DATA SHEET

FQ1216ME (MK3 family)
Multi-Standard Desktop Video Modules

Product specification

Approval by :

Name / Date : Toh Kong Lim / 16.02.2004

PHILIPS

Multi-Standard Desktop Video Module FQ1216ME MK3

FEATURES

- Multi-Standard TV Systems Broadcast reception
- True 5 V device (low power dissipation)
- Full frequency range from channel E2 (48.25 MHz) to channel E69 (855.25 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
- Demodulated video output, AF sound output, second IF sound output.
- I^2C-bus control of tuning, address selection, AFC status information
- User-settable 2nd IF address for PIP application
- Complies with European regulations on radiation, signal handling and immunity ("CENELEC 55020, 55013")
- Small horizontally mounted metal 70 mm housing

ORDERING INFORMATION

TYPE	DESCRIPTION	ORDER NUMBERS
FQ1216ME/I H-3	IEC / Horizontal / User-settable 2nd IF address	3139 147 18291
FQ1216MP/I H-3	IEC / Horizontal User-settable 2nd IF address	3139 147 18321
FQ1216ME/I V-3	IEC / Vertical / 2nd fixed IF address	3139 147 19151
FQ1216ME/P H-3	Phono / Horizontal / User-settable 2nd IF address	3139 147 18771
FQ1216ME/L H-3	Long IEC / Horizontal / User-settable 2nd IF address	3139 147 18891

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

DESCRIPTION

The FQ1216ME 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 FQ1216ME combines the functions of an all-band TV tuner, and a multi-standard TV IF demodulation unit for both positive and negative modulated TV systems. The FQ1216ME is intended for CCIR L/L' (France), B/G, I and D/K systems. The FQ1216MP covers only CCIR B/G, D/K and I.

The frontends have a built-in digital (I^2C) PLL tuning system. A DC-DC converter circuit is built-in in the FQ1216ME to synthesize the tuning voltage required, thus making the frontend a true 5V device.

The FQ1216ME/IV-3 has a fixed address of # 84 for the IF processor. For all others, a second address can be set by using a 2K2 resistor at 10 of the module.
All modules use the narrowband AGC detection system.

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)
Low band	48.25 to 158.00 MHz+
Mid band	160.00 to 442.00 MHz
High band	442.00 to 863.25 MHz

+ Can cover down to 45.75 MHz (Ch A for Ireland)

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	I²C-Serial Clock
SDA	5	I²C-Serial Data
AS_TU	6	I²C-Address Select_Tuner part (see Pg 20)
-	x	Not Connected
-	x	Not Connected
NC	9	Not Connected
IF-AS	10	**Second Address for IF circuit * see Pg 20)**
2nd IF sound	11	Second IF sound output
CVBS	12	Composite Video Baseband Signal
+5V, IF	13	Supply Voltage, IF section
AF O/P	14	AF sound output
GROUND		Mounting Tags (TH1,TH2,TH3,TH4)

*** For process use only**

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 Vb Ripple susceptibility (*see Note 2)* 20Hz - 1kHz 1kHz - 200kHz Supply current	3	4.75	5 80	5.25 2 10 150	V mVpp mVpp 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
	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 Ripple susceptibility (see Note 2) 20Hz - 1kHz 1kHz - 500kHz Current	13	4.75	 100	5.25 2 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.

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.

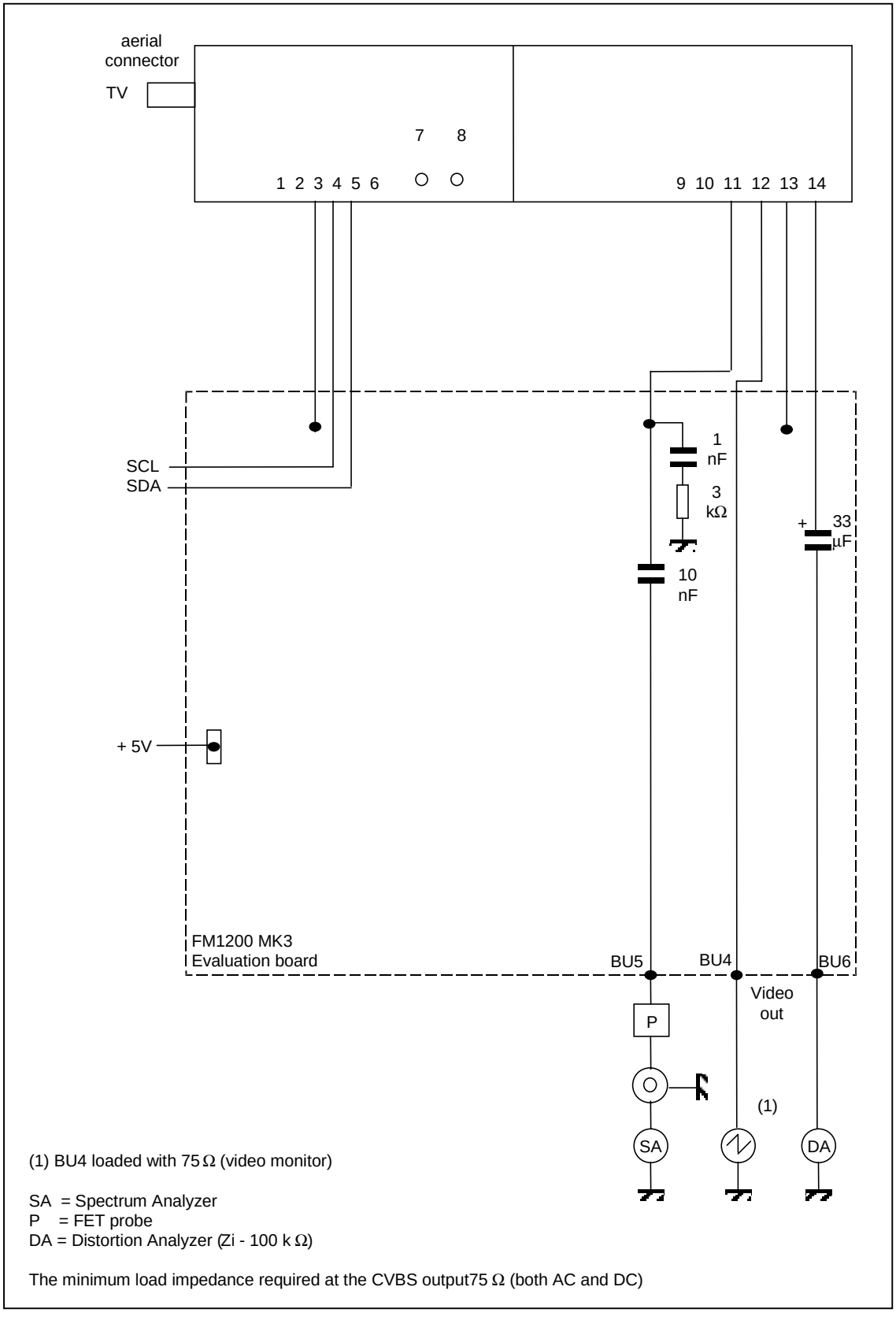
SYMBOL	PARAMETER	VALUE	UNIT
T_{AMB}	ambient temperature	25 ± 5	^oC
RH	relative humidity	60 ± 15	%
V_S	supply voltage (tuner and IF section)	5 ± 0.125	V
$Z_{S(AE)}$	aerial source impedance (unbalanced)	75	Ω
Z_{IF}	second IF sound output load	0.5	kΩ
	Video output load	75	Ω
V_{ST}	AF1 sound output load	100	kΩ

TUNER CHARACTERISTICS

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

TEST DIAGRAM

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



(1) BU4 loaded with 75 Ω (video monitor)

SA = Spectrum Analyzer
P = FET probe
DA = Distortion Analyzer (Zi - 100 k Ω)

The minimum load impedance required at the CVBS output75 Ω (both AC and DC)

Definitions of test signals

TEST SIGNAL	FREQ. (MHz)	AMPLITUDE	MODULATION
A0: unmodulated vision carrier	480.25	60 dB(μV)	
A1: L-system signal with video modulation	480.25	60 dB(μV) (peak white)	100 % (sync. level at 0%), 2T-pulse and bar, unless otherwise indicated.
A2: B/G/D/K/I -system signal with video modulation	480.25	60 dB(μV) (top sync.)	100% (rest carrier 10%), 2T-pulse and bar, unless otherwise indicated
A3: L' - system signal with video modulation.	55.75	60 dB(μV) (peak white)	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 μs 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

AERIAL INPUT CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
VSWR		referred to 75 Ω at RF picture carrier frequency	-	5	
V_{SURGE}	surge protection		5		kV
V_{ANT}	antenna terminal disturbance voltage	up to 1.75 GHz	-	46	dBµV

GENERAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f_b	frequency range low band mid band high band		 48.25 160.00 442.00		 158.00 442.00 863.25	 MHz MHz MHz
Δf_b	margin low band mid/high band		 1.5 1.5			 MHz MHz
voltage gain	low band mid band high band		36 36 36	45 45 45	55 55 55	dB dB dB
α_j	Image rejection low band mid band high band	- wanted test signal F_{ant} at 60 dBuV - 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_{lj}	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
	Maximum signal handling	F_{wanted}	100	110	-	dBµV

Video and audio characteristics

PARAMETER	TEST SIGNAL	TEST POINT	MIN.	TYP.	MAX.	UNIT
CVBS output level Amplitude video signal DC level of sync. Pulse	A1 A1	BU4 BU4	0.7	1.0 0.35	1.3	Vpp V
CVBS amplitude at discrete frequencies 2 MHz 3 MHz 4.43 MHz	 A1 A1 A1	 BU4 BU4 BU4		 0.0 - 0.5 -1.0	 - 1.5 - 2.5 - 4.0	 dB dB dB
Sound Carriers Rejection Specification valid for : B/G, I and D/K mode wrt 1 MHz for : 5.5/6.0 MHz 6.5 MHz	A2 + B1 + B4	BU4	 42 40			 dB dB
Unweighted CVBS Signal to Noise Ratio Specification valid for : L/L', B/G, I, D/K modes Unweighted SNR	A1 or A2 or A3	BU4	40	44		dB
Gain limited sensitivity (-1dB video signal) Carrier level of test signal	A2	BU4			33	dBµV

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)** measured via LP 20 kHz filter, RMS detector 50µs de-emphasis for AF1 at 1 kHz (C5 = 1, C6 = 1)	A2 + B3	BU6	400	500	600	mVrms
Specification valid for : L/L' mode (C5 = 0) modulation = 54% **AF output level (C7 = 0)**	A1 +B2 or A3 + B6	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 (C5 = 1, C6 = 1)	 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) (C5 = 1, C6 = 1) **Audio sensitivity**	A2 + B3	BU6			40	dBµV
Specification valid for : L/L' mode (S/N = 38 dB) **Audio sensitivity**	A1 + B2 or A3 + B6	BU6			45	dBµV

APPLICATION INFORMATION

DEMONSTRATION KIT
A demonstration kit is available for the FQ1216ME (software, Application Note and evaluation board). Please contact your local Sales Engineer for details about the price and availability

I^2C PROGRAMMING
For information regarding general aspects of I²C bus control see 'The I^2C-bus and how to use it', published by Philips Semiconductors under the code : 9398 393 40011.
The FQ1216ME contains two I^2C transceivers, one in the tuner part and one in the IF part. It is imperative to ensure that both I^2C devices are programmed correctly according to their addresses

If in doubt, please refer to the demonstration software.

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: F_{IF} = 38.9 MHz, except for L' mode. In this case F_{IF} = 33.95 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

Test Mode Setting:
T2 = 0, T1 = 0, T0 = 1 for normal operation (default)
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

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 dBµV		0	0	0
115 dBµV		0	0	1
112 dBµV	default mode at POR	0	1	0
109 dBµV	Recommended for negative modulation	0	1	1
106 dBµV	Recommended for positive modulation	1	0	0
103 dBµV		1	0	1
$I_{AGC} = 0$	External AGC . **See remarks (1) & (3)**.	1	1	0
3.5 V	Disabled . **See remarks (2)**.	1	1	1

Remarks:

1). The AGC detector is disabled. Both the sinking and sourcing current from the IC is disabled. The AGC output 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 $I_{AGC} = 9$ µA.

Note:

The AGC detection system has been changed to the narrowband mode for both negative and positive modulation systems. All new versions carry the code SV21 (old versions carry the code SV20).
The settings have been hard-coded inside the modules and customers are not required to change their software to adapt to the new AGC system.

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 : Not used.

IF Part Programming (Write Mode)

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

I^2C 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

**** Note The FQ1216ME/IV-3 (12 NC = 3139 147 19151) has a fixed IF address of # 84.**

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

DATA BYTE FOLLOWING SAD	MSB D7	D6	D5	D4	D3	D2	D1	LSB D0
SWITCHING (B DATA)	0	0	X	X	X	X	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	not used
	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

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

Description	Bits	B/G	I	D/K	L	L'	Force Audio Mute
		TV Systems					
Video Trap Bypass	B 0	0	0	0	0	0	X
Auto Mute FM	B 1	1	1	1	1	1	X
Carrier Mode	B 2	1	1	1	1	1	X
FM Mode	B 3	0	0	0	0	0	X
TV Modulation	B 4	1	1	1	0	0	X
Forced Mute Audio	B 5	0	0	0	0	0	1
Not Used (OP1)	B 6	0	0	0	0	0	X
L/L' Sound (OP2)	B 7	0	0	0	0	1	X
TOP Adjustment	C 0	0	0	0	0	0	X
	C 1	0	0	0	0	0	X
	C 2	0	0	0	0	0	X
	C 3	0	0	0	0	0	X
	C 4	1	1	1	1	1	X
De-Emphasis	C 5	1	1	1	0	0	X
De-Emphasis Time	C 6	1	1	1	1	1	X
Audio Gain	C 7	0	0	0	0	0	X
Sound Intercarrier	E 0	1	0	1	1	1	X
	E 1	0	1	1	1	1	X
Video IF	E 2	0	0	0	0	0	X
	E 3	1	1	1	1	0	X
	E 4	0	0	0	0	1	X
IF Gain	E 5	0	0	0	0	0	X
L/L' PLL Gating	E 6	1	1	1	1	1	X
VIF AGC Output	E 7	0	0	0	0	0	0

IF Part Programming (Read Mode)

The IF uses the new TDA9885 (MP versions) or TDA9886 (ME versions) demodulation IC from Philips Semiconductors.

I^2C 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.

**** Note The FQ1216ME/IV-3 (12 NC = 3139 147 19151) has a fixed IF address of # 84.**

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 = Not used.

VIFL = 1 Video IF level HIGH
VIFL = 0 Video IF level LOW

AFC STATUS

It is possible to monitor the AFC status via the D1-D4 bits.

Function	**Bits**			
AFC F_{VIF} vs F_0 (1)	**D4**	**D3**	**D2**	**D1**
$F_{VIF} \leq F_0 - 187.5$ 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

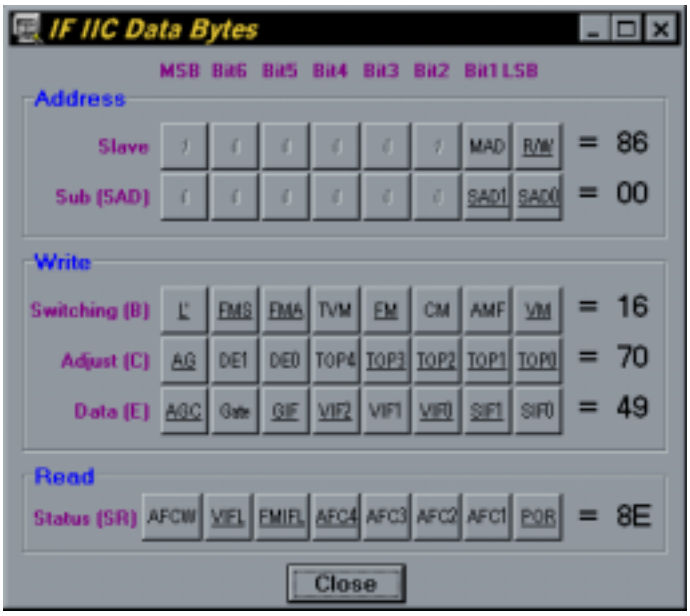
PROGRAMMING EXAMPLES

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

Fosc = 471.25 + 38.9 = 510.15 MHz
N = (510.15 MHz) / (62.5 kHz) = 1F E2 (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)

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

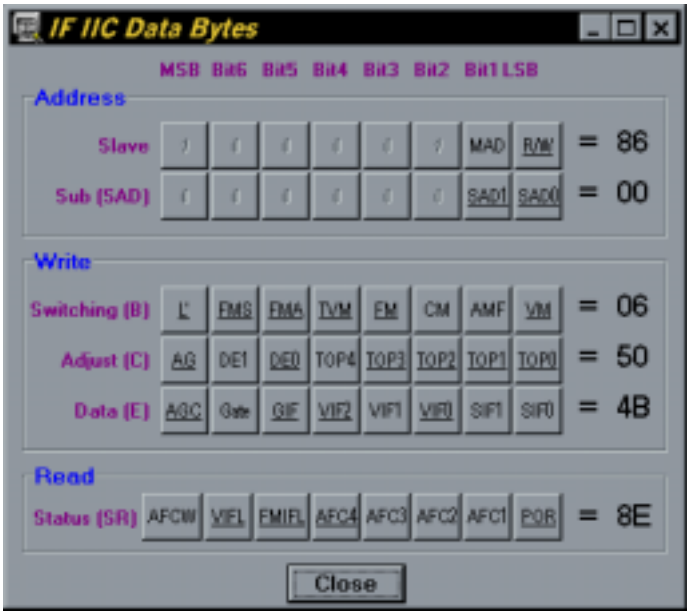
Tuner I^{2}C program



IF I^{2}C program

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

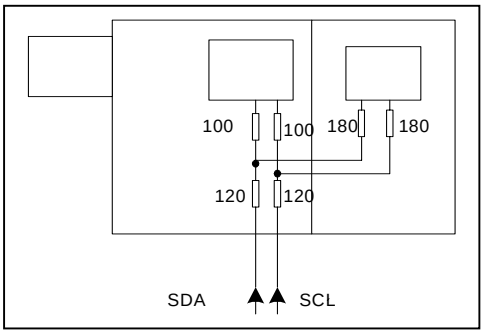
Tuner I^{2}C program



IF I^{2}C program

LOADING OF I²C BUS

The FQ1216ME contains series impedances in the SCL and SDA lines : a total of R= 220 ohms leading to the tuner part and R= 300 ohms leading to the IF demodulation part. See the diagram below. 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".



AUDIO EMPHASIS

The audio de-emphasis (50 us) is set by the bits C5 and C6

C5=0 de-emphasis OFF
C5=1 de-emphasis ON
C6=1 50us
C6=0 75 us

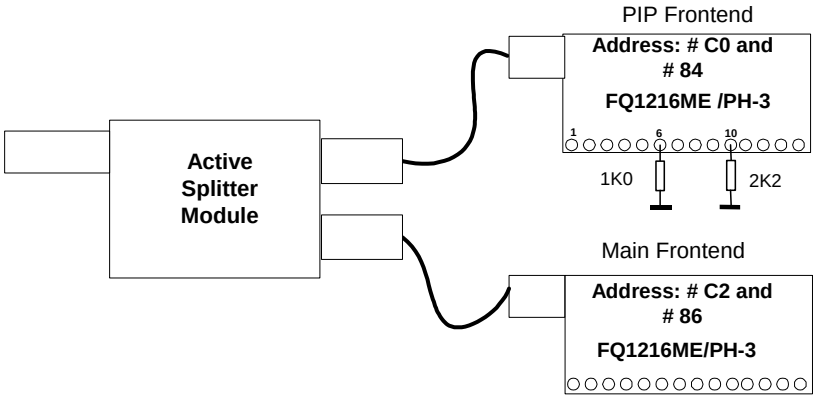
De-emphasis should be switched off in L/L' mode since it is not required for AM sound.

CVBS LOAD / TUNING VOLTAGE SUPPLY

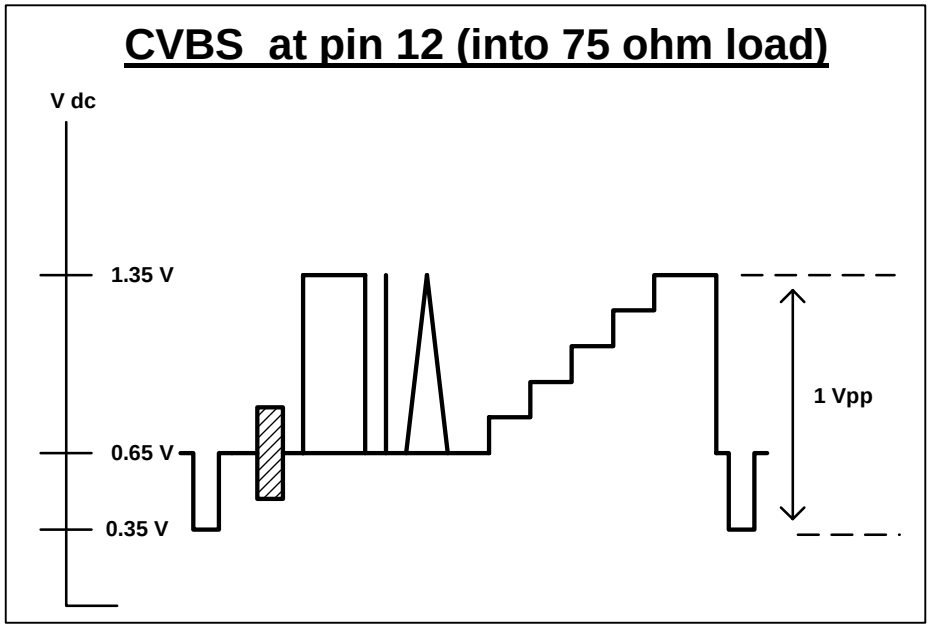
A video buffer is built into the frontend to enable the unit to drive a 75 Ω load directly (e.g. into the SAA711x directly). A DC-DC converter for providing the required tuning voltage supply is already built into the FQ1216ME.

PIP APPLICATION

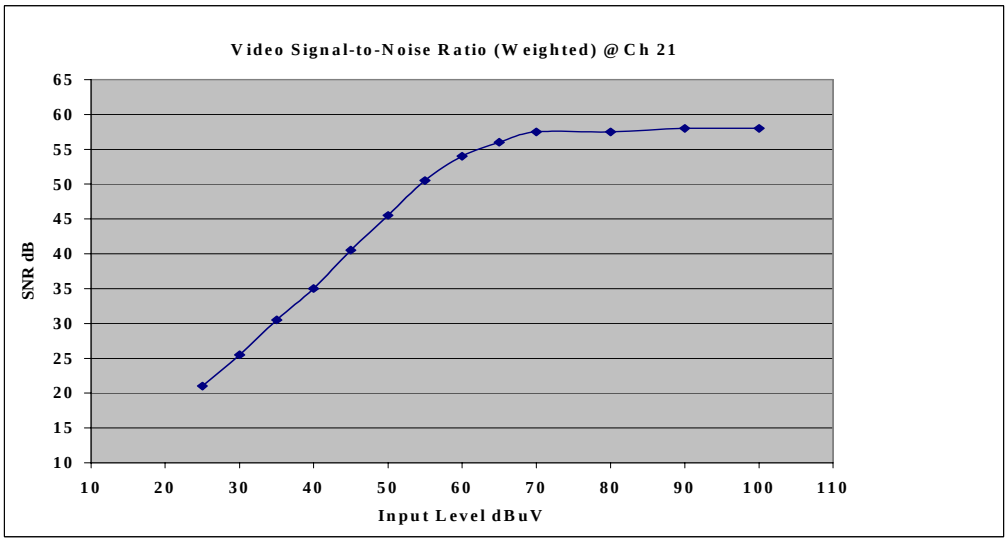
The FQ1216ME has a second user-defined address for the IF circuit. By setting a 2K2 resistor at pin 10, the AFRIC address is set to # 84. In the same manner, with a 1K resistor to ground at pin 6, the tuner is set to an address of # C0. The other FQ1216ME Mk3 remains unchanged with an address of # C2 and # 86 respectively. An example is shown below.



CVBS Output level



VIDEO SIGNAL TO NOISE RATIO



MECHANICAL DATA

See product drawing 3139 149 0120

AERIAL CONNECTIONS

Standard connector in accordance with type order information found on Page 2 and drawings found on Page 25.

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.

Mounting Type		Dimension B x w x h (cm)	No. of sets	Gross Wt (Kg)
Horizontal-mount type	Carton	46 x 34 x 5.4	40	2.34
	Pallet	120 x 105 x 105	4280	272.38
Vertical-mount type	Carton	46 x 34 x 10.2	120	6.38
	Pallet	120 x 105 x 105	6960	392.04

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*":

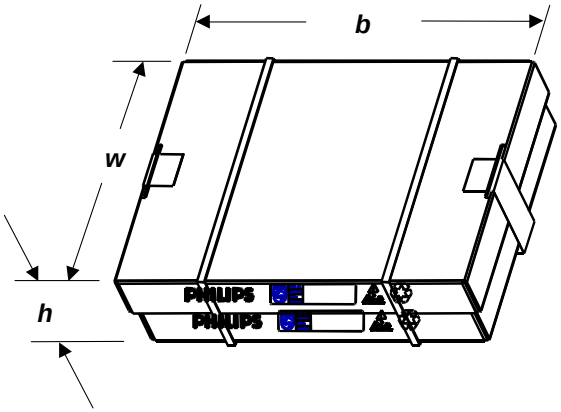
- Test Ua1, tensile of 10N in axial direction
- Test Ua2, thrust of 4N in axial direction

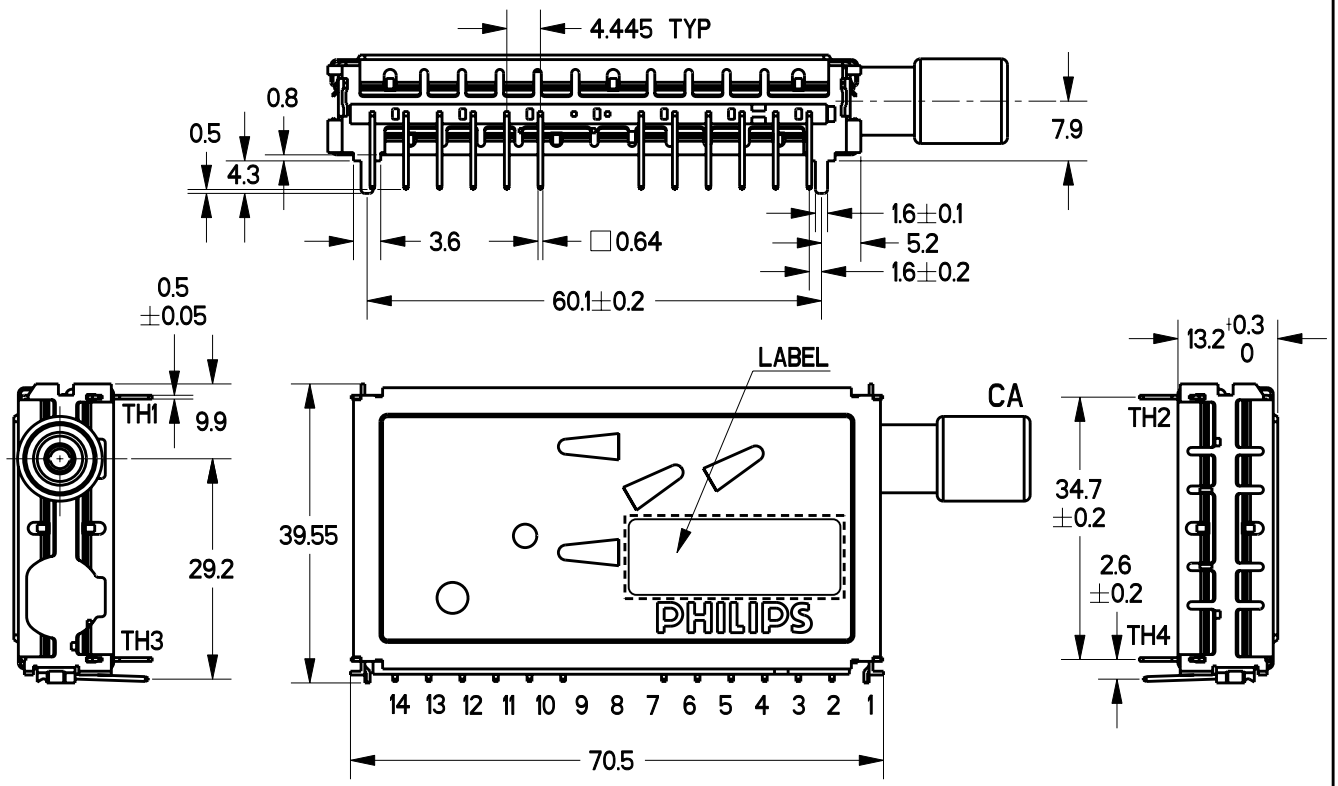
PUNCHING PATTERN OF CHASSIS PCB

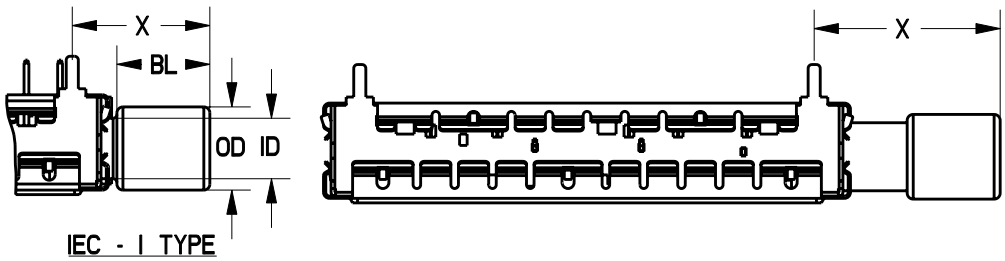
For optimum mounting of the tuner to a PCB, the punching pattern is recommended (see 3139 149 0120).

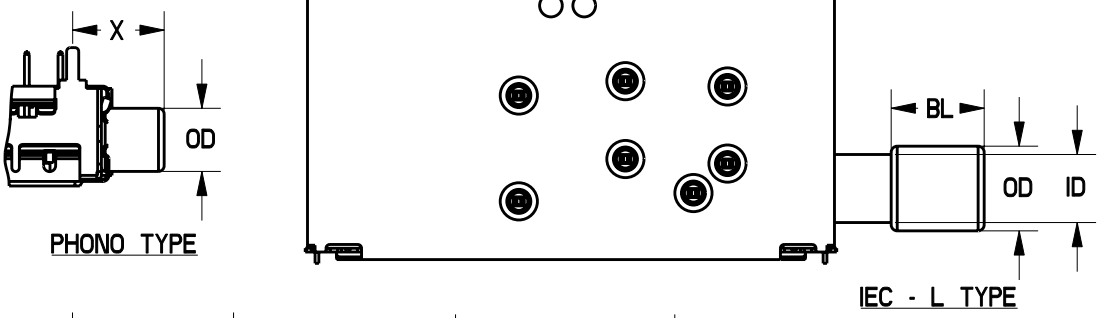
The tuner must be mounted without clearance between the tuner supporting surface and the printed circuit board (PCB). When mounted in this way, the tuner must be soldered to the PCB. This can be achieved by pressing the unit vertically onto the PCB during soldering.

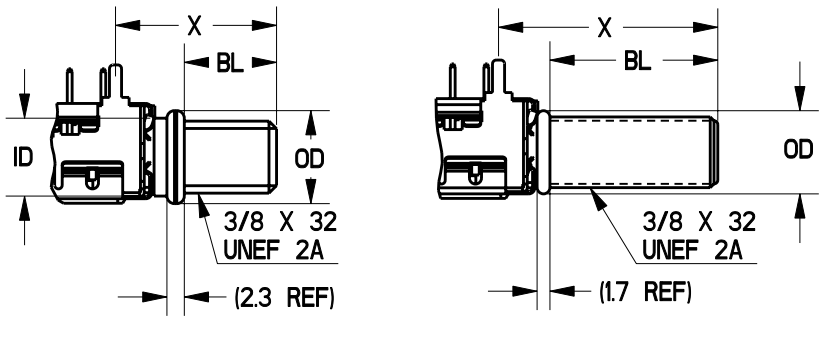
Example of Carton Box:





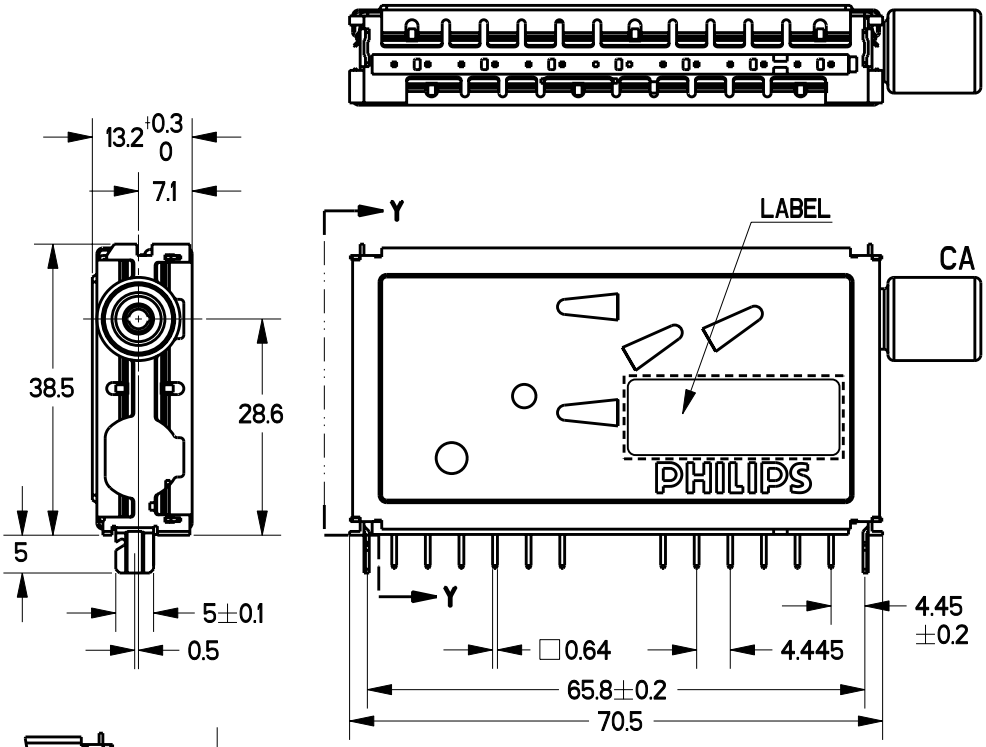


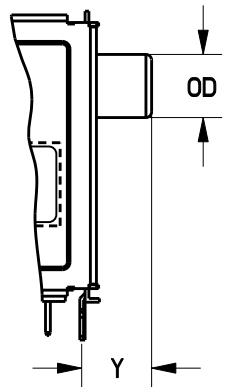




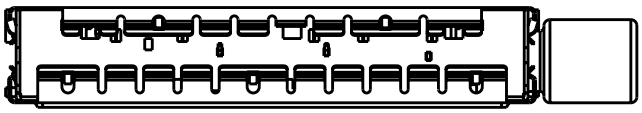
NOTE:
- DRAWING FOR SINGLE CONNECTOR TYPE, HORIZONTAL MOUNT
- GENERAL TOLERANCE ±0.5mm
- ALL DIMENSIONS IN MILLIMETER.
- DRAWING NOT TO SCALE.

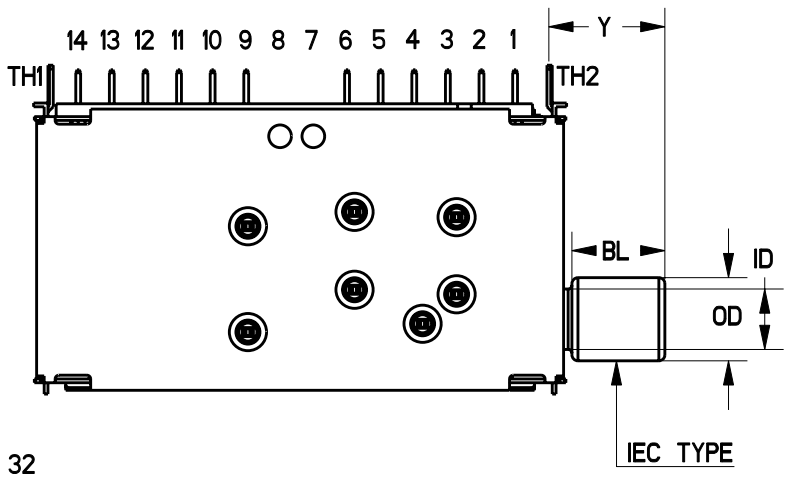
CLASS NO. 3UM900	PRODUCT DRAWING FQ/FM1200MK3 MECHANICS	3139 149 0120	1 03-09-16
00-12-19			1 03-06-12
.			1 02-05-16
01-01-19			1 02-05-06
			. .
NAME SOH KL	SUPERS xxxx xxx xxxx	6	10 / 110 - 3 / A4
SV / CHECK	DATE 00-12-19	©	PHILIPS ELECTRONICS N.V.



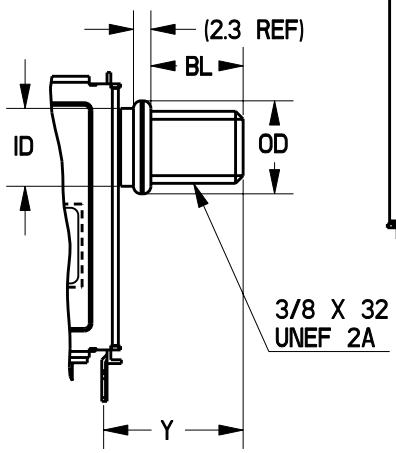


PHONO TYPE





IEC TYPE



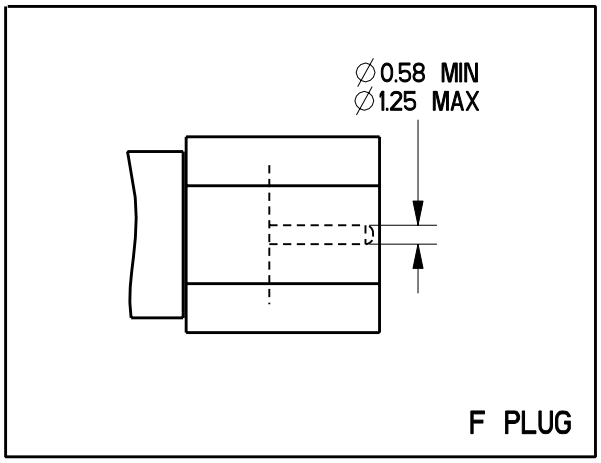
F- TYPE

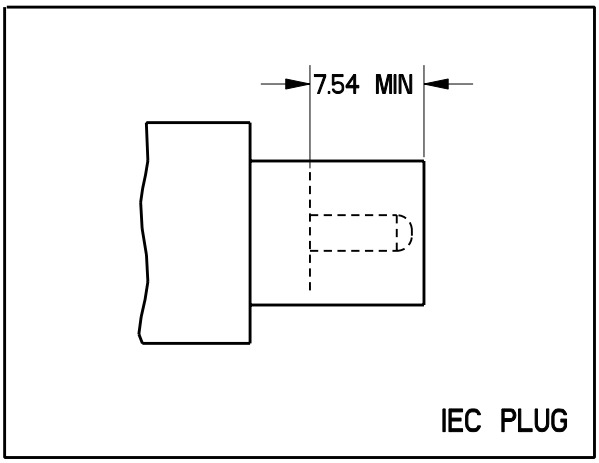
NOTE:
- DRAWING FOR SINGLE CONNECTOR TYPE, VERTICAL MOUNT.
- GENERAL TOLERANCE ±0.5mm
- ALL DIMENSIONS IN MILLIMETER.
- DRAWING NOT TO SCALE.

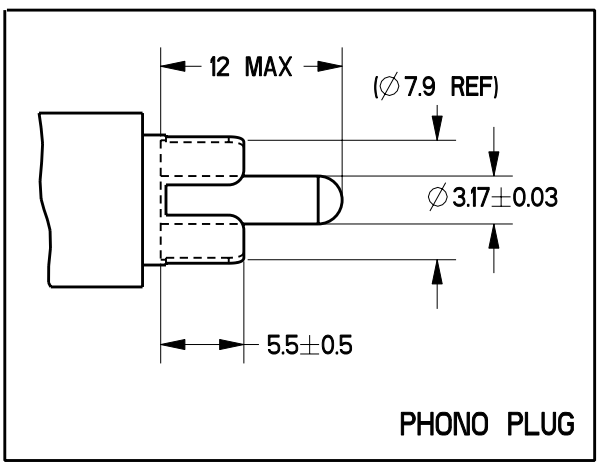
CLASS NO. 3UM900	PRODUCT DRAWING FQ/FM1200MK3 MECHANICS	3139 149 0120	1 03-09-16 / 1 03-06-12 / 1 02-05-16 / 1 02-05-06
00-12-19 / . / 01-01-19			
NAME SOH KL	SUPERS xxxx xxx xxxx	6 / 10 / 110 - 4	A4
SV / CHECK	DATE 00-12-19	© PHILIPS ELECTRONICS N.V.	

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	22.2±0.3	∅11.0±0.2	-
	CB						
P	CA	PHONO	12.1±0.5	9.25±0.5	-	∅8.35+0/-0.1	-
	CB						

MALE CONNECTOR REQUIREMENTS





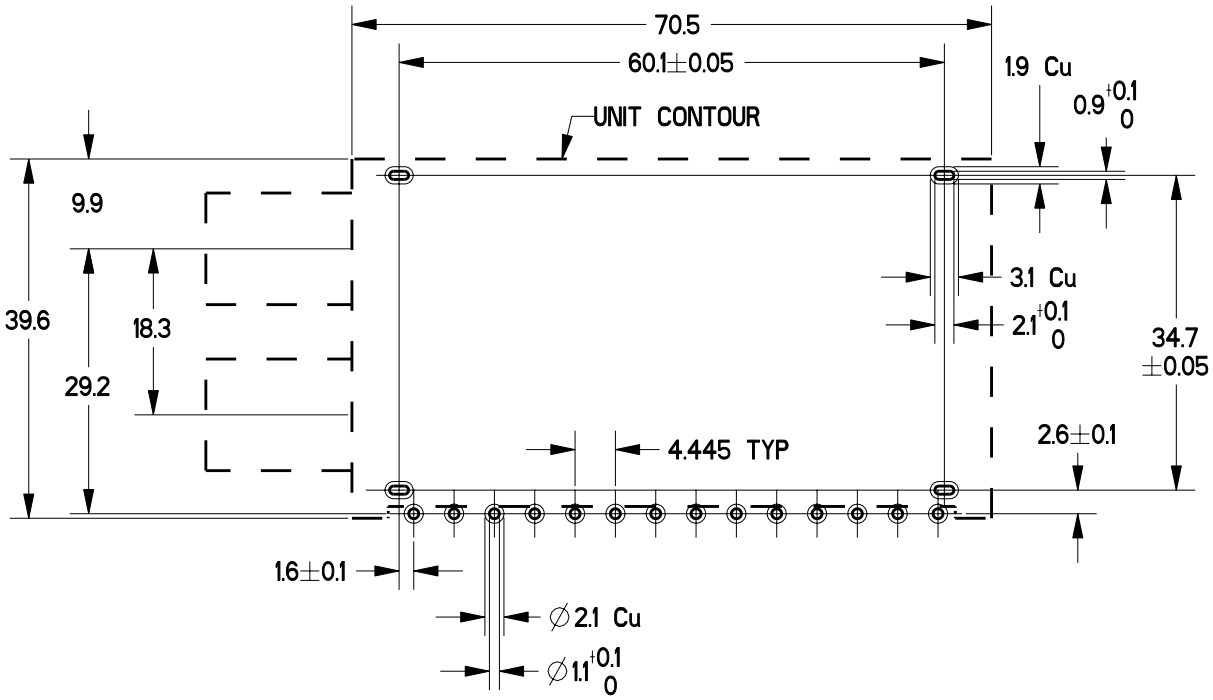


For dimensions which are not reflected in the drawing, refer to IEC 600169-24 (for F plug) and IEC 600169-2 (for IEC plug).

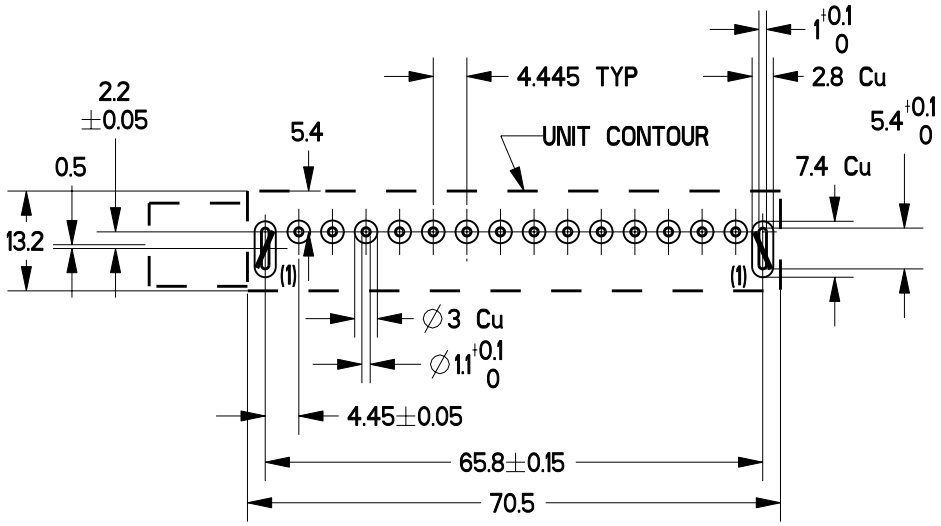
CLASS NO. 3UM900	PRODUCT DRAWING FQ/FM1200MK3 MECHANICS	3139 149 0120	1 03-09-16
00-12-19 / . / 01-01-19			. . / . . / . .
NAME SOH KL	SUPERS xxxx xxx xxxx	6 / 10 / 110 - 5	A4
SV / CHECK	DATE 02-05-06	© PHILIPS ELECTRONICS N.V.	

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 FQ/FM1200MK3 MECHANICS	3139 149 0120	1 03-09-16
00-12-19 / . / 01-01-19			. . / . . / . .
NAME SOH KL	SUPERS xxxx xxx xxxx	6 / 10 / 110 - 6	A4
SV / CHECK	DATE 02-05-06	© PHILIPS ELECTRONICS N.V.	

Document revision history

Rev #	Date	Approved by	Remarks
0	20-02-01	Toh Kong Lim	New
0.1	16-04-01	Toh Kong Lim	Trigger by Soh KL, changes in page 18
0.2	17-07-01	Toh Kong Lim	Trigger by Toh KL, changes in pg 10-13, 16-19
0.3	18-10-01	Toh Kong Lim	Trigger by Paxton Tan, changes in pg 11-20 and product drawings.
0.3	10-12-01		Updating last page
0.3	28-02-02		Updating last page
0.4	01-04-02	Toh Kong Lim	Trigger by Toh KL, changes in pg 2
1	06-05-02	Toh Kong Lim	Trigger by Soh KL, product drawings changed under CP 63459
1	15-05-02	Toh Kong Lim	Trigger by Paxton Tan, changes in pg 2 (1 new model added), pg 3 (Channel Coverage) and product drawings.
1.1	21-06-02	Toh Kong Lim	Data sheet updated by Paxton, changes in pg 2, 3, 4, 5, 8, 10, 13, 14, 15, 20, 22 & prod. dwgs.
1.2	15-07-02	Toh Kong Lim	Trigger by Toh KL, updating pg 10 (Audio output characteristics)
1.3	-	-	no change
1.4	20-09-02	Toh Kong Lim	Trigger by Toh KL, updating pg 9, 10 & last page.
b	18-12-02	Toh Kong Lim	Updating front and last page
c	15-07-03	Toh Kong Lim	Updating last page & Pg 13 : 1) change of TOP to a lower value; 2) set ATC = 0
d	01-10-03	Toh Kong Lim	Trigger by Soh KL, updating mechanical drawings
e	10-11-03	Toh Kong Lim	Triggered by Toh KL; Pg 2, 3, 13, 15, 17 : remarks added. Pg 20 : Adding I^2C drawing and PIP drawing;
f	10-02-04	Toh Kong Lim	Trigger by Toh KL; Pg 2 : features description add - User-settable 2^{nd} IF address for PIP application and ordering information description changed. Pg 3 : description add - For all others, a second address can be set by using a 2K2 resistor at 10 of the module. All modules use the narrowband AGC detection system. Pg 14 : add notes.
g	16-02-04	Toh Kong Lim	Trigger by Toh KL; Pg 14 – notes – all new versions carry the code SV21 instead of SV22 with effect from 1 April 2004

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

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For all other countries apply to:
Philips RF Solutions
Prof. Holstlaan 4, Building WL
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