ISL75054SLHDEMO1Z

Radiation Hardened ISL75054SLH Ultra Low Noise LDO Board

Description

The ISL75054SLHDEMO1Z demonstration 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 ISL75054SLHDEMO1Z demonstration board provides a quick and easy method for evaluating the ISL75054SLH part in a form factor optimized for minimum solution size. For information about the device operation, function, and performance, refer to the *ISL75054SLH Datasheet*.

Features

- Form factor optimized for minimum solution size
- Ultra-low noise
- High PSRR
- Adjustable enable, power-good, and current limit thresholds
- Output current monitoring through OCP pin
- Adjustable startup timing and fast-start capability

Specifications

- Input voltage supply (V_{IN}): 3.3V + V_{DO} to 20V
- Preset output voltage (V_{OUT}): 3.3V
- Maximum output current: 1A
- PCB Layers/Thickness: 4 layers, 1oz outer, 0.5oz inner

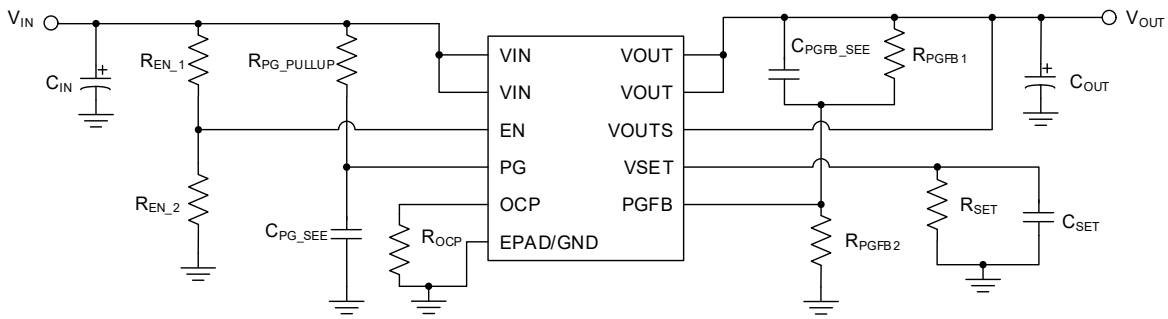

Figure 1. Board Block Diagram

Contents

1. Functional Description

The ISL75054SLHDEMO1Z demonstration board is configured for an output voltage of 3.3V and is capable of an input voltage of 3.3V + V_{DO} to 20V.

The ISL75054SLHDEMO1Z demonstration board provides access to the pins of the IC device and test connectors for test equipment. For more information, see the schematic, PCB layers, and Bill of Materials.

1.1 Operational Characteristics

The ISL75054SLHDEMO1Z requires only a single voltage supply of 3.3V + V_{DO} to 20V connected to VIN to operate, outputting 3.3V on VOUT. This board is rated for 1A of output current. The input operating voltage at which the IC turns on is set by the resistor divider (R2 and R3) on the EN pin and the VIN UVLO Threshold of 2.7V.

Input voltages of up to 20V are possible using the ISL75054SLHDEMO1Z, however, to avoid foldback and over temperature protection, Renesas recommends that the power dissipation of the device is less than 2W.

1.2 Setup and Configuration

- Apply input source to VIN and VIN_GND terminals.
- A resistive or electronic load can be connected to VOUT and VOUT_GND terminals

1.3 VOUT Setting

The ISL75054SLHDEMO1Z is configured for a 3.3V output voltage by placing a 33.2kΩ RSET resistor (R7) from VSET to GND. A resistor divider from VOUT to PGFB (R5 and R6) sets the fast startup and power-good thresholds.

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 setting the current limit to a typical value of 1.4A.

2. Board Design

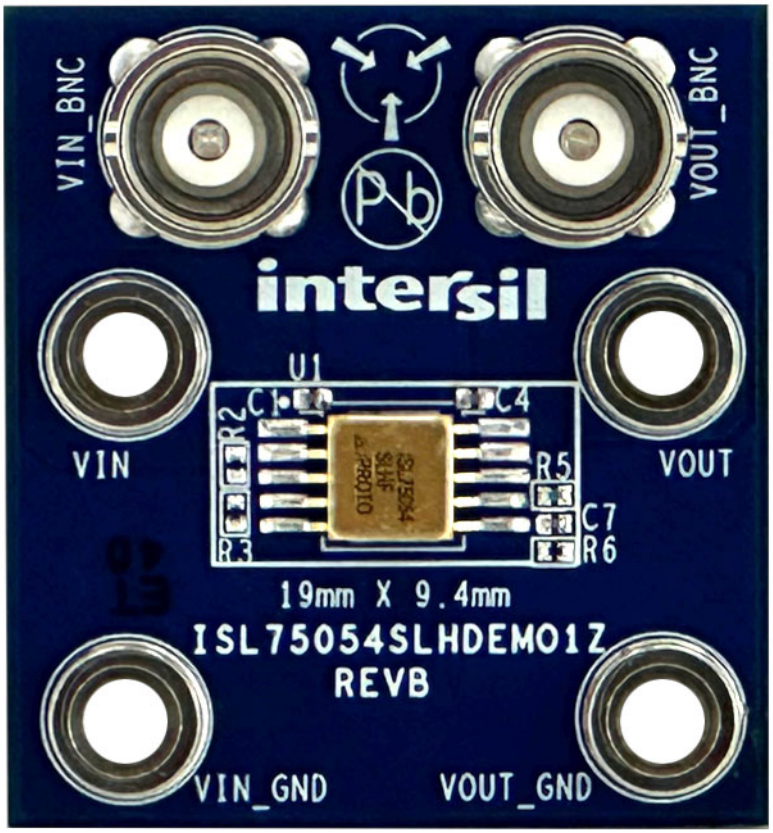

Figure 2. ISL75054SLHDEMO1Z Evaluation Board (Top)

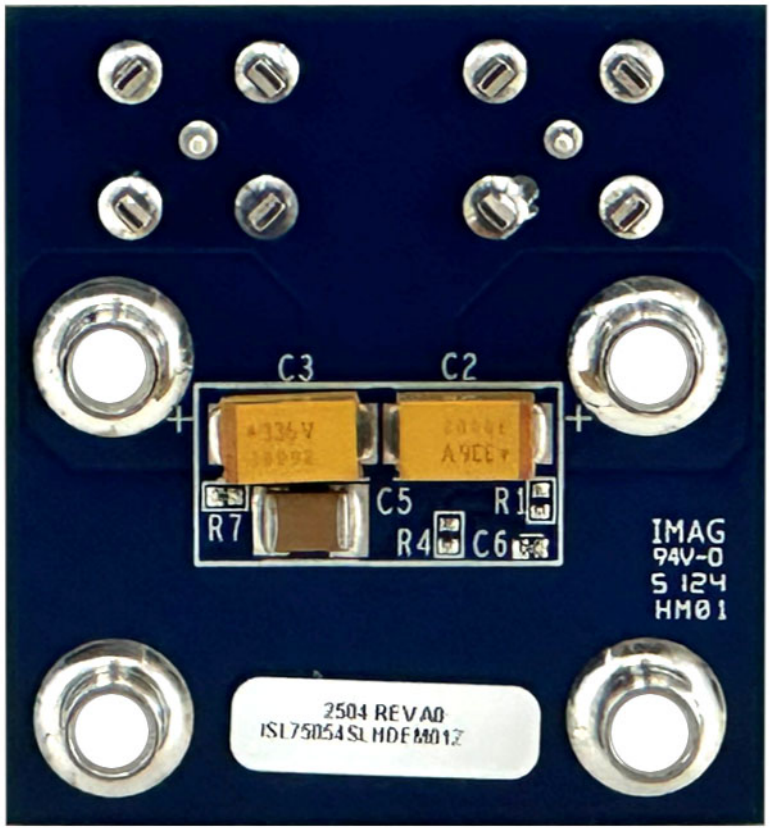

Figure 3. ISL75054SLHDEMO1Z Evaluation Board (Bottom)

2.1 Schematic Diagrams

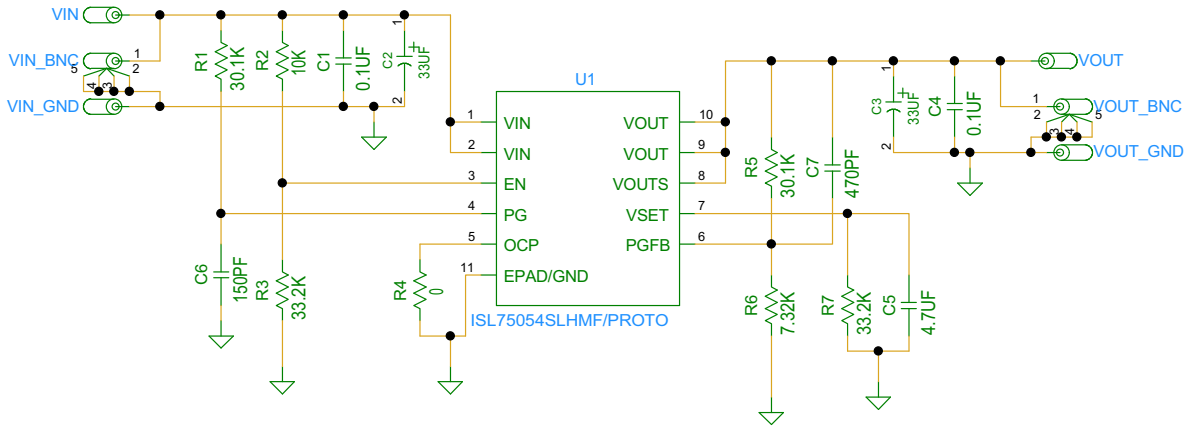

Figure 4. ISL75054SLHDEMO1Z Schematic

2.2 Bill of Materials

Qty	Ref Des	Description	Manufacturer	Part Number
2	VIN_BNC, VOUT_BNC	Silver Plated 50Ω PCB MOUNT RECEPTACLE	Amphenol	31-5329-51RFX
4	VIN, VIN_GND, VOUT, VOUT_GND	L = 0.350in SOLDER MOUNT BANANA PLUG	Keystone	575-8
1	C5	4.7µF, 10%, 50V, CAP_1812, Ceramic Chip Cap	Kemet	C1812C475K5RACAUTO
1	R1	30.1K, 1%, 1/16W, RES_0402, Thick Film Chip Resistor	Vishay	CRCW040230K1FKED
1	R6	7.32K, 1%, 1/16W, RES_0402, Thick Film Chip Resistor	Panasonic	ERA-2AEB7321X
2	C1, C4	0.1µF, 10%, 25V, CAP_0402, Ceramic Chip Cap	Murata	GRM155R71E104KE14J
1	C6	150PF, 10%, 50V, CAP_0402, Multilayer Cap	Various	Generic
1	C7	470PF, 10%, 50V, CAP_0402, Multilayer Cap	Various	Generic
1	R4	0, 1/16W, RES_0402, Thick Film Chip Resistor	Various	Generic
1	R2	10K, 1%, 1/16W, RES_0402, Thick Film Chip Resistor	Various	Generic
2	R3, R7	33.2K, 1%, 1/16W, RES_0402, Thick Film Chip Resistor	Various	Generic
1	U1	RH Ultra Low Noise LDO	Renesas	ISL75054SLHMF/PROTO
1	R5	30.1K, 1%, 1/16W, RES_0402, Thick Film Chip Resistor	Vishay	TNPW040230K1BEED
2	C2, C3	ESR 65mΩ 2006ma Commercial Multi-anode High Power Tantalum Capacitor	Kyocera AVX	TPME336K035R0065

2.3 Board Layout

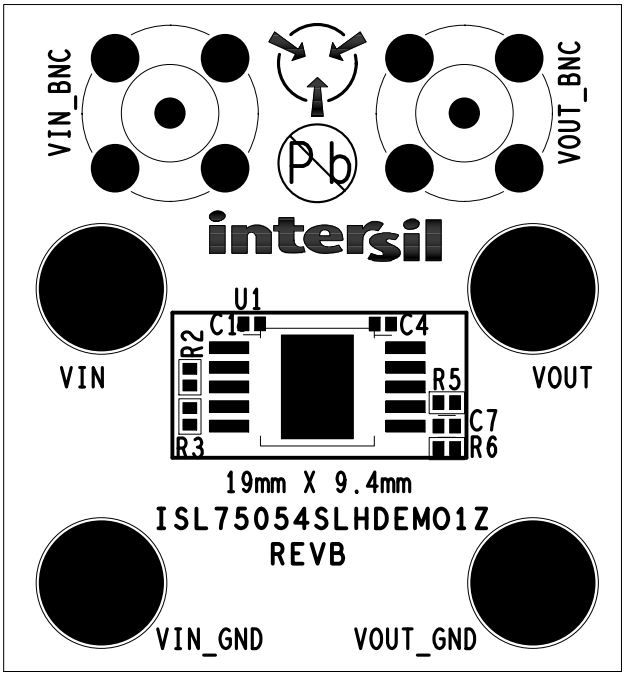

Figure 5. Silkscreen Top

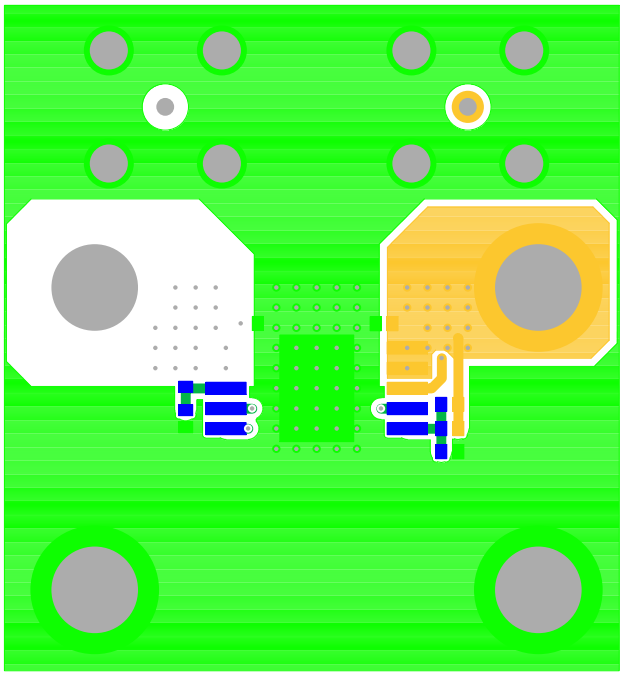

Figure 6. Top Layer

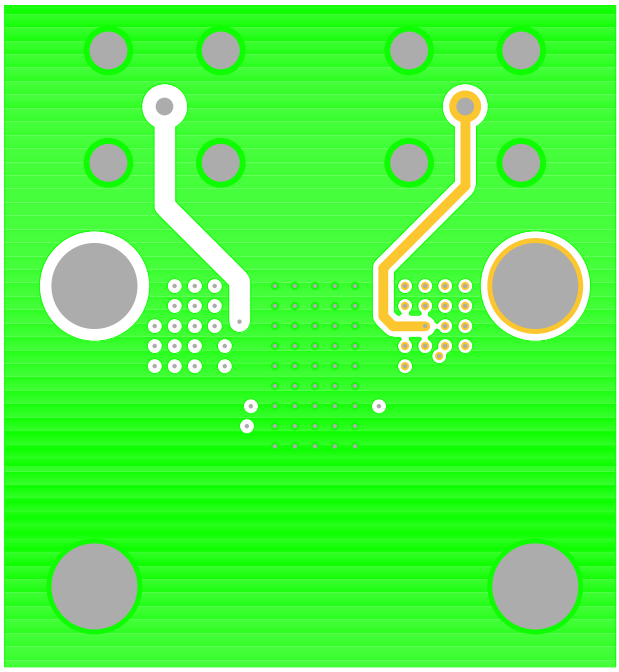

Figure 7. Layer 2

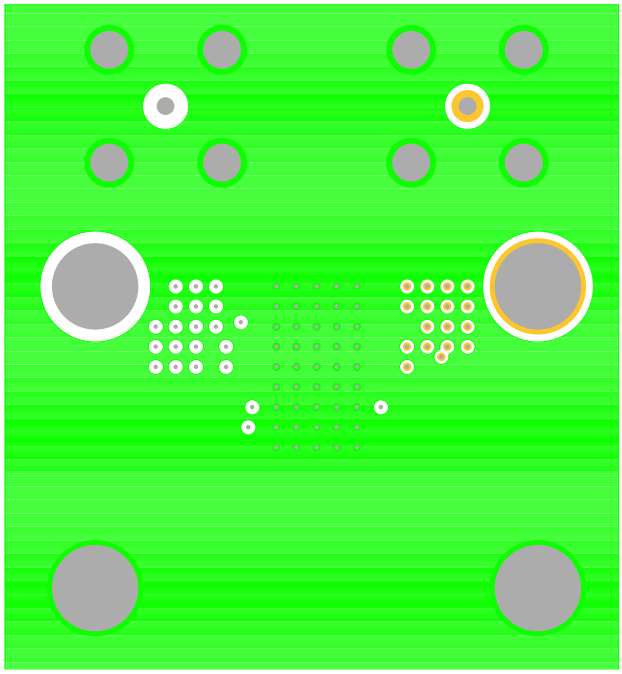

Figure 8. Layer 3

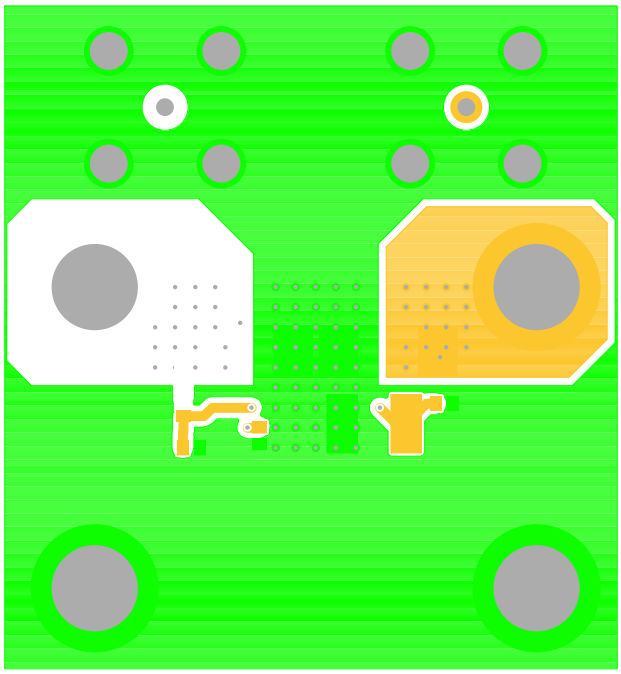

Figure 9. Bottom Layer

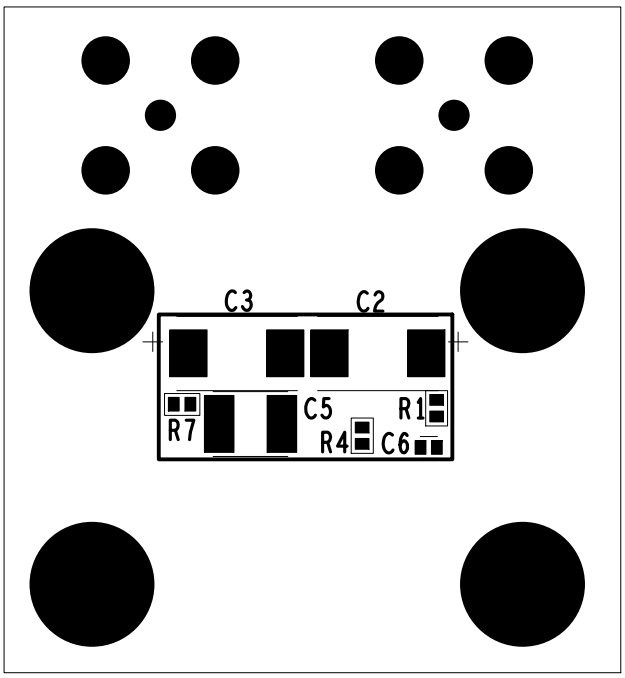

Figure 10. Silkscreen Bottom

3. Typical Performance Graphs

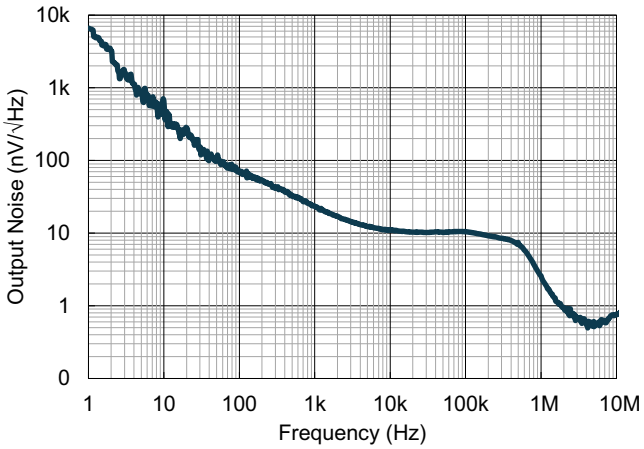

Figure 11. Noise vs Frequency

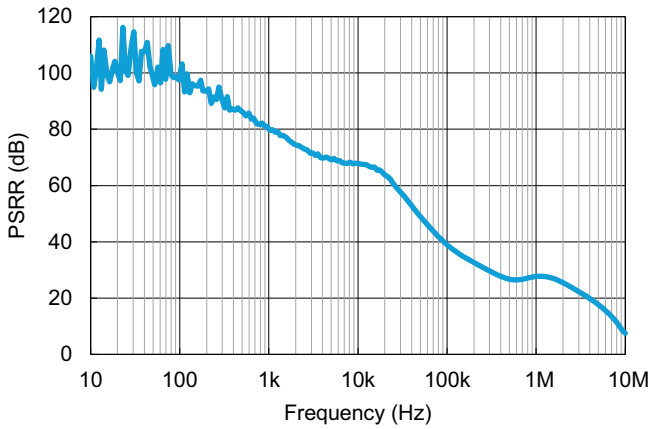

Figure 12. PSRR vs Frequency, 1A Load

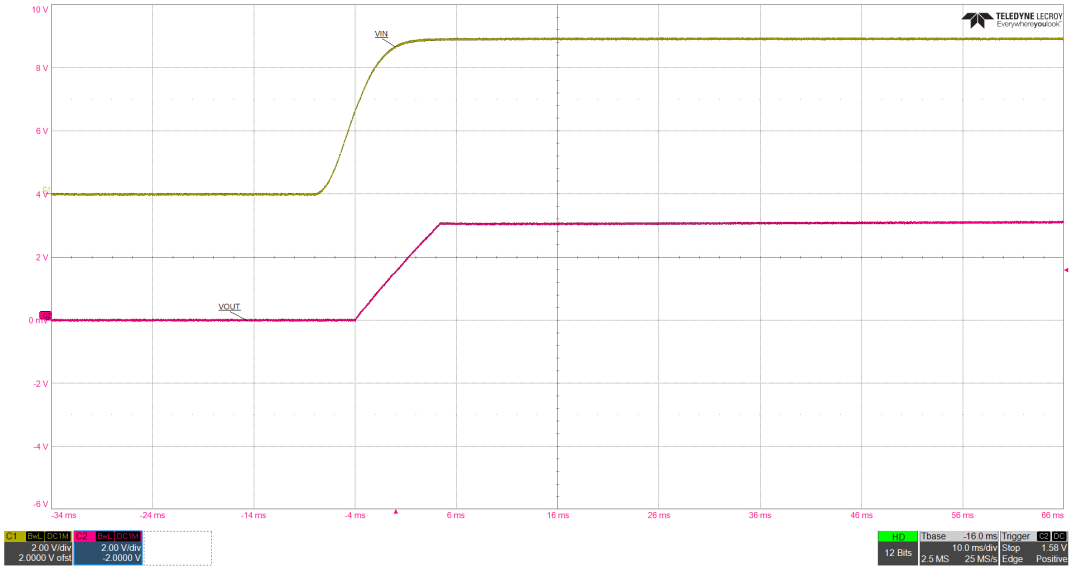

Figure 13. Startup: 1A Load

4. Ordering Information

Part Number	Description
ISL75054SLHDEMO1Z	Radiation Hardened ISL75054SLH Ultra Low Noise LDO Board

5. Revision History

Revision	Date	Description
1.00	May 6, 2025	Initial release.

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