Ordering number : EN2056B

Monolithic Linear IC

# LA1600

## 1-Band AM Radio

## Overview

The LA1600, being an AM tuner IC placed in a 9-pin SIP, provides the functions of an AM tuner. It is usable in the band range up to SW band and is especially suited for use in low-cost AM radios and radio-controlled receivers.

## Functions

• AM : RF amp, MIX, OSC, IF amp, detector, AGC.

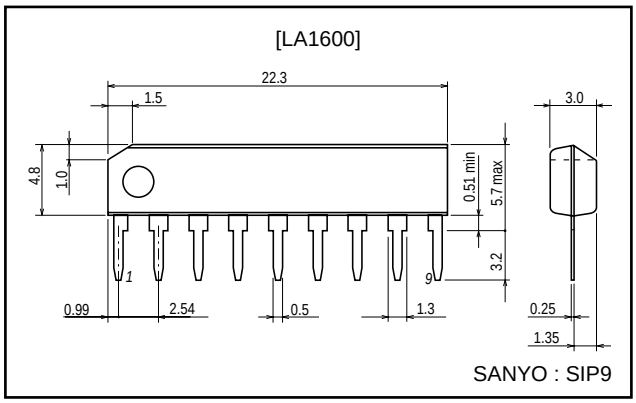
## Features

• Minimum number of external parts required.
• Low current drain (3.7mA).
• Low supply voltage (1.8V min).
• Adoption of double-balanced mixer.
• Usable in the band range up to SW band.

## Package Dimensions

unit : mm

**3017B-SIP9**




## Specifications

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

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum supply voltage | $V_{CC}$ max | Pin 3 | 9 | V |
| | | Pin 4 | 9 | V |
| | | Pin 8 | 7 | V |
| Allowable power dissipation | Pd max | Ta≤70°C | 100 | 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 | $V_{CC}$ | | 3 | V |
| Operating voltage range | $V_{CC}$ op | | 1.8 to 6.0 | V |

### Operating Characteristics at Ta=25°C, $V_{CC}$=3V, See specified Test Circuit.

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| [AM Characteristics/f=1MHz] | | | | | | |
| Quiescent current | Icco | $V_{IN}$=No input | | 3.7 | 4.6 | mA |
| Detection output | $V_O$1 | $V_{IN}$=23dBμ, 1kHz-30% mod | –30 | –25 | –20 | dBm |
| | | | 24 | 43 | 78 | mV |
| | $V_O$2 | $V_{IN}$=80dBμ, 1kHz-30% mod | –18 | –14 | –10 | dBm |
| | | | 97 | 155 | 250 | mV |
| S/N | S/N1 | $V_{IN}$=23dBμ | 18 | 21.5 | | dB |
| | S/N2 | $V_{IN}$=80dBμ | 48 | 53 | | dB |
| Total harmonic distortion | THD1 | $V_{IN}$=80dBμ, 1kHz-30% mod | | 0.3 | 1.2 | % |
| | THD2 | $V_{IN}$=100dBμ, 1kHz-30% mod | | 0.4 | 1.5 | % |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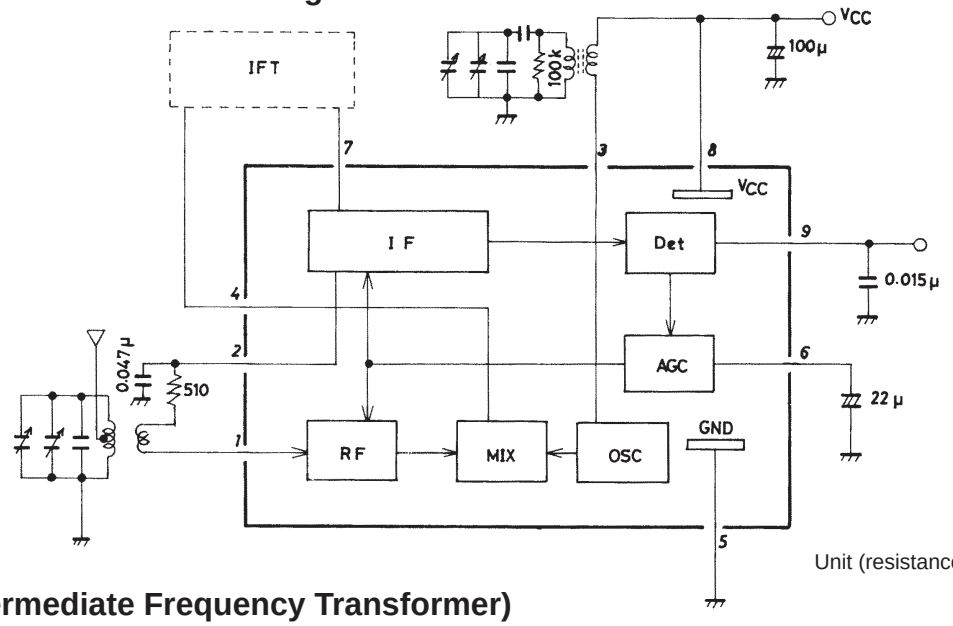
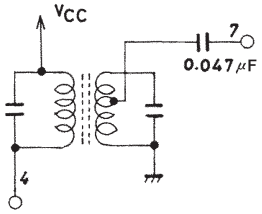
## Equivalent Circuit Block Diagram



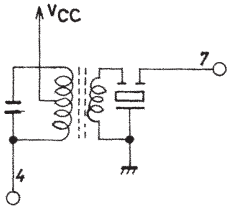

Unit (resistance : Ω, capacitance : F)

## IFT (Intermediate Frequency Transformer)

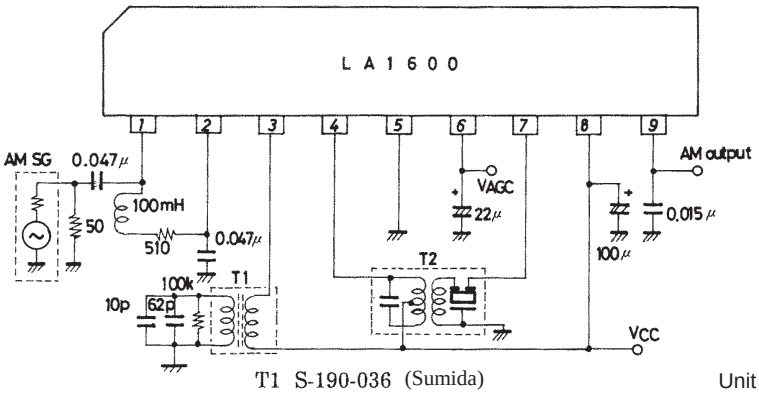
1. Using double tuning coil




2. Using ceramic filter



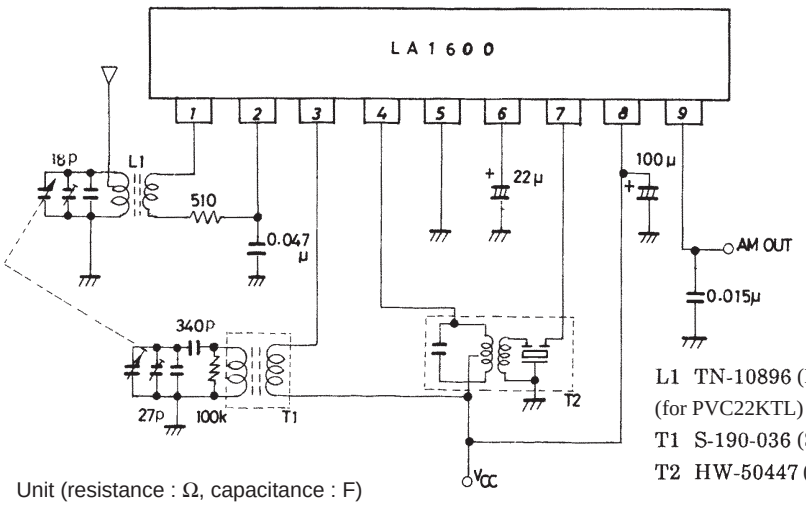

## Specified Test Circuit Diagram




T1 S-190-036 (Sumida)
T2 HW-50447 (Mitsumi)

Unit (resistance : Ω, capacitance : F)

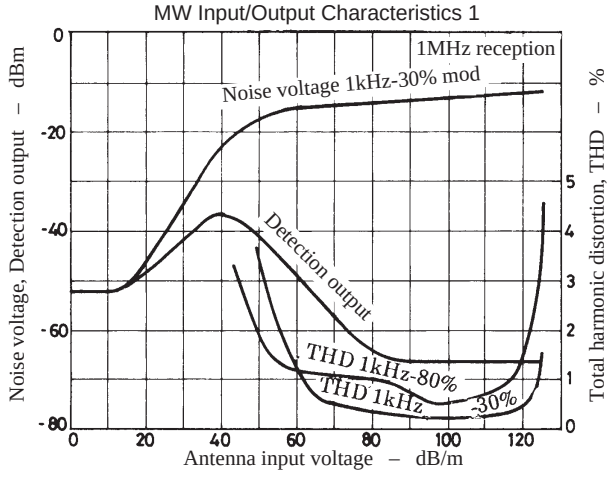
## Test Circuit 1 : AM-MW



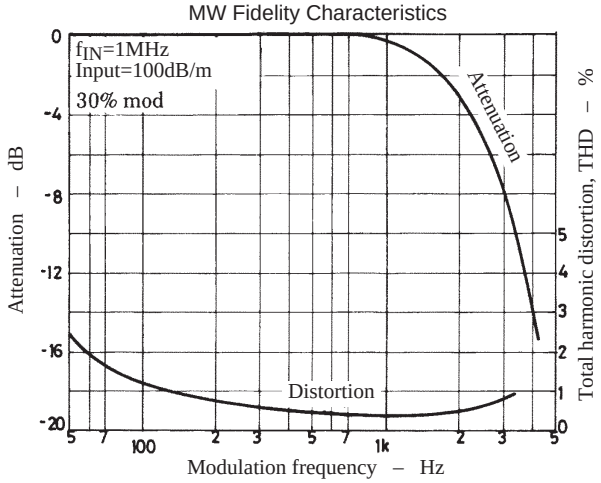

L1 TN-10896 (Mitsumi)
(for PVC22KTL)
T1 S-190-036 (Sumida)
T2 HW-50447 (Mitsumi)

Unit (resistance : Ω, capacitance : F)

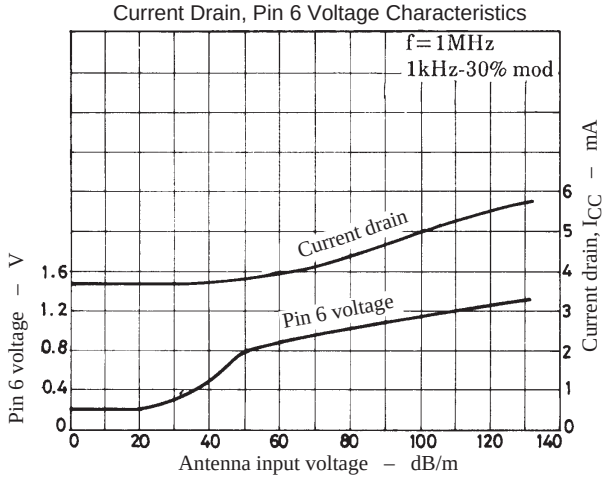
MW Input/Output Characteristics 1



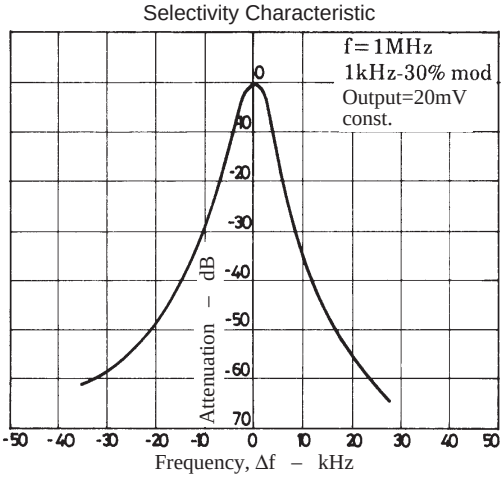

MW Fidelity Characteristics



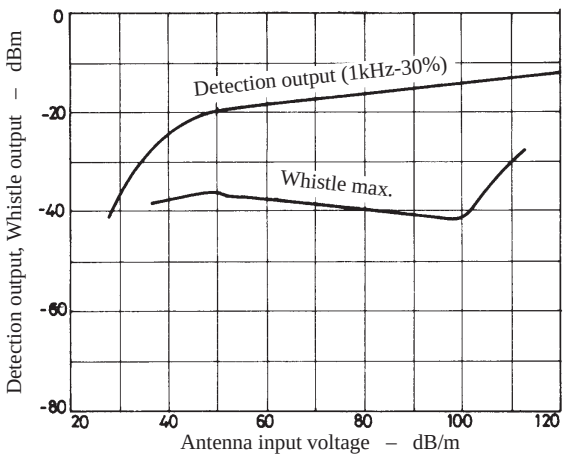

Current Drain, Pin 6 Voltage Characteristics



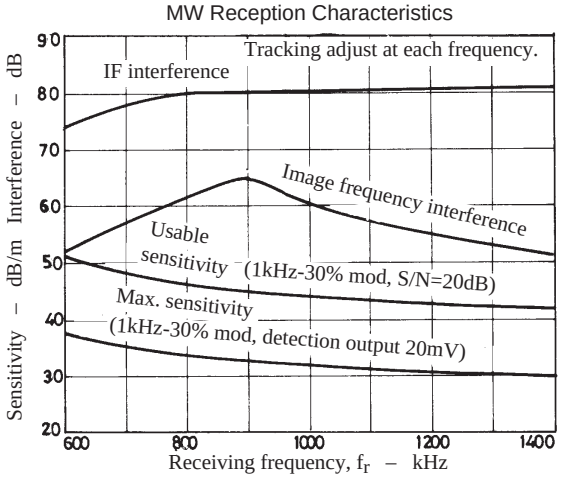

Selectivity Characteristic



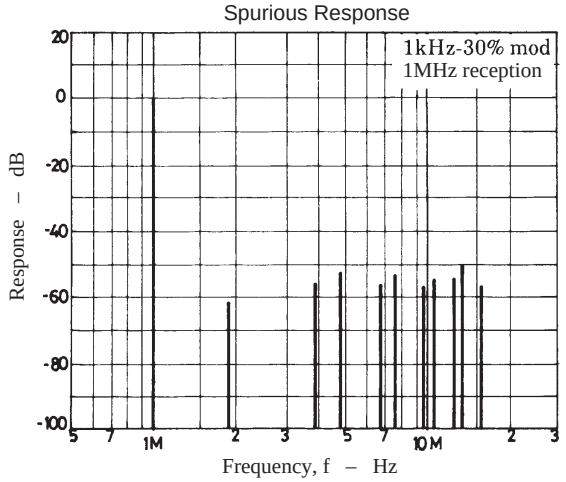

Whistle Characteristics



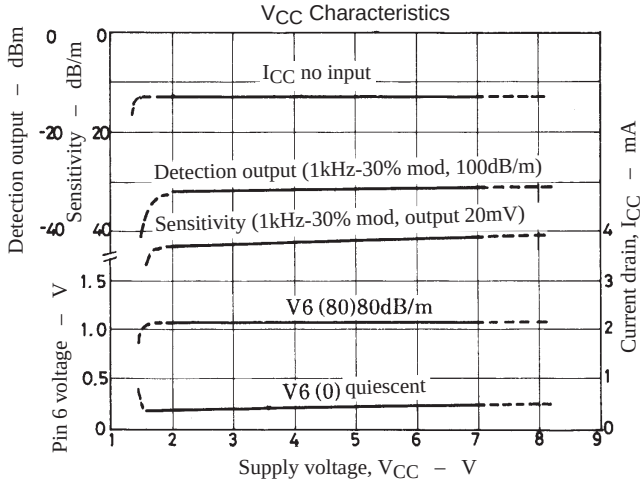

MW Reception Characteristics

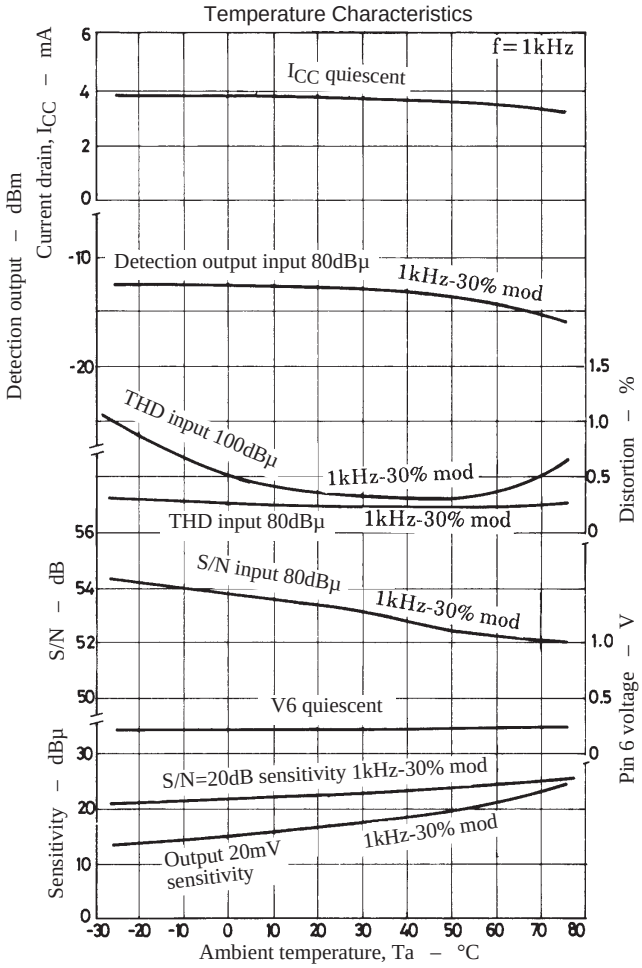



Spurious Response

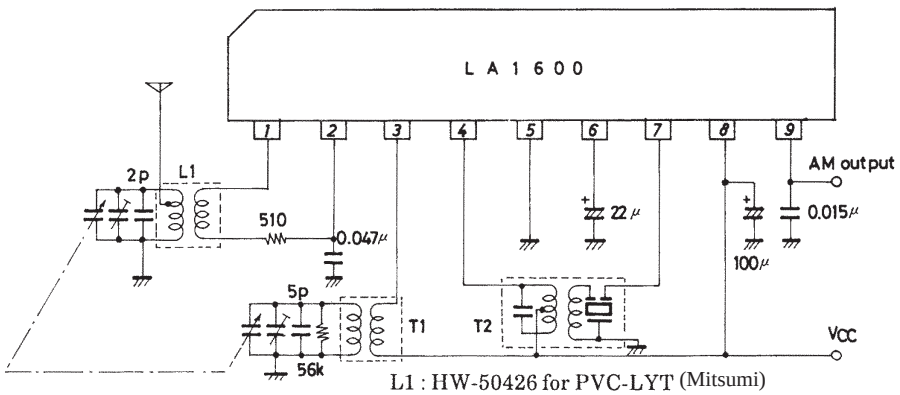



$V_{CC}$ Characteristics



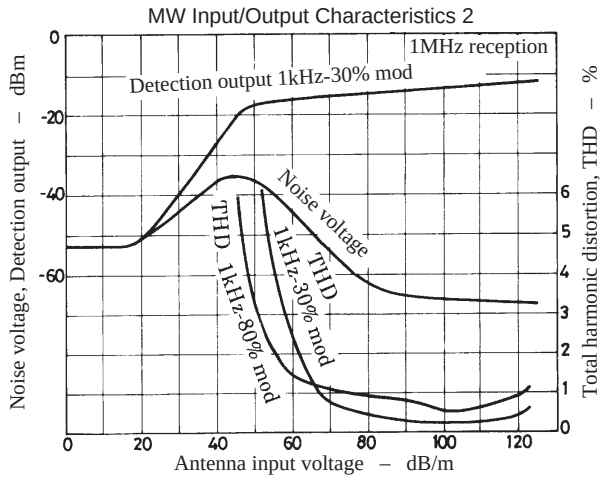



## Test Circuit 2 : AM-MW

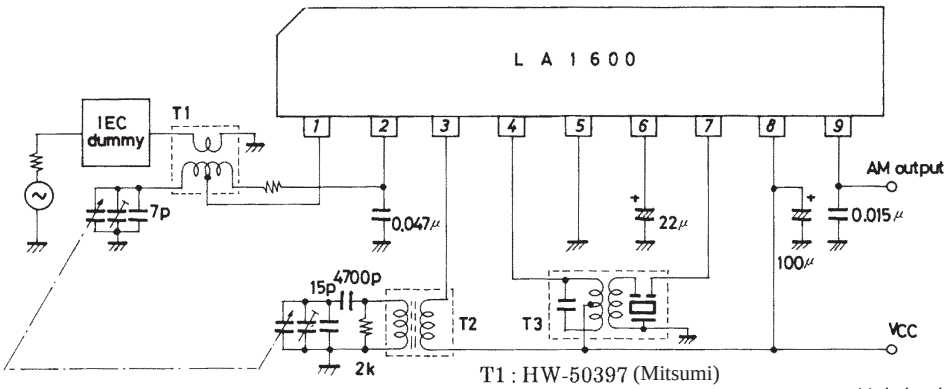



L1 : HW-50426 for PVC-LYT (Mitsumi)
T1 : HW-50425 (Mitsumi)
T2 : HW-50447 (Mitsumi)

Unit (resistance : Ω, capacitance : F)



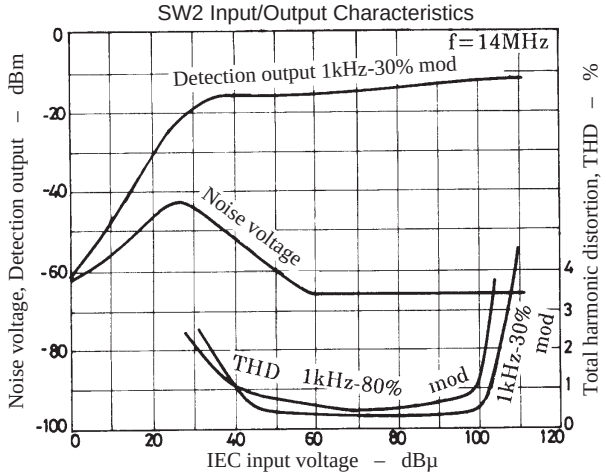
## Test Circuit 3 : SW2 (7.2 to 24.0MHz)



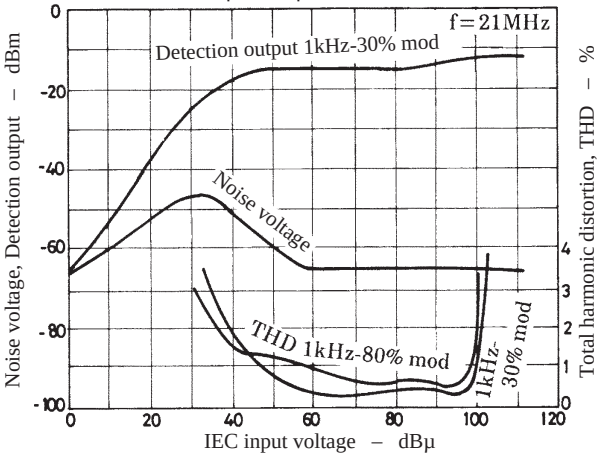

T1 : HW-50397 (Mitsumi)
T2 : HW-50422 (Mitsumi)
T3 : HW-50447 (Mitsumi)

Unit (resistance : Ω, capacitance : F)

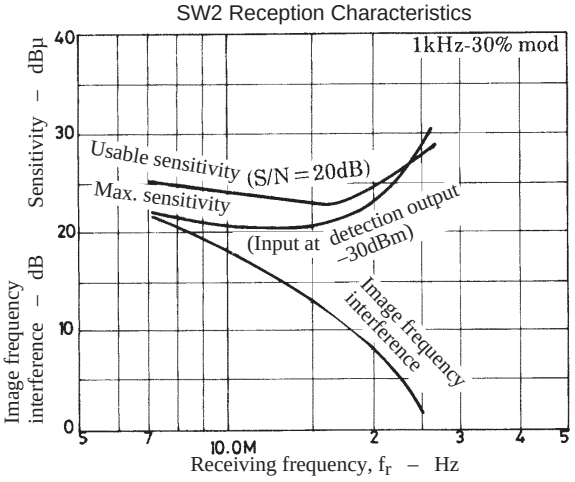
SW2 Input/Output Characteristics



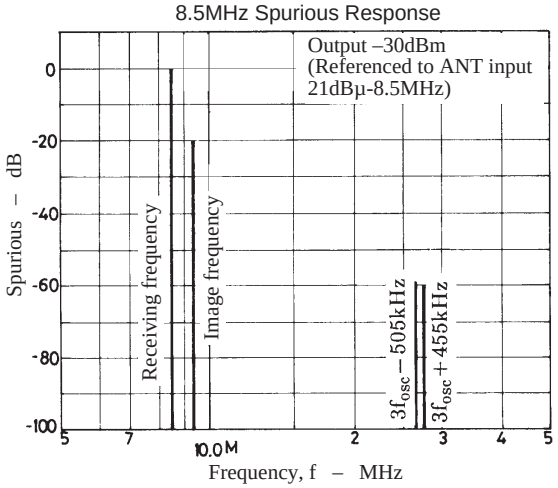

SW2 Input/Output Characteristics



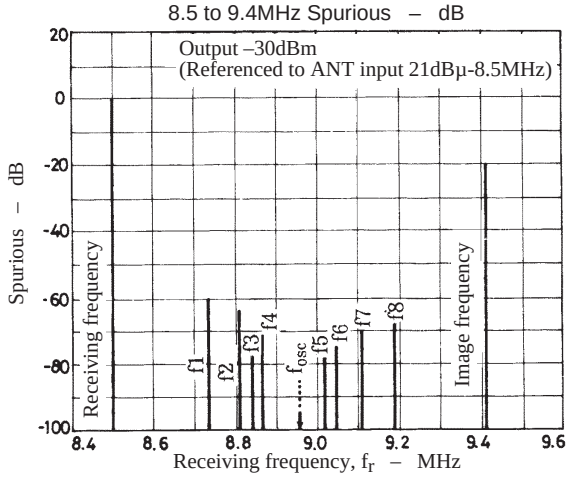

SW2 Reception Characteristics




8.5MHz Spurious Response




8.5 to 9.4MHz Spurious – dB



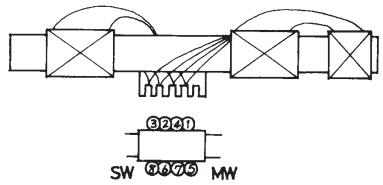

f1 : 8.7336MHz → $2f_{OSC}$-2f1 = 455kHz
f2 : 8.8097MHz → $3f_{OSC}$-3f2 = 455kHz
f3 : 8.8478MHz → $4f_{OSC}$-4f3 = 455kHz
f4 : 8.8702MHz → $5f_{OSC}$-5f4 = 455kHz
f5 : 9.0263MHz → 5f5-$5f_{OSC}$ = 455kHz
f6 : 9.0525MHz → 4f6-$4f_{OSC}$ = 455kHz
f7 : 9.1130MHz → 3f7-$3f_{OSC}$ = 455kHz
f8 : 9.1888MHz → 2f8-$2f_{OSC}$ = 455kHz

## Coil Specifications

MW antenna

Bar antenna (for PVC22KTL)

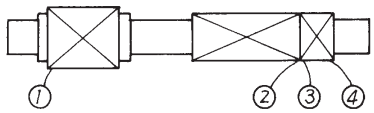
• TN-10896 (Mitsumi)




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 = 260μH, $Q_O$ = 330 (≧ 200)
⑤-⑥ L = 15μH, $Q_O$ = 250 (≧ 150)

Bar antenna (for PVC-LYT)

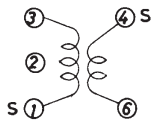
• HW-50426 (Mitsumi)




①-② 21T + 100T
③-④ 30T
①-② L = 604μH, $Q_O$ ≧ 120

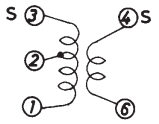
MW OSC

• S-190-036 (Sumida)
For PVC22KTL




①-③ 75T, ④-⑥ 8T
$Q_O$ ≧ 80, L = 140μH

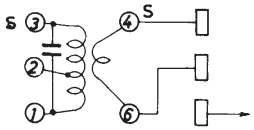
• HW-50426 (Mitsumi)
For PVC-LYT




③-② 2T, ④-⑥ 9T
②-① 86T
$Q_O$ ≧ 80, L = 270μH

AM-IFT

• HW-50447 (Mitsumi)

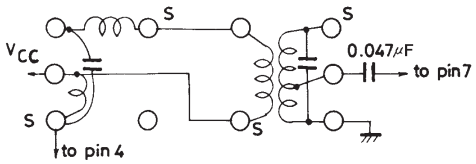



①-② 82T, ③-② 70T,
④-⑥ 7T
$Q_O$ = 110 ± 20%, f = 450kHz
Internal 180pF
C.F : SFU450B

AM-IFT

Application where a double tuning coil is used

HW-50475 HW-50498



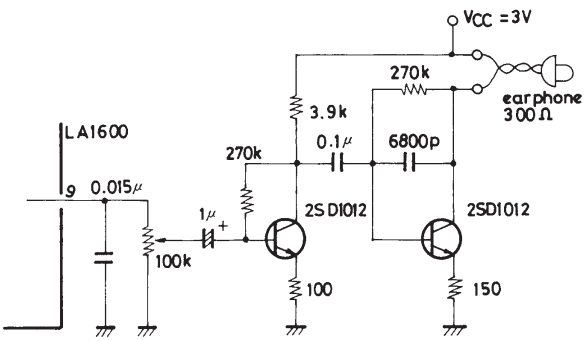

HW-50475
(Mitsumi)
①-② 80T
④-③ 70 1/2T
Internal 180pF
$Q_O$ = 120 ± 20%

HW-50498
(Mitsumi)
①-② 134T
④-⑥ 3T
②-③ 18T
Internal 180pF
$Q_O$ = 70 ± 20%

## Sample Application Circuit 1

Earphone

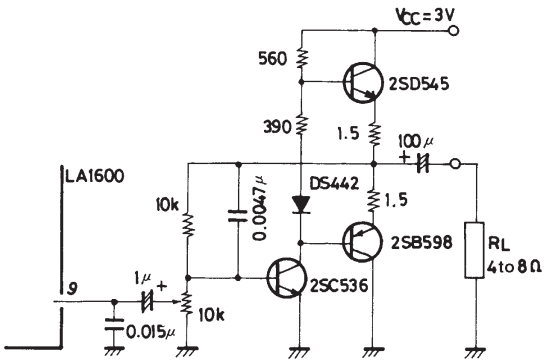
Transistor rank=G280 to 560




## Sample Application Circuit 2

Power amp using 3 discrete devices

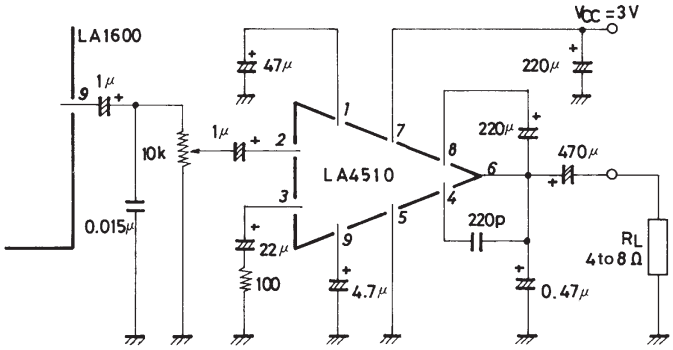
Transistor rank=E100 to 200




Unit (resistance : Ω, capacitance : F)

## Sample Application Circuit 3

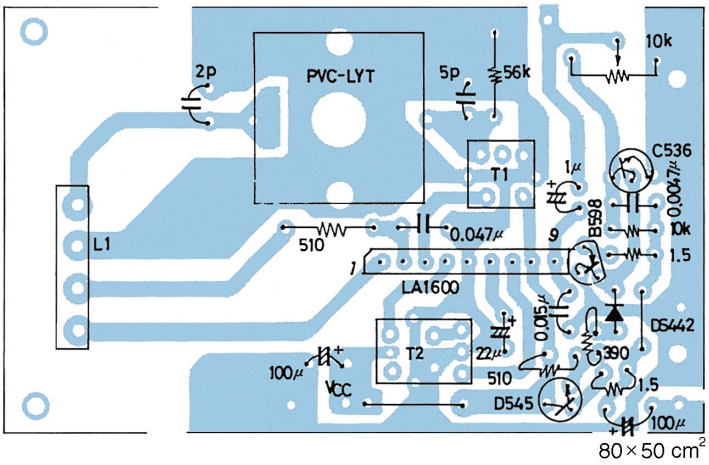
Using the LA4510




Unit (resistance : Ω, capacitance : F)

## Sample Printed Circuit Pattern :

LA1600 + Power amp using 3 discrete devices
(For the circuit diagram, refer to Test Circuit 2 and Sample Application Circuit 2.)




L1 : HW-50426 (Mitsumi)
L1 : HW-50425 (Mitsumi)
T2 : HW-50447 (Mitsumi)