Application Note	*THAN0146_Rev.1.20_E*

THCV226 Application Note

System Diagram and PCB Design Guideline

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Application Diagrams

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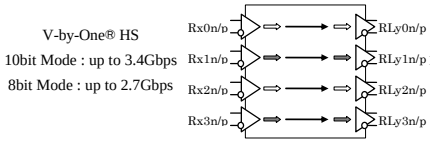
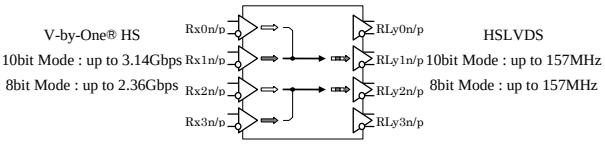
THCV226
 
</td><td>High-speed LVDS Mode
THCV226
 
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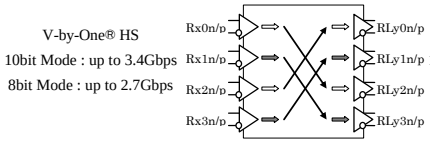
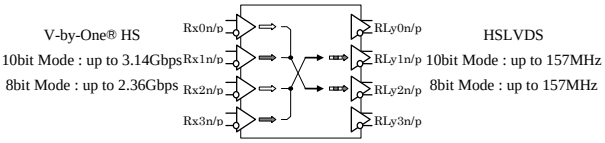
 
</td><td>High-speed LVDS with Crossing Mode
THCV226
 
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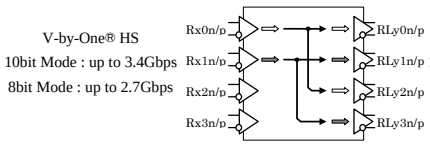
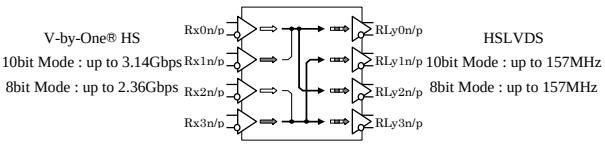
<tr><th>Case5 (See Page8)</th><th>Case6 (See Page9)</th></tr>
<tr><td>Normal LVDS with Distribution Mode 1
THCV226
 
</td><td>High-speed LVDS with Distribution Mode 1
THCV226
 
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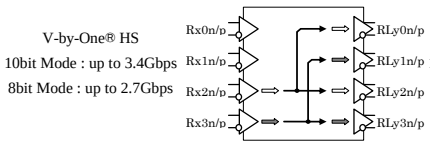
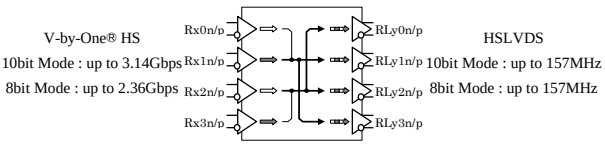
 
</td><td>High-speed LVDS with Distribution Mode 2
THCV226
 
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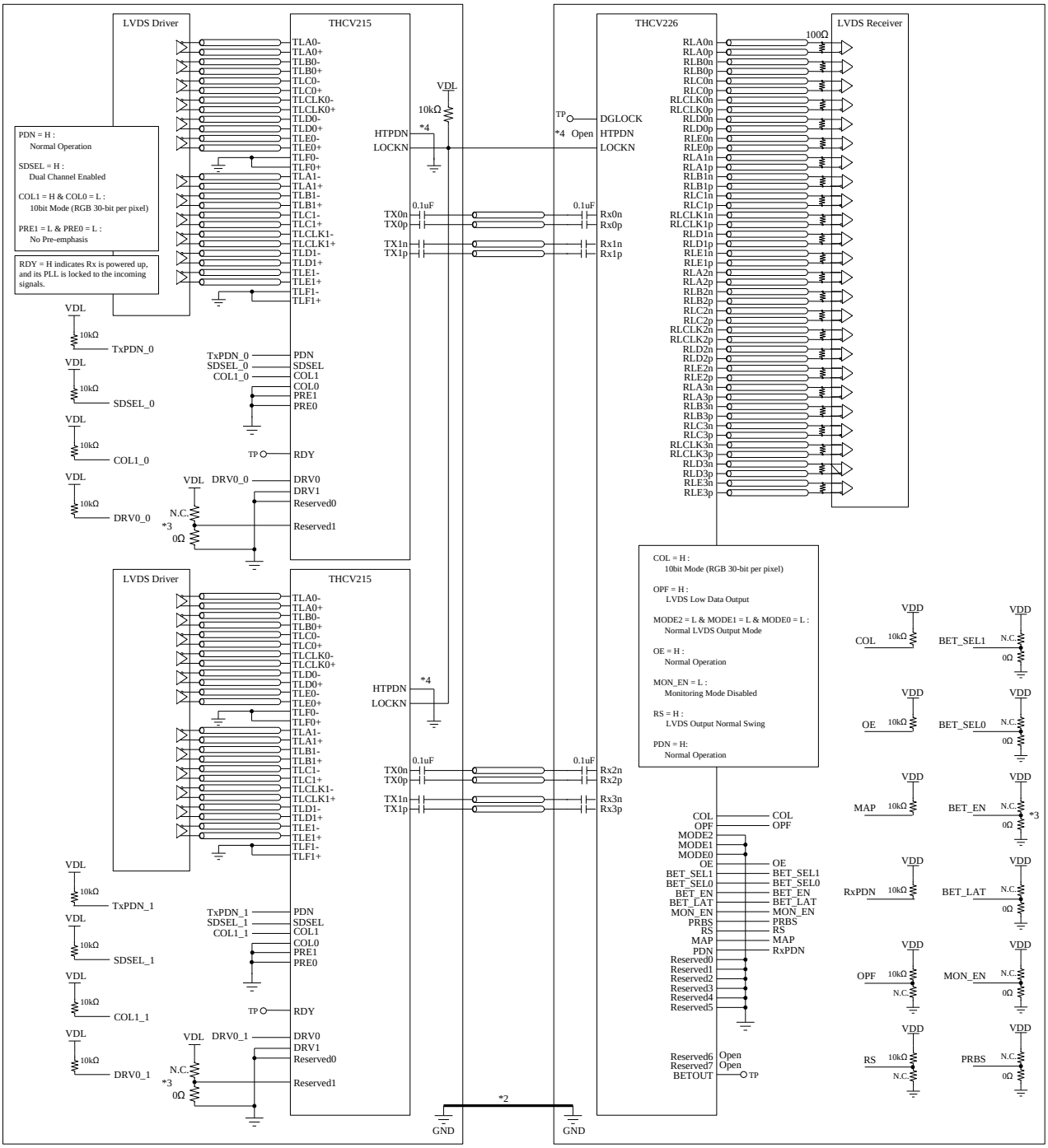
</table>

Application Diagram (Case1)

Normal LVDS Mode / 10bit Mode (RGB 30bit per pixel) / Connected with THCV215



*1 ⊏⊐ indicates microstrip lines or cables with their differential characteristic impedance being 100Ω .

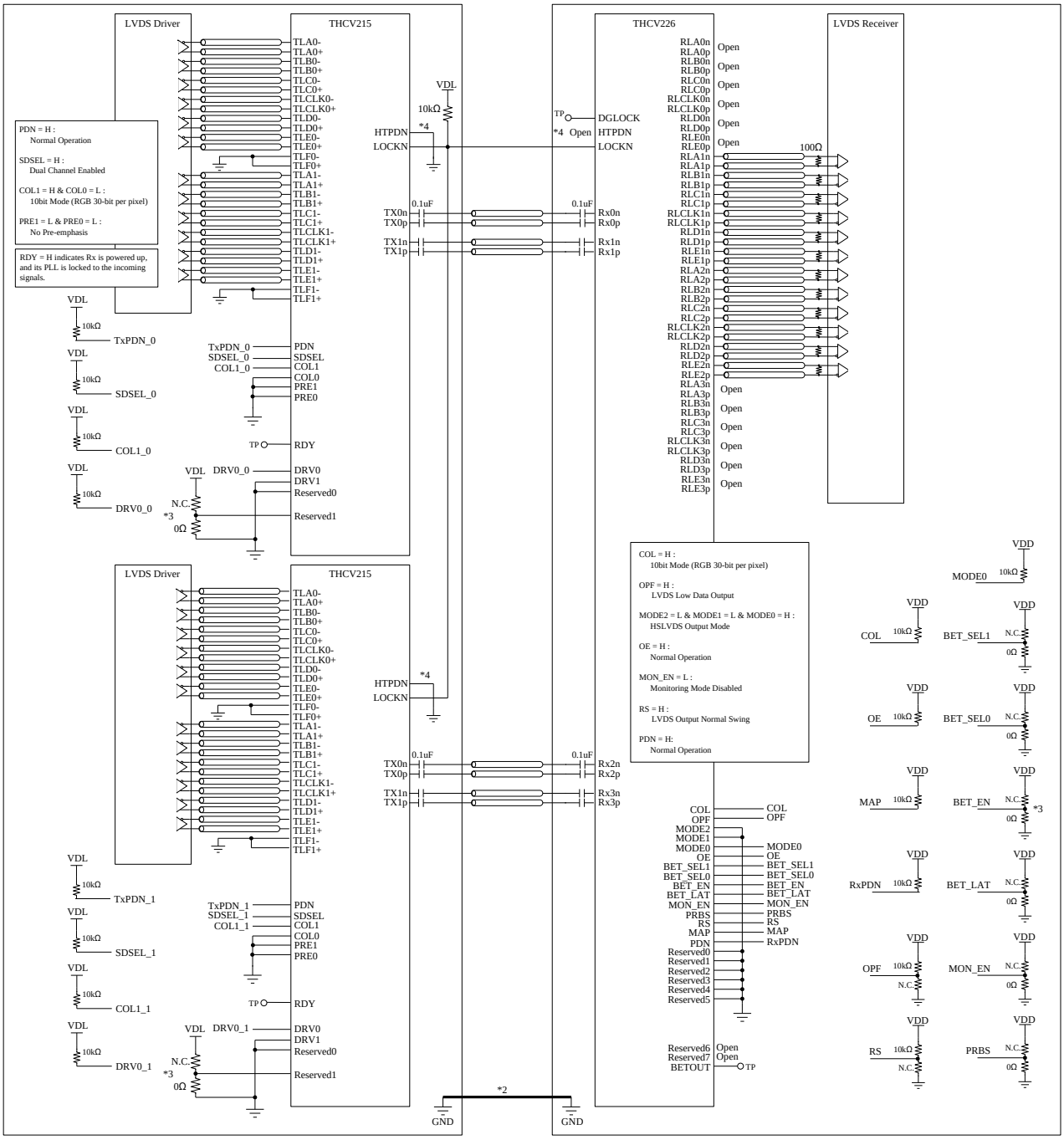
*2 Connect GNDs of both Tx and Rx PCB.

3 Field BET operation. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

4 No HTPDN connection option. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

Application Diagram (Case2)

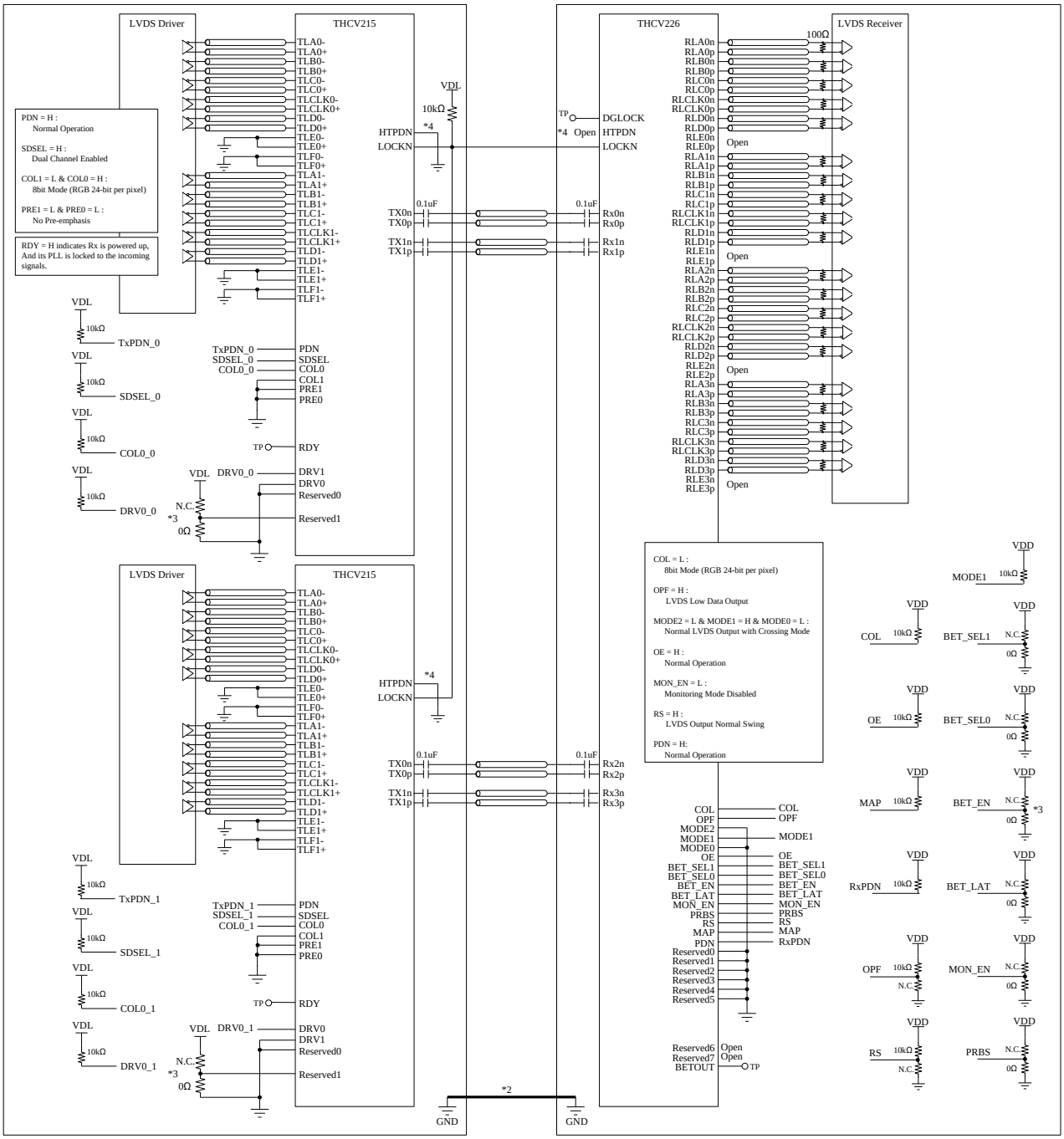
HSLVDS Mode / 10bit Mode (RGB 30bit per pixel) / Connected with THCV215



*1 ⊏⊐ indicates microstrip lines or cables with their differential characteristic impedance being 100Ω .
*2 Connect GNDs of both Tx and Rx PCB.
3 Field BET operation. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)
4 No HTPDN connection option. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

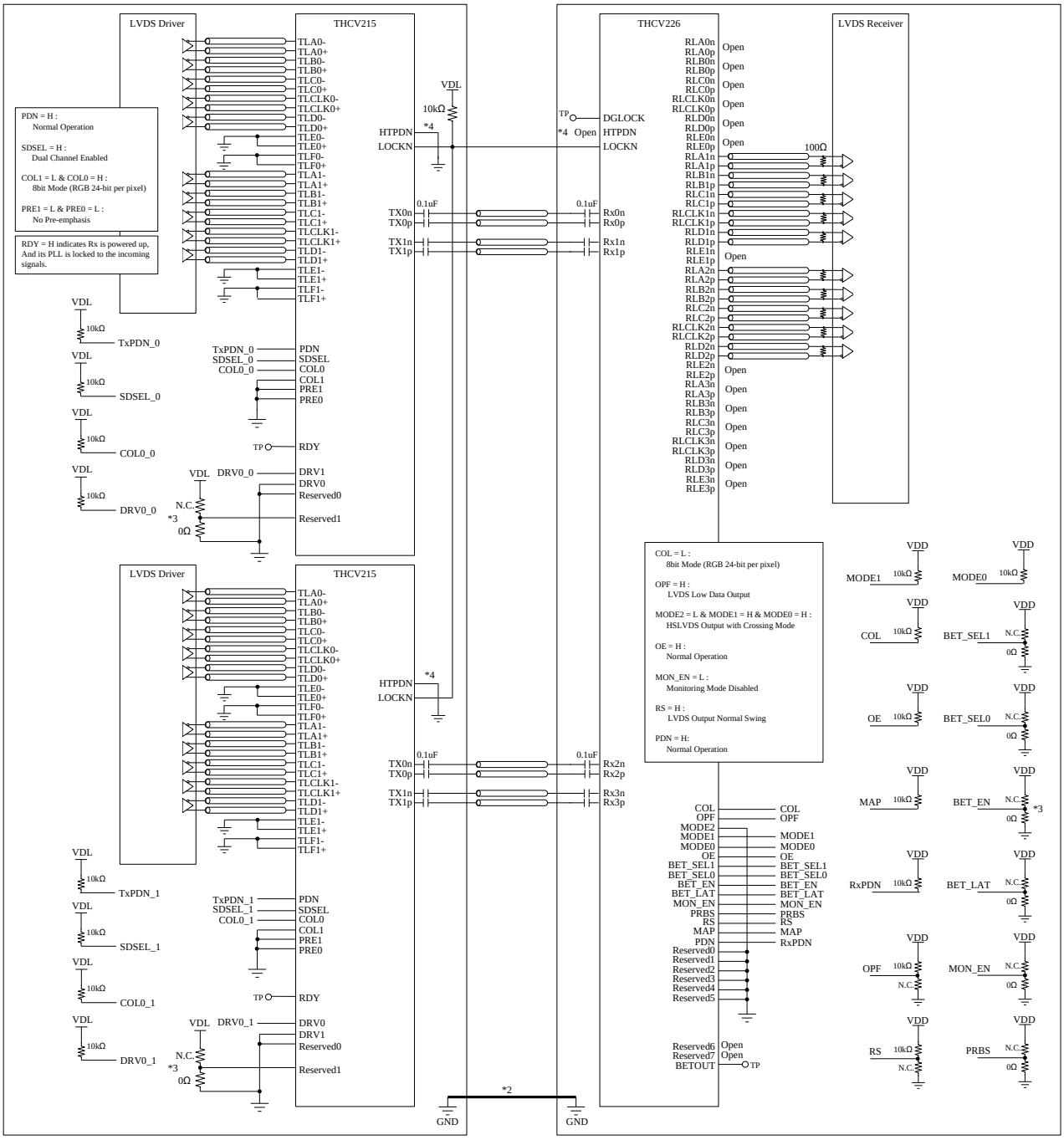
Application Diagram (Case3)

Normal LVDS with Crossing Mode / 8bit Mode (RGB 24bit per pixel) / Connected with THCV215



Application Diagram (Case4)

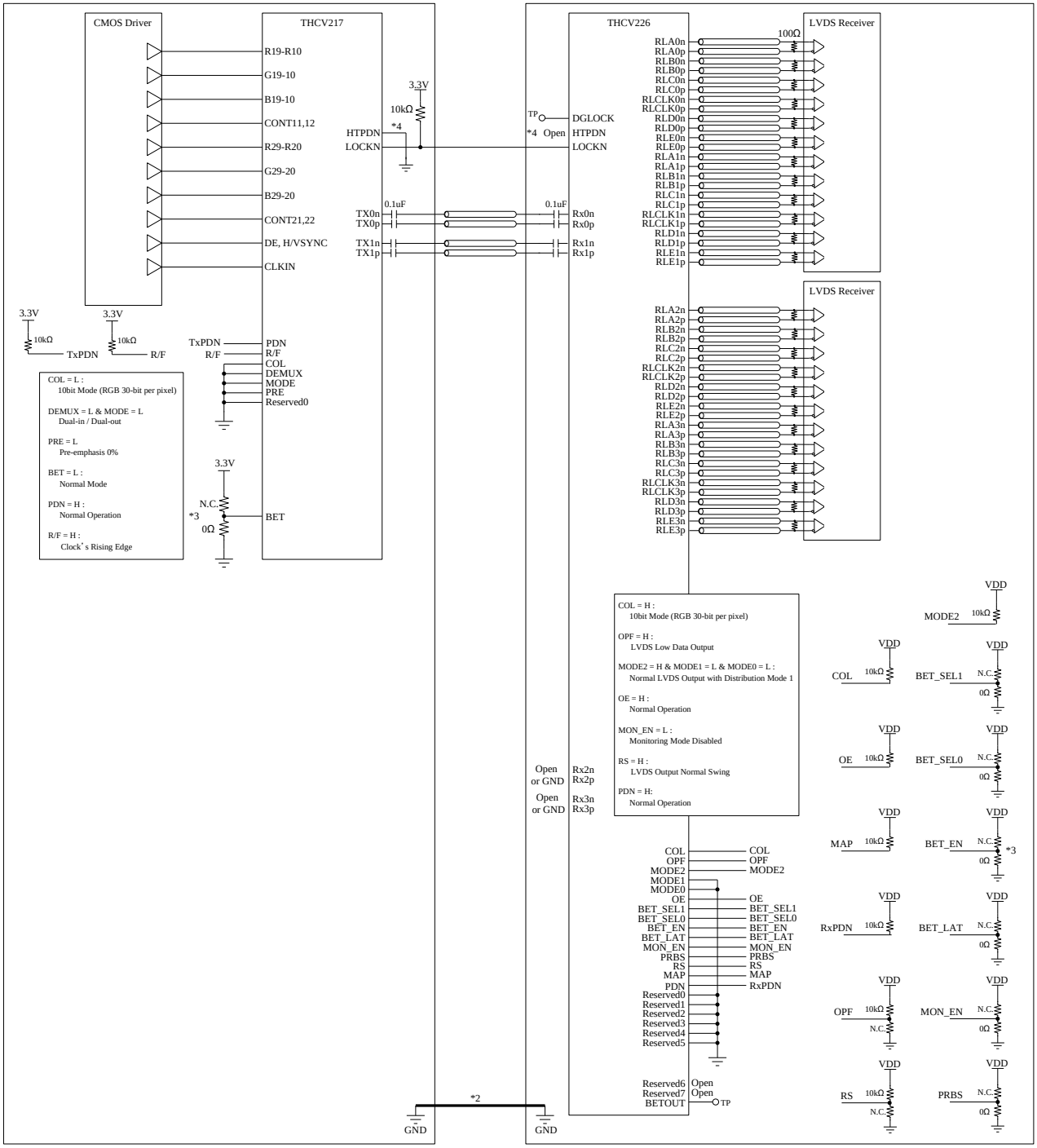
HSLVDS with Crossing Mode / 8bit Mode (RGB 24bit per pixel) / Connected with THCV215



*1 indicates microstrip lines or cables with their differential characteristic impedance being 100Ω .
*2 Connect GNDs of both Tx and Rx PCB.
3 Field BET operation. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)
4 No HTPDN connection option. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

Application Diagram (Case5)

Normal LVDS with Distribution Mode 1 / 10bit Mode (RGB 30bit per pixel) / Connected with THCV217



*1 indicates microstrip lines or cables with their differential characteristic impedance being 100Ω .

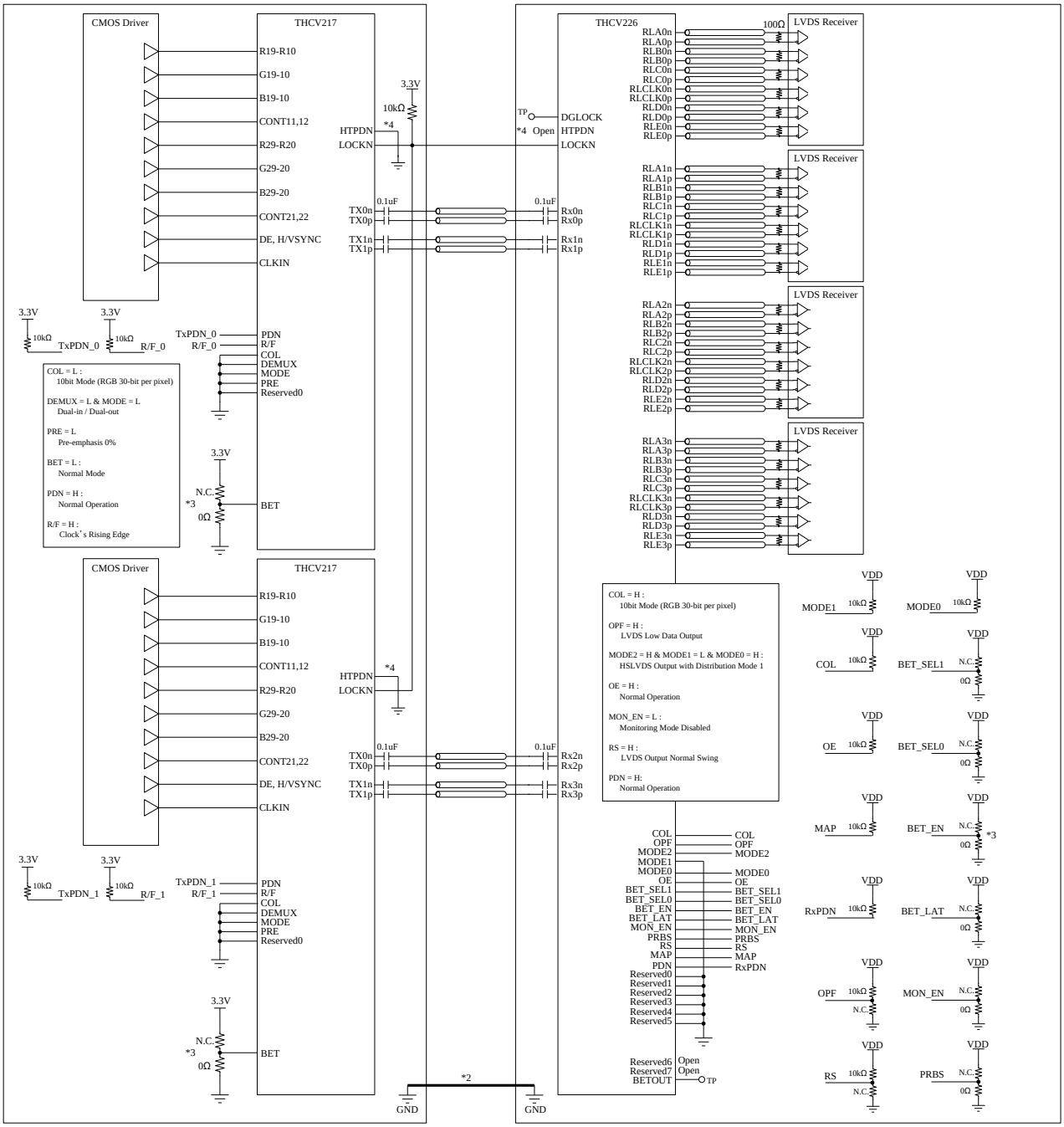
*2 Connect GNDs of both Tx and Rx PCB.

3 Field BET operation. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

4 No HTPDN connection option. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

Application Diagram (Case6)

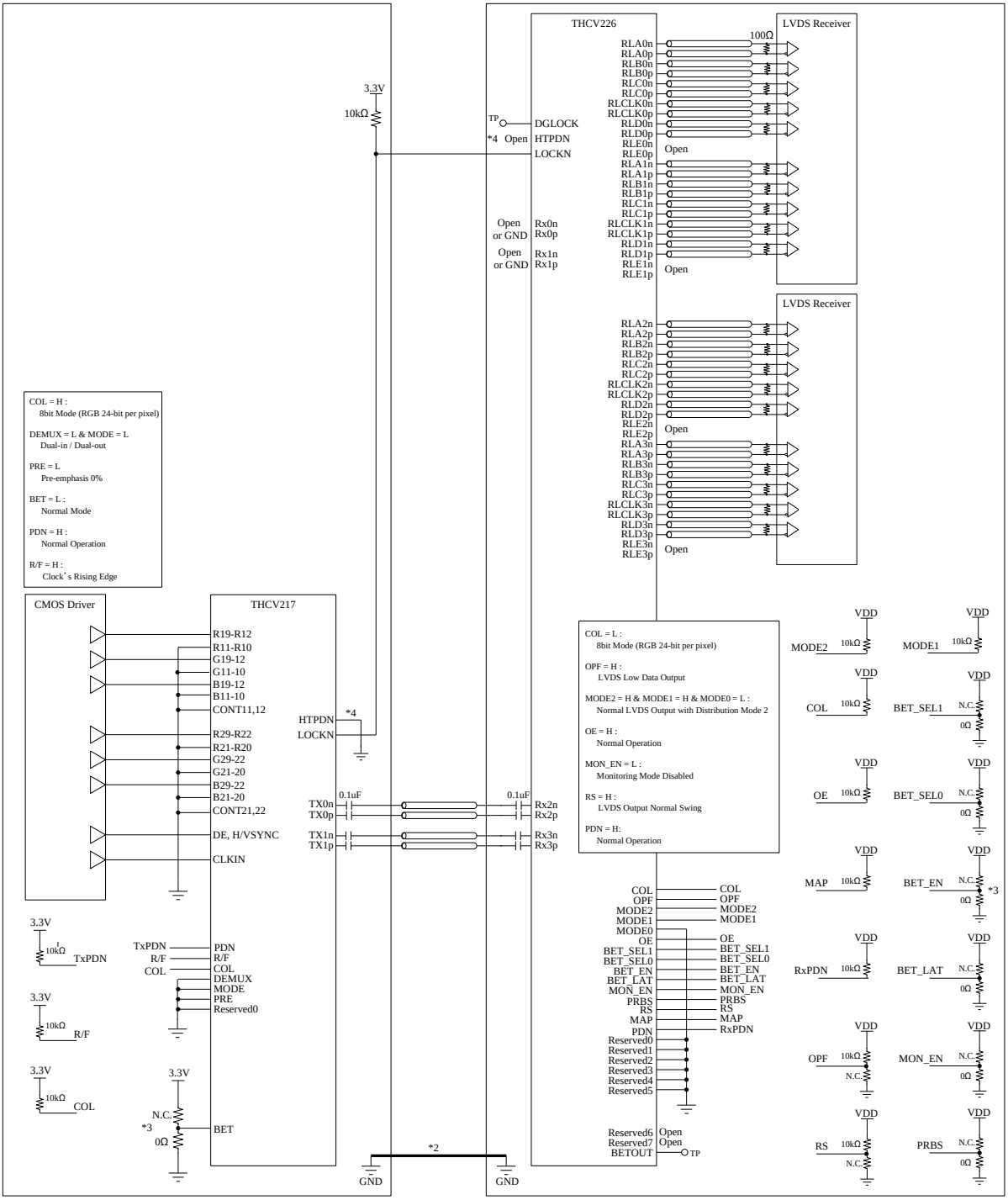
HSLVDS with Distribution Mode 1 / 10bit Mode (RGB 30bit per pixel) / Connected with THCV217



*1 ═══ indicates microstrip lines or cables with their differential characteristic impedance being 100Ω .
*2 Connect GNDs of both Tx and Rx PCB.
3 Field BET operation. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)
4 No HTPDN connection option. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

Application Diagram (Case7)

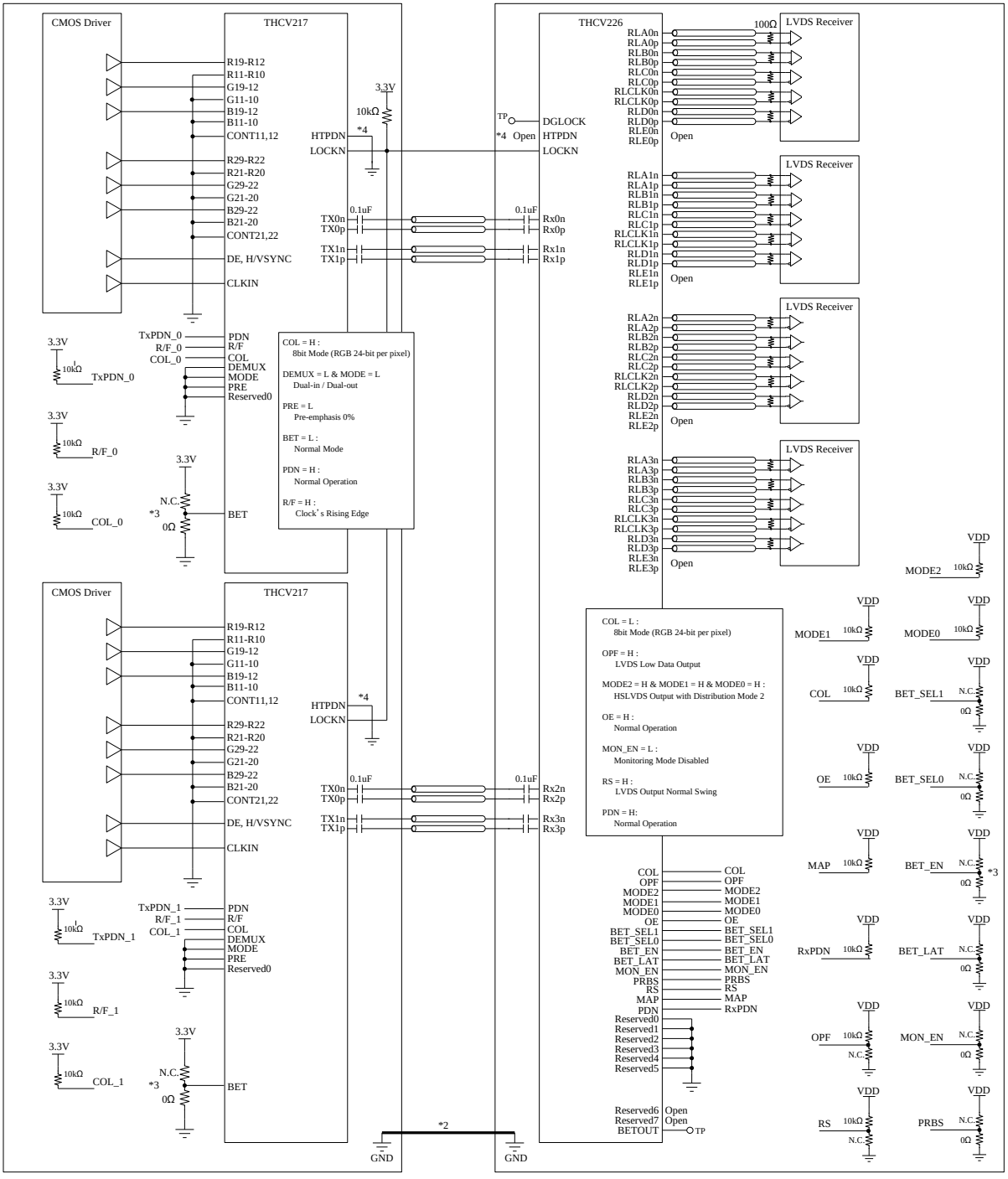
Normal LVDS with Distribution Mode 2 / 8bit Mode (RGB 24bit per pixel) / Connected with THCV217



*1 indicates microstrip lines or cables with their differential characteristic impedance being 100Ω .
*2 Connect GNDs of both Tx and Rx PCB.
3 Field BET operation. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)
4 No HTPDN connection option. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

Application Diagram (Case8)

HSLVDS with Distribution Mode 2 / 8bit Mode (RGB 24bit per pixel) / Connected with THCV217



*1 indicates microstrip lines or cables with their differential characteristic impedance being 100Ω .

*2 Connect GNDs of both Tx and Rx PCB.

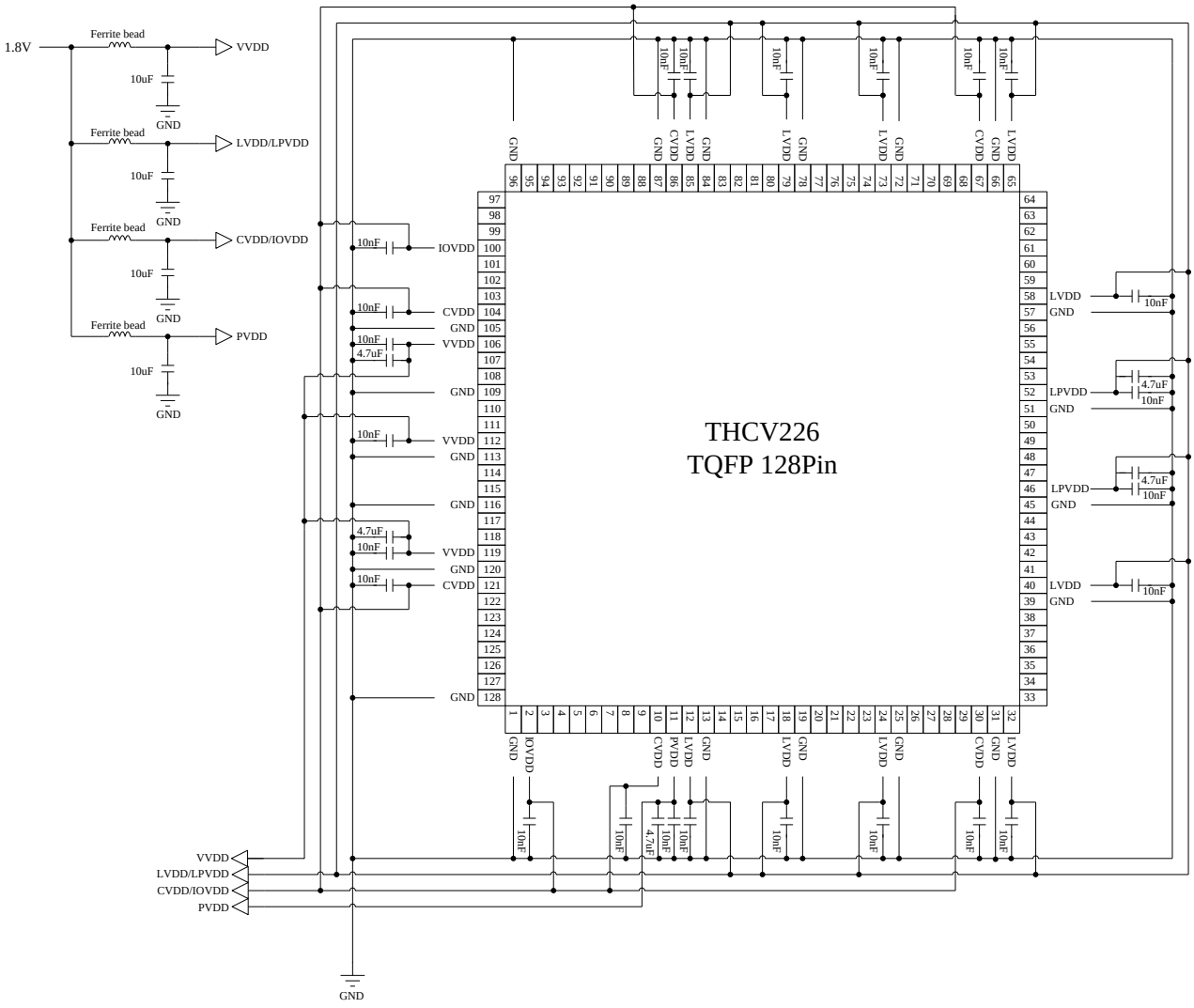
3 Field BET operation. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

4 No HTPDN connection option. Please refer to the datasheet for details. (THCV226_Rev..**_E.pdf)

Recommendations for Power Supply

- Separate the power domains into VVDD, LVDD(/LPVDD), CVDD(/IOVDD), and PVDD in order to avoid unwanted noise coupling between noisy digital and sensitive analog domains.
- Use high frequency ceramic capacitors of 10nF or 0.1µF as bypass capacitors between power and ground pins. Place them as close to each power pin as possible.
- Adding 4.7µF capacitors to PLL's power pins including V-by-One® HS power domain, along with the smaller bypass capacitors, is recommended.

Recommended Power Supply for THCV226



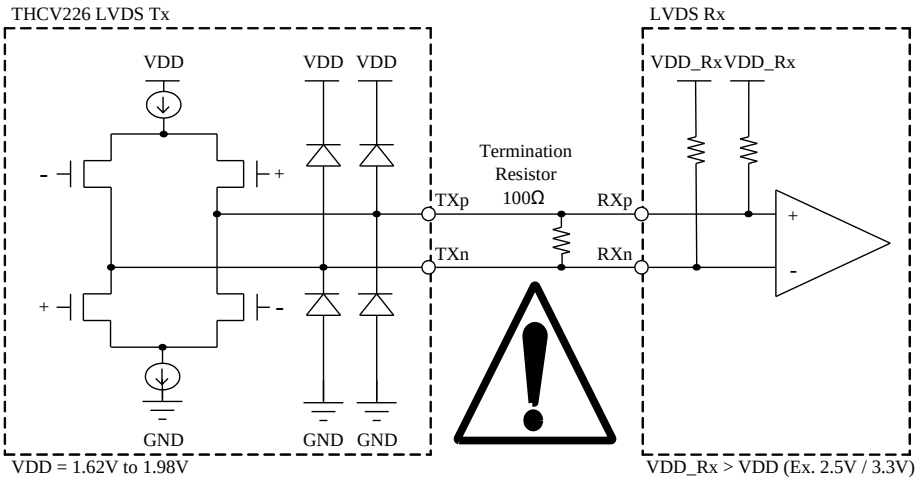
Note

1) LVDS Output Pin Connection

In case that the LVDS Rx of destination device is equipped with pull-up resistors connected to higher than THCV226's VDD voltage, this can cause violation of absolute maximum ratings to THCV226. This phenomenon may be happened at power-on phase and Hi-Z state of the whole system including LVDS Rx

device.

One solution for this problem is power-down control for LVDS Rx device during no LVDS input or Hi-Z state period, if its pull-up resistors can be cut off at power-down state. Another solution is to set THCV226's OPF option pin to VDD. This setting provides low fixed data output mode at PDN = H, not Hi-Z state mode.



2) Cable Connection and Disconnection

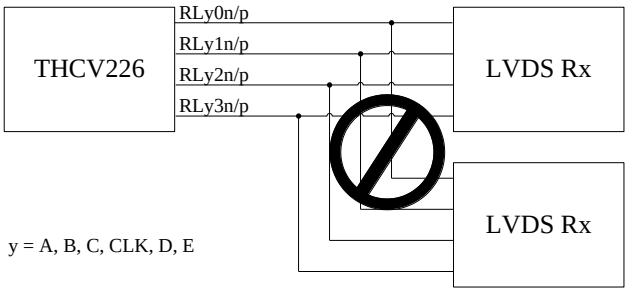
Do Not connect and disconnect the LVDS and CML cable, when the power is supplied to the system.

3) GND Connection

Connect the each GND of the PCB which Transmitter and THCV226 on it. It is better for EMI reduction to place GND cable as close to LVDS and CML cable as possible.

4) Multi-drop Connection

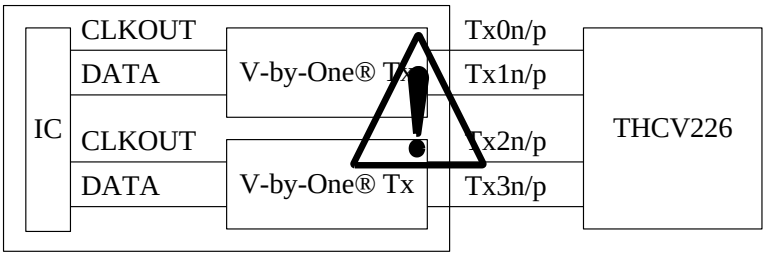
Multi-drop connection is not recommended.



5) Multiple Counterpart Use

Multiple counterpart use such as the following system is not recommended. If it is not avoidable, please check whether tRISK and tRIJT spec of THCV226 can be kept or not. Furthermore, please contact to

mspsupport@thine.co.jp (for FAE mailing list)

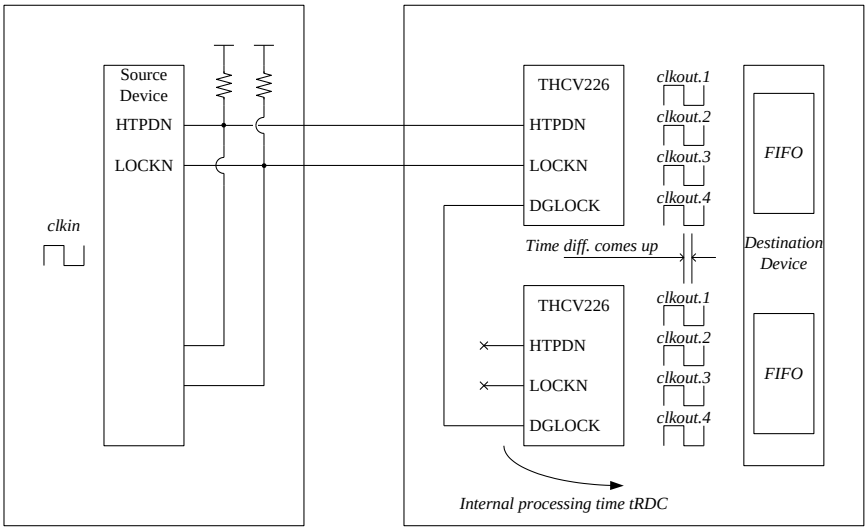


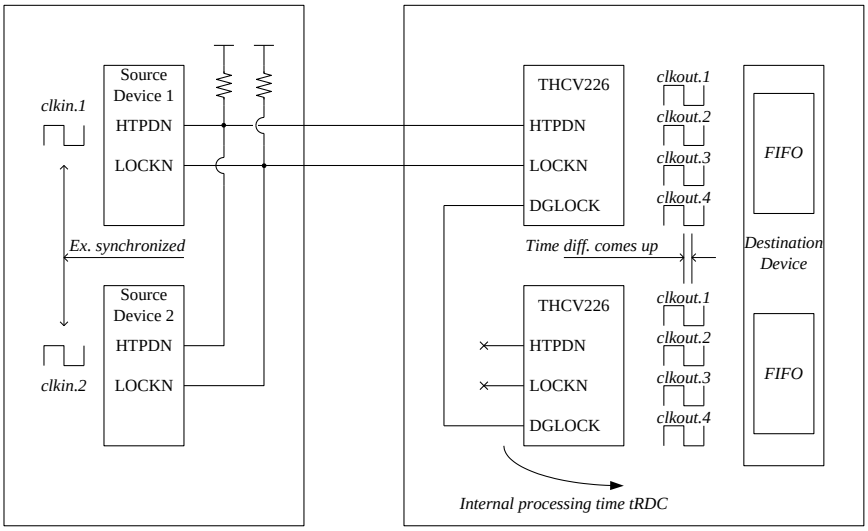
6) Multiple Device Connection

HTPDN and LOCKN signals are supposed to be connected properly for their purpose like the following figure.

HTPDN should be from just one THCV226 to multiple Tx devices because its purpose is only ignition of all Tx devices. LOCKN should be connected so as to indicate that CDR status of all Rx devices becomes ready to receive normal operation data. LOCKN of Tx side can be simply split to multiple Tx devices. THCV226's DGLOCK is appropriate for multiple Rx use.

Also possible time difference of internal processing time (THCV226 tRDC) on multiple data stream must be accommodated and compensated by the following destination device connected to multiple THCV226 chips, which may have internal FIFO.

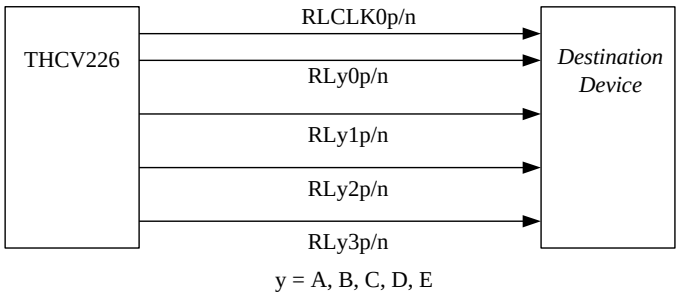


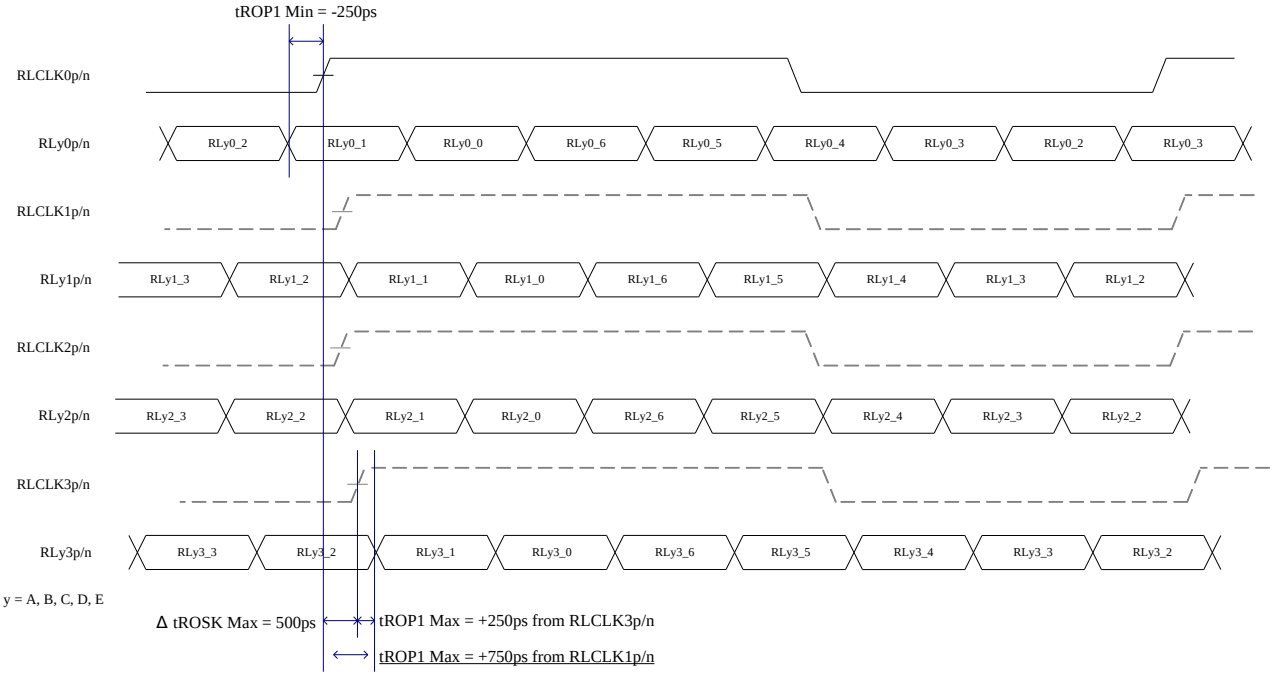


7) LVDS Link Skew Consideration
Single Chip Case in use of Only One Clock Signal out of LVDS Channels :

Let tRCOP = 13.47ns (74.25MHz) at normal LVDS mode.

As a result, the total amount of LVDS skew, tROP1, is calculated as +/- 750ps in use of only one clock signal out of LVDS channels for the connection between THCV226 and destination device.

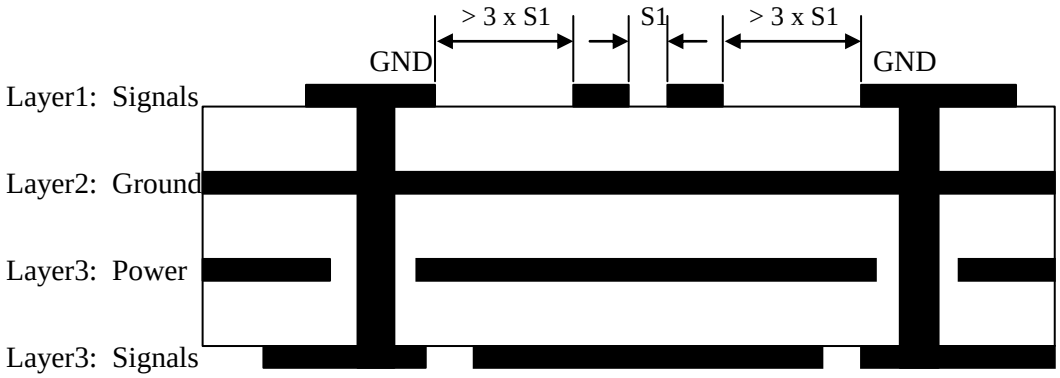



tROP1 Min = -250ps
RLCLK0p/n
RLy0p/n
RLy0_2
RLy0_1
RLy0_0
RLy0_6
RLy0_5
RLy0_4
RLy0_3
RLy0_2
RLy0_3
RLCLK1p/n
RLy1p/n
RLy1_3
RLy1_2
RLy1_1
RLy1_0
RLy1_6
RLy1_5
RLy1_4
RLy1_3
RLy1_2
RLCLK2p/n
RLy2p/n
RLy2_3
RLy2_2
RLy2_1
RLy2_0
RLy2_6
RLy2_5
RLy2_4
RLy2_3
RLy2_2
RLCLK3p/n
RLy3p/n
RLy3_3
RLy3_2
RLy3_1
RLy3_0
RLy3_6
RLy3_5
RLy3_4
RLy3_3
RLy3_2
y = A, B, C, D, E
Δ tROSK Max = 500ps
tROP1 Max = +250ps from RLCLK3p/n
tROP1 Max = +750ps from RLCLK1p/n

PCB Layout Considerations

- Use at least four-layer PCBs with signals, ground, power, and signals assigned for each layer. (Refer to figure below.)
- PCB traces for high-speed signals must be single-ended micorstirp lines or coupled microstrip lines whose differential characteristic impedance is 100Ω.
- Minimize the distance between traces of a differential pair (S1) to maximize common mode rejection and coupling effect which works to reduce EMI(Electro-Magnetic Interference).
- Route differential signal traces symmetrically.
- Avoid right-angle turns or minimize the number of vias on the high speed traces because they usually cause impedance discontinuity in the transmission lines and degrade the signal integrity.
- Mismatch among impedances of PCB traces, connectors, or cables, also causes reflection, limiting the bandwidth of the high-speed channels.
- Using common-mode filter on differential traces is desirable to reduce EMI. Pay attention on data-rate driven noise. For example, if data-rate is 1.5Gbps, common mode choke coil of 1.5GHz common mode impedance is desired to be high, while 1.5GHz differential impedance is low.

PCB Cross-sectional View
for Microstrip Lines



Notices and Requests

1. The product specifications described in this material are subject to change without prior notice.

2. The circuit diagrams described in this material are examples of the application which may not always apply to the customer's design. We are not responsible for possible errors and omissions in this material. Please note if errors or omissions should be found in this material, we may not be able to correct them immediately.

3. This material contains our copyright, know-how or other proprietary. Copying or disclosing to third parties the contents of this material without our prior permission is prohibited.

4. Note that if infringement of any third party's industrial ownership should occur by using this product, we will be exempted from the responsibility unless it directly relates to the production process or functions of the product.

5. Product Application
   5.1 Application of this product is intended for and limited to the following applications: audio-video device, office automation device, communication device, consumer electronics, smartphone, feature phone, and amusement machine device. This product must not be used for applications that require extremely high-reliability/safety such as aerospace device, traffic device, transportation device, nuclear power control device, combustion chamber device, medical device related to critical care, or any kind of safety device.
   5.2 This product is not intended to be used as an automotive part, unless the product is specified as a product conforming to the demands and specifications of ISO/TS16949 ("the Specified Product") in this data sheet. THine Electronics, Inc. (“THine”) accepts no liability whatsoever for any product other than the Specified Product for it not conforming to the aforementioned demands and specifications.
   5.3 THine accepts liability for demands and specifications of the Specified Product only to the extent that the user and THine have been previously and explicitly agreed to each other.

6. Despite our utmost efforts to improve the quality and reliability of the product, faults will occur with a certain small probability, which is inevitable to a semi-conductor product. Therefore, you are encouraged to have sufficiently redundant or error preventive design applied to the use of the product so as not to have our product cause any social or public damage.

7. Please note that this product is not designed to be radiation-proof.

8. Testing and other quality control techniques are used to this product to the extent THine deems necessary to support warranty for performance of this product. Except where mandated by applicable law or deemed necessary by THine based on the user’s request, testing of all functions and performance of the product is not necessarily performed.

9. Customers are asked, if required, to judge by themselves if this product falls under the category of strategic goods under the Foreign Exchange and Foreign Trade Control Law.

10. The product or peripheral parts may be damaged by a surge in voltage over the absolute maximum ratings or malfunction, if pins of the product are shorted by such as foreign substance. The damages may cause a smoking and ignition. Therefore, you are encouraged to implement safety measures by adding protection devices, such as fuses.

THine Electronics, Inc.
sales@thine.co.jp