

### Summary

SynQor has developed EVAL-1000007, an evaluation board to facilitate testing of our DualQor DC-DC converters.

### Introduction

This application note is a guide to the features, schematic, component placement, and BOM for this evaluation board. The applicable modules are the DualQor DQ series of DC-DC converters.

For assistance with testing the performance of our DC-DC power converters, please refer to our application note “Guidelines for Testing SynQor DC-DC Converters”.

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**Note:** *This evaluation board was designed for lower voltage converters. Do not apply more than 100 Vdc on the input.*

**Shock Warning:** There are areas of this evaluation board that have exposed access to high voltage. Exercise caution to avoid contact with those voltages. Also note that the evaluation board may retain high voltage temporarily after input power has been removed. Exercise caution when handling

**Application of Input Power:** Never apply input power to a converter with a switch closure, such as a knife switch or circuit breaker. That type of action applies input voltage with an uncontrolled very high rate of rise (dV/dt) that could be damaging to the converter and to external components before the converter. Instead, apply input voltage with a controlled rate of rise. Also, ensure input voltage is off before inserting or removing a converter module from the evaluation board

**Thermal Considerations:** When testing converters on an evaluation board, ensure adequate cooling. Apply cooling air with a fan blowing across the converter or across a heatsink attached to the converter. Monitor the converter temperature to ensure it doesn't exceed the maximum rated per the datasheet specification

**Sockets:** This evaluation board uses sockets to provide the option of testing multiple converters. These sockets are not rated for continuous high currents. Short-term testing is fine, but be aware of this limitation for longer-term testing. The spring fingers in the sockets will add resistance in the power path, which will cause voltage drops at higher currents that could contribute significant errors in regulation and efficiency measurements. These spring fingers also do not provide the thermal cooling path from the module pins to PCB routing that is enabled by soldered connections. This may contribute to higher converter temperatures and error when performing thermal evaluations. For longer-term testing, thermal testing, and permanent installations use soldered connections.

## Section 1 – Input and Output Connections

Input power is applied through connector JIN1 as Vin(+) and Vin(-).

Output power is applied through connectors JO1 and JO2 as Vout\_2+, Vout(-), and Vout\_1+.

See Table 1, 2, and 3 for connector signal descriptions.

**Table 1: Connector JIN1**

Terminal # of Connector	Signal Name
1	VIN(+)
2	VIN(+)
3	VIN(+)
4	VIN(-)
5	VIN(-)
6	VIN(-)

**Table 2: Connector JO1**

Terminal # of Connector	Signal Name
1	Vout_2+
2	Vout_2+
3	Vout_2+
4	Vout_2+
5	Vout(-)
6	Vout(-)

**Table 3: Connector JO2**

Terminal # of Connector	Signal Name
1	Vout(-)
2	Vout(-)
3	Vout_1+
4	Vout_1+
5	Vout_1+
6	Vout_1+

**Note:** Please refer to the appropriate SynQor converter datasheet for descriptions of these features.

## Section 2 – Switches, Trim Resistors, and BNC Connectors

### Description of Switches

#### Enable On/Off Switch

Toggling switch SONOFF1 ON/OFF to the side closest to the power converter module (up) enables the positive enable converters to turn on and disables negative logic converters. Toggling switch SONOFF1 ON/OFF to the side furthest from the power converter module (down) enables the negative enable converters to turn on and disables positive logic converters.

### Voltage Trim Switches

#### OUTPUT1 TRIM

DualQor converters with a part number for the standard “S” Optional Feature Set have one TRIM pin (converter module pin 6), which adjusts both outputs, Vout1 and Vout2, simultaneously. The evaluation board OUTPUT1 TRIM switch adjusts both output voltages simultaneously by the same amount in the same direction for these converters. To increase both output voltages toggle OUTPUT1 TRIM switch away from converter. This will connect Trim to O/P\_RTN (Vout\_M) through RTR3 and RTR4. To decrease both output voltages toggle OUTPUT1 TRIM switch towards the converter. This will connect Trim to Vout2 (Vout\_2+) through RTR1 and RTR2. Leave OUTPUT1 TRIM switch in the center position when not trimming these outputs.

For DualQor converters with a part number for the 2nd TRIM “T” Optional Feature Set, the evaluation board OUTPUT1 TRIM switch will only control the trim of the lower voltage output, Vout2. As described above, to increase Vout2 output voltage toggle OUTPUT1 TRIM switch away from converter. To decrease Vout2 output voltage toggle OUTPUT1 TRIM switch towards the converter. Leave OUTPUT1 TRIM switch in the center position when not trimming this output.

The evaluation board comes with zero Ohm resistors installed in positions RTR1 and RTR3. This will produce a trim up of 10 % and a trim down of 10 % when toggling this switch. Refer to the datasheet of the unit under test to determine the resistor values for the desired increase/decrease of the output voltages.

#### OUTPUT2 TRIM

DualQor converters with a part number for the 2nd TRIM “T” Optional Feature Set have two TRIM pins (converter module pin 6 and pin A). This allows independent adjustment of each output voltage. The OUTPUT1 TRIM switch adjusts the lower voltage output Vout2 (see section above) and the OUTPUT2 TRIM switch adjusts the higher voltage output Vout1.

To increase the output voltage of the higher voltage output Vout1, toggle OUTPUT2 TRIM switch away from converter. This will connect Trim2 to Vout\_M (output return) through RTR5 and RTR6. To decrease the output voltage of the higher voltage output Vout1, toggle OUTPUT2 TRIM switch towards the converter. This will connect Trim2 to Vout\_1+ through RTR7 and RTR8. Leave OUTPUT2 TRIM switch in the center position when not trimming this output.

The evaluation board comes with zero Ohm resistors installed in positions RTR5 and RTR7. This will produce a trim up of 10 % and a trim down of 10 % when toggling this switch. Refer to the datasheet of the unit under test to determine the resistor values for the desired increase/decrease of the output voltages.

## BNC Monitoring Point Descriptions

JIN2  
Converter input voltage +Vin

JOUT3  
Converter Vout\_1 Kelvin sense

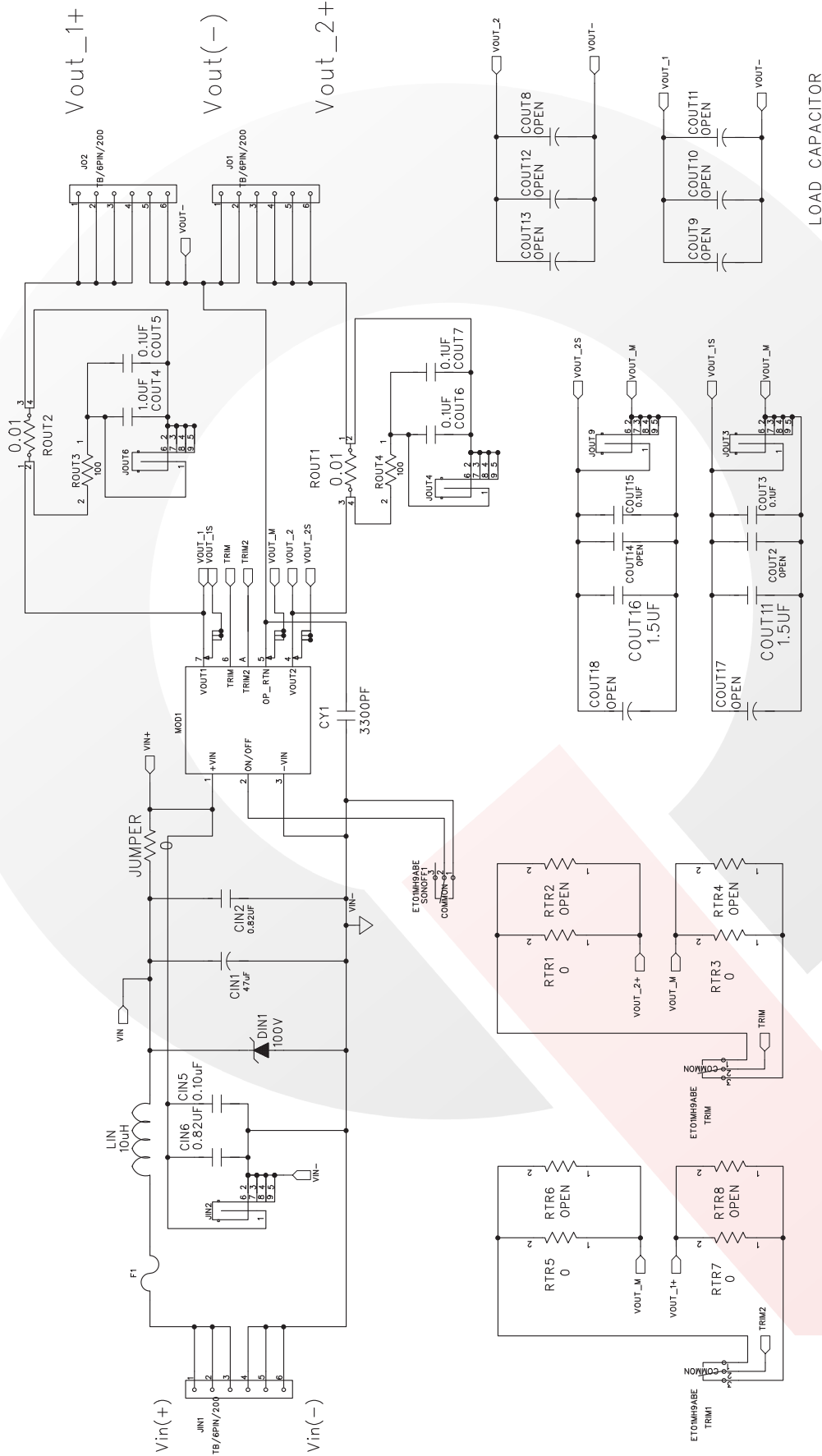
JOUT4  
Converter Iout\_2 output current as measured across shunt ROUT1

JOUT6  
Converter Iout\_1 output current as measured across shunt ROUT2

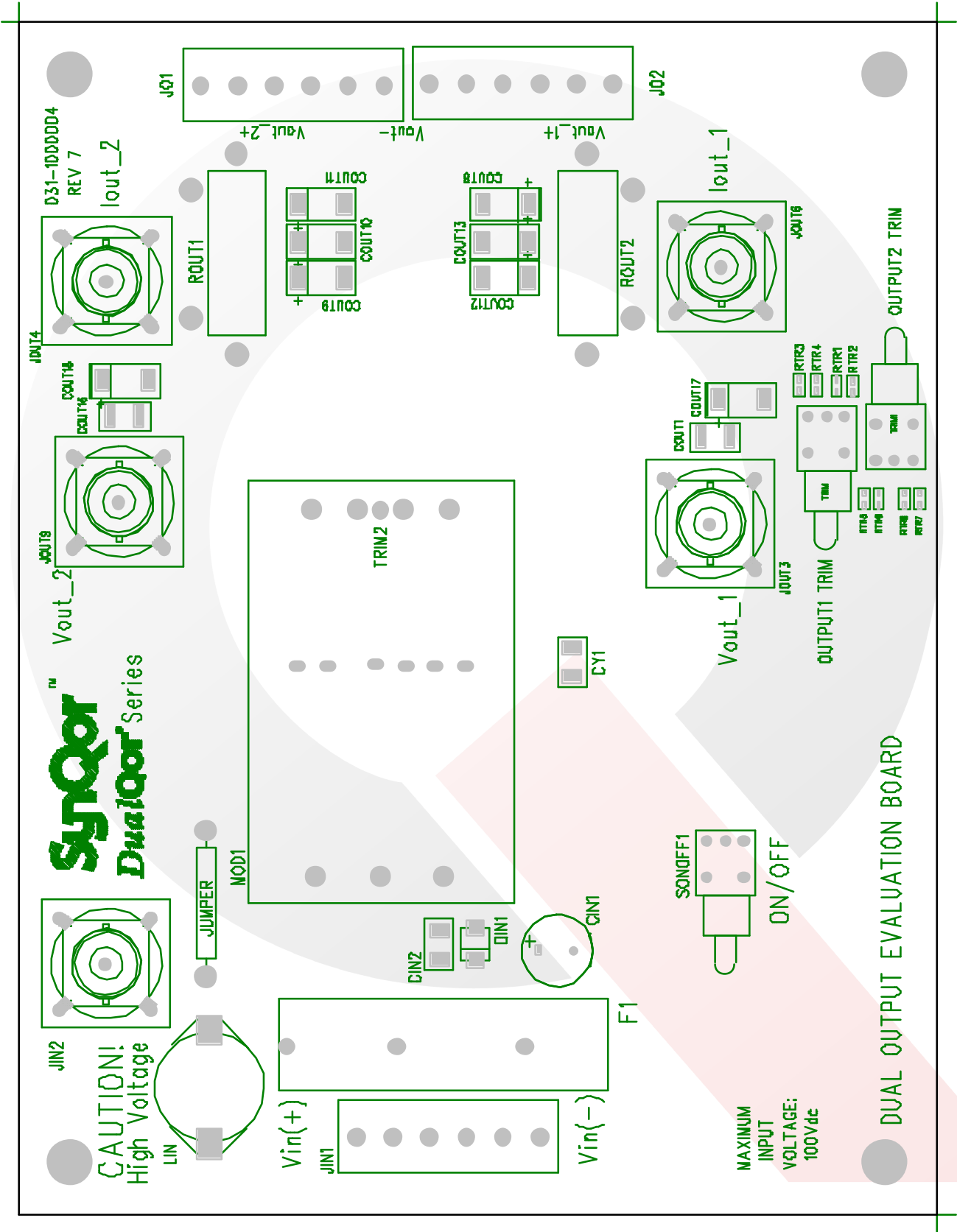
JOUT9  
Converter Vout\_2 Kelvin sense

**CAUTION:** Do not connect an oscilloscope probe to JOUT4 or JOUT6. Doing so would connect the scope ground to VOUT\_1 and/or VOUT\_2 output. Only use isolated DMM's on these BNC connectors.

Section 3 – Schematic



Section 4 – Component Placement



## Section 5 – Bill of Materials (BOM)

Table 4: EVAL-1000007

Ref Des	Value	Tolerance	Package	Description
CIN1	47 uF	10 %		Aluminum Electrolytic
CIN2	0.82 uF	10 %	1812	Capacitor, ceramic
CIN5	0.1 uF	10 %	1812	Capacitor, ceramic
CIN6	0.82 uF	10 %	1812	Capacitor, ceramic
COU1	1.5 uF	10 %	1812	Capacitor, ceramic
COU2	OPEN		1206	Capacitor
COU3	0.1 uF	10 %	0805	Capacitor, ceramic X7R 25 V
COU4	1.0 uF	10 %	0805	Capacitor, ceramic X7R 10 V
COU5	0.1 uF	10 %	0805	Capacitor, ceramic X7R 25 V
COU6	1.0 uF	10 %	0805	Capacitor, ceramic X7R 25 V
COU7	0.1 uF	10 %	0805	Capacitor, ceramic X7R 25 V
COU8	OPEN		D CASE	Capacitor
COU9	OPEN		D CASE	Capacitor
COU10	OPEN		D CASE	Capacitor
COU11	OPEN		D CASE	Capacitor
COU12	OPEN		D CASE	Capacitor
COU13	OPEN		D CASE	Capacitor
COU14	OPEN		1206	Capacitor
COU15	0.1 uF	10 %	0805	Capacitor, ceramic X7R 25 V
COU16	1.5 uF	10 %	1812	Capacitor
COU17	OPEN		D CASE	Capacitor
COU18	OPEN		D CASE	Capacitor
CY1	3300 pF	10 %	1812	Capacitor
DIN1	OPEN		SMB	Diode
F1	15 A		AGC	Fuse
LIN	10 uH	20 %		SMT Power Inductor
ROUT1	0.01	1%		Precision Low Ohm 4-Terminal Shunt Resistor
ROUT2	0.01	1%		Precision Low Ohm 4-Terminal Shunt Resistor
RTR1	0	5 %	0603	Resistor
RTR2	OPEN		0603	Resistor
RTR3	0	5 %	0603	Resistor
RTR4	OPEN		0603	Resistor
RTR5	0	5 %	0603	Resistor
RTR6	OPEN		0603	Resistor
RTR7	0	5 %	0603	Resistor
RTR8	OPEN		0603	Resistor