LVDS Interface LSI

LVDS Transmitter for Automotive

BU92T101-M

General Description

BU92T101-M LVDS transmitter operates from 15MHz to 174MHz wide clock frequency range, and 35 bits data of parallel LVCMOS level inputs (R/G/B 30 bits and VSYNC, HSYNC, DE, CNTL1, CNTL2) are converted to 5 channels of LVDS data stream. Data is transmitted seven times (x7) stream and reduce cable number by 3(1/3).
BU92T101-M has low swing mode to be able to expect further low power and low EMI.

Features

- AEC-Q100 Qualified *(Note 1)*
- LVDS Maximum Data Rate is 1.218Gbps/Channel
- LVDS Transmitter Support Wide Frequency Range from 15MHz up to 174MHz (☆) *(Note 2)*
- Support Reduced Swing LVDS Output for Low EMI
- Support Input Clock Edge Select Function
- Support Power Down Mode

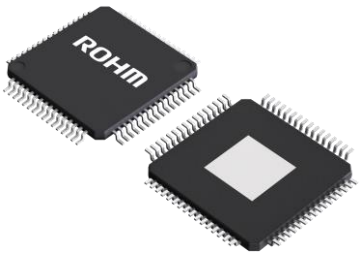
(Note 1) Grade2
(Note 2) (☆): Special Characteristics

Key Specifications

- Power Supply Voltage : VDD 3.0V to 3.6V
  LVDD 3.0V to 3.6V
- CLKIN Input Frequency: 15MHz to 174MHz
- LVDS Output Frequency: 15MHz to 174MHz
- Operating Temperature Range: -40°C to +105°C

Package

	W(Typ) x D(Typ) x H(Max)
HTQFP64AV	12.00mm x 12.00mm x 1.00mm



Applications

- Car Navigation System
- CID (Center Information Display)
- HUD (Head Up Display)

Block Diagram

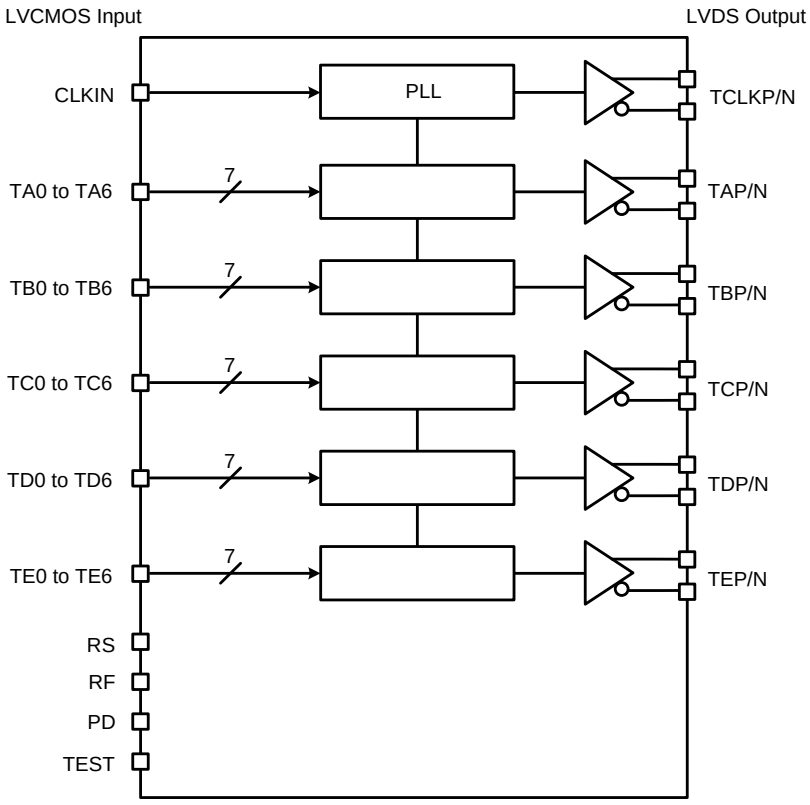


Figure 1. Block Diagram

Pin Configuration

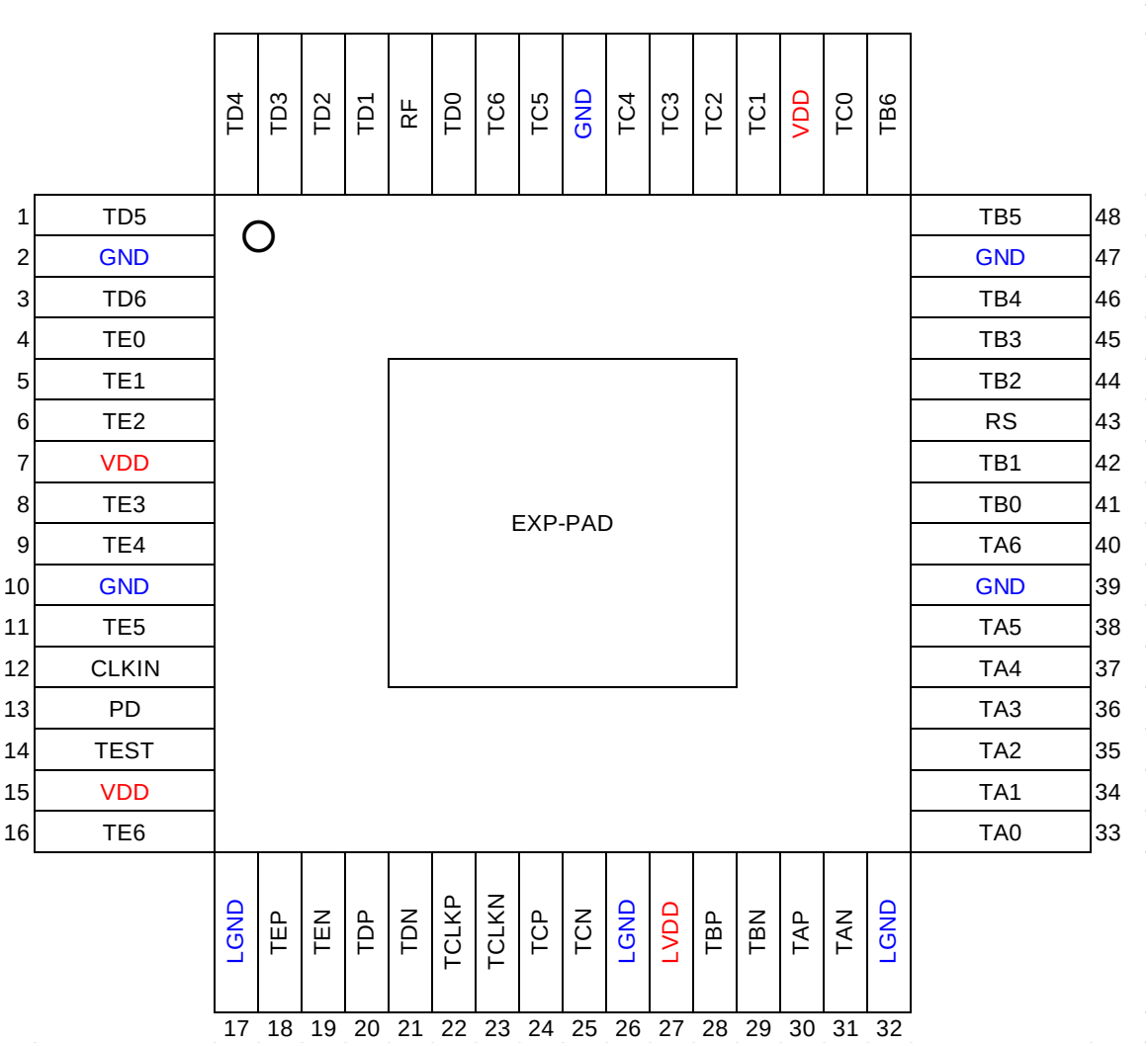
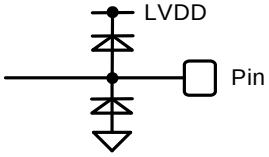
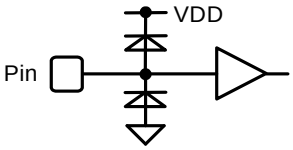
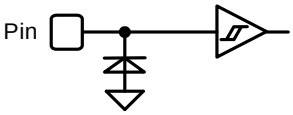
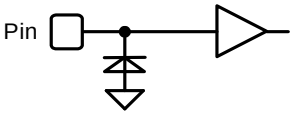
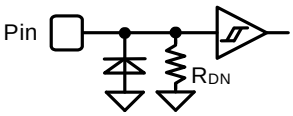


Figure 2. Pin Configuration (TOP VIEW)

Pin Descriptions

Pin No.	Pin Name	Type	Descriptions
30,31	TAP, TAN	LVDS OUT	LVDS data
28,29	TBP, TBN	LVDS OUT	
24,25	TCP, TCN	LVDS OUT	
20,21	TDP, TDN	LVDS OUT	
18,19	TEP, TEN	LVDS OUT	
22,23	TCLKP, TCLKN	LVDS OUT	LVDS clock
33,34,35,36, 37,38,40	TA0, TA1, TA2, TA3, TA4, TA5, TA6	LVCMOS IN	LVCMOS pixel data
41,42,44,45, 46,48,49	TB0, TB1, TB2, TB3, TB4, TB5, TB6	LVCMOS IN	
50,52,53,54, 55,57,58	TC0, TC1, TC2, TC3, TC4, TC5, TC6	LVCMOS IN	
59,61,62,63, 64,1,3	TD0, TD1, TD2, TD3, TD4, TD5, TD6	LVCMOS IN	
4,5,6,8, 9,11,16	TE0, TE1, TE2, TE3, TE4, TE5, TE6	LVCMOS IN	
12	CLKIN	LVCMOS IN	LVCMOS clock
13	PD	LVCMOS IN	Power down H: Normal operation L: Power down (All LVDS output signals are Hi-Z)
43	RS	LVCMOS IN	LVDS output swing mode select H: Normal swing (350mV) L: Reduced swing (200mV)
60	RF	LVCMOS IN	Input clock edge select (Refer to Figure 5) H: Rising edge L: Falling edge
14	TEST	LVCMOS IN	Test mode enable with internal pull down resistor Connect to GND directly H: Vendor test mode L: Normal operation
27	LVDD	Power	Power Supply for LVDS
7,15, 51	VDD	Power	Power Supply for I/O
17,26,32	LGND	Ground	Ground for LVDS
2,10,39,47,56	GND	Ground	Ground for I/O
-	EXP-PAD	-	Must tie to ground

I/O Equivalence Circuit

Type	Circuit Type	Applied Pins
LVDS OUT		TAP, TAN, TBP, TBN, TCP, TCN, TDP, TDN, TEP, TEN, TCLKP, TCLKN
LVCMOS IN		TA0, TA1, TA2, TA3, TA4, TA5, TA6, TB0, TB1, TB2, TB3, TB4, TB5, TB6, TC0, TC1, TC2, TC3, TC4, TC5, TC6, TD0, TD1, TD2, TD3, TD4, TD5, TD6, TE0, TE1, TE2, TE3, TE4, TE5, TE6, CLKIN
LVCMOS IN		PD, RS,
LVCMOS IN		RF
LVCMOS IN		TEST

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit	Note
Power Supply Voltage	V_{DD}	-0.3 to +4.5	V	For VDD, LVDD
Input Voltage	V_{IN}	-0.3 to V_{DD}+0.3	V	V_{DD}+0.3 < 4.5V
Storage Temperature Range	Tstg	-55 to +125	°C	
Maximum Junction Temperature	Tjmax	125	°C	

Caution 1: *Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.*

Caution 2: *Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, design a PCB boards with thermal resistance taken into consideration by increasing board size and copper area so as not to exceed the maximum junction temperature rating.*

Thermal Resistance*(Note 3)*

Parameter	Symbol	Thermal Resistance (Typ)		Unit
		1s*(Note 5)*	2s2p*(Note 6)*	
HTQFP64AV				
Junction to Ambient	θ_{JA}	63.4	14.9	°C/W
Junction to Top Characterization Parameter*(Note 4)*	Ψ_{JT}	2	1	°C/W

(Note 3) Based on JESD51-2A(Still-Air)

(Note 4) The thermal characterization parameter to report the difference between junction temperature and the temperature at the top center of the outside surface of the component package.

(Note 5) Using a PCB board based on JESD51-3.

Layer Number of Measurement Board	Material	Board Size
Single	FR-4	114.3mm x 76.2mm x 1.57mmt

Top	
Copper Pattern	Thickness
Footprints and Traces	70µm

(Note 6) Using a PCB board based on JESD51-5, 7.

Layer Number of Measurement Board	Material	Board Size	Thermal Via*(Note 7)*	
			Pitch	Diameter
4 Layers	FR-4	114.3mm x 76.2mm x 1.6mmt	1.20mm	Φ0.30mm

Top		2 Internal Layers		Bottom	
Copper Pattern	Thickness	Copper Pattern	Thickness	Copper Pattern	Thickness
Footprints and Traces	70µm	74.2mm x 74.2mm	35µm	74.2mm x 74.2mm	70µm

(Note 7) This thermal via connects with the copper pattern of all layers.

Recommended Operating Conditions

Parameter	Symbol	Rating			Unit	Conditions
		Min	Typ	Max		
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	For VDD, LVDD
Operating Temperature Range	Tj	-40	+25	+105	°C	
Operating Frequency	f_{IN}	15	-	174	MHz	
	f_{OUT}	15	-	174	MHz	

Electrical Characteristics

DC Electrical Characteristics

Table 1. LVCMOS DC Specifications

Parameter	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
High Level Input Voltage	V_{IH}	V_{DD}x0.7	-	V_{DD}	V	All LVCMOS IN Pins
Low Level Input Voltage	V_{IL}	GND	-	V_{DD}x0.3	V	All LVCMOS IN Pins
Hysteresis Voltage	V_H	-	600	-	mV	The PD, RS, TEST Pin
Input Leakage Current	I_{IZ}	-10	-	+10	μA	$0V \le V_{IN} \le V_{DD}$ (Except the TEST Pin)
Pull Down Resistor	R_{DN}	35	50	65	kΩ	The TEST Pin

Table 2. LVDS DC Specifications

Parameter	Symbol	Limit			Unit	Conditions	
		Min	Typ	Max			
Differential Output Voltage	V_{OD}	250	350	450	mV	R_L=100Ω (Refer to Figure 3, 4)	RS=H
		140	200	300	mV		RS=L
Change in V_{OD} Between Complementary Output States	ΔV_{OD}	-	-	35	mV	R_L=100Ω (Refer to Figure 3, 4)	
Common Mode 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}	-	100	150	mA	LVDS Transmitter Pin Force=0V	
Output Tri-state Current	I_{OZ}	-10	-	+10	μA	PD=L LVDS Transmitter Pin Force=0V to V_{DD}	

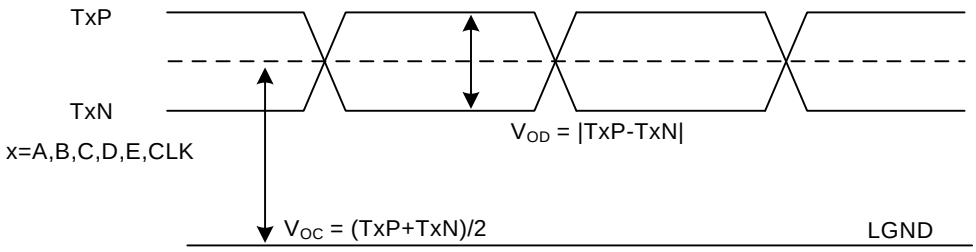


Figure 3. LVDS DC Characteristics

AC Electrical Characteristics

Table 3. Switching Characteristics (R_L=100Ω, C_L=5pF)

Parameter	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
CLKIN Input Frequency (☆)	f_{IN}	15	-	174	MHz	*(Note 8)*
CLKIN Input Period	t_{TCP}	5.75	-	66.6	ns	(Refer to Figure 5)
CLKIN High Time	t_{TCH}	$0.35t_{TCP}$	$0.5t_{TCP}$	$0.65t_{TCP}$	ns	
CLKIN Low Time	t_{TCL}	$0.35t_{TCP}$	$0.5t_{TCP}$	$0.65t_{TCP}$	ns	
LVCMOS Data Setup Time to CLKIN	t_{TS}	0.8	-	-	ns	
LVCMOS Data Hold Time from CLKIN	t_{TH}	0.8	-	-	ns	
LVDS Clock Output Frequency (☆)	f_{OUT}	15	-	174	MHz	*(Note 8)*
LVDS Clock Output Period	t_{TCOP}	5.75	-	66.6	ns	(Refer to Figure 6)
LVDS Transition Time	t_{LVT}	-	-	0.5	ns	(Refer to Figure 4)
Differential Output Setup Time	t_{TSUP}	-	-	120	ps	f_{OUT}=174MHz
Differential Output Hold Time	t_{THLD}	-	-	120	ps	f_{OUT}=174MHz
Output Data Position 1	t_{TOP1}	$-t_{THLD}$	0	$+t_{TSUP}$	ns	(Refer to Figure 6)
Output Data Position 0	t_{TOP0}	$\frac{t_{TCOP}}{7} - t_{THLD}$	$\frac{t_{TCOP}}{7}$	$\frac{t_{TCOP}}{7} + t_{TSUP}$	ns	
Output Data Position 6	t_{TOP6}	$2\frac{t_{TCOP}}{7} - t_{THLD}$	$2\frac{t_{TCOP}}{7}$	$2\frac{t_{TCOP}}{7} + t_{TSUP}$	ns	
Output Data Position 5	t_{TOP5}	$3\frac{t_{TCOP}}{7} - t_{THLD}$	$3\frac{t_{TCOP}}{7}$	$3\frac{t_{TCOP}}{7} + t_{TSUP}$	ns	
Output Data Position 4	t_{TOP4}	$4\frac{t_{TCOP}}{7} - t_{THLD}$	$4\frac{t_{TCOP}}{7}$	$4\frac{t_{TCOP}}{7} + t_{TSUP}$	ns	
Output Data Position 3	t_{TOP3}	$5\frac{t_{TCOP}}{7} - t_{THLD}$	$5\frac{t_{TCOP}}{7}$	$5\frac{t_{TCOP}}{7} + t_{TSUP}$	ns	
Output Data Position 2	t_{TOP2}	$6\frac{t_{TCOP}}{7} - t_{THLD}$	$6\frac{t_{TCOP}}{7}$	$6\frac{t_{TCOP}}{7} + t_{TSUP}$	ns	
Input Modulation Frequency	f_{IMOD}	30	-	250	kHz	
Input Modulation Ratio	r_{IMOD}	-2.0	-	+2.0	%	

(Note 8) (☆): Special Characteristics

AC Timing Diagrams

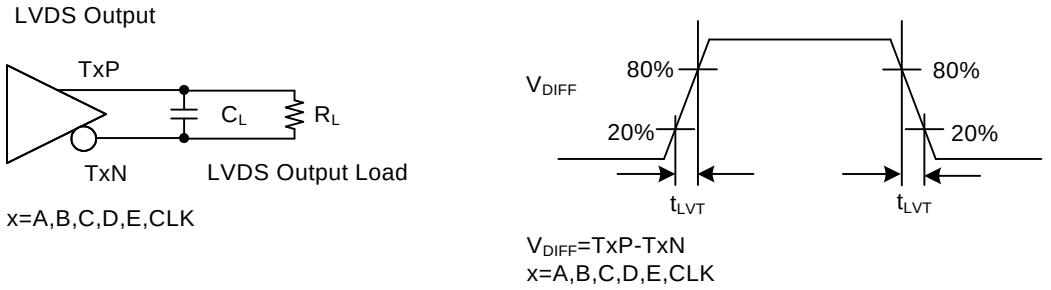


Figure 4. LVDS Output Load and Transition Time

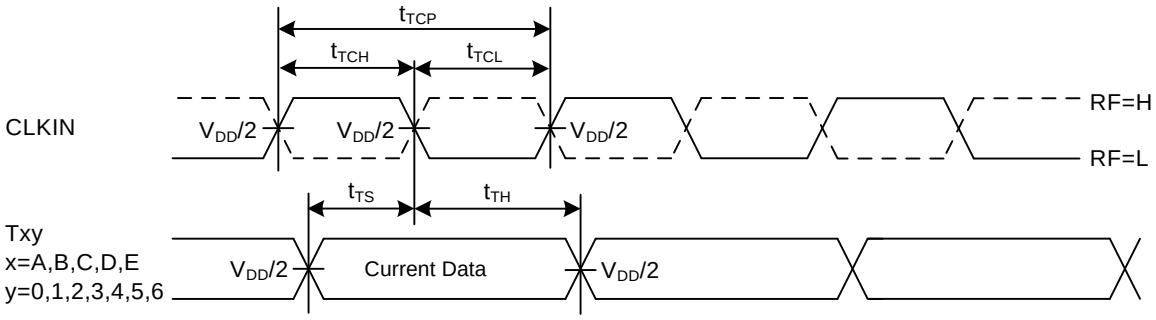


Figure 5. LVCMOS Input AC Timing Diagrams

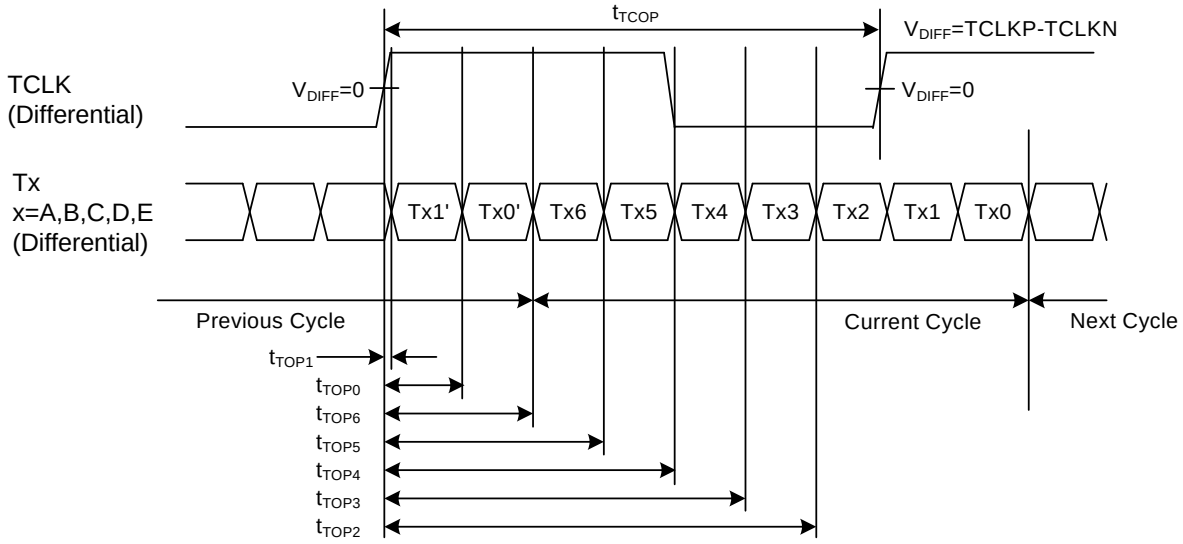


Figure 6. LVDS Output AC Timing Diagrams

Supply Current

Table 4. Supply Current (R_L=100Ω, C_L=5pF)

Parameter	Symbol	Limit			Unit	Conditions	
		Min	Typ	Max			
Supply Current Worst Case Pattern (Refer to Figure 7)	I_{TCCW}	-	70	95	mA	RS=L (200mV)	$f_{IN}=f_{OUT}$=90MHz
		-	100	130	mA		$f_{IN}=f_{OUT}$=174MHz
		-	88	115	mA	RS=H (350mV)	$f_{IN}=f_{OUT}$=90MHz
		-	118	150	mA		$f_{IN}=f_{OUT}$=174MHz
Power Down Current	I_{TCCS}	-	5	8	mA	PD=L All LVCMOS Pixel Data, Clock Pins=L	

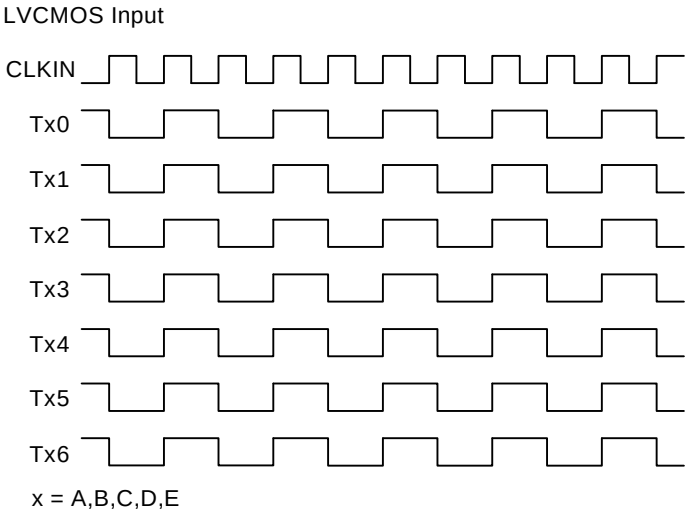


Figure 7. Worst Case Pattern (Maximum Power Condition)

Timing Chart

Power Supply Timing

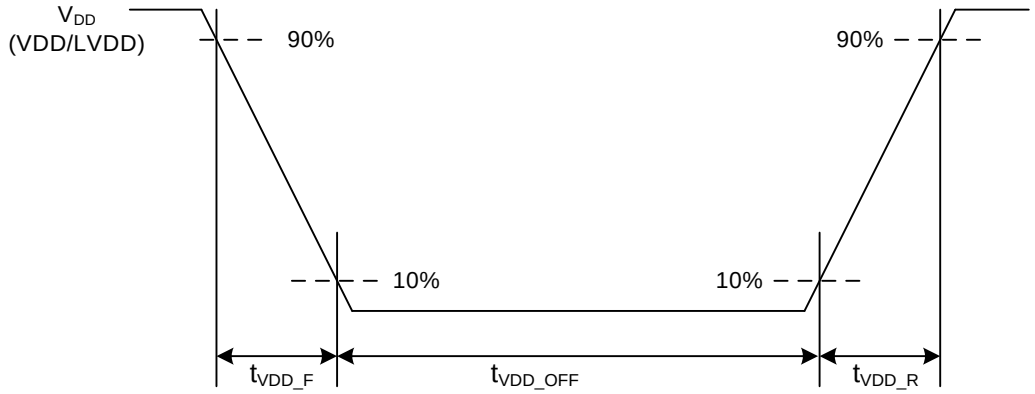


Figure 8. Power Supply Rise and Fall Timing

Table 5. Power Supply Timing

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
V_{DD} Rise Time	t_{VDD_R}	-	-	10	ms	
V_{DD} Fall Time	t_{VDD_F}	-	-	10	ms	
V_{DD} Off Time	t_{VDD_OFF}	100	-	-	ms	

Reset Release Timing

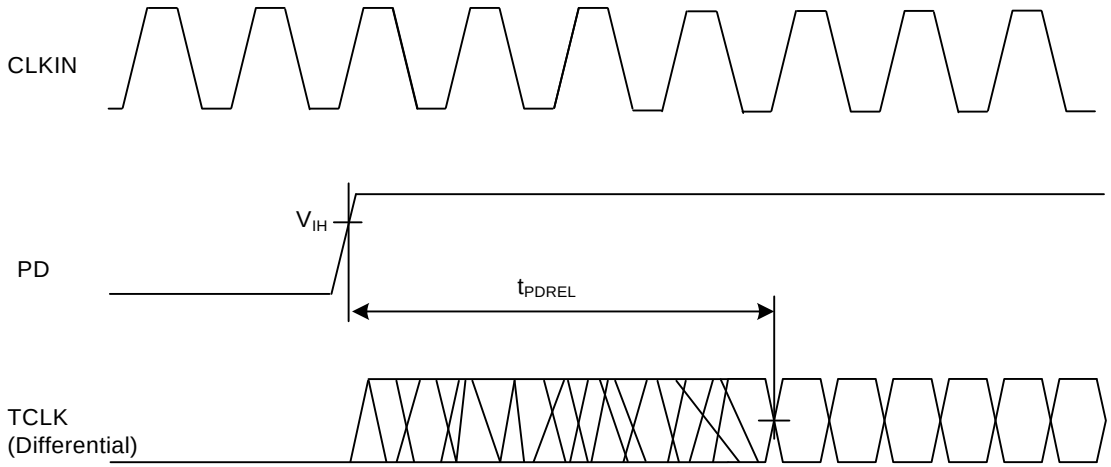


Figure 9. Reset Release Timing

Table 6. Reset Release Timing

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output Stable Time	t_{PDREL}	-	-	10	ms	

Application Examples

Typical Application Example

LVCMOS Parallel Data Input:	35 Bits (R/G/B 30 Bits, HSYNC, VSYNC, DE, CNTL1, CNTL2) Input Clock Edge: Falling Edge (RF=L)
LVDS Data Output:	LVDS Output Swing: 350mV (RS=H)

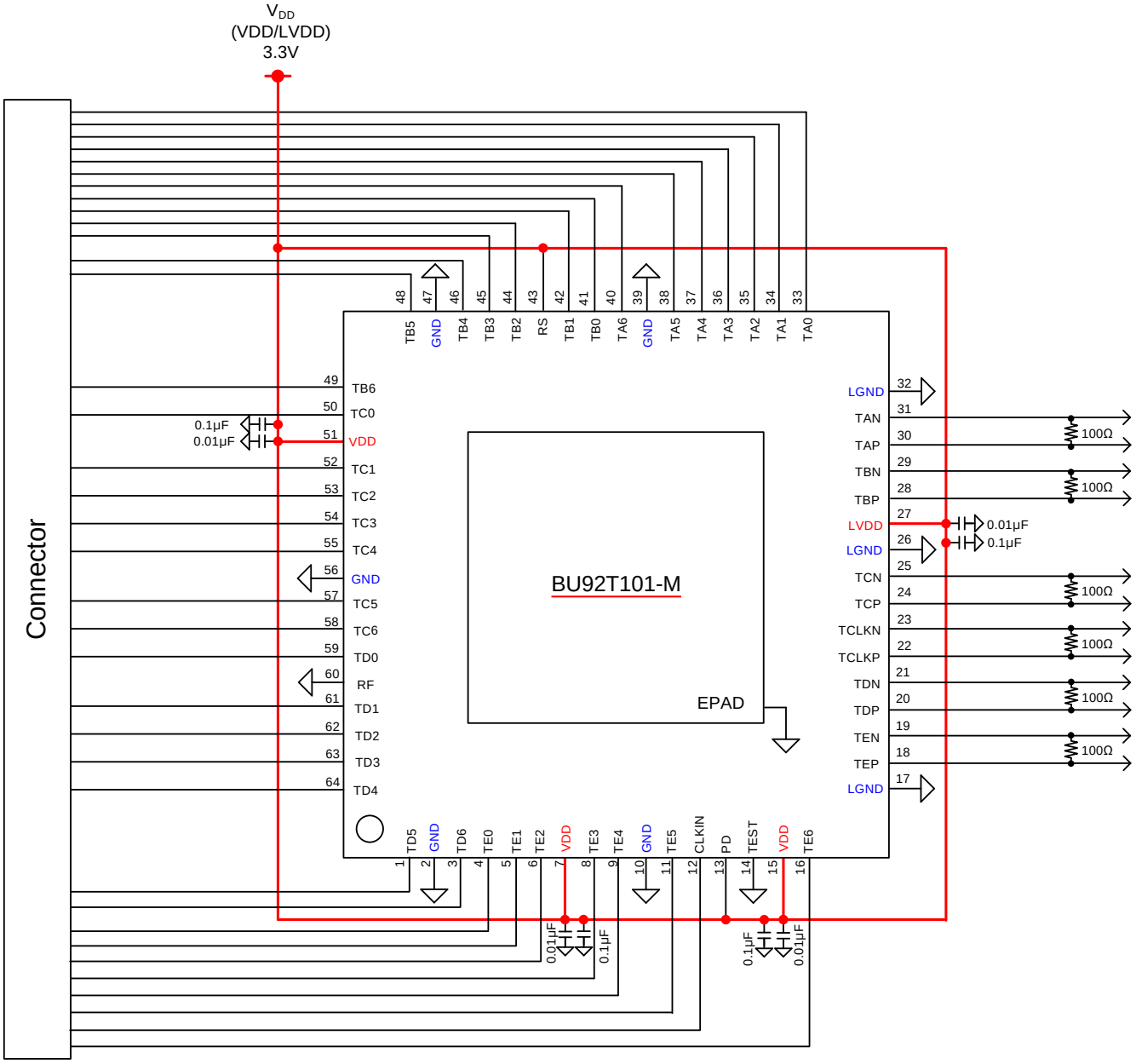


Figure 10. Application Example (1)

Application Examples - continued

BU92T101-M Connect with LVDS Receiver

BU92T101-M (LVDS Transmitter)
LVCMOS Parallel Data Input: 33 Bits (R/G/B 30 Bits, HSYNC, VSYNC, DE)
Input Clock Edge: Falling Edge (RF=L)
LVDS Data Output: LVDS Output Swing: 350mV (RS=H)

BU16002KVT (LVDS Receiver)
LVDS Data Input: (Need Termination Resistor on PCB)
LVCMOS Data Output: 33 Bits (R/G/B 30 Bits, HSYNC, VSYNC, DE)
Output Clock Edge: Falling Edge (RF=L)

SOC
LVDS Data Mapping: JEIDA Format (10Bit)

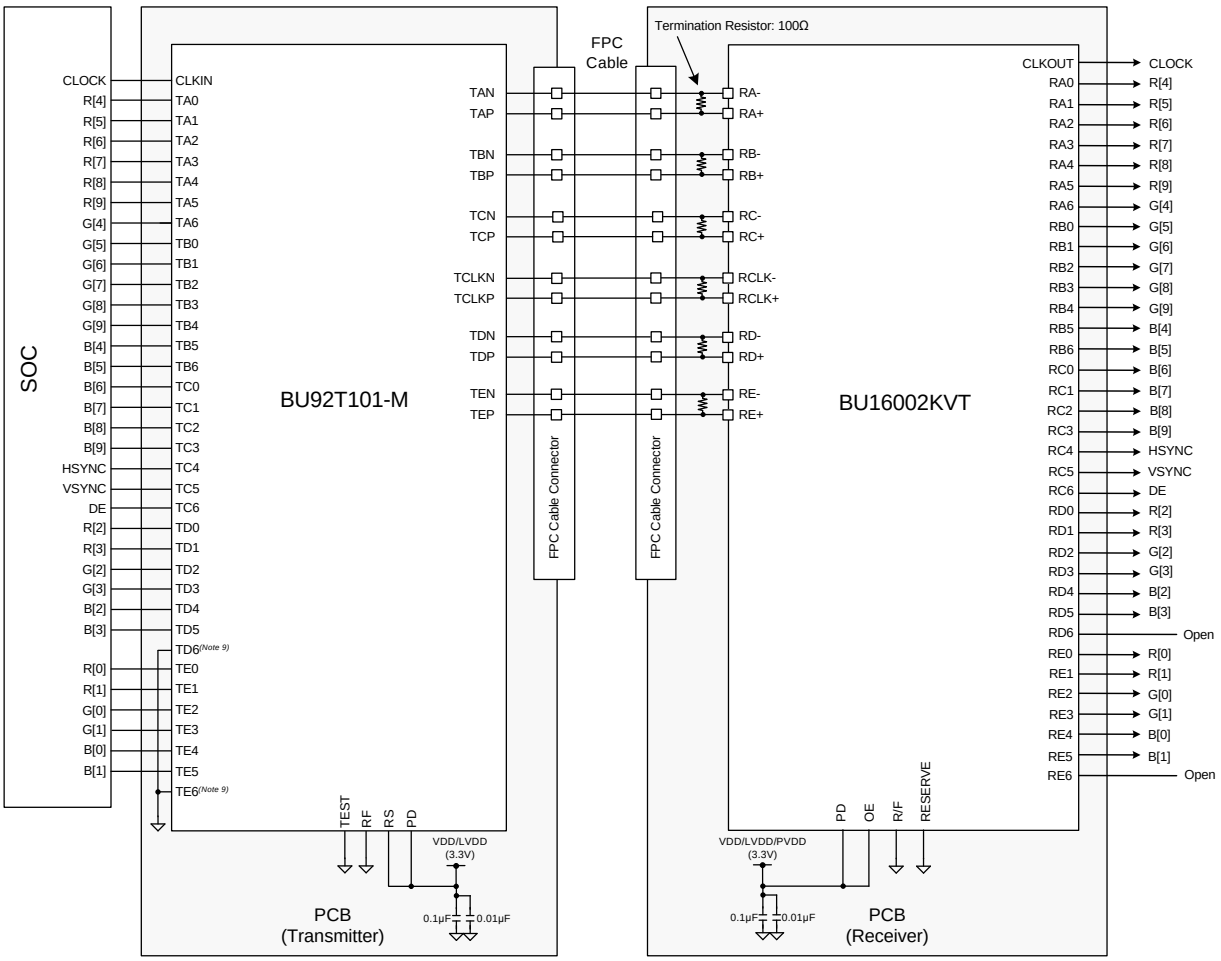


Figure 11. Application Example (2)

(Note 9) LVCMOS pixel data pins unused are recommended to connect to GND.

Application Examples - continued

BU92T101-M Connect with LVDS Repeater

BU92T101-M (LVDS Transmitter)
LVCMOS Parallel Data Input: 27 Bits (R/G/B 24 Bits, HSYNC, VSYNC, DE)
Input Clock Edge: Falling Edge (RF=L)
LVDS Data Output: LVDS Output Swing: 350mV (RS=H)

BU92RT82-M (LVDS Repeater)
LVDS Data Input: Single-in (Select LVDS Receiver 1st Link Data)
LVDS Data Output: Single-out
LVDS Output Swing: 350mV (RS=H)

SOC
LVDS Data Mapping: VESA Format (8Bit)

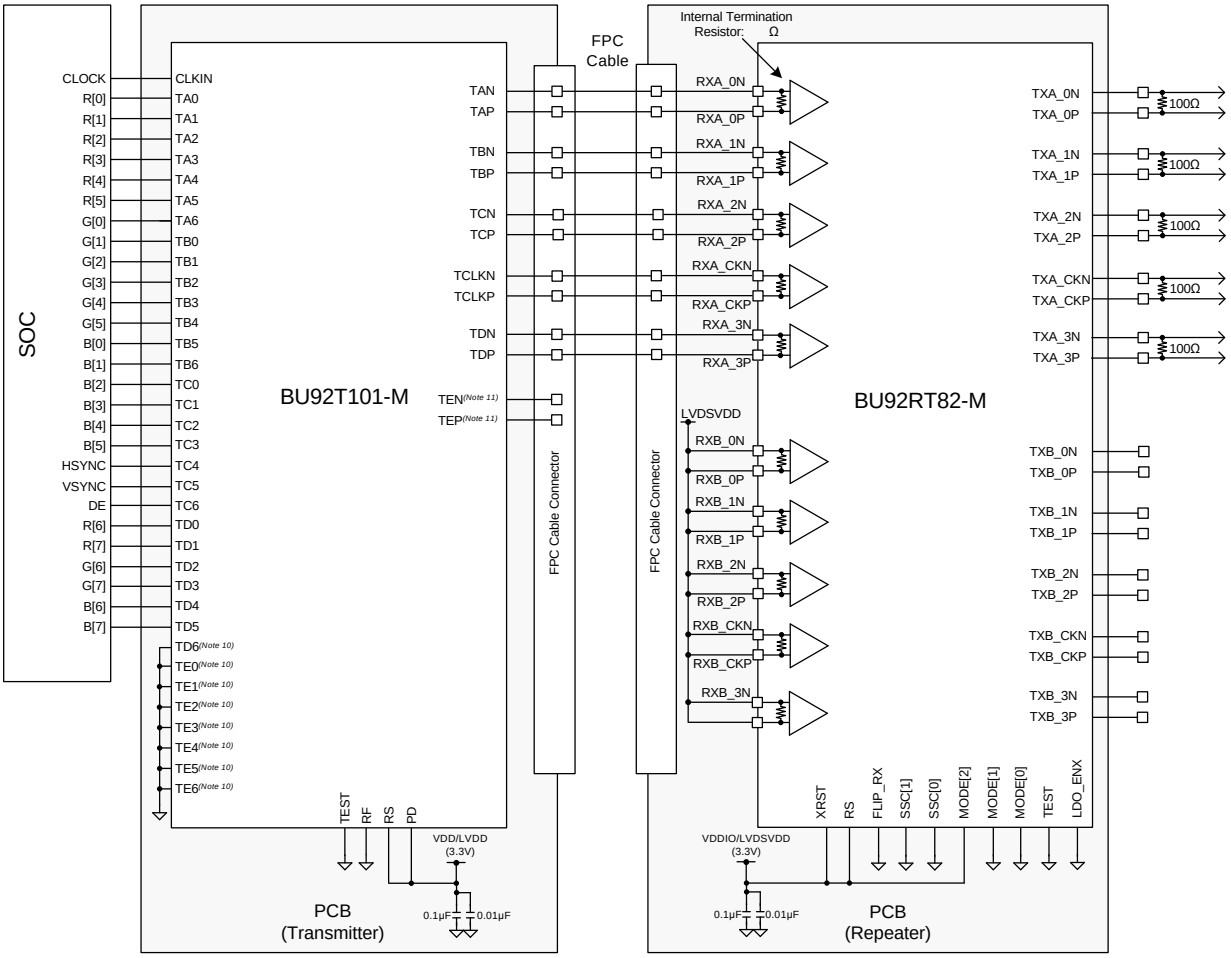


Figure 12. Application Example (3)

(Note 10) LVCMOS pixel data pins unused are recommended to connect to GND.
(Note 11) LVDS pins unused should be open.

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Recommended Operating Conditions**
   The function and operation of the IC are guaranteed within the range specified by the recommended operating conditions. The characteristic values are guaranteed only under the conditions of each item specified by the electrical characteristics.

6. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

7. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

8. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

9. **Inter-pin Short and Mounting Errors**
   Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

10. **Unused Input Pins**
    Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

11. **Regarding the Input Pin of the IC**
    In the construction of this IC, P-N junctions are inevitably formed creating parasitic diodes or transistors. The operation of these parasitic elements can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions which cause these parasitic elements to operate, such as applying a voltage to an input pin lower than the ground voltage should be avoided. Furthermore, do not apply a voltage to the input pins when no power supply voltage is applied to the IC. Even if the power supply voltage is applied, make sure that the input pins have voltages within the values specified in the electrical characteristics of this IC.

12. **Ceramic Capacitor**
    When using a ceramic capacitor, determine a capacitance value considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

Ordering Information

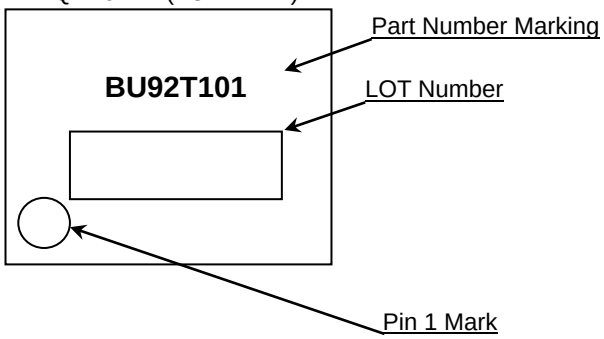
B U 9 2 T 1 0 1	-	ME2

Part Number

Product Rank
M: for Automotive
Packaging and forming specification
E2: Embossed tape and reel

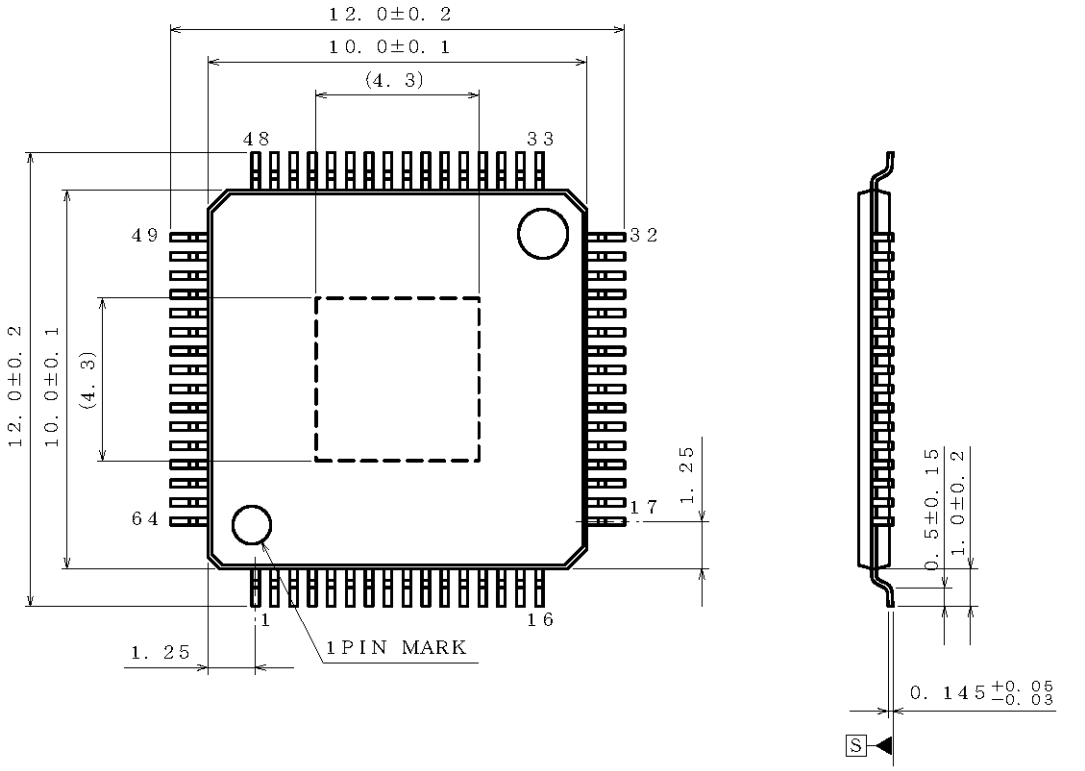
Marking Diagram

HTQFP64AV (TOP VIEW)



Physical Dimension and Packing Information

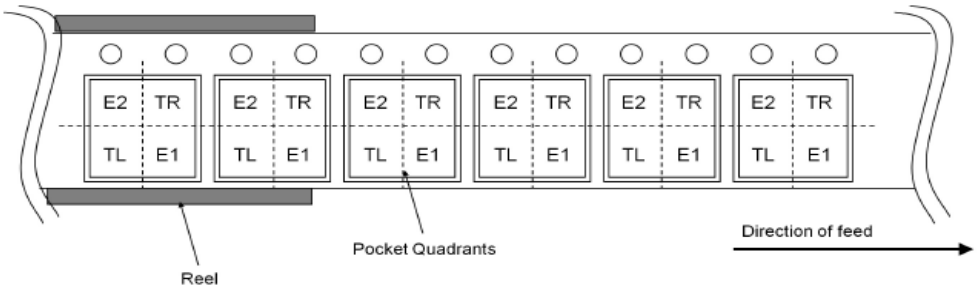
Package Name	HTQFP64AV



(UNIT : mm)
PKG : HTQFP64AV
Drawing No. EX285-5001

<Tape and Reel information>

Tape	Embossed carrier tape (with dry pack)
Quantity	1000pcs
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)



Revision History

Date	Revision	Changes
25.Oct.2017	001	New Release

Notice

Precaution on using ROHM Products

1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), aircraft/spacecraft, nuclear power controllers, 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 not designed 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 depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction 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 on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, 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

A two-dimensional barcode 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 concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM 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.

2. ROHM shall not have any obligations where the claims, actions or demands arising from the combination of the Products with other articles such as components, circuits, systems or external equipment (including software).

3. No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of ROHM or any third parties with respect to the Products or the information contained in this document. Provided, however, that ROHM will not assert its intellectual property rights or other rights against you or your customers to the extent necessary to manufacture or sell products containing the Products, subject to the terms and conditions herein.

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.

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