

## Evaluating the LT9890, 150 A Current Monitor for Intel Psys Applications

### FEATURES

- ▶ Fully featured evaluation board for the [LT9890](#)
- ▶ Response bandwidth greater than 1 MHz
- ▶ Compatible with Intel VR14 Psys systems

### GENERAL DESCRIPTION

The EVAL-LT9890-A1Z showcases the LT9890 high-precision current monitor with internal current-sense element supporting up to 150 A of load current. The LT9890 IOUT pin outputs a monitor current with 26600:1 ratio to the pass current flowing through IP to IM pins. The IOUT monitor current flows through an external ground referenced 200  $\Omega$  || 100 pF network (~8 MHz low-pass filter) to the P4 (1x2, 100 mil) and J1 (SMA) headers for convenient measurement. The LT9890 current sense element is factory calibrated to 1% of the total unadjusted error and has a zero-temperature coefficient architecture. The IOUT current monitor has a response bandwidth greater than 1 MHz, providing a fast and accurate ground-referenced output signal insensitive to ground voltage variations. Minimal power loss is achieved through a low, 150  $\mu\Omega$  current path resistance and an aspect ratio conducive to wide printed circuit board (PCB) traces. In addition, the LT9890 is compatible with Intel VR14 Psys systems. The key performance characteristics of the EVAL-LT9890-A1Z are shown in the [Performance Summary](#).

Design files for the EVAL-LT9890-A1Z are available on the [EVAL-LT9890](#) evaluation board page.

For full details on the LT9890, see the LT9890 data sheet, which should be consulted in conjunction with this user guide when using the EVAL-LT9890-A1Z evaluation board.

### EVALUATION BOARD PHOTOGRAPH

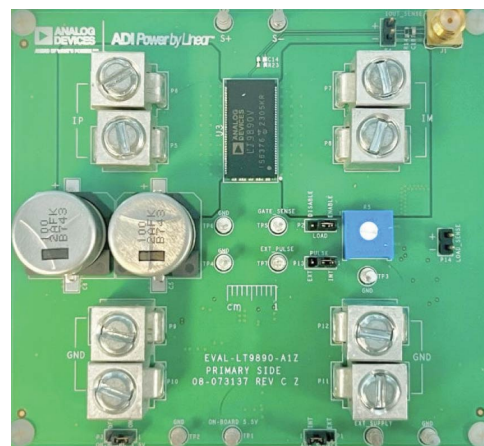


Figure 1. EVAL-LT9890-A1Z Evaluation Board Photograph

TABLE OF CONTENTS

Features.....	1	Operating Principles.....	4
General Description.....	1	Evaluation Board Descriptions.....	5
Evaluation Board Photograph.....	1	Quick Start Procedure.....	6
Performance Summary.....	3		

REVISION HISTORY

3/2024—Revision 0: Initial Version

## PERFORMANCE SUMMARY

Specifications are at  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

**Table 1. Performance Summary**

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
Operating Voltage Range	$V_{IP}$		2.7		65	V
Start-Up Time	$t_{STARTUP}$	Time from undervoltage lockout to output current within 1%		200		$\mu\text{s}$
Current From IP to IM	$I_{SENSE}$		7.5		150	A
Current Path Resistance	$R_{PATH}$	Resistance from IP to IM		150	325	$\mu\Omega$
Input-to-Output Current Ratio	RATIO			26,600		
Output Voltage Ratio to Input Current	$V_{OUT}/I_{SENSE}$	$V_{OUT} = I_{SENSE} \times 200/26600$		0.0075188		V/A

## OPERATING PRINCIPLES

The LT9890 is a high-side, current-sense amplifier with an integrated current-sense element. The current-sense element is copper (using a proprietary method that corrects for the non-ideal resistance traits of the copper). The sense voltage across the sense element is amplified and level shifted to a ground-referenced IOUT. The output signal is analog and can be used as-is or processed with an output filter.

On the EVAL-LT9890-A1Z, the monitor resistor installed is 200  $\Omega$ , which sets the gain to 7.5188 mV/A. Other scaling can be produced by resistor replacement on the demo circuit. This evaluation board is simple to set up to evaluate the performance of the LT9890.

## EVALUATION BOARD DESCRIPTIONS

Jumper settings on the EVAL-LT9890-A1Z evaluation board are detailed in [Table 2](#), which lists the default configuration that must be in place to ensure correct operation. Also, see [Figure 2](#).

**Table 2. Jumper Settings**

Jumper	Default Configurations
P1 (AUX SOURCE)	Set to INT. The auxiliary source is the power supply to the pulse generator. P1 is a two-position jumper between the 5 V and an external 5 V supply.
P2 (LOAD)	Set LOAD to ENABLE. P2 is also a 2-way jumper to swap between enabling and disabling the load.
P3 (ON-BOARD 5.5V)	Set P3 to ON for the on-board 5.5 V supply; otherwise, P3 is set to OFF.
P4 (IOUT_SENSE)	No jumper is needed. One pin of P4 is connected to IOUT, and the other pin of P4 is connected to DGND.
P13 (PULSE)	Set to INT. P13 is also a 2-way jumper to swap between an on-board pulse generator and an external pulse injection through TP7.
P14 (LOAD_SENSE)	No jumper is needed. P14 senses the load when it is enabled or when it is disabled, which was set in P2.

There are several test points available on the EVAL-LT9890-A1Z to connect to probes of the oscilloscope and read different expected values. The descriptions of the test points are as follows:

- ▶ TP1 is an on-board regulator that regulates 5.5 V and can be probed on TP1 to monitor the internal supply.
- ▶ TP2, TP3, TP4, and TP6 can be used as GND signals.
- ▶ TP5 is the gate of the N-channel, metal-oxide semiconductor field-effect transistor (MOSFET) used in the dynamic load circuit.
- ▶ TP8 and TP9 (mentioned as S+ and S-) monitor the incoming supply voltage.
- ▶ TP7 connects to P13 (PULSE). This pulse signal drives the dynamic load circuit. If it is set to EXT, TP7 can be used to inject the external pulse.
- ▶ There is one more turret at the bottom right corner of the EVAL-LT9890-A1Z that can supply the pulse generator and dynamic load circuits if the AUX SOURCE at P1 is set to EXT.

## QUICK START PROCEDURE

Follow these quick start procedure steps:

1. All jumpers must be in the positions detailed in [Table 2](#).
2. For powering on the EVAL-LT9890-A1Z, connect the power supply positive node to IP and the negative node to GND. This supply must be in the 2.7 V to 65 V range and at least a 10 A supply.
3. Connect a load to the IM terminal and GND. The load can be a power resistor, active load instrument, or other circuit of interest.
4. Turn the power supply on, connect a digital multimeter to TP8 and TP9, and examine the supply. This voltage should be the same as the supply.
5. Connect an oscilloscope probe to TP1; the voltage must be approximately 5.5 V. If the waveform exhibits a periodic drop to 0 V, either increase the current limit in the power supply or turn the R5 potentiometer clockwise until the periodic drop disappears.
6. For the output current measurement, connect a point type oscilloscope probe to  $V_{MON}$  (J1), which is a SMA connector or a hook type to Pin 1 of P4.
7. The output voltage measured at J1 corresponds to the load current.  $V_{MON} = 7.5188e^{-3} \times I_{OUT}$  for the factory installed 200  $\Omega$  resistor. The current asserts when the pulse signal is high (center tap of P13).
8. [Figure 2](#) displays a pictorial view of the EVAL-LT9890-A1Z with labeling.

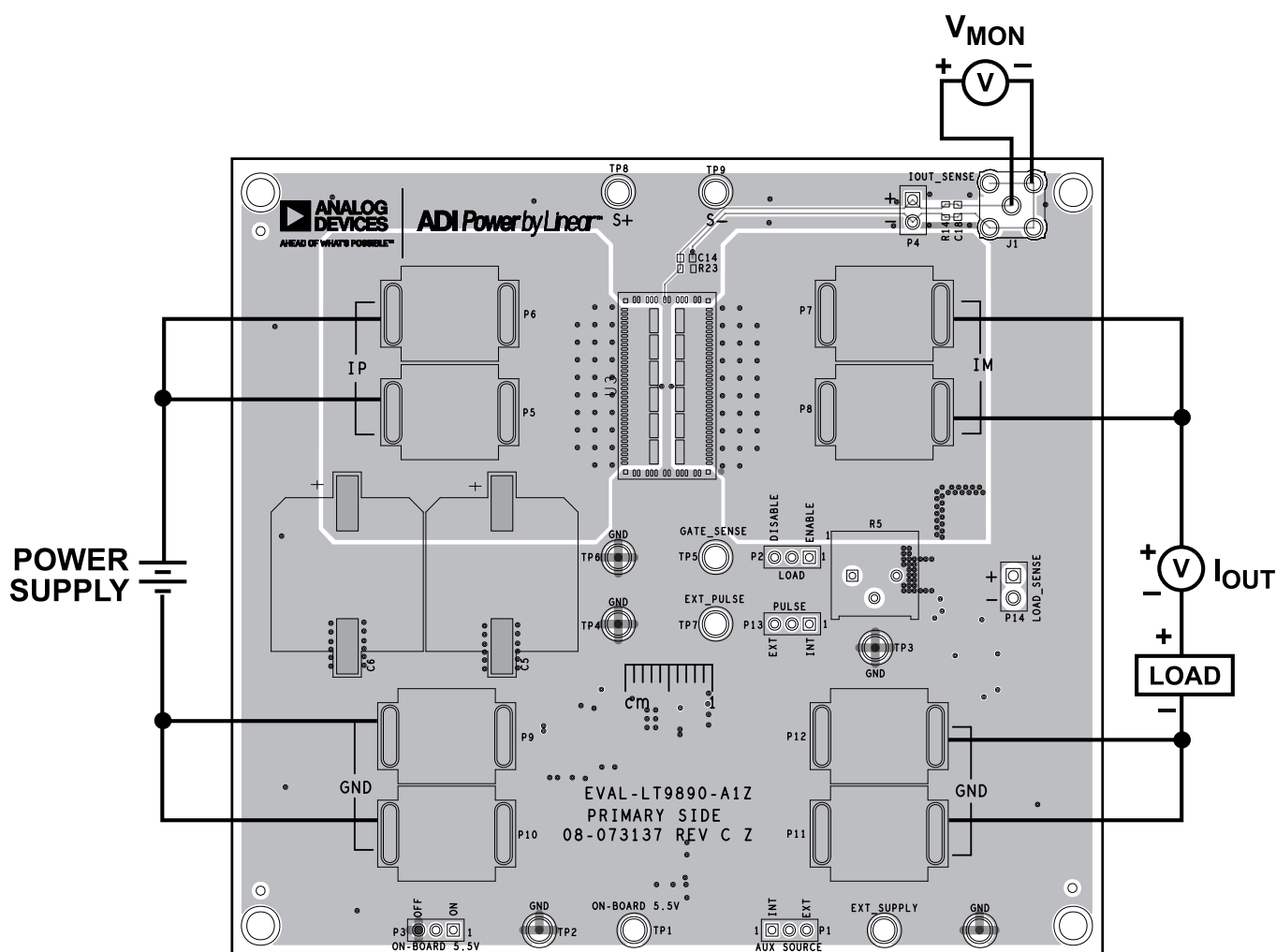


Figure 2. Proper Measurement Equipment Setup

## NOTES

**ESD Caution**

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

**Legal Terms and Conditions**

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

