MOTOROLA
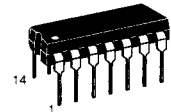# SEMICONDUCTOR ■■■■■■■■
TECHNICAL DATA

MC1357

TV Sound IF or FM IF Amplifier with Quadrature Detector
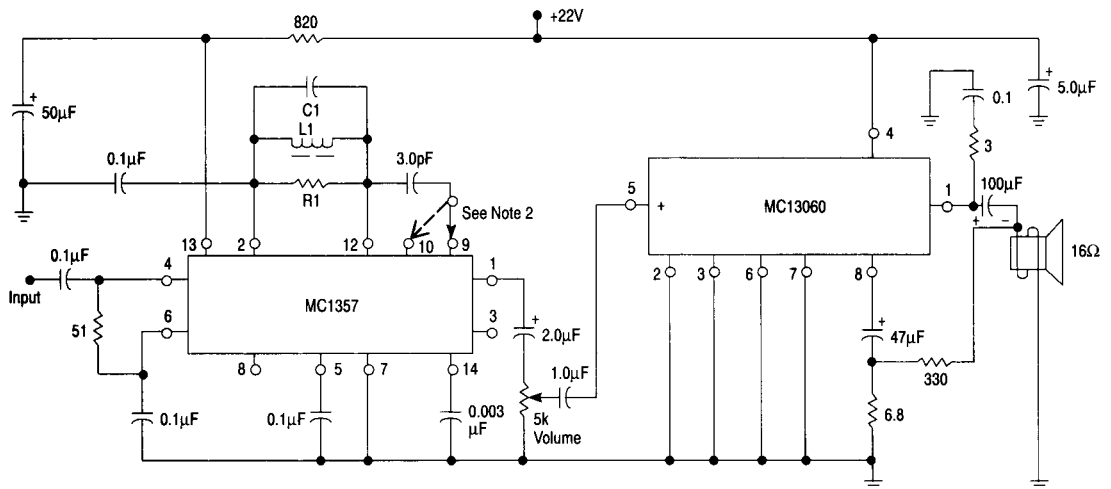
IF AMPLIFIER WITH QUADRATURE DETECTOR

SILICON MONOLITHIC INTEGRATED CIRCUIT

- A Direct Replacement for the ULN211A
- Greatly Simplified FM Demodulator Alignment
- Excellent Performance at V_{CC} = 8.0 Vdc

P SUFFIX
PLASTIC PACKAGE
CASE 646

14
1

Figure 1. TV Typical Application Circuit

Typical Performance
2.0 W Output
2% Distortion
250 μV Sensitivity (3 dB Lim.)

C1 = 120 pF
L1 = 14 μH
R1 = 20 kΩ
Q = 30

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MAXIMUM RATINGS (T$_A$ = +25°C, unless otherwise noted.)

Rating	Value	Unit
Power Supply Voltage	16	Vdc
Input Voltage (Pin 4)	3.5	Vp
Power Dissipation (Package Limitation) Plastic Package Derate above T$_A$ = +25°C	625 5.0	mW mW/°C
Operating Temperature Range (Ambient)	0 to +70	°C
Storage Temperature Range	−65 to +150	°C

ELECTRICAL CHARACTERICISTICS (V$_{CC}$ = 12 Vdc, T$_A$ = +25°C, unless otherwise noted.)

Characteristics		Pin	Min	Typ	Max	Unit
Drain Current	V$_{CC}$ = 8.0 V V$_{CC}$ = 12 V	13	10 —	12 15	19 21	mA
Amplifier Input Reference Voltage		6	—	1.45	—	Vdc
Detector Input Reference Voltage		2	—	3.65	—	Vdc
Amplifier High Level Output Voltage		10	1.25	1.45	1.65	Vdc
Amplifier Low Level Output Voltage		9	—	0.145	0.2	Vdc
Detector Output Voltage	V$_{CC}$ = 8.0 V V$_{CC}$ = 12 V	1	— —	3.7 5.4	— —	Vdc
Amplifier Input Resistance		4	—	5.0	—	kΩ
Amplifier Input Capacitance		4	—	11	—	pF
Detector Input Resistance		12	—	70	—	kΩ
Detector Input Capacitance		12	—	2.7	—	pF
Amplifier Output Resistance		10	—	60	—	Ω
Detector Output Resistance		1	—	200	—	Ω
De-Emphasis Resistance		14	—	8.8	—	kΩ

DYNAMIC CHARACTERICISTICS FM Modulation Frequency = 1.0 kHz, Source Resistance = 50 Ω, T$_A$ = +25°C for all tests.

(V$_{CC}$ = 12 Vdc, f$_O$ = 4.5 MHz, Δf = ±25 kHz, Peak Separation = 150 kHz)

Characteristics	Pin	Min	Typ	Max	Unit
Amplifier Voltage Gain (V$_{in}$ ≤ 50 μV[rms])	10	—	60	—	dB
AM Rejection* (V$_{in}$ = 10 mV[rms])	1	—	36	—	dB
Input Limiting Threshold Voltage	4	—	250	—	μVrms
Recovered Audio Output Voltage (V$_{in}$ = 10 mV[rms])	1	—	0.72	—	Vrms
Output Distortion (V$_{in}$ = 10 mV[rms])	1	—	3.0	—	%

(V$_{CC}$ = 12 Vdc, f$_O$ = 5.5 MHz, Δf = ±50 kHz, Peak Separation = 260 kHz)

Characteristics	Pin	Min	Typ	Max	Unit
Amplifier Voltage Gain (V$_{in}$ ≤ 50 μV[rms])	10	—	60	—	dB
AM Rejection* (V$_{in}$ = 10 mV[rms])	1	—	40	—	dB
Input Limiting Threshold Voltage	4	—	250	—	μVrms
Recovered Audio Output Voltage (V$_{in}$ = 10 mV[rms])	1	—	1.2	—	Vrms
Output Distortion (V$_{in}$ = 10 mV[rms])	1	—	5.0	—	%

(V$_{CC}$ = 8.0 Vdc, f$_O$ = 10.7 MHz, Δf = ±75 kHz, Peak Separation = 550 kHz)

Characteristics	Pin	Min	Typ	Max	Unit
Amplifier Voltage Gain (V$_{in}$ ≤ 50 μV[rms])	10	—	53	—	dB
AM Rejection* (V$_{in}$ = 10 mV[rms])	1	—	37	—	dB
Input Limiting Threshold Voltage	4	—	600	—	μVrms
Recovered Audio Output Voltage (V$_{in}$ = 10 mV[rms])	1	—	0.3	—	Vrms
Output Distortion (V$_{in}$ = 10 mV[rms])	1	—	1.4	—	%

(V$_{CC}$ = 12 Vdc, f$_O$ = 10.7 MHz, Δf = ±75 kHz, Peak Separation = 550 kHz)

Characteristics	Pin	Min	Typ	Max	Unit
Amplifier Voltage Gain (V$_{in}$ ≤ 50 μV[rms])	10	—	53	—	dB
AM Rejection* (V$_{in}$ = 10 mV[rms])	1	—	45	—	dB
Input Limiting Threshold Voltage	4	—	600	—	μVrms
Recovered Audio Output Voltage (V$_{in}$ = 10 mV[rms])	1	—	0.48	—	Vrms
Output Distortion (V$_{in}$ = 10 mV[rms])	1	—	1.4	—	%

NOTE: *100% FM, 30% AM Modulation
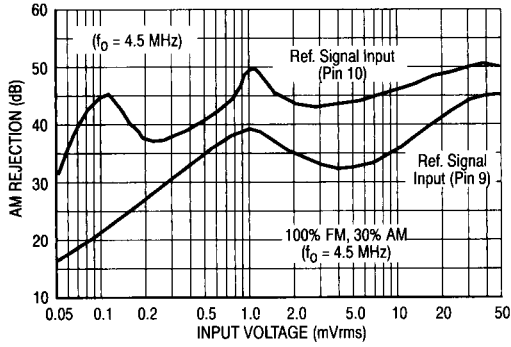
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Figure 2. AM Rejection
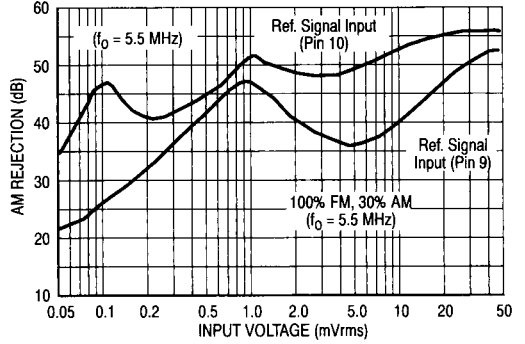

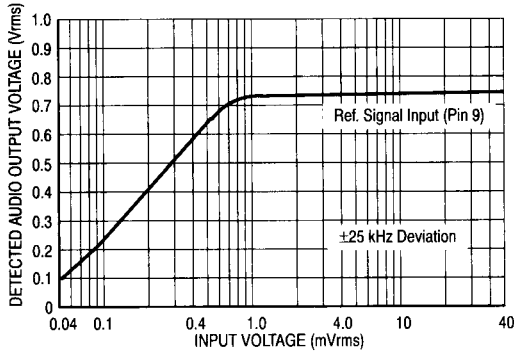**Figure 3. AM Rejection**
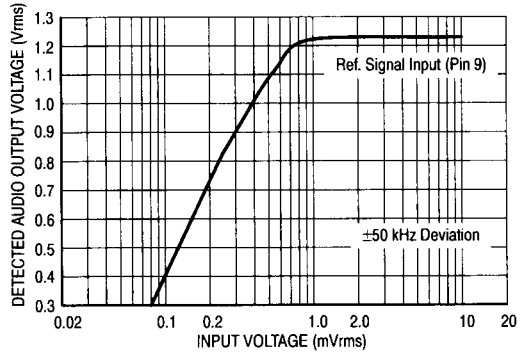

Figure 4. Detected Audio Output

Figure 5. Detected Audio Output

Figure 6. Detector Transfer Characteristic
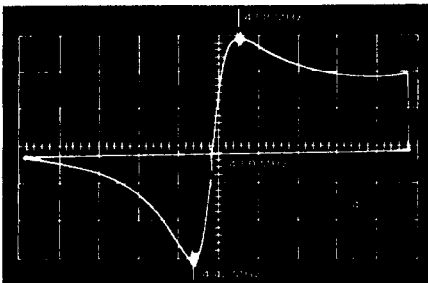
Figure 7. Detector Transfer Characteristic
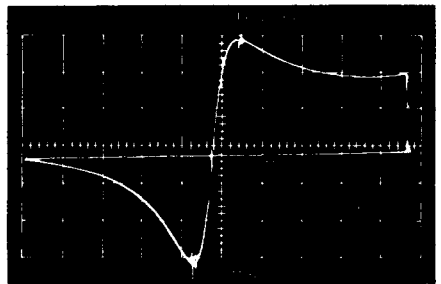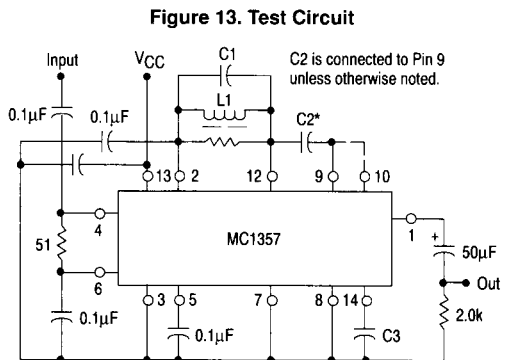
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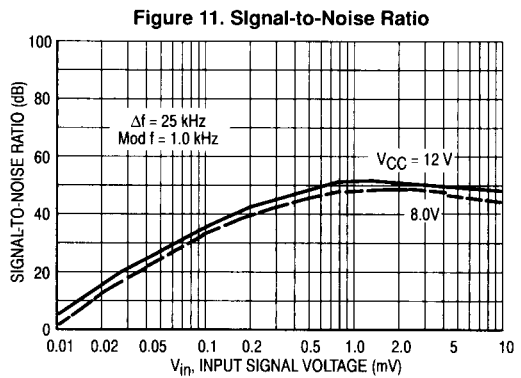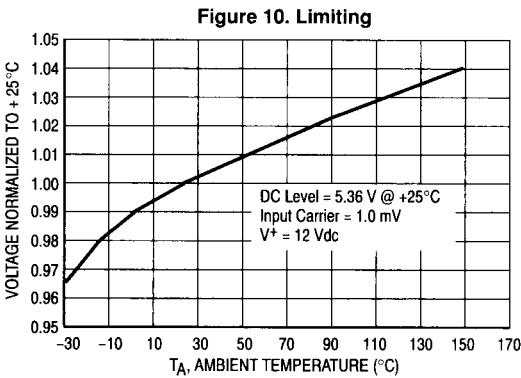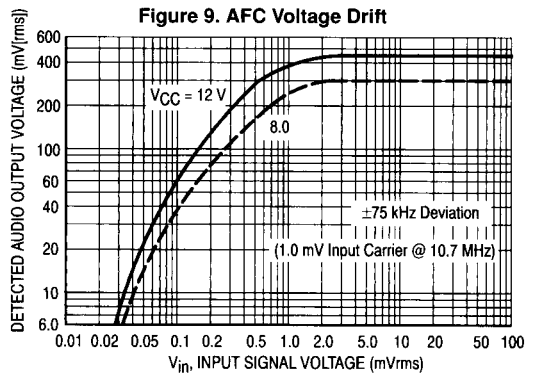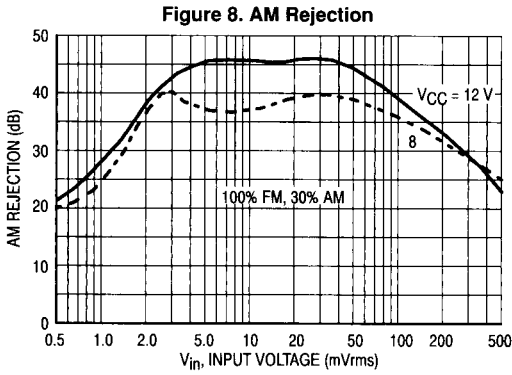**TYPICAL CHARACTERISITICS** (continued)
(f_O = 10.7 MHz, T_A = +25°C, unless otherwise noted.)
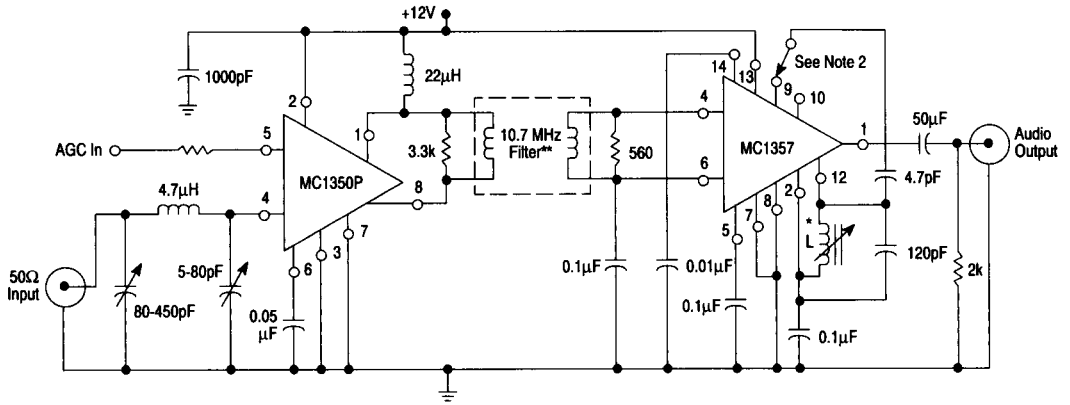(Use Test Circuit of Figure 13)

Figure 8. AM Rejection

AM REJECTION (dB) vs V_{in}, INPUT VOLTAGE (mVrms)
V_{CC} = 12 V
100% FM, 30% AM

Figure 9. AFC Voltage Drift

DETECTED AUDIO OUTPUT VOLTAGE (mV(rms)) vs V_{in}, INPUT SIGNAL VOLTAGE (mVrms)
V_{CC} = 12 V
8.0
±75 kHz Deviation
(1.0 mV Input Carrier @ 10.7 MHz)

Figure 10. Limiting

VOLTAGE NORMALIZED TO + 25°C vs T_A, AMBIENT TEMPERATURE (°C)
DC Level = 5.36 V @ +25°C
Input Carrier = 1.0 mV
V+ = 12 Vdc

Figure 11. Signal-to-Noise Ratio

SIGNAL-TO-NOISE RATIO (dB) vs V_{in}, INPUT SIGNAL VOLTAGE (mV)
Δf = 25 kHz
Mod f = 1.0 kHz
V_{CC} = 12 V
8.0V

Figure 12. Detector Transfer Characteristic

OUTPUT VOLTAGE (V) vs f, FREQUENCY (MHz)
V+ = 12 V
Input 1.0 mVrms

Figure 13. Test Circuit

C2 is connected to Pin 9 unless otherwise noted.

COMPONENT VALUES

f	L1	C1	R1	Q(R1,L1)	C2	C3
MHz	μH	pF	kΩ		pF	μF
4.5	14	120	20	30	3.0	0.003
5.5	8.0	100	20	30	3.0	0.003
10.7	2.0	120	3.9	20	4.7	0.01

MOTOROLA LINEAR/INTERFACE ICs DEVICE DATA

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Figure 14. FM Radio Typical Application Circuit

Note 1:
   Information shown in Figures 15, 16, and 17 was obtained using the circuit of Figure 14.

Note 2:
   Optional input to the quadrature coil may be from either Pin 9 or Pin 10 in the application shown. Pin 9 has commonly been used on this type of part to avoid overload with various tuning techniques. For this reason, Pin 9 is used in tests on the preceding pages (except as noted). However, a significant improvement of limiting sensitivity can be obtained using Pin 10, see Figure 17, and no overload problems have been incurred with this tuned circuit configuration.
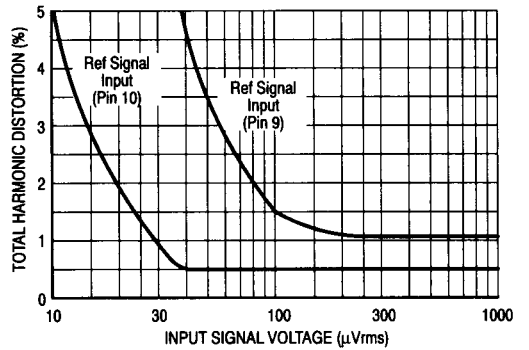
Figure 15. Output Distortion

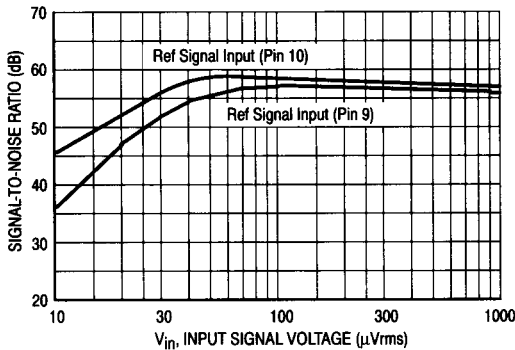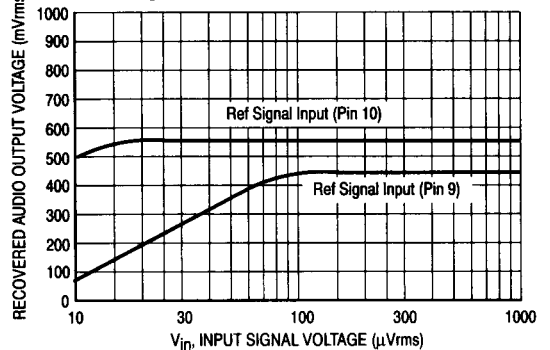## Figure 16. Signal-to-Noise Ratio

Figure 17. Recovered Audio Output

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Figure 18. Circuit Schematic