

# FDD6778A

## N-Channel PowerTrench® MOSFET

25 V, 14.0 mΩ

### Features

- Max  $r_{DS(on)}$  = 14.0 mΩ at  $V_{GS} = 10$  V,  $I_D = 10.0$  A
- Max  $r_{DS(on)}$  = 30.0 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 9.7$  A
- 100% UIL tested
- RoHS Compliant

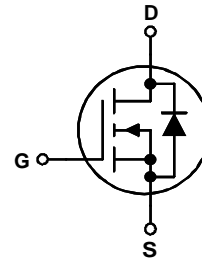
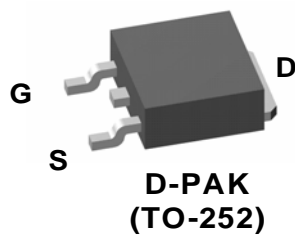


### General Description

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.

### Applications

- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture



### MOSFET Maximum Ratings $T_C = 25$ °C unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	25	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25$ °C	10	A
	-Continuous (Silicon limited) $T_C = 25$ °C	30	
	-Continuous $T_A = 25$ °C (Note 1a)	12	
	-Pulsed	50	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	12	mJ
$P_D$	Power Dissipation $T_C = 25$ °C	24	W
	Power Dissipation $T_A = 25$ °C (Note 1a)	3.7	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +175	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	6.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	40	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD6778A	FDD6778A	D-PAK (TO-252)	13 "	12 mm	2500 units

## Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		17		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	1.0	1.9	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-6		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 10.0\text{ A}$		11.4	14	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 9.7\text{ A}$		22.0	30.0	
		$V_{GS} = 10\text{ V}$ , $I_D = 10.0\text{ A}$ , $T_J = 150\text{ }^\circ\text{C}$		17.2	21.2	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}$ , $I_D = 10.0\text{ A}$		33		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 13\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		652	870	pF
$C_{oss}$	Output Capacitance			142	190	pF
$C_{riss}$	Reverse Transfer Capacitance			129	195	pF
$R_g$	Gate Resistance			0.8		$\Omega$

### Switching Characteristics

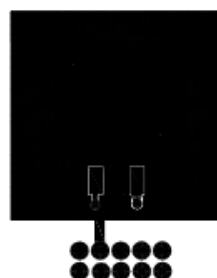
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 13\text{ V}$ , $I_D = 10.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		6	12	ns	
$t_r$	Rise Time			3	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			14	26	ns	
$t_f$	Fall Time			2	10	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{ V to }10\text{ V}$		12	17	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to }5\text{ V}$	$V_{DD} = 13\text{ V}$ , $I_D = 10.0\text{ A}$		7	10	nC
$Q_{gs}$	Gate to Source Charge				2.0		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				2.8		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 3.1\text{ A}$ (Note 2)		0.9	1.3	V
		$V_{GS} = 0\text{ V}$ , $I_S = 10.0\text{ A}$ (Note 2)		0.8	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 10.0\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		14	26	ns
$Q_{rr}$	Reverse Recovery Charge			3	10	nC

#### Notes:

- 1:  $R_{\theta JA}$  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.



a)  $40\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $96\text{ }^\circ\text{C/W}$  when mounted on a minimum pad

2: Pulse Test: Pulse Width <  $300\text{ }\mu\text{s}$ , Duty cycle < 2.0%.

3:  $E_{AS}$  of 12 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 1\text{ mH}$ ,  $I_{AS} = 5\text{ A}$ ,  $V_{DD} = 23\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 12\text{ A}$ .

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

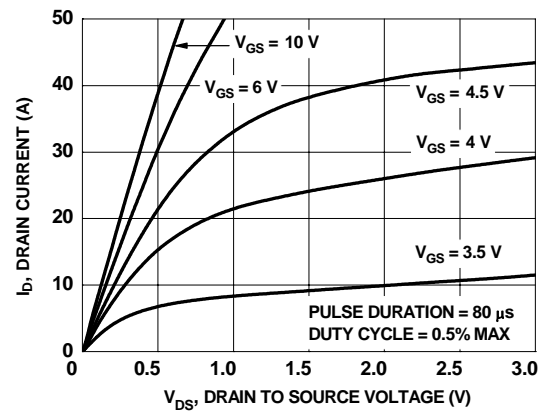


Figure 1. On Region Characteristics

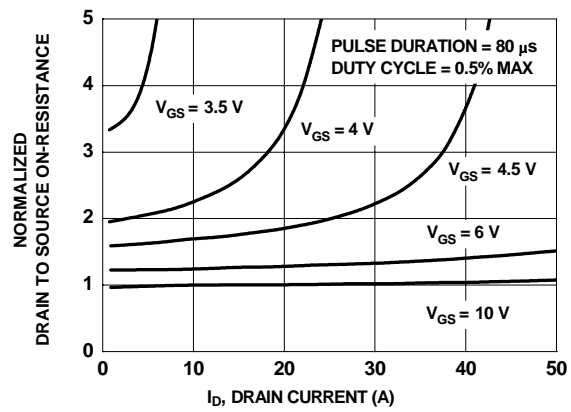


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

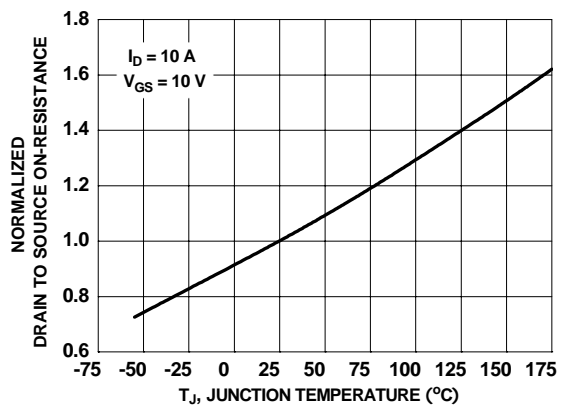


Figure 3. Normalized On Resistance vs Junction Temperature

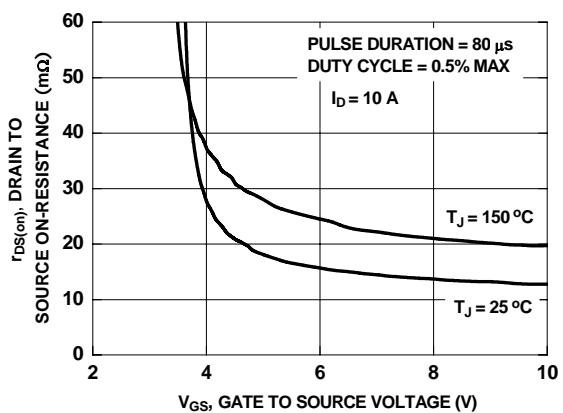


Figure 4. On-Resistance vs Gate to Source Voltage

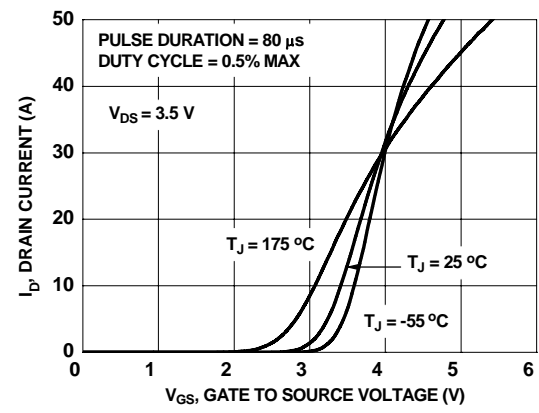


Figure 5. Transfer Characteristics

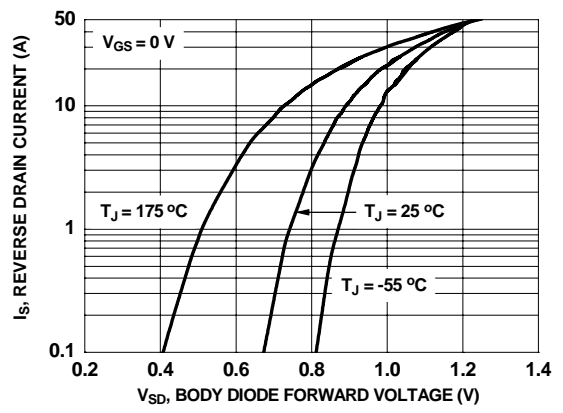
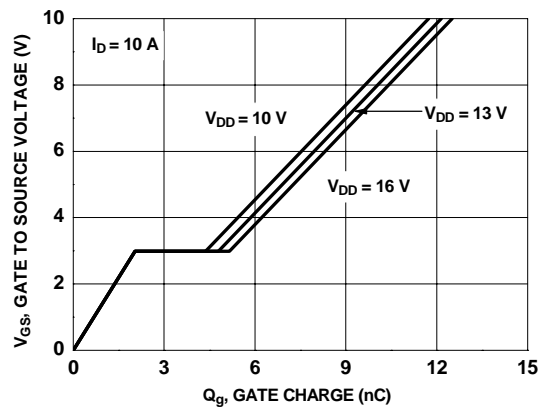
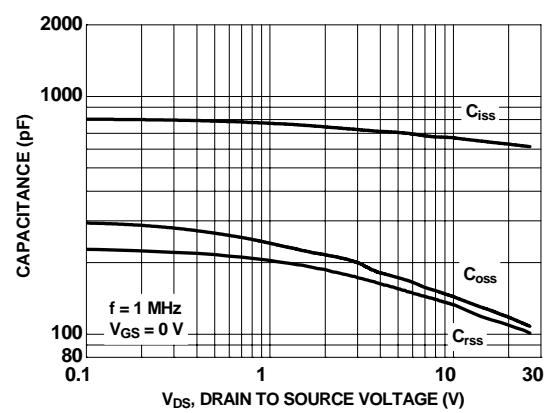


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

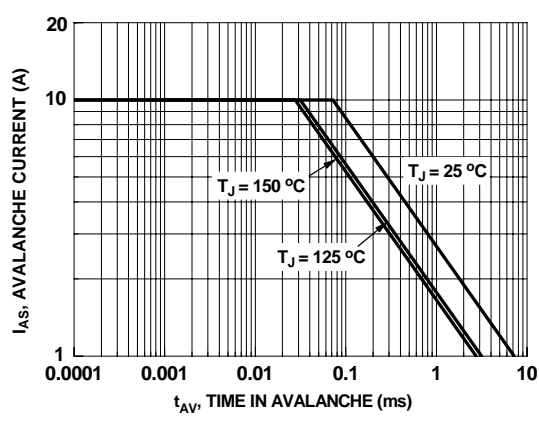
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



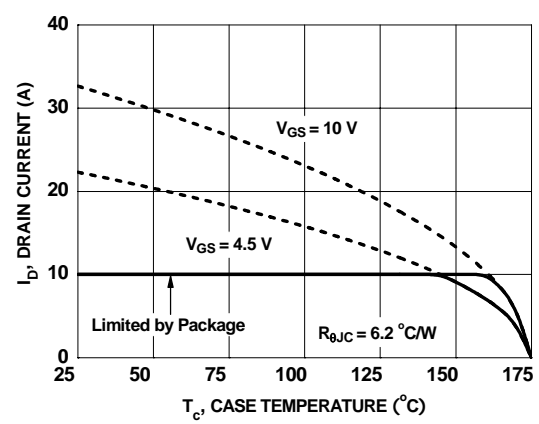
**Figure 7. Gate Charge Characteristics**



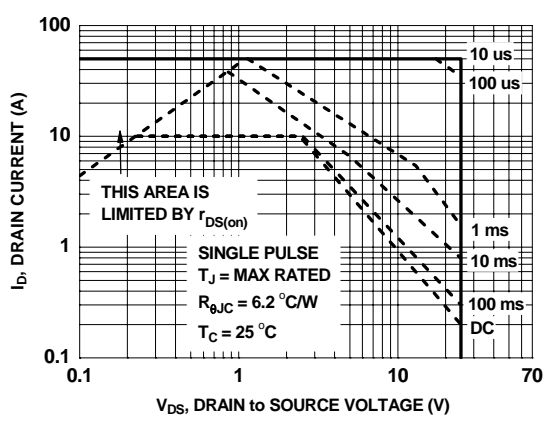
**Figure 8. Capacitance vs Drain to Source Voltage**



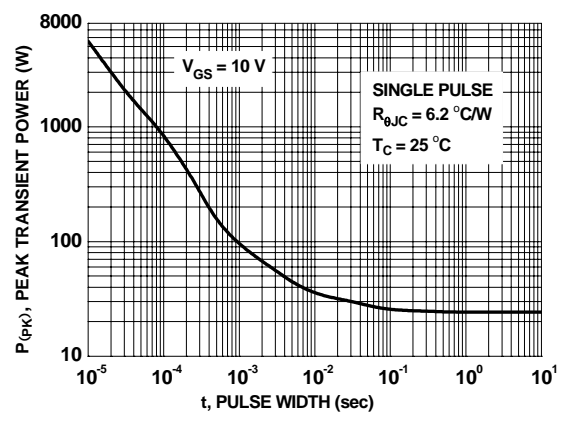
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

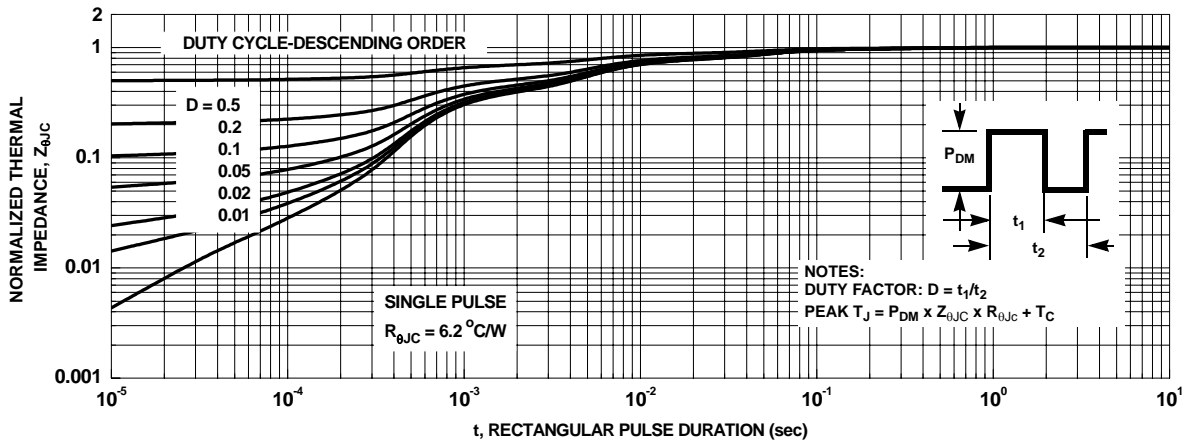


**Figure 11. Forward Bias Safe Operating Area**

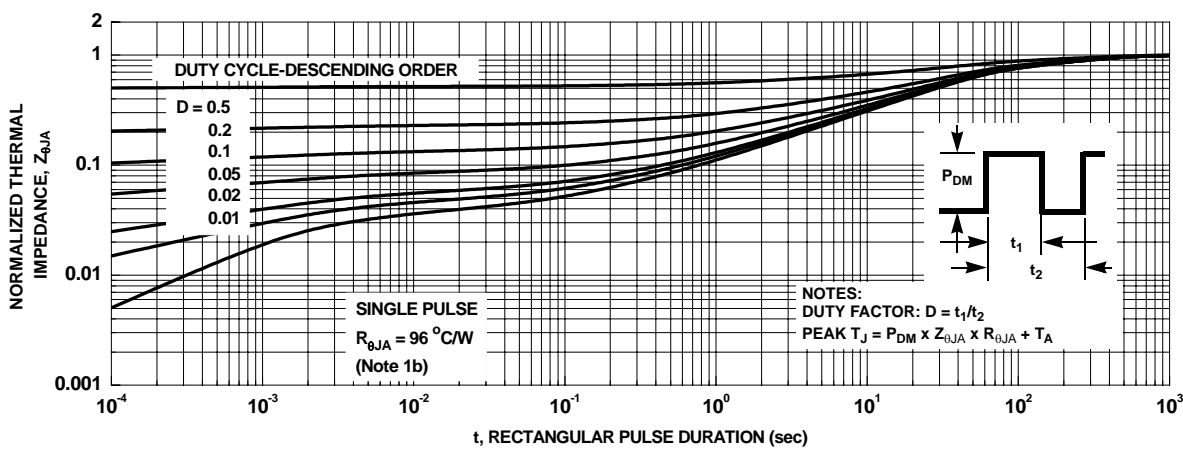


**Figure 12. Single Pulse Maximum Power Dissipation**

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



**Figure 13. Junction-to-Case Transient Thermal Response Curve**









**Figure 14. Junction-to-Ambient Transient Thermal Response Curve**



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