Video Accessory ICs

NTSC / PAL Analog Video Encoders

BH7236AF,BH7240AKV

No.10069EAT06

●Description

BH7236AF and BH7240AKV are NTSC/PAL analog video encoders which convert R, G, and B component signals to 6 types video signal format for NTSC and PAL: Composite video output, luminance output, chrominance output and R, G, and B output. The encoders eliminate the need for complicated register settings and require only few external parts.

●Features

1) BH7236AF –RGB analog input. BH7240AKV: RGB 8bit digital input
2) 6 outputs support (V, Y, C, R, G, B, however BH7236AF also supports sync output)
3) NTSC/PAL support
4) 5.0V single power supply
5) Logic input 3.0V to 5.0V
6) Subcarrier input (corresponded to sine-wave and pulse-wave)
7) Built-in 75Ω driver
8) High-speed DAC (only BH7240AKV)
9) Few external parts
10) LC filter for reducing cross-color (with external parts)
11) Unnecessary Initialization
12) Package (SOP24 :BH7236AF :VQFP48C :BH7240AKV)

●Applications

Video Games, Television Display Terminals, etc.

●Line up matrix

Parameter	BH7236AF	BH7240AKV
Input format	R,G,B analog	R,G,B digital (Parallel 8bit × 3)
Output format	7output VOUT : composite video output YOUT : luminance signal output COUT : color signal output ROUT : Red signal output GOUT : Green signal output BOUT : Blue signal output SYNCOUT: composite sync output	6 output VOUT :composite video output YOUT :luminance signal output COUT :color signal output ROUT :Red signal output GOUT :Green signal output BOUT :Blue signal output
Input DAC(only BH7240AKV)	-	Built-in(8bit × 3)
Package	SOP24	VQFP48C

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●Absolute maximum ratings

Parameter		Symbol	Ratings		Unit
Supply voltage		VCC	7		V
Power dissipation	BH7236AF	Pd	550	※1	mW
	BH7240AKV		900	※2	
Storage temperature range		Tstg	-55 ～ +125		℃

※1 Reduce by 5.5mW/°C over 25°C (A measured value at mounting on 50×50×1.6mm glass epoxy substrate.)
※2 Reduce by 9.0mW/°C over 25°C (A measured value at mounting on 50×50×1.6mm glass epoxy substrate.)

●Recommended operation ratings

Parameter	Symbol	Ratings		Unit
Supply voltage	VCC	4.5 ～ 5.5		V
Operation temperature range	Topr	-20 ～ +70		℃
Input High level (SYNCIN, NT/PAL)	VIH	2.2 ～ 5.0	※1	V
Input Low level(SYNCIN,NT/PAL)	VIL	0.0 ～ 0.8	※1	V
Input level (SCIN)	Vsci	0.4 ～ 5.0		Vpp
[BH7236AF]				
Input level(R,G,B)	Vrgbi	0 ～ 1.0		Vpp
[BH7240AKV]				
Input High level (VCLK,RDATA,GDATA,BDATA)	VIH2	2.2 ～ 5.0	※1	V
Input Low level (VCLK,RDATA,GDATA,BDATA)	VIL2	0 ～ 0.8	※1	V

※1 BH7236AF: VCC1=VCC2=5.0V BH7240AKV: DVDD=AVCC1=AVCC2=5.0V

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●Electrical characteristics

◎BH7236AF(Ta=25℃, VCC1=VCC2=5.0V unless otherwise noted.)

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
Consumption current	Icc	-	42	55	mA	RIN=GIN=BIN=0.0Vpp input
Luminance level (Vout,Yout)						
White level	Vlwhite	0.63	0.70	0.77	Vpp	RIN=GIN=BIN=1.0Vpp input
Red level	Vlred	0.19	0.21	0.23	Vpp	RIN= 1.0Vpp input
Green level	Vlgreen	0.37	0.41	0.45	Vpp	GIN= 1.0Vpp input
Blue level	Vlblue	0.07	0.08	0.09	Vpp	BIN= 1.0Vpp input
Sync level	Vsync	0.27	0.30	0.33	Vpp	
Sync/White level ratio	Rs/w	0.38	0.43	0.48		Rs/w = Vsync/Vlwhite
Chroma level (Vout,Cout)						
Red/Burst level ratio	Vcr/Vbur	2.84	3.16	3.48	-	RIN= 1.0Vpp input ※1
Green/Burst level ratio	Vcg/Vbur	2.65	2.95	3.25	-	GIN= 1.0Vpp input ※1
Blue/Burst level ratio	Vcb/Vbur	2.01	2.24	2.47	-	BIN= 1.0Vpp input ※1
Burst level	Vbur	0.23	0.29	0.35	Vpp	※2
Red phase	θ red	94	104	114	deg	RIN= 1.0Vpp input ※1
Green phase	θ green	231	241	251	deg	GIN= 1.0Vpp input ※1
Blue phase	θ blue	337	347	357	deg	BIN= 1.0Vpp input ※1
PAL burst phase	θ bur+	125	135	145	deg	Color subcarrier ※1 =4.433619MHz (NT/PAL = L)
	θ bur-	215	225	235	deg	
PAL burst level ratio	Rbur	0.9	1.0	1.1	-	Level ratio per line
Carrier leak	Vcl	-	-	35	mVpp	※2
RGB level (Rout,Gout,Bout)						
Red level	Vro	0.63	0.70	0.77	Vpp	RIN= 1.0Vpp input
Green level	Vgo	0.63	0.70	0.77	Vpp	GIN= 1.0Vpp input
Blue level	Vbo	0.63	0.70	0.77	Vpp	BIN= 1.0Vpp input
SYNCOUT High level	Vhsync	3.90	-	-	V	
SYNCOUT Low level	Vlsync	-	-	0.80	V	
Output DC voltage						
YOUT	Vyo	1.30	1.70	2.10	V	
COUT	Vco	2.00	2.40	2.80	V	
VOUT	Vvo	1.15	1.55	1.95	V	
ROUT	Vro	1.40	1.80	2.20	V	
GOUT	Vgo	1.40	1.80	2.20	V	
BOUT	Vbo	1.40	1.80	2.20	V	

※1 This specification is design target.

※2 This specification is measured with 3.58MHz BPF.

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◎BH7240AKV(Ta=25℃, DVDD=AVCC1=AVCC2=5.0V unless otherwise noted.)

Parameter	Symbol	Limits			Unit	Condition	
		Min.	Typ.	Max.			
Consumption current	Icc	-	85	105	mA	RGB DATA=00h input	
Luminance level (Vout,Yout)							
White level	Vlwhite	0.59	0.70	0.81	Vpp	RGB DATA=FFh input	
Red level	Vlred	0.18	0.21	0.24	Vpp	R DATA=FFh input	
Green level	Vlgreen	0.35	0.41	0.47	Vpp	G DATA=FFh input	
Blue level	Vlblue	0.07	0.08	0.09	Vpp	B DATA=FFh input	
Sync level	Vsync	0.27	0.30	0.33	Vpp		
Sync/White level ratio	Rs/w	0.37	0.43	0.49			
Chroma level (Vout,Cout)							
Red/Burst level ratio	Vcr/Vbur	2.69	3.16	3.63	-	R DATA=FFh input	※1
Green/Burst level ratio	Vcg/Vbur	2.51	2.95	3.39	-	G DATA=FFh input	※1
Blue/Burst level ratio	Vcb/Vbur	1.91	2.24	2.57	-	B DATA=FFh input	※1
Burst level	Vbur	0.25	0.29	0.33	Vpp		※2
Red phase	θ red	94	104	114	deg	R DATA=FFh input	※1
Green phase	θ green	231	241	251	deg	G DATA=FFh input	※1
Blue phase	θ blue	337	347	357	deg	B DATA=FFh input	※1
RGB level (Rout,Gout,Bout)							
Red level	Vrout	0.56	0.70	0.81	Vpp	R DATA=FFh input	
Green level	Vgout	0.59	0.70	0.81	Vpp	G DATA=FFh input	
Blue level	Vbout	0.59	0.70	0.81	Vpp	B DATA=FFh input	
Others							
RGB DATA conversion frequency	Fda	-	-	20	MHz		
RGB DATA Set-up time	Tset	20	-	-	nsec		
RGB DATA Hold-time	Thold	20	-	-	nsec		
SYNCIN, NT/PAL Input current at High	IH	-	-	300	μA	Terminal is applied to 5V.	
SYNCIN, NT/PAL Input current at Low	IL	-200	-	-	μA	Terminal is applied to 0V.	

※1 This specification is design target.
※2 This specification is measured with 3.58MHz BPF.

Notes:

1) Please use these semiconductor devices within the guaranteed temperature range. ROHM guarantees -20 to 70℃
2) The accuracy of subcarrier signal is important and is specified as 2.8ppm, per the television standard.
   It is recommended to use a crystal oscillator as the subcarrier input. Since the margin of accuracy is not guaranteed for all televisions (can be up to 100ppm).
3) The unused RGB CMOS data input of the BU7240AKV must be terminated to "high" or "low" level.

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●Block diagram, Application circuit, Pin arrangement

(BH7236AF)

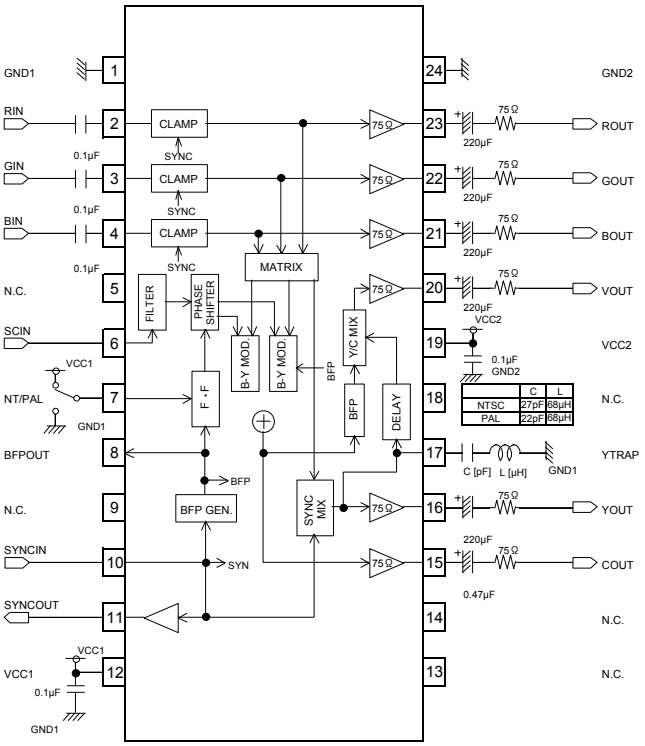

Fig. 1 BH7236AF Block Diagram

Terminal number	Terminal name	Description of terminals
1	GND1	Ground terminal. (For all circuits except 75Ω driver)
2	RIN	Analog Red signal input terminal. This signal should be driven at sufficiently low impedance.
3	GIN	Analog Green signal input terminal. This signal should be driven at sufficiently low impedance.
4	BIN	Analog Blue signal input terminal. This signal should be driven at sufficiently low impedance.
5	N.C.	No Connection. (Not connected internally)
6	SCIN	Color subcarrier input terminal. Input the sine-wave or pulse-wave (duty 50%) according to a required output format (3.579545MHz for NTSC, 4.433619MHz for PAL). Moreover, this input must not exceed more than power supply level and less than ground level.
7	NT/PAL	Input terminal for the selection of TV output format. Connect “high” for NTSC and “low” for PAL. The internal pull-up register 50kΩ is connected NT/PAL to VCC.
8	BFPOUT	Burst timing signal output terminal. The burst timing signal is generated inside the device by inputting a color subcarrier and a composite sync.
9	N.C.	No Connection. (not connected internally)
10	SYNCIN	Composite sync input terminal. Composite sync is output to YOUT and VOUT at the timing when SYNCIN is set to “low”. Moreover, RGB input signals are dc-clamped internally at this timing. The internal pull-up register 100kΩ is connected to VCC.
11	SYNCOUT	Composite sync output terminal.
12	VCC1	Power supply terminal. (for all circuits except 75Ω driver)
13	N.C.	No Connection. (not connected internally)
14	N.C.	No Connection. (not connected internally)
15	COUT	Chroma signal output terminal. Built-in 75Ω driver.
16	YOUT	Luminance signal output terminal. Built-in 75Ω driver.
17	YTRAP	Luminance trap terminal. The output impedance is about 2kΩ.
18	N.C.	No Connection. (Not connected internally)
19	VCC2	Power supply terminal. (for 75Ω driver)
20	VOUT	Composite video output terminal. Built-in 75Ω driver.
21	BOUT	Analog B signal output terminal. Built-in 75Ω driver.
22	GOUT	Analog G signal output terminal. Built-in 75Ω driver.
23	ROUT	Analog R signal output terminal. Built-in 75Ω driver.
24	GND2	Ground terminal (for 75Ω driver)

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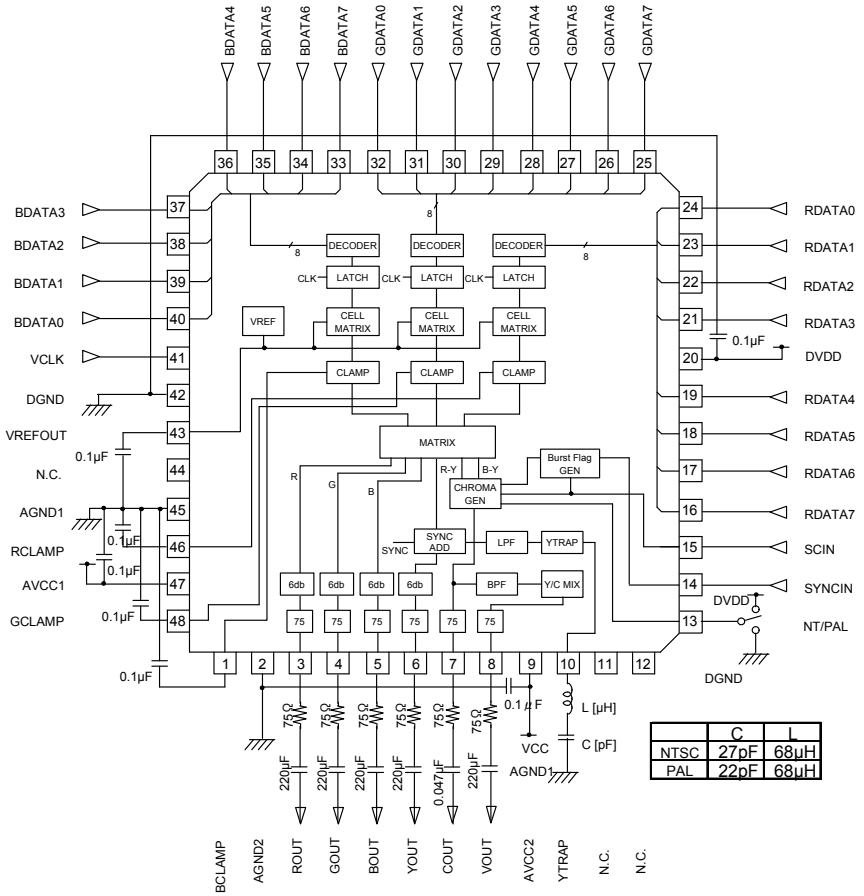
(BH7240AKV)



	C	L
NTSC	27pF	68µH
PAL	22pF	68µH

Fig. 2 BH7240AKV Block Diagram

Terminal number	Terminal name	Description of terminals
1	BCLAMP	Analog Blue signal clamp terminal.
2	AGND2	Ground terminal. (For 75Ω driver)
3	ROUT	Analog Red signal output terminal. Built-in 75Ω driver.
4	GOUT	Analog Green signal output terminal. Built-in 75Ω driver.
5	BOUT	Analog Blue signal output terminal. Built-in 75Ω driver.
6	YOUT	Luminance signal output terminal. Built-in 75Ω driver.
7	COUT	Chrominance signal output terminal. Built-in 75Ω driver.
8	VOUT	Composite video signal output terminal. Built-in 75Ω driver.
9	AVCC2	Power supply terminal. (For 75Ω driver)
10	YTRAP	Luminance trap filter terminal. By connecting it, the chrominance component contained in a luminance signal is eliminated, and cross-color gets reduced. Output impedance is about 2kΩ.It's effective for only the composite video output.
11	N.C.	No Connection. (Not connected internally)
12	N.C.	No Connection. (Not connected internally)
13	NT/PAL	Input terminal for the selection of TV output format. Connect to NT/PAL, "high" for NTSC and "low" for PAL.
14	SYNCIN	Composite sync input terminal. Composite sync is output to YOUT and VOUT at the timing when SYNCIN is set to "low". Moreover, RGB input signals are dc-clamped internally at this timing.
15	SCIN	Color subcarrier input terminal. Input the sine-wave or pulse-wave (duty 50%) according to a required output format (3.579545MHz for NTSC, 4.433619MHz for PAL). Moreover, this input must not exceed more than power supply level and less than ground level.

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Terminal number	Terminal name	Description of terminals
16	RDATA7	Red data input terminal (bit 7)
17	RDATA6	Red data input terminal (bit 6)
18	RDATA5	Red data input terminal (bit 5)
19	RDATA4	Red data input terminal (bit 4)
20	DVDD	The power supply terminal for digital circuits.
21	RDATA3	Red data input terminal (bit 3)
22	RDATA2	Red data input terminal (bit 2)
23	RDATA1	Red data input terminal (bit 1)
24	RDATA0	Red data input terminal (bit 0)
25	GDATA7	Green data input terminal (bit 7)
26	GDATA6	Green data input terminal (bit 6)
27	GDATA5	Green data input terminal (bit 5)
28	GDATA4	Green data input terminal (bit 4)
29	GDATA3	Green data input terminal (bit 3)
30	GDATA2	Green data input terminal (bit 2)
31	GDATA1	Green data input terminal (bit 1)
32	GDATA0	Green data input terminal (bit 0)
33	BDATA7	Blue data input terminal (bit 7)
34	BDATA6	Blue data input terminal (bit 6)
35	BDATA5	Blue data input terminal (bit 5)
36	BDATA4	Blue data input terminal (bit 4)
37	BDATA3	Blue data input terminal (bit 3)
38	BDATA2	Blue data input terminal (bit 2)
39	BDATA1	Blue data input terminal (bit 1)
40	BDATA0	Blue data input terminal (bit 0)
41	VCLK	DAC clock input. By rising edge of this clock, RGB data are taken in inside the device.
42	DGND	Ground terminal. (For digital circuits)
43	VREFOUT	RGBDAC reference voltage output terminal. Connect VREFOUT to GND through 0.1μF capacitor.
44	N.C.	No Connection. (Not connected internally)
45	AGND1	GND terminal (For analog circuit except 75Ω driver).
46	RCLAMP	Analog Red signal clamp terminal.
47	AVCC1	The power supply terminal (For analog circuit except 75Ω driver).
48	GCLAMP	Analog Green signal clamp terminal.

●Operation explanation for each block

- Clamp-Circuit (CLAMP)
  This circuit sets the black (pedestal) level for the RGB signals eliminated DC level during the sync period (external sync is the low level). When the external sync is at the low level, the R, G, B data should not be input, since the dc input level is clamped at this timing. (BH7240AKV:00h, BH7236AF:0Vpp)
- RGB Matrix Circuit (MATRIX)
  This circuit converts R, G and B signals to Y, R-Y and B-Y for color television.
- Balanced Modulation Circuit(BH7236AF:R-YMOD,G-YMOD BH7240AKV:CHROMAGEN)
  Modulator circuit that modulates color-difference-signal (generated in RGB MATRIX) by 2 types of subcarrier that are 90 degrees different phase. The chrominance signal is generated by mixing these modulated signals.
- Mixed Circuit (YCMIX)
  This circuit generates the composite video signal by combining the luminance (in the RGB MATRIX circuit) and the chrominance (in the balanced modulation circuit).
- TRAP Filter (external)
  This filter eliminates the chrominance frequency component contained in luminance by connecting L (coil) and C (capacitor) to YTRAP terminal in series. Output impedance is about 2kΩ. This filter is effective only in a composite output (Vout), and does not influence luminance output (Yout). Refer to the "Application part selection method" regarding to the selection of L and C.
- 75Ω Driver
  Driver which can drive 75Ω load directly. The 75Ω driver outputs the regular level based on the video standard, when 75Ω is connected as load. If 75Ω is not connected as load, users may no longer take the accurate image, since the video signal output level is changed to a different one. Moreover, it is prohibited to use less than 75Ω.

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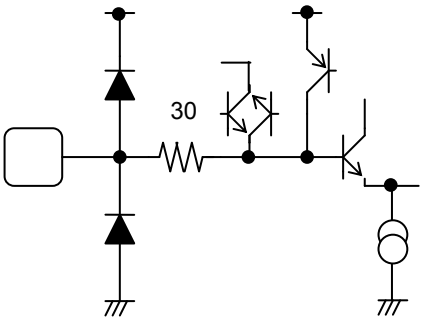
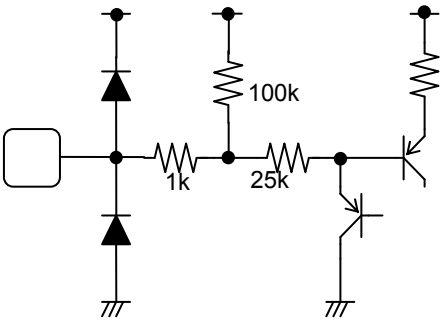
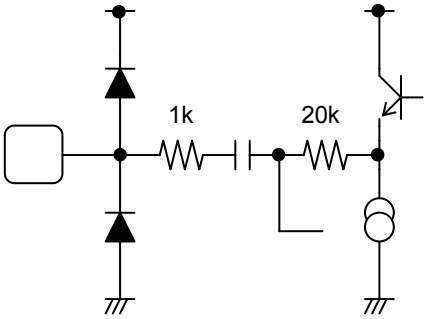
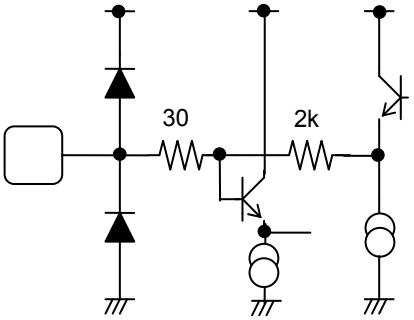
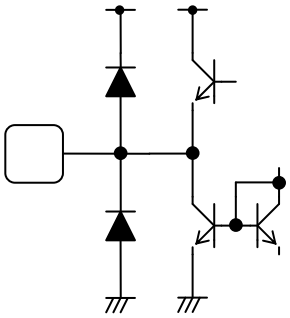
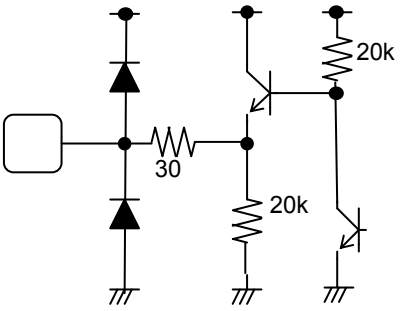
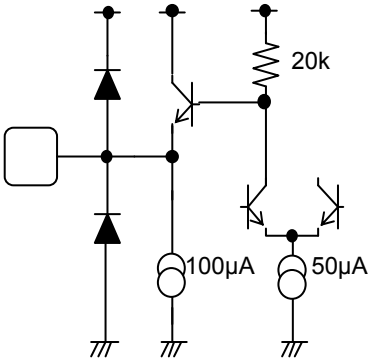
●I/O Equivalent circuit

◎BH7236AF Input/Output Equivalent Circuit

Terminal Number	Terminal Name	Equivalent Circuit	Terminal Number	Terminal Name	Equivalent Circuit
2 3 4	RIN GIN BIN		10 7	SYNCIN NT/PAL	
6	SCIN		17	YTRAP	
23 22 21 20 16 15	ROUT GOUT BOUT VOUT YVOUT COUT		11	SYNC OUT	
8	BFP OUT				

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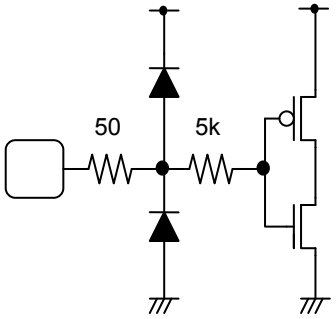
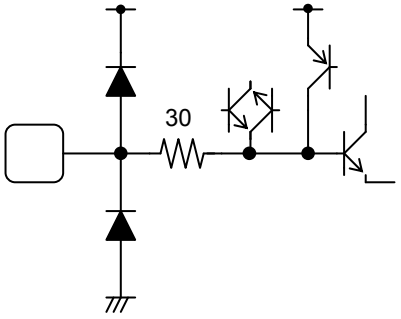
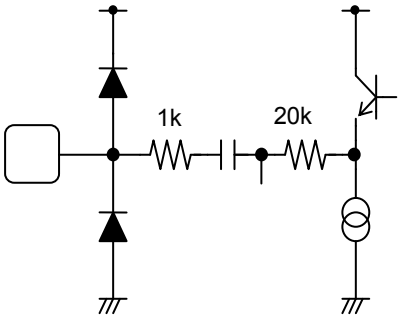
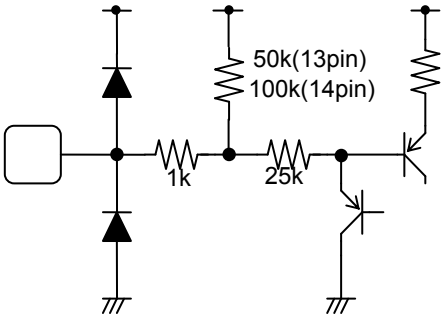
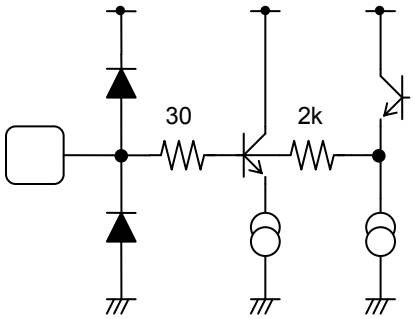
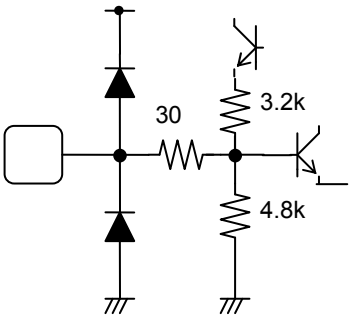
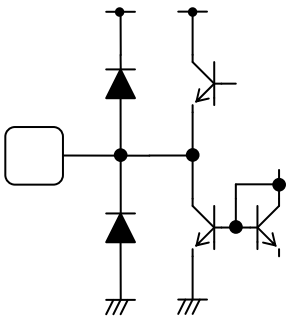
◎BH7240AKV Input/Output Equivalent Circuit

Terminal Number	Terminal Name	Equivalent Circuit	Terminal Number	Terminal Name	Equivalent Circuit
16-19 21-24 25-32 33-40	RDATA [7:0] GDATA [7:0] BDATA [7:0]		46 48 1	Red CLAMP Green CLAMP Blue CLAMP	
15	SCIN		13 14	NT/PAL SYNCIN	
10	YTRAP		43	VREF OUT	
3 4 5 6 7 8	ROUT GOUT BOUT YOUT COUT VOUT				

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●**Reference data** **I/O Characteristics** (Only BH7236AF Condition:VCC1=VCC2=5.0V)

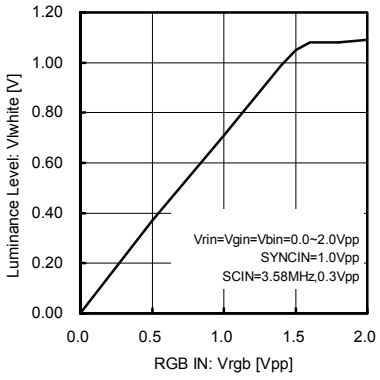

Fig.3 Yout (White) Characteristic

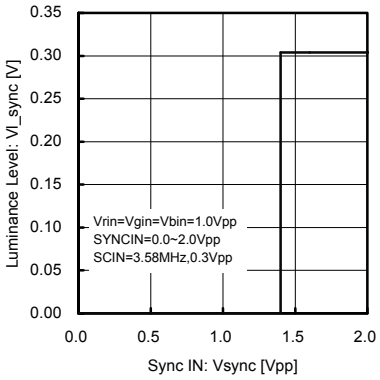

Fig.4 Yout (Sync) Characteristic

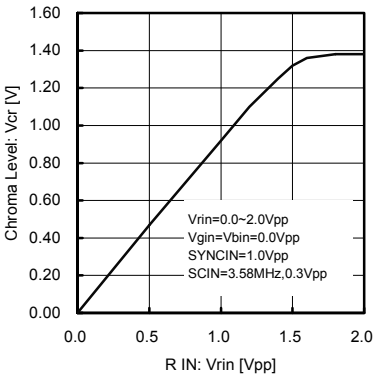

Fig.5 Cout (Red) Characteristic

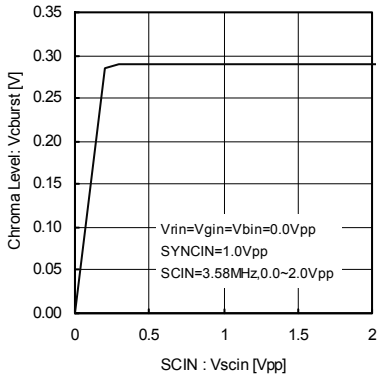

Fig.6 Cout (Burst) Characteristic

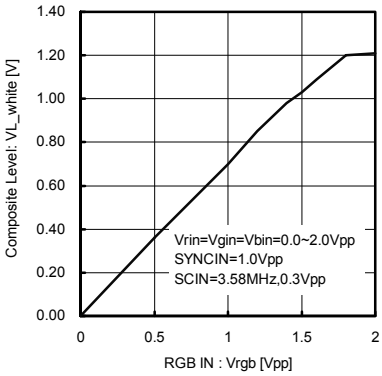

Fig.7 Vout Luminance (White) Characteristic

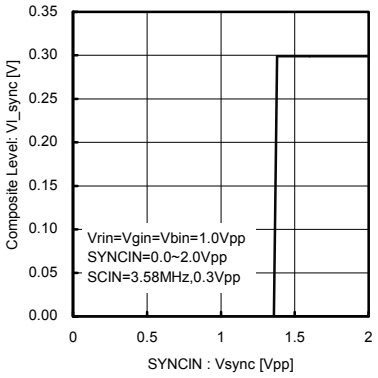

Fig.8 Vout Luminance (Sync) Characteristic

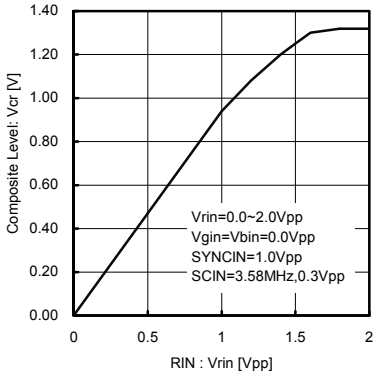

Fig.9 Vout Chroma (Red) Characteristic

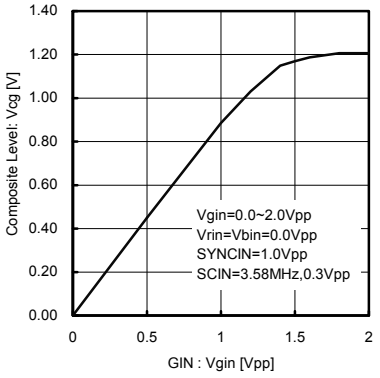

Fig.10 Vout Chroma (Green) Characteristic

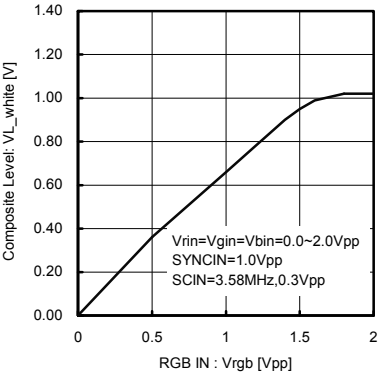

Fig.11 Vout Chroma (Blue) Characteristic

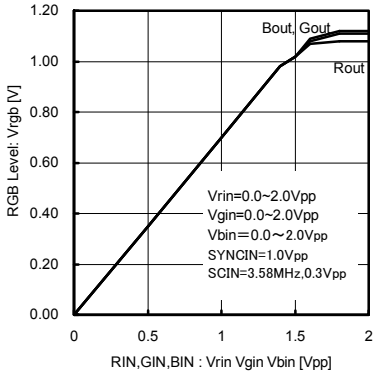

Fig.12 RGBout Characteristic

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●**Reference data** **Temperature Characteristics** (BH7236AF, BH7240AKV)

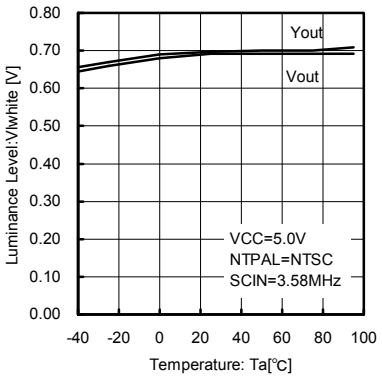

Fig.13 Luminance (White) Characteristics

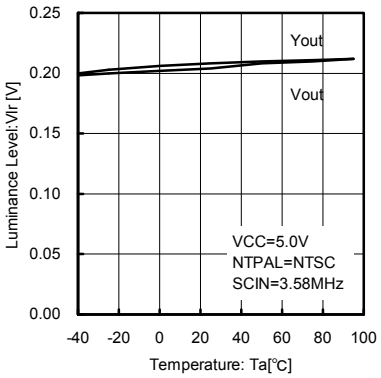

Fig.14 Luminance (Red) Characteristics

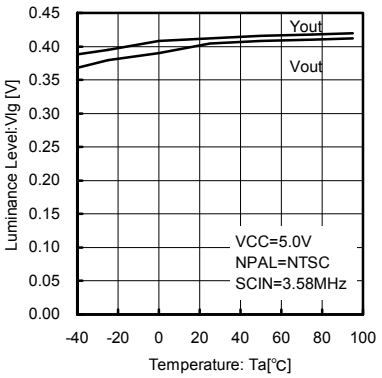

Fig.15 Luminance (Green) Characteristics

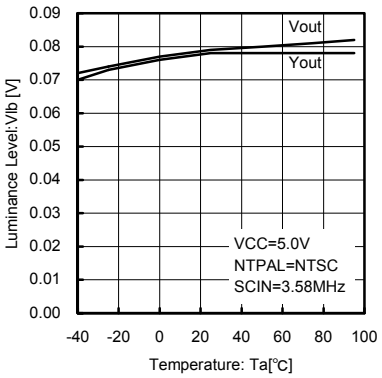

Fig.16 Luminance (Blue) Characteristics

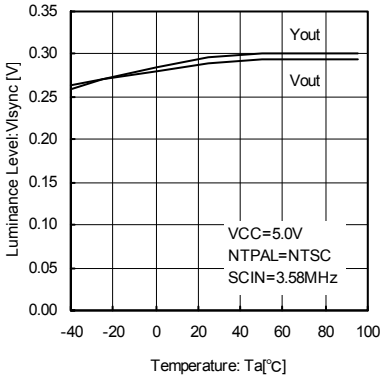

Fig.17 Luminance (Sync) Characteristics

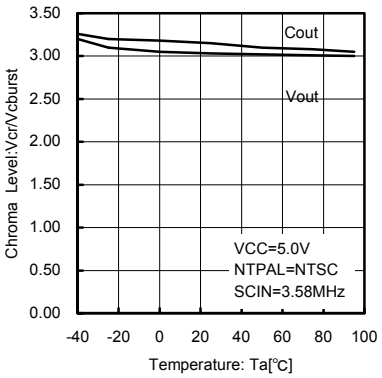

Fig.18 Chroma (Red/Burst) Characteristics

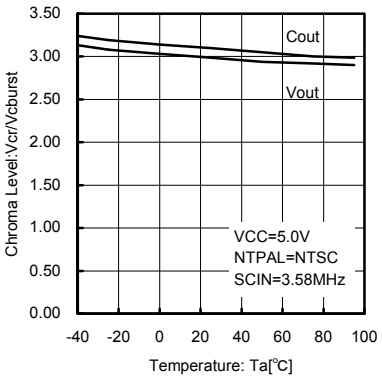

Fig.19 Chroma (Green/Burst) Characteristics

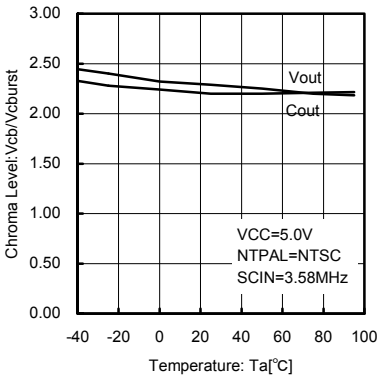

Fig.20 Chroma (Blue/Burst) Characteristics

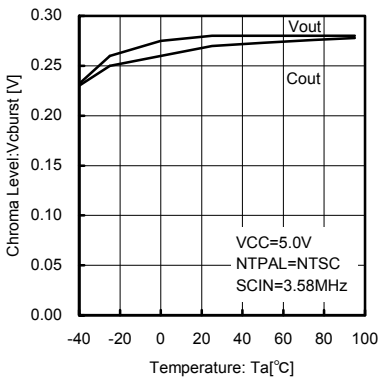

Fig.21 Chroma (Burst) Characteristics

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●**Reference data** **Output Characteristics** (BH7236AF, BH7240AKV)

[Condition SCIN:High=2.0V,Low=1.0V SYNCIN:High=2.0V, Low=1.0V]

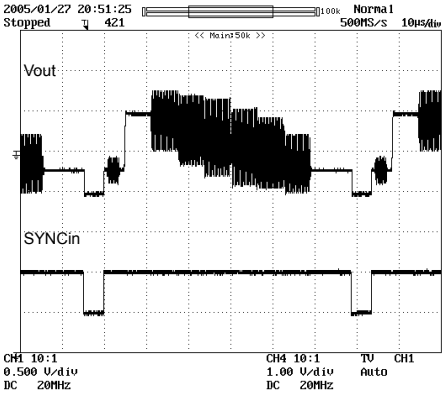

Fig.22 Vout, SYNCIN Waveform

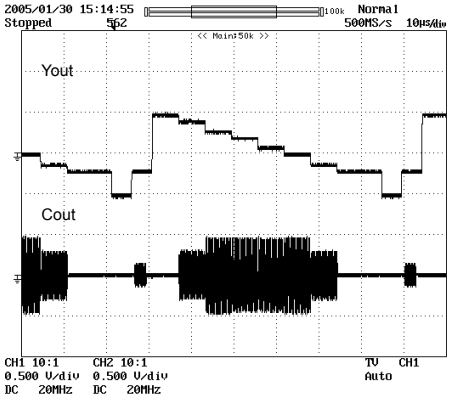

Fig.23 Yout, Cout Waveform

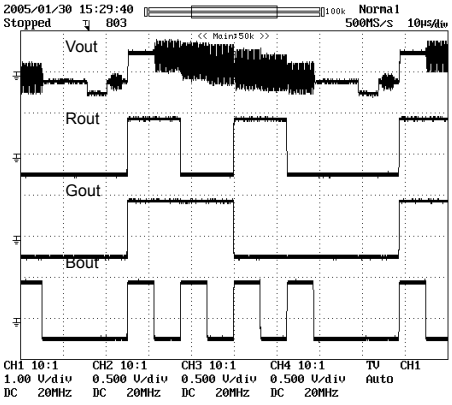

Fig.24 Vout,Rout,Gout,Bout Waveform

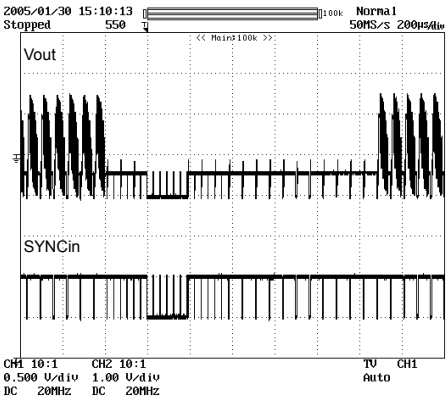

Fig.25 Blanking Section (NTSC ODD)

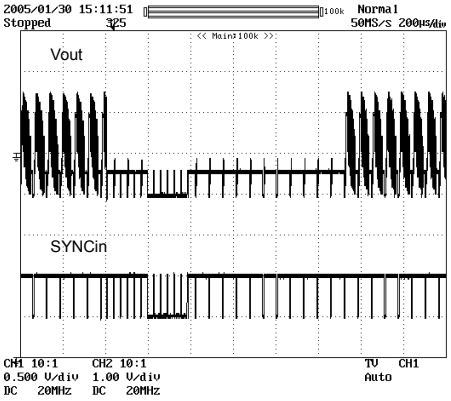

Fig.26 Blanking Section (NTSC EVEN)

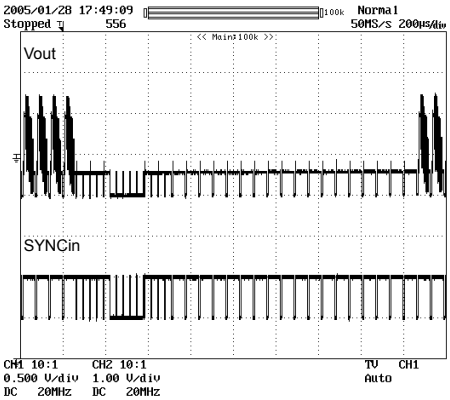

Fig.27 Blanking Section (PAL ODD)

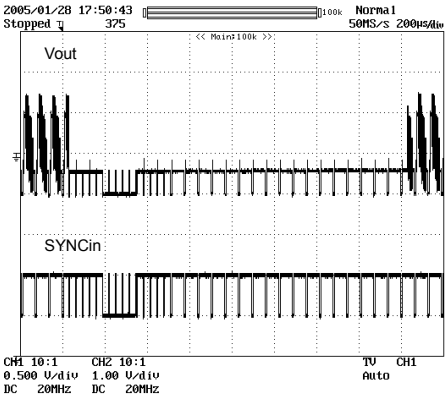

Fig.28 Blanking Section (PAL EVEN)

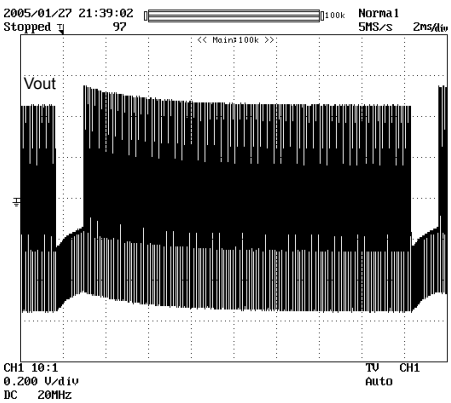

Fig.29 Vout (C=22μF)

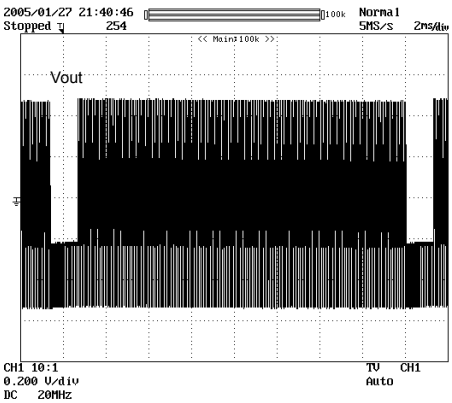

Fig.30 Vout (C=220μF)

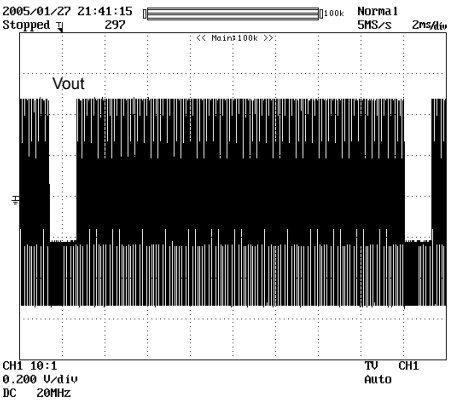

Fig.31 Vout (C=1000μF)

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●Timing chart

・DAC, R, G, B Input Timing (only BH7240AKV)

Clock should be input at VCLK terminal (41 pins) ay the system clock of DAC.
At the rising edge of this clock, RGB DATA is taken from inside the device.

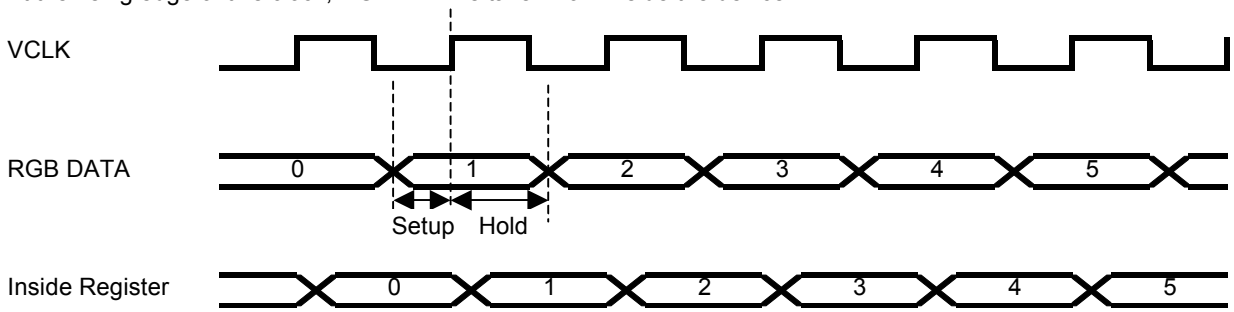

Fig.32 Input Timing of RGB, VCLK

・Data Input Timing, Composite, Sync Input Timing

Since BH7236AF and BH7240AKV do not have the mask function of data input, users do not input the data in the blanking terminal (reference to Fig 33-36). Instead, input the composite sync of the television standards to the SYNCIN terminal. The composite sync input needs to include the equalizing pulse in addition to H-Sync and V-Sync.

[In the case of NTSC]

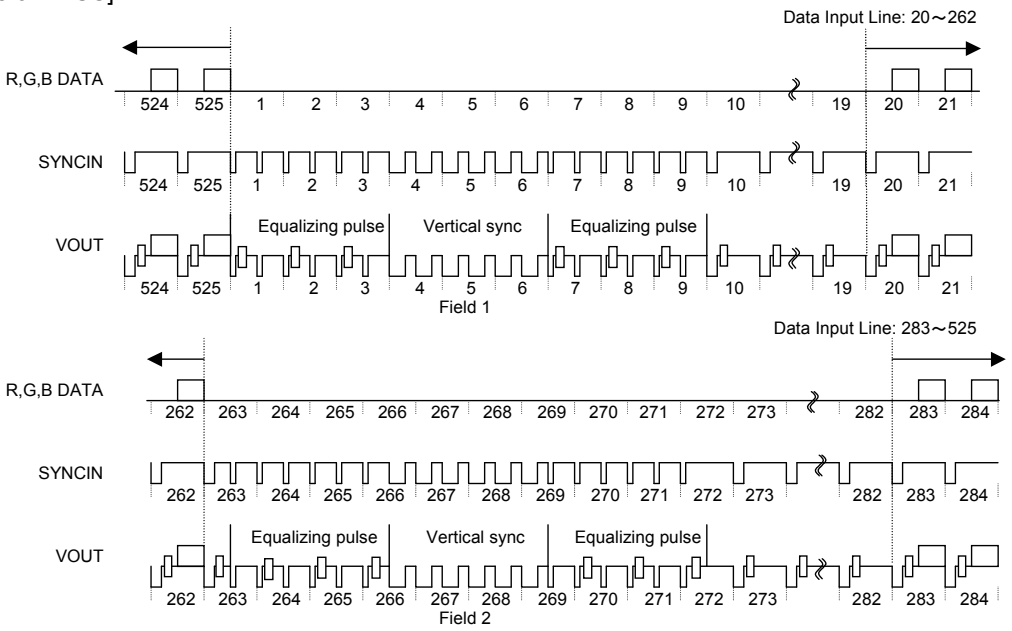

Fig.33 Data Input Range in the Field (NTSC)

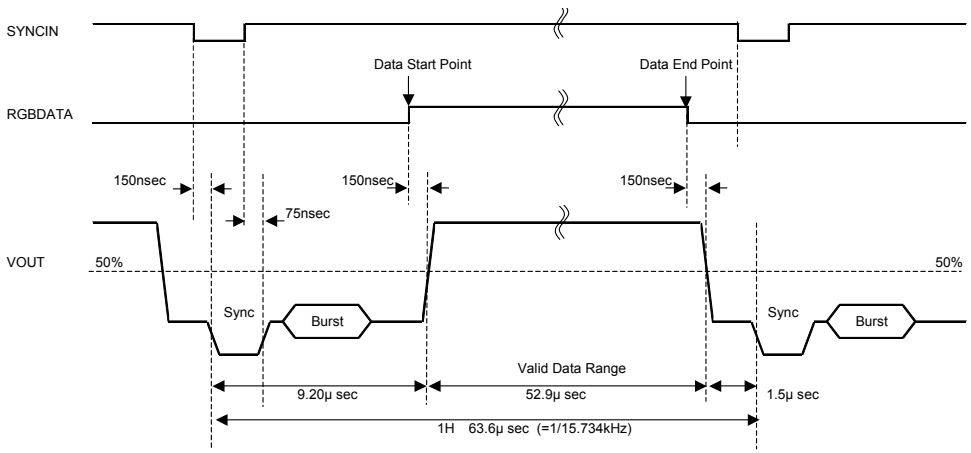

Fig.34 Data Input Range in 1H Line (NTSC)

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[In the case of PAL]

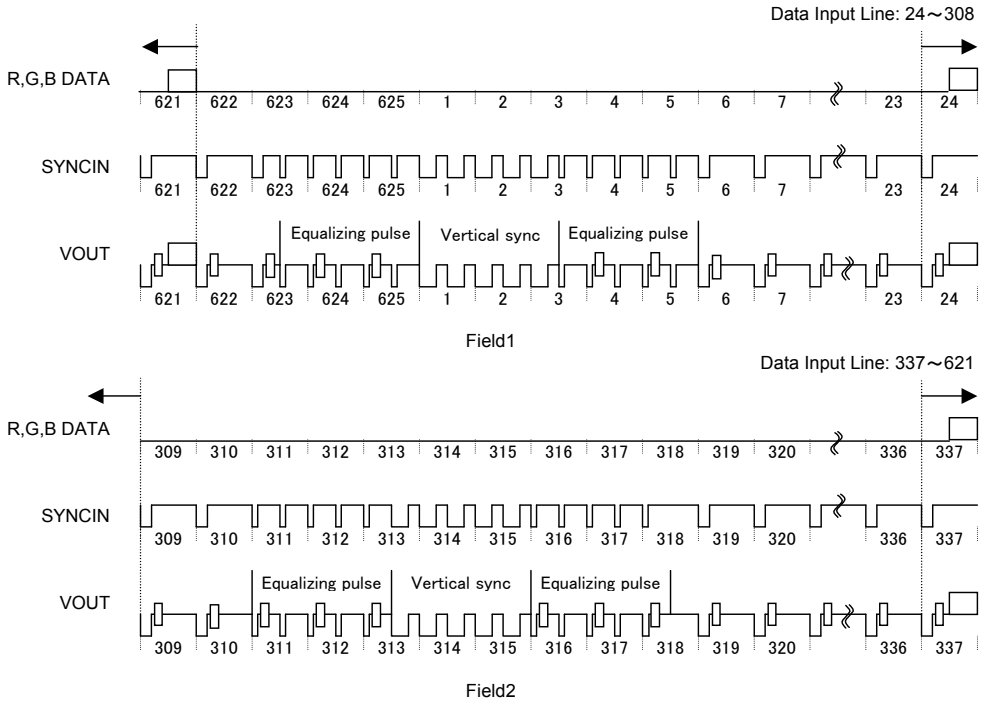

Fig.35 Data Input Range in the Field (PAL)

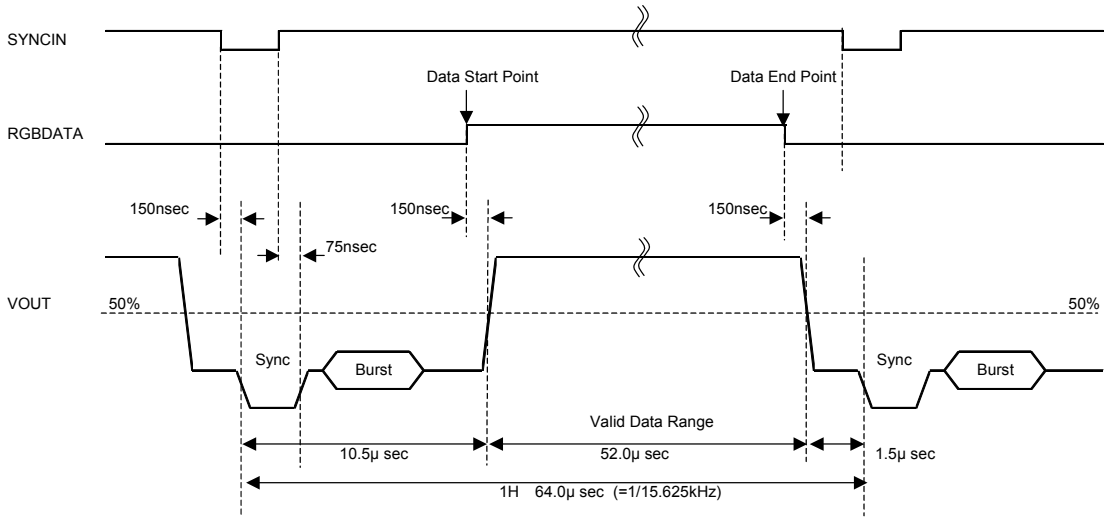

Fig.36 Data Input Range in 1H Line (PAL)

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●Application part selection method

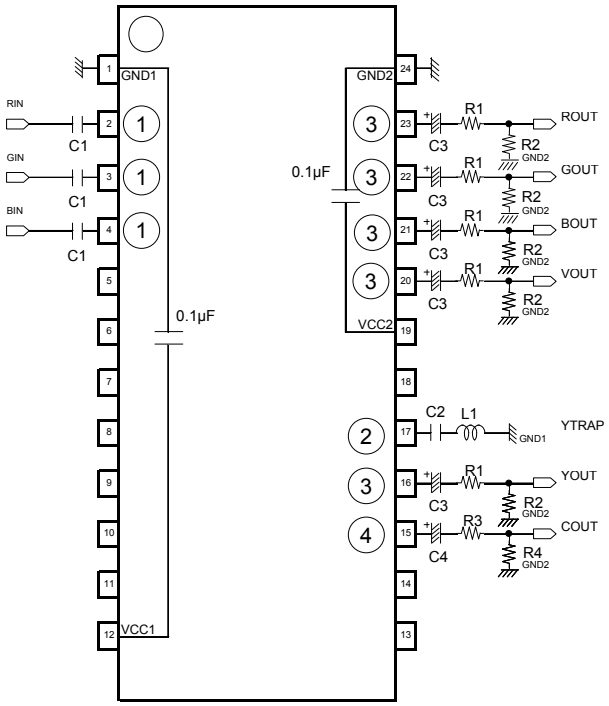

Fig. 37 BH7236AF Recommended External Part

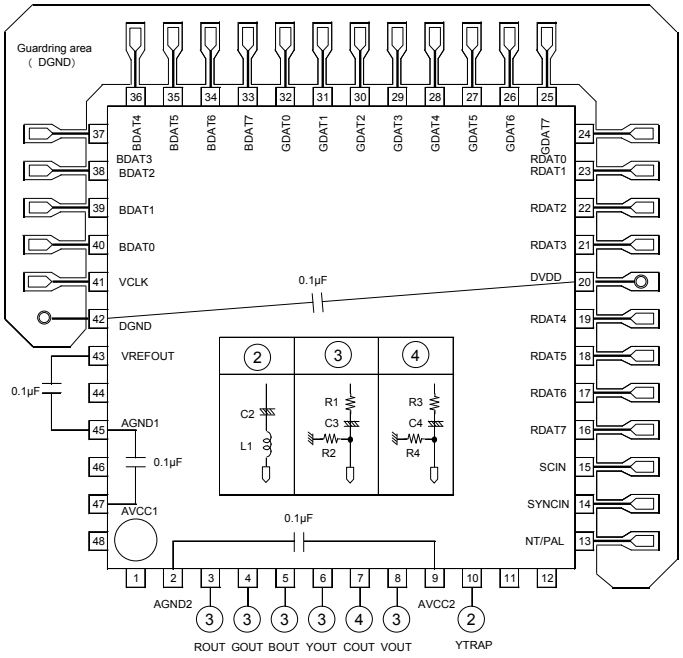

Fig.38 BH7240AKV Recommended External Part

Design Method	Calculation Example	BH7236AF Terminal Number	BH7240AKV Terminal Number
①: The method of selecting C1 C1 is an input coupling capacitor.	[Recommended Value by ROHM] C1=0.1 [μF]	2 3 4	-
②: The method of selecting C2 and L1 C2 and L1 compose the Y trap filter. The purpose is to eliminate the chrominance component contained in Y signal. NTSC C2=27pF, L1=68μH PAL C2=22pF, L1=68μH	[Recommended Value by ROHM] [NTSC] $f = \frac{1}{2\pi \times \sqrt{LC}} = 3.71\,[MHz]$ [PAL] $f = \frac{1}{2\pi \times \sqrt{LC}} = 4.11\,[MHz]$	17	10
③: The method of selecting C3, R1, and R2 The purpose is to cut DC component contained in the (output of) Yout and Vout. Moreover, in order to prevent V sag as shown in Fig.29, ROHM recommend the capacitor more than 220μF.	[Recommended Value by ROHM] C3=220 [μF], R1=75 [Ω], R2=75 [Ω] $f = \frac{1}{2\pi \times CR} = 4.82\,[MHz]$	16 20 21 22 23	3 4 5 6 8
④: The method of selecting C4,R3,R4 The output of chrominance needs to be output the signal of 3 - 4MHz frequency band, and 0.047μF is recommended as C4.	$f = \frac{1}{2\pi \times CR} = 22.6\,[kHz]$ [Recommended Value by ROHM] C4=0.047 [μF], R3=75 [Ω], R4=75 [Ω]	15	7

●Notes of substrate layout

1) Please set the bypass capacitor (0.1μF) adjacently between the power supply and ground (for 75Ω driver).
   BH7236AF: between VCC2 (pin 19) and GND2 (pin 24) BH7240AKV: between AVCC2 (pin 9) and AGND2(pin 2)
2) Please set the capacitor and coil of Y trap filter directly to pins.
   BH7236AF : pin 17 BH7240AKV : pin 10
3) The input line of subcarrier and logic input are intended to act as a barrier on both sides of line in order to prevent coupling-capacitance.
   BH7236AF : pin 6 BH7240AKV : pin 15, pin 16-19, pin 21-41
4) Digital inputs (8bitx3) wiring should be uniform in length.
   (Only BH7240AKV) pin 16-19, pin 21-40

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●Notes for use

1. Absolute Maximum Ratings
   An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

2. Operating Voltage Range and Operating Temperature Range
   These conditions represent a range within which characteristics can be provided approximately as expected.
   The electrical characteristics are guaranteed under the conditions of each parameter.

3. Reverse connection of power source connector
   Connecting the of power supply in reverse polarity can damage IC. Take precautions when connecting the power supply lines. An external direction diode can be added.

4. Power supply line
   Design PCB layout pattern to provide low impedance GND and supply lines. To obtain a low noise ground and supply line, separate the ground section and supply lines of the digital and analog blocks. Furthermore, for all power supply terminals to ICs, connect a capacitor between the power supply and the GND terminal. When applying electrolytic capacitors in the circuit, note that capacitance characteristic values are reduced at low temperatures.

5. GND voltage
   Ground-GND potential should maintain at the minimum ground voltage level. Furthermore, no terminals should be lower than the GND potential voltage including an electric transients.

6. Inter-pin shorts and mounting errors
   Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if positive and ground power supply terminals are reversed. The IC may also be damaged if pins are shorted together or are shorted to other circuit's power lines.

7. Operation in a strong electromagnetic field
   Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

8. Inspection of set circuit board
   When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Always turn the IC's power supply off before connecting it to, or removing it from a jig or fixture, during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting and storing the IC.

9. Input terminals
   In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

10. Ground wiring patterns
    The power supply and ground lines must be as short and thick as possible to reduce line impedance. Fluctuating voltage on the power ground line may damage the device.

11. External capacitor
    When using external ceramic capacitors, consider degradation in the nominal capacitance value due to DC bias and changes in the capacitance with temperature.

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●Ordering part number

B	H	7	2	3	6	A	F	-	E	2

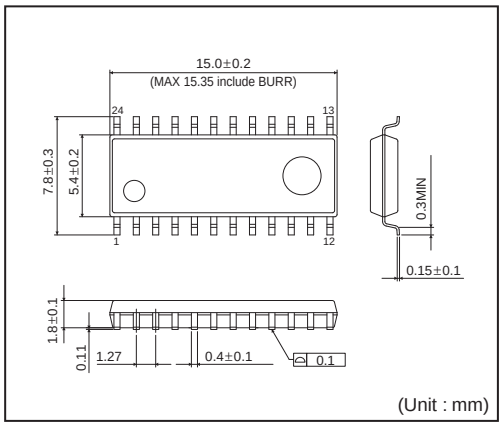
Part No.

Part No.
7236A
7240A

Package
F :SOP24
KV:VQFP48C

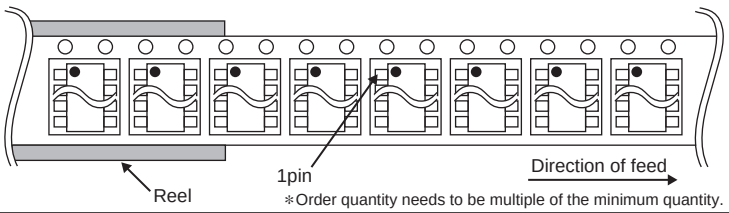
Packaging and forming specification
E2: Embossed tape and reel

SOP24



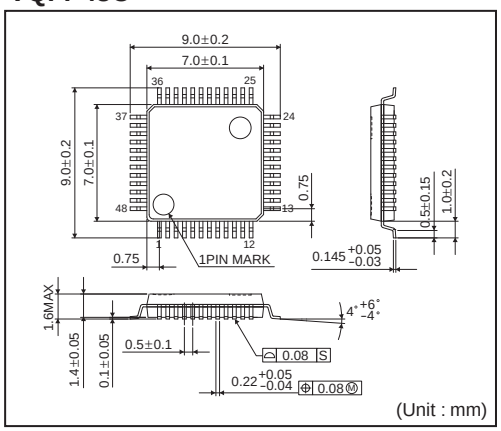
<Tape and Reel information>

Tape	Embossed carrier tape
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)



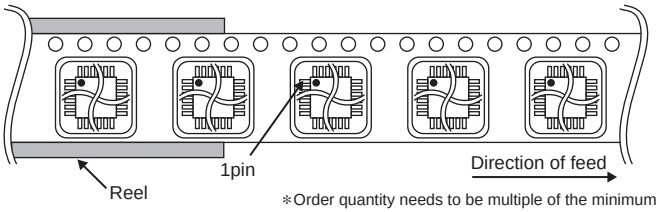
∗Order quantity needs to be multiple of the minimum quantity.

VQFP48C



<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	1500pcs
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.

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Notes

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