UM11650

KIT-TPLSNIFEVB tool

Rev. 1 — 4 August 2021 **User manual**

Document information

Information	Content
Keywords	TPL, Transformer Physical Layer, decoder, TPL sniffer
Abstract	This document helps users understand how to use the KIT-TPLSNIFEVB to acquire TPL communications.

Revision history

Revision history

Rev	Date	Description
v.1	20210804	• Initial version

1 Introduction

The KIT-TPLSNIFEVB board, also called TPL sniffer is working with a logic analyzer (preferably a Saleae Logic Analyzer) and its software to help analyze any TPL signals.

Figure 1. KIT-TPLSNIFEVB

Placed in any TPL bus, it non-intrusively listens to all TPL messages and monitors the frame traffic on the bus (the TPL sniffer works in listen mode only). The corresponding received data (in SPI format) is available on a data output port, to be connected to a logic analyzer and its software which provides further analysis of such data.

Additionally, several DLLs (or plug-ins) to add to the Saleae Logic Analyzer software have been developed in order to decode TPL frames. Go to http://www.nxp.com/KIT-TPLSNIFEVB for additional details.

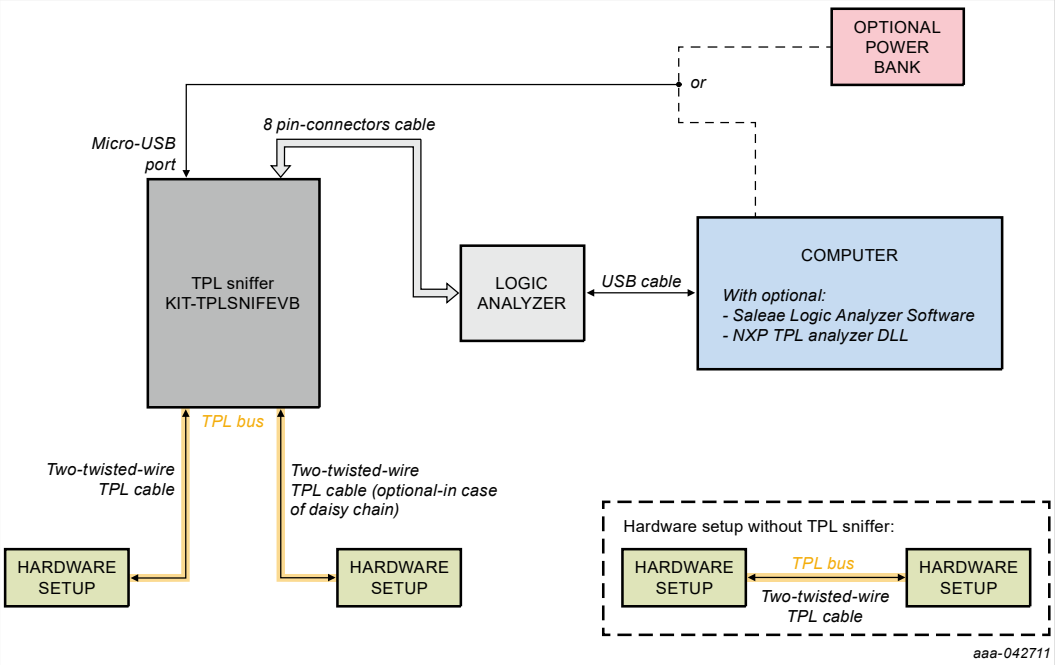

Figure 2. TPL sniffer toolchain

Note: *This product has not undergone formal EU EMC assessment. As a component used in a research environment, it will be the responsibility of the user to ensure the finished assembly does not cause undue interference when used and cannot be CE marked unless assessed.*

2 Finding kit resources and information on the NXP web site

NXP Semiconductors provides online resources for this evaluation board and its supported device(s) on http://www.nxp.com.The information page for KIT-TPLSNIFEVB tool is at http://www.nxp.com/KIT-TPLSNIFEVB. The information page provides overview information, documentation, software and tools, parametrics, ordering information and a Getting Started tab. The Getting Started tab provides quick-reference information applicable to using the KIT-TPLSNIFEVB tool, including the downloadable assets referenced in this document.

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3 Getting ready

3.1 Kit contents

- Assembled and tested TPL sniffer dongle in anti-static bag
- A logic analyzer connection cable with 8-pin headers
- A TPL bus connection twisted cable with 2-pin headers

Figure 3. Kit contents

3.2 Additional hardware and software

The TPL sniffer requires only a 5.0 V with 50 mA (average) and 150 mA (peak) power supply through a USB Micro-B connector (for example, a power bank, or a USB cable connected to a computer).

To analyze the data sourced from the TPL sniffer a logic analyzer (for example, Saleae Logic Analyzer) is required along with its software.

Optionally, several DLLs (or plug-ins) to add to the Saleae Logic Analyzer software have been developed in order to decode TPL frames. For additional details, go to http://www.nxp.com/KIT-TPLSNIFEVB.

4 Getting to know the hardware

4.1 KIT-TPLSNIFEVB features

- Internal galvanic isolation between the TPL and rest of the circuits
- Connection to any point of the monitored TPL bus
- Minimal loading of the TPL line
- Logic analyzer connection, with a provided cable pin-to-pin compatible with the Saleae Logic 8 and Logic Pro 8/16 Analyzer series
- Powered through a USB connector by a 5.0 V source, typically a USB power bank or a USB cable connected to a computer
- Integrated keep-alive function to avoid power bank self shut-off

4.2 Block diagram

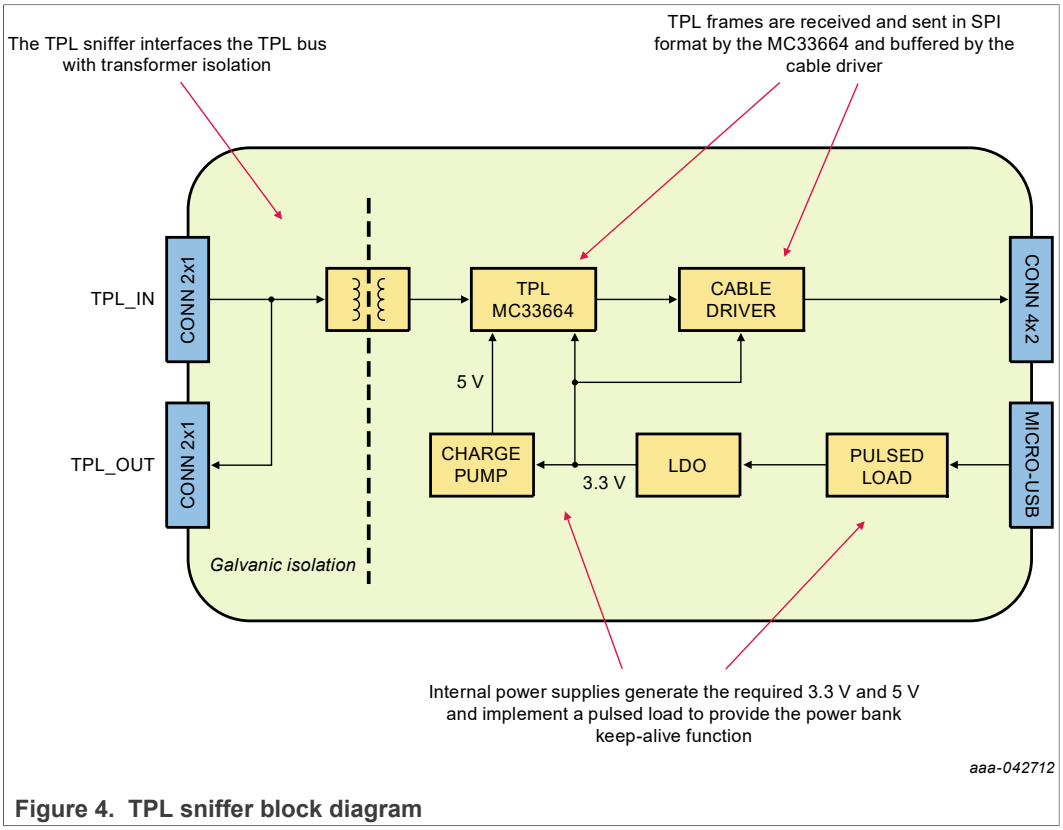

Figure 4. TPL sniffer block diagram

4.3 Schematics

The schematics for the KIT-TPLSNIFEVB tool are available at http://www.nxp.com/KIT-TPLSNIFEVB.

5 Configuring the hardware

The TPL sniffer exposes a set of connectors on two sides. One side is dedicated to the TPL bus connection and on the other side all other connectors are present. The two sides are galvanically isolated from each other, that is, the TPL bus connectors are isolated from all other accessible points on the housing.

5.1 Connecting to the TPL bus

As shown in Figure 4, the TPL connectors are located on one side of the housing and are marked *TPL_IN* and *TPL_OUT* with a polarity indication + and -. The correct polarity of the connection is mandatory for the proper functioning of the sniffer and, in most cases, also for the system to be sniffed.

Conversely, the terms *IN* and *OUT* are conventional and the two connectors are electrically in parallel inside the TPL sniffer. They are physically duplicated to make it easier to connect the wires in certain use cases. For example, in the case of a daisy chain, the original TPL bus is cut and the two ends must be plugged onto the receptacles of the TPL sniffer shown in Figure 5. In other cases, for example, when the TPL bus has

only one differential end available for connection to the TPL sniffer, there is no difference between the *TPL_IN* and *TPL_OUT* connectors, as long as the polarity is respected.

As a rule, if a branch is created from the original TPL bus, its length should be as short as possible.

Note: *The two TPL interface connectors are named J1 and J2 in the schematic diagram.*

Figure 5. TPL bus connectors

5.1.1 Optional TPL bus loading

The TPL sniffer is designed to add minimal load to the TPL bus by default. Therefore, it does not add any termination impedance and the differential load seen from the bus is that of an input impedance of the MC33664 reflected on the high voltage side by the 1:1 ratio T1 isolation transformer.

In case an interface other than the default one is desired, some settings are possible on the PCB:

- The two jumpers JP1 and JP2 located on the bottom side, should be closed (with a drop of solder) in case a standard 150 Ω termination is desired.
- Additional component footprints are available on the top side of the PCB to accommodate different loads on the TPL bus interface. These are R13 (default DNP) and R14 and R15 (default 0 Ω).

Note: *If the board must be modified and then powered without housing, proceed with caution.*

5.2 Power and data connections

The side of the case opposite the TPL connectors has all the other available connectors of the TPL sniffer.

- The GND banana plug: used to connect, if necessary, the GND of the *TPL sniffer* to another potential. It is labeled J5 in the schematics.
  In some cases of use, the whole system including, for example, the TPL sniffer, the power supply, the logic analyzer and the associated PC, could be an electrically floating block. This connector allows, if desired, the ground potential of the system (for example, the TPL sniffer and anything else that has its ground connected to the TPL sniffer ground) to be set to any other convenient potential, that is, the protective earth or the vehicle chassis ground (KL31).
- The data-out 8-pin connector: buffered SPI signals to be routed to the logic analyzer. It is labeled J3 in the schematics. See Section 5.2.1 "Connecting to the logic analyzer" for more details.
- The power-on LED indicator

- The USB Micro-B connector: to connect to a 5.0 V source. It is labeled J4 in the schematics.

Figure 6. Power and data connectors

5.2.1 Connecting to the logic analyzer

The data output connector (J3) is an 8-pin 4x2 male connector used as an interface to the logic analyzer, to transfer TPL messages converted to SPI format.

The signals are all unidirectional and their direction is from the TPL sniffer (output) to the logic analyzer (input).

The TPL sniffer is designed such that the cable connection to the logic analyzer can be relatively long, with a maximum length of 2 m, without loss of signal integrity and therefore maintaining the logic and timing information.

This statement is only true if the following two rules are both satisfied:

- The cable used for the connection must have a characteristic impedance of 100 Ω. This is the impedance normally found on standard IDC ribbon cables.
- The logic analyzer side of the cable should only be loaded with high impedance terminations such as a High-Z input from an oscilloscope, for example, 15 pF || 1 MΩ, or 5 pF || 10 MΩ (better), or digital inputs from a logic analyzer (for example, 10 pF || 2 MΩ).

Failure to follow these rules does not guarantee proper operation of the TPL sniffer, unless the cable length is considerably short (< 15 cm) so that reflections in the cable can be neglected.

For signal integrity and EMI reduction, the data lines are interleaved with the ground potential with the pinout described in Table 1.

The TPL sniffer data output lines and the TPL inputs are internally protected by ESD suppression devices. Nevertheless, standard electrostatic precautions should be taken when handling and using the TPL sniffer.

The pin assignment for the data output connector is described in the following table:

Table 1. ANALYZER connector (J3) pin assignment

Pin	Signal	Description
1	INTB	SPI interrupt signal
2	GND	Ground
3	RXCLK	SPI bus clock
4	GND	Ground
5	RXDATA	SPI bus data

Table 1. ANALYZER connector (J3) pin assignment*...continued*

Pin	Signal	Description
6	GND	Ground
7	RXCSB	SPI chip select
8	GND	Ground

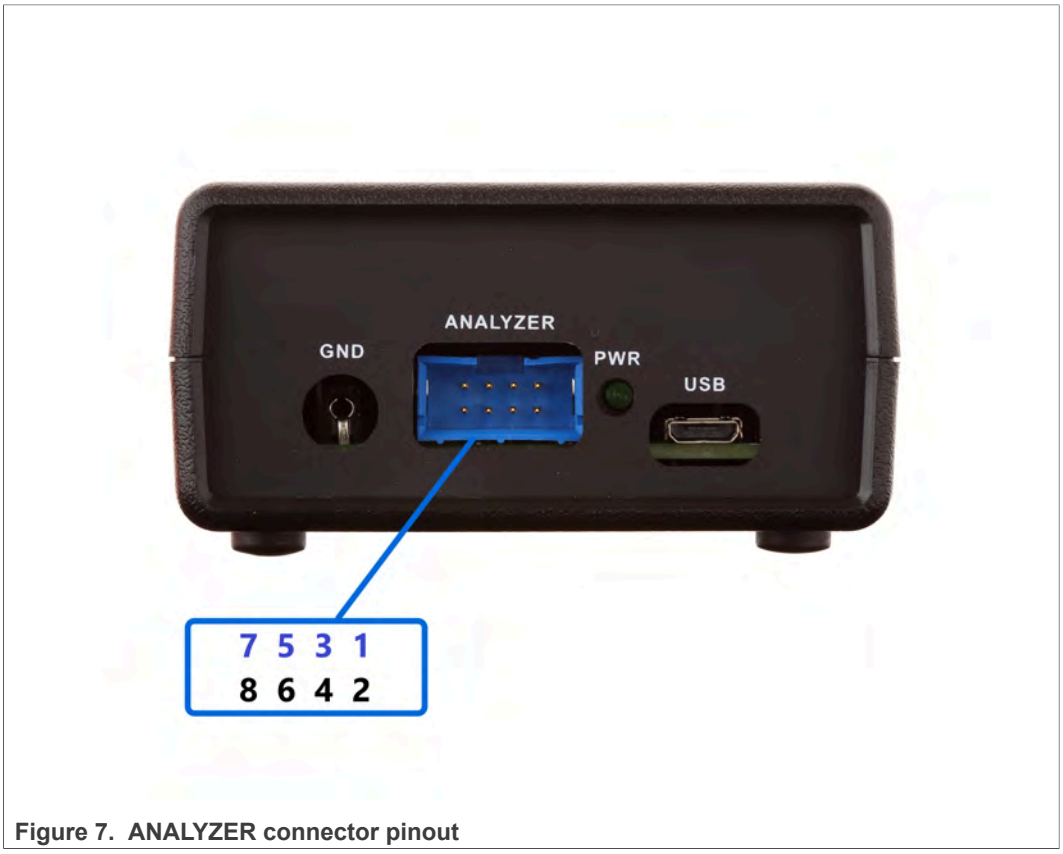

Figure 7. ANALYZER connector pinout

The supplied 8-pin connection cable should be plugged into the ANALYZER connector with the blue wires on top (NXP logo side) and the black wires on the bottom.

5.2.1.1 Interfacing with the Saleae Logic Analyzer

The supplied 8-pin connectors cable is fitting the Saleae Logic 8 and Logic Pro 8/16 analyzer series input connectors. To connect to the Saleae Logic Analyzer, the cable should be plugged with the blue wires on top (Saleae logo side) and the black wires on the bottom.

Figure 8. Saleae Logic Analyzer

Saleae provides a software interface with its product to help decode the acquired signals. To learn more, visit the Saleae website.

As a plug-in to the Saleae software interface, a DLL has been developed to decode TPL frames. Go to http://www.nxp.com/KIT-TPLSNIFEVB for more details.

5.2.2 Powering the TPL sniffer

The TPL sniffer can be powered through the USB Micro-B connector (J4, labeled PWR) by a 5.0 V source with 50 mA (average) and 150 mA (peak), typically a USB power bank or a USB cable connected to a computer.

5.2.2.1 Power bank keep-alive function

The purpose of the keep-alive feature is to avoid the activation of the automatic shutdown feature found on most consumer USB power banks. Such a shutdown would likely occur due to the limited power consumption of the TPL sniffer circuit alone, in the 10 mA to 20 mA range. Therefore, the sniffer activates an additional 150 mA of internal power consumption with a period of 5.8 seconds and a duty cycle of 20 % (all figures are approximate). This simulates a load large enough to keep most power banks energized.

If the power-on LED indicator goes out shortly after the TPL sniffer is first powered up with a power bank, consider trying another power bank model.

6 Hardware specifications

Table 2. Electrical characteristics

Description	Value
Power supply voltage	5.0 V (± 10 %)
Power consumption	< 50 mA (averaged over 20 seconds)

Table 3. Environmental characteristics

Description	Value
Operating temperature	0 °C to 40 °C
Storage temperature	-40 °C to 70 °C
Humidity	5 % to 95 % relative humidity, non-condensing

Table 4. Mechanical characteristics

Description	Value
Enclosure dimensions	72 mm W x 35 mm H x 103 mm D
TPL connectors (on TPL sniffer)	MOLEX - Micro-Fit3.0 - 2-pin header. Reference No. 43650-0213
TPL connectors (on TPL cable)	MOLEX - Micro-Fit3.0 - 2-pin receptacle. Reference No. 43645-0200 MOLEX - Micro-Fit3.0 - crimp pin. Reference No. 43030-0001
Power connector	USB Micro-B receptacle
Data connector (on TPL sniffer)	AMPHENOL - 4x2 header 2.54 mm. Reference No. 75867-132LF
GND connector	HIRSHMANN - 2 mm Test socket. Reference No. 930224100

7 References

[1] **KIT-TPLSNIFEVB** — detailed information on this board, including documentation, downloads, and software and tools http://www.nxp.com/KIT-TPLSNIFEVB

[2] **MC33664** — product information on MC33664, Isolated Network High-Speed Transceiver http://www.nxp.com/MC33664

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