ISL75054SLHEVAL1Z

Radiation Hardened ISL75054SLH Ultra Low Noise LDO Board

Description

The ISL75054SLHEVAL1Z evaluation board features the ISL75054SLH LDO. This IC is an ultra-low noise, high PSRR, radiation hardened, low dropout regulator ideal for powering RF devices and ADCs.

The ISL75054SLH has an operational supply voltage range from 2.7V to 30V, an output range of 0.5V to V_{IN}-V_{DO}, and an output capability of up to 1A of current.

The ISL75054SLH features adjustable soft-start control, an open-drain power-good indicator, and overvoltage and undervoltage detection for power-good.

Built-in protections include V_{IN} - V_{OUT} foldback current limiting, externally programmable current limit, and over-temperature protection.

The integration of a precision internal current source and a high-performance voltage buffer error amplifier results in ultra-low noise and high PSRR, while reducing the number of external components required for designs using the ISL75054SLH. This minimizes the overall solution size, reduces the BOM, and simplifies the design.

The ISL75054SLHEVAL1Z evaluation board provides a quick and easy method for evaluating the ISL75054SLH. This board features test points and connectors to assist with evaluation. For information about the device operation, function, and performance, refer to the *ISL75054SLH Datasheet*.

Features

- Test points and connectors for evaluation
- Ultra-low noise
- High PSRR
- Adjustable enable, power-good, and current limit thresholds
- Output current monitoring through OCP pin
- Wide input voltage ranges up to 30V
- Adjustable startup timing and fast-start capability

Specifications

- Input voltage supply (V_{IN}): 3.3V + V_{DO} to 30V
- Preset output voltage (V_{OUT}): 3.3V
- Maximum output current: 1A
- PCB Layers/Thickness: 4 layers, 1oz outer, 0.5oz inner

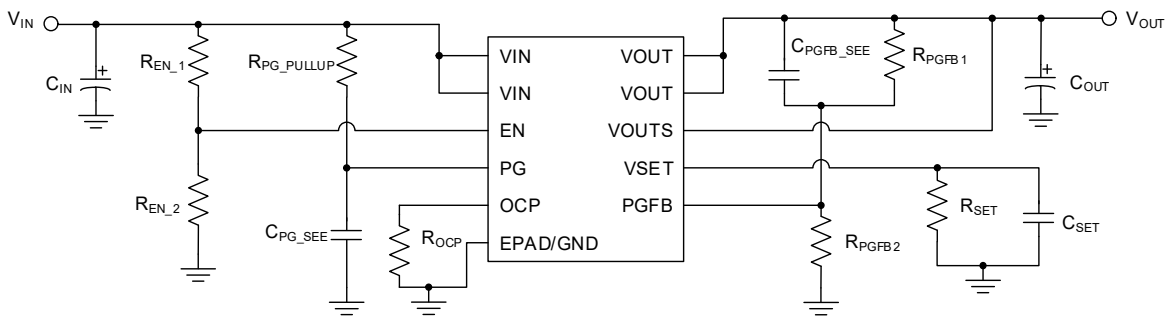

Figure 1. Board Block Diagram

Contents

1. Functional Description

The ISL75054SLHEVAL1Z evaluation board is configured for an output voltage of 3.3V and is capable of an input voltage of 3.3V + V_{DO} to 30V.

The ISL75054SLHEVAL1Z demonstration board provides access to the pins of the IC device and test connectors for test equipment. See the schematic, PCB layers, and Bill of Materials for more information.

1.1 Operational Characteristics

The ISL75054SLHEVAL1Z requires only a single voltage supply of 3.3V + V_{DO} to 30V connected to VIN to operate, outputting 3.3V on VOUT. This board is configured for 1A of current. The input operating voltage at which the IC turns on is set by the resistor divider (R1 and R2) on the EN pin and the VIN UVLO Threshold of 2.7V.

The ISL75054SLHEVAL1Z can handle input voltages of up to 30V; however, Renesas recommends that the power dissipation be less than 2W to avoid foldback and over-temperature protection.

1.2 Setup and Configuration

- Place a jumper on EN_JP (JP1).
- Place a jumper on PGFB_JP (JP3).
  - Jumper setting 1-2: Fast startup disabled
  - Jumper setting 2-3: Fast startup enabled
- Apply input source to VIN terminal.
- A resistive or electronic load can be connected to VOUT terminal.

1.3 VOUT Setting

The ISL75054SLHEVAL1Z is configured for a 3.3V output voltage by placing a 33.2kΩ R_{SET} resistor (R7) from VSET to GND. A resistor divider from VOUT to PGFB (R5 and R6) sets the fast startup and power-good thresholds.

If fast start-up and power-good functionality are not required, set PGFB_JP to position 1-2.

Use Equation 1 to calculate the R_{SET} resistor required for a specific output voltage.

(EQ. 1) $$R_{SET}(\Omega) = \frac{V_{OUT}(V)}{100\mu A}$$

Use Equation 2 to calculate the recommended resistor divider from VOUT to PGFB to enable fast startup and power-good functionality. A 665mV PGFB threshold is chosen as the midpoint between the 605mV fast-start shutoff and 725mV overvoltage typical thresholds.

(EQ. 2) $$665mV = \frac{V_{OUT}(V) \times R_{PGFB1}(k\Omega)}{R_{PGFB1}(k\Omega) + R_{PGFB2}(k\Omega)}$$

1.4 Soft-Start Setting

The ISL75054SLH soft start is set by placing a C_{SET} capacitor (C9) from the VSET pin to GND. In addition to configuring the startup time, this capacitor creates a noise filter for the internal current reference. In general, a lower capacitor results in a faster soft-start time but higher noise. Renesas recommends using a C_{SET} capacitor between 0.47µF and 10µF.

1.5 Resistor Adjustable OCP

The ISL75054SLH features both internal and resistor adjustable overcurrent protection and foldback. The resistor adjustable overcurrent limit is set by a R_{OCP} resistor (R4) from the OCP pin to GND and can be calculated using Equation 3.

(EQ. 3) $$R_{OCP} = \frac{150A \times \Omega}{I_{OUT(Limit)}}$$

With R_{OCP} of 150Ω, the maximum output current is limited to 1A (typical). With a R_{OCP} of 750Ω, the maximum output current is limited to 200mA (typical). When OCP is connected directly to GND, only internal overcurrent protection is functional. The default R_{OCP} resistor on the evaluation board is 0Ω, therefore disabling external overcurrent protection.

2. Board Design

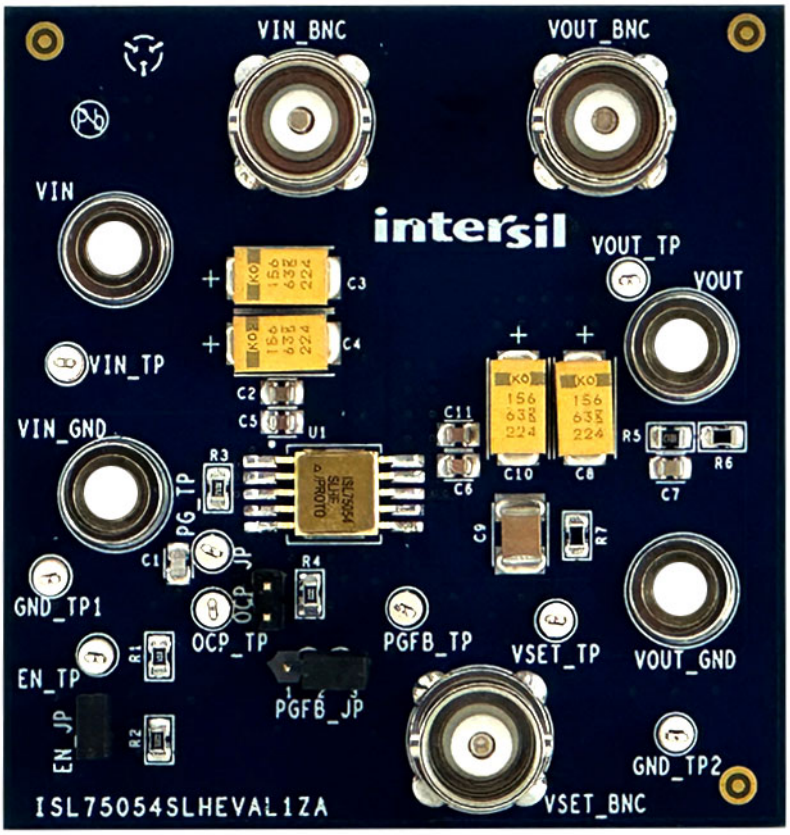

Figure 2. ISL75054SLHEVAL1Z Evaluation Board (Top)

2.1 Schematic Diagrams

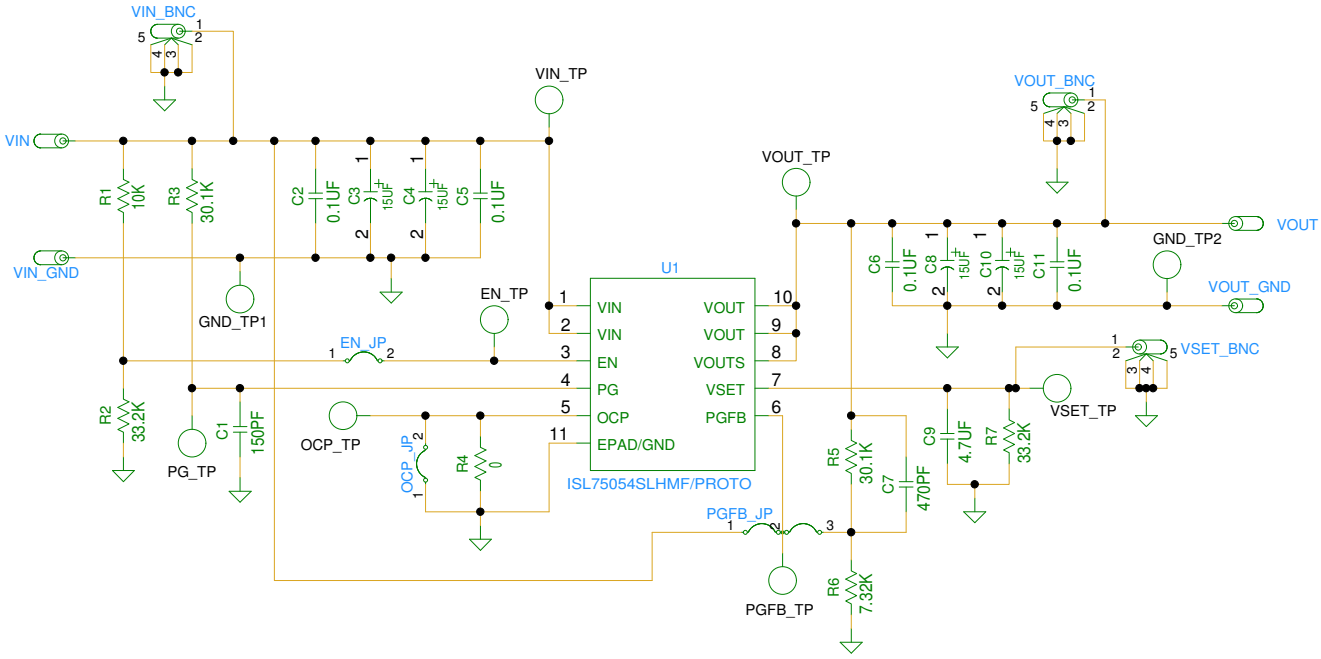

Figure 3. ISL75054SLHEVAL1Z Schematic

2.2 Bill of Materials

Qty	Ref Des	Description	Manufacturer	Part Number
1	C1	CAP, SMD, 0805, 150pF, 50V, 5%, C0G/NPO, ROHS	Generic	C0805C151J5GACTU-T
1	C7	CAP, SMD, 0805, 470pF, 50V, 10%, X7R, ROHS	Generic	08052R471K9B20D-T
1	C9	CAP, SMD, 1812, 4.7µF, 50V, 10%, X7R, ROHS	Kemet	C1812C475K5RACAUTO-T
4	C2, C5, C6, C11	CAP-AEC-Q200, SMD, 0805, 0.1µF, 100V, 10%, X7R, RoHS	Kemet	C0805C104K1RACTU-T
4	C3, C4, C8, C10	CAP-TANT, SMD, 7.3×4.3×4.3, 15µF, 63V, 20%, RoHS	Kemet	T541X156M063AH6510-T
3	VIN_BNC, VOUT_BNC, VSET_BNC	CONN-BNC, RECEPTACLE, TH, 4 POST, 50Ω, SILVER, RoHS	Amphenol	31-5329-51RFX
2	EN_JP, OCP_JP	CONN-HEADER, 1×2, RETENTIVE, 2.54SLHm, RoHS	Amphenol	69190-202HLF
1	PGFB_JP	CONN-HEADER, 1×3, BREAKAWY 1×36, 2.54SLHm, RoHS	Amphenol	68000-236HLF-1X3
4	VIN, VIN_GND, VOUT, VOUT_GND	CONN-JACK, STD BANANA, SDRLESS, 0.350inch, RoHS	Keystone	575-8
9	EN_TP, GND_TP1, GND_TP2, OCP_TP, PGFB_TP, PG_TP, VIN_TP, VOUT_TP, VSET_TP	CONN-MINI Test Point, Vertical, White, RoHS	Keystone	5002
1	R1	RES, AEC-Q200, SMD, 0805, 10K, 1/10W, 5%, TF, RoHS	Panasonic	ERJ-6GEYJ103-T
1	R3	RES, AEC-Q200, SMD, 0805, 30.1K, 1/8W, 1%, TKF, RoHS	Panasonic	ERJ-6ENF3012V-T
1	R2	RES, AEC-Q200, SMD, 0805, 33.2K, 1/8W, 1%, TKF, RoHS	Panasonic	ERJ-6ENF3322V-T

Qty	Ref Des	Description	Manufacturer	Part Number
1	R6	RES, AEC-Q200, SMD, 0805, 7.32K, 1/8W, 0.1%, TF, RoHS	Panasonic	ERA-6AEB7321V-T
1	R5	RES, SMD, 0805, 30.1K, 1/10W, 0.1%, TNF, RoHS	Panasonic	RN73C2A30K1BTDF-T
1	R7	RES, SMD, 0805, 33.2K, 1/8W, 0.1%, THINFILM, RoHS	Panasonic	ERA-6AEB3322V-T
1	R4	RES-AEC-Q200, SMD, 0805, 0Ω, 1/8W, TF, RoHS	Panasonic	ERJ-6GEY0R00V-T
1	U1	RH Ultra Low Noise LDO	Renesas	ISL75054SLHMF/PROTO

2.3 Board Layout

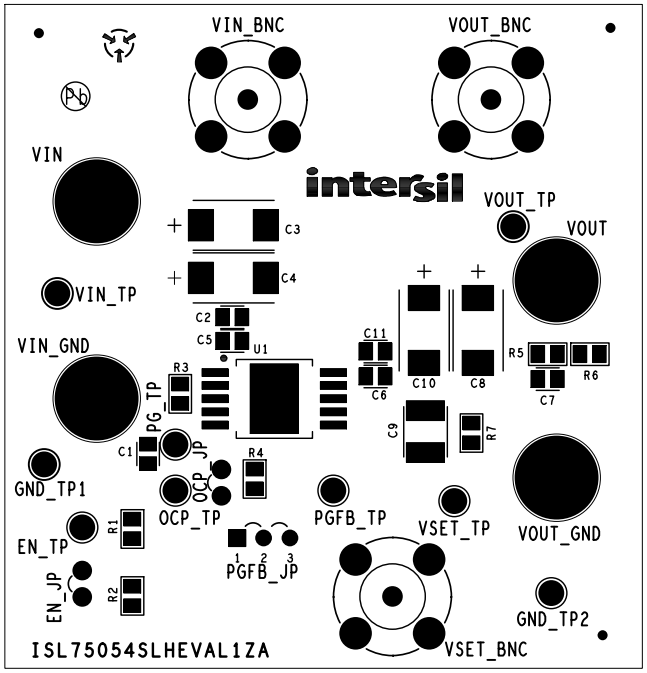

Figure 4. Silkscreen Top

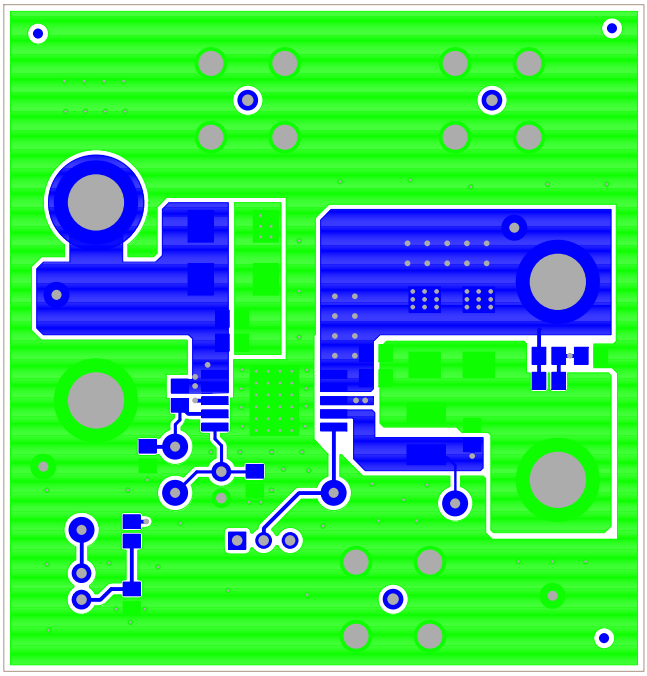

Figure 5. Top Layer

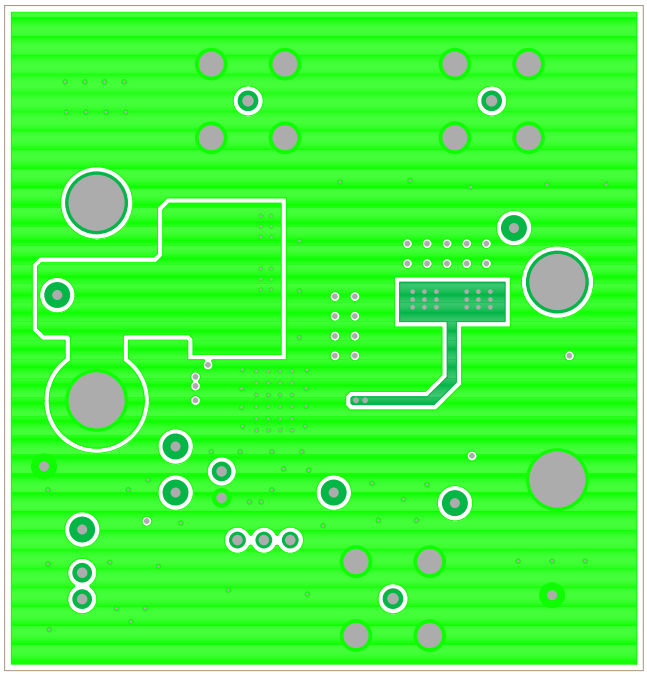

Figure 6. Layer 2

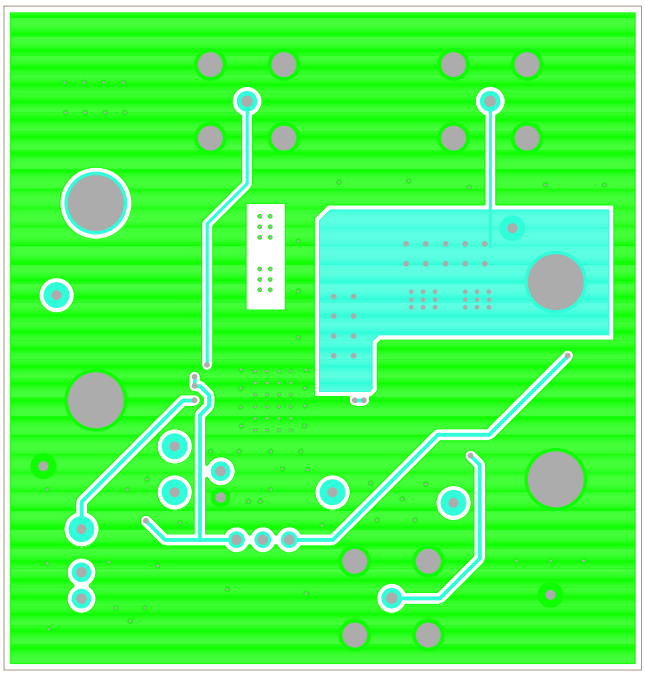

Figure 7. Layer 3

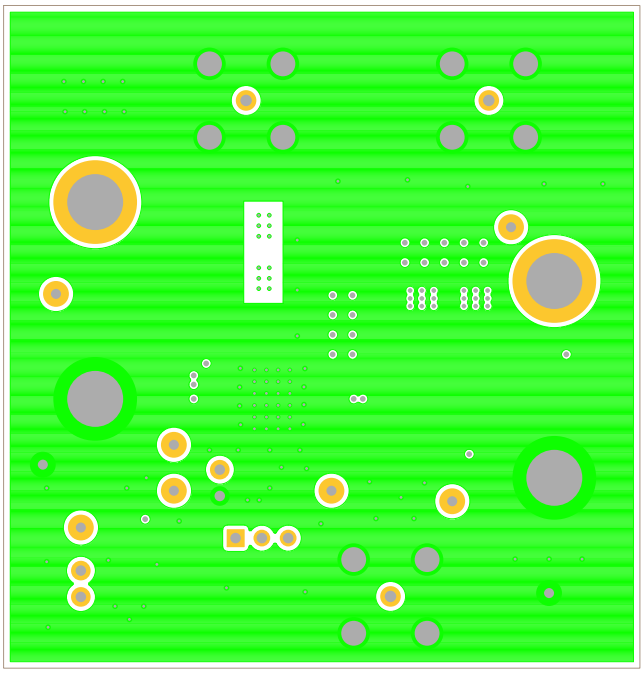

Figure 8. Bottom Layer

3. Typical Performance Graphs

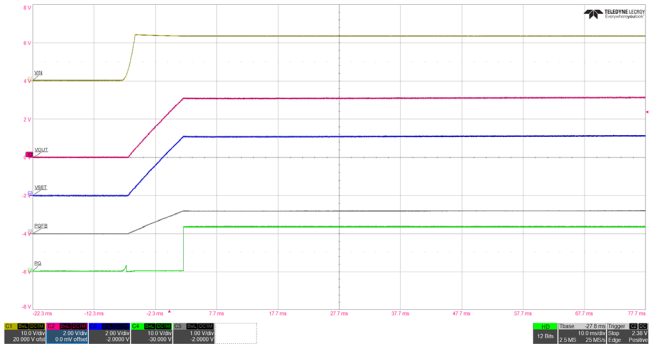

Figure 9. Startup: Fast Start Enabled, 1A Load

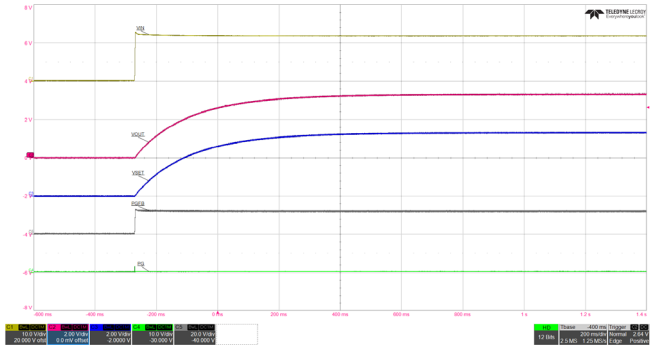

Figure 10. Startup: Fast Start Disabled, 1A Load

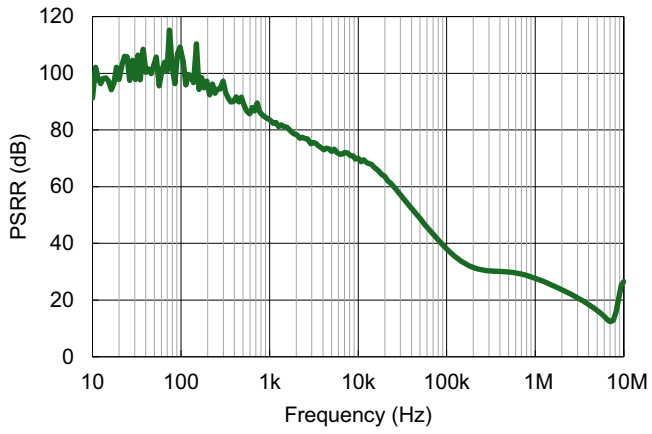

Figure 11. PSRR vs Frequency, 1A Load

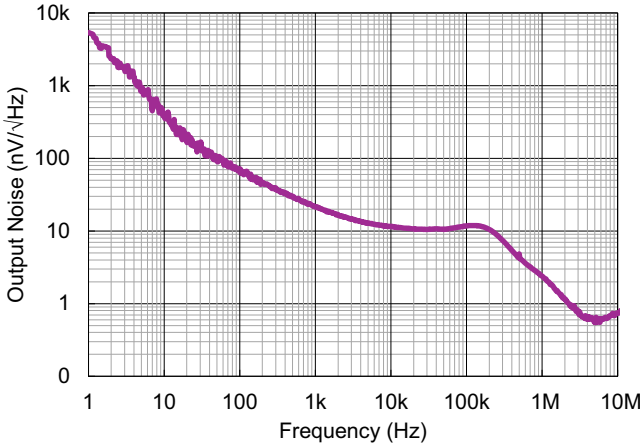

Figure 12. Noise vs Frequency

4. Ordering Information

Part Number	Description
ISL75054SLHEVAL1Z	Radiation Hardened ISL75054SLH Ultra Low Noise LDO Board

5. Revision History

Revision	Date	Description
1.00	May 15, 2025	Initial release.

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