Ordering number : EN1506D

Monolithic Linear IC

LA1260

FM/AM Tuner System for Radio-Casette Recorders, Music Centers

Functions

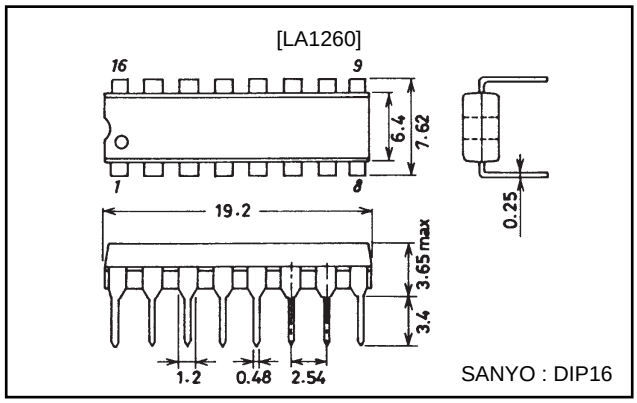
FM : IF amplifier, quadrature detector, AF preamplifier, tuning indicator drive output.

AM : RF amplifier, MIX, OSC (with ALC), IF amplifier, Detector, AGC, tuning indicator drive.

Package Dimensions

unit : mm

3006B-DIP16



Features

- Minimum number of external parts required (No AM detection coil required).
- High S/N : FM 81dB
  AM 53dB
- Low-level AM oscillator with ALC : Pin 16 OSC output
  MW 130mV
  SW 70 mV to 90 mV
  (7MHz) (24MHz)
- Less AM whistle interference : Whistle 1% at input 100dB/m.
- On-chip LED tuning indicator driver.
- On-chip FM/AM selector.
- Independent FM/AM output pins : Possible to set FM/AM frequency characteristic independently.

Specifications

Maximum Ratings at Ta=25°C, See specified Test Circuit.

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	Pins 6, 12	9	V
Maximum current drain	I_{CC} max	Pins 6+7+12	50	mA
Flow-in current	I_7	Pin 7	20	mA
Flow-out current	I_{15}	Pin 15	0.1	mA
Allowable power dissipation	Pd max	Ta≤70°C	450	mW
Operating temperature	Topr		–20 to +70	°C
Storage temperature	Tstg		–40 to +125	°C

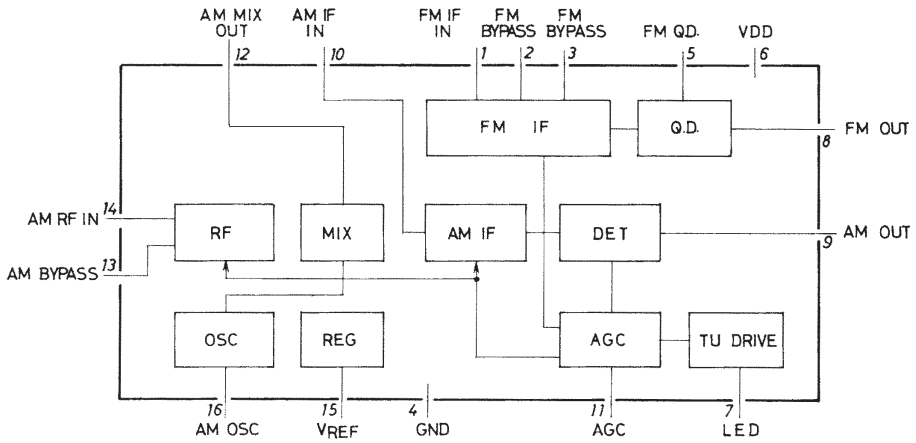
Operating Conditions at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended operating voltage	V_{CC}		4.5	V
Operating voltage range	V_{CC} op		3.0 to 8.0	V

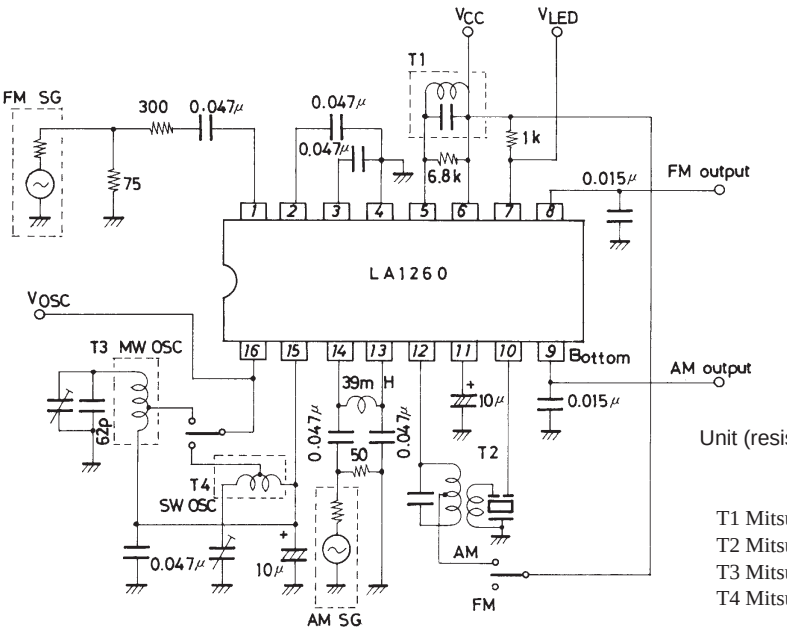
Operating Characteristics at Ta=25°C, V_{CC}=4.5V, See specified Test Circuit

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[AM Characteristics : f=1MHz]						
Quiescent current	Icco AM	V_{IN}=No input		7.5	10.5	mA
Detection output	V_O1	V_{IN}=23dBμ, 400Hz-30% mod.	–33	–28	–23	dBm
			17.3	31	55	mV
S/N ratio	S/N1	V_{IN}=23dBμ, 400Hz-30% mod.	18.0	21.5		dB
Detection output	V_O2	V_{IN}=60dBμ, 400Hz-30% mod.	–19.0	–16.0	–13.0	dBm
			87	122	174	mV
S/N ratio	S/N2	V_{IN}=60dBμ, 400Hz-30% mod.	48	53		dB
Total harmonic distortion	THD1	V_{IN}=60dBμ, 400Hz-30% mod.		0.45	1.3	%
	THD2	V_{IN}=100dBμ, 400Hz-30% mod.		1.5	3.0	%
LED lighting voltage	V_{LEDAM}	I_C=1mA	22	30	38	dBm
Oscillation output (24MHz)	V_{OSC24M}		60	86	120	mV
[FM Characteristics : f=10.7MHz]						
Quiescent current	IccoFM	V_{IN}=No input		8.5	12.0	mA
–3dB sensitivity	V_{IN}lim	–3dB down, 400Hz-100% mod.		35	42	dBμ
Demodulation output	V_O3	V_{IN}=80dBμ, 400Hz-100% mod.	–12.5	–9.5	–6.5	dBm
			183	260	367	mV
S/N ratio	S/N3	V_{IN}=80dBμ, 400Hz-100% mod.	77	81		dB
	S/N4	V_{IN}=80dBμ, 400Hz-30% mod.		71		dB
Total harmonic distortion	THD3	V_{IN}=80dBμ, 400Hz-100% mod.		0.55	1.2	%
	THD4	V_{IN}=80dBμ, 400Hz-30% mod.		0.05		%
LED lighting voltage	V_{LEDFM}	I_L=1mA		39	49	dBμ
AM rejection ratio	AMR	V_{IN}=80dBμ, 400Hz-100% FM mod. 1kHz-30% AM mod.		60		dB

Equivalent Circuit Block Diagram



Test Circuit



Unit (resistance : Ω, capacitance : F)

T1 Mitsumi YT30194 (56pF tuning)
T2 Mitsumi KW30011
T3 Mitsumi YT30105
T4 Mitsumi YT30112

Proper Cares in Using the IC

External parts placement and pattern

- The AM local oscillation parts, AM local oscillation coil, and antenna circuit parts such as bar antenna must be separated from each other as far as possible to prevent Qs from worsening.
- Pin 16 (AM oscillation injection pin) and pin 14 (RF input pin) must be separated from each other on the pattern as shown in Figure. A below. Care should be taken not to make unwanted coupling by parallel wiring as shown in Figure B to prevent Qs from worsening.

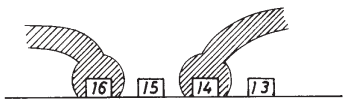


Figure A Good example

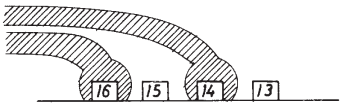


Figure B Bad example

FM quadrature detection coil

- The values recommended for the detection coil are shown below. (See Figure 1.)

  Tuning capacitance : 56pF

  Damping resistance : 6.8kΩ

- Values other than recommended provide the LED drive characteristic as shown below.

	Value increased	Value decreased
Tuning capacitance	• Lighting is delayed. • No lighting may occur at low temperature.	• Lighting is advanced. • Mislighting may occur in the absence of signal.
Damping resistance	• Lighting is advanced. • Mislighting may occur in the absence of signal.	• Lighting is delayed. • No lighting may occur at low temperature.

If the product of tuning capacitance and damping resistance is equal to that of values recommended above (e. g. tuning capacitance=82pF, damping resistance=4.7kΩ), other characteristics (demodulation output, S/N, THD, etc.) than the LED drive characteristic remain almost unaffected.

- For applications where a double tuning coil is used, refer to "Applications where a double coil is used" on page 13.

How to apply FM AFC

The S curve at the FM output pin (pin 8) is as shown in Figure 1. Therefore, the domestic (Japan) band (lower local oscillation) use and foreign band (upper local oscillation) use differ as shown in Figures 2 and 3.

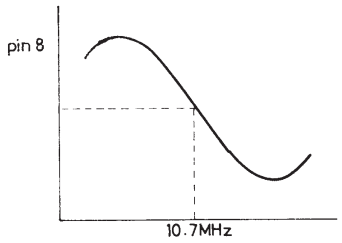


Figure 1

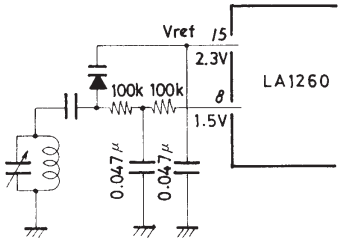


Figure 2 Domestic (lower local oscillation) band

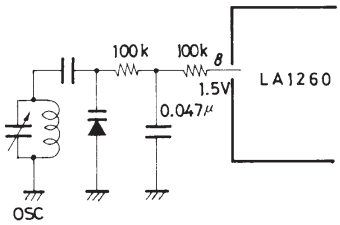
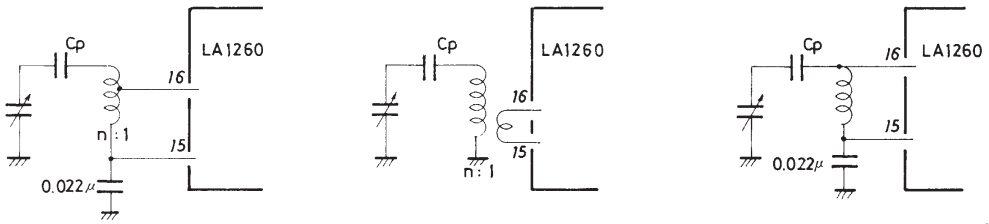


Figure 3 Foreign (upper local oscillation) band

Unit (resistance : Ω, capacitance : F)

AM local oscillation

Since the LA1260 contains an ALC circuit, the oscillation level at pin 16 can be limited to 60 to 150mV in the following applications where a coil is used.



Unit (capacitance : F)

Stable oscillation occurs at a coil impedance of 5kΩ or greater viewed from across pins 16 and 15. Turn ratio n and Q_O must be determined so that the oscillation level at pin 16 becomes 75mV or greater for MW use and 60mV or greater for SW use.

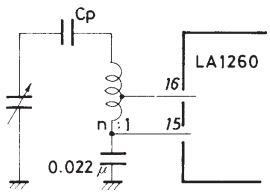
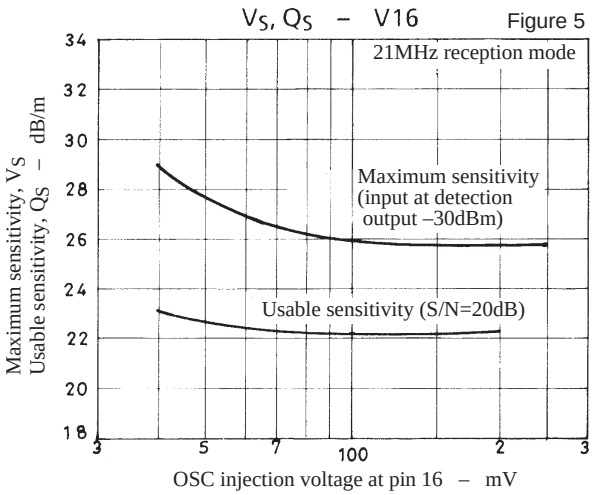


Figure 4

If turn ratio n is increased more than needed, the oscillation level at pin 16 drops, thereby lowering the maximum sensitivity as shown in Figure 5 and 6. Figure 7 shows the relation between turn ratio n and oscillation level at pin 16 in the MW band.

Unit (capacitance : F)



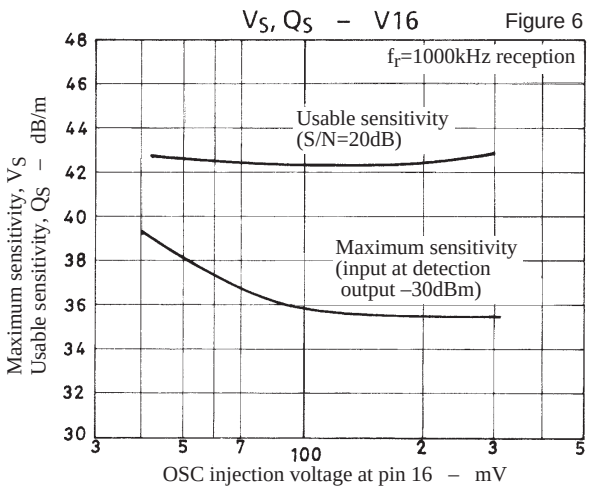
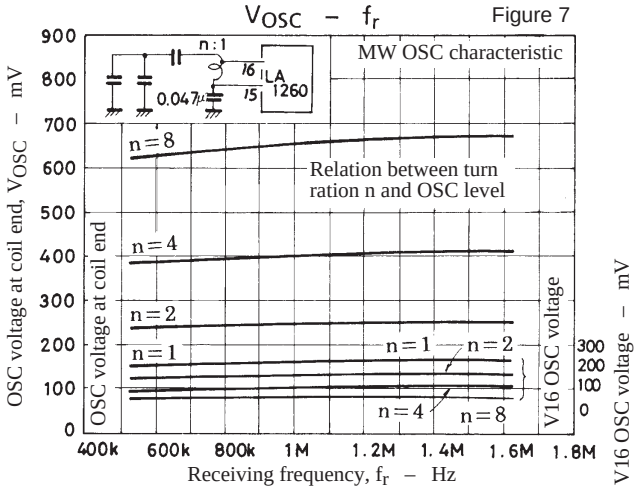
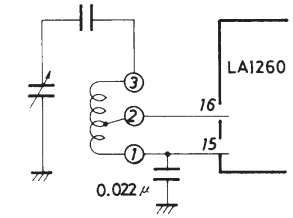


Figure 7



AM oscillation coil



Unit (capacitance : F)

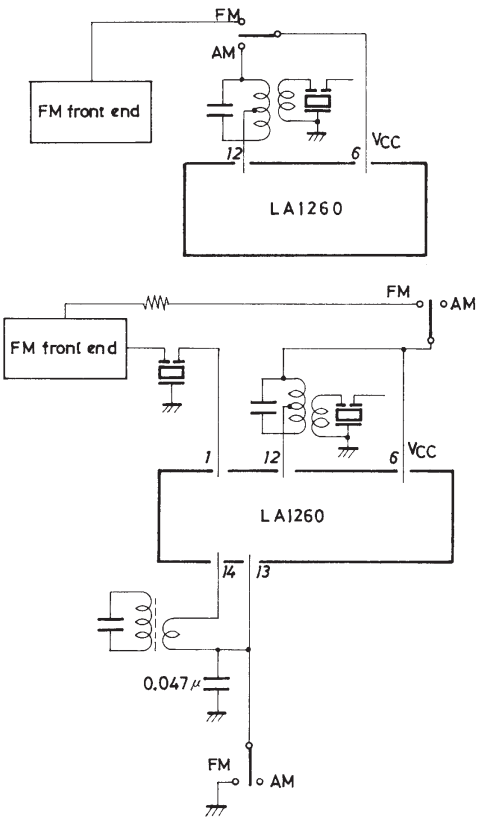
Generally speaking, the following should be noted. Winding with loose coupling between 1 and 2 and between 1 and 3 must be avoided. (Particularly SW1, SW2).

To put in concretely, the pot core type is better than the screw core type which is loose in coupling. This prevents the local oscillation frequency from turning third resonance frequency related to the coupling coefficient.

LED unlighted time and distortion in AM (MW)

By increasing the value of the electrolytic capacitor for AGC at pin 11 (Figure 8), the distortion in the AM mode can be improved, but the LED unlighted time is made longer. 10μF is recommended for obtaining the optimum LED unlighted time and distortion. The LED unlighted time is 200ms at this value (Approximately 400ms at 22μF).

FM-AM selection and dc level at pin 12



Unit (capacitance : F)

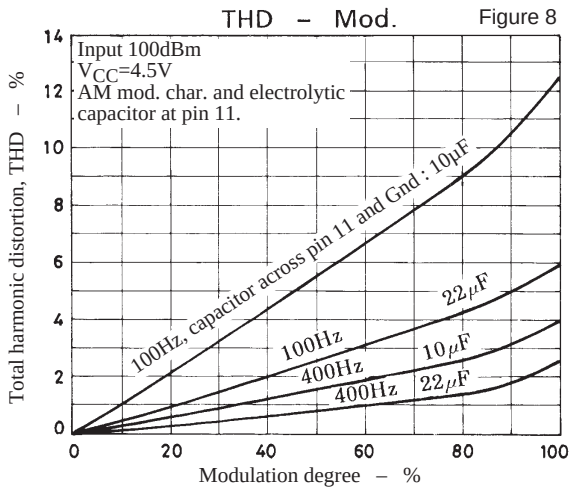
(1) Pin 12-used method=recommended circuit

The FM mode is entered with pin 12 open. When pin 12 and pin 6 are at the same potential in terms of DC, the AM circuit is turned on by the internal switch. It should be noted that the dynamic range is narrowed whether the potential at pin 12 is lower or high than that at pin 6.

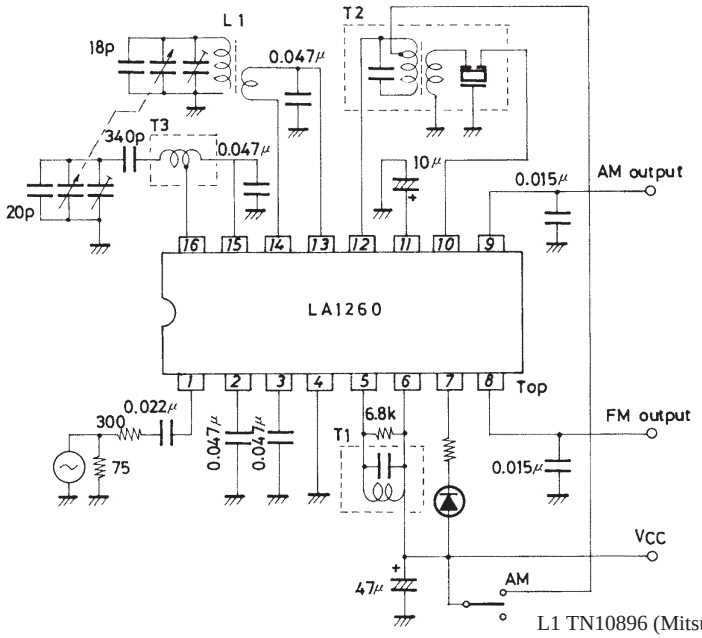
(2) Pin 13-used method

The AM mode is entered with pin 13 open. When pin 13 is grounded, the FM circuit is turned on and the AM circuit is turned off by the internal switch. In this case, pin 12 and pin 6 (V_{CC}) are at the same potential.

Figure 8



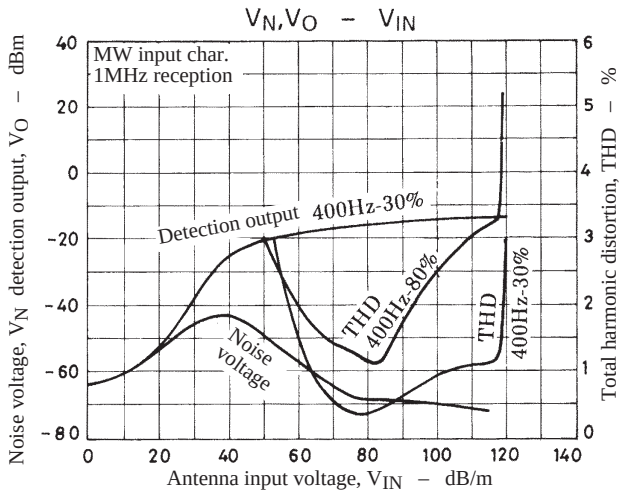
FM IF/MW Test Circuit

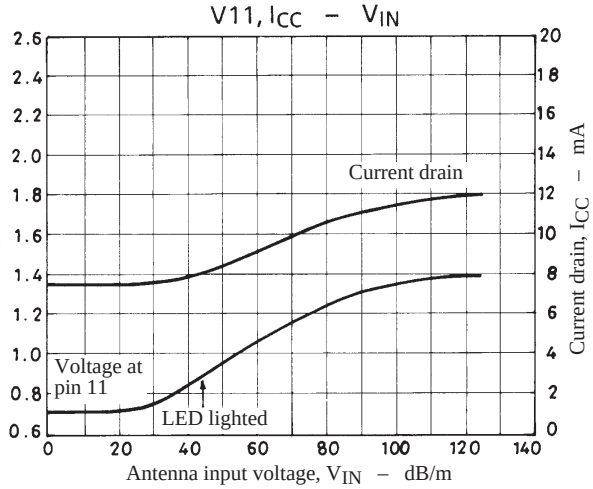


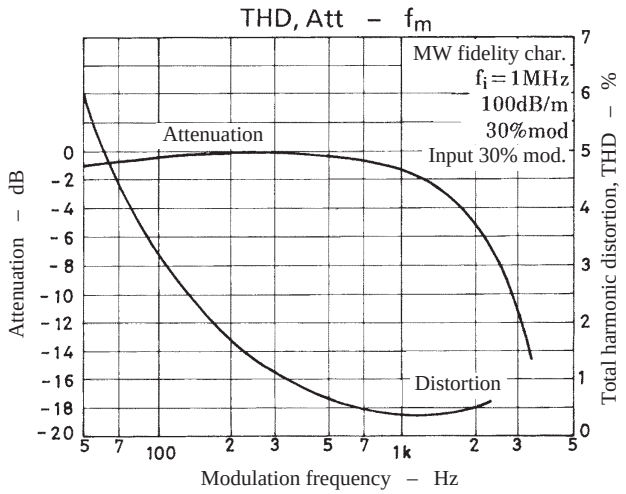
L1 TN10896 (Mitsumi)
T1 YT-30194 (Mitsumi), 2153-4095-239 (Sumida)
T2 KW-30011 (Mitsumi)
T3 YT-30105 (Mitsumi)

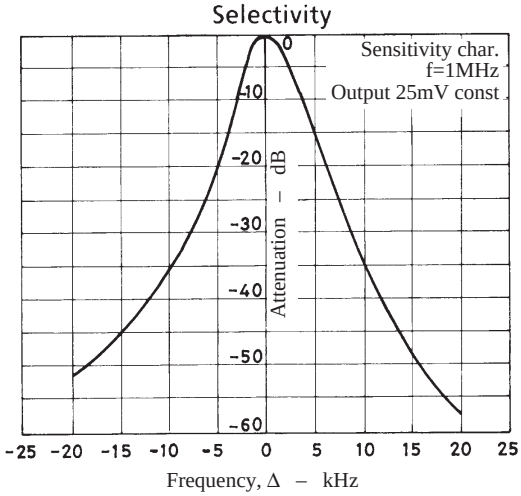
Unit (resistance : Ω, capacitance : F)

[FM Characteristics]

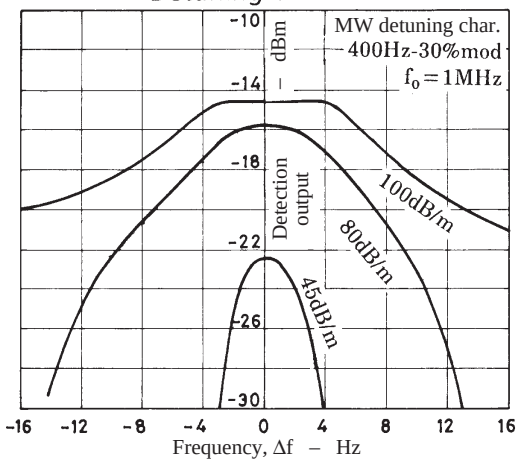




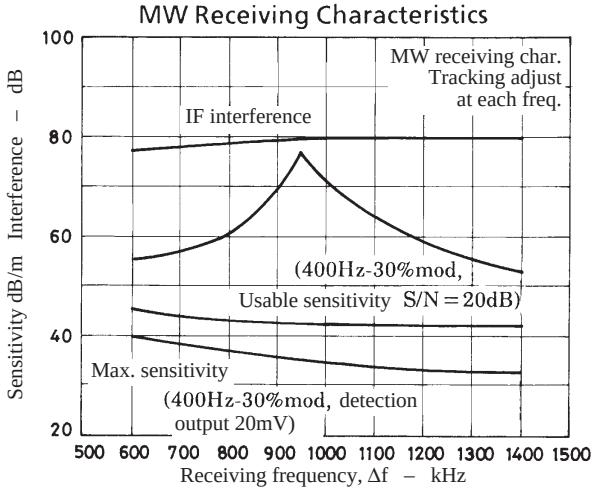




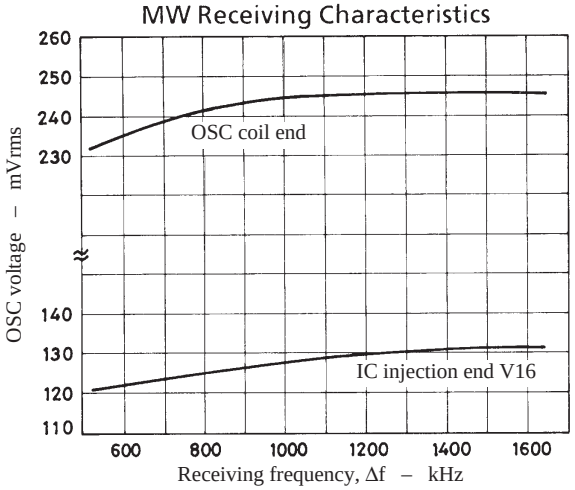
Detuning Characteristic



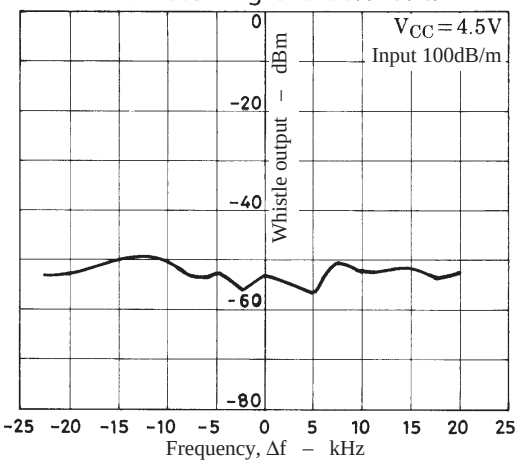
MW Receiving Characteristics



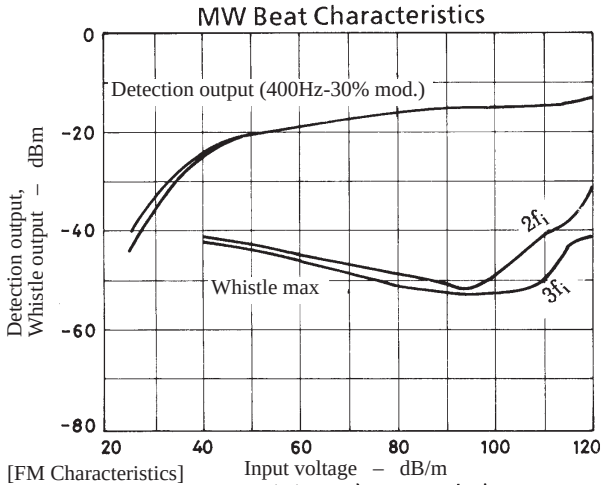
MW Receiving Characteristics



MW Receiving Characteristics

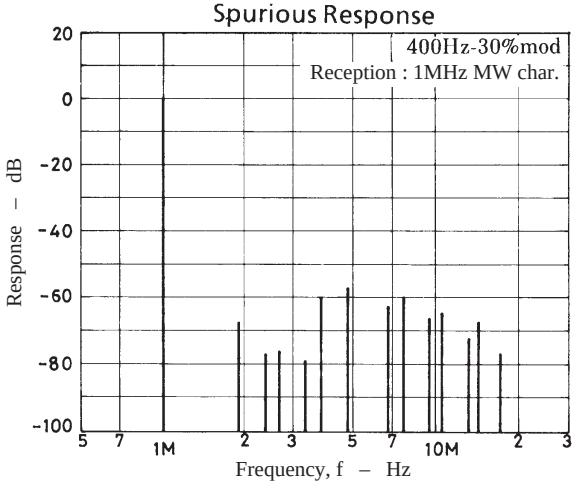


MW Beat Characteristics

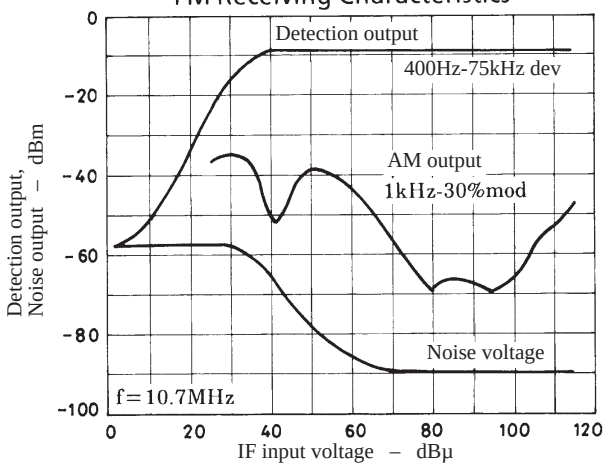


[FM Characteristics]

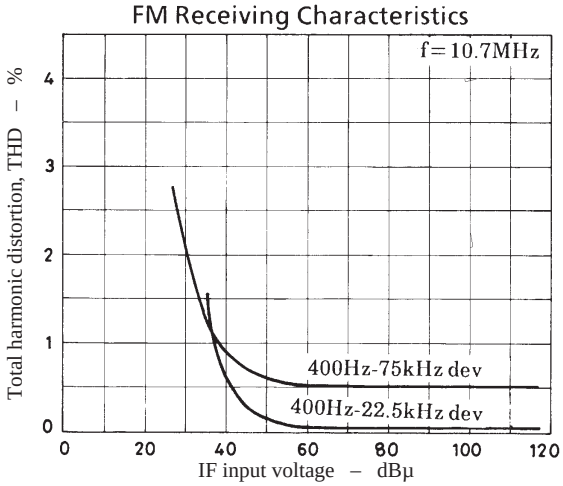
Spurious Response



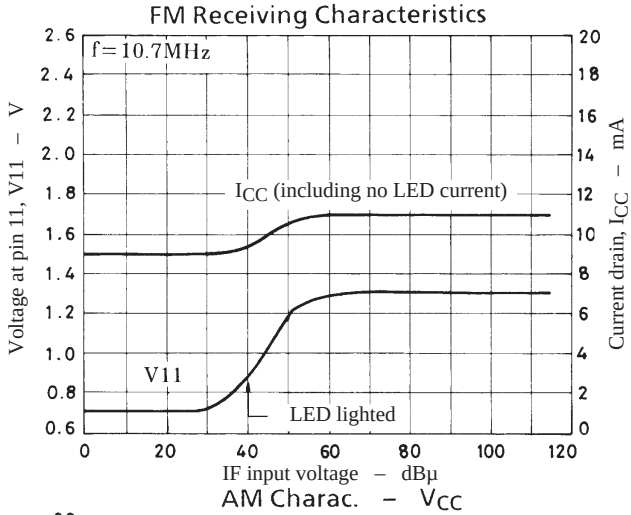
FM Receiving Characteristics



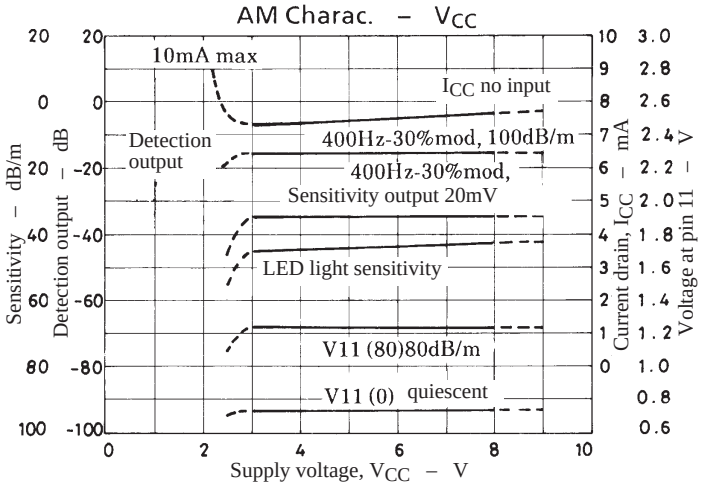
FM Receiving Characteristics



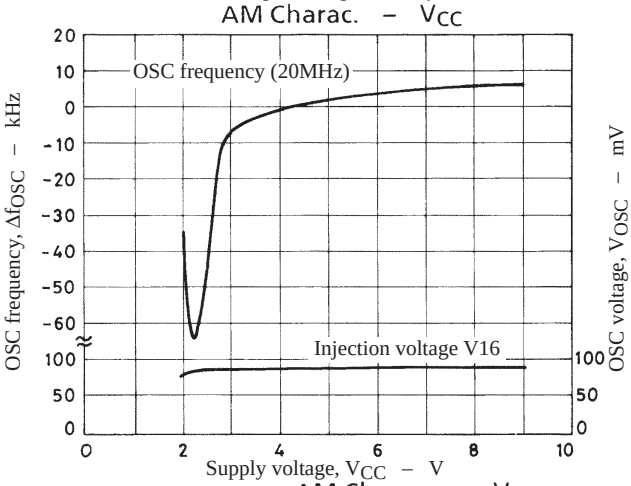
FM Receiving Characteristics



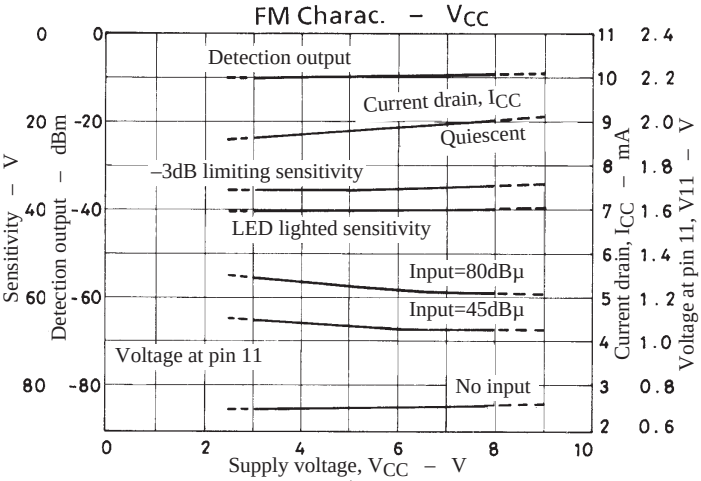
AM Charac. – V_{CC}



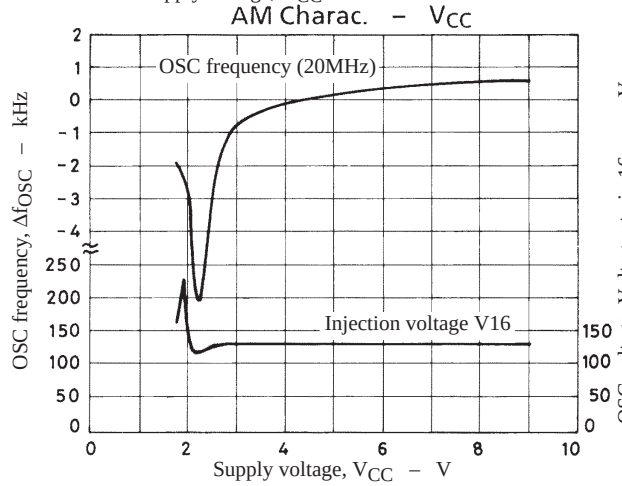
AM Charac. – V_{CC}



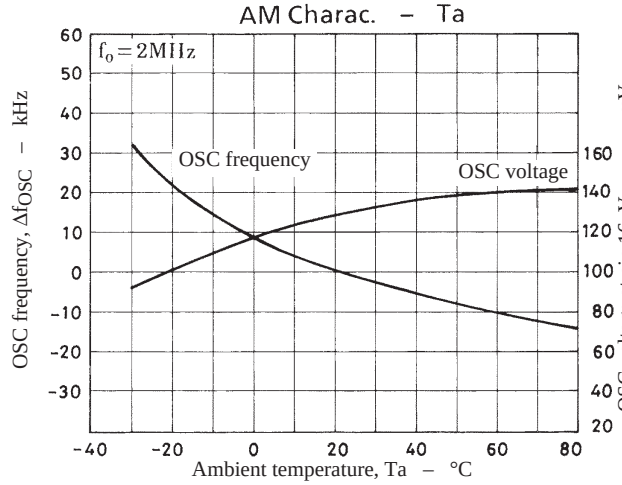
FM Charac. – V_{CC}



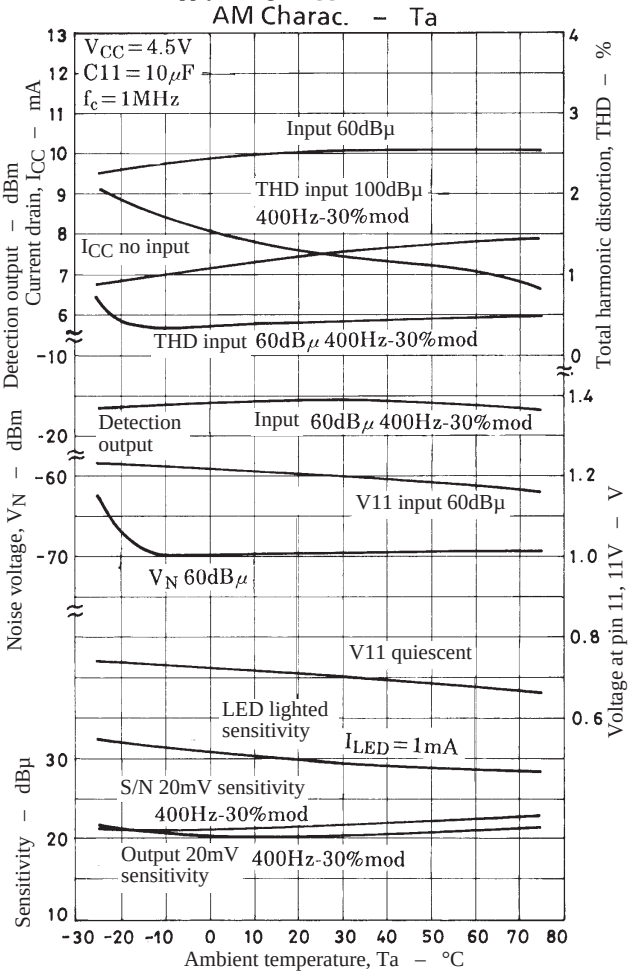
AM Charac. – V_{CC}

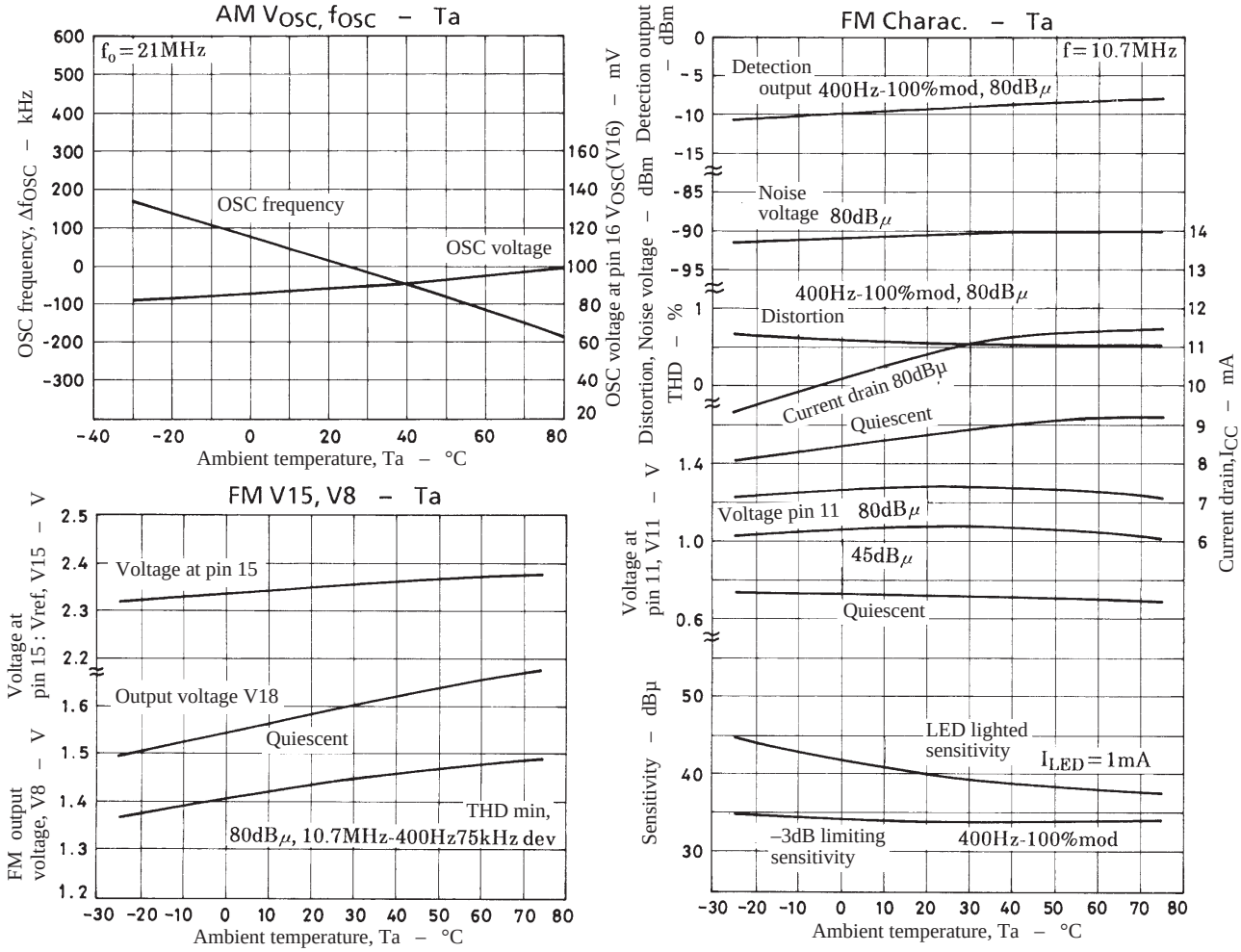


AM Charac. – Ta

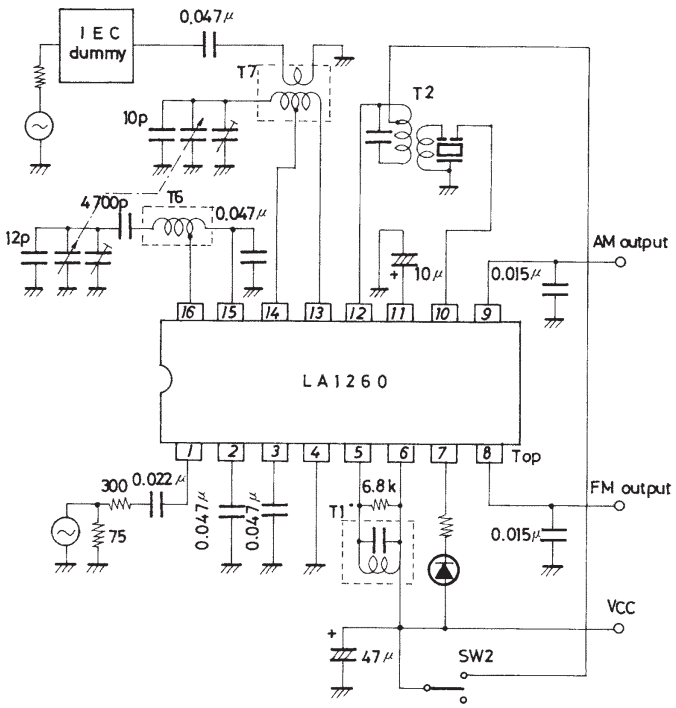


AM Charac. – Ta



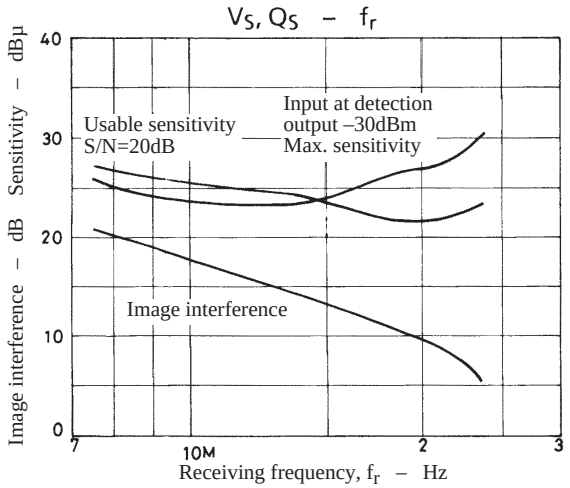


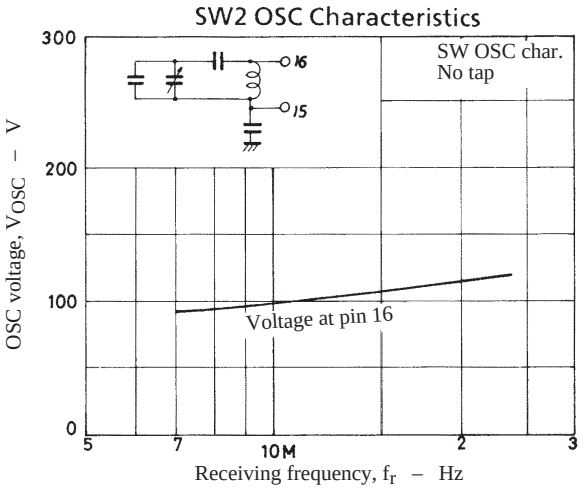
Sample Application Circuit 1 : FM IF/SW2 (7.2 to 24.0MHz)

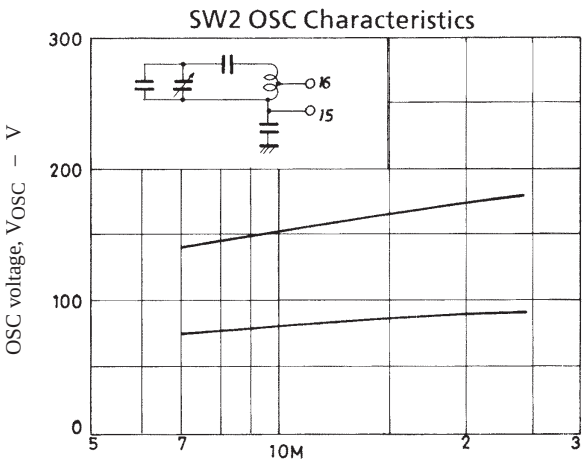


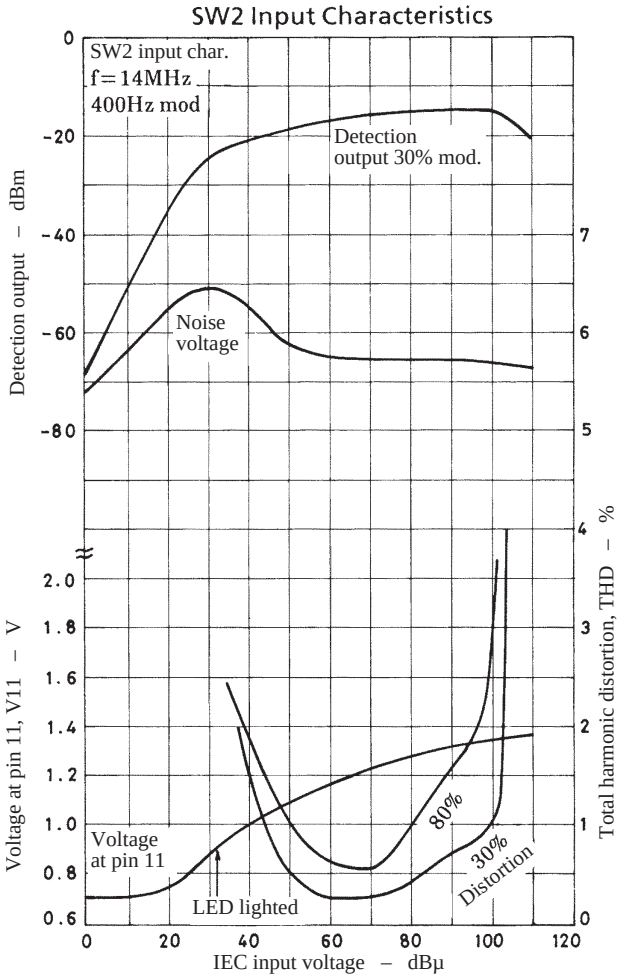
T1 YT-30194 (Mitsumi), 2153-4095-339 (Sumida)
T2 KW-30011 (Mitsumi)
T6 YT-30112 (Mitsumi)
T7 YT-30117 (Mitsumi), 2158-4140-044 (Sumida)

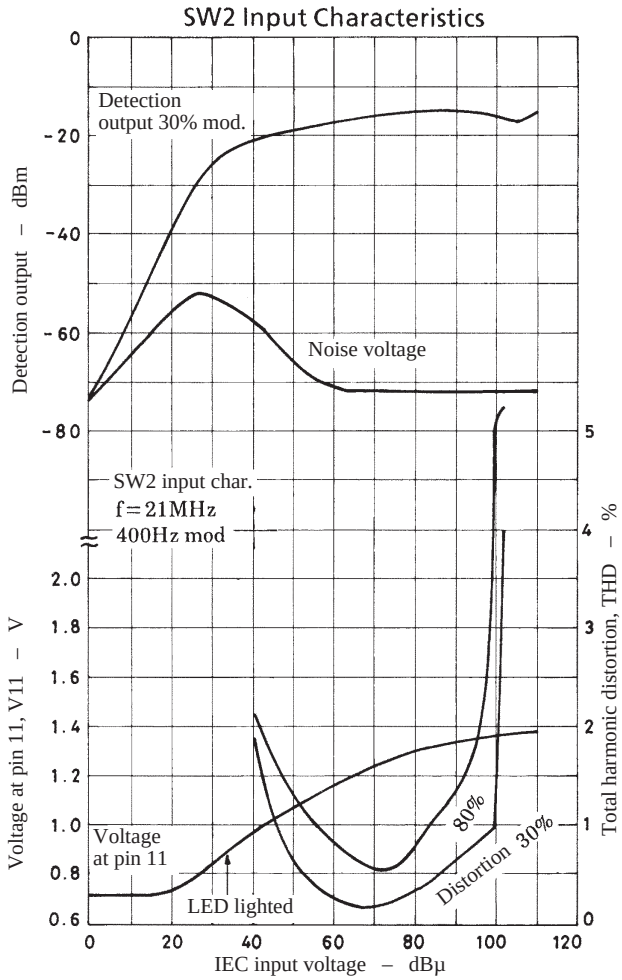
Unit (resistance : Ω, capacitance : F)


V_S, Q_S – f_r
Image interference – dB Sensitivity – dBμ
Usable sensitivity
S/N=20dB
Input at detection
output –30dBm
Max. sensitivity
Image interference
Receiving frequency, f_r – Hz

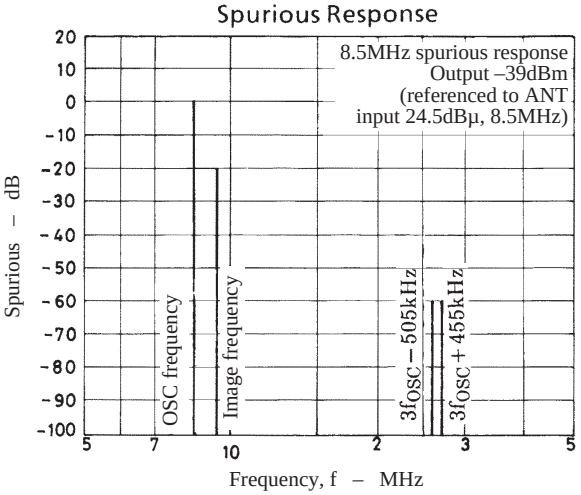

SW2 OSC Characteristics
SW OSC char.
No tap
Voltage at pin 16
OSC voltage, V_{OSC} – V
Receiving frequency, f_r – Hz


SW2 OSC Characteristics
OSC voltage, V_{OSC} – V

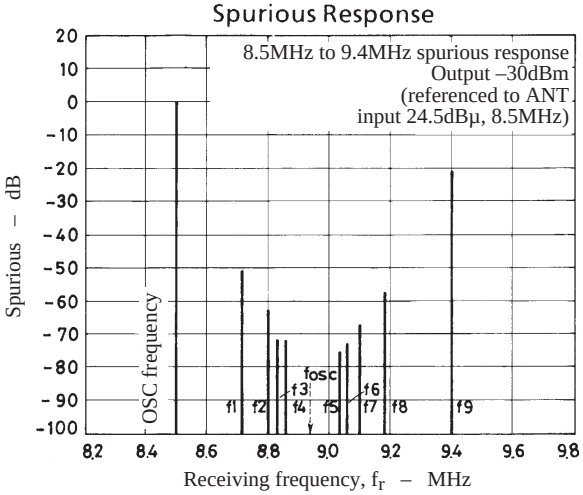

SW2 Input Characteristics
SW2 input char.
f=14MHz
400Hz mod
Detection
output 30% mod.
Noise
voltage
Detection output – dBm
Voltage at pin 11, V11 – V
Total harmonic distortion, THD – %
Voltage
at pin 11
LED lighted
80%
30%
Distortion
IEC input voltage – dBμ


SW2 Input Characteristics
Detection
output 30% mod.
Noise voltage
SW2 input char.
f=21MHz
400Hz mod
Detection output – dBm
Voltage at pin 11, V11 – V
Total harmonic distortion, THD – %
Voltage
at pin 11
LED lighted
80%
Distortion 30%
IEC input voltage – dBμ

Spurious Response

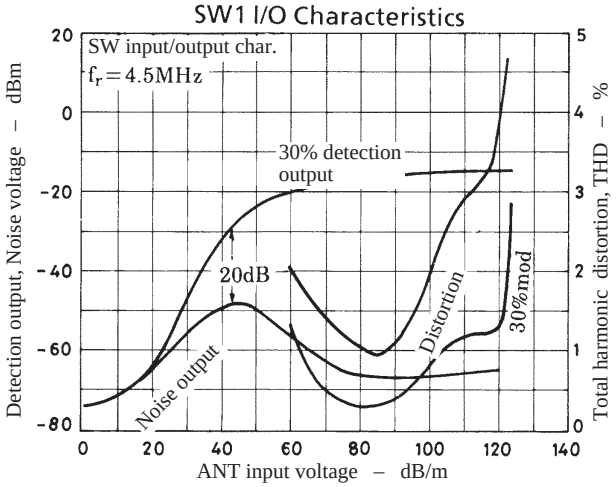


Spurious Response

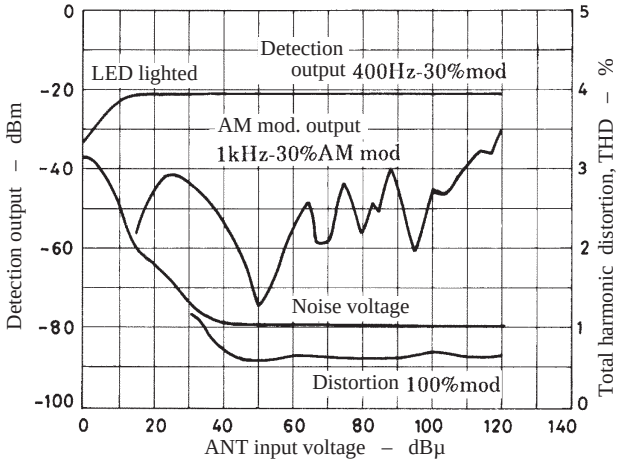


f1 : 8.729MHz → $2f_{OSC}$-2f1 = 455kHz
f2 : 8.803MHz → $3f_{OSC}$-3f2 = 455kHz
f3 : 8.840MHz → $4f_{OSC}$-4f3 = 455kHz
f4 : 8.864MHz → $5f_{OSC}$-5f4 = 455kHz
f5 : 9.047MHz → 5f5-$5f_{OSC}$ = 455kHz
f6 : 9.069MHz → 4f6-$4f_{OSC}$ = 455kHz
f7 : 9.107MHz → 3f7-$3f_{OSC}$ = 455kHz
f8 : 9.183MHz → 2f8-$2f_{OSC}$ = 455kHz

SW1 I/O Characteristics

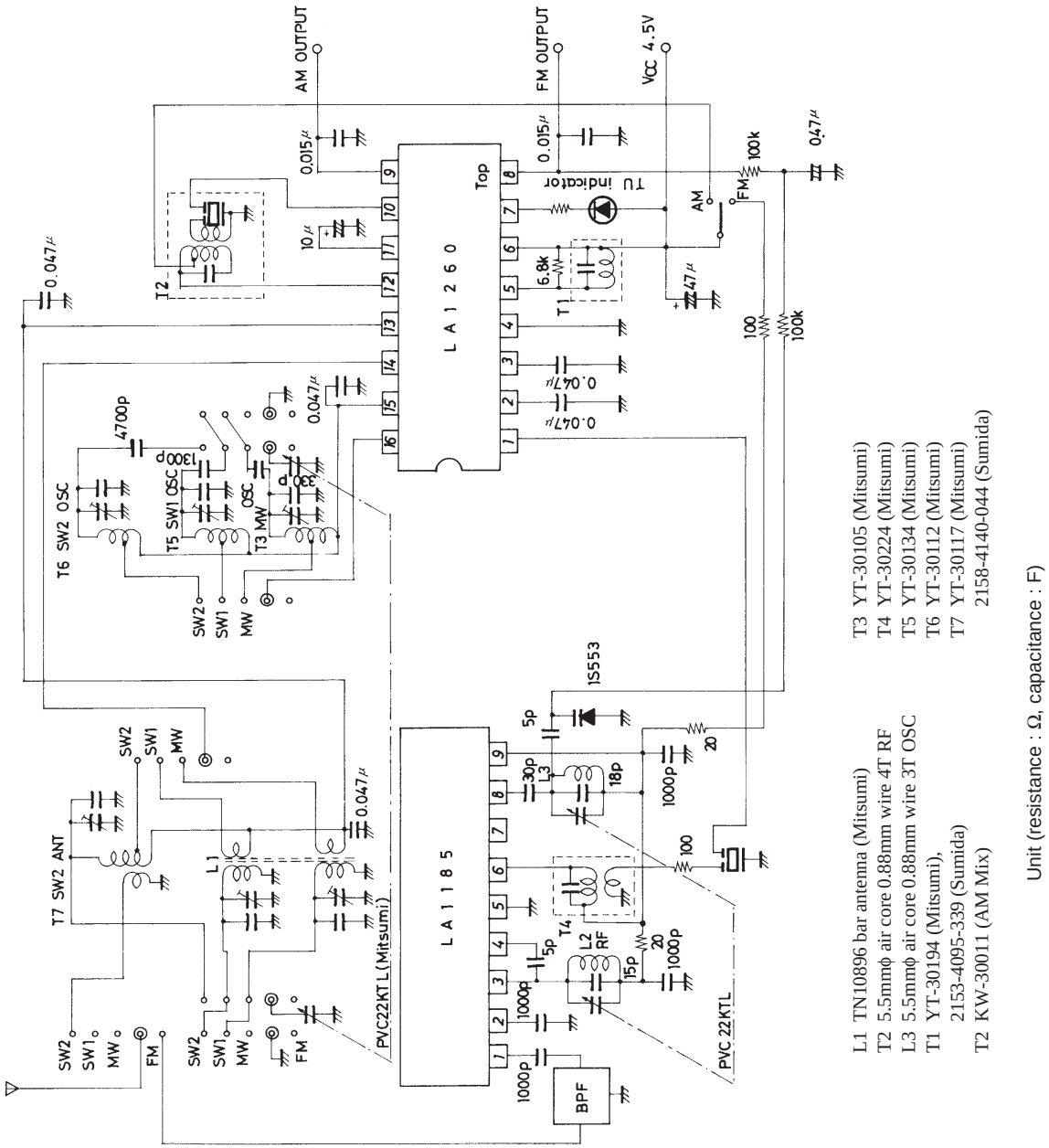


FM Characteristic



Sample Application Circuit 2 : FM (band in US) /MW/SW1 (2.2 to 7.5MHz) /SW2 (7.2 to 24.0MHz)
Application where the LA1185 and LA1260 are used

[Circuit Diagram] (The sample printed circuit pattern is shown on page 13.)

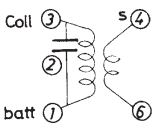


L1 TN10896 bar antenna (Mitsumi)
T2 5.5mmϕ air core 0.88mm wire 4T RF
L3 5.5mmϕ air core 0.88mm wire 3T OSC
T1 YT-30194 (Mitsumi),
2153-4095-339 (Sumida)
T2 KW-30011 (AM Mix)

T3 YT-30105 (Mitsumi)
T4 YT-30224 (Mitsumi)
T5 YT-30134 (Mitsumi)
T6 YT-30112 (Mitsumi)
T7 YT-30117 (Mitsumi)
2158-4140-044 (Sumida)

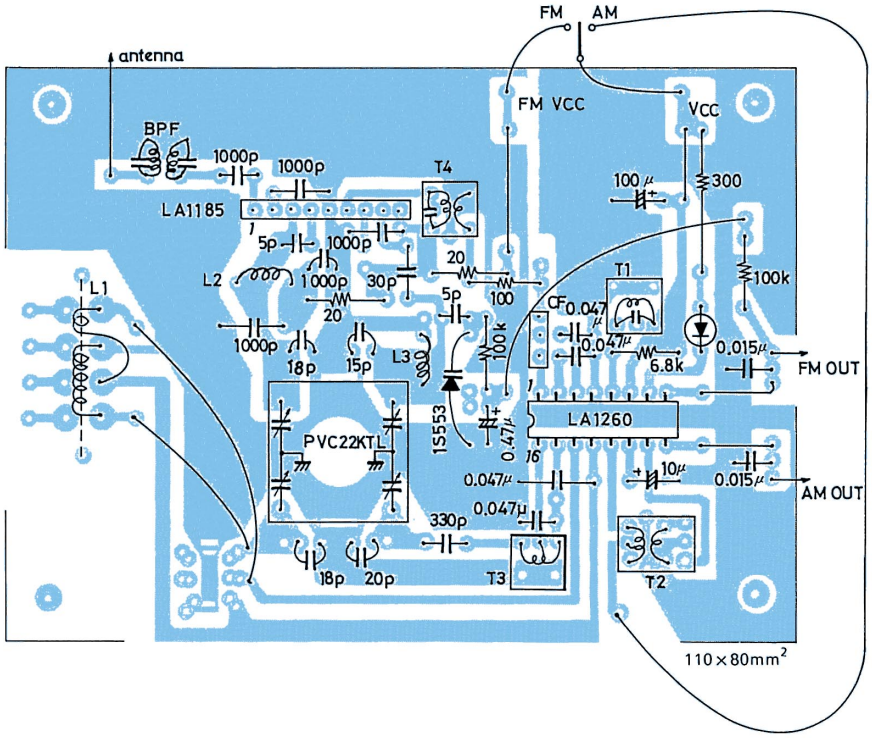
Unit (resistance : Ω, capacitance : F)

T4 : YT-30224 (Mitsumi)
FM IF

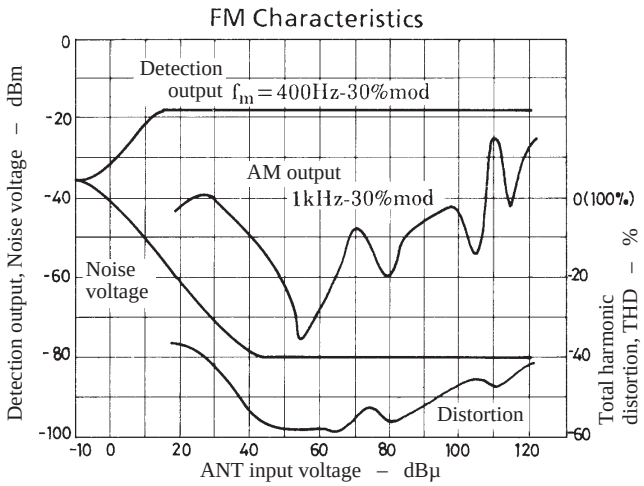


①-③ 8T, ④-⑥ 2T
0.12mm 2UEW
Internal 100pF, external 5pF
$f_O = 10.7MHz$, $Q_O = 80$

Sample Printed Circuit Pattern : Cu-foiled area (The circuit diagram is shown on page 12.)

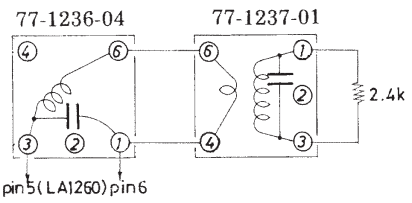


Unit (resistance : Ω, capacitance : F)

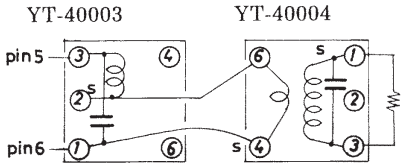


$f_r = 108MHz$
$V_{CC} = 4.5V$
Q.S. = 9.5dBμ
−3dB L.S. = 9dBμ
LED lighting sensitivity 11.5dBμ

• Applications where a double tuning coil is used (See page 3.)
The use of the following coil improves the distortion approximately 0.1% at 100% modulation.



77-1236-04 (Korin Giken)	77-1237-01 (Korin Giken)
③-⑥ 19.5T	①-③ 20T
①-③ 68pF	⑥-④ 1T
$Q_O = 78 \pm 20\%$	①-③ 82pF
0.08φ 2UEW	$Q_O = 59 \pm 20\%$



YT-40003 (Mitsumi)	YT-40004 (Mitsumi)
②-③ 25T	④-⑥ 1T
①-③ 56pF	①-③ 23T 82pF
$Q_O = 40 \pm 20\%$	$Q_O = 40 \pm 20\%$
0.1mmφ 2UEW	0.1mmφ 2UEW