# LDI Demonstration Kit User Guide (LVDS Display Interface)

# User's Guide

Literature Number: SNLU036A
April 1999–Revised April 2014

# LDI Demonstration Kit User Guide (LVDS Display Interface) Introduction

Texas Instruments' LDI demo kit contains a Transmitter (Tx) demo board and a Receiver (Rx) demo board. This kit will demonstrate the chipsets interfacing from a graphics controller using Low Voltage Differential Signaling (LVDS) to a Liquid Crystal Display (LCD) flat panel.

The Transmitter board accepts 3V LVTLL/CMOS RGB signals from a graphics controller along with the clock and control signals. The LVDS Transmitter converts the LVTLL/CMOS parallel lines into serialized LVDS pairs. The serial data streams toggle at 3.5 times the clock speed.

The Receiver board accepts the LVDS serialized data (and clock) and converts them back into parallel LVTLL/CMOS RGB signals for the Panel Timing Controller.

The user needs to provide the proper RGB inputs to the Transmitter and also to provide a proper interface from the Receiver output to the panel timing controller. In some cases, a cable conversion board or harness scramble may be necessary depending on type of cable/connector interface used.

**Warnings**:

The maximum voltage that should ever be applied to the LDI Transmitter or Receiver Vcc is 4 V. The Transmitter and Receiver power supply pins (Vccs) are **NOT** 5 V tolerant. The Transmitter can however accept a 3.3 V or 5 V LVTLL/CMOS level on the inputs (TxIN). The Transmitter inputs are 5 V tolerant. The maximum voltage that can be applied to any input pin is 5.0 V.

**Topic** **Page**

# 1 Contents of Demo Kit

1. One Transmitter board with IDC connectors on Tx input DS90C387MTD - 48 bit Transmitter (http://www.ti.com/lit/ds/symlink/ds90c387.pdf)
2. One Receiver board with IDC connectors on Rx output DS90CF388MTD - 48 bit Receiver (http://www.ti.com/lit/ds/symlink/ds90cf388.pdf)

**NOTES**:

1. The demo board trace layout is designed for minimum skew between channels. It is not absolutely required in most applications but be aware that the skew margins will be reduced if your board layout is not optimized.
2. The MDR LVDS connector footprint has been set to accept a D26-1 pinout. In order to connect the two boards, use a .050" Mini D Ribbon (MDR) cable assembly, **14526-EZHB-XXX-0QC**. Please refer to: http://www.3m.com/Interconnects.

# 2 Applications

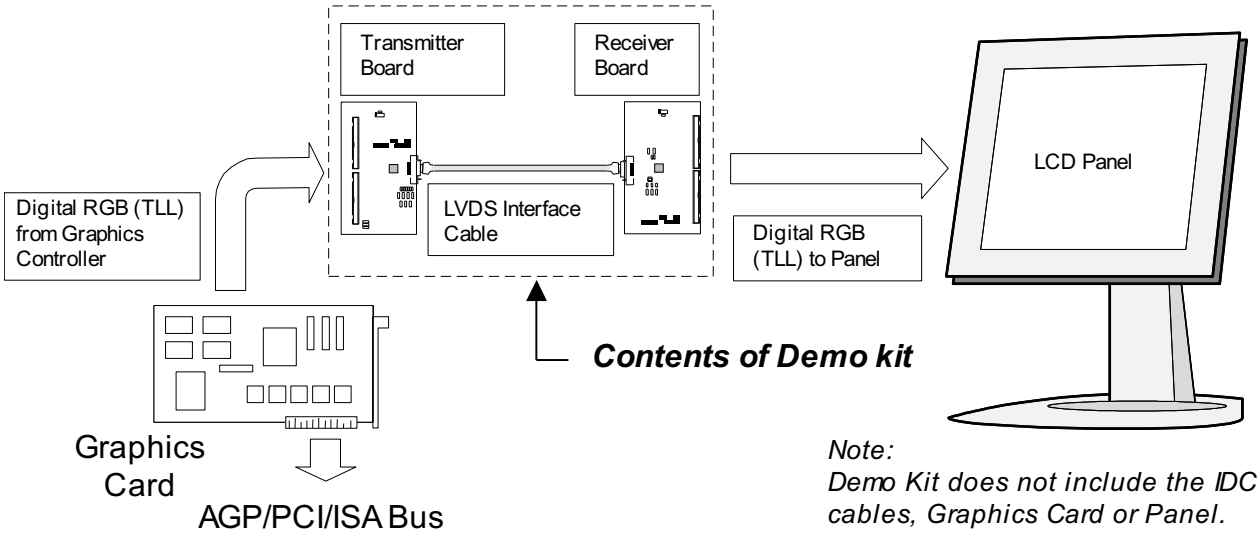



**Figure 1. LDI Application**

The diagram above illustrates the use of the Chipset (Tx/Rx) in a Host to LCD Panel Interface.

Chipsets support up to 24-bit single pixel or 24-bit dual pixel AM-TFT LCD Panels for any VGA (640X480), SVGA (800X600), XGA (1024X768), SXGA (1280X1024), or UXGA (1600X1200).

Because of the non-periodic nature of STN-DD SHFCLK, the Chipset may not work with all D-STN panels. The PLL CLK input of the Transmitter requires a free running periodic SHFCLK. Most Graphics Controller can provide a separate pin with a free running clock. In this case the STN-DD SHFCLK can be sent as Data while the free running clock can be used as SHFCLK for the PLL ref CLK. For example, C&T's 65550's WEC (Pin102) can be programmed to provide a free running clock using the BMP (Bios Modification Program). Please refer to STN Application using (AN-1056) for more information.

Refer to the proper datasheet information on Chipsets (Tx/Rx) provided on each board for more detailed information.

**Note**: Refer to AN-1127 for suggested mapping schemes.

# 3 Features and Explanations

## 3.1 Transmitter

### 3.1.1 Pre-Emphasis (PRE - pin 14/JP1):

1. 1. This feature enables you to overcome cable capacitance through the LVDS interface. This function provides additional instantaneous current during switching transitions. NOTE: This function does NOT affect Rx output drive.
2. This function works in “Old Mode” or “New Mode”.
3. This function affects Tx A0-A7 and CLKs LVDS outputs only.
4. To disable this function, pin 14 must be tied LOW. LVDS output drive will then be at its standard value of 3.5mA.
5. The input will be pulled low (0.7 V) if no jumper is used. To adjust the level of pre-emphasis, place a jumper on JP1 to Vcc. R48 will now be connected. R48 is a 2K potentiometer. Use a number 1.4mm jeweler’s screwdriver to adjust R48. Turning clockwise will increase the pre-emphasis value. Turning counterclockwise will decrease the pre-emphasis value. R48 should be adjusted to reduce overshoot. Too much pre-emphasis can create an overshoot condition at the rising edge and an undershoot condition on the falling edge. Icc will increase but allows you to drive longer cables. Too little pre-emphasis will not allow you to drive longer cables. Monitor any one of the LVDS lines (A0-A7) or CLK1 for a visual confirmation of its effect. It is recommended that you monitor the LVDS signals with a differential probe. If a differential probe is not used, a single ended probe can be used for a quick check.

### 3.1.2 PLL range select (PLLSEL - pin 15/JP5):

1. Auto-range is selected by tying pin 15 HIGH.
2. Low-range is selected by tying pin 15 LOW.
3. This function works in “Old Mode” or “New Mode”.

### 3.1.3 Dual/Single Operation (DUAL - pin 23/JP7):

1. This feature provides three different modes of operation. The modes of operation are:
   1) Dual 112MHz TxIN, Dual 112MHz TxOUT (pin 23 = HIGH; jumper JP7 to Vcc)
   2) Single 170MHz TxIN, Dual 85MHz TxOUT (pin 23 = Vcc/2; no jumper on JP7)
   3) Single 112MHz TxIN, Single 112MHz TxOUT (pin 23 = LOW; jumper JP7 to GND)

2. This function works in “Old Mode” or “New Mode”.

3. In Single to Single mode, TxOUT0 through TxOUT3 and associated Tx inputs are active. TxOUT4 through TxOUT7 and associated inputs are disabled to promote power savings on the part.

### 3.1.4 DC Balance (BAL - pin 24/JP4):

1. This feature prevents charging of a cable in one state e.g. all “1s” or all “0s” for an extended period of time. The benefit to this is to “open” up the LVDS “eye-pattern” (Reducing the Inter-Symbol Interference).

2. This function works in “New Mode” ONLY.

3. It affects Tx A0-A7 and LVDS CLK outputs only.

4. To disable this function, pin 24 is tied LOW. To enable this function pin 24 is tied HIGH.

5. BAL (pin 6 of the Rx/JP6 on Rx board) must also be tied HIGH to enable this function.

6. In this mode, the part is NOT backward compatible with existing FPD-Link technology. This feature must be turned off to be backward compatible with current FPD-Link chipsets.

**NOTE**: Refer to the “Application Notes” on back of the data sheet for complete description of each feature.

# 4 Receiver

## 4.1 PLL range select (PLLSEL - pin 5/JP5):

1. Auto-range is selected by tying pin 5 HIGH.
2. Low-range is selected by tying pin 5 LOW.

## 4.2 DESKEW option (pin 4/JP4):

1. This function works in "New Mode" ONLY.
2. In order for the "DESKEW" feature to be operational (DESKEW=HIGH), a minimum of four clock cycles is required during blanking time.
3. To set "DESKEW" feature OFF, set jumper JP4 LOW.

## 4.3 DC Balance (BAL - pin 6/JP6):

1. This feature prevents charging of a cable in one state e.g. all “1s” or all “0s” for an extended period of time. The benefit to this is to “open” up the LVDS “eye-pattern”.
2. This function works in “New Mode” ONLY.
3. To disable this function, pin 6 is tied LOW. To enable this function pin 6 is tied HIGH.
4. BAL (pin 24 of the Tx/JP4 on Tx board) must also be tied HIGH to enable this function.
5. In this mode, the chipset is NOT backward compatible with existing FPD-Link technology. This feature must be turned off to be backward compatible with current FPD-Link chipsets.

**NOTE**: Refer to the “Application Notes” section on the back of the datasheet for complete description of each feature.

# 5 How to Hook up the Demo Boards (Overview)

The Tx demo board TxIN has been laid out to accept data from the Video Graphics card through two 50 pin IDC connectors. The TxOUT/RxIN interface uses the 3M MDR connector and 3M MDR cable with a D26-1 pin out. This combination provides minimal skew between LVDS channels. The receiver board RxOUT is laid out generically and must be mapped correctly to the panel being used.

1. Connect one end of the D26-1 MDR cable to the transmitter board and the other end to the receiver board. This is a standard pinout cable, longer lengths are available for purchase from 3M - see http://www.mmm.com
2. Jumpers have been configured from the factory (Refer to Tx and Rx "Jumper Default Settings" on pages 11 and 17) to run in normal mode with Deskew function OFF and with pre-emphasis ON. Jumpers are also provided on both boards so make sure that they are positioned correctly. See "Jumper Setting Examples" on page 22 and page 25 for different application configurations.
3. From the Graphics card, connect the appropriate IDC cable to the transmitter board and connect two 50-pin IDC cables from the receiver boards to the panel (Note: Refer to AN-1127 for suggested mapping schemes.) Note that pin 1 on the connector should be connected to pin 1 of the cable.
4. Power for the Tx and Rx boards are supplied externally through Test Pad (TP) TP1. Grounds for both boards are connected through TP2.
5. Turn on the PC first then power up the panel.

**Warning**:

Clock 2 is brought over to the Rx board through the USB pair, which are not matched in length with Clock 1, or LVDS data lines. Also the differential impedance of the USB pair is rated at 90 Ω.

## 6 Power Connections

The Transmitter and Receiver boards can only be powered by supplying power externally through TP1 (Vcc) and TP2 (GND). The maximum voltage that should ever be applied to the LDI Transmitter or Receiver Vcc is 4V. For the transmitter and the receiver to be operational, /PD must be tied to Vcc which is labeled as “JP3” and "JP1", respectively.

**Note**: J4 on the Tx and J1 on the Rx provide the interface for LVDS signals.

## 7 Transmitter Board

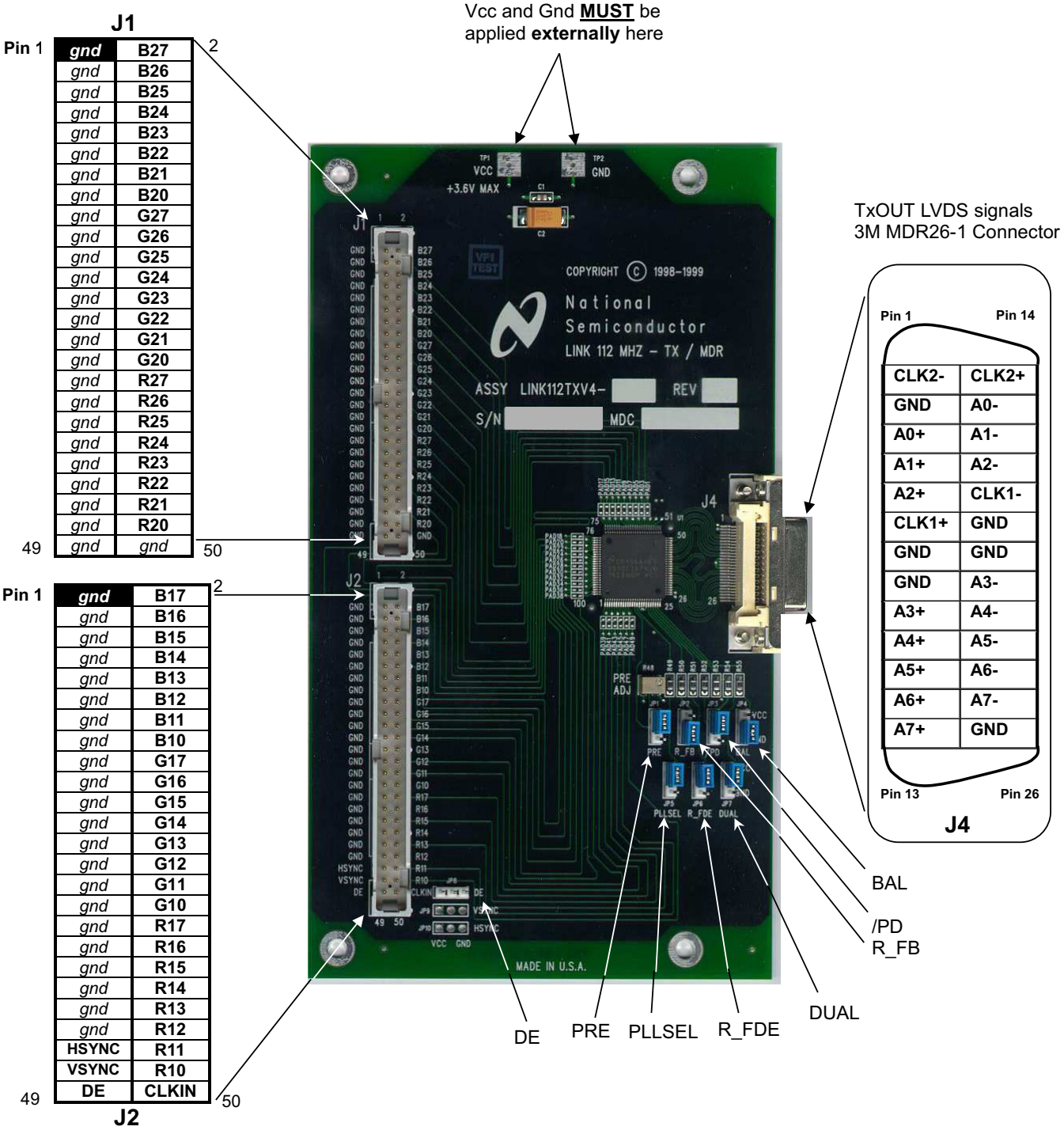
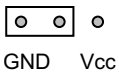
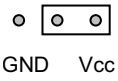
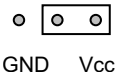
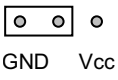
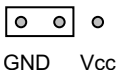
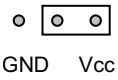
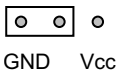
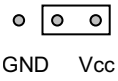
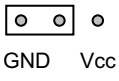
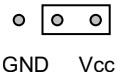
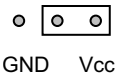
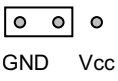
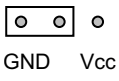
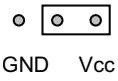



**Figure 2. Transmitter Board**

# 8 Tx Board Jumper Definition

**Table 1. Tx Board Jumper Definition(1)**

| Jumper | Purpose | Settings |
|---|---|---|
| PRE (JP1) | **PRE**-emphasis |  = NONE  = ON<br>GND Vcc GND Vcc<br>(NONE: NO pre-emphasis; ON: pre-emphasis is adjusted through R48) When NO jumper is used, pre-emphasis is at 0.7 V value. |
| R_FB (JP2) | **R**ising or **F**alling Data Strobe |  = Rising  = Falling<br>GND Vcc GND Vcc |
| /PD (JP3) | **P**ower **D**own |  = OFF  = ON<br>GND Vcc GND Vcc<br>(OFF: Tx powers down; ON: Tx is operational) |
| BAL (JP4) | DC **BAL**ance |  = OFF  = ON<br>GND Vcc GND Vcc<br>(Old Mode DC Balance OFF; New Mode DC Balance ON) |
| PLLSEL (JP5) | **PLL SEL**ect (auto-range) |  = LOW  = High<br>GND Vcc GND Vcc<br>(LOW: auto-range OFF; HIGH: auto-range ON) |
| R_FDE (JP6) | **R**ising or **F**alling **D**ata **E**nable(1) |  = Rising  = Falling<br>GND Vcc GND Vcc |
| DUAL (JP7) | **DUAL**/single mode |  = Single  = Dual<br>GND Vcc GND Vcc<br>(When NO jumper is used, it is in Single to Dual Mode.) |

(1) In Old Mode, the R_FDE pin is ignored by both the Tx and Rx when operating in Single (DUAL=LOW) or DUAL (DUAL=HIGH) mode. When the transmitter is operating in Single-to-Dual Mode (DUAL=1/2 Vcc), the R_FDE pin must be set HIGH if active data when DE signal is HIGH. In New Mode, R_FDE pins of both Tx and Rx boards MUST set to HIGH if DE signal is High during active data. R_FDE pins must set to LOW when DE signal is LOW during active data.

## 9 Tx Board Jumper Default Settings

The default setting for the Tx board is set to Old Mode, Dual-pixel mode and with pre-emphasis.

**Table 2. Tx Board Jumper Default Settings[1]**

| Jumper Name | Purpose | Settings | Jumper Number |
|---|---|---|---|
| PRE | **PRE**-emphasis[1] | GND Vcc | JP1 |
| R_FB | **R**ising or **F**alling Data Strobe | GND Vcc | JP2 |
| /PD | **P**ower **D**own | GND Vcc | JP3 |
| BAL | DC **BAL**ance (Old Mode) | GND Vcc | JP4 |
| PLLSEL | **PLL SEL**ect (auto-range) | GND Vcc | JP5 |
| R_FDE | **R**ising or **F**alling **D**ata **E**nable | GND Vcc | JP6 |
| DUAL | **DUAL**/single mode | GND Vcc | JP7 |

(1) An adjustable potentiometer (2K Ω) is mounted at location R48. This allows pre-emphasis to be adjusted (only if JP1 has a jumper to VCC). Use a number 1.4mm jewelers screwdriver to adjust R48. Turning clockwise will increase the pre-emphasis value. Turning counterclockwise will decrease the pre-emphasis value. R48 should be adjusted to reduce overshoot. If no jumper is used, the pre-emphasis value will be 0.7 V. See Tx Features and Explanations - Pre-Emphasis for description of feature.

## 10 LVDS Mapping by IDC Connector

The following two figures show how the Tx inputs are mapped to the IDC connector (It is also printed on the demo boards.) and to each of the eight LVDS channels. Note: Refer to AN-1127 for suggested mapping schemes.

### Mapping for Old Mode (Transmitter Board)

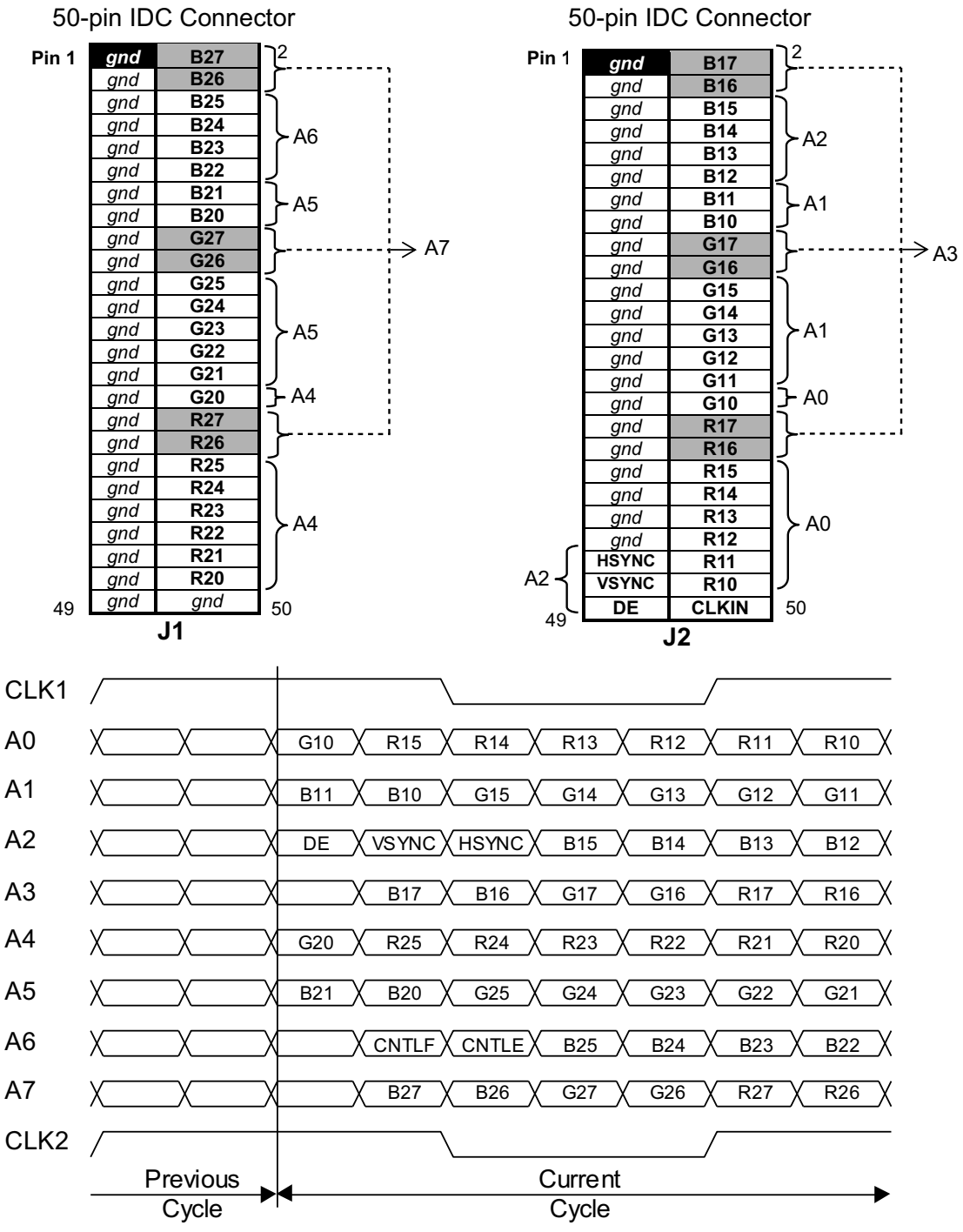
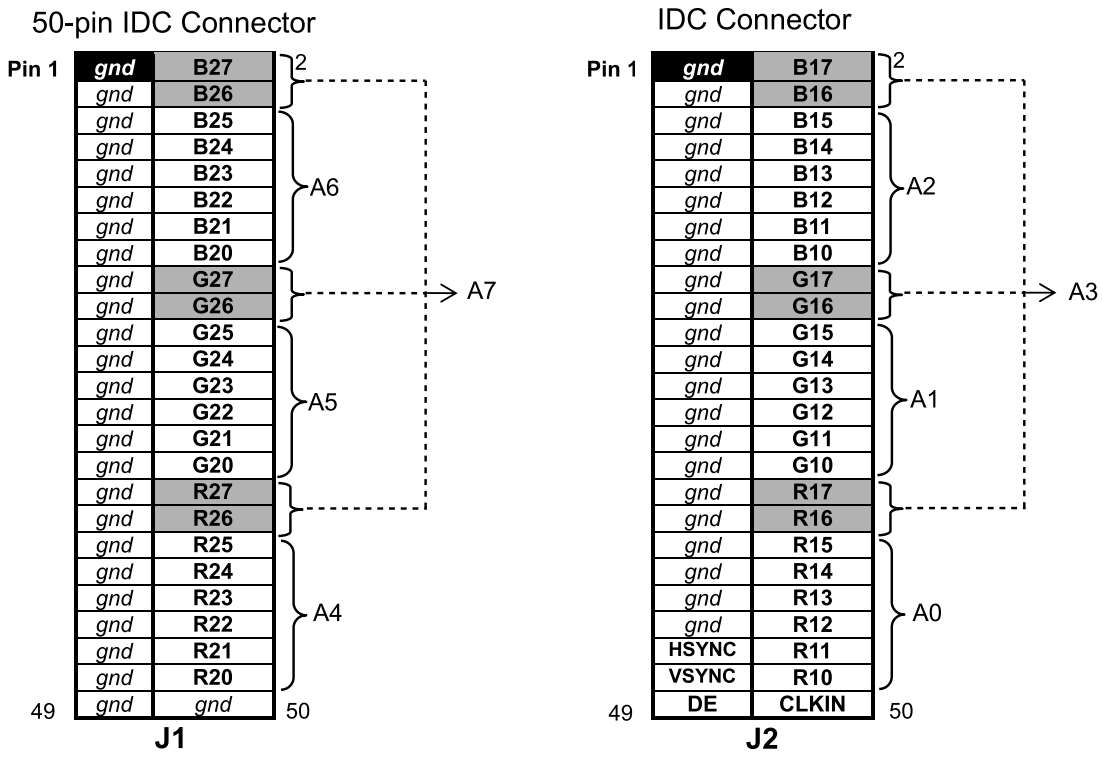



**Figure 3. Mapping for Old Mode (Transmitter Board)**

**Figure 4. Mapping for New Mode (Transmitter Board)**



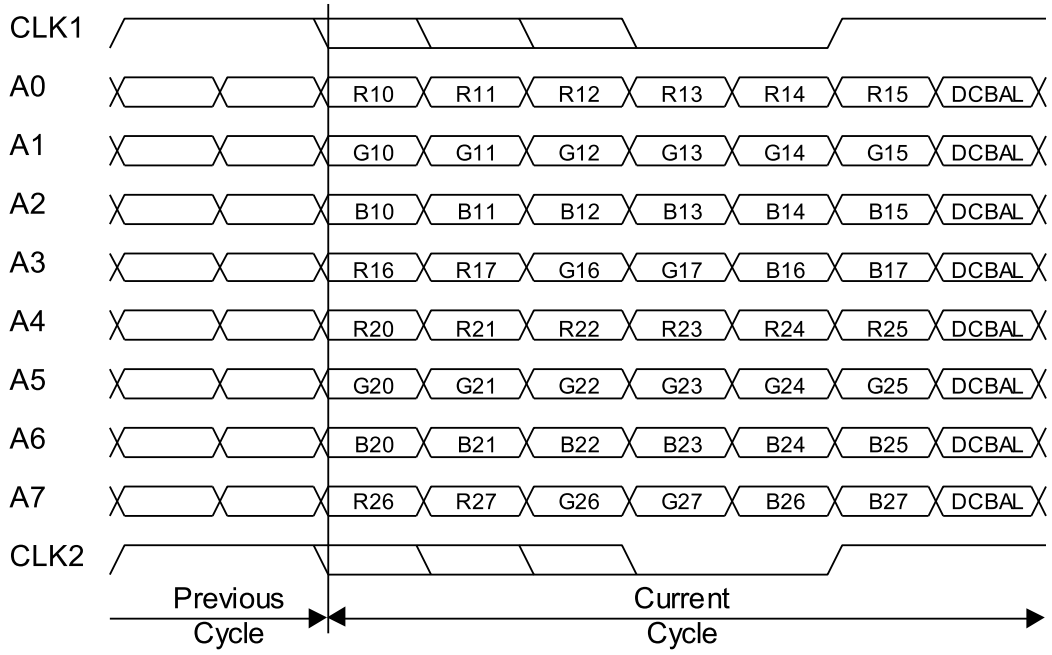




**Figure 5. Mapping for New Mode (Transmitter Board)**

## 11 Tx Optional: Parallel Termination for TxIN

On the Tx demo board, there are 50 inputs that have an 0402 pad on one side and the other side tied to ground. These pads are unpopulated from the factory but are provided if the user needs to adjust the input termination to match the impedance of the input signal. PAD1 TO PAD48 and PAD50 to PAD52 are associated with the Tx data input lines. PAD49 is associated with CLKIN.

Mapping for Transmitter Inputs for the Optional Parallel Termination Resistors:

**Mapping for Transmitter Inputs for the Optional Parallel Termination Resistors**

| Tx Pin Names | Tx Pin Number | Parallel Termination Resistor | | Tx Pin Names | Tx Pin Number | Parallel Termination Resistor |
|---|---|---|---|---|---|---|
| R10 | 10 | PAD48 | | R22 | 80 | PAD22 |
| R11 | 9 | PAD47 | | R23 | 79 | PAD21 |
| R12 | 8 | PAD46 | | R24 | 78 | PAD20 |
| R13 | 7 | PAD45 | | R25 | 77 | PAD19 |
| R14 | 6 | PAD44 | | R26 | 76 | PAD18 |
| R15 | 5 | PAD43 | | R27 | 75 | PAD17 |
| R16 | 4 | PAD42 | | G20 | 74 | PAD16 |
| R17 | 3 | PAD41 | | G21 | 73 | PAD15 |
| G10 | 2 | PAD40 | | G22 | 72 | PAD14 |
| G11 | 1 | PAD39 | | G23 | 71 | PAD13 |
| G12 | 100 | PAD38 | | G24 | 70 | PAD12 |
| G13 | 99 | PAD37 | | G25 | 69 | PAD11 |
| G14 | 96 | PAD36 | | G26 | 66 | PAD10 |
| G15 | 95 | PAD35 | | G27 | 65 | PAD9 |
| G16 | 94 | PAD34 | | B20 | 64 | PAD8 |
| G17 | 93 | PAD33 | | B21 | 63 | PAD7 |
| B10 | 92 | PAD32 | | B22 | 62 | PAD6 |
| B11 | 91 | PAD31 | | B23 | 61 | PAD5 |
| B12 | 90 | PAD30 | | B24 | 60 | PAD4 |
| B13 | 89 | PAD29 | | B25 | 59 | PAD3 |
| B14 | 88 | PAD28 | | B26 | 58 | PAD2 |
| B15 | 87 | PAD27 | | B27 | 57 | PAD1 |
| B16 | 86 | PAD26 | | DE | 56 | PAD50 |
| B17 | 85 | PAD25 | | VSYNC | 55 | PAD51 |
| R20 | 84 | PAD24 | | HSYNC | 54 | PAD52 |
| R21 | 81 | PAD23 | | CLKIN | 11 | PAD49 |

## BOM (Bill of Materials)

**LDI3V8BT-112 TX BOM**

| Type | Pattern | Value | Designators |
|---|---|---|---|
| 3M_MDR_D26-1<br>Qty = 1 | | | J4 |
| 3_PIN_HEADER<br>Qty = 10 | .1" spacing | | JP1 JP2 JP3 JP4 JP5 JP6 JP7 JP8 JP9 JP10 |
| 25X2_IDC_CONN<br>Qty = 2 | | | J1 J2 |
| PAD<br>Qty = 52 | 0402 (See previous page) | Optional | PAD1 PAD2 PAD3 PAD4 PAD5 PAD6 PAD7 PAD8 PAD9 PAD10 PAD11 PAD12 PAD13 PAD14 PAD15 PAD16 PAD17 PAD18 PAD19 PAD20 PAD21 PAD22 PAD23 PAD24 PAD25 PAD26 PAD27 PAD28 PAD29 PAD30 PAD31 PAD32 PAD33 PAD34 PAD35 PAD36 PAD37 PAD38 PAD39 PAD40 PAD41 PAD42 PAD43 PAD44 PAD45 PAD46 PAD47 PAD48 PAD49 PAD50 PAD51 PAD52 |
| CAP<br>Qty = 2 | CC0805 | .001uF | C4 C10 |
| CAP<br>Qty = 4 | CC0805 | .01uF | C5 C6 C8 C11 |
| CAP<br>Qty = 5 | CC0805 | .1uF | C1 C3 C7 C9 C12 |
| DS90C387<br>Qty = 1 | | | U1 |
| POT<br>Qty = 1 | | 10 KΩ | R48 |
| RES<br>Qty = 7 | | 10 Ω | R49 R50 R51 R52 R53 R54 R55 |
| TESTPAD_.2"X.2"<br>Qty = 2 | | | TP1 TP2 |
| CAP100P<br>Qty = 4 | CAP100P | 10uF | C2 C13 C14 C15 |

## 12 Receiver Board

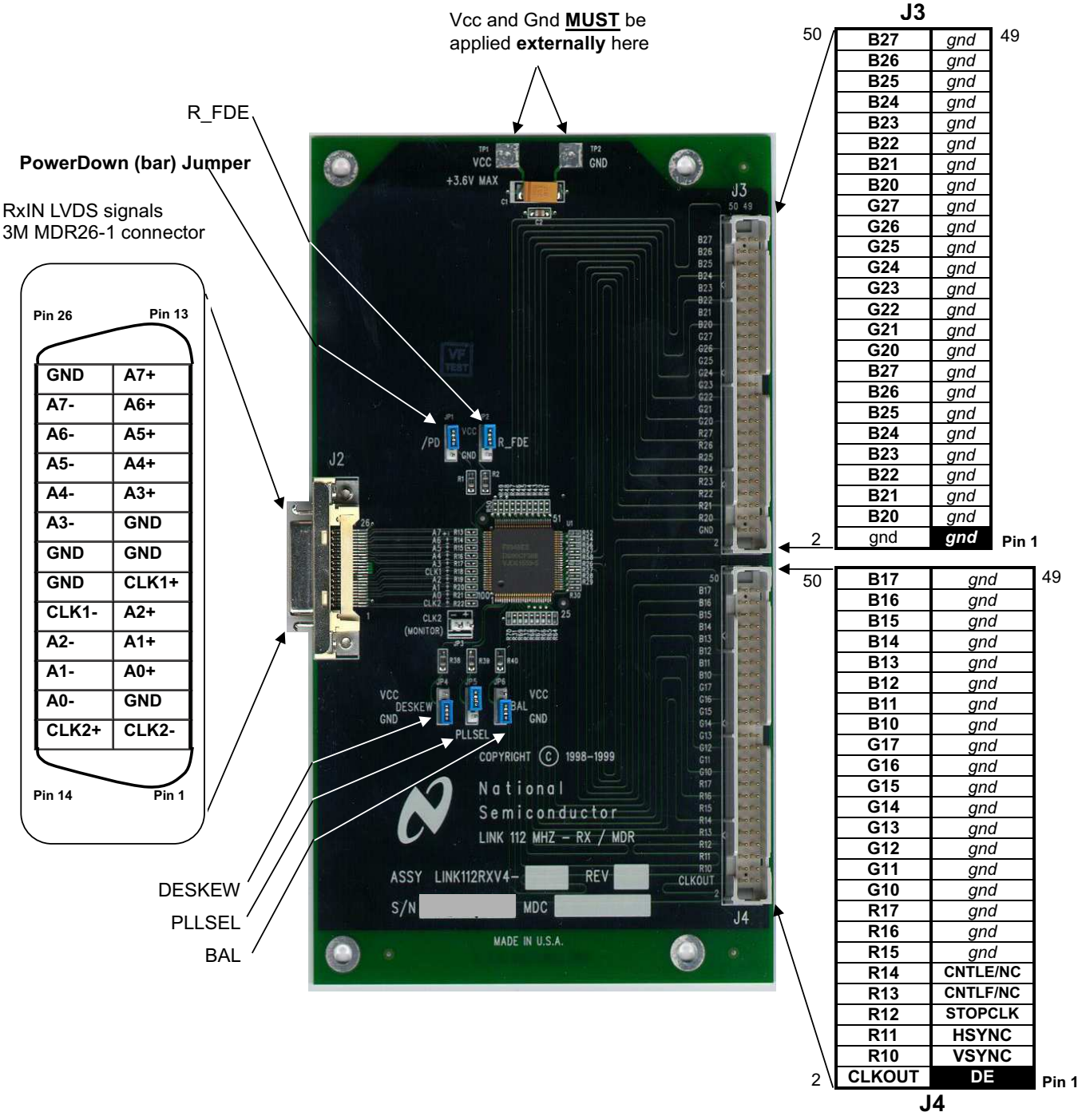
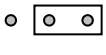
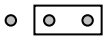
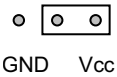
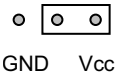
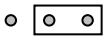



**Figure 6. Receiver Board**

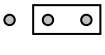
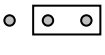
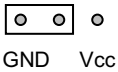
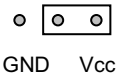
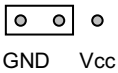
## 13 Rx Board Jumper Definition

**Table 3.**

| Jumper | Purpose | Settings |
|---|---|---|
| /PD (JP1) | **P**ower**D**own |  = OFF GND Vcc  = ON GND Vcc (OFF Tx powers down; ON Tx is operational) |
| R_FDE (JP2) | **R**ising or **F**alling **D**ata **E**nable |  = Falling GND Vcc  = Rising GND Vcc |
| DESKEW (JP4) | **DESKEW** |  = OFF GND Vcc  = ON GND Vcc |
| PLLSEL (JP5) | **PLL SEL**ect (auto range) |  = OFF GND Vcc  = ON GND Vcc |
| BAL (JP6) | DC **BAL**ance |  = OFF GND Vcc  = ON GND Vcc (Old Mode DC Balance OFF; New Mode DC Balance ON) |

## 14 Rx Board Jumper Default Settings

**Table 4.**

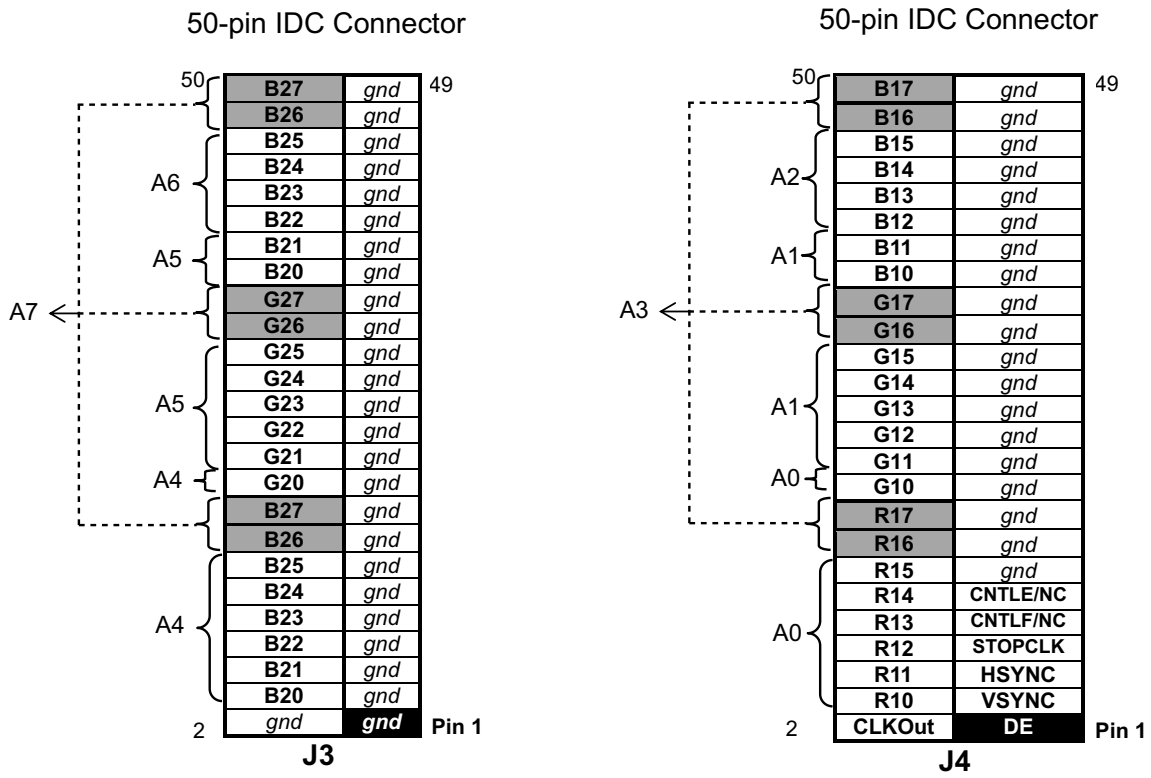
| Jumper | Purpose | Settings | Jumper Number |
|---|---|---|---|
| /PD | **P**ower**D**own -- ON (Part is enabled) |  GND Vcc | JP1 |
| R_FDE | **R**ising or **F**alling **D**ata **E**nable |  GND Vcc | JP2 |
| DESKEW | **DESKEW** |  GND Vcc | JP4 |
| PLLSEL | **PLL SEL**ect (auto range) |  GND Vcc | JP5 |
| BAL | DC **BAL**ance |  GND Vcc | JP6 |

## 15 LVDS Mapping by IDC Connector

The following two figures show how the Rx outputs are mapped to the IDC connector and to each of the eight LVDS channels.

**Note**: Refer to AN-1127 for suggested mapping schemes.

**Figure 7. Mapping for Old Mode (Receiver Board)**



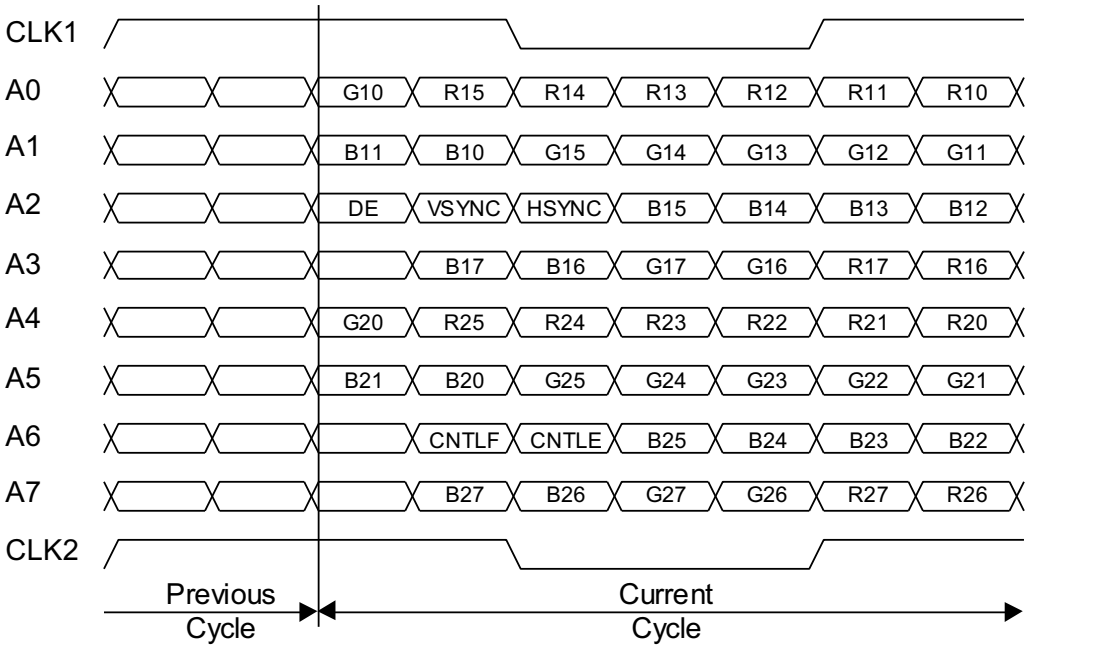
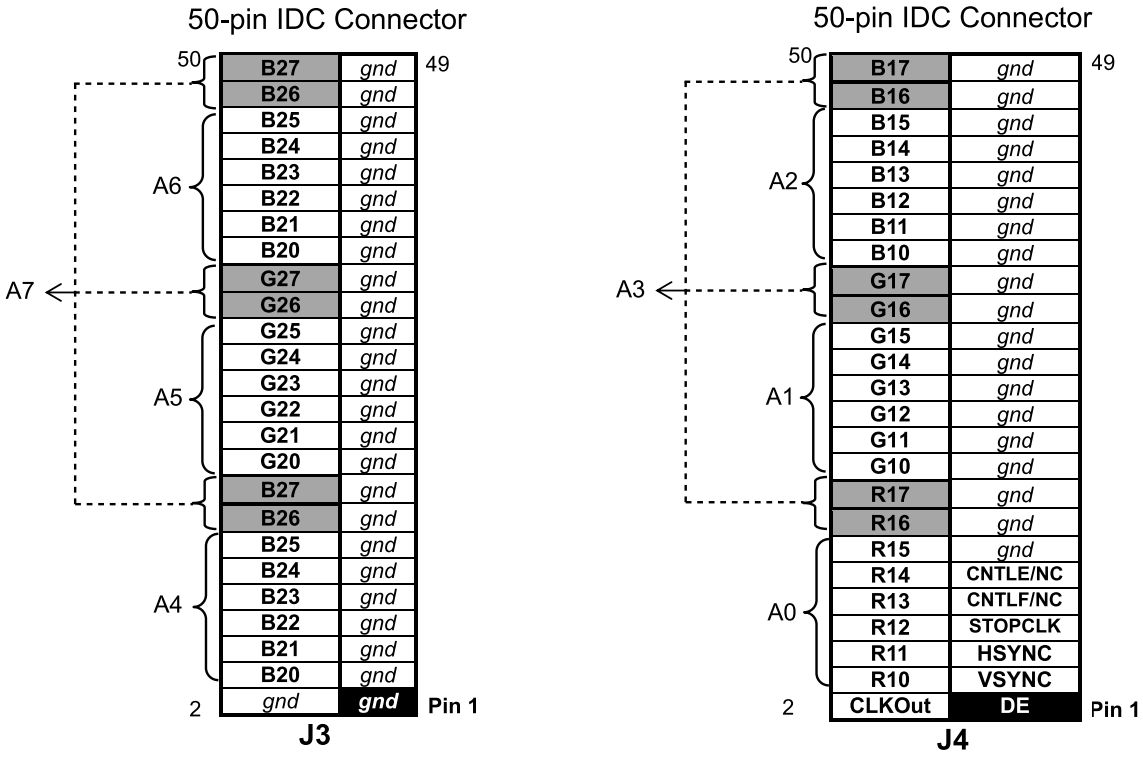




**Figure 8. Mapping for Old Mode (Receiver Board)**

**Mapping for New Mode (Receiver Board)**



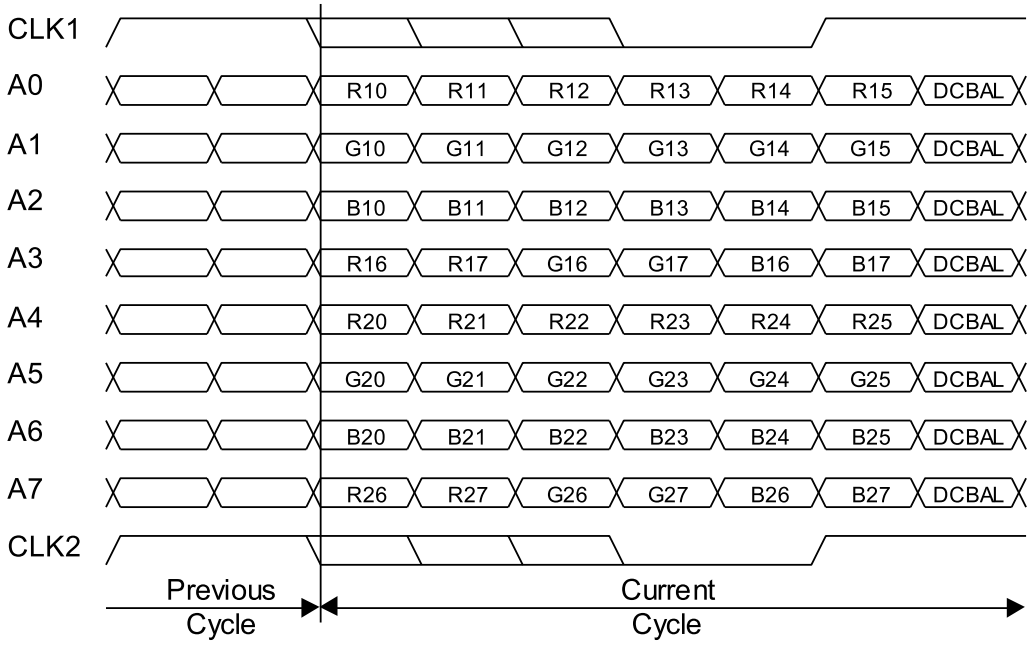




**Figure 9.**

## Rx Optional: Series Termination for RxOut

On the Rx demo board there are 49 outputs that have an 0402 pad in series (but shorted). These pads are unpopulated from the factory but are provided if the user needs to adjust the output series termination to match the impedance of an input line the user must cut the short out before mounting a series resistor. R6-R12, R24-R37, R41-R70 are associated with the DATA input lines. R23 is associated with CLKOUT.

| Rx Pin Names | Rx Pin Number | Parallel Termination Resistor | | Rx Pin Names | Rx Pin Number | Parallel Termination Resistor |
|---|---|---|---|---|---|---|
| R10 | 8 | R70 | | R24 | 43 | R56 |
| R11 | 9 | R31 | | R25 | 46 | R55 |
| R12 | 10 | R69 | | R26 | 47 | R54 |
| R13 | 11 | R32 | | R27 | 48 | R53 |
| R14 | 12 | R68 | | G20 | 49 | R52 |
| R15 | 14 | R33 | | G21 | 50 | R51 |
| R16 | 15 | R67 | | G22 | 51 | R41 |
| R17 | 17 | R34 | | G23 | 52 | R12 |
| G10 | 18 | R66 | | G24 | 53 | R42 |
| G11 | 19 | R35 | | G25 | 55 | R11 |
| G12 | 20 | R65 | | G26 | 57 | R43 |
| G13 | 21 | R36 | | G27 | 58 | R10 |
| G14 | 22 | R64 | | B20 | 59 | R44 |
| G15 | 24 | R37 | | B21 | 60 | R9 |
| G16 | 26 | R30 | | B22 | 61 | R45 |
| G17 | 27 | R63 | | B23 | 62 | R8 |
| B10 | 28 | R29 | | B24 | 64 | R46 |
| B11 | 29 | R62 | | B25 | 65 | R7 |
| B12 | 30 | R28 | | B26 | 67 | R47 |
| B13 | 31 | R61 | | B27 | 68 | R6 |
| B14 | 32 | R27 | | DE | 69 | R48 |
| B15 | 34 | R60 | | VSYNC | 70 | R5 |
| B16 | 36 | R26 | | HSYNC | 71 | R49 |
| B17 | 37 | R59 | | STOPCLK | 73 | R4 |
| R20 | 38 | R58 | | CNTLF/NC | 74 | R50 |
| R21 | 39 | R25 | | CNTLE/NC | 75 | R3 |
| R22 | 40 | R57 | | | | |
| R23 | 41 | R24 | | CLKOUT | 42 | R23 |

## BOM (Bill of Materials)

### LDI3V8BT-112 RX BOM

| Type | Pattern | Value | Designators |
|---|---|---|---|
| 2_PIN_HEADER<br>Qty = 1 | .1" spacing | | JP3 |
| 3M_MDR_D26--1<br>Qty = 1 | | | J2 |
| 3_PIN_HEADER<br>Qty = 5 | .1" spacing | | JP1 JP2 JP4 JP5 JP6 |
| 25X2_IDC_R<br>Qty = 2 | | | J3 J4 |
| PAD<br>Qty = 6 | 402 | Shorted | PAD1 PAD2 PAD3 PAD4 PAD5 PAD6 |
| CAP<br>Qty = 2 | CC0805 | .001 uF | C4 C10 |
| Qty = 4 | CC0805 | .01 uF | C5 C6 C8 C11 |
| Qty = 5 | CC0805 | .1 uF | C2 C3 C7 C9 C12 |
| DS90CF388<br>Qty = 1 | | | U1 |
| R0402<br>Qty = 55 | Optional<br>(See previous page) | | R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37 R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55 R56 R57 R58 R59 R60 R61 R62 R63 R64 R65 R66 R67 R68 R69 R70 |
| RES<br>Qty = 10 | | 100 Ω | R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 |
| Qty = 5 | | 10 Ω | R1 R2 R38 R39 R40 |
| TESTPAD_.2"X.2"<br>Qty = 2 | | | TP1 TP2 |
| CAP100P<br>Qty = 4 | CAP100P | 10 uF | C1 C13 C14 C15 |

## Jumper Setting Examples 1 (Old Mode)

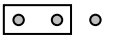
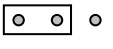
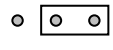
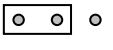
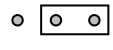
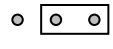
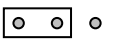
The LDI chipset supports up to 24-bit single pixel and 24-bit dual pixel formats. The following examples show how to set the jumpers for a specific pixel format in Old Mode.

## 18-bit or 24-bit Single Pixel (Old Mode)

The jumper settings below are for Old Mode, Single to Single pixel application.

**For Tx board:** (**For Rx board** jumper settings in this application, see Rx Board Jumper Default Settings)

**Tx Board settings**[1][2]

| Jumper | Purpose | Settings | Jumper Number |
|---|---|---|---|
| PRE | **PRE**-Emphasis[3] |  GND Vcc | JP1 |
| R_FB | **R**ising or **F**alling data strobe |  GND Vcc | JP2 |
| /PD | **P**ower**D**own |  GND Vcc | JP3 |
| BAL | DC **BAL**ance |  GND Vcc | JP4 |
| PLLSEL | **PLL SEL**ect (auto range) |  GND Vcc | JP5 |
| R_FDE | **R**ising or **F**alling **D**ata **E**nable[4] |  GND Vcc | JP6 |
| DUAL | **DUAL**/single mode |  GND Vcc | JP7 |

(1) In the single pixel mode, only TxOUT0 through TxOUT3 (LVDS channels A0-A3) and their associated inputs are active. TxOUT4 through TxOUT7 and their associated inputs and CLK2 are disabled for power savings.

(2) "Old Mode" is backward compatible to existing FPD-Link technology.

(3) An adjustable potentiometer (2K ohm) is mounted at location R48. This allows pre- emphasis to be adjusted (only if JP1 has a jumper to VCC). Use a number 1.4mm jewelers screwdriver to adjust R48. Turning clockwise will increase the pre-emphasis value. Turning counterclockwise will decrease the pre-emphasis value. R48 should be adjusted to reduce overshoot. If no jumper is used, the pre-emphasis value will be 0.7 V. See Section 3.1.1 for description of feature.

(4) In Old Mode, R_FDE can be set HIGH or LOW.

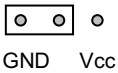
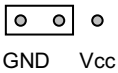
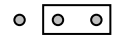
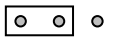
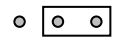
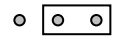
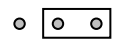
## 18-bit or 24-bit Dual Pixel (Old Mode)

(Default Setting from the factory)

The jumper settings below are for Old Mode, Dual to Dual pixel application.

**For Tx board:** (**For Rx board** jumper settings in this application, see Rx Board Jumper Settings).

**18-bit or 24-bit Dual Pixel (Old Mode)**

| Jumper | Purpose | Settings | Jumper Number |
|---|---|---|---|
| PRE | **PRE**-Emphasis[1] |  GND Vcc | JP1 |
| R_FB | **R**ising or **F**alling data strobe |  GND Vcc | JP2 |
| /PD | **P**ower**D**own |  GND Vcc | JP3 |
| BAL | DC **BAL**ance |  GND Vcc | JP4 |
| PLLSEL | **PLL SEL**ect (auto range) |  GND Vcc | JP5 |
| R_FDE | **R**ising or **F**alling **D**ata **E**nable[2] |  GND Vcc | JP6 |
| DUAL | **DUAL**/single mode |  GND Vcc | JP7 |

(1) An adjustable potentiometer (2K ohm) is mounted at location R48. This allows pre- emphasis to be adjusted (only if JP1 has a jumper to VCC). Use a number 1.4mm jewelers screwdriver to adjust R48. Turning clockwise will increase the pre-emphasis value. Turning counterclockwise will decrease the pre-emphasis value. R48 should be adjusted to reduce overshoot. If no jumper is used, the pre-emphasis value will be 0.7V. See Section 3.1.1 for description of feature.

(2) In Old Mode, R_FDE can be set HIGH or LOW.

## Jumper Setting Example 2 (New Mode)

The LDI chipset supports up to 24-bit single pixel and 24-bit dual pixel formats. The following examples show how to set the jumper for a specific pixel format in New Mode.

### 18-bit or 24-bit Single Pixel (New Mode)

The jumper settings below are for New Mode, Single to Single pixel application.

**For Tx board**: (**The Rx board** jumper settings in this application is the same as Rx Board Jumper Default Settings except the BAL pin(JP6), which must be set to Vcc.)

**Table 5. 18-bit or 24-bit Single Pixel (New Mode)(1)**

| Jumper | Purpose | Settings | Jumper Number |
|---|---|---|---|
| PRE | **PRE**-Emphasis(2) | GND Vcc | JP1 |
| R_FB | **R**ising or **F**alling data strobe | GND Vcc | JP2 |
| /PD | **P**ower**D**own | GND Vcc | JP3 |
| BAL | DC **BAL**ance | GND Vcc | JP4 |
| PLLSEL | **PLL SEL**ect (auto range) | GND Vcc | JP5 |
| R_FDE | **R**ising or **F**alling **D**ata **E**nable(3) | GND Vcc | JP6 |
| DUAL | **DUAL**/single mode | GND Vcc | JP7 |

(1) In the single pixel mode, only TxOUT0 through TxOUT3 (LVDS channels A0-A3) and their associated inputs are active. TxOUT4 through TxOUT7 and their associated inputs and CLK2 are disabled for power savings.

(2) An adjustable potentiometer (2K Ω) is mounted at location R48. This allows pre- emphasis to be adjusted (only if JP1 has a jumper to VCC). Use a number 1.4mm jewelers screwdriver to adjust R48. Turning clockwise will increase the pre-emphasis value. Turning counterclockwise will decrease the pre-emphasis value. R48 should be adjusted to reduce overshoot. If no jumper is used, the pre-emphasis value will be 0.7 V.

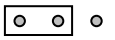
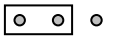
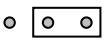
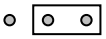
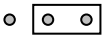
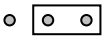
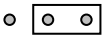
(3) In Balanced Mode (New Mode), R_FDE pin (pin 21) MUST be set to HIGH if DE signal (pin 56) is HIGH during active data. R_FDE pin must set to LOW when DE signal is LOW during active data.

## 16 18-bit or 24-bit Dual Pixel (New Mode)

The jumper settings below are for New Mode, Dual to Dual pixel application.

**For Tx Board:** (**The Rx board** jumper settings in this application is the same as the Rx Board Jumper Default Settings on page 17 except the BAL pin(JP6), which must be set to Vcc.)

**Table 6. 18-bit or 24-bit Dual Pixel (New Mode)**

| Jumper | Purpose | Settings | Jumper Number |
|---|---|---|---|
| PRE | **PRE**-Emphasis[1] |  GND Vcc | JP1 |
| R_FB | **R**ising or **F**alling data strobe |  GND Vcc | JP2 |
| /PD | **P**ower**D**own |  GND Vcc | JP3 |
| BAL | DC **BAL**ance (New Mode) |  GND Vcc | JP4 |
| PLLSEL | **PLL SEL**ect (auto range) |  GND Vcc | JP5 |
| R_FDE | **R**ising or **F**alling **D**ata **E**nable[2] |  GND Vcc | JP6 |
| DUAL | **DUAL**/single mode |  GND Vcc | JP7 |

(1) An adjustable potentiometer (2K ohm) is mounted at location R48. This allows pre-emphasis to be adjusted (only if JP1 has a jumper to VCC). Use a number 1.4mm jewelers screwdriver to adjust R48. Turning clockwise will increase the pre-emphasis value. Turning counterclockwise will decrease the pre-emphasis value. R48 should be adjusted to reduce overshoot. If no jumper is used, the pre-emphasis value will be 0.7V. See Tx Features and Explanations - Pre-Emphasis for description of feature.

(2) In Balanced Mode (New Mode), R_FDE pin (pin 21) MUST be set to HIGH if DE signal (pin 56) is HIGH during active data. R_FDE pin must set to LOW when DE signal is LOW during active data.

# 17 Troubleshooting

If the demo boards are not performing properly, use the following as a guide for quick solutions to common problems. If the problem persists, contact the hotline number listed under Additional Information section of this document.

Check the following:

1. Power and Ground are connected to both Tx AND Rx boards
2. Supply voltage (typical 3.3 V) and current (It's around 200 mA with clock and one data bit at 66 MHz.) are correct.
3. Input clock and input data (It's best to start with one data bit.) to the Tx board.
4. Jumpers are set correctly or to default settings.
5. The 2 meter cable is connecting the Tx and Rx boards.
6. Make sure all of the connections are good.
7. Start with a low clock frequency (40 or 66 MHz) and work from there.

Trouble shooting chart:

**Table 7. Troubleshooting Chart**

| Problem | Solution |
|---|---|
| There is only the output clock. There is no output data. | Make sure the data scramble/mapping is correct.<br>Make sure there is data input. |
| No output data and clock. | Make sure Power is on. Input data and clock are active and connected correctly.<br>Make sure that the 2 meter cable is secured to both demo boards. |
| Power, ground, input data and input clock are connected correctly, but no outputs. | Check the Power Down pins of both boards and make sure the devices are enabled (/PD=ON) for operation. |
| The devices are pulling more than 1A of current. | Check for shorts on the demo boards. |
| After powering up the demo boards, the power supply reads less than 3 V when it is set to 3.3 V. | Use a larger power supply that will provide enough current for the demo boards. |

# 18 Additional Information

For more information on FPD-Link Transmitters/Receivers and other Interface products, refer to the Texas Instruments URL: http://www.ti.com/lsds/ti/analog/interface/interface.page

## *18.1 Application Notes*

- AN-971 An Overview of LVDS technology
- AN-1032 An Introduction to FPD-Link
- AN-1127 LVDS Display Interface TFT Data Mapping for Interoperability with FPD-Link
- AN-1163 TFT Data Mapping for Dual Pixel LDI Application - Alternate A - Color Map
- AN-1085 FPD-Link PCB and Interconnect Design-In Guidelines
- AN-977 LVDS Signal Quality: Jitter measurement using Eye pattern
- AN-977 LVDS Signal Quality: Jitter measurement using Eye pattern
- AN-1059 High Speed Transmission with LVDS Devices

SID'99 LDI Paper:

http://www.ti.com/lit/an/snla168/snla168.pdf

# 19 3M 26-Mini D Ribbon Cable and Connector

The next few pages provide a full description of the cable and connector. For product request please contact 3M.

3M Cable and Connector Data is available at: http://www.mmm.com/Interconnects

## Revision History

| DATE | CHANGES |
|---|---|
| April 2014 | Converted to TI User Guide format. |
| January 2014 | • Removed cables from parts included with the kit.<br>• Updated 3M datasheet information.<br>• Updated contact info and links to reflect TI references. |
| 2001 | Included EVK schematic with documentation. |
| 1999 | • Updated 3M datasheet information.<br>• Updated Transmitter/Receiver Rev 4 demo board schematics. |
| 1999 | The first version of the LDI3V8BT 112MHz evaluation boards documentation. |

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**U.S. Federal Communications Commission Compliance**

**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 could void the user's authority to operate the equipment.

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

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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.

**Industry Canada Compliance (English)**

**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.

**Canada Industry Canada Compliance (French)**

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.

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**EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.**

If user uses EVMs in Japan, user is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs 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 EVMs only after user obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after user obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless user gives the same notice above to the transferee. Please note that if user does not follow the instructions above, user will be subject to penalties of Radio Law of Japan.

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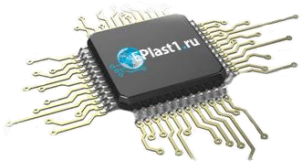


**Как с нами связаться**

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