

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# TA1209F

FOR LCD TVS, SEPARATE CARRIER PIF AND SIF SYSTEMS

## FEATURES

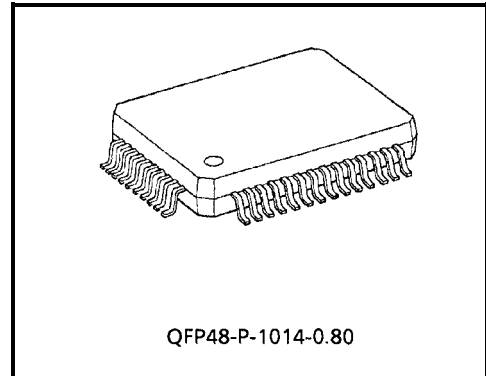
### PIF circuit

- High input sensitivity
- High-speed response peak AGC with dual time constant
- Forward / Reverse RF AGC output
- Output with black & white noise inverter
- Output without black & white noise inverter
- Video output adjustment
- Single polarity AFT output
- Built-in sync.separation circuit

### SIF circuit

- Separate carrier type detection circuit
- Downconvert circuit to 10.7 MHz with local OSC
- Quadrature-type detection circuit
- Station detector
- Field strength detector slider circuit
- Field strength detection muting

Note: This product is weak for surge voltage. Please handle with care.

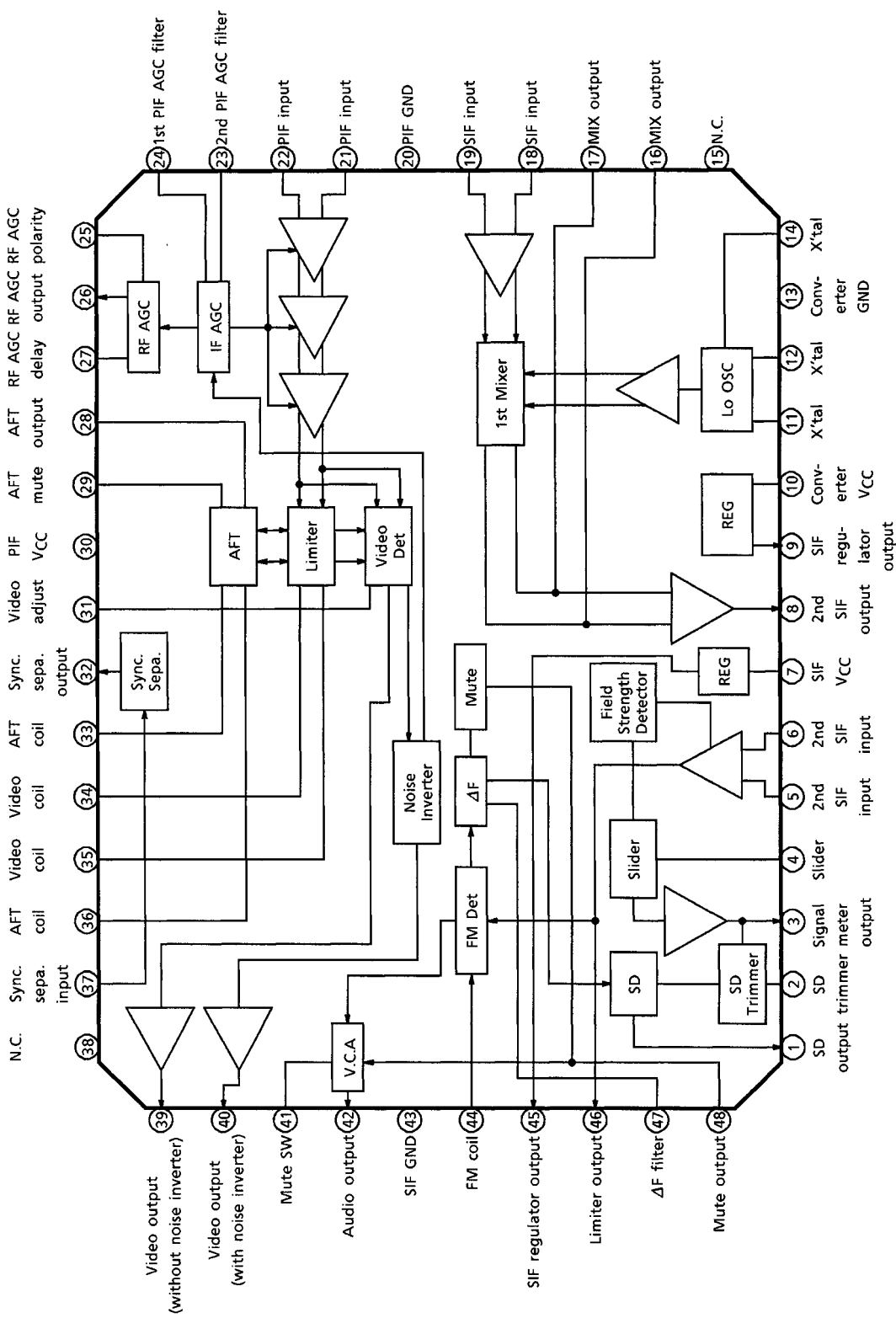


Weight: 0.83g (Typ.)

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**BLOCK DIAGRAM**



## TERMINAL FUNCTION

PIN No.	PIN NAME	FUNCTION	INTERFACE
1	SD Output	SD Output terminal. (tuned : Hi, not tuned : Lo) This terminal is open collector output. Connect pull-up register.	
2	SD Trimmer	Terminal to control SD sensitivity.	
3	Signal meter Output	Outputted DC voltage rises in proportion to input level.	
4	Slider	According to resistance connected between this terminal and GND, controlling dc offset of #3 terminal is possible.	

PIN No.	PIN NAME	FUNCTION	INTERFACE
5	2nd SIF Input	2nd SIF input terminal. Input 2nd SIF output signal through 10.7 MHz ceramic filter. Built-in matching register for ceramic filter (330 Ω).	
6	2nd SIF Input	Bias terminal for 2nd SIF input. Connect capacitor between this terminal and GND.	
7	SIF V <sub>CC</sub>	SIF V <sub>CC</sub> terminal (8.5 V is recommended.)	—
8	2nd SIF Output	10.7 MHz 1st SIF signal converted by Lo OSC signal is outputted.	

PIN No.	PIN NAME	FUNCTION	INTERFACE
9	SIF Regulator Output	SIF regulator output terminal (Typ. : 4.8 V)	
10	Converter V <sub>CC</sub>	Converter V <sub>CC</sub> (8.5 V is recommended.)	—
11	X'tal	Terminal for connecting crystal resonator to generate local OSC signal.	
12			
14		Emitter of local OSC circuit. Connect register and capacitor.	
13	Converter GND	Converter GND	—
15	N.C.	Non connection.	—

PIN No.	PIN NAME	FUNCTION	INTERFACE
16  17	MIX Output	Mixer output terminal.	<p>The diagram shows a mixer stage. Pin 10 is connected to a network of resistors and diodes. Pin 16 is the output of the mixer stage. Pin 17 is connected to a network of resistors and diodes. The circuit includes a 0.06 pF capacitor, 2kΩ resistors, and connections for Local OSC and SIF IN.</p>
18  19	SIF Input	SIF input terminal. (input impedance : 1.2 kΩ (Typ.))	<p>The diagram shows an input stage for the SIF input. Pin 10 is connected to a network of resistors and diodes. Pin 18 is the input terminal. Pin 19 is connected to a network of resistors and diodes. The circuit includes 1.2kΩ resistors, 12.5kΩ resistors, a 1kΩ resistor, a 3V source, and diodes.</p>
20	PIF GND	PIF GND.	—

PIN No.	PIN NAME	FUNCTION	INTERFACE
21	PIF Input	PIF Input terminal. (input impedance : 5 kΩ (Typ.))	
22			
23	2nd PIF AGC filter	Terminal to connect capacitor for PIF AGC. To improve AGC responsibility, this IC is adopted dual time constant AGC circuit.	
24	1st PIF AGC filter		

PIN No.	PIN NAME	FUNCTION	INTERFACE
25	RF AGC Polarity	Terminal to switch RF AGC Polarity. (open : reverse, GND : forward)	
26	RF AGC Output	RF AGC Output terminal. (open-collector output)	
27	RF AGC Delay	Changing comparator reference voltage adjusts RF AGC delay point.	



PIN No.	PIN NAME	FUNCTION	INTERFACE
28	AFT Output	AFT detector output terminal based on double balanced multiplier.	
29	AFT Mute	AFT output is muted, when this terminal is connected to GND.	
33	AFT Coil	Connect AFT detection coil.	
36			
30	PIF V <sub>CC</sub>	PIF V <sub>CC</sub> terminal. (5 V is recommended.)	—
31	Video adjust	Video signal output voltage adjustment terminal. Changing this terminal voltage, it is possible to adjust video signal output voltage to 1.0 V <sub>p-p</sub> . (With no adjustment, video signal output voltage is 1 V <sub>p-p</sub> (Typ.)) To prevent noise, connecting capacitor (0.01 μF) to GND is recommended.	

PIN No.	PIN NAME	FUNCTION	INTERFACE
32	Sync. sepa.Output	Sync. sepa. input and output terminal.	
37	Sync. sepa.Input		
34  35	Video Coil	Connect video detection coil.	
38	N.C.	Non connection.	—
39	Video Output (without noise inverter)	Video signal output terminal. Video signal without noise inverter is outputted, and can thus be used for diversity circuit, for example. Video output signal voltage is controlled by voltage of pin 4.	

PIN No.	PIN NAME	FUNCTION	INTERFACE
40	Video Output (with noise inverter)	Video signal output terminal. Video signal with noise inverter is outputted. Video output signal voltage is controlled by voltage of pin 4.	
41	Mute SW	Audio mute SW. (open : mute on, GND : mute off)	
42	Audio Output	Audio signal output terminal.	
43	SIF GND	SIF GND.	—
44	FM Coil	Connect FM coil. Input limiter output signal through the coil for phase shift.	

PIN No.	PIN NAME	FUNCTION	INTERFACE
45	SIF Regulator Output	SIF Regulator Output terminal. (Typ. : 4.8 V)	
46	Limiter Output	Limiter output terminal.	

PIN No.	PIN NAME	FUNCTION	INTERFACE
47	$\Delta F$ filter	Connect capacitor for $\Delta F$ circuit.	
48	Mute Output	DC voltage in proportion to input level is outputted. This voltage control audio mute.	

## MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V <sub>CC</sub> PIF	8	V
	V <sub>CC</sub> CONV	13	
	V <sub>CC</sub> SIF	13	
Power Dissipation	P <sub>Dmax</sub> (Note)	845	mW
Operating Temperature	T <sub>opr</sub>	-20~75	°C
Storage Temperature	T <sub>stg</sub>	-55~150	°C

Note: When using the device at above Ta = 25°C, decrease the power dissipation by 6.9 mW for each increase of 1°C.

## OPERATING SUPPLY VOLTAGE

PIN No.	PIN NAME	MIN	TYP.	MAX	UNIT
PIF V <sub>CC</sub>	30	4.5	5.0	5.5	V
CONV V <sub>CC</sub>	10	8.0	8.5	9.0	
SIF V <sub>CC</sub>	7				

## ELECTRICAL CHARACTERISTICS

### DC CHARACTERISTIC

(Unless otherwise specified, PIF  $V_{CC} = 5.0\text{ V}$ , SIF (CONV)  $V_{CC} = 8.5\text{ V}$ , all switches : ON)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	CONDITION	MIN	TYP	MAX	UNIT
Supply Current	I <sub>PIF</sub>	1	—	7.5	11	15	mA
	I <sub>CONV</sub>		—	8.5	13	17	
	I <sub>SIF</sub>		—	13	18.5	24	
Terminal Voltage	V5	1	SW <sub>1</sub> : off	1.7	2.0	2.3	V
	V6		SW <sub>1</sub> : off	1.7	2.0	2.3	
	V8		—	3.8	4.1	4.4	
	V9		—	4.5	4.8	5.1	
	V16		SW <sub>2</sub> : off	6.5	6.8	7.1	
	V17		SW <sub>2</sub> : off	6.5	6.8	7.1	
	V18		SW <sub>3</sub> : off	2.8	3.1	3.4	
	V19		SW <sub>3</sub> : off	2.8	3.1	3.4	
	V21		SW <sub>4</sub> : off	2.4	2.7	3.0	
	V22		SW <sub>4</sub> : off	2.4	2.7	3.0	
	V25		—	2.9	3.2	3.5	
	V27		—	2.3	2.5	2.7	
	V28		—	1.5	2.5	3.5	
	V29		—	4.9	4.95	5.0	
	V31		—	0.7	0.95	1.2	
	V33		SW <sub>6</sub> : off	4.7	4.85	5.0	
	V34		SW <sub>5</sub> : off	4.4	4.6	4.8	
	V35		SW <sub>5</sub> : off	4.4	4.6	4.8	
	V36		SW <sub>6</sub> : off	4.7	4.85	5	
	V39		—	1.8	2.15	2.5	
	V40		—	1.8	2.15	2.5	
	V41		—	3.5	3.8	4.1	
	V42		—	4.4	4.8	5.2	
	V45		SW <sub>7</sub> : off	4.5	4.8	5.1	
V46	—	4.4	4.7	5.0			
V47	—	4.4	4.7	5.0			

**AC CHARACTERISTICS**

(Unless otherwise specified, PIF  $V_{CC} = 5.0\text{ V}$ , SIF (CONV)  $V_{CC} = 8.5\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

**PIF CIRCUIT**

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	CONDITION	MIN	TYP.	MAX	UNIT
Output Signal Voltage	$V_p$ out	2	(Note 1)	0.7	1.0	1.3	$V_{p-p}$
Signal-Noise Ratio	S/N P		(Note 2)	50	60	—	dB
-3dB Video Bandwidth	$f_c$ video		(Note 3)	4.0	5.0	—	MHz
PIF Input Signal Voltage Sensitivity	$V_p$ min		(Note 4)	—	25	35	$\text{dB}\mu\text{V}$
Maximum Input Signal Voltage	$V_p$ max		(Note 5)	95	100	—	$\text{dB}\mu\text{V}$
Inter Modulation	IM		(Note 6)	30	—	—	dB
Suppression of Picture Career	CR		(Note 7)	60	—	—	dB
Suppression of Picture Career Harmonics	HR		(Note 8)	50	—	—	dB
Differential Gain	DG		(Note 9)	—	5	10	%
Differential Phase	DP			—	3	8	$^\circ$
Sync Voltage Level	$V_p$ sync		(Note 10)	0.7	0.9	1.1	V
AFT Control Steepness	$\Delta f / \Delta V$		(Note 11)	12	25	38	$\text{kHz}/\text{V}$
AFT Mute Voltage	$V_{\text{AFT mute}}$		(Note 12)	2.2	2.5	2.8	V
RF AGC Maximum Output Voltage	$V_{\text{RFAGC max}}$		(Note 13)	4.6	4.9	—	V
RF AGC Minimum Output Voltage	$V_{\text{RFAGC min}}$			—	0	0.3	V
Black Noise Invert Level	$V_{\text{Bth}}$		(Note 14)	0.2	0.5	0.8	V
Black Noise Clamp Level	$V_{\text{Bcl}}$			0.9	1.2	1.5	V
White Noise Invert Level	$V_{\text{Wth}}$	2.0		2.3	2.5	V	
White Noise Clamp Level	$V_{\text{Wcl}}$	1.2		1.4	1.6	V	

**CONVERTER CIRCUIT**

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	CONDITION	MIN	TYP.	MAX	UNIT
Conversion Gain	CG	2	(Note 15)	20	25	30	dB
2nd SIF Maximum Output	$V$ CONV max		(Note 16)	110	120	—	$\text{dB}\mu\text{V}$



## SIF CIRCUIT

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	CONDITION	MIN	TYP.	MAX	UNIT	
AF Output Signal Voltage	$V_A$ out	2	(Note 17)	320	400	480	mV <sub>rms</sub>	
SIF Input Signal VoltageSensitivity	$V_A$ lin		(Note 18)	—	30	35	dB $\mu$ V	
-3 dB AF Bandwidth	$BW_A$		(Note 19)	160	200	280	kHz	
Signal-Noise Ratio	S / $N_A$		(Note 20)	50	60	—	dB	
AM Rejection	AMR		(Note 21)	45	55	—	dB	
Total Harmonic Distortion	THD		(Note 22)	—	0.2	1.0	%	
Signal Meter Output Voltage	(20dB $\mu$ V)		$V_{sld}$ 20	(Note 23)	—	0.6	—	V
	(50dB $\mu$ V)		$V_{sld}$ 50		1.9	2.6	3.3	
	(80dB $\mu$ V)		$V_{sld}$ 80		4.9	5.6	6.3	
	(100dB $\mu$ V)		$V_{sld}$ 100		6.3	7.0	—	
Station Detector Bandwidth	$BW_{SD}$		(Note 24)	80	120	160	kHz	
Station Detector Sensitivity	$V_{SD}$	(Note 25)	42	48	54	dB $\mu$ V		

### TEST CONDITION (Unless otherwise specified, SW<sub>1</sub> : OFF, SW<sub>2</sub> : ON)

<PIF circuit>

Note 1: Output signal voltage

PIF input :  $f_p = 58.75$  MHz, standard television signal (V / S = 10 : 4 ramp waveform), 87.5%AM, 84 dB $\mu$ V  
Measure output signal voltage at pin 40.

Note 2: Signal-noise ratio

PIF input : (1)  $f_p = 58.75$  MHz,  $f_m = 15.75$  kHz, 30%AM, 84 dB $\mu$ V (AM)  
(2)  $f_p = 58.75$  MHz, CW, 84 dB $\mu$ V (non-mod.)

$S / N$  [ dB ] =  $20 \log$  ([output signal voltage] / [output signal voltage (non-mod)]) $\times 6$

Note 3: -3 dB video width

PIF input :  $f_p = 58.75$  MHz, 84 dB $\mu$ V, CW

Measure 2nd AGC voltage and supply that voltage from external source.

Then, input following composite signals to the PIF input

SG : 1 58.75 MHz, 84 dB $\mu$ V (frequency : fixed)

SG : 1 58.65 MHz~45 MHz, 64 dB $\mu$ V (frequency : variable)

Monitor spectrum of output signal at pin 40. Measure frequency of SG : 2, when video output signal is -3 dB. Difference between that frequency and 58.75 MHz is -3 dB band width.

Note 4: PIF input signal voltage sensitivity

PIF input :  $f_p = 58.75$  MHz,  $f_m = 15.7$  kHz, 30%AM, 84 dB $\mu$ V

Measure output signal voltage at pin 40. (This voltage is 0 dB.) Lower input signal voltage gradually, measure the input signal voltage when output signal voltage at pin 40 is -3 dB.

Note 5: Maximum input signal voltage

PIF input :  $f_p = 58.75$  MHz,  $f_m = 15.7$  kHz, 30%AM, 84 dB $\mu$ V

Measure output signal voltage at pin 40. (This voltage is 0 dB.) Raise input signal voltage gradually, measure the input signal voltage when output signal voltage at pin 40 is +0.5 dB.

Note 6: Intermodulation

Input following composite signals to be PIF input.

- (1) SG : 1 58.75 MHz, 84 dB $\mu$ V
- (2) SG : 2 54.25 MHz, 74 dB $\mu$ V
- (3) SG : 3 55.17 MHz, 74 dB $\mu$ V

Supply DC voltage to 2nd AGC terminal from external source, so that bottom of output signal voltage matches sync. tip level. Measure the difference of output signal voltage at pin 40 between 3.58 MHz component (chroma) and 920 kHz component.

Note 7: Suppression of picture career

PIF input :  $f_p = 58.75$  MHz,  $f_m = 15.7$  kHz, 78%AM, 84 dB $\mu$ V

Measure the difference of output signal voltage at pin 40 between 15.7 kHz component (video) and 58.75 MHz component (career).

Note 8: Suppression of picture career harmonics

PIF input :  $f_p = 58.75$  MHz,  $f_m = 15.7$  kHz, 78%AM, 84 dB $\mu$ V

Measure the difference of output signal voltage at pin 40 between 15.7 kHz component (video) and 117.5 MHz component (2nd harmonics).

Note 9: Differential gain / Differential phase

PIF input :  $f_p = 58.75$  MHz, standard television signal (V / S = 10 : 4 ramp waveform), 87.5%AM, 84 dB $\mu$ V

Measure differential gain and differential phase.

Note 10: Sync voltage level

PIF input :  $f_p = 58.75$  MHz, standard television signal (V / S = 10 : 4 ramp waveform), 87.5%AM, 84 dB $\mu$ V

Measure sync tip voltage level.

Note 11: AFT control steepness

PIF input :  $f_p = 58.75$  MHz, 84 dB $\mu$ V, CW

Measure AFT output voltage. ( $V_{AFT1}$ ) Raise input frequency by 20 kHz, measure AFT output voltage ( $V_{AFT2}$ ). AFT control steepness is calculated by following equality.

$$\text{AFT control steepness} = \Delta f / \Delta V = 20 / \Delta V \text{ [ kHz / V ]}$$

Note 12: AFT mute voltage

PIF : non input

SW<sub>1</sub> : GND, 2nd AGC : GND

Measure AFT output voltage.

Note 13: RF AGC maximum output voltage / minimum output voltage

(1) RF AGC maximum output voltage

PIF input :  $f_p = 58.75$  MHz,  $f_m = 15.7$  kHz, 30%AM, 20 dB $\mu$ V

Measure RF AFT output voltage.

(2) RF AGC minimum output voltage

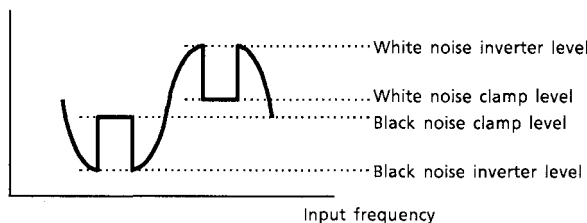
PIF input :  $f_p = 58.75$  MHz,  $f_m = 15.7$  kHz, 30%AM, 100 dB $\mu$ V

Measure RF AFT output voltage.

Note 14: Black & white noise inverter level and clamp level

PIF input :  $f_p = 57\sim 65$  MHz, 84 dB $\mu$ V

Supply DC voltage to 2nd AGC from external source, sweep input frequency.



<Converter circuit>

Note 15: Conversion gain

SIF input :  $f_s = 54.25$  MHz, 80 dB $\mu$ V

Measure 10.7 MHz (2nd SIF) component of output signal voltage at pin 8.

$$CG = [10.7 \text{ MHz level}] - 80 \text{ dB}\mu\text{V}$$

Note 16: 2nd SIF maximum output

SIF input :  $f_s = 54.25$  MHz, 120 dB $\mu$ V

Measure 10.7 MHz component of output signal voltage at pin 8.

## &lt;SIF circuit&gt;

## Note 17: AF output signal voltage

2nd SIF input :  $f_s = 10.7 \text{ MHz}$ ,  $f_m = 1 \text{ kHz}$ , 25 kHz / devi, 100 dB $\mu$ V

Measure AF output signal voltage at pin 42.

## Note 18: SIF input signal voltage sensitivity

2nd SIF input :  $f_s = 10.7 \text{ MHz}$ ,  $f_m = 1 \text{ kHz}$ , 25 kHz / devi, 100 dB $\mu$ V

Measure AF output signal voltage at pin 42. (This voltage is 0 dB) Lower input signal voltage gradually, measure the input signal voltage when output signal voltage at pin 42 is -3 dB.

## Note 19: -3 dB AF bandwidth

2nd SIF input :  $f_s = 10.4 \text{ MHz} \sim 11.0 \text{ MHz}$ ,  $f_m = 1 \text{ kHz}$ , 25 kHz / devi, 100 dB $\mu$ V

(1) Measure AF output signal voltage at pin 42. (This voltage is 0 dB) Lower input signal frequency gradually, measure the input signal frequency when output signal voltage at pin 42 is -3 dB. ( $BW_A \text{ lo}$ )

(2) Raise input signal frequency gradually, measure the input signal frequency when output signal voltage at pin 42 is -3 dB. ( $BW_A \text{ hi}$ )

The difference between ( $BW_A \text{ lo}$ ) and ( $BW_A \text{ hi}$ ) is -3 dB AF bandwidth.

## Note 20: Signal-noise ratio

(1) 2nd SIF input :  $f_s = 10.7 \text{ MHz}$ ,  $f_m = 1 \text{ kHz}$ , 25 kHz / devi, 100 dB $\mu$ V

Measure AF output signal voltage at pin 42. ( $V_A \text{ out}$ )

(2) 2nd SIF input :  $f_s = 10.7 \text{ MHz}$ , CW, 100 dB $\mu$ V

Measure AF output signal voltage at pin 42. ( $V_A \text{ out no-mod}$ )

Signal-noise ratio is calculated by following equality.

Signal-noise ratio =  $20 \log [(V_A \text{ out}) / (V_A \text{ out no-mod})]$

## Note 21: AM suppression

(1) 2nd SIF input :  $f_s = 10.7 \text{ MHz}$ ,  $f_m = 1 \text{ kHz}$ , 25 kHz / devi, 100 dB $\mu$ V

Measure AF output signal voltage at pin 42. ( $V_A \text{ out}$ )

(2) 2nd SIF input :  $f_s = 10.7 \text{ MHz}$ ,  $f_m = 1 \text{ kHz}$ , 30%AM, 100 dB $\mu$ V

Measure AF output signal voltage at pin 42. ( $V_A \text{ out AM}$ )

AM suppression calculated by following equality.

AM suppression =  $20 \log [(V_A \text{ out}) / (V_A \text{ out AM})]$

## Note 22: Total harmonic distortion

2nd SIF input :  $f_s = 10.7 \text{ MHz}$ ,  $f_m = 1 \text{ kHz}$ , 25 kHz / devi, 100 dB $\mu$ V

Measure total harmonic distortion of output signal at pin 42.

## Note 23: Signal meter output voltage

2nd SIF input :  $f_s = 10.7 \text{ MHz}$ , CW

Measure output voltage at pin 3, when input signal voltage are 100 dB $\mu$ V, 80 dB $\mu$ V, 50 dB $\mu$ V and 20 dB $\mu$ V.

## Note 24: Station detector bandwidth

2nd SIF input :  $f_s = 10.5 \text{ MHz} \sim 10.9 \text{ MHz}$ , CW, 100 dB $\mu$ V

Change input signal frequency, measure the bandwidth when output voltage at pin 1 is hi.

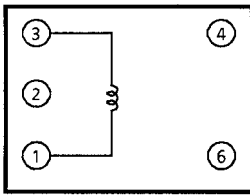
## Note 25: Station detector sensitivity

2nd SIF input :  $f_s = 10.7 \text{ MHz}$ , CW, 100 dB $\mu$ V

Lower input signal voltage gradually, measure the input signal voltage when output signal voltage at pin 1 turn Lo. from Hi.

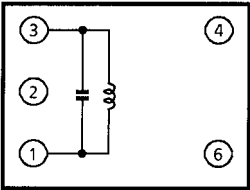
<COIL SPECIFICATION (bottom view)>

1. PIF / AFT COIL



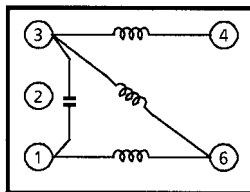
- PART NUMBER : 611SNS-1065Z (TOKO)
- CENTER FREQUENCY : 58.75 MHz
- ADJUSTMENT RANGE : 56 pF ± 3%
- Q (non-load) : 72 ± 20%
- EXTERNAL CAPACITOR : 56 pF

2. LOCAL OSC COIL



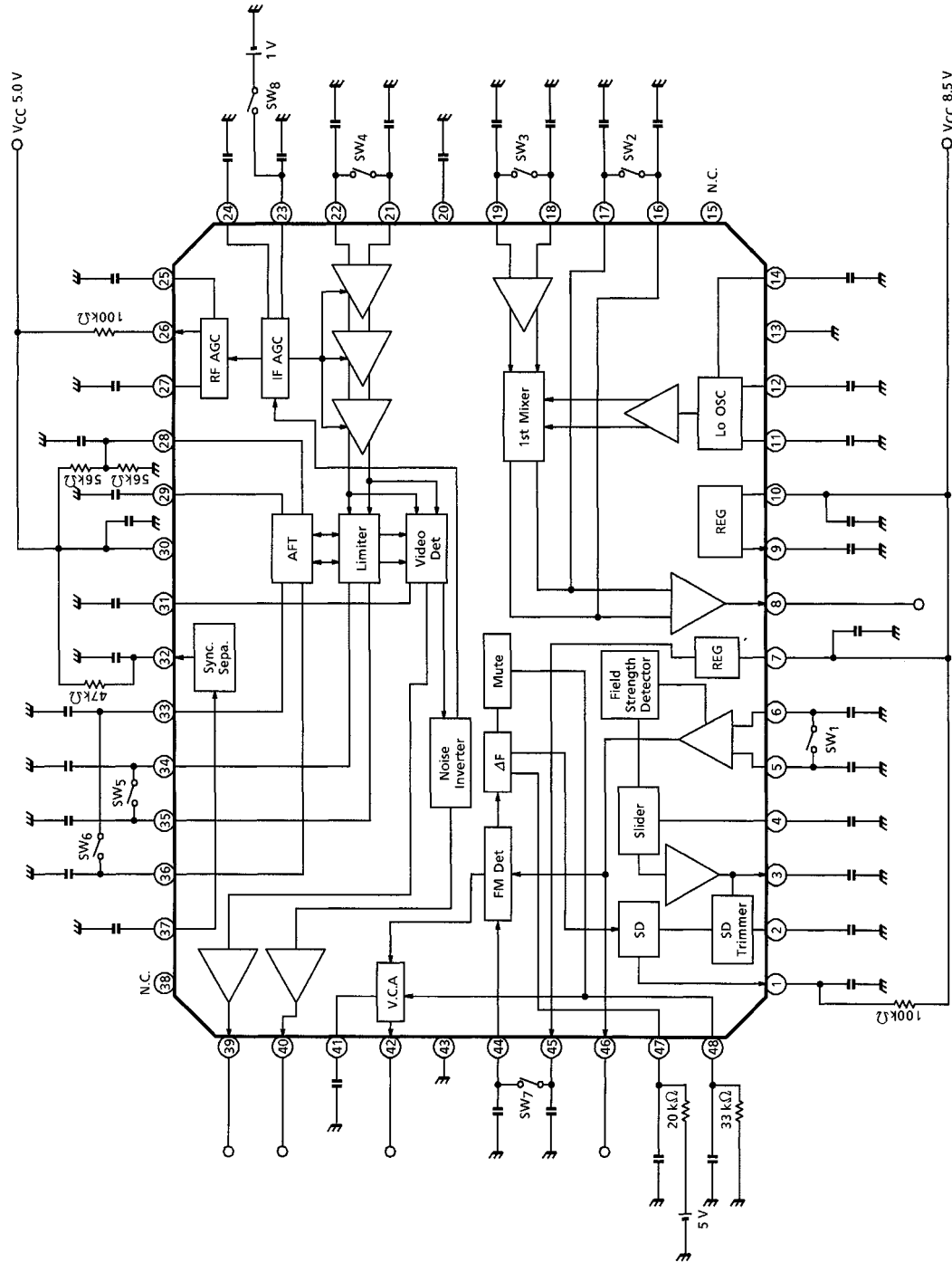
- PART NUMBER : 600GJS-9796IB (TOKO)
- CENTER FREQUENCY : 40 MHz
- ADJUSTMENT RANGE : 40 MHz ± 3%
- Q (non-load) : 72 ± 20%
- INTERNAL CAPACITOR : 82 pF

3. FM COIL



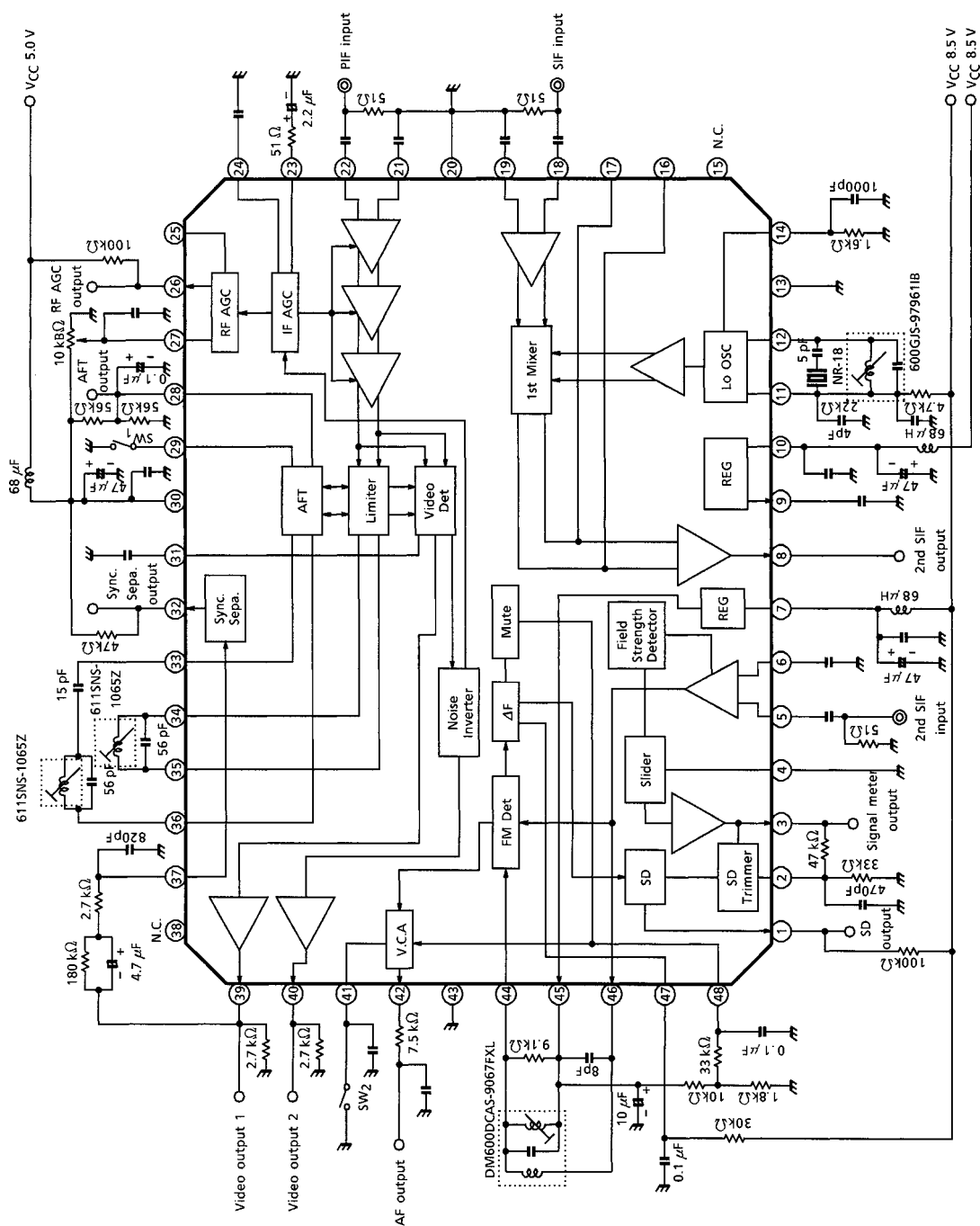
- PART NUMBER : DM600DCAS-9067FXL (TOKO)
- CENTER FREQUENCY : 10.7 MHz
- ADJUSTMENT RANGE : 10.7 MHz ± 50 kHz
- Q (non-load) : 41 ± 20%
- INTERNAL CAPACITOR : 82 pF

**TEST CIRCUIT 1**  
DC test

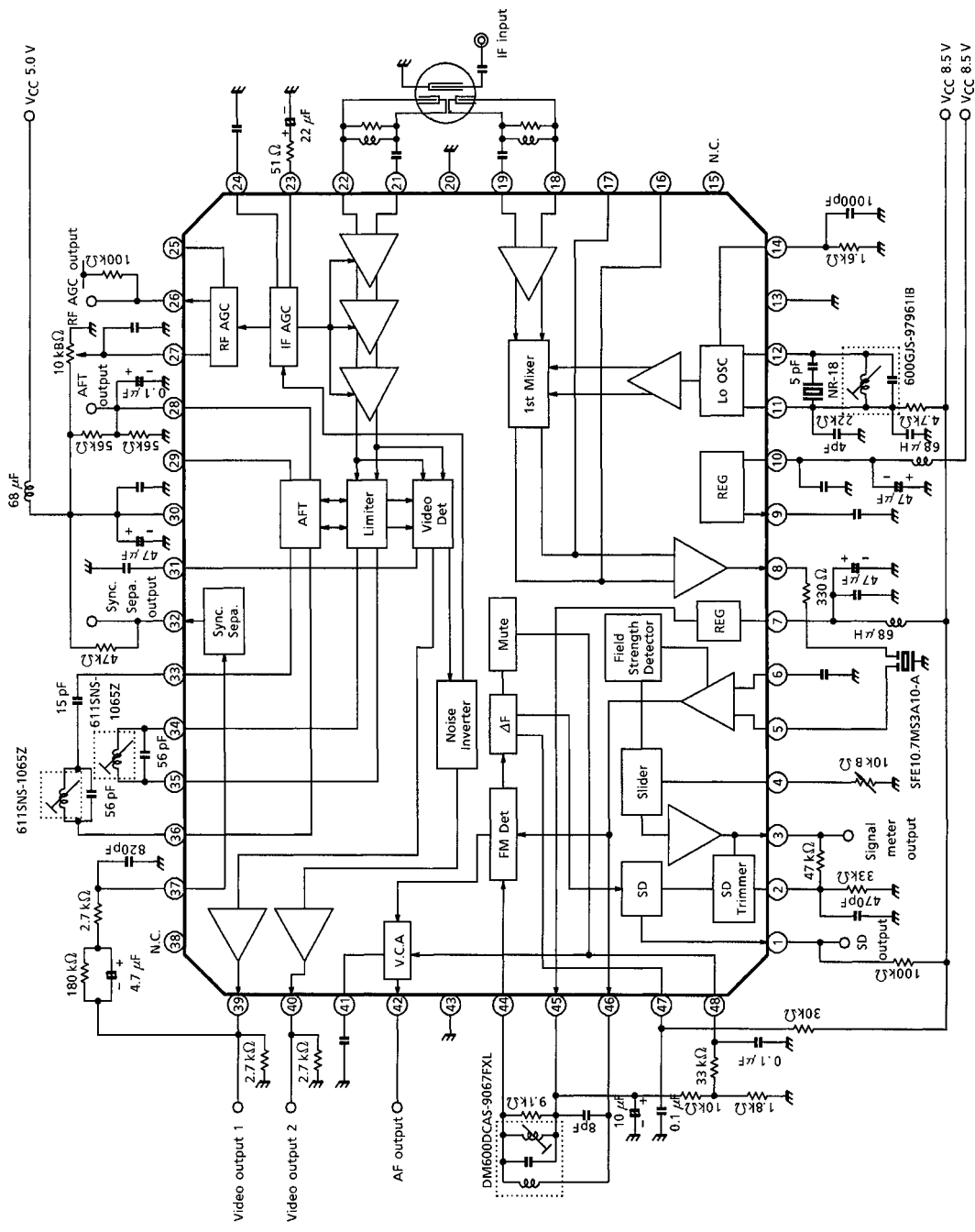


(Note) Unless otherwise specified, capacitance is 0.01 μF

**TEST CIRCUIT 2**  
**AC test**



(Note) Unless otherwise specified, capacitance is 0.01μF

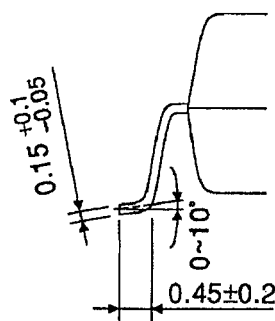
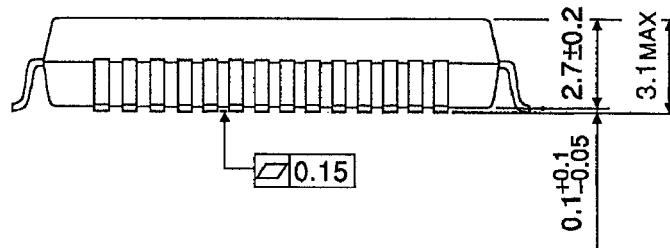
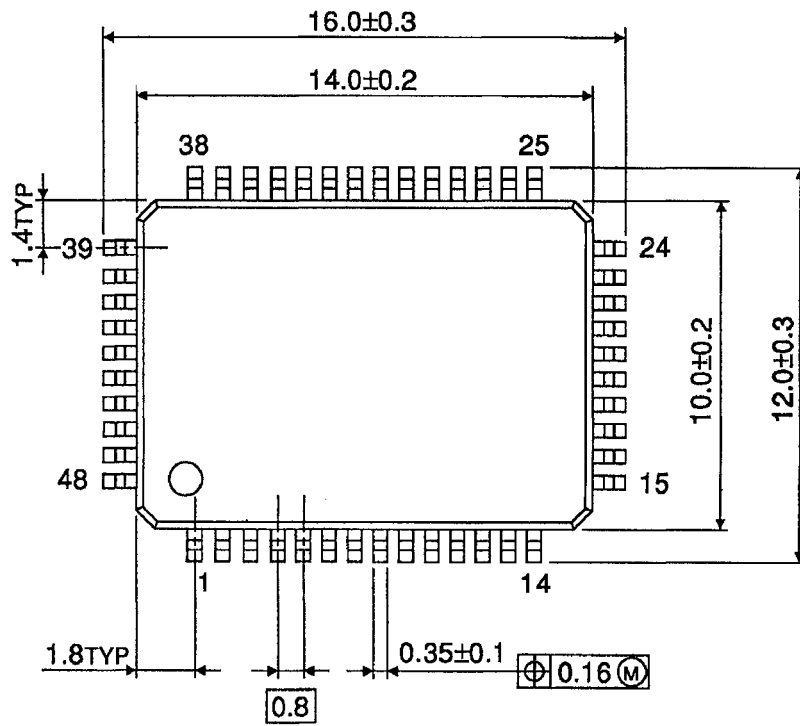
**APPLICATION CIRCUIT**

(Note) Unless otherwise specified, capacitance is 0.01  $\mu$ F

**PACKAGE DIMENSIONS**

QFP48-P-1014-0.80

Unit : mm



Weight: 0.83 g(Typ.)