# MAINTENANCE MANUAL
# ORION™
# UHF CONTROL LOGIC/IF BOARD
# CMC-682/CMF-138

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## ILLUSTRATIONS



ERICSSON

**Ericsson Inc.**
Private Radio Systems
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Printed in U.S.A.

# DESCRIPTION

The System Control Logic/IF circuit board combines functions of receive circuit 1st IF, 2nd IF, audio detection, audio signal processing and system control on one circuit board. As an option, an additional circuit board can be plugged into this board to provide **AEGIS**™ (digital encryption system). Programming and personality information is stored in **FLASH** and **EEPROM** memory on the logic/IF board. The audio speaker amplifier is also part of the same board.

Electrical interfaces are achieved between this board and the Control Unit (LCC), synthesizer, RF PA (APC) and the **O**ption and **R**emote **C**ontrol **C**onnector **(ORCC)** on the rear of the assembled radio.

All radio control signals originate or terminate on the control logic/IF board. Two microcomputers share the processing load. Control signals are connected through a high speed digital link with the control unit, either through the LCC or ORCC connectors, making possible either front or remote control for the radio. The same link also makes possible dual radio or dual control head configuration. An RS-232 compatible digital link is available at the ORCC interface, to facilitate programming or Radio Data Interface to Mobile Digital terminals.

This circuit board also generates Type 99, Channel Guard, GE-Star and DTMF signals if so programmed.

The System Control Logic/IF board consists of the following control logic, IF and audio circuits (see figures 1 & 2).

## SYSTEM CONTROL LOGIC (CMC-682)

- CMOS Microprocessor (IC701, IC702)
- Custom CMOS ASIC Chip (IC703)
- Address Decoder (IC704)
- RS-485 (IC705)
- RS-232 (IC706)
- Flash EEPROM (IC707)
- EEPROM (IC708)
- CMOS SRAM (IC709)
- CMOS Inverters (IC711)
- Silicon Serial Number (IC712)
- TTL Inverters (IC713)

## IF (CMF-138)

- Custom CMOS ASP Chip (IC601)
- Operational Amplifier (IC602, IC603)
- Audio Amplifier (IC604)
- 5 Volt Regulator (IC606, IC607)
- 9 Volt Regulator (IC605, IC608, IC609)
- Reset Circuit (IC610)
- Bilateral Switch (IC611, IC612)

# CIRCUIT ANALYSIS

## LOGIC SECTION (CMC-682)

### Microcomputer

The main microcomputer circuit in the **ORION** radio consist of microprocessor IC701, EEPROM IC708, Flash EEPROM IC707, RAM IC709 and custom ASIC IC703. This circuitry runs at a 9.8304 MHz rate determined by crystal X701 and controls the radio through a second microprocessor IC702. This second microprocessor runs at a 4.9152 MHz rate. The 4.9152 MHz rate is determined by ASIC IC703.

- Controlling the **ASIC**, **FLASH EEPROM** and **RAM**
- Loading data to the frequency synthesizer
- Fetching and processing the PTT, monitor, channel, selection and volume control
- Controlling the audio circuit (processor)
- Decoding the squelch
- Encoding/Decoding the Channel Guard and Digital Channel Guard
- Controlling the loading interface for the radio data (channel nujmber and signaling)

### FLASH EEPROM (IC707)

This memory contains the software to control the microprocessor. This Flash EEPROM has a storage capacity of 256k x 8 bits.

### CMOS SRAM (IC709)

This SCRATCH RAM has a storage capacity of 32k x 8 bits. The memory is available for variables, buffers, etc.

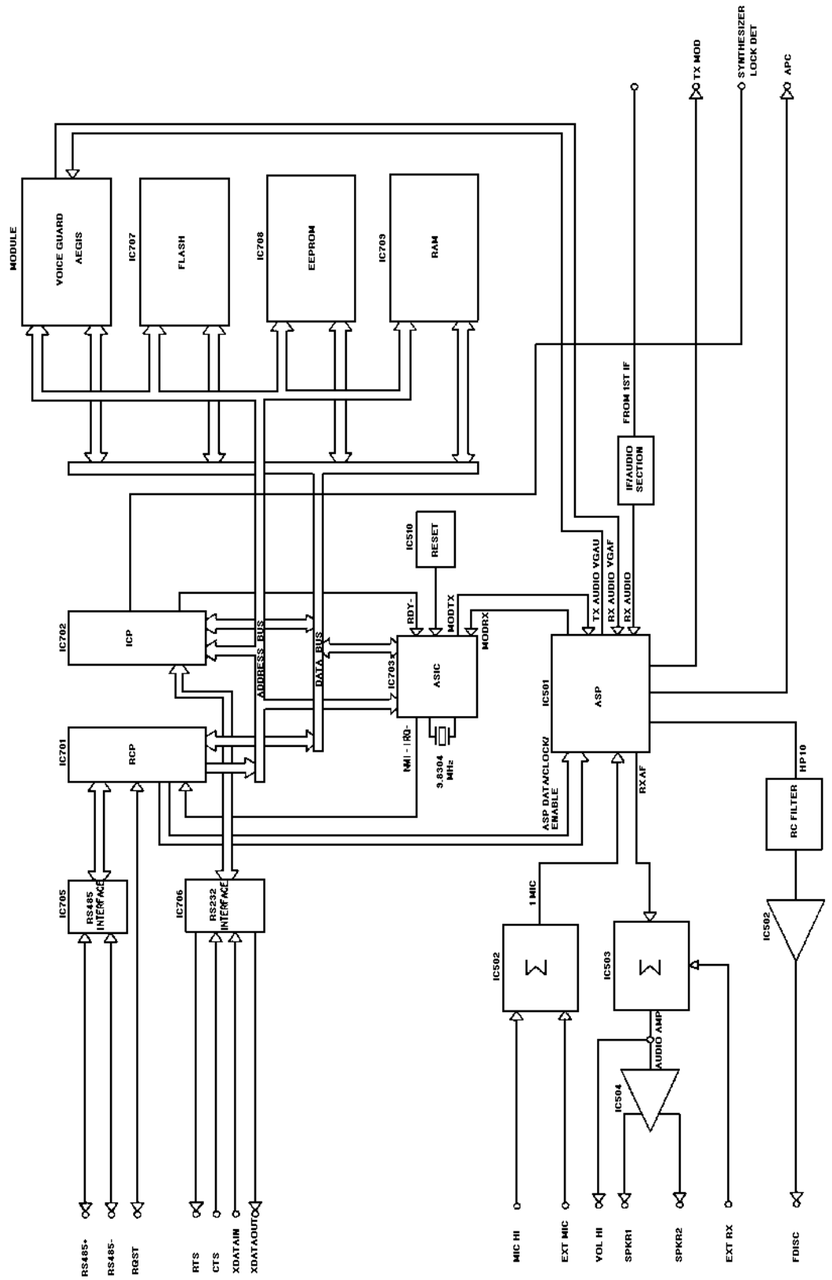



Figure 1 - Logic Section Block Diagram

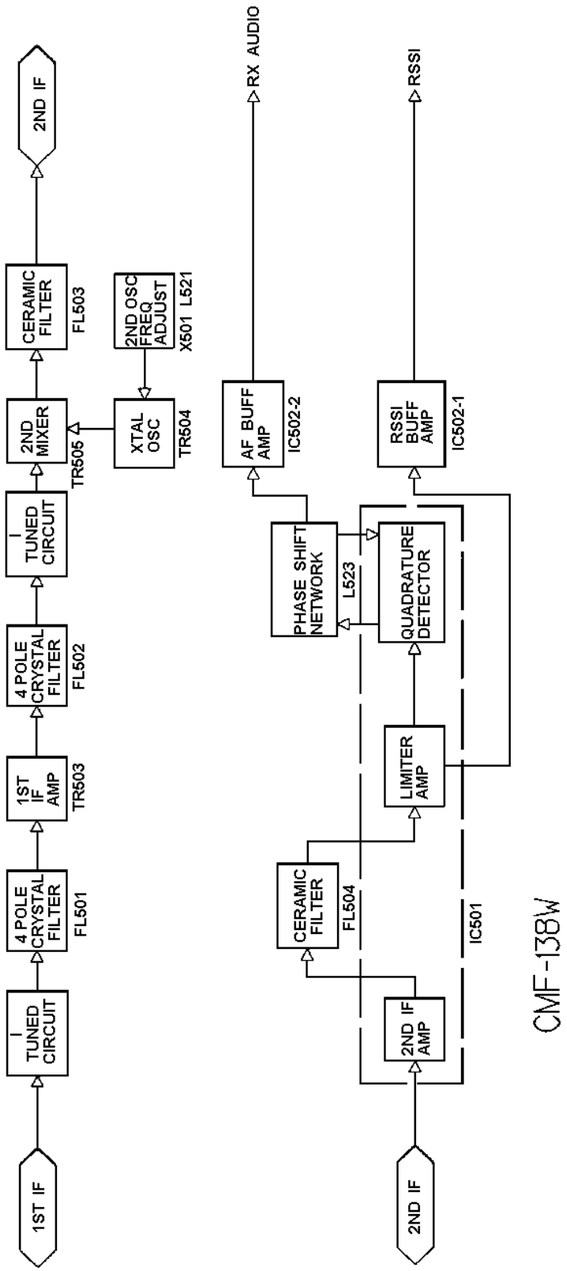



Figure 2 - IF Section Block Diagram

## EEPROM (IC708)

This EEPROM has a storage capacity of 8k x 8 bits. The memory contatins the user configurable parameters that must be maintained through a power cycle. This personality controls various functions of the radio. The personality data is entered from outside the radio through the ORCC connector to the microprocessor and then to the EEPROM.

The data mainly consists of the following:

- Chanel Frequency Data
- CG/DCG Data
- Tx Power, Tx MOdulation Data
- Squelch Data
- Display Data, etc.

## APPLICATION OF SPECIFIC INTEGRATED CIRCUITS

## ASIC (IC703)

The ASIC is basically a chip that integrates may miscellaneous funtcions. The chip provides functions as follows:

- MODEM
- Watch Dog Timer
- Clock Control
- Interrupt Control
- Address Decode etc.

## Voltage Regualtors (IC606, IC607) (IC605, IC608, IC609)

Voltage regulators IC606 and IC607 each generate a 5 Vdc for the Control Board. Voltage regulators IC605, IC608 and IC609 each generate a 9 Vdc for the Control Board and Voice Guard Adapter Module.

## Audio Amplifier (IC604)

The audio amplifier is located between the audio processor and the speaker. Amplifier IC604 amplifies the output signal of the ASP (IC601) to the level adequate for driving the speaker.

## Audio Signal Porocessor (ASP ) (IC601)

The audio process consists of a one-chip IC accommodating almost all of the audio functions. The audio functions are under control of the microcomputer in compliance with the function of the radio unit.

The functions of the audio processor are as follows:

- Rx Audio porcess with Tone Reject Filter, De-emphasis and Programmable Attenuator.
- Data Limiting
- CG/DCG filtering and limiting
- Noise Squelch filtering and detecting
- 8 bits D/A Converter with sample and hold
- Tx audio process with microphone amplifier, pre-emphasis, deviagion limiter, summing amplifier, post limiter filter and progarmmable attenuator
- Data signal filtering
- Two 6 bits programmable divider for clock and altet tone

All of these functions are made up of switched capacitor filters, amplifiers and timing logic. The timing for this logic is derive from the 4.9152 MHz clock generator (ASIC).

## RS-485 (IC705)

This is a high speed differential TRI-STATE bus/line transceiver designed to meet the requirements of EIA standard RS-485 specification. The IC705 is located between the Radio Unit and the Control Unit.

## RS-232 (IC706)

This IC consists of line drivers/receivers designed to meet the requirements of EIA standard RS-232 specifications. The IC706 is located between the radio unit and the ORCC.

## Reset Circuit (IC610)

This is an active low reset IC which includes a delay time generating circuit. Delay time can be set up by externally using a capacitor and a resistor. The function of this IC is to accurately reset the system after detecting voltage at the time of switching power on and instantaeous power off.

## Option and Remote Control Connector (ORCC)

The ORCC is located on the rear of the radio and is used for options and accessories when Control Unit and Radio Unit are directly attached and for remote control in all other configurations. The ORCC allows various kinds of external equipment connections to be made. External equipment connecting signals are as follows:

| PIN | SIGNAL | PIN | SIGNAL |
|---|---|---|---|
| 1 | SUP GND | 20 | RTS |
| 2 | XDATA IN | 21 | INP1 |
| 3 | XDATA OUT | 22 | OUT1 |
| 4 | RS485+ | 23 | INP2 |
| 5 | RS485- | 24 | IGN A+ |
| 6 | CTS | 25 | SW + |
| 7 | GND | 26 | HKSW |
| 8 | FPROG | 27 | EXTMIC |
| 9 | OUT2 | 28 | EXTRX |
| 10 | IGN SEN | 29 | FDISC |
| 11 | MIC HI | 30 | EXTALO |
| 12 | ALO | 31 | CUTST |
| 13 | VOL HI | 32 | SPARE |
| 14 | CTL ON | 33 | SPARE |
| 15 | XTONENC | 34 | SPARE |
| 16 | XTONEDEC | 35 | SDATA |
| 17 | RQST | 36 | SONOFF |
| 18 | SPKR1 | 37 | HORNRING |
| 19 | SPKR2 | | |

## IF SECTION (CMF-138)

### 1st IF

The 82.2 MHz 1st IF output signal is coupled from the output of the first mixer circuit, located on the Synthesizer/Receiver/IF board, through 30-pin connector P501-1 and capacitor C501 to the source input of buffer amplifier Junction Field Effect Transistors (JFET) TR501 and TR502. This input can be monitored at test point TP1. The output of TR501 and TR502 is coupled through inductor L502 to 4-pole crystal band-pass filter FL501. The highly-selective crystal filters FL501-1 and FL502-2 provide the first part of receiver IF selectivity. The output of the filters is coupled through the impedance matching network consisting of inductor L502 and capacitors C504 and C505 to the base of 1st IF amplifier transistor TR503.

The crystal filter output of FL501 is applied to the base of 1st IF amplifier transistor TR503. This amplified signal is taken from the collector of TR503 through an impedance matching network consisting inductor L505, capacitor C506 and resistor R507 that matches the amplifier output to the input of 4-pole crystal filters FL502-1 and FL502-2 which provides the second part of receiver IF selectivity. The output of the crystal filters is coupled through an impedance-matching network consisting of inductor L507, capacitor C508, resistor R508 and coupling capacitor C509 to the base of 2nd IF amplifier transistor TR505.

### 2nd Mixer

The 82.2 MHz IF input is applied to transistor TR505 and mixed with a 82.655 MHz frequency supplied by a crystal oscillator circuit consisting of X501 and oscillator transistor TR504. Variable inductor L521 sets the frequency of the oscillator circuit. This signal can be monitored at test point TP5.

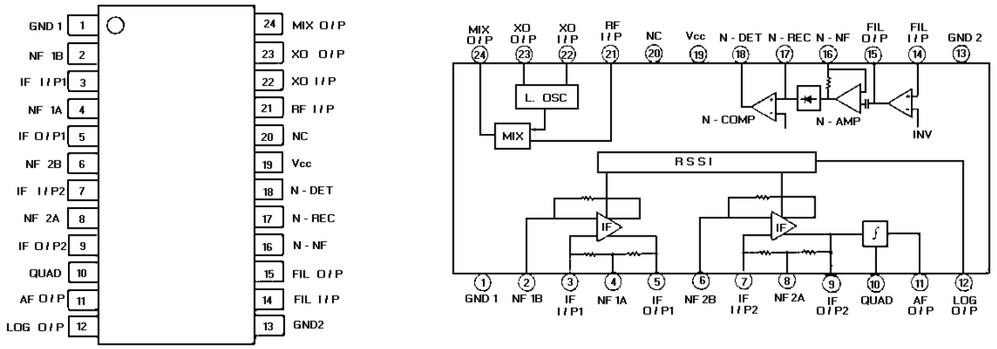
### 2nd IF And Detector

The output of the 2nd mixer is coupled to the input of 4-pole ceramic filter FL503 which provides 455 kHz 2nd IF selectivity. The 455 kHz IF output of ceramic filter FL503 is coupled to Pin 3 of Limiter/FM Detector IC501. The IF signal is amplified internal to IC501 then applied to 4-pole ceramic filter FL504 which provides additional 455 kHz IF selectivity (Refer to IC DATA for IC501). The output of the 455 kHz filter is applied to IC501, Pin 7. The 2nd IF signal is amplified and limited internal to IC501. Inductor L523 shifts the IF signal by 90  and applies it to the internal FM detector. The FM detector compares the shifted IF signal to the internal IF signal to recover the audio modulation. The audio output of the operational amplifier internal to IC501 is applied the input of buffer amplifier IC502-2. The AUDIO output of IC502-2 is applied to the System Control Logic circuit. This signal can be monitored at test point TP4. The output on Pin 12 of IC501 is applied to the input of amplifier buffer IC502-1. The output of IC502-1 provides a Receiver Signal Strength Indicator (RSSI) signal also sent to the System Control Logic circuit. This signal can be monitored at test point TP3.

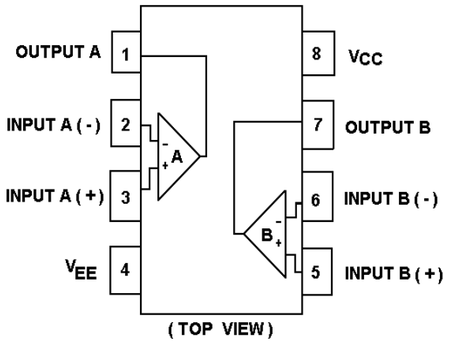
### 9 Volt Regulator

The 9-volt regualtor circuit powers the IF circuits of CMF-138 and consists of regulator IC503 and filter capacitors C570, C571 C572 and C573. An input voltage of +13.8 Vdc is applied to the input of IC503  This input is monitored at test point TP2.

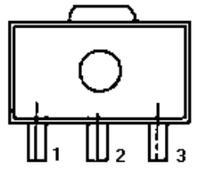
### Linear, IF Amplifier/Detector IC501



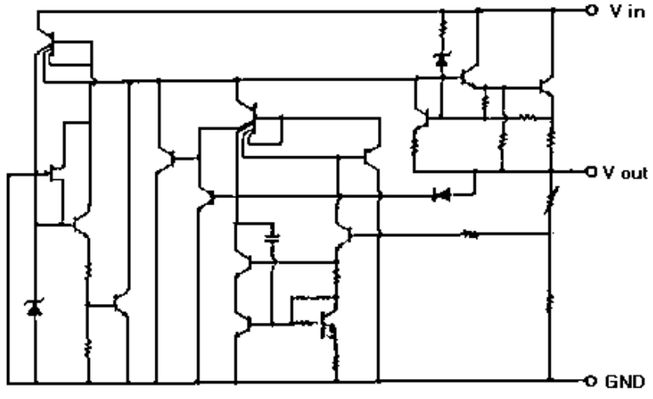

### Linear, Dual Operational Amplifier IC502



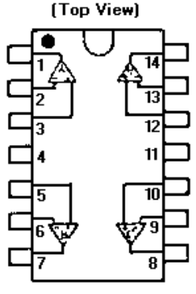
## Linear, Positive Voltage Regulator IC503



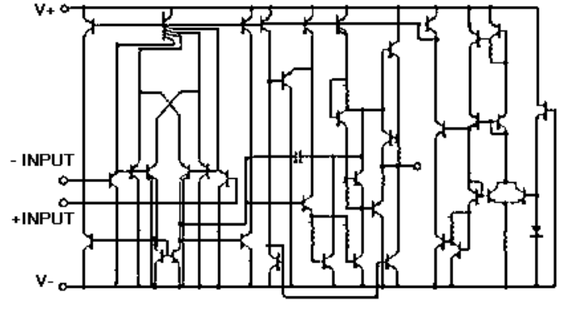

1. OUT
2. GND
3. IN



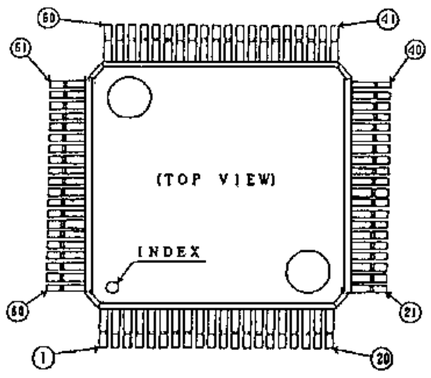

## Linear Audio Amplifier IC602, IC603

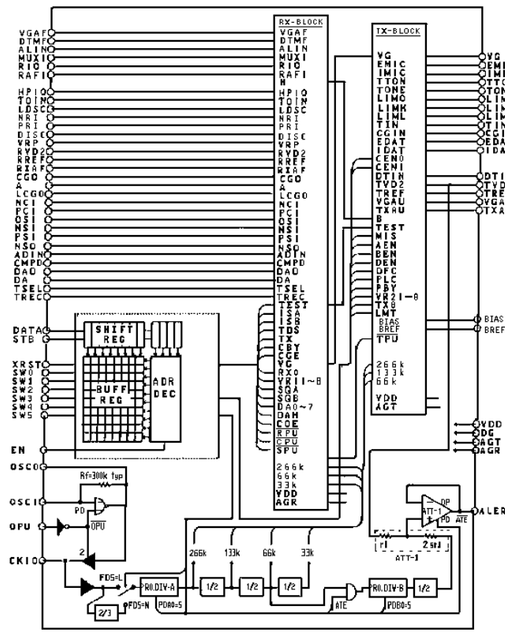



1. A OUTPUT
2. A - INPUT
3. A + INPUT
4. V+
5. B+ INPUT
6. B- INPUT
7. B OUTPUT
8. C OUTPUT
9. C- INPUT
10. C+INPUT
11. V-
12. D+ INPUT
13. D- INPUT
14. D OUTPUT

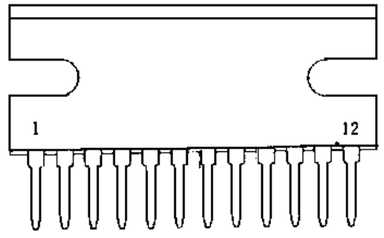



## Audio Signal Processor IC601

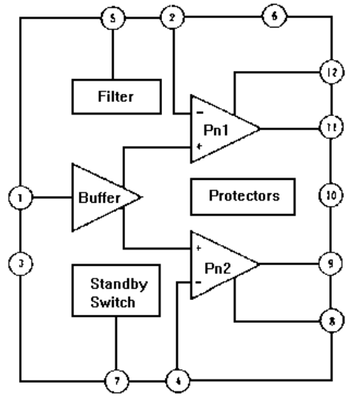


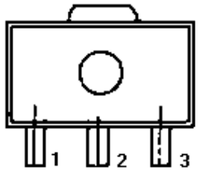

## Audio Frequency Power Amplifier IC604



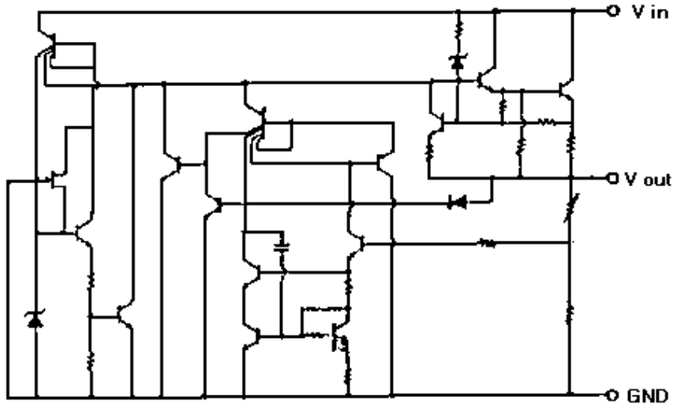

1. INPUT
2. NFB 1
3. GND(INPUT)
4. NFB 2
5. FILTER
6. VCC
7. STAND-BY SW
8. BOOTSTRAP 2
9. OUTPUT 2
10. GND(OUTPUT)
11. OUTPUT 1
12. BOOTSTRAP 1



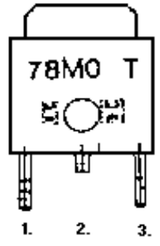
**Linear: Positive Voltage Regulator IC605, IC609**



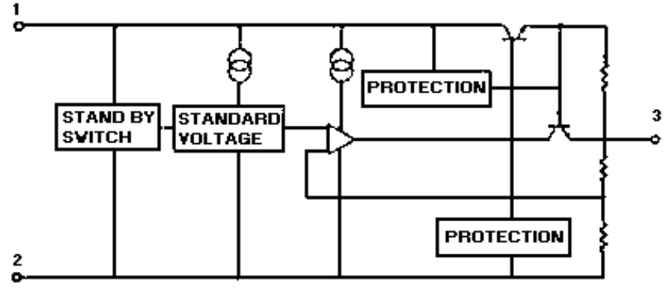

1. OUT
2. GND
3. IN



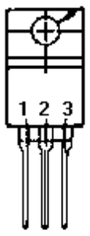

**Linear: Positive Voltage Regulator IC607,IC608**



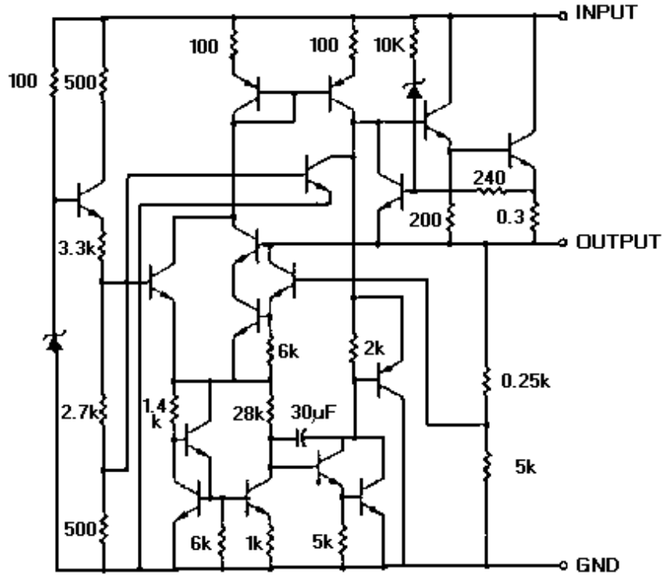

1. INPUT
2. GND
3. OUTPUT



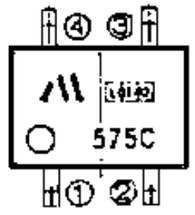

**Reset Circuit IC610**



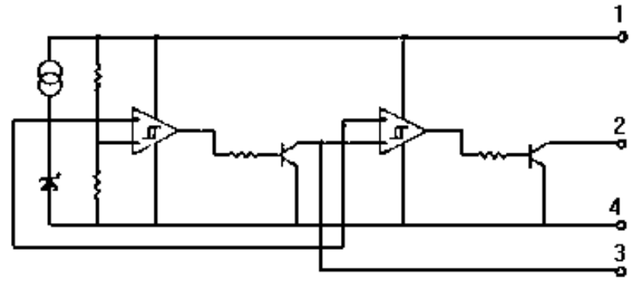

PIN 1. INPUT
2. GROUND
3. OUTPUT



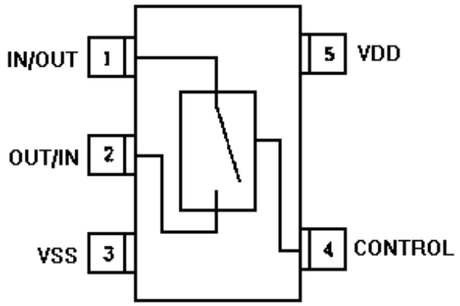

**Linear: Positive Voltage Regulator IC608**

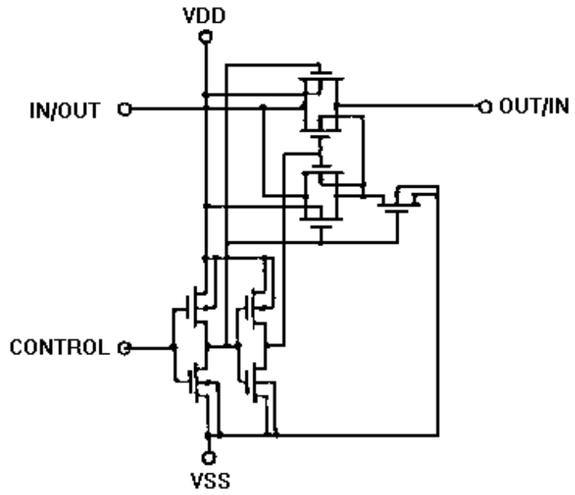



1. VCC
2. OUT
3. CO
4. GND

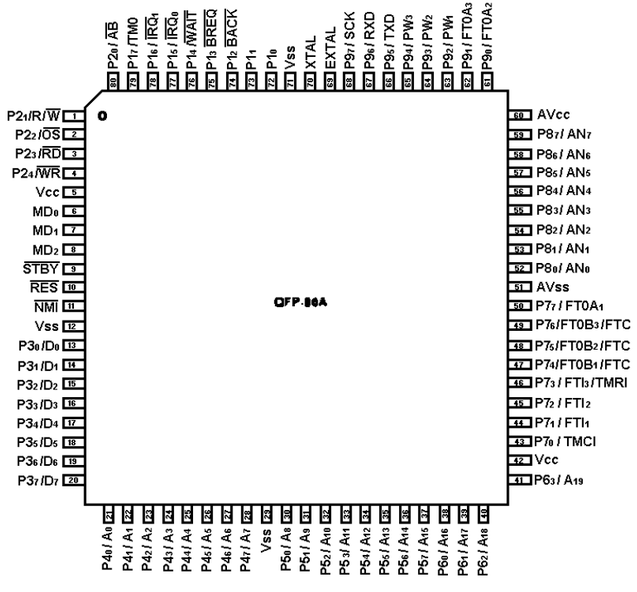


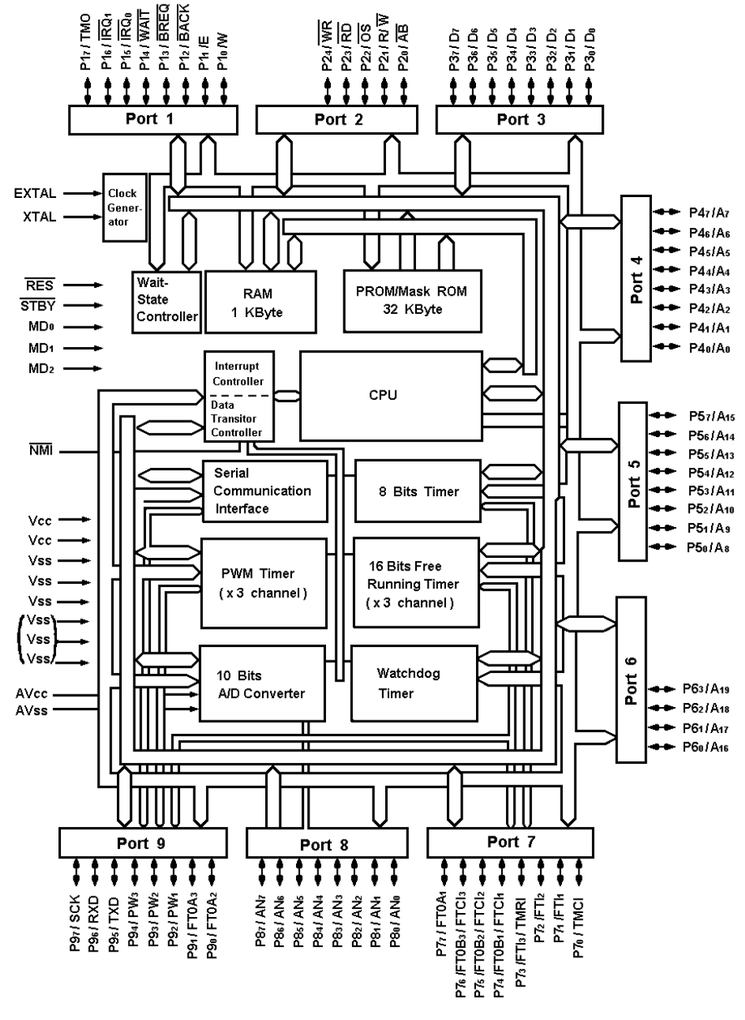
**Bilateral Switch IC611, IC612**



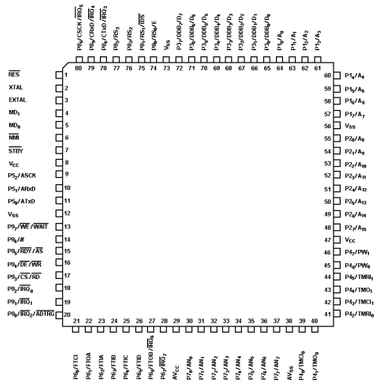

**Central Processing Unit IC701**

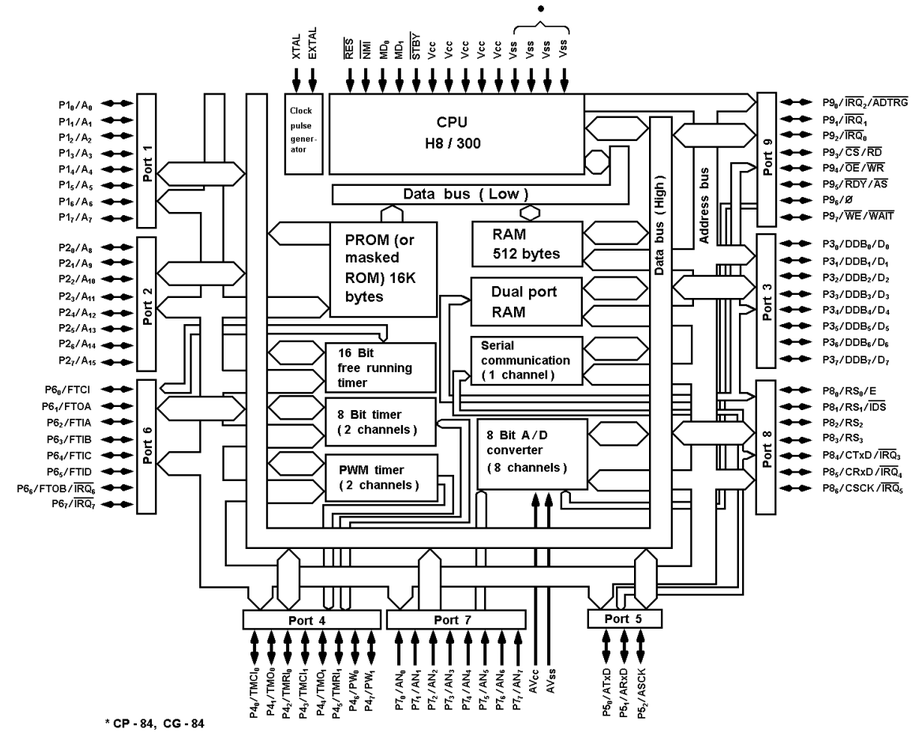


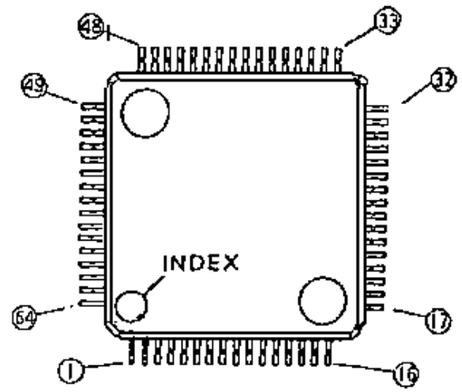

*CP-84 and CO-84 only

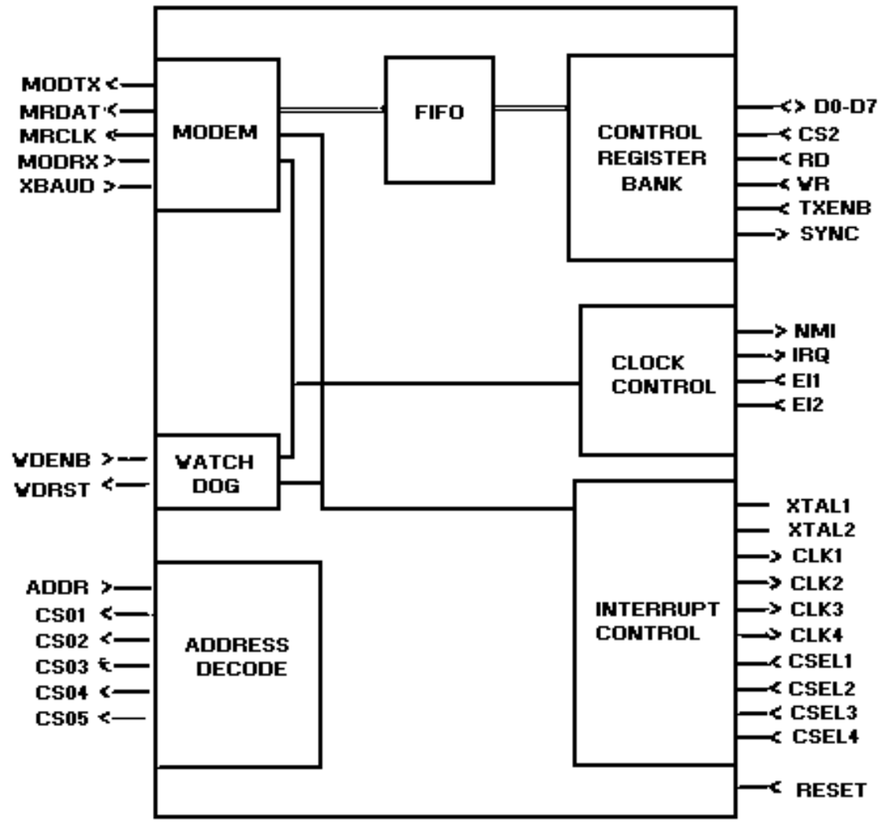
## Central Processing Unit U702



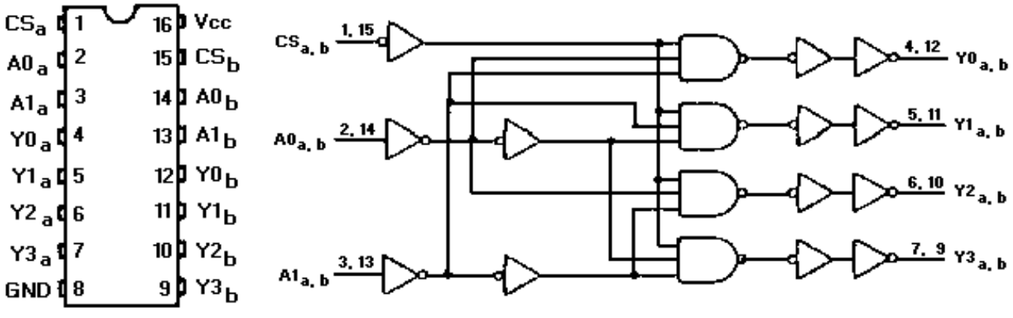



## ASIC IC703

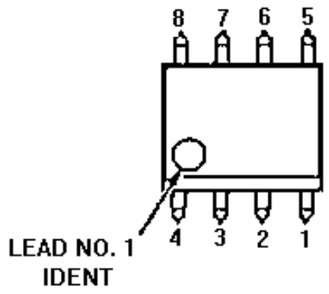


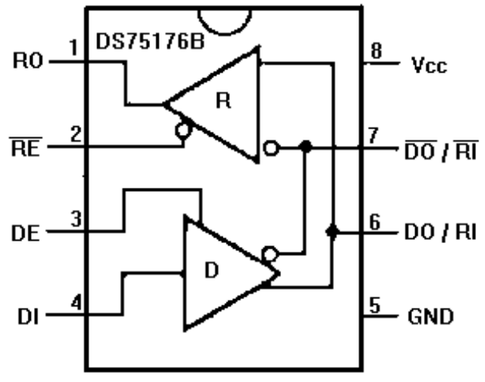



**Decoder IC704**

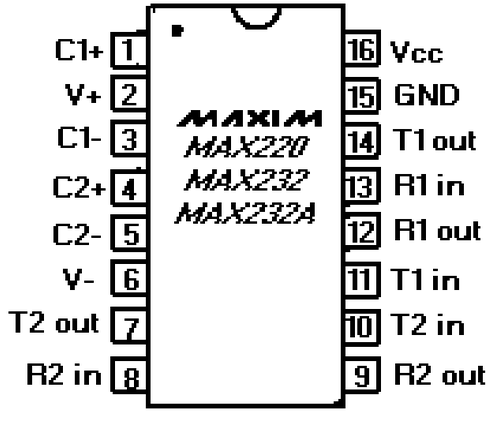


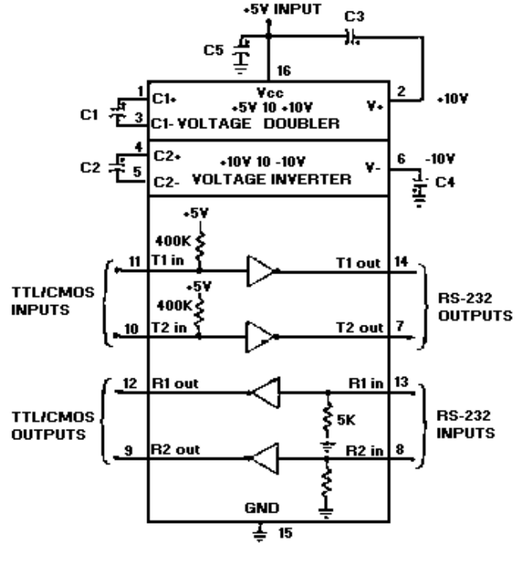

**RS-485 Driver/Receiver IC705**



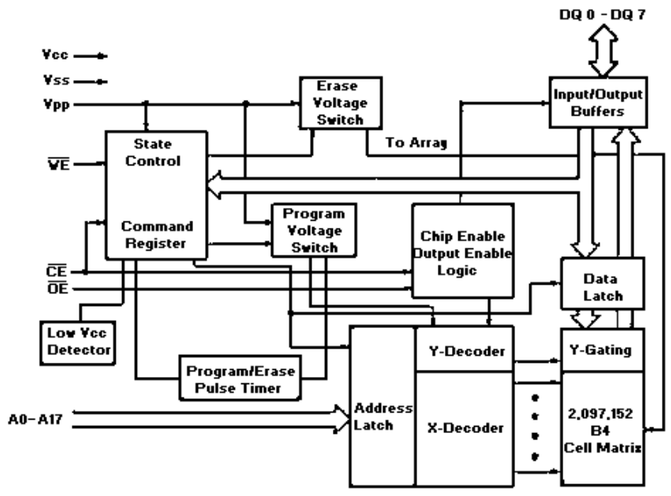



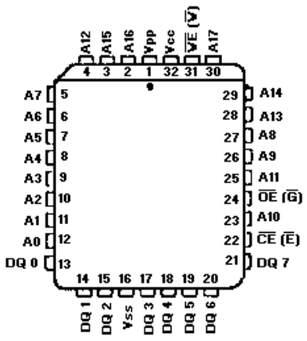

**RS-232 Driver/Receiver IC706**



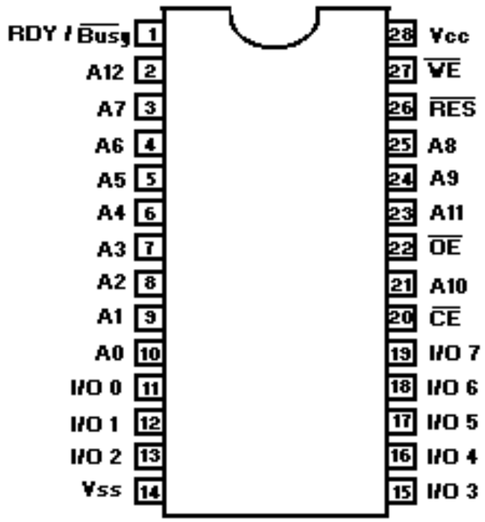



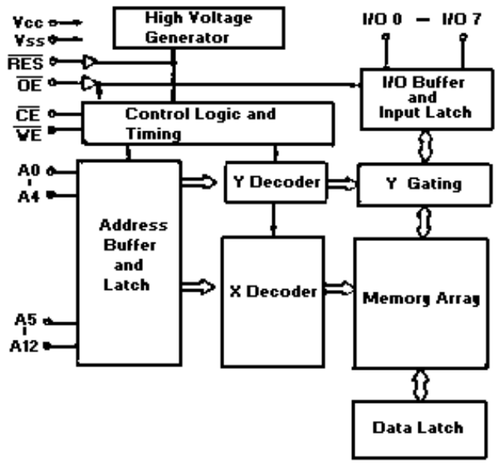

**Flash Memory IC707**



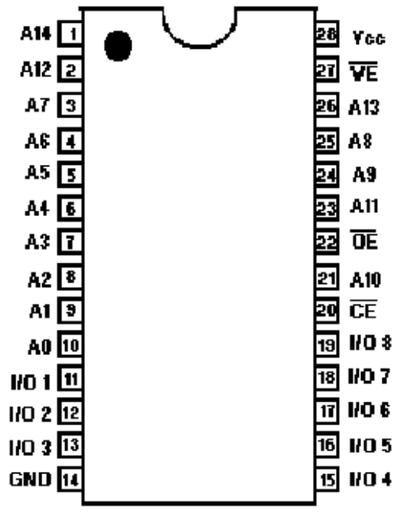



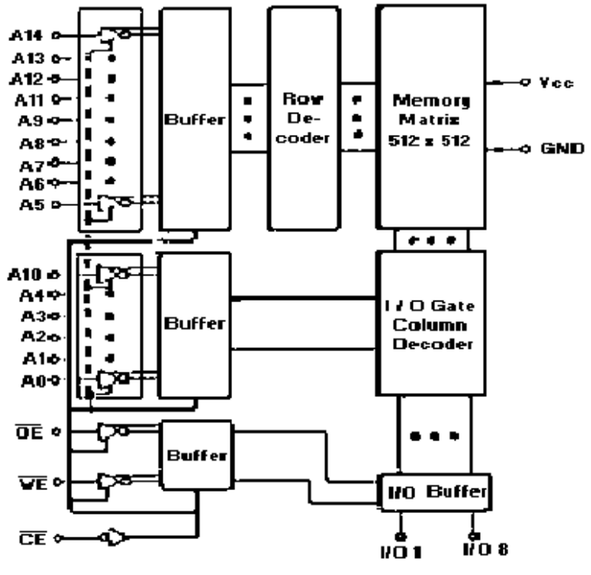
**EEPROM IC708**



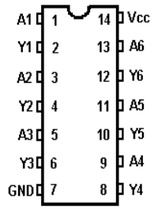



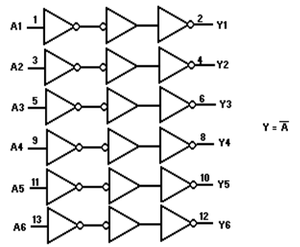

**RAM IC709**



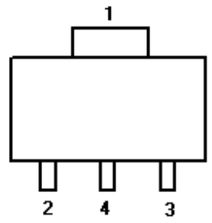




**Inverter IC711**

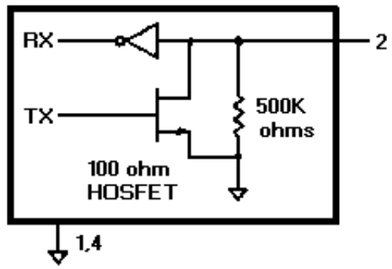


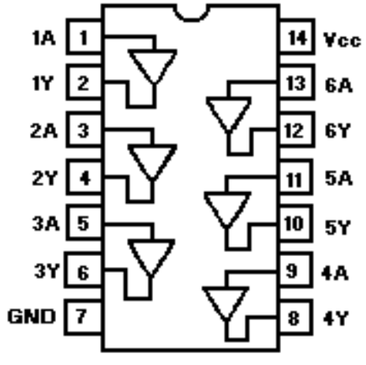

**Silicon Seral Number IC712**

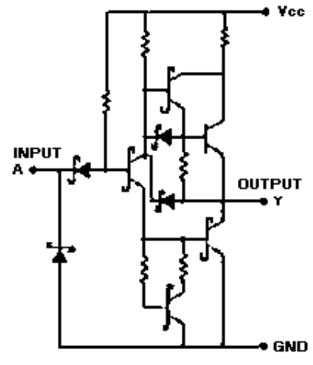



1. GND
2. DATA (DG)
3. NC
4. GND




**Inverter IC713**



**PARTS LIST**
**LOGIC/IF BOARD**
**LOGIC SECTION**
**CMC-682**
**(Used in P1, P2, P3)**

| SYMBOL | PART NO. | DESCRIPTION |
|---|---|---|
| | | ---------- CAPACITORS ---------- |
| C601 | NOTE: Parts listed are for reference only. Refer to Service Section for serviceable parts. | Ceramic: 0.01 µF ±10% 50 VDC, temp coef ±15%. |
| C602 | | Ceramic: 1 µF +80%/-20% 16 VDCW, temp coef +22%/-82%. |
| C603 | | Ceramic: 220 pF ±5% 50 VDCW, temp coef 0±30 PPM/°C. |
| C604 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW. |
| C605 | | Ceramic: 0.01 µF ±10% 50 VDC, temp coef ±15%. |
| C606 | | Tantalum: 1 µF ±20% 16 VDCW. |
| C607 Thru C609 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C610 | | Tantalum: 1 µF ±20% 16 VDCW. |
| C611 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C612 | | Tantalum: 3.3 µF ±20% 16 VDCW. |
| C613 | | Tantalum: 1 µF ±20% 16 VDCW. |
| C614 | | Tantalum: 0.33 µF ±20% 35 VDCW. |
| C615 | | Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM/°C. |
| C616 | | Ceramic: 1 µF +80%/-20% 16 VDCW, temp coef +22%/-82%. |
| C617 | | Tantalum: 0.33 µF ±20% 35 VDCW. |
| C618 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C621 And C622 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C623 | | Tantalum: 22 µF ±20% 16 VDCW. |
| C624 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C625 | | Tantalum: 1 µF ±20% 16 VDCW. |
| C626 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C627 | | Tantalum: 22 µF ±20% 16 VDCW. |
| C628 And C629 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C630 | | Tantalum: 22 µF ±20% 16 VDCW. |
| C631 And C632 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C633 | | Tantalum: 22 µF ±20% 16 VDCW. |
| C634 Thru C637 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C638 | | Ceramic: 220 pF ±5% 50 VDCW, temp coef 0±30 PPM/°C. |
| C639 | | Electrolytic: 47 µF ±20% 25 VDCW. |
| C640 | | Ceramic: 0.1 F +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C641 And C642 | | Electrolytic: 22 µF ±20% 16 VDCW. |
| C643 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C644 | | Electrolytic: 10 µF ±20% 25 VDCW. |
| C645 | | Ceramic: 1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C646 | | Ceramic: 1000 pF +80%/-20% 50 VDCW temp coef +22%/-82%. |
| C647 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C649 And C650 | | Electrolytic: 22 µF ±20% 16 VDCW. |
| C651 And C652 | | Ceramic: 0.47 µF +80%/-20% 25 VDCW temp coef +30%/-80%. |
| C653 And C654 | | Tantalum: 2.2 µF ±20% 16 VDCW. |
| C655 And C656 | | Electrolytic: 10 µF ±20% 25 VDCW. |
| C657 And C658 | | Ceramic: 0.047 µF +80%/-20% 50 VDCW temp coef +22%/-82%. |
| C659 And C660 | | Tantalum: 1 µF ±20% 16 VDCW. |
| C661 Thru C664 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C665 And C666 | | Ceramic: 0.1 µF ±10% 25 VDCW, temp coef ±15%. |
| C667 | | Tantalum: 1 µF ±20% 16 VDCW. |
| C670 | | Ceramic: 3300 pF ±10% 50 VDCW, temp coef ±15%. |
| C701 Thru C706 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C707 | | Ceramic: 47 pF ±5% 50 VDCW, temp coef 0±30 PPM/°C. |
| C708 And C709 | | Ceramic: 12 pF 20.25 pF 50 VDCW, temp coef 0±30 PPM/°C. |
| C710 | | Ceramic: 47 pF ±5% 50 VDCW, temp coef 0±30 PPM/°C. |
| C711 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C712 And C713 | | Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM/°C. |
| C714 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C715 Thru C719 | | Tantalum: 1 µF ±20% 16 VDCW. |
| C720 Thru C722 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C726 And C727 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C728 Thru C743 | | Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM/°C. |
| C744 And C745 | | Ceramic: 0.1 µF +80%/-20% 25 VDCW, temp coef +22%/-82%. |
| C746 | | Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%. |
| C747 | | Ceramic: 1000 pF ±10% 16 VDCW, temp coef ±10%. |
| | | ---------- DIODES ---------- |
| CD601 And CD602 | | POWER Supply rectification diode: sim to SANKEN SFPM-64V. |
| CD604 | | Silicon fast recovery (2 diodes in series):sim to TOSHIBA ISS300. |
| CD606 | | Zener, 900mW, 22V. |
| CD701 Thru CD705 | | Silicon fast recovery (2 diodes in series):sim to TOSHIBA ISS302. |
| CD709 And CD710 | | Silicon fast recovery (2 diodes in series):sim to TOSHIBA ISS302. |
| CD711 | | Silicon fast recovery (2 diodes in series):sim to TOSHIBA ISS300. |
| CD712 | | Zener 900mW 22 V: sim to Hitachi HZF12. |
| CX701 And CX702 | | EMI Filter. |
| F601 | | Fuse ,5A. |
| | | ---------- INTEGRATED CIRCUITS ---------- |
| IC601 | | Audio Signal PROCESSOR. |
| IC602 And IC603 | | Linear Audio Amplifier: sim to NJRC 3403. PC1230H2. |
| IC604 | | AF Power Amplifier: sim to NEC UPC2500H. |
| IC605 | | Linear Positive Voltage Regulator: sim to NJRC NJM78L09UA. |
| IC606 | | Linear: Positive Voltage Regulator; sim to MOTOROLA MC7805CT. |
| IC607 | | Linear: Positive Voltage Regulator; sim to SANYO L78M05T. |
| IC608 | | Linear: Positive Voltage Regulator; sim to SANYO L78M09T. |
| IC609 | | Linear Positive Voltage Regulator: sim to NJRC NJM78L09UA. |
| IC610 | | Reset Circuit: sim to MITSUMI PST575. |
| IC611 And IC612 | | Bilateral Switch: sim to TOSHIBA TC4S66F. |
| IC701 | | CPU: sim to HITACHI HD6435328RC72E. |
| IC702 | | CPU: sim to HITACHI HD6433308RR91E. |
| IC703 | | ASIC: sim to TOSHIBA TC24SC090AF. |
| IC704 | | DECODER: Sim to MOTOROLA MC74HC139. |
| IC705 | | RS485 Driver/Receiver: sim to NS AS75176. |
| IC706 | | RS232 Driver/Receiver: sim to MAXIM MA232EWE. |
| IC707 | | FLASH MEMORY: sim to INTEL N28F020. |
| IC708 | | EEPROM: sim to HITACHI HN58C66FP. |
| IC709 | | RAM: sim to TOSHIBA TC55257CFL. |
| IC711 | | Inverter: sim to MOTOROLA MC74HC04. |
| IC712 | | Silicon Seral Number: sim to DALLAS DS24012. |
| IC713 | | Inverter: sim to HITACHI HD74LS04FP. |
| | | ---------- JACKS ---------- |
| J701 | | Connector: 18 pins. |
| J702 And J703 | | Connector: 24 pins. |
| J704 | | Connector: 4 pins. |
| J706 | | Connector: 10 pins. |
| J707 | | Connector: 13 pins. |
| J708 | | Connector: 5 pins. |
| K601 | | Relay: sim to TAKAMIZAWA JY9H-K. |
| | | ---------- RESISTORS ---------- |
| R601 | | Metal film: 15k ohms ±5% 100 VDCW 1/16W. |
| R602 | | Metal film: 33K ohms ±5% 100 VDCW 1/16W. |
| R603 | | Metal film: 68k ohms ±5% 100 VDCW 1/16W. |
| R604 | | Metal film: 120K ohms ±5% 100 VDCW 1/16W. |
| R605 | | Metal film: 270K ohms ±5% 100 VDCW 1/16W. |
| R606 | | Metal film: 56K ohms ±5% 100 VDCW 1/16W. |
| R607 | | Metal film: 150K ohms ±5% 100 VDCW 1/16W. |
| R608 | | Metal film: 680 ohms ±5% 100 VDCW 1/16W. |
| R609 | | Metal film: 2.2k ohms ±5% 100 VDCW 1/16W. |
| R610 And R611 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| R612 And R613 | | Metal film: 39k ohms ±5% 100 VDCW 1/16W. |
| R614 | | Metal film: 4.7K ohms ±5% 100 VDCW 1/16W. |
| R615 | | Metal film: 100k ohms ±5% 100 VDCW 1/16W. |
| R616 | | Metal film: 470K ohms ±5% 100 VDCW 1/16W. |
| R617 | | Metal film: 3.3 M ±10% 200 VDCW 1/10W. |
| R618 And R619 | | Metal film: 100k ohms ±5% 100 VDCW 1/16W. |
| R620 | | Metal film: 47K ohms ±5% 100 VDCW 1/16W. |
| R621 | | Metal film: 22k ohms ±5% 100 VDCW 1/16W. |
| R622 Thru R624 | | Metal film: 56K ohms ±5% 100 VDCW 1/16W. |
| R625 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| R626 | | Metal film: 56k ohms ±5% 100 VDCW 1/16W. |
| R627 | | Metal film: 150k ohms ±5% 100 VDCW 1/16W. |
| R628 And R629 | | Metal film: 100K ohms ±5% 100 VDCW 1/16W. |
| R630 | | Metal film: 3.3M ohms ±10% 200 VDCW 1/10W. |
| R631 | | Metal film: 47k ohms ±5% 100 VDCW 1/16W. |
| R632 | | Metal film: 100K ohms ±5% 100 VDCW 1/16W |
| R633 | | Metal film: 22k ohms ±5% 100 VDCW 1/16W. |
| R634 | | Metal film: 1M ohms ±5% 100 VDCW 1/16W. |
| R635 | | Metal film: 6.8k ohms ±5% 100 VDCW 1/16W. |
| R636 | | Metal film: 27k ohms ±5% 100 VDCW 1/16W. |
| R637 Thru R639 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| R640 | | Metal film: 3.3k ohms ±5% 100 VDCW 1/16W. |
| R641 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| R642 | | Metal film: 22k ohms ±5% 100 VDCW 1/16W. |
| R643 And R644 | | Metal film: 22 ohms ±5% 100 VDCW 1/16W. |
| R645 And R646 | | Metal film: 1.0k ohms ±5% 100 VDCW 1/16W. |
| R647 | | Metal film: 8.2k ohms ±5% 100 VDCW 1/16W. |
| R648 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| R649 | | Metal film: 1M ohms ±5% 100 VDCW 1/16W. |
| R650 | | Metal film: 680 ohms ±5% 100 VDCW 1/16W. |
| R652 | | Metal film: 15K ohms ±5% 100 VDCW 1/16W. |
| R653 | | Metal film: 15K ohms ±5% 100 VDCW 1/16W. |
| R654 | | Metal film: 15K ohms ±5% 100 VDCW 1/16W. |
| R655 | | Metal film: 56k ohms ±5% 100 VDCW 1/16W. |
| R656 | | Metal film: 1.0k ohms ±5% 100 VDCW 1/16W. |
| R657 | | Carbon film: 560 ohms ±5% 200 VDCW 1/4W. |
| R660 | | Metal film: 0 ohms |
| R664 | | Metal film: 2.2k ohms ±5% 200 VDCW 1/4W. |
| R701 Thru R703 | | Metal film: 100 ohms ±5% 100 VDCW 1/16W. |
| R704 | | Metal film: 68k ohms ±5% 100 VDCW 1/16W. |
| R705 | | Metal film: 100 ohms ±5% 100 VDCW 1/16W. |
| R706 And R707 | | Metal film: 1.0k ohms ±5% 100 VDCW 1/16W. |
| R709 And R710 | | Metal film: 100 ohms ±5% 100 VDCW 1/16W. |
| R718 | | Metal film: 4.7k ohms ±5% 100 VDCW 1/16W. |
| R719 | | Metal film: 100k ohms ±5% 100 VDCW 1/16W. |
| R720 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| R721 | | Metal film: 47k ohms ±5% 100 VDCW 1/16W. |

| SYMBOL | PART NO. | DESCRIPTION |
|---|---|---|
| R724 And R725 | | Metal film: 2.7K ohms ±5% 100 VDCW 1/16W. |
| R726 | | Metal film: 1M ohms ±5% 100 VDCW 1/16W. |
| R729 And R730 | | Metal film: 0 ohms. |
| R732 | | Metal film: 0 ohms. |
| R733 | | Metal film: 4.7K ohms ±5% 100 VDCW 1/16W. |
| R734 | | Metal film: 1.0k ohms ±5% 100 VDCW 1/16W. |
| R735 | | Metal film: 4.7K ohms ±5% 100 VDCW 1/16W. |
| R736 | | Metal film: 6.8K ohms ±5% 100 VDCW 1/16W. |
| R737 Thru R740 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| R741 | | Metal film: 27k ohms ±5% 100 VDCW 1/16W. |
| R742 And R743 | | Metal film: 4.7K ohms ±5% 100 VDCW 1/16W. |
| R744 And R745 | | Metal film: 470 ohms ±5% 100 VDCW 1/10W. |
| R747 | | Metal film: 0 ohms. |
| R748 | | Metal film: 10K ohms ±5% 100 VDCW 1/16W. |
| R749 | | Metal film: 100K ohms ±5% 100 VDCW 1/16W. |
| R750 And R751 | | Metal film: 22k ohms ±5% 100 VDCW 1/16W. |
| R752 And R753 | | Metal film: 10k ohms ±5% 100 VDCW 1/16W. |
| SW601 | | Slide Switch. |
| SW701 | | Slide Switch. |
| | | ---------- TRANSISTORS ---------- |
| TR602 | | Transistor NPN: sim to SANYO 2SC3398. |
| TR603 | | Transistor NPN: sim to NEC 2SD596. |
| TR701 | | Transistor NPN: sim to TOSHIBA RN2301. |
| TR702 Thru TR712 | | FET: sim to NEC 2SK1582. |
| TR713 And TR714 | | Transistor NPN: sim to TOSHIBA 2SC2859. |
| TR715 And TR716 | | Transistor NPN: sim to NEC 2SC3736. |
| X701 | | Crystal: 9.8304 MHz CP12A. |

## PARTS LIST
## UHF LOGIC/IF BOARD
## LOGIC SECTION
## CMF-138W
## (Used in P1, P2, P3)

| SYMBOL | PART NO. | DESCRIPTION |
|---|---|---|
| | | ----------CAPACITORS---------- |
| C501 | NOTE: Parts listed are for reference only. Refer to Service Section for serviceable parts. | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C502 | | Ceramic: 5pF 0.25 pF 50 VDCW temp coef 0±60 PPM. |
| C503 | | Ceramic: 1.5pF 0.25 pF 50 VDCW temp coef 0±250 PPM. |
| C504 | | Ceramic: 7pF 0.5 pF 50 VDCW temp coef 0±60 PPM. |
| C505 | | Ceramic: 10pF 0.5 pF 50 VDCW temp coef 0±60 PPM. |
| C506 | | Ceramic: 5pF 0.25 pF 50 VDCW temp coef 0±60 PPM. |
| C507 | | Ceramic: 1.5pF 0.25 pF 50 VDCW temp coef 0±250 PPM. |
| C508 | | Ceramic: 5pF 0.25 pF 50 VDCW temp coef 0±60 PPM. |
| C509 Thru C512 | | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C513 And C514 | | Ceramic: 0.75pF 0.25pF 50 VDCW temp coef 0±250 PPM. |
| C515 And C516 | | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C521 | | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C522 And C523 | | Ceramic: 0.1F ±10% 25 VDCW temp coef ±15%. |
| C524 | | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C525 | | Ceramic: 15pF ±5% 50 VDCW temp coef 0±60 PPM. |
| C526 | | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C527 | | Ceramic: 33pF ±5% 50 VDCW temp coef 0±60 PPM. |
| C528 | | Ceramic: 15pF ±5% 50 VDCW temp coef 0±60 PPM. |
| C529 | | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C530 | | Ceramic: 0.01F ±10% 50 VDCW temp coef ±15%. |
| C531 | | Ceramic: 1pF 0.25pF 50 VDCW temp coef 0±250 PPM. |
| C553 | | Ceramic: 0.01F ±10% 50 VDCW temp coef ±15%. |
| C554 Thru C556 | | Ceramic: 0.1F ±10% 25 VDCW temp coef ±15%. |
| C557 | | Ceramic: 15pF ±5% 50 VDCW temp coef 0±60 PPM. |
| C558 And C559 | | Ceramic: 0.1F ±10% 25 VDCW temp coef ±15%. |
| C560 | | Ceramic: 1000pF ±10% 50 VDCW temp coef ±15%. |
| C561 Thru C565 | | Ceramic: 0.1F ±10% 25 VDCW temp coef ±15%. |
| C567 | | Electrolytic: 10F ±20% 16 VDCW. |
| C571 And C572 | | Ceramic: 0.1F ±10% 25 VDCW temp coef ±15%. |
| C573 | | Electrolytic: 10F ±20% 16 VDCW. |
| | | ----------FILTERS ---------- |
| FL501 And FL502 | | Crystal Filter: 82.2 MHz. |
| FL503 | | Ceramic: Filter: 455 KHz. |
| FL504 | | Ceramic: Filter: 455 KHz. |
| | | ---------- INTEGRATED CIRCUITS ---------- |
| IC501 | | Linear, IF Amplifier/Audio Detector; sim to TOSHIBA TA31132F. |
| IC502 | | Linear, Dual OP AMP; sim to NJRC NJM3404AM. |
| IC503 | | Linear, Positive Voltage Regulator; sim to NJRC NJM78L09UA. |
| | | ----------CONNECTORS ---------- |
| P501 | | Connector: 30 Pins. |
| | | ---------- COILS ---------- |
| L501 | | Coil: RF 1 H ±20%. |
| L502 | | Coil: RF . |
| L503 | | Coil: RF . |
| L504 And L505 | | Coil: RF . |
| L506 | | Coil: RF . |
| L507 | | Coil: RF . |
| L521 | | Coil: RF . |
| L522 | | Coil: RF 0.22 H ±10%. |
| L523 | | Coil: RF . |
| | | ----------RESISTORS ---------- |
| R501 | | Metal film: 82 ohms ±5% 100 VDCW.1/10W. |
| R502 | | Metal film: 18 ohms ±5% 100 VDCW.1/10W. |
| R503 | | Metal film: 3.9K ohms ±5% 50 VDCW.1/16W. |
| R505 | | Metal film: 150K ohms ±5% 50 VDCW.1/16W. |
| R506 | | Metal film: 330 ohms ±5% 50 VDCW.1/16W. |
| R507 And R508 | | Metal film: 10K ohms ±5% 50 VDCW.1/16W. |
| R509 | | Metal film: 220 ohms ±5% 50 VDCW.1/16W. |
| R510 | | Metal film: 5.6K ohms ±5% 50 VDCW.1/16W. |
| R511 | | Metal film: 330 ohms ±5% 50 VDCW.1/16W. |
| R521 | | Metal film: 15K ohms ±5% 50 VDCW.1/16W. |
| R522 | | Metal film: 4.7K ohms ±5% 50 VDCW.1/16W. |
| R523 | | Metal film: 1.5K ohms ±5% 50 VDCW.1/16W. |
| R524 | | Metal film: 100 ohms ±5% 50 VDCW.1/16W. |
| R525 | | Metal film: 33 ohms ±5% 50 VDCW.1/16W. |
| R526 | | Metal film: 1K ohms ±5% 50 VDCW.1/16W. |
| R527 | | Metal film: 4.7K ohms ±5% 50 VDCW.1/16W. |
| R528 | | Metal film: 10K ohms ±5% 50 VDCW.1/16W. |
| R529 | | Metal film: 1K ohms ±5% 50 VDCW.1/16W. |
| R530 | | Metal film: 10K ohms ±5% 50 VDCW.1/16W. |
| R531 | | Metal film: 100 ohms ±5% 50 VDCW.1/16W. |
| R552 | | Metal film: 1.5K ohms ±5% 50 VDCW.1/16W. |
| R556 And R557 | | Metal film: 1.5K ohms ±5% 50 VDCW.1/16W. |
| R559 | | Metal film: 820 ohms ±5% 50 VDCW.1/16W. |
| R560 | | Metal film: 18K ohms ±5% 50 VDCW.1/16W. |
| R562 | | Metal film: 10K ohms ±5% 50 VDCW.1/16W. |
| R563 | | Metal film: 6.8K ohms ±5% 50 VDCW.1/16W. |
| R564 | | Metal film: 1.2K ohms ±5% 50 VDCW.1/16W. |
| R565 | | Metal film: 5.6K ohms ±5% 50 VDCW.1/16W. |
| R566 | | Metal film: 0 ohms, 1/16W. |
| RV501 | | Variable: 10K ohms. |
| | | ----------TRANSISTORS ---------- |
| TR501 And TR502A | | N-Channel, field effect 2SK1577. |
| TR503 | | Silicon, NPN; sim to NEC 2SC2223. |
| TR504 And TR505 | | Silicon, NPN; sim to HITACHI 2SC2620. |
| | | ---------- CRYSTALS ---------- |
| X501 | | Quartz crystal: 82.655 MHz. |
| XS501A And XS501B | | Crystal Socket. |

### PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number on the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the description of parts affected by these revisions.

**REV. A - UHF TX RX 344A4578P1, P2 & P3**
**Control Logic Board CMC-862**

To eliminate "sneak" current path on switched outputs. Deleted diodes CD713 and CD714.

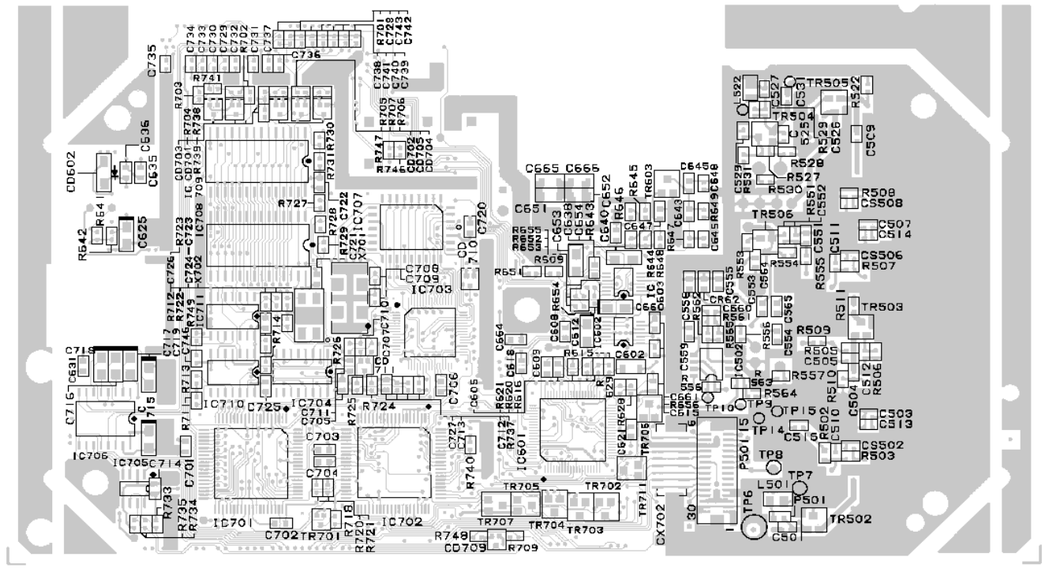
**REV. B - UHF TX RX 344A4578P1, P2 & P3**
**Control Logic Board CMC-862**

To reduce TX hum and noise. Added 2.2k ohms resistor between capacitor C670 and capacitor C603.

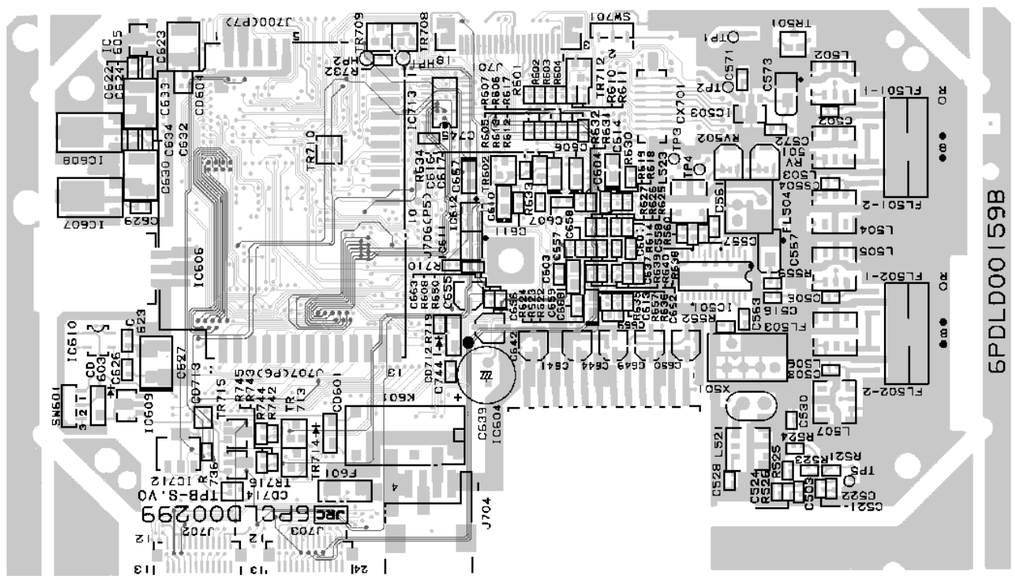
**REV. C - UHF TX RX 344A4578P1, P2 & P3**

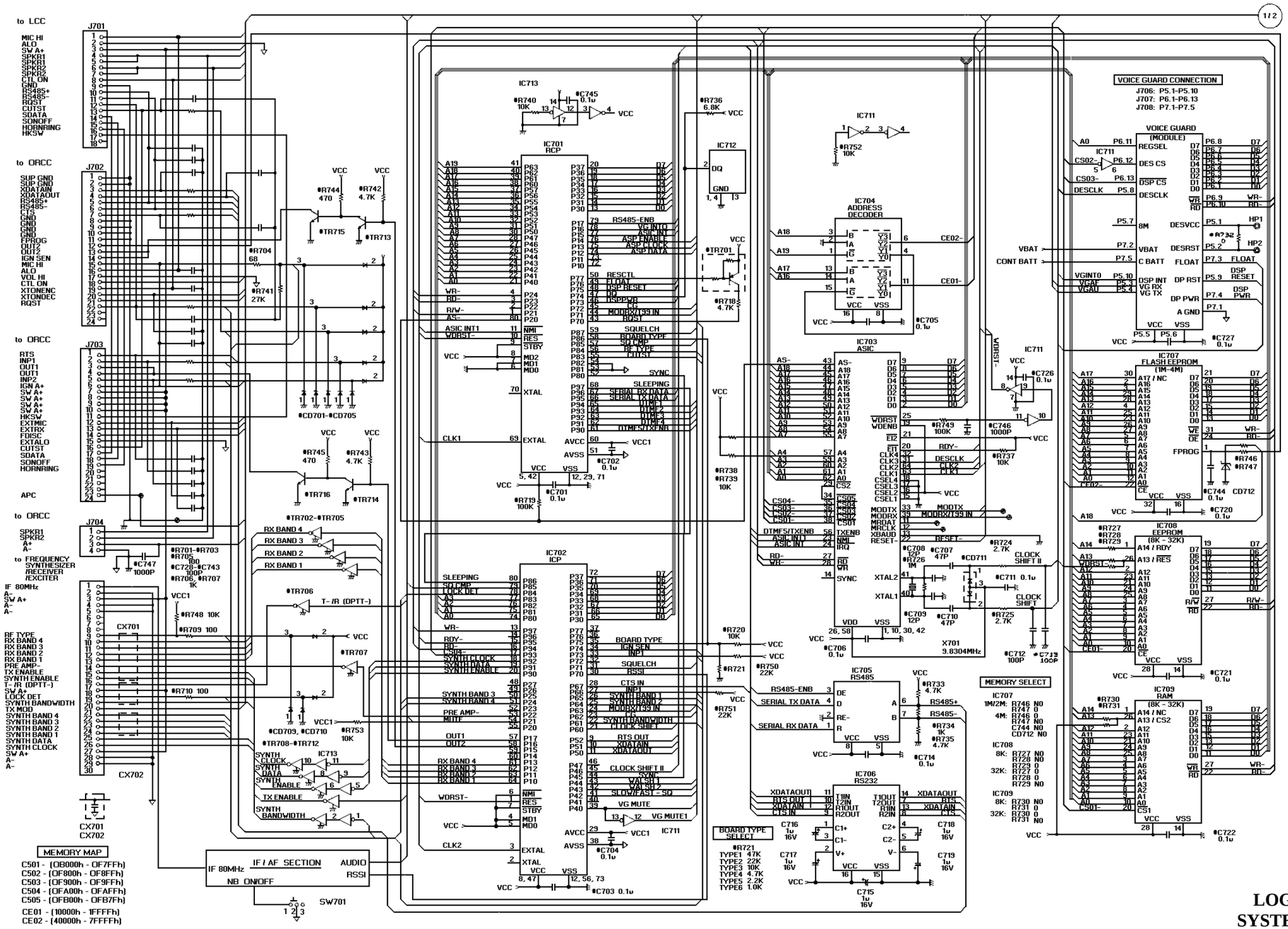
To improve Dual Radio speaker gain balance and improve RF Type decoding. Removed CD606 and R651, R636 was 10k ohms, R609 was 22k ohms, added R664 and CD606 and connected R748 to Vcc1.

**COMPONENT SIDE**



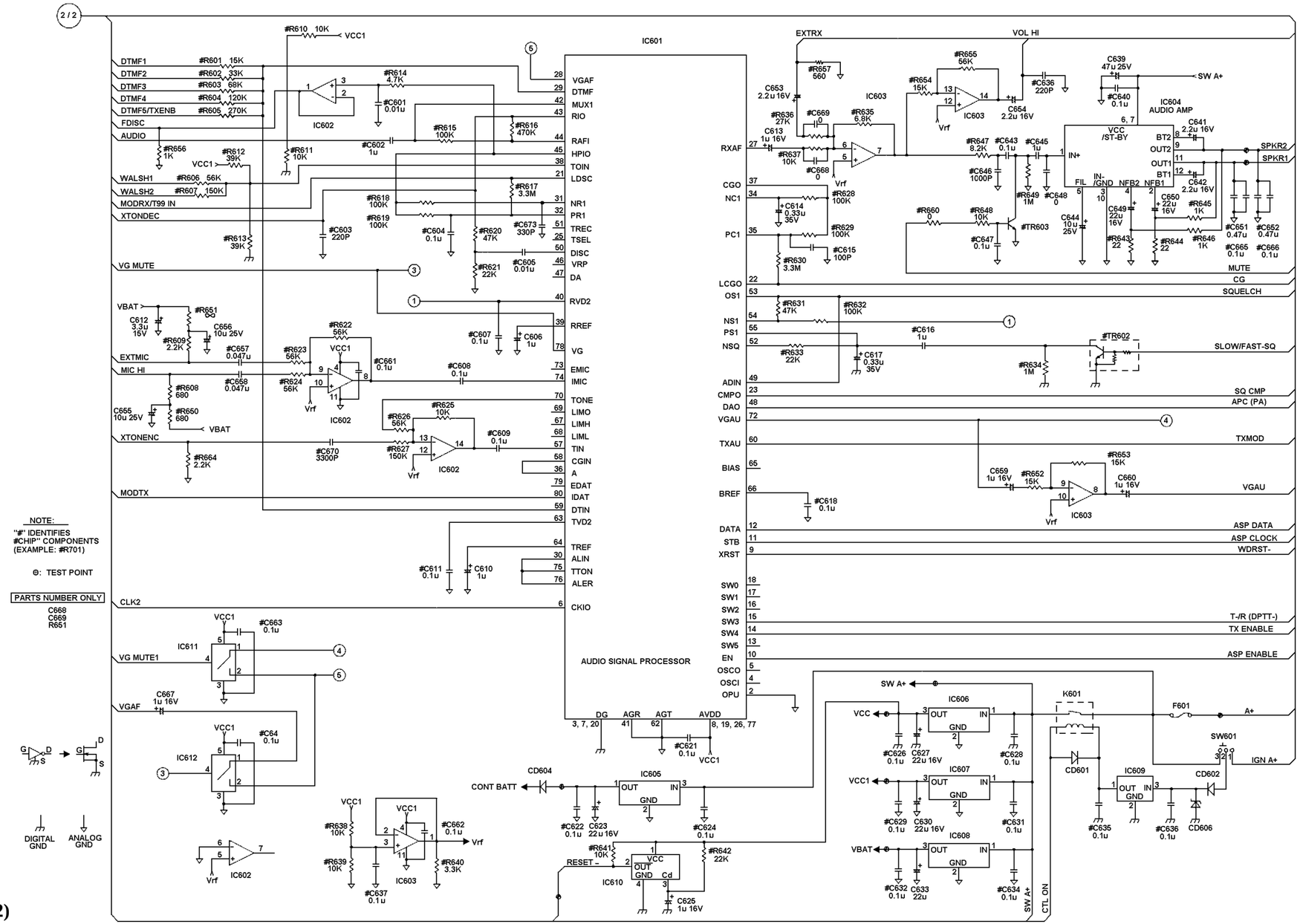
**SOLDER SIDE**





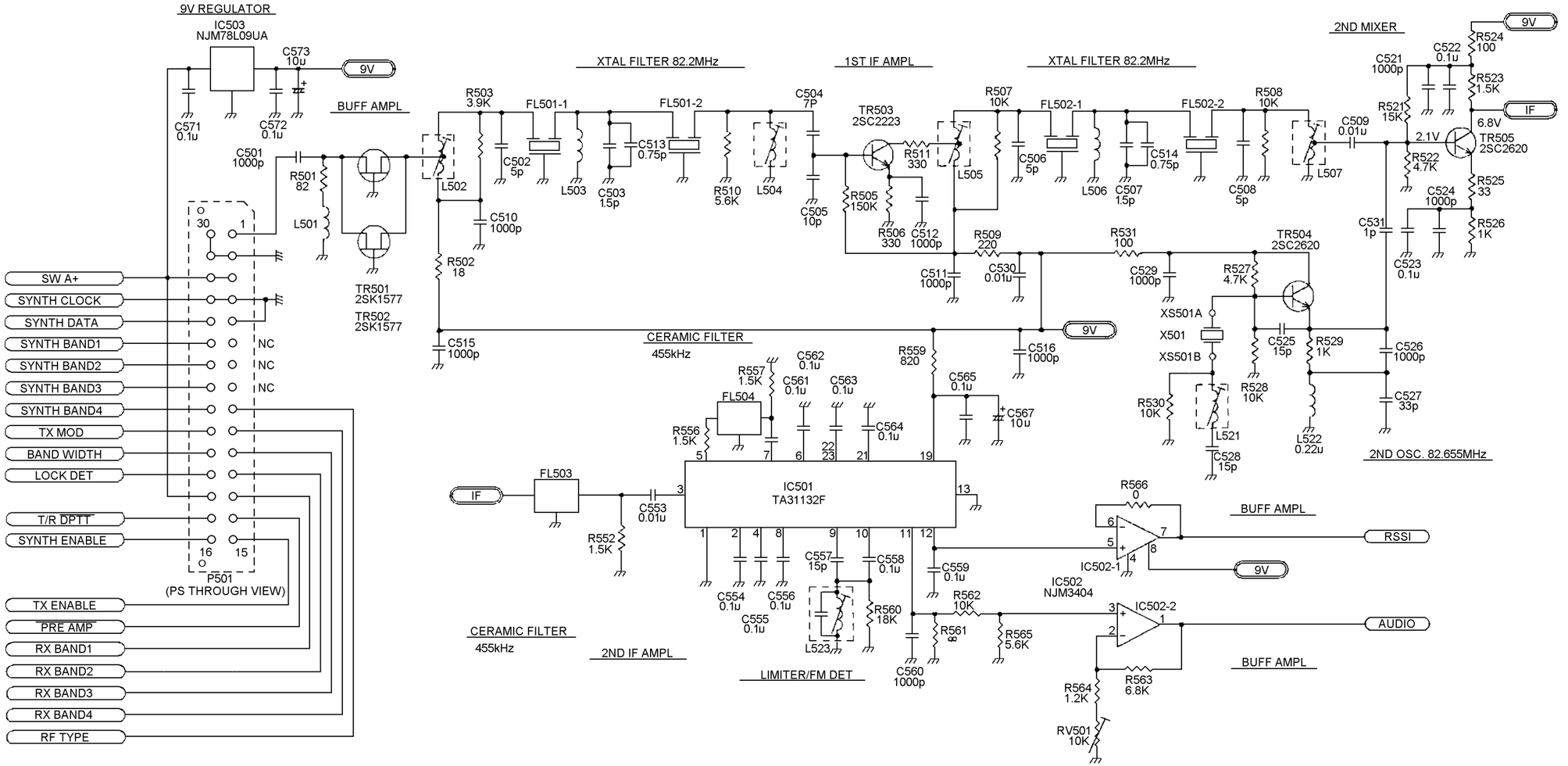

**LOGIC (CMC-682)**
**SYSTEM CONTROL**

(DD00-CMC-682 1/2)




## LOGIC (CMC-682)
## SYSTEM CONTROL

(DD00-CMC-682 2/2)




NOTE:
ALL RESISTORS ARE 1/16 WATT UNLESS OTHERWISE SPECIFIED. RESITOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M. CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER u, n OR p. INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m, u OR n.

**IF(CMF-138W)**

(DD02-CMF-138W)