

FDMC7570S

MOSFET – N-Channel, POWER TRENCH[®], SyncFET[™]

25 V, 40 A, 2 mΩ

General Description

The FDMC7570S 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 $R_{DS(on)}$ = 2 mΩ at V_{GS} = 10 V, I_D = 27 A
- Max $R_{DS(on)}$ = 2.9 mΩ at V_{GS} = 4.5 V, I_D = 21.5 A
- Advanced Package and Combination for Low $R_{DS(on)}$ and High Efficiency
- SyncFET Schottky Body Diode
- 100% UIL Tested
- These Devices are Pb-Free and are 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

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

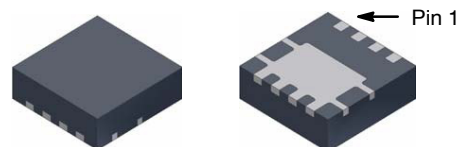
Parameter	Symbol	Rating	Unit
Drain to Source Voltage	V_{DS}	25	V
Gate to Source Voltage (Note 4)	V_{GS}	±20	V
Drain Current	I_D		A
– Continuous (Package limited) T_C = 25°C		40	
– Continuous (Silicon limited) T_C = 25°C		132	
– Continuous T_A = 25°C (Note 1a)		27	
– Pulsed		120	
Single Pulse Avalanche Energy (Note 3)	E_{AS}	144	mJ
Power Dissipation T_C = 25°C	P_D	59	W
Power Dissipation T_A = 25°C (Note 1a)		2.3	
Operating and Storage Junction Temperature Range	T_J, T_{STG}	–55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



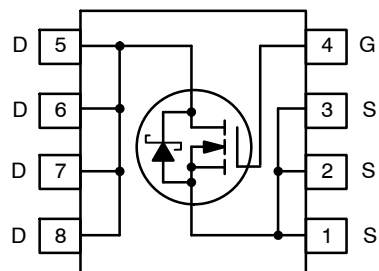
ON Semiconductor[®]

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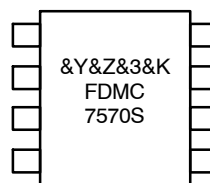


Power 33
PQFN8
CASE 483AK

PIN ASSIGNMENT



MARKING DIAGRAM



&Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = 3-Digit Data Code
&K = 2-Digit Lot Traceability Code
FDMC7570S = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping [†]
FDMC7570S	PGFN8 (Pb-Free)	3,000 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.1	°C/W
Thermal Resistance, Junction to Ambient (Note 1a)	$R_{\theta JA}$	53	

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTIC

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

ON CHARACTERISTICS

Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1\text{ mA}$	$V_{GS(th)}$	1.2	1.7	3	V
Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, referenced to 25°C	$\Delta V_{GS(th)} / \Delta T_J$		-4		mV/°C
Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 27\text{ A}$	$R_{DS(on)}$		1.6	2	mΩ
	$V_{GS} = 4.5\text{ V}, I_D = 21.5\text{ A}$			2.4	2.9	
	$V_{GS} = 10\text{ V}, I_D = 27\text{ A}, T_J = 125^\circ\text{C}$			2.2	2.8	
Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 27\text{ A}$	g_{FS}		154		S

DYNAMIC CHARACTERISTICS

Input Capacitance	$V_{DS} = 13\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	C_{iss}		3315	4410	pF
Output Capacitance		C_{oss}		1010	1345	pF
Reverse Transfer Capacitance		C_{rss}		168	255	pF
Gate Resistance		R_g		1.2	2.1	Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{DD} = 13\text{ V}, I_D = 27\text{ A}, V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$	$t_{d(on)}$		14	26	ns
Rise Time		t_r		6.8	14	ns
Turn-Off Delay Time		$t_{d(off)}$		34	55	ns
Fall Time		t_f		4.5	10	ns
Total Gate Charge	$V_{GS} = 0\text{ V to }10\text{ V}, V_{DD} = 13\text{ V}$	Q_g		49	68	nC
Total Gate Charge	$V_{GS} = 0\text{ V to }4.5\text{ V}, V_{DD} = 13\text{ V}$	Q_g		22	31	nC
Gate to Source Gate Charge	$I_D = 27\text{ A}$	Q_{gs}		10.8		nC
Gate to Drain "Miller" Charge		Q_{gd}		5.5		nC

DRAIN-SOURCE DIODE CHARACTERISTICS

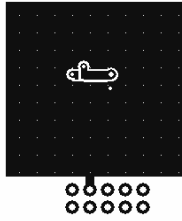
Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 27\text{ A}$ (Note 2)	V_{SD}		0.78	1.2	V
	$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)			0.43	0.8	
Reverse Recovery Time	$I_F = 27\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$	t_{rr}		30	48	ns
Reverse Recovery Charge		Q_{rr}		29	46	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 × 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) 53°C/W when mounted on
a 1 in² pad of 2 oz copper.



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

2. Pulse Test: Pulse Width < 300 μ s, Duty cycle < 2.0%.
3. E_{AS} of 144 mJ is based on starting $T_J = 25^\circ\text{C}$, $L = 1$ mH, $I_{AS} = 17$ A, $V_{DD} = 23$ V, $V_{GS} = 10$ V. 100% test at $L = 0.3$ mH, $I_{AS} = 25$ A.
4. As an N-ch device, the negative V_{GS} rating is for lower duty cycle pulse occurrence only. No continuous rating is implied.

TYPICAL CHARACTERISTICS

($T_J = 25^\circ\text{C}$ unless otherwise noted)

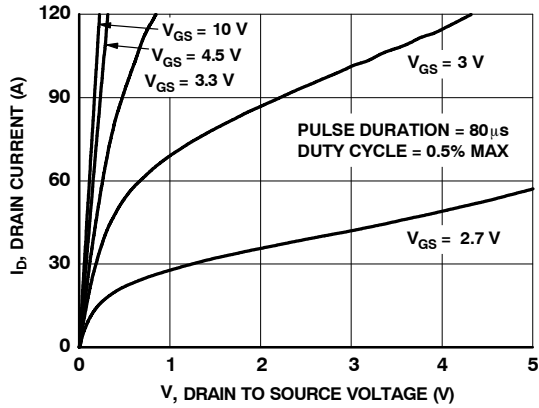


Figure 1. On-Region Characteristics

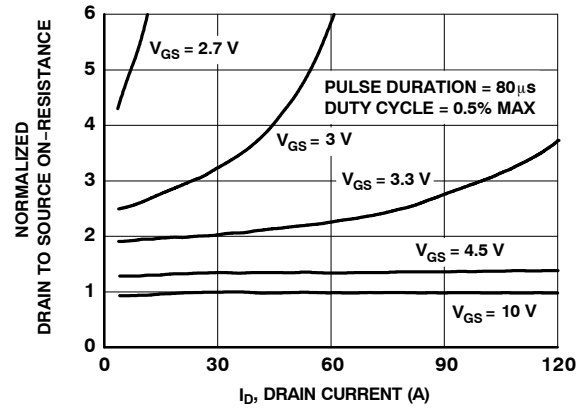


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

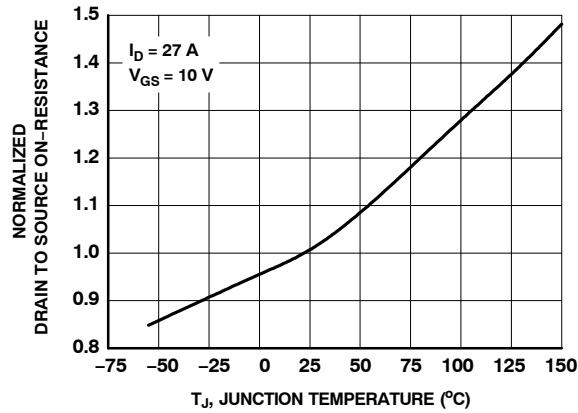


Figure 3. Normalized On-Resistance vs. Junction Temperature

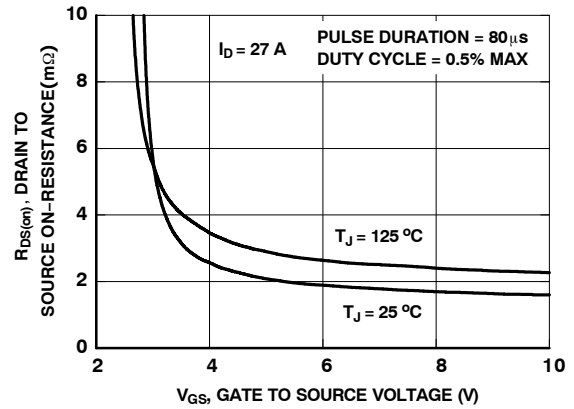


Figure 4. On-Resistance vs. Gate to Source Voltage

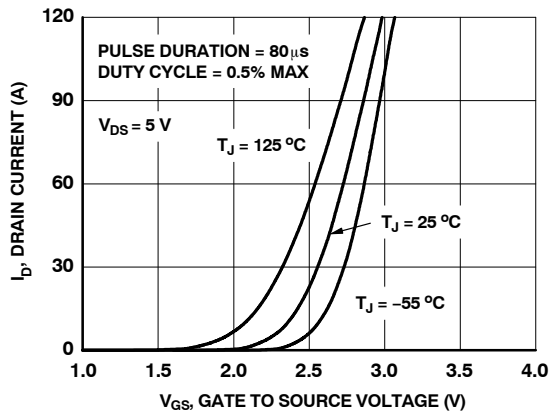


Figure 5. Transfer Characteristics

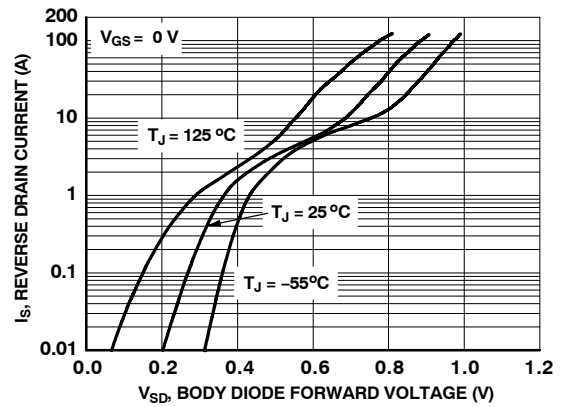


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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TYPICAL CHARACTERISTICS (continued)

($T_J = 25^\circ\text{C}$ unless otherwise noted)

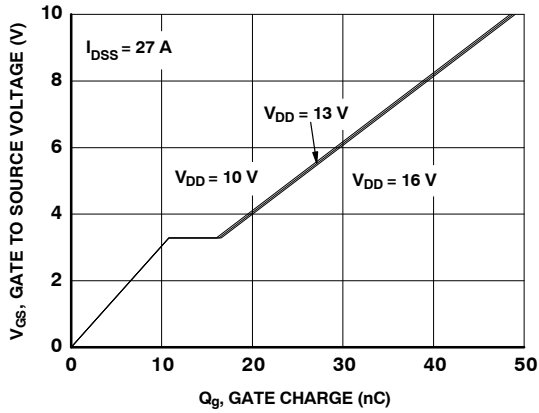


Figure 7. Gate Charge Characteristics

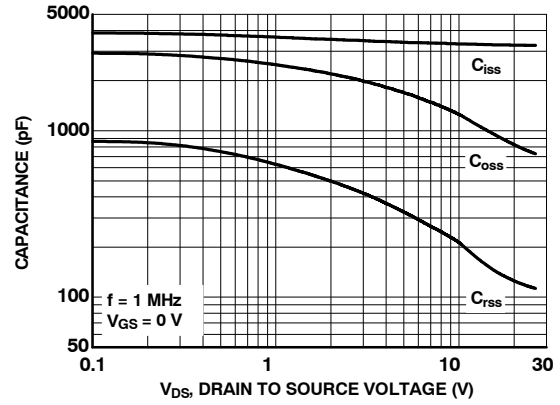


Figure 8. Capacitance vs Drain to Source Voltage

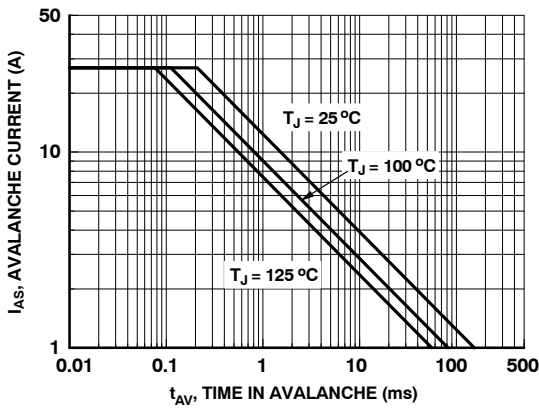


Figure 9. Unclamped Inductive Switching Capability

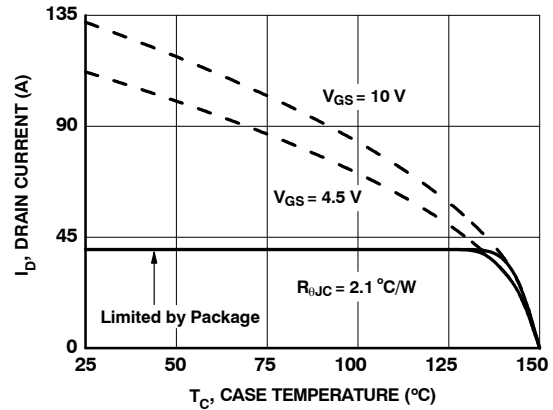


Figure 10. Maximum Continuous Drain Current vs Case Temperature

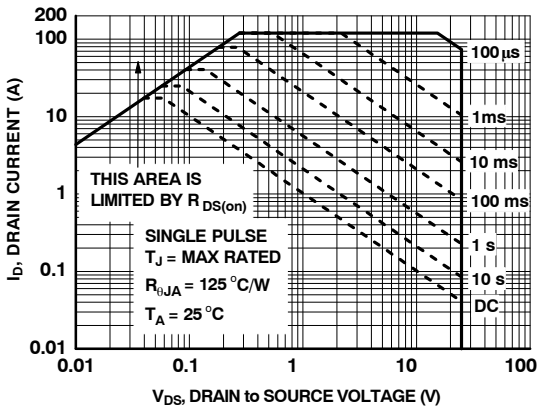


Figure 11. Forward Bias Safe Operating Area

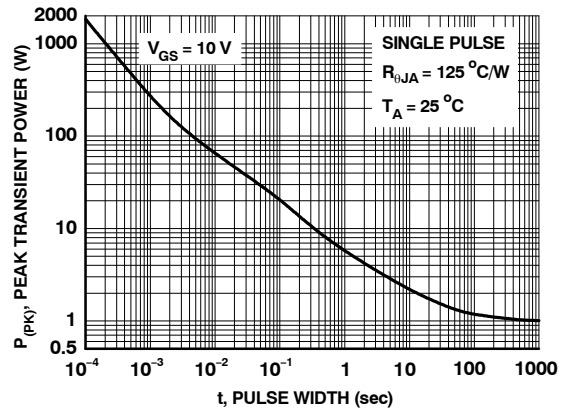


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

($T_J = 25^\circ\text{C}$ unless otherwise noted)

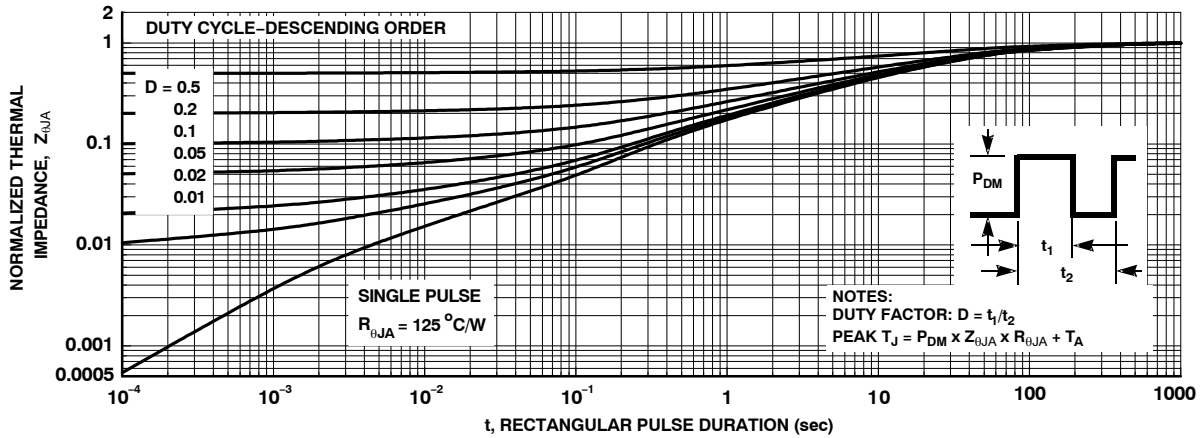


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

SyncFET SCHOTTKY BODY DIODE CHARACTERISTICS

ON Semiconductor'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 FDMC7570S.

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

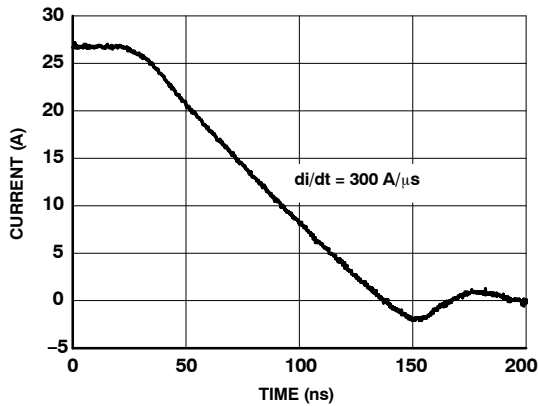


Figure 14. FDMC7570S SyncFET Body Diode Reverse Recovery Characteristic

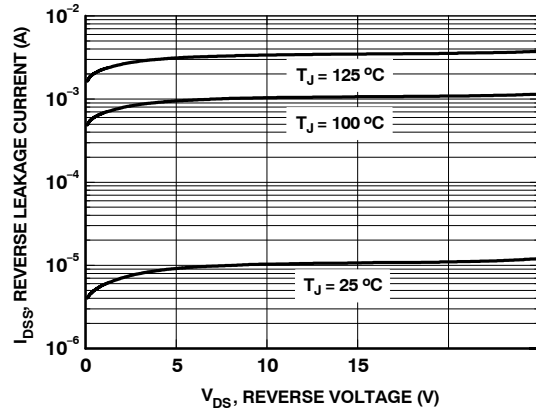
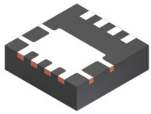
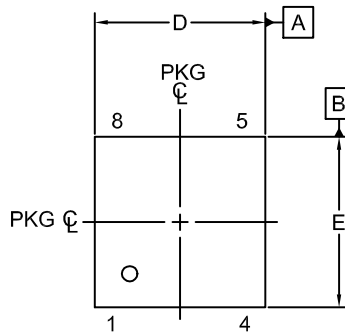


Figure 15. SyncFET Body Diode Reverse Leakage vs. Drain-Source Voltage

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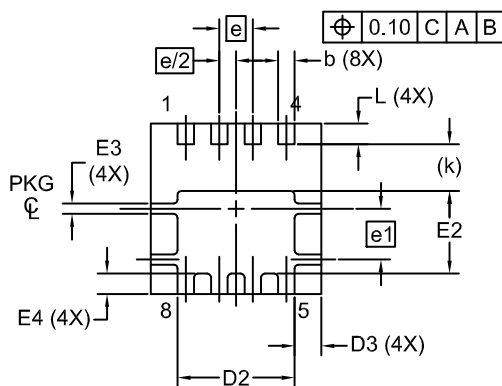
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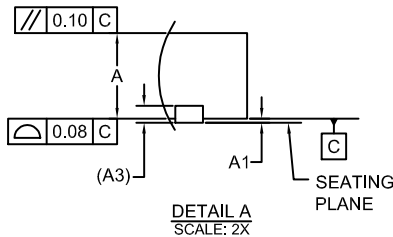
TOP VIEW



FRONT VIEW

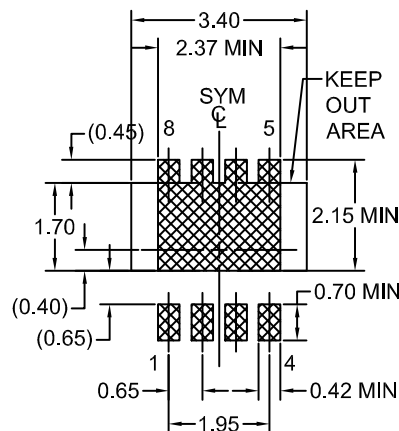


BOTTOM VIEW



DETAIL A
SCALE: 2X

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.



LAND PATTERN RECOMMENDATION

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL. SOLDERRM/D.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
A3	0.20 REF		
b	0.27	0.32	0.37
D	3.20	3.30	3.40
D2	2.17	2.27	2.37
D3	0.42	0.52	0.62
E	3.20	3.30	3.40
E2	1.50	1.60	1.70
E3	0.10	0.20	0.30
E4	0.29	0.39	0.49
e	0.65 BSC		
e/2	0.325 BSC		
e1	0.98 BSC		
k	0.91 REF		
L	0.30	0.40	0.50

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DESCRIPTION:	PQFN8 3.3X3.3, 0.65P	PAGE 1 OF 1

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