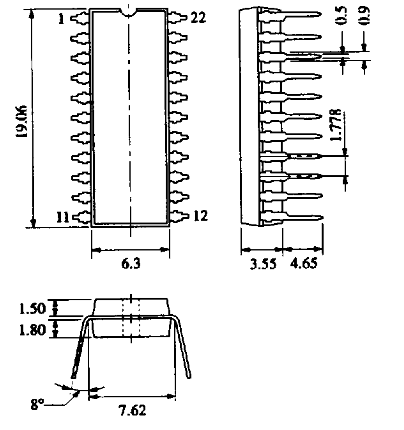
AN7238K

Single Chip IC for FM-AM IF, AM Tuner, FM MPX

Unit : mm



22-Lead Shrunk DIL Plastic Package (22-SDIP)

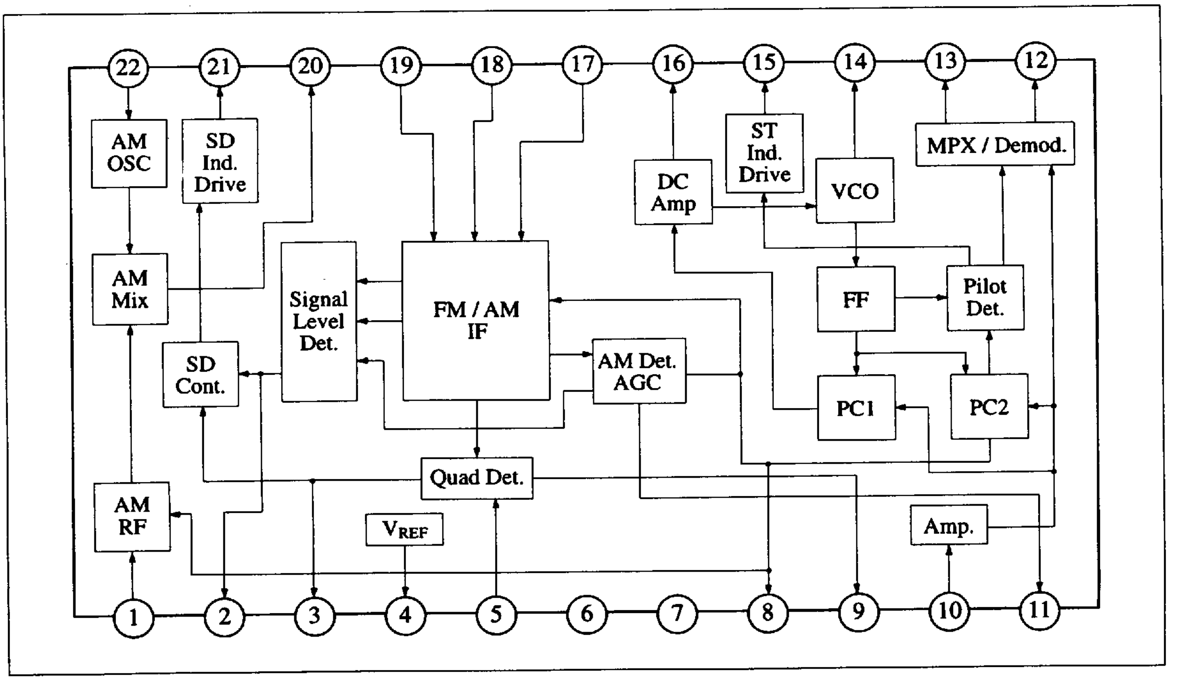
■ Description

The AN7238K is a monolithic integrated circuit designed for FM-AM IF, AM Tuner and FM MPX Demodulation which are most suitable for DTS radio cassette recorder. The chip is encapsulated into 22-lead Shrunk DIL package.

■ Features

- One chip (FM-AM IF, AM Tuner, FM MPX)
- With tuning indicator pin which can utilize as stop signal.
- Stop sensitivity variable.
- Stop width variable (Only FM)
- V_{CC} range: V_{CC} = 3.8V ~ 7V

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25°C)

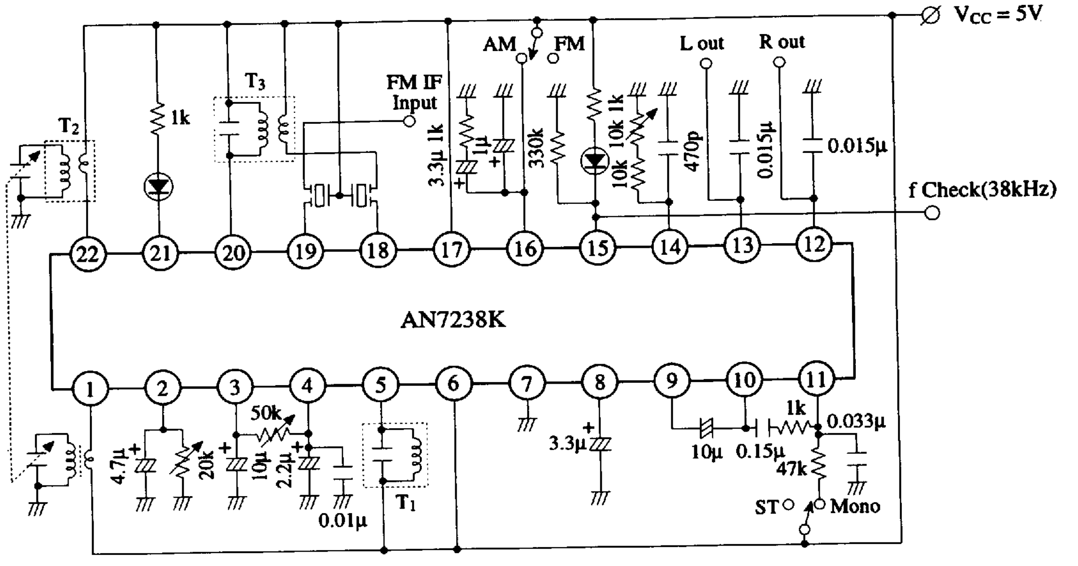
Item	Symbol	Rating	Unit
Supply Voltage	V_{CC}	7	V
Supply Current	I_{CC}	25	mA
Power Dissipation	P_D	175	mW
Operating Ambient Temperature	Topr	-20 ~ +75	°C
Storage Temperature	Tstg	-55 ~ +150	°C

Operating Supply Voltage Range: V_{CC} = 3.8V ~ 7.0V

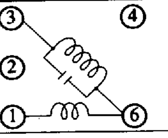
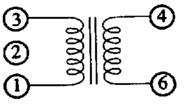
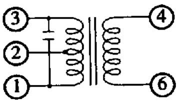
■ Electrical Characteristics (V_{CC}=5V, Ta=25°C)

Item	Symbol	Condition	min.	typ.	max.	Unit
FM						
Total Circuit Current	$I_{tot(FM)}$			19		mA
Detection Output Voltage	$V_{O(FM)}$	f_c = 10.7MHz, f = 1kHz 30% Mod., V_{in} = 80dBμ	48	69	90	mV
Limiting Sensitivity	$V_{in(lim)}$	f_c = 10.7MHz, f = 1kHz 30% Mod., V_O = -3dB	33	36	39	dBμ
Total Harmonic Distortion	THD	f_c = 10.7MHz, f = 1kHz 30% Mod.		0.1		%
Signal to Noise Ratio	S/N (FM)	f_c = 10.7MHz, f = 1kHz 30% Mod., V_{in} = 80dBμ		63		dB
SD ON Level	$V_{in(SD\ ON)}$	No modulation	41	51	61	dBμ
AM						
Total Circuit Current	$I_{tot(AM)}$			14		mA
Detection Output Voltage	$V_{O(AM)}$	f_c = 450kHz, f = 400Hz 30% Mod., V_{in} = 60dBμ	52	74	96	mV
Maximum Sensitivity	S_{max}	f_c = 450kHz, f = 400Hz 30% Mod., V_O = 20mV	4	13	22	dBμ
Total Harmonic Distortion	THD	f_c = 450kHz, f = 400Hz 30% Mod., V_{in} = 80dBμ		1.5		%
Signal to Noise Ratio	S/N (FM)	f_c = 450kHz, f = 400Hz 30% Mod., V_{in} = 80dBμ		43		dB
SD ON Level	$V_{in(SD\ ON)}$	No modulation	12	22	32	dBμ
MPX (At buffer gain = 1)						
Separation	Sep.	V_{L+R} = 252mV, V_P = 28mV, f = 1kHz, MPX filter ON, HPF (400Hz) and LPF (30kHz) ON	36	46		dB
Pilot ON Level	$V_{P(ON)}$	V_{in} = 280mV only pilot signal		3.5	7.0	%
Pilot OFF Level	$V_{P(OFF)}$	V_{in} = 280mV only pilot signal	0.9	2.3		%
Synthesis (MPX Filter ON, BPF (400Hz ~ 30kHz) ON)						
FM Signal to Noise Ratio (Mono)	$S/N_{tot(MONO)}$	f_c = 10.7MHz, f = 1kHz 30% Mod.		64		dB
FM Signal to Noise Ratio (Stereo)	$S/N_{tot(STEREO)}$	f_c = 10.7MHz, f = 1kHz 30% Mod.		59		dB
FM Total Harmonic Distortion (Mono)	$THD_{tot(MONO)}$	f_c = 10.7MHz, f = 1kHz 30% Mod.		0.1		%
FM Total Harmonic Distortion (Stereo)	$THD_{tot(STEREO)}$	f_c = 10.7MHz, f = 1kHz 30% Mod.		0.15		%

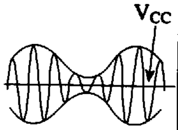
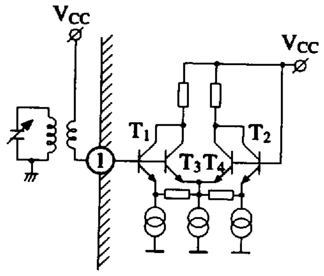
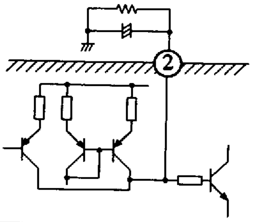
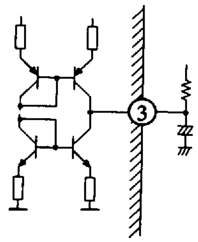
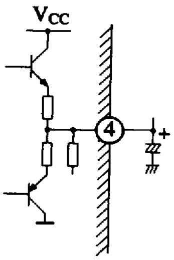
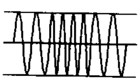
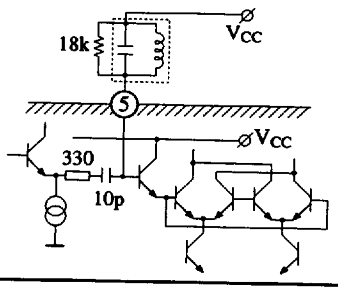
■ Application Circuit



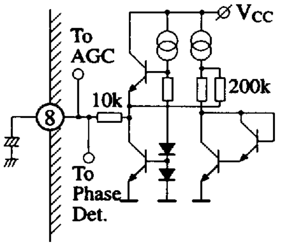
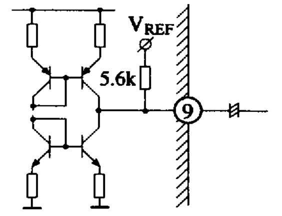
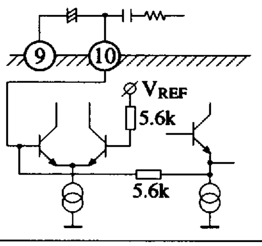
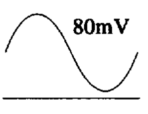
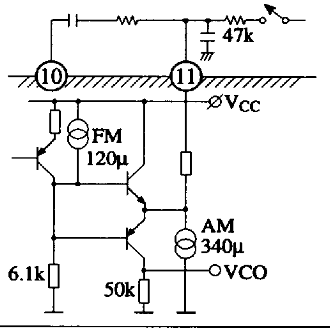
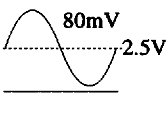
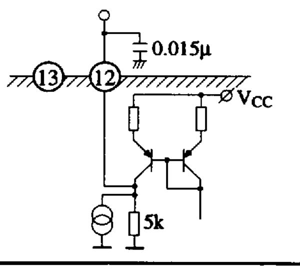
■ Coil Specifications

Symbol	Use, Freq.	Type No.	Maker	Connection Diagram	Number of Turns	Tuning Cap.	Unloaded Q
T_1	FM Quad Coil 10.7MHz	S-121-113	Sumida		①···⑥ 7T ③···⑥ 18.5T	82pF±10%	34±20%
T_2	AM MW Osc. Coil	L-5K7-H4	Mitsumi		①···③ 68T ④···⑥ 7T	–	80
T_3	AM Mixer Output 455kHz	IFT-21K7H-4	Mitsumi		③···② 43T ⑥···④ 14T ①···② 10T	1500pF	130±30%

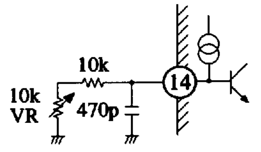
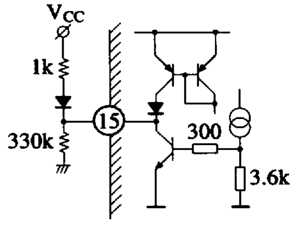
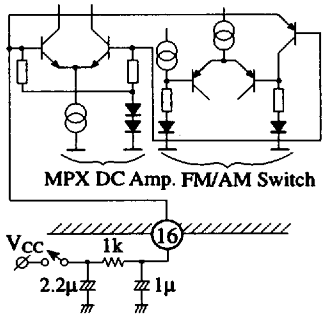
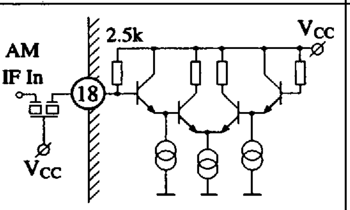
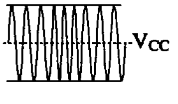
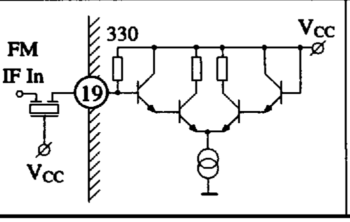
■ Pin Descriptions

Pin No.	Pin Name	Waveform	Equivalent Circuit	Description
1	AM RF			AM RF input pin. Configuration of RF amp. is a differential amp. Input to base of T_1 & T_3 need DC bias via external coil to V_{CC}. Usable sensitivity is better if antenna coil is used. (Band-pass filter for noise.) AGC operates when T_1 & T_2 are off, T_3 & T_4 on, differential amp. for small input signal & conversely when T_1 & T_2 are on, T_3 & T_4 are off, differential amp. for large input signal.
2	Signal Level output	DC		Signal level output pin. When this pin is more than 2V, SD lamp turns on in AM / FM mode.
3	AFC	DC		AFC pin. Adjust SD lamp on width pin. In FM mode, this pin is V_{REF} + 1.0V, SD lamp turns on.
4	V_{REF}	DC		V_{REF} pin. V_{REF} = 2.5V, not affected by V_{CC}.
5	FM Det.	 f = 10.7MHz		FM detector pin. FM detector configuration is quadrature detector. Phase shift capacitor is located internally. 18kΩ resistor affects detector output level & harmonic distortion.

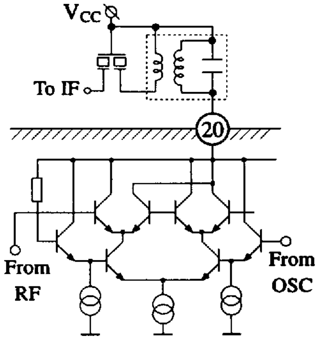
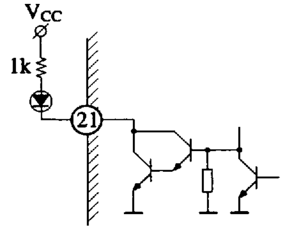
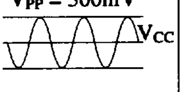
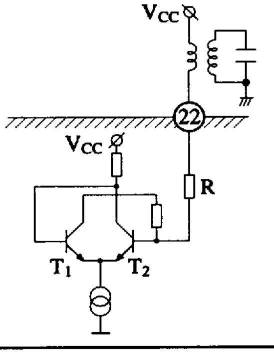
■ Pin Descriptions (Continue)

<table>
<tr><th>Pin No.</th><th>Pin Name</th><th>Waveform</th><th>Equivalent Circuit</th><th>Description</th></tr>
<tr><td>6</td><td>V_{CC}</td><td>DC</td><td></td><td></td></tr>
<tr><td>7</td><td>GND</td><td>0V</td><td></td><td></td></tr>
<tr><td>8</td><td>AGC</td><td>DC</td><td></td><td>AGC & phase detector using LPF pin.
AGC output impedance is 210Ω.
Phase detector LPF output impedance is 10kΩ. Common value 3.3μF capacitor at pin 5.
Cannot connect low impedance circuit to pin 5.</td></tr>
<tr><td>9</td><td>FM Det-out</td><td>DC(≈ V_{REF})</td><td></td><td>Detector output level pin for FM.
Output impedance is 5.6kΩ.</td></tr>
<tr><td>10</td><td>MPX In</td><td></td><td></td><td>MPX input pin.
This pin is imaginary GND formed by operational amplifier. In AM mode INPUT-COUPLING CAPACITOR forms low-cut filter.</td></tr>
<tr><td>11</td><td>AM Det-out (Mono)</td><td>AM 30% Mod.
</td><td></td><td>Detector output level pin for AM.
Capacitor join to GND forms high-cut filter.
Output impedance is 1kΩ.
When this pin join to V_{CC} through 47kΩ, operate in FORCE-MONO mode. (only in FM mode)</td></tr>
<tr><td>12</td><td>R-Ch Out</td><td rowspan="2">FM 30% Mod.
</td><td rowspan="2"></td><td rowspan="2">MPX output pins.
Output circuit configuration is a current mirror.
Output impedance is 5kΩ.
Time constant & de-emphasis is 75μs, determined by external capacitor 0.015μF. Output dynamic range is fixed at 800mV.
No effect by V_{CC}</td></tr>
<tr><td>13</td><td>L-Ch Out</td></tr>
</table>

■ Pin Descriptions (Continue)

Pin No.	Pin Name	Waveform	Equivalent Circuit	Description
14	VCO	76kHz 		VCO pin. Oscillation of this circuit is 76kHz determined by external resistors & capacitior. For VCO adjustment, please join 330kΩ between pin 15 & GND. Adjust VCO range to 38kHz±100Hz. The 470p is a styrole /polypropylene film capacitor for guarantee of temperature characterisitcs & limits.
15	ST Indicator / VCO monitor	38kHz 		Stereo LED driver and VCO monitor pin. Current capability is 30mA maximum. Usable LED current is 4mA. For VCO monitor, please join 330kΩ resistor to GND. Only this pin can be connected to 12V via 1kΩ pull-up resistor.
16	MPX Phase Detector LPF			MPX phase detector LPF pin. Also used as switch for AM/FM. Please use discrete parts for LPF. If discrete parts are not used, then characteristics for THD & S/N in stereo mode will be poor.When switch is open, FM mode. When switch is V_{CC}, AM mode. Please maintain this switching condition for AM, use 2.5V & above. Current in AM mode from V_{CC} to pin 14 is 800μA.
17	V_{CC}			V_{CC} For FM stage connect centre pin of ceramic filter to this pin.
18	AM IF In			AM IF input pin. AGC operates by controlling the emitter current of 1st. stage IF amp. Input impedance decided by 2.5kΩ resistor. AM IF amp. configuration is 3 stage differential amp. Total gain is 60dB.
19	FM IF In	f = 10.7MHz 		FM IF input pin. Input impedance decided by 330Ω internal resistor. Limiting amp. configuration is 5-stage differential amp.. Total gain is 60dB.

■ Pin Descriptions (Continue)

Pin No.	Pin Name	Waveform	Equivalent Circuit	Description
20	AM Mix Out			AM MIX Out pin. Mixer configuration is double-balanced mixer. Oscillation leakage is minimized.
21	SD	DC		SD lamp pin. Pin's values are 0.9V in SD-ON mode.
22	AM Osc.			AM Osc. pin. Configuration of osc. circuit is differential amp.. Note that osc. stops when Q factor of external coil is low. To test for osc. stop, touch by hand secondary coil pins. In good case, when hand is removed, osc. re-starts. Osc. level at pin 22 is 120mV. Resistor R is for prevention of stop osc.. If R = 0Ω, then at V_{CC} "ON". there is no DC loading and T_1 and T_2 is "OFF", so no oscillation.