

**VGA/SVGA/XGA 24-bit Transmitter**

**Description**

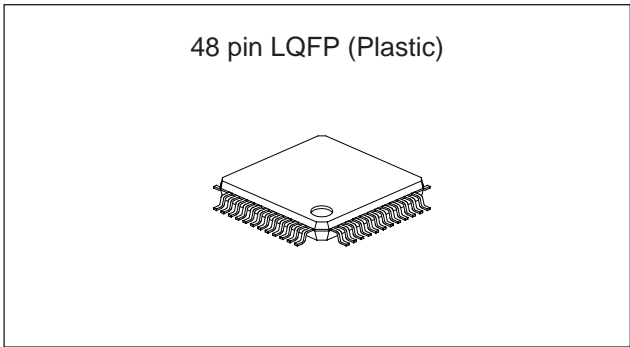
The CXB1455R is the IC which transmits the 24-bit VGA/SVGA/XGA definition moving picture based on the GVIF (Gigabit Video Interface) technology.

**Features**

- 1 chip transmitter for serial transmission of 24-bit color VGA/SVGA/XGA picture
- On-chip PLL synthesizer
- On-chip differential cable driver
- TTL/CMOS compatible interface
- Supports 1 pixel/shift clock mode with 1 chip and 2 pixel/shift clock mode with 2 chips
- Single 3.3V power supply
- Low power consumption
- 48-pin plastic QFP package (7mm × 7mm)

**Application**

Gigabit video interface



**Structure**

Bi-CMOS IC

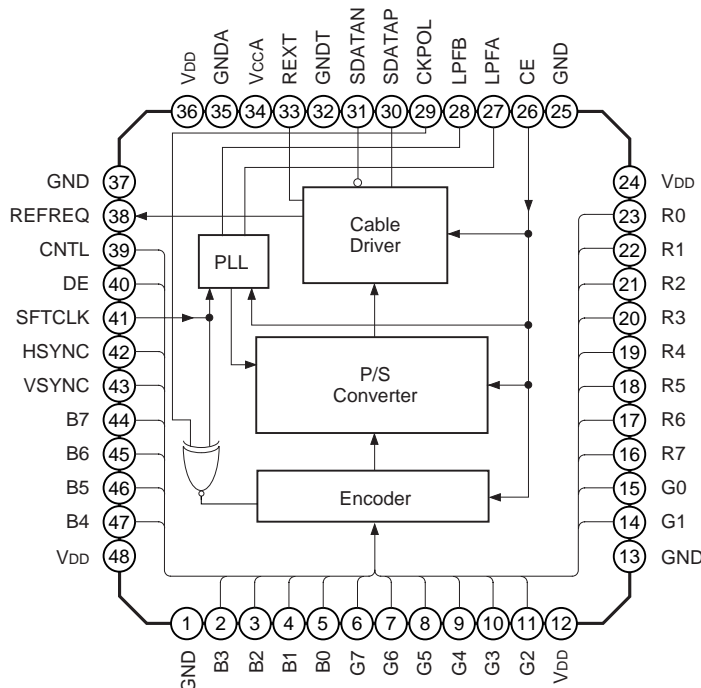
**Absolute Maximum Ratings**

• Power supply	V <sub>CC</sub>	4.2	V
• Operating temperature	T <sub>opr</sub>	0 to +85	°C
• Storage temperature	T <sub>stg</sub>	-65 to +150	°C
• Allowable power dissipation	P <sub>D</sub>	333	mW

**Recommended Operating Condition**

Supply voltage	3.3 ± 0.3	V
----------------	-----------	---

**Block Diagram and Pin Configuration**



**Fig. 1. Block Diagram and Pin Configuration**

Sony reserves the right to change products and specifications without prior notice. This information does not convey any license by any implication or otherwise under any patents or other right. Application circuits shown, if any, are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits.

Pin Description

Power Supply/Ground

Symbol	Pin No.	Description
VDD	12, 24, 36, 48	Logic power supply; connected to 3.3V ± 0.3V
GND	1, 13, 25, 37	Logic ground; connected to 0V
VccA	34	Analog power supply; connected to 3.3V ± 0.3V
GND A	35	Analog ground; connected to 0V
GNDT	32	Transmission ground; connected to 0V

Digital Signal

Symbol	Pin No.	Type	Description	Equivalent Circuit
SFTCLK	41	TTL in 1	Shift clock, for the data fetch at rising or falling edge	
RED (7 to 0)	16, 17, 18, 19, 20, 21, 22, 23	TTL in 1	Pixel data. 1 pixel/shift clock input.	
GRN (7 to 0)	6, 7, 8, 9, 10, 11, 14, 15			
BLU (7 to 0)	44, 45, 46, 47, 2, 3, 4, 5			
HSYNC	42	TTL in 1	Hsync data	
VSYNC	43	TTL in 1	Vsync data	
CNTL	39	TTL in 1	Panel control data	
DE	40	TTL in 1	Data enable	
CE	26	TTL in 2	Chip enable	
CKPOL	29	TTL in 2	SFTCLK polarity	
SDATAP/N	30, 31	Tx	Serial output and Refclk request input	

Symbol	Pin No.	Type	Description	Equivalent Circuit
REFREQ	38	TTL out	Refclk request detection flag	

**Special**

Symbol	Pin No.	Description	Equivalent Circuit
REXT	33	SDATAP/N output current trimming. Connect to the external resistor.	
LPFA/B	27, 28	External loop filter	

Electrical Characteristics

Table 1. Absolute Maximum Ratings

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	V <sub>CC</sub>	-0.3		4.2	V	
TTL DC input voltage	V <sub>I_T</sub>	-0.5		6.5	V	
TTL H level output current	I <sub>OH_T</sub>	-20		0	mA	
TTL L level output current	I <sub>OL_T</sub>	0		20	mA	
Serial output pin voltage	V <sub>sdout</sub>	V <sub>CC</sub> -1.2		V <sub>CC</sub> + 0.5	V	
Ambient temperature	T <sub>a</sub>	-55		120	°C	Under bias
Storage temperature	T <sub>stg</sub>	-65		150	°C	

Table 2. Recommended Operating Conditions

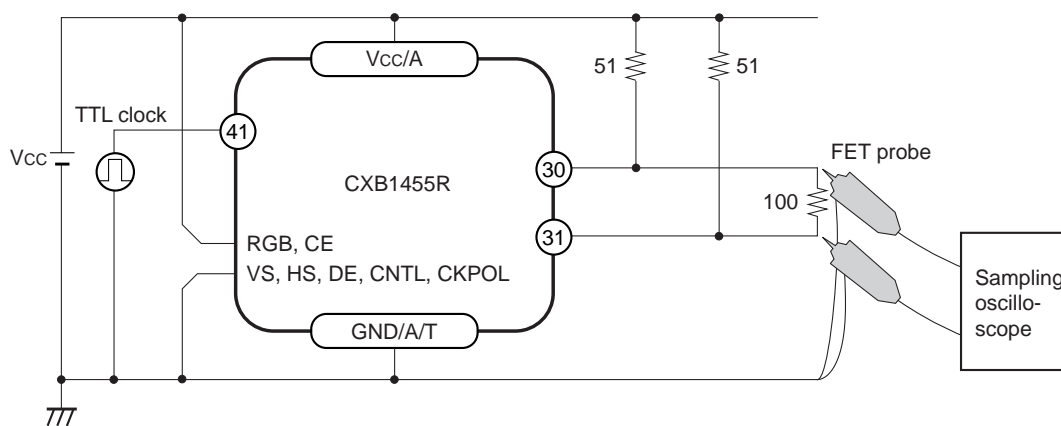
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply voltage (Includes V <sub>DD</sub> and V <sub>CC</sub> A)	V <sub>CC</sub>	3.0	3.3	3.6	V	
Ambient temperature	T <sub>a</sub>	0		85	°C	

Table 3. DC Characteristics (Under the recommended operating conditions. See Table 2.)

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions	
TTL High level input voltage	V <sub>IH_T</sub>	2		5.5	V		
TTL Low level input voltage	V <sub>IL_T</sub>	0		0.8	V		
TTL High level input current	I <sub>IH_T</sub>			1.0	μA	V <sub>IN</sub> = V <sub>CC</sub>	
TTL Low level input current	I <sub>IL_T</sub>	-1.0			μA	V <sub>IN</sub> = 0	
CE, CKPOL High level input voltage	V <sub>IH_C</sub>	V <sub>CC</sub> - 0.5		5.5	V		
CE, CKPOL Low level input voltage	V <sub>IL_C</sub>	0		0.5	V		
CE, CKPOL High level input current	I <sub>IH_C</sub>			1.0	μA	V <sub>IN</sub> = V <sub>CC</sub>	
CE, CKPOL Low level input current	I <sub>IL_C</sub>	-1.0			μA	V <sub>IN</sub> = 0	
TTL High level output voltage	V <sub>OH_T</sub>	2.4			V	I <sub>OH</sub> = -8mA	
TTL Low level output voltage	V <sub>OL_T</sub>			0.4	V	I <sub>OL</sub> = 8mA	
SDATA High level output current	I <sub>OH_SD</sub>	-0.1	0	+0.5	mA	R <sub>EXT</sub> = 4.7kΩ	
SDATA Low level output current	I <sub>OL_SD</sub>	14.5	15.7	17	mA		
SDATA High level output voltage	V <sub>IH_SD</sub>	V <sub>CC</sub> - 0.55			V	Common mode voltage	
SDATA Low level output voltage	V <sub>IL_SD</sub>			V <sub>CC</sub> - 0.76	V		
Supply current	GRAYSCALE	I <sub>CC</sub>	44.0	61.0	77.0	mA	@65MHz See Fig. 8 See Fig. 7
	WORSTCASE		50.0	71.0	92.0	mA	

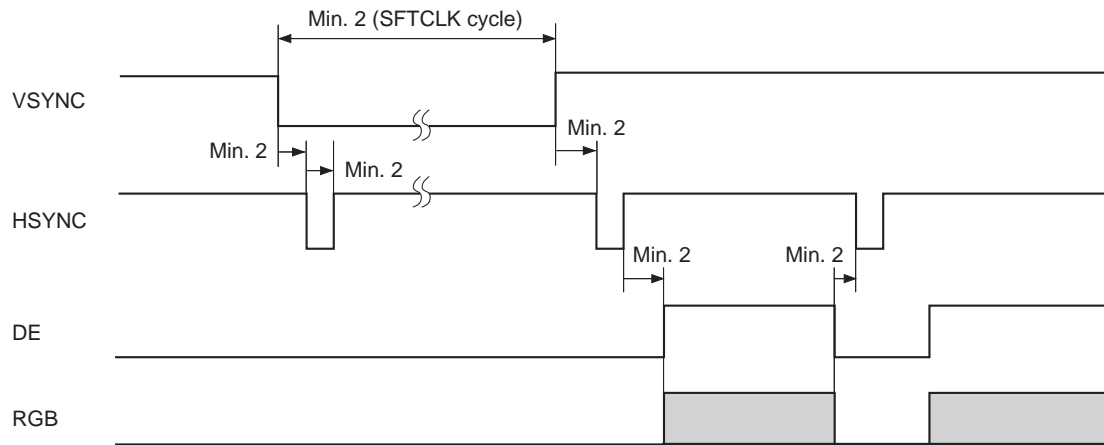
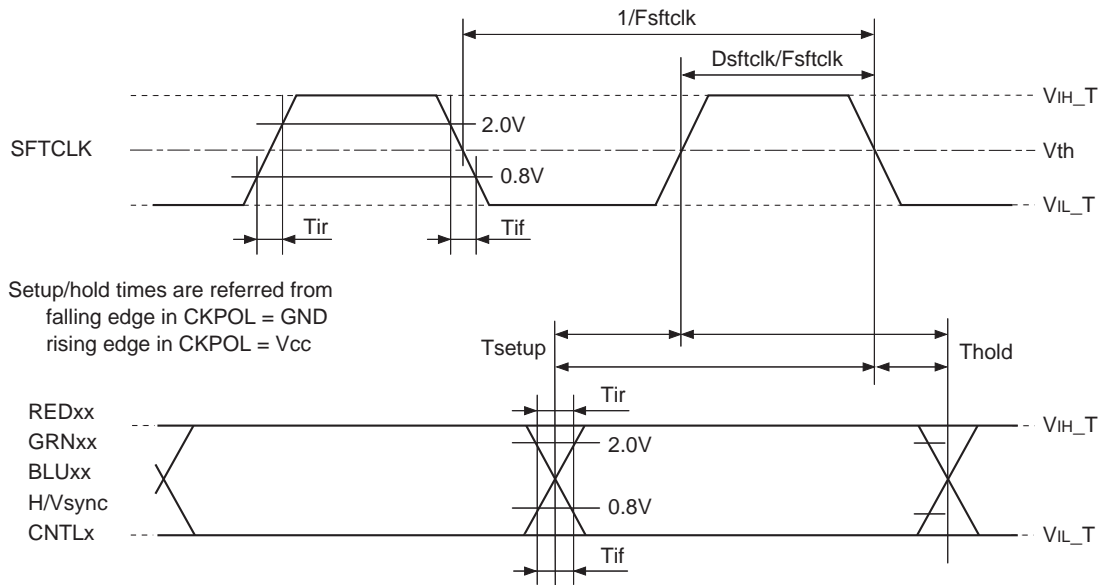
**Table 4. AC Characteristics (Under the recommended operating conditions. See Table 2.)**

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
TTL input rise time	Tir	0.7		5.0	ns	0.8 to 2.0V
TTL input fall time	Tif	0.7		5.0	ns	2.0 to 0.8V
Minimum SFTCLK frequency	Fsftclk	65.0		25.0	MHz	
Maximum SFTCLK frequency			MHz			
SFTCLK duty factor	Dsftclk	40		60	%	Vth = 1.4V
Pixel/Sync/Cntl setup time to SFTCLK	Tsetup	2.5			ns	
Pixel/Sync/Cntl hold time to SFTCLK	Thold	2.5			ns	
SDATA rise time	Tor		200		ps	20 to 80%, CL = 2pF See Fig. 2.
SDATA fall time	Tof		200		ps	
Clock mode assert time	TAclk		50		ns	
Clock mode deassert time	TDclk		10		ns	
Idle mode assert time	TAidle		150		ns	
Idle mode deassert time	TDidle		100		ns	
PLL lock-in time	Tlockin		0.1		ms	



**Fig. 2. SDATA waveform measurement**

Timing Chart



CNTL There must be 2 SFTCLK cycles or more left between the CNTL edge and the HSYNC, VSYNC and DE edges.

Fig. 3. TTL input timing

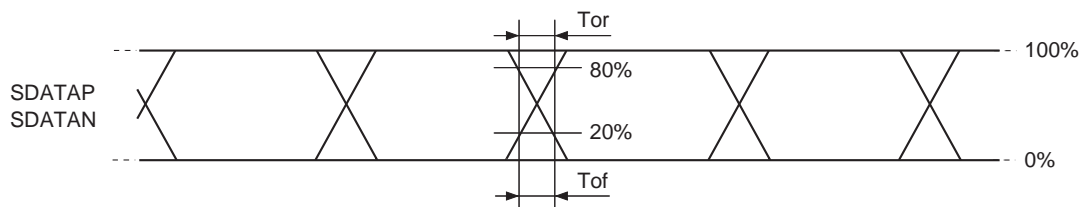


Fig. 4. Serial output timing

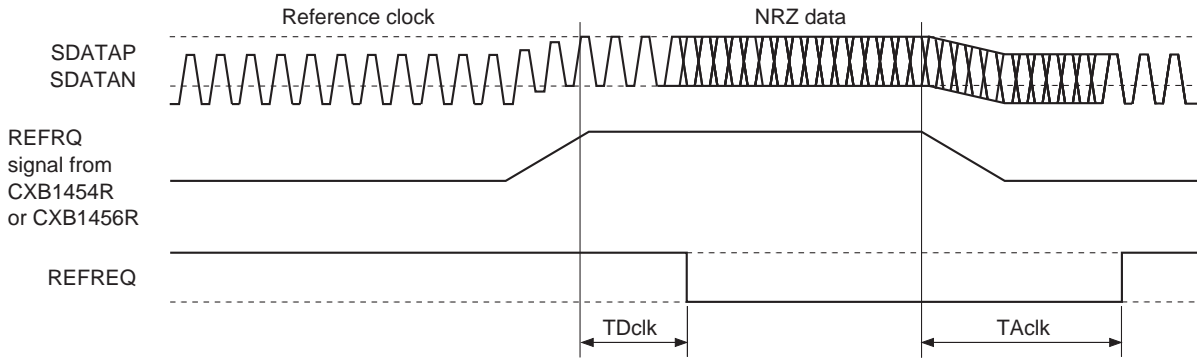


Fig. 5. Refclk request timing

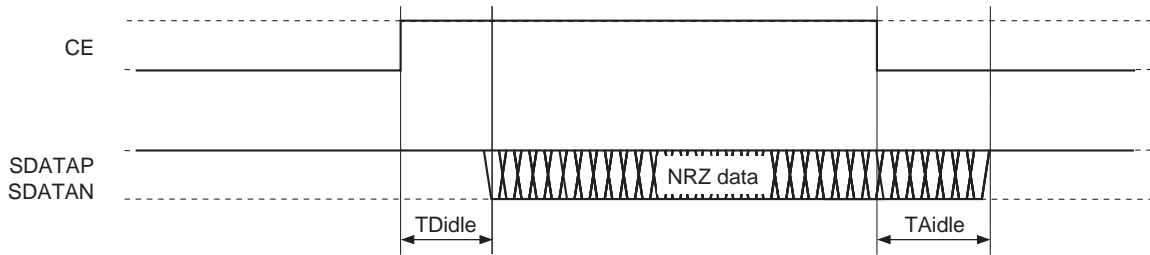


Fig. 6. Idle mode timing

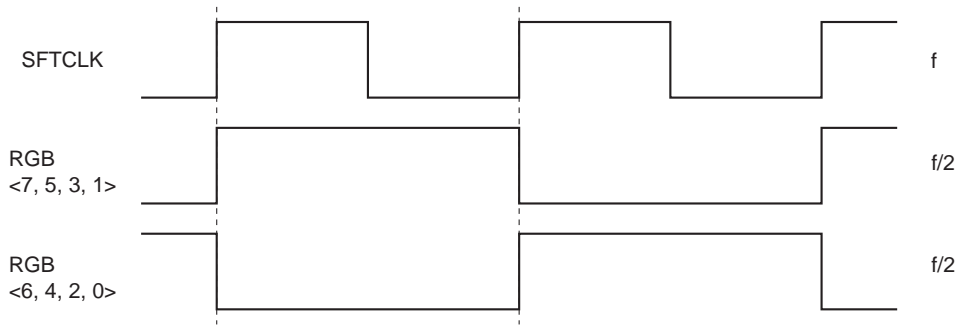


Fig. 7. Worst case test pattern

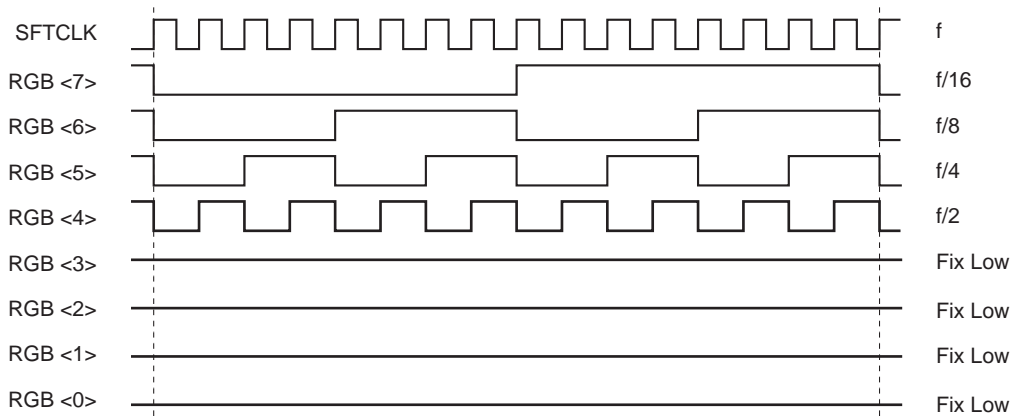
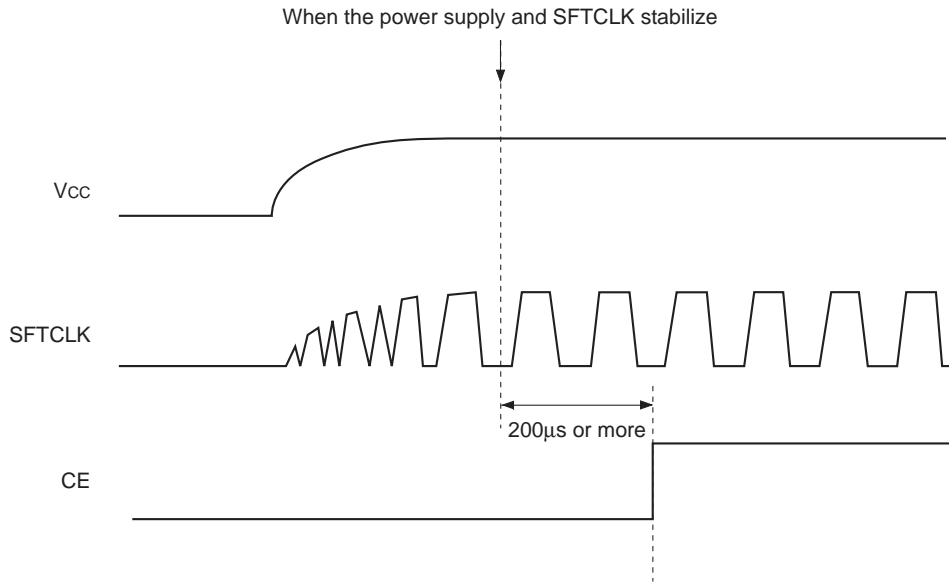


Fig. 8. 16 grayscale test pattern

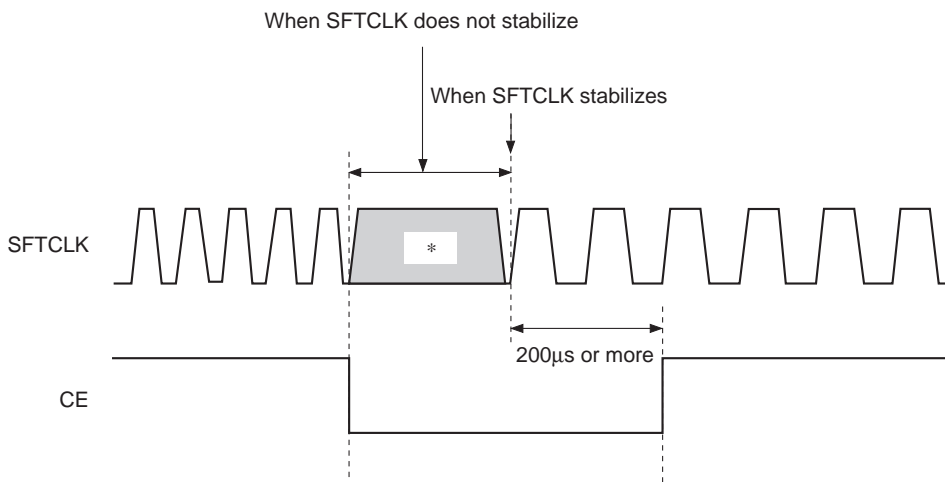
**CE Pin Control**

The CE pin should be controlled as follows.

When the power is turned ON or SFTCLK stops, or when the SFTCLK input signal falls into the disorder while the SFTCLK frequency is varied, the CE pin should be set to Low level and the CE pin should be set to High level after the SFTCLK frequency stabilizes. (Figs. 9 and 10)



**Fig. 9. CE timing when power supply is turned ON**



\* When SFTCLK stops or the frequencies of 15MHz or less and 75MHz or more are input.

**Fig. 10. CE timing when SFTCLK input signal is not stabilized**



**CKPOL Pin Control**

The CKPOL pin selects the SFTCLK data sampling trigger edge. (See Table 5)

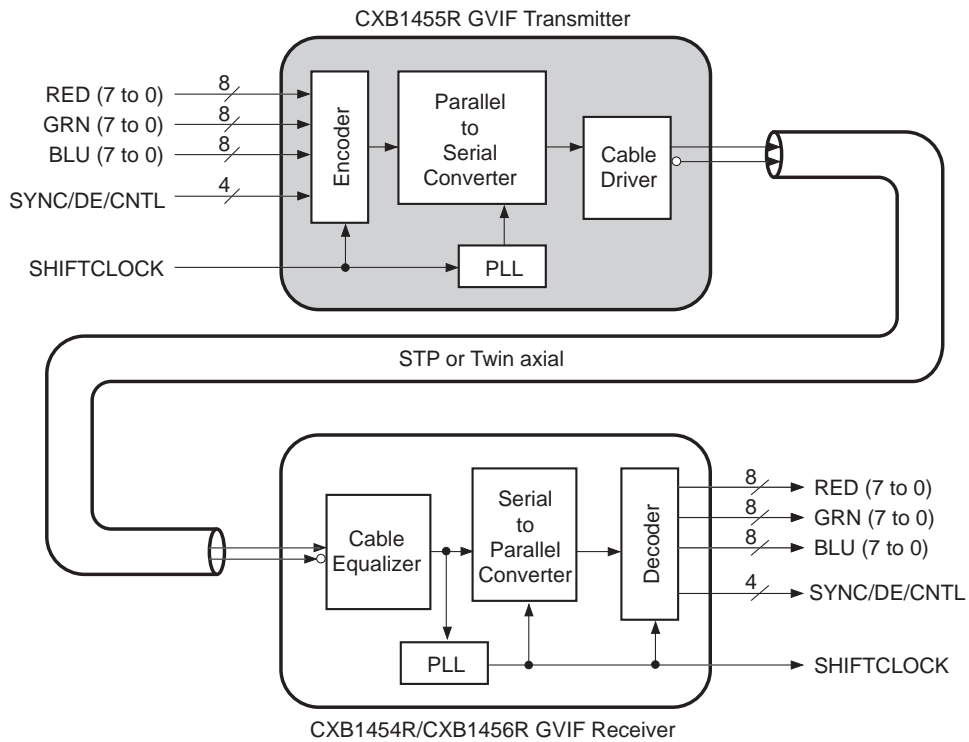
**Table 5. SFTCLK polarity**

CKPOL	SFTCLK data sampling trigger
L	Falling edge
H	Rising edge

**Applications**

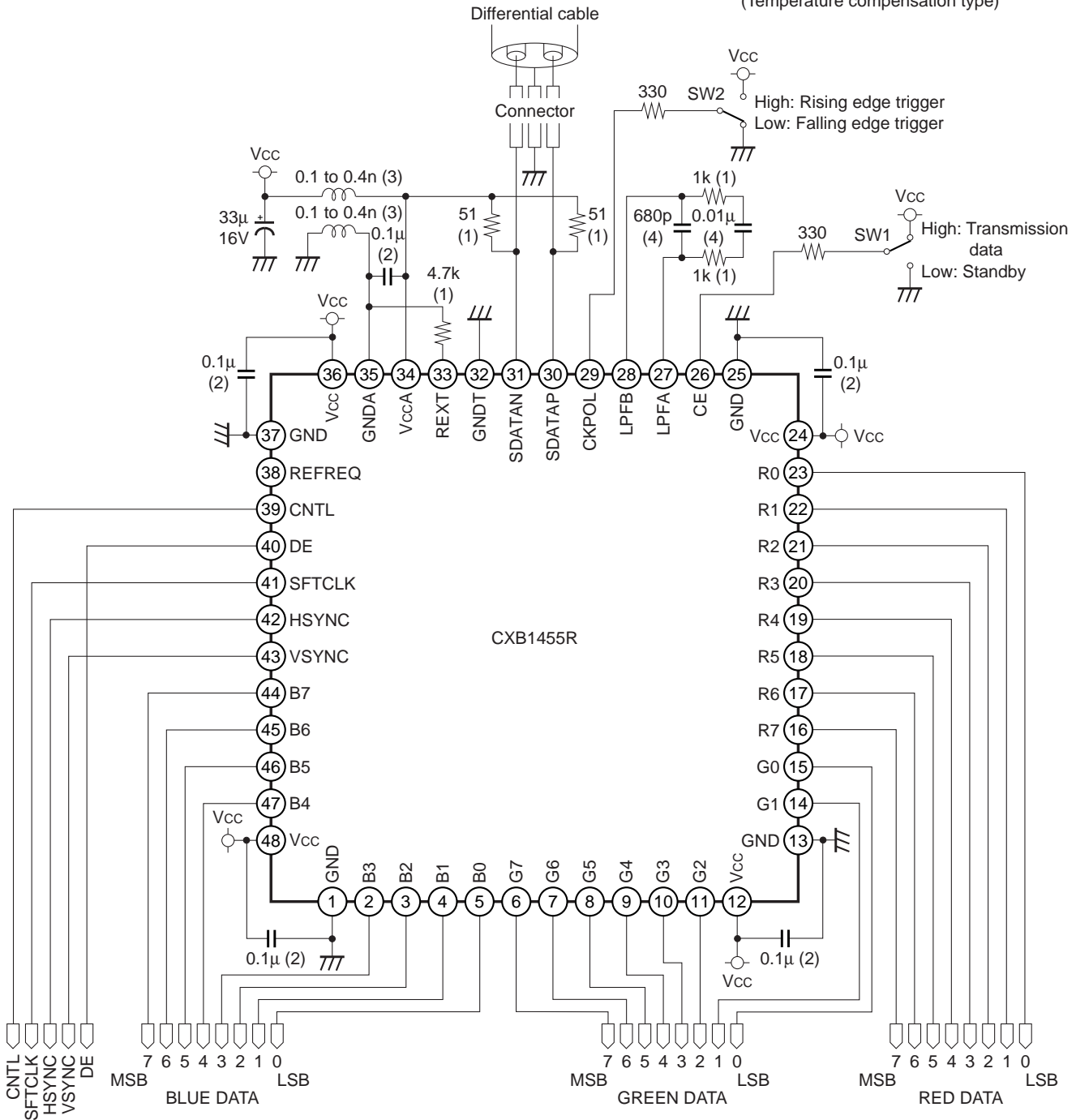
The CXB1455R GVIF transmitter is applied to the digital RGB signal transmission for

- P/C with LCD monitor
  - Video-on-demand system
  - Monitoring system
  - Graphical controller
  - Projector
  - Digital TV monitor
  - Automobile Navigation System
- with GVIF receivers, CXB1454R/CXB1456R.



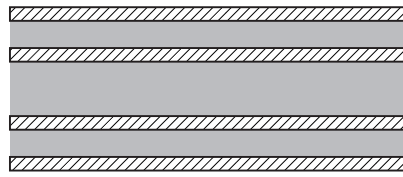
Application Circuit

- (1) Chip resistor (1%)
- (2) Chip capacitor
- (3) Formed by the printed circuit pattern  
(L = 0.5 to 1.0mm/W = 0.5 to 1.0mm)
- (4) LPF chip capacitor  
(Temperature compensation type)



Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

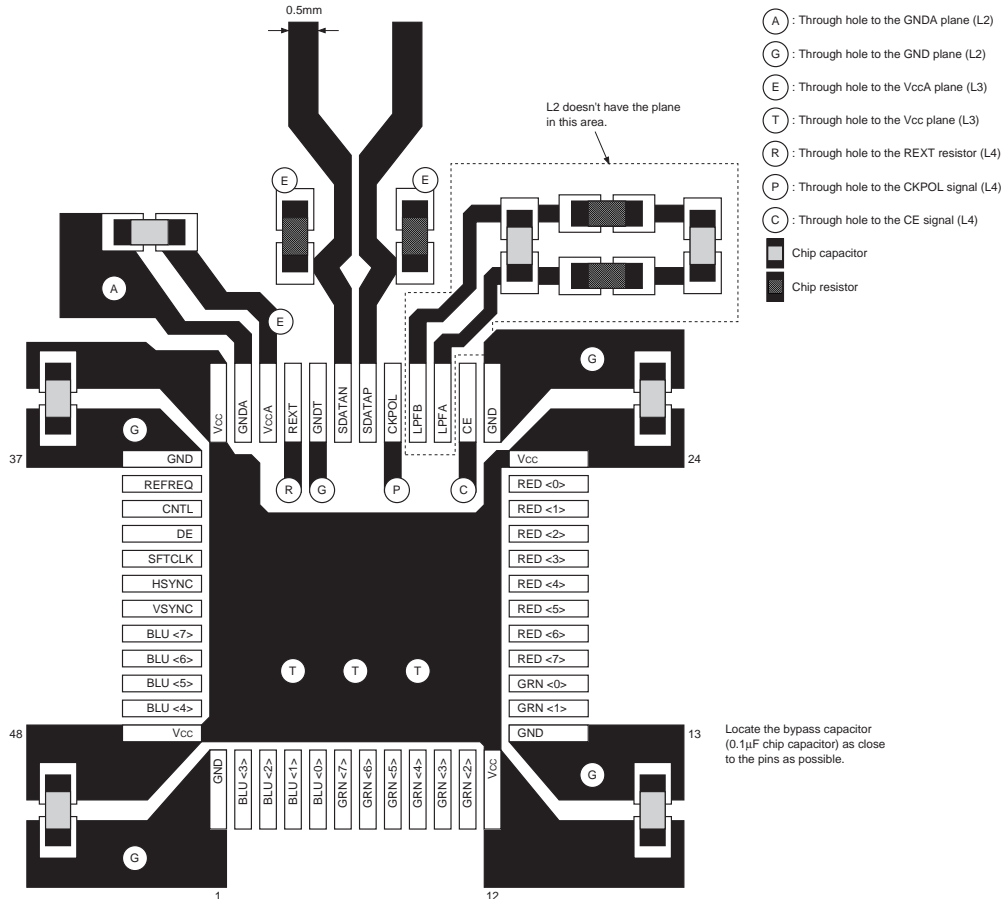
**Recommended Printed Board Structure**



- L1: Cu plate (18µm) + solder coat
- L1: Fiber-glass epoxy core (0.3mm)
- L2: Cu plate (36µm)
- L2: Fiber-glass epoxy core (0.8mm)
- L3: Cu plate (36µm)
- L3: Fiber-glass epoxy core (0.3mm)
- L4: Cu plate (18µm) + solder coat

**Recommended Printed Circuit Board Pattern**

**Example of power supply and special signal routing**



**Microstrip Line**

The microstrip line with the characteristic impedance of 50Ω should be used to connect the LSI transmission signal pin SDATAP/N to the connector foot printer as GVIF transmits the high-speed digital signal with the maximum speed of 2Gb/s. The optimal line can be made by forming 0.5mm pattern on L1. (See the board structure shown below.) The line lengths should be the same and the through hole should be not used. Normally, L2 should be the mat GND.

**Termination Elements**

Locate the 51Ω termination resistors as close to the LSI as possible.

**Filter Device and Reference Resistor**

The capacitor and resistor connected to LPFA/B and REXT are the filter and the reference resistor. Locate them as close to the LSI as possible. Decrease the parasitic capacitance by removing the L2 GND plane under these elements and wiring.

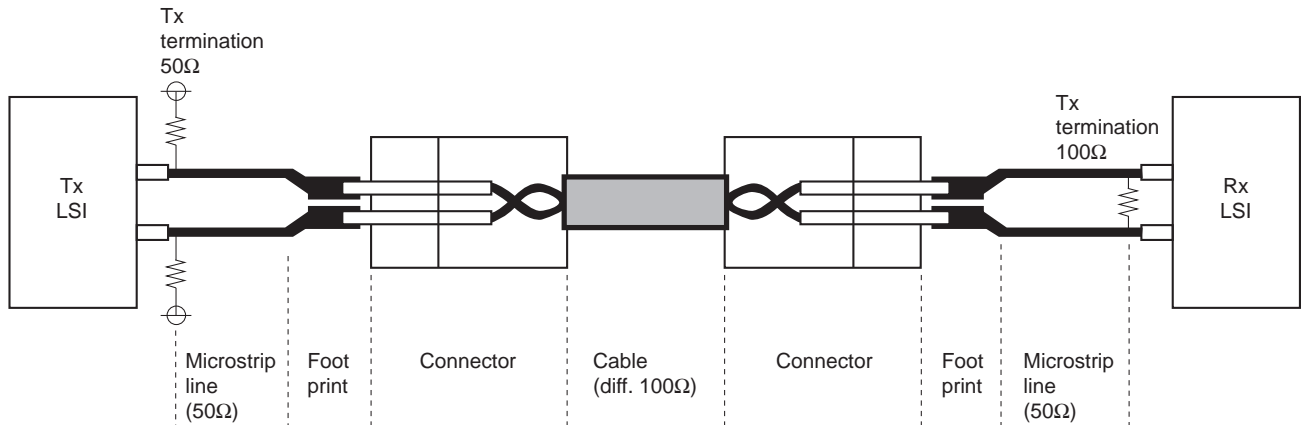
### By-pass Capacitor

Locate a 0.1  $\mu\text{F}$  chip capacitor as close to the pin as possible as shown in the Recommended Circuit Diagram.

### Notes on Transmission System Configuration

The GVIF uses termination on both the transmitting and receiving ends, built-in equalizers, small amplitude differential signals, etc. in order to more easily resolve problems such as signal reflectance, signal attenuation and EMI which interfere with high-speed data transmission.

However, a number of cautions must be observed over the entire transmission system shown in the figure below in order to completely resolve these problems.



The transmission system has the following four requirements.

- Impedance matching shall be excellent. (Reflectance shall be low.)

A differential impedance that falls within the template shown on the following page is recommended.

- Attenuation shall be low and regular.

For the CXB1454R (built-in equalizer)

Attenuation of 15 dB (conforming to root f attenuation) @ 1 GHz or less is recommended.

See the following page.

For the CXB1456R (no equalizer)

Attenuation of 6 dB @ 1 GHz or less is recommended.

- Differential signal POS/NEG skew shall be small.

12% or less during the time for one bit is recommended.

160 ps @ VGA, 100 ps @ SVGA, 60 ps @ XGA

- EMI characteristics shall be excellent.

The following measures are effective for satisfying these requirements.

- Use a low attenuation, low skew differential cable with excellent impedance accuracy.

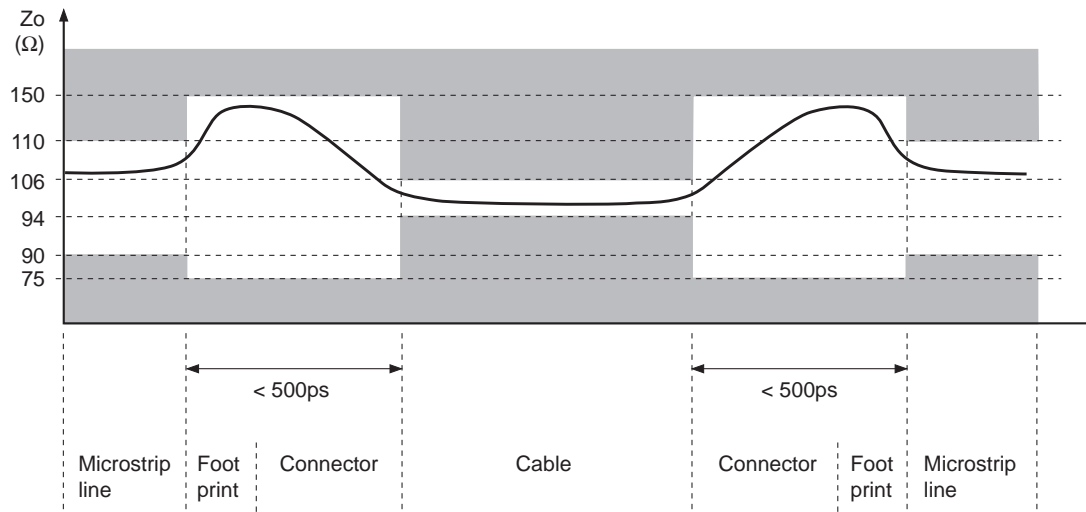
A cable with a two-core coaxial (shielded twisted pair) structure is recommended.

- Use low reflectance connectors.
- Take care for the connector pin assignment.

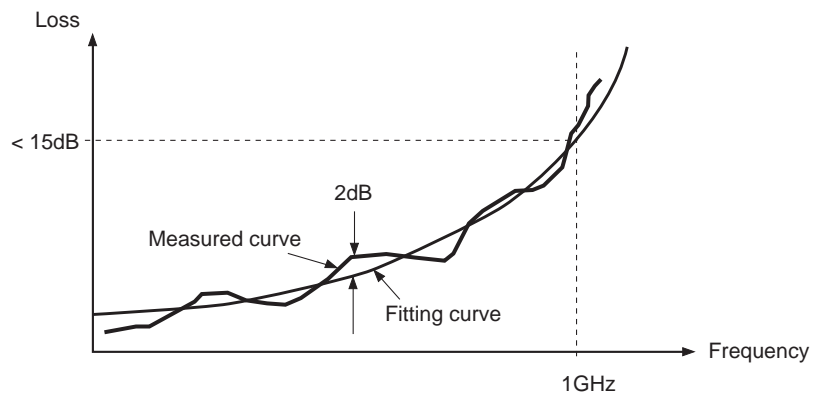
Select pins so that there is no interference with other signals and so that the positive and negative signal wiring are the same length on the board.

- Use a cable with a double shielded structure.

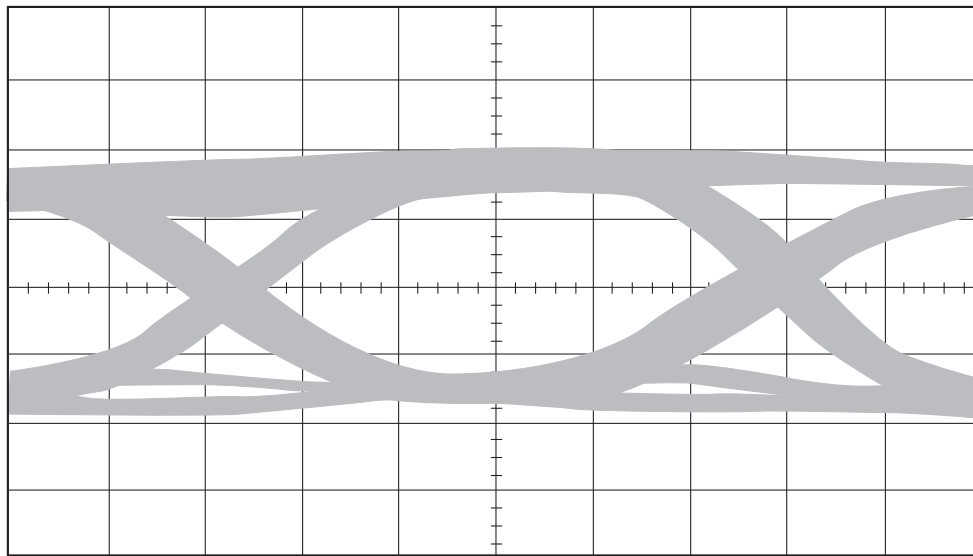
**Recommended Transmission Path : Differential impedance template**



**Recommended Transmission Path : Attenuation Characteristics**

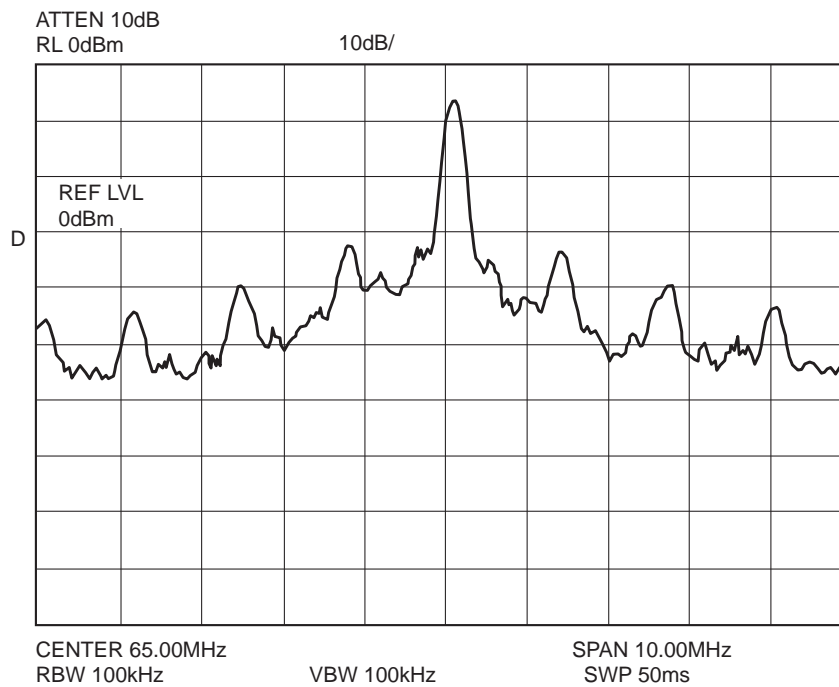


1.95Gbps SDATAP output waveform



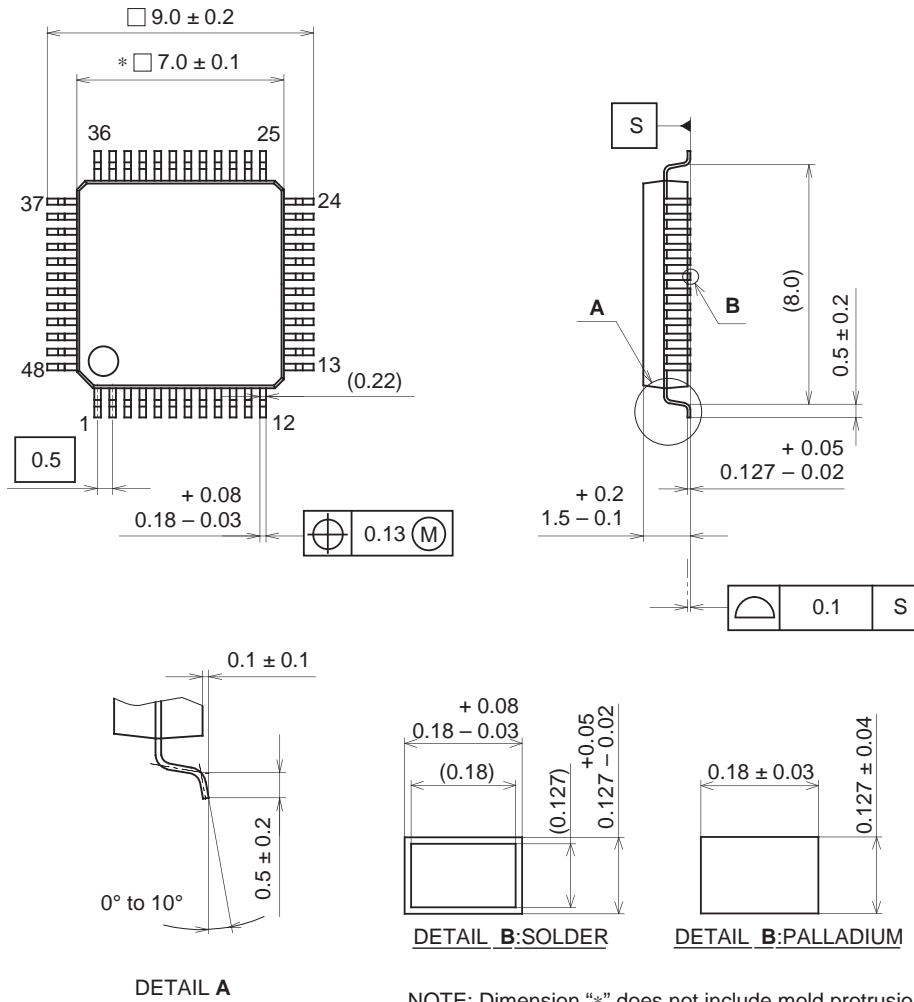
100mV/div  
100ps/div

SFCLK jitter tolerance: Example of power spectrum which can be used for transmission



Package Outline Unit: mm

48PIN LQFP (PLASTIC)



NOTE: Dimension "\*" does not include mold protrusion.

PACKAGE STRUCTURE

SONY CODE	LQFP-48P-L01
EIAJ CODE	LQFP048-P-0707
JEDEC CODE	_____

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER/PALLADIUM PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	0.2g

NOTE : PALLADIUM PLATING

This product uses S-PdPPF (Sony Spec.-Palladium Pre-Plated Lead Frame).