CA3088E

AM Receiver Subsystem

Includes: AM Converter, IF Amplifiers, Detector and Audio Preamplifier

For Applications in a Variety of AM Broadcast and Communications Receivers and Applications Requiring an Array of Amplifiers

Features:

- **Excellent overload characteristics**
- **AGC for IF amplifier**
- **Buffered output signal for tuning meter**
- **Internal Zener diode provides voltage regulation**
- **Two IF amplifier stages**
- **Low-noise converter and first IF amplifier**
- **Low harmonic distortion (THD)**
- **Delayed AGC for RF amplifier**
- **Terminals for optional inclusion of tone control**
- **Operates from wide range of power supplies: V^+ = 6 to 16 volts**
- **Optional AC and/or DC feedback on wide-band amplifier**
- **Array of amplifiers for general-purpose applications**
- **Suitable for use with optional external RF stage, either MOS or bipolar**

RCA-CA3088E*, a monolithic integrated circuit, is an AM subsystem that provides the converter, IF amplifier, detector, and audio preamplifier stages for an AM receiver.

The CA3088E also provides internal AGC for the first IF amplifier stage, delayed AGC for an optional external RF amplifier, a buffer stage to drive a tuning meter, and terminals facilitating the optional use of a tone control.

Fig. 2 is a functional diagram of the CA3088E. The signal from the low-noise converter is applied to the first IF amplifier and is then coupled to the second IF amplifier. This IF signal is then detected and externally filtered. The resultant audio signal is applied to an audio preamplifier. Optionally, a tone control circuit may be connected at the junction of the detector circuit and the audio preamplifier. The gain of the first IF amplifier stage is controlled by an internal AGC circuit. The CA3088E supplies a delayed AGC signal output for use with an external RF amplifier. A buffered output signal is also available for driving a tuning meter. A DC voltage, internally regulated by a Zener diode, supplies the second IF amplifier, the AGC and tuning meter circuits and may also be used with any other stage.

The CA3088E features four independent transistor amplifiers, each incorporating internal biasing for temperature tracking. These amplifiers are particularly useful in general-purpose amplifier, oscillator, and detector applications in a wide variety of equipment designs.

*Formerly Developmental Type TA5842.

MAXIMUM RATINGS, *Absolute Maximum Values, at T_A = 25°C*

DC SUPPLY VOLTAGE:		
Across Term. 5 and Terms. 3, 6, 13, 16, respectively	16	V
DC CURRENT:		
At Terms. 3, 6, 13, 16, respectively	10	mA
At Term. 10	30	mA
DEVICE DISSIPATION:		
Up to T_A = 50°C	760	mW
Above T_A = 50°C	derate linearly 7.6	mW/°C
AMBIENT TEMPERATURE RANGE:		
Operating	−55 to +125	°C
Storage	−65 to +150	°C
LEAD TEMPERATURE (During soldering):		
At distance not less than 1/32" (0.79 mm) from case for 10 seconds max.	+265	°C

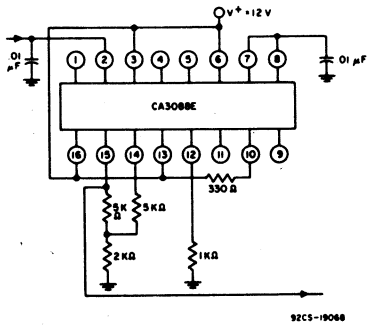


Fig.1—Test circuit for DC characteristics.

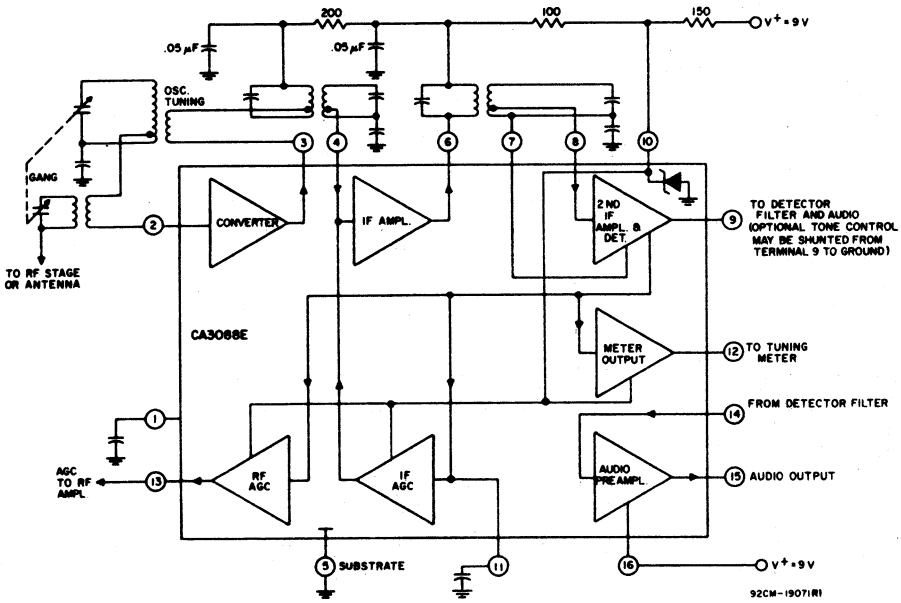


Fig.2—Functional block diagram of the CA3088E.

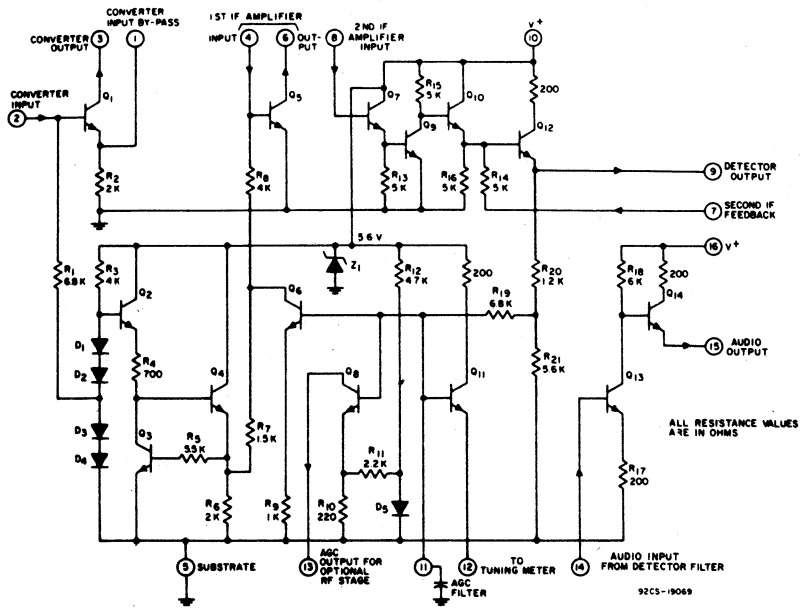


Fig.3—Schematic diagram of the CA3088E.

CA3088E

TYPICAL ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITIONS T_A = 25°C, V+ = 12 V	TEST CIRCUIT FIG. NO.	TYPICAL VALUES	UNITS
Static (DC) Characteristics					
DC Voltages:					
Terms. 1, 4, 9, 11	$V_{1,4,9,11}$		1	0.7	V
Terms. 2, 7, 8	$V_{2,7,8}$			1.4	V
Term. 10	V_{10}			5.6	V
Term. 12	V_{12}			0	V
Term. 15	V_{15}			3.5	V
DC Current:					
Term. 3	I_3		1	0.35	mA
Term. 6	I_6			1.0	mA
Term. 10	I_{10}			20	mA
Term. 13	I_{13}			0	mA
Term. 16	I_{16}			1.2	mA
Dynamic Characteristics					
Detector Output		30% Modulation	4	75	mV RMS
Audio Amplifier Gain	A_{AF}	f = 1 kHz	4	30	dB
Audio Distortion		V_{OUT} = 100 mV	4	0.2	%
Sensitivity:		f_{IN} = 1 MHz			
At Converter Stage Input		Signal-to-Noise Ratio (S/N) = 20 dB	2	200	μV/m
At RF Stage Input			4	100	μV/m
Total Harmonic Distortion	THD	30% Modulation	4	1.0	%
Input Resistance:	R_I				
At Transistor Q1				3500	Ω
At Transistor Q5		No AGC,		2000	Ω
Input Capacitance:	C_I				
At Transistor Q1		Input signal frequency		12	pF
At Transistor Q5		(f_{IN}) = 1 MHz		17	pF
Feedback Capacitance:	C_{FB}				
At Transistor Q1				1.5	pF
At Transistor Q5				1.5	pF

The typical characteristics for the CA3088E are intended for guidance purposes in evaluating this device for equipment design.

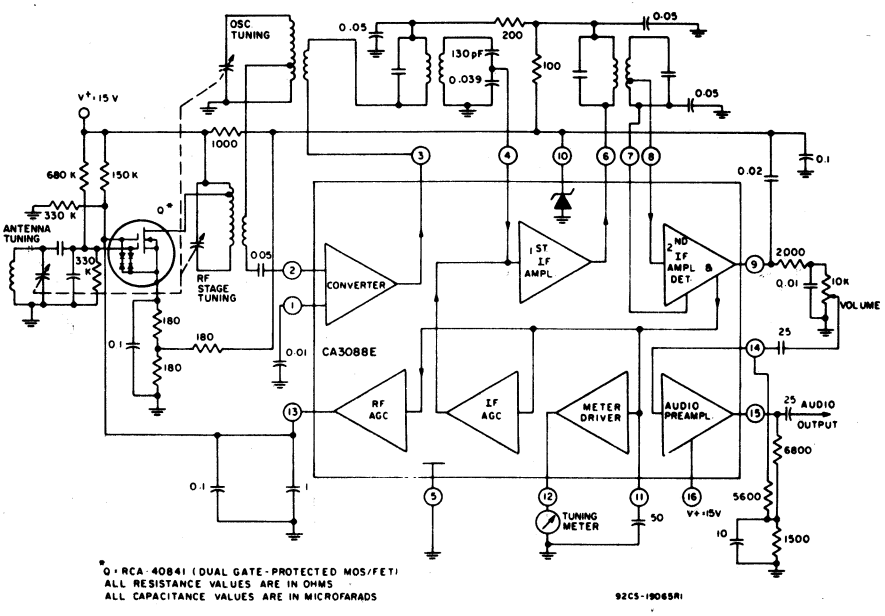


Fig.4—Typical AM broadcast receiver using the CA3088E with optional RF amplifier stage.

CA3089E

FM IF System

Includes———IF Amplifier, Quadrature Detector, AF Preamplifier, and Specific Circuits for AGC, AFC, Muting (Squelch), and Tuning Meter

For FM IF Amplifier Applications in High-Fidelity Automotive, and Communications Receivers

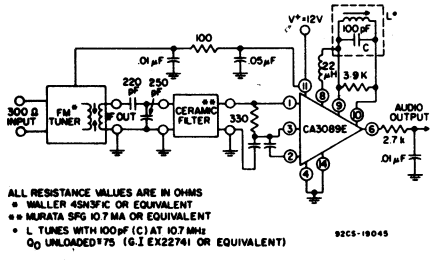
Features:

- **Exceptional limiting sensitivity: 12 μV typ. at −3 dB point**
- **Low distortion: 0.1% typ. (with double-tuned coil)**
- **Single-coil tuning capability**
- **High recovered audio: 400 mV typ.**
- **Provides specific signal for control of interchannel muting (squelch)**
- **Provides specific signal for direct drive of a tuning meter**
- **Provides delayed AGC voltage for RF amplifier**
- **Provides a specific circuit for flexible AFC**
- **Internal supply-voltage regulators**

RCA-CA3089E is a monolithic integrated circuit that provides all the functions of a comprehensive FM-IF system. Fig. 1 is a block diagram showing the CA3089E features, which include a three-stage FM-IF amplifier/limiter configuration with level detectors for each stage, a doubly-balanced quadrature FM detector and an audio amplifier that features the optional use of a muting (squelch) circuit.

The advanced circuit design of the IF system includes desirable deluxe features such as delayed AGC for the RF tuner, an AFC drive circuit, and an output signal to drive a tuning meter and/or provide stereo switching logic. In addition, internal power supply regulators maintain a nearly constant current drain over the voltage supply range of +8.5 to +16 volts.

The CA3089E is ideal for high-fidelity operation. Distortion in a CA3089E FM-IF System is primarily a function of the phase linearity characteristic of the outboard detector coil.



Performance data at f_0 = 98 MHz, f_{MOD} = 400 Hz, Deviation = ±75 kHz:

-3dB Limiting Sensitivity . . . . . 2μV (Antenna Level)
20dB Quieting Sensitivity . . . . . 1μV (Antenna Level)
30dB Quieting Sensitivity . . . . 1.5μV (Antenna Level)

Fig.2 - Typical FM tuner using the CA3089E with a single-tuned detector coil.

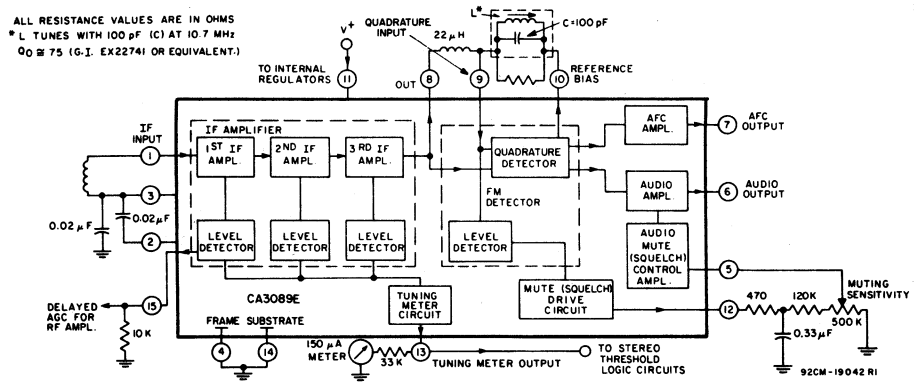


Fig.1-Block diagram of the CA3089E.

MAXIMUM RATINGS, *Absolute Maximum Values, at* $T_A = 25^oC$

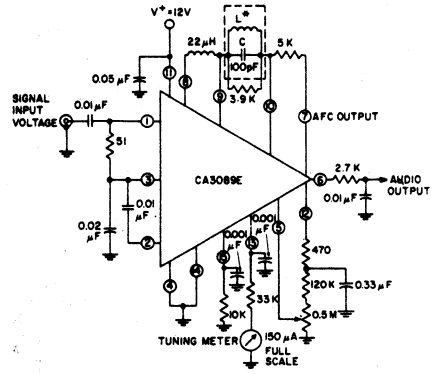
DC Supply Voltage:		
Between Terminals 11 and 4	16	V
Between Terminals 11 and 14	16	V
DC Current (out of Terminal 15)	2	mA
Device Dissipation:		
Up to $T_A = 60^oC$	600	mW
Above $T_A = 60^oC$	derate linearly 6.7 mW/°C	
Ambient Temperature Range:		
Operating	−55 to +125	°C
Storage	-65 to +150	°C
Lead Temperature (During Soldering):		
At distance not less than 1/32" (0.79mm) from case for 10 seconds max.	+265	°C

ELECTRICAL CHARACTERISTICS, at $T_A = 25^oC$, $V^+ = 12$ Volts

CHARACTERISTIC	SYMBOL	TEST CONDITIONS		Circuit Fig. No.	LIMITS Min.	Typ.	Max.	UNITS
Static (DC) Characteristics								
Quiescent Circuit Current	I_{11}	No signal input, Non muted		3, 4	16	23	30	mA
DC Voltages:								
Terminal 1 (IF Input)	V_1				1.2	1.9	2.4	V
Terminal 2 (AC Return to Input)	V_2				1.2	1.9	2.4	V
Terminal 3 (DC Bias to Input)	V_3				1.2	1.9	2.4	V
Terminal 6 (Audio Output)	V_6				5.0	5.6	6.0	V
Terminal 10 (DC Reference)	V_{10}				5.0	5.6	6.0	V
Dynamic Characteristics								
Input Limiting Voltage (-3 dB point)	V_I(lim)	–		3, 4	–	12	25	μV
AM Rejection (Term. 6)	AMR	V_{IN} = 0.1 V, AM Mod. = 30%	f_0 = 10.7 MHz,		45	55	–	dB
Recovered AF Voltage (Term. 6)	V_O(AF)				300	400	500	mV
Total Harmonic Distortion: *		V_{IN} = 0.1 V						
Single Tuned (Term. 6)	THD		$f_{mod.}$ = 400 Hz,	3	–	0.5	1.0	%
Double Tuned (Term. 6)	THD		Deviation = ±75 kHz	4	–	0.1	–	%
Signal plus Noise to Noise Ratio (Term. 6)	S + N/N			3, 4	60	67	–	dB

* THD characteristics are essentially a function of the phase characteristics of the network connected between terminals 8, 9, and 10.

CA3089E



ALL RESISTANCE VALUES ARE IN OHMS
*L: TUNES WITH 100 pF (C) AT 10.7 MHz
Q_0(UNLOADED) ≅ 75 (G.I. AUTOMATIC MFG. DIV. EX22741 OR EQUIVALENT)

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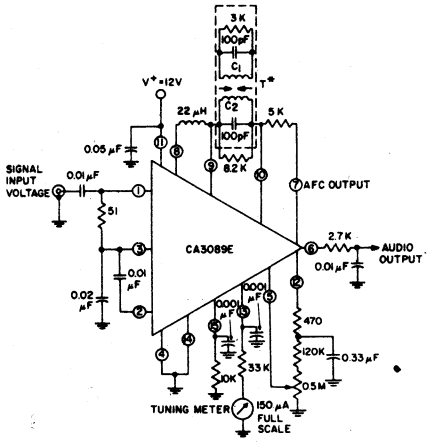
Fig.3-Test circuit for CA3089E using a single-tuned detector coil.



ALL RESISTANCE VALUES ARE IN OHMS
*T: PRI. – Q_0(UNLOADED) ≅ 75 (TUNES WITH 100 pF (C1) 20 t OF 34e ON 7/32" DIA. FORM
SEC. – Q_0(UNLOADED) ≅ 75 (TUNES WITH 100 pF (C2) 20 t OF 34e ON 7/32" DIA FORM
kQ (PER CENT OF CRITICAL COUPLING) ≅ 70 %
(ADJUSTED FOR COIL VOLTAGE V_C = 150 mV
ABOVE VALUES PERMIT PROPER OPERATION OF MUTE (SQUELCH) CIRCUIT
"E" TYPE SLUGS, SPACING 4mm

92CM-19041R1

Fig.4-Test circuit for CA3089E using a double-tuned detector coil.

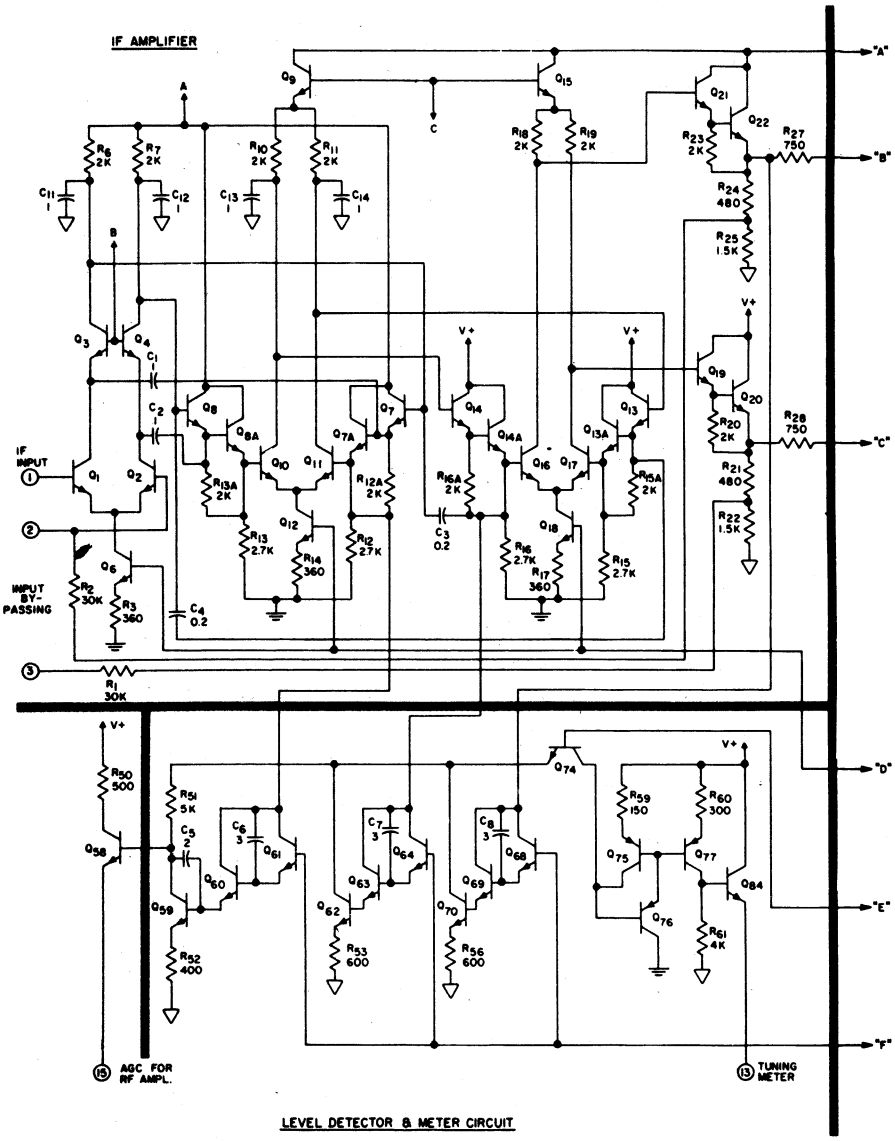


Fig.5 -Schematic diagram of the CA3089E.

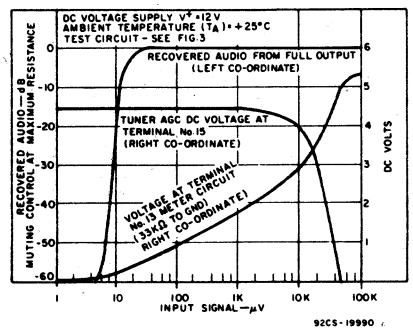


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Fig.6-Muting action, tuner AGC, and tuning meter output as a function of input signal voltage.

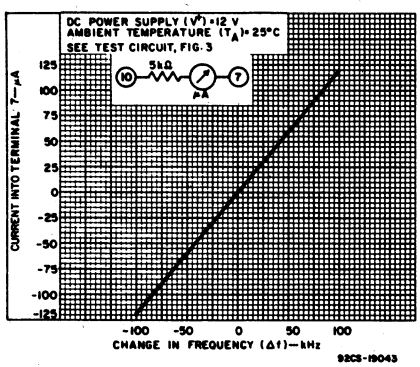

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Fig.7-AFC characteristics (current at Term. 7 as a function of change in frequency).

CA3089E

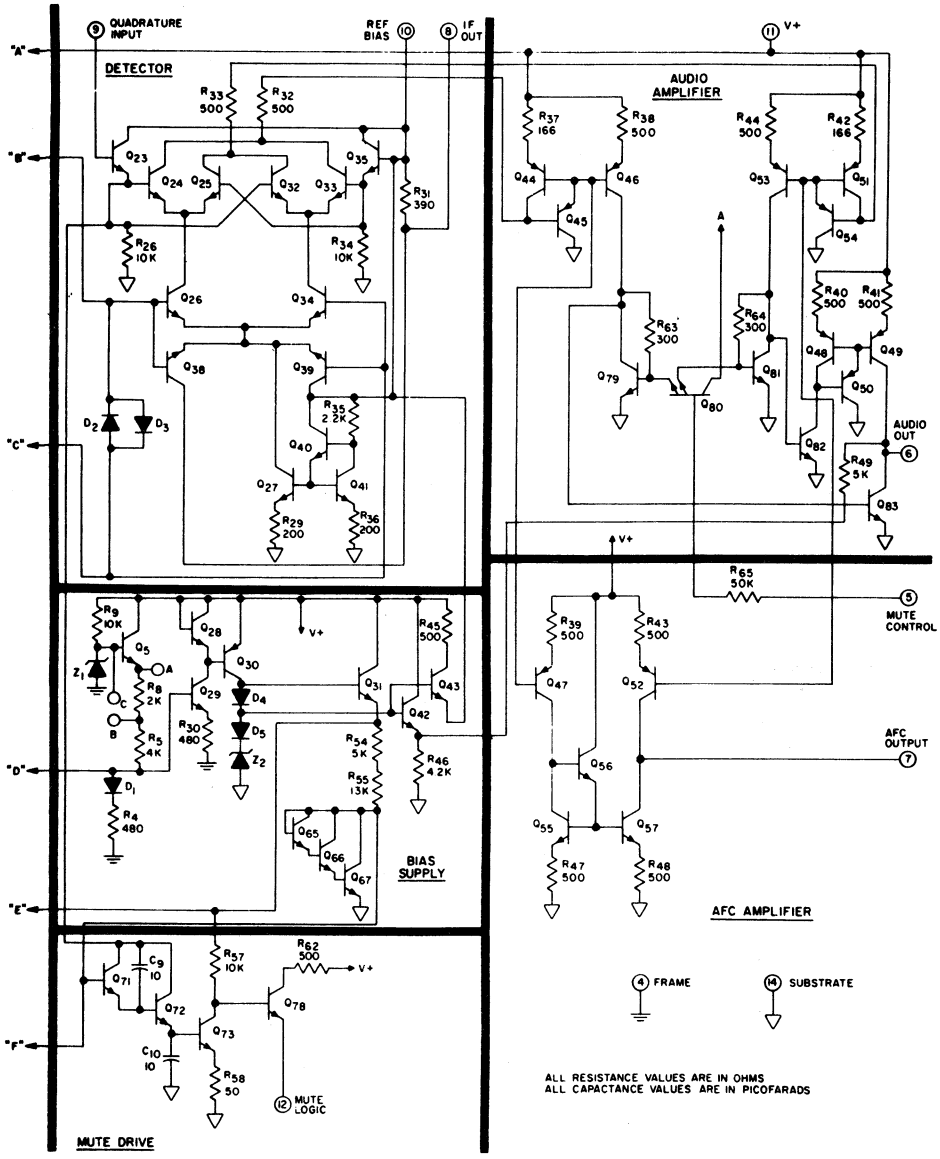
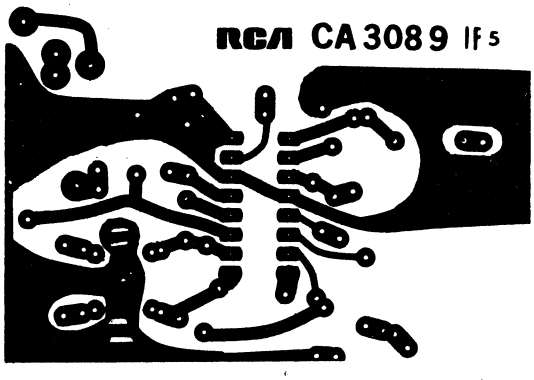


Fig.5 - Schematic diagram of the CA3089E.



a) Bottom view of printed-circuit board.

b) Component side — top view.

Fig.8-Actual size photographs of the CA3089E and outboard components mounted on a printed-circuit board.