National Semiconductor

September 1992

LM3089 FM Receiver IF System

General Description

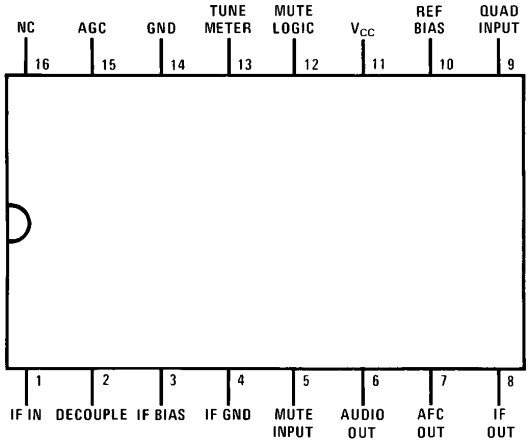
The LM3089 has been designed to provide all the major functions required for modern FM IF designs of automotive, high-fidelity and communications receivers.

Features

- Three stage IF amplifier/limiter provides 12 μV (typ) −3 dB limiting sensitivity
- Balanced product detector and audio amplifier provide 400 mV (typ) of recovered audio with distortion as low as 0.1% with proper external coil designs.
- Four internal carrier level detectors provide delayed AGC signal to tuner, IF level meter drive current and interchannel mute control
- AFC amplifier provides AFC current for tuner and/or center tuning meters
- Improved operating and temperature performance, especially when using high Q quadrature coils in narrow band FM communications receivers
- No mute circuit latchup problems
- A direct replacement for CA3089E

Connection Diagram

Dual-In-Line Package



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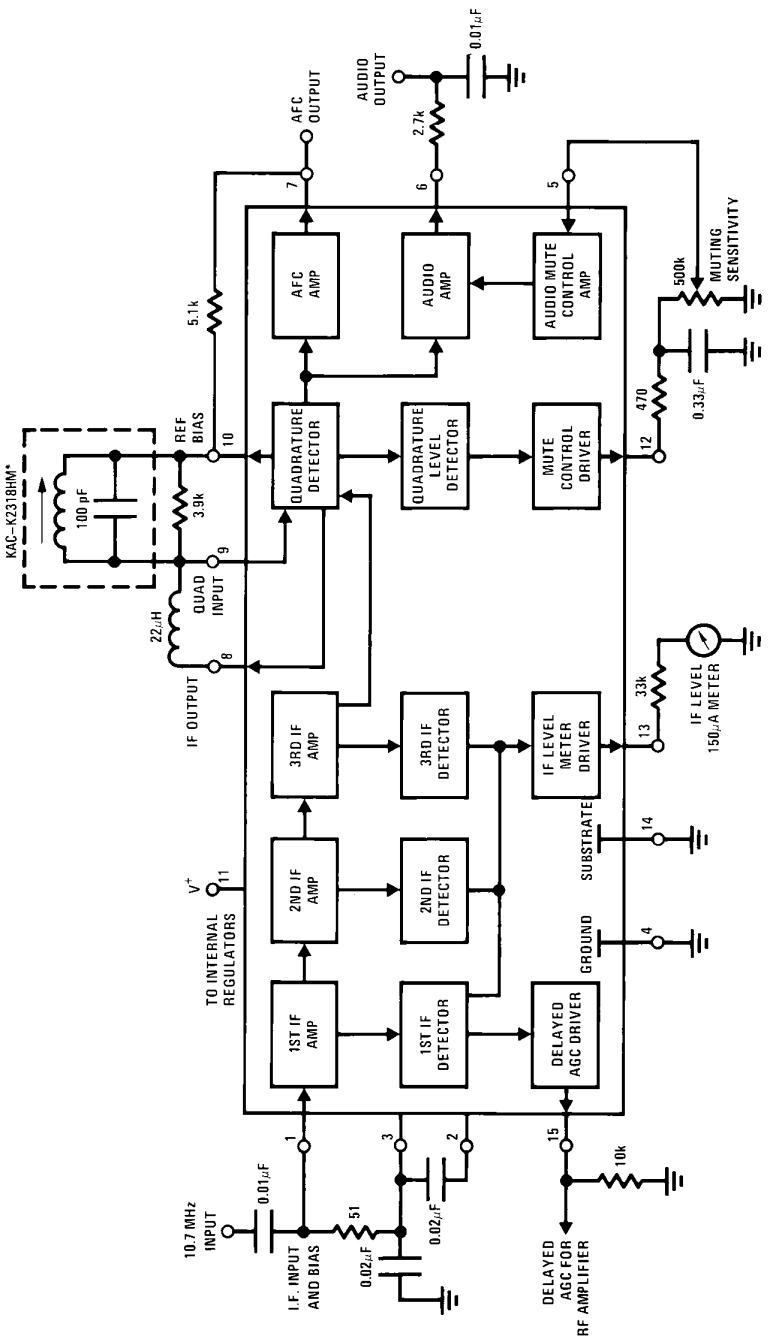
Top View

Order Number LM3089N
See NS Package Number N16E

  RRD-B30M115/Printed in U. S. A.

Block Diagram



Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage Between Pin 11 and Pins 4, 14	+16V
DC Current Out of Pin 12	5 mA
DC Current Out of Pin 13	5 mA
DC Current Out of Pin 15	2 mA
Power Dissipation (Note 2)	1500 mW
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	260°C

Electrical Characteristics (T_A = 25°C, V_{CC} = +12V, see Test Circuit)

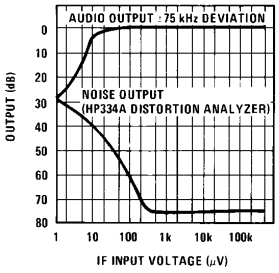
Symbol	Parameter	Conditions	Min	Typ	Max	Units
DC CHARACTERISTICS (V_{IN} = 0, NOT MUTED)						
I_{11}	Supply Current		16	23	30	mA
V1, 2, 3	IF Input and Bias		1.2	1.9	2.4	V
V6	Audio Output		5.0	5.6	6.0	V
V7	AFC Output		5.0	5.6	6.0	V
V10	Reference Bias		5.0	5.6	6.0	V
V12	Mute Control		5.0	5.4	6.0	V
V13	IF Level			0	0.5	V
V15	Delayed AGC		4.2	4.7	5.3	V
DYNAMIC CHARACTERISTICS f_o = 10.7 MHZ, Δf = ±75 kHz @ 400 Hz						
V_{IN}(LIM)	Input Limiting −3 dB			12	25	μV
AMR	AM Rejection	V_{IN} = 100 mV, AM: 30%	45	55		−dB
V_O(AF)	Recovered Audio	V_{IN} = 10 mV	300	400	500	mVrms
THD	Total Harmonic Distortion					
	Single Tuned (Note 1)	V_{IN} = 100 mV		0.5	1.0	%
	Double Tuned (Note 1)	V_{IN} = 100 mV		0.1	0.3	%
S+N/N	Signal to Noise Ratio	V_{IN} = 100 mV	60	70		dB
V12	Mute Control	V_{IN} = 100 mV		0	0.5	V
V13	IF Level	V_{IN} = 100 mV	4.0	5.0	6.0	V
V13	IF Level	V_{IN} = 500 μV	1.0	1.5	2.0	V
V15	Delayed AGC	V_{IN} = 100 mV		0.1	0.5	V
V15	Delayed AGC	V_{IN} = 30 mV		2.5		V
V_O(AF)	Audio Muted	V_{IN} = 100 mV, V5 = +2.5V		60		−dB

Note 1: Distortion is a function of quadrature coil used.

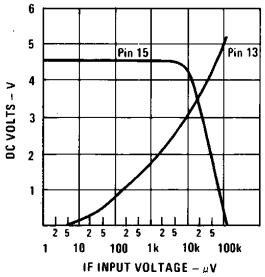
Note 2: For operation in ambient temperatures above 25°C, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance of 80°C/W junction to ambient.

Typical Performance Characteristics

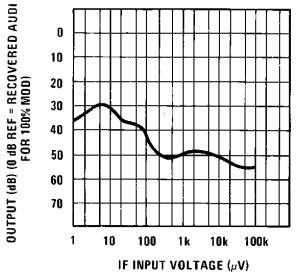
Typical S + N/N and IF Limiting Sensitivity vs IF Input Signal



Typical AGC (Pin 15) and Meter Output (Pin 13) vs IF Input Signal



AM Rejection (30% Mod) vs IF Input Signal



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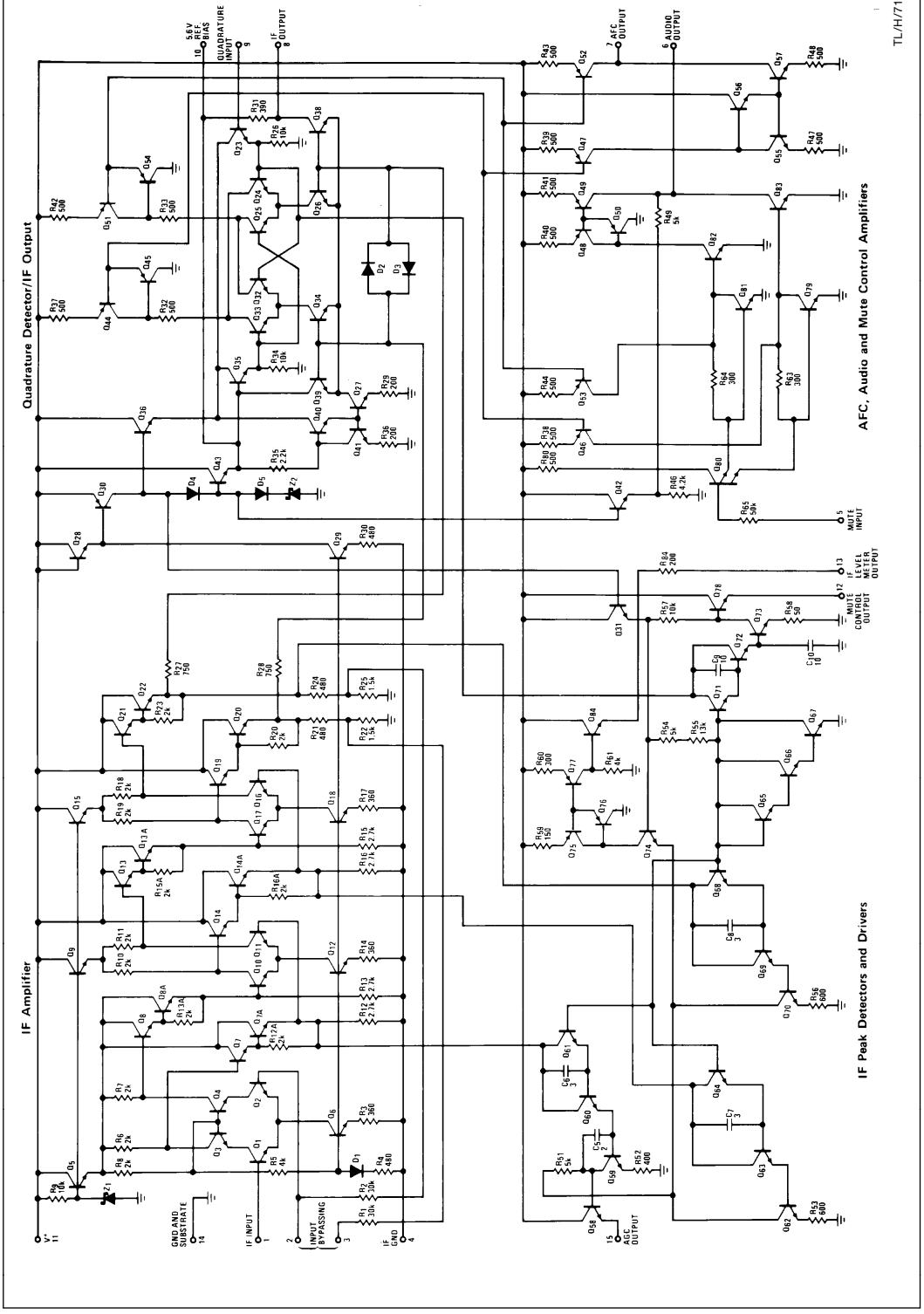
Schematic Diagram



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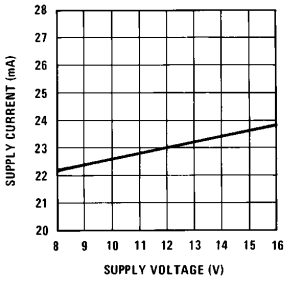
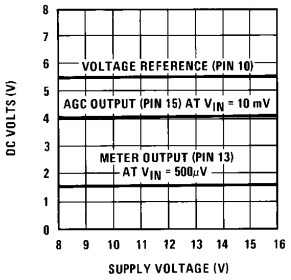
Typical Performance Characteristics

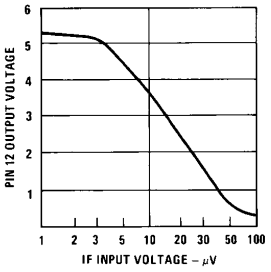
Supply Current (I_{11}) vs Supply Voltage (V11)



Reference Voltage, AGC and Meter Output vs Supply Voltage



Mute Control Output (Pin 12) vs IF Input Signal



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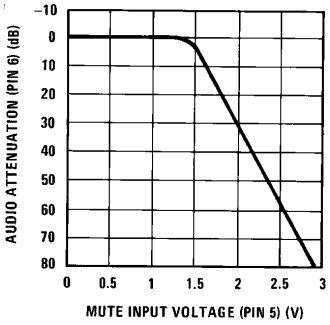
Typical Audio Attenuation (Pin 6) vs Mute Input Voltage (Pin 5)



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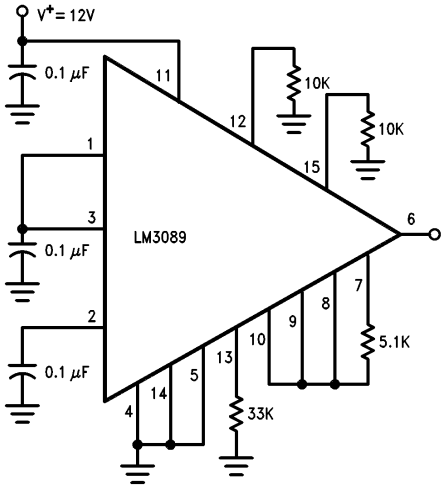
DC Test Circuit



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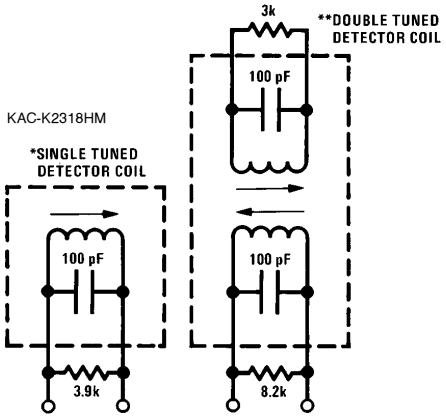
AC Test Circuit



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*For single tuned dectector coil:
L_O tunes with 100 pF at 10.7 MHz
Q_{UL} (unloaded) ≅ 75
Q_L (loaded) ≅ 13 for V9 ≅ 150 mVrms

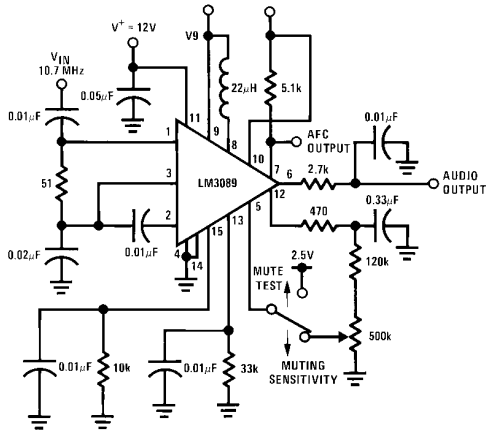
**For double tuned detector coil:
$Q_{ULPRI} = Q_{ULSEC}$ ≅ 75
kQ ≅ 0.7 for V9 ≅ 150 mVrms

Note:

The recovered audio output voltage will be approximately 0.5 dB less when using the double tuned detector coil.

For proper operation of the mute circuit, the RF voltage at pin 9 should be 150 mVrms ±30 mV.

AC Test Circuit (Continued)



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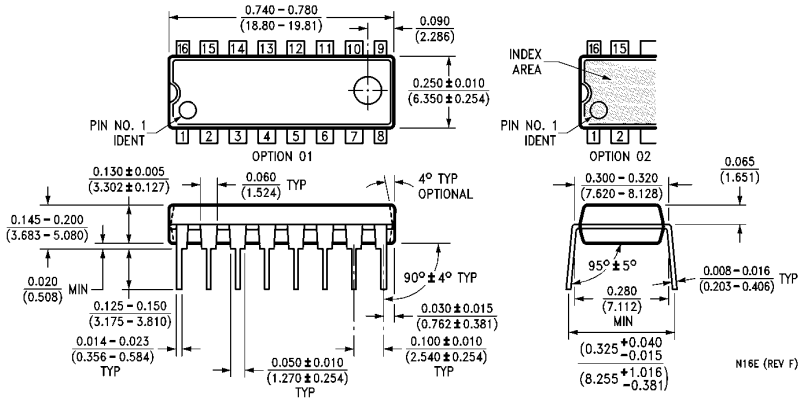
Physical Dimensions inches (millimeters)



Dual-In-Line Package (N)
Order Number LM3089N
See NS Package Number N16E

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