DATA SHEET

FM1216

Desktop video & FM radio module system B/G

Preliminary specification

Supersedes data of 1997 Mar 13

File under Tuners, DC03

1999 Nov 03

Philips
Components

PHILIPS

Desktop video & FM radio module system B/G

FM1216
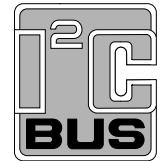
FEATURES

- System B and G, and FM radio broadcast
- True 5 V device (low power dissipation)
- Full frequency range from channel 2 (48.25 MHz) to channel 69 (855.25 MHz)
- FM radio band coverage from 87.50 MHz to 108.00 MHz
- PLL controlled tuning
- Programmable PLL step size (31.25, 50 or 62.5 kHz)
- True-synchronous vision IF demodulator (PLL)
- Ultra linear FM PLL demodulator for FM radio broadcast
- Demodulated video output, AF sound output, second IF sound output
- I^2C-bus control of tuning, address selection, AFC status information
- Complies with European regulations on radiation, signal handling and immunity *("CENELEC 55020, 55013"* and *"Amtsblatt 15/92"*)
- Small horizontally mounted metal housing.

DESCRIPTION

The FM1216 front-end is designed to receive both TV and FM stereo signals in the PC Multimedia environment. The units are available with separate 75 Ω inputs for TV and FM broadcast reception. The input connectors available are either standard phono or IEC type (female for TV, male for FM radio). The tuning, bandswitching and antenna selection are made through the I^2C-bus.

The front-end covers the TV bands from 48.25 MHz to 855.25 MHz. The FM band covers the standard 87.50 MHz to 108.00 MHz. An RDS decoder can be connected to the AF-MPX output. The FM1216 meets the input immunity and radiation requirements of CENELEC.

The FM1216 consists of a TV tuner, an FM radio tuner and an IF section, all designed on a single PCB. The front-end is assembled in a metal housing made of a rectangular tin-plated steel frame, with front and rear covers, which have soldered contacts to the frame. The two phono or IEC antenna connectors (female for TV, male for FM radio) are mounted on one side of the frame for the TV/FM signal inputs. All other connections are made via pins at the bottom.

The TV IF section uses an intercarrier SAW filter, followed by a true-synchronous vision IF demodulator (PLL) IC. The analog AFC voltage is fed to the 5-level A/D converter in the PLL tuning IC, so that the AFC status can be read via the I^2C-bus.

In the FM radio mode, the level detector and AFT functions are provide for the auto-search routines. The level detector and AFT status can be read from the A/D bits in the status-byte. The mute function is also provided to suppress the audio output signal, if required.

The tuner AGC for both TV and FM radio operation, is generated with a novel AGC detector which measures the IF signal level directly at the tuner IF output pins. As opposed to the conventional AGC detector, this new circuit allows a higher take-over level and offers superior immunity against tuner overload.

The demodulation of the TV sound and FM radio IF (10.70 MHz) is done with a PLL demodulation circuit contained in the IF IC. In the FM radio mode, the multiplexed AF signal is then channelled to a stereo decoder IC which extracts the left/right analog signals. The multiplexed audio signal is also available at pin 25 to support RDS or BTSC implementations. The second IF sound output is provided to connect external (analog 2 carrier or digital) stereo processing.

ORDERING INFORMATION

TYPE	DESCRIPTION	CATALOGUE NUMBERS
FM1216/HM/PH	standard phono	3139 147 13371
FM1216/HM/I	IEC connector	3139 147 13381

MARKING

The following items of information are printed on a sticker that is on the top cover of the tuner:

- Type number
- Code number
- Origin letter of factory
- Change code
- Year and week code.

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INTERMEDIATE FREQUENCIES

SYSTEM	FREQUENCY (MHz)
Picture carrier	38.90
Colour	34.47
Sound 1	33.40
Sound 2	33.16
NICAM	33.05
FM	10.70

CHANNEL COVERAGE

BAND	FREQUENCY (MHz)
FM radio band	87.50 to 108.00
Low band	48.25 to 170.00
Mid band	170.00 to 450.00
High band	450.00 to 855.25

PINNING

| SYMBOL	PIN	DESCRIPTION
V_T	11	tuning voltage (monitor)
$V_{S(tuner)}$	12	supply voltage tuner section +5 V
SCL	13	I^{2}C-bus serial clock
SDA	14	I^{2}C-bus serial data
AS	15	I^{2}C-bus address select
AF O/P right	20	FM radio right channel
AF O/P left	21	FM radio left channel
2nd IF sound output	22	second IF sound output
CVBS	23	Composite Video Baseband Signal (CVBS) output
$V_{S(IF)}$	24	supply voltage IF section +5 V
AF O/P	25	AF sound output
−	TH1, TH2, TH3 and TH4	mounting tags (ground)
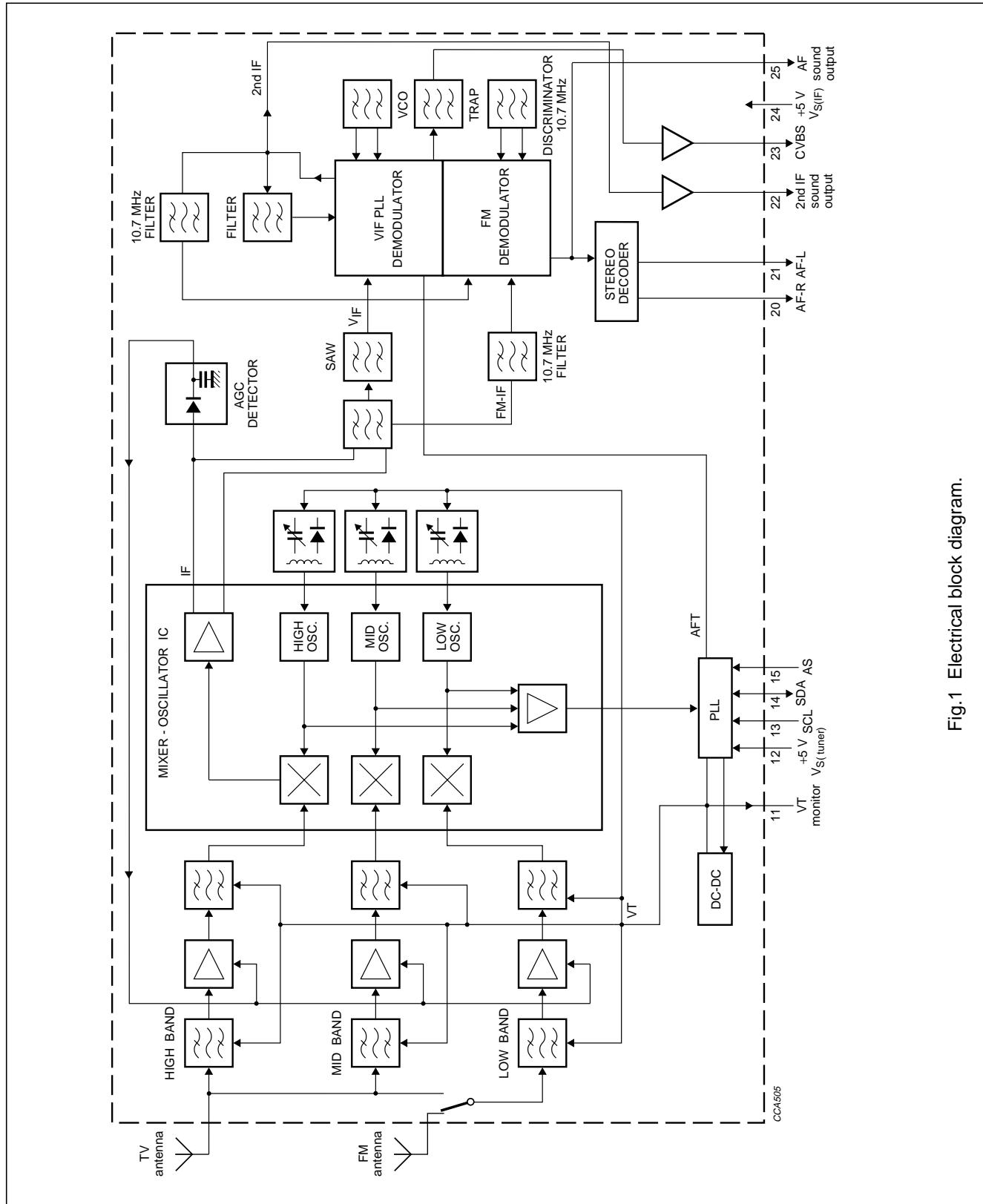
BLOCK DIAGRAM

Fig.1 Electrical block diagram.

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LIMITING VALUES

Limiting values under operational conditions

The tuner can be guaranteed to function properly under the following conditions.

SYMBOL	PARAMETER	PIN	MIN.	TYP.	MAX.	UNIT
V_S	supply voltage		4.75	5.00	5.25	V
$V_{S(ripple)}$	peak-to-peak ripple voltage susceptibility (at 5 V ±5%); note 1	12				
	20 Hz to 100 kHz		–	–	5	mV
	>100 kHz to 500 kHz		–	–	10	mV
$I_{S(tuner)}$	supply current		–	–	120	mA
V_{SCL}	SCL bus input voltage	13	–0.3	–	+5.25	V
V_{SDA}	SDA bus input voltage	14	–0.3	–	+5.25	V
I_{SDA}	SDA bus current (open collector)		–1	–	+5	mA
V_{AS}	address select voltage; note 2	15	–	–	+5.25	V
$V_{AFright(FM)}$	FM right channel DC voltage		–	1.0	–	V
$Z_{AFright(FM)}$	FM right channel load impedance parallel connected:	20				
	resistive value		–	50	–	kΩ
	capacitive value		–	9	–	pF
$V_{AFleft(FM)}$	FM left channel DC voltage		–	1.0	–	V
$Z_{AFleft(FM)}$	FM left channel load impedance:	21				
	resistive value		–	50	–	kΩ
	capacitive value		–	9	–	pF
Z_{IF}	second IF sound output load impedance	22	0.5	–	–	kΩ
Z_{CVBS}	Composite Video Baseband Signal load impedance	23	–	75	–	Ω
t_L	CVBS load time constant		–	–	100	ns
$V_{S(IF)}$	IF supply voltage	24	4.75	5.0	5.25	V
$I_{S(IF)}$	IF supply current		–	–	150	mA
Z_{AF}	AF sound output load impedance parallel connected:	25				
	resistive value		5.0	–	–	kΩ
	capacitive value		–	–	4	nF

Notes

1. Sinusoidal ripple voltage superimposed on the 5 V supply voltage in the frequency range of 20 Hz to 500 kHz. Criteria for TV interference >57 dB.

2. For detailed information about the address decoding, refer to "Application information".

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Environmental conditions

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Non-operational conditions						
T_{amb}	ambient temperature		−25	–	+85	°C
RH	relative humidity		–	–	100	%
g_B	bump acceleration	25 g	–	–	245	m/s^2
g_S	shock acceleration	50 g	–	–	490	m/s^2
	vibration amplitude	10 to 55 Hz	–	0.35	–	mm
Operational conditions						
T_{amb}	ambient temperature		−10	–	+60	°C
RH	relative humidity		–	–	95	%

OVERALL PERFORMANCE

Conditional data

Unless otherwise specified, all electrical values for "Overall performance" apply at the following conditions.

SYMBOL	PARAMETER	VALUE	UNIT
T_{amb}	ambient temperature	25 ±5	°C
RH	relative humidity	60 ±15	%
V_S	supply voltage (tuner and IF section)	5 ±0.125	V
Z_{CVBS}	video output load impedance (DC)	75	Ω
Z_{IF}	second IF sound output load impedance (DC)	0.5	kΩ
Z_{AF}	AF sound output load impedance	100	kΩ
t_{pr}	pre-heating time (+5 V at pin 24)	10	minutes
$Z_{S(AE)}$	aerial source impedance (asymmetrical)	75	Ω

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TUNER CHARACTERISTICS

For detailed information about the PLL programming, refer to "Application information".

The desktop video tuner is guaranteed to function properly within the specified operational conditions, but a certain deterioration of performance parameters may occur at the limits of the operational conditions.

Required data for test equipment to be used

EQUIPMENT	PARAMETER	VALUE	UNIT
DC voltmeter	input impedance	>1	MΩ
Oscilloscope	input impedance:		
	resistance	>1	MΩ
	capacitance	<15	pF
Spectrum analyzer	input impedance	50	Ω
FET probe	input impedance:		
	resistance	1	MΩ
	capacitance	3.5	pF
	output impedance	50	Ω
	voltage gain	0	dB
AC millivoltmeter	input impedance	>100	kΩ

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Fig.2 Typical test set-up.
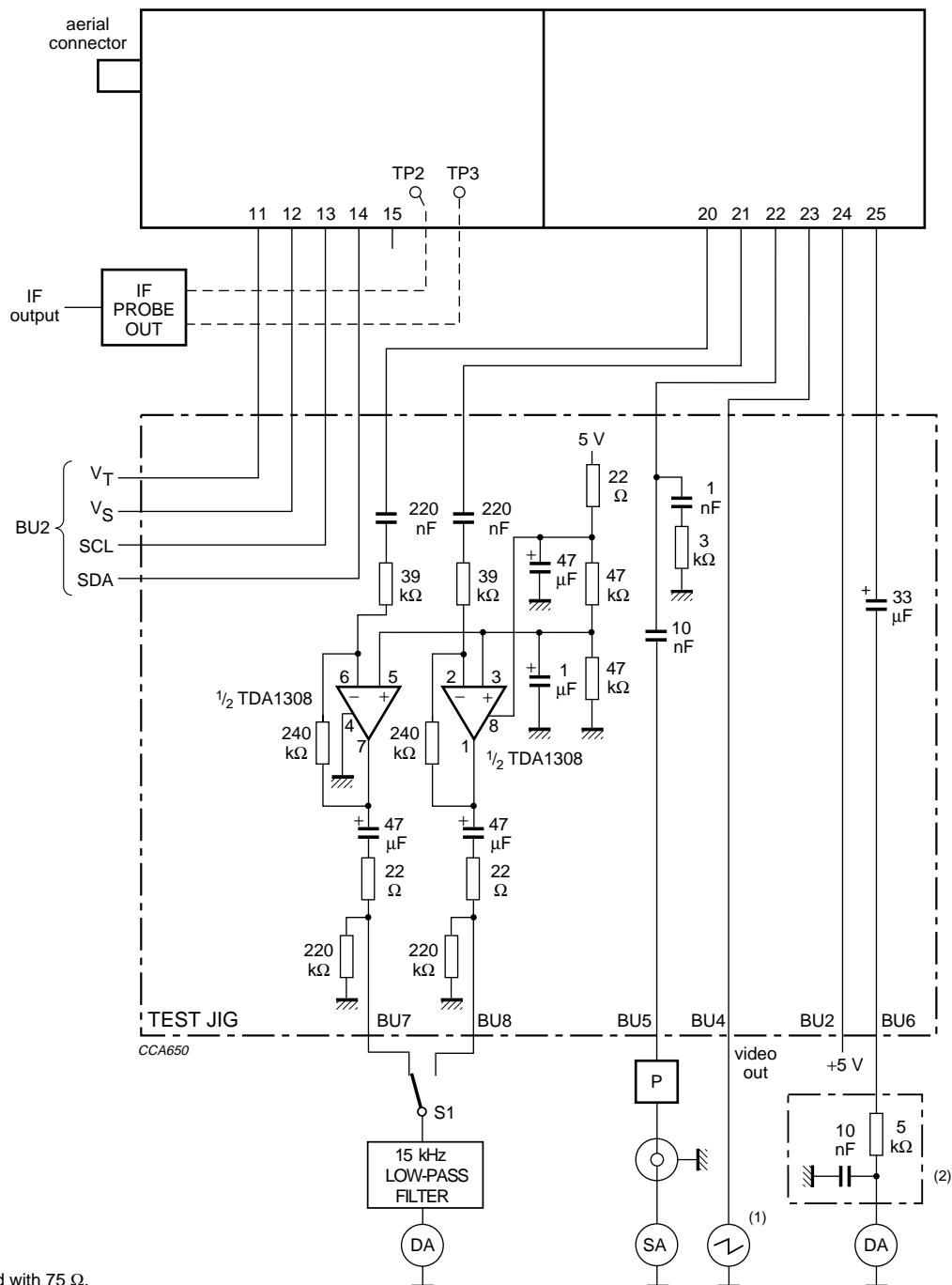
(1)   BU4 loaded with 75 Ω.

(2)   50 µs de-emphasis.

SA = Spectrum Analyzer.

P = FET probe.

DA = Distortion Analyzer.

The minimum load impedance required at the CVBS output (pin 23) is 75 Ω (both AC and DC).

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Definitions of test signals (see Fig.2)

TEST SIGNAL	FREQ. (MHz)	AMPLITUDE	MODULATION	
			VIDEO	**AUDIO**
A0: unmodulated vision carrier	480.25	60 dBμV		
A1: RF B, G standard signal with video modulation	480.25	60 dBμV (top sync)	100% (rest carrier 10%) 2T pulse and bar	
B1: unmodulated sound carrier B, G system	485.75	−13 dB w.r.t. A0 to A1		
B2: FM modulated sound carrier B, G system	485.75	−13 dB w.r.t. A0 to A1		1 kHz; modulation frequency deviation ±25 kHz; 50 μs pre-emphasis
B3: unmodulated sound carrier B, G system	478.75	−13 dB w.r.t. A0 to A1		
C1: FM modulated sound carrier	98.00	60 dBμV		1 kHz; modulation frequency deviation ±22.5 kHz
C2: FM modulated sound carrier	97.70 or 98.30	60 dBμV		1 kHz; modulation frequency deviation ±22.5 kHz
C3: FM modulated sound carrier	98.00	60 dBμV		1 kHz; modulation frequency deviation ±75 kHz; 10% pilot carrier (L = R); 50 μs pre-emphasis

Aerial input characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
VSWR	reflection coefficient	referred to 75 Ω impedance (worst case on or between picture and sound carrier at maximum gain):			
		all channels in TV mode	–	5	
		FM (centre of channel)	–	4	
V_{PSM}	surge protection voltage		5	–	kV
V_{ant}	antenna connection disturbance voltage	<1.75 GHz	–	46	dBμV

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General characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT

f_b	frequency range:
	   FM band
	   low band
	   mid band
	   high band
			87.50
			48.25
			175.25
			455.25
				–
				–
				–
				–
					108.00
					168.25
					447.25
					855.25
						MHz
						MHz
						MHz
						MHz

Δf_b	margin:
	   for FM band
	   for low band
	   for mid/high band
			3
			1.5
			3
				–
				–
				–
					–
					–
					–
						MHz
						MHz
						MHz

α_i	image rejection (nominal gain to 10 dB gain reduction):
	   low band
	   mid band
	   mid band
	   high band (channel 14 to 69)
		
		<300 MHz
		>300 MHz
		
			68
			66
			60
			50
				
				–
				–
				–
				–
					
					–
					–
					–
					–
						
						dB
						dB
						dB
						dB

α_{IF}	IF rejection (picture)		60	–	–	dB

Z_{IF}	$\frac{1}{2}$ IF susceptibility:
	   low, mid band
	   high band
			
			75
			60
				
				–
				–
					
					–
					–
						
						dBμV
						dBμV

m_x	cross modulation:
	   in-channel
	   in-band
	   low band (n ±2)
	   mid band (n ±3)
	   high band (n ±5)
	   out of band
			
			65
			
			78
			78
			84
			–
				
				–
				
				–
				–
				–
				100
					
					–
					
					–
					–
					–
					–
						
						dBμV
						
						dBμV
						dBμV
						dBμV
						dBμV

	breakthrough susceptibility: channel 2 to 69		 60	 –	 –	 dBμV
V_{osc}	oscillator voltage at all pins		–	–	70	dBμV
t_{li}	oscillators lock-in time	charge pump set logic HIGH	–	–	150	ms
α_{vs}	the video signal-to-sound interference ratio with the tuner exposed to sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 μPa)		40	–	–	dB
	audio S/N ratio		40	–	–	dB
V_{ESD}	electrostatic discharge (ESD) on all pins	note 1	2	–	–	kV

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
FM radio characteristics						
$\alpha26$	limiting sensitivity for (S+N)/N	test signal C1	–	7	30	dBµV
$\alpha50$		test signal C3	–	30	40	dBµV
S/N	S/N ratio: mono at f = 22.5 kHz mono at f = 75 kHz stereo	test signal C1 test signal C3	 50 55 55	 58 63 63	 – – –	 dB dB dB
$\alpha_{i(FM)}$	FM image rejection	test signal C1	53	65	–	dB
	effective selectivity S_{300}	test signal C1 + C2	50	–	–	dB
	frequency response: lower –3 dB point upper –3 dB point	test signal C3; –3 dB points	 – 14	 20 18	 40 –	 Hz kHz
	AM suppression	test signal C1	38	–	–	dB
	FM AF output level at terminal 20/21 (RMS value): mono stereo	 test signal C1 test signal C3	 40 120	 57 175	 74 230	 mV mV
	stereo separation	test signal C3; 1 kHz	28	35	–	dB
THD	total harmonic distortion: stereo at 1 kHz during overmodulation at f = ±100 kHz	test signal C3	 – –	 0.8 1.5	 1.5 3	 % %

Note

1. All the pins of the desktop video tuner are protected against electrostatic discharge (ESD) up to 2 kV. The product is classified in category B *("MIL-STD-883C")*.

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Video and audio characteristics (see Fig.2)

PARAMETER	TEST SIGNAL	TEST POINT	MIN.	TYP.	MAX.	UNIT
CVBS characteristics:						
video amplitude signal at pin 23	A1 (peak-to-peak value)	BU4	0.75	0.95	1.15	V
DC level sync pulse at pin 23	A1	BU4	–	0.7	–	V
Video amplitude drop with respect to modulation 1 MHz at T_{amb} = 45 °C:						
at 2 MHz	A1	BU4	−1.5	–	+1.5	dB
at 3 MHz	A1	BU4	−2.5	–	+1.5	dB
at 4 MHz	A1	BU4	−4.0	–	+2.0	dB
at 4.43 MHz	A1	BU4	−4.0	–	+2.0	dB
Sound carrier rejection	A1 (1 MHz) + B1	BU4	40	–	–	dB
Residual 40.40 MHz signal in video channel: level of 1.5 MHz	A1 + B3	BU4	–	–	68	dBµV
Residual 77.8 MHz signal in video channel	A1	BU4	–	–	80	dBµV
Second IF sound output level at level of 5.5 MHz	A1 (black) + B1	BU5	84	–	–	dBµV
Test on 2T pulse at T_{amb} = 45 °C:						
2T pulse/bar response	A1	BU4	−2.8	–	+2.8	%
2T pulse response	A1	BU4	–	–	+3.5	%
CVBS S/N (unweighted)	A1 + B1	BU4	41	–	–	dB
Gain limited sensitivity at 1 dB reduction of video output	A1	BU4	–	–	30	dBµV
Maximum usable single input signal	A1	BU4	90	–	–	dBµV
Audio characteristics:						
AF output level measured via LP 200 kHz filter, RMS detector, 50 µs de-emphasis	A1 + B2	BU6	250	350	450	mV
THD (Total Harmonic Distortion) measured via LP 200 kHz filter, RMS detector, 50 µs de-emphasis	A1 + B2	BU6	–	–	0.5	%
S/N measured via CCIR filter, peak CCIR detector, 50 µs de-emphasis	A1 (full field colour bar) + B1	BU6	38	–	–	dB
AM suppression ratio	A1 (black) + B2	BU6	40	–	–	dB
Aerial input level for S/N = 41 dB	A1 (black) + B2	BU6	–	–	45	dBµV

Digital AFC status

ADC word at I^2C-bus during read operation.

DIGITAL READ-OUT	FREQUENCY (kHz)
00	−125
01	−62.5
02	0
03	+62.5
04	+125

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APPLICATION INFORMATION

A detailed description of the I²C-bus specification, with applications, is given in brochure *"The I²C-bus and how to use it".* This brochure may be ordered using the code number 9398 393 40011.

WRITE mode

BYTE	BITS								
	7 MSB	6	5	4	3	2	1	0 LSB	$A^{(1)}$
Address byte	1	1	0	0	0	MA1	MA0	0	A
Program divider byte 1	0	n14	n13	n12	n11	n10	n9	n8	A
Program divider byte 2	n7	n6	n5	n4	n3	n2	n1	n0	A
Control information byte 1	1	CP	T2	T1	T0	RSA	RSB	OS	A
Control information byte 2	P7	P6	P5	P4	P3	P2	P1	P0	A

Note

1. A = Acknowledge.

ADDRESS SELECTION

V_S = +5 V (PLL supply voltage).

MA1	MA0	ADDRESS	VOLTAGE AT PIN 15 (see note 1)
0	0	C0	$0.0V_S$ to $0.1V_S$
0	1	C2	$0.2V_S$ to $0.3V_S$
1	0	C4	$0.4V_S$ to $0.6V_S$
1	1	C6	$0.9V_S$ to $1.0V_S$

Note

1. If the AS pin is left floating, the internal bias will automatically set the address to C2.

PROGRAMMABLE DIVIDER SETTINGS (BYTES 1 AND 2)

Divider ratio:

$N = 16 \times \{f_{RF(pc)} + f_{IF(pc)}\}$, where (pc) is picture carrier and f_{RF} and f_{IF} are expressed in MHz.

$f_{osc} = {}^N/_{16}$ (MHz).

$N = (2^{13} \times n13) + (2^{12} \times n12) + (2^{11} \times n11) + (2^{10} \times n10) + (2^9 \times n9) + (2^8 \times n8) + (2^7 \times n7) + (2^6 \times n6) + (2^5 \times n5) + (2^4 \times n4) + (2^3 \times n3) + (2^2 \times n2) + (2 \times n1) + n0$

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CONTROL BYTE

Charge pump settings:

CP = 1, for fast tuning

CP = 0, for moderate speed tuning with slightly better residual oscillator FM.

It is recommended to set CP = 1 at all times in the TV mode. In the FM radio mode, set CP = 1 only during the search tuning. Once the wanted channel is obtained, set CP = 0 to get the best signal-to-noise ratio.

Test mode settings:

T2 = T1 = 0; T0 = 1, for normal operation.

PLL disabling:

OS = 0, for normal operation

OS = 1, for switching the charge pump to the high impedance state. I_{DC} output voltage is LOW.

Ratio select bits

RSA	RSB	STEP SIZE
X	0	50 kHz (for FM band)
0	1	31.25 kHz (for slow picture search)
1	1	62.5 kHz (for normal picture search)

PORTS BYTE

FUNCTION	BIT							
	P7	**P6**	**P5**	**P4**	**P3**	**P2**	**P1**	**P0**
TV/FM bandswitching								
FM band	1	0	1	0		1		
Low band	1	0	1	0		0		
Mid band	1	0	0	1		0		
High band	0	0	1	1		0		
TV mode								
Power down mode; see note 1					0	0	0	1
System B, G negative mode					0	0	0	0
FM radio mode								
AFC; see note 2					0	1	0	1
R_{IF}; see note 3					0	1	0	0
Mono					0	1	1	0
Mute					1	1	0	0

Notes

1. If the TV function is not required, the tuner can be switched to power-down mode. In this mode the tuner reduces the current consumption by up to 100 mA.

2. By this setting the FM radio AFC status can be read from the A/D bits in the status byte.

3. By this setting the RF input level can be read from the A/D bits in the status byte.

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TELEGRAM EXAMPLES (WRITE MODE)

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb - Ack - Pb - Ack - Stop.

Start - Adb - Ack - Cb - Ack - Pb - Ack - Db1 - Ack - Db2 - Ack - Stop.

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb - Ack - Stop.

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Stop.

Where:

   Start = start condition

   Adb = address byte

   Ack = acknowledge

   Db1 = divider byte 1

   Db2 = divider byte 2

   Cb = control byte

   Pb = ports byte

   Stop = stop condition.

READ mode

The in-lock can be read by setting the R/W bit to 1.

BYTE	BITS								
	7 MSB	6	5	4	3	2	1	0 LSB	A[5]
Address byte	1	1	0	0	0	MA1	MA0	1	A
Status byte	POR[1]	FL[2]	I2[3]	I1[3]	I0[3]	A2[4]	A1[4]	A0[4]	A

Notes

1. POR = Power On Reset. POR is internally set to 1 in case V_S drops below 3 V. The POR bit is reset when an end of data is detected by the PLL IC.

2. FL = In-lock flag; FL = 1: loop is phase-locked. The loop must be phase-locked during at least 8 periods of the internal reference frequency (either 7.8125 kHz, 3.90625 kHz or 6.25 kHz) before the FL flag is internally set to 1.

3. I2, I1 and I0 = digital information for I/O ports P2, P1 and P0 respectively.

4. A2, A1 and A0 = built-in 5-level A/D converter on the internal I/O port P6 (see Table "Digital AFC status").

5. A = Acknowledge.

TELEGRAM EXAMPLES (READ MODE)

Start - Adb - Ack - STB - Ack - STB - - Stop (no Ack from processor = End-of-data).

Start - Adb - Ack - STB - - Stop (no Ack from processor = End-of-data).

Where:

   STB = Status byte.

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Fig.3 I²C-bus load.
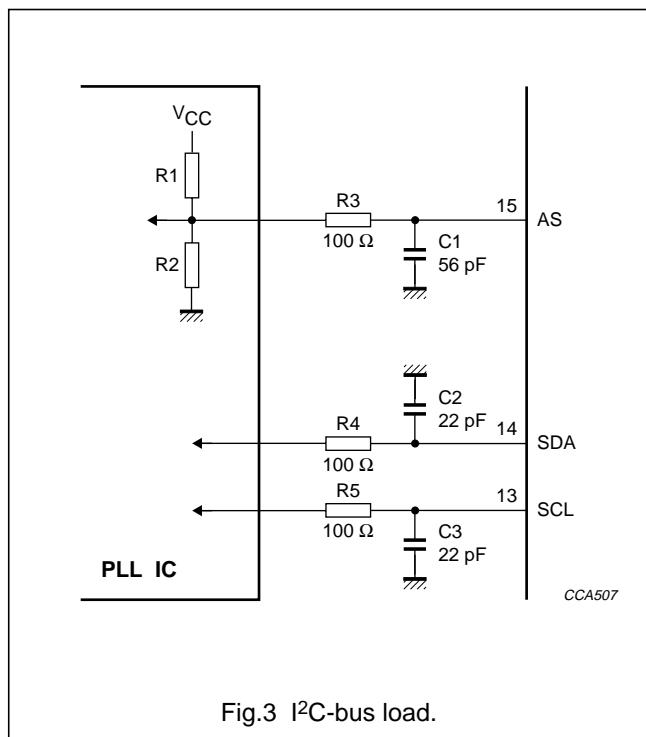
Video buffer

A video buffer is built into the video module to enable the unit to drive a 75 Ω load directly.

TV mono sound

The AF/MPX signal is also tapped to the FM stereo decoder. In the absence of a 19 kHz pilot signal for FM radio, the stereo decoder will remain in the mono mode. So the TV mono sound can also be obtained from pins 20 and 21 (both identical mono signal), but the output level will be lower (≈80 mV) than from pin 25 (≈250 mV).

Therefore TV mono sound can also be taken from pins 20 and 21.

I²C-bus load

The FM1216 contains a series resistor (R = 100 Ω) in the SCL and SDA lines. Both lines also have a capacitive load of typical 22 pF (see Fig.3).

Fig.4 Typical video signal-to-noise ratio versus RF input level.
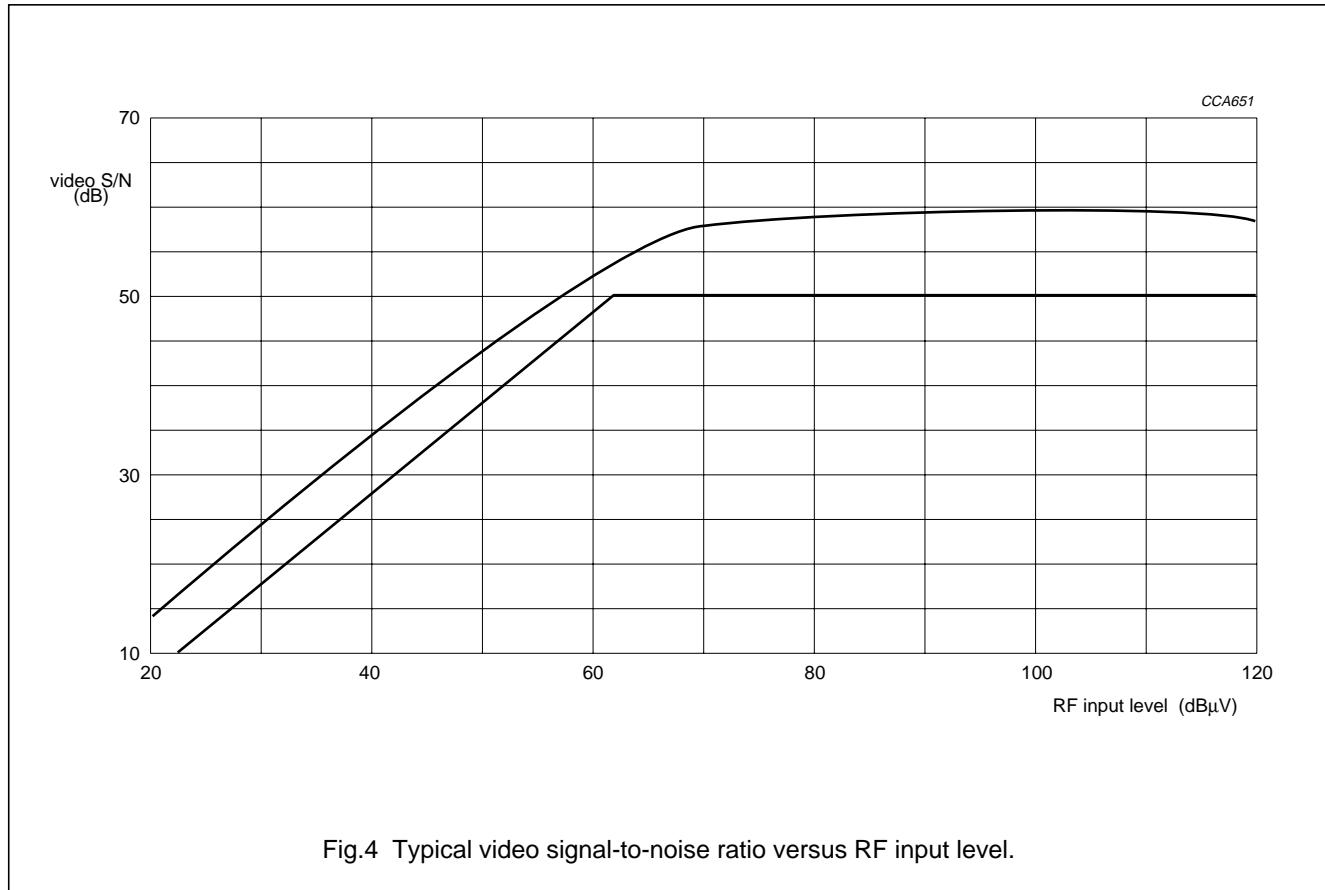
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MECHANICAL DATA
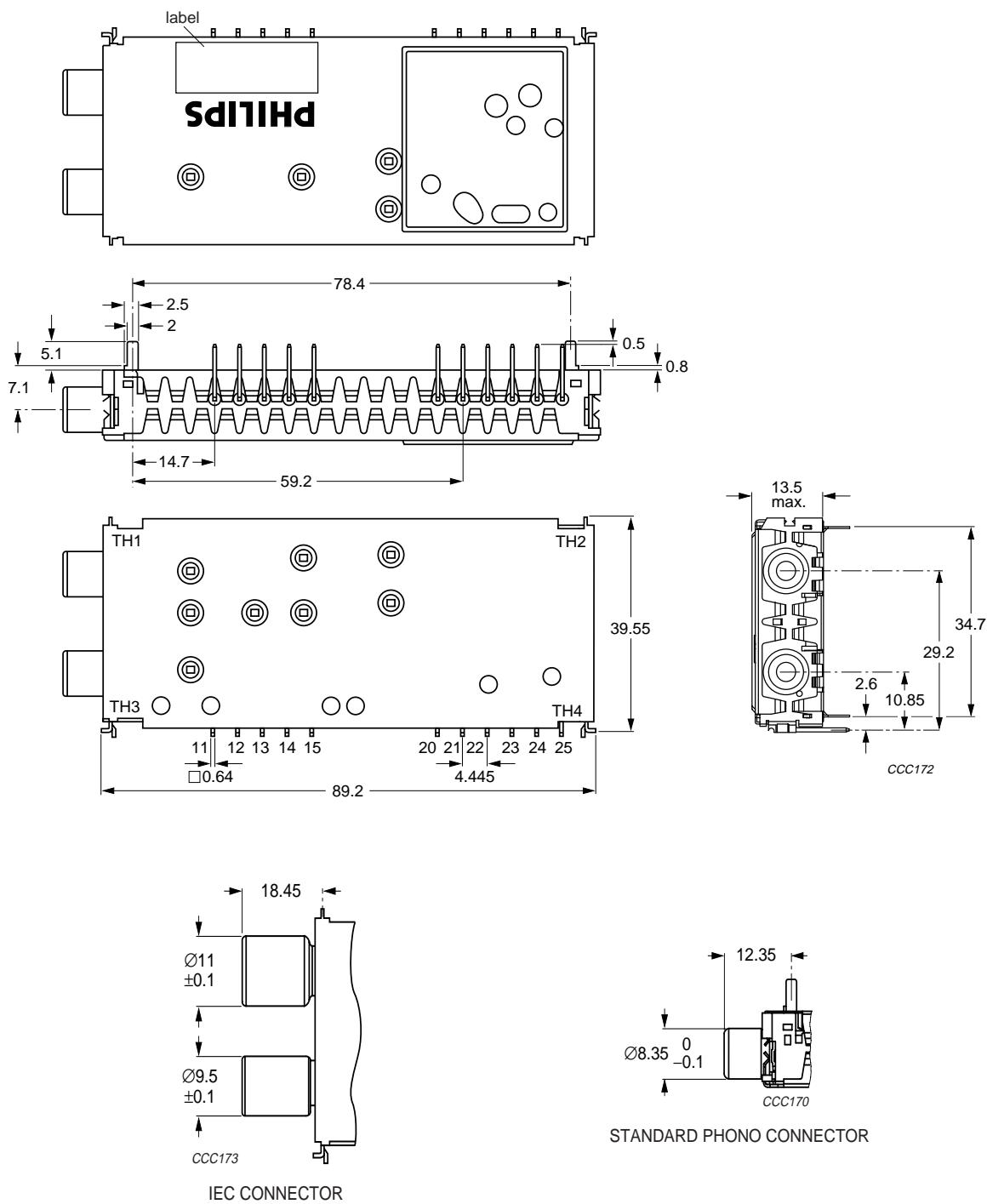
Fig.5 Mechanical outline and connector detail.

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Aerial connections

Standard-phono socket female 75 Ω or IEC (female for TV,
male for FM radio).

Solderability

The solderability of pins and mounting tags when tested
initially and after 16 hours steam ageing in accordance
with *"IEC 60068-2-20"*, test Ta, method 1 (solder bath
235 ±5 °C for 2 ±5 s), results in a wetted area of 95%.
No de-wetting will occur when soldered at
260 ±5 ° C for 5 ±0.5 s.

Resistance to soldering heat

The product will not be damaged when tested in
accordance with *"IEC 60068-2-20"*, test Tb, method 1A
(solder bath 260 ±5 °C for 5 ±1 s).

Mass

Approximately 50 g.

Robustness of pins

The pins will not be damaged when tested in accordance
with *"IEC 60068-2-21"* of which the following tests are
applied:

• Test Ua1, tensile of 20 N in axial direction

• Test Ua2, thrust of 4 N in axial direction

Punching pattern of chassis PCB

Field rejects are often related to broken tag joints.
Therefore, the following punching pattern is recommended
(see Fig.6).
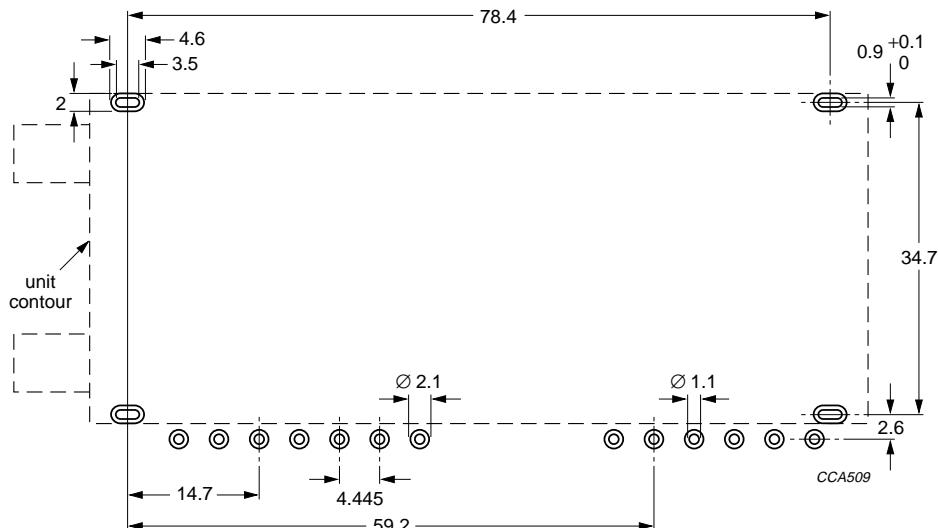
Fig.6 Punching pattern seen from solder side.

Desktop video & FM radio module
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TV CHANNEL FREQUENCIES (MHz)

CCIR cable

Vision IF = 38.90 MHz; sound IF = 33.40 MHz.

CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY	CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY
E2	47-54	48.25	53.75	S15	258-265	259.25	264.75
E3	54-61	55.25	60.75	S16	265-272	266.25	271.75
E4	61-68	62.25	67.75	S17	272-279	273.25	278.75
S01	68-75	69.25	74.75	S18	279-286	280.25	285.75
S02	75-82	76.25	81.75	S19	286-293	287.25	292.75
S03	82-89	83.25	88.75	S20	293-300	294.25	299.75
S1	104-111	105.25	110.75	S21	302-310	303.25	308.75
S2	111-118	112.25	117.75	S22	310-318	311.25	316.75
S3	118-125	119.25	124.75	S23	318-326	319.25	324.75
S4	125-132	126.25	131.75	S24	326-334	327.25	332.75
S5	132-139	133.25	138.75	S25	334-342	335.25	340.75
S6	139-146	140.25	145.75	S26	342-350	343.25	348.75
S7	146-153	147.25	152.75	S27	350-358	351.25	356.75
S8	153-160	154.25	159.75	S28	358-366	359.25	364.75
S9	160-167	161.25	166.75	S29	366-374	367.25	372.75
S10	167-174	168.25	173.75	S30	374-382	375.25	380.75
E5	174-181	175.25	180.75	S31	382-390	383.25	388.75
E6	181-188	182.25	187.75	S32	390-398	391.25	396.75
E7	188-195	189.25	194.75	S33	398-406	399.25	404.75
E8	195-202	196.25	201.75	S34	406-414	407.25	412.75
E9	202-209	203.25	208.75	S35	414-422	415.25	420.75
E10	209-216	210.25	215.75	S36	422-430	423.25	428.75
E11	216-223	217.25	222.75	S37	430-438	431.25	436.75
E12	223-230	224.25	229.75	S38	438-446	439.25	444.75
S11	230-237	231.25	236.75	S39	446-454	447.25	452.75
S12	237-244	238.25	243.75	S40	454-462	455.25	460.75
S13	244-251	245.25	250.75	S41	462-470	463.25	468.75
S14	251-258	252.25	257.75				

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CCIR B/G

Vision IF = 38.90 MHz; sound IF = 33.40 MHz.

CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY	CHANNEL	FREQ. RANGE	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY
2	47-54	48.25	53.75	40	622-630	623.25	628.75
3	54-61	55.25	60.75	41	630-638	631.25	636.75
4	61-68	62.25	67.75	42	638-646	639.25	644.75
5	174-181	175.25	180.75	43	646-654	647.25	652.75
6	181-188	182.25	187.75	44	654-662	655.25	660.75
7	188-195	189.25	194.75	45	662-670	663.25	668.75
8	195-202	196.25	201.75	46	670-678	671.25	676.75
9	202-209	203.25	208.75	47	678-686	679.25	684.75
10	209-216	210.25	215.75	48	686-694	687.25	692.75
11	216-223	217.25	222.75	49	694-702	695.25	700.75
12	223-230	224.25	229.75	50	702-710	703.25	708.75
21	470-478	471.25	476.75	51	710-718	711.25	716.75
22	478-486	479.25	484.75	52	718-726	719.25	724.75
23	486-494	487.25	492.75	53	726-734	727.25	732.75
24	494-502	495.25	500.75	54	734-742	735.25	740.75
25	502-510	503.25	508.75	55	742-750	743.25	748.75
26	510-518	511.25	516.75	56	750-758	751.25	756.75
27	518-526	519.25	524.75	57	758-766	759.25	764.75
28	526-534	527.25	532.75	58	766-774	767.25	772.75
29	534-542	535.25	540.75	59	774-782	775.25	780.75
30	542-550	543.25	548.75	60	782-790	783.25	788.75
31	550-558	551.25	556.75	61	790-798	791.25	796.75
32	558-566	559.25	564.75	62	798-806	799.25	804.75
33	566-574	567.25	572.75	63	806-814	807.25	812.75
34	574-582	575.25	580.75	64	814-822	815.25	820.75
35	582-590	583.25	588.75	65	822-830	823.25	828.75
36	590-598	591.25	596.75	66	830-838	831.25	836.75
37	598-606	599.25	604.75	67	838-846	839.25	844.75
38	606-614	607.25	612.75	68	846-854	847.25	852.75
39	614-622	615.25	620.75	69	854-862	855.25	860.75

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Italy

Vision IF = 38.90 MHz; sound IF = 33.40 MHz.

CHANNEL	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY
A	53.75	59.25
B	62.25	67.75
C	82.25	87.75
D	175.25	180.75
E	183.75	189.25
F	197.25	192.75
G	201.25	206.75
H	210.25	215.75
H1	217.25	222.75
H2	224.25	229.75

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

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