



ON Semiconductor®

FDMC0202S

N-Channel Power Trench® SyncFET™ 25 V, 40 A, 3.15 mΩ

General Description

The FDMC0202S has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest $r_{DS(on)}$ while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic Schottky body diode.

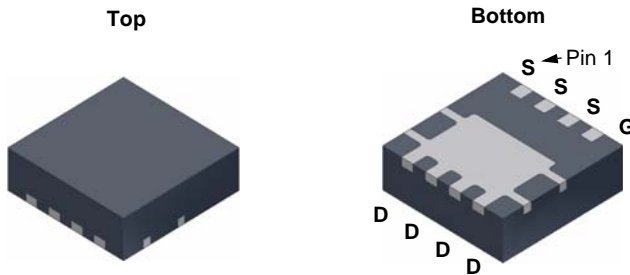
Features

- Max $r_{DS(on)}$ = 3.15 mΩ at $V_{GS} = 10\text{ V}$, $I_D = 22.5\text{ A}$
- Max $r_{DS(on)}$ = 4.7 mΩ at $V_{GS} = 4.5\text{ V}$, $I_D = 18\text{ A}$
- Advanced Package and Silicon combination for low $r_{DS(on)}$ and high efficiency
- SyncFET Schottky Body Diode
- 100% UIL Tested
- RoHS Compliant

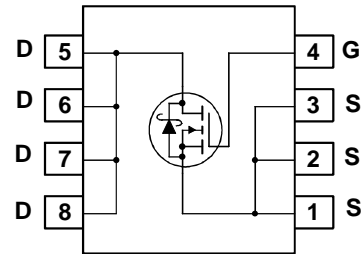


Applications

- Synchronous Rectifier for DC/DC Converters
- Notebook Vcore/ GPU low side switch
- Networking Point of Load low side switch
- Telecom secondary side rectification



Power 33



MOSFET Maximum Ratings $T_A = 25\text{ °C}$ unless otherwise noted

Symbol	Parameter	Rated	Units
V_{DS}	Drain to Source Voltage	25	V
V_{GS}	Gate to Source Voltage (Note 4)	± 20	V
I_D	Drain Current -Continuous (Package limited) $T_C = 25\text{ °C}$	40	A
	-Continuous (Silicon limited) $T_C = 25\text{ °C}$	103	
	-Continuous $T_A = 25\text{ °C}$ (Note 1a)	22.5	
	-Pulsed	120	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	84	mJ
P_D	Power Dissipation $T_C = 25\text{ °C}$	52	W
	Power Dissipation $T_A = 25\text{ °C}$ (Note 1a)	2.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	2.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC0202S	FDMC0202S	Power 33	13 "	12 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 1\text{ mA}, V_{GS} = 0\text{ V}$	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, referenced to $25\text{ }^\circ\text{C}$		21		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			500	μA
I_{GSS}	Gate to Source Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1\text{ mA}$	1.2	1.7	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, referenced to $25\text{ }^\circ\text{C}$		-5		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 22.5\text{ A}$		2.5	3.15	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 18\text{ A}$		3.6	4.7	
		$V_{GS} = 10\text{ V}, I_D = 22.5\text{ A}, T_J = 125\text{ }^\circ\text{C}$		3.5	4.5	
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 22.5\text{ A}$		122		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 13\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		2031	2705	pF
C_{oss}	Output Capacitance			596	795	pF
C_{rss}	Reverse Transfer Capacitance			134	205	pF
R_g	Gate Resistance			1.1	2.4	Ω

Switching Characteristics

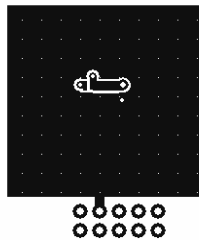
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 13\text{ V}, I_D = 22.5\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		11	22	ns	
t_r	Rise Time			3.6	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			26	41	ns	
t_f	Fall Time			3	10	ns	
Q_g	Total Gate Charge		$V_{GS} = 0\text{ V to }10\text{ V}$		31	44	nC
Q_g	Total Gate Charge		$V_{GS} = 0\text{ V to }4.5\text{ V}$	$V_{DD} = 13\text{ V}$ $I_D = 22.5\text{ A}$		14	20
Q_{gs}	Gate to Source Gate Charge				6.5		nC
Q_{gd}	Gate to Drain "Miller" Charge				3.9		nC

Drain-Source Diode Characteristics

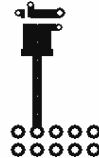
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 22.5\text{ A}$ (Note 2)		0.79	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)		0.47	0.8	
t_{rr}	Reverse Recovery Time	$I_F = 22.5\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$		24	39	ns
Q_{rr}	Reverse Recovery Charge			19	34	nC

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a $1.5 \times 1.5\text{ in.}$ board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



53 °C/W when mounted on a
1 in² pad of 2 oz copper



125 °C/W when mounted on
a minimum pad of 2 oz copper

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

3. E_{AS} of 84 mJ is based on starting $T_J = 25\text{ }^\circ\text{C}$, $L = 1\text{ mH}$, $I_{AS} = 13\text{ A}$, $V_{DD} = 23\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 0.3\text{ mH}$, $I_{AS} = 20\text{ A}$.

4. As an N-ch device, the negative V_{GS} rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

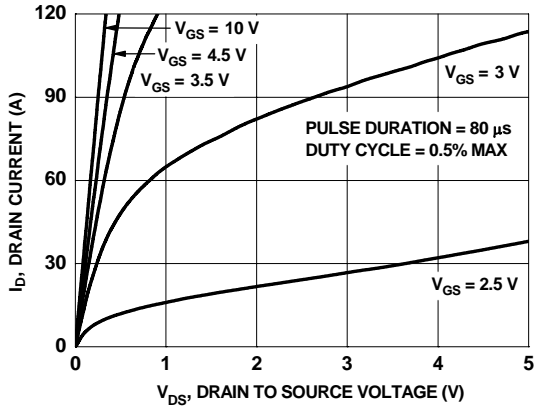


Figure 1. On-Region Characteristics

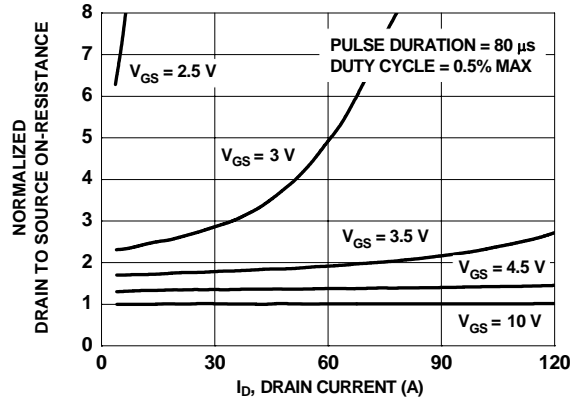


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

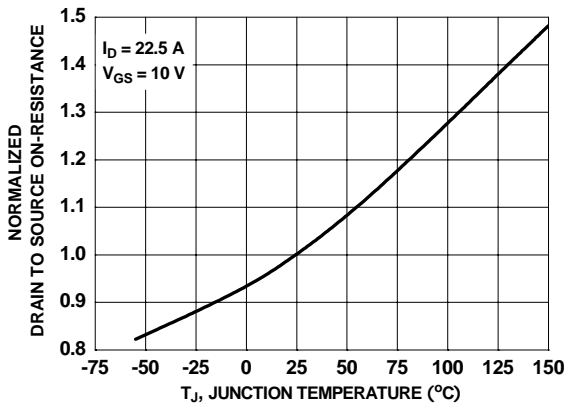


Figure 3. Normalized On-Resistance vs Junction Temperature

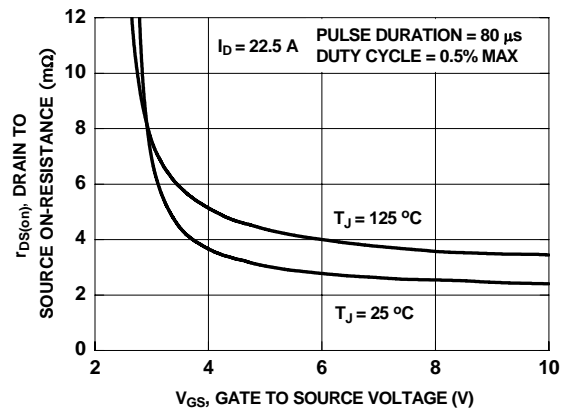


Figure 4. On-Resistance vs Gate to Source Voltage

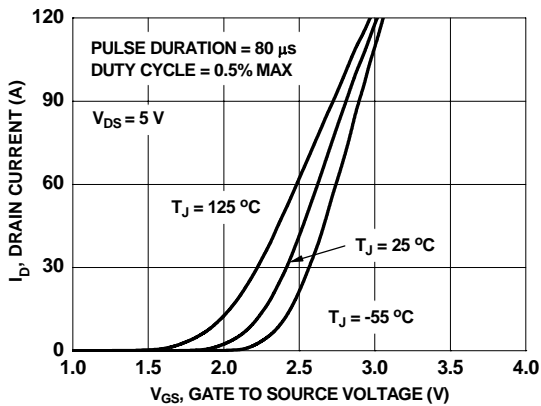


Figure 5. Transfer Characteristics

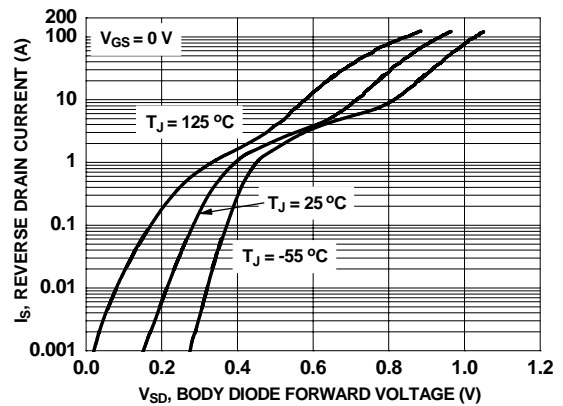


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

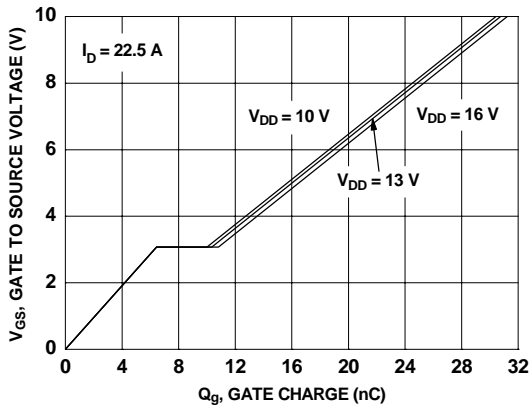


Figure 7. Gate Charge Characteristics

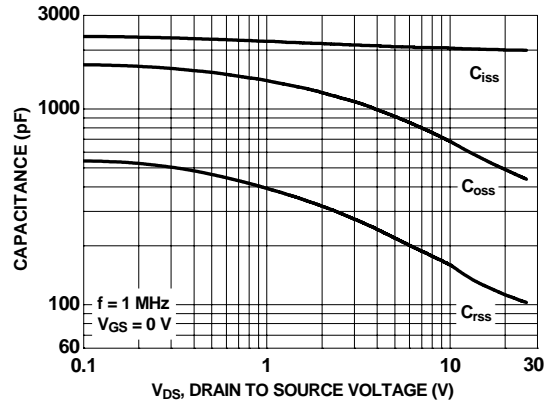


Figure 8. Capacitance vs Drain to Source Voltage

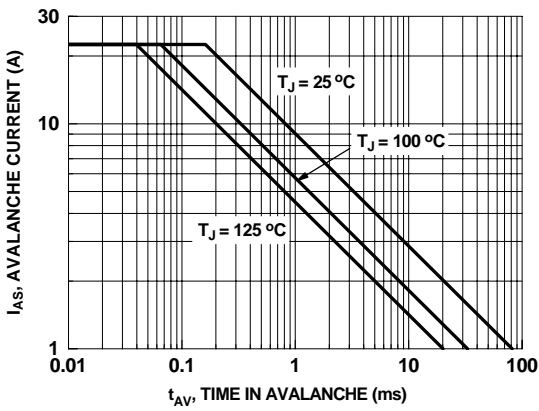


Figure 9. Unclamped Inductive Switching Capability

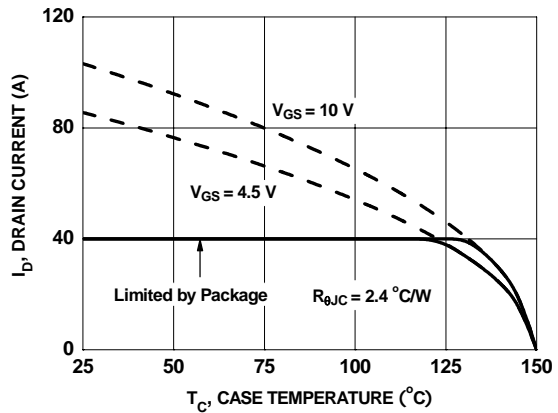


Figure 10. Maximum Continuous Drain Current vs Case Temperature

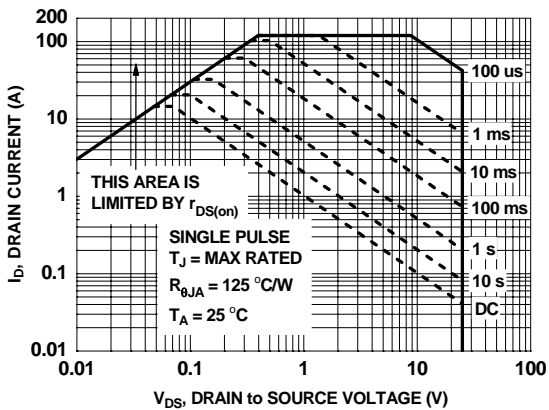


Figure 11. Forward Bias Safe Operating Area

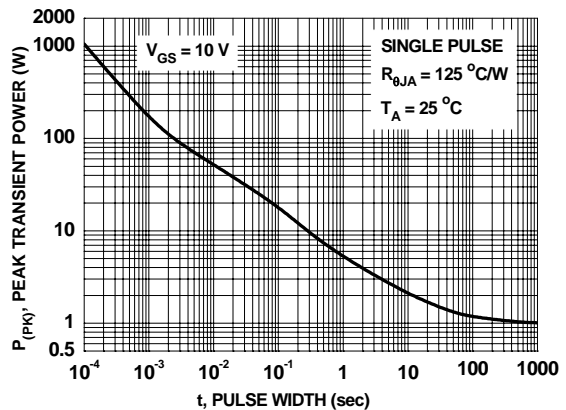


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

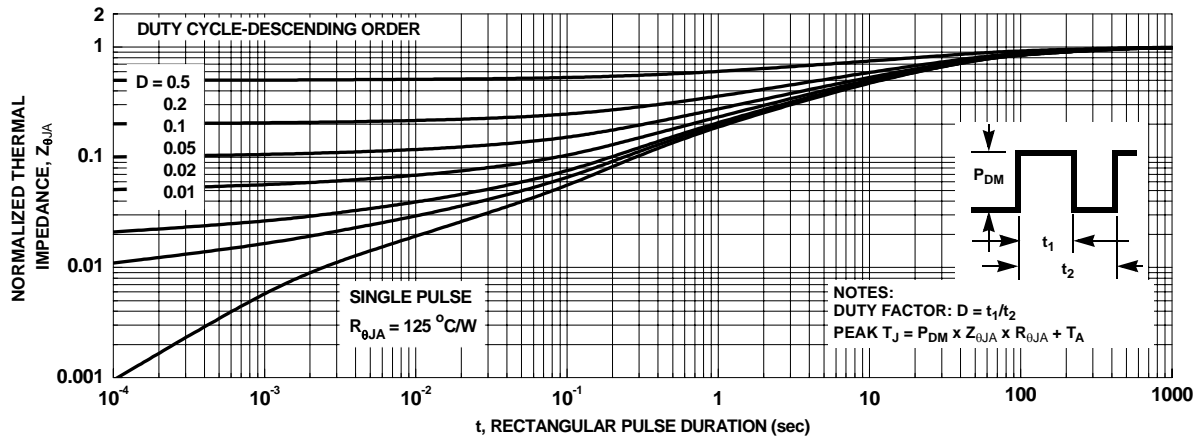


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFET Schottky body diode Characteristics

ON Semiconductor SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 13 shows the reverse recovery characteristic of the FDMC0202S.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

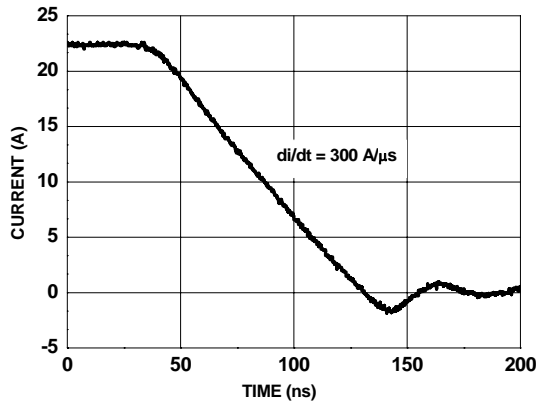


Figure 13. FDMC0202S SyncFET body diode reverse recovery characteristic

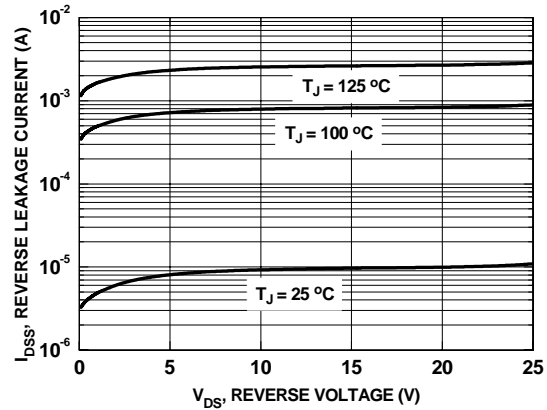
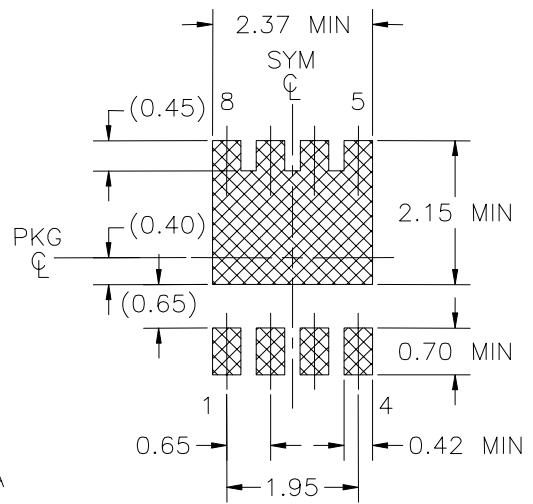
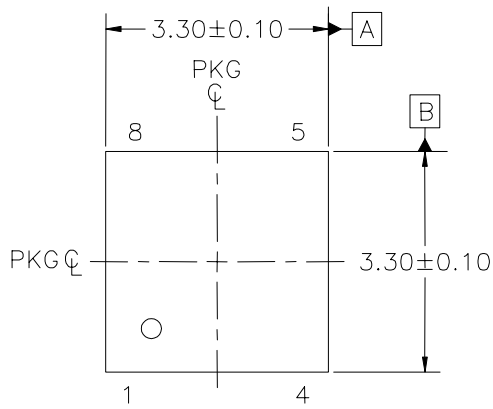
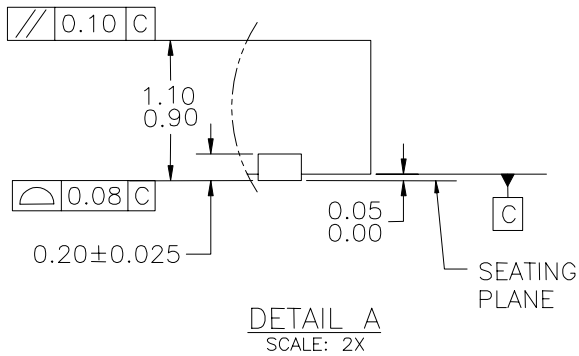
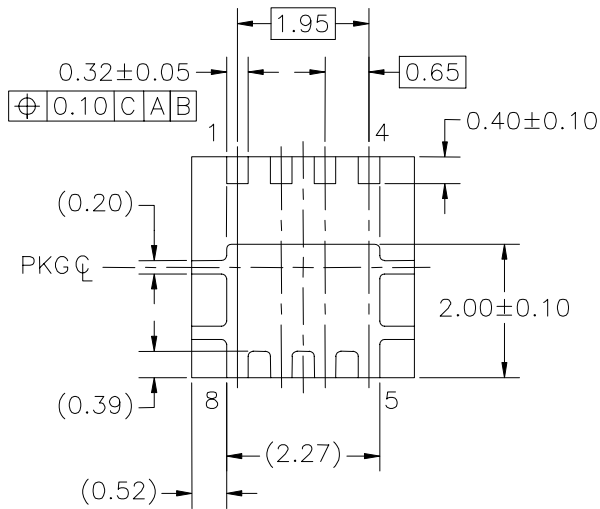
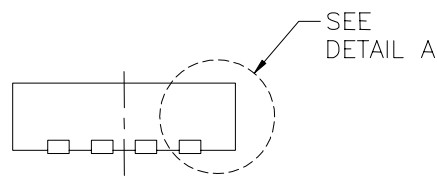


Figure 14. SyncFET body diode reverse leakage versus drain-source voltage

Dimensional Outline and Pad Layout



LAND PATTERN RECOMMENDATION



NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE:
JEDEC MO-240, ISSUE A, VAR. BA,
DATED OCTOBER 2002.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS
OR MOLD FLASH. MOLD FLASH OR
BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER
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- E) DRAWING FILE NAME: PQFN08BREV1

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