

March 2013

# FDB024N06

# N-Channel PowerTrench<sup>®</sup> MOSFET 60 V, 265 A, 2.4 m $\Omega$

#### **Features**

- $R_{DS(on)}$  = 1.8 m $\Omega$  ( Typ.)@  $V_{GS}$  = 10 V,  $I_D$  = 75 A
- · Fast Switching Speed
- · Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{\mbox{\scriptsize DS(on)}}$
- · High Power and Current Handling Capability
- · RoHS Compliant

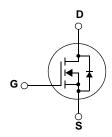
# **Description**

This N-Channel MOSFET is produced using Fairchild Semiconductor<sup>®</sup>'s advanced PowerTrench<sup>®</sup> 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<sub>C</sub> = 25°C unless otherwise noted

Symbol		Parameter		FDB024N06	Unit
$V_{DSS}$	Drain to Source Voltage	Source Voltage			V
$V_{GSS}$	Gate to Source Voltage			±20	V
		-Continuous (T <sub>C</sub> = 25°C, Silico	n Limited)	265*	
$I_D$	Drain Current	-Continuous (T <sub>C</sub> = 100°C, Silic	on Limited)	190*	А
		-Continuous (T <sub>C</sub> = 25°C, Pack	age Limited)	120	
I <sub>DM</sub>	Drain Current	- Pulsed	(Note 1)	1060	А
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		(Note 2)	2531	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	6.0	V/ns
D	Dower Discipation	$(T_C = 25^{\circ}C)$		395	W
$P_{D}$	Power Dissipation	- Derate above 25°C		2.6	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

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

# **Thermal Characteristics**

Symbol	Parameter	FDB024N06	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.38	
Р	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
FDB024N06	FDB024N06	D <sup>2</sup> -PAK	330mm	24mm	800

# **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	$I_D = 250 \mu A, V_{GS} = 0 V$	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
ı	Zero Gate Voltage Drain Current	$V_{DS} = 60V, V_{GS} = 0V$	-	-	1	μА
DSS	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	$V_{GS} = 10V, I_D = 75A$	•	1.8	2.4	mΩ
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = 10V, I_{D} = 75A$	ı	200	ı	S

# **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V$ f = 1MHz		11190	14885	pF
C <sub>oss</sub>	Output Capacitance			1610	2140	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 1101112	-	750	1125	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10V		-	174	226	nC
Q <sub>gs</sub>	Gate to Source Gate Charge	$V_{DS} = 48V, I_{D} = 75A$	-	54	-	nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge	$V_{GS} = 10V$ (Note	4) -	50	-	nC

# **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time			-	134	278	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{DD} = 30V, I_{D} = 75A$		-	324	658	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS} = 10V, R_{GEN} = 25\Omega$		-	348	706	ns
t <sub>f</sub>	Turn-Off Fall Time		(Note 4)	-	250	510	ns

# **Drain-Source Diode Characteristics**

I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current			-	265	Α
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	1060	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	-	69	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	-	152	-	nC

#### Notes

- 1. Repetitive Rating: Pulse width limited by maximum junction temperature
- 2. L = 0.9mH, I  $_{AS}$  = 75A, V  $_{DD}$  = 50V, R  $_{G}$  = 25 $\!\Omega$ , Starting T  $_{J}$  = 25 $^{\circ}C$
- 3.  $I_{SD} \le 75 A$ , di/dt  $\le 200 A/\mu s$ ,  $V_{DD} \le BV_{DSS}$ , Starting  $T_J = 25^{\circ}C$
- 4. Essentially Independent of Operating Temperature Typical Characteristics

# **Typical Performance Characteristics**

Figure 1. On-Region Characteristics

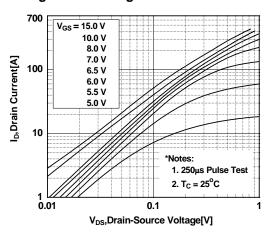
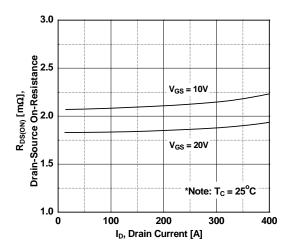


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage



**Figure 5. Capacitance Characteristics** 

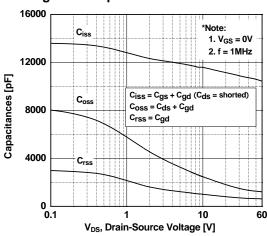


Figure 2. Transfer Characteristics

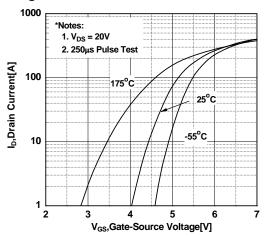


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

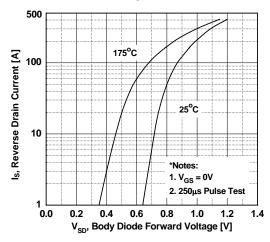
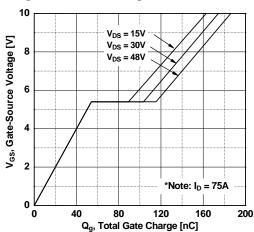


Figure 6. Gate Charge Characteristics



# **Typical Performance Characteristics (Continued)**

Figure 7. Breakdown Voltage Variation vs. Temperature

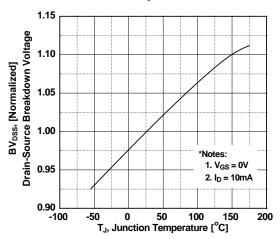


Figure 9. Maximum Safe Operating Area

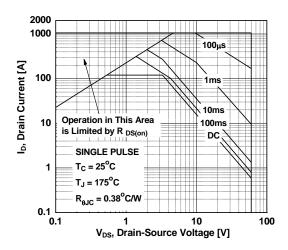


Figure 8. On-Resistance Variation vs. Temperature

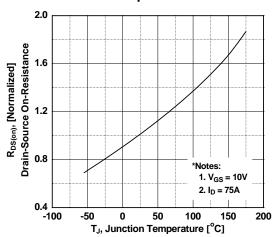


Figure 10. Maximum Drain Current vs. Case Temperature

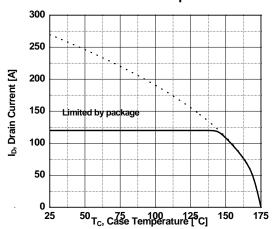
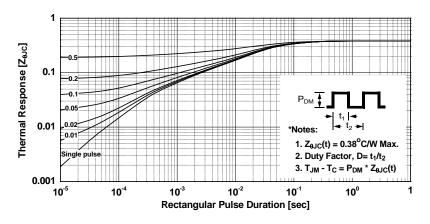
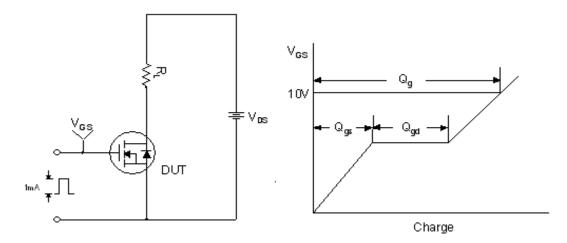


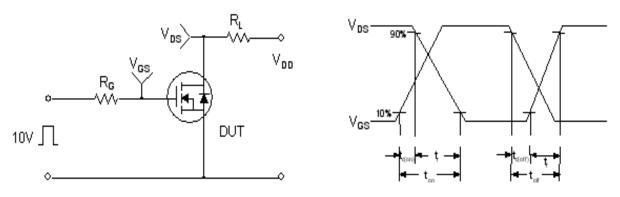
Figure 11. Transient Thermal Response Curve



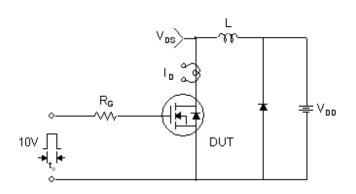
# **Gate Charge Test Circuit & Waveform**

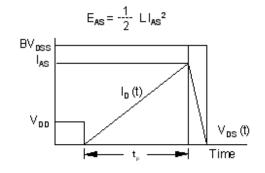


# **Resistive Switching Test Circuit & Waveforms**

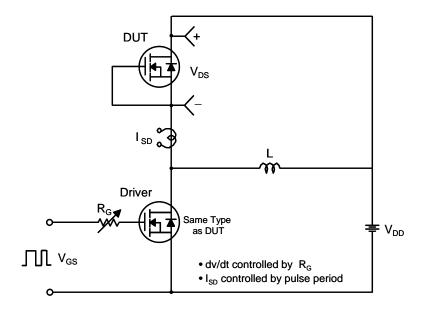


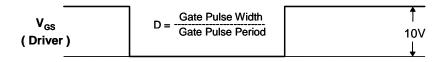
**Unclamped Inductive Switching Test Circuit & Waveforms** 

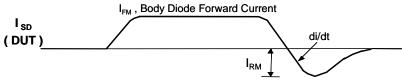




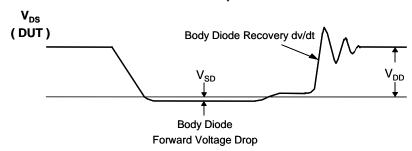
# Peak Diode Recovery dv/dt Test Circuit & Waveforms





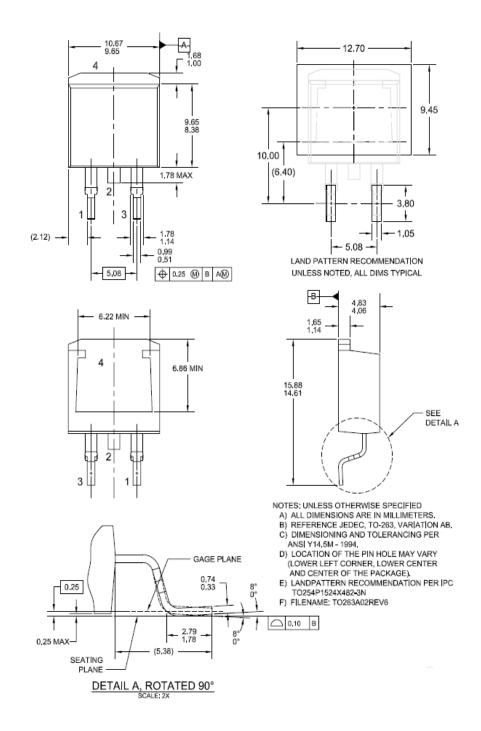


Body Diode Reverse Current



# **Mechanical Dimensions**

# $D^2PAK$



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