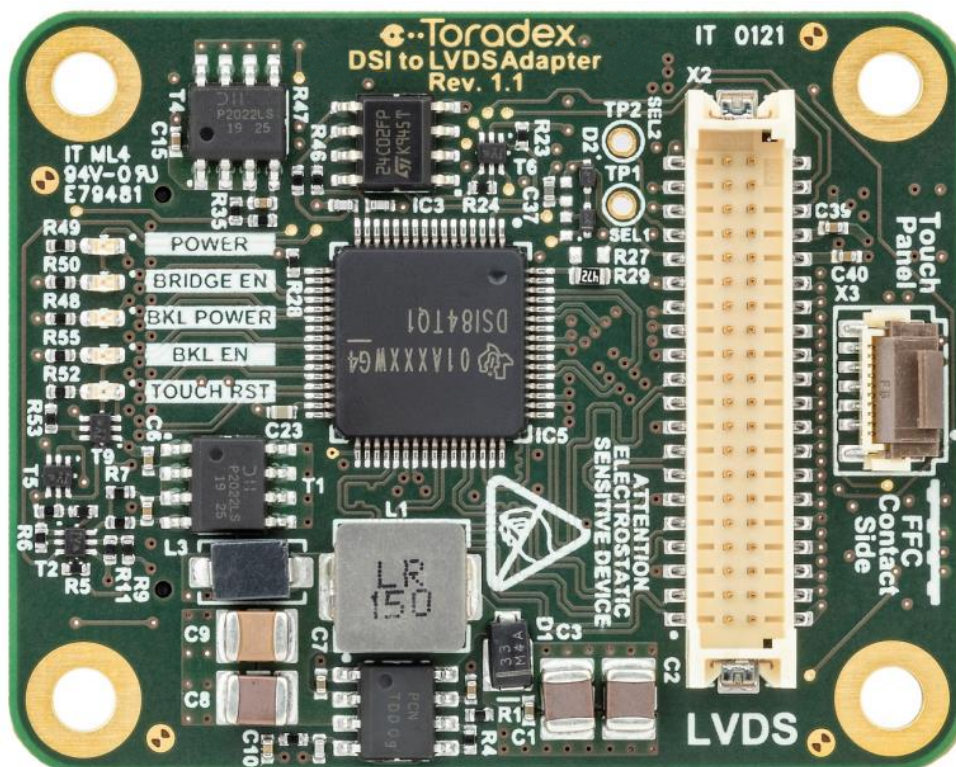




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HW Datasheet



Revision History

Document Revisions

Date	Doc. Revision	Product Version	Changes
12-May-2021	Rev. 1.00	V1.1	Initial document release.
02-Dec-2024	Rev. 1.01	V1.1	Rename the product from "Verdin DSI to LVDS Adapter" to "Toradex DSI to LVDS Adapter"
24-Jun-2025	Rev. 1.02	V1.1	Update document layout following the new standard template. Section 2.3 : Update naming in Block Diagram on Figure 1 Section 2.4 : Update naming in Block Diagram on Table 2 Minor fixes.

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1 Introduction

The Toradex DSI to LVDS Adapter is an add-on board for the Verdin Development Board which uses a MIPI-DSI Interface to provide an LVDS data output.

The Toradex DSI to LVDS Adapter uses Texas Instruments SN65DSI84-Q1 DSI to Single/DualChannel LVDS Bridge. It features a Single-Channel MIPI® D-PHY receiver front-end configuration with 4 data lanes per channel operating at 1Gbps per data lane and a maximum input bandwidth of 4Gbps.

The bridge decodes MIPI® DSI 18-bpp RGB666 and 24-bpp RGB888 packets and converts the formatted video data-stream to an LVDS output operating at pixel clocks range from 25 MHz to 154 MHz, offering a Dual-Channel LVDS or Single-Channel LVDS with four data lanes per channel. It is well suited for WUXGA (1920 x 1080) at 60 frames per second (fps) with up to 24 bits-per-pixel (bpp).

The Toradex DSI to LVDS Adapter can be connected to the MIPI® DSI connector on the related connector on supported carrier boards.

1.1 Reference Documents

For detailed technical information on the suitable computer modules and other reference documents, please refer to the following sections:

1.1.1 Verdin Development Board V1.1 Datasheet

https://docs.toradex.com/109463-verdin_development_board_datasheet_v1.1.pdf

1.1.2 Aquila Development Board

<https://developer.toradex.com/hardware/aquila-som-family/carrier-boards/aquila-development-board>

1.1.3 Dahlia Carrier Board V1.1 Datasheet

https://docs.toradex.com/109590-dahlia_datasheet_v1.1.pdf

1.1.4 Toradex 10.1" LVDS Capacitive Touch Display Datasheet

<https://docs.toradex.com/105952-10-1-inch-lvds-capacitive-touch-display-1280x800-datasheet.pdf>

1.1.5 Toradex Developer Website

<http://developer.toradex.com/>

1.1.6 SN65DSI84-Q1 MIPI® DSI to Dual-Link LVDS Bridge Product Datasheet

<http://www.ti.com/lit/ds/symlink/sn65dsi84-q1.pdf>

1.2 Abbreviations

Table 1: Abbreviations

Abbreviation	Explanation
ADC	Analog to Digital Converter
CAN	Controller Area Network, a bus that is mainly used in the automotive and industrial environment
CAN FD	Controller Area Network Flexible Data-Rate, an extension to the original CAN bus protocol which allows higher data rates and larger message sizes.
CEC	Consumer Electronic Control, HDMI feature that allows controlling CEC compatible devices
CPU	Central Processor Unit
CSI	Camera Serial Interface
DAC	Digital to Analog Converter
DDC	Display Data Channel, interface for reading out the capability of a monitor. In this document DDC2B (based on I2C) is always meant.
DFP	Downstream Facing Port, USB Type-C port that acts as a host
DRP	Dual-Role Port, USB Type-C port that can operate as power sink and source
DSI	Display Serial Interface
DVI	Digital Visual Interface, digital signals are electrically compatible with HDMI
EDID	Extended Display Identification Data, timing setting information provided by the display in a PROM
EMI	Electromagnetic Interference, high-frequency disturbances
ESD	Electrostatic Discharge, high voltage spike or spark that can damage electrostatic-sensitive devices
FPD-Link	Flat Panel Display Link, high-speed serial interface for liquid crystal displays. In this document is also called the LVDS interface.
GBE	Gigabit Ethernet, Ethernet interface with a maximum data rate of 1000Mbit/s
GND	Ground
GND_CHASSIS	Chassis Ground
GPIO	General Purpose Input/Output, pin that can be configured as an input or output
GSM	Global System for Mobile Communications
HDA	High-Definition Audio (HD Audio), the digital audio interface between CPU and audio codec
I2C	Inter-Integrated Circuit, the two-wire interface for connecting low-speed peripherals
I2S	Integrated Interchip Sound, serial bus for connecting PCM audio data between two devices
I/O	Input-Output
JTAG	Joint Test Action Group, widely used debug interface
LCD	Liquid Crystal Display
LSB	Least Significant Bit
LVDS	Low-Voltage Differential Signaling, electrical interface standard that can transport high-speed signals over twisted-pair cables. Many interfaces like PCIe or SATA use this interface. Since the first successful application was the Flat Panel Display Link, LVDS became a synonymous for this interface. In this document, the term LVDS is used for the FPD-Link interface.
MAC	Medium Access Control is part of the second layer (data link layer) in the Ethernet stack
MIPI	Mobile Industry Processor Interface Alliance
MDI	Medium Dependent Interface, the physical interface between Ethernet PHY and cable connector
MDIO	Management Data Input/Output, an interface that is used for controlling the Ethernet PHY. The bus consists of the MDC clock and the MDIO bidirectional data signal.
mini PCIe	PCI Express Mini Card, the card form factor for internal peripherals. The interface features PCIe and USB 2.0 connectivity
MMC	MultiMediaCard, flash memory card

Continued on next page

Table 1: Abbreviations (Continued)

Abbreviation	Explanation
MSB	Most Significant Bit
NC	Not Connected
OD	Open-Drain
OTG	USB On-The-Go, a USB host interface that can also act as USB client when connected to another host interface
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect, parallel computer expansion bus for connecting peripherals
PCIe	PCI Express, a high-speed serial computer expansion bus, replaces the PCI bus
PCM	Pulse-Code Modulation, digitally representation of analog signals, standard interface for digital audio
PD	Pull-Down Resistor
PHY	The physical layer of the OSI model
PU	Pull-up Resistor
PWM	Pulse-Width Modulation
PWR	Power
QSPI	Quad SPI, SPI interface with four bidirectional data signals
RGMII	Reduced Gigabit Media-Independent Interface, the interface between Ethernet MAC and PHY for up to 1Gb/s
RJ45	Registered Jack, common name for the 8P8C modular connector that is used for Ethernet wiring
RS232	The single-ended serial port interface
RS485	Differential signaling serial port interface, half-duplex, multi-drop configuration possible
R-UIM	Removable User Identity Module, identifications card for CDMA phones and networks, an extension of the GSM SIM card
SD	Secure Digital, flash memory card
SDIO	Secure Digital Input Output, an external bus for peripherals that uses the SD interface
SIM	Subscriber Identification Module, an identification card for GSM phones
SMBus	System Management Bus (SMB), a two-wire bus based on the I ² C specifications, is used in x86 designs for system management.
SoC	System on a Chip, IC which integrates the main component of a computer on a single chip
SoM	System on a Module, PCB which integrates the main component of a computer on a single board
SPI	Serial Peripheral Interface Bus, synchronous four-wire full-duplex bus for peripherals
TIM	Thermal Interface Material, thermally conductive material between CPU and heat spreader or heat sink
TMDS	Transition-Minimized Differential Signaling, serial high-speed transmitting technology that is used by DVI and HDMI
TVS Diode	Transient-Voltage-Suppression Diode, a diode that is used to protect interfaces against voltage spikes
UFP	Upstream Facing Port, USB Type-C port that acts as a client
UART	Universal Asynchronous Receiver/Transmitter, serial interface, in combination with a transceiver an RS232, RS422, RS485, IrDA or similar interface can be achieved
USB	Universal Serial Bus, serial interface for internal and external peripherals

2 Features

2.1 One-Channel MIPI® DSI Receiver

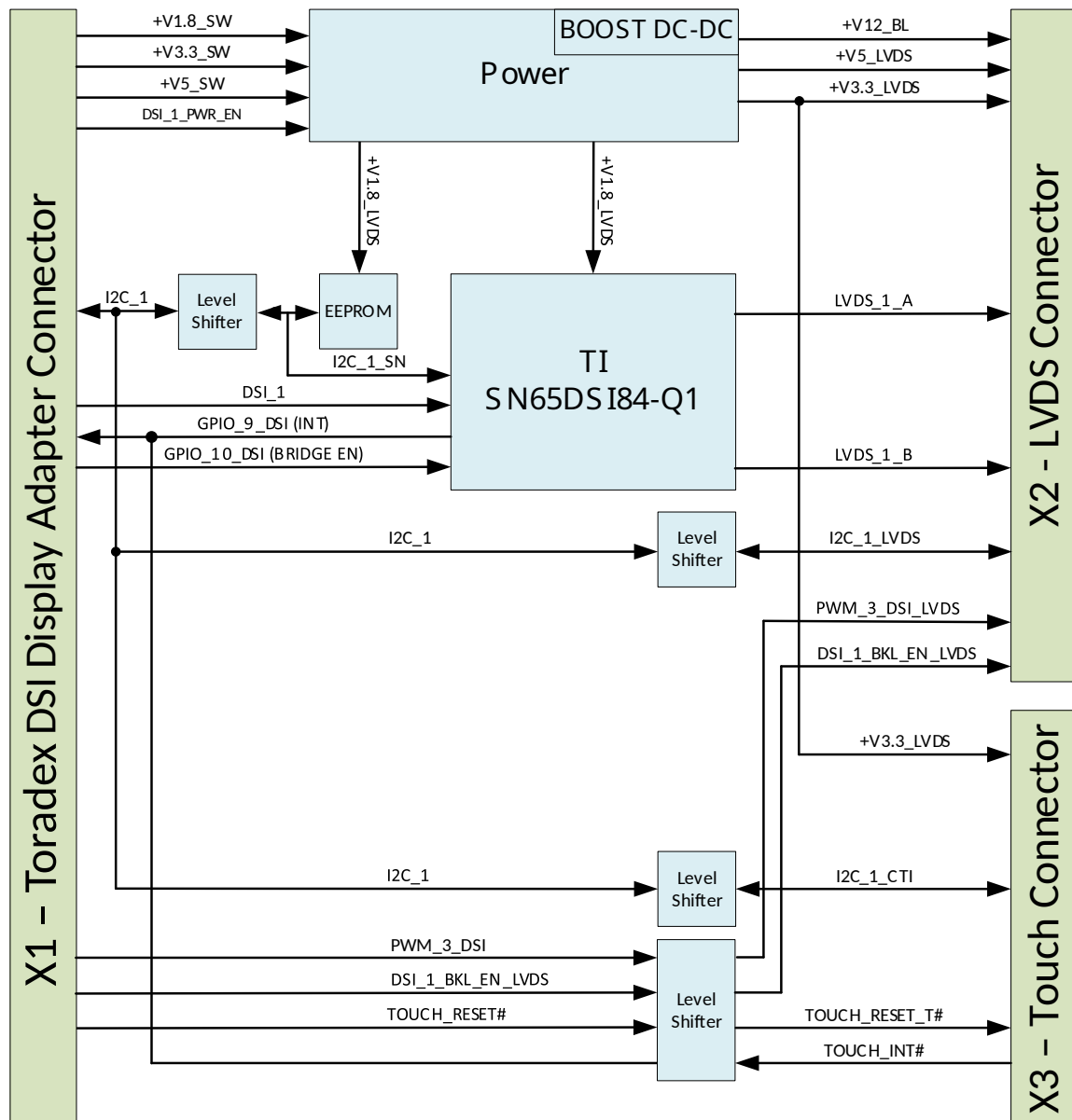
- Implements MIPI D-PHY version 1.00.00 Physical Layer Front-end and DSI version 1.02.00
- Single-Channel DSI Receiver configurable for one, two, three, or four D-PHY data lanes per channel operating up to 1 Gbps per lane
- Supports 18-bpp and 24-bpp DSI Video Packets with RGB666 and RGB888 Formats

2.2 LVDS Transmitter

- Suitable for 60-fps WUXGA 1920 x 1200 resolution at 18-bpp and 24-bpp color (DualChannel LVDS), and 60-fps 1366 x 768 resolution at 18-bpp and 24-bpp (SingleChannel LVDS)
- Output Configurable for Single-Channel or Dual-Channel LVDS
- Supports Single-Channel DSI to Dual-Channel LVDS operating mode
- LVDS Output-Clock Range of 25 MHz to 154 MHz in Dual-Channel or Single-Channel mode
- LVDS Channel SWAP, LVDS PIN Order Reverse feature for ease of PCB routing

2.3 Hardware Architecture Block Diagram

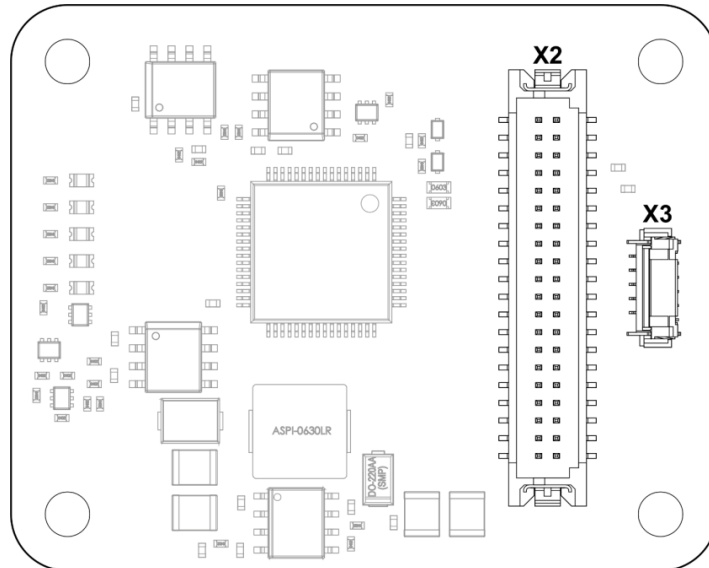
Figure 1: Toradex DSI to LVDS Adapter Hardware Architecture



2.4 Physical Drawing

2.4.1 Top Side Connector

Figure 2: Toradex DSI to LVDS Adapter – Top Side



2.4.2 Bottom Side Connector

Figure 3: Toradex DSI to LVDS Adapter – Bottom Side

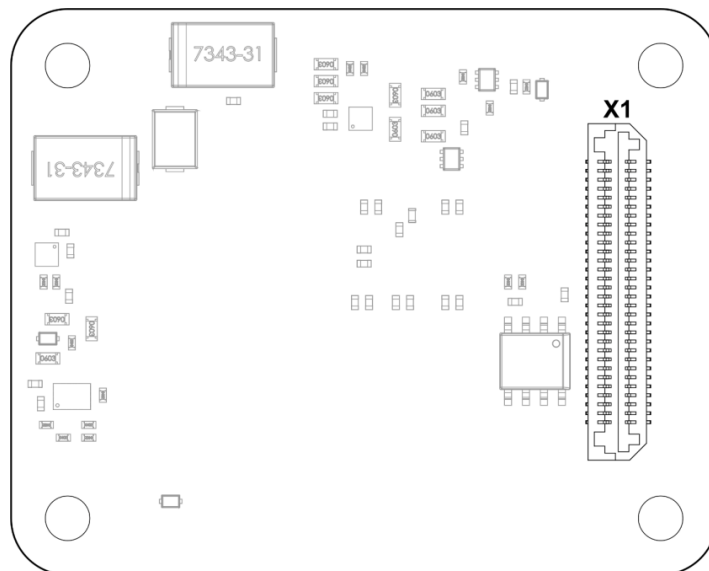


Table 2: Connectors

Ref	Description	Remarks
X1	Toradex DSI Display Adapter Connector	
X2	LVDS Connector	
X3	Capacitive Touch Panel Connector	

2.4.3 Hardware Setup

Figure 4: Toradex DSI to LVDS Adapter – installed on the Verdin Development Board

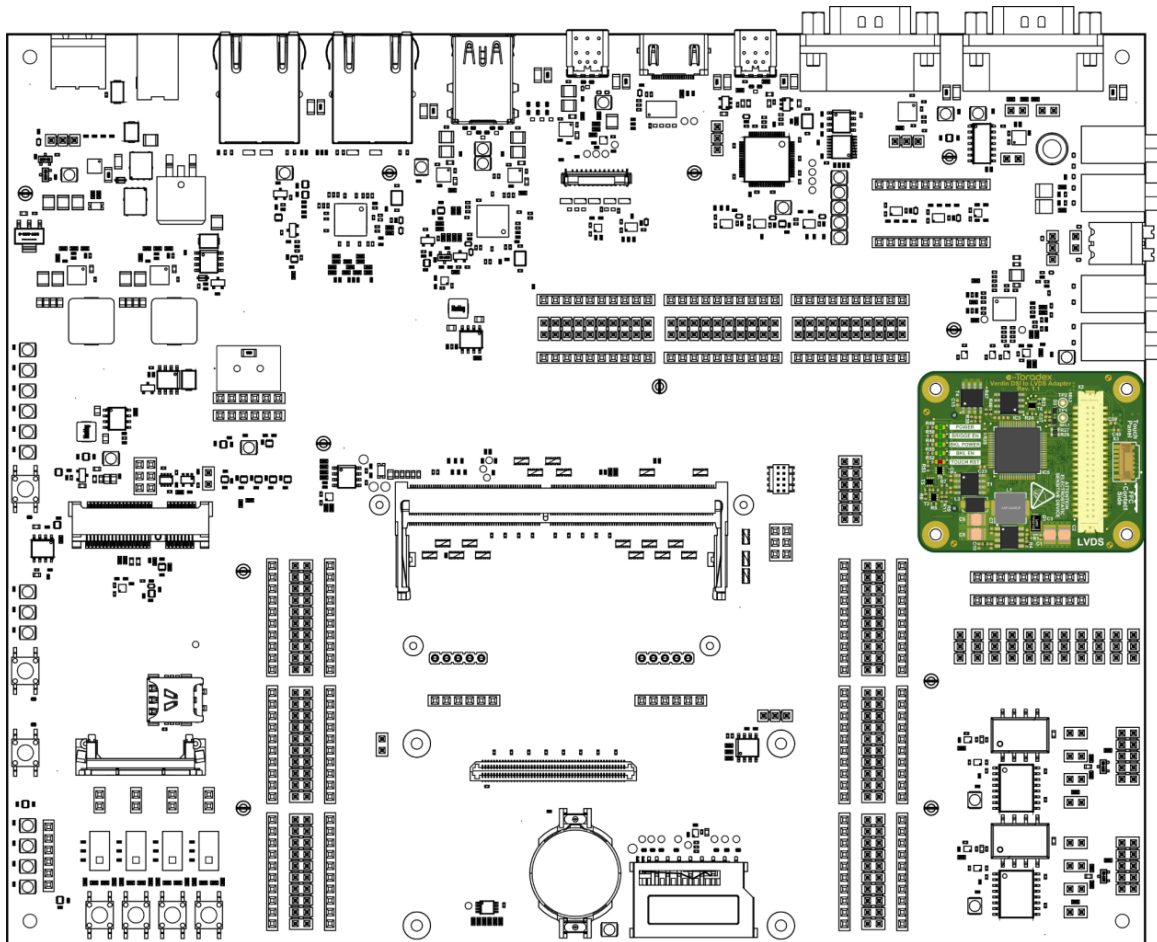
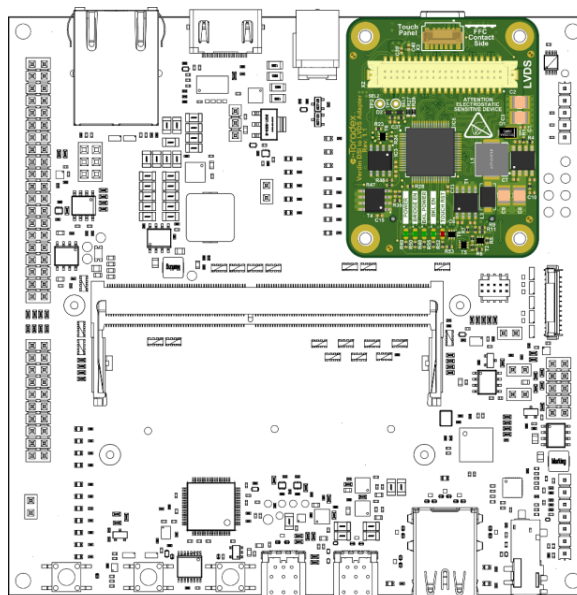


Figure 5: Toradex DSI to LVDS Adapter – installed on the Dahlia Carrier Board



3 Interface Description

3.1 DSI Display Adapter Connector (X1)

Manufacturer: Samtec LSS-130-03-L-DV-A-K-TR

Connector Type: High-Speed Socket

Table 3: DSI Display Adapter Connector (X1)

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down	Description
1	NC				Not connected
3	GND	PWR			
5	NC				Not connected
7	NC				
9	NC				
11	NC				
13	NC				
15	NC				
17	NC				
19	+V5_SW	PWR	+5V		+5V power supply input
21	+V5_SW	PWR	+5V		
23	+V5_SW	PWR	+5V		
25	+V5_SW	PWR	+5V		
27	+V5_SW	PWR	+5V		
29	NC				Not connected
31	+V3.3_SW	PWR	+3.3V		+3.3V power supply input
33	+V3.3_SW	PWR	+3.3V		
35	+V3.3_SW	PWR	+3.3V		
37	+V3.3_SW	PWR	+3.3V		
39	+V3.3_SW	PWR	+3.3V		
41	NC				Not connected
43	+V1.8_SW	PWR	+1.8V		+1.8V power supply input
45	+V1.8_SW	PWR	+1.8V		
47	+V1.8_SW	PWR	+1.8V		
49	+V1.8_SW	PWR	+1.8V		
51	+V1.8_SW	PWR	+1.8V		
53	NC				Not connected
55	GND	PWR			
57	NC				Not connected
59	DSI_1_PWR_EN	I	+1.8V	34k to GND	Enable LVDS Adapter power supply.
2	NC				Not connected
4	I2C_1_SDA	I/O	+1.8V	On a carrier board	I ² C interface, used for LVDS bridge IC configuration and communicating with EEPROM, display, touchscreen.

Continued on next page

Table 3: DSI Display Adapter Connector (X1) (Continued)

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down	Description
6	I2C_1_SCL	I	+1.8V	On a carrier board	I ² C interface, used for LVDS bridge IC configuration and communicating with EEPROM, display, touchscreen.
8	GPIO_9_DSI	O(OD)	+1.8V	4.7k to +V1.8_SW	Interrupt signal output with an open drain.
10	GND	PWR			
12	DSI_1_D0_P	I/O			DSI Interface data lane 0
14	DSI_1_D0_N	I/O			
16	GND	PWR			
18	DSI_1_D1_P	I			DSI Interface data lane 1
20	DSI_1_D1_N	I			
22	GND	PWR			
24	DSI_1_CLK_P	I			DSI Interface clock
26	DSI_1_CLK_N	I			
28	GND	PWR			
30	DSI_1_D2_P	I			DSI Interface data lane 2
32	DSI_1_D2_N	I			
34	GND	PWR			
36	DSI_1_D3_P	I			DSI Interface data lane 3
38	DSI_1_D3_N	I			
40	GND	PWR			
42	TOUCH_RESET#	I	+1.8V	100k to +V1.8_SW	Touchscreen controller RESET input
44	NC				Not connected
46	DSI_1_BKL_EN	I	+1.8V	100k to GND	Display backlight ENABLE input
48	NC				Not connected
50	GND	PWR			
52	NC				Not connected
54	NC				
56	GPIO_10_DSI	I	+1.8V		LVDS bridge IC ENABLE/RESET input
58	PWM_3_DSI	I	+1.8V	10k to +V1.8_SW	Display brightness control input
60	GND	PWR			

3.2 LVDS Connector (X2)

Manufacturer: Hirose DF13EA-40DP-1.25V(76)

Connector Type: Header connector

Table 4: LVDS Connector (X2)

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down	Description
1	LVDS_1_A_TX3_P	O			LVDS data lane 3 for channel A
2	GND	PWR			
3	LVDS_1_A_TX3_N	O			LVDS data lane 3 for channel A
4	LVDS_1_B_CLK_N	O			LVDS clock for channel B
5	GND	PWR			
6	LVDS_1_B_CLK_P	O			LVDS clock for channel B
7	LVDS_1_A_TX2_P	O			LVDS data lane 2 for channel A
8	GND	PWR			
9	LVDS_1_A_TX2_N	O			LVDS data lane 2 for channel A
10	LVDS_1_B_TX0_N	O			LVDS data lane 0 for channel B
11	GND	PWR			
12	LVDS_1_B_TX0_P	O			LVDS data lane 0 for channel B
13	LVDS_1_A_TX1_P	O			LVDS data lane 1 for channel A
14	GND	PWR			
15	LVDS_1_A_TX1_N	O			LVDS data lane 1 for channel A
16	LVDS_1_B_TX1_N	O			LVDS data lane 1 for channel B
17	GND	PWR			
18	LVDS_1_B_TX1_P	O			LVDS data lane 1 for channel B
19	LVDS_1_A_TX0_P	O			LVDS data lane 0 for channel A
20	GND	PWR			
21	LVDS_1_A_TX0_N	O			LVDS data lane 0 for channel A
22	LVDS_1_B_TX2_N	O			LVDS data lane 2 for channel B
23	GND	PWR			
24	LVDS_1_B_TX2_P	O			LVDS data lane 2 for channel B
25	LVDS_1_A_CLK_P	O			LVDS clock for channel A
26	GND	PWR			
27	LVDS_1_A_CLK_N	O			LVDS clock for channel A
28	LVDS_1_B_TX3_N	O			LVDS data lane 3 for channel B
29	GND	PWR			
30	LVDS_1_B_TX3_P	O			LVDS data lane 3 for channel B
31	RESERVED (SEL1)				Not connected (0R resistor not assembled)
32	+V3.3_LVDS	PWR	+3.3V		LVDS display power output
33	RESERVED (SEL2)				Not connected (0R resistor not assembled)
34	+V5_LVDS	PWR	+5V		LVDS display power output

Continued on next page

Table 4: LVDS Connector (X2) (Continued)

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down	Description
35	PWM_3_DSI_LVDS	O	+3.3V		Display brightness control output ¹
36	I2C_1_LVDS_SDA	I/O	+3.3V	4.7k to +V3.3_LVDS	I ² C interface for configuring LVDS display
37	DSI_1_BKL_EN_LVDS	O	+3.3V		Display backlight ENABLE output
38	I2C_1_LVDS_SCL	O	+3.3V	4.7k to +V3.3_LVDS	I ² C interface for configuring LVDS display
39	+V12_BL	PWR	+12V		Display backlight power output
40	+V12_BL	PWR	+12V		

¹ Backlight Brightness = 100% if PWM = 0. Backlight Brightness = 0% if PWM = 100%

3.3 Capacitive Touch Connector (X3)

Manufacturer: Hirose FH12-10S-0.5SVA(54)

Connector Type: Receptacle FPC/FFC connector

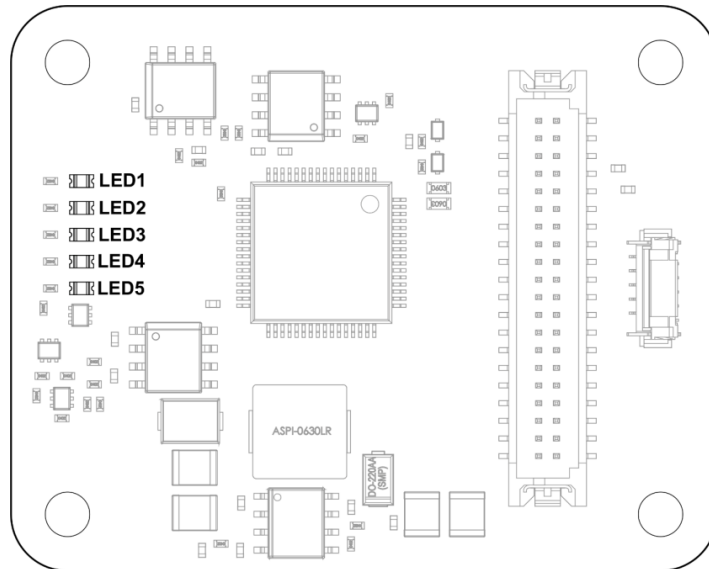
Table 5: Capacitive Touch Connector (X3)

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down	Description
1	I2C_1_CTI_SDA	I/O	+3.3V	4.7k to +V3.3_LVDS	I ² C interface, used for communicating with the capacitive touchscreen controller
2	I2C_1_CTI_SCL	O	+3.3V	4.7k to +V3.3_LVDS	
3	GND	PWR			
4	TOUCH_INT#	I	+3.3V	100k to +V3.3_LVDS	Touchscreen controller interrupt input
5	TOUCH_RESET_T#	O	+3.3V		Touchscreen controller RESET output
6	+V3.3_LVDS	PWR	+3.3V		Touchscreen controller power output
7	NC				Not connected
8	NC				
9	NC				
10	NC				

3.4 LED Indications

The Toradex DSI to LVDS Adapter board features 5 LEDs. These LEDs show the status of the power supply and an important control signals.

Figure 6: Toradex DSI to LVDS Adapter LEDs



The LEDs and their functions are listed below.

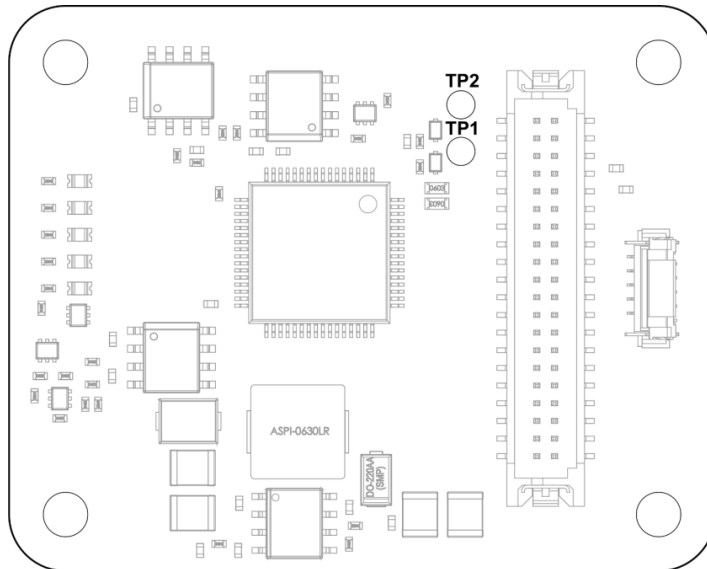
Table 6: LED Indications

Designator	Silkscreen Name	Description
LED1	POWER	LED is lit when adapter board power is enabled
LED2	BRIDGE EN	LED is lit when DSI to LVDS bridge IC5 is enabled
LED3	BKL POWER	LED is lit when DC-DC converter 12V output for powering display backlight is available
LED4	BLK EN	LED is lit when LVDS display backlight is enabled
LED5	TOUCH RST	LED is lit when LVDS display touch controller is in a "RESET" state

3.5 Test Points

The Toradex DSI to LVDS Adapter board features 2 test points to provide an access to the important signals.

Figure 7: Toradex DSI to LVDS Adapter Test Points



The Test Points and their functions are listed below.

Table 7: Test Points

Designator	Description
TP1	Connected to the TOUCH_INT# through the R30. R30 is not assembled. Reserved for future displays.
TP2	Connected to the TOUCH_RESET_T# through the R31. R31 is not assembled. Reserved for future displays.

4 Electrical Characteristics

4.1 Power Supply Characteristics

4.1.1 Supply Voltage

Table 8: Supply Voltage

Parameter	Min.	Typ.	Max.	Unit
+V1.8_SW Supply Voltage	1.65	1.8	1.95	V
+V3.3_SW Supply Voltage	3	3.3	3.5	V
+V5_SW Supply Voltage (not used)	-	-	-	V
+V_SUPPLY_FILT_SW Supply Voltage (not used)	-	-	-	V

4.1.2 Current Consumption

Table 9: Current Consumption

Parameter	Conditions	Typ. Supply Current	Unit
+V1.8_SW Supply Voltage	SN65DSI84: SINGLE Channel DSI to DUAL Channel LVDS, 1440 x 900 ($T_{amb} = 25^{\circ}\text{C}$)	108	mA
+V3.3_SW Supply Voltage	($T_{amb} = 25^{\circ}\text{C}$) Without display	6	mA
+V3.3_SW Supply Voltage	($T_{amb} = 25^{\circ}\text{C}$) With Toradex 10.1inch LVDS display	2.24	A

4.1.3 Backlight BOOST DC-DC Converter

Table 10: Backlight BOOST DC-DC Converter

Parameter	Min.	Typ.	Max.	Unit
Output Voltage ($T_{amb} = 25^{\circ}\text{C}$)	-	12	-	V
Output Current ($T_{amb} = 25^{\circ}\text{C}$)	-	-	600	mA

5 Operating Conditions

5.1 Operating Temperature Range

- -30 to +85 °C

6 Mechanical Data

6.1 Toradex DSI to LVDS Adapter Dimensions

Figure 8: Toradex DSI to LVDS Adapter Dimensions (mm) – top side, top view

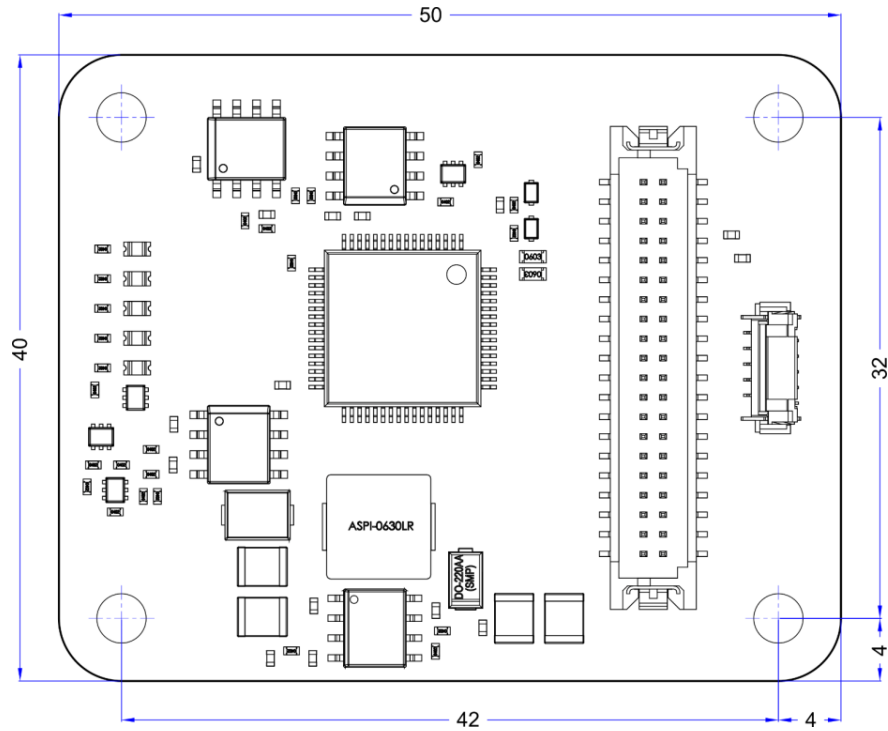


Figure 9: Toradex DSI to LVDS Adapter Dimensions (mm) – side 1, side 1 view

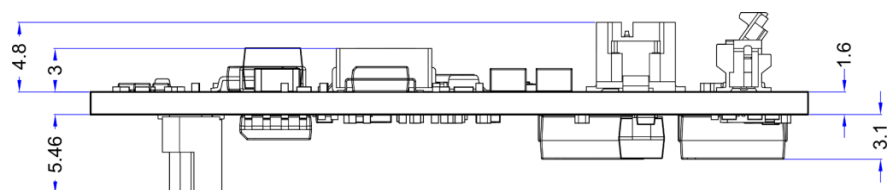
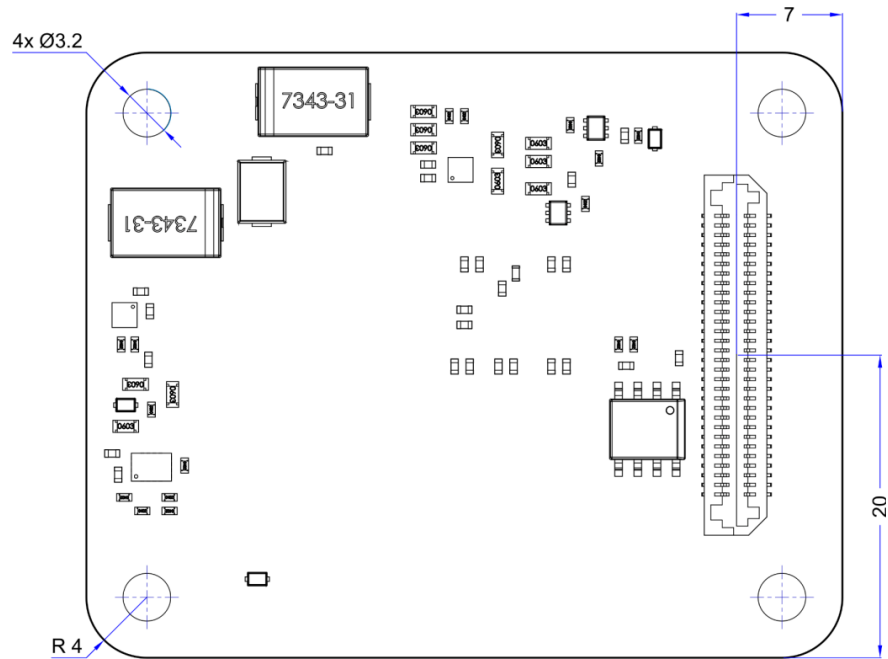


Figure 10: Toradex DSI to LVDS Adapter Dimensions (mm) - bottom side, bottom view



7 Design Data

The design data for the Toradex carrier boards and adapter boards are freely available in the Altium Designer format. The design data includes schematics, layout, and component libraries.

To download the board design data, please use the link below:

<http://developer.toradex.com/carrier-board-design/reference-designs>

8 Product Compliance

Up-to-date information about product compliance such as RoHS, CE, UL-94, Conflict Mineral, REACH etc. can be found on our website at: <http://www.toradex.com/support/product-compliance>.

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