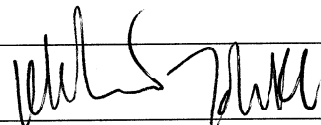


DATA SHEET

FM1216ME (MK3 family) Multi-Standard Desktop Video & FM Radio Module

Product specifications

Approval by :



Name / Date : Toh Kong Lim / 18.10.2001



PHILIPS

Multi-Standard Desktop Video & FM Radio Module

FM1216ME

FEATURES

- Multi-Standard TV Systems and FM Radio Broadcast reception
- True 5 V device (low power dissipation)
- Full frequency range from channel E2 (48.25 MHz) to channel E69 (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 kHz 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.
- FM Auto Search Tuning capable
- I²C-bus control of tuning, address selection, AFC status information
- Complies with European regulations on radiation, signal handling and immunity ("CENELEC 55020, 55013")
- Small horizontally mounted metal 70 mm housing



DESCRIPTION

The FM1216ME family belongs to the new FM1200 MK3 family of small size frontends, which are designed to meet a wide range of RF applications in the PC /TV Multi-Media environment. The FM1216ME combines the functions of an FM radio tuner, an all-band TV tuner, and a multi-standard TV IF demodulation unit for both positive and negative modulated TV systems. The FM1216ME is intended for CCIR L/L' (France), B/G, I and D/K systems and FM broadcast. The FM1216MP covers only CCIR B/G, D/K and I systems as well as FM radio

The frontends have a built-in digital (I²C) PLL tuning system. A DC-DC converter circuit is built-in in the FM1216ME to synthesize the tuning voltage required, thus making the frontend a true 5V device.

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
FM1216ME/I H	IEC / Horizontal	3139 147 18201
FM1216MP/I H	IEC / Horizontal	3139 147 18231

Multi-Standard Desktop Video & FM Radio Module**FM1216ME****INTERMEDIATE FREQUENCIES**

SYSTEM	L	L'	B/G	D/K	I
Picture carrier	38.90	33.95	38.90	38.90	38.90
Colour	34.47	38.38	34.47	34.47	34.47
Sound 1	32.40	40.40	33.40	32.40	32.90
Sound 2	-	-	33.16	-	-
NICAM	33.05	39.80	33.05	33.05	32.348

CHANNEL COVERAGE

BAND	FREQUENCY (MHz)
FM radio band	87.50 to 108.00 MHz
Low band	48.25 to 160.00 MHz
Mid band	160.00 to 442.00 MHz
High band	442.00 to 863.25 MHz

PINNING

SYMBOL	PIN	DESCRIPTION
N.C.	1	(AGC Monitor) Do Not Connect *
N.C.	2	(Tuning Voltage Monitor **) Do Not Connect *
+5V	3	Supply Voltage Vb, Tuner section
SCL	4	I ² C-Serial Clock
SDA	5	I ² C-Serial Data
AS	6	I ² C-Address Select
NC	7	Not Connected
NC	8	Not Connected
AF-R	9	FM radio Left Channel
AF-L	10	FM radio Right Channel
2 nd IF sound	11	Second IF sound output
CVBS	12	Composite Video Baseband Signal
+5V, IF	13	Supply Voltage, IF section
AF O/P (TV) **	14	AF sound output
GROUND		Mounting Tags (TH1,TH2,TH3,TH4)

* For process use only

** See remarks on pg 19.

Multi-Standard Desktop Video & FM Radio Module**FM1216ME****LIMITING VALUES****Limiting values under operational conditions**

The tuners are guaranteed to function properly under the following conditions.

SYMBOL	PARAMETER	PIN	MIN.	TYP.	MAX.	UNIT
V _{AGC}	AGC Voltage Monitor (not to be connected) (See Note 1)	1	10 M			Ω
V _T	Tuning Voltage Monitor (not to be connected)	2	-	-	-	-
V _S	Supply Voltage V _b Ripple susceptibility (see Note 2) 20Hz - 100kHz 100kHz - 200kHz Supply current	3	4.75	5 80	5.25 5 10 150	V mV _{pp} mV _{pp} mA
V _{SCL}	SCL bus input voltage	4	-0.3		5.25	V
V _{SDA}	SDA Bus input voltage SDA Bus current (open collector)	5	-0.3 -1.0		5.25 5	V mA
	AS voltage (see Note 3)	6			5.25	V
	FM - Right Channel - DC voltage - Load impedance	9		1.0 100		V kΩ
	FM - Left Channel - DC voltage - Load impedance	10		1.0 100		V kΩ
	2 nd IF sound output - Load impedance D.C. A.C.	11	1.0 1.0			kΩ kΩ
	Composite Video Baseband Signal - Load impedance D.C. (see 10.3) (modulus) A.C. - Load time constant	12	75 75		100	Ω Ω ns
	Supply voltage, IF section (see Note 2) Ripple susceptibility (max permitted) 20Hz - 100kHz 100kHz - 500kHz Current	13	4.75	100	5.25 10 10 160	V mV _{pp} mV _{pp} mA
	AF output - Load impedance D.C. A.C.	14	100.0 10.0			kΩ kΩ

Note 1 : Minimum impedance required is 10MΩ, otherwise AGC voltage is loaded down. For process only.

Note 2 : Maximum allowable Ripple voltage superimposed on the +5V supply in the frequency range from 20 Hz to 500 kHz. Criteria : for TV : Δf < 2.12 kHz or AM < 0.28%

Note 3 : For detailed information about address coding, refer to Application Information.

Multi-Standard Desktop Video & FM Radio Module**FM1216ME****Environmental conditions**

SYMBOL	PARAMETER	CONDITIONS	MIN.	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	(10-55 Hz)	-	0.35	mm
Operational conditions					
T_{AMB}	Ambient temperature		0	+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
$Z_{S(AE)}$	aerial source impedance (unbalanced)	75	Ω
Z_{IF}	second IF sound output load	0.5	k Ω
	Video output load	75	Ω
V_{ST}	AF1 sound output load	100	k Ω

Multi-Standard Desktop Video & FM Radio Module**FM1216ME****TUNER CHARACTERISTICS**

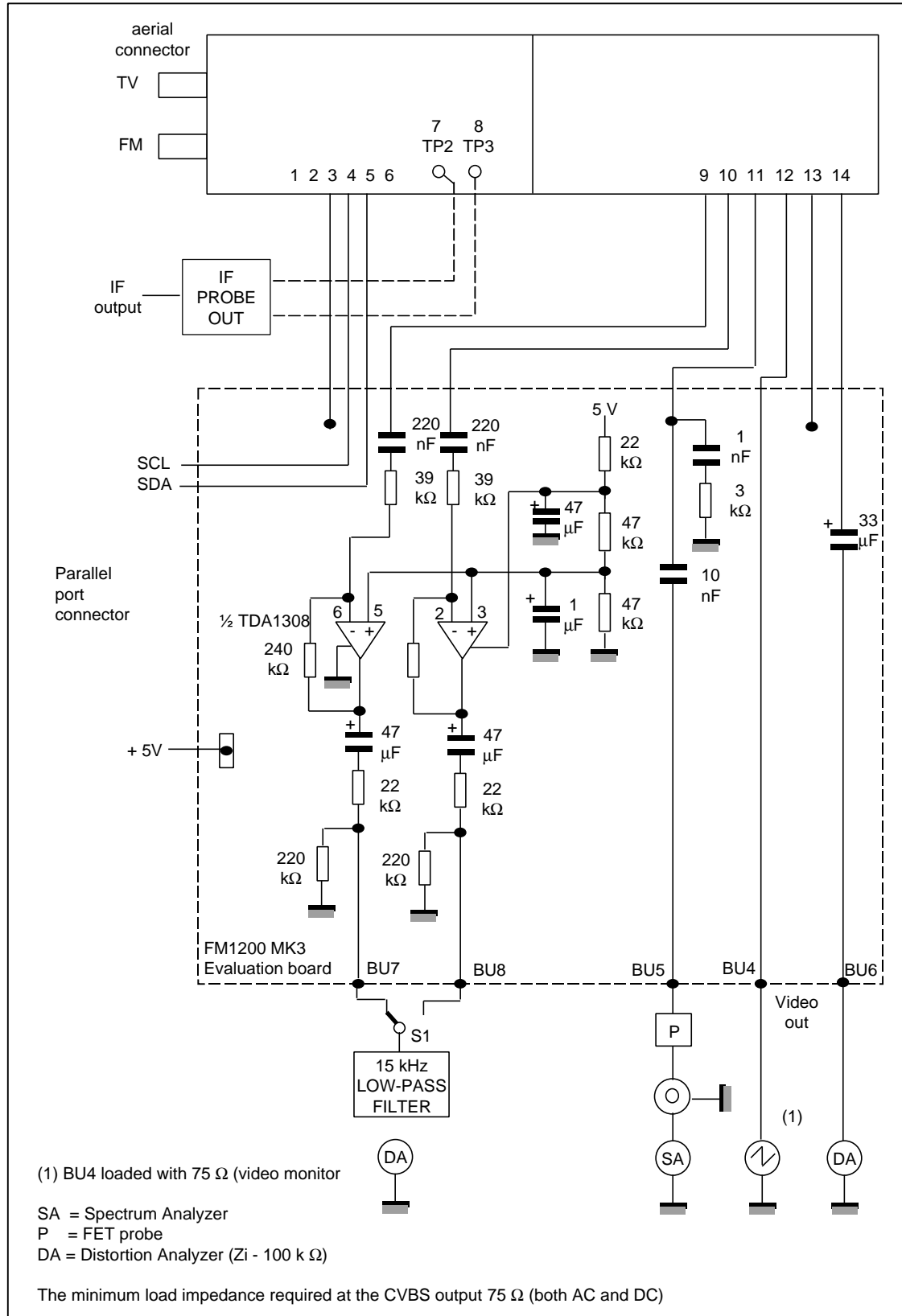
EQUIPMENT	PARAMETER	VALUE	UNIT
DC Voltmeter	input impedance	10	M Ω
Oscilloscope	input impedance	1	M Ω
	resistance		PF
	capacitance	15	
Spectrum analyzer	input impedance	50	Ω
FET probe	input impedance	10	M Ω
	resistance		PF
	capacitance	3.5	

Multi-Standard Desktop Video & FM Radio Module

FM1216ME

TEST DIAGRAM

The frontend characteristics are measured according to the test diagram depicted below :



Multi-Standard Desktop Video & FM Radio Module**FM1216ME****Definitions of test signals**

TEST SIGNAL	FREQ. (MHz)	AMPLITUDE	MODULATION
A0: unmodulated vision carrier	480.25	60 dB(μ V)	
A1: L-system signal with video modulation	480.25	60 dB(μ V) (peak white)	100 % (sync. level at 0%), 2T-pulse and bar, unless otherwise indicated.
A2: B/G -system signal with video modulation	480.25	60 dB(μ V) (top sync.)	100% (rest carrier 10%), 2T-pulse and bar, unless otherwise indicated
A3: L' - system signal with video modulation.	55.75	60 dB(μ V)	100% (sync. white < 6%), 2T pulse and bar, unless otherwise indicated
B1: unmodulated main sound carrier B/G/I/D/K system as chosen	A2 + 5.5/6.0/6.5 MHz	-13 dB respectively wrt A2	
B2: AM-modulated sound carrier L-system	486.75 MHz	-10 dB with respect to test signals A0 or A1	m=0.54, mod. freq. 1 kHz, unless otherwise indicated
B3: FM-modulated main sound carrier B/G/I/D/K system respectively	A2 + 5.5/6.0/6.5 MHz	-13 dB respectively wrt A2	freq.dev.=27 kHz, mod.freq. 1kHz, 50 μ s pre-emphasis, unless otherwise indicated
B4: unmodulated 2nd sound carrier B/G – system	A2 + 5.85 MHz	-20 dB respectively wrt A2	
B5: unmodulated main sound carrier L system	A1 + 6.5 MHz	-10 dB wrt test signal A1	
B6: AM modulated sound carrier L' system	A3 - 6.5 MHz	-10 dB wrt test signal A3	M = 0.54, mod. freq. 1 kHz, unless otherwise indicated
C1: FM-modulated Mono sound carrier	98.00 MHz	60 dB μ V	freq. dev. = 22.5 kHz , mod. freq. = 1 kHz
C2: FM-modulated Mono sound carrier	97.70 or 98.30 MHz	60 dB μ V	freq. dev. = 22.5 kHz , mod. freq. = 1 kHz
C3: FM-modulated Stereo sound carrier	98.00 MHz	60 dB μ V	freq. dev. = 75.0 kHz , mod. freq. = 1 kHz, 10% pilot carrier (L=R), 90 % M+S signal level
D0: unmodulated (N-1) sound carrier	(RF carrier frequency of A2) - 1.5 MHz	-13 dB wrt test signal A2	
D1: unmodulated (N-1) sound carrier L system	(RF carrier frequency of A1) - 1.5 MHz	-10 dB wrt test signal A1	

Multi-Standard Desktop Video & FM Radio Module**FM1216ME****AERIAL INPUT CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
VSWR		referred to 75 Ω at RF picture carrier frequency both inputs for phono version only	- -	5 6	
V _{SURGE}	surge protection	Both inputs	5		kV
V _{ANT}	antenna terminal disturbance voltage	Both inputs up to 1.75 GHz	-	46	dB μ V

GENERAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f _b	frequency range low band mid band high band FM band		48.25 160.00 442.00 88.00		160.00 442.00 863.25 108.00	MHz MHz MHz MHz
Δ f _b	margin low band mid/high band FM band		1.5 1.5 1.5			MHz MHz MHz
voltage gain	low band mid band high band		36 36 36	45 45 42	52 52 50	dB dB dB
α_j	Image rejection low band mid band high band	- wanted test signal F _{ant} at 60 dB μ V - unwanted test signal at (F _{ant} + 77.7) MHz	65 60 50			dB dB dB
α_{IF}	IF rejection All bands	- wanted test signal F _{ant} . - unwanted test signal A0 with frequency (F _{IF,PC} - 1) MHz	60			dB
t _{ij}	Oscillators lock-in time	Tuning speed (lock bit, CP = 1)			150	ms
V _{ESD}	ESD protection at the terminals	All terminals of each frontend are protected against electrostatic discharge up to The products are classified in category B (MIL-STD-883C).	2			kV

Multi-Standard Desktop Video & FM Radio Module**FM1216ME**

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
FM radio characteristics						
α_{26}	Limiting Sensitivity for (S+N)/N mono	test signal C1, bit C7 = 0	-	20	35	dB μ V
α_{50}		test signal C3	-	30	45	dB μ V
S/N	Signal-to-Noise Ratio mono at $\Delta f = 22.5$ kHz $\Delta f = 75.0$ kHz	test signal C1, bit C7 = 0	43	53		dB
		test signal C3	53	63		dB
$\alpha_{j(FM)}$	FM image rejection	test signal C1	50	60		dB
	frequency response	test signal C3; 3 dB points	40		14	kHz
	audio output level					
	FM AF output level at terminal Bu7/Bu8 – mono	test signal C1, bit C7 = 0	200	300	400	mV
	Stereo	test signal C3, bit C7 = 1	350	450	550	mV
	stereo separation	test signal C3	25	33		dB
	total harmonic distortion	test signal C3		0.8	2.0	%

Video and audio characteristics

PARAMETER	TEST SIGNAL	TEST POINT	MIN.	TYP.	MAX.	UNIT
CVBS output level	A1	BU4	0.7	1.0	1.3	V _{pp}
Amplitude video signal	A1	BU4		0.35		V
DC level of sync. Pulse						
CVBS amplitude at discrete frequencies						
2 MHz	A1	BU4		0.0	- 1.5	dB
3 MHz	A1	BU4		- 0.5	- 2.5	dB
4.43 MHz	A1	BU4		-1.0	- 4.0	dB
<u>Sound Carriers Rejection</u>						
Specification valid for : B/G, I and D/K mode wrt 1 MHz for :	A2 + B1 + B4	BU4				
5.5/6.0 MHz			42			dB
6.5 MHz			40			dB
<u>Unweighted CVBS Signal to Noise Ratio</u>						
Specification valid for : L/L', B/G, I, D/K modes	A1 or A2	BU4				
Unweighted SNR			40	44		dB
Gain limited sensitivity (-1dB video signal)	A2	BU4			33	dB μ V
Carrier level of test signal						

Multi-Standard Desktop Video & FM Radio Module**FM1216ME**

PARAMETER	TEST SIGNAL	TEST POINT	MIN.	TYP.	MAX.	UNIT
Audio output characteristics Specification valid for : B/G, D/K and I modes AF output level (C7=0)	A2 + B3		350	450	550	mVrms
Specification valid for : L/L' mode AF output level (C7=0)		BU6	350	450	550	mVrms
Specification valid for : B/G, D/K, I modes THD (Total Harmonic Distortion) Signal-to -Noise ratio measured via LP 20 kHz filter, RMS detector 50µs de-emphasis for AF1 at 1 kHz	A2 + B3	BU6	- 50	0.2 63	0.6 -	% dB
Specification valid for : L/L' mode THD (Total Harmonic Distortion) Signal-to -Noise ratio measured via LP 20 kHz filter, RMS detector for AF1 at 1 kHz	A1 + B2 or A3 + B6	BU6	- 42	0.8 50	1.5 -	% dB
Specification valid for : B/G, D/K and I modes (S/N = 40 dB)	A2 + B3				40	dBµV
Specification valid for : L/L' mode (S/N = 38 dB)	A1 + B2				45	dBµV

APPLICATION INFORMATION**DEMONSTRATION KIT**

A demonstration kit is available for the FM1216ME (software, Application Note and evaluation board). Please contact your local Sales Engineer for details about the price and availability

I²C PROGRAMMING

For information regarding general aspects of I²C bus control see 'The I²C-bus and how to use it', published by Philips Semiconductors under the code : 9398 393 40011.

The FM1216ME contains two I²C transceivers, one in the tuner part and one in the IF part. It is imperative to ensure that both I²C devices are programmed correctly according to their addresses.

If in doubt, please refer to the demonstration software.

Multi-Standard Desktop Video & FM Radio Module

FM1216ME

Tuner Part Programming (Write Mode)

BIT ALLOCATION

(WRITE MODE , R/W = 0).

Write Data	MSB	bit6	bit5	bit4	bit3	bit2	bit1	LSB	ACK
Address Byte ADB	1	1	0	0	0	MA1	MA0	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 Byte CB	1	CP	T2	T1	T0	RSA	RSB	OS	A
Bandswitch Byte BB	P7	P6	P5	P4	P3	P2	P1	P0	A
Auxiliary Byte AB (note *)	ATC	AL2	AL1	AL0	0	0	0	0	A

Note *: By default it is set to AL2=0, AL1=1, AL0=0. This sets the tuner TOP to 112 dBuV upon power-on reset.

ADDRESS SELECTION (BYTE ADB)

Voltage at terminal 6	Address	MA1	MA0
0 0.1 V _{cc}	C0	0	0
0.2.....0.3 V _{cc}	C2	0	1
0.4 0.6 V _{cc}	C4	1	0
0.9 V _{cc} 5 V	C6	1	1

Note: If the AS pin is left floating, the internal biasing will automatically set the address to C2.

PROGRAMMABLE DIVIDER SETTING (BYTES DB1 AND DB2)

Divider ratio:
$$N = F_{OSC}/F_{SS}$$

where $F_{OSC} = (F_{RF} + F_{IF})$ and F_{SS} is the step-size set by RSA and RSB as described below.

$$N = 8192*N13 + 4096*N12 + 2048*N11 + 1024*N10 + 512*N9 + 256*N8 + 128*N7 + 64*N6 + 32*N5 + 16*N4 + 8*N3 + 4*N2 + 2*N1 + N0$$

Note: For TV Mode: $F_{IF} = 38.9$ MHz, except for L' mode. In this case $F_{IF} = 33.95$ MHz
 For FM Radio Mode: $F_{IF} = 10.7$ MHz

CONTROL BYTE CB

Charge Pump Setting:

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

CP = 1, charge pump current = 280uA results in fastest tuning (default mode)

CP = 0, charge pump current = 60uA results in moderate speed tuning with slightly better residual oscillator FM. **It is recommended to set CP=0 in the FM mode at all times.**

Test Mode Setting:

T2 = 0, T1 = 0, T0 = 1 for normal operation (default)

Multi-Standard Desktop Video & FM Radio Module**FM1216ME**

T2 = 0, T1 = 1, T0 = 1 indicates that Byte AB will follow Byte CB instead of Byte BB for the current IIC Byte sequence.

PLL Disabling:

OS=0 for normal operation,

OS=1 switches off the PLL tuning amplifier (PLL tuning is disabled)

Ratio Select Bits

RSA = 0, RSB = 0 gives 50 kHz step-size

RSA = 0, RSB = 1 gives 31.25 kHz step-size (for slow picture-search)

RSA = 1, RSB = 0 gives 166.7 kHz step-size

RSA = 1, RSB = 1 gives 62.5 kHz step-size (for normal picture-search)

BANDSWITCHING BYTE BB

PORTS	P0	P1	P2	P3	P4	P5	P6	P7
LOW BAND	1	0	0	0	0	X	X	X
MID BAND	0	1	0	0	0	X	X	X
HIGH BAND	0	0	1	0	0	X	X	X
FM BAND STEREO	1	0	0	1	1	X	0	X
FM BAND MONO	1	0	0	1	1	X	1	X

AUXILLIARY BYTE AB

The AGC Take Over Point can be set by programming the following bits AL2, AL1, AL0

IF output level, symmetrical mode	Remark	AL2	AL1	AL0
115 dB μ V		0	0	0
115 dB μ V		0	0	1
112 dB μ V	default mode at POR	0	1	0
109 dB μ V	Recommended for negative modulation	0	1	1
106 dB μ V	Recommended for positive modulation	1	0	0
103 dB μ V		1	0	1
I _{AGC} = 0	External AGC . See remarks (1).	1	1	0
3.5 V	Disabled . See remarks (1).	1	1	1

Remarks:

- 1). The AGC detector is disabled. Both the sinking and sourcing current from the IC is disabled. The AGC out-put goes into a high impedance state and an external AGC source can be connected in parallel and will not be influenced.
- 2). The AGC detector is disabled and I_{AGC} = 9 μ A.

It is recommended to set the TOP at 109 dB μ V for PAL B/G, D/K, I and NTSC M systems.

For system L/L', it is recommended to set the TOP at 106 dB μ V.

For FM radio, it is also recommended to set the TOP to 109 dB μ V.

Multi-Standard Desktop Video & FM Radio Module**FM1216ME****Important:**

ATC = AGC time constant.

In B/G, D/K and I modes, ATC = 1 $I_{AGC} = 9 \mu\text{A}$, time constant = 50 ms
 In L/L' mode, ATC = 0 $I_{AGC} = 220 \text{ nA}$, time constant = 2 s.

Tuner Part Programming (Read Mode)

BIT ALLOCATION (READ MODE R/W = 1)

	MSB	bit6	bit5	bit4	bit3	bit2	bit1	LSB	ACK
Address Byte ADB	1	1	0	0	0	MA1	MA0	R/W=1	A
Status Byte SB	POR	FL	1	1	AGC	A2	A1	A0	A

The following data can be read from the device through the status byte:

POR (power on reset): POR is internally set to 1 in case V_{cc} drops below 3V. The POR bit is reset when an end of data is detected by the PLL-IC.

FL: in lock flag (FL = 1 when the phase lock loop is in lock).

The loop must be phase-locked during at least 8 periods of the internal 7.8125 kHz reference-frequency (i.e. 1 msec) before the FL flag is internally set to 1.

AGC : internal AGC flag. AGC=1 when internal AGC is active (level below 3V)

A2, A1, A0 : Used for indicating if the FM signal received is transmitted in stereo or mono.

If A2 =1 and A1=A0=0, then the signal is in stereo, otherwise, it is mono.

Multi-Standard Desktop Video & FM Radio Module**FM1216ME****IF Part Programming (Write Mode)**

The IF uses the new TDA9887 demodulation IC from Philips Semiconductors.

I²C Bus Control –format to WRITE (slave receives data)

S	SLAVE ADDRESS	R/W=0	A	SAD	A	DATA	A	P
---	---------------	-------	---	-----	---	------	---	---

BIT	FUNCTION
S	START condition
Standard SLAVE ADDRESS	100 0011X where X is the value of R/W
R/W = 0	Write Mode
A	acknowledge, generated by slave
SUBADDRESS (SAD)	See table below
DATA	Bytes B, C and E (described below)
P	STOP condition

SUB ADDRESS BYTE (SAD, second byte after slave address)

DATA BYTE FOLLOWING SAD	MSB							LSB	
	D7 ⁽¹⁾	D6	D5	D4	D3	D2	D1	D0	
SWITCHING (B DATA)	0	0	X ₍₂₎	X ₍₂₎	X ₍₂₎	X ₍₂₎	0	0	
ADJUST (C DATA)	0	0	0	0	0	0	0	1	
DATA (E DATA)	0	0	0	0	0	0	1	0	

DESCRIPTION OF THE BITS OF THE VARIOUS DATA BYTES

DATA BYTE	BIT	SUBADDRESS	FUNCTION
B DATA	B0	SWITCHING	video mode (sound trap)
	B1	SWITCHING	auto mute FM
	B2	SWITCHING	carrier mode
	B3 and B4	SWITCHING	TV standard positive/negative modulation (B3=0)
	B5	SWITCHING	forced mute audio
	B6	SWITCHING	FM Sensitivity
	B7	SWITCHING	L/L' Sound
C DATA	Co to C4	ADJUST	TOP adjustment
	C5 to C6	ADJUST	de-emphasis
	C7	ADJUST	audio gain
E DATA	E0 and E1	DATA	standard sound carrier
	E2 to E4	DATA	standard video IF
	E5	DATA	VIF, SIF and tuner minimum gain
	E6	DATA	L standard PLL gating HIGH
	E7	DATA	VIF-AGC

Multi-Standard Desktop Video & FM Radio Module

FM1216ME

For convenience, the programming has been consolidated as a single table.

Video Trap Bypass	B 0	0	0	0	0	0	0	X	X	X	X	X
Auto Mute FM	B 1	1	1	1	1	1	1	1	1	1	1	X
Carrier Mode	B 2	1	1	1	1	1	1	X	X	X	X	X
FM Mode	B 3	0	0	0	0	0	0	1	1	1	1	X
TV Modulation	B 4	1	1	1	1	0	0	X	X	X	X	X
Forced Mute Audio	B 5	0	0	0	0	0	0	0	0	0	0	1
FM Sensitivity (OP1)	B 6	0	0	0	0	0	0	X	X	1	0	X
L/L' Sound (OP2)	B 7	0	0	0	0	0	0	1	1	1	1	X
TOP Adjustment	C 0	0	0	0	0	0	0	0	0	0	0	X
	C 1	0	0	0	0	0	0	0	0	0	0	X
	C 2	0	0	0	0	0	0	0	0	0	0	X
	C 3	0	0	0	0	0	0	0	0	0	0	X
	C 4	1	1	1	1	1	1	1	1	1	1	X
De-Emphasis	C 5	1	1	1	1	1	0	0	1	1	1	X
De-Emphasis Time	C 6	1	1	1	1	1	1	1	0	0	0	X
Audio Gain	C 7	0	0	0	0	0	0	1	0	0	0	X
Sound Intercarrier	E 0	1	0	0	1	1	1	1	X	X	X	X
	E 1	0	0	1	0	1	1	1	X	X	X	X
Video IF	E 2	0	0	1	0	1	0	0	X	X	X	X
	E 3	1	0	1	0	1	0	0	X	X	X	X
	E 4	0	0	0	0	0	1	0	X	X	X	X
IF Gain	E 5	0	0	0	0	0	0	1	1	1	1	X
L/L' PLL Gating	E 6	1	1	0	1	0	1	0	X	X	X	X
VIF AGC Output	E 7	0	0	0	0	0	0	0	0	0	0	0
Description	Bits	B/G	I	D/K	L	L'	Stereo	Mono	High Sensitivity	Normal Sensitivity	Force Audio Mute	TV & FM
		TV Systems										

Multi-Standard Desktop Video & FM Radio Module

FM1216ME

IF Part Programming (Read Mode)

The IF uses the new TDA9887 demodulation IC from Philips Semiconductors.

I²C Bus Control –format to READ (slave transmits data)

S	SLAVE ADDRESS	R/W=1	A	DATA	AN	P
---	---------------	-------	---	------	----	---

BIT	FUNCTION
S	START condition
Standard SLAVE ADDRESS	100 0011X where X is the value of R/W
R/W = 1	Read Mode
A	acknowledge, generated by slave
DATA	Byte D (described below)
AN	acknowledge not, generated by the master
P	STOP condition, generated by the master

The master generates an acknowledge when it has received the dataword READ. The master next generates an acknowledge, then slave begins transmitting the dataword READ, and so on until the master generates no acknowledge and transmits a STOP condition.

Byte D (Transmitted byte after read condition - Status Register)

FUNCTION	MSB							LSB
	D7	D6	D5	D4	D3	D2	D1	D0
READ	AFCWIN	VIFL	FMIFL	AFC4	AFC3	AFC2	AFC1	PONR

PONR = 1 After power-on reset or after supply breakdown

PONR = 0 After a successful reading of the status register

FMIFL = 0 FM IF Level low.

FMIFL = 1 FM IF Level high.

VIFL = 1 Video IF level HIGH

VIFL = 0 Video IF level LOW

Multi-Standard Desktop Video & FM Radio Module**FM1216ME**

AFC STATUS

It is possible to monitor the AFC status via the D1-D4 bits. Thus auto search tuning for FM can be implemented by reading the AFC status through the bits D1-D4.

Function	Bits			
	D4	D3	D2	D1
AFC F_{VIF} vs F_0 (1)				
$F_{VIF} \leq F_0 - 187.5$ kHz	0	1	1	1
$F_{VIF} = F_0 - 162.5$ kHz	0	1	1	0
$F_{VIF} = F_0 - 137.5$ kHz	0	1	0	1
$F_{VIF} = F_0 - 112.5$ kHz	0	1	0	0
$F_{VIF} = F_0 - 87.5$ kHz	0	0	1	1
$F_{VIF} = F_0 - 62.5$ kHz	0	0	1	0
$F_{VIF} = F_0 - 37.5$ kHz	0	0	0	1
$F_{VIF} = F_0 - 12.5$ kHz	0	0	0	0
$F_{VIF} = F_0 + 12.5$ kHz	1	1	1	1
$F_{VIF} = F_0 + 37.5$ kHz	1	1	1	0
$F_{VIF} = F_0 + 62.5$ kHz	1	1	0	1
$F_{VIF} = F_0 + 87.5$ kHz	1	1	0	0
$F_{VIF} = F_0 + 112.5$ kHz	1	0	1	1
$F_{VIF} = F_0 + 137.5$ kHz	1	0	1	0
$F_{VIF} = F_0 + 162.5$ kHz	1	0	0	1
$F_{VIF} \geq F_0 + 187.5$ kHz	1	0	0	0

Note

1. F_0 = nominal F_{VIF}

AFCWIN = 1 F_{VIF} inside AFC Window

AFCWIN = 0 F_{VIF} outside AFC Window

PROGRAMMING EXAMPLES

Example 1: To tune to Ch E21 (471.25 MHz) in high band

$F_{osc} = 471.25 + 38.9 = 510.15$ MHz

$N = (510.15 \text{ MHz}) / (62.5 \text{ kHz}) = 1F \text{ E}2$ (Hexadecimal)

So DB1 = 1F H

and DB2 = E2 H

CB = 86H if CP is set to low or CB = C6H if CP is set to high

BB = 44H (because of high band selected)

Multi-Standard Desktop Video & FM Radio Module

FM1216ME

Example 2 : To tune to a PAL B/G program at 471.25 MHz

Tuner I²C Data Bytes

MSB Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 LSB

Address
 ADB 1 1 0 0 0 MA1 MA0 R/W = C2

Write

DB1 0 N14 N13 N12 N11 N10 N9 N8 = 1F
 DB2 N7 N6 N5 N4 N3 N2 N1 N0 = E2
 CB 1 CP T2 T1 T0 RSA RSB OS = 86
 BB SW FMST P5 TV FM High Mid Low = 44
 AB ATC AL2 AL1 AL0 0 0 0 0 = A0

Read
 SB POR FL 1 1 AGC A2 A1 A0 = 70

Close

Tuner I²C program

IF I²C Data Bytes

MSB Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 LSB

Address
 Slave 1 0 0 0 0 1 MAD R/W = 86
 Sub (SAD) 0 0 0 0 0 0 SAD1 SAD0 = 00

Write

Switching (B) L' FMS FMA TVM FM CM AMF VM = 16
 Adjust (C) AG DE1 DE0 TOP4 TOP3 TOP2 TOP1 TOP0 = 70
 Data (E) AGC Gate GIF VIF2 VIF1 VIF0 SIF1 SIF0 = 49

Read
 Status (SR) AFCW VIFL FMIFL AFC4 AFC3 AFC2 AFC1 POR = 8E

Close

IF I²C program

Example 3 : To tune to a SECAM program at 471.25 MHz (L system)

Tuner I²C Data Bytes

MSB Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 LSB

Address
 ADB 1 1 0 0 0 MA1 MA0 R/W = C2

Write

DB1 0 N14 N13 N12 N11 N10 N9 N8 = 1F
 DB2 N7 N6 N5 N4 N3 N2 N1 N0 = E2
 CB 1 CP T2 T1 T0 RSA RSB OS = 86
 BB SW FMST P5 TV FM High Mid Low = 44
 AB ATC AL2 AL1 AL0 0 0 0 0 = 20

Read
 SB POR FL 1 1 AGC A2 A1 A0 = 70

Close

Tuner I²C program

IF I²C Data Bytes

MSB Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 LSB

Address
 Slave 1 0 0 0 0 1 MAD R/W = 86
 Sub (SAD) 0 0 0 0 0 0 SAD1 SAD0 = 00

Write

Switching (B) L' FMS FMA TVM FM CM AMF VM = 06
 Adjust (C) AG DE1 DE0 TOP4 TOP3 TOP2 TOP1 TOP0 = 50
 Data (E) AGC Gate GIF VIF2 VIF1 VIF0 SIF1 SIF0 = 4B

Read
 Status (SR) AFCW VIFL FMIFL AFC4 AFC3 AFC2 AFC1 POR = 8E

Close

IF I²C program

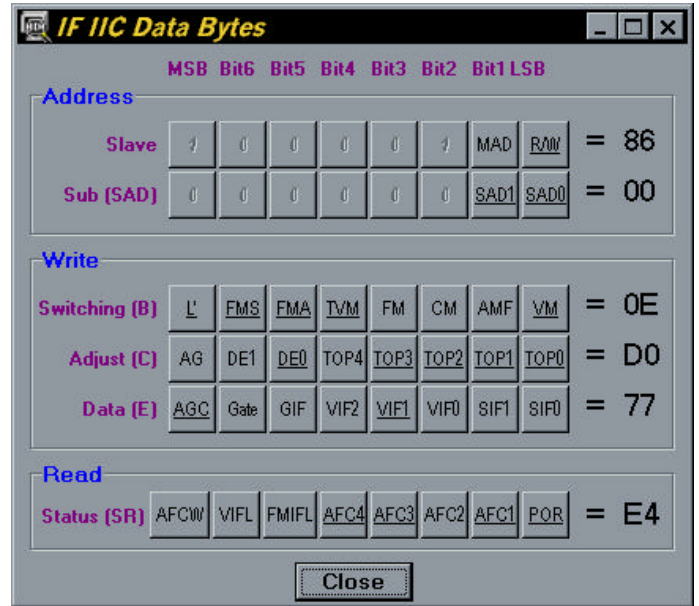
Multi-Standard Desktop Video & FM Radio Module

FM1216ME

Example 4 : To tune to a FM radio broadcast at 98.00 MHz



Tuner I²C program



IF I²C program

Note: Stereo Mode and Normal FM Sensitivity has been selected.

Important:

When tuning to a desired FM channel, it is recommended first to set to the TV mode at a high frequency (e.g.150 MHz), then set to FM mode (IF=10.70 MHz) and then set to the desired FM station. This is to ensure that the tuning voltage does not stay locked at 0V.

Multi-Standard Desktop Video & FM Radio Module

FM1216ME

LOADING OF I²C BUS

The FM1216ME contains a series impedance $R = 200$ ohms in the SCL and SDA lines. Both lines also have capacitive loads of $C = 22$ pF max. Care must be taken to ensure that the total load on the bus does not exceed that as mentioned in the brochure "The I²C-bus and how to use it".

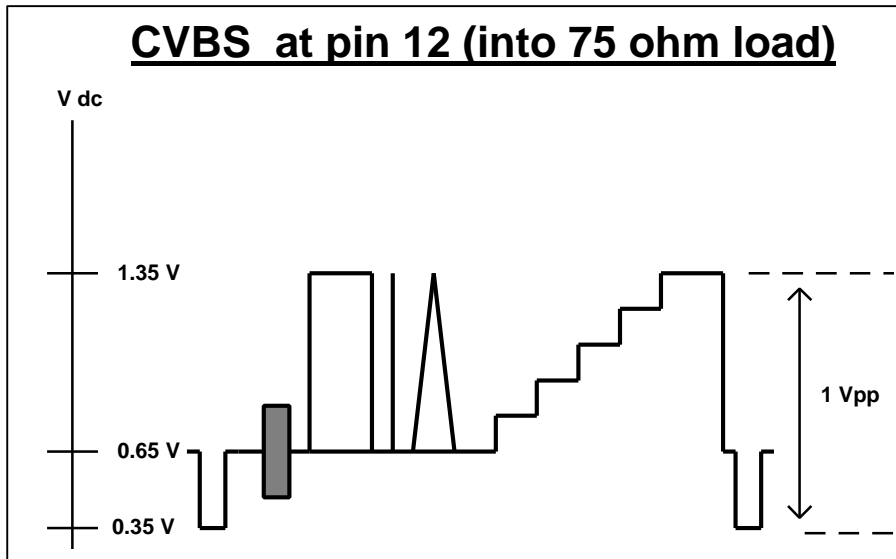
CVBS LOAD / TUNING VOLTAGE SUPPLY

A video buffer is built into the frontend to enable the unit to drive a 75Ω load directly (e.g. into the SAA711x directly). A DC-DC converter for providing the required tuning voltage supply is already built into the FM1216ME.

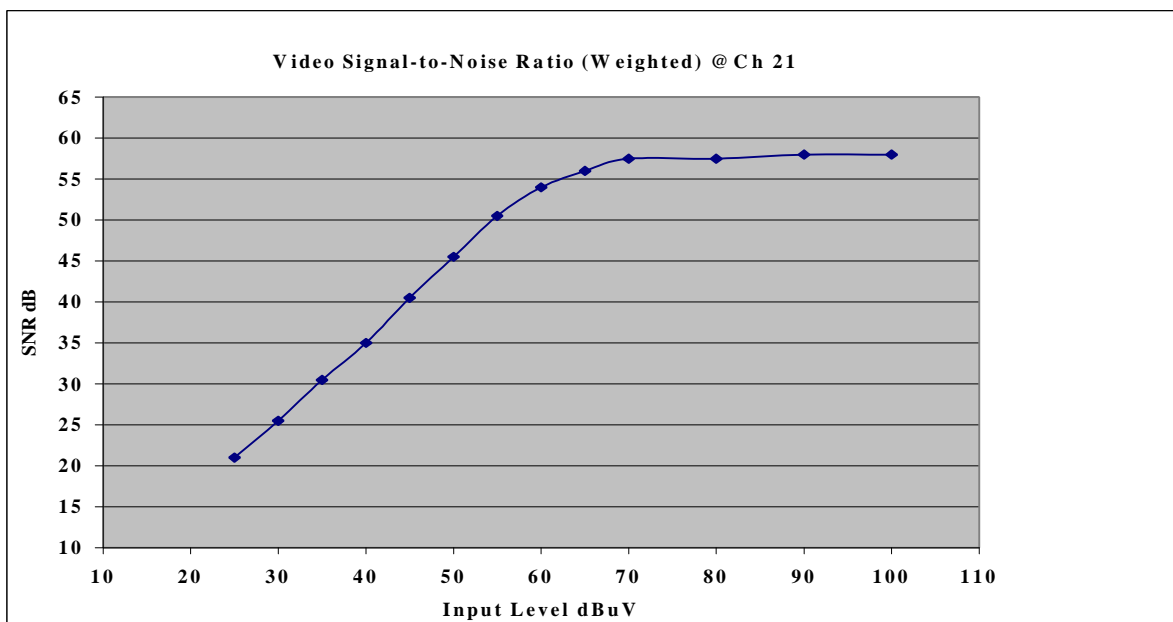
AUDIO OUTPUT AT PINS 9 & 10

The pins 9 and 10 are used to provide the FM radio stereo outputs AF_L and AF_R. For TV mode, the MONO sound output is also available at these 2 pins.

CVBS OUTPUT LEVEL



VIDEO SIGNAL TO NOISE RATIO



Multi-Standard Desktop Video & FM Radio Module

FM1216ME

MECHANICAL DATA

See product drawing 3139 149 0120

AERIAL CONNECTIONS

Standard IEC socket female 75Ω.

SOLDERABILITY

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

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°C for 10±1 s).

MASS

Approximately 45g.

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 5.4	40	2.34
Pallet	120 x 105 x 105	4280	272.38

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

ROBUSTNESS OF PINS

The pins will not be damaged when tested in accordance with "IEC 60068-2-21":

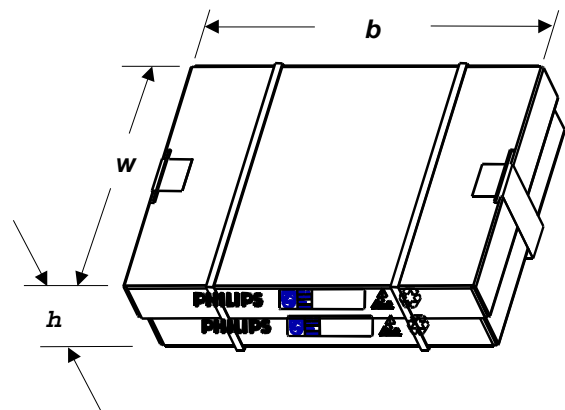
- Test Ua1, tensile of 10N in axial direction
- Test Ua2, thrust of 4N in axial direction

PUNCHING PATTERN OF CHASSIS PCB

For optimum mounting of the tuner to a PCB, the punching pattern is recommended (see 3139 149 0120).

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

Example of Carton Box:



Multi-Standard Desktop Video & FM Radio Module**FM1216ME****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	

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.

PURCHASE OF PHILIPS I²C COMPONENTS

Purchase of Philips I²C components conveys a license under the Philips I²C patent to use the components in the I²C systems to the I²C specification defined by Philips. This specification can be ordered using the code 9398 393 40011.

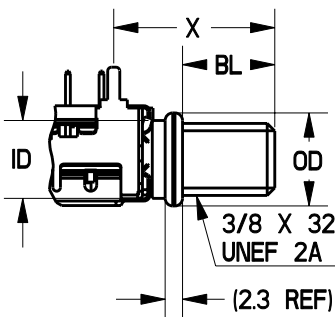
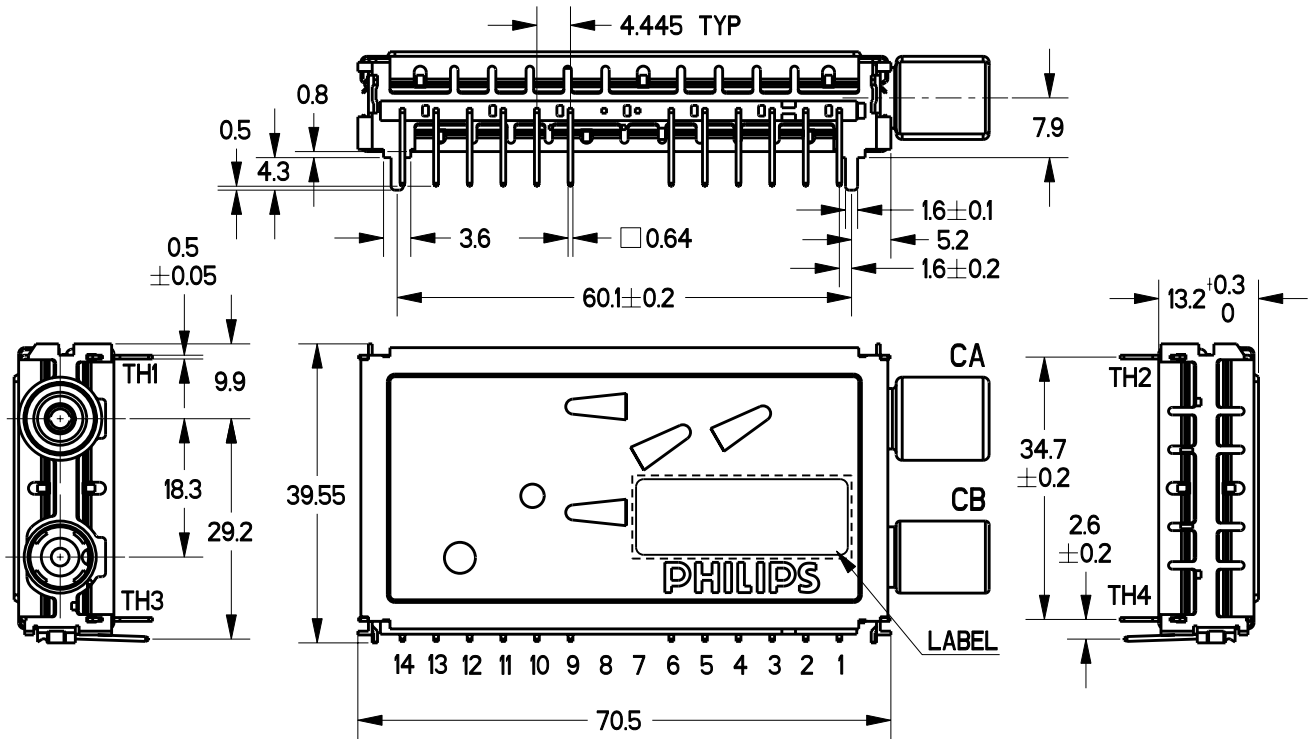
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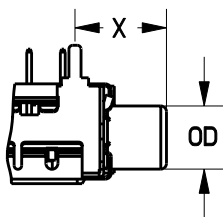
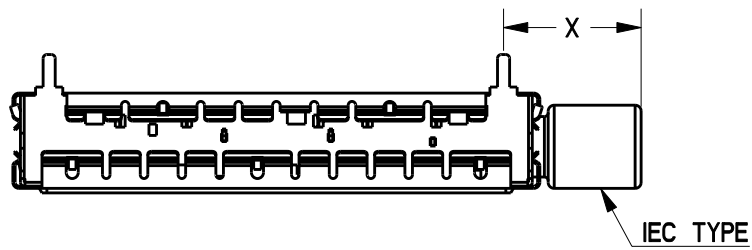
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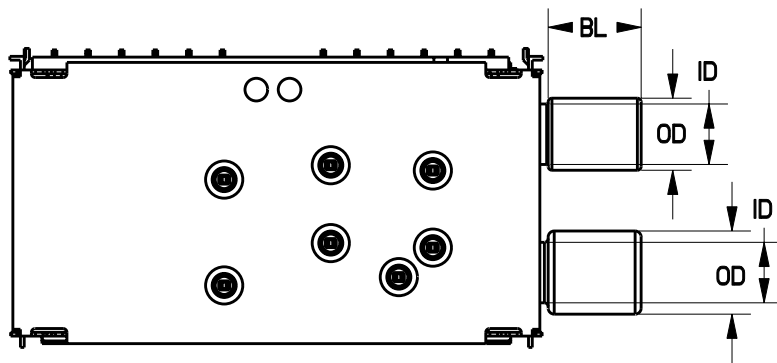
HORIZONTAL MOUNTING



F- TYPE



PHONO TYPE



NOTE:

- GENERAL TOLERANCE ±0.5mm
- ALL DIMENSIONS IN MILLIMETER.
- DRAWING NOT TO SCALE.
- CONNECTOR CB IS VOID FOR SINGLE CONNECTOR VERSIONS.

CLASS NO. 3UM900 00-12-19	PRODUCT DRAWING FQ/FM1200MK3 MECHANICS		3139 149 0120		1 1 1 - -
01-01-19	NAME SOH KL	SUPERS XXXX XXX XXXX	4	10	110 - 1
SV	CHECK	DATE 00-12-19	©	PHILIPS ELECTRONICS N.V.	
					A4

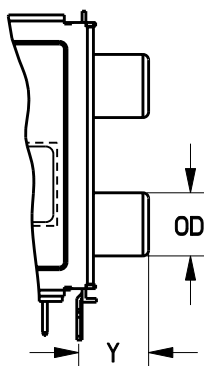
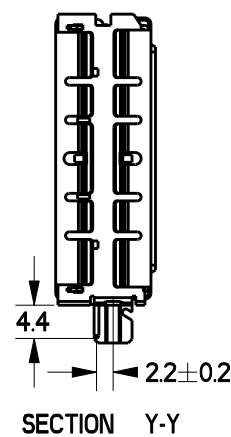
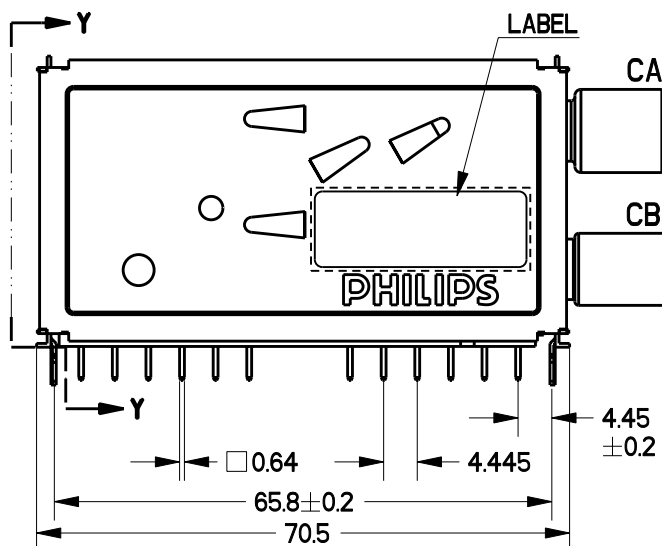
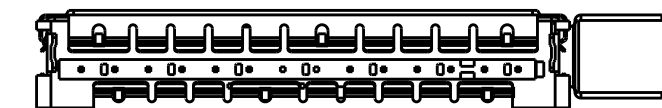
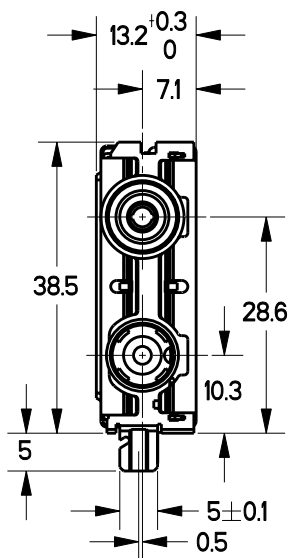
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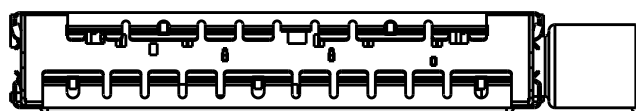
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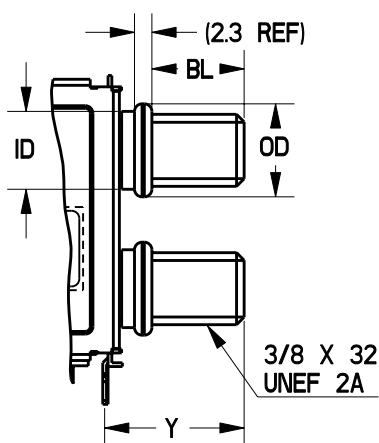
VERTICAL MOUNTING



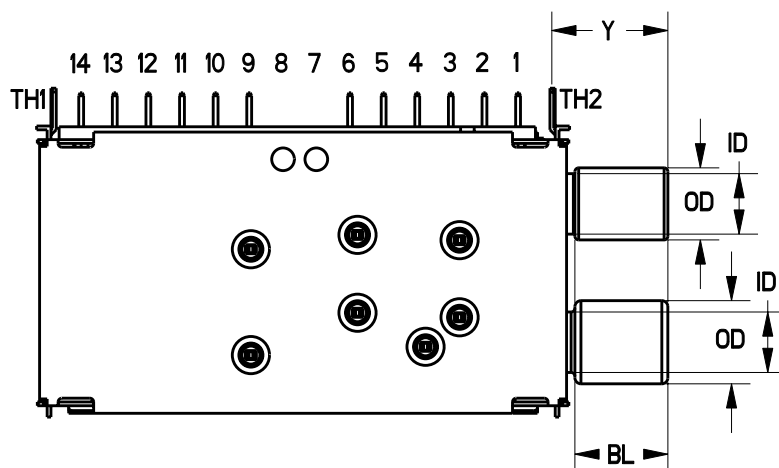
PHONO TYPE



IEC TYPE



F- TYPE



- NOTE:
- GENERAL TOLERANCE $\pm 0.5\text{mm}$
 - ALL DIMENSIONS IN MILLIMETER.
 - DRAWING NOT TO SCALE.
 - CONNECTOR CB IS VOID FOR SINGLE CONNECTOR VERSIONS.

CLASS NO. 3UM900 00-12-19	PRODUCT DRAWING FQ/FM1200MK3 MECHANICS		3139 149 0120		1 1 1 - -
01-01-19	NAME SOH KL	SUPERS XXXX XXX XXXX	4	10	110 - 2
SV	CHECK	DATE 00-12-19	©	PHILIPS ELECTRONICS N.V.	A4

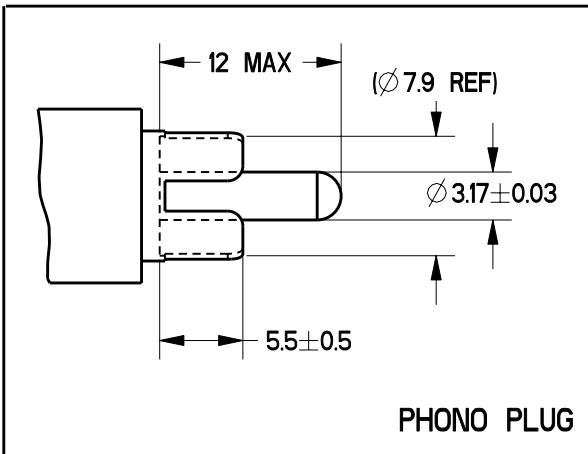
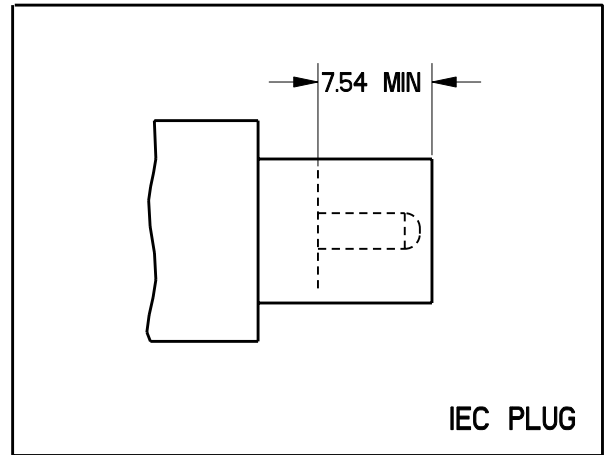
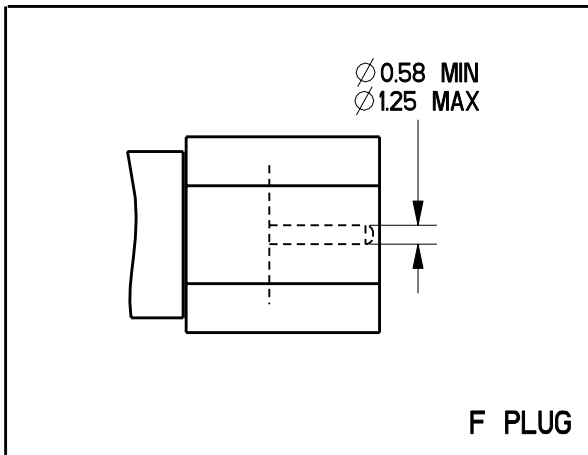


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AERIAL CONNECTOR TYPE			CONNECTOR DISTANCE, X	CONNECTOR DISTANCE, Y	BODY LENGTH, BL	OVERALL DIAMETER, OD	INNER DIAMETER, ID
I	CA	IEC FEMALE	18.2±0.5	15.35±0.5	12.2±0.3	∅11.0±0.1	∅8.0±0.2
	CB	IEC MALE				∅9.53±0.05	
L	CA	IEC FEMALE	24.6±0.5	21.75±0.5	12.2±0.3	∅11.2±0.1	∅9.0±0.3
	CB	-	-	-	-	-	-
F	CA	F- TYPE	21.3±0.5	18.45±0.5	12.2±0.3	∅12.3+0/-0.3	∅10.2±0.2
	CB						
G	CA	F- TYPE	25.6±0.5	22.75±0.5	16.5±0.3	∅12.3+0/-0.3	∅10.2±0.2
	CB						
W	CA	F- TYPE	29.0±0.5	26.15±0.5	19.9±0.3	∅12.3+0/-0.3	∅10.2±0.2
	CB						
P	CA	PHONO	12.1±0.5	9.25±0.5	-	∅8.35+0/-0.1	-
	CB						

MALE CONNECTOR REQUIREMENTS



For dimensions which are not reflected in the drawing, refer to IEC 600169-24 (for F plug) and IEC 600169-2 (for IEC plug).

CLASS NO. 3UM900 00-12-19	PRODUCT DRAWING FQ/FM1200MK3 MECHANICS	3139 149 0120		1	---
01-01-19		10	110 - 3	1	01-01-19
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SV	CHECK	DATE 00-12-19	©	-	-
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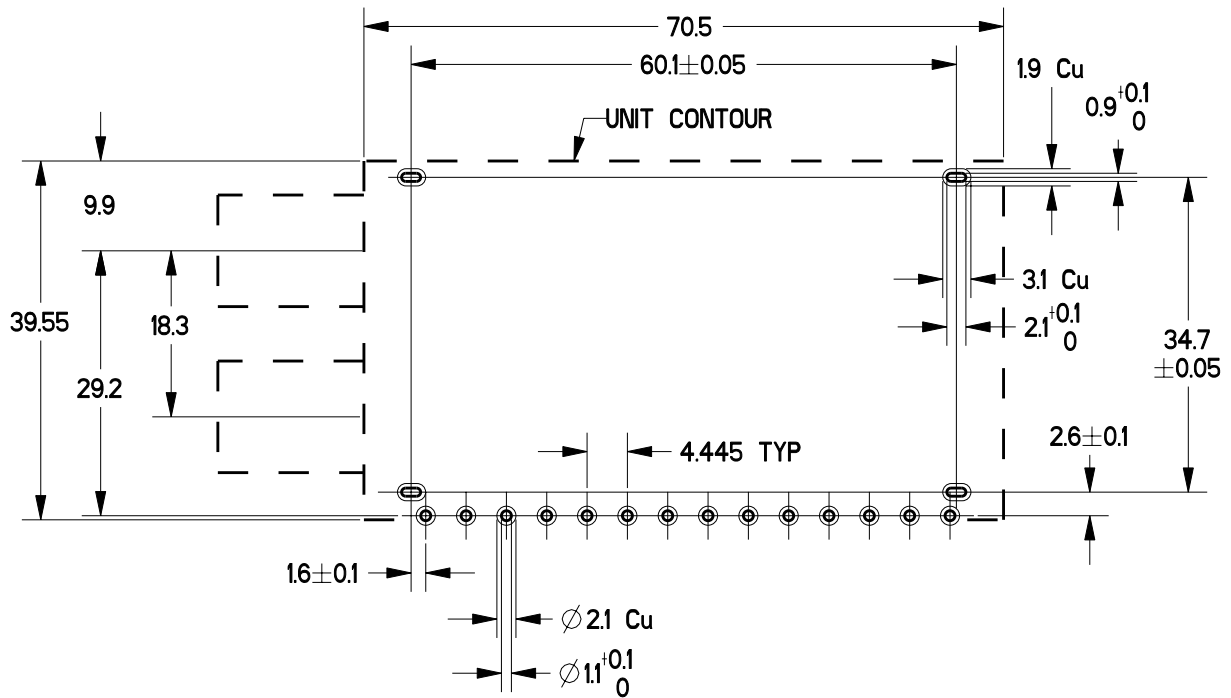


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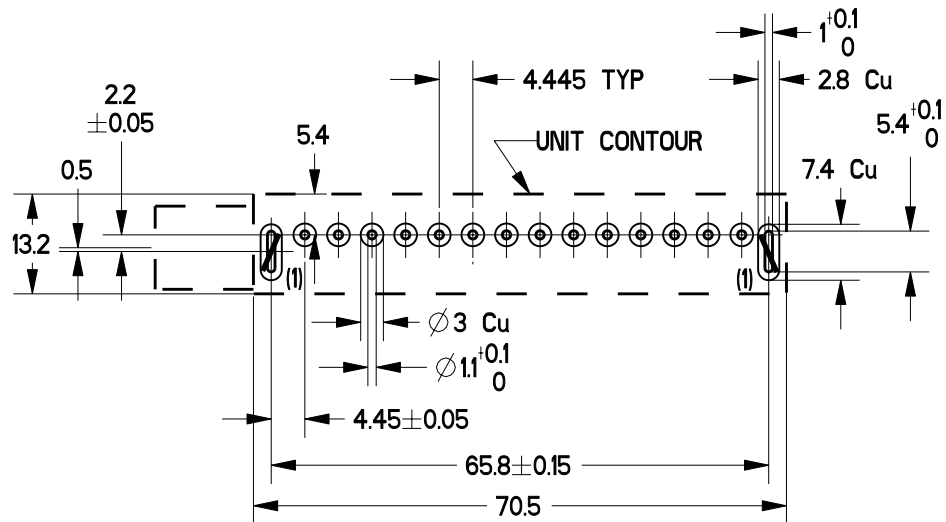


PUNCHING PATTERN OF CHASSIS PCB

PUNCHING PATTERN SEEN FROM SOLDER SIDE



HORIZONTAL MOUNTING



(1) LUG TWIST ANGLE 30° IN DIRECTION SHOWN.

VERTICAL MOUNTING

CLASS NO.		3UM900		PRODUCT DRAWING		3139 149 0120		1	---
00-12-19				FQ/FM1200MK3 MECHANICS				1	01-01-19
01-01-19								1	01-10-18
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