ISL72991RHEVAL2Z Evaluation Board User Guide

Description

The ISL72991RHEVAL2Z platform showcases the radiation hardened ISL72991RH, a low dropout adjustable negative voltage regulator with an output voltage range of -2.25V to -26V. The device features a 1A output current capability, an adjustable current limit pin (ILIM) and a shutdown pin (SD) for easy on/off control.

Specifications

This board has been default configured for the following operating conditions:

- V_{IN} = -7V to -26V
- V_{OUT} = -5V
- I_{MAX} = 0.8A
- Board temperature: +25°C

Key Features

- Small, compact design
- V_{IN} range of -3V to -30V
- V_{OUT} adjustable from -2.25V to -26V
- Convenient power connection

References

ISL72991RH Datasheet

Ordering Information

PART NUMBER	DESCRIPTION
ISL72991RHEVAL2Z	ISL72991RHEVAL2Z Evaluation Kit

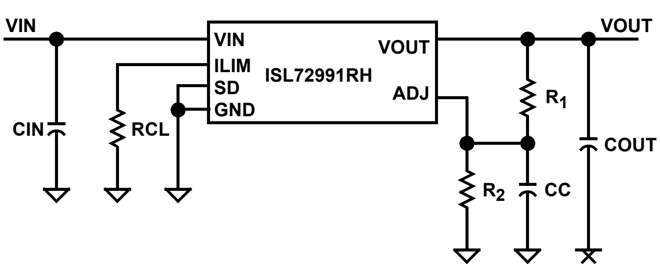


FIGURE 1. ISL72991RHEVAL2Z TYPICAL USAGE BLOCK DIAGRAM

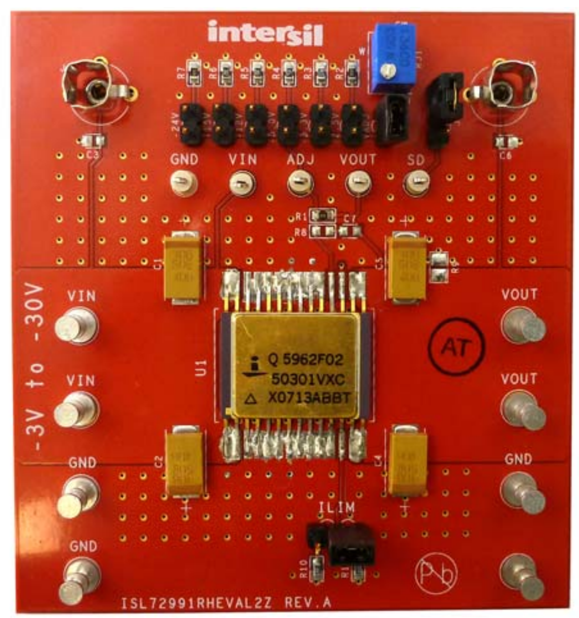


FIGURE 2. ISL72991RHEVAL2Z TOP SIDE

Functional Description

The ISL72991RHEVAL2Z board provides a simple platform to demonstrate the features and functionality of this negative voltage regulator. Capable of being biased from -3V to -30V the ISL72991RH is ideal for generating up to 1A of load current limited by its power dissipation driven die temperature for output voltages ranging from -2.25V to -26V. This platform features adjustable voltage and current limiting along with a signalled turn-on via the SD input or turn-on as input voltage is applied.

By default, the ISL72991RHEVAL2Z is configured for an output voltage of -5V and a 0.8A current limit and also allowing for easy adjustment of both of these operating points.

The board V_{IN} range is -3V to -30V. The board V_{OUT} is default set to -5V by a jumper JP4 and can be changed by changing the jumper position including to the jumper position (JP1) that connects to a potentiometer for a custom voltage provided beyond jumper pin strapping.

The ISL72991RHEVAL2Z provides jumper configurations for several common voltages including, -2.5V, -3.3V, -5.0V, -12V, -15V and -24V.

The output current limit threshold of the regulator is set with a single external resistor (R_{CL}) connected from I_{LIM} to ground.

The effective current limit at any single R_{CL} value is influenced by the V_{IN} to V_{OUT} difference, temperature and V_{IN} amplitude. Because of these numerous variables, there is no single formula relating R_{CL} to I_{CL} that will suffice for the range of likely possible operating conditions.

Figures 7 through 10 provide guidance in setting the R_{CL} value for a limited number of possible conditions. Users are advised to evaluate their specific condition for satisfactory performance.

Operating Range

By default, the board V_{IN} range is -7V to -30V for a V_{OUT} of -5V and an I_{OUT} of up to ~0.8A, both set by jumpers. Modifying the operating conditions will change the performance results.

PCB Layout Guidelines

The ISL72991EVAL2Z PCB layout has been optimized for electrical and thermal performance.

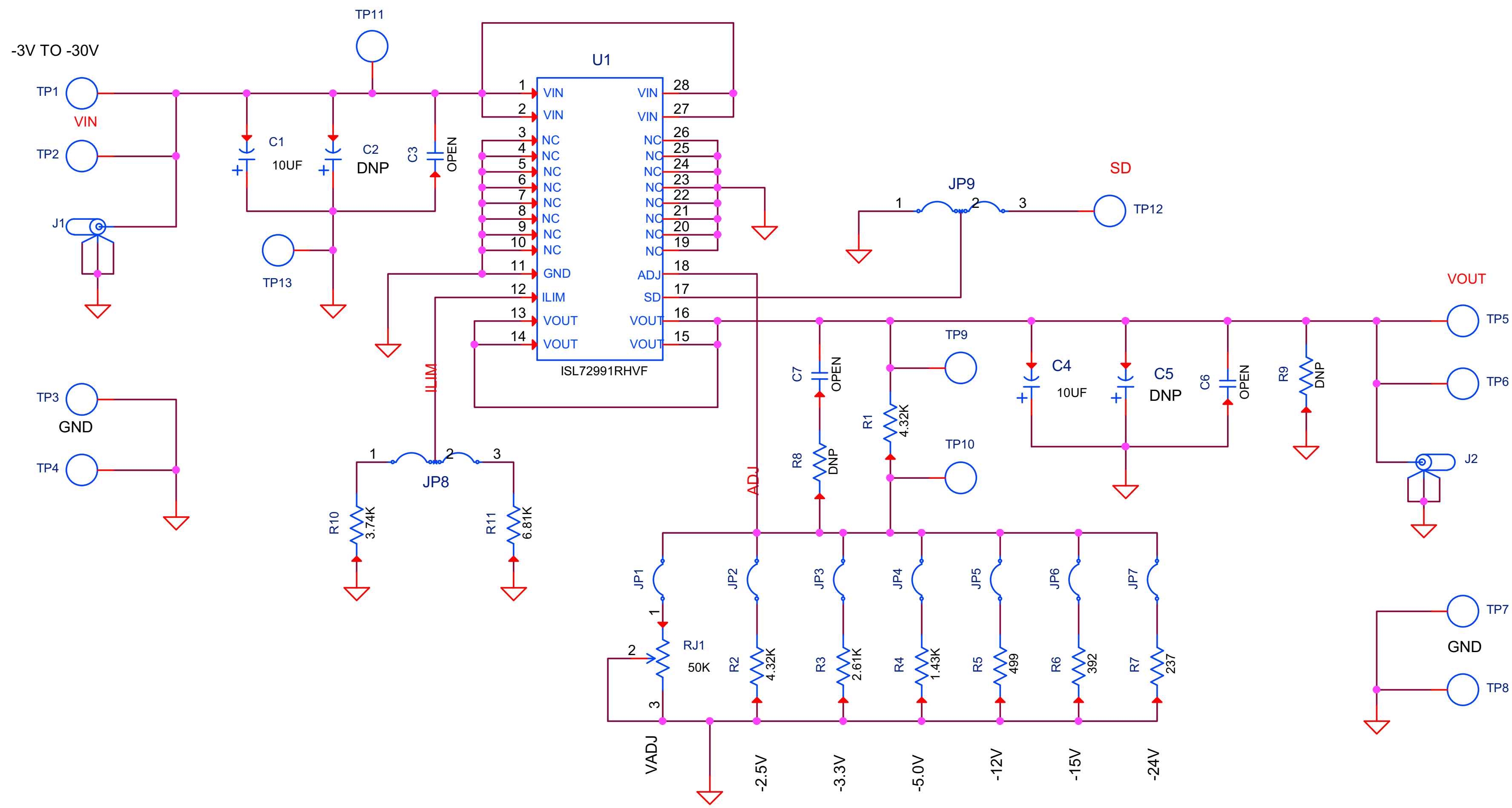
The stability of the regulator is sensitive to layout. It is strongly recommended that a continuous copper ground plane (1 ounce or greater) be used. In addition, component lead lengths and interconnects should be minimized, but should not exceed 1/2 inch. Finally, the return lead of the compensation capacitor (C_C) should be connected as close as possible to the GND pin of the IC.

For optimum thermal performance, generally place a pattern of vias on the layer of the PCB directly underneath the IC and connect the vias to the plane which serves as a heatsink. In general, to ensure good thermal contact, thermal interface material such as a Sil-Pad or thermally conductive epoxy should be used to fill the gap between the vias and the bottom of the IC of the ceramic package.

Quick Start Guide

1. Ensure that the board is properly connected to the negative voltage supply and loads prior to applying any power.
2. Connect the negative voltage input supply to VIN (-7V to -30V)
3. Connect the load to VOUT and GND connectors.
4. Turn input power supply ON.
5. Confirm default -5V output voltage, test ISL72991RH operation.

ISL72991RHEVAL2Z Circuit Schematic



Bill of Materials

ITEM	QTY	REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	MANUFACTURER	DESCRIPTION
1	2	J1, J2	131-4353-00	TEKTRONIX	Scope Probe Test Point PCB Mount
2	8	TP1-TP8	1514-2	KEYSTONE	Test Point Turret 0.150 Pad 0.100 Thole
3	1	RJ1	3262W-1-503	BOURNS	Trimmer Potentiometer
4	5	TP9-TP13	5002	KEYSTONE	Miniature White Test Point 0.100 Pad 0.040 Thole
5	3	C3, C6, C7	H1045-OPEN	GENERIC	Multilayer Cap
6	1	R8	H2505-DNP-DNP-1	GENERIC	Metal Film Chip Resistor (Do Not Populate)
7	1	R9	H2506-DNP-DNP-1	GENERIC	Metal Film Chip Resistor (Do Not Populate)
8	1	R5	H2511-04990-1/16W1	GENERIC	Thick Film Chip Resistor
9	2	R1, R2	H2511-04301-1/16W1	GENERIC	Thick Film Chip Resistor
10	1	R6	H2511-03920-1/16W1	GENERIC	Thick Film Chip Resistor
11	1	R3	H2511-02611-1/16W1	GENERIC	Thick Film Chip Resistor
12	1	R7	H2511-02370-1/16W1	GENERIC	Thick Film Chip Resistor
13	1	R10	H2511-03741-1/16W1	GENERIC	Thick Film Chip Resistor
14	1	R4	H2511-01431-1/10W1	GENERIC	Thick Film Chip Resistor
15	1	R11	H2511-06811-1/16W1	GENERIC	Thick Film Chip Resistor
16	1	U1	ISL72991RHVF	INTERSIL	RH Negative Low Dropout Adjustable Voltage Regulator
17	2	JP8, JP9	JUMPER-3-100	GENERIC	Three Pin Jumper
18	7	JP1-JP7	JUMPER2_100	GENERIC	Two Pin Jumper
19	4	C1, C2, C4, C5	T491D106K050AT	KEMET	T491 Series Solid Tantalum Chip Cap

Board Layout - 2 Layers

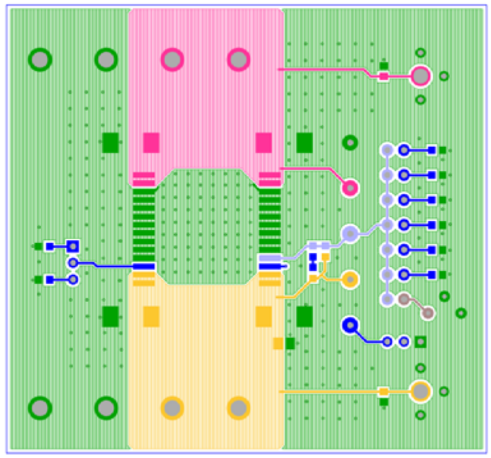


FIGURE 3. TOP LAYER

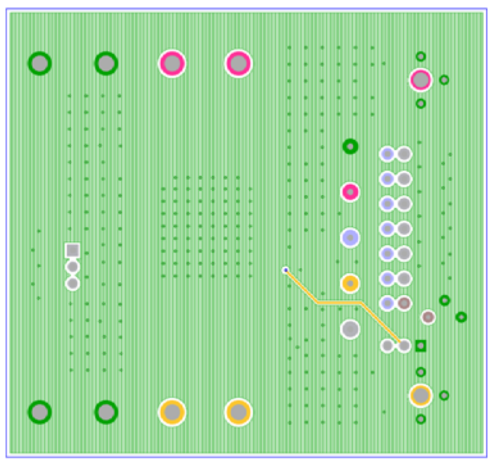


FIGURE 4. PCB – BOTTOM LAYER (VIEWED FROM TOP)

Typical Performance Curves

Unless noted: V_{IN} = -12V, V_{OUT} = -5V, T_A = +25°C

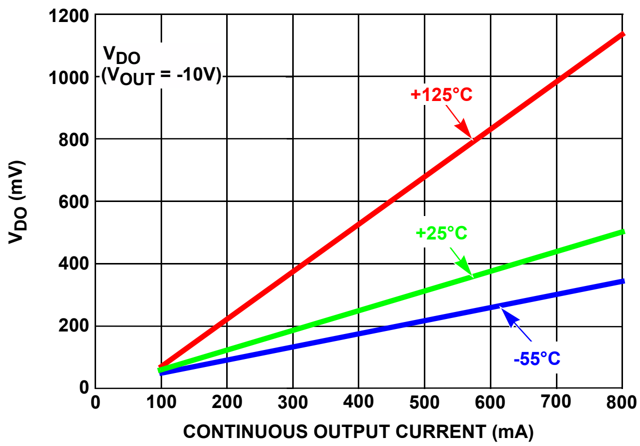


FIGURE 5. DROP-OUT VOLTAGE vs AMBIENT TEMPERATURE

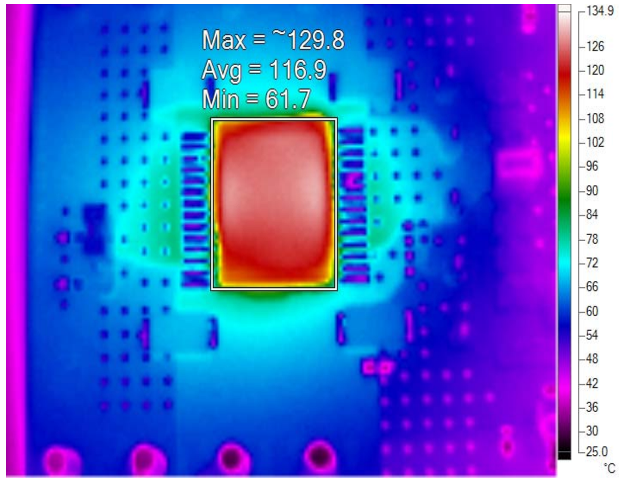


FIGURE 6. PACKAGE TEMP AT -12V_{IN}, -5V_{OUT}, 0.76A, Pd = 5.3W

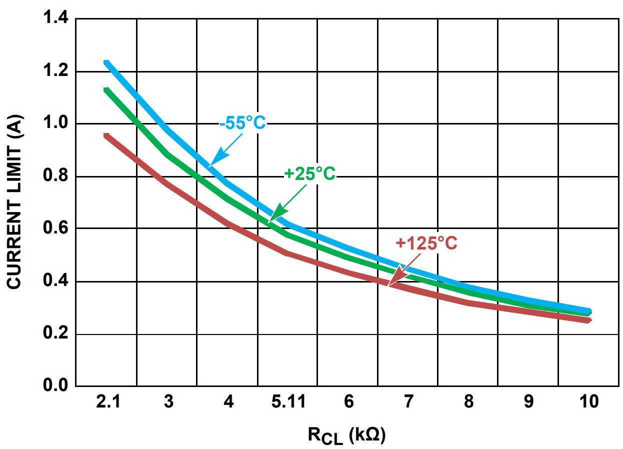


FIGURE 7. -7V_{IN}, -5V_{OUT}

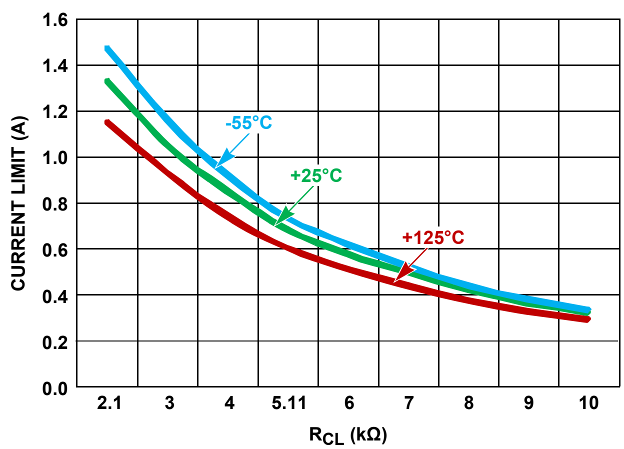


FIGURE 8. -12V_{IN}, -5V_{OUT}

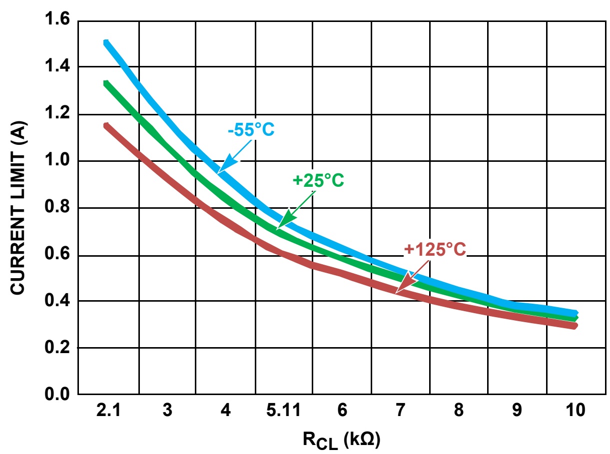


FIGURE 9. -12V_{IN}, -10V_{OUT}

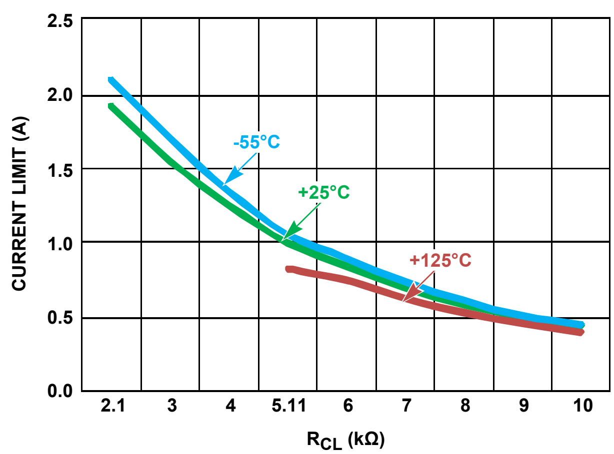


FIGURE 10. -20V_{IN}, -10V_{OUT}

Dynamic Response

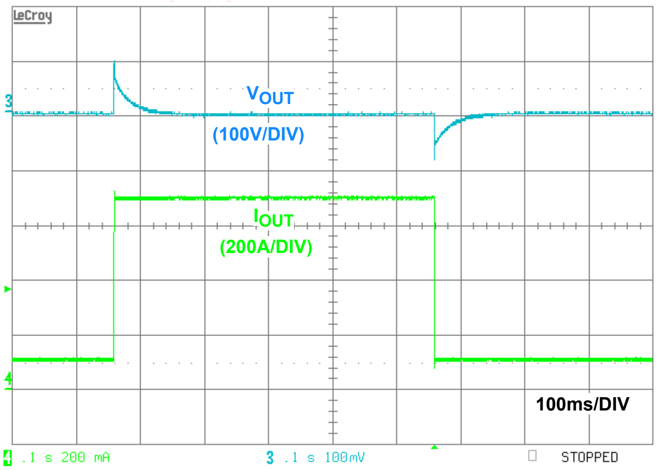


FIGURE 11. 0.1A TO 0.7A LOAD STEP. V_{OUT} IS AC COUPLED TO ILLUSTRATE THE EXTENT OF VOLTAGE DEFLECTION

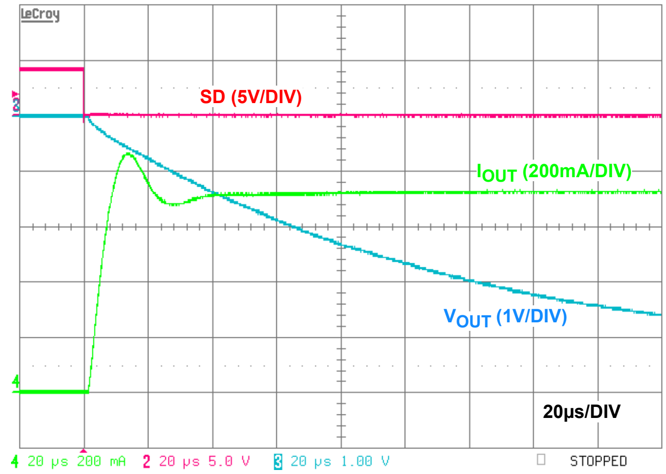


FIGURE 12. SD ENABLE ON INTO 0.76A LOAD, V_{IN} = -12V, V_{OUT} = -5V

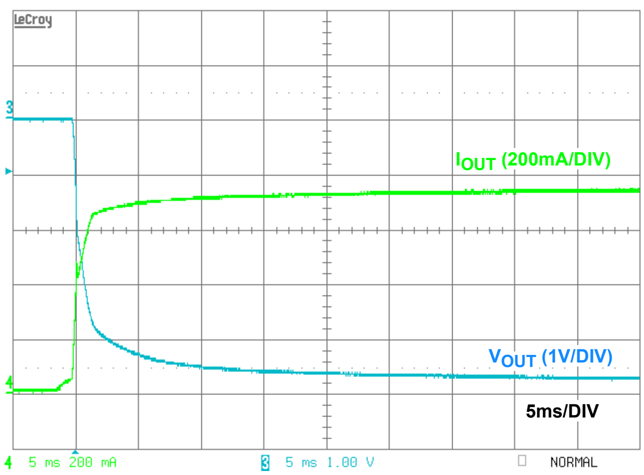


FIGURE 13. POWER ON INTO 0.76A LOAD, V_{IN} = -12V, V_{OUT} = -5V

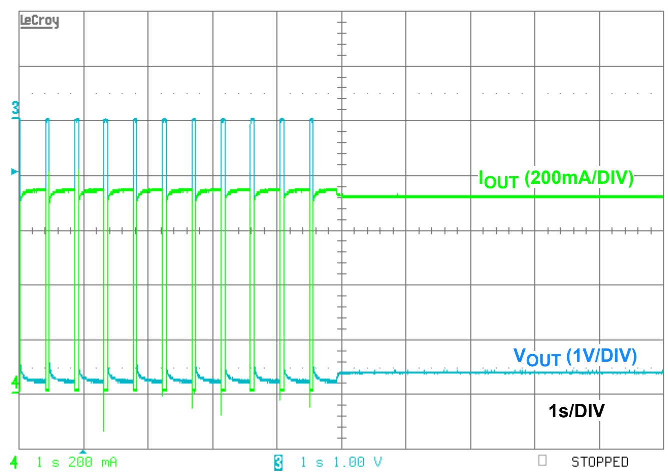


FIGURE 14. RECOVERY FROM OVER TEMPERATURE

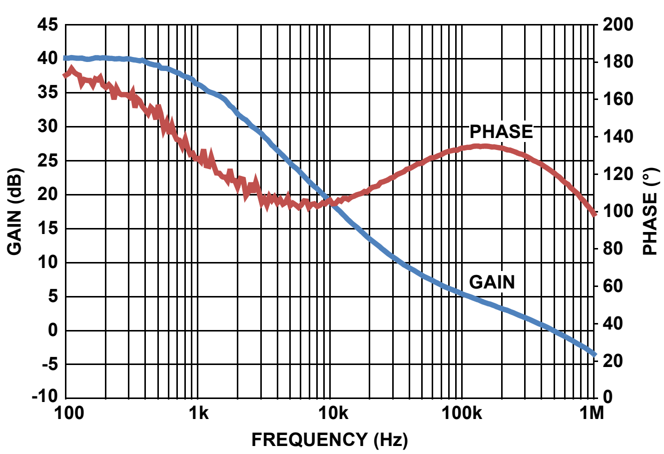


FIGURE 15. GAIN/PHASE $-12V_{IN}$, $-5V_{OUT}$, 0.5A I_{OUT}

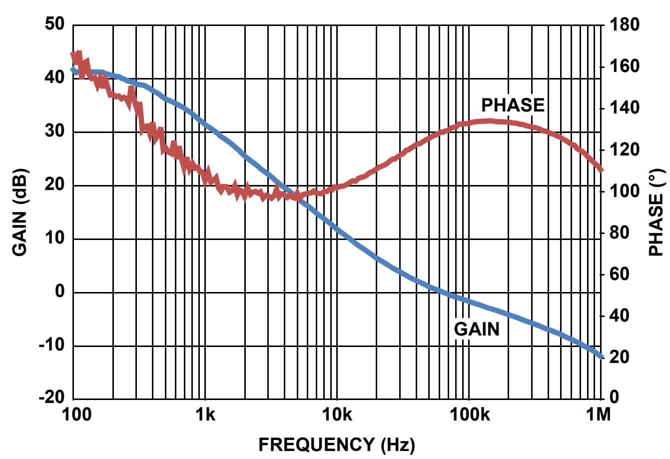


FIGURE 16. GAIN/PHASE $-20V_{IN}$, $-15V_{OUT}$, 0.5A I_{OUT}