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# FDB039N06

# N-Channel PowerTrench<sup>®</sup> MOSFET 60 V, 174 A, 3.9 m $\Omega$

## **Features**

- $R_{DS(on)}$  = 2.95 m $\Omega$  ( Typ.) @  $V_{GS}$  = 10 V,  $I_D$  = 75 A
- · Fast Switching Speed
- · Low Gate Charge
- $\bullet$  High Performance Trench Technology for Extremely Low  $R_{\mbox{\scriptsize DS(on)}}$
- · High Power and Current Handling Capability
- RoHS Compliant

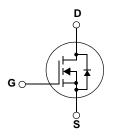
# **General Description**

This N-Channel MOSFET is produced using Fairchild Semiconductor  $^{\!0}\!\!^{\!0}$ 's advanced PowerTrench  $^{\!0}\!\!^{\!0}$  process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

# **Applications**

- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- · Motor drives and Uninterruptible Power Supplies
- Renewable system





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

Symbol		Parameter		FDB039N06	Unit
V <sub>DSS</sub>	Drain to Source Voltage	urce Voltage		60	V
V <sub>GSS</sub>	Gate to Source Voltage			±20	V
		-Continuous (T <sub>C</sub> = 25°C, Silicion L	imited)	174*	
I <sub>D</sub>	Drain Current	-Continuous (T <sub>C</sub> = 100°C, Silicion	Limited)	123*	Α
		-Continuous (T <sub>C</sub> = 25°C, Package	Limited)	120	
I <sub>DM</sub>	Drain Current	- Pulsed	- Pulsed (Note 1)		Α
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		(Note 2)	872	mJ
dv/dt	Peak Diode Recovery dv/d	It	(Note 3)	7.0	V/ns
<u> </u>	Davier Dissipation	$(T_C = 25^{\circ}C)$		231	W
$P_{D}$	Power Dissipation	- Derate above 25°C		1.54	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range			-55 to +175	°С
T <sub>L</sub>	Maximum Lead Temperate 1/8" from Case for 5 Seco			300	°C

\*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 120A.

# **Thermal Characteristics**

Symbol	Parameter	FDB039N06	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.65	
Б	Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max.	62.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (1 in <sup>2</sup> pad of 2 oz copper), Max.	40	

# **Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDB039N06	FDB039N06	TO-263	Tube	-	50

# **Electrical Characteristics** $T_C = 25^{\circ}C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	cteristics					
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	$I_D = 250\mu A$ , $V_{GS} = 0V$ , $T_C = 25^{\circ}C$	60	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	-	0.04	-	V/°C
	Zoro Coto Voltago Proin Current	$V_{DS} = 60V, V_{GS} = 0V$	-	-	1	
IDSS	Zero Gate Voltage Drain Current	$V_{DS} = 60V, V_{GS} = 0V, T_{C} = 150^{\circ}C$	-	-	500	μΑ
I <sub>GSS</sub>	Gate to Body Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	±100	nA

# **On Characteristics**

V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	2.5	3.5	4.5	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	$V_{GS} = 10V, I_D = 75A$	-	2.95	3.9	mΩ
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = 10V, I_{D} = 75A$	-	169	i	S

# **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V 05V V 0V	-	6190	8235	pF
C <sub>oss</sub>	Output Capacitance	$V_{DS} = 25V, V_{GS} = 0V$ f = 1MHz		900	1195	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 11/11/12	-	385	580	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10V	V <sub>DS</sub> = 48V, I <sub>D</sub> = 75A	-	102	133	nC
$Q_{gs}$	Gate to Source Gate Charge	V <sub>GS</sub> = 10V	-	32	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	(Note 4)	-	32	-	nC

# **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time			-	30	70	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{DD} = 30V, I_{D} = 75A$		-	40	90	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS} = 10V, R_{GEN} = 4.7\Omega$		-	55	120	ns
t <sub>f</sub>	Turn-Off Fall Time		(Note 4)	-	24	58	ns

### **Drain-Source Diode Characteristics**

I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	174	Α
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	696	Α
$V_{SD}$	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 75A	-	-	1.3	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 75A	-	41	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	-	47	-	nC

- **Notes:**1. Repetitive Rating: Pulse width limited by maximum junction temperature 2: L = 0.31mH,  $I_{AS} = 75A$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}C$ 3:  $I_{SD} \le 75A$ , di/dt  $\le 200A/\mu s$ ,  $V_{DD} \le BV_{DSS}$ , Starting  $T_J = 25^{\circ}$ 4: Essentially Independent of Operating Temperature Typical Characteristics

# **Typical Performance Characteristics**

Figure 1. On-Region Characteristics

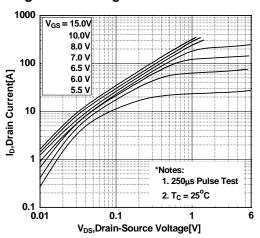


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

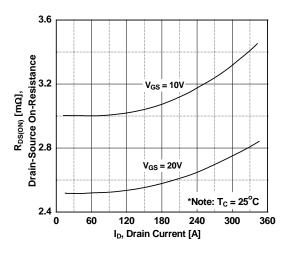


Figure 5. Capacitance Characteristics

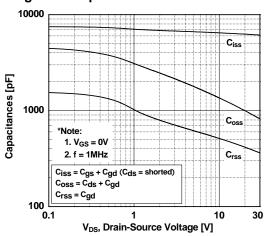


Figure 2. Transfer Characteristics

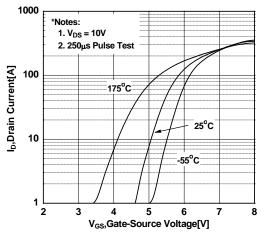


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

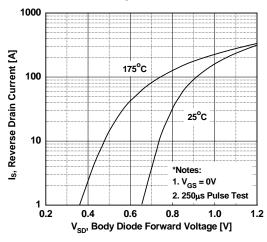
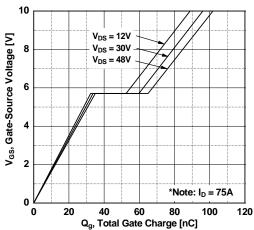


Figure 6. Gate Charge Characteristics



# **Typical Performance Characteristics (Continued)**

Figure 7. Breakdown Voltage Variation vs. Temperature

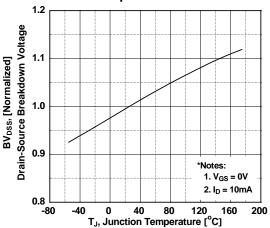


Figure 8. On-Resistance Variation vs. Temperature

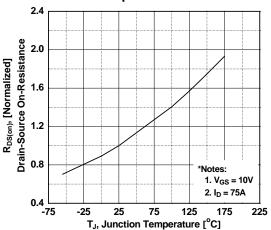


Figure 9. Maximum Safe Operating Area

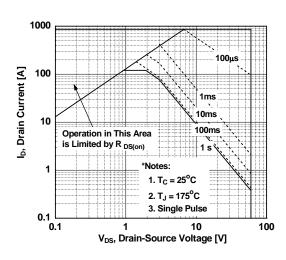


Figure 10. Maximum Drain Current vs. Case Temperature

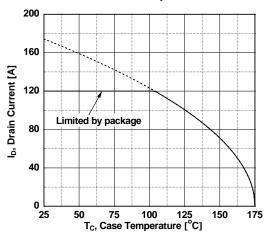
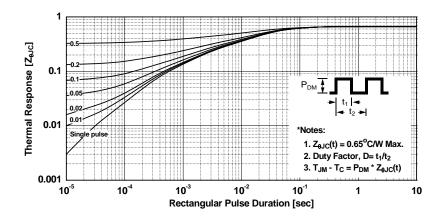
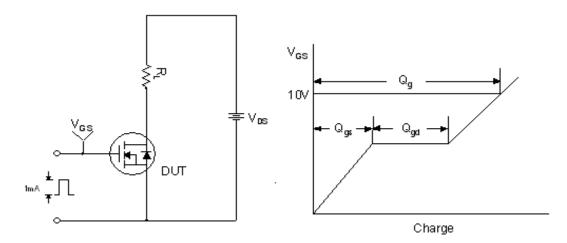


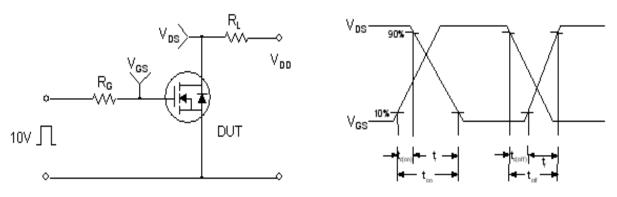
Figure 11. Transient Thermal Response Curve



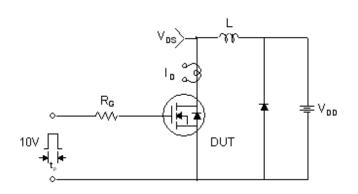
# **Gate Charge Test Circuit & Waveform**

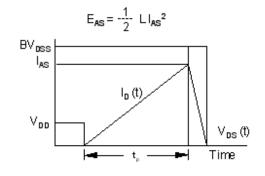


# **Resistive Switching Test Circuit & Waveforms**

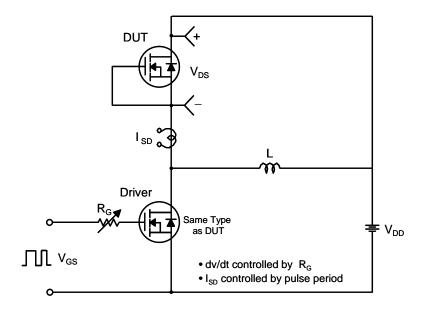


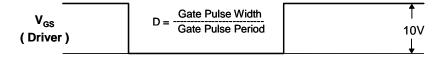
**Unclamped Inductive Switching Test Circuit & Waveforms** 

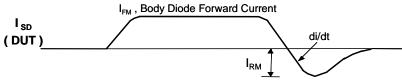




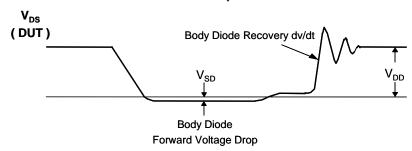
### Peak Diode Recovery dv/dt Test Circuit & Waveforms





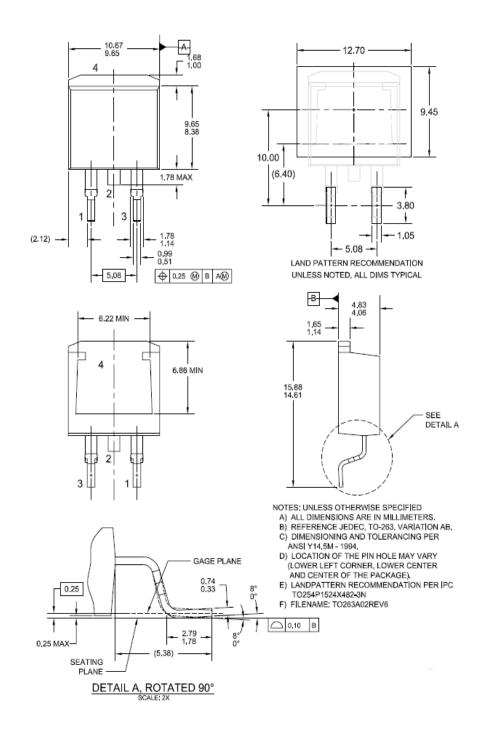


Body Diode Reverse Current



# **Mechanical Dimensions**

# D<sup>2</sup>PAK







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