

## LVDS Interface ICs

# 4bit LVDS Transceiver


**BU90LV049A**

No.09057EAT01

**●Description**

LVDS Interface IC of ROHM "Serializer" "Deserializer" operate from 8MHz to 150MHz 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) >500 Mbps (250 MHz) switching rates
- 2) Flow-through pinout simplifies PCB layout.
- 3) 400 ps typical driver channel-to-channel skew
- 4) 150 ps typical receiver channel-to-channel skew
- 5) 3.3V single power supply design
- 6)  $\pm 200\text{mV}$  and  $\pm 350\text{mV}$  selectable differential signaling (driver)
- 7) 6mA and 8mA selectable output drive strength (receiver)
- 8) 3-STATE output control
- 9) Internal fail-safe biasing of receiver inputs
- 10) High impedance on LVDS outputs on power down
- 11) Conforms to TIA/EIA-644-A LVDS Standard
- 12) Industrial operating temperature range (-40°C to +85°C)

**●Applications**

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

**●Precaution**

- This chip is not designed to protect from radioactivity.

● Absolute maximum ratings

Item	Symbol	Value		Unit
		Min.	Max.	
Supply voltage	$V_{CC}$	-0.3	4.0	V
Input voltage	$V_{IN}$	-0.3	$V_{CC}+0.3$	V
Output voltage	$V_{OUT}$	-0.3	$V_{CC}+0.3$	V
Storage temperature range	Tstg	-55	150	°C

● Package Power

Package	PD(mW)	DERATING(mW/°C) ※1
SSOP-B16	400	4.0
	450 <sup>*2</sup>	4.5 <sup>*2</sup>

※1 At temperature  $T_a > 25^{\circ}\text{C}$

※2 Package power when mounting on the PCB board.

The size of PCB board :70 × 70 × 1.6 (mm<sup>3</sup>)

The material of PCB board :The FR4 glass epoxy board.(3% or less copper foil area)

● Operating conditions

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Supply voltage	Vcc	3.0	3.3	3.6	V	
Operating temperature range	Topr	-40	25	85	°C	

## ●Electrical characteristics

Symbol	Parameter	Conditions	Pin	Min	Typ	Max	Units
<b>LVC MOS Input DC Specification (Driver Inputs, ENABLE Pins)</b>							
$V_{IH}$	Input High Voltage		D <sub>IN</sub> EN SL	$V_{CC} \times 0.8$	–	$V_{CC}$	V
$V_{IL}$	Input Low Voltage			GND	–	$V_{CC} \times 0.2$	V
$I_I$	Input Current	$V_{IN} = 0V$ or $V_{CC}$		–10	–	+10	$\mu A$
$V_{CL}$	Input Clamp Voltage	$V_{CL} = -18mA$		–1.5	–0.8	–	V
<b>LVDS Output DC Specification (Driver Output)</b>							
$ V_{OD1} $	Differential Output Voltage	SL = GND, $R_L = 100\Omega$ (Figure 4)	D <sub>OUT-</sub>	250	350	450	mV
$ V_{OD2} $	Differential Output Voltage	SL = $V_{CC}$ , $R_L = 100\Omega$ (Figure 4)	D <sub>OUT+</sub>	120	200	300	mV
$\Delta V_{OD}$	Change in Magnitude of $V_{OD}$ for Complementary Output States			–	1	35	mV
$V_{OS}$	Offset Voltage	SL = $V_{CC}$ or GND, $R_L = 100\Omega$ (Figure 4)		1.125	1.25	1.375	V
$\Delta V_{OS}$	Change in Magnitude of $V_{OS}$ for Complementary Output States			–	1	25	mV
$I_{OS}$	Output Short Circuit Current	ENABLED, D <sub>IN</sub> = $V_{CC}$ , D <sub>OUT+</sub> = 0V or D <sub>IN</sub> = GND, D <sub>OUT-</sub> = 0V		–	–5.4	–9.0	mA
$I_{OSD}$	Differential Output Short Circuit Current	ENABLED, $V_{OD} = 0V$		–	–5.4	–9.0	mA
$I_{OZ}$	Output 3-STATE Current	EN = 0V and SL = $V_{CC}$ $V_{OUT} = 0V$ or $V_{CC}$		–10	1	+10	$\mu A$
<b>LVDS Input DC Specification (Receiver Inputs)</b>							
$V_{TH}$	Differential Input High Threshold	$V_{CM} = 1.2V, 0.05V, 2.35V$	R <sub>IN+</sub>	–	–	100	mV
$V_{TL}$	Differential Input Low Threshold		R <sub>IN-</sub>	–100	–	–	mV
$V_{CMR}$	Common-Mode Voltage Range	$V_{ID} = 200mV$ pk to pk		0.1	–	2.3	V
$I_{IN}$	Input Current	$V_{IN} = 0$ or $V_{CC}$		–20	–	+20	$\mu A$
<b>LVC MOS Output DC Specification (Receiver Outputs)</b>							
$V_{OH1}$	Output High Voltage	$I_{OH} = -8 mA$ , $V_{ID} = +200 mV$ , SL = GND	R <sub>OUT</sub>	$V_{CC} - 0.4$	–	–	V
$V_{OH2}$	Output High Voltage	$I_{OH} = -6 mA$ , $V_{ID} = +200 mV$ , SL = $V_{CC}$		$V_{CC} - 0.4$	–	–	
$V_{OL1}$	Output Low Voltage	$I_{OL} = 8 mA$ , $V_{ID} = -200 mV$ , SL = GND		–	–	0.4	V
$V_{OL2}$	Output Low Voltage	$I_{OL} = 6 mA$ , $V_{ID} = -200 mV$ , SL = $V_{CC}$		–	–	0.4	
$I_{OZ}$	Output 3-STATE Current	Disabled, $V_{OUT} = 0V$ or $V_{CC}$		–10	1	+10	$\mu A$
<b>General DC Specifications</b>							
$I_{CC}$	Power Supply Current	EN = $V_{CC}$ and SL = 0V	$V_{CC}$	–	12	–	mA
$I_{CCZ}$	TRI-STATE Supply Current	EN = 0V and SL = 0V		–	2	–	mA

## ● Switching Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>LVDS Outputs (Driver Outputs)</b>						
$t_{PHLD}$	Differential Propagation Delay High to Low	$R_L = 100\Omega$ , $C_L = 15pF$ (Figure 5 and Figure 6)	0.5	1.7	2.8	ns
$t_{PLHD}$	Differential Propagation Delay Low to High		0.5	1.7	2.8	ns
$t_{SKD1}$	Differential Pulse Skew $ t_{PHLD} - t_{PLHD} $		0	0.3	0.4	ns
$t_{SKD2}$	Differential Channel-to-Channel Skew		0	0.4	0.5	ns
$t_{SKD3}$	Differential Part to Part Skew		0	-	1.0	ns
$t_{TLH}$	Rise Time		-	0.5	1.5	ns
$t_{THL}$	Fall Time		-	0.5	1.5	ns
$t_{PHZ}$	Disable Time High to Z	$R_L = 100\Omega$ , $C_L = 15pF$ (Figure 7 and Figure 8)	-	2	5	ns
$t_{PLZ}$	Disable Time Low to Z		-	2	5	ns
$t_{PZH}$	Enable Time Z to High		-	3	7	ns
$t_{PZL}$	Enable Time Z to Low		-	3	7	ns
$f_{Max}$	Maximum Operating Frequency		250	-	-	MHz
<b>LVCMOS Outputs (Receiver Outputs)</b>						
$t_{PHL}$	Propagation Delay High to Low	$C_L = 15pF$ $V_{ID} = 200mV$ (Figure 9 and Figure 10)	1.2	2.0	3.7	ns
$t_{PLH}$	Propagation Delay Low to High		1.2	1.9	3.7	ns
$t_{SK1}$	Pulse Skew $ t_{PHLD} - t_{PLHD} $		0	0.1	0.4	ns
$t_{SK2}$	Channel-to-Channel Skew		0	0.15	0.5	ns
$t_{SK3}$	Part to Part Skew		-	-	1.0	ns
$t_{TLH}$	Rise Time		-	0.5	1.5	ns
$t_{THL}$	Fall Time		-	0.5	1.5	ns
$t_{PHZ}$	Disable Time High to Z	$R_L = 2k\Omega$ $C_L = 15pF$ (Figure 11 and Figure 12)	-	8	14	ns
$t_{PLZ}$	Disable Time Low to Z		-	8	14	ns
$t_{PZH}$	Enable Time Z to High		-	3	14	ns
$t_{PZL}$	Enable Time Z to Low		-	9	14	ns
$f_{Max}$	Maximum Operating Frequency		250	-	-	MHz

●Block diagram

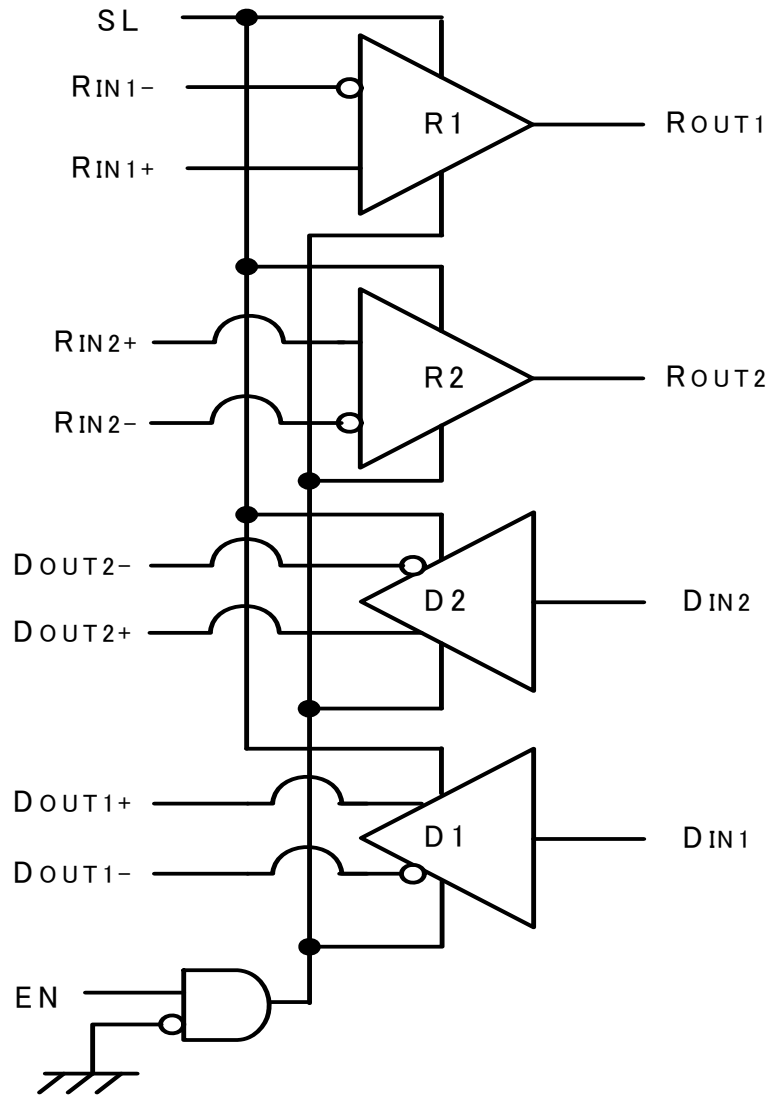


Figure 1. Block Diagram

●SSOP-B16 Package Outline and Specification

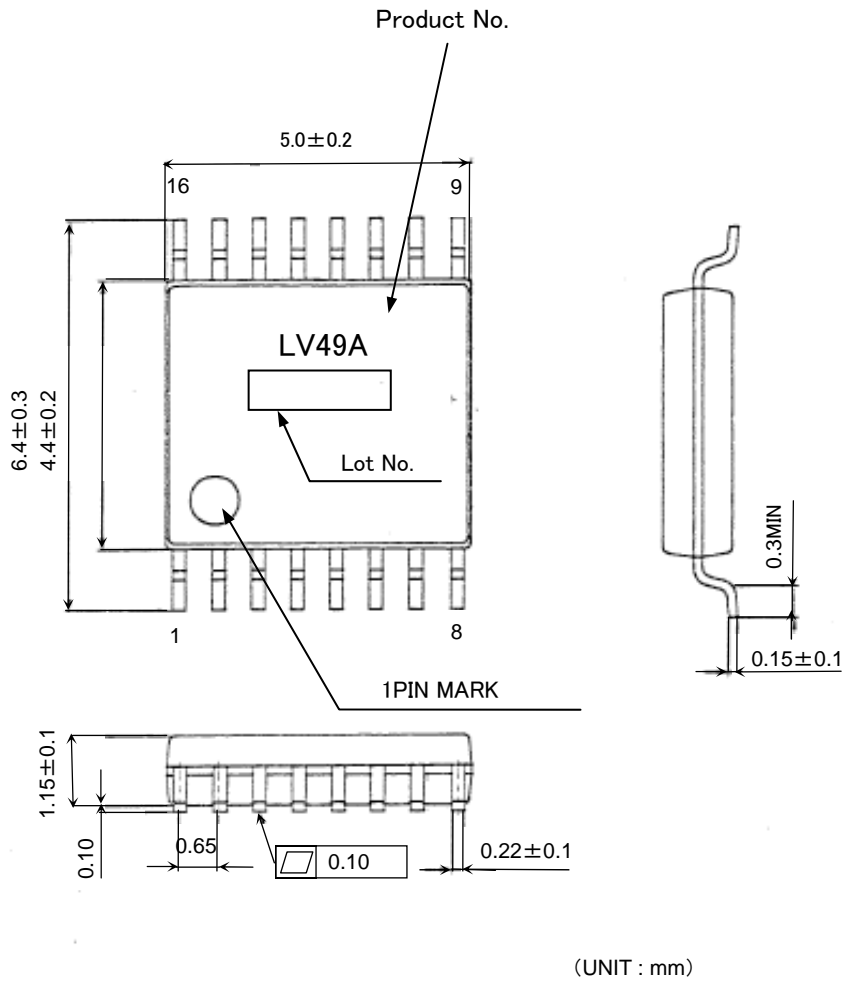


Figure 2. SSOP-B16 Package Outline and Specification

## ● Pin Configuration

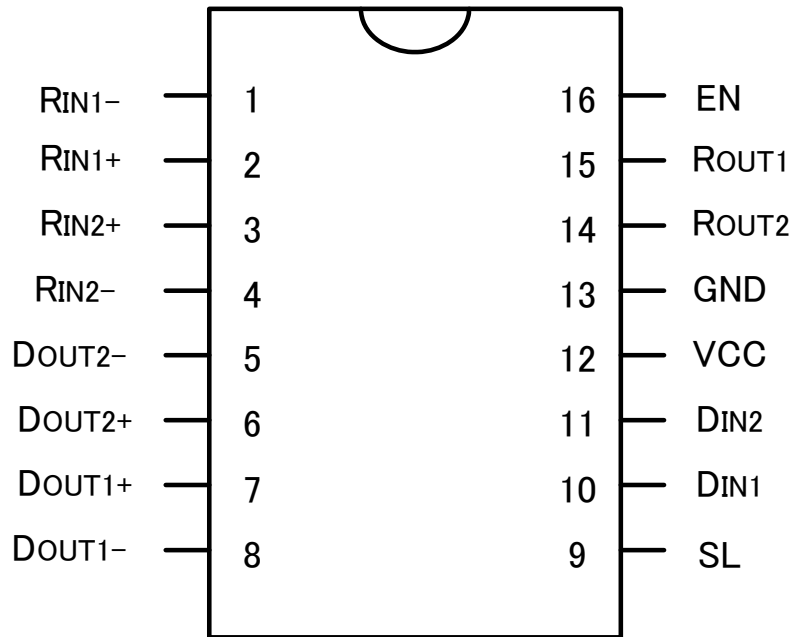


Figure 3. Pin Diagram (Top View)

## ● Pin Description

Table 1 : Pin Description

Pin Name	Pin No.	Type	Descriptions
DIN	10, 11	LVC MOS In	Driver input pin, LVC MOS levels.
DOUT+	6, 7	LVDS Out	Non-inverting driver output pin, LVDS levels.
DOUT-	5, 8	LVDS Out	Inverting driver output pin, LVDS levels.
RIN+	2, 3	LVDS In	Non-inverting receiver input pin, LVDS levels.
RIN-	1, 4	LVDS In	Inverting receiver input pin, LVDS levels.
ROUT	14, 15	LVC MOS Out	Receiver output pin, LVC MOS levels.
SL	9	LVC MOS In	Drive strength and Swing Level select pin : When SL is low or open, Rout set 8mA mode and the driver is normal swing level (350mV). When SL is high, Rout set 6mA mode and the driver is reduce swing level (200mV).
EN	16	LVC MOS In	Enable pin: When EN is Low or open, the receiver and driver are disabled. When EN is high, the receiver and driver are enabled.
VCC	12	Power	Power supply pin, +3.3V±0.3V.
GND	13	GND	Ground pin.

## ● Function Description

## ■ Driver Truth Table

		INPUT	OUTPUTS		Swing Level
EN	SL	DIN	DOUT+	DOUT-	
H	L or Open	L	L	H	350mV
		H	H	L	
H	H	L	L	H	200mV
		H	H	L	
All other combinations of EN, SL inputs		X	Z	Z	

## ■ Receiver Truth Table

		INPUT	OUTPUTS	Drive Strength
EN	SL	$R_{IN+} - R_{IN-}$	$R_{OUT}$	
H	L or Open	$VID \geq 0V$	H	8mA
		$VID \leq -0.1V$	L	
		Full Fail-safe OPEN/SHORT or Terminated	H	
H	H	$VID \geq 0V$	H	6mA
		$VID \leq -0.1V$	L	
		Full Fail-safe OPEN/SHORT or Terminated	H	
All other combinations of EN, SL inputs		X	Z	



●Parameter Measurement Information

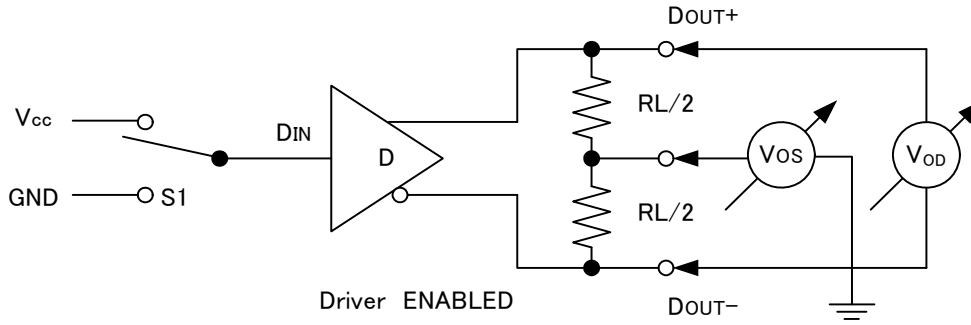


Figure 4. Driver VOD and VOS Test Circuit

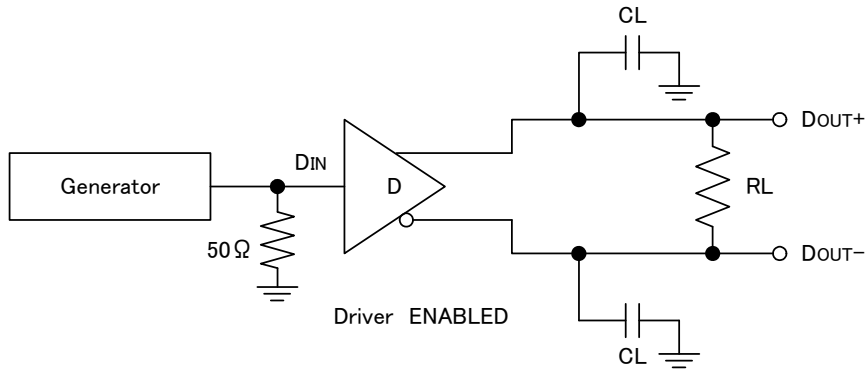


Figure 5. Driver Propagation Delay and Transition Time Test Circuit

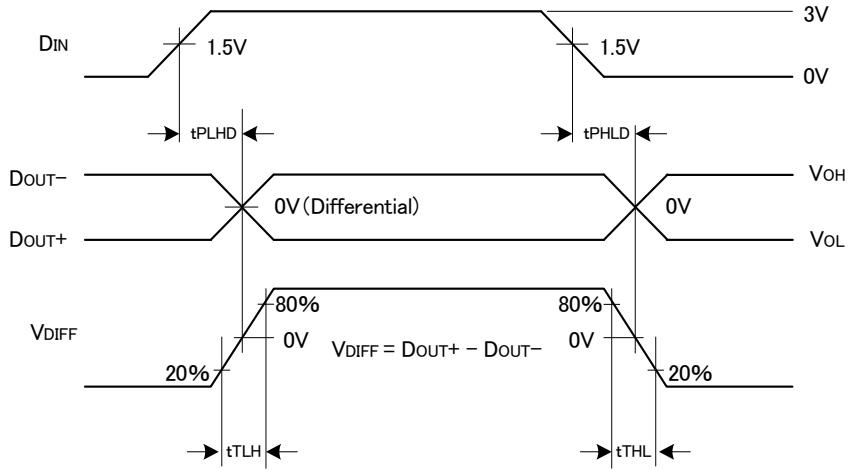


Figure 6. Driver Propagation Delay and Transition Time Waveforms

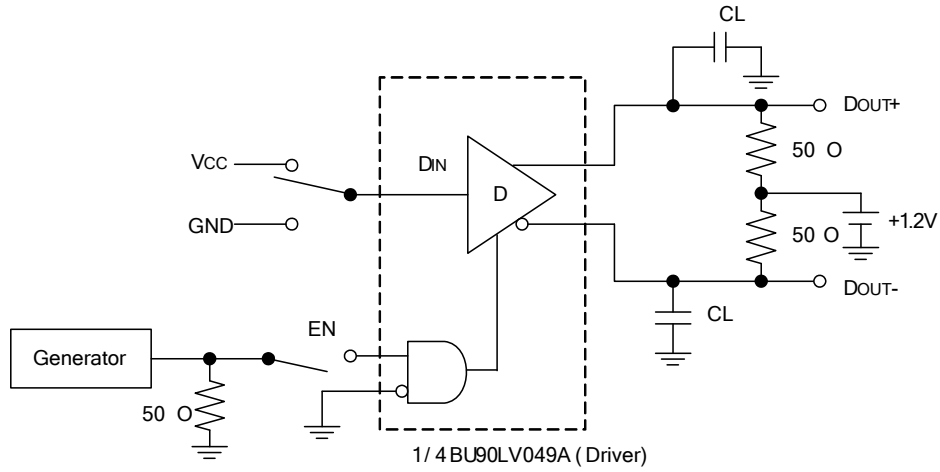


Figure 7. Driver 3-STATE Delay Test Circuit

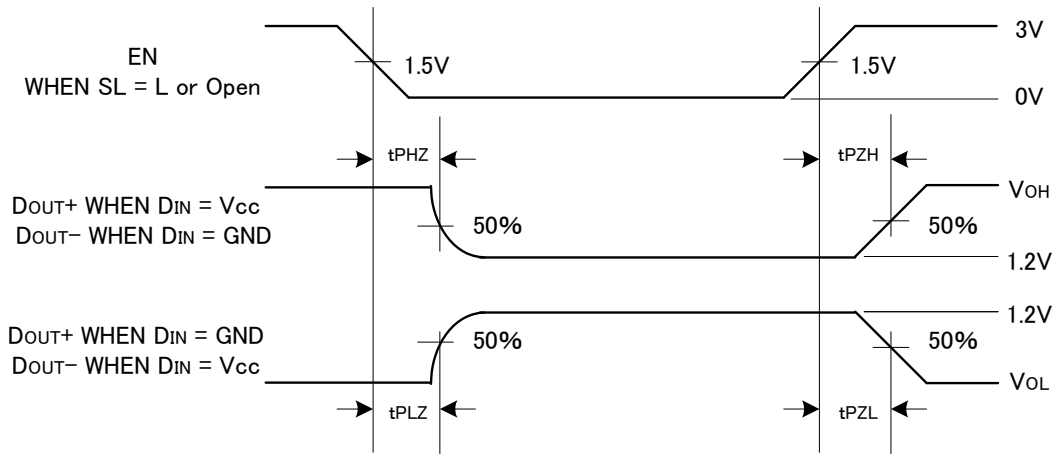


Figure 8. Driver 3-STATE Delay Waveform

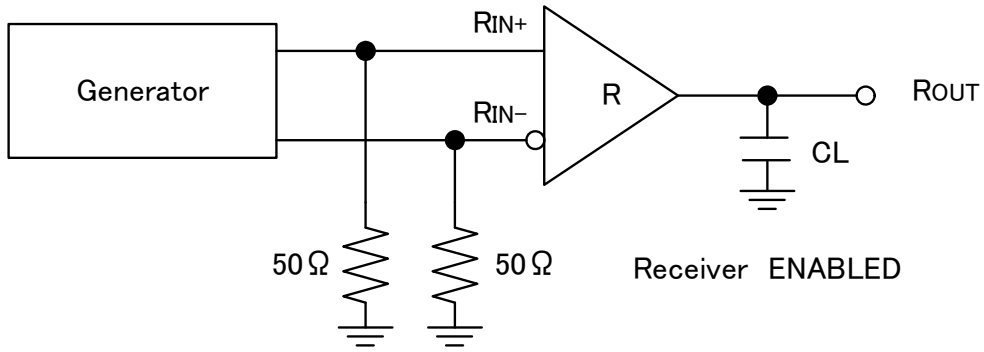


Figure 9. Receiver Propagation Delay and Transition Time Test Circuit

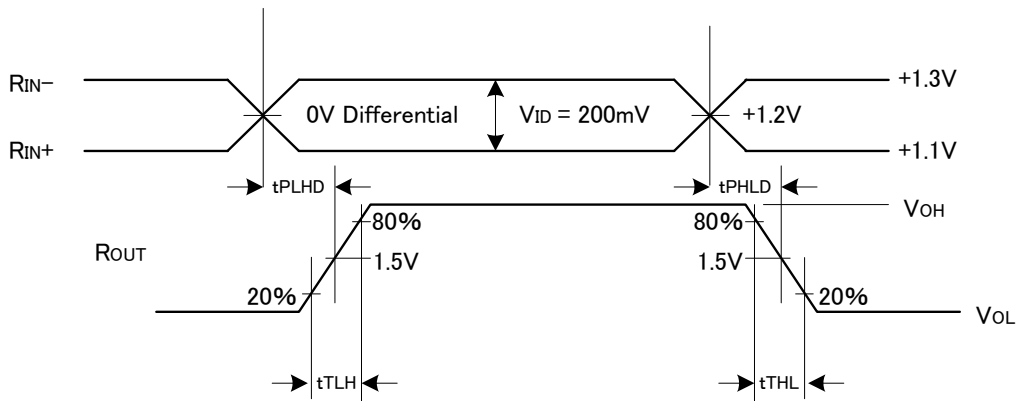


Figure 10. Receiver Propagation Delay and Transition Time Waveforms

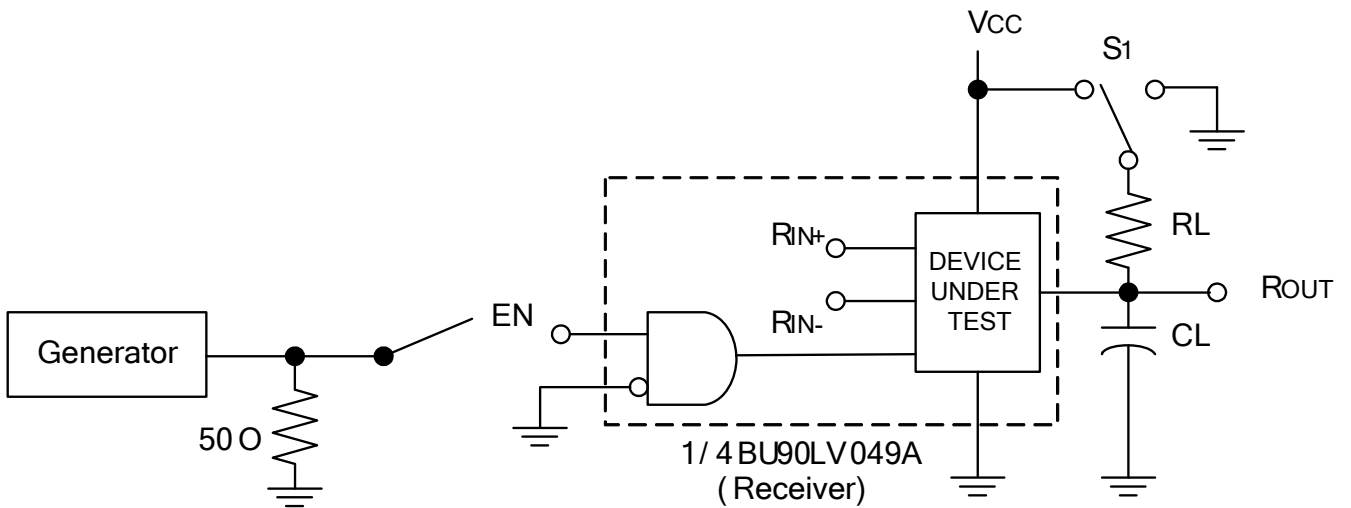


Figure 11. Receiver 3-STATE Delay Test Circuit

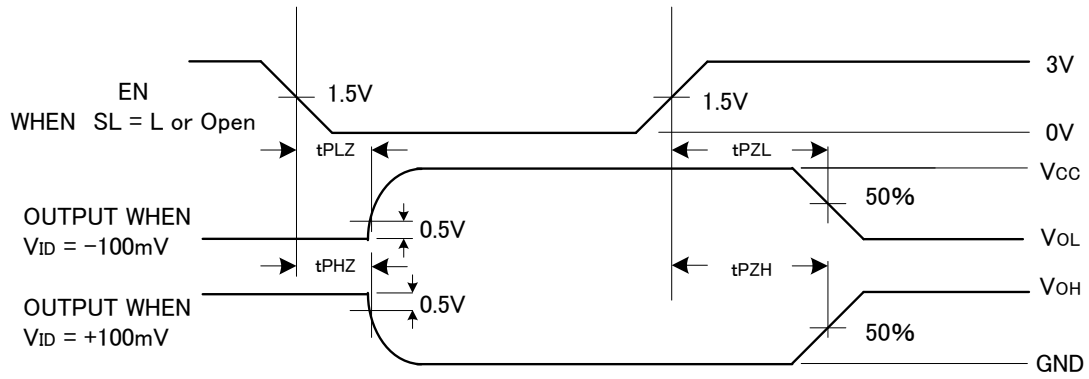


Figure12. Receiver 3-STATE Delay Waveforms

● Typical Application

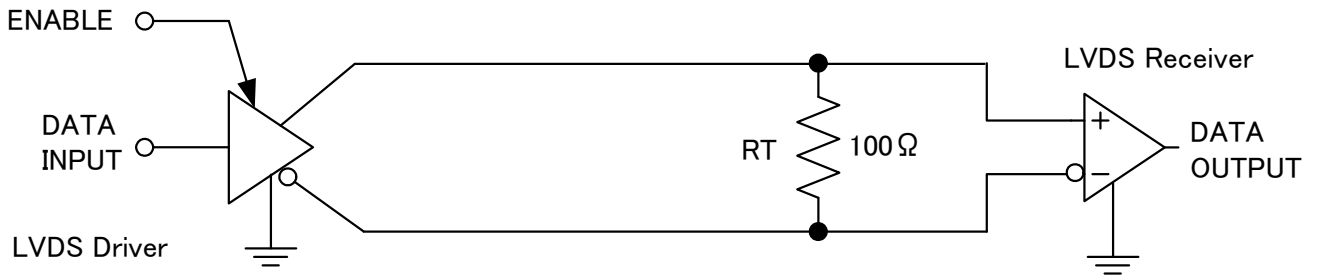


Figure 13. Point-to-Point Application

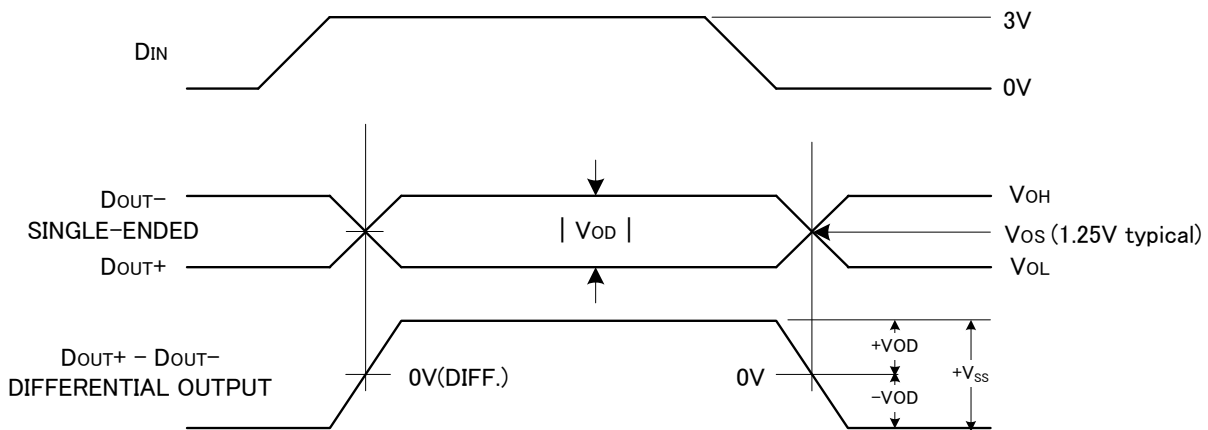


Figure 14. Driver Output Levels

●Ordering part number

B	U
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Part No.

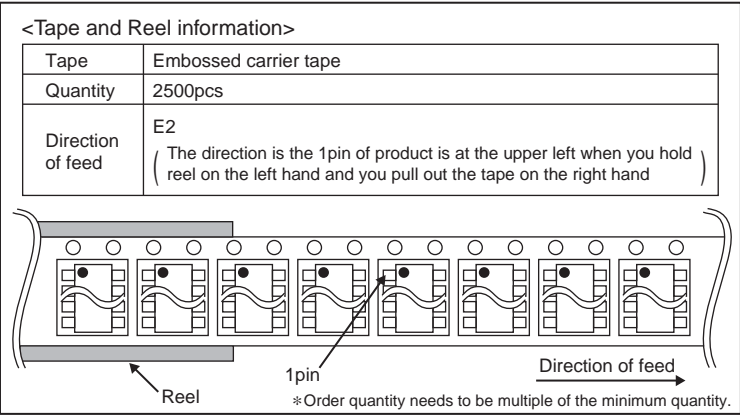
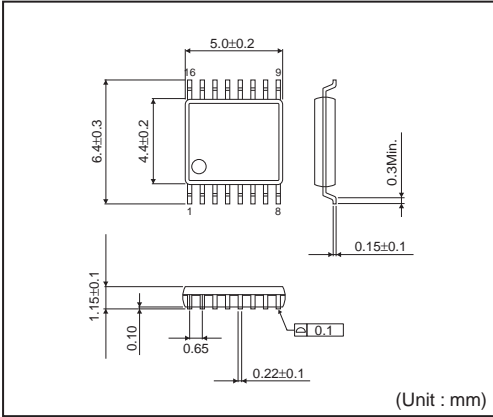
9	0	L	V	0	4	9	A
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Part No.

E	2
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Packaging and forming specification  
E2: Embossed tape and reel

SSOP-B16



# Notice

## Precaution on using ROHM Products

- 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 <sup>(Note 1)</sup>, 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
CLASS III	CLASS III	CLASS II b	CLASS III
CLASS IV		CLASS III	

- 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:
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  - Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
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  - Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
  - Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
  - Sealing or coating our Products with resin or other coating materials
  - 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
  - Use of the Products in places subject to dew condensation
- The Products are not subject to radiation-proof design.
- Please verify and confirm characteristics of the final or mounted products in using the Products.
- 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.
- De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
- Confirm that operation temperature is within the specified range described in the product specification.
- 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

- When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
- 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 Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [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

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