



SANYO Semiconductors

DATA SHEET

Monolithic Linear IC

LA1247 — AM Electronic Tuner

The LA1247 is a high-performance IC developed for AM electronic tuning systems. It performs all the functions needed for AM tuner systems and also provides auto search stop signal, local oscillation buffer output, low-level local oscillation. Moreover, the local oscillation is stable from LW to SW, facilitating multiband applications.

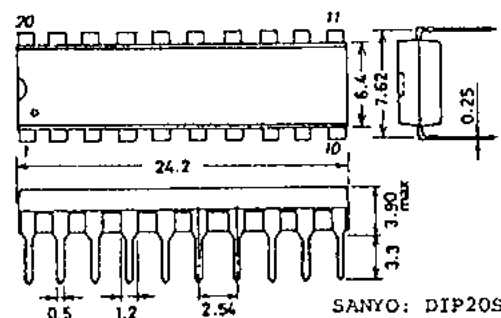
Functions

- RF amplification
- OSC (with ALC)
- Detection
- Signal meter drive output
(also used as auto search stop signal)
- Others
- MIX
- IF amplification
- AGC
- Local oscillation buffer output

Features

1. Narrow-band signal meter: Usable as auto search stop signal (possible to make wide-band)
Signal meter output 1/2 frequency ± 1.5 kHz typ.
2. Local oscillation buffer output: Easy to design electronic tuning frequency display
3. LSC (with ALC): Stabilized oscillation output for varactor diode and improved tracking error
4. RF amplification: Excellent usable sensitivity (45 dB/m typ.) due to low noise transistor cascode connection
5. MIX: Highly resistant to spurious interference, IF interference due to double balanced type differential MIX (IF interference = 85 dB typ.)
6. Low noise: Good S/N (57 dB typ.) for medium input
7. VCC variation compensation: Little variation in gain, distortion, etc. (8 to 15 V)
8. Pop noise reduction: Possible to reduce pop noise at the time of VCC-on, mode-on by selecting AGC time constant
9. Meeting AM stereo requirements: Subchannel S/N is more improved as compared with the LA1245.

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Case Outline 3021B-D20SIC
(unit:mm)

Specifications and information herein are subject to change without notice.

SANYO Electric Co., Ltd. Semiconductor Company

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8029TA/2126KI/8044KI/6233KI, TS 秀 No.1304-1/11

Maximum Ratings at $T_a = 25^\circ\text{C}$

				unit
Supply voltage	V_{CC} max	Pin 8, 14	16	V
Output voltage	V_O	Pin 5, 7	24	V
Input voltage	V_I	Pin 3	5.6	V
Supply current	I_{CC} max	Pin 5 + 7 + 8 + 14	32	mA
Output high drive current	I_{18}	Pin 18	5	mA
	I_{20}	Pin 20	2	mA
Allowable power dissipation	P_D max	See Fig. 2	700	mW
Operating temperature	T_{opg}		$-20 \sim +70$	$^\circ\text{C}$
Storage temperature	T_{stg}		$-40 \sim +125$	$^\circ\text{C}$

Recommended Operating Condition at $T_a = 25^\circ\text{C}$

				unit
Recommended supply voltage	V_{CC}		12	V
Operating voltage range	V_{CC}		8 ~ 16	V

Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{ V}$, $f_r = 1\text{ MHz}$, $f_m = 400\text{ Hz}$, at specified test circuit (based on application circuit).

			min	typ	max	unit
Current dissipation	I_{CC} (1)	quiescent	16.0	25.0	35.0	mA
	I_{CC} (2)	with 107 dB μ input	19.0	29.0	40.0	mA
Detection output	V_O (1)	with 23 dB μ input, mod. 30 %	-27.5	-23.0	-18.5	dBm
	V_O (2)	with 80 dB μ input, mod. 30 %	-15.5	-12.5	-9.5	dBm
Signal to noise ratio	S/N (1)	with 23 dB μ input, mod. 30 %	16	20		dB
	S/N (2)	with 80 dB μ input, mod. 30 %	52	57		dB
Total harmonic distortion	THD (1)	with 80 dB μ input, mod. 30 %		0.4	1.0	%
	THD (2)	with 107 dB μ input, mod. 30 %		0.3	1.0	%
Signal meter output	VSM (1)	quiescent		0	0.5	V
	VSM (3)	with 107 dB μ input	3.5	5.0	7.0	V
Input at signal meter output = 1 V	V_{IN} (1)	VSM output 1 V	20.0	26.0	32.0	dB μ
Local oscillation-buffer output	V_{osc}		380	530		mVrms

Reference Characteristics

			typ	unit
Signal meter output	VSM (2)	with 40 dB μ input	2.5	V
Total harmonic distortion	THD (3)	with 112 dB μ input, mod. 30	2	%
Local oscillation fluctuation within a band	ΔV_{osc}	from V_{oscL} (522 kHz) to V_{oscH} (1647 kHz)	10	mVrms
Signal meter band width*	VSM-BW1	with 80 dB μ input, 1/2 output frequency	± 1.5	kHz
	VSM-BW2	with 80 dB μ input, 1/10 output frequency	$-4.5/+7$	kHz
Selectivity		$\pm 10\text{ kHz}$ at 30 % mod.	45	dB
IF Interference		$f_r = 600\text{ kHz}$	85	dB
Image frequency interference ratio		$f_r = 1400\text{ kHz}$	40	dB
AM stereo subchannel	S/N	Subchannel S	50	dB

(See Subchannel S/N test circuit on page 6.)

* BFB450C4 N (MURATA, JAPAN) was used as a narrow band filter.

(note) 0 dBm = 775 mV, 0 dB μ = 1 μ V.

Using the automatic search-stop signal

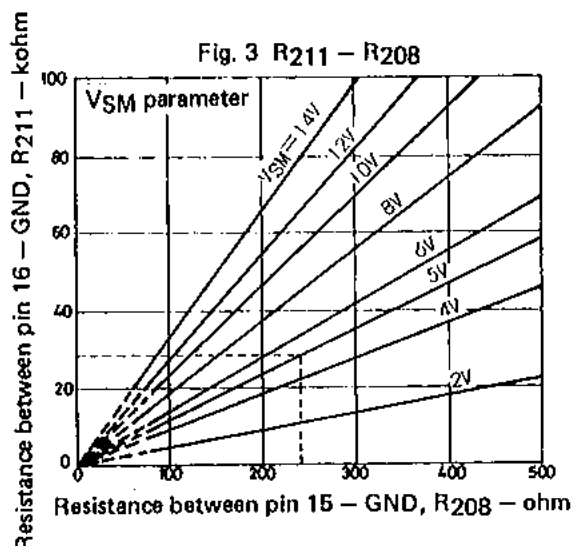
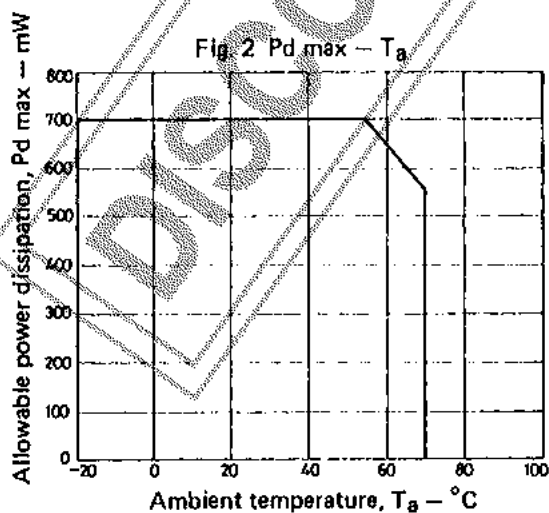
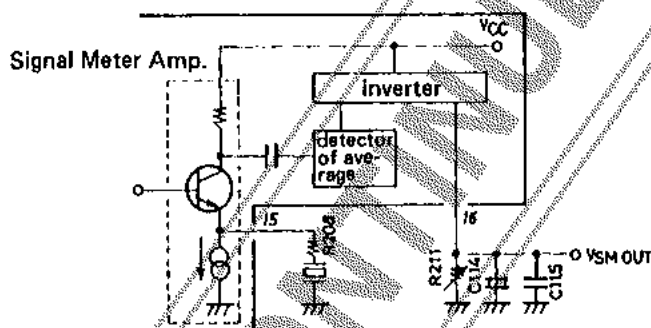
Signal Meter-driving output is equivalent to Fig.1, signal meter driving output (abbreviated as V_{SM}) is narrowed in band width and can be used as an automatic search-stop signal when a narrow band series resonator is connected to pin 15. V_{SM} can be adjusted with R_{208} and R_{211} both in wide band and narrow band since R_{208} is inversely proportional to V_{SM} , while R_{211} is proportional to V_{SM} . R_{208} is related to the Q of narrow band signal meter. When the resistance of R_{208} is increased, the Q will be damped and the band width increased. On the other hand, R_{211} used as the output impedance of V_{SM} and affects the cut-off frequency and time constant of low pass filter for V_{SM} and the meter drive impedance. The time constant and the cut-off frequency f_c can be expressed as follows:

$$\tau = (C_{114} + C_{115} + C_S) \times (R_{211} / R_{in})$$

$$f_c = \frac{1}{2\pi\tau}$$

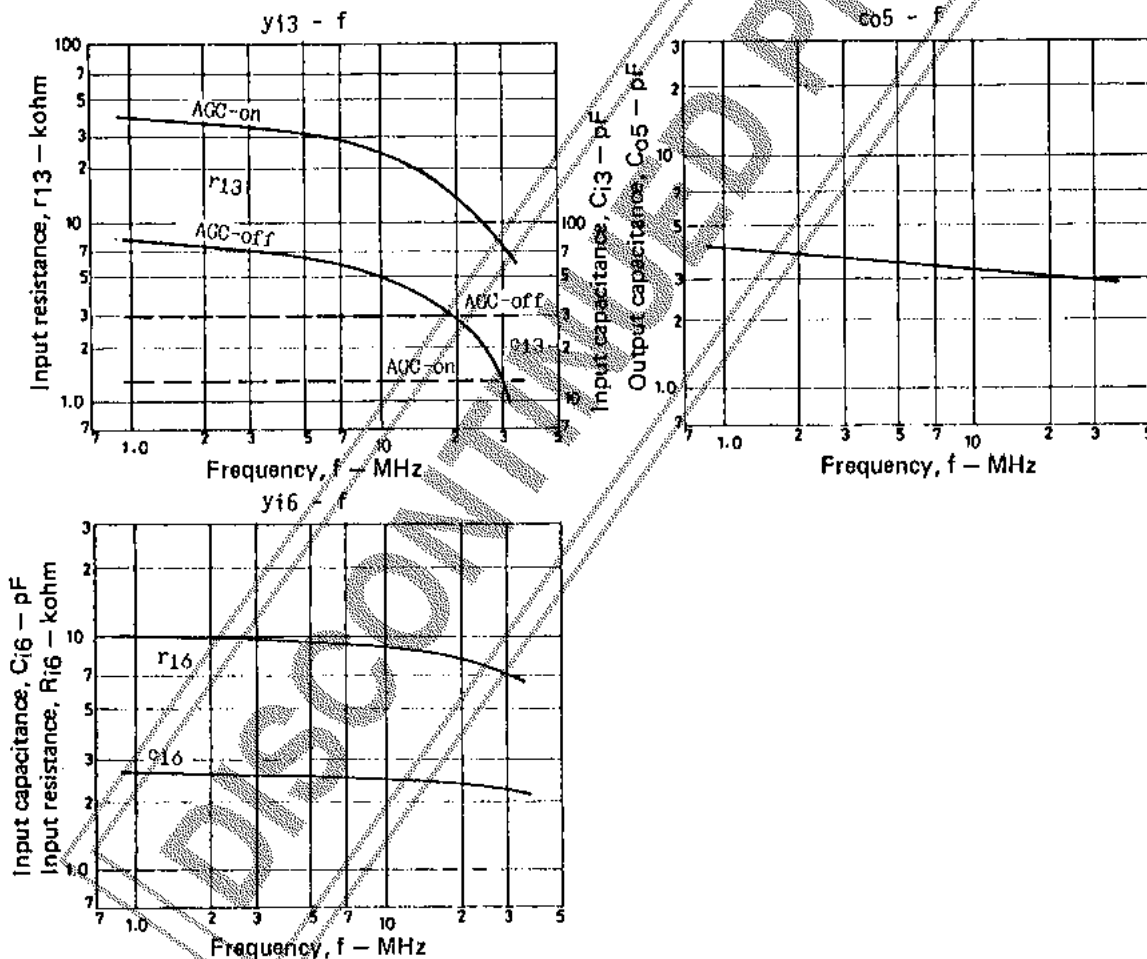
A semi-fixed resistor is recommended to be used as R_{211} to allow the fluctuation of V_{SM} . Refer to Fig. 3 for the value of the semi-fixed resistor since this depends upon V_{SM} and R_{208} . Fig. 3 shows the lowest limit of the semi-fixed resistor in relation to R_{208} with the parameter of V_{SM} set point the value of the semi-fixed resistor will be equal to or greater than that shown in Fig. 3. For example, when $V_{SM} = 5$ V and $R_{208} = 240$ ohm, R_{211} becomes 28 kohm. Thus, the value of the semi-fixed resistor is determined to be about 30 kohm. When the value of V_{SM} is too large, it is limited and saturated to the source voltage so it is recommended to follow the condition of $V_{SM} \leq V_{CC} - 2$ (V). When a narrow band serial resonator is used, include the resonant impedance to determine the value of R_{208} .

Fig. 1 Signal Meter Detector Circuit



Input/Output Admittance

—	parameter	frequency	—	AGC-off	AGC-on
RF	Yi3	1 MHz	r _i	8 k Ω	40 k Ω
	Yo5	1 MHz	c _i	30 pF	13 pF
MIX	Yo5	1 MHz	r _o	—	—
			c _o	4 pF	—
MIX	Yi6	1 MHz	r _i	10 k Ω	—
			c _i	2.6 pF	—
MIX	Yo7	500 kHz	r _o	—	—
			c _o	2 pF	—
1st IF	Yi9	500 kHz	r _i	3 k Ω	3.2 k Ω
			c _i	7 pF	3 pF
1st IF	Yo10	500 kHz	r _o	45 Ω	42 Ω
			c _o	20 pF	20 pF
2nd IF	Yi11	500 kHz	r _i	80 Ω	—
			c _i	150 pF	—



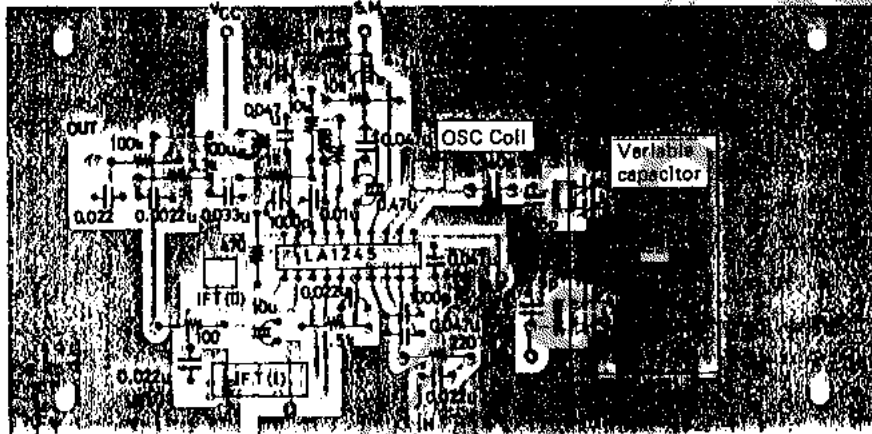
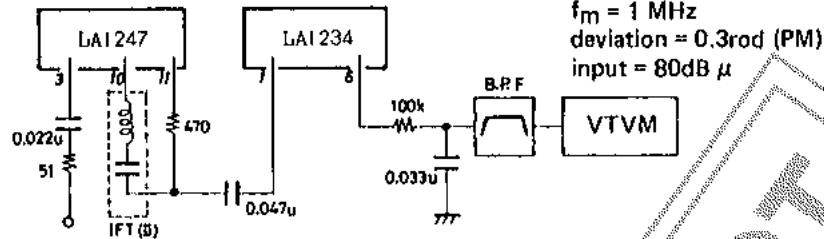
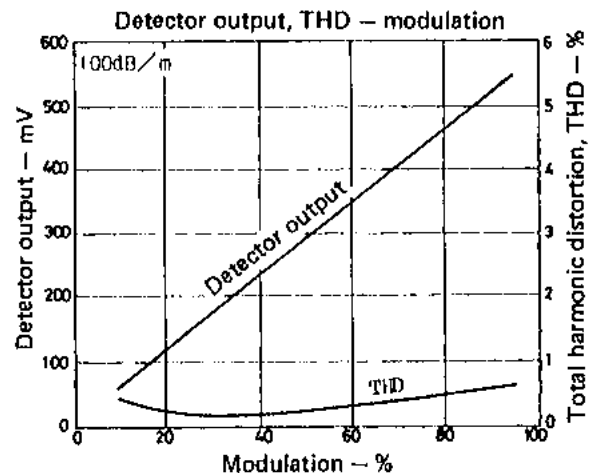
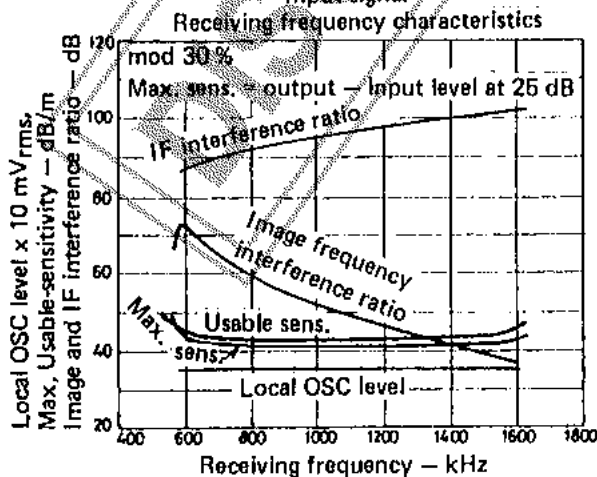
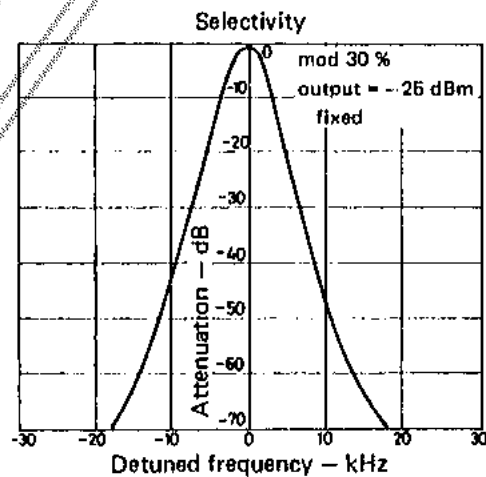
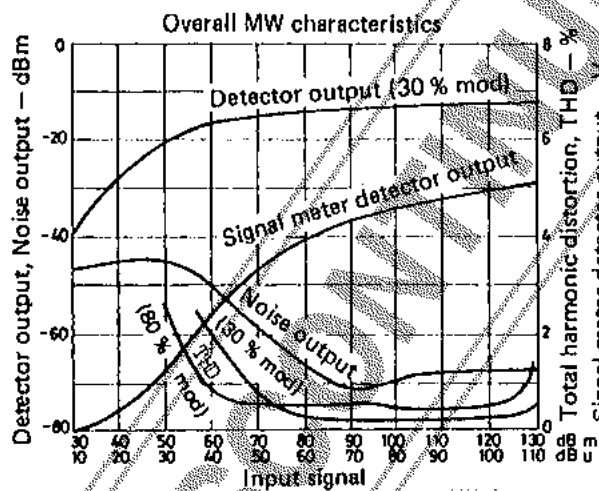
Notes on LA1247 usage

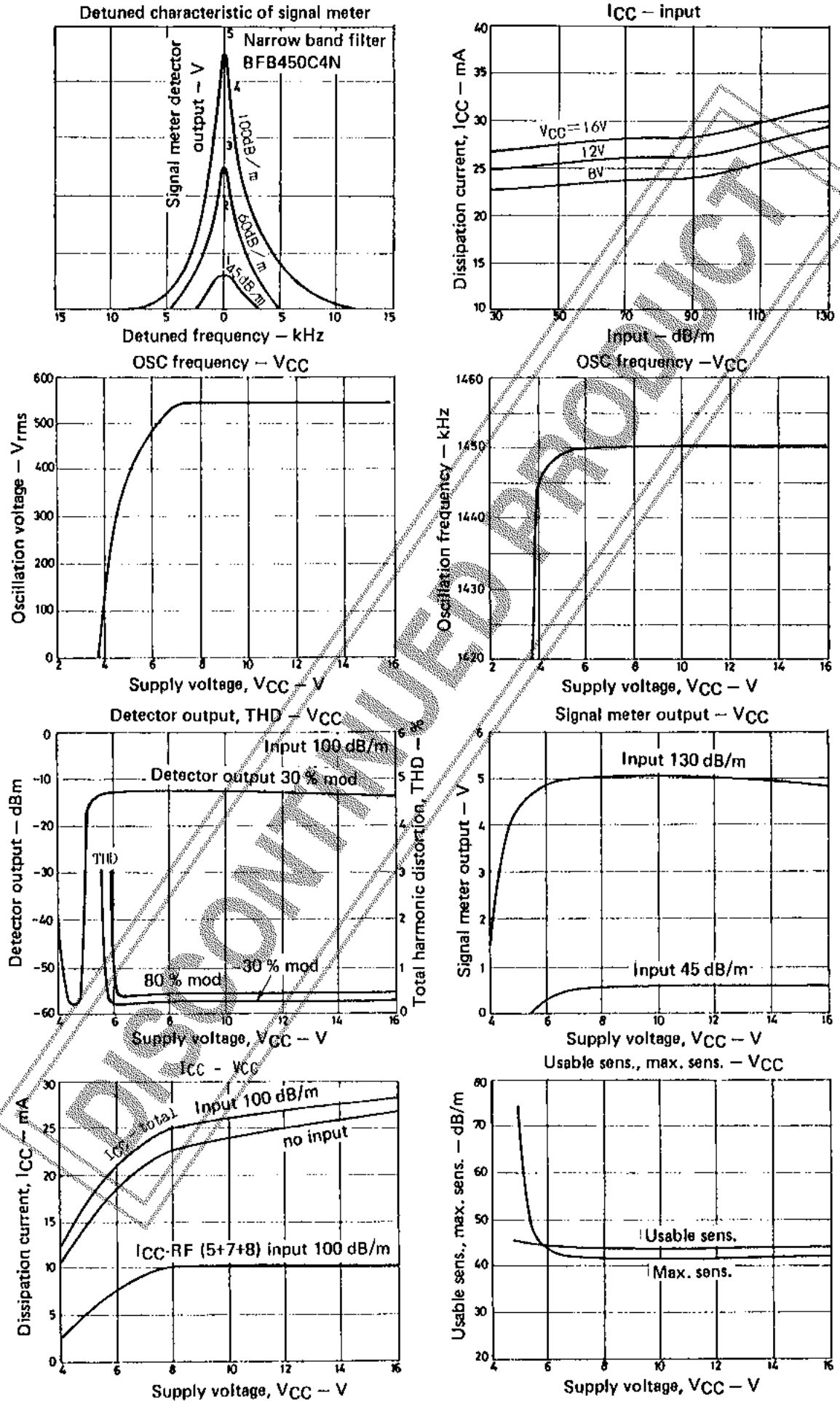
1. When suddenly tuned to a broadcasting station of intermediate or high field strength, a large current of high frequency flows into the signal meter circuit, causing the local oscillator malfunctions and abnormal noises.

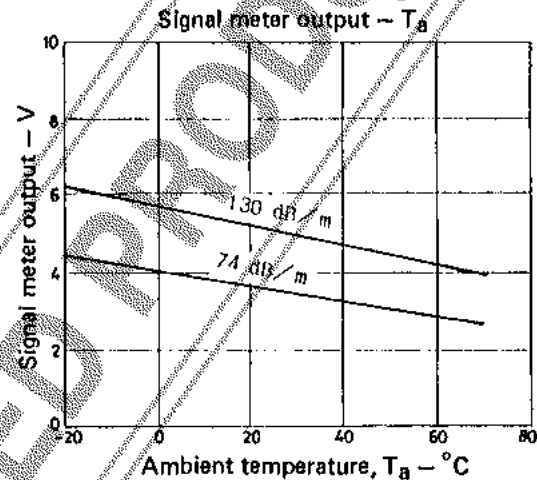
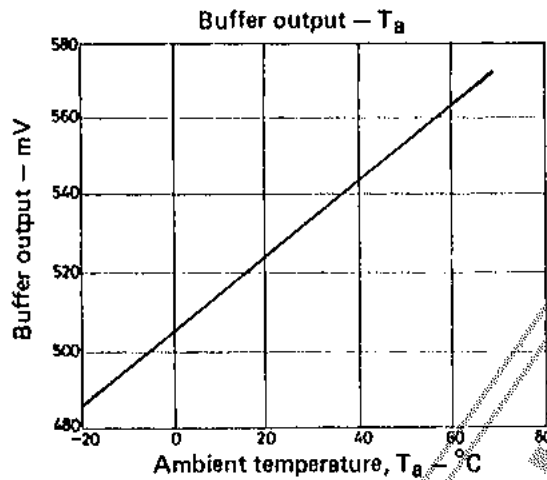
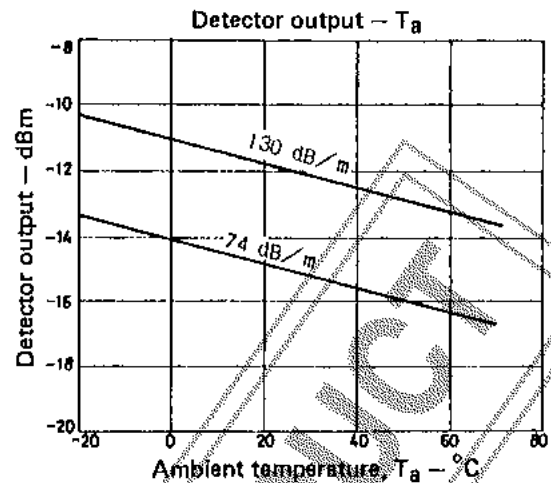
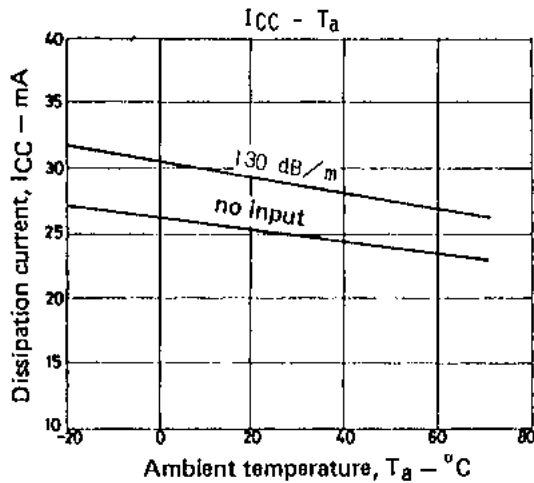
To eliminate this:

- Use $R_{208} \geq 240$ ohm for manual tuning type.
- Use $R_{208} \geq 82$ ohm, and use the local oscillation coil at the 1/3 tap (except SW for electronic tuning type (which uses a narrow band filter)).

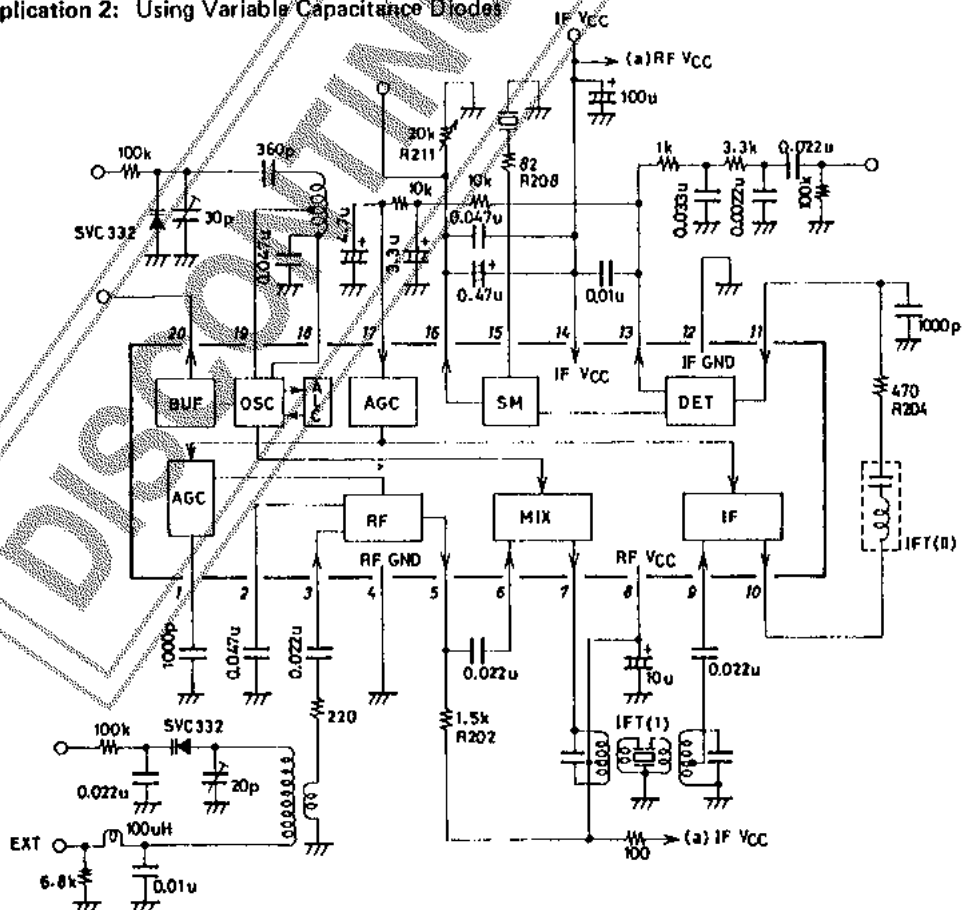
□ Subchannel S/N test circuit

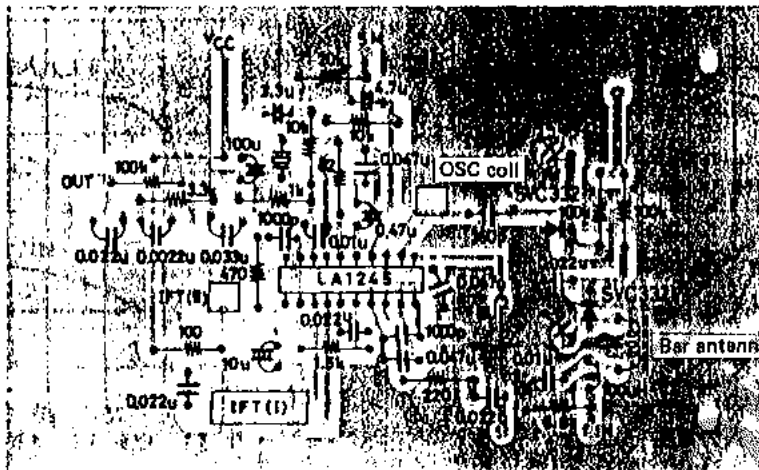
An Example of Printed Pattern (Cu-foiled area) (150 x 72 mm²)



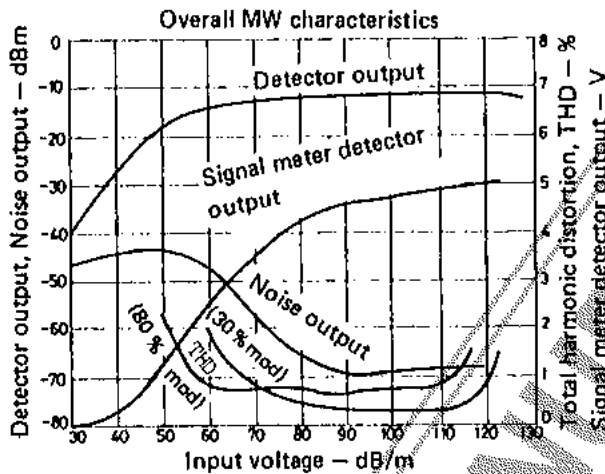


■ Application 2: Using Variable Capacitance Diodes



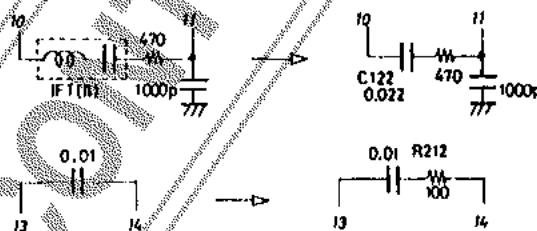


An Example of Printed Pattern (Cu-foil area) (130 x 80 mm)



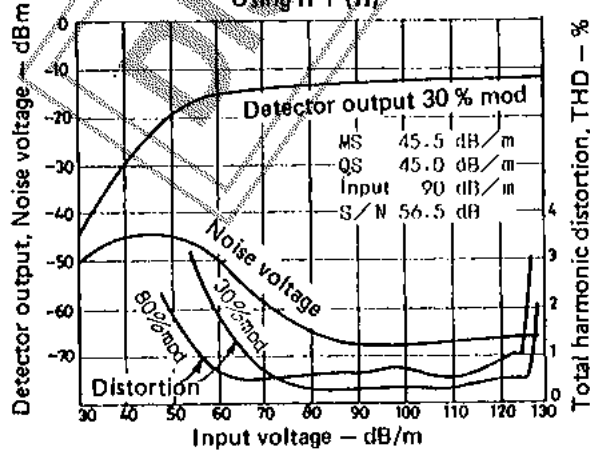
■ Application 3: Rejecting IFT (II)

Following 2 changes are recommended as C-coupling without IFT (II).



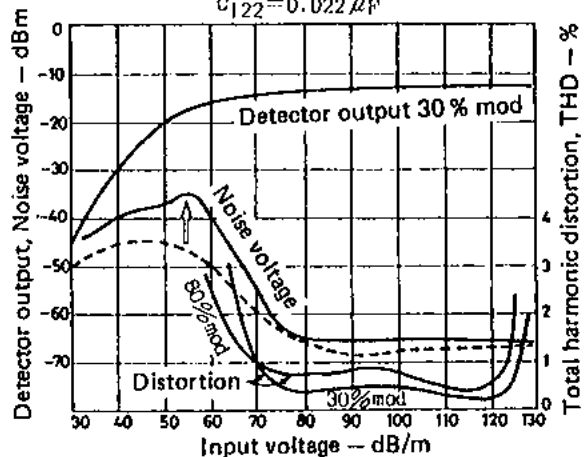
Comparison of characteristics varying parts.

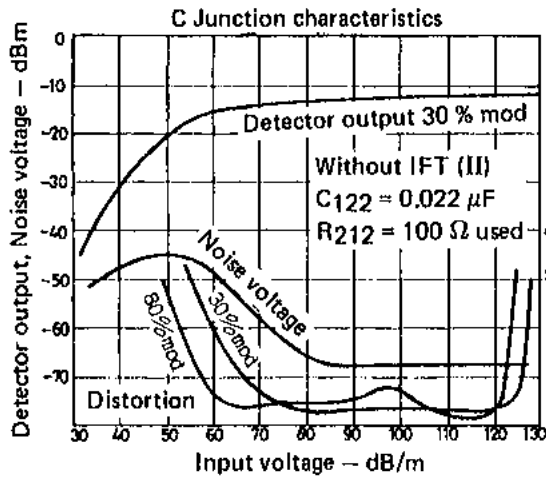
Using IFT (II)



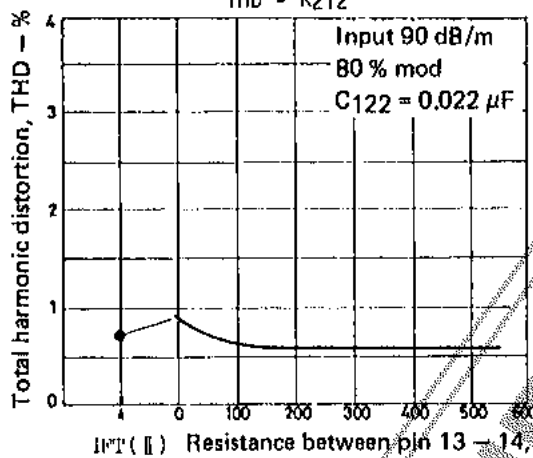
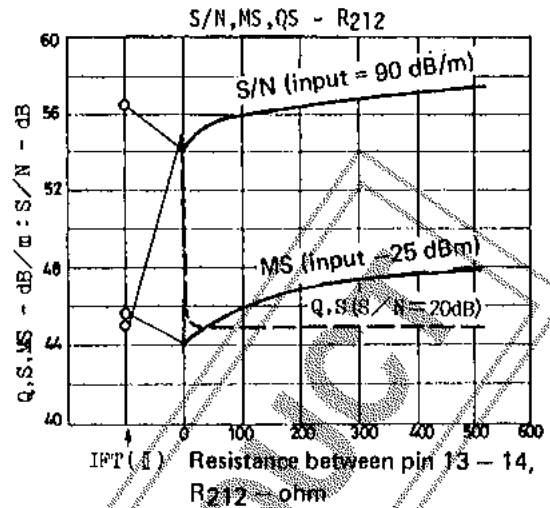
Without IFT (II), C-coupled

$C_{122} = 0.022 \mu F$



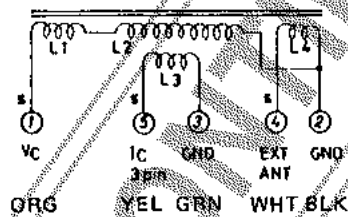


Total harmonic distortion, THD - %



Peripheral Parts

(1) Bar Antenna (34H-052-869 Sumida Co.)

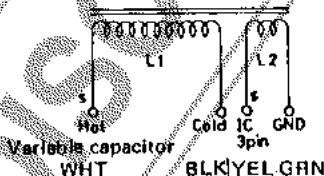


For use of general variable capacitor

 L (between pin 1, 2) = 270 μH $Q \geq 180$

L1: solenoid	43 t.
L2: space	42 t.
L3: solenoid	7 t.
L4: solenoid	4 t.

(2) Bar Antenna (C-4698 Coil Snake Co.)

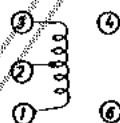


For use of variable capacitor diode

 L (between pin 1, 2) = 250 μH $Q \geq 250$

L1: solenoid	55 t.
L2: solenoid	5 t.

(3) Osc coil



2157-223-072 Sumida

2157-223-082 Sumida

7BR-6654Y Toko

 L (between pin 1 and 3) = 147 μH L (between pin 1 and 3) = 147 μH L (between pin 1 and 3) = 147 μH $Q \geq 85$ $Q \geq 85$ $Q \geq 90$

3 - 2 39 t.

3 - 2 26 t.

3 - 2 31 t.

2 - 1 39 t.

2 - 1 52 t.

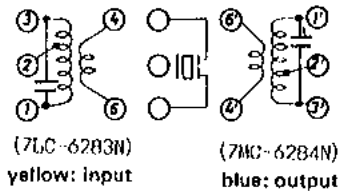
2 - 1 31 t.

(4) Variable Capacitor (C123A Alps Co.,)

c max 326.8 pF
c min 6.7 pF

(5) Variable Capacitor Diode (SVC332 Sanyo)

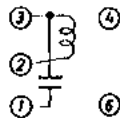
(6) IFT (I) (CMFQ-021A Toko Co.,)



CMFQ-021A

3-2	58 t.	3-2	18 t.
2-1	98 t.	2-1	130 t.
6-4	16 t.	6-4	16 t.
Cent. Freq. 450 kHz		Cent. Freq. 450 kHz	
Qu = 70 + 20 %		Qu = 110	
Tuned Cap. 180 pF		Tuned Cap. 180 pF	

(7) IFT (II)



2150-208-033 Sumida Co.,
Cent. Freq. 455 kHz
 $Q \geq 95$
between 2 and 3 170 t.
Tuned Cap. 180 pF
2150-208-033 Sumida Co.,

7LC-4751B Toko Co.,
Cent. Freq. 455 kHz
 $Q \geq 75$
between 2 and 3 146 t.
Tuned Cap. 180 pF
7LC-4751B Toko Co.,

(8) Narrow Band Resonator (BFB450C4 N Murata Co.,)