

VIF / SIF signal processor for televisions and VCRs

BH7370FS

The BH7370FS is a VIF / SIF signal processor that supports the M mode (used in the U.S. and Japan). An application of BiCMOS process and active filter technology, this IC has been designed with an internal VCO, AFT, sound band-pass filter, sound-trap and FM demodulator circuit. And thanks to Rohm's original automatic adjustment technology, the digital AFT circuit, internal tank circuit and filter circuit are all adjustment-free.

●Applications

TVs, LCD TVs, and tuner blocks for multimedia devices

●Features

- 1) Internal adjustment-free IF tank coil and audio filter.
- 2) Digital AFT circuit, for highly precise, highly stable frequencies.
- 3) The reference signal input from the tuner fixed at 4MHz, eliminating the need for an oscillator.
- 4) No VCO coil is used, allowing for excellent resistance to magnetic noise.
- 5) A pulse count audio detector circuit with excellent S / N and linearity.
- 6) Internal B / W inverter circuit.

●Absolute maximum ratings (Ta = 25°C)

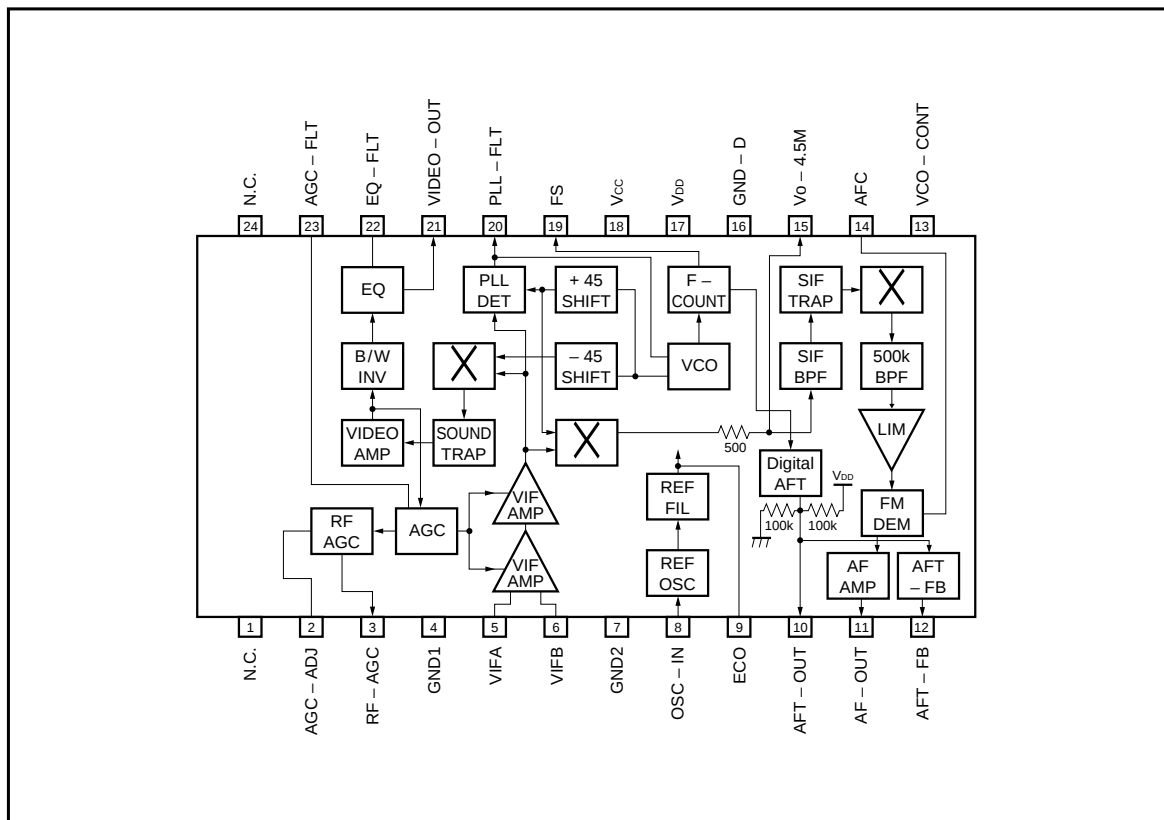
Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	7.0	V
Power dissipation	P _d	650*	mW
Operating temperature	T _{opr}	- 15 ~ + 75	°C
Storage temperature	T _{stg}	- 40 ~ + 150	°C

* Reduced by 6.5mW for each increase in Ta of 1°C over 25°C.

●Operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V _{CC5V}	4.7	5.0	5.3	V
Guaranteed operating power supply voltage	V _{CC}	4.5	5.0	5.5	V

●Block diagram



●Pin descriptions

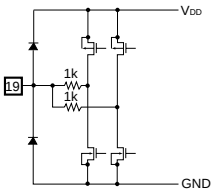
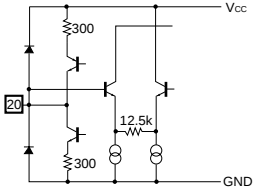
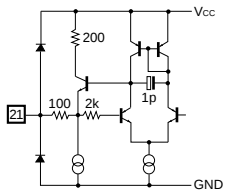
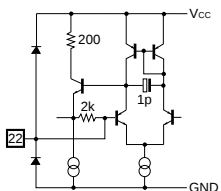
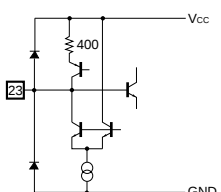
Pin No.	Pin name	Function
1	N.C.	—
2	AGC – ADJ	Adjusting the RF AGC delay point
3	RF – AGC	RF AGC output
4	GND1	VIF GND
5	VIFA	VIFA input
6	VIFB	VIFB input
7	GND2	SIF and VCO GND
8	OSC – IN	4MHz oscillator input
9	ECO	Reference filter detection
10	AFT – OUT	AFT output
11	AF – OUT	Audio output
12	AFT – FB	FB pin for PLL-FL

Pin No.	Pin name	Function
13	VCO – CONT	Switching between 45.75MHz (U.S.) and 58.75MHz (Japan)
14	AFC	Audio detection filter and audio / video mute switch
15	Vo – 4.5M	2nd SIF output
16	GND – D	CMOS ground
17	V _{DD}	CMOS V _{DD}
18	V _{CC}	Bipolar V _{CC}
19	FS	F-counter output
20	PLL – FLT	PLL phase detection FILTER
21	VIDEO – OUT	VIDEO OUT
22	EQ – FLT	EQ FILTER
23	AGC – FLT	IF AGC FILTER
24	N.C.	—

● Input / output circuits

Pin No.	Pin name	IN / OUT	Voltage	Equivalent circuit	Function
1	N.C.	—	—	—	Internally open
2	AGC – ADJ	—	0.2V (13kΩ connection)		Adjusting the RFAGC delay point. A fixed resistor (20kΩ) is normally fixed between grounds. For greater precision, adjust with a variable resistor (50kΩ).
3	RF – AGC	OUT	—		RF-AGC output (reverse). Because of open collector output, gain can be set with an attached resistor (the minimum value for pin 3's maximum sink current is 0.7mA). Pin 3 voltage should remain below 7 V.
4	GND1	—	0V	—	Bipolar ground for the VIF, AGC and video system.
5 6	VIFA VIFB	IN	3.4V		IF input. Use equilibrium input.
7	GND2	—	0V	—	Bipolar ground for the SIF and VCO.
8	REF OSC – IN	IN	2V		4MHz reference oscillator input (input level = 25 - 100mV _{P-P} , frequency precision = 0.1% or less)
9	ECO	—	2.2V		Reference filter detection output.
10	AFT – OUT	OUT	—		AFT output (CMOS output). V _{DD} and the ground each have an internal 100kΩ resistor. Output is 1 / 2V _{DD} at the center frequency.

Pin No.	Pin name	IN / OUT	Voltage	Equivalent circuit	Function
11	AF – OUT	OUT	2.2V		Audio signal output. A de-emphasis constant should normally be attached.
12	AFTF – FB	OUT	—		The Lo range of the AFT curve can be expanded by feeding back to PLL—FIL.
13	VCO – CONT	IN	—		Switching the internal VCO frequency. High = 45.75MHz (U.S.) (connect to Vcc) Low = 58.75MHz (Japan) (connect to ground)
14	AFC	—	2.2V		Automatic adjustment FB for the 500kHz pulse counter FM DEMO. Attach a capacitor (roughly 4.7μF). Lowering this pin below 0.3V Mutes Audio and Video.
15	VO – 4.5M	—	2.4V		2nd SIF output. Sound Filter characteristics can be changed by connecting this pin to the TRAP. To reduce color buzzing, attach a 3.5MHz trap. Internal impedance is approximately 500Ω. Attach a Buffer if output.
16	GND – D	—	0V	—	C-MOS GND. Locate the pattern as far as possible from the Bipolar – GND.
17	V _{DD}	—	4.5V	—	C-MOS V _{DD} . CMOS radiation can be greatly reduced by positioning a CR filter between this pin and Bipolar – Vcc.

Pin No.	Pin name	IN / OUT	Voltage	Equivalent circuit	Function
18	V _{CC}	—	5.0V	—	Power supply for the entire bipolar system.
19	FS	—	—		Output of the F-counter's CMOS charge pump.
20	PLL – FLT	—	3.0V		Attached time constant of the PLL filter.
21	VIDEO – OUT	OUT	2.0V (SYNC)		Video output. Output via the sound trap, B / W noise inverter, and EQ amplifier.
22	EQ – FLT	—	2.0V (SYNC)		EQ filter (normally left open). For EQ characteristics, use an LCR series resonator to connect this pin to the ground.
23	AGC – FLT	—	4.0V		Attaching the filter time constant for the VIF and AGC.
24	N.C.	—	—	—	Internally open.

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 5V, P = 45.75MHz)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply current	I _{CC}	—	50	—	mA	—
(Internal stabilization supply voltage)	(V _{REG})	—	(2.6)	—	V	—
(VIF)						
Input sensitivity	V _{VMin.}	—	40	46	dBμ	V _{VO} = − 3dB
Max. allowable input level	V _{VMax.}	100	110	—	dBμ	V _{VO} = + 1dB
AGC range	GR	62	70	—	dB	V _{VO} = ± 3dB range
Quiescent video output voltage	V _{P21}	—	3.2	—	V	No signal, V ₂₃ = V _{CC}
Video detection output level	V _{VO}	—	1.2	—	V _{P-P}	P = 90dBμ, AM 87.5% MOD, 100% white video signal
Synehronous signal tip voltage	V _{P21SY}	—	1.9	—	V	
Video output (DG)	DG	—	2	5	%	P = 90dBμ, AM 87.5% MOD, 3-step video signal
Video output (DP)	DP	—	1	5	deg	
Sound trap attenuation	G _{VO4.5}	—	45	—	dB	20LOG (VO4.5M / VO0.2M)
920kHz beat level	I ₉₂₀	—	46	—	dB	P = 0, P / C = 4, P / S = 14dB
Video output S / N	S / N _V	47	53	—	dB	P = 90dBμ, 100% white
White noise threshold voltage	V _{WTH}	—	3.6	—	V	CW = 70dBμ
White noise clamping voltage	V _{WCL}	—	2.5	—	V	Change in frequency and pin 23 voltage
Black noise threshold voltage	V _{BTH}	—	1.5	—	V	
Black noise clamping voltage	V _{BCL}	—	2.5	—	V	
RF AGC Max. sink current	I _{P3SI}	0.4	1.0	—	mA	CW = 100dBμAGC _{ADJ} = 20k
RF AGC delay point	V _{RFAGC}	—	90	—	dB	AGC _{ADJ} = 20k
(AFT)						
Maximum AFT voltage	V _{P10Max.}	4.0	4.5	—	V	CW = 45.25MHz
Minimum AFT voltage	V _{P10Min.}	—	0.1	1.0	V	CW = 46.25MHz
AFT detection sensitivity	S _τ	—	− 80 + 50	—	kHz	—
VCO free-running frequency	F _{VCO}	− 250	± 125	+ 250	kHz	—
(PLL)						
PLL capture range 1	f _{CU}	+ 1.0	+ 2.0	—	MHz	CW = 80dBμ Frequency change
PLL capture range 2	f _{CL}	—	− 2.0	− 1.0	MHz	
PLL lock range 1	f _{LU}	+ 1.0	+ 2.0	—	MHz	
PLL lock range 2	f _{LL}	—	− 2.0	− 1.0	MHz	
VCO control sensitivity	β	—	9.0	—	kHz / mV	
(SIF) P = 45.75MHz / 90dBμ S = 41.25MHz / 70dBμ						
Input sensitivity	V _{SMin.}	—	24	39	dBμ	f _m = 400Hz, Δf = 25kHz
SIF Max. allowable input level	V _{SMax.}	75	—	—	dBμ	5% distortion
FM detection output level	V _{SO}	—	500	—	mV _{rms}	f _m = 400Hz, Δf = 25kHz
Audio output S / N	SN _{AF}	—	55	—	dB	f _m = 400Hz, Δf = 25kHz
Audio output distortion	THD	—	0.2	1.0	%	f _m = 400Hz, Δf = 25kHz
AMR	AMR	—	53	—	dB	Δf = 12.5kHz, AM30%
Muted video output voltage	V _{VMUTE}	—	2.5	—	V	V _{P14} = GND
Muted audio output voltage	V _{SMUTE}	—	2.2	—	V	V _{P14} = GND
MUTE start voltage	V _{14MUTE}	—	—	0.3	V	—
VO4.5M output level	V _{VO4.5M}	10	20	50	mV _{P-P}	P = 90dBμ P / S = 20dB, when using FET probe
4MHz oscillator input	V _{OSC}	25	—	100	mV _{P-P}	—

● Measurement circuit

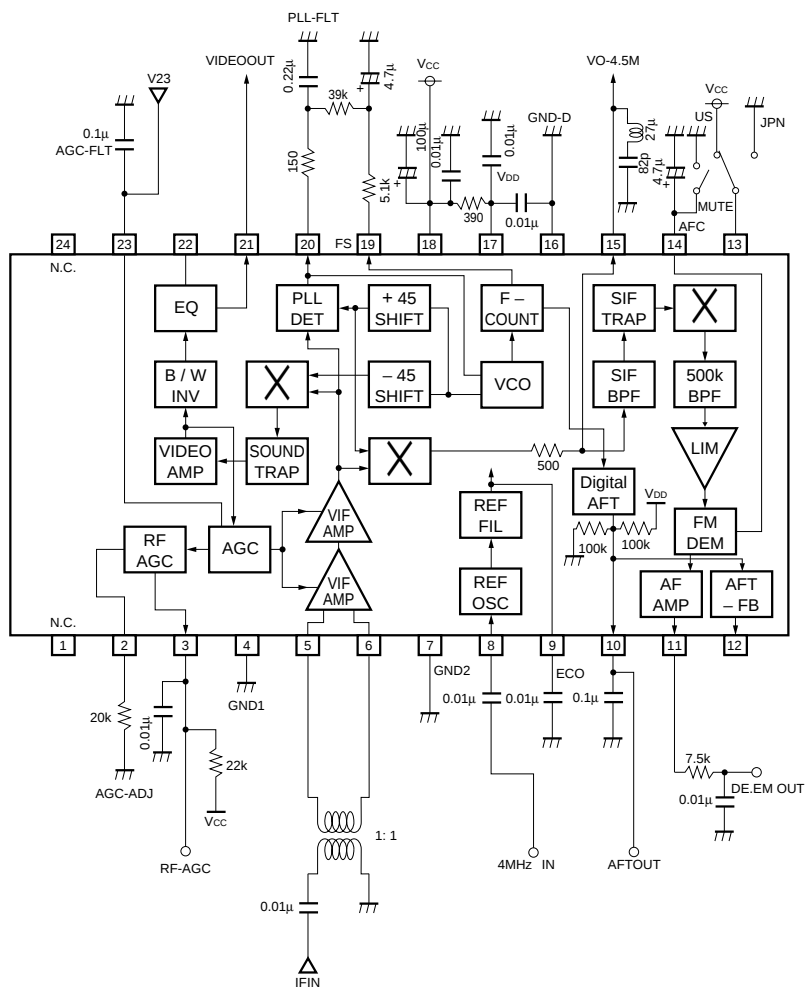


Fig. 1

The diagram illustrates the internal architecture of the Philips 7445, a monolithic IC for FM/AM radio reception. The IC is a 24-pin DIP package. The internal blocks and their interconnections are as follows:

- RF AGC** (Radio Frequency Automatic Gain Control) is connected to Pin 3 (RF-AGC) and Pin 2 (AGC-ADJ, 20k resistor to GND1).
- AGC** (Automatic Gain Control) is connected to Pin 3 (RF-AGC) and Pin 2 (AGC-ADJ, 20k resistor to GND1).
- VIF AMP** (Video Intermediate Frequency Amplifier) is connected to Pin 5 (intercarrier, to SAW FILTER) and Pin 6 (4MHz IN).
- SOUND TRAP** is connected to Pin 5 (intercarrier, to SAW FILTER) and Pin 6 (4MHz IN).
- PLL DET** (Phase-Locked Loop Detector) is connected to Pin 20 (PLL-FLT, 0.22μF capacitor to GND-D, 39k resistor to GND-D, 47μF capacitor to GND-D) and Pin 21 (VIDEOOUT, 0.22μF capacitor to GND-D).
- PLL-FLT** (Phase-Locked Loop Filter) is connected to Pin 20 (PLL-FLT, 0.22μF capacitor to GND-D, 39k resistor to GND-D, 47μF capacitor to GND-D) and Pin 21 (VIDEOOUT, 0.22μF capacitor to GND-D).
- +45 SHIFT** and **-45 SHIFT** are connected to Pin 20 (PLL-FLT, 0.22μF capacitor to GND-D, 39k resistor to GND-D, 47μF capacitor to GND-D) and Pin 21 (VIDEOOUT, 0.22μF capacitor to GND-D).
- VCO** (Voltage-Controlled Oscillator) is connected to Pin 18 (VCC, 100μF capacitor to GND-D) and Pin 17 (VDD, 0.01μF capacitor to GND-D).
- F-COUNT** (Frequency Counter) is connected to Pin 18 (VCC, 100μF capacitor to GND-D) and Pin 17 (VDD, 0.01μF capacitor to GND-D).
- SIF TRAP** (Sound Intermediate Frequency Trap) is connected to Pin 15 (VO-4.5M, 133pF capacitor to VCC, 4.7μF capacitor to GND-D) and Pin 14 (US, open).
- SIF BPF** (Sound Intermediate Frequency Bandpass Filter) is connected to Pin 15 (VO-4.5M, 133pF capacitor to VCC, 4.7μF capacitor to GND-D) and Pin 14 (US, open).
- 500k BPF** (500kHz Bandpass Filter) is connected to Pin 15 (VO-4.5M, 133pF capacitor to VCC, 4.7μF capacitor to GND-D) and Pin 14 (US, open).
- LIM** (Limiting Amplifier) is connected to Pin 15 (VO-4.5M, 133pF capacitor to VCC, 4.7μF capacitor to GND-D) and Pin 14 (US, open).
- FM DEM** (FM Demodulator) is connected to Pin 15 (VO-4.5M, 133pF capacitor to VCC, 4.7μF capacitor to GND-D) and Pin 14 (US, open).
- AF AMP** (Audio Frequency Amplifier) is connected to Pin 11 (AF AMP, 7.5k resistor to DE.EM OUT) and Pin 12 (AFT-FB, 3.9k resistor to AFTOUT).
- AFT-FB** (Automatic Frequency Tuning Feedback) is connected to Pin 11 (AF AMP, 7.5k resistor to DE.EM OUT) and Pin 12 (AFT-FB, 3.9k resistor to AFTOUT).
- Digital AFT** (Digital Automatic Frequency Tuning) is connected to Pin 15 (VO-4.5M, 133pF capacitor to VCC, 4.7μF capacitor to GND-D) and Pin 14 (US, open).
- REF FIL** (Reference Filter) is connected to Pin 8 (REF OSC, 0.01μF capacitor to GND2) and Pin 9 (ECO, 0.01μF capacitor to GND2).
- REF OSC** (Reference Oscillator) is connected to Pin 8 (REF OSC, 0.01μF capacitor to GND2) and Pin 9 (ECO, 0.01μF capacitor to GND2).
- EQ** (Equalizer) is connected to Pin 23 (AGC-FLT, 0.1μF capacitor to GND-D) and Pin 24 (N.C.).

The IC is a 24-pin DIP package. The pin connections are as follows:

- Pin 1: N.C.
- Pin 2: AGC-ADJ (20k resistor to GND1)
- Pin 3: RF-AGC (100Ω resistor to GND1)
- Pin 4: GND1
- Pin 5: intercarrier (to SAW FILTER)
- Pin 6: 4MHz IN
- Pin 7: GND2
- Pin 8: REF OSC (0.01μF capacitor to GND2)
- Pin 9: ECO (0.01μF capacitor to GND2)
- Pin 10: AFTOUT (0.1μF capacitor to GND2)
- Pin 11: AF AMP (7.5k resistor to DE.EM OUT)
- Pin 12: AFT-FB (3.9k resistor to AFTOUT)
- Pin 13: JPN (open)
- Pin 14: US (open)
- Pin 15: VO-4.5M (133pF capacitor to VCC, 4.7μF capacitor to GND-D)
- Pin 16: GND-D
- Pin 17: VDD (0.01μF capacitor to GND-D)
- Pin 18: VCC (100μF capacitor to GND-D)
- Pin 19: FS (5.1k resistor to GND-D)
- Pin 20: PLL-FLT (0.22μF capacitor to GND-D, 39k resistor to GND-D, 47μF capacitor to GND-D)
- Pin 21: VIDEOOUT (0.22μF capacitor to GND-D)
- Pin 22: EQ (open)
- Pin 23: AGC-FLT (0.1μF capacitor to GND-D)
- Pin 24: N.C.

ROHM

● External dimensions (Units: mm)

