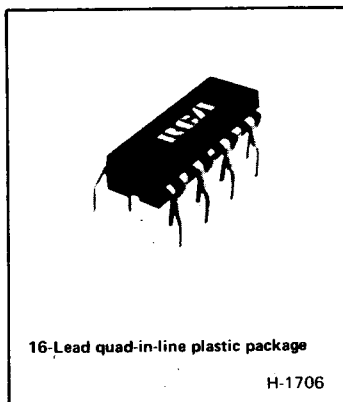


## CA3090AQ



## Stereo Multiplex Decoder

For FM Stereo Multiplex Systems

### FEATURES:

- Requires the use of only one low-inductance tuning coil
- Automatic stereo switching
- Directly drives a stereo indicator lamp up to 100 mA
- Includes driver for stereo-lamp indicator
- Operates from a wide range of power supplies: 10 to 16 volts
- Requires only one adjustment for alignment
- Switching from monaural to stereo and stereo to monaural produces no audible thumps

RCA-CA3090AQ\*, a monolithic silicon integrated circuit, is a stereo multiplex decoder intended for FM multiplex systems.

The CA3090AQ is the successor to the CA3090Q; it offers three major advantages over the CA3090Q as follows:

1. Can directly drive a stereo indicator lamp with a current drain of up to 100 mA.
2. Stereo Defeat/Enable control-voltage specifications.
3. Capable of operation with lower distortion.

This stereo multiplex decoder requires only one low-inductance tuning coil (requires only one adjustment for complete alignment), provides automatic stereo switching, energizes a stereo indicator lamp, and operates from a wide range of voltage supplies.

Figure 1 shows the block diagram for the CA3090AQ. The input signal from the detector is amplified by a low-distortion preamplifier and simultaneously applied to both the 19-kHz and 38-kHz synchronous detectors. A 76-kHz signal, generated by a local voltage-controlled oscillator (VCO), is counted down by two frequency dividers to a 38-kHz signal and to two 19-kHz signals in phase quadrature. The 19-kHz pilot-tone supplied by the FM detector is compared to the locally generated 19-kHz signal in a synchronous detector. The resultant signal controls the voltage controlled oscillator (VCO) so that it produces an output signal to phase-lock the stereo decoder with the pilot tone. A second synchronous detector compares the locally generated 19-kHz signal with the 19-kHz pilot tone. If the pilot tone exceeds an externally adjustable threshold voltage, a Schmitt trigger circuit is energized. The signal from the Schmitt trigger lights the stereo indicator, enables the 38-kHz synchronous detector, and automatically switches the CA3090AQ from monaural to stereo operation. The output signal from the 38-kHz detector and the composite signal from the preamplifier are applied to a

- Low distortion: under 0.5%
- Separate dc input permits stereo defeat or enable
- High signal output: directly drives audio amplifiers
- Excellent SCA (storecast) rejection: 55 dB typ.
- High audio channel separation: 40 dB typ.

matrixing circuit from which emerge the resultant left and right channel audio signals. These signals are applied to their respective left and right post amplifiers for amplification to a level sufficient to drive most audio amplifiers.

The CA3090AQ may be used without the stereo defeat/enable function (see Fig. 6) if a control voltage for this function is not readily available. In this case, Terminal 4 should be grounded.

The CA3090AQ utilizes the 16-lead quad-in-line plastic package and operates over the ambient temperature range of -40°C to +85°C.

\*Formerly Developmental Type No. TA6262G.

### MAXIMUM RATINGS, Absolute-Maximum Values at $T_A = 25^\circ\text{C}$ :

|                                           |               |
|-------------------------------------------|---------------|
| DC Supply Voltage .....                   | 16 V          |
| Current at Term. 12 .....                 | 100 mA        |
| Input Signal Voltage (Composite) ■ .....  | 400 mV        |
| Ambient Temperature Range:                |               |
| Operating .....                           | -40 to +85°C  |
| Storage .....                             | -65 to +150°C |
| Lead Temperature (during soldering):      |               |
| At distance not less than 1/32" (0.79 mm) |               |
| from case for 10 s max. ....              | +265°C        |

■ For stereo operation, a minimum input signal voltage (composite) of 40 mV is required.

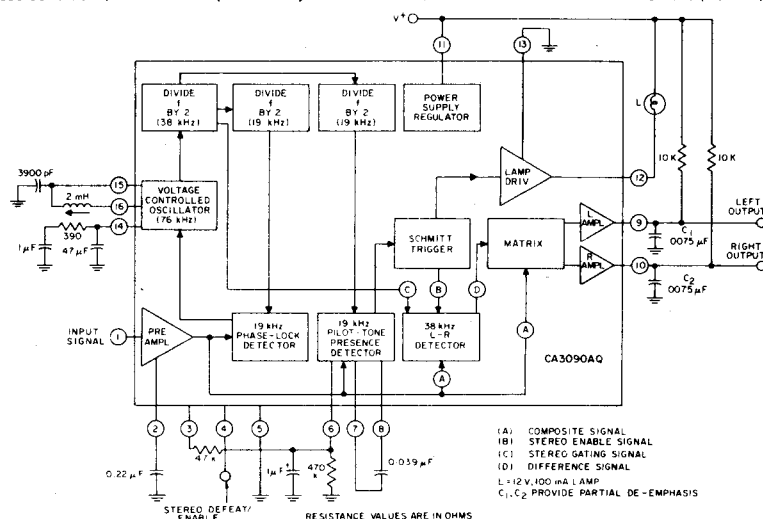
## ELECTRICAL CHARACTERISTICS

**CA3090AQ**

| CHARACTERISTIC                                                                                                                         | TERMINAL<br>MEASURED<br>AND<br>SYMBOL | TEST CONDITIONS                    |                                                                                |                             | LIMITS |      |      | UNITS |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------------|--------------------------------------------------------------------------------|-----------------------------|--------|------|------|-------|
|                                                                                                                                        |                                       | Typ.<br>Char.<br>Curve<br>Fig. No. | T <sub>A</sub> = 25°C<br>V <sub>+</sub> = 12 V (unless<br>specified otherwise) | Cir-<br>cuit<br>Fig.<br>No. | Min.   | Typ. | Max. |       |
| Static Characteristics                                                                                                                 |                                       |                                    |                                                                                |                             |        |      |      |       |
| Total Current (Terms. 9, 10, 11)                                                                                                       | I <sub>total</sub>                    |                                    | Lamp OFF                                                                       | 3                           | —      | 22   | 27   | mA    |
| DC Voltage:<br>Term. 1                                                                                                                 | V <sub>1</sub>                        |                                    |                                                                                | 3                           | 1.6    | 2.3  | 3.1  | V     |
| Term. 6 (Indicator Lamp OFF)                                                                                                           | V <sub>6</sub>                        |                                    |                                                                                | 3                           | —      | 2.1  | 3.6  | V     |
| Terms. 9 and 10                                                                                                                        | V <sub>9 &amp; 10</sub>               |                                    |                                                                                | 3                           | 3.7    | 5.4  | 7.4  | V     |
| Term. 12 (Indicator Lamp OFF)                                                                                                          | V <sub>12</sub>                       |                                    | V <sup>+</sup> = 16 V                                                          |                             | 12.7   | —    | —    | V     |
| Voltage Differential (Term. 2—Term. 1)                                                                                                 | V <sub>2</sub> - V <sub>1</sub>       |                                    |                                                                                | 3                           | —      | 0    | 0.1  | V     |
| Current at Term. 12 (In actual use external circuit resistance (e.g. lamp should limit Term. 12 to the maximum rated value of 100 mA.) |                                       | 4                                  | V <sub>IN</sub> (at f = 19 kHz) = 18 mV                                        | 1                           | 75     | 100  | —    | mA    |
| Dynamic Characteristics                                                                                                                |                                       |                                    |                                                                                |                             |        |      |      |       |
| Input Impedance                                                                                                                        | Z <sub>IN</sub>                       |                                    |                                                                                | 7                           | —      | 50k  | —    | Ω     |
| Channel Separation (L + R Reference)*                                                                                                  |                                       |                                    |                                                                                | 7                           | 25     | 40   | —    | dB    |
| Channel Balance (Monaural)                                                                                                             |                                       |                                    |                                                                                | 7                           | —      | 0.3  | 3    | dB    |
| Monaural Gain                                                                                                                          |                                       |                                    | V <sub>IN</sub> = 180 mV                                                       |                             | 3      | 6    | 9    | dB    |
| Stereo/Monaural Gain Ratio*                                                                                                            |                                       |                                    |                                                                                | 7                           | —      | ±0.3 | ±3   | dB    |
| Indicator Lamp — Turn-ON Voltage                                                                                                       |                                       | 5                                  | 19-kHz pilot-tone @ Term. 1                                                    | 7                           | —      | 4    | —    | mV    |
| Capture Range (Deviation from 76-kHz center frequency)                                                                                 |                                       | 7, 8                               | 19-kHz pilot-tone voltage = 18 mV                                              | 7                           | ±6.6   | ±10  | —    | %     |
| Distortion (75-μs de-emphasis):<br>2nd Harmonic                                                                                        |                                       |                                    | V <sub>IN</sub> = 240 mV                                                       | 7                           | —      | 0.2  | —    | %     |
| 3rd, 4th, and 5th Harmonic                                                                                                             |                                       |                                    |                                                                                | 7                           | —      | <0.1 | —    | %     |
| 19-kHz Rejection                                                                                                                       |                                       |                                    |                                                                                | 7                           | —      | 35   | —    | dB    |
| 38-kHz Rejection                                                                                                                       |                                       |                                    |                                                                                | 7                           | —      | 25   | —    | dB    |
| SCA (storecast) Rejection                                                                                                              |                                       |                                    |                                                                                | 7                           | —      | 55   | —    | dB    |
| Stereo Defeat Voltage (V <sub>4</sub> )                                                                                                |                                       |                                    |                                                                                |                             | —      |      | <0.9 | V     |
| Stereo Enable Voltage (V <sub>4</sub> )                                                                                                |                                       |                                    |                                                                                |                             | >1.6   |      | —    | V     |

**NOTE:** For improved pilot sensitivity and overload characteristics, replace the .039  $\mu\text{F}$  capacitor between Terminals 7 and 8 with a Series L-C Network ( $L = 4.7 \text{ mH}$ ,  $C = 0.015 \mu\text{F}$ ). Under these conditions, Indicator Lamp Sensitivity: 'ON' = 3.3 mV, 'OFF' = 2.0 mV

\* For stereo operation, test conditions require a composite stereo input signal (modulated\* at 1 kHz) including a 19-kHz (18 mV) pilot-tone signal.



**Fig. 1 — Functional block diagram of the CA3090AQ.**

CA3090AQ

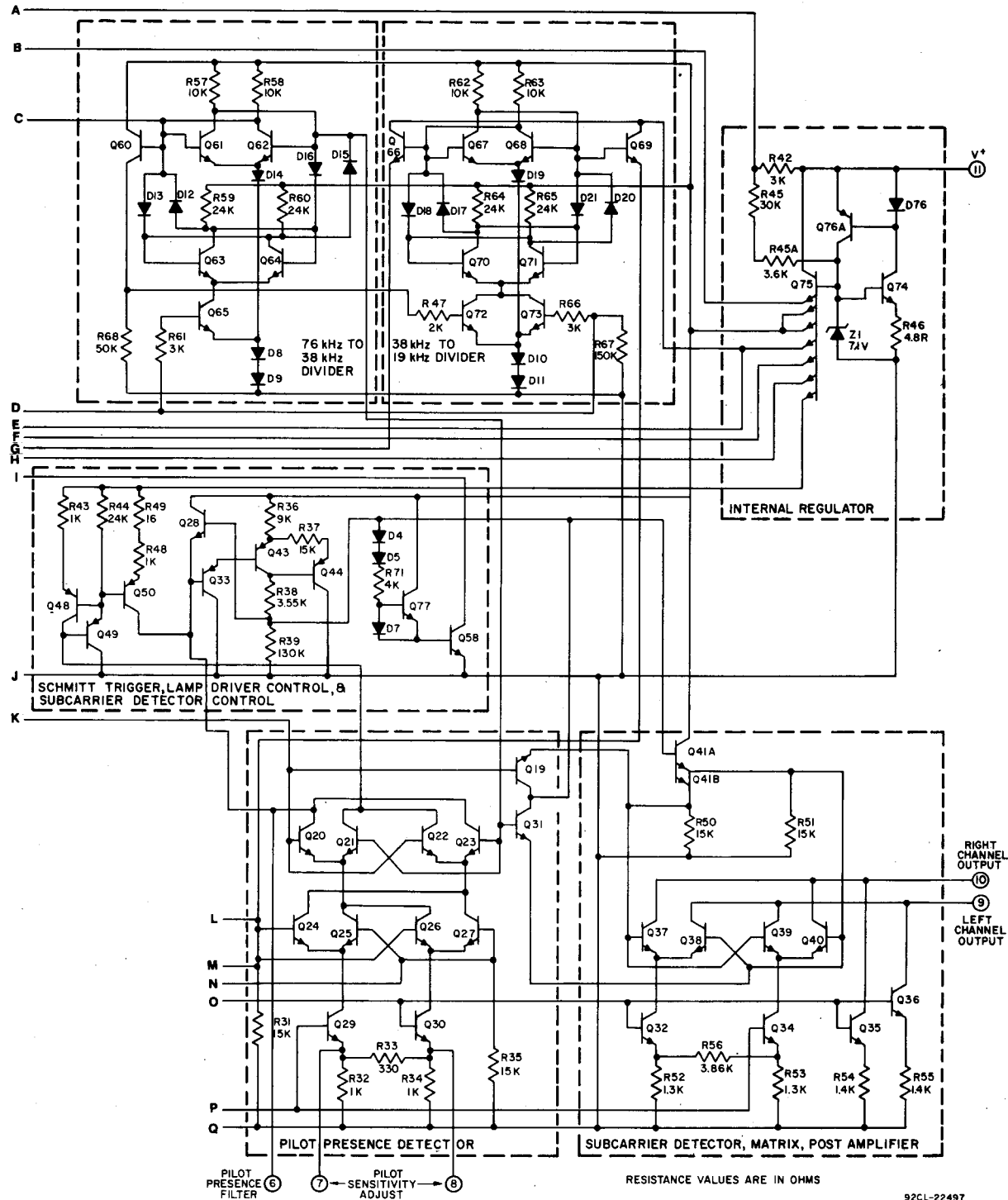
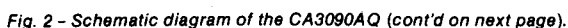


Fig. 2 - Schematic diagram of the CA3090AQ (cont'd from previous page).

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CA3090AQ

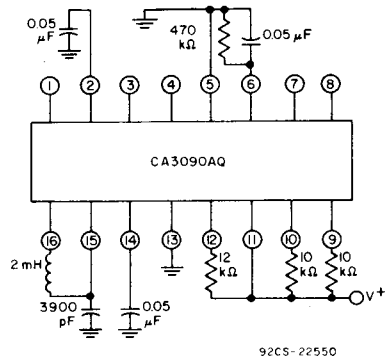


Fig. 3 - Test circuit for DC characteristics.

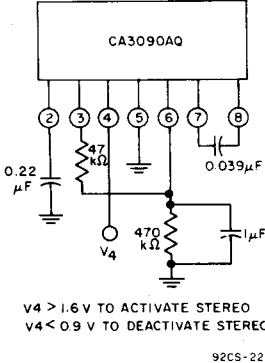


Fig. 5 - Test circuit for use with stereo defeat/enable.

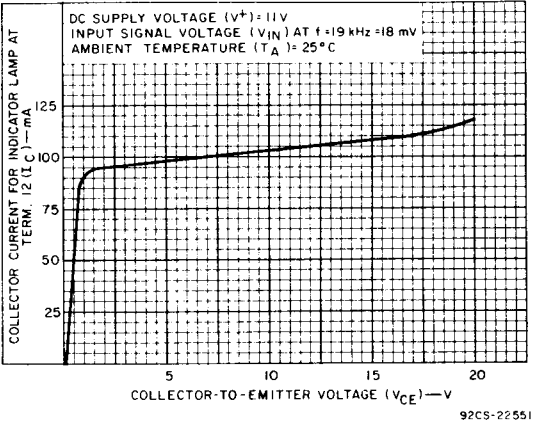


Fig. 4 - Indicator lamp characteristics (I<sub>C</sub> vs. V<sub>CE</sub>).

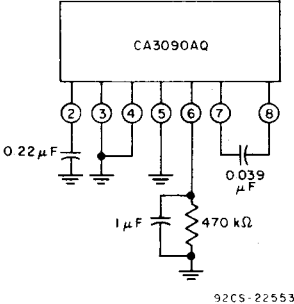


Fig. 6 - Test circuit for use without stereo defeat/enable.

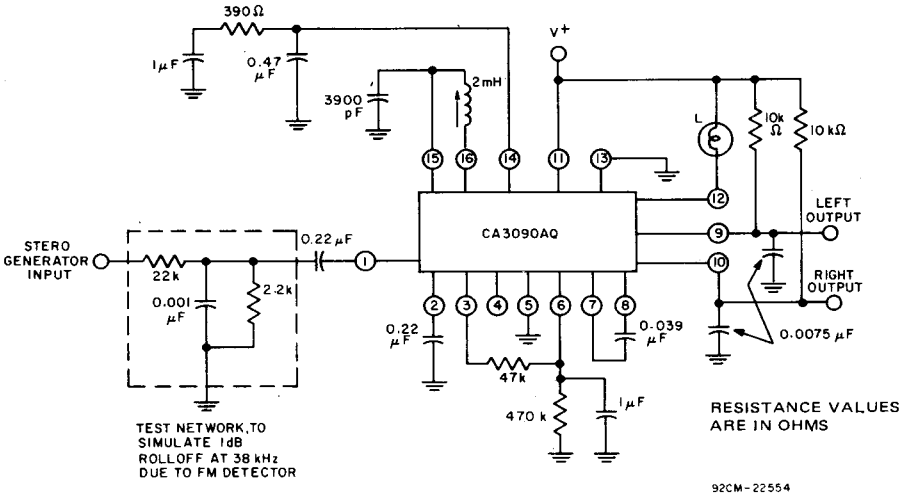


Fig. 7 - Test circuit for measurement of dynamic characteristics.

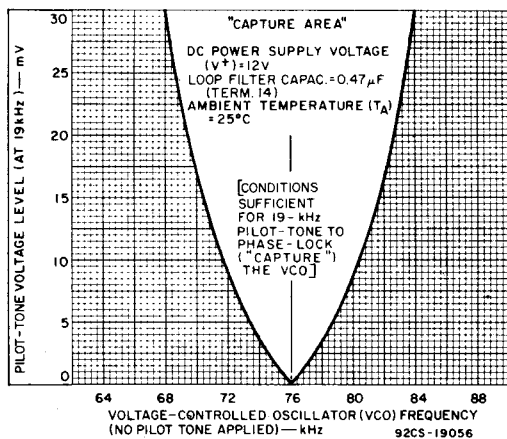


Fig. 8 — Pilot-tone voltage level vs. VCO frequency with no pilot-tone applied.

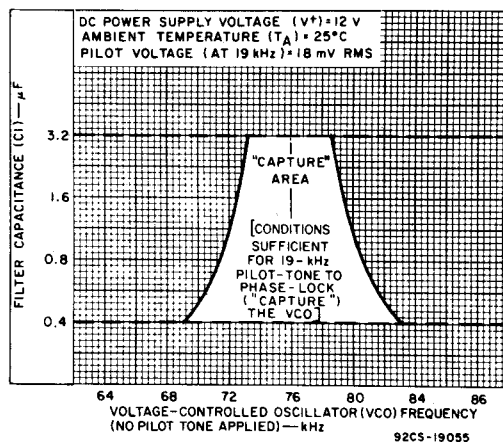
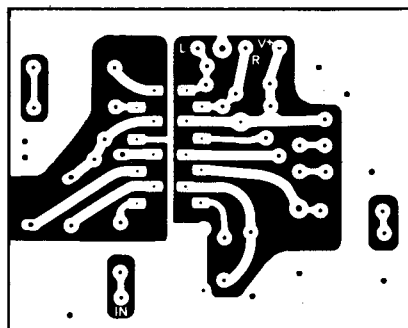
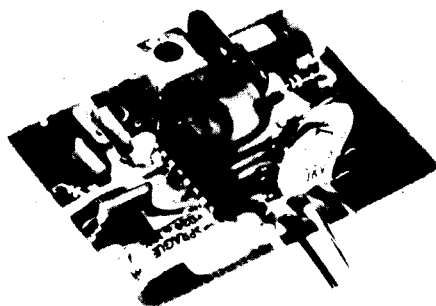


Fig. 9 — Filter capacitance vs. VCO frequency with no pilot-tone applied.



A—Foil side.



B—Component side.

Fig. 10 — Photographs of the CA3090AQ and outboard components mounted on a 2 X 2½-inch printed-circuit board to constitute a complete stereo multiplex decoder.