

LM3089 FM Receiver IF System

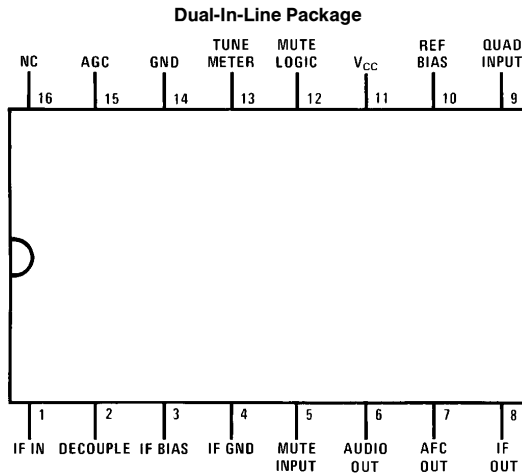
General Description

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

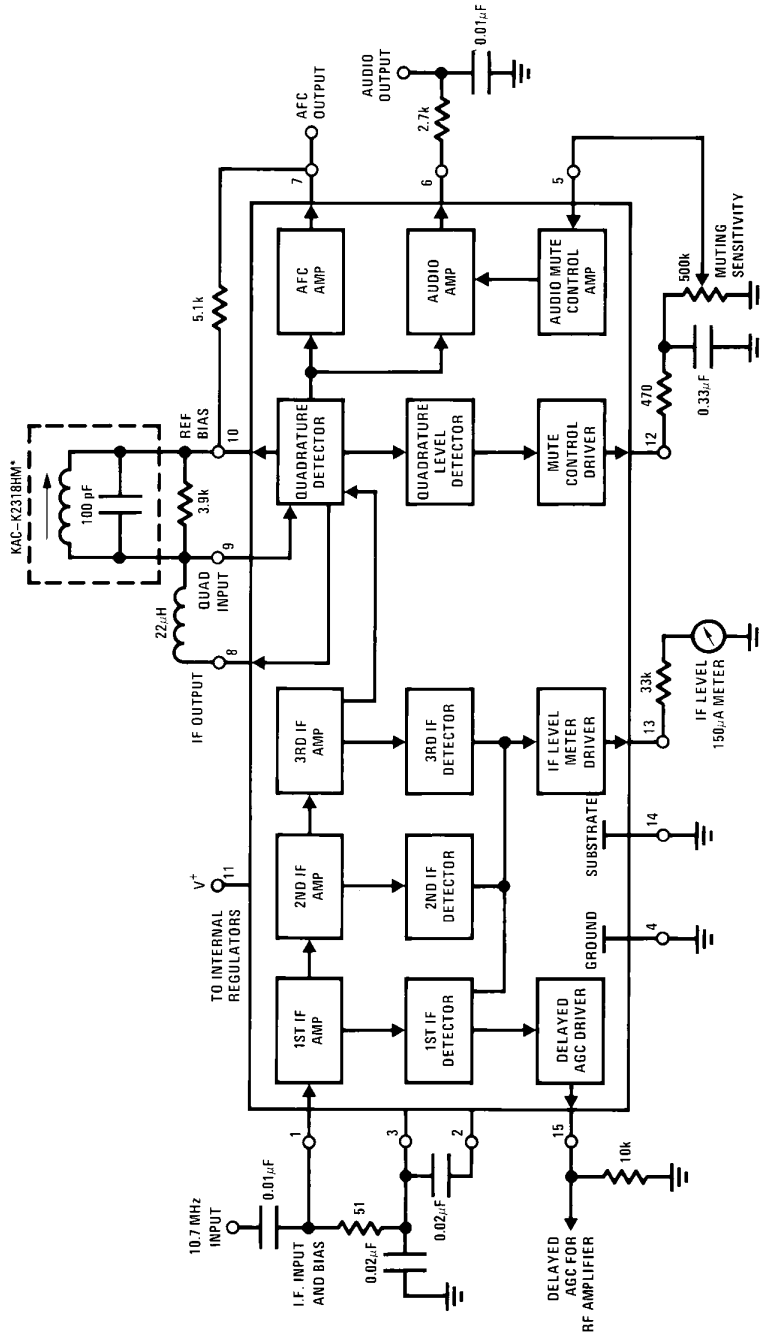


TL/H/7149-2

Top View

Order Number LM3089N
See NS Package Number N16E

Block Diagram



TL/H7149-1

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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)

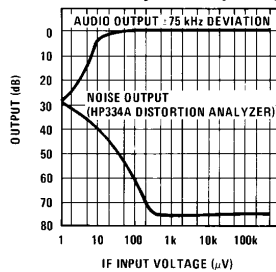
Symbol	Parameter	Conditions	Min	Typ	Max	Units
DC CHARACTERISTICS (V_{IN} = 0, NOT MUTED)						
I ₁₁	Supply Current		16	23	30	mA
V _{1, 2, 3}	IF Input and Bias		1.2	1.9	2.4	V
V ₆	Audio Output		5.0	5.6	6.0	V
V ₇	AFC Output		5.0	5.6	6.0	V
V ₁₀	Reference Bias		5.0	5.6	6.0	V
V ₁₂	Mute Control		5.0	5.4	6.0	V
V ₁₃	IF Level			0	0.5	V
V ₁₅	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
V ₁₂	Mute Control	V _{IN} = 100 mV		0	0.5	V
V ₁₃	IF Level	V _{IN} = 100 mV	4.0	5.0	6.0	V
V ₁₃	IF Level	V _{IN} = 500 μV	1.0	1.5	2.0	V
V ₁₅	Delayed AGC	V _{IN} = 100 mV		0.1	0.5	V
V ₁₅	Delayed AGC	V _{IN} = 30 mV		2.5		V
V _O (AF)	Audio Muted	V _{IN} = 100 mV, V ₅ = +2.5V		60		-dB

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

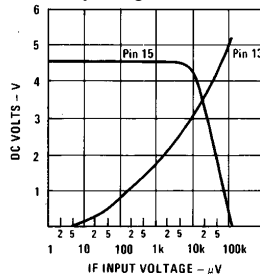
Note 2: For operation in ambient temperatures above 25°C, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance of 80°C/W junction to ambient.

Typical Performance Characteristics

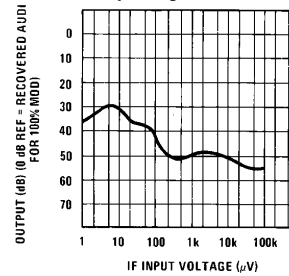
Typical S + N/N and IF Limiting Sensitivity vs IF Input Signal



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

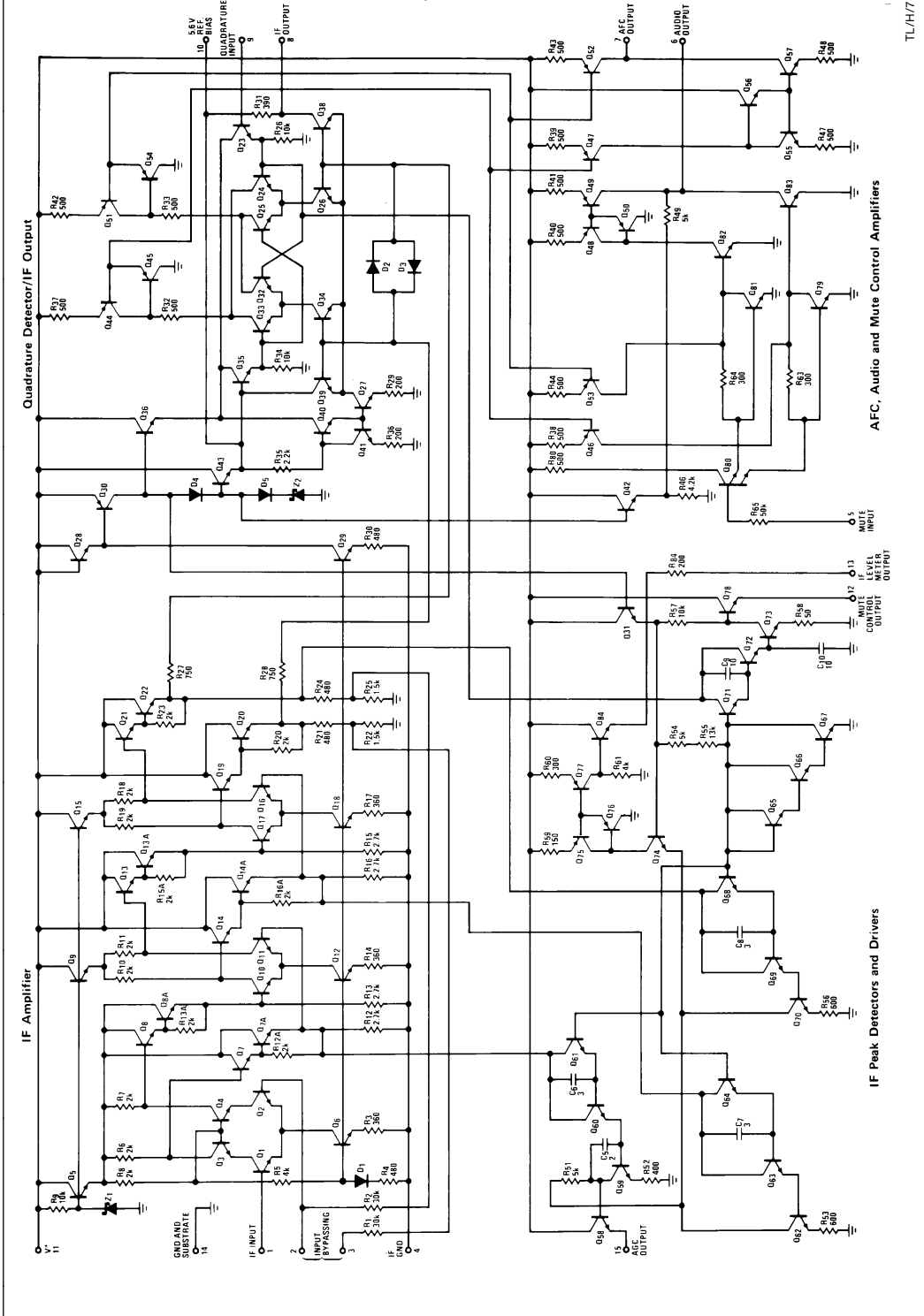


AM Rejection (30% Mod) vs IF Input Signal



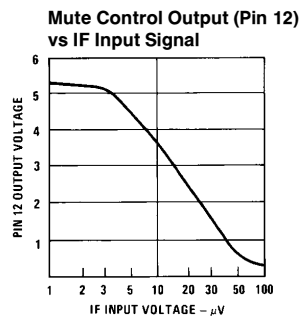
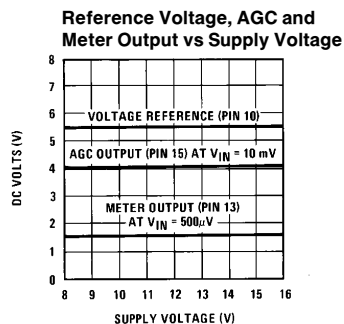
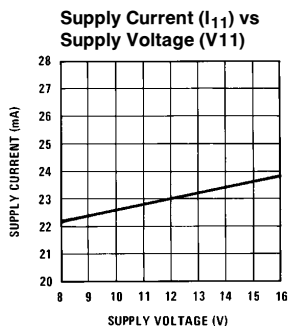
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Schematic Diagram



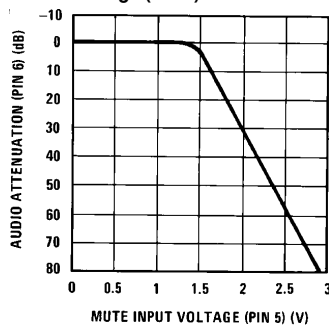
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Typical Performance Characteristics



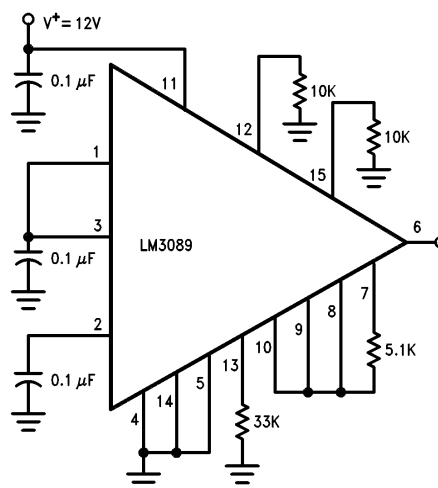
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Typical Audio Attenuation (Pin 6) vs Mute Input Voltage (Pin 5)



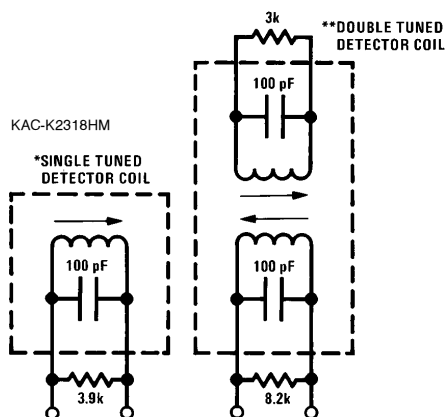
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DC Test Circuit



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AC Test Circuit



*For single tuned detector coil:
 L_0 tunes with 100 pF at 10.7 MHz
 Q_{UL} (unloaded) ≈ 75
 Q_L (loaded) ≈ 13 for $V_9 \approx 150\text{ mVrms}$

**For double tuned detector coil:
 $Q_{ULPRI} = Q_{ULSEC} \approx 75$
 $kQ \approx 0.7$ for $V_9 \approx 150\text{ mVrms}$

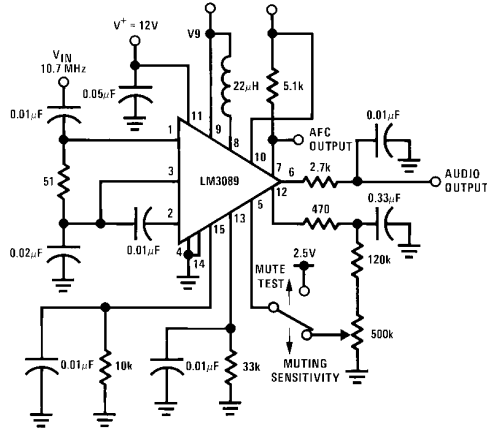
Note:

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 $\pm 30\text{ mV}$.

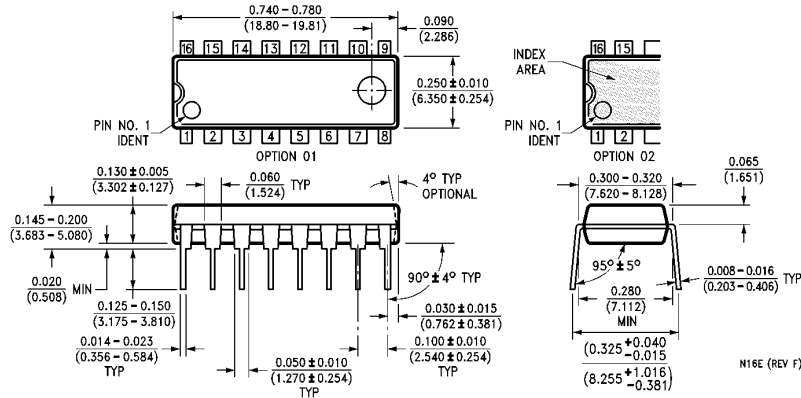
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AC Test Circuit (Continued)



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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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