Radiation Report

TPS7H1302-SP Total Ionizing Dose (TID) Report

Abstract

This report discusses the total ionizing dose (TID) parametric results for the Texas Instruments TPS71302-SP, 3V to 6.3V input, 400mA, -6V to -0.6V radiation hardened switched capacitor voltage inverter with integrated low dropout regulator. The study was done to determine the TID effects under high dose rate (HDR) up to 100krad(Si). The results show that all samples passed within the specified limits up to 100krad(Si).

Table of Contents

1 Device Information 2
1.1 Product Description 2
1.2 Device Details 2
2 Total Dose Test Setup 3
2.1 Test Overview 3
2.2 Test Description and Facilities 3
2.3 Test Setup Details 3
2.4 Test Configuration and Condition 4
3 TID Characterization Test Results 5
3.1 TID Characterization Summary Results 5
4 Applicable and Reference Documents 7
4.1 Applicable Documents 7
4.2 Reference Documents 7
A Appendix: HDR TID Report Data 8
B Revision History 9

List of Figures

Figure 2-1. Bias Diagram Used in TID Exposure 3

List of Tables

Table 1-1. Device and Exposure Details 2
Table 2-1. HDR: 3krad(Si), 10krad(Si), 30krad(Si), 50krad(Si) and 100krad(Si) Biased Device Information 4
Table 2-2. HDR: 3krad(Si), 10krad(Si), 30krad(Si), 50krad (Si) and 100krad (Si) Unbiased Device Information 4
Table 3-1. Specification Compliance Matrix 5

Trademarks

Gammacell® is a registered trademark of MDS Nordion Inc..
All trademarks are the property of their respective owners.

Copyright © 2026 Texas Instruments Incorporated

1 Device Information

1.1 Product Description

The TPS7H1302-SP is a charge pump positive-to-negative voltage inverters with an integrated negative low dropout regulator (LDO). The device accepts a positive input supply voltage range of 3V to 6.3V and deliver up to 400mA of output current, with integrated enable and power-good functionality.

The TPS7H1302 delivers a fixed –1.8V output voltage with a 1MHz (typical) charge pump switching frequency. By eliminating the need for external feedback resistors, the TPS7H1302 reduces both external component count and overall solution size.

The TPS7H1302-SP is packaged in a 14-pin HBL ceramic flat package. A standard microcircuit drawing (SMD) is 5962R2421502VXC.

1.2 Device Details

Table 1-1 lists the device information used in this TID HDR characterization.

Table 1-1. Device and Exposure Details

TID Exposure Details	
TI Device	TPS7H1302-SP
TI Part Name	5962R2421502VXC
Package	14-pin HBL (CFP)
Technology	LBC7
Quantity Tested	50
Lot Accept/Reject	Passed up to 100krad(Si)
HDR Radiation Facility	Texas Instruments, Dallas, TX
HDR Dose Level	3krad(Si), 10krad(Si), 30krad(Si), 50krad(Si) and 100krad(Si)
HDR Dose Rate	138.71rads(Si)/s
HDR Radiation Source	Gammacell® (Hopewell, GR420) Co-60
Irradiation Temperature	Ambient room temperature

Copyright © 2026 Texas Instruments Incorporated

2 Total Dose Test Setup

2.1 Test Overview

The TPS7H1302-SP was tested according to MIL-STD-883, Test Method 1019.9. For this testing, condition A was used. The product was irradiated up to the target radiation level, and then put through full electrical parametric testing on the production automated test equipment (ATE). All devices remained functional passing all parametric test limits.

2.2 Test Description and Facilities

The TPS7H1302-SP HDR exposure was performed on biased and unbiased devices in a Co-60 gamma cell at the TI facility in Dallas, Texas. The unattenuated dose rate of this cell is 138.71rads(Si)/s. After exposure, the devices were packed in dry ice (per MIL-STD-883 Method 1019.9 section 3.10) and full post-radiation electrical evaluation using Texas Instruments ATE was conducted. ATE test limits are set per datasheet electrical limits based on qualification and characterization data. Post-radiation measurements were taken within 30 minutes of removing the devices from the dry ice container. The devices were allowed to reach room temperature prior to electrical post-radiation measurements.

2.3 Test Setup Details

The devices under HDR exposure were tested in two conditions (biased and unbiased) as described in the following sections.

2.3.1 Unbiased

For the unbiased HDR conditions, the exposure was performed with all pins grounded.

2.3.2 Biased

Figure 2-1 shows the diagram for HDR exposure with biased condition.

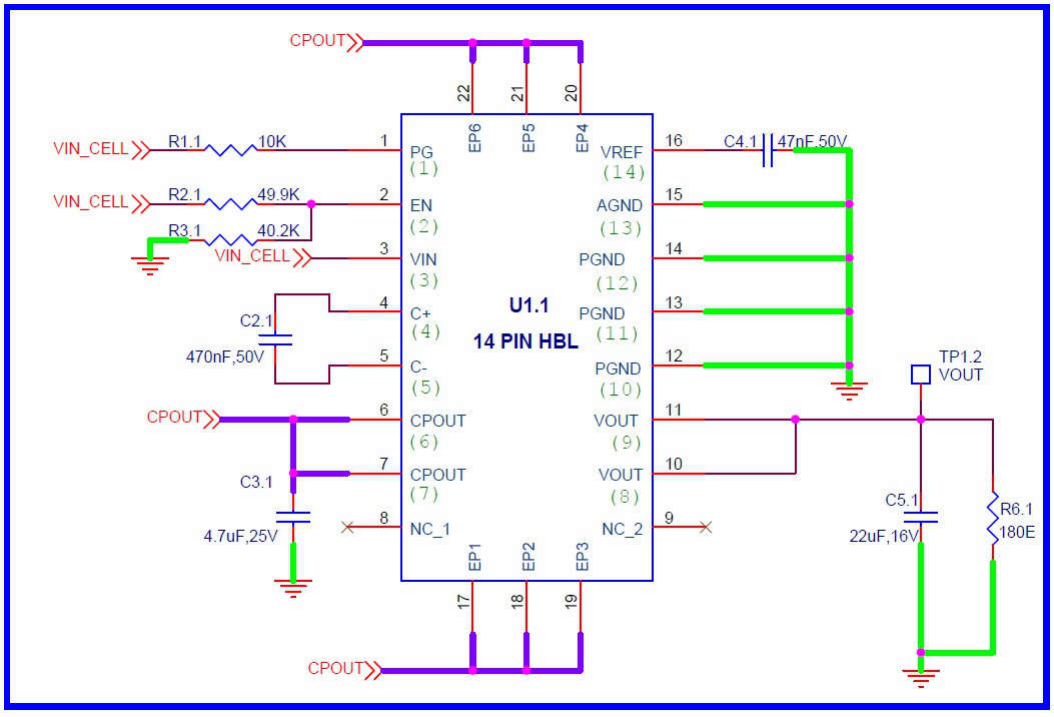


Figure 2-1. Bias Diagram Used in TID Exposure

Copyright © 2026 Texas Instruments Incorporated

2.4 Test Configuration and Condition

HDR devices were stressed at 30krad(Si), 50krad(Si) and 100krad(Si) for biased and unbiased conditions.

Table 2-1. HDR: 3krad(Si), 10krad(Si), 30krad(Si), 50krad(Si) and 100krad(Si) Biased Device Information

Total Samples: 25				
Exposure Levels				
3krad(Si)	10krad(Si)	30krad(Si)	50krad(Si)	100krad(Si)
15, 16, 17, 18, 19	25, 26, 27, 28, 29	35, 36, 37, 38, 39	45, 46, 47, 48, 49	55, 56, 57, 58, 59

Table 2-2. HDR: 3krad(Si), 10krad(Si), 30krad(Si), 50krad (Si) and 100krad (Si) Unbiased Device Information

Total Samples: 25				
Exposure Levels				
3krad(Si)	10krad(Si)	30krad(Si)	50krad(Si)	100krad(Si)
10, 11, 12, 13, 14	20, 21, 22, 23, 24	30, 31, 32, 33, 34	40, 41, 42, 43, 44	50, 51, 52, 53, 54

Copyright © 2026 Texas Instruments Incorporated

3 TID Characterization Test Results

3.1 TID Characterization Summary Results

The parametric data for the TPS7H1302-SP passes up to 100krad(Si) HDR TID irradiation. The drifts of the electrical parameters through HDR were within the data sheet limits.

Overall, the TPS7H1302-SP showed a strong degree of hardness to HDR TID irradiation up to 100krad(Si) for both biased and unbiased exposure conditions. The measurements taken post-irradiation for each sample set showed a marginal shift for most parameters at each dose level for both biased and unbiased. The parameters that showed a greater degree of change between pre- and post-irradiation were still within the electrical performance characteristics specified in the data sheet electrical parameters. See *TPS7H130X-SP 3V to 6.3V Input, 400mA, -6V to -0.6V Radiation Hardened Switched Capacitor Voltage Inverter with Integrated Low Dropout Regulator* for the data sheet electrical parameters and associated tests.

See Appendix A for the HDR report up to 100krad(Si).

Over 3V ≤ V_{IN} ≤ 6.3V, $V_{OUT\ (set)}$ = –1.8V, I_{OUT} = 10mA, C_{REF} = 47nF, over operating temperature range (T_A = –55℃ to 125℃); unless otherwise specified in the Test Conditions column. Typical values are at T_A = 25℃, unless otherwise noted; includes RLAT at T_A = 25℃.

Table 3-1. Specification Compliance Matrix

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT	Test No
POWER SUPPLIES and CURRENTS								
I_Q	Quiescent Current	I_{OUT} = 0A, V_{EN} = 7V			12	45	mA	31.3, 205.2, 205.4
I_{SHDN}	Shutdown Current	V_{EN} = 0V, I_{OUT} = 0A			0.8	1.5	mA	31.2, 31.4, 205.1, 205.3
I_{FB}	Feedback leakage current	V_{FB} = -0.6V			25	100	nA	31.1
ENABLE								
$V_{EN(rising)}$	Enable rising threshold (turn-on)			0.57	0.6	0.625	V	65.2, 65.6, 65.10
$V_{EN(falling)}$	Enable falling threshold (turn-off)			0.445	0.5	0.555	V	65.3, 65.7, 65.11
$t_{EN(delay)}$	EN propagation delay,	EN high to PG high at V_{IN} = 5V, V_{OUT} = -1.8V			14	18	ms	65.4, 65.8, 65.12
$I_{EN(LKG)}$	Enable leakage current	V_{EN} = 7V			25	330	nA	65.1, 65.5, 65.9
POWER GOOD								
$V_{PG(rise)}$	Power good rising threshold as a percent of V_{OUT}	SR V_{OUT} = 10V/s		91.8%	94.8%	98.05%		71.2, 71.5,
$V_{PG(fall)}$	Power good falling threshold as a percent of V_{OUT}	SR V_{OUT} = 10V/s		86.25%	90%	94.1%		71.3, 71.6
$V_{PG(OL)}$	Power good output low	$I_{PG(SINK)}$ = 2mA			90	190	mV	70.3, 70.4
$V_{IN(MIN_PG)}$	Minimum V_{IN} for valid PG (V_{PG} < 0.5V)	$I_{PG(sink)}$ = 0.5mA			0.8	1	V	71.1
$I_{PG(LKG)}$	Power good leakage	V_{PG} = 7V, V_{OUT} = -1.8V			0.05	2	µA	70.1, 70.2
CHARGE PUMP								
f_{SW}	Switching frequency			800	1000	1200	kHz	35.1 to 35.6
$R_{DS(ON1)}$	Switch array MOSFET1 drain source resistance	I_{RDSON} = 100mA V_{IN} = 5V			300	480	mΩ	40.2
$R_{DS(ON2)}$	Switch array MOSFET2 drain source resistance				175	345	mΩ	40.5
$R_{DS(ON3)}$	Switch array MOSFET3 drain source resistance				235	300	mΩ	40.3
$R_{DS(ON4)}$	Switch array MOSFET4 drain source resistance				220	370	mΩ	40.6

Copyright © 2026 Texas Instruments Incorporated

Table 3-1. Specification Compliance Matrix (continued)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT	Test No
DROPOUT								
I_{DO}	Dropout current	$V_{OUT(set)}$ = -1.8V $I_{OUT(meas.)}$ = 98% × $V_{OUT(NOM)}$	V_{IN} = 3V	75	125		mA	44.1
			V_{IN} = 3.3V	100	150			44.2
			V_{IN} = 4.0V	200	300			44.3
		$V_{OUT(set)}$ = -1.8V $I_{OUT(meas.)}$ = 97% × $V_{OUT(NOM)}$	V_{IN} = 5.0V	400				44.4
ACCURACY								
$\Delta V_{OUT}/\Delta V_{IN}$	Line regulation	3.3V ≤ V_{IN} ≤ 6.3V	ΔV = 3V I_{OUT} = 150mA		100	1300	µV/V	55.1, 55.2
$\Delta V_{OUT}/\Delta I_{OUT}$	Load regulation	10mA ≤ I_{OUT} ≤400mA V_{IN} = 5V, V_{OUT} = -1.8V			24	90	mV/A	55.3
V_{REF}				-0.610	-0.6	-0.593	V	30.1, 30.2, 30.3

Copyright © 2026 Texas Instruments Incorporated

4 Applicable and Reference Documents

4.1 Applicable Documents

- Texas Instruments, *TPS7H130X-SP 3V to 6.3V Input, 400mA, -6V to -0.6V Radiation Hardend Switched Capacitor Voltage Inverter with Integrated Low Dropout Regulator* datasheet

4.2 Reference Documents

Texas Instruments total ionizing dose radiation (total dose) test procedure follows the standards put forth in MIL-STD-883 TM 1019. The document can be found at the DLA website.

Copyright © 2026 Texas Instruments Incorporated

A Appendix: HDR TID Report Data

This appendix contains the HDR TID report data.

Copyright © 2026 Texas Instruments Incorporated

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (September 2026) to Revision A (October 2026)	Page
• Updated HDR levels, quantity of units and the associated graphs	2

Copyright © 2026 Texas Instruments Incorporated

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale, TI’s General Quality Guidelines, or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025