



# MC3357

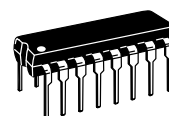
## Low Power Narrowband FM IF

... includes Oscillator, Mixer, Limiting Amplifier, Quadrature Discriminator, Active Filter, Squelch, Scan Control, and Mute Switch. The MC3357 is designed for use in FM dual conversion communications equipment.

- Low Drain Current (3.0 mA (Typical) @  $V_{CC} = 6.0$  Vdc)
- Excellent Sensitivity: Input Limiting Voltage –  
(– 3.0 dB) = 5.0  $\mu$ V (Typical)
- Low Number of External Parts Required
- Recommend MC3372 for Replacement/Upgrade

### LOW POWER FM IF

### SEMICONDUCTOR TECHNICAL DATA

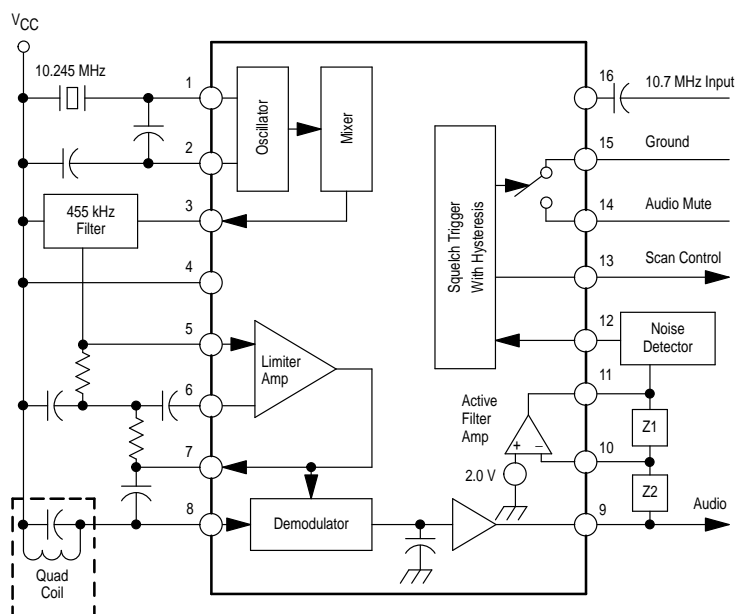


**P SUFFIX**  
PLASTIC PACKAGE  
CASE 648

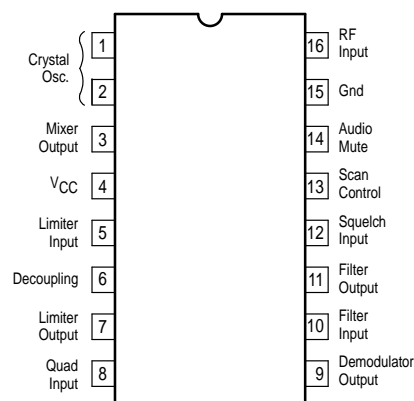
**D SUFFIX**  
PLASTIC PACKAGE  
CASE 751B  
(SO-16)



**Figure 1. Representative Block Diagram**



### PIN CONNECTIONS



### ORDERING INFORMATION

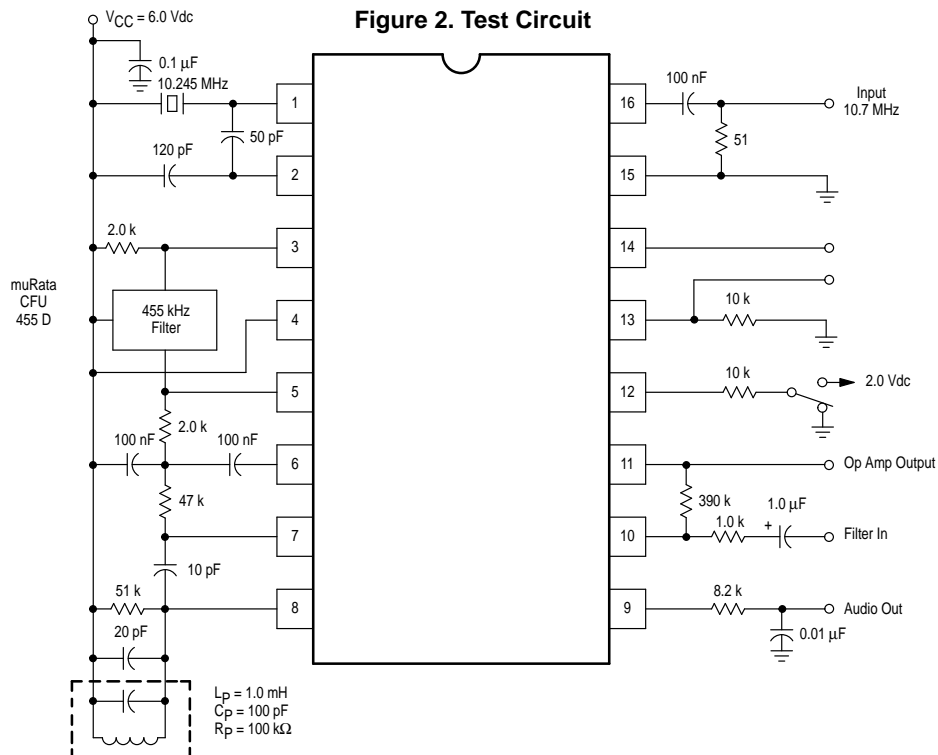
Device	Operating Temperature Range	Package
MC3357D	$T_A = -30$ to $+70^\circ\text{C}$	SO-16
MC3357P		Plastic DIP

**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

Rating	Pin	Symbol	Value	Unit
Power Supply Voltage	4	$V_{CC}(\text{max})$	12	Vdc
Operating Supply Voltage Range	4	$V_{CC}$	4 to 8	Vdc
Detector Input Voltage	8	—	1.0	Vp-p
Input Voltage ( $V_{CC} \geq 6.0$ Volts)	16	$V_{16}$	1.0	$V_{\text{RMS}}$
Mute Function	14	$V_{14}$	-0.5 to 5.0	$V_{\text{pk}}$
Junction Temperature	—	$T_J$	150	$^\circ\text{C}$
Operating Ambient Temperature Range	—	$T_A$	-30 to +70	$^\circ\text{C}$
Storage Temperature Range	—	$T_{\text{stg}}$	-65 to +150	$^\circ\text{C}$

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 6.0$  Vdc,  $f_o = 10.7$  MHz,  $\Delta f = \pm 3.0$  kHz,  $f_{\text{mod}} = 1.0$  kHz,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

Characteristic	Pin	Min	Typ	Max	Unit
Drain Current Squelch Off	4	—	2.0	—	mA
Squelch On	—	—	3.0	5.0	—
Input Limiting Voltage (-3 dB Limiting)	16	—	5.0	10	$\mu\text{V}$
Detector Output Voltage	9	—	3.0	—	Vdc
Detector Output Impedance	—	—	400	—	$\Omega$
Recovered Audio Output Voltage ( $V_{\text{in}} = 10$ mV)	9	200	350	—	mVrms
Filter Gain (10 kHz) ( $V_{\text{in}} = 5$ mV)	—	40	46	—	dB
Filter Output Voltage	11	1.8	2.0	2.5	Vdc
Trigger Hysteresis	—	—	100	—	mV
Mute Function Low	14	—	15	50	$\Omega$
Mute Function High	14	1.0	10	—	$\text{M}\Omega$
Scan Function Low (Mute Off) ( $V_{12} = 2$ Vdc)	13	—	0	0.5	Vdc
Scan Function High (Mute On) ( $V_{12} = \text{Gnd}$ )	13	5.0	—	—	Vdc
Mixer Conversion Gain	3	—	20	—	dB
Mixer Input Resistance	16	—	3.3	—	$\text{k}\Omega$
Mixer Input Capacitance	16	—	2.2	—	pF



## CIRCUIT DESCRIPTION

The MC3357 is a low power FM IF circuit designed primarily for use in voice communication scanning receivers.

The mixer-oscillator combination converts the input frequency (e.g., 10.7 MHz) down to 455 kHz, where, after external bandpass filtering, most of the amplification is done. The audio is recovered using a conventional quadrature FM detector. The absence of an input signal is indicated by the presence of noise above the desired audio frequencies. This "noise band" is monitored by an active filter and a detector. A squelch trigger circuit indicates the presence of a noise (or a tone) by an output which can be used to control scanning. At the same time, an internal switch is operated which can be used to mute the audio.

The oscillator is an internally-biased Colpitts type with the collector, base, and emitter connections at Pins 4, 1, and 2 respectively. A crystal can be used in place of the usual coil.

The mixer is doubly-balanced to reduce spurious responses. The input impedance at Pin 16 is set by a 3.0 k $\Omega$  internal biasing resistor and has low capacitance, allowing the circuit to be preceded by a crystal filter. The collector output at Pin 3 must be dc connected to B+, below which it can swing 0.5 V.

After suitable bandpass filtering (ceramic or LC), the signal goes to the input of a five-stage limiter at Pin 5. The output of the limiter at Pin 7 drives a multiplier, both internally directly,

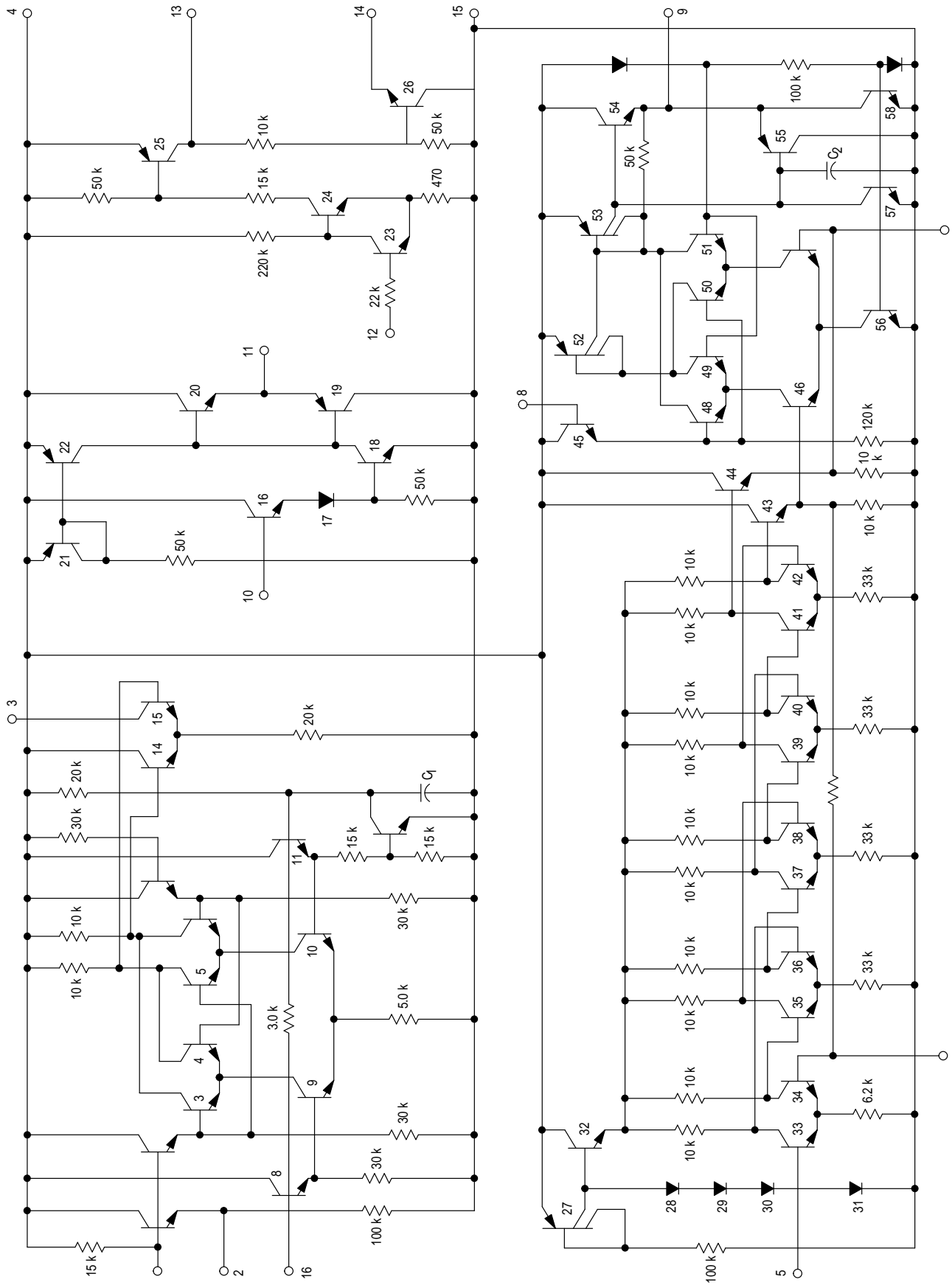
and externally through a quadrature coil, to detect the FM. The output at Pin 7 is also used to supply dc feedback to Pin 5. The other side of the first limiter stage is decoupled at Pin 6.

The recovered audio is partially filtered, then buffered, giving an impedance of around 400  $\Omega$  at Pin 9. The signal still requires de-emphasis, volume control and further amplification before driving a loudspeaker.

A simple inverting op amp is provided with an output at Pin 11 providing dc bias (externally) to the input at Pin 10 which is referred internally to 2.0 V. A filter can be made with external impedance elements to discriminate between frequencies. With an external AM detector, the filtered audio signal can be checked for the presence of noise above the normal audio band, or a tone signal. This information is applied to Pin 12.

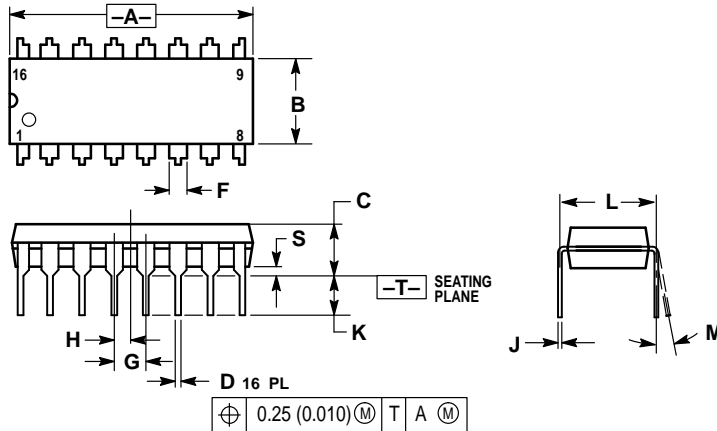
An external positive bias to Pin 12 sets up the squelch trigger circuit such that Pin 13 is low at an impedance level of around 60 k $\Omega$ , and the audio mute (Pin 14) is open circuit. If Pin 12 is pulled down to 0.7 V by the noise or tone detector, Pin 13 will rise to approximately 0.5 Vdc below supply where it can support a load current of around 500  $\mu$ A and Pin 14 is internally short-circuited to ground. There is 100 mV of hysteresis at Pin 12 to prevent jitter. Audio muting is accomplished by connecting Pin 14 to a high-impedance ground-reference point in the audio path between Pin 9 and the audio amplifier.

Figure 3. Circuit Schematic



## OUTLINE DIMENSIONS

**P SUFFIX**  
**PLASTIC PACKAGE**  
CASE 648-08  
ISSUE R

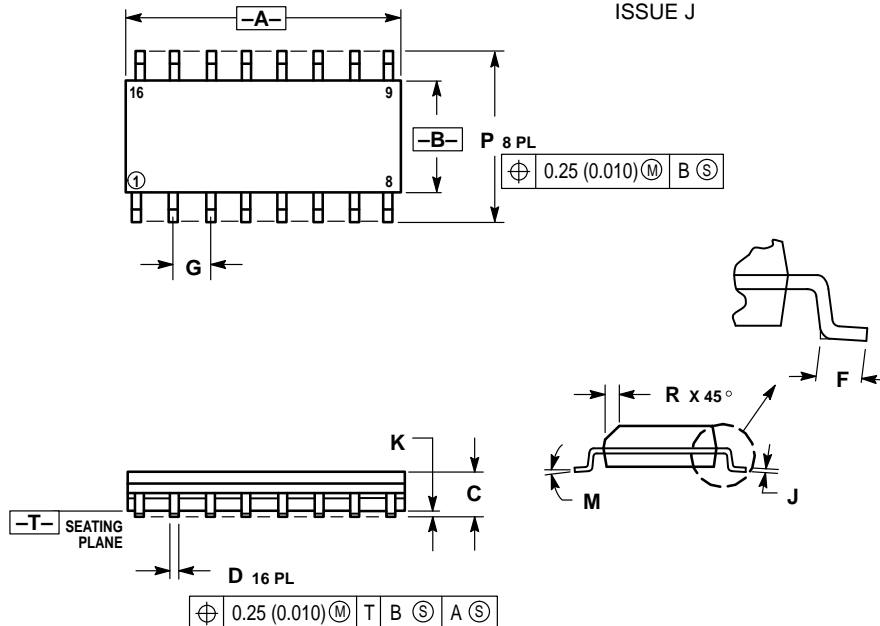


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01


**D SUFFIX**  
**PLASTIC PACKAGE**  
CASE 751B-05  
(SO-16)  
ISSUE J



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS 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 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.388	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

**How to reach us:**

**USA/EUROPE:** Motorola Literature Distribution;  
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,  
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

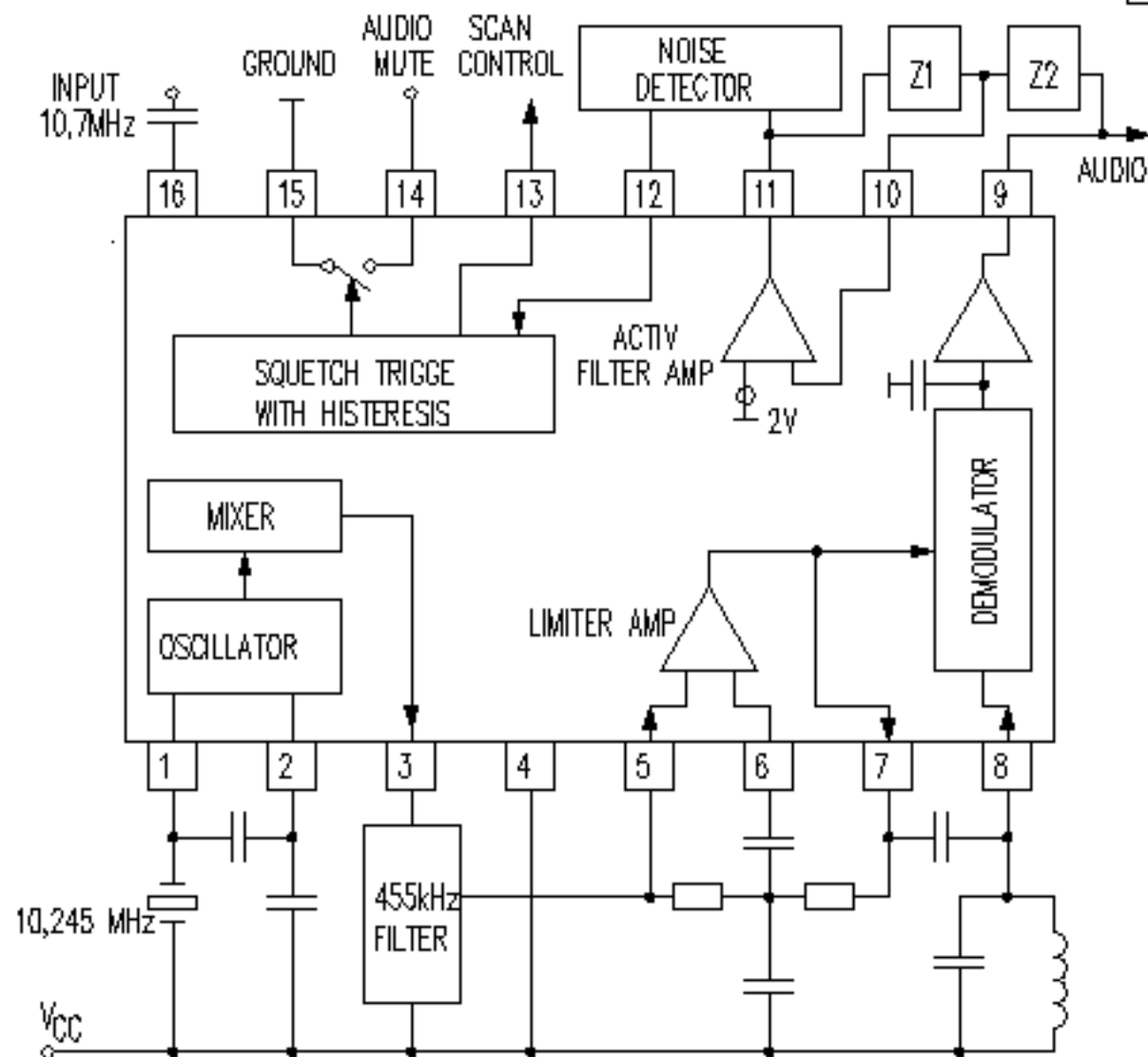
**MFAX:** RMFAX0@email.sps.mot.com - TOUCHTONE (602) 244-6609  
**INTERNET:** <http://Design-NET.com>

**HONG KONG:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



# LOW POWER FM IM

# MC3357



Vccmax = 12V (Pin4)

Vccrng = 4...8V

Iccmax = 5mA

Case DIP16

S016