TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA1209F

FOR LCD TVS, SEPARATE CARRIER PIF AND SIF SYSTEMS

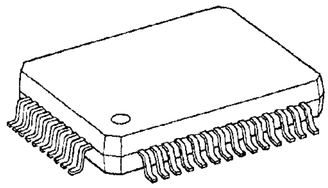
FEATURES

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

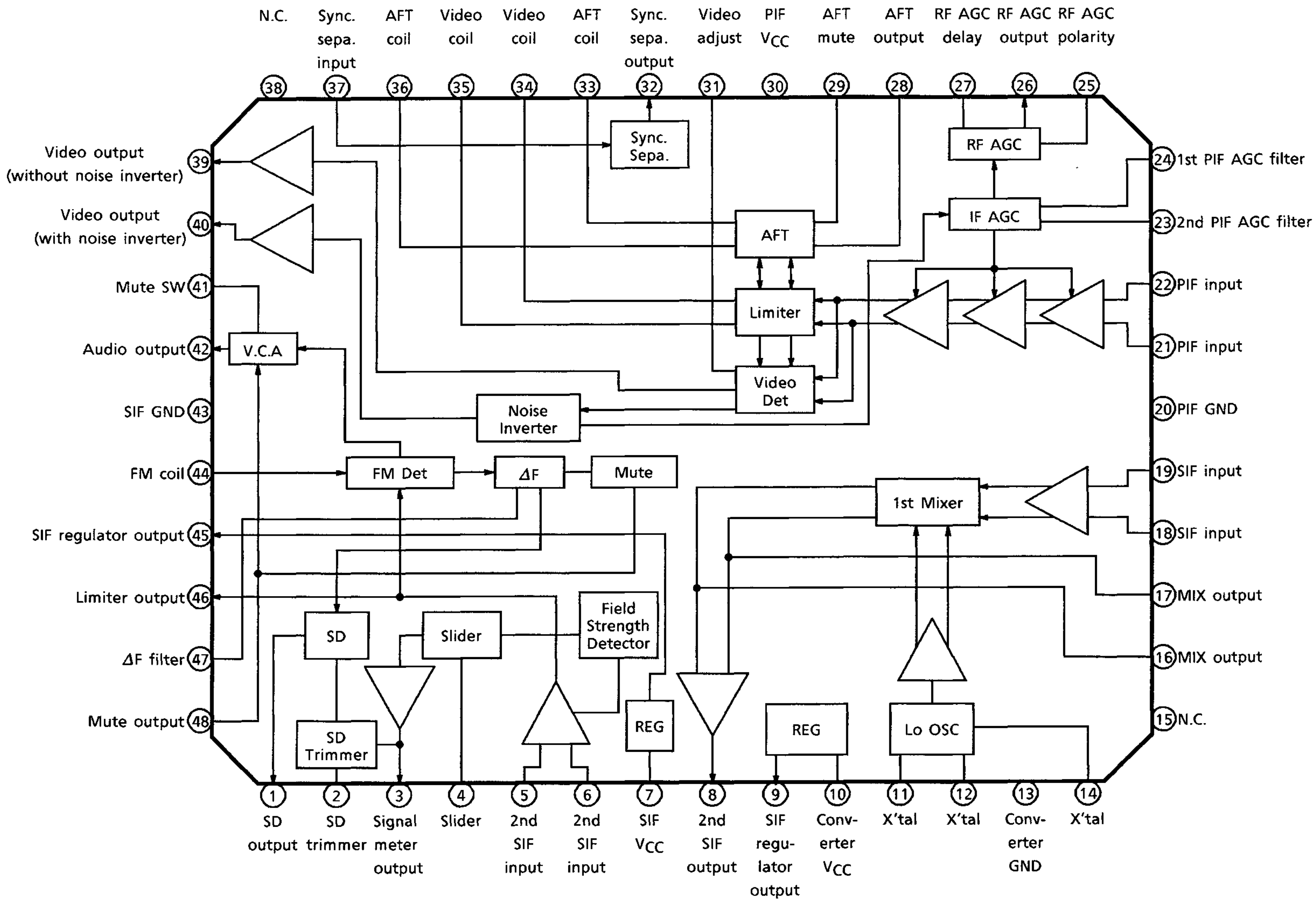


QFP48-P-1014-0.80

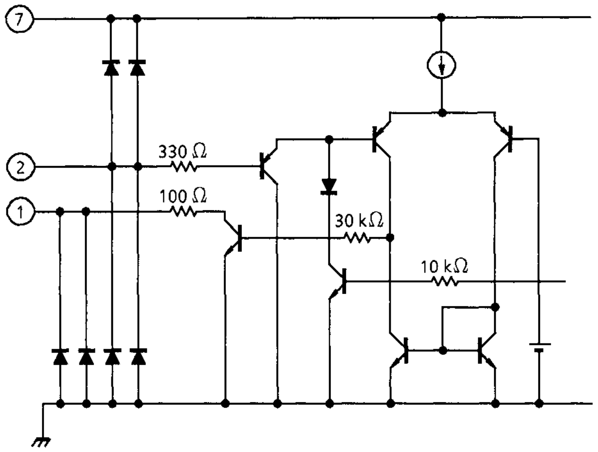
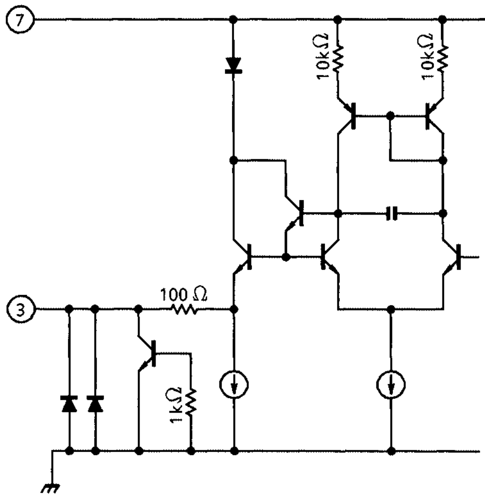
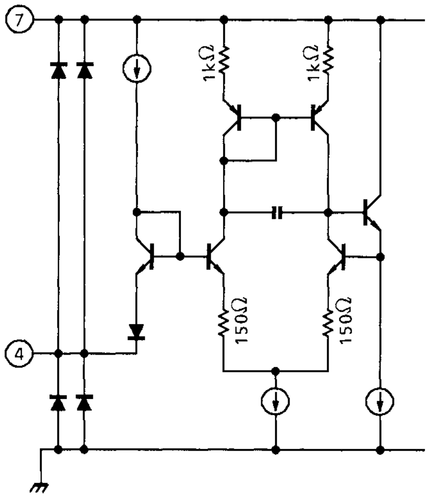
Weight: 0.83g (Typ.)

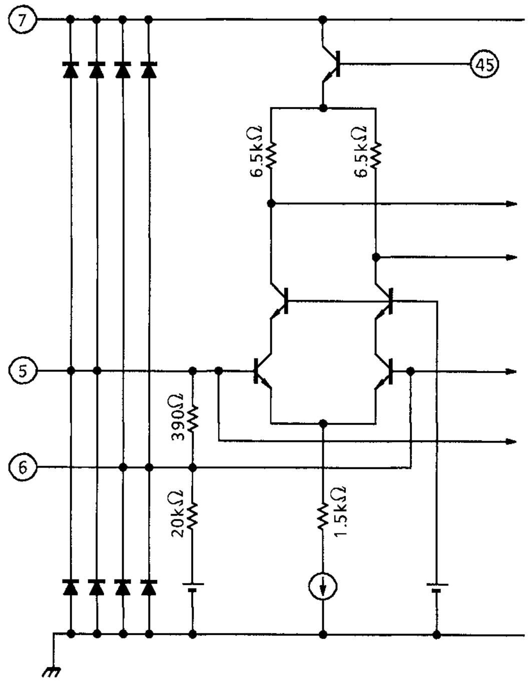
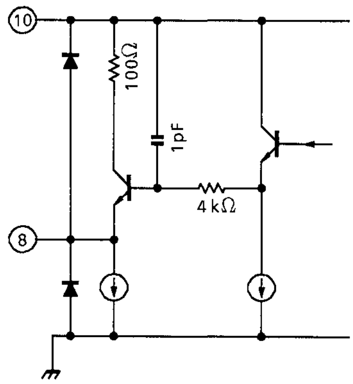
Note: This product is weak for surge voltage. Please hadle with care.

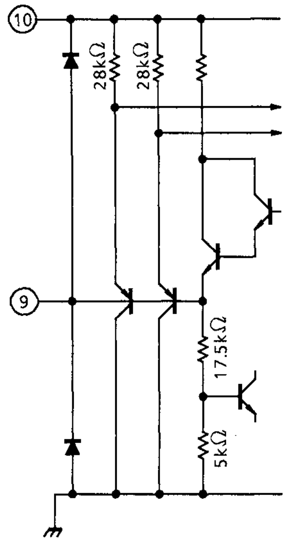
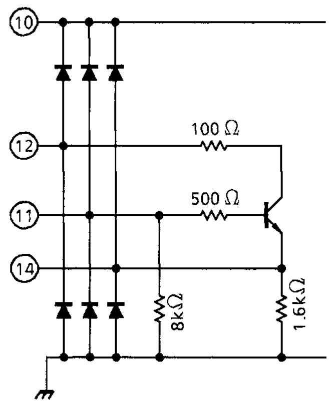
BLOCK DIAGRAM

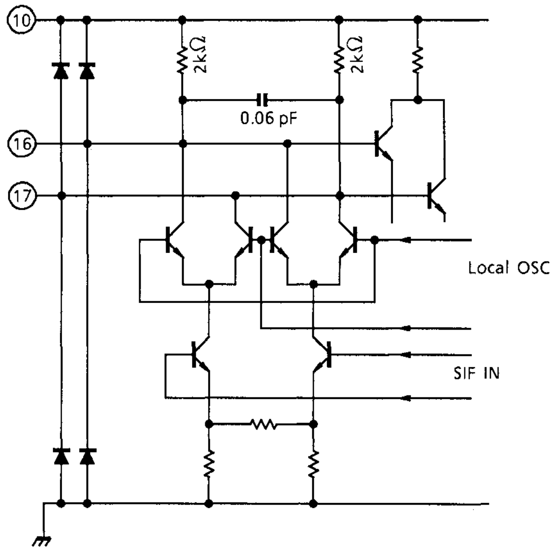
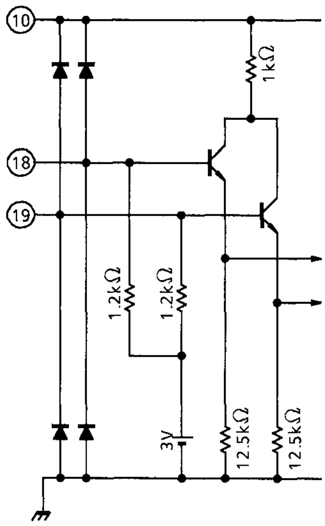


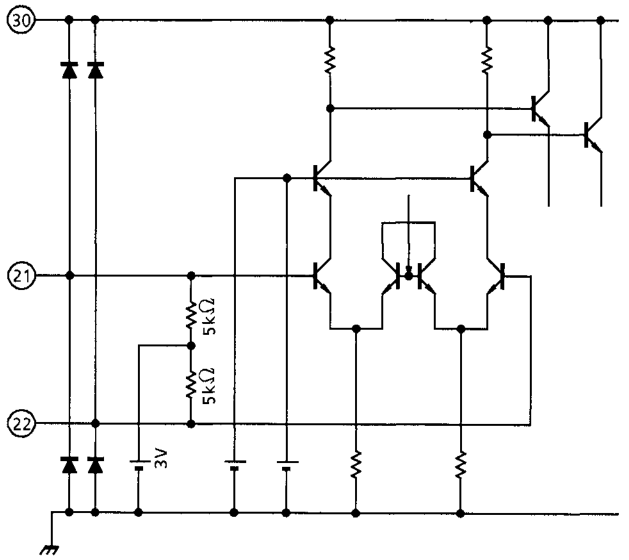
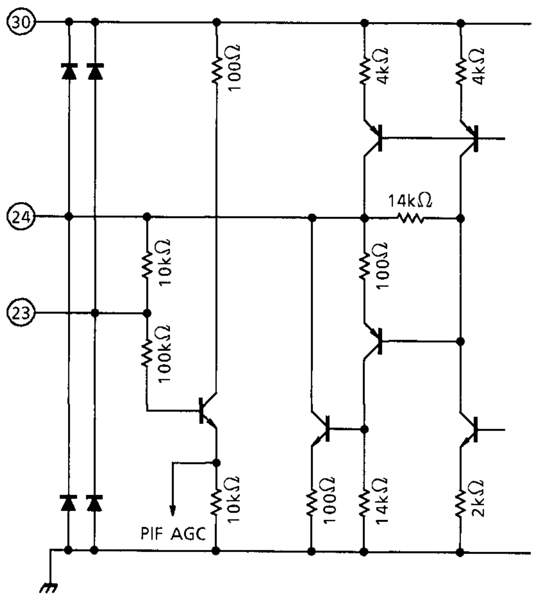
TERMINAL FUNCTION

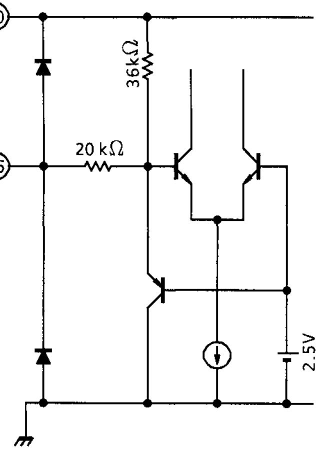
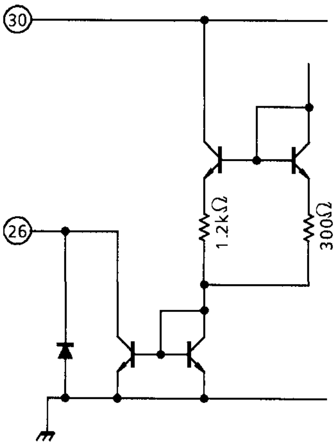
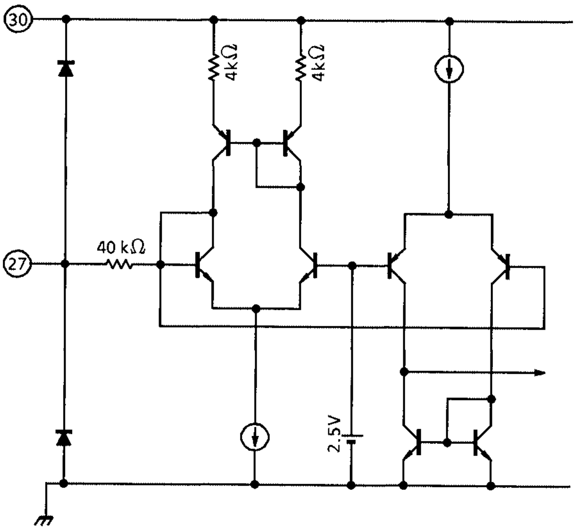
PIN No.	PIN NAME	FUNCTION	INTERFACE
1	SD Output	SD Output terminal. (tuned : Hi, not tuned : Lo) This terminal is open collector output. Connect pull-up register.	
2	SD Trimmer	Termina to control SD sensitivity.	
3	Signal meter Output	Outputted DC voltage rises in proportion to input level.	
4	Slider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

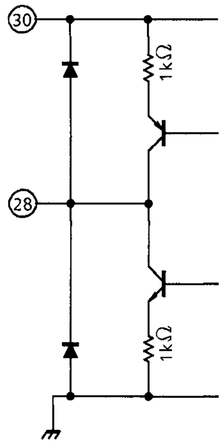
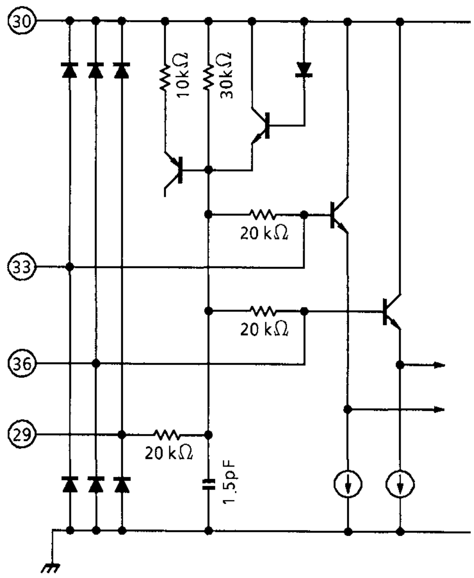
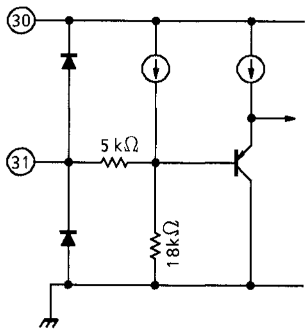
<table>
<tr><th>PIN No.</th><th>PIN NAME</th><th>FUNCTION</th><th>INTERFACE</th></tr>
<tr><td>5</td><td>2nd SIF Input</td><td>2nd SIF input terminal. Input 2nd SIF output signal through 10.7 MHz ceramic filter. Built-in matching register for ceramic filter (330 Ω).</td><td rowspan="2">
</td></tr>
<tr>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

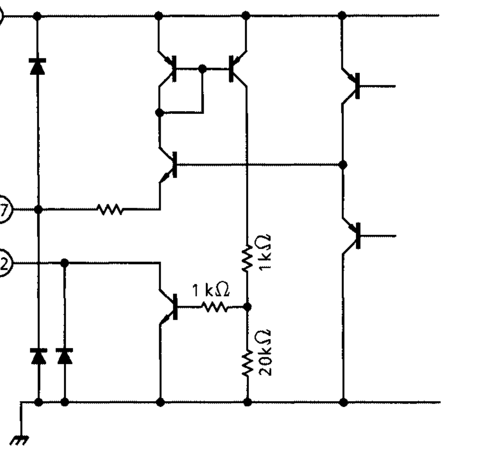
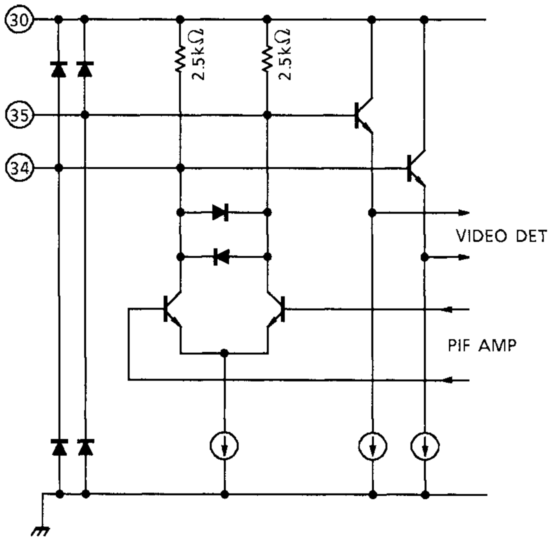
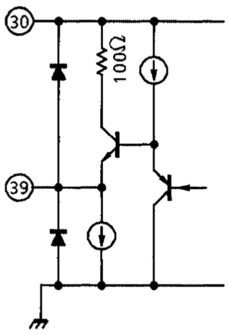
PIN No.	PIN NAME	FUNCTION	INTERFACE
9	SIF Regulator Output	SIF regulator output terminal (Typ. : 4.8 V)	
10	Converter V_{CC}	Converter V_{CC} (8.5 V is recommended.)	—
11	X'tal	Terminal for connecting crystal resonator to generate local OSC signal.	
12			
14		Emitter of local OSC circuit. Connect register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

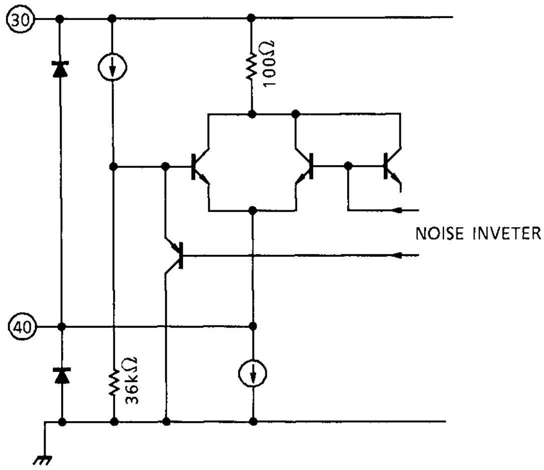
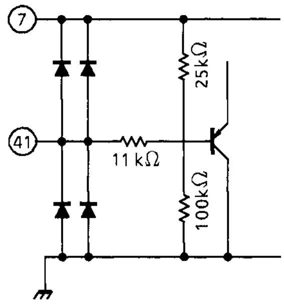
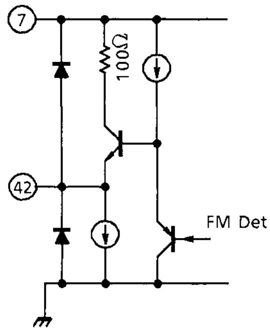
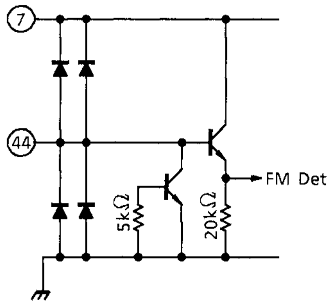
PIN No.	PIN NAME	FUNCTION	INTERFACE
16 17	MIX Output	Mixer output terminal.	
18 19	SIF Input	SIF input terminal. (input impedance : 1.2 kΩ (Typ.))	
20	PIF GND	PIF GND.	—

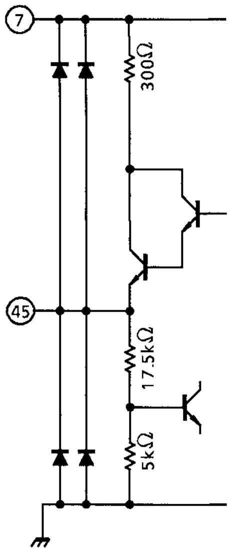
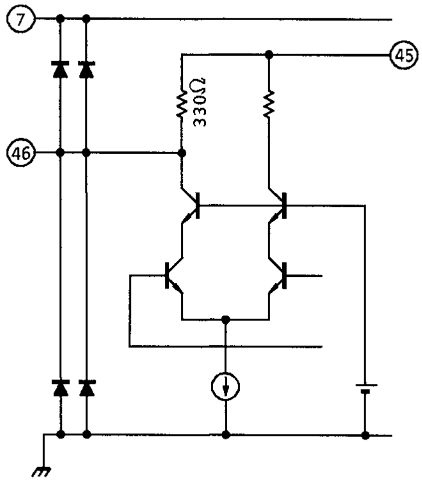
<table>
<tr><th>PIN No.</th><th>PIN NAME</th><th>FUNCTION</th><th>INTERFACE</th></tr>
<tr><td>21</td><td rowspan="2">PIF Input</td><td rowspan="2">PIF Input terminal.
(input impedance : 5 kΩ (Typ.))</td><td rowspan="2"></td></tr>
<tr><td>22</td></tr>
<tr><td>23</td><td>2nd PIF AGC filter</td><td rowspan="2">Terminal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

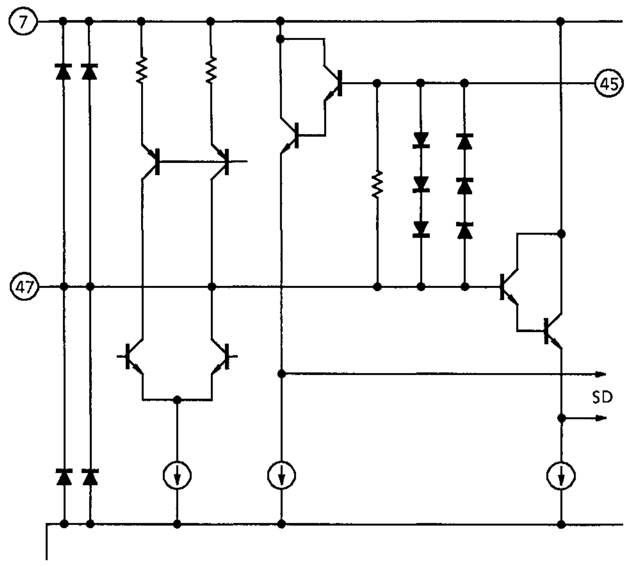
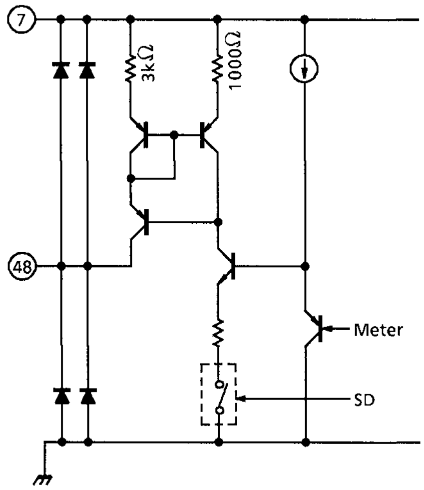
PIN No.	PIN NAME	FUNCTION	INTERFACE
25	RF AGC Polarity	Terminal to switch RF AGC Polarity. (open : reverse, GND : forward)	
26	RF AGC Output	RF AGC Output terminal. (open-collector output)	
27	RF AGC Delay	Changing comparator reference voltage adjusts RF AGC delay point.	

<table>
<tr><th>PIN No.</th><th>PIN NAME</th><th>FUNCTION</th><th>INTERFACE</th></tr>
<tr><td>28</td><td>AFT Output</td><td>AFT detector output terminal based on double balanced multiplier.</td><td>
</td></tr>
<tr><td>29</td><td>AFT Mute</td><td>AFT output is muted, when this terminal is connected to GND.</td><td rowspan="3">
</td></tr>
<tr><td>33</td><td rowspan="2">AFT Coil</td><td rowspan="2">Connect AFT detection coil.</td></tr>
<tr><td>36</td></tr>
<tr><td>30</td><td>PIF V_{CC}</td><td>PIF V_{CC} terminal.
(5 V is recommended.)</td><td>—</td></tr>
<tr><td>31</td><td>Video adjust</td><td>Video signal output voltage adjustment terminal.
Changing this terminal voltage, it is possible to adjust video signal output voltage to 1.0 V_{p-p}.
(With no adjustment, video signal output voltage is 1 V_{p-p} (Typ.))
To prevent noise, connecting capacitor (0.01 μF) to GND is recommended.</td><td>
</td></tr>
</table>

PIN No.	PIN NAME	FUNCTION	INTERFACE
32	Sync. sepa.Output	Sync. sepa. input and output terminal.	
37	Sync. sepa.Input		
34	Video Coil	Connect video detection coil.	
35			
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	ΔF filter	Connect capacitor for ΔF 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_{CC} PIF	8	V
	V_{CC} CONV	13	
	V_{CC} SIF	13	
Power Dissipation	P_{Dmax} (Note)	845	mW
Operating Temperature	T_{opr}	−20~75	°C
Storage Temperature	T_{stg}	−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_{CC}	30	4.5	5.0	5.5	V
CONV V_{CC}	10	8.0	8.5	9.0	
SIF V_{CC}	7				

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	CONDITION	MIN	TYP	MAX	UNIT
Supply Current	I_{PIF}	1	—	7.5	11	15	mA
	I_{CONV}		—	8.5	13	17	
	I_{SIF}		—	13	18.5	24	
Terminal Voltage	V5		SW_1 : off	1.7	2.0	2.3	V
	V6		SW_1 : off	1.7	2.0	2.3	
	V8		—	3.8	4.1	4.4	
	V9		—	4.5	4.8	5.1	
	V16		SW_2 : off	6.5	6.8	7.1	
	V17		SW_2 : off	6.5	6.8	7.1	
	V18		SW_3 : off	2.8	3.1	3.4	
	V19		SW_3 : off	2.8	3.1	3.4	
	V21		SW_4 : off	2.4	2.7	3.0	
	V22		SW_4 : 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_6 : off	4.7	4.85	5.0	
	V34		SW_5 : off	4.4	4.6	4.8	
	V35		SW_5 : off	4.4	4.6	4.8	
	V36		SW_6 : 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_7 : 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 V, SIF (CONV) V_{CC} = 8.5 V, Ta = 25°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	$V_{p\text{-}p}$
Signal-Noise Ratio	S/N P		(Note 2)	50	60	—	dB
−3dB Video Bandwidth	fc video		(Note 3)	4.0	5.0	—	MHz
PIF Input Signal Voltage Sensitivity	V_P min		(Note 4)	—	25	35	dBμV
Maximum Input Signal Voltage	V_P max		(Note 5)	95	100	—	dBμV
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	°
Sync Voltage Level	V_P sync		(Note 10)	0.7	0.9	1.1	V
AFT Control Steepness	Δf / ΔV		(Note 11)	12	25	38	kHz/ V
AFT Mute Voltage	V_{AFT} mute		(Note 12)	2.2	2.5	2.8	V
RF AGC Maximum Output Voltage	V_{RFAGC} max		(Note 13)	4.6	4.9	—	V
RF AGC Minimum Output Voltage	V_{RFAGC} min			—	0	0.3	V
Black Noise Invert Level	V_{Bth}		(Note 14)	0.2	0.5	0.8	V
Black Noise Clamp Level	V_{Bcl}			0.9	1.2	1.5	V
White Noise Invert Level	V_{Wth}			2.0	2.3	2.5	V
White Noise Clamp Level	V_{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	—	dBμV

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_{rms}
SIF Input Signal VoltageSensitivity		V_A lin		(Note 18)	—	30	35	dBμV
−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	(20dBμV)	V_{sld} 20		(Note 23)	—	0.6	—	V
	(50dBμV)	V_{sld} 50			1.9	2.6	3.3	
	(80dBμV)	V_{sld} 80			4.9	5.6	6.3	
	(100dBμV)	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	dBμV

TEST CONDITION (Unless otherwise specified, SW_1 : OFF, SW_2 : 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 dBμV
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 dBμV (AM)
(2) f_p = 58.75 MHz, CW, 84 dBμV (non-mod.)
S / N [dB] = 20 log ([output signal voltage] / [output signal voltage (non-mod)]×6)

Note 3: −3 dB video width
PIF input : f_p = 58.75 MHz, 84 dBμV, 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 dBμV (frequency : fixed)
SG : 1 58.65 MHz~45 MHz, 64 dBμV (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 dBμV
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 dBμV
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 dBμV
(2) SG : 2 54.25 MHz, 74 dBμV
(3) SG : 3 55.17 MHz, 74 dBμV
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 dBμV
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 dBμV
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 dBμV
Measure differential gain and differential phase.

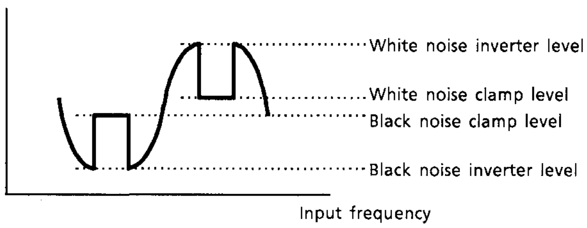
Note 10: Sync voltage level
PIF input : f_p = 58.75 MHz, standard television signal (V / S = 10 : 4 ramp waveform), 87.5%AM, 84 dBμV
Measure sync tip voltage level.

Note 11: AFT control steepness
PIF input : f_p = 58.75 MHz, 84 dBμV, 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.
AFT control steepness = $\Delta f / \Delta V = 20 / \Delta V$ [kHz / V]

Note 12: AFT mute voltage
PIF : non input
SW_1 : 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 dBμV
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 dBμV
Measure RF AFT output voltage.

Note 14: Black & white noise inverter level and clamp level
PIF input : f_p = 57~65 MHz, 84 dBμV
Supply DC voltage to 2nd AGC from external source, sweep input frequency.



<Converter circuit>

Note 15: Conversion gain
SIF input : fs = 54.25 MHz, 80 dBμV
Measure 10.7 MHz (2nd SIF) component of output signal voltage at pin 8.
CG = [10.7 MHz level]−80 dBμV

Note 16: 2nd SIF maximum output
SIF input : fs = 54.25 MHz, 120 dBμV
Measure 10.7 MHz component of output signal voltage at pin 8.

<SIF circuit>

Note 17: AF output signal voltage

2nd SIF input : fs = 10.7 MHz, f_m = 1 kHz, 25 kHz / devi, 100 dBμV

Measure AF output signal voltage at pin 42.

Note 18: SIF input signal voltage sensitivity

2nd SIF input : fs = 10.7 MHz, f_m = 1 kHz, 25 kHz / devi, 100 dBμV

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 : fs = 10.4 MHz~11.0 MHz, f_m = 1 kHz, 25 kHz / devi, 100 dBμV

(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 lo)

(2) Raise input signal frequency gradually, measure the input signal frequency when output signal voltage at pin 42 is −3 dB. (BW_A hi)

The difference between (BW_A lo) and (BW_A hi) is −3 dB AF bandwidth.

Note 20: Signal-noise ratio

(1) 2nd SIF input : fs = 10.7 MHz, f_m = 1 kHz, 25 kHz / devi, 100 dBμV
Measure AF output signal voltage at pin 42. (V_A out)

(2) 2nd SIF input : fs = 10.7 MHz, CW, 100 dBμV
Measure AF output signal voltage at pin 42. (V_A out no-mod)
Signal-noise ratio is calculated by following equality.

Signal-noise ratio = 20 λog [(V_A out) / (V_A out no-mod)]

Note 21: AM suppression

(1) 2nd SIF input : fs = 10.7 MHz, f_m = 1 kHz, 25 kHz / devi, 100 dBμV
Measure AF output signal voltage at pin 42. (V_A out)

(2) 2nd SIF input : fs = 10.7 MHz, f_m = 1 kHz, 30%AM, 100 dBμV
Measure AF output signal voltage at pin 42. (V_A out AM)
AM suppression calculated by following equality.

AM suppression = 20 λog [(V_A out) / (V_A out AM)]

Note 22: Total harmonic distortion

2nd SIF input : fs = 10.7 MHz, f_m = 1 kHz, 25 kHz / devi, 100 dBμV

Measure total harmonic distortion of output signal at pin 42.

Note 23: Signal meter output voltage

2nd SIF input : fs = 10.7 MHz, CW

Measure output voltage at pin 3, when input signal voltage are 100 dBμV, 80 dBμV, 50 dBμV and 20 dBμV.

Note 24: Station detector bandwidth

2nd SIF input : fs = 10.5 MHz~10.9 MHz, CW, 100 dBμV

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

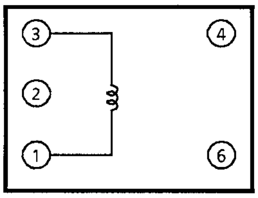
Note 25: Station detector sensitivity

2nd SIF input : fs = 10.7 MHz, CW, 100 dBμV

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

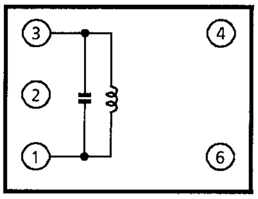
<COIL SPECIFICATION (bottom view)>

1. PIF / AFT COIL



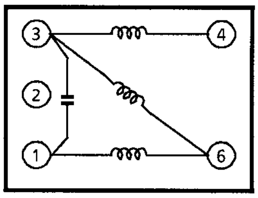
- PART NUMBER : 611SNS-1065Z (TOKO)
- CENTER FREQUENCY : 58.75 MHz
- ADJUSTMENT RANGE : 56 pF ± 3%
- Q (non-load) : 72 ± 20%
- EXTERNAL CAPACITOR : 56 pF

2. LOCAL OSC COIL



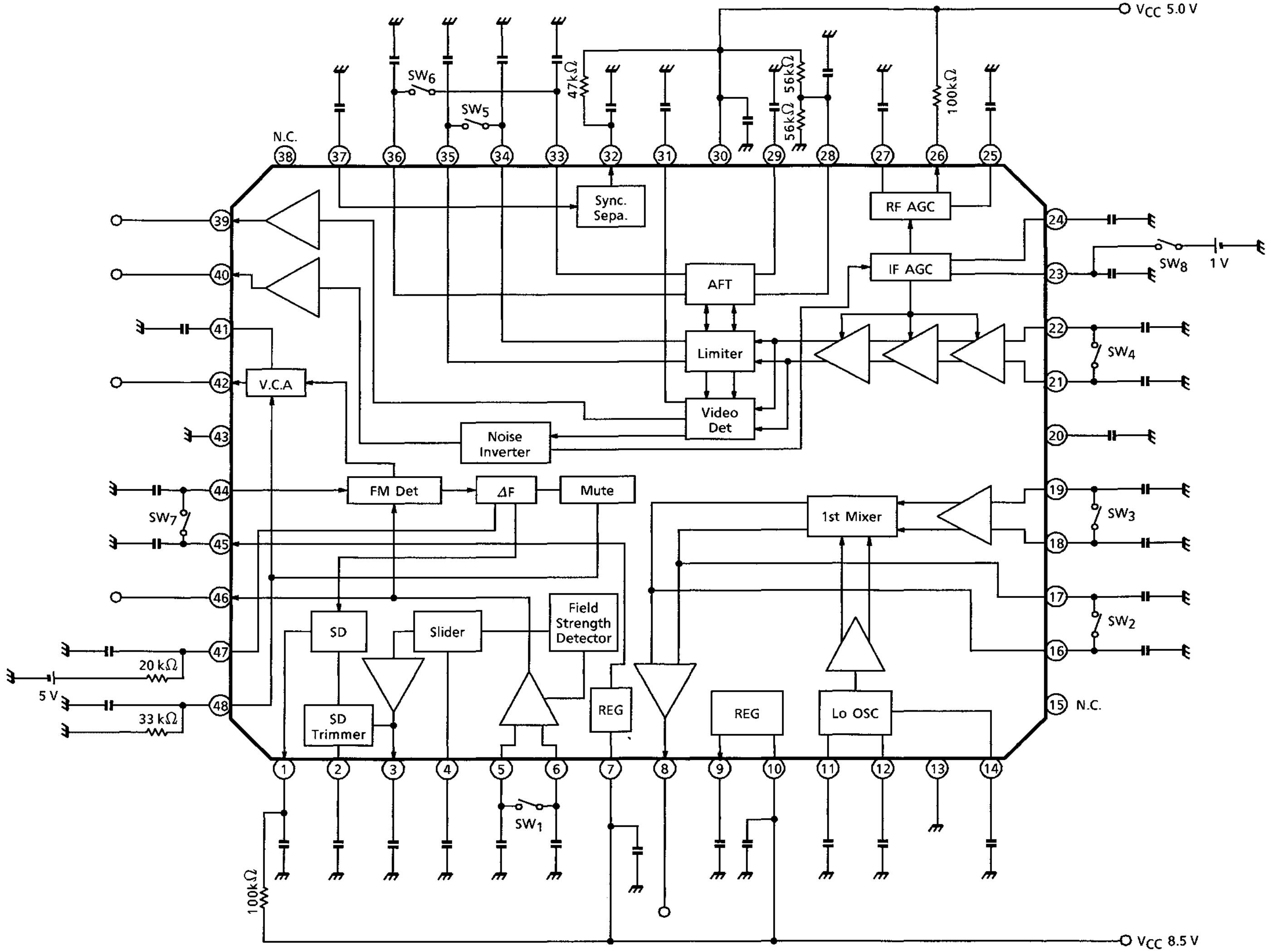
- PART NUMBER : 600GJS-9796IB (TOKO)
- CENTER FREQUENCY : 40 MHz
- ADJUSTMENT RANGE : 40 MHz ± 3%
- Q (non-load) : 72 ± 20%
- INTERNAL CAPACITOR : 82 pF

3. FM COIL



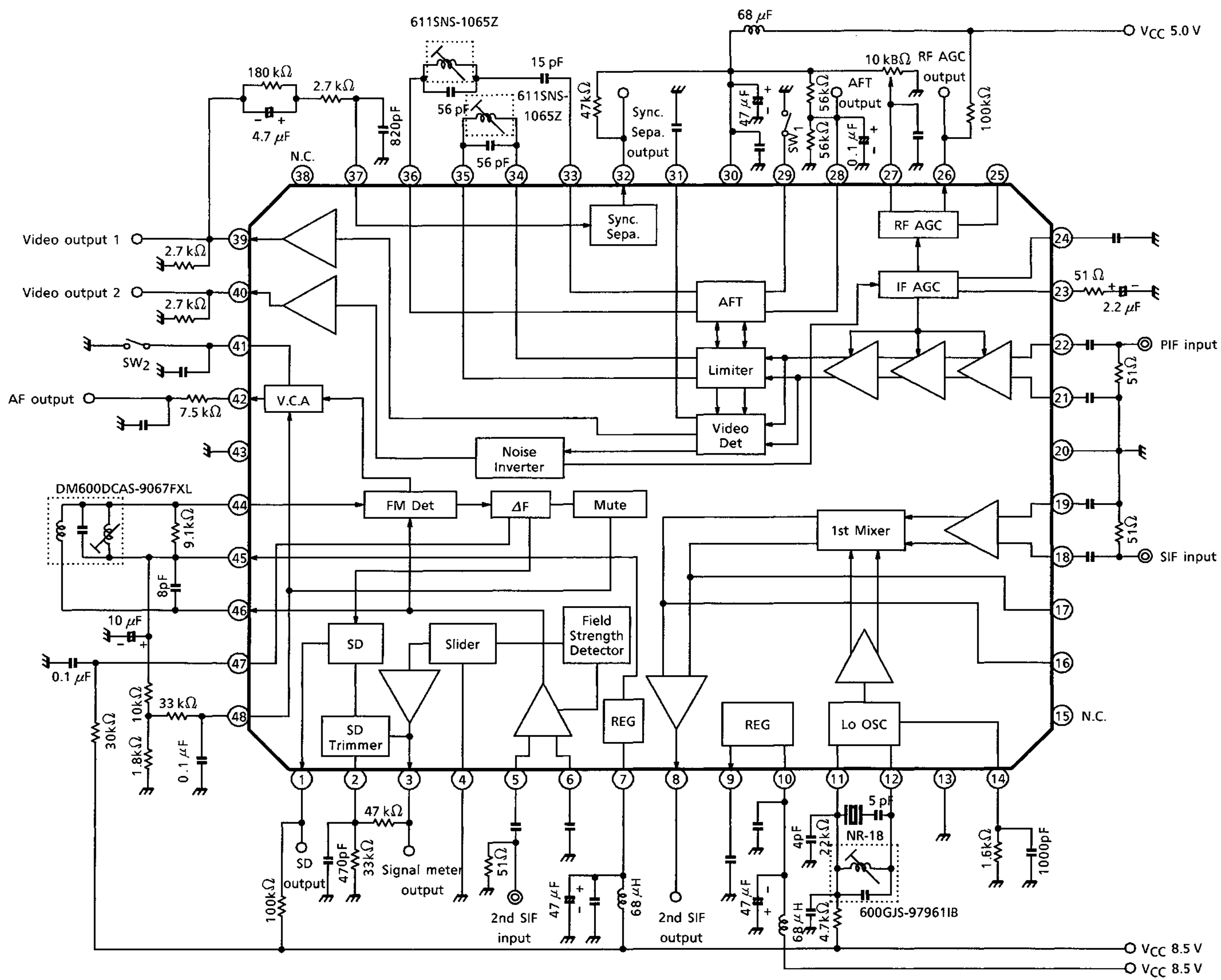
- PART NUMBER : DM600DCAS-9067FXL (TOKO)
- CENTER FREQUENCY : 10.7 MHz
- ADJUSTMENT RANGE : 10.7 MHz ± 50 kHz
- Q (non-load) : 41 ± 20%
- INTERNAL CAPACITOR : 82 pF

TEST CIRCUIT 1
DC test



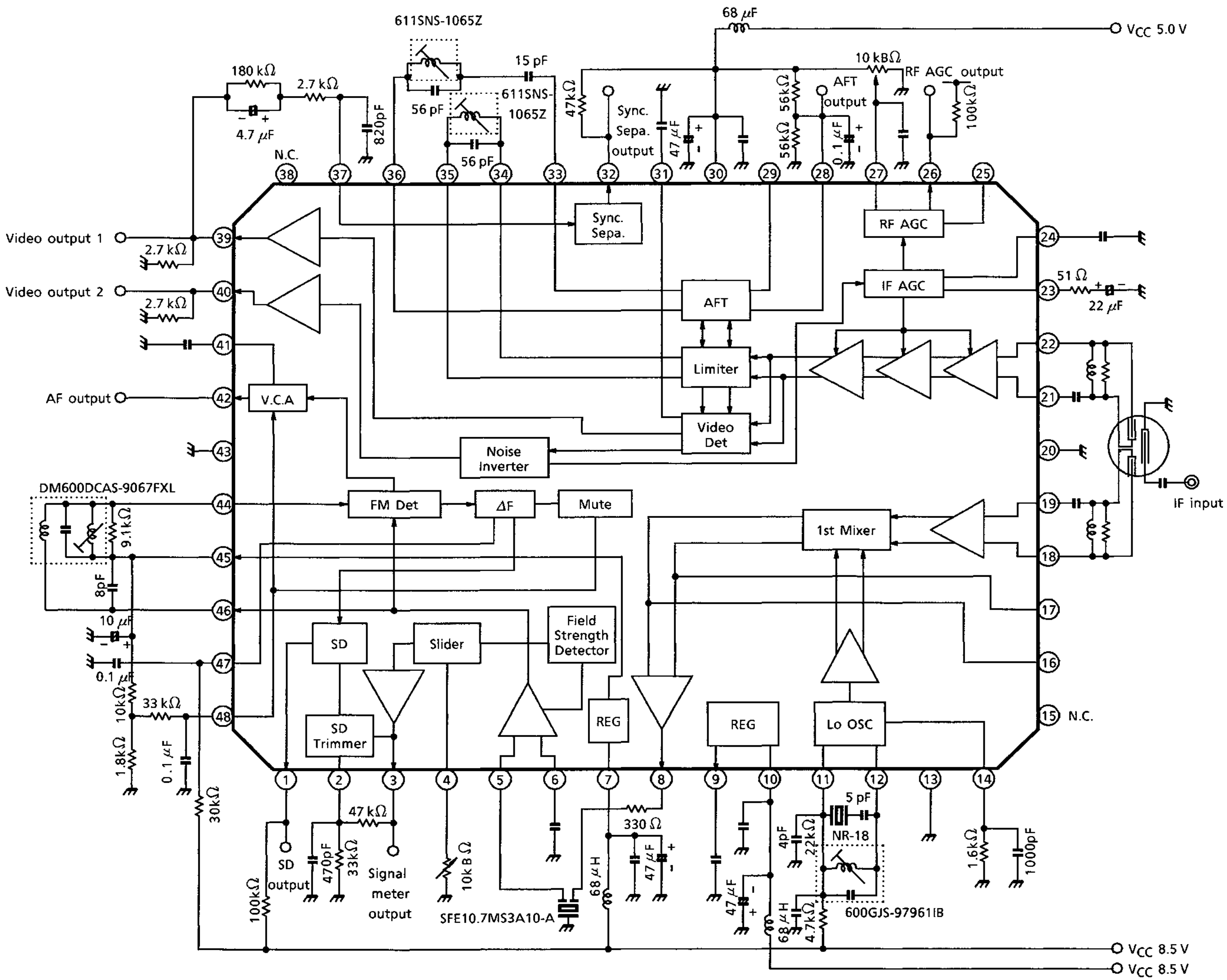
(Note) Unless otherwise specified, capacitance is 0.01 μF

TEST CIRCUIT 2
AC test



(Note) Unless otherwise specified, capacitance is 0.01μF

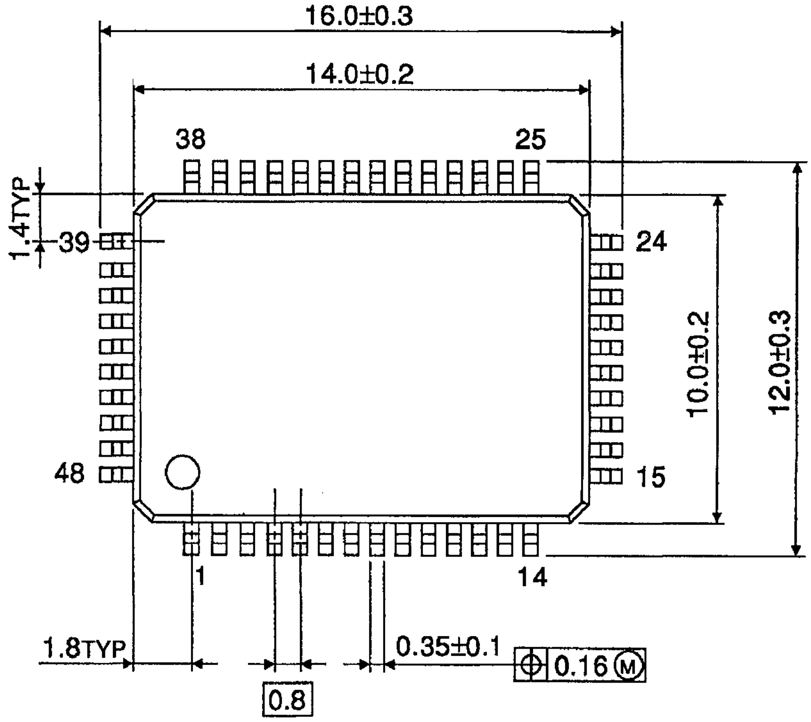
APPLICATION CIRCUIT

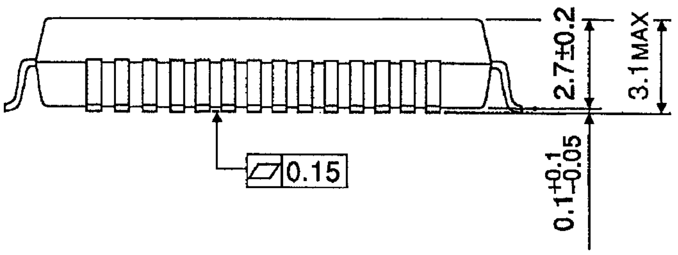


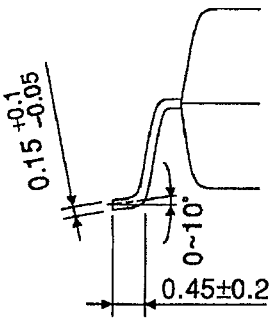
(Note) Unless otherwise specified, capacitance is 0.01 μF

PACKAGE DIMENSIONS

QFP48-P-1014-0.80 Unit : mm







Weight: 0.83 g(Typ.)