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**April 2013** 

# **FDP8440**

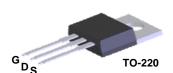
# N-Channel PowerTrench<sup>®</sup> MOSFET 40 V, 277 A, 2.2 m $\Omega$

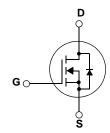
#### **Features**

- $R_{DS(on)} = 1.64 \text{ m}\Omega \text{ (Typ.)} @ V_{GS} = 10 \text{ V}, I_D = 80 \text{ A}$
- $Q_{g(tot)} = 345 \text{ nC (Typ.)} @ V_{GS} = 10 \text{ V}$
- · Low Miller Charge
- Low Q<sub>rr</sub> Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- RoHS Compliant

# **Applications**

- Power Tools
- Motor Drives and Uninterruptible Power Supplies
- Synchronous Rectification
- · Battery Protection Circuit





### MOSFET Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter			FDP8440	Unit
V <sub>DSS</sub>	Drain to Source Voltage	ge	40	V	
V <sub>GSS</sub>	Gate to Source Voltage	је		±20	V
I <sub>D</sub>	Drain Current - Continuous ( $T_C = 25^{\circ}C$ , Silicon Limited) - Continuous ( $T_C = 100^{\circ}C$ , Silicon Limited) - Continuous ( $T_C = 25^{\circ}C$ , Package Limited)			277* 196* 100	А
I <sub>DM</sub>	Drain Current	- Pulsed (	Note 1)	500	Α
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		1682	mJ	
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C) - Derate above 25°C		306 2.04	W/°C
T <sub>J,</sub> T <sub>STG</sub>	Operating and Storage Temperature Range			-55 to +175	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300	°C

<sup>\*</sup>Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 100A.

#### **Thermal Characteristics**

$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.49	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Sink (Typ.)	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	°C/W

# **Package Marking and Ordering Information**

Device Marking Device		Package	Reel Size Tape Width		Quantity	
FDP8440	FDP8440	TO-220	N/A	N/A	50units	

# **Electrical Characteristics** $T_C = 25$ °C unless otherwise noted

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Off Charac	teristics			1	I.		
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$		40			V
	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 32V	V <sub>DS</sub> = 32V			1	μΑ
I <sub>DSS</sub>		$V_{GS} = 0V$	$T_{\rm C} = 150^{\rm o}{\rm C}$			250	μА
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>GS</sub> = ±20V				±100	nA
On Charac	teristics					I I	
V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu$	A	1		3	V
. ,	Static Drain-Source On-Resistance	$V_{GS} = 4.5V, I_D = 80A$			1.88	2.4	mΩ
$R_{DS(on)}$		V <sub>GS</sub> = 10V, I <sub>D</sub> = 80A			1.64	2.2	
		$V_{GS} = 10V, I_D = 80A,$ $T_C = 175^{\circ}C$			3.00	4.4	1115.2
Dynamic C	haracteristics						
C <sub>iss</sub>	Input Capacitance				18600	24740	pF
C <sub>oss</sub>	Output Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ f = 1.0MHz			1840	2450	pF
C <sub>rss</sub>	Reverse Transfer Capacitance				1400	2100	pF
R <sub>G</sub>	Gate Resistance	$V_{GS} = 0.5V, f = 1MHz$			1.1		Ω
Q <sub>g(tot)</sub>	Total Gate Charge at 10V	V <sub>GS</sub> = 0V to 10V			345	450	nC
Q <sub>g(2)</sub>	Threshold Gate Charge	V <sub>GS</sub> = 0V to 2V	V <sub>DD</sub> = 20V		32.5		nC
Q <sub>gs</sub>	Gate to Source Gate Charge		I <sub>D</sub> = 80A		49		nC
Q <sub>gs2</sub>	Gate Charge Threshold to Plateau	I <sub>g</sub> = 1.0mA			16.5		nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge				74		nC
Switching	Characteristics (V <sub>GS</sub> = 10V)	·		•			
t <sub>ON</sub>	Turn-On Time				175	360	ns
t <sub>d(on)</sub>	Turn-On Delay Time				43	95	ns
t <sub>r</sub>	Rise Time	$V_{DD} = 20V, I_D = 80A$ $V_{GS} = 10V, R_{GEN} = 79$	0		130	275	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	VGS = 10V, NGEN = 732			435	875	ns
t <sub>f</sub>	Fall Time				290	590	ns
t <sub>OFF</sub>	Turn-Off Time				730	1470	ns
	ce Diode Characteristics and Maximu	ım Ratings		1	1	1 1	
V	Source to Drain Diade Voltage	I <sub>SD</sub> = 80A				1.25	V
$V_{SD}$	Source to Drain Diode Voltage	I <sub>SD</sub> = 40A				1.0	V
t <sub>rr</sub>	Reverse Recovery Time	$I_{SD} = 75A$ , $dI_{SD}/dt = 100A/\mu s$			59		ns
Q <sub>RR</sub>	Reverse Recovery Charge	$I_{SD} = 75A$ , $dI_{SD}/dt = 100A/\mu s$			77		nC

#### NOTES

<sup>1:</sup> Pulse width limited by maximum junction temperature.

<sup>2:</sup> Starting T  $_{J}$  = 25°C, L = 1mH, I  $_{AS}$  = 58A, V  $_{DD}$  = 36V, V  $_{GS}$  = 10V.

## **Typical Performance Characteristics**

Figure 1. On-Region Characteristics

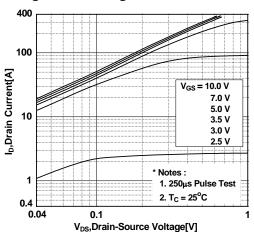
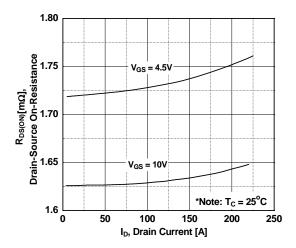


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage



**Figure 5. Capacitance Characteristics** 

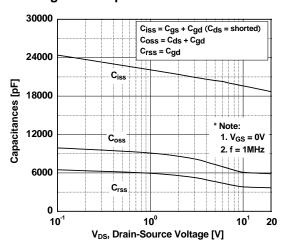


Figure 2. Transfer Characteristics

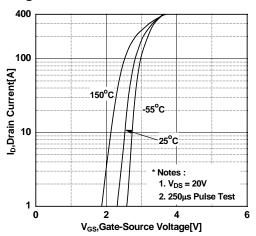


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

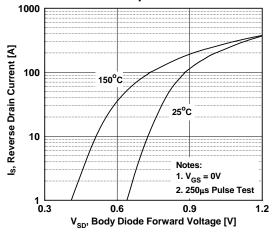
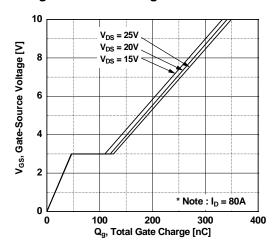


Figure 6. Gate Charge Characteristics



## **Typical Performance Characteristics** (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

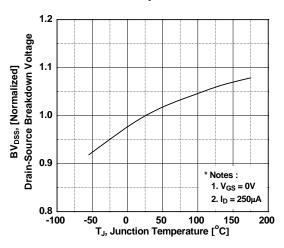


Figure 9. Unclamped Inductive Switching Capability

Figure 8. On-Resistance Variation vs. Temperature

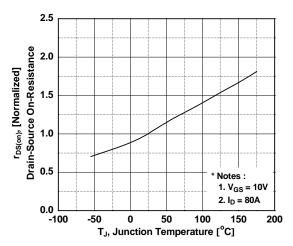
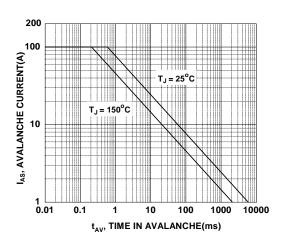


Figure 10. Safe Operating Area



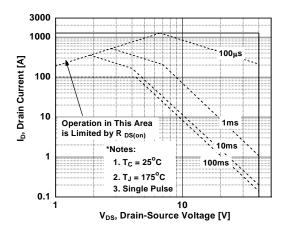
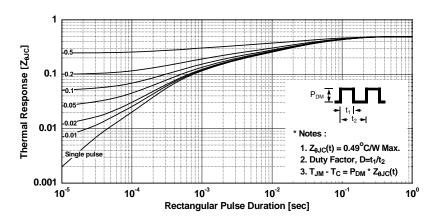
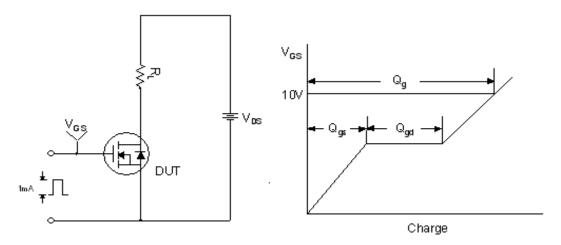


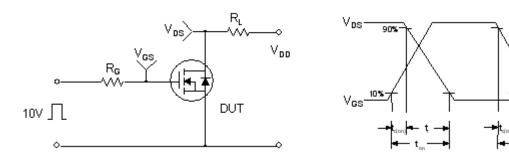
Figure 11. Transient Thermal Response Curve



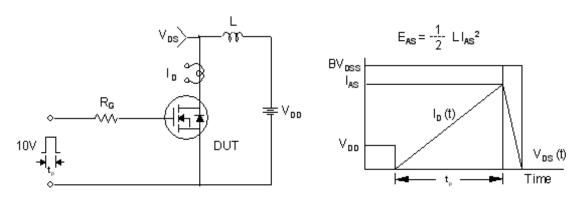
#### **Gate Charge Test Circuit & Waveform**



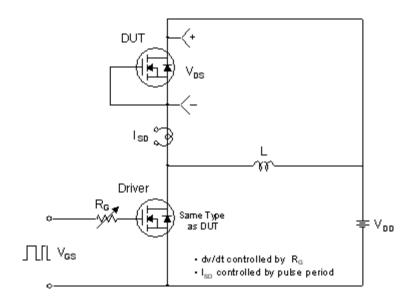
#### **Resistive Switching Test Circuit & Waveforms**

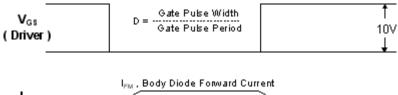


#### **Unclamped Inductive Switching Test Circuit & Waveforms**

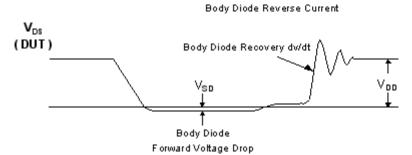


#### Peak Diode Recovery dv/dt Test Circuit & Waveforms



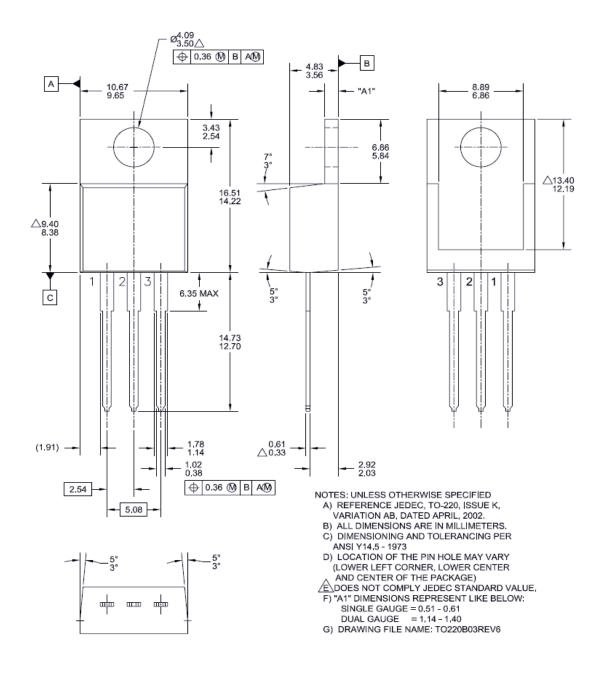






#### **Mechanical Dimensions**

# TO-220B03







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