

FDS4080N3

40V N-Channel Bottomless™ PowerTrench® MOSFET

General Description

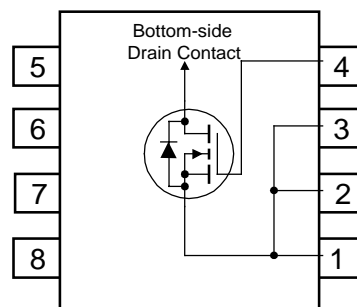
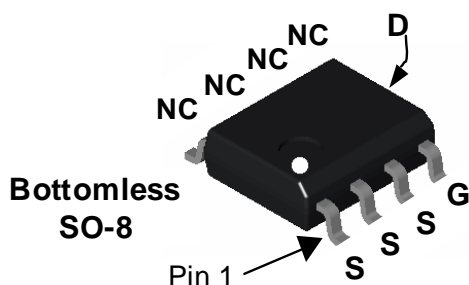
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for "low side" synchronous rectifier operation, providing an extremely low $R_{DS(ON)}$ in a small package.

Applications

- Synchronous rectifier
- DC/DC converter

Features

- 13 A, 40 V $R_{DS(ON)} = 10.5 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- Fast switching ($Q_g = 30 \text{ nC}$)
- Bottomless™ SO-8 package: Enhanced thermal performance in industry-standard package size



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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	40	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current – Continuous (Note 1a)	13	A
	– Pulsed	60	
P_D	Power Dissipation for Single Operation (Note 1a)	3.9	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +175	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	40	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Ambient	0.5	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS4080N3	FDS4080N3	13"	12mm	2500 units

Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Drain-Source Avalanche Ratings (Note 2)

E_{AS}	Drain-Source Avalanche Energy	Single Pulse, $V_{DD} = 10\text{V}$, $I_D = 13\text{A}$			200	mJ
I_{AS}	Drain-Source Avalanche Current				13	A

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}$, $I_D = 250\ \mu\text{A}$	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		44		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 32\text{V}$, $V_{GS} = 0\text{V}$			1	μA
I_{GSSF}	Gate-Body Leakage, Forward	$V_{GS} = 20\text{V}$, $V_{DS} = 0\text{V}$			100	nA
I_{GSSR}	Gate-Body Leakage, Reverse	$V_{GS} = -20\text{V}$, $V_{DS} = 0\text{V}$			-100	nA

On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	2	3.9	5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		-8		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{V}$, $I_D = 13\text{A}$ $V_{GS} = 10\text{V}$, $I_D = 13\text{A}$, $T_J = 125^\circ\text{C}$		8.5 12.5	10.5 22	m Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{V}$, $V_{DS} = 5\text{V}$	30			A
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{V}$, $I_D = 13\text{A}$		41		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 20\text{V}$, $V_{GS} = 0\text{V}$, $f = 1.0\text{MHz}$		1750		pF
C_{oss}	Output Capacitance			357		pF
C_{riss}	Reverse Transfer Capacitance			138		pF

Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\text{V}$, $I_D = 1\text{A}$, $V_{GS} = 10\text{V}$, $R_{GEN} = 6\ \Omega$		12	21	ns
t_r	Turn-On Rise Time			8	17	ns
$t_{d(off)}$	Turn-Off Delay Time			29	46	ns
t_f	Turn-Off Fall Time			14	25	ns
Q_g	Total Gate Charge	$V_{DS} = 20\text{V}$, $I_D = 13\text{A}$, $V_{GS} = 10\text{V}$		30	40	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			10		nC

Drain-Source Diode Characteristics and Maximum Ratings

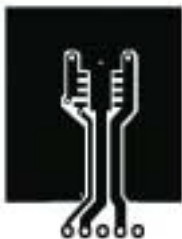
I_S	Maximum Continuous Drain-Source Diode Forward Current				3.2	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{V}$, $I_S = 3.2\text{A}$ (Note 2)		0.7	1.2	V

Electrical Characteristics

$T_A = 25^\circ\text{C}$ unless otherwise noted

Notes:

- $R_{\theta JA}$ 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) 49°C/W when mounted on a 1in^2 pad of 2 oz copper



b) 85°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width $< 300\mu\text{s}$, Duty Cycle $< 2.0\%$

Typical Characteristics

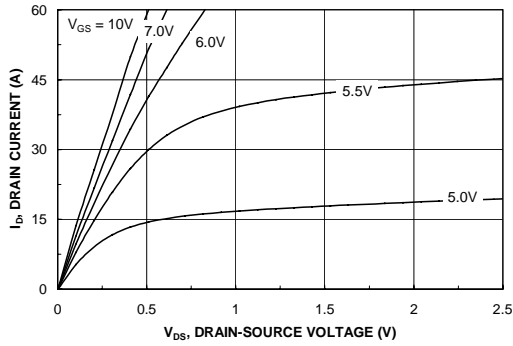


Figure 1. On-Region Characteristics.

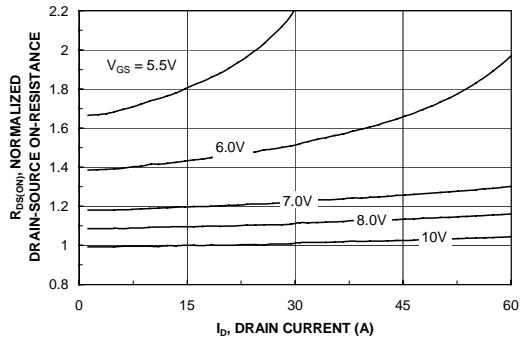


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

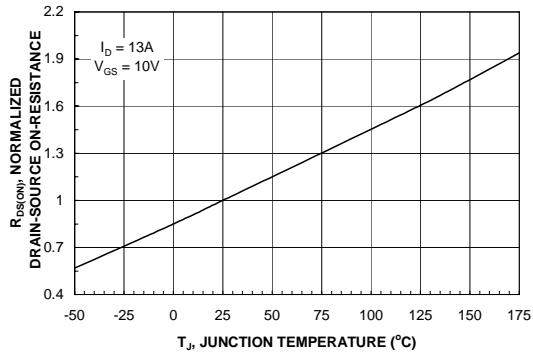


Figure 3. On-Resistance Variation with Temperature.

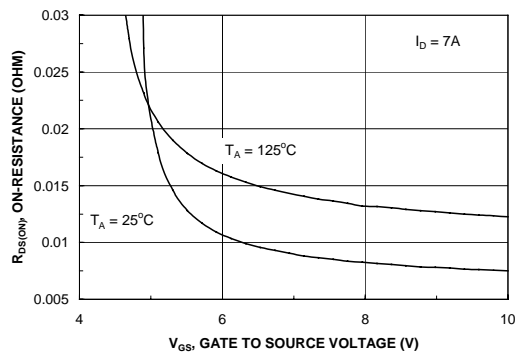


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

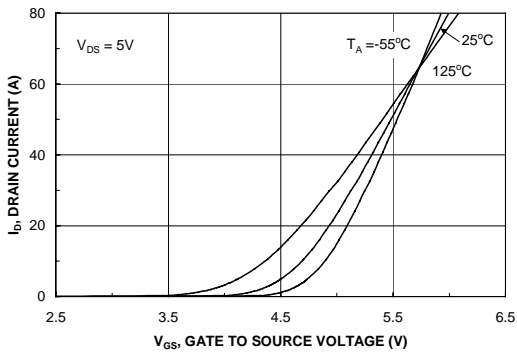


Figure 5. Transfer Characteristics.

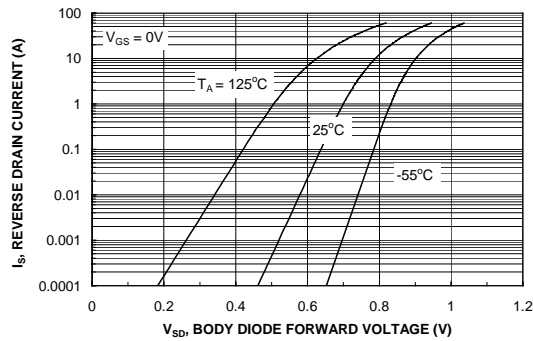


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

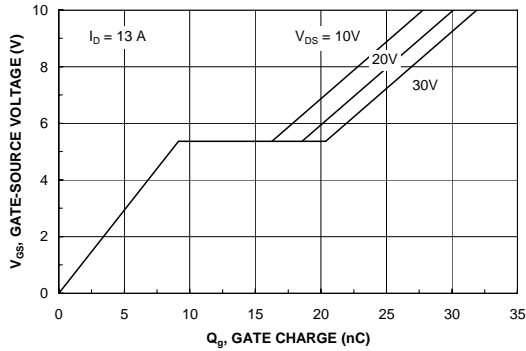


Figure 7. Gate Charge Characteristics.

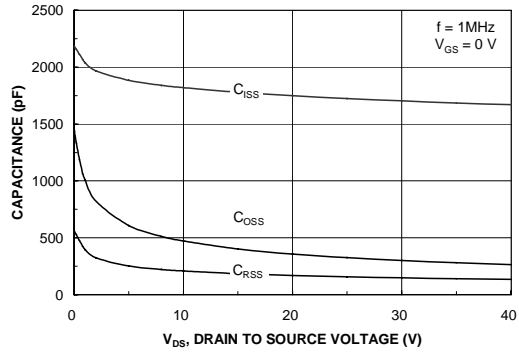


Figure 8. Capacitance Characteristics.

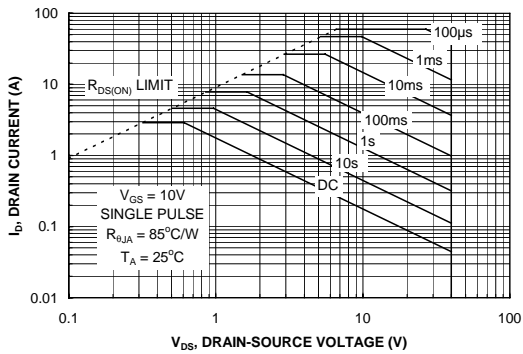


Figure 9. Maximum Safe Operating Area.

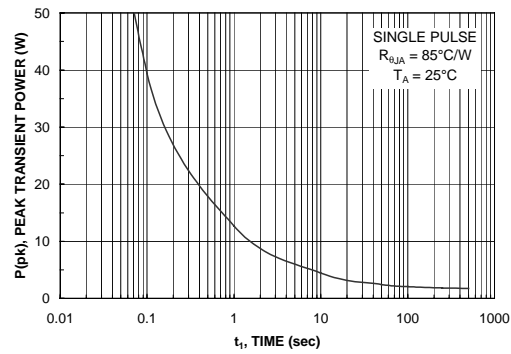


Figure 10. Single Pulse Maximum Power Dissipation.

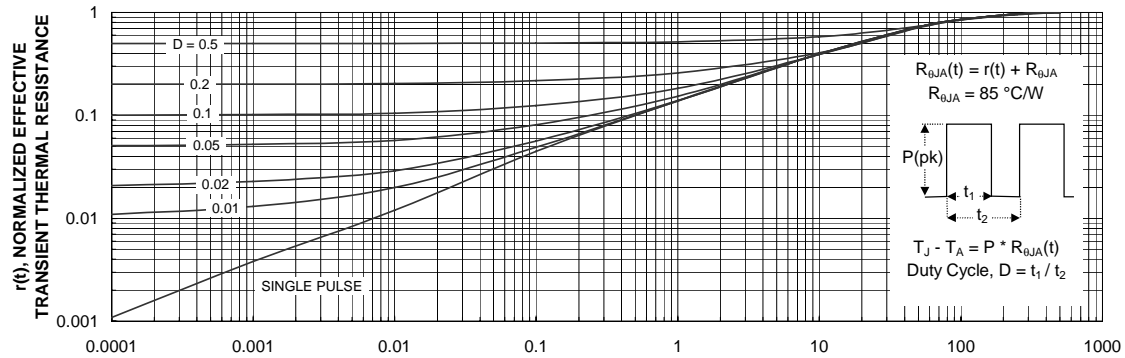
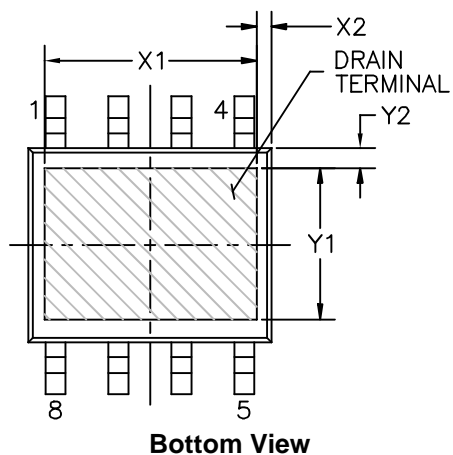


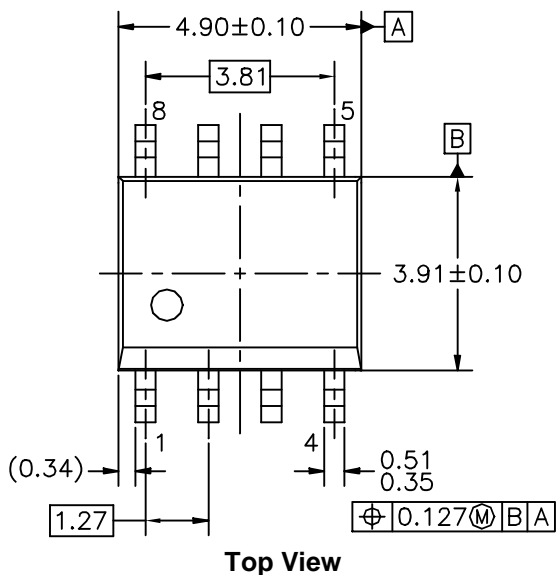
Figure 11. Transient Thermal Response Curve.

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

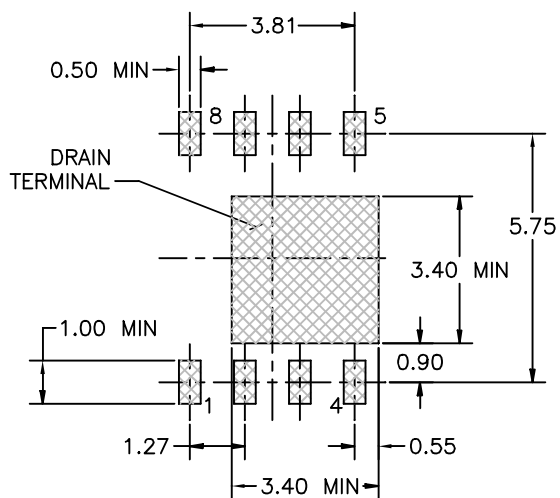
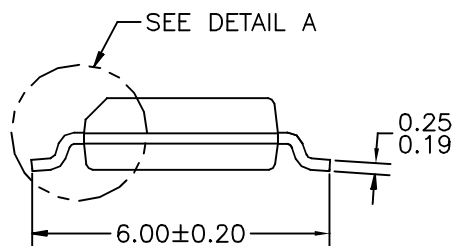
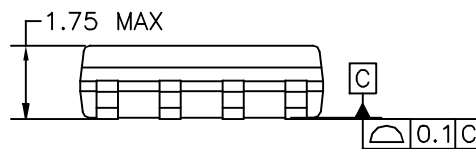
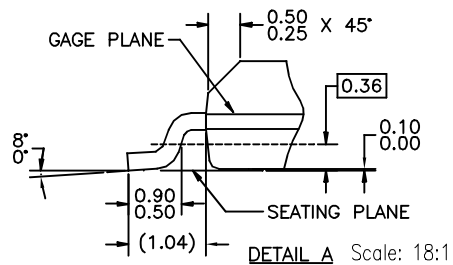
Dimensional Outline and Pad Layout



Bottom View



Top View



Minimum Recommended Landing Pattern

Notes: Unless otherwise Specified

- a) All dimensions in mm
- b) Standard lead finish:
20 – 80 μ inches nickel /
6 μ inches palladium
- c) Chip Size Dimensional Table

Chip Size		X2	Y2
X1	Y1		
2.36	2.36	0.75	0.67

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