ELFA

PRODUKTINFORMATION

ELFA artikelnr.   **Antal sidor: 20**
73-104-85 UV1316/IEC TV-tuner

DATA SHEET

UV1316

VHF/UHF television tuner

Preliminary specification

File under BU Tuners, DC03

1996 Oct 10

PHILIPS

VHF/UHF television tuner UV1316

FEATURES

- Member of the UV1300 family small sized UHF/VHF tuners
- Systems CCIR: B/G, H, L, L', I and I'; OIRT: D/K
- Digitally controlled (PLL) tuning via I²C-bus
- Off-air channels, S-cable channels and Hyperband
- Globally standardized mechanical dimensions and global standard pinning
- Compact size
- Complies to *"CENELEC EN55020"* and *"EN55013"*.

DESCRIPTION

The UV1316 tuner belongs to the UV1300 family of tuners, which are designed to meet a wide range of applications. It is a combined VHF, UHF tuner suitable for CCIR systems B/G, H, L, L', I and I'. The low IF output impedance has been designed for direct drive of a wide variety of saw filters with sufficient suppression of triple transient.

The tuners comply with the requirements of radiation, signal handling capability and immunity conforming with:

- CISPR 13 (1990) incl. amendment 1 (1992) and amendment 2 (1993)
- European standards CENELEC EN55013, EN55020.

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.

ORDERING INFORMATION

TYPE	DESCRIPTION	ORDER NUMBERS
UV1316/I	IEC; symmetrical IF output	3139 147 13171
UV1316AS/I	IEC; asymmetrical IF output	3139 147 13191
UV1316/PH	standard phono; symmetrical IF output	3139 147 13161
UV1316AS/PH	standard phono; asymmetrical IF output	3139 147 13181

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INTERMEDIATE FREQUENCIES

SIGNAL	FREQUENCY[1] (MHz)					
	SYSTEM B/G, H	SYSTEM L	SYSTEM L'	SYSTEM D/K	SYSTEM I	SYSTEM I'
Picture carrier	38.90	38.90	33.40	38.90	39.50	38.90
Colour	34.47	34.47	37.83	34.62	35.07	34.47
Sound 1	33.40	32.40	39.90	32.40	33.50	32.90
Sound 2 (if applicable)	33.16	–	–	–	33.00	32.40

Note

1. The oscillator frequency is above the input signal frequency.

CHANNEL COVERAGE

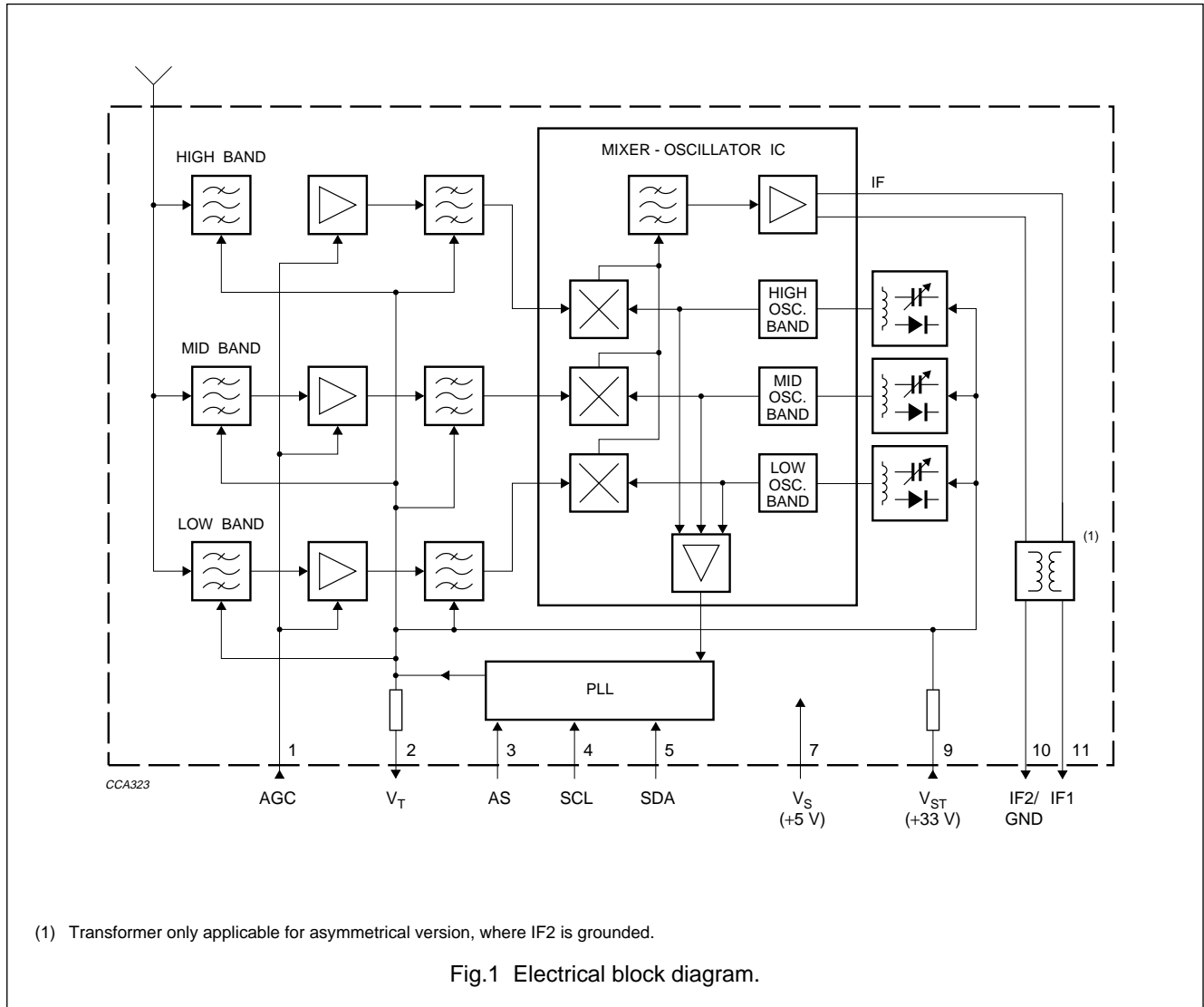| BAND	OFF-AIR CHANNELS		CABLE CHANNELS	
	CHANNELS	FREQUENCY RANGE (MHz)	CHANNELS	FREQUENCY RANGE (MHz)
Low band	E2 to C	48.25 to 82.25[1]	S01 to S10	69.25 to 168.25
Mid band	E5 to E12	175.25 to 224.25	S11 to S39	231.25 to 447.25
High band	E21 to E69	471.25 to 855.25[2]	S40 to S41	455.25 to 463.25

Notes

1. Enough margin is available to tune down to 45.25 MHz.

2. Enough margin is available to tune up to 863.25 MHz.

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BLOCK DIAGRAM

(1) Transformer only applicable for asymmetrical version, where IF2 is grounded.

Fig.1 Electrical block diagram.

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PINNING

SYMBOL	PIN	DESCRIPTION
AGC	1	gain control voltage
V_T	2	tuning voltage
AS	3	I²C-bus address select
SCL	4	I²C-bus serial clock
SDA	5	I²C-bus serial data
n.c.	6	not connected
V_S	7	PLL supply voltage +5 V
n.c.	8	not connected
V_{ST}	9	tuner supply voltage +33 V
IF2/GND	10	UV1316: symmetrical IF output; UV1316AS: ground
IF1	11	UV1316: symmetrical IF output; UV1316AS: asymmetrical IF output
GND	TH1, TH2, TH3 and TH4	mounting tags (ground)

LIMITING VALUES

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/s²
g_S	shock acceleration	50 g	–	–	490	m/s²
	vibration amplitude	10 to 55 Hz	–	0.35	–	mm
Operational conditions						
T_{amb}	ambient temperature		−10	–	+60	°C
RH	relative humidity		–	–	95	%

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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	7	4.75	5.00	5.50	V
$V_{S(ripple)}$	peak-to-peak ripple voltage susceptibility; note 1		–	–	28.5	mV
I_S	supply current		–	–	130	mA
V_{ST}	supply voltage	9	30	33	35	V
$V_{ST(ripple)}$	peak-to-peak ripple voltage susceptibility		–	–	10	mV
I_{ST}	supply current		–	–	1.7	mA
V_{AGC}	AGC input voltage	1	–	4.0	4.5	V
ΔV_{AGC}	AGC input voltage range		0.3	–	4.0	V
I_{AGC}	AGC input current		–	–	20	μA
V_{AS}	address select input voltage	3	–	–	5.5	V
V_{SCL}	serial clock input voltage	4	–0.3	–	5.5	V
V_{SDA}	serial data input voltage	5	–0.3	–	5.5	V
I_{SDA}	serial data input current		–1	–	5	mA

Note

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.

ELECTRICAL DATA

Conditional data

Unless otherwise specified, all electrical values for Chapter "Electrical data" apply at the following conditions and the electrical performance is related to system B,G and H.

A proper function is guaranteed within the specified operational conditions but a certain deterioration of performance parameters may occur at the limits of the operational conditions.

SYMBOL	PARAMETER	VALUE	UNIT
T_{amb}	ambient temperature	25 ±5	°C
RH	relative humidity	60 ±15	%
V_S	supply voltage	5.0 ±0.125	V
V_{AGC}	AGC input voltage	4.0 ±0.1	V
V_{ST}	tuning voltage	33 ±0.5	V
t_{pr}	pre-heating time (+5 V at pin 7)	10	minute
$Z_{S(AE)}$	aerial source impedance (unbalanced)	75	Ω

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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)	–	5	
V_{PSM}	surge protection voltage		5	–	kV
V_{ant}	antenna connection disturbance voltage	<1.75 GHz; complies to *"EN55013 section 3.3"*	–	46	dBμV

General characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f_b	frequency range:					
	low band		48.25	–	170.00	MHz
	mid band		170.00	–	450.00	MHz
	high band		450.00	–	855.25	MHz
Δf_b	margin:					
	for low band		±1	–	–	MHz
	for mid/high band		±3	–	–	MHz
G_V	voltage gain:					
	all channels		38	44	50	dB
	gain taper (off-air channels)		–	–	8	dB
	noise:					
	low band		–	6	9	dB
	mid band		–	6	9	dB
	high band		–	6	9	dB
ΔV_{AGC}	AGC input voltage range:					
	VHF off-air channels		40	65	–	dB
	cable channels		35	60	–	dB
	high band		30	50	–	dB
α_i	image rejection (nominal gain to 10 dB gain reduction):					
	low and mid band	<300 MHz	70	75	–	dB
	mid band	>300 MHz	60	75	–	dB
	high band		50	75	–	dB
α_{IF}	IF rejection (picture)		60	80	–	dB
Z_{IF}	½ IF susceptibility:					
	channel E2 to E12		75	90	–	dBμV
	channel E21 to E69		60	80	–	dBμV

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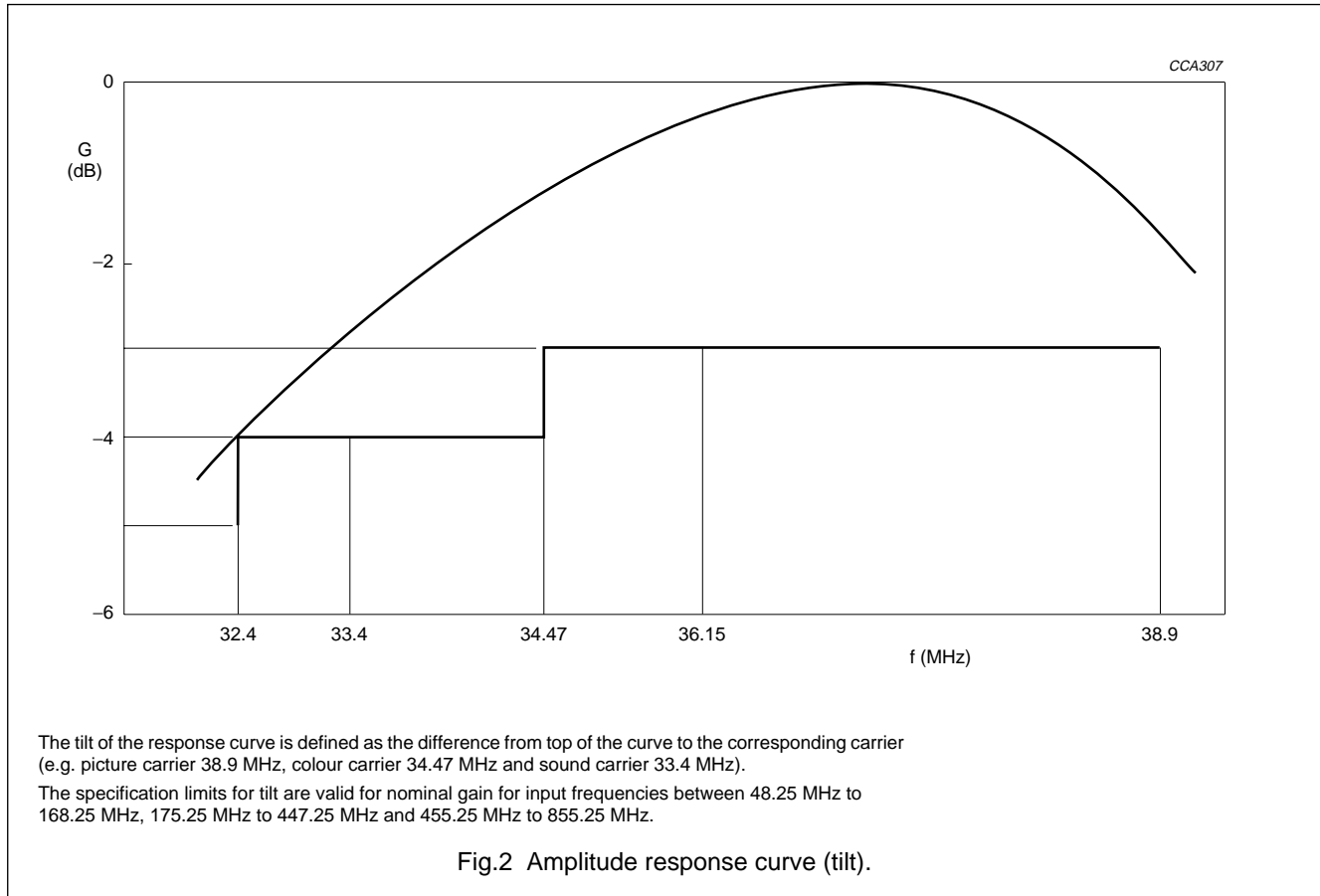| SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
α_S	sound-chrominance moiré rejection:					
	off-air	up to 40 dB gain reduction	56	65	–	dB
	UHF	up to 30 dB minimum gain reduction	56	75	–	dB
	breakthrough susceptibility		60	–	–	dBμV
m_x	cross modulation:					
	in-channel		68	–	–	dBμV
	in-band					
	low band (n ±2)		80	–	–	dBμV
	mid band (n ±3)		80	–	–	dBμV
	high band (n ±5)		84	–	–	dBμV
	out of band		–	100	–	dBμV
V_{osc}	oscillator voltage:					
	IF pin		–	–	85	dBμV
	all other pins		–	–	70	dBμV
	overloading:					
	1 dB gain compression		74	81	–	dB
	detuning of oscillator at +300 to −1000 kHz		80	100	–	dB
	PLL lock-out		90	–	–	dB
	pulling	10 kHz	68	–	–	dB
	tuning system interference:					
	crystal harmonics interference rejection at IF output		54	–	–	dB
	divider interference rejection at IF output	input level 50 dBμV	57	–	–	dB
	residual carrier FM caused by I^2C-bus cross-talk		–	–	5	kHz
V_{ESD}	electrostatic discharge (ESD) on all pins	note 1	2	–	–	kV
	oscillator characteristics:					
	oscillator tuning resolution		–	–	±250	kHz
	oscillator instability	V_S = 5 V ±10%; T_{amb} = 0 to 60 °C	–	–	±500	kHz
	lock-in time		–	–	150	msec

Note

1. All the pins of the 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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AMPLITUDE RESPONSE

CCA307

The tilt of the response curve is defined as the difference from top of the curve to the corresponding carrier (e.g. picture carrier 38.9 MHz, colour carrier 34.47 MHz and sound carrier 33.4 MHz).

The specification limits for tilt are valid for nominal gain for input frequencies between 48.25 MHz to 168.25 MHz, 175.25 MHz to 447.25 MHz and 455.25 MHz to 855.25 MHz.

Fig.2 Amplitude response curve (tilt).

Visibility test (input immunity and immunity from radiated fields)

The tuners meet the requirements of the european norm *"EN55020"*, when measured in an adequate television receiver.The AGC must be adjusted such that the picture carrier level (top sync.) at the tuner output does not exceed 105 dBμV at an input signal level of 74 dBμV or greater.

Radiation

The tuners meet the requirements of the european norm *"EN55013"* and *"CISPR13"* (1990), when measured in an adequate television receiver.

Microphony

For sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 μPa), the video signal to sound interference ratio will be greater than 40 dB.

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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								A[1]
	7 MSB	6	5	4	3	2	1	0 LSB	
Address byte	1	1	0	0	0	MA1	MA0	R/W[2]	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	0	0	1	1	1	0	A
Control information byte 2	P7	P6	P5	P4	P3	P2	P1	P0	A

Notes

1. A = Acknowledge.

2. R/W bit = 0 for WRITE mode, R/W bit = 1 for READ mode.

ADDRESS SELECTION

V_S = +5 V (PLL supply voltage); for all UV1316 tuner types, the AS input (pin 3) is left floating.

MA1	MA0	ADDRESS	VOLTAGE AT PIN 3
0	0	C0	0 to $0.1V_S$
0	1	C2	don't care (see notes 1 and 2)
1	0	C4	0.4 to $0.6V_S$
1	1	C6	$0.9V_S$ to V_S

Notes

1. This general address is always valid for all tuner types of this group. It is recommended not to use this address in applications where a further tuner becomes necessary, e.g. television sets with an option for picture-in-picture or satellite television.

2. 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).

$N = (8192 \times n13) + (4096 \times n12) + (2048 \times n11) + (1024 \times n10) + (512 \times n9) + (256 \times n8) + (128 \times n7) + (64 \times n6) + (32 \times n5) + (16 \times n4) + (8 \times n3) + (4 \times n2) + (2 \times n1) + n0$

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CONTROL BYTE 1

CP can be set to either 0 (low current) or 1 (high current).

Charge pump settings:

  CP = 1, for fast tuning

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

CONTROL BYTE 2

BAND SWITCHING	BIT [1]							
	P0	P1	P2	P3[2]	P4	P5	P6	P7
Low band	X	X	X	0	0	1	0	1
Mid band	X	X	X	0	1	0	0	1
High band	X	X	X	0	1	1	0	0

Notes

1. X = don't care; P0 to P7 are output ports on the PLL device.

2. P3 must be set 0, because at this combined input/output port, the address voltage is applied.

TELEGRAM EXAMPLES (WRITE MODE)

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb1 - Ack - Cb2 - Ack - Stop.

Start - Adb - Ack - Cb1 - Ack - Cb2 - Ack - Db1 - Ack - Db2 - Ack - Stop.

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb1 - Ack - Stop.

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

Where:

  Start = start condition

  Adb = address byte

  Db1 = divider byte 1

  Db2 = divider byte 2

  Cb1 = control byte 1

  Cb2 = control byte 2

  Stop = stop condition.

Remark: for channel selection involving band switching, and to ensure smooth tuning to the desired channel without causing unnecessary charge pump action, it is recommended to consider the difference between wanted channel frequency (f_w) and the current channel frequency (f_c):

• If $f_w > f_c$, use telegram as:

  Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb1 - Ack - Cb2 - Ack - Stop.

• If $f_w < f_c$, use telegram as:

  Start - Adb - Ack - Cb1 - Ack - Cb2 - Ack - Db1 - Ack - Db2 - Ack - Stop.

Unnecessary charge pump action will result in very low tuning voltage ($V_T \approx 0$ V) which may drive the oscillator to extreme conditions.

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READ mode

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

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

Notes

1. A = Acknowledge.

2. R/W bit = 0 for WRITE mode, R/W bit = 1 for READ mode.

3. 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.

4. FL = In-lock flag; FL = 1: loop is phase-locked. The loop must be phase-locked during at least 8 periods of the internal 7.8125 kHz reference frequency before the FL flag is internally set to 1.

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

6. A2, A1 and A0 = not used.

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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Tuning supply voltage

Pin 9 must be set to a typical tuning voltage of 33 V (maximum 35 V and minimum 30 V). Alternatively, a constant current of 1 to 1.5 mA can also be applied. Figure 3 shows an alternative supply from a 140 V source. The Zener diode prevents the tuning voltage at pin 9 from exceeding 33 V.
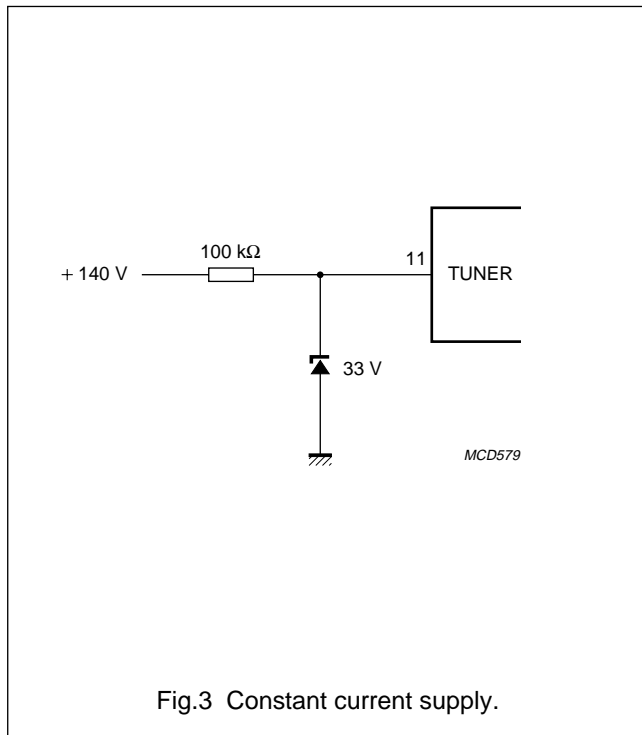
I²C-bus load

The UV1316 contains a series resistor (R = 100 Ω) in the SCL and SDA lines. Both lines also have a capacitive load of typical 56 pF (see Fig.4).

Fig.3 Constant current supply.

Fig.4 I²C-bus load.
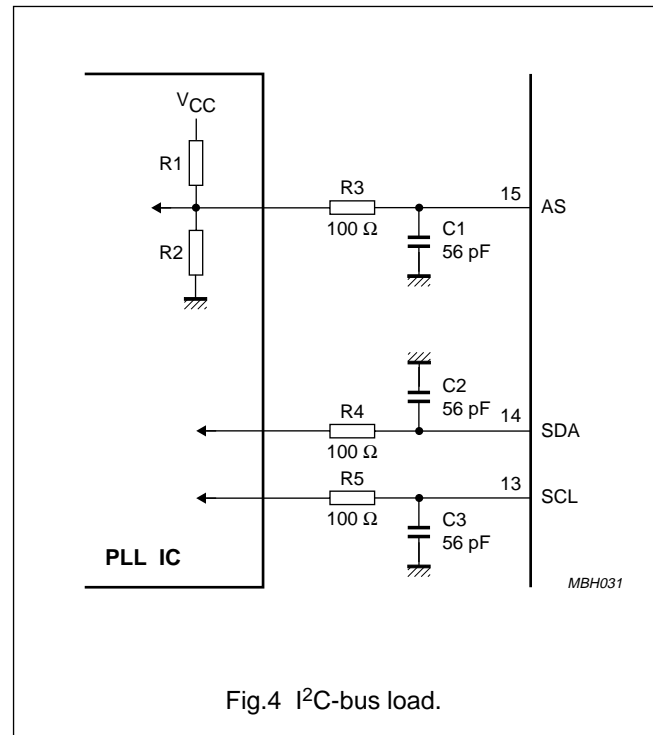
IF bandwidth

The typical IF bandwidth is 12 MHz.

IF output impedance

The IF output impedance at 36.15 MHz is $73+j40.4$ Ω for symmetrical versions. For asymmetrical versions it is $73+j48.2$ Ω.

IF load

The minimum permissible resistive load is 1 kΩ, the maximum capacitive load is 22 pF.

To guarantee optimal signal handling performance the reactive load of the IF circuitry (interconnections, saw filter) has to be tuned to tuner IF centre frequency.

The IF output is to be maintained at 105 dBμV maximum. In case this limit is exceeded, the tuner gain should be reduced accordingly.
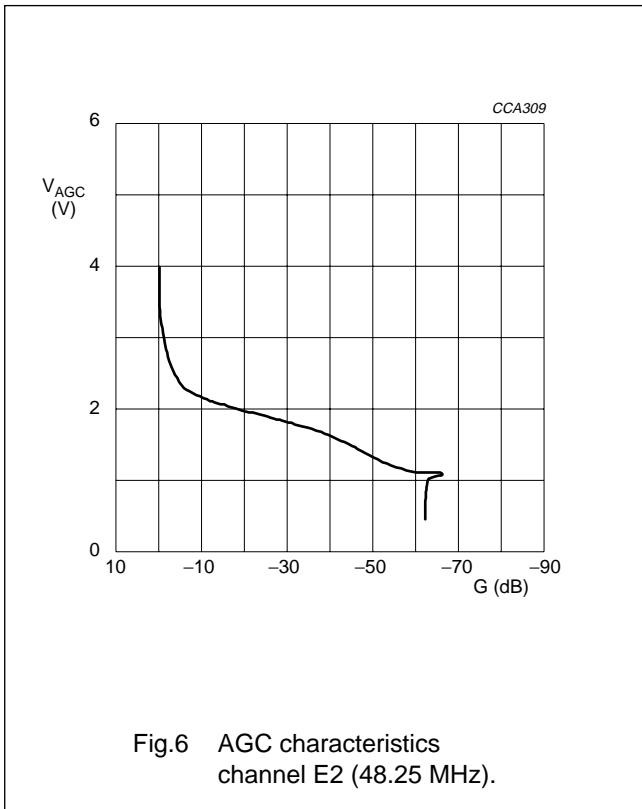
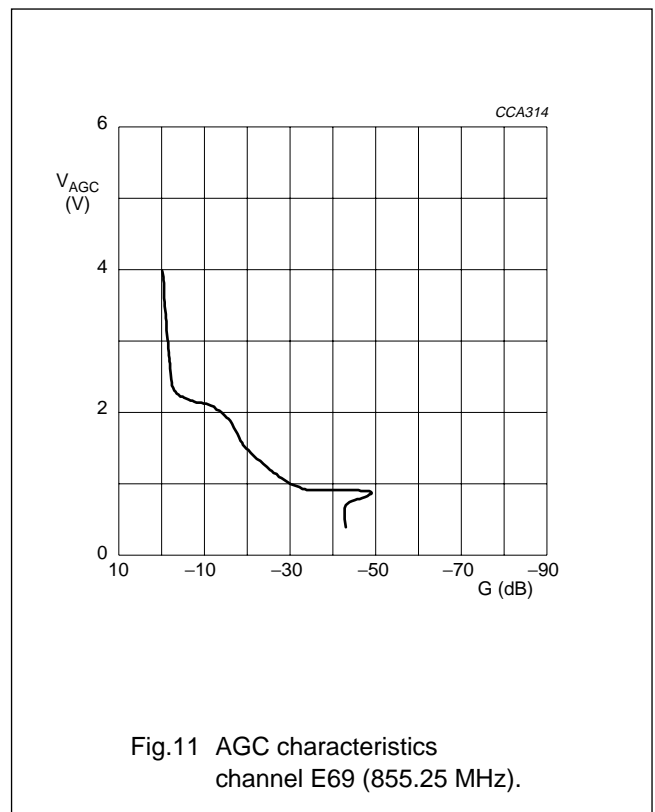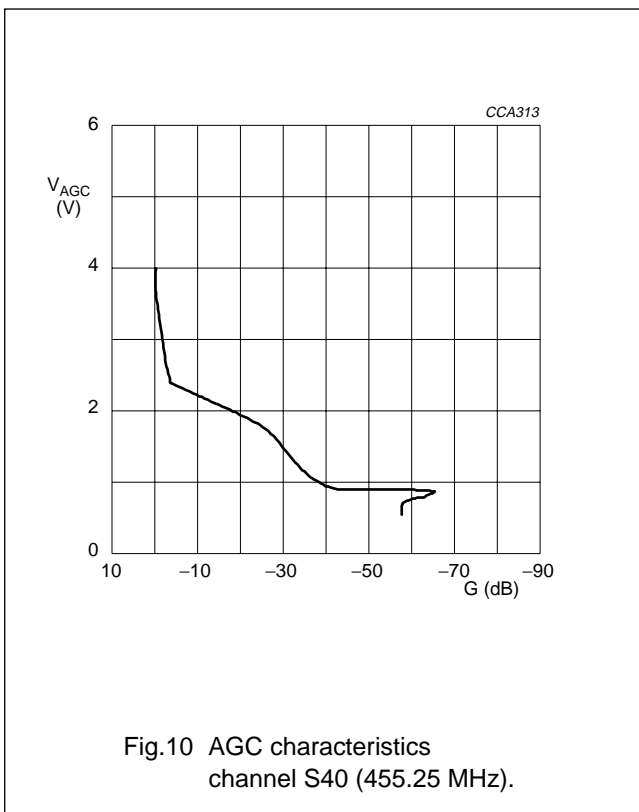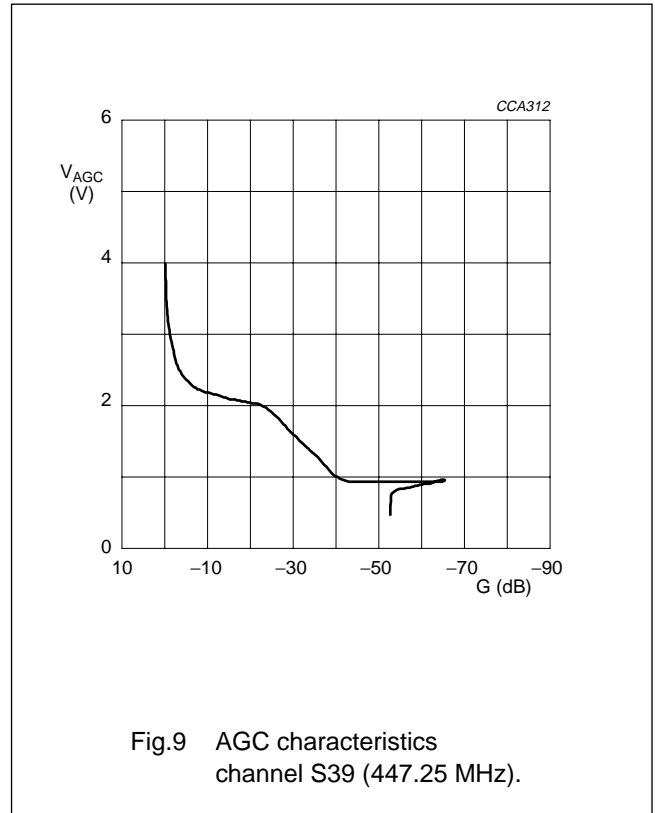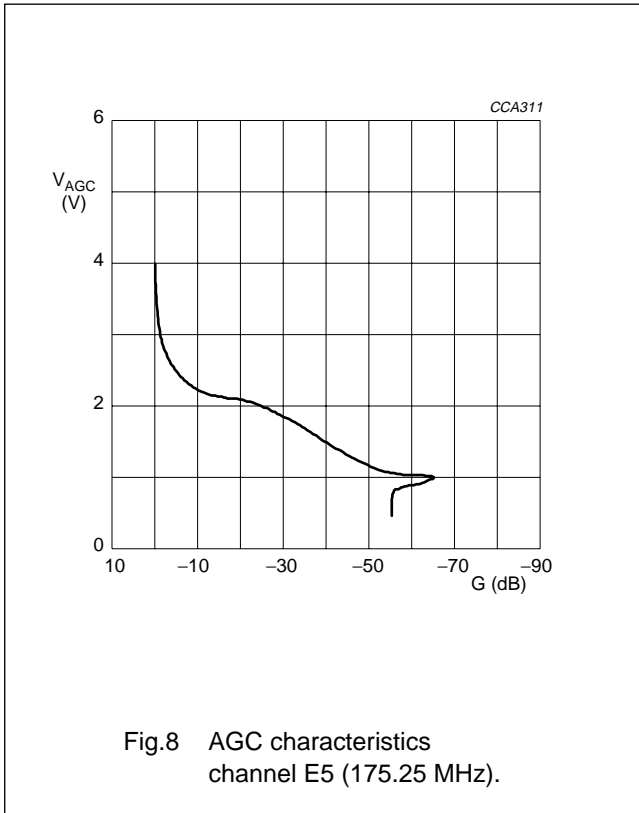# VHF/UHF television tuner

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Automatic gain control (AGC)

10 kΩ   1.0 nF   → High band input

10 kΩ   4.7 nF   → Mid band input

AGC   10 kΩ   → Low band input

4.7 nF   360 kΩ   4.7 nF

CCA308

For optimum performance, the adjustment of the AGC take over point should be maintained at IF output level of 105 dBμV.

Fig.5 Internal AGC circuit.

TYPICAL AGC CURVES

CCA309

V_{AGC} (V)

G (dB)

Fig.6   AGC characteristics channel E2 (48.25 MHz).

CCA310

V_{AGC} (V)

G (dB)

Fig.7   AGC characteristics channel S10 (168.25 MHz).

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Fig.8   AGC characteristics
         channel E5 (175.25 MHz).

Fig.9   AGC characteristics
         channel S39 (447.25 MHz).

Fig.10 AGC characteristics
         channel S40 (455.25 MHz).

Fig.11 AGC characteristics
         channel E69 (855.25 MHz).

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MECHANICAL DATA

Dimensions in mm.

(1) Standard phono socket female 75 Ω.

(2) Alternative IEC connection.
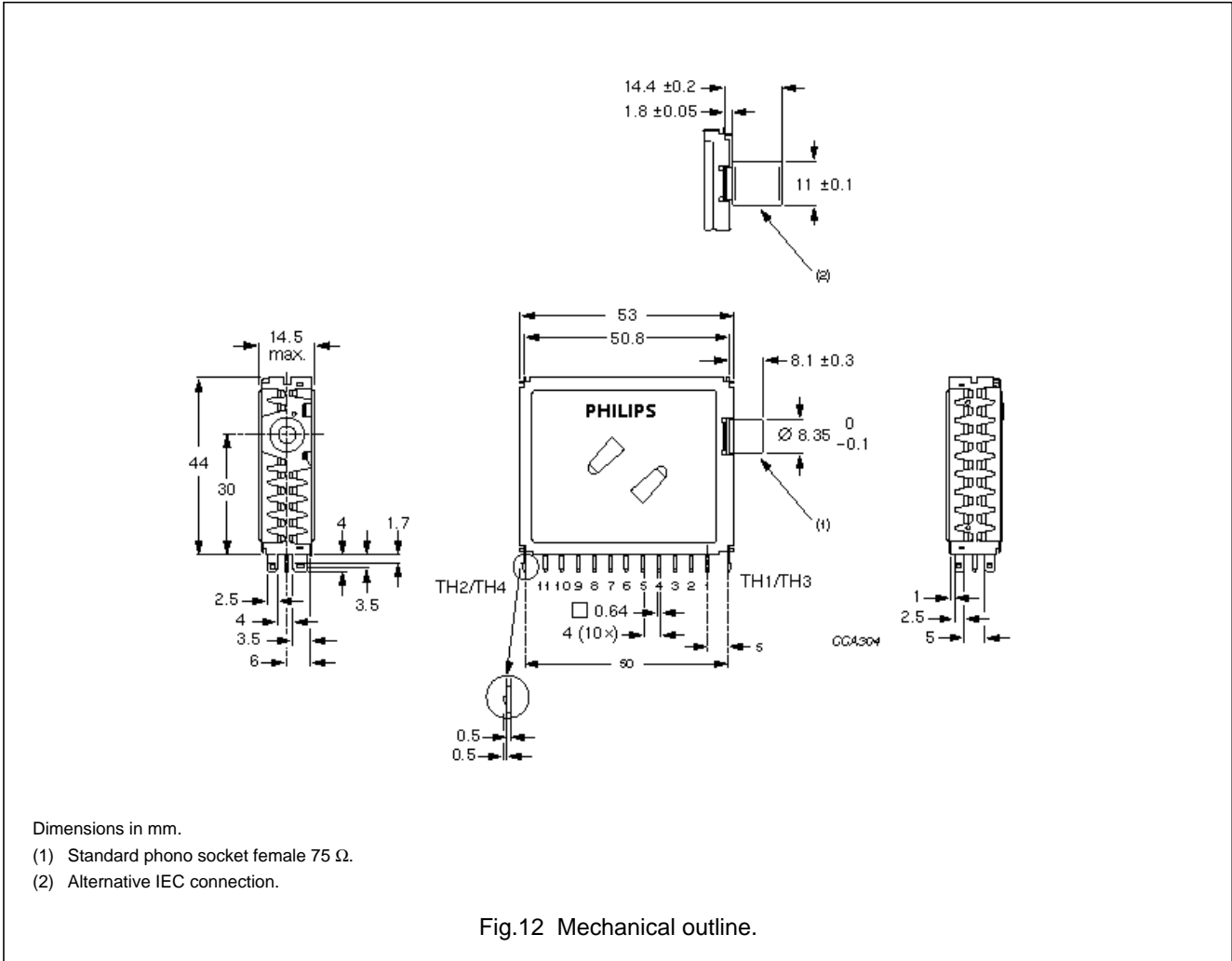
Fig.12 Mechanical outline.

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Aerial connections

Standard-phono socket female 75 Ω or IEC (female).

Solderability

The solderability of pins and mounting tags when tested initially and after 16 hours steam ageing in accordance with *"IEC 68-2-20"*, test Ta, method 1 (solder bath 235 °C for 2 s), results in a wetted area of 95%. No de-wetting will occur when soldered at 260 °C for 5 s.

Resistance to soldering heat

The product will not be damaged when tested in accordance with *"IEC 68-2-20"*, test Tb, method 1A (solder bath 260 °C for 10 ±1 s).

Mass

Approximately 35 g.

Robustness of pins

The pins will not be damaged when tested in accordance with *"IEC 68-2-21"*:

• Test Ua1, tensile of 10 N in axial direction

• Test Ua2, thrust of 4 N in axial direction.

Punching pattern of chassis PCB

For optimal mounting of the tuner to a PCB the following punching pattern is recommended (see Fig.13).

The tuner must be mounted without clearance between the tuner supporting surface and the printed wiring board. When mounted in this way, the tuner must be soldered to the printed circuit board (PCB). This can be achieved by pressing the unit vertically on the PCB during soldering.
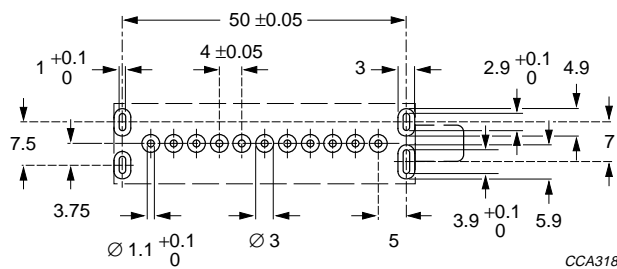
Dimensions in mm.

Fig.13 Punching pattern seen from solder side.

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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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