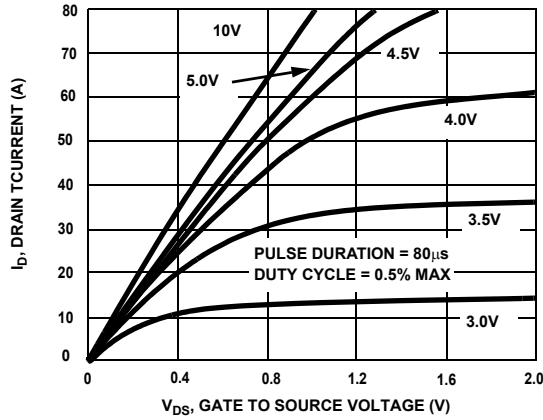


Figure 1. On Region Characteristics

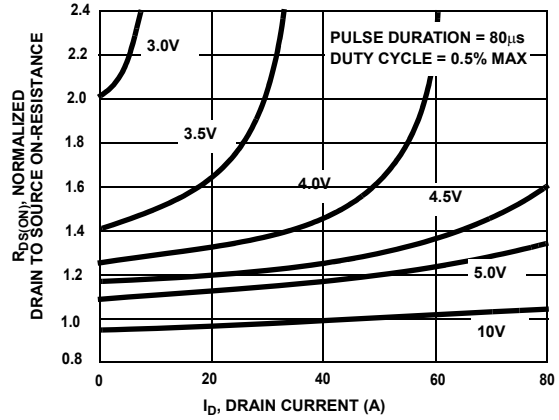


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

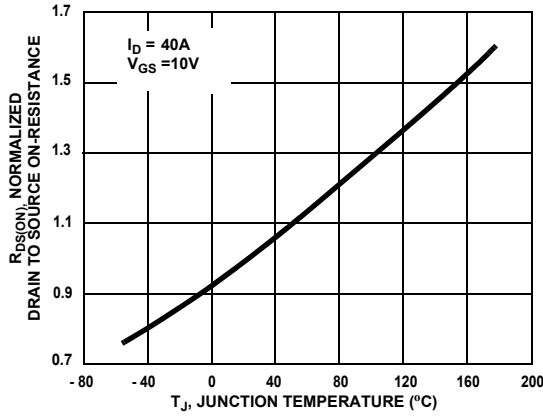


Figure 3. On Resistance Variation with Temperature

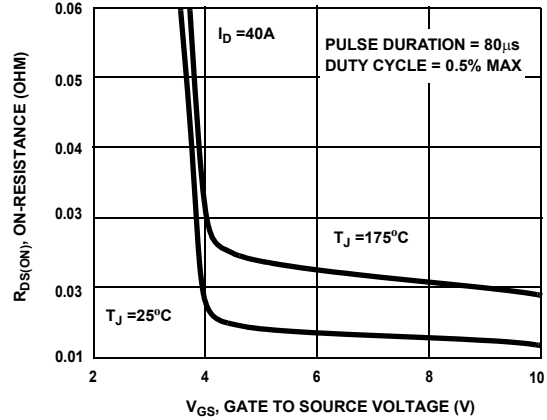


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

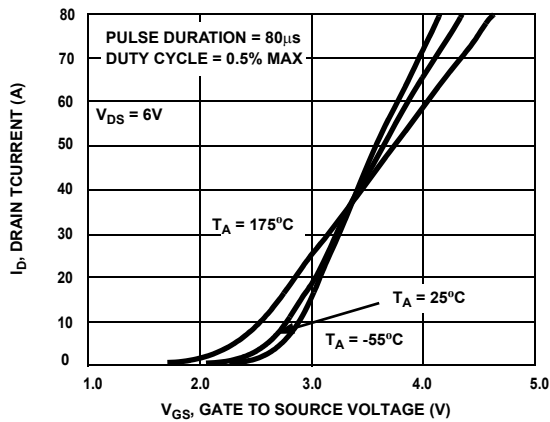


Figure 5. Transfer Characteristics

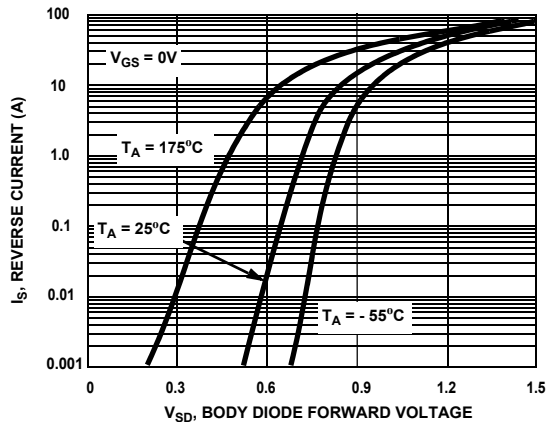
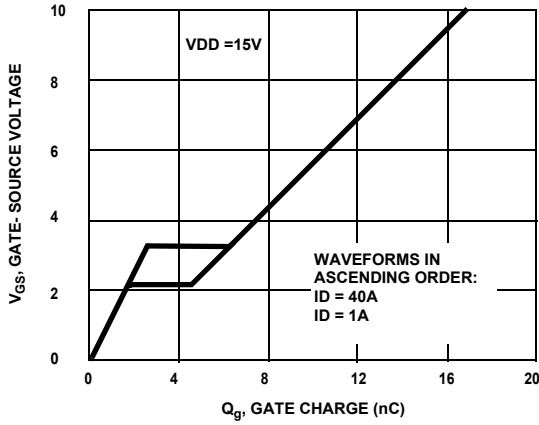
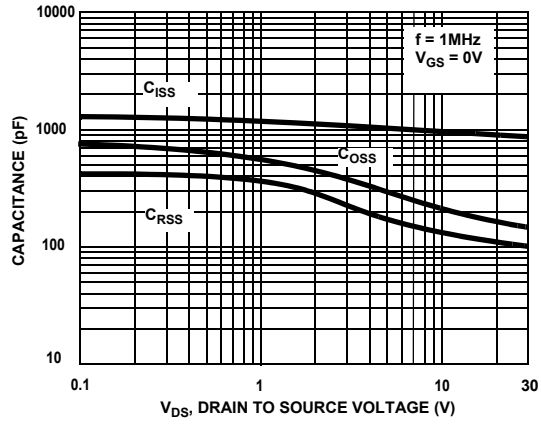


Figure 6. Body Diode Forward Voltage Variation With Source Current and Temperature

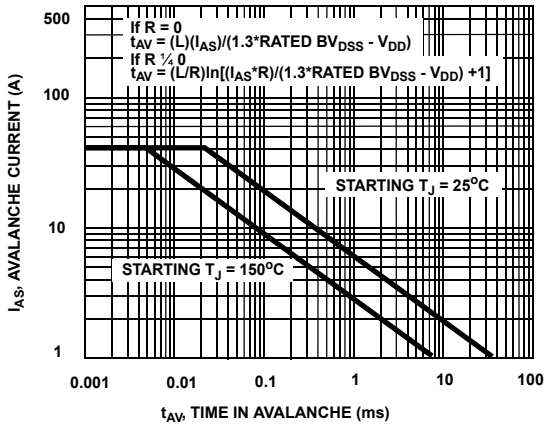
**Typical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted



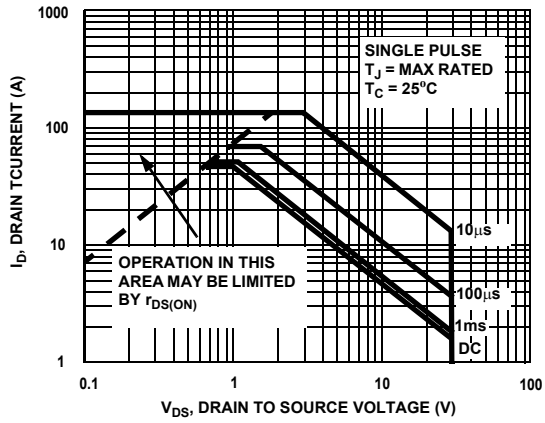
**Figure 7. Gate Charge Characteristics**



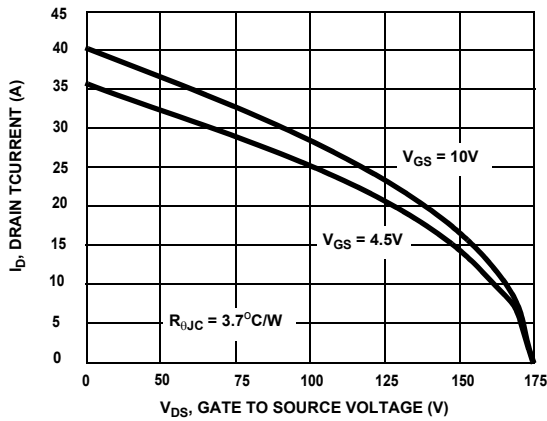
**Figure 8. Capacitance Characteristics**



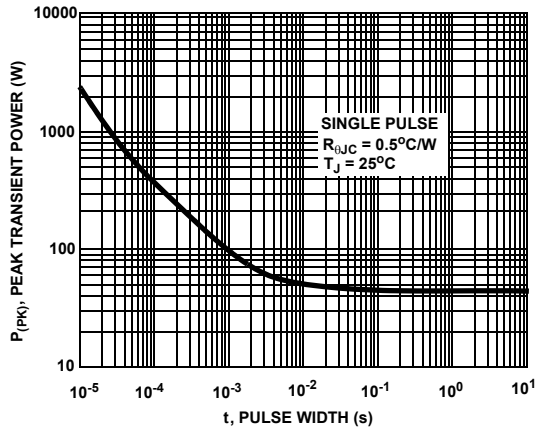
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Safe Operating Area**



**Figure 11. Maximum Continuous Drain Current vs Case Temperature**



**Figure 12. Single Pulse Maximum Power Dissipation**

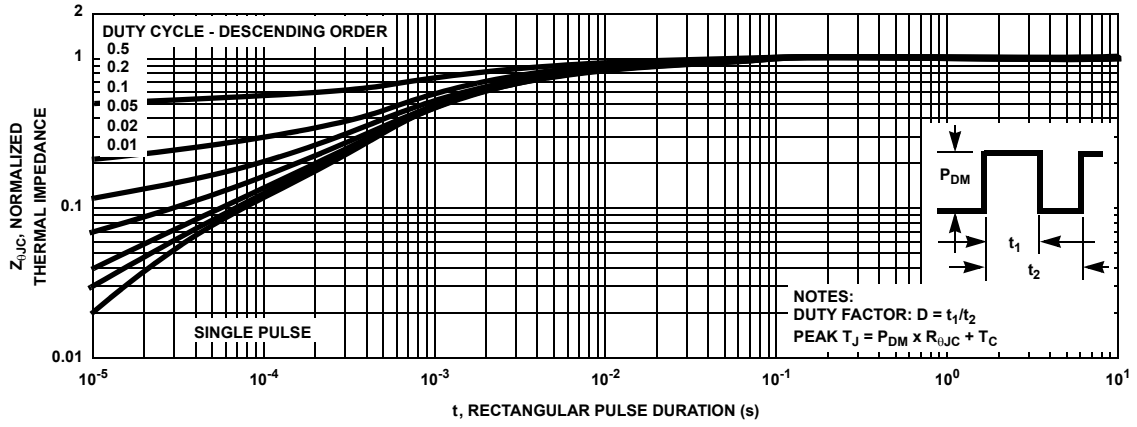


Figure 13. Transient Thermal Response Curve

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