

# **DS22EV5110-EVKC**

## **HDMI Extender Demo Kit for CAT5 Cables**

### **User's Guide**



Literature Number: SNLU016A  
October 2009—Revised October 2013

## ***DS22EV5110-EVKC HDMI Extender Demo Kit for CAT5 Cables***

The DS22EV5110-EVKC CAT5 / CAT6 Cable Extender Demo Kit provides a complete HDMI system extension solution with cost effective CAT5 or CAT6 cables, using Texas Instruments DS22EV5110 - a DVI, HDMI extended reach equalizer with retimer and output de-emphasis.

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## 1 Description

The kit consists of following boards for different application needs:

- The DS22EV5110 receiver board with RJ45-in and HDMI-out connectors (**Board ID: 551600199-022**)
- A passive adapter board with RJ-45 and HDMI connectors (**Board ID: 980013178**)

The DS22EV5110 receiver board has two RJ45 jacks as the inputs and one HDMI female receptacle connector as the output.

The passive adapter board has two RJ45 jacks and one HDMI female receptacle connector. Either can be the input(s) or the output(s).

The DS22EV5110 on the boards equalizes the long reach HDMI or CAT5 cable at the input, and then sends out the low jitter TMDS signal to the HDMI cable through output.

All of the TMDS signals are connected through one RJ45 jack between two boards.

The DDC signals are connected through an I2C buffer. The hot plug, 5V power and 5V ground are directly connected between the connectors, making this demo kit HDCP compliant.

A 3.3V VCC 1-pin header and a GND 1-pin header are used for the power supply for the DS22EV5110 boards.

Alternately, an AC/DC power adapter (>800 mA) can be used for each driver or receiver board of the evaluation kit to provide 5V DC voltage for easy portability. A 1.8 mm DC power jack is used to connect the AC/DC power adapter. Texas Instruments LP3965, a 3.3V, 1500 mA, fast, ultra low dropout linear regulator, converts the 5V power supply voltage to a 3.3 V power supply voltage that powers the DS22EV5110.

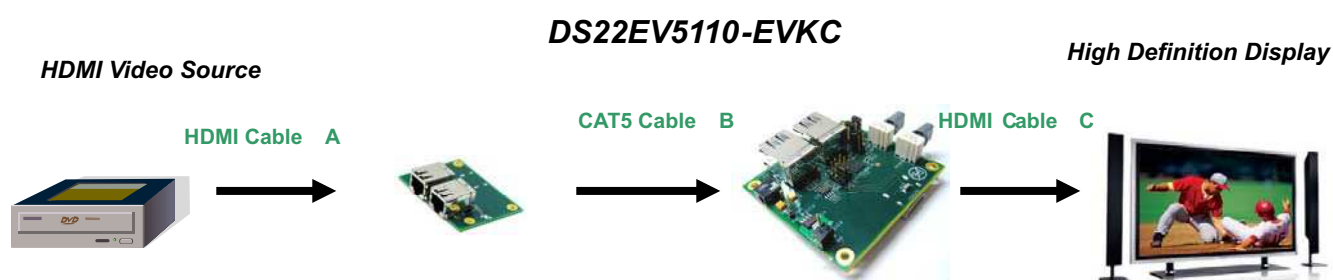
## 2 Features

- Compatible with DTV Resolutions 480i, 480p, 720i, 720p, 1080i, and 1080p with 8-bit and 12-bit Deep Color Depths
- Compatible with Computer Resolutions of VGA, SVGA, XGA, SXGA, and UXGA
- Supports TMDS HDMI Single Link
- DC Coupled Configurations
- Adjustable Rotary Switches for Easy Custom EQ Boost Level Setting and De-Emphasis Setting to Reach Maximum Length of TMDS Interface with CAT5, HDMI, or DVI Cables
- Single 3.3 V Supply
- Ultra Portable with AC/DC Power Adapters (not included in this kit)
- 8 kV ESD Rating
- 0 to 70°C Temperature Range

### 3 Applications

- Repeater Applications:
  - DVI / HDMI Extender Box
- Source Applications:
  - Video Cards
  - Blu-ray DVD Players
  - Game Consoles
- Sink Applications:
  - High Definition Displays
  - Projectors

### 4 Typical Configuration



**Figure 1. DS22EV5110-EVKC**

The DS22EV5110 demo kit extends TMDS with HDMI or CAT5 / CAT6 cables as follows:

	Pixel Bandwidth (MPixel/s) 60 Hz LCD with 20% Blanking	Per Channel Bandwidth (Gb/s) 60 Hz LCD with 20% Blanking	HDMI Cable A + CAT5 Cable B (Total Length)	HDMI Cable C (28 AWG)
HDTV (1080i)	75	0.75	>50m	>20m
HDTV (1080p) 8-bit Color Depth	150	1.5	>35m	>15m
HDTV (1080p) 12-bit Color Depth	225	2.25	>25m	>7.5m

## 5 Quick Start Guide

1. Connect 3.3V DC power and ground of the boards to the headers from the power supply. Or, plug the AC/DC power adapter to the DC power jack.  
**(AC/DC power adapter requirement: Output DC 4V~6V, Output current >800 mA)**
2. Attach all the applicable cables to the boards.
  - (a) Attach one pair of CAT5 / CAT6 cable between “JR1” and “JR3” for TMDS links
  - (b) Attach one pair of CAT5 / CAT6 cable between “JR2” and “JR4” for other control signals
3. Turn on the DVD/Computer and the Monitor/HDTV.

## 6 Adjustments and Controls

**Table 1. Adjustments and Controls**

Component	Name	Function
<b>Receiver Board</b>		
D6	PWR	LED turns on when power is applied
D7	SD / LOCK	GREEN LED turns on when the incoming signal is detected by DS22EV5110 ORANGE LED turns on when the PLL of the DS22EV5110 is locked
J31	5V DC	Optional DC power jack for 1.5 mm adaptor plug
J29	3.3V	3.3V VCC power supply
J30	GND	GND
JP14	CS	SMBus control - assert HIGH to access SMBus (optional)
JP12, J13	SDA, SDC	SDA = SMBus data I/O, SDC = SMBus clock I/O (optional)
JP38, JP39	VOD_CRL	Connect JP38 - sets external resistor = 24 kΩ for VO = 1000 mVpp Connect JP39 - sets external resistor = 12 kΩ for VO = 2000 mVpp
JP27, JP28, JP29	SD / LOCK / EN	Connect JP27 and JP29 to enable D3 Connect JP28 to disable the device outputs Or, use as SD-EN, LOCK-EN auto control (see datasheet)
JP22	BYPASS	Connect JP22 to VDD to bypass reclock function
U15	Rotary Switch (EQ)	Turn the switch to control the EQ boost setting. “0” on the switch refers to the boost setting of “0X00”, “7” on the switch refers to the boost setting of “0X07”. (See datasheet for detailed boost setting information.)
U14	Rotary Switch (DE)	Turn the switch to control the DE setting. “0” = 0 dB, “1” = -3 dB, “2” = -6 dB, “3” = -9 dB, “4”, “5”, “6”, “7” = N/A Set to “0” in most cases

## 7 Bill of Materials

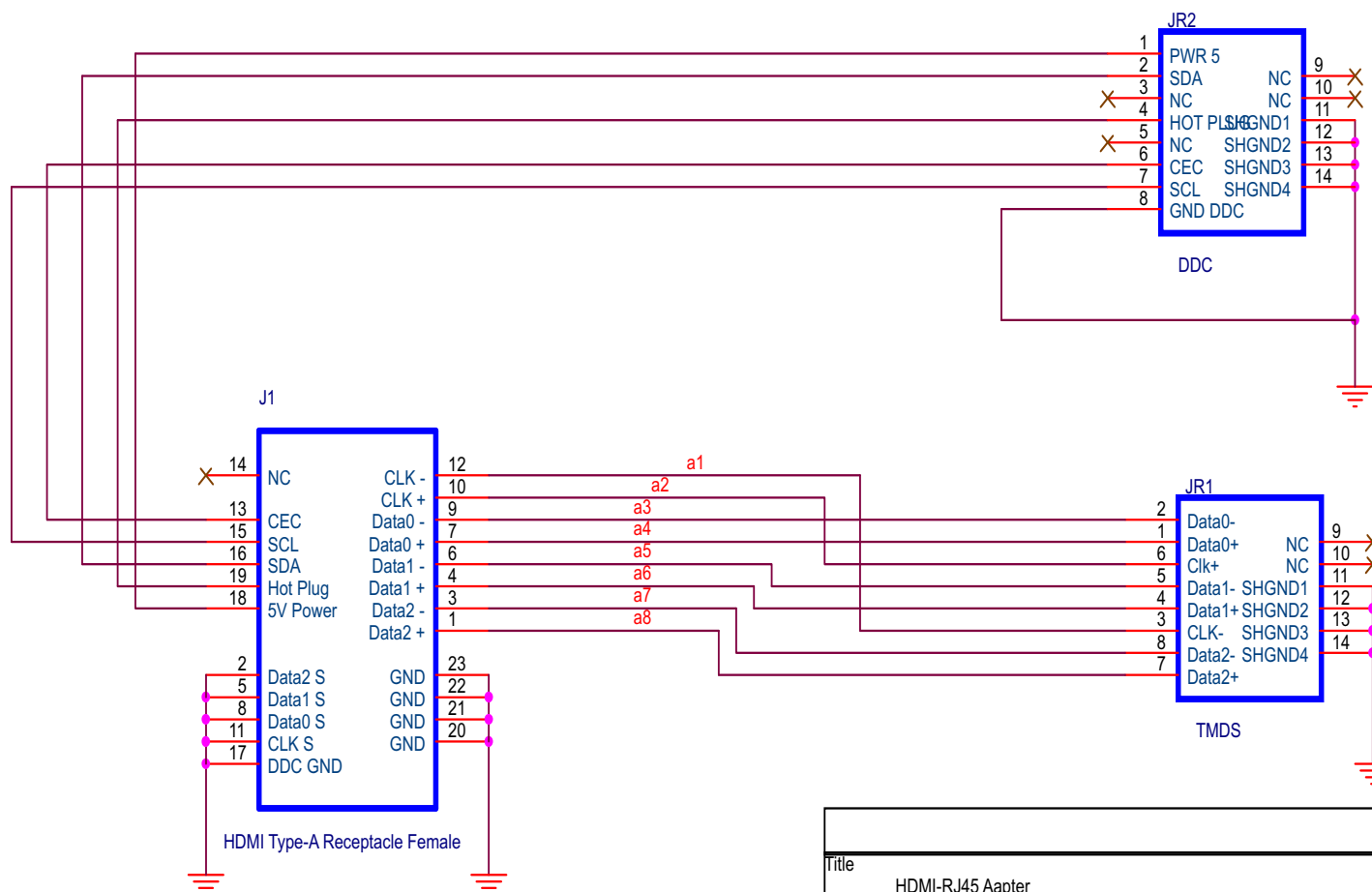
**Table 2. DS22EV5110-EVKC Bill of Materials**

Reference	Qty	Description
<b>Receiver Board</b>		
C70, C72, C73, C75, C77, C80	6	0.1 uF $\pm 5\%$ Ceramic Capacitor 0402
C71, C74, C76, C78	4	0.01 uF $\pm 5\%$ Ceramic Capacitor 0402
C6	1	0.1 uF $\pm 5\%$ Ceramic Capacitor 0603
C79	1	2.2 nF $\pm 5\%$ Ceramic Capacitor 0603
C67, C99	2	1.5 uF $\pm 5\%$ Ceramic Capacitor 1206
C68	1	33 uF $\pm 5\%$ Tantalum Capacitor 3528
C69	1	68 uF $\pm 5\%$ Tantalum Capacitor 3528
D6	1	LED Green Right Angel
D7	1	LTST-C155KGJSKT (Orange/Yellow) Dual LED
R32	1	453 $\Omega$ $\pm 5\%$ Resistor 0402
R33	1	10 k $\Omega$ $\pm 5\%$ Resistor 0402
R34, R35	2	220 $\Omega$ $\pm 5\%$ Resistor 0402
R103, R104	2	4.7 k $\Omega$ $\pm 5\%$ Resistor 0603
R9, R10, R11, R12	4	10 k $\Omega$ $\pm 5\%$ Resistor 0603
R31	1	24 k $\Omega$ $\pm 5\%$ Resistor 0603
R56	1	12 k $\Omega$ $\pm 5\%$ Resistor 0603
R36	1	3.3 k $\Omega$ $\pm 5\%$ Resistor 0603
J33	1	HDMI Receptacle Female 210008715-040
JR3, JR4	2	RJ45
J31	1	DC Power Jack 1.8 mm
J29, J30	2	1 pin header
JP27, JP28, JP33, JP38, JP39	5	1x2 pin header
JP12, JP13, JP14, JP22	4	1x3 pin header
U3	1	PCA9517D Philips Semiconductor I2C Buffer
U13	1	Texas Instruments DS22EV5110
U12	1	Texas Instruments LP3965 – 3.3V -1500 mA
U14, U15	2	94HBB08RAT Rotary Dip Switch
<b>Passive Driver Board</b>		
JR1, JR2	2	RJ45 Jack
J1	1	HDMI Receptacle Female

## 8 Board Design Considerations

- Use one RJ45 jack for all TMDS signals in order to minimize the inter-pair skew.
- Use another RJ45 jack for the rest of the control pins, plus at least one ground connection between two boards to set the common ground.
- Use pin 3 and pin 6 on the RJ45 jack for the TMDS clock path.

## 9 Schematics



Title		
HDMI-RJ45 Aapter		
Size	Document Number	Rev
B	980013178	A
Date:	Tuesday, February 27, 2007	Sheet 1 of 1

Figure 2. Schematic (Passive Adapter Board)

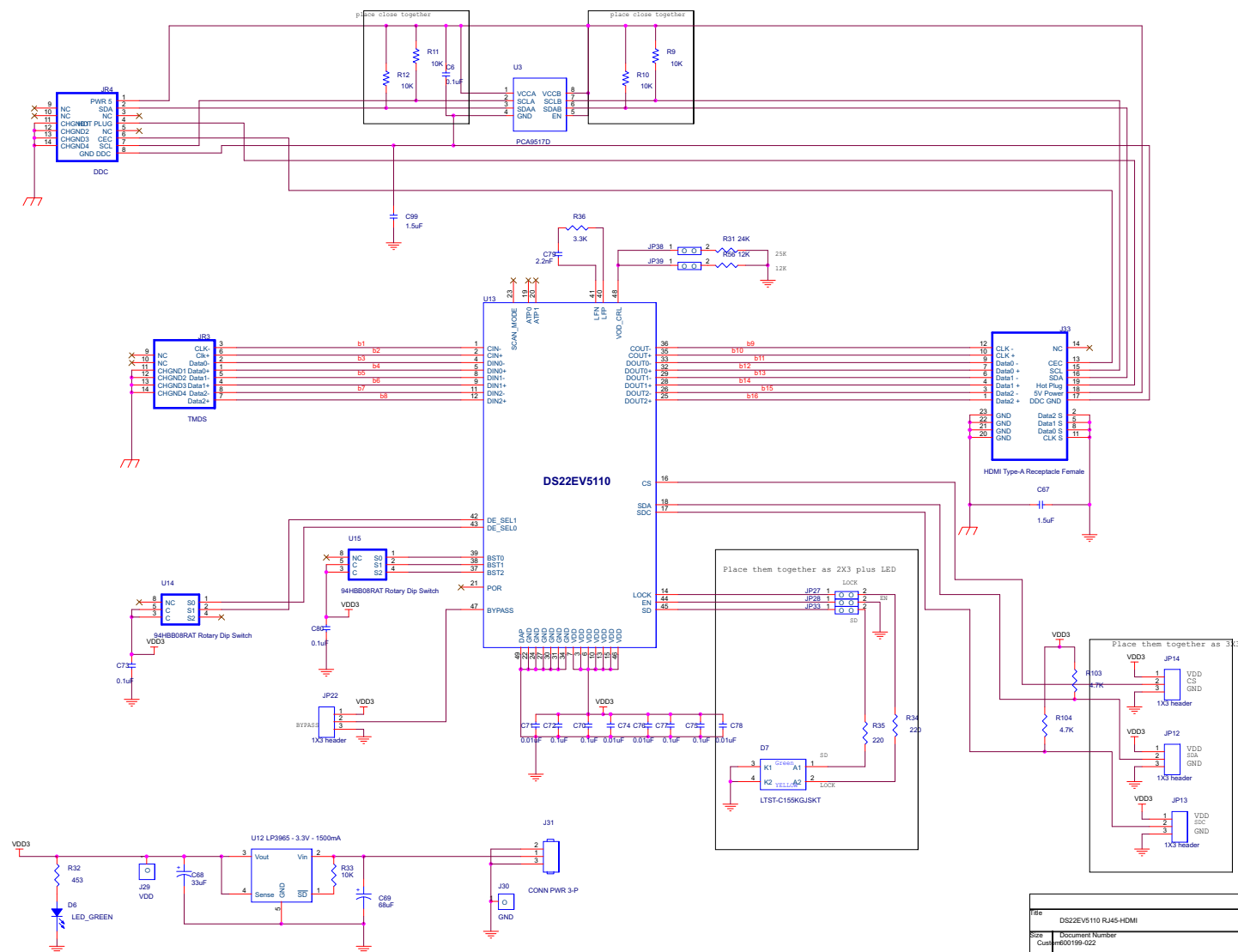


Figure 3. Schematic (Receiver Board)



## 10 Layout Considerations

- Keep the clock and data transmission lines as short as possible with controlled 50Ω single-ended impedance with matched lengths for any TMDS signals connected to RJ45 jack.
- Use differentially coupled traces with 100Ω impedance for DS22EV5110 TMDS outputs.
- Avoid using vias on the data transmission lines on the input side of the DS22EV5110.
- Place power supply decoupling capacitors close to the VCC pins.

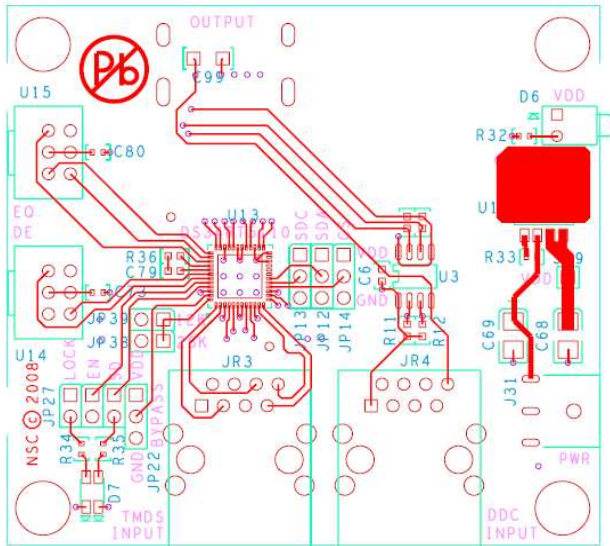


Figure 4. Receiver Board Layout (Top View)

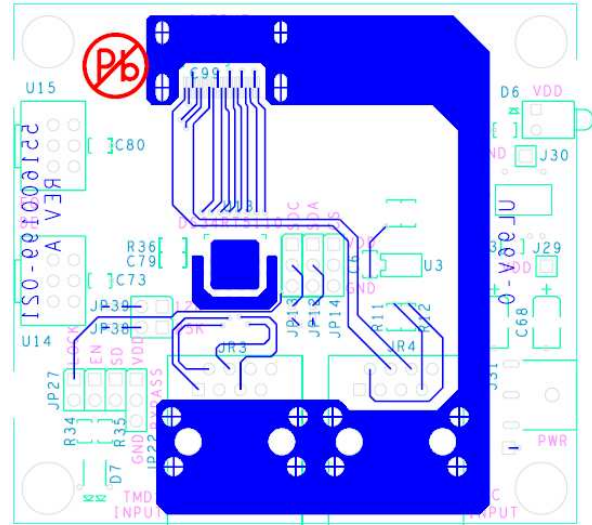


Figure 5. Receiver Board Layout (Bottom View)

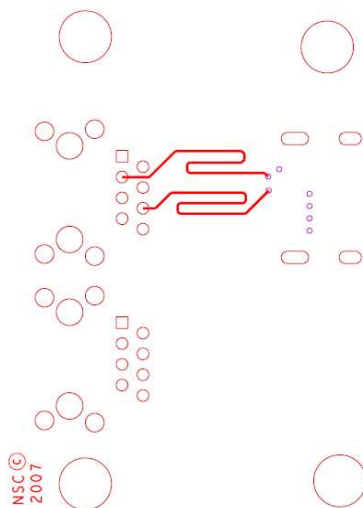


Figure 6. Passive Adapter Board Layout (Top View)

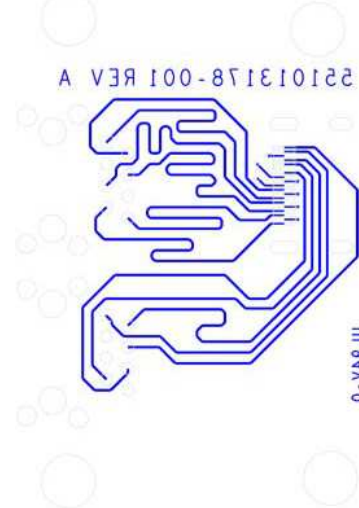


Figure 7. Passive Adapter Board Layout (Bottom View)

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**Changes from Original (January, 2012) to A Revision**
**Page**

- 
- Added "(not included in this kit)" ..... [3](#)
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NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
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