FQ1216ME MK5

Multi-standard desktop video modules

Rev.k — 14.06.2007 **Product data sheet**

1. General description

The FQ1216ME belongs to the new MK5 family of small size frontends, especially developed for LCD-TV application where a low noise figure and best-in-class performance is desired. 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 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 5 V device.

The FQ1216ME fulfills the requirement of IEC 60950-1 (2^{nd} Edition) in respect of chapter 7 for Electric Strength Test and Impulse Test

For PIP/Double Window application, a second module address can be set for both the tuner and IF part. The footprint is identical to the Mk3, but the overall thickness is lower.

Table 1. Intermediate frequencies

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

Table 2. Channel coverage

Band	Frequency range (MHz)
Low band	48.25 to 158.00 [1]
Mid band	160.00 to 442.00
High band	442.00 to 863.25

[1] Can cover down to 45.75 MHz (Ch A for Ireland). Does not guarantee Ch FA (47.75 MHz) for L'

2. Features

- Multi-Standard TV Systems Broadcast reception
- Especially developed for LCD-TV / PDP application
- New input configuration (patent pending) results in Best-in-Class noise figure typically 5.5 dB in UHF
- True 5 V device (low power consumption compared to Mk3)
- Full frequency range from 48.25 MHz to 863.25 MHz
- PLL controlled tuning
- 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 2^{nd} IF address for PIP application
- Complies with European regulations on radiation, signal handling and immunity (CENELEC 55020, 55013)
- Complies to CISPR13 (4^{th} edition) including amendment 1 (1992) and amendment
- Fulfills the requirement of IEC 60950-1 (2^{nd} edition) in respect of chapter 7 for Electric Strength Test and Impulse Test
- Low profile horizontally mounted metal 70 mm housing
- Environmentally friendly lead-free process used
- Suitable for lead-free wave soldering

3. Applications

- STB
- LCD / Plasma TV
- PC-TV cards

4. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
FQ1216ME/I H-5	3139 147 22641	IEC connector / Horizontal mounting	-
FQ1216ME/I V-5	3139 147 22981	IEC connector / Vertical mounting	-
FQ1216ME/P H-5	3139 147 22991	Phono connector / Horizontal mounting	-
FQ1216ME/P V-5	3139 147 23001	Phono connector / Vertical mounting	-
FQ1216ME/L H-5	3139 147 24061	Long IEC connector / Horizontal mounting	-

5. Marking

The following information is printed on a sticker that is on the top cover of the module

- Type number
- Code number
- Origin letter of factory
- Change code
- Year and week code

6. Block diagram

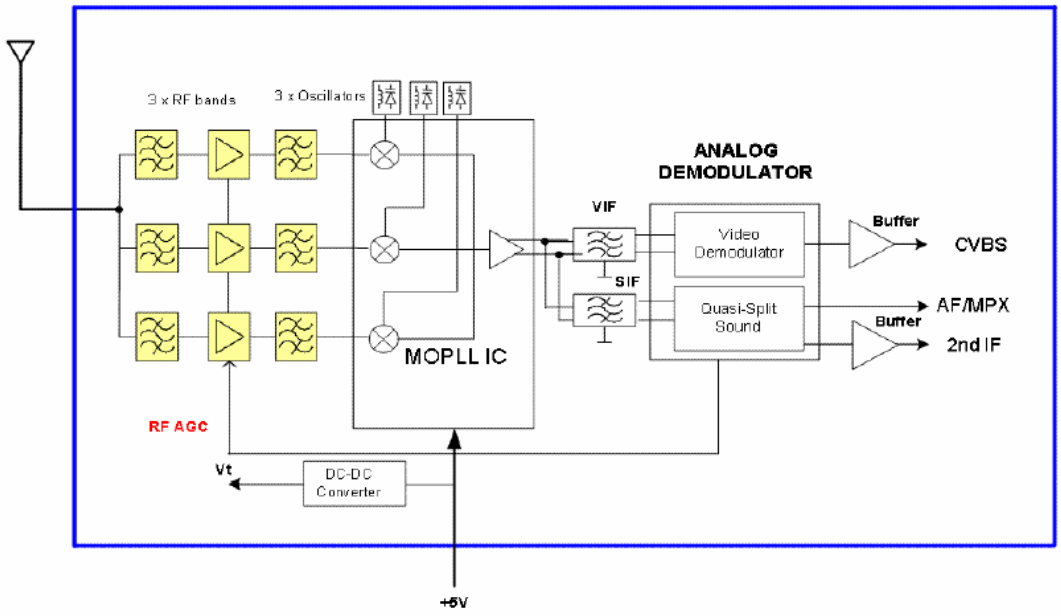


Fig 1. Block diagram

7. Pinning information

Table 4. Pin description

Pin name	Pin	Description
N.C	1	(AGC monitor) do not connect [1]
N.C	2	(Tuning voltage monitor) do not connect [1]
+5 V	3	Supply voltage Vb, Tuner section
SCL	4	I^2C-Bus Serial Clock
SDA	5	I^2C-Bus Serial Data
AS_TU	6	I^2C-address Select - Tuner Part

Pin name	Pin	Description
-	x	Not connected
-	x	Not connected
N.C	9	Not connected
AS_IF	10	I^2C-address Select – IF Part
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	14	AF sound output
GND		Mounting Tags (TH1, TH2, TH3, TH4)

[1] For process use only

8. Limiting values

Table 5. 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	1	[1]	10	-	-	MΩ
V_{CC}	Supply voltage	3		4.75	5	5.25	V
V_{ripple}	Ripple voltage susceptibility 20 Hz to 1 kHz		[2]	-	-	5	mV_{PP}
	1 kHz to 200 kHz			-	-	10	mV_{PP}
I_{CC}	Supply current at 5 V			-	65	100	mA
V_{SCL}	Voltage on pin SCL	4		−0.3	-	5.25	V
V_{SDA}	Voltage on pin SDA	5					
	High level			3	-	5.5	V
	Low level			−0.3	-	1.5	V
I_{SDA}	current on pin SDA (open collector)			−1.0	-	5	mA
-	AS voltage	6	[3]	-	-	5.25	V
2^{nd} IF sound output							
$Z_{L(DC)}$	load impedance DC	11		1.0	-	-	kΩ
$Z_{L(AC)}$	load impedance AC			1.0	-	-	kΩ
Composite video baseband signal							

Symbol	Parameter	Pin		Min	Typ	Max	Unit
$Z_{L(DC)}$	load impedance DC	12		75	-	-	Ω
$Z_{L(AC)}$	load impedance AC			75	-	-	Ω
$\tau_{(load)}$	load time constant			-	-	100	ns
IF section							
V_{CC}	Supply voltage	13		4.75	5	5.25	V
V_{ripple}	Ripple susceptibility		[2]				
	20 Hz to 1 kHz			-	-	5	mV_{PP}
	1 kHz to 500 kHz			-	-	10	mV_{PP}
I_{CC}	Supply current at 5 V			-	100	130	mA
AF Output							
$Z_{L(DC)}$	load impedance DC	14		100.0	-	-	kΩ
$Z_{L(AC)}$	load impedance AC			10.0	-	-	kΩ

[1] **Minimum impedance required is 10 MΩ, otherwise AGC voltage is loaded down. For process only**

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

[3] **For detailed information about address coding, refer to Application Information**

Table 6. Limiting values under 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 Hz to 55 Hz		-	0.35	mm
Operational Conditions						
T_{amb}	ambient temperature		[1]	0	+70	°C
RH	relative humidity			-	95	%

[1] The typical MTBF is about 20,000 hours at this operational ambient temperature. For every 10 °C increase, the MTBF is reduced by half.

9. Static Characteristics

9.1 Overall performance

Unless otherwise specified, all electrical values for overall performance apply at the following conditions.

Table 7. Static characteristics (conditional data)

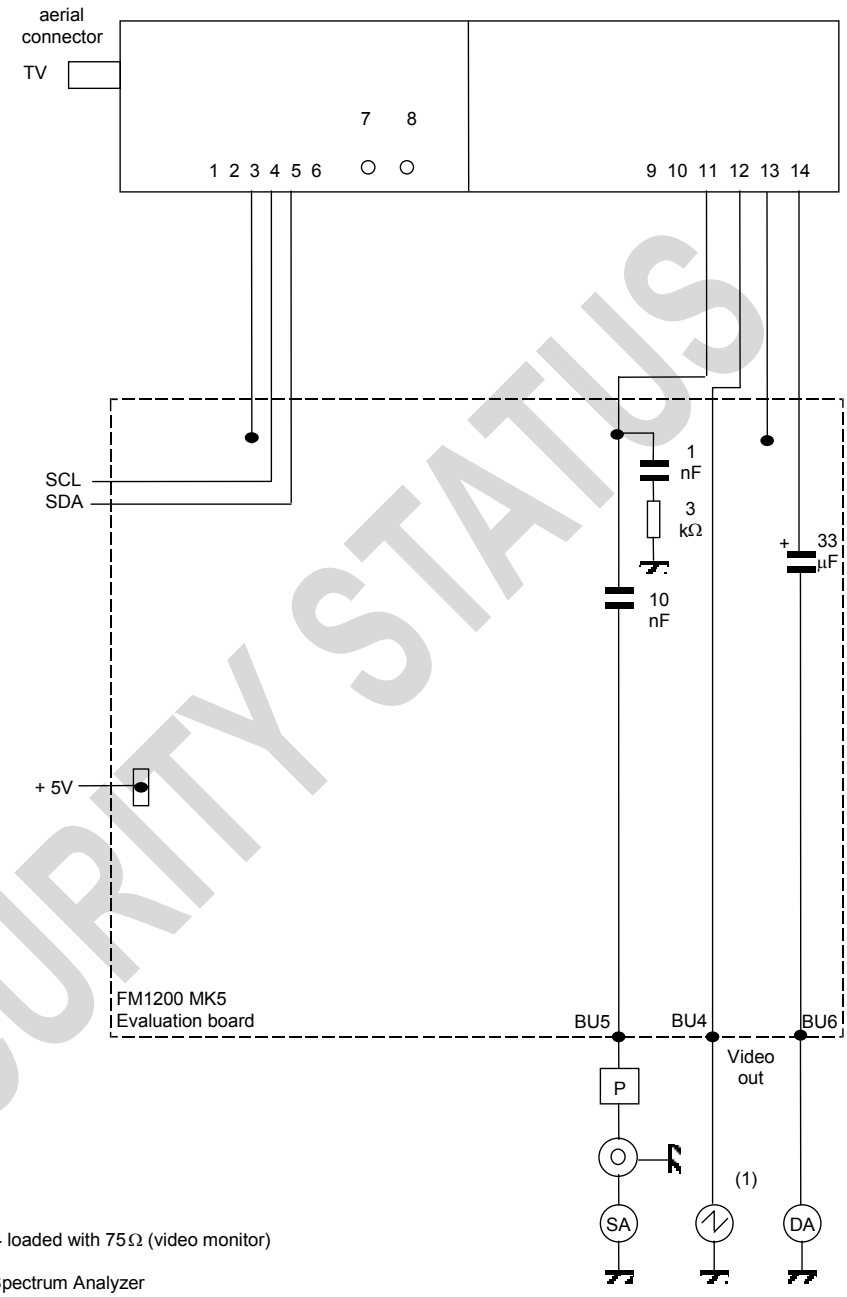
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb}	ambient temperature		-	25 ± 5	-	°C
RH	relative humidity		-	60 ± 15	-	%
V_{CC}	supply voltage	tuner and IF section	-	5 ± 0.125	-	V
Z_S	source impedance	unbalanced	-	75	-	Ω
$Z_{O(2nd\_IF)}$	second IF sound output load		-	0.5	-	kΩ
$Z_{O(video)}$	video output load		-	75	-	Ω
$Z_{O(AF)}$	AF1 sound output load		-	100	-	kΩ

Table 8. Static characteristics (Test equipment)

Equipment	Parameter	Min	Typ	Max	Unit
DC voltmeter	input impedance	-	10	-	MΩ
Oscilloscope	input impedance resistance	-	1	-	MΩ
	input impedance capacitance	-	15	-	pF
Spectrum analyzer	input impedance	-	50	-	Ω
FET probe	input impedance resistance	-	10	-	MΩ
	input impedance capacitance	-	3.5	-	pF

9.2 Test diagram

The frontend characteristics are measured according to the test diagram.



(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)

Fig 2. Test diagram

Table 9. Static characteristics (Definitions of test signals)

Test signal		Frequency (MHz)	Amplitude	Modulation
A0	Un-modulated vision carrier	480.25	60 dBμV	
A1	L-system signal with video modulation	480.25	60 dBμV (peak white)	100 % (sync level at < 6 %), 2T-pulse and bar, unless otherwise indicated
A2	B/G/D/K/I–system signal with video modulation	480.25	60 dBμV (top sync)	100 % (rest carrier 10 %), 2T-pulse and bar, unless otherwise indicated
A3	L'–system signal with video modulation	55.75	60 dBμV (peak white)	100 % (sync white < 6 %), 2T-pulse and bar, unless otherwise indicated
B1	Un-modulated 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 signal A0 or A1	m = 0.54, modulation frequency 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	frequency deviation = 27 kHz, modulation frequency 1 kHz, 50 μs pre-emphasis, unless otherwise indicated
B4	Un-modulated 2nd sound carrier B/G system	A2 + 5.85 MHz	−20 dB respectively wrt A2	
B5	Un-modulated 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 with test signal A3	m = 0.54, modulation frequency 1 kHz, unless otherwise indicated

Table 10. Static characteristics (Aerial input)

Symbol	Parameter	Conditions	Min	Max	Unit
VSWR		Referred to 75 Ω at RF picture carrier frequency	-	5	
V_{ANT}	antenna terminal disturbance voltage	Up to 1.75 GHz	-	46	dBμV

10. Dynamic Characteristics

Table 11. Dynamic characteristics (General)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_b	Frequency range					
	low band		48.25	-	158.00	MHz
	mid band		160.00	-	442.00	MHz
	high band		442.00	-	863.25	MHz
Δf_b	Margin					
	low band		1.5	-	-	MHz
	mid band		1.5	-	-	MHz
	high band		1.5	-	-	MHz
G_V	Voltage gain					
	low band		40	46	52	dB
	mid band		40	46	52	dB
	high band		40	46	50	dB
NF	Noise figure					
	low band		-	5.5	8.0	dB
	mid band		-	5.5	8.0	dB
	high band		-	5.5	8.0	dB
α_{image}	Image rejection	- wanted test signal F_{ant} at 60 dBμV - Un-wanted test signal at (F_{ant} + 77.7 MHz)				
	low band		68	75	-	dB
	mid band		62	70	-	dB
	high band		52	62	-	dB
α_{IF}	IF rejection All band	- wanted test signal F_{ant} - Un-wanted test signal A0 with frequency ($F_{IF,PC}$ − 1 MHz)	60	75	-	dB
t_{lj}	Oscillators lock-in time	Tuning speed (lock bit, CP = 1)	-	-	100	ms

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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

Table 12. Dynamic characteristics (Video)

Base on recommended setting on Table 28

Parameter	Test signal	Test point	Min	Typ	Max	Unit
CVBS output amplitude	A1	BU4	0.7	1.0	1.3	V_{PP}
DC level of sync pulse	A1	BU4	-	0.35	-	V
CVBS amplitude response at 1 MHz						
2 MHz	A1	BU4	-	0.0	−1.0	dB
3 MHz	A1	BU4	-	−0.5	−2.5	dB
4.43 MHz	A1	BU4	-	−0.5	−3.5	dB
Sound carriers rejection, specification valid for B/G, I and D/K mode wrt 1 MHz	A2 + B1 + B4	BU4				
5.5 / 6.0 MHz			45	50	-	dB
6.5 MHz			45	50	-	dB
Un-weighted CVBS signal to noise ratio, specification valid for L/L', B/G, I and D/K mode un-weighted SNR	A1 or A2 or A3	BU4	41	46	-	dB
Noise limited sensitivity (S/N 30 dB, un-weighted)	A1 or A2 or A3	BU4	-	41	46	dBμV
Gain limited sensitivity (−1 dB video signal) carrier level of test signal	A2	BU4	-	23	33	dBμV
2nd sound IF level (all systems)	A1 or A2 or A3	BU5	90	103	-	dBμV

Table 13. Dynamic characteristics (Audio)

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 50 μs de-emphasis for AF1 at 1 kHz (C5 = 1, C6 = 1)	A2 + B3	BU6	400	480	600	mVrms
Specification valid for L/L' mode (C5 = 0) modulation = 54 % AF output level (C7 = 0)	A1 + B2 or A3 + B6	BU6	400	500	600	mVrms
Specification valid for B/G, D/K and I modes THD (total harmonic distortion)	A2 + B3	BU6	-	0.2	0.6	%
Signal-to–noise ratio measured via LP 20 kHz filter, RMS detector 50 μs de-emphasis for AF1 at 1 kHz (C5 = 1, C6 = 1)	A2 + B3	BU6	52	60	-	dB
Specification valid for L/L' mode THD (total harmonic distortion)	A1 + B2 or A3 + B6	BU6	-	0.8	1.5	%
Signal-to–noise ratio measured via LP 20 kHz filter, RMS detector for AF1 at 1 kHz	A1 + B2 or A3 + B6	BU6	42	50	-	dB
Specification valid for B/G, D/K and I modes (S/N = 40 dB) (C5 = 1, C6 = 1) Audio sensitivity	A2 + B3	BU6	-	23	40	dBμV
Specification valid for L/L' mode (S/N = 38 dB) Audio sensitivity	A1 + B2 or A3 + B6	BU6	-	35	45	dBμV

11. Application information

11.1 Demonstration kit

A demonstration kit is available for the FQ1216ME MK5 (software, application note and evaluation board).

Please contact your local sales engineer for details about the price and availability.

11.2 I²C programming

For information regarding general aspects of I²C-Bus control see "The I²C-Bus Specifications", published by NXP Semiconductors on the website www.nxp.com

The FQ1216ME MK5 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

11.3 Tuner part programming

11.3.1 Write mode

Table 14. BIT allocation

Write mode, R/W = 0

Write data	Byte	MSB							LSB	ACK
		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
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	WSB=0	A
Bandswitch byte	BB	X	X	X	P4	P3	P2	P1	P0	A

Table 15. Address selection (byte ADB)

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

Voltage at terminal 6	Address	MA1	MA0
0 V to 0.5 V	C0	0	0
1.5 V to 2.0 V	C2	0	1
2.0 V to 3.0 V	C4	1	0
4.5 V to 5.0 V	C6	1	1

Table 16. Programmable divider setting (bytes DB1 and DB2)

Divider ratio : N = F_{OSC}/F_{ss}

where F_{OSC} = (F_{RF} + F_{IF} [1]) 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

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

Table 17. Control byte (CB)

Charge pump setting

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

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

CP = 0, charge pump current = 60 μA results in moderate speed tuning with better residual oscillator

PLL Disabling

OS = 0, for normal operation

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

Weak signal booster

WSB must be set to 0 otherwise tuner overload will occur

Table 18. Test mode setting

T2	T1	T0	Test mode
0	0	0	Normal mode (read and write mode bytes allowed)
0	0	1	Normal mode (read and write mode bytes allowed) [1]
0	1	0	Charge pump is off
0	1	1	Byte BB ignored
1	0	0	Charge pump sinks current
1	0	1	Charge pump sources current
1	1	0	½ f ref output from port P3
1	1	1	½ f ref output from port P3

[1] Default mode at power-on reset

Table 19. Reference divider ratio select bits

RSA	RSB	Reference frequency / Step size	Remarks
0	1	31.25 kHz	Slow picture search
1	1	62.5 kHz	Normal picture search

Table 20. Bandswitching byte (BB)

Ports	P0	P1	P2	P3	P4
Low band	1	0	0	0	0
Mid band	0	1	0	0	0
High band	0	0	1	0	0

11.3.2 Read mode

Table 21. BIT allocation

Read mode, R/W = 1

Name	Byte	MSB							LSB	ACK
		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
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 3 V. 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 for at least 8 periods of the internal 7.8125 kHz reference frequency 1 msec before the FL flag is internally set to 1

11.4 IF part programming

The IF uses the new TDA9886 demodulation IC from NXP Semiconductors.

11.4.1 I²C bus control – format to write mode

Table 22. Slave receives data

S	Slave address	R/W = 0	A	SAD	A	DATA	A	P

Description of Bit

Bit	Function
S	Start condition
Standard Slave address	100 0011X, where X is the value of R/W, see Table 23
R/W = 0	Write mode
A	Acknowledge, generated by slave
Sub address (SAD)	See Table 24
DATA	Bytes B, C and E (described below)
P	Stop condition

Table 23. Slave address

Value (hex)	A6	A5	A4	A3	A2	A1	A0	R/W
86 [1]	1	0	0	0	0	1	1	0
84 [2]	1	0	0	0	0	1	0	0

[1] Default address = 86 (hex) pin 10 open

[2] Alternate address = 84 (hex), 2nd tuner for PIP application, connect pin 10 with 2k2 resistor to ground

Table 24. Sub address byte (SAD)

The first byte after slave address.

Data byte following SAD	MSB							LSB
	D7	D6	D5	D4	D3	D2	D1	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

Table 25. Description of the bits of the various data bytes

Data byte	Bits	Sub-address	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	C0 to C4	Adjust	TOP adjustment
	C5 and 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

Table 26. AGC take over adjustment

C4	C3	C2	C1	C0	TOP adjustment (dB)
1	1	1	1	1	+15
1	1	1	1	0	+14
1	1	1	0	1	+13
1	1	1	0	0	+12
1	1	0	1	1	+11
1	1	0	1	0	+10
1	1	0	0	1	+9
1	1	0	0	0	+8
1	0	1	1	1	+7
1	0	1	1	0	+6
1	0	1	0	1	+5
1	0	1	0	0	+4
1	0	0	1	1	+3
1	0	0	1	0	+2
1	0	0	0	1	+1
1	0	0	0	0	+0
0	1	1	1	1	-1
0	1	1	1	0	-2
0	1	1	0	1	-3
0	1	1	0	0	-4
0	1	0	1	1	-5
0	1	0	1	0	-6
0	1	0	0	1	-7
0	1	0	0	0	-8
0	0	1	1	1	-9
0	0	1	1	0	-10
0	0	1	0	1	-11
0	0	1	0	0	-12
0	0	0	1	1	-13
0	0	0	1	0	-14

C4	C3	C2	C1	C0	TOP adjustment (dB)
0	0	0	0	1	-15
0	0	0	0	0	-16

Table 27. Optimum setting

Optimum setting between overall picture quality and signal handling to fulfill CISPR20 / EN55020 requirements it is recommended to use these settings

However customers have the choice to make their own setting

Top setting	B/G/DK/I	L/L'
Low band	+0 dB	+0 dB
Mid band	−2 dB	−2 dB
High band	+0 dB	−2 dB

Table 28. Consolidated programming for TV systems

Description	Bits	TV systems					Force audio mute
		B/G	I	D/K	L	L'	
Video trap bypass	B0	0	0	0	0	0	X
Auto mute FM	B1	1	1	1	1	1	X
Carrier mode	B2	1	1	1	1	1	X
FM mode	B3	0	0	0	0	0	X
TV modulation	B4	1	1	1	0	0	X
Forced mute audio	B5	0	0	0	0	0	1
Not used (OP1)	B6	1	1	1	1	1	X
L/L' sound (OP2)	B7	0	0	0	0	1	X
TOP adjustment	C0	0	0	0	0	0	X
	C1	1	1	1	0	0	X
	C2	0	0	0	0	0	X
	C3	0	0	0	0	0	X
	C4	1	1	1	1	1	X
De-emphasis	C5	1	1	1	0	0	X
De-emphasis time	C6	1	1	1	1	1	X
Audio gain	C7	0	0	0	0	0	X
Sound inter-carrier	E0	1	0	1	1	1	X
	E1	0	1	1	1	1	X
Video IF	E2	0	0	0	0	0	X

Description	Bits	TV systems					Force audio mute
		B/G	I	D/K	L	L'	
	E3	1	1	1	1	0	X
	E4	0	0	0	0	1	X
IF gain	E5	0	0	0	0	0	X
L/L' PLL gating	E6	1	1	1	1	1	X
VIF AGC output	E7	0	0	0	0	0	0

11.4.2 I²C bus control – format to read mode

Table 29. Slave transmits data

S	Slave address	R/W = 1	A	DATA	AN	P

Description of Bits

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, see Table 30
AN	Acknowledge not, generated by the master [1]
P	Stop condition, generated by the master [1]

[1] The master generates an acknowledge, when it has received the data word "READ". The master next generates an acknowledge, then slave begins transmitting the data word "READ", and so on until the master generates no acknowledge and transmits a STOP condition

Table 30. 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
- AFCWIN = 1, F_{VIF} inside AFC window (within +/1.6 MHz) [1]
- AFCWIN = 0, F_{VIF} outside AFC window (everywhere else)

[1] Due to the Nyquist slope and the adjacent sound trap in the video SAW filter, the useable AFC window is typically from 500 kHz to + 1.6 MHz

Table 31. AFC status

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

Function	Bits			
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

[1] F_0 = nominal F_{VIF}

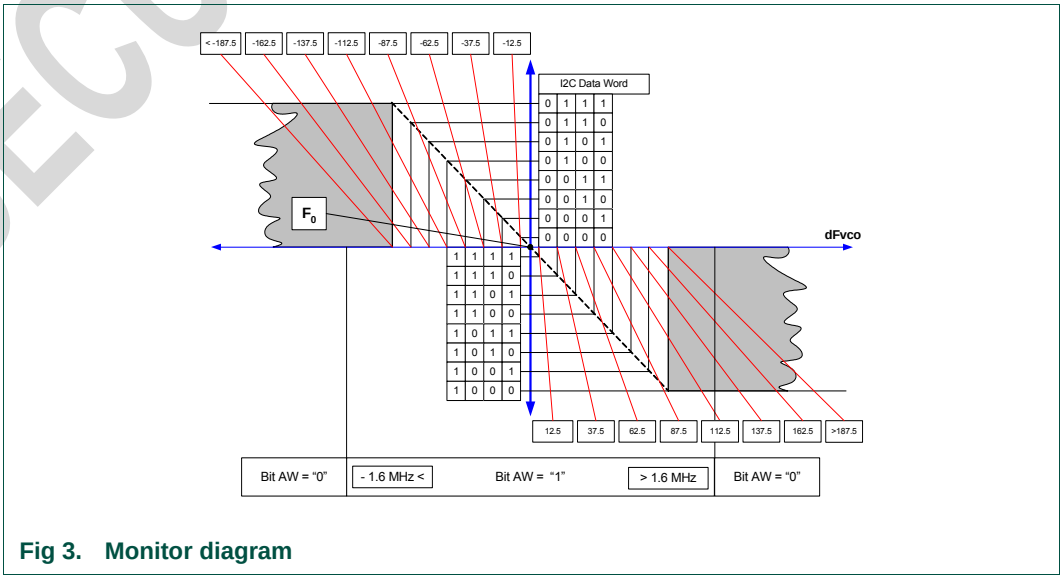


Fig 3. Monitor diagram

11.4.3 Programming examples

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

- F_{osc} = 471.25 MHz + 38.9 MHz = 510.15 MHz
- N = (510.15 MHz) / (62.5 kHz) = 1F E2 (Hexadecimal)
- So DB1 = 1F H
- and DB2 = E2 H
- CB = 8E
- BB = 44 H (because of high band selected)

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

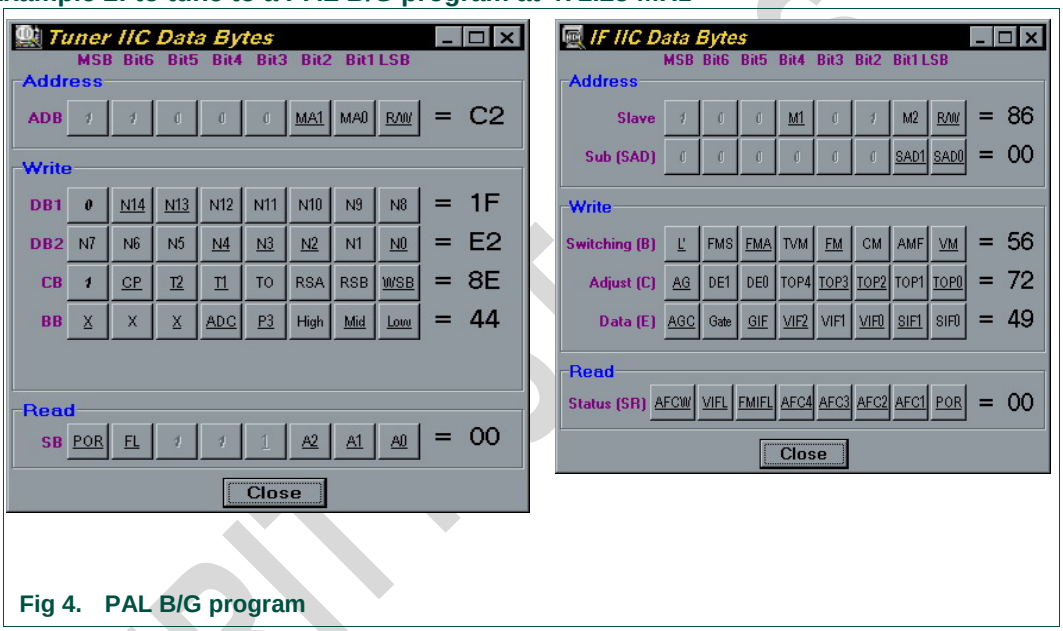


Fig 4. PAL B/G program

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

The settings are only for reference. Please refer to the demonstration software

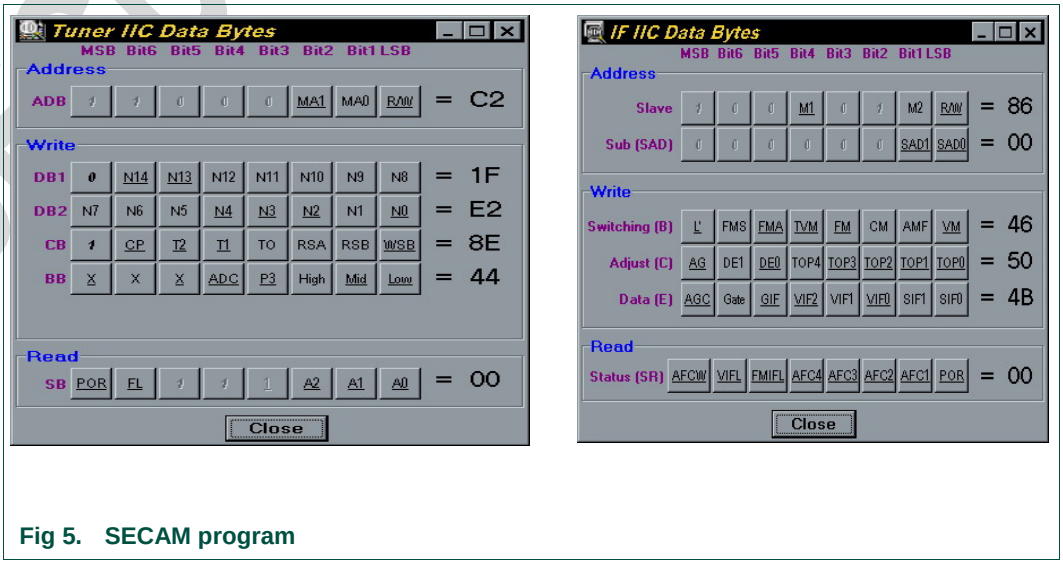


Fig 5. SECAM program

11.5 Loading of I²C-BUS

The FQ1216ME MK5 contains series impedances in the SCL and SDA as shown in the diagram below. Both lines also have capacitive loads of C = 39 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 specifications".

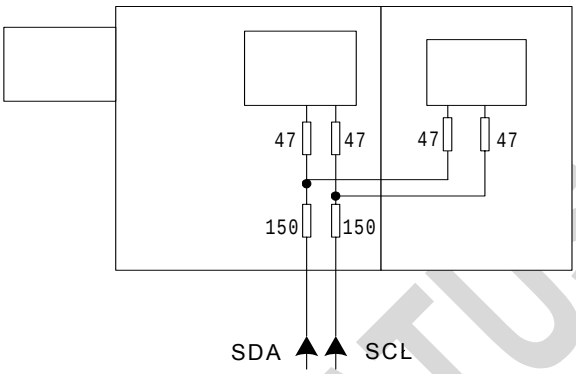


Fig 6. Series impedances diagram

11.6 CVBS load and 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 MK5

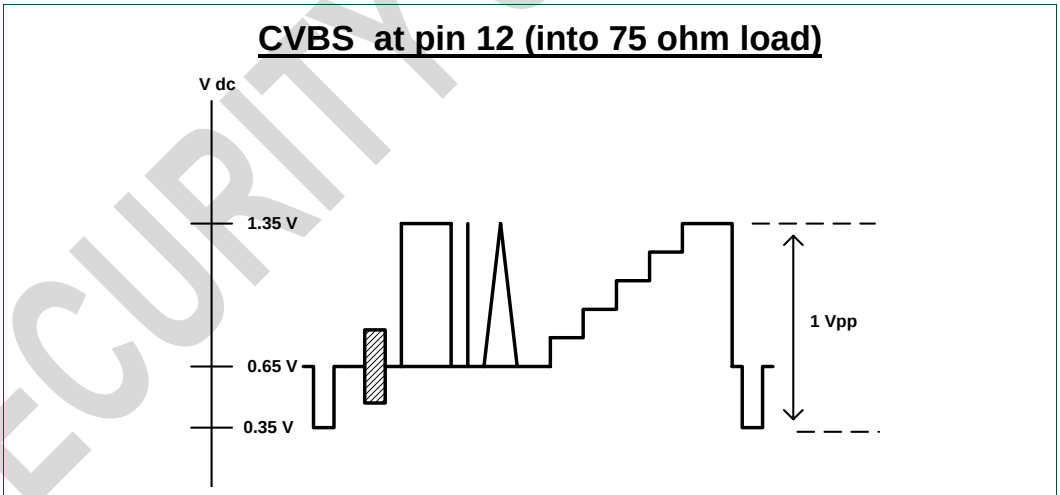


Fig 7. CVBS output level

11.7 Video signal to noise ratio (B/G system)

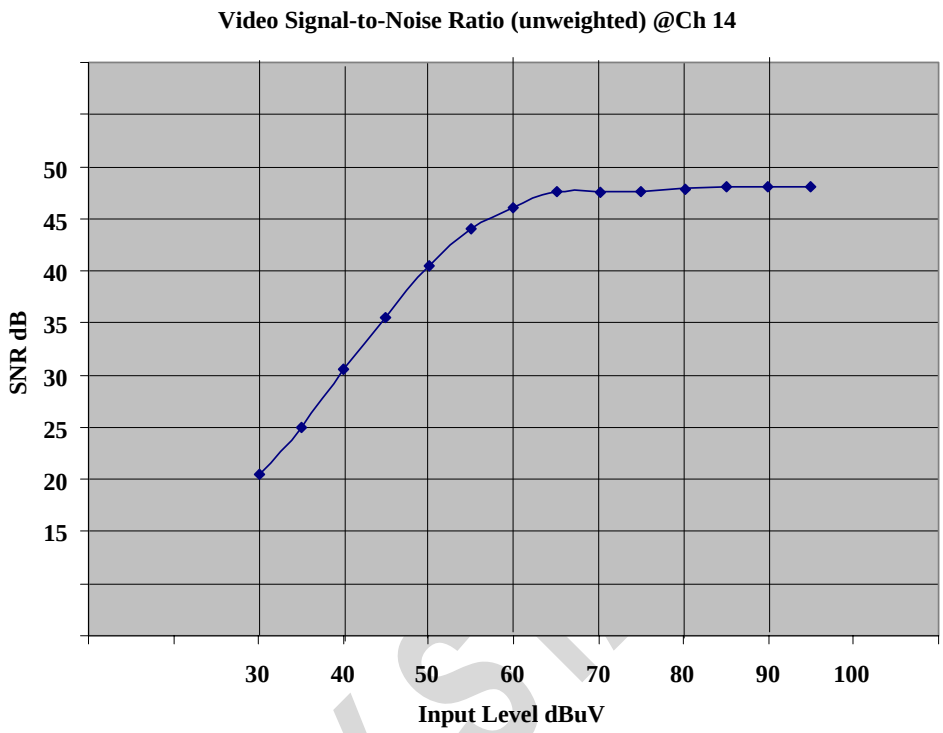


Fig 8. Video signal to noise ratio

11.8 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.

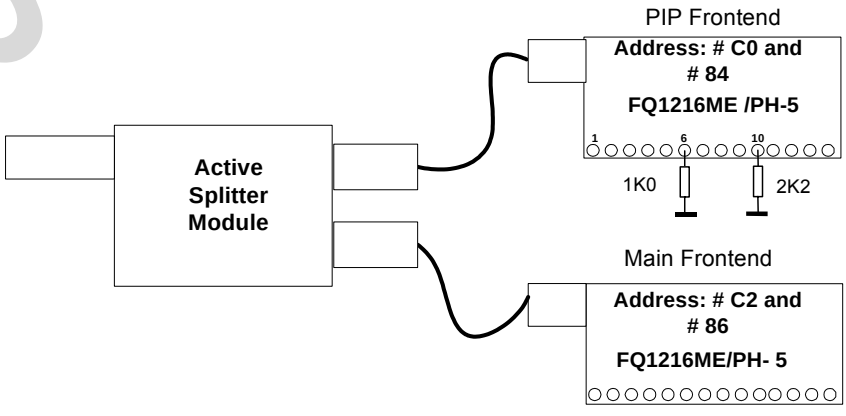
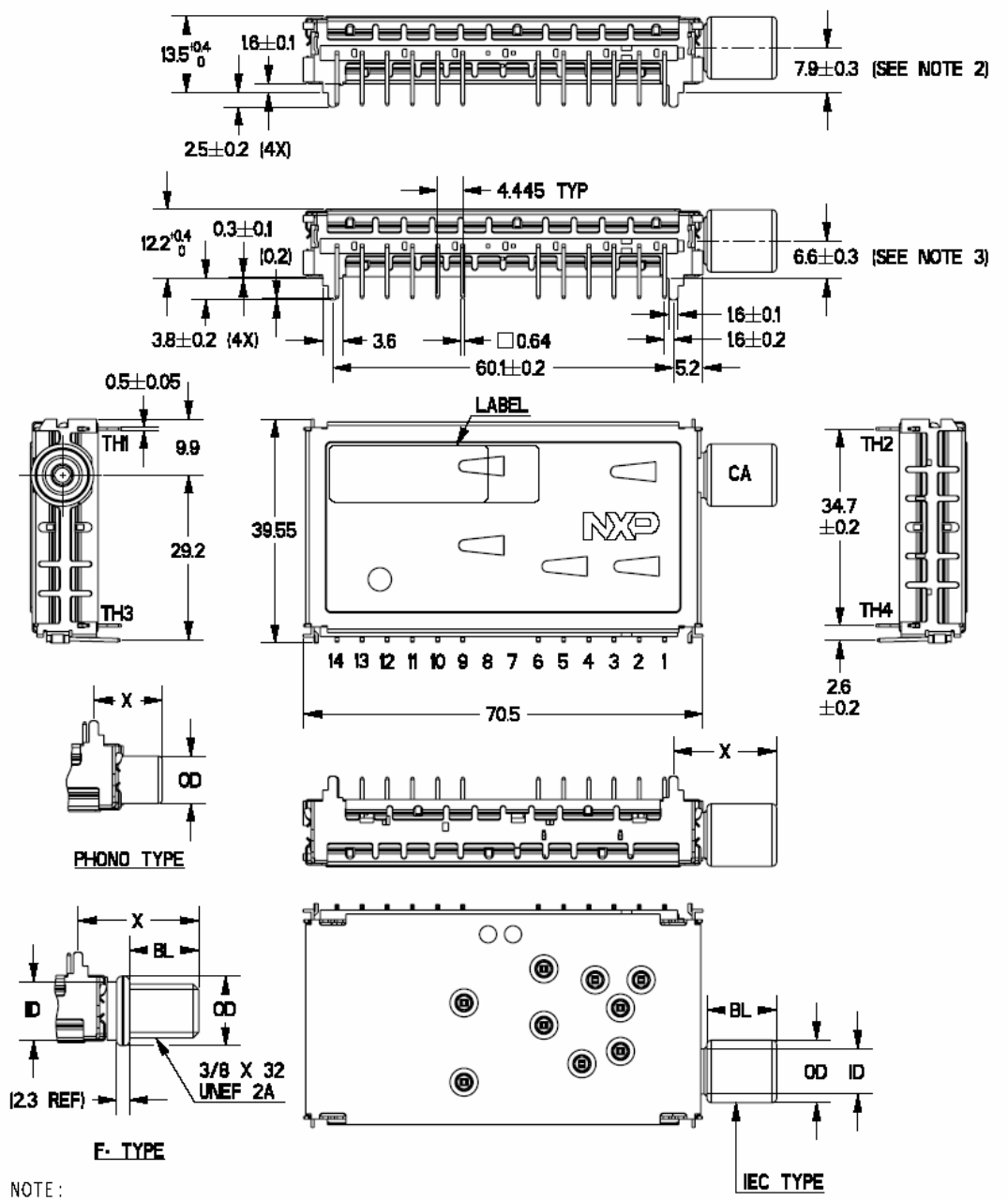


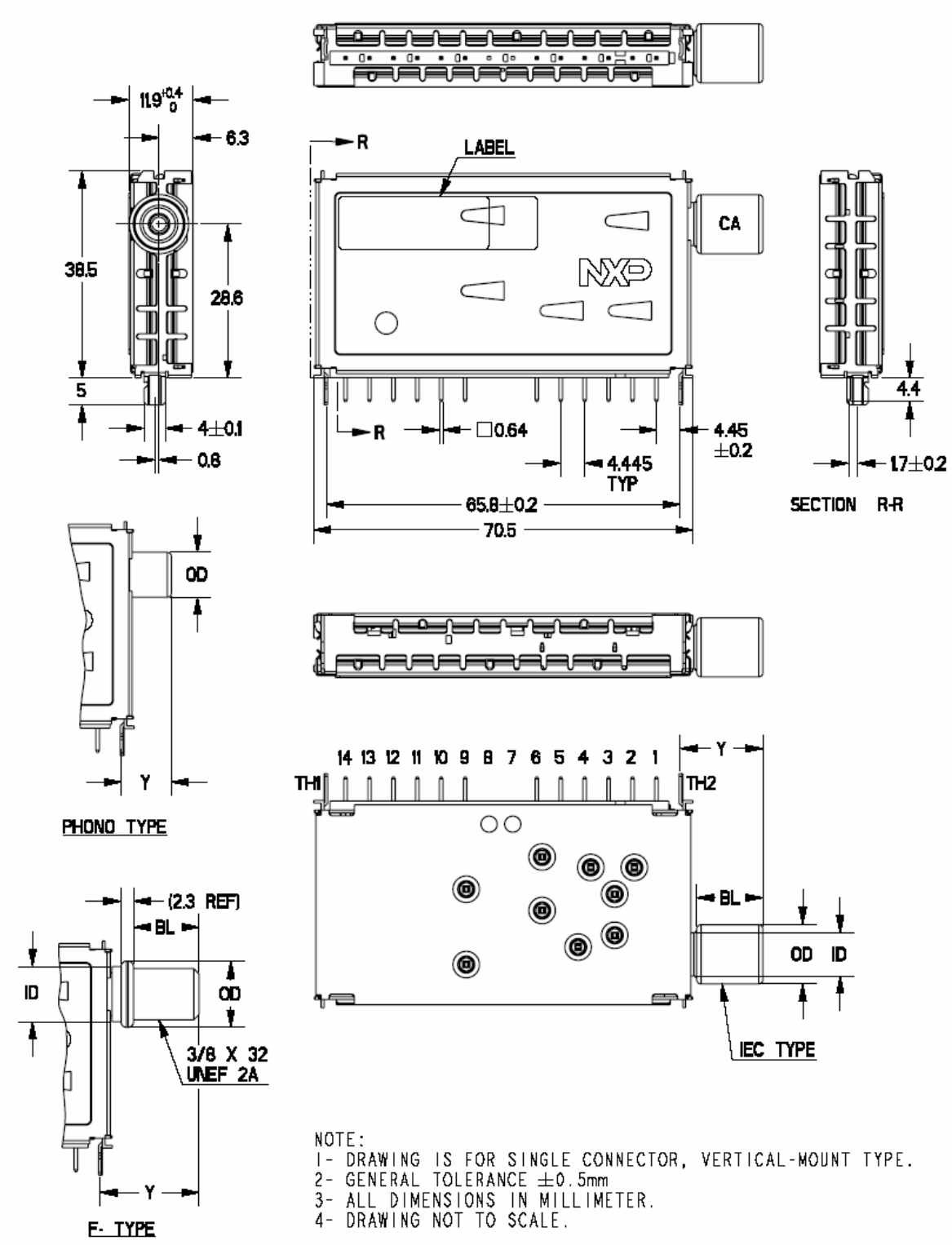
Fig 9. PIP application

12. Package outline



(1) Product drawing 3139 149 0207 page 1 (date 2006-12-01)

Fig 10. Package outline

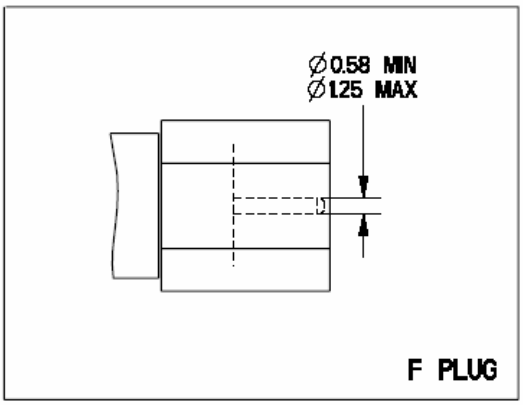


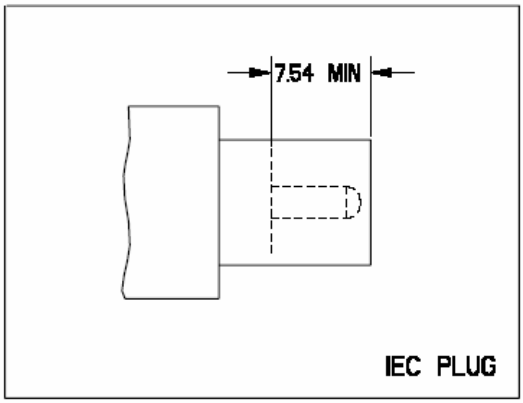
(2) Product drawing 3139 149 0207 page 2 (date 2006-12-01)

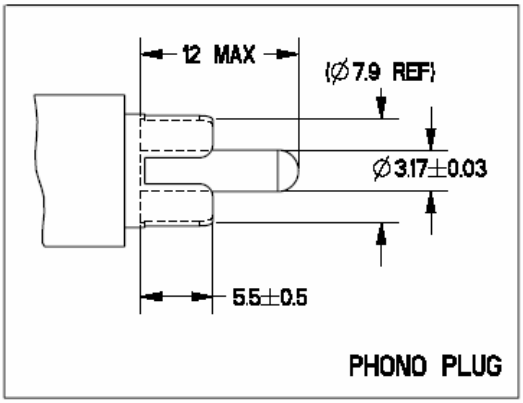
Fig 11. Package outline

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	Ø11.0±0.1	Ø8.0±0.2
	CB	IEC MALE				Ø9.53±0.05	
L	CA	IEC FEMALE	24.6±0.5	21.75±0.5	12.2±0.3	Ø11.2±0.1	Ø9.0±0.3
	CB	-	-	-	-	-	-
F	CA	F- TYPE	21.3±0.5	18.45±0.5	12.2±0.3	Ø12.3+0/-0.3	Ø9.8±0.2
	CB						
G	CA	F- TYPE	25.6±0.5	22.75±0.5	16.5±0.3	Ø12.3+0/-0.3	Ø9.8±0.2
	CB						
W	CA	F- TYPE	29.0±0.5	26.15±0.5	19.9±0.3	Ø12.3+0/-0.3	Ø9.8±0.2
	CB						
P	CA	PHONO	12.1±0.5	9.25±0.5	-	Ø8.35+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).

(3) Product drawing 3139 149 0207 page 5 (date 2006-12-01)

Fig 12. Package outline

13. Packing information

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

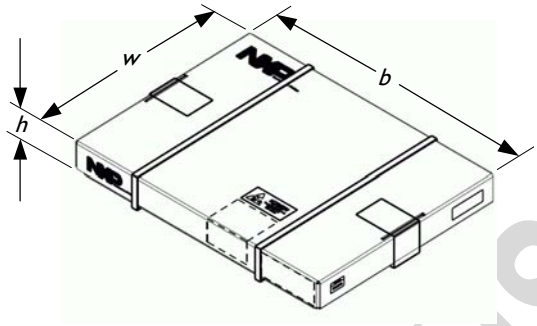


Fig 13. Example of Carton Box

Table 32. Package information

Carton boxes are made of corrugated fibreboard which is free of environmentally banned substances

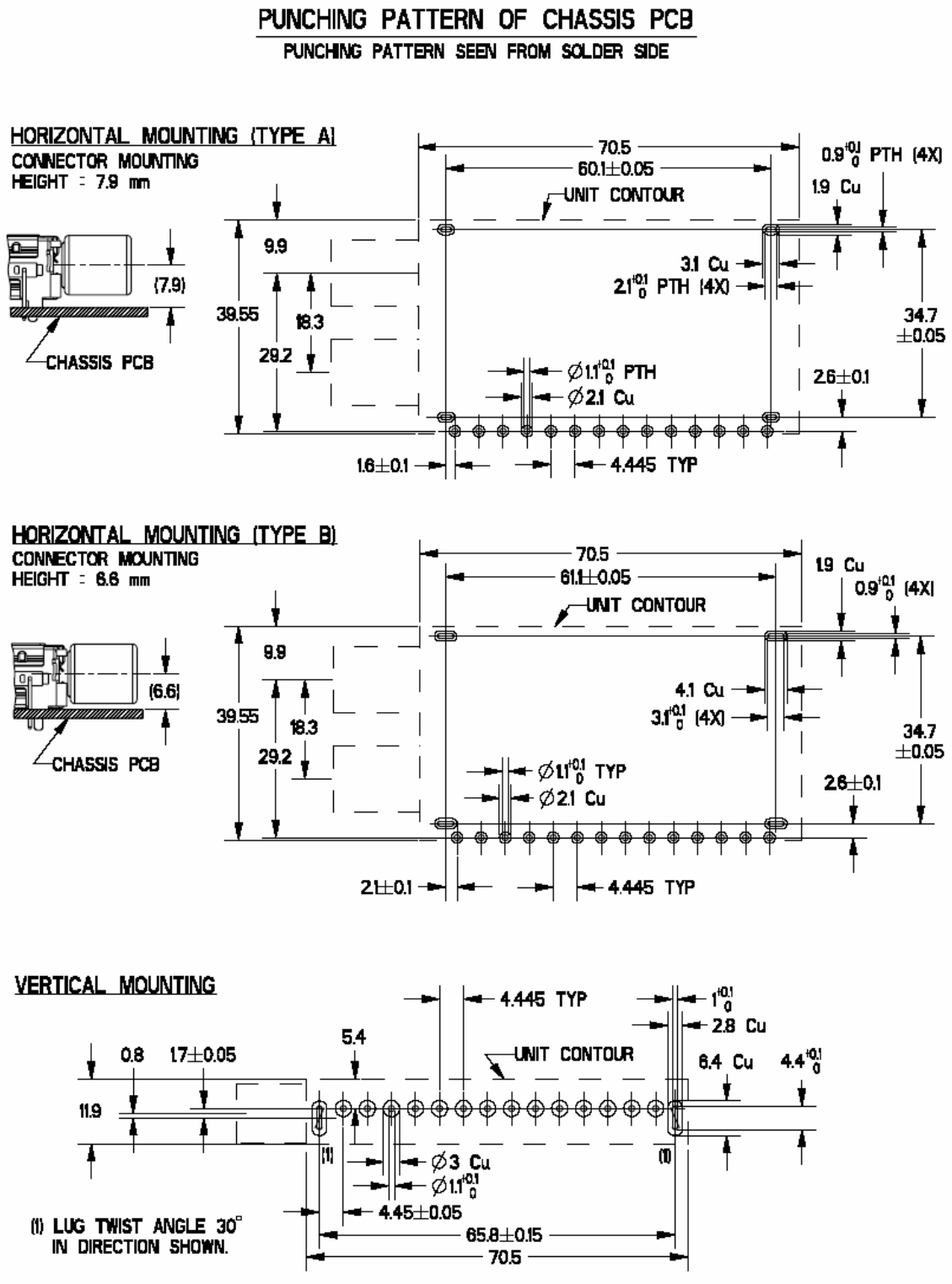
Mounting type	Package	Dimension L x W x H (cm)	Number of sets	Gross weight (kg)
Horizontal	Carton	46 x 34 x 5.4	40	2.34
	Pallet	120 x 105 x 105	4280	272.38
Vertical	Carton	46 x 34 x 10.2	120	6.38
	Pallet	120 x 105 x 105	6960	392.04

14. Mounting

14.1 Punching pattern of chassis PCB

For optimum mounting of the tuner to a PCB, the punching pattern is recommended

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



(1) Product drawing 3139 149 0207 page 6 (date 2006-12-01)

Fig 14. Mounting

14.2 Aerial connection

Standard connector in accordance with type order information found on Table 3 and drawings found on Fig 12.

14.3 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 2 s), results in a wetted area of 95 %. No de-wetting will occur when soldered at 260 °C for 5 s.

14.4 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)

14.5 Mass

Approximately : 45 g

14.6 Robustness of pins

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

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

15. Revision history

Table 33. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
FQ1216ME_MK5	30-04-2004	Preliminary data sheet	Rev.a	-
Modifications	• Draft			
FQ1216ME_MK5	07-06-2004	Preliminary data sheet	Rev.b	30-04-2004
Modifications	• Updating of application information • Updated mechanical drawings • Updated product code as SV 21			
FQ1216ME_MK5	13-07-2004	Preliminary data sheet	Rev.c	07-06-2004
Modifications	• Pg 15 - Add table 26 : AGC TOP adjustment • Pg 16 – Updated IF TOP setting for B/G = +2 dB and L = 0 dB in table 27 • Pg 17 - Update table 28 : consolidated programming for TV system • Pg 24 to 28 - Updated mechanical drawings			
FQ1216ME_MK5	02-08-2004	Preliminary data sheet	Rev.d	13-07-2004
Modifications	• Pg 24 to 28 - Updated mechanical drawings			
FQ1216ME_MK5	10-11-2004	Product data sheet	Rev.e	02-08-2004
Modifications	• Pg 2 – add new type FQ1216ME/L H-5 in ordering information			
FQ1216ME_MK5	12-01-2005	Product data sheet	Rev.f	10-11-2004
Modifications	• Pg 15 - Add table 27 : AGC TOP settings recommended			
FQ1216ME_MK5	11-03-2005	Product data sheet	Rev.g	12-01-2005
Modifications	• Pg 24 to 28 - Updated mechanical drawings			
FQ1216ME_MK5	02-11-2005	Product data sheet	Rev.h	11-03-2005
Modifications	• Pg 21 - Updated I^2C bus loading diagram			
FQ1216ME_MK5	28-02-2006	Product data sheet	Rev.i	02-11-2005
Modifications	• Pg 1 – correction of error			
FQ1216ME_MK5	18-09-2006	Product data sheet	Rev.j	28-02-2006
Modifications	• Pg 1 & 2 – Add IEC 60950-1 (2^{nd} edition) • Pg 18 – Add a table note for table 31 : AFC window • Update product code as SV23 introduce in WK 0643			
FQ1216ME_MK5	14-06-2007	Product data sheet	Rev.k	18-09-2006
Modifications	• Update from Philips to NXP			

16. Legal information

16.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification
Product [short] data sheet	Production	This document contains the product specification

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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18. Contents

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