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# FDP020N06B

## N-Channel PowerTrench® MOSFET

60 V, 313 A, 2 mΩ



### Features

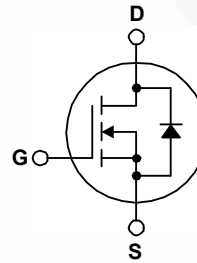
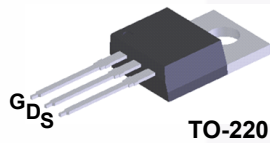
- $R_{DS(on)} = 1.65 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 100 \text{ A}$
- Low FOM  $R_{DS(on)} * Q_G$
- Low Reverse-Recovery Charge,  $Q_{rr} = 194 \text{ nC}$
- Soft Reverse-Recovery Body Diode
- Enables High Efficiency in Synchronous Rectification
- Fast Switching Speed
- 100% UIL Tested
- RoHS Compliant

### Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® 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



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

Symbol	Parameter	FDP020N06B_F102	Unit
$V_{DSS}$	Drain to Source Voltage	60	V
$V_{GSS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ , Silicon Limited)	313*
		- Continuous ( $T_C = 100^\circ\text{C}$ , Silicon Limited)	221*
		- Continuous ( $T_C = 25^\circ\text{C}$ , Package Limited)	120
$I_{DM}$	Drain Current	- Pulsed (Note 1)	1252
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	1859
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	6.0
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	333
		- Derate Above $25^\circ\text{C}$	2.2
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

\* Package limitation current is 120A.

### Thermal Characteristics

Symbol	Parameter	FDP020N06B_F102	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.45	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP020N06B_F102	FDP020N06B	TO-220	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{V}$	60	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.03	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48 \text{V}, V_{GS} = 0 \text{V}$ $V_{DS} = 48 \text{V}, T_C = 150^\circ\text{C}$	-	-	1 500	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20 \text{V}, V_{DS} = 0 \text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	2.5	3.3	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{V}, I_D = 100 \text{A}$	-	1.65	2.0	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10 \text{V}, I_D = 100 \text{A}$	-	263	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 30 \text{V}, V_{GS} = 0 \text{V},$ $f = 1 \text{MHz}$	-	16100	20930	pF
$C_{oss}$	Output Capacitance		-	3840	4992	pF
$C_{rss}$	Reverse Transfer Capacitance		-	127	-	pF
$C_{oss(er)}$	Energy Related Output Capacitance	$V_{DS} = 30 \text{V}, V_{GS} = 0 \text{V}$	-	5897	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 30 \text{V}, I_D = 100 \text{A},$ $V_{GS} = 10 \text{V}$	-	206	268	nC
$Q_{gs}$	Gate to Source Gate Charge		-	87	-	nC
$Q_{gs2}$	Gate to Threshold to Plateau		-	36	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	34	-
ESR	Equivalent Series Resistance(G-S)	$f = 1 \text{MHz}$	-	0.9	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30 \text{V}, I_D = 100 \text{A},$ $V_{GS} = 10 \text{V}, R_G = 4.7 \Omega$	-	74	158	ns
$t_r$	Turn-On Rise Time		-	62	134	ns
$t_{d(off)}$	Turn-Off Delay Time		-	112	234	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	42	94

### Drain-Source Diode Characteristics

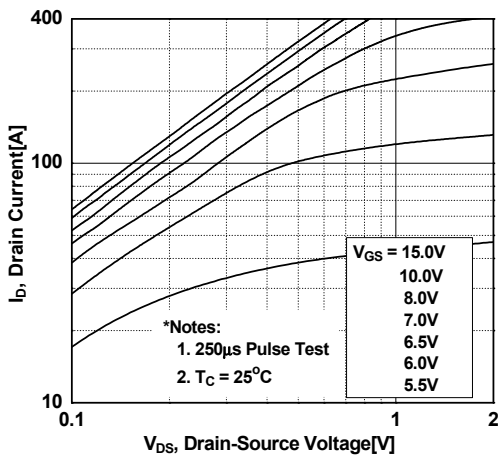
$I_S$	Maximum Continuous Drain to Source Diode Forward Current		-	-	313*	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current		-	-	1252	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{V}, I_{SD} = 100 \text{A}$	-	-	1.25	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{V}, V_{DD} = 30 \text{V}, I_{SD} = 100 \text{A},$ $di_F/dt = 100 \text{A}/\mu\text{s}$	-	106	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	194	-	nC

#### Notes:

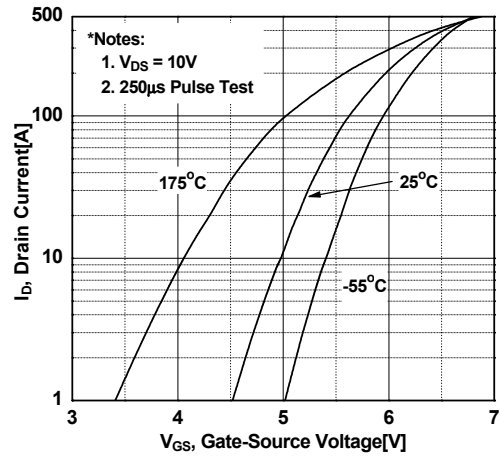
- 1: Repetitive rating: pulse-width limited by maximum junction temperature
- 2: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3 \text{mH}$ ,  $I_{AS} = 35.2 \text{A}$
- 3:  $I_{SD} \leq 100 \text{A}$ ,  $di/dt \leq 200 \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$
- 4: Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

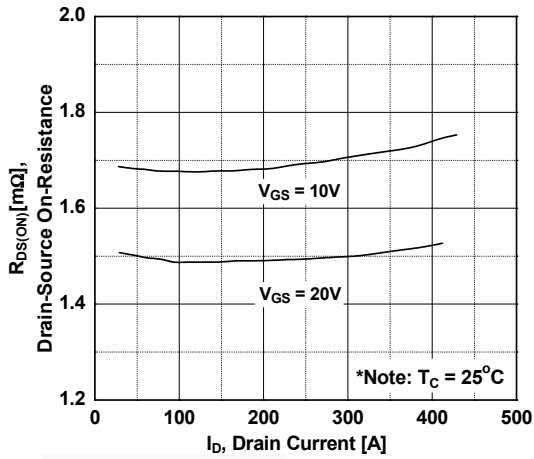
**Figure 1. On-Region Characteristics**



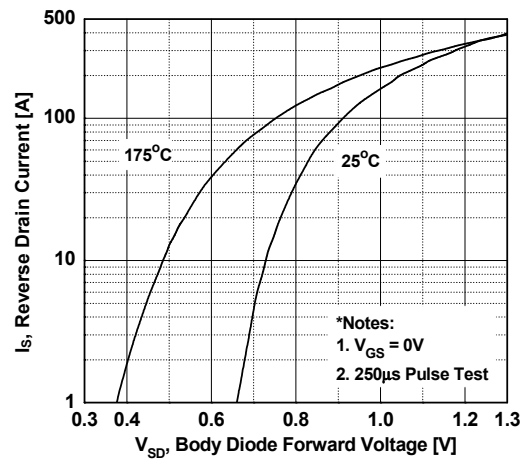
**Figure 2. Transfer Characteristics**



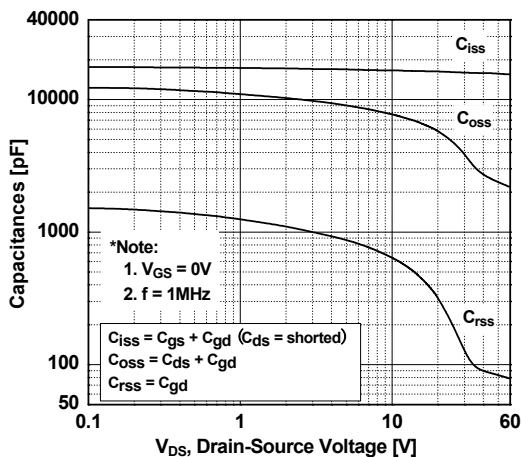
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



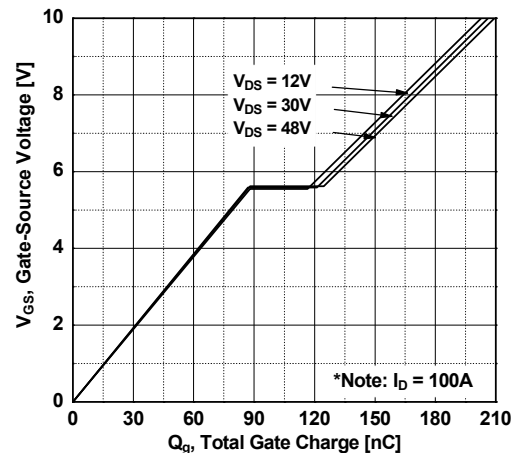
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

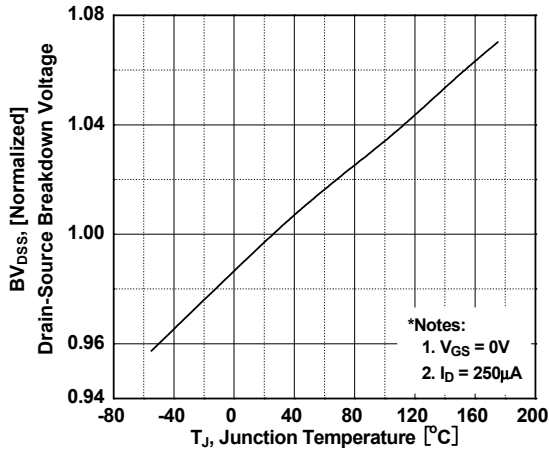


Figure 8. On-Resistance Variation vs. Temperature

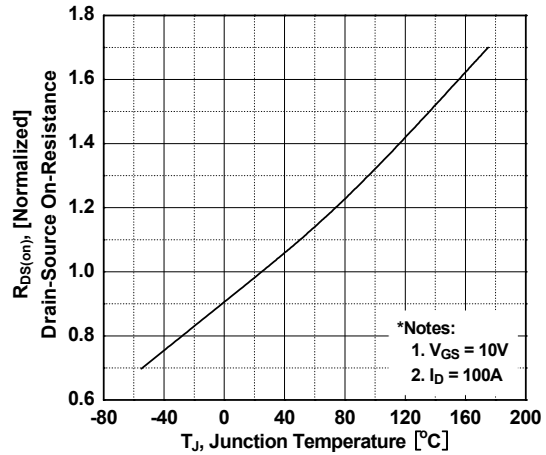


Figure 9. Maximum Safe Operating Area

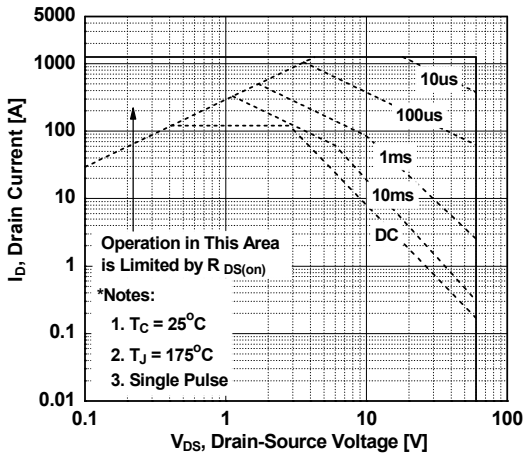


Figure 10. Maximum Drain Current vs. Case Temperature

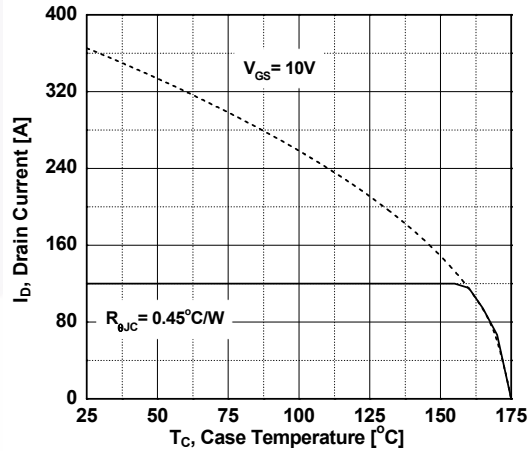


Figure 11. Unclamped Inductive Switching Capability

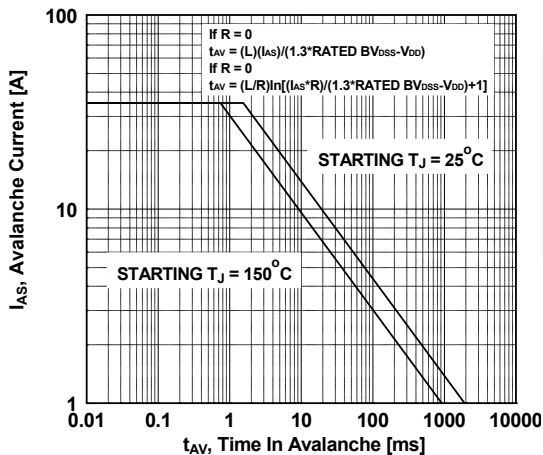
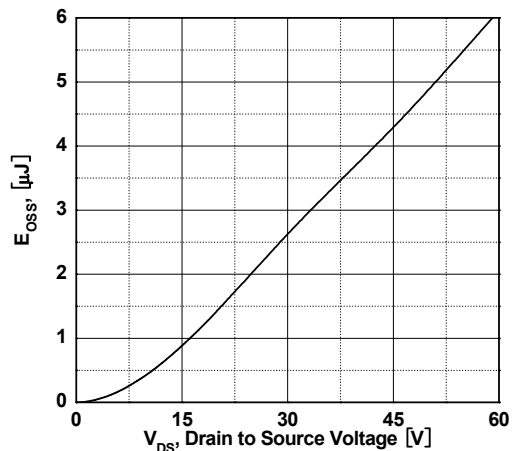


Figure 12. Eoss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve

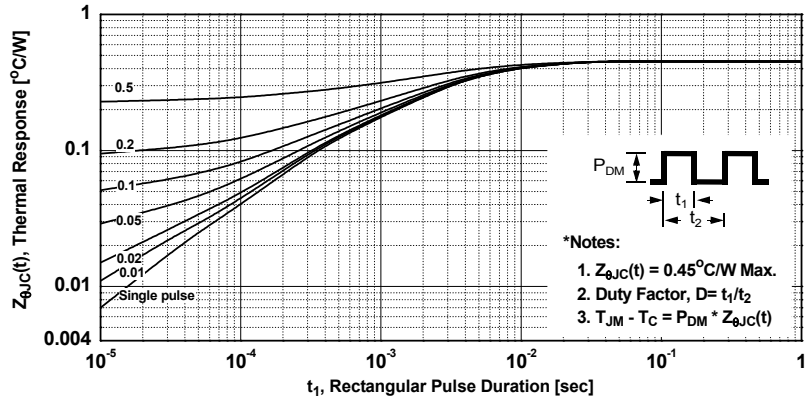




Figure 14. Gate Charge Test Circuit & Waveform



Figure 15. Resistive Switching Test Circuit & Waveforms



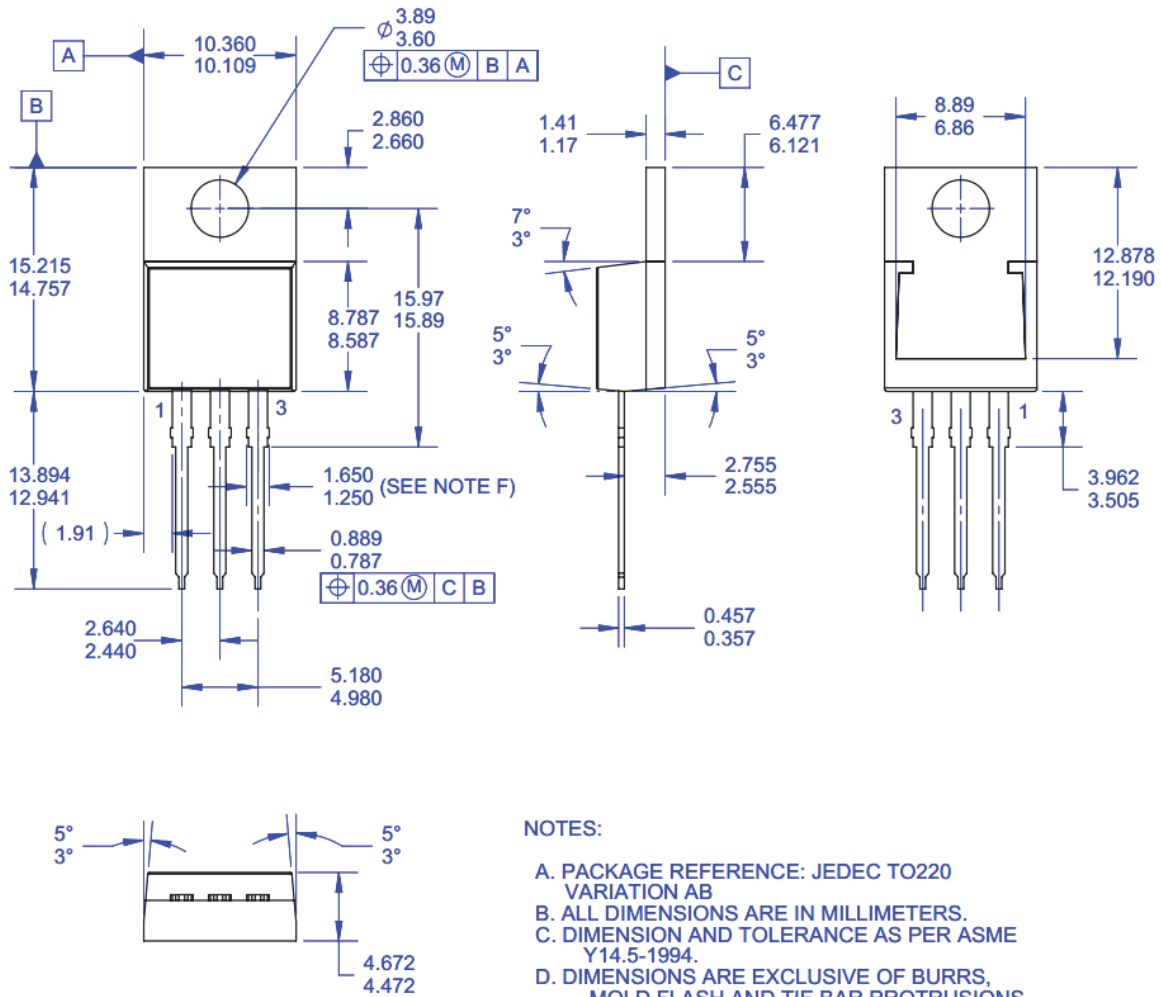
Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



## Mechanical Dimensions



**Figure 18. TO-220, Molded, 3-Lead, Jedec Variation AB (Delta)**

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