# THC63LVDM83C(5S)

REDUCED SWING LVDS 24Bit COLOR HOST-LCD PANEL INTERFACE

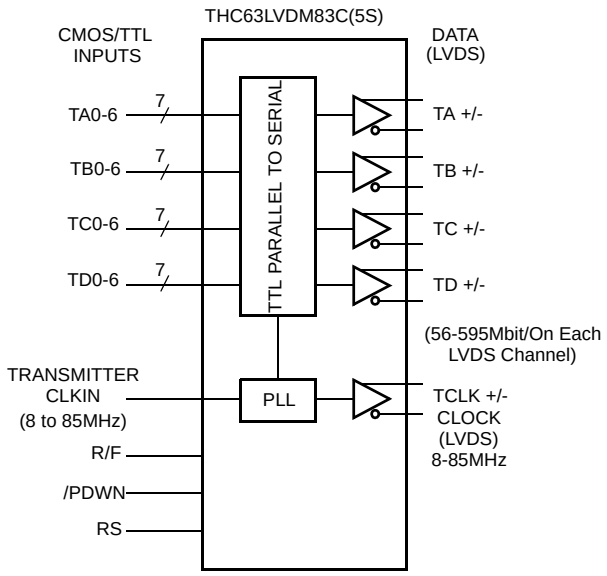
## General Description

The THC63LVDM83C(5S) transmitter is designed to support pixel data transmission between Host and Flat Panel Display from NTSC up to SXGA+ resolutions. The THC63LVDM83C(5S) converts 28bits of CMOS/TTL data into LVDS(Low Voltage Differential Signaling) data stream. The transmitter can be programmed for rising edge or falling edge clocks through a dedicated pin. At a transmit clock frequency of 85MHz, 24bits of RGB data and 4bits of timing and control data (HSYNC, VSYNC, CNTL1, CNTL2) are transmitted at an effective rate of 595Mbps per LVDS channel.

## Features

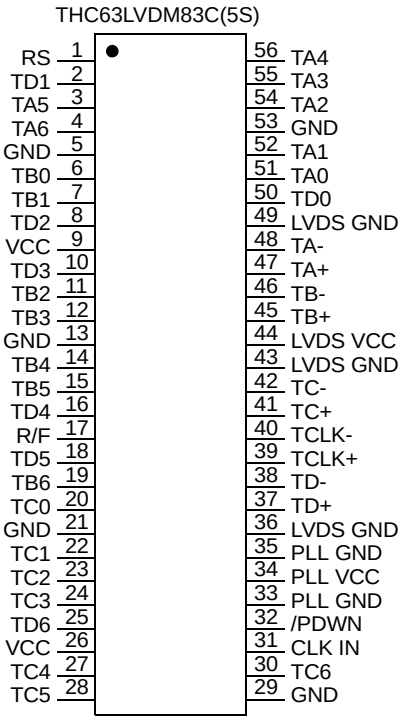
- Wide dot clock range: 8-85MHz suited for NTSC, VGA, SVGA, XGA
- PLL requires no external components
- Supports spread spectrum clock generator
- On chip jitter filtering
- Clock edge selectable
- Supports reduced swing LVDS for low EMI
- Power down mode
- Low power single 3.3V CMOS design
- Low profile 56 Lead TSSOP Package
- 1.2 up to 3.3V tolerant data inputs to connect directly to low power,low voltage application and graphic processor.
- Backward compatible with THC63LVDM83R(24bits)

## Block Diagram




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# Pin Out




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# Pin Description

<table>
<tr><th>Pin Name</th><th>Pin #</th><th>Type</th><th>Description</th></tr>
<tr><td>TA+, TA-</td><td>47, 48</td><td>LVDS OUT</td><td rowspan="4">LVDS Data Out.</td></tr>
<tr><td>TB+, TB-</td><td>45, 46</td><td>LVDS OUT</td></tr>
<tr><td>TC+, TC-</td><td>41, 42</td><td>LVDS OUT</td></tr>
<tr><td>TD+, TD-</td><td>37, 38</td><td>LVDS OUT</td></tr>
<tr><td>TCLK+, TCLK-</td><td>39, 40</td><td>LVDS OUT</td><td>LVDS Clock Out.</td></tr>
<tr><td>TA0 ~ TA6</td><td>51, 52, 54, 55, 56, 3, 4</td><td>IN</td><td rowspan="4">Pixel Data Inputs.</td></tr>
<tr><td>TB0 ~ TB6</td><td>6, 7, 11, 12, 14, 15, 19</td><td>IN</td></tr>
<tr><td>TC0 ~ TC6</td><td>20, 22, 23, 24, 27, 28, 30</td><td>IN</td></tr>
<tr><td>TD0 ~ TD6</td><td>50, 2, 8, 10, 16, 18, 25</td><td>IN</td></tr>
<tr><td>/PDWN</td><td>32</td><td>IN</td><td>H: Normal operation,<br>L: Power down (all outputs are Hi-Z)</td></tr>
<tr><td>RS</td><td>1</td><td>IN</td><td>LVDS swing mode, VREF select.<br><table><tr><th>RS</th><th>LVDS Swing</th><th>Small Swing Input Support</th></tr><tr><td>VCC</td><td>350mV</td><td>N/A</td></tr><tr><td>0.6 ~ 1.4V</td><td>350mV</td><td>RS=VREF[a]</td></tr><tr><td>GND</td><td>200mV</td><td>N/A</td></tr></table>a. VREF is Input Reference Voltage.</td></tr>
<tr><td>R/F</td><td>17</td><td>IN</td><td>Input Clock Triggering Edge Select.<br>H: Rising edge, L: Falling edge</td></tr>
<tr><td>VCC</td><td>9, 26</td><td>Power</td><td>Power Supply Pins for TTL inputs and digital circuitry.</td></tr>
<tr><td>CLKIN</td><td>31</td><td>IN</td><td>Clock in.</td></tr>
<tr><td>GND</td><td>5, 13, 21,<br>29, 53</td><td>Ground</td><td>Ground Pins for TTL inputs and digital circuitry.</td></tr>
<tr><td>LVDS VCC</td><td>44</td><td>Power</td><td>Power Supply Pins for LVDS Outputs.</td></tr>
<tr><td>LVDS GND</td><td>36, 43, 49</td><td>Ground</td><td>Ground Pins for LVDS Outputs.</td></tr>
<tr><td>PLL VCC</td><td>34</td><td>Power</td><td>Power Supply Pin for PLL circuitry.</td></tr>
<tr><td>PLL GND</td><td>33, 35</td><td>Ground</td><td>Ground Pins for PLL circuitry.</td></tr>
</table>

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## Absolute Maximum Ratings [1]

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | -0.3V ~ +4.0V |
| CMOS/TTL Input Voltage | -0.3V ~ ($V_{CC}$ + 0.3V) |
| CMOS/TTL Output Voltage | -0.3V ~ ($V_{CC}$ + 0.3V) |
| LVDS Driver Output Voltage | -0.3V ~ ($V_{CC}$ + 0.3V) |
| Output Current | continuous |
| Junction Temperature | +125°C |
| Storage Temperature Range | -55°C ~ +150°C |
| Resistance to soldering heat | +260°C /10sec |
| Maximum Power Dissipation @+25°C | 0.5W |

## Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|
| All Supply Voltage | 3.0 | 3.3 | 3.6 | V |
| Operating Ambient Temperature | -40 | | 85 | °C |
| CLK IN Frequency | 8 | | 85 | MHz |

1. "Absolute Maximum Ratings" are those valued beyond which the safety of the device can not be guaranteed. They are not meant to imply that the device should be operated at these limits. The tables of "Electrical Characteristics" specify conditions for device operation.

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# Electrical Characteristics

## CMOS/TTL DC Specifications

$V_{CC}$ = VCC = PLL VCC = LVDS VCC

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{IH}$ | High Level Input Voltage | RS=VCC or GND | 2.0 | | $V_{CC}$ | V |
| $V_{IL}$ | Low Level Input Voltage | RS=VCC or GND | GND | | 0.8 | V |
| $V_{DDQ}$[1] | Small Swing Voltage | | 1.2 | | 2.8 | V |
| $V_{REF}$ | Input Reference Voltage | Small Swing (RS=$V_{DDQ}$/2) | | $V_{DDQ}$/2 | | |
| $V_{SH}$[2] | Small Swing High Level Input Voltage | $V_{REF}$ = $V_{DDQ}$/2 | $V_{DDQ}$/2 +100mV | | | V |
| $V_{SL}$[2] | Small Swing Low Level Input Voltage | $V_{REF}$ = $V_{DDQ}$/2 | | | $V_{DDQ}$/2 -100mV | V |
| $I_{INC}$ | Input Current | $0V \le V_{IN} \le V_{CC}$ | | | ±10 | uA |

Notes: [1]$V_{DDQ}$ voltage defines max voltage of small swing input. It is not an actual input voltage.
[2] Small swing signal is applied to TA0-6,TB0-6,TC0-6,TD0-6 and CLKIN.

## LVDS Transmitter DC Specifications

$V_{CC}$ = VCC = PLL VCC = LVDS VCC

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| VOD | Differential Output Voltage | RL=100Ω | Normal swing RS=$V_{CC}$ | 250 | 350 | 500 | mV |
| | | | Reduced swing RS=GND | 100 | 200 | 300 | mV |
| ΔVOD | Change in VOD between complementary output states | RL=100Ω | | | | 35 | mV |
| VOC | Common Mode Voltage | | | 1.125 | 1.25 | 1.375 | V |
| ΔVOC | Change in VOC between complementary output states | | | | | 35 | mV |
| $I_{OS}$ | Output Short Circuit Current | VOUT=0V, RL=100Ω | | | | -24 | mA |
| $I_{OZ}$ | Output TRI-STATE Current | /PDWN=0V, $V_{OUT}$=0V to $V_{CC}$ | | | | ±10 | uA |

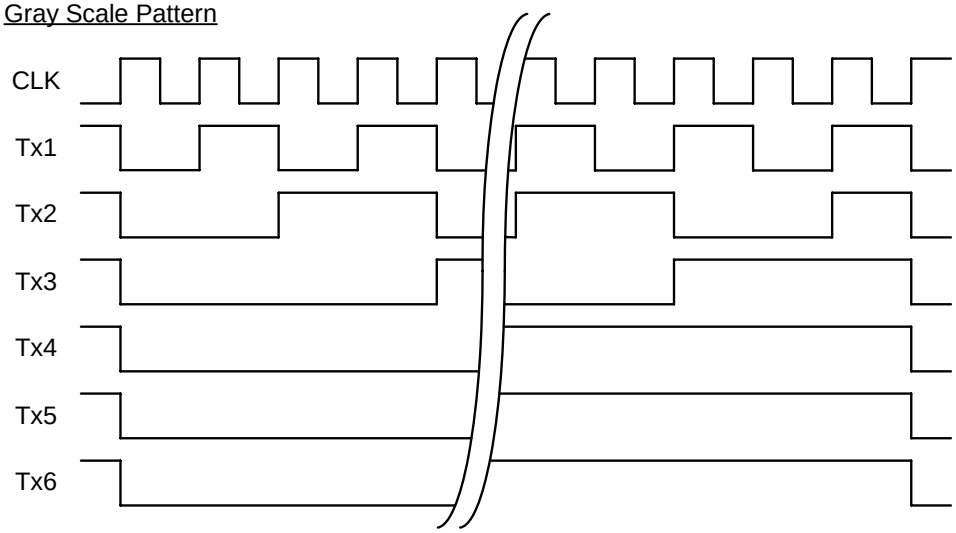
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## Supply Current

$V_{CC}$ = VCC = PLL VCC = LVDS VCC

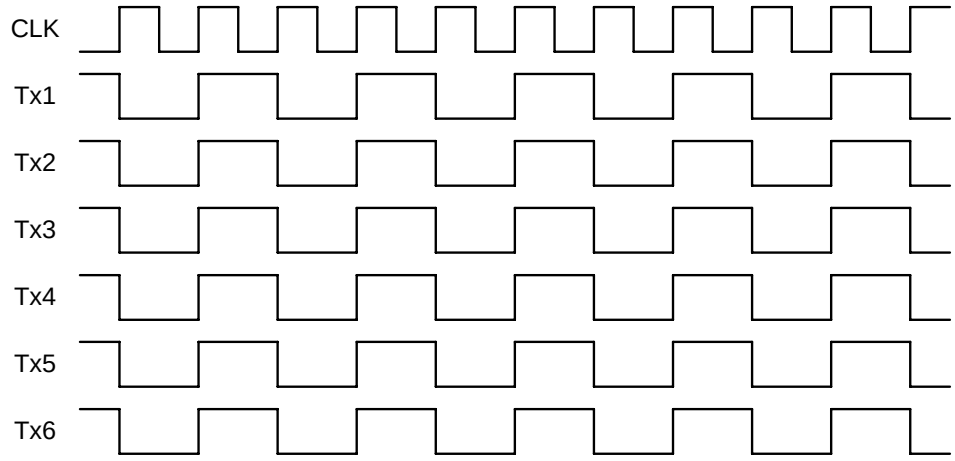
| Symbol | Parameter | Condition(*) | | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_{TCCG}$ | Transmitter Supply Current | RL=100Ω,CL=5pF<br>$V_{CC}$=3.3V, f=85MHz<br>Gray Scale Pattern | RS=$V_{CC}$ | 52 | 58 | mA |
| | | | RS=GND | 40 | 46 | mA |
| $I_{TCCW}$ | Transmitter Supply Current | RL=100Ω,CL=5pF<br>$V_{CC}$=3.3V, f=85MHz<br>Worst Case Pattern | RS=$V_{CC}$ | 61 | 67 | mA |
| | | | RS=GND | 50 | 56 | mA |
| $I_{TCCS}$ | Transmitter Power Down Supply Current | /PDWN = L | | | 10 | uA |

Gray Scale Pattern




x= A, B, C, D

Worst Case Pattern




x= A, B, C, D

Fig1. Data Pattern

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## Switching Characteristics

$V_{CC}$ = VCC = PLL VCC = LVDS VCC

| Symbol | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| $t_{TCIT}$ | CLK IN Transition time | | | 5.0 | ns |
| $t_{TCP}$ | CLK IN Period | 11.7 | T | 125 | ns |
| $t_{TCH}$ | CLK IN High Time | 0.35T | 0.5T | 0.65T | ns |
| $t_{TCL}$ | CLK IN Low Time | 0.35T | 0.5T | 0.65T | ns |
| $t_{TCD}$ | CLK IN to TCLK+/- Delay | | 3T | | ns |
| $t_{TS}$ | TTL Data Setup to CLK IN | 2.5 | | | ns |
| $t_{TH}$ | TTL Data Hold from CLK IN | 0 | | | ns |
| $t_{LVT}$ | LVDS Transition Time | | 0.6 | 1.5 | ns |
| $t_{TOP1}$ | Output Data Position0 (T=11.7ns) | -0.2 | 0.0 | +0.2 | ns |
| $t_{TOP0}$ | Output Data Position1 (T=11.7ns) | $\frac{T}{7}-0.2$ | $\frac{T}{7}$ | $\frac{T}{7}+0.2$ | ns |
| $t_{TOP6}$ | Output Data Position2 (T=11.7ns) | $2\frac{T}{7}-0.2$ | $2\frac{T}{7}$ | $2\frac{T}{7}+0.2$ | ns |
| $t_{TOP5}$ | Output Data Position3(T=11.7ns) | $3\frac{T}{7}-0.2$ | $3\frac{T}{7}$ | $3\frac{T}{7}+0.2$ | ns |
| $t_{TOP4}$ | Output Data Position4 (T=11.7ns) | $4\frac{T}{7}-0.2$ | $4\frac{T}{7}$ | $4\frac{T}{7}+0.2$ | ns |
| $t_{TOP3}$ | Output Data Position5 (T=11.7ns) | $5\frac{T}{7}-0.2$ | $5\frac{T}{7}$ | $5\frac{T}{7}+0.2$ | ns |
| $t_{TOP2}$ | Output Data Position6 (T=11.7ns) | $6\frac{T}{7}-0.2$ | $6\frac{T}{7}$ | $6\frac{T}{7}+0.2$ | ns |
| $t_{TPLL}$ | Phase Lock Loop Set | | | 10.0 | ms |

## AC Timing Diagrams

### TTL Input

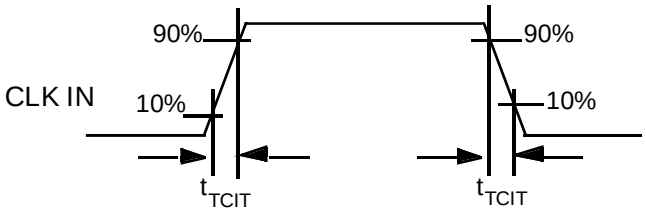



Fig2. CLKIN Transition Time

### LVDS Output

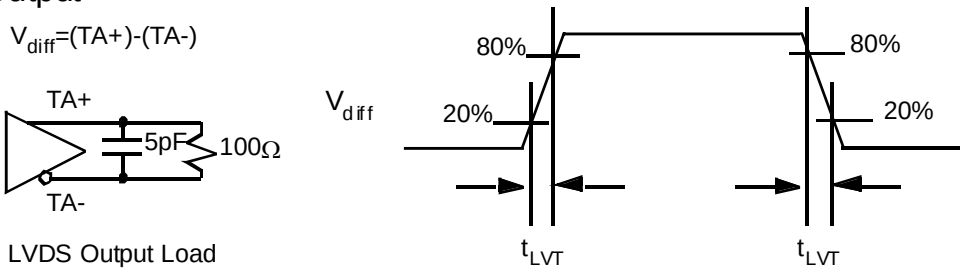
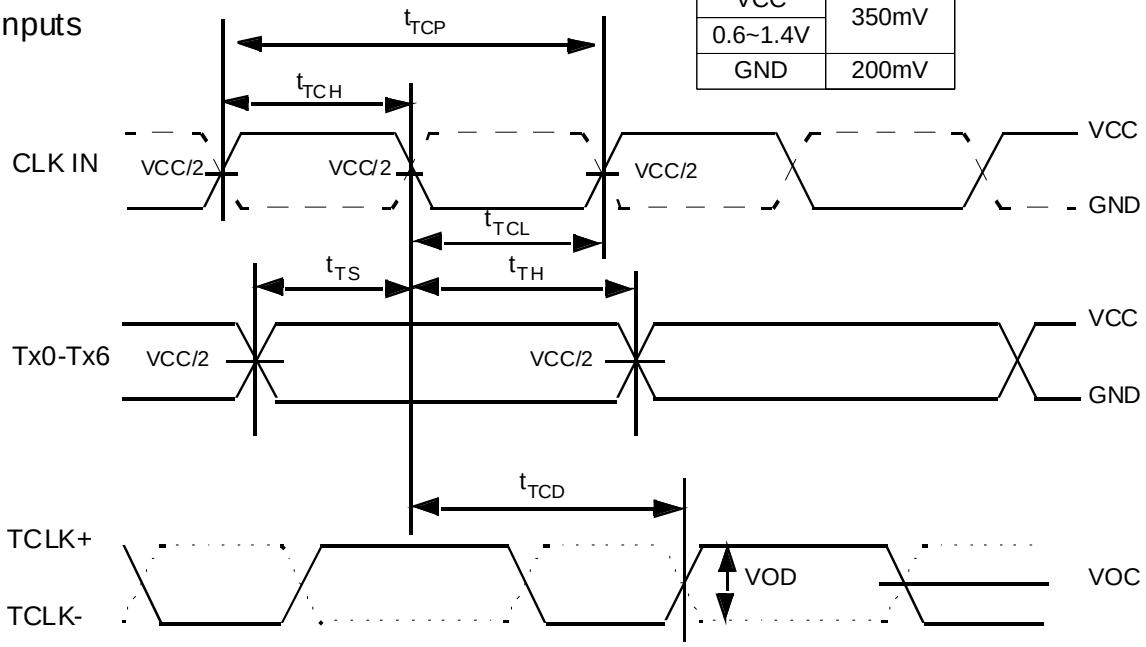



Fig3. LVDS Output Load and Transition Time

TTL Inputs

| RS Pin | VOD |
|---|---|
| VCC | 350mV |
| 0.6~1.4V | |
| GND | 200mV |

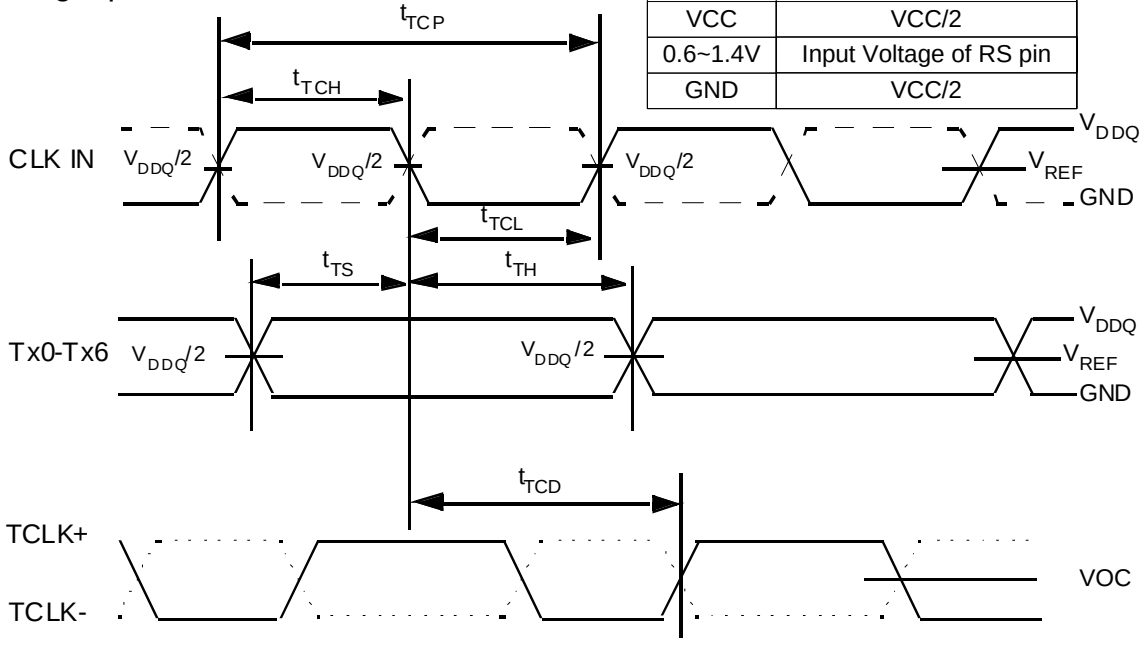



Note:
CLK IN: for R/F=GND, denote as solid line,
for R/F=VCC, denote as dashed line.

Fig4. CLKIN Period, High/Low Time, Setup/Hold Timing

Small Swing Inputs

| RS Pin | VREF |
|---|---|
| VCC | VCC/2 |
| 0.6~1.4V | Input Voltage of RS pin |
| GND | VCC/2 |




Note:
CLK IN: for R/F=GND, denote as solid line,
for R/F=VCC, denote as dashed line.

Fig5. Small Swing Inputs

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## AC Timing Diagrams

### LVDS Output

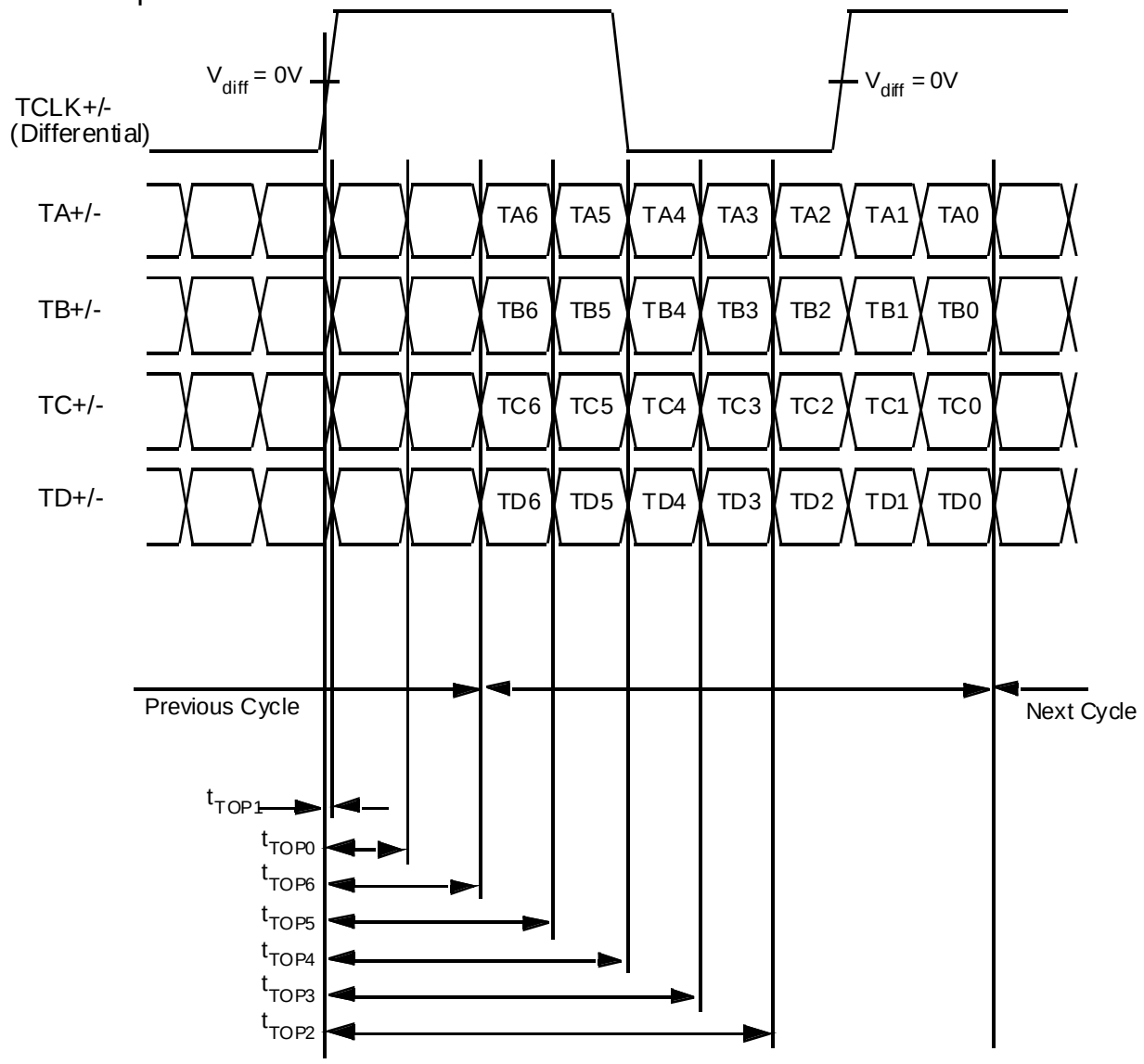



Fig6. LVDS Output Data Position

### Phase Lock Loop Set Time

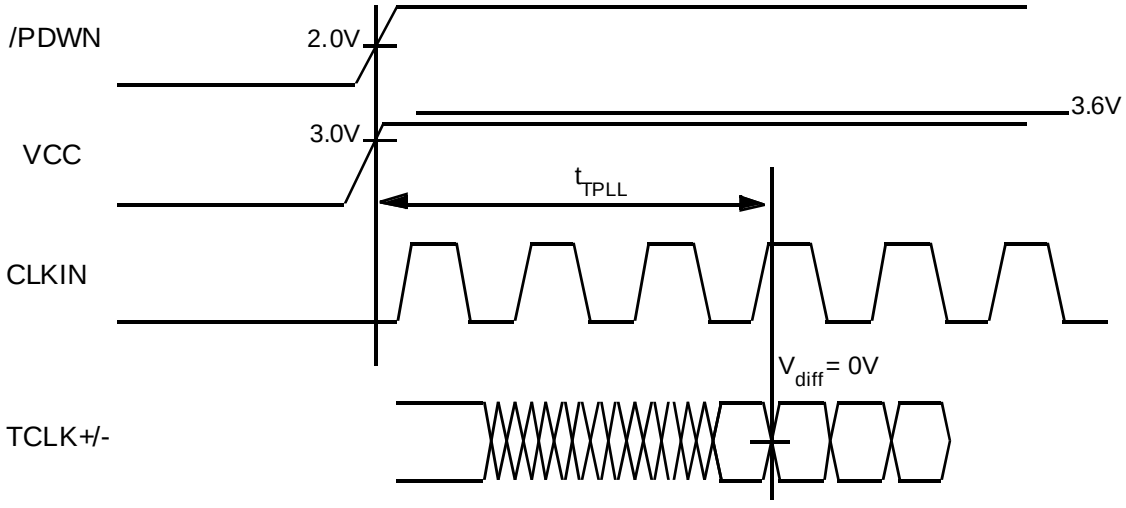



Fig7. PLL Lock Set Time

# Note

## 1)Cable Connection and Disconnection

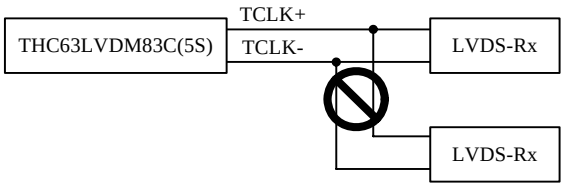
Don't connect and disconnect the LVDS cable, when the power is supplied to the system.

## 2)GND Connection

Connect the each GND of the PCB which THC63LVDM83C(5S) and LVDS-Rx on it. It is better for EMI reduction to place GND cable as close to LVDS cable as possible.

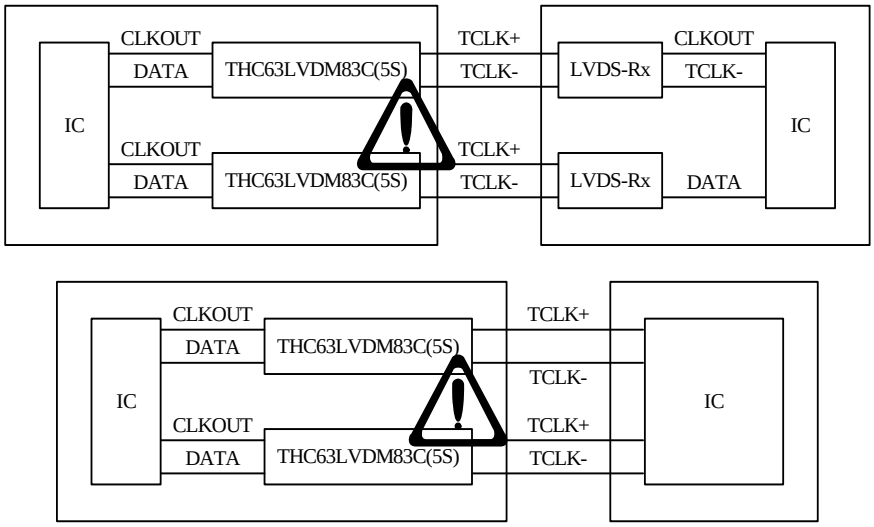
## 3)Multi Drop Connection

Multi drop connection is not recommended.



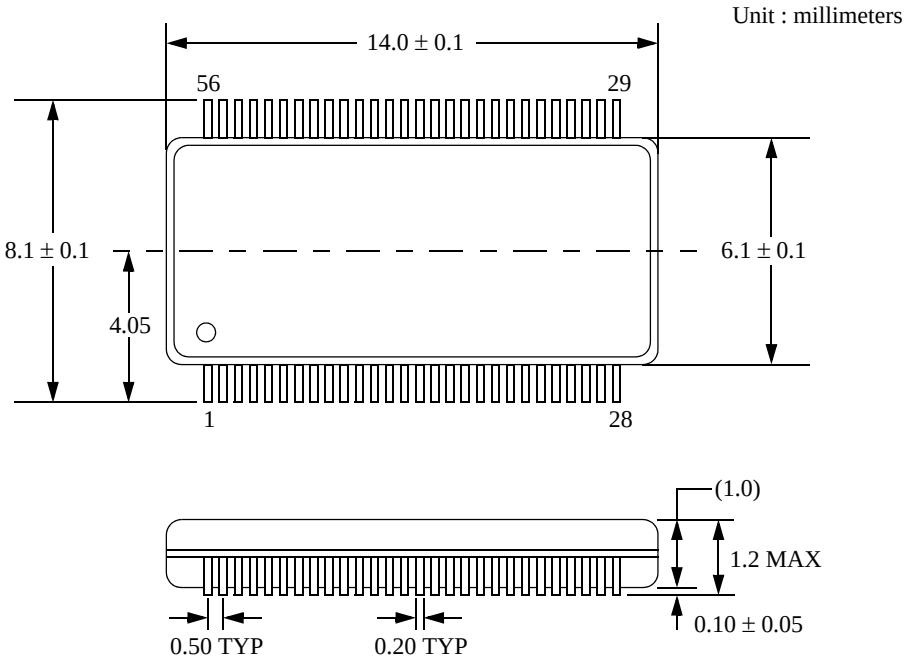

## 4)Asynchronous use

Asynchronous use such as following systems are not recommended.



# Package

56 Lead Molded Thin Shrink Small Outline Package, JEDEC



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