SONY

PDIC for Blu-ray Disc Player

CXA2958EN

Description

The CXA2958EN is a PDIC (photodetector IC) developed as a photodetector for optical pickups of Blu-ray disc players. This IC has the photodetector area separately for BD/DVD and CD. Therefore, the optical pickup can be configured with the minimum number of parts using the two-wavelength one package laser diode.

(Applications: Optical pickups for Blu-ray disc players)

Features

- CD/DVD/BD three wavelengths supported (Blue laser + CD/DVD two-wavelength laser configuration)
- Gain switching function (0 dB, 9 dB and 15 dB)
- High sensitivity photodiode (0.285 A/W @ 405 nm)
- Low noise amplifier
- Reflow mounting possible

Package

Open photodetector type resin molded ultra-small package (18 pin)

Structure

CMOS silicon monolithic IC

E12511

Absolute Maximum Ratings

(Ta = 25 ℃)

・ Supply voltage	V_{CC}	5.7	V
・ Operating temperature	Topr	-10 to +80	℃
・ Storage temperature	Tstg	-40 to +125	℃
・ Allowable power dissipation	P_D	400	mW

Operating Conditions

・ Supply voltage 1	V_{CC}	4.5 to 5.5	V
・ Supply voltage 2	Vc	1.65 to 2.5	V
・ SW select voltage range (Low)	Vsw	0 to 0.4	V
・ SW select voltage range (Middle)	Vsw	1.3 to 2.0	V
・ SW select voltage range (High)	Vsw	2.5 to V_{CC}	V

Output Sensitivity Table

Gain	Gain ratio [dB]	Output sensitivity [mV/μW]								
		Main			Sub			RF±		
		Blue	DVD	CD	Blue	DVD	CD	Blue	DVD	CD
High gain	15	69.9	91.7	129.9	394.8	518.3	733.9	35.0	45.9	65.0
Middle gain	9	35.0	45.9	45.6	197.9	259.5	257.6	17.5	23.0	22.8
Low gain	0	12.3	16.1	—	69.4	91.2	—	6.15	8.07	—
Sleep	—	Hi-Z			Hi-Z			Hi-Z		

The sensitivity table is specified according to the measurement conditions of electrical and optical characteristics.

Note) The output sensitivity ratio is as shown right. 405 nm : 650 nm : 780 nm = 1 : 1.312 : 1.302

Mode Setting

SW1	SW2	Mode	Gain
H	H	Blue mode	High gain
	M		Middle gain
	L		Low gain
M	H	DVD mode	High gain
	M		Middle gain
	L		Low gain
L	H	CD mode	High gain
	M		Middle gain
	L	Sleep	Hi-Z

SW3	Sub PD mode
H	Blue/DVD-differential astigmatism
L	Blue/DVD-DPP

Note) SW1 to SW3 internal pull-down resistor: 50 kΩ

SW1: Mode switching

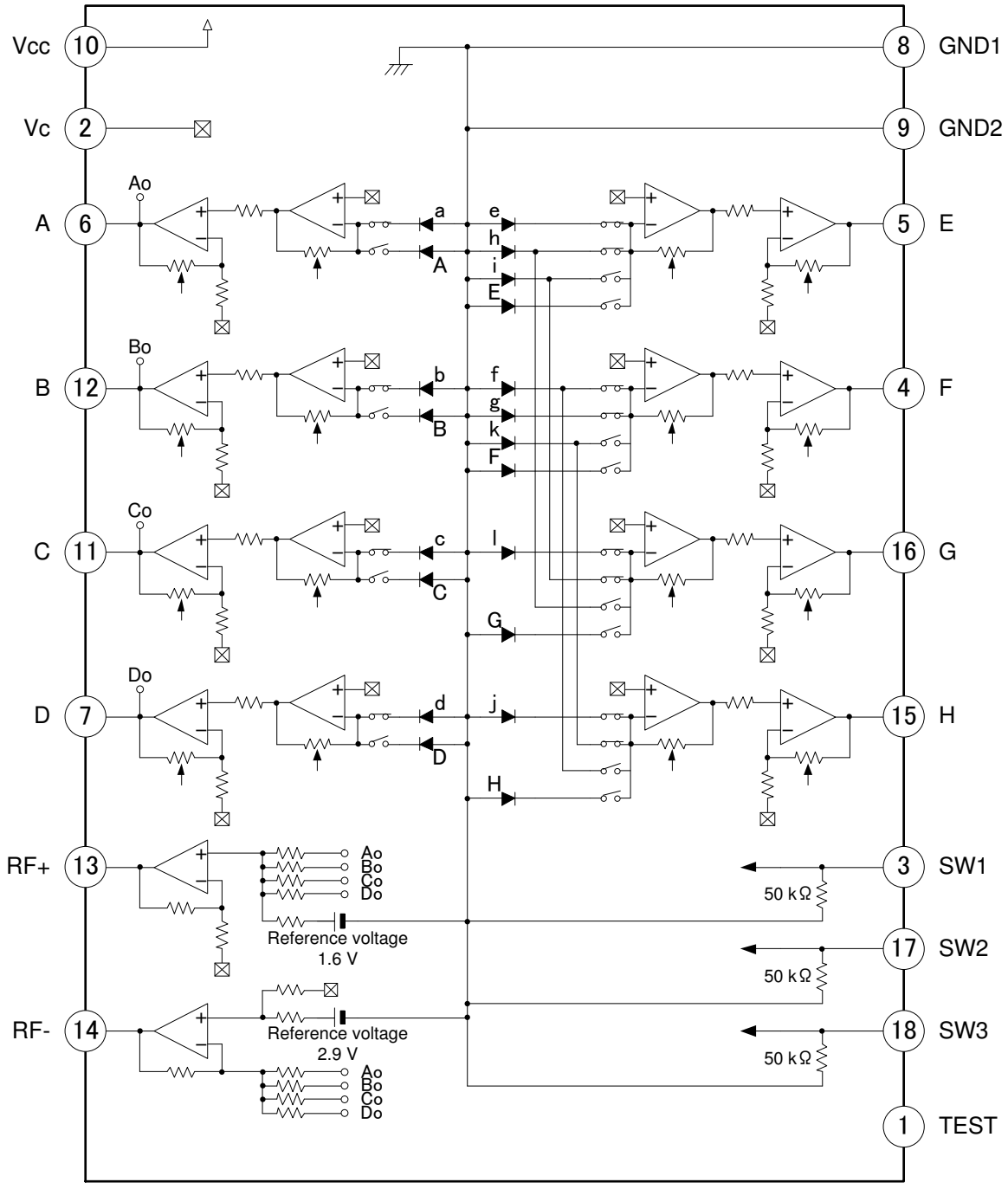
SW2: Gain switching

SW3: Sub PD switching

Photodetector Switching

Pin name	Connected PD		
	Blue/DVD-DPP mode	Blue/DVD-differential astigmatism mode	CD mode
A	a		A
B	b		B
C	c		C
D	d		D
E	e + h	e + i	E
F	f + g	g + k	F
G	i + l	h + l	G
H	j + k	f + j	H
RF+	+ 0.5 × (a + b + c + d)		+ 0.5 × (A + B + C + D)
RF-	- 0.5 × (a + b + c + d)		- 0.5 × (A + B + C + D)

Block Diagram



Each output pin is Hi-Z in sleep mode.

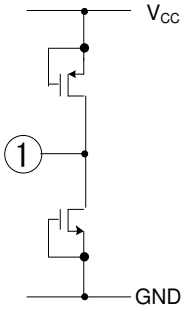
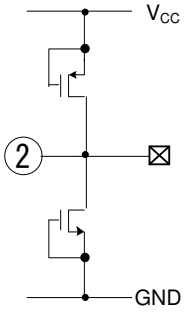
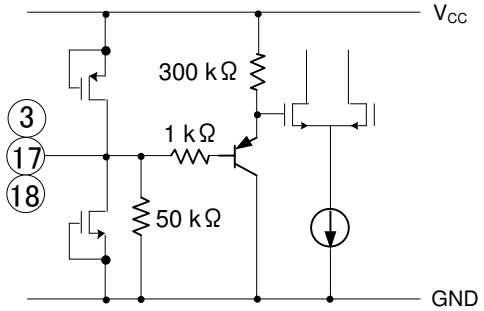
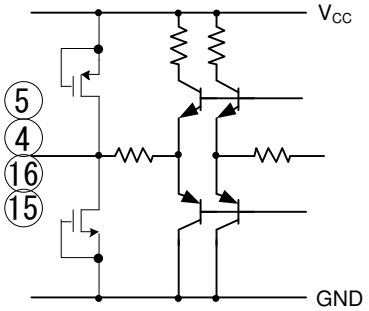
TEST (Pin 1): Sony test pin (Use it with left open or grounded.)

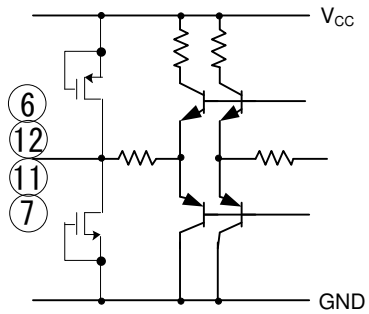
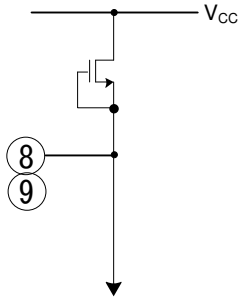
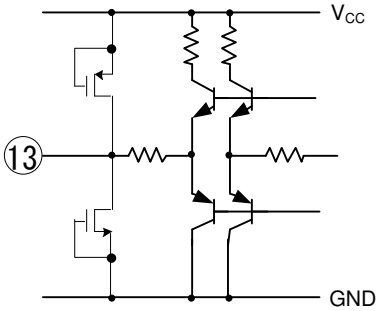
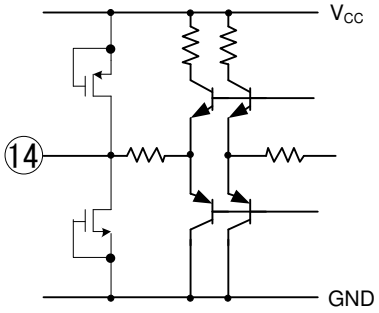
Note) Short-circuit GND1 and GND2 on the flexible printed circuit board.

Arithmetic formulas

RF+ = (A + B + C + D)/2
RF- = -(A + B + C + D)/2

Pin Description

Pin No.	Symbol	I/O	Equivalent circuit	Description
1	TEST	I		Sony test pin. (Leave open or connect to GND.)
2	V_C	I		Reference voltage input.
3 17 18	SW1 SW2 SW3	I		Mode switching input. 0 V to 0.4 V : Low 1.3 V to 2.0 V : Middle 2.5 V to V_{CC} : High
5 4 16 15	E F G H	O		Output of voltage signals converted from optical signals.

Pin No.	Symbol	I/O	Equivalent circuit	Description
6 12 11 7	A B C D	O		Output of voltage signals converted from optical signals.
8 9	GND1 GND2	I		Ground.
10	V_{CC}	I	—	Positive power supply.
13	RF+	O		Non-inverted output of added A to D signals.
14	RF–	O		Inverted output of added A to D signals.

Electrical and Optical Characteristics

(Vcc = 5.0 V, Vc = 2.2 V, Ta = 25 ˚C)

1. Current Consumption

Item	Symbol	Conditions	Output	Gain	Min.	Typ.	Max.	Unit
Current consumption	Icc	In the dark	—	—	—	28	35	mA
Current consumption Sleep	Iccs				—	0.32	0.56	
Current consumption Vc	Ivc1				—	0.1	—	
Current consumption Vc	Ivc2	For output voltage of 1 V			—	-1.4	—	

2. Output Offset Voltage

Item	Symbol	Conditions	Output	Gain	Min.	Typ.	Max.	Unit
Output offset voltage	Voff	In the dark, Vc reference	A to D	High	- 35	—	35	mV
				Middle	- 35	—	35	
				Low	- 35	—	35	
			E to H	High	- 45	—	45	
				Middle	- 40	—	40	
				Low	- 40	—	40	
RFP reference voltage	VRFP	In the dark, GND reference	RF+	High	1.45	1.6	1.75	V
				Middle				
				Low				
RFN reference voltage	VRFN	In the dark, GND reference	RF-	High	2.65	2.9	3.15	V
				Middle				
				Low				
Output offset voltage difference	ΔVoff	In the dark, Vc reference	(A + D) - (B + C)	High	- 70	—	70	mV
				Middle	- 70	—	70	
				Low	- 70	—	70	
			(A + C) - (B + D)	High	-70	—	70	
				Middle	- 70	—	70	
				Low	- 70	—	70	
			A + B +C + D	High	- 100	—	100	
				Middle	- 100	—	100	
				Low	- 100	—	100	
			(E + H) - (F + G)	High	- 90	—	90	
				Middle	- 80	—	80	
				Low	- 80	—	80	
			(E + G) - (F + H)	High	- 90	—	90	
				Middle	- 80	—	80	
				Low	- 80	—	80	
			E + F +G + H	High	- 90	—	90	
				Middle	- 80	—	80	
				Low	- 80	—	80	

3. Output Offset Temperature Drift

Item	Symbol	Conditions	Output	Gain	Min.	Typ.	Max.	Unit
Output offset temperature drift*	ΔVoff/T	In the dark Vc reference 0 °C to 80 °C	A to D	High	-100	—	100	μV/°C
				Middle				
				Low				
			E to H	High	-200	—	200	
				Middle				
				Low				
			RF+ RF-	High	-1.5	—	1.5	mV/°C
				Middle				
				Low				

4. Output Sensitivity

Item	Symbol	Conditions	Po	Output	Gain	Min.	Typ.	Max.	Unit
Output sensitivity*	DCS	λ = 405 nm	5 μW	A to D	High	52.4	69.9	87.4	mV /μW
			5 μW		Middle	26.3	35.0	43.8	
			15 μW		Low	9.2	12.3	15.4	
			2 μW	E to H	High	296.1	394.8	493.5	
			5 μW		Middle	148.4	197.9	247.4	
			15 μW		Low	52.1	69.4	86.8	
			5 μW	RF+ RF-	High	26.3	35.0	43.8	
			5 μW		Middle	13.1	17.5	21.9	
			15 μW		Low	4.61	6.15	7.69	
		λ = 650 nm	5 μW	A to D	High	68.8	91.7	114.6	
			5 μW		Middle	34.4	45.9	57.4	
			15 μW		Low	12.1	16.1	20.1	
			2 μW	E to H	High	388.7	518.3	647.9	
			5 μW		Middle	194.6	259.5	324.4	
			15 μW		Low	68.4	91.2	114.0	
			5 μW	RF+ RF-	High	34.4	45.9	57.4	
			5 μW		Middle	17.3	23.0	28.8	
			15 μW		Low	6.08	8.10	10.13	
		λ = 780 nm	3 μW	A to D	High	97.4	129.9	162.4	
			5 μW		Middle	34.2	45.6	57.0	
			2 μW	E to H	High	550.4	733.9	917.4	
			5 μW		Middle	193.2	257.6	322.0	
			3 μW	RF+ RF-	High	48.8	65.0	81.3	
			5 μW		Middle	17.1	22.8	28.5	
Output saturation voltage	Vomax	DC		A to D E to H RF+	High Middle Low	3.6	3.8	—	V
	Vomin	DC		RF-	High Middle Low	—	1.2	1.4	

5. AC Characteristics

Item	Symbol	Conditions	Output	Gain	Min.	Typ.	Max.	Unit
Frequency response*	fc	λ = 405 nm, 650 nm 100 kHz ref. -3 dB BD/DVD mode	A to D	High	90	120	—	MHz
				Middle	132	160	—	
				Low	132	160	—	
			E to H	High	1	4	—	
				Middle	1	4	—	
				Low	1	4	—	
			RF+ RF-	High	90	120	—	
				Middle	132	160	—	
				Low	132	160	—	
		λ = 780 nm 100 kHz ref. -3 dB CD mode	A to D	High	40	70	—	
				Middle	40	70	—	
			E to H	High	1	4	—	
				Middle	1	4	—	
			RF+ RF-	High	40	70	—	
				Middle	40	70	—	
Group delay difference*	ΔGd	λ = 405 nm, 650 nm 1 MHz to 66 MHz BD/DVD mode	A to D	High	—	0.5	1.5	ns
			(RF+) - (RF-)		—	0.5	1.5	
		λ = 405 nm, 650 nm 1 MHz to 99 MHz BD/DVD mode	A to D	Middle	—	0.5	1.5	
			(RF+) - (RF-)		—	0.5	1.5	
			A to D	Low	—	0.5	1.5	
			(RF+) - (RF-)		—	0.5	1.5	
		λ = 780 nm 1 MHz to 30 MHz CD mode	A to D	High	—	0.5	1.5	
			(RF+) - (RF-)		—	0.5	1.5	
			A to D	Middle	—	0.5	1.5	
			(RF+) - (RF-)		—	0.5	1.5	

6. Output Noise Level

Item	Symbol	Conditions	Output	Gain	Min.	Typ.	Max.	Unit
Output noise level*	Vn	1 MHz to 66 MHz, RBW = 30 kHz, in the dark BD/DVD mode	A to D	High	—	-74	-69	dBm
			RF+, RF-		—	-73	-68	
		1 MHz to 99 MHz, RBW = 30 kHz, in the dark BD/DVD mode	A to D	Middle	—	-76.5	-73	
			RF+, RF-		—	-75.5	-72	
			A to D	Low	—	-85.5	-82	
			RF+, RF-		—	-84	-81	
		1 MHz to 30 MHz, RBW = 30 kHz, in the dark CD mode	A to D	High	—	-73	-68	
			RF+, RF-		—	-72	-67	
			A to D	Middle	—	-80	-75	
			RF+, RF-		—	-79	-74	

7. Supply Voltage Rejection Ratio

Item	Symbol	Conditions	Output	Gain	Min.	Typ.	Max.	Unit
Supply voltage rejection ratio*	PSRR	In the dark, Ripple voltage 100 mV 10 kHz to 200 kHz	(RF+) - (RF-)	High	—	30	—	dB

8. Output Impedance

Item	Symbol	Conditions	Output	Gain	Min.	Typ.	Max.	Unit
Output impedance*	Zo	In the dark	A to D	High Middle Low	—	55	—	Ω
			E to H		—	200	—	
			RF+ RF-		—	55	—	

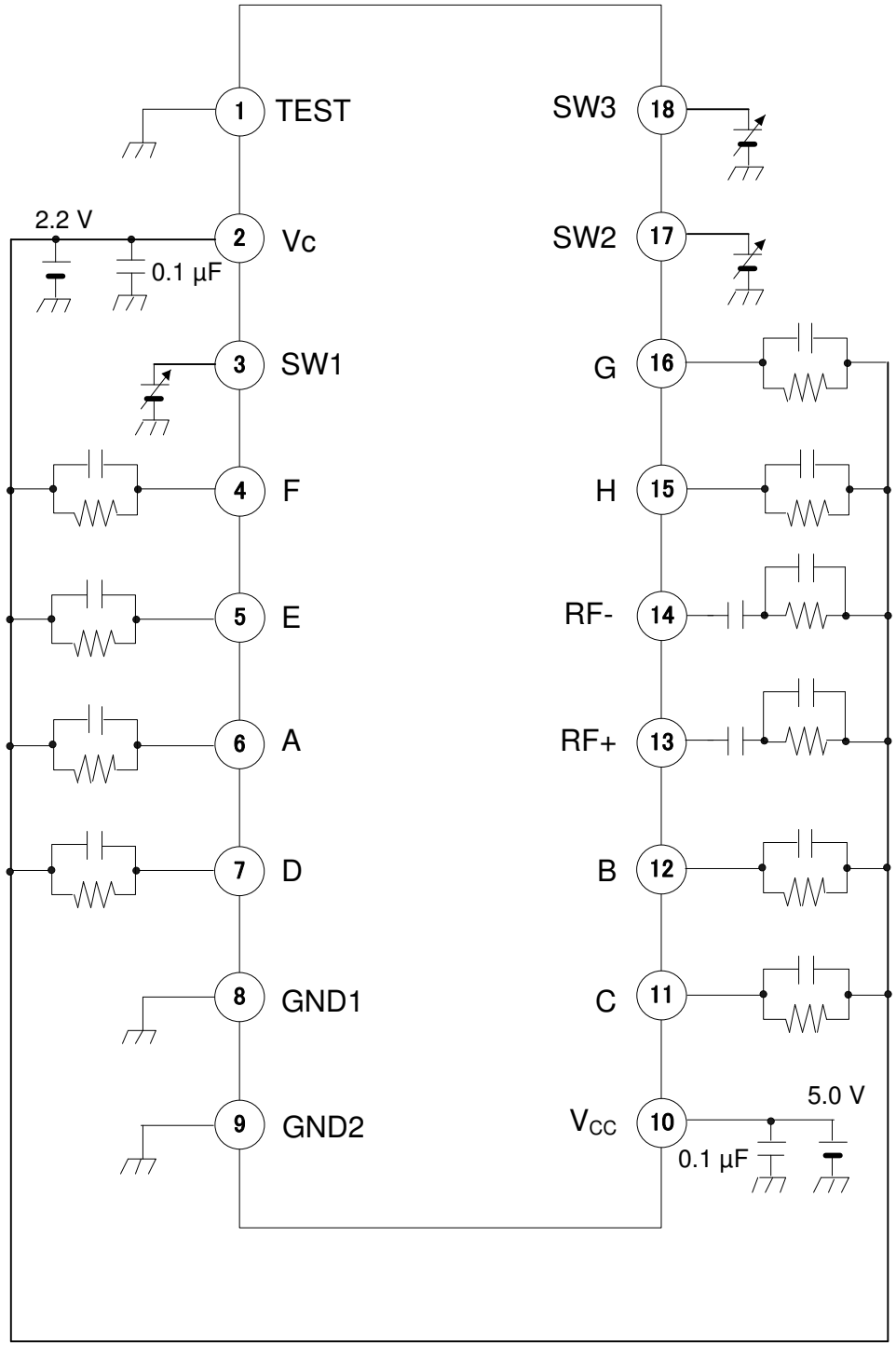
Notes on Measurement (for all modes)

1. Vc is the reference for output offset voltage of A to D and E to H.
2. Output voltage: Vc is the reference for A to D and E to H. 1.6 V is the reference for RF+. 2.9 V is the reference for RF–. Then, the offset voltage is excluded.
3. GND is the reference for the maximum output potential and minimum output potential.
4. Items with an asterisk (*) are design guaranteed items.
5. Measurement by optical input: Measurement is made by emitting light to the center of each photodiode.
6. Load conditions (for Vc) are as follows.): A to D: 2.5 kΩ//5 pF,

   E to H: 10 kΩ//5 pF,

   RF±: 0.1 µF + (2.5 kΩ//5 pF)

Measurement Circuit



The load conditions (for Vc)

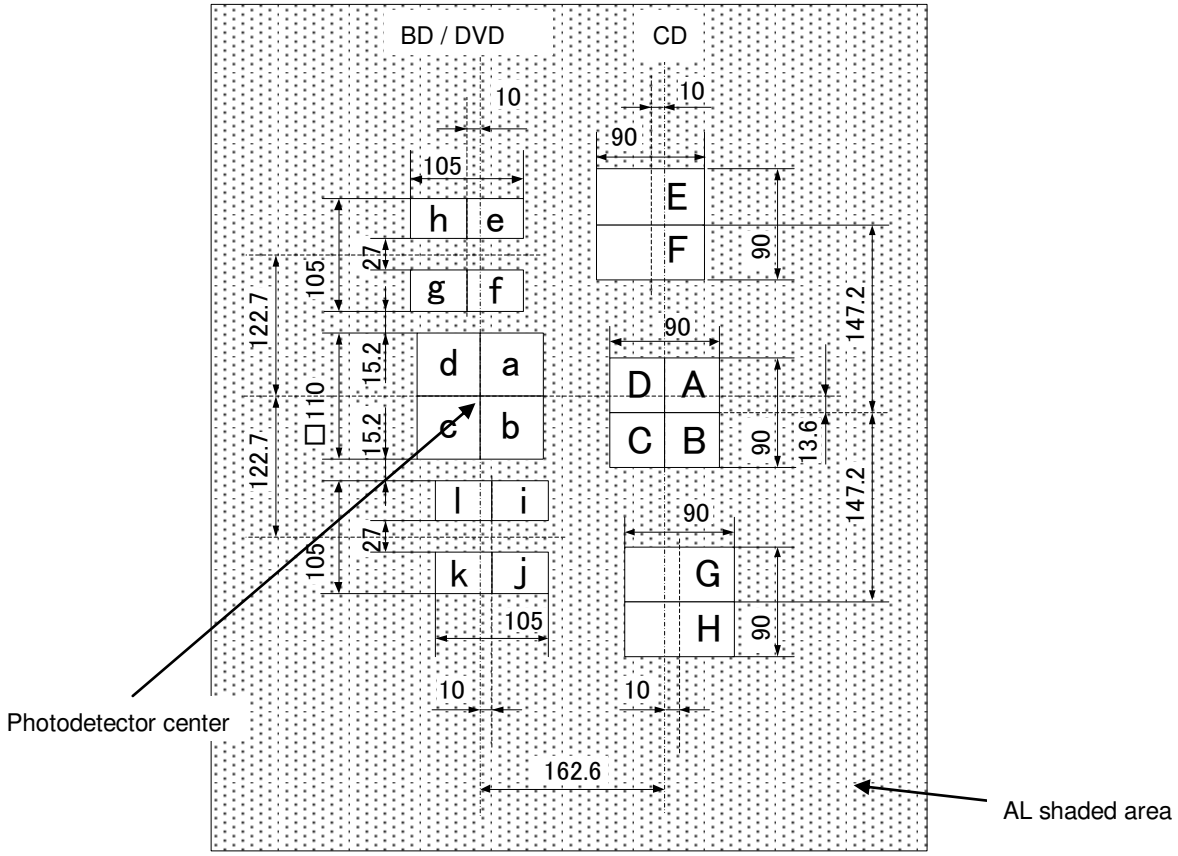
: A to D : 2.5 kΩ//5 pF, E to H : 10 kΩ//5 pF

RF± : 0.1 µF + (2.5 kΩ//5 pF)

Photodetector Dimensions

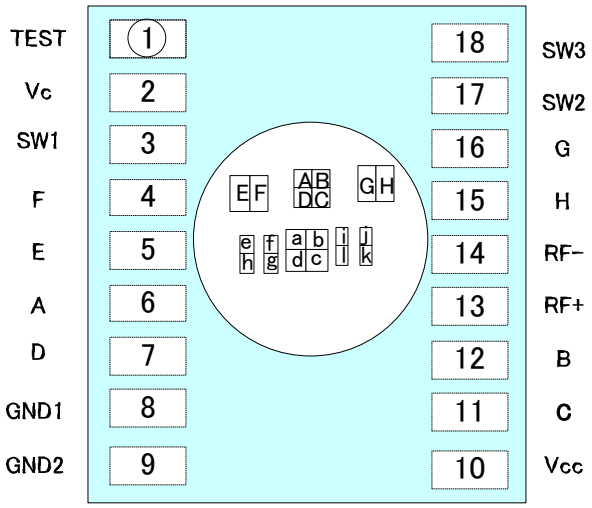
Unit (µm)

Top View



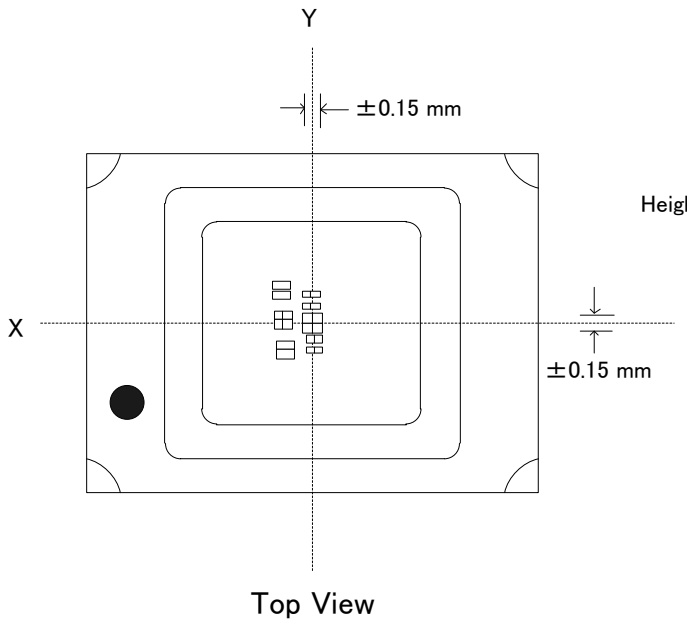
Pin Configuration

Top View (Viewed from the photodetector side)

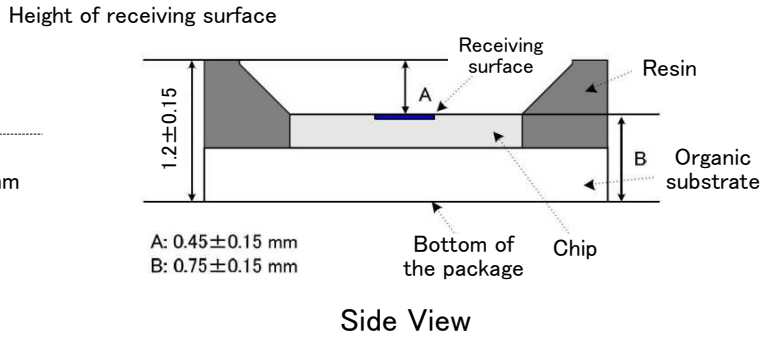


TEST: Sony test pin (Leave open or connect to GND.)

Photodetector Position



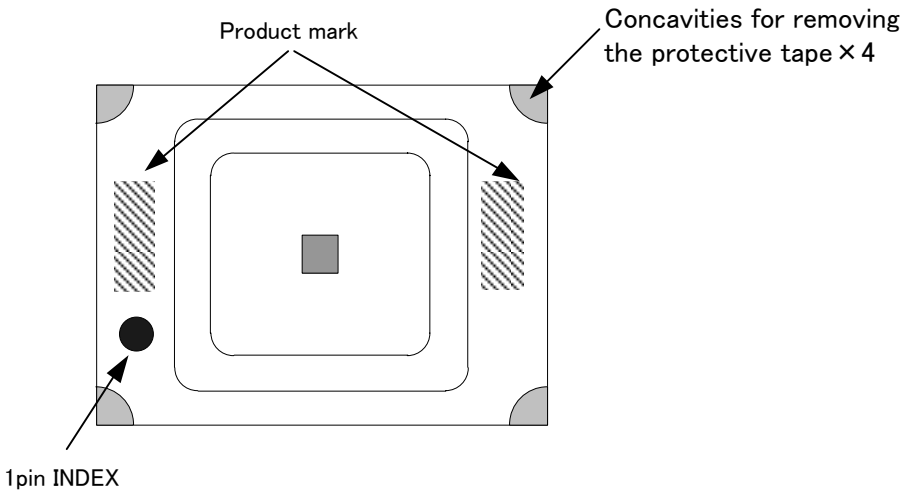
Top View



Side View

Position accuracy: X, Y ±0.15 mm
θ ±2°

PKG Top View

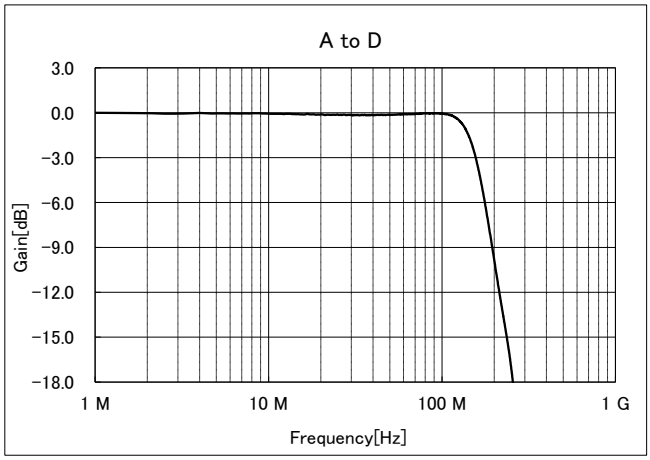


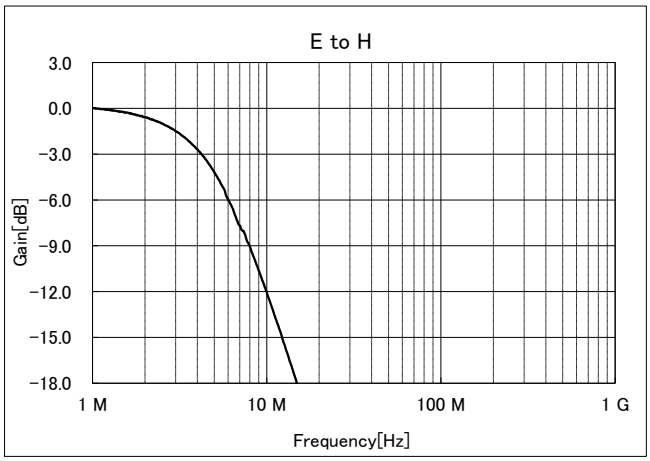
Example of Representative Characteristics

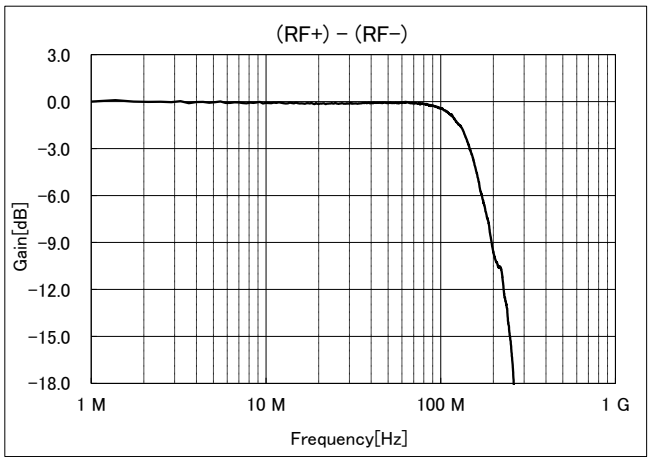
Frequency response

(X: 1 MHz to 1 GHz log, Y: 3 dB/div)

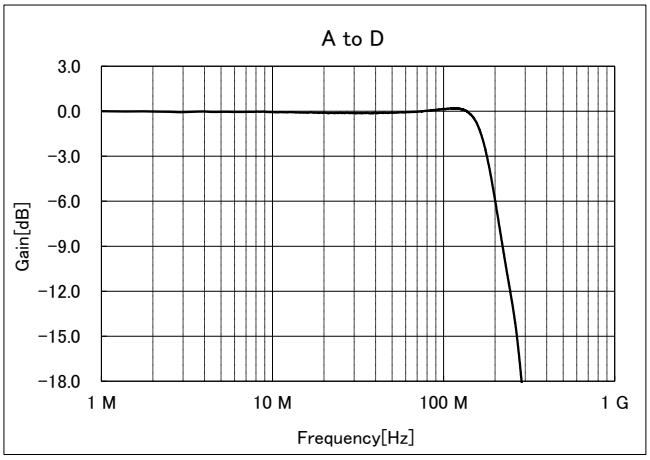
・BD High Gain Mode

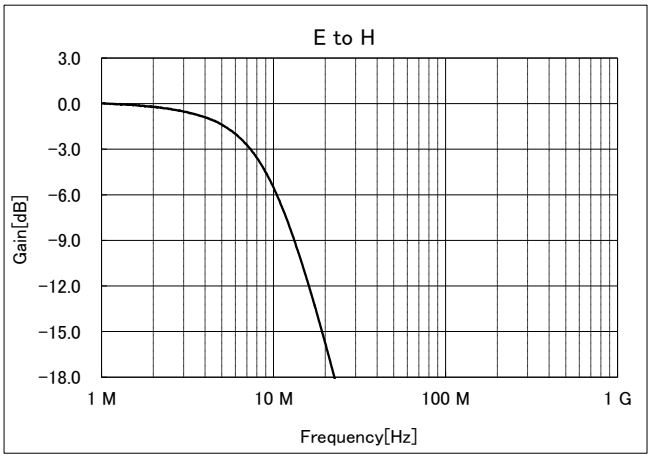


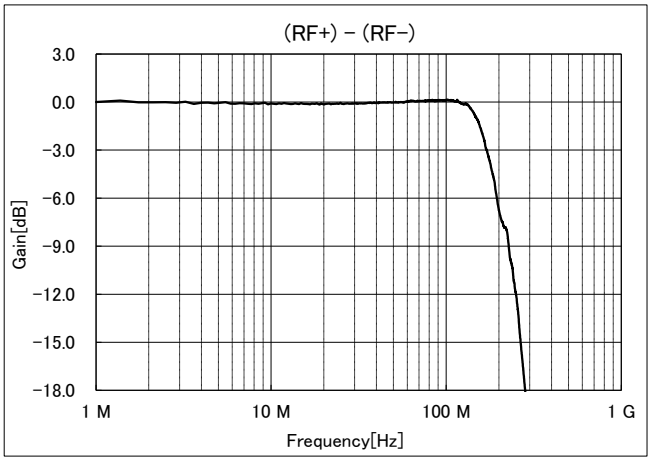




・BD Middle Gain Mode



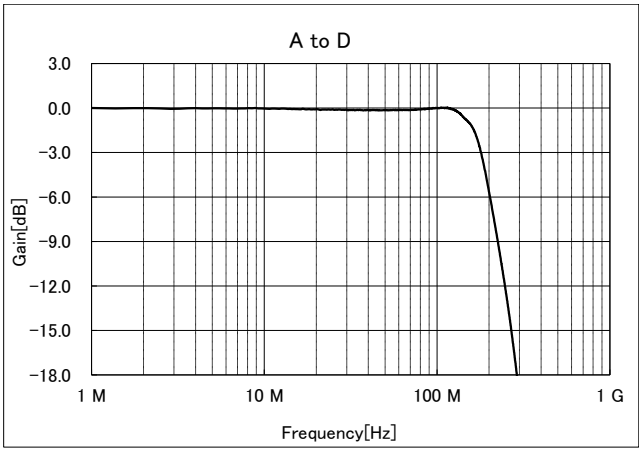


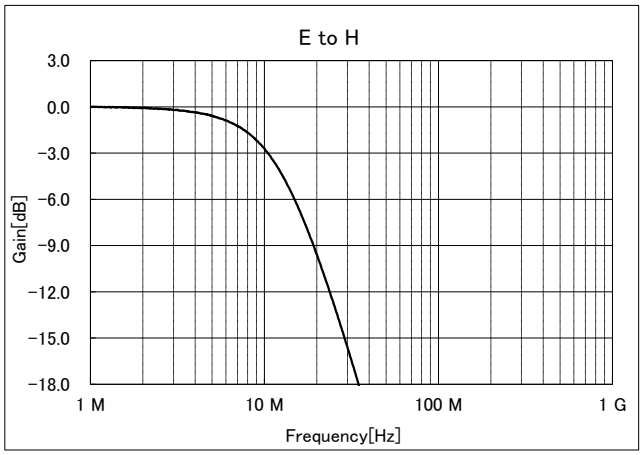


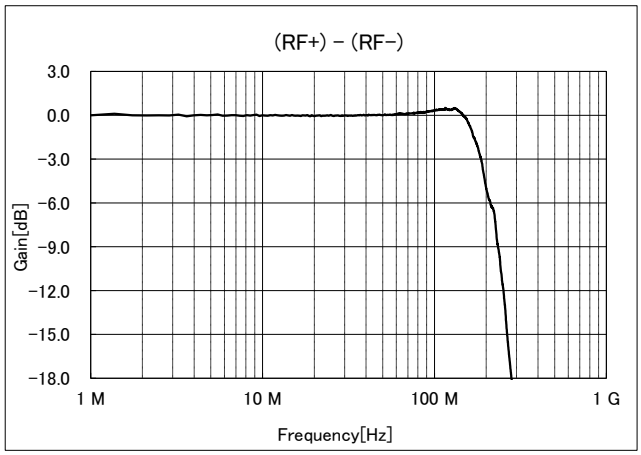
Frequency response

(X: 1 MHz to 1 GHz log, Y: 3 dB/div)

・BD Low Gain Mode



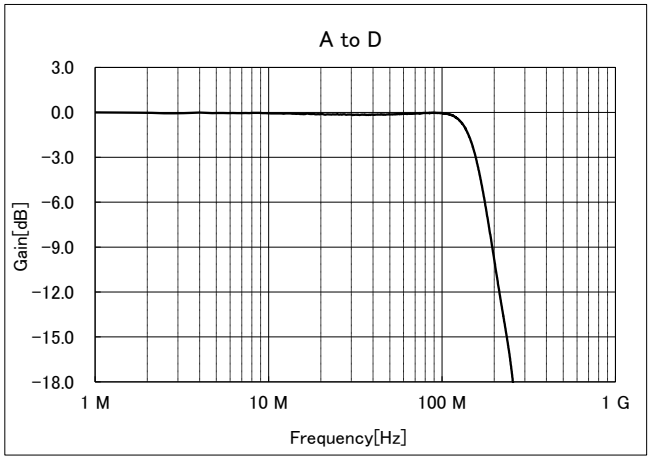


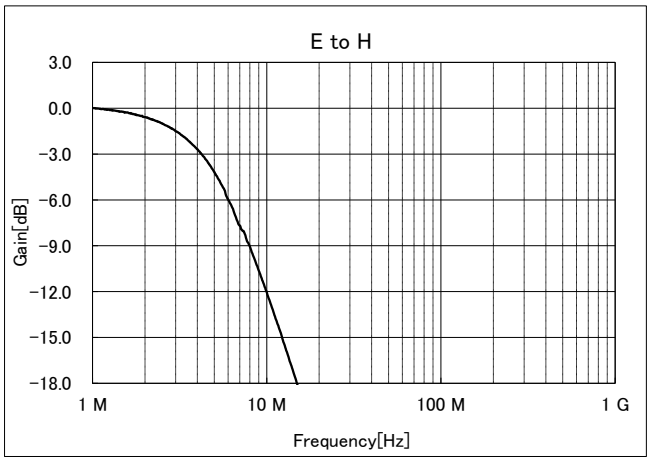


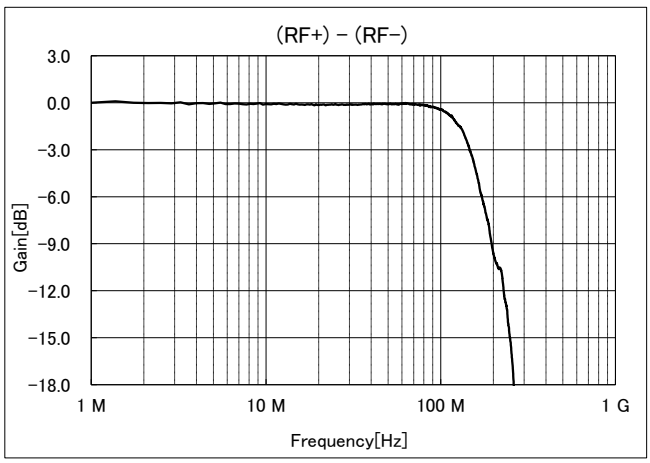
Frequency response

(X: 1 MHz to 1 GHz log, Y: 3 dB/div)

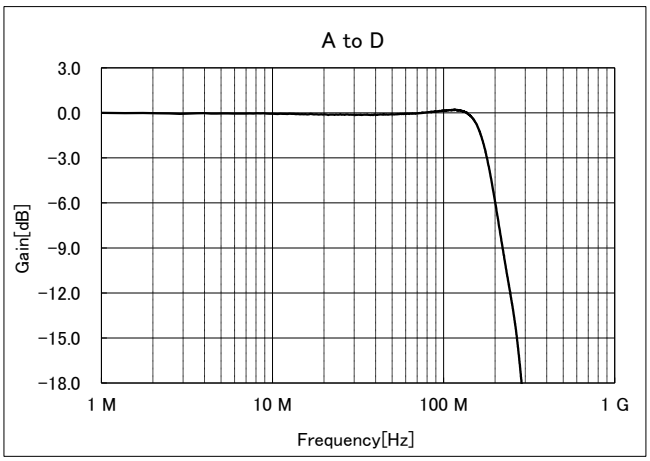
・DVD High Gain Mode

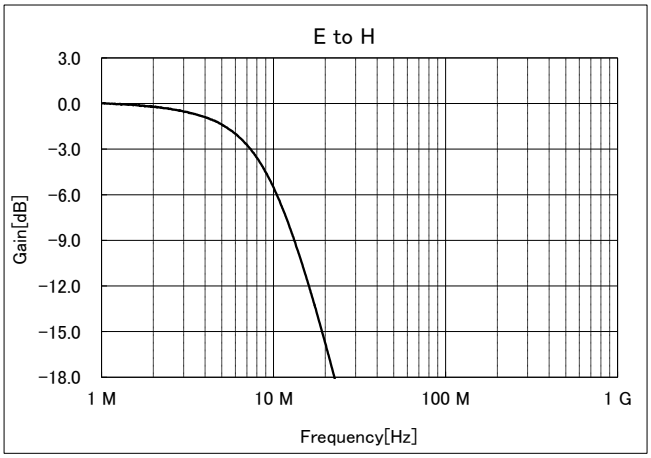


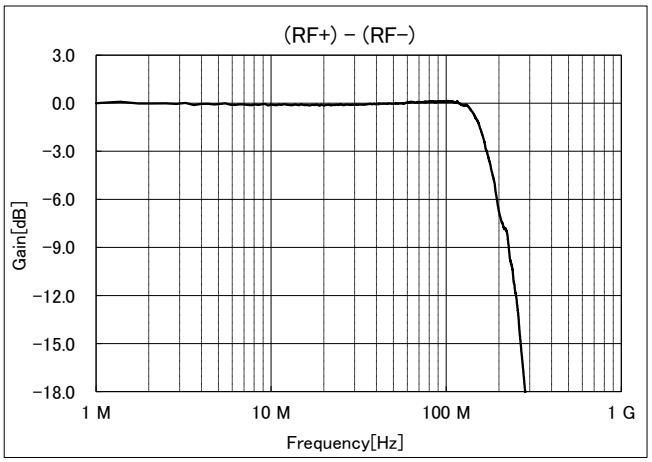




・DVD Middle Gain Mode



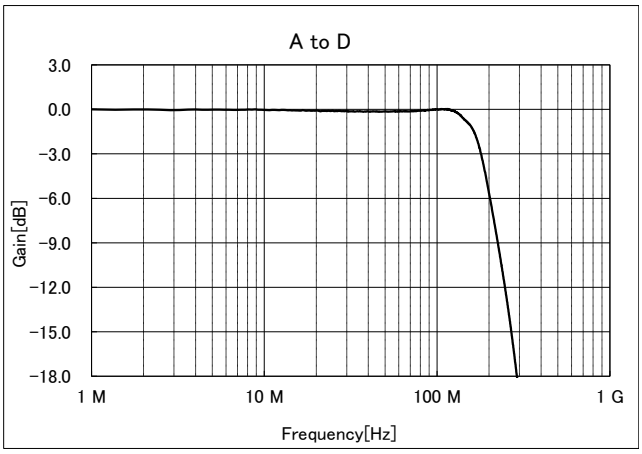


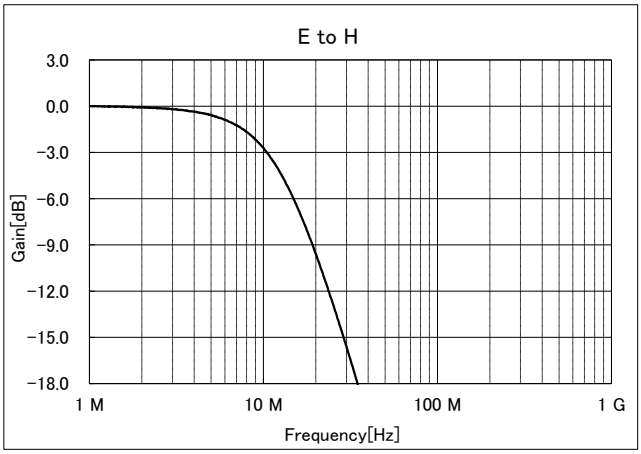


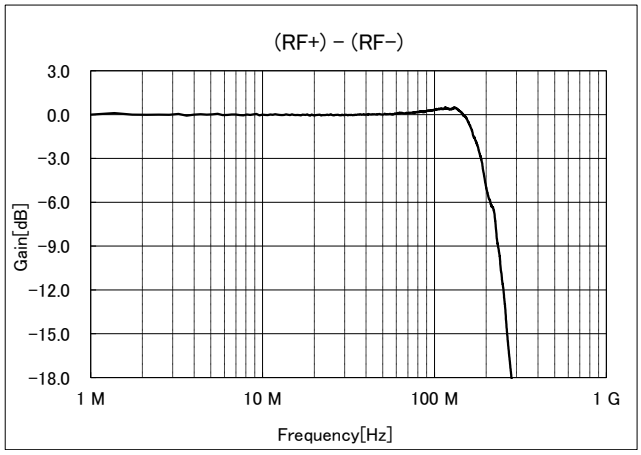
Frequency response

(X: 1 MHz to 1 GHz log, Y: 3 dB/div)

・DVD Low Gain Mode



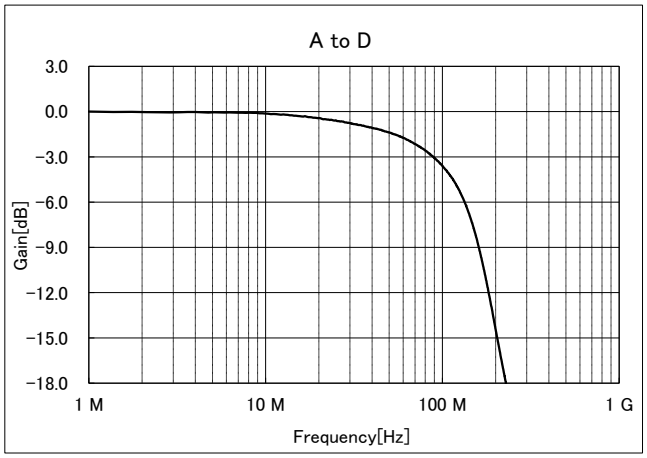


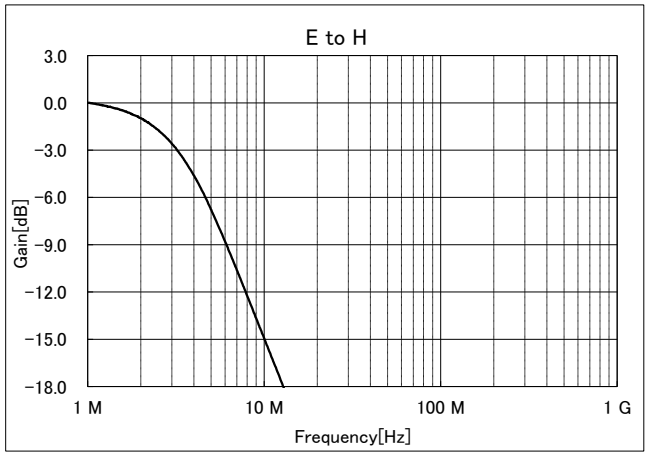


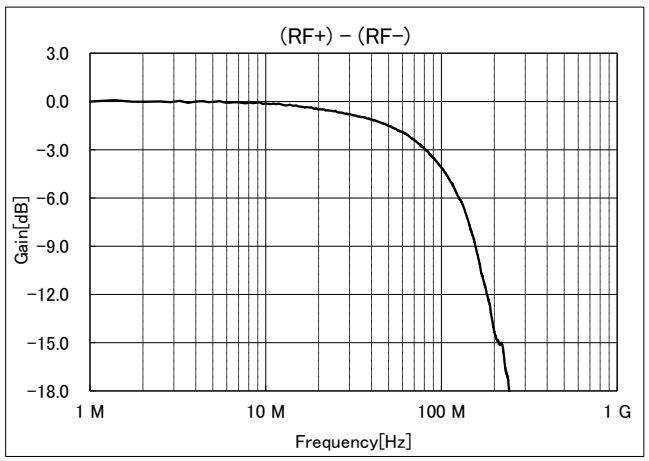
Frequency response

(X: 1 MHz to 1 GHz log, Y: 3 dB/div)

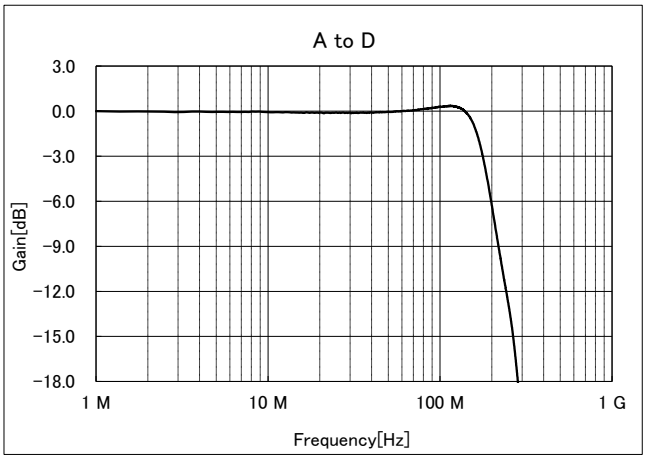
・CD High Gain Mode

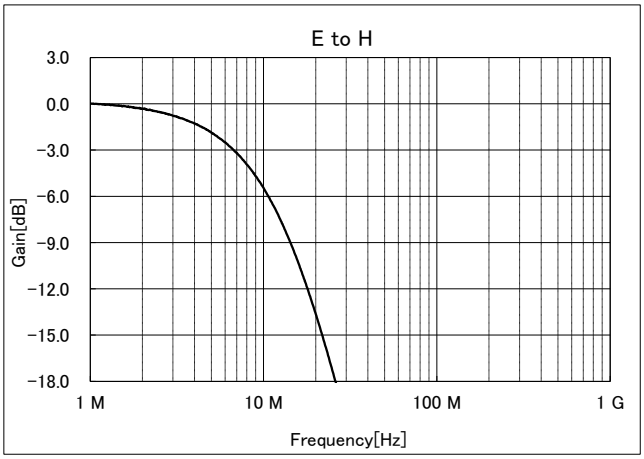


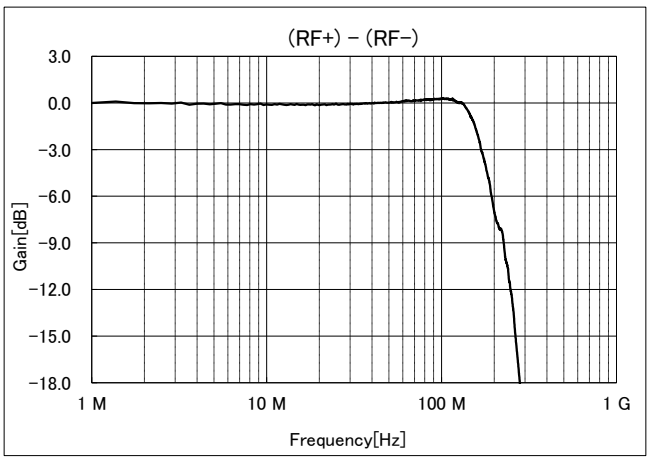




・CD Middle Gain Mode







Notes on Handling

1. Mechanical strength of package

The mechanical strength of the package is not guaranteed for the CXA2958EN.
Do not employ a mounting method which applies a heavy load to the package such as supporting a board with the package.

2. Visual inspection standards

The visual inspection standards over the photodetector are as follows.
(1) Foreign object limit : Equivalent area 10 µmϕ or less
(2) Inspection method : Focus on the photodetector and measure the size of the foreign object.
(3) Inspection range : Entire photodetector area (on page 12)

3. Bypass capacitors

Connect 0.1 µF capacitors between the Vcc and GND pins and between the Vc and GND pins to lower the power supply line impedance. Use a flexible printed circuit (FPC) pattern or take other measures so that the bypass capacitors can be located near (3 mm or less) the PDIC.

4. Soldering

It has been confirmed that the following conditions are satisfied for the reflow soldering.
R390 and IPC/JEDEC J-STD-020D MSL 3
Floor Life 30 ˚C 60 % RH 168 hours

<Reflow soldering recommended conditions in actual use>

(1) Perform infrared or hot air reflow, or use an oven that combines these methods.
(2) Perform reflow soldering a maximum of three times.
(3) Finish reflow soldering within the conditions of 30 ˚C and 60 % RH in 168 hours after unsealing the moisture-proof packing.
(4) Mount this IC at the reflow peak temperature of 255 ˚C or less according to the reflow profile of IPC/JEDEC J-STD-020D.
(5) Unless reflow soldering can be performed within the specifications above, bake the IC before reflow soldering.

[Baking conditions]

- 125 ˚C, 10 to 48 h
- Transfer to a heat proof tray or a heat proof vessel for baking.
- Perform baking only one time.

(6) Finish reflow soldering within the specifications above after baking.

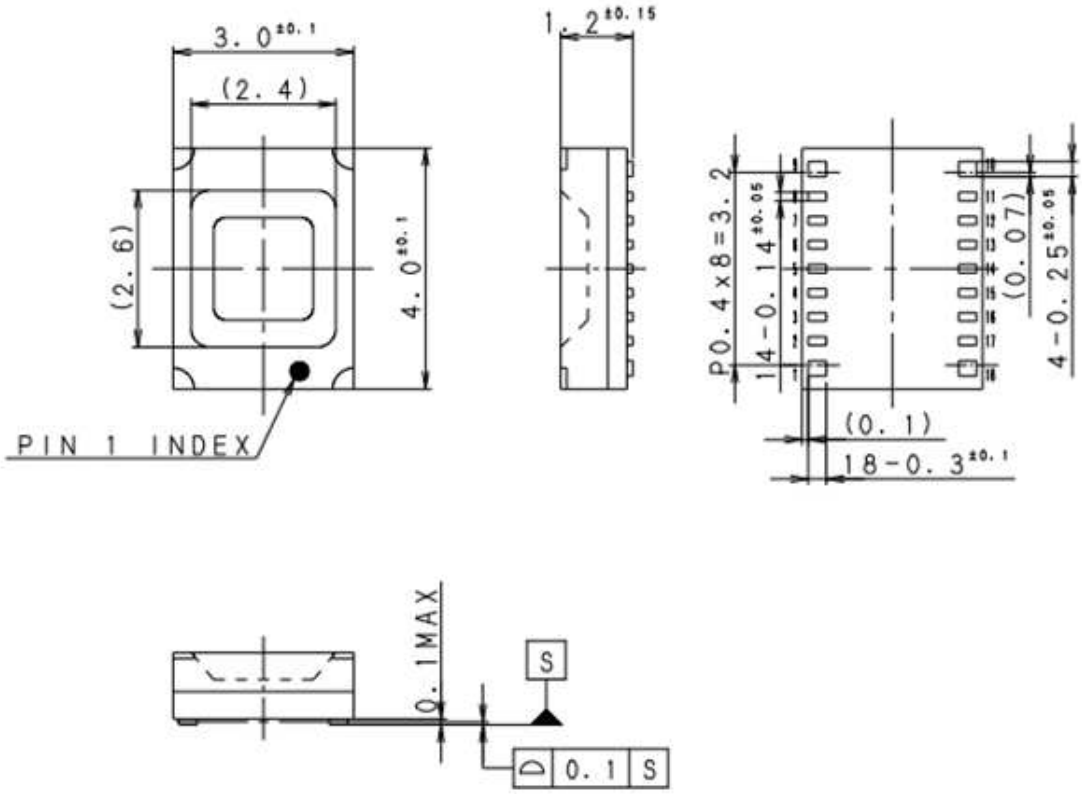
5. Others

(1) If outgas is emitted from the materials used such as an uncured portion of the adhesive, foreign objects may deposit on the photodetector by laser irradiation. Cure the adhesive thoroughly and check it thoroughly by laser aging, etc.
(2) This package has a bare-chip structure. Avoid using materials that emit strong corrosive outgas.

Package Outline

(Unit: mm)

18PIN VSON



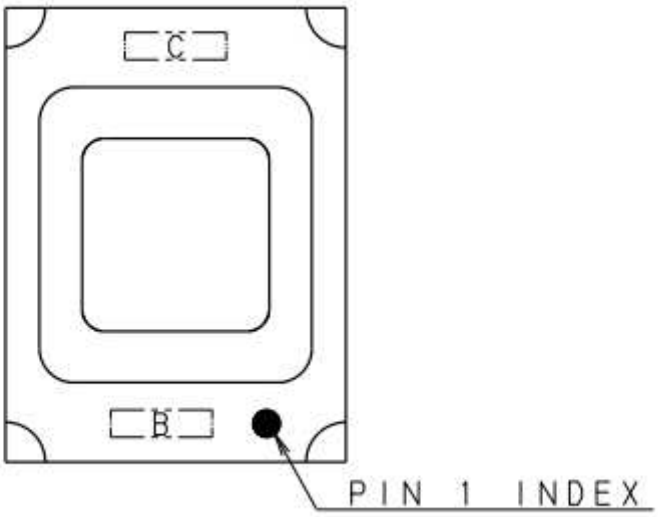
SONY CODE	VSON-18P-391
JEITA CODE	P-VSON18-3X4-0.4
JEDEC CODE	————

PACKAGE STRUCTURE

PACKAGE MATERIAL	ORGANIC SUBSTRATE
LEAD TREATMENT	NICKEL & GOLD PLATING
LEAD MATERIAL	COPPER
PACKAGE MASS	0.03g

PART No. AP-2000-18SNAN1	Rev. 2
ISSUED 11.11.17	REVISED 12.02.08
PRODUCTION LINE	COMPILING DIV. SONY SEMICONDUCTOR.
REMARKS PKG CODE:EM-18-DAN	

Marking



MARKING C: 2958

注1） C部は製品名（Max4文字）を配置する。
（4文字を超える場合は製品名省略標示規定に従う。）
2） B部はロット番号（Max4文字）を配置する。

< INSTRUCTIONS >
1) TYPE NO. (MAX 4 CHARACTERS) IN SECTION C.
(FOR MORE THAN 4 CHARACTERS FOLLOW RULES FOR ABBREVIATIONS.)
2) LOT NO. (MAX 4 CHARACTERS) IN SECTION B.

Note

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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.