DS34RT5110-EVKC
HDMI / RJ45 Extender Demo Kit for CAT5 Cables

General Description

The DS34RT5110-EVKC CAT5 Cable Extender Demo Kit provides a complete HDMI system extension solution with cost effective CAT5 cables, using National's DS34RT5110 - a DVI, HDMI Retimer with Input Equalization and Output De-Emphasis.

The kit consists of following boards for different application needs:

- a DS34RT5110 driver board with HDMI-in and RJ45-out connectors
  Board ID: 551600199-034
- a DS34RT5110 repeat board with RJ45-in and RJ45-out connectors
  Board ID: 551600199-014
- a DS34RT5110 receiver board with RJ45-in and HDMI-out connectors
  Board ID: 551600199-024
- a passive adapter board with RJ-45 and HDMI connectors
  Board ID 980013178

The DS34RT5110 driver board has one HDMI female receptacle connector as the input and two RJ45 jacks as the outputs.

The DS34RT5110 repeater board has two RJ45 jacks as the inputs and two RJ45 jacks as the outputs.

The DS34RT5110 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, can be as either the input or the output.

The DS34RT5110 on the boards equalizes and retimes the long reach HDMI or CAT5 cable at the input, then sends out the low jitter TMDS signal to the HDMI or CAT5 cable through output.

All 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 DS34RT5110 boards.

Alternately, an AC/DC power adapter (>800mA) is required for each driver or receiver board of the evaluation kit to provide 5V DC voltage for easy portability. A 1.8mm DC Power Jack is used to connect the AC/DC Power Adapter. National's LP3965, a 3.3V, 1500mA, Fast, Ultra Low Dropout Linear Regulator, converts the 5V power supply voltage to a 3.3V power supply voltage that powers the DS34RT5110.

Board Errata Information

This set of demo boards are designed for either AC or DC coupled application.
The current boards in this kit are assembled for the DC coupled application. For proper demo with this DC coupled setup, the GND jumpers (ic. J26, J30, and J34) on these boards have to be connected together, in order to share the same common ground on all boards.
This approach is not required if AC coupled application is used.

Features

- **Compatible with DTV Resolutions 480i, 480p, 720i, 720p, 1080i, and 1080p with 8 bit, 12 bit and 16bit deep color depths.**
- **Compatible with Computer Resolutions of VGA, SVGA, XGA, SXGA, UXGA**
- **Supports TMDS HDMI Single Link**
- **DC coupled configurations (suitable for AC coupled application with minor rework of the boards)**
- **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 3.3V Supply**
- **Ultra Portable with AC/DC Power Adapters (Two are included in this kit)**
- **8kV ESD Rating**
- **0 to 70C Temperature Range**

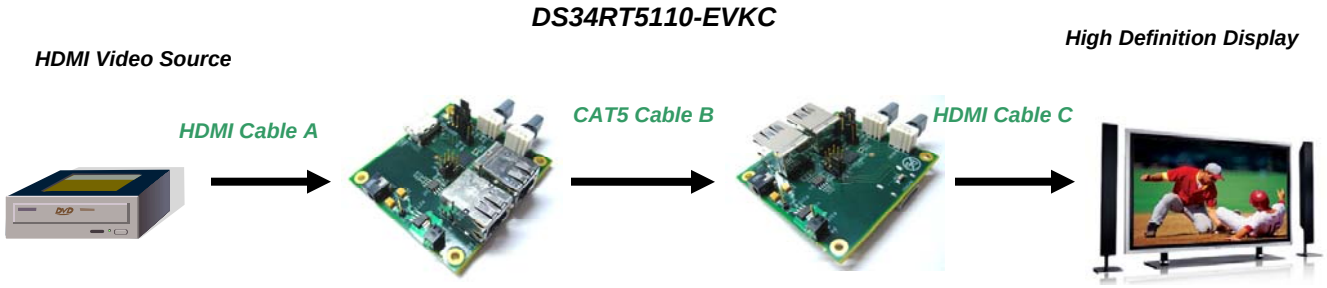
Applications

- Repeater Applications:
  - Digital Routers
  - HDMI / DVI Extender Hubs
- Source Applications:
  - Video Cards
  - Blu-ray DVD Players
  - Game Consoles
- Sink Applications:
  - High Definition Displays
  - Projectors
- Multi-hop Applications:
  - Studio and Home Entertainment Systems

Ordering Information

PART: DS34T5110SQ
Demo board: DS34RT5110-EVKC

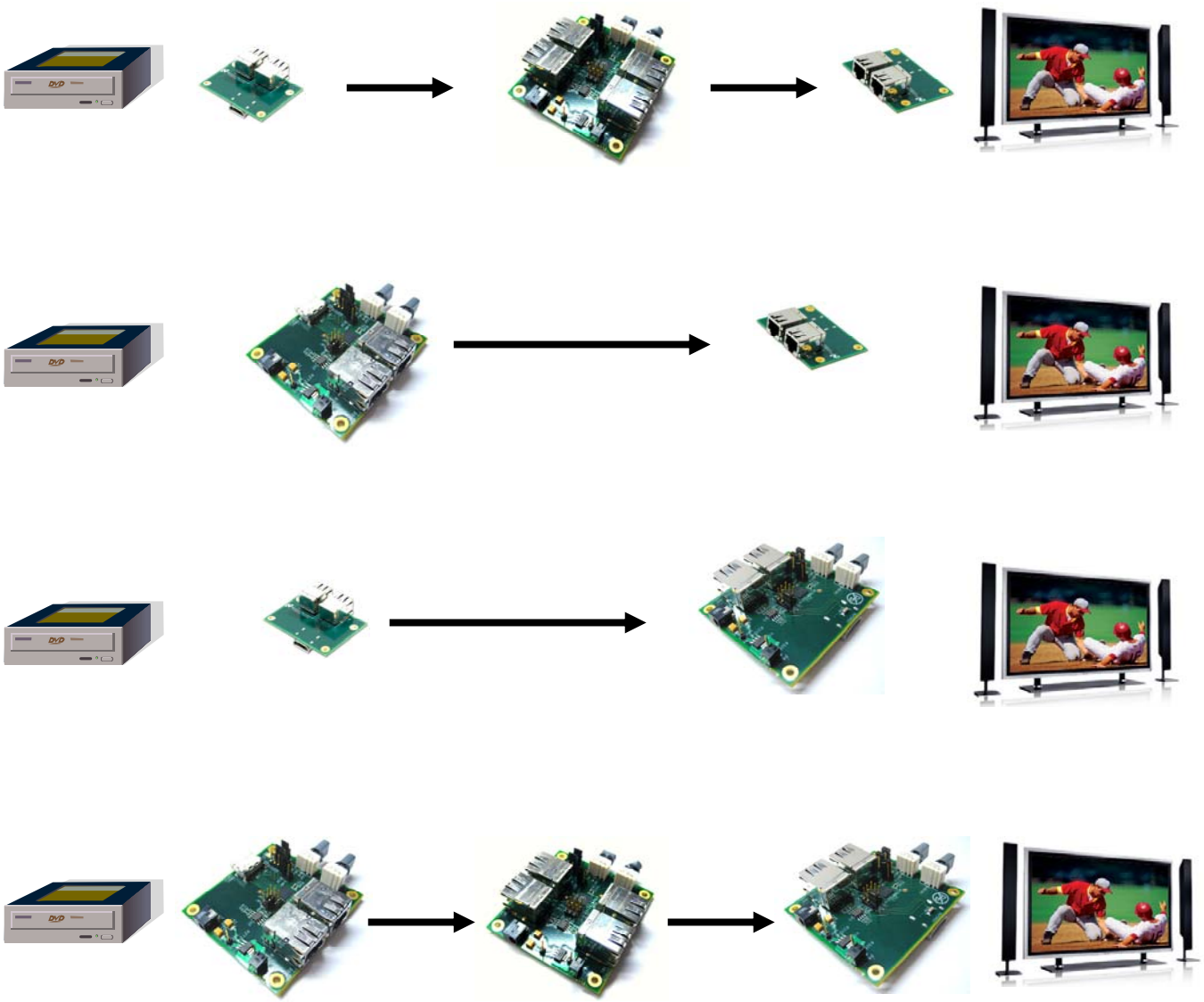
Typical Configuration



The DS34RT5110 demo kit extends TMDS with the 28 AWG STP DVI cable as follows:

	Pixel bandwidth (MPixel/s) 60Hz LCD with 20% blanking	Per channel bandwidth (Gb/s) 60Hz LCD with 20% blanking	HDMI Cable A (28 AWG)	CAT5 Cable B (24 AWG)	HDMI Cable C (28 AWG)
HDTV (1080i)	75	0.75	> 60m	> 60 m	> 20m
HDTV (1080p) 8 bit Color Depth	150	1.5	> 30m	> 30m	> 15m
HDTV (1080p) 12 bit Color Depth	225	2.25	> 20m	> 20m	> 7.5m
HDTV (1080p) 16 bit Color Depth	300	3	> 15m	> 15m	> 5m

Other Examples



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 > 800mA
2. Attach all the applicable cables to the boards
3. **Connect GND jumpers on all three boards together with wires to share the same common ground on all boards.**
4. Turn on the DVD/Computer and the Monitor/HDTV.

Adjustment and Control Description

Component	Name	Function
Driver Board		
D4	PWR	The LED turns on when power applies
D5	SD / LOCK	The "GREEN" LED turns on when the incoming signal is detected by DS34RT5110 The "ORANGE" LED turns on when the PLL of the DS34RT5110 is locked
J20	5V DC	Optional DC Power Jack for 1.5 mm Adaptor Plug
J25	3.3V	3.3V VCC power supply
J26	GND	GND (need to connect to J30 or J34)
JP29, JP37	VOD_CRL	Connect JP29, Sets external resistor = 24K ohm for VO = 1000mVpp Connect JP37, Sets external resistor = 12K ohm for VO = 2000mVpp
JP30, JP31, JP32	LOCK /EN/SD	Connect JP30 and JP32 to enable D3 Connect JP31 to disable the device outputs Or, use as SD-EN, LOCK-EN auto control. See datasheet
JP32	BYPASS	Connect JP32 to VDD to bypass Reclock function
JP51	MODE	Connect JP51 to VDD to bypass Clock Channel PLL function. **Do not connect for the Driver Board**
U9	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 detail Boost setting information.
U10	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 **Recommend to leave the setting as "0" for multi-hop application**
Repeat Board		
D8	PWR	The LED turns on when power applies
D9	SD / LOCK	The "GREEN" LED turns on when the incoming signal is detected by DS34RT5110 The "ORANGE" LED turns on when the PLL of the DS34RT5110 is locked
J35	5V DC	Optional DC Power Jack for 1.5 mm Adaptor Plug
J32	3.3V	3.3V VCC power supply
J34	**GND**	**GND (need to connect to J26 or J30)**
JP40, JP41	VOD_CRL	Connect JP40, Sets external resistor = 24K ohm for VO = 1000mVpp Connect JP41, Sets external resistor = 12K ohm for VO = 2000mVpp
JP34, JP35, JP36	LOCK /EN/SD	Connect JP34 and JP36 to enable D9 Connect JP35 to disable the device outputs Or, use as SD-EN, LOCK-EN auto control. See datasheet
JP23	BYPASS	Connect JP23 to VDD to bypass Reclock function
JP49	MODE	Connect JP49 to VDD to bypass Clock Channel PLL function. **Connect to VDD for the Repeater Board**
U20	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 detail Boost setting information.
U19	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 **Recommend to leave the setting as "0" for multi-hop application**
Receiver Board		
D6	PWR	The LED turns on when power applies
D7	SD / LOCK	The "GREEN" LED turns on when the incoming signal is detected by DS34RT5110 The "ORANGE" LED turns on when the PLL of the DS34RT5110 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 (need to connect to J30 or J34)**
JP39, JP46	VOD_CRL	Connect JP39, Sets external resistor = 24K ohm for VO = 1000mVpp Connect JP46, Sets external resistor = 12K ohm for VO = 2000mVpp
JP27, JP28, JP33	LOCK /EN/SD	Connect JP27 and JP33 to enable D3 Connect JP28 to disable the device outputs Or, use as SD-EN, LOCK-EN auto control. See datasheet
JP38	BYPASS	Connect JP22 to VDD to bypass Reclock function
JP50	MODE	Connect JP51 to VDD to bypass Clock Channel PLL function. **Do not connect for the Receiver Board**
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 detail 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 **Recommend to leave the setting as "0", or adjust the setting for max reach of the cable to the SINK**

Bill of Materials

Driver Board

QYT	DESIGNATION	DESCRIPTION
7	C4,C54,C56,C58,C60,C63,C64	0.1uF +/- 10% 16V 0402
2	C50,C52	33uF +/- 10% 16V 3528
2	C51,C53	68uF +/- 10% 16V 3528
4	C55,C57,C59,C61	0.01uF +/- 10% 16V 0402
1	C62	2.2nF +/- 10% 16V 0402
1	D4	LEDSSF-LXH103LGD
1	D5	LTST-C155KGJSKT
1	JP20	HDR1X1
5	JP29,JP30,JP31,JP32,JP37	HDR1X2
2	JP47,JP51	HDR1X3
1	JR1	RJ45 CN-PHONE8P8C-RA-SHLD
1	JR2	RJ45 CN-PHONE8P8C-RA-SHLD
1	J25	HDR1X1
1	J26	HDR1X1
1	J27	PJ-014D
1	J28	HDMI Female 500254-1927
6	R5,R6,R7,R8,R28,R90	10K +/- 1% 1/10W 0402
1	R19	24K +/- 1% 1/10W 0402
1	R23	12K +/- 1% 1/10W 0402
1	R27	453 +/- 1% 1/10W 0402
2	R29,R30	220 +/- 1% 1/10W 0402
1	R76	3.3K +/- 1% 1/10W 0402
1	U2	PCA9517D
1	U7	LP3965 - 3.3V - 1500mA SOT223-5
1	U8	DS34RT5110 LLP48
2	U9,U10	94HBB08RAT Rotary Dip Switch
1	U33	LP3965 - 5V - 1500mA SOT223-5

Repeater Board

QYT	DESIGNATION	DESCRIPTION
7	C8,C83,C85,C86,C88,C90,C93	0.1uF +/- 10% 16V 0402
2	C32,C81	33uF +/- 10% 16V 3528
2	C33,C82	68uF +/- 10% 16V 3528
4	C84,C87,C89,C91	0.01uF +/- 10% 16V 0402
1	C92	2.2nF +/- 10% 16V 0402
8	C95,C100,C101,C102,C103,C104,C105,C106	0 ohm +/- 1% 1/10W
1	D8	LEDSSF-LXH103LGD
1	D9	LTST-C155KGJSKT
1	JP15	Header 1x1
2	JP23,JP49	Header 1x3
5	JP34,JP35,JP36,JP40,JP41	Header 1x2
2	JR5,JR7	RJ45 CN-PHONE8P8C-RA-SHLD
2	JR6,JR8	RJ45 CN-PHONE8P8C-RA-SHLD
1	J32	HDR1X1
1	J34	HDR1X1

1	J35	PJ-014D
6	R13,R14,R15,R16,R42,R88	10K +/- 1% 1/10W 0402
1	R41	453 +/- 1% 1/10W 0402
2	R43,R44	220 +/- 1% 1/10W 0402
1	R49	3.3K +/- 1% 1/10W 0402
1	R59	24K +/- 1% 1/10W 0402
1	R60	12K +/- 1% 1/10W 0402
1	U16	LP3965 - 3.3V - 1500mA SOT223-5
1	U17	PCA9517D
1	U18	DS34RT5110 LLP48
2	U19,U20	94HBB08RAT Rotary Dip Switch
1	U31	LP3965 - 5V - 1500mA SOT223-5

Receiver Board

QYT	DESIGNATION	DESCRIPTION
7	C6,C70,C72,C73,C75,C77, C80	0.1uF +/- 10% 16V 0402
2	C34,C68	33uF +/- 10% 16V 3528
2	C35,C69	68uF +/- 10% 16V 3528
4	C71,C74,C76,C78	0.01uF +/- 10% 16V 0402
1	C79	2.2nF +/- 10% 16V 0402
8	C96,C99,C107,C108,C109, C110,C111,C112	0 ohm +/- 1% 1/10W
1	D6	LEDSSF-LXH103LGD
1	D7	LTST-C155KGJSKT
1	JP12	HDR1X1
5	JP27,JP28,JP33,JP39,JP46	HDR1X2
2	JP38,JP50	HDR1X3
1	JR3	RJ45 CN-PHONE8P8C-RA-SHLD
1	JR4	RJ45 CN-PHONE8P8C-RA-SHLD
1	J29	HDR1X1
1	J30	HDR1X1
1	J31	PJ-014D
1	J33	HDMI Female 500254-1927
6	R9,R10,R11,R12,R33,R89	10K +/- 1% 1/10W 0402
1	R32	453 +/- 1% 1/10W 0402
2	R34,R35	220 +/- 1% 1/10W 0402
1	R66	3.3K +/- 1% 1/10W 0402
1	R67	24K +/- 1% 1/10W 0402
1	R68	12K +/- 1% 1/10W 0402
1	U3	PCA9517D
1	U12	LP3965 - 3.3V - 1500mA SOT223-5
1	U13	DS34RT5110 LLP48
2	U14,U15	94HBB08RAT Rotary Dip Switch
1	U32	LP3965 - 5V - 1500mA SOT223-5

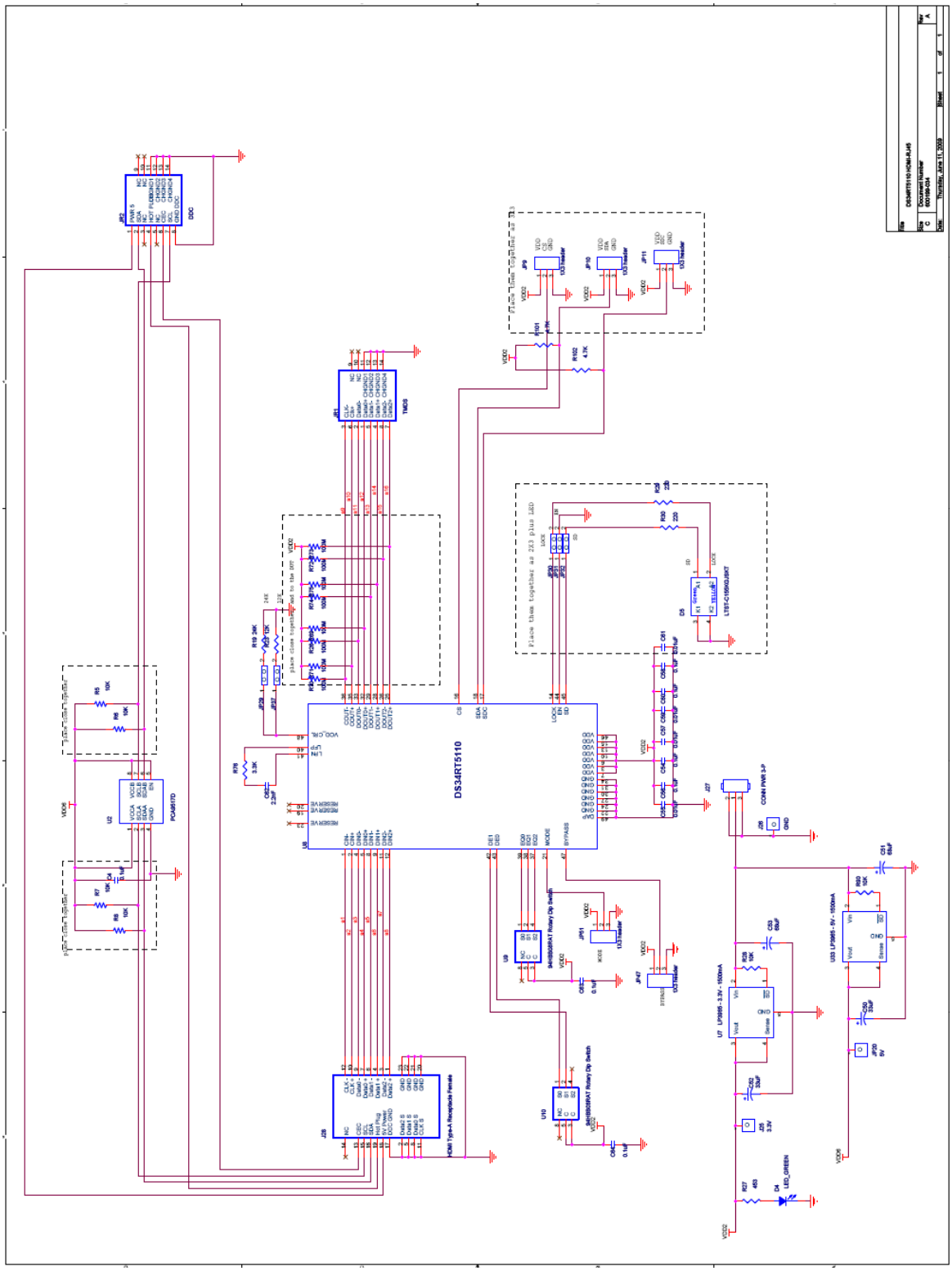
Passive Driver Board

QYT	DESIGNATION	DESCRIPTION
2	JR1, JR2	RJ45 CN-PHONE8P8C-RA-SHLD
1	J1	HDMI Female 500254-1927

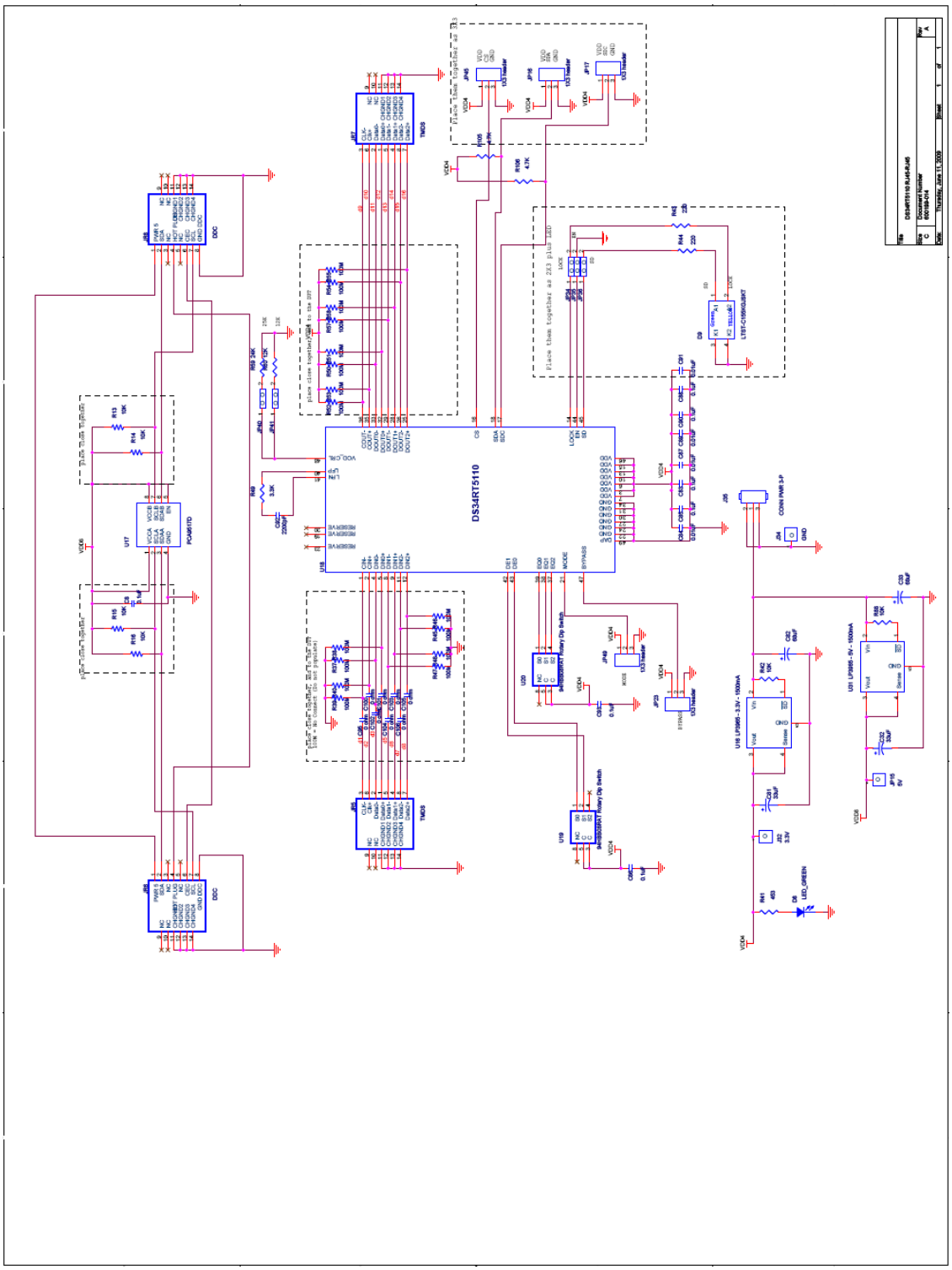
Board Design Consideration

- Using One RJ45 Jack for all TMDS signals in order to minimize the inter pair skew.
- Using another RJ45 Jack for all rest of 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.

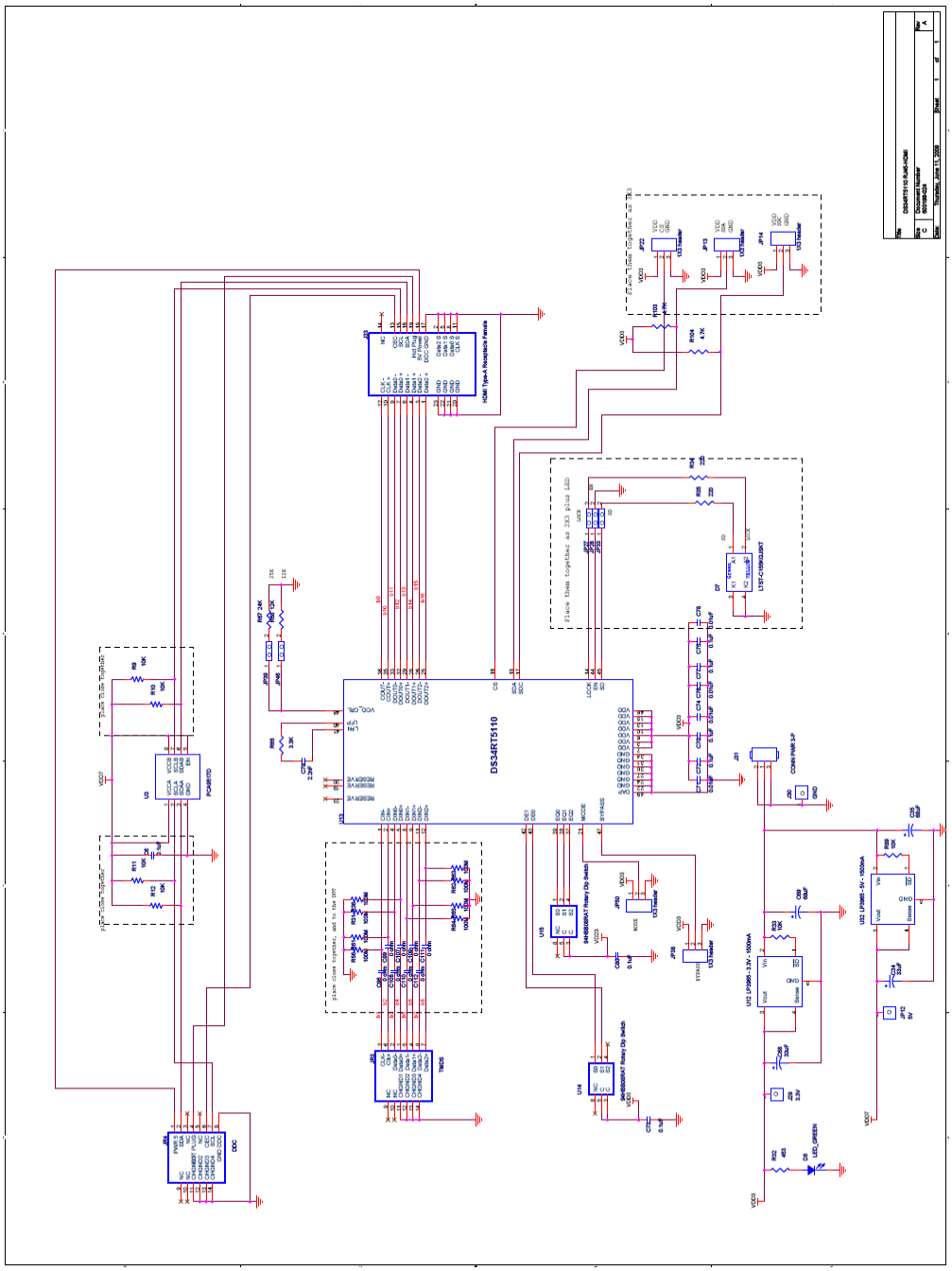
Schematics (Driver Board)



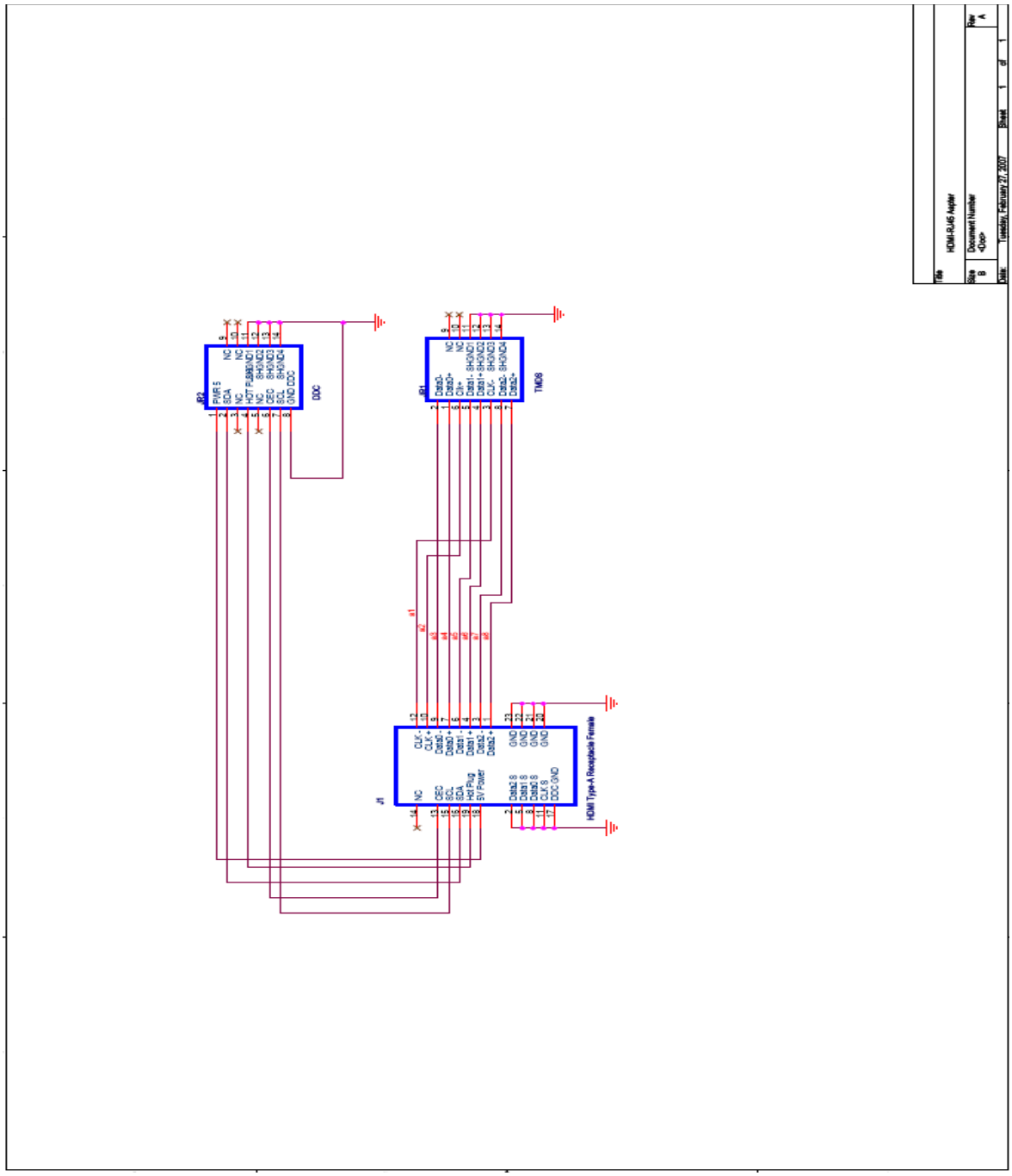
Schematics (Repeater Board)



Schematics (Receiver Board)



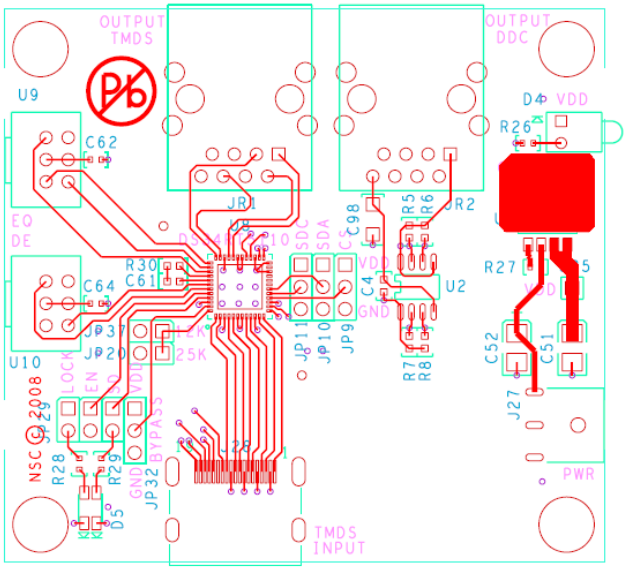
Schematics (Passive Adapter Board)



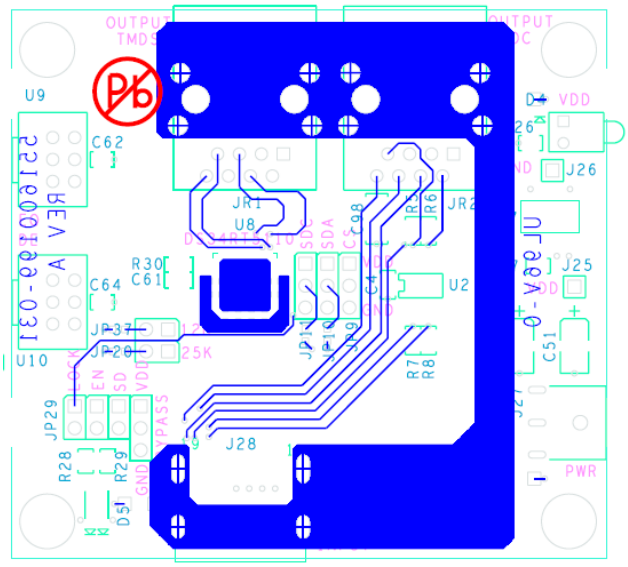
Layout Considerations

- Keep the clock and data transmission lines as short as possible with controlled 50 ohm single-ended impedance with matched lengths for any TMDS signals connected to RJ45 Jack.
- Use differentially coupled traces with 100 ohm impedance for DS34RT5110 TMDS outputs.
- Avoid using vias on the data transmission lines on the input side of the DS34RT5110.
- Place power supply decoupling capacitors close to the VCC pins.
-

Driver Board Layout
(For reference use only, actual layout on this board may be slightly different)

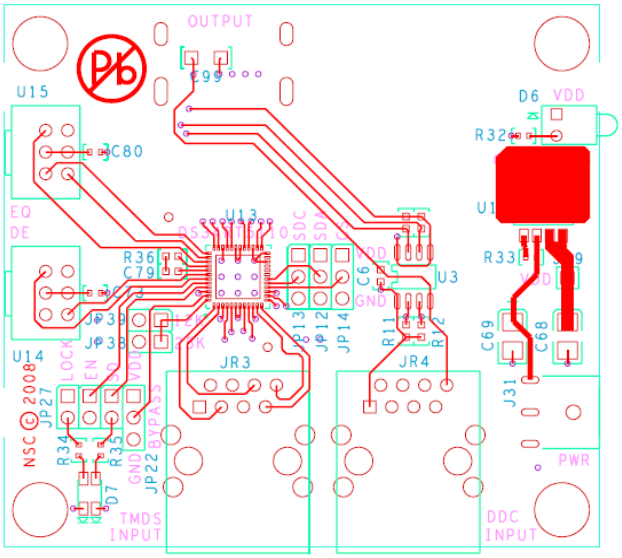


Top View

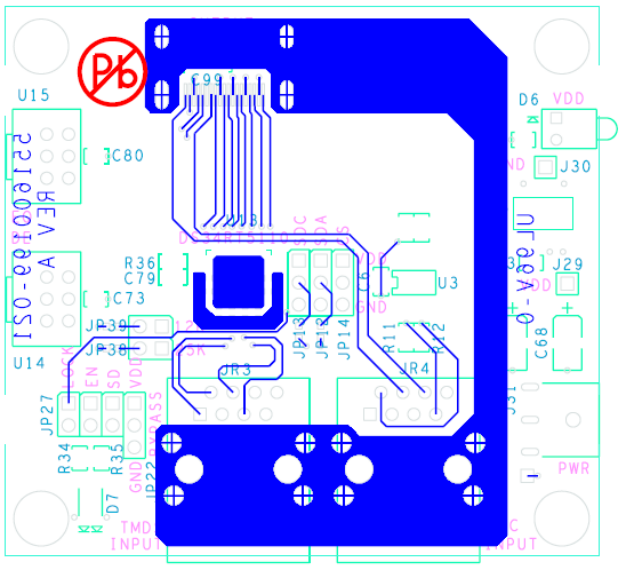


Bottom View

Receiver Board Layout
(For reference use only, actual layout on this board may be slightly different)

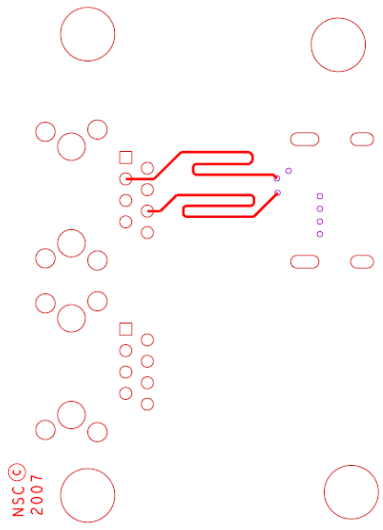


Top View

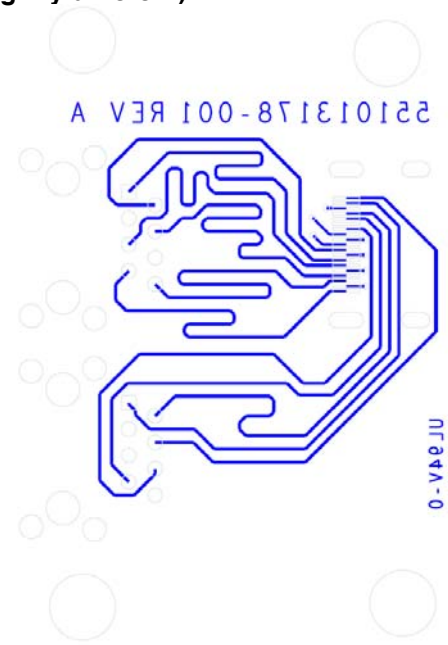


Bottom View

Passive Adapter Board Layout
(For reference use only, actual layout on this board may be slightly different)



Top View



Bottom View

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