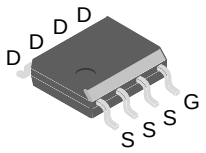
SyncFET™ – N-Channel, POWERTRENCH®

30 V, 21 A, 3.6 mΩ

FDS6699S

V_{DSS}	$R_{DS(on)}$ MAX	I_D
30 V	3.6 mΩ @ 10 V	21 A
	4.5 mΩ @ 4.5 V	



SOIC8
(SO−8)
CASE 751EB

General Description

The FDS6699S is designed to replace a single SO−8 MOSFET and Schottky diode in synchronous DC:DC power supplies. This 30 V MOSFET is designed to maximize power conversion efficiency, providing a low $R_{DS(on)}$ and low gate charge. The FDS6699S includes an integrated Schottky diode using **onsemi**'s monolithic SyncFET technology.

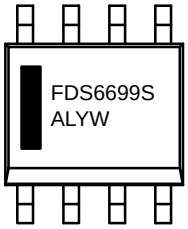
Features

- 21 A, 30 V
  - Max $R_{DS(on)}$ = 3.6 mΩ at V_{GS} = 10 V
  - Max $R_{DS(on)}$ = 4.5 mΩ at V_{GS} = 4.5 V
- Includes SyncFET Schottky Body Diode
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$ and Fast Switching
- High Power and Current Handling Capability
- 100% R_G (Gate Resistance) Tested
- These Devices are Pb−Free and are RoHS Compliant

Applications

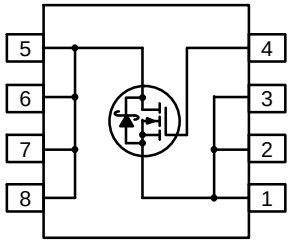
- Synchronous Rectifier for DC/DC Converters
  - Notebook Vcore Low Side Switch
  - Point of Load Low Side Switch

MARKING DIAGRAM



FDS6699S = Specific Device Code
A = Assembly Site
L = Wafer Lot Number
YW = Assembly Start Week

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

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

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain−Source Voltage	30	V
V_{GSS}	Gate−Source Voltage	±20	V
I_D	Drain Current − Continuous (Note 1a) − Pulsed	 21 105	A
E_{AS}	Single Pulse Avalanche Energy (Note 4)	541	mJ
P_D	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	 2.5 1.2 1	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	−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.

THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient (Note 1a)	50	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case (Note 1)	25	

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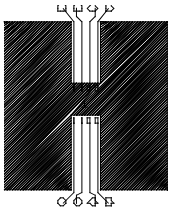
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

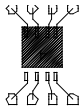
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	30	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C	–	28	–	mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V	–	–	500	μA
I_{GSS}	Gate–Body Leakage	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 = 1 mA	1	1.4	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C	–	–3.2	–	mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 21 A V_{GS} = 4.5 V, I_D = 19 A V_{GS} = 10 V, I_D = 21 A, T_J = 150°C	– – –	3.0 3.6 4.6	3.6 4.5 5.6	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 21 A	–	100	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz	–	3610	4800	pF
C_{oss}	Output Capacitance		–	1080	1435	pF
C_{rss}	Reverse Transfer Capacitance		–	340	680	pF
R_G	Gate Resistance	V_{GS} = 15 mV, f = 1.0 MHz	–	1.8	–	Ω
SWITCHING CHARACTERISTICS (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω	–	11	20	ns
t_r	Turn–On Rise Time		–	12	22	ns
$t_{d(off)}$	Turn–Off Delay Time		–	73	117	ns
t_f	Turn–Off Fall Time		–	38	61	ns
$Q_{g(TOT)}$	Total Gate Charge at Vgs = 10 V	V_{DD} = 15 V, I_D = 21 A	–	65	91	nC
Q_g	Total Gate Charge at Vgs = 5 V		–	35	49	nC
Q_{gs}	Gate–Source Charge		–	9	–	nC
Q_{gd}	Gate–Drain Charge		–	11	–	nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 3.5 A (Note 2)	–	0.36	0.7	V
t_{rr}	Diode Reverse Recovery Time	I_F = 21 A, d_{iF}/d_t = 300 A/μs (Note 3)	–	32	–	ns
I_{RM}	Diode Reverse Recovery Current		–	2.2	–	A
Q_{rr}	Diode Reverse Recovery Charge		–	35	–	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.

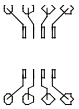
1. $R_{\theta JA}$ is the sum of the junction−to−case and case−to−ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. 50°C/W when mounted on a 1 in^2 pad of 2 oz copper.



b. 105°C/W when mounted on a .04 in^2 pad of 2 oz copper.



c. 125°C/W when mounted on a minimum pad.

Scale 1:1 on letter size paper

2. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%
3. See "SyncFET Schottky Body Diode Characteristics" below.
4. E_{AS} of 541 mJ is based on starting T_J = 25°C, L = 3 mH, I_{AS} = 19 A, V_{DD} = 30 V, V_{GS} = 10 V. 100% test at L = 1 mH, I_{AS} = 25 A.

TYPICAL CHARACTERISTICS

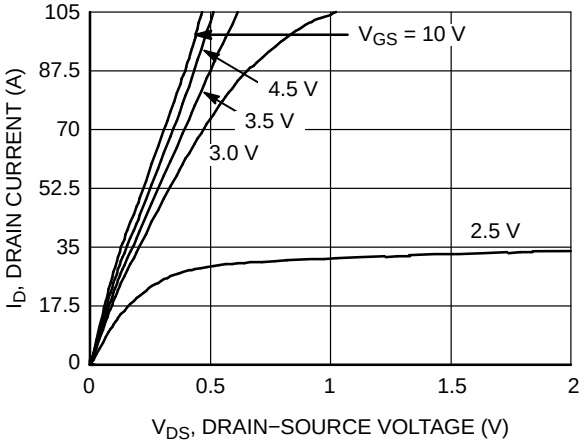


Figure 1. On−Region Characteristics

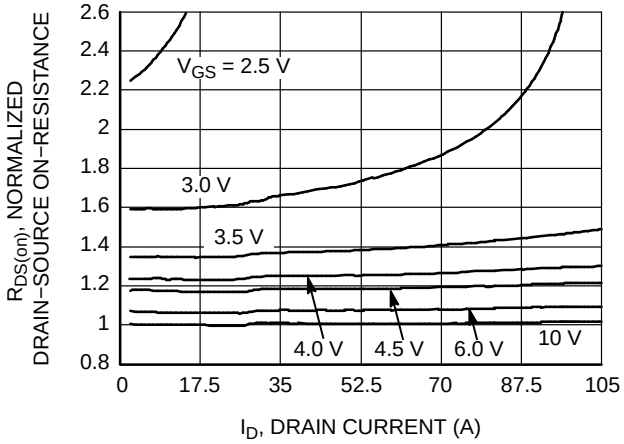


Figure 2. On−Resistance Variation with Drain Current and Gate Voltage

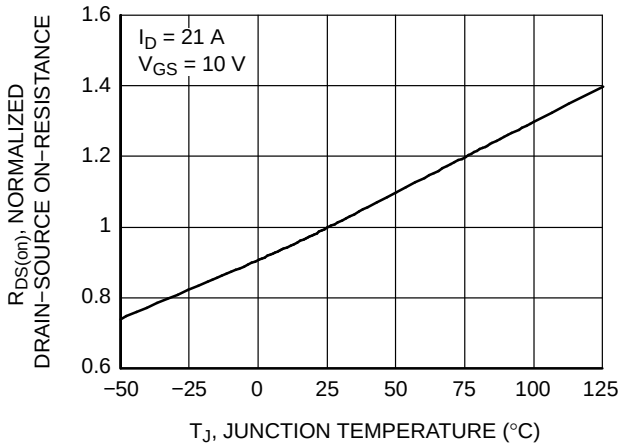


Figure 3. On−Resistance Variation with Junction Temperature

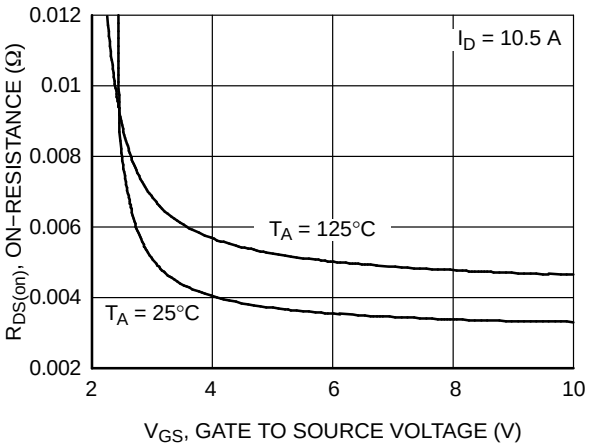


Figure 4. On−Resistance Variation with Gate−to−Source Voltage

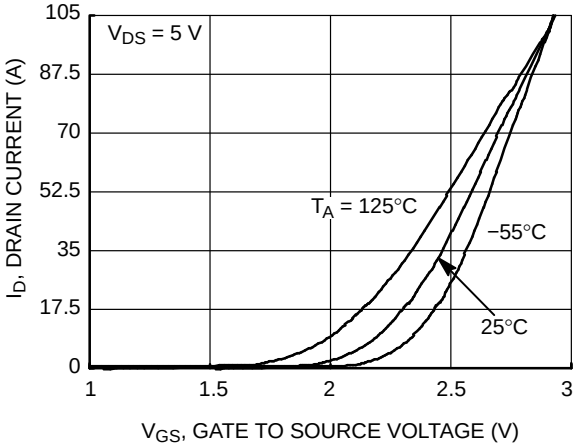


Figure 5. Transfer Characteristics

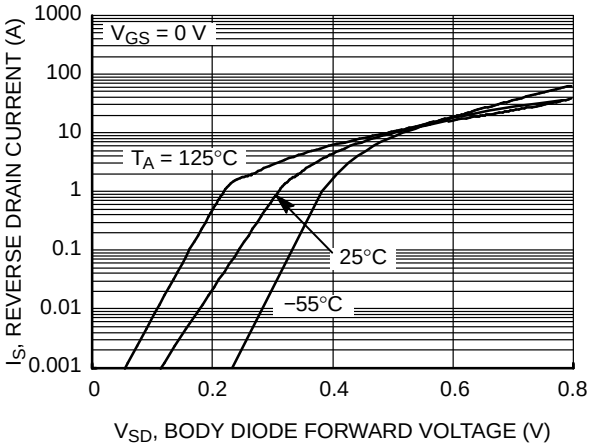


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL CHARACTERISTICS (CONTINUED)

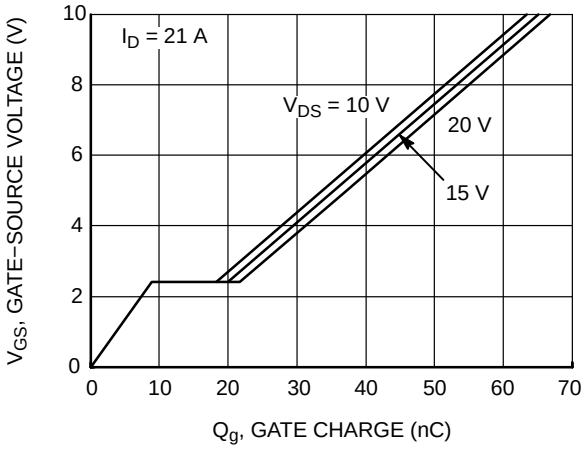


Figure 7. Gate Charge Characteristics

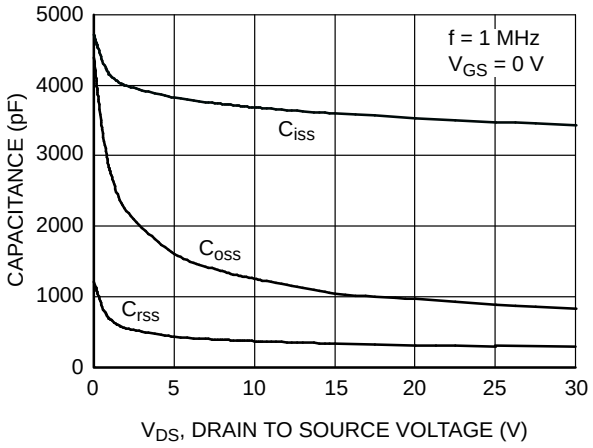


Figure 8. Capacitance Characteristics

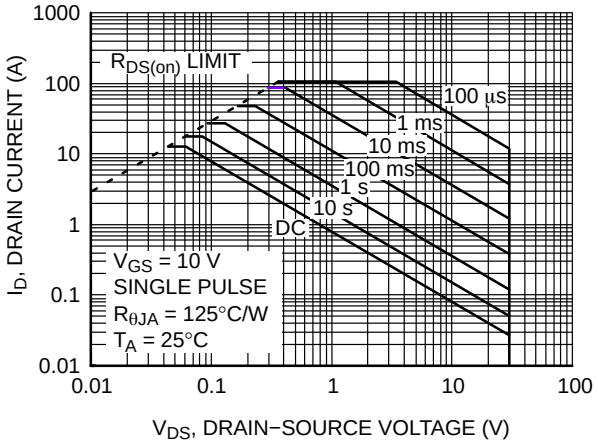


Figure 9. Maximum Safe Operating Area

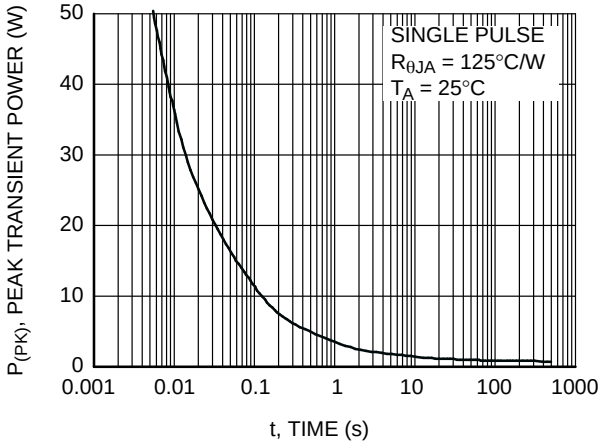


Figure 10. Single Pulse Maximum Power Dissipation

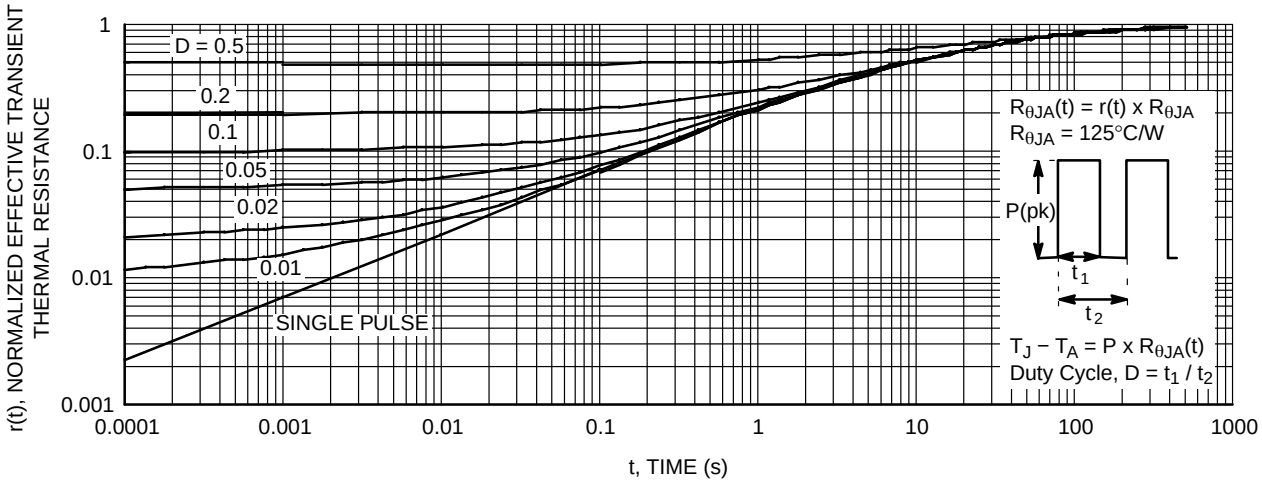


Figure 11. Transient Thermal Response Curve

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

TYPICAL CHARACTERISTICS (CONTINUED)

SyncFET Schottky Body Diode Characteristics

onsemi'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 12 shows the reverse recovery characteristic of the FDS6699S.

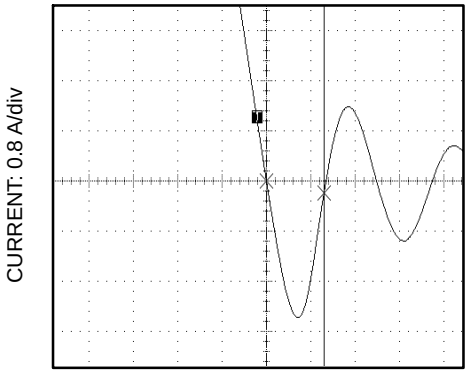


Figure 12. FDS6699S SyncFET Body Diode Reverse Recovery Characteristics

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

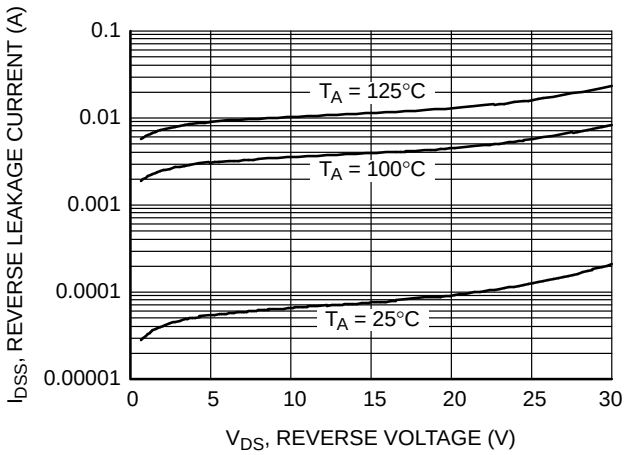


Figure 13. SyncFET Body Diode Reverse Leakage vs. Drain−Source Voltage and Temperature

PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package Type	Reel Size	Tape Width	Shipping†
FDS6699S	FDS6699S	SOIC8 (SO−8) (Pb−Free, Halide Free)	13”	12 mm	2500 / Tape & Reel

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

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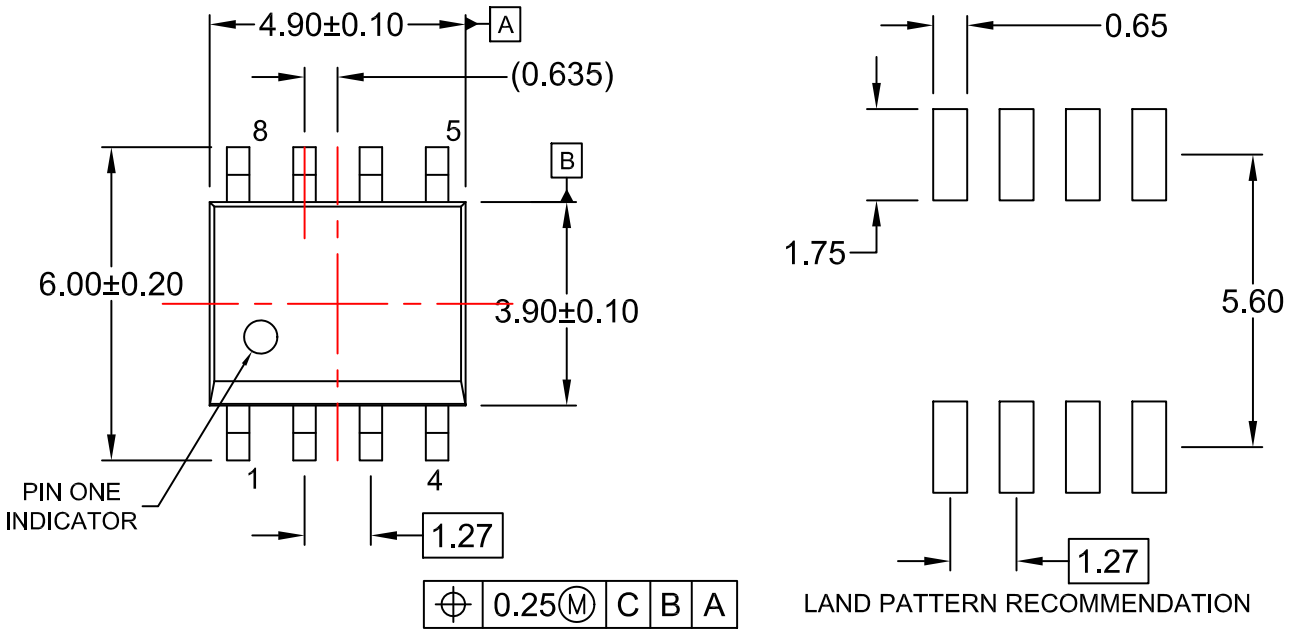
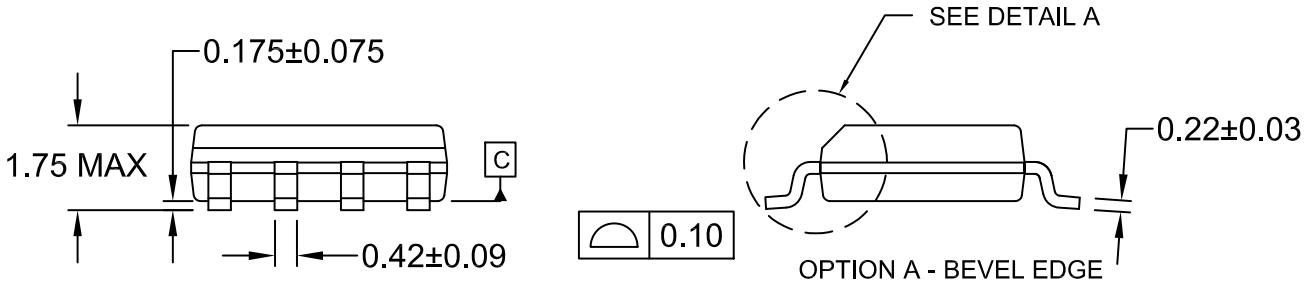
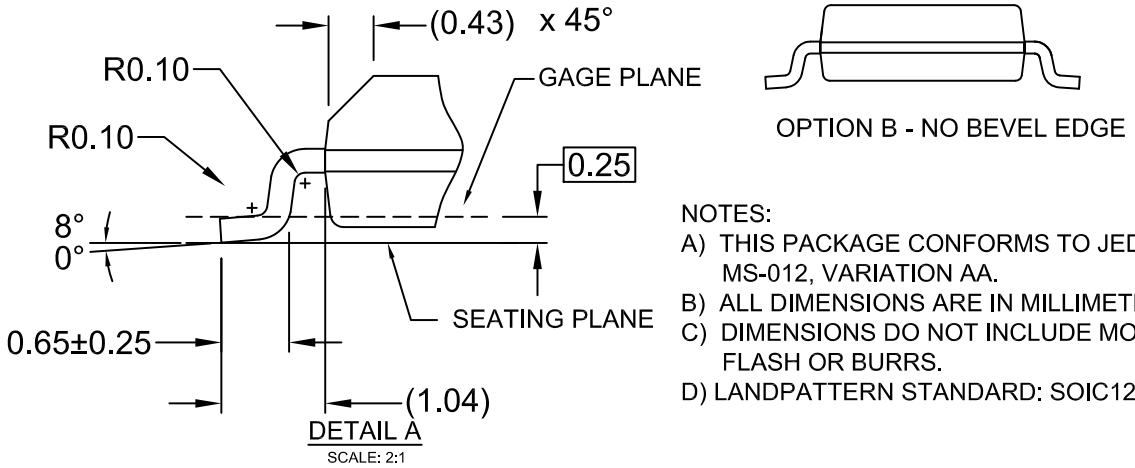
SOIC8
CASE 751EB
ISSUE A

DATE 24 AUG 2017







NOTES:
A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
D) LANDPATTERN STANDARD: SOIC127P600X175-8M

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