



March 2006

FDD8780/FDU8780

N-Channel PowerTrench[®] MOSFET

25V, 35A, 8.5mΩ



General Description

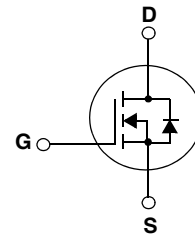
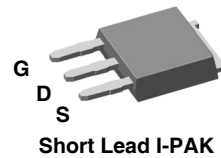
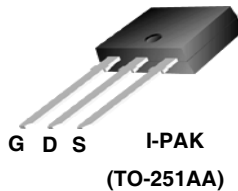
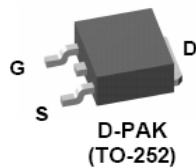
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

Features

- Max $r_{DS(on)}$ = 8.5mΩ at $V_{GS} = 10V$, $I_D = 35A$
- Max $r_{DS(on)}$ = 12.0mΩ at $V_{GS} = 4.5V$, $I_D = 35A$
- Low gate charge: $Q_{g(10)}$ = 21nC(Typ), $V_{GS} = 10V$
- Low gate resistance
- Avalanche rated and 100% tested
- RoHS Compliant

Application

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



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ 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)	35	A
	-Continuous (Die Limited)	60	
	-Pulsed (Note 1)	224	
E_{AS}	Single Pulse Avalanche Energy (Note 2)	73	mJ
P_D	Power Dissipation	50	W
T_J, T_{STG}	Operating and Storage Temperature	-55 to 175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case TO-252, TO-251	3.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252, TO-251	100	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252, 1in ² copper pad area	52	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8780	FDD8780	TO-252AA	13"	12mm	2500 units
FDU8780	FDU8780	TO-251AA	N/A(Tube)	N/A	75 units
FDU8780	FDU8780_F071	TO-251AA	N/A(Tube)	N/A	75 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

B_{VDSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	25			V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, referenced to 25°C		12		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 20\text{V}, V_{GS} = 0\text{V}$ $T_J = 150^\circ\text{C}$			1 250	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	1.2	1.8	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°C		-6.3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 35\text{A}$ $V_{GS} = 4.5\text{V}, I_D = 35\text{A}$ $V_{GS} = 10\text{V}, I_D = 35\text{A}$ $T_J = 175^\circ\text{C}$		6.5 9.1 10.4	8.5 12.0 15.0	m Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 13\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		1080	1440	pF
C_{oss}	Output Capacitance			265	355	pF
C_{rss}	Reverse Transfer Capacitance			180	270	pF
R_g	Gate Resistance		$f = 1\text{MHz}$	0.9		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 13\text{V}, I_D = 35\text{A}$ $V_{GS} = 10\text{V}, R_{GS} = 17\Omega$		7	14	ns
t_r	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			43	69	ns
t_f	Fall Time			24	38	ns
Q_g	Total Gate Charge		$V_{GS} = 0\text{V to } 10\text{V}$		21	29
Q_g	Total Gate Charge	$V_{GS} = 0\text{V to } 5\text{V}$	$V_{DD} = 13\text{V}$ $I_D = 35\text{A}$ $I_g = 1.0\text{mA}$	11.2	16	nC
Q_{gs}	Gate to Source Gate Charge			3.5		nC
Q_{gd}	Gate to Drain "Miller" Charge			4.7		nC

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 35\text{A}$ $V_{GS} = 0\text{V}, I_S = 15\text{A}$		0.92 0.84	1.25 1.0	V
t_{rr}	Reverse Recovery Time	$I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$		28	42	ns
Q_{rr}	Reverse Recovery Charge	$I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$		20	30	nC

Notes:

- 1: Pulse time < 300 μs , Duty cycle = 2%.
- 2: Starting $T_J = 25^\circ\text{C}$, $L = 0.3\text{mH}$, $I_{AS} = 22\text{A}$, $V_{DD} = 23\text{V}$, $V_{GS} = 10\text{V}$.

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

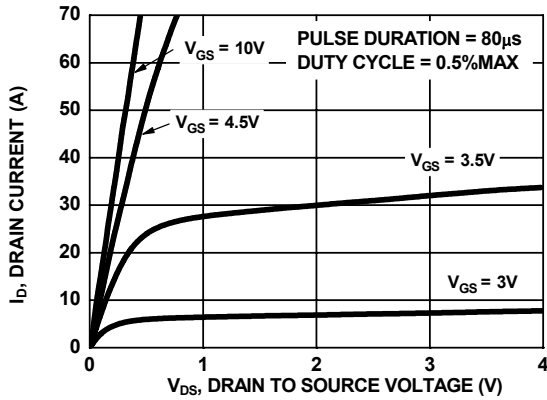


Figure 1. On Region Characteristics

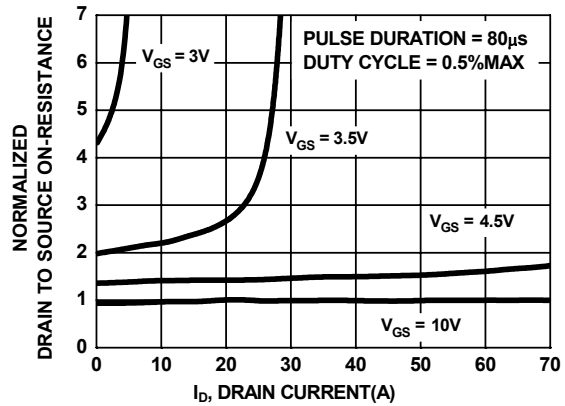


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

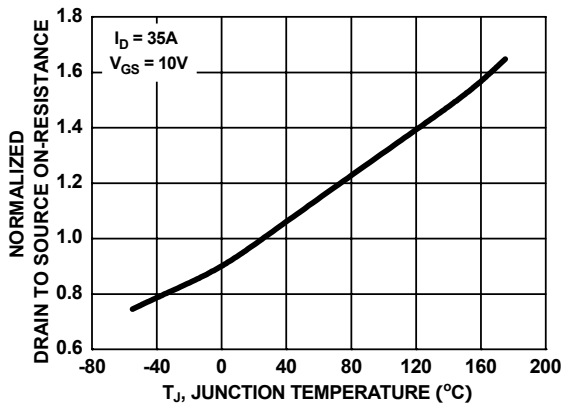


Figure 3. Normalized On Resistance vs Junction Temperature

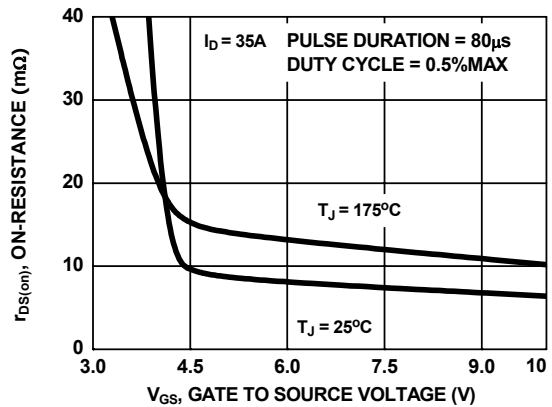


Figure 4. On-Resistance vs Gate to Source Voltage

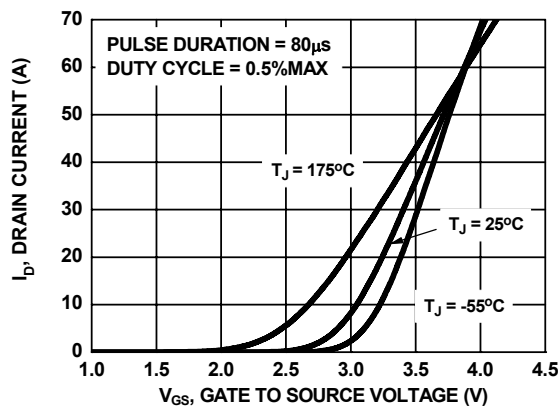


Figure 5. Transfer Characteristics

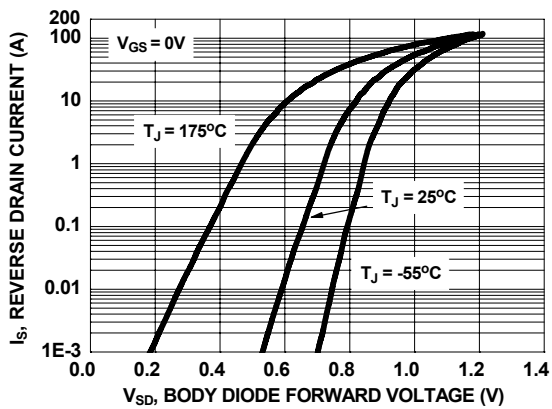


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

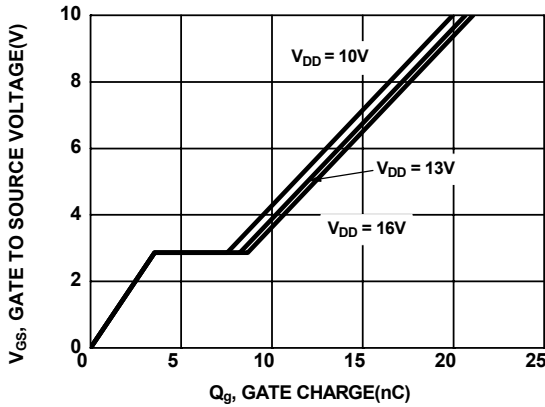


Figure 7. Gate Charge Characteristics

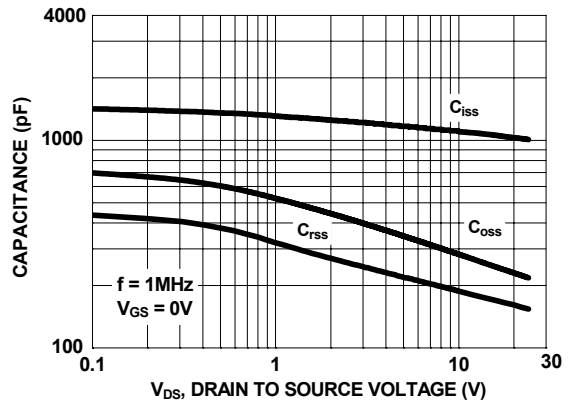


Figure 8. Capacitance vs Drain to Source Voltage

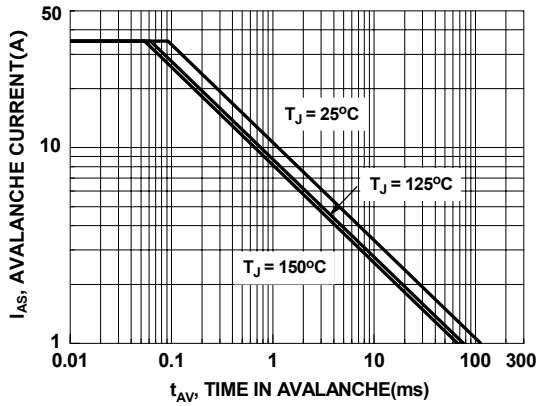


Figure 9. Unclamped Inductive Switching Capability

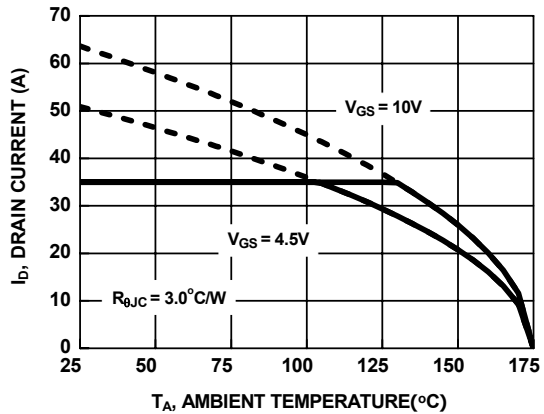


Figure 10. Maximum Continuous Drain Current vs Case Temperature

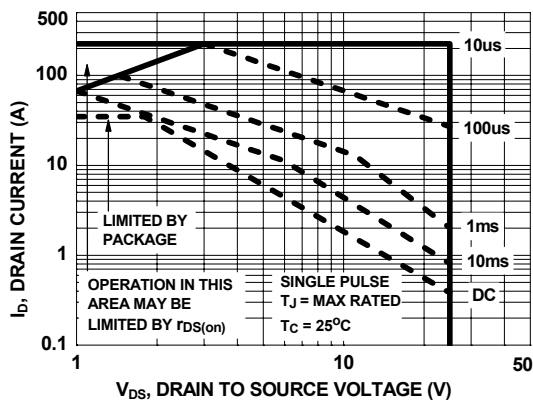


Figure 11. Forward Bias Safe Operating Area

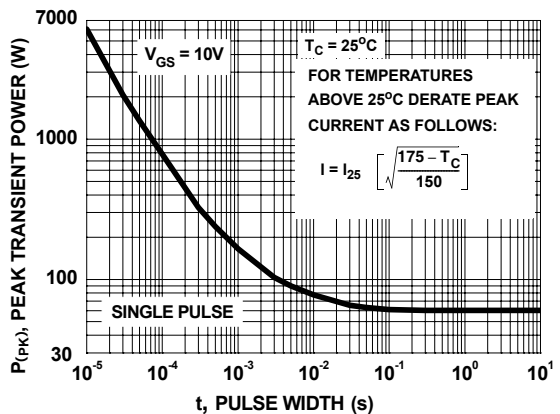


Figure 12. Single Pulse Maximum Power Dissipation

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

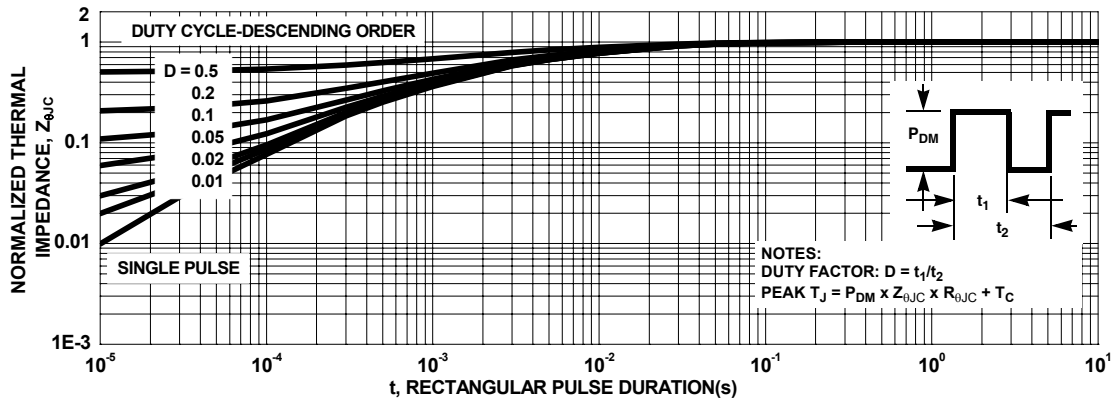


Figure 13. Transient Thermal Response Curve

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