

PRODUKTINFORMATION



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— Vi reserverar oss mot fel samt förbehåller oss rätten till ändringar utan föregående meddelande —

ELFA artikelnr.
73-104-85 UV1316/IEC TV-tuner

Antal sidor: 20

DATA SHEET

UV1316 VHF/UHF television tuner

Preliminary specification
File under BU Tuners, DC03

1996 Oct 10

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.

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 |

**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

| 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 |

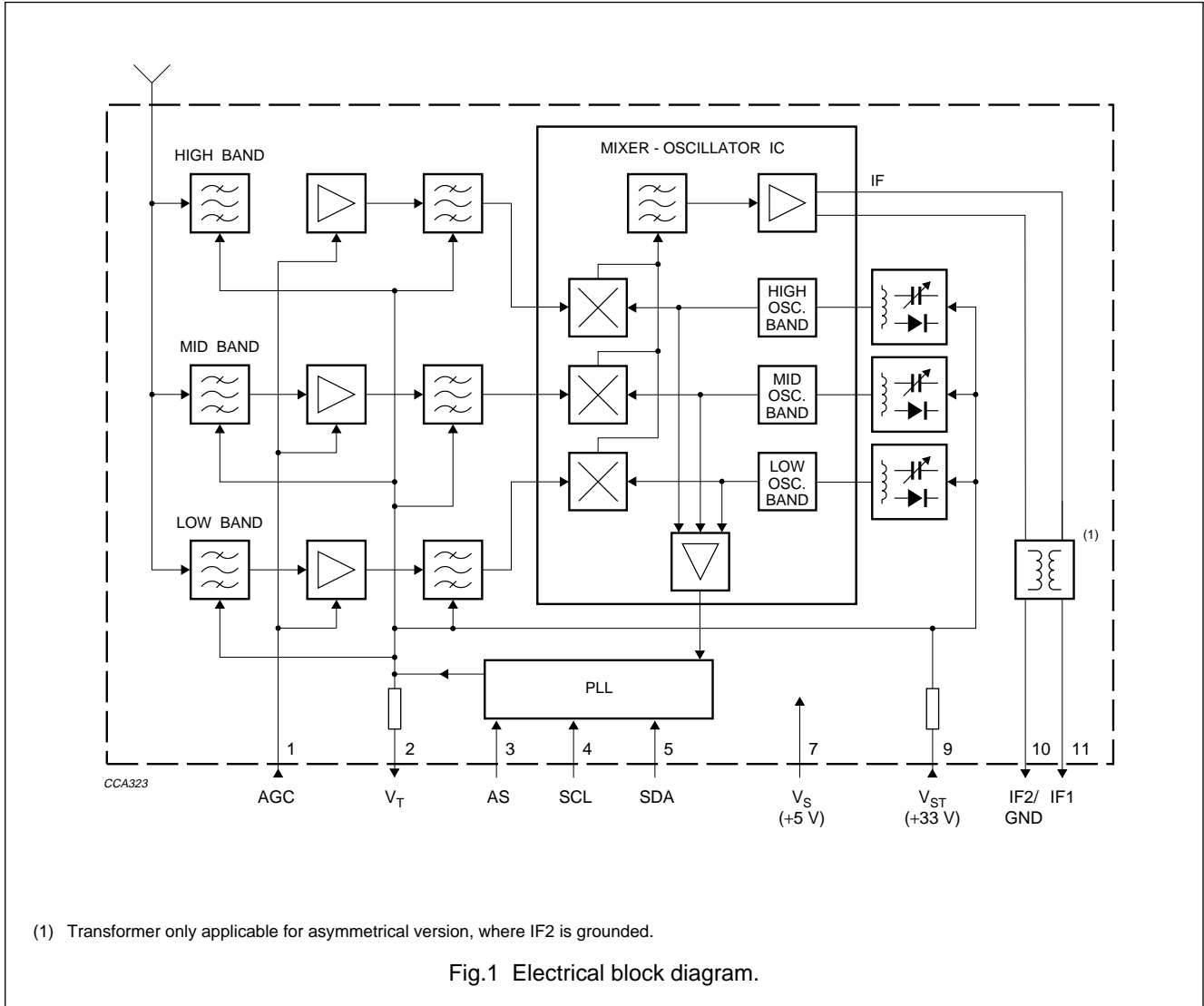
Notes

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



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PINNING

| SYMBOL | PIN | DESCRIPTION |
|-----------------|-----------------------|---|
| AGC | 1 | gain control voltage |
| V _T | 2 | tuning voltage |
| AS | 3 | I ² C-bus address select |
| SCL | 4 | I ² C-bus serial clock |
| SDA | 5 | I ² C-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/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 | % |

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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 |
|------------------|--|--|------|------|------------|
| V _{SWR} | 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 | dB μ V |

General characteristics

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|------------------|---|----------------------|-------------------------|----------------|-------------------------|--------------------------|
| f _b | frequency range: low band mid band high band | | 48.25 170.0 450.0 | – – – | 170.0 450.0 855.2 | MHz MHz MHz |
| Δf_b | margin: for low band for mid/high band | | ± 1 ± 3 | – – | – – | MHz MHz |
| G _V | voltage gain: all channels gain taper (off-air channels) | | 38 – | 44 – | 50 8 | dB dB |
| | noise: low band mid band high band | | – – – | 6 6 6 | 9 9 9 | dB dB dB |
| ΔV_{AGC} | AGC input voltage range: VHF off-air channels cable channels high band | | 40 35 30 | 65 60 50 | – – – | dB dB dB |
| α_i | image rejection (nominal gain to 10 dB gain reduction): low and mid band mid band high band | <300 MHz >300 MHz | 70 60 50 | 75 75 75 | – – – | dB dB dB |
| α_{IF} | IF rejection (picture) | | 60 | 80 | – | dB |
| Z _{IF} | $\frac{1}{2}$ IF susceptibility: channel E2 to E12 channel E21 to E69 | | 75 60 | 90 80 | – – | dB μ V dB μ V |

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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 | – | – | dB μ V |
| m_x | cross modulation: in-channel | | 68 | – | – | dB μ V |
| | in-band | | | | | |
| | low band (n \pm 2) | | 80 | – | – | dB μ V |
| | mid band (n \pm 3) | | 80 | – | – | dB μ V |
| | high band (n \pm 5) | | 84 | – | – | dB μ V |
| | out of band | | – | 100 | – | dB μ V |
| V_{osc} | oscillator voltage: IF pin | | – | – | 85 | dB μ V |
| | all other pins | | – | – | 70 | dB μ V |
| | 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 dB μ V | 57 | – | – | dB |
| | residual carrier FM caused by I ² C-bus cross-talk | | – | – | 5 | kHz |
| V_{ESD} | electrostatic discharge (ESD) on all pins | note 1 | 2 | – | – | kV |
| | oscillator characteristics: oscillator tuning resolution | | – | – | \pm 250 | kHz |
| | oscillator instability | $V_S = 5\text{ V} \pm 10\%$; $T_{amb} = 0\text{ to }60\text{ }^\circ\text{C}$ | – | – | \pm 500 | kHz |
| | lock-in time | | – | – | 150 | msec |

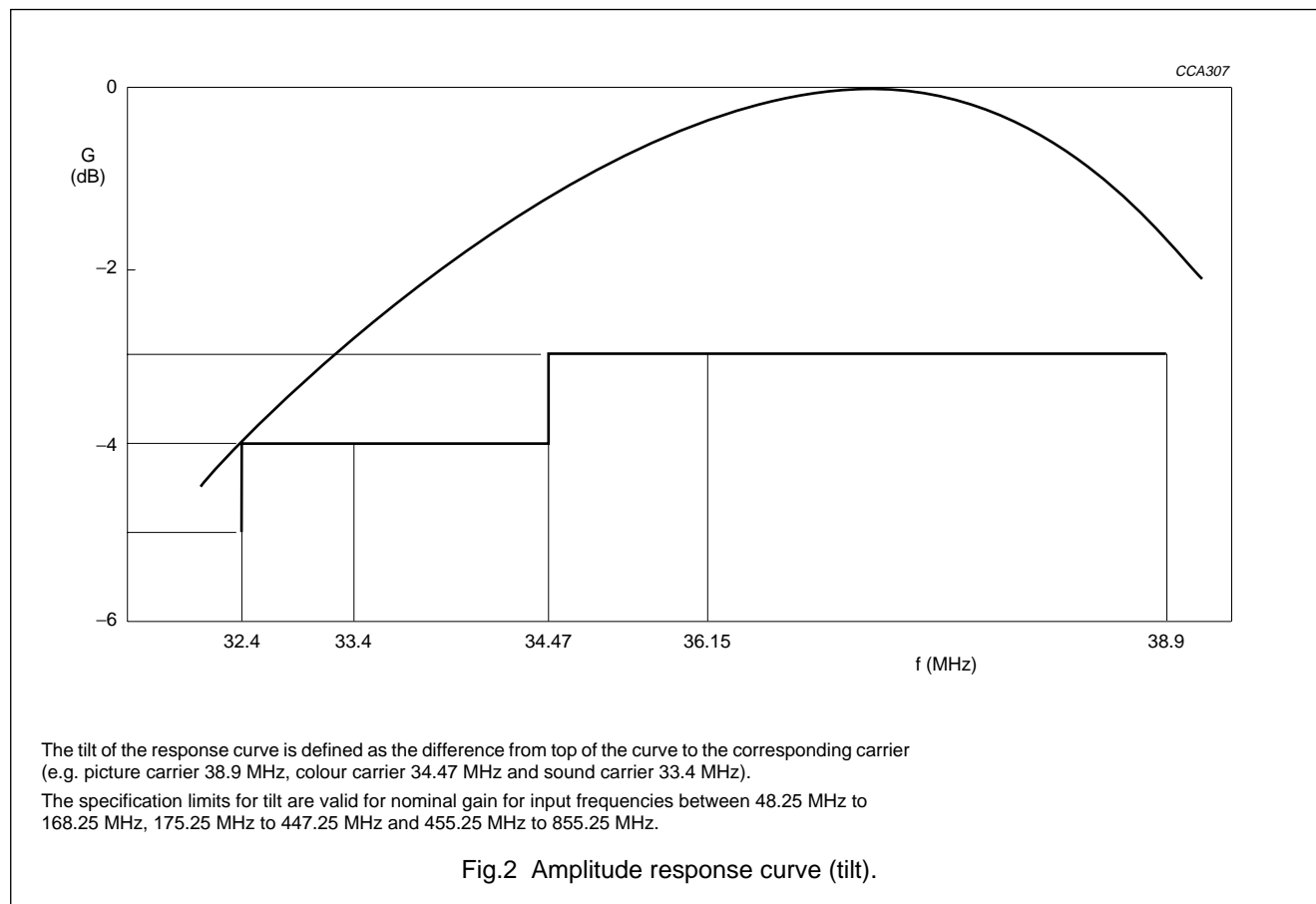
Note

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

**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 dB μ V at an input signal level of 74 dB μ V 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 μ Pa), 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 | | | | | | | | |
|----------------------------|----------|-----|-----|-----|-----|-----|-----|--------------------|------------------|
| | 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 |
| 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:

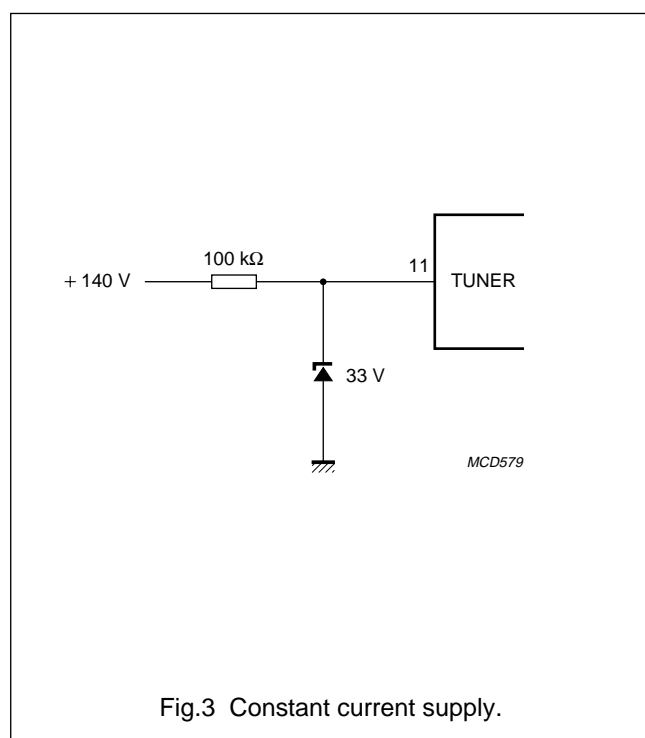
STB = Status byte.

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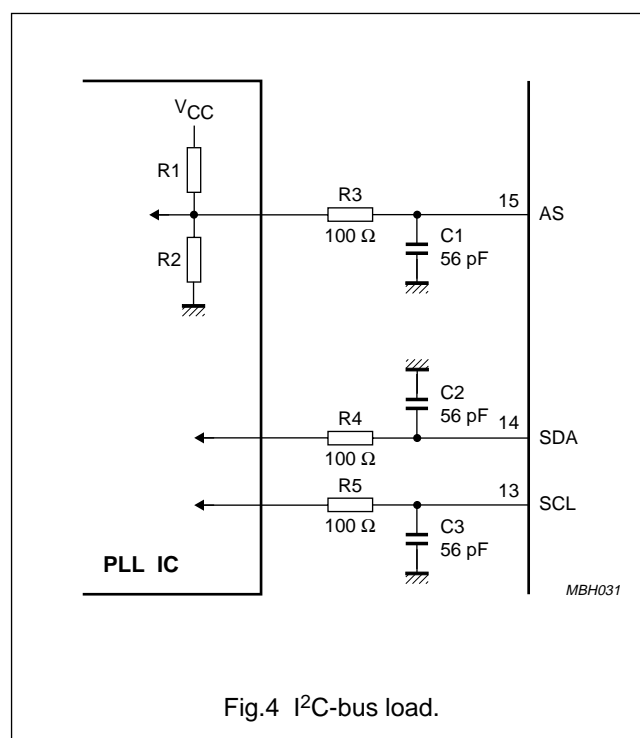
UV1316

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 ($R = 100 \Omega$) in the SCL and SDA lines. Both lines also have a capacitive load of typical 56 pF (see Fig.4).

**IF bandwidth**

The typical IF bandwidth is 12 MHz.

IF output impedance

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

IF load

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

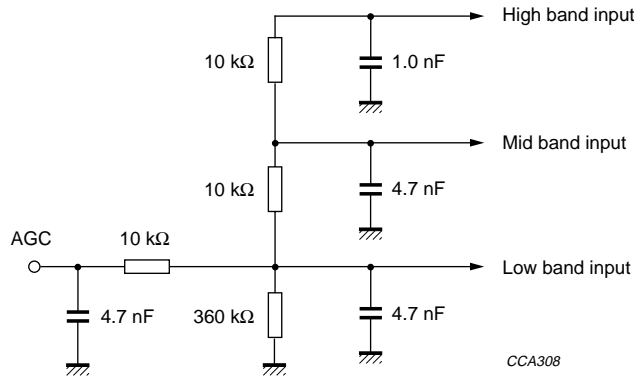
To guarantee optimal signal handling performance the reactive load of the IF circuitry (interconnections, saw filter) has to be tuned to tuner IF centre frequency.

The IF output is to be maintained at 105 dB μ V maximum. In case this limit is exceeded, the tuner gain should be reduced accordingly.

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Automatic gain control (AGC)



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

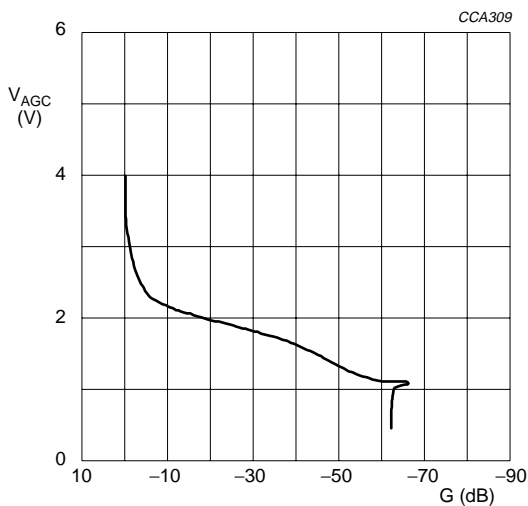


Fig.6 AGC characteristics channel E2 (48.25 MHz).

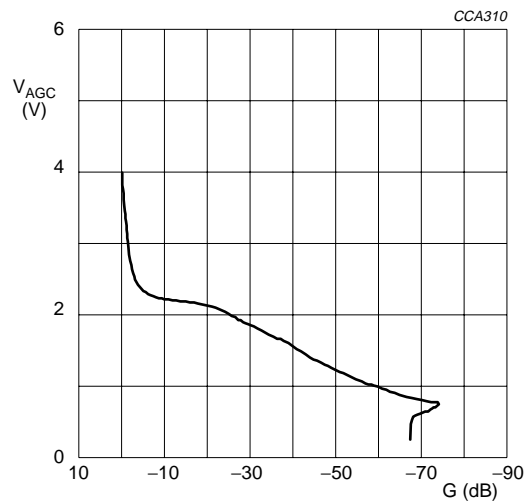
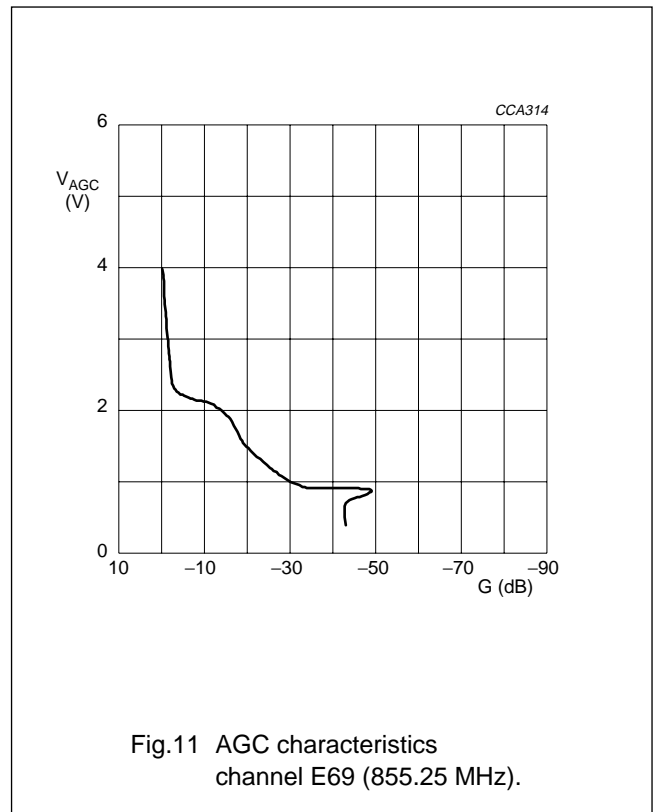
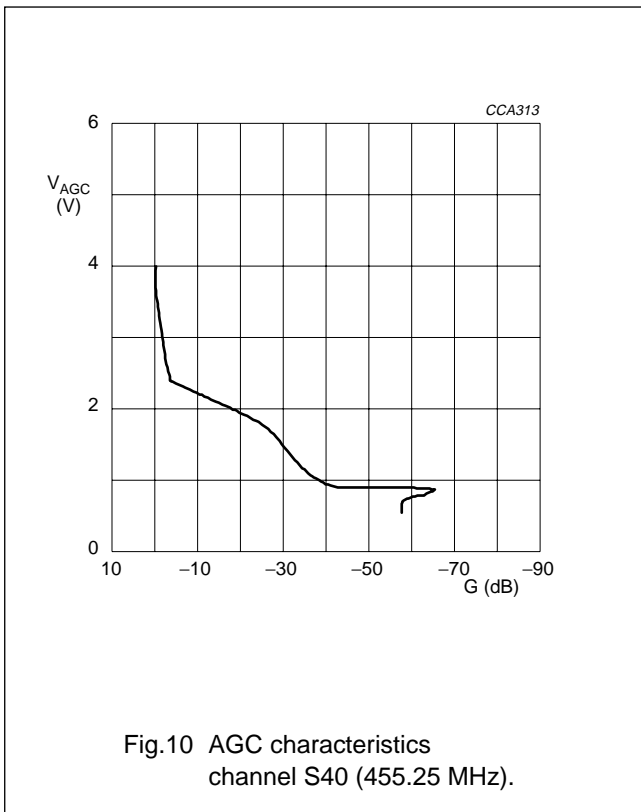
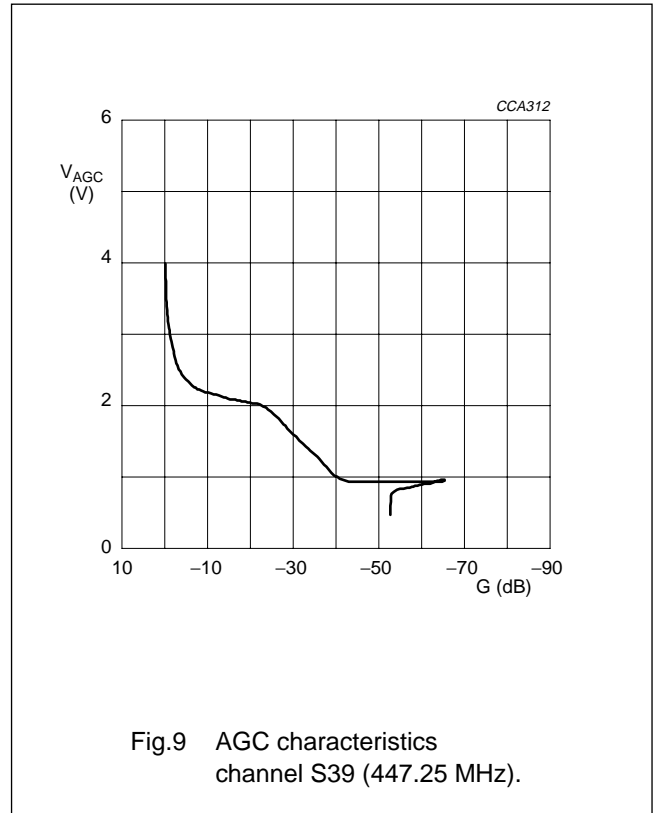
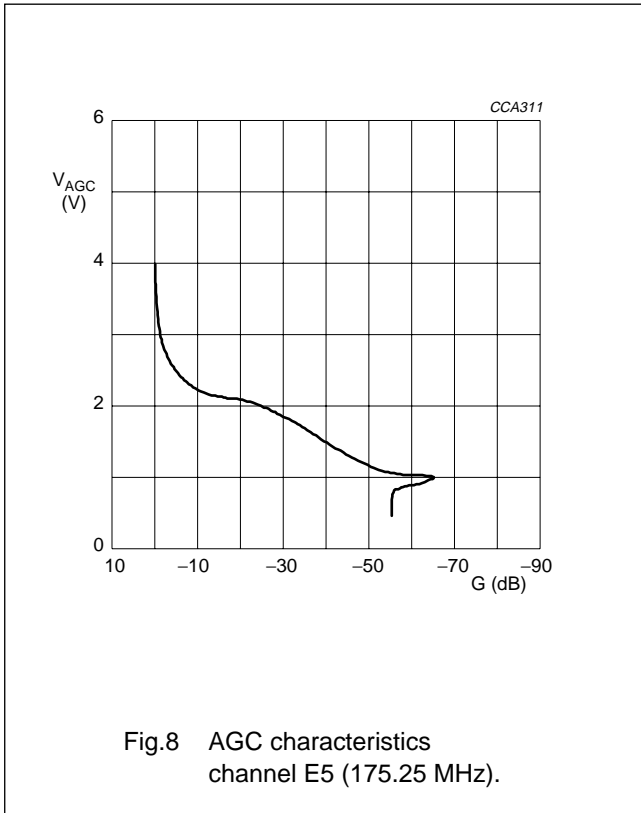


Fig.7 AGC characteristics channel S10 (168.25 MHz).

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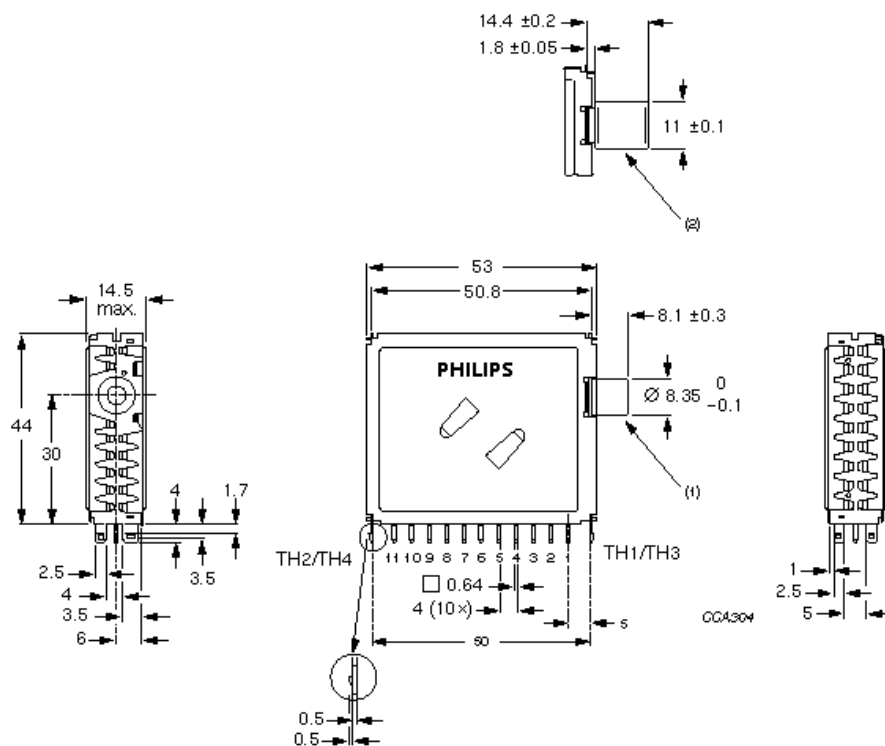
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MECHANICAL DATA



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 \pm 1 s).

Mass

Approximately 35 g.

Robustness of pins

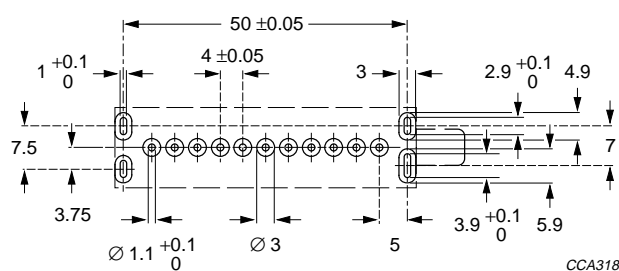
The pins will not be damaged when tested in accordance with "IEC 68-2-21":

- 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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Tel. (5172) 200 915, Fax. (5172) 200 773.

Brazil: Philips Components, SÃO PAULO,
Tel. (011) 821 2333, Fax. (011) 829 1849.

Canada: Philips Electronics Ltd., SCARBOROUGH,
Tel. (0416) 292 5161, Fax. (0416) 754 6248.

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Tel. (02) 77 38 16, Fax. (02) 735 35 94.

China: Philips Company, SHANGHAI,
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