

AN7234/S

RF + FM IF + AM Tuner for Radio and Radio/Cassette Tape Recorder

The specification herein are subject to change without prior notice due to under development. Refer to our up-to-date specification when discussing the final design.

■ Description

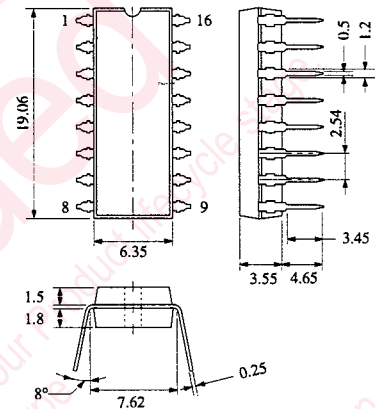
The AN7234/S are the monolithic integrated circuits with FM FE, AM/FM IF, FM Quad Det, AM Det and AGC built-in. It is suitable for radio and radio cassette recorder at 3V operation.

■ Features

- Good AM rejection ratio
- Internal AM/FM switch
- Wide operating voltage (1.8 ~ 7.0V)
- Good IM characteristics

AN7234

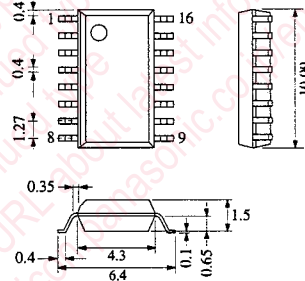
Unit : mm



16-Lead DIL Plastic Package (16-DIP)

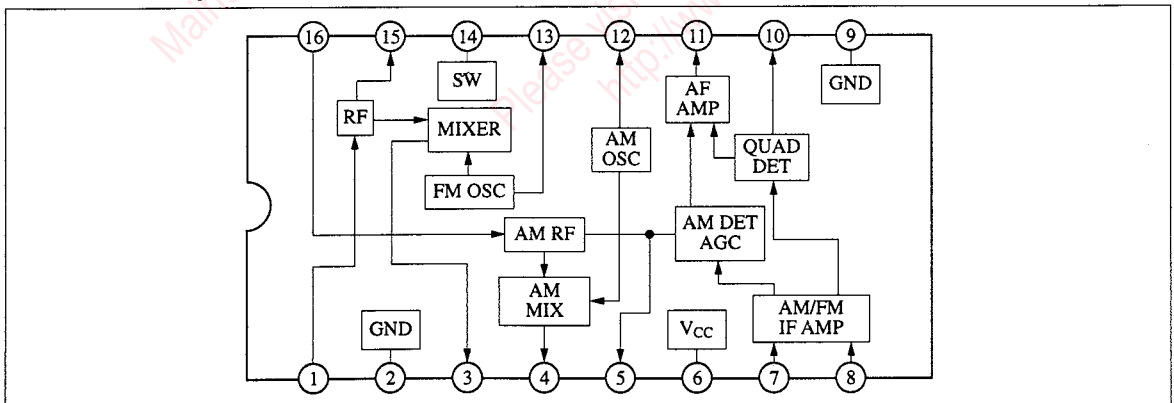
AN7234S

Unit : mm



16-Lead PANAFLAT Plastic Package (SO-16D)

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Supply Voltage	V _{CC}	7	V
Supply Current	I _{CC}	25	mA
Power Dissipation	P _D	175	mW
Operating Ambient Temperature	T _{opr}	-20 ~ +75	°C
Storage Temperature	T _{stg}	-55 ~ +150	°C

Operating Supply Voltage Range: V_{CC} = 1.8V ~ 7.0V

■ Electrical Characteristics (V_{CC}=3V, Ta=25°C)

Item	Symbol	Condition	min.	typ.	max.	Unit
Total Quiescent Current (FM)	I _{tot(FM)}	No input	8	11	14	mA
Total Quiescent Current (AM)	I _{tot(AM)}	No input	4.5	6	7.7	mA
FM FE		f _{RF} = 98MHz, f _{OSC} = 108.7MHz				
IF Output	V _{IF}	V _{in} = 55dBμ	80	85	90	dBμ
Oscillator Output	V _{OSC}	No input	72	126	-	mV
FM						
Detector Output Voltage	V _{O(FM)}	V _{in} = 80dBμ	43	60	88	mV
Limiting Sensitivity	V _{in(lim)}	V _{out} = -3dB	42	47	52	dBμ
Signal to Noise Ratio	S/N	V _{in} = 80dBμ	50	60	-	dB
Total Harmonic Distortion	THD	V _{in} = 80dBμ	-	0.5	1.5	%
AM Rejection Ratio	AMR	V _{in} = 60dBμ	33	40	-	dB
AM						
AM Detector Out	V _{O(AM)}	V _{in} = 80dBμ	43	60	88	mV
Maximum Sensitivity	S _{max}	V _{out} = 10mV	12	17	23	dBμ
Signal to Noise Ratio	S/N	V _{in} = 80dBμ	40	45	-	dB
Total Harmonic Distortion	THD	V _{in} = 80dBμ	-	1.0	3.0	%

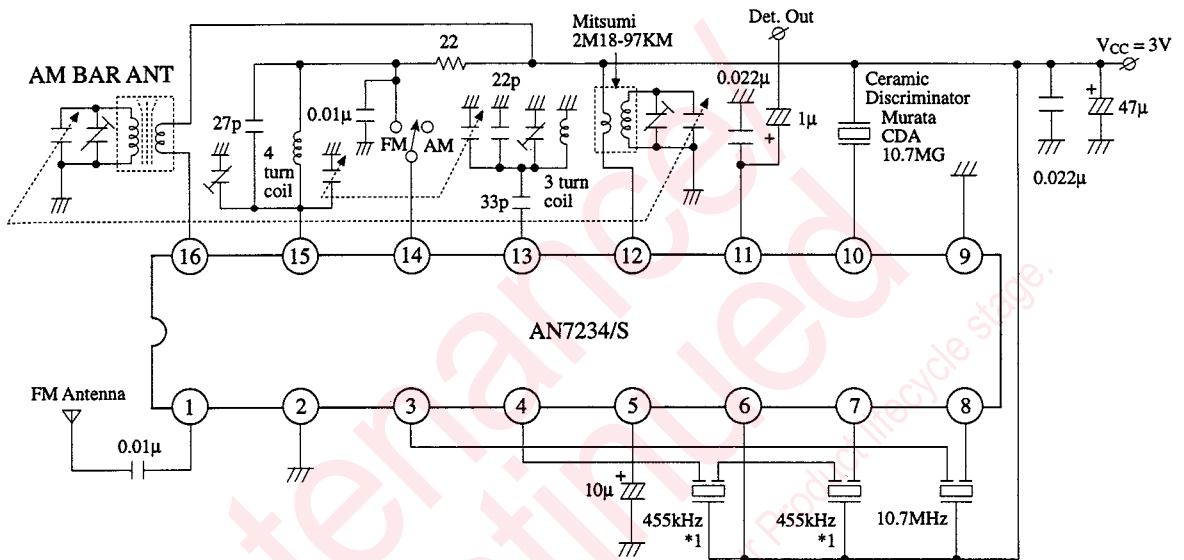
NB. FM: Unless specified, f_c = 10.7MHz, f = 1kHz, 30% Mod

AM: Unless specified, f_c = 1MHz, f_{OSC} = 455kHz, f = 1kHz, 30% Mod

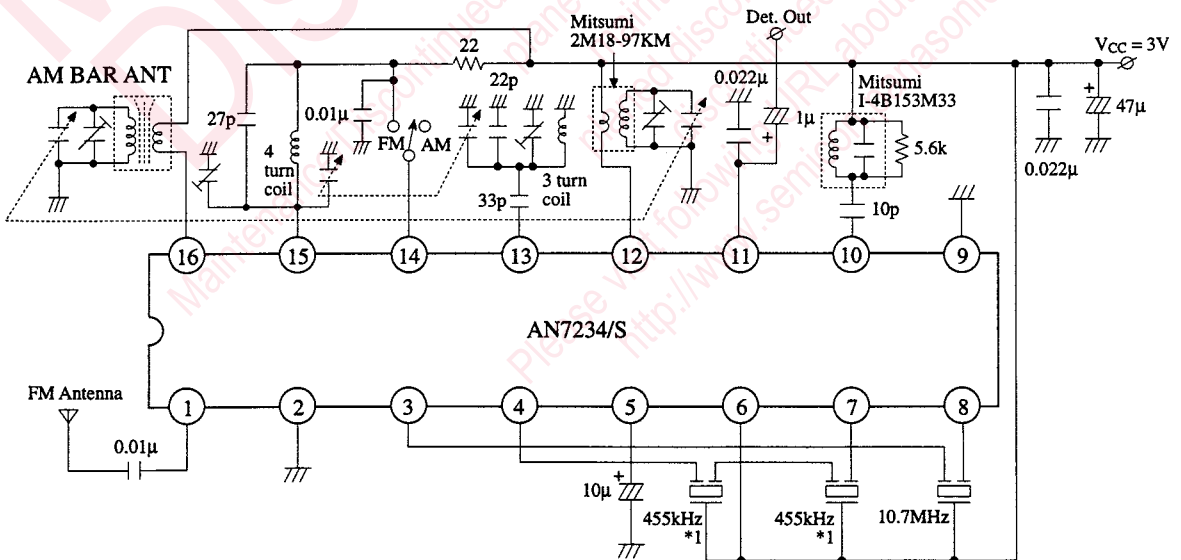
■ Pin

Pin No.	Pin Name	Pin No.	Pin Name
1	FM RF In	9	GND
2	FM FE Gnd	10	FM Quad.
3	FM Mix Out	11	Det. Out
4	AM Mix Out	12	AM OSC
5	AGC	13	FM OSC
6	V _{CC}	14	AM/FM SW
7	AM IF In	15	FM RF
8	FM IF In	16	AM RF In

■ Application Circuit 1 (using Ceramic Discriminator)

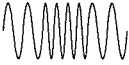
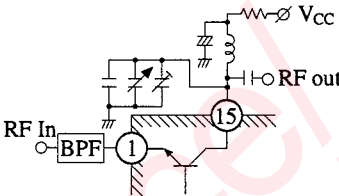
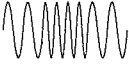
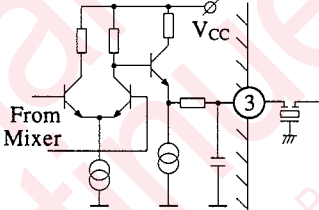
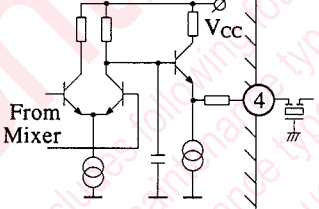
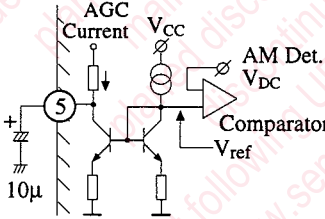
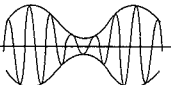
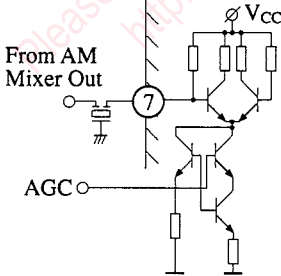


■ Application Circuit 2 (using FM Quad. Coil)



Note : *1 AM Ceramic Filter (Murata SFZ455JL)

■ Pin Descriptions

Pin No.	Pin Name	Waveform/ DC Bias (V)	Equivalent Circuit	Description
1	FM RF In	 RF Signal DC = 0.6V		This pin provide the RF signal after a Band Pass Filter. Common Base Amplifier used is to reduce high frequency signal feedback through CB parasitive capacitor.
15	FM RF	 RF Signal DC = 2.9V		With connection to the PVC externally, it is possible to tune the resonant point RF amplifier so as there is a constant tracking of 10.7MHz with the Oscillator.
2	FM FE GND	0V		
3	FM Mixer Out	DC = 1.8V		FM Mixer output pin. An active filter is employed to boost up the IF signal before the ceramic filter (10.7MHz). The mixer is a double balance modulator.
4	AM Mixer Out	DC = 1.8V		AM Mixer output pin. An active filter is employed to boost up the IF signal before the ceramic filter (455kHz). The mixer is a double balance modulator.
5	AGC	AM DC = 1.2V	AM ON : 	During AM ON When the signal level is low, AGC will not operate. When signal is high such that $V_{DC} + \nu_{AM} < V_{ref}$ then AGC will start to operate. The AGC is connected to AM IF Amp & AM RF Amp. It is used to reduce the gains of both stages so as not to clip the AM signal when the input signal is strong.
6	Vcc	3V		
7	AM IF In	DC = 2.9V  AM IF=455kHz		AM IF input pin. 3 stages of differential amplifiers made up of this AM IF Amp., with one stage shared between AM & FM. First stage differential amplifier, making use of the load for FM first stage differential amplifier is controllable through AGC. In which, gain can be controlled.

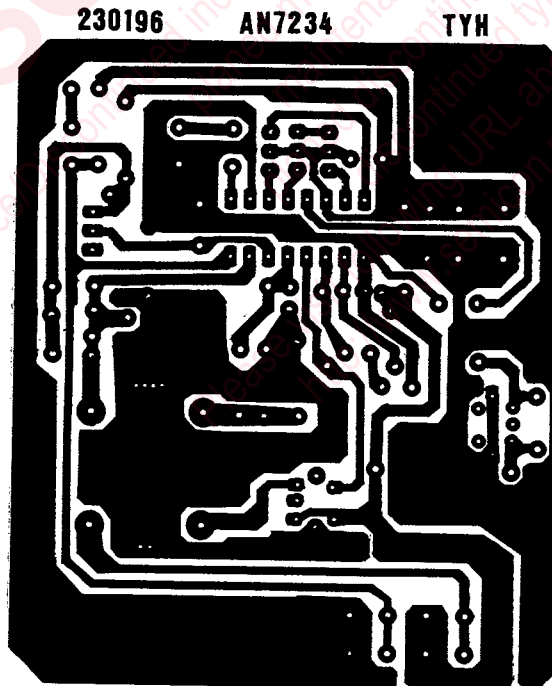
■ Pin Descriptions (Continue)

Pin No.	Pin Name	Waveform/ DC Bias (V)	Equivalent Circuit	Description
8	FM IF In	FM DC = 2.9V		FM IF input pin. Input impedance is decided by the resistor connected from Input Transistor Base to Reg., and the transistor Base impedance. FM IF Amplifier is made up of 5 stages of Differential Amplifiers.
9	GND	0V		GND for the rest of the circuit except FM FE.
10	FM Quad.	DC = 0.5V AF Signal		Making use of Double Balance Modulator for this Quadrature Detector. Input signal of IF frequency is converted to AF frequency. Pin 10 is connected to a Ceramic Discriminator to give a 90° phase shift for the IF signal. R in series is to reduce the Q factor of Ceramic Discriminator, and hence the output level.
11	Det Out	FM DC = 0.8V AM DC = 0.7		AM & FM Detector Output pin. Both AM and FM employed an Emitter Follower at their output stage to obtain a low output impedance.
12	AM Osc	DC = 2.9V f_{osc} AC = 0.3Vpp		AM Osc pin. Positive Feedback Oscillator forms by differential pairs. Oscillation level decided by the saturation current. Oscillation \approx 105mVrms.
13	FM Osc	DC = 2.9V f_{osc} AC = 0.6Vpp		A Colpitts Oscillation is used here. The Oscillator tank which is a PVC used in conjunction with the RF Amplifier tank has a common tuning knob which shifts both frequency at the same time. Here we can have $F_{osc} = F_{rf} + 10.7\text{MHz}$ or $F_{osc} = F_{rf} - 10.7\text{MHz}$ depends on the parallel capacitor and inductor coil used with the PVC.

■ Pin Descriptions (Continue)

Pin No.	Pin Name	Waveform/ DC Bias (V)	Equivalent Circuit	Description
14	AM / FM Switch	FM DC = 3.0V AM DC = 0.1V		When the switch is at Vcc, the comparator will turn the FM circuitry ON. But when pin 14 is floating or grounded, the AM circuitry will turn ON. By switching Pin 14 to Vcc, FM FE will be turned on as well.
16	AM RF In	DC = 2.9V RF Signal		2 pairs of Differential Amplifier made up the AM RF Amplifier. AM RF signal input through the BASE of the Differential Amplifier Normal operation involve only the internal Differential pair. When AGC is on during high signal input, external Differential Amplifier and the active loads turns on which lower down the RF Amplifier gain.

■ Printed Circuit Board Layout (Scale: 1:1)



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