

### DSI to HDMI adapter board for STM32 Development Tools

## Introduction

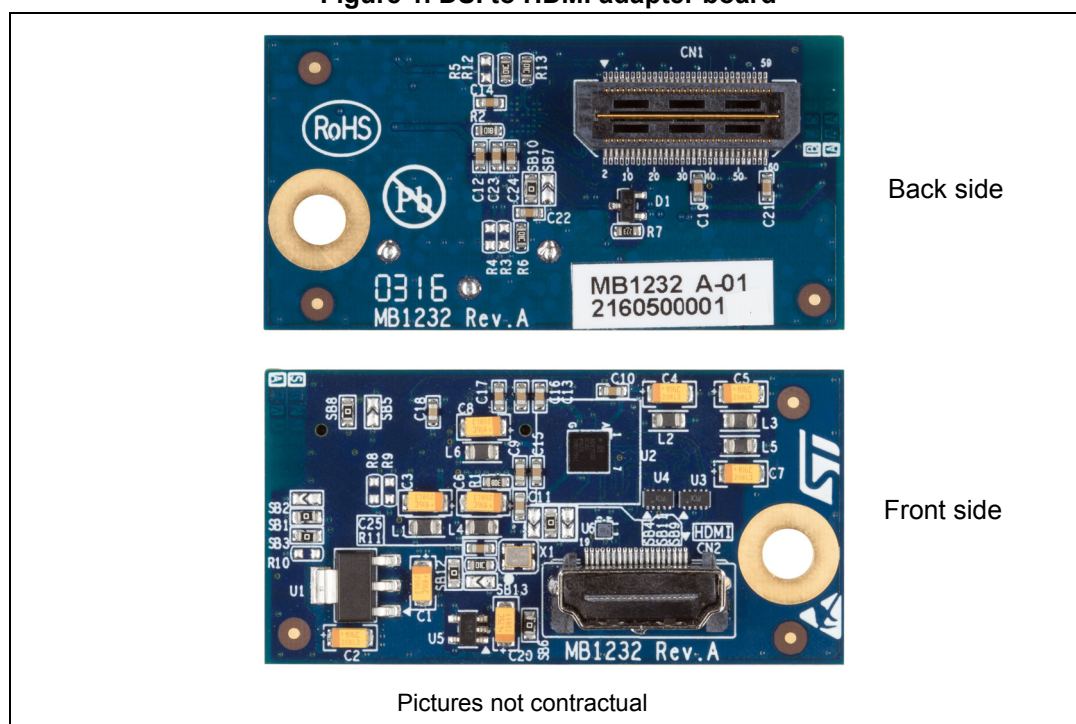
The DSI to HDMI adapter board (order code B-LCDAD-HDMI1) provides DSI input port and HDMI output port. It can be used on STM32 evaluation boards or discovery boards, to demonstrate video solutions based on STM32 MCUs.

Thanks to the bridge chip ADV7533, the DSI to HDMI adapter board can support 2-, 3- or 4-lanes DSI video input data, S/PDIF, 2-channels I<sup>2</sup>S audio input data and HDMI v1.3 output port.

The B-LCDAD-HDMI1 adapter board has the following features:

- Up to four lanes of MIPI/DSI data, each running up to 800 Mbps (video mode only: Non-Burst mode with synchronization pulse)
- 2-channels I<sup>2</sup>S transmit stereo up to 192 kHz sampling rate
- S/PDIF carries stereo LPCM audio or compressed audio
- HDMI output connector:
  - Support of video resolutions with pixel clocks up to 80 MHz
  - Support of CEC signals, 5 V-tolerant I<sup>2</sup>C and HPD I/Os
  - Common-mode filters with ESD protection

**Figure 1. DSI to HDMI adapter board**



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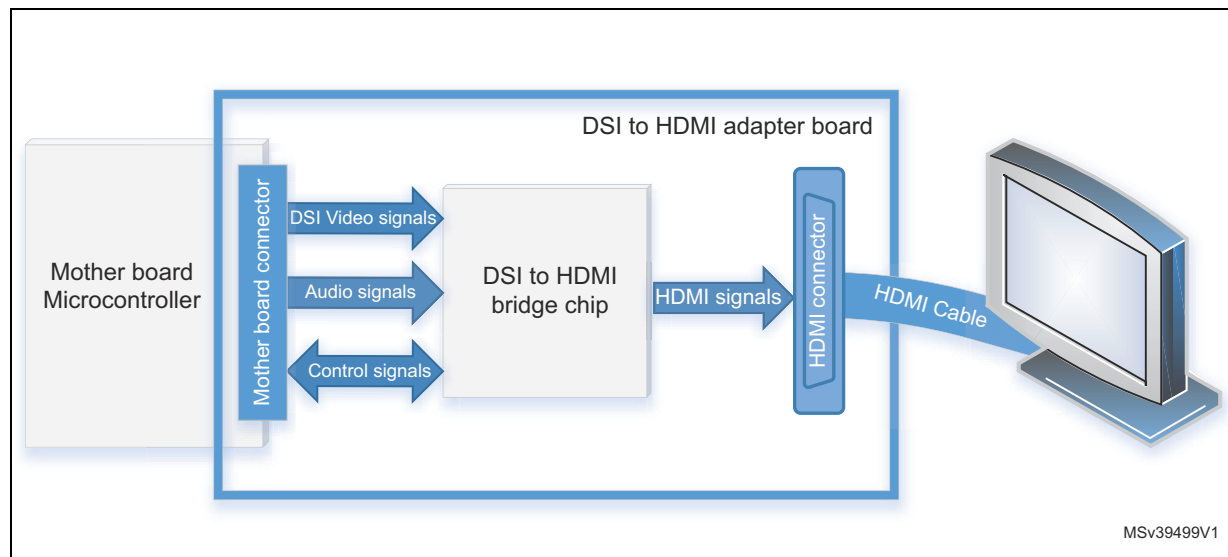
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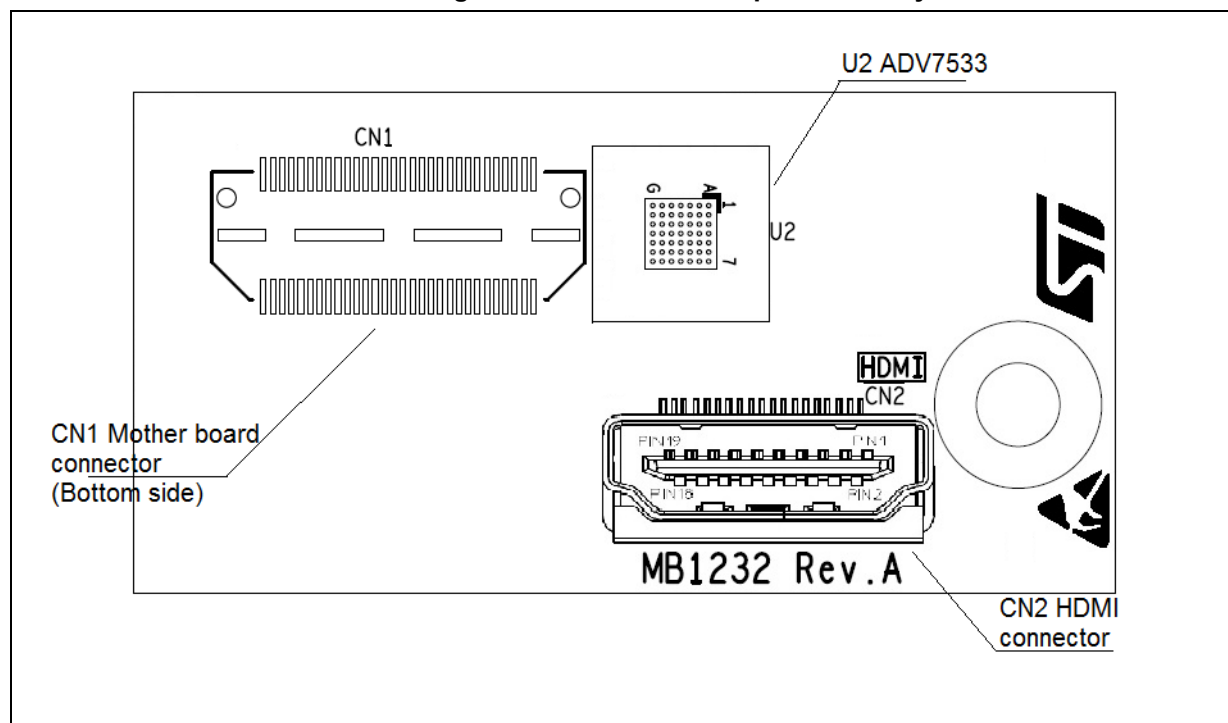
# 1 Hardware Layout and configuration

DSI to HDMI adapter board is designed around the ADV7533. [Figure 2](#) illustrates the connections on DSI to HDMI adapter board and [Figure 3](#) will help to locate these features on the actual evaluation board.

**Figure 2. Hardware Block Diagram**



**Figure 3. DSI to HDMI adapter board layout**



## 2 Video and audio input connector

A male high speed connector CN1 on bottom side is used to implement DSI to HDMI adapter board on mother board. The 4-lane DSI video signals, audio (I<sup>2</sup>S or S/PDIF) signals, CEC signals and control signals (I<sup>2</sup>C bus, reset and interrupt signals) are on this connector.

*Table 1* shows the pinout of CN1.

**Table 1. Video and audio input connector CN1**

| Pin number | Description | Interface   | Pin number | Description | Interface        |
|------------|-------------|-------------|------------|-------------|------------------|
| 1          | GND         | -           | 2          | -           | -                |
| 3          | DSI_CK_P    | DSI         | 4          | INT         | Interrupt output |
| 5          | DSI_CK_N    | DSI         | 6          | GND         | -                |
| 7          | GND         | -           | 8          | DSI_D2_P    | DSI              |
| 9          | DSI_D0_P    | DSI         | 10         | DSI_D2_N    | DSI              |
| 11         | DSI_D0_N    | DSI         | 12         | GND         | -                |
| 13         | GND         | -           | 14         | DSI_D3_P    | DSI              |
| 15         | DSI_D1_P    | DSI         | 16         | DSI_D3_N    | DSI              |
| 17         | DSI_D1_N    | DSI         | 18         | -           | -                |
| 19         | GND         | -           | 20         | -           | -                |
| 21         | +5 V        | -           | 22         | -           | -                |
| 23         | +5 V        | -           | 24         | -           | -                |
| 25         | -           | -           | 26         | -           | -                |
| 27         | -           | -           | 28         | -           | -                |
| 29         | -           | -           | 30         | -           | -                |
| 31         | -           | -           | 32         | -           | -                |
| 33         | -           | -           | 34         | -           | -                |
| 35         | SCLK/MCLK   | Audio       | 36         | 3.3 V       |                  |
| 37         | LRCLK       | Audio       | 38         | -           | -                |
| 39         | I2S/SPDIF   | Audio       | 40         | I2C_SDA     | I2C              |
| 41         | -           | -           | 42         | -           | -                |
| 43         | -           | -           | 44         | I2C_SCL     | I2C              |
| 45         | CEC_CLK     | CEC         | 46         | -           | -                |
| 47         | CEC         | CEC         | 48         | -           | -                |
| 49         | -           | -           | 50         | -           | -                |
| 51         | -           | -           | 52         | -           | -                |
| 53         | -           | -           | 54         | -           | -                |
| 55         | -           | -           | 56         | -           | -                |
| 57         | RESET       | Reset input | 58         | -           | -                |
| 59         | -           | -           | 60         | 1.8V        | -                |

## 2.1 Video input (MIPI DSI) signals

4-lane MIPI DSI signals are connected on DSI to HDMI adapter board as video input interface. This board supports 2-, 3- or 4-lane DSI video input data and each running up to 800 Mbps.

DSI interface is compatible with DPHY V.0.90 and DSI V.1.02 and Supports inputs of 16-bit RGB 4:4:4, 24-bit RGB 4:4:4 and 30-bit RGB 4:4:4.

## 2.2 Audio input (S/PDIF & I<sup>2</sup>S) signals

S/PDIF or I<sup>2</sup>S audio input interface is implemented on CN1. DSI to HDMI adapter board supports standard S/PDIF for stereo LPCM or compressed audio up to 192 kHz, or 2-channel uncompressed LPCM I<sup>2</sup>S audio up to 192 kHz.

## 2.3 Control signals

I<sup>2</sup>C bus on CN1 serves as the serial port data I/O slave for register access. The default address is 0x7A.

Reset signal from mother board is connected to Power Down (PD) pin on ADV7533. It is internal pulled up by ADV7533.

Interrupt output signal is for mother board and it is pull up on DSI to HDMI adapter board.

### 3 HDMI output connector

A standard HDMI output connector CN2 is implemented on DSI to HDMI adapter board. The output supports all video and graphics resolutions from 480i to 1080p at 30 Hz. Thanks to common-mode filter with ESD protection parts, HDMI output connector is complies with IEC 61000-4-2 level 4 standard.

On CN2, I<sup>2</sup>C master for EDID reading and HDCP operations reports HDMI events through interrupts and registers. Hot Plug Detect Signal (HPD) Indicates to the interface whether the receiver is connected.

[Table 2](#) shows the pinout of CN2.

**Table 2. HDMI output connector CN2**

| Pin number | Description | Pin number | Description                         |
|------------|-------------|------------|-------------------------------------|
| 1          | TMDS D2+    | 11         | GND                                 |
| 2          | GND         | 12         | TMDS Clock-                         |
| 3          | TMDS D2-    | 13         | CEC                                 |
| 4          | TMDS D1+    | 14         | NC                                  |
| 5          | GND         | 15         | DDC_I2C_SCL                         |
| 6          | TMDS D1-    | 16         | DDC_I2C_SDA                         |
| 7          | TMDS D0+    | 17         | GND                                 |
| 8          | GND         | 18         | HDMI_5V_Source from power switch U5 |
| 9          | TMDS D0-    | 19         | HPD                                 |
| 10         | TMDS Clock+ | -          | -                                   |

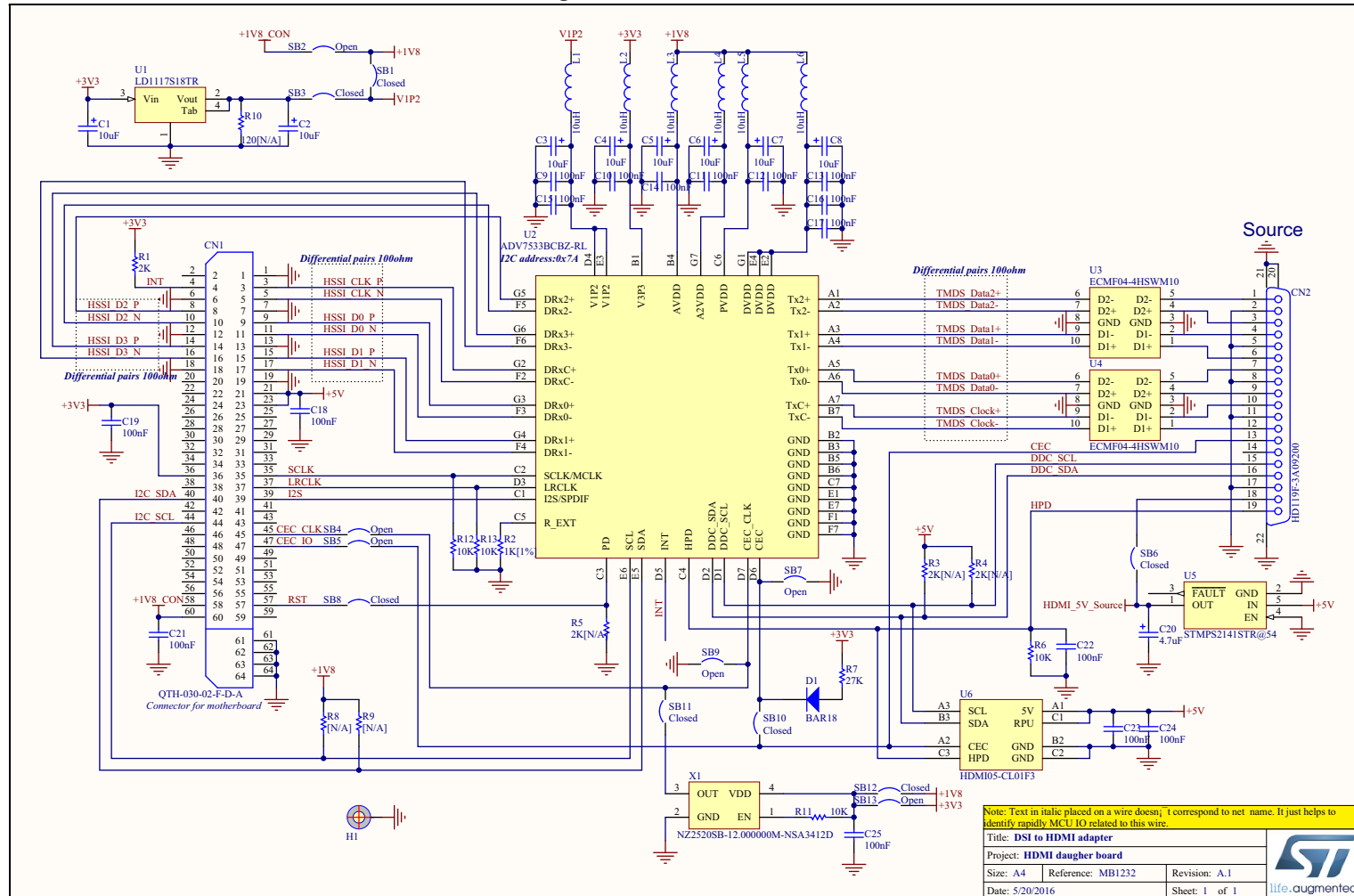
## 4 CEC

There are two sources of CEC signal on HDMI output connector on DSI to HDMI adapter board. One source (Default setting) is from ADV7533 and its clock is from X1 on the board. The other source is from CN1 and mother board. Some PCB reworks should be done when using the second source shown in [Table 3](#).

**Table 3. CEC source connection**

| CEC source         | Mount | Remove |
|--------------------|-------|--------|
| ADV7533 (Default)  | SB10  | SB5    |
| CN1 (Mother board) | SB5   | SB10   |

Figure 4. Board schematic



## 6 Revision history

**Table 4. Document revision history**

| <b>Date</b> | <b>Revision</b> | <b>Changes</b>   |
|-------------|-----------------|------------------|
| 09-Jun-2016 | 1               | Initial release. |

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