Ordering number: EN 1506D

Monolithic Linear IC

SANYO No.1506D

# LA1260

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

**Functions**

FM: IF amp., quadrature detector, AF preamp., tuning indicator drive output
AM: RF amp., MIX, OSC (with ALC), IF amp, Detector, AGC, tuning indicator drive

**Featues**

- 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 70mV to 90mV
  (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.

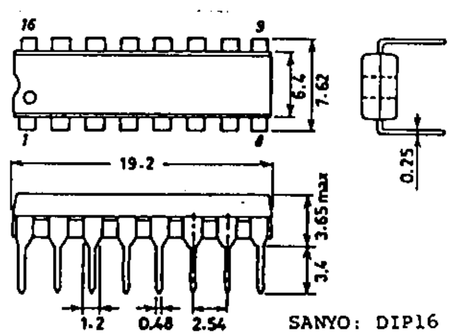
**Maximum Ratings** at Ta=25°C,See specified Test Circuit.

| | | | | unit |
|---|---|---|---|---|
| Maximum Supply Voltage | $V_{CC}max$ | Pins 6,12 | 9 | V |
| Maximum Current Dissipation | $I_{CC}max$ | 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 | $P_dmax$ | $Ta\leq70°C$ | 450 | mW |
| Operating Temperature | Topr | | -20 to +70 | °C |
| Storage Temperature | Tstg | | -40 to +125 | °C |

**Operating Conditions** at Ta=25°C

| | | | unit |
|---|---|---|---|
| Recommended Operating Voltage | $V_{CC}$ | 4.5 | V |
| Operating Voltage Range | $V_{CC}op$ | 3.0 to 8.0 | V |

**Package Dimensions**
(unit: mm)
3006B

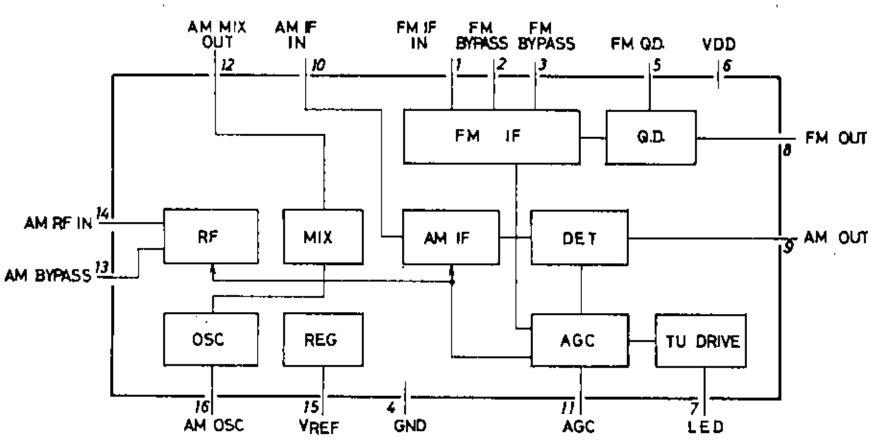



SANYO Electric Co.,Ltd. Semiconductor Business Headquarters
TOKYO OFFICE Tokyo Bldg.,1-10,1 Chome, Ueno, Taito-ku, TOKYO, 110 JAPAN

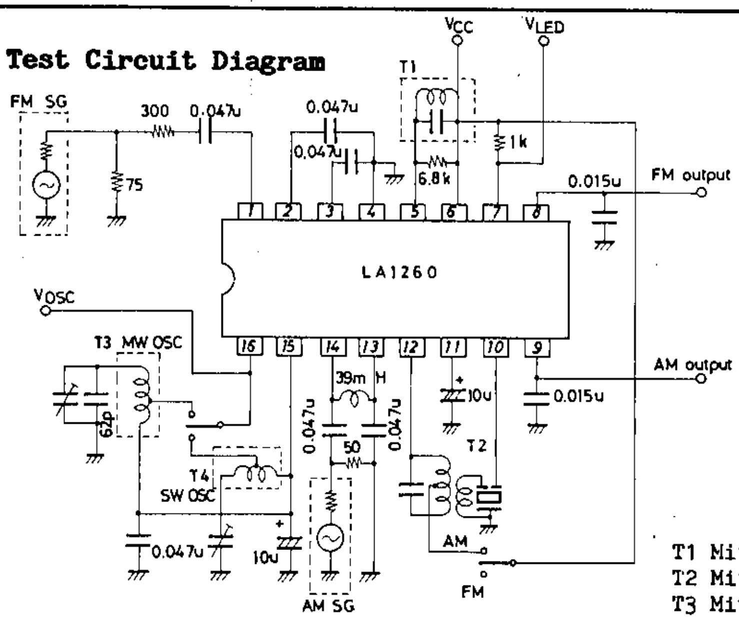
**Operating Characteristics** at Ta=25°C,$V_{CC}$=4.5V,See specified Test Circuit.

| | | | min | typ | max | unit |
|---|---|---|---|---|---|---|
| [AM Characteristics: f=1MHz] | | | | | | |
| Quiescent Current | IccoAM | $V_{IN}$=No input | | 7.5 | 10.5 | mA |
| Detection Output | Vo1 | $V_{IN}$=23dBu,400Hz-30%mod | -33 | -28 | -23 | dBm |
| | | | 17.3 | 31 | 55 | mV |
| S/N Ratio | S/N1 | $V_{IN}$=23dBu,400Hz-30%mod | 18.0 | 21.5 | | dB |
| Detection Output | Vo2 | $V_{IN}$=60dBu,400Hz-30%mod | -19.0 | -16.0 | -13.0 | dBm |
| | | | 87 | 122 | 174 | mV |
| S/N Ratio | S/N2 | $V_{IN}$=60dBu,400Hz-30%mod | 48 | 53 | | dB |
| Total Harmonic Distortion | THD1 | $V_{IN}$=60dBu,400Hz-30%mod | | 0.45 | 1.3 | % |
| | THD2 | $V_{IN}$=100dBu,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] | | | min | typ | max | unit |
| Quiescent Current | Icco | $V_{IN}$=No input | | 8.5 | 12.0 | mA |
| -3dB Sensitivity | Vilim | -3dBdown,400Hz-100%mod | | 35 | 42 | dBu |
| Demodulation Output | Vo3 | $V_{IN}$=80dBu,400Hz-100%mod | -12.5 | -9.5 | -6.5 | dBm |
| | | | 183 | 260 | 367 | mV |
| S/N Ratio | S/N3 | $V_{IN}$=80dBu,400Hz-100%mod | 77 | 81 | | dB |
| | S/N4 | $V_{IN}$=80dBu,400Hz-30%mod | | 71 | | dB |
| Total Harmonic Distortion | THD3 | $V_{IN}$=80dBu,400Hz-100%mod | | 0.55 | 1.2 | % |
| | THD4 | $V_{IN}$=80dBu,400Hz-30%mod | | 0.05 | | % |
| LED Lighting Level | $V_{LEDFM}$ | $I_L$=1mA | | 39 | 49 | dBu |
| AM Rejection | AMR | $V_{IN}$=80dBu,400Hz-100%mod 1kHz-30%mod | | 60 | | dB |

**Equivalent Circuit Block Diagram**



**Specified Test Circuit Diagram**




Unit (resistance: Ω, capacitance: F)

T1 Mitsumi YT30194(56PF tuning)
T2 Mitsumi KW30011
T3 Mitsumi YT30105
T3 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 Fig. A below. Care should be taken not to make unwanted coupling by parallel wiring as shown in Fig. B to prevent Qs from worsening.

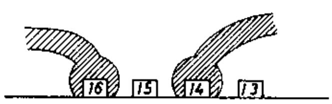



Fig. A Good example

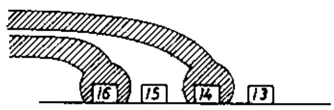



Fig. B Bad example

FM quadrature detection coil

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

  Tuning capacitance 56pF
  Damping resistance 6.8kohms

- 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 temperatures. | . 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=4.7kohms), other characteristics (demodulation output, S/N, THD, etc.)

Continued on next page.

Continued from preceding page.

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 15.

How to apply FM AFC

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

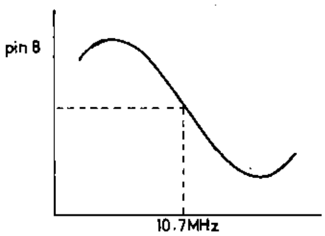



Fig. 1

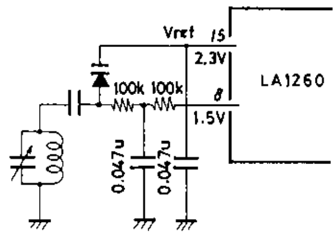



Fig. 2 Domestic (lower local oscillation) band

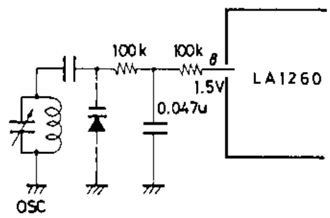
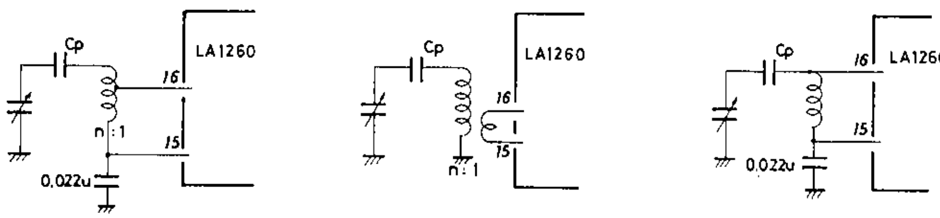



Fig. 3 Foreign (upper local oscillation) band

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 5kohms or greater viewed from across pins 16 and 15. Turn ratio n and Qo 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.

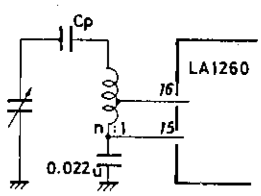



Fig. 4

Unit (capacitance: F)

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

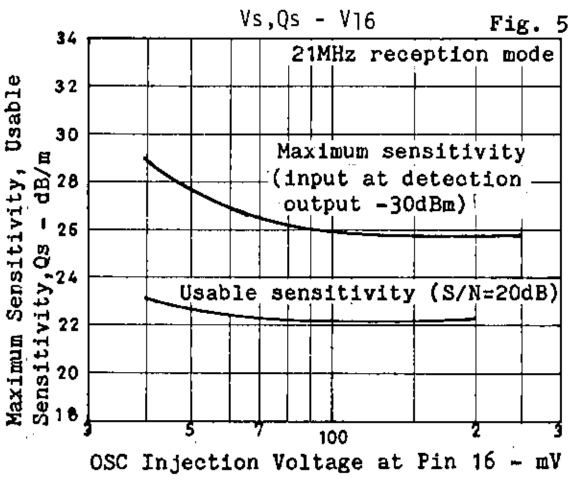



Fig. 5

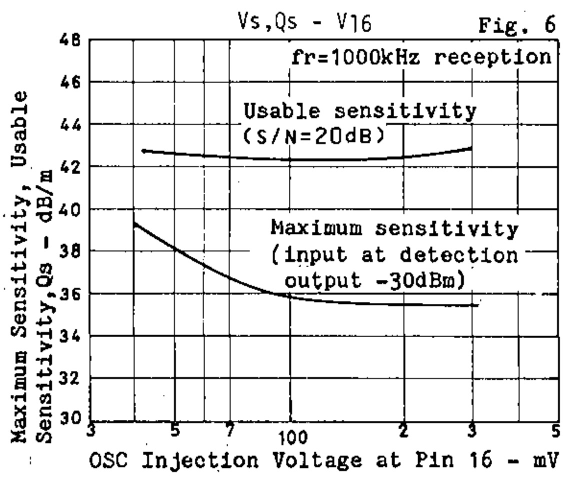
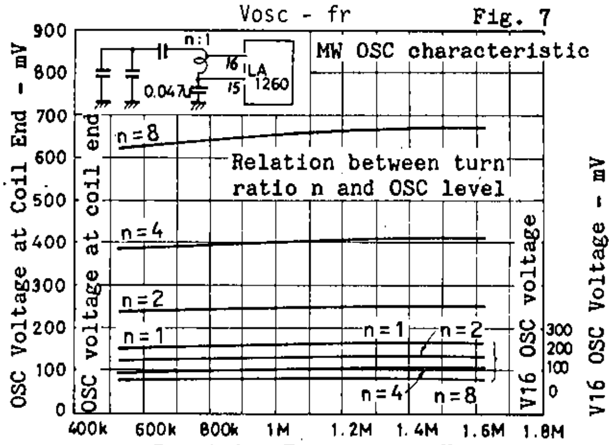
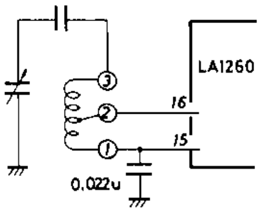



Fig. 6

Vosc - fr Fig. 7




AM oscillation coil



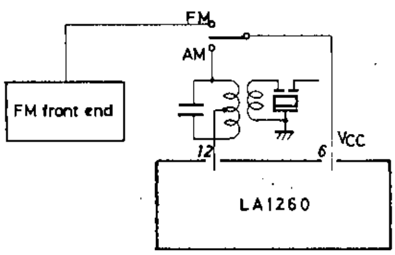

Unit ( capacitance: F )

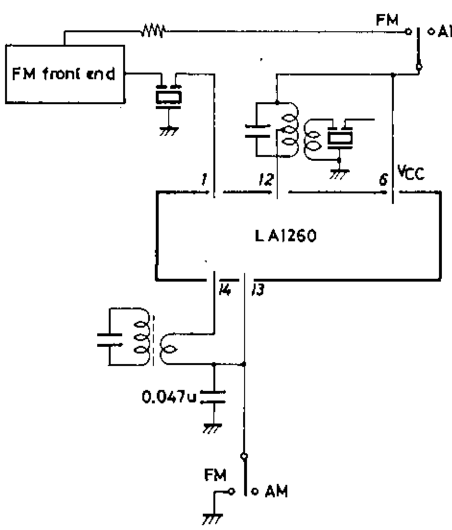
Generally speaking, the following should be noted. Winding with loose coupling between ① and ② and between ① and ③ must be avoided. (Particularly SW1, SW2)
To put it concretely, the pot core type is better than the screw core type which is loose in coupling. This prevents the local oscillation frequency 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 (Fig. 8), the distortion in the AM mode can be improved, but the LED unlighted time is made longer. 10uF is recommended for obtaining the optimum LED unlighted time and distortion. The LED unlighted time is 200msec. at this value. (Approximately 400msec. at 22uF)

FM-AM selection and dc level at pin 12



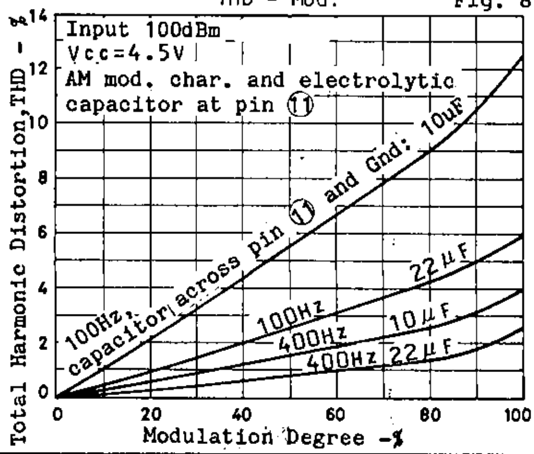




Unit ( capacitance: F )

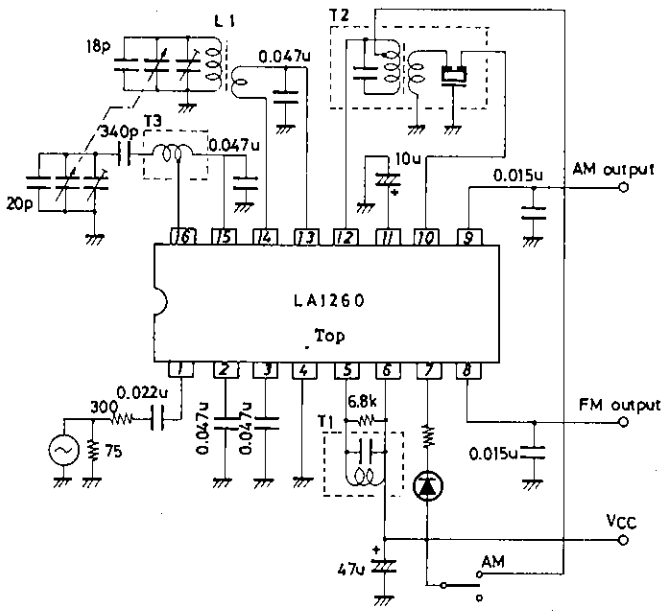
(1) Pin 12-used method=recommended circuit
The FM mode is entered with pin 12 open. When pin 12 and pin 6 are at the same potential in terms of DC, the AM circuit is turned on by the internal switch. It should be noted that the dynamic range is narrowed whether the potential at pin 12 is lower or high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

THD - Mod. Fig. 8



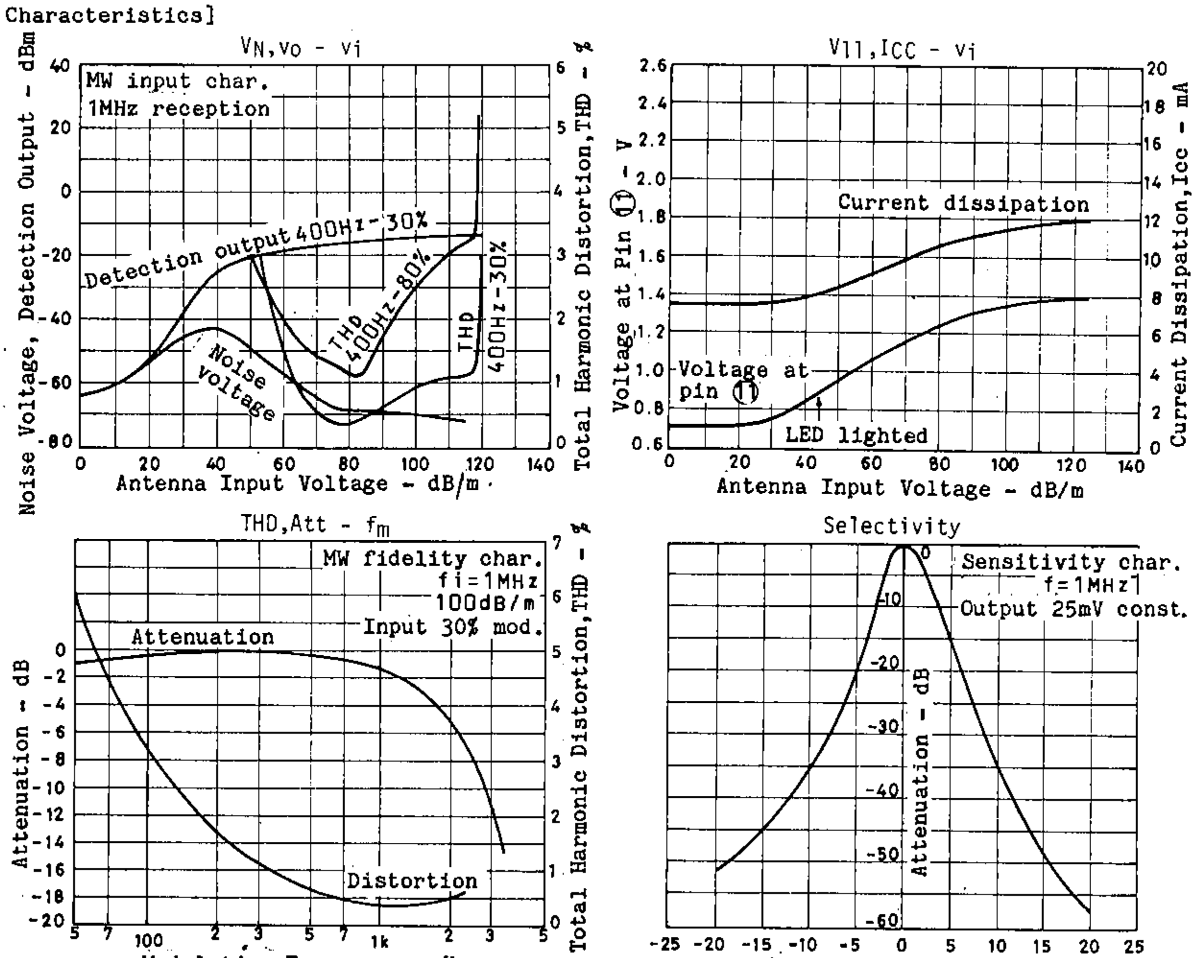
## FM IF/MW Test Circuit



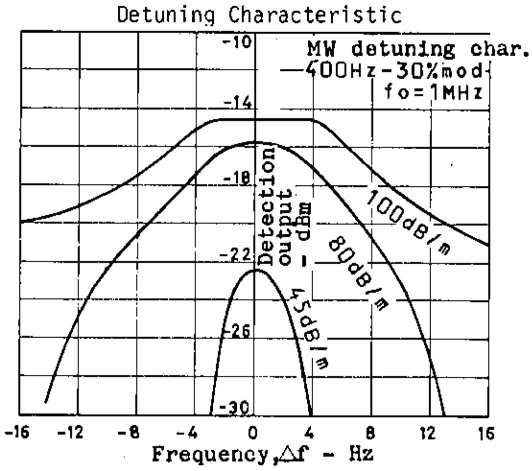

Unit (resistance: Ω, capacitance: F)

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

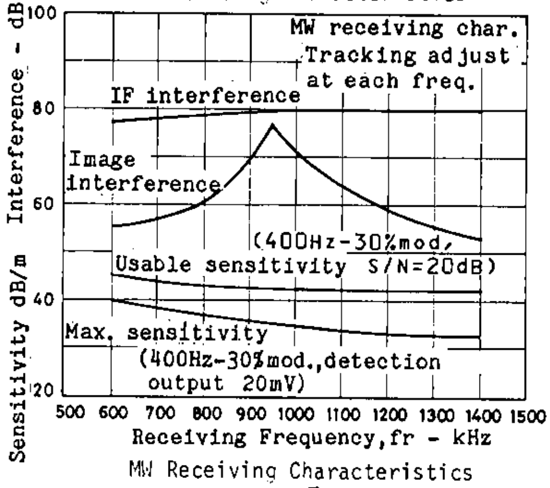
[MW Characteristics]



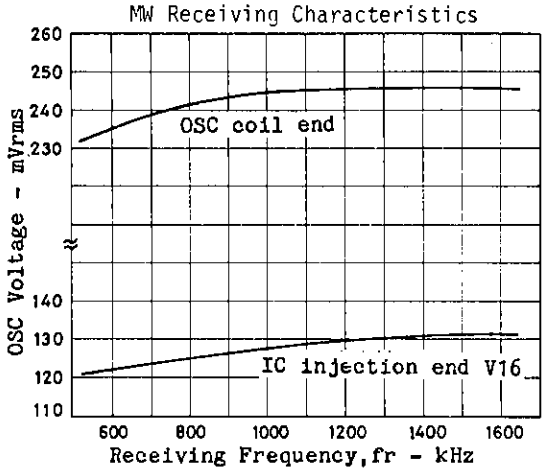
Detuning Characteristic



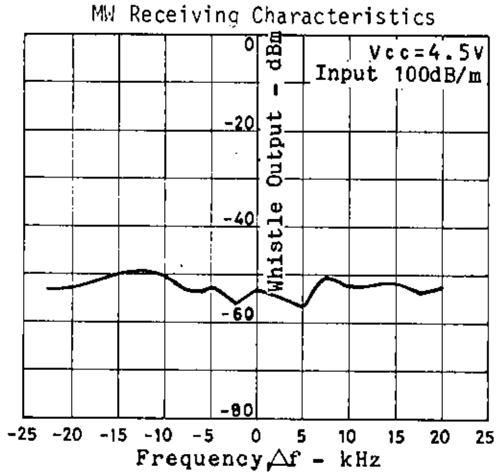

MW Receiving Characteristics



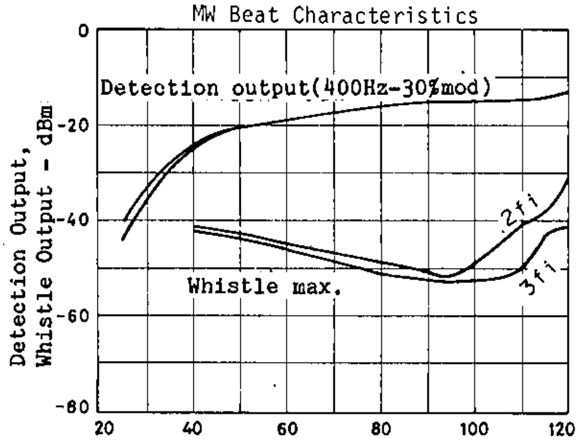

MW Receiving Characteristics



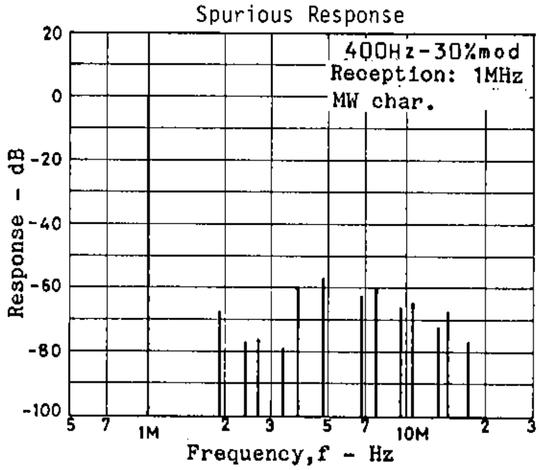

MW Receiving Characteristics




MW Beat Characteristics

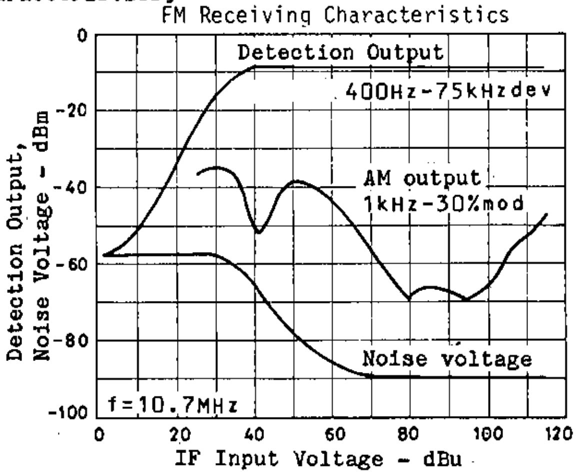



Spurious Response

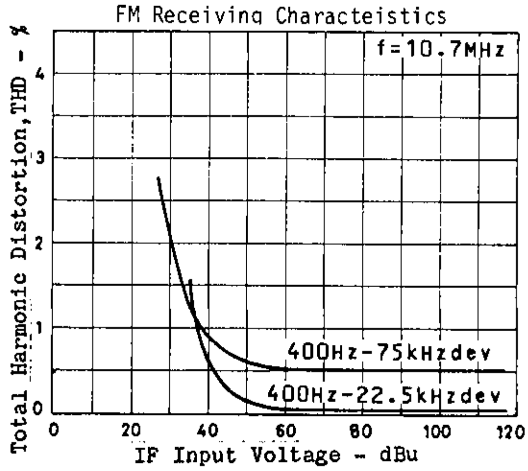



[FM Characteristics]

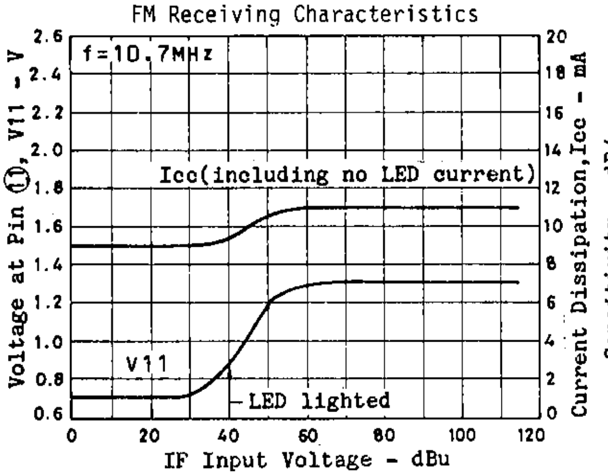
FM Receiving Characteristics



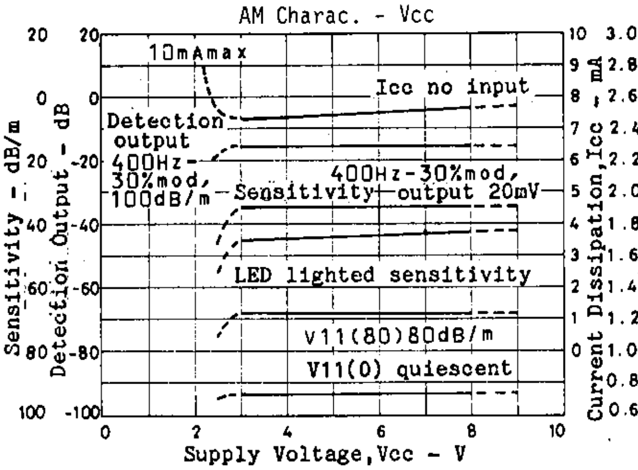

FM Receiving Characteistics



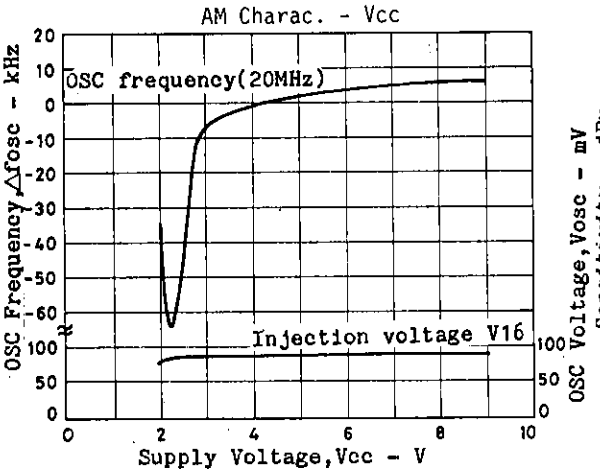
FM Receiving Characteristics



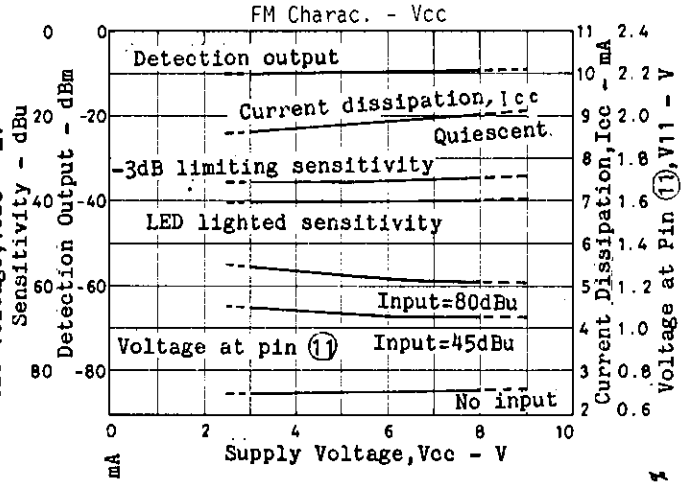

AM Charac. - Vcc



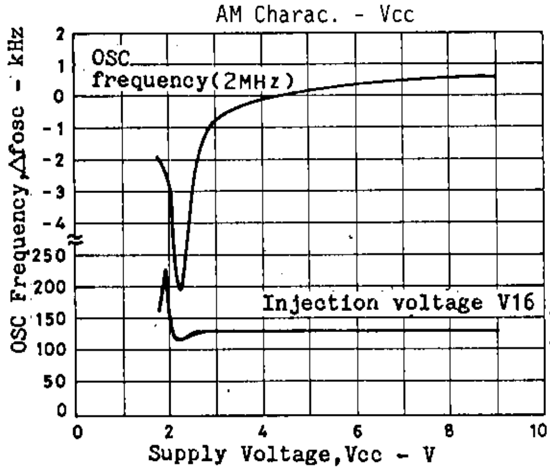

AM Charac. - Vcc



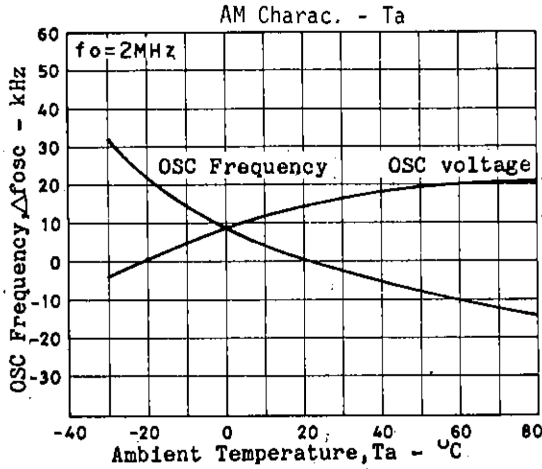

FM Charac. - Vcc



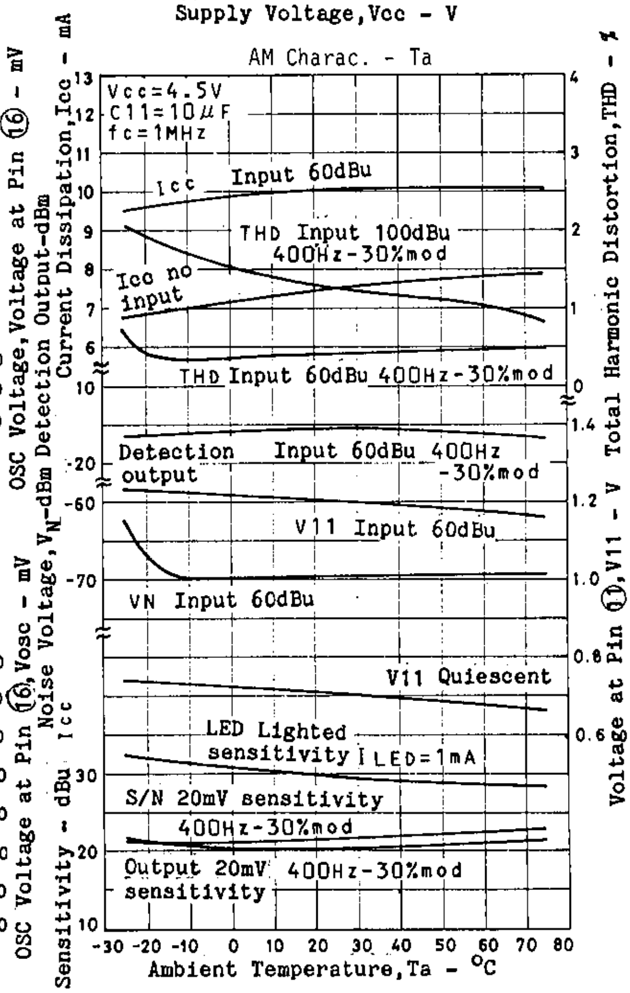

AM Charac. - Vcc

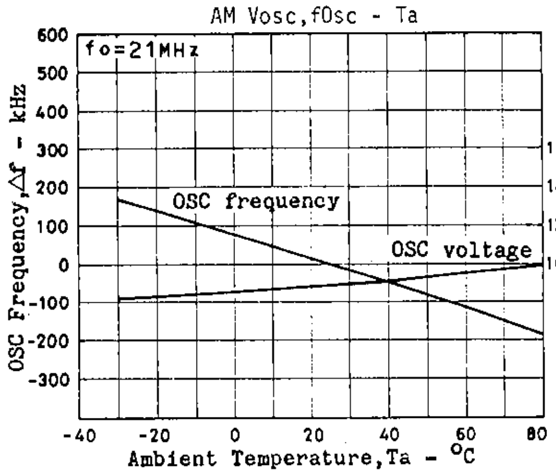


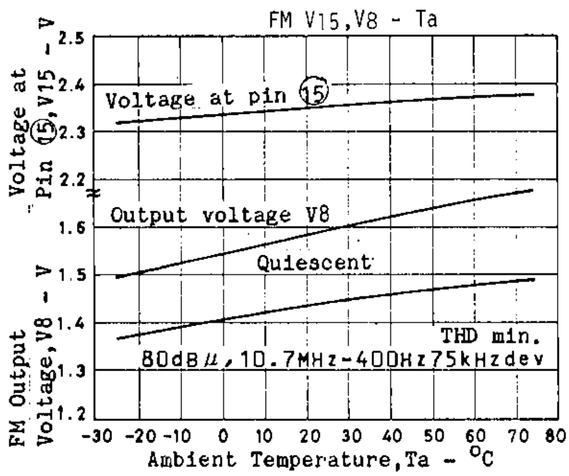

AM Charac. - Ta

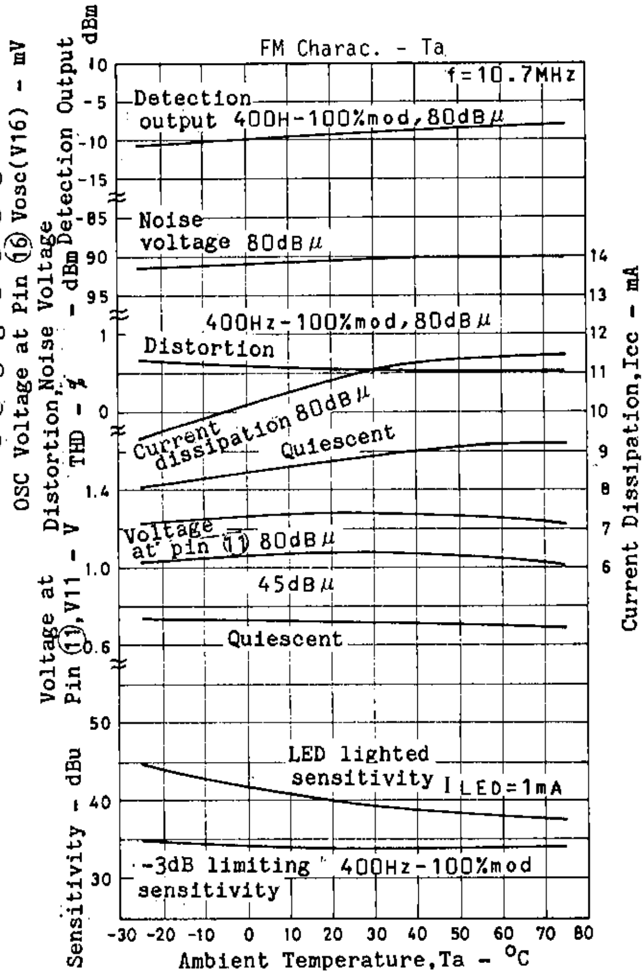



AM Charac. - Ta

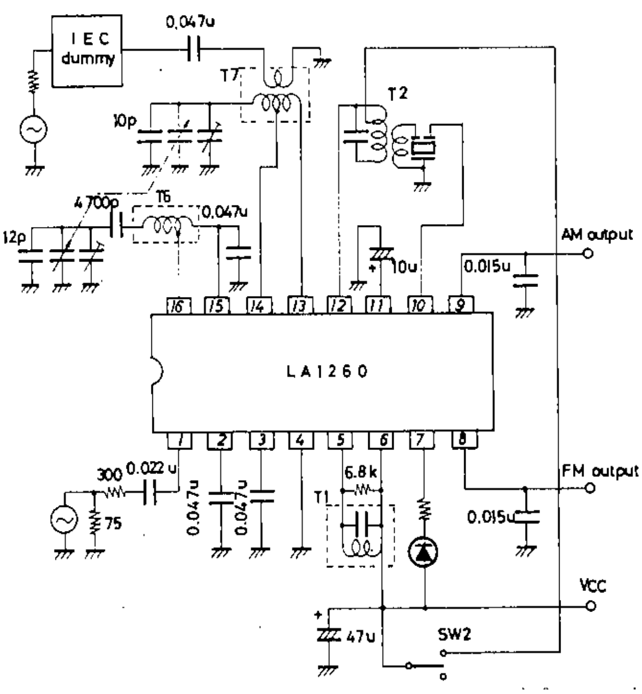




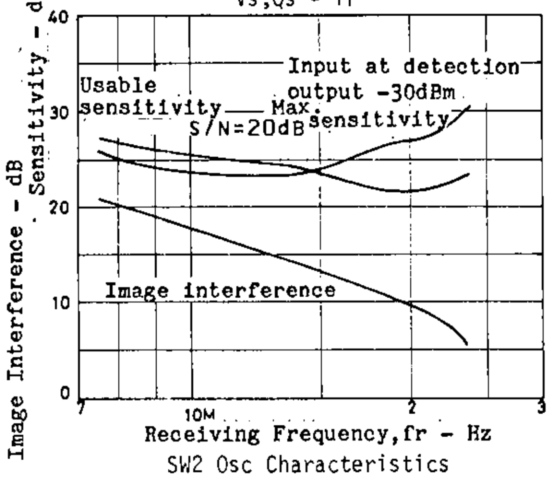

**Sample Application Circuit 1 : FM IF/SW2 (7.2 to 24.0 MHz)**



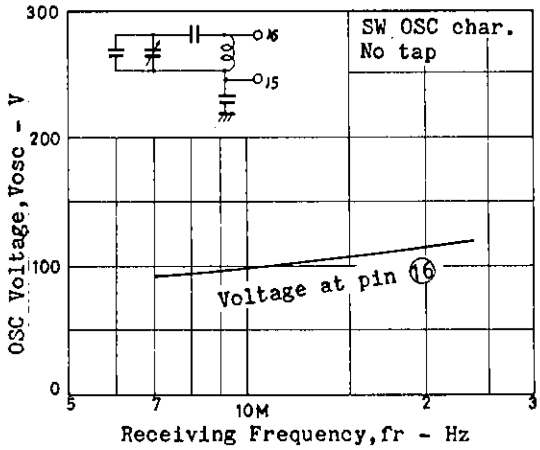

Unit (resistance: Ω, capacitance: F)

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

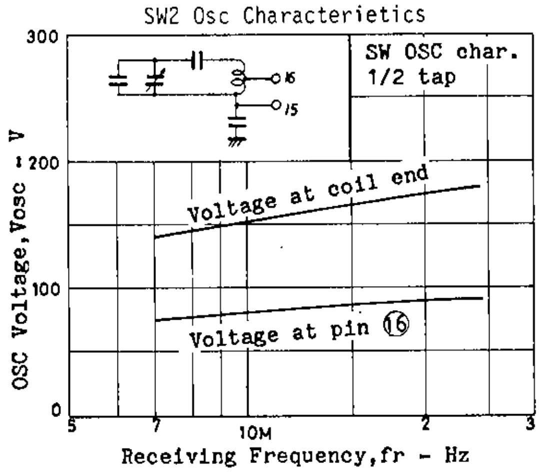
Vs,Qs - fr



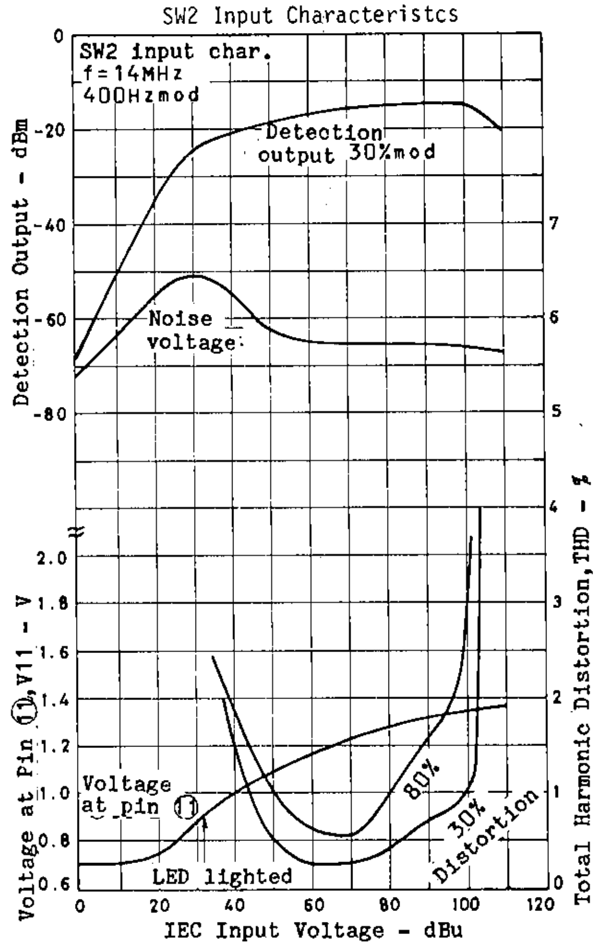

SW2 Osc Characteristics



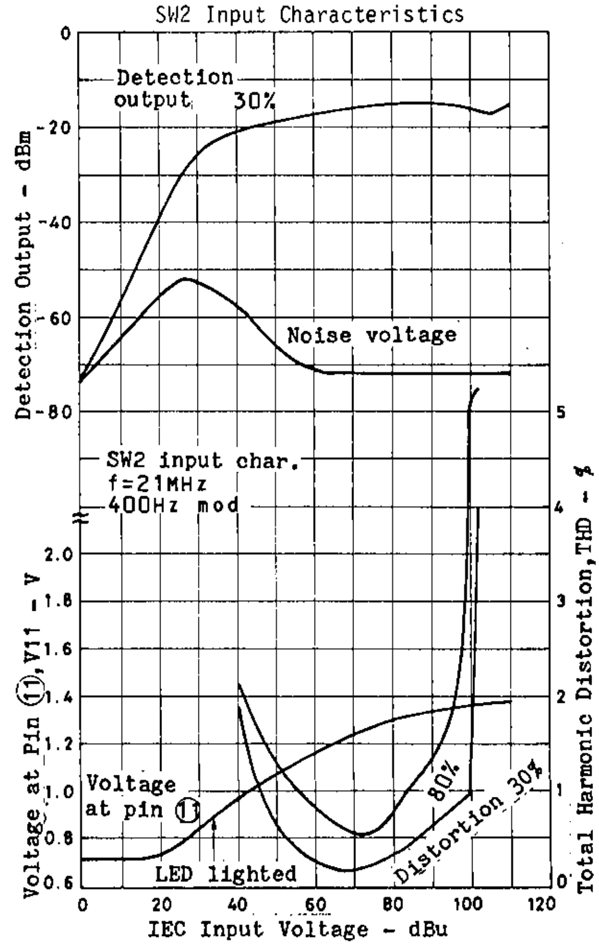

SW2 Osc Characterietics

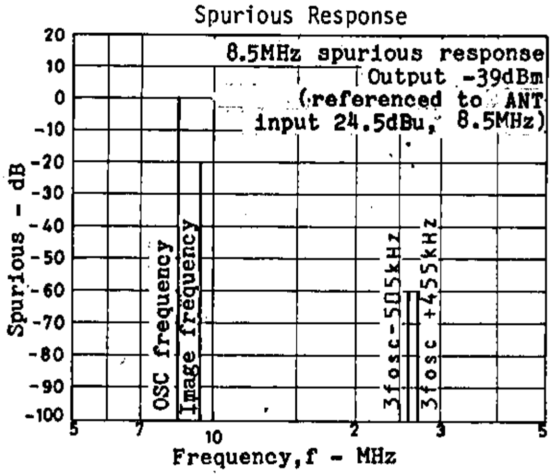


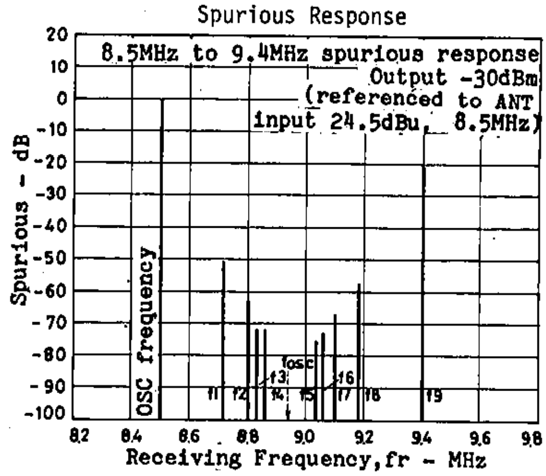

SW2 Input Characteristcs




SW2 Input Characteristics



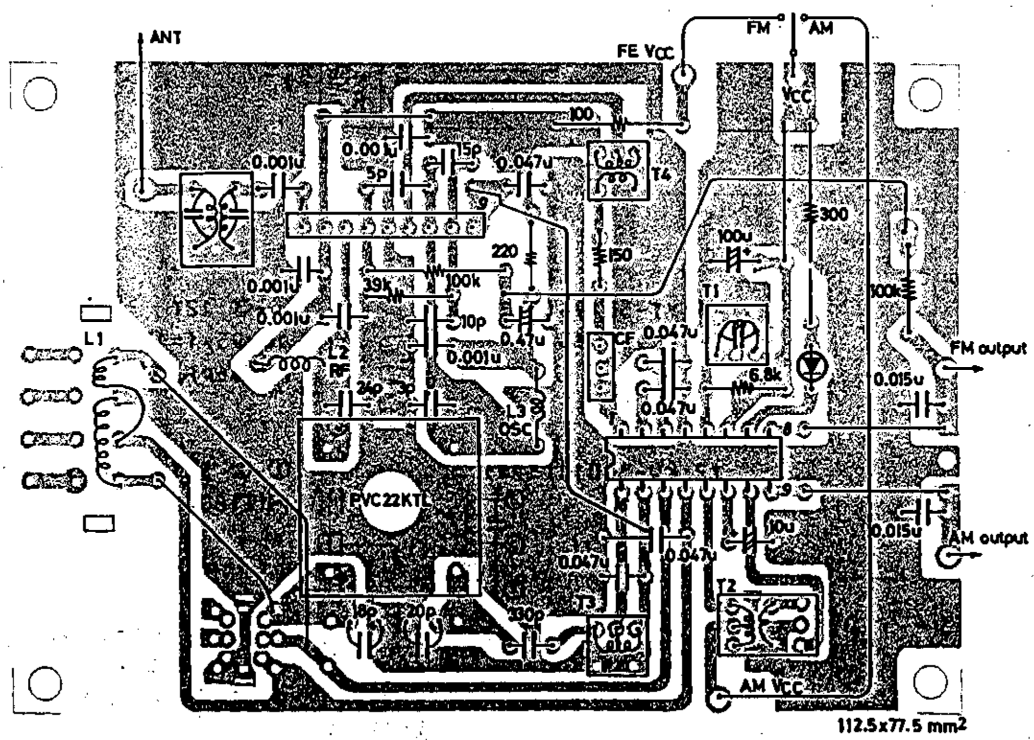



f1:8.729MHz →2fosc-2f1=455kHz
f2:8.803MHz →3fosc-3f2=455kHz
f3:8.840MHz →4fosc-4f3=455kHz
f4:8.864MHz →5fosc-5f4=455kHz
f5:9.047MHz →5f5-5fosc=455kHz
f6:9.069MHz →4f6-4fosc=455kHz
f7:9.107MHz →3f7-3fosc=455kHz
f8:9.183MHz →2f8-2fosc=455kHz

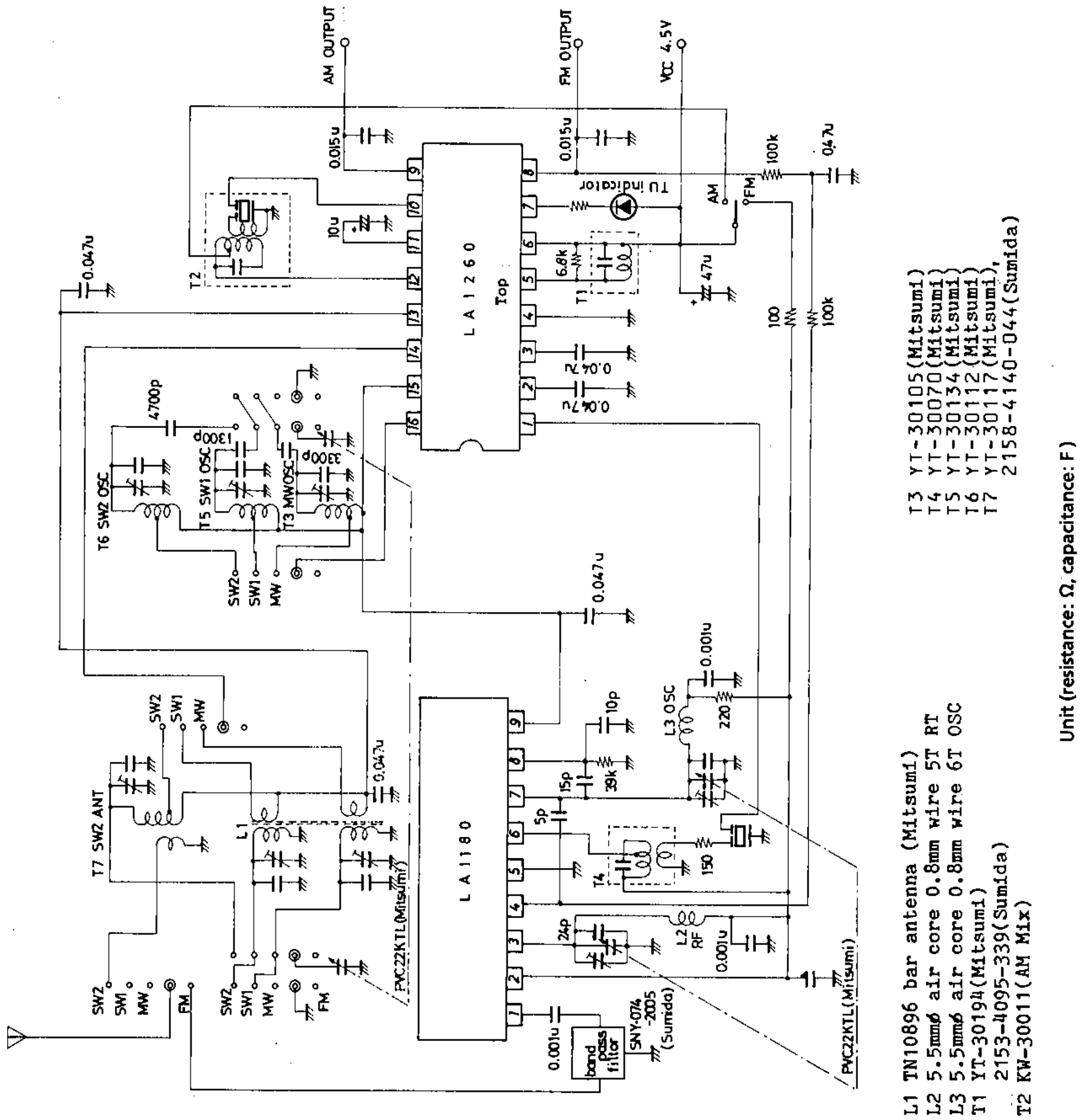
**Sample Application Circuit 2 :** FM (band in Japan)/MW/SW1(2.2 to 7.5MHz)/SW2(7.2 to 24.0MHz)
Application where the LA1185 and LA1260 are used

Sample printed circuit pattern (Cu-foiled area) (The circuit diagram is shown on page 12.)

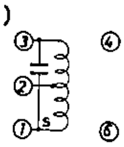



Unit (resistance: Ω, capacitance: F)

[Circuit Diagram] (The sample printed circuit pattern is shown on page 11.)

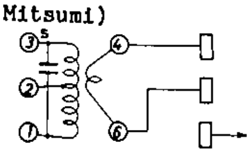



T1:YT-30194(Mitsumi)
FM quadrature



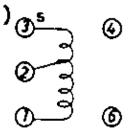
①-③ 12T
Qo=95, f=10.7MHz
Internal 56pF, external 15pF

T2:KW-30011(Mitsumi)
AM IF



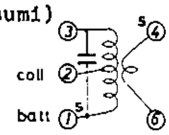
①-② 58T, ③-② 94T, ④-⑥ 7T
Internal 180pF

T3:YT-30105(Mitsumi)
MW OSC



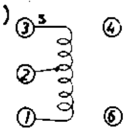
③-② 32T, ②-① 32T
0.07mm 2UEW,
Qo=140, L=140uH

T4:YT-30070(Mitsumi)
FM IF



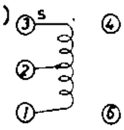

①-② 7T,②-③ 3T,④-⑥ 1T
0.12mm 2UEW
Internal 100pF, external 5pF
fo=10.7MHz,Qo=85

T5:YT-30134(Mitsumi)
SW1 OSC



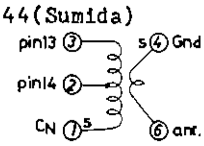
③-② 12T,②-① 12T
0.1mm 2UEW,
Qo=80,L=12uH

T6:YT-30112(Mitsumi)
SW2 OSC



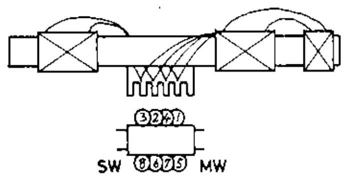
③-② 4T,②-① 4T
0.12mm 2UEW
Qo=80,L=1.25uH

T7:2158-4140-044(Sumida)

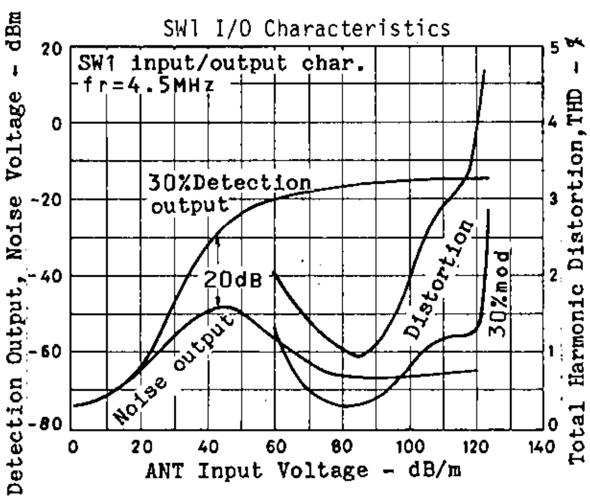


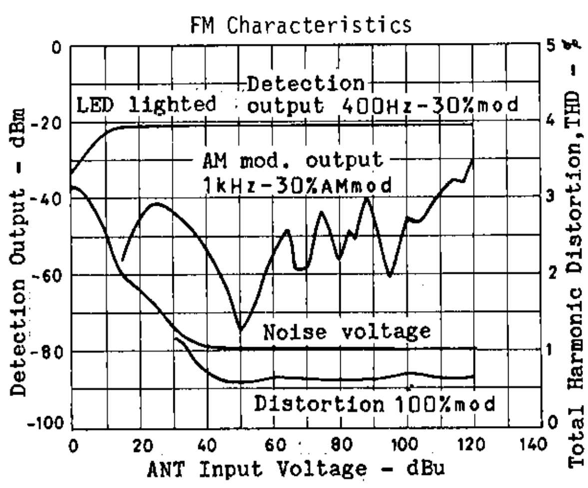

①-② 4T,②-③ 5T,④-⑥ 2T
0.12mm UEW,
Qo≧50,L=1.4uH

L1:TN-10896(Mitsumi)
MW bar antenna




①-② 22T+49T,③-④ 10T
Tight solenoid direct winding
⑤-⑥ 17T 0.5ϕ space winding
⑦-⑧ 4T tight solenoid winding
①-② L=260uH,Qo=330(≧200)
⑤-⑥ L=15uH,Qo=250(≧150)

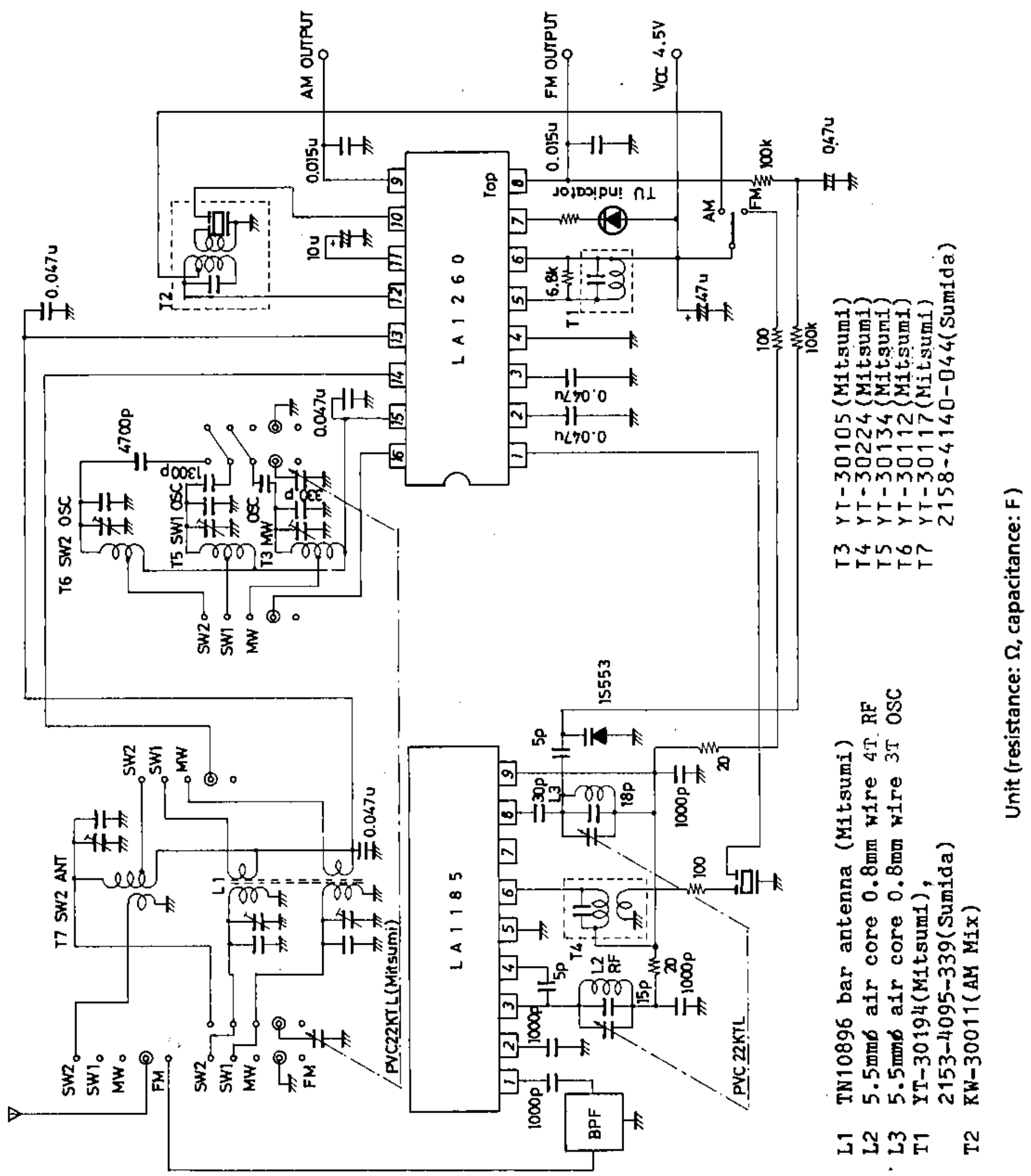


**Sample Application Circuit 3 :** FM (band in US)/MW/SW1(2.2 to 7.5MHz)/SW2(7.2 to 24.0MHz)

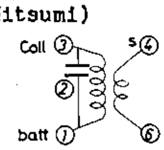
Application where the LA1185 and LA1260 are used

[Circuit Diagram] (The sample printed circuit pattern is shown on page 15.)




T4:YT-30224(Mitsumi)

FM IF




①-③ 8T,④-⑥ 2T

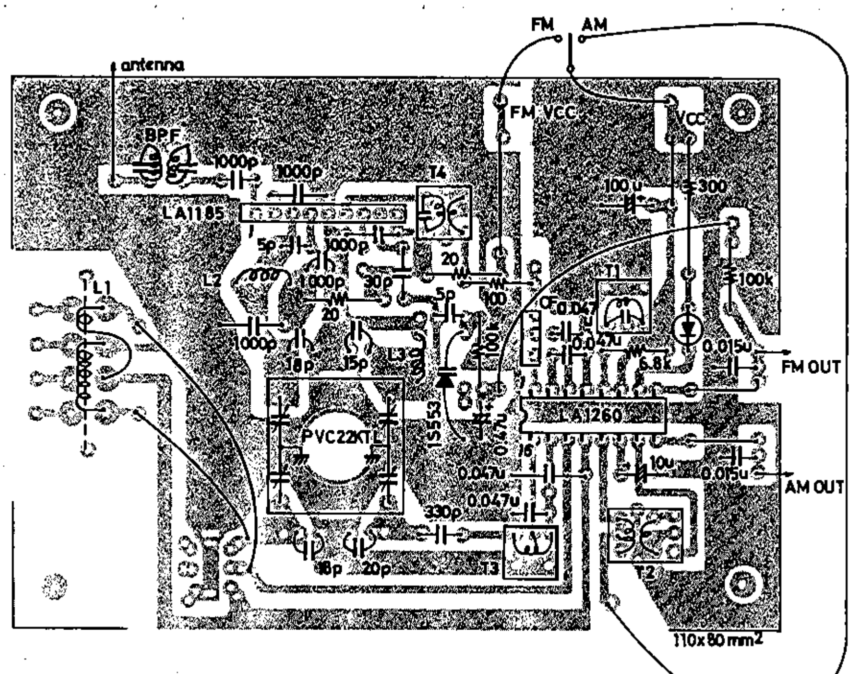
0.12mm 2UEW

Internal 100pF, external 5pF

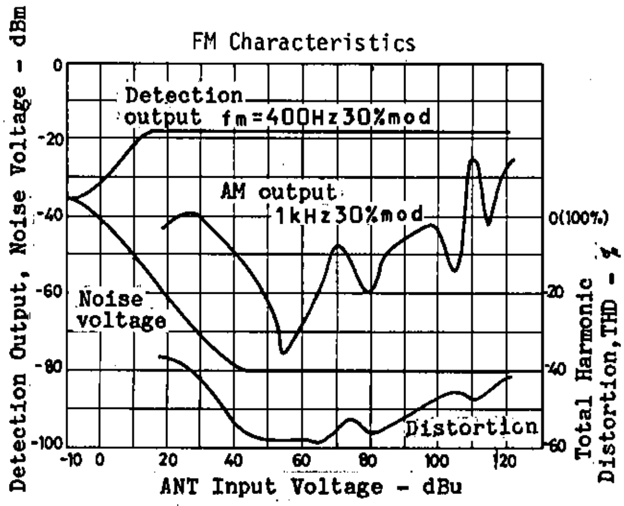
fo=10.7MHz,Qo=80

For the specifications for other coils than T4, refer to Sample Application Circuit 2.

[Sample Printed Circuit Pattern=Cu-foiled area] (The circuit diagram is shown on page 14.)

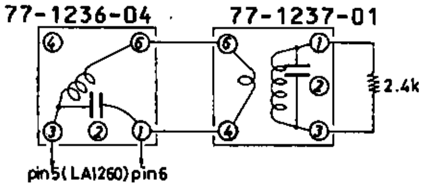



Unit (resistance: Ω, capacitance: F)



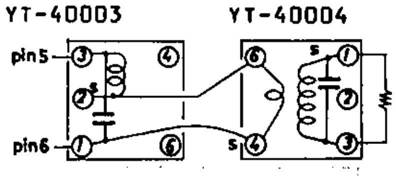

fr=108MHz
Vcc=4.5V
Q.S.=9.5dBμ
-3dB L.S.=9dBμ
LED lighting sensitivity 11.5dBu

- 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)
③-⑥ 19.5T
①-③ 68PF
Qo=78±20%
0.08φ 2UEW

77-1237-01 (Korin Giken)
①-③ 20T
⑥-④ 1T
①-③ 82PF
Qo=59±20%




YT-40003 (Mitsumi)
②-③ 25T
①-③ 56PF
Qo=40±20%
0.1mmφ 2UEW

YT-40004 (Mitsumi)
④-⑥ 1T
①-③ 23T 82PF
Qo=40±20%
0.1mmφ 2UEW