

# MOSFET – N-Channel, POWERTRENCH®

**40 V, 18 A, 4.3 mΩ**

## FDS8638

### General Description

This N-Channel MOSFET is produced using onsemi's advanced POWERTRENCH process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Features

- Max  $R_{DS(on)} = 4.3 \text{ mΩ}$  at  $V_{GS} = 10 \text{ V}$ ,  $I_D = 18 \text{ A}$
- Max  $R_{DS(on)} = 5.4 \text{ mΩ}$  at  $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 16 \text{ A}$
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- 100% UIL Tested
- This Device is Pb-Free, Halide Free and is RoHS Compliant

### Applications

- Synchronous Rectifier
- Load Switch

### MOSFET MAXIMUM RATINGS

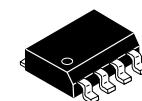
( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Ratings	Unit
$V_{DS}$	Drain to Source Voltage	40	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous – Pulsed	18 100	A
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	541	mJ
$P_D$	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a) $T_A = 25^\circ\text{C}$ (Note 1b)	2.5 1	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

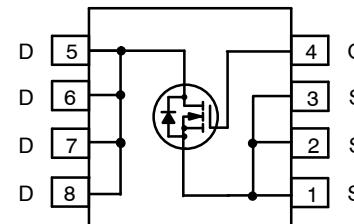
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

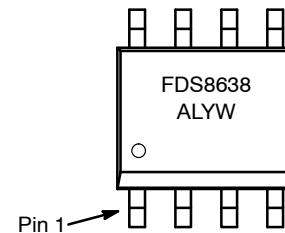
Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	25	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	°C/W



SOIC8  
CASE 751EB



### MARKING DIAGRAM



FDS8638 = Specific Device Code  
 A = Assembly Site  
 L = Wafer Lot Number  
 YW = Assembly Start Week

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
FDS8638	SOIC8 (Pb-Free/ Halide Free)	2500 / Tape & Reel

<sup>†</sup>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](#).

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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## OFF CHARACTERISTICS

$\text{BV}_{\text{DSS}}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	40	–	–	V
$\frac{\Delta \text{BV}_{\text{DSS}}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$	–	32	–	$\text{mV}^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS} = 32 \text{ V}, V_{GS} = 0 \text{ V}$	–	–	1	$\mu\text{A}$
$I_{\text{GSS}}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	–	–	$\pm 100$	nA

## ON CHARACTERISTICS

$V_{GS(\text{th})}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	1.0	1.9	3.0	V
$\frac{\Delta V_{GS(\text{th})}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$	–	–7	–	$\text{mV}^\circ\text{C}$
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 18 \text{ A}$	–	3.3	4.3	$\text{m}\Omega$
		$V_{GS} = 4.5 \text{ V}, I_D = 16 \text{ A}$	–	4.0	5.4	
		$V_{GS} = 10 \text{ V}, I_D = 18 \text{ A}, T_J = 125^\circ\text{C}$	–	4.8	6.3	
$g_{\text{FS}}$	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 18 \text{ A}$	–	88	–	S

## DYNAMIC CHARACTERISTICS

$C_{\text{iss}}$	Input Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	–	4270	5680	pF
$C_{\text{oss}}$	Output Capacitance		–	1175	1560	
$C_{\text{rss}}$	Reverse Transfer Capacitance		–	120	180	
$R_G$	Gate Resistance		–	0.9	–	$\Omega$

## SWITCHING CHARACTERISTICS

$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{DD} = 20 \text{ V}, I_D = 18 \text{ A}, V_{GS} = 10 \text{ V}, R_{\text{GEN}} = 6 \Omega$	–	16	30	ns
$t_r$	Rise Time		–	6	13	
$t_{\text{d(off)}}$	Turn-Off Delay Time		–	39	63	
$t_f$	Fall Time		–	5	10	
$Q_{\text{g(TOT)}}$	Total Gate Charge	$V_{GS} = 0 \text{ V} \text{ to } 10 \text{ V}, V_{DD} = 20 \text{ V}, I_D = 18 \text{ A}$	–	61	86	nC
		$V_{GS} = 0 \text{ V} \text{ to } 4.5 \text{ V}, V_{DD} = 20 \text{ V}, I_D = 18 \text{ A}$	–	27	39	
$Q_{\text{gs}}$	Gate to Source Charge	$V_{DD} = 20 \text{ V}, I_D = 18 \text{ A}$	–	12	–	nC
$Q_{\text{gd}}$	Gate to Drain "Miller" Charge		–	7.2	–	

## DRAIN-SOURCE DIODE CHARACTERISTICS

$V_{\text{SD}}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 18 \text{ A}$ (Note 2)	–	0.81	1.3	V
		$V_{GS} = 0 \text{ V}, I_S = 2.1 \text{ A}$ (Note 2)	–	0.71	1.2	
$t_{\text{rr}}$	Reverse Recovery Time	$I_F = 18 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	–	51	82	ns
			–	30	49	

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:

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<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°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz. copper.



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

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%
- Starting  $T_J = 25^\circ\text{C}$ ;  $L = 3 \text{ mH}$ ,  $I_{AS} = 19 \text{ A}$ ,  $V_{DD} = 40 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$



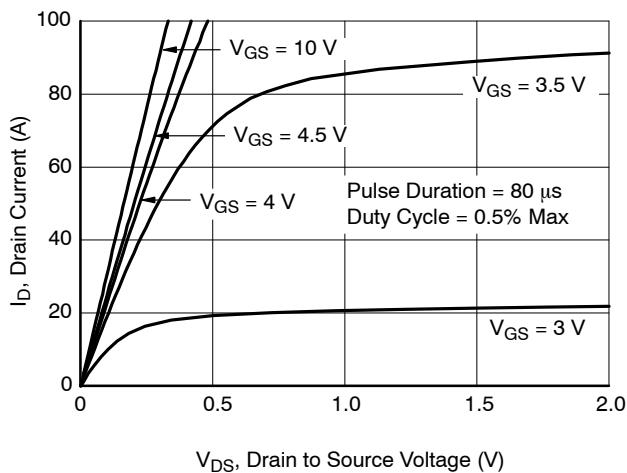
TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Figure 1. On Region Characteristics

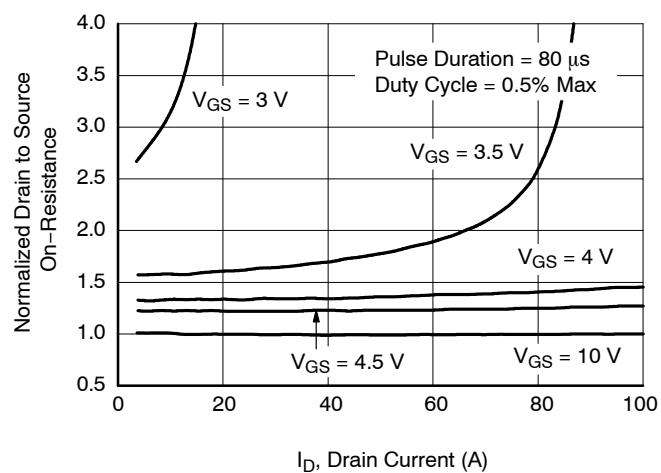


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

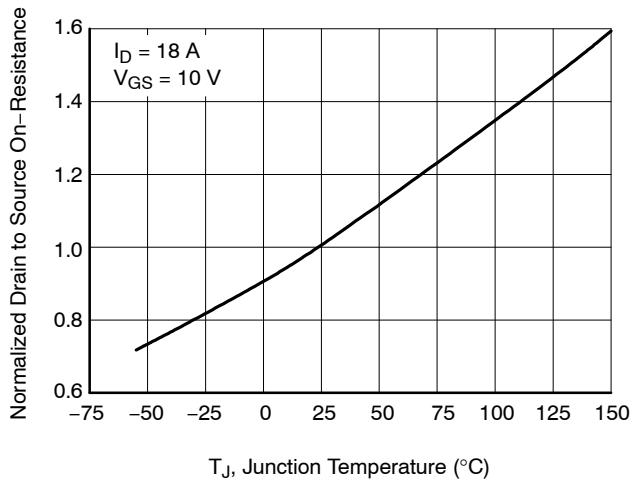


Figure 3. Normalized On Resistance vs. Junction Temperature

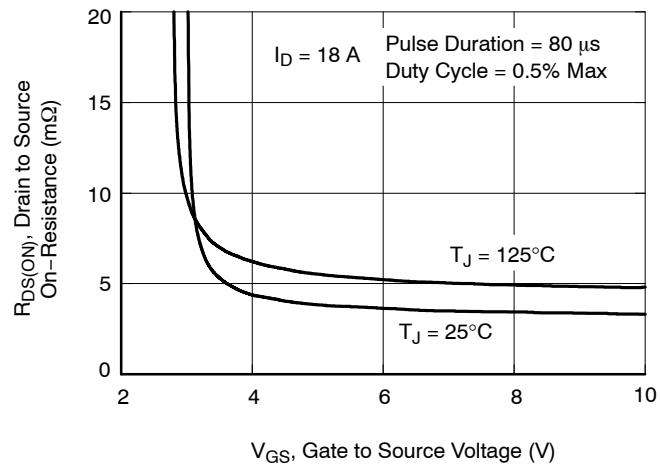


Figure 4. On-Resistance vs. Gate to Source Voltage

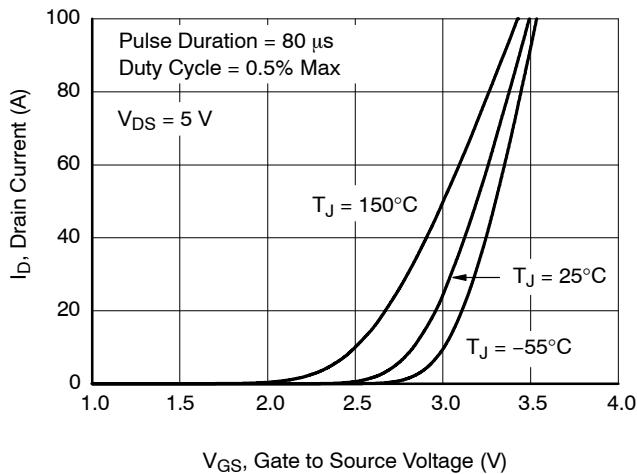


Figure 5. Transfer Characteristics

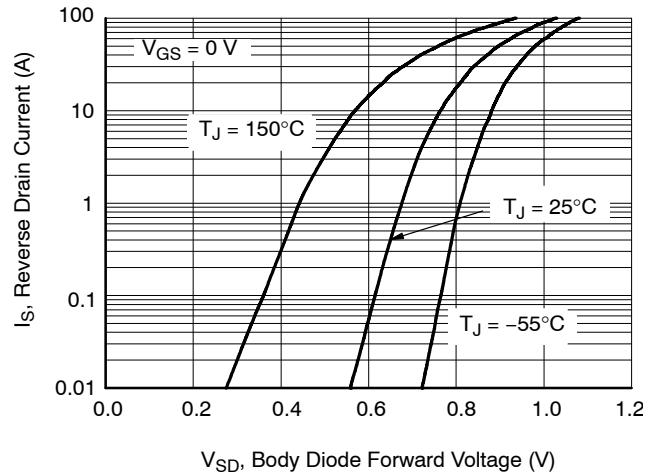


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

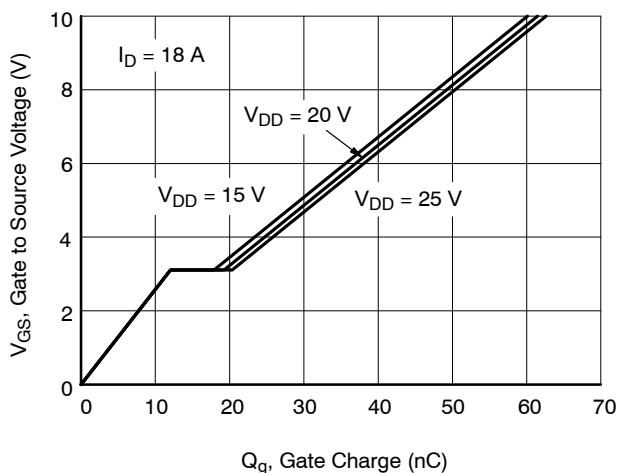
TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted) (continued)

Figure 7. Gate Charge Characteristics

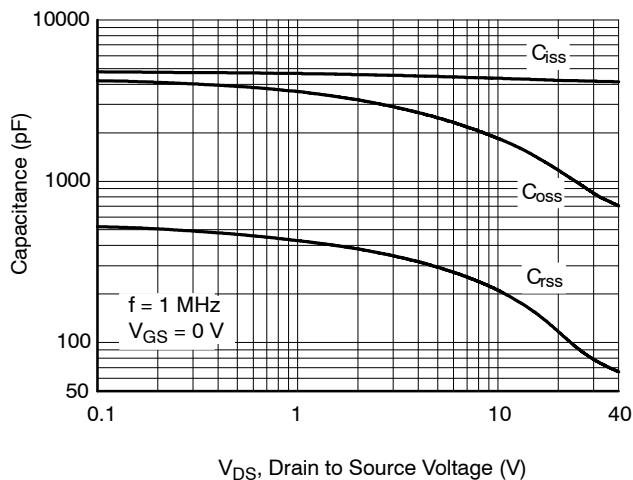


Figure 8. Capacitance vs. Drain to Source Voltage

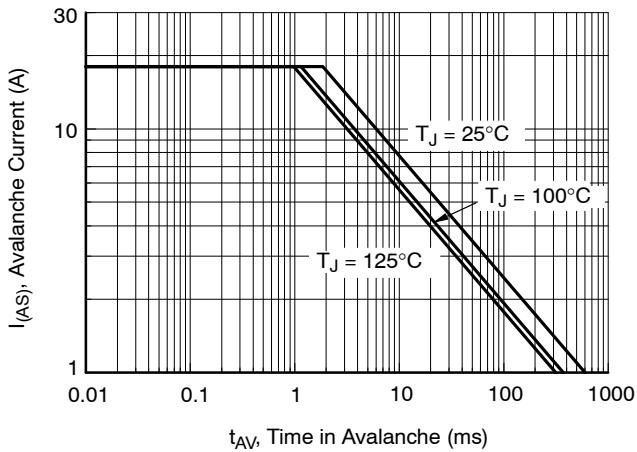


Figure 9. Unclamped Inductive Switching Capability

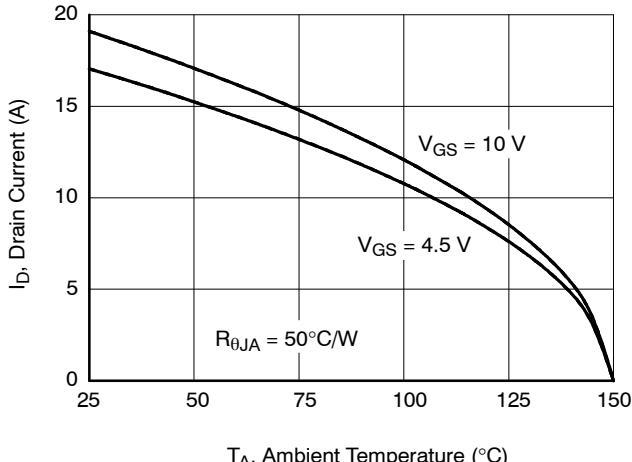


Figure 10. Maximum Continuous Drain Current vs. Ambient Temperature

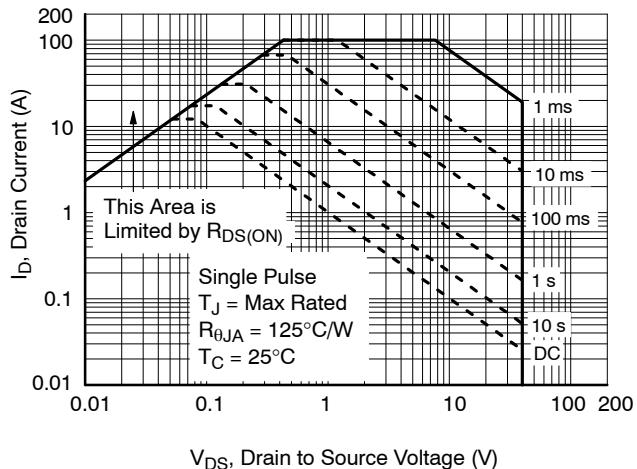


Figure 11. Forward Bias Safe Operating Area

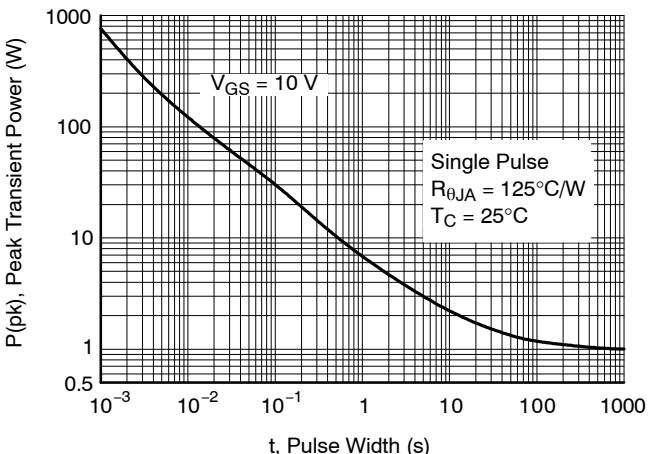


Figure 12. Single Pulse Maximum Power Dissipation

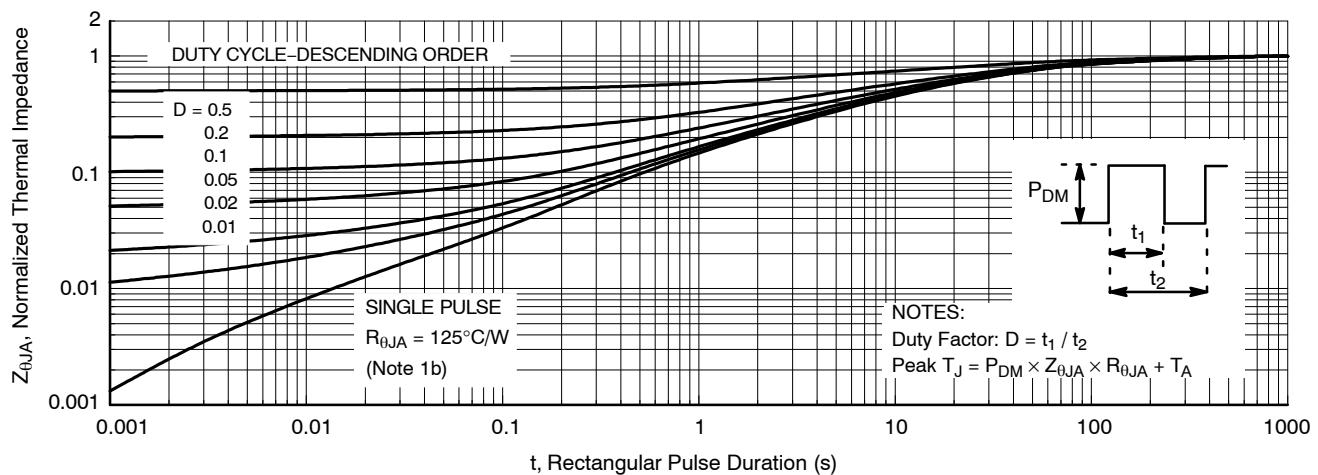
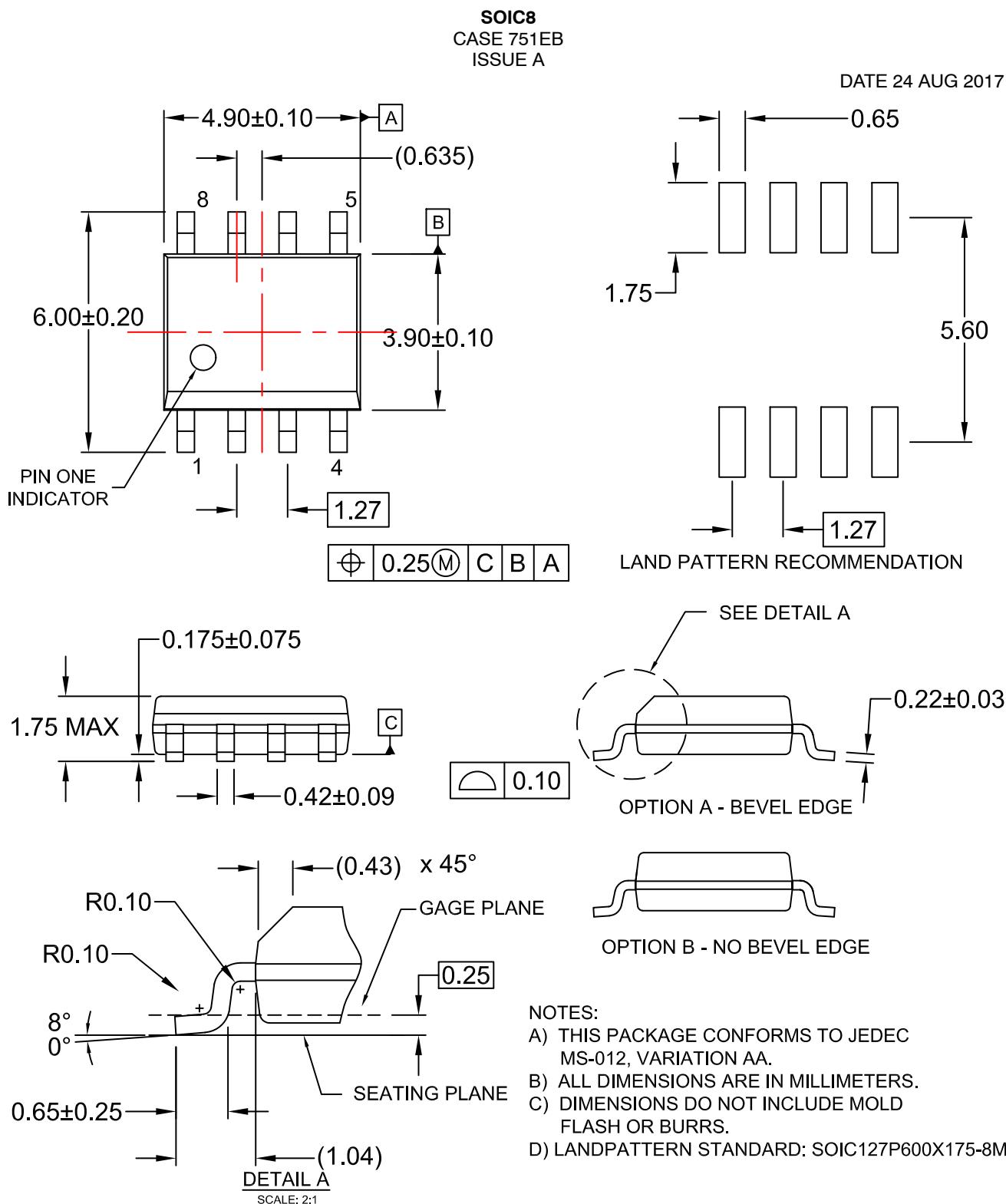
TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted) (continued)

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

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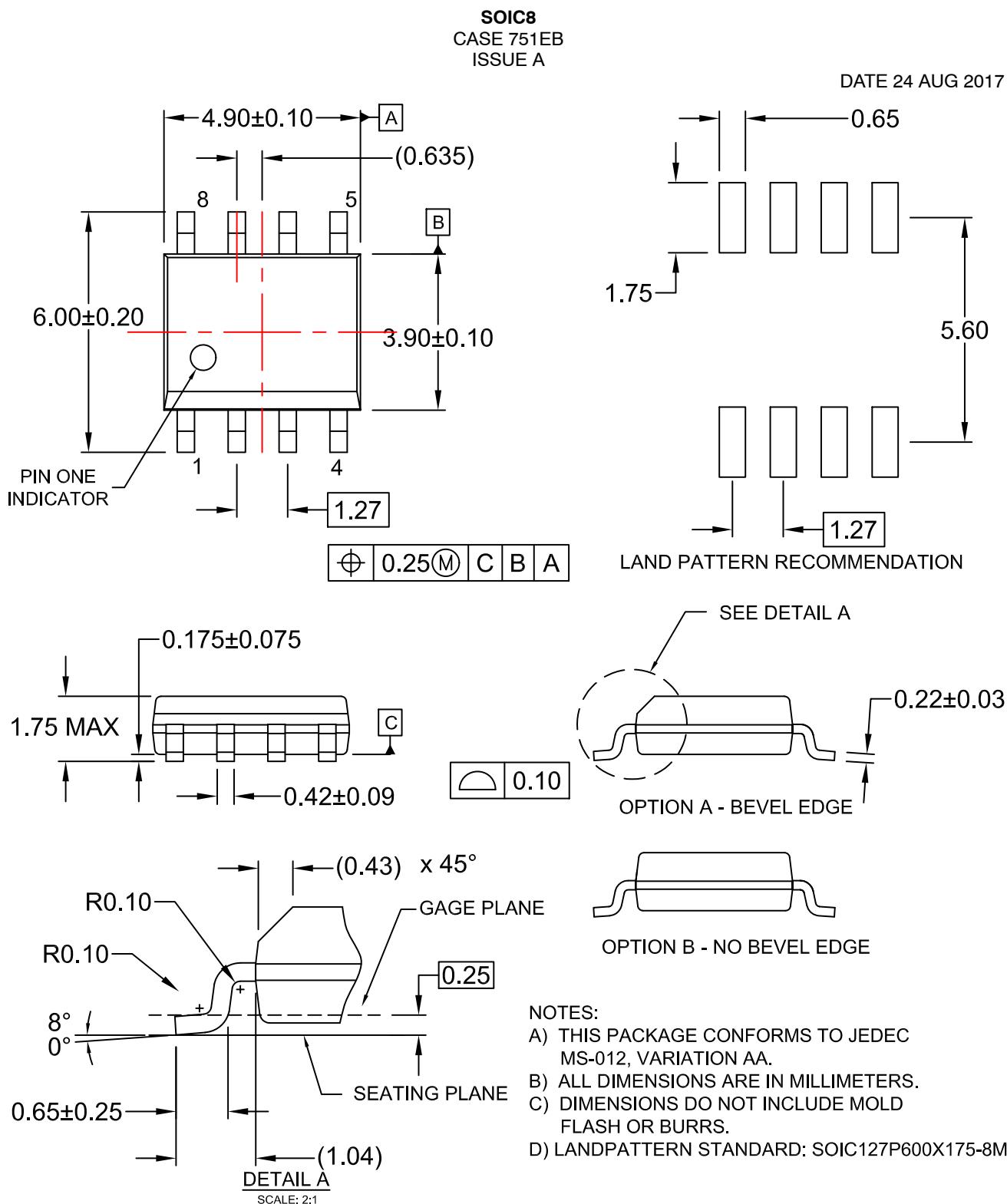
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