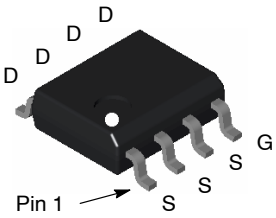
MOSFET – P-Channel, POWERTRENCH®

60 V

NDS9407

V_{DSS}	$R_{DS(on)}$ MAX	I_D MAX
−60 V	150 mΩ @ −10 V	−3A
	240 mΩ @ −4.5 V	



SOIC8
CASE 751EB

General Description

This P−Channel MOSFET is a rugged gate version of **onsemi**'s advanced PowerTrench process. It has been optimized for power management applications requiring a wide range of gate drive voltage ratings (4.5 V – 20 V).

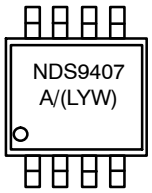
Features

- −3 A, −60 V. $R_{DS(ON)}$ = 150 mΩ @ V_{GS} = −10 V
  $R_{DS(ON)}$ = 240 mΩ @ V_{GS} = −4.5 V
- Low Gate Charge
- Fast Switching Speed
- High Performance Trench Technology for Extremely Low $R_{DS(ON)}$
- High Power and Current Handling Capability
- These Device is Pb−Free and Halide Free

Applications

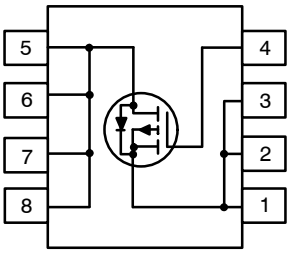
- Power Management
- Load Switch
- Battery Protection

MARKING DIAGRAM



NDS9407 = Specific Device Code
A = Assembly Site
L = Wafer Lot Number
YW = Assembly Start Week

PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS T_A = 25°C unless otherwise noted

Symbol	Parameter	Value	Unit
V_{DSS}	Drain−Source Voltage	−60	V
V_{GSS}	Gate−Source Voltage	±20	V
I_D	Drain Current − Continuous (Note 1a) − Pulsed	 −3.0 −12	A
P_D	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	 2.5 1.2 1.0	W
T_J, T_{stg}	Operating and Storage Junction Temperature Range	−55 to +175	°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 T_A = 25°C unless otherwise noted

Symbol	Parameter	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient (Note 1a) (Note 1c)	50 125	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case (Note 1)	25	°C/W

ORDERING INFORMATION

Device	Package	Shipping†
NDS9407	SOIC8 CASE 751EB (Pb−Free)	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.

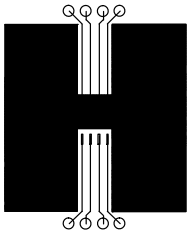
ELECTRICAL CHARACTERISTICS T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain−Source Breakdown Voltage	V_{GS} = 0 V, I_D = −250 μA	−60	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = −250 μA, Referenced to 25°C	–	−45	–	mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = −48 V, V_{GS} = 0 V V_{DS} = −48 V, V_{GS} = 0 V, T_J = 55°C	–	–	−1 −10	μA
I_{GSSF}	Gate−Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V	–	–	100	nA
I_{GSSR}	Gate−Body Leakage, Reverse	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 = −250 μA	−1	−1.6	−3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = −250 μA, Referenced to 25°C	–	4.0	–	mV/°C
$R_{DS(on)}$	Static Drain−Source On−Resistance	V_{GS} = −10 V, I_D = −3.0 A V_{GS} = −4.5 V, I_D = −1.6 A, V_{GS} = −10 V, I_D = −3.0 A, T_J = 125°C	– – –	78 99 122	150 240 250	Ω
$I_{D(on)}$	On−State Drain Current	V_{GS} = −10 V, V_{DS} = −5 V	−12	–	–	A
g_{FS}	Forward Transconductance	V_{DS} = −15 V, I_D = −3.0 A	–	8	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = −30 V, V_{GS} = 0 V, f = 1.0 MHz	–	732	–	pF
C_{oss}	Output Capacitance		–	86	–	pF
C_{rss}	Reverse Transfer Capacitance		–	38	–	pF
SWITCHING CHARACTERISTICS (Note 2)						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = −30 V, I_D = −1 A, V_{GS} = −10 V, R_{GEN} = 6 Ω	–	8	16	ns
t_r	Turn−On Rise Time		–	11	20	ns
$t_{d(off)}$	Turn−Off Delay Time		–	10	20	ns
t_f	Turn−Off Fall Time		–	10	20	ns
trr	Diode Reverse Recovery Time	I_F = −3.0 V, d_{if} / d_t = 100 A/ μs	–	24	–	ns
Q_{rr}	Diode Reverse Recovery Change		–	66	–	nC
Q_g	Total Gate Charge	V_{DS} = −30 V, I_D = −3.0 A, V_{GS} = −10 V	–	16	22	nC
Q_{gs}	Gate−Source Charge		–	2.2	–	nC
Q_{gd}	Gate−Drain Charge		–	3.3	–	nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I_S	Maximum Continuous Drain−Source Diode Forward Current		–	–	−2.1	A
V_{SD}	Drain−Source Diode Forward Voltage	V_{GS} = 0 V, I_S = −2.1 A (Note 2)	–	−0.8	−1.2	V

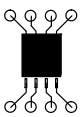
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

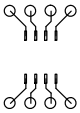
1. $R_{\theta JA}$ is the sum of the junction−to−case and case−to−ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



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



b) 105°C/W when mounted on a 0.04 in^2 pad of 2 oz copper.



b) 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%

TYPICAL CHARACTERISTICS

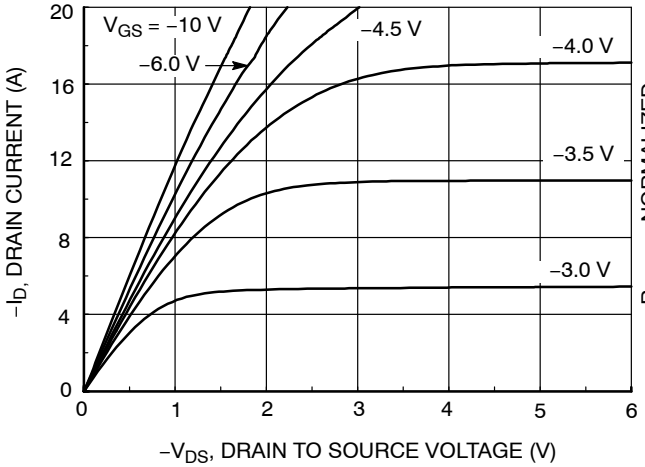


Figure 1. On−Region Characteristics

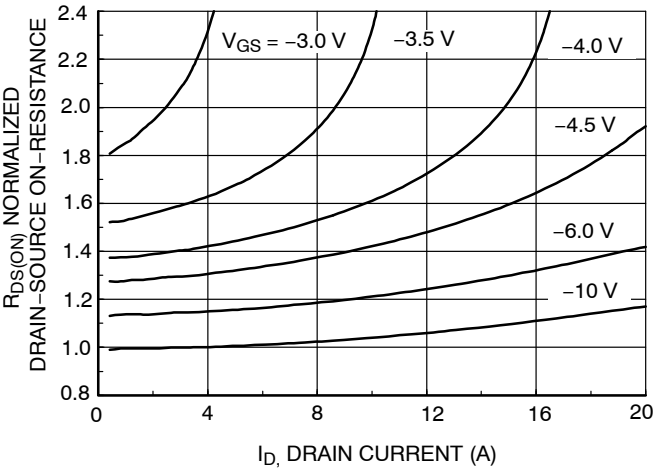


Figure 2. On−Resistance Variation with Drain Current and Gate Voltage

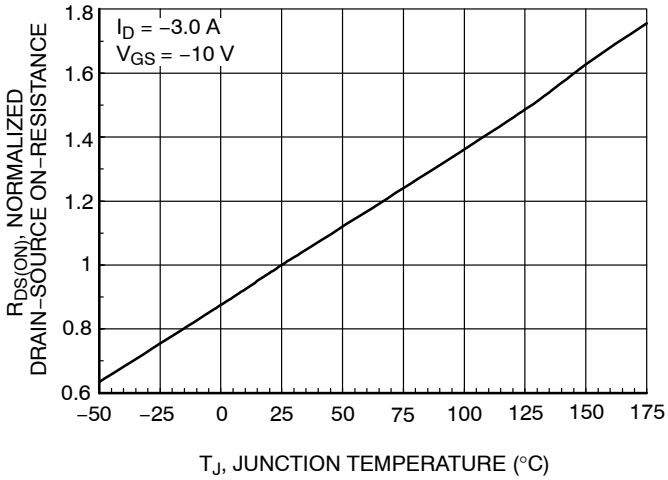


Figure 3. On−Resistance Variation with Temperature

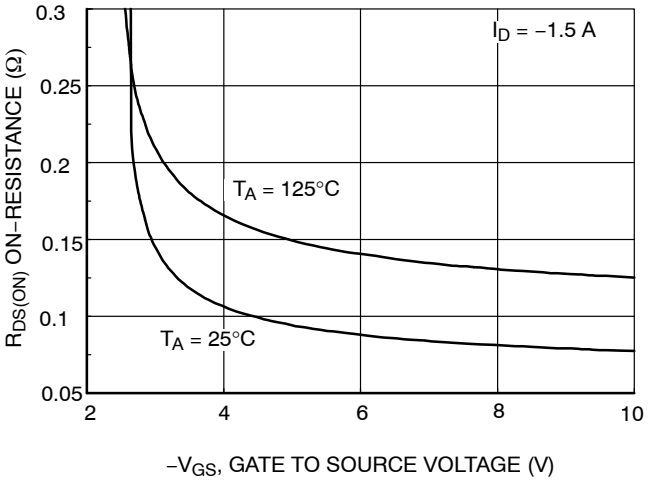


Figure 4. On−Resistance Variation with Gate−to−Source Voltage

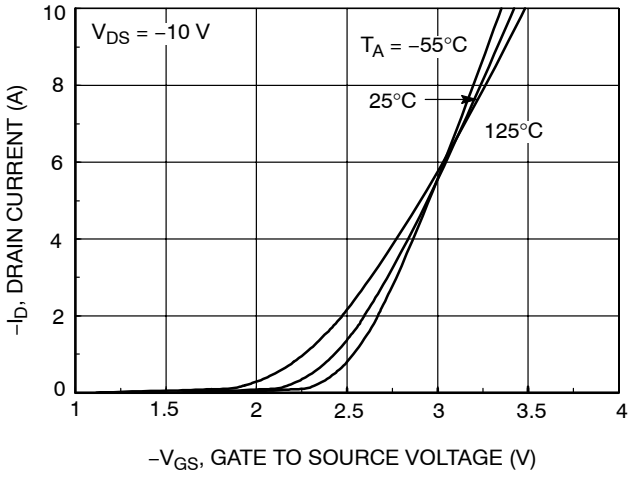


Figure 5. Transfer Characteristics

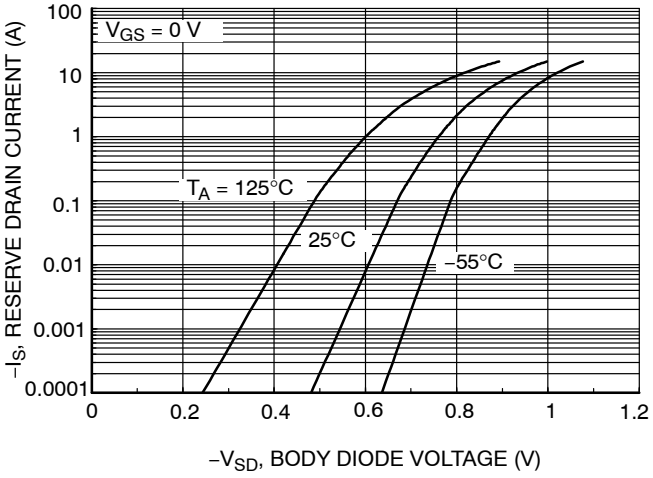


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL CHARACTERISTICS (continued)

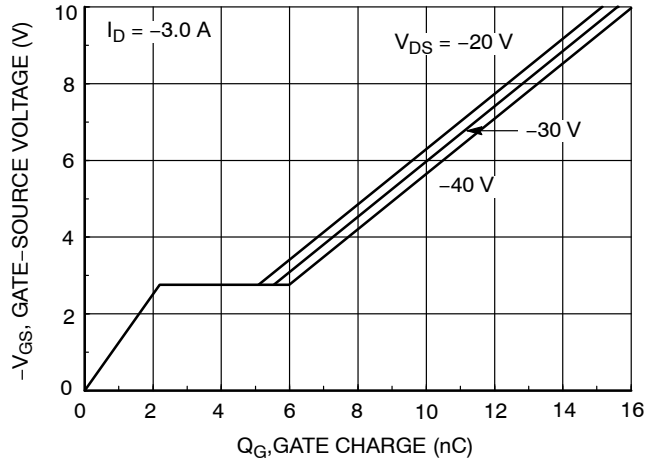


Figure 7. Gate Charge Characteristics

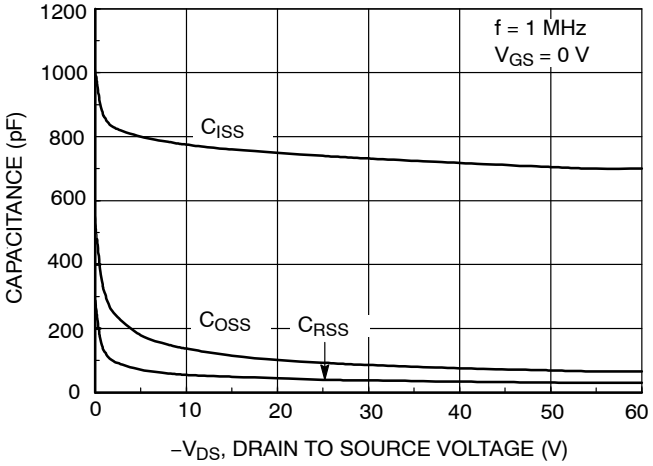


Figure 8. Capacitance Characteristics

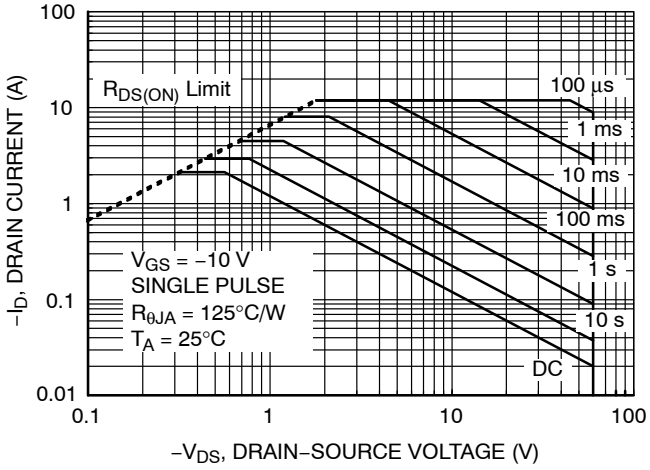


Figure 9. Maximum Safe Operating Area

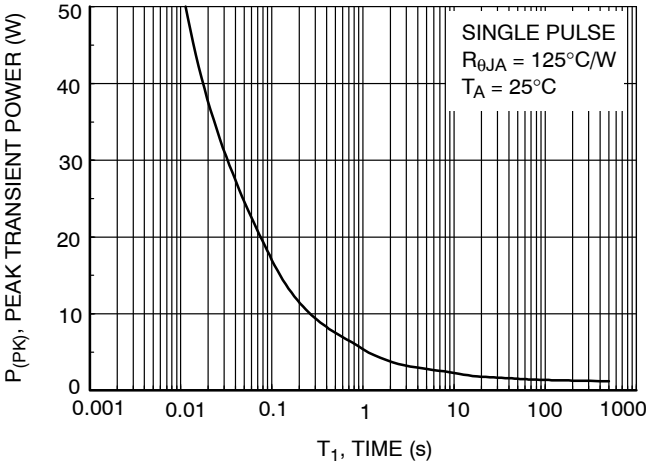


Figure 10. Single Pulse Maximum Power Dissipation

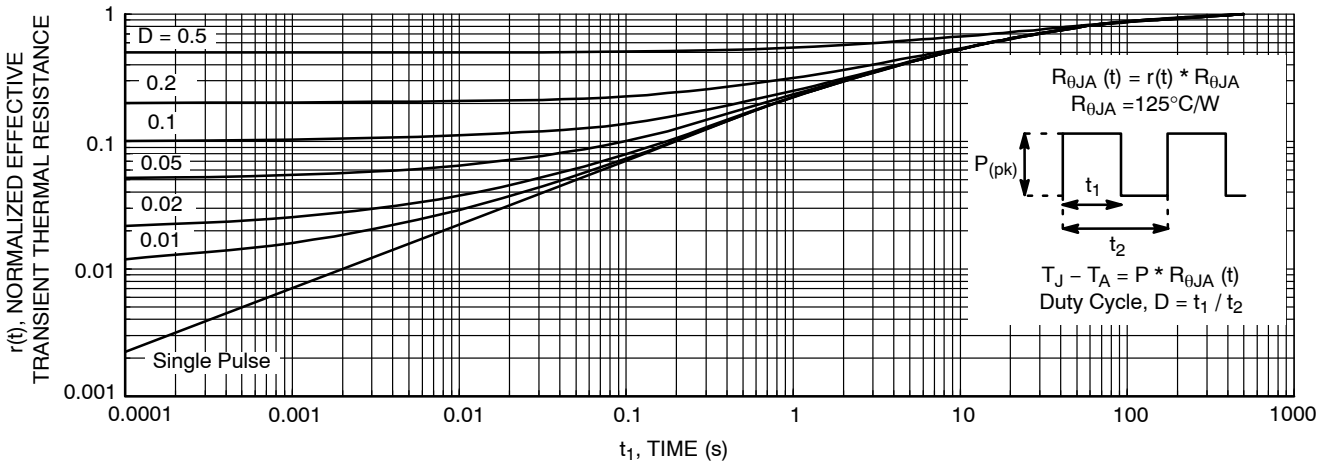


Figure 11. Transient Thermal Response Curve

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

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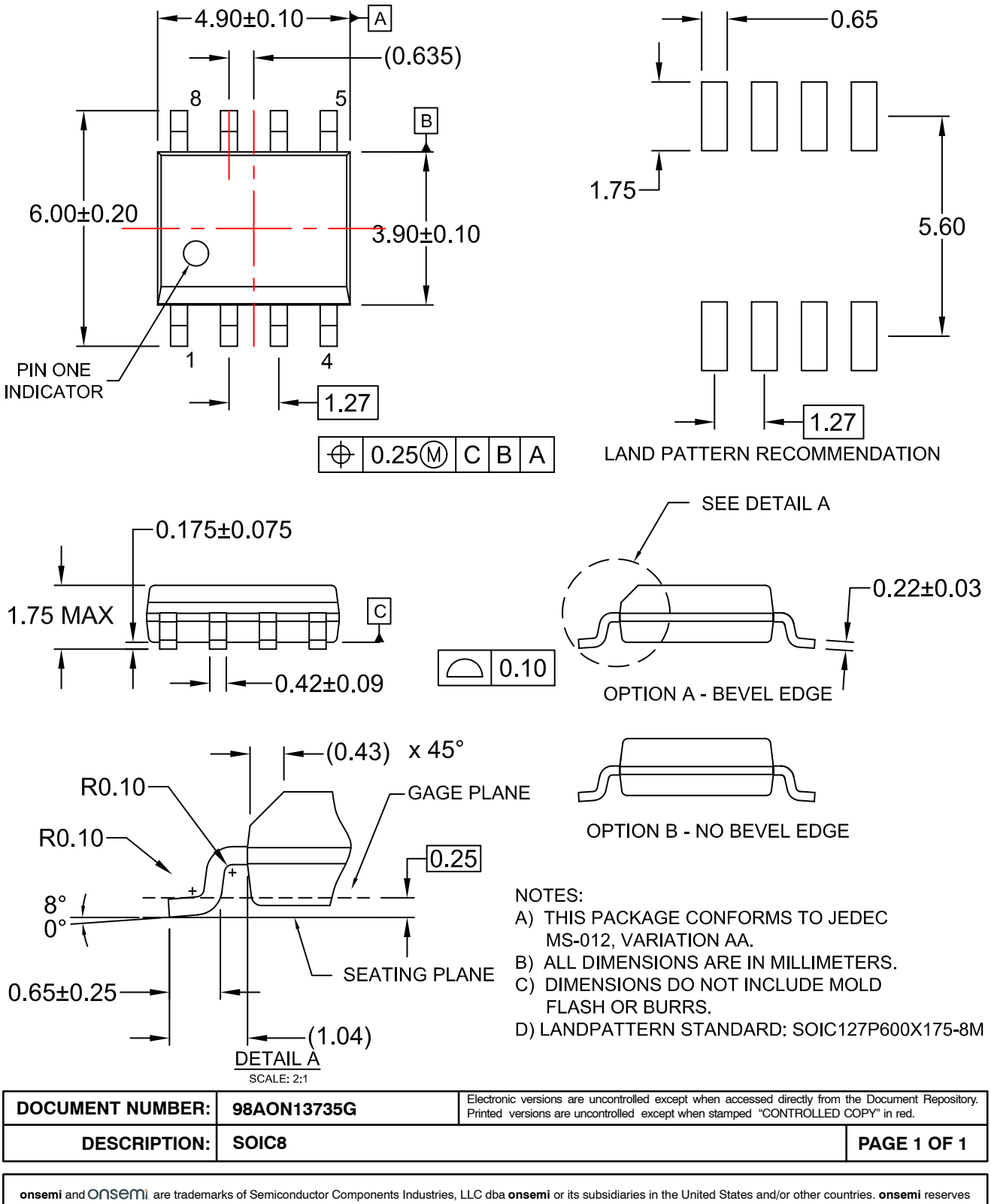
ISSUE A

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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