

Hyperband television tuner

TUN14418

FEATURES

- VHF/Hyperband/UHF tuner
- Systems CCIR: B/G, H
- Digitally controlled (PLL) tuning via I²C-bus
- Off-air channels, S-cable channels and Hyperband
- World standardized mechanical dimensions and world standard pinning
- Compact size
- Comply to “CENELEC EN55020” and “EN55013”

DESCRIPTION

The TUN14418 belong to the family of tuners, which are designed to meet a wide range of applications. It is a combined VHF/Hyperband/ UHF tuner suitable for CCIR systems B/G and H. 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) include. amendment 1 (1992) and amendment 2 (1993)
- European standards CENELEC EN55013, EN55020

ORDERING INFORMATION

TYPE	SYSTEM	DESCRIPTION
TUN14418	CCIR	symmetrical IF output; IEC connector (14.5 mm), I ² C status byte

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INTERMEDIATE FREQUENCIES

SIGNAL	FREQUENCY (MHz)	
	SYSTEM	B/G, H
Picture carrier	38.90	
Colour	34.47	
Sound	33.40	

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 S41	231.25 to 463.25
High band	E21 to E69	471.25 to 855.25 ⁽²⁾		

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.

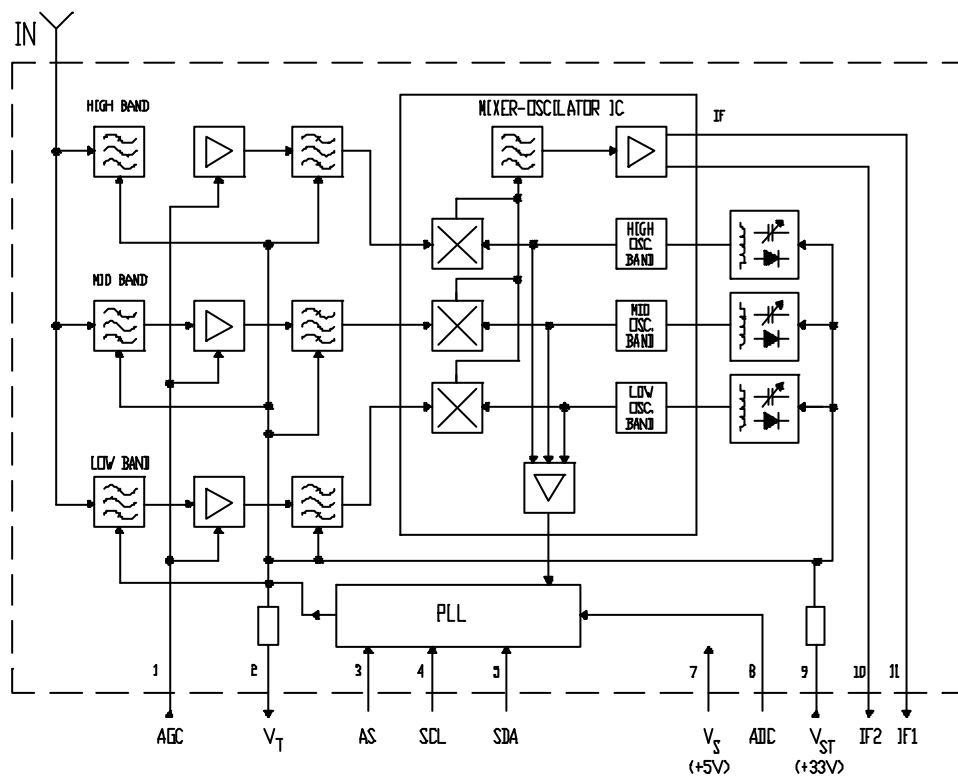


Fig.1 Electrical block diagram

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PINNING

SYMBOL	PIN	DESCRIPTION
AGC	1	gain control voltage
V _T	2	tuning voltage
AS	3	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
ADC	8	ADC input
V _{ST}	9	tuning supply voltage +33 V
IF2	10	symmetrical IF output
IF1	11	symmetrical IF output
GND	MT1, MT2	mounting tags (ground)
IN		aerial input connector IEC (14.5 mm)

LIMITING VALUES

Environmental conditions

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
Non-operational conditions				
T _{amb}	ambient temperature	-40	+60	°C
RH	relative humidity	-	100	%
Operational conditions				
T _{amb}	ambient temperature	-15	+60	°C
RH	relative humidity	-	93	%

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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	5.5	V
I _S	supply current		-	-	130	mA
V _{ST}	supply voltage	9	30	33	35	V
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	-	-	5.5	V
V _{SDA}	serial data input voltage	5	-	-	5.5	V
I _{SDA}	serial data input current		-1	-	5	mA

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 both to systems 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 operational conditions.

SYMBOL	PARAMETER	VALUE	UNIT
T _{amb}	ambient temperature	25 +/- 5	°C
RH	relative humidity	60 +/- 15	%
V _S	supply voltage	5.0 +/- 0.1	V
V _{AGC}	AGC input voltage	4.0 +/- 0.1	V
V _{ST}	tuning supply 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.	TYP.	MAX.	UNIT
V _{SWR}	reflection coefficient	referred to 75 Ω impedance	-	2	4	
V _{ant}	antenna connection disturbance voltage	< 1.75 GHz; comply to "EN55013 section 3.3"	-	-	46	dB μ V

General characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f _p	frequency range: low band mid band high band		48.25 175.25 471.25	- - -	168.25 463.25 855.25	MHz MHz MHz
G _v	voltage gain: all channels gain taper	The IF output is loaded with a test circuit according diagram fig.2	40 -	45 -	52 7	dB dB
F	noise: low band mid band high band	The IF output is loaded with a test circuit according diagram fig.3	- - -	6.0 6.0 6.0	9 9 8	dB dB dB
ΔV_{AGC}	AGC input voltage range: low and mid band high band		45 40	60 50	- -	dB dB
α_i	image rejection: low band mid band high band		66 60 50	70 69 60	- - -	dB dB dB
α_{IF}	IF rejection (picture): channel E2 low, mid and high bands		55 65	68 71	- -	dB dB
V _{ESD}	electrostatic discharge (ESD): protection on pins 1 to 5 and 6 to 11 protection on antenna socket	note 1	2 8	- -	- -	kV kV
	oscillator characteristics: oscillator tuning resolution lock-in time		- -	- -	note 2 150	kHz msec

Notes

1. The tuner meets specifications IEC 1000-4-2 level 1 for pins and level 4 for antenna socket.
2. Resolution 31.25 kHz, 50.00 kHz or 62.5 kHz (see Table "Ratio select bits").

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Visibility test

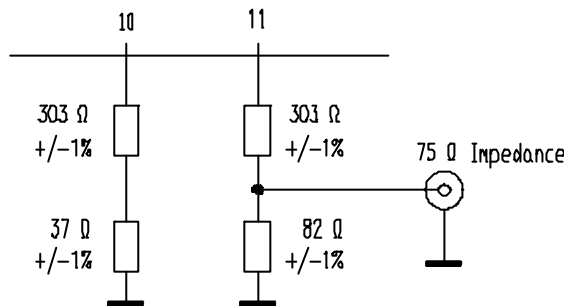
The tuners meet the requirements of the European norm "EN55020", when measured in an adequate television receiver.

Recommended adjustment of Tuner AGC in TV chassis:

- Channel: E21 (471.25 MHz PC-frequency)
- Input level: 70 dB μ V/75 Ω
- IF output level: 105 dB μ V
- Gain reduction: 10 dB
- AGC-Voltage: 2.6 V +/-0.2V

Radiation

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



test circuit attenuation : 26 dB

Fig. 2 Test circuit for voltage gain.

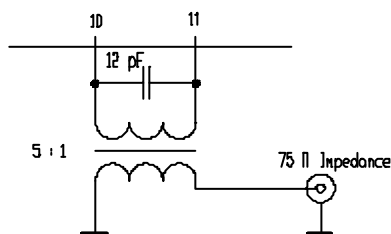


Fig. 3 Test circuit for noise figure.

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APPLICATION INFORMATION

WRITE mode

BYTE	BITS								
	7 ⁽¹⁾ MSB	6	5	4	3	2	1	0 LSB	A ⁽²⁾
Address byte	1	1	0	0	0	MA1	MA2	R\W ⁽³⁾	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 byte1	1	CP	0	0	1	RSA	RSB	0	A
Control information byte 2	P7	P6	P5	P4	X	P2	P1	P0	A

Notes

1. X = don't care.
2. A = Acknowledge.
3. R/W bit = 0 for WRITE mode, R/W bit = 1 for READ mode.

Address selection

V_s = =5 V (PLL supply voltage).

MA1	MA0	ADDRESS	VOLTAGE AT PIN 3
0	0	C0	GND to 0.1XV _s
0	1	C2	OPEN or 0.2XV _s to 0.3XV _s
1	0	C4	0.4XV _s to 0.7XV _s
1	1	C6	0.8XV _s to 1.1XV _s

Programmable divider settings (bytes 1 and 2)

Divider ratio:

$$N = R \times \{ f_{RF,pc} + f_{IF,pc} \},$$

R = 16 with reference divider = 512

R = 20 with reference divider = 640

R = 32 with reference divider =1024

$$N = (16384 \times n14) + (8192 \times n13) + (4096 \times n12) + (2048 \times n11) + (1024 \times n10) + (512 \times n9) + (256 \times n8) + (128 \times n7) + (64 \times n6) + (32 \times n5) + (16 \times n4) + (8 \times n3) + (4 \times n2) + (2 \times n1) + n0$$

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.

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

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Ratio select bits

RSA	RSB	REFERENCE DIVIDER	STEP SIZE (kHz)
X	0	640	50.00
0	1	1024	31.25
1	1	512	62.50

Band switching (Control byte 2)

BIT								ACTIVE PORT	BAND
P7 MSB	P6	P5	P4	P3	P2	P1	P0 LSB		
X	X	X	X	X	0	1	0	P1	Low band
X	X	X	X	X	1	0	0	P2	Mid band
X	X	X	X	X	0	0	1	P0	High band

READ mode

BYTE	BITS								
	7 MSB	6	5	4	3	2	1	0 LSB	A ⁽¹⁾
Address byte	1	1	0	0	0	MA1	MA0	1	A
Status byte	POR ⁽²⁾	FL ⁽³⁾	X	X	X	A2 ⁽⁴⁾	A1 ⁽⁴⁾	A0 ⁽⁴⁾	A

Notes

1. A = Acknowledge.
2. POR = Power On Reset flag (POR=1 at power on).
3. FL = In-lock flag (FL=1 at loop is phase-locked).
4. A2, A1, and A0 are the digital outputs of the 5 level ADC.

ADC byte

VOLTAGE AT PIN 8	A2	A1	A0
0.60XV _S to V _S	1	0	0
0.45XV _S to 0.60XV _S	0	1	1
0.30XV _S to 0.45XV _S	0	1	0
0.15XV _S to 0.30XV _S	0	0	1
0 to 0.15XV _S	0	0	0

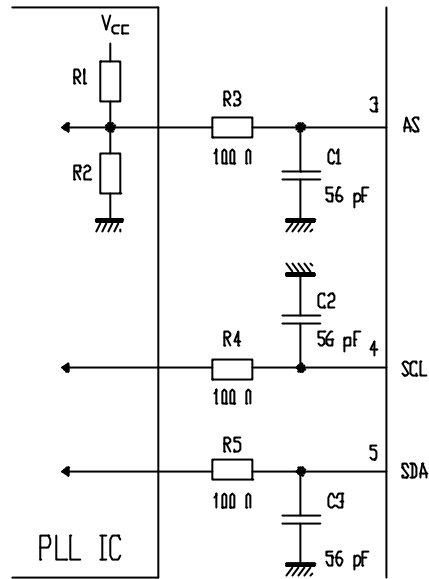


Fig.4 I²C-bus load.

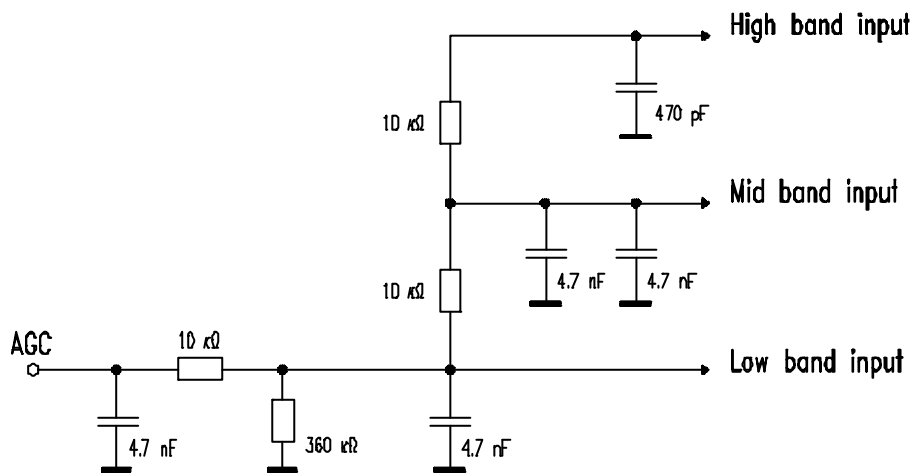


Fig.5 Internal AGC circuit.

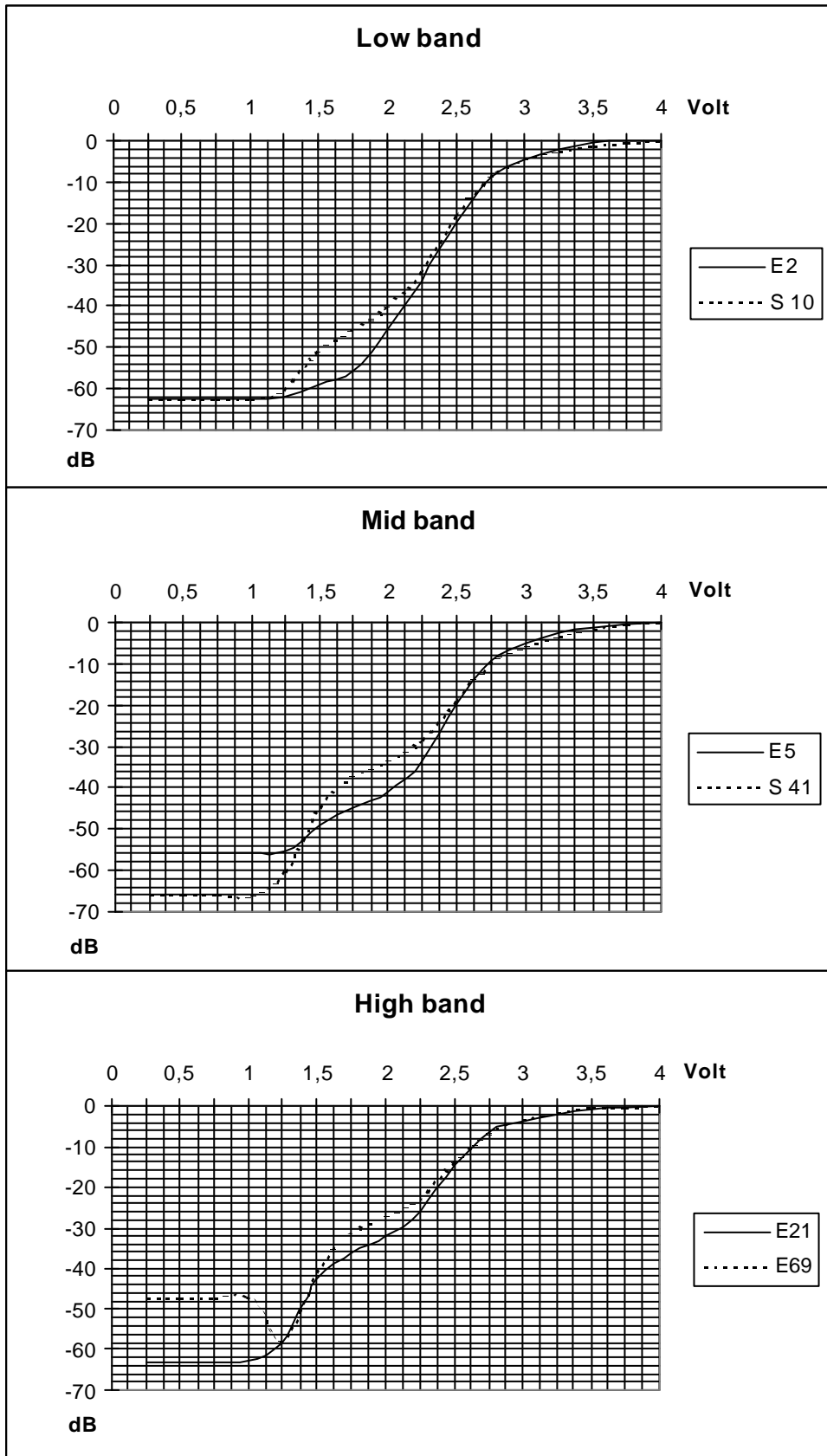


Fig.6 AGC characteristics.

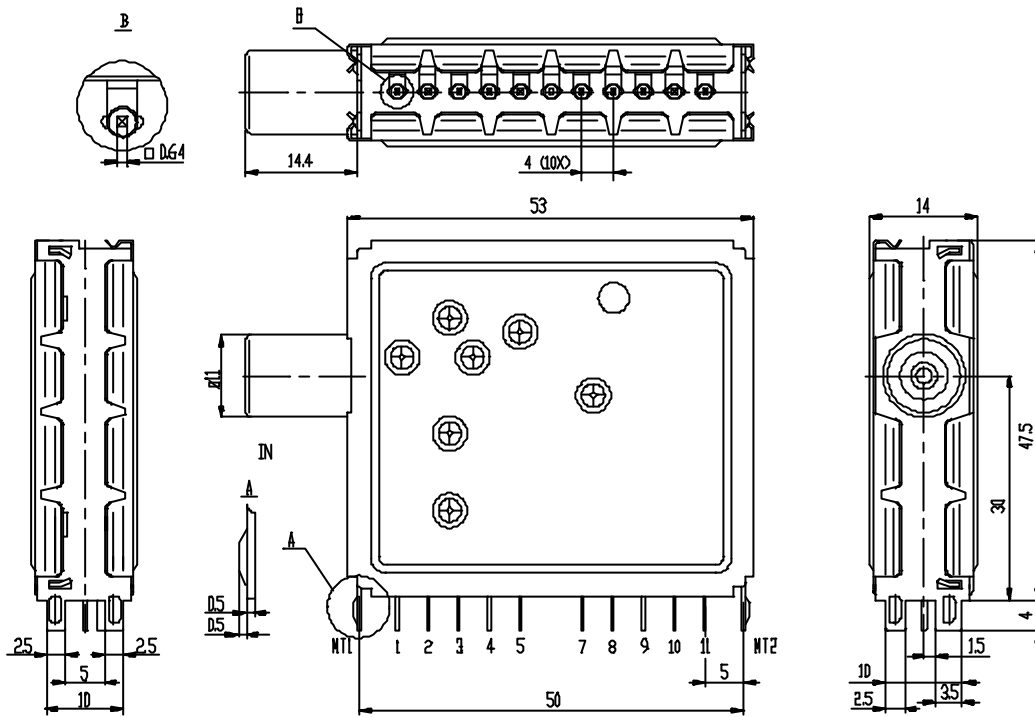


Fig.7 Mechanical outline

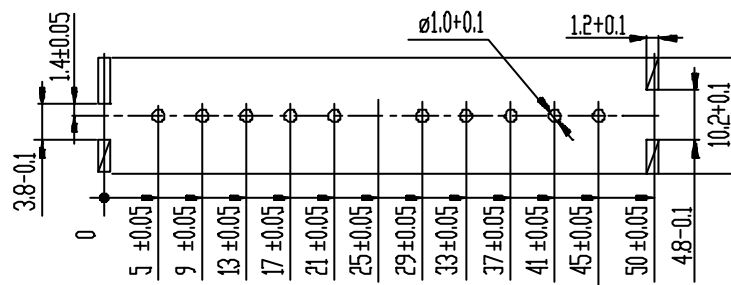


Fig.8 Punching pattern seen from solder side

Aerial connections

Standard IEC socket female 75 Ω.