

M61101FP

PLL VIF/SIF TV Tuner

REJ03F0124-0120

Rev.1.2

Apr 11, 2005

Description

M61101FP is a semiconductor integrated circuit consisting of VIF/SIF signal processing system for portable devices such as mobile phones, notebook PCs with low voltage and low consumption.

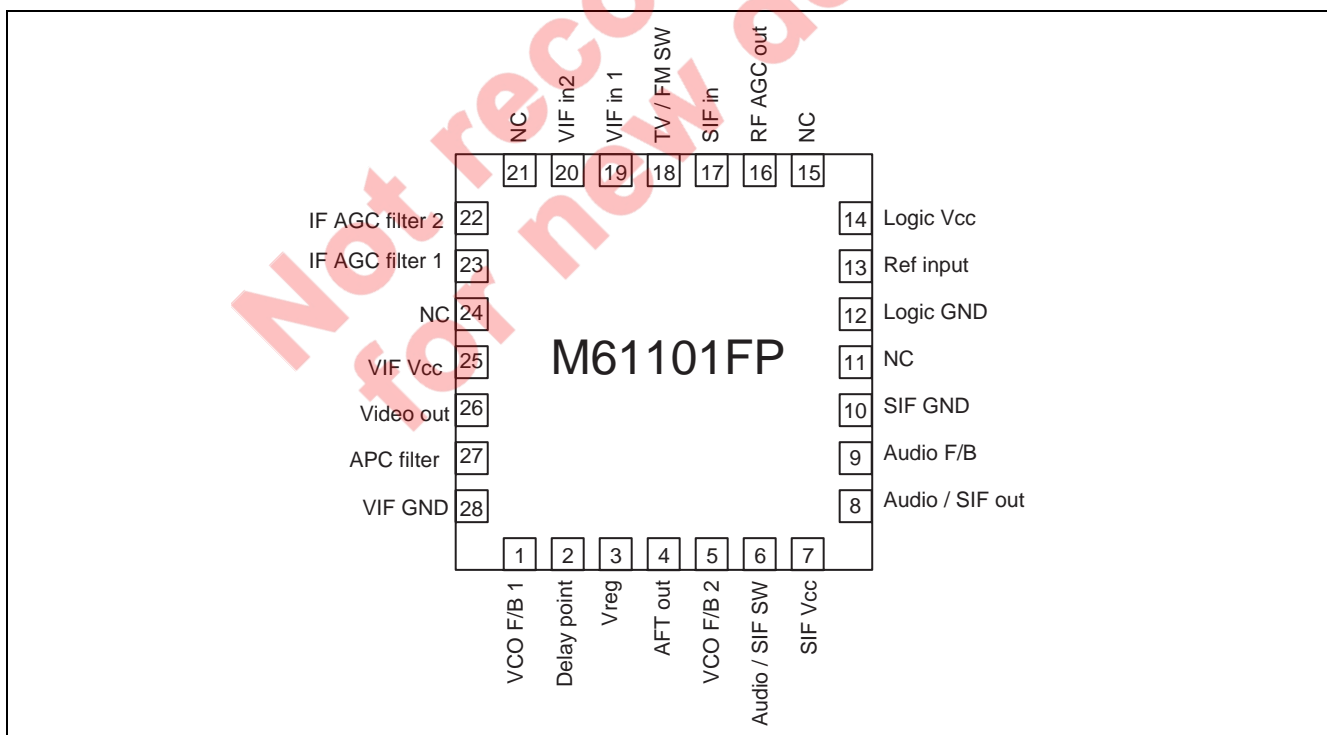
Functions

- PLL split-carrier VIF/ SIF signal processing system compliant with NTSC

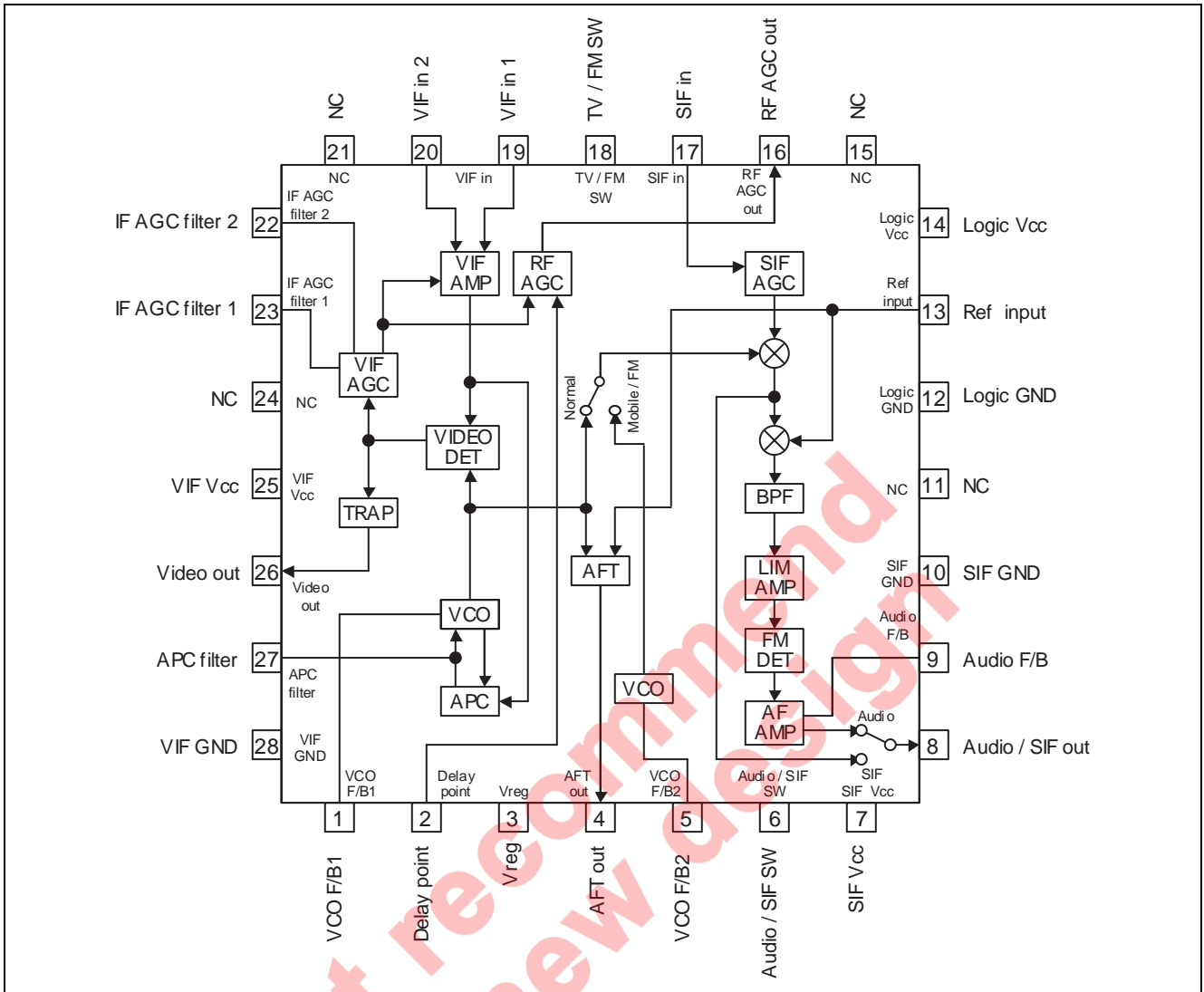
Features

- Recommended supply voltage: 3.3V
- Adjustment free
- Coil-less VCO
- Built-in SIF trap and SIF band-pass filter
- Split-carrier system enables VIF and SIF signal processing independently.
- FM radio reception capability
- Package: QFN with 28pin

Pin Arrangement



Block Diagram

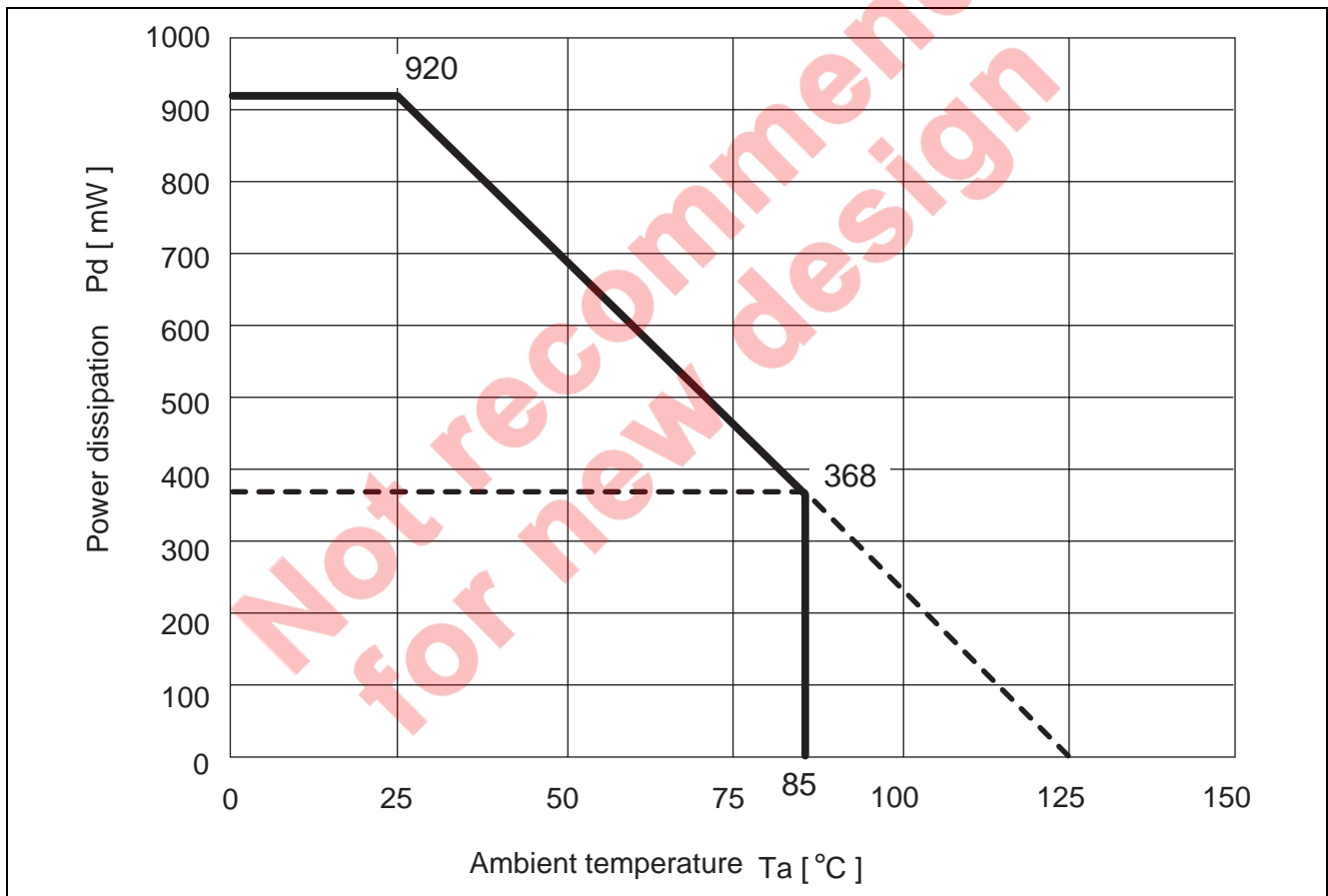


Absolute Maximum Ratings

(Unless otherwise noted, Ta = 25°C)

Item	Symbol	Ratings	Unit	Remarks
Supply voltage	Vcc	6.0	V	—
Power consumption	Pd	920	mW	This rating is on the conditions stated below and varies depending on the materials of packaging board, Cu occupancy, etc. <ul style="list-style-type: none"> • 70mm□, 1.6mm(t-first-layer board) • Board material: Glass epoxy(FR-4) • Board Cu occupancy: 50% • WV: 0m/sec
Operating ambient temperature	Topr1	-20 to 85	°C	—
Storage temperature	Tstg	-40 to 125	°C	—

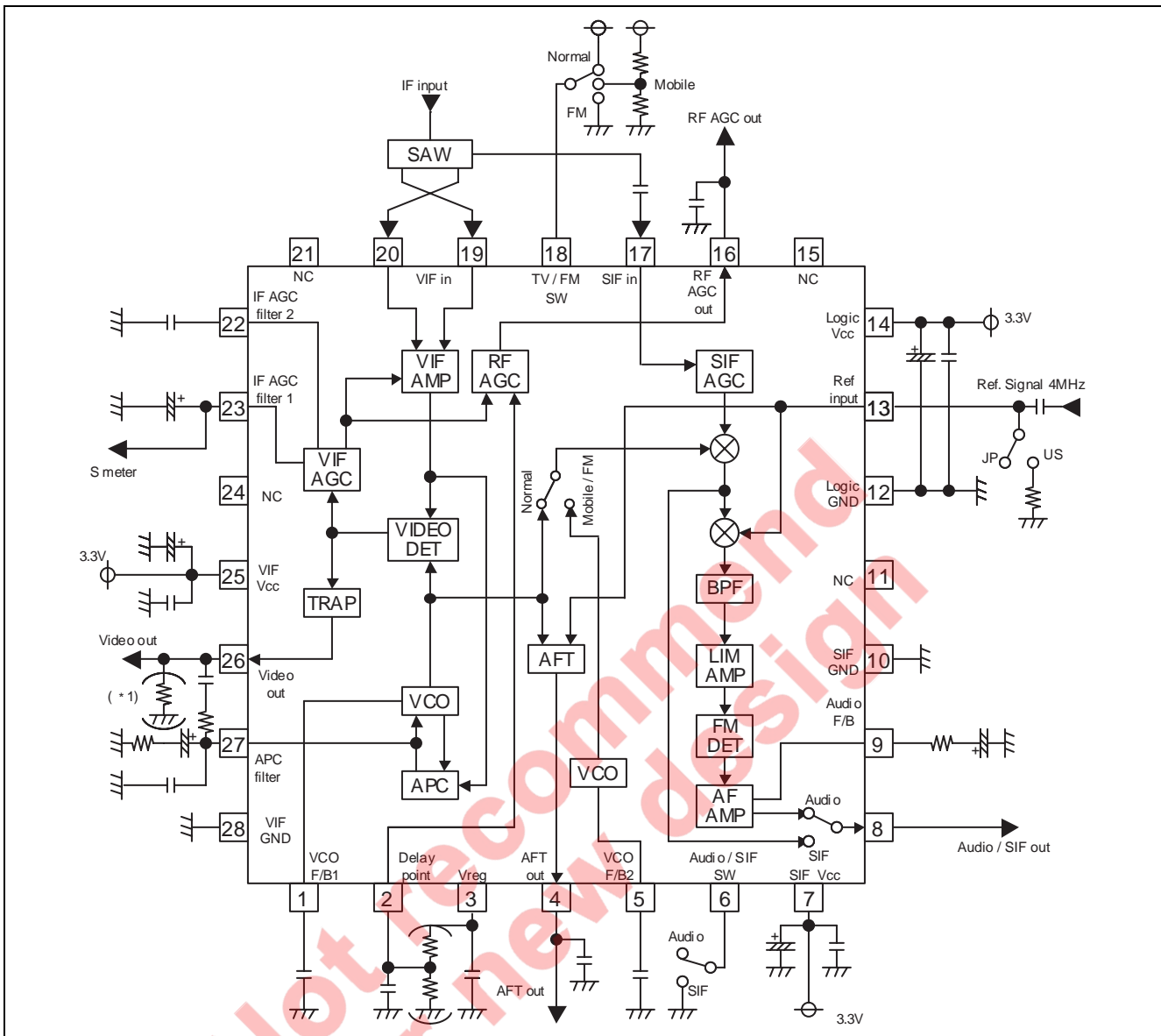
Thermal Derating (Maximum rating)



Recommended Operation Condition

Item	Pin No.	Recommended value	Unit
Operation supply voltage	7, 14, 25	3.15 to 5.25	V
Recommended supply voltage	7, 14, 25	3.3	V
Standard signal frequency	13	4.000000	MHz

Application Circuit Example




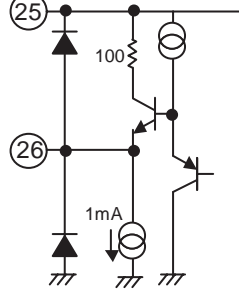
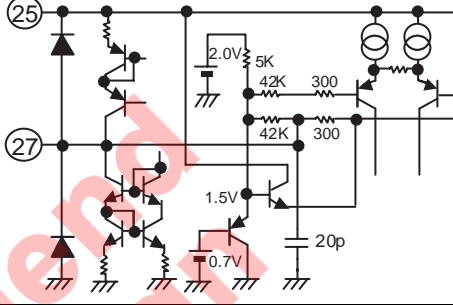

- M61101FP is a specialized semiconductor integrated circuit for Sprit-Carrier. This IC cannot be used for Inter-Carrier.
- Set up the bypass capacitor of LogicVcc(Pin14) in the near of LogicGND(pin12).
- For decreasing the wrap-around to VIF input, keep the balance connection from SAW filter to VIF input pin to short as far as possible. Furthermore, we recommend it to be crossed by a chip capacity or jumper cable.
- When using IFAGC filter 1(Pin23) as S meter output, keep the wire connection short as far as possible. If interference may occur, add a buffer. Moreover, also make the high enough impedance high by the receiver side, because the output impedance of S-meter is high.
- When attaching resistance of (*1) to a video output terminal, more than 10k Ω is recommended.
- For the following reasons, the bandwidth of SAW filter (connected with Pin17) by the SIF side should use the narrowest as far as possible.
 - 1) When using pin8 as SIF out, any bandwidth isn't limited by the integrated circuit. (At Normal TV mode)
 - 2) Because the adjacent channel of FM wave is near such as several hundred kHz, interference may occur. (At FM mode)
- When connecting the metallic surface of the center on the rear face to the wiring, connect to pin12(GND) and don't connect another wiring.
- At power injection, apply the voltage to 3 Vcc terminals (pin7.14.25) simultaneously.
- Be sure to apply 3 Vcc terminals to a bypass capacity (Over 0.1 μ F).

Pin Description

No.	Name	Function	Pin's voltage	Internal equivalent circuit
1	VCO F/B 1	VCO F/B (Feedback). For keeping the free-running frequency of built-in VCO constant, VCO F/B pin roles in Feedback control.	2.1V	
2	RF AGC Delay Point	RF AGC delay terminal. This terminal set the delay point of RF AGC.	1.2V to 1.6V	
3	VREG	Constant voltage regulator terminal. This terminal outputs about 2V.	2.0V	
4	AFT OUT	AFT output terminal. Because this terminal output pulse signal at TV mode, it will be smoothed by external capacity. When VIF is in a status of weak electric field, the output mute operation will be on. Moreover, at FM radio mode, the mute function always on.	3.3V to 0V	
5	VCO F/B 2	SIF VCO F/B(Feedback) terminal. For keeping the free-running frequency of built-in VCO stabilized, this terminal controls Feedback operation.	2.1V	

No.	Name	Function	Pin's voltage	Internal equivalent circuit
6	Audio / SIF SW	Selector SW for AUDIO OUT and SIF OUT. OPEN: AUDIO OUT GND: SIF OUT	3.3V	
7	SIF VCC	The power supply terminal of SIF.	3.3V	
8	AUDIO OUT	AUDIO output and SIF output terminals. This terminal needs de-emphasis characteristics for external. As described the following figure, the terminal voltage is the center voltage value of output signal.	1.8V	
9	AUDIO F/B	AF Bypass terminal. AUDIO F/B pin is connected to one or the other input of differential amplifier and could be got the gain by smoothing a sound signal with external capacity. When connecting the resistance in series with the capacity, this terminal enable to lower the amplitude of audio input.	1.5V	
10	SIF GND	GND terminal of SIF.	GND	
11	NC	NC terminal.	—	
12	LOGIC GND	GND terminal of Logic block and Ref Amplifier.	GND	
13	Ref Input (JP/US SW)	Input terminal of reference frequency. This terminal inputs the external signal(sine wave) and doubles as JP/US selector SW. In case of no connection between Ref input pin and GND: JPN(58.75M) In case of 10kΩconnection: USA(45.75M)	2.0V	
14	Logic Vcc	Power supply voltage terminal of logic block and ref amplifier.	3.3V	
15	NC	NC terminal.	—	

No.	Name	Function	Pin's voltage	Internal equivalent circuit
16	RF AGC OUT	RF AGC output terminal. This terminal is the current-driven type.	3.3V to 0V	
17	SIF IN	SIF input terminal. This terminal inputs SIF signal after passing the SAW filter.	1.1V	
18	TV/ FM SW	Each selector SW of Normal TV / Mobile TV / FM mode	—	
19	VIF in1	VIF input terminal. These terminals input VIF signal after passing SAW filter. Balance input.	1.1V	
20	VIF in2			
21	NC	NC terminal.	—	
22	IF AGC 2	IFAGC filter terminal 2.	3.1V to 0V	
23	IF AGC 1	IF AGC Filter terminal 1. This pin changes AGC speed by external capacity value. When this terminal is grounded, the profit of VIF amplifier will become minimum. Moreover, it is available to use this terminal as S meter output. Because the impedance is high, give it attention to enough at the impedance by the side of wiring leading and a receptacle impedance.	3.1V to 0V	

No.	Name	Function	Pin's voltage	Internal equivalent circuit
25	VIF VCC	VIF power supply terminal.	3.3V	
26	Video out	Video out terminal. As described the following figure, terminal voltage is zero carrier.	1.9V	
27	APC FILTER	APC filter terminal. As described the following figure, terminal voltage are at the time of no signal from VIF IN and IF AGC GND.	1.5V	
28	GND	GND terminal of VIF.	GND	

Note: Each voltage, current and resistance values are reference, so these values aren't guaranteed.

Not recommended for new designs

Electrical Characteristics

General characteristics

(Unless otherwise noted, Ta=25°C, Vcc=3.3V, and 200mVpp is inputted to pin13)

No.	Item	Symbol	Test circuit	Test point	Input point	Input signal	Measurement Switches set to position 1 unless otherwise noted.	Limits			Unit	Note
								Min	Typ	Max		
1	VIF/SIF power supply current	Icc1	1	Pin7,25	—	—		—	43	51.6	mA	
2	Logic power supply current	Icc2	1	Pin14	—	—		—	2.5	3	mA	
3	Reference signal amplitude	Fref	1	Pin13	Pin13	4MHz Sine wave		100	200	400	mVpp	

VIF section

(Unless otherwise noted, Ta=25°C, Vcc=3.3V, and 200mVpp is inputted to pin13)

No.	Item	Symbol	Test circuit	Test point	Input point	Input signal	Measurement Switches set to position 1 unless otherwise noted.	Limits			Unit	Note
								Min	Typ	Max		
4	Video output	Vodet	1	TP26	Pin19,20	1		0.8	1	1.2	Vpp	
5	Sink bottom voltage	Vsync	1	TP26	Pin19,20	2		0.50	0.8	1.10	V	
6	Video S/N	VoS/N	1	TP26	Pin19,20	2		45	48	—	dB	1
7	Input sensitivity	VinMIN	1	TP26	Pin19,20	3		—	40	50	dBμV	2
8	Maximum allowable input	VinMAX	1	TP26	Pin19,20	4		95	99	—	dBμV	3
9	Capture range CR-U	CR-U	1	TP26	Pin19,20	5		0.8	1.5	—	MHz	4
10	Capture range CR-L	CR-L	1	TP26	Pin19,20	5		1.0	1.5	—	MHz	5
11	Inter Modulation	IM	1	TP26	Pin19,20	6		27	35	—	dB	6
12	Differential Gain	DG	1	TP26	Pin19,20	7		—	7	10	%	
13	Differential Phase	DP	1	TP26	Pin19,20	7		—	7	10	deg	
14	RF AGC Maximum voltage	RFagcH	1	TP16	Pin19,20	8		Vcc -0.5	Vcc -0.2	—	V	
15	RF AGC Minimum voltage	RFagcL	1	TP16	Pin19,20	9		—	0.2	0.5	V	
16	RFAGC Delay point (Normal TV mode)	RFDP1	1	TP16	Pin19,20	10		85	90	95	dBμV	7
17	RFAGC Delay point (Normal FM mode)	RFDP2	1	TP16	Pin17	11	SW18=3	73	80	88	dBμV	8
18	AFT det sensitivity	μ	1	TP4	Pin19,20	12		10	26	40	mV /kHz	9
19	AFT Maximum voltage	AFTH	1	TP4	Pin19,20	13		Vcc -0.5	Vcc -0.2	—	V	9
20	AFT Minimum voltage	AFTL	1	TP4	Pin19,20	14		—	0.2	0.5	V	9
21	AFT Mute voltage	AFTM	1	TP4	—	—		Vcc/2 -0.4	Vcc/2	Vcc/2 +0.4	V	
22	AFT center voltage (US mode)	VaftUS	1	TP4	Pin19,20	16	SW13=2	Vcc/2 -0.35	Vcc/2 -0.05	Vcc/2 +0.25	V	
23	AFT center voltage (JP mode)	VaftJP	1	TP4	Pin19,20	2		Vcc/2 -0.48	Vcc/2 -0.18	Vcc/2 +0.12	V	
24	Video band width @4.0MHz	VF40	1	TP26	Pin19,20	17		-10	-5	-2	dB	10
25	Video band width @4.5MHz(TRAP)	VF45	1	TP26	Pin19,20	17		—	-25	-20	dB	10
26	VIF VCO Free-running frequency(US mode)	FvcfUS	1	TP4	—	—	SW4,13=2 SW17,23=2	-500	0	500	kHz	11
27	VIF VCO Free-running frequency(JP mode)	FvcfJP	1	TP4	—	—	SW4=2 SW17,23=2	-500	0	500	kHz	11

SIF section

(Unless otherwise noted, Ta=25°C, Vcc=3.3V, and 200mVpp is inputted to pin13)

No.	Item	Symbol	Test circuit	Test point	Input point	Input signal	Measurement Switches set to position 1 unless otherwise noted	Limits			Unit	Note
								Min	Typ	Max		
28	Audio output amplitude (Normal TV mode)	VoAF1	1	TP8	Pin17 Pin19,20	18 2		0.6	1.0	1.4	Vpp	
29	Audio output amplitude (Mobile TV mode)	VoAF1m	1	TP8	Pin17 Pin19,20	18 2	SW18=2	0.6	1.0	1.4	Vpp	
30	Audio output amplitude (FM mode)	VoAF2	1	TP8	Pin17	19	SW18=3	0.6	1.0	1.4	Vpp	
31	Audio output distortion (Normal TV mode)	THDAF1	1	TP8	Pin17 Pin19,20	18 2		—	0.5	1.0	%	
32	Audio output distortion (Mobile TV mode)	THDAF1m	1	TP8	Pin17 Pin19,20	18 2	SW18=2	—	0.5	1.0	%	
33	Audio output distortion (FM mode)	THDAF2	1	TP8	Pin17	19	SW18=3	—	0.5	1.0	%	
34	Audio S/N (Normal TV mode)	AF S/N1	1	TP8	Pin17 Pin19,20	20 2		48	53	—	dB	12
35	Audio S/N (Mobile TV mode)	AF S/N1m	1	TP8	Pin17 Pin19,20	20 2	SW18=2	39	45	—	dB	12
36	Audio S/N (FM mode)	AF S/N2	1	TP8	Pin17	20	SW18=3	50	56	—	dB	13
37	Input limiting sensitivity (Normal TV mode)	LIM1	1	TP8	Pin17 Pin19,20	21 22 2		—	35	40	dBμV	14
38	Input limiting sensitivity (Mobile TV mode)	LIM1m	1	TP8	Pin17 Pin19,20	21 22 2	SW18=2	—	35	40	dBμV	14
39	Input limiting sensitivity (FM mode)	LIM2	1	TP8	Pin17	21 22	SW18=3 SW23=2	—	35	40	dBμV	14
40	SIF output amplitude (Normal TV mode)	SIFG1	1	TP8A	Pin17 Pin19,20	20 2	SW6=2 SW8=2	100	105	110	dBμV	15
41	BPF frequency characteristics	BWBPF	1	TP8A	Pin17	23	SW6,18=2S W8,23=2	—	-20	-15	dB	16
42	S meter output @TV 90dBμV	ST90	1	TP23	Pin19,20	2		0.9	1.2	1.5	V	
43	S meter output @TV 70dBμV	ST70	1	TP23	Pin19,20	8		1.5	1.8	2.1	V	
44	S meter output @FM 90dBμV	SF90	1	TP23	Pin17	24	SW18=3	1.07	1.37	1.67	V	
45	S meter output @FM 70dBμV	SF70	1	TP23	Pin17	25	SW18=3	1.5	1.8	2.1	V	

Mode setting

(Ta = 25°C)

• Switching terminal voltage of Normal TV mode / Mobile TV mode / FM mode

Normal / Mobile / FM select	18pin setting	Note
Normal TV	(Vcc-0.5V) to Vcc	Receiving of Normal TV wave
Mobile TV	(Vcc/2-0.3V) to (Vcc/2+0.3V)	Dividing SIF type or VIF type
FM	0 to 0.5V	Receiving of FM radio wave

• 4MHz reference signal input terminal

US / JP VCO select	13pin setting
US	Pull down (10K±10%)
JP	DC open

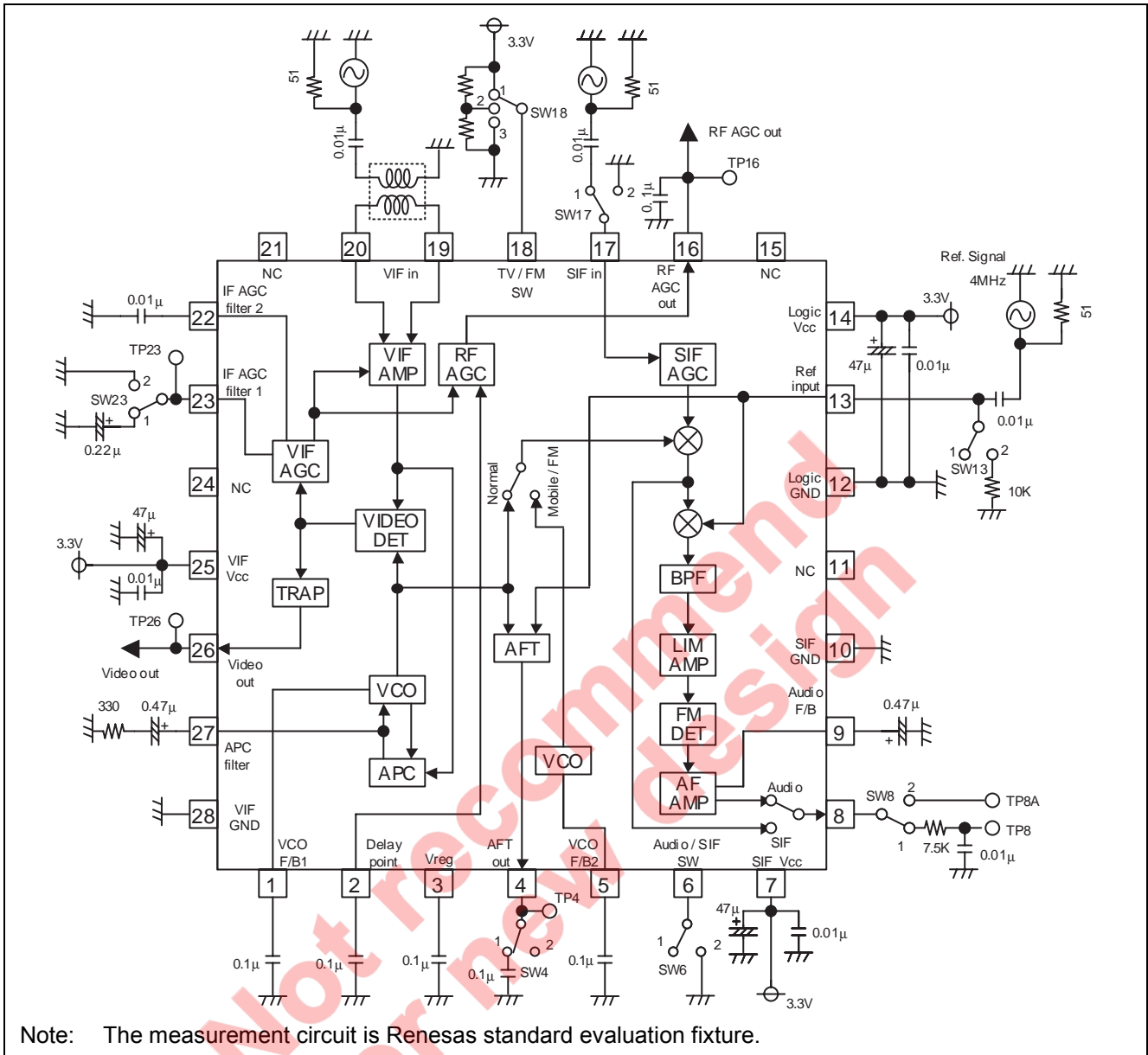
• Audio/SIF output switching terminal

Audio/SIF select	6pin setting
Audio output	DC open
SIF output	GND

Note: SIF output can use only Normal TV mode.

(When selected at Mobile TV and FM mode, a signal for test is outputted.)

Measuring Circuit



Note: The measurement circuit is Renesas standard evaluation fixture.

Input Signal

SG	50Ω termination			
1	f0=58.75MHz	Vi=90dBμV	fm=20kHz	AM=77.8%
2	f0=58.75MHz	Vi=90dBμV	CW	
3	f0=58.75MHz	Level variable	fm=20kHz	AM=77.8%
4	f0=58.75MHz	Level variable	fm=20kHz	AM=16.0%
5	f0=Frequency variable	Vi=90dBμV	fm=20kHz	AM=77.8%
6	f1=58.75MHz	Vi=90dBμV	CW	} Mixed signal
	f2=55.17MHz	Vi=80dBμV	CW	
	f0=54.25MHz	Vi=80dBμV	CW	
7	f0=58.75MHz	Sync tip level=90dBμV		Video moderation=87.5%
	TV modulation 10 stair-steps waveform			
8	f0=58.75MHz	Vi=70dBμV	CW	
9	f0=58.75MHz	Vi=100dBμV	CW	
10	f0=58.75MHz	Level variable	CW	
11	f0=54.25MHz	Level variable	CW	
12	f0=Frequency variable	Vi=90dBμV	CW	
13	f0=58.75-0.5MHz	Vi=90dBμV	CW	
14	f0=58.75+0.5MHz	Vi=90dBμV	CW	
15	f0=58.75+/-5MHz	Vi=90dBμV	CW	
16	f0=45.75MHz	Vi=90dBμV	CW	
17	f1=58.75MHz	Vi=90dBμV	CW	} Mixed signal
	f2=Frequency variable	Vi=80dBμV	CW	
18	f0=54.25MHz	Vi=80dBμV	fm=1kHz +/-25kHz dev	
19	f0=54.25MHz	Vi=80dBμV	fm=1kHz +/-75kHz dev	
20	f0=54.25MHz	Vi=80dBμV	CW	
21	f0=54.25MHz	Level variable	fm=1kHz +/-25kHz dev	
22	f0=54.25MHz	Level variable	CW	
23	f0=54.25+/-0.3MHz	Vi=80dBμV	CW	
24	f0=54.25MHz	Vi=90dBμV	CW	
25	f0=54.25MHz	Vi=70dBμV	CW	

Electrical characteristic measurement

Note1: Video S/N : VoS/N

Input SG2 to VIF IN(Pin19,20) and measure the video out (TP26) in r.m.s. through a 5MHz(-3dB)L.P.F.

$$S/N = 20\log\left(\frac{0.7 \times V_{odet} (V_{pp})}{NOISE (rms)}\right) \quad (dB)$$

Note2. Input sensitivity: VinMIN

Input SG3($V_i=90dB\mu V$) to VIF IN(Pin19,20) and measure the input level when the 20kHz component of video output TPIA reaches -3dB from V_o det level.

Note3. Maximum allowable Input : VinMAX

Input SG4($V_i = 90dB\mu V$) to VIF IN(Pin19,20), and measure the level of the 20kHz components of Video output. Gradually increase the V_i of SG and measure the input level when the output reaches -3dB.

Note4. Capture range : CR-U

Input SG5 to VIF IN(Pin19,20), increase the frequency until the VCO is out locked-oscillation. And decrease the frequency of SG5 and measure the frequency f_U when the VCO is locked.

$$CR - U = f_U - 58.75 \quad (MHz)$$

Note5. Capture range : CR-L

Input SG5 to VIF IN(Pin19,20), decrease the frequency is out locked-oscillation. And increase the frequency of SG5 and measure the frequency f_L when the VCO is locked.

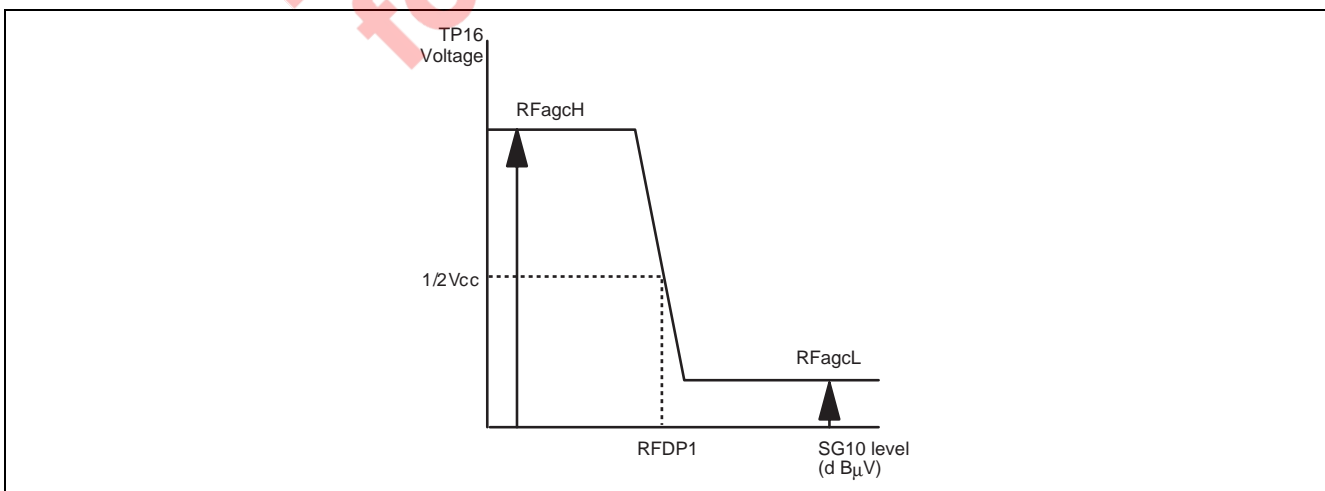
$$CR - L = 58.75 - f_L \quad (MHz)$$

Note6. Inter modulation : IM

Input SG9 to VIF IN(Pin19,20), and measure video output(TP26) with an oscilloscope. Adjust AGC filter voltage TP23 so that the minimum DC level of the output waveform is the same level as the Sync bottom voltage(V_{sync}). At that time, measure TP26 with a spectrum analyzer. The inter modulation is defined as a difference between 0.92MHz and 3.58MHz frequency components.

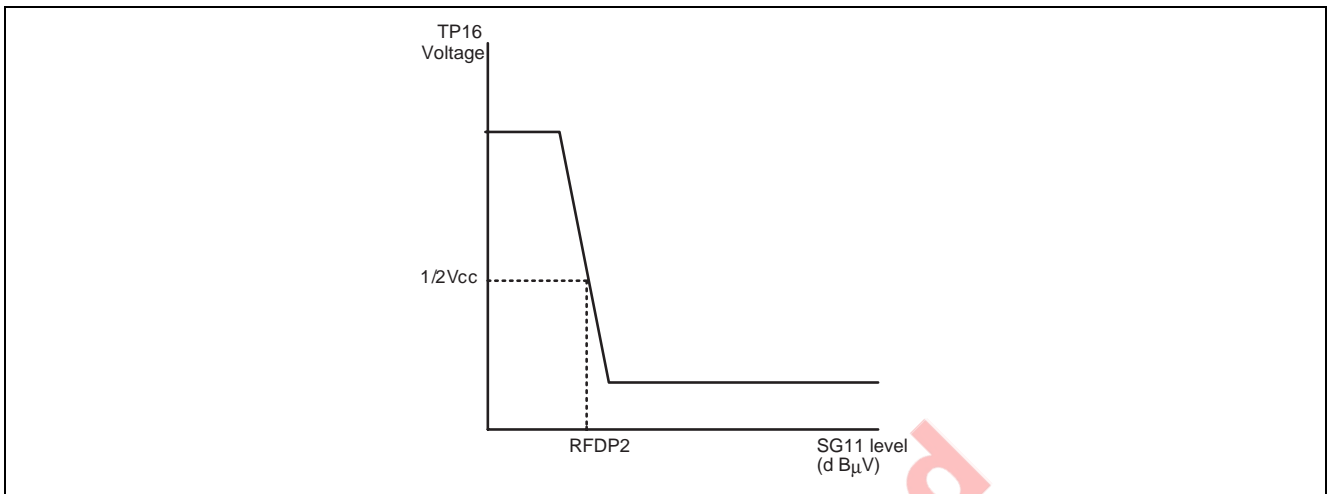
Note7.RF AGC Delay Point (Normal TV mode • Mobile TV mode) : RFDP1

Input SG10 to VIF IN(Pin19,20), measure the level of SG10 when the RF AGC Output(TP16) to $1/2V_{cc}$. At that time, measure the Pin12 in the open status.



Note8: RF AGC Delay point (FM mode)

Set the Pin18 to GND, input SG11 to SIF IN(Pin17), and measure the level of SG11 when the RE AGC Output(TP16) to 1/2 Vcc. At that time, measure the Pin12 in the open status.



Note9. AFT det sensitivity: μ, AFT Maximum voltage : AFTH, AFT Minimum voltage : AFTL

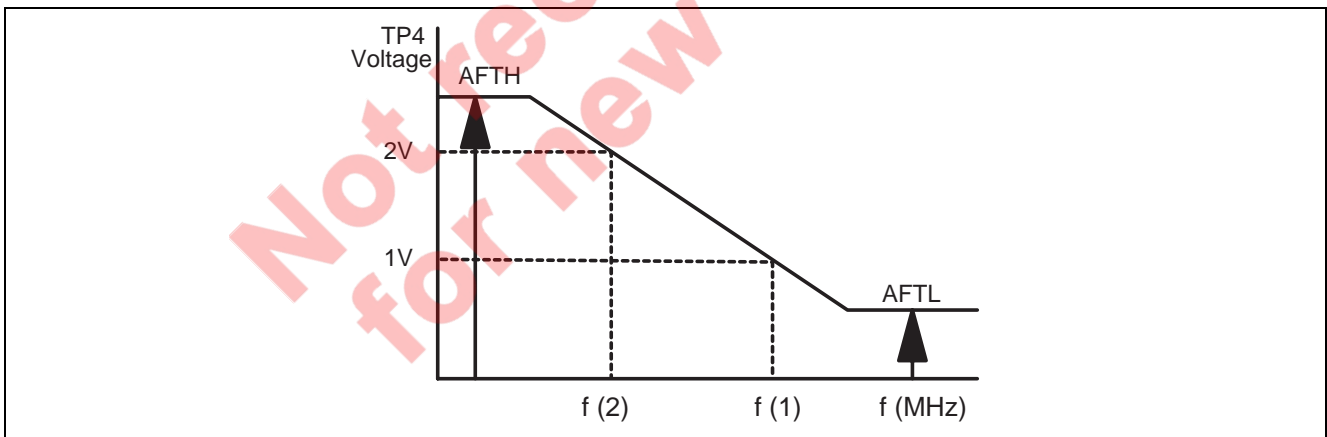
Input SG12 to VIF IN(Pin19,20), set the frequency of SG12 as the voltage of AFT output (TP4) to 2V, and set the frequency to f(2).

Set the frequency of SG12 as the voltage of AFT output(TP4) to 1V, and set the frequency to f(1).

Set the AFT output voltage when inputting the SG13 and SG14 to VIF I(Pin19, 20)

each to AFT Maximum voltage = AFTH, AFT Minimum voltage = AFTL.

$$\mu = \frac{1000 \text{ (mV)}}{f(1) - f(2) \text{ (kHz)}} \text{ (mV/kHz)}$$

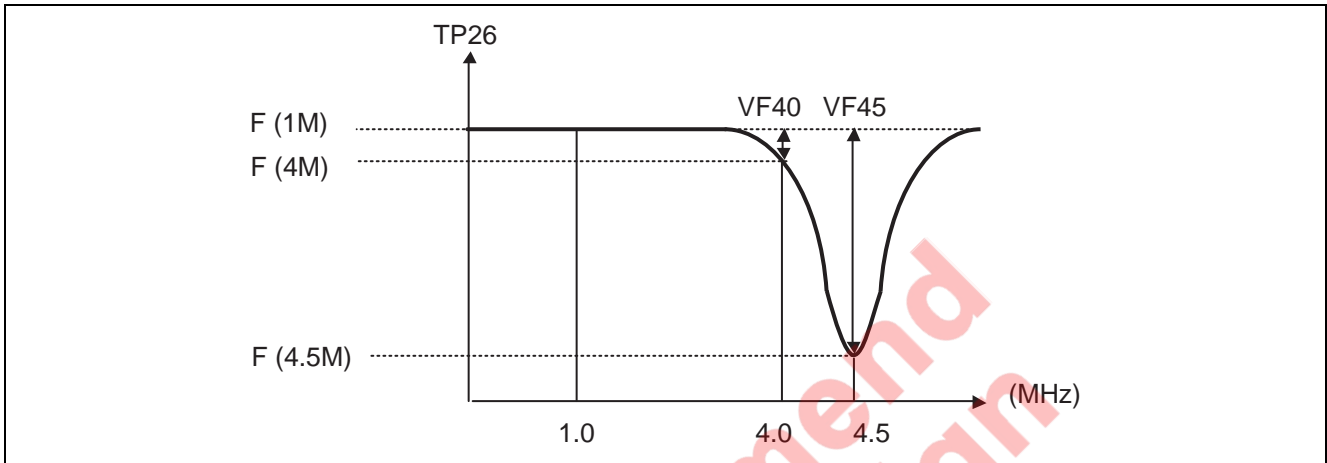


Note10. Video frequency characteristics (4.0MHz,4.5MHz) : VF40,VF45

Input SG17 to VIF IN(Pin19,20), measure 1MHz level of video output at f2=57.75MHz and set the level to F(1M). Measure the voltage at that time of TP23, apply the voltage to TP23 and fix. Set the frequency of SG17(f2) to 54.75MHz, measure the level of TP26 at 4MHz and set to F(4M). Also set the frequency of f2 to 54.75MHz, measure the level of TP26 at 4.5MHz and set to (4.5V).

$$VF40 = F(4M) - F(1M) \quad (dB)$$

$$VF45 = F(4.5M) - F(1M) \quad (dB)$$



Note11. VIF VCO Free-running frequency : FvcfJP • FvcfUS

Input 4.00MHz to Ref IN(Pin13), Set the each SW status to the following table.

*US/JP SW

SW No.	JP Mode		US Mode	
	Setting	Status	Setting	Status
4	2	With no capacitor	2	With no capacitor
13	1	No 10kΩ	2	10Ω
17	2	GND	2	GND
18	1	Vcc	1	Vcc
23	2	GND	2	GND

At that time, switch No signal pull-down resistor of Pin13(=JP mode) or pull-down resistor of Pin13(=JP mode) or pull-down resistor of Pin13, measure each frequency of output signal into AFT out(TP4).

Set the frequency as JP mode =FaftJP and US mode=FaftUS, calculate the difference of VCO free-running frequency and 58.75MHz(45.75MHz) from the following formula.

<Reference signal: fref=4.00MHz>

JP Mode
 $FvcfJP = 65.143(MHz) - 8 \times FaftJP - 58.75(MHz) \quad [MHz]$

US Mode
 $FvcfUS = 52.148(MHz) - 8 \times FaftUS - 45.75(MHz) \quad [MHz]$

Note12, Audio S/N(Normal TV mode• Mobile TV mode) : AF S/N1,AF S/N1m

Input SG2 to VIF IN(Pin19,20) and the same as SG20 to SIF IN(Pin17), measure the noise of audio output(TP8) by FLAT and r.m.s., and set the value to Vn1.

$$AF\ S/N1 = 20\log\left(\frac{VoAF1(mVrms)}{Vn1(mVrms)}\right) \quad (dB)$$

(AF S/N1m)

Note13. Audio S/N(FM mode): AF S/N2

Input SG20 to SIF IN(Pin17), measure the noise by FLAT and r.m.s., set the value to Vn1. At this time, Pin18 is GND.

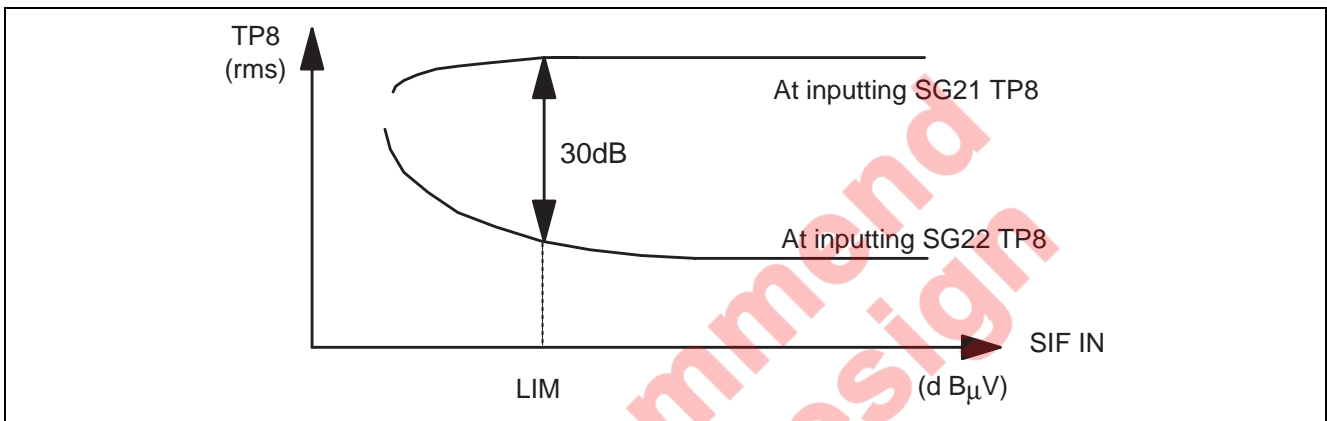
$$AF\ S/N2 = 20\log\left(\frac{VoAF2\ (mVrms)}{Vn2(mVrms)}\right) \ (dB)$$

Note14. Input limiting sensitivity: LIM1,LIM1m,LIM2

Input SG21 to SIF IN(Pin17), and measure the level of 1kHz element at audio output(TP8) to FLAT, r.m.s.(At normal TV mode and Mobile TV mode, input SG2 to VIF IN.)

And input SG22 to SIF IN(Pin17), and measure the noise level of audio output(TP8) to FLAT, r.m.s.(At Normal TV mode and Mobile TV mode, input SG2 to VIF IN.)

As for each amplitude of SG21 and 22, set the input level for SIF IN(Pin17) to the input limiting sensitivity LIM1(LIM1m, LIM2) when the level difference is 30dB.

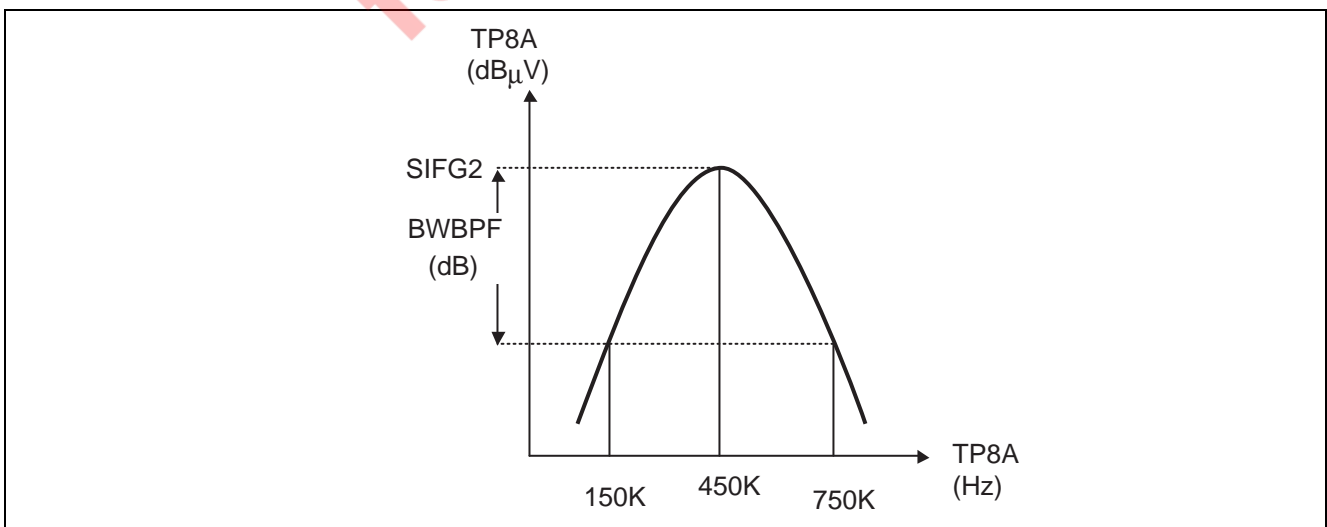


Note15. SIF output amplitude (Normal TV mode) : SIFG1

Set Vcc to Pin18, and input SG2 to VIF IN(Pin19,20) and same as SG20 to SIF IN(Pin17). Next, set Pin6 to GND (SW8=2), and measure the level of 4.5MHz element appearing in TP8A. At that time, keep in mind that internal BPF has not passed the 4.5MHz signal of TP8A.

Note16.BPF frequency characteristics (±300kHz): BWBPF

Set GND(SW8=2) to Pin16 and same as 1/2Vcc to Pin18, and input SG23 to SIF IN(Pin17). At that time, when the frequency of SG23 is set to 54.25MHz+300kHz and 54.25MHz-300kHz, the frequency outputted of TP8A are each 750kHz and 150kHz. And measure the levels each 750kHz and 150kHz, set the value as BWBPF the level of SIFG2(450kHz) when being based on the level is set to BWBPF.

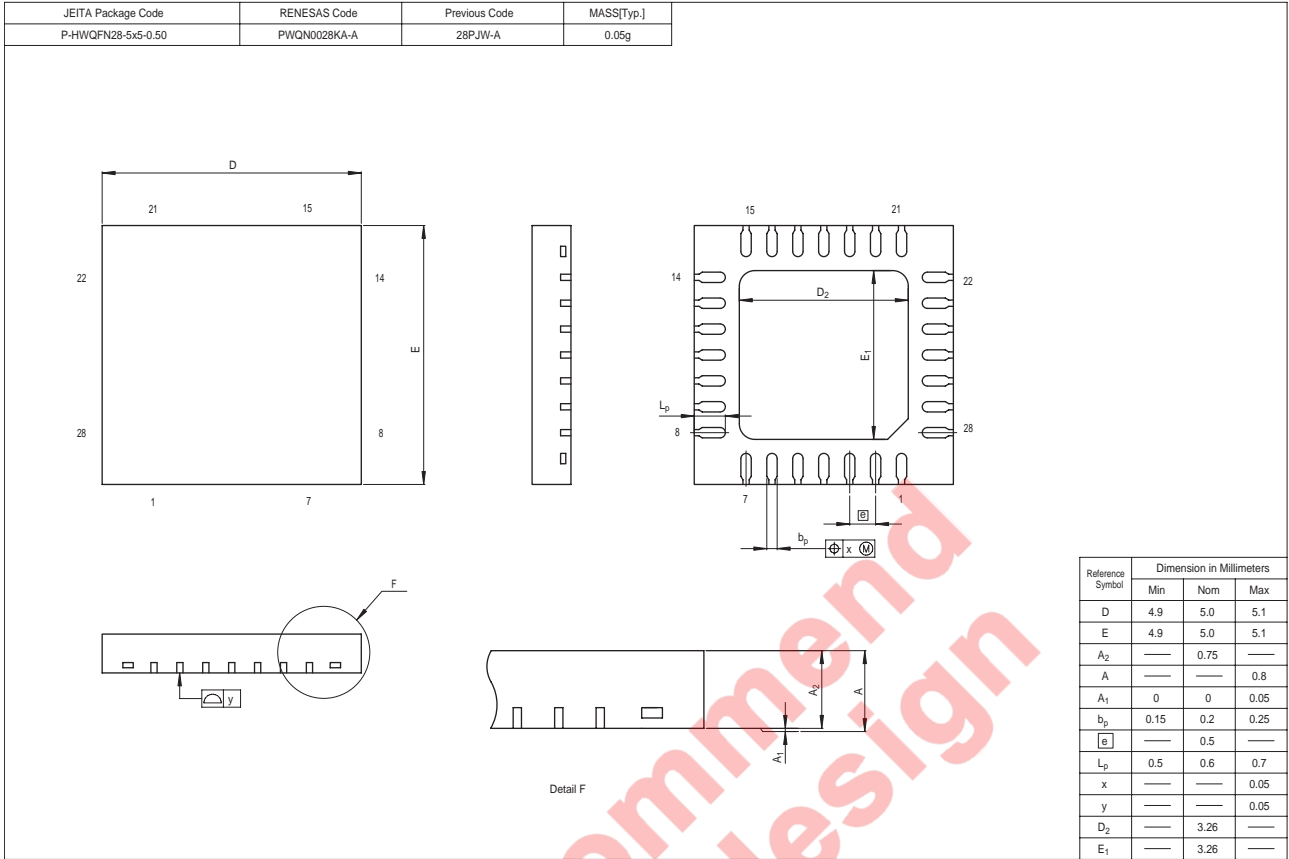


Precautions for handling M61101FP

- Since this IC is using the detailed process, be careful of surge enough.
- The FM receiving function for this IC is different from the IC developed for FM wave receiving. This IC enables it to receive an FM wave in simple using the SIF signal-processing circuit for TV reception. Therefore, since many FM reception-related properties (ex: receiving sensitivity, interference, etc.) may not be enough compared with exclusive use IC which please note.
- The group delay property of Built-in SIF TRAP is as follows (reference value).
<Group delay in each frequency at the time of being based on the value in 1MHz>
 - 2.0MHz 20 nsec
 - 3.0MHz 100 nsec
 - 3.5MHz 250 nsec

Not recommend
for new design

Package Dimensions



Not recommended for new design

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