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Fairchild Semiconductor
FDZ5047N

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FAIRCHILD SEMICONDUCTOR®

January 2004

FDZ5047N

30V N-Channel Logic Level PowerTrench® BGA MOSFET

General Description

Combining Fairchild's 30V PowerTrench process with state of the art BGA packaging, the FDZ5047N minimizes both PCB space and $R_{DS(ON)}$. This BGA MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, high current handling capability, ultra-low profile packaging, low gate charge, and low $R_{DS(ON)}$.

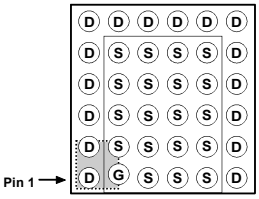
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(ON)}$ specifications resulting in DC/DC power supply designs with higher overall efficiency.

Applications

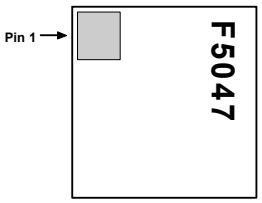
- DC/DC converters
- Solenoid drive

Features

- 22 A, 30 V. $R_{DS(ON)}$ = 2.9 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 4.5 mΩ @ V_{GS} = 4.5 V
- Occupies only 27.5 mm^2 of PCB area:
  1/5 of the area of a TO-220 package
- Ultra-thin package: less than 0.90 mm height when mounted to PCB
- Outstanding thermal transfer characteristics
- Ultra-low gate charge x $R_{DS(ON)}$ product



Bottom



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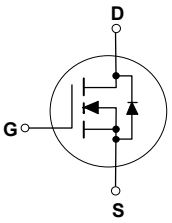


Absolute Maximum Ratings

T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		30	V
V_{GSS}	Gate-Source Voltage		±20	
I_D	Drain Current – Continuous	(Note 1a)	22	A
	– Pulsed		75	
P_D	Total Power Dissipation @ T_A = 25°C		2.8	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–50 to +150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	44	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Ball	(Note 1)	2.7	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	0.3	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
5047N	FDZ5047N	13''	12mm	3000 units

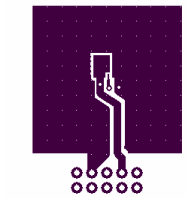
Electrical Characteristics

T_A = 25°C unless otherwise noted

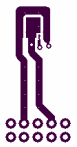
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		24		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	µA
I_{GSSF}	Gate–Body Forward Leakage	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate–Body Reverse Leakage	V_{GS} = –20 V, V_{DS} = 0 V			–100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.3	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		–5		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 22 A V_{GS} = 4.5 V, I_D = 18 A V_{GS} = 10 V, I_D = 22 A, T_A=125°C		2.3 3.2 3.4	2.9 4.5 5.0	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 22 A		100		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		4993		pF
C_{oss}	Output Capacitance			1144		pF
C_{rss}	Reverse Transfer Capacitance			498		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		11	20	ns
t_r	Turn–On Rise Time			12	22	ns
$t_{d(off)}$	Turn–Off Delay Time			119	190	ns
t_f	Turn–Off Fall Time			55	88	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 22 A, V_{GS} = 5 V		52	73	nC
Q_{gs}	Gate–Source Charge			11		nC
Q_{gd}	Gate–Drain Charge			17		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current (Note 1a)				2.3	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.3 A (Note 2)		0.7	1.2	V
t_{rr}	Diode Reverse Recovery Time	I_F = 22A, d_{iF}/d_t = 100 A/µs		42		nS
Q_{rr}	Diode Reverse Recovery Charge			59		nC

- **Notes:**

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² 2 oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. The thermal resistance from the junction to the circuit board side of the solder ball, $R_{\theta JB}$, is defined for reference. For $R_{\theta JC}$, the thermal reference point for the case is defined as the top surface of the copper chip carrier. $R_{\theta JC}$ and $R_{\theta JB}$ are guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.



a) 44°C/W when mounted on a 1in² pad of 2 oz copper



b) 95°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%

Typical Characteristics

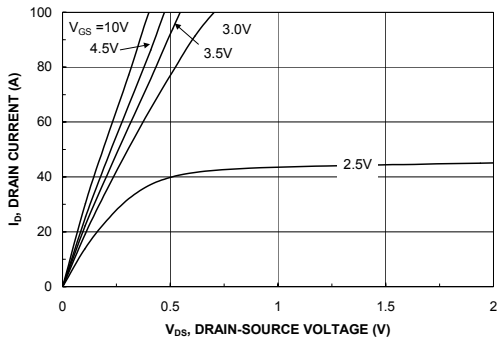


Figure 1. On-Region Characteristics.

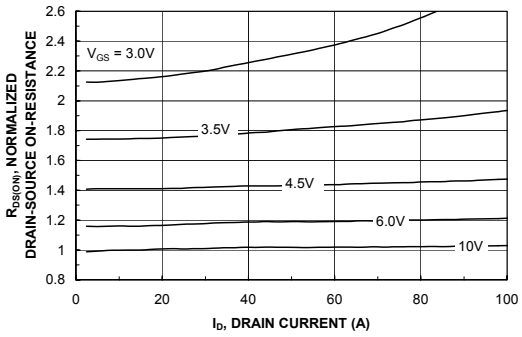


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

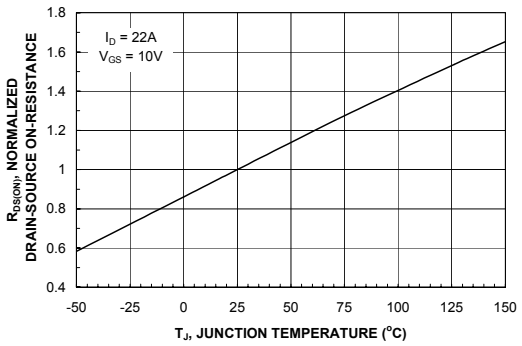


Figure 3. On-Resistance Variation with Temperature.

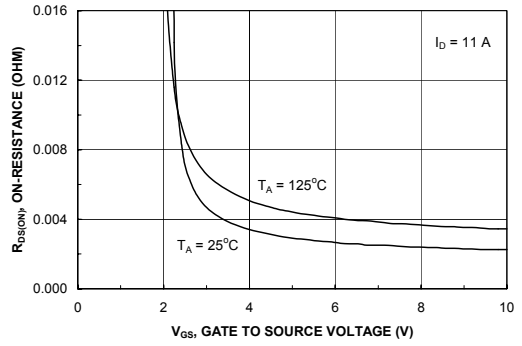


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

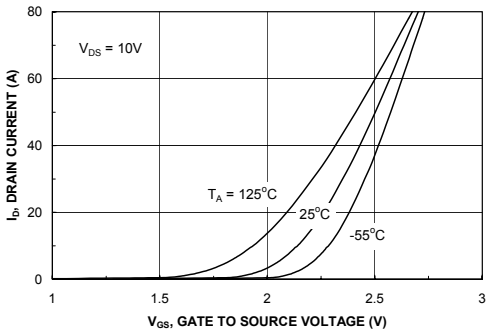


Figure 5. Transfer Characteristics.

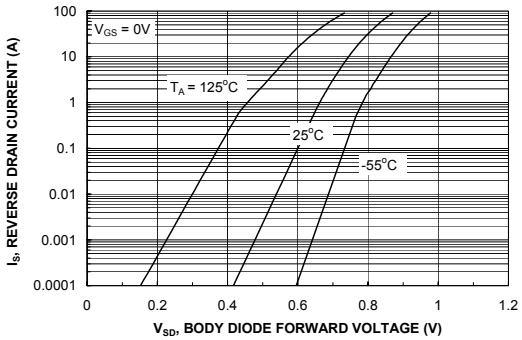


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

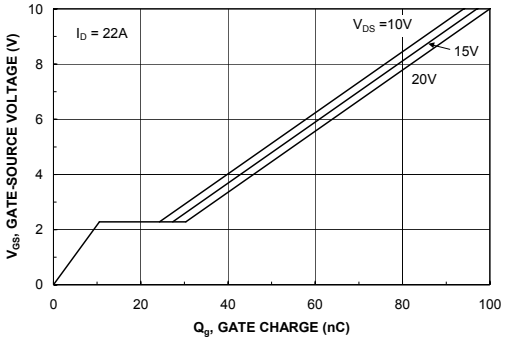


Figure 7. Gate Charge Characteristics.

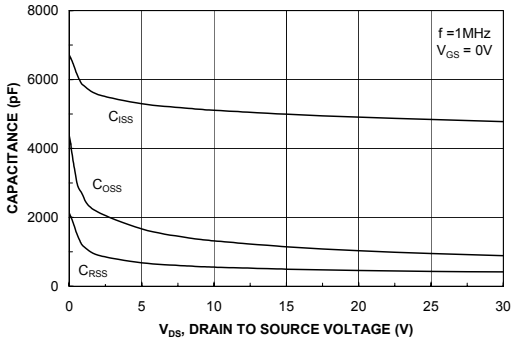


Figure 8. Capacitance Characteristics.

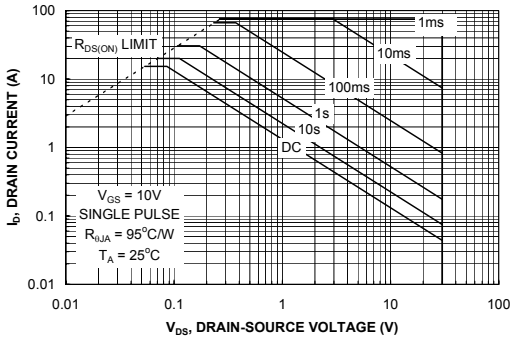


Figure 9. Maximum Safe Operating Area.

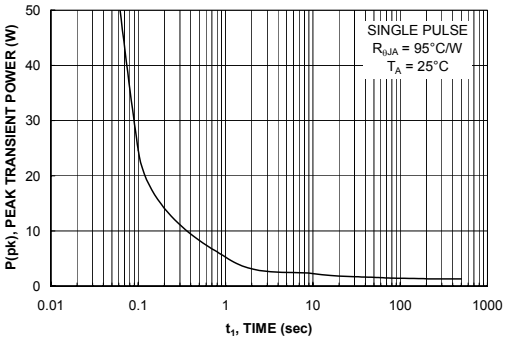


Figure 10. Single Pulse Maximum Power Dissipation.

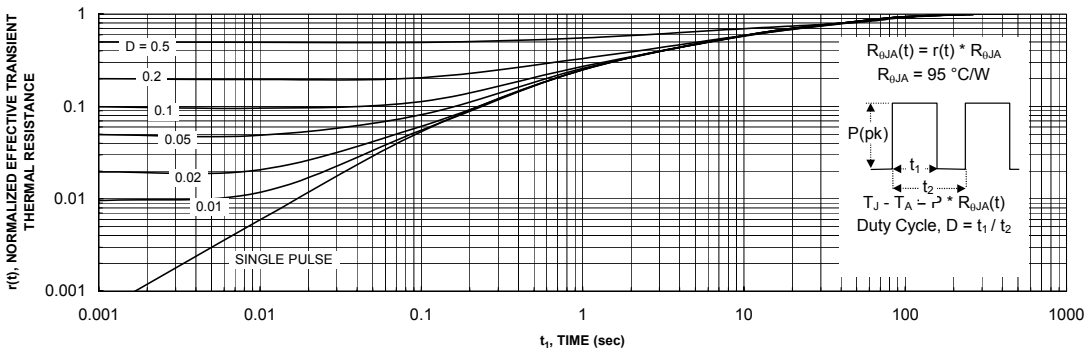
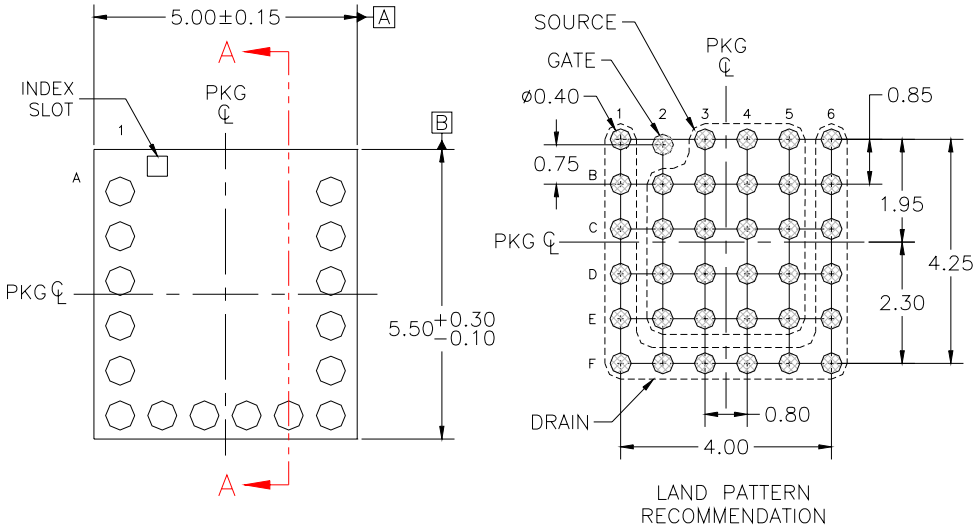
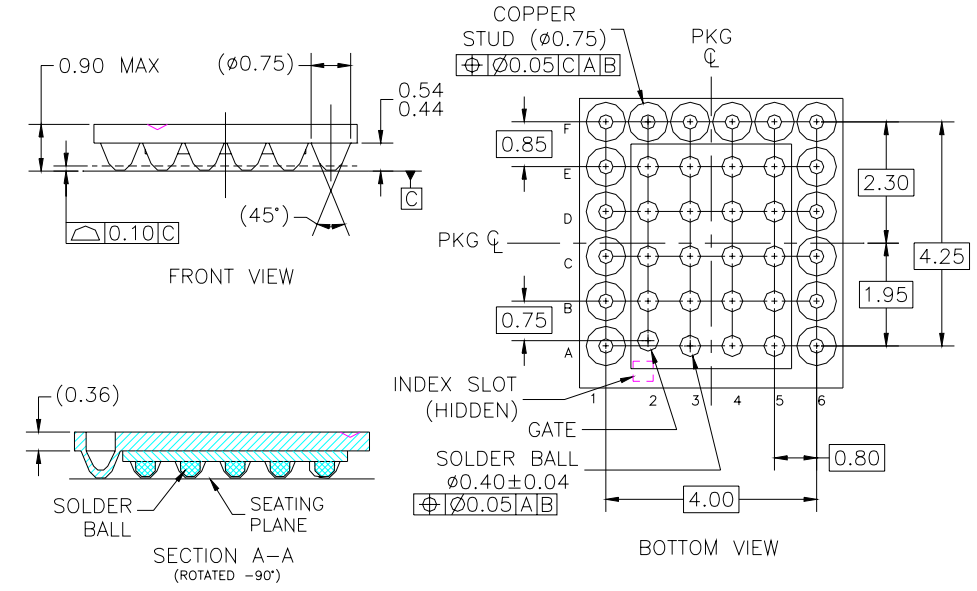


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.

Dimensional Outline and Pad Layout





NOTES: UNLESS OTHERWISE SPECIFIED

A) ALL DIMENSIONS ARE IN MILLIMETERS.

B) NO JEDEC REGISTRATION REFERENCE AS OF JULY 1999.

C) BALL CONFIGURATION TABLE

TERMINAL	DESIGNATION
A1,B1,C1,D1,E1,F1,F2,F3, F4,F5,F6,E6,D6,C6,B6,A6	DRAIN
A3,A4,A5,B2,B3,B4,B5,C2,C3, C4,C5,D2,D3,D4,D5,E2,E3,E4,E5	SOURCE
A2	GATE

BGA20AREVC

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Bottomless™	FASTr™	MICROCOUPLER™	PowerTrench®	SuperSOT™-6
CoolFET™	FPS™	MicroFET™	QFET®	SuperSOT™-8
CROSSVOLT™	FRFET™	MicroPak™	QS™	SyncFET™
DOME™	GlobalOptoisolator™	MICROWIRE™	QT Optoelectronics™	TinyLogic®
EcoSPARK™	GTO™	MSX™	Quiet Series™	TINYOPTO™
E²CMOS™	HiSeC™	MSXPro™	RapidConfigure™	TruTranslation™
EnSigna™	I²C™	OCX™	RapidConnect™	UHC™
FACT™	ImpliedDisconnect™	OCXPro™	SILENT SWITCHER®	UltraFET®
Across the board. Around the world.™		OPTOLOGIC®	SMART START™	VCX™
The Power Franchise™		OPTOPLANAR™	SPM™	
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