

QPO-1LZ Evaluation Board

Description

The QPO-1-EVAL1 kit is designed to allow full testing of the QPO-1LZ and the various performance options to optimize a final system design. The board offers two terminal options for vertical or horizontal mounting. **The user must select the required values for the Rhr, Rsc and Rsa resistors and solder them in the designated positions before applying power to the QPO-1-EVAL1.** Please refer to the QPO-1LZ product data sheet, schematics and the following pages for the proper application of this board.

The QPO-1LZ output ripple attenuator SiP uses active filtering to reduce output ripple and noise (PARD) over 20 dB from 500 Hz to 500 kHz and can be extended down to 50 Hz with additional capacitance added to the VREF pin. The QPO-1LZ operates over a voltage range from 3 to 30 Vdc and supports load currents as high as 10A. Output regulation is maintained with remote sense or trim adjustment of the power supply. The closed loop architecture improves transient response and ensures quiet point-of-load regulation when used in conjunction with the power supply's control loop or trim node.

Features QPO-1LZ

- >30 dB PARD attenuation, 1 kHz to 500 kHz
- 3-30 Vdc operating range
- 10A rating
- Supports precise point-of load regulation
- 90-99% efficiency
- User selectable performance optimization for Attenuation, power dissipation, transient response
- 1.0 x 1.0 x 0.2" SiP
- LGA mounting
- Closed control loop improves transient response of most DC-DC converters and power supplies
- Reduces required number of output capacitors to support dynamic loads.
- Evaluation board includes Johnson Jack for low-noise measurement of QPO-1LZ performance.

Typical Application

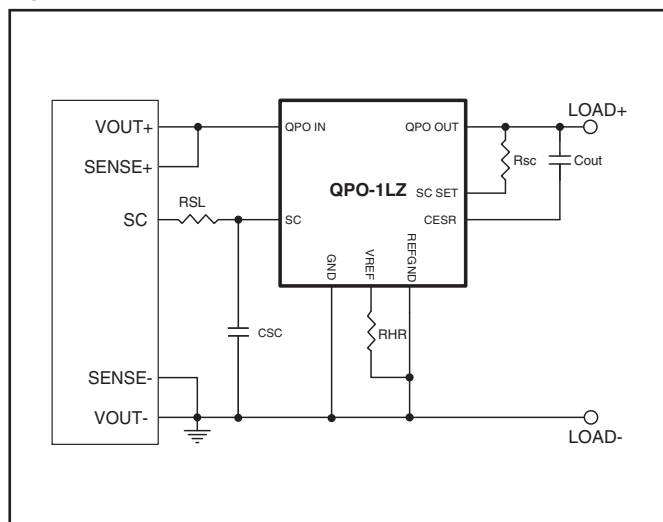


Figure 1 – SC/Trim supports applications that don't require remote sense.

QPO-1LZ Performance

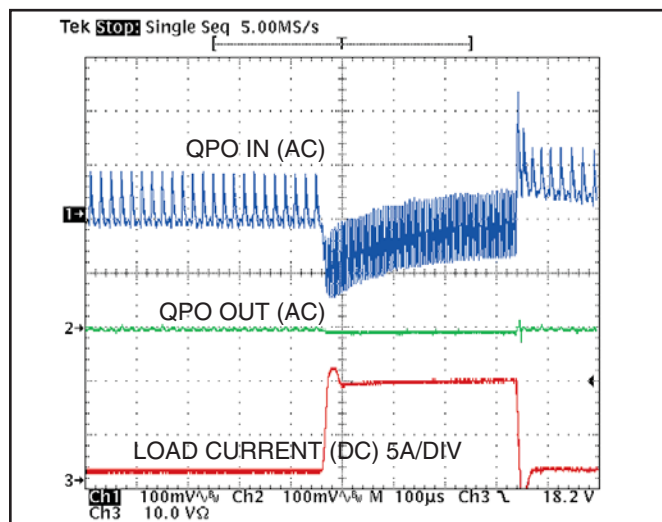
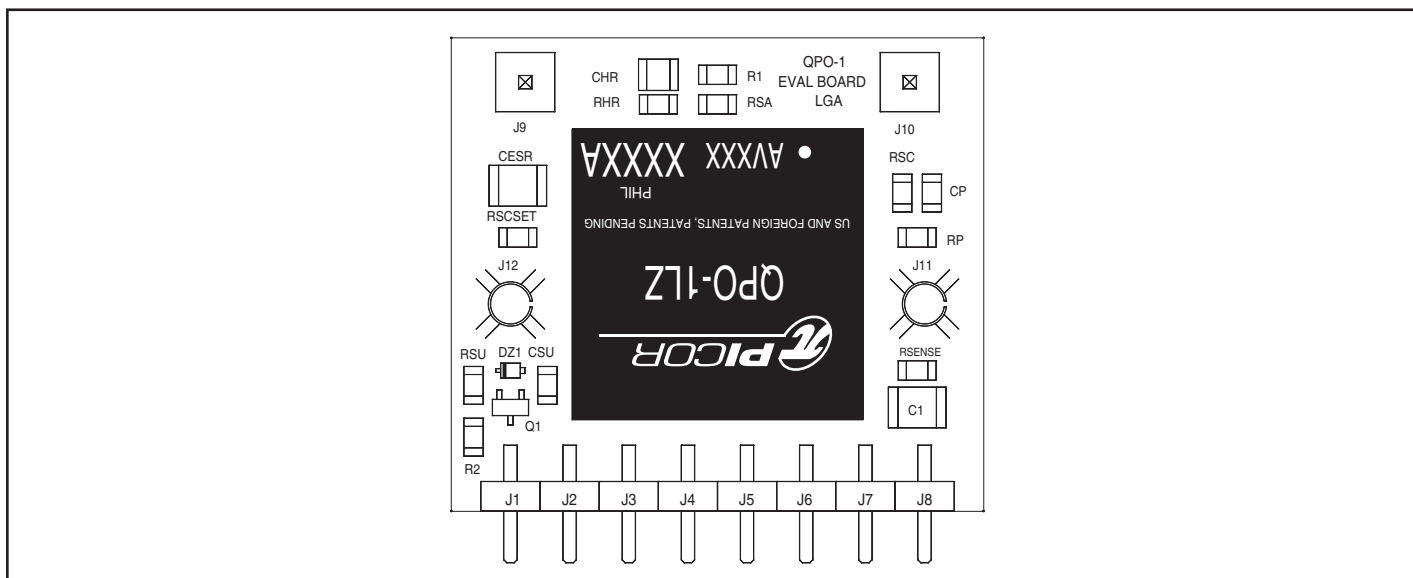
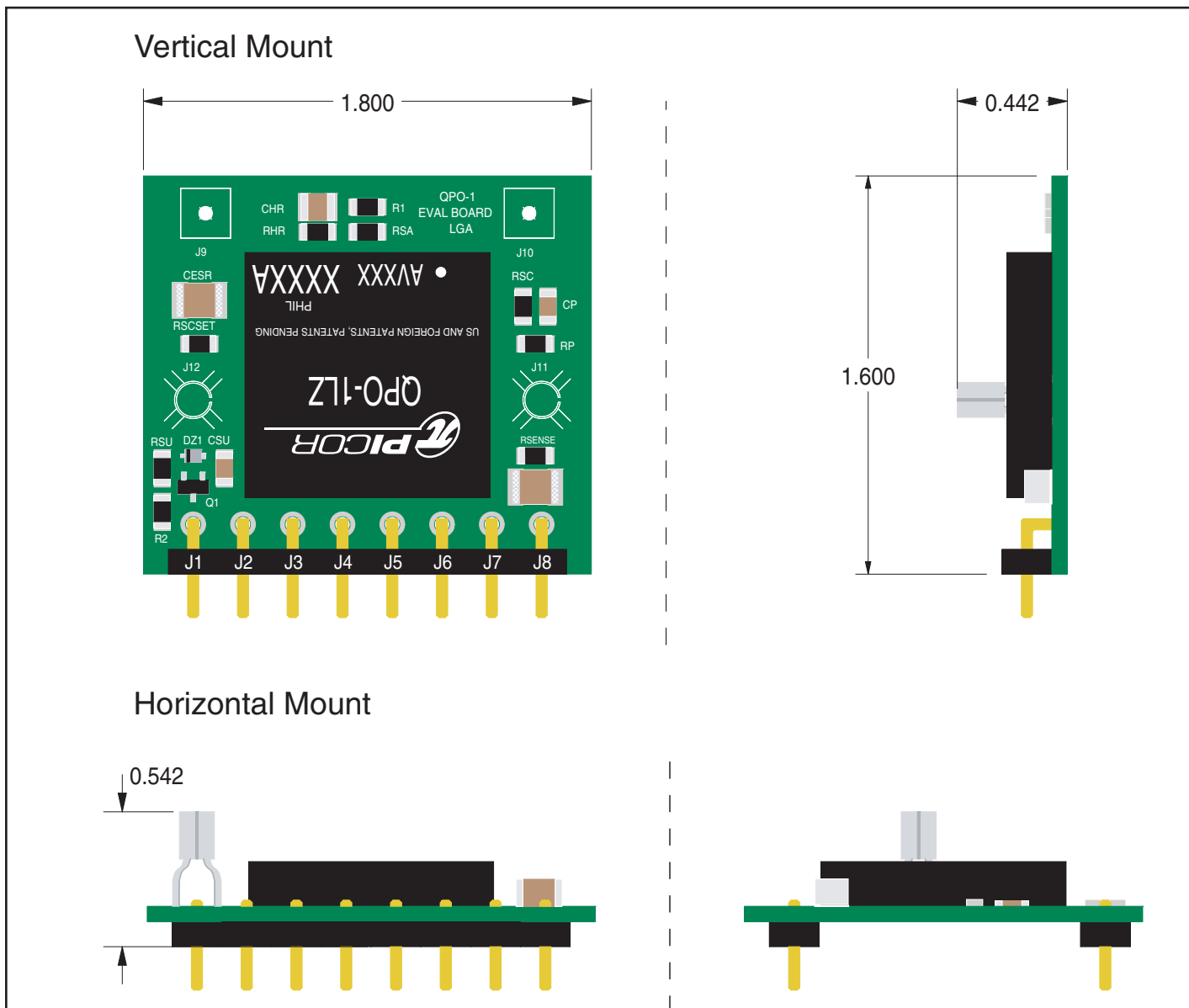


Figure 2 – Typical performance with a 3.3 Volt converter, showing 1 to 10 A load step.

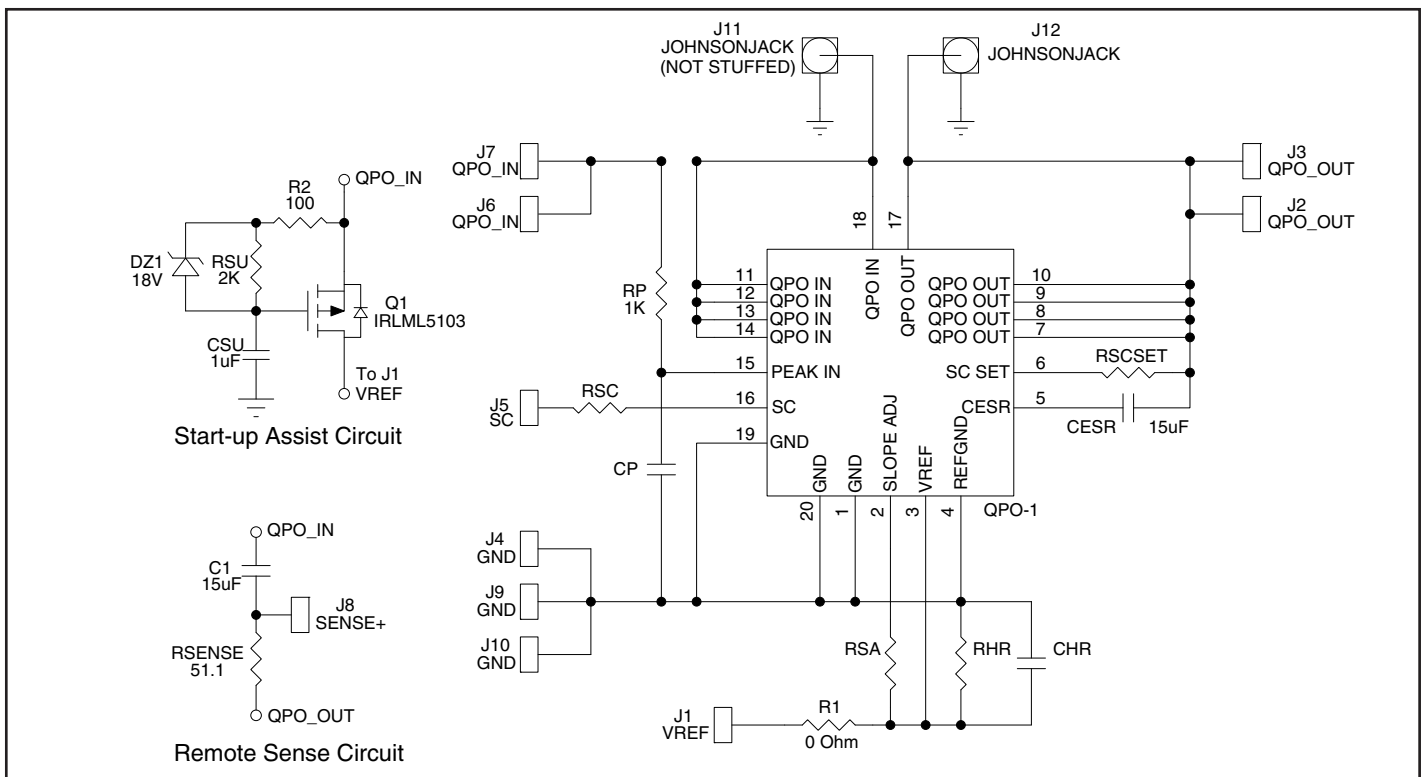
PC Board Layout Diagram



Mounting Options



Board Circuit Schematic



Instructions for Use

The EVAL1 board has the following components, QPO-1LZ, C_{esr}=15uF and R_p=1k Ohm already soldered to the PCB as well as the zero-headroom start-up assist circuit shown in the schematic above. The remaining pads are spaced for 1206 chip size components. If these are not available to the user, once values are determined axial component leads can be formed to line up with the pads and hand soldered to the proper pads. Refer to the schematic and mechanical drawing above for the pad locations to connect these components.

Component values can be determined using the formulas below. Refer to the QPO-1LZ product data sheet for a complete explanation of the features and the parameters set by these component values. First determine the headroom resistor value.

$$R_{hr} = \frac{QPO_{out}}{V_{hr}} * 2.5k\Omega$$

where; R_{hr} = headroom setting resistor value,

QPO_{out} = the expected voltage on the QPO's output,

V_{hr} = the target headroom voltage determined from the product data sheet.

The RSC resistor is tied between QPO_{out} and SC SET pin and sets the correction current used to trim up the converter to maintain a constant output voltage on the QPO's output. The value for the SC SET resistor is calculated by the following equation:

$$R_{SC} = \frac{R_{IN} * V_{OUT}}{V_{RPT}}$$

where; R_{SC} is the SC SET resistor value,

R_{IN} is the resistance of the SC or TRIM input of the converter,

V_{OUT} is the desired QPO output voltage,

V_{RPT} is the pre-trimmed reference of the SC or TRIM.

The peak detector function is enabled on the evaluation board. Connecting a 0.1uF capacitor to the CP pads disables the peak detector if not desired for the application. The QPO's peak detector circuit will increase the headroom of the QPO by roughly half of the peak-to-peak ripple on the QPO's input. Excessive ripple with low voltage converters could create enough additional headroom to cause the converter's output to increase to the point where an over-voltage fault is created and the converter will shut down. Check the converter's OVP set point and select component values to keep the QPO headroom adjustment from reaching the OVP trip point.

The slope adjust feature can be set to zero providing relatively constant headroom versus load using an Rsa of 100kΩ. To improve efficiency of the filter the slope adjust feature can provide a specific reduction in headroom (slope adjust) over a desired current range. The user can optimize performance based on the expected variation in load current and the desired power dissipation range. The formula below should be used to calculate the Rsa value for the desired headroom slope versus current. If the peak detector is enabled, the peak of the ripple will be added back to the headroom at a given load condition.

$$R_{SA} = 0.05(V/A) * \frac{\Delta I_{out}}{\Delta V_{hr}} * 2.5k\Omega$$

where:

ΔIout = Maximum load current change

ΔVhr = Change in headroom desired over the load range

Rsa = Slope adjust resistor value

Typical standard 1% values for the Rhr and Rsc resistors and the listed voltages

QPOout Voltage	Headroom Voltage	Rhr Value	Rsc Value ¹
3.3 V	375 mV	22 k	2.67 k
5.0 V	375 mV	33.2 k	4.02 k
12.0 V	375 mV	80.6 k	9.76 k
15.0 V	375 mV	100 k	12.1 k
24.0 V	375 mV	160 k	19.6 k
28.0 V	375 mV	187 k	22.6 k

Note1: These Rsc values are for a converter with a 1.23 Volt pre-trimmed reference and 1k Ohm input resistance on the SC/Trim.

Typical Value For Rsa Resistor and Typical Voltages

QPOout Voltage	Headroom Voltage Change (Slope=ΔV)	Rsa Value	Load Current Change
3.3 V	150 mV	8.25 k	10 A
5.0 V	150 mV	8.25 k	10 A
12.0 V	150 mV	8.25 k	10 A
15.0 V	150 mV	8.25 k	10 A
24.0 V	150 mV	8.25 k	10 A
28.0 V	150 mV	8.25 k	10 A

Ordering Information

Part Number	Description
QPO-1-EVAL1	Evaluation board for QPO-1LZ

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