



SANYO Semiconductors

## DATA SHEET

# LA1245 — Monolithic Linear IC AM Electronic Tuner

## Overview

LA1245 is a high performance IC to be used as an AM electronic tuner. It provides an automatic search-stop signal, local oscillator buffer-output, and the low level local oscillation, as well as providing all other functions required of an AM tuner. Moreover, the stable local oscillation from LW to SW facilitates the use of many band.

## Features

- Narrow-band signal meter : Available as an automatic search-stop signal (also available as a wide-band signal meter). Signal meter output =  $1/2$  frequency  $\pm 1.5$ kHz typ.
- Local oscillation buffer-output : Facilitates the design of electronic tuning systems and frequency representation.
- OSC (with ALC) : The oscillation output is stabilized at a low level (350mVrms) for a varactor diode, and tracking error is minimized.
- RF amplifier : Excellent in usable sensitivity by incorporating low-noise transistors in cascade circuit (45dB/m typ).
- MIX : Double balanced differential MIX prevents the influence of spurious radiation and IF interferences (IF interference = 85dB typ).
- Low noise : Excellent in S/N for intermediate input (57dB typ).
- Compensation for V<sub>CC</sub> fluctuation : Allows little gain fluctuation and little distortion fluctuation (8 to 16V).
- Low shock noise : Able to decrease the shock noise by selecting AGC time constant when changing V<sub>CC</sub>-on and/or switching the mode.

## Functions

- RF amplifier
- IF amplifier
- Signal meter driving output (also used as an automatic search stop-signal)
- etc.
- MIX
- AGC
- OSC (with ALC)
- Local oscillation buffer-output
- Detection

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**SANYO Semiconductor Co., Ltd.**

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**Specifications**

**Maximum Ratings** at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V <sub>CC</sub> max	Pin 8, 14	16	V
Output voltage	V <sub>O</sub>	Pin 5, 7	24	V
Input voltage	V <sub>I</sub>	Pin 3	5.6	V
Supply current	I <sub>CC</sub> max	Pin 5+7+8+14	32	mA
Output high drive current	I <sub>18</sub>	Pin 18	5	mA
	I <sub>20</sub>	Pin 20	2	mA
Allowable power dissipation	Pd max	See Figure 2	700	mA
Operating temperature	Topr		-20 to +70	°C
Storage temperature	Tstg		-40 to +125	°C

**Recommended Operating Conditions** at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V <sub>CC</sub>		12	V

**Electrical Characteristics** at Ta = 25°C, V<sub>CC</sub> = 12V, f<sub>r</sub> = 1MHz, f<sub>m</sub> = 400Hz, at specified test circuit (based on application circuit).

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I <sub>CC1</sub>	quiescent	16.0	25.0	35.0	mA
	I <sub>CC2</sub>	107dBμ input	19.0	29.0	40.0	mA
Detection output	V <sub>O1</sub>	23dBμ input, mod. 30%	-27.5	-23.0	-18.5	dBm
	V <sub>O2</sub>	80dBμ input, mod. 30%	-15.5	-12.5	-9.5	dBm
Signal to noise ratio	S/N1	23dBμ input, mod. 30%	16	20		dB
	S/N2	80dBμ input, mod. 30%	52	57		dB
Total harmonic distortion	THD1	80dBμ input, mod. 30%		0.4	1.0	%
	THD2	107dBμ input, mod. 30%		0.3	1.0	%
Signal meter output	V <sub>SM1</sub>	quiescent		0	0.5	V
	V <sub>SM3</sub>	107dBμ input	3.0	4.5	7.0	V
Input at signal meter output = 1V	V <sub>IN1</sub>	V <sub>SM</sub> output = 1V	19.0	25.0	31.0	dBμ
Local oscillation-buffer output	V <sub>OSC</sub>		250	350		mVrms

**Reference Characteristics**

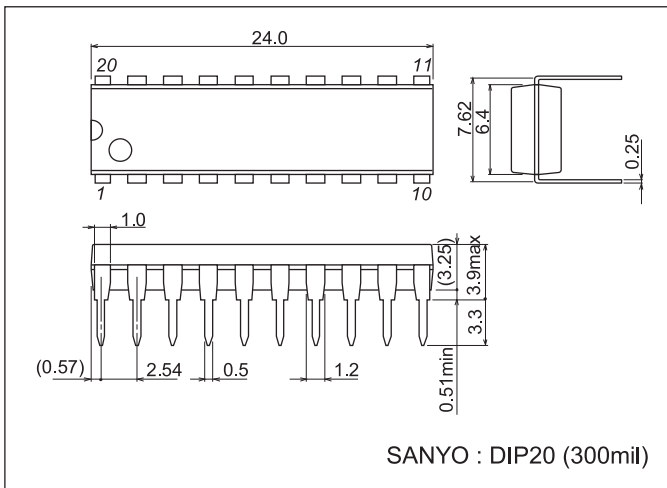
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Signal meter output	V <sub>SM2</sub>	40dBμ input		2.5		V
Total harmonic distortion	THD3	112dBμ input, mod.30%		2		%
Local oscillation fluctuation within a band	ΔV <sub>OSC</sub>	V <sub>OSCL</sub> (522kHz) to V <sub>OSCH</sub> (1647kHz)		10		mVrms
Signal meter band width*	V <sub>SM-BW1</sub>	80dBμ input, 1/2 output frequency		±1.5		kHz
	V <sub>SM-BW2</sub>	80dBμ input, 1/10 output frequency		-4.5/+7		kHz
Selectivity		±10kHz at 30% mod.		45		dB
IF interference		f <sub>r</sub> = 600kHz		85		dB
Image frequency interference ratio		f <sub>r</sub> = 1400kHz		40		dB

\* BFB450C4 N (Murata, Co.) was used as a narrow band filter.

(Note) 0dBm = 775mV, 0dBu = 1μV.

Package Dimensions

unit : mm (typ)  
3021C



Using the automatic search-stop signal

Signal Meter-driving output circuit is equivalent to Figure. 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  $\tau$  and the cut-off frequency  $f_c$  can be expressed as follows :

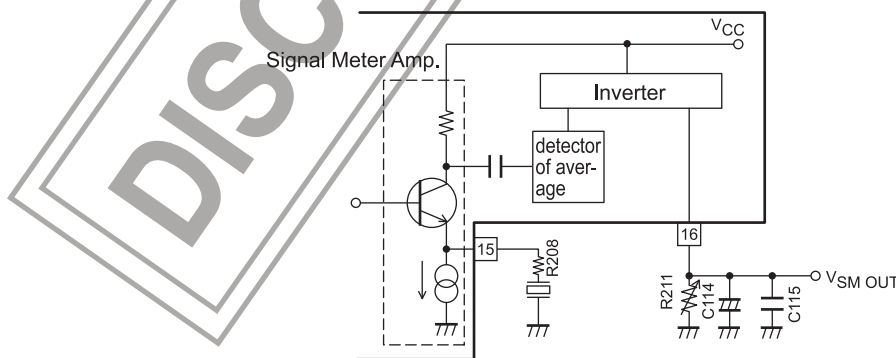
$$\tau = (C_{114} + C_{115} + C_S) \times (R_{211} / R_{in})$$

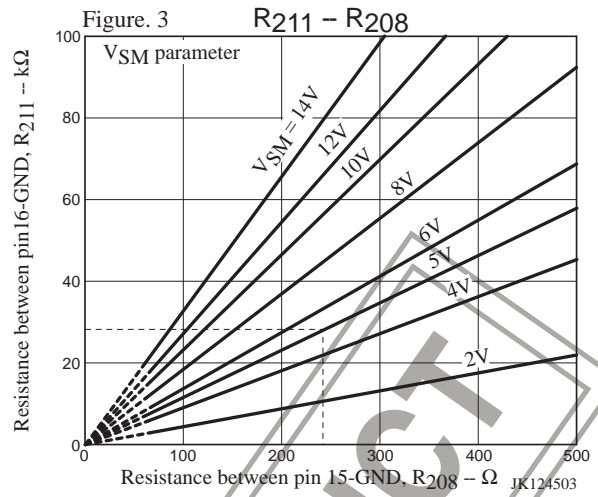
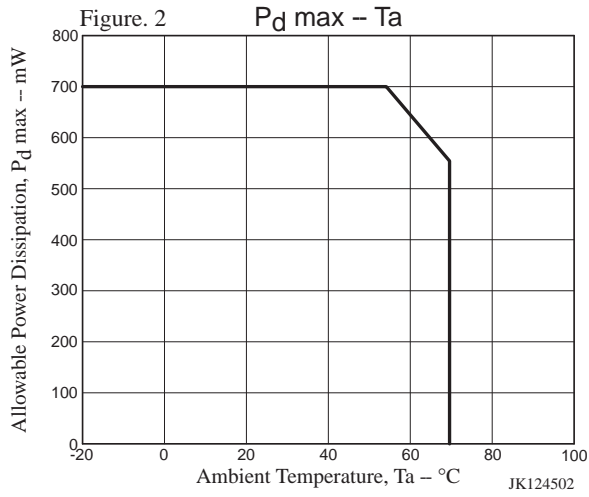
$$f_c = \frac{1}{2\pi\tau}$$

where  $C_S$  is the input capacitance of the pin 16 peripherals and the meter drive circuit, and  $R_{in}$  is the input resistance of the meter drive circuit.

A semi-fixed resistor is recommended to be used as  $R_{211}$  to cope with the fluctuation of  $V_{SM}$ . Refer to Figure. 3 for the value of the semi-fixed resistor since this depends upon  $V_{SM}$  and  $R_{208}$ . Figure. 3 shows the lowest limit of the semi-fixed resistor in relation to  $R_{208}$  with the parameter of  $V_{SM}$  set point, and the value of the semi-fixed resistor will be equal to or greater than that shown in Figure. 3. For example, when  $V_{SM} = 5V$  and  $R_{208} = 240\Omega$ ,  $R_{211}$  becomes  $28k\Omega$ . Thus, the value of the semi-fixed resistor is determined to be about  $30k\Omega$ . 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  $R_{208}$ .

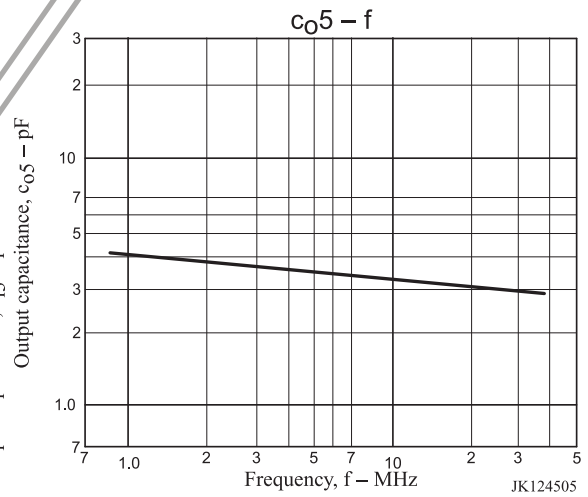
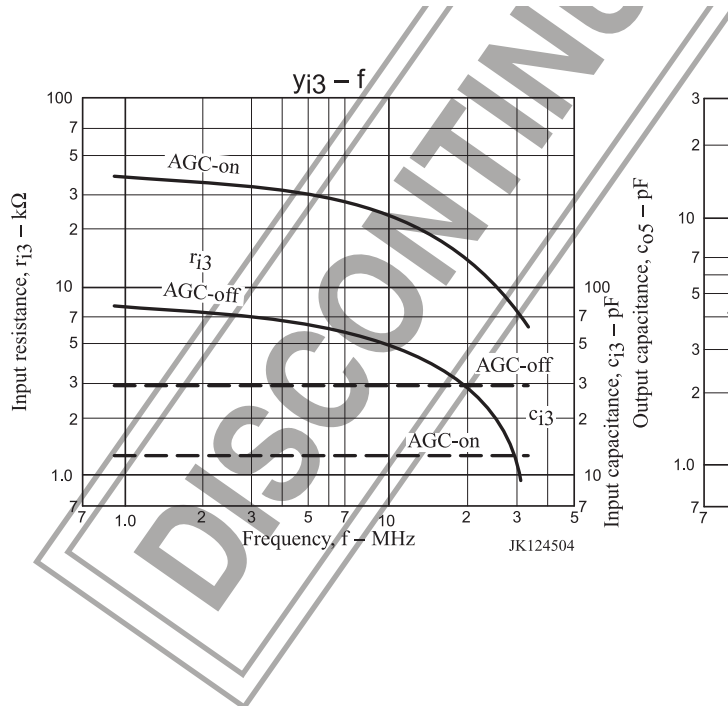
Figure. 1 Signal Meter Detector Circuit

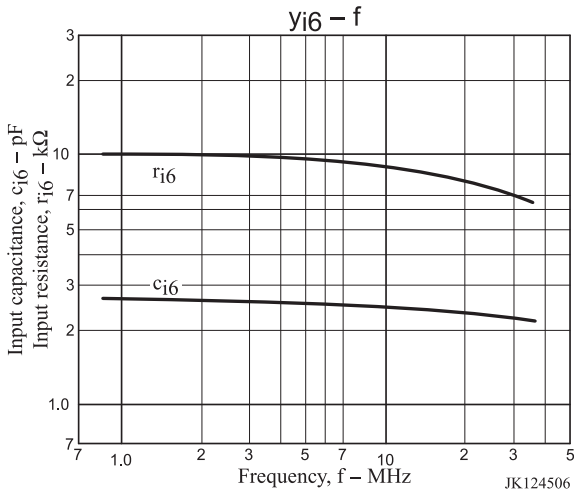




Input/ Output Admittance

	Parameter	Frequency		AGC-off	AGC-on
RF	$y_{i3}$	1MHz	$r_{i3}$	8kΩ	40kΩ
	$y_{o5}$	1MHz	$c_{i3}$	30pF	13pF
MIX	$y_{i6}$	1MHz	$r_o$	-	-
	$y_{o7}$	500KHz	$c_o$	4pF	-
1st IF	$y_{i9}$	500KHz	$r_{i3}$	10kΩ	-
	$y_{o10}$	500KHz	$c_{i3}$	2.6pF	-
2nd IF	$y_{i11}$	500KHz	$r_o$	-kΩ	-
			$c_o$	2pF	-
			$r_{i3}$	3kΩ	3.2kΩ
			$c_{i3}$	7pF	3pF
			$r_o$	45Ω	42Ω
			$c_o$	20pF	20pF
			$r_{i3}$	80Ω	-
			$c_{i3}$	-150pF	-





### Notes on LA1245 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  $R_{208} \geq 240\Omega$  for manual tuning type.
  - Use  $R_{208} \geq 80\Omega$ , and use the local oscillation coil at the 1/3 tap (except SW) for electronic tuning type (which uses a narrow band filter).
2. Use the bias on the condition  $RF V_{CC} \leq IF V_{CC}$ , since abnormal noise levels might be caused when detuning a strong input on the condition  $RF V_{CC} > IF V_{CC}$ .
3. Use the signal meter driving output ( $V_{SM}$ ) at  $V_{SM} \leq V_{CC} - 2$  (V) to avoid saturation caused by  $V_{CC}$ .
4. Use 1/2 or more tap of LW and MW oscillation coil to improve S/N and the detuning characteristics of the distortion ratio.
5. Use the full-tap of SW oscillation coil, to allow the sag in oscillation power by the decreasing of Q.
6. Avoid the coupling of the antenna tuning circuit and the local oscillating circuit so as not to leak the local oscillation into the antenna tuning circuit.
7. Connect the detection capacitor  $C_{113}$  between pin 13 (output) and pin 14 ( $V_{CC}$ ) to avoid the leakage of the IF signal into the GND line. Connection between pin 13 and pin 12 (GND) increases the tweet interference and deteriorates the usable sensitivity.
 

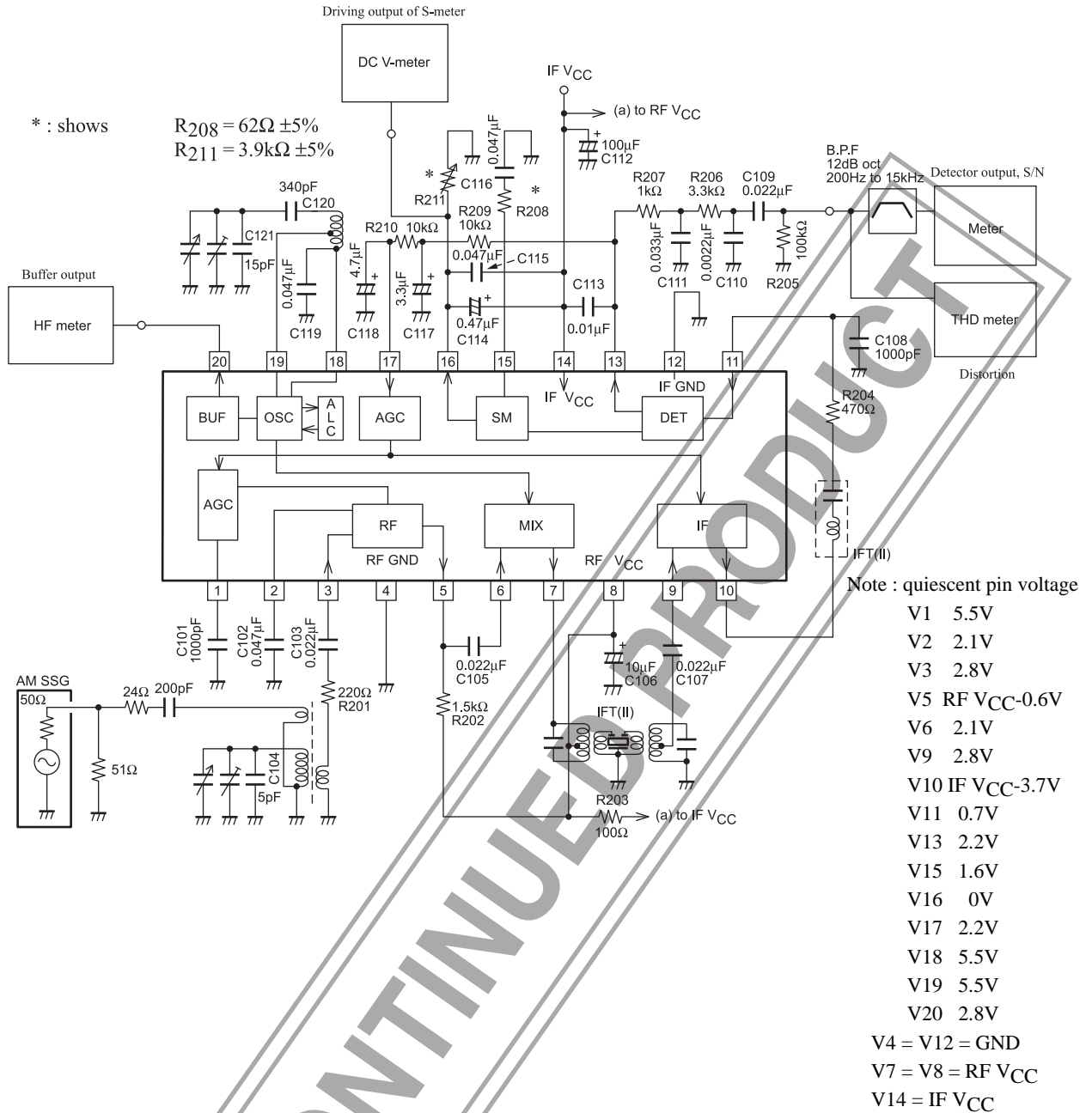
Moreover, depending on the positions of  $C_{113}$  and the bar antenna, higher harmonics having twice or three times the frequency of the IF signal may pass into the antenna and cause tweet interference, and in extreme cases oscillation might be cause. To prevent this :

  - Shorter lead wires and connect them near 13 and 14 pins.
  - Place  $C_{113}$  far from the antenna.
8. When a cable or something similar is connected to a local oscillation buffer (pin 20), which is equivalent to connecting a capacitor of about 20pF, the output from the buffer will be of sawtooth waves, causing the level low at the short wave band. To prevent this, connect a resistor between pin 20 and GND, which will increase the operating current of the buffer amplifier. Since the maximum current obtained from pin 20 is 2mA, the suitable resistance between pin 20 and GND is 1.5kΩ.
9. Use a semi-fixed resistor for  $R_{211}$  to allow the fluctuation of  $V_{SM}$ .
10. When changing an IFT or using an RF tuner, select a filter and related circuits according to the following conditions. The input levels of each terminal where 30% modulated detection output of -25dBm is obtained are as follows :
 

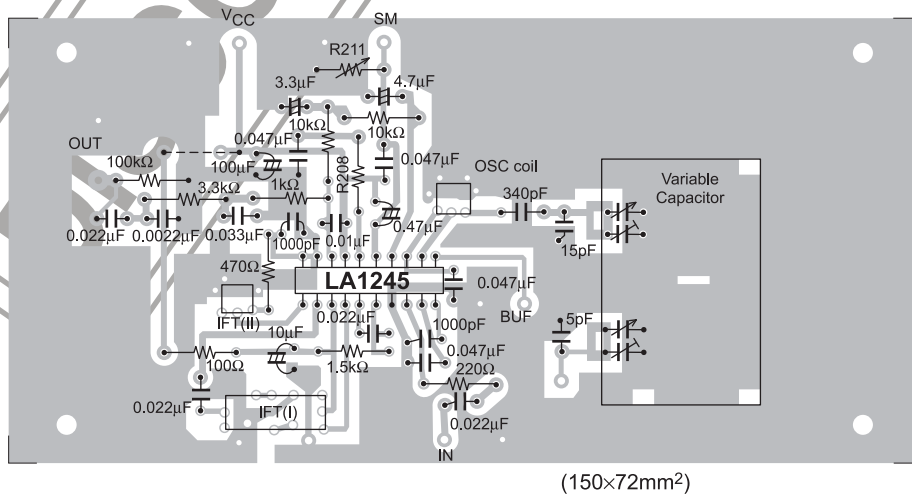
Pin 11 input	when $R_g = 520\Omega$ ( $470\Omega + 50\Omega$ )	75dBμ
Pin 9 input	when $R_g = 50\Omega$	53dBμ
Pin 6 input	when $R_g = 50\Omega$	48dBμ
Pin 3 input	when $R_g = 50\Omega$	22dBμ

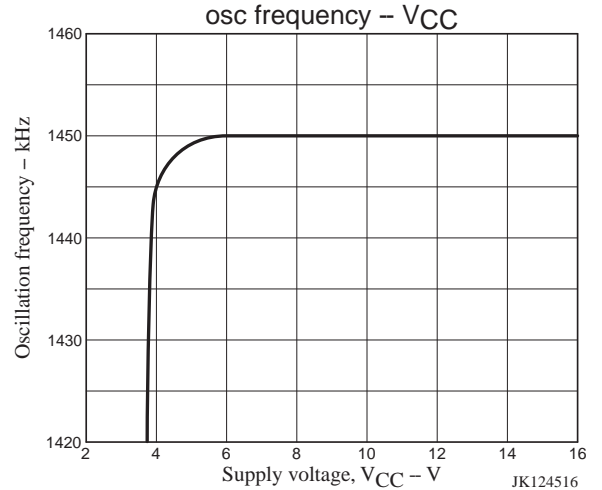
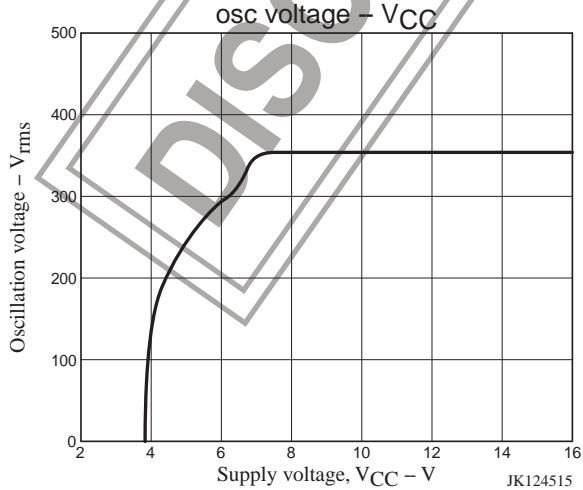
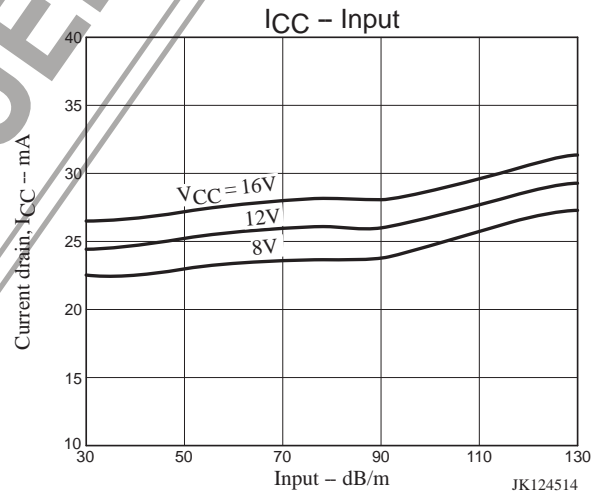
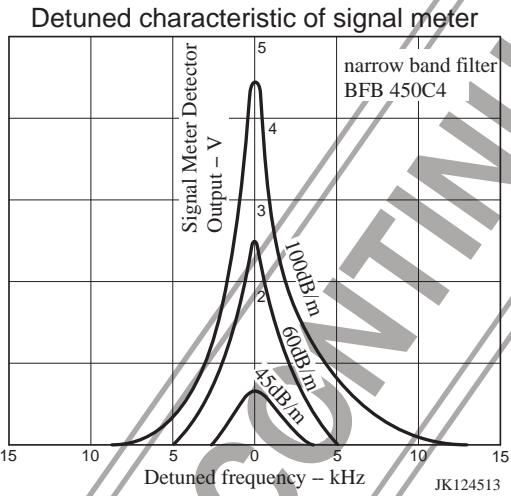
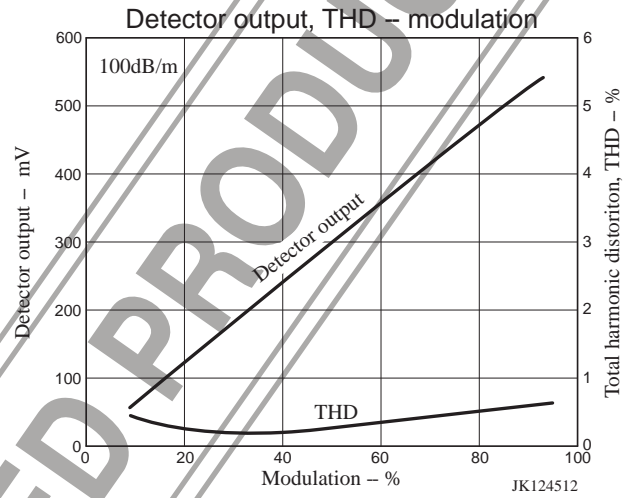
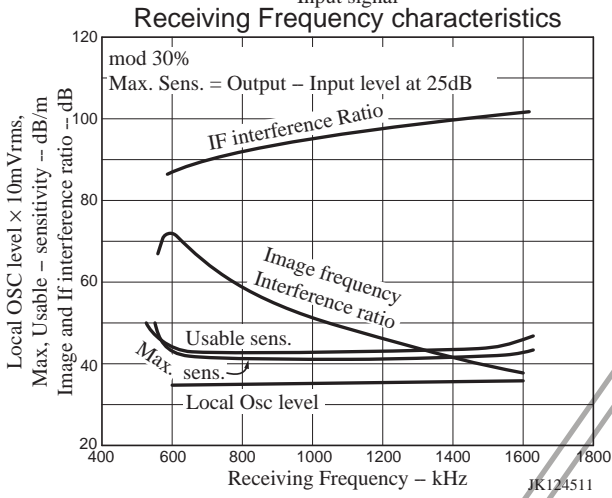
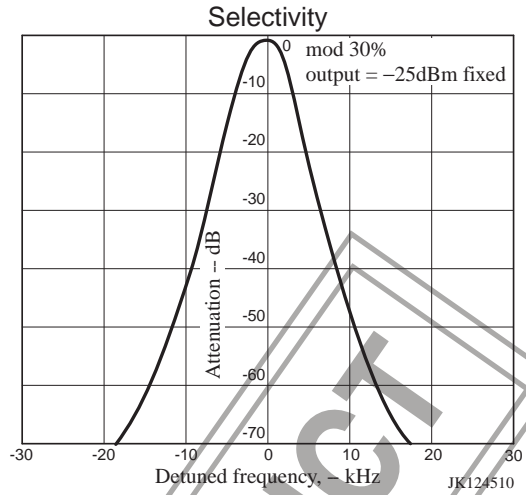
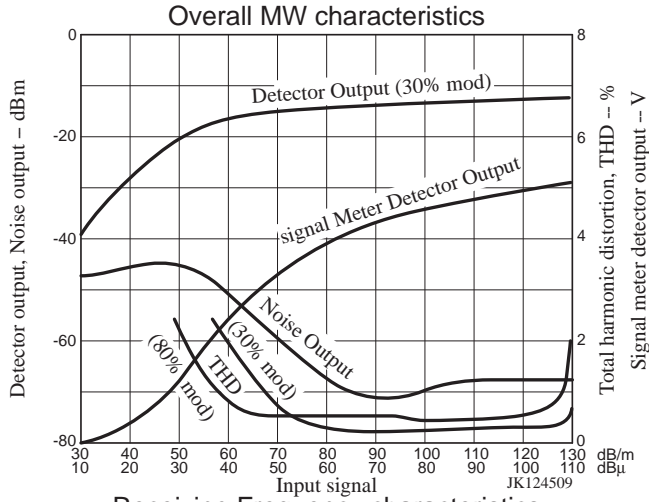
Slight change in IFT, however, will be covered by changing the constant of resistors  $R_{202}$  and  $R_{204}$ .
11. When the coupling coefficient of the local oscillation coil is small and an anti-resonance point of about 100MHz is present or the stray capacitance between pin 19 and pin 20 is large, the buffer output (pin 20) may be subject to parasitic oscillation of about 100MHz. In this case, connect a capacitor of about 30pF between pin 20 and GND. To observe parasitic oscillation, connect a capacitor of 5pF in series with the probe. If the probe is connected direct to pin 20, the input capacitance of the probe causes parasitic oscillation to stop, which makes it impossible to observe.

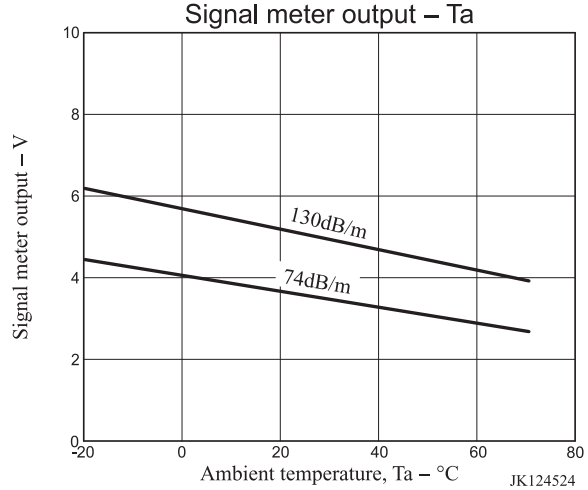
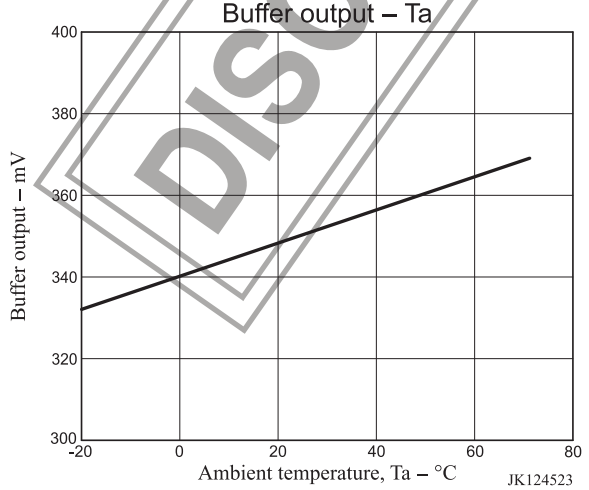
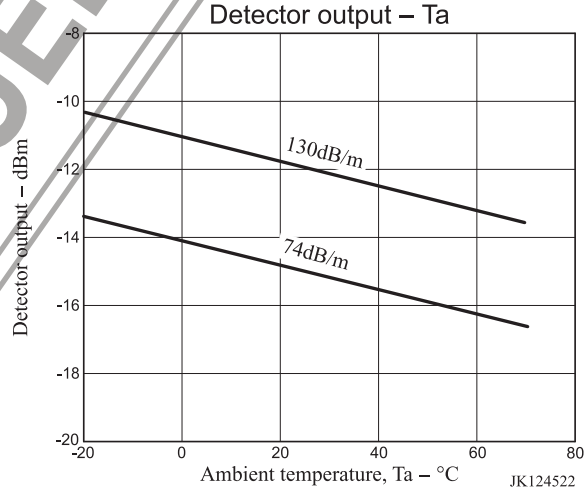
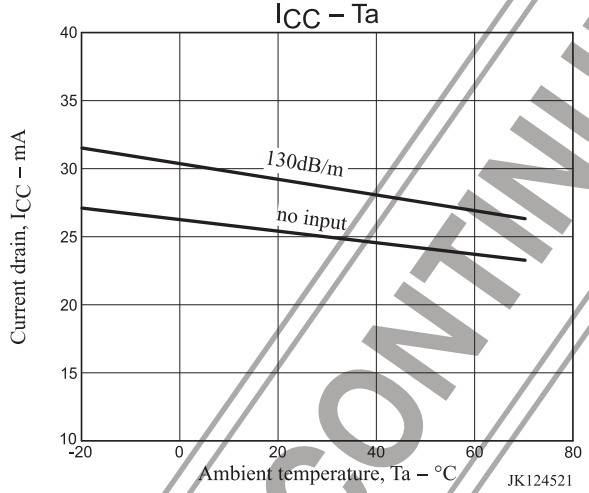
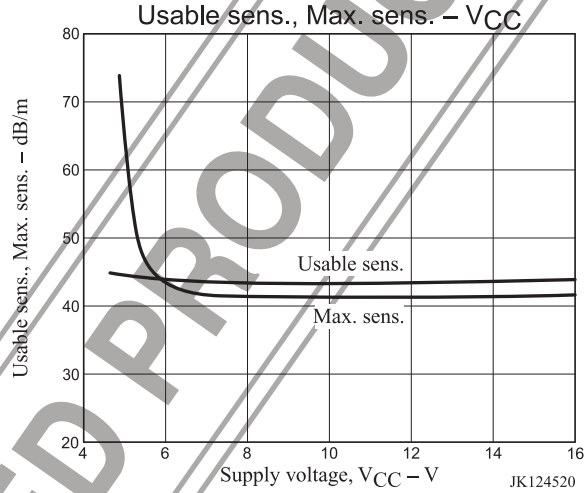
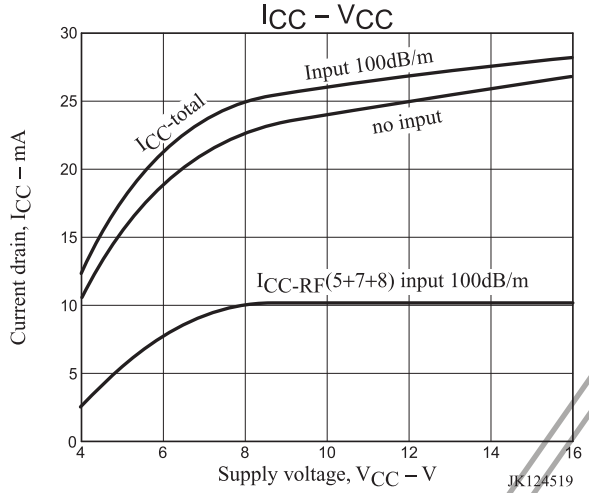
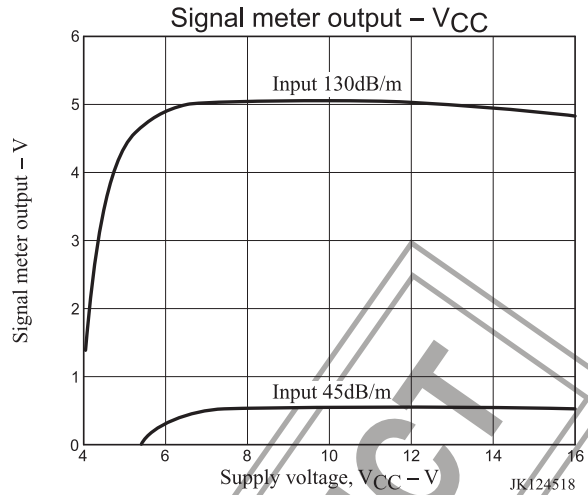
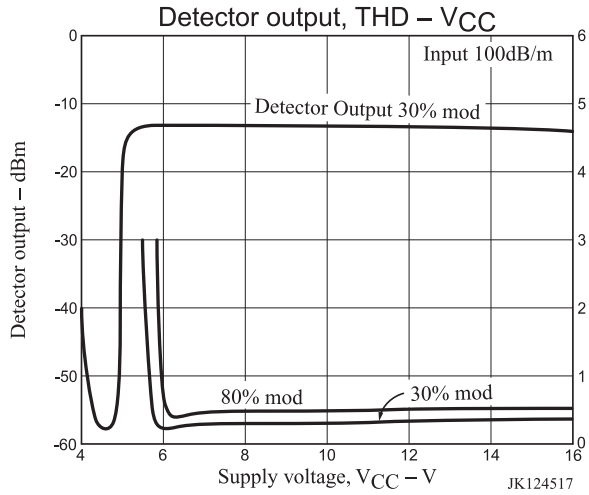
Sample Application Circuit 1



Sample Printed Circuit Pattern (Cu-foiled area)



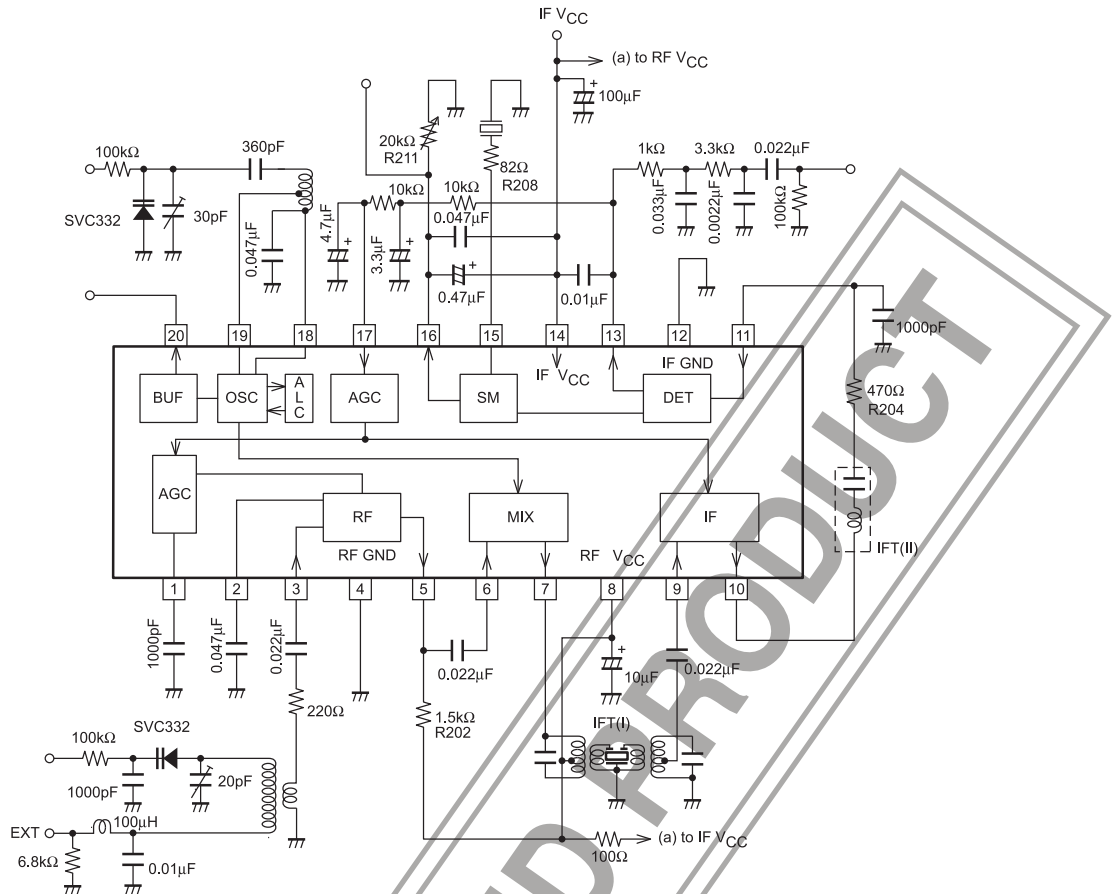




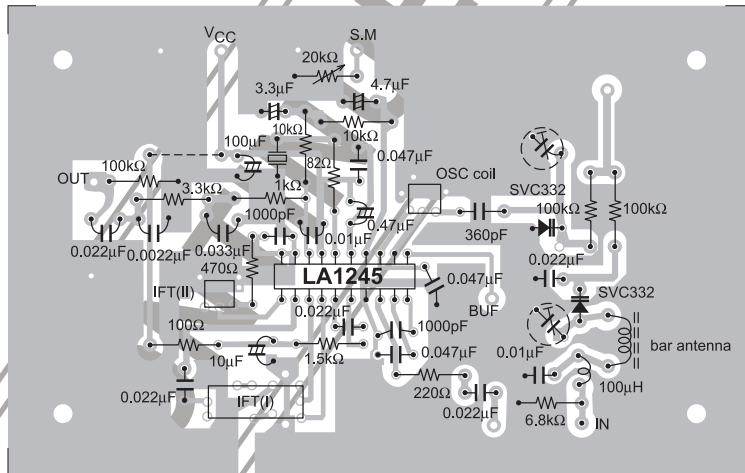


# LA1245

## Sample Application Circuit 2 : Using variable capacitance diodes

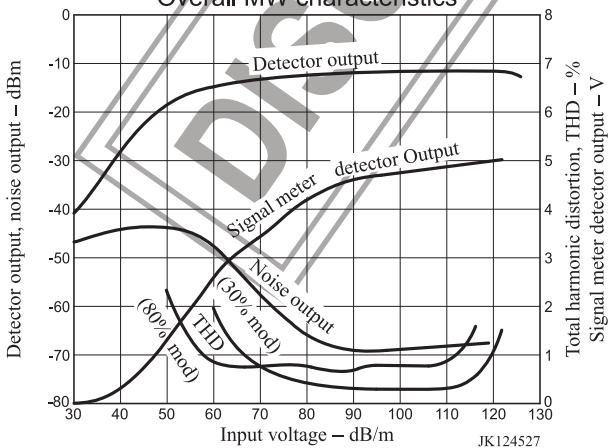


### Sample Printed Circuit Pattern (Cu-foiled area)



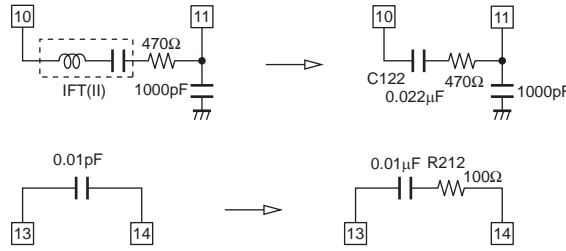
Overall MW characteristics

130x80mm<sup>2</sup>

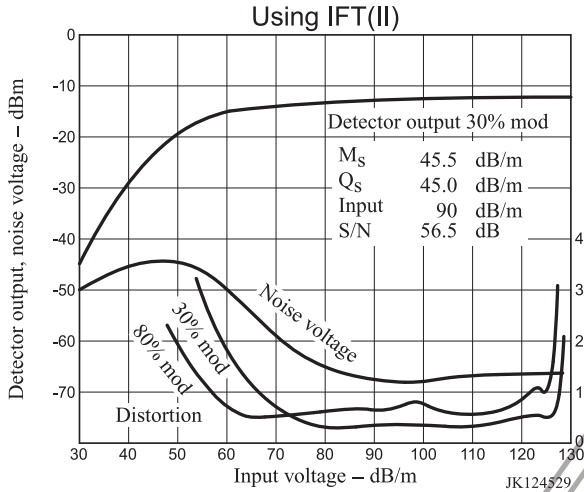


Sample Application Circuit 3 : Rejecting IFT (II)

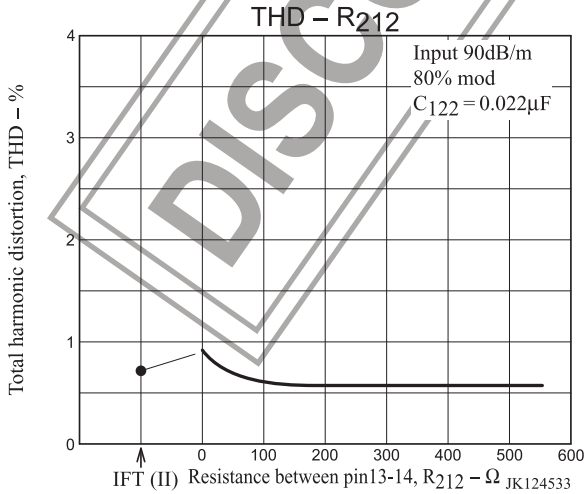
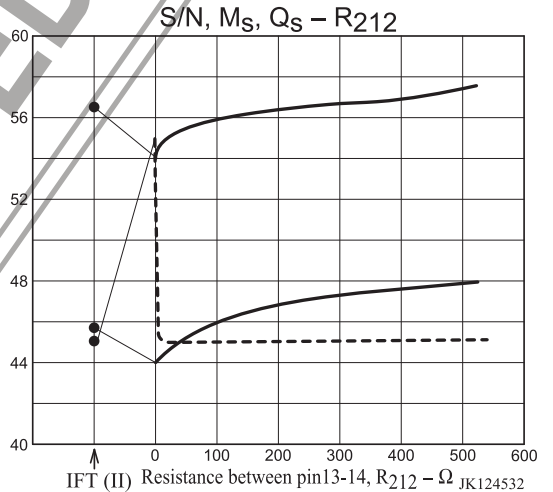
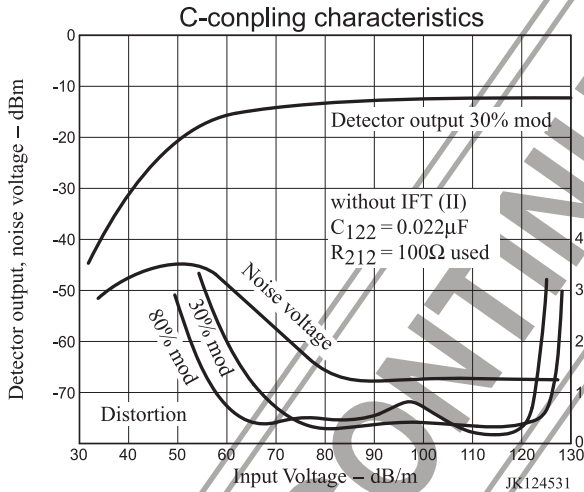
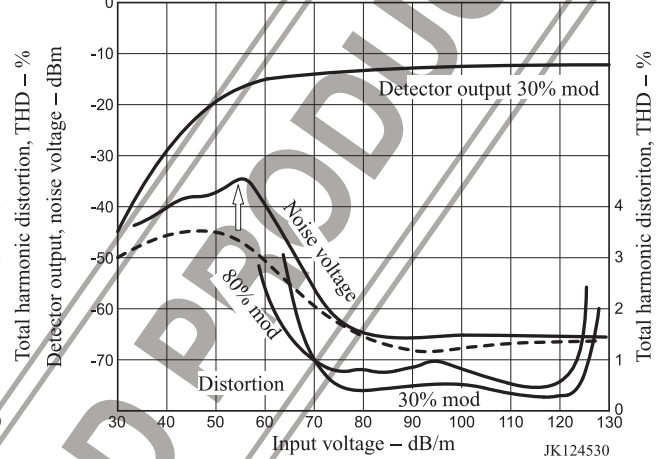
Following 2 changes are recommended as C-coupling without IFT (II)



Comparison of characteristics varying parts.

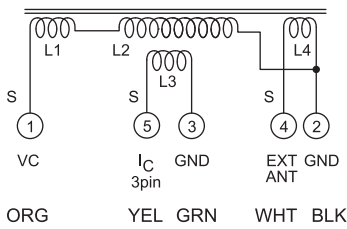


C-coupling characteristics – IFT (II) Rejecting  
C122 = 0.022μF



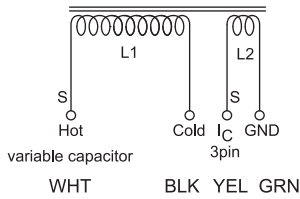
Peripheral Parts

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



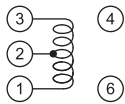
For use of general variable capacitor  
 L (between pins 1, 2) = 270 $\mu$ H  
 Q  $\geq$  180  
 L1 : solenoid 43t.  
 L2 : space 42t.  
 L3 : solenoid 7t.  
 L4 : solenoid 4t.

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



For use of variable capacitor diode  
 L (between pins 1, 2) = 250 $\mu$ H  
 Q  $\geq$  250  
 L1 : solenoid 55t.  
 L2 : solenoid 5t.

(3) Osc coil



2157-223-072 Sumida  
 L (between pins 1 and 3) = 147 $\mu$ H  
 Q  $\geq$  85  
 ③-② 39t.  
 ②-① 39t.

2157-223-082 Sumida  
 L (between pins 1 and 3) = 147 $\mu$ H  
 Q  $\geq$  85  
 ③-② 26t.  
 ②-① 52t.

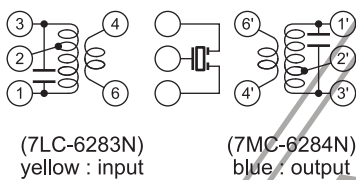
7BR-6654Y Toko  
 L (between pins 1 and 3) = 147 $\mu$ H  
 Q  $\geq$  90  
 ③-② 31t.  
 ②-① 31t.

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

c max 326.8pF  
 c min 6.7pF

(5) Variable Capacitor Diode (SVC332 Sanyo)

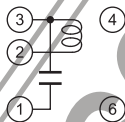
(6) IFT (I) (CMFQ-021A Toko Co.,)



CFMQ-021A  
 ③-② 58t.  
 ②-① 98t.  
 ⑥-④ 16t.  
 Cent. Freq. 450kHz  
 Qu = 70+20%  
 Tuned Cap. 180pF

③-② 18t.  
 ②-① 130t.  
 ⑥-④ 16t.  
 Cent. Freq. 450kHz  
 Qu = 110  
 Tuned Cap. 180pF

(7) IFT (II)



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

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

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

UNVALUED PRODUCT

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