THC63LVD1022

30Bit Color/150Mpps Dual-Link LVDS to LVCMOS converter

General Description

The THC63LVD1022 LVDS (Low Voltage Differential Signaling) converter is designed to support pixel data transmission between Host and Flat Panel Display up to Full-HD 1080p resolutions.
The THC63LVD1022 receives dual channel LVDS data stream and transmits LVTTL/LVCMOS data through Dual Pixel Link Input / Single Link output conversion.
At a transmit data of 150Mpixel/sec, 30bits/pixel and 5bits of timing and control data (HSYNC, VSYNC, DE) are received at an effective rate of 525Mbps per LVDS channel.

Application

- Security Camera / Industrial Camera
- Medium and Small Size Panel
- Tablet PC / Notebook PC
- Multi Function Printer
- Industrial Equipment
- Medical Equipment Monitor

Features

- 20MHz to 75MHz 30bits/pixel dual-Link LVDS input
- Up to 150MHz 30bit s/pixel single port LVCMOS output
- Operating Temperature Range : 0 to 85°C
- LVDS input skew margin: ±400ps at 75MHz
- Dual input / Single output mode [clkout = 2x clkin]
- Output Enable / Disable mode supported
- No Special Start-up Sequence Required
- 100pin TQFP Package
- 3.3V single voltage power supply
- PLL requires no external components
- Compliant with RoHS and REACH

Block Diagram

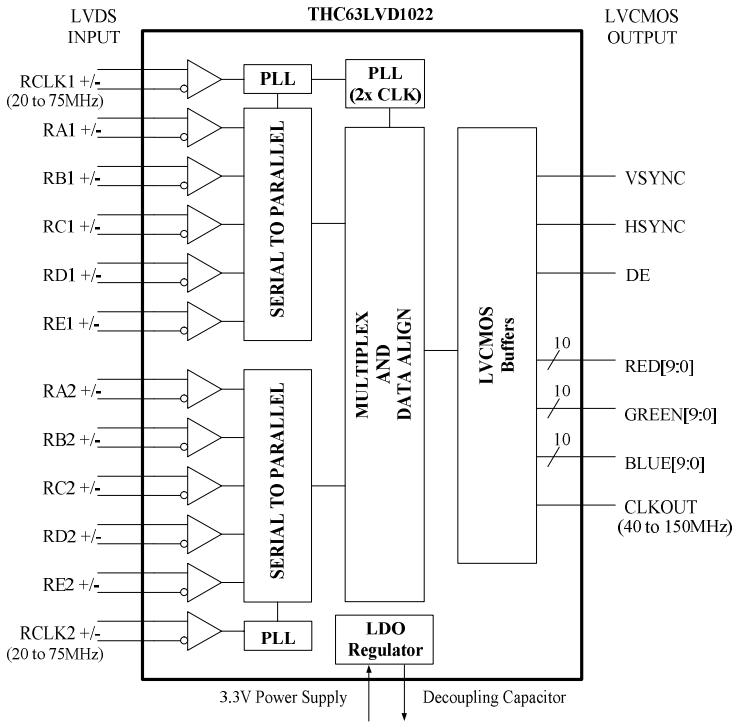

Figure 1. Block Diagram

Pin Diagram

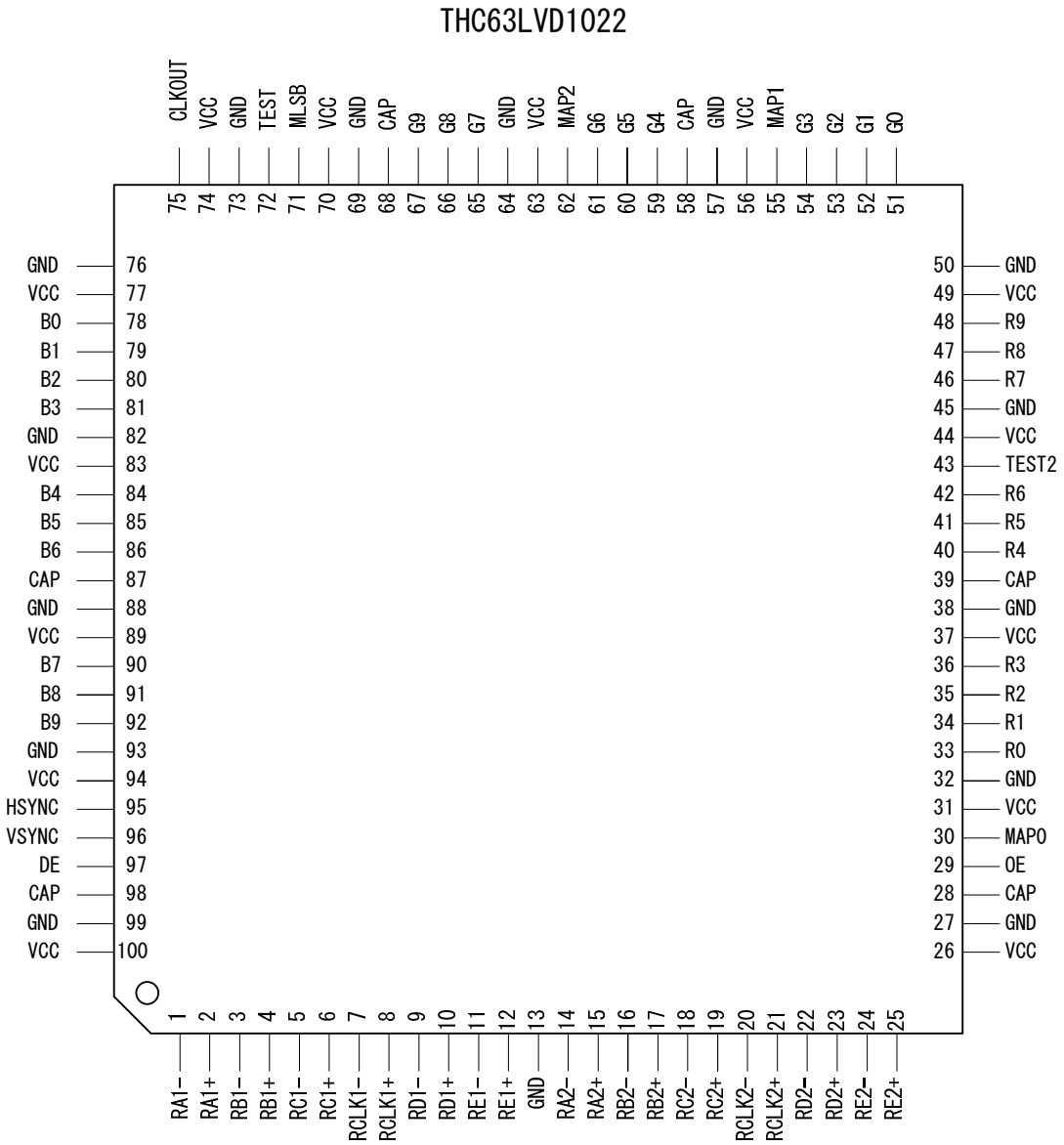

Figure 2. Pin Diagram

Pin Description

Table 1. Pin Description

<table>
<tr><th>Pin Name</th><th>Pin #</th><th>Type</th><th>Description</th></tr>
<tr><td>RA1+, RA1-</td><td>2, 1</td><td rowspan="11">LVDS Input</td><td rowspan="5">LVDS 1st Link Data In.</td></tr>
<tr><td>RB1+, RB1-</td><td>4, 3</td></tr>
<tr><td>RC1+, RC1-</td><td>6, 5</td></tr>
<tr><td>RD1+, RD1-</td><td>10, 9</td></tr>
<tr><td>RE1+, RE1-</td><td>12, 11</td></tr>
<tr><td>RCLK1+,RCLK1-</td><td>8, 7</td><td>LVDS Clock Input for 1st Link.</td></tr>
<tr><td>RA2+, RA2-</td><td>15, 14</td><td rowspan="5">LVDS 2nd Link Data In.</td></tr>
<tr><td>RB2+, RB2-</td><td>17, 16</td></tr>
<tr><td>RC2+, RC2-</td><td>19, 18</td></tr>
<tr><td>RD2+, RD2-</td><td>23, 22</td></tr>
<tr><td>RE2+, RE2-</td><td>25, 24</td></tr>
<tr><td>RCLK2+,RCLK2-</td><td>21, 20</td><td>LVDS Clock Input for 2nd Link.</td></tr>
<tr><td>TEST, TEST2</td><td>72, 43</td><td rowspan="4">LVCMOS/TTL Input</td><td>Reserved
L: Normal Operation
(Table. 10)</td></tr>
<tr><td>OE</td><td>29</td><td>Output Enable
H: Normal Operation
L: Fix Output signals(Hold the previous logic value)</td></tr>
<tr><td>MLSB</td><td>71</td><td>Output bit order selection
H: MSB = 9 / LSB = 0
L: MSB = 0 / LSB = 9</td></tr>
<tr><td>MAP2 ~ 0</td><td>62, 55, 30</td><td>Output color mapping selection
<table>
<tr><th rowspan="2">MAP0:1:2</th><th colspan="3">RGB</th></tr>
<tr><th>Rch</th><th>Gch</th><th>Bch</th></tr>
<tr><td>HHH</td><td>R</td><td>G</td><td>B</td></tr>
<tr><td>HHL</td><td>R</td><td>B</td><td>G</td></tr>
<tr><td>HLH</td><td>B</td><td>R</td><td>G</td></tr>
<tr><td>HLL</td><td>B</td><td>G</td><td>R</td></tr>
<tr><td>LHH</td><td>G</td><td>R</td><td>B</td></tr>
<tr><td>LHL</td><td>G</td><td>B</td><td>R</td></tr>
<tr><td>LLH</td><td>R</td><td>G</td><td>B</td></tr>
<tr><td>LLL</td><td>R</td><td>G</td><td>B</td></tr>
</table></td></tr>
<tr><td>DE</td><td>97</td><td rowspan="5">LVCMOS/TTL Output</td><td>Data Enable Output</td></tr>
<tr><td>VSYNC</td><td>96</td><td>Vsync Output</td></tr>
<tr><td>HSYNC</td><td>95</td><td>Hsync Output</td></tr>
<tr><td>R9 ~ 0</td><td>48, 47, 46, 42, 41, 40, 36, 35, 34, 33</td><td>Pixel Data Output(Rch)</td></tr>
<tr><td>G9 ~ 0</td><td>67, 66, 65, 61, 60, 59, 54, 53, 52, 51</td><td>Pixel Data Output(Gch)</td></tr>
<tr><td>B9 ~ 0</td><td>92, 91, 90, 86, 85, 84, 81, 80, 79, 78</td><td>Pixel Data Output(Bch)</td></tr>
<tr><td>CLKOUT</td><td>75</td><td>Clock Output</td></tr>
<tr><td>VCC</td><td>26, 31, 37, 44, 49, 56, 63, 70, 74, 77, 83, 89, 94, 100</td><td rowspan="3">-</td><td>Power Supply Pins</td></tr>
<tr><td>GND</td><td>13, 27, 32, 38, 45, 50, 57, 64, 69, 73, 76, 82, 88, 93, 99</td><td>Ground Pins</td></tr>
<tr><td>CAP</td><td>28, 39, 58, 68, 87, 98</td><td>Decoupling cap.
External 0.1uF or more capacitance required.</td></tr>
</table>

Absolute Maximum Ratings

Table 2. Absolute Maximum Rating

Parameter	Min	Max	Unit
Supply Voltage (VCC)	-0.3	+4.0	V
LVCMOS/TTL Input Voltage	-0.3	VCC + 0.3	V
LVDS Input Pin	-0.3	VCC + 0.3	V
Junction Temperature	-	+125	°C
Storage Temperature	-55	+125	°C

Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Symbol	Parameter		Min	Typ	Max	Unit
-	All Supply Voltage		3.0	3.3	3.6	V
Ta	Operating Ambient Temperature		0	25	+85	°C
-	Clock Frequency	LVDS Input	20	-	75	MHz
		LVCMOS Output	40	-	150	

"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.
"Absolute Maximum Rating" values also include behavior of overshooting and undershooting.

Equivalent LVDS Input Schematic Diagram

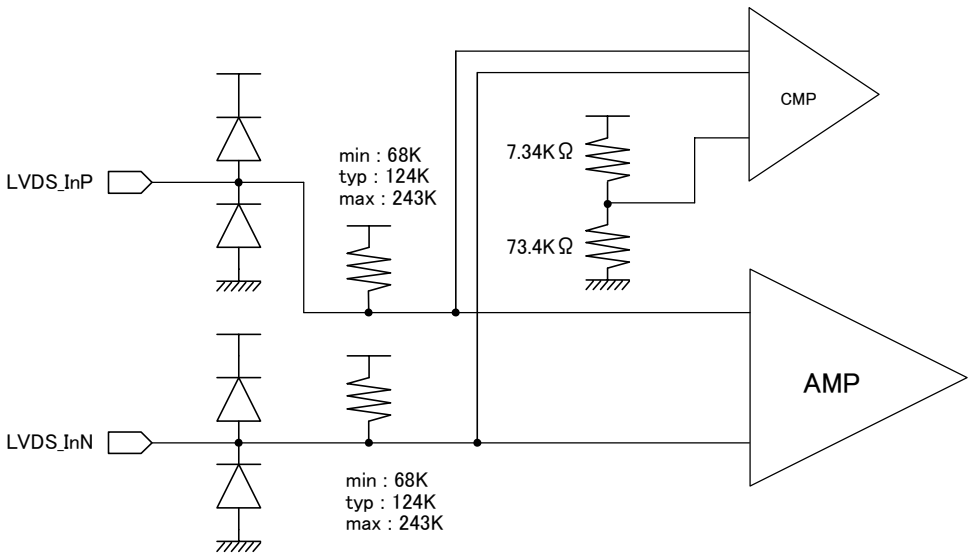

Figure 3. LVDS Input Schematic Diagram

Power Consumption

Table 4. Power Consumption

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Conditions	Typ*	Max	Unit
I_{RCCW}	LVDS Receiver Operating Current Gray Scale Pattern (Fig.4)	RL=100Ω, CL=5pF, RCLK=75MHz	139	-	mA
	LVDS Receiver Operating Current Worst Case Pattern (Fig.5)	RL=100Ω, CL=5pF, RCLK=75MHz	-	-	mA

* Typ values are at the conditions of VCC=3.3V and Ta = +25ºC

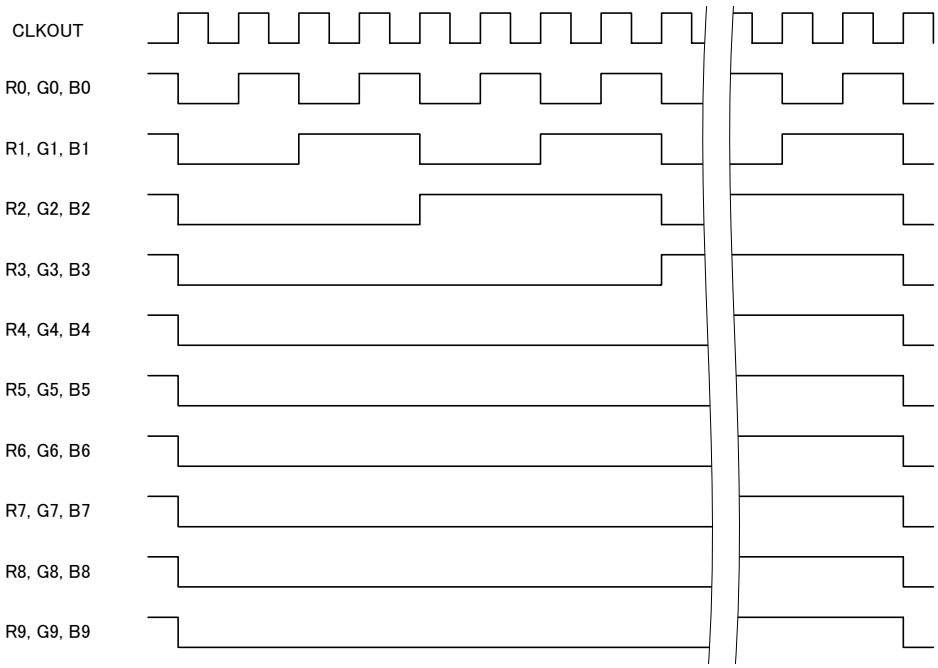

Figure 4. Grayscale Pattern

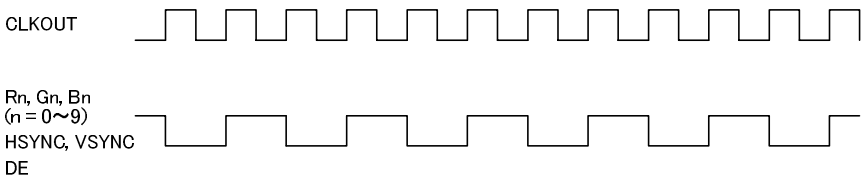

Figure 5. Worst Case Pattern

Electrical Characteristics

Table 5. LVCMOS/TTL DC Specifications

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ*	Max	Unit
V_{IH}	High Level Input Voltage	RS=VCC or GND	2.0	-	VCC	V
V_{IL}	Low Level Input Voltage	RS=VCC or GND	GND	-	0.8	V
VOH	High Level Output Voltage	I_{OH}=12mA(Data), 16mA(Clk)	2.4	-	-	V
VOL	Low Level Output Voltage	I_{OH}=12mA(Data), 16mA(Clk)	-	-	0.4	V
I_{IL}	Input Leakage Current		-	-	±1	μA
P_D	Power Dissipation		-	0.46	-	W

* Typ values are at the conditions of VCC=3.3V and Ta = +25ºC

Table 6. LVDS Receiver DC Specifications

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ*	Max	Unit
V_{IC}	Differential Input Common Voltage		0.6	1.2	1.8	V
$\|V_{ID}\|$	Differential Voltage		100	-	600	mV
V_{TH}	Differential Input High Threshold	V_{IC} = 1.2V	-	-	100	mV
V_{TL}	Differential Input Low Threshold	V_{IC} = 1.2V	-100	-	-	mV
I_{INLVDS}	LVDS Input Current		-	-	±20	μA

*Typ values are at the conditions of VCC=3.3V and Ta = +25ºC

Table 7. LVCMOS/TTL & LVDS Receiver AC Specifications

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter		Min	Typ	Max	Unit
t_{RCP}	CLK Period	RCLK1/2	13.3	-	50	ns
		CLKOUT	6.6	-	25	
t_{RCH}	CLKOUT High Time		2/7 T_{RCP}	4/7 T_{RCP}	5/7 T_{RCP}	ns
t_{RCL}	CLKOUT Low Time		5/7 T_{RCP}	3/7 T_{RCP}	2/7 T_{RCP}	ns
t_{DOUT}	LVCMOS Data OUT Period		6.6	-	25	ns
t_{RS}	LVCMOS Data Setup to CLKOUT		2.0	-	4.6	ns
t_{RH}	LVCMOS Data Hold to CLKOUT		2.0	-	4.6	ns
t_{SK}	Receiver Skew Margin		-400	-	400	ps
t_{RIP1}	Input Data Position0		- t_{SK}	0	+ t_{SK}	ns
t_{RIP0}	Input Data Position1		t_{RCIP} /7- t_{SK}	t_{RCIP} /7	t_{RCIP} /7+ t_{SK}	ns
t_{RIP6}	Input Data Position2		2t_{RCIP} /7- t_{SK}	2t_{RCIP} /7	2t_{RCIP} /7+ t_{SK}	ns
t_{RIP5}	Input Data Position3		3t_{RCIP} /7- t_{SK}	3t_{RCIP} /7	3t_{RCIP} /7+ t_{SK}	ns
t_{RIP4}	Input Data Position4		4t_{RCIP} /7- t_{SK}	4t_{RCIP} /7	4t_{RCIP} /7+ t_{SK}	ns
t_{RIP3}	Input Data Position5		5t_{RCIP} /7- t_{SK}	5t_{RCIP} /7	5t_{RCIP} /7+ t_{SK}	ns
t_{RIP2}	Input Data Position6		6t_{RCIP} /7- t_{SK}	6t_{RCIP} /7	6t_{RCIP} /7+ t_{SK}	ns
t_{RPLL}	Phase Lock Loop Set		-	-	1	ms

* Typ values are at the conditions of VCC=3.3V and Ta = +25ºC

AC Timing Diagrams

LVCMOS Output

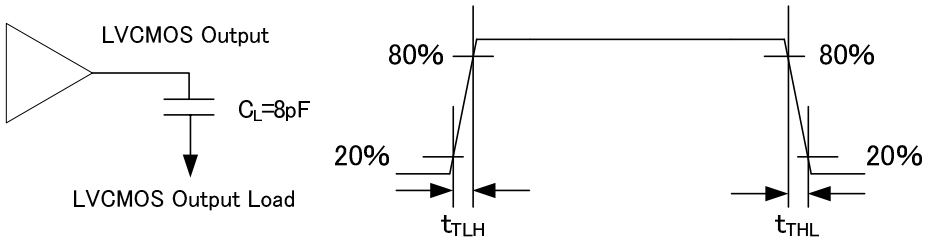

Figure 6. CLKOUT Transmission Time

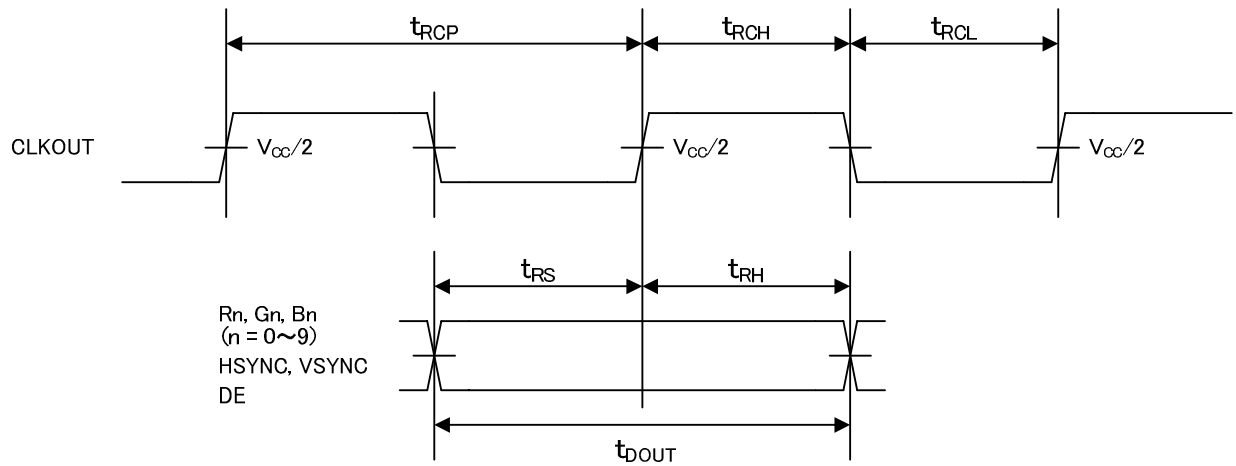

Figure 7. CLKOUT Period, High/Low Time, Setup/Hold Timing

LVDS Input Data Position

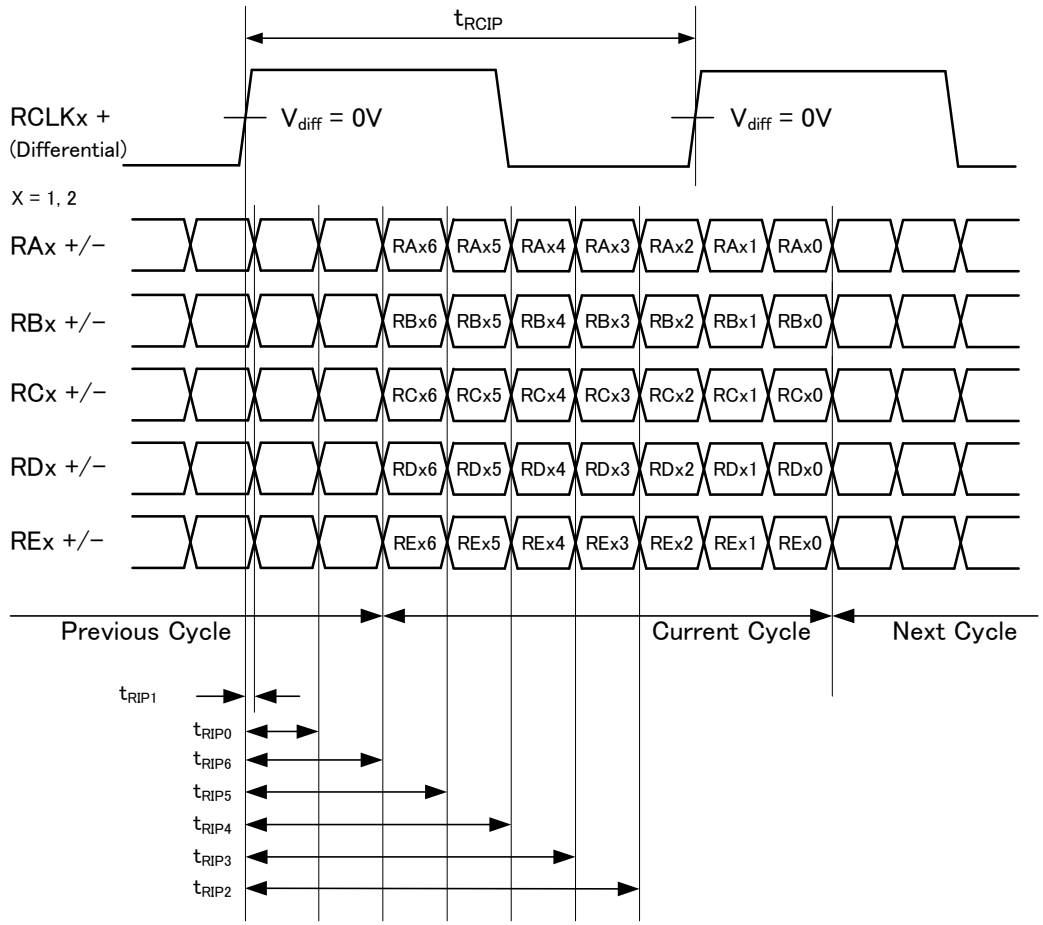

Figure 8. LVDS Input Data Position

Phase Lock Loop Set Time

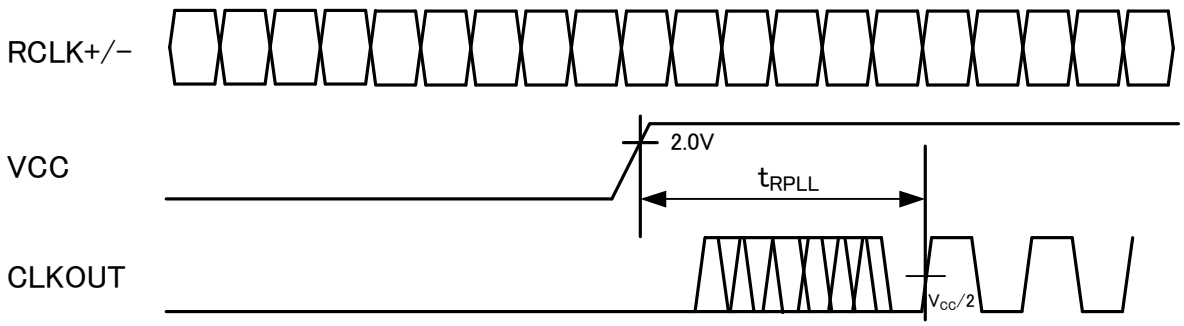

Figure 9. PLL Lock Set Time

LVDS Data Timing Diagram

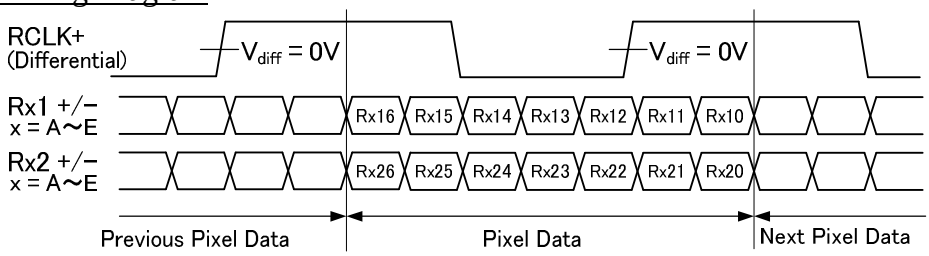

Figure 10. LVDS Data Timing Diagram

Table 8. LVDS Input Data Mapping

LVDS Input Data Mapping (MLSB=High, MAP[2:0]=High)

LVDS Input Data (1st Pixel Data)	1st pix data	LVDS Input Data (2nd Pixel Data)	2nd pix data
RA10	R4 (n)	RA20	R4 (n+1)
RA11	R5 (n)	RA21	R5 (n+1)
RA12	R6 (n)	RA22	R6 (n+1)
RA13	R7 (n)	RA23	R7 (n+1)
RA14	R8 (n)	RA24	R8 (n+1)
RA15	R9 (n)	RA25	R9 (n+1)
RA16	G4 (n)	RA26	G4 (n+1)
RB10	G5 (n)	RB20	G5 (n+1)
RB11	G6 (n)	RB21	G6 (n+1)
RB12	G7 (n)	RB22	G7 (n+1)
RB13	G8 (n)	RB23	G8 (n+1)
RB14	G9 (n)	RB24	G9 (n+1)
RB15	B4 (n)	RB25	B4 (n+1)
RB16	B5 (n)	RB26	B5 (n+1)
RC10	B6 (n)	RC20	B6 (n+1)
RC11	B7 (n)	RC21	B7 (n+1)
RC12	B8 (n)	RC22	B8 (n+1)
RC13	B9 (n)	RC23	B9 (n+1)
RC14	HSYNC	RC24	-
RC15	VSYNC	RC25	-
RC16	DE	RC26	-
RD10	R2 (n)	RD20	R2 (n+1)
RD11	R3 (n)	RD21	R3 (n+1)
RD12	G2 (n)	RD22	G2 (n+1)
RD13	G3 (n)	RD23	G3 (n+1)
RD14	B2 (n)	RD24	B2 (n+1)
RD15	B3 (n)	RD25	B3 (n+1)
RD16	-	RD26	-
RE10	R0 (n)	RE20	R0 (n+1)
RE11	R1 (n)	RE21	R1 (n+1)
RE12	G0 (n)	RE22	G0 (n+1)
RE13	G1 (n)	RE23	G1 (n+1)
RE14	B0 (n)	RE24	B0 (n+1)
RE15	B1 (n)	RE25	B1 (n+1)
RE16	-	RE26	-

Output Disable Mode

Table 9. Output Disable Mode Setting

Input Signal	Normal Mode Setting	Output Disable Mode Setting
OE	H	L
TEST	L	H
TEST2	L	L
MAP0	X	H
MAP1	X	H
MAP2	X	H
Other Input Signals	X	X

Table 10. Output Disable Mode Signal Definition

Output Signal	Normal Mode	Output Disable Mode
B9	Normal Operation	L
Other Output Signals		Hi-Z

Typical Connection

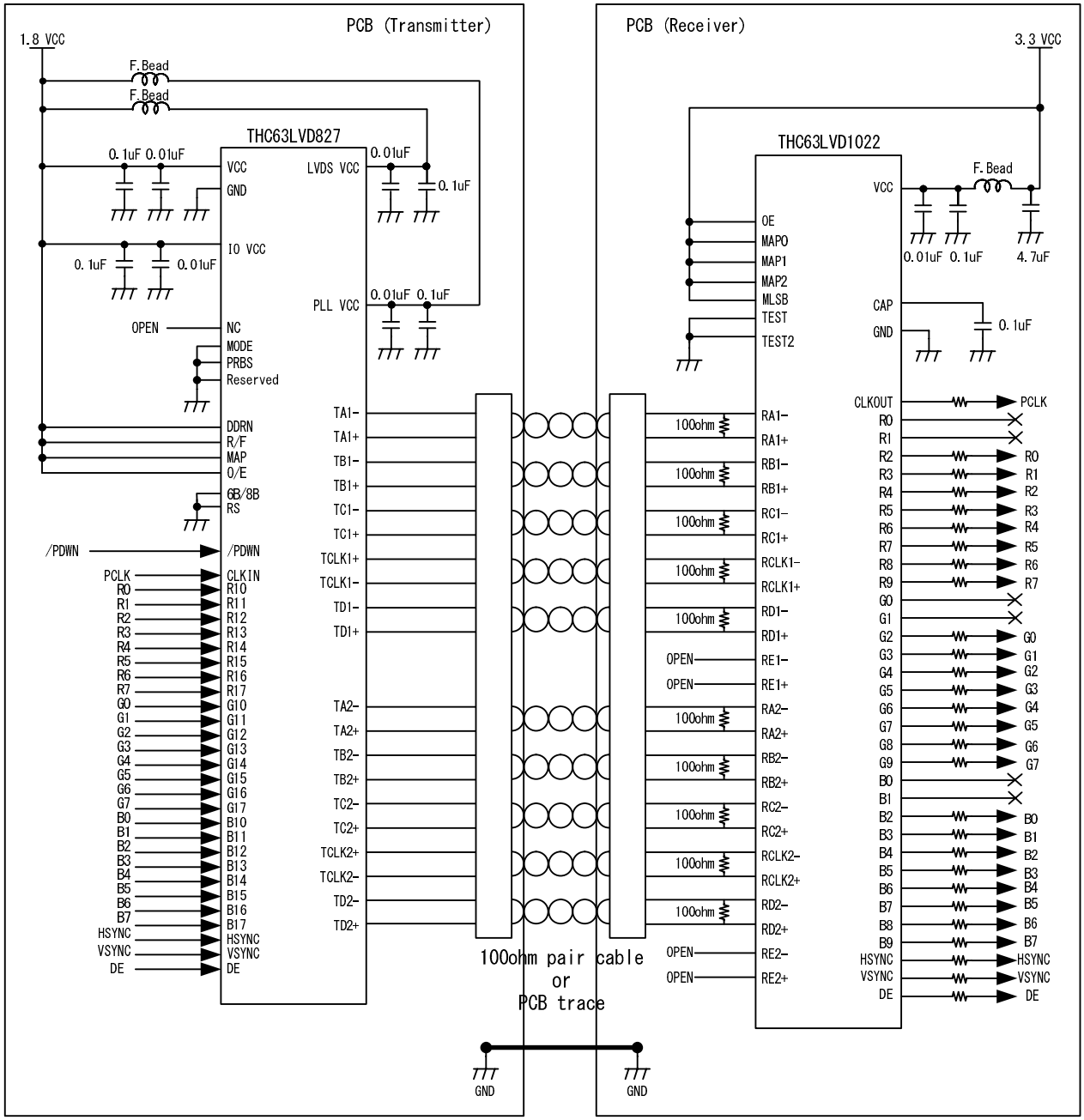

Figure 11. Typical Connection Diagram

Notes

1) Cable Connection and Disconnection

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

2) GND Connection

Connect each GND of the PCB which THC63LVD1022 and LVDS-Tx 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.

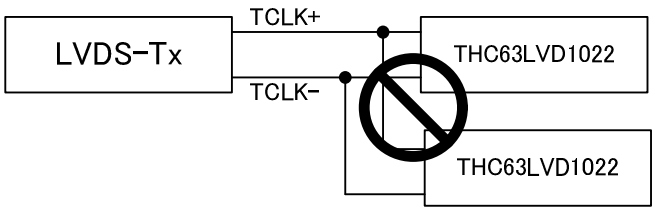

Figure 12. Multi Drop Connection

4) Asynchronous use

Asynchronous using such as following system is not recommended.

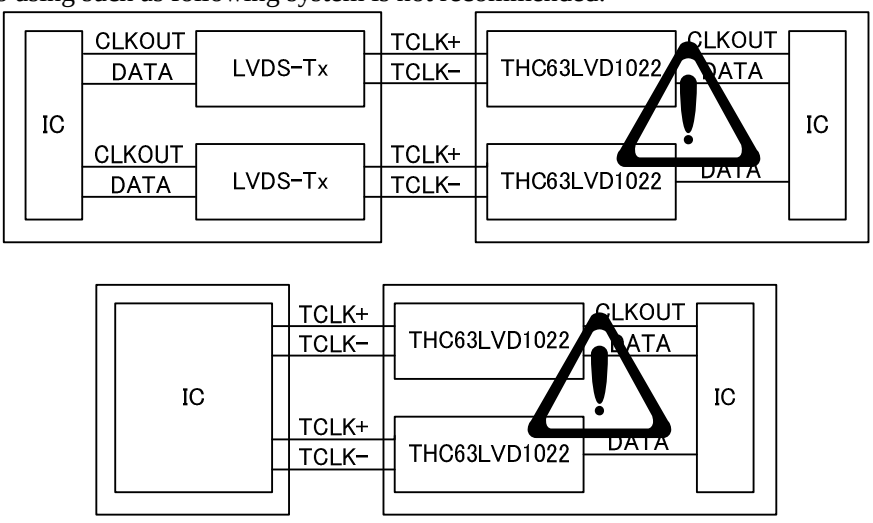

Figure 13. Asynchronous Use

Package

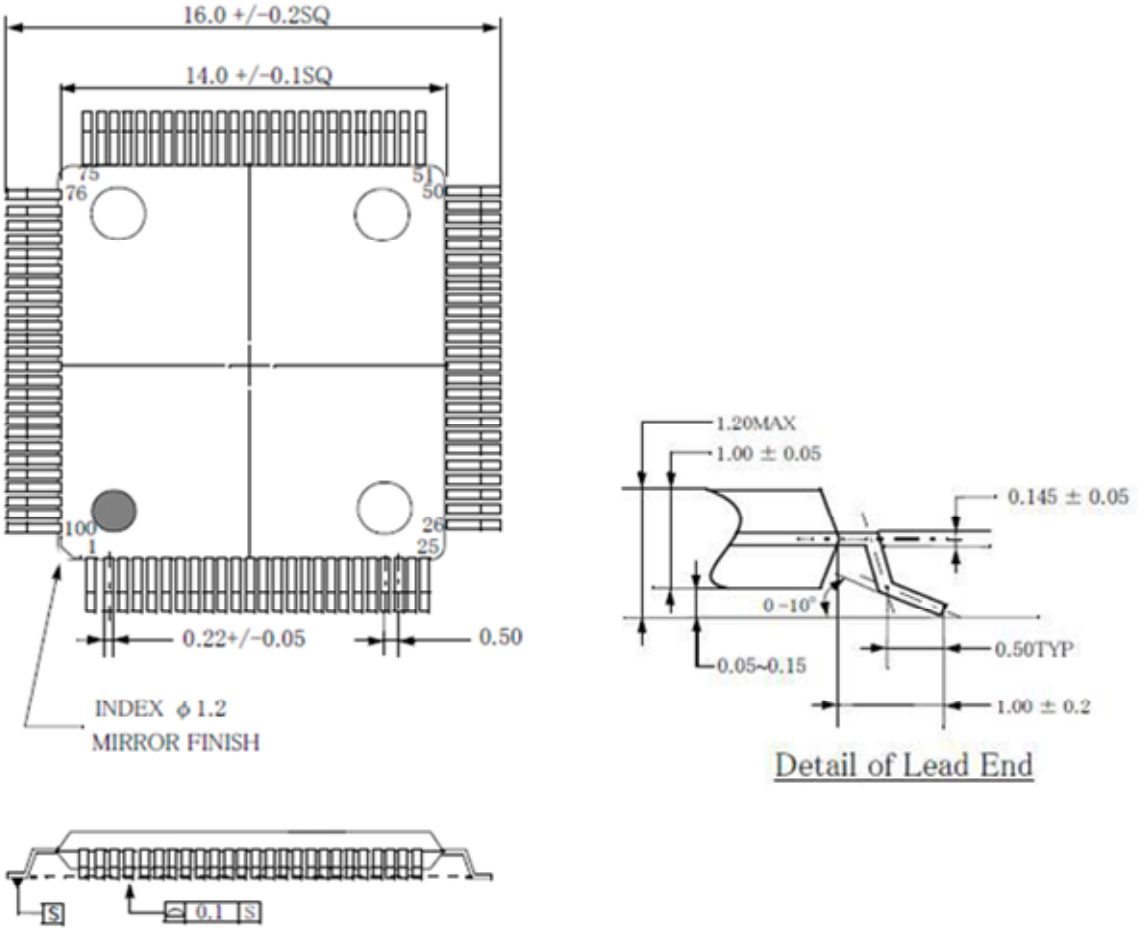

Figure 14. Package Diagram

Reference of Land Pattern

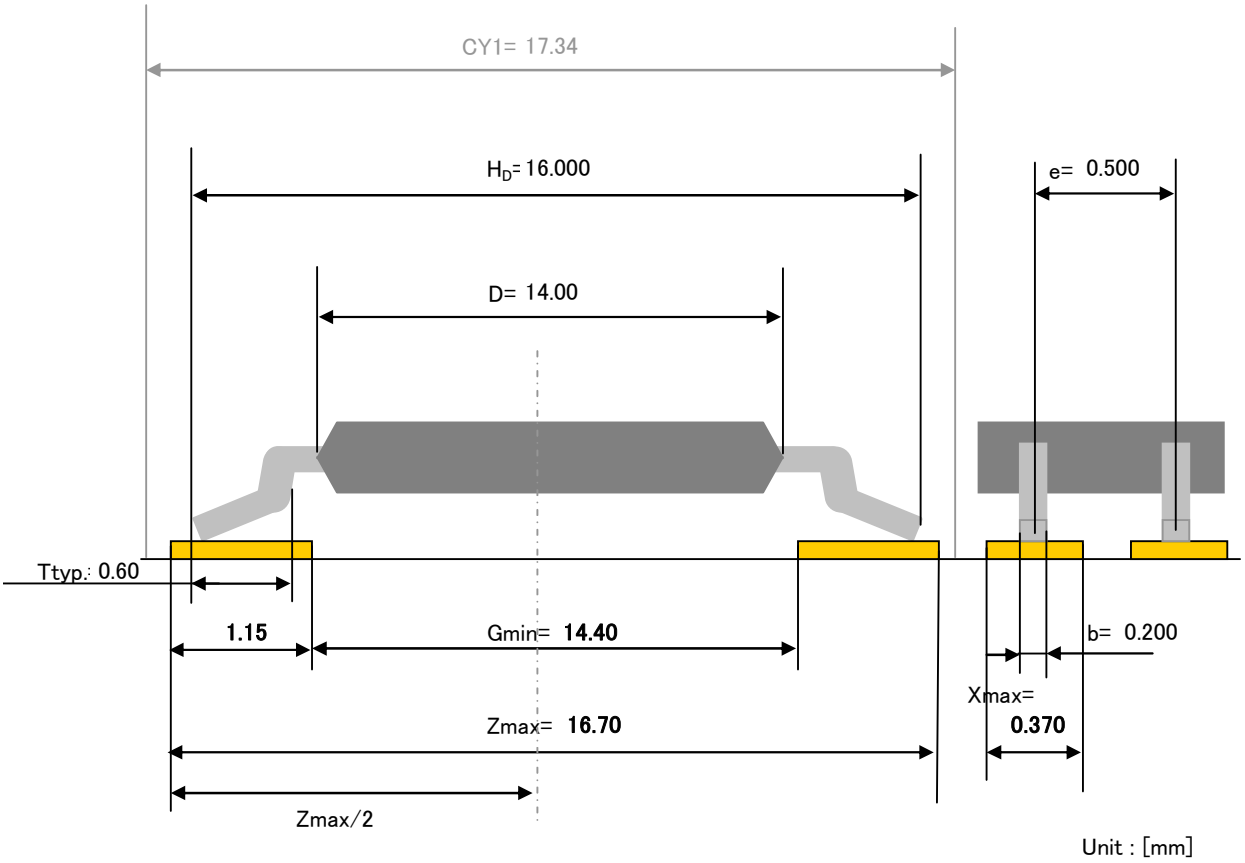

Figure 15. Reference of Land Pattern

The recommendation mounting method of THine device is reflow soldering.
The reference pattern is using the calculation result on condition of reflow soldering.

Notes
This land pattern design is a calculated value based on JEITA ET-7501.
Please take into consideration in an actual substrate design about enough the ease of mounting, the intensity of connection, the density of mounting, and the solder paste used, etc… The optimal land pattern size changes with these parameters. Please use the value shown by the land pattern as reference data.

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7. This product may be permanently damaged and suffer from performance degradation or loss of mechanical functionality if subjected to electrostatic charge exceeding capacity of the ESD (Electrostatic Discharge) protection circuitry. Safety earth ground must be provided to anything in contact with the product, including any operator, floor, tester and soldering iron.

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