LVDS Interface ICs

70bit LVDS Distributor

BU90RT102

No.13057EBT08

●Description

LVDS Interface IC of ROHM "Serializer" "Deserializer" operates from 20MHz to 135MHz wide clock range, and number of bits range is from 35 to 70. Data is transmitted seven times (7X) stream and reduce cable number by 3(1/3) or less. The ROHM's LVDS has low swing mode to be able to expect further low EMI.
Driver and Receiver of 4 bits operate to 250MHz. It can be used for a variety of purposes, home appliances such as LCD-TV, business machines such as decoders, instruments, and medical equipment.

●Features

1) RGB10bits dual channel LVDS Receiver and Transmitter
2) Operating frequency range : 20～135MHz
3) Power down mode supported.
4) Support spread spectrum clock generator.
5) Support reduced swing LVDS for low EMI.
6) Package HTSSOP-C64

●Applications

Digital TV (Signal System)
Car Navigation System
Copier
FA equipment
Medical equipment
Vending machine, Ticket vending machine

●Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Supply Voltage	V_{DD}	-0.3 ~ 4.0	V
Input Voltage	V_{IN}	-0.3 ~ V_{DD}+0.3	V
Output Voltage	V_{OUT}	-0.3 ~ V_{DD}+0.3	V
Storage Temperature Range	Tstg	-55 ~ 125	℃

●Recommended Operating Conditions

Parameter	Symbol	Ratings			Unit
		Min	Typ	Max	
Supply Voltage	V_{DD}	3.0	3.3	3.6	V
Operating Temperature Range	Topr	-20	-	85	℃
Dual-in/Dual-out	Fin	20	-	135	MHz
	Fout	20	-	135	MHz
Distribution	Fin	20	-	135	MHz
	Fout	20	-	135	MHz
Single-in / Dual-out	Fin	40	-	135	MHz
	Fout	20	-	67.5	MHz
Dual-in / Single-out	Fin	20	-	67.5	MHz
	Fout	40	-	135	MHz

●Block Diagram

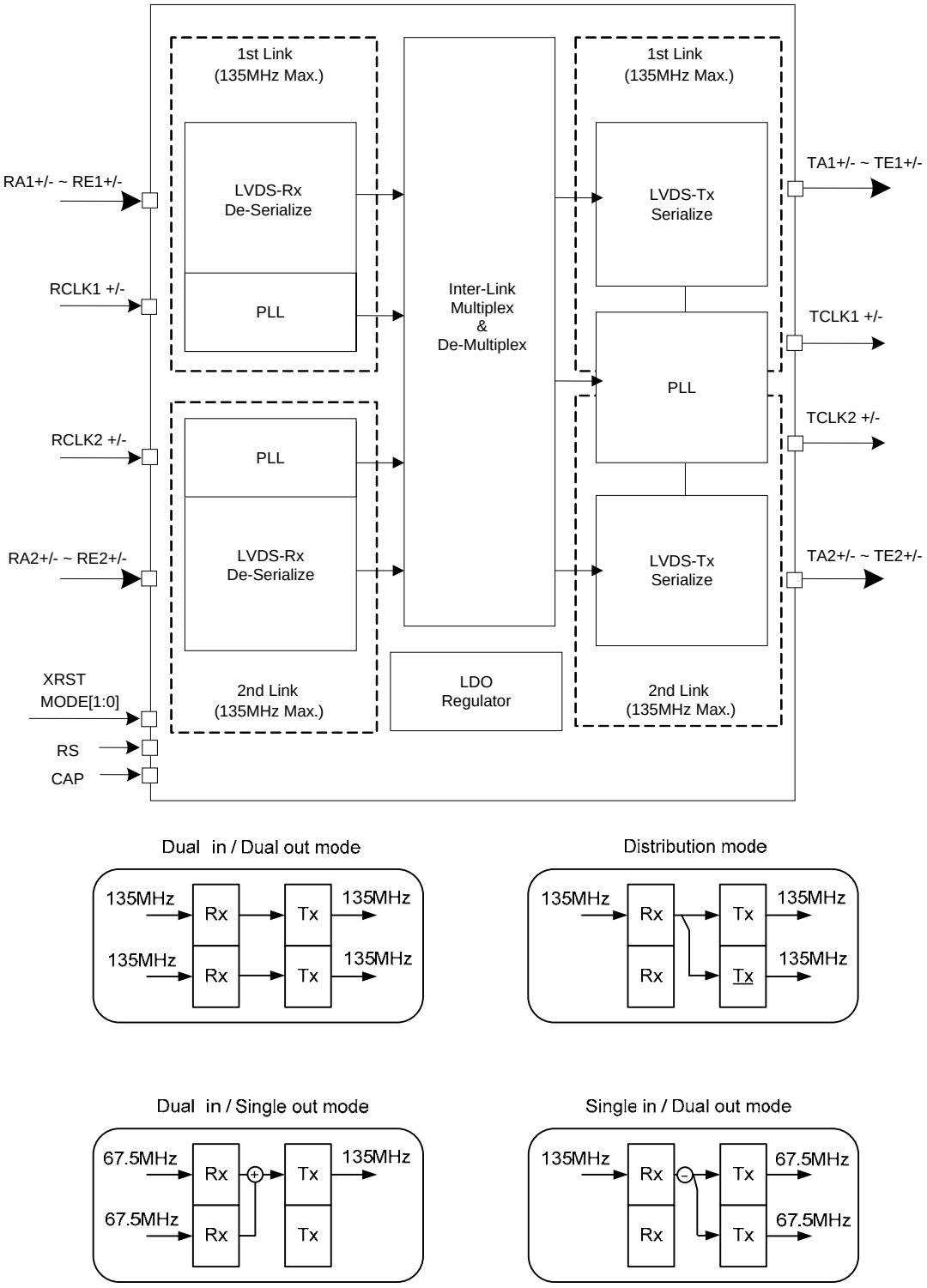


Fig.1 Block Diagram

●**Pin Configuration**

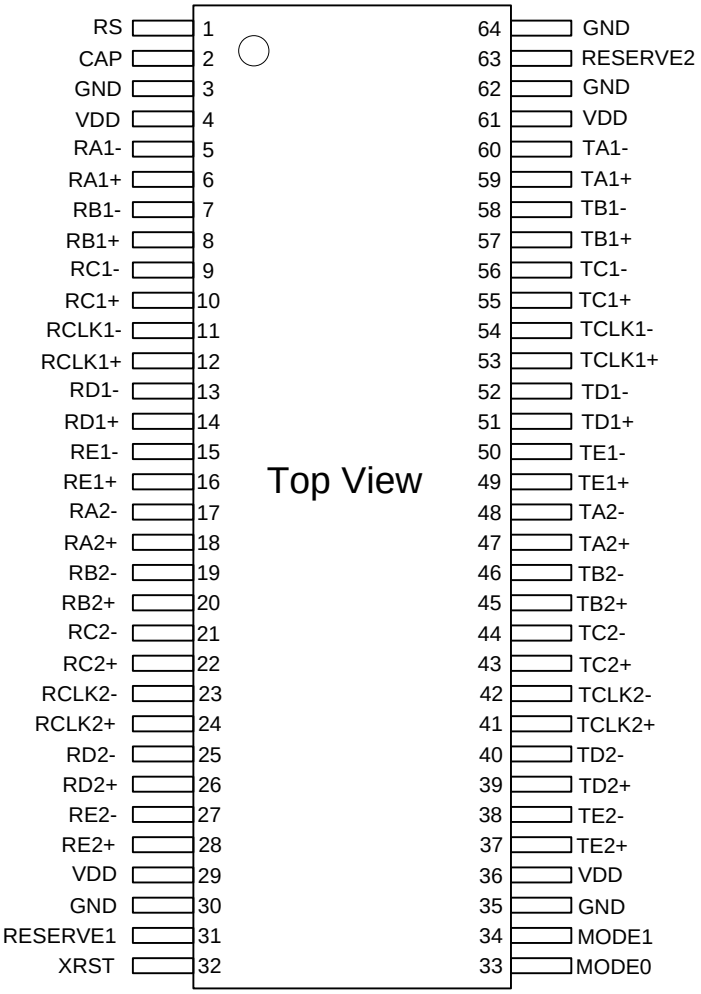


Fig.2 Pin Configuration (Top View)

●Pin Description

<table>
<tr><th>Pin Name</th><th>Pin No.</th><th colspan="2">Type</th><th>Descriptions</th></tr>
<tr><td>RA1+/-</td><td>5,6</td><td rowspan="12">Input</td><td rowspan="24">LVDS</td><td>Link1 chA LVDS data input</td></tr>
<tr><td>RB1+/-</td><td>7,8</td><td>Link1 chB LVDS data input</td></tr>
<tr><td>RC1+/-</td><td>9,10</td><td>Link1 chC LVDS data input</td></tr>
<tr><td>RD1+/-</td><td>13,14</td><td>Link1 chD LVDS data input</td></tr>
<tr><td>RE1+/-</td><td>15,16</td><td>Link1 chE LVDS data input</td></tr>
<tr><td>RCLK1+/-</td><td>11,12</td><td>Link1 LVDS clock input</td></tr>
<tr><td>RA2+/-</td><td>17,18</td><td>Link2 chA LVDS data input</td></tr>
<tr><td>RB2+/-</td><td>19,20</td><td>Link2 chB LVDS data input</td></tr>
<tr><td>RC2+/-</td><td>21,22</td><td>Link2 chC LVDS data input</td></tr>
<tr><td>RD2+/-</td><td>25,26</td><td>Link2 chD LVDS data input</td></tr>
<tr><td>RE2+/-</td><td>27,28</td><td>Link2 chE LVDS data input</td></tr>
<tr><td>RCLK2+/-</td><td>23,24</td><td>Link2 LVDS clock input</td></tr>
<tr><td>TA1+/-</td><td>59,60</td><td rowspan="12">Output</td><td>Link1 chA LVDS data output</td></tr>
<tr><td>TB1+/-</td><td>57,58</td><td>Link1 chB LVDS data output</td></tr>
<tr><td>TC1+/-</td><td>55,56</td><td>Link1 chC LVDS data output</td></tr>
<tr><td>TD1+/-</td><td>51,52</td><td>Link1 chD LVDS data output</td></tr>
<tr><td>TE1+/-</td><td>49,50</td><td>Link1 chE LVDS data output</td></tr>
<tr><td>TCLK1+/-</td><td>53,54</td><td>Link1 LVDS clock output</td></tr>
<tr><td>TA2+/-</td><td>47,48</td><td>Link2 chA LVDS data output</td></tr>
<tr><td>TB2+/-</td><td>45,46</td><td>Link2 chB LVDS data output</td></tr>
<tr><td>TC2+/-</td><td>43,44</td><td>Link2 chC LVDS data output</td></tr>
<tr><td>TD2+/-</td><td>39,40</td><td>Link2 chD LVDS data output</td></tr>
<tr><td>TE2+/-</td><td>37,38</td><td>Link2 chE LVDS data output</td></tr>
<tr><td>TCLK2+/-</td><td>41,42</td><td>Link2 LVDS clock output</td></tr>
<tr><td>XRST</td><td>32</td><td>Input</td><td rowspan="3">CMOS</td><td>Power Down
H : Normal operation
L : Power down (all outputs are Hi-Z)</td></tr>
<tr><td>RS</td><td>1</td><td>Input</td><td>LVDS swing level select
H : TYP=350mV
L : TYP=200mV</td></tr>
<tr><td>MODE1
MODE0</td><td>33,34</td><td>Input</td><td>Pixel data mdoe
<table>
<tr><th>MODE1</th><th>MODE0</th><th>RCLK2/-</th><th>Description</th></tr>
<tr><td>L</td><td>L</td><td>clkin</td><td>Dual-in/Dual-out mode</td></tr>
<tr><td>L</td><td>L</td><td>Hi-z</td><td>Distribution mode</td></tr>
<tr><td>H</td><td>L</td><td>Hi-z</td><td>Single-in/Dual-out mode</td></tr>
<tr><td>L</td><td>H</td><td>clkin</td><td>Dual-in/Single-out mode</td></tr>
<tr><td>H</td><td>H</td><td>-</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td>VDD</td><td>4,29,36,61</td><td>-</td><td rowspan="3">-</td><td>Power supply pins.</td></tr>
<tr><td>GND</td><td>3,30,35,62,64</td><td>-</td><td>Ground pins</td></tr>
<tr><td>CAP</td><td>2</td><td>-</td><td>Decoupling capacitor pin
This pin should be connected to external decoupling capacitor.
Recommended capacitor is 2.2µF.*1</td></tr>
<tr><td>RESERVE1/2</td><td>31,63</td><td>Input</td><td>-</td><td>Reserve pins
Must be open</td></tr>
</table>

*1. Parts list of recommended external decoupling capacitor

Maker	Parts Number	Size [mm]	Capacity [µF]	Capacitance Tolerance [%]	Temperature Characteristics	Reference Temperature [℃]	Capacitance Change [%]	Operating Temperature Range [℃]	Voltage [V]
Murata	GRM155B30G225ME15D	1.0x0.5x0.5	2.2	±20	B	20	±10%	-25～85	4.0
Murata	GRM155R60J225ME15D	1.0x0.5x0.5	2.2	±20	X5R	25	±15%	-55～85	6.3
TDK	C1005X7R1H222KT	1.0x0.5x0.5	2.2	±20	X7R	25	±15%	-55～125	5.0
Kyocera	CM05X5R225K04AH	1.0x0.5x0.5	2.2	±20	X5R	25	±15%	-55～85	4.0
Kyocera	CM05X5R225M04AH	1.0x0.5x0.5	2.2	±20	X5R	25	±15%	-55～85	4.0

●DC Characteristics

Table 1 : LVCMOS DC Characteristics(V_{DD}=3.0V～3.6V, Ta=-20℃～+85℃)

Parameter	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
High Level Input Voltage	V_{IH}	V_{DD}×0.8	-	V_{DD}	V	-
Low Level Input Voltage	V_{IL}	GND	-	V_{DD}×0.2	V	-
Input Leak Current	I_{INC}	-10	-	+10	μA	$0V \leq V_{IN} \leq V_{DD}$
Pull-down resistor	P_{DR}	20	46	100	KΩ	-

Table 2 : LVDS Receiver DC Characteristics(V_{DD}=3.0V～3.6V, Ta=-20℃～+85℃)

Parameter	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
LVDS-Rx Input Voltage	V_{IN_RX}	0.4	-	2.1	V	-
LVDS-Rx Common Voltage	V_{IC_RX}	0.7	1.2	1.8	V	-
Differential Input High Threshold	V_{TH_RX}	-	-	+100	mV	V_{IC_RX}=1.2V
Differential Input Low Threshold	V_{TL_RX}	-100	-	-	mV	V_{IC_RX}=1.2V
LVDS-Rx Differential Voltage	$\|V_{ID\_RX}\|$	100	-	600	mV	-
LVDS-Rx Input Current	V_{IN_RX}	-20	-	20	μA	-

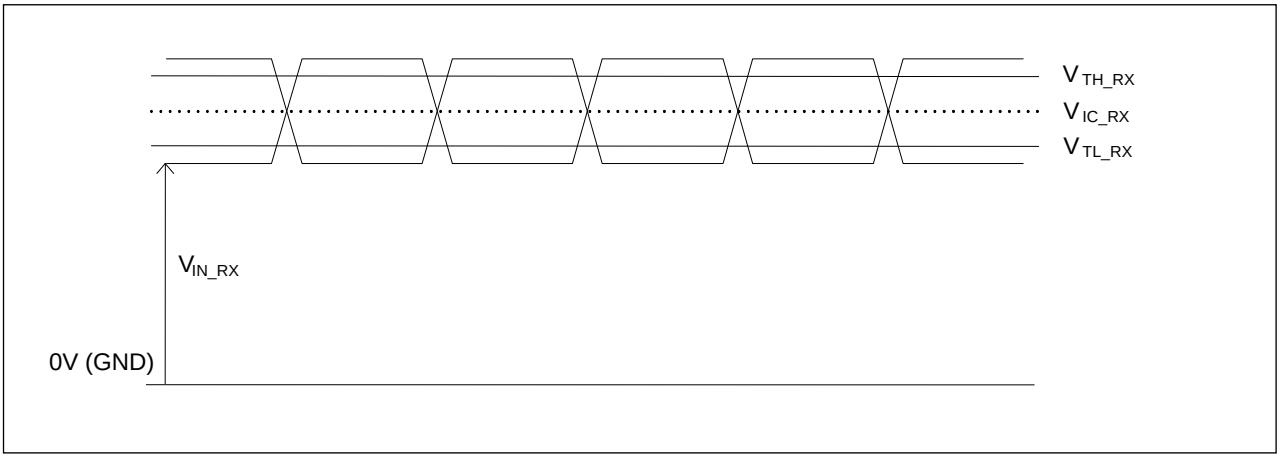


Fig.3 LVDS Receiver DC Characteristics

Table 3 : LVDS Transmitter DC Characteristics(V_{DD}=3.0V～3.6V, Ta=-20℃～+85℃)

Parameter	Symbol	Limits			Unit	Conditions	
		Min	Typ	Max			
Differential Output Voltage	V_{OD}	250	350	450	mV	RL=100Ω	Normal swing RS=V_{DD}
		100	200	300	mV		Reduced swing RS=GND
Change in V_{OD} between complementary output states	ΔV_{OD}	-	-	35	mV	RL=100Ω	
Common Voltage	V_{OC}	1.125	1.25	1.375	V		
Change in V_{OC} between complementary output states	ΔV_{OC}	-	-	35	mV		
Output Short Circuit Current	I_{OS}	-60	-	-	mA	V_{OUT}=0V	
Output Tri-state Current	I_{OZ}	-10	-	+10	μA	XRST=0V, V_{OUT}=0V to V_{DD}	

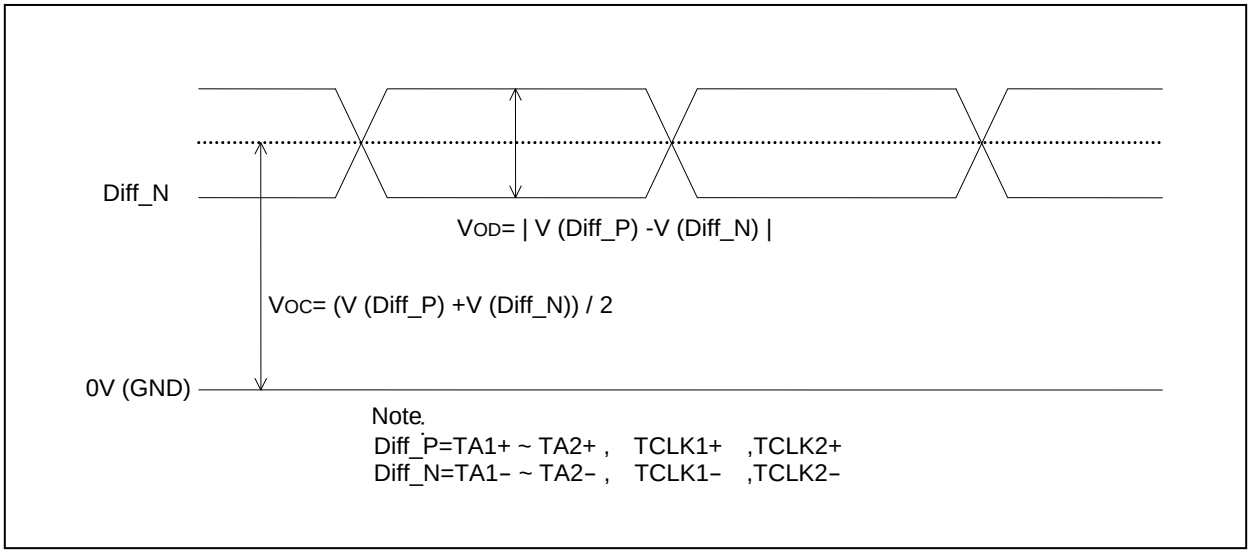


Fig.4 LVDS Transmitter DC Characteristics

●AC Characteristics

Table 4 : Switching Characteristics(VDD=3.3V, Ta=25℃)

Parameter		Symbol	Limits			Unit
			Min	Typ	Max	
Skew Time between RCLK1 and RCLK2		t_{CK12}	-0.3 t_{RCP}	-	0.3 t_{RCP}	ns
Phase Lock Loop Set Time		t_{LT}	-	-	10	ms
Data Latency	dual-in/dual-out	t_{RIP6}	-	$4t_{RCP}$+5	-	ns
	distribution		-	$4t_{RCP}$+5	-	ns
	single-in/dual-out		-	$6t_{RCP}$+5	-	ns
	dual-in/single-out		-	$2.5t_{RCP}$+5	-	ns
DE Input High Time		t_{DEH}	2 t_{RCP}	-	-	ns
DE Input Low Time		t_{DEL}	2 t_{RCP}	-	-	ns
DE Input Period		t_{DEL}	4 t_{RCP}	Must be $2nt_{RCP}$ (n=integer)	-	ns

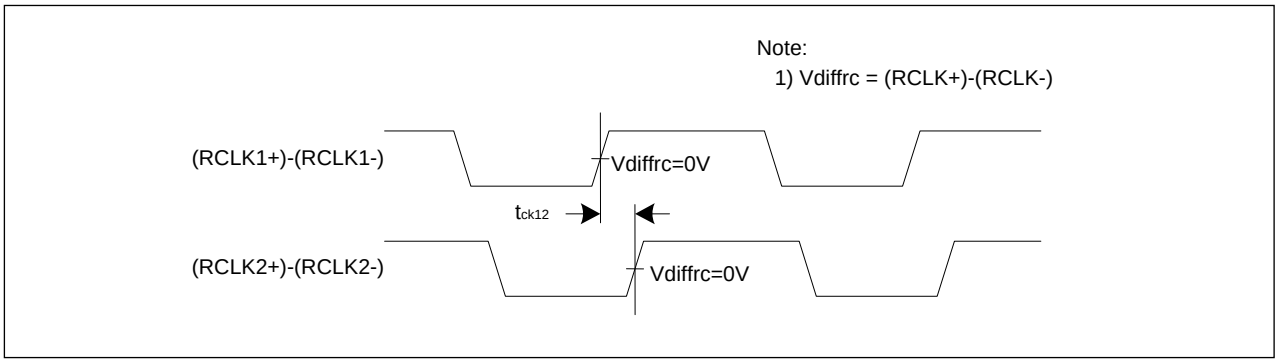


Fig.5 Skew Time between RCLK1 and RCLK2

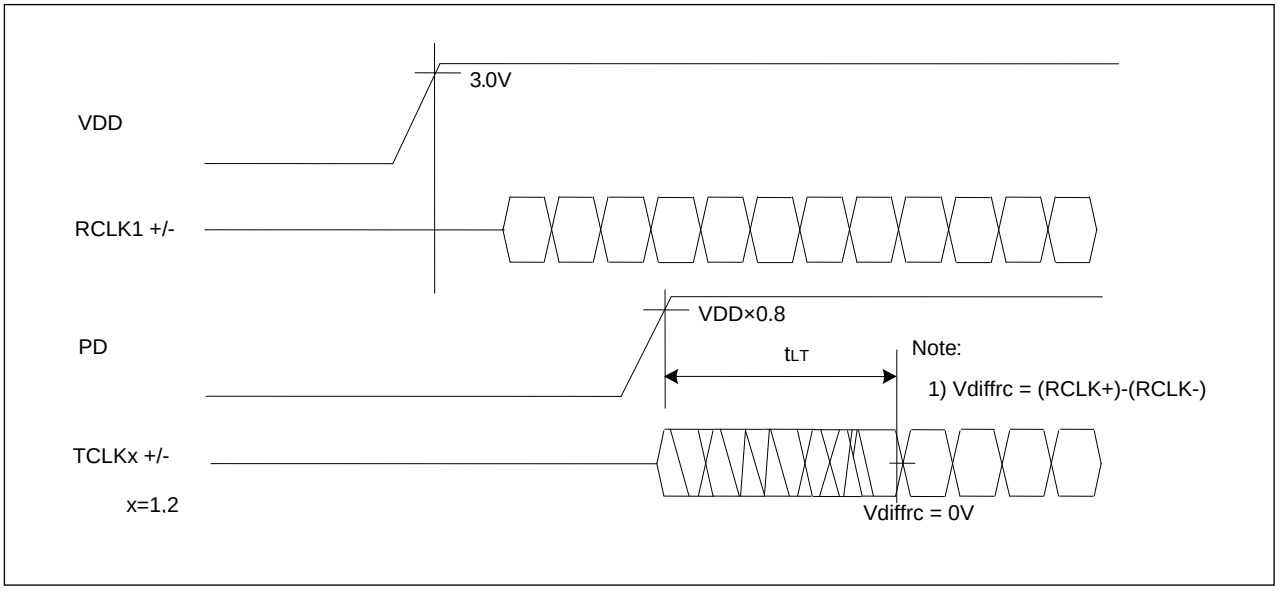


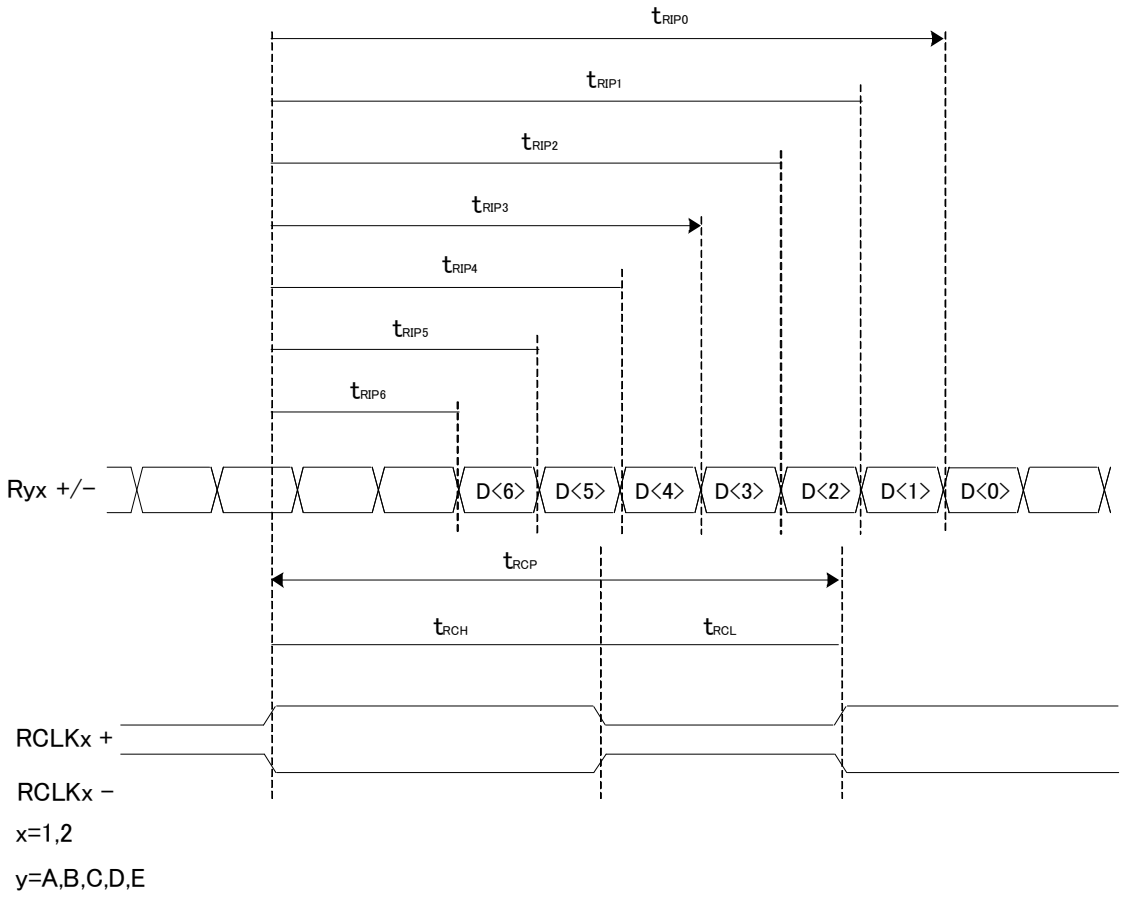
Fig.6 Phase Lock Loop Set Time

●LVDS Receiver AC Characteristics

Table 5 : Switching Characteristics(VDD=3.3V, Ta=25℃)

Parameter		Symbol	Limits			Unit
			Min	Typ	Max	
Input Clock Period	dual /dual	t_{RCP}	7.4	-	50	ns
	distribution		7.4	-	50	ns
	single/dual		7.4	-	25	ns
	dual/single		14.8	-	50	ns
Differential Input Data Setup Margin	CLKIN= 75MHz	t_{RSUP}	480	-	-	ps
	CLKIN= 112MHz		250	-	-	ps
	CLKIN= 135MHz		220	-	-	ps
Differential Input Data Hold Margin	CLKIN= 75MHz	t_{RHLD}	480	-	-	ps
	CLKIN= 112MHz		250	-	-	ps
	CLKIN= 135MHz		220	-	-	ps
Differential Input Data Position 6		t_{RIP6}	$2\frac{t_{RCP}}{7}-t_{RHLD}$	$2\frac{t_{RCP}}{7}$	$2\frac{t_{RCP}}{7}+t_{RSUP}$	ns
Differential Input Data Position 5		t_{RIP5}	$3\frac{t_{RCP}}{7}-t_{RHLD}$	$3\frac{t_{RCP}}{7}$	$3\frac{t_{RCP}}{7}+t_{RSUP}$	ns
Differential Input Data Position 4		t_{RIP4}	$4\frac{t_{RCP}}{7}-t_{RHLD}$	$4\frac{t_{RCP}}{7}$	$4\frac{t_{RCP}}{7}+t_{RSUP}$	ns
Differential Input Data Position 3		t_{TOP3}	$5\frac{t_{RCP}}{7}-t_{RHLD}$	$5\frac{t_{RCP}}{7}$	$5\frac{t_{RCP}}{7}+t_{RSUP}$	ns
Differential Input Data Position 2		t_{RIP2}	$6\frac{t_{RCP}}{7}-t_{RHLD}$	$6\frac{t_{RCP}}{7}$	$6\frac{t_{RCP}}{7}+t_{RSUP}$	ns
Differential Input Data Position 1		t_{RIP1}	$7\frac{t_{RCP}}{7}-t_{RHLD}$	$7\frac{t_{RCP}}{7}$	$7\frac{t_{RCP}}{7}+t_{RSUP}$	ns
Differential Input Data Position 0		t_{RIP0}	$8\frac{t_{RCP}}{7}-t_{RHLD}$	$8\frac{t_{RCP}}{7}$	$8\frac{t_{RCP}}{7}+t_{RSUP}$	ns

●**AC Timing Diagram**



Ry1 +/− skew margin is the one between RCLK1 +/− and Ry1 +/−
Ry2 +/− skew margin is the one between RCLK2 +/− and Ry2 +/−

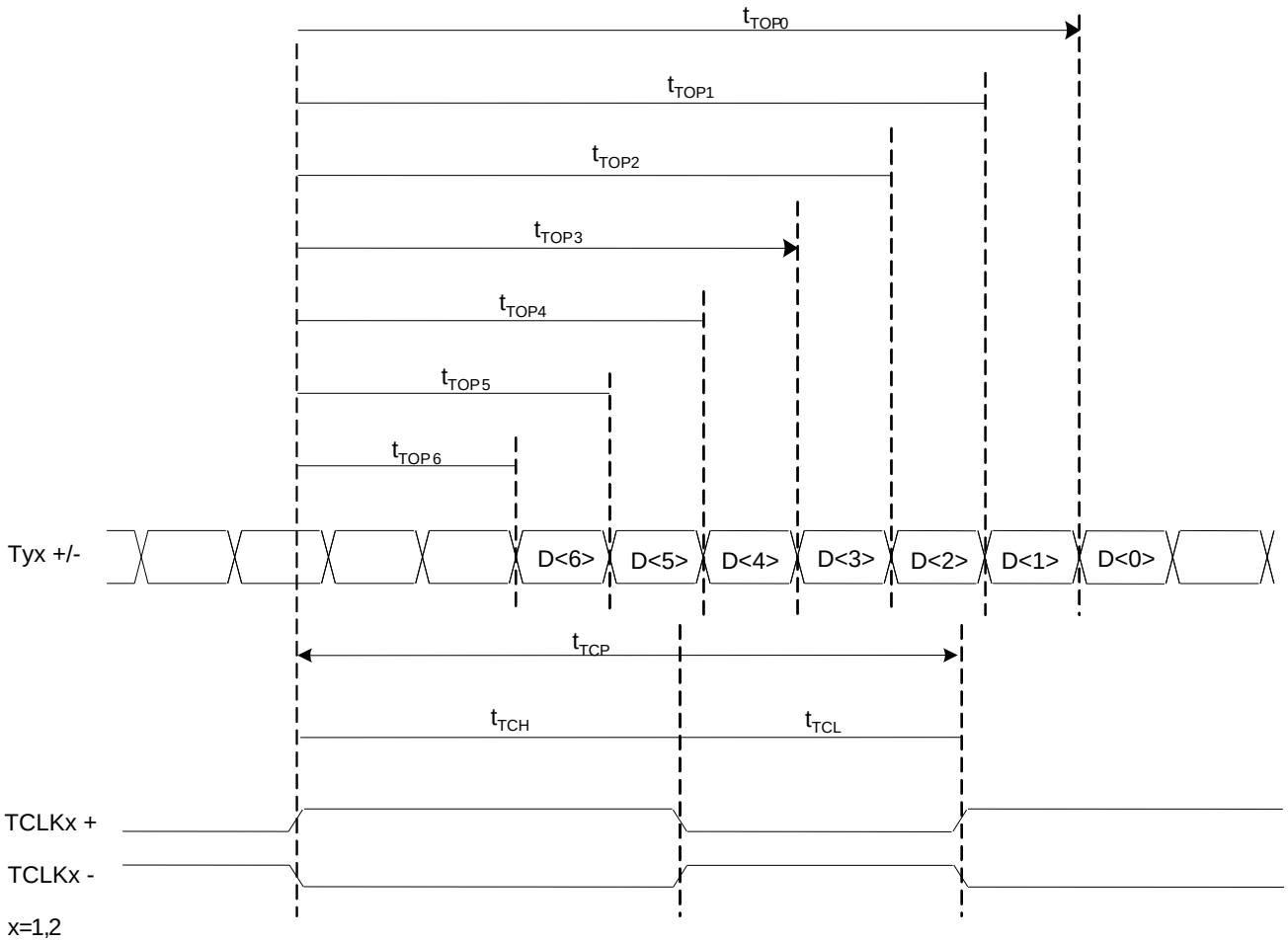
Fig.7 AC Timing Diagram (1)

●LVDS Transmitter AC Characteristics

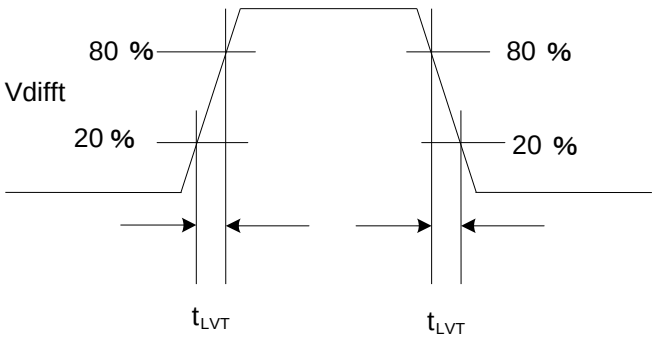
Table 6 : Switching Characteristics(VDD=3.3V, Ta=25℃)

Parameter		Symbol	Limits			Unit
			Min	Typ	Max	
Output Clock Period	dual /dual	t_{TCP}	7.4	-	50	ns
	distribution		7.4	-	50	ns
	single/dual		14.8	-	50	ns
	dual/single		7.4	-	25	ns
Differential Output Transition Time		t_{LVT}	-	0.6	1.5	ns
Differential Output Setup Time	CLKOUT=75MHz	T_{TSUP}	-	-	250	ps
	CLKOUT=112MHz		-	-	200	ps
	CLKOUT=135MHz		-	-	170	ps
Differential Output Hold Time	CLKOUT=75MHz	T_{THLD}	-	-	250	ps
	CLKOUT=112MHz		-	-	200	ps
	CLKOUT=135MHz		-	-	170	ps
Differential Output Position 6		t_{TOP6}	$2\frac{tTCP}{7} - T_{THLD}$	$2\frac{tTCP}{7}$	$2\frac{tTCP}{7} + T_{TSUP}$	ns
Differential Output Position 5		t_{TOP5}	$3\frac{tTCP}{7} - T_{THLD}$	$3\frac{tTCP}{7}$	$3\frac{tTCP}{7} + T_{TSUP}$	ns
Differential Output Position 4		t_{TOP4}	$4\frac{tTCP}{7} - T_{THLD}$	$4\frac{tTCP}{7}$	$4\frac{tTCP}{7} + T_{TSUP}$	ns
Differential Output Position 3		t_{TOP3}	$5\frac{tTCP}{7} - T_{THLD}$	$5\frac{tTCP}{7}$	$5\frac{tTCP}{7} + T_{TSUP}$	ns
Differential Output Position 2		t_{TOP2}	$6\frac{tTCP}{7} - T_{THLD}$	$6\frac{tTCP}{7}$	$6\frac{tTCP}{7} + T_{TSUP}$	ns
Differential Output Position 1		t_{TOP1}	$7\frac{tTCP}{7} - T_{THLD}$	$7\frac{tTCP}{7}$	$7\frac{tTCP}{7} + T_{TSUP}$	ns
Differential Output Position 0		t_{TOP0}	$8\frac{tTCP}{7} - T_{THLD}$	$8\frac{tTCP}{7}$	$8\frac{tTCP}{7} + T_{TSUP}$	ns

●AC Timing Diagram



Ty1 +/- output timing is the one between TCLK1 +/- and Ty1 +/- .
Ty2 +/- output timing is the one between TCLK2 +/- and Ty2 +/- .



Note
1) Vdifft =(Ty+)-(Ty-)
=A,B,C,CLK,D,E
y=1,2

Fig.8 AC Timing Diagram (2)

●LVDS Data Mapping(1)

Dual-in / Dual-out mode

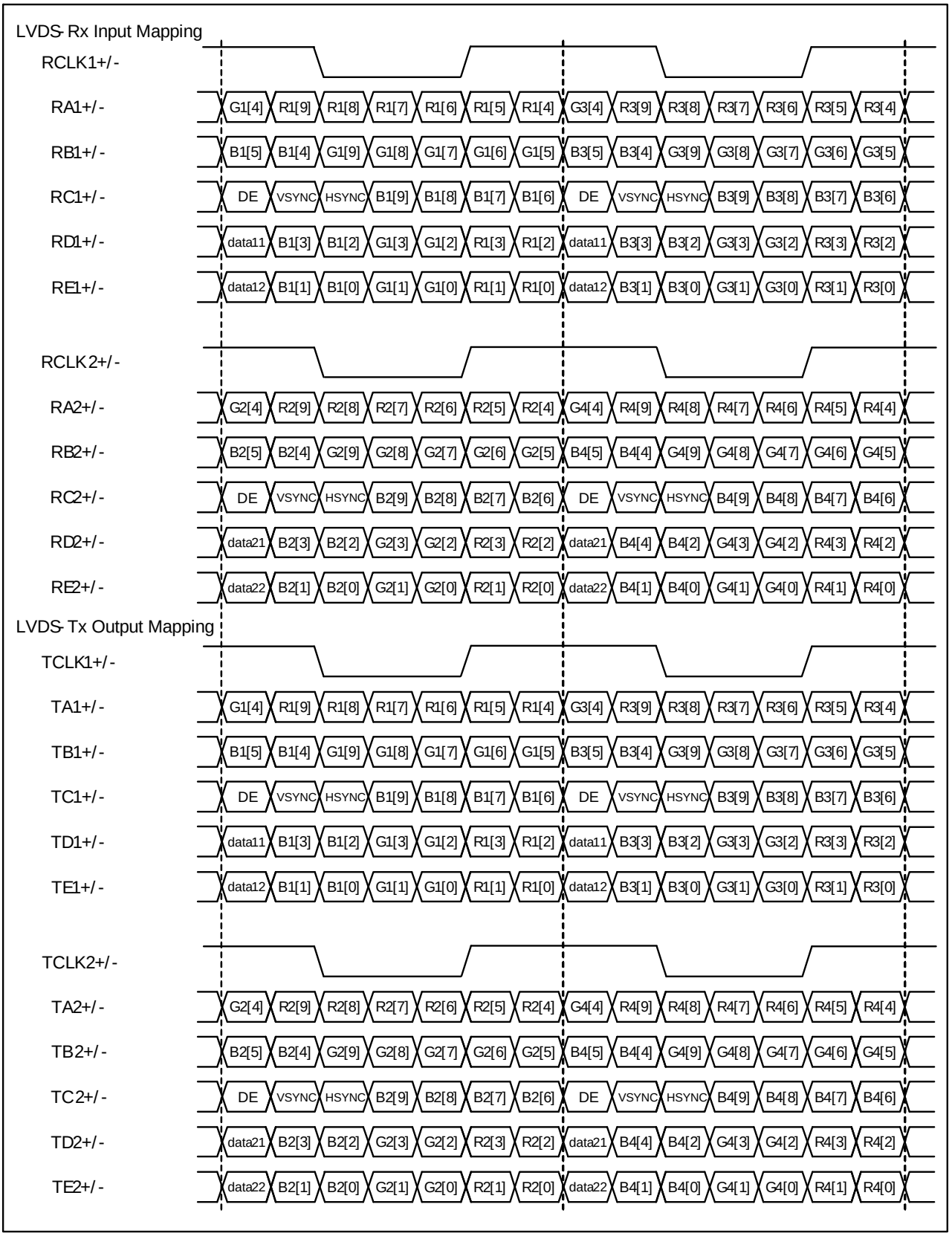


Fig.9 LVDS Data Mapping(1)

●LVDS Data Mapping(2)

Distribution Mode

Distribution mode,RCLK2+/- must be High-z.

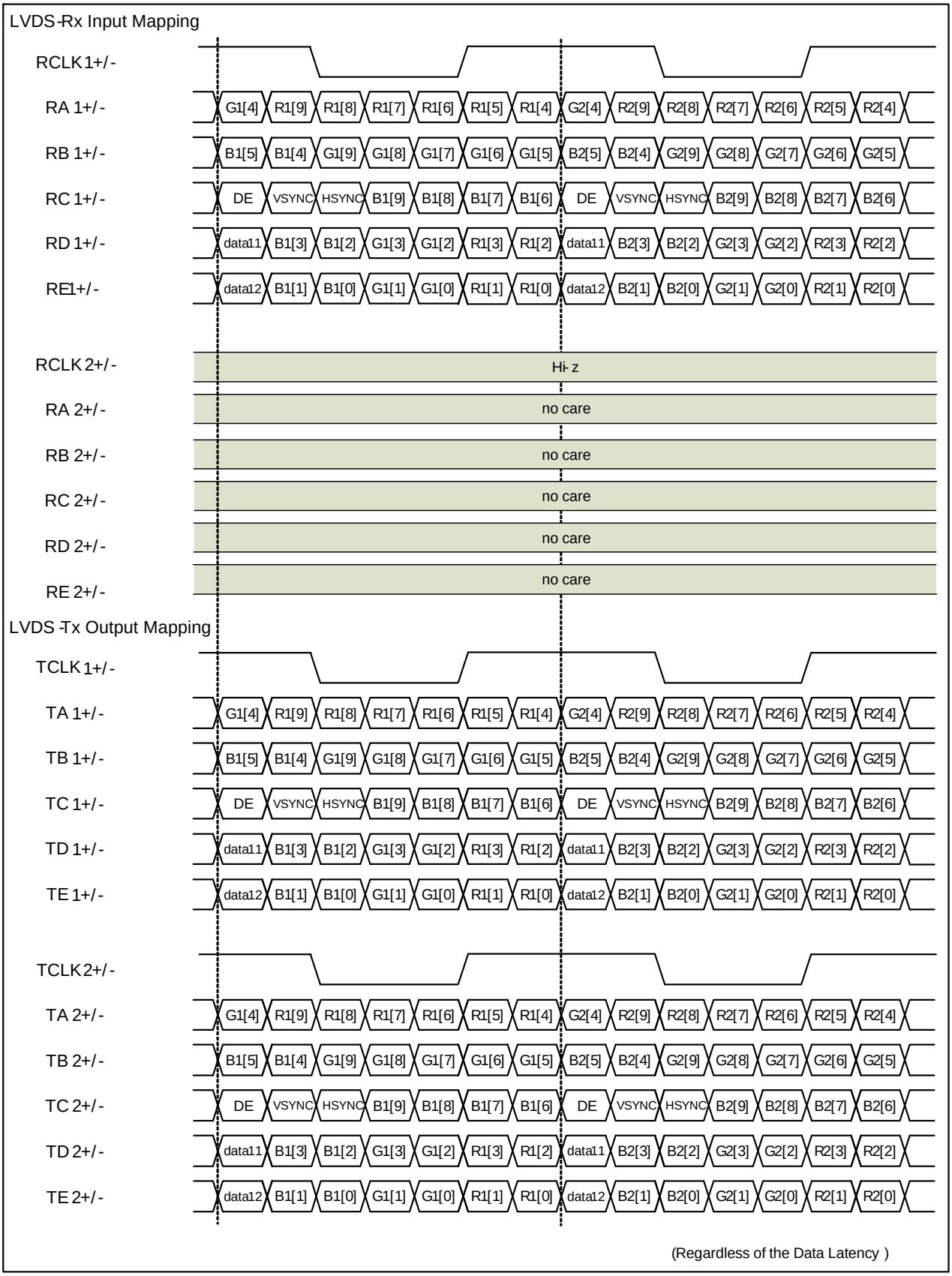


Fig.10 LVDS Data Mapping(2)

●LVDS Data Mapping(3)

Single-in / Dual-out mode

Single-in / Dual-out mode, RCLK2+/- must be High-z.

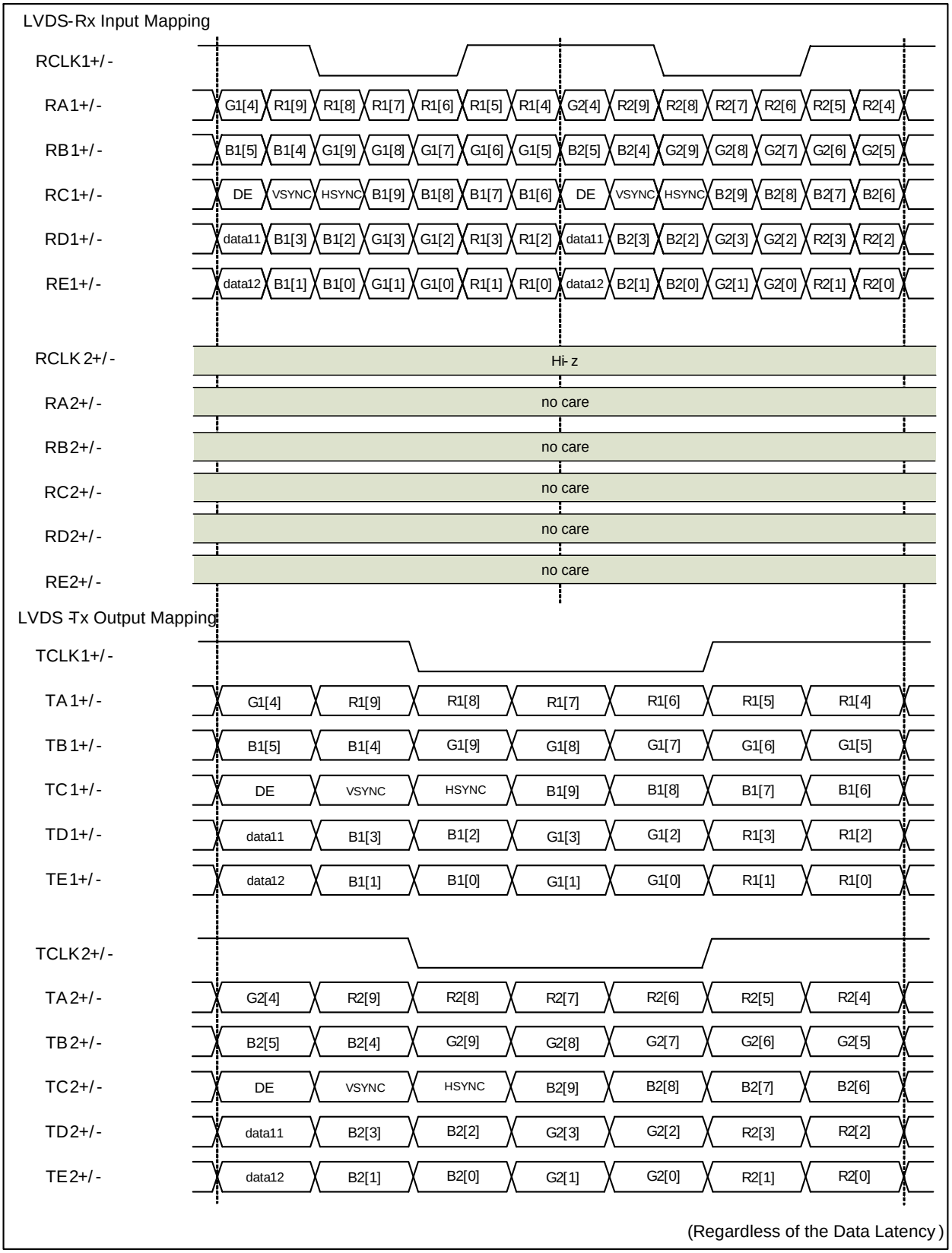


Fig.11 LVDS Data Mapping (3)

●LVDS Data Mapping(4)

Dual-in / Single-out mode

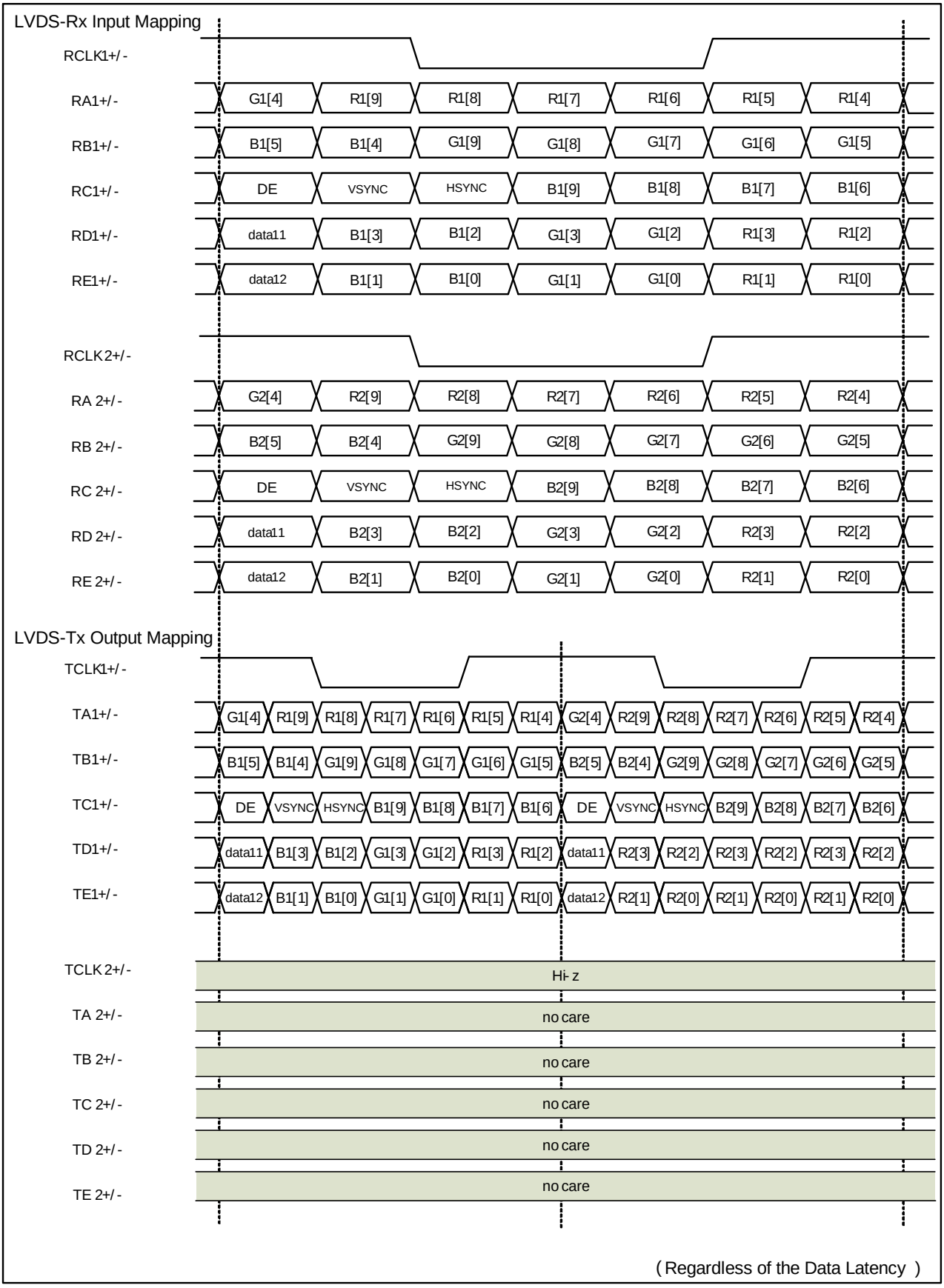


Fig.12 LVDS Data Mapping(4)

●Application Circuit

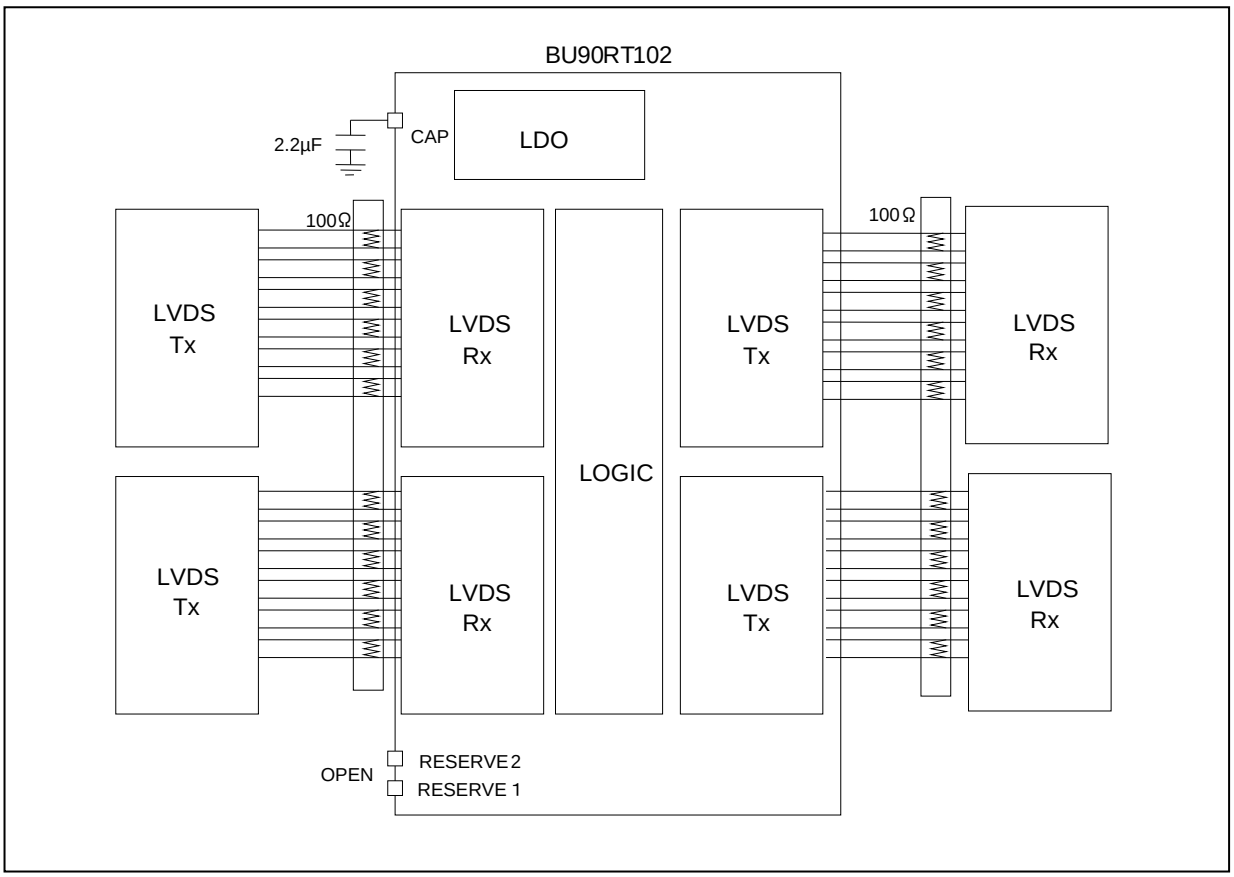


Fig.13 Application circuit example

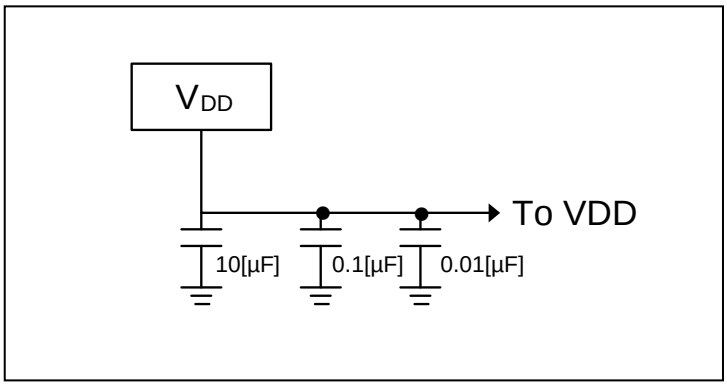


Fig.14 Filtering capacitor of power line

●Ordering part number

B	U	9	0	R	T	1	0	2	-	E	2

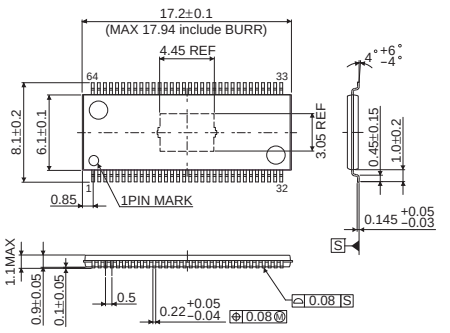
Part No.

Part No.
90RT102

Package
HTSSOP-C64

Packaging and forming specification
E2: Embossed tape and reel

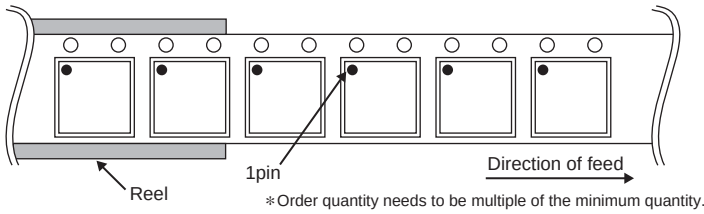
HTSSOP-C64



(Unit : mm)

<Tape and Reel information>

Tape	Embossed carrier tape (with dry pack)
Quantity	2000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

Precaution Regarding Intellectual Property Rights

1. All information and data including but not limited to application example contained in this document is for reference only. ROHM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data. ROHM shall not be in any way responsible or liable for infringement of any intellectual property rights or other damages arising from use of such information or data.:

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Other Precaution

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2. The Products may not be disassembled, converted, modified, reproduced or otherwise changed without prior written consent of ROHM.

3. In no event shall you use in any way whatsoever the Products and the related technical information contained in the Products or this document for any military purposes, including but not limited to, the development of mass-destruction weapons.

4. The proper names of companies or products described in this document are trademarks or registered trademarks of ROHM, its affiliated companies or third parties.

General Precaution

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.

2. All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.

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