Application Note	*THAN0060-Rev.1.50_E*

THCV215/THCV216 Application Note

System Diagram and PCB Design Guideline

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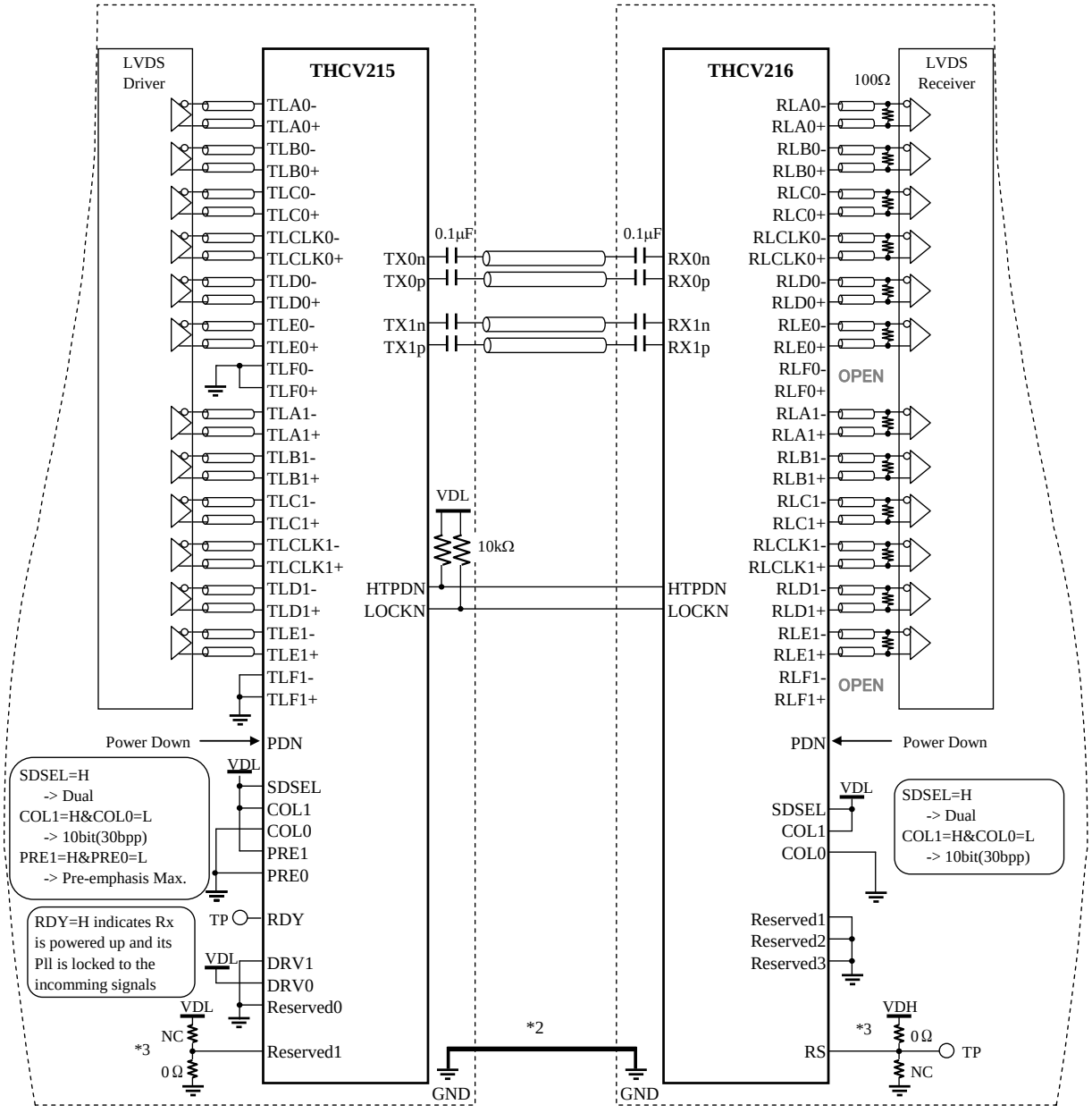
Application Diagrams

Dual/10bit(30bit per pixel) with Maximum Pre-emphasis

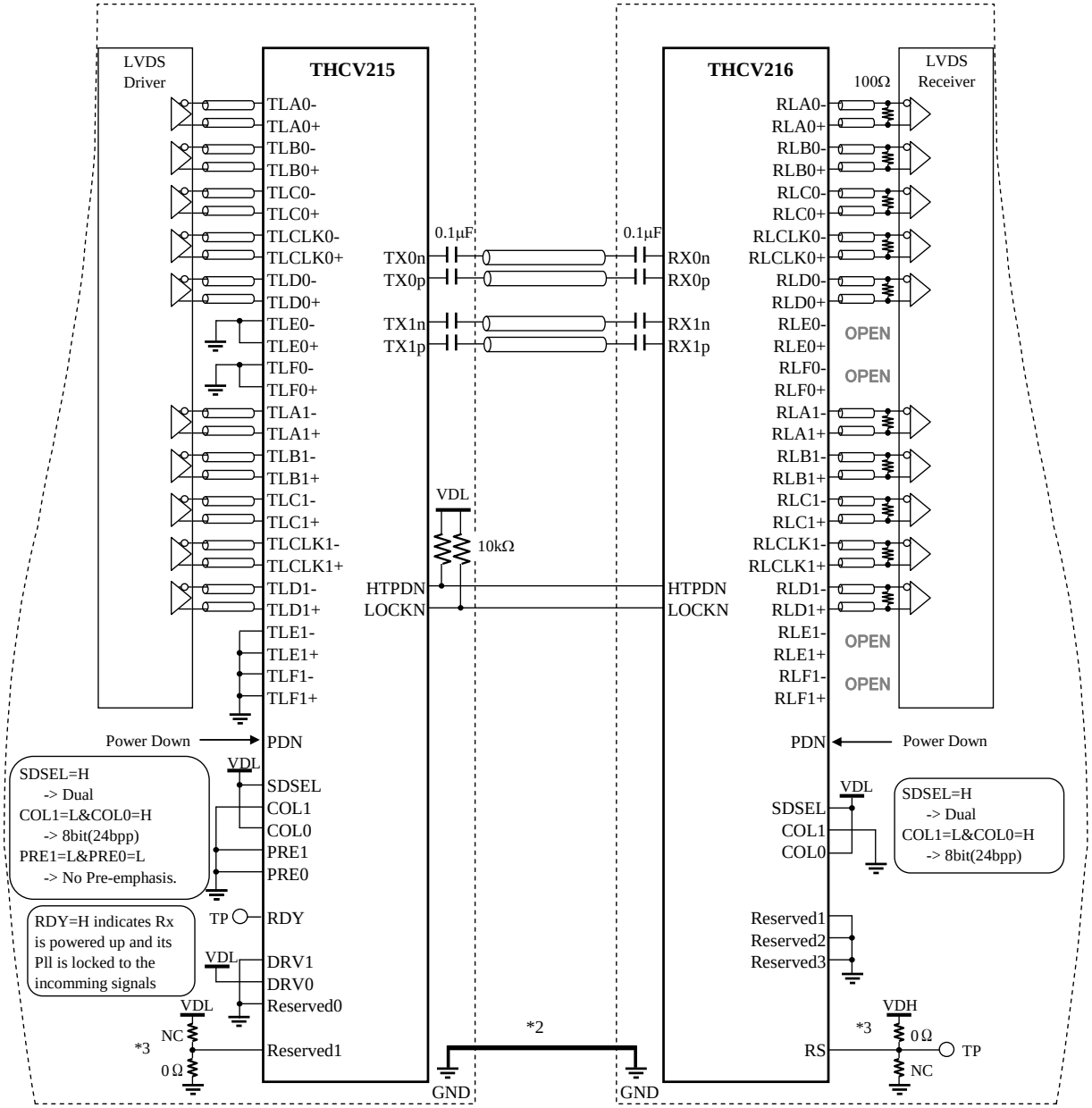
Setting SDSEL **HIGH** places THCV215/THCV216 in the Dual Link mode.
Setting COL1 **HIGH** and COL0 **LOW** results in the 10bit mode (30bit per pixel.)
Setting PRE1 **HIGH** and PRE0 **LOW** maximizes the strength of pre-emphasis.



*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 see the datasheet for details. (THCV215-216_Rev.x.xx_E.pdf)

Dual/8bit(24bit per pixel) without Pre-emphasis

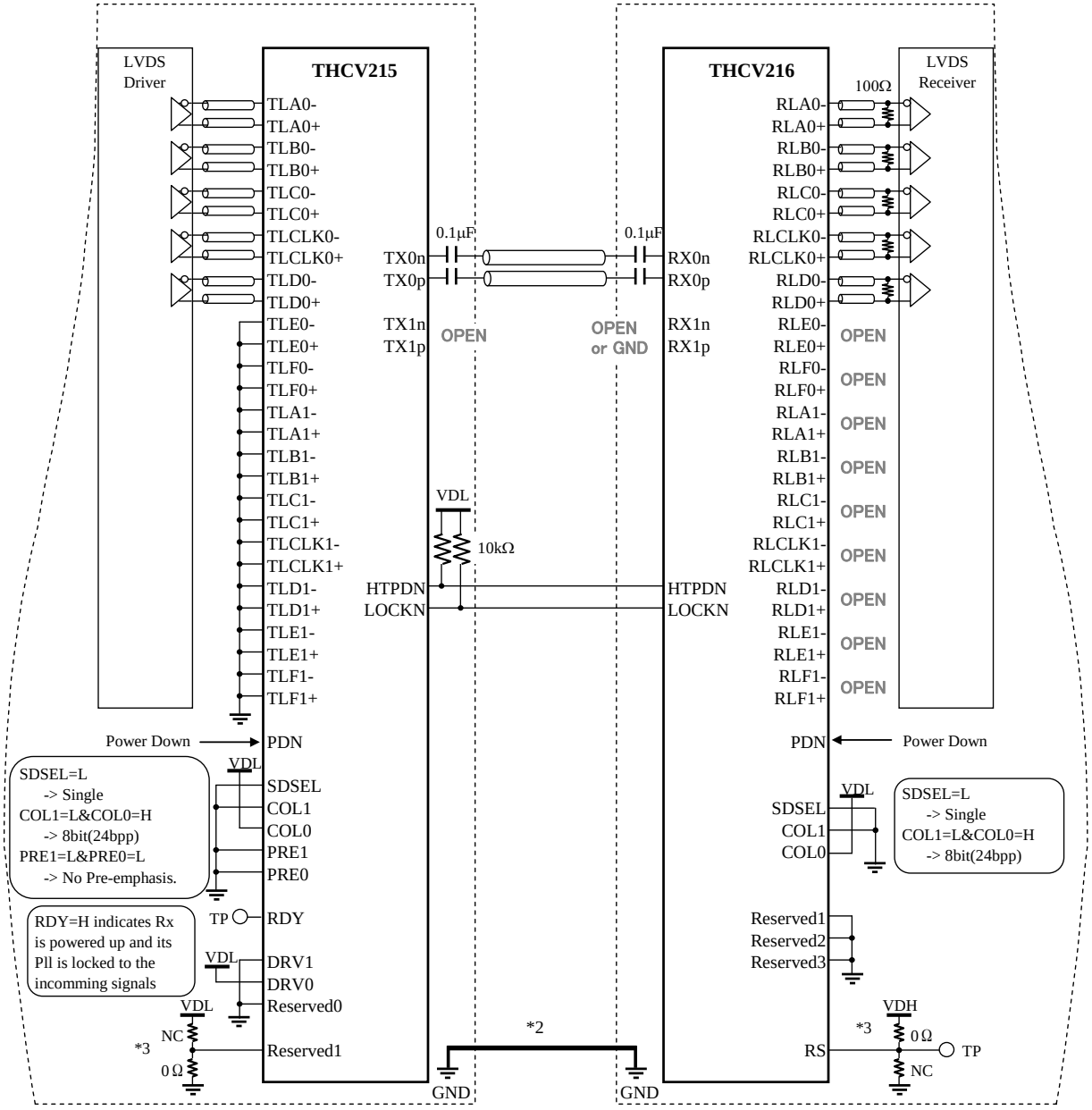
Setting SDSEL **HIGH** places THCV215/THCV216 in the Dual Link mode.
Setting COL1 **LOW** and COL0 **HIGH** results in the 8bit mode (24bit per pixel.)
Setting PRE1 **LOW** and PRE0 **LOW** disables pre-emphasis.



*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 see the datasheet for details. (THCV215-216_Rev.x.xx_E.pdf)

Single/8bit(24bit per pixel) without Pre-emphasis

Setting SDSEL **LOW** places THCV215/THCV216 in the Single Link mode.
Setting COL1 **LOW** and COL0 **HIGH** results in the 8bit mode (24bit per pixel.)
Setting PRE1 **LOW** and PRE0 **LOW** disables pre-emphasis.

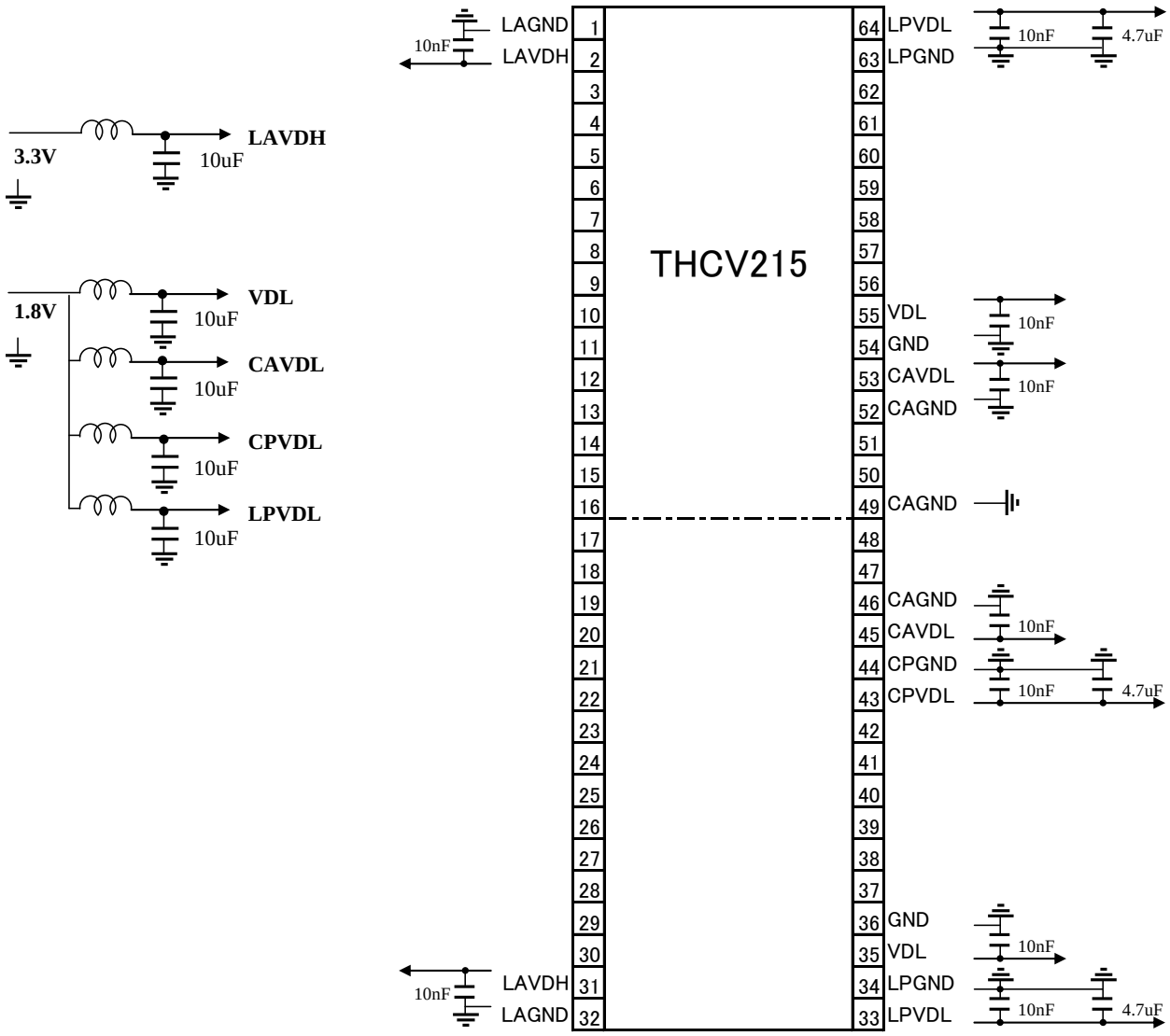


*1 indicates microstrip lines or cables with their differential characteristic impedance being 100Ω
*2 Connect GNDs of both Tx and Rx PCB
*3 Field BET Operation. Please see the datasheet for details. (THCV215-216_Rev.x.xx_E.pdf)

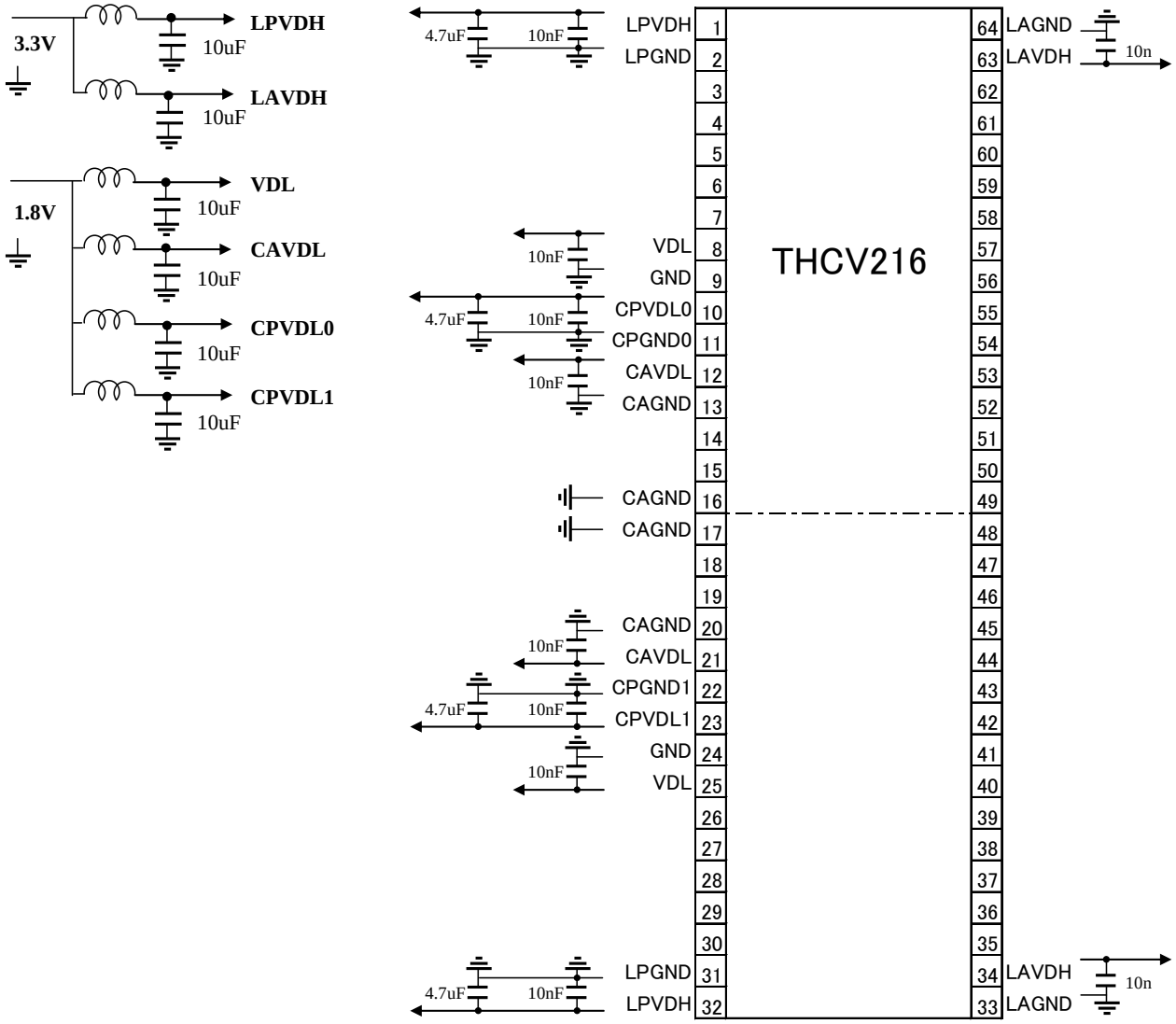
Recommendations for Power Supply

- Separate all the power domains 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, along with the smaller bypass capacitors, is recommended.

Recommended Power Supply for THCV215



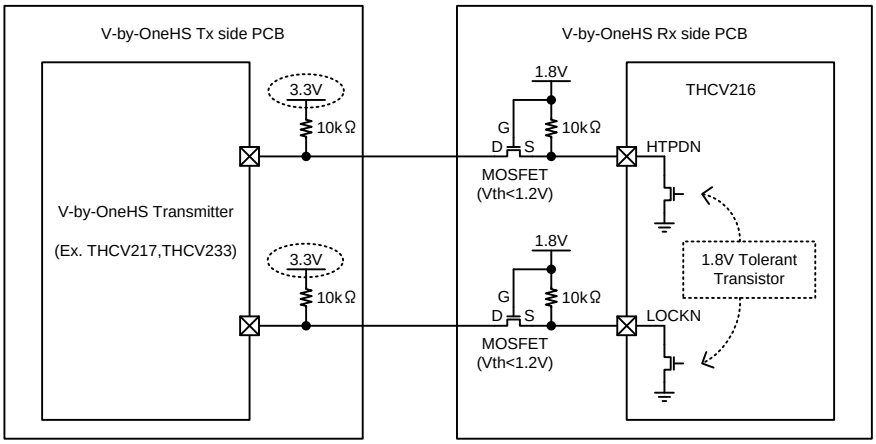
Recommended Power Supply for THCV216



Note

1) HTPDN/LOCKN connection between high VDD V-by-One® HS transmitter and THCV216

When using THCV216 with high VDD V-by-One® HS transmitter, user have to take care of HTPDN/LOCKN connection because THCV216 HTPDN/LOCKN output pins absolute maximum ratings are VDL+0.3V; therefore high VDD pull-up at transmitter side can cause violation of usage. Users are supposed to connect those HTPDN/LOCKN line between two devices with appropriate level-shifter configuration.

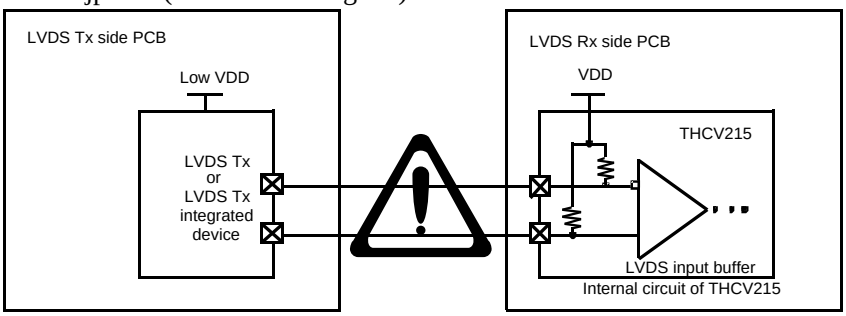


2)LVDS input pin connection

When LVDS line is not drived from the previous device, the line is pulled up to 3.3V internally in THCV215.This can cause violation of absolute maximum ratings to the previous LVDS Tx device whose operating condition is lower voltage power supply than 3.3V. This phenomenon may happen at power on phase of the whole system including THCV215. One solution for this problem is PD=L control during no LVDS input period because pull-up resistors are cut off at power down state.

If this situation is not avoidable and PD=L is hard to apply, there still is several remedy; therefore please contact to

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



3)Power On Sequence

Don't input RCLK#+/- before THCV215 is on in order to keep absolute maximum ratings.
If it is not avoidable, please contact to

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

4)Unused LVDS input pins

First, select appropriate color depth with COL0,COL1 pins. If there are inevitably remained LVDS no input pins which are originally active, tie them to GND.

Second, avoid the situation that LVDS input pins in use are open. You can use PDN=L control during no LVDS

input period to cut off pulled-up resistors.

5)Cable Connection and Disconnection

Don't connect and disconnect the LVDS cable, when the power is supplied to the system.

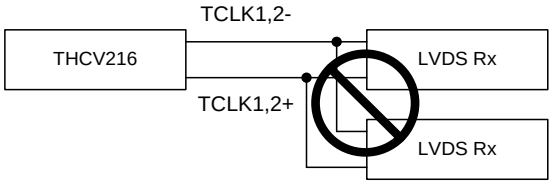
6)GND Connection

Connect the each GND of the PCB which Transmitter, Receiver and THCV215 on it. It is better for EMI reduction to place GND cable as close to LVDS cable as possible.

7)Multi Drop Connection

Multi drop connection is not recommended. If it is not avoidable, please contact to

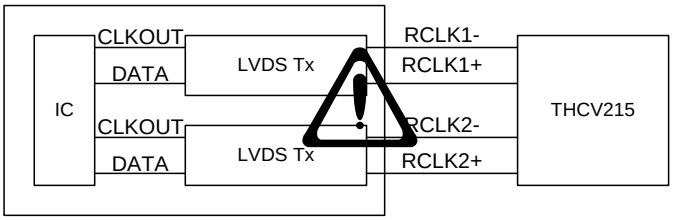
mspsupport@thine.co.jp (for FAE mailing list)



8)Multiple counterpart use

Multiple counterpart use such as following systems are not recommended. If it is not avoidable, please check if Data Sheet p.15 tTISK spec can be kept or not and more further, please contact to

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



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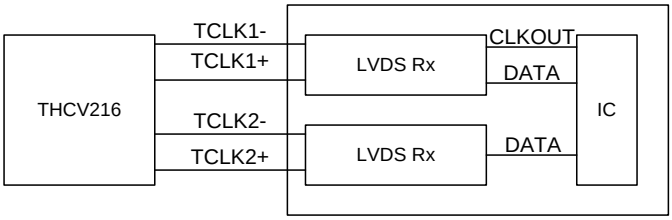
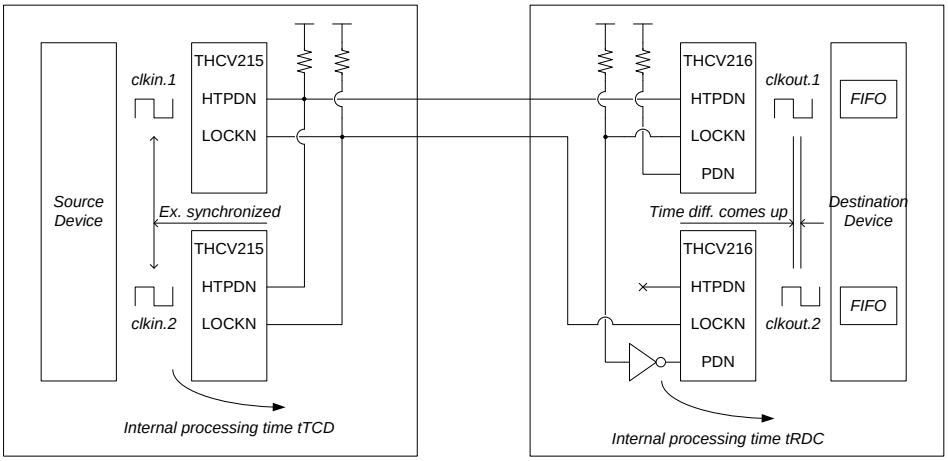


9) Multiple device connection

HTPDN and LOCKN signals are supposed to be connected proper for their purpose like the following figure.
HTPDN should be from just one THCV216 to multiple Tx because its purpose is only ignition of all Tx.
LOCKN should be connected so as to indicate that all Rx CDR become ready to receive normal operation data.
LOCKN of Tx side can be simply split to multiple Tx.

There could be other applicable circuits like ‘OR gate of LOCKN’, ‘npn transistor with resistors as inverter’, etc.

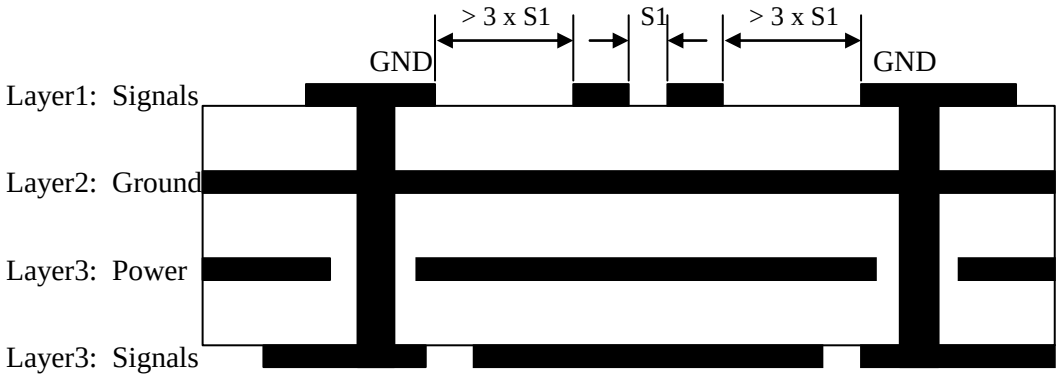
Also possible time difference of internal processing time (THCV215 tTCD and THCV216 tRDC) on multiple data stream must be accommodated and compensated by the following destination device connected to multiple THCV216, which may have internal FIFO.



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 caused 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



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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.

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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.

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sales@thine.co.jp