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April 1st, 2010
Renesas Electronics Corporation

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M61111FP

Coil-less VIF/SIF

REJ03F0014-0100Z
Rev.1.00
Aug.25.2003

Description

The M61111FP is a semiconductor integrated circuit built-in the PLL inter-carrier method VIF/SIF dedicated to NTSC. The circuit includes the VIF amplifier, image waveform detection, APC detection, IF/RF, AGC, VCO, AFT, LOCK DET, EQ, AF amplifier, limitter, FM waveform detector circuits, and acts as a small tuner.

Features

- Eliminates the need for the VCO coil for intermediate frequency signal processing
- AFT adjustment is not required and flat temperature characteristics is realized
- Reference frequency of 3.58 MHz/4.00 MHz
- Image intermediate frequency US (47.75 MHz)/JP (58 .75 MHz)
- VIF/SIF mute function
- SIF buffer output available
- FM receivable (optional)

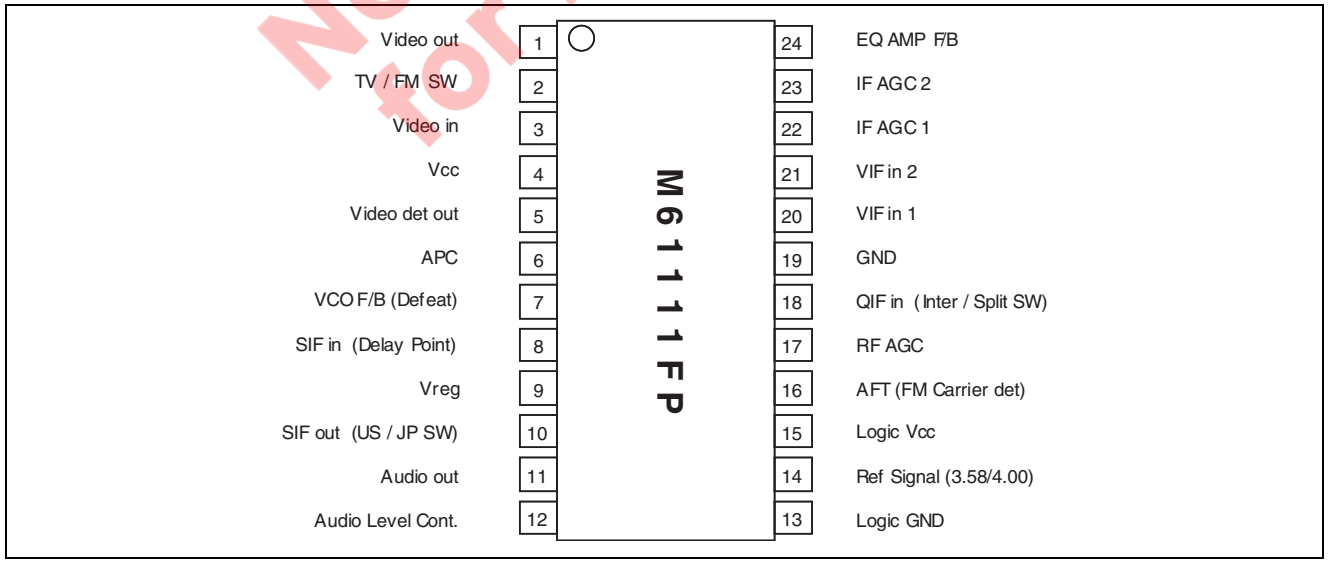
Recommended Operating Conditions

- Power-supply voltage range: 4.75 to 5.25 V
- Recommended power-supply voltage: 5.0 V

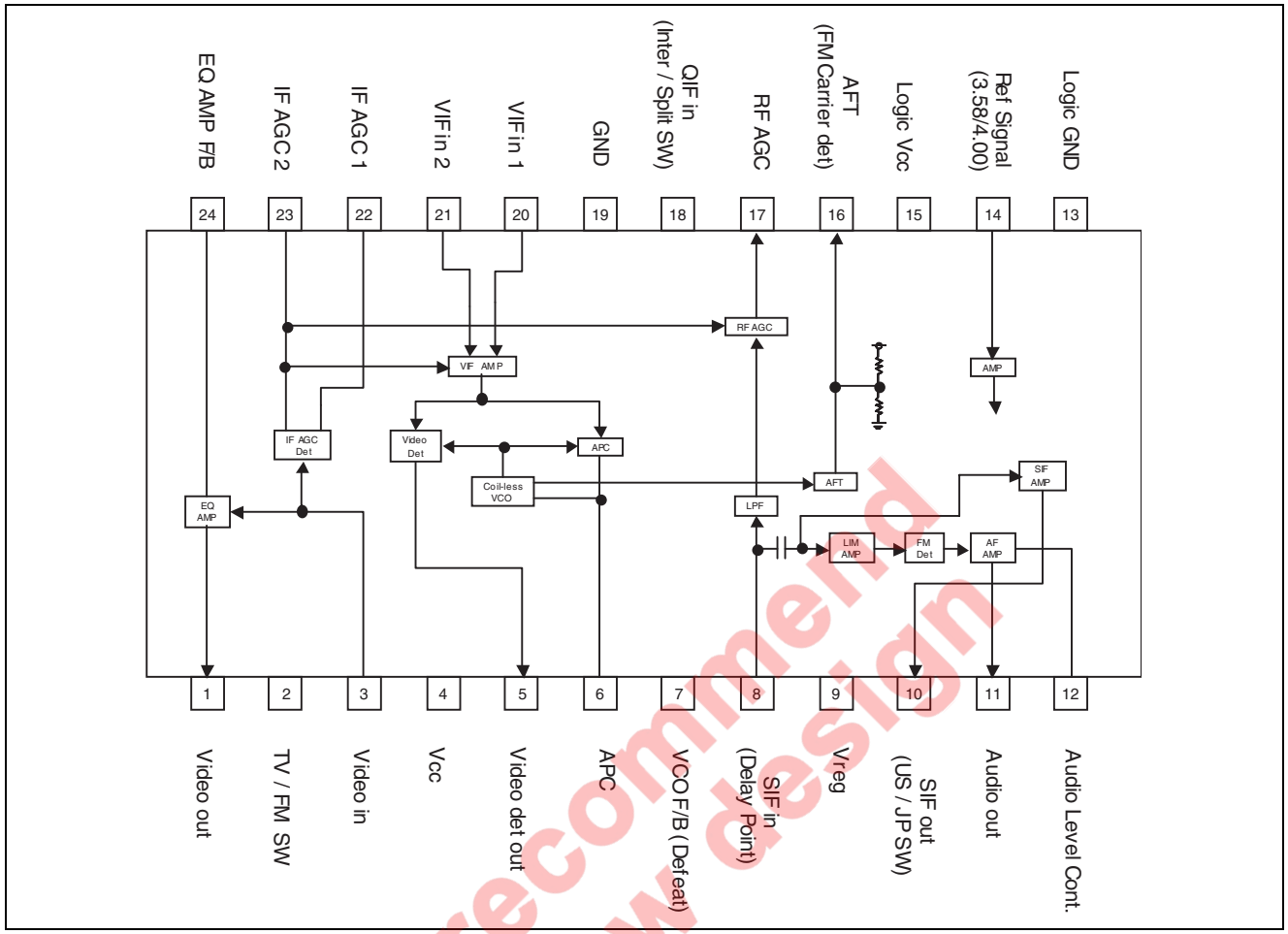
Application

- TV, VCR

Pin Configuration



Block Diagram

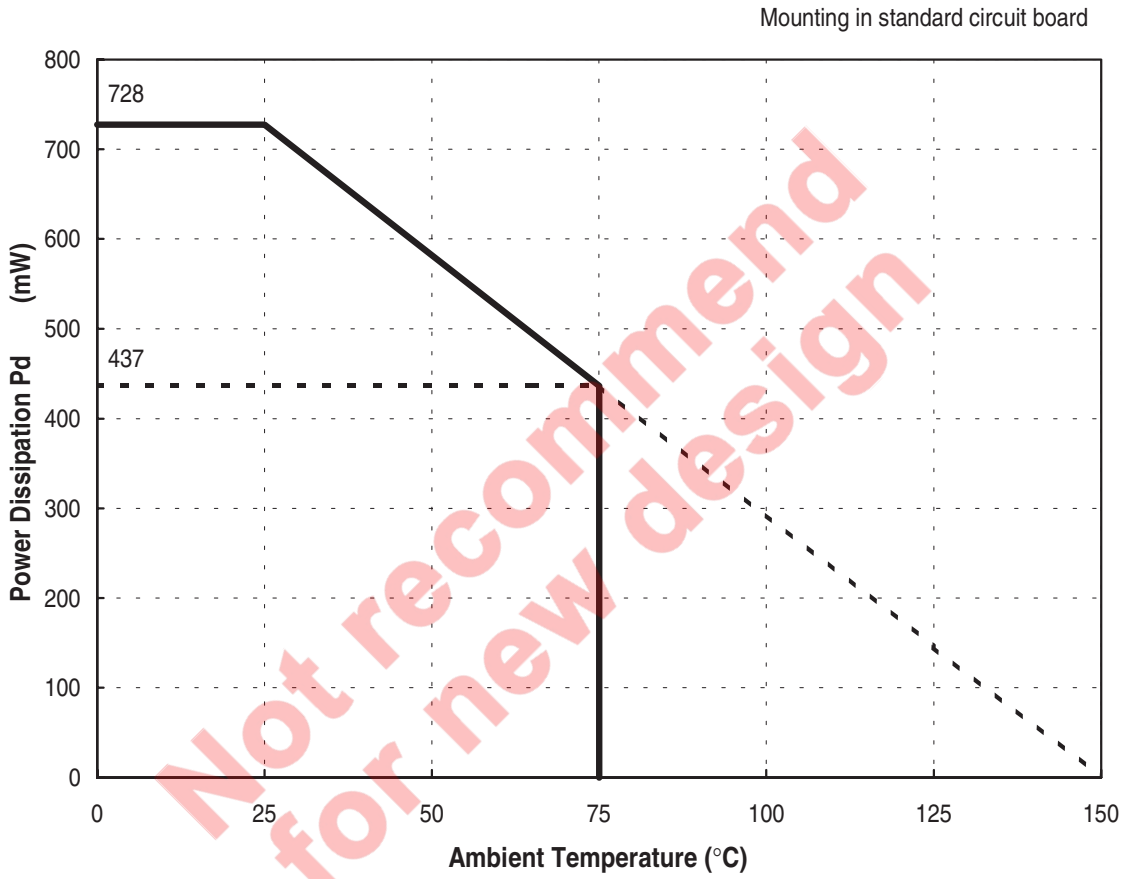


Absolute Maximum Ratings

(25°C, unless otherwise noted)

Parameter	Symbol	Ratings	Unit
Supply voltage	Vcc	6.0	V
Total power dissipation	Pd	728	mW
Operating temperature	Topr1	–20 to 75	°C
Storage temperature	Tstg	–40 to 150	°C

Temperature Characteristics (Maximum Ratings)

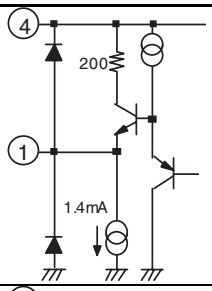
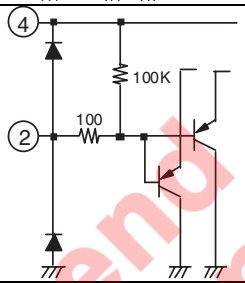
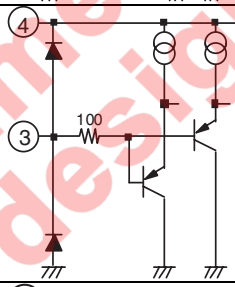
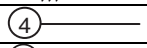
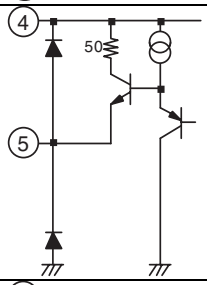
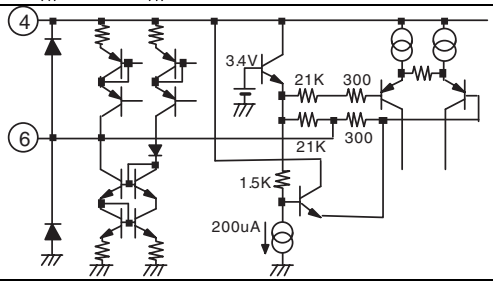


Recommended Operating Conditions

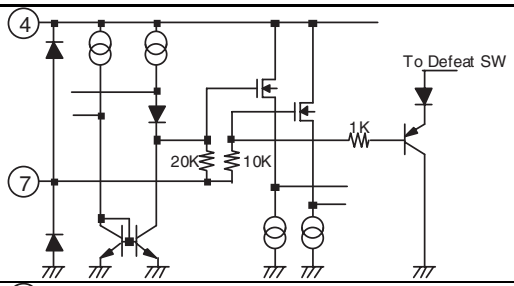
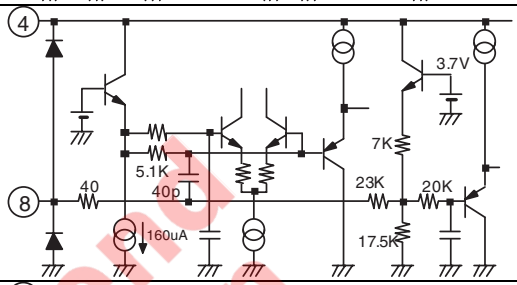
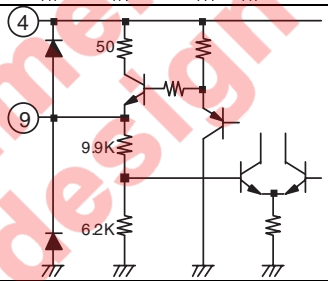
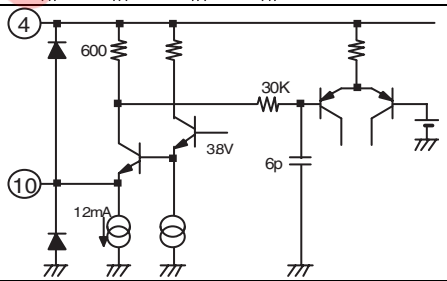
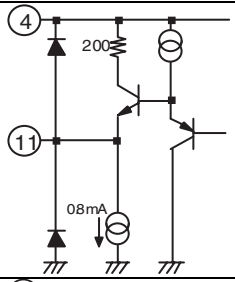
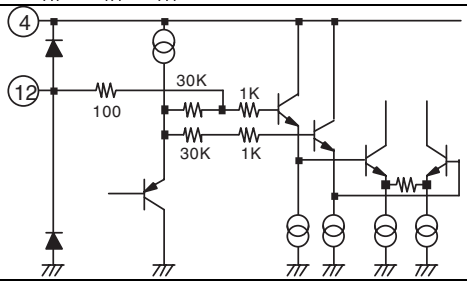
(25°C, unless otherwise noted)

Parameter	Terminal #	Ratings	Unit
Supply voltage	4, 15	5.0	V
Functional supply voltage range	4, 15	4.75 to 5.25	V
Reference Frequency	14	3.579545	MHz
GND	13, 18, 19	GND	—

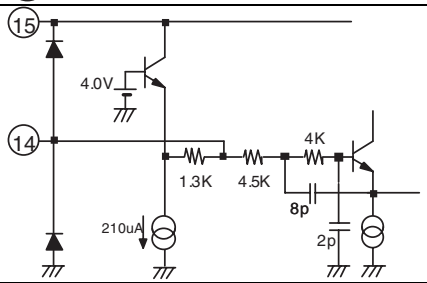
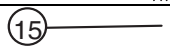
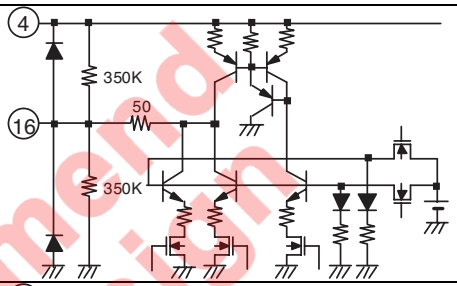
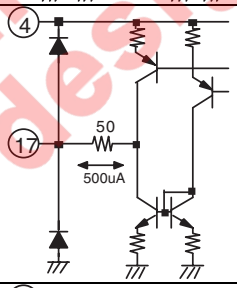
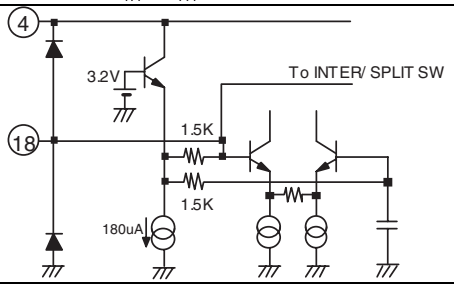
Pin Function

Pin No.	Pin Name	Function	Equivalent Circuit
1	Video out	Video out terminal.	
2	TV/FM SW	TV/FM SW terminal Open: TV Mode GND: FM Mode Connecting to GND with 100 kohm or adding to 1/2 Vcc at this terminal select to search mode.	
3	Video in	This terminal is input the video signal from Pin5 “Video det out” by SIF trap. Input this terminal to DC of Video det signal is necessary for IF AGC function.	
4	Vcc	Power supply terminal for VIF and SIF.	
5	Video det out	Video detector output terminal. SIF trap and SIF BPF are connected to this terminal. It is necessary connecting external resistor for drive, because open emitter configuration.	
6	APC	APC filter terminal.	

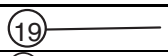
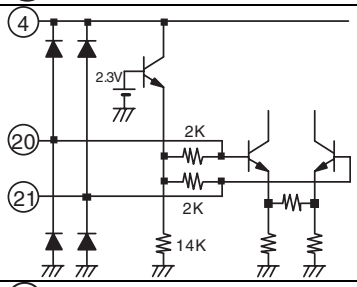
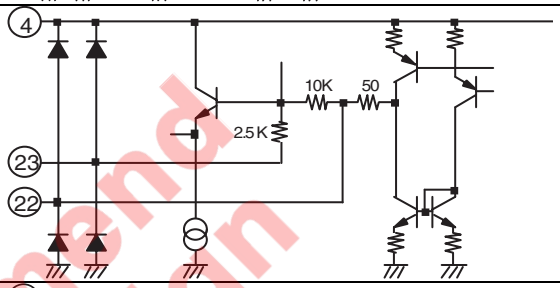
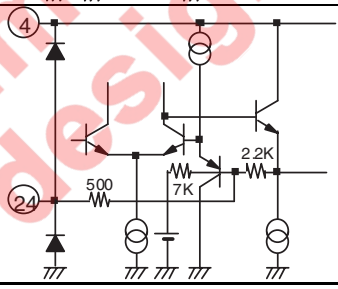
Pin Function (cont)

Pin No.	Pin Name	Function	Equivalent Circuit
7	VCO F/B	VCO Feedback terminal. The feedback control is to keep the internal VCO of the uniform free-running frequency. This terminal has dual function, connecting to gnd select mode with VIF/SIF defeat.	
8	SIF in (Delay Point)	RF AGC Delay terminal. 4.5 MHz SIF signal “LIM IN” is input at this pin which has dual function. The RF AGC Delay Point is set up of DC component of this signal. AC component is FM signal.	
9	Vreg	Regulated voltage output terminal. The voltage is approximately 3 V.	
10	SIF out (US/JP SW)	SIF output terminal. FM signal which is converted to 4.5 MHz is output. This pin has dual function of being VIF VCO type selection terminal. Connect to GND with 1.5 kΩ; JPN “58.75 MHz” No connect; USA “45.75 MHz”	
11	Audio out	Sound output terminal. De-emphasis is achieved by external components.	
12	Audio Level Cont.	AF Bypass terminal. It is connected to one of the input of a differential amplifier, external capacitor provides AC filtering. When resistor is connected in series with capacitor, it is possible to lower the amplitude of the audio output. when audio output terminal is not use, please connect this terminal to GND.	

Pin Function (cont)

Pin No.	Pin Name	Function	Equivalent Circuit
13	Logic GND	Ground terminal for Logic and Ref amp.	
14	Ref Signal (3.58/4.00)	Reference signal input terminal. It is input external signal with sinewave. In case of 4 MHz mode, connect to GND with 4.7 kΩ.	
15	Logic Vcc	Power supply terminal for Logic and Ref amp.	
16	AFT (FM Carrier det)	AFT output terminal. Because of pulse-like signal output, Smoothing capacitor is connected externally with TV mode. Under FM mode, this pin is carrier detector. Active; High Non-active; Low	
17	RF AGC	RF AGC output terminal. It is current drive type.	
18	QIF in (Inter/Spilt SW)	QIF Input terminal with SPLIT. This pin has dual function, the other is INTER/SPLIT SW. INTER: GND SPLIT: DC Open	

Pin Function (cont)

Pin No.	Pin Name	Function	Equivalent Circuit
19	GND	Ground terminal for VIF and SIF.	
20	VIF in 1	IF signal after SAW filter is input. It is balance-type input.	
21	VIF in 2		
22	IF AGC 1	IF AGC filter terminal 1. External capacitor affects AGC speed. Where this terminal is grounded, the effect of VIF amp, becomes minimum gain.	
23	IF AGC 2	IF AGC filter terminal 2.	
24	EQ AMP F/B	Equalizer feedback terminal. It is possible to change the AC response of the video signal by attaching L, C, R to this terminal.	

Electrical Characteristics

General

(Unless otherwise specified: Ta = 25°C, Vcc = 5.0 V, Ref Signal = 3.579545 MHz, Vi = 100 mVpp, SW = 1)

No.	Parameter	Symbol	Test circuit	Test point	Input point	Input signal	SW condition	Limits			Unit	Note#
								Min	Typ	Max		
1	VIF/SIF Vcc current	Icc1	1	Pin4	—	—	—	44	63	82	mA	
2	Logic Vcc Current	Icc2	1	Pin15	—	—	—	3.2	4.7	6.1	mA	
3	VIF/SIF Vcc current@Defeat	Icc3	1	Pin4 Pin15	—	—	SW7=2	6.3	9.0	12.0	mA	
4	Video out voltage@FM Mode	Vofm	1	TP1	—	—	SW2=2	—	0	0.5	V	
5	Ref. signal input level	Fref	1	Pin14	Pin14	—		50	100	600	mVpp	

VIF Section 1

(Unless otherwise specified: Ta = 25°C, Vcc = 5.0 V, Ref Signal = 3.579545 MHz, Vi = 100 mVpp, SW = 1)

No.	Parameter	Symbol	Test circuit	Test point	Input point	Input signal	SW condition	Limits			Unit	Note#
								Min	Typ	Max		
6	Video out	Vodet	1	TP1	Pin20, 21	SG1		0.95	1.20	1.45	Vpp	
7	Sync Tip level	Vsync	1	TP1	Pin20, 21	SG2		1.20	1.45	1.70	V	
8	Video S/N	VoS/N	1	TP1	Pin20, 21	SG2	SW12=2	48	50	—	dB	1
9	Video Out Freq. response	BW	1	TP1	Pin20, 21	SG3		6	7	—	MHz	2
10	Input sensitivity	VinMIN	1	TP1	Pin20, 21	SG4		—	45	52	dBuV	3
11	Max. IF input	VinMAX	1	TP1	Pin20, 21	SG5		101	105	—	dBuV	4
12	IF AGC Range	GR	1	—	—			49	60	—	dB	5
13	IF AGC voltage @80 dBuV	IFAGC	1	TP23	Pin20, 21	SG6		2.7	3.0	3.3	V	
14	Capture range U	CR-U	1	TP1	Pin20, 21	SG7		0.80	1.00	—	MHz	6
15	Capture range L	CR-L	1	TP1	Pin20, 21	SG7		1.38	1.75	—	MHz	7
16	Inter modulation	IM	1	TP1	Pin20, 21	SG8		32	38	—	dB	8
17	D/G	DG	1	TP5	Pin20, 21	SG9		—	3	5	%	
18	D/P	DP	1	TP5	Pin20, 21	SG9		—	3	5	deg	
21	RF AGC High voltage	RFagcH	1	TP17	Pin20, 21	SG10	SW8=3	4.4	4.7	5.0	V	
22	RF AGC Low voltage	RFagcL	1	TP17	Pin20, 21	SG11	SW8=3	0	0.3	0.6	V	
23	RF AGC delay point @TV mode	RFDP1	1	TP17	Pin20, 21	SG12	SW8=3	82	85	88	dBuV	9
24	RF AGC delay point @FM mode	RFDP2	1	TP17	Pin20, 21	SG13	SW2=2 SW8=3	44	50	56	dBuV	10
25	Inter carrier level @FM mode	VoFM	1	TP5	Pin20, 21	SG14	SW2=2 SW8=3	88	103	118	dBuV	11

VIF Section 2

(Unless otherwise specified: Ta = 25°C, Vcc = 5.0 V, Ref Signal = 3.579545 MHz, Vi = 100 mVpp, SW = 1)

No.	Parameter	Symbol	Test circuit	Test point	Input point	Input signal	SW condition	Limits			Unit	Note#
								Min	Typ	Max		
26	AFT sensitivity	μ	1	TP16	Pin20, 21	SG15		10	26	40	mV/ kHz	12
27	AFT High voltage	AFTH	1	TP16	Pin20, 21	SG16		4.3	4.7	5.0	V	12
28	AFT Low voltage	AFTL	1	TP16	Pin20, 21	SG17		0	0.3	0.7	V	12
29	AFT Mute voltage	AFTM	1	TP16	Pin20, 21	SG18		2.4	2.5	2.6	V	
30	AFT Center voltage @US mode	VaftUS	1	TP16	Pin20, 21	SG2		2.40	2.65	2.90	V	
31	AFT Center voltage @JP mode	VaftJP	1	TP16	Pin20, 21	SG19	SW10=2	2.60	2.87	3.15	V	

SIF Section

(Unless otherwise specified: Ta = 25°C, Vcc = 5.0 V, Ref Signal = 3.579545 MHz, Vi = 100 mVpp, SW = 1)

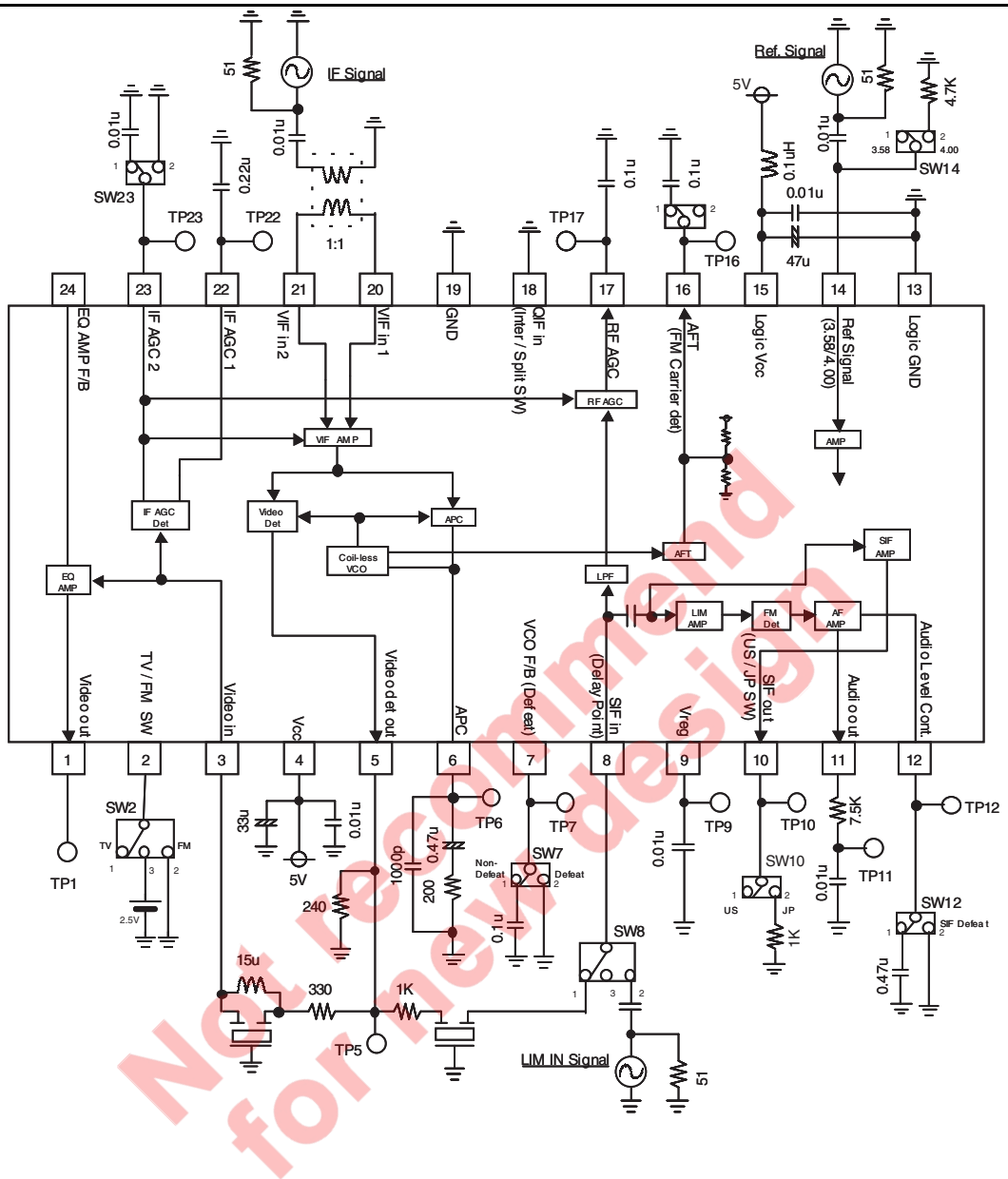
No.	Parameter	Symbol	Test circuit	Test point	Input point	Input signal	SW condition	Limits			Unit	Note#
								Min	Typ	Max		
32	AF output level @TV mode	VoAF1	1	TP11	Pin8	SG20	SW8=2	400	700	1000	mVrms	
33	AF output level @FM mode	VoAF2	1	TP11	Pin8	SG21	SW2=2 SW8=2	455	800	1140	mVrms	
34	AF output THD @TV mode	THDAF1	1	TP11	Pin8	SG20	SW8=2	—	0.4	0.9	%	
35	AF output THD @FM mode	THDAF2	1	TP11	Pin8	SG21	SW2=2 SW8=2	—	0.4	0.9	%	
36	Audio S/N @TV mode	AF S/N1	1	TP11	Pin8	SG22	SW8=2 SW23=2	50	55	—	dB	13
37	Audio S/N @FM mode	AF A/N2	1	TP11	Pin8	SG22	SW2,8=2 SW23=2	55	60	—	dB	14
38	Limiting sensitivity	LIM	1	TP11	Pin8	SG23	SW8=2	—	50	55	dBuV	15
39	SIF output level @TV mode	SIFG1	1	TP10	Pin8	SG22	SW8=2	90	96	102	dBuV	
40	SIF output level @FM mode	SIFG2	1	TP10	Pin8	SG22	SW2=2 SW8=2	79	85	91	dBuV	

VCO Section

(Unless otherwise specified: Ta = 25°C, Vcc = 5.0 V, Ref Signal = 3.579545 MHz, Vi = 100 mVpp, SW = 1)

No.	Parameter	Symbol	Test circuit	Test point	Input point	Input signal	SW condition	Limits			Unit	Note#
								Min	Typ	Max		
41	VIF VCO freerun @US mode	FvcofUS	1	TP16	—	—	SW2=3 SW12=2 SW16,23=2	-500	0	+500	kHz	16
42	VIF VCO freerun @JP mode	FvcofJP	1	TP16	—	—	SW2=3 SW10,12=2 SW16,23=2	-500	0	+500	kHz	16

Test Circuit



Note: This test circuit is based on RENESAS board for evaluation.

Input Signal

SG	Termination with 50 ohm			
1	f0 = 45.75 MHz	Vi = 90 dBuV	fm = 20 kHz	AM = 77.8%
2	f0 = 45.75 MHz	Vi = 90 dBuV	CW	
3	f1 = 45.75 MHz	Vi = 90 dBuV	CW	Mixed signal
	f2 = Freq. Variable	Vi = 70 dBuV	CW	
4	f0 = 45.75 MHz	Vi = Variable	fm = 20 kHz	AM = 77.8%
5	f0 = 45.75 MHz	Vi = Variable	fm = 20 kHz	AM = 16.0%
6	f0 = 45.75 MHz	Vi = 80 dBuV	CW	
7	f0 = Freq. Variable	Vi = 90 dBuV	fm = 20 kHz	AM = 77.8%
8	f1 = 45.75 MHz	Vi = 90 dBuV	CW	Mixed signal
	f2 = 42.17 MHz	Vi = 80 dBuV	CW	
	f3 = 41.25 MHz	Vi = 80 dBuV	CW	
9	f0 = 45.75 MHz	Sync Tip Level = 90 dBuV		
	87.5% TV modulation 10 step waveform			
10	f0 = 45.75 MHz	Vi = 70 dBuV	CW	
11	f0 = 45.75 MHz	Vi = 100 dBuV	CW	
12	f0 = 45.75 MHz	Vi = Variable	CW	
13	f0 = 42.341 MHz	Vi = Variable	CW	
14	f0 = 42.341 MHz	Vi = 90 dBuV	CW	
15	f0 = Freq. Variable	Vi = 90 dBuV	CW	
16	f0 = 45.75-0.5 MHz	Vi = 90 dBuV	CW	
17	f0 = 45.75+0.5 MHz	Vi = 90 dBuV	CW	
18	f0 = 45.75+/-0.5 MHz	Vi = 90 dBuV	CW	
19	f0 = 58.75 MHz	Vi = 90 dBuV	CW	
20	f0 = 4.5 MHz	Vi = 90 dBuV	fm = 1 kHz +/- 25 kHz dev	
21	f0 = 4.5 MHz	Vi = 90 dBuV	fm = 1 kHz +/- 75 kHz dev	
22	f0 = 4.5 MHz	Vi = 90 dBuV	CW	
23	f0 = 4.5 MHz	Vi = Variable	fm = 1 kHz +/- 25 kHz dev	
24	f0 = 4.5 MHz	Vi = Variable	CW	

Mode Select

Recommended Condition: Ta = 25°C, Vcc = 5.0 V

TV/FM select	2 pin condition	Recommendation
TV	DC Open	Open
Search (#1)	2.2-2.8 V	1/2 Vcc
FM	within 1.0 V	GND

#1: Search mode use for shipping test only.

IF Defeat select	7 pin condition	Recommendation
Un defeat	DC Open	DC open
Defeat	within 0.5 V	GND

US/JP select	10 pin condition	Recommendation
US	No resistance	No resistance
JP	Pull down 1.0 kΩ +/–10%	1 kΩ to GND

Ref signal select	14 pin condition	Recommendation
3.58 M	No resistance	No resistance
4.00 M	Pull down 4.7 kΩ +/–10%	4.7 kΩ to GND

SIF defeat select	12 pin condition	Recommendation
Un defeat	DC Open	DC Open
Defeat	within 0.3 V	GND

FM Mode IF Frequency (INTER)

INTER	Ref signal	IF Frequency
US	3.58 MHz	42.341 MHz
	4.00 MHz	42.500 MHz
JP	3.58 MHz	55.330 MHz
	4.00 MHz	55.357 MHz

Notes

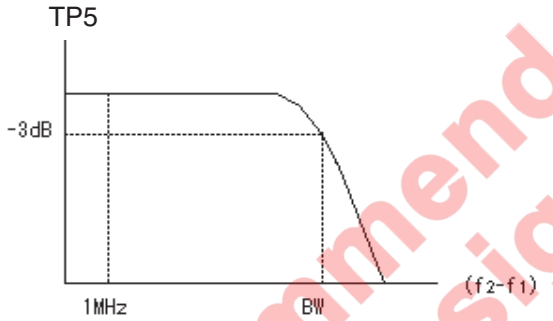
Note 1 Video S/N: VoS/N

Input SG2 to VIF IN (Pin 20, 21) and measure the video out (TP1) noise in r.m.s. through a 5 MHz (–3 dB) L.P.F..

$$S/N = 20\log\left(\frac{0.7 \times \text{Vodet (Vpp)}}{\text{NOISE (rms)}}\right) \quad \text{(dB)}$$

Note 2 Video Band Width: BW

1. Measure the 1 MHz component level of Video output TP1 with a spectrum analyzer when SG3 (f2 = 44.75 MHz) is input to VIF IN (Pin 20, 21). At that time, measure the voltage at TP23, and them fix TP23 at that voltage.
2. Reduce f2 and measure the value of (f2-f1) when the (f2-f1) component level reaches –3 dB from the 1 MHz component level as shown below.



Note 3 Input Sensitivity: VIN MIN

Input SG4 (Vi = 90 dBu) to VIF IN (Pin 20, 21) and then gradually reduce Vi and measure the input level when the 20 kHz component of Video output TP1 reaches –3 dB from Vo det level.

Note 4 Maximum Allowable Input: VIN MAX

1. Input SG5 (Vi = 90 dBu) to VIF IN (Pin 20, 21), and measure the level of the 20 kHz component of Video output (TP1).
2. Gradually increase the Vi of SG and measure the input level when the output reaches –3 dB.

Note 5 AGC Control Range: GR

GR = VinMAX – VinMIN (dB)

Note 6 Capture Range: CR-U

1. Increase the frequency of SG7 until the VCO is out of locked-oscillation.
2. And decrease the frequency of SG7 and measure the frequency fU when the VCO is locked.

CR – U = fU – 45.75 (MHz)

Note 7 Capture Range: CR-L

1. Decrease the frequency of SG7 until the VCO is out of locked-oscillation.
2. And increase the frequency of SG7 and measure the frequency fL when the VCO is locked.

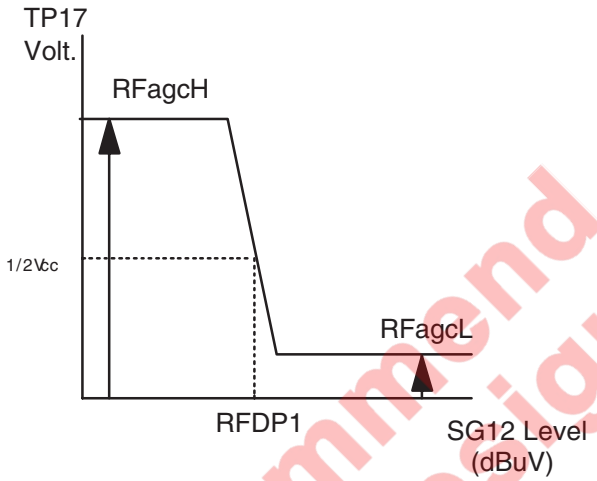
CR – L = fU – 45.75 – fL (MHz)

Note 8 Inter Modulation: IM

1. Input SG8 to VIF IN (Pin 20, 21), and measure video output TP1 with an oscilloscope.
2. Adjust AGC filter voltage TP23 so that the minimum DC level of the output waveform is Vsync.
3. At that time, measure TP1 with a spectrum analyzer. The inter modulation is defined as a difference between 0.92 MHz and 3.58 MHz frequency components.

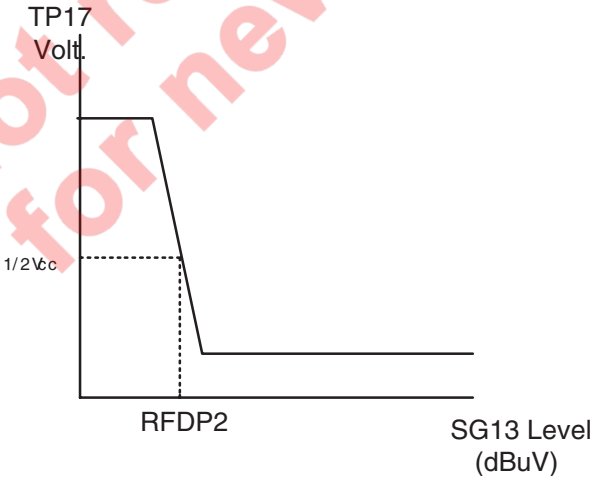
Note 9 RF AGC Delay Point (TV Mode): RFDP1

1. Input SG12 to VIF IN (Pin 20, 21) and gradually reduce level and then measure the input level when RF AGC output (TP17) reaches 1/2Vcc, as shown below.
2. At that time, the state of Pin 8 is DC open.



Note 10 RF AGC Delay Point (FM Mode): RFDP2

1. Input SG13 to VIF IN (Pin 20, 21) and gradually reduce level and then measure the input level when RF AGC output (TP17) reaches 1/2Vcc, as shown below.
2. At that time, the state of Pin 8 is DC open, and Pin 2 should be connected to GND.



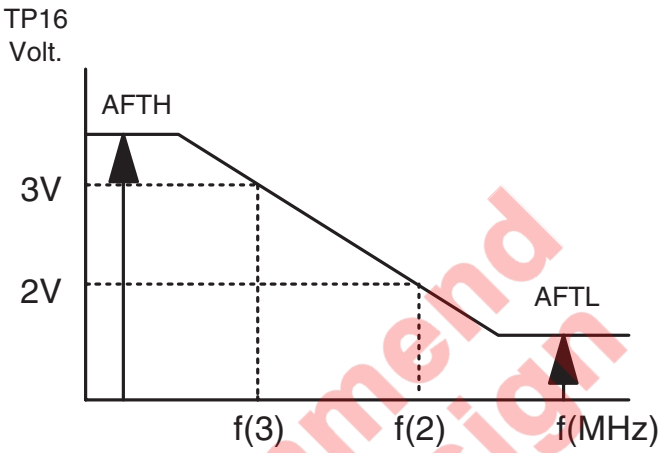
Note 11 Inter Carrier Level: VoFM

Input SG14 to VIF IN (Pin 20,21), and measure the 4.5 MHz component level of Video det out (TP5) with connecting Pin 2 to GND.

Note 12 AFT sensitivity: μ, Maximum AFT Voltage: AFTH, Minimum AFT Voltage: AFTL

1. Input SG15 to VIF IN (Pin 20, 21) and set the frequency of SG15 so that the voltage of AFT output TP16 is 3 V. The frequency is named f(3).
2. Set the frequency of SG15 so that the AFT output voltage is 2 V. This frequency is named f(2).
3. In the graph shown below, maximum and minimum DC voltage are AFTH and AFTL, respectively.

$$\mu = \frac{1000 \quad (mV)}{f(2) - f(3) \quad (KHz)} \qquad (mV/KHz)$$



Note 13 Audio S/N (TV Mode): AFS/N1

Input SG22 to SIF IN (Pin 8), and measure the output noise level of Audio output (TP11) with FLAT-r.m.s.. This level is named Vn1.

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

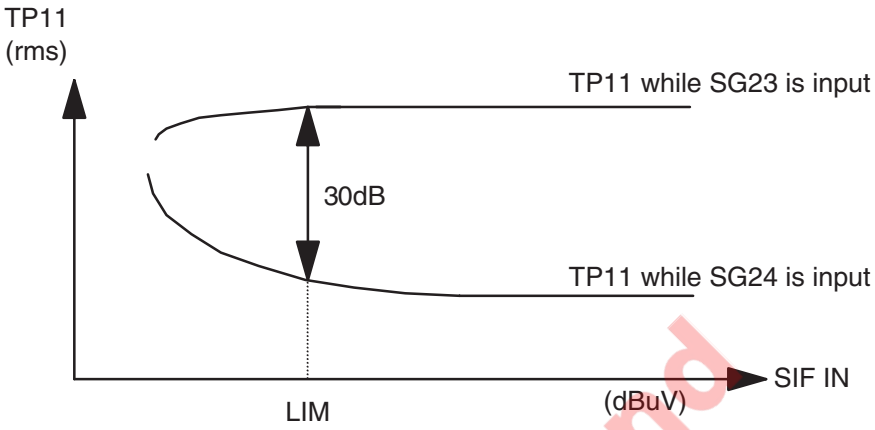
Note 14 Audio S/N (FM Mode): AFS/N2

Input SG22 to SIF IN (Pin 8), and measure the output noise level of Audio output (TP11) with FLAT-r.m.s.. This level is named Vn1. At this time Pin 2 should be connected to GND.

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

Note 15 Limiting Sensitivity: LIM

1. Input SG23 to LIM IN, and measure the 1 kHz component level of AF output TP11 with FLAT-r.m.s..
2. Input SG24 to LIM IN, and measure the noise level of AF output TP11 with FLAT-r.m.s..
3. The input limiting sensitivity is defined as the input level when the difference between each 1 kHz components of audio output (TP11) is 30 dB, as shown below.



Note 16 VIF VCO Freerun Frequency: FvcofUS/FvcofJP

Input 3.579545 MHz to Ref IN (Pin 14), and set up SW as shown following.

	US Mode		JP Mode		
SW No.	**Setting**	**Condition**	**Setting**	**Condition**	
2	3	Add to 2.5 V	3	Add to 2.5 V	*VCO SW: US/JP
10	1	No-Connecting R	2	Connecting 1 kohm	
12	2	GND	2	GND	#Fref SW
14	1	No-Connecting R	1	No-Connecting R	
16	2	No-Connecting C	2	No-Connecting C	
23	2	GND	2	GND	

1. Measure the frequency of output signal at AFT out (TP16) each when be selected US or JP by SW10.
2. Measured frequency's are defined FaftUS (US Mode), FaftJP (JP Mode). The VCO freerun frequency is calculated by following.

<Fref = 3.579545 MHz>

- US Mode

$$FvcofUS = 52.915\ (MHz) - 2 \times FaftUS\ (MHz) - 45.75\ (MHz) \quad [MHz]$$

- JP Mode

$$FvcofJP = 65.925\ (MHz) - 2 \times FaftJP\ (MHz) - 58.75\ (MHz) \quad [MHz]$$

Case of Fref frequency is 4.00 MHz, SW14 should be set up 2 (Pin 14 is connected 4.7 kΩ to GND).

Other Condition's are same as case of 3.58 MHz mode, and the VCO freerun frequency is calculated by following.

<Fref = 4.00 MHz>

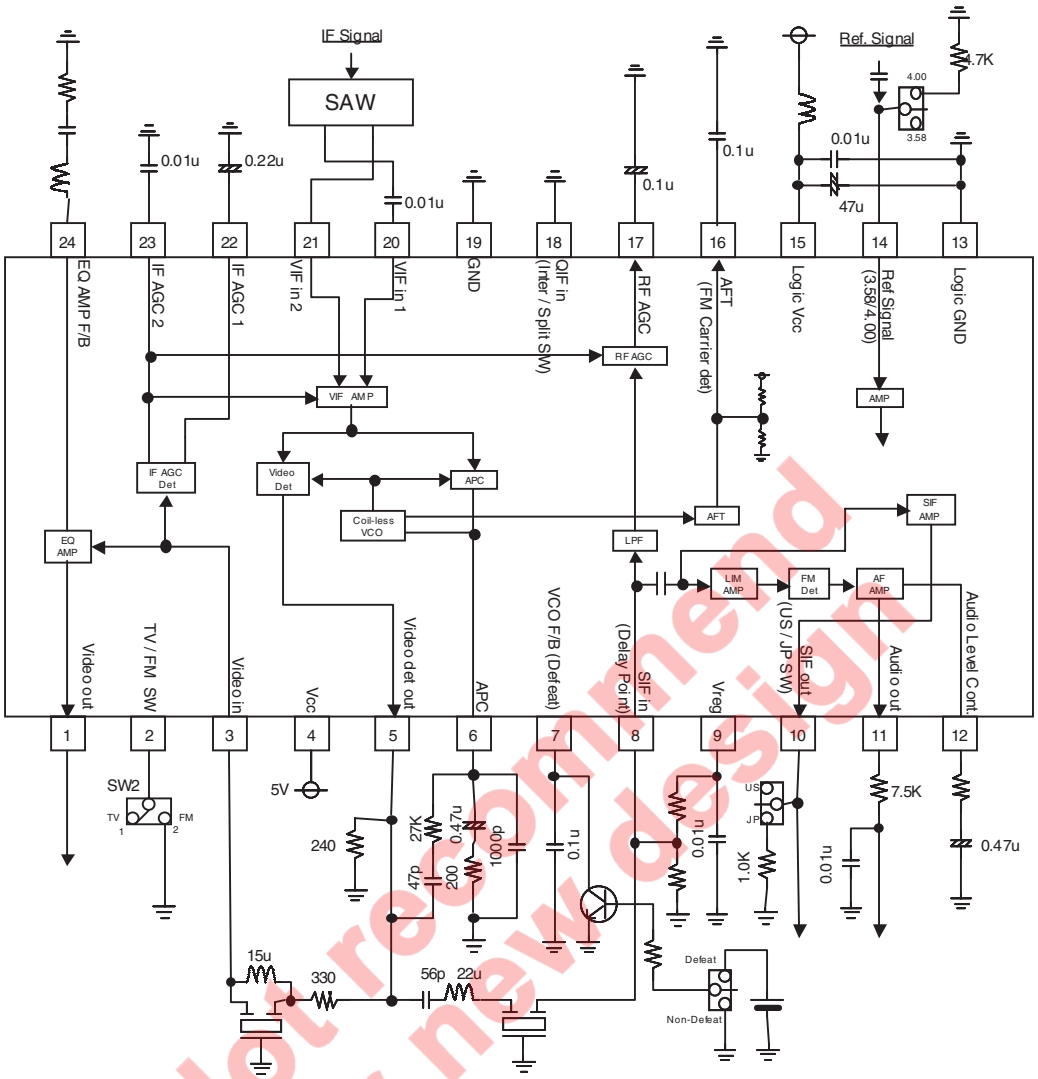
- US Mode

$$FvcofUS = 52.952\ (MHz) - 9 \times FaftUS\ (MHz) - 45.75\ (MHz) \quad [MHz]$$

- JP Mode

$$FvcofJP = 65.951\ (MHz) - 9 \times FaftJP\ (MHz) - 58.75\ (MHz) \quad [MHz]$$

Application



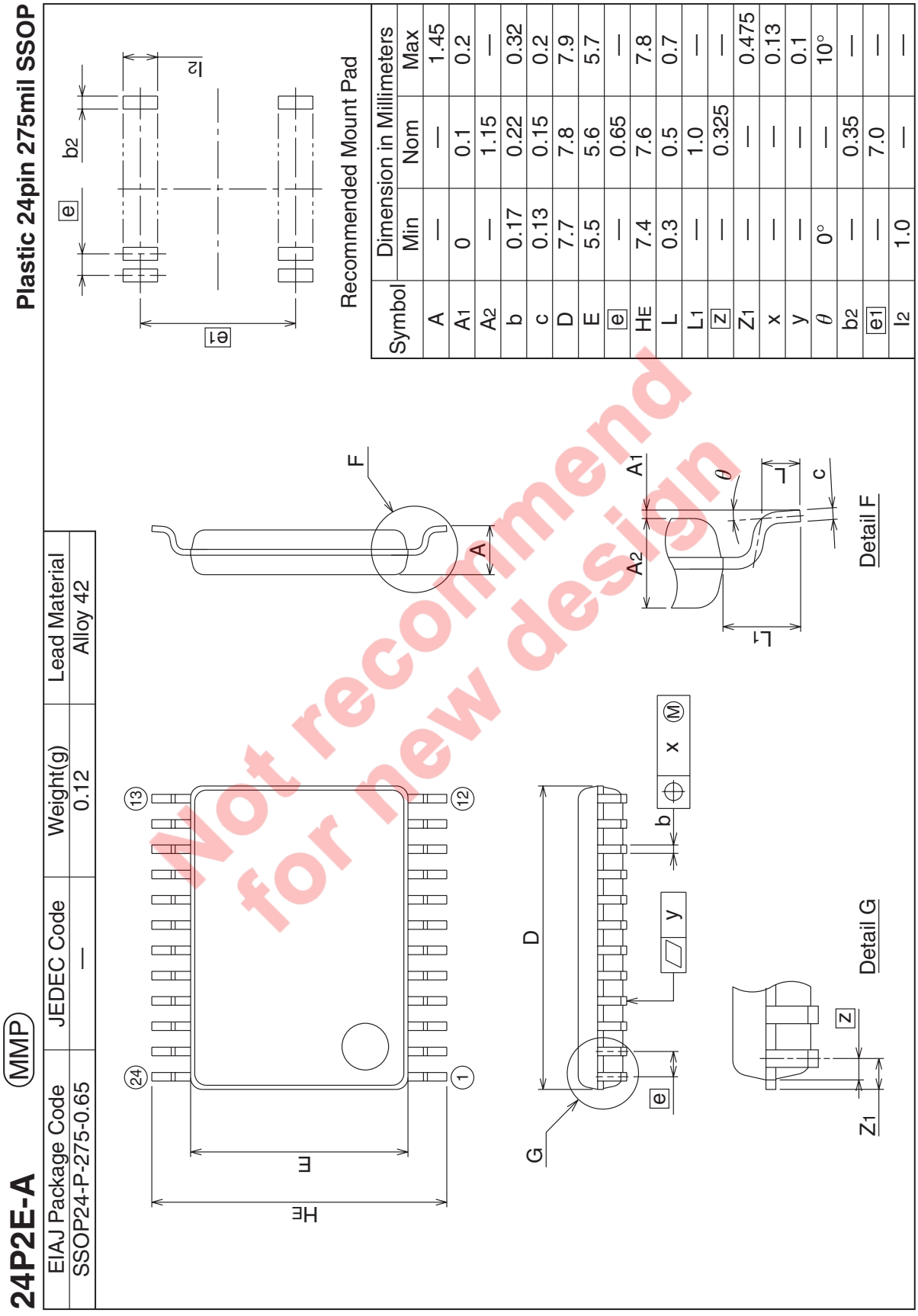
Recommendation

* By pass capacitance for Logic Vcc(Pin15) should be mounted close hard by Logic GND(Pin13)
* In order to mitigate the surroundings lump by the VIF input, the balanced connection from a SAW filter to the VIF input pin of 20,21 recommends a putter which serves as a 1t coil by Tip C or the jumper.

Special components

SAW:SAF45MA210Z
TRP:TPSRA4M50B00
BPF:SFSH4.5MEB2

Package Dimensions



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