OPTIREG™ linear voltage regulator TLF4x77-3Lx demoboard

Family overview

Support

Preface

Scope and purpose

This document describes the usage of the OPTIREG™ linear voltage regulator TLF4x77-3Lx demoboard for the TLF4477-3LA from Infineon Technologies AG. Please also refer to the corresponding datasheets.

Intended audience

This document is intended for engineers who develop applications.

Table of contents

1 Introduction

1.1 General description

The TLF4477-3LA is a monolithic integrated low drop out voltage regulator for loads up to 300 mA at each output. It provides an adjustable output voltage range from 3 V to 20 V for an input voltage up to 40 V. Each output provides individual current limitation, current monitoring and diagnostics.

The unique integrated current monitoring feature provides diagnostics and system protection functionality.

The device monitors the following fault conditions and indicates these at the current sense output:

- overtemperature
- overcurrent
- output overvoltage

Additional status pins for each channel indicate the following fault conditions:

- output overvoltage
- thermal shutdown
- overcurrent

Each output can be enabled independently to reduce the power consumption.

A current sense output CSOx is available to sense the current of the channel selected by the CSOxSel pin. Applying an intermediate voltage level on CSOxSel puts CSOx into a high impedance state. This allows multiplexing of the CSOx pins of several TLF4477-3LA devices and sequential reading by a single microcontroller quantizer.

1.2 TLF4477-3LA features

- Integrated current monitor
- Detection of overvoltage, overtemperature and overcurrent
- Adjustable output voltage
- Output current up to 300 mA
- Adjustable output current limitation
- Very low dropout voltage
- Stable with ceramic output capacitor of 1 µF
- Wide input voltage range up to 40 V
- Reverse current protection
- Reverse polarity protection
- Short circuit protected
- Overtemperature shutdown
- Switch off inductive loads
- Automotive temperature range T_j = -40°C to 150°C
- Green Product (RoHS compliant)

1.3 Block diagram

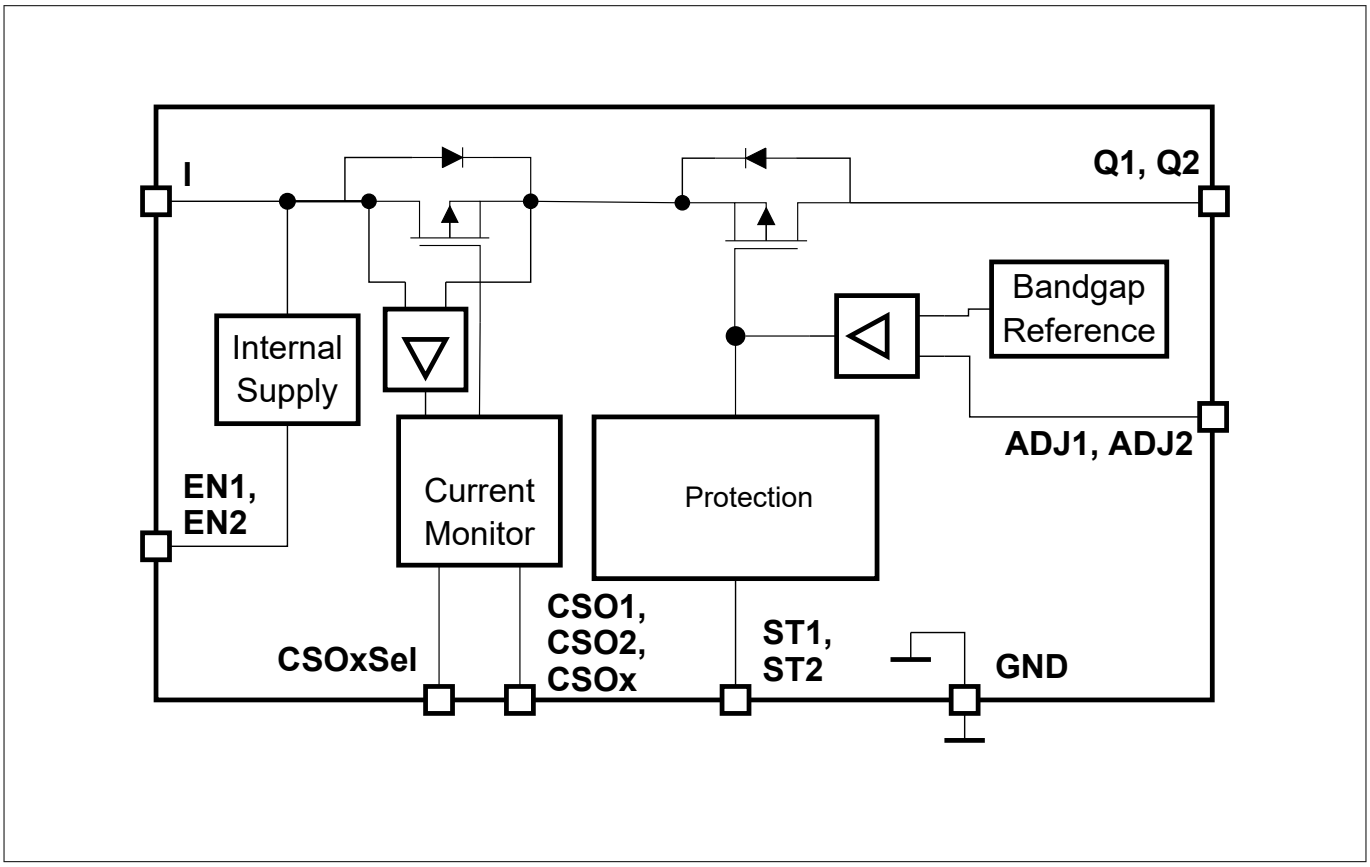

Figure 1 Block diagram TLF4477-3LA

2 Demoboard

Figure 2 shows the OPTIREG™ linear voltage regulator TLF4x77-3Lx demoboard.

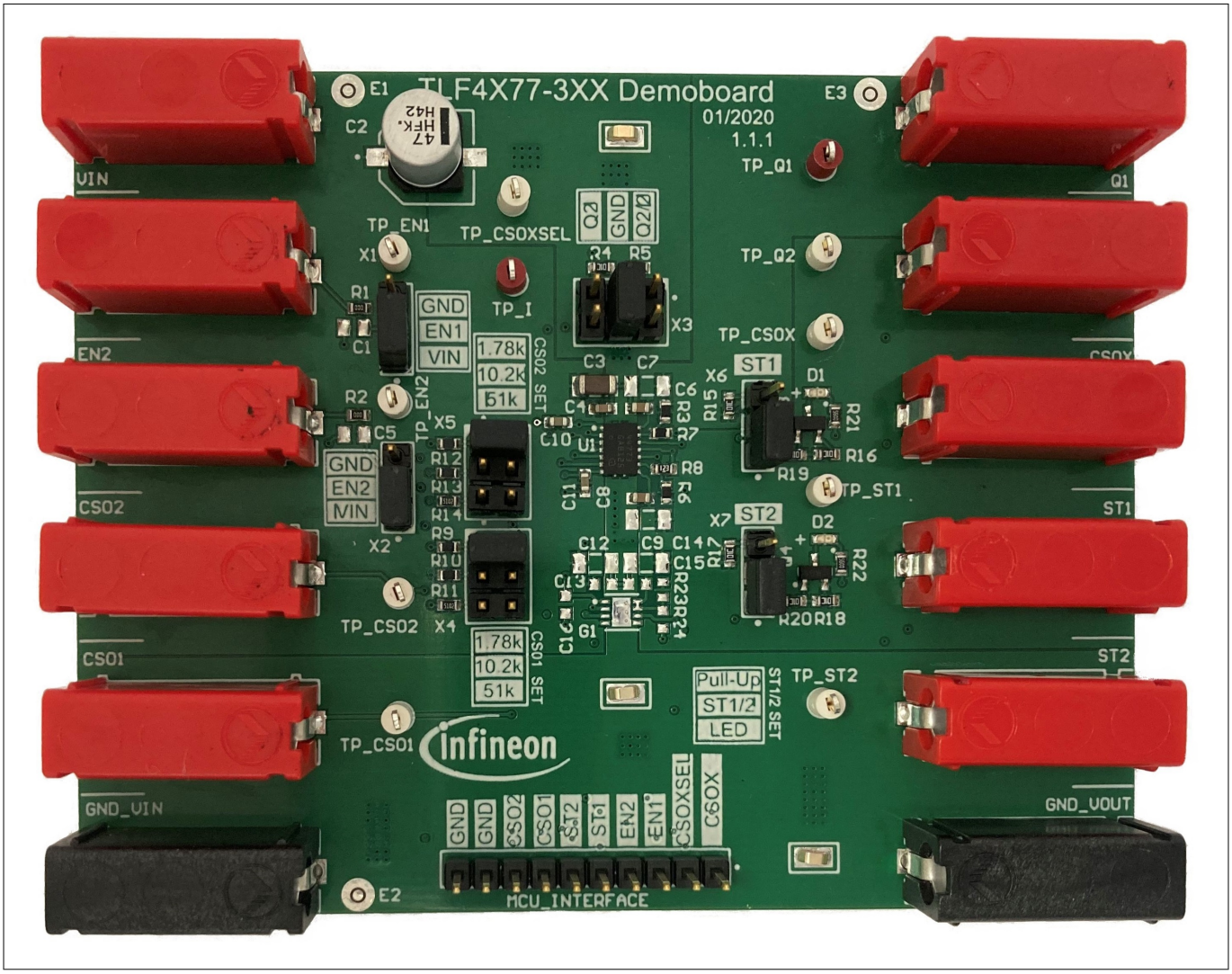

Figure 2 OPTIREG™ linear voltage regulator TLF4x77-3Lx demoboard

2 Demoboard

2.1 Assembly

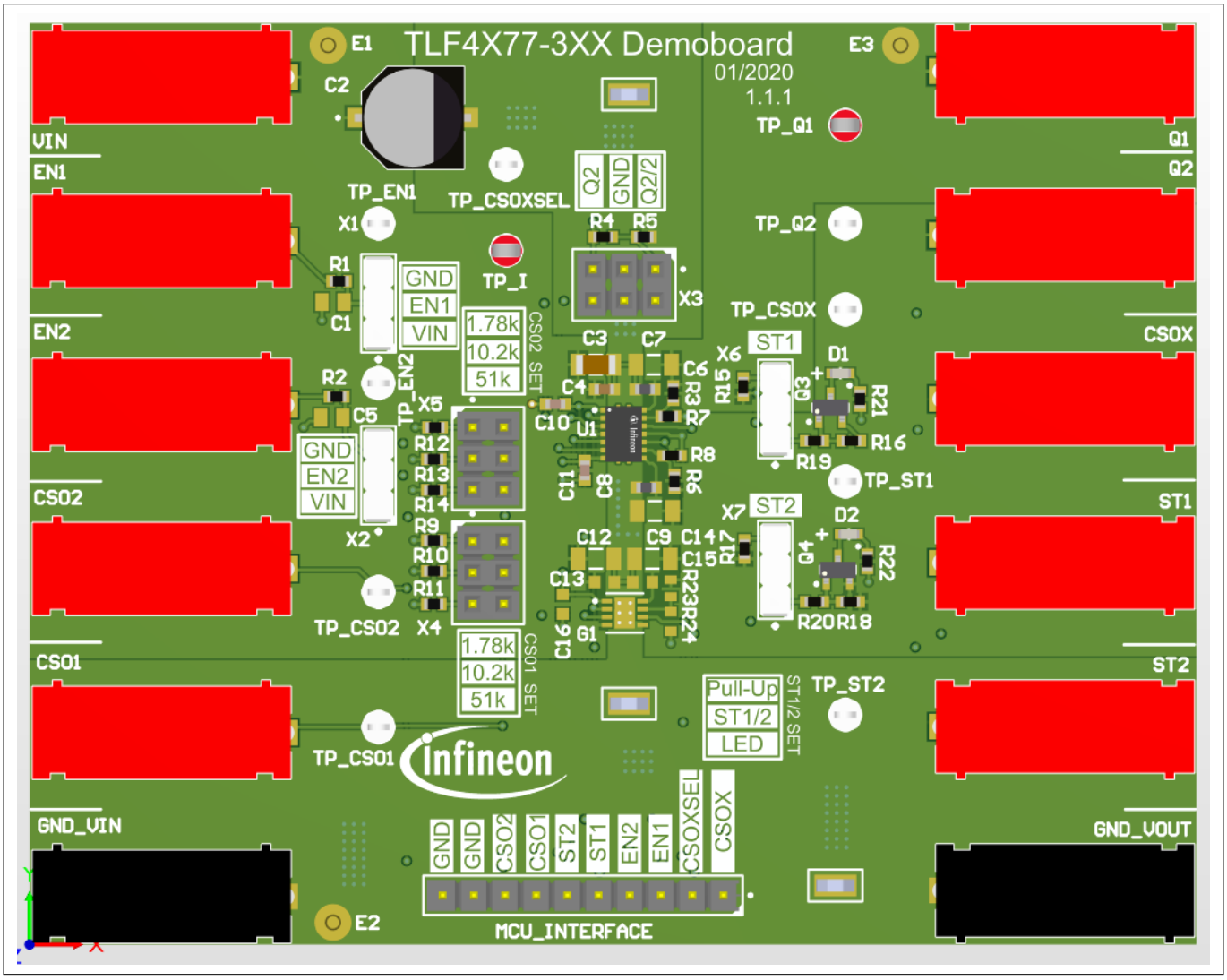

Figure 3 Assembly of TLF4x77-3Lx demoboard for TLF4477-3LA

2.2 Operating conditions

To avoid electrical damage of the demoboard, the values in Table 1 must be maintained.

Table 1 Limit values for operation[1)]

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
Board supply voltage	V_{IN}	0	–	40	V	–
Regulator output channel 1 voltage	V_{Q1}	0	–	16	V	2)
Regulator output channel 2 voltage	V_{Q2}	0	–	16	V	2)
Enable input regulator channel 1 voltage	V_{EN1}	0	–	40	V	–
Enable input regulator channel 2 voltage	V_{EN2}	0	–	40	V	–
Current monitor channel 1 voltage	V_{CSO1}	-0.3	–	5	V	3)
Current monitor channel 2 voltage	V_{CSO2}	-0.3	–	5	V	3)
Current monitor output x voltage	V_{CSOx}	-0.3	–	5	V	3)
Status output channel 1 sink current	I_{ST1}	–	–	1.8	mA	3)
Status output channel 1 voltage	V_{ST1}	-0.3	–	45	V	3)
Status output channel 2 sink current	I_{ST2}	–	–	1.8	mA	3)
Status output channel 2 voltage	V_{ST2}	-0.3	–	45	V	3)
Ground voltage	V_{GND}	0	–	0	V	–

1) T_A = 25°C.
2) Limited by voltage rating of output capacitor.
3) Absolute maximum rating.

2.3 Configuration

The demoboard can be easily configured via jumpers on the board.
The board provides the following configuration options:

- connect the enable signals EN1 and EN2 to VIN or to GND with a jumper
- select one of three resistors for CSO1 and CSO2 to set the current limit
- set the voltage level of CSOxSel with a jumper to Q2 or to 0.26 × Q2
- select ST1 and ST2 to be pulled up to Q1 or to Q2 or to signal status "low" by lighting an LED
- provide all relevant signals on a pin-header to allow the optional connection of an external microcontroller
- place optional bulk output capacitors C7, C9 and C17

2.3.1 Quickstart

In order to get started with the demoboard right away, despite the numerous configuration options, a default configuration is presented. Placing the jumpers as shown in Figure 4 powers the device and applies an output voltage on each channel. The current limit is then set to 286 mA. In case of an assertion of the ST signals, the corresponding LED lights up. A voltage which is proportional to the output current of Q1 can be measured on the CSOx pin.

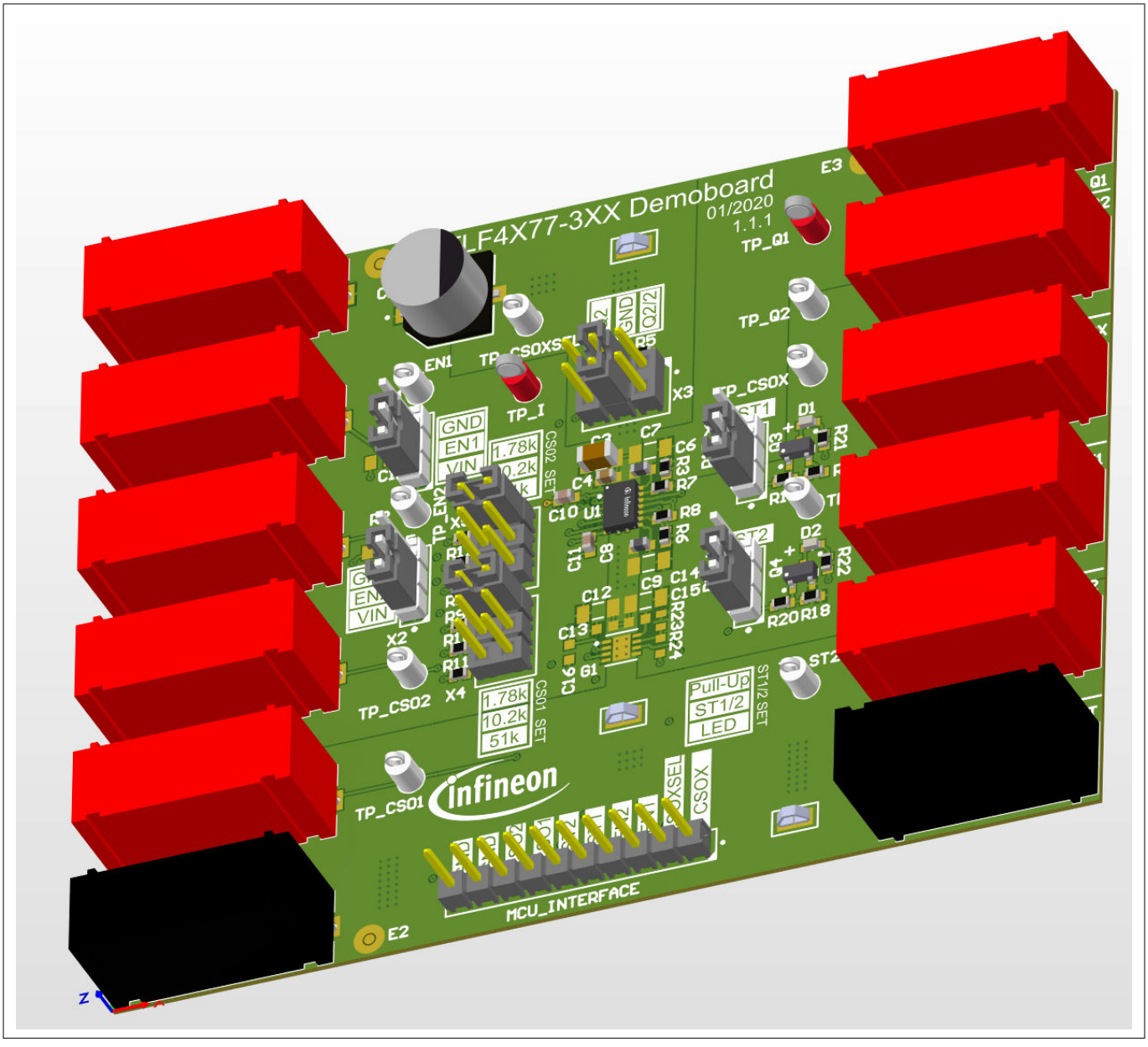

Figure 4 Quickstart configuration for the TLF4x77-3Lx demoboard

2.3.2 Enable

There are two jumpers on the board which can be used to enable the device. Each channel can be enabled or disabled separately. Placing the jumper between ENx and VIN connects the enable signal to VIN and enables the channel. To disable the channel, place the jumper between ENx and GND. Figure 5 shows the jumpers.

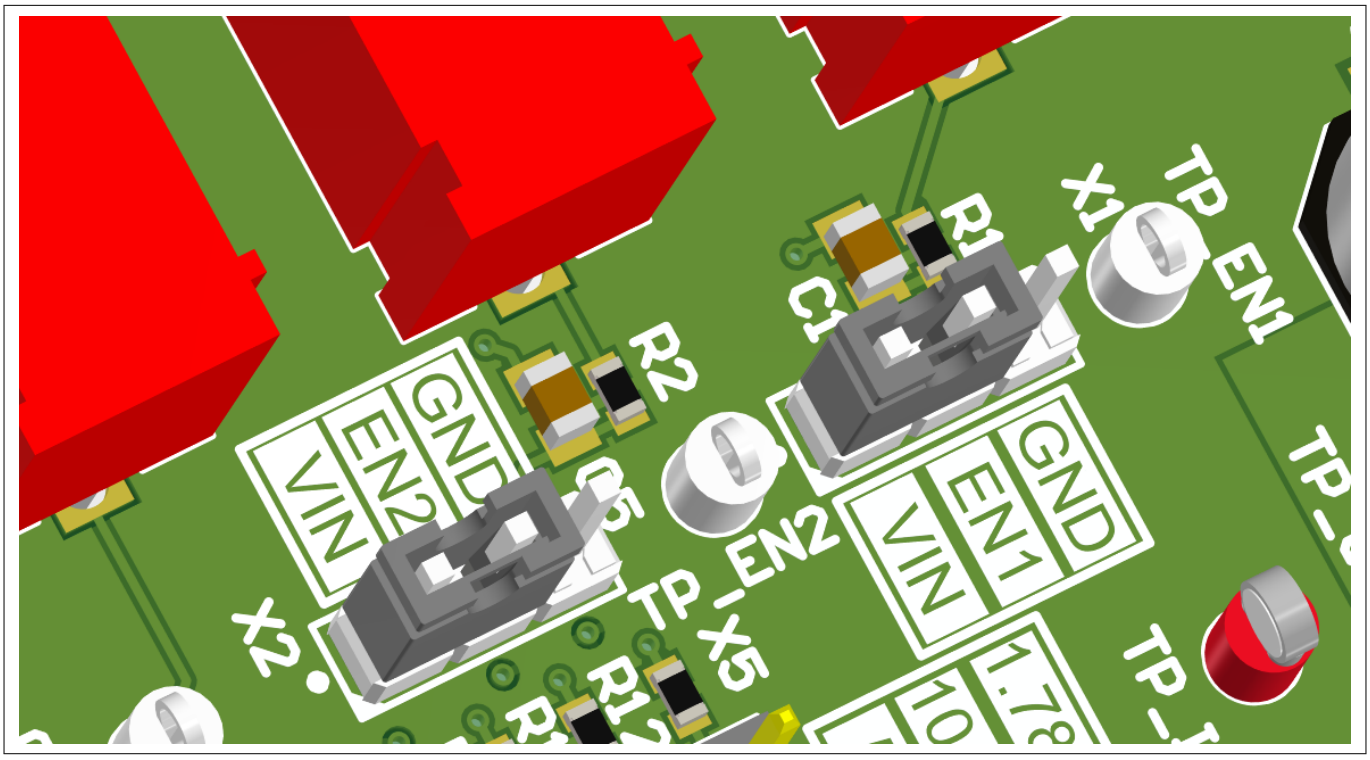

Figure 5 ENx jumpers

2.3.3 CSOxSel selection

The CSOxSel-pin can be used to program the behavior of CSOx. Depending on the votlage applied at the CSOxSel-pin, CSOx can either be connected to CSO1, CSO2 internally or put into a high impedance state. A jumper on the board allows to connect the CSOxSel-pin either directly to Q2, to GND or to Q2 with the means of a resistor divider. Table 2 shows the relationship between the jumper setting and the resulting CSOx state. Only one jumper may be placed at the pins shown in Figure 6.

Table 2 CSOx states depending on CSOxSel jumper setting

Jumper position	Q2	GND	Q2/2
CSOx state	CSO2	CS01	high Z

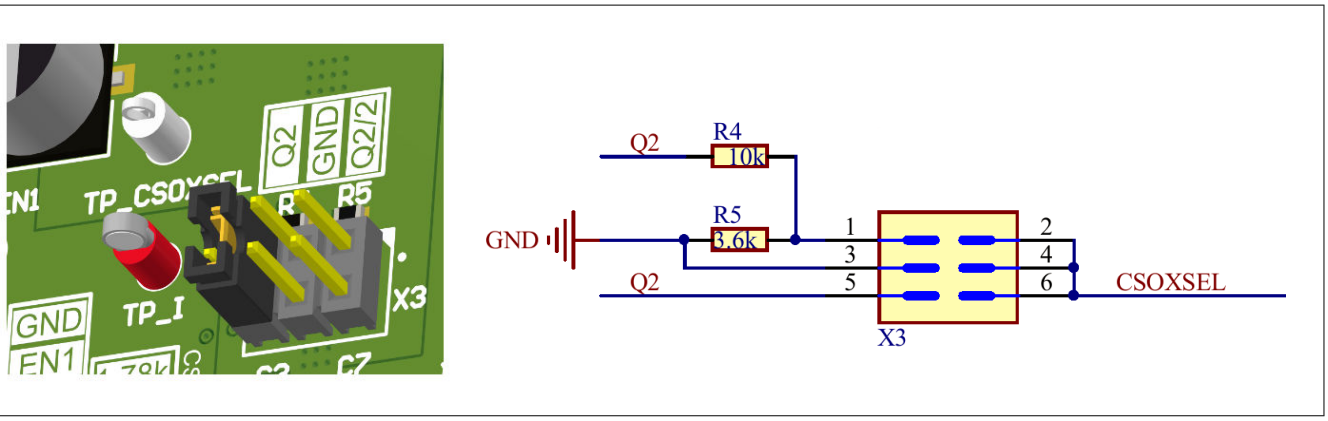

Figure 6 CSOxSel jumper

2.3.4 Current limit selection

The jumpers CSO1 SET and CSO2 SET set the current limit for each channel. Placing a jumper sets the series resistor on the respective channels CSO1 or CSO1. Equation 1 shows the relationship between resistor value and current limit. Table 3 shows the possible combinations and resulting current limits. Figure 7 shows details on how to set the jumper.

$$I_{Q,\mathrm{lim}} = \frac{2.55\,V \times 200}{R_{\mathrm{CSO}}}$$

Equation 1

Table 3 Adjustable current limit settings

R_{CSO}	1.78 kΩ	10.2 kΩ	51 kΩ
$I_{\mathrm{Q,lim}}$	286 mA	50 mA	10 mA

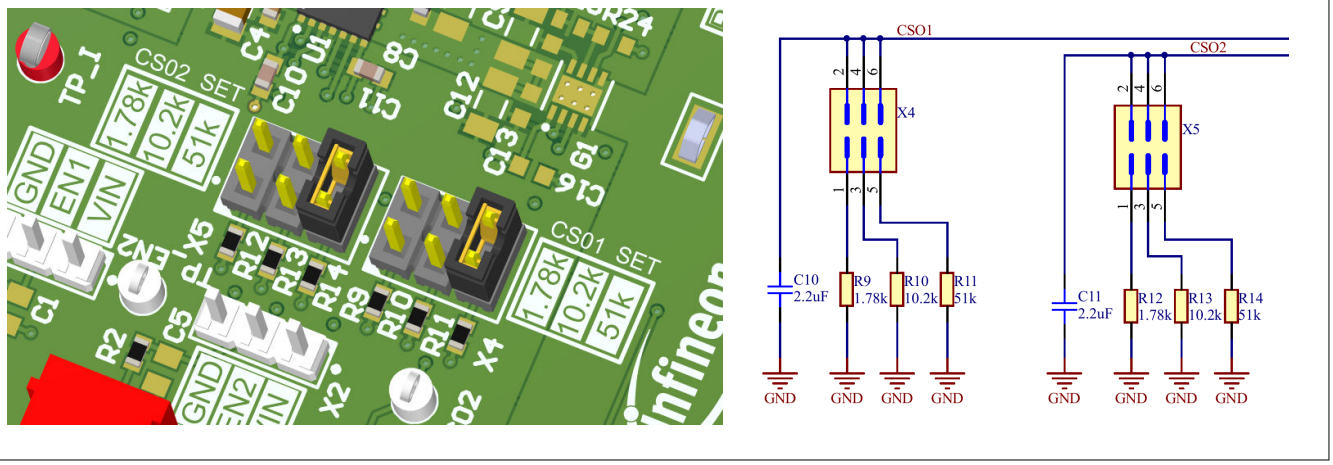

Figure 7 CSO1 SET and CSO2 SET jumper setting

2.3.5 ST1 and ST2 selection

The status outputs ST1 and ST2 can be configured with additional jumpers. There are three possible configurations indicated on the PCB. ST1 and ST2 are open drain outputs. They can either be pulled up to their corresponding output channels Q1 and Q2 or set to indicate an active "low" state by lighting an LED. If no jumpers are placed, then the ST1 and ST2 require external pull-up resistor to indicate the signal state. With an external circuit connected, the maximum sink current at ST1 and ST2 pin must be considered, see Operating conditions.

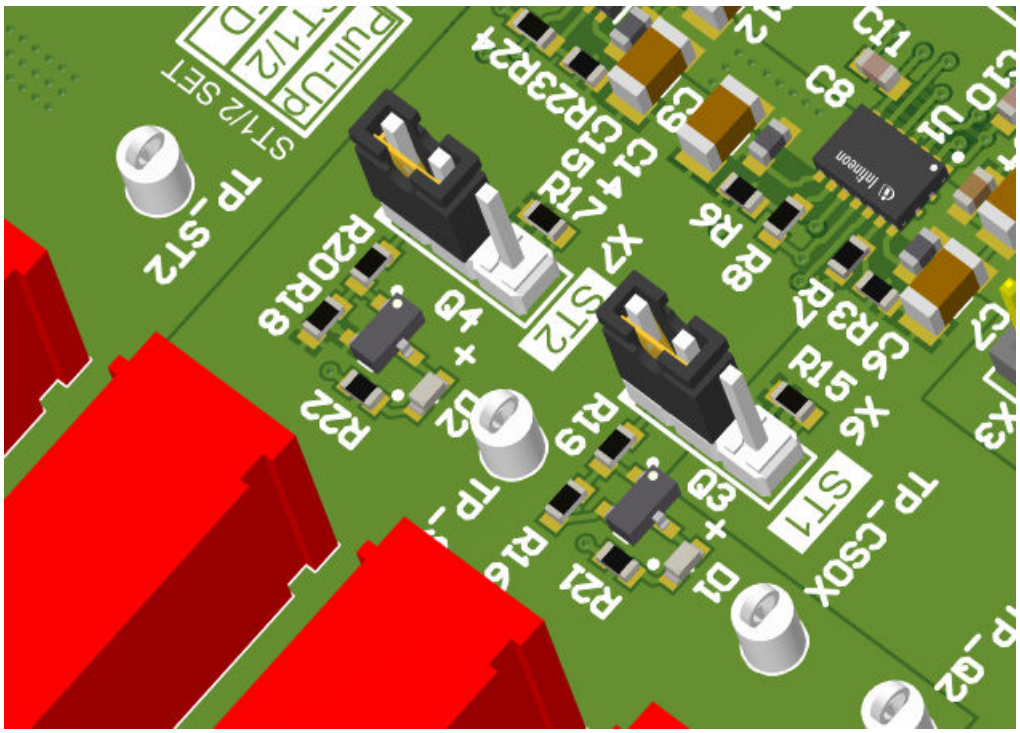

Figure 8 ST1 and ST2 jumper setting

If the jumper is configured to light an LED when ST1 or ST2 are "low", then the schematic from Figure 9 applies. If the output voltages Q1 and Q2 are changed, then the series resistors R21 and R22 must be adapted. Make sure R21 and R22 limit the current through LEDs D1 and D2 to 20 mA maximum. The typical forward voltage drop of D1 and D2 is 1.8 V.

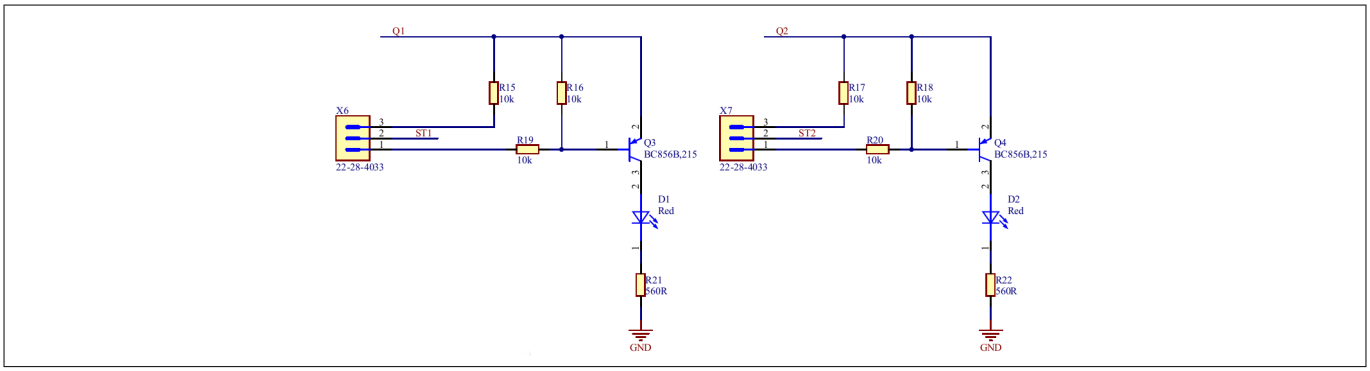

Figure 9 ST1 and ST2 LED indicator schematic

2.3.6 Signal adaption

Test points are distributed on the PCB for easy signal adaption, for example connecting probes of an oscilloscope. The label of each test point indicates the probed signal. For details on the mapping between test points and signals see Schematic. The GND clip of the probe can be attached to one of several ground hooks, see Figure 10.

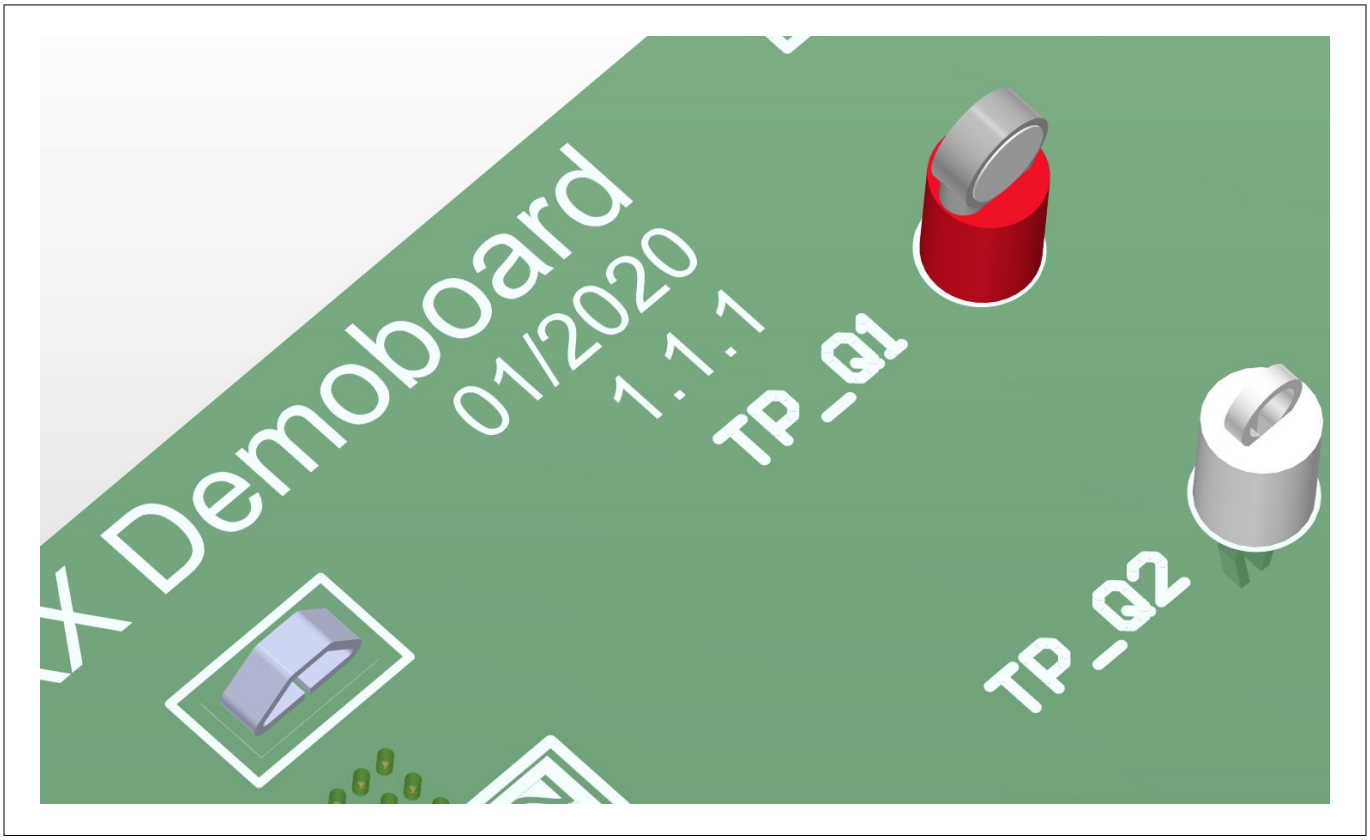

Figure 10 Testpoint and GND hook example

3 Schematic and layout

3.1 Schematic

Parts that are not placed are grayed out and crossed out.

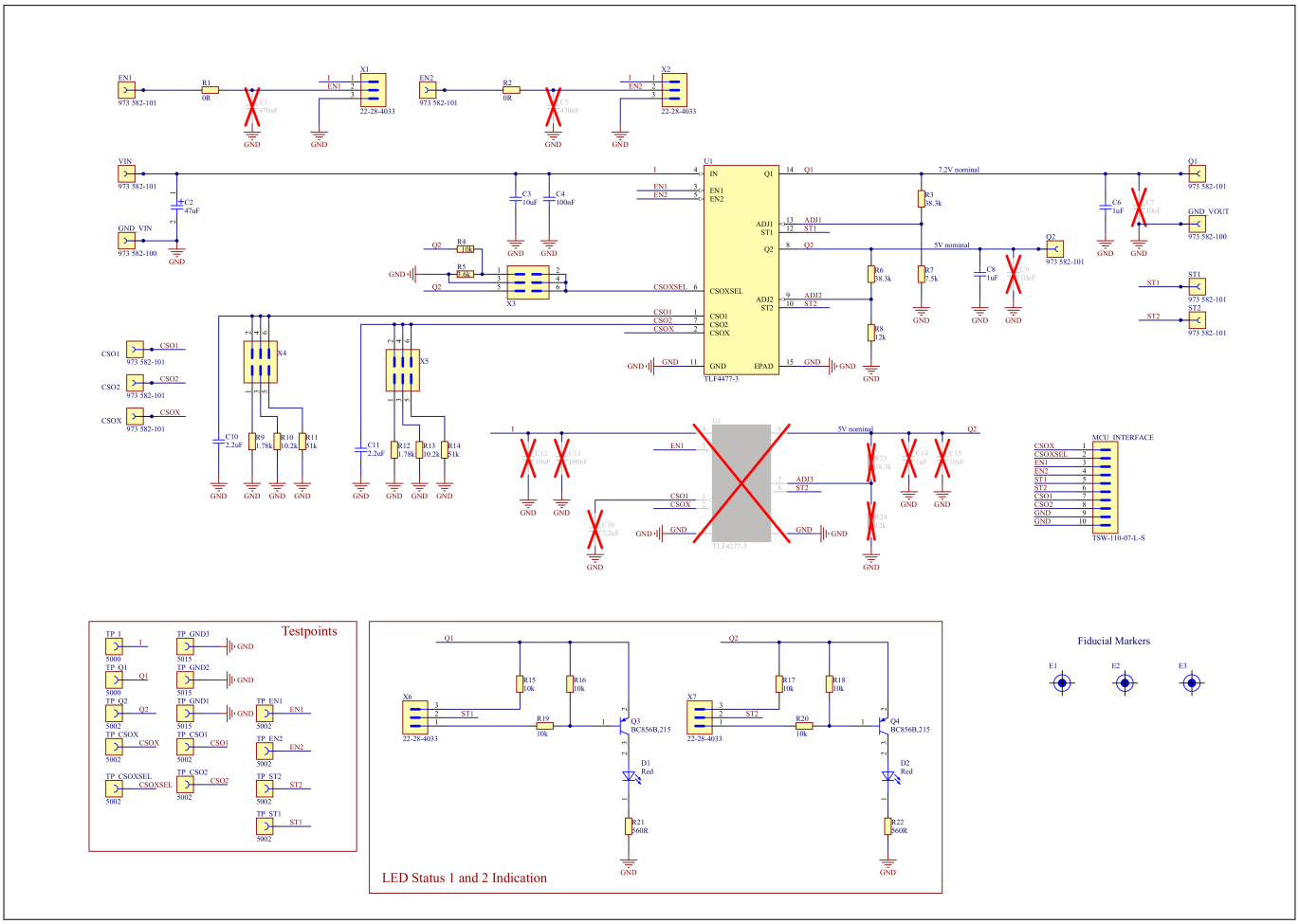

Figure 11 Schematic TLF4477-3LA assembly

3.2 Layout

The PCB uses a four layer standard stack-up. The product can also be soldered to double layer boards. However, four layers offer better thermal characteristics. The configuration on this demoboard is comparable to the "2s2p" thermal interface situation.

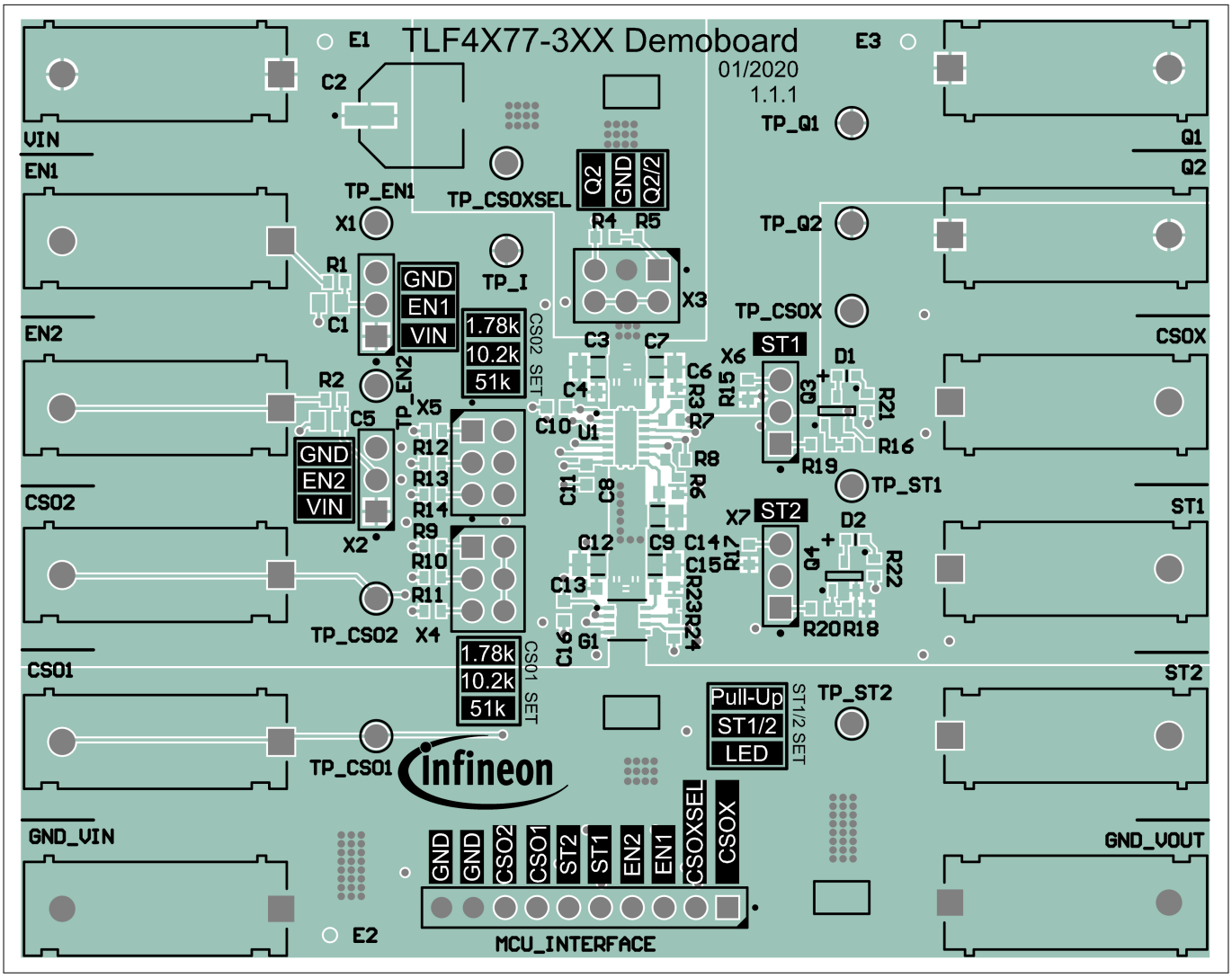

Figure 12 Top layer and components TLF4x77-3Lx demoboard

3 Schematic and layout

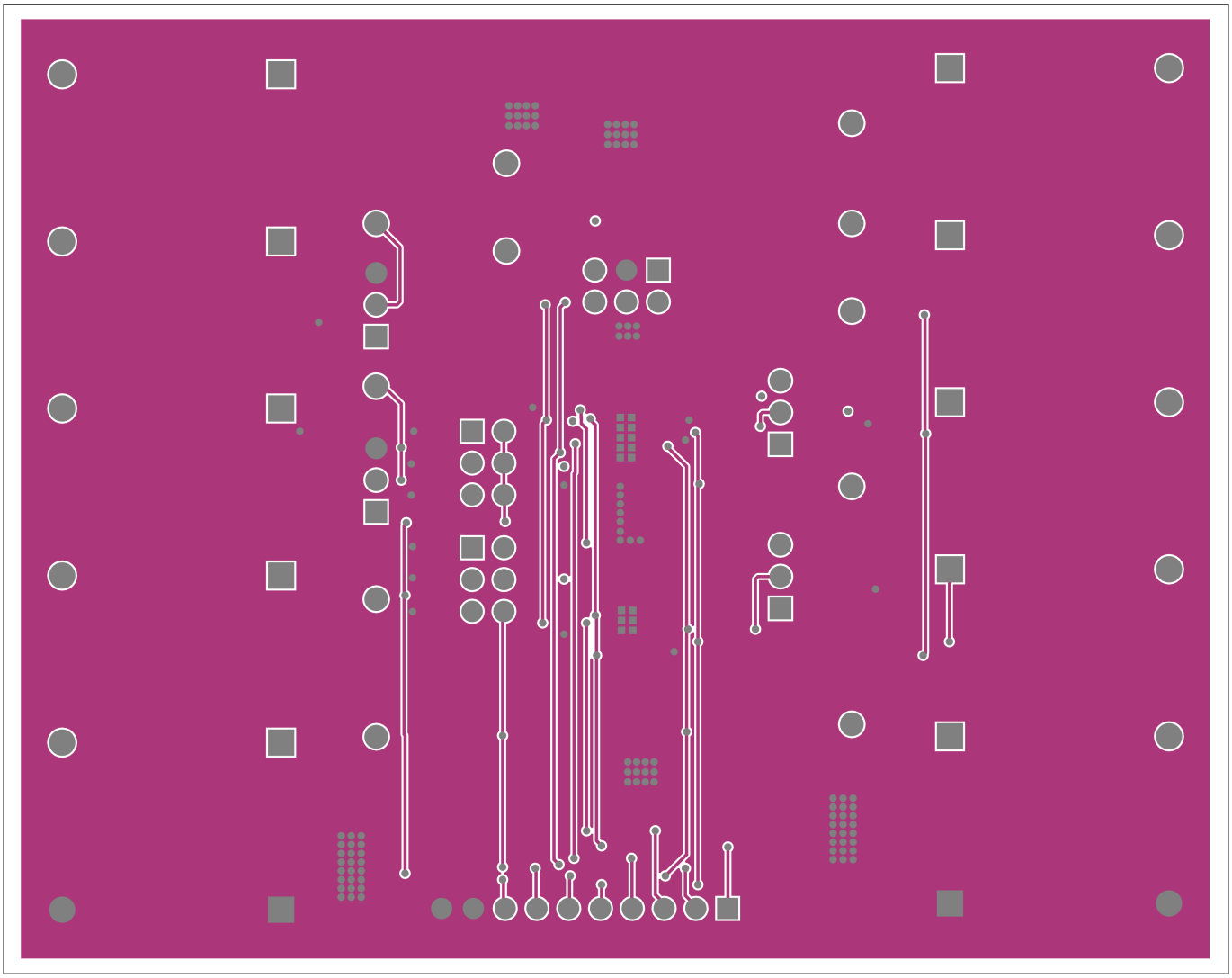

Figure 13 Internal layer 1 TLF4x77-3Lx demoboard

3 Schematic and layout

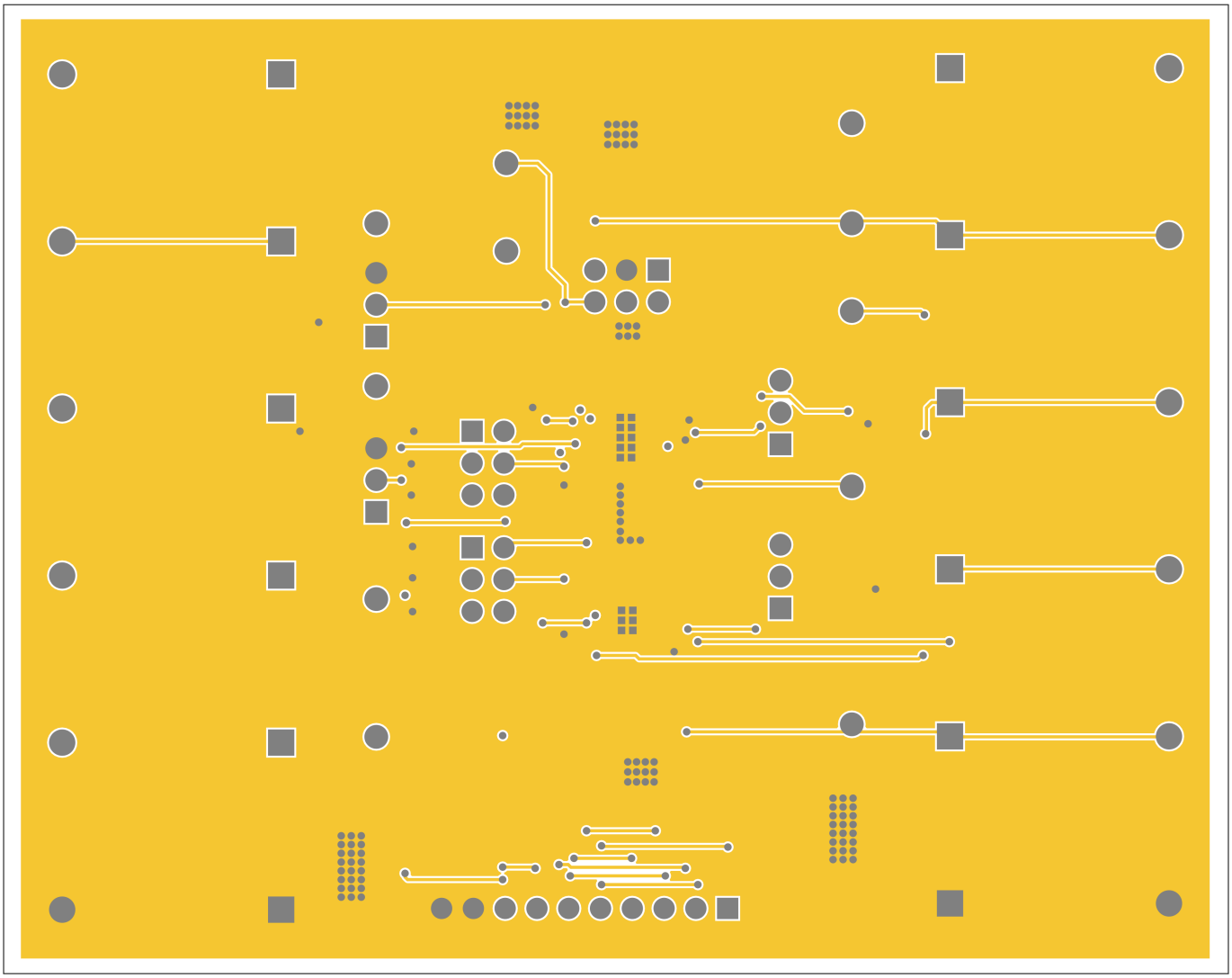

Figure 14 Internal layer 2 TLF4x77-3Lx demoboard

3 Schematic and layout

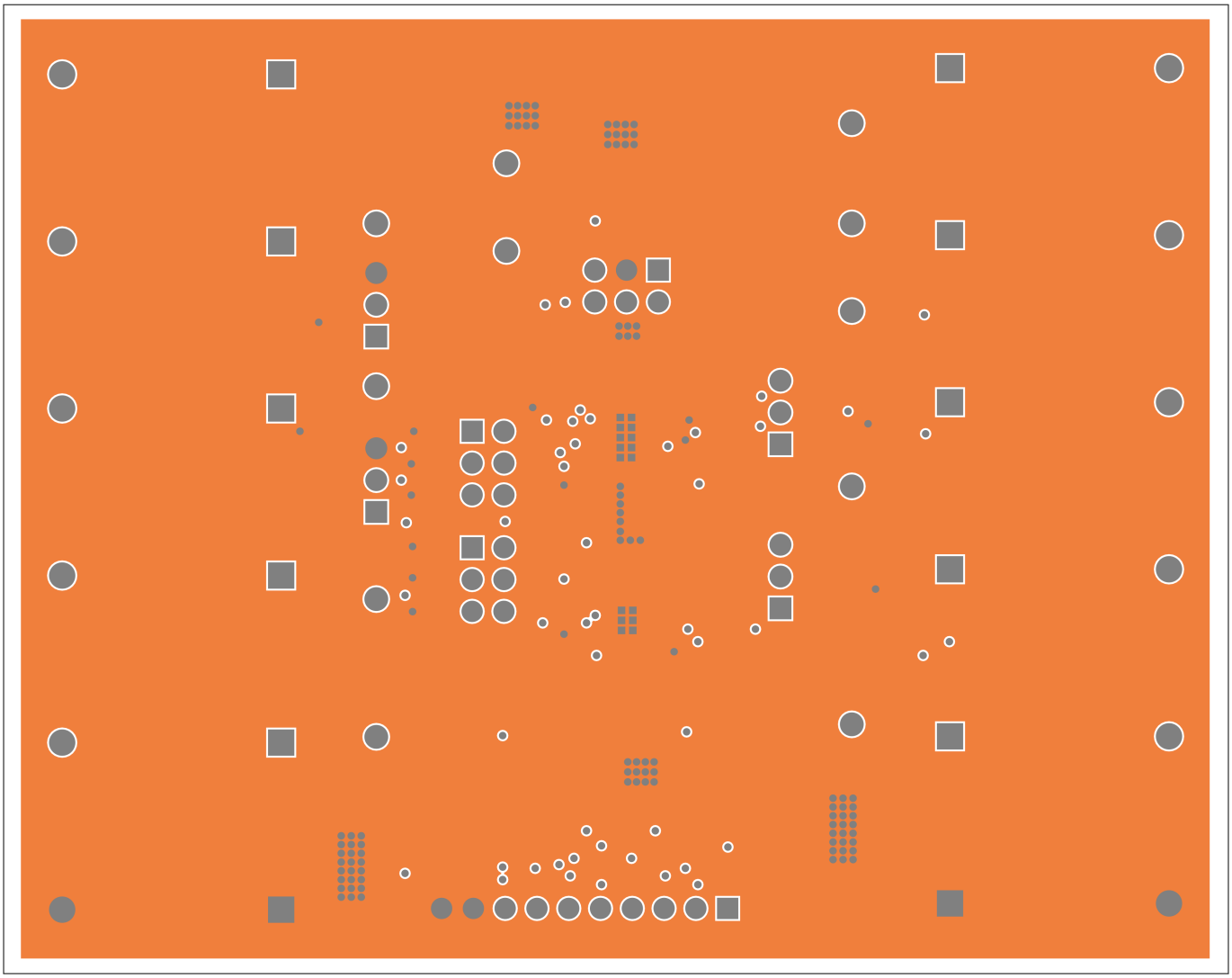

Figure 15 Bottom layer TLF4x77-3Lx demoboard

4 Bill of materials

The bill of materials shows the components for both product specific assembly variants of the demoboard. For the mounting condition of each component see Schematic. Mechanical parts, such as connectors or test-points are not mentioned.

Table 4 Bill of materials

Part	Value	Package
C1, C5	470 nF	0805
C2	47 µF	n.a.
C3, C7, C9, C12, C15	10 µF / 50 V	1206
C4, C13	100 nF / 50 V	0603
C6, C8, C14	1 µF / 16 V	0603
C10, C11, C16	2.2 µF / 6.3 V	0603
D1, D2	LED RED	0603
Q3, Q4	BC856B, 215	SOT23-3
R1, R2	0 Ω	0603
R3, R6, R23	38.3 kΩ	0603
R4, R15, R16, R17, R18, R19, R20	10 kΩ	0603
R5	3.6 kΩ	0603
R7	7.5 kΩ	0603
R8, R24	12 kΩ	0603
R9, R12	1.78 kΩ	0603
R10, R13	10.2 kΩ	0603
R11, R14	51 kΩ	0603
R21, R22	560 Ω	0603

5 Restrictions

This demoboard offers limited features only for evaluation and testing of Infineon products. The demoboard is not an end product or finished appliance, nor is it intended or authorized by Infineon to be integrated into end products. The demoboard may not be used in any production system.

For further information please visit www.infineon.com.

6 Revision history

Revision	Date	Changes
1.02	2024-12-30	Editorial changes
1.01	2022-12-01	Editorial changes
1.0	2020-02-20	Document created

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