Ordering number: EN2659C

Monolithic Linear IC

LA1816, 1816M

Single-Chip AM/FM, MPX Tuner System for Headphone Stereos, Radio-Cassette Recorders

Functions

- FM: RF amplifier, MIX, OSC, IF amplifier, quadrature detector
- AM: RF amplifier, MIX, OSC, IF amplifier, detector, AGC
- MPX: PLL stereo decoder, stereo indicator, VCO stop

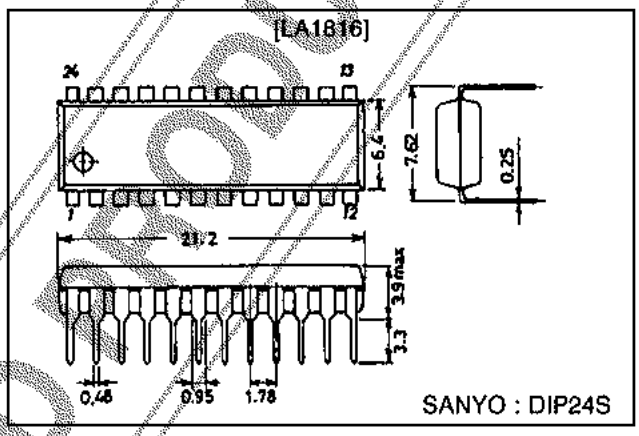
Features

- Contains FM tuner, AM tuner, MPX on a single chip.
- Adjustment-free FM detector and AM IF
- Minimum number of external parts required
- Low-voltage operation
- Low current drain
- Less carrier leak of MPX (no-input, monaural-input mode)

Package Dimensions

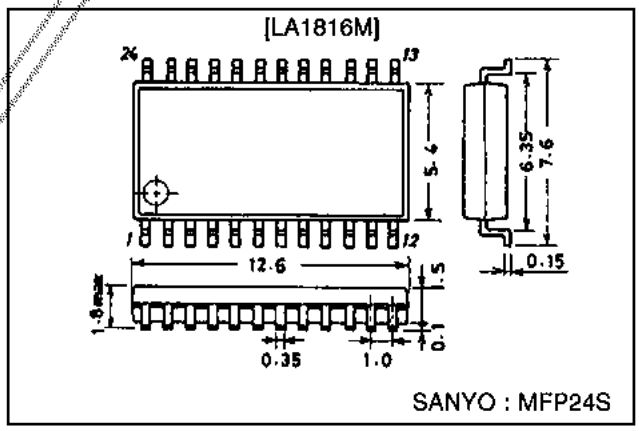
unit : mm

3067-DIP24S



unit : mm

3112-MFP24S



Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	Pins 8, 9, 11, 18, 20, 22	7	V
Maximum supply current	I_{CC} max	Pins 8 + 18 + 20 + 22	50	mA
Flow-in current (Indicator drive current)	I_{LED}	Pin 9	10	mA
Flow-out current	I_{21}	Pin 21	0.1	mA
Allowable power dissipation	Pd max	Ta ≦ 70°C	350	mW
Operating temperature	Topr		−20 to +70	°C
Storage temperature	Tstg		−40 to +125	°C

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

Operating Conditions at Ta = 25°C

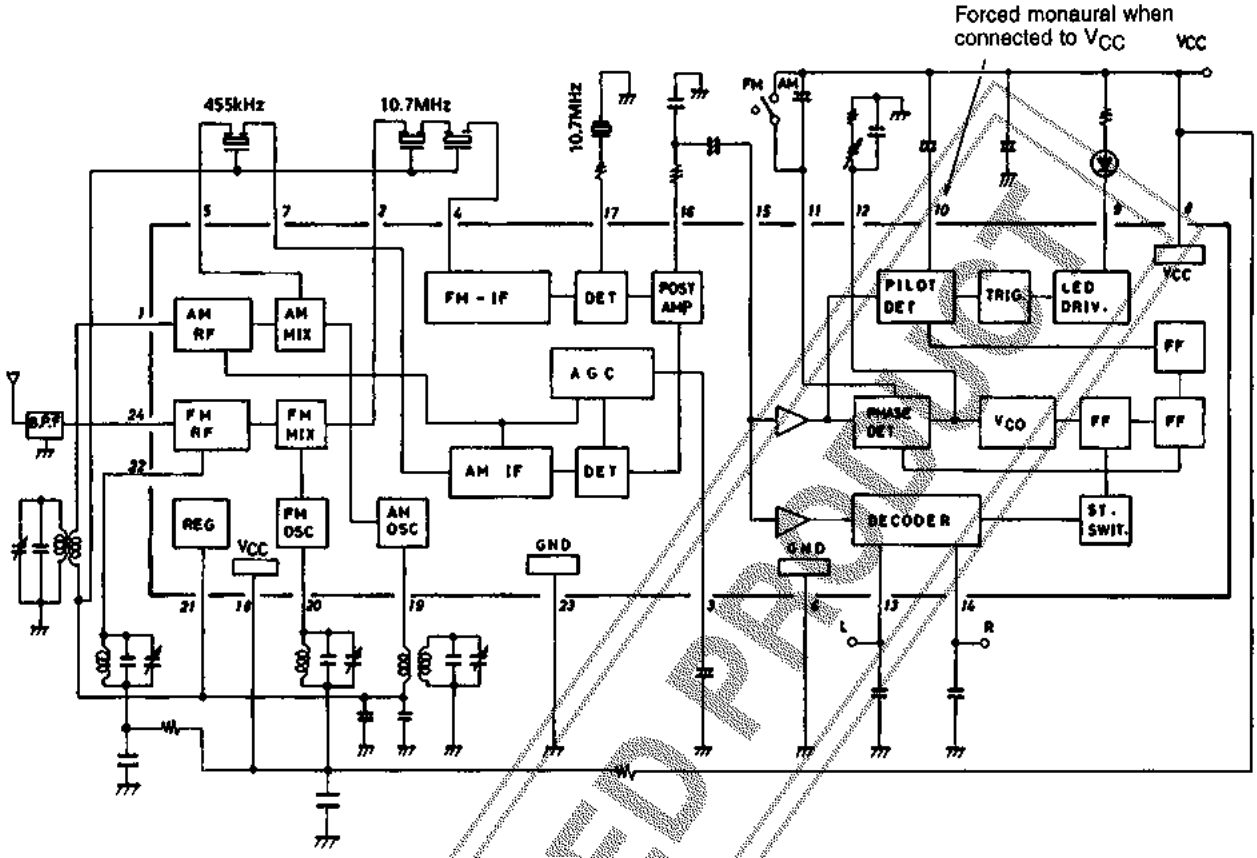
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3	V
Operating voltage range	V_{CC} op		1.8 to 6.0	V

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

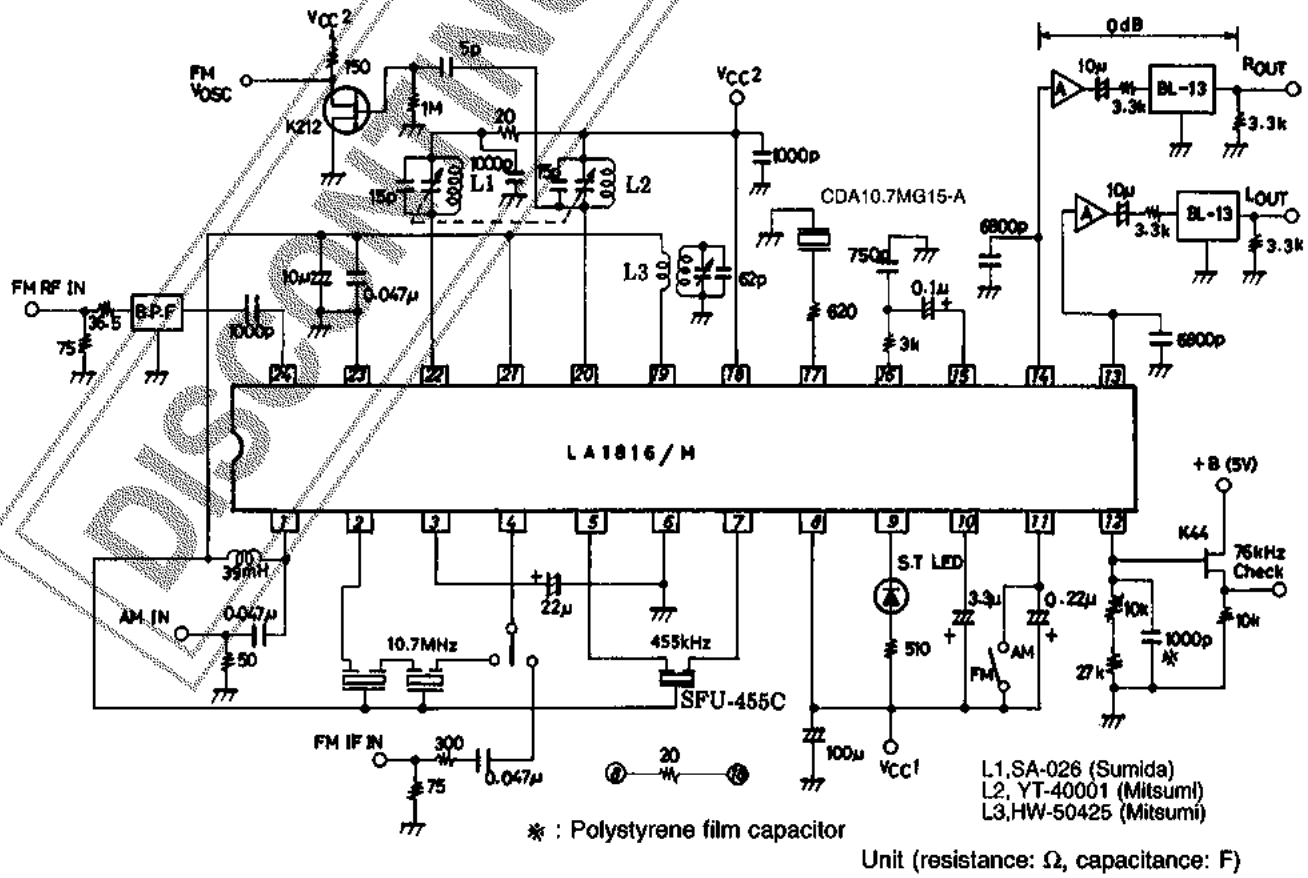
Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	I_{CCO} (FM)	FM mode V_{IN} = 0		8.9	15	mA
	I_{CCO} (AM)	AM mode V_{IN} = 0		3.3	5.5	mA
[AM Characteristics] : f_c = 1000 kHz, f_m = 1 kHz						
Detection output	V_O1	V_{IN} = 23 dBμ, 30% mod.	12	23	41	mV
	V_O2	V_{IN} = 80 dBμ, 30% mod.	48	74	120	mV
Signal to noise ratio	S/N1	V_{IN} = 23 dBμ, 30% mod.	16	21		dB
	S/N2	V_{IN} = 80 dBμ, 30% mod.	45	52		dB
Total harmonic distortion	THD1	V_{IN} = 80 dBμ, 30% mod.		0.3	1.3	%
	THD2	V_{IN} = 107 dBμ, 30% mod.		0.6	2.0	%
[FM Characteristics] (F.E.) : f_c = 98 MHz, f_m = 1 kHz						
–3 dB sensitivity	–3dBL.S.	Referenced to V_{IN} = 80 dBμ , 30% mod., 3 dB down		12		dBμ
Local oscillation voltage	V_{OSC}	f_{OSC} = 108.7 MHz	75	110	160	mV
[FM Characteristics] (IF + MPX, MONO) : f_c = 10.7 MHz, f_m = 1 kHz						
–3 dB sensitivity	–3dBL.S.	Referenced to V_{IN} = 100 dBμ, 100% mod., 3 dB down		39	46	dBμ
Demodulation output	V_O	V_{IN} = 100 dBμ, 100% mod.	100	135	200	mV
Channel balance	C.B.	V_{IN} = 100 dBμ, 100% mod.		0	2.0	dB
Total harmonic distortion	THD (mono)	V_{IN} = 100 dBμ, 100% mod.		0.7	3.0	%
Signal to noise ratio	S/N	V_{IN} = 100 dBμ, 100% mod.	70	75		dB
[FM Characteristics] (IF + MPX, STEREO) : f_c = 10.7 MHz, f_m = 1 kHz, L + R = 90%, pilot = 10%, V_{IN} = 100 dBμ						
Channel separation*	Sep		25	34		dB
Total harmonic distortion	THD (main)			0.6	2.5	%
LED-ON level	V_{LED-ON}		2.0	3.5	5.0	%
LED-OFF level	$V_{LED-OFF}$			2.7		%

* Sep = 45 dB (typ) at MPX IN

Equivalent Circuit Block Diagram



Test Circuit



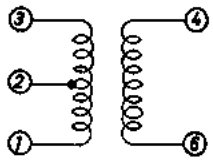
Coil Specifications

FM

- ANT B.P.F
  SNY-074-2001 (Sumida)
- OSC
  YT-40001 (Mitsumi)
  5.5 mm ø air core, 0.8 mm wire, 3T
- RF SA-026(Sumida)
  3.5 mm ø air core, 1.0 mm wire, 5T
- Discriminator
  CDA 10.7MG (15) (Murata)

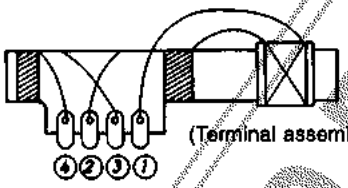
AM

- MW OSC
  HW-50425
  (Mitsumi)



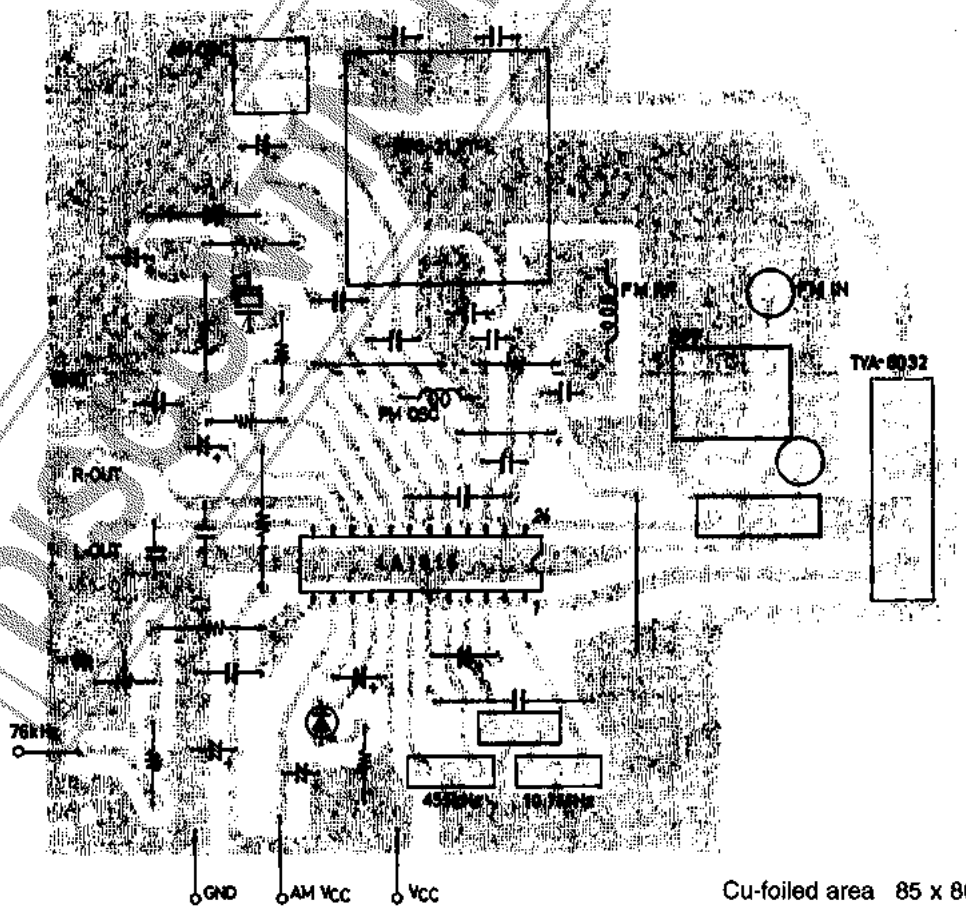
③ – ② 2T
④ – ⑥ 9T Qo ≧ 80
② – ① 86T L = 270 µH

- Bar antenna
  TYA-8032 (PVC-2LXT-L)
  (Mitsumi)



① – ② 21T • 100T
③ – ④ 30T
① – ② L = 604 µH
Qo ≧ 120

Sample Printed Circuit Pattern



Cu-foiled area 85 x 80 mm²

How to use the LA1816

1. VCO stop
   The VCO is stopped by shorting pin 10 and pin 8 (V_{CC} pin).
   Note) The maximum supply voltage on pin 10 must not exceed the voltage on pin 8.
2. Free-running frequency check
   Either of the following two methods is used to check the free-running frequency.
   (a) Connect pin 12 to a frequency counter through the high input impedance amplifier.

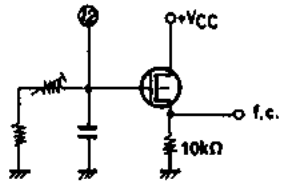


Figure 1

(b) Connect the connection point of the semifixed resistor connected to pin 12 and the fixed resistor to a frequency counter through the resistor of 240 kΩ or greater.
How the error changes with the resistor value is shown in Figure 2.

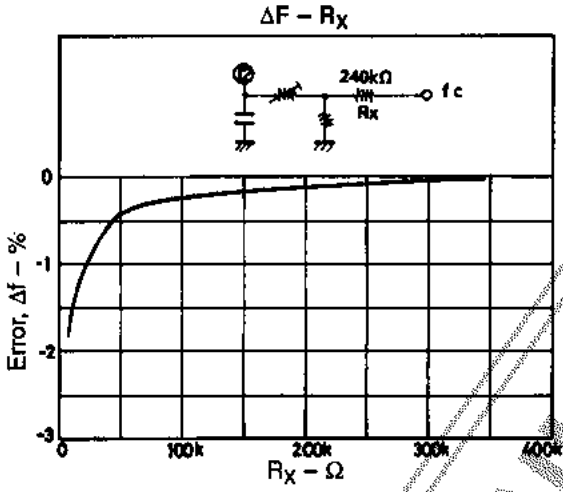


Figure 2

3. How to use the FM DET coil
   For pin 17 (FM DET), a coil may be used instead of adjustment-free FM discriminator.

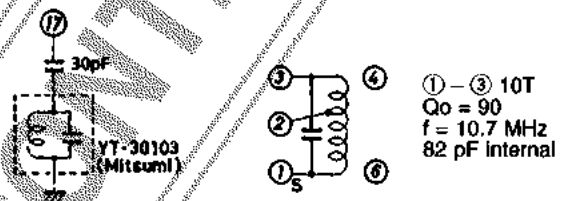


Figure 3 How to use the FM DET coil

Figure 4 FM DET Coil Characteristics

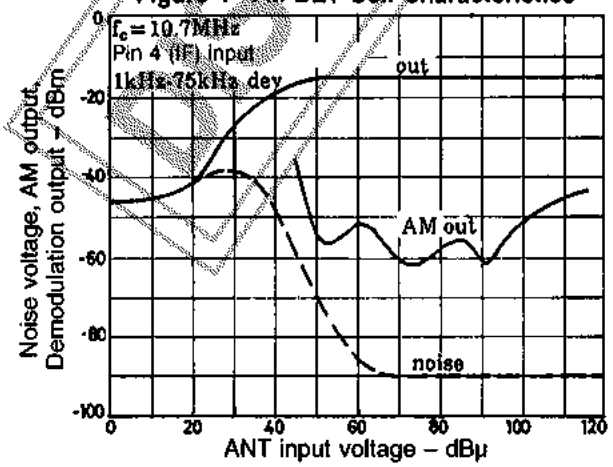
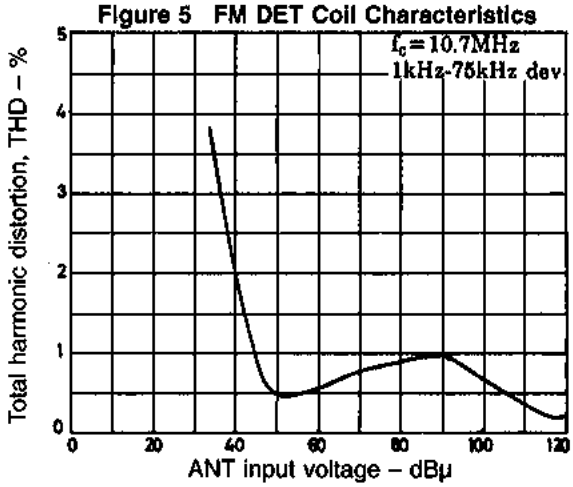


Figure 5 FM DET Coil Characteristics



4. How to use the FM AFC
The S curve at output pin 16 is as shown Figure 6. Figure 7 shows how to provide FM AFC.

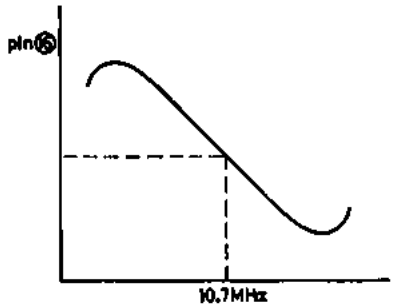


Figure 6

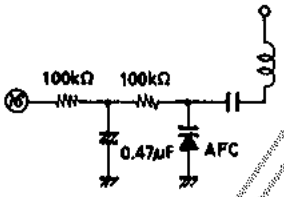


Figure 7

5. AM-FM selection
The FM mode is entered with pin 11 open as shown in Figure 8 . When pin 11 and pin 8 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 8.

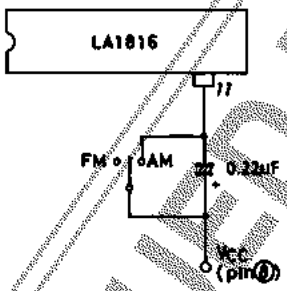
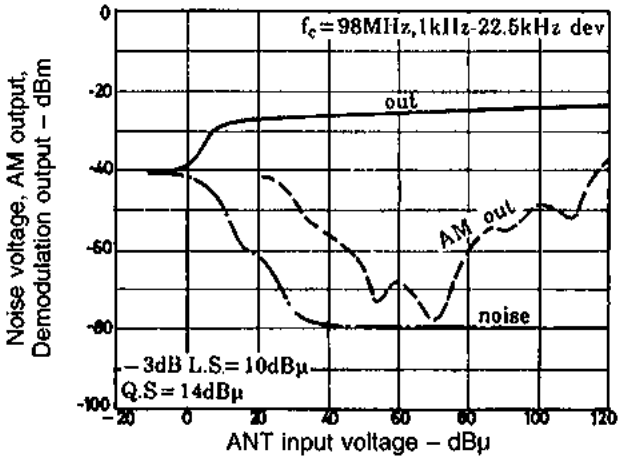
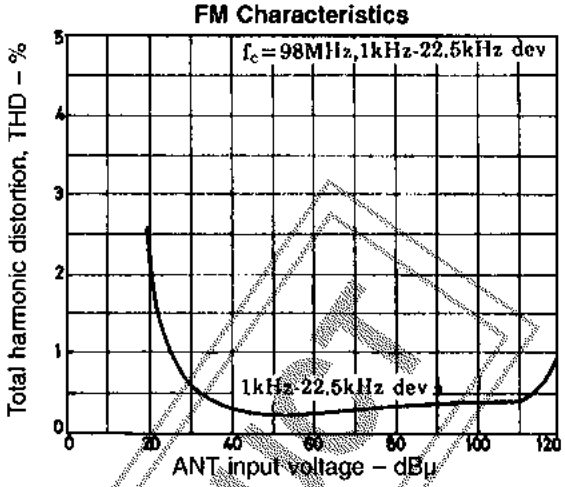


Figure 8

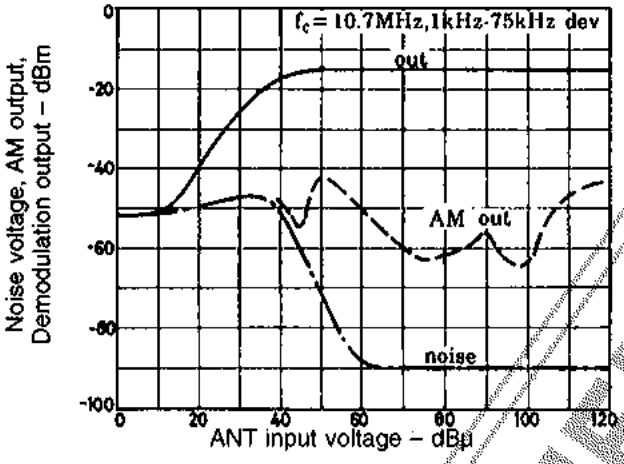
FM Characteristics



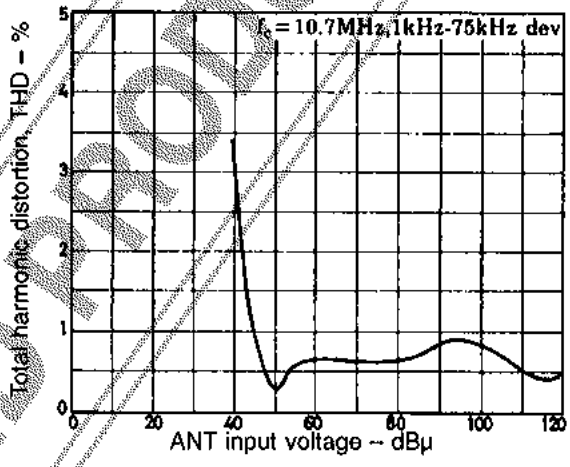
FM Characteristics



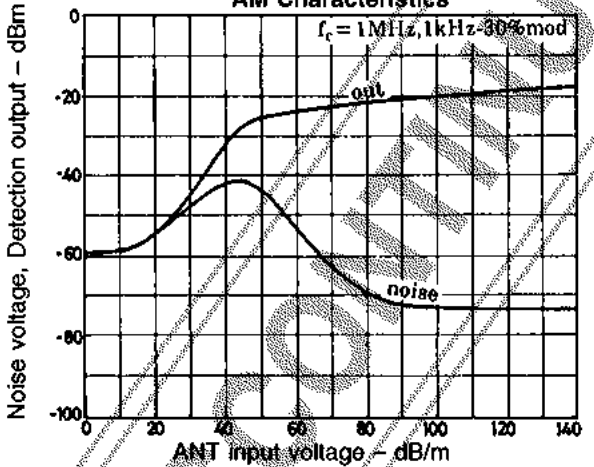
FM IF Characteristics



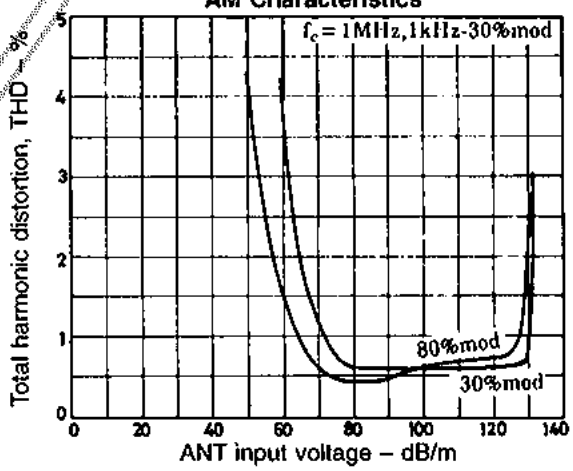
FM IF Characteristics



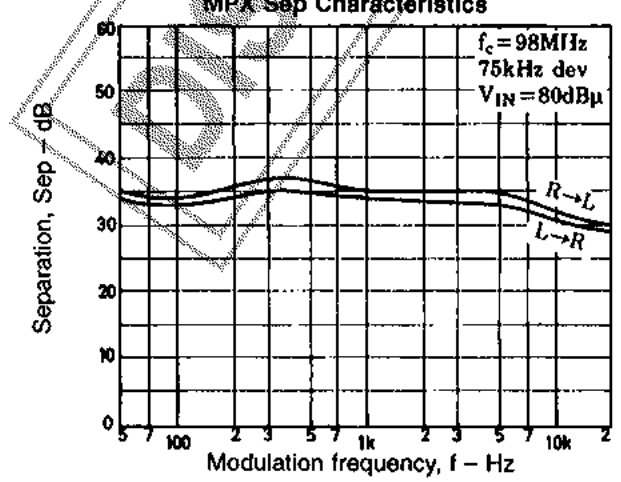
AM Characteristics



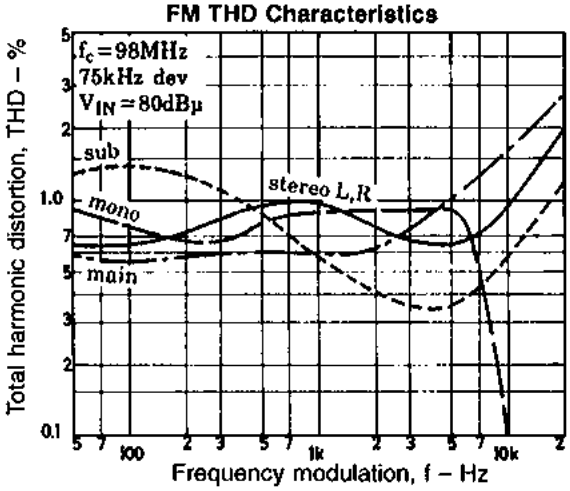
AM Characteristics



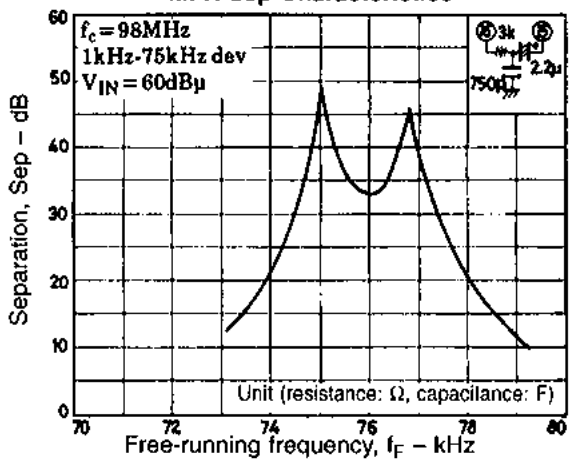
MPX Sep Characteristics



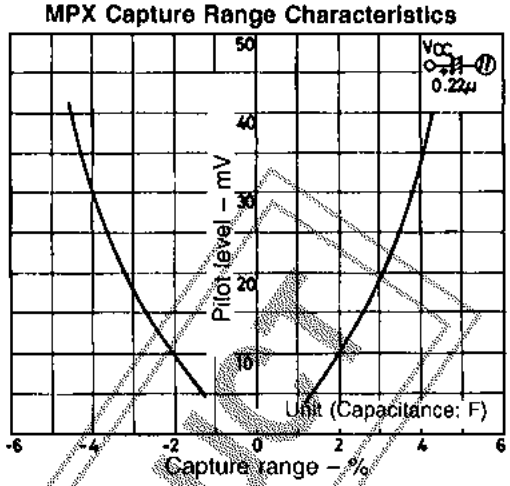
FM THD Characteristics



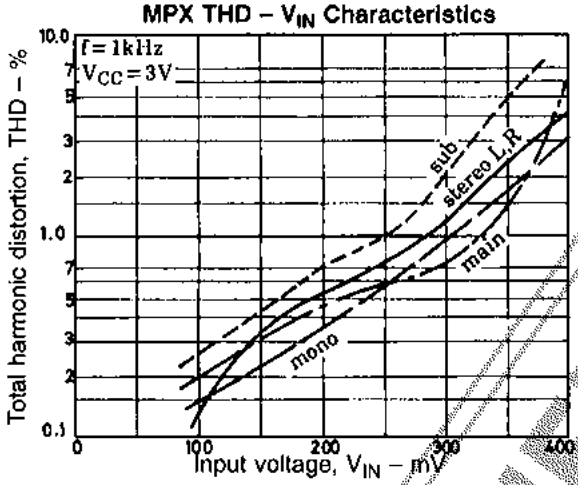
MPX Sep Characteristics



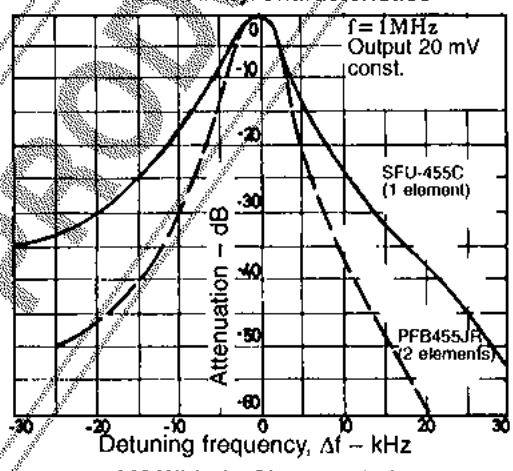
MPX Capture Range Characteristics



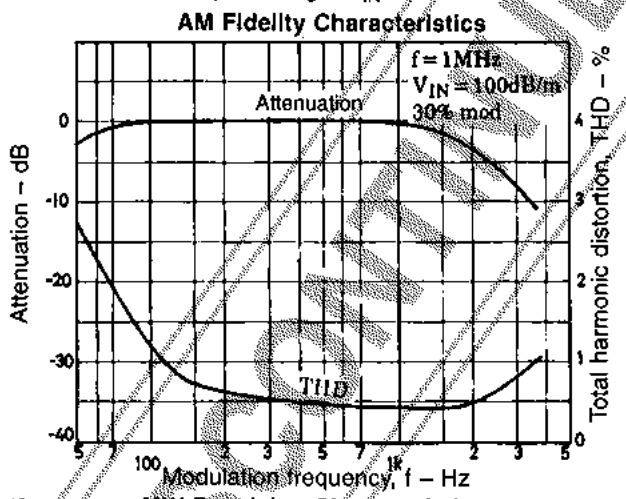
MPX THD – V_{IN} Characteristics



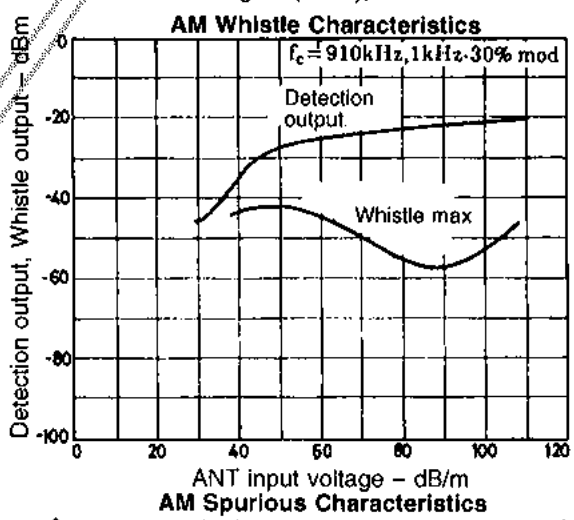
AM Selectivity Characteristics



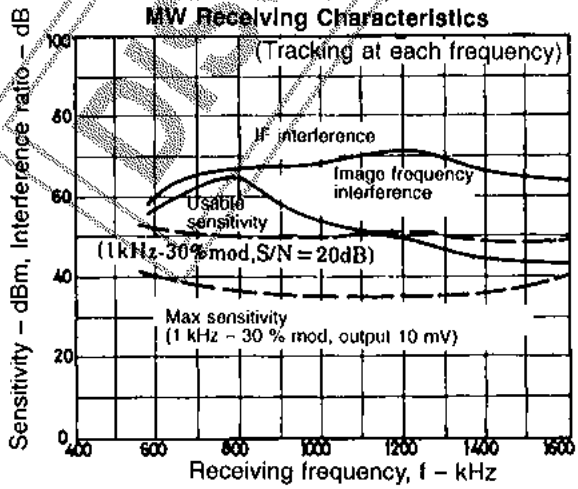
AM Fidelity Characteristics



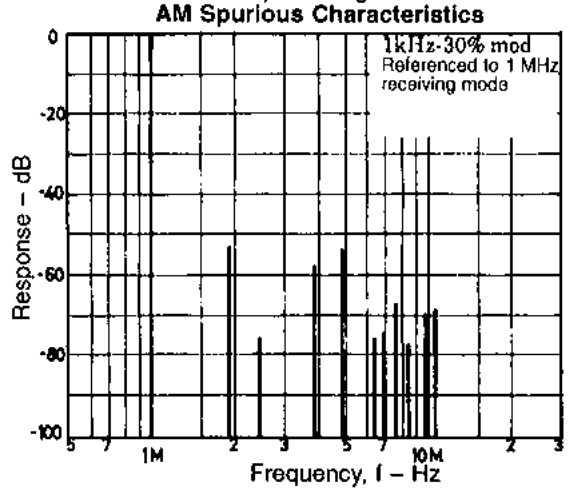
AM Whistle Characteristics

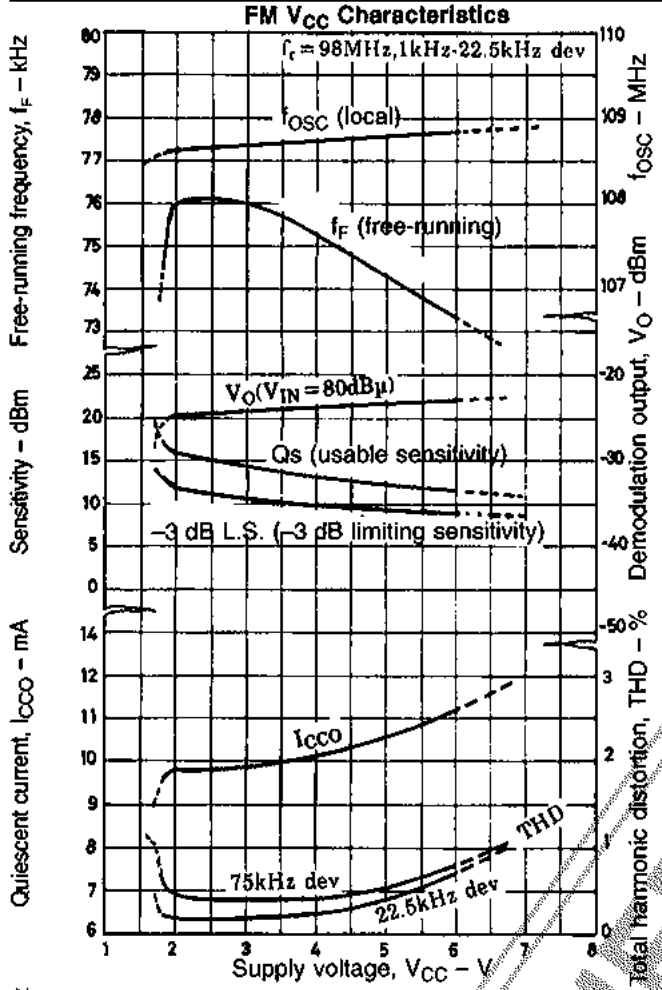


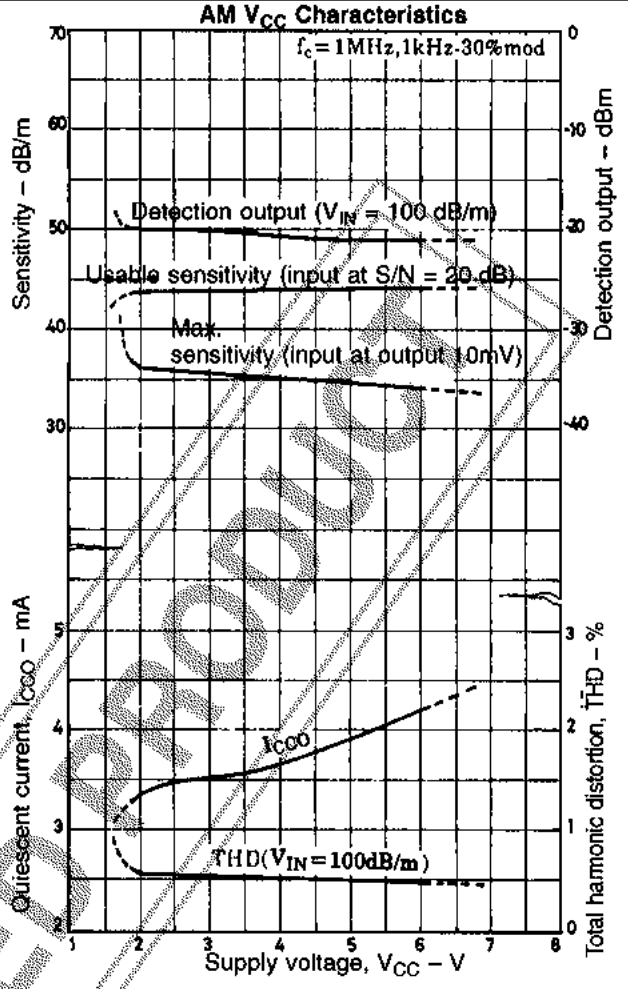
MW Receiving Characteristics

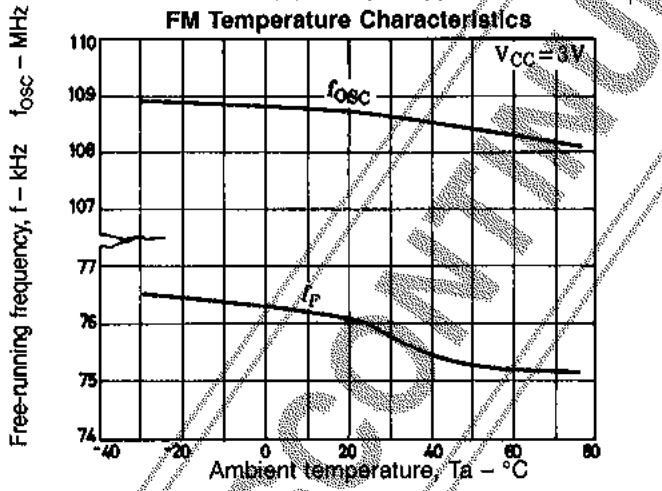


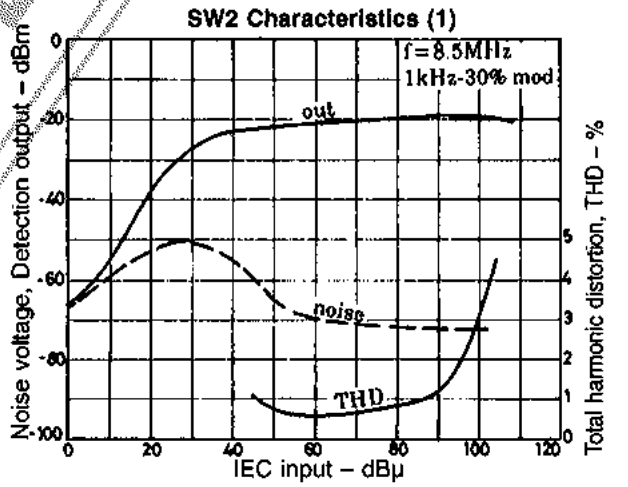
AM Spurious Characteristics

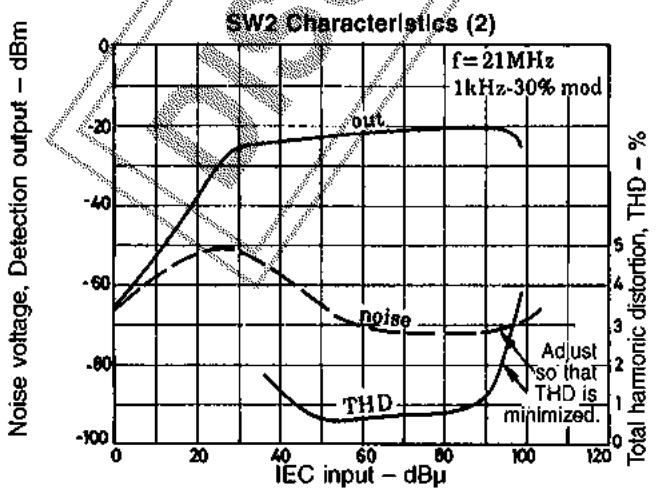


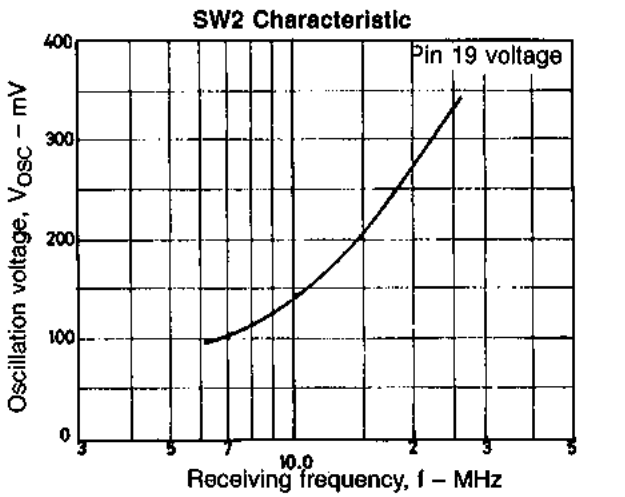




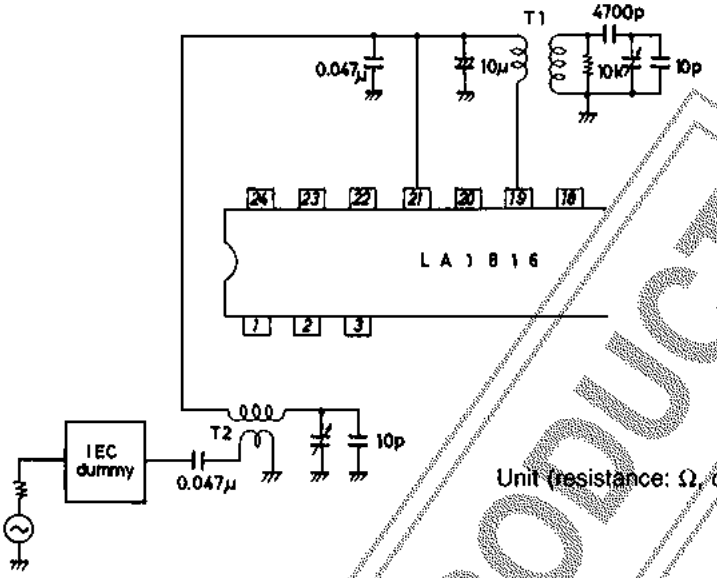








SW Band Test Circuit



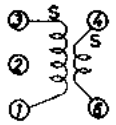
Unit (resistance: Ω, capacitance: F)

Coil Specifications

T1 SW2 OSC
HW 40184 (Mitsumi)

④ – ⑥ 8T
③ – ① 12T
Qo ≧ 28,
L = 1.31μH

0237 1500 (Sumida)

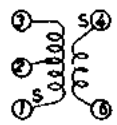


④ – ⑥ 8T
③ – ① 12T
Qo ≧ 20,
L = 1.31 μH

T1 SW2 ANT
YT 30117 (Mitsumi)

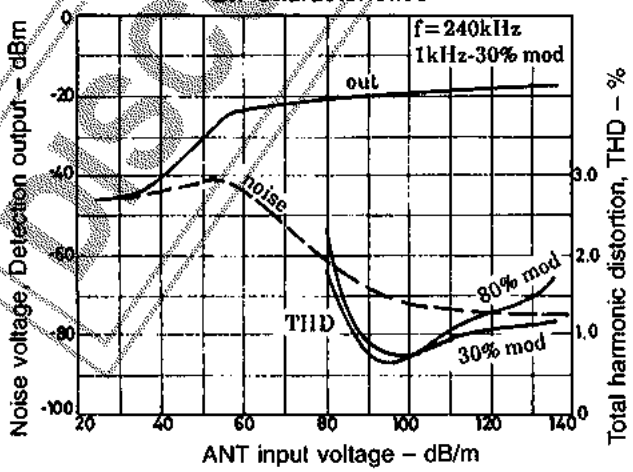
① – ② 4T
④ – ⑥ 2T
② – ③ 4T
Qo = 95,
L = 1.4 μH

2158 4095 319A (Sumida)

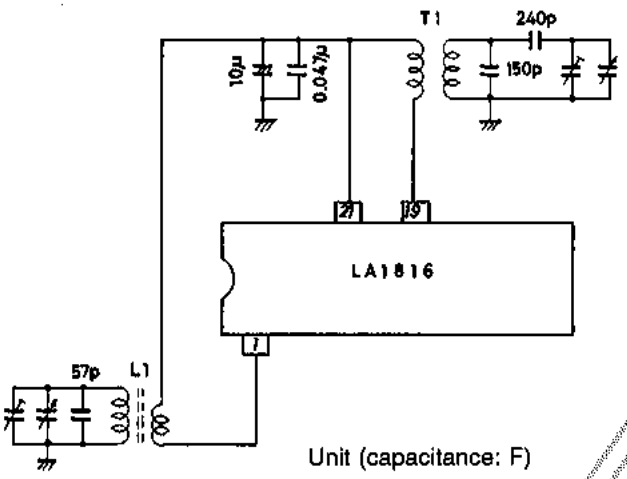


④ – ⑥ 2T
① – ② 5T
② – ③ 5T
Qo ≧ 40,
L = 1.4 μH

LW Characteristics



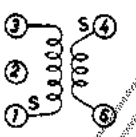
LW Band Test Circuit



Unit (capacitance: F)

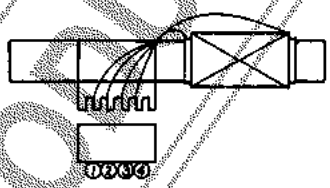
Coil Specifications

T1 • LW OSC
MA-7014 (Mitsumi)



④ – ⑥ 40T
① – ③ 80T
L = 220 μH, Qo = 130

L1 • LW bar antenna
HH-50161 (Mitsumi)



①– ② 20T
③– ④ 200T
③– ④ L = 2.74 mH, Qo ≧ 200