FAIRCHILD SEMICONDUCTOR®

January 2004

FDC3616N

100V N-Channel PowerTrench® MOSFET

General Description

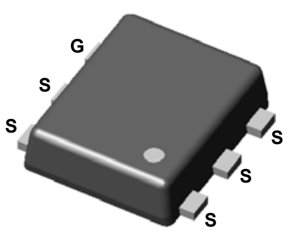
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

Applications

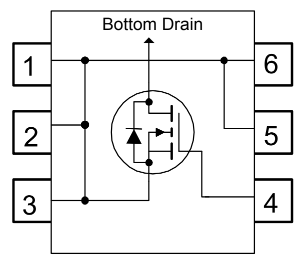
- DC/DC converter
- Load Switching

Features

- 3.7 A, 100 V. $R_{DS(ON)}$ = 70 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 80 mΩ @ V_{GS} = 6.0 V
- High performance trench technology for extremely low $R_{DS(ON)}$
- Low gate charge (23nC typical)
- High power and current handling capability
- Fast switching speed.



SuperSOT-6™ FLMP



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		100	V
V_{GSS}	Gate-Source Voltage		± 20	V
I_D	Drain Current – Continuous	(Note 1a)	3.7	A
	– Pulsed		20	
P_D	Maximum Power Dissipation	(Note 1a)	2	W
		(Note 1b)	1.1	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C

Thermal Characteristics

Symbol	Parameter		Ratings	Units
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	60	°C/W
		(Note 1b)	111	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case		0.5	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.616	FDC3616N	7’’	8mm	3000 units

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 2)						
W_{DSS}	Drain-Source Avalanche Energy	Single Pulse, V_{DD} = 50 V, I_D= 3.7A			244	mJ
I_{AR}	Drain-Source Avalanche Current				3.7	A
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		114		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 80 V, V_{GS} = 0 V			10	µA
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 30 V, V_{GS} = 0 V			1	µA
I_{GSSF}	Gate–Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	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	2	2.5	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		–7.4		mV/°C
$R_{DS(on)}$	Static Drain–Source On Resistance	V_{GS} = 10 V, I_D = 3.7 A V_{GS} = 6.0 V, I_D = 3.5 A V_{GS} = 10 V, I_D = 3.7 A, T_J = 125°C		55 58 104	70 80 139	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 3.7 A		19		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 50 V, V_{GS} = 0 V, f = 1.0 MHz		1215		pF
C_{oss}	Output Capacitance			72		pF
C_{rss}	Reverse Transfer Capacitance			39		pF
R_G	Gate Resistance	V_{GS} = 15 mV, f = 1.0 MHz		1.1		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 50 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		9	18	ns
t_r	Turn–On Rise Time			4	8	ns
$t_{d(off)}$	Turn–Off Delay Time			28	45	ns
t_f	Turn–Off Fall Time			10	20	ns
Q_g	Total Gate Charge	V_{DS} = 50 V, I_D = 3.7 A, V_{GS} = 10 V		23	32	nC
Q_{gs}	Gate–Source Charge			4.8		nC
Q_{gd}	Gate–Drain Charge			5.4		nC

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain–Source Diode Characteristics and Maximum Ratings						
t_{rr}	Diode Reverse Recovery Time	I_F = 3.7 A, d_{iF}/d_t = 100 A/µs		41		nS
Q_{rr}	Diode Reverse Recovery Charge			107		nC
I_S	Maximum Continuous Drain–Source Diode Forward Current				2.1	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.1 A (Note 2)		0.75	1.2	V

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

a) 60°C/W when mounted on a 1in^2 pad of 2 oz copper

b) 111°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

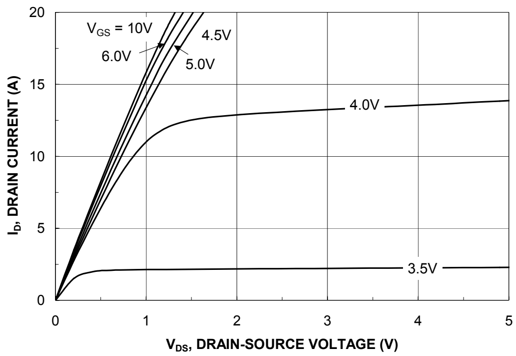


Figure 1. On-Region Characteristics.

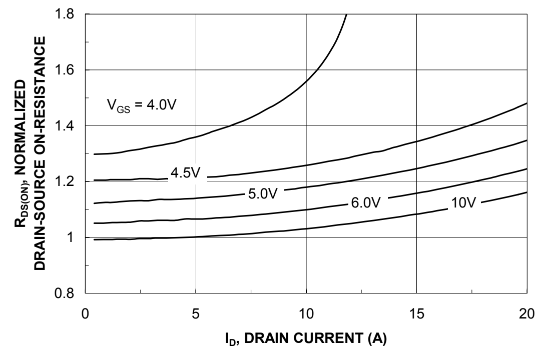


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

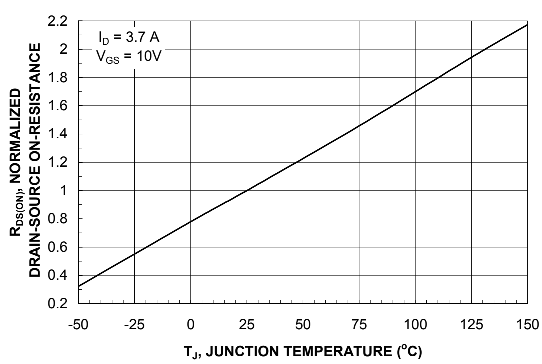


Figure 3. On-Resistance Variation with Temperature.

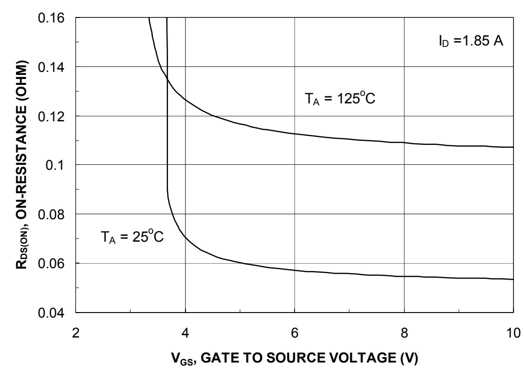


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

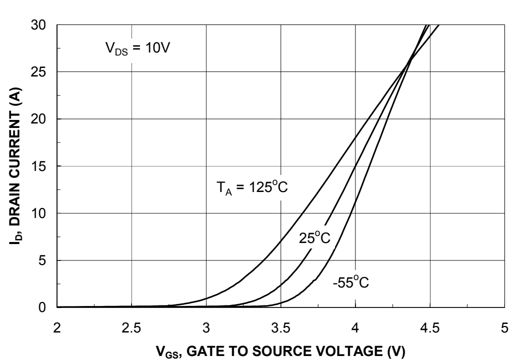


Figure 5. Transfer Characteristics.

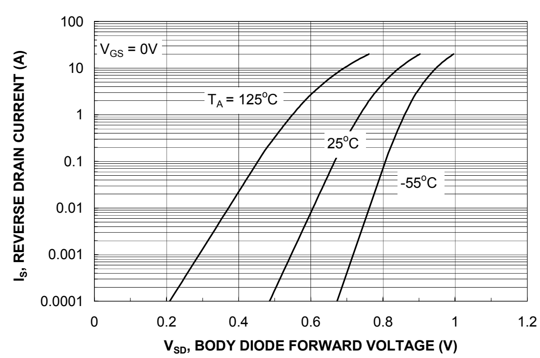


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

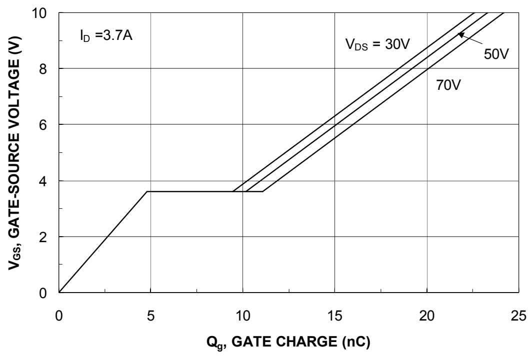


Figure 7. Gate Charge Characteristics.

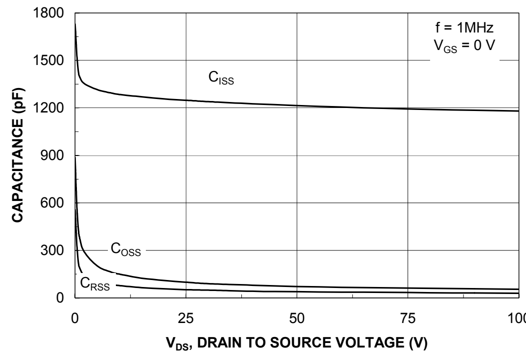


Figure 8. Capacitance Characteristics.

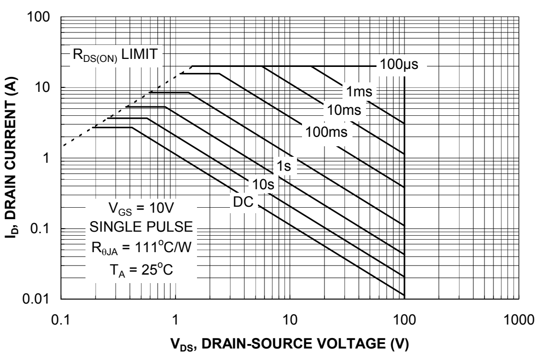


Figure 9. Maximum Safe Operating Area.

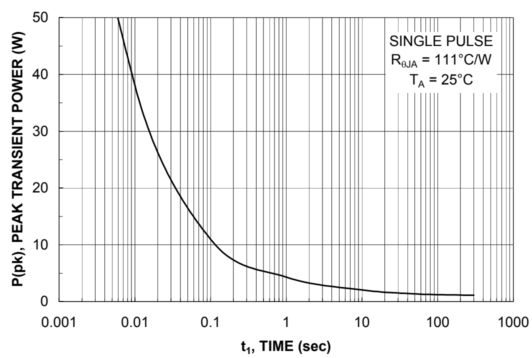


Figure 10. Single Pulse Maximum Power Dissipation.

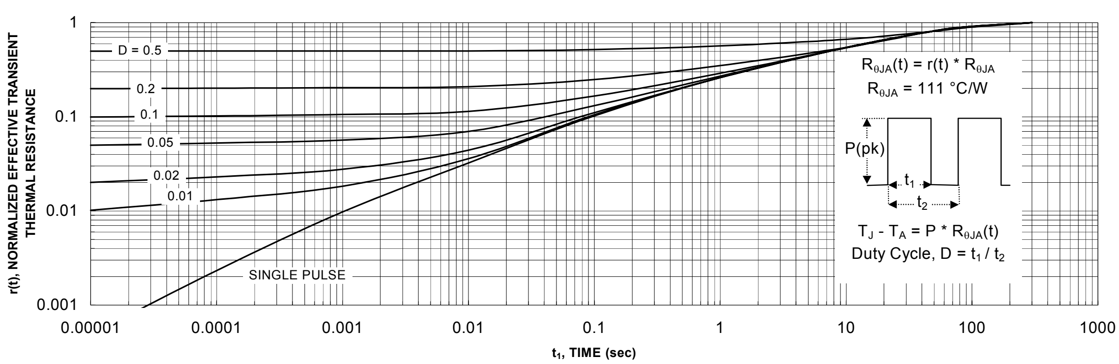
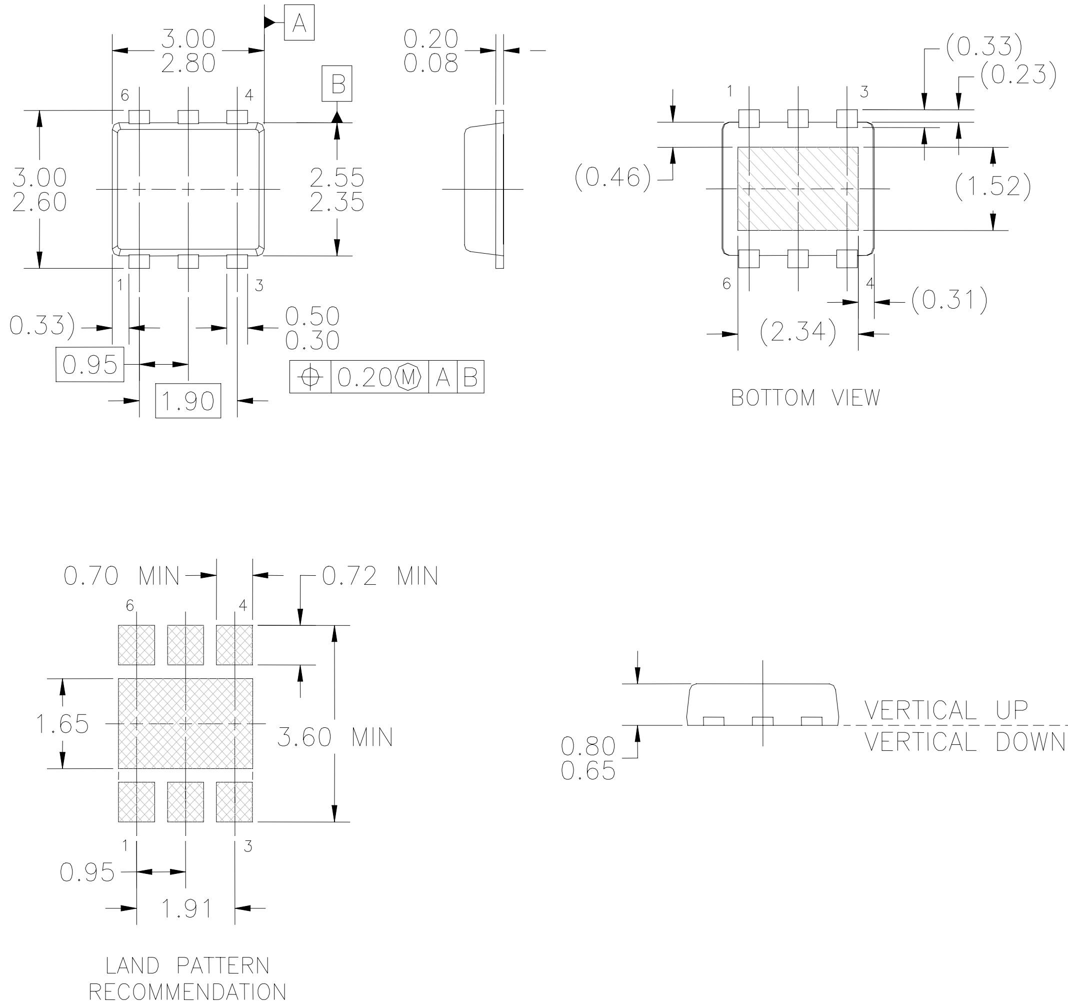


Figure 11. Transient Thermal Response Curve.

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) NO PACKAGE STANDARD REFERENCE AS OF MARCH, 2001.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS DO NOT INCLUDE MOLD FLASH AND CUTTING BURRS.

D) LEAD TIP BURR:
   HORIZONTAL: 0.20 mm MAX
   VERTICAL UP: 0.20 mm MAX
   VERTICAL DOWN: 0.05 mm MAX

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.