CA3065

IF Amplifier-Limiter, FM Detector, Electronic Attenuator, Audio Driver

For Television Sound-System Applications

Features:

- *Electronic attenuator – replaces conventional volume control*
- *Differential peak detector – requires on single tuned coil*
- *Internal Zener diode regulated supply*
- *Inherent high stability*
- *Excellent AM rejection – 50 dB typ. at 4.5 MHz*
- *Low harmonic distortion*
- *High sensitivity – 200 μV limiting (knee) at 4.5 MHz*
- *Audio drive capability – 6 mA p-p*
- *Undistorted audio output voltage – 7 V p-p*

The RCA CA3065• Television Sound System is a monolithic integrated circuit which combines a multistage IF amplifier limiter, an FM detector, an electronic attenuator, a zener diode regulated power supply, and an audio amplifier-driver that is designed to directly drive an n-p-n power transistor or high-transconductance tube. Because the circuit is so inclusive, a minimum number of external components is required. A block diagram of the integrated circuit television sound system is shown in Fig. 1.

The CA3065 with its advanced circuit design provides a high-performance multistage subsystem for the sound system of a television receiver. A particular feature of the CA3065 is the electronic attenuator which performs the conventional volume control function. Volume control is accomplished when the bias levels in the attenuator are changed by means of a variable resistor connected between Terminal 6 and ground (attenuation in excess of 60 dB is attained). Because no audio signal is present in this control, hum or noise pickup can be bypassed. In most cases, only a single unshielded wire is required between the IF board and the variable resistor (volume control).

The CA3065 is supplied in the 14-lead dual-in-line plastic package (E suffix), in the 14-lead quad-in-line plastic package, and is also available in chip form.

•Formerly Dev. Type No. TA5814

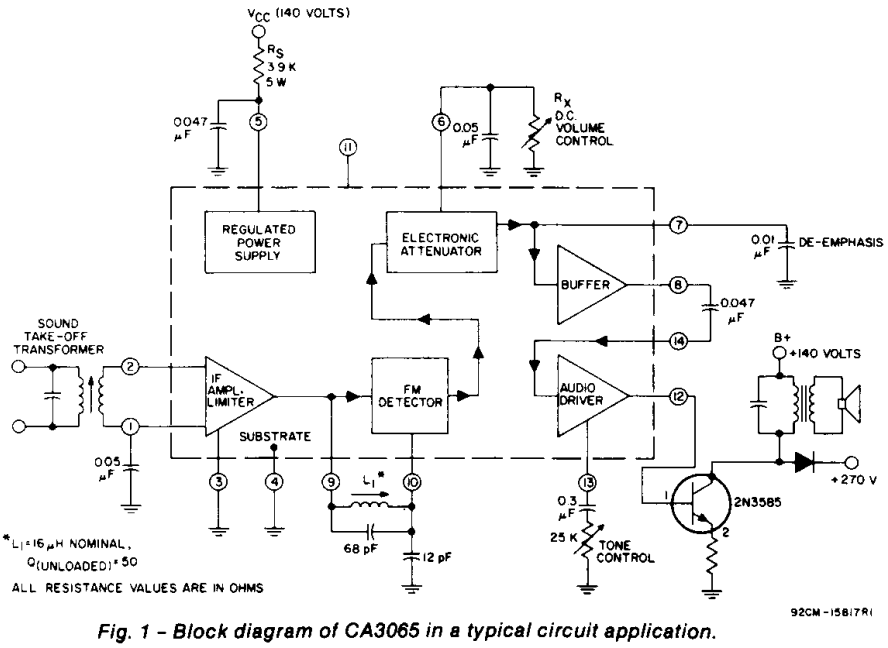

Fig. 1 – Block diagram of CA3065 in a typical circuit application.

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

Input Signal Voltage (between Terminals 1 and 2) . . .	±3	V
Power Supply Current (Terminal 5)	50	mA
Power Dissipation:		
Up to T_A = 25°C	850	mW
Above T_A = 25°C	Derate linearly 6.67	mW/°C
Ambient Temperature Range:		
Operating	−40 to +85	°C
Storage	−65 to +150	°C

MAXIMUM VOLTAGE RATINGS at T_A = 25°C

The following chart gives the range of voltages which can be applied to the terminals listed vertically with respect to the terminals listed horizontally. For example, the voltage range of the vertical terminal 9 with respect to terminal 3 is 0 to +4 volts.

TERMINAL No.	4	5	6	7	8	9	10	11	12	13	14	1	2	3
4		SUBSTRATE CONNECTION – ALWAYS CONNECT TO TERMINAL 3												
5			+13 0	+13 0	+13 0	*	*	INTERNAL CONNECTION DO NOT USE	+13 0	+13 0	*	*	*	NOTE 1
6				*	*	*	*		*	*	*	*	*	+13 −5
7					+1 −4	*	*		*	*	*	*	*	+13 0
8						*	*		*	*	*	*	*	*
9							*		*	*	*	*	*	+4 0
10									*	*	*	*	*	+4 −5
11									INTERNAL CONNECTION DO NOT USE					
12										+4 −1	*	*	*	*
13											*	*	*	*
14												*	*	+3 −5
1													+5 −5	+5 −5
2														+4 −5
3														

MAXIMUM CURRENT RATINGS

TERMINAL No.	I_{IN} mA	I_{OUT} mA
4	SUBSTRATE: CONNECT TO TERMINAL 3	
5	50	1
6	1	1
7	1	1
8	0.5	6
9	1	1
10	1	0.1
11	INT. CONN. DO NOT USE	
12	0.5	6
13	1	2
14	1	0.1
1	1	0.1
2	1	0.1
3	0.1	50

Note 1: Terminal No. 5 may be connected to any positive voltage through a suitable resistor provided that the current and dissipation ratings of the CA3065 are not exceeded.

*Voltages are not normally applied between these terminals. Voltages appearing between these terminals will be safe if specified limits between all other terminals are not exceeded.

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ELECTRICAL CHARACTERISTICS *at T_A = 25° C, V_{CC} = +140 V applied to Terminal 5 through R_S = 3.9 kΩ, and DC Volume Control (R_x) = 0 unless otherwise indicated.*

CHARACTERISTIC	SYMBOL	TEST CIRCUIT Fig. No.	SPECIAL TEST CONDITIONS	LIMITS Min.	LIMITS Typ.	LIMITS Max.	UNITS
Static Characteristics							
Zener Regulating Voltage Terminal No. 5	V_5	–		10.3	11.2	12.2	V
Current into Terminal 5	I_5	–	Connect Terminal 5 to +9 V	10	16	24	mA
Total Device Dissipation	P_T	–		343	370	400	mW
Terminal Voltages: 1	V_1	–		–	2	–	V
6	V_6			–	4.8	–	
7	V_7			–	6.1	–	
9	V_9			–	3.7	–	
12	V_{12}			4	5.1	5.8	
Dynamic Characteristics							
IF AMPLIFIER Input Limiting Voltage (at −3 dB point)	$V_{i(lim)}$	3	f_0 = 4.5 MHz, f_m = 400 Hz, Deviation = ±25 kHz,	–	200	400	μV
AM Rejection	AMR	3	Amplitude Modulation = 30% f = 4.5 MHz	40	50	–	dB
Transconductance Magnitude	$\lvert G_m \rvert$(IF)	–	f = 4.5 MHz IF Input Terminals: 2, 1 IF Output Terminals: 9, 3	–	500	–	mmho
Phase Angle	θ(IF)	–		–	46	–	degrees
Feedback Capacitance	C_{fb}	–	f = 1 MHz; Terminals 2 and 9	–	<0.02	–	pF
Input Impedance Components: Parallel Input Resistance	R_i(IF)	–	Measured between Terminal Nos. 1 and 2 f = 4.5 MHz	–	17	–	kΩ
Parallel Input Capacitance	C_i(IF)	–		–	4	–	pF
Output Impedance Components: Parallel Output Resistance	R_0(IF)	–	Measured between Terminal No. 9 and gnd f = 4.5 MHz	–	3.25	–	kΩ
Parallel Output Capacitance	C_0(IF)	–		–	75	–	pF
DETECTOR Recovered AF Voltage	V_0(af)	3	f = 4.5 MHz; V_I = 100 mV Δf = ±25 kHz fm = 400 Hz	0.5	0.75	–	V(rms)
Total Harmonic Distortion	THD	3		–	0.9	2	%
Output Resistance: Terminal 7	R_0	–		–	7.5	–	kΩ
Terminal 8		–		–	300	–	Ω
ATTENUATOR Max. Attenuation	–	3	See Fig. 7 R_X = ∞	60	80	–	dB
Max. "Play-through" Voltage*	–	3	R_X = ∞	–	0.075	1	mV
AUDIO AMPLIFIER Voltage Gain	A(af)	4	V_I = 0.1 V(rms), f = 400 Hz	17.5	20	–	dB
Total Harmonic Distortion	THD	4	V_O = 2 V(rms), f = 400 Hz	–	1.5	–	%
Undistorted Output Voltage	–	4	THD = 5%, f = 400 Hz	2	2.5	–	V(rms)
Input Resistance	R_i(af)	–	f = 400 Hz	–	70	–	kΩ
Output Resistance	R_0(af)	–	f = 400 Hz	–	270	–	Ω

*"Playthrough" voltage is the unwanted signal, measured at Terminal 8, when the volume control is set for minimum output.

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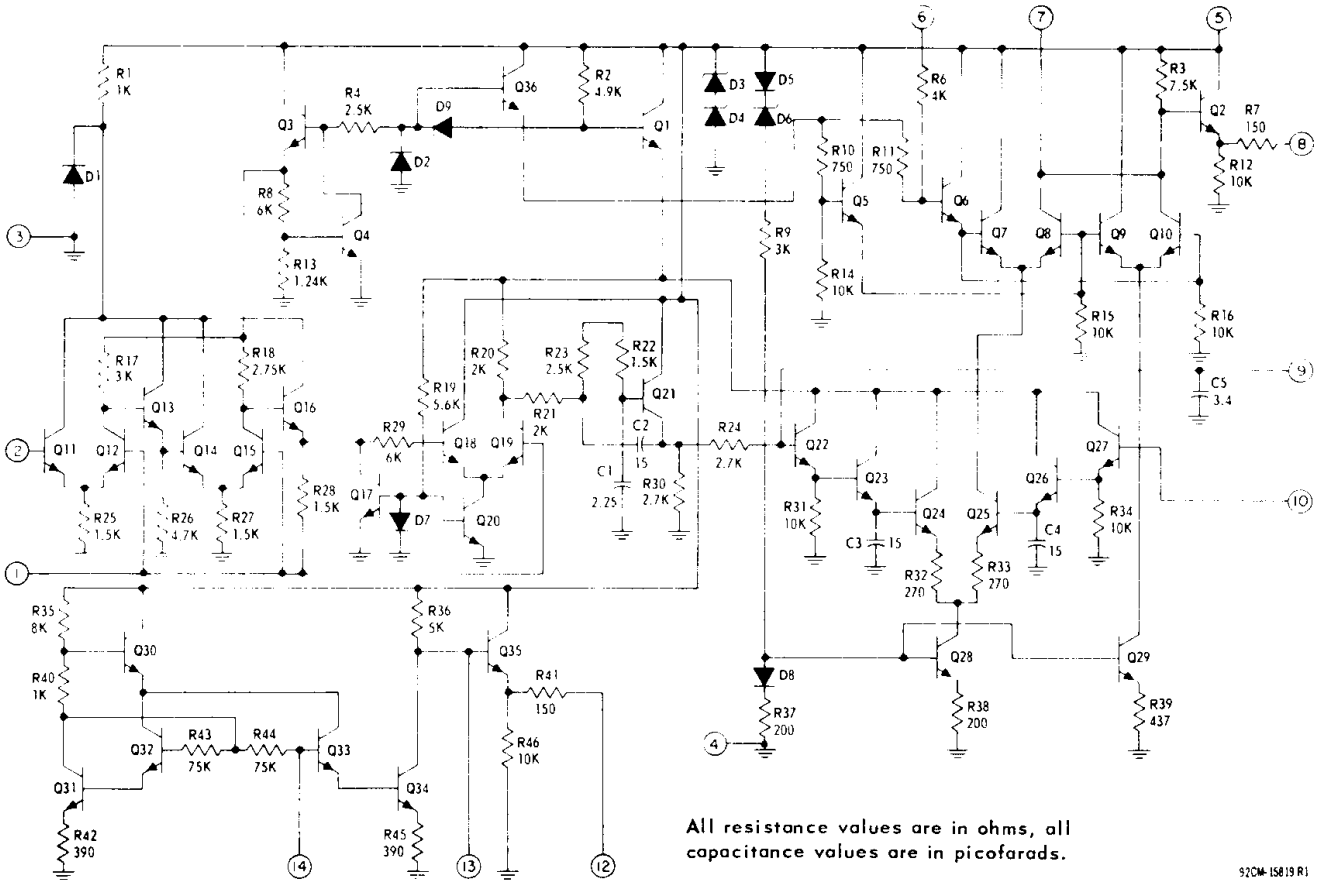

Fig. 2 - Schematic diagram of CA3065

The resistance values included on the schematic diagram have been supplied as a convenience to assist Equipment Manufacturers in optimizing the selection of "outboard" components of equipment designs. The values shown may vary as much as ±30%.

RCA reserves the right to make any changes in the Resistance Values provided such changes do not adversely affect the published performance characteristics of the device.

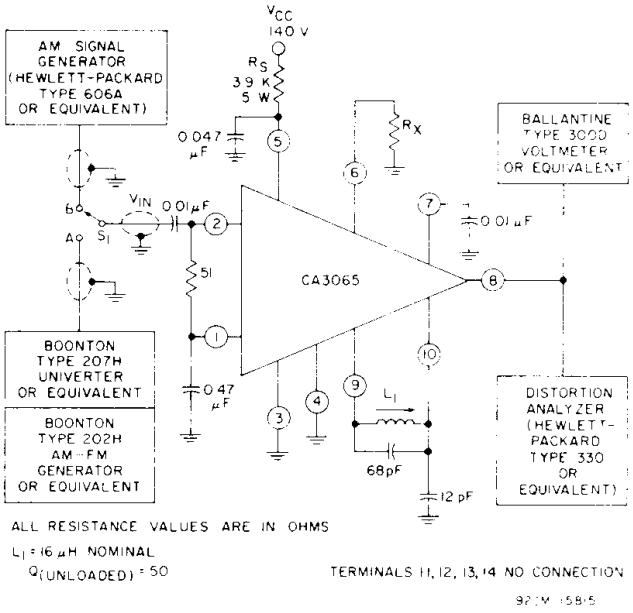

Fig. 3 - Input limiting voltage, AM rejection, recovered audio, total harmonic distortion, maximum attenuation, maximum "play-through" test circuit.

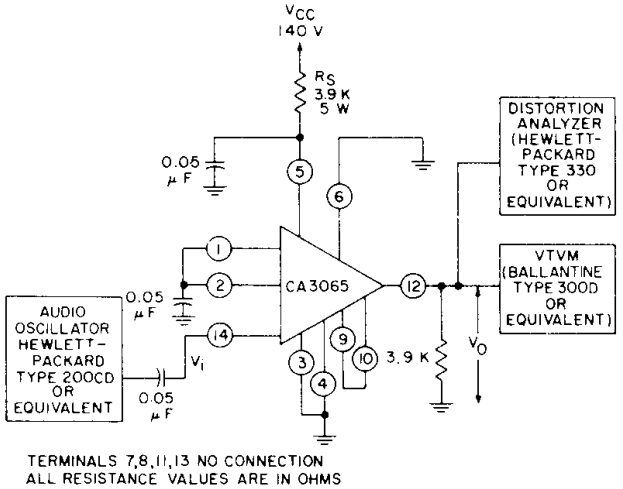

Fig. 4 - Audio voltage gain (undistorted output) test circuit.

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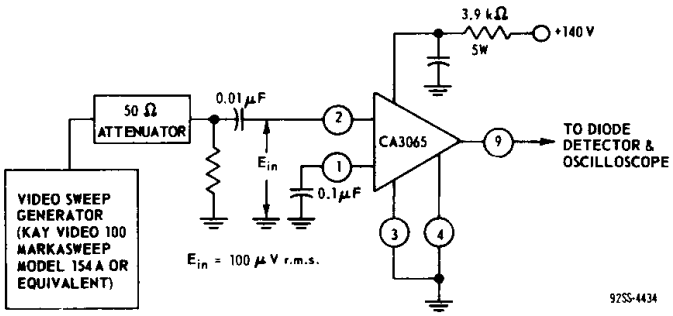
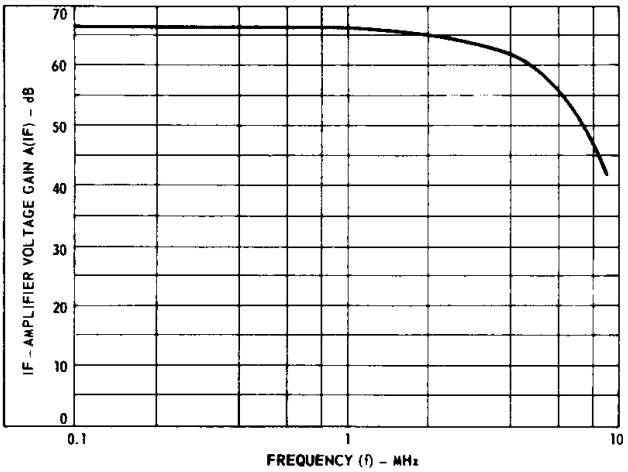
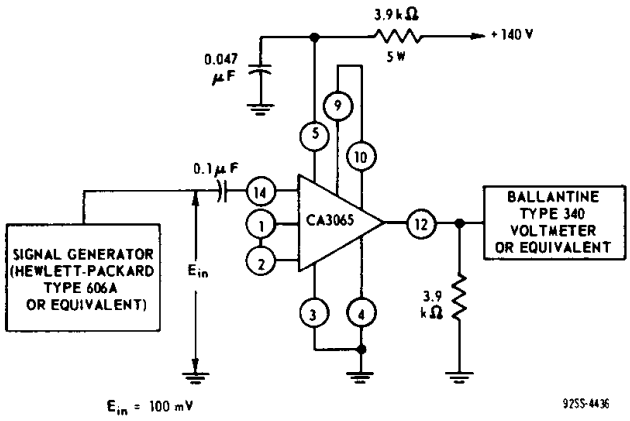


(a) Test circuit

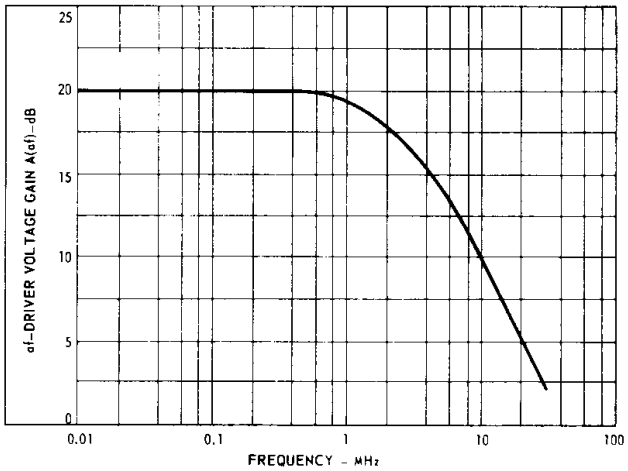


(b) Response curve

Fig. 5 - Frequency response of IF-amplifier section of CA3065



(a) Test circuit



(b) Response curve

Fig. 6 - Frequency response of af-amplifier section of CA3065

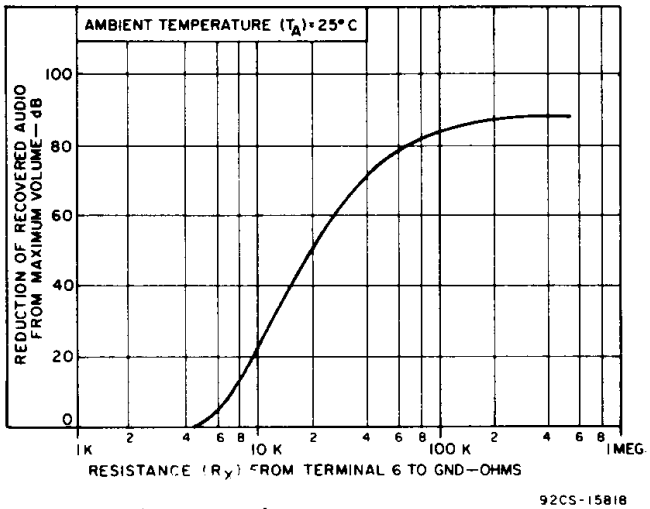
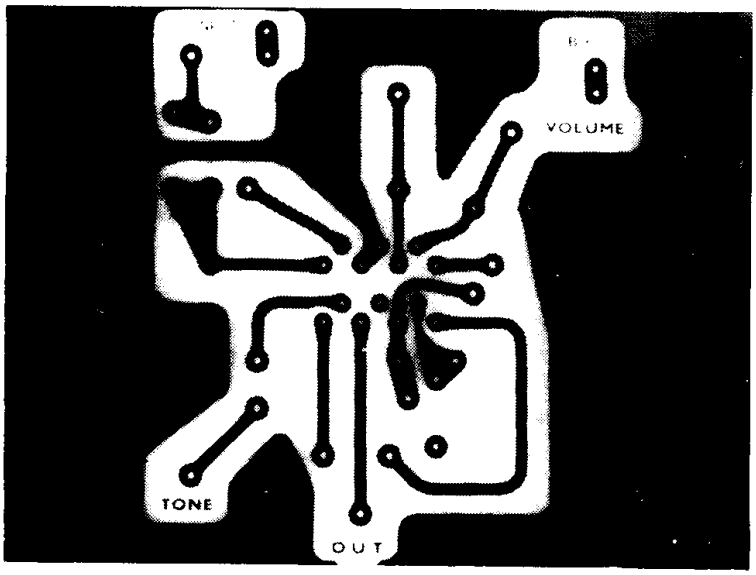


Fig. 7 - Gain reduction vs. resistance (terminal 6 to gnd)

OPERATING CONSIDERATIONS

As in all TV receivers, precaution should be taken to prevent destruction of the CA3065 in the event of cascade arcs originating in the picture tube or in the output tube. In the case of arcing in the output tube a resistor of 150k in series with terminal No. 12 and the grid of the tube is usually sufficient protection.

To prevent damage from picture tube arcs, a careful analysis of board layout and coupling modes (electrostatic or magnetic) may be necessary to suggest alternate layouts or appropriate locations for the placement of spark gaps to absorb the high energy discharge.



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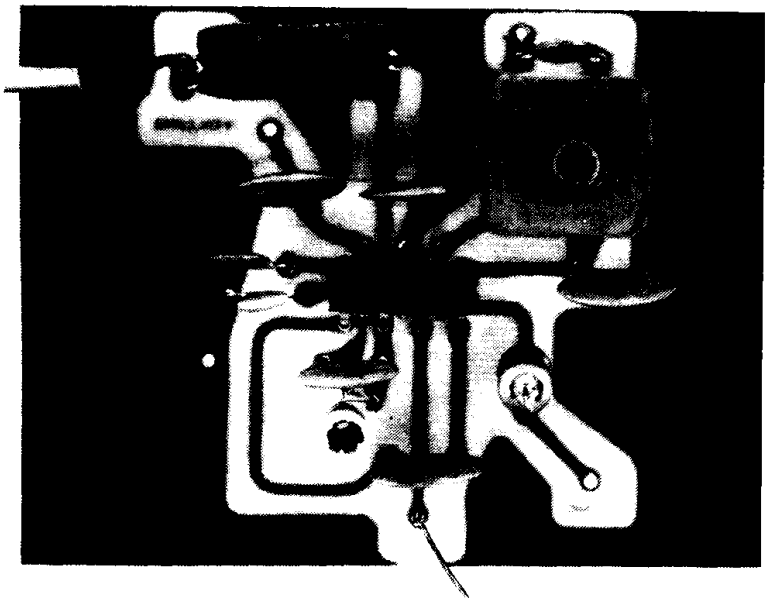
*(a) Printed circuit board – bottom view**
Full Size



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*(b) Parts layout – top view**
Full Size

Fig. 8 - Recommended parts layout for TV receiver sound strip using CA3065.

* A 200 mil square grid was used in the layout of passive components on the printed circuit board. The Quad-in-line formed leads conform to a standard grid spacing of 100 mil centers.