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# FDD8451

## N-Channel PowerTrench<sup>®</sup> MOSFET

### 40V, 28A, 24mΩ

#### Features

- Max  $r_{DS(on)}$  = 24mΩ at  $V_{GS} = 10V, I_D = 9A$
- Max  $r_{DS(on)}$  = 30mΩ at  $V_{GS} = 4.5V, I_D = 7A$
- Low gate charge
- Fast Switching
- High performance trench technology for extremely low  $r_{DS(on)}$
- RoHS compliant

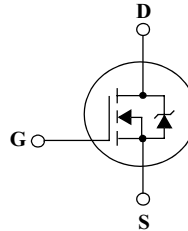
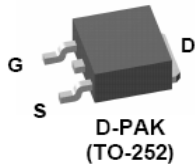


#### General Description

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, fast switching speed and extremely low  $r_{DS(on)}$ .

#### Application

- DC/DC converter
- Backlight inverter



#### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	40	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous @ $T_C=25^\circ\text{C}$	28	A
	-Continuous @ $T_A=25^\circ\text{C}$ (Note 1a)	9	
	-Pulsed	78	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	20	mJ
$P_D$	Power Dissipation	30	W
$T_J, T_{STG}$	Operating and Storage Temperature	-55 to 150	$^\circ\text{C}$

#### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	4.1	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	40	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	96	$^\circ\text{C/W}$

#### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8451	FDD8451	D-PAK(TO-252)	13"	16mm	2500 units

FDD8451 N-Channel PowerTrench<sup>®</sup> MOSFET

**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**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		33.5		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 32\text{V}, V_{GS} = 0\text{V}$			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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	1	2.1	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-5.7		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 9\text{A}$		19	24	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 7\text{A}$		23	30	
		$V_{GS} = 10\text{V}, I_D = 9\text{A}$ $T_J = 150^\circ\text{C}$		32	41	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{V}, I_D = 9\text{A}$		29		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 20\text{V}, V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$		780	990	pF
$C_{oss}$	Output Capacitance			112	150	pF
$C_{rss}$	Reverse Transfer Capacitance			72	110	pF
$R_g$	Gate Resistance		$f = 1\text{MHz}$		1.1	

**Switching Characteristics**

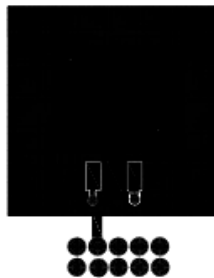
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\text{V}, I_D = 9\text{A}$ $V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$		7	14	ns
$t_r$	Rise Time			3	10	ns
$t_{d(off)}$	Turn-Off Delay Time			19	34	ns
$t_f$	Fall Time			2	10	ns
$Q_g$	Total Gate Charge at 10V	$V_{DS} = 20\text{V}, I_D = 9\text{A}$ $V_{GS} = 10\text{V}$		16	20	nC
$Q_g$	Total Gate Charge at 5V			8.6	11	nC
$Q_{gs}$	Gate to Source Gate Charge			2.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			3.7		nC

**Drain-Source Diode Characteristics**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 9\text{A}$		0.87	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 9\text{A}, di/dt = 100\text{A}/\mu\text{s}$		25	38	ns
$Q_{rr}$	Reverse Recovery Charge	$I_F = 9\text{A}, di/dt = 100\text{A}/\mu\text{s}$		19	29	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  $^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



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

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

3: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.1\text{mH}$ ,  $I_{AS} = 20\text{A}$ ,  $V_{DD} = 36\text{V}$ ,  $V_{GS} = 10\text{V}$ .

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

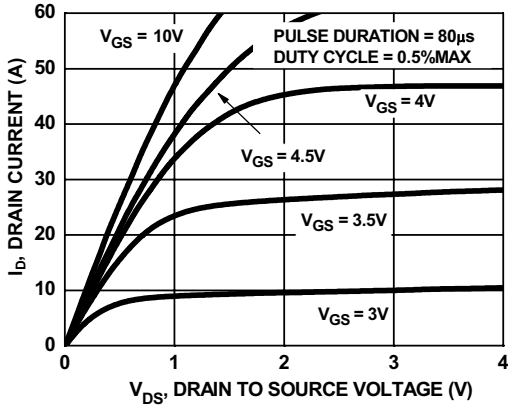


Figure 1. On Region Characteristics

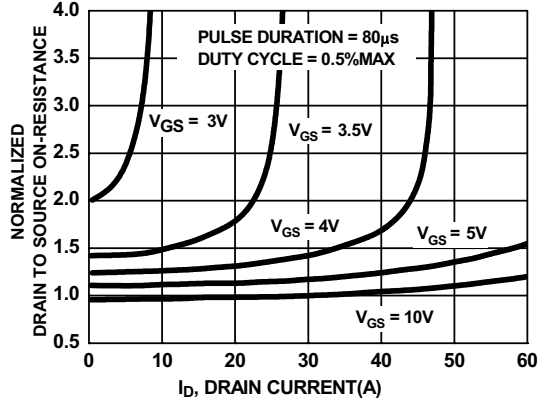


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

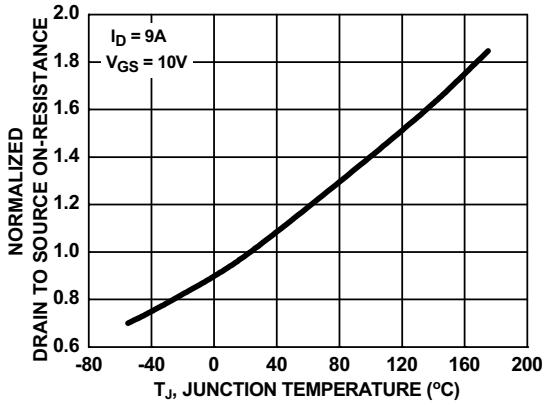


Figure 3. Normalized On Resistance vs Junction Temperature

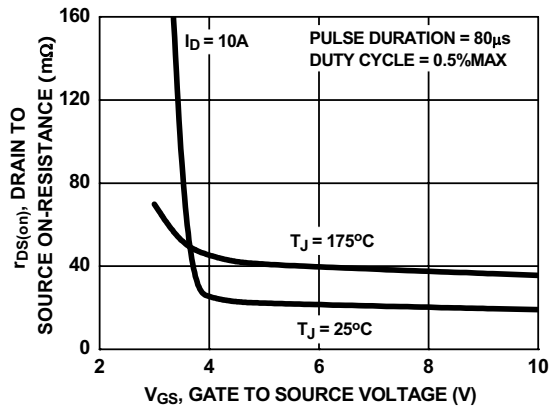


Figure 4. On-Resistance vs Gate to Source Voltage

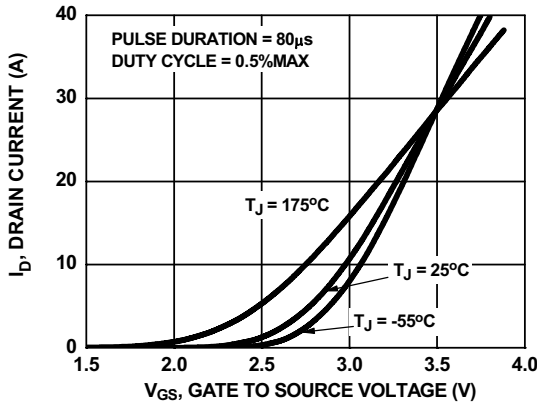


Figure 5. Transfer Characteristics

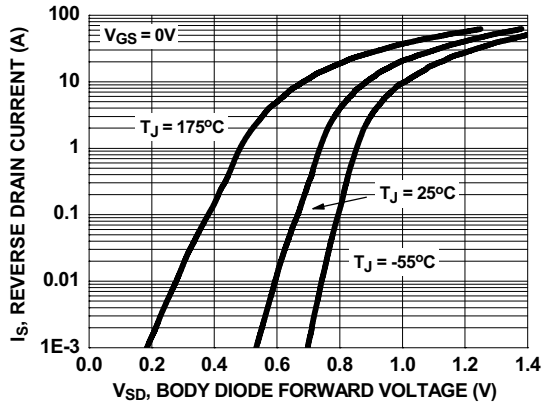


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

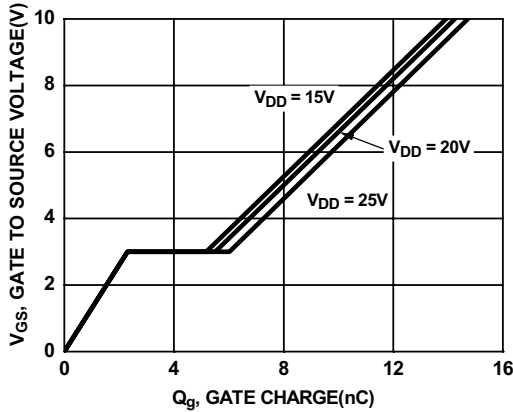


Figure 7. Gate Charge Characteristics

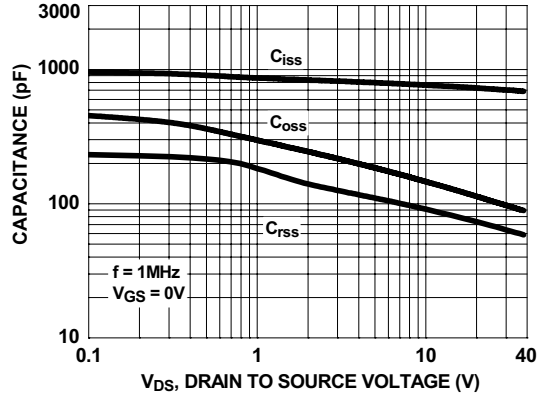


Figure 8. Capacitance vs Drain to Source Voltage

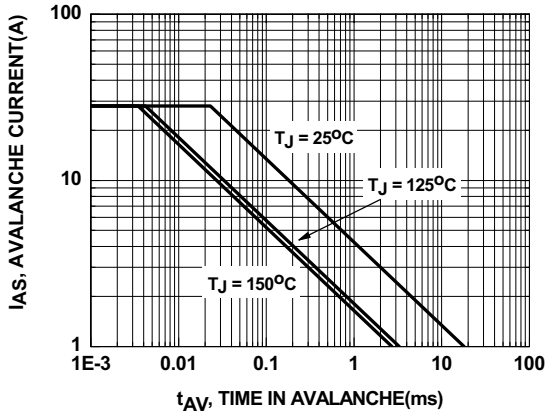


Figure 9. Unclamped Inductive Switching Capability

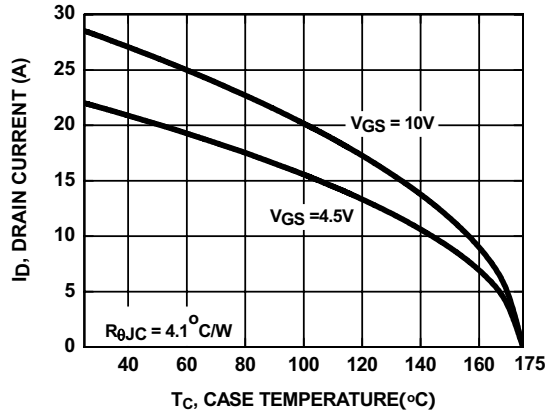


Figure 10. Maximum Continuous Drain Current vs Case Temperature

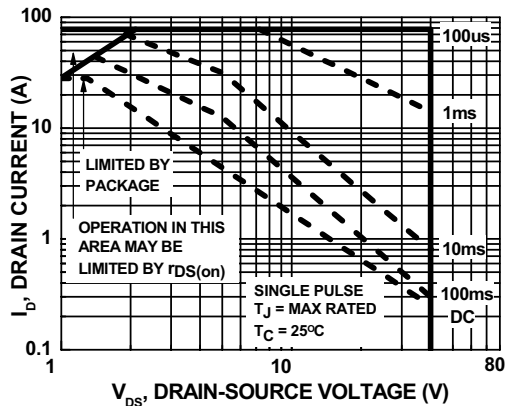


Figure 11. Forward Bias Safe Operating Area

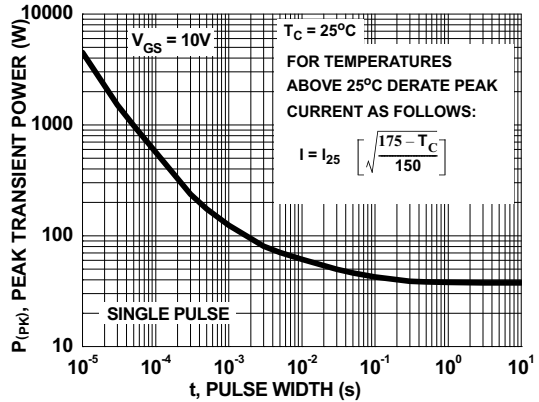


Figure 12. Single Pulse Maximum Power Dissipation

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

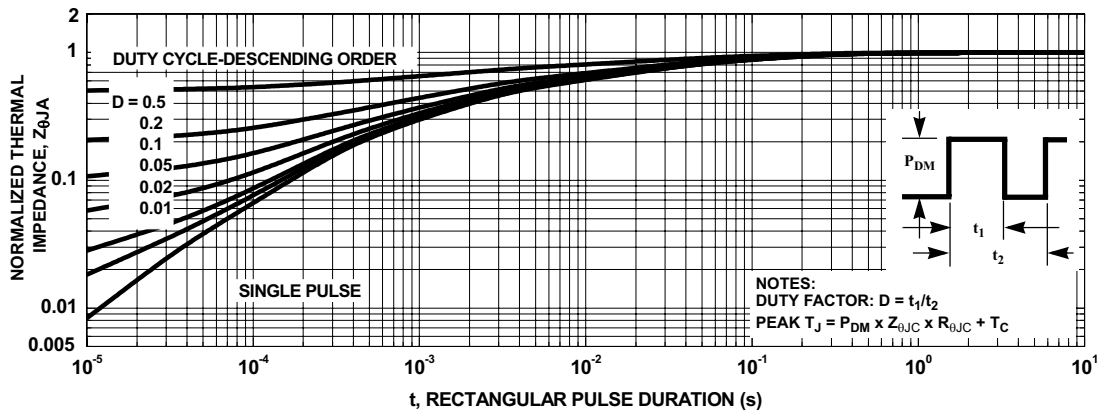


Figure 13. Transient Thermal Response Curve



NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
- E) TRIMMED METAL CENTER LEAD IS PRESENT ON FOR NON-DIODE PRODUCTS
- F) DIMENSIONS ARE EXCLUSIVE OF BURS, MOLD FLASH AND TIE BAR EXTRUSIONS.
- G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.
- H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV11



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