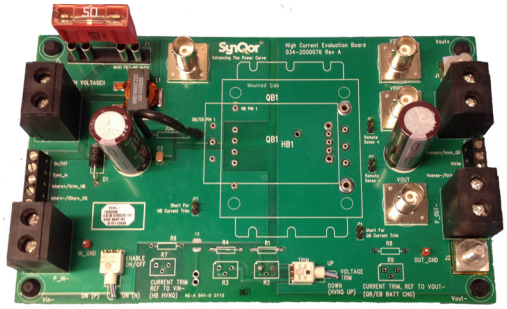
EVAL-1000008

Evaluation Board for High Current Isolated Converters; Half, Quarter, and Eighth Brick



Summary

SynQor has developed EVAL-1000008, an evaluation board to facilitate testing of our high current isolated half-brick, quarter-brick and eighth-brick DC-DC converters rated to 100 V or less.

Introduction

This application note is a guide to the features, schematic, component placement, and BOM for this evaluation board. The applicable series of DC-DC converter modules include MCOTS-C-28/28V/28VE, MCOTS-C-48, PowerQor®(PQ), InQor®(IQ), RailQor®(RQ), BusQor®(BQ), Semi-Regulated BusQor (SQ) and CFQor (CF) rated to 100 V or less. 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”.

Contents

Shock Warning: There are areas of this evaluation board that have exposed access to high voltage. Exercise caution to avoid contact with those voltages. This 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 – Evaluation Board Configuration

This high current evaluation board EVAL-1000008 is designed to facilitate testing of multiple types of half-brick, quarter-brick and eighth-brick isolated DC-DC converters. Other versions of this evaluation board can be configured to facilitate testing of other DC-DC converter modules. The other evaluation board versions include EVAL-1000014, EVAL-1000018, and EVAL-1000019. The configuration of jumpers JP1 through JP6, along with some component differences determine the version of the evaluation board and which DC-DC converters are appropriate to test.

A comparison of the jumper configurations is shown in Table1 below. The BOM of this evaluation board and a comparison of component differences between this evaluation board and the other versions are shown on Tables 4 and 5, respectively, in Section 6.

Caution is advised if changing the jumper configurations as incorrect jumper placement may cause improper converter operation and could potentially damage the converter. Some of the electrical components on this version of the evaluation board are not appropriate for all versions of this family of evaluation boards. If changing the jumper configuration from the original then check the components on the evaluation board to ensure they are suitable for the converter being tested.

See the specific application note for EVAL-1000014, EVAL-1000018, and EVAL-1000019 for detailed description of those evaluation boards, and refer to the appropriate product datasheet prior to testing a power converter module.

Table 1: Evaluation Board Jumper Configurations

Evaluation Board Part Number	Converter Type	Jumper JP1	Jumper JP2
EVAL-1000008	Isolated converters: half, quarter and eighth brick less than 100V	Short for local sense Open for remote sense	Short for local sense Open for remote sense
EVAL-1000014	Non-isolated half brick converters	Short for local sense Open for remote sense	Short for local sense Open for remote sense
EVAL-1000018	Non-isolated converters S-Version quarter and eighth brick	Short for local sense Open for remote sense	Short for local sense Open for remote sense
EVAL-1000019	Non-isolated converters C-Version quarter and eighth brick	Open	Open

Evaluation Board Part Number	Converter Type	Jumper JP3	Jumper JP4	Jumper JP5	Jumper JP6
EVAL-1000008	Isolated converters: half, quarter and eighth brick less than 100V	Open	Open	Open	Short
EVAL-1000014	Non-isolated half brick converters	Short	Open	Open	Short
EVAL-1000018	Non-isolated converters S-Version quarter and eighth brick	Open	Open	Open	Short
EVAL-1000019	Non-isolated converters C-Version quarter and eighth brick	Open	Short	Short	Open

Section 2 – Input and Output Connections

Input power is applied through connectors P_IN+ and P_IN-.

Output power is applied through connectors P_OUT+ / J1 and P_OUT- / J2.

Control signals are applied through connectors C_IN and C_OUT. See Tables 2 and 3 below for descriptions.

Table 2: Input Signal Connector (C_IN)

Terminal # of Connector C_IN	Standard Isolated Converter Half, Quarter, Eighth Brick	Full-Featured Isolated Converter Half Brick	Full-Featured Isolated Converter Half Brick Zeta series (Z)
1	On/Off	On/Off	On/Off
2	No Connection	Clock Sync	No Connection
3	No Connection	Start Sync	Current Share +
4	No Connection	Current Share	Current Share -
5	Vin-	Vin-	Vin-

Table 3: Output Signal Connector (C_OUT)

Terminal # of Connector C_OUT	Standard & Full Featured Isolated Converter
1	Sense +
2	Voltage Trim
3	Sense -

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

Section 3 – Switches, Trim Resistors, and BNC Connectors

Description of Switches

Enable On/Off Switch

Moving this switch to the ON (N) position enables “N” type negative on/off logic converters. Moving this switch to the ON (P) position enables “P” type positive on/off logic converters. The enable signal is connected to the input control connector (C_IN) for remote access.

Voltage Trim Switch

For the isolated converters, moving this switch to the “Up” or “Down” position connects the converter trim pin to Vout+ or Vout- pin through the trim resistors, R1-R4. This allows for trimming the output voltage up or down by adjusting the trim resistors. Leaving the switch in the middle position will disable the output voltage trim function.

Description of Trim Resistors

Voltage Trim

Fixed resistor R1 and potentiometer R2 are used to adjust up the output voltage set-point of the non-isolated converter.

Fixed resistor R4 and potentiometer R3 are used to adjust down the output voltage set-point of the non-isolated converter.

The trim resistors R1 through R4 are not populated in this evaluation board. This is to allow the user to determine and install the needed trim resistance values based on the range of desired output voltage adjustment of the module being evaluated.

BNC Monitoring Point Descriptions

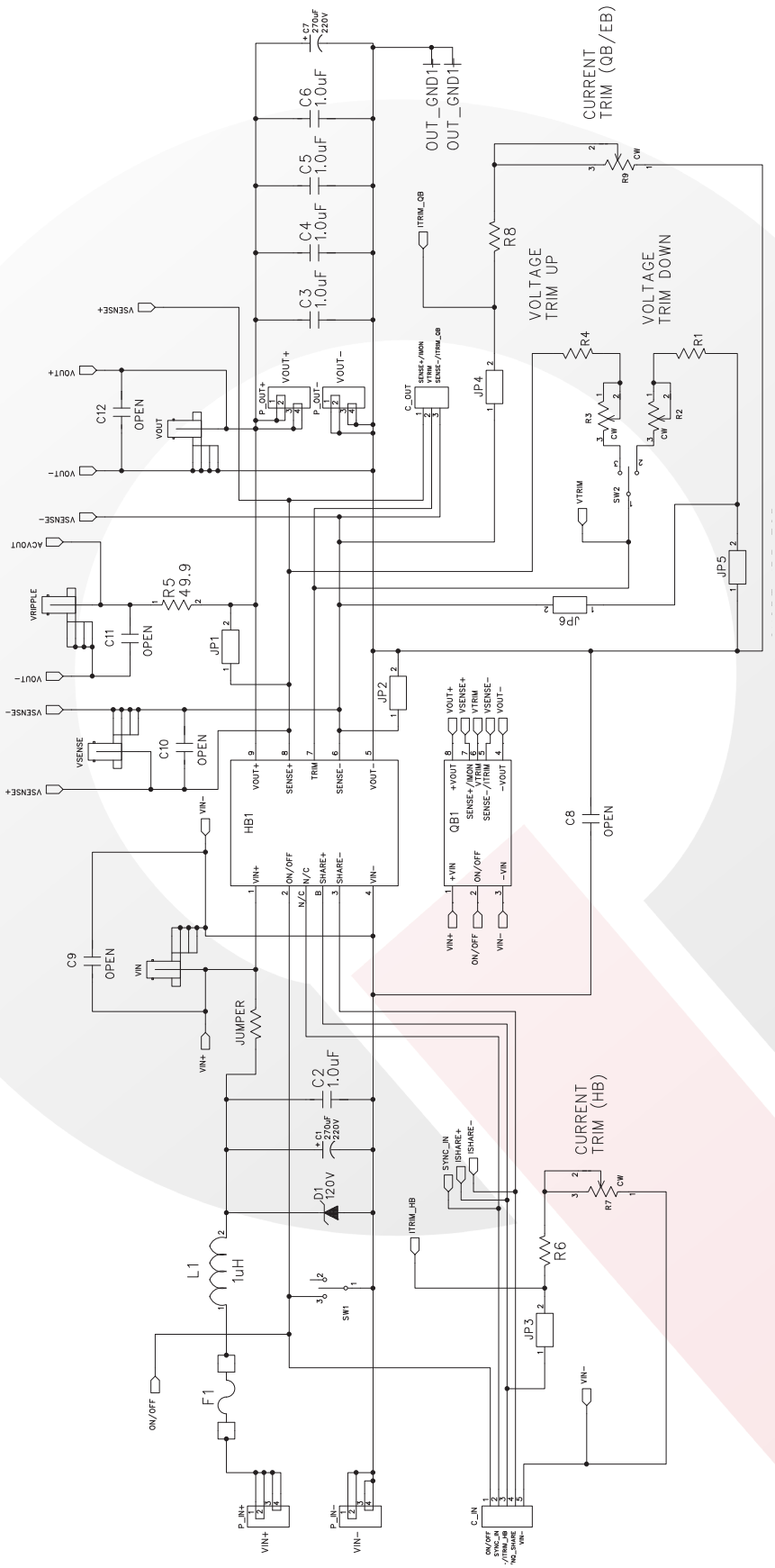
VIN – Converter Input Voltage

VOUT – Converter Output Voltage

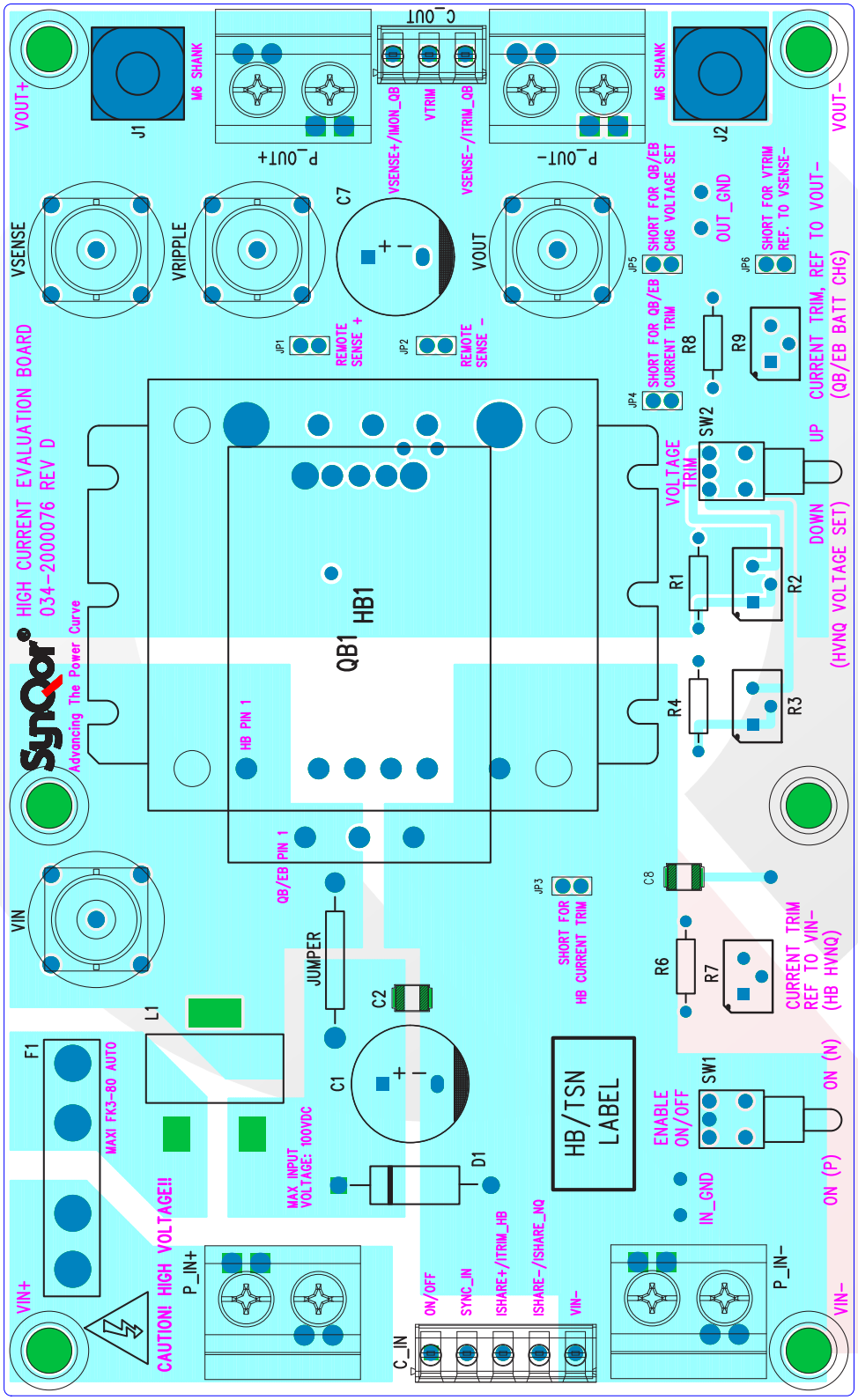
VSENSE – Output Sense Voltage

VRIPPLE – Output ripple voltage measurement point. Use this BNC with AC coupling on the oscilloscope.

Section 4 – Schematic



Section 5 – Component Placement



Section 6 – Bill of Materials (BOM)

Table 4: EVAL-1000008

Ref Des	Value	Tolerance	Package	Description
C1	270 uF	20 %	16X35MM	Cap, Alum Elec, 220 V
C2	1 uF	10 %	1812	Cap, ceramic, X7R, 100V
C3	1 uF	10 %	1812	Cap, ceramic, X7R, 100V (on bottom of PCB)
C4	1 uF	10 %	1812	Cap, ceramic, X7R, 100V (on bottom of PCB)
C5	1 uF	10 %	1812	Cap, ceramic, X7R, 100V (on bottom of PCB)
C6	1 uF	10 %	1812	Cap, ceramic, X7R, 100V (on bottom of PCB)
C7	OPEN		16X35MM	Cap, Alum Elec
C8	OPEN		1812	Cap, ceramic
C9	OPEN		0805	Cap, ceramic (on bottom of PCB)
C10	OPEN		0805	Cap, ceramic (on bottom of PCB)
C11	OPEN		0805	Cap, ceramic (on bottom of PCB)
C12	OPEN		0805	Cap, ceramic (on bottom of PCB)
D1	120 V		DO-201	TVS, axial, 1.5KE120A
F1	40 A			Fuse, Littelfuse, Maxi Blade, 80V, 166.6885.5401
L1	1 uH	20 %		Inductor, SMT, Coilcraft, SER2010-102ML
R1	OPEN			Resistor, ¼ W, through-hole
R2	OPEN			Resistor, Trim Potentiometer, 3299Y-1-xxx LF (xxx = value)
R3	OPEN			Resistor, Trim Potentiometer, 3299Y-1-xxx LF (xxx = value)
R4	OPEN			Resistor, ¼ W, through-hole
R5	49.9	1 %	0805	Resistor (on bottom of PCB)
R6	OPEN			Resistor, ¼ W, through-hole
R7	OPEN			Resistor, Trim Potentiometer, 3299Y-1-xxx LF (xxx = value)
R8	OPEN			Resistor, ¼ W, through-hole
R9	OPEN			Resistor, Trim Potentiometer, 3299Y-1-xxx LF (xxx = value)

Table 5: Component Differences of Evaluation Board Versions

Ref Des	EVAL-1000008	EVAL-1000014	EVAL-1000018	EVAL-1000019
C7	OPEN	270 uF	270 uF	270 uF
F1	40 A	50 A	50 A	50 A
JP1	SHORT or OPEN	SHORT or OPEN	SHORT or OPEN	OPEN
JP2	SHORT or OPEN	SHORT or OPEN	SHORT or OPEN	OPEN
JP3	OPEN	SHORT	OPEN	OPEN
JP4	OPEN	OPEN	OPEN	SHORT
JP5	OPEN	OPEN	OPEN	SHORT
JP6	SHORT	SHORT	SHORT	OPEN
L1	1 uH	0.3 uH	0.3 uH	0.3 uH
R1	OPEN	220	220	220
R2	OPEN	200K	200K	200K
R6	OPEN	560	OPEN	OPEN
R7	OPEN	100K	OPEN	OPEN
R8	OPEN	OPEN	OPEN	560
R9	OPEN	OPEN	OPEN	100K