

# FDMS8670S

## N-Channel PowerTrench® SyncFET™

30V, 42A, 3.5mΩ

### Features

- Max  $r_{DS(on)}$  = 3.5mΩ at  $V_{GS}$  = 10V,  $I_D$  = 20A
- Max  $r_{DS(on)}$  = 5.0mΩ at  $V_{GS}$  = 4.5V,  $I_D$  = 17A
- Advanced Package and Silicon combination for low  $r_{DS(on)}$  and high efficiency
- SyncFET Schottky Body Diode
- MSL1 robust package design
- RoHS Compliant

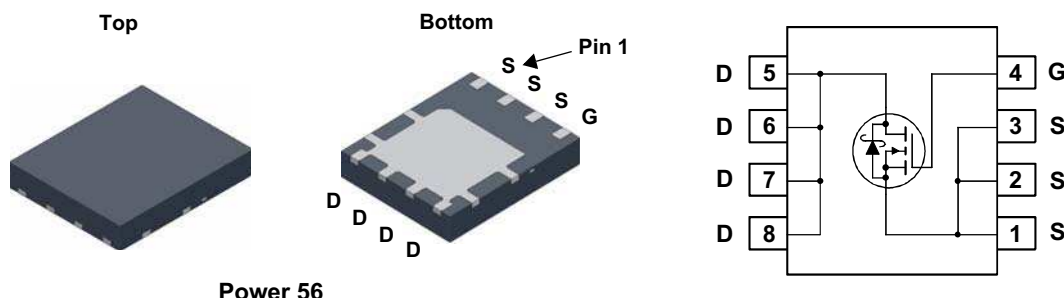


### General Description

The FDMS8670S 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.

### Application

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



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	42	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	116	
	-Continuous (Silicon limited) $T_C = 100^\circ\text{C}$	74	
	-Continuous $T_A = 25^\circ\text{C}$	20	
	-Pulsed	200	
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	78	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.5	
	Power Dissipation $T_A = 85^\circ\text{C}$ (Note 1a)	1.3	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.6	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS8670S	FDMS8670S	Power 56	13"	12mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 1\text{mA}, V_{GS} = 0\text{V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{mA}$ , referenced to $25^\circ\text{C}$		17		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}, V_{GS} = 0\text{V}$			500	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$			$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1\text{mA}$	1	1.5	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 50\text{mA}$ , referenced to $25^\circ\text{C}$		-2.8		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 20\text{A}$		2.8	3.5	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 17\text{A}$		3.6	5.0	
		$V_{GS} = 10\text{V}, I_D = 20\text{A}, T_J = 125^\circ\text{C}$		3.9	6.0	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{V}, I_D = 20\text{A}$		98		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$		3005	4000	pF
$C_{oss}$	Output Capacitance			865	1150	pF
$C_{rss}$	Reverse Transfer Capacitance			320	480	pF
$R_g$	Gate Resistance	$f = 1\text{MHz}$		1.4	5.0	$\Omega$

**Switching Characteristics**

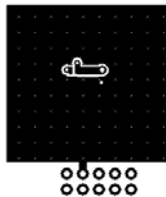
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{V}, I_D = 20\text{A}$ $V_{GS} = 10\text{V}, R_{GEN} = 5\Omega$		14	26	ns
$t_r$	Rise Time			19	35	ns
$t_{d(off)}$	Turn-Off Delay Time			37	60	ns
$t_f$	Fall Time			10	20	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0\text{V}$ to 10V	$V_{DS} = 15\text{V}$ $I_D = 20\text{A}$	52	73	nC
$Q_{g(4.5V)}$	Total Gate Charge at 4.5V	$V_{GS} = 0\text{V}$ to 4.5V		24	34	nC
$Q_{gs}$	Gate to Source Gate Charge			8		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			10		nC

**Drain-Source Diode Characteristics**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 2\text{A}$		0.4	0.7	V
$t_{rr}$	Reverse Recovery Time	$I_F = 20\text{A}, di/dt = 300\text{A}/\mu\text{s}$		26	42	ns
$Q_{rr}$	Reverse Recovery Charge			24	39	nC

**Notes:**

1:  $R_{\theta JA}$  is determined with the device mounted on a 1in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 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.



a.  $50^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

2: Pulse time < 300 $\mu\text{s}$ , Duty cycle < 2%.

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

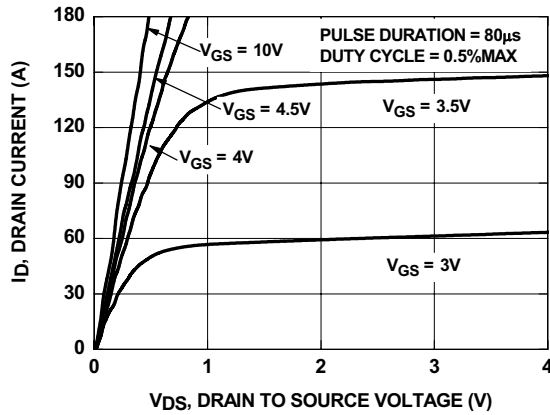


Figure 1. On Region Characteristics

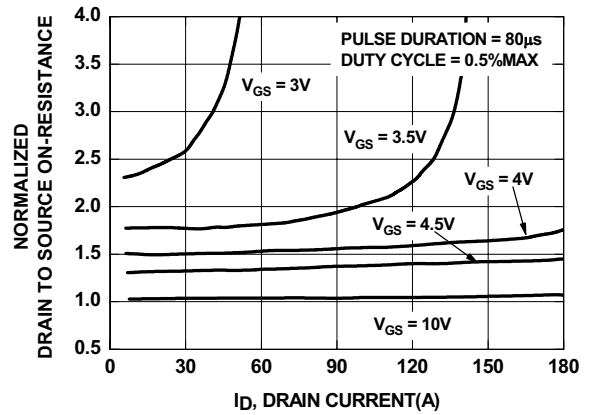


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

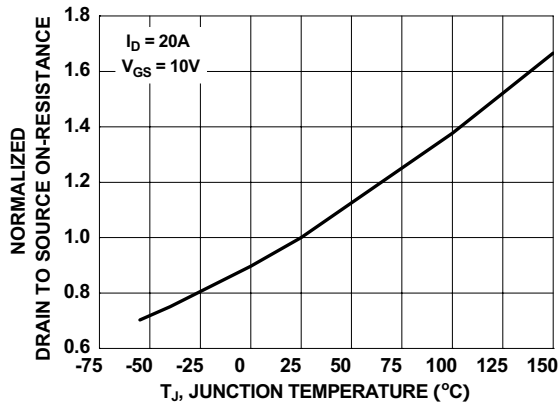


Figure 3. Normalized On Resistance vs Junction Temperature

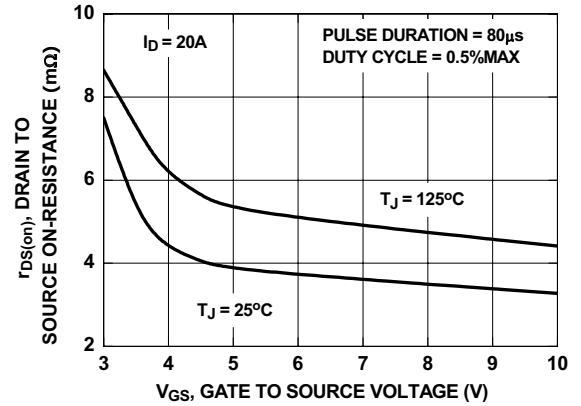


Figure 4. On-Resistance vs Gate to Source Voltage

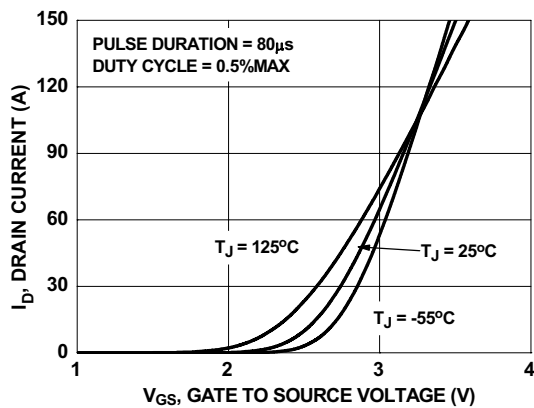


Figure 5. Transfer Characteristics

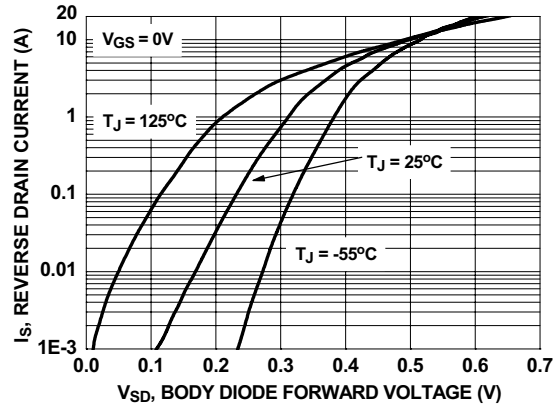


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

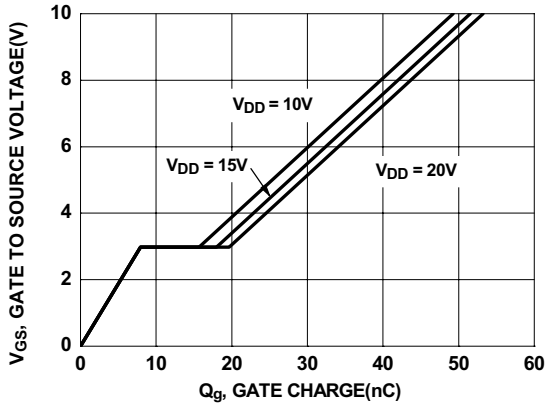


Figure 7. Gate Charge Characteristics

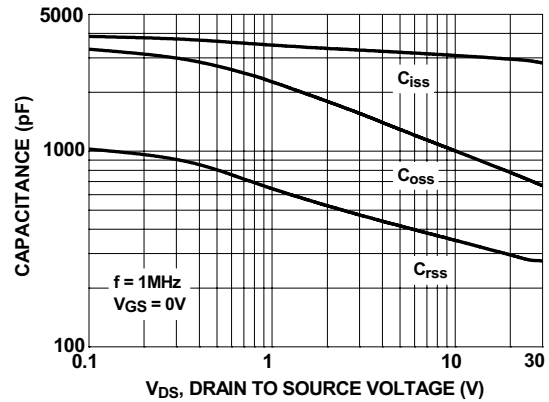


Figure 8. Capacitance vs Drain to Source Voltage

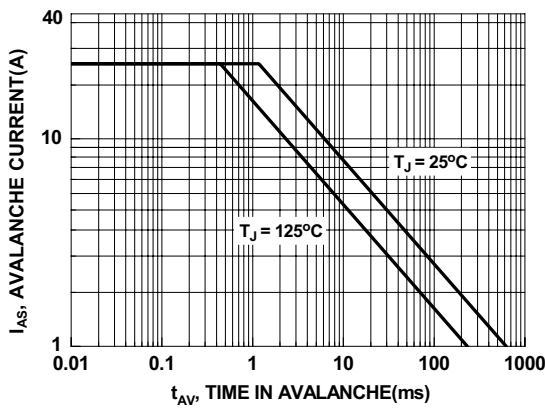


Figure 9. Unclamped Inductive Switching Capability

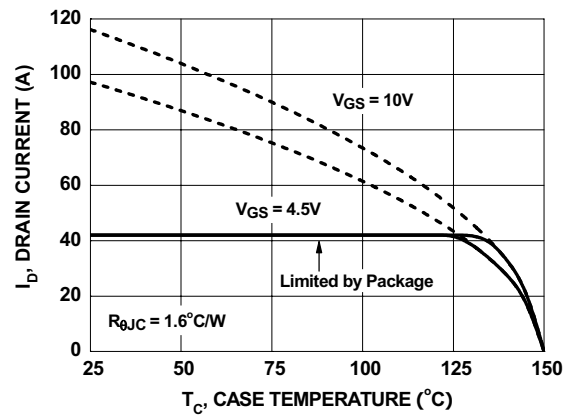


Figure 10. Maximum Continuous Drain Current vs Case Temperature

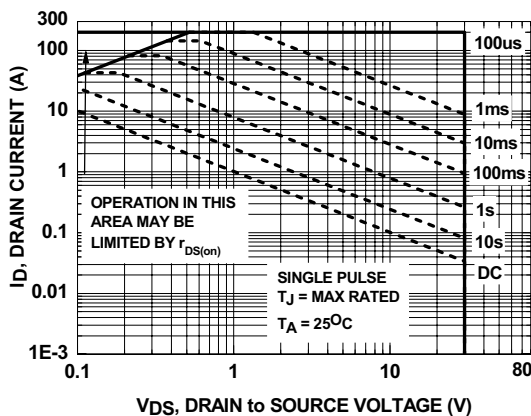


Figure 11. Forward Bias Safe Operating Area

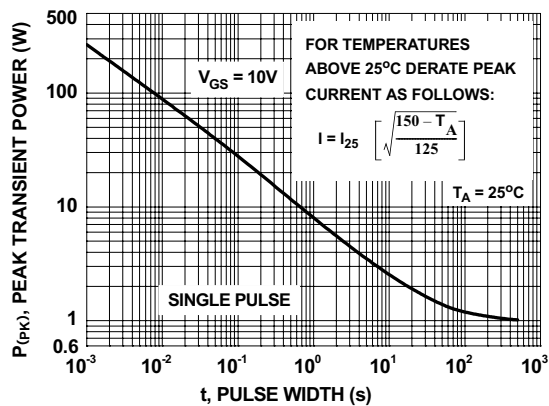
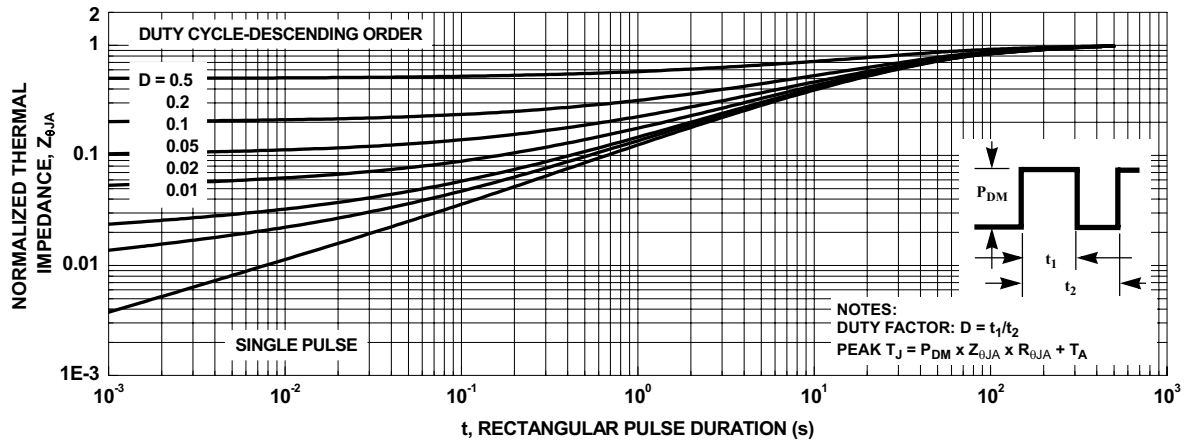


Figure 12. Single Pulse Maximum Power Dissipation

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



## Typical Characteristics (continued)

### SyncFET Schottky body diode Characteristics

Fairchild's 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 14 shows the reverse recovery characteristic of the FDMS8670S.

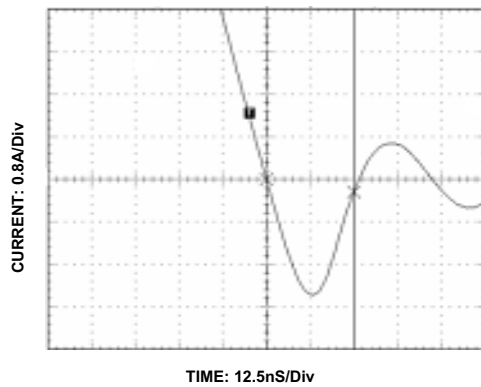


Figure 14. FDMS8670S SyncFET Body Diode reverse recovery characteristics

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

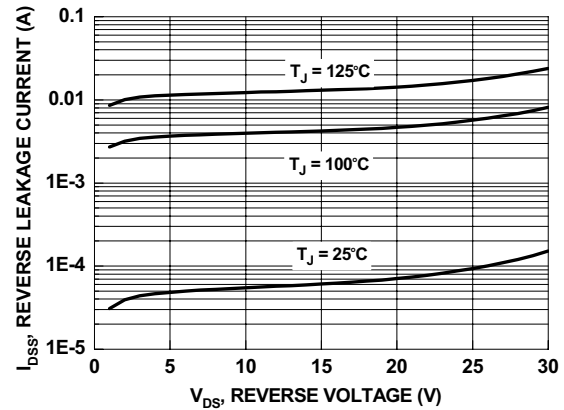
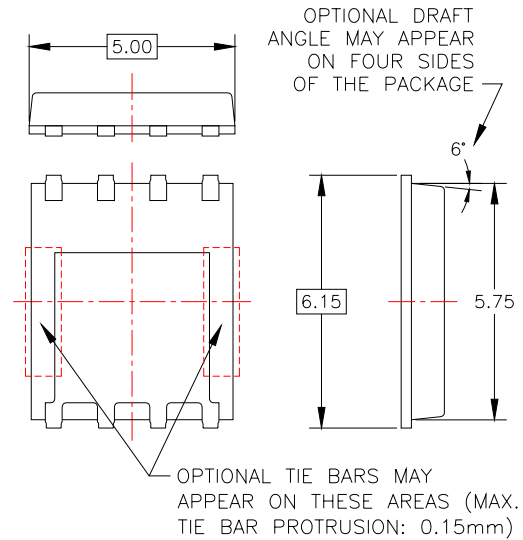
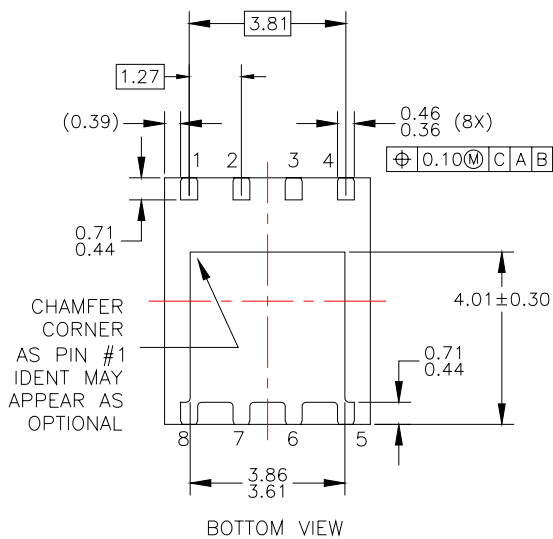
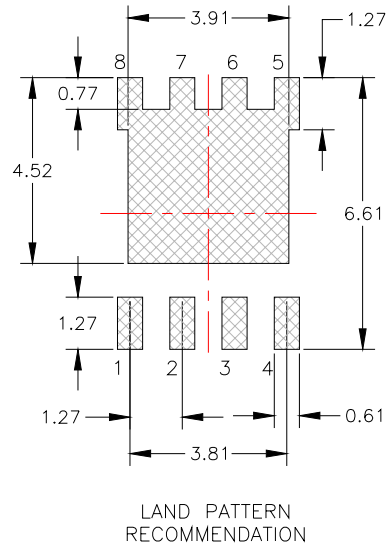
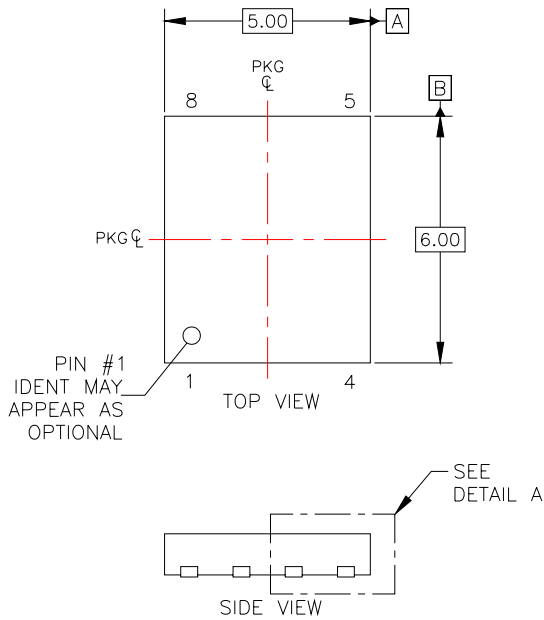


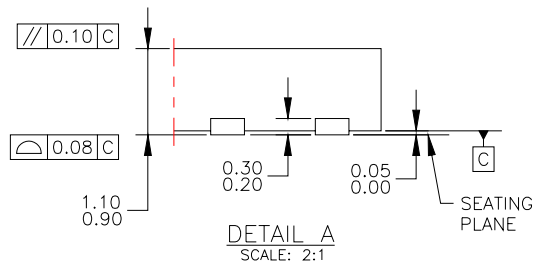
Figure 15. SyncFET Body Diode reverse leakage vs drain to source voltage

## Dimensional Outline and Pad Layout









NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA, 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 ASME Y14.5M-1994.
- E) DRAWING FILE NAME: PQFN08AREV4



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