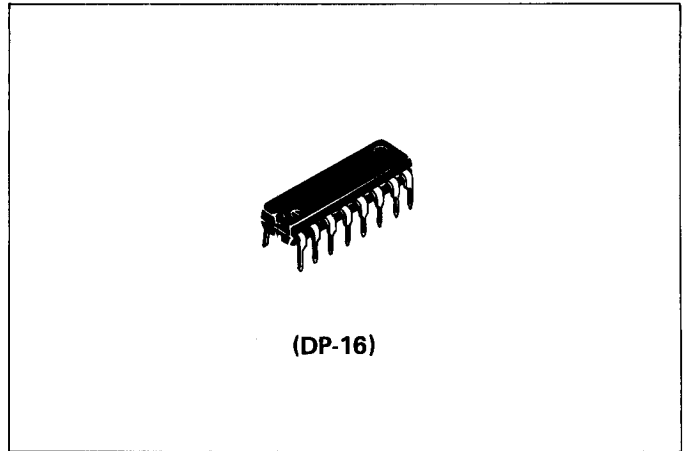


# HA1137W

## FM IF SYSTEM

### FUNCTIONS

- IF Amplifier
- Quadrature Detector
- Low-noise AF Preamplifier
- Delayed AGC Circuit for Tuner Front End
- Tuning Meter Circuit
- Center Meter Circuit
- Muting (Squelch) Circuit (Operates as input signal decreases)
- Muting (Squelch) Circuit (Operates when detuned)
- AFC Circuit
- Multipath Circuit



### FEATURES

Exceptional Input Limiting Sensitivity :

15 $\mu$ V typ. @(-3dB point, measured between term. No. 1 and GND)

High AM Rejection Ratio :

40dB typ. @(Vin = 60dB $\mu$ . FM: 400 Hz, 30% mod. AM: 1 kHz, 30% mod.)

Low Harmonic Distortion :

0.1% typ. \*(When doubly-tuned detector coil is used)

\* Total harmonic distortion of the HA1137W essentially depends on frequency-phase characteristics of the detector coil. A simple-tuned detector coil is also applicable.

High Recovered AF Voltage :

350 mVrms typ. (When doubly-tuned detector coil is used. 100% mod.)

Muting Circuit without shock sound :

Muting band width  $\pm 50$  kHz typ. (Where  $R_{105} = 15$  k $\Omega$ )  
(Muting band width adjustable by changing only one resistor value)

Wide Operating Voltage Range :

9V to 14V

### GENERAL DESCRIPTION

The HITACHI HA1137W is a monolithic integrated circuit developed for the FM IF system in a Hi-Fi stereo tuner set. It includes all those functions necessary for a FM IF housed in a 16-lead, dual-in-line plastic package.

The block diagram shows that the input signal is fed to a three-stage FM IF amplifier/limiter configuration and to a three-stage detector for a tuning meter driver. The detector circuit utilizes a double-balanced quadrature FM detector followed by an audio amplifier and a muting (squelch) circuit.

The HA1137W's sophisticated muting circuit features a conventional muting circuit as well as a "0-volt switch." The

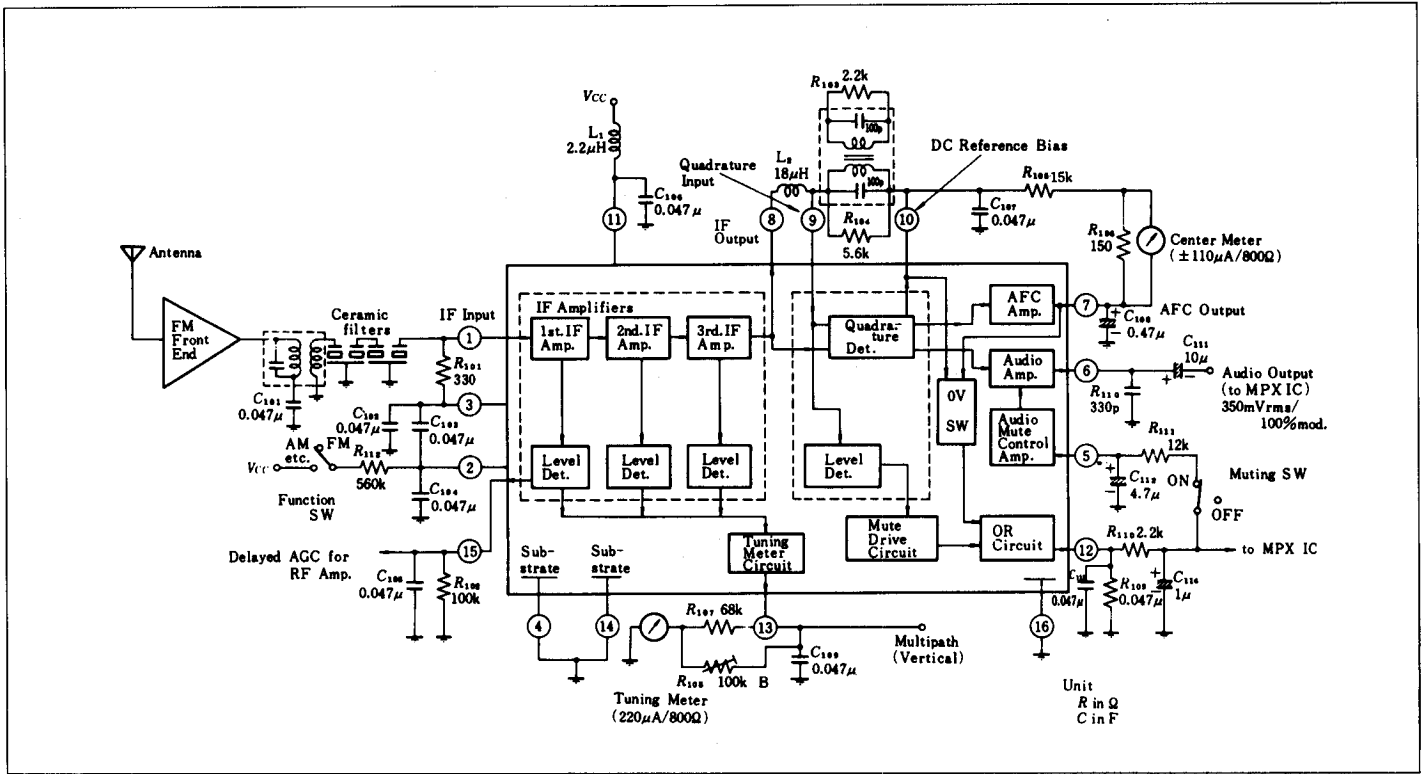
"0-volt switch," utilizing a so-called S-shaped curve of FM detectors, operates sensitively when the receiving frequency is slightly detuned, thus preventing any small shock sound regardless of whether the muting switch is ON and OFF.

The HA1137W offers exceptionally high sensitivity and a high AM rejection ratio, permitting it to be easily applied to highly sensitive, selective sets, using a detector coil and doubly-tuned ceramic filter as a coupler between the front end and the IF stage.

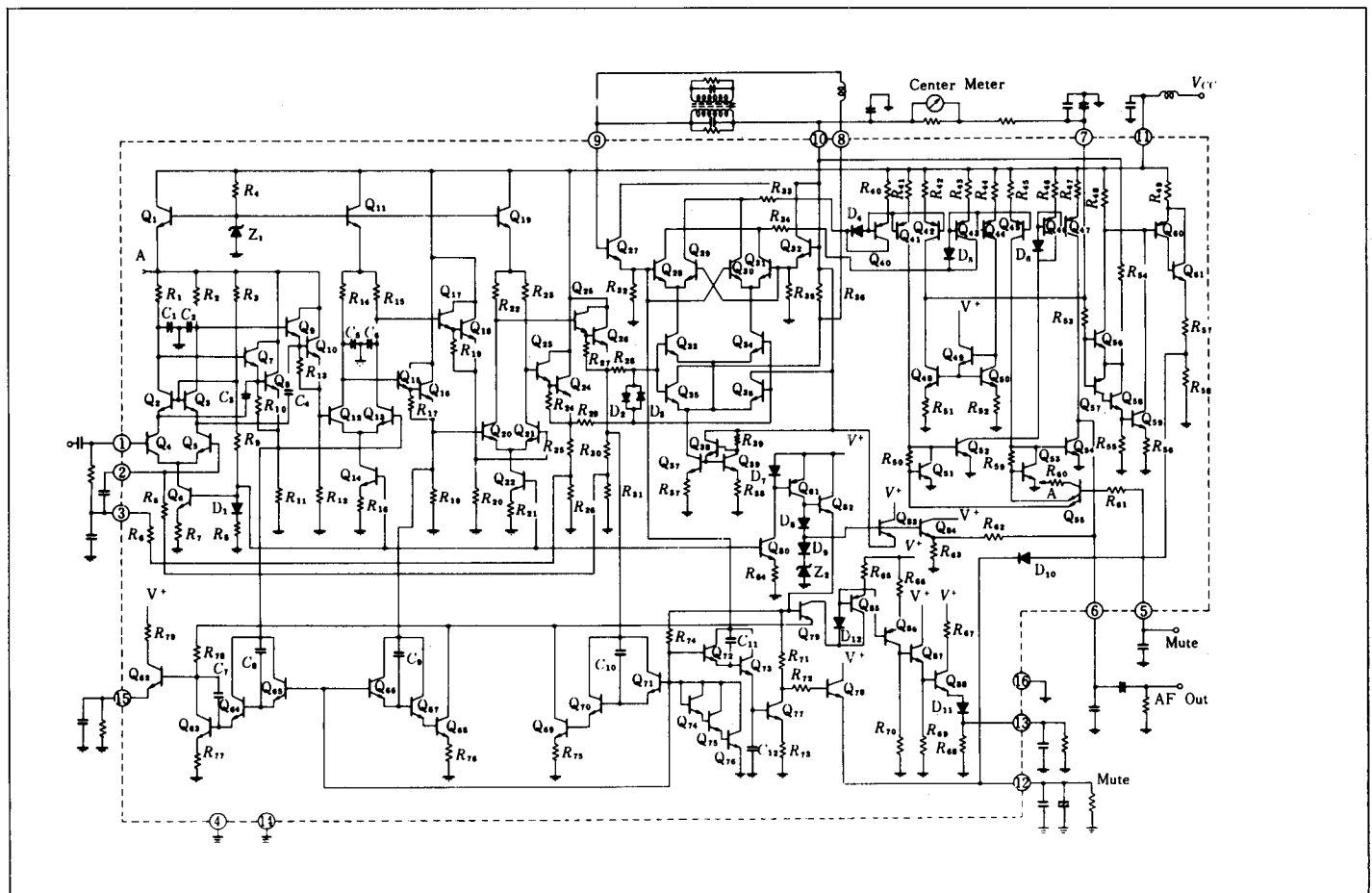
### ABSOLUTE MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

Item	Symbol	Rating	Unit
DC Supply Voltage	$V_{CC}$	14	V
Total Power Dissipation	$P_T$	550 ( $T_a = 60^\circ\text{C}$ )	mW
Operating Temperature	$T_{opr}$	-20 to +60	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +125	$^\circ\text{C}$

■ BLOCK DIAGRAM



■ CIRCUIT SCHEMATIC



# HA1137W

## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C)

### Static (DC) Characteristics

Item	Symbol	Test Condition	min	typ	max	Unit
Terminal 1 (IF Input)	V1	See Test Circuit	—	1.9	—	V
Terminal 2 (DC Feedback to Input)	V2		—	1.9	—	V
Terminal 3 (DC Bias to Input)	V3		—	1.9	—	V
Terminal 6 (Audio Output)	V6		—	5.6	—	V
Terminal 7 (AFC)	V7		—	5.6	—	V
Terminal 10 (DC Reference)	V10		—	5.6	—	V

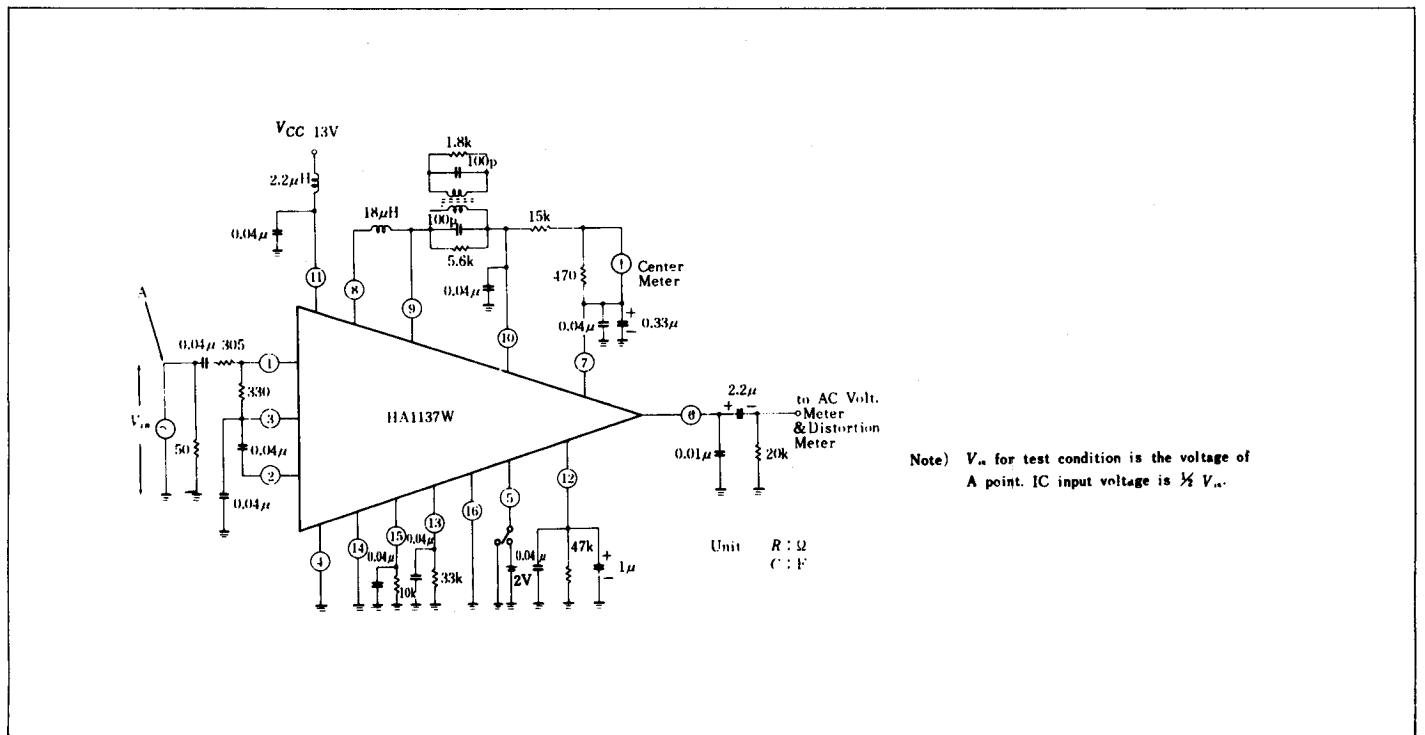
### Dynamic Characteristics (Note.1)

Item	Symbol	Test Condition	min	typ	max	Unit
Dynamic Circuit Current	$I_{11}$	$V_{in} = 100\text{dB}\mu$ , Mute : ON	—	32	39	mA
Input Limiting Voltage	$V_{in(lim)}$	-3dB Point from output voltage when 100 dB $\mu$ input.	—	31	37	dB $\mu$
Recovered AF Voltage	$V_{O(AF)}$		72	92	138	mVrms
Total Harmonic Distortion	THD		—	0.1	0.3	%
Signal-to-noise Ratio	$(S+N)/N$		57	—	—	dB
AM Rejection	AMR	$V_{in} = 100\text{dB}\mu$ FM : 400Hz, 30% mod AM : 1kHz, 30% mod	—	45	—	dB
Muting Sensitivity	$V_{in(MUTE)}$	$V_{12} = 1.4\text{V}$	—	35	—	dB $\mu$
Output Voltage of Tuning Meter (1)	$V_{13-70}$	$V_{in} = 70\text{dB}\mu$	—	1.5	—	V
Output Voltage of Tuning Meter (2)	$V_{13-100}$	$V_{in} = 100\text{dB}\mu$	—	5.7	—	V
Muting Band Width	$BW(MUTE)$	$V_{12} = 1.4\text{V}$	—	95	—	kHz
Muting Attenuation	Mute(ATT)	$V_5 = 2\text{V}$	60	—	—	dB

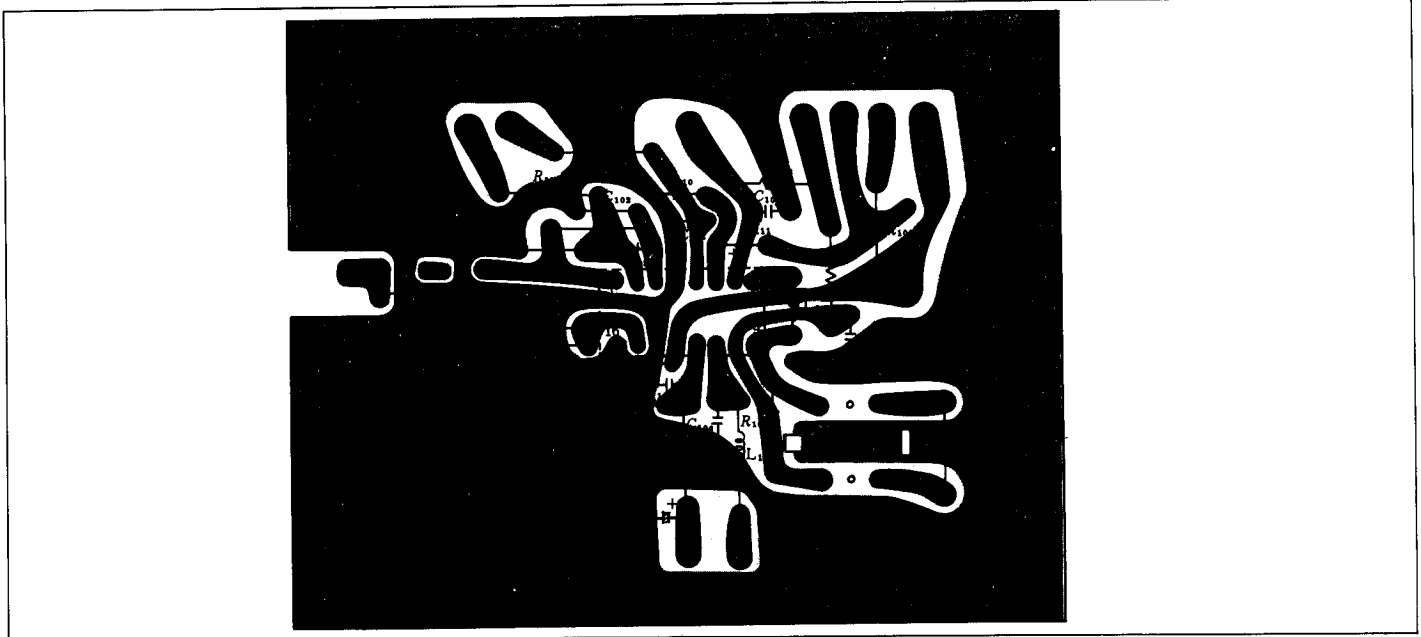
Notes: 1. Unless otherwise noted, supply voltage  $V_{CC} = 13\text{V}$ , center frequency  $f = 10.7\text{ MHz}$ , modulation frequency  $f_{mod} = 400\text{Hz}$ , input signal voltage  $V_{in} = 100\text{dB}\mu$ , and maximum frequency deviation  $f = 22.5\text{kHz}$  (30% modulation)

2.  $V_{in}$  is measured at point A noted on the test circuit. Input voltage at the IC input terminals (between term No. 1 and GND) becomes one-half of  $V_{in}$ .

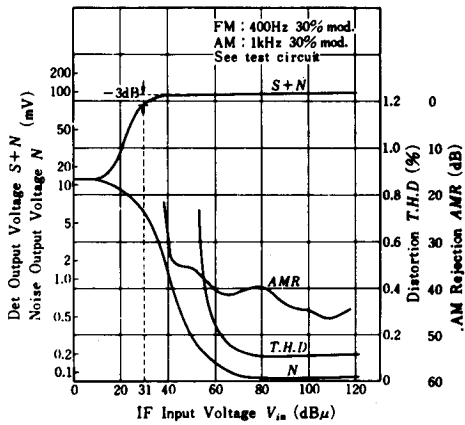
## ■ TEST CIRCUIT



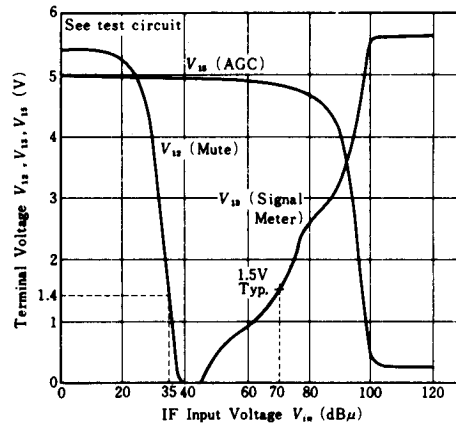
■ PRINTED CIRCUIT BOARD (Bottom View)



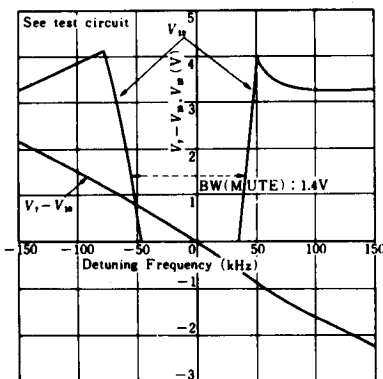
RECOVERED AF VOLTAGE, NOISE VOLTAGE, AM REJECTION AND TOTAL HARMONIC DISTORTION VS. IF INPUT VOLTAGE



MUTING ACTION, TUNER AGC AND TUNING METER OUTPUT VS. IF INPUT VOLTAGE



TERMINAL No. 12 VOLTAGE AND VOLTAGE BETWEEN TERMINAL No. 7 AND No. 10 VS. CHANGE IN FREQUENCY



## ■ EXTERNAL COMPONENTS

Parts No.	Recommended Value	Purpose	Influence		Remarks
			Larger than Recommended Value	Smaller than Recommended Value	
R <sub>101</sub>	330Ω	Input biasing	Influence of ceramic filter characteristics	Influence of ceramic filter characteristics	—
R <sub>103</sub> R <sub>104</sub>	2.2kΩ 5.6kΩ	Damping of detecting coil	Increase in output Decrease in detector dynamic range	Decrease in output	—
R <sub>105</sub>	15kΩ	Determination of $dV_z/df$	Decrease in muting bandwidth	Increase in muting bandwidth	—
R <sub>106</sub>	150Ω	Current by-pass of center meter	Increase in indicating position drift of center meter	Decrease in center meter sensitivity	—
R <sub>107</sub> R <sub>108</sub>	68kΩ 100kΩ (B-type)	Determination of signal meter sensitivity	Poor sensitivity	Excessive over sensitivity	—
R <sub>109</sub> R <sub>110</sub>	47kΩ 2.2kΩ	Prevention of muting errors	Error in muting	Error in muting	—
R <sub>111</sub>	12kΩ	Time constant with C <sub>112</sub>	Delay in muting build up	Error in muting Large pop noise	—
C <sub>102</sub> C <sub>103</sub> C <sub>104</sub>	0.047μF 0.047μF 0.047μF	By-pass capacitors of input amplifier	—	Oscillation	Use ceramic capacitors
C <sub>108</sub>	0.47μF	By-pass capacitor of detected output	Delay in AFC build up	Decrease in muting bandwidth	—
C <sub>109</sub>	0.047μF	By-pass capacitor of detected output	—	Increase in THD at low input level	—
C <sub>110</sub>	330pF	By-pass capacitor of detected output	Poor high-frequency characteristics of audio output	Increase in THD (crosstalk of internal frequency component)	—
C <sub>111</sub>	10μF	DC cutting Capacitor	Large pop noise during power ON/OFF	—	—