

AN7024

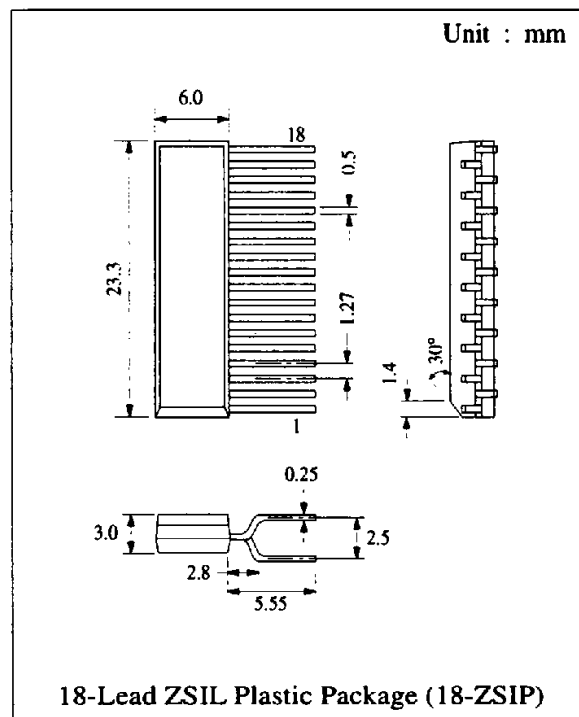
AM Tuner, FM-IF + MPX IC for Radio, Radio Cassette Recorder

Description

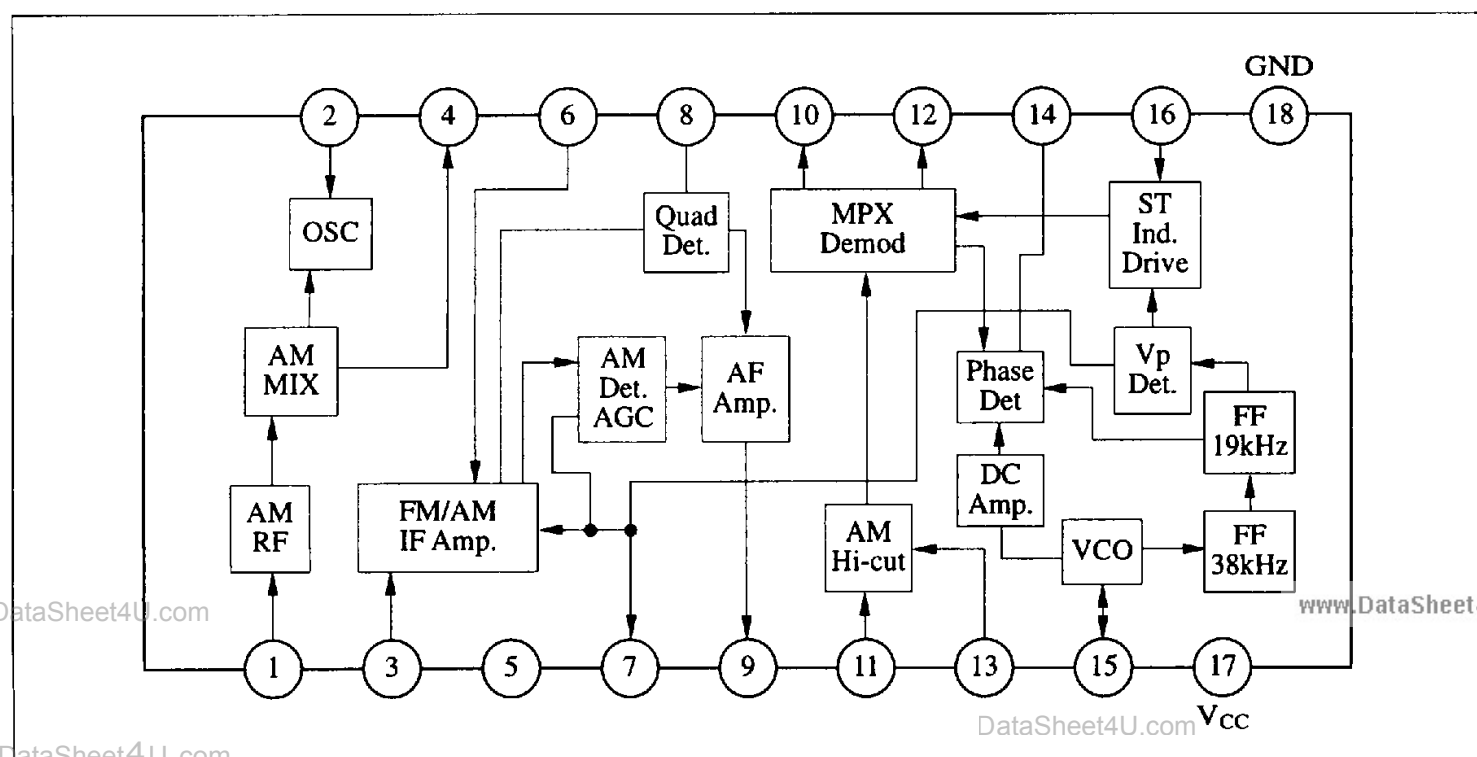
The AN7024 is a monolithic integrated circuit incorporating AM-Tuner, FM-IF, FM-MPX and demodulation circuit which is most suitable for radio cassette recorder. Integration into 18-pin ZIL package makes possible to reduce external parts. (7 pieces reduced by in-house comparison)

Features

- Incorporating on a single chip (AM Tuner, FM-IF, FM-MPX)
- Fewer external parts
- Built-in stereo indicator
- VCC range: $V_{CC} = 3V \sim 7V$



Block Diagram



■ Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Supply Voltage	V _{CC}	7	V
Supply Current	I _{CC}	30	mA
Power Dissipation	P _D	210	mW
Operating Ambient Temperature	Topr	-20 ~ +70	°C
Storage Temperature	Tstg	-55 ~ +150	°C

Operating Supply Voltage Range: V_{CC} = 3.0V ~ 7.0V

■ Electrical Characteristics (V_{CC}=5V, Ta=25°C)

Item	Symbol	Condition	min.	typ.	max.	Unit
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FM

Total Circuit Current	I _{tot(FM)}	Stereo no input		14		mA
Signal to Noise Ratio	S/N _(FM)	V _{in} = 80dBμ, Stereo		66		dB
Detection Output Voltage	V _{O(FM)}	V _{in} = 80dBμ, Monaural	67	89	119	mV
Limiting Sensitivity	V _{L(FM)}	Input which V _{O(FM)} decreases by 3dB, Monaural	31	34	37	dBμ

AM

Detection Output Voltage	V _{O(AM)}	V _{in} = 60dBμ	47	63	84	mV
Sensitivity	V _G	V _{O(AM)} = 20mV	2.5	8	13.5	dBμ
Total Circuit Current	I _{tot(AM)}	No input		11		mA
Signal to Noise Ratio	S/N _(AM)	V _{in} = 60dBμ		44		dB

MPX

Channel Balance	CB	V _{in} = 80dBμ, Monaural		0		dB
Stereo Separation	Sep	V _{in} = 80dBμ, Stereo	36	46		dB
Total Harmonic Distortion	THD	V _{in} = 80dBμ, Stereo		0.5	1.5	%
Stereo Lamp ON Level	V _{P(ON)}	V _{in} = 80dBμ, Modulation indication		4.2	8.0	%
Stereo Lamp OFF Level	V _{P(OFF)}	V _{in} = 80dBμ, Modulation indication	0.9	2.3		%

Note) Unless otherwise specified,

FM: monaural; f_{in} = 10.7MHz, 1kHz 30% modulation

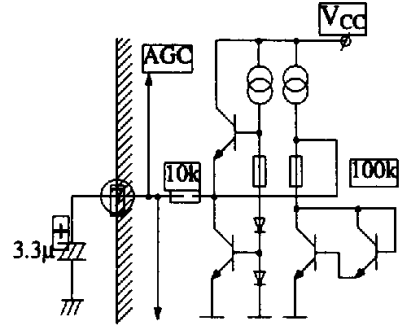
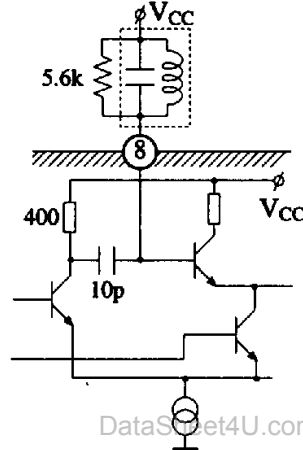
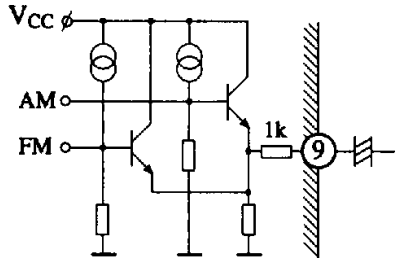
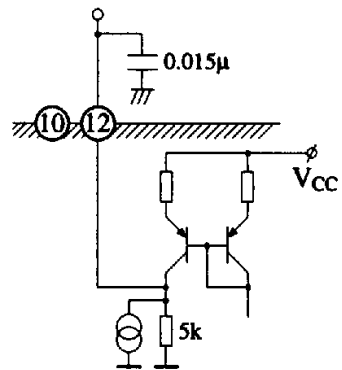
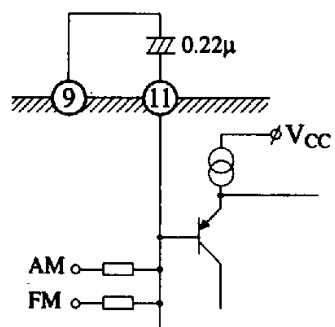
Stereo; f_{in} = 10.7MHz, 1kHz 100% modulation (L + R = 90%, pilot 10%).

AM: -----; f_{in} = 1MHz, 400Hz 30% modulation

Pin Descriptions

Pin No.	Pin Name	DC Voltage	Equivalent Circuit	Description
1	AM RF Input	5V		<p>Configuration of RF amp is differential amp. Input of base T1 & T3 need dc bias via external coil to V_{CC}.</p> <p>Usable sensitivity is better if antenna coil is used.</p> <p>AGC operates when T1 & T2 are off, T3 & T4 are on, becoming differential amp for small signal.</p> <p>On the other hand, when T1 & T2 are on, T3 & T4 are off, becoming differential for large signal.</p>
2	AM Oscillator	5V		<p>Configuration of OSC circuit is a differential amp.</p> <p>Note that OSC stops when Q factor of external coil is low.</p> <p>To test for OSC stop, use bare hand to touch on the secondary coil pins.</p> <p>In good case, when hand is removed, OSC restarts.</p> <p>Resistor R is for the prevention of stop OSC.</p> <p>If R=0, then at V_{CC} "ON", there is no DC loading and T1 & T2 are not "ON", there will be no oscillation.</p> <p>Level at pin 2 is 120mV.</p>
3	FM IF IN	5V		<p>Input impedance decided by 500Ω internal resistor.</p> <p>Limiting amp configuration is a 5-stages differential amp.</p> <p>The total gain is 60dB.</p>
4	AM MIX OUT	5V		<p>Mixer configuration is double-balanced mixer.</p> <p>Oscillation leakage is minimized.</p>
6	AM IF IN	5V		<p>AGC operates by controlling the emitter current of first stage IF amp.</p> <p>Input impedance decided by 2.5kΩ resistor.</p> <p>AM IF amp configuration is 3-stages differential amp.</p> <p>The total gain is 60dB.</p>

■ Pin Descriptions (Continue)

Pin No.	Pin Name	DC Voltage	Equivalent Circuit	Description
7	AGC & MPX Pilot Signal Detector	1.4V		<p>AGC output impedance is 110kΩ.</p> <p>Phase detector LPF output impedance is 10kΩ.</p> <p>Common value 3.3μF capacitor at pin 7.</p> <p>Cannot connect low impedance circuit to pin 7.</p>
8	FM Detector	5V		<p>FM detector configuration is quadrature detector.</p> <p>Phase shift capacitor is located internally.</p> <p>5.6kΩ resistor affects detector output level & harmonic distortion.</p>
9	Detector Output	AM 0.3V FM 0.7V		<p>Common for both AM & FM.</p> <p>Output impedance is 1kΩ.</p>
10 12	MPX Output	1.2V		<p>Output circuit configuration is a current mirror.</p> <p>Output impedance is 5kΩ.</p> <p>Time constant & de-emphasis is 75μs, determined by external capacitor 0.015μF.</p> <p>Output dynamic range is fixed at 800mV.</p> <p>No effect by Vcc.</p>
11	MPX IN	0.7V		<p>Input impedance is 30kΩ in AM mode & 100kΩ in FM mode.</p> <p>The input coupling capacitor is 0.22μF.</p> <p>Cutoff frequency is 55Hz for AM & 7Hz for FM.</p>

Pin Descriptions (Continue)

Pin No.	Pin Name	DC Voltage	Equivalent Circuit	Description
13	AM Hi-Cut	0.4V		<p>Capacitor at pin 13 and output impedance of pin 9 decides the input impedance of pin 13.</p> <p>Pin 13 is joined to GND by low impedance in AM mode.</p> <p>High-cut frequency is 4.8kHz.</p> <p>In FM mode, pin 13 is high impedance.</p>
14	MPX Phase Detector LPF	AM 5V FM 1.4V (Stereo) FM 0V (Mono)		<p>Used as switch for FM/AM & force mono.</p> <p>Please use discrete parts for LPF.</p> <p>If discrete parts are not used, the characteristics for THD & S/N in stereo mode will be poor.</p> <p>When switch is open, FM stereo mode.</p> <p>When switch is GND, FM mono mode.</p> <p>When switch is V_{CC}, AM Mode.</p> <p>Please maintain this switching condition at 0.5V & below for FM mono mode.</p> <p>For AM, use 2.5V & above.</p> <p>Current in AM mode from V_{CC} to pin 14 is 800μA.</p> <p>When pin 14 is switched to GND, there is no current.</p>
15	VCO	AM 0V FM 76kHz Oscillation		<p>Oscillation of this circuit is 76kHz, determined by external resistor & capacitor.</p> <p>For VCO adjustment, please join 330kΩ between pin 16 & GND.</p> <p>Adjust VCO range to 38kHz±100Hz.</p> <p>The 470pF is a styrole/polypropylene film capacitor for guarantee of temperature characteristics & limits.</p>
16	Stereo LED Driver and VCO monitor	AM 3.3V FM 0.13V (Stereo) FM 4.2V (Mono)		<p>Current capability is 30mA maximum.</p> <p>Usable LED current is 4mA.</p> <p>For VCO monitor, please join 330kΩ resistor to GND.</p> <p>Only this pin can be connected to 12V via 1kΩ pull-up resistor.</p>
5	V _{CC}			<p>V_{CC} for FM stage</p> <p>Connect centre pin of ceramic filter to this pin.</p>
17	V _{CC}	5V		
18	GND	0V		