# Maintenance Manual

FRONT PANEL
ASSEMBLY

ERICSSON

**Ericsson Inc.**
Private Radio Systems
Mountain View Road
Lynchburg, Virginia 24502
1-800-528-7711 (Outside USA, 804-528-7711)

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# DESCRIPTION

The Panel Control, Display and Dual Tone Multi Frequency (DTMF) Switch boards are housed in the Front Panel Assembly of the EDACS FMD mobile radio (Figure 1). The Display board contains the control switches, indicators, and display used to communicate information between the radio and the operator. The Panel Control board interfaces and processes signals between the Display board and the rest of the radio.

# CIRCUIT ANALYSIS

## PANEL CONTROL BOARD

The Panel Control board interfaces between the Display board, the System Control board, DTMF SW board (System model), speaker, microphone, and the MDT connector. The board contains an 87552 microcontroller (IC921), voltage regulators, power reset and interface circuitry, and backlighting control.

Power enters the board through connector P921-2 from the System Control board. Switched A + (SW A +) is applied to two voltage regulators (IC923 and IC924). Regulator IC923 provides + 5 Vdc to power the logic circuitry, and IC924 provides + 9 Vdc for the backlight LED indicators. Power- on reset is provided by the 5-volt regulator (RST line) and is applied through inverter TR921 to the RESET input of the microcontroller (IC921-15).

Microphone connections are made to the board through J923. No audio processing is performed on the Control Panel board and the microphone lines (MIC HI and MIC LO) are passed to the System Control board through P921-1.

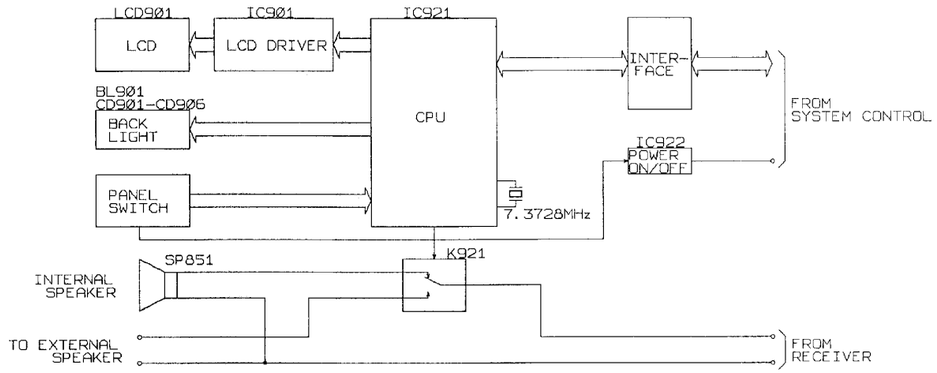
Signal lines from the operating control switches (GRP DWN, VOL UP, etc.) on the Display board enter the Control Panel board at J921. These active-low lines are diode protected by CD921 thru CD931 and pulled up to 5 volts by R921 thru R932. All lines, with the exception of the POWER switch, connect directly to microcontroller IC921.

The POWER switch is handled differently from the rest of the switch lines. A dual D-type flip-flop (IC922) is used to debounce the switch and provide a toggle action to the push-button power switch. The POWER switch on the Display board is tied to the Control Panel board at J921-A7 (PWR). The PWR line is diode protected (CD942) and tied to the preset (PR) line of IC922. Power (A +) is applied to the flip-flops and is also used to hold both preset (PR) lines high.

When power is applied to the radio, the Q output (IC922-5) is preset to zero which holds the clock (CK) input (IC922-11) low. The Q output of the second flip-flop (IC922-9) is also preset to zero, which is applied to the input of transistor switch TR938, causing the POW ON(-) output to be held high indicating a power off condition. The Q(-) line (IC922-8) is now high and is fed back to the D input of the flip-flop (IC922-12) ready to be clocked in when CK goes high.

When the POWER switch is pressed, the PWR line is held low and starts to discharge C932 through R941. As the voltage decreases across C932, the preset (PR) line (IC922-4) will go low causing the Q output (IC922-5) to go high. The high on the Q output causes a one to be clocked into the second flip-flop causing its Q output to go high, turning on TR938. When TR938 is turned on, POWER ON (-) goes low signalling a power-on condition. At the same time TR938 is turned on, the Q(-) output of the flip-flop goes low causing the D input (IC922-12) to be driven low. The next time the POWER switch is pressed, the zero will be clocked into the flip-flop causing TR928 to turn off.

**SCAN MODEL**




**SYSTEM MODEL**

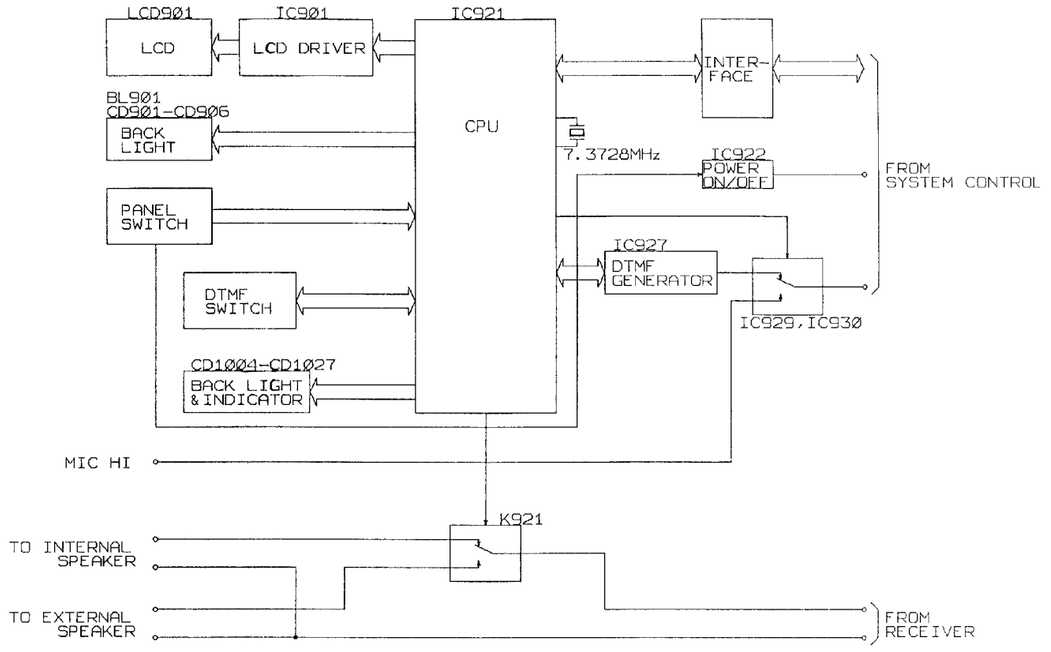



Figure 1 - Front Assembly Block Diagrams

Backlight levels of the LCD and operating controls are set by current switches TR922 and TR924. The switches complete the path from + 9 volts, through the backlight diodes on the Display board and back to ground. Return current from the backlight LEDs flows into the Control Panel board at J921-B7 (BKLT) and is tied to the current switches through R948 and R949. The BK HI (backlight high) and BK LO (backlight low) lines from the microcontroller (IC921-53 & -54) are connected to switch drivers TR923 and TR925. Depending on the levels of BK LO and BK HI, the two current switches are turned on (or off) in different combinations, effectively placing different values of resistance (R948 and R949) in the return path. Four different backlight levels are possible.

Serial data (SER Tx DATA) enters the board at P921-1 pin 1 and is filtered and diode protected before being tied to the microcontroller RXD input (IC921-24). The SER Tx DATA line is also connected to the MDT connector (J924-A1).

Serial data generated by the microcontroller (IC921-25) is applied to driver TR931 which controls open-collector driver TR930. The output of TR930 is filtered and connected to P921-1 pin 2 and J924-A2.

If the microcontroller has data to send over the serial link, it lowers the SER RQST (serial request) line (IC921-52). When SER RQST is lowered it causes open-collector driver TR932 to pull the SER RQST line (J924-A3) low.

The microcontroller clock frequency is set by X921 which is connected to IC921 pins 34 & 35. Jumper F and capacitor C949 are used to shift the oscillator frequency when required. Should the 7.3728 MHz frequency become incompatible with any units in the system, jumper F may be removed to shift the frequency.

An optional external alarm may be controlled by the radio through the EXTERNAL ALARM line (J924-B1). When the microcontroller lowers the ALARM (IC921-51) line, open-collector driver TR935 turns on and activates the external equipment.

The radio will support an internal or external speaker system. Relay K921 determines the audio path between the speaker connector P922 and the MDT connector J923. The relay is controlled by the microcontroller INT line (IC921-50). When this line is high, driver TR937 is turned on keeping K921 energized and routing audio to the external speaker. When INT is low, TR937 is off and the internal speaker is selected.

## DISPLAY BOARD

The Display board contains the LCD, display decoder/driver, indicators, front panel controls, and the backlight unit. The Display board interfaces directly to the Panel Control board through connector P901.

The LCD has eight fourteen-segment alphanumeric characters and nine status indicators. Serial data to be displayed by the LCD comes from the microcontroller bus through the Panel Control Board and is applied to IC901-1. The clock and load pulses are applied to the LCD decoder/driver at pins 2 (SCL) and 12 (VLCD). Backlighting is provided for the LCD and the VOLUME, GROUP and SYSTEM controls. Diodes CD901 thru CD906 illuminate the operating controls and LED backlight unit BL901 illuminates the LCD. Chip resistors R901 and R904 are used to limit the current through the backlight diodes.

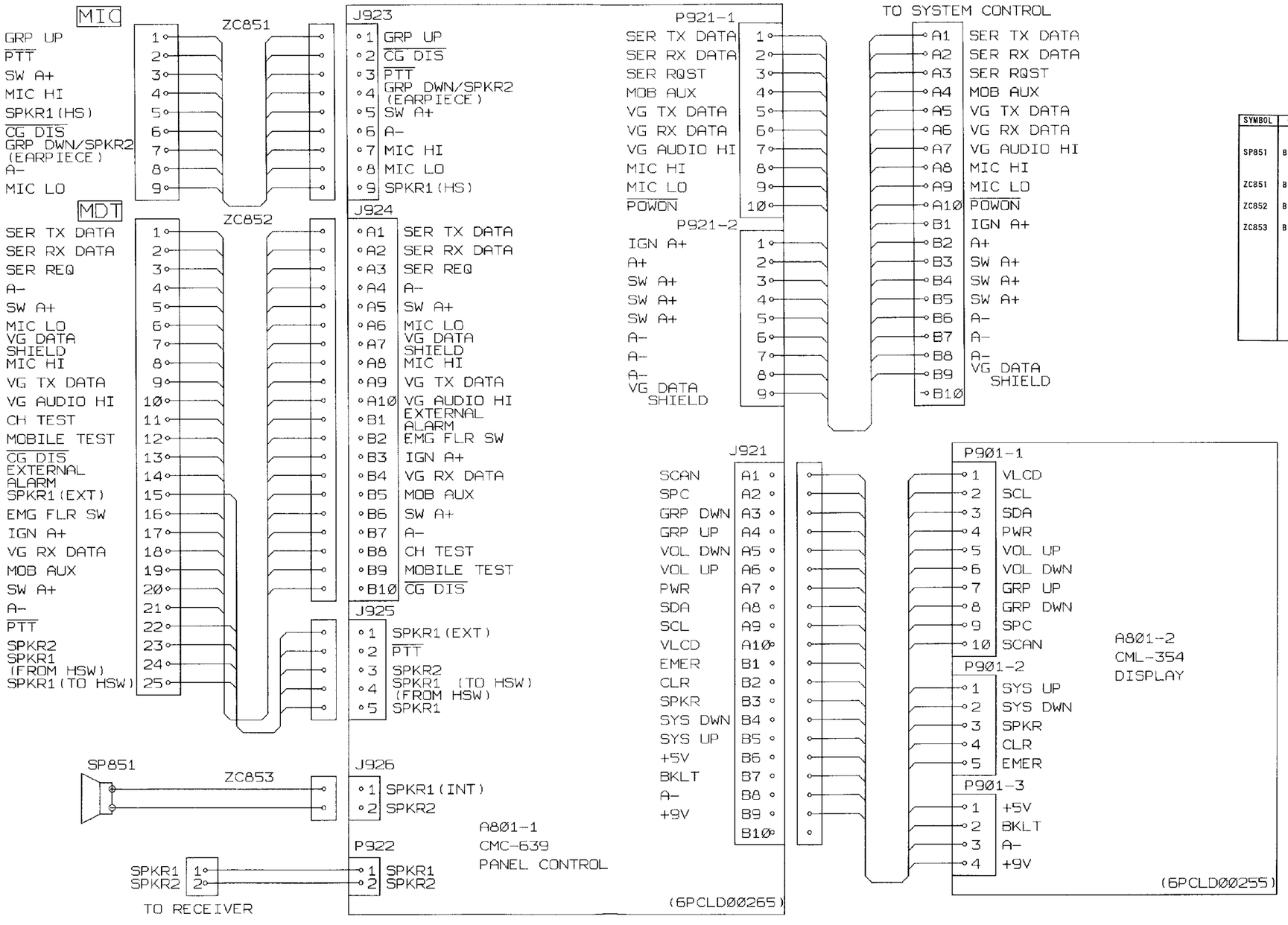
There are four backlight levels (including off) that are available. These levels are set on the Panel Control board through the use of two current switches. The amount of current flowing from + 9V through the back-light diodes and returning to ground (BKLT) is controlled by the settings of the current switches on the Panel Control board.

The operating control switches on the front panel are all tied to a bus through connector P901 to the Panel Control board. The switch states are read by the microcontroller on the Control Panel board.

## DTMF SW BOARD (SYSTEM MODEL)

The Dual Tone Multiple Frequency (DTMF) Switch board contains the keypad function LEDs (CD1004 - CD1015), button backlight LEDs (CD1016 - CD1027), and DTMF switches. This board interfaces to the Panel Control board through connector P1001.

A pair of cascaded shift registers (IC1001 and IC1002) are used to receive the serial data signal (SDA1) and provide a parallel output used to drive the keypad function LEDs. The backlight LEDs for the keypad buttons are controlled with the BKLT1 line from the Panel Control Board through P1001-14. The backlight LED control circuitry is similar to that explained under DISPLAY BOARD above. The DTMF switch states are read by the microcontroller on the Panel Control board.

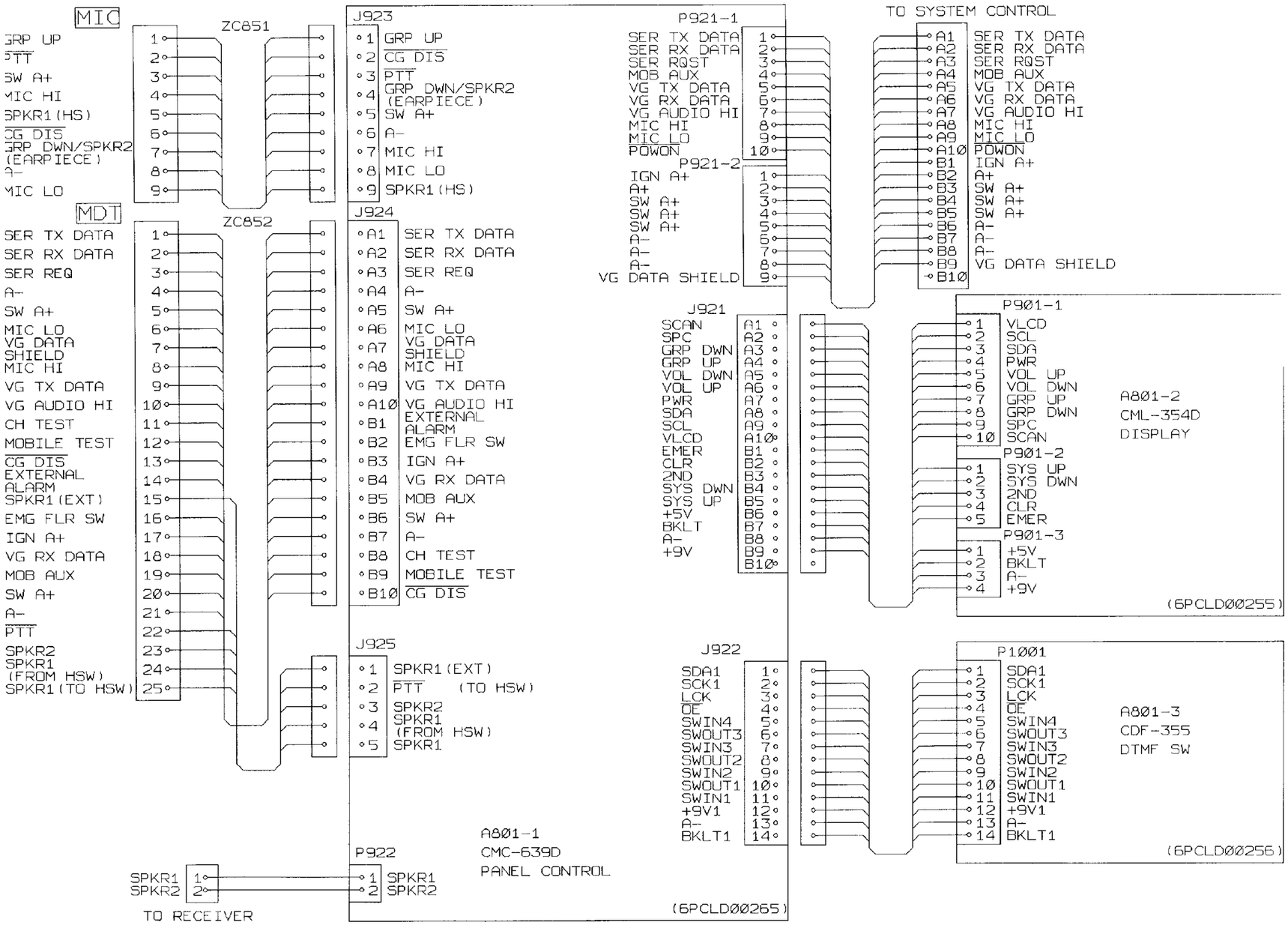



PARTS LIST

ALPHANUMERIC FMD
PANEL
(SCAN MODEL)
B19/CMD-507

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - SPEAKERS - - - - - - - - - - |
| SP851 | B19/5USAF00077 | Speaker: 16 ohms. |
| | | - - - - - - - - - - PLUGS - - - - - - - - - - |
| ZC851 | B19/6ZCLD00032 | Cable Assembly. |
| ZC852 | B19/6ZCLD00112 | Cable Assembly. |
| ZC853 | B19/6ZCLD00046 | Cable Assembly. |

**PANEL (SCAN MODEL)**
**B19/CMD-507**



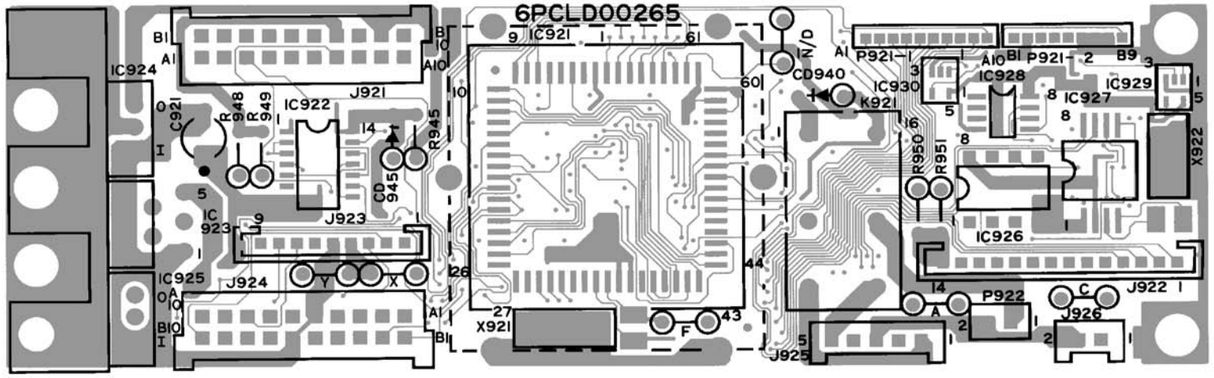

PARTS LIST

ALPHANUMERIC FWD PANEL (SYSTEM MODEL) B19/CMD-507D

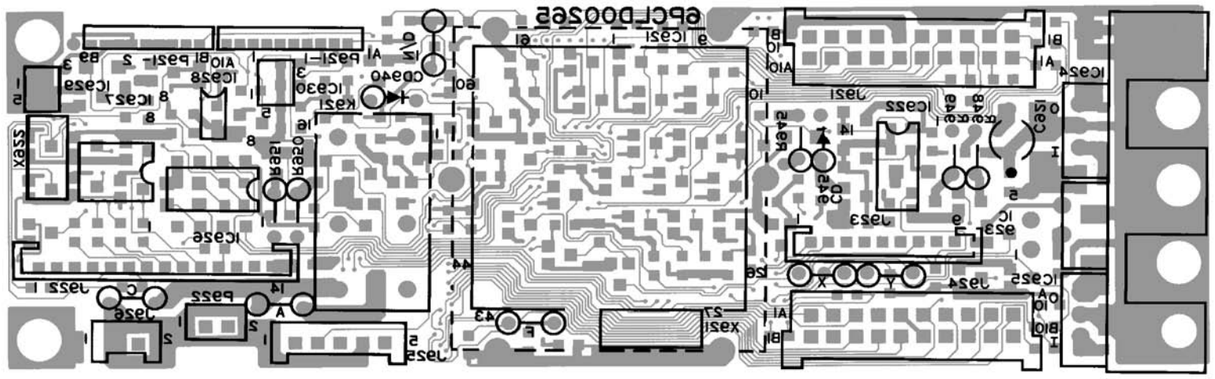
| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - PLUGS - - - - - - - - - - |
| ZC851 | B19/6ZCLD00032 | Cable Assembly. |
| ZC852 | B19/6ZCLD00112 | Cable Assembly. |

**PANEL (SYSTEM MODEL)**
**B19/CMD-507D**

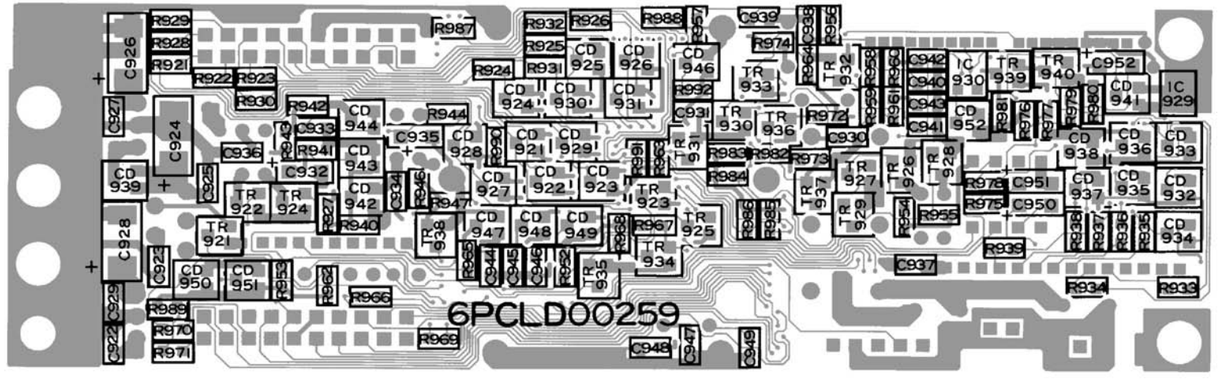
**COMPONENT SIDE**



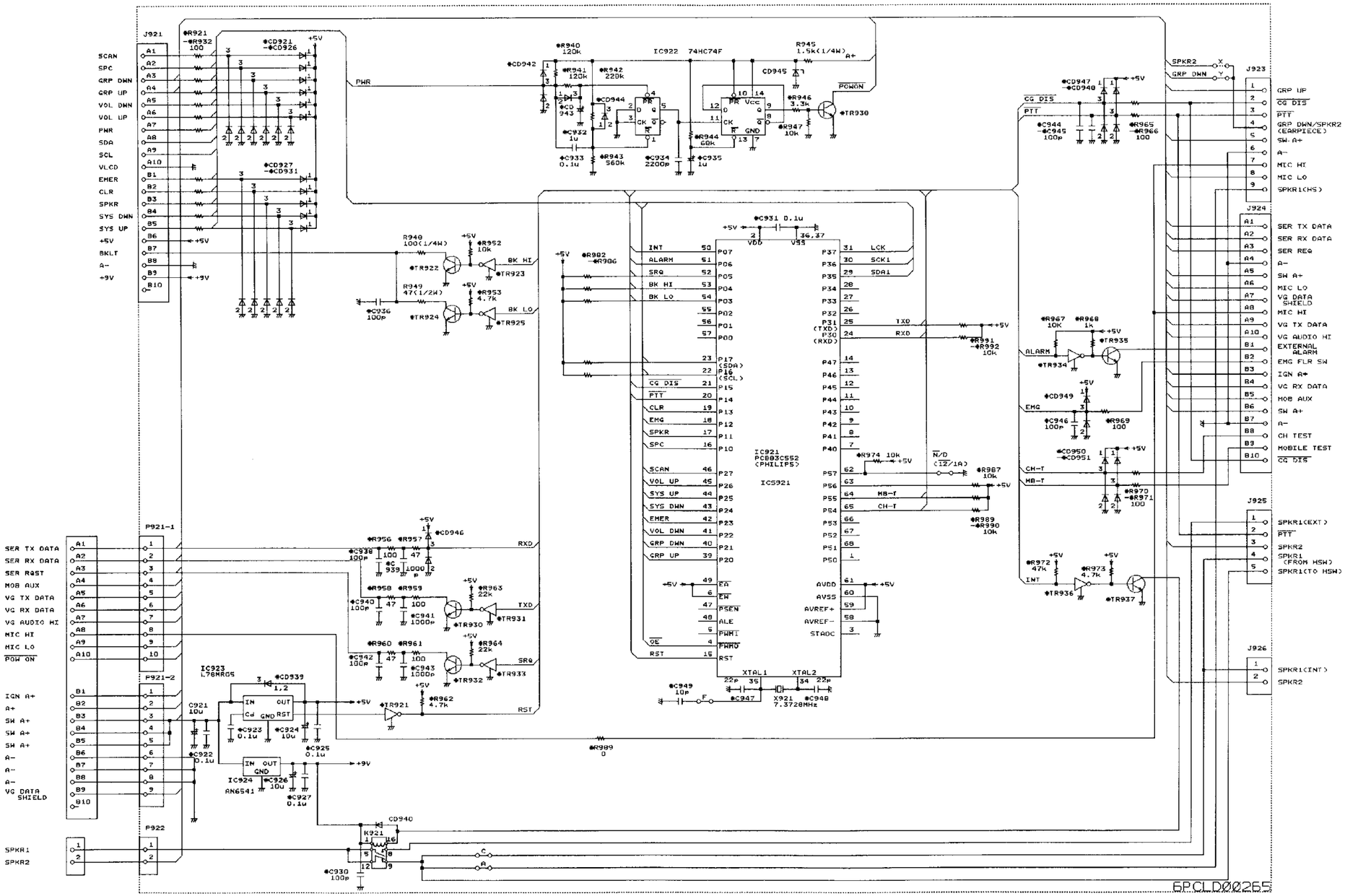

**SOLDER SIDE**



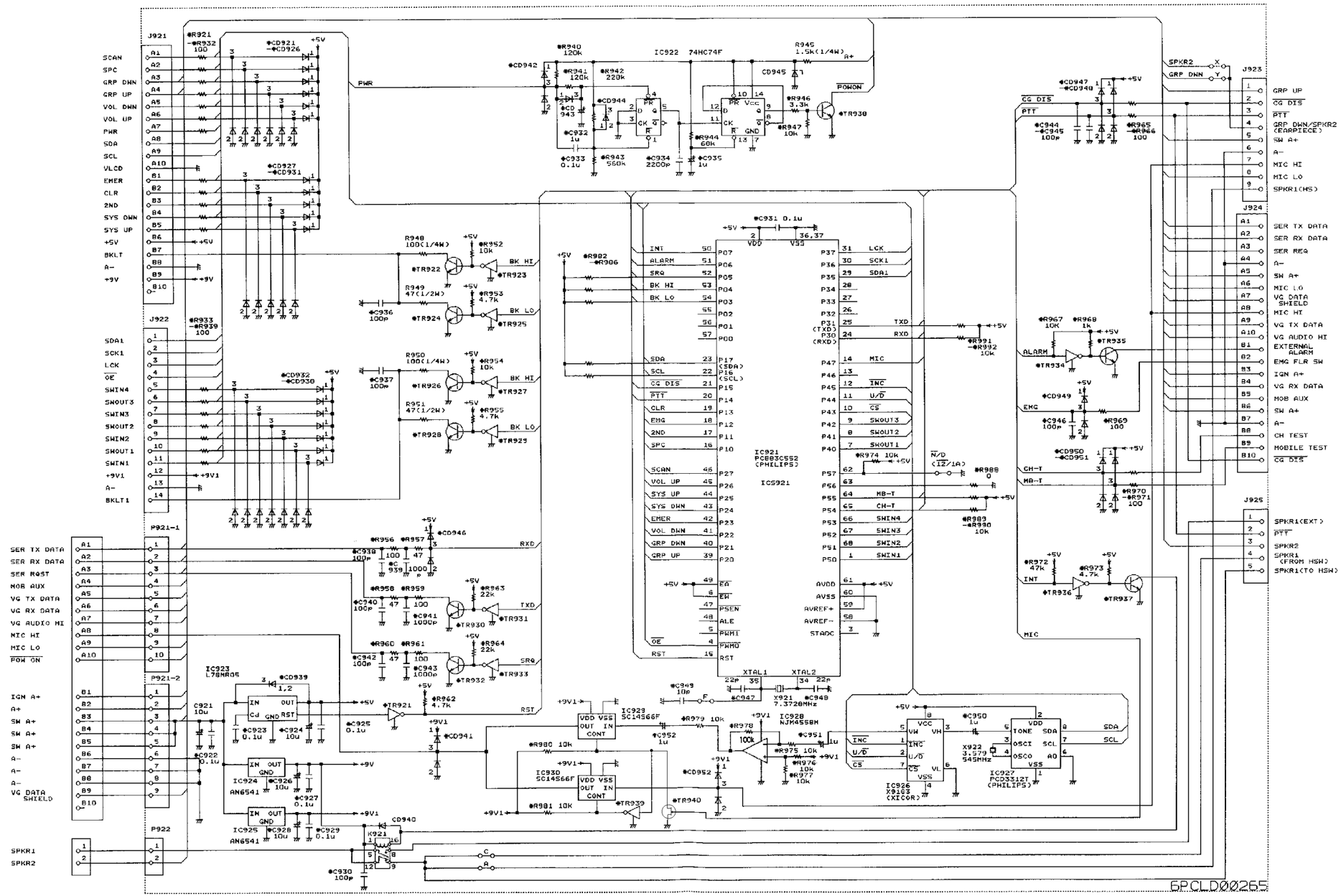
**CHIP COMPONENT SIDE (THROUGH BOARD VIEW)**




**PANEL CONTROL BOARD**
**B19/CMC-639 (SCAN MODEL)**
**B19/CMC-639D (SYSTEM MODEL)**




**PANEL CONTROL (SCAN MODEL)**
**B19/CMC-639**




**PANEL CONTROL (SYSTEM MODEL)**
**B19/CMC-639D**

PARTS LIST

ALPHANUMERIC FMD
PANEL CONTROL
(SCAN MODEL)
B19/CMC-639

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - CAPACITORS - - - - - - - - - |
| C921 | B19/5CEAA01864 | Electrolytic: 10uF, ±20%, 25VDCW. |
| C922 and C923 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C924 | B19/5CSAA00298 | Tantalum: 10uF, ±10%, 16VDCW. |
| C925 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C926 | B19/5CSAA00298 | Tantalum: 10uF, ±10%, 16VDCW. |
| C927 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C930 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C931 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C932 | B19/5CEAA02249 | Tantalum: 1uF, ±10%, 16VDCW. |
| C933 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C934 | B19/5CAAD00946 | Ceramic: 2200pF, ±10%, 50VDCW, temp coef 0±15%. |
| C935 | B19/5CEAA02249 | Tantalum: 1uF, ±10%, 16VDCW. |
| C936 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C938 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C939 | B19/5CAAD00838 | Ceramic: 1000pF, ±10%, 50VDCW, temp coef 0±15%. |
| C940 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C941 | B19/5CAAD00838 | Ceramic: 1000pF, ±10%, 50VDCW, temp coef 0±15%. |
| C942 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| C943 | B19/5CAAD00838 | Ceramic: 1000pF, ±10%, 50VDCW, temp coef 0±15%. |
| C944 thru C946 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C947 and C948 | B19/5CAAD00840 | Ceramic: 22pF, ±5%, 50VDCW, temp coef 0±15 PPM. |
| C949 | B19/5CAAD00953 | Ceramic: 10pF, ±5%, 50VDCW, temp coef 0±15 PPM. |
| | | - - - - - - - - - - DIODES - - - - - - - - - - |
| CD921 thru CD931 | B19/5TXAD00330 | Silicon, fast recovery (2 diodes in series): sim to TOSHIBA 1SS226. |
| CD939 | B19/5TXAD00291 | Silicon, fast recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184. |
| CD940 | B19/5TXAN00068 | Silicon, fwd current 1A, 200PIV: sim to SANKEN EM01ZW. |
| CD942 | B19/5TXAD00330 | Silicon, fast recovery (2 diodes in series): sim to TOSHIBA 1SS226. |
| CD943 and CD944 | B19/5TXAD00291 | Silicon, fast recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184. |
| CD945 | B19/5TXAE00568 | Zener, 500mW, 5V: sim to HITACHI HZ5C1. |
| CD946 thru CD951 | B19/5TXAD00330 | Silicon, fast recovery (2 diodes in series): sim to TOSHIBA 1SS226. |
| | | - - - - - - INTEGRATED CIRCUITS - - - - - - |
| IC921 | B19/5DDEG00031 | Microcomputer: sim to PHILIPS S87C552. |
| IC922 | B19/5DAAJ00852 | Flip-Flops: sim to MOTOROLA MC74HC74AF. |
| IC923 | B19/5DDCC00024 | Linear, Positive Voltage Regulator: sim to SANYO L78MR05. |
| IC924 | B19/5DAAJ00581 | Linear, Positive Voltage Regulator: sim to MOTOROLA MC7809CT. |
| | | - - - - - - - - - CONNECTORS - - - - - - - - - |
| J921 | B19/5JWAV00116 | Connector: 20 pins. |
| J923 | B19/5JWAV00117 | Connector: 9 pins. |
| J924 | B19/5JWAV00116 | Connector: 20 pins. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| J925 | B19/5JJAL00090 | Connector: 5 pins. |
| J926 | B19/5JWAV00120 | Connector: 2 pins. |
| | | - - - - - - - - - - RELAYS - - - - - - - - - - |
| K921 | B19/5KLAD00703 | Relay, DC9V: sim to NATIONAL DSP1-DC9V. |
| | | - - - - - - - - - - PLUGS - - - - - - - - - - |
| P921 | B19/6ZCLD00104 | Cable Assembly. |
| P922 | B19/6ZCLD00040 | Cable Assembly. |
| | | - - - - - - - - - RESISTORS - - - - - - - - - |
| R921 thru R932 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R940 and R941 | B19/5RDAC02487 | Metal film: 120K ohms, ±5%, 100VDCW, 1/10W. |
| R942 | B19/5RDAC02453 | Metal film: 220K ohms, ±5%, 100VDCW, 1/10W. |
| R943 | B19/5RDAC02463 | Metal film: 560K ohms, ±5%, 100VDCW, 1/10W. |
| R944 | B19/5RDAC02485 | Metal film: 68K ohms, ±5%, 100VDCW, 1/10W. |
| R945 | B19/5RDAA01349 | Carbon film: 1.5K ohms, ±5%, 1/4W. |
| R946 | B19/5RDAC02462 | Metal film: 3.3K ohms, ±5%, 100VDCW, 1/10W. |
| R947 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R948 | B19/5RDAA01321 | Carbon film: 100 ohms, ±5%, 1/4W. |
| R949 | B19/5RDAA01066 | Carbon film: 47 ohms, ±5%, 1/2W. |
| R952 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R953 | B19/5RDAC02478 | Metal film: 4.7K ohms, ±5%, 100VDCW, 1/10W. |
| R956 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R957 and R958 | B19/5RDAC02460 | Metal film: 47 ohms, ±5%, 100VDCW, 1/10W. |
| R959 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R960 | B19/5RDAC02460 | Metal film: 47 ohms, ±5%, 100VDCW, 1/10W. |
| R961 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R962 | B19/5RDAC02478 | Metal film: 4.7K ohms, ±5%, 100VDCW, 1/10W. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| R963 and R964 | B19/5RDAC02454 | Metal film: 22K ohms, ±5%, 100VDCW, 1/10W. |
| R965 and R966 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R967 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R968 | B19/5RDAC02446 | Metal film: 1K ohms, ±5%, 100VDCW, 1/10W. |
| R969 thru R971 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R972 | B19/5RDAC02439 | Metal film: 47K ohms, ±5%, 100VDCW, 1/10W. |
| R973 | B19/5RDAC02478 | Metal film: 4.7K ohms, ±5%, 100VDCW, 1/10W. |
| R974 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R982 thru R987 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R989 | B19/5RDAC02581 | Metal film: 0 ohms. |
| R990 thru R993 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| TR921 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR922 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR923 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR924 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR925 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR930 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR931 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR932 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR933 and TR934 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR935 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR936 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| TR937 and TR938 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| | | - - - - - - - - - - CRYSTALS - - - - - - - - - - |
| X921 | B19/5XNAM00022 | Quartz crystal: 7.3728MHz. |

PARTS LIST

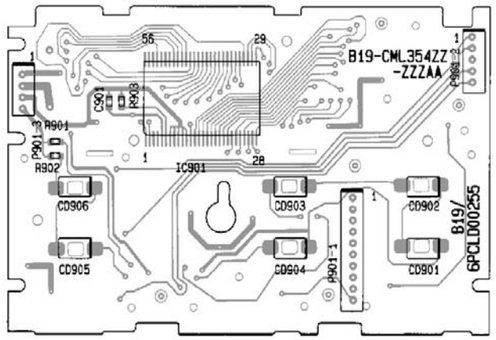
ALPHANUMERIC FMD
PANEL CONTROL
(SYSTEM MODEL)
B19/CMC-639D

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - - |
| C921 | B19/5CEAA01864 | Electrolytic: 10uF, ±20%, 25VDCW. |
| C922 and C923 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C924 | B19/5CSAA00298 | Tantalum: 10uF, ±10%, 16VDCW. |
| C925 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C926 | B19/5CSAA00298 | Tantalum: 10uF, ±10%, 16VDCW. |
| C927 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C928 | B19/5CSAA00298 | Tantalum: 10uF, ±10%, 16VDCW. |
| C929 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C930 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C931 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C932 | B19/5CEAA02249 | Tantalum: 1uF, ±10%, 16VDCW. |
| C933 | B19/5CAAD01586 | Ceramic: 0.1uF, +80% -20%, 25VDCW. |
| C934 | B19/5CAAD00946 | Ceramic: 2200pF, ±10%, 50VDCW, temp coef 0±15%. |
| C935 | B19/5CEAA02249 | Tantalum: 1uF, ±10%, 16VDCW. |
| C936 thru C938 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C939 | B19/5CAAD00838 | Ceramic: 1000pF, ±10%, 50VDCW, temp coef 0±15%. |
| C940 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C941 | B19/5CAAD00838 | Ceramic: 1000pF, ±10%, 50VDCW, temp coef 0±15%. |
| C942 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C943 | B19/5CAAD00838 | Ceramic: 1000pF, ±10%, 50VDCW, temp coef 0±15%. |
| C944 thru C946 | B19/5CAAD00839 | Ceramic: 100pF, ±5%, 50VDCW, temp coef 0±30 PPM. |
| C947 and C948 | B19/5CAAD00840 | Ceramic: 22pF, ±5%, 50VDCW, temp coef 0±15 PPM. |
| C949 | B19/5CAAD00953 | Ceramic: 10pF, ±5%, 50VDCW, temp coef 0±15 PPM. |
| C950 thru C952 | B19/5CEAA02249 | Tantalum: 1uF, ±10%, 16VDCW. |
| | | - - - - - - - - - - DIODES - - - - - - - - - - |
| CD921 thru CD938 | B19/5TXAD00330 | Silicon, fast recovery (2 diodes in series): sim to TOSHIBA 1SS226. |
| CD939 | B19/5TXAD00291 | Silicon, fast recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184. |
| CD940 | B19/5TXAN00068 | Silicon, fwd current 1A, 200PIV: sim to SANKEN EM01ZW. |
| CD941 and CD942 | B19/5TXAD00330 | Silicon, fast recovery (2 diodes in series): sim to TOSHIBA 1SS226. |
| CD943 and CD944 | B19/5TXAD00291 | Silicon, fast recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184. |
| CD945 | B19/5TXAE00568 | Zener, 500mW, 5V: sim to HITACHI HZ5C1. |
| CD946 thru CD952 | B19/5TXAD00330 | Silicon, fast recovery (2 diodes in series): sim to TOSHIBA 1SS226. |
| | | - - - - - - INTEGRATED CIRCUITS - - - - - - |
| IC921 | B19/5DDEG00031 | Microcomputer: sim to PHILIPS S87C552. |
| IC922 | B19/5DAAJ00852 | Flip-Flops: sim to MOTOROLA MC74HC74AF. |
| IC923 | B19/5DDCC00024 | Linear, Positive Voltage Regulator: sim to SANYO L78MR05. |
| IC924 and IC925 | B19/5DAAJ00581 | Linear, Positive Voltage Regulator: sim to MOTOROLA MC7809CT. |
| IC926 | B19/5DDBY00064 | EEPOT: sim to XICOR X9103. |
| IC927 | B19/5DDEG00033 | DTMF generators: sim to PHILIPS PCD3312T. |
| IC928 | B19/5DAAN00109 | Linear, OP AMP: sim to New JRC NJM4558M. |
| IC929 and IC930 | B19/5DAAJ00962 | Bilateral switch: sim to MOTOROLA SC14S66F. |
| | | - - - - - - - - - CONNECTORS - - - - - - - - - |
| J921 | B19/5JWAV00116 | Connector: 20 pins. |
| J922 | B19/5JWAV00145 | Connector: 14 pins. |
| J923 | B19/5JWAV00117 | Connector: 9 pins. |
| J924 | B19/5JWAV00116 | Connector: 20 pins. |
| J925 | B19/5JJAL00090 | Connector: 5 pins. |
| | | - - - - - - - - - - RELAYS - - - - - - - - - - |
| K921 | B19/5KLAD00703 | Relay, DC9V: sim to NATIONAL DSP1-DC9V. |
| | | - - - - - - - - - - PLUGS - - - - - - - - - - |
| P921 | B19/6ZCLD00104 | Cable Assembly. |
| P922 | B19/6ZCLD00040 | Cable Assembly. |
| | | - - - - - - - - - RESISTORS - - - - - - - - - |
| R921 thru R939 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R940 and R941 | B19/5RDAC02487 | Metal film: 120K ohms, ±5%, 100VDCW, 1/10W. |
| R942 | B19/5RDAC02453 | Metal film: 220K ohms, ±5%, 100VDCW, 1/10W. |
| R943 | B19/5RDAC02463 | Metal film: 560K ohms, ±5%, 100VDCW, 1/10W. |
| R944 | B19/5RDAC02485 | Metal film: 68K ohms, ±5%, 100VDCW, 1/10W. |
| R945 | B19/5RDAA01349 | Carbon film: 1.5K ohms, ±5%, 1/4W. |
| R946 | B19/5RDAC02462 | Metal film: 3.3K ohms, ±5%, 100VDCW, 1/10W. |
| R947 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R948 | B19/5RDAA01321 | Carbon film: 100 ohms, ±5%, 1/4W. |
| R949 | B19/5RDAA01066 | Carbon film: 47 ohms, ±5%, 1/2W. |
| R950 | B19/5RDAA01321 | Carbon film: 100 ohms, ±5%, 1/4W. |
| R951 | B19/5RDAA01066 | Carbon film: 47 ohms, ±5%, 1/2W. |

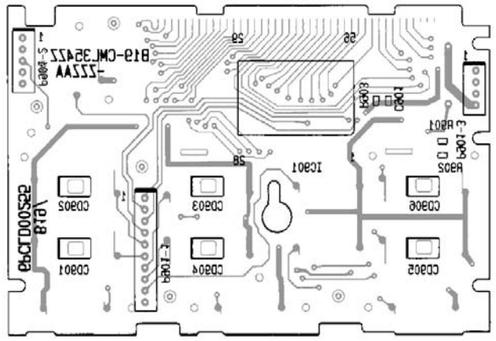
| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| R952 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R953 | B19/5RDAC02478 | Metal film: 4.7K ohms, ±5%, 100VDCW, 1/10W. |
| R954 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R955 | B19/5RDAC02478 | Metal film: 4.7K ohms, ±5%, 100VDCW, 1/10W. |
| R956 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R957 and R958 | B19/5RDAC02460 | Metal film: 47 ohms, ±5%, 100VDCW, 1/10W. |
| R959 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R960 | B19/5RDAC02460 | Metal film: 47 ohms, ±5%, 100VDCW, 1/10W. |
| R961 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R962 | B19/5RDAC02478 | Metal film: 4.7K ohms, ±5%, 100VDCW, 1/10W. |
| R963 and R964 | B19/5RDAC02454 | Metal film: 22K ohms, ±5%, 100VDCW, 1/10W. |
| R965 and R966 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R967 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R968 | B19/5RDAC02446 | Metal film: 1K ohms, ±5%, 100VDCW, 1/10W. |
| R969 thru R971 | B19/5RDAC02447 | Metal film: 100 ohms, ±5%, 100VDCW, 1/10W. |
| R972 | B19/5RDAC02439 | Metal film: 47K ohms, ±5%, 100VDCW, 1/10W. |
| R973 | B19/5RDAC02478 | Metal film: 4.7K ohms, ±5%, 100VDCW, 1/10W. |
| R974 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R978 | B19/5RDAC02449 | Metal film: 100K ohms, ±5%, 100VDCW, 1/10W. |
| R986 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R988 | B19/5RDAC02581 | Metal film: 0 ohms. |
| R990 thru R993 | B19/5RDAC02445 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| TR921 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR922 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR923 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR924 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR925 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR926 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR927 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR928 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR929 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR930 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR931 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR932 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR933 and TR934 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR935 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR936 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR937 and TR938 | B19/5TDAB00098 | Silicon, NPN: sim to NEC 2SD596. |
| TR939 | B19/5TCAZ00011 | Silicon, NPN: sim to SANYO 2SC3398. |
| TR940 | B19/5TCAZ00012 | MOSFET, NCH-ENH: sim to SANYO 2SK536. |
| | | - - - - - - - - - - CRYSTALS - - - - - - - - - - |
| X921 | B19/5XNAM00022 | Quartz crystal: 7.3728MHz. |
| X922 | B19/5XNAM00023 | Quartz crystal: 3.579545MHz. |

## OUTLINE DIAGRAM

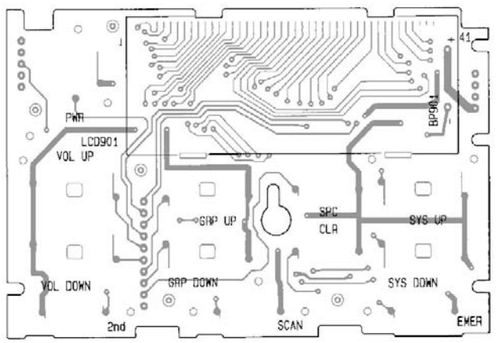
### COMPONENT SIDE



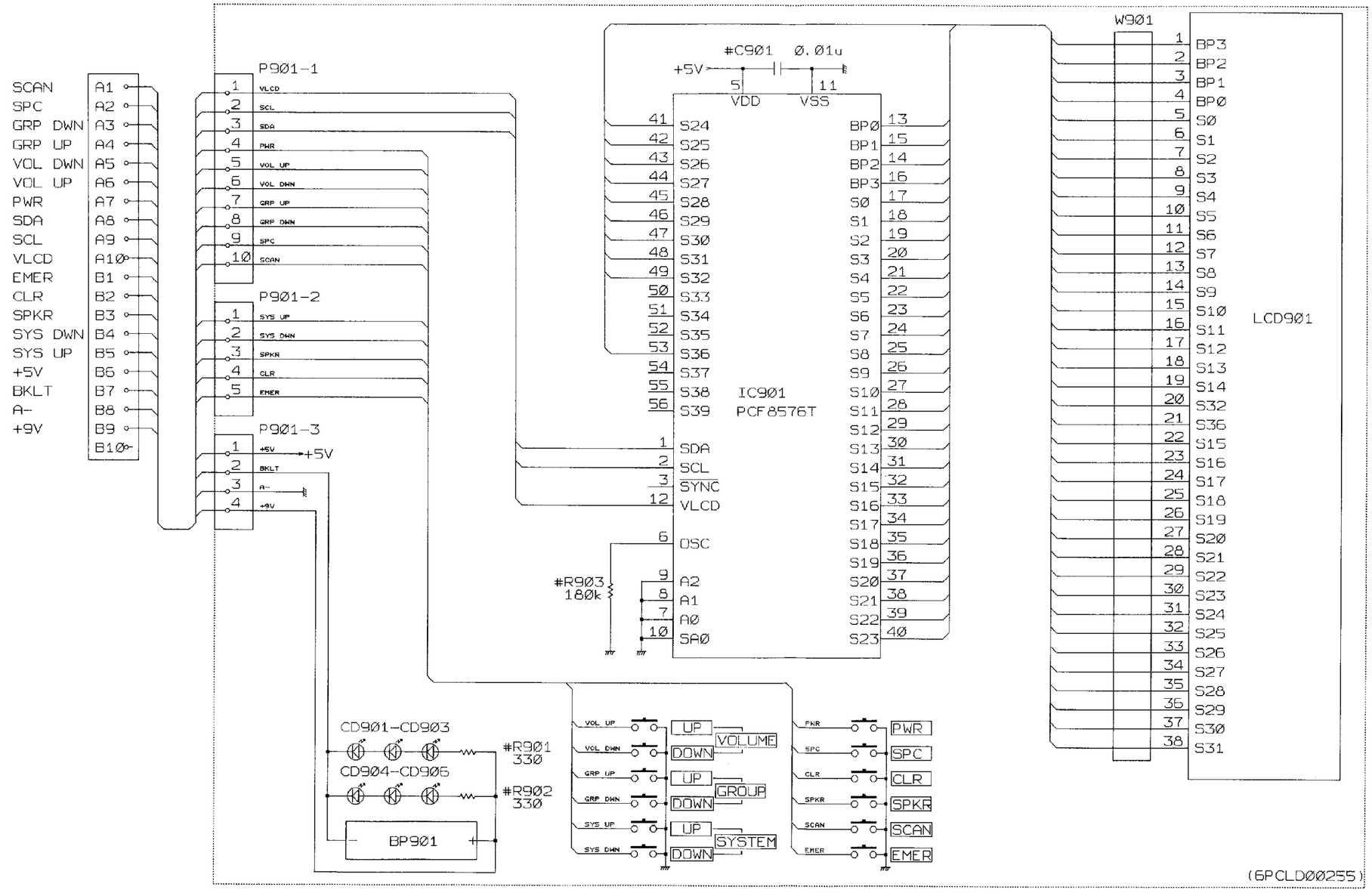

### SOLDER SIDE



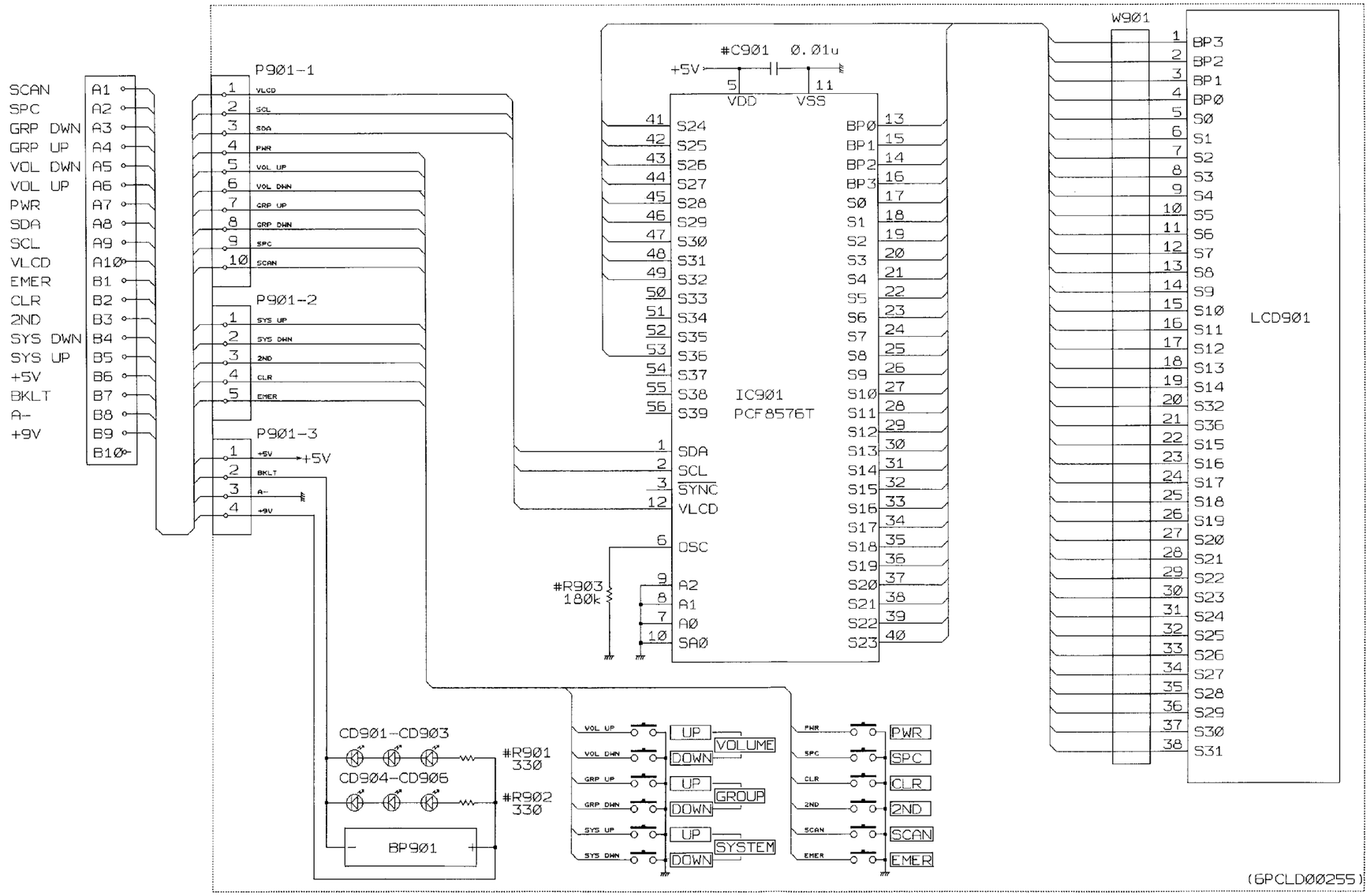

### DISPLAY SIDE




**DISPLAY BOARD**
**B19/CML-354 (SCAN)**
**B19/CML-354D (SYSTEM)**




**DISPLAY (SCAN MODEL)**
**B19/CML-354**




NOTES. "#" INDENTIFIES "CHIP" COMPONENT (EXAMPLE: #R901)
WHICH ARE LOCATED ON THE SOLDER SIDE OF THE BOARD.
ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER U,N OR P.

**DISPLAY (SYSTEM MODEL)**
**B19/CML-354D**

PARTS LIST

ALPHANUMERIC FMD
DISPLAY (SCAN MODEL)
B19/CML-354

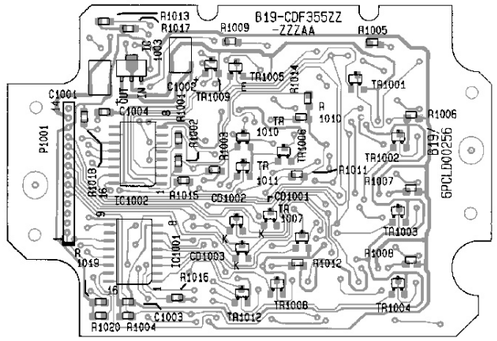
| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| BL901 | B19/6WZLD00001 | Backlight Unit. |
| | | - - - - - - - - - CAPACITORS - - - - - - - - - |
| C901 | B19/5CAAA02094 | Ceramic: 0.01uF, ±10%, 50VDCW. |
| | | - - - - - - - - - - DIODES - - - - - - - - - - |
| CD901 thru CD906 | B19/5TXBG00039 | Diode, Optoelectronic: orange, sim to STANLEY AA2222S. |
| | | - - - - - - - INTEGRATED CIRCUITS - - - - - - |
| IC901 | B19/5DDEG00032 | LCD Driver: sim to PHILIPS PCF8576T. |
| | | - - - - - - - - - - DISPLAY - - - - - - - - - |
| LCD901 | B19/5JWGE00010 | LCD |
| | | - - - - - - - - - - PLUG - - - - - - - - - - |
| P901 | B19/6ZCLD00034 | Cable Assembly. |
| | | - - - - - - - - - RESISTORS - - - - - - - - - |
| R901 and R902 | B19/5RDAC02555 | Metal film: 270 ohms, ±5%, 100 VDCW, 1/10W |
| R903 | B19/5RDAC02459 | Metal film: 180K ohms, ±5%, 100 VDCW, 1/10W. |
| | | - - - - - - - - - CONNECTORS - - - - - - - - - |
| W901 | B19/6JWLD00002 | Rubber connector. |

PARTS LIST

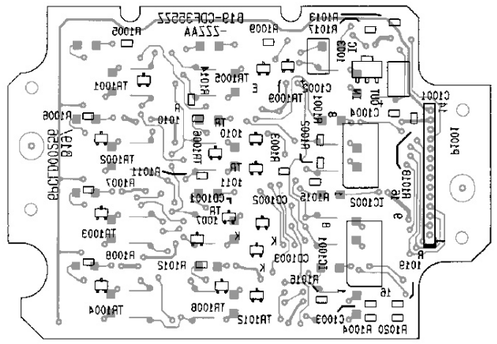
ALPHANUMERIC FMD
DISPLAY (SYSTEM MODEL)
B19/CML-354D

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| BL901 | B19/6WZLD00001 | Backlight Unit. |
| | | - - - - - - - - - CAPACITORS - - - - - - - - - |
| C901 | B19/5CAAA02094 | Ceramic: 0.01uF, ±10%, 50VDCW. |
| | | - - - - - - - - - - DIODES - - - - - - - - - - |
| CD901 thru CD906 | B19/5TXBG00039 | Diode, Optoelectronic: orange, sim to STANLEY AA2222S. |
| | | - - - - - - - INTEGRATED CIRCUITS - - - - - - |
| IC901 | B19/5DDEG00032 | LCD Driver: sim to PHILIPS PCF8576T. |
| | | - - - - - - - - - - DISPLAY - - - - - - - - - |
| LCD901 | B19/5JWGE00010 | LCD |
| | | - - - - - - - - - - PLUG - - - - - - - - - - |
| P901 | B19/6ZCLD00034 | Cable Assembly. |
| | | - - - - - - - - - RESISTORS - - - - - - - - - |
| R901 and R902 | B19/5RDAC02555 | Metal film: 270 ohms, ±5%, 100 VDCW, 1/10W. |
| R903 | B19/5RDAC02459 | Metal film: 180K ohms, ±5%, 100 VDCW, 1/10W. |
| | | - - - - - - - - - CONNECTORS - - - - - - - - - |
| W901 | B19/6JWLD00002 | Rubber connector. |

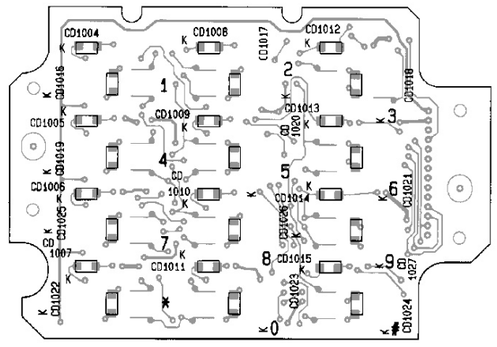
## COMPONENT SIDE



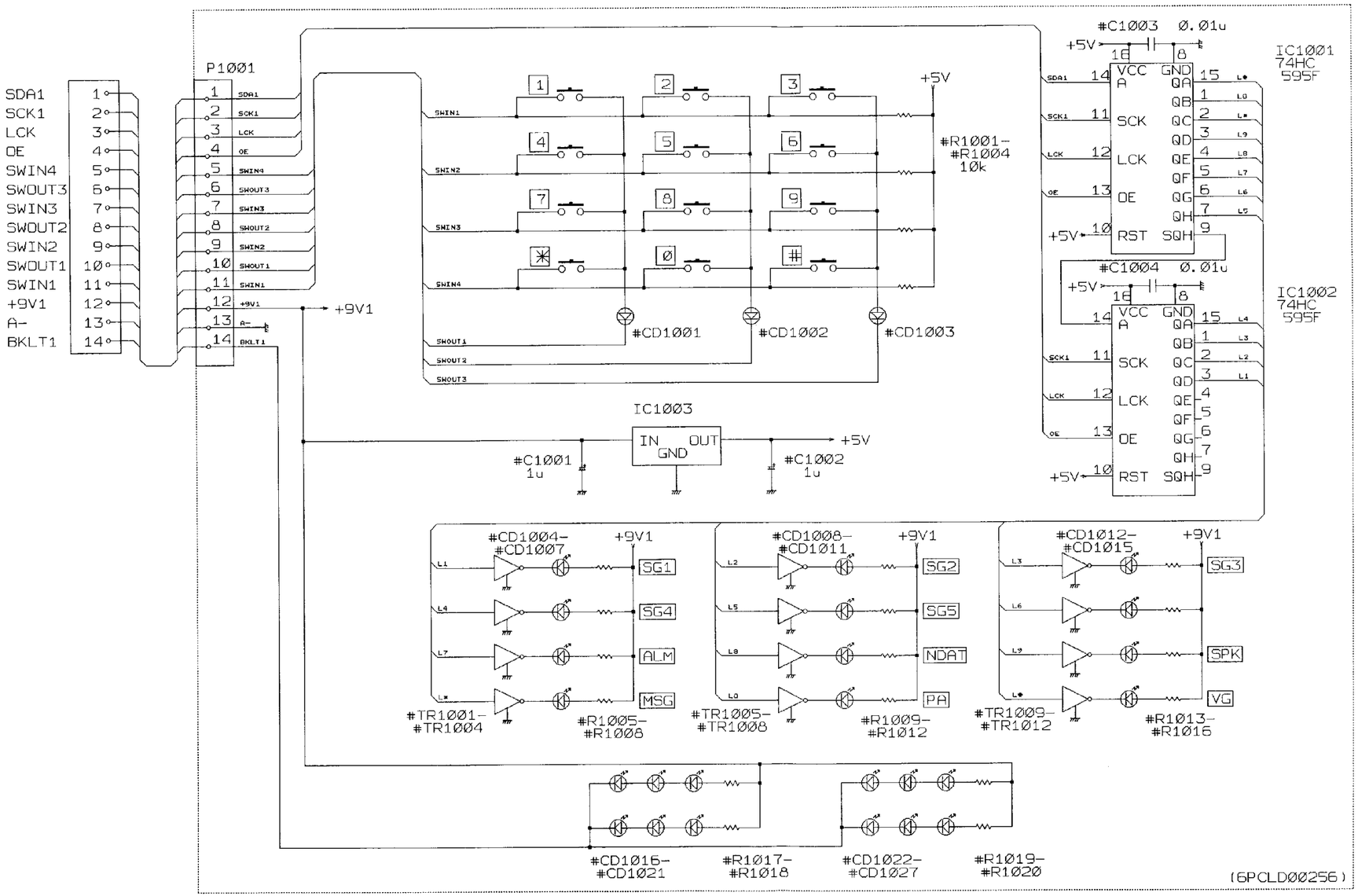

## SOLDER SIDE



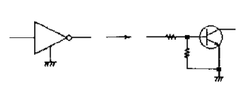
## SWITCH SIDE



**DTMF SW BOARD (SYSTEM MODEL)**
**B19/CDF-355**




NOTES. "●" INDENTIFIES "CHIP" COMPONENTS (EXAMPLE:#R1001)
WHICH ARE LOCATED ON THE SOLDER SIDE OF THE BOARD.
ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER k OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER u,n OR p.



**DTMF SW (SYSTEM MODEL)**
**B19/CDF-355**

PARTS LIST

ALPHANUMERIC FMD
DTMF SW(SYSTEM MODEL)
B19/CDF-355

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - - |
| C1001 and C1002 | B19/5CABP00001 | Electrolytic: 1uF, ±20%, 50VDCW. |
| C1003 and C1004 | B19/5CAAD02131 | Ceramic: 0.01uF, +80% -20%, 25VDCW. |
| | | - - - - - - - - - - DIODES - - - - - - - - - - |
| CD1001 thru CD1003 | B19/5TXCW00063 | Silicon, fast recovery: sim to ROHM DA116. |
| CD1004 thru CD1015 | B19/5TZAW00147 | Diode, Optoelectronic: red, sim to STANLEY BR1101. |
| CD1016 thru CD1027 | B19/5TZAW00148 | Diode, Optoelectronic: orange, sim to STANLEY AA1101. |
| | | - - - - - - INTEGRATED CIRCUITS - - - - - - |
| IC1001 and IC1002 | B19/5DDAE02014 | Shift Register: sim to TOSHIBA TC74HC595AF. |
| IC1003 | B19/5DAAN00535 | Linear, Positive Voltage Regulator: sim to New JRC NJM78L05UA. |
| | | - - - - - - - - - - PLUGS - - - - - - - - - - |
| P1001 | B19/6ZCLD00103 | Cable Assembly. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R1001 thru R1004 | B19/5RZBW00067 | Metal film: 10K ohms, ±5%, 100VDCW, 1/10W. |
| R1005 thru R1016 | B19/5RZBW00065 | Metal film: 3.3K ohms, ±5%, 100VDCW, 1/10W. |
| R1017 thru R1020 | B19/5RZBW00066 | Metal film: 270 ohms, ±5%, 100VDCW, 1/10W. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - TRANSISTORS - - - - - - - - |
| TR1001 thru TR1012 | B19/5TZCU00059 | Silicon, NPN: sim to ROHM DTC114YK. |