


DATA SHEET

CD(M)1300L - 3

Tuner module for analog and digital cable (QAM) applications

PRODUCT SPECIFICATION

Approved by :

 1/9/2015

Name / Date : Edward Neo/01-09-05

PHILIPS

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

PRODUCT FACT FILE



- Highly integrated RF-module, UHF modulator plus active loopthrough plus 3-band tuner
- +5V supply voltage only; no external tuning voltage required
- Tuners for horizontal and vertical mounting available
- Tuners comply with relevant CENELEC standards with regard to requirements concerning signal handling capability and immunity
- Optional: DC-connection between pin1 and RF-input connector (e.g. outdoor unit power supply)

- RF-in to RF-out loopthrough amplifiers
 - Low noise and excellent linearity
 - Full VHF to UHF frequency range coverage
 - Standard connectors (IEC or F) for in- and output
 - Option: pin-output instead of connector output

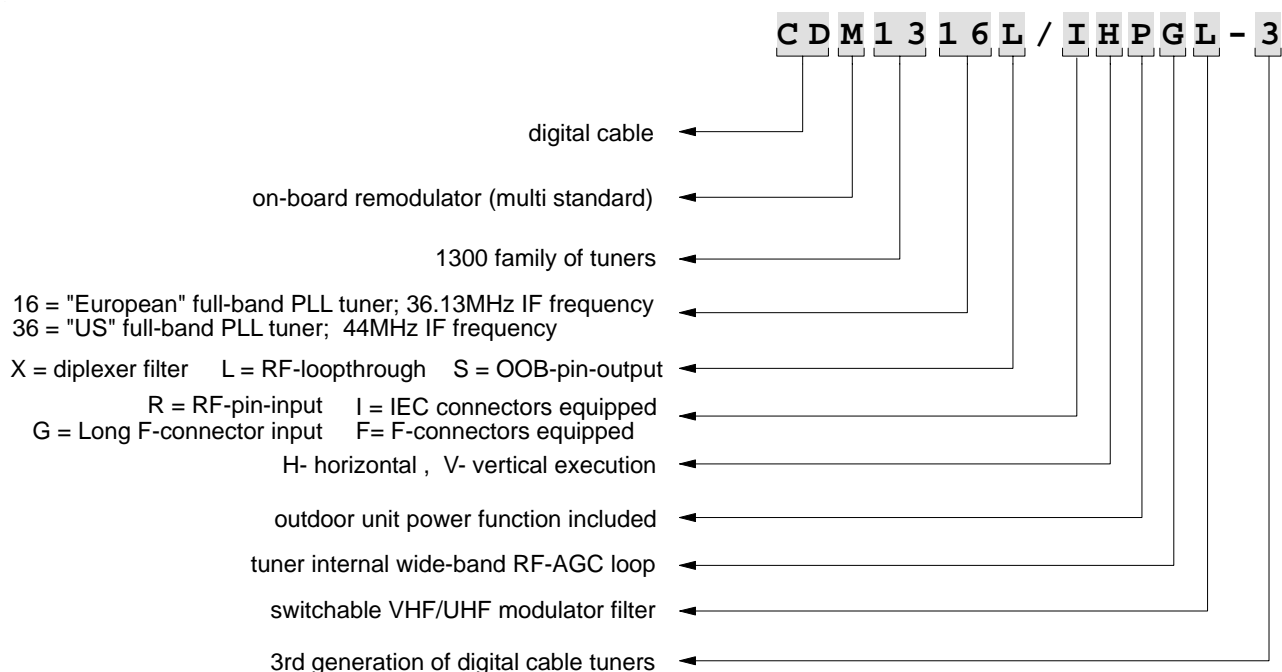
- Option: I²C controllable multi-standard modulator
 - Full UHF frequency coverage with PLL accuracy
 - System related sound subcarriers addressable
 - Pattern generator included
 - 3.3V and 5V Bus level and 400kHz clock compliant
 - Stand-by mode addressable
 - Option: UHF and VHF ch 3/4 operation with switchable harmonics suppression filter

- High performance and cost effective single conversion PLL tuner
 - I²C programmable (3.3V and 5V Bus level)
 - 400kHz Bus clock
 - Fast PLL tuning speed (step size 62.5kHz and others)
 - Tuner internal gain control loop with selectable TakeOverPoint settings via I²C Bus
 - External gain control possible with internal loop disabled
 - Flat overall frequency response
 - Very low oscillator phase noise
 - SAW-filter and IF-amplifier included
 - IF-amplification controllable over a wide range
 - Two IF-outputs, one for digital downstream, one for standard analog demodulation
- Differential, 'digital' IF-output to directly drive the channel decoder

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

TYPE NAME DESCRIPTION



ORDERING INFORMATION

Tuner Type	Mounting	RF-connector	Remarks	12 NC
CD1316L/IVP-3	Vertical	Standard IEC	European type with 8MHz SAW filter, RF-loopthrough	3112 297 14071
CD1316L/IHP-3	Horizontal	Standard IEC	horizontal mounting	3112 297 14061
CDM1316L/IVP-3	Vertical	Standard IEC	European type; 8MHz SAW filter; PAL UHF remodulator; outdoor unit power;	3112 297 13691
CDM1316L/IHP-3	Horizontal	Standard IEC	horizontal mounting	3112 297 13681
CDM1316L/IVPG-3	Vertical	Standard IEC	European type; 8MHz SAW filter; PAL UHF remodulator; outdoor unit power; RF-wideband AGC;	3112 297 13711
CDM1316L/IHPG-3	Horizontal	Standard IEC	horizontal mounting	3112 297 13701
CD1316L/GIVP-3	Vertical	Long F-connector input std. IEC-connector output	Special type with long F-connector input; vertical mounting	3112 297 14211
CD1316L/GIHP-3	Horizontal	Long F-connector input std. IEC-connector output	Special type with long F-connector input; horizontal mounting	3112 297 14201
CDM1316L/FHP-3	Horizontal	Standard F	horizontal mounting	3112 297 14771

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

PRODUCT DESCRIPTION

CD(M)1300L-3 tuners are complex RF-modules designed for hybrid, digital and analog cable Set Top Box applications. Apart from the core tuner function, these modules provide a various number of additional functions which, as such, enable a fast and cost effective implementation into the frontend section of todays cable STBs.

CD(M)1300L-3 supersedes the predecessor family of tuners CD(M)1316L-2.

The input compartment of CD(M)1300L-3 is equipped with an active, RF-in to RF-out loopthrough, providing high linearity and low noise figures. Optionally a DC-current path from one of the tuner terminals to the RF-input connector to supply for instance an outdoor unit, is available on request.

A key-element of the tuners' input section, that can be added on request as well, is the multistandard, PAL, NTSC and Secam remodulator. Besides the standard UHF range, this remodulator can operate in VHF ch 3/4 also; the modulators' harmonics suppression filter in that case can be switched accordingly.

The single conversion, I²C - PLL controlled tuner section covers the entire frequency range from about 50MHz to 860MHz, whereby it's subdivided into three bands, low- mid- and high-band.

A gain control loop is on-board which controls the RF-gain; four Take-Over-Points are addressable.

This RF-gain control loop is optionally available, hence it can be left open in case customers prefer a tuner external gain control application.

The on-board DC/DC converter provides the necessary tuning voltage.

The IF-part is equipped with a channel SAW filter that is followed by a gain controllable, balanced IF-amplifier with channel decoder drive capability. The IF-frequency is centered at 36.13MHz for the "European" type of tuner while it's centered at 44MHz for the "US" tuner type.

Mechanically, CD(M)1300L-3 tuners are comparable to the predecessor mk2-tuners, having the same tuner housing horizontal and vertical as well, same footprint and pinning.

Frequency allocation table:

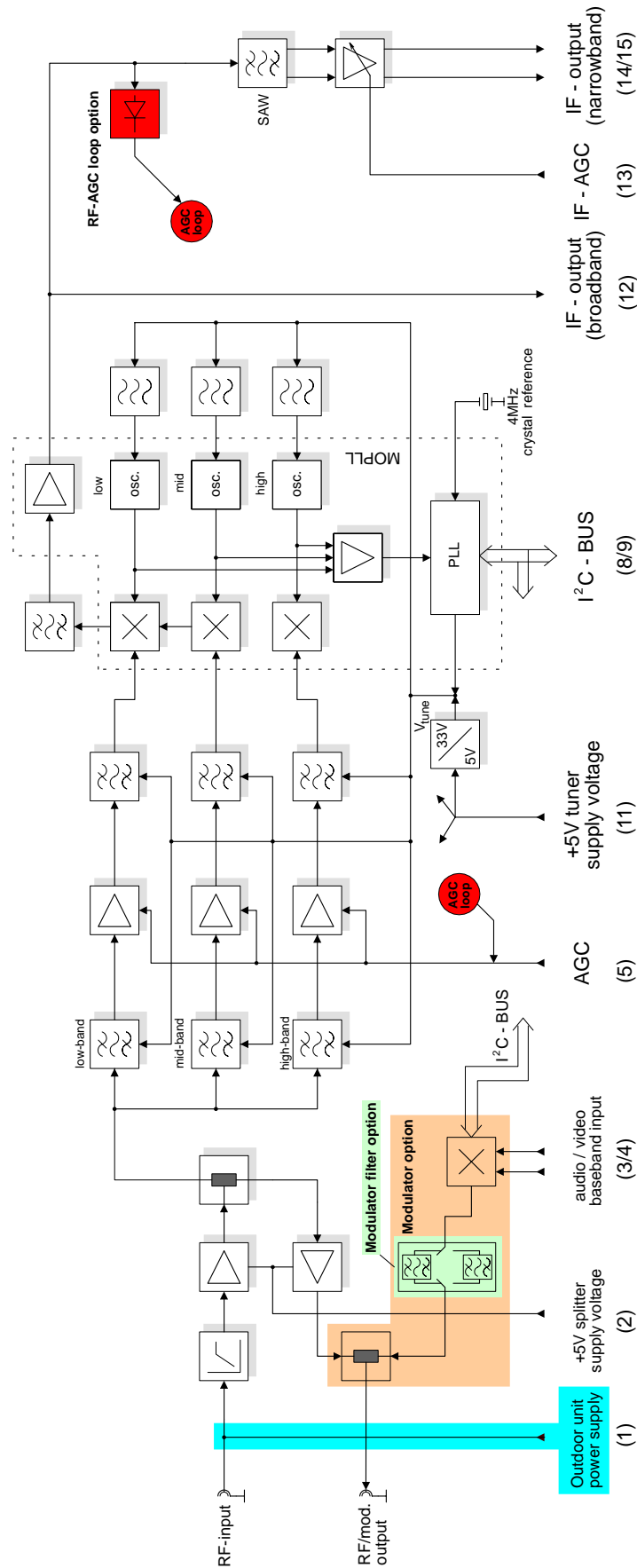
	CDM1316L-3 CD1316L-3	CDM1336L-3
RF frequency range	51MHz – 858MHz ^(*)	57MHz – 863MHz ^(*)
RF-loopthrough range	ch E2 - ch E69	ch A2 - ch A79
Modulator range (for tuners with modulator only)	ch E21 - ch E69 option: PAL ch 3/4	ch 3 - ch 4
IF-center frequency	36.13 MHz	44 MHz
SAW filter channel bandwidth	8 MHz	6 MHz

^(*) data refer to RF-channel center frequency.

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

BLOCK DIAGRAMM



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CD(M)1300L-3

RATINGS

Environmental conditions

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Non-operational Conditions					
T_{AMB}	Ambient temperature		-25	+85	°C
RH	Relative humidity		-	95	%
g_B	Bump acceleration	25g	-	245	m/s ²
g_S	Shock acceleration	50g	-	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	%

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_{Ant} I_{Ant}	Outdoor unit DC-power	1			25 300	V mA
V_S I_S	Loopthrough (LP) Relevant supply current	2	4.75	5.00	5.25	V mA
V_{AGC} ΔV_{AGC} I_{AGC} Z_{AGC}	Tuner AGC input voltage AGC input voltage range AGC input current Impedance of external control voltage source	5	- 0.3 - -	3.8 - - -	4.5 4.0 t.b.f. 200	V V uA ohms
V_{AS}	Address select input voltage	7	-	-	5.25	V
V_{SCL}	Serial clock input voltage	8	-0.3	-	5.25	V
V_{SDA} I_{SDA}	Serial data input voltage Serial data input current	9	-0.3 -10	- -	5.25 -	V uA
V_{TU} I_{TU}	Tuner supply voltage Relevant supply current	11	4.75 -	5.00 140	5.25 185	V mA
V_{IF-AGC} ΔV_{IF-AGC} I_{IF-AGC}	IF- AGC input voltage IF- AGC input voltage range IF- AGC input current	13	- 0 -	3.0 - -	4.0 3.5 10	V V μA

Tuner module for analog and digital cable (QAM) applications

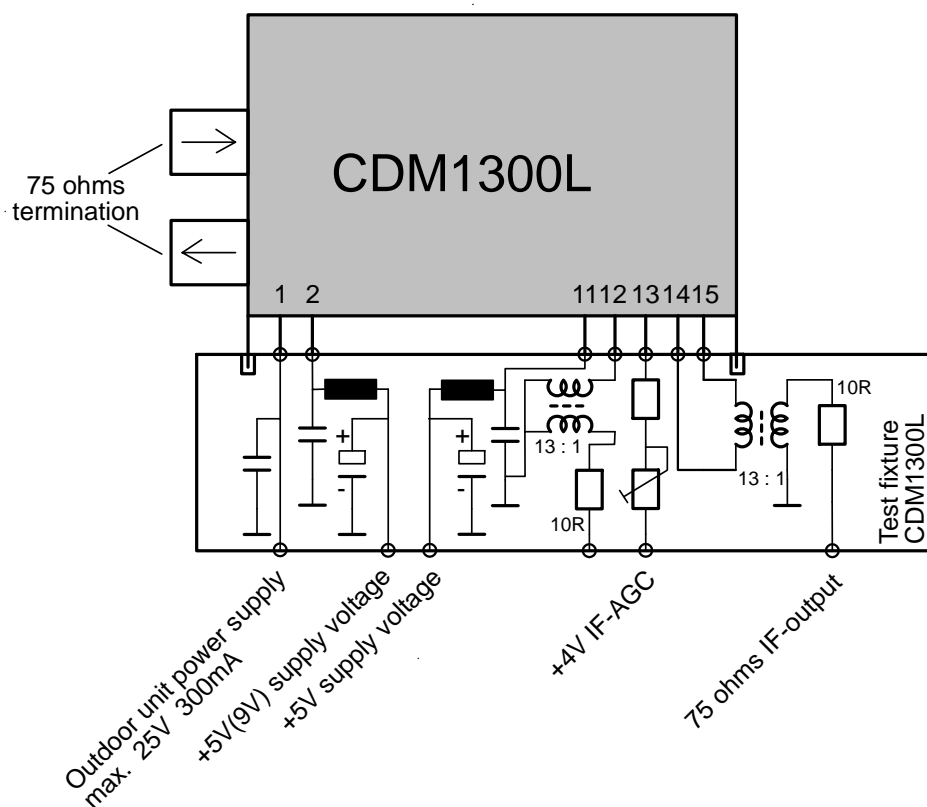
CD(M)1300L-3

SPECIFICATION DATA

If not otherwise stated the electrical performance refers to:

- ambient temperature : 22°C \pm 2°C
- relative humidity : 60% \pm 10%
- supply voltages : 5V \pm 0.1V
- RF-gain control voltage : 4.0V \pm 0.1V (internal AGC detector disabled; see application notes)
- IF-gain control voltage : 1V max.
- RF-input termination : 75 ohms
- RF-output termination : 75 ohms
- IF-center frequency of 1316-tuners : 36.13 MHz
- IF-center frequency of 1336-tuners : 44.00 MHz

Tuner test fixture to be used for performance measurements:



Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

If not otherwise stated, next specification data refer to the overall performance from RF-input to broad-band IF-output (pin12).

The tuner has to be tuned as such that coincidence between RF-channel center and IF-center frequency is given.

	MIN.	TYP.	MAX.
Frequency ranges 1316-tuners ⁽¹⁾ low-band mid-band high-band	49MHz 167MHz 454MHz		167MHz 454MHz 860MHz
Frequency ranges 1336-tuners ⁽¹⁾ low-band mid-band high-band	53MHz 160MHz 454MHz		164MHz 458MHz 865MHz
RF voltage gain ⁽²⁾		47dB	
Overall gain taper ⁽²⁾		6dB	
RF AGC range	35dB		
Image rejection (referred to IF-center frequency) 1316-tuners low- mid-band high-band	66dB 57dB	70dB 60dB	
1336-tuners low- mid- high-band	60dB		
Osc. voltage at aerial input (f < 1000MHz)		<20dB μ V	
RF-input return loss (75ohms) ⁽⁴⁾	6dB		
In-channel return loss ^{(3) (4)}		8dB	
ESD protection of terminals	2kV		
Surge protection at RF-input	8kV		
Osc. phase noise (10kHz) (100kHz)		-87dBc/Hz -107dBc/Hz	-85dBc/Hz -105dBc/Hz
CSO / CTB CENELEC conditions 1316-tuners OpenCable conditions 1336-tuners			t.b.f. t.b.f.
Noise figure		7dB	

Note 1: channel center including tuning margin

Note 2: to be measured at 'broadband' IF-output loaded as specified
(see chapter 'Application Notes')

Note 3: to be measured at RF-input in the range channel-center \pm 3MHz

Note 4: data only valid for tuners with IEC- or F-connectors

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

In-Channel Flatness (tilt) of overall responds curve (to be measured at broad-band IF-output):

Definition: tilt of curve is defined in the specified channel bandwidth from highest to lowest gain point at nom. gain

CD(M)1316L : channel spacing 7MHz (50Mhz – 300MHz) : 2.5dB max.
channel spacing 8MHz (300Mhz – 860MHz) : 3.5dB max.

CD(M)1336L : channel spacing 6MHz : 2.5dB max.

Deterioration of flatness during AGC (0dB to 30dB) : 1.0dB max.

Next specification data refer to the overall performance from RF-input to the balanced narrow-band IF-output (pin14/15).

The tuner has to be tuned as such that coincidence between RF-channel center and IF-center frequency is given.

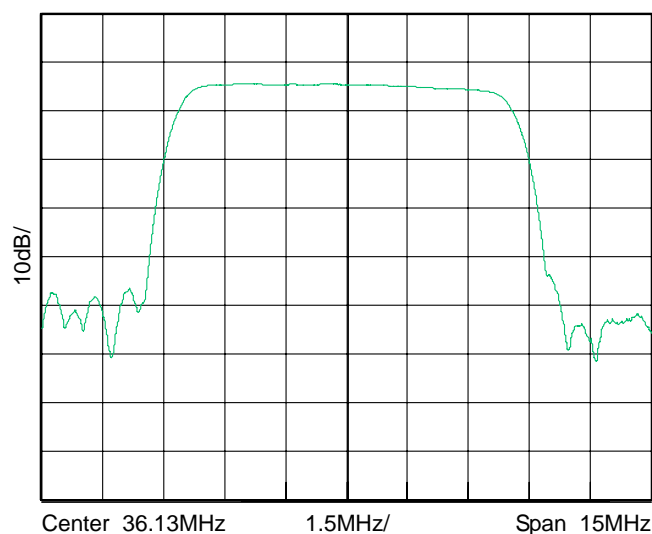
	MIN.	TYP.	MAX.
Overall-gain (terminals 14/15) ⁽¹⁾		77dB	
IF AGC range ⁽²⁾	40dB		
In-Channel flatness (1316-tuners) 8MHz SAW (1336-tuners) 6MHz SAW		3.0dB 2.5dB	
IF-output level (balanced) ⁽²⁾	1Vpp		

Note 1: RF-AGC set to 3.5V (pin 5) ; IF-AGC set to 3.0V (pin 13)

Note 2: min.tuner input level of -15dBmV; RF-AGC set to max. gain ($V_{AGC}=3.8V$);

V_{IF-AGC} range between 3.5V max. gain and 0.4V min. gain

Typical response curves at narrowband IF-output (tuner set to 470MHz):



6MHz wide SAW filter
t.b.f.

8MHz wide SAW-filter

Tuner module for analog and digital cable (QAM) applications

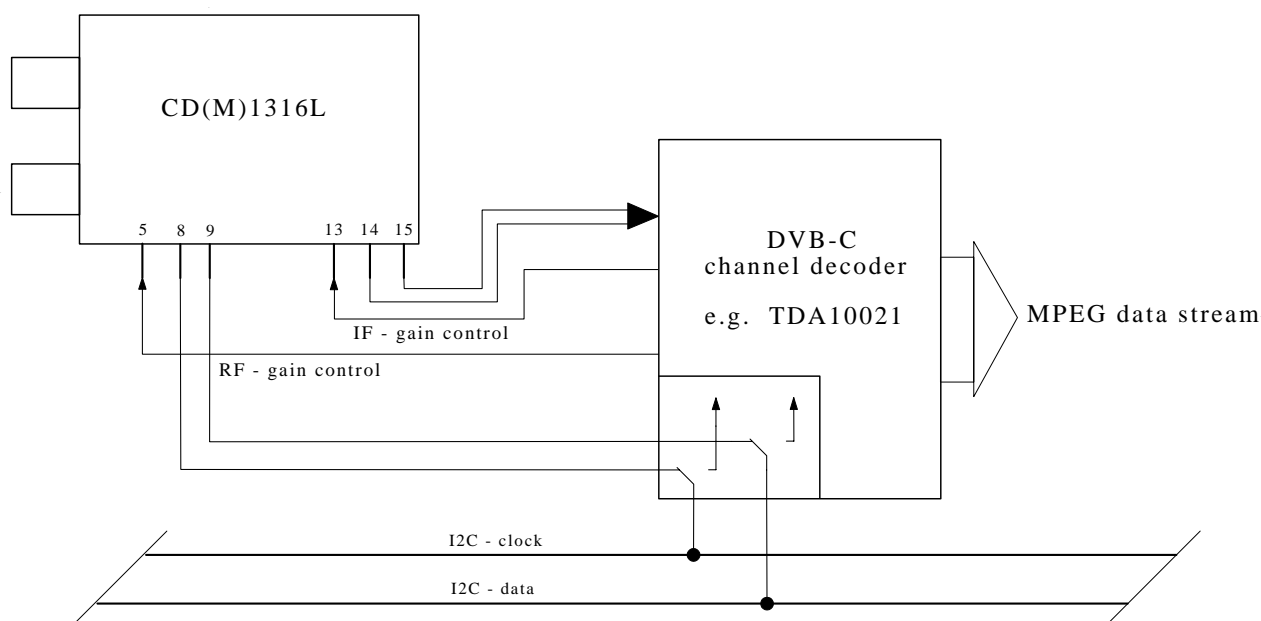
CD(M)1300L-3

Next specification data refer to the overall performance from RF-input to RF-output.
(relevant for 1316- and 1336- tuners)

	MIN.	TYP.	MAX.
Frequency range (referred to channel center)	51MHz		868MHz
Power gain		3.5dB (2dB *)	
Overall gain taper		2dB	
Noise figure		7dB	
CSO / CTB	-57dBc		
RF-output return loss (referred to 75Ω)		10dB	

* **Note:** only valid for tuners CDM1316L/FHP-3

Performance data of CD(M)1316L tuners when used in an adequate application:
(data for tuners CD(M)1336L to be determined)



	MIN.	TYP.	MAX.
Input sensitivity 256 QAM (no external noise added)			-64.0dBm
Carrier to Noise ratio (0dBmV input level) 64 QAM	26.5dB		
256 QAM	32.5dB		

Conditions: 6.9 msym/sec / BER $2 \cdot 10^{-4}$ before error correction

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

Next specification data are assigned to the modulator section of tuner CDM1316L-3.

Data refer to the PAL systems G,H, I, K only.

Data for tuners CDM1336L to be determined !

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zi(audio)	Z audio-in		45	53	61	k Ω
Vi(audio)	Audio input level			0.23		Vrms
Vo(audio)	Deviation from ideal Audio freq. Response	F=0.1-10kHz including pre-emphasis circuit (FM)			3	dB
S/N(audio)	Audio signal to noise	EBU color bar 75% Weighting filter CCIR468-2	45	50		dB
D(audio)	Audio distortion	0.23Vrms, 1kHz sine wave			3	%
Fc(sound)	Sound carrier frequency accuracy	W/n +/- 8kHz	4492	5500	5508	kHz
$\Delta F(1\text{kHz})$ *	Deviation at 1 kHz (FM)	0.23Vrms audio-in		40		kHz
Zi(video)	Z video-in input		500			k Ω
Vi(video)	Video-in level (p-p)			1		Vp-p
M(video)	PAL video modulation depth	1Vp-p, negative sync	75	80	88	%
$\Delta F(\text{video})$	Deviation from ideal video frequency characteristic	Fvideo = 0.5...4.3MHz			2	dB
Vo(RF,video)	RF-out video level		67		76	dB μ V
PS	Picture to Sound distance	PS bit set to 0 PS bit set to 1		16 12		dB dB
S/N(video)	Video signal to noise ratio	Unweighted	45			dB
Gdiff	Differential gain	APL= 10 to 90%			7	%
Φ_{diff}	Differential phase	APL= 10 to 90%			7	deg.
F _{Video} UHF	Video carrier frequency	471.25...855.25MHz	21		69	CH.
F _{Video} VHF	Video carrier frequency	55.25....62.25MHz	3		4	CH.
	Video carrier freq accuracy		-100		100	kHz
	Thermal Stability of Video carrier frequency	Tamb = 0° to 60° C	-100		100	kHz
	Thermal stability of Sound carrier frequency	Tamb = 0° to 60° C	-12		12	kHz
	Thermal Stability of RF video output level	Tamb = 0° to 60° C	-5		5	dB
	Thermal Stability of Sound carrier output level	Tamb = 0° to 60° C	-5		5	dB
	Out of band spurious			-60	-42	dB
	In band spurious			-65	-60	dB
	Video carrier and harmonics at CATV-input	< 2150MHz			46	dB μ V
	Harmonics of Video carrier at TV-output	<2150MHz			46	dB μ V

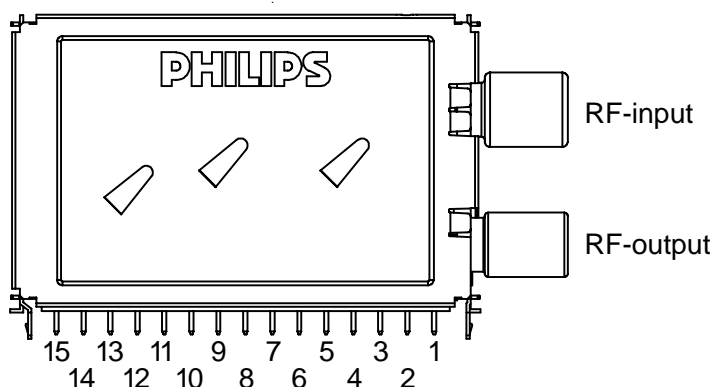
* **Note:** for optimal audio S/N performance the frequency deviation (FM) should be restricted to 45kHz

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

DEFINITION OF TERMINALS / SUPPLY DATA

You



Terminal	Function	Remark
1	n.c. option for RF-output option for outdoor unit power supply	
2	+5V \pm 5% splitter (V_S)	
3	Audio - baseband input (not connected for tuners without remodulator)	AC - coupled
4	Video - baseband input (not connected for tuners without remodulator)	AC - coupled
5	External RF-gain control voltage (0.5V - 4.0V)	In case the internal AGC loop is enabled, the max. source impedance is limited to 200 ohms
6	do not connect, leave terminal open	for testing only
7	PLL chip address select (I^2C / tuner)	see application notes
8	SCL (I^2C / tuner)	
9	SDA (I^2C / tuner)	
10	n.c.	
11	+5V \pm 5% supply tuner (V_{TU})	
12	'broadband' IF - output	AC coupled
13	IF-gain control voltage	max. gain at 3V min. gain at 0V (see application notes)
14	'narrowband' IF - output	AC coupled
15	'narrowband' IF - output	AC coupled

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

APPLICATION NOTES

Programming of tuner PLL

The tuner control (frequency selection and band switching) is done via the I²C bus.

One address byte and four data bytes are needed to fully program the tuner.

A PLL lock flag can be read from the tuner during 'READ' - mode.

Four independent PLL addresses are available; which one is actually valid depends on the address select voltage that is connected to terminal 7.

I²C-bus data format, 'WRITE' - mode:

BYTE NAME	BYTE	MSB							LSB	ACK
Address Byte	ADB	1	1	0	0	0	CA2	CA1	R/W=0	A
Divider Byte 1	DB1	0	N14	N13	N12	N11	N10	N9	N8	A
Divider Byte 2	DB2	N7	N6	N5	N4	N3	N2	N1	N0	A
Control Data Byte	CB	1	1	0	0	0	RSA	RSB	0	A
Bandswitch byte	BB	0	0	0	AGC2	AGC1	SP3	SP2	SP1	A

A = acknowledge

Description of used symbols:

- CA2, CA1 : chip address selection bits
(see table: Programmable address selection bits)
- R/W : Read / Write bit ; Bit = 0 \Rightarrow Write mode
Bit = 1 \Rightarrow Read mode
- N14 to N0 : LO frequency divider bits
- RSA, RSB : reference divider bits (see table: Reference Divider Settings)
- AGC2, AGC1 : RF-AGC loop Take Over Point (TOP) switch ports (**optional**)
(see table: RF-AGC TOP selection)
- SP5 SP1 : Switch ports; bit = 1 \Rightarrow port V_{out} is 'ON'
bit = 0 \Rightarrow port V_{out} is 'OFF'
(see table: Band selection table)

CA2, CA1: Programmable address selection bits:

CA2	CA1	Voltage applied to terminal 7
0	0	0V to 0.1xV _{TU}
0	1	terminal open
1	0	0.4xV _{TU} to 0.6xV _{TU}
1	1	0.9xV _{TU} to 1.0xV _{TU}

N14 to N0: programmable divider bits:

divider ratio: $N = N14 \times 2^{14} + N13 \times 2^{13} + \dots + N1 \times 2^1 + N0$

How to calculate the divider ratio N :

$$N = \frac{(f_{input} + f_{IF})}{f_{ref}} \left[\frac{Hz}{Hz} \right] \quad \text{whereby} \quad f_{ref} = \frac{4 \cdot 10^6}{64^{(1)}} [Hz] = 62.5 kHz$$

Note ⁽¹⁾ : divider ratio to be set with Bits ' RSA and RSB ' (see table below)

IMPORTANT NOTE:

Do not set the divider ratio as such that the tuner is tuned into extreme conditions i.e. far below or far above the specified frequency ranges.

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

RSA, RSB: PLL reference divider settings:

PLL step size	PLL ref. divider ratio	RSA	RSB
50.0 kHz	80	0	0
31.25 kHz	128	0	1
62.5 kHz	64	1	1

AGC2, AGC1: RF-AGC TOP selection: (optional for tuners with type name extension "G")

AGC2	AGC1	RF-AGC TOP	Remarks
0	0	High	Recommended for digital cable applications
1	0	Medium 2	
0	1	Medium 1	
1	1	Low	Recommended for analog cable applications

SP5 SP1: RF-Band selection table:

	SP3	SP2	SP1
low – band	0	0	1
mid – band	0	1	0
high - band	1	0	0

I²C-bus data format , ' READ ' - mode:

Name	MSB					LSB			
Address byte	1	1	0	0	0	CA1	CA0	R/W=1	A
Status byte	POR	FL	1	1	1	X	X	X	A

A : Acknowledge / X : Don't care

CA1 / CA0 = chip address (see address selection table)

POR = power-on-reset-flag ; POR = 1 on power-on

FL = in-lock-flag ; FL = 1 when PLL is phase locked

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

Conditions at Power-on reset:

At power-on the default setting of the bits is as following:

BYTE NAME	BYTE	MSB							LSB
Address Byte	ADB	1	1	0	0	0	CA2	CA1	X
Divider Byte 1	DB1	0	X	X	X	X	X	X	X
Divider Byte 2	DB2	X	X	X	X	X	X	X	X
Control Data Byte	CB	1	1	1	1	0	X	X	0
Bandswitch byte	BB	X	X	X	0	0	0	0	0

X= don't care

Below a threshold voltage at tuner terminal 11 of 3.2V at room temperature, the MOPLL is reset to the power-on state.

In that situation all switchports are OFF and the high-band oscillator is active.

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

Programming of remodulator PLL

Following data are assigned to PAL TV-systems only!

I²C-bus data format , 'write' mode:

NAME	BYTE	BITS								ACK
		MSB				LSB				
Address byte	ADB	1	1	0	0	1	0	1	0	A
Divider byte 1	DB1	0	TPN	N11	N10	N9	N8	N7	N6	A
Divider byte 2	DB2	N5	N4	N3	N2	N1	N0	VHF1	VHF0	A
Control byte 1	CB1	1	0	STB1	SW	PS	0	VHF2	0	A
Control byte 2	CB2	0	STB2	STB3	SC1	SC0	0	0	0	A

Description of symbols:

- TPN: test pattern generator bit; TPN = 0 \Rightarrow pattern generator off (normal operation)
TPN = 1 \Rightarrow pattern generator on
- N11...N0: programmable divider bits; step size = 250kHz in UHF (VHF2, VHF1, VHF0 = 0, 0, 0)
- VHF2, VHF1, VHF0 programmable prescaler bits (see table "VHF prescaler")
- SW = modulator filter switch (**only valid for tuners with type name extension "L"**)
SW = 0 \Rightarrow modulator filter characteristic set to UHF mode
SW = 1 \Rightarrow modulator filter characteristic set to VHF ch 3/4 mode
- PS: programmable picture to sound ratio control bit ; PS = 0 \Rightarrow P/S = 12dB
PS = 1 \Rightarrow P/S = 16dB
- STB2, STB1, STB0 = 0, 0, 0 \Rightarrow normal operation (see table "Stand-By")
- SC1, SC0 sound subcarrier frequency control bits (see table "Sound Subcarrier Frequencies")
- A: acknowledge bit

'VHF ch 3/4 prescaler' settings:

The VHF prescaler needs to be set in case the modulator has to operate in the VHF frequency range.

NOTE: The VHF range should be limited to a max, frequency of 70MHz and the modulator output filter should be switched "on" (Bit 'SW') in order to suppress the harmonics of the selected output channel.

The switchable VHF/UHF filter is only available in tuners with type name extension "L".
All other tuner versions are restricted to the UHF modulator range!

VHF2	VHF1	VHF0	Divider ratio of prescaler
0	0	0	Ratio = RF/1 ; UHF-operation; step size 250kHz
0	1	1	Ratio = RF/8 ; VHF channel 4; step size 31.25kHz
1	0	0	Ratio = RF/16 ; VHF channel 3; step size 15.625kHz

Example: set modulator to channel E4 (picture carrier 62.25MHz)

Modulator oscillator set to 498MHz, divided by 8 results in 62.25MHz

Channel 3 corresponds to an initial modulator frequency of 884MHz !

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

'Sound Subcarrier Frequencies' settings:

SC1	SC0	Sound Subcarrier Frequency
0	0	4.5 MHz
0	1	5.5 MHz
1	0	6.0 MHz
1	1	6.5 MHz

'Stand-By' settings:

STB1	STB2	STB3	Stand-By conditions
1	1	1	Modulator Stand-By mode: sound and UHF oscillators, as well as sound and video modulator sections turned off; the I ² C bus section of modulator in stand-by mode

Test Pattern Generator (TPN bit) :

The MOD-IC generates a simple test pattern, which can be switched under bus control to permit a TV receiver to tune to the modulator output frequencies. The pattern consists of two white vertical bars on a black background and a 976Hz audio test signal.

How to calculate the divider ratio N:

The tuner internal 4MHz reference frequency is divided by 128 (fixed divider ratio), resulting in a remodulator reference frequency of 31.25kHz .

This reference frequency is used for both PLLs Video and Sound .

With a fixed, internal 1:8 divider, the divider ratio N for a wanted frequency F is given by:

$$N = \frac{F}{8} \cdot \frac{128}{4 \cdot 10^6} \frac{[Hz]}{[Hz]}$$

with: $N = 2048 \times N_{11} + 1024 \times N_{10} + \dots + 4 \times N_2 + 2 \times N_1 + N_0$

Note: Do not set the divider ratio as such that the UHF oscillator of the modulator is tuned into extreme conditions i.e. below or above the specified UHF range

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

I²C-bus data format , 'read' mode:

NAME	BYTE	BITS								ACK
		MSB				LSB				
Address byte	ADB	1	1	0	0	1	0	1	1	A
Status byte	SB	-	-	-	-	-	Y2	Y1	OOR	A

- don't care

Description of symbols:

- Y2 = 0 \Rightarrow UHF VCO is active
- Y1 = VCO Out-Of-Range information ; Y1^(*) = 0 \Rightarrow VCO frequency too low
Y1^(*) = 1 \Rightarrow VCO frequency too high
(*) only valid if OOR = 1
- OOR = VCO range status ; OOR = 0 \Rightarrow VCO in range (normal operation)
OOR = 1 \Rightarrow VCO out of range

Max. IF-output level:

In order not to drive the tuner into extreme signal handling conditions, especially for analog applications the RF-gain control loop should be set to :

105dBuV (or AGC2, AGC1 = 1, 1 in case of internal AGC enabled)

referred to the 'broadband' IF-output !

Max. Permissible IF-load impedance:

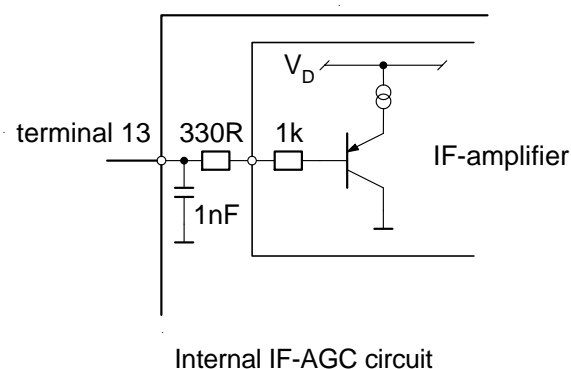
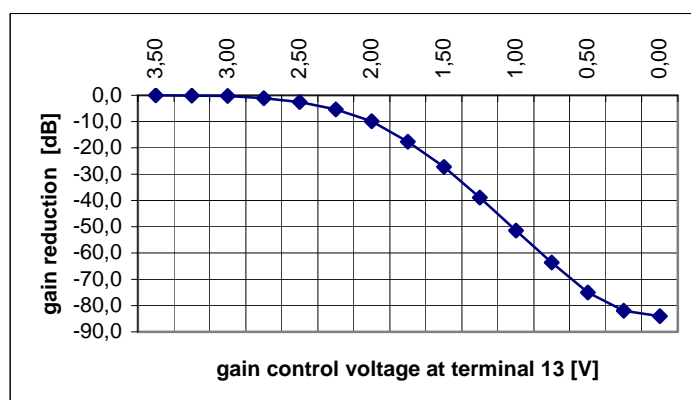
The max. load applied to the 'broadband' IF-output of the tuner should not exceed:

2k Ω min./15pF max.

The reactive load has to be compensated (tuned-out to the IF-center frequency) by an inductance connected in parallel to the load.

The max. load applied to the 'narrowband' balanced IF-output of the tuner is limited to **1k Ω min.** .

Gain control characteristic of IF-amplifier (terminal 13) :



**Tuner module for analog and digital
cable (QAM) applications**

CD(M)1300L-3

I²C bus traffic and crosstalk

To avoid this I²C bus crosstalk and be able to have a clean noise spectrum, it is necessary to use a bus gate that enables the signal on the bus to drive the MOPLL. This is used only when the communication is intended for the tuner part (such a kind of I²C bus gate is included into the Philips terrestrial channel decoders), and to avoid unnecessary repeated sending of the same information.

Main board recommendations :

The tracks on the main board connected to the tuners' terminals should be kept as short as possible in order to avoid interferences because of immunity problems and/or to avoid problems with regard to radiation of the local oscillator.

**For tuners with DC-power path between pin 1 and RF-input connector :
(type name extension 'P')**

The max. current is limited to 300mA

The max. voltage is limited to 25V

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

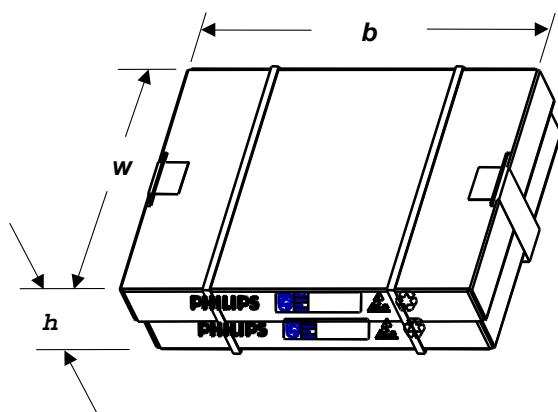
PACKAGING INFO

The products are packed in the carton box and transferred to customers by Pallet Transport.

	Dimension b x w x h (cm)	No. of sets	Gross Wt (Kg)
Carton	46 x 34 x 12.2	90	5.7
Pallet	120 x 105 x 105	4590	309

Carton Boxes are made of Corrugated Fibreboard which are free of environmentally banned substances.

Example of Carton Box:

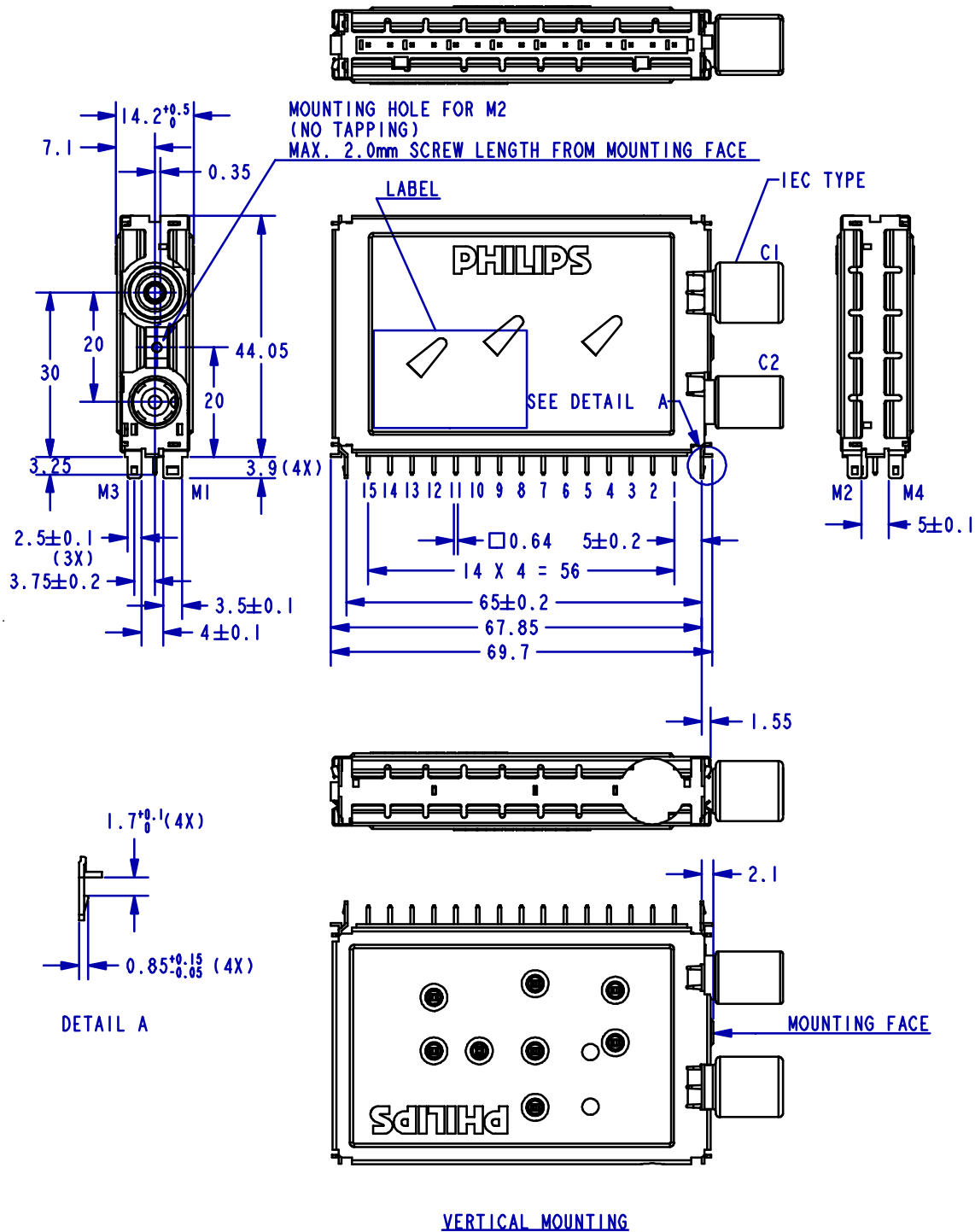


Tuner module for analog and digital cable (QAM) applications

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MECHANICAL DIMENSIONS

general tolerances $\pm 0.5\text{mm}$ unless otherwise stated / all dimensions in millimeter / drawings not to scale

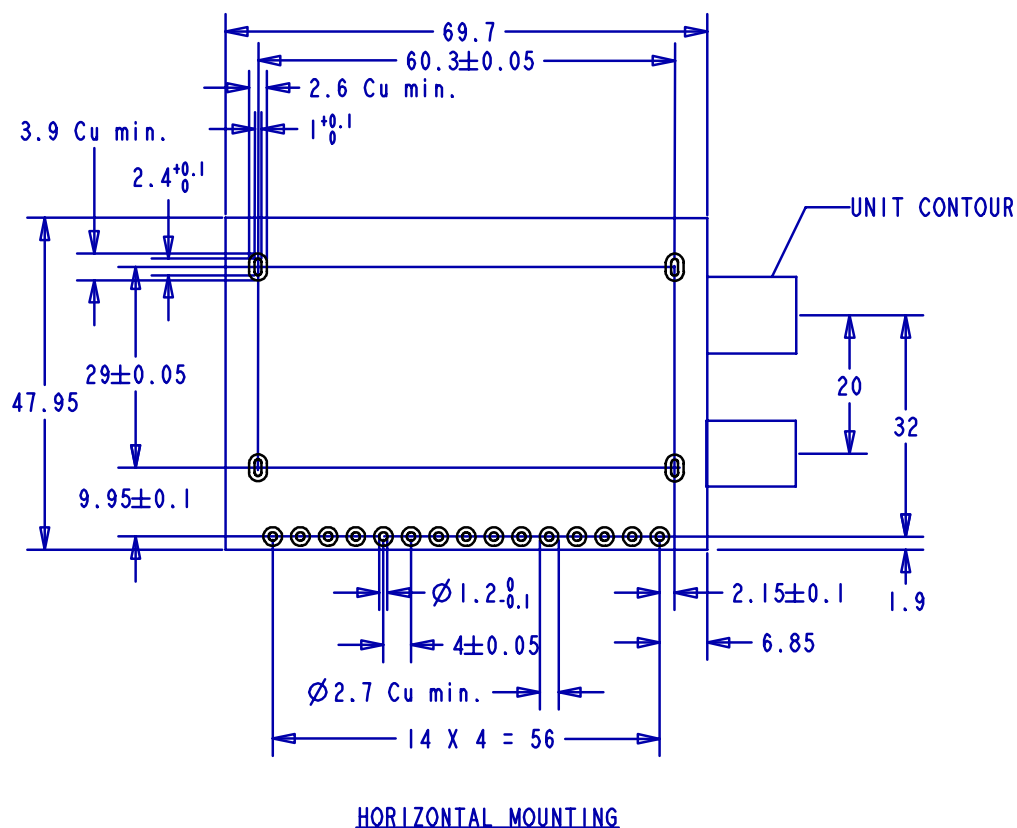
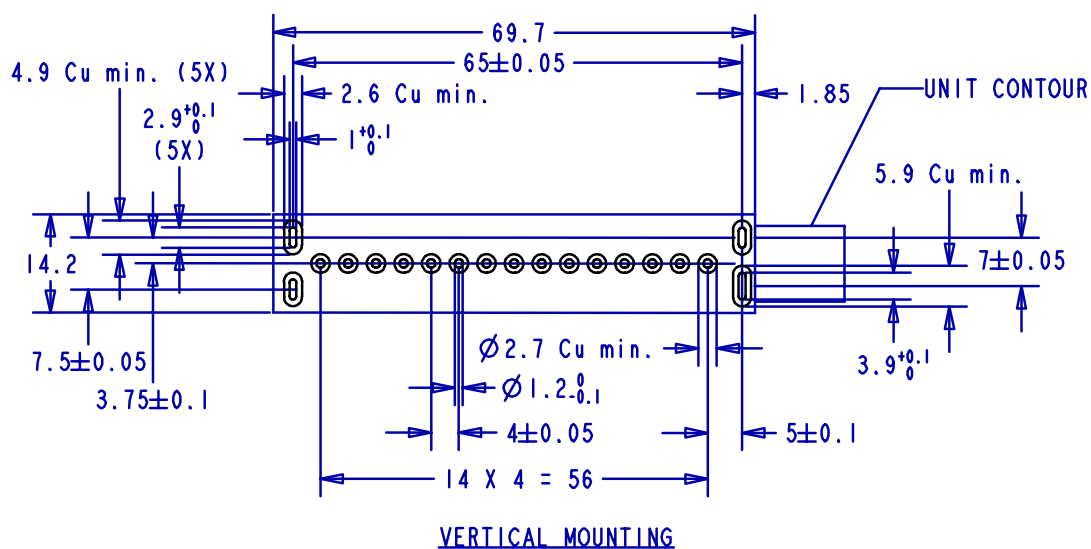


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PUNCHING PATTERN OF CHASSIS PCB

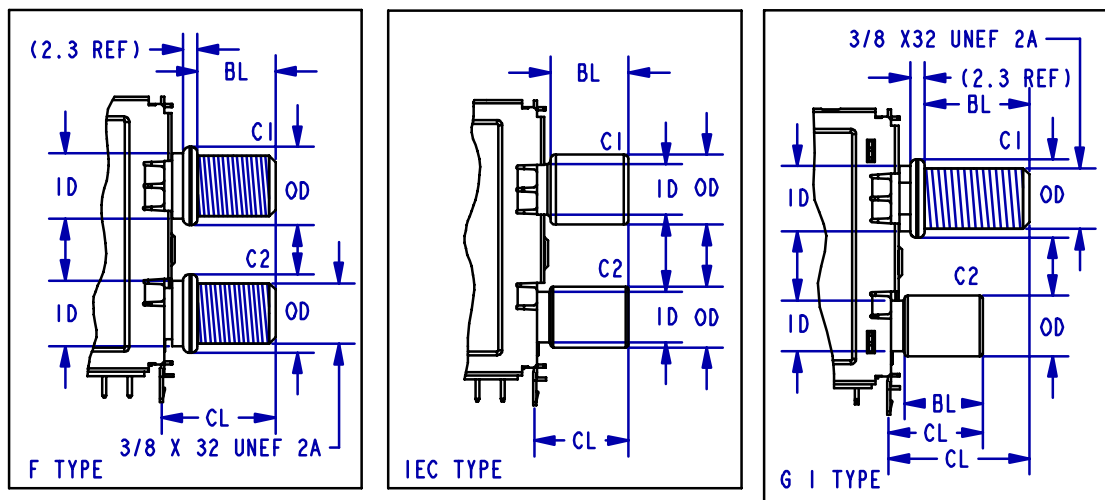
PUNCHING PATTERN SEEN FROM SOLDER SIDE



Tuner module for analog and digital cable (QAM) applications

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RF-connector data



CONNECTOR TYPE		CONNECTOR LENGTH, CL	BODY LENGTH, BL	OVERALL DIAMETER, OD	INNER DIAMETER, ID
F - F	C1 : F	17.9±0.5	12.2±0.3	12.3+0/-0.3	10.2±0.2
	C2 : F	17.9±0.5	12.2±0.3	12.3+0/-0.3	10.2±0.2
IEC - I	C1 : IEC FEMALE	14.8±0.5	12.3±0.3	11.0±0.1	8.0±0.2
	C2 : IEC MALE	14.8±0.5	12.3±0.3	9.53±0.05	8.0±0.2
GI	C1 : F	22.2±0.5	16.5±0.3	12.3+0/-0.3	10.2±0.2
	C2 : IEC MALE	14.8±0.5	12.3±0.3	9.53±0.05	8.0±0.2

In case of tuners equipped with IEC connector, RF-input is standard IEC female, RF-output is standard IEC male !
Connector C2 is void in case of single connector tuner types.

Tuner module for analog and digital cable (QAM) applications

CD(M)1300L-3

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 specification.
Application Information	
Where application information is given, it is advisory and does not form part of the specification	

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