

How to Modify a 4-Channel TPS7H4001QEVM-CVAL Into a 1-Channel EVM

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ABSTRACT

This document outlines the procedures required to convert a TSP7H4001QEVM-CVAL, a 4-channel quadrature phase buck converter evaluation module, into a 1-channel buck converter EVM.

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1 Introduction

The TPS7H4001-SP is a radiation-hardness-assured, 7-V, 18-A synchronous buck converter. Operation of the device is demonstrated on the [TPS7H4001EVM-CVAL evaluation module](#), which contains a single buck converter capable of supplying 18-A of load current. A key feature of the TPS7H4001-SP is that it supports parallel operation easily allowing four buck converters to operate in quadrature phase and deliver up to 72-A of load current to a tightly regulated line. Parallel operation is demonstrated on the TPS7H4001QEVM-CVAL evaluation module.

As different applications call for unique load current requirements even within a single system, users may wish to evaluate these different applications with the same hardware, avoiding multiple hardware purchases. This document provides instructions on how to do just that; specifically, listing the modifications required on the 4-Channel EVM in order to realize a 1-channel design. Note, this application report is part of a series of reports showing how to convert 4-channel to 1-channel, 4-channel to 2-channel, and 4-channel to 3-channel designs. Please refer to other documents if 2-channel or 3-channel designs are desired.

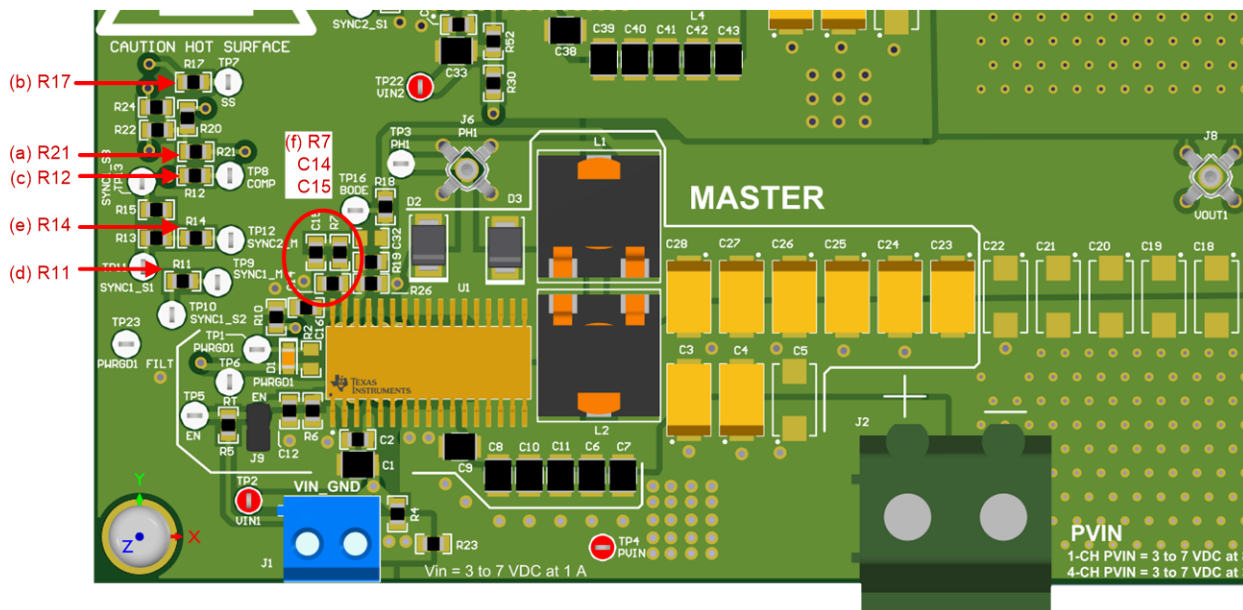
2 BOM Modifications Required

The following steps must be taken to ensure proper operation of a 1-channel buck converter on a populated 4-channel EVM (TPS7H4001QEVM-CVAL). A summary of all changes is provided in [Table 1](#).

1. Modifications near MASTER DUT U1 ([Figure 1](#) and [Figure 6](#))

- a. Isolate VSENSE feedback pins 32 of slave devices by removing 0-ohm jumper R21
- b. Isolate soft start (SS/TR pin 31) of slave devices by removing 0-ohm jumper R17
- c. Isolate COMP pin 33 of slave devices by removing 0-ohm jumper R12
- d. Isolate SYNC1 pin 5 of slave devices by removing 0-ohm jumper R11
- e. Isolate SYNC2 pin 6 of slave devices by removing 0-ohm jumper R14
- f. Replace compensation circuit at R7, C14, C15 near DUT U1:
 - i. R7=10kohms
 - ii. C15=10nF
 - iii. C14=150pF

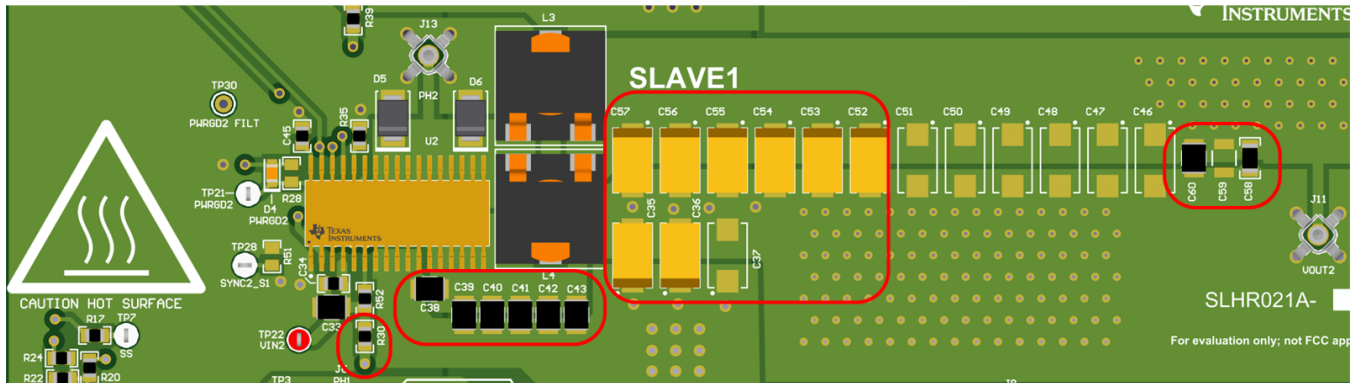
Figure 1. Modifications near MASTER DUT U1



2. Modifications near SLAVE1 DUT U2 ([Figure 2](#) and [Figure 7](#))

- a. Isolate VIN pin 4 of Slave 1 DUT U2 by removing 0-ohm jumper R30
- b. Remove input capacitors of Slave 1 DUT U2 by completely removing, or lifting one terminal of each capacitor as shown in [Figure 3](#). (C35, C36, C38, C39, C40, C41, C42, C43)
- c. Remove output capacitors of Slave 1 DUT U2 by completely removing, or lifting one terminal of each capacitor so as to remove from circuit as shown in [Figure 3](#). (C52, C53, C54, C55, C56, C57, C58, C60)

Figure 2. Modifications near SLAVE1 DUT U2



3. Modifications near SLAVE2 DUT U3 (Figure 4 and Figure 8)
 - a. Isolate VIN pin 4 of Slave 2 DUT U3 by removing 0-ohm jumper R39
 - b. Remove input capacitors of Slave 2 DUT U3 by completely removing, or lifting one terminal of each capacitor as shown in Figure 3. (C63, C64, C66, C67, C68, C69, C70, C71)
 - c. Remove output capacitors of Slave 2 DUT 3 by completely removing, or lifting one terminal of each capacitor so as to remove from circuit as shown in Figure 3. (C80, C81, C82, C83, C84, C85, C86, C88)

Figure 3. Open Circuit Input/Output Capacitors

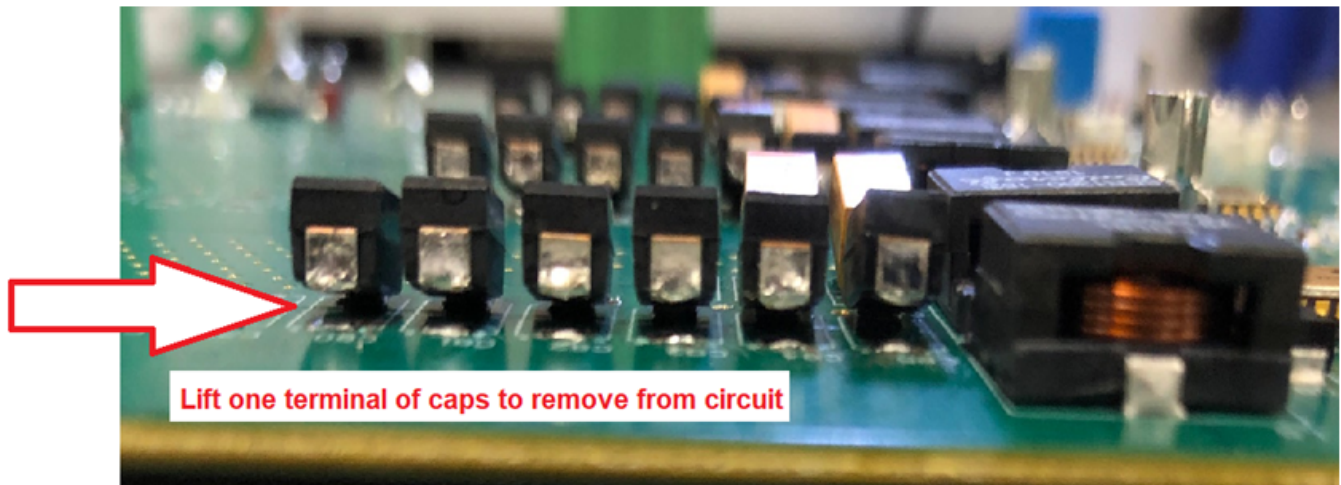
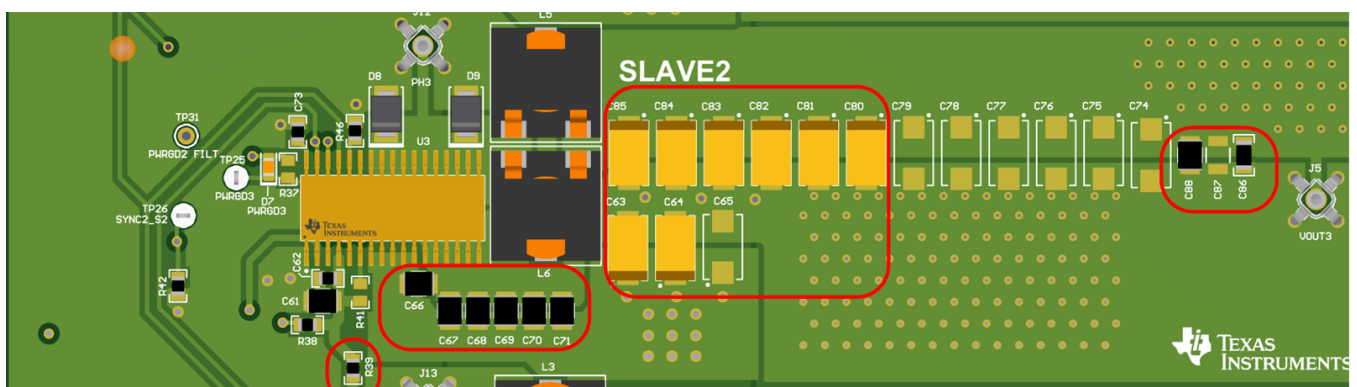


Figure 4. Modifications near SLAVE2 DUT U3



4. Modifications near SLAVE3 DUT U4 (Figure 5 and Figure 9)
 - a. Isolate Enable pins 2 of slave devices by removing 0-ohm jumper R55
 - b. Isolate VIN pin 4 of Slave 3 DUT U4 by removing 0-ohm jumper R50
 - c. Remove input capacitors of Slave 3 DUT 4 by completely removing, or lifting one terminal of each capacitor as shown in Figure 3. (C91, C92, C94, C95, C96, C97, C98, C99)
 - d. Remove output capacitors of Slave 3 DUT U4 by completely removing, or lifting one terminal of each capacitor so as to remove from circuit as shown in Figure 3. (C108, C109, C110, C111, C112, C113, C114, C116)

Figure 5. Modifications near SLAVE3 DUT U4

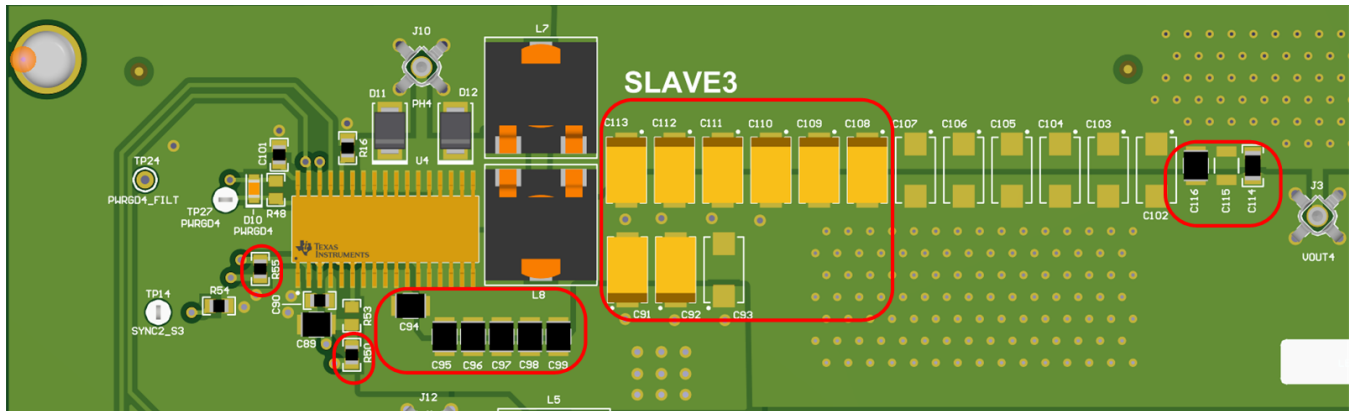


Table 1. Summary of BOM Changes

| Position on PCB | Component Designator | Action |
|-----------------|--|----------------------|
| MASTER DUT U1 | R21, R17, R12, R11, R14 | DNI |
| | R7 | Replace with 10kohms |
| | C14 | Replace with 150pF |
| | C15 | Replace with 10nF |
| SLAVE1 DUT U2 | R30 | DNI |
| | C35, C36, C38, C39, C40, C41, C42, C43 | DNI |
| | C52, C53, C54, C55, C56, C57, C58, C60 | DNI |
| SLAVE 2 DUT U3 | R39 | DNI |
| | C63, C64, C66, C67, C68, C69, C70, C71 | DNI |
| | C80, C81, C82, C83, C84, C85, C86, C88 | DNI |
| SLAVE3 DUT U4 | R55 | DNI |
| | C91, C92, C94, C95, C96, C97, C98, C99 | DNI |
| | C108, C109, C110, C111, C112, C113, C114, C116 | DNI |

3 Schematic Changes

Figure 6. Master DUT U1 Modifications
MASTER (POL1) at U1

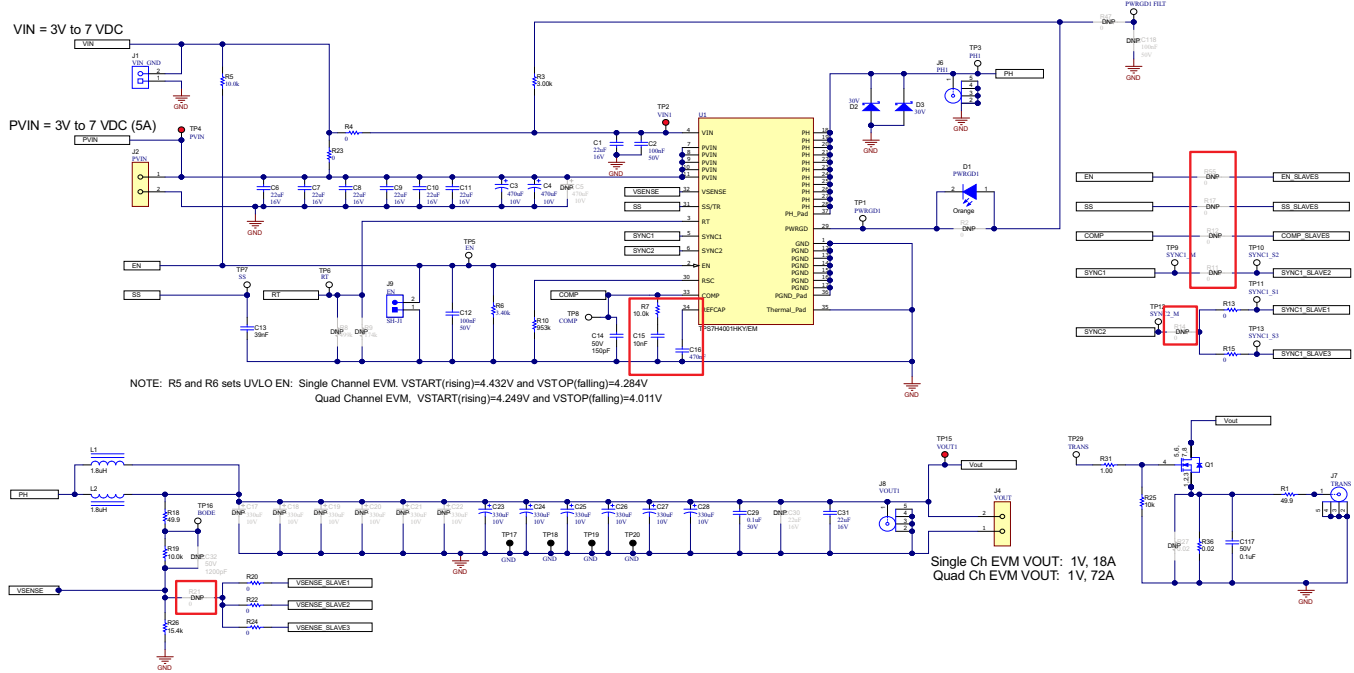
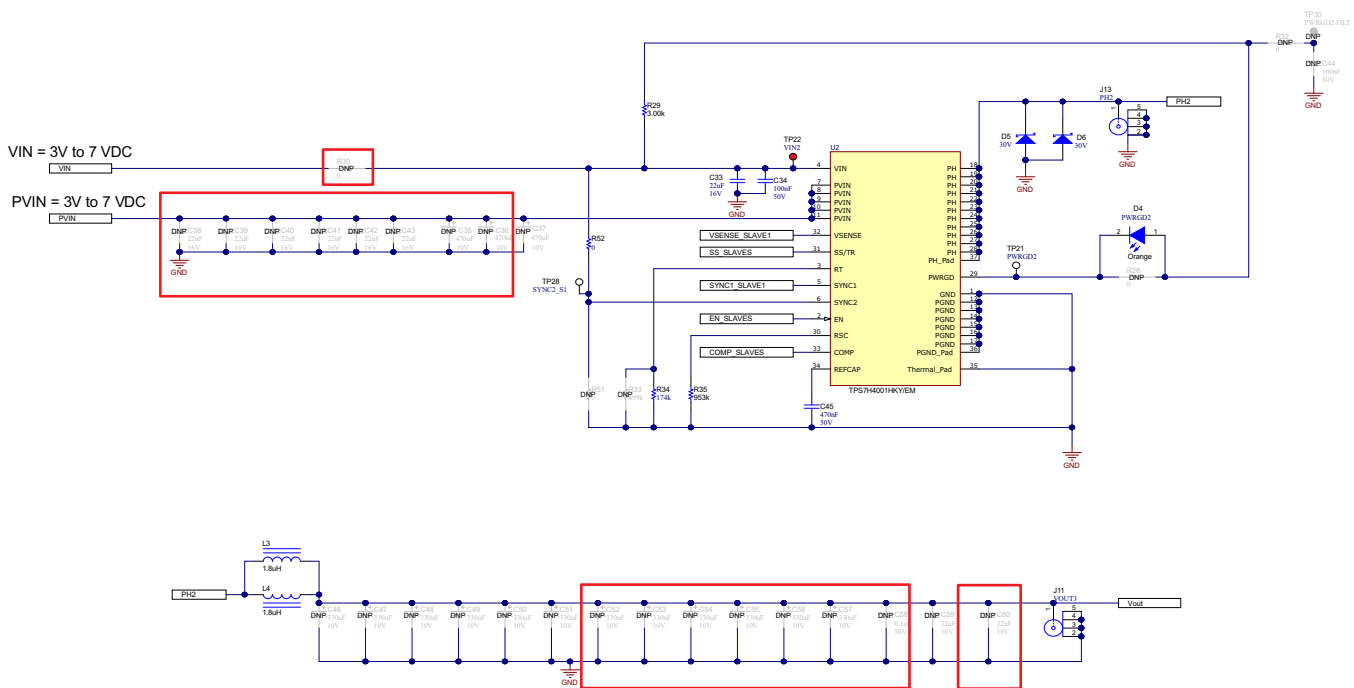


Figure 7. SLAVE1 DUT U2 Modifications
SLAVE1 (POL2) at U2



4 Summary

Implementing the EVM modifications described in this document will allow users of a 4-channel TPS7H4001QEVM-CVAL evaluation module to realize single channel operation. With these changes, one can refer to the TPS7H4001EVM-CVAL Evaluation Module (EVM) User's Guide for a guide on how to measure common parameters.

5 References

- [TPS7H4001-SP Radiation-Hardness-Assured 3-V to 7-V Input 18-A Synchronous Buck Converter Data Sheet](#)
- [TPS7H4001EVM-CVAL Evaluation Module \(EVM\) User's Guide](#)

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