

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

## **User's Guide**



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

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The DS34RT5110-EVKC CAT5 Cable Extender Demo Kit provides a complete HDMI system extension solution with cost effective CAT5 cables, using the Texas Instruments 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 RJ45 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 DS34RT5110 **passive adapter board** has two RJ45 jacks and one HDMI female receptacle connector, and 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 the 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 DS34RT5110 boards.

Alternately, an AC/DC power adapter (>800mA) can be used 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. The Texas Instruments 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.

## 1 Features

- Compatible with DTV resolutions 480i, 480p, 720i, 720p, 1080i, and 1080p with 8-bit, 12-bit and 16-bit deep color depths
- Compatible with computer resolutions: VGA, SVGA, XGA, SXGA, UXGA
- Supports TMDS HDMI single link
- DC coupled configuration (suitable for AC coupled applications 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 (not included in this kit)
- 8kV ESD rating
- 0 to 70°C temperature range

## 2 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

## 3 Board Errata Information

This set of demo boards is designed for either AC or DC coupled applications.

The boards in this kit are assembled for DC coupled applications. For proper use with this DC coupled setup, the GND jumpers (i.e. 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 for AC coupled applications.

#### 4 Typical Configuration DS34RT5110-EVKC

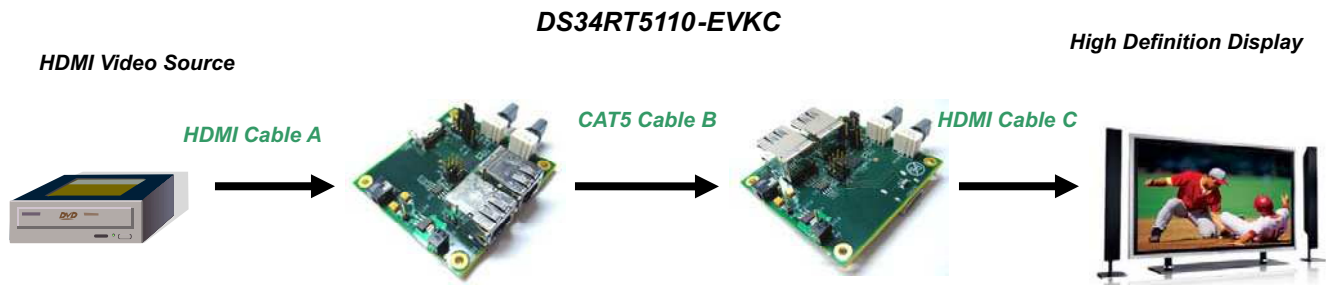


Figure 1. DS34RT5110-EVKC

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

Table 1. DS34RT5110 Demo Kit TMDS Extension

	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	> 60m	> 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

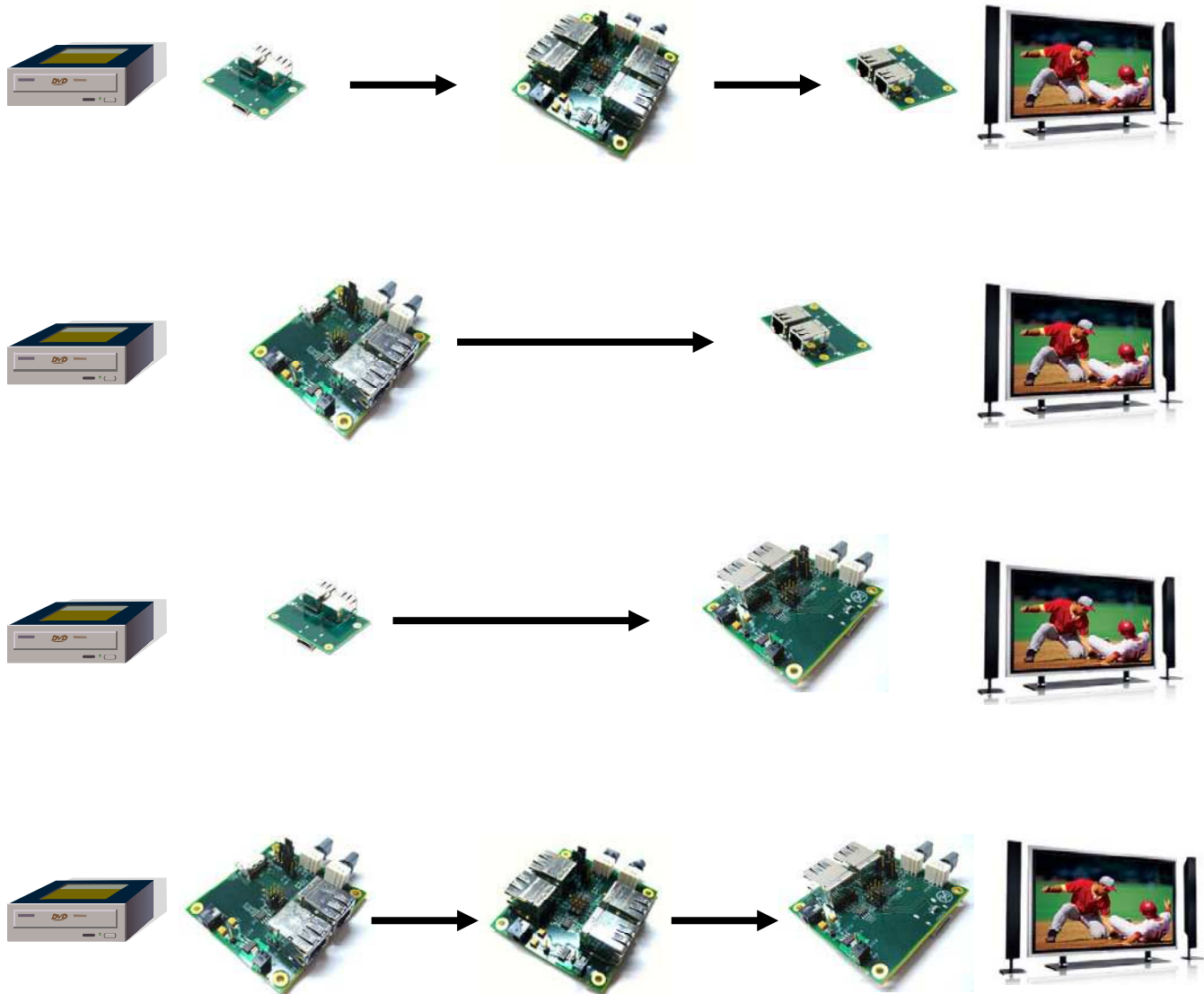


Figure 2. Typical Configuration

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 of the applicable cables to the boards.
3. Connect the 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.

## 5 Adjustments and Controls

**Table 2. Adjustments and Controls**

Component	Name	Function
<b>Driver Board</b>		
D4	PWR	The LED turns on when power is applied
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	<b>GND (need to connect to J30 or J34)</b>
JP29, JP37	VOD_CRL	Connect JP29, Sets external resistor = 24 kΩ for VO = 1000 mVpp Connect JP37, Sets external resistor = 12 kΩ for VO = 2000 mVpp
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. <b>Do not connect for the Driver Board</b>
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 <b>Recommend to leave the setting as "0" for multi-hop application</b>
<b>Repeater Board</b>		
D8	PWR	The LED turns on when power is applied
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	<b>GND (need to connect to J26 or J30)</b>
JP40, JP41	VOD_CRL	Connect JP40, Sets external resistor = 24 kΩ for VO = 1000 mVpp Connect JP41, Sets external resistor = 12 kΩ for VO = 2000 mVpp
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. <b>Connect to VDD for the Repeater Board</b>
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 <b>Recommend to leave the setting as "0" for multi-hop application</b>



**Table 2. Adjustments and Controls (continued)**

Component	Name	Function
<b>Receiver Board</b>		
D6	PWR	The LED turns on when power is applied
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	<b>GND (need to connect to J30 or J34)</b>
JP39, JP46	VOD_CRL	Connect JP39, Sets external resistor = 24 kΩ for VO = 1000 mVpp Connect JP46, Sets external resistor = 12 kΩ for VO = 2000 mVpp
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. <b>Do not connect for the Receiver Board</b>
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 <b>Recommend to leave the setting as "0", or adjust the setting for max reach of the cable to the SINK</b>

**6 Bill of Materials**
**Table 3. Driver Board BOM**

QYT	REFERENCE	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
2	U9, U10	94HBB08RAT Rotary Dip Switch
1	U33	LP3965 - 5V - 1500mA SOT223-5

**Table 4. Repeater Board BOM**

QYT	REFERENCE	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
2	U19, U20	94HBB08RAT Rotary Dip Switch
1	U31	LP3965 - 5V - 1500mA SOT223-5

**Table 5. Receiver Board BOM**

QYT	REFERENCE	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
2	U14, U15	94HBB08RAT Rotary Dip Switch
1	U32	LP3965 - 5V - 1500mA SOT223-5

**Table 6. Passive Adapter Board BOM**

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

## 7 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.

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**NOTE:** Please see the Schematics on the following pages.

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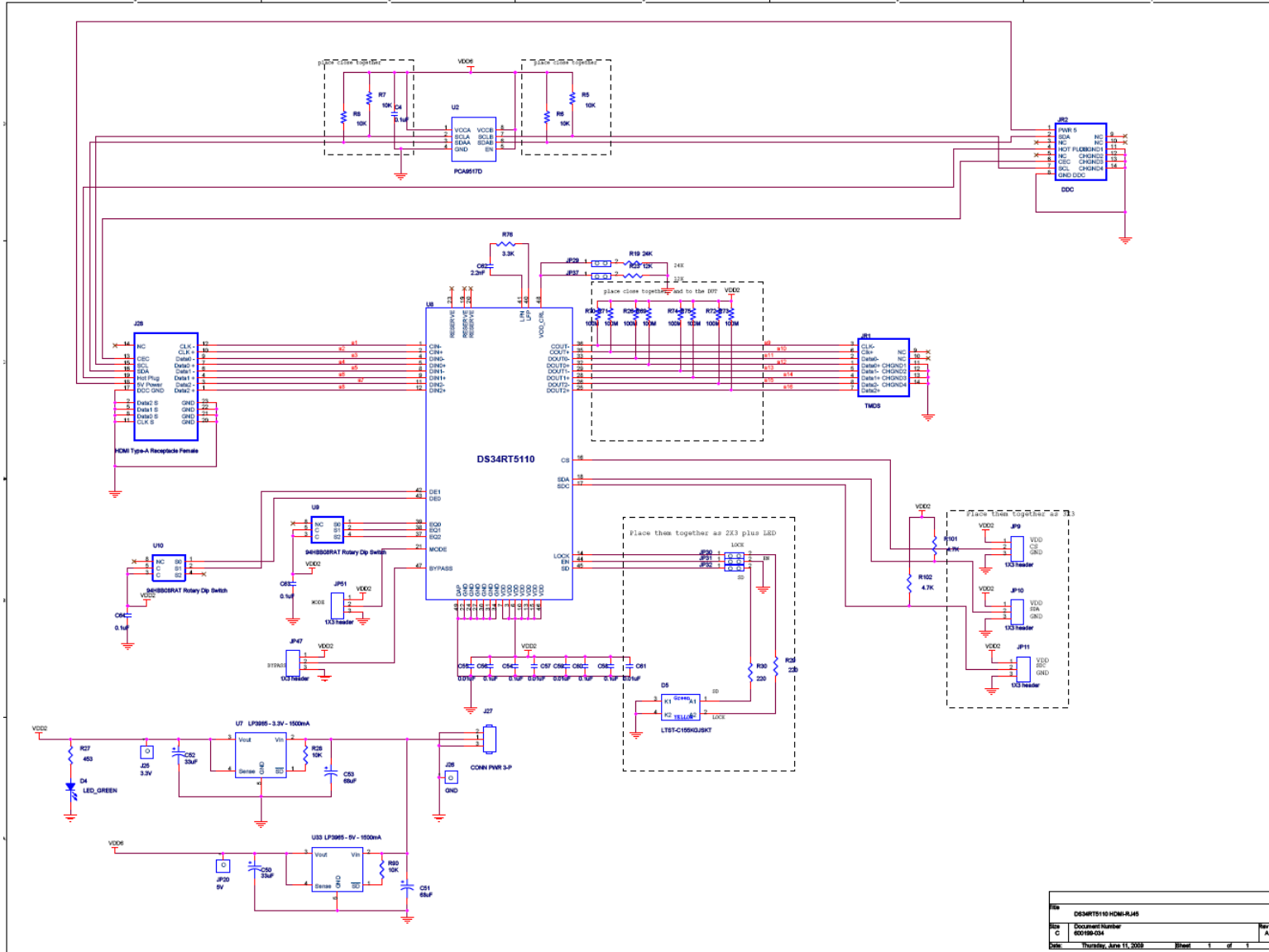


Figure 3. Schematic (Driver Board)

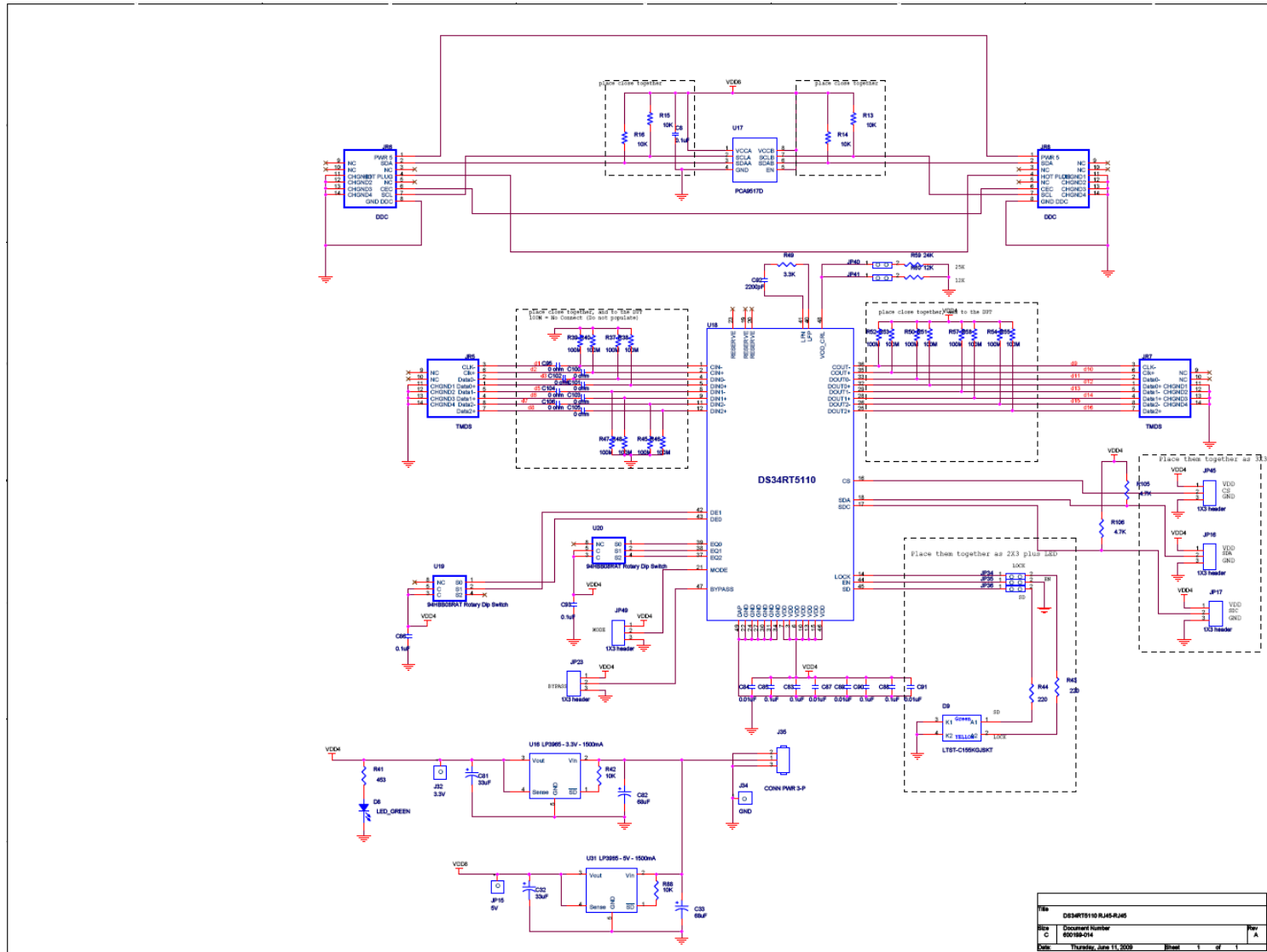


Figure 4. Schematic (Repeater Board)

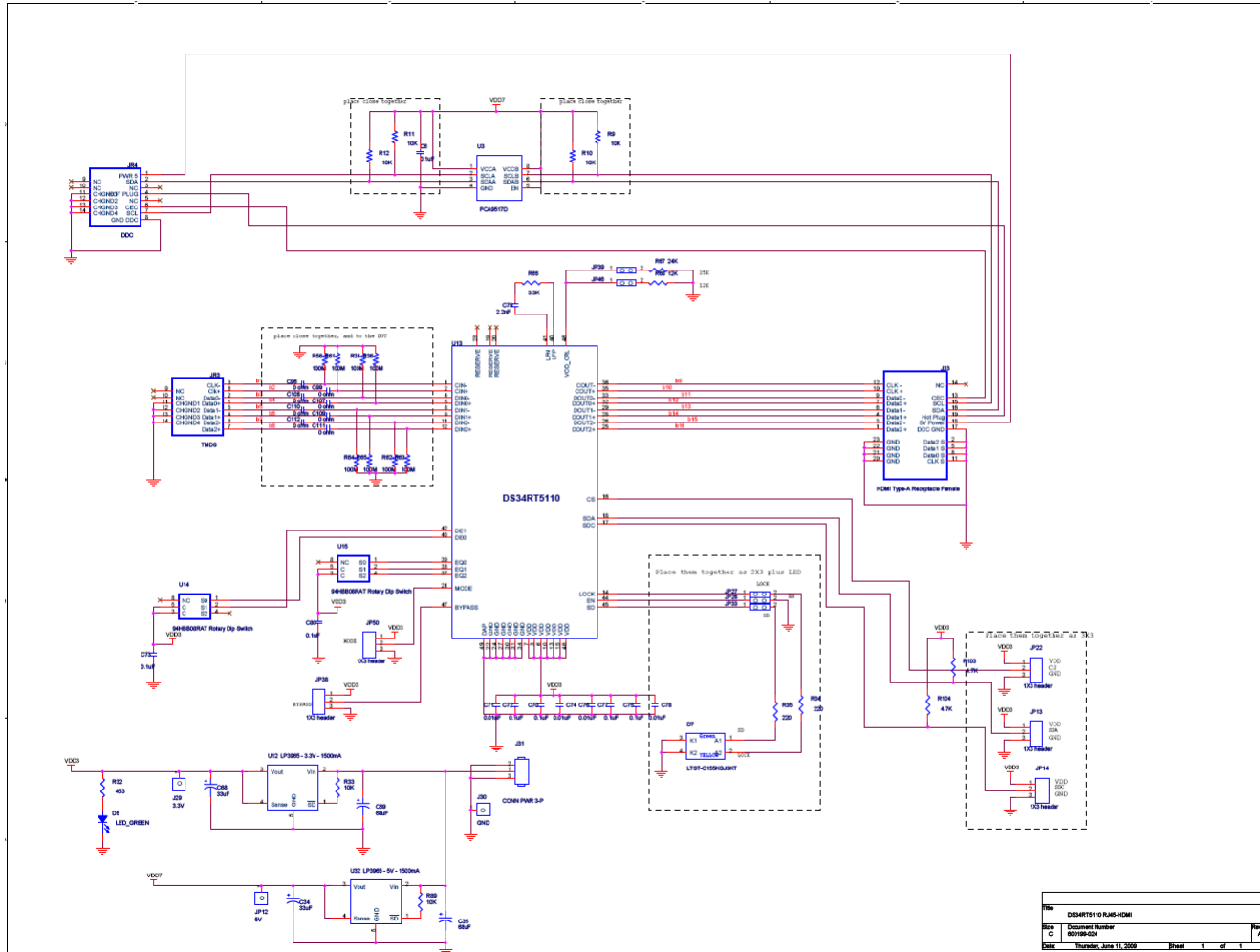


Figure 5. Schematic (Receiver Board)

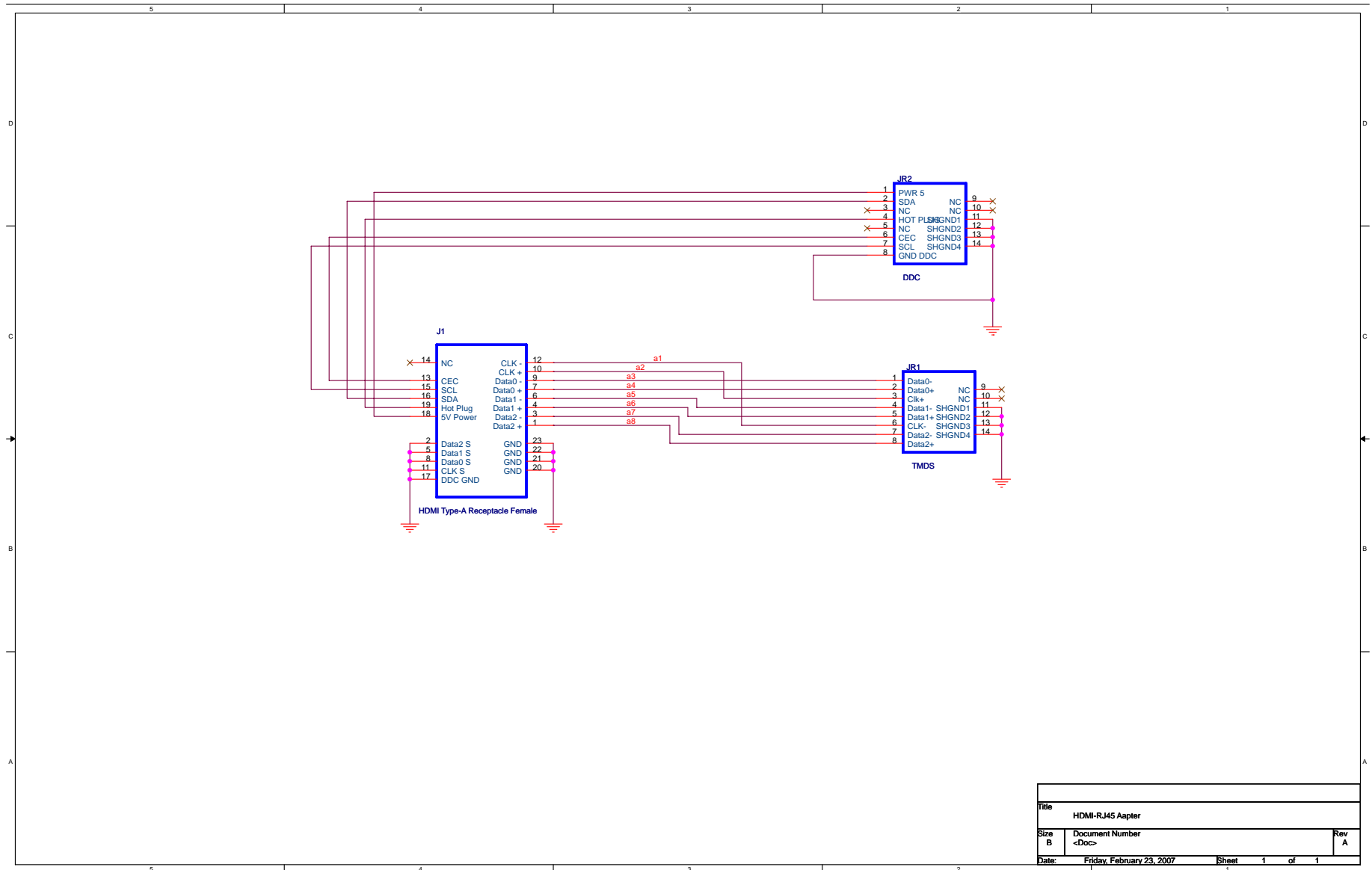


Figure 6. Schematic (Passive Adapter Board)



## 8 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 the RJ45 jack.
- Use differentially coupled traces with 100Ω 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.

### 8.1 Driver Board Layout

(For reference only; actual layout on this board may be slightly different)

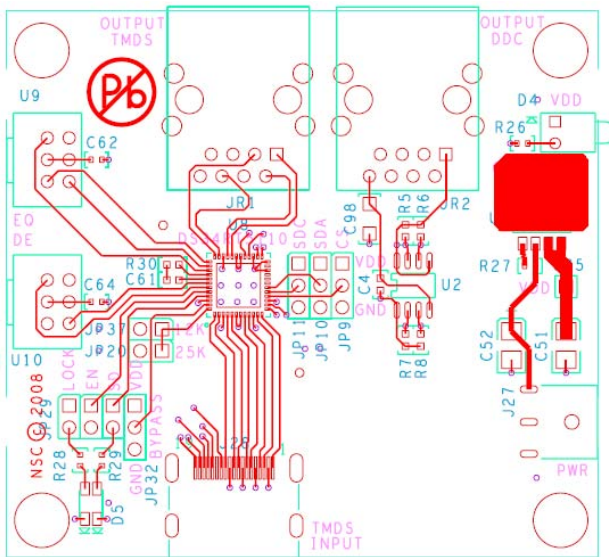


Figure 7. Driver Board Layout (Top View)

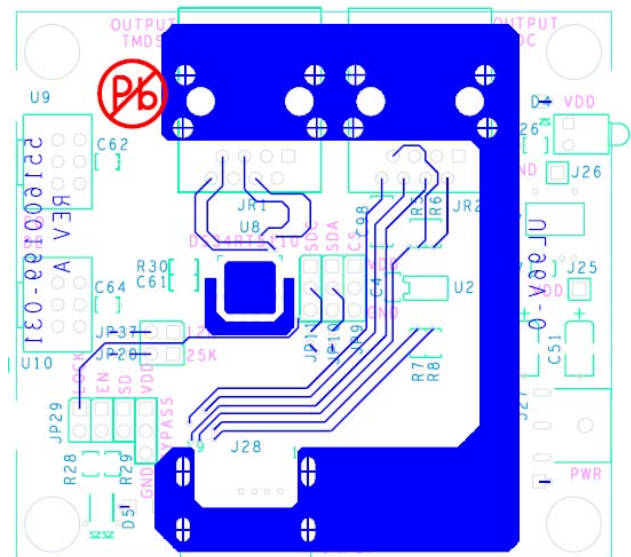
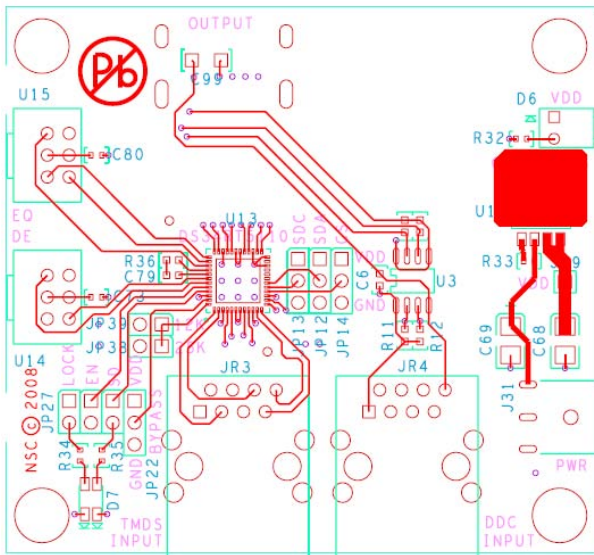


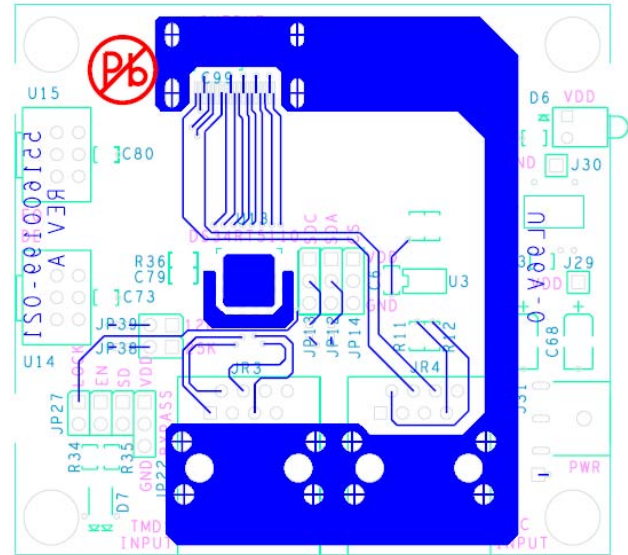
Figure 8. Driver Board Layout (Bottom View)

## 8.2 Receiver Board Layout

(For reference only; actual layout on this board may be slightly different)



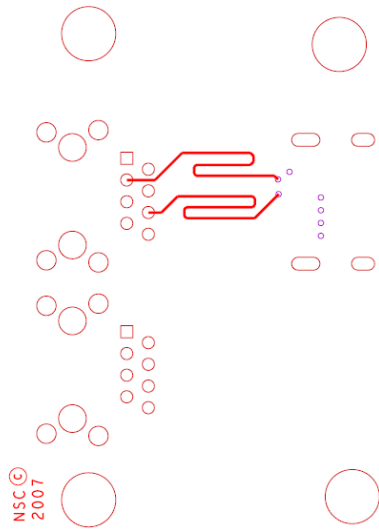
**Figure 9. Receiver Board Layout (Top View)**



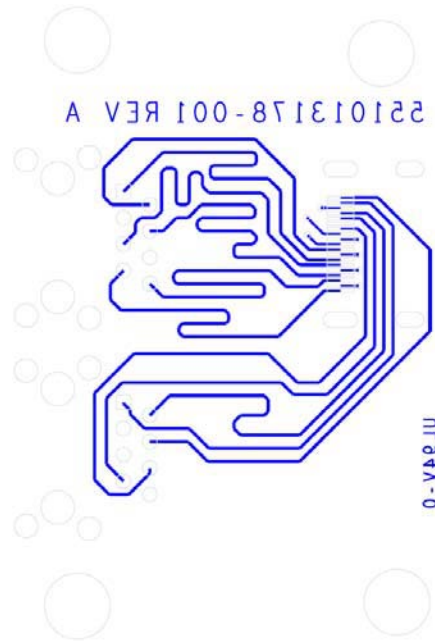
**Figure 10. Receiver Board Layout (Bottom View)**

### 8.3 Passive Adapter Board Layout

(For reference only; actual layout on this board may be slightly different)



**Figure 11. Passive Adapter Board Layout (Top View)**



**Figure 12. Passive Adapter Board Layout (Bottom View)**

## EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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## REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

### General Statement for EVMs including a radio

*User Power/Frequency Use Obligations:* This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

### For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

#### Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

### **FCC Interference Statement for Class B EVM devices**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- 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.

### **For EVMs annotated as IC – INDUSTRY CANADA Compliant**

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **Concerning EVMs including radio transmitters**

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

### **Concerning EVMs including detachable antennas**

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

### **Concernant les EVMs avec appareils radio**

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### **Concernant les EVMs avec antennes détachables**

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

## **【Important Notice for Users of EVMs for RF Products in Japan】**

**This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan**

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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## **EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS**

**For Feasibility Evaluation Only, in Laboratory/Development Environments.** Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

**Certain Instructions.** It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

**Agreement to Defend, Indemnify and Hold Harmless.** You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

**Safety-Critical or Life-Critical Applications.** If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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