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MOTOROLA

MC13022

Advanced Medium Voltage AM Stereo Decoder

The MC13022 is designed for home, portable and automotive AM stereo radio applications. The circuits and functions included in the design allow implementation of a full–featured C–QUAM® AM stereo radio with relatively few, inexpensive external parts. It is available in either 28–lead DIP or EIAJ compatible wide–bodied 28–lead SOIC.

- Operation from 4.0 V to 10 V Supply with Current Drain of 18 mA Typ
- IF Amplifier with Two Speed AGC
- Post Detection Filters that Allow Manual or Automatic Adjustable Audio Bandwidth Control and 9.0 or 10 kHz Notch Filtering
- Signal Quality Controlled Stereo Blend and Noise Reduction
- Noise and Co–Channel Discriminating Stop–On–Station
- Signal Strength Indicator Output for RF AGC and/or Meter Drive
- Signal Strength Controlled IF and Audio Bandwidth
- Noise Immune Pilot Detector Needs no Precision Filter Components
- MC13023 Complementary Tuning System IC

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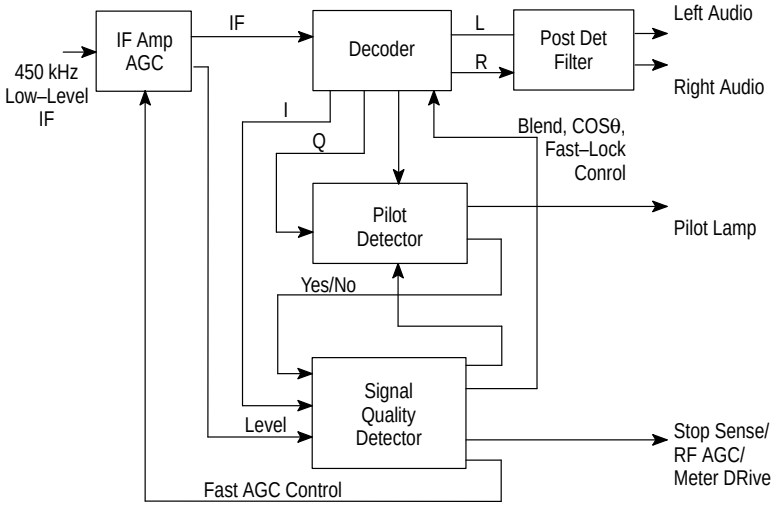
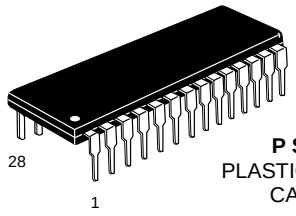
Simplified Application

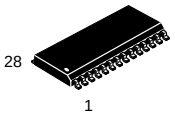


C–QUAM ADVANCED MEDIUM VOLTAGE AM STEREO DECODER

SEMICONDUCTOR TECHNICAL DATA



P SUFFIX
PLASTIC PACKAGE
CASE 710



DW SUFFIX
PLASTIC PACKAGE
CASE 751F
(SO–28L)

PIN CONNECTIONS

(Top View)

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC13022P	T_A = – 40° to +85°C	Plastic Power
MC13022DW		SO–28L

MAXIMUM RATINGS

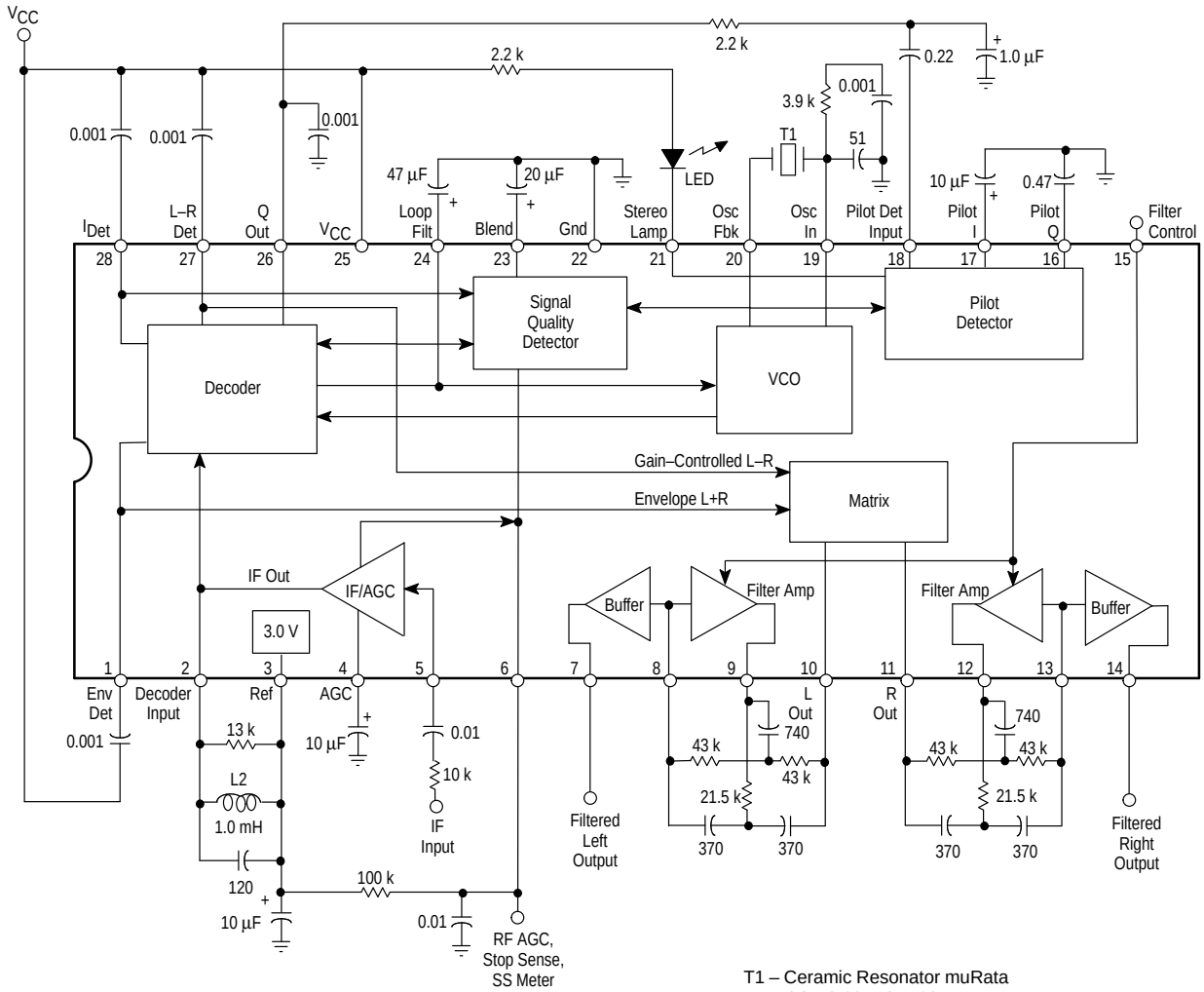
Rating	Symbol	Value	Unit
Power Supply Input Voltage	V_{CC}	12	Vdc
Stereo Indicator Lamp Current (Pin 21)	–	30	mAdc
Operating Ambient Temperature	T_A	–40 to +85	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	$T_{J(max)}$	150	°C
Power Dissipation Derate above 25°C	P_D	1.25 10	W mW/°C

NOTE: ESD data available upon request.

ELECTRICAL CHARACTERISTICS (V_{CC} = 8.0 V, T_A = 25°C, Test Circuit of Figure 1, unless otherwise noted.)

Characteristic	Min	Typ	Max	Unit
Power Supply Operating Range	4.0	8.0	10	Vdc
Supply Line Current Drain (Pin 25)	11	16	22	mAdc
Minimum Input Signal Level, Unmodulated for Full Operation (Pin 5)	–	5.0	–	mVrms
Audio Output Level, 50% Modulation, L only or R only (Pins 10, 11) Stereo	100	140	180	mVrms
Audio Output Level, 50% Modulation (Pins 10, 11) Monaural	50	70	90	mVrms
Output THD, 50% Modulation Monaural Stereo	 – –	 0.3 0.5	 0.5 2.0	%
Channel Separation, L only or R only, 50% Modulation Stereo	22	35	–	dB
Pilot Acquisition Time Following Blend Reset to 0.3 Vdc	–	–	600	ms
Audio Output Impedance at 1.0 kHz (Pins 7, 14)	–	300	–	Ω
Stereo Indicator Lamp Pin Saturation Voltage at 3.0 mA Load Current (V_{sat} Pin 21)	–	–	200	mVdc
Stereo Indicator Lamp Pin Leakage Current (Pin 21)	–	–	1.0	μAdc
Notch Filter Control (Pin 15), Response versus Voltage	(See Figure 2)			

Figure 1. Test Circuit



T1 – Ceramic Resonator muRata
CSA 3.60 MGF103
L2 – Miller 9230–92

EXPLANATION OF FEATURES

Blend and Noise Reduction

Although AM stereo does not have the extreme difference in S/N between mono and stereo that FM does (typically less than 3.0 dB versus greater than 20 dB for FM), sudden switching between mono and stereo is quite apparent. Some forms of interference such as co–channel have a large L–R component that makes them more annoying than would ordinarily be expected for the measured level. The MC13022 measures the interference level and reduces L–R as interference increases, blending smoothly to monaural. The pilot indicator remains on as long as a pilot signal is detected, even when interference is severe, to minimize annoying pilot light flickering.

RF AGC/Meter Drive

A dc voltage proportional to the log of signal strength is provided at Pin 6. This can be used for RF AGC, signal strength indication, and/or control of the post detection filter. Normal operation is above 2.2 V as shown is Figure 4.

Stop Sense

Multiplexed with the signal strength information is the stop sense signal. The stop sense is activated when scanning by externally pulling the blend capacitor on Pin 23 below 0.5 V. This would typically be done from the mute line in a frequency synthesizer.

If at any time Pin 23 is low and there is either no signal in the IF or a noisy signal of a predetermined interference level, Pin 6 will go low. This low can be used to tell the frequency synthesizer to immediately scan to the next channel. The interference detection prevents stopping on many unlistenable stations, a feature particularly useful at night when many frequencies may have strong signals from multiple co–channel stations.

IF Bandwidth Control

IF AGC attenuates the signal by shunting the signal at the IF input. This widens the IF bandwidth by decreasing the loaded Q of the input coupling coil as signal strength increases.

Post Detection Filtering

With weak, noisy signals, high frequency rolloff greatly improves the sound. Conventional tone controls do not attenuate the highs sufficiently to control noise without also significantly affecting the mid–range. Also, notch filters are necessary with any wide–band AM radio to eliminate the 10 kHz whistle from adjacent stations.

By using a twin–T filter with variable feedback to the normally grounded center leg, a variable Q notch filter is formed that provides both the 10 kHz notch and variable high frequency rolloff functions. Typical range of response is shown in Figure 3. Response is controlled by the dc voltage on Pin 15.

Pin 15 could interface with a dc operated tone control such as the TDA1524, or could be tied to Pin 6 for automatic audio bandwidth control as a function of signal strength.

Figure 2. High Performance Home Type AM Stereo Receiver

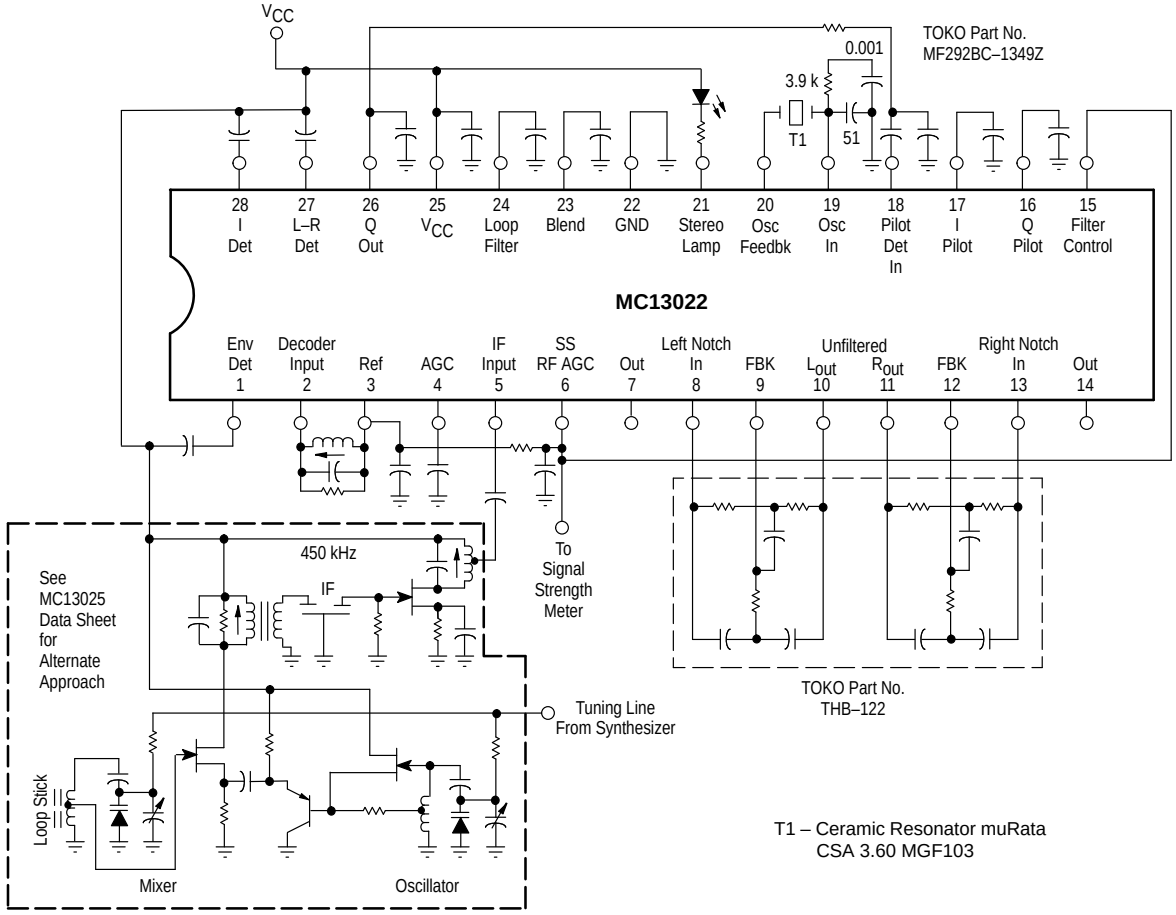


Figure 3. Overall Selectivity of a Typical Receiver versus Filter Control Voltage

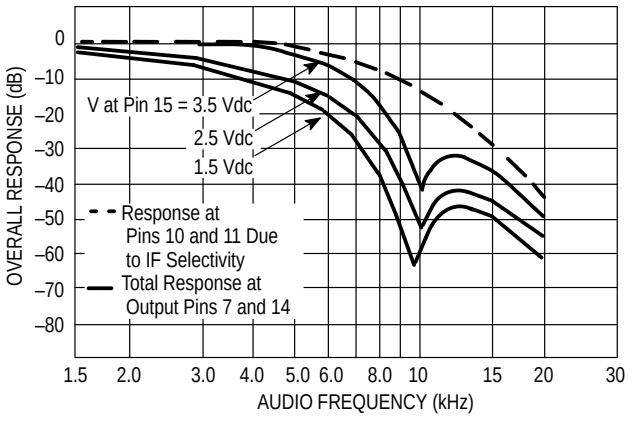
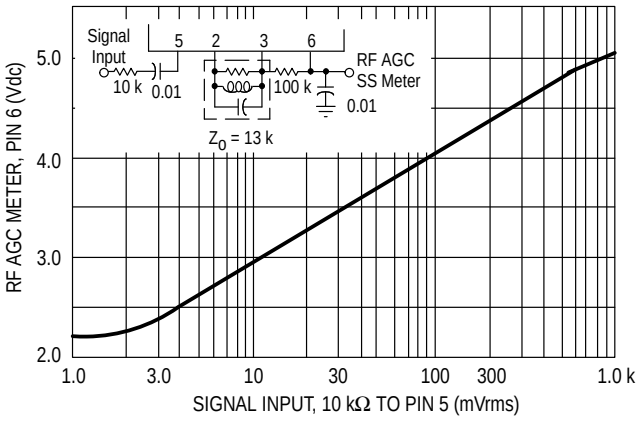
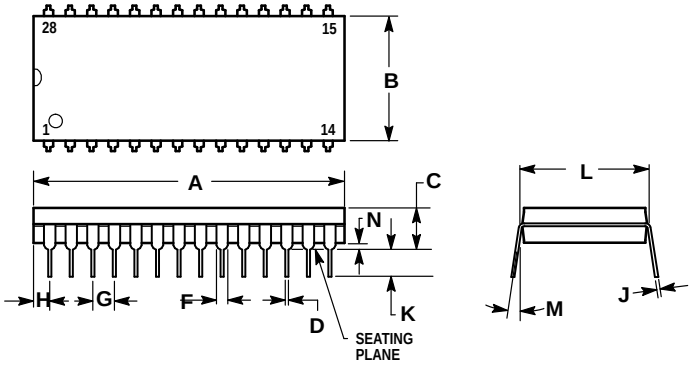


Figure 4. RF AGC/Signal Strength Output versus Input Signal



OUTLINE DIMENSIONS

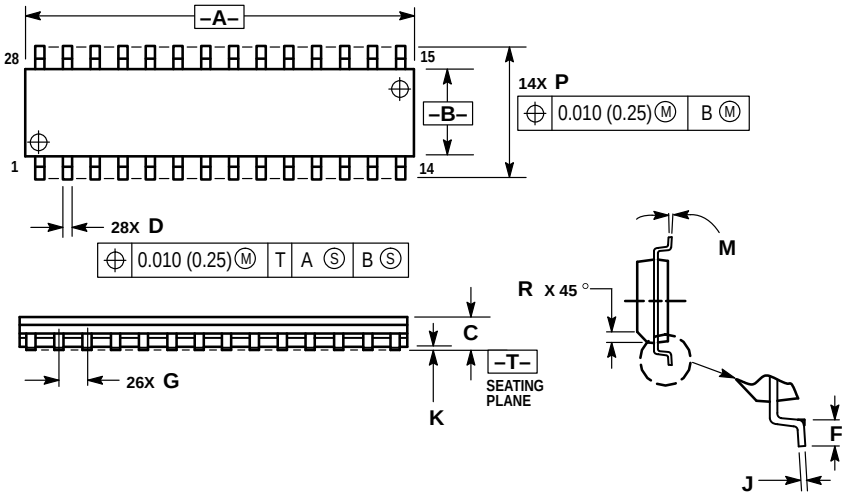
P SUFFIX
PLASTIC PACKAGE
CASE 710–02
ISSUE B



NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25 (0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	36.45	37.21	1.435	1.465
B	13.72	14.22	0.540	0.560
C	3.94	5.08	0.155	0.200
D	0.36	0.56	0.014	0.022
F	1.02	1.52	0.040	0.060
G	2.54 BSC		0.100 BSC	
H	1.65	2.16	0.065	0.085
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.115	0.135
L	15.24 BSC		0.600 BSC	
M	0 °	15 °	0 °	15 °
N	0.51	1.02	0.020	0.040

DW SUFFIX
PLASTIC PACKAGE
CASE 751F–04
(SO–28L)
ISSUE E



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	17.80	18.05	0.701	0.711
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.41	0.90	0.016	0.035
G	1.27 BSC		0.050 BSC	
J	0.23	0.32	0.009	0.013
K	0.13	0.29	0.005	0.011
M	0 °	8 °	0 °	8 °
P	10.01	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

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