



SANYO Semiconductors

DATA SHEET

Monolithic Linear IC

LA1805 — AM / FM-IF / MPX Tuner System for Radio-Cassette Recorders, Music Centers

Overview

The LA1805 is a characteristics-improved version of the LA1810, with the same pin assignment and package as those of the LA1810. Improvements are made on the following point:

- Separation (35dB→48dB) and its dependence on freerunning frequency (Sep - f_F Characteristic on page 5).
- FM main distortion (0.8%→0.45%).
- AM detection output (approximately 5dB increased).

The constants on five external parts are changed as shown on page 11.

Functions

- FM-IF: IF amp, quadrature detector, soft muting, tuning indicator.
- MPX: PLL stereo decoder, stereo indicator, forced monaural, VCO stop.
- AM: RF amp, MIX, OSC (with ALC), IF amp, detector, AGC, tuning indicator.

Features

- FM / AM / MPX functions contained on a single chip.
- Minimum number of external parts required.
- On-chip FM muting function.
- High sensitivity.
- Less carrier leak of MPX.

Specifications

Maximum Ratings at $T_a=25^\circ\text{C}$, See specified Test Circuit.

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$	Pins 3, 7, 8, 11, 20, 21	9	V
Maximum supply current	$I_{CC\text{ max}}$	Pins 3+20+21	50	mA
Flow-in current (Indicator drive current)	I_{LED}	Pins 7, 8	20	mA
Flow-out current	I_{23}	Pin 23	0.1	mA
Allowable power dissipation	$P_{d\text{ max}}$	$T_a \leq 70^\circ\text{C}$	500	mW
Operating temperature	T_{opr}		-20 to +70	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +125	$^\circ\text{C}$

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

SANYO Electric Co.,Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

LA1805

Operating Conditions at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended operating voltage	VCC		4.5	V
Operating voltage range	VCC op		3.0 to 8.0	V

Note: The FM output level forms an N curve (LA1805) and an S curve (LA1806).

LA1805: N curve (for US band)

LA1806: S curve (for Japanese band). Your desired output level can be set by varying the output resistance.

Operating Characteristics at Ta=25°C, VCC=4.5V, See specified Test Circuit.

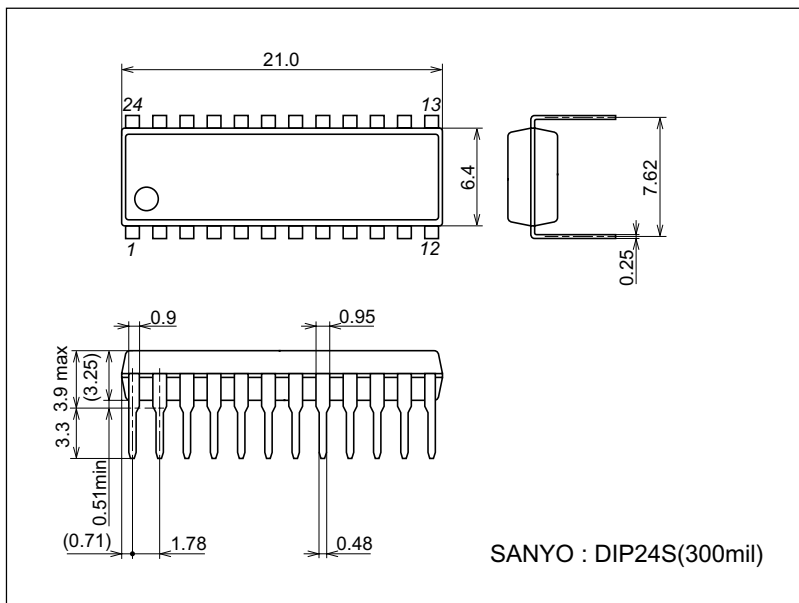
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM characteristics (Mono): $f_c=10.7\text{MHz}$, $f_m=1\text{kHz}$]						
Quiescent current	I _{CCO}	No input		13	20	mA
-3dB sensitivity	-3dBLS.	Referenced to $V_{IN}=100\text{dB}\mu$, 100%, down 3dB		28	35	dB μ
Demodulation output	V _O	$V_{IN}=100\text{dB}\mu$, 100% mod.	140	205	280	mV
Channel balance	C.B.	$V_{IN}=100\text{dB}\mu$, 100% mod.	0	0	1.5	dB
Total harmonic distortion	THD	$V_{IN}=100\text{dB}\mu$, 100% mod.		0.45	1.2	%
Signal to noise ratio	S / N	$V_{IN}=100\text{dB}\mu$, 100% mod.	70	80		dB
LED ON sensitivity	V _{LED}	I _L =1mA	23	33	43	dB μ
[FM characteristics (Stereo): $f_c=10.7\text{MHz}$, $f_m=1\text{kHz}$, L+R=90%, pilot=10%, $V_{IN}=100\text{dB}\mu$]						
Separation	Sep		32	48		dB
Stereo distortion	THD (Main)			0.45	1.2	%
LED ON level	V _{LED-on}		2.4	3.9	5.4	%
LED OFF level	V _{LED-off}			2.7		%
[AM characteristics: $f_c=1000\text{kHz}$, $f_m=1\text{kHz}$]						
Quiescent current	I _{CCO}	No input		9.5	14.5	mA
Demodulation output	V _{O1}	$V_{IN}=23\text{dB}\mu$, 30% mod.	27	50	90	mV
	V _{O2}	$V_{IN}=80\text{dB}\mu$, 30% mod.	70	113	173	mV
Signal to noise ratio	S / N1	$V_{IN}=23\text{dB}\mu$, 30% mod.	17	21		dB
	S / N2	$V_{IN}=80\text{dB}\mu$, 30% mod.	50	55		dB
Total harmonic distortion	THD1	$V_{IN}=80\text{dB}\mu$, 30% mod.		0.45	1.2	%
	THD2	$V_{IN}=100\text{dB}\mu$, 30% mod.		0.6	1.5	%
LED on sensitivity	V _{LED}	I _L =1mA	16	24	32	dB μ

Note: Be fully careful of dielectric breakdown.

Package Dimensions

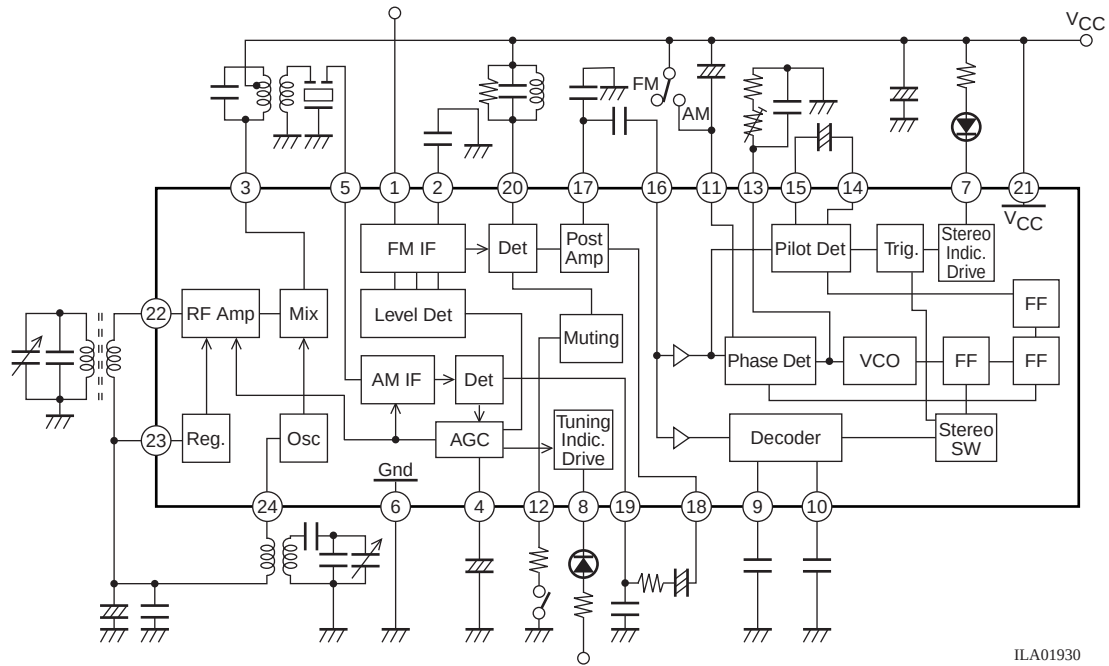
unit : mm

3067B

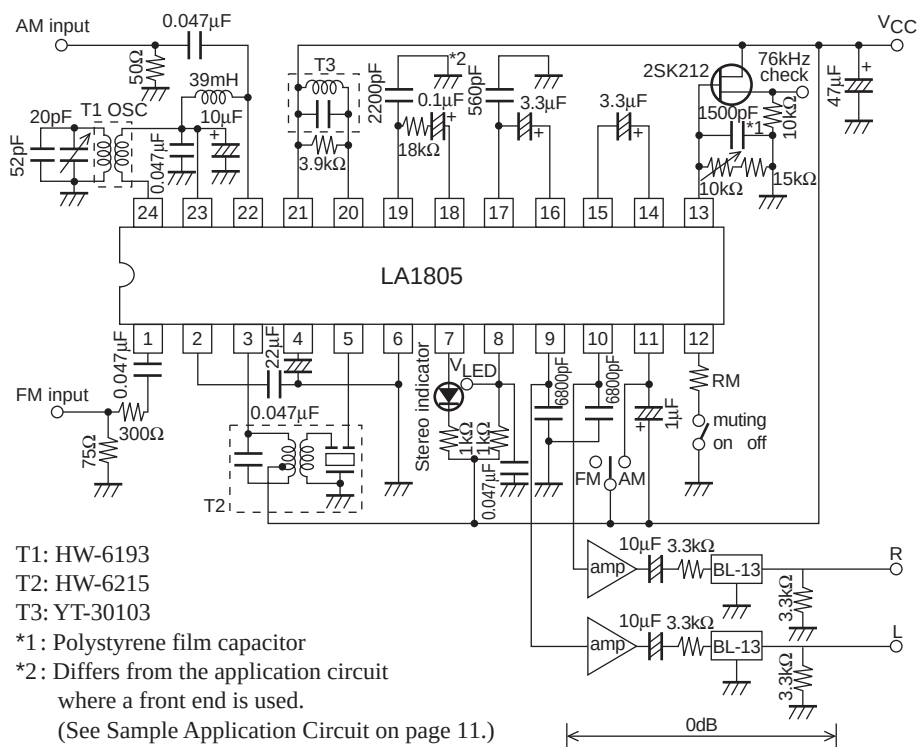


LA1805

Equivalent Circuit Block Diagram



Test Circuit



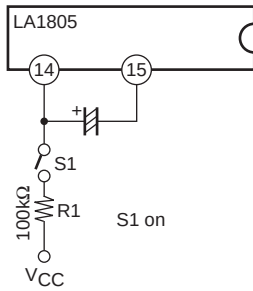
How to use the LA1805

1. Forced monaural mode.

Figures 1 and 2 show how to cause the forced monaural mode to be entered.

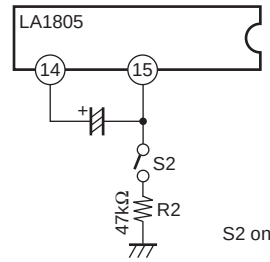
(1) Connect pin 14 to VCC through a resistor of 100k Ω . (Turn ON the SW1 in Figure 1.)

(2) Connect pin 15 to GND through a resistor of 47k Ω . (Turn ON the SW2 in Figure 2.)



ILA01932

Figure 1 Forced Monaural Mode Setting Method

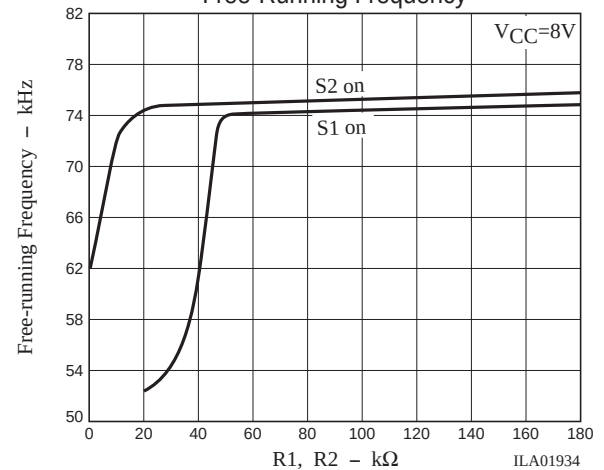


ILA01933

Figure 2 Forced Monaural Mode Setting Method

Either above-mentioned (1) or (2) causes the forced monaural mode to be entered. In this case, the VCO does not stop operating. If the resistance of R1 and R2 are decreased, internal bias will vary when the S1 or S2 is turned ON. This data is shown in Figure 3.

Figure 3 Forced Monaural Mode Setting Resistance Free-Running Frequency



ILA01934

2. VCO Stop

The VCO is so designed as to stop automatically at the AM mode.

(when pin 11 and pin 21 are at the same potential)

There is no pin available for stopping the VCO at the FM mode. However, the method shown right can be used to stop the VCO at the FM mode, causing the forced monaural mode to be entered.

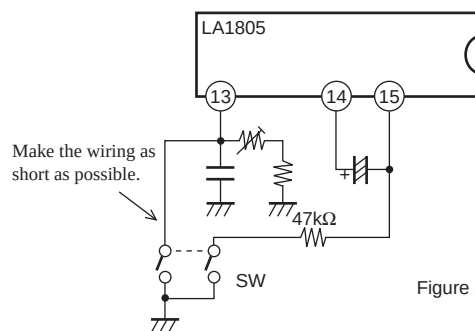


Figure 4

ILA01935

3. Free-running frequency measurement and adjustment

Either of the following two methods is used to measure the free-running frequency.

- (1) Connect pin 13 to a frequency counter through the high input impedance amplifier.
- (2) Connect the connection point of the semifixed resistor connected to pin 13 and the fixed resistor to a frequency counter through the resistor of 240k Ω or greater.

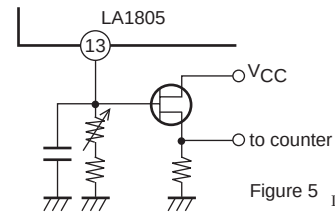


Figure 5 ILA01936

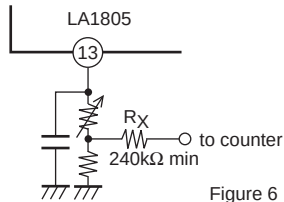
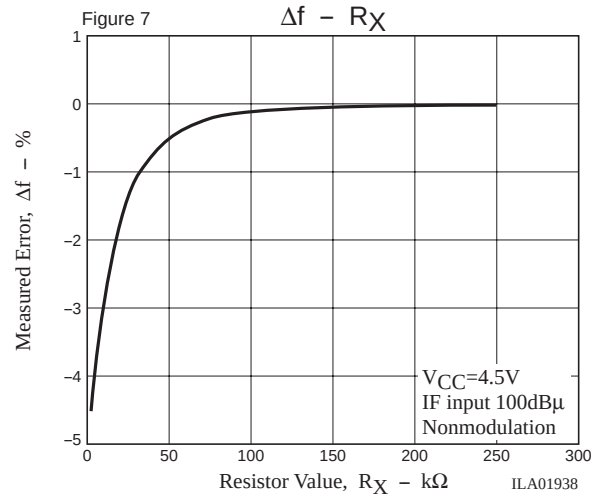


Figure 6 ILA01937

How the error changes with the resistor value is shown in Figure 7.

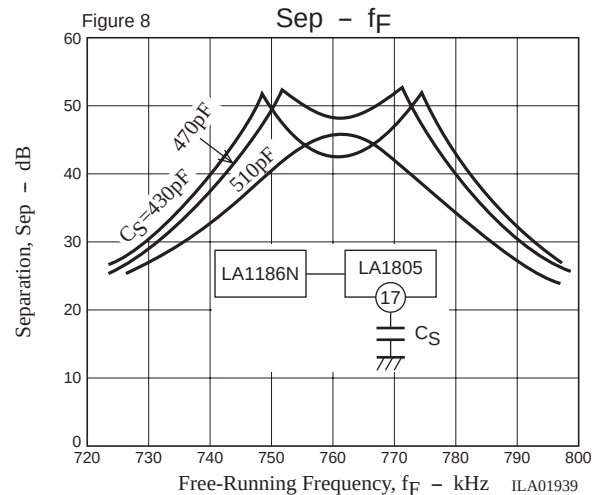


When setting the free-running frequency, the following must be noted.

Apply a 10.7MHz 100dB μ nonmodulation carrier as IF input signal and set to 76kHz $\pm$ 50Hz with the tuning indicator lighted.

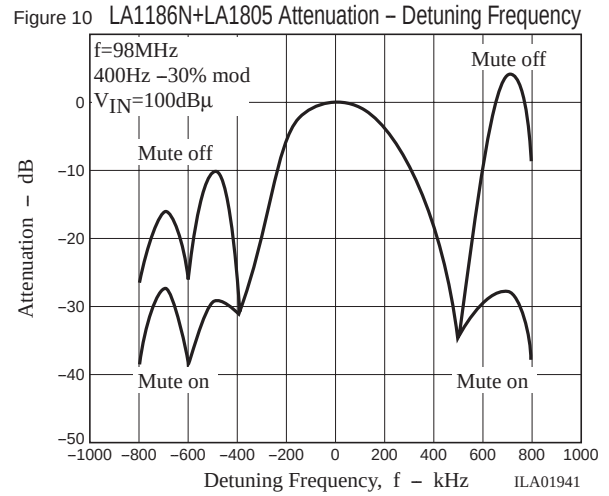
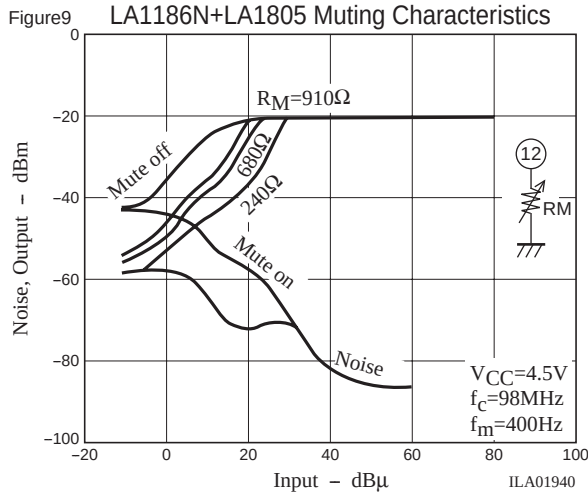
4. Separation setting capacitor C_S

The separation characteristic for the LA1805 alone (IF input) differs from that for the antenna input with a front end. This difference is caused by the characteristics of the front end and ceramic filter. Shown right is how the separation characteristic changes with the separation setting capacitor value when the LA1186N is used as front end. Referring to this separation characteristic, choose the optimum separation for your set model.

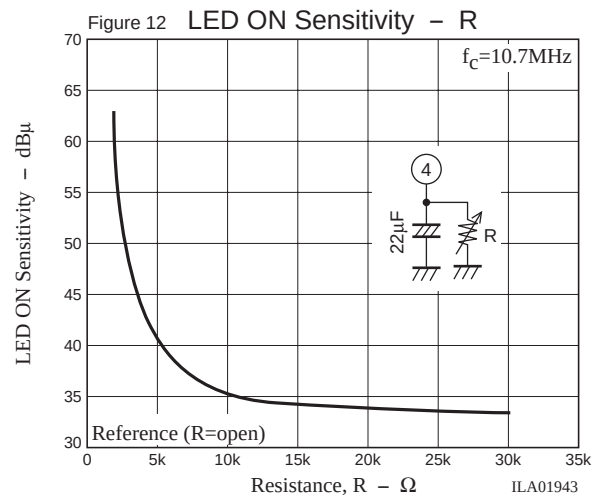
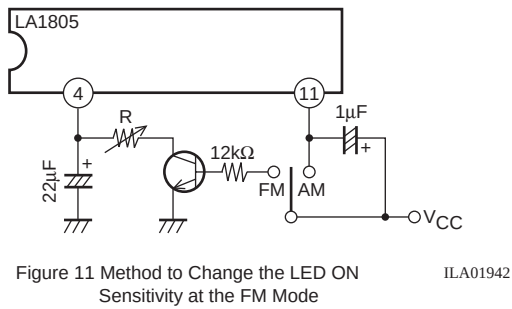


5. FM muting pin

The external resistor connected to pin 12 can be used to vary the muting level (Figure 9). The abnormal sound at the time of side peak reception at the FM mode can be reduced by weak signal muting.

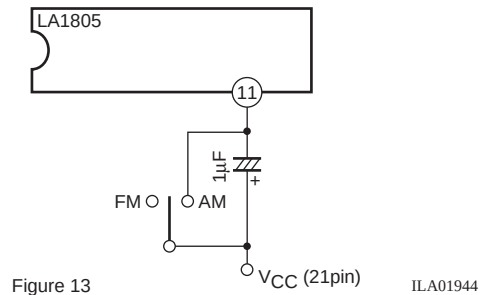


6. The following method can be used to change the LED ON sensitivity at the FM mode (Figure 11). The data on the LED ON sensitivity setting resistance and LED ON sensitivity is shown in Figure 12.



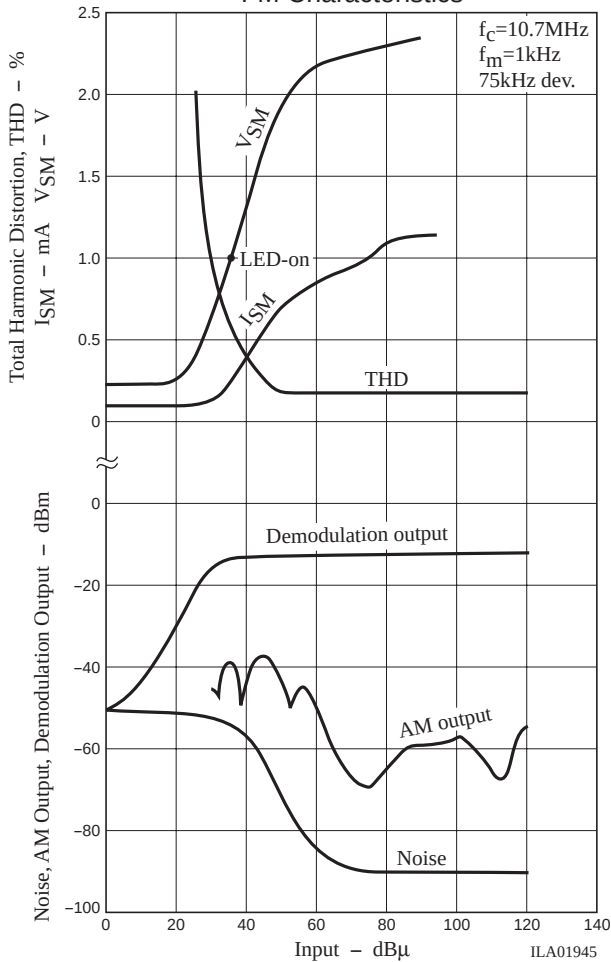
7. AM-FM selection

The FM mode is entered with pin 11 open as shown in Figure 13. When pin 11 and pin 21 are made to be at the same potential in terms of DC, the AM mode is entered. It should be noted that the dynamic range is narrowed whether the potential at pin 11 is lower or higher than that at pin 21.

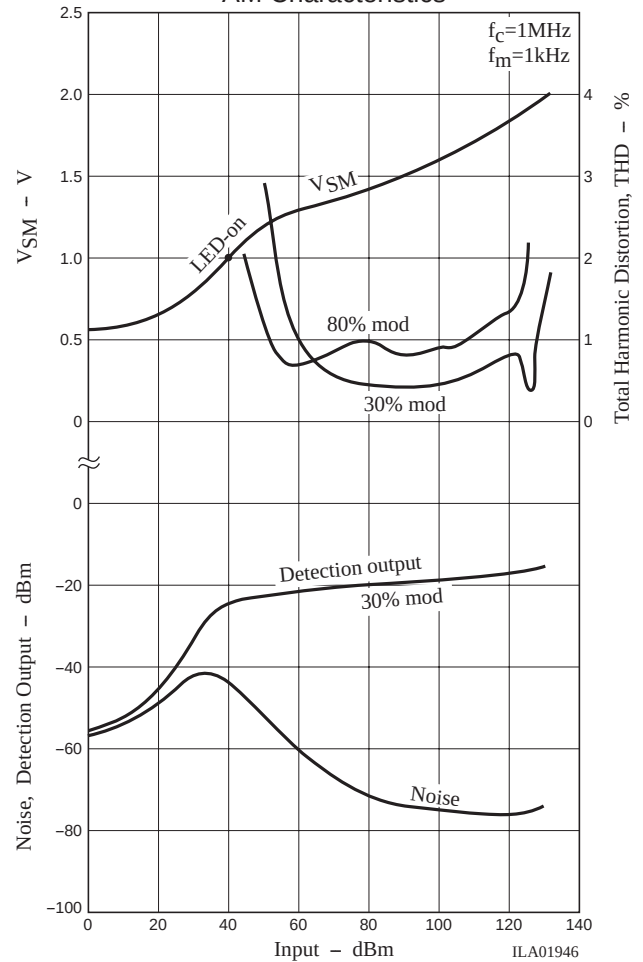


8. If a noise appears in the detection output when the tuning LED goes ON at the AM mode, connect a capacitor across pin 8 and GND to eliminate the noise.

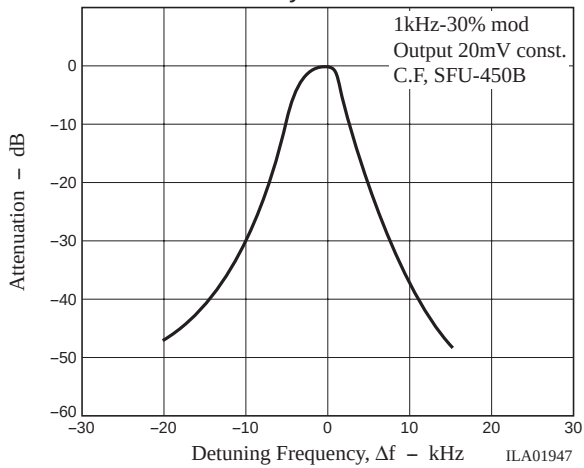
FM Characteristics



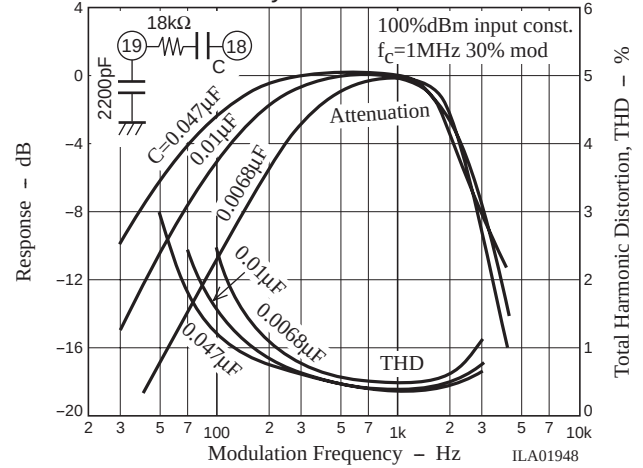
AM Characteristics



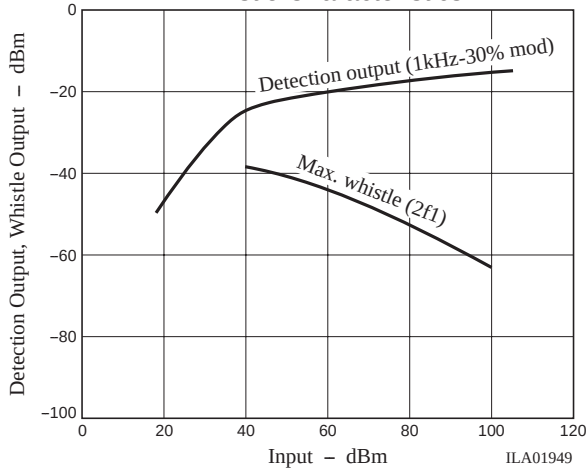
Selectivity Characteristic



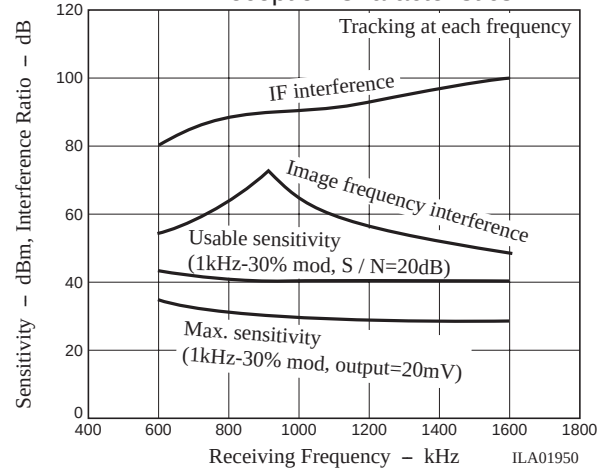
Fidelity Characteristics

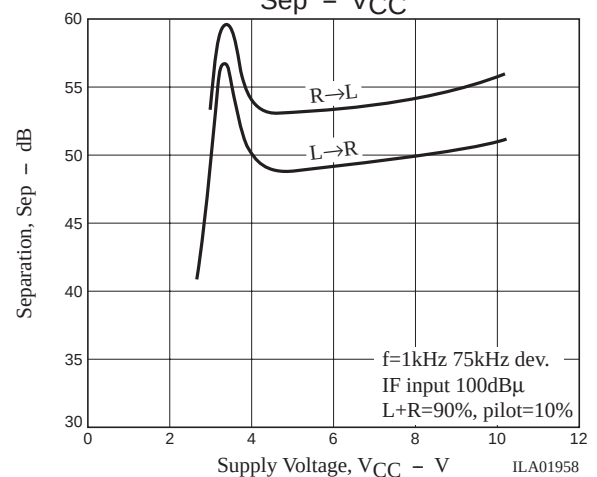
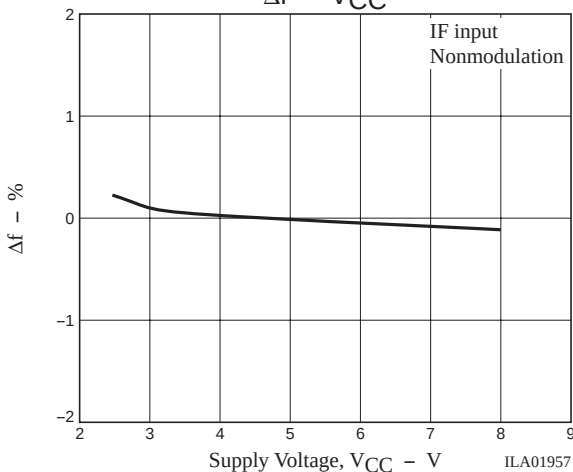
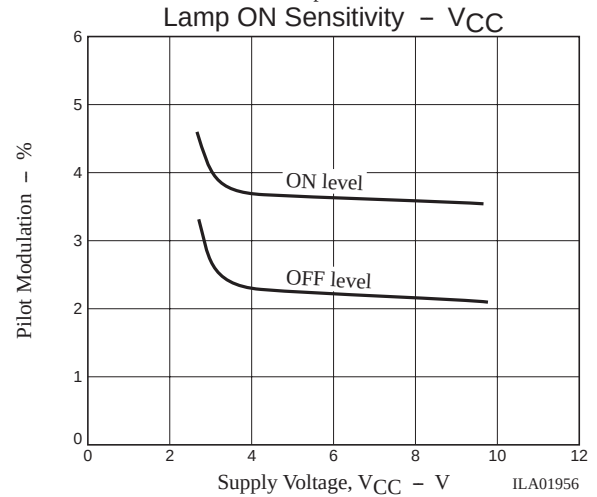
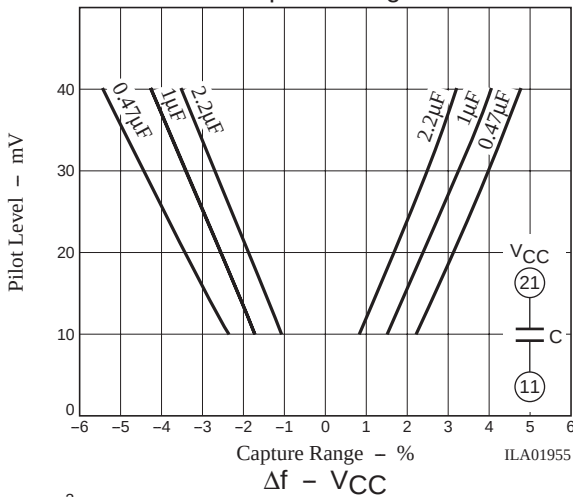
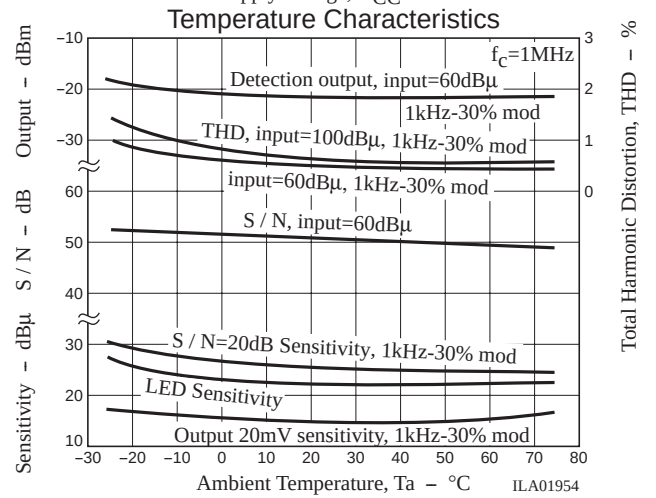
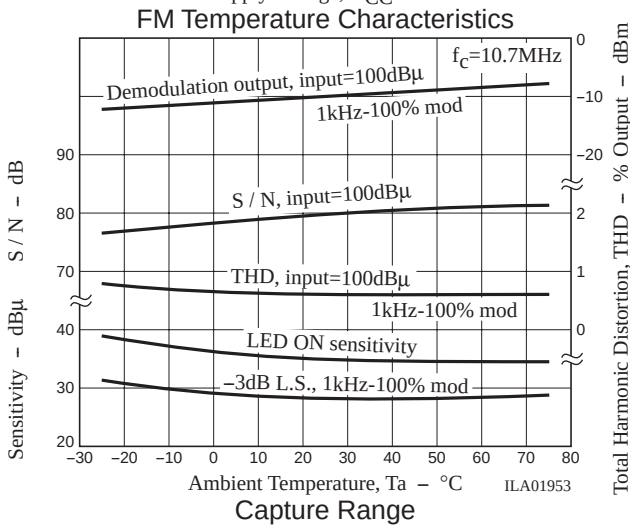
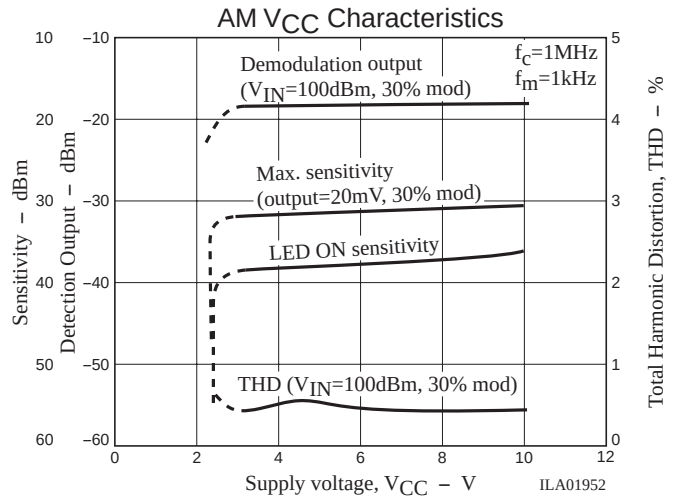
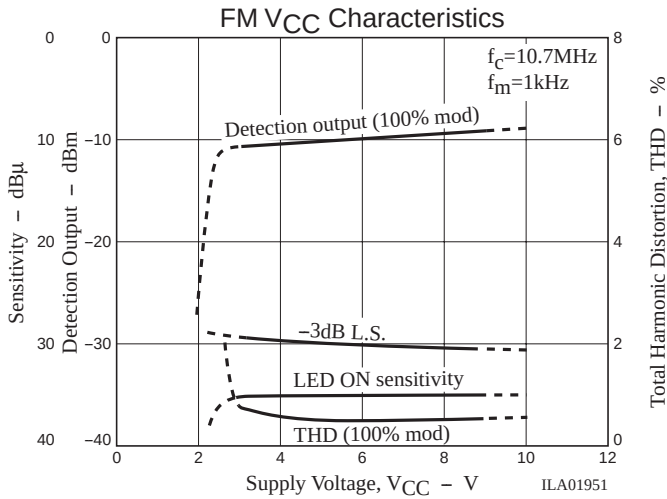


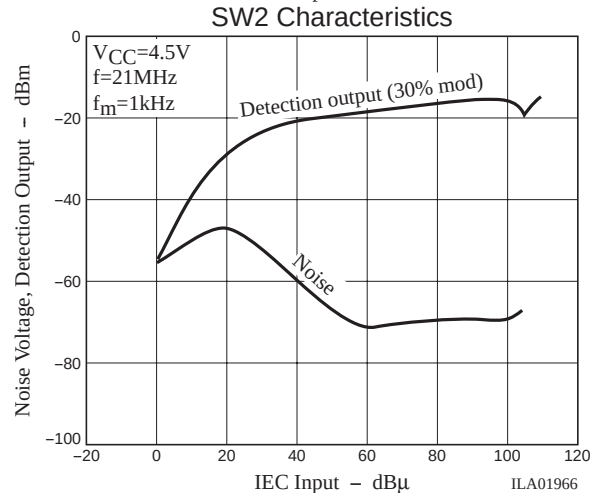
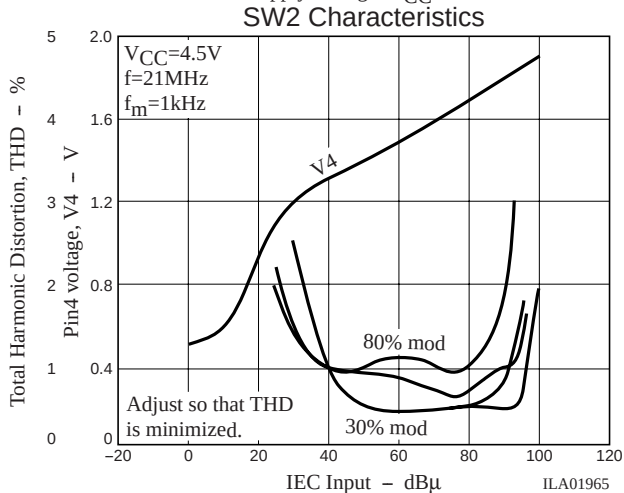
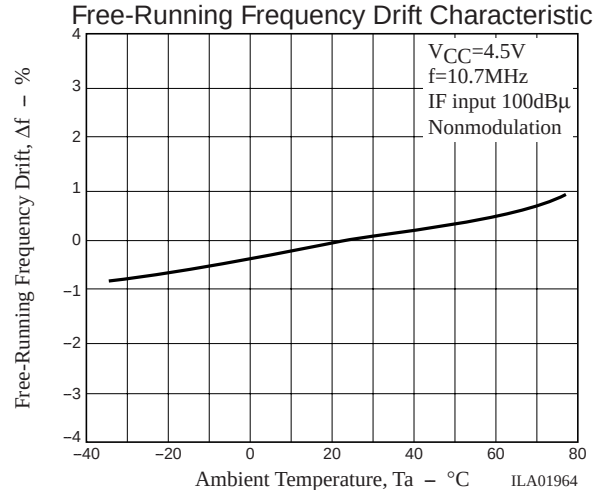
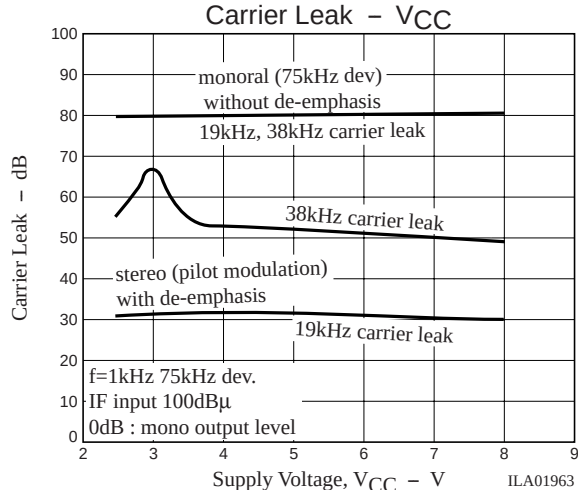
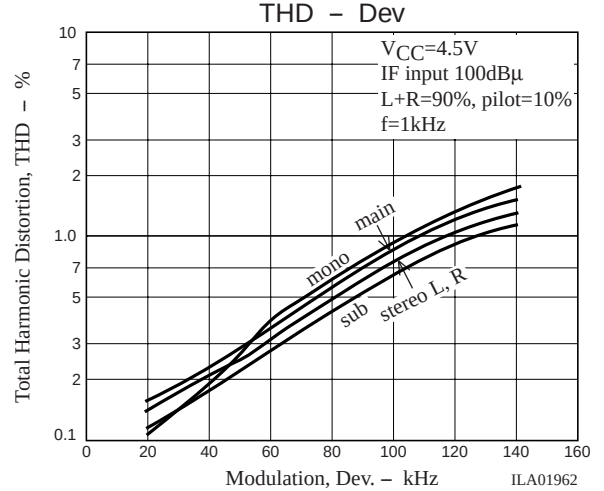
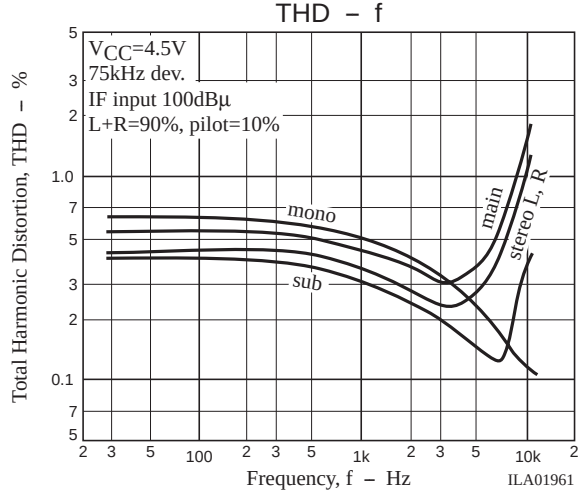
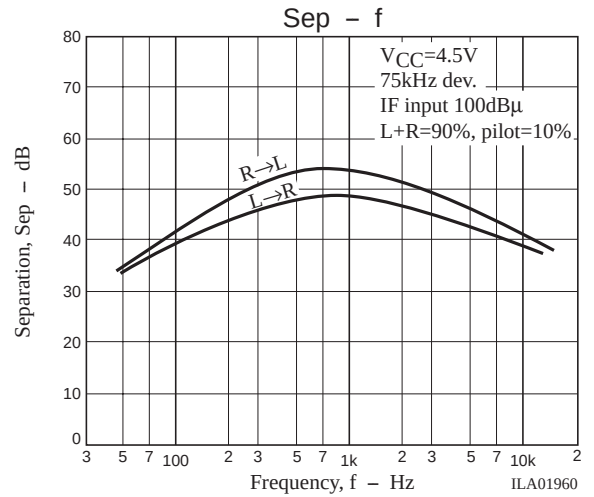
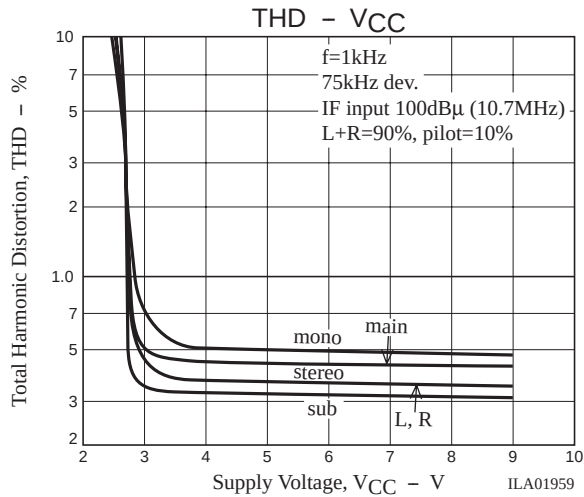
Whistle Characteristics

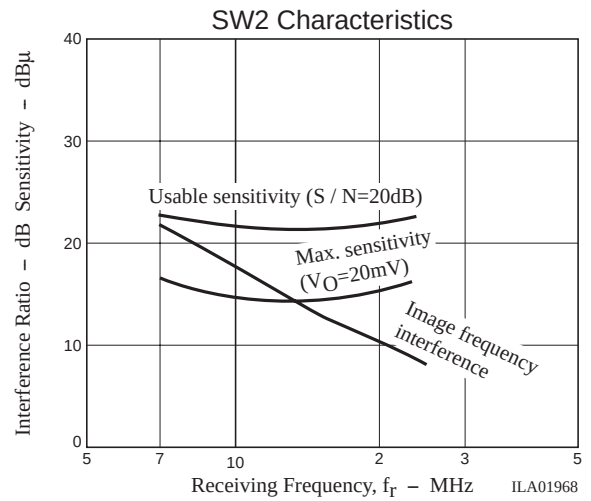
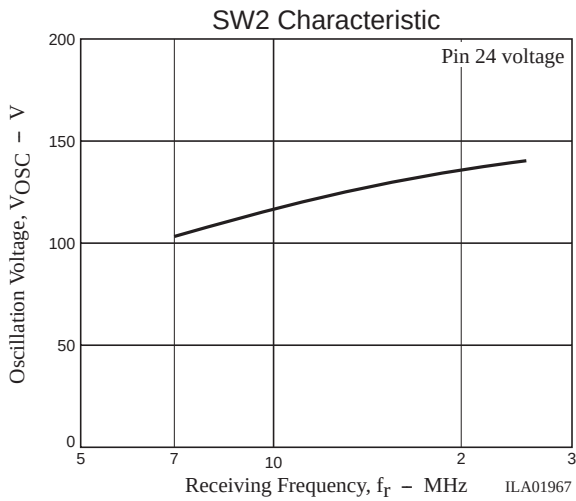


MW Reception Characteristics

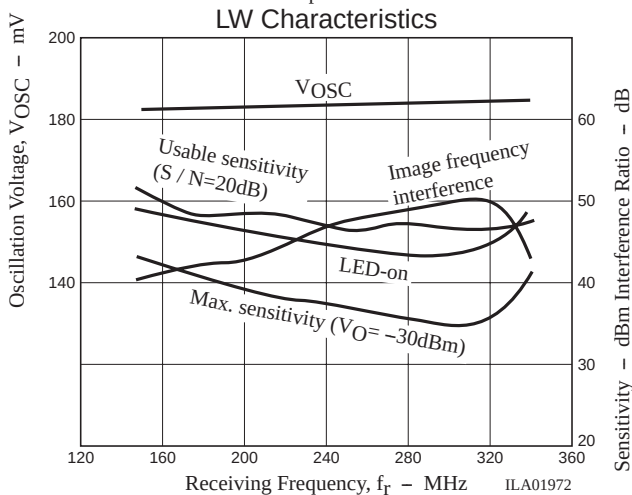
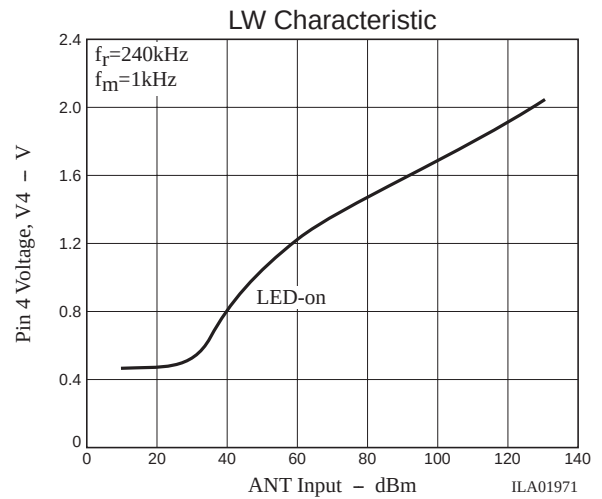
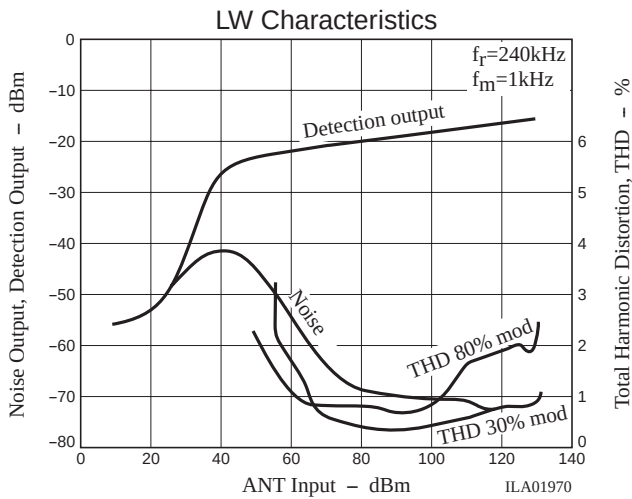
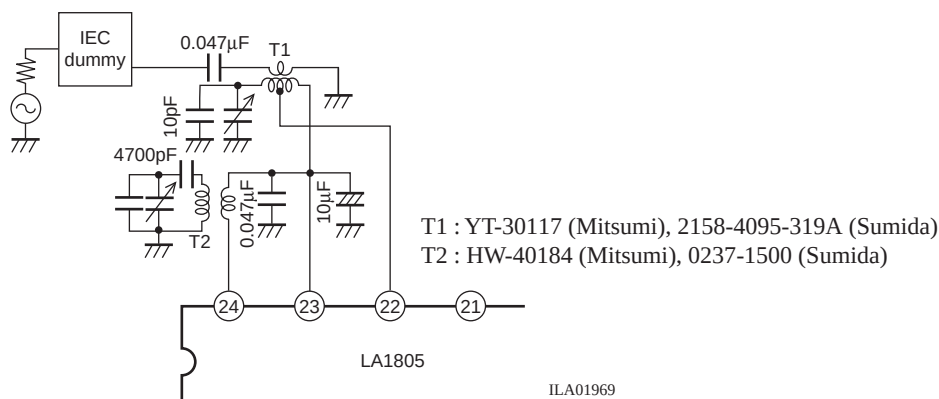




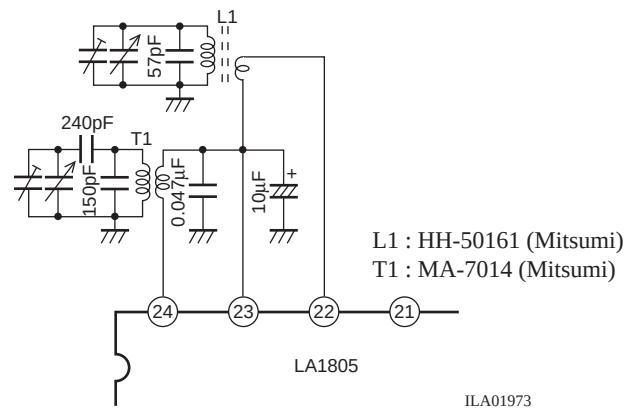




SW Band Test Circuit

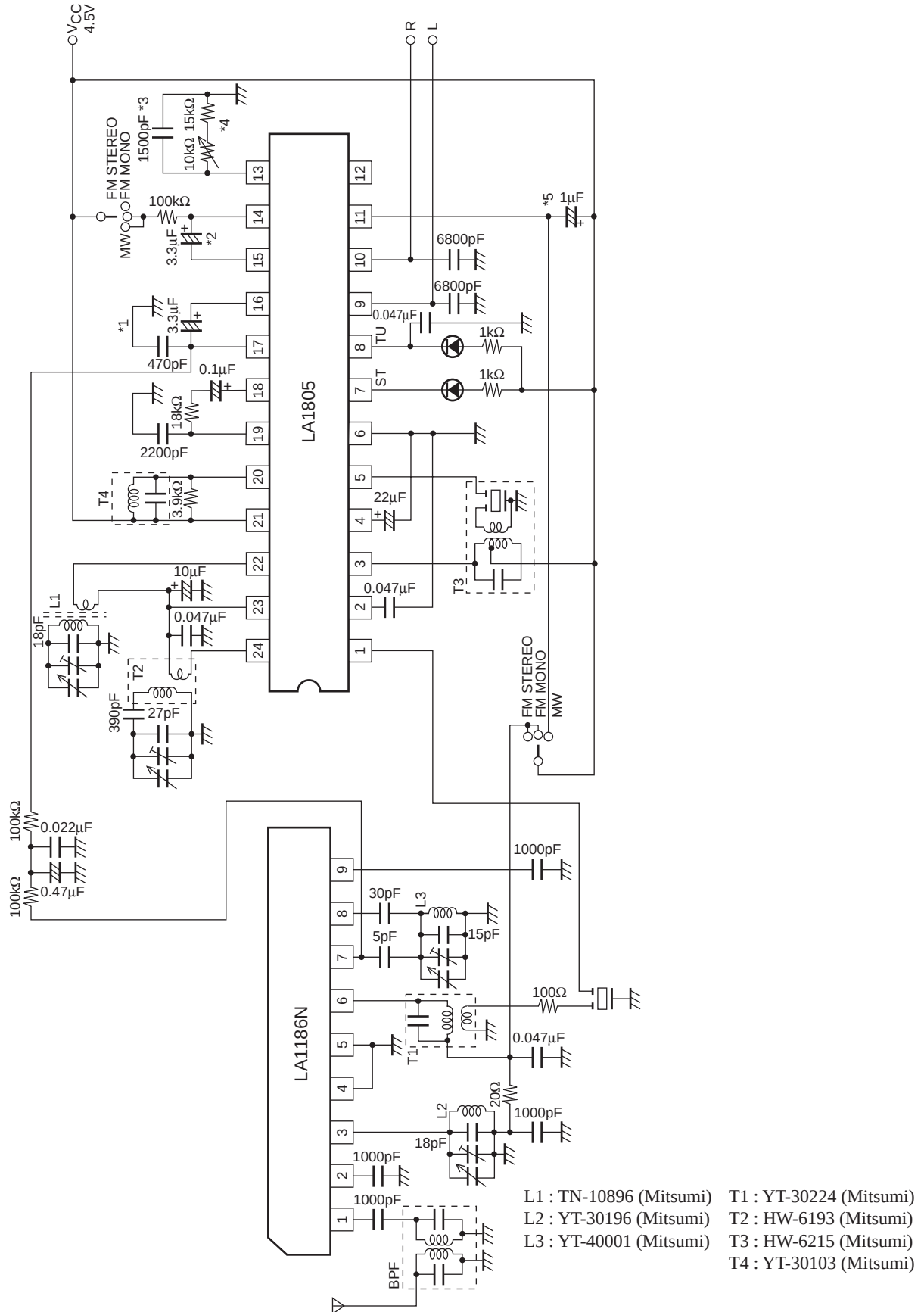


LW Band Test Circuit



LA1805

Sample Application Circuit: LA1186N+LA1805 FM/MW

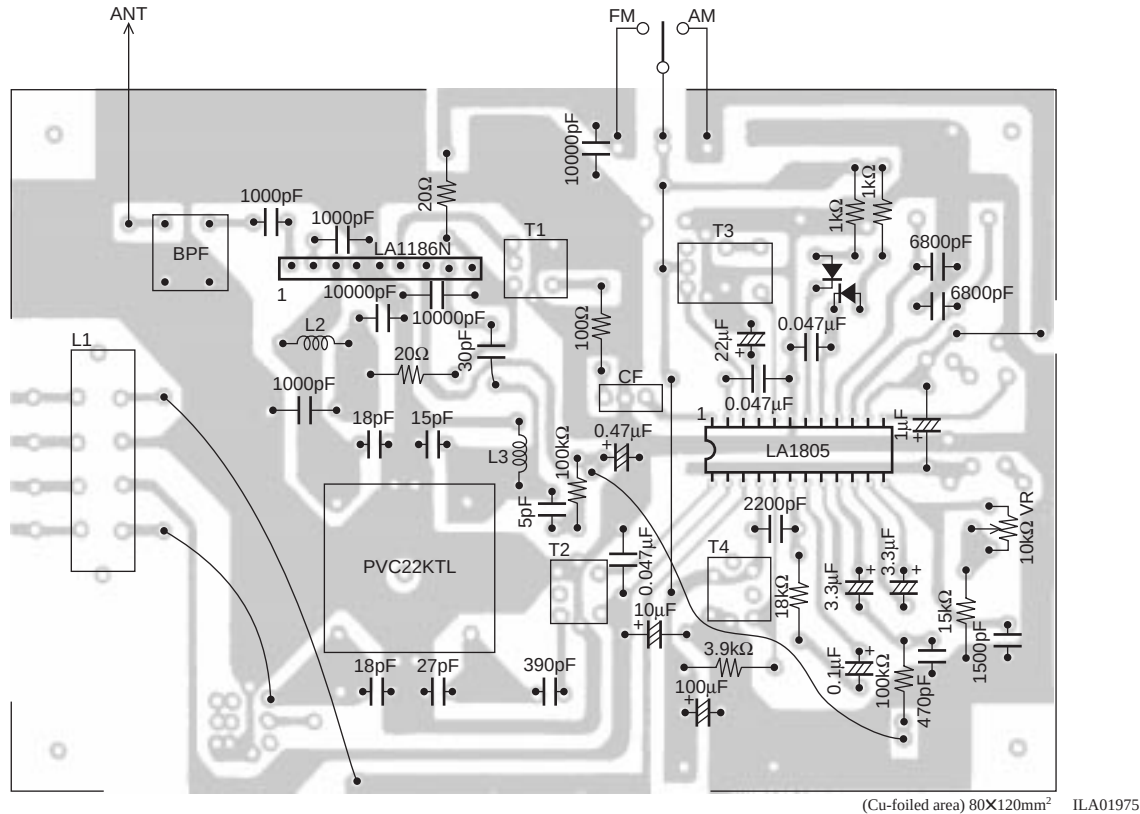


Note : The constants of parts *1 to *5 are changed from those of the LA1810.

ILA01974

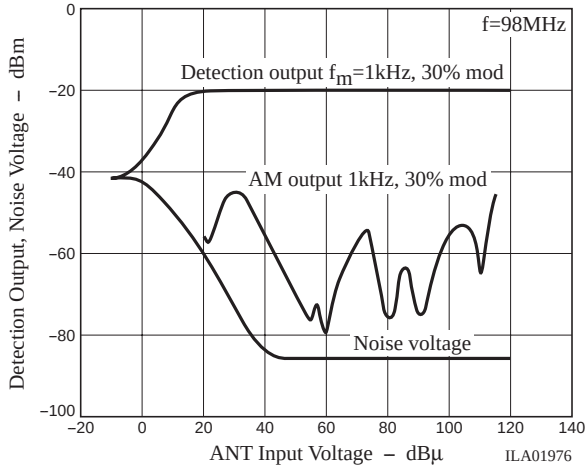
LA1805

Sample Printed Circuit Pattern (See Sample Application Circuit.)



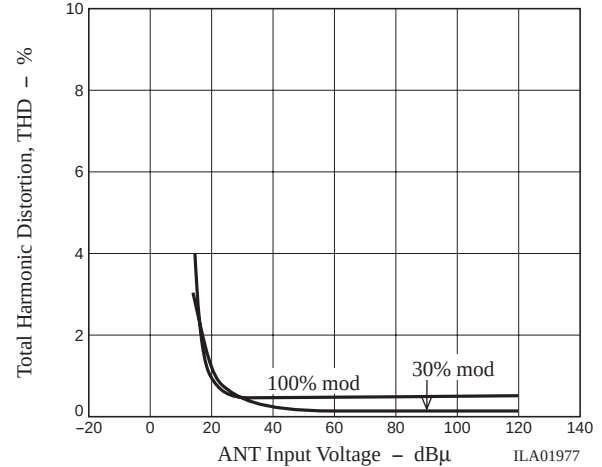
(Cu-foiled area) 80X120mm² ILA01975

LA1186N+LA1805 Over Characteristics



ILA01976

LA1186N+LA1805 Over Characteristics



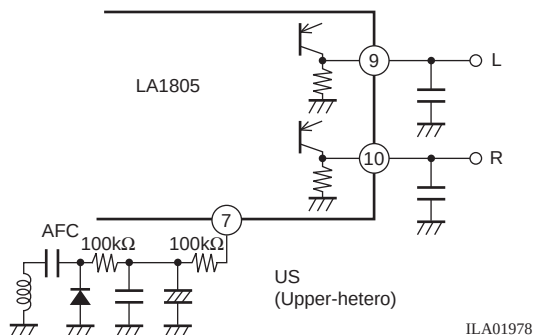
ILA01977

Differences between LA1805 and LA1806

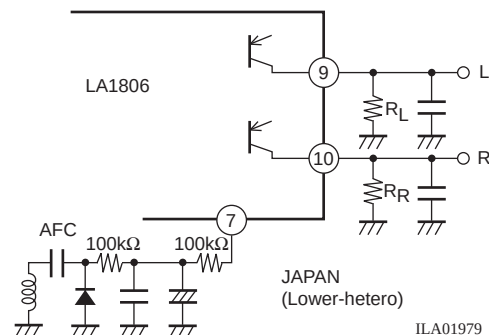
(1) Same pin assignment

(2) The internal circuit of the MPX OUT (pin 9, pin 10) is different as shown below.

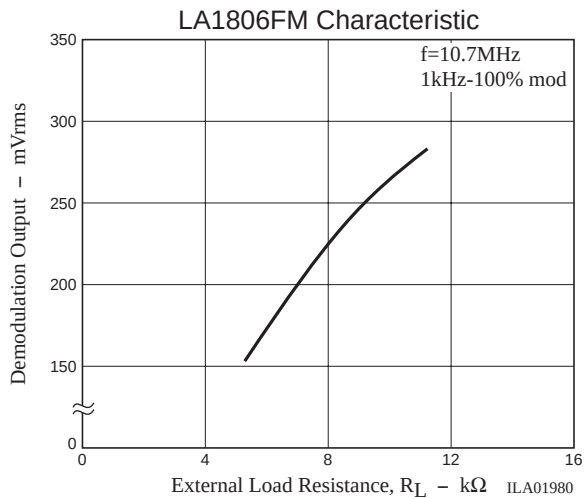
The FM S curve at pin 17 is in the opposite direction and the circuit in which AFC is provided is the same for the US band and Japanese band.



The LA1805 contains the output load resistors
(Output load resistance=6.8kΩ)

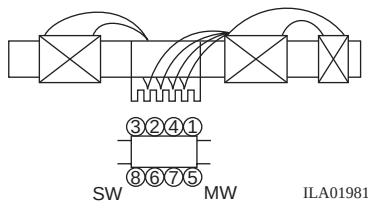


For the LA1806, output load resistors R_L , R_R are connected externally.
The graph of demodulation output vs. R_L (R_R) is shown below.



Coil Specifications

- MW bar antenna
TN-10896 (Mitsumi)



①-② 22T+49T, ③-④ 10T

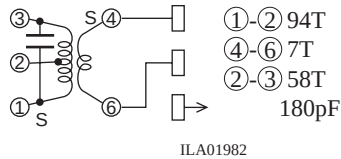
⑤-⑥ 17T, 0.5 ϕ

⑦-⑧ 4T

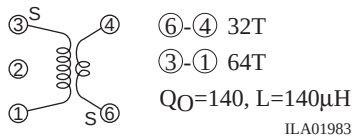
①-② $L=260\mu\text{H}$, $Q_0=330$ (≥ 200)

⑤-⑥ $L=15\mu\text{H}$, $Q_0=250$ (≥ 150)

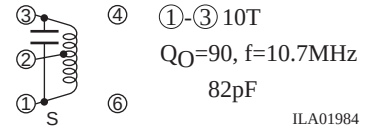
- AM IFT
HW-6215 (Mitsumi) HW-6194
SFU-450B



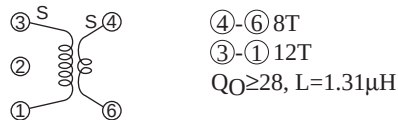
- MW OSC
HW-6193 (Mitsumi)



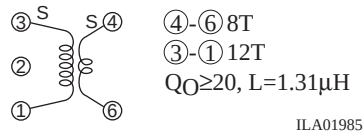
- FM quadrature
YT-30103 (Mitsumi)



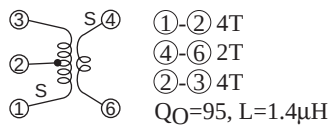
- SW2 OSC
HW-40184 (Mitsumi)



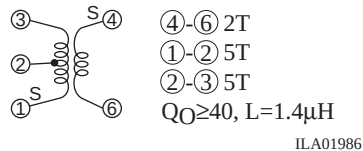
- 0237-1500 (Mitsumi)



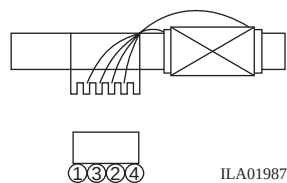
- SW2 ANT
YT-30117 (Mitsumi)



- 2158-4095-319A (Sumida)

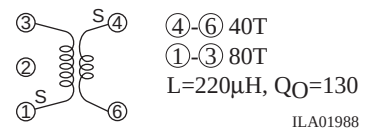


- LW bar antenna
HH-50161 (Mitsumi)



①-② 20T
③-④ 200T
③-④ $L=2.74\text{mH}$, $Q_0 \geq 200$

- LW OSC
MA-7014 (Mitsumi)



- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products(including technical data,services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of January, 2006. Specifications and information herein are subject to change without notice.