

# IRHNME597110 (JANSR2N7506U8CE)

PD-98032

## Radiation Hardened Power MOSFET Surface Mount (SMD-0.2e Ceramic Lid) -100V, -3.1A, P-channel, R5 Technology

### Features

- Single event effect (SEE) hardened
- Low total gate charge
- Simple drive requirements
- Hermetically sealed
- Surface mount
- Ceramic package
- Light weight
- ESD rating: Class 1A per MIL-STD-750, Method 1020

### Potential Applications

- DC-DC converter
- Motor drives

### Product Validation

Qualified according to MIL-PRF-19500 for space applications

### Description

IR HiRel R5 technology provides high performance power MOSFETs for space applications. These devices have been characterized for Single Event Effects (SEE) with useful performance up to an LET of 80MeV·cm<sup>2</sup>/mg. The combination of low  $R_{DS(on)}$  and low gate charge reduces the power losses in switching applications such as DC-DC converters and motor control. These devices retain all of the well-established advantages of MOSFETs such as voltage control, fast switching, ease of paralleling and temperature stability of electrical parameters switching and temperature stability of electrical parameters.

### Ordering Information

**Table 1** Ordering options

Part number	Package	Screening Level	TID Level
IRHNME597110	SMD-0.2e (Ceramic Lid)	COTS	100 krad(Si)
JANSR2N7506U8CE	SMD-0.2e (Ceramic Lid)	JANS	100 krad(Si)
IRHNME593110	SMD-0.2e (Ceramic Lid)	COTS	300 krad(Si)
JANSF2N7506U8CE	SMD-0.2e (Ceramic Lid)	JANS	300 krad(Si)

### Product Summary

- $BV_{DSS}$ : -100V
- $I_D$ : -3.1A
- $R_{DS(on), max}$ : 1.2Ω
- $Q_{G, max}$ : 11nC
- REF: MIL-PRF-19500/749



**Table of contents**

**Table of contents**

**Potential Applications**..... **1**

**Product Validation**..... **1**

**Description** ..... **1**

**Ordering Information**..... **1**

**Table of contents**..... **2**

**1 Absolute Maximum Ratings** ..... **3**

**2 Device Characteristics** ..... **4**

2.1 Electrical Characteristics (Pre-Irradiation)..... 4

2.2 Source-Drain Diode Ratings and Characteristics (Pre-Irradiation) ..... 5

2.3 Thermal Characteristics ..... 5

2.4 Radiation Characteristics..... 5

2.4.1 Electrical Characteristics — Post Total Dose Irradiation ..... 5

2.4.2 Single Event Effects — Safe Operating Area ..... 6

**3 Electrical Characteristics Curves (Pre-irradiation)** ..... **7**

**4 Test Circuits (Pre-irradiation)** ..... **11**

**5 Package Outline** ..... **12**

**Revision history**..... **13**

## Absolute Maximum Ratings

## 1 Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings (Pre-Irradiation)

Symbol	Parameter	Value	Unit
$I_{D1} @ V_{GS} = -12V, T_C = 25^\circ C$	Continuous Drain Current	-3.1	A
$I_{D2} @ V_{GS} = -12V, T_C = 100^\circ C$	Continuous Drain Current	-2.0	A
$I_{DM} @ T_C = 25^\circ C$	Pulsed Drain Current <sup>1</sup>	-12.4	A
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	23	W
	Linear Derating Factor	0.18	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$E_{AS}$	Single Pulse Avalanche Energy <sup>2</sup>	28	mJ
$I_{AR}$	Avalanche Current <sup>1</sup>	-3.1	A
$E_{AR}$	Repetitive Avalanche Energy <sup>1</sup>	2.3	mJ
dv/dt	Peak Diode Reverse Recovery <sup>3</sup>	-21	V/ns
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Lead Temperature	300 (for 5s)	
	Weight	0.25 (Typical)	g

<sup>1</sup> Repetitive Rating; Pulse width limited by maximum junction temperature.<sup>2</sup>  $V_{DD} = -50V$ , starting  $T_J = 25^\circ C$ ,  $L = 5.8mH$ , Peak  $I_L = -3.1A$ ,  $V_{GS} = -12V$ <sup>3</sup>  $I_{SD} \leq -3.1A$ ,  $di/dt \leq 544A/\mu s$ ,  $V_{DD} \leq -100V$ ,  $T_J \leq 150^\circ C$

## Device Characteristics

## 2 Device Characteristics

## 2.1 Electrical Characteristics (Pre-Irradiation)

Table 3 Static and Dynamic Electrical Characteristics  $T_J = 25^\circ\text{C}$  (Unless Otherwise Specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	-100	—	—	V	$V_{GS} = 0V, I_D = -1.0mA$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.13	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = -1mA$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	—	1.2	$\Omega$	$V_{GS} = 12V, I_{D2} = -2.0A^1$
$V_{GS(th)}$	Gate Threshold Voltage	-2.0	—	-4.0	V	$V_{DS} = V_{GS}, I_D = -1.0mA$
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	4.88	—	mV/ $^\circ\text{C}$	
$G_{fs}$	Forward Transconductance	1.9	—	—	S	$V_{DS} = -15V, I_{D2} = -2.0A^1$
$I_{DSS}$	Zero Gate Voltage Drain Current	—	—	-10	$\mu\text{A}$	$V_{DS} = -80V, V_{GS} = 0V$
		—	—	-25		$V_{DS} = -80V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Leakage Forward	—	—	-100	nA	$V_{GS} = -20V$
	Gate-to-Source Leakage Reverse	—	—	100		$V_{GS} = 20V$
$Q_G$	Total Gate Charge	—	—	11	nC	$I_{D1} = -3.1A$
$Q_{GS}$	Gate-to-Source Charge	—	—	5.0		$V_{DS} = -50V$
$Q_{GD}$	Gate-to-Drain ('Miller') Charge	—	—	4.0		$V_{GS} = -12V$
$t_{d(on)}$	Turn-On Delay Time	—	—	18	ns	$I_{D1} = -3.1A^{**}$ $V_{DD} = -50V$ $R_G = 7.5\Omega$ $V_{GS} = -12V$
$t_r$	Rise Time	—	—	26		
$t_{d(off)}$	Turn-Off Delay Time	—	—	24		
$t_f$	Fall Time	—	—	85		
$L_s + L_D$	Total Inductance	—	6.8	—	nH	Measured from center of Drain pad to center of Source pad
$C_{iss}$	Input Capacitance	—	379	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	98	—		$V_{DS} = -25V$
$C_{rSS}$	Reverse Transfer Capacitance	—	9.5	—		$f = 1MHz$
$R_G$	Gate Resistance	—	24	—	$\Omega$	$f = 1.0MHz$ , open drain

\*\* Switching speed maximum limits are based on manufacturing test equipment and capability.

<sup>1</sup> Pulse width  $\leq 300 \mu\text{s}$ ; Duty Cycle  $\leq 2\%$

## Device Characteristics

## 2.2 Source-Drain Diode Ratings and Characteristics (Pre-Irradiation)

Table 4 Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	-3.1	A	
$I_{SM}$	Pulsed Source Current (Body Diode) <sup>1</sup>	—	—	-12.4	A	
$V_{SD}$	Diode Forward Voltage	—	—	-5.0	V	$T_J = 25^\circ\text{C}$ , $I_S = -3.1\text{A}$ , $V_{GS} = 0\text{V}$ <sup>2</sup>
$t_{rr}$	Reverse Recovery Time	—	—	100	ns	$T_J = 25^\circ\text{C}$ , $I_F = -3.1\text{A}$ , $V_{DD} \leq -50\text{V}$ $di/dt = -100\text{A}/\mu\text{s}$ <sup>2</sup>
$Q_{rr}$	Reverse Recovery Charge	—	271	—	nC	
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

## 2.3 Thermal Characteristics

Table 5 Thermal Resistance

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case	—	—	5.4	$^\circ\text{C}/\text{W}$

## 2.4 Radiation Characteristics

IR HiRel radiation hardened MOSFETs are tested to verify their radiation hardness capability. The hardness assurance program at IR HiRel is comprised of two radiation environments. Every manufacturing lot is tested for total ionizing dose (per notes 3 and 4) using the TO-3 package. Both pre- and post-irradiation performance are tested and specified using the same drive circuitry and test conditions in order to provide a direct comparison.

## 2.4.1 Electrical Characteristics — Post Total Dose Irradiation

Table 6 Electrical Characteristics  $T_J = 25^\circ\text{C}$ , Post Total Dose Irradiation<sup>3, 4</sup>

Symbol	Parameter	100 krad (Si) <sup>5</sup>		300 krad (Si) <sup>6</sup>		Unit	Test Conditions
		Min.	Max.	Min.	Max.		
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	-100	—	-100	—	V	$V_{GS} = 0\text{V}$ , $I_D = -1.0\text{mA}$
$V_{GS(th)}$	Gate Threshold Voltage	-2.0	-4.0	-2.0	-4.0	V	$V_{DS} = V_{GS}$ , $I_D = -1.0\text{mA}$
$I_{GSS}$	Gate-to-Source Leakage Forward	—	-100	—	-100	nA	$V_{GS} = -20\text{V}$
	Gate-to-Source Leakage Reverse	—	100	—	100		$V_{GS} = 20\text{V}$
$I_{DSS}$	Zero Gate Voltage Drain Current	—	-10	—	-10	$\mu\text{A}$	$V_{DS} = -80\text{V}$ , $V_{GS} = 0\text{V}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance (TO-3) <sup>2</sup>	—	0.916	—	0.936	$\Omega$	$V_{GS} = -12\text{V}$ , $I_{D2} = -2.0\text{A}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance (SMD-0.2) <sup>2</sup>	—	1.2	—	1.2	$\Omega$	$V_{GS} = -12\text{V}$ , $I_{D2} = -2.0\text{A}$
$V_{SD}$	Diode Forward Voltage	—	-5.0	—	-5.0	V	$V_{GS} = 0\text{V}$ , $I_F = -3.1\text{A}$

<sup>1</sup> Repetitive Rating; Pulse width limited by maximum junction temperature.

<sup>2</sup> Pulse width  $\leq 300 \mu\text{s}$ ; Duty Cycle  $\leq 2\%$

<sup>3</sup> Total Dose Irradiation with  $V_{GS}$  Bias.  $V_{GS} = -12\text{V}$  applied and  $V_{DS} = 0$  during irradiation per MIL-STD-750, Method 1019, condition A.

<sup>4</sup> Total Dose Irradiation with  $V_{DS}$  Bias.  $V_{DS} = -80\text{V}$  applied and  $V_{GS} = 0$  during irradiation per MIL-STD-750, Method 1019, condition A.

<sup>5</sup> Part numbers IRHNME597110 (JANSR2N7506U8CE)

<sup>6</sup> Part numbers IRHNME593110 (JANSF2N7506U8CE)

Device Characteristics

2.4.2 Single Event Effects — Safe Operating Area

IR HiRel radiation hardened MOSFETs have been characterized in heavy ion environment for Single Event Effects (SEE). Single Event Effects characterization is illustrated in Fig. 1 and Table 7.

Table 7 Worst Case Single Event Effects Safe Operating Area

LET (MeV·cm <sup>2</sup> /mg)	Energy (MeV)	Range (μm)	V <sub>DS</sub> (V)				
			V <sub>GS</sub> = 0V	V <sub>GS</sub> = 5V	V <sub>GS</sub> = 10V	V <sub>GS</sub> = 15V	V <sub>GS</sub> = 20V
38 ± 5%	270 ± 7.5%	35 ± 7.5%	-100	-100	-100	-100	-100
61 ± 5%	330 ± 7.5%	30 ± 7.5%	-100	-100	-100	-100	-25
84 ± 5%	350 ± 7.5%	28 ± 7.5%	-100	-100	-100	-30	—

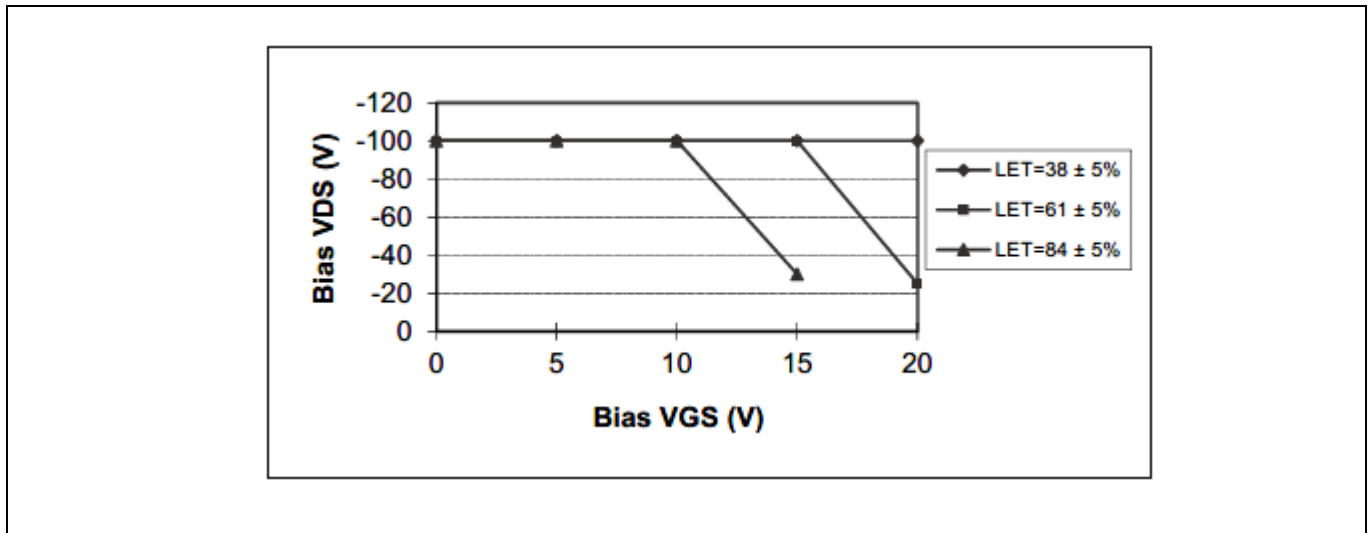


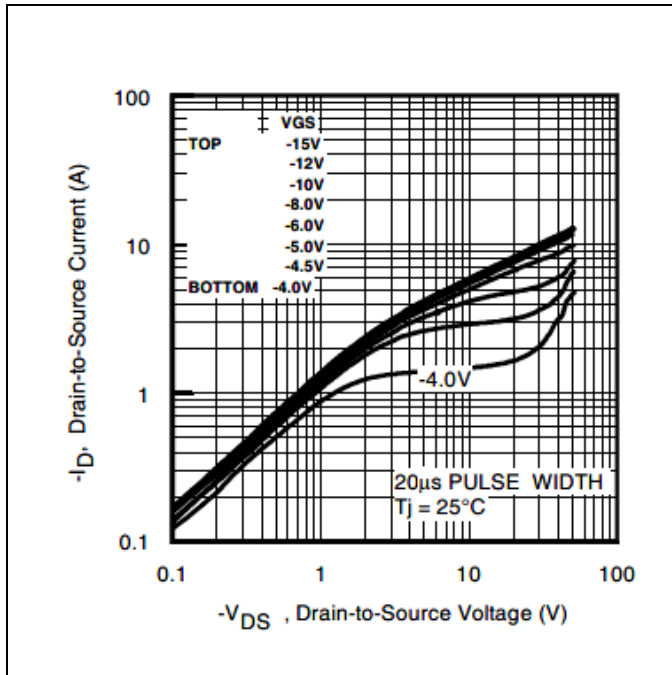
Figure 1 Worst Case Single Event Effect, Safe Operating Area

**IRHNME597110 (JANSR2N7506U8CE)**

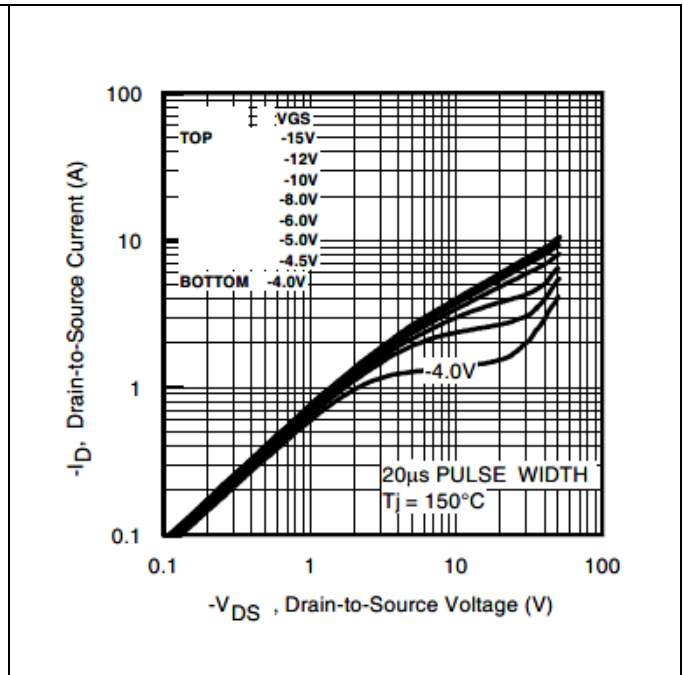
**Radiation Hardened Power MOSFET Surface mount (SMD-0.2e Ceramic Lid)**

**Electrical Characteristics Curves (Pre-irradiation)**

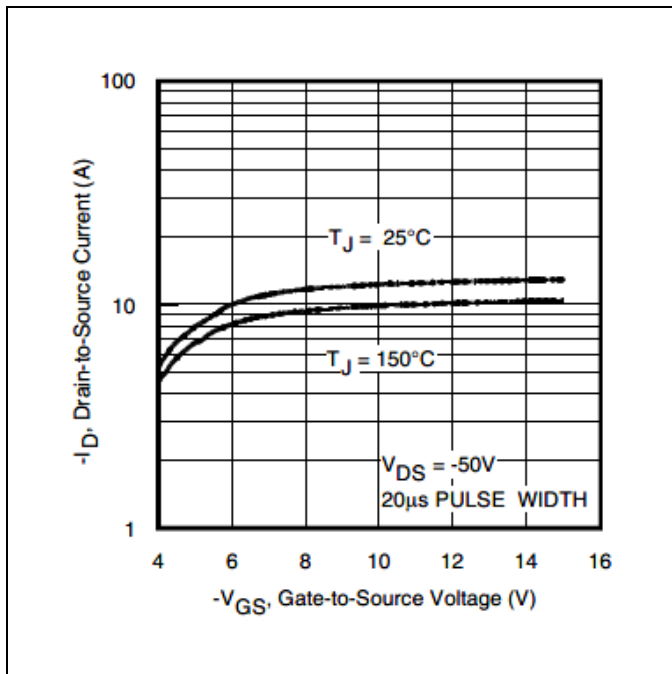
**3 Electrical Characteristics Curves (Pre-irradiation)**



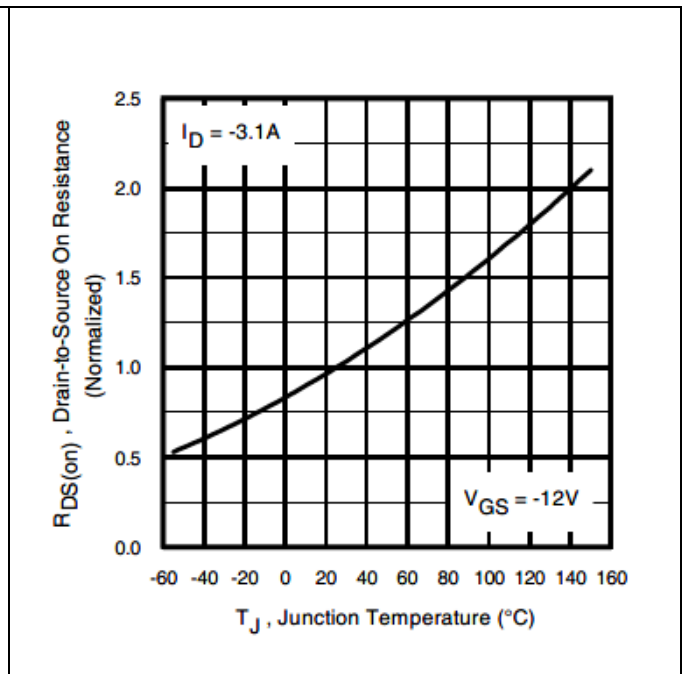
**Figure 2 Typical Output Characteristics**



**Figure 3 Typical Output Characteristics**



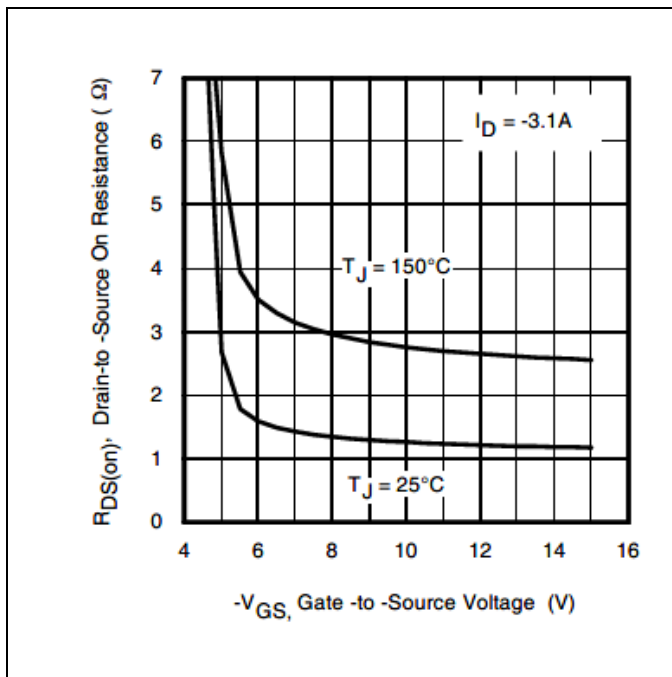
**Figure 4 Typical Transfer Characteristics**



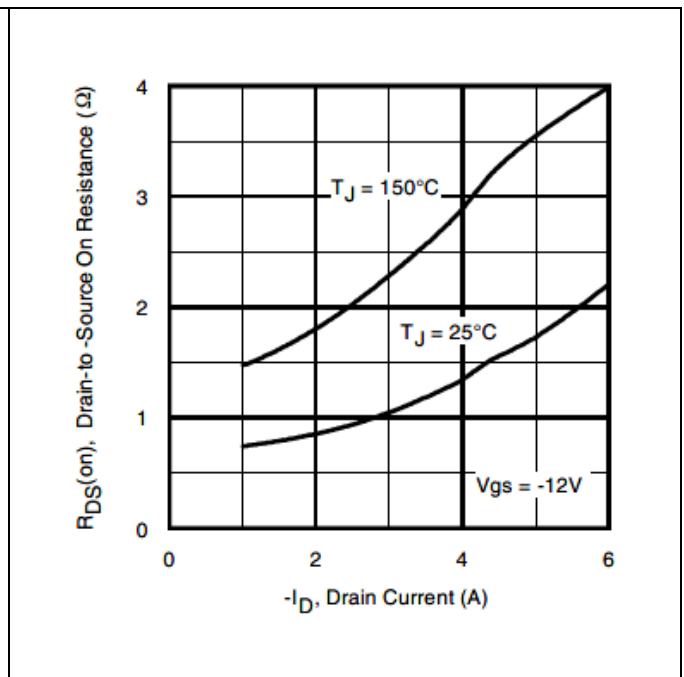
**Figure 5 Normalized On-Resistance Vs. Temperature**

Radiation Hardened Power MOSFET Surface mount (SMD-0.2e Ceramic Lid)

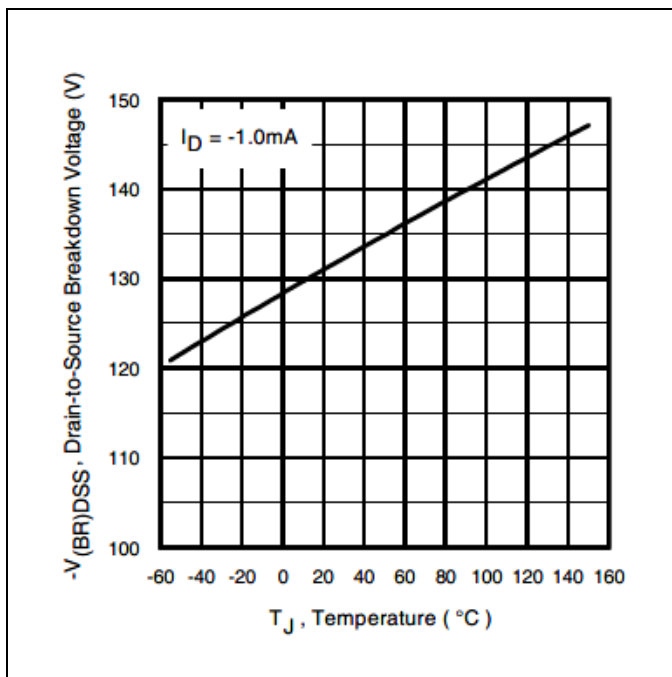
Electrical Characteristics Curves (Pre-irradiation)



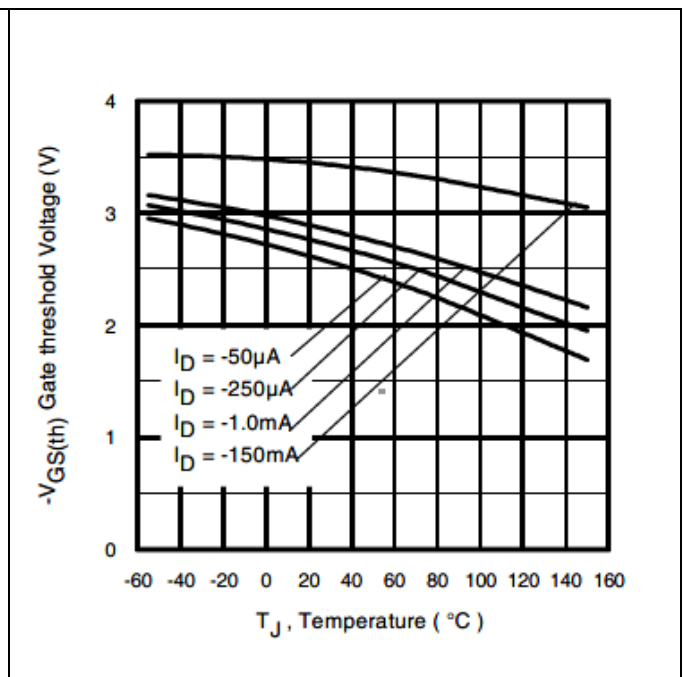
**Figure 6** Typical On-Resistance Vs. Gate Voltage



**Figure 7** Typical On-Resistance Vs. Drain Current



**Figure 8** Typical Drain-to-Source Breakdown Voltage Vs. Temperature

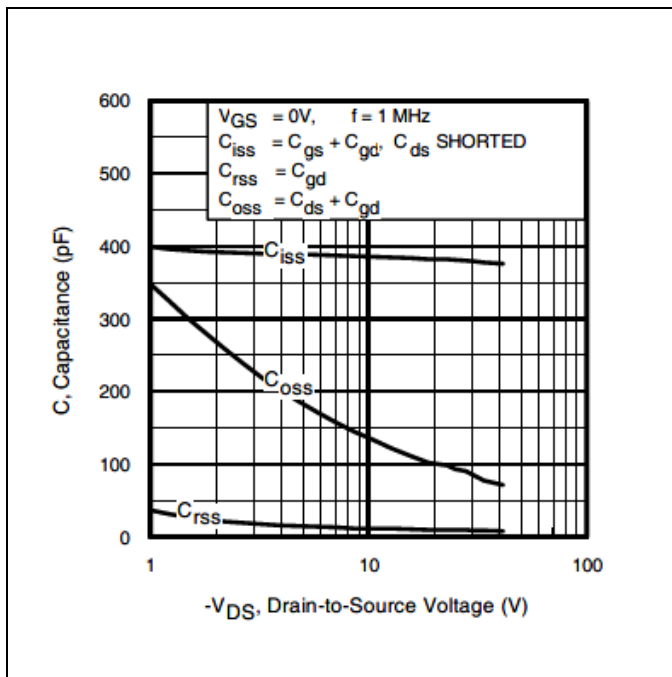


**Figure 9** Typical Threshold Voltage Vs. Temperature

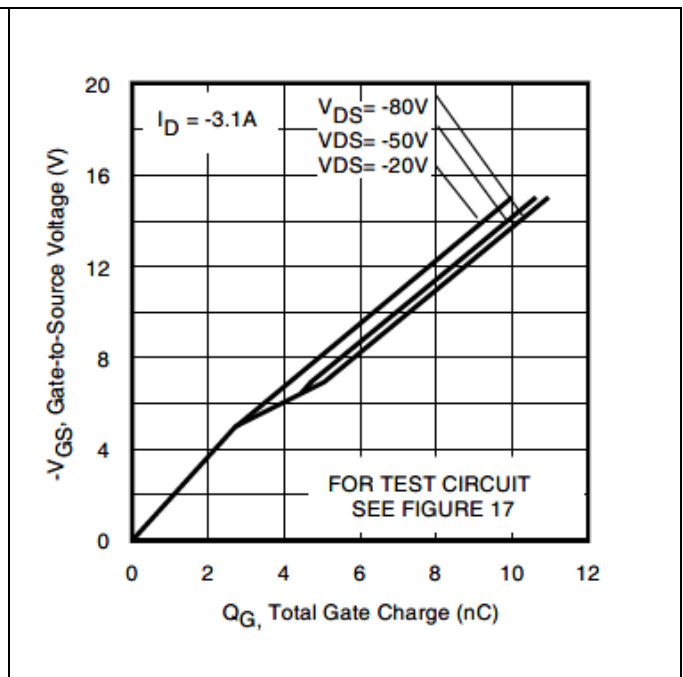
**IRHNME597110 (JANSR2N7506U8CE)**

**Radiation Hardened Power MOSFET Surface mount (SMD-0.2e Ceramic Lid)**

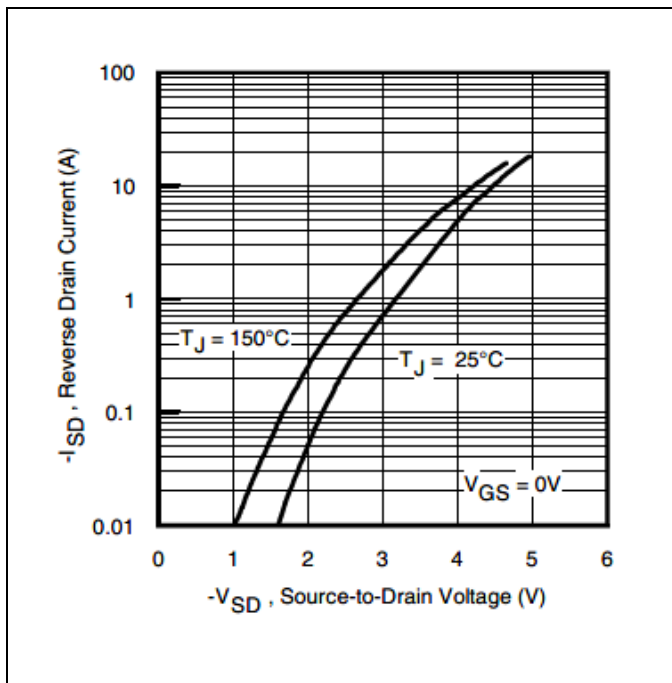
**Electrical Characteristics Curves (Pre-irradiation)**



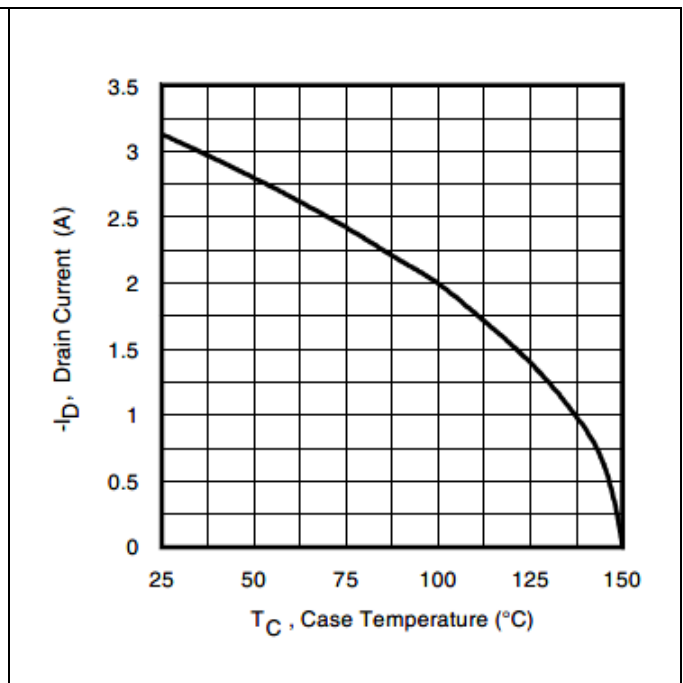
**Figure 10 Typical Capacitance Vs. Drain-to-Source Voltage**



**Figure 11 Gate-to-Source Voltage Vs. Typical Gate Charge**



**Figure 12 Typical Source-Drain Current Vs. Diode Forward Voltage**

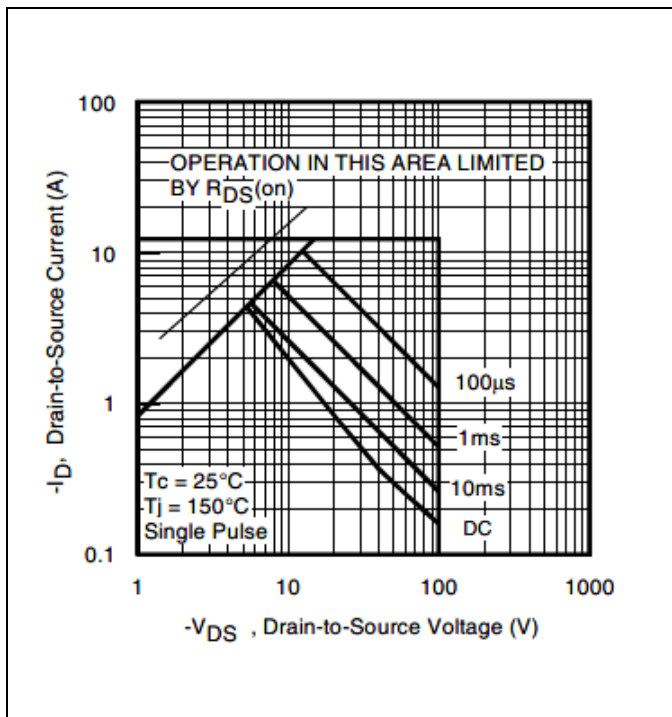


**Figure 13 Maximum Drain Current Vs. Case Temperature**

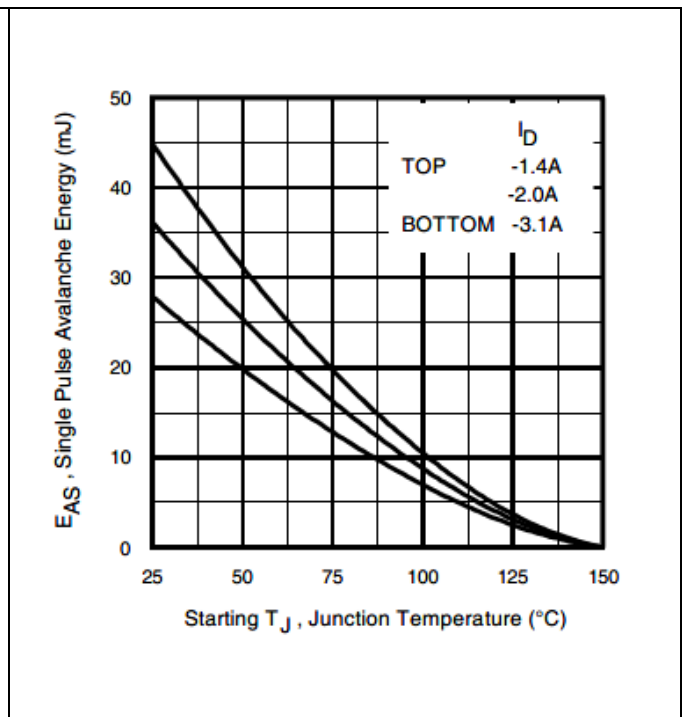
**IRHNME597110 (JANSR2N7506U8CE)**

**Radiation Hardened Power MOSFET Surface mount (SMD-0.2e Ceramic Lid)**

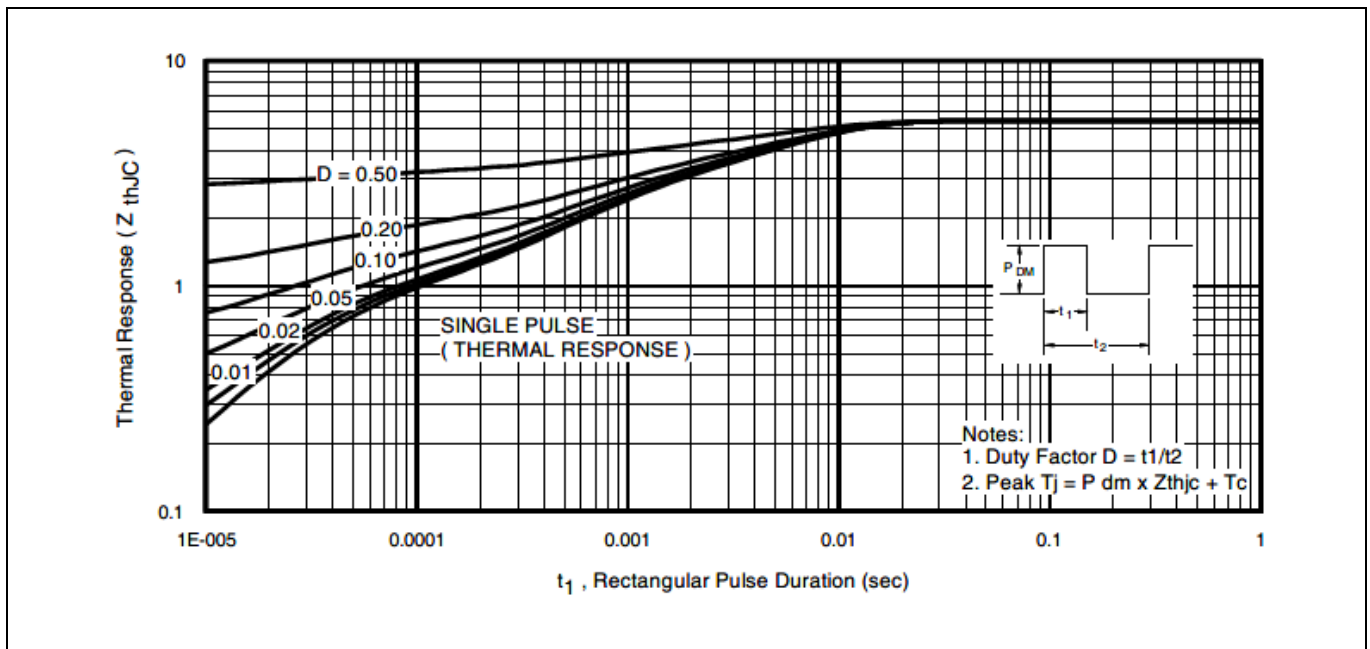
**Electrical Characteristics Curves (Pre-irradiation)**



**Figure 14 Maximum Safe Operating Area**



**Figure 15 Maximum Avalanche Energy Vs. Junction Temperature**



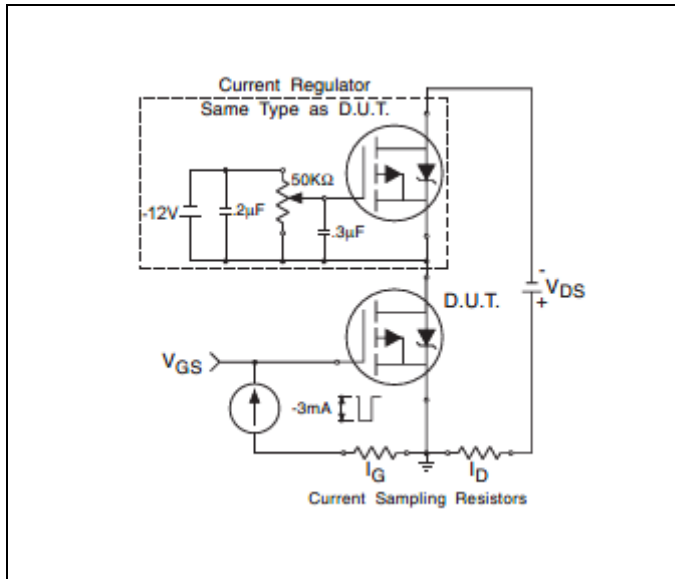
**Figure 16 Maximum Effective Transient Thermal Impedance, Junction-to-Case**

**IRHNME597110 (JANSR2N7506U8CE)**

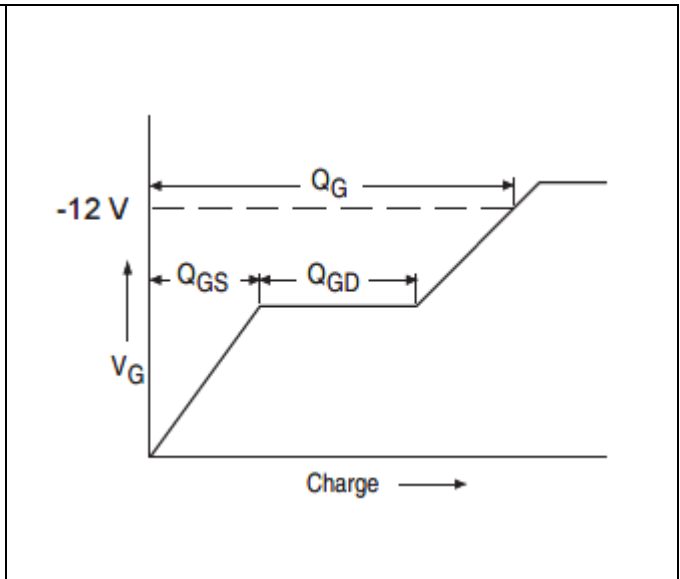
**Radiation Hardened Power MOSFET Surface mount (SMD-0.2e Ceramic Lid)**

**Test Circuits (Pre-irradiation)**

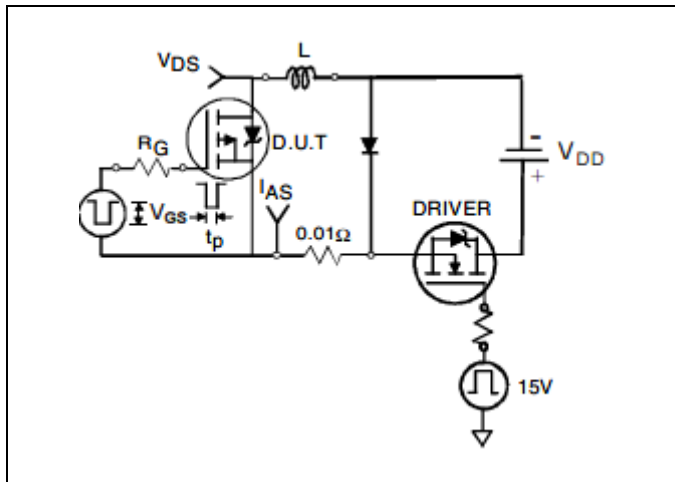
**4 Test Circuits (Pre-irradiation)**



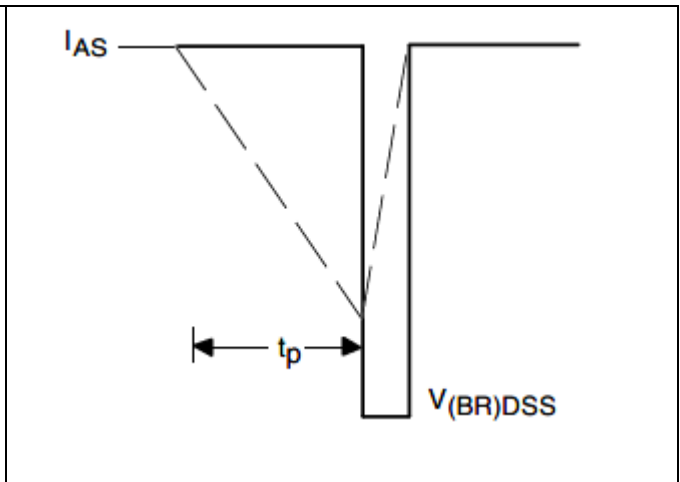
**Figure 17 Gate Charge Test Circuit**



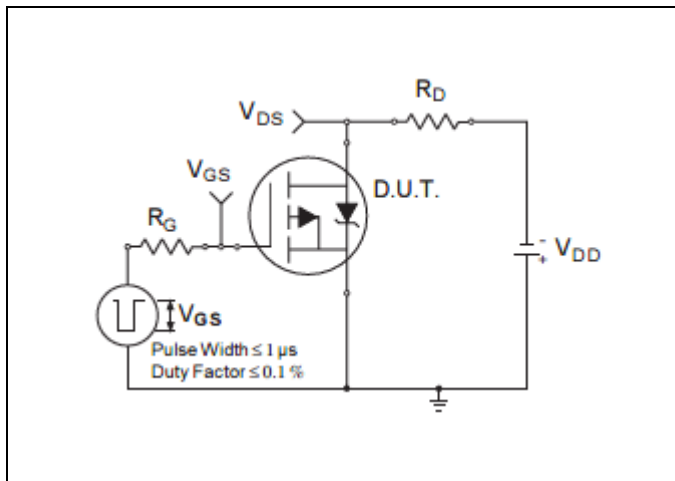
**Figure 18 Gate Charge Waveform**



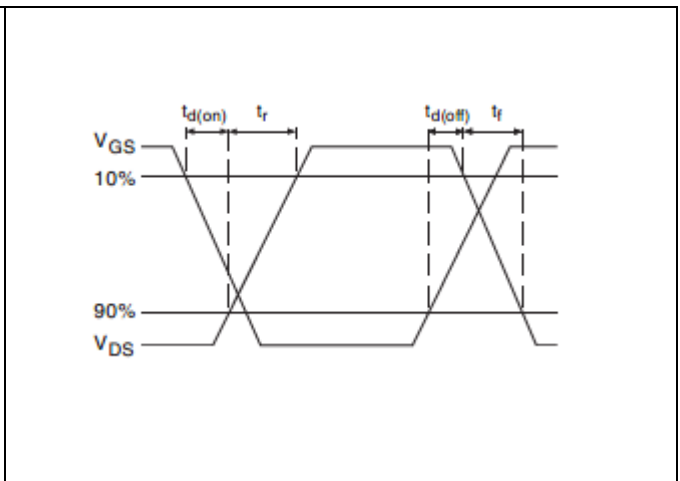
**Figure 19 Unclamped Inductive Test Circuit**



**Figure 20 Unclamped Inductive Waveform**



**Figure 21 Switching Time Test Circuit**



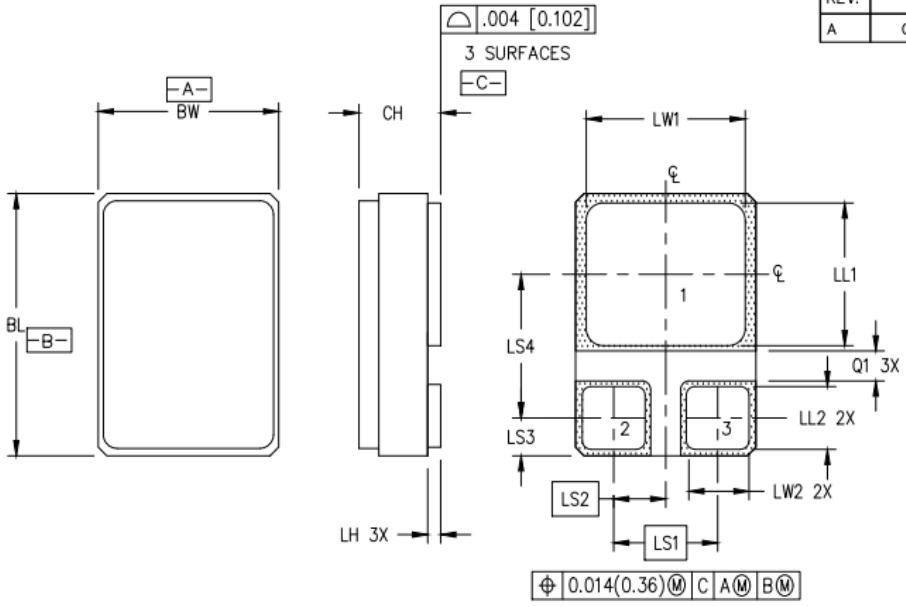
**Figure 22 Switching Time Waveforms**

Package Outline

# 5 Package Outline

Note: For the most updated package outline, please see the website: [SMD-0.2e \(Ceramic Lid\)](#)


REV.	DESCRIPTION	ECN	DATE
A	CHANGE PER ECN	1120_10124	10-14-24



Symbol	Inches		Millimeters	
	Min	Max	Min	Max
BL	0.300	0.310	7.62	7.87
BW	0.205	0.215	5.21	5.46
CH	0.097		2.46	
LH	0.010	0.020	0.25	0.51
LW1	0.180	0.190	4.57	4.83
LW2	0.068	0.078	1.73	1.98
LL1	0.161	0.171	4.09	4.34
LL2	0.068	0.078	1.73	1.98
LS1	.121 BSC		3.07 BSC	
LS2	.083 BSC		1.54 BSC	
LS3	.044 BSC		1.12 BSC	
LS4	.167 BSC		4.24 BSC	
Q1	0.030		0.76	

**NOTES:**  
 1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.  
 2. CONTROLLING DIMENSION: INCH.  
 3. DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].  
 4. STANDARD FINAL FINISH ON ALL TERMINALS IS SOLDER ALLOY 63%Sn 37%Pb.

**PAD ASSIGNMENTS**  
 1 = DRAIN  
 2 = GATE  
 3 = SOURCE



An Infineon Technologies Company

TITLE: SMD-0.2 ENHANCED OUTLINE WITH CERAMIC LID	
DRAWING NO. D101029G-WEB	REV A

# IRHNME597110 (JANSR2N7506U8CE)

## Radiation Hardened Power MOSFET Surface mount (SMD-0.2e Ceramic Lid)

### Revision history

## Revision history

Document version	Date of release	Description of changes
	11/25/2025	Final datasheet with PD number (PD-98032)

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