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# DS16EV51-AEVKC
# HDMI-RJ45 Extender Demo Kit for CAT5 Cables

## General Description

The DS16EV51-AEVKC CAT5 Cable Extender Demo Kit provides a complete HDMI system extension solution with cost effective CAT5 cables, using National's DS16EV5110A - a Video Equalizer.

The kit consists of a driver adapter board and a receiver equalizer board. The driver board has one HDMI female receptacle connector and two RJ45 jacks. It is a passive board without power supply. It serves as an adapter between HDMI and CAT5 interfaces. The receiver equalizer board has two RJ45 jacks and one HDMI female receptacle connector with other components, including a DS16EV5110A device.

All the TMDS signals are connected through first RJ45 jack between two boards. The DDC signals, Hot Plug, 5V Power and 5V Ground are directly connected between the HDMI connectors to the second RJ45 jack on both boards, making this demo kit HDCP compliant.

A 3.3V VCC 1-pin header (J4) and a GND 1-pin header (J5) are used for the power supply for the receiver equalizer board.

Alternately, an AC/DC power adapter (>300mA) can be used for the receiver equalizer board 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 LP3964, a 3.3V, 800mA, Fast, Ultra Low Dropout Linear Regulator, converts the 5V power supply voltage to a 3.3V power supply voltage that powers the DS16EV5110A and other active components on the receiver board.

## Features

- **Compatible with DTV Resolutions 480i, 480p, 720i, 720p, 1080i, 1080p, and 1080p with 12 bit deep color depth.**
- **Compatible with Computer Resolutions of VGA, SVGA, XGA, SXGA, UXGA**
- **Supports TMDS HDMI or DVI Single Link**
- **Adjustable rotary switch for easy custom EQ boost level setting to reach maximum length of TMDS Interface with Twisted Pair , HDMI, or DVI Cables**
- **Single 3.3V Supply**
- **Ultra Portable with AC/DC Power Adapter (not included in the kit)**
- **500 mW Typical Power Consumption**
- **>6kV ESD Rating**
- **-40 to 85C Industrial Temperature Range**
- **The DS16EV51-AEVKC demo kit extends TMDS with the UTP (Unshielded Twist Pairs) CAT5 or CAT6 cable as follows**:

| | Resolution | Pixel bandwidth (MPixel/s) 60Hz LCD with 20% blanking | Per channel bandwidth (Gb/s) 60Hz LCD with 20% blanking | UTP CAT5/6 Length |
|---|---|---|---|---|
| **SDTV (480p)** | 704 x 480 | 25 | 0.25 | > 80 m |
| **HDTV (720p)** | 1280 x 720 | 66.4 | 0.664 | > 55 m |
| **HDTV (1080i)** | 1920 x1080 | 75 | 0.75 | > 50 m |
| **HDTV (1080p)** | 1920 x1080 | 150 | 1.5 | > 25 m |
| **HDTV (1080p) 12 bit Deep Color Depth** | 1920 x1080 | 225 | 2.25 | > 20 m |

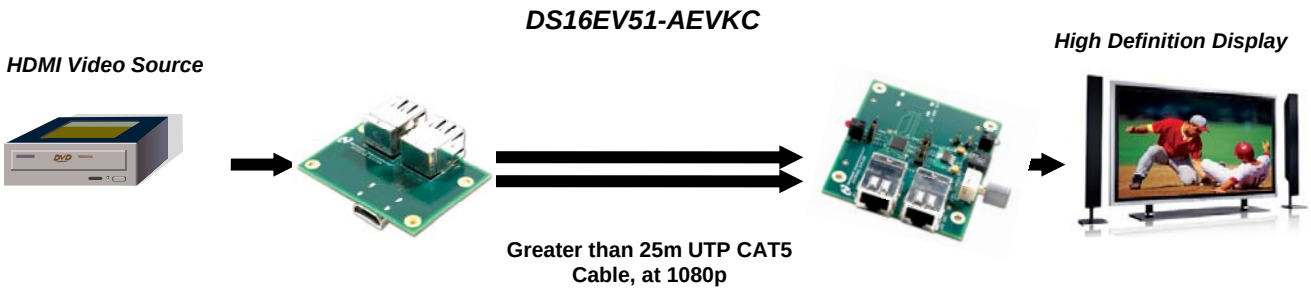
## Applications

High Definition Displays and Televisions
High Definition Front- Projectors
LCD Computer Monitors
Cable Extender

## Ordering Information

**PART:** DS16EV5110ASQ
**Demo Board for CAT5 Cables:** DS16EV51-AEVKC

## Typical Applications




## Bill of Materials

**Passive Driver Board**

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| JR1, JR2 | 2 | RJ45 Jack |
| J1 | 1 | HDMI Receptacle Female |

**Equalizer Receiver Board**

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| C2, C4, C8, C10 | 4 | 0.01uF ±10% Ceramic Capacitor 0402 |
| C1, C3, C7, C9, C11 | 5 | 0.1uF ±10% Ceramic Capacitor 0402 |
| C5 | 1 | 33uF ±10% Tantalum Capacitor 3528 |
| C6 | 1 | 68uF ±10% Tantalum Capacitor 3528 |
| D1 | 1 | LED Green |
| D2 | 1 | LED Red |
| JR1, JR2 | 2 | RJ45 Jack |
| R1, R2 | 2 | 453 ohm ±5% Resistor 0402 |
| R7 | 1 | 10K ohm ±5% Resistor 0402 |
| J2 | 1 | HDMI Receptacle Female |
| J3 | 1 | DC Power Jack 1.8 mm |
| J4, J5 | 2 | 1 pin header (J4: VDD=3.3V, J5:GND) |
| J7, J8, J10, J11 | 4 | 1X2 pin header |
| J9 | 1 | 1X4 pin header |
| U1 | 1 | National DS16EV5110A |
| U2 | 1 | National LP3965 – 3.3V -1500mA |
| U3 | 1 | 94HBB08RAT Rotary Dip Switch |

## Quick Start Guide:

1. Attach HDMI cable from the source to the drive board.
2. Attach HDMI cable from the sink to the receiver board.
3. Connect 3.3V DC power to J4 and ground to J5 from the power supply on the receiver board.
   Or, plug the AC/DC power adapter to the DC power Jack
   ***AC/DC power adapter requirement: Output DC 4V~6V, Output current > 800mA***
4. Attach two CAT5 cables between the driver board and the receiver board with JR1 to JR1, and JR2 to JR2.
5. Turn on the source (DVD/Computer) and the sink (Monitor/HDTV).

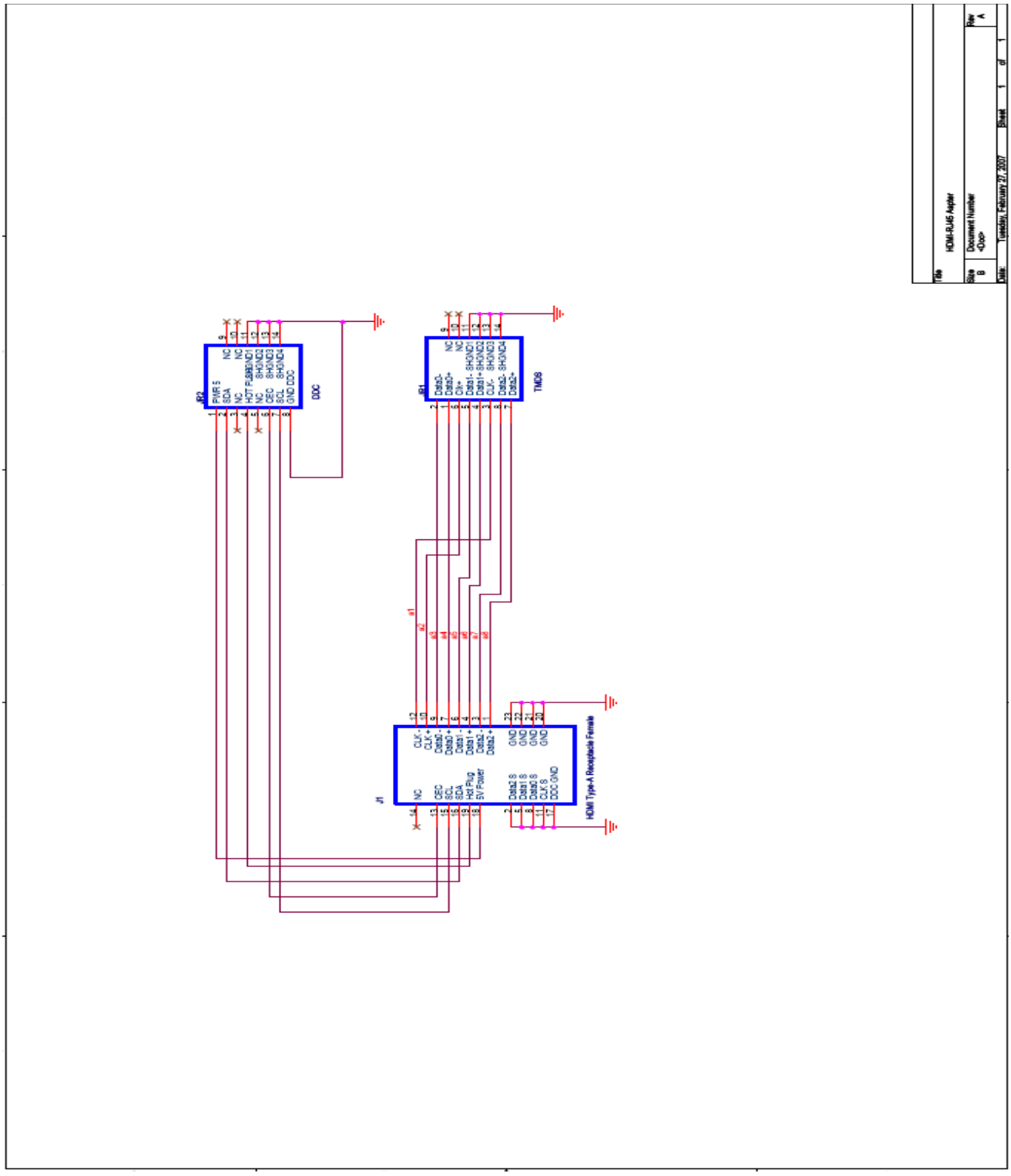
**Adjustment and Control Description on Receiver Board**

| Component | Name | Function |
|---|---|---|
| D1 | PWR | The LED turns on when 5V DC applies |
| D2 | SD | The LED turns on when the DS16EV5110A does not detect input signal |
| J3 | 5V DC | Optional DC Power Jack for 1.5 mm Adaptor Plug |
| J4 | 3.3V | 3.3V VCC power supply |
| J5 | GND | GND |
| J7 | FEB | Optional SMBus Control. See Datasheet. |
| J8 | CS | Optional SMBus Control. See Datasheet |
| J10, J11 | SDA, SDC | Optional SMBus access. See Datasheet |
| J9 | Loop Back Control | Connect “LED” and “SD” to enable D2 function.<br>Connect “SD” and “EN” to enable look back control function. When the clock signal is not detected, the DS16EV5110A sets to power down mode. |
| U3 | Rotary Switch | 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. |

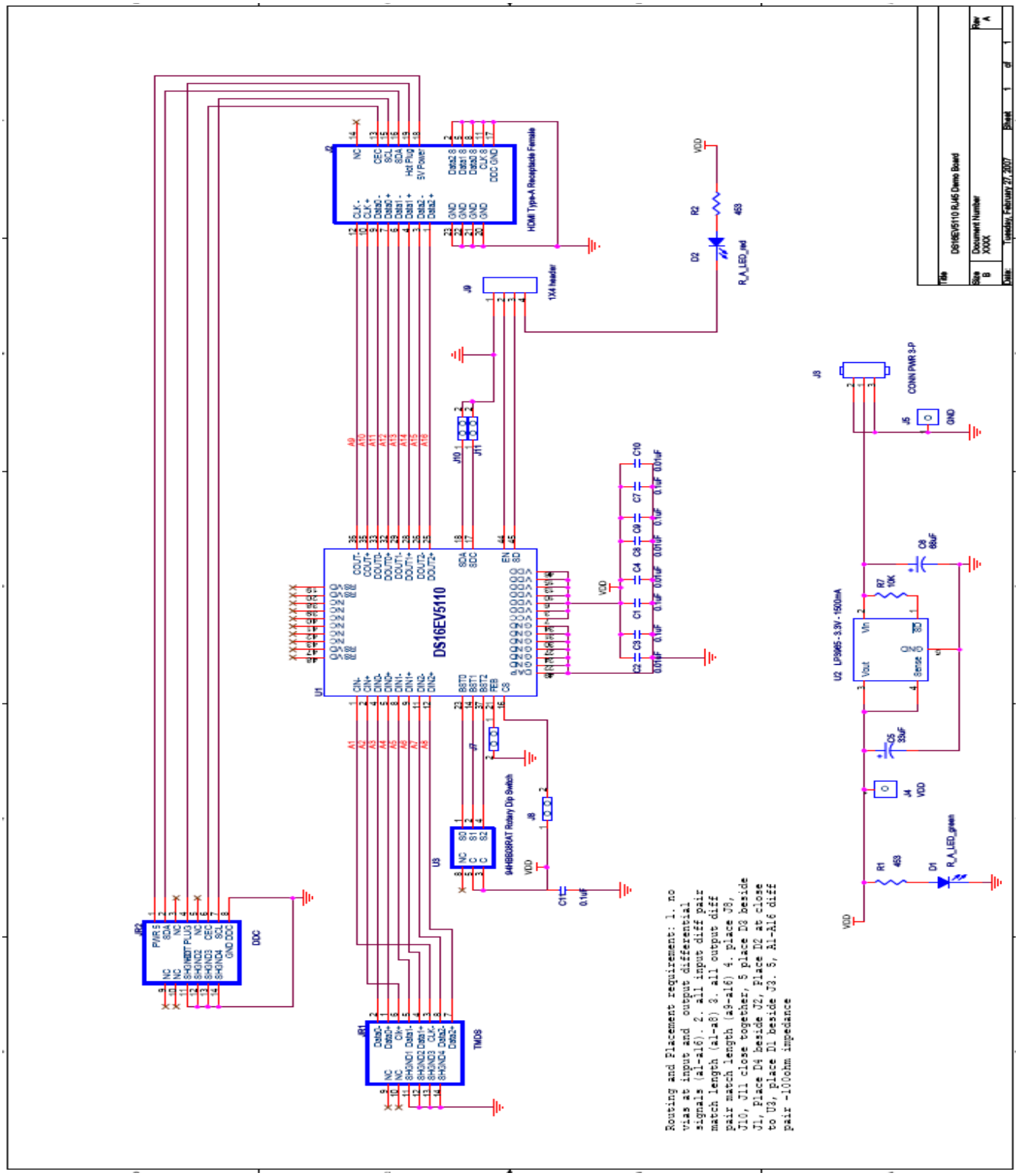
## Board Design Consideration

- 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 Adapter Board)



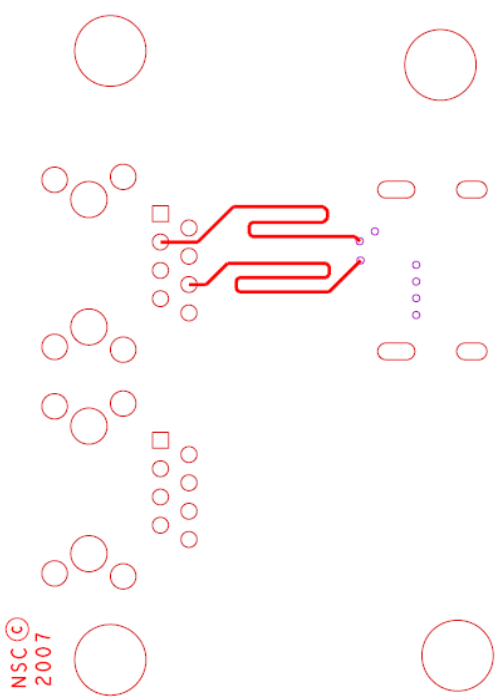
## Schematics (Receiver Equalizer Board)



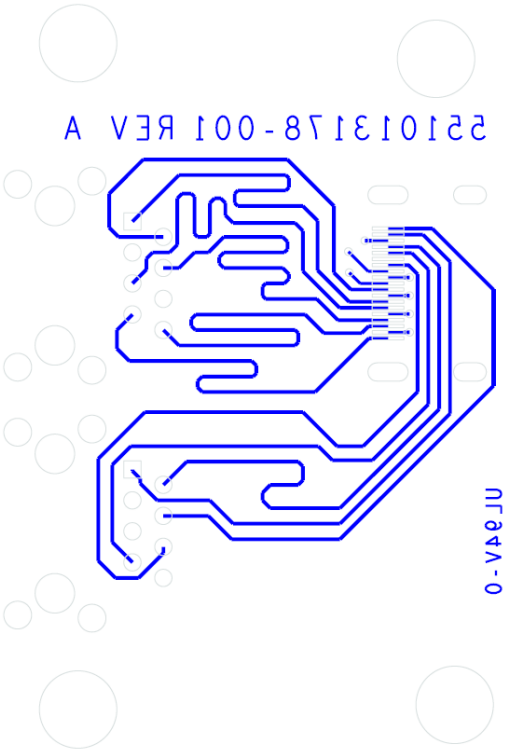
## Layout Considerations

- 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 DS16EV5110A TMDS outputs.
- Avoid using vias on the data transmission lines on the input side of the DS16EV5110A.
- Place power supply decoupling capacitors close to the VCC pins.

## Layout (Driver Adapter Board)

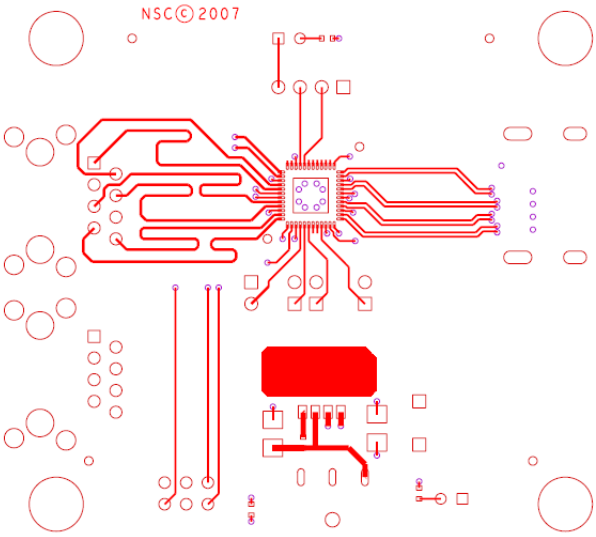



**Top View**




**Bottom View**

## Layout (Receiver Equalizer Board)

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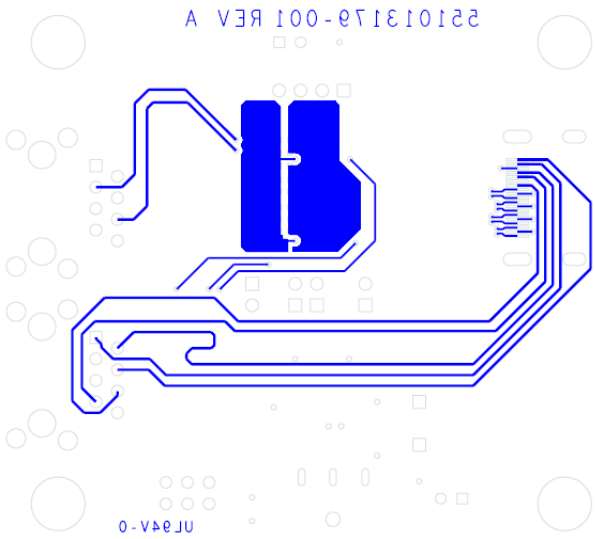

**Bottom View**

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