ISL71148x

Neutron Test Results of the ISL71148x 8-Channel, 14-Bit 900/480ksps SAR ADC

Introduction

This report summarizes results of 1MeV equivalent neutron testing of the ISL71148x 8-Channel, 14-Bit 900/480ksps SAR ADC. This test was conducted on samples of the ISL71148M to determine the sensitivity of the part to displacement damage (DD) caused by neutron or proton environments but is applicable to all versions of this part on various flows (Rad-Tolerant Plastic, Rad-Hard Plastic, and Rad-Hard Hermetic). Neutron fluences ranged from 5×10^{11}n/cm^2 to 1×10^{13}n/cm^2.

Product Description

The ISL71148M is a radiation-tolerant 8-channel high-precision 14-bit, 900/480ksps SAR Analog-to-Digital Converter (ADC). The ADC core is preceded by eight fully differential analog input channels, a buffered 8-to-1 multiplexer, and a PGA (Programmable Gain Amplifier). The device features a peak SNR of 83.2dBFS when operating at 900ksps. With the PGA enabled, sampling rates up to 480ksps are supported. The PGA can be bypassed to increase the sample rate to 900ksps.

The product features 900/480ksps throughput with no data latency, excellent linearity, and dynamic accuracy. The ISL71148M offers a high-speed SPI-compatible serial interface that supports logic ranging from 2.2V to 3.6V using a separate digital I/O supply pin.

The ISL71148M offers a separate low-power mode (LPM) pin that reduces power dissipation at lower sample rates. An external reference with a supported input range of 2.4V to 2.6V determines the analog input signal range. A block diagram is shown in Figure 1.

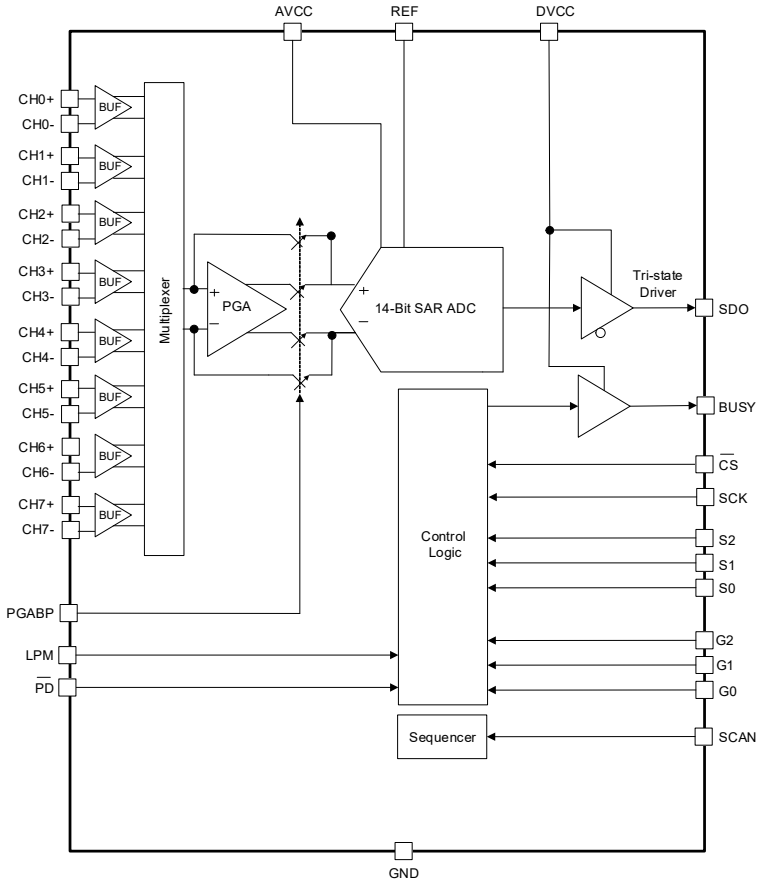

Figure 1. Block Diagram

The ISL71148M is available in a 48-lead Thin Quad Flat-Pack (TQFP) space plastic. The pin assignments for the ISL71148M is shown in Figure 2.

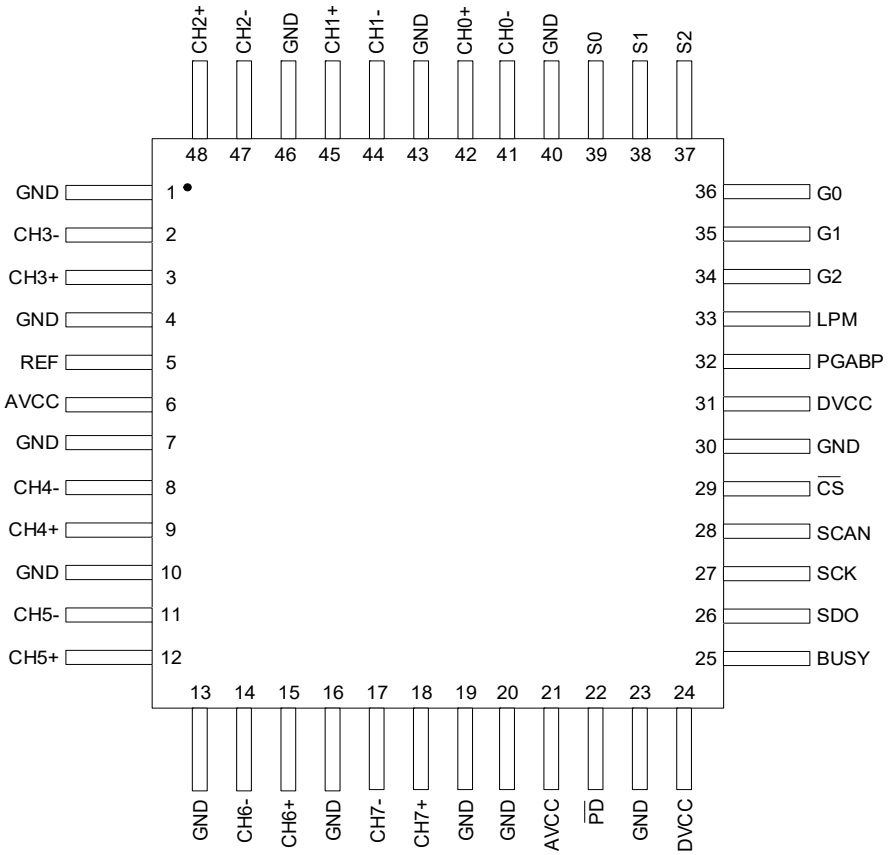

Figure 2. Pin Assignments - Top View

Related Information

For a full list of related documents, visit our website:

- ISL71148M and ISL71148SLH device pages
- MIL-STD-883 Test Method 1017

Contents

1. Test Description

1.1 Irradiation Facilities

Neutron fluence irradiations were performed on the test samples on May 27, 2025, at the University of Massachusetts, Lowell (UMASS Lowell) fast neutron irradiator per Mil-STD-883G, Method 1017.2, with each part unpowered during irradiation. The target irradiation levels were 5×10^{11}n/cm^2, 2×10^{12}n/cm^2, and 1×10^{13}n/cm^2. The parts were shipped back to Renesas (Palm Bay, FL) for post-irradiation electrical testing.

1.2 Test Fixturing

No formal irradiation test fixturing is involved, as these DD tests are bag tests in the sense that the parts are irradiated with all leads unbiased.

1.3 Radiation Dosimetry

Table 1 shows dosimetry from UMASS Lowell indicating the total accumulated gamma dose and actual neutron fluence exposure levels for each set of samples.

Table 1. ISL71148M Neutron Fluence Dosimetry Data

Irradiation	Requested Fluence (n/cm^2)	Reactor Power (kW)	Time (s)	Flux (n/cm^2-s)[1][2]	Gamma Dose (rad(Si))[3]	Measured Fluence (n/cm^2)[4]
CRF#98191-C	5.00E+11	40	262	3.06E+09	119	6.12E+11
CRF#98191-D	2.00E+12	80	531	6.12E+09	484	2.38E+12
CRF#98191-E	1.00E+13	800	266	6.12E+10	2424	1.19E+13

1. Dosimetry method: ASTM E-265.
2. The neutron fluence rate is determined from *Initial Testing of the New Ex-Core Fast Neutron Irradiator at UMass Lowell* (6/18/02). Validated on 6/07/2011 under the Trident II D5LE neutron facility study by Navy Crane. Re-affirmed 8/1/17 using SACRR transistor transfer calibration based on ASTM E1855 – 15.
3. Based on reactor power at 1000kW, the gamma dose is 41 ±5.3% krad(Si)/hr as mapped by TLD-based dosimetry.
4. Validated by S-32 flux monitors.

1.4 Characterization Equipment and Procedures

Electrical testing was performed before and after irradiation using the Renesas production automated test equipment (ATE). All electrical testing was performed at room temperature.

1.5 Experimental Matrix

Testing proceeded in general accordance with the guidelines of MIL-STD-883 TM 1017. The experimental matrix consisted of five samples to be irradiated at 5×10^{11}n/cm^2, five to be irradiated at 2×10^{12}n/cm^2, and five to be irradiated at 1×10^{13}n/cm^2. The actual levels achieved, which are shown in Table 1, were 6.12×10^{11}n/cm^2, 2.38×10^{12}n/cm^2, and 1.19×10^{13}n/cm^2. Three control units were used.

The 18 ISL71148M samples were drawn from Lot F6XR21.1, which were packaged in the 48Ld TQFP-EP.

2. Test Results

Neutron testing of the ISL71148M is complete and the results are reported in the balance of this report. It should be noted when interpreting the data that each neutron irradiation was performed on a different set of samples; this is not total dose testing, where the damage is cumulative. Each marker represents a different set of five samples. The line connecting them is for trend visualization only.

2.1 Attributes Data

Table 2 shows the ISL71148M attributes data.

Table 2. ISL71148M Attributes Data

1MeV Fluence, (n/cm^2)		Sample Size	Pass[1]	Fail	Notes
Planned	Actual				
5×10^{11}	6.12E+11	5	5	0	All passed
2×10^{12}	2.38E+12	5	5	0	All passed
1×10^{13}	1.19E+13	5	5	0	All passed

1. A Pass indicates a sample that passes all post-irradiation datasheet limits.

2.2 Key Parameter Variables Data

The plots in Figure 3 through Figure 48 show data plots for selected key parameters before and after irradiation to each neutron fluence level. The plots show the mean of each parameter as a function of neutron irradiation. Each marker represents a different set of five samples. The line connecting them is for trend visualization only. The plots also include error bars at each downpoint, representing the minimum and maximum measured values of the samples, although in some plots the error bars might not be visible due to their values compared to the scale of the graph. The applicable electrical limits taken from the datasheet are also shown.

The irradiated parts passed all tested parameters up to the highest actual fluence of $1.19\times10^{13}n/cm^2$.

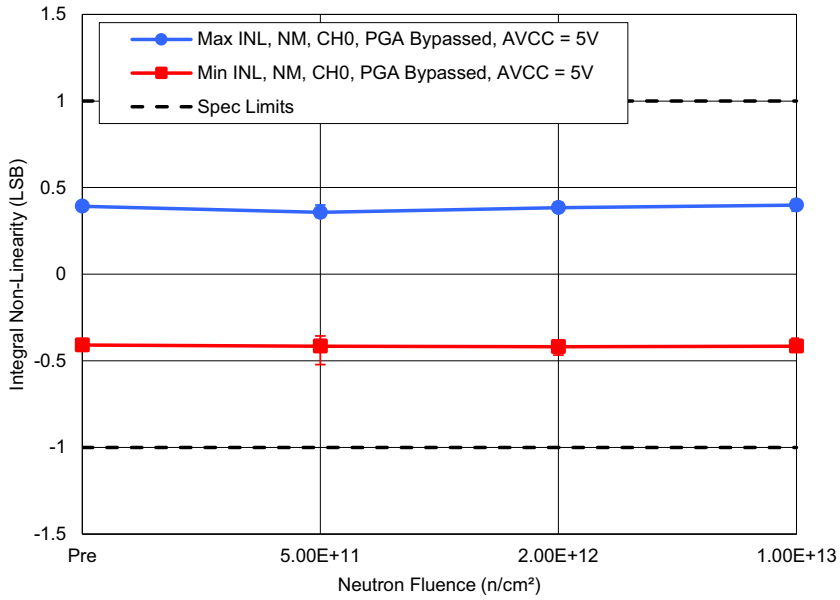

Figure 3. ISL71148M average CH0 minimum and maximum integral non-linearity (INL) in normal operating mode (NM) with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of -1LSB and a maximum of 1LSB.

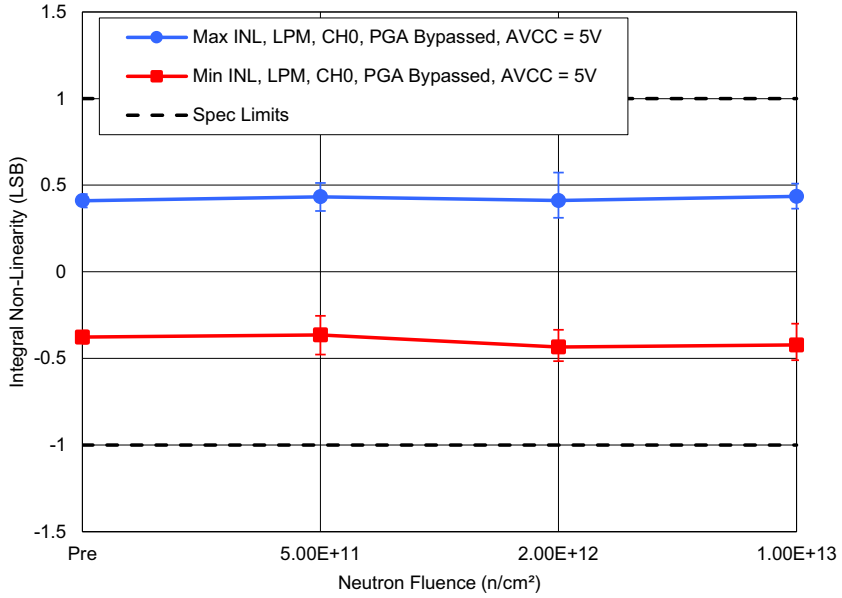

Figure 4. ISL71148M average CH0 minimum and maximum integral non-linearity (INL) in low-power operating mode (LPM) with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of -1LSB and a maximum of 1LSB.

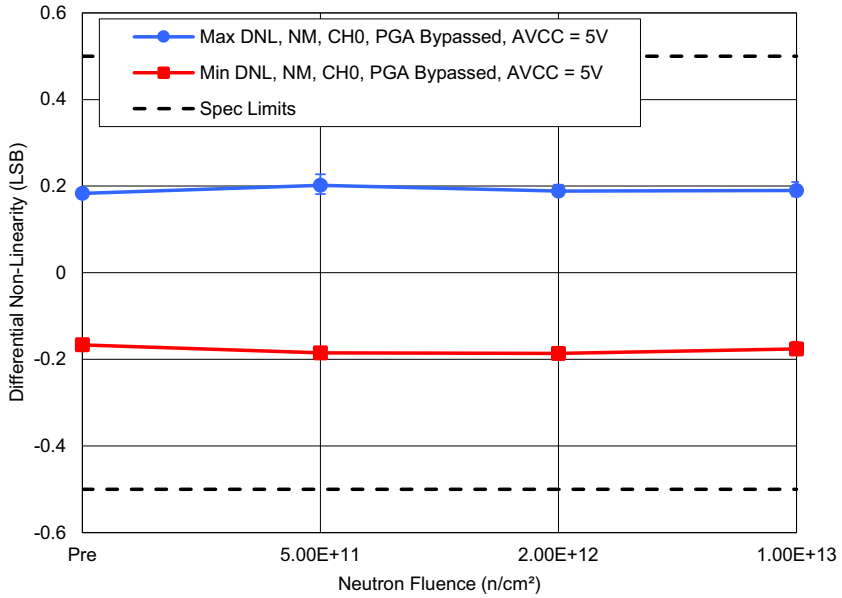

Figure 5. ISL71148M average CH0 minimum and maximum differential non-linearity (DNL) in normal operating mode (NM) with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of -0.5LSB and a maximum of 0.5LSB.

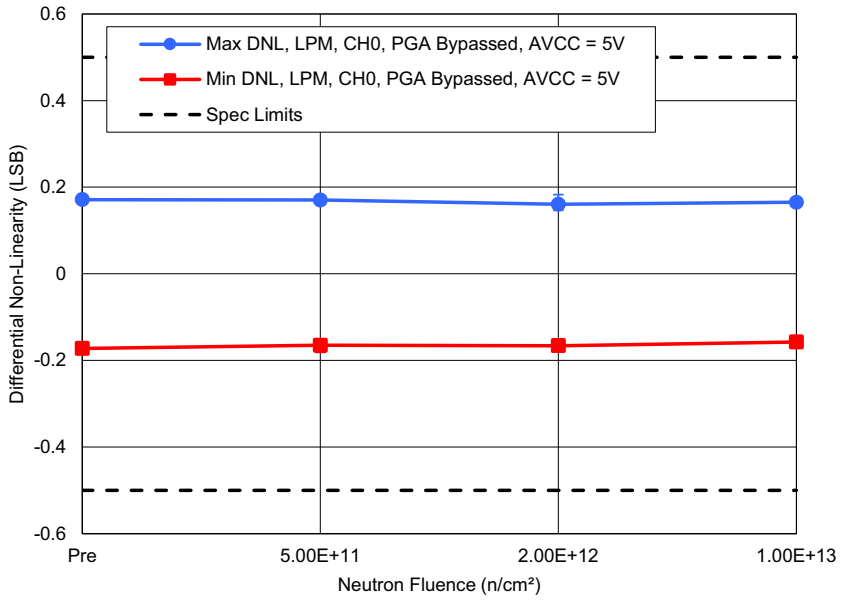

Figure 6. ISL71148M average CH0 minimum and maximum differential non-linearity (DNL) in low-power operating mode (LPM) with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of -0.5LSB and a maximum of 0.5LSB.

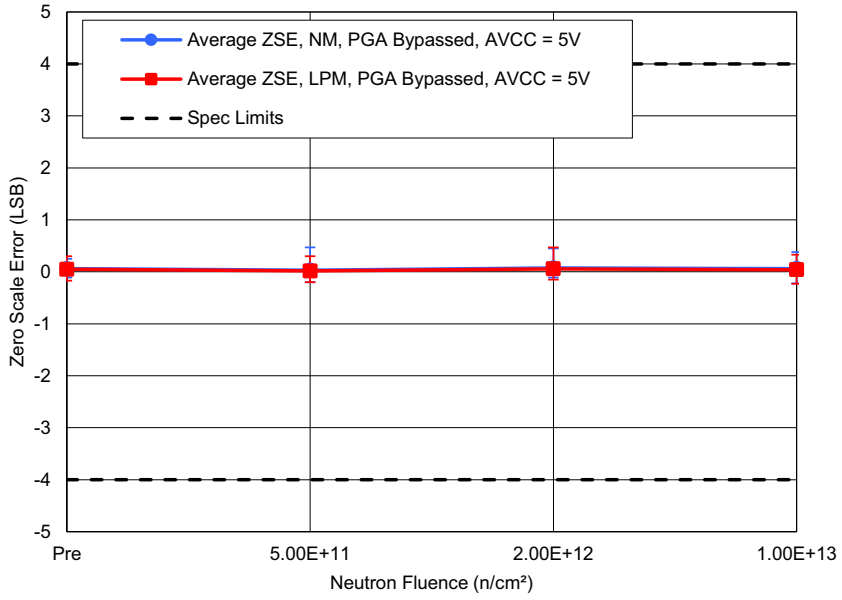

Figure 7. ISL71148M average zero-scale error (ZSE) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limits are a minimum of -4LSB and a maximum of 4LSB.

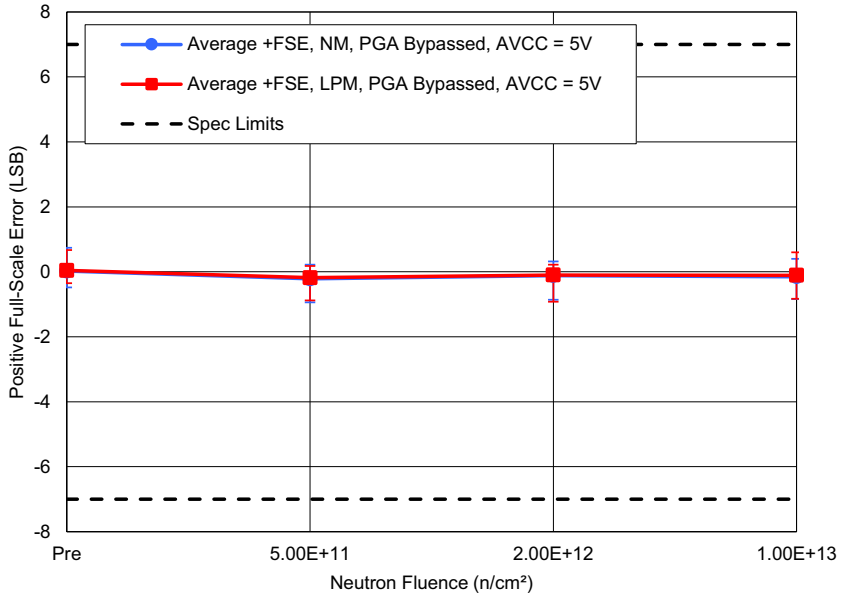

Figure 8. ISL71148M average positive full-scale error (+FSE) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limits are a minimum of -7LSB and a maximum of 7LSB.

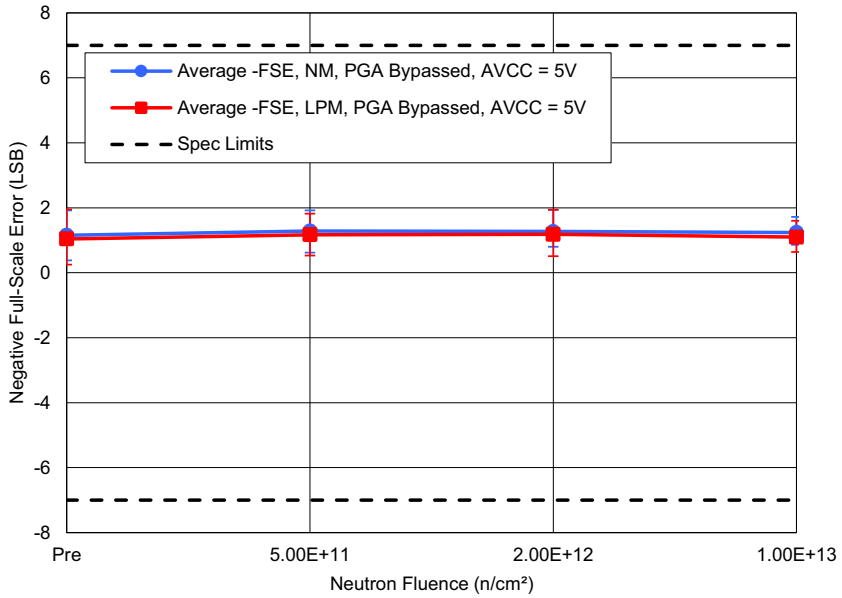

Figure 9. ISL71148M average negative full-scale error (-FSE) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limits are a minimum of -7LSB and a maximum of 7LSB.

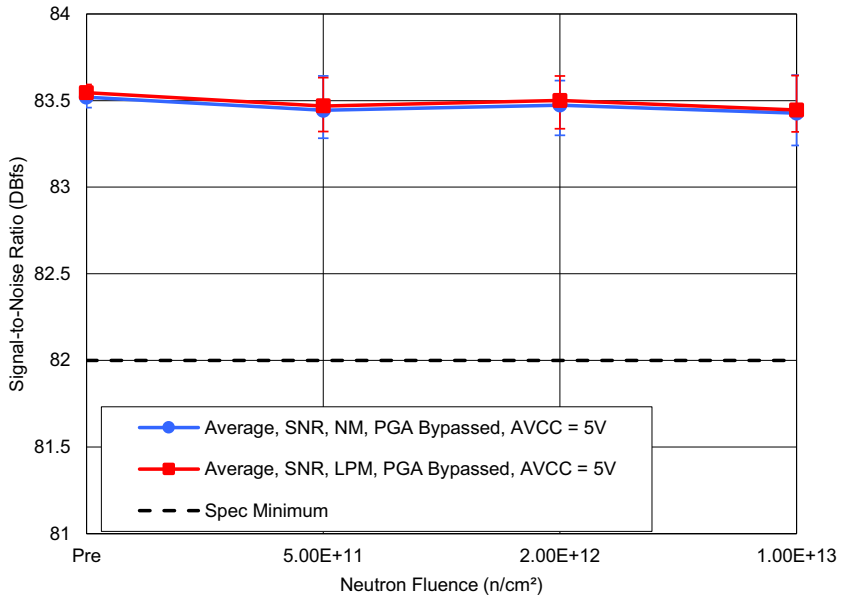

Figure 10. ISL71148M average signal-to-noise ratio (SNR) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 82dBFS.

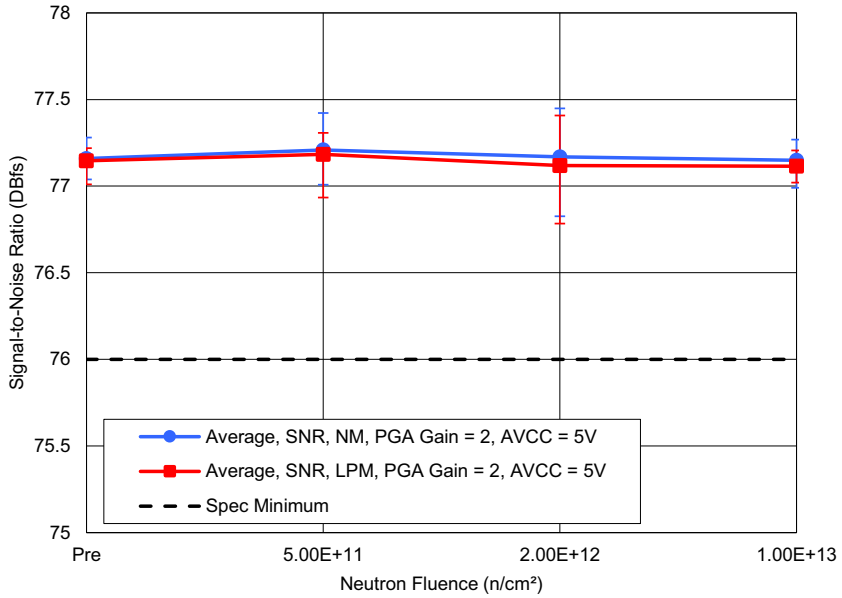

Figure 11. ISL71148M average signal-to-noise ratio (SNR) in normal or low-power operating mode with AV_{CC} = 5V and PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 76dBFS.

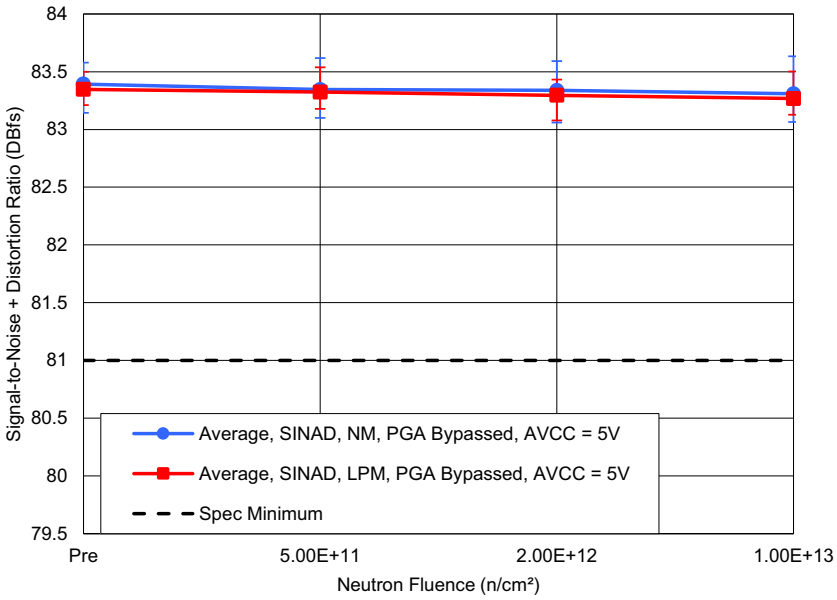

Figure 12. ISL71148M average signal to noise + distortion ratio (SINAD) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 81dBFS.

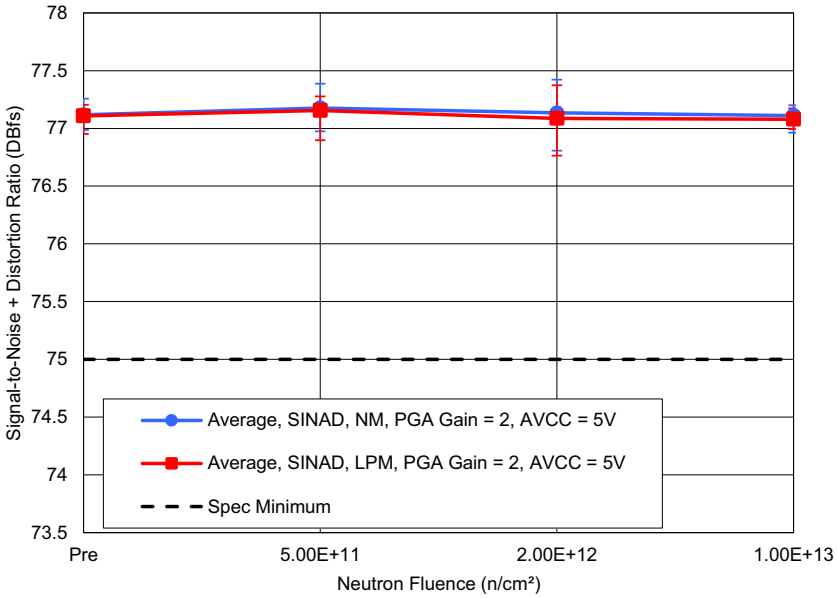

Figure 13. ISL71148M average signal to noise + distortion ratio (SINAD) in normal or low-power operating mode with AV_{CC} = 5V and PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 75dBFS.

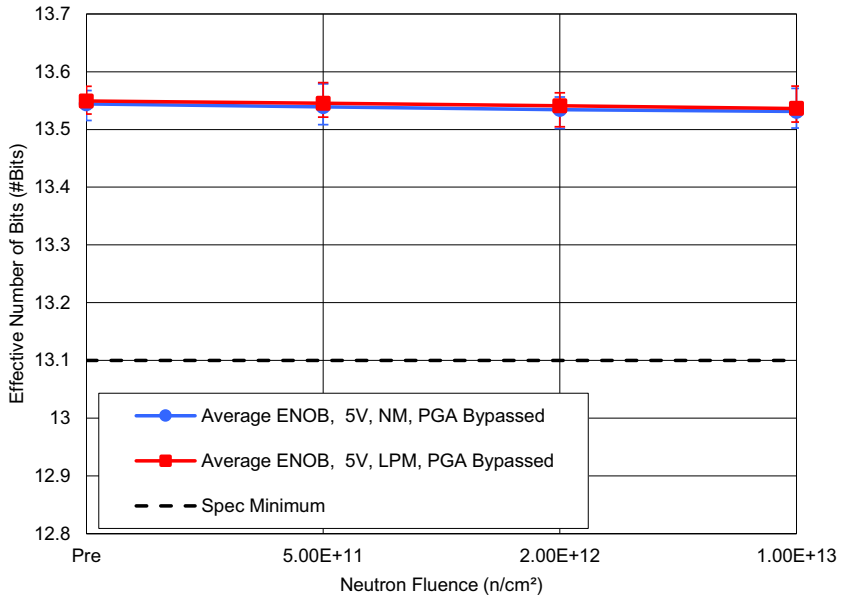

Figure 14. ISL71148M average effective number of bits (ENOB) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 13.1bits.

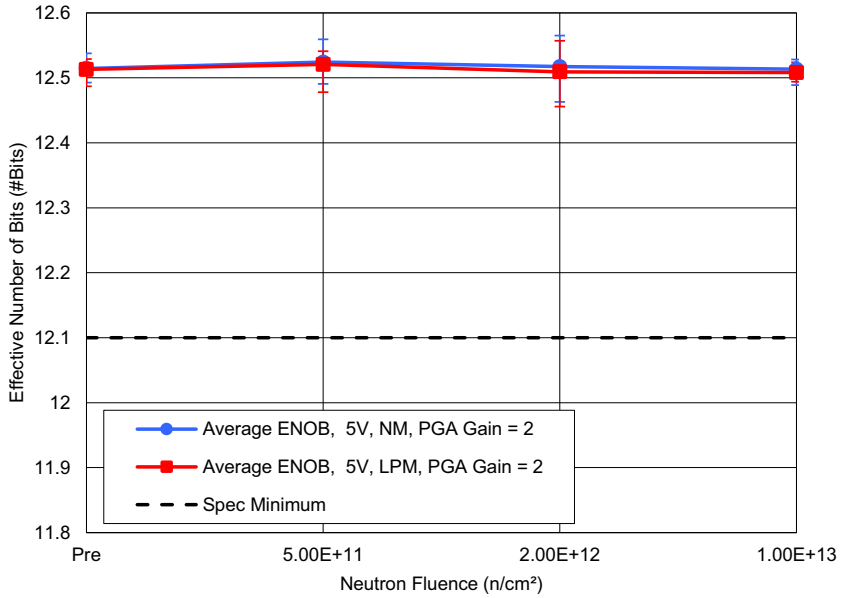

Figure 15. ISL71148M average effective number of bits (ENOB) in normal or low-power operating mode with AV_{CC} = 5V and PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 12.1bits.

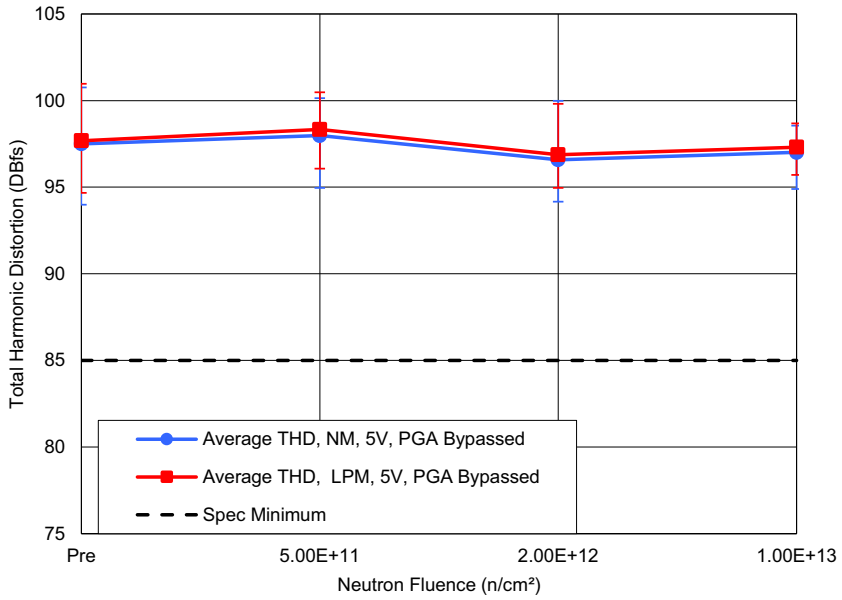

Figure 16. ISL71148M average total harmonic distortion (THD) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 85dBFS.

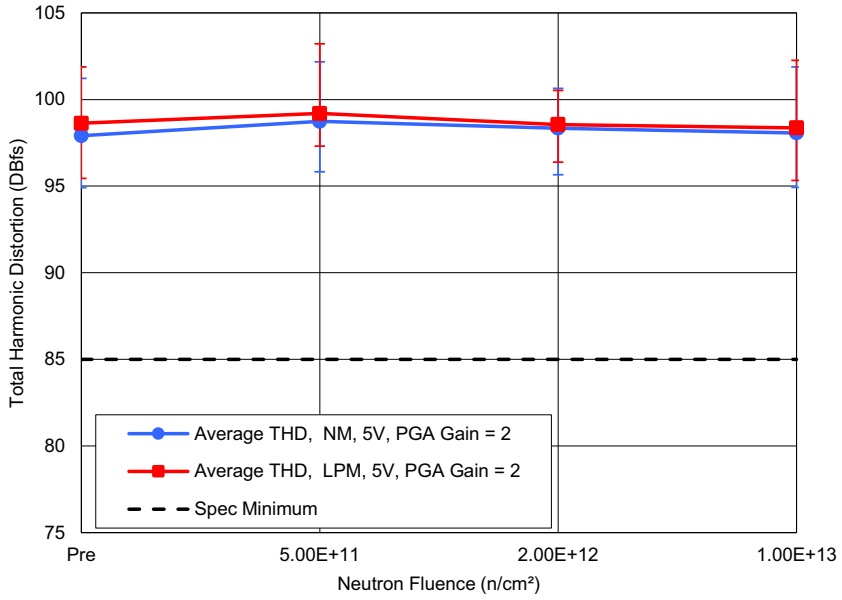

Figure 17. ISL71148M average total harmonic distortion (THD) in normal or low-power operating mode with AV_{CC} = 5V and PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 85dBFS.

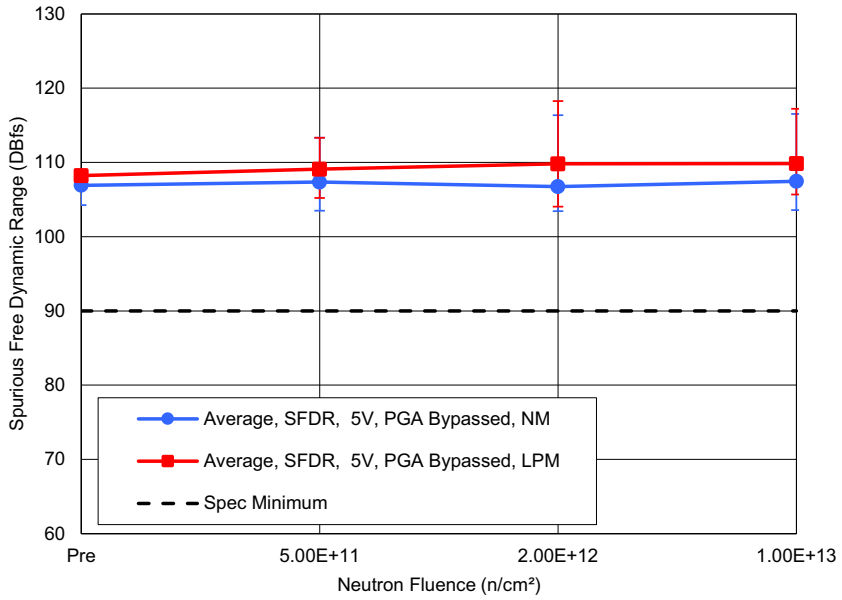

Figure 18. ISL71148M average spurious free dynamic range (SFDR) in normal or low-power operating mode with AV_{CC} = 5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 90dBFS.

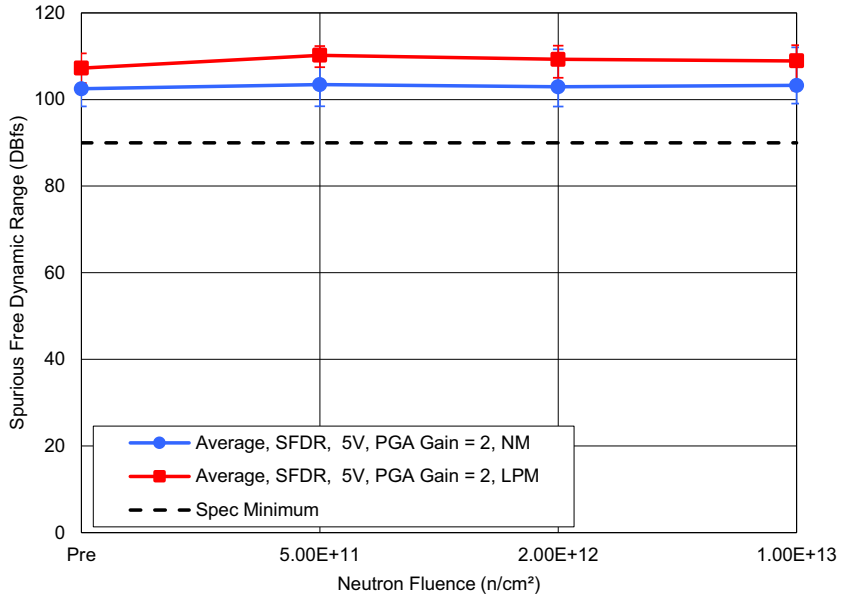

Figure 19. ISL71148M average spurious free dynamic range (SFDR) in normal or low-power operating mode with AV_{CC} = 5V and PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limit is a minimum of 90dBFS.

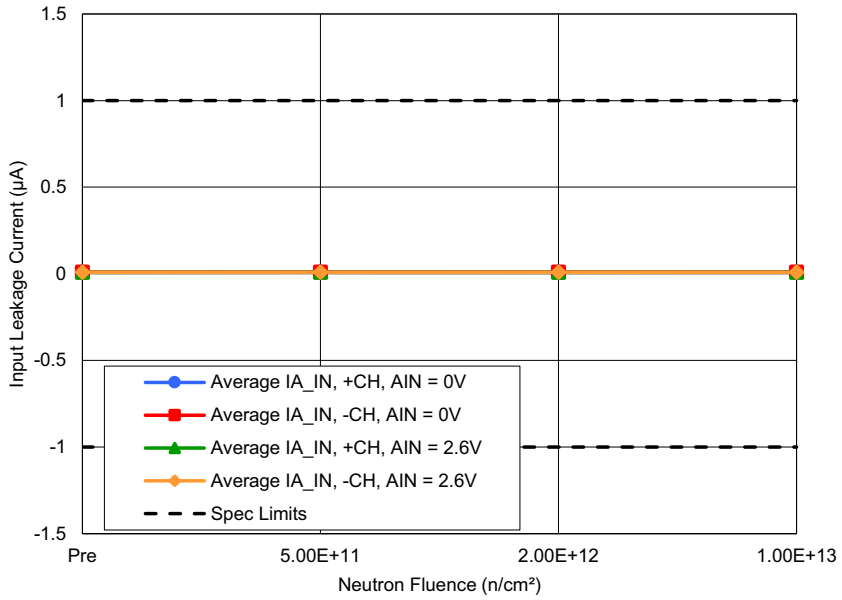

Figure 20. ISL71148M average input leakage current (IA_{IN}) with A_{IN} = 0V or 2.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all channels. The datasheet limits are a minimum of -1µA and a maximum of 1µA.

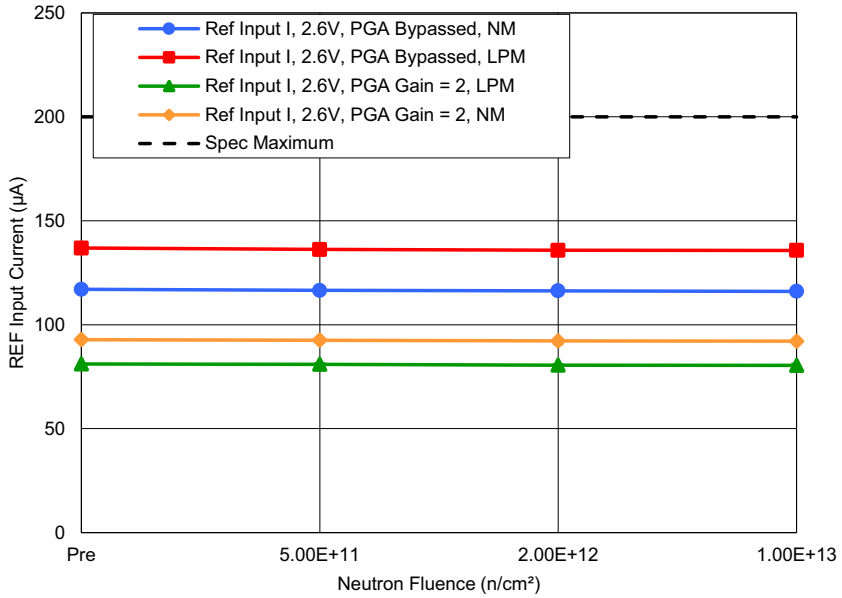

Figure 21. ISL71148M average REF input current (IREF) in normal or low-power operating mode with V_{REF} = 2.6V and PGA bypassed or with PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 200µA.

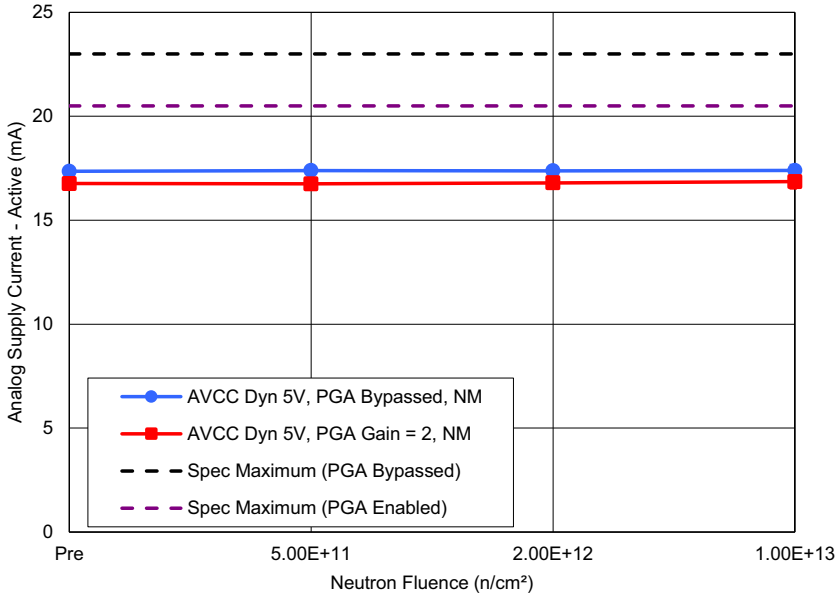

Figure 22. ISL71148M average analog supply current - active (I_{AVCC}) in normal operating mode with AV_{CC} = 5V and with PGA bypassed and f_{SAMP} = 900.901ksps or with PGA Gain = 2 and f_{SAMP} = 483.092ksps as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are 23mA maximum with PGA bypassed and 20.5mA maximum with PGA Gain = 2.

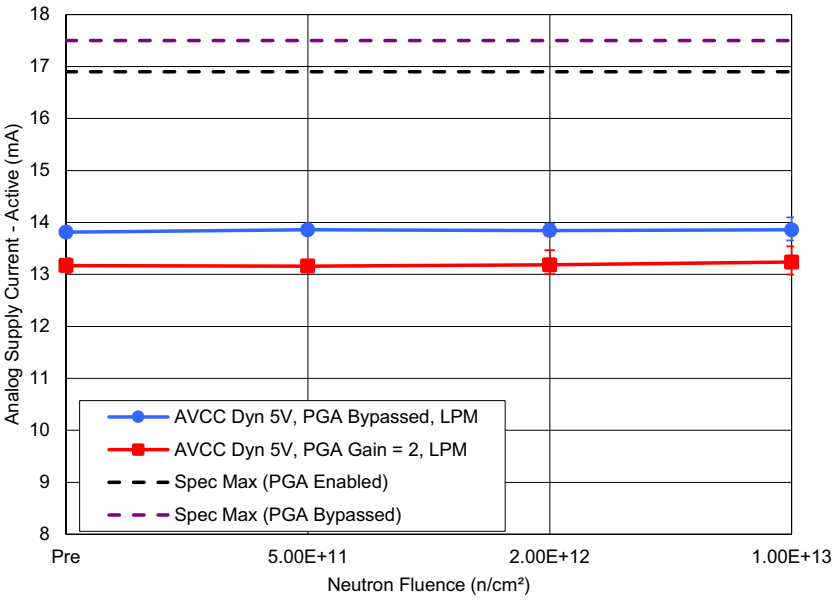

Figure 23. ISL71148M average analog supply current - active (I_{AVCC}) in low-power operating mode with AV_{CC} = 5V and with PGA bypassed and f_{SAMP} = 670ksps or with PGA Gain = 2 and f_{SAMP} = 413.223ksps as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are maximums of 17.5mA with PGA bypassed and 16.9mA with PGA Gain = 2.

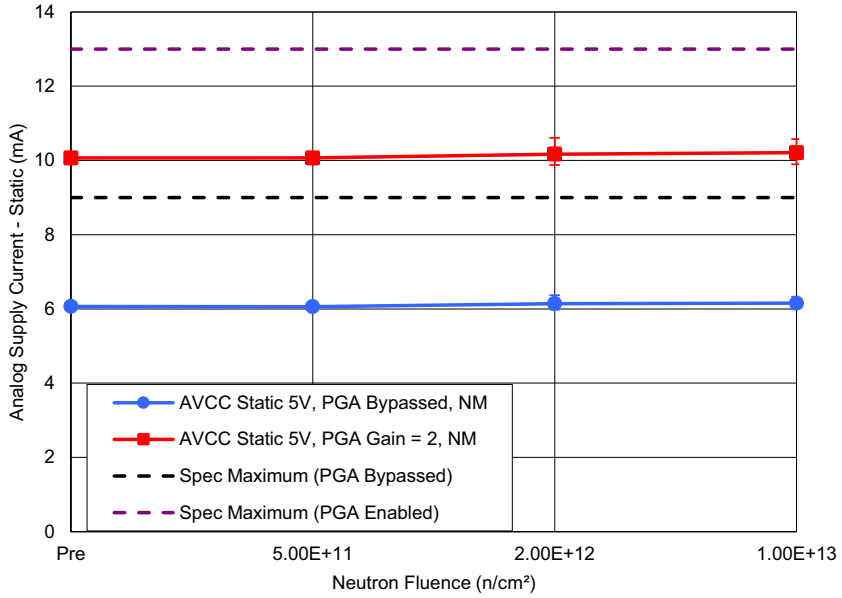

Figure 24. ISL71148M average analog supply current - static (I_{STATIC}) in normal operating mode with AV_{CC} = 5V and PGA bypassed or with PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 9mA with PGA bypassed and a maximum of 13mA with PGA Gain = 2.

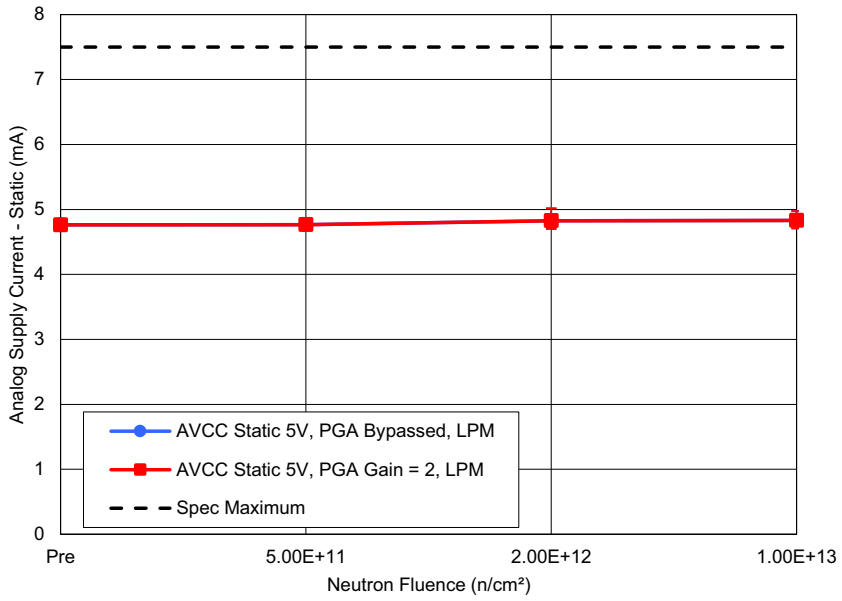

Figure 25. ISL71148M average analog supply current - static (I_{STATIC}) in normal operating mode with AV_{CC} = 5V and PGA bypassed or with PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 7.5mA.

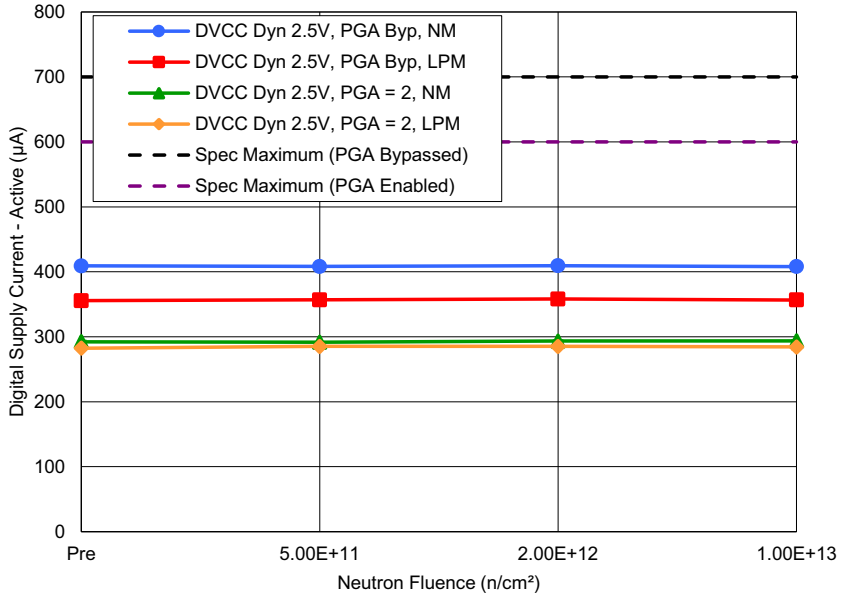

Figure 26. ISL71148M average digital supply current - active (I_{DVCC}) in normal or low-power operating mode with DV_{CC} = 2.5V, f_{SCK} = 50MHz, and PGA bypassed and with PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a maximum of 700µA with PGA bypassed and a maximum of 600µA with PGA Gain = 2.

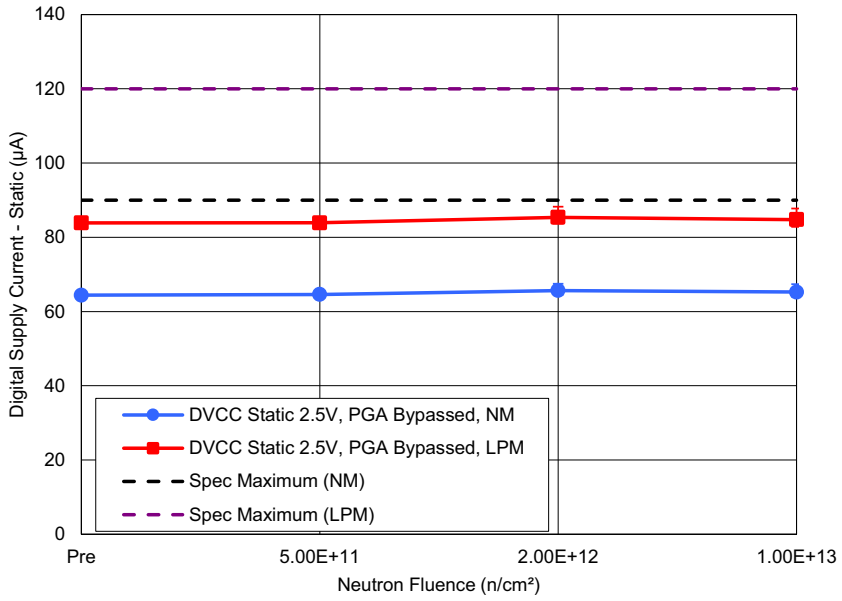

Figure 27. ISL71148M average digital supply current - static (I_{STDVCC}) in normal or low-power operating mode with DV_{CC} = 2.5V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are 90µA maximum in normal mode and 120µA in low-power mode.

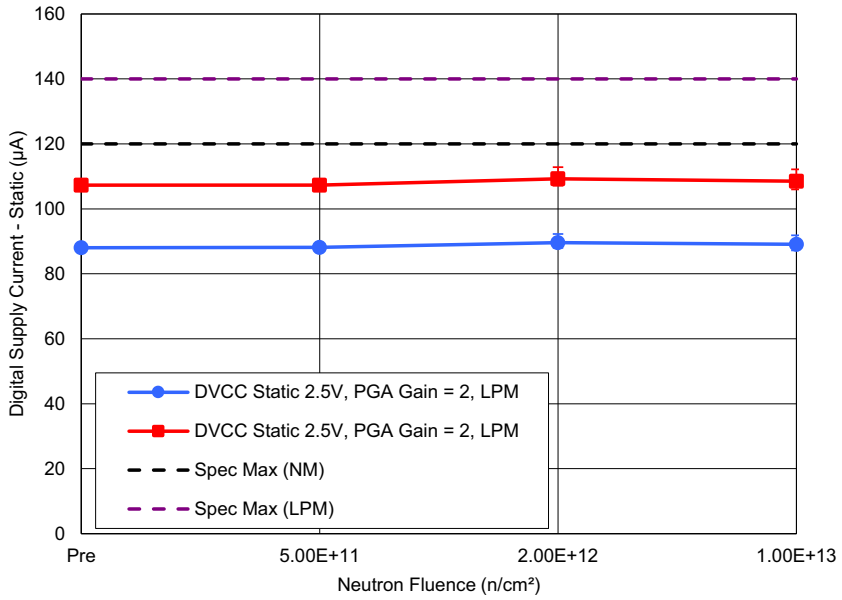

Figure 28. ISL71148M average digital supply current - static (I_{STDVCC}) in normal or low-power operating mode with DV_{CC} = 2.5V and PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are 120µA maximum in normal mode and 140µA in low-power mode.

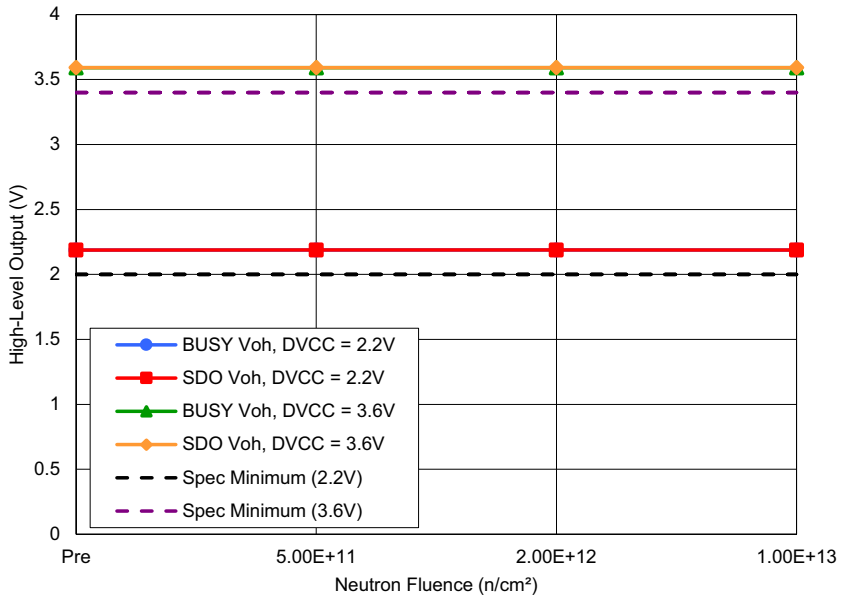

Figure 29. ISL71148M average high-level output (V_{OH}) with DV_{CC} = 2.2V and 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are 2.0V minimum for 2.2V and 3.4V minimum for 3.6V.

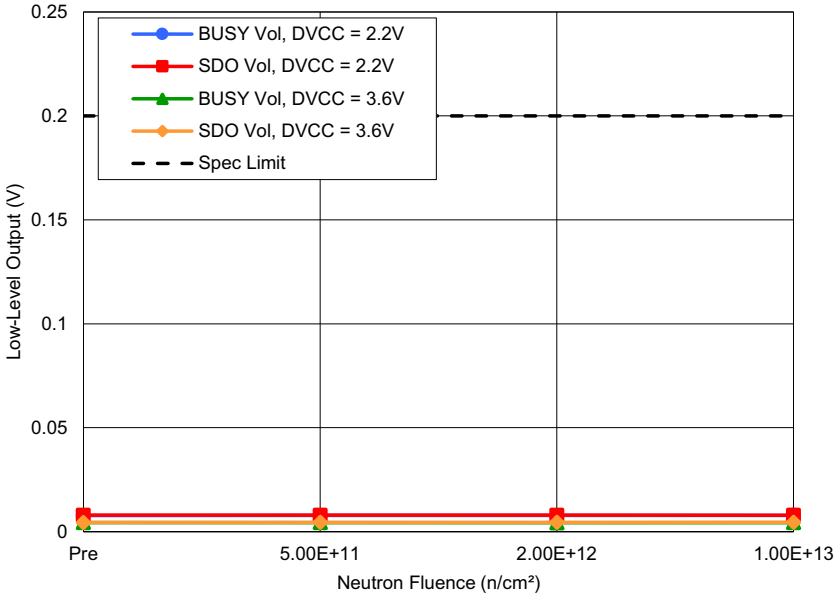

Figure 30. ISL71148M average low-level output (V_{OL}) with DV_{CC} = 2.2V and 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is 0.2V maximum.

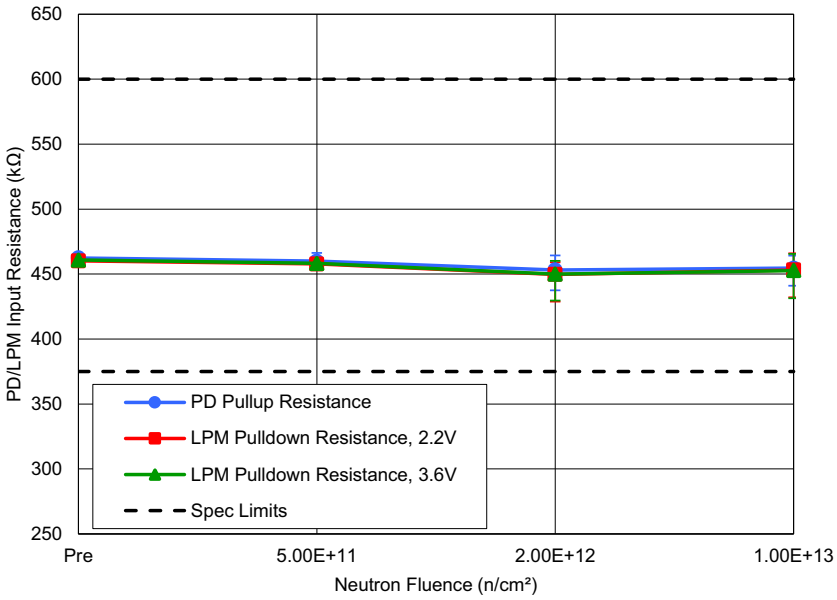

Figure 31. ISL71148M average PD pull-up resistance (R_{INPDL}) and LPM pull-down resistance (R_{INLPM}) as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of 375kΩ and a maximum of 600kΩ.

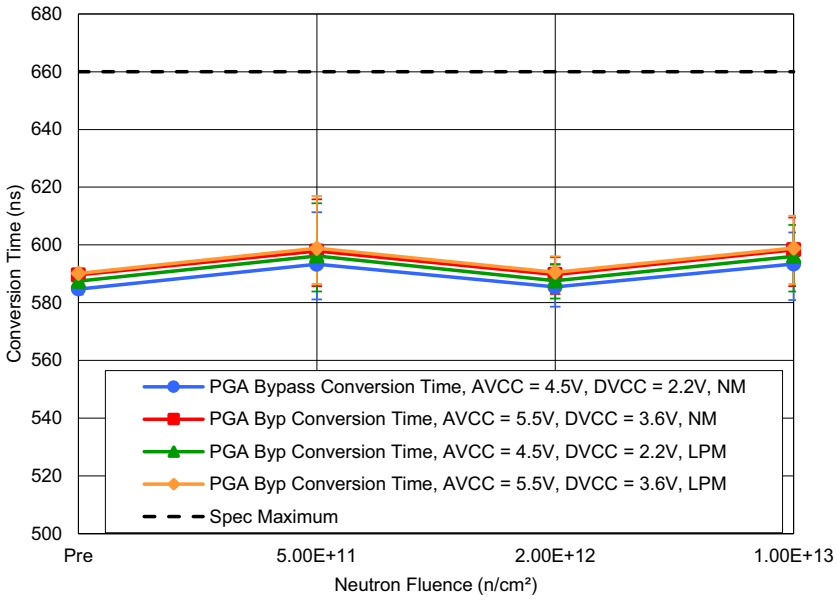

Figure 32. ISL71148M average conversion time (t_{CONV}) in normal or low-power operating mode with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V, DV_{CC} = 3.6V and PGA bypassed as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 660ns.

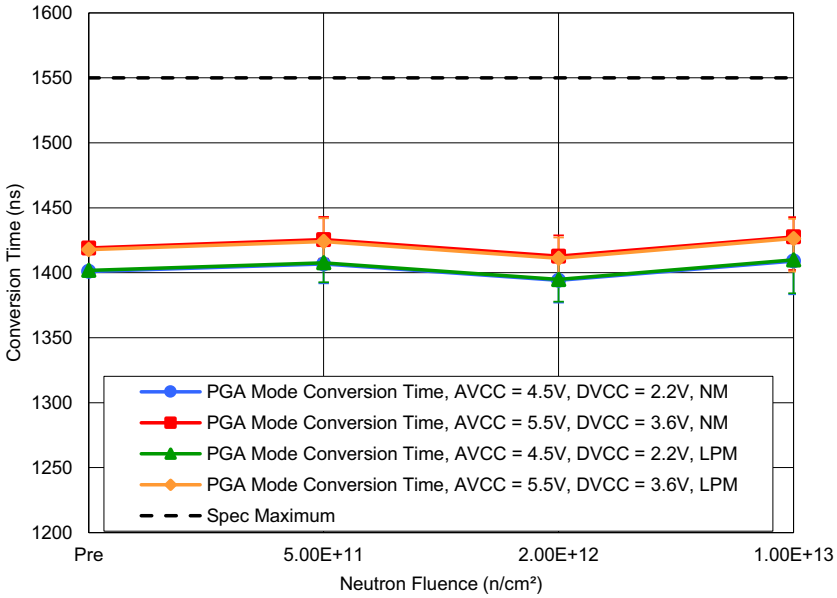

Figure 33. ISL71148M average conversion time (t_{CONV}) in normal or low-power operating mode with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V, DV_{CC} = 3.6V and PGA Gain = 2 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 1550ns.

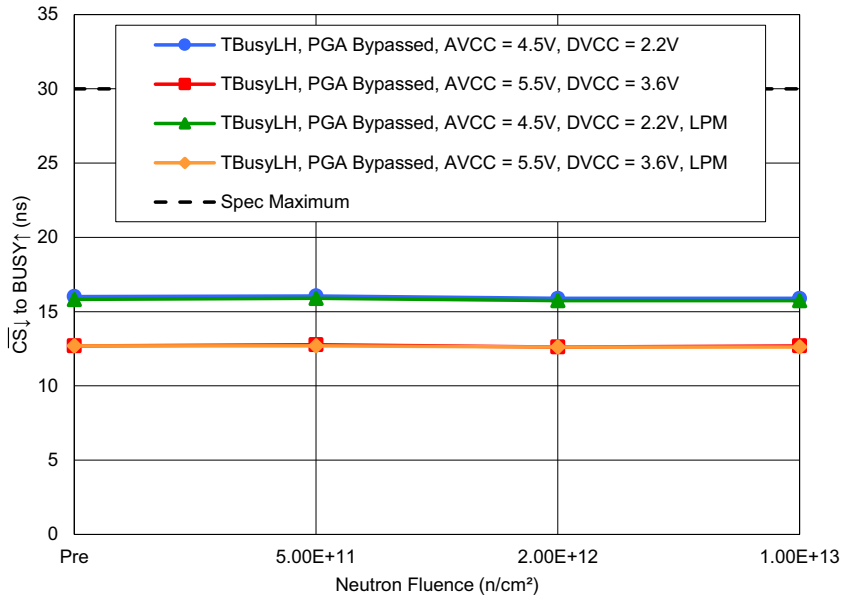

Figure 34. ISL71148M average $\overline{CS}\downarrow$ to BUSY↑ (t_{BUSYLH}) in normal or low-power operating mode with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V, DV_{CC} = 3.6V C_L = 10pF and PGA bypassed, as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 30ns.

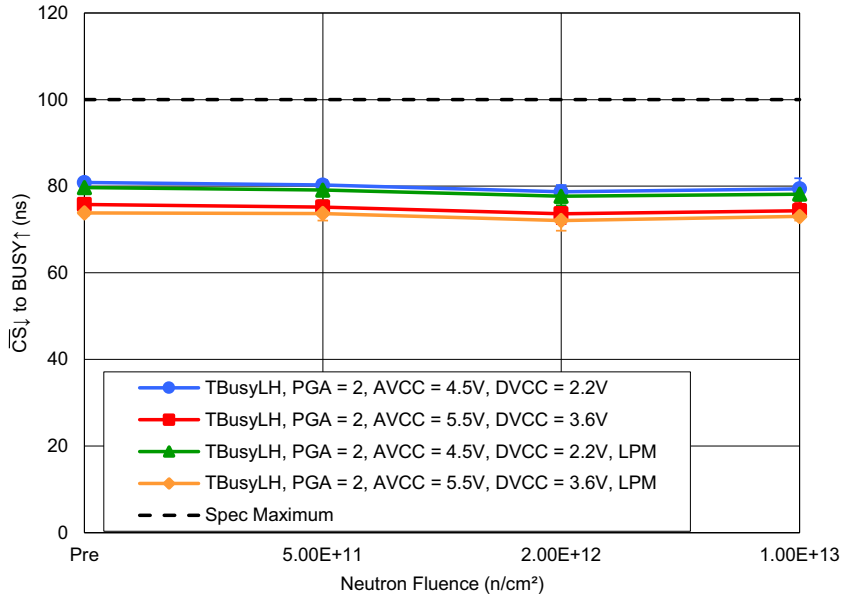

Figure 35. ISL71148M average $\overline{CS}\downarrow$ to BUSY↑ (t_{BUSYLH}) in normal or low-power operating mode with PGA Gain = 2, C_L = 10pF and with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 100ns.

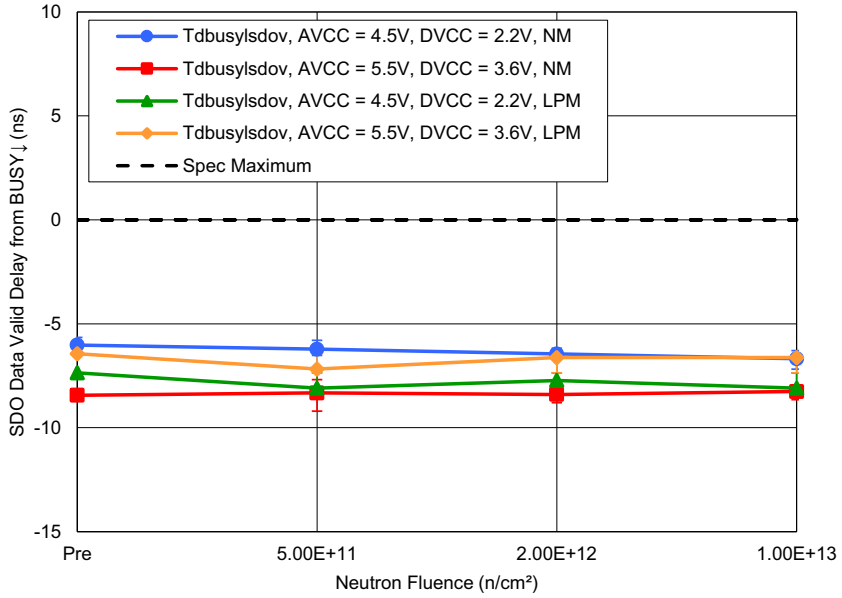

Figure 36. ISL71148M average SDO Data Valid Delay from BUSY↓ ($t_{DBUSYLSDOV}$) in normal or low-power operating mode with C_L = 10pF and with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 0ns.

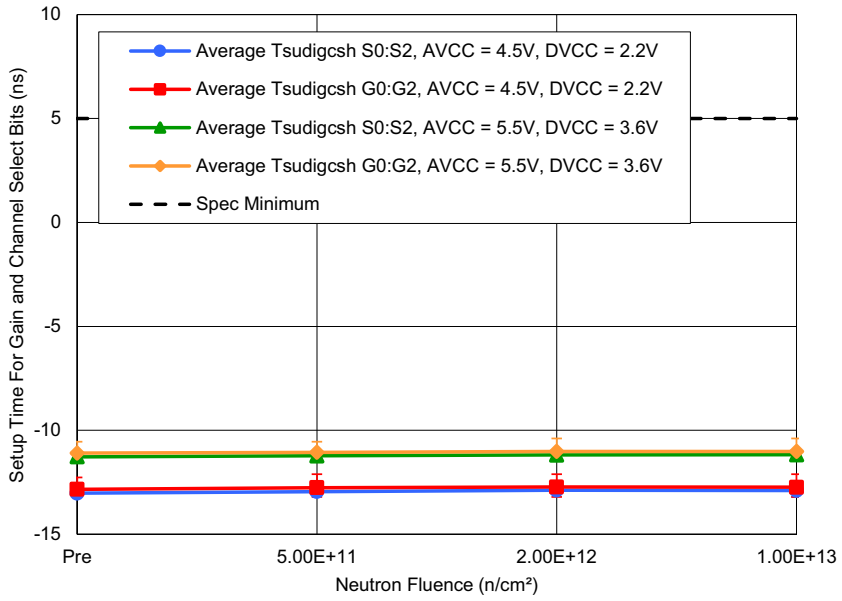

Figure 37. ISL71148M average G2:0, S2:0 to $\overline{CS}$↑ ($t_{SUDIGCSH}$) in normal operating mode with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all pins. The datasheet limit is a minimum of 5ns.
***Note*: The measured values are the actual maximum required hold times, so the datasheet limits are the maximums of the measured values.**

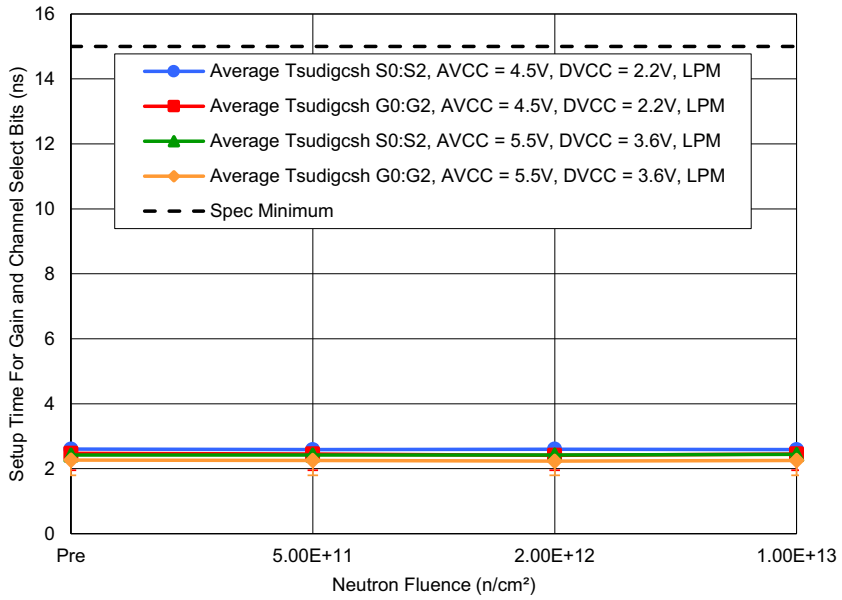

Figure 38. ISL71148M average G2:0, S2:0 to $\overline{CS}\uparrow$ ($t_{SUDIGCSH}$) in low-power mode operating with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all pins. The datasheet limit is a minimum of 15ns.
***Note*: The measured values are the actual maximum required hold times, so the datasheet limits are the maximums of the measured values.**

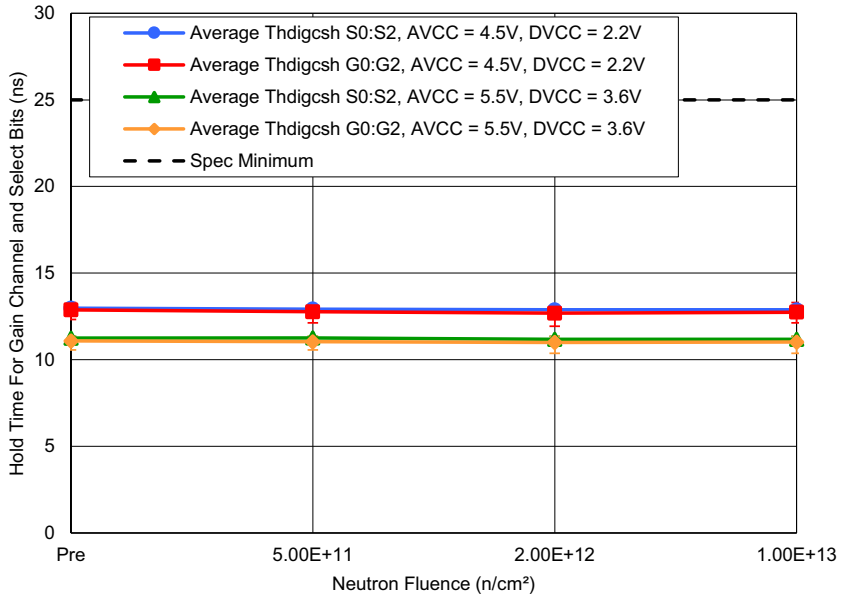

Figure 39. ISL71148M average G2:0, S2:0 from $\overline{CS}\uparrow$ ($t_{HDIGCSH}$) in normal operating mode with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all pins. The datasheet limit is a minimum of 25ns.
***Note*: The measured values are the actual maximum required hold times, so the datasheet limits are the maximums of the measured values.**

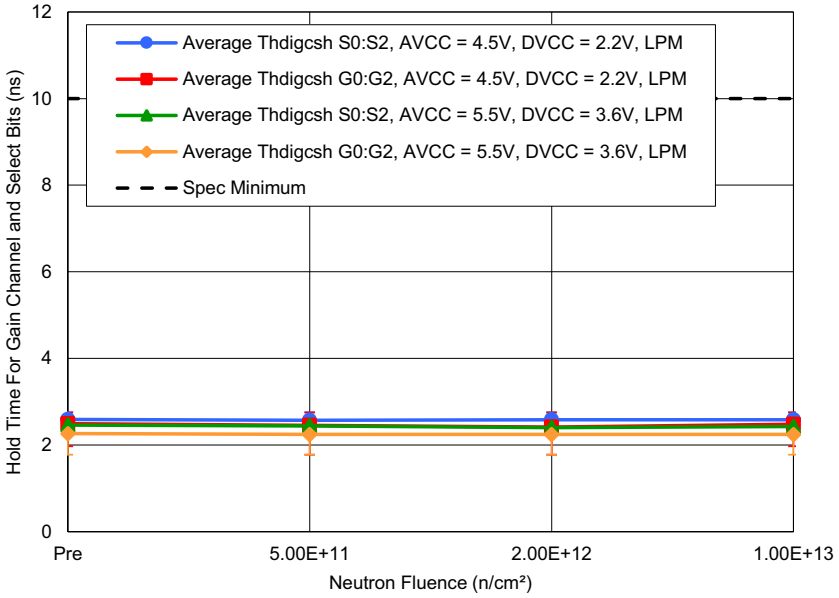

Figure 40. ISL71148M average G2:0, S2:0 from $\overline{CS}\uparrow$ ($t_{HDIGCSH}$) in low-power operating mode with AVCC = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function neutron fluence. The error bars (if visible) represent the minimum and maximum measured values across all pins. The datasheet limit is a minimum of 10ns.
***Note*: The measured values are the actual maximum required hold times, so the datasheet limits are the maximums of the measured values.**

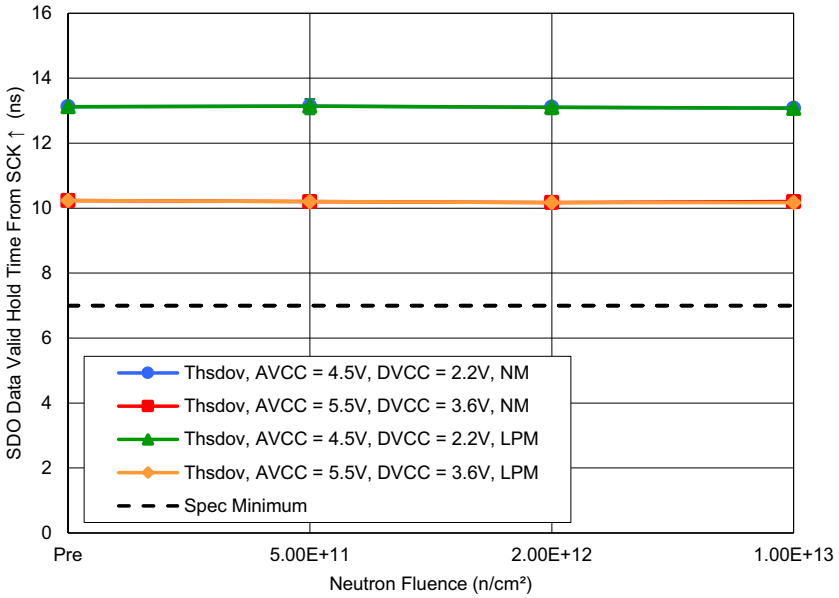

Figure 41. ISL71148M average SDO Data Valid Hold Time from SCK↑ (t_{HSDOV}) in low-power operating mode with C_L = 10pF and with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a minimum of 7ns.

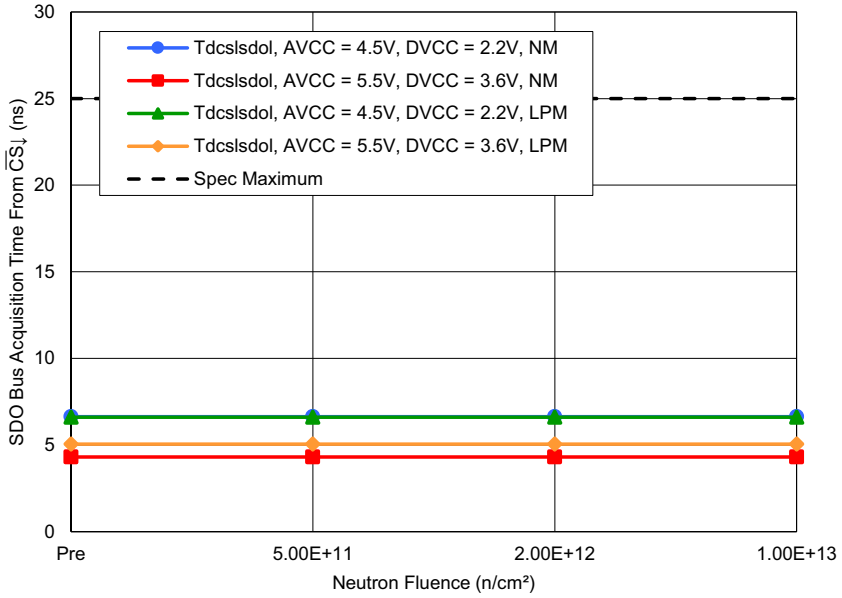

Figure 42. ISL71148M average SDO Bus Acquisition Time from $\overline{CS}\downarrow$ ($t_{DCSLSDOL}$) in normal or low-power operating mode with CL = 10pF and with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 25ns.

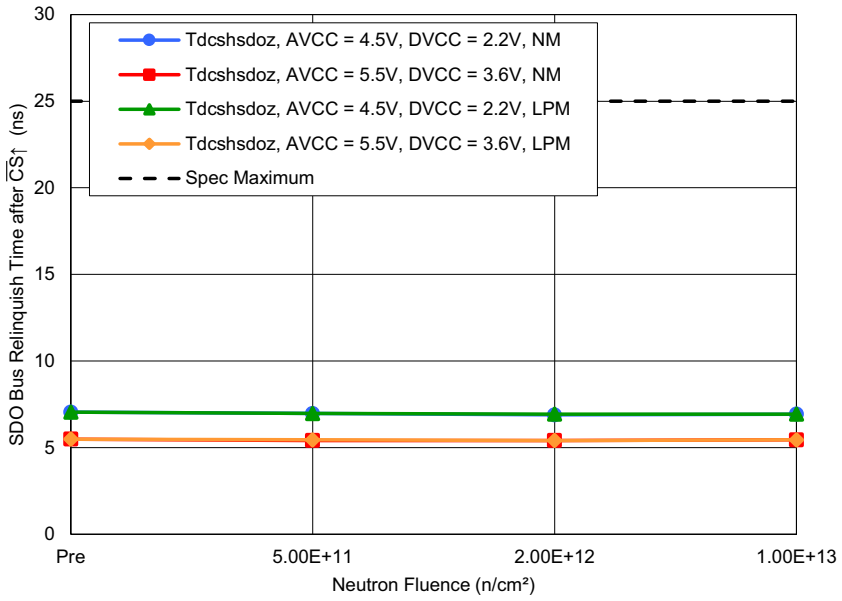

Figure 43. ISL71148M average SDO Bus Relinquish Time after $\overline{CS}\uparrow$ ($t_{DCSHSDOZ}$) in normal or low-power operating mode with CL = 10pF and with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 25ns.

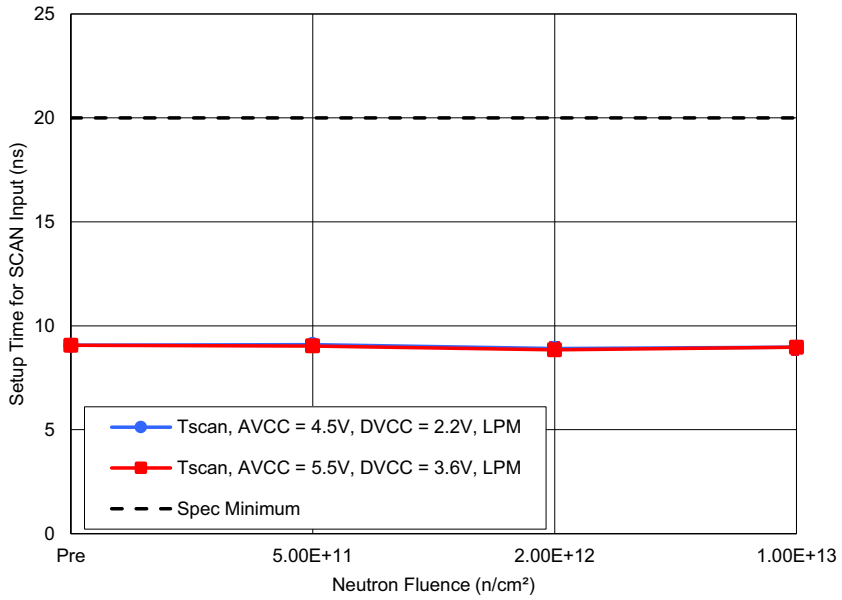

Figure 44. ISL71148M average SCAN to $\overline{CS}\uparrow$ ($t_{SCANCSH}$) in low-power operating mode with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a minimum of 20ns.
***Note*: The measured values are the actual maximum required hold times, so the datasheet limits are the maximums of the measured values.**

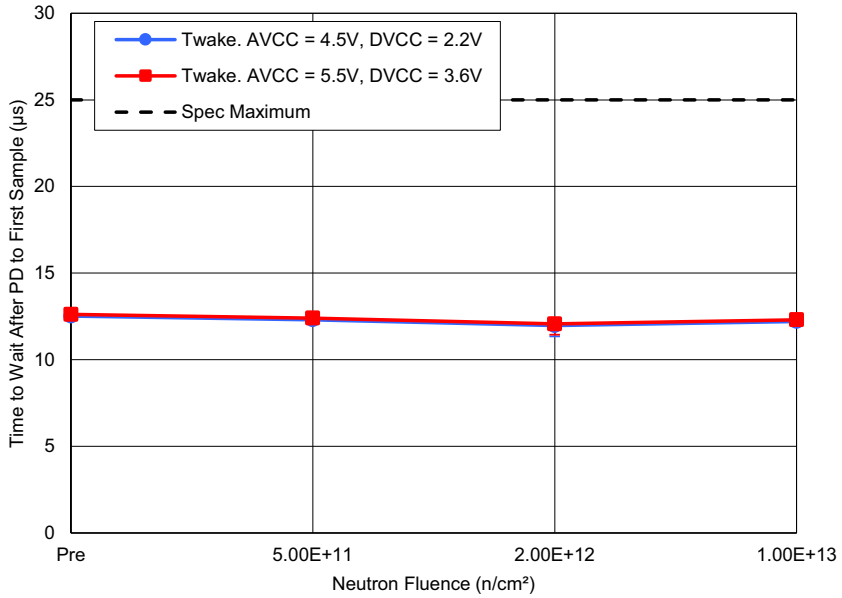

Figure 45. ISL71148M average wake-up time from power-down mode (t_{WAKE}) in normal operating mode (results also apply to LPM) with AV_{CC} = 4.5V and DV_{CC} = 2.2V or AV_{CC} = 5.5V and DV_{CC} = 3.6V as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limit is a maximum of 25µs.

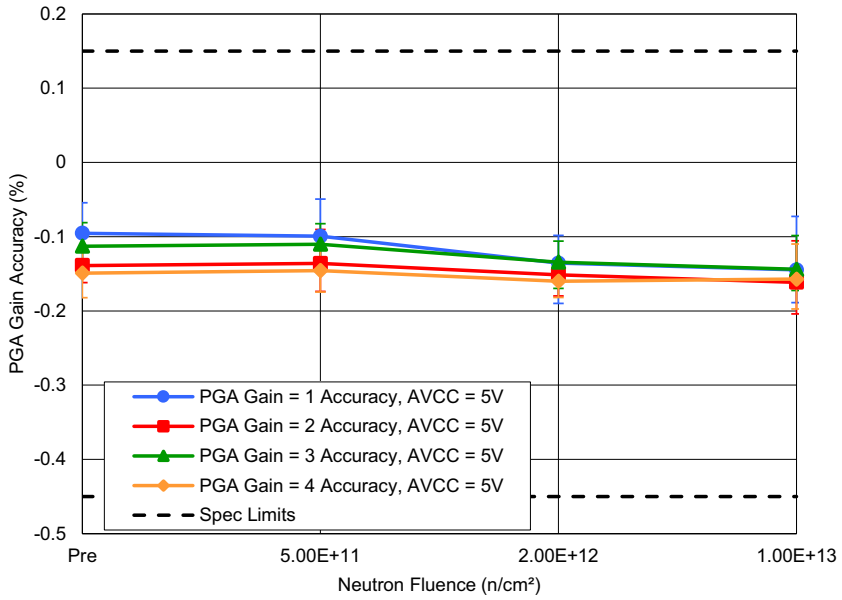

Figure 46. ISL71148M average PGA Gain Accuracy with AV_{CC} = 5V and PGA Gain = 1, 2, 3, and 4 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of -0.45% and a maximum of 0.15%.

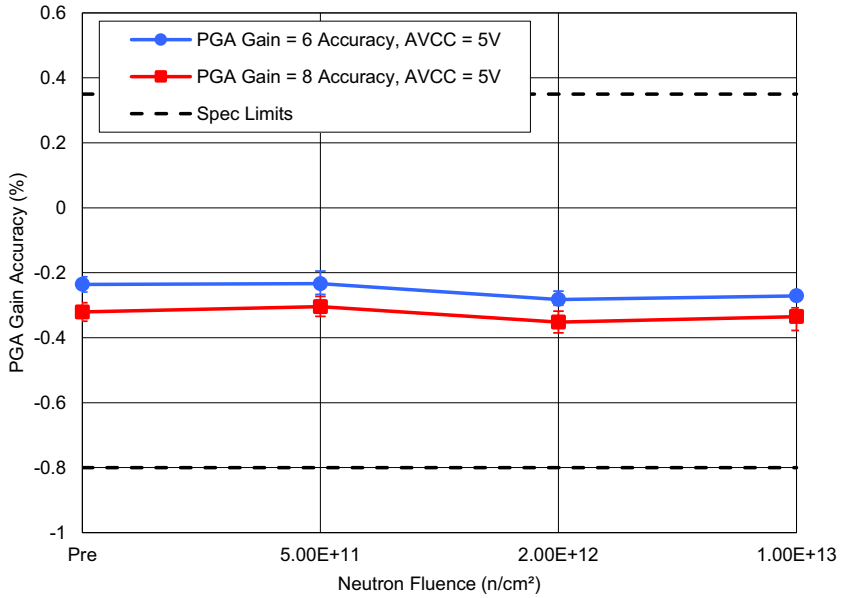

Figure 47. ISL71148M average PGA Gain Accuracy with AV_{CC} = 5V and PGA Gain = 6 and 8 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of -0.8% and a maximum of 0.35%.

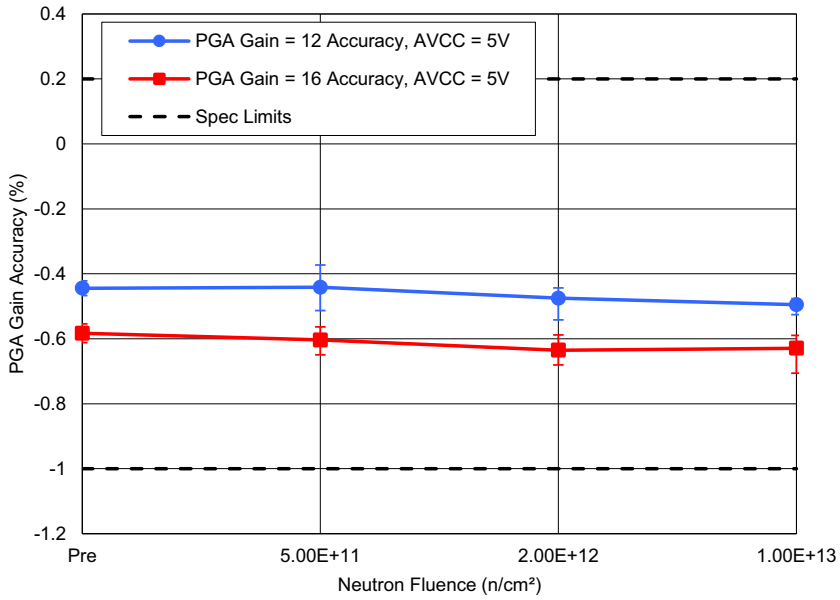

Figure 48. ISL71148M average PGA Gain Accuracy with AV_{CC} = 5V and PGA Gain = 12 and 16 as a function of neutron fluence. The error bars (if visible) represent the minimum and maximum measured values. The datasheet limits are a minimum of -1% and a maximum of 0.2%.

3. Conclusion

This document reports the results of 1MeV equivalent neutron testing for the ISL71148M radiation-tolerant low dropout linear regulator. Parts were tested after actual fluences of 6.12×10^{11}n/cm^2, 2.38×10^{12}n/cm^2, and 1.19×10^{13}n/cm^2. The results of selected key parameters before and after irradiation to each level are plotted in Figure 3 through Figure 48. The plots show the mean of each parameter as a function of neutron irradiation, with error bars that represent the minimum and maximum measured values. The figures also show the applicable post-radiation electrical limits taken from the datasheet. All samples passed at all levels up to and including 1.19×10^{13}n/cm^2. These results are applicable to all versions of this part on various flows (Rad-Tolerant Plastic, Rad-Hard Plastic, and Rad-Hard Hermetic).

4. Revision History

Revision	Date	Description
1.00	Feb 24, 2026	Initial release.

A. Reported Parameters

Table 3 lists the key parameters that are considered indicative of part performance. These parameters are plotted in Figure 3 through Figure 48. All limits are taken from the *ISL71148M Datasheet*.

Table 3. ISL71148M Key Parameters (TA = 25°C)

Fig.	Parameter	Symbol	Conditions	Min	Max	Unit
3	Integral Non-Linearity	INL	Normal Mode; PGA Bypassed; AV_{CC} = 5V	-1	1	LSB
4			LPM; PGA Bypassed; AV_{CC} = 5V			
5	Differential Non-Linearity	DNL	Normal Mode; PGA Bypassed; AV_{CC} = 5V	-0.5	0.5	LSB
6			LPM; PGA Bypassed; AV_{CC} = 5V			
7	Zero-Scale Error	ZSE	Normal Mode; PGA Bypassed; AV_{CC} = 5V	-4	4	LSB
			LPM; PGA Bypassed; AV_{CC} = 5V			
8	Positive Full-Scale Error	+FSE	Normal Mode; PGA Bypassed; AV_{CC} = 5V	-7	7	LSB
			LPM; PGA Bypassed; AV_{CC} = 5V			
9	Negative Full-Scale Error	-FSE	Normal Mode; PGA Bypassed; AV_{CC} = 5V	-7	7	LSB
			LPM; PGA Bypassed; AV_{CC} = 5V			
10	Signal-to-Noise Ratio	SNR	Normal Mode; PGA Bypassed; AV_{CC} = 5V	82	-	dBFS
			LPM; PGA Bypassed; AV_{CC} = 5V			
11			Normal Mode; PGA Gain = 2; AV_{CC} = 5V	76	-	dBFS
			LPM; PGA Gain = 2; AV_{CC} = 5V			
12	Signal-to-Noise + Distortion Ratio	SINAD	Normal Mode; PGA Bypassed; AV_{CC} = 5V	81	-	dBFS
			LPM; PGA Bypassed; AV_{CC} = 5V			
13			Normal Mode; PGA Gain = 2; AV_{CC} = 5V	75	-	dBFS
			LPM; PGA Gain = 2; AV_{CC} = 5V			
14	Effective Number of Bits	ENOB	Normal Mode; PGA Bypassed; AV_{CC} = 5V	13.1	-	bits
			LPM; PGA Bypassed; AV_{CC} = 5V			
15			Normal Mode; PGA Gain = 2; AV_{CC} = 5V	12.1	-	bits
			LPM; PGA Gain = 2; AV_{CC} = 5V			
16	Total Harmonic Distortion	THD	Normal Mode; PGA Bypassed; AV_{CC} = 5V	85	-	dBFS
			LPM; PGA Bypassed; AV_{CC} = 5V			
17			Normal Mode; PGA Gain = 2; AV_{CC} = 5V	85	-	dBFS
			LPM; PGA Gain = 2; AV_{CC} = 5V			
18	Spurious Free Dynamic Range	SFDR	Normal Mode; PGA Bypassed; AV_{CC} = 5V	90	-	dBFS
			LPM; PGA Bypassed; AV_{CC} = 5V			
19			Normal Mode; PGA Gain = 2; AV_{CC} = 5V	90	-	dBFS
			LPM; PGA Gain = 2; AV_{CC} = 5V			
20	Input Leakage Current	IA_{IN}	A_{IN} = 0V, 2.6V	-1	1	µA
21	REF Input Current	I_{REF}	Normal Mode, LPM; PGA Bypassed; V_{REF} = 2.6V	-	200	µA

Table 3. ISL71148M Key Parameters (TA = 25°C) (Cont.)

Fig.	Parameter	Symbol	Conditions	Min	Max	Unit
22	Analog Supply Current – Active	I_{AVCC}	Normal Mode; PGA Bypassed; A_{VCC} = 5V; f_{SAMP} = 900.901ksps	-	23	mA
			Normal Mode; PGA Gain = 2; A_{VCC} = 5V; f_{SAMP} = 483.092ksps	-	20.5	mA
23			LPM; PGA Bypassed; A_{VCC} = 5V; f_{SAMP} = 670ksps	-	17.5	mA
			LPM; PGA Gain = 2; A_{VCC} = 5V; f_{SAMP} = 413.223ksps	-	16.9	mA
24	Analog Supply Current – Static	I_{AVCC}	Normal Mode; PGA Bypassed; A_{VCC} = 5V; $\overline{CS}$ held low	-	9	µA
			Normal Mode; PGA Gain = 2; A_{VCC} = 5V; $\overline{CS}$ held low	-	13	µA
25			LPM; PGA Bypassed; A_{VCC} = 5V; $\overline{CS}$ held low	-	7.5	µA
			LPM; PGA Gain = 2; A_{VCC} = 5V; $\overline{CS}$ held low			
26	Digital Supply Current – Active	I_{DVCC}	Normal Mode; PGA Bypassed; D_{VCC} = 2.5V; f_{SCK} = 50MHz	-	700	µA
			LPM; PGA Bypassed; D_{VCC} = 2.5V; f_{SCK} = 50MHz			
			Normal Mode; PGA Gain = 2; D_{VCC} = 2.5V; f_{SCK} = 50MHz		600	µA
			LPM; PGA Gain = 2; D_{VCC} = 2.5V; f_{SCK} = 50MHz			
27	Digital Supply Current – Static	I_{STDVCC}	Normal Mode; PGA Bypassed; D_{VCC} = 2.5V; $\overline{CS}$ held low	-	90	µA
			LPM; PGA Bypassed; D_{VCC} = 2.5V; $\overline{CS}$ held low	-	120	µA
28			Normal Mode; PGA Gain = 2; D_{VCC} = 2.5V; $\overline{CS}$ held low	-	120	µA
			LPM; PGA Gain = 2; D_{VCC} = 2.5V; $\overline{CS}$ held low	-	140	µA
29	High-Level Output	V_{OH}	DV_{CC} = 2.2V; DV_{CC} – Output; I_O = -500µA	2	-	V
			DV_{CC} = 3.6V; DV_{CC} – Output; I_O = -500µA	3.4	-	V
30	Low-Level Output	V_{OL}	DV_{CC} = 2.2V; I_O = 500µA	-	0.2	V
			DV_{CC} = 3.6V; I_O = 500µA			
31	PD Input Resistance	R_{INPDL}	Internal pull-up resistance to DVCC	375	600	kΩ
	LPM Input Resistance	R_{INLPM}	Internal pull-down resistance to GND; DV_{CC} = 2.2V, 3.6V			

Table 3. ISL71148M Key Parameters (TA = 25°C) (Cont.)

Fig.	Parameter	Symbol	Conditions	Min	Max	Unit
32	Conversion Time	t_{CONV}	Normal Mode; PGA bypassed; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; BUSY output high time	-	660	ns
			LPM; PGA bypassed; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; BUSY output high time			
33			Normal Mode; PGA Gain = 2; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; BUSY output high time	-	1550	ns
			LPM; PGA Gain = 2; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; BUSY output high time			
34	$\overline{CS}\downarrow$ to BUSY↑	t_{BUSYLH}	Normal Mode; PGA bypassed; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	-	30	ns
			LPM; PGA bypassed; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF			
35			Normal Mode; PGA Gain = 2; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	-	100	ns
			LPM; PGA Gain = 2; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF			
36	SDO Data Valid Delay from BUSY↓	$t_{DBUSYLSDOV}$	Normal Mode; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	-	0	ns
			LPM; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF			
37	G2:0, S2:0 to $\overline{CS}$↑	$t_{SUDIGCSH}$	Normal Mode; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V	5	-	ns
38			LPM; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V	15	-	
39	G2:0, S2:0 from $\overline{CS}$↑	$t_{HDIGCSH}$	Normal Mode; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	25	-	ns
40			LPM; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	10	-	
41	SDO Data Valid Hold Time from SCK↑	t_{HSDOV}	Normal Mode; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	7	-	ns
			LPM; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF			
42	SDO Bus Acquisition Time from $\overline{CS}\downarrow$	$t_{DCSLSDOL}$	Normal Mode; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	-	25	ns
			LPM; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF			
43	SDO Bus Relinquish Time after $\overline{CS}$↑	$t_{DCSHSDOZ}$	Normal Mode; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF	-	25	ns
			LPM; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V; C_L = 10pF			
44	SCAN to $\overline{CS}$↑	$t_{SCANCSH}$	LPM; AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V	20	-	ns

Table 3. ISL71148M Key Parameters (TA = 25°C) (Cont.)

Fig.	Parameter	Symbol	Conditions	Min	Max	Unit
45	Wake-Up time from Power-Down Mode	t_{WAKE}	Normal Mode (but results apply to LPM); AV_{CC} = 4.5V, 5.5V; DV_{CC} = 2.2V, 3.6V	-	25	µs
46	PGA Gain Accuracy	-	Gain = 1, G2:G0 = 000; Gain = 2, G2:G0 = 001; Gain = 3, G2:G0 = 010; Gain = 4, G2:G0 = 011;	-0.45	0.15	%
47			Gain = 6, G2:G0 = 100; Gain = 8, G2:G0 = 101;	-0.8	0.35	%
48			Gain = 12, G2:G0 = 110; Gain = 16, G2:G0 = 111;	-1	0.2	%

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit www.renesas.com/contact-us/.

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