Color TV Signal Encoder
BH7236AF

The BH7236AF converts analog RGB signals into color TV signals in the NTSC and PAL formats. From inputs of analog RGB signals, a composite synch signal, burst pulses and a color carrier, this IC generates a color TV signal, and can be adapted for either NTSC or PAL standards, which are selected externally. When set to PAL, chroma phase is switched for each line.
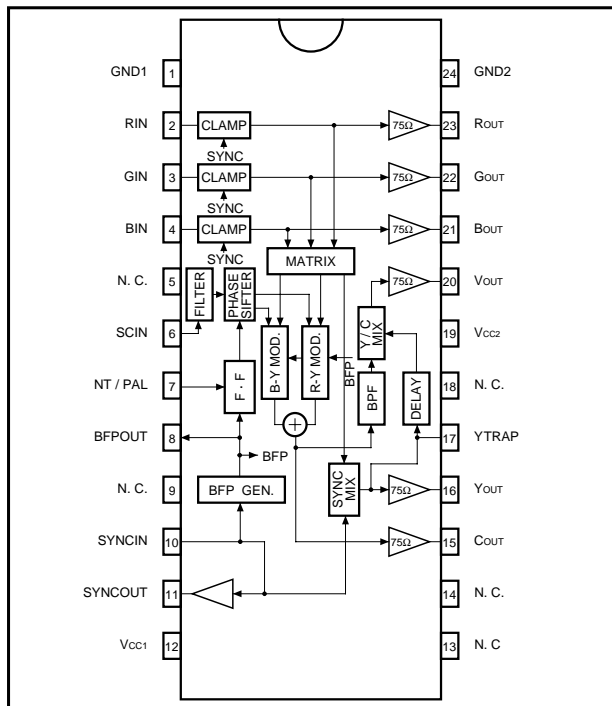
The chroma signals and luminosity signals can be combined into a color TV signal or output separately, making this IC suitable for S pins. There are also pins for analog RGB signal output, and each output pin has its own internal 75Ω driver.

●Applications
TV peripherals

●Features
1) Can be adapted for NTSC and PAL formats.
2) Internal burst timing signal generator with half-H killer.
3) Internal flip-flop for PAL phase switching.
4) Separate Y / C output pins.

5) Analog RGB signal output pins.
6) Internal 75Ω driver. (outputs color TV signals, luminosity signals, chroma signals and analog RGB signals)
7) Adaptable for color subcarrier pulse input.

●Block diagram

●Pin descriptions

Pin No.	Pin name	Function
1	GND1	Ground for all drivers other than the 75Ω driver.
2	RIN	Analog R signal input. Drive at low impedance.
3	GIN	Analog G signal input. Drive at low impedance.
4	BIN	Analog B signal input. Drive at low impedance.
5	N. C.	This pin is not connected inside the IC.
6	SCIN	Color subcarrier input. Input a 3.579545MHz (NTSC) or 4.433619MHz (PAL) sign wave or pulse wave (50% duty). Do not exceed the range of GND-Vcc.
7	NT / PAL	Selecting the type of color TV signal output. The high level selects NTSC, the low level PAL. Internally pulled up to 50kΩ.
8	BFPOUT	Burst timing output. Burst timing is generated inside the IC when the subcarrier and composite synchronization signal.
9	N. C.	This pin is not connected inside the IC.
10	SYNCIN	Composite synchronization signal input. When the low level is input, the synchronization signal is output to both YOUT and VOUT, and inputs to RIN, GIN and BIN are clamped. This pin is internally pulled up to 100kΩ.
11	SYNCOUT	Composite synchronization signal output.
12	V_{CC1}	Power supply pin for all except the 75Ω driver.
13	N. C.	This pin is not connected inside the IC.
14	N. C.	This pin is not connected inside the IC.
15	C_{OUT}	Chroma signal output. Internal 75Ω driver.
16	Y_{OUT}	Luminance signal output. Internal 75Ω driver.
17	YTRAP	Attached luminance trap filter. Attaching a trap filter reduces chroma signal cross-color caused by the luminance signal. Output impedance is approximately 2kΩ.
18	N. C.	This pin is not connected inside the IC.
19	V_{CC2}	Power supply pin for the 75Ω driver.
20	V_{OUT}	Color TV signal output. Internal 75Ω driver.
21	B_{OUT}	Analog B signal output. Internal 75Ω driver.
22	G_{OUT}	Analog G signal output. Internal 75Ω driver.
23	R_{OUT}	Analog R signal output. Internal 75Ω driver.
24	GND2	Ground for the 75Ω driver.

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●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	7	V
Power dissipation	Pd	550*	mW
Operating temperature	Topr	− 20 ~ + 70	°C
Storage temperature	Tstg	− 55 ~ + 125	°C

∗ When mounted on a 50 × 50 × 1.6mm glass epoxy board.
   Reduced by 5.5mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	4.5 ~ 5.5	V
RIN input level	υ_{RI}	0 ~ 1.0	Vp-p
GIN input level	υ_{GI}	0 ~ 1.0	Vp-p
BIN input level	υ_{BI}	0 ~ 1.0	Vp-p
SCIN input level	υ_{SC}	0.4 ~ 5.0	Vp-p

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V$_{CC}$ = 5V, NTSC format)

Parameter		Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply current		I$_{CC}$	—	42	55	mA	υ$_{RI}$ = υ$_{GI}$ = υ$_{BI}$ = 1.0V$_{P-P}$
Y$_{OUT}$ V$_{OUT}$	Luminance level	υ$_L$	0.63	0.70	0.77	V$_{P-P}$	υ$_{RI}$ = 1.0V$_{P-P}$*1
	Luminance level R	υ$_{L(R)}$	0.19	0.21	0.23	V$_{P-P}$	υ$_{GI}$ = 1.0V$_{P-P}$*1
	Luminance level G	υ$_{L(G)}$	0.37	0.41	0.45	V$_{P-P}$	υ$_{BI}$ = 1.0V$_{P-P}$*1
	Luminance level B	υ$_{L(B)}$	0.07	0.08	0.09	V$_{P-P}$	
	Synchronization level	υ$_S$	0.27	0.30	0.33	V$_{P-P}$	R$_{YO}$ = υ$_S$ / υ$_L$
	Synchronization / Luminance level ratio	R$_{S/L}$	0.38	0.43	0.48	—	
C$_{OUT}$ V$_{OUT}$	R / burst level ratio	R$_{R/BU}$	2.84	3.16	3.48	—	υ$_{RI}$ = 1.0V$_{P-P}$*1
	R phase	θ$_R$	94	104	114	deg	
	G / burst level ratio	R$_{G/BU}$	2.65	2.95	3.25		υ$_{GI}$ = 1.0V$_{P-P}$*1
	G phase	θ$_G$	231	241	251	deg	
	B / burst level ratio	R$_{B/BU}$	2.01	2.24	2.47	—	υ$_{BI}$ = 1.0V$_{P-P}$*1
	B phase	θ$_B$	337	347	357	deg	
	Burst level	υ$_{BU}$	0.23	0.29	0.35	V$_{P-P}$	*2
	PAL burst phase (+)	θ$_{BU}^+$	125	135	145	deg	PAL*1
	PAL burst phase (−)	θ$_{BU}^-$	215	225	235	deg	PAL*1
	PAL burst level ratio	R$_{BU}$	0.9	1.0	1.1	—	PAL*1
	Carrier leak	υ$_{CL}$	—	—	35	mV$_{P-P}$	*2
SYNCOUT, "H" level		—	3.90	—	—	V	
SYNCOUT, "L" level		—	—	—	0.80	V	
ROUT output level		υ$_{RO}$	0.63	0.70	0.77	V$_{P-P}$	υ$_{RI}$ = 1.0V$_{P-P}$
GOUT output level		υ$_{GO}$	0.63	0.70	0.77	V$_{P-P}$	υ$_{GI}$ = 1.0V$_{P-P}$
BOUT output level		υ$_{BO}$	0.63	0.70	0.77	V$_{P-P}$	υ$_{BI}$ = 1.0V$_{P-P}$
YOUT DC voltage		V$_{YO}$	1.30	1.70	2.10	V	
COUT DC voltage		V$_{CO}$	2.00	2.40	2.80	V	
VOUT DC voltage		V$_{VO}$	1.15	1.55	1.95	V	
ROUT DC voltage		V$_{RO}$	1.40	1.80	2.20	V	
GOUT DC voltage		V$_{GO}$	1.40	1.80	2.20	V	
BOUT DC voltage		V$_{BO}$	1.40	1.80	2.20	V	
Input volt. SYNCIN, NT / PAL, "H" level		V$_H$	2.2	—	—	V	
Input volt. SYNCIN, NT / PAL, "L" level		V$_L$	—	—	0.8	V	
Input curr. SYNCIN, NT / PAL, "H" level		I$_H$	—	—	300	μA	Input current when applied = 5V
Input curr. SYNCIN, NT / PAL, "L" level		I$_L$	—	—	200	μA	Input current when applied = 0V

＊1 Guaranteed performance.

＊2 Measured with a 3.58MHz BPF.

○ Not designed for radiation resistance.

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●Measurement circuit
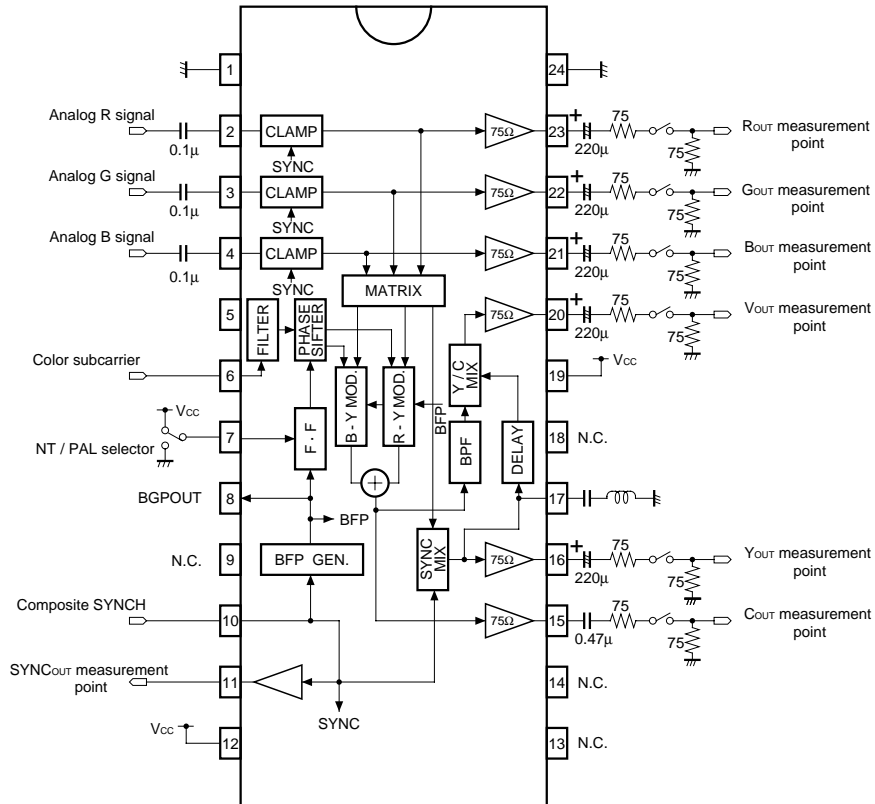
●Circuit operation

(1) SYNCIN is for composite synch input. During low input, the synchronization signal is output to YOUT, VOUT and SYNCOUT. This signal also controls the timing of the pedestal clamps of R_{IN}, G_{IN} and B_{IN}. (The pedestal levels of R_{IN}, G_{IN} and B_{IN} are kept constant by charging an attached capacitor.)

(2) SCIN is for color subcarrier input. Set input to a pulse wave or sine wave (3.579545MHz for NTSC and 4.433619MHz for PAL).

(3) NT / PAL is the NTSC / PAL selector pin, and connects to Vcc when set to NTSC and to GND when set to PAL. Chroma phase is switched for each line when the IC is set to PAL.

(4) Using the composite synch and subcarrier inputs, the IC generates a burst flag signal, according to which a burst signal is output to COUT and VOUT. The half-H killer presents the burst signal from being output at the wrong points.

(5) PAL chroma phases are also switched at a regular cycle (1H) during vertical synchronization.

(6) COUT and YOUT are for output of chroma signals and luminosity signals, respectively. Because the chroma signal and luminosity signals can be output separately, the IC can be adapted for S pins. Each has a 75Ω driver.

(7) VOUT is for color TV signal output, and has an internal 75Ω driver.

(8) ROUT, GOUT and BOUT are for analog RGB signal output, and have an internal 75Ω driver.

●Application example (NTSC color TV signal)
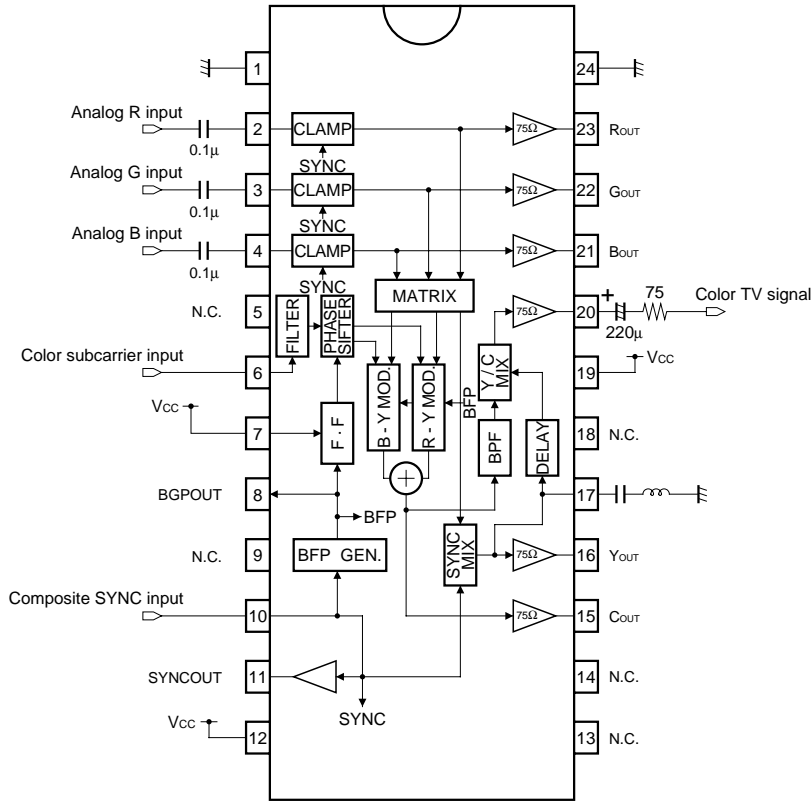
●Operation notes

(1) Input impedance at the input terminals should be as low as possible as the analog RGB signal is clamped there.

(2) The color subcarrier should have a duty of 50%. Duty fluctuation will affect chroma phase.

(3) Composite synch and burst flag pulse inputs should conform to their respective standards, as input of an off-standard signal will shift the burst position and cause other problems that may prevent the TV from displaying color images. For input, use the TTL level and an impedance of 8kΩ.

●External dimensions (Units: mm)

SOP24

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