

IRHLUC7670Z4

PD-97268E

Radiation Hardened Logic Level Power MOSFETs Surface Mount (LCC-6) 60V Dual 1N & 1P, R7 Technology

Features

- 5V CMOS and TTL compatible
- Low $R_{DS(on)}$
- Single event effect (SEE) hardened
- Fast switching
- Low total gate charge
- Simple drive requirements
- Hermetically sealed
- Light weight
- Surface mount
- ESD rating: Class 0B 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 R7 Logic Level Power MOSFETs provide simple solution to interfacing CMOS and TTL control circuits to power devices in space and other radiation environments. The threshold voltage remains within acceptable operating limits over the full operating temperature and post radiation. This is achieved while maintaining single event gate rupture and single event burnout immunity. The device is ideal when used to interface directly with most logic gates, linear IC's, micro-controllers, and other device types that operate from a 3.3-5V source. It may also be used to increase the output current of a PWM, voltage comparator or an operational amplifier where the logic level drive signal is available.

Ordering Information

Table 1 Ordering options

Part number	Package	Screening Level	TID Level
IRHLUC7670Z4	LCC-6	COTS	100 krad(Si)
IRHLUC7670Z4SCS	LCC-6	S-Level	100 krad(Si)
IRHLUC7630Z4	LCC-6	COTS	300 krad(Si)

Product Summary

- BV_{DSS} : $\pm 60V$
- I_D : 0.89A (N-Ch), -0.65A (P-Ch)
- $R_{DS(on), max}$: 0.75 Ω (N-Ch), 1.6 Ω (P-Ch)
- $Q_{G, max}$: 3.6nC (N-Ch), 3.6nC (P-Ch)



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-N channel)	4
2.2 Electrical Characteristics (Pre-Irradiation P-channel)	5
2.3 Source-Drain Diode Ratings and Characteristics (Pre-Irradiation N-channel)	6
2.4 Thermal Characteristics (N channel)	6
2.5 Radiation Characteristics (N channel)	6
2.5.1 Electrical Characteristics — Post Total Dose Irradiation (N channel)	6
2.6 Source-Drain Diode Ratings and Characteristics (Pre-Irradiation P-channel).....	7
2.7 Thermal Characteristics (P channel)	7
2.8 Radiation Characteristics (P channel)	7
2.8.1 Electrical Characteristics — Post Total Dose Irradiation (P channel)	7
2.8.2 Single Event Effects — Safe Operating Area (N channel)	8
2.8.3 Single Event Effects — Safe Operating Area (P channel)	9
3 Electrical Characteristics Curves (Pre-Irradiation N-channel)	10
4 Electrical Characteristics Curves (Pre-Irradiation P-channel)	14
5 Test Circuits (Pre-Irradiation N-channel)	18
6 Test Circuits (Pre-Irradiation P-channel).....	19
7 Package Outline	20
Revision history.....	21

Absolute Maximum Ratings

1 Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings (Pre-Irradiation)

Symbol	Parameter	N-Channel	P-Channel	Unit
I _{D1} @ V _{GS} = ±4.5V, T _C = 25°C	Continuous Drain Current	0.89	-0.65	A
I _{D2} @ V _{GS} = ±4.5V, T _C = 100°C	Continuous Drain Current	0.56	-0.41	A
I _{DM} @ T _C = 25°C	Pulsed Drain Current ¹	3.56	-2.6	A
P _D @ T _C = 25°C	Maximum Power Dissipation	1.0	1.0	W
	Linear Derating Factor	0.01	0.01	W/°C
V _{GS}	Gate-to-Source Voltage	± 10	± 10	V
E _{AS}	Single Pulse Avalanche Energy ^{2, 3}	20	34	mJ
I _{AR}	Avalanche Current ¹	0.89	-0.65	A
E _{AR}	Repetitive Avalanche Energy ¹	0.1	0.1	mJ
dv/dt	Peak Diode Reverse Recovery ^{4, 5}	4.7	-5.6	V/ns
T _J T _{STG}	Operating Junction and Storage Temperature Range	-55 to +150		°C
	Lead Temperature	300 (for 5s)		
	Weight	0.2 (Typical)		
				g

¹ Repetitive Rating; Pulse width limited by maximum junction temperature.² $V_{DD} = 25V$, starting $T_J = 25^\circ C$, $L = 50.4mH$, Peak $I_L = 0.89A$, $V_{GS} = 10V$ ³ $V_{DD} = -25V$, starting $T_J = 25^\circ C$, $L = 161mH$, Peak $I_L = -0.65A$, $V_{GS} = -10V$ ⁴ $I_{SD} \leq 0.89A$, $di/dt \leq 200A/\mu s$, $V_{DD} \leq 60V$, $T_J \leq 150^\circ C$ ⁵ $I_{SD} \leq -0.65A$, $di/dt \leq -150A/\mu s$, $V_{DD} \leq -60V$, $T_J \leq 150^\circ C$

Device Characteristics

2 Device Characteristics

2.1 Electrical Characteristics (Pre-Irradiation-N channel)

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.07	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1.0\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	—	0.75	Ω	$V_{GS} = 4.5V, I_{D2} = 0.56A^1$
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-4.5	—	mV/ $^\circ\text{C}$	
G_{fs}	Forward Transconductance	1.1	—	—	S	$V_{DS} = 15V, I_{D2} = -0.56A^1$
I_{DSS}	Zero Gate Voltage Drain Current	—	—	1.0	μA	$V_{DS} = 48V, V_{GS} = 0V$
		—	—	10		$V_{DS} = 48V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 10V$
	Gate-to-Source Leakage Reverse	—	—	-100		$V_{GS} = -10V$
Q_G	Total Gate Charge	—	—	3.6	nC	$I_{D1} = 0.89A$
Q_{GS}	Gate-to-Source Charge	—	—	1.5		$V_{DS} = 30V$
Q_{GD}	Gate-to-Drain ('Miller') Charge	—	—	1.8		$V_{GS} = 4.5V$
$t_{d(on)}$	Turn-On Delay Time	—	—	8.0	ns	$I_{D1} = 0.89A^{**}$ $V_{DD} = 30V$ $R_G = 24\Omega$ $V_{GS} = 5.0V$
t_r	Rise Time	—	—	15		
$t_{d(off)}$	Turn-Off Delay Time	—	—	30		
t_f	Fall Time	—	—	12		
$L_s + L_D$	Total Inductance	—	33	—	nH	Measured from center of Drain pad to center of Source pad
C_{iss}	Input Capacitance	—	145	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	43	—		$V_{DS} = -25V$
C_{rss}	Reverse Transfer Capacitance	—	2.5	—		$f = 1.0\text{MHz}$
R_G	Gate Resistance	—	9.5	—	Ω	$f = 1.0\text{MHz}$, open drain

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

¹ Pulse width $\leq 300\mu s$; Duty Cycle $\leq 2\%$

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Device Characteristics

2.2 Electrical Characteristics (Pre-Irradiation P-channel)

Table 4 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	-60	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.06	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = -1.0\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	—	1.6	Ω	$V_{GS} = -4.5V, I_{D2} = -0.41A^1$
$V_{GS(th)}$	Gate Threshold Voltage	-1.0	—	-2.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	3.6	—	mV/ $^\circ\text{C}$	
G_{fs}	Forward Transconductance	0.6	—	—	S	$V_{DS} = -15V, I_{D2} = -0.41A^1$
I_{DSS}	Zero Gate Voltage Drain Current	—	—	-1.0	μA	$V_{DS} = -48V, V_{GS} = 0V$
		—	—	-20		$V_{DS} = -48V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Leakage Forward	—	—	-100	nA	$V_{GS} = -10V$
	Gate-to-Source Leakage Reverse	—	—	100		$V_{GS} = 10V$
Q_G	Total Gate Charge	—	—	3.6	nC	$I_{D1} = -0.65A$ $V_{DS} = -30V$ $V_{GS} = -4.5V$
Q_{GS}	Gate-to-Source Charge	—	—	1.5		
Q_{GD}	Gate-to-Drain ('Miller') Charge	—	—	1.8		
$t_{d(on)}$	Turn-On Delay Time	—	—	23	ns	$I_{D1} = -0.65A^{**}$ $V_{DD} = -30V$ $R_G = 24\Omega$ $V_{GS} = -5.0V$
t_r	Rise Time	—	—	22		
$t_{d(off)}$	Turn-Off Delay Time	—	—	32		
t_f	Fall Time	—	—	26		
$L_s + L_D$	Total Inductance	—	33	—	nH	Measured from center of Drain pad to center of Source pad
C_{iss}	Input Capacitance	—	147	—	pF	$V_{GS} = 0V$ $V_{DS} = -25V$ $f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	46	—		
C_{rss}	Reverse Transfer Capacitance	—	8.1	—		
R_G	Gate Resistance	—	52	—	Ω	$f = 1.0\text{MHz}$, open drain

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

¹ Pulse width $\leq 300\mu s$; Duty Cycle $\leq 2\%$

Device Characteristics

2.3 Source-Drain Diode Ratings and Characteristics (Pre-Irradiation N-channel)

Table 5 Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	0.89	A	
I _{SM}	Pulsed Source Current (Body Diode) ¹	—	—	3.56	A	
V _{SD}	Diode Forward Voltage	—	—	1.2	V	T _J = 25°C, I _S = 0.89A, V _{GS} = 0V ²
t _{rr}	Reverse Recovery Time	—	—	65	ns	T _J = 25°C, I _F = 0.89A, V _{DD} ≤ 25V di/dt = 100A/μs ²
Q _{rr}	Reverse Recovery Charge	—	—	67	nC	
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L _S +L _D)				

2.4 Thermal Characteristics (N channel)

Table 6 Thermal Resistance

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JA}$	Junction-to-Ambient	—	—	125	$^\circ\text{C}/\text{W}$
$R_{\theta JL}$	Junction-to-Lead	—	—	40	

2.5 Radiation Characteristics (N channel)

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.

2.5.1 Electrical Characteristics — Post Total Dose Irradiation (N channel)

Table 7 Electrical Characteristics @ $T_J = 25^\circ\text{C}$, Post Total Dose Irradiation ^{3, 4}

Symbol	Parameter	Up to 300 krad (Si) ⁵		Unit	Test Conditions
		Min.	Max.		
BV_{DSS}	Drain-to-Source Breakdown Voltage	60	—	V	$V_{GS} = 0\text{V}$, $I_D = 250\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	1.0	2.0	V	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$
I_{GSS}	Gate-to-Source Leakage Forward	—	100	nA	$V_{GS} = 10\text{V}$
	Gate-to-Source Leakage Reverse	—	-100		$V_{GS} = -10\text{V}$
I_{DSS}	Zero Gate Voltage Drain Current	—	1.0	μA	$V_{DS} = 48\text{V}$, $V_{GS} = 0\text{V}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance (TO-39) ²	—	0.65	Ω	$V_{GS} = 4.5\text{V}$, $I_{D2} = 0.56\text{A}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance (LCC-6) ²	—	0.75	Ω	$V_{GS} = 4.5\text{V}$, $I_{D2} = 0.56\text{A}$
V_{SD}	Diode Forward Voltage	—	1.2	V	$V_{GS} = 0\text{V}$, $I_F = 0.89\text{A}$

¹ Repetitive Rating; Pulse width limited by maximum junction temperature.

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

³ Total Dose Irradiation with V_{GS} Bias. $V_{GS} = 10\text{V}$ applied and $V_{DS} = 0$ during irradiation per MIL-STD-750, Method 1019, condition A.

⁴ Total Dose Irradiation with V_{DS} Bias. $V_{DS} = 48\text{V}$ applied and $V_{GS} = 0$ during irradiation per MIL-STD-750, Method 1019, condition A.

⁵ Part numbers: IRHLUC7670Z4 and IRHLUC7630Z4

Device Characteristics

2.6 Source-Drain Diode Ratings and Characteristics (Pre-Irradiation P-channel)

Table 8 Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	-0.65	A	
I _{SM}	Pulsed Source Current (Body Diode) ¹	—	—	-2.6	A	
V _{SD}	Diode Forward Voltage	—	—	-5.0	V	T _J = 25°C, I _S = -0.65A, V _{GS} = 0V ²
t _{rr}	Reverse Recovery Time	—	—	35	ns	T _J = 25°C, I _F = -0.65A, V _{DD} ≤ -25V di/dt = -100A/μs ²
Q _{rr}	Reverse Recovery Charge	—	—	9.8	nC	
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L _S +L _D)				

2.7 Thermal Characteristics (P channel)

Table 9 Thermal Resistance

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JA}$	Junction-to-Ambient	—	—	125	$^\circ\text{C}/\text{W}$
$R_{\theta JL}$	Junction-to-Lead	—	—	40	

2.8 Radiation Characteristics (P channel)

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.

2.8.1 Electrical Characteristics — Post Total Dose Irradiation (P channel)

Table 10 Electrical Characteristics @ $T_J = 25^\circ\text{C}$, Post Total Dose Irradiation ^{3, 4}

Symbol	Parameter	Up to 300 krad (Si) ⁵		Unit	Test Conditions
		Min.	Max.		
BV_{DSS}	Drain-to-Source Breakdown Voltage	-60	—	V	$V_{GS} = 0\text{V}$, $I_D = -250\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	-1.0	-2.0	V	$V_{DS} = V_{GS}$, $I_D = -250\mu\text{A}$
I_{GSS}	Gate-to-Source Leakage Forward	—	-100	nA	$V_{GS} = -10\text{V}$
	Gate-to-Source Leakage Reverse	—	100		$V_{GS} = 10\text{V}$
I_{DSS}	Zero Gate Voltage Drain Current	—	-1.0	μA	$V_{DS} = -48\text{V}$, $V_{GS} = 0\text{V}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance (TO-39) ²	—	1.4	Ω	$V_{GS} = -4.5\text{V}$, $I_{D2} = -0.41\text{A}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance (LCC-6) ²	—	1.6	Ω	$V_{GS} = -4.5\text{V}$, $I_{D2} = -0.41\text{A}$
V_{SD}	Diode Forward Voltage	—	-5.0	V	$V_{GS} = 0\text{V}$, $I_F = -0.65\text{A}$

¹ Repetitive Rating; Pulse width limited by maximum junction temperature.

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

³ Total Dose Irradiation with V_{GS} Bias. $V_{GS} = -10\text{V}$ applied and $V_{DS} = 0$ during irradiation per MIL-STD-750, Method 1019, condition A.

⁴ Total Dose Irradiation with V_{DS} Bias. $V_{DS} = -48\text{V}$ applied and $V_{GS} = 0$ during irradiation per MIL-STD-750, Method 1019, condition A.

⁵ Part numbers: IRHLUC7670Z4 and IRHLUC7630Z4

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Device Characteristics

2.8.2 Single Event Effects — Safe Operating Area (N channel)

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 11 Typical Single Event Effects Safe Operating Area

LET (MeV·cm ² /mg)	Energy (MeV)	Range (μm)	V _{DS} (V)					
			V _{GS} = 0V	V _{GS} = -2V	V _{GS} = -3V	V _{GS} = -4V	V _{GS} = -5V	V _{GS} = -6V
38.1	358	43.9	60	60	60	60	60	60
60.9	659	54	60	60	60	60	60	—
90.7	1375	75.4	60	60	—	—	—	—

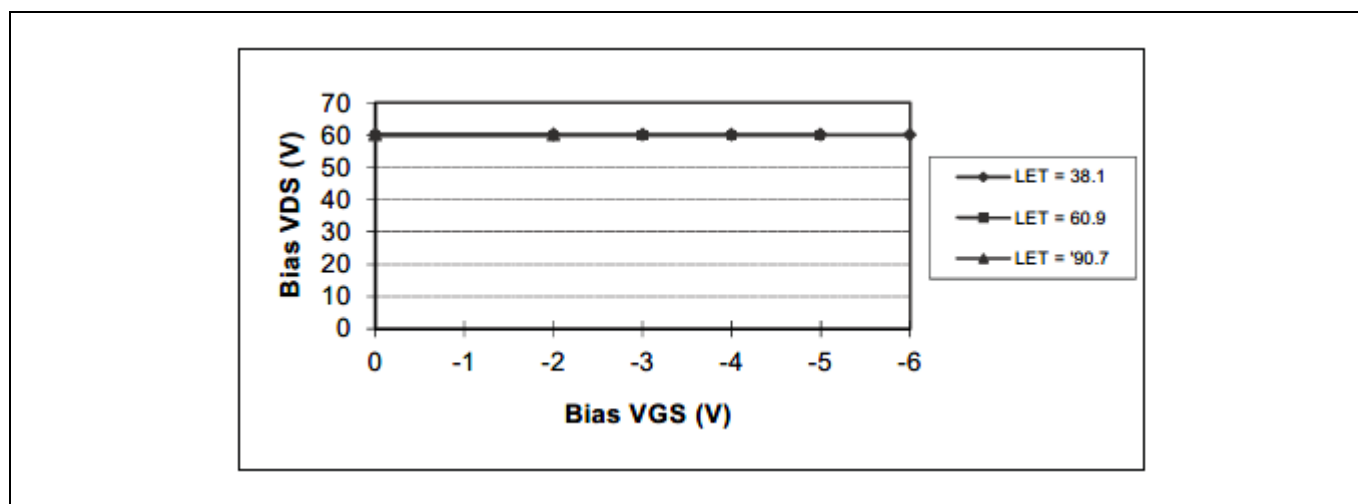


Figure 1 Typical Single Event Effect, Safe Operating Area

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Device Characteristics

2.8.3 Single Event Effects — Safe Operating Area (P channel)

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 12 Typical Single Event Effects Safe Operating Area

LET (MeV·cm ² /mg)	Energy (MeV)	Range (μm)	V _{DS} (V)					
			V _{GS} = 0V	V _{GS} = 2V	V _{GS} = 4V	V _{GS} = 5V	V _{GS} = 6V	V _{GS} = 7V
38 ± 5%	300 ± 7.5%	38 ± 7.5%	-60	-60	-60	-60	-60	-50
62 ± 5%	355 ± 7.5%	33 ± 7.5%	-60	-60	-60	-60	-60	—
85 ± 5%	380 ± 7.5%	29 ± 7.5%	-60	-60	-60	-60	—	—

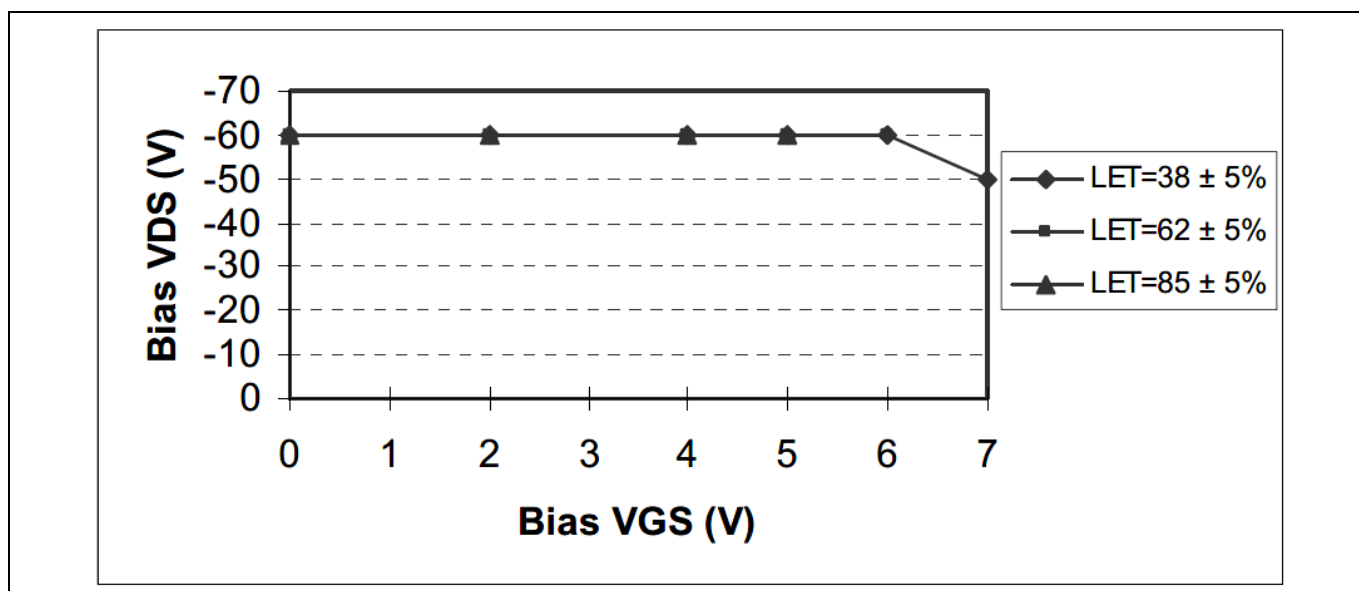


Figure 2 Worst Case Single Event Effect, Safe Operating Area

3 Electrical Characteristics Curves (Pre-Irradiation N-channel)

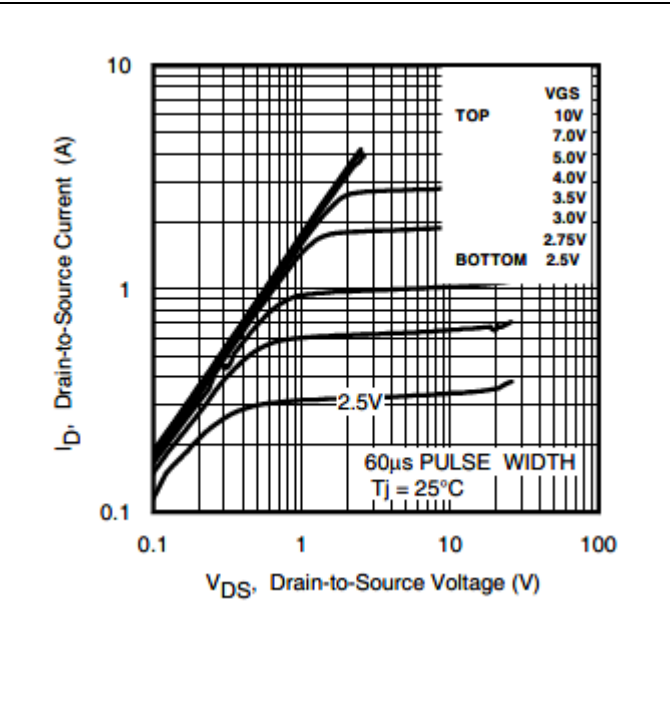


Figure 3 Typical Output Characteristics

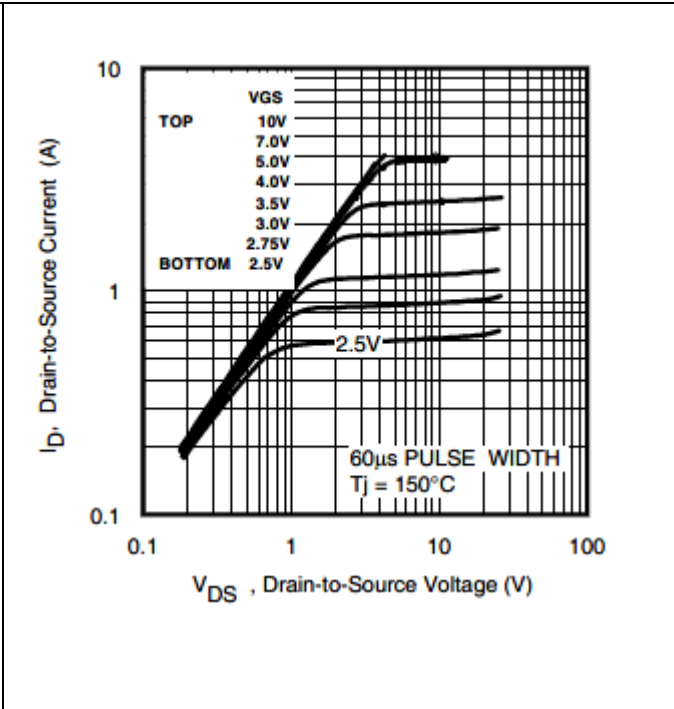


Figure 4 Typical Output Characteristics

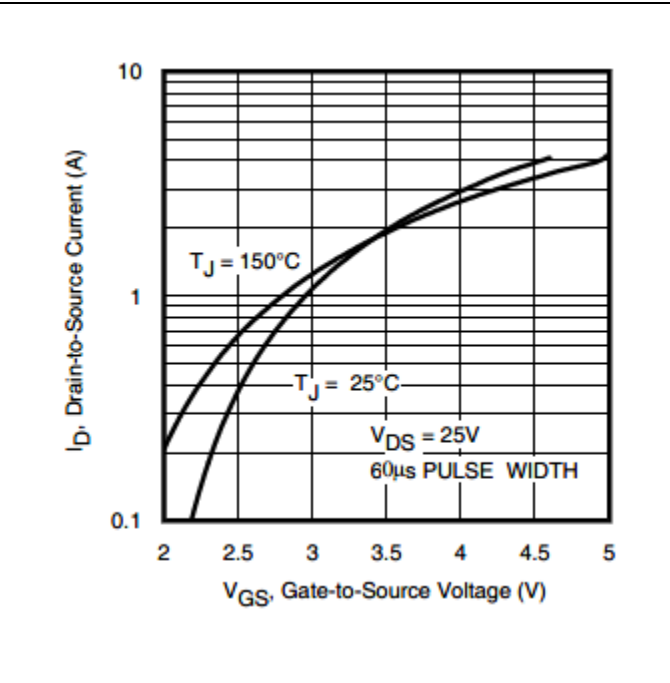


Figure 5 Typical Transfer Characteristics

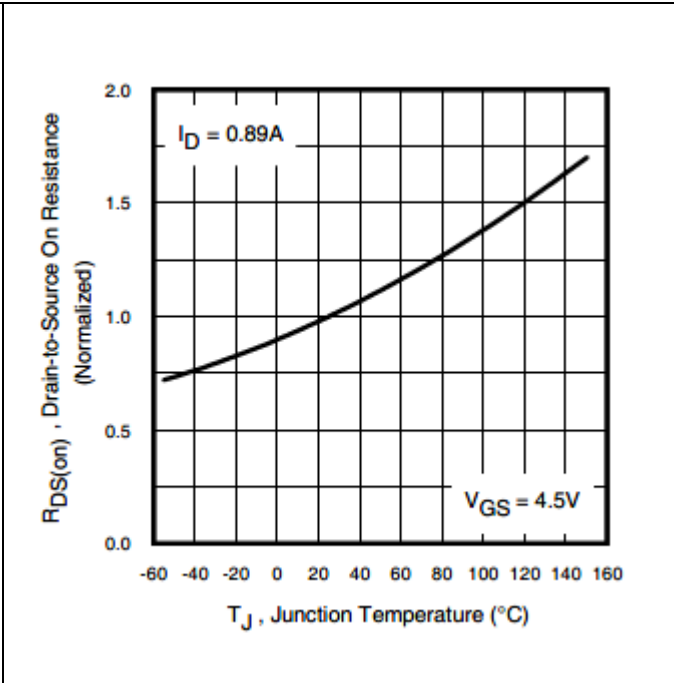


Figure 6 Normalized On-Resistance Vs. Temperature

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Electrical Characteristics Curves (Pre-Irradiation N-channel)

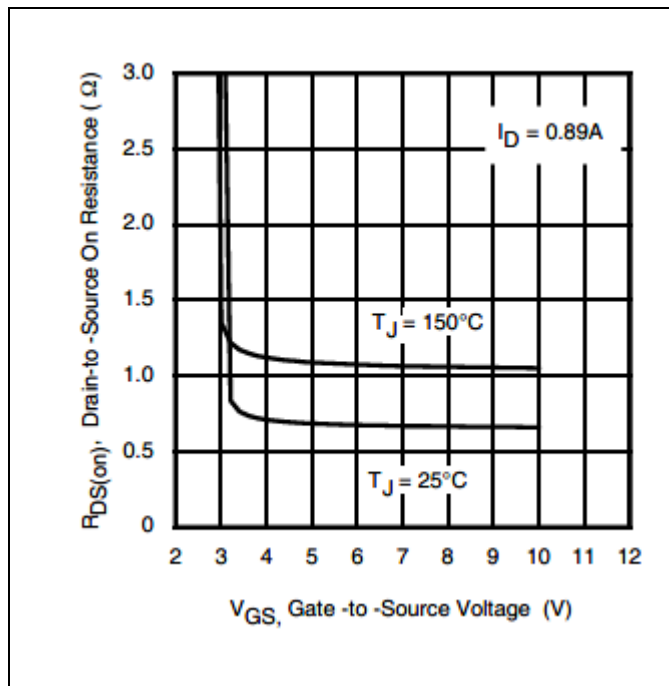


Figure 7 Typical On-Resistance Vs. Gate Voltage

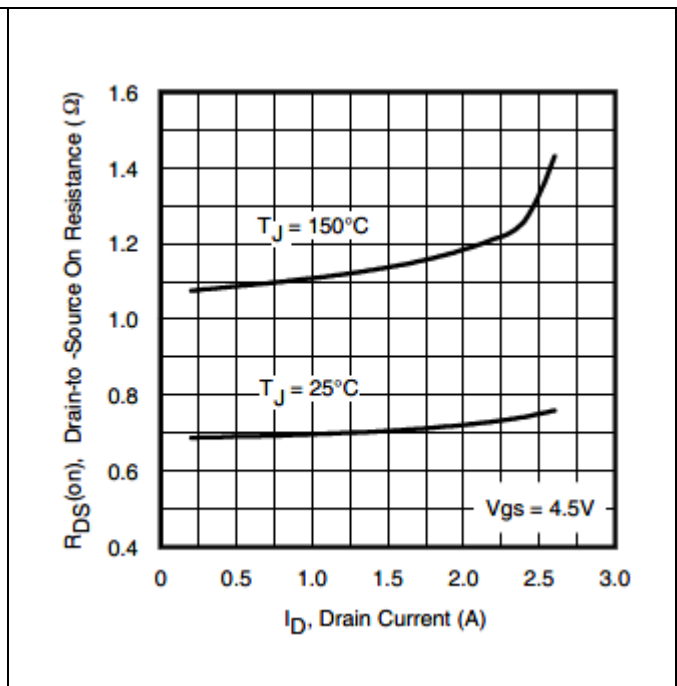


Figure 8 Typical On-Resistance Vs. Drain Current

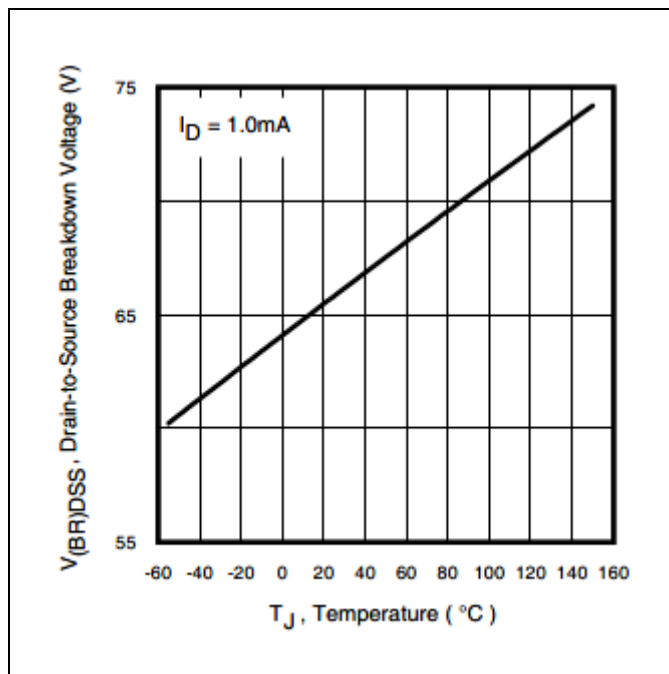


Figure 9 Typical Drain-to-Source Breakdown Voltage Vs. Temperature

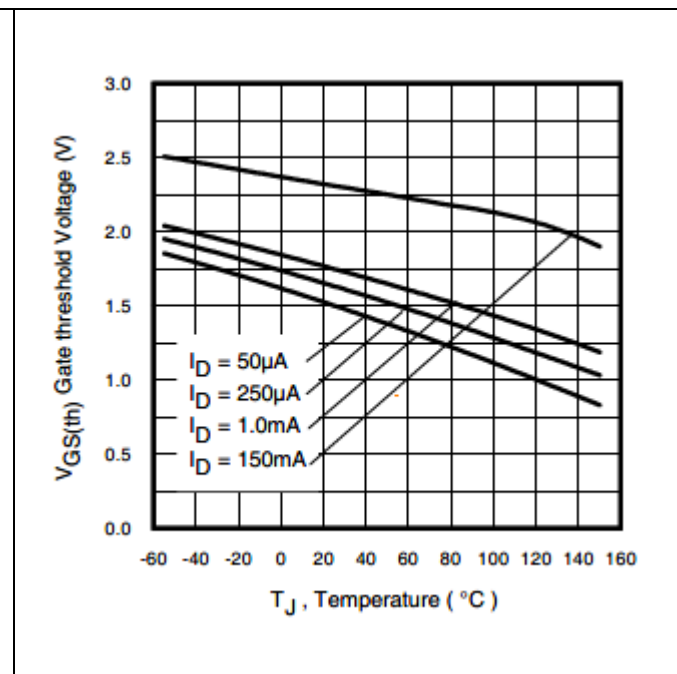


Figure 10 Typical Threshold Voltage Vs. Temperature

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Electrical Characteristics Curves (Pre-Irradiation N-channel)

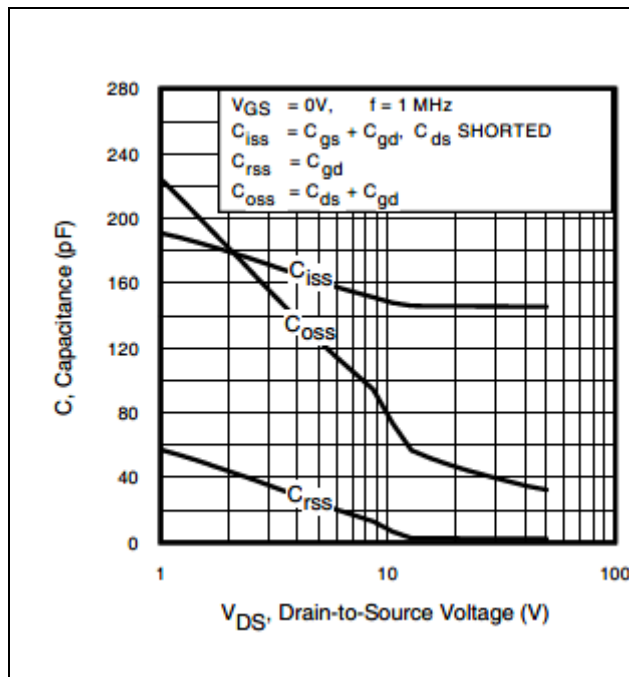


Figure 11 Typical Capacitance Vs. Drain-to-Source Voltage

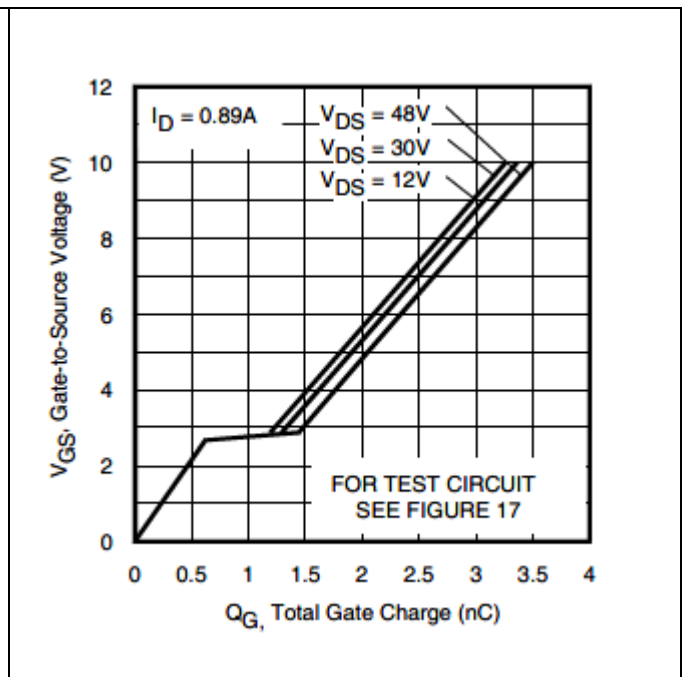


Figure 12 Gate-to-Source Voltage Vs. Typical Gate Charge

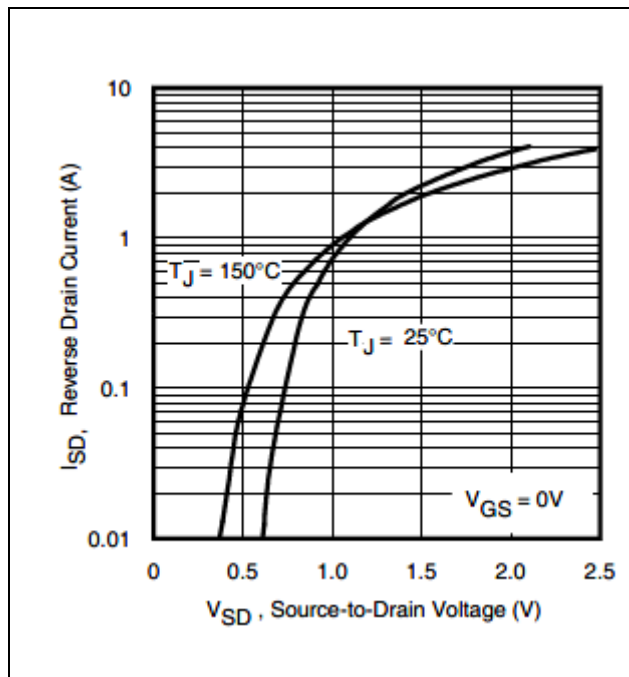


Figure 13 Typical Source-Drain Current Vs. Diode Forward Voltage

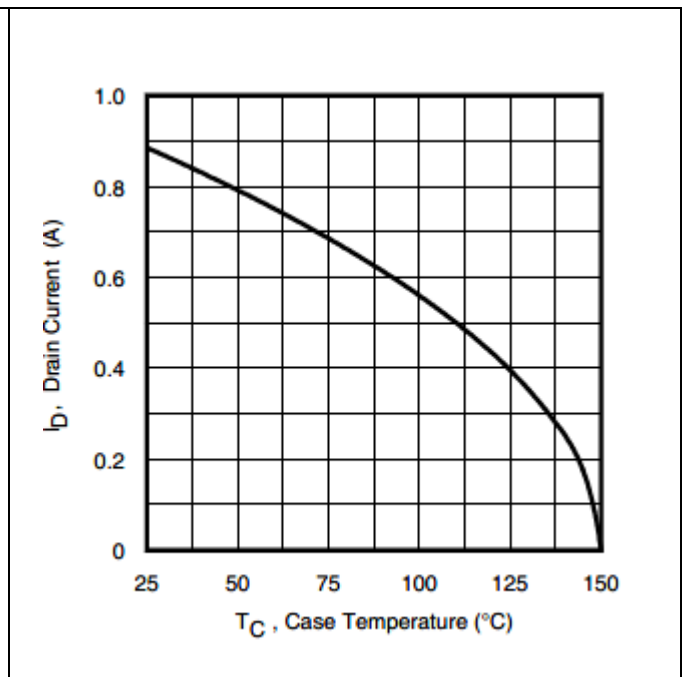


Figure 14 Maximum Drain Current Vs. Case Temperature

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Electrical Characteristics Curves (Pre-Irradiation N-channel)

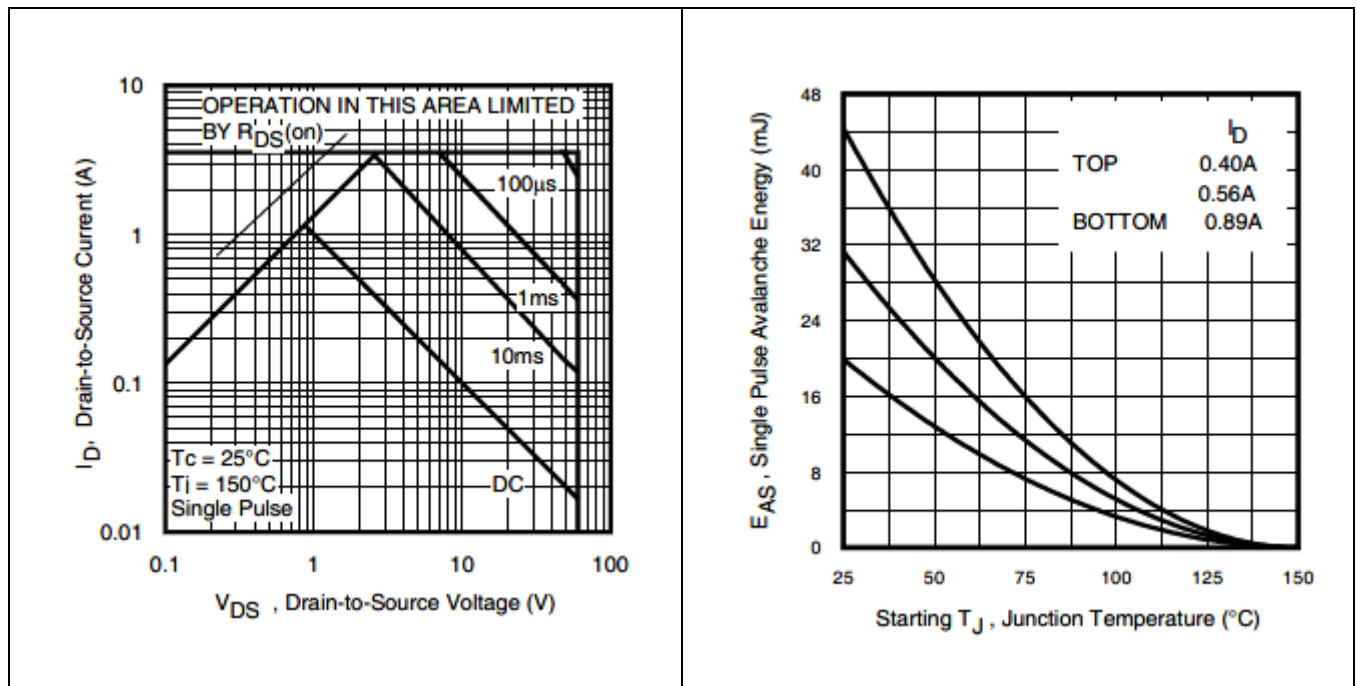


Figure 15 Maximum Safe Operating Area

Figure 16 Maximum Avalanche Energy Vs. Junction Temperature

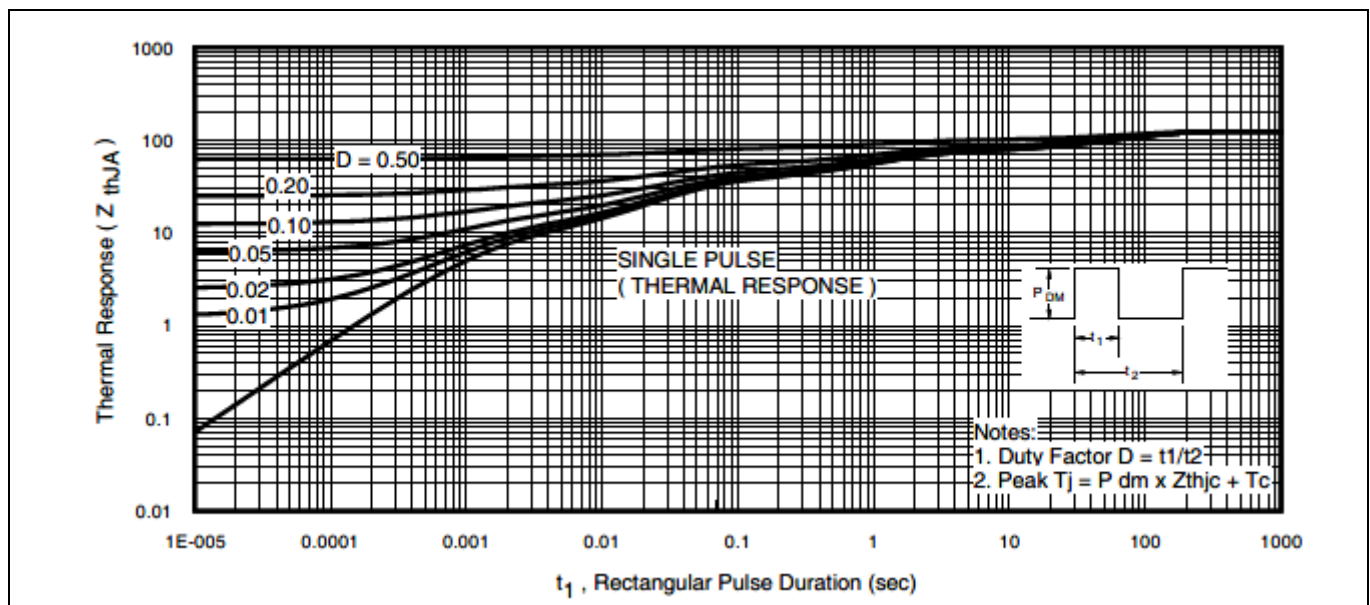


Figure 17 Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

4 Electrical Characteristics Curves (Pre-Irradiation P-channel)

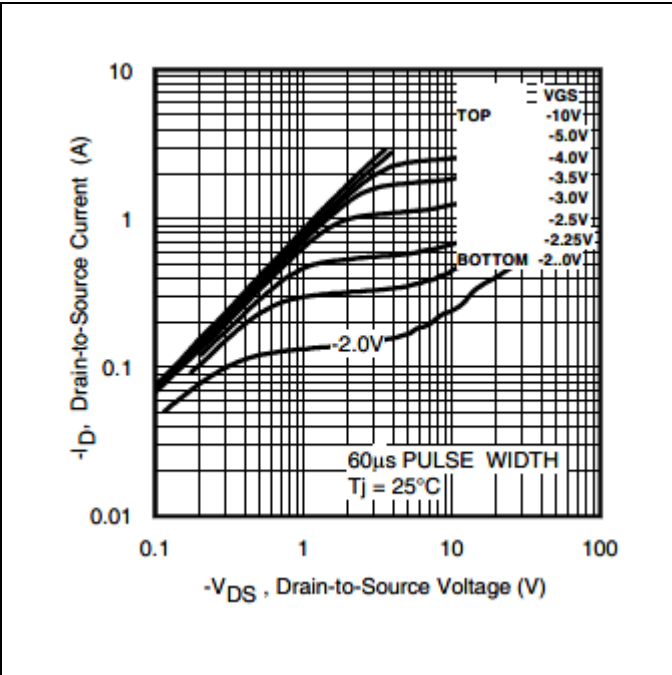


Figure 18 Typical Output Characteristics

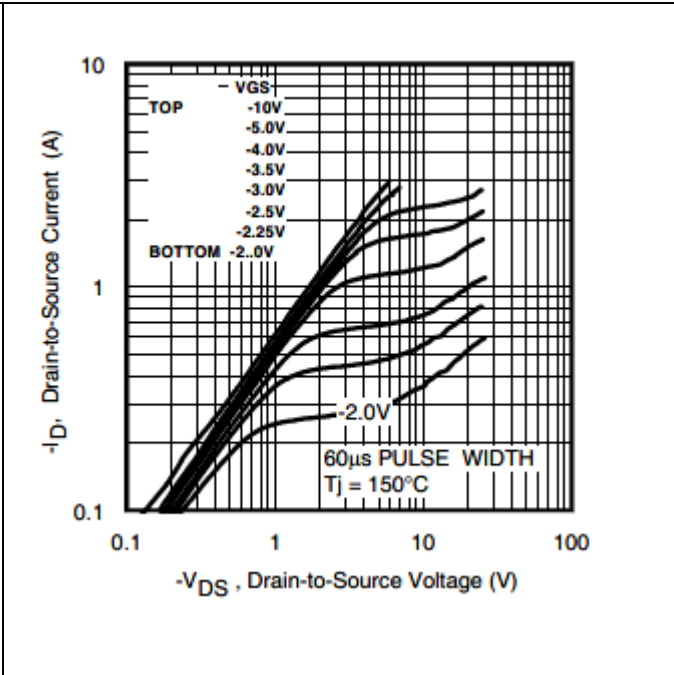


Figure 19 Typical Output Characteristics

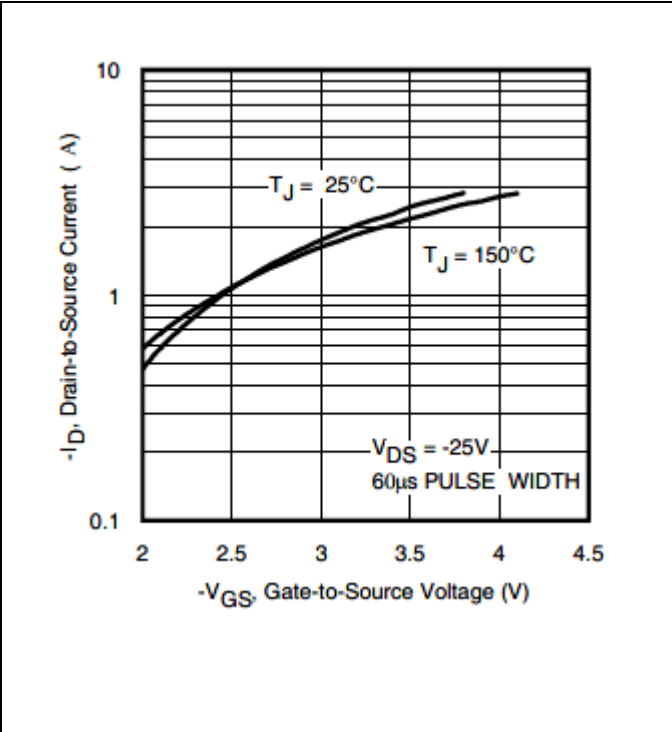


Figure 20 Typical Transfer Characteristics

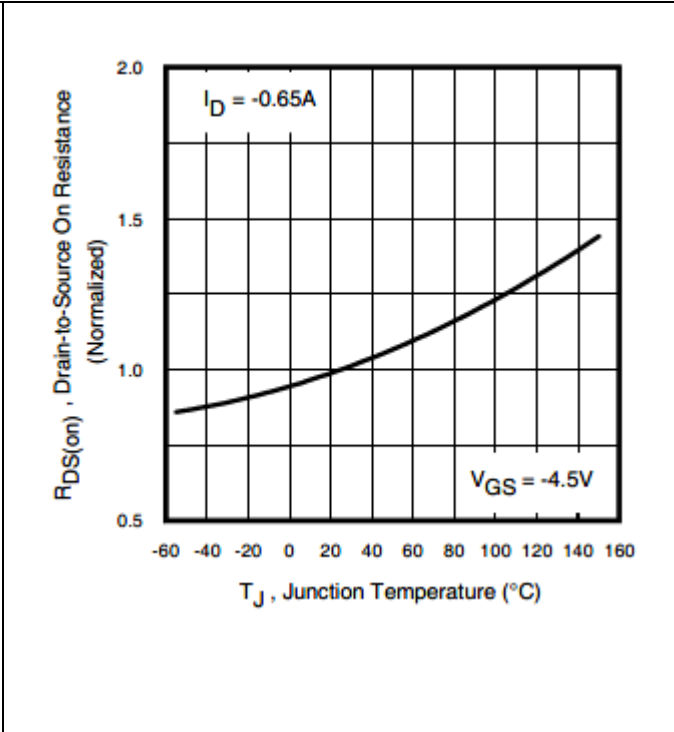


Figure 21 Normalized On-Resistance Vs. Temperature

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Electrical Characteristics Curves (Pre-Irradiation P-channel)

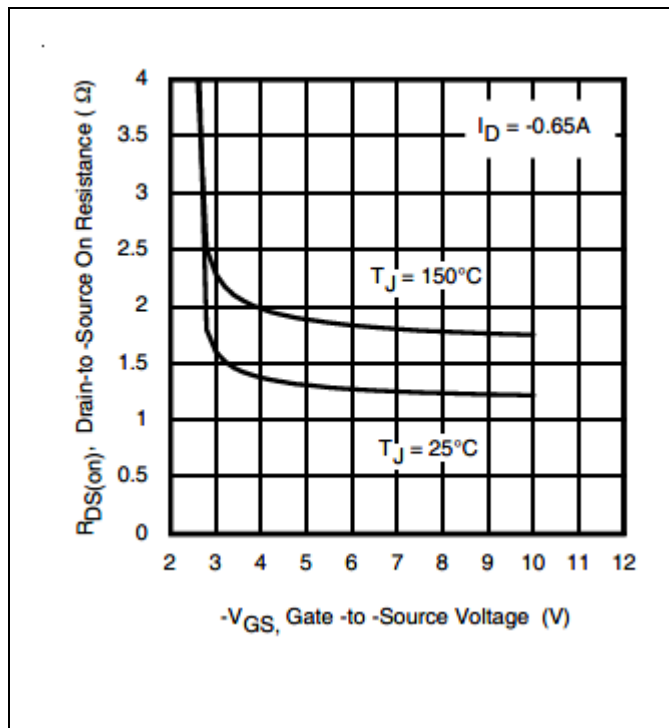


Figure 22 Typical On-Resistance Vs. Gate Voltage

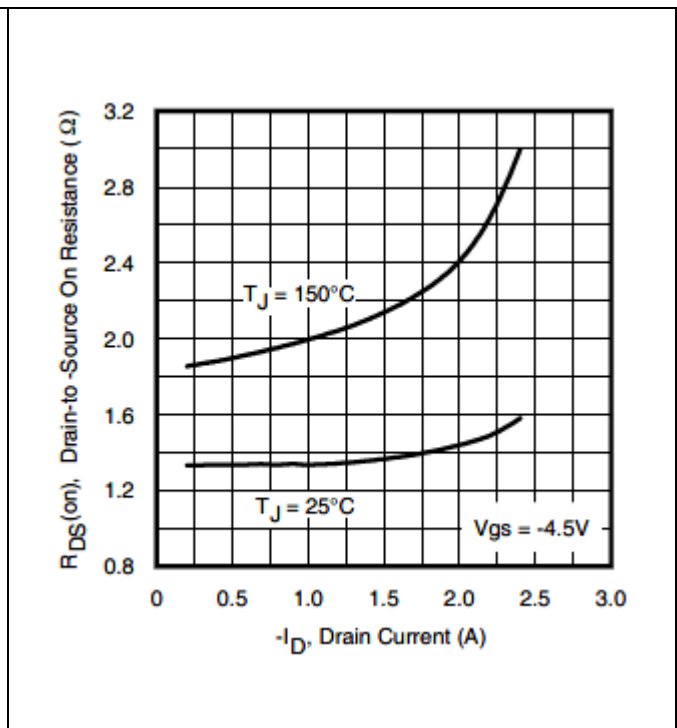


Figure 23 Typical On-Resistance Vs. Drain Current

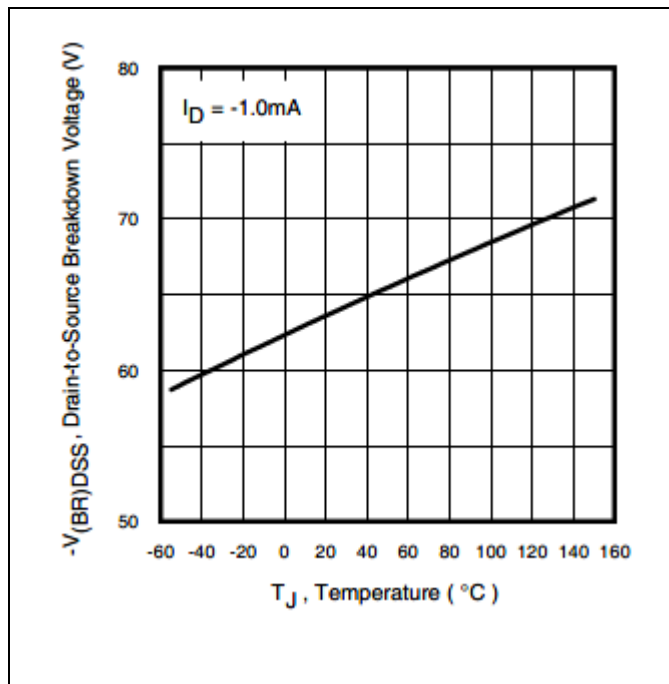


Figure 24 Typical Drain-to-Source Breakdown Voltage Vs. Temperature

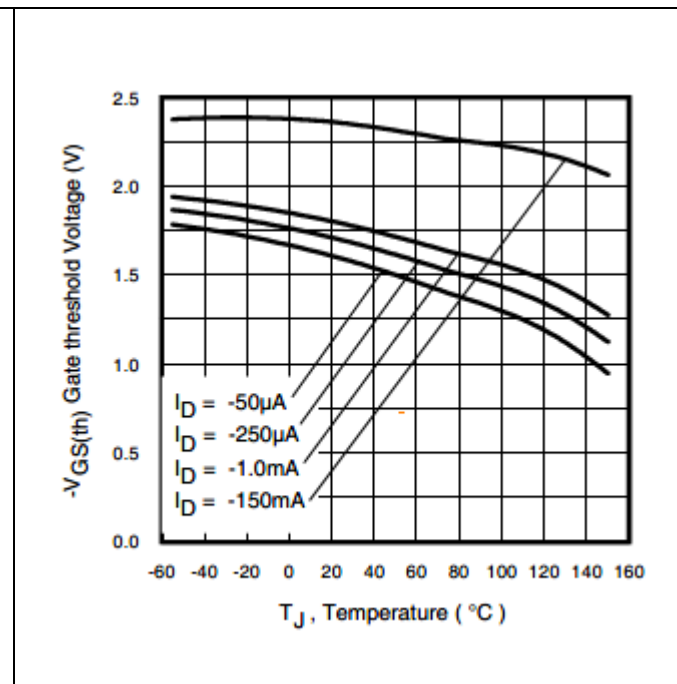


Figure 25 Typical Threshold Voltage Vs. Temperature

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Electrical Characteristics Curves (Pre-Irradiation P-channel)

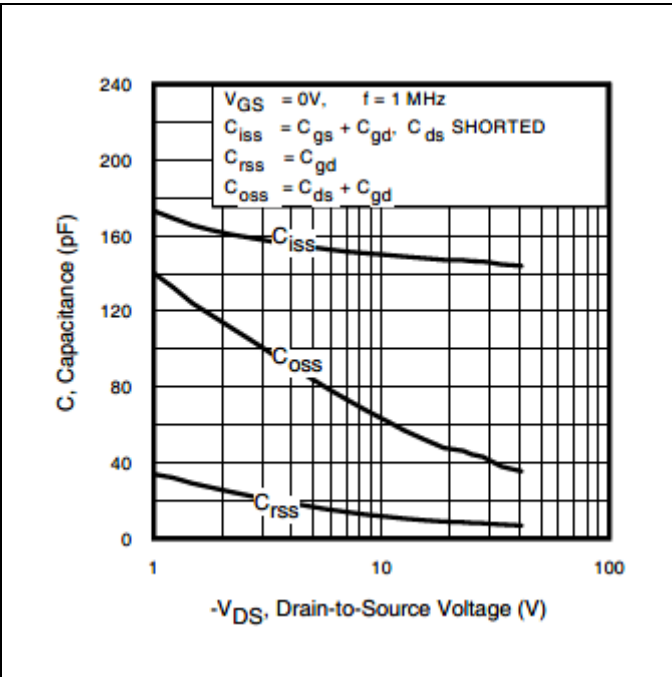


Figure 26 Typical Capacitance Vs. Drain-to-Source Voltage

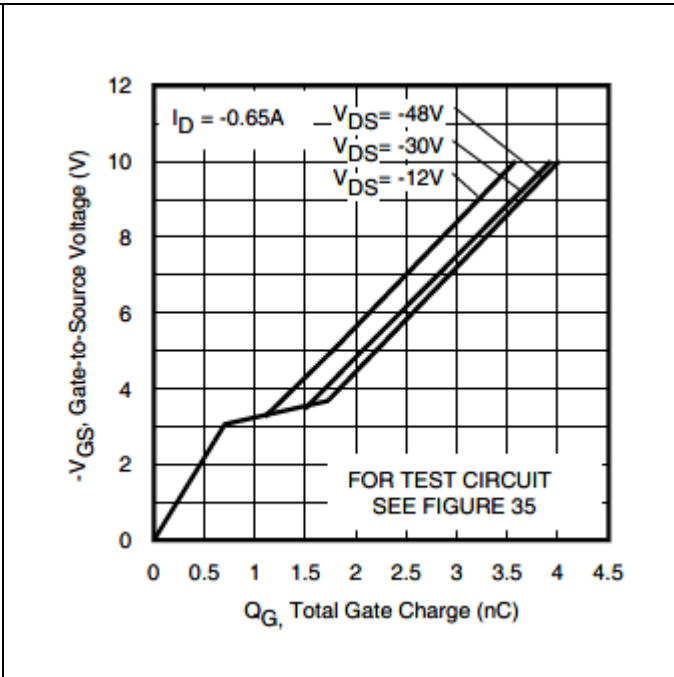


Figure 27 Gate-to-Source Voltage Vs. Typical Gate Charge

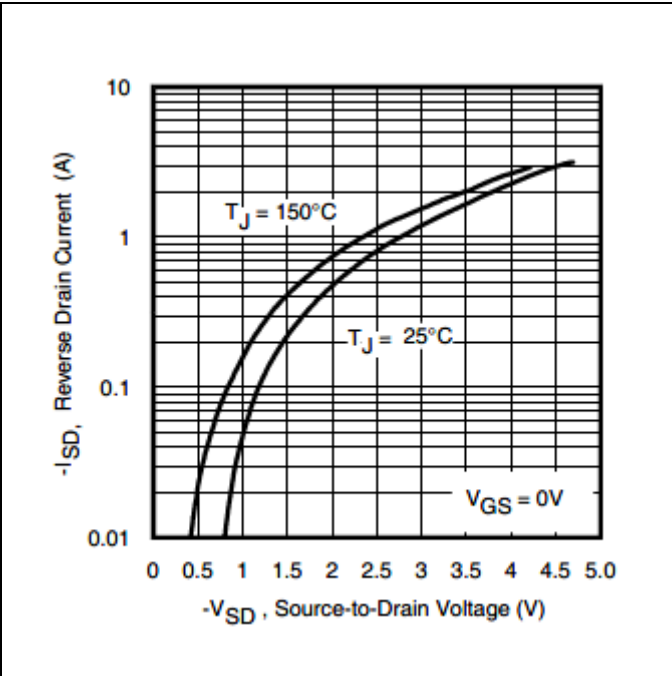


Figure 28 Typical Source-Drain Current Vs. Diode Forward Voltage

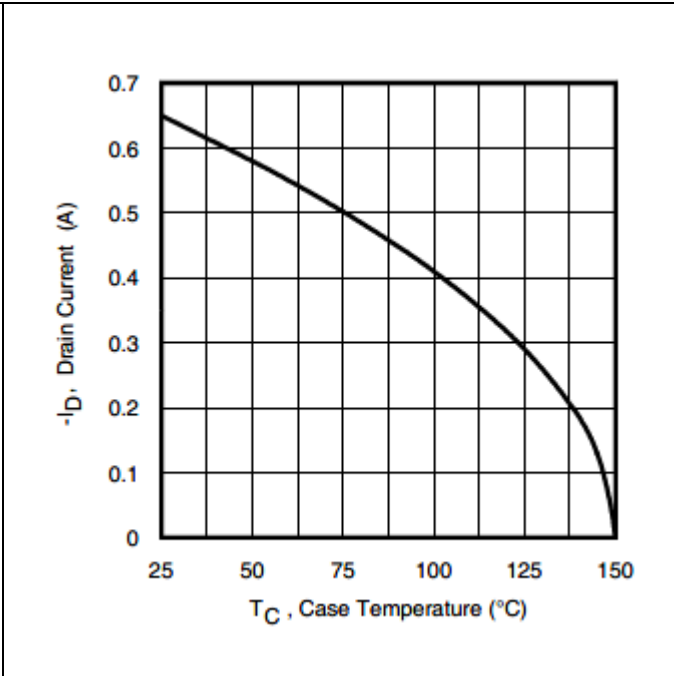


Figure 29 Maximum Drain Current Vs. Case Temperature

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Electrical Characteristics Curves (Pre-Irradiation P-channel)

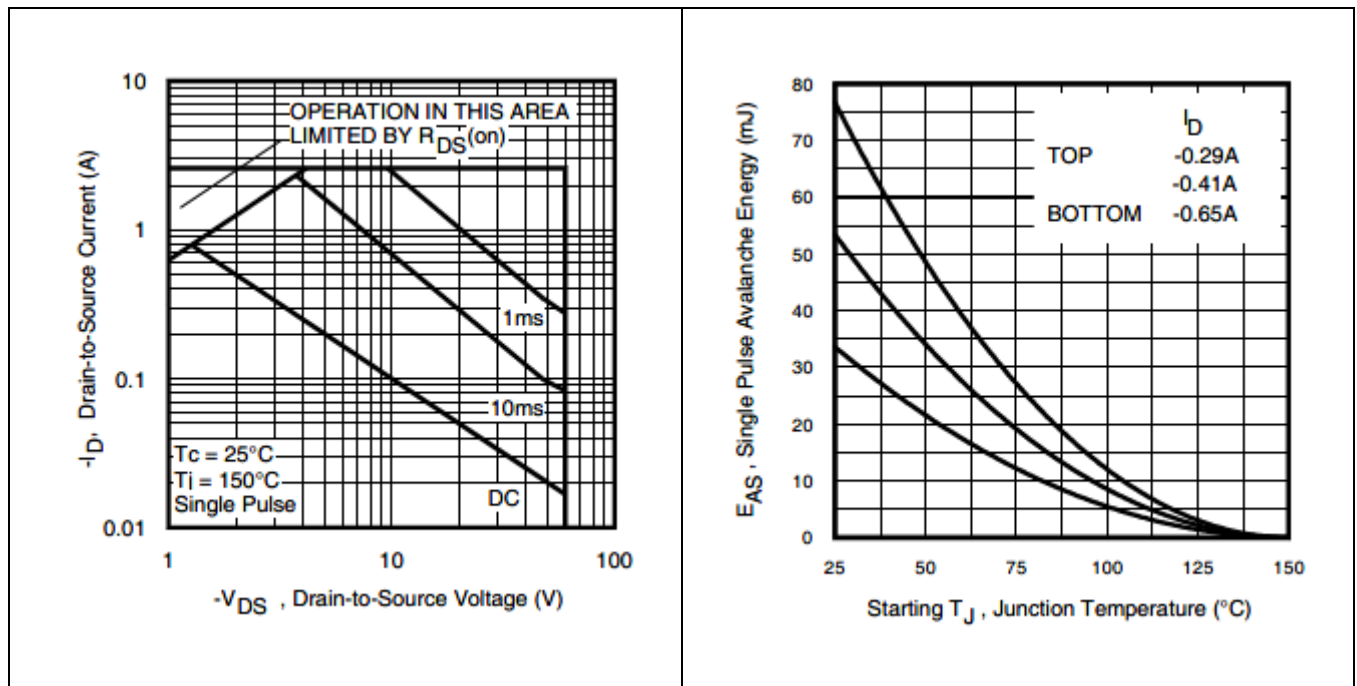


Figure 30 Maximum Safe Operating Area

Figure 31 Maximum Avalanche Energy Vs. Junction Temperature

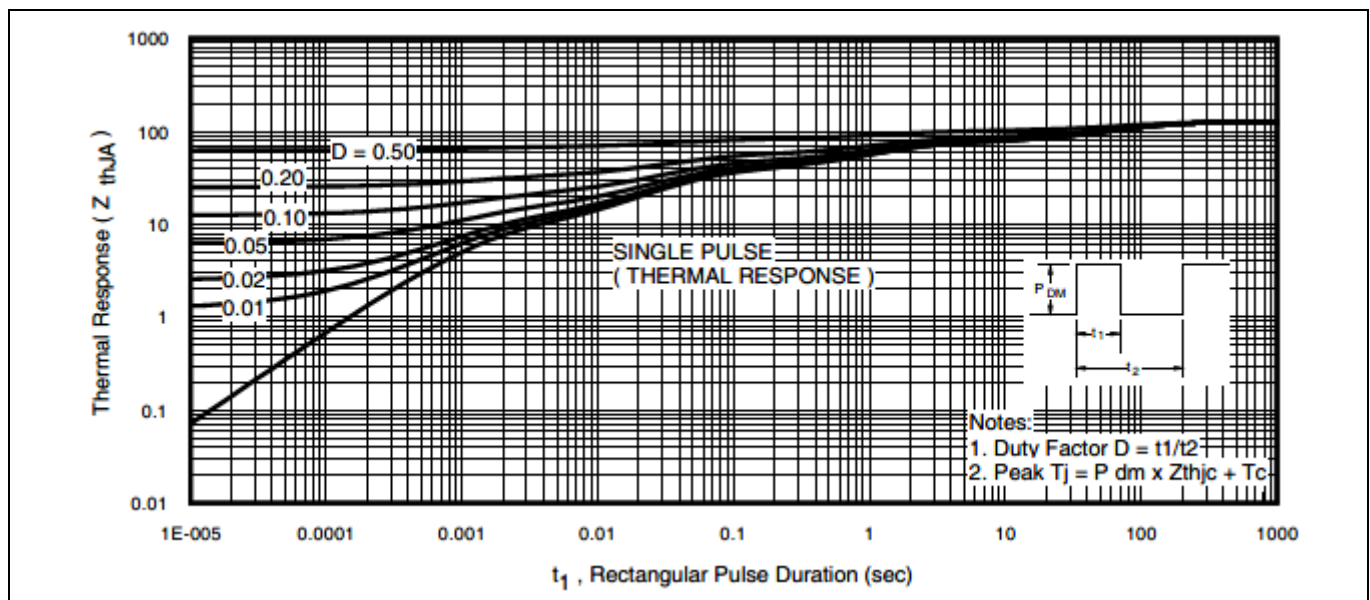


Figure 32 Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Test Circuits (Pre-Irradiation N-channel)

5 Test Circuits (Pre-Irradiation N-channel)

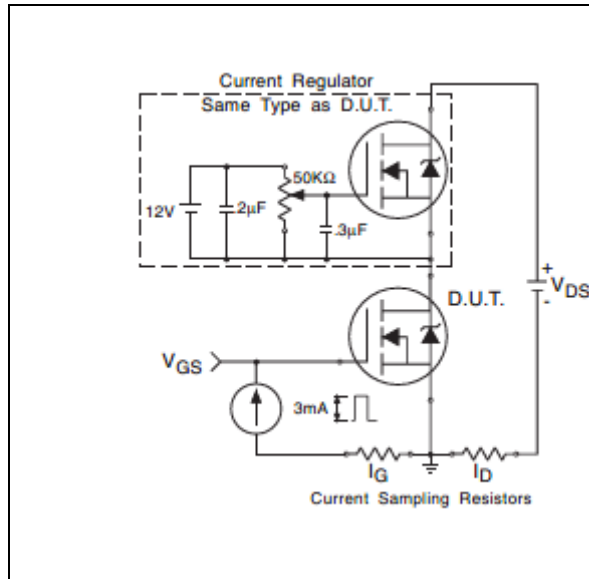


Figure 33 Gate Charge Test Circuit

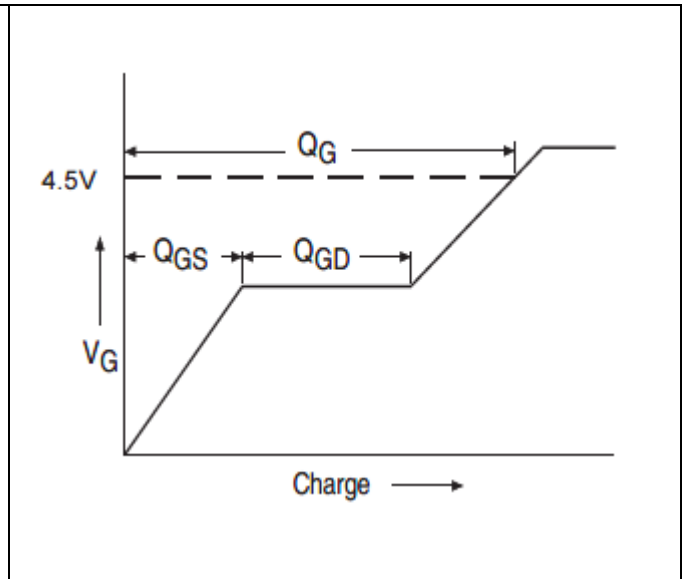


Figure 34 Gate Charge Waveform

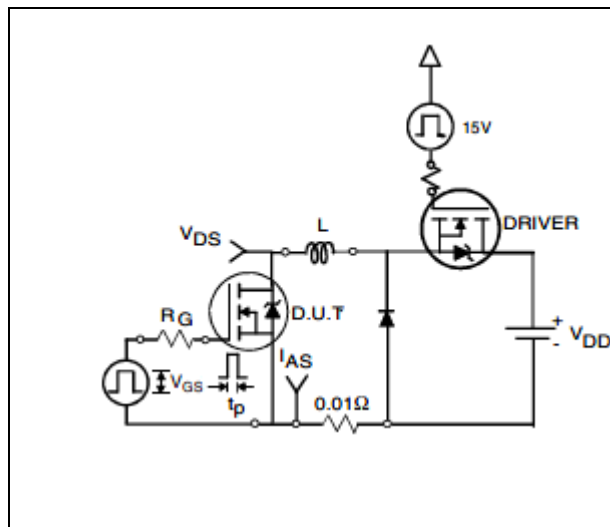


Figure 35 Unclamped Inductive Test Circuit

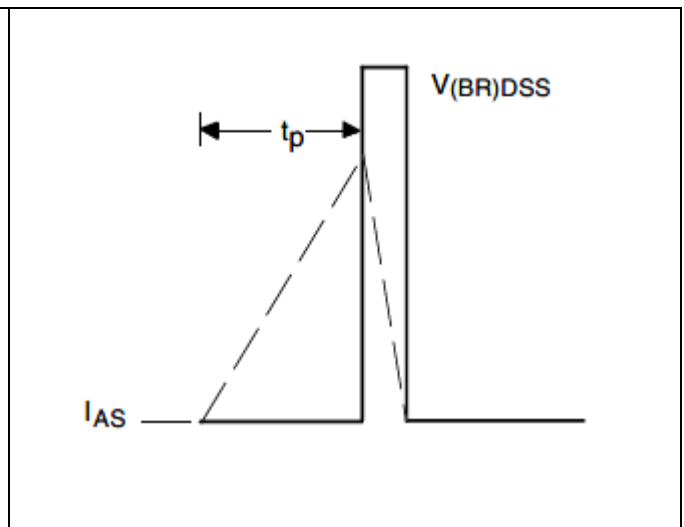


Figure 36 Unclamped Inductive Waveform

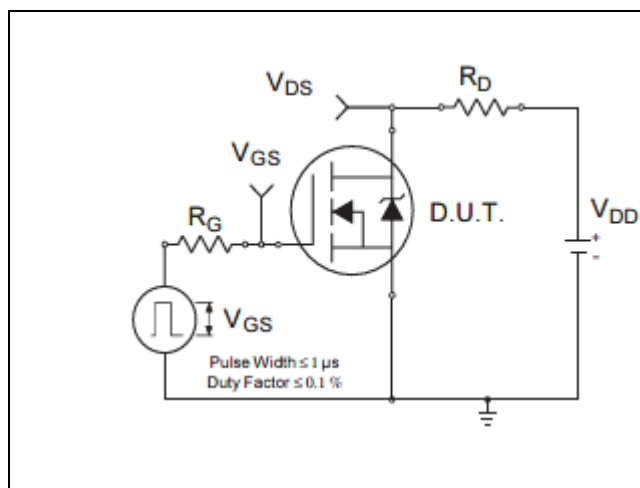


Figure 37 Switching Time Test Circuit

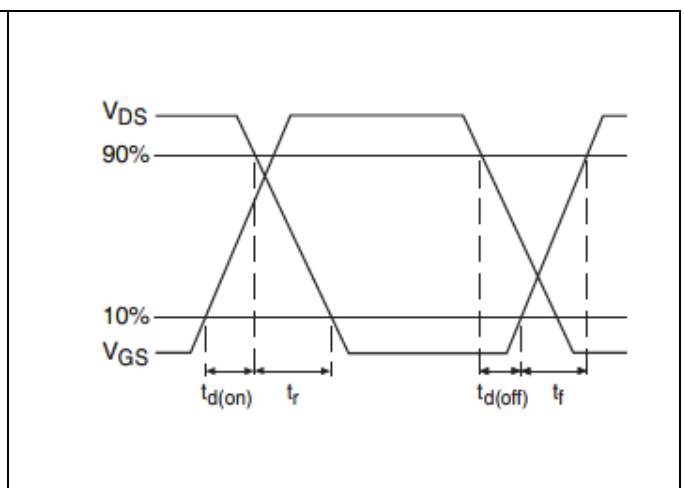


Figure 38 Switching Time Waveforms

IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Test Circuits (Pre-Irradiation P-channel)

6 Test Circuits (Pre-Irradiation P-channel)

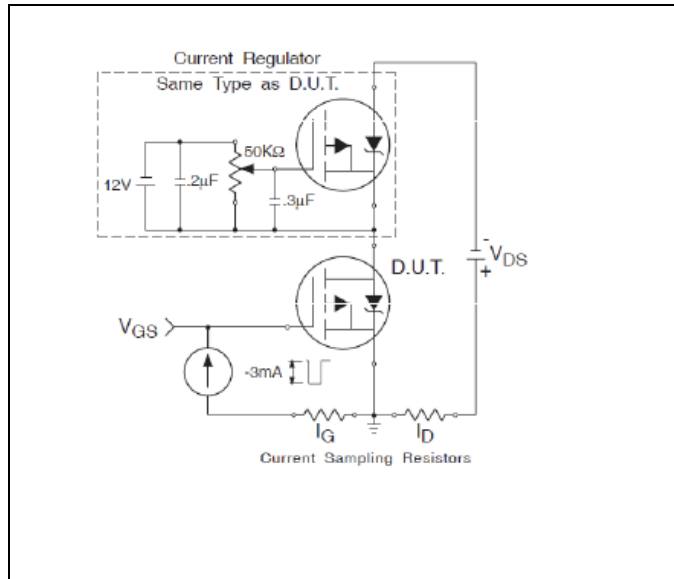


Figure 39 Gate Charge Test Circuit

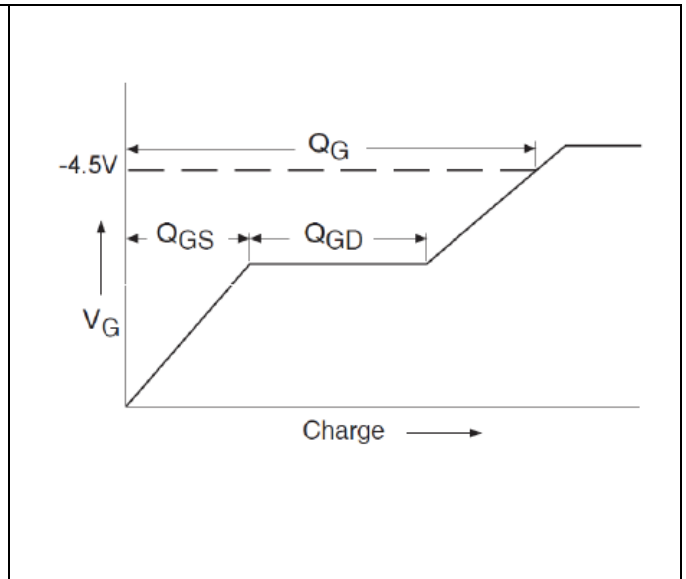


Figure 40 Gate Charge Waveform

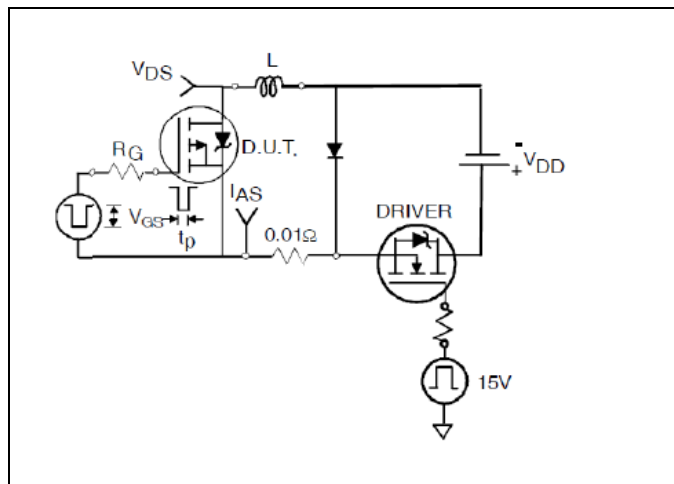


Figure 41 Unclamped Inductive Test Circuit

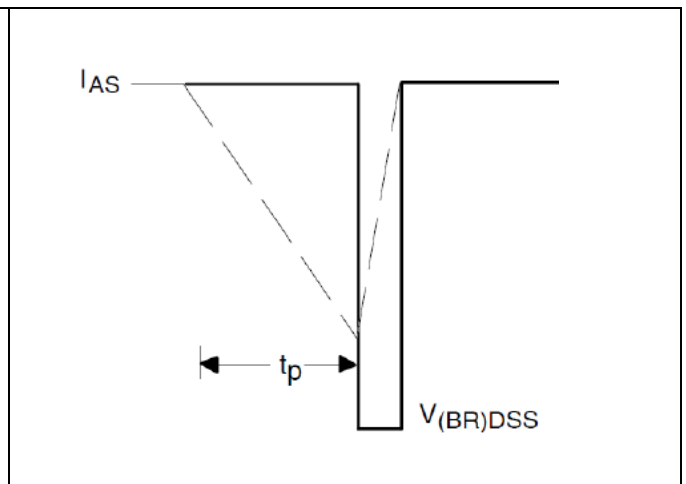


Figure 42 Unclamped Inductive Waveform

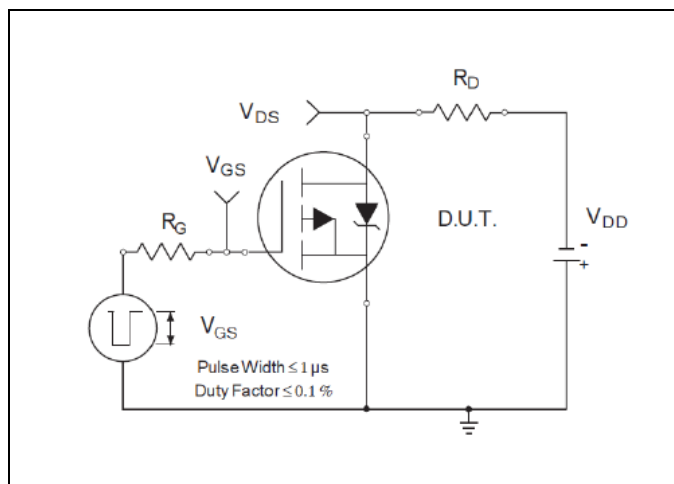


Figure 43 Switching Time Test Circuit

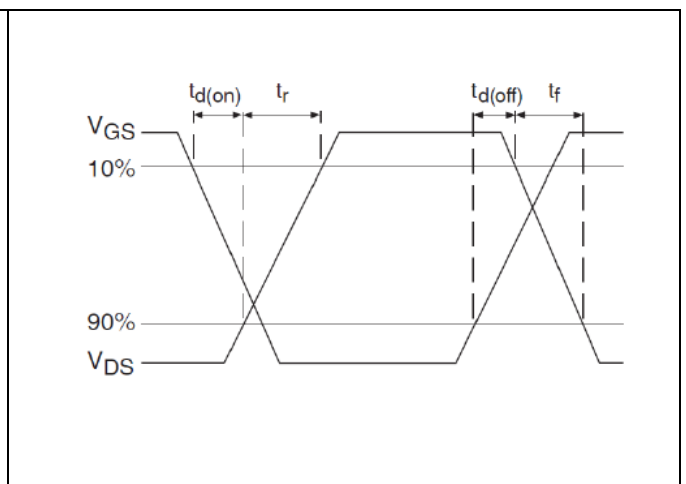


Figure 44 Switching Time Waveforms

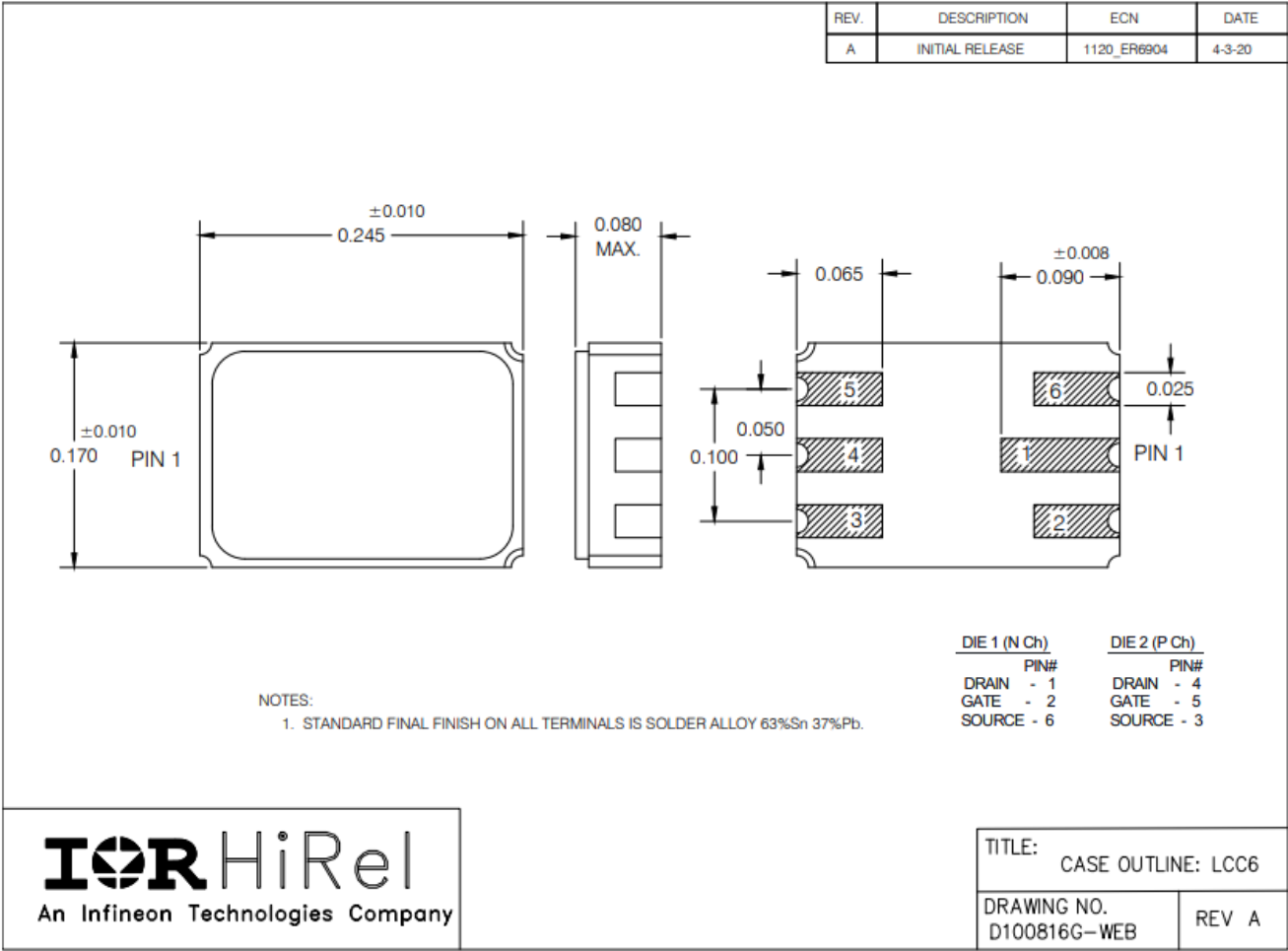
IRHLUC7670Z4

Radiation Hardened Logic Level Power MOSFET Surface-Mount (LCC-6)

Package Outline

7 Package Outline

Note: For the most updated package outline, please see the website: [LCC-6](#)



Revision history**Revision history**

Document version	Date of release	Description of changes
	03/26/2008	Datasheet (PD-94268)
Rev A	10/20/2010	Updated swtchtime
Rev B	02/13/2019	Updated based on ECN-1120_05818
Rev C	02/28/2019	Updated based on ECN-1120_06911
Rev D	08/13/2019	Updated based on ECN-1120_07306
Rev E	08/12/2022	Updated based on ECN-1120_09174

Trademarks

All referenced product or service names and trademarks are the property of t2022-08-12

Edition 2022-08-12

Published by

International Rectifier HiRel Products, Inc.

An Infineon Technologies company

**E2022E \@ "yyyy" * MERGEFORMAT
2022 Infineon Technologies AG.**

All Rights Reserved.

Do you have a question about this document?

Email: erratum@infineon.com

Document reference

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest International Rectifier HiRel Products, Inc., an Infineon Technologies company, office.

International Rectifier HiRel Components may only be used in life-support devices or systems with the expressed written approval of International Rectifier HiRel Products, Inc., an Infineon Technologies company, if failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety and effectiveness of that device or system.

Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.