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.

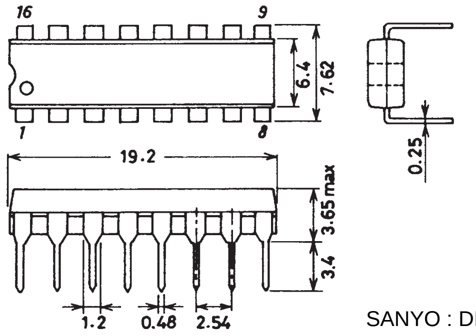
Features

- 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.

Package Dimensions

unit : mm

3006B-DIP16



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

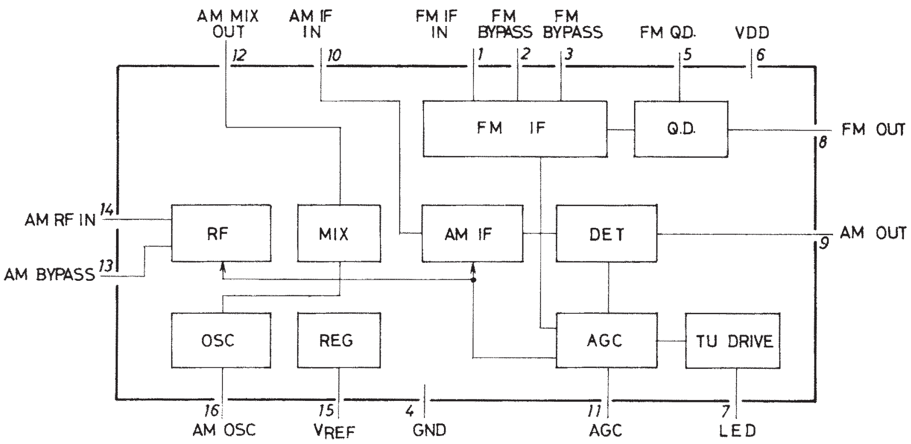
Operating Conditions at Ta=25°C

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

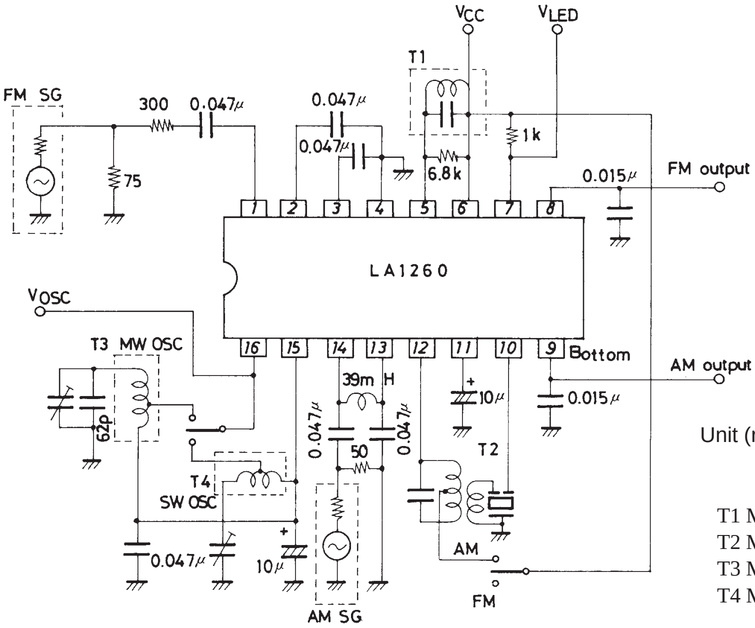
Operating Characteristics at Ta=25°C, V_{CC}=4.5V, See specified Test Circuit

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.

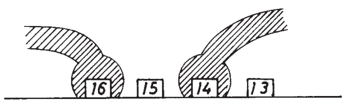


Figure A Good example

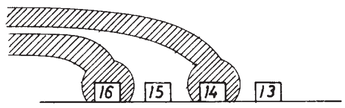


Figure B Bad example

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 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.

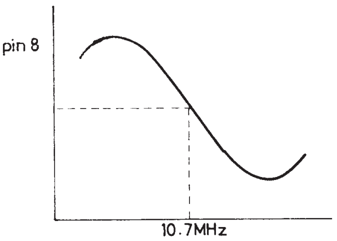


Figure 1

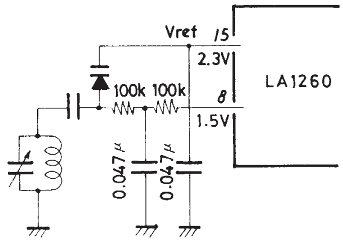


Figure 2 Domestic (lower local oscillation) band

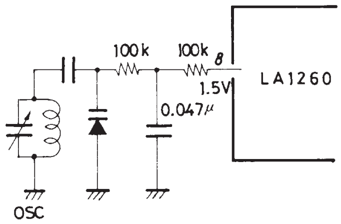
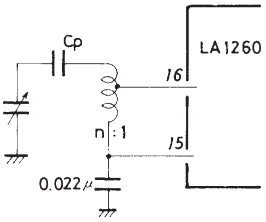


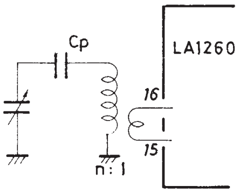
Figure 3 Foreign (upper local oscillation) band

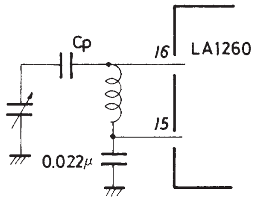
Unit (resistance : Ω, capacitance : F)

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.

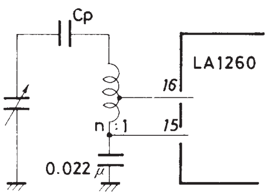


Figure 4

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)

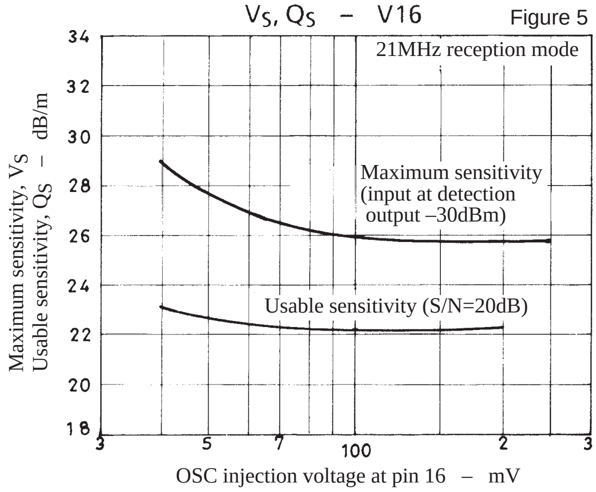


Figure 5

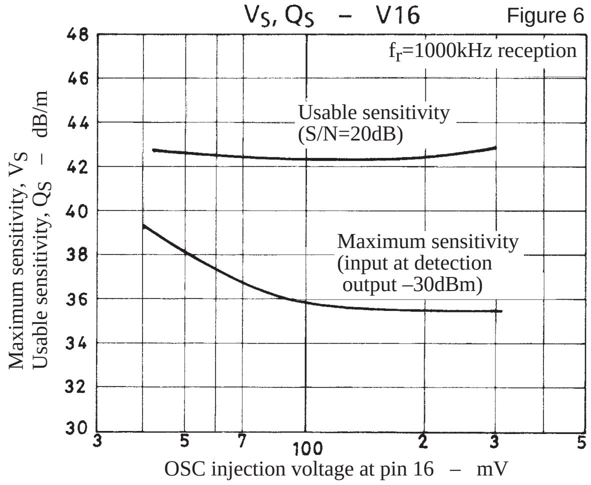
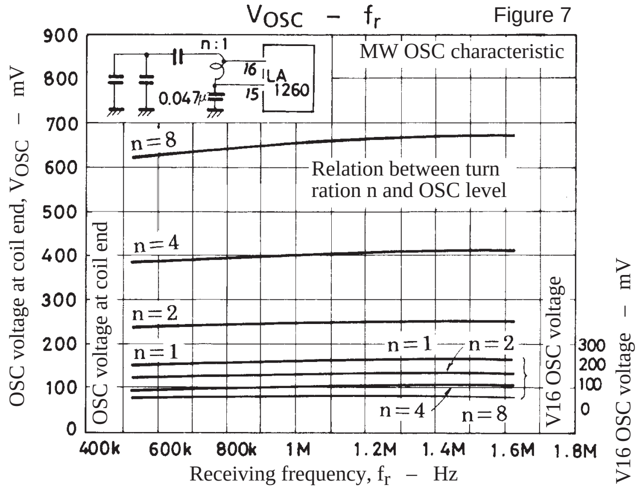
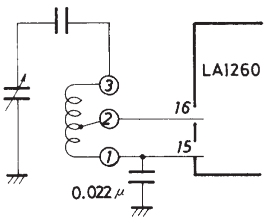


Figure 6

Figure 7



AM oscillation coil



Unit (capacitance : F)

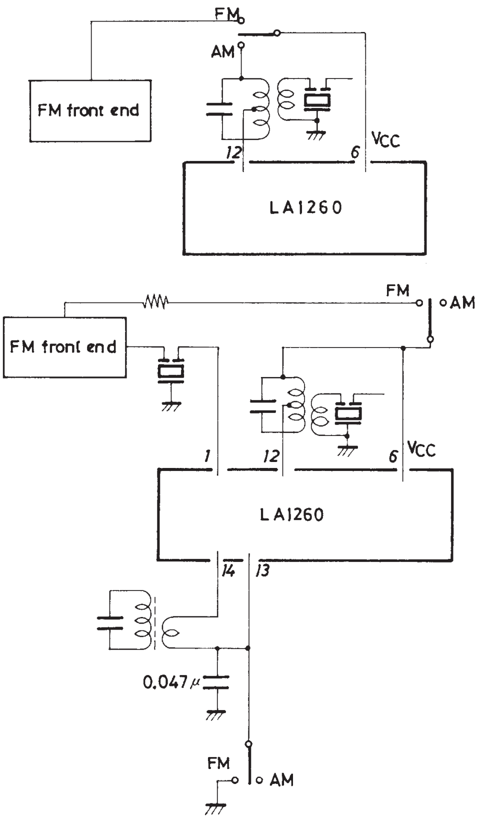
Generally speaking, the following should be noted. Winding with loose coupling between 1 and 2 and between 1 and 3 must be avoided. (Particularly SW1, SW2).

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)

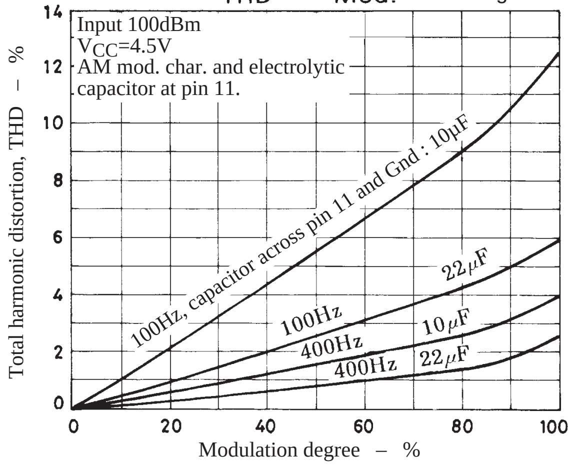
(1) Pin 12-used method=recommended circuit

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.

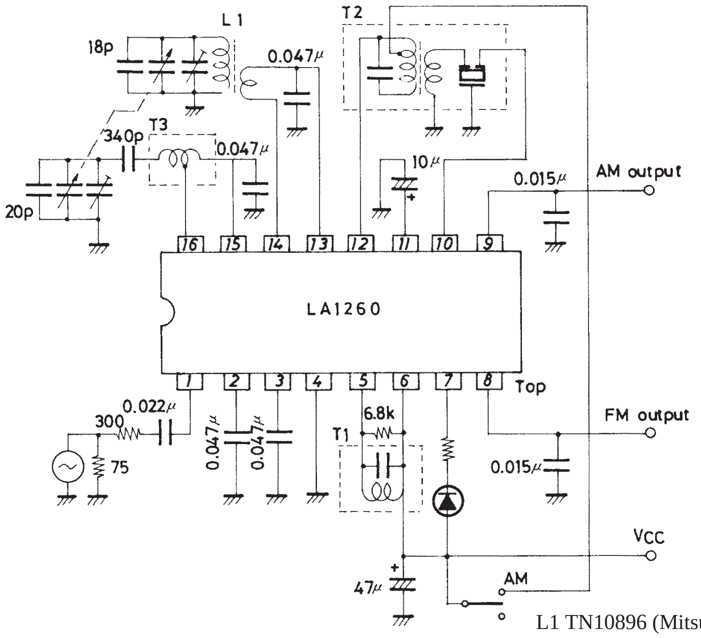
(2) Pin 13-used method

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



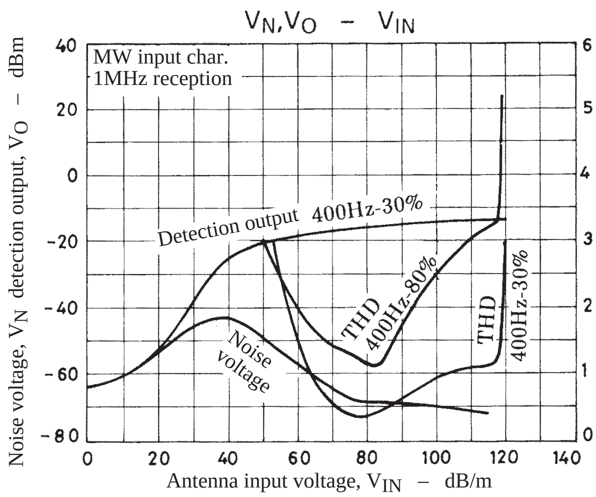
FM IF/MW Test Circuit

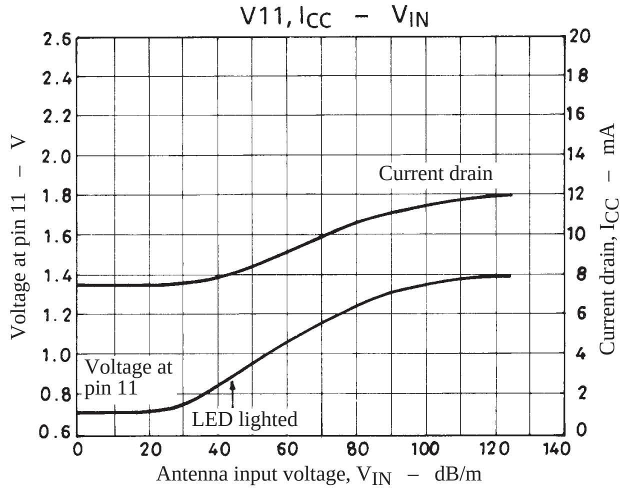


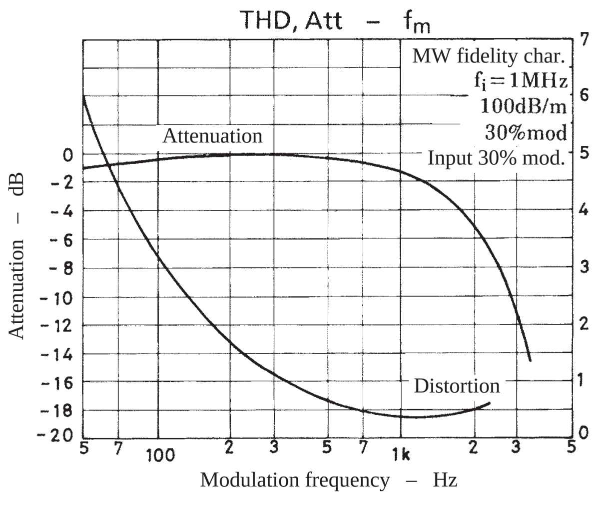
L1 TN10896 (Mitsumi)
T1 YT-30194 (Mitsumi), 2153-4095-239 (Sumida)
T2 KW-30011 (Mitsumi)
T3 YT-30105 (Mitsumi)

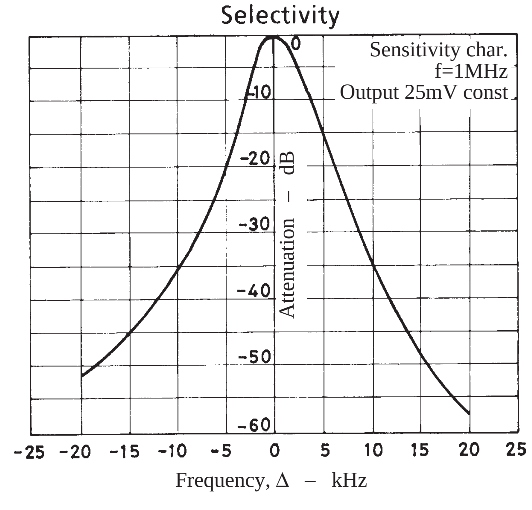
Unit (resistance : Ω, capacitance : F)

[FM Characteristics]

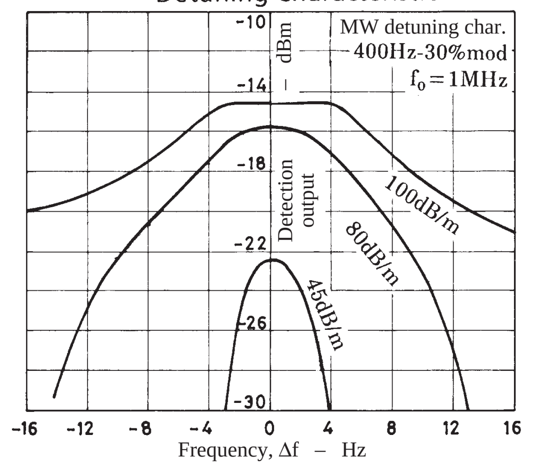




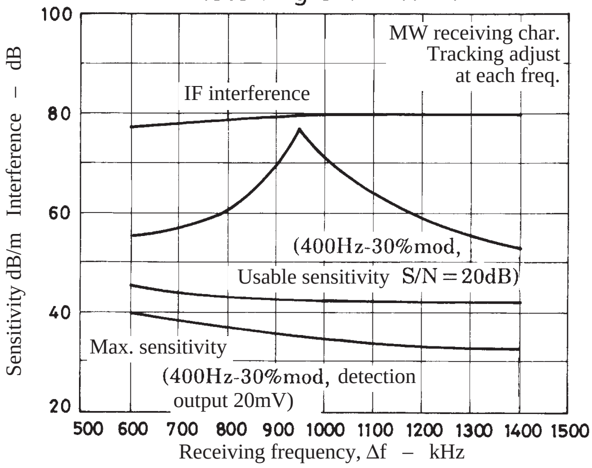




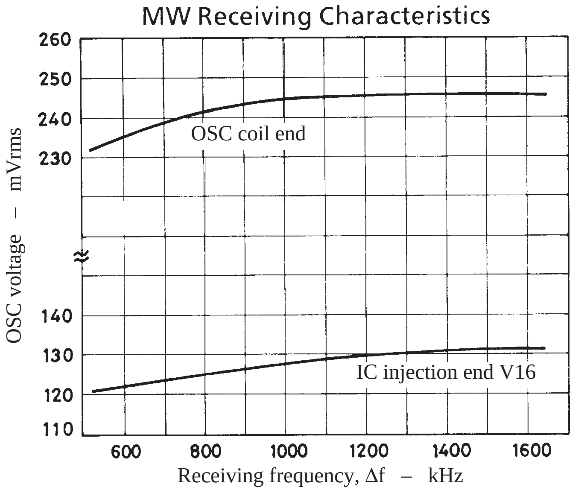
Detuning Characteristic



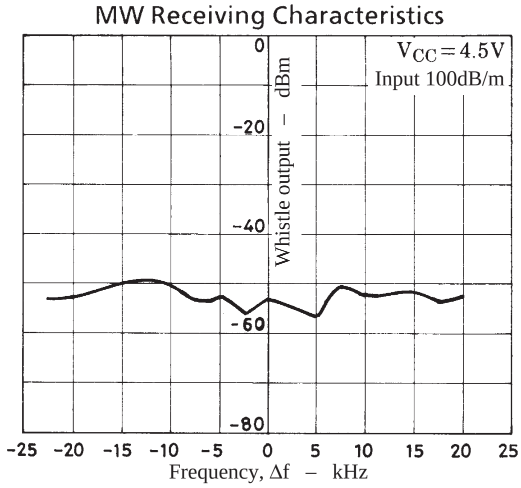
MW Receiving Characteristics



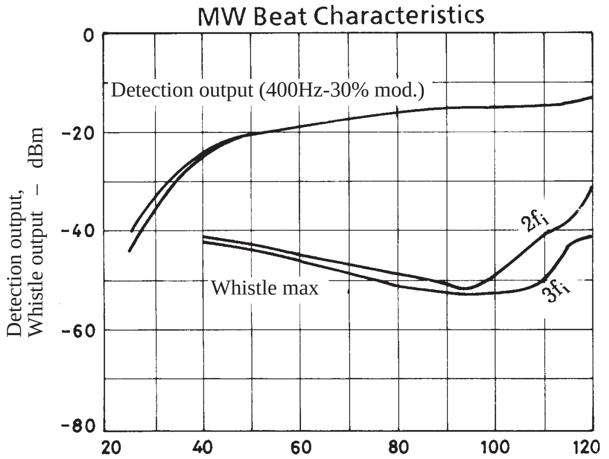
MW Receiving Characteristics



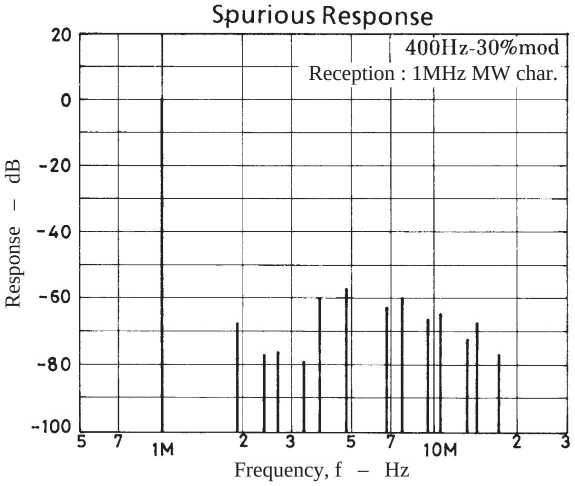
MW Receiving Characteristics



MW Beat Characteristics

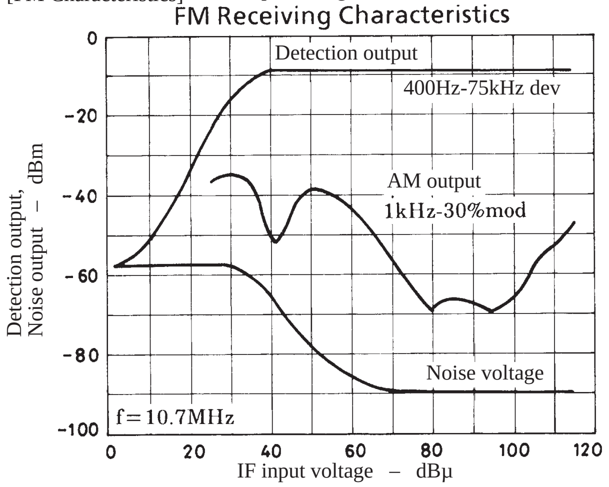


Spurious Response

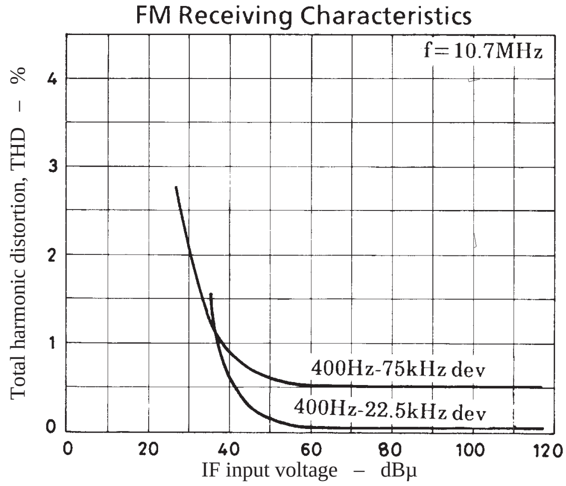


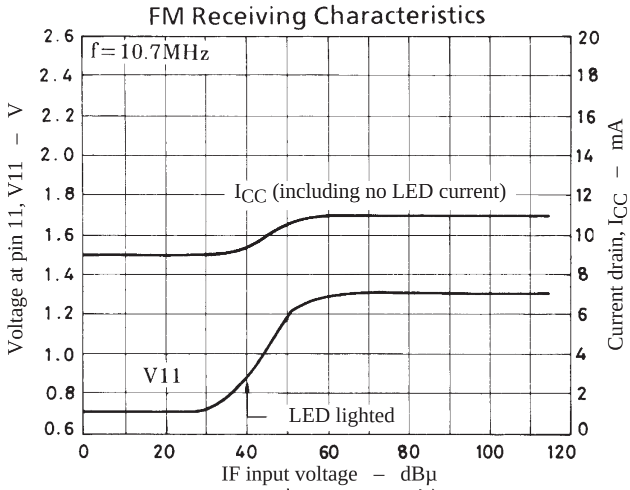
[FM Characteristics]

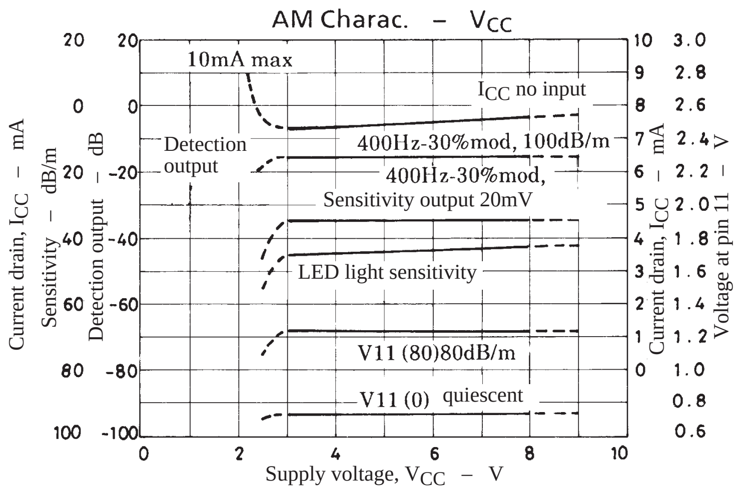
FM Receiving Characteristics

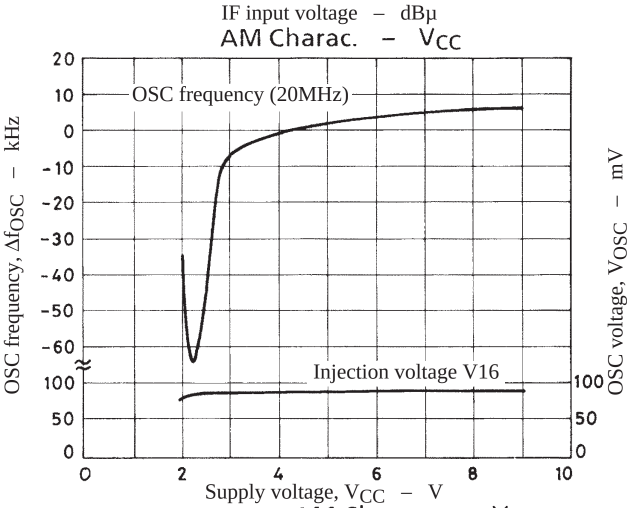


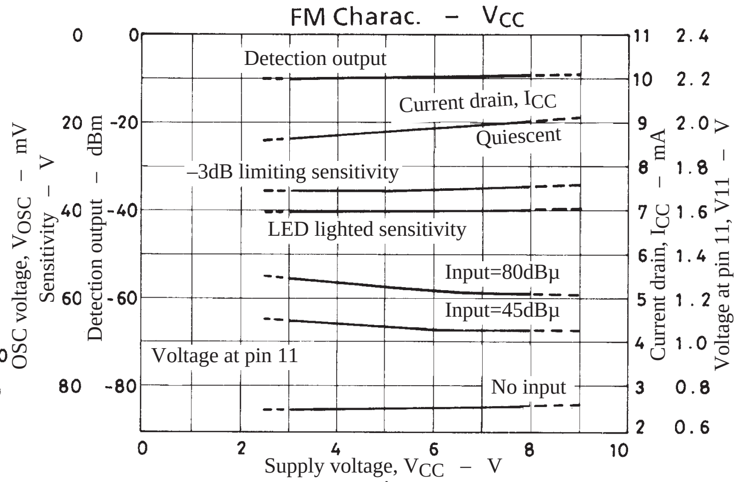
FM Receiving Characteristics

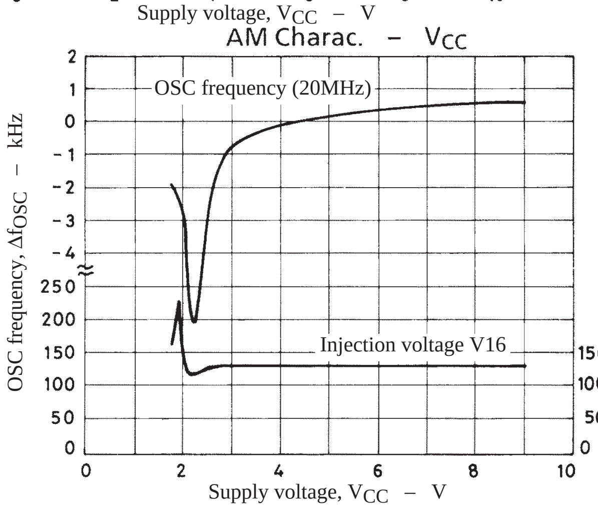


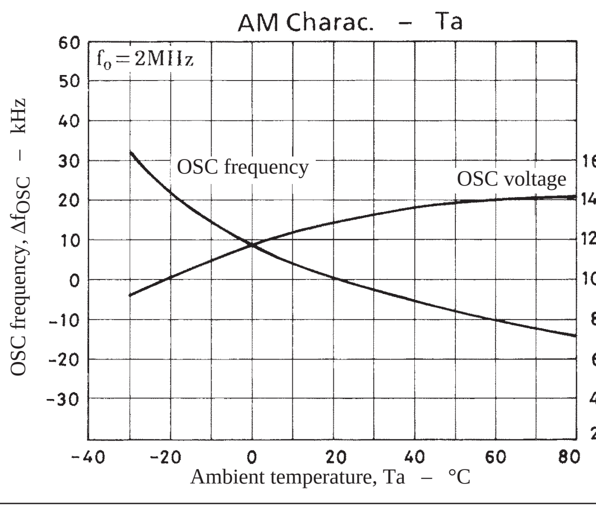

FM Receiving Characteristics
f＝10.7MHz
ICC (including no LED current)
V11
LED lighted
Voltage at pin 11, V11 – V
Current drain, ICC – mA
IF input voltage – dBμ

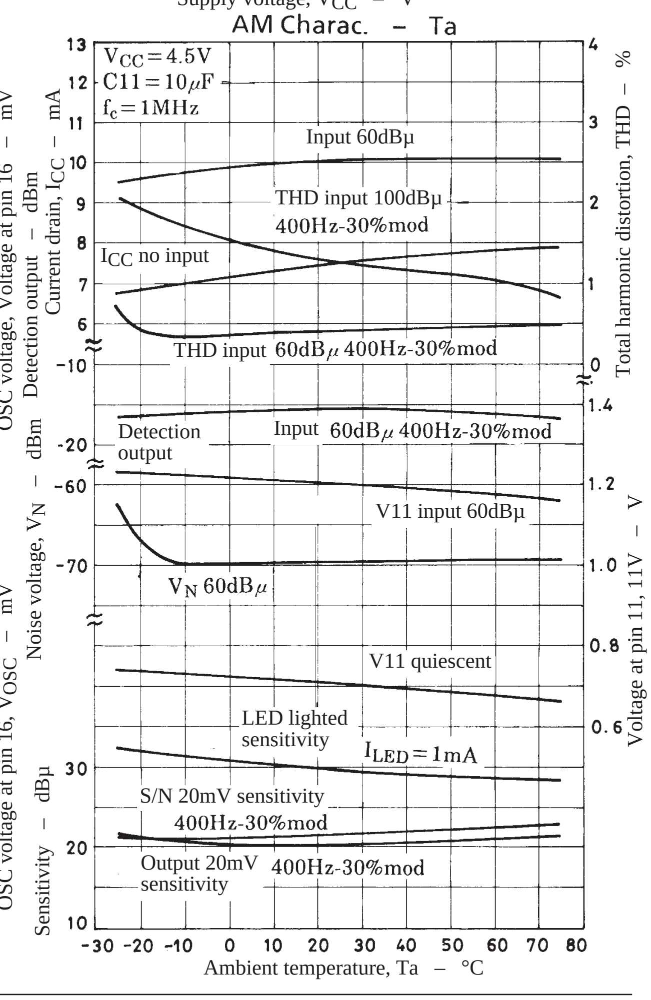

AM Charac. – VCC
10mA max
ICC no input
Detection output
400Hz-30%mod, 100dB/m
400Hz-30%mod,
Sensitivity output 20mV
LED light sensitivity
V11 (80)80dB/m
V11 (0) quiescent
Sensitivity – dB/m
Detection output – dB
Current drain, ICC – mA
Voltage at pin 11 – V
Supply voltage, VCC – V

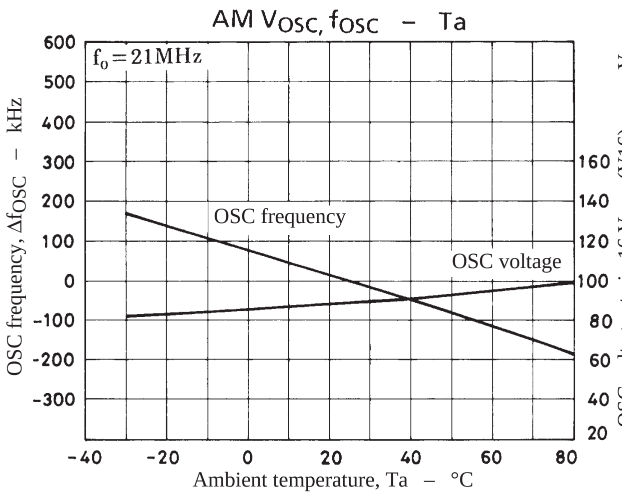

AM Charac. – VCC
OSC frequency (20MHz)
Injection voltage V16
OSC frequency, ΔfOSC – kHz
OSC voltage, VOSC – mV
Supply voltage, VCC – V

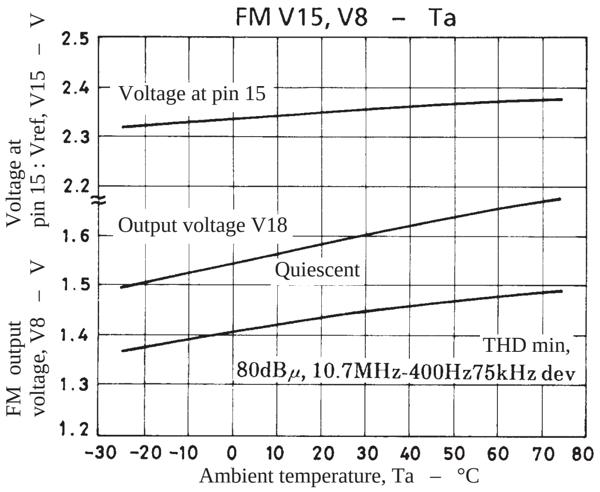

FM Charac. – VCC
Detection output
Current drain, ICC
Quiescent
–3dB limiting sensitivity
LED lighted sensitivity
Input=80dBμ
Input=45dBμ
Voltage at pin 11
No input
Sensitivity – V
Detection output – dBm
Current drain, ICC – mA
Voltage at pin 11, V11 – V
Supply voltage, VCC – V

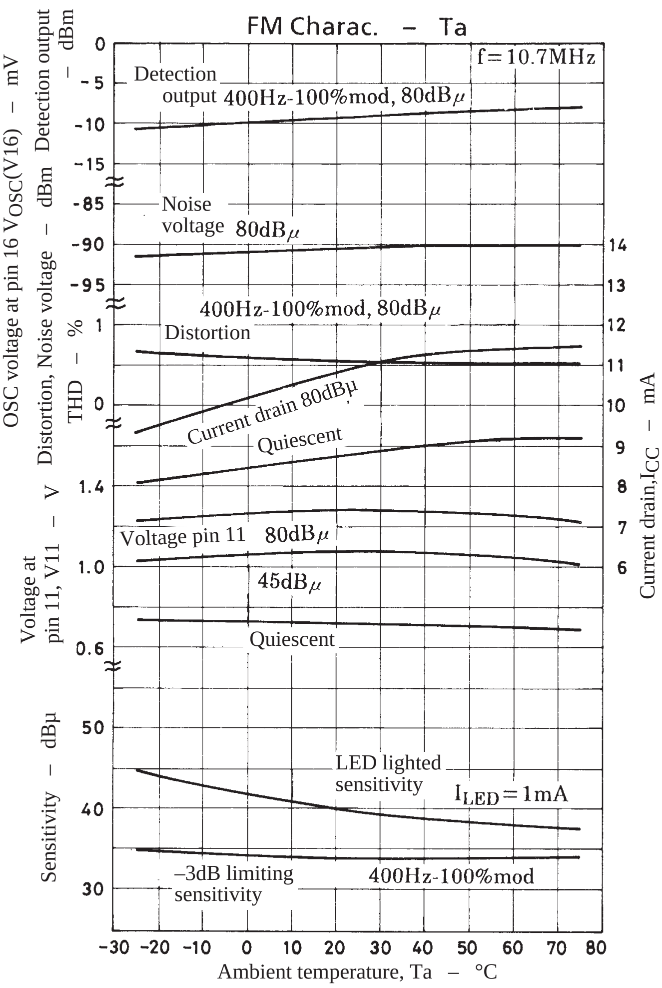

AM Charac. – VCC
OSC frequency (20MHz)
Injection voltage V16
OSC frequency, ΔfOSC – kHz
OSC voltage, Voltage at pin 16 – mV
Supply voltage, VCC – V


AM Charac. – Ta
fo＝2MHz
OSC frequency
OSC voltage
OSC frequency, ΔfOSC – kHz
OSC voltage at pin 16, VOSC – mV
Ambient temperature, Ta – °C

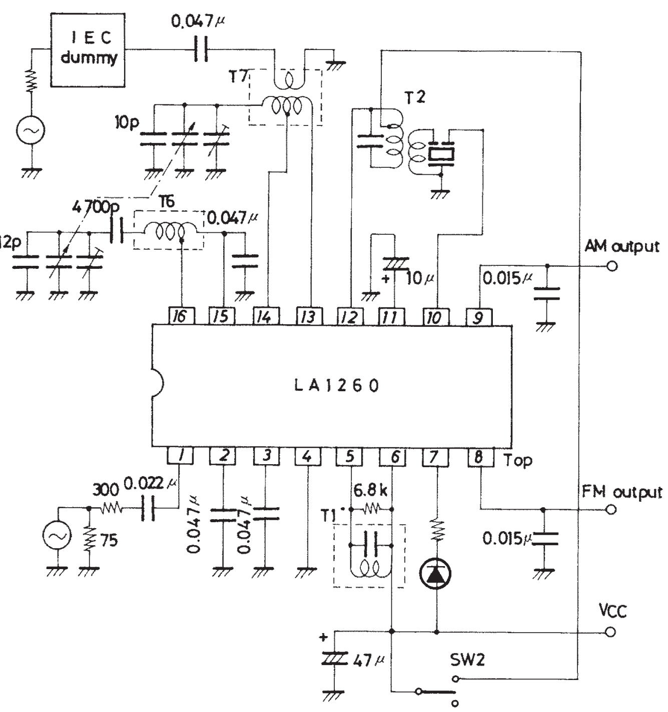

AM Charac. – Ta
VCC＝4.5V
C11＝10μF
fc＝1MHz
Input 60dBμ
THD input 100dBμ
400Hz-30%mod
ICC no input
THD input 60dBμ 400Hz-30%mod
Detection output
Input 60dBμ 400Hz-30%mod
V11 input 60dBμ
VN 60dBμ
V11 quiescent
LED lighted sensitivity
ILED＝1mA
S/N 20mV sensitivity
400Hz-30%mod
Output 20mV sensitivity
400Hz-30%mod
Current drain, ICC – mA
Detection output – dBm
Noise voltage, VN – dBm
Sensitivity – dBμ
Total harmonic distortion, THD – %
Voltage at pin 11, 11V – V
Ambient temperature, Ta – °C







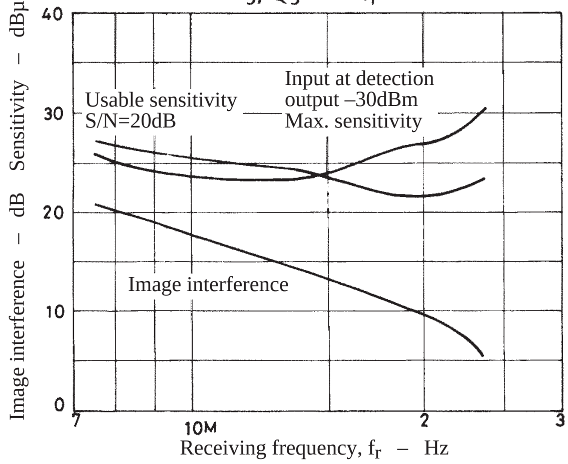
Sample Application Circuit 1 : FM IF/SW2 (7.2 to 24.0MHz)



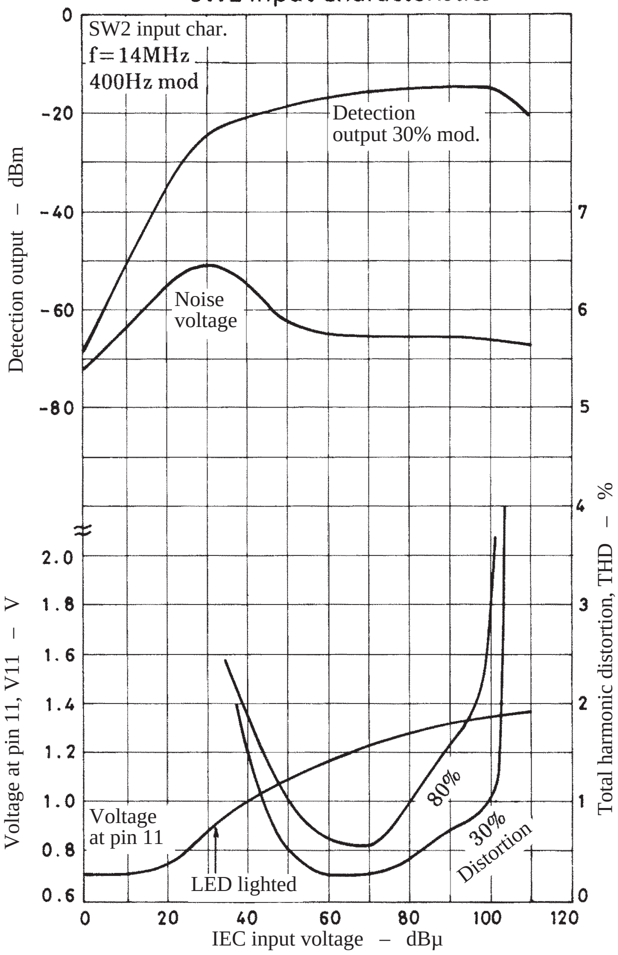
T1 YT-30194 (Mitsumi), 2153-4095-339 (Sumida)
T2 KW-30011 (Mitsumi)
T6 YT-30112 (Mitsumi)
T7 YT-30117 (Mitsumi), 2158-4140-044 (Sumida)

Unit (resistance : Ω, capacitance : F)

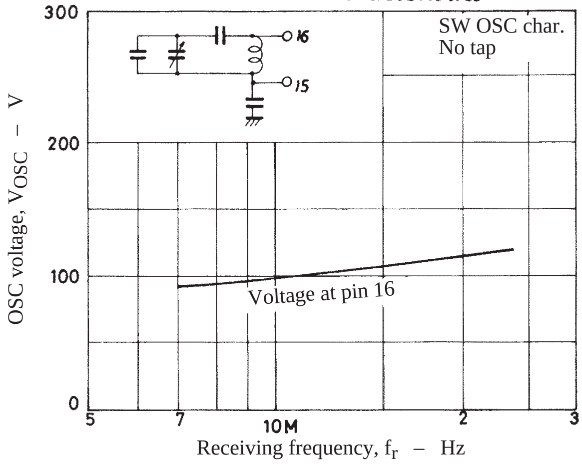
V_S, Q_S – f_r



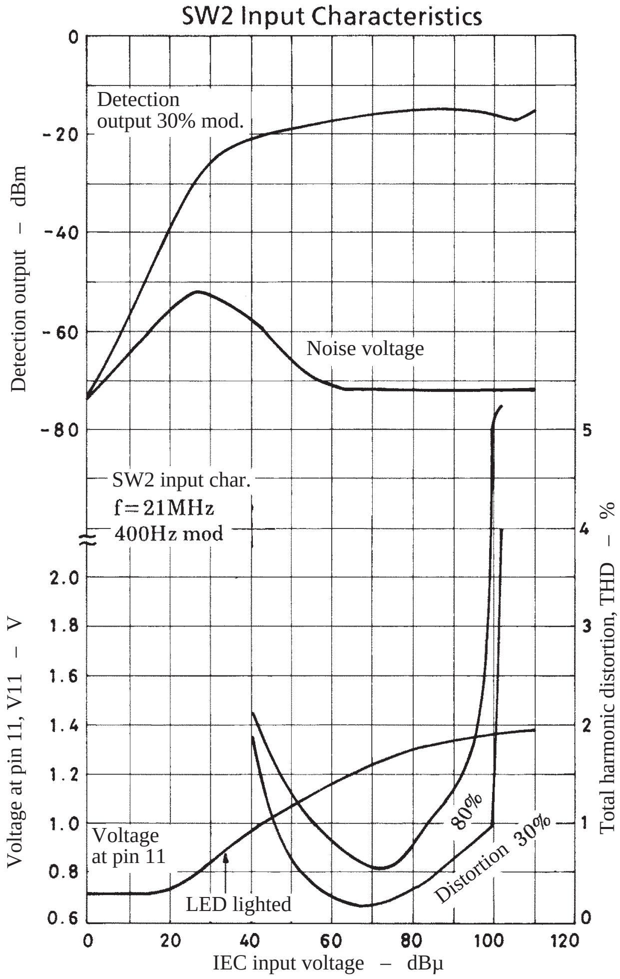
SW2 Input Characteristics



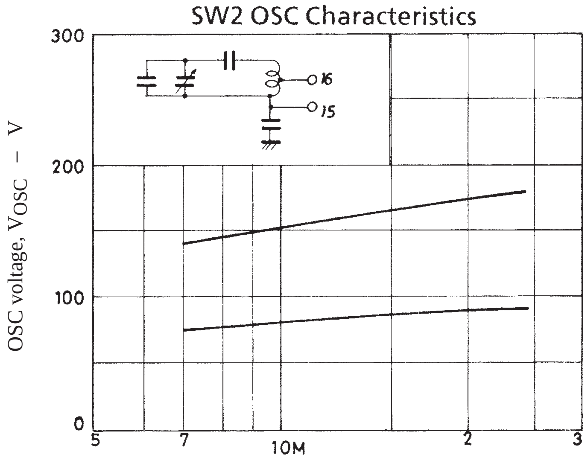
SW2 OSC Characteristics

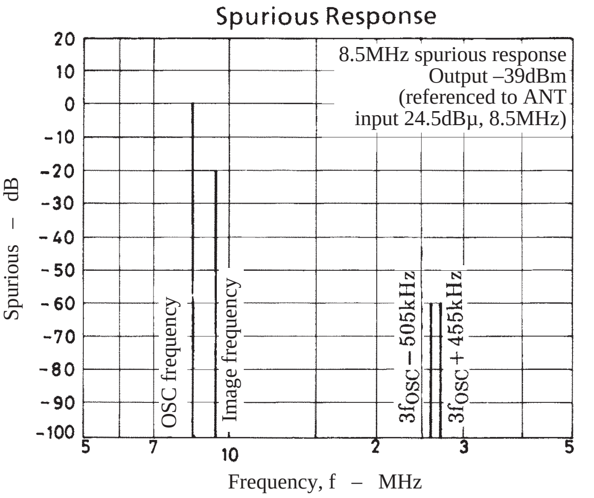


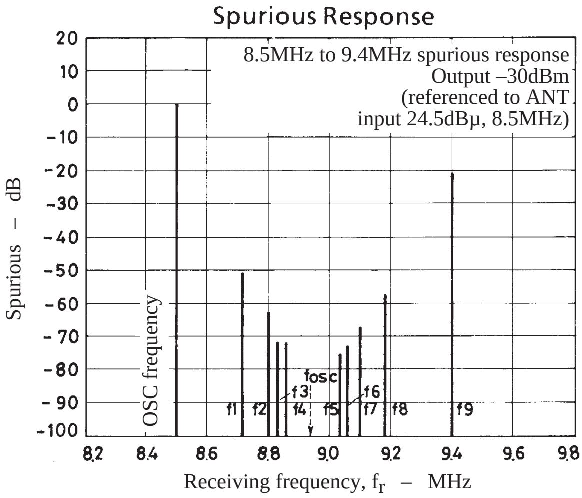
SW2 Input Characteristics



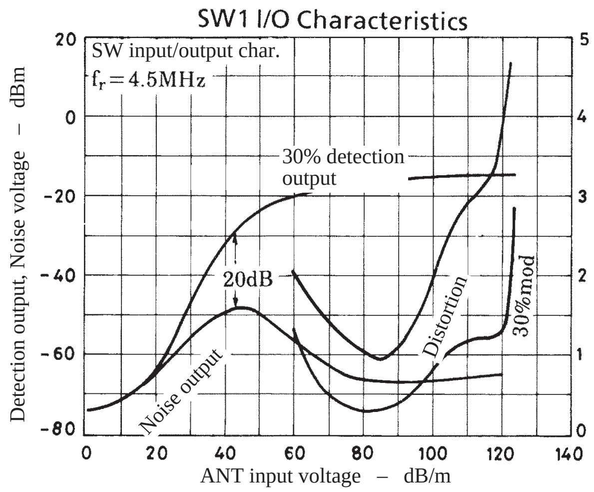
SW2 OSC Characteristics

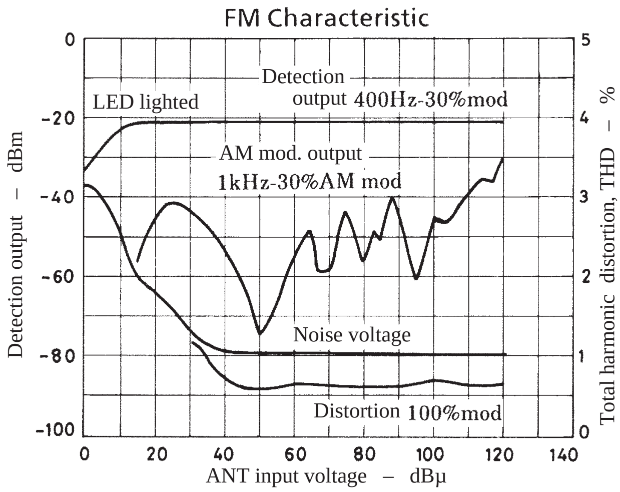






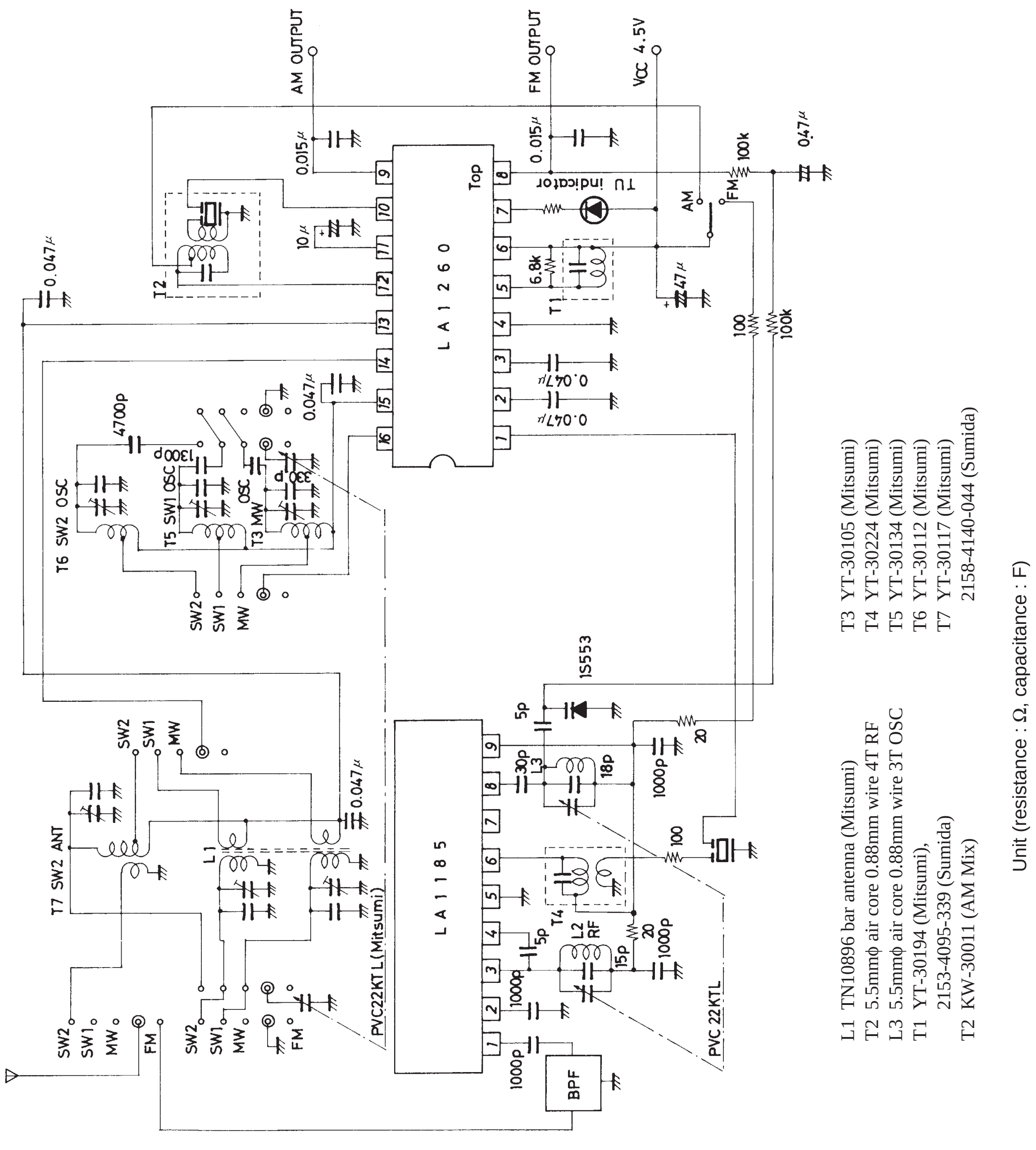
f1 : 8.729MHz → $2f_{OSC}$-2f1 = 455kHz
f2 : 8.803MHz → $3f_{OSC}$-3f2 = 455kHz
f3 : 8.840MHz → $4f_{OSC}$-4f3 = 455kHz
f4 : 8.864MHz → $5f_{OSC}$-5f4 = 455kHz
f5 : 9.047MHz → 5f5-$5f_{OSC}$ = 455kHz
f6 : 9.069MHz → 4f6-$4f_{OSC}$ = 455kHz
f7 : 9.107MHz → 3f7-$3f_{OSC}$ = 455kHz
f8 : 9.183MHz → 2f8-$2f_{OSC}$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



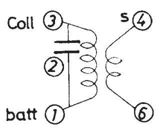


Sample Application Circuit 2 : FM (band in US) /MW/SW1 (2.2 to 7.5MHz) /SW2 (7.2 to 24.0MHz)
Application where the LA1185 and LA1260 are used

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

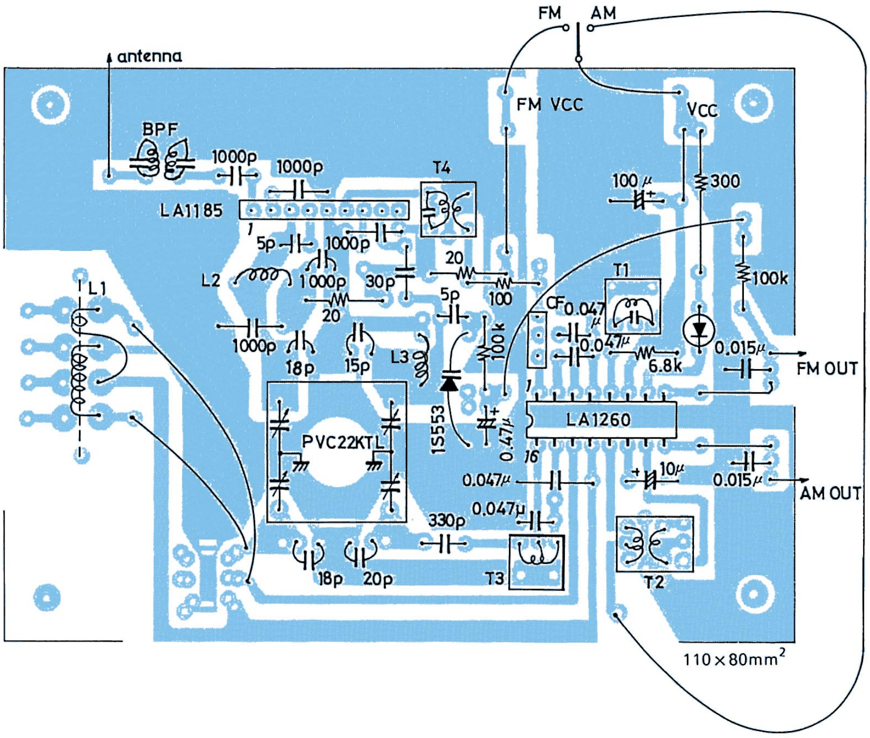


T4 : YT-30224 (Mitsumi)
FM IF

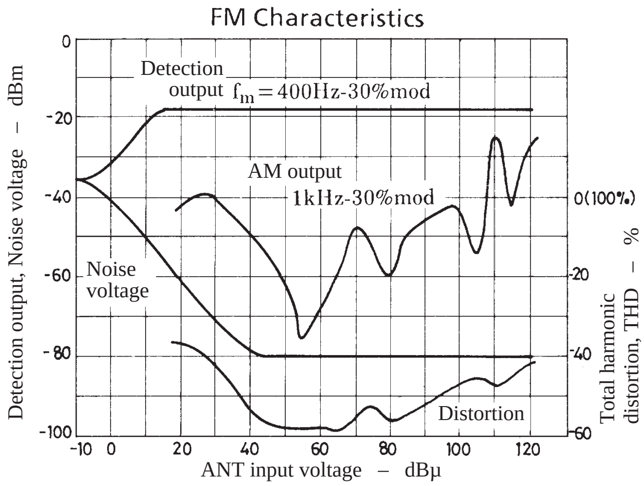


①-③ 8T, ④-⑥ 2T
0.12mm 2UEW
Internal 100pF, external 5pF
$f_O = 10.7MHz$, $Q_O = 80$

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



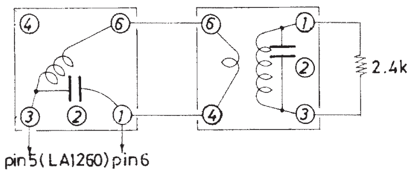
Unit (resistance : Ω, capacitance : F)



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

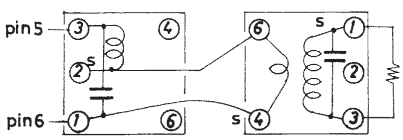
• Applications where a double tuning coil is used (See page 3.)
The use of the following coil improves the distortion approximately 0.1% at 100% modulation.

77-1236-04 77-1237-01



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 ± 20%	①-③ 82pF
0.08φ 2UEW	Q_O = 59 ± 20%

YT-40003 YT-40004



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