



# YAESU

## SERVICE MANUAL

VHF FM Land Mobile Transceivers

# FTL - 2011 2014



FTL-2014

The 40-watt FTL-2011 and FTL-2014 are rugged, full-featured FM transceivers designed for flexible business communications in the VHF land mobile band. The FTL-2011 provides 12 channels (and optionally 24) with full scanning and priority features, while the FTL-2014 provides up to 4 pushbutton-selectable channels.



FTL-2011

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**FTL-2011/-2014**  
**Service Manual**



## Operating Manual Reprint for the FTL-2011 & FTL-2014 VHF FM Land Mobile Transceivers

The 40-watt FTL-2011 and FTL-2014 are rugged, full-featured FM transceivers designed for flexible business communications in the VHF land mobile band. The FTL-2011 provides 12 channels (and optionally 24) with full scanning and priority features, while the FTL-2014 provides up to 4 pushbutton-selectable channels.

Reliability is assured by a highly integrated surface mount circuit design and a die-cast aluminum chassis with metal housing. Important channel frequency data is stored in EEPROM, and is easily programmable by dealers using a personal computer and the Yaesu FRB-2 Interface Box, CE-5 Software and the T9101410 Connection Cable.

Special features include a built-in CTCSS (Continuous Tone Coded Squelch System) and in the 12-channel versions, two sets of scanning channels, one set preselectable by the dealer and another set operator selectable. The operator can select which set to scan, and also two priority channels. Dealers can program Busy Channel Lockout, transmitter time out timers and scan stop activities for talkback on the paused channel, priority channel or the home channel (on which scanning was initiated). Scanning is not provided in the 4-channel versions.

Each model is supplied with a mobile bracket and hand microphone. Options include the FP-700 AC Power Supply for operation from the AC mains, the FDS-1 Digitally Coded Squelch Unit and F2D-4 2-Tone Decoder programmable by the dealer.

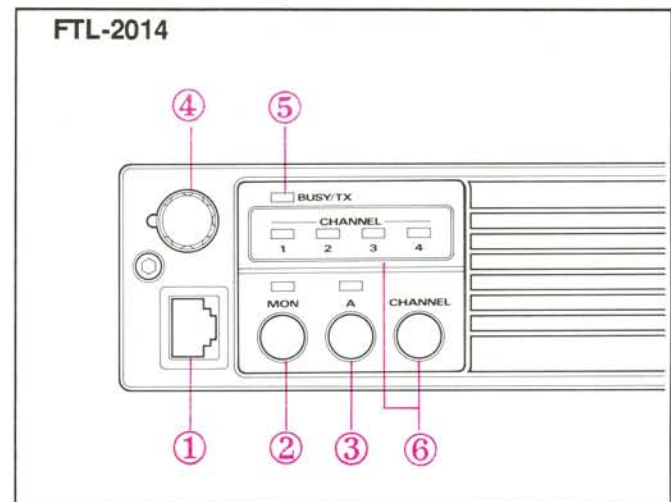
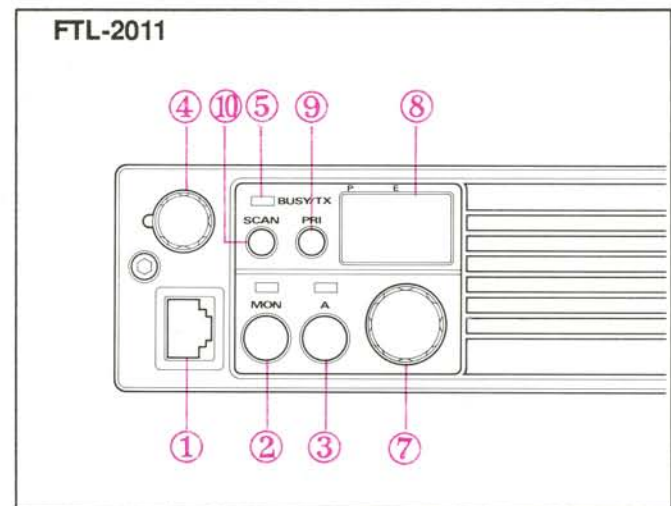
Please take a few minutes to read this manual carefully. The information presented will allow you to derive maximum performance from the equipment. After reading it, keep it handy near the radio for quick reference.

## Controls & Connectors

### Front Panel

#### ① Microphone Jack

Connect the microphone plug to this jack.



#### ② MON Button & Indicator

This button selects the squelch (receiver mute) mode. When the indicator is off, tone (or coded) squelch is active. When the indicator glows steadily (after pressing this button momentarily or removing the microphone from its hanger), only noise squelch is active, and any signal will be heard. Holding this button for two seconds disables all squelch, and the yellow indicator blinks. If the indicator is blinking, press this button once to return the previous squelch mode, and again to select the other mode.

#### ③ A (Accessory) Button & Indicator

This button (and the green indicator above it) is provided for special applications, such as high/low power selection, talk-around and call alert functions, as determined by your network requirements and programmed by your Yaesu dealer. The green indicator lights when the function is active. Your network ad-



administrator can advise you of the function of this button (if any). Otherwise, it may be disabled.

#### ④ Volume and Power On/Off Knob

This knob adjusts the receiver volume, and turns the transceiver off when turned all the way to the left into the click-stop.

#### ⑤ BUSY/TX Indicator Lamp

This lamp glows green when the channel is busy, and red while transmitting. Do not transmit when this indicator is green.

*The following item is unique to the FTL-2014:*

#### ⑥ CHANNEL Numbered Indicators & Button

Press the button to select the operating channel, indicated by which of the numbered orange LED indicators is lit.

*The remaining items are unique to the FTL-2011:*

#### ⑦ Channel Selector Knob

Turn this knob to select the operating channel, as shown on the display.

#### ⑧ Numeric Channel Display

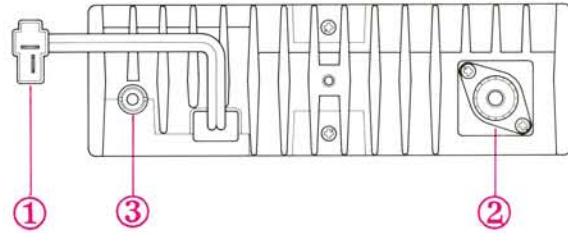
Shows the selected channel number and priority/scan status. The **P** and **E** dots along the top of the display light if the selected channel is enabled for user-selectable priority or scanning, respectively.

#### ⑨ PRI (Priority) Button

This button is used to select a channel for priority monitoring, and together with the **SCAN** button for selecting scanning modes, as described in the next chapter, *How to Use the Transceiver*.

#### ⑩ SCAN Button

This button is used to activate scanning, to select and deselect channels for scanning, and together with the **PRI** button to select scanning modes, as described in the next section.



### REAR (Heatsink)

#### ① 13.6VDC Cable Pigtail w/Connector

The supplied DC power cable must be connected to this 2-pin connector. Use only the supplied fused cable, extended if necessary, for power connection.

#### ② Antenna Socket

The 50-ohm coaxial feedline to the antenna must be connected here using a type-M (PL-259) plug.

#### ③ EXT SP (External Speaker)

An optional external loudspeaker may be connected to this 2-contact mini-phone jack.

## How To Use The Transceiver

**Important!** - Before turning on the radio the first time, confirm that the power connections have been made correctly to the power source and that a proper antenna is connected to the antenna jack. If the transceiver is not installed, see *Installation* near the back of this chapter.

Turn the Volume/Power knob clockwise to turn on the radio. LEDs will light, indicating the channel and status of the radio (as set when last used).

In the FTL-2011, the display should show either a channel number, or a scan mode indicator (**Sc**, **Ur**, **SP** or **UP**). If **E2** is displayed instead, the transceiver has not yet been programmed with channel frequencies: switch off the power and contact your network administrator or Yaesu dealer for programming. If a scan mode indicator is displayed, you can press the **SCAN** button to display a channel number, and turn the channel selector to select a channel.

In the FTL-2014, just press the **CHANNEL** button to change channels.



### Setting the Volume

If no signals are heard and the **BUSY/TX** indicator is not glowing green (so you can adjust the volume on a signal), press and hold the **MON** button for two seconds until a beep is heard and the yellow indicator above the button begins to blink. Then adjust the volume control for a comfortable level on a signal or background noise. Press the **MON** button again momentarily so the yellow indicator stops blinking. See the box below for more information on controlling the squelch system.

### Transmitting

To transmit, wait until the **BUSY/TX** indicator is off (the channel is not in use), and press the PTT (Push-To-Talk) switch on the side of the microphone (the **BUSY/TX** lamp will glow red). While holding the PTT switch, speak across the face of the microphone in a clear, normal voice, and then release the PTT switch to receive. The box below describes some other features that may be programmed to affect your transmissions.

*The rest of the operating instructions apply to the FTL-2011 only.*

### Scanning

Four scanning modes are available when the **SCAN** button has been pressed. Once a scan mode is selected, it remains selected when the transceiver is turned off, or when scanning is disabled (by pressing the **SCAN** button again, so that a channel number is displayed. The **SCAN** modes and their corresponding displays are as follows:

### Special Transmitter Functions

If your transceiver has been programmed for *busy channel lock-out*, the transmitter will not be activated when the PTT switch is pressed unless the **BUSY/TX** lamp is off (to prevent interference to other stations).

If the selected channel has been programmed for *automatic time-out*, you must limit the length of your transmissions. While transmitting, a beep will sound ten seconds before time-out, and then another beep will sound as the time-out period expires: the **BUSY/TX** indicator will turn off and transmission will cease. Release the PTT switch, listen for a moment, and then press it again to resume transmitting.

Display	Scanning Function
<b>Sc</b>	Scan all channels
<b>Ur</b>	Scan only user-selected channels
<b>SP</b>	Monitor one channel and pre-programmed priority(ies)
<b>UP</b>	Scan user-selected channels with user priority(ies)

The user-selected channels for the **Ur** and **UP** modes are those you can set yourself, as described in the box on the next page. The priority channels are those on which signals will take priority over signals received on other

### Coded Squelch – the MON Button

Your transceiver may use the built-in CTCSS (Continuous Tone Coded Squelch System), or optional DCS (Digitally Coded Squelch) or 2-Tone Sequential Codes, to keep the receiver quiet for all signals except those intended for you.

The transceiver may be programmed so that when the microphone is removed from its hanger, the coded squelch is defeated, and you can hear any signal on the channel (the yellow **MON** indicator will be lit). The same result is obtained without lifting the microphone by pressing the **MON** button momentarily. To avoid listening to unnecessary chatter, keep the microphone in its hanger, and press the **MON** button when necessary to turn the yellow indicator off unless you want to listen to other calls.

Holding the **MON** button for two seconds defeats not only the coded squelch, but also the noise squelch, so background noise can be heard (the **MON** indicator will blink). This is useful for setting the volume when no signals are present. Press the **MON** button again momentarily to return the yellow indicator to its previous state (off, or steadily on).



### *User-Programmable Channel Selections*

You can program a set of channels to be scanned, and up to 2 channels to be priority monitored. Your selections will be retained in memory until changed or deleted. To create or modify the user selections:

Turn the radio off, and then hold the **SCAN** button while switching it back on. The display will indicate a channel number.

The **E** (scan enable) indicator at the top center of the display is lit when the displayed channel is to be included in User-selected channel scanning. Press the **PRI** button, if necessary, to set the **E** indicator as desired for this channel. Then turn the channel selector and repeat the selection/deselection process on each channel.

To determine which channels are currently selected for priority monitoring, rotate the channel selector and watch the **P** indicator at the top left of the display. At the 1st priority channel the **P** indicator will blink, at the 2nd the indicator will stay lit. To change the priority channels, first cancel *both* by selecting *either* and pressing the **PRI** button. Then select the 1st new channel, and hold the **PRI** button for two seconds, until a beep sounds and the **P** indicator blinks. Next select the 2nd new channel, and again hold the **PRI** button, this time until the **P** indicator just lights.

Note: clearing priority selections also clears scan selection of the same channels (both **P** and **E** indicators turn off), so be sure to reselect them for scanning afterwards, if desired.

When you have the channels set up as desired for User scanning and priority monitoring, press the **SCAN** button to exit the user programming mode and return to normal operation.

channels: that is, if a signal appears on a priority channel while another appears on a non-priority channel, the priority signal will be heard, and not the other. Up to two of the installed channels may be designated by your network administrator or dealer as pre-programmed priority channels for the **SP** mode (the radio does not indicate which they are), and you can program any two channels as user priorities for the **UP** mode. The non-priority channel in the **SP** mode is the one last displayed.

While a scan mode is displayed, you can select another by pressing the **PRI** button repeatedly (the display will cycle through the above). Make sure the microphone is in its hanger if you want to hear only calls intended for you. While scanning, if a signal is received which includes the correct code to open your squelch, the channel number on which the signal appears will be displayed as you hear their call, and the display will then alternate between the scan mode indicator and the channel number. Scanning will resume automatically either after a preset interval of a few seconds, or after the station stops transmitting (depending on how your set was programmed).

## INSTALLATION

Normally, your Yaesu Dealer will provide complete installation of all stations in your system. However, basic installation information is provided here for your reference.

### *The P (Priority) & E (Scan Enable) Indicators*

When a channel number is displayed, either during manual (non-scanning) operation, or when paused during scanning, the **P** and **E** indicators at the top of the display may be lit. These indicate that the displayed channel has been selected by the user to be included in the user scanning modes (**Ur** and **UP**). If the **P** indicator is blinking, the channel is the 1st (highest priority) channel for the **UP** mode. If the **P** is not blinking, but steadily on, the channel is the 2nd priority channel. Both priority channels serve as ordinary user-selected scan channels in the **Ur** mode.



For mobile service, your transceiver should be installed so that the controls, indicators and microphone are easily accessible for operation and viewing, without interfering with road vision, and so that the loudspeaker may be easily heard. The radio may be installed in any position without loss of performance. Typical installation locations are beneath the dashboard or atop the transmission tunnel in small vehicles, or overhead in a truck cabin.

The MMB-48 universal mounting bracket and mounting hardware are supplied with the transceiver.

### **Mobile Mounting Procedure**

- Using the mounting bracket as a template, mark the locations of the mounting holes in the desired position. Use a 3/16" diameter bit to drill the holes after making certain that there will be enough space for the transceiver, connecting cables and controls. Secure the bracket with the screws, washers and nuts supplied, as shown in the drawing on the next page.
- Position the transceiver in the bracket so that the holes in the side panels are aligned with those in the sides of the bracket, and bolt the transceiver into place with the supplied short screws and flat washers.
- The microphone hanger must be installed so as to make electrical contact with the car body. Otherwise the hanger may be installed wherever convenient.

### **Base Station Installation**

The FP-700 AC Power Supply may be used to operate the transceiver from a variety of AC mains voltages. Connect the fused DC Cable supplied with the transceiver to the colored terminals on the rear of the FP-700.

**NOTE:** In all installations, means must be provided to ground the metal mounting loop on the microphone in order for the squelch and scanning/monitoring systems to function. In base installations, a grounding hook must be provided in which to rest the microphone when not transmitting.

### **Power Connections**

For mobile installations, the power cable should be connected directly to the automobile battery. This allows the radio to operate without turning on the ignition, and may also reduce noise in the receiver. Connection to the cigarette lighter or other existing circuits may result in overloading, or degradation of transceiver performance.

Always use the supplied DC power cable, which includes fuses to protect you, your vehicle and the equipment. If it is necessary to lengthen the power cable, use #12 AWG stranded, insulated copper wire. Use the shortest length possible, connected to the end of the DC cable that does not have connectors installed.

Refer to the diagrams below for connection details of the power cable.

- Before connecting the supplied DC cable to the transceiver, connect the RED lead of the DC cable to the POSITIVE (+) battery (or power supply) terminal, and the BLACK lead to the NEGATIVE (-) terminal.
- Connect the DC power cable to the connector on the cable pigtail at the back of the transceiver.
- Connect the coaxial plug on the antenna cable (not supplied) to the coaxial antenna jack on the transceiver. Antenna impedance must be 50 ohms at the operating frequency.
- Connect the microphone plug to the jack on the transceiver.
- If an optional external speaker is to be installed, insert the plug from the speaker into the **EXT SP** jack on the rear (disabling the internal speaker).

## Maintenance And Service

Keep the outside of the transceiver clean by wiping with a soft cloth as necessary. Avoid rain or immersion in water, and protect the radio from dust as much as possible. Do not open the case. If the radio fails to operate, check the cable connections, and inspect the fuses in the DC cable.

## Regular Maintenance Plan

Your Yaesu dealer will advise you of the preventative maintenance plan that best suits your needs. We recommend that the transceiver be returned to your Yaesu dealer at least once every two years, for testing of receiving sensitivity and transmitter power output.

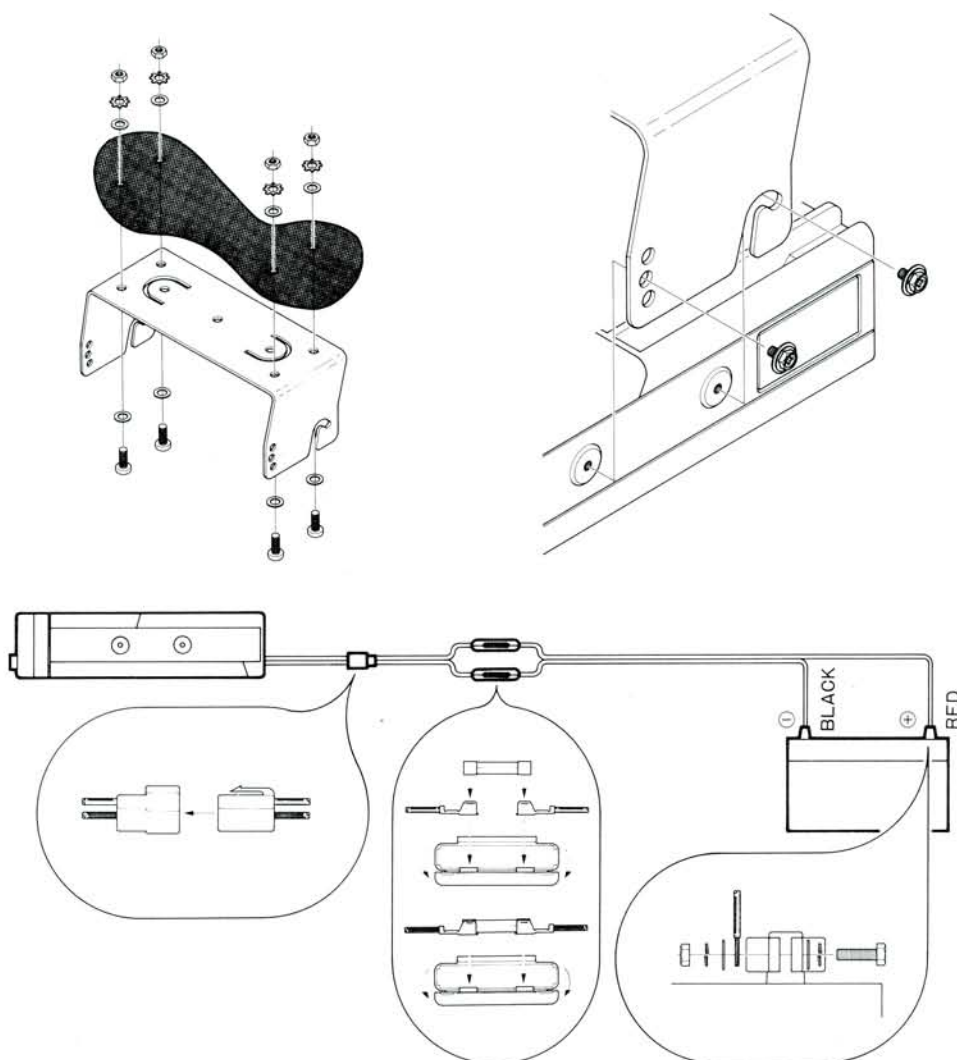
If the need for servicing does arise, phone your Yaesu dealer for a service appointment. Your dealer will be pleased to answer any service-related questions, and his qualified service technicians will make sure that your radio is back in service as quickly as possible.

## Fuse Replacement

If a fuse is blown, before replacing it, see if you can determine if it was caused by something outside of the radio (perhaps a short circuit due to a worn cable or pigtail near the radio). Contact your Yaesu dealer at once if you do not find the cause. Replace fuses only with the same type installed.

## Service Information

If the transceiver fails to operate when switched on, check the fuses in the power cable. If either is found to have blown, attempt to locate and correct the cause of the problem before replacing the fuse(s). The FTL-2011 and FTL-2014 have no user-serviceable parts inside.





## Specifications

### General

<b>Frequency Range</b>	134 ~ 160 MHz (vers. A) or 148~ 174 MHz (vers. C)
<b>Nr. of Channels &amp; Spacing</b>	4 channels (x014 versions), 12 channels (x011 versions, 24 optional) 25-kHz spacing (12.5-kHz optional)
<b>Mode of Emission</b>	16K0F3E (direct frequency modulation)
<b>Antenna Requirement</b>	50-Ω, unbalanced (SO-239 socket)
<b>Voltage Requirement</b>	10.8 to 15.6 V DC, negative ground
<b>Current Consumption (approx.)</b>	300 mA Standby, 700 mA Receive, 7.0 A Transmit
<b>Operating Temperature Range</b>	-30 to +60 °C (-22 to +140 °F)
<b>Size (WHD, approx.)</b>	160 × 50 × 180 mm (6-1/4 × 2 × 7-1/8")
<b>Weight (approx.)</b>	1.5 kg (3.3 lbs.)

### Receiver

<b>Receiver Circuit Type</b>	Double Conversion Superheterodyne
<b>Intermediate Frequencies</b>	21.4 MHz and 455 kHz
<b>Sensitivity</b>	0.25 μV for 12 dB SINAD, 0.35 μV for 20 dB QN
<b>Hum &amp; Noise Ratio</b>	Better than 45 dB
<b>Adjacent Channel Selectivity</b>	Better than 75 dB
<b>Intermodulation Distortion</b>	Better than 70 dB (3-signal)
<b>Spurious Rejection</b>	Better than 80 dB
<b>Audio Output Power</b>	5 watts into 4 ohms with <10% THD

### Transmitter

<b>Power Output</b>	40/5 watts (high/low, programmable)
<b>Modulation Type/Deviation</b>	Frequency Modulation, ± 5 kHz (± 2.5 kHz optional)
<b>Hum &amp; Noise Ratio</b>	Better than 45 dB
<b>Modulation Distortion</b>	Less than 5%
<b>Spurious Emissions</b>	Better than 70 dB (below carrier)
<b>Microphone Impedance</b>	600-Ω

*Specifications subject to change without notice or obligation.*

## Circuit Description

### Receive Signal Path

Incoming RF from the antenna jack is delivered to the Main Unit and passed through a lowpass filter and a  $\frac{1}{4}$ -wave antenna switching network consisting of coils L1003 & L1004, capacitors C1003 & C1004, and diodes D1001 & D1002. Signals within the frequency range of the transceiver are then passed through a varactor-tuned bandpass filter consisting of T1001/T1002 before RF amplification by Q1001 (3SK131). The amplified RF is then bandpass filtered again by varactor-tuned resonators T1003/T1004, to ensure pure in-band input to 1st mixer Q1002/Q1003 (2SK302  $\times$  2).

Buffered output from the VCO Unit is amplified by Q1005 (2SC2759) and lowpass filtered by L1009 and C1042/C1043, to provide a pure 1st local signal between 126.6 and 152.6 MHz to the 1st mixer. The resulting 21.4-MHz product of the 1st mixer is passed through dual monolithic crystal filter XF1001 ( $\pm$  7.5 kHz BW) to strip away all but the desired signal, which is then amplified by Q1004 (2SC2714).

The amplified 1st IF signal is applied to FM IF subsystem IC Q1008 (MC3361P), which contains the 2nd mixer, 2nd local oscillator, limiter amplifier, noise amplifier and squelch gates. A 2nd local signal is generated from 20.945 MHz crystal X1001, which produces the 455 kHz 2nd IF when mixed with the 1st IF signal within Q1008. The 2nd IF is passed through ceramic filter CF-1001 to strip away unwanted mixer products, and then applied to the limiter amp in Q1008, which removes amplitude variations in the 455 kHz IF before detection of the speech by Q1008 via quadrature coil T1007.

Detected audio is delivered to the Control Unit for de-emphasis and highpass filtering by Q2008 (NJM-2902M- $\frac{1}{4}$  &  $\frac{3}{4}$ ) and Q2011 (NJM2902M- $\frac{1}{4}$ ), and then past audio muting gate Q2014 (DTC323TK) and the volume control to audio power amplifier Q1023 (TDA2003) on the Main Unit, providing up to 3 watts to the optional headphone jack or 4-ohm loudspeaker.

### Squelch Control

The squelch circuit consists of noise amplifier Q1007 (2SC2712GR) and a highpass filter and squelch trigger within Q1008 on the Main Unit, and control circuitry

within microprocessor Q2009 (HD404808H-A30H) on the Control Unit.

When no carrier is received, noise at the output of the detector stage in Q1008 is amplified by Q1007 and highpass filtered by the noise amp section of Q1008, and then rectified by D1012/1013 to provide a DC control voltage for the squelch switching section within Q1008. With no carrier, pin 13 of Q1008 is low. This SCAN STOP signal is delivered to the microprocessor on the Control Unit, and through Q2022 (DTC114EK) to the **BUSY** indicator on the front panel, which remains off until a carrier is received. The microprocessor causes audio mute pull-down gate Q2014 (DTC323TK) to ground the audio line, thus inhibiting input to the audio amplifier, and silencing the receiver while no signal is being received, and during transmission.

When a carrier appears at the discriminator, noise is removed from the output, causing pin 13 of Q1008 to go high, which in turn causes Q2022 to turn on the **BUSY** indicator. The microprocessor then checks for internal CTCSS tone information, plus Digital Code Squelch information if that option is installed. If not transmitting and no tone squelch is programmed for the channel, or if the received tone matches that programmed, the microprocessor switches Q2014 to allow audio to pass to the amplifier and loudspeaker.

Received signals are sampled at the output of the detector, after delivery to the Control Unit, by highpass filter Q2008 ( $\frac{3}{4}$ ), which along with lowpass filters Q2007 (NJM2902M  $\frac{1}{4}$  &  $\frac{3}{4}$ ) and Q2005 (NJM2902M) separates subaudible CTCSS tones from received audio for the microprocessor.

### Transmit Signal Path

Speech input from the microphone is delivered to the Control Unit, where it is highpass filtered by Q2007 ( $\frac{3}{4}$  &  $\frac{3}{4}$ ) to remove extraneous background noise before pre-emphasis by R2071 and C2036, and amplification by Q2011 (NJM2902M,  $\frac{3}{4}$ ). Q2008 ( $\frac{3}{4}$ ) then provides IDC (Instantaneous Deviation Control), and Q2011 ( $\frac{3}{4}$  &  $\frac{3}{4}$ ) filters the speech signal to remove any high frequency components that might result in overdeviation.

The processed audio is then mixed with a CTCSS tone generated by the microprocessor and filtered by



Q2001 (2SC2712GR), if so programmed, and delivered to diode D305 (HVU202) on the VCO Unit, frequency modulating the PLL carrier up to  $\pm 5$  kHz from the unmodulated carrier at the transmitting frequency. The modulated signal from transmitter VCO Q303 (MMBR951L) is buffered by Q305 (2SC2759) and delivered to the Main Unit for amplification by Q1012 (2SC2759), Q1011 (MMBR951L) and Q1010 (2SC2538). The low level transmit signal is then delivered to the PA Unit for final amplification by Q901 (2SC2539) and Q902 (2SC2630) up to 40 watts. Harmonic spurious radiation in the final output is suppressed by a 3-pole lowpass filter on the Main Unit, and the transmit signal then passes through  $\frac{1}{4}$ -wave antenna switch D1016 before delivery to the antenna.

### *Automatic Transmit Power Control*

RF power output from the final amplifier is sampled by C1064 and C1088, and rectified by D1017 (1SS108). The resulting DC is passed by high/low power controller Q1017 (FMS1) and transmit inhibit gate Q1018 (IMX1) to Automatic Power Controller Q1019 (2SB772Q) which regulates supply voltage to transmitter RF amplifiers Q1010 and Q1011, so as to maintain stable high or low output power under varying antenna loading conditions.

### *Spurious Suppression*

Generation of spurious products by the transmitter is minimized by the fundamental carrier frequency being equal to the final transmitting frequency, modulated directly in the transmit VCO. Additional harmonic suppression is provided by a 3-pole lowpass filter consisting of L1002, L1013, L1014 and C1002, C1061, C1063 and C1065-C1067, resulting in more than 65dB harmonic suppression prior to delivery to the antenna.

### *PLL Frequency Synthesizer*

PLL circuitry on the Main Unit consists of swallow counter Q1025 (MC12022SLAD) and PLL subsystem IC Q1024 (MC145158F), which contains a reference oscillator/divider, serial-to-parallel data latch, programmable divider and a phase comparator. Stability is obtained by a regulated 5-V supply via Q1014 (2SC2712GR) to Q1024 and temperature compensating capacitors associated with 12.8-MHz frequency reference crystal X1002.

Receiver VCO Q301 (MMBR951L) on the VCO Unit oscillates between 126.6 and 152.6 according to the pro-

grammed receiving frequency. The VCO output is buffered by Q305 (2SC2759) on the VCO Unit, and then returned to the Main Unit where a sample of the output is buffered by Q1028 (2SC2714) for application to prescaler/swallow counter Q1025. There the VCO signal is divided by 64 or 65, according to a control signal from the data latch section of Q1024, before being applied to the programmable divider section of the PLL chip.

The data latch section of Q1024 also receives serial dividing data from microprocessor Q2009 on the Control Unit, which causes the predivided VCO signal to be further divided by 25,320 — 30,520 in the programmable divider section, depending upon the desired receive frequency, so as to produce a 5-kHz (or 6.25-kHz for 12.5-kHz/step versions) derivative of the current VCO frequency. Meanwhile, the reference divider section of Q1024 divides the 12.8-MHz crystal reference by 2560 (or 2048) to produce the 5-kHz (or 6.25-kHz) loop reference (respectively).

The 5-kHz (or 6.25-kHz) signal from the programmable divider (derived from the VCO) and that derived from the crystal are applied to the phase detector section of Q1024, which produces a dual 5-V pulsed output with pulse duration depending on the phase difference between the input signals. This pulse train is converted to DC by charge pump Q1026/Q1027 (IMX3/IMZ2), low-pass filtered, and then fed back to varactors D301 and D302 (1T363  $\times$  2) on the VCO Unit.

Changes in the level of the DC voltage applied to D301/D302 affect the reactance in the tank circuit of VCO Q301, changing the oscillating frequency according to the phase difference between the signals derived from the VCO and the crystal reference oscillator. The VCO is thus phase-locked to the crystal reference oscillator.

The output of receiver VCO Q301, after buffering by Q305, is delivered to the Main Unit for amplification by Q1005 before application to the 1st mixer, as described previously.

Transmitter VCO Q303 (MMBR951L) oscillates between 148 and 174 MHz according to the programmed transmit frequency. The remainder of the PLL circuitry is shared with the receiver. However, the dividing data from the microprocessor is such that the VCO frequency is at the actual transmit frequency (rather than offset for IFs, as in the receiving case). Also, the transmitter VCO is



modulated by the filtered speech audio applied to modulating varactor D305, as described previously. If the Digital Coded Squelch option is installed, DCS modulation is applied both to the VCO and to the PLL frequency reference, via varactor D1021 (HVU202).

### *Transmit Inhibit*

When the transmit PLL is unlocked pin 7 of PLL chip Q1024 goes to a logic low, turning on Q1020 (DTA143EK) and turning off half of Q1018. This unlock signal produces a low impedance at the base the other half of Q1018, which then turns off Automatic Power Controller Q1019 to disable the supply voltage to transmitter RF amplifiers Q1010 and Q1011, disabling the transmitter.

### *Miscellaneous Circuits*

#### *Push-To-Talk Transmit Activation*

The PTT switch on the microphone is connected to pin 10 of microprocessor Q2009, so that when the switch is closed pin 78 (tx/rx) goes low. This signal is delivered

to power bus controller Q1021 (IMH5) on the Main Unit, which then disables the receiver by disabling the 9-V supply bus at Q1022 (DTA143EK) to the front end, IF, discriminator and receiver VCO circuitry. At the same time, Q1015 (2SB772Q) activates the transmit 9-V supply line to enable the transmitter.

### *Channel Selection & Display*

The rotary channel selector switch on the front panel causes microprocessor Q2009 to select the operating frequency, display data and CTCSS tone frequency from serial EEPROM Q2017 (BR93C56). The operating frequency data is in the form of PLL dividing ratios, which are passed to the PLL IC on the Main Unit via strobe, data and clock outputs at pins 2, 3 and 4, respectively.

The channel digit display data from the microprocessor is strobed by pin 1 to display latch Q101 (TD62C850N) on the Display Unit, which decodes and drives the two 7-segment display digit LEDs and function indicator LEDs.



## EEPROM Programming Software Instructions

To program the Yaesu FTL-2011 and FTL-2014 series transceivers you need the FRB-2 Programming Connection Box, programming diskette and an IBM PC/AT® or PS/2® compatible computer with:

- at least 128k RAM,
- PCDOS® or MSDOS® 2.0 or later,
- one 5-1/4" (360k or 1.2MB) floppy drive,
- a monochrome or color monitor,
- one Async port (COM1) with 25-pin connector (or suitable adapter).

Of course you also need a printer if you want to get hard copy of the data.

The Yaesu programming diskette contains the following files:

- CE5.EXE – The EEPROM programming program
- CE5.HLP – Help file used by the main program
- INSTRUCT.DOC – A text file containing a copy of these instructions (in case you mislay the printed instructions)
- ALNccsb.CH – Channel Data for alignment purposes, where the latter part of the file name signifies as follows:

*cc* = two numbers indicating the maximum number of channels of the model to be aligned (04, 12 or 24);  
*s* = the subband version (A, B, C, etc.);  
*b* = the band of the transceiver (V for vhf)

You can use the software to create and edit data files without having to connect the computer to the transceiver. However, before connecting a transceiver for programming or cloning, turn off your computer and the transceiver, and connect the Programming Interface Box to the computer and the transceiver as shown below. Then restart the computer. Turning off the equipment during interconnection avoids damage to the electronics.

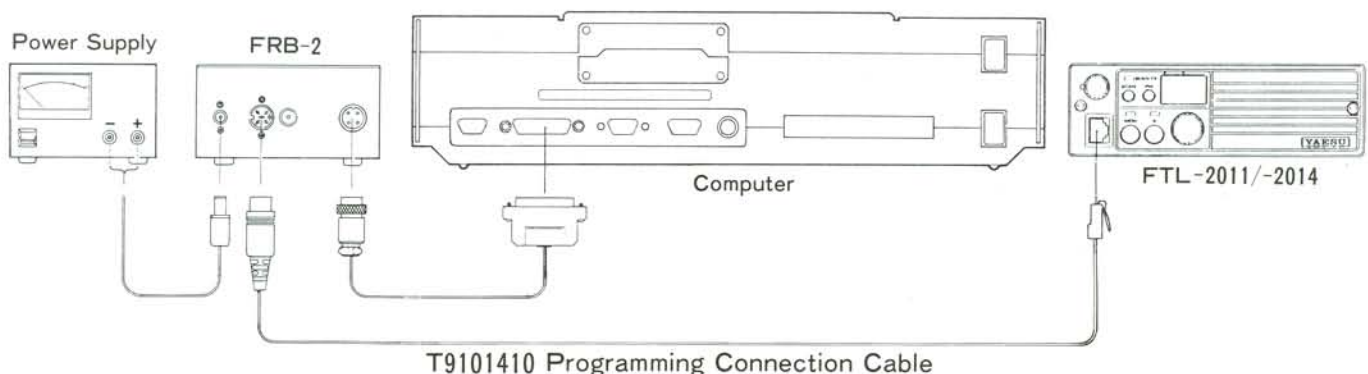
When ready to run the program (after booting DOS), place your *copy* of the Yaesu diskette (**not** the original!) in drive A, and log onto this drive (type "A:↵"). Then type "CE5↵" to start the program. You should be greeted briefly by an introductory screen, followed by the screen shown on the following page.

### Important!

Do not work directly with the Yaesu-programming diskette! Make a copy of it and use the copy when programming the transceiver, since you will be storing data on it. Keep the original in a safe place in case you need to make another copy later. The manuals that came with your computer should explain how to make a copy of a diskette, using the DOS COPY command. If you want to be able to boot the computer from your programming diskette copy, use the FORMAT command with /S parameter (on a blank diskette) to make a system disk, and then copy the files from the original diskette.

### The Channel Programming Screen

The main screen consists of four major sections: Common Data Items, Key Help, Channel Data, and,



Channel Programming Interconnections



along the bottom of the screen, Function Key Selections. These are described in a bit more detail next.

### Main Screen Common Data Items

At the upper right are the Ch, Step, Tx timer, Edit and A key items, which are “Common” Data items that you may need to refer to when making entries in the Channel Data. In this program, “Common” refers to global nature of these parameters: they are not channel-specific, but apply to programming and operation of the transceiver on any and all channels.

Ch indicates the maximum number of channels that can be displayed on the screen and programmed in this transceiver, and Step is the channel frequency multiple (all channel frequencies entered must be whole multiples of the indicated step size).

The Tx timer, which can be either enabled or disabled, determines whether transmissions will be limited by an internal timer. If disabled, the content of the TOT field at the right side of the screen will be ignored during transceiver operation.

The Edit entry is the name of the current data file being edited, if any. If no file has been read (via the F3, DiskLoad function) or saved (via the F4, DiskSave function), “noname.ch” is displayed here.

The A key setting indicates the function currently selected for the auxiliary key on the transceiver panel.

Common Data cannot be changed from this screen.

### Key Help Box

The KEY HELP box at the upper right indicates the keyboard keys that can be used to edit data at any given moment. The contents of this box change according to the location of the cursor in the Channel Data table, so

you will need to watch this box while becoming familiar with the channel editor. For example, when the program first starts, the cursor is in the “Pri Ch” (Priority Channel) field, which can accept only a number 1 or 2, to set the current channel as a priority channel. You can press the F1 key for more detailed help on the functions of particular keys in the current cursor field. Of course you can always use the cursor keys to select another field (unless in the middle of entering new field data).

### Channel Data Table

The largest section of the screen is the Channel Data table. Press the up, down, left and right arrow keys on the PC’s keyboard to move the cursor around the table (you may have to press the Num Lock key to switch the keypad from numeric to cursor movement mode if your keyboard does not have separate cursor keys). Each line in the editing table represents one channel, with the columns indicating the current setting of each parameter that can be set for that channel. Hyphens indicate that a parameter is not currently being used. If all of the fields on a line are hyphens, the channel is currently blanked (hidden from use).

Note that the Channel Data table is actually wider (by 16 columns) than the normal 80 columns that can be displayed on the computer screen. To access the right-most columns (DCS encoder, Tx Pwr and TOT – time-out timer), just move the cursor to the right from the right-most edge of the screen. The table will scroll sideways to reveal the additional columns, as indicated below.

### Function Key Selections

The main features of the program are indicated along the bottom of the screen, and are accessible by pressing the corresponding function keys (F1 to F8, located along the left side or top of your keyboard). You will always

```

EEPROM DATA EDITOR <CE-5>
Ch: 12 ch
Step: 5.0,6.25kHz Tx timer: Enabled
Edit: 12chpict.ch A key: High/Low

KEY HELP
1,2 Set Priority Channel

Pri Ch Rx Freq. Decoders 2-TONE Dec. BCL0 Scan Tx Freq. Enco
Ch 01 155.00000 94.8 off off off tone skip 155.00000 94.8
2 02 155.25500 107.2 off off off tone skip 155.25500 107.2
3 03 155.72500 118.8 off off off cw skip 155.72500 118.8
4 04 155.85000 156.7 off off off cw skip 155.85000 off
5 05 156.10000 91.5 off off off cw stop 156.10000 91.5
6 06 156.25000 127.3 off off off tone stop 156.25000 103.5
7 07 156.28500 136.5 off off off tone stop 156.28500 off
8 08 156.30000 91.5 off off off tone stop 156.30000 off
9 09 156.45500 127.3 off off off tone stop 156.45500 141.3
10 10 156.56000 94.8 off off off tone stop 156.56000 179.9
11 11 156.65000 100.0 off off off tone stop Tx INH. ---
12 12 156.70000 100.0 off off off tone stop Tx INH. ---

```

Channel Programmer Main Screen (Left)

```

KEY HELP
Tx Timer ON/OFF

Encoders Tx
CTCSS DCS Pwr TOT
94.8 off Hi on
107.2 off Hi on
118.8 off Lo on
off off Lo on
91.5 off Lo on
103.5 off Lo on
off off Hi on
off off Hi on
141.3 off Hi on
179.9 off Hi on
--- --- --- ---

```

scrolled right



return to this screen after completing one of the actions listed, and can then edit channel data, select another feature, or quit. When finished with the program, always use the **Quit** selection (F8, and then Y). Don't turn off the power switch or disconnect the cables to the transceiver until after the program has exited.

### What to do First

#### Reading Data from the Transceiver

If you have a transceiver connected to the computer, we recommend that you upload the data from the transceiver and save it to disk before doing anything else. Press the F5 key (Read ROM) to do this, and follow the prompts. If an error message is displayed when attempting to upload the data, check your cables, Connection Box and power supplies carefully. After uploading the data from the transceiver, save it to disk right away as described below under "Saving Data to Disk".

#### Loading Data from Disk

If no transceiver is connected to the computer and you just want to view or edit data files already on the disk, press F3 (DiskLoad). A window like the following will appear:

aln04au.ch	aln04av.ch	aln04bv.ch	aln04cv.ch
aln04du.ch	aln12au.ch	aln12av.ch	aln12bv.ch
aln12cv.ch	aln12du.ch	aln24au.ch	aln24av.ch
aln24bv.ch	aln24cv.ch	aln24du.ch	custom1.ch
custom2.ch	custom3.ch	dod.ch	fbi.ch
motorol1.ch	motorol2.ch		

File to Load A:\\*.ch

#### File Directory Window

You will be asked for the name of the file to load, which *must* be the name of a channel data file already on

#### Important Note

Before entering new channel data from the keyboard, you must either upload data from a transceiver, or from a (valid) data file.

Some EEPROM data, such as IF and reference frequencies, is specific to the transceiver hardware, and cannot be changed without modifying the circuitry. This data is, however, read and written from/to the EEPROM. If it does not match the hardware for the transceiver to be programmed, the transceiver will not operate properly.

the disk. The only such files provided on the original diskette are **ALNccsb.CH**, but you will be adding your own files to these. To see a list of all files, type ".L" (period and Enter), and then type the name of the file you want to load.

If an error message appears during loading, either no file could be found on the disk with that name, or the file data was corrupted since it was last stored. If the data was corrupted you will have to build a new file from scratch, or enter another file name. We suggest you erase any corrupted files from the disk to avoid confusion. Just enter **DEL filename.ext** from the DOS prompt (substituting the name of your file for "filename.ext").

#### Editing Channel Data

After loading data from a transceiver or a data file, as just described, you are ready to edit it. Just move the cursor from one field to another using the cursor keys, and enter the new data desired. Refer to the Key Help box for which keys are effective in each field, and press F1 for additional help on each field, as needed.

The Decoders and Encoders fields will allow you to choose tone or code frequencies from a selection window, as shown here (for the CTCSS selections):

TONE SELECT			
67.0	71.9	74.4	77.0
79.7	82.5	85.4	88.5
91.5	94.8	97.4	100.0
103.5	107.2	110.9	114.8
118.8	123.0	127.3	131.8
136.5	141.3	146.2	151.4
156.7	162.2	167.9	173.8
179.9	186.2	192.8	203.5
210.7	218.1	225.7	233.6
241.8	250.3		

#### Tone Selection Window

When you have entered all of the channel data desired, we recommend that you first save it to disk before downloading to a transceiver.

#### Saving Data to Disk

You can save data to a disk file at any time by pressing the F4 (DiskSave) function key. A file list window like that illustrated for DiskLoad will appear. Remember that you *must* save a file if you have just edited the Channel Data or Common Data and want to use it again later, but we also suggest you do this as soon as you have uploaded data from a transceiver (so you will be able to restore it if a problem develops later). You will be asked for a file name to save to. This can be any valid DOS file name, but we recommend you choose a name that you will be able to recognize easily later. Be careful not to select a name that already exists (you should not use



ALNccsb.CH, for example). If you need to see what files are on the disk, just enter a period (.).

### ***Sending Data to the Transceiver***

After editing data and saving it to a file on disk, you can download it to a transceiver, if connected. If the cables are not connected, however, you should press **F8 (Quit)** after making sure you have saved any edited data to a file, and then turn off the computer to connect the Connection Box, Transceiver and cables. Then turn the computer back on and restart the program, reload the saved file from disk (function key **F3**), and then press function key **F6 (WriteROM)** and follow the prompts on the screen.

The Space bar will then start the download. If an error message is displayed when attempting to download the data, check your cables, Connection Box and power supplies carefully. Any key will return you to the Main Menu, where you can try again, if necessary. To program another transceiver with the same data, you can change the cable connection without having to turn off the computer and restart the program.

### ***Editing Changeable Common Data***

“Common” data here means those parameters which affect all channels in the transceiver. Those parameters which can be reprogrammed without modifying the circuitry are shown on the first submenu, accessed by pressing **F2**:

EDIT COMMON DATA	
Scan-Stop Resume:	5s timer
Scan During Priority:	Enabled
Priority Speed:	Slow
Talk Back:	Enabled
Home Channel:	.....
OFF Hook:	Enabled
Monitor:	Enabled
Tx Time-Out:	7.5 min
Time-Out Resume:	0 sec
Tx Carrier Delay:	Disabled
A key:	High/Low

### **Common Data Submenu**

Use the Space bar to toggle switchable parameters on and off, or with the Backspace key to step through numeric selections (numbers are not entered directly). Press the **F1 (Help)** function key for detailed help on all modifiable Common Data selection.

When finished, press **F8** or **ESC** to return to the Main Menu, and remember to save any changes to disk.

### ***Viewing Environment Data***

HARDWARE ENVIRONMENT	
Prescaling:	1/64
Channel Step:	5.0,6.25kHz
IF:	00.0MHz
Local Offset:	Lower
Scan Speed:	50 ms
Memory channel:	12ch

### **Hardware Environment Submenu**

Environment Data (most of which cannot be changed without changing the hardware), can be viewed by entering the second submenu from the Common Data submenu, by pressing **F2** again from the submenu. These parameters are stored in EEPROM along with the changeable parameters, but, with exception of the hardware-independent **Scan Speed** and **Local Offset**, they *must also match the circuitry of the transceiver(s) being programmed*. This means you have to be careful, whenever editing Channel or Common data, to begin with data that will match the target transceiver(s). To change any of the Environment parameters, you must restart the program with “/P” switch (“CE5 /P”).

### ***Listing Data to Screen or Printer***

If you want to have a printed copy of a set of data, or if you just want to view data without making any changes, press **F7 (PrintOut)** from the Main Screen.

To print a displayed page on the printer, if you have a PC keyboard with the **PrtSc** key also serving as an asterisk key, press and hold the **Shift** key while pressing **PrtSc**. Otherwise, if you have an enhanced AT keyboard, just press the **Print Screen** key (near the upper right).



## ALIGNMENT

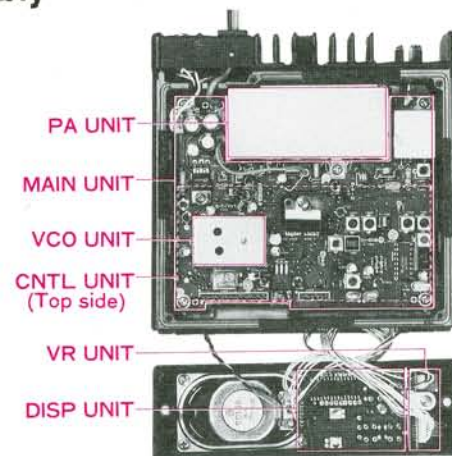
The FTL-2011/-2014 has been aligned at the factory for the specified performance across the frequency range specified for each version. Realignment should therefore not be necessary except in the event of a component failure, or alteration of version. All component replacement and service should be performed only by an authorized Yaesu representative, or the warranty policy may be voided.

### Required Test Equipment

- IBM PC®/compatible Computer
- Yaesu FRB-2 Service Kit, with CE-5 Channel Programming Diskette
- RF Signal Generator with calibrated output level at 200 MHz
- Deviation Meter (linear detector)
- Oscilloscope
- AF Millivoltmeter
- SINAD Meter
- Inline Wattmeter with 5% accuracy at 200 MHz
- Regulated DC Power Supply adjustable from 10 to 17V, 15A
- 50-Ω Non-reactive Dummy Load: 100W at 200 MHz
- Frequency Counter:  $\pm 0.2$ ppm accuracy at 200 MHz
- AF Signal Generator
- DC Voltmeter: high impedance
- Spectrum Analyzer
- VHF Sampling Coupler

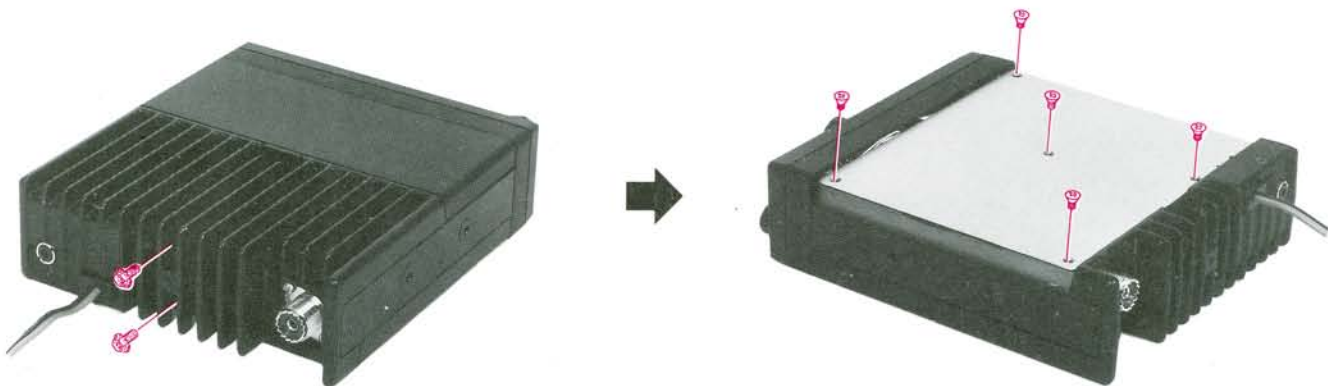
### Case Disassembly

- Make sure the transceiver is off. Loosen the screws on the heatsink and remove the top and bottom covers. The Control Unit is now accessible on the top of the chassis.
- In the bottom of the set, remove the 5 screws from the shield cover, and remove the shield to gain access to the Main Unit.



(Chassis Bottom View)

### Board Locations



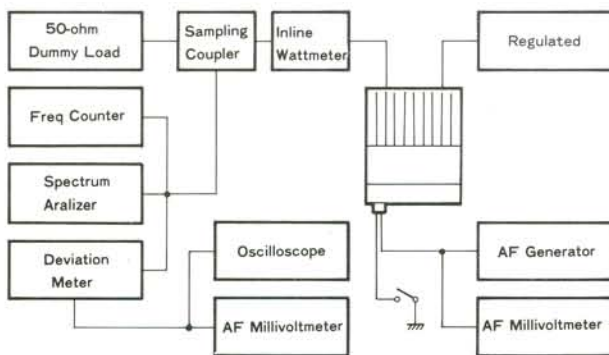
Before beginning alignment, connect the transceiver and PC to the FRB-2 Connection Box as described in the *Channel Programming* chapter, and download the EEPROM data from the transceiver to the computer. Then store this data in a disk file so that it can be uploaded when alignment is finished.

Next, using the CE-5 channel editor, program channel 1 to 148.000 MHz, channel 2 to 161.000 MHz and channel 3 to 174.000 MHz. Set these three channels to simplex, high power output, and turn off any tone settings for these channels. Download this new data to the transceiver.

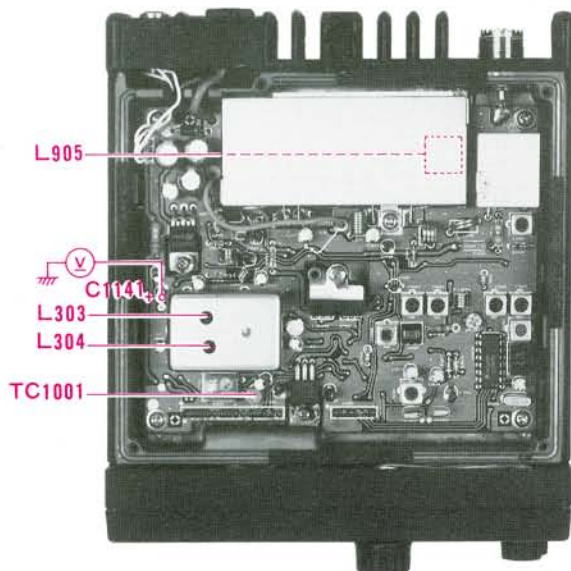
**NOTE:** when finished alignment, make certain to reload the original channel data from disk, and then download it back into the transceiver.

**PLL & Transmitter**

Set up the test equipment as shown here for transmitter alignment. Adjust the supply voltage to 13.6V for all steps.



**PLL & Transmitter Alignment Setup**



**PLL VCV (Varactor Control Voltage)**

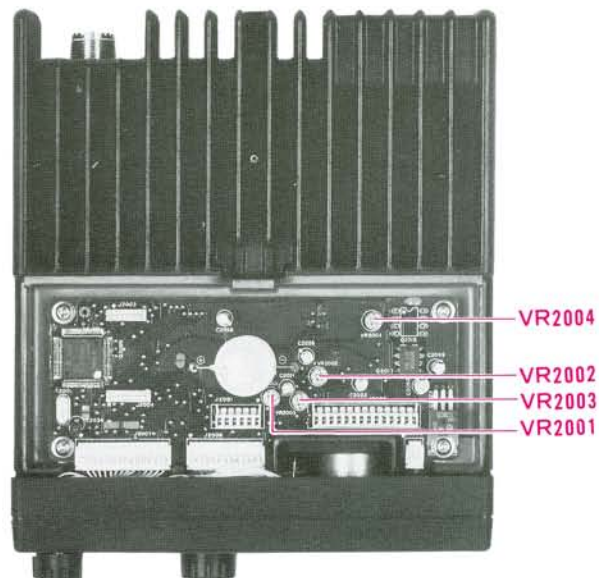
- (1) Connect the DC voltmeter between the positive terminal of C1141 on the Main Unit and chassis ground.
- (2) Set the transceiver to high band edge channel 3, and adjust coil L303 on the VCO Unit for 6.8 V on the voltmeter.
- (3) Select low band edge channel 1, and confirm at least 1.5V on the meter.
- (4) Select channel 3 again, and this time key the transmitter while adjusting coil L304 on the VCO Unit for 6V on the voltmeter.
- (5) Again select low band edge channel 1, key the transmitter, and confirm at least 1V on the meter.

**PLL Reference Frequency**

- (1) With the wattmeter, dummy load and frequency counter connected to the ANT jack, select band center channel 2, key the transmitter, and adjust TC1001 on the Main Unit, if necessary, so the counter frequency is within 100 Hz of 161.000 MHz.

**Transmitter Output Power & APC**

- (1) Preset trimmer potentiometer VR2003 fully clockwise.
- (2) With the transceiver set to band center channel 2, key the transmitter and confirm at least 45W power output. Select channels 1 and 3, and adjust L905, if necessary, for at least 45W output on these channels.
- (3) On the PC, reprogram channel 1 for low power output, and download this data to the transceiver.



**PLL & Transmitter Alignment Points**



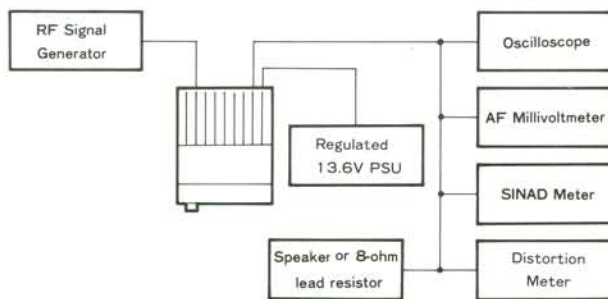
- (4) Select channel 2, and adjust VR2003 for 40W output.
- (5) Select channel 1, and adjust VR2002 for 5W output.

### Transmitter Deviation

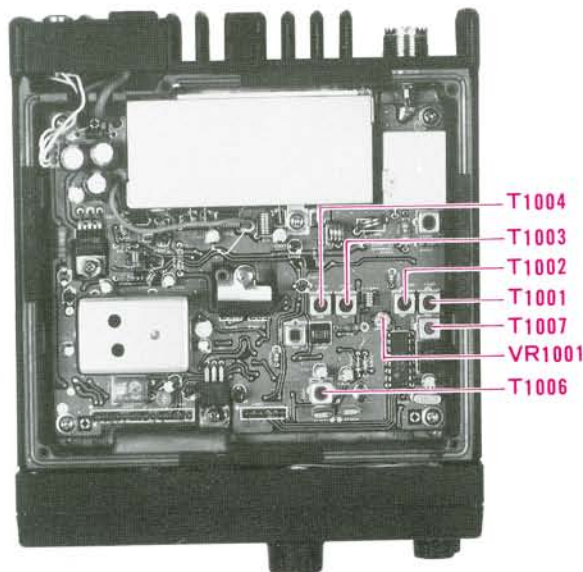
- (1) Select channel 3, and adjust the AF generator attenuator for 25-mV output at 1 kHz to the MIC jack.
- (2) Key the transmitter and adjust VR2004 on the Main Unit for  $\pm 4.5$  kHz deviation on the deviation meter (within 100 Hz).
- (3) On the PC, reprogram channel 3 to enable a 100-Hz CTCSS tone (encode), and download this to the transceiver.
- (4) Reduce the AF generator injection to zero. Key the transmitter, and adjust VR2001 on the Main Unit for  $\pm 0.7$  kHz deviation (within 100 Hz).

### Receiver

Set up the test equipment as shown below for receiver alignment.



### Receiver Alignment Setup



### Receiver Alignment Points

### Discriminator Coil

- (1) Set the transceiver set to channel 1, With the RF signal generator at the ANT jack tuned to the same frequency, set the generator for  $\pm 3$  kHz deviation of 1-kHz tone modulation, and set the output level for minimum distortion.
- (2) Adjust T1007 on the Main Unit for peak on the AF millivoltmeter.

### SINAD

- (1) Adjust T1001 through T1004 and T1006 on the Main Unit for optimum SINAD.
- (2) After adjusting the transformers, generator level should be  $-6$  dB  $\mu$  or less for 12dB SINAD. Confirm this SINAD level on the other two alignment channels.

### Squelch

- (1) With channel 2 selected, tune the RF signal generator to the same frequency, and set the generator level to  $-12$  dB $\mu$ .
- (2) Turn VR1001 clockwise until the squelch just closes, and then counterclockwise very slightly so that it just opens.

*Reload the original channel data from disk, and then download it back into the transceiver.*

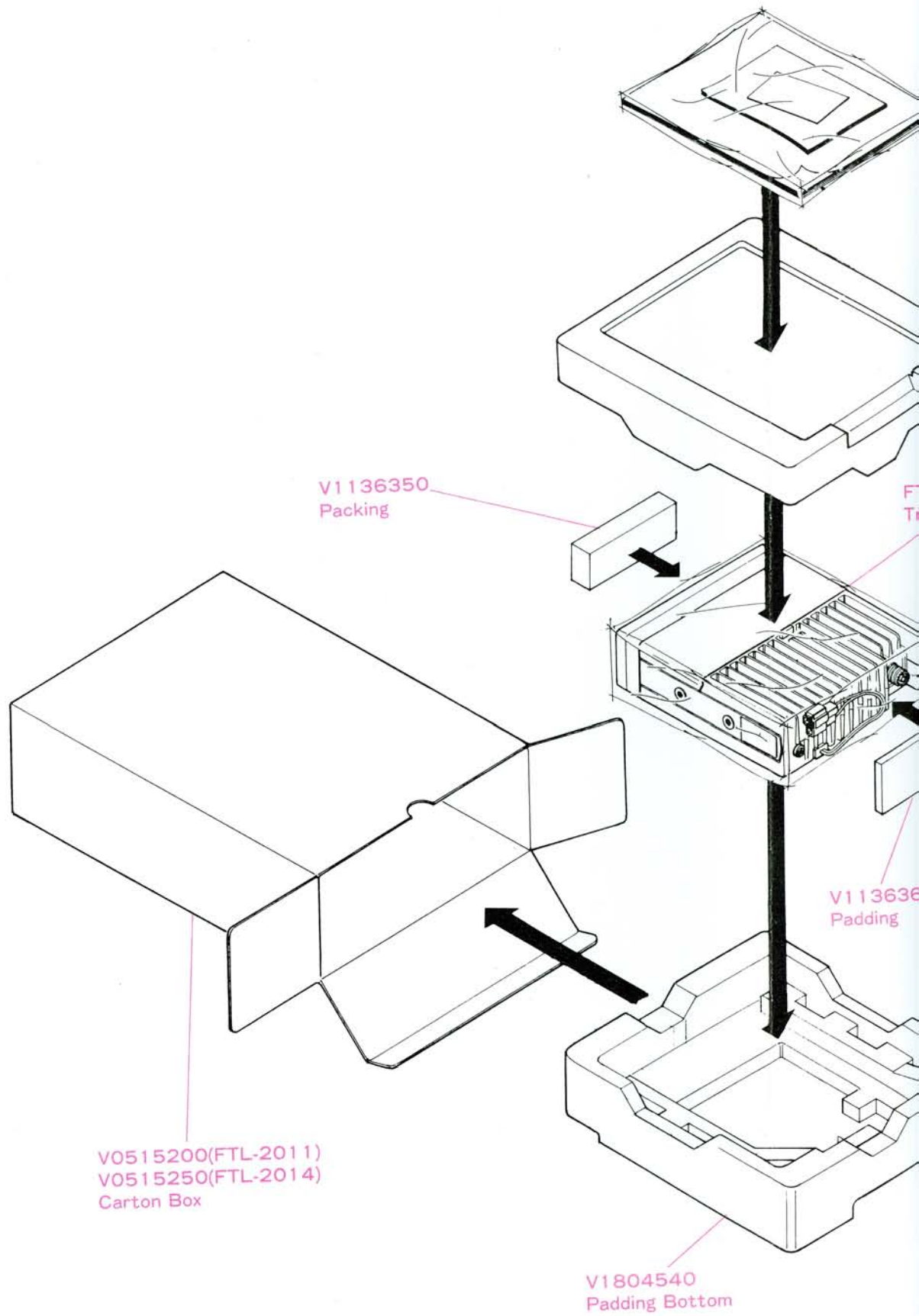
## Supplied Accessories

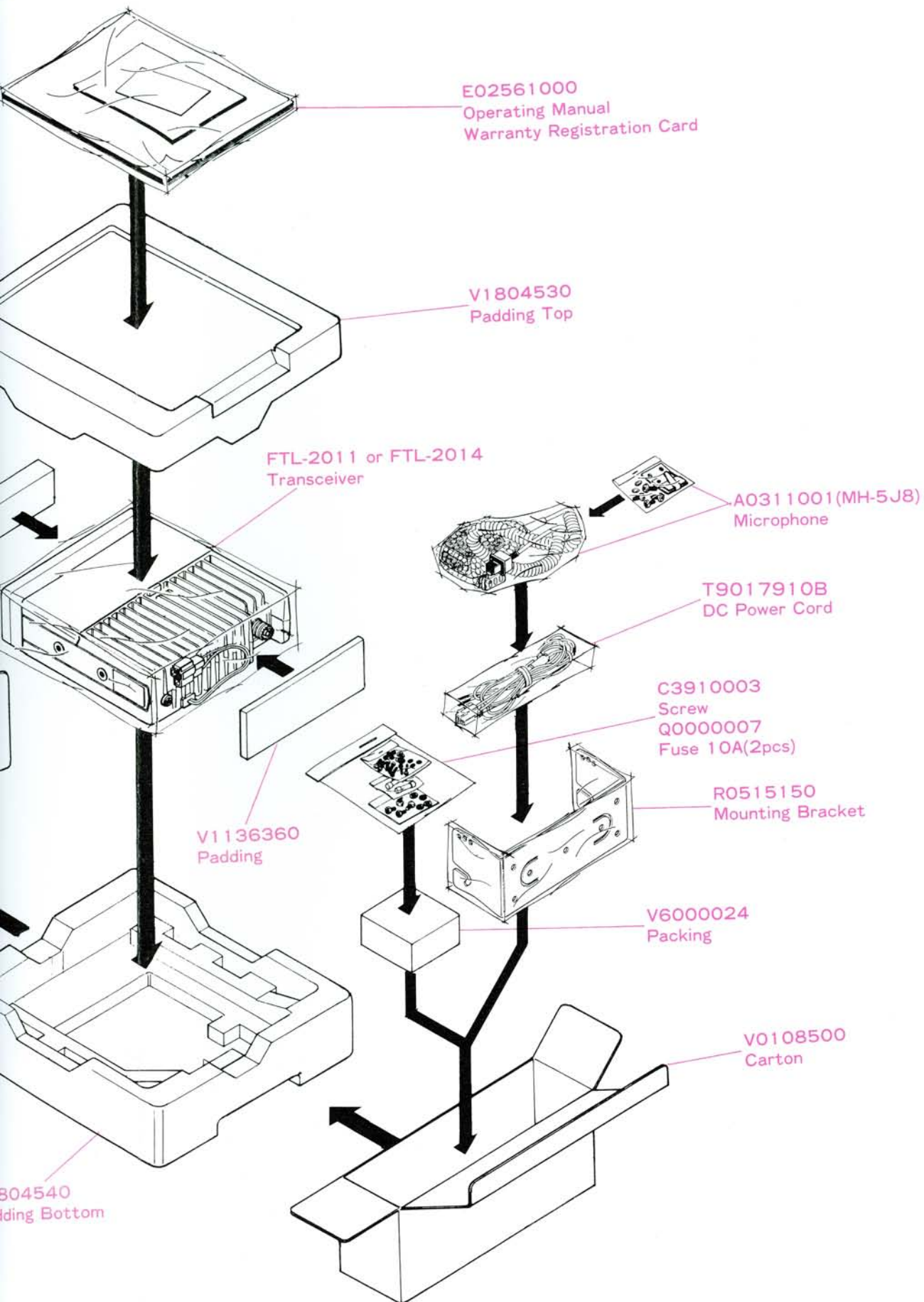
CODE NO	DESCRIPTION
A0311001	MH-5J8 Microphone (optional in USA)
T9017910B	Fused DC Cable w/tow 10-A fuses
R0515150	MMB-48 Mobile Mounting Bracket

## Optional Accessories

CODE NO	DESCRIPTION
D3000591	FDS-1 Digitally Coded Squelch Unit
D3000588	F2D-4 Sequential 2-Tone Decoder
A00480002	FRB-2 Programming Interface Box
	CE-5 Channel Programming Software (for IBM PC/compatibles only)
T9101410	Programming Connection Cable
T9101411	Transceiver-to-transceiver Cloning Connection Cable
A625501	FP-700 AC (Base Station) Power Supply





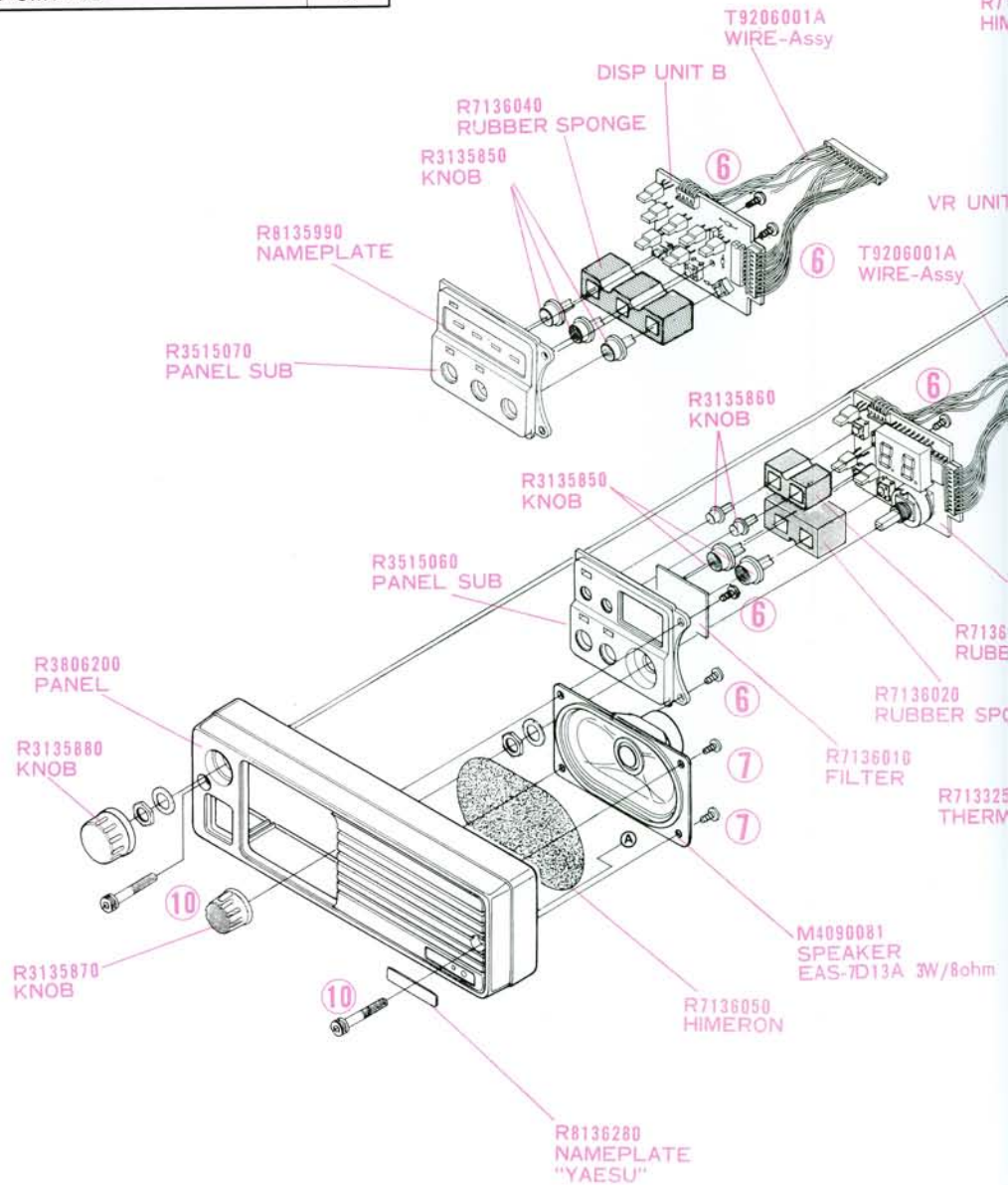


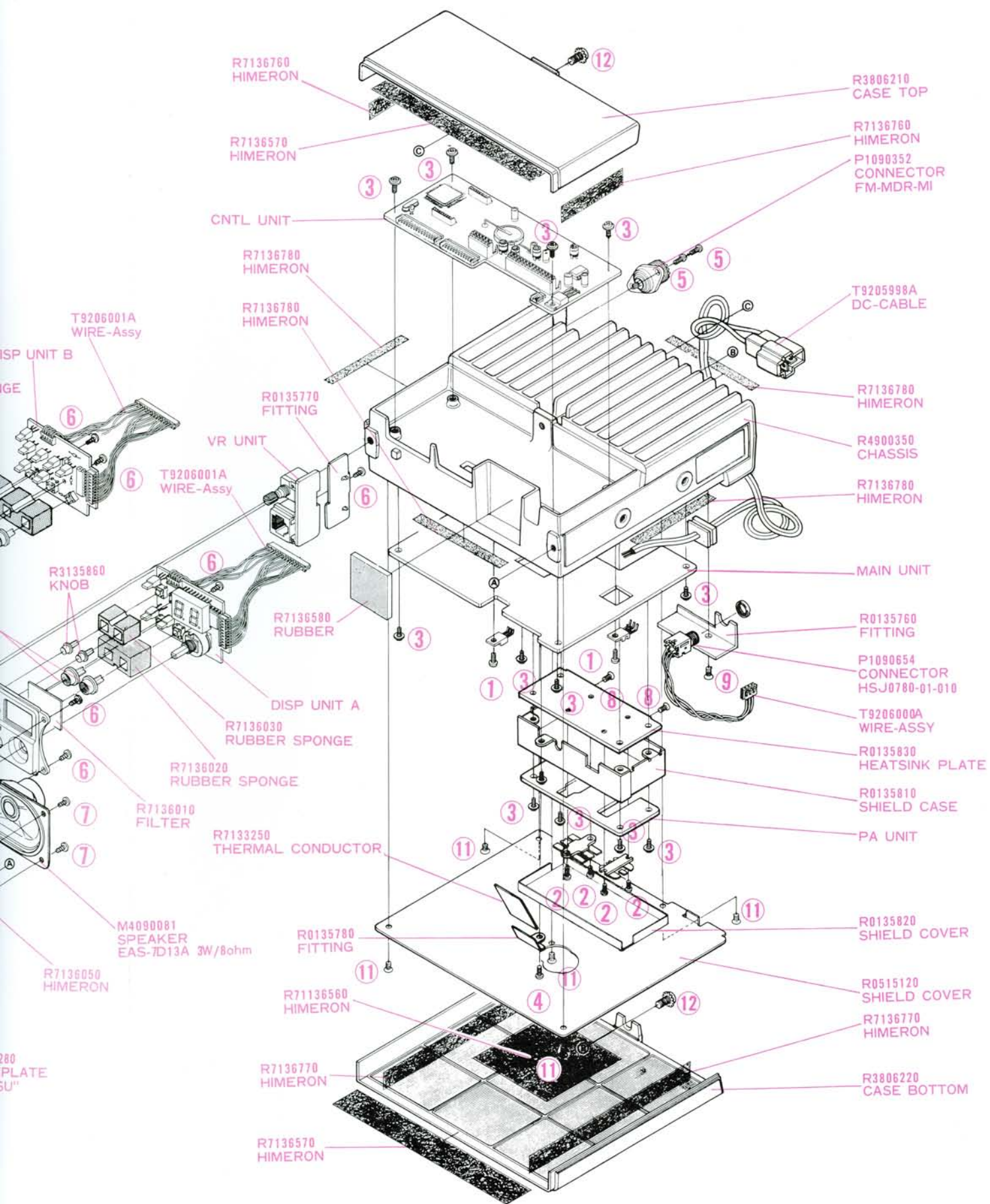
Packaging



No.	Parts No.	Description	Qty.
①	U74206001	SEMS SCREW HSM2.6×6	2
②	U02306001	SEMS SCREW SM3×6	4
③	U05308002	CAP SCREW TM3×8NI	13
④	U20306001	BINDING HEAD SCREW M3×6	1
⑤	U20306002	BINING HEAD SCREW M3×6NI	2
⑥	U23306001	TAPTITE SCREW M3×6	4 5*
⑦	U24305001	TAPTITE SCREW M3×5	2
⑧	U30204001	FLAT HEAD SCREW M2.6×4	2
⑨	U30306007	FLAT HEAD SCREW M3×6B	1
⑩	U51425007	HEX SOCKET HEAD BOLT M4×25B	2
⑪	U30206001	FLAT HEAD SCREW M2.6×6	5
⑫	U06408007	SCREW OM4×8B	2

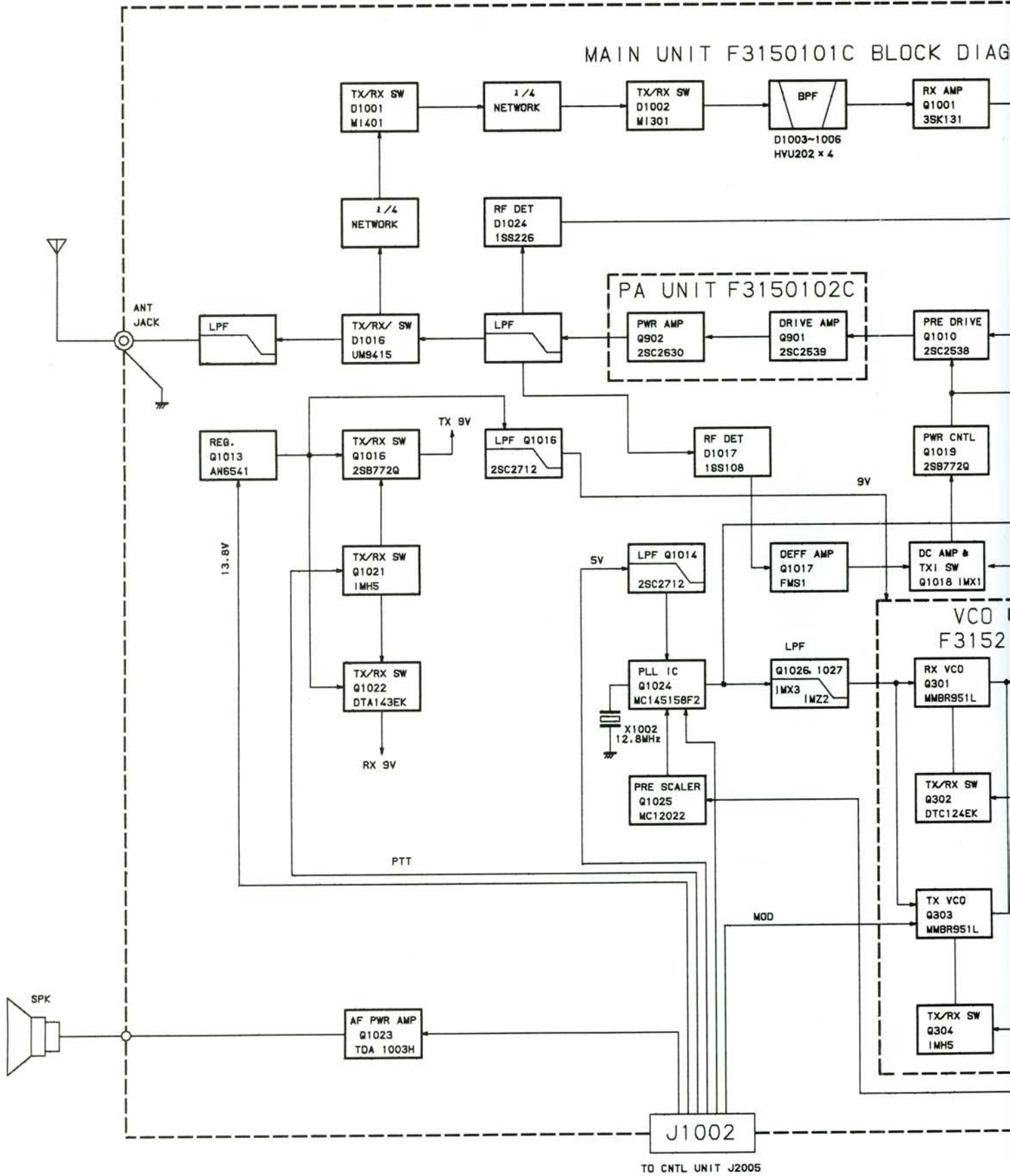
\*: DISP UNIT B Type



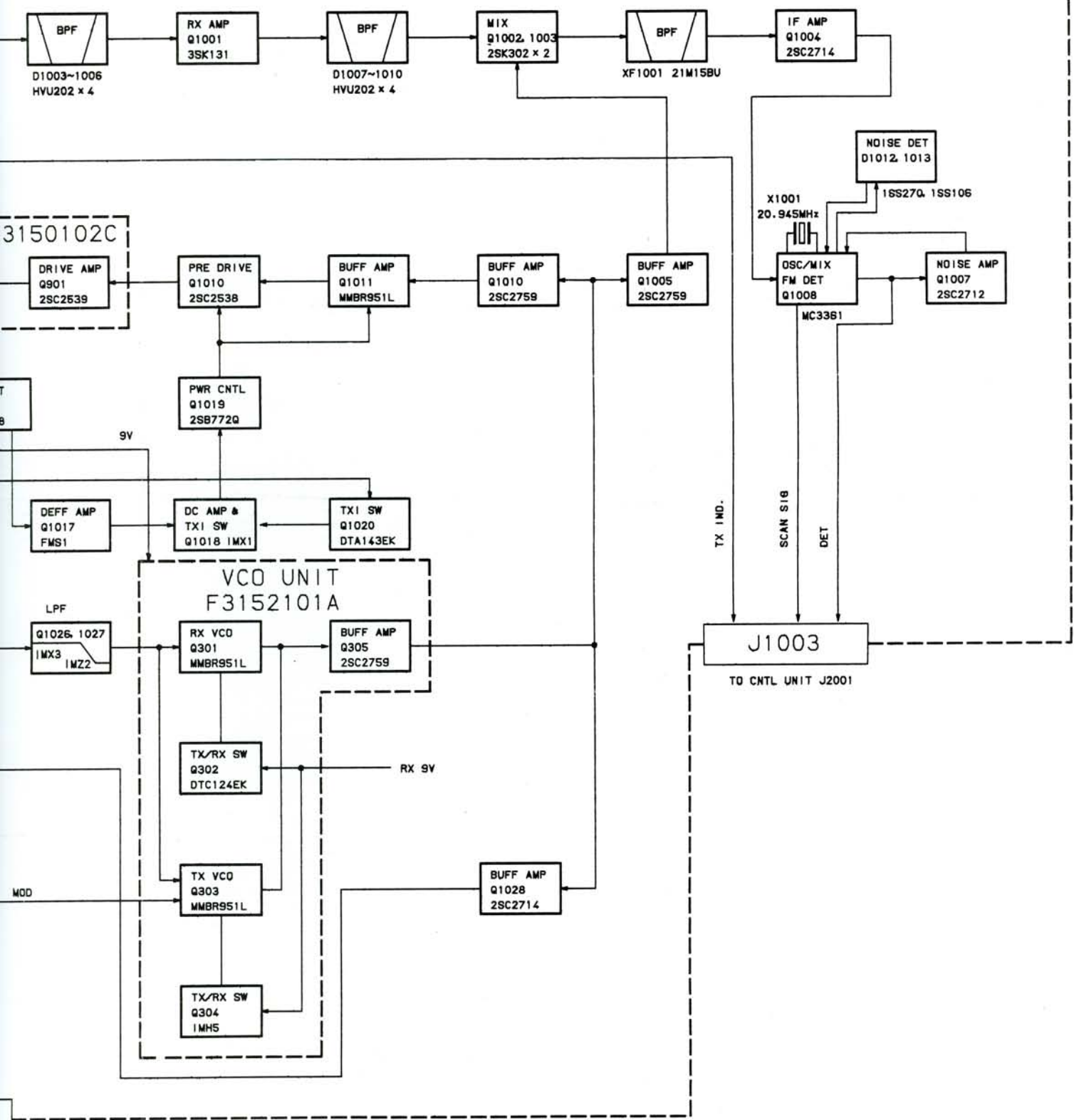




MAIN UNIT F3150101C BLOCK DIAG

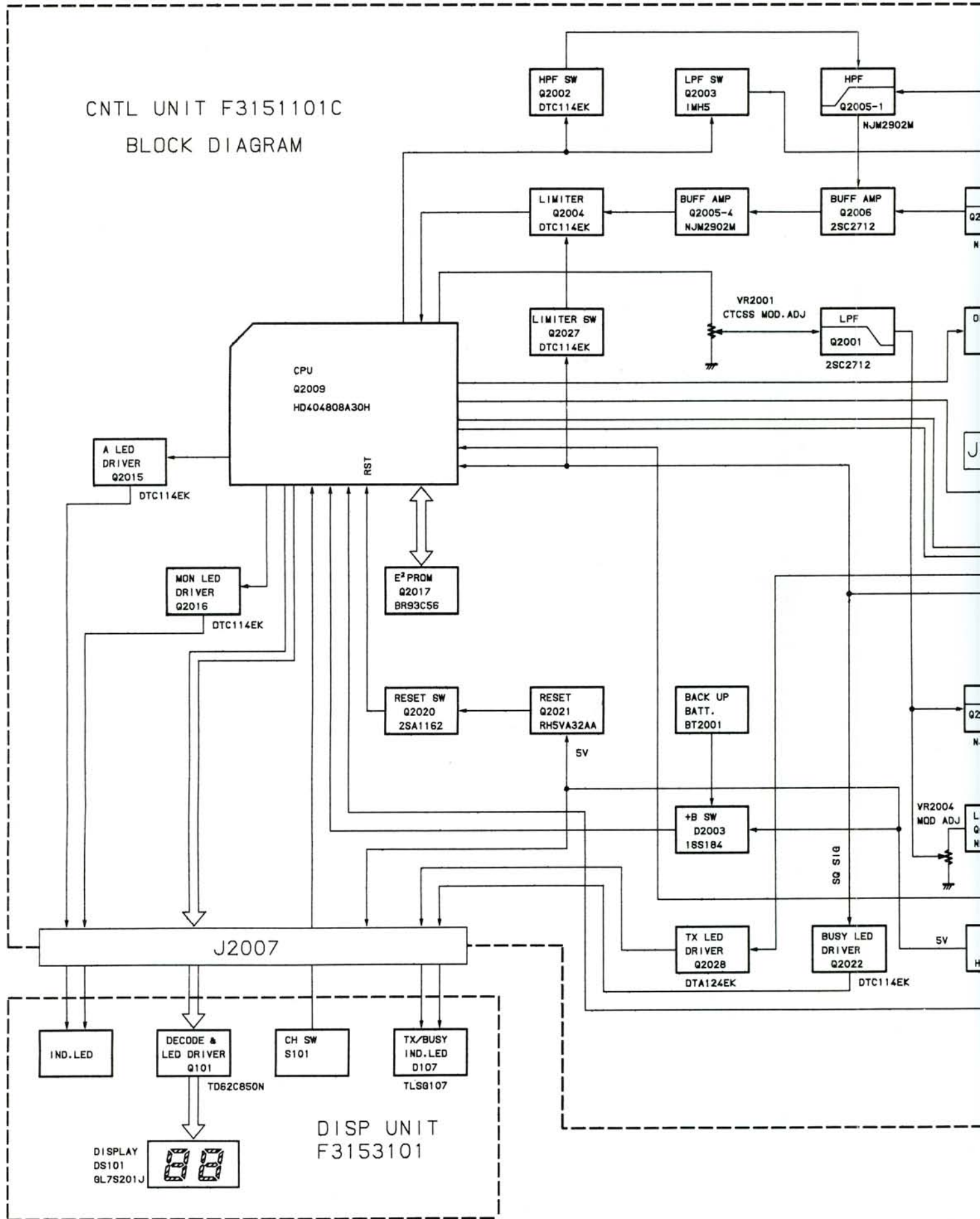


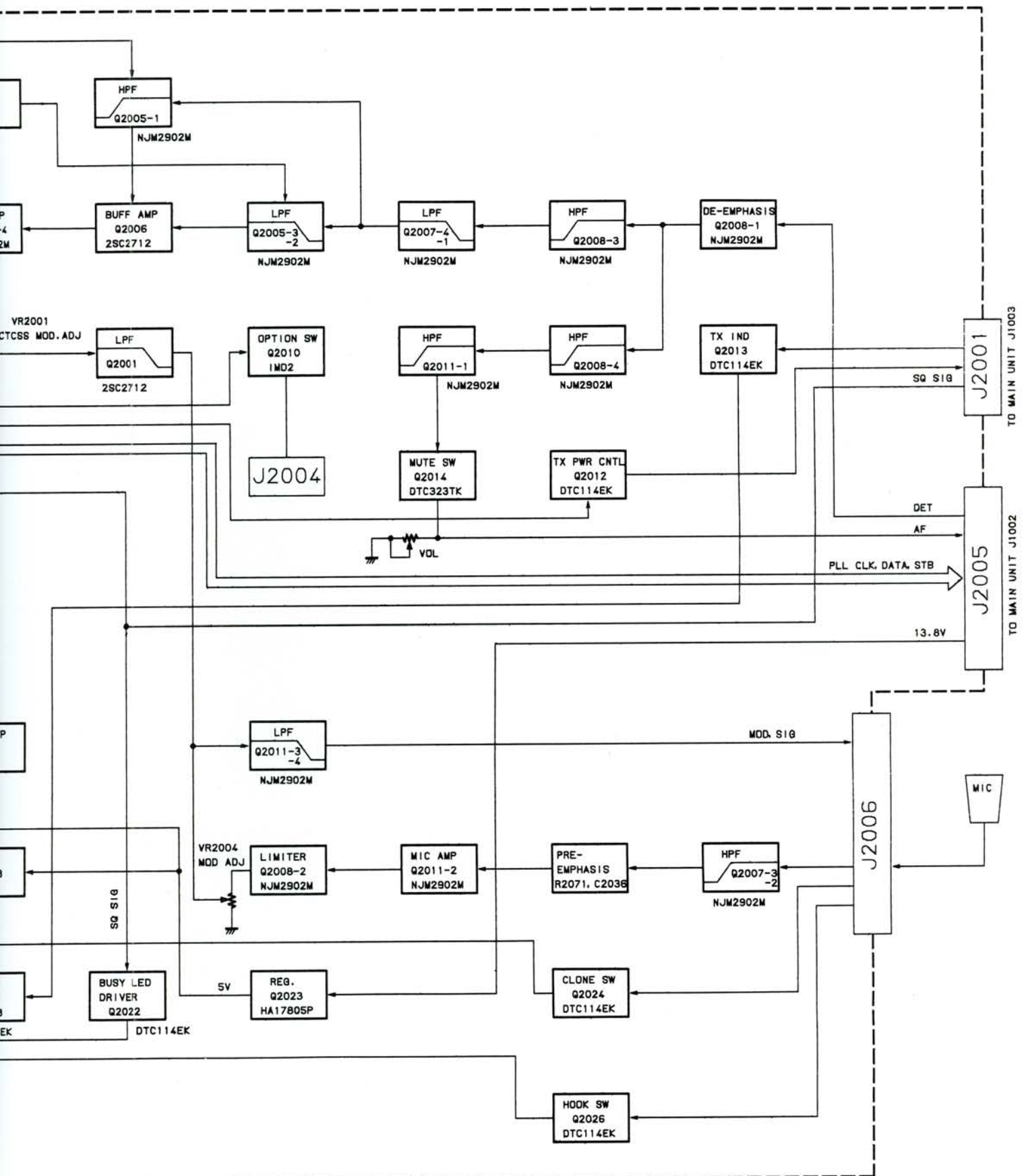
3150101C BLOCK DIAGRAM





CNTL UNIT F3151101C  
BLOCK DIAGRAM







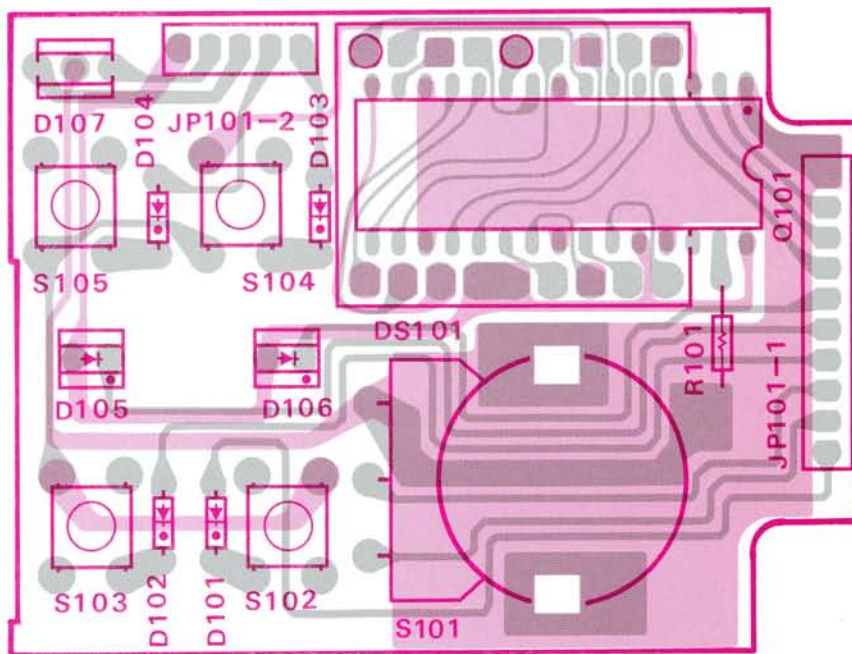
## Parts List

\*\*\* DISP UNIT A \*\*\*  
(FTL-2011 Type)

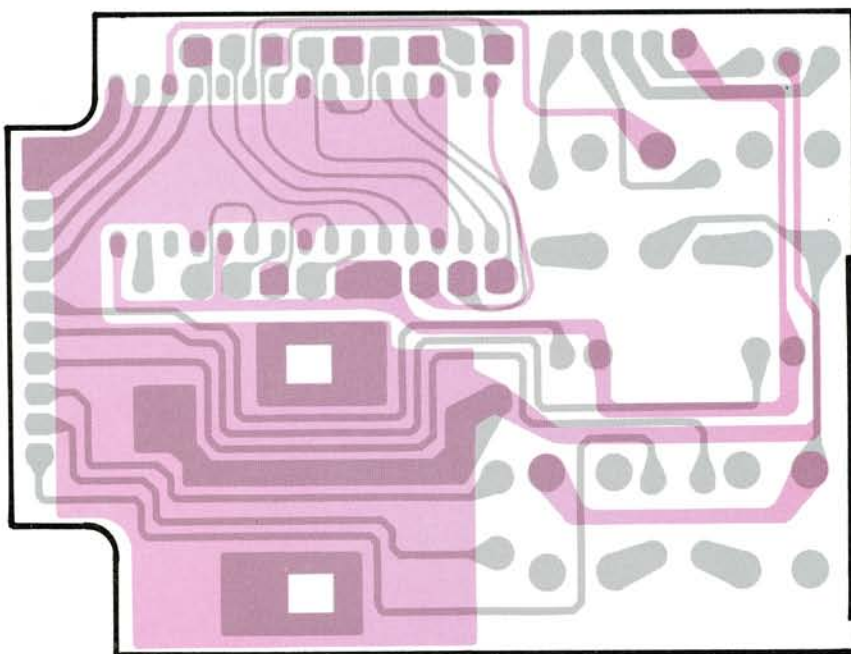
	CS0915001	PCB with Components			
	F3153101	Printed Circuit Board			
ADD	CODE NO	DESCRIPTION	DEVICE		LOT NO
D 0101	G2060004	DIODE	1SS270TJ		
D 0102	G2060004	DIODE	1SS270TJ		
D 0103	G2060004	DIODE	1SS270TJ		
D 0104	G2060004	DIODE	1SS270TJ		
D 0105	G2090151	LED	TLY208		
D 0106	G2090147	LED	TLG208		
D 0107	G2090486	LED	TLSG208		
DS0101	G2090488	LED	GL7S201J		
JP0101	T9206001	WIRE-ASSY			
Q 0101	G1091142	IC	TD62C850N		
R 0101	J01225471	CARBON FILM RES.	RD16PJ471	470	1/6W
S 0101	Q9000545	ROTARY CODE SW	EVQ-WWRF1524B		
S 0102	N5090011	TACT SWITCH	KHH10910		
S 0103	N5090011	TACT SWITCH	KHH10910		
S 0104	N5090011	TACT SWITCH	KHH10910		
S 0105	N5090011	TACT SWITCH	KHH10910		
	R7136820	PRESS BOARD			

# Parts Layout & Circuit Diagram

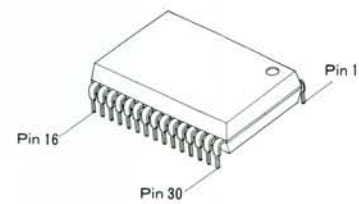
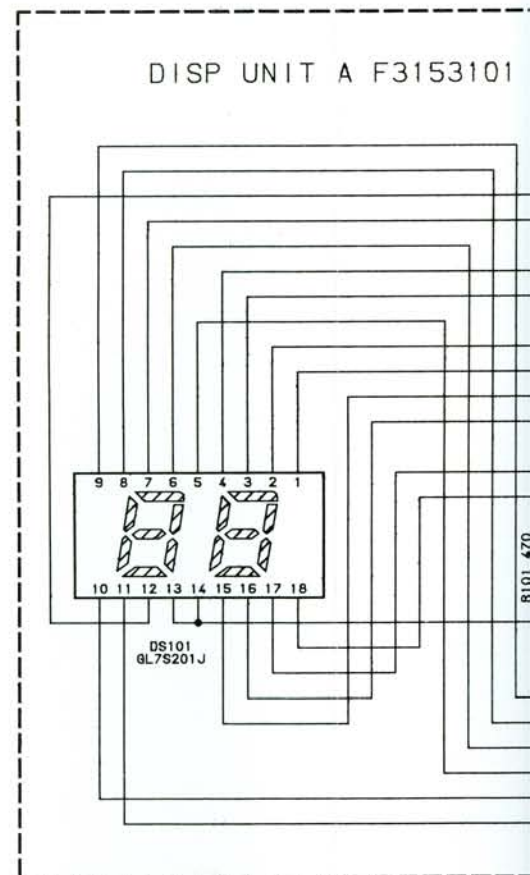
DISP Unit A (Nos. 1xx)



Obverse View of Component Side

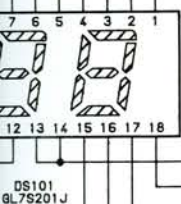
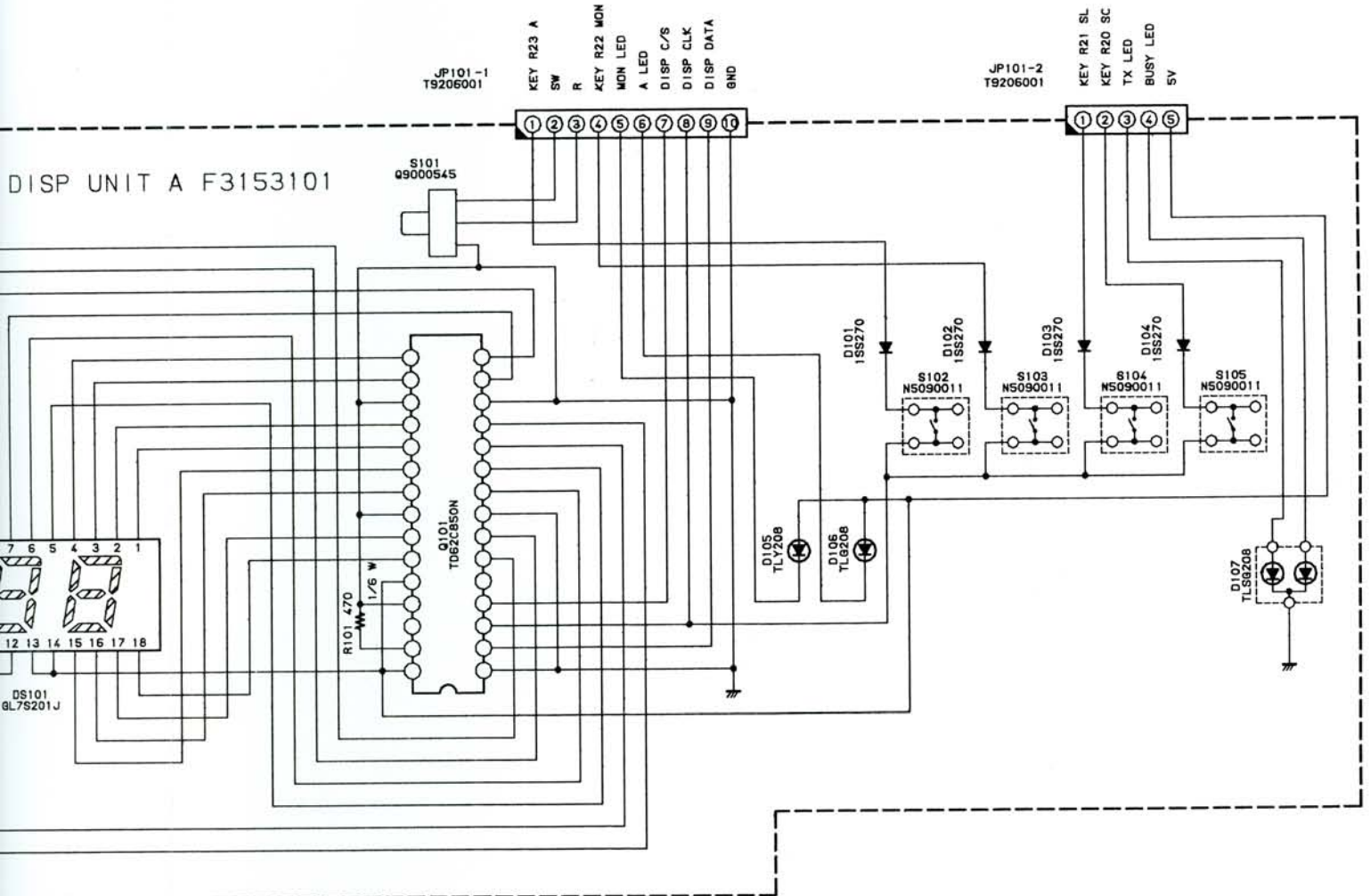


Obverse View of Solder Side

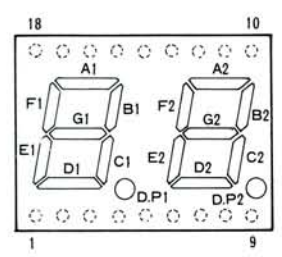


TD62C850N(Q101)

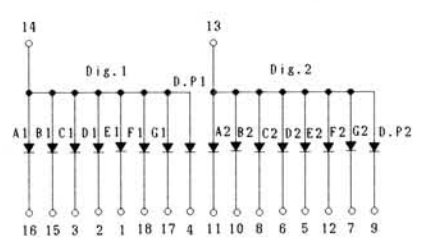




TD62C850N(Q101)



GL7S201J(DS101)



GL7S201J CIRCUIT DIAGRAM

## Parts List

\*\*\* DISP UNIT B \*\*\*  
(FTL-2014 Type)

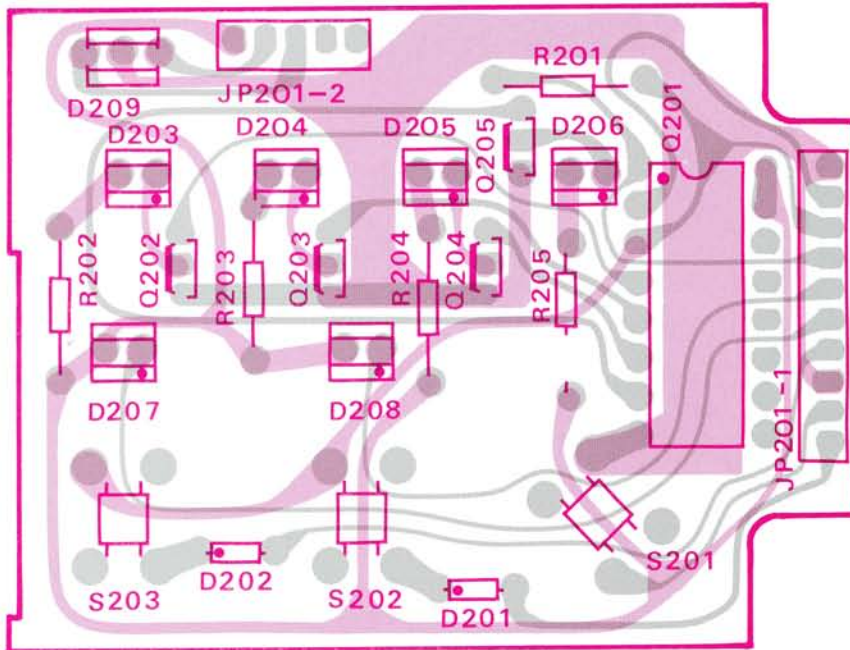
CS0918001 PCB with Components  
F3154101 Printed Circuit Board(Lot 2)  
F3154101A Printed Circuit Board(Lot 3-)

ADD	CODE NO	DESCRIPTION	DEVICE	LOT NO	
D 0201	G2060004	DIODE	1SS270TJ		
D 0202	G2060004	DIODE	1SS270TJ		
D 0203	G2090492	LED	TLO208		
D 0204	G2090492	LED	TLO208		
D 0205	G2090492	LED	TLO208		
D 0206	G2090492	LED	TLO208		
D 0207	G2090151	LED	TLY208		
D 0208	G2090147	LED	TLG208		
D 0209	G2090486	LED	TLSG208		
JP0201	T9206001	WIRE-ASSY			
Q 0201	G1090297	IC	UPD4094BC		
Q 0202	G3090074	TRANSISTOR	BA1A4M		
Q 0203	G3090074	TRANSISTOR	BA1A4M		
Q 0204	G3090074	TRANSISTOR	BA1A4M		
Q 0205	G3090074	TRANSISTOR	BA1A4M		
R 0201	J01225103	CARBON FILM RES.	RD16PJ103	10K	1/6W
R 0202	J01225271	CARBON FILM RES.	RD16PJ271	270	1/6W
R 0203	J01225271	CARBON FILM RES.	RD16PJ271	270	1/6W
R 0204	J01225271	CARBON FILM RES.	RD16PJ271	270	1/6W
R 0205	J01225271	CARBON FILM RES.	RD16PJ271	270	1/6W
S 0201	N5090011	TACT SWITCH	KHH10910		
S 0202	N5090011	TACT SWITCH	KHH10910		
S 0203	N5090011	TACT SWITCH	KHH10910		

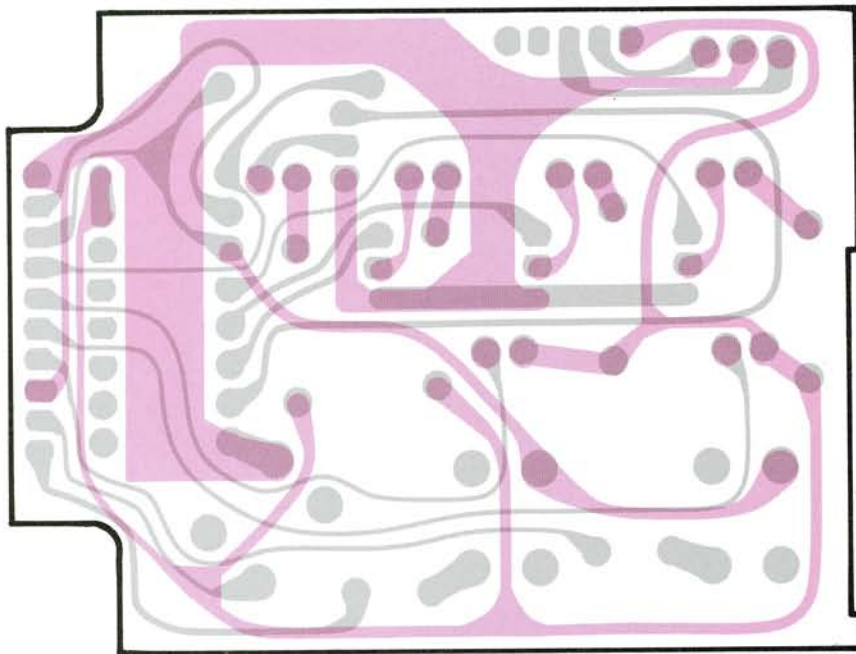


# Parts Layout & Circuit Diagram

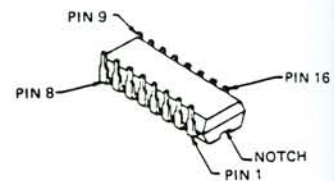
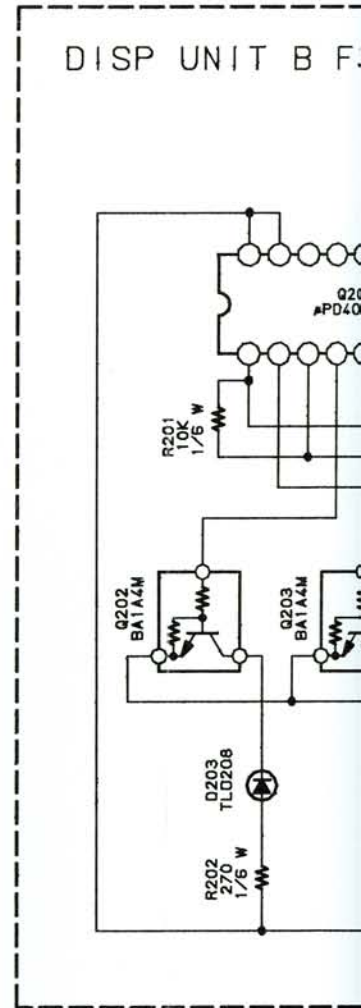
DISP Unit B (Nos. 2xx)



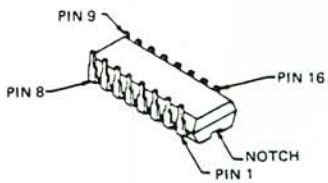
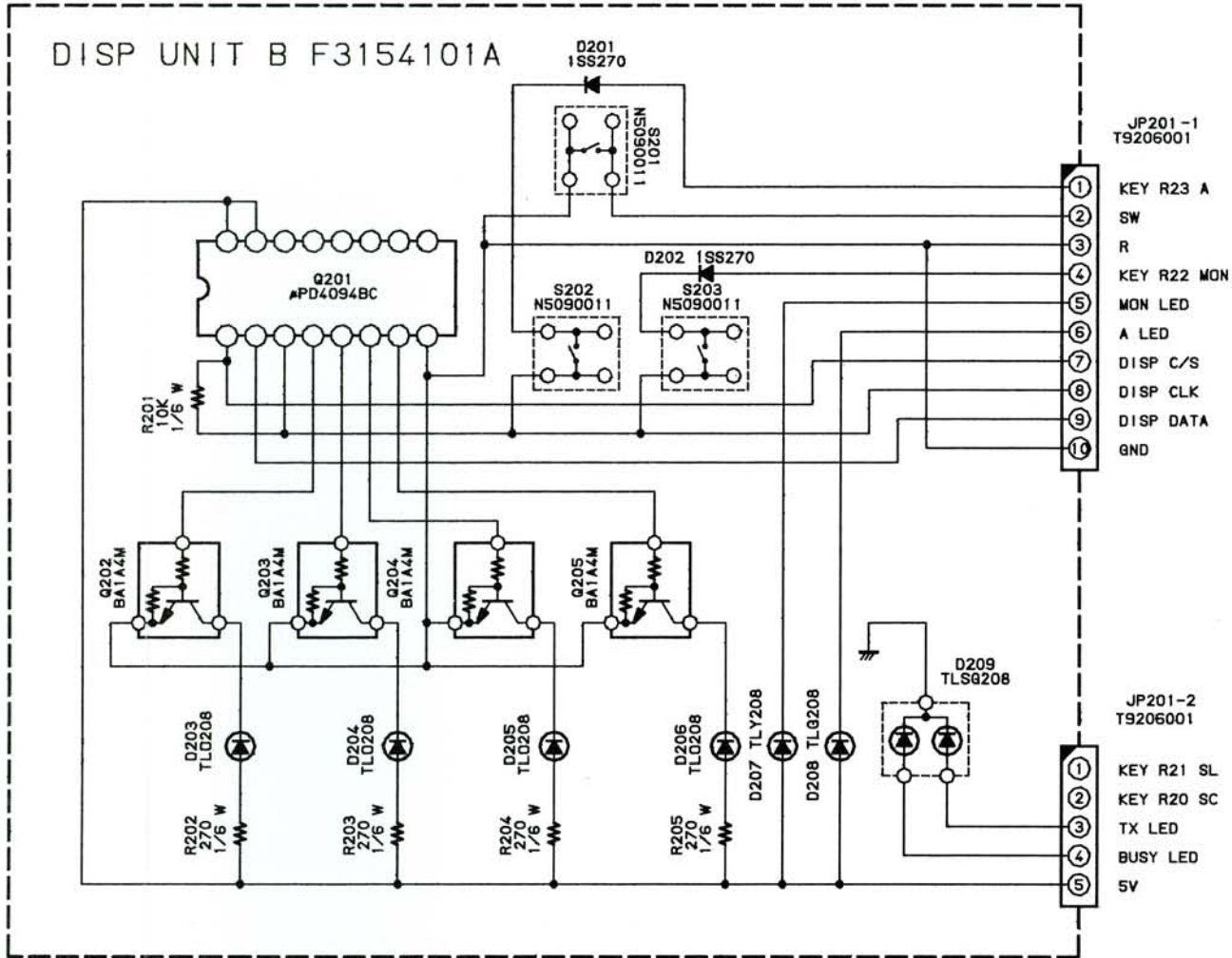
Obverse View of Component Side



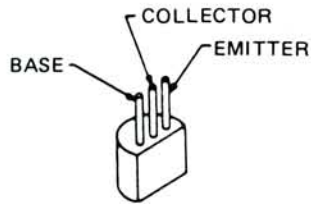
Obverse View of Solder Side



μPD4094BC (Q201)



$\mu$ PD4094BC (Q201)



BA1A4M  
(Q202, 203, 204, 205)



## Parts List

\*\*\* VCO UNIT \*\*\*

CA0244001 PCB with Components

F3152101A Printed Circuit Board

ADD	CODE NO	DESCRIPTION	DEVICE			LOT NO
C 0301	K22170206	CHIP CAP.	GRM40CH050C50PT	5pF	50V	CH
C 0302	K22170211	CHIP CAP.	GRM40CH100D50PT	10pF	50V	CH
C 0303	K22170217	CHIP CAP.	GRM40CH180J50PT	18pF	50V	CH
C 0304	K22170215	CHIP CAP.	GRM40CH150J50PT	15pF	50V	CH
C 0305	K22170202	CHIP CAP.	GRM40CK010C50PT	1pF	50V	CK
C 0306	K46120007	AL.ELECTRO.CAP.	16V101M6X7TR2	100uF	16V	
C 0307	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0308	K22170202	CHIP CAP.	GRM40CK010C50PT	1pF	50V	CK
C 0309	K22170207	CHIP CAP.	GRM40CH060D50PT	6pF	50V	CH
C 0310	K22170215	CHIP CAP.	GRM40CH150J50PT	15pF	50V	CH
C 0311	K22170217	CHIP CAP.	GRM40CH180J50PT	18pF	50V	CH
C 0312	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH
C 0313	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0314	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0315	K22170203	CHIP CAP.	GRM40CK020C50PT	2pF	50V	CK
C 0316	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0317	K22170211	CHIP CAP.	GRM40CH100D50PT	10pF	50V	CH
C 0318	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0319	K22170205	CHIP CAP.	GRM40CH040C50PT	4pF	50V	CH
C 0320	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0321	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0322	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
D 0301	G2070114	DIODE	1T363-01-T08A			
D 0302	G2070114	DIODE	1T363-01-T08A			
D 0303	G2070114	DIODE	1T363-01-T08A			
D 0304	G2070114	DIODE	1T363-01-T08A			
D 0305	G2070092	DIODE	HVU202-10TRP			
L 0301	L1190203	M.RFC	LAL03NA4R7K	4.7uH		
L 0302	L1190203	M.RFC	LAL03NA4R7K	4.7uH		
L 0303	L0190168	COIL	S7-T2 R12-K868C			
L 0304	L0190169	COIL	S7-T2 R12-K868B			
L 0305	L1690017	COIL	32CS 380LB-2R2M=P	2.2uH		
L 0306	L1690017	COIL	32CS 380LB-2R2M=P	2.2uH		
Q 0301	G3070056	TRANSISTOR	MMBR951LT1			
Q 0302	G3070034	TRANSISTOR	DTC124EK T97			
Q 0303	G3070056	TRANSISTOR	MMBR951LT1			
Q 0304	G3070027	TRANSISTOR	IMH5 T108			
Q 0305	G3327597B	TRANSISTOR	2SC2759-T2B U22			
R 0301	J24205273	CHIP RES.	RMC1/10T 273J	27K	1/10W	
R 0302	J24205273	CHIP RES.	RMC1/10T 273J	27K	1/10W	
R 0303	J24205222	CHIP RES.	RMC1/10T 222J	2.2K	1/10W	
R 0304	J24205470	CHIP RES.	RMC1/10T 470J	47	1/10W	
R 0305	J24205273	CHIP RES.	RMC1/10T 273J	27K	1/10W	
R 0306	J24205273	CHIP RES.	RMC1/10T 273J	27K	1/10W	
R 0307	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W	
R 0308	J24205332	CHIP RES.	RMC1/10T 332J	3.3K	1/10W	
R 0309	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W	
R 0310	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W	
R 0311	J24205152	CHIP RES.	RMC1/10T 152J	1.5K	1/10W	

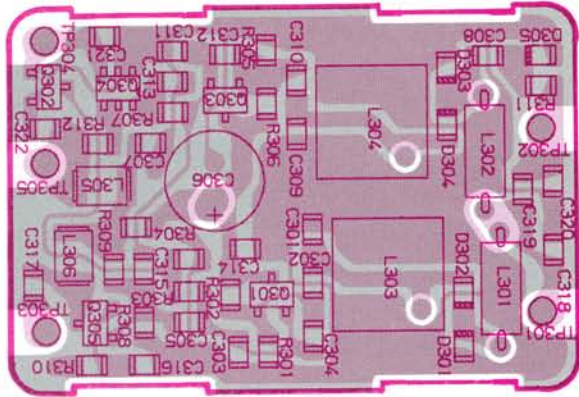
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R 0312	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
TP0301	Q5000037	TP-H	MK-10160		
TP0302	Q5000037	TP-H	MK-10160		
TP0303	Q5000037	TP-H	MK-10160		
TP0304	Q5000037	TP-H	MK-10160		
TP0305	Q5000037	TP-H	MK-10160		
	R0136240	SHIELD CASE			

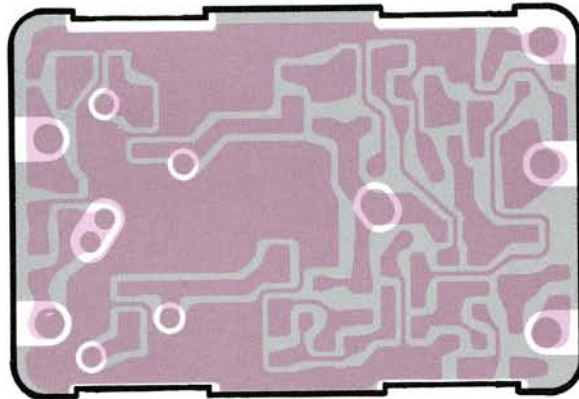


# Parts Layout & Circuit Diagram

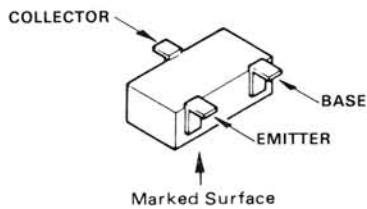
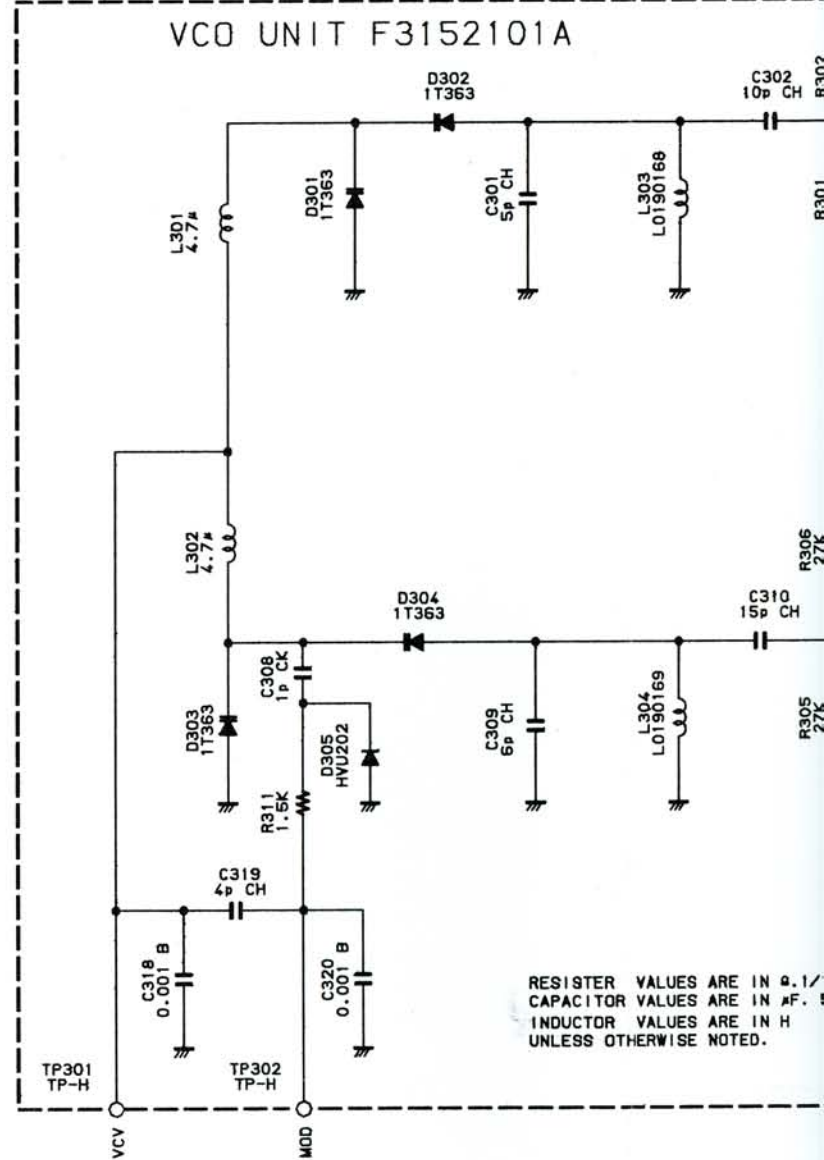
VCO Unit (Nos. 3xx)



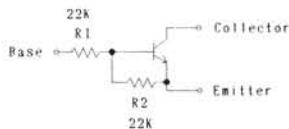
Obverse View of "Mixed Component" Side



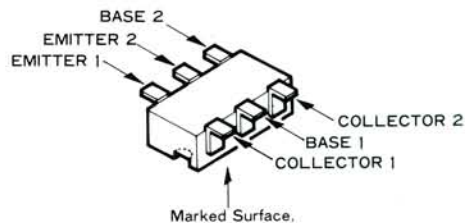
Obverse View of Solder Side



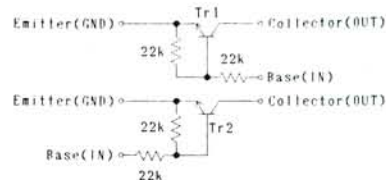
MMBR951 (7Z) (Q301, 303)  
DTC124EK (25) (Q302)  
2SC2759 (U22) (Q305)



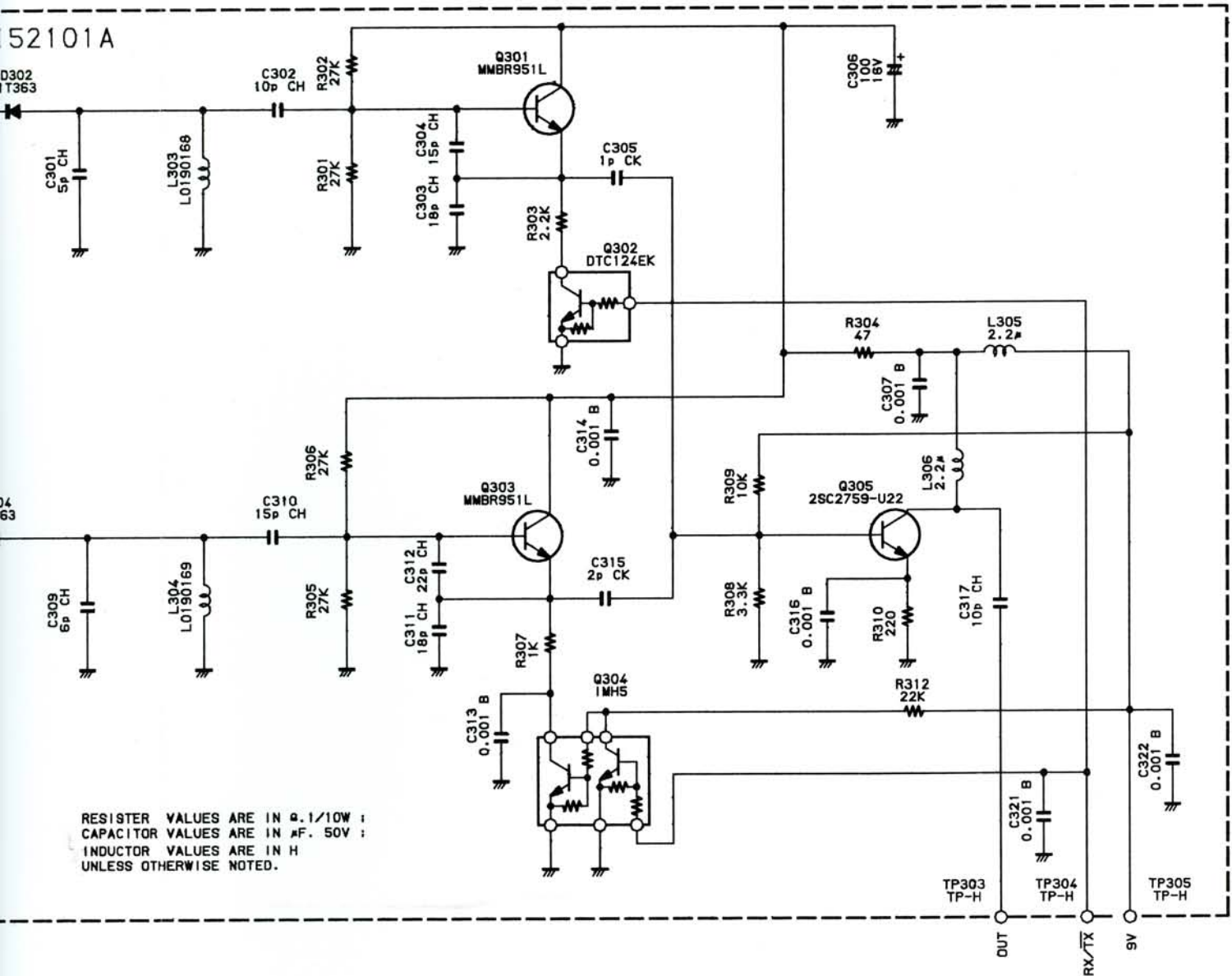
DTC124EK CIRCUIT DIAGRAM



IMH5 (H5) (Q304)



IMH5 CIRCUIT DIAGRAM





### Parts List

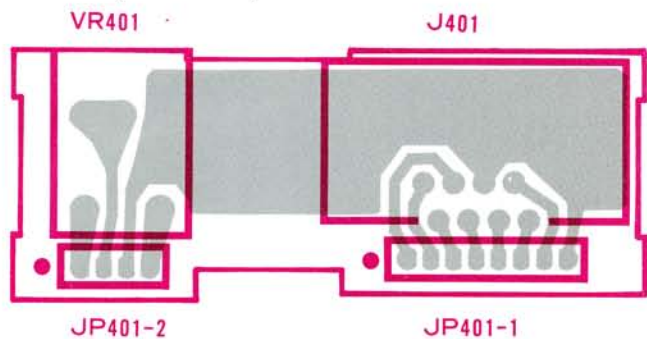
\*\*\* VR UNIT \*\*\*

CS0919001	PCB with Components (FTL-2014 Type)
CS0916001	PCB with Components (FTL-2011 Type)
F3153102	Printed Circuit Board (FTL-2014 Type)
F3154102A	Printed Circuit Board (FTL-2011 Type)

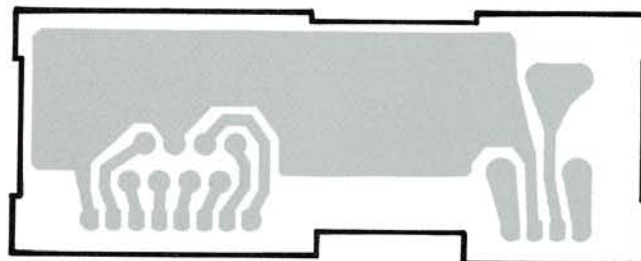
ADD	CODE NO	DESCRIPTION	DEVICE	LOT NO
J 0401	P1090677	CONNECTOR	R41-2736H	
JP0401	T9206002	WIRE-ASSY		
VR0401	J60800134	POT.	RK097111100WA 10KA/SW 10KA/SW	

### Parts Layout

VR Unit (Nos. 4xx)

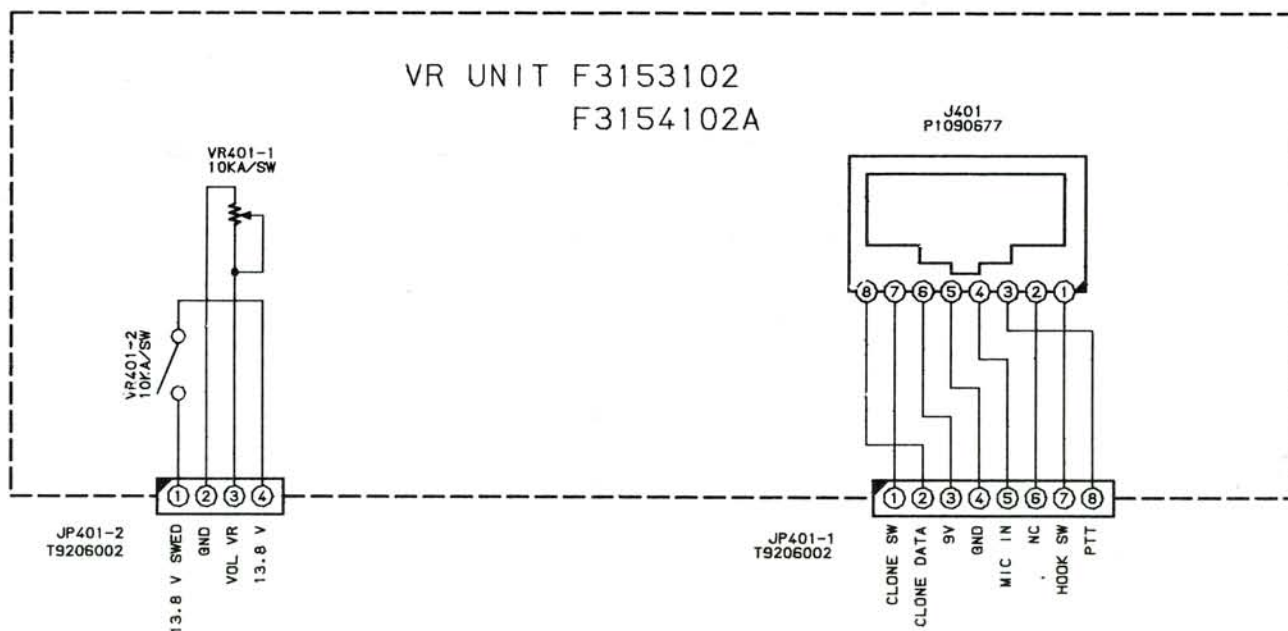


Obverse View of Component Side



Obverse View of Solder Side

### Circuit Diagram



## Parts List

\*\*\* PA UNIT \*\*\*

CP2748001 PCB with Components

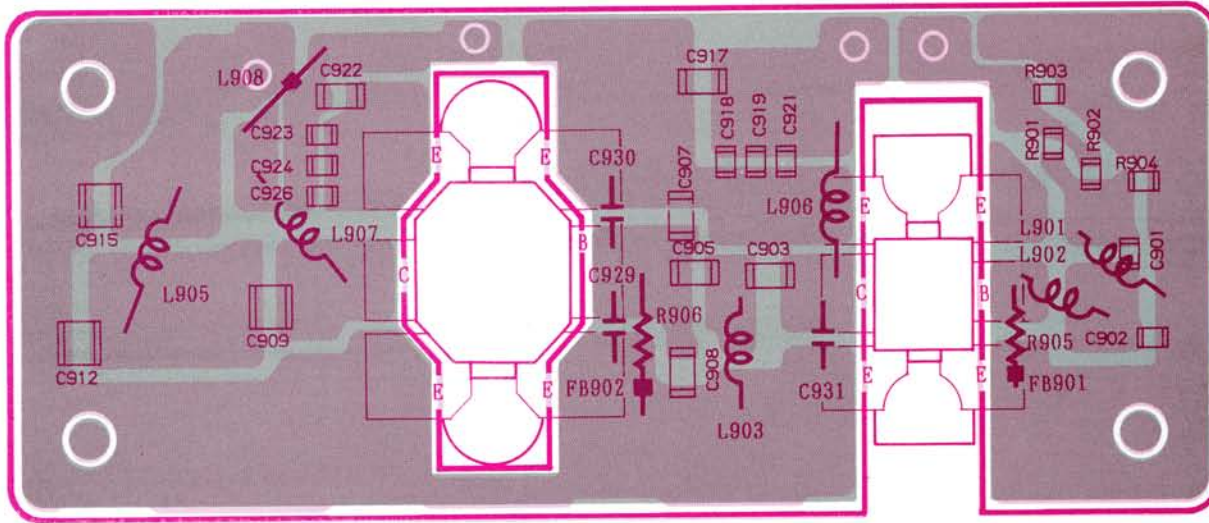
F3150102C Printed Circuit Board

ADD	CODE NO	DESCRIPTION	DEVICE			LOT NO
C 0901	K22170229	CHIP CAP.	GRM40CH560J50PT	56pF	50V	CH
C 0902	K22170239	CHIP CAP.	GRM40CH151J50PT	150pF	50V	CH
C 0903	K22201201	CHIP CAP.	GRM42-6CH471J100PT	470pF	100V	CH
C 0905	K22201201	CHIP CAP.	GRM42-6CH471J100PT	470pF	100V	CH
C 0907	K22171241	CHIP CAP.	GRM42-6CH181J50T	180pF	50V	CH
C 0908	K22171241	CHIP CAP.	GRM42-6CH181J50T	180pF	50V	CH
C 0909	K22203202	CHIP CAP.	GRH111CH561K100	560pF	100V	CH
C 0912	K22233205	CHIP CAP.	GRH111CH221K200	220pF	200V	CH
C 0915	K22273201	CHIP CAP.	GRH111CH470K500	47pF	500V	CH
C 0917	K22141809	CHIP CAP.	GRM42-6B104M25PT	0.1uF	25V	B
C 0918	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 0919	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0921	K22170801	CHIP CAP.	GRM40B471M50PT	470pF	50V	B
C 0922	K22141809	CHIP CAP.	GRM42-6B104M25PT	0.1uF	25V	B
C 0923	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 0924	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 0926	K22170801	CHIP CAP.	GRM40B471M50PT	470pF	50V	B
C 0929	K00279003	CERAMIC CAP.	HM60SJSLS560J	56pF	500V	SL
C 0930	K00279003	CERAMIC CAP.	HM60SJSLS560J	56pF	500V	SL
C 0931	K02175560	CERAMIC CAP.	DD106CH560J50	56pF	50V	CH
FB0901	L9190001	FERRITE BEADS	4A2 RI3X3-1			
FB0902	L9190001	FERRITE BEADS	4A2 RI3X3-1			
L 0901	L0022060	COIL	1.5T4.0D0.6UEW R			
L 0902	L0021743A	COIL	0.5T5.0D1.2ACW			
L 0903	L0021751	COIL	0.5T5.0D0.8ACW			
L 0905	L0022061	COIL	1.5T5.0D1.2UEW R			
L 0906	L0022061	COIL	1.5T5.0D1.2UEW R			
L 0907	L0022059	COIL	4.5T5.0D1.0UEW R			
L 0908	L1190389	INDUCTOR	FBA03VA450AB-00			
Q 0901	G3325390	TRANSISTOR	2SC2539			
Q 0902	G3326300	TRANSISTOR	2SC2630			
R 0901	J24205689	CHIP RES.	RMC1/10T 6R8J	6.8	1/10W	
R 0902	J24205689	CHIP RES.	RMC1/10T 6R8J	6.8	1/10W	
R 0903	J24205821	CHIP RES.	RMC1/10T 821J	820	1/10W	
R 0904	J24205821	CHIP RES.	RMC1/10T 821J	820	1/10W	
R 0905	J01245229	CARBON FILM RES.	RD14TJ2R2 2.2	2.2	1/4W	
R 0906	J20306229	METAL FILM RES.	RS1B 1W K 2.2	2.2	1W	
	R0135810	SHIELD CASE				
	R0135830	HEATSINK PLATE				

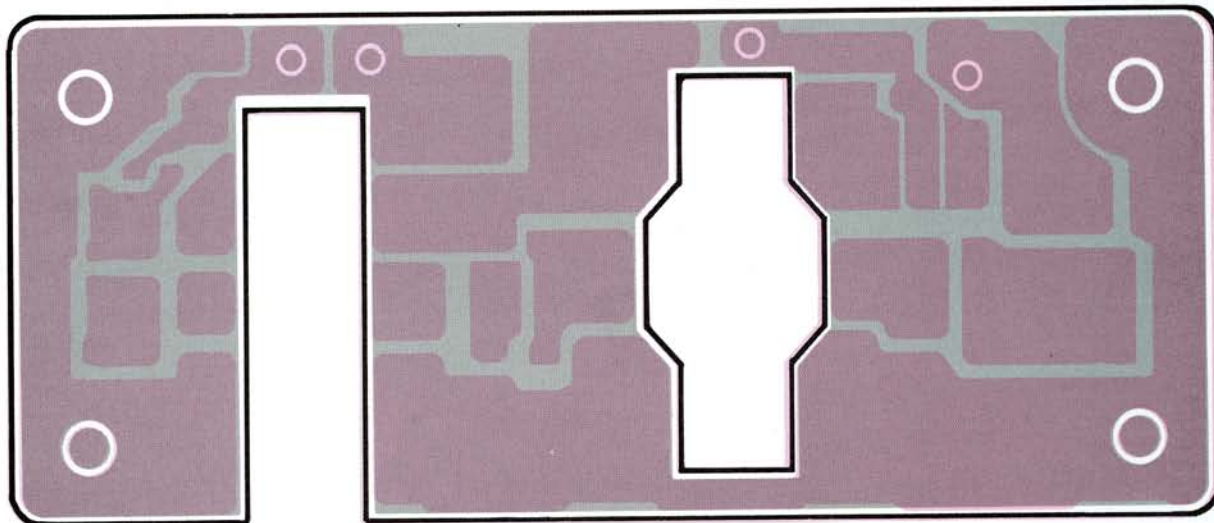


# Parts Layout & Circuit Diagram

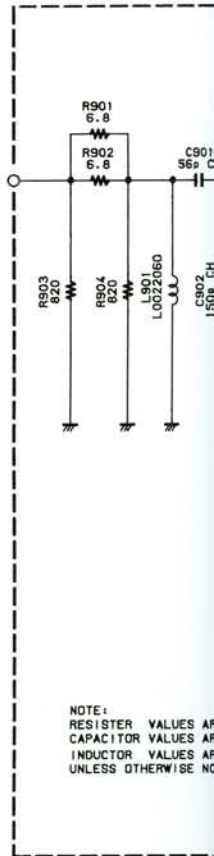
PA Unit (Nos. 9xx)



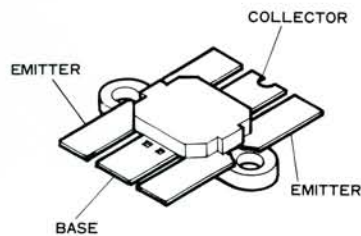
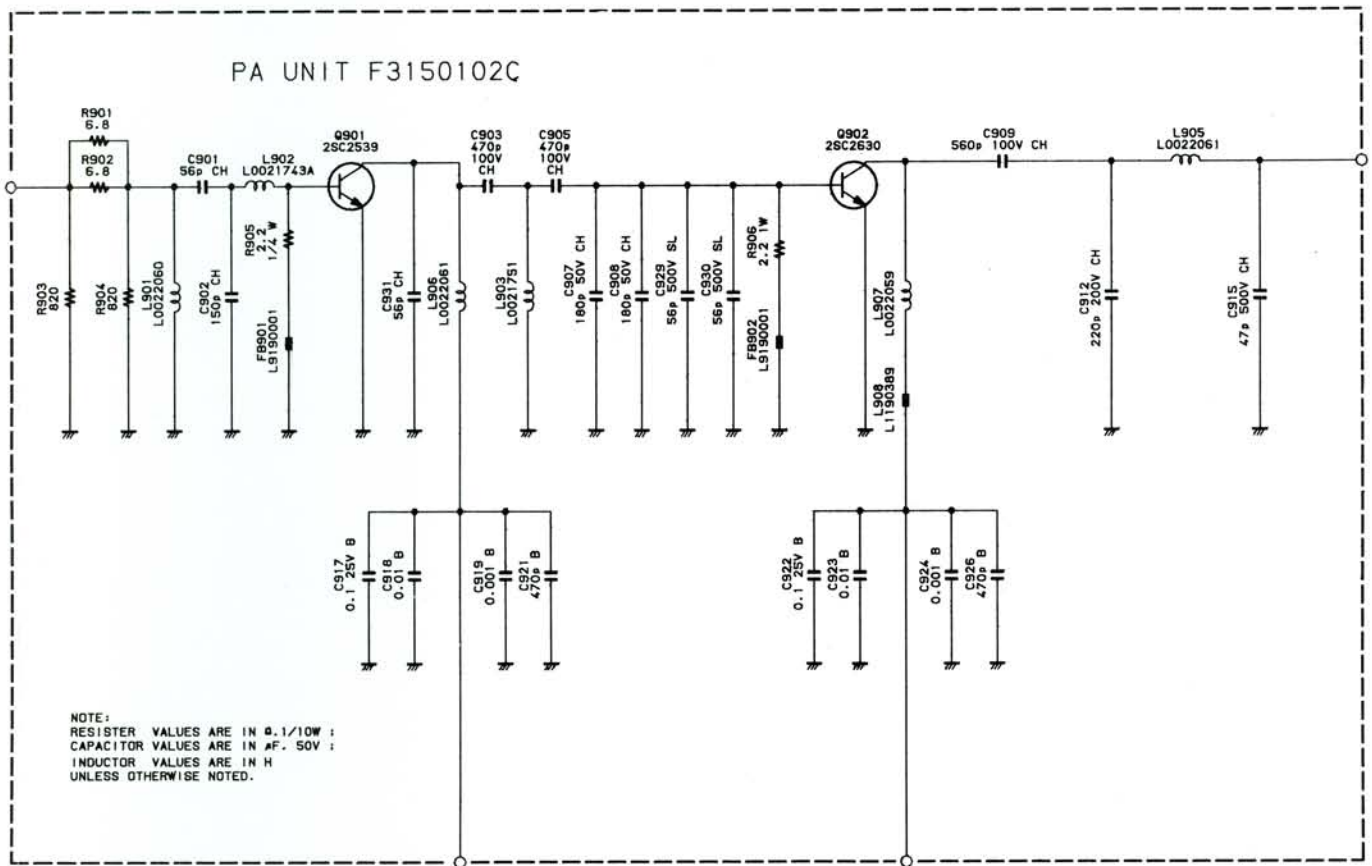
Obverse View of "Mixed Component" Side



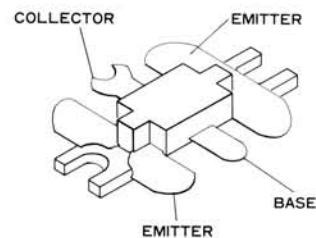
Obverse View of Solder Side



NOTE:  
RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED  
CAPACITOR VALUES ARE IN PICO FARADS UNLESS OTHERWISE SPECIFIED  
INDUCTOR VALUES ARE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED



2SC2630(Q902)



2SC2539(Q901)



## Parts List

\*\*\* MAIN UNIT \*\*\*

CP2747001 PCB with Components  
 F3150101B Printed Circuit Board(Lot 2)  
 F3150101C Printed Circuit Board(Lot 3-)

ADD	CODE NO	DESCRIPTION	DEVICE			LOT NO
C 1001	K22275809	CHIP CAP.	GRM42-2W5R102K500PT	0.001uF	500V	W5R
C 1002	K22275217	CHIP CAP.	GRM42-2CH150J500PT	15pF	500V	CH
C 1003	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH
C 1004	K22170204	CHIP CAP.	GRM40CJ030C50PT	3pF	50V	CJ
C 1005	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1006	K22170203	CHIP CAP.	GRM40CK020C50PT	2pF	50V	CK
C 1007	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1008	K22170205	CHIP CAP.	GRM40CH040C50PT	4pF	50V	CH
C 1010	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH
C 1011	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1012	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1013	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1014	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1015	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1016	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1017	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1018	K22170202	CHIP CAP.	GRM40CK010C50PT	1pF	50V	CK
C 1019	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1020	K22170203	CHIP CAP.	GRM40CK020C50PT	2pF	50V	CK
C 1021	K22170203	CHIP CAP.	GRM40CK020C50PT	2pF	50V	CK
C 1023	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1025	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1027	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1028	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1029	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1030	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1031	K22170211	CHIP CAP.	GRM40CH100D50PT	10pF	50V	CH
C 1032	K22170211	CHIP CAP.	GRM40CH100D50PT	10pF	50V	CH
C 1033	K22170209	CHIP CAP.	GRM40CH080D50PT	8pF	50V	CH
C 1034	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1035	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1036	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1037	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1038	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1039	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1040	K22170227	CHIP CAP.	GRM40CH470J50PT	47pF	50V	CH
C 1041	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1042	K22170221	CHIP CAP.	GRM40CH270J50PT	27pF	50V	CH
C 1043	K22170211	CHIP CAP.	GRM40CH100D50PT	10pF	50V	CH
C 1045	K76160017	TANTALUM CAP.	TPDN1VR22M8S(MX0)	0.22uF	35V	
C 1046	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1047	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1048	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1049	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1050	K22170809	CHIP CAP.	GRM40B222M50PT	0.0022uF	50V	B
C 1051	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1052	K22170231	CHIP CAP.	GRM40CH680J50PT	68pF	50V	CH
C 1053	K22170225	CHIP CAP.	GRM40CH390J50PT	39pF	50V	CH
C 1054	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1055	K22170231	CHIP CAP.	GRM40CH680J50PT	68pF	50V	CH
C 1056	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1057	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B

C 1058	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1059	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1060	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1061	K22275221	CHIP CAP.	GRM42-2CH220J500PT	22pF	500V	CH
C 1063	K22275219	CHIP CAP.	GRM42-2CH180J500PT	18pF	500V	CH
C 1064	K22170202	CHIP CAP.	GRM40CK010C50PT	1pF	50V	CK
C 1065	K22275221	CHIP CAP.	GRM42-2CH220J500PT	22pF	500V	CH
C 1066	K22170202	CHIP CAP.	GRM40CK010C50PT	1pF	50V	CK
C 1067	K22275212	CHIP CAP.	GRM42-2CH090J500PT	9pF	500V	CH
C 1068	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1069	K46160005	AL. ELECTRO. CAP.	35V100M5X7TR2	10uF	35V	
C 1070	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1071	K46160005	AL. ELECTRO. CAP.	35V100M5X7TR2	10uF	35V	
C 1072	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1074	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH
C 1075	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1076	K22170223	CHIP CAP.	GRM40CH330J50PT	33pF	50V	CH
C 1077	K22170221	CHIP CAP.	GRM40CH270J50PT	27pF	50V	CH
C 1078	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1080	K22170221	CHIP CAP.	GRM40CH270J50PT	27pF	50V	CH
C 1081	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1082	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH
C 1083	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1084	K40149037	AL. ELECTRO. CAP.	RE2-25V471M	470uF	25V	
C 1085	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1086	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1087	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1089	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1090	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1091	K76120019	TANTALUM CAP.	TPDN1C100M8S(MX0)	10uF	16V	
C 1092	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1093	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1094	K76120019	TANTALUM CAP.	TPDN1C100M8S(MX0)	10uF	16V	
C 1095	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1096	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1097	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1098	K76160027	TANTALUM CAP.	TPDN1V100M8S(MX0)	10uF	35V	
C 1099	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1100	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1101	K76120019	TANTALUM CAP.	TPDN1C100M8S(MX0)	10uF	16V	
C 1102	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1104	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1105	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1106	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1107	K76120015	TANTALUM CAP.	TPDN1C2R2M8S(MX0)	2.2uF	16V	
C 1108	K76140013	TANTALUM CAP.	TPDN1E010M8S(MX0)	1uF	25V	
C 1109	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1110	K22170235	CHIP CAP.	GRM40CH101J50PT	100pF	50V	CH
C 1111	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1112	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1113	K46120010	AL. ELECTRO. CAP.	RC2-16V470M-T34(5X7)	47uF	16V	
C 1114	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1115	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1116	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1117	K40149037	AL. ELECTRO. CAP.	RE2-25V471M	470uF	25V	
C 1118	K40129067	AL. ELECTRO. CAP.	RE3-16V102M	1000uF	16V	
C 1119	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1120	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1121	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1122	K22170821	CHIP CAP.	GRM40B223M50PT	0.022uF	50V	B
C 1123	K46120010	AL. ELECTRO. CAP.	RC2-16V470M-T34(5X7)	47uF	16V	



C 1124	K22170223	CHIP CAP.	GRM40CH330J50PT	33pF	50V	CH
C 1125	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH
C 1126	K22170227	CHIP CAP.	GRM40CH470J50PT	47pF	50V	CH
C 1127	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1128	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1129	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1130	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1131	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1132	K22170211	CHIP CAP.	GRM40CH100D50PT	10pF	50V	CH
C 1133	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1134	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1135	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B
C 1136	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V	
C 1137	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1138	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B
C 1139	K19149021	CERAMIC CAP.	UAT08X473K-L45AE	0.047uF	25V	X
C 1140	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1141	K76120015	TANTALUM CAP.	TPDN1C2R2M8S(MX0)	2.2uF	16V	
C 1142	K19149029	CERAMIC CAP.	UAT06V103K-L45AC	0.01uF	25V	V
C 1143	K19149009	CERAMIC CAP.	UAT05X472K-L05AE	0.0047uF	25V	X
C 1144	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1145	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1146	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH
C 1150	K22170223	CHIP CAP.	GRM40CH330J50PT	33pF	50V	CH
C 1151	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1152	K22170202	CHIP CAP.	GRM40CK010C50PT	1pF	50V	CK
C 1153	K22170202	CHIP CAP.	GRM40CK010C50PT	1pF	50V	CK
C 1154	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1155	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B
C 1157	K22170217	CHIP CAP.	GRM40CH180J50PT	18pF	50V	CH
C 1158	K22170813	CHIP CAP.	GRM40B472M50PT	0.0047uF	50V	B
CF1001	H3900200	CERAMIC FILTER	CFW455E			
D 1001	G2090345	DIODE	M1407			
D 1002	G2090033	DIODE	MI301			
D 1003	G2070092	DIODE	HVU202-10TRP			
D 1004	G2070092	DIODE	HVU202-10TRP			
D 1005	G2070092	DIODE	HVU202-10TRP			
D 1006	G2070092	DIODE	HVU202-10TRP			
D 1007	G2070092	DIODE	HVU202-10TRP			
D 1008	G2070092	DIODE	HVU202-10TRP			
D 1009	G2070092	DIODE	HVU202-10TRP			
D 1010	G2070092	DIODE	HVU202-10TRP			
D 1012	G2060004	DIODE	1SS270TJ			
D 1013	G2090244	DIODE	1SS106			
D 1014	G2070062	DIODE	02CZ5.1Y TE85R			
D 1015	Q9000534	SURGE ABSORBER	P6KE18			
D 1016	G2090425	DIODE	UM9415			
D 1017	G2090377	DIODE	1SS108			
D 1018	G2060004	DIODE	1SS270TJ			
D 1019	G2060004	DIODE	1SS270TJ			
D 1020	G2070009	DIODE	1SS184 TE85R			
D 1021	G2070092	DIODE	HVU202-10TRP			
D 1022	G2070048	DIODE	1SS272 TE85R			
D 1024	G2070003	DIODE	1SS226 TE85R			
J 1001	P0090667	CONNECTOR	B3B-EH			
J 1002	P0090787	CONNECTOR	IMSA-1068-14Z040			
J 1003	P0090786	CONNECTOR	IMSA-1068-06Z040			

L 1002	L0022052	COIL	1.5T8.0D1.2UEW R		
L 1003	L0021835	COIL	2.5T6.0D0.8UEW R		
L 1004	L0190166	COIL	S7-T2 R12-K869C		
L 1005	L1190342	M.RFC	LAL02KRR22M	0.22uH	
L 1006	L0021705	COIL	5.5T3.5D0.6UEW R		
L 1008	L1190352	M.RFC	LAL02KRR47M	0.47uH	
L 1009	L0190167	COIL	S7-T2 R12-K869D		
L 1010	L1190390	M.RFC	LAL03KH102K	1mH	
L 1012	L1190095	M.RFC	LAL04NA4R7K	4.7uH	
L 1013	L0022052	COIL	1.5T8.0D1.2UEW R		
L 1014	L0022051	COIL	2.5T6.0D1.2UEW R		
L 1015	L0020751	COIL	8.5T4.0D0.8UEW R		
L 1016	L0020751	COIL	8.5T4.0D0.8UEW R		
L 1017	L0021359	COIL	1.5T3.5D0.6UEW R		
L 1018	L0021811A	COIL	2.5T3.0D0.6UEW R		
L 1019	L0020679	COIL	4.5T3.5D0.6UEW R		
L 1020	L0021811A	COIL	2.5T3.0D0.6UEW R		
L 1021	L0020679	COIL	4.5T3.5D0.6UEW R		
L 1022	L0020679	COIL	4.5T3.5D0.6UEW R		
Q 1001	G4801317B	FET	3SK131-T2B V12		
Q 1002	G3803027G	FET	2SK302GR TE85R		
Q 1003	G3803027G	FET	2SK302GR TE85R		
Q 1004	G3327147Y	TRANSISTOR	2SC2714YTE85R		
Q 1005	G3327597B	TRANSISTOR	2SC2759-T2B U22		
Q 1006	G3070034	TRANSISTOR	DTC124EK T97		
Q 1007	G3327127G	TRANSISTOR	2SC2712GR TE85R		
Q 1008	G1090809	IC	MC3361P		
Q 1010	G3325380	TRANSISTOR	2SC2538		
Q 1011	G3070056	TRANSISTOR	MMBR951LT1		
Q 1012	G3327597B	TRANSISTOR	2SC2759-T2B U22		
Q 1013	G1091146	IC	AN6541		
Q 1014	G3327127G	TRANSISTOR	2SC2712GR TE85R		
Q 1015	G3207720Q	TRANSISTOR	2SB772Q		
Q 1016	G3327127G	TRANSISTOR	2SC2712GR TE85R		
Q 1017	G3070008	TRANSISTOR	FMS1 T98		
Q 1018	G3070024	TRANSISTOR	IMX1 T110		
Q 1019	G3207720Q	TRANSISTOR	2SB772Q		
Q 1020	G3070010	TRANSISTOR	DTA143EK T96		
Q 1021	G3070027	TRANSISTOR	IMH5 T108		
Q 1022	G3070010	TRANSISTOR	DTA143EK T96		
Q 1023	G1090815	IC	TDA2003H		
Q 1024	G1091105	IC	MC145158F2L		
Q 1025	G1091103	IC	MC12022SLADR2		
Q 1026	G3070059	TRANSISTOR	IMX3 T108		
Q 1027	G3070060	TRANSISTOR	IMZ2 T108		
Q 1028	G3327147Y	TRANSISTOR	2SC2714YTE85R		
R 1001	J24205225	CHIP RES.	RMC1/10T 225J	2.2M	1/10W
R 1002	J24205225	CHIP RES.	RMC1/10T 225J	2.2M	1/10W
R 1003	J24205154	CHIP RES.	RMC1/10T 154J	150K	1/10W
R 1004	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 1005	J24205183	CHIP RES.	RMC1/10T 183J	18K	1/10W
R 1006	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 1007	J24205470	CHIP RES.	RMC1/10T 470J	47	1/10W
R 1008	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1009	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 1010	J24205225	CHIP RES.	RMC1/10T 225J	2.2M	1/10W
R 1011	J24205225	CHIP RES.	RMC1/10T 225J	2.2M	1/10W
R 1012	J24205470	CHIP RES.	RMC1/10T 470J	47	1/10W
R 1014	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W



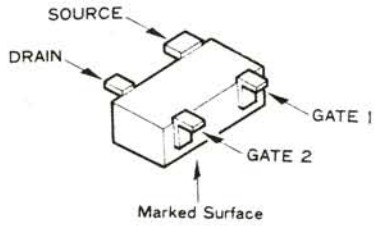
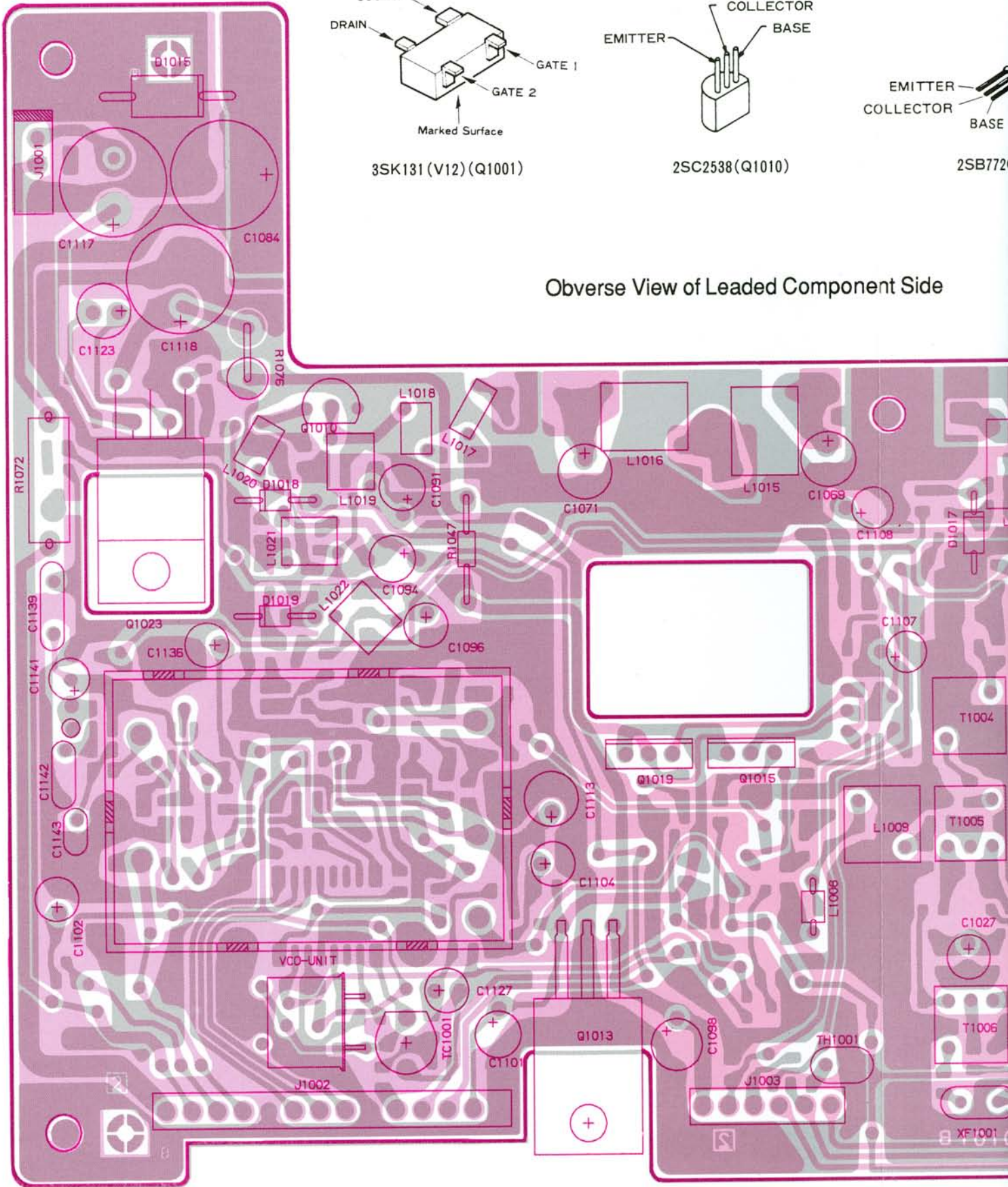
R 1015	J24205100	CHIP RES.	RMC1/10T 100J	10	1/10W
R 1016	J24205000	CHIP RES.	RMC1/10T 000J	0	1/10W
R 1017	J24205821	CHIP RES.	RMC1/10T 821J	820	1/10W
R 1018	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 1019	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W
R 1020	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W
R 1021	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 1022	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 1023	J24205150	CHIP RES.	RMC1/10T 150J	15	1/10W
R 1024	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 1025	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1026	J24205270	CHIP RES.	RMC1/10T 270J	27	1/10W
R 1027	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1028	J24205563	CHIP RES.	RMC1/10T 563J	56K	1/10W
R 1029	J24205474	CHIP RES.	RMC1/10T 474J	470K	1/10W
R 1030	J24205000	CHIP RES.	RMC1/10T 000J	0	1/10W
R 1031	J24205474	CHIP RES.	RMC1/10T 474J	470K	1/10W
R 1032	J24205824	CHIP RES.	RMC1/10T 824J	820K	1/10W
R 1033	J24205474	CHIP RES.	RMC1/10T 474J	470K	1/10W
R 1034	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1035	J24205394	CHIP RES.	RMC1/10T 394J	390K	1/10W
R 1036	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 1037	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 1038	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 1039	J24205822	CHIP RES.	RMC1/10T 822J	8.2K	1/10W
R 1040	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 1041	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W
R 1042	J22305820	METAL FILM RES.	ERG-1SJ820	82	1W
R 1043	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1044	J24205222	CHIP RES.	RMC1/10T 222J	2.2K	1/10W
R 1045	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 1046	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1047	J07245100	CARBON FILM RES.	RD14TPJ100	10	1/4W
R 1048	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 1049	J24205122	CHIP RES.	RMC1/10T 122J	1.2K	1/10W
R 1050	J24205330	CHIP RES.	RMC1/10T 330J	33	1/10W
R 1051	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W
R 1052	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1053	J24205470	CHIP RES.	RMC1/10T 470J	47	1/10W
R 1054	J24205560	CHIP RES.	RMC1/10T 560J	56	1/10W
R 1055	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1056	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 1057	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W
R 1058	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 1059	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W
R 1060	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1061	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 1062	J24205222	CHIP RES.	RMC1/10T 222J	2.2K	1/10W
R 1063	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1064	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 1066	J24205000	CHIP RES.	RMC1/10T 000J	0	1/10W
R 1067	J24205681	CHIP RES.	RMC1/10T 681J	680	1/10W
R 1068	J24205222	CHIP RES.	RMC1/10T 222J	2.2K	1/10W
R 1069	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 1070	J24205182	CHIP RES.	RMC1/10T 182J	1.8K	1/10W
R 1071	J24205152	CHIP RES.	RMC1/10T 152J	1.5K	1/10W
R 1072	J20306229	METAL FILM RES.	RS1B 1W K	2.2	1W
R 1073	J24205010	CHIP RES.	RMC1/10T 1R0J	1	1/10W
R 1074	J24205221	CHIP RES.	RMC1/10T 221J	220	1/10W
R 1075	J24205229	CHIP RES.	RMC1/10T 2R2J	2.2	1/10W
R 1076	J20306229	METAL FILM RES.	RS1B 1W K	2.2	1W

R 1077	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 1079	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 1080	J24205474	CHIP RES.	RMC1/10T 474J	470K	1/10W
R 1081	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 1082	J24205470	CHIP RES.	RMC1/10T 470J	47	1/10W
R 1083	J24205470	CHIP RES.	RMC1/10T 470J	47	1/10W
R 1084	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1085	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 1086	J24205153	CHIP RES.	RMC1/10T 153J	15K	1/10W
R 1087	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1088	J24205100	CHIP RES.	RMC1/10T 100J	10	1/10W
R 1089	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1090	J24205122	CHIP RES.	RMC1/10T 122J	1.2K	1/10W
R 1091	J24205000	CHIP RES.	RMC1/10T 000J	0	1/10W
R 1092	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1093	J24205561	CHIP RES.	RMC1/10T 561J	560	1/10W
R 1094	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 1095	J24205561	CHIP RES.	RMC1/10T 561J	560	1/10W
R 1096	J24205225	CHIP RES.	RMC1/10T 225J	2.2M	1/10W
R 1097	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 1098	J24205560	CHIP RES.	RMC1/10T 560J	56	1/10W
R 1099	J24205822	CHIP RES.	RMC1/10T 822J	8.2K	1/10W
R 1100	J24205822	CHIP RES.	RMC1/10T 822J	8.2K	1/10W
R 1101	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1102	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 1103	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 1104	J24205222	CHIP RES.	RMC1/10T 222J	2.2K	1/10W
R 1105	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 1106	J24205150	CHIP RES.	RMC1/10T 150J	15	1/10W
R 1109	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 1110	J24205470	CHIP RES.	RMC1/10T 470J	47	1/10W
R 1111	J24205151	CHIP RES.	RMC1/10T 151J	150	1/10W
R 1112	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 1113	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 1114	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 1115	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 1116	J24205181	CHIP RES.	RMC1/10T 181J	180	1/10W
R 1117	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 1118	J24205471	CHIP RES.	RMC1/10T 471J	470	1/10W
R 1119	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
T 1001	L0022053	COIL	160M R12-K905X		
T 1002	L0022055	COIL	160M R12-K907X		
T 1003	L0022054	COIL	160M R12-K908X		
T 1004	L0022056	COIL	160M R12-K906X		
T 1005	L0190173	COIL	456DB-1007		
T 1006	L0021997	COIL	21.4M		
T 1007	L0021469	COIL	455K R12-3980C		
TC1001	K91000071	TRIMMER CAP.	TZ03R200ER	20pF	
TH1001	G9090008	THERMISTOR	112102-2		
VR1001	J51745473	POT.	H0651A017-47KB	47K	B
X 1001	H0102816	XTAL	HC-49/T	20.945MHZ	
X 1002	H0102799	XTAL	UM-2	12.800MHZ	
XF1001	H1102095	XTAL	21M15BU		
	R3129530	XTAL		2pcs	

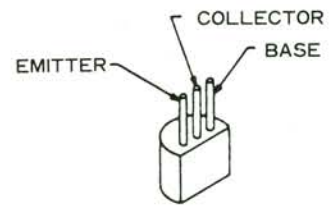


# Parts Layout

Main Unit (Nos. 1xxx)



3SK131 (V12) (Q1001)



2SC2538 (Q1010)



2SB772 (Q1002)

Obverse View of Leaded Component Side



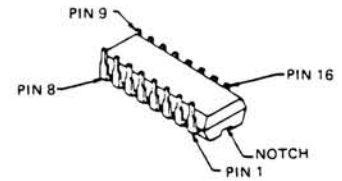
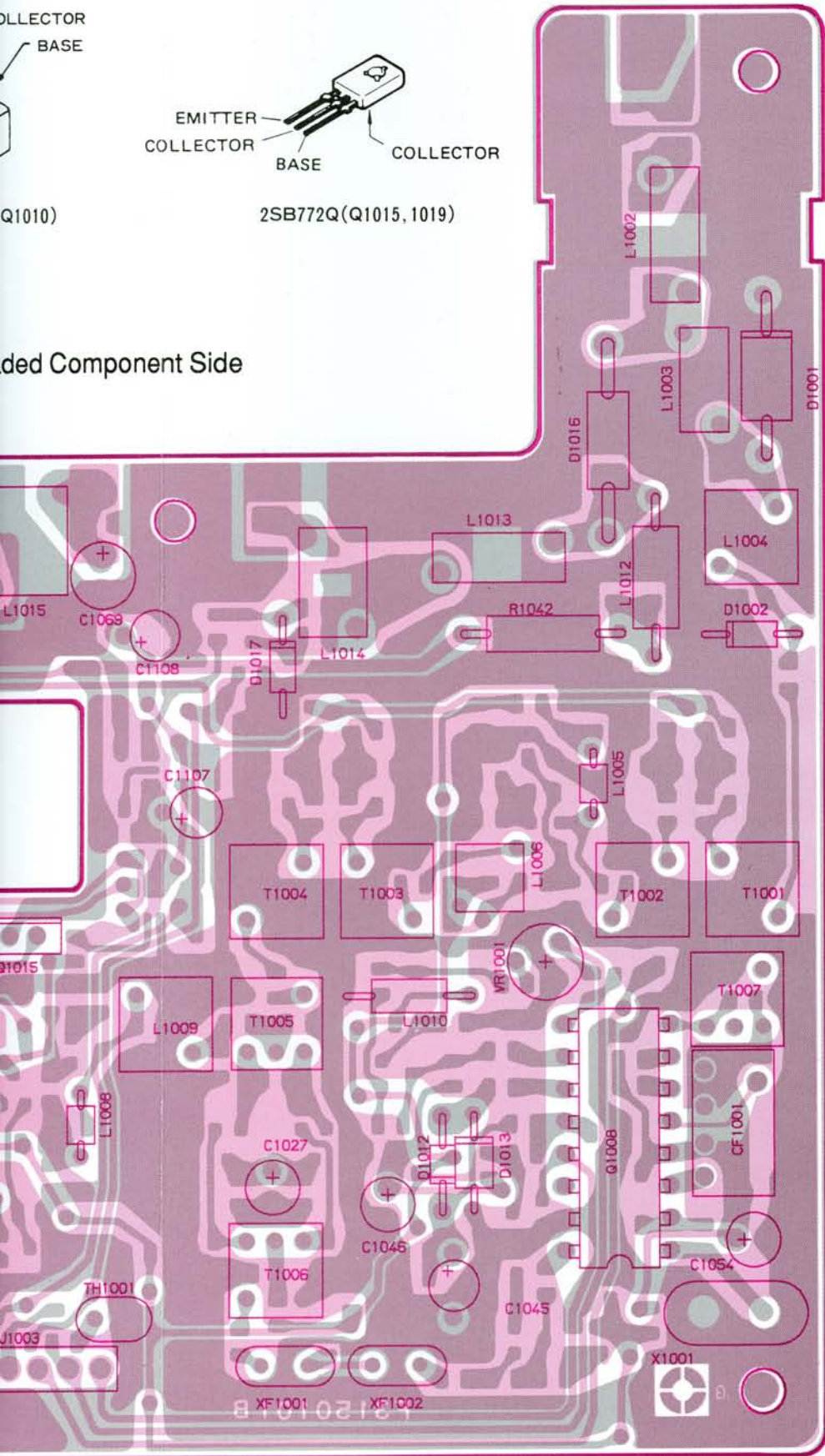
COLLECTOR  
BASE

Q1010)

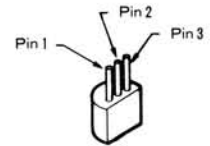
ded Component Side



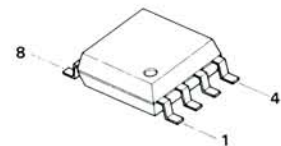
2SB772Q(Q1015, 1019)



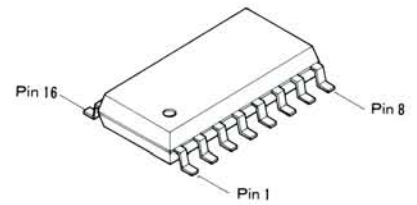
MC3361P(Q1008)



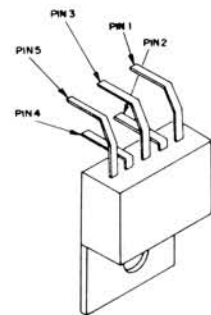
AN6541(Q1013)



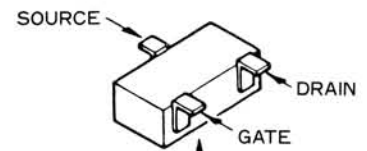
MC12022SLADR2(Q1025)



MC145158F(Q1024)



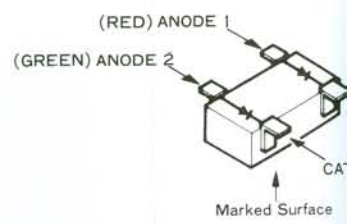
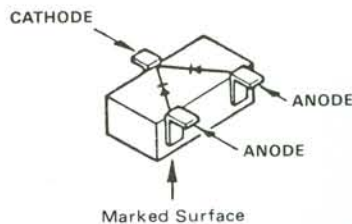
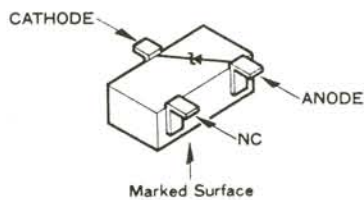
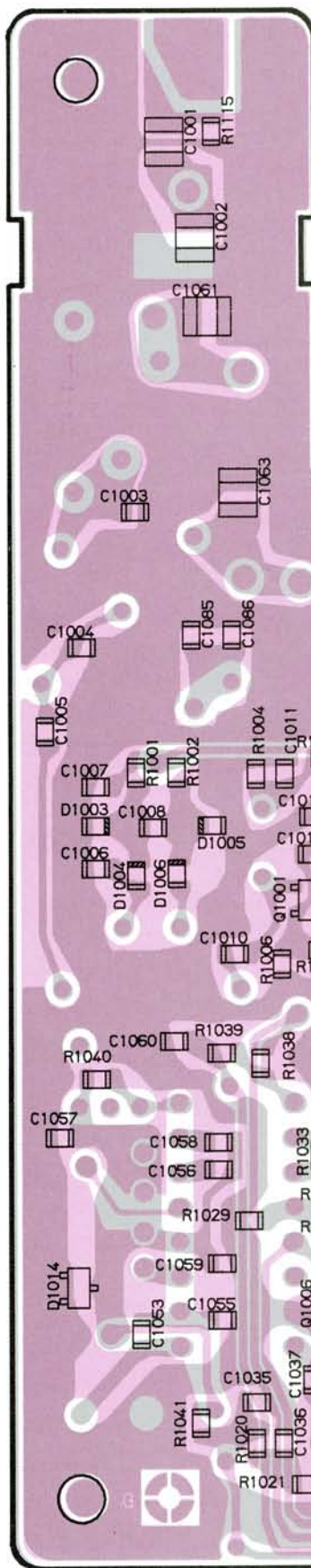
TDA2003H(Q1023)



Marked Surface

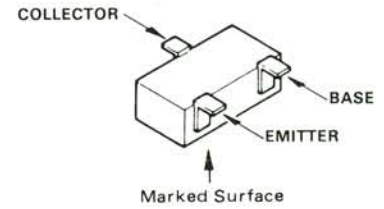
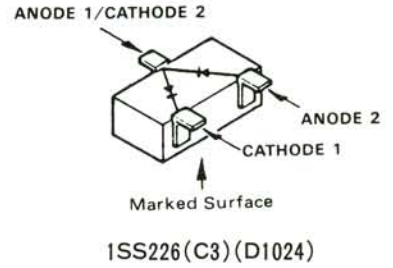
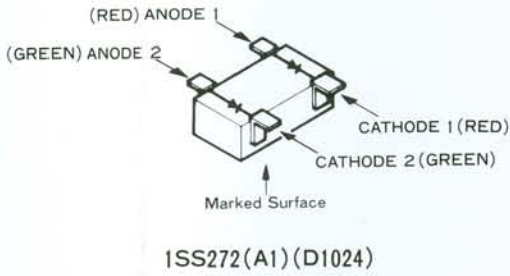
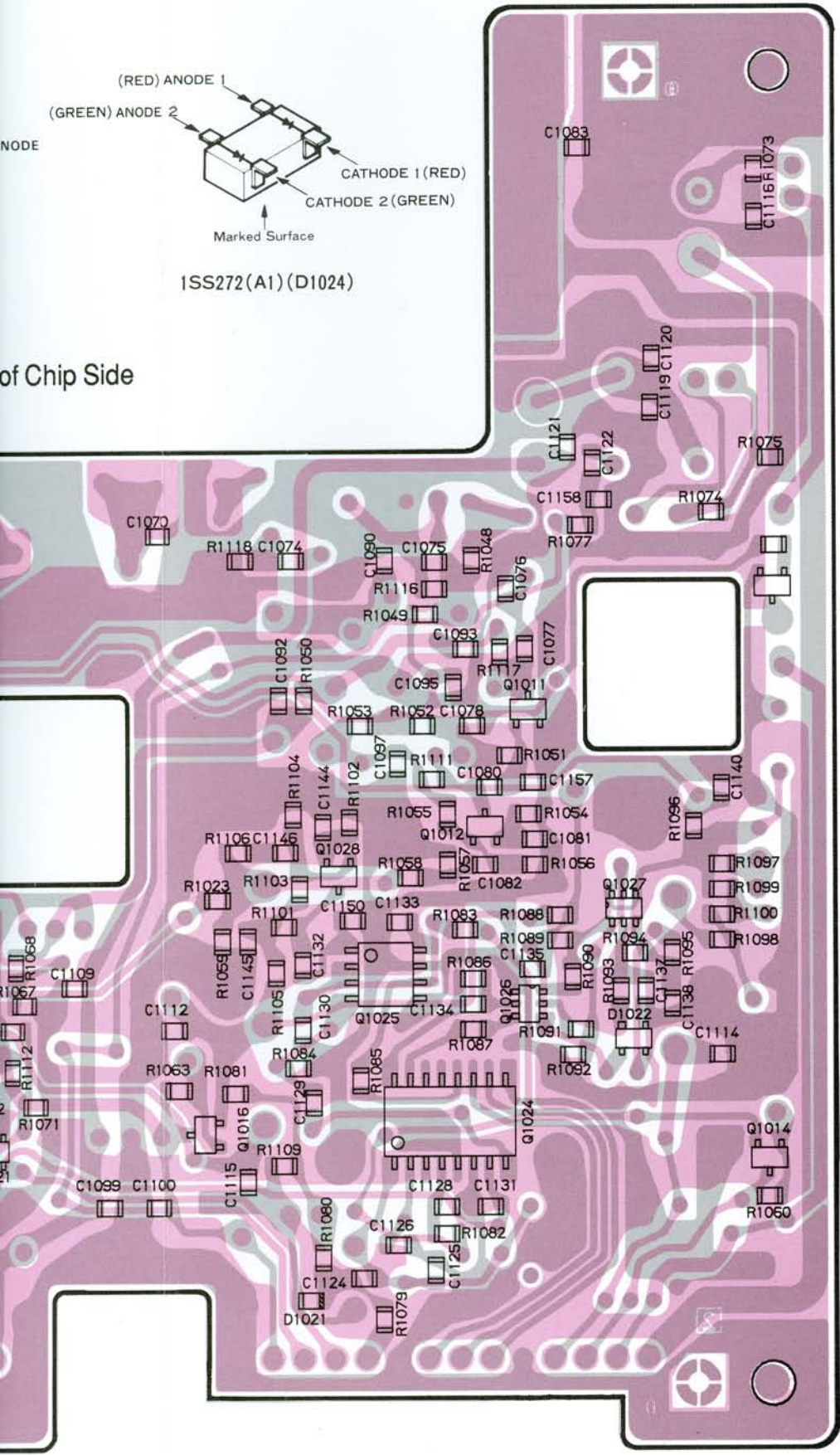
2SK302GR(TG)(Q1002, 1003)



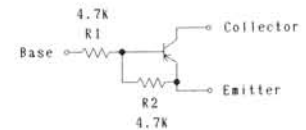


Obverse View of Chip Side

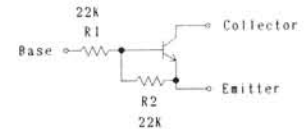




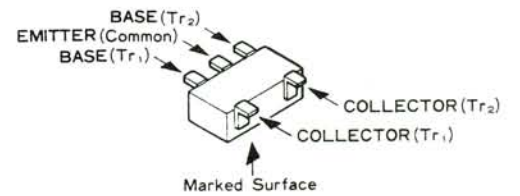
- 2SC2714Y(QY)(Q1004, 1028)
- 2SC2712GR(LG)(Q1007, 1014, 1016)
- 2SC2759(U22)(Q1005, 1012)
- DTA143EK(13)(Q1020, 1022)
- MMBR951(7Z)(Q1011)
- DTC124EK(24)(Q1006)



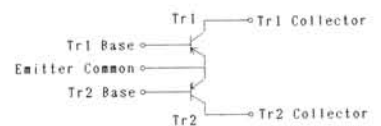
DTA143EK CIRCUIT DIAGRAM



DTC124EK CIRCUIT DIAGRAM



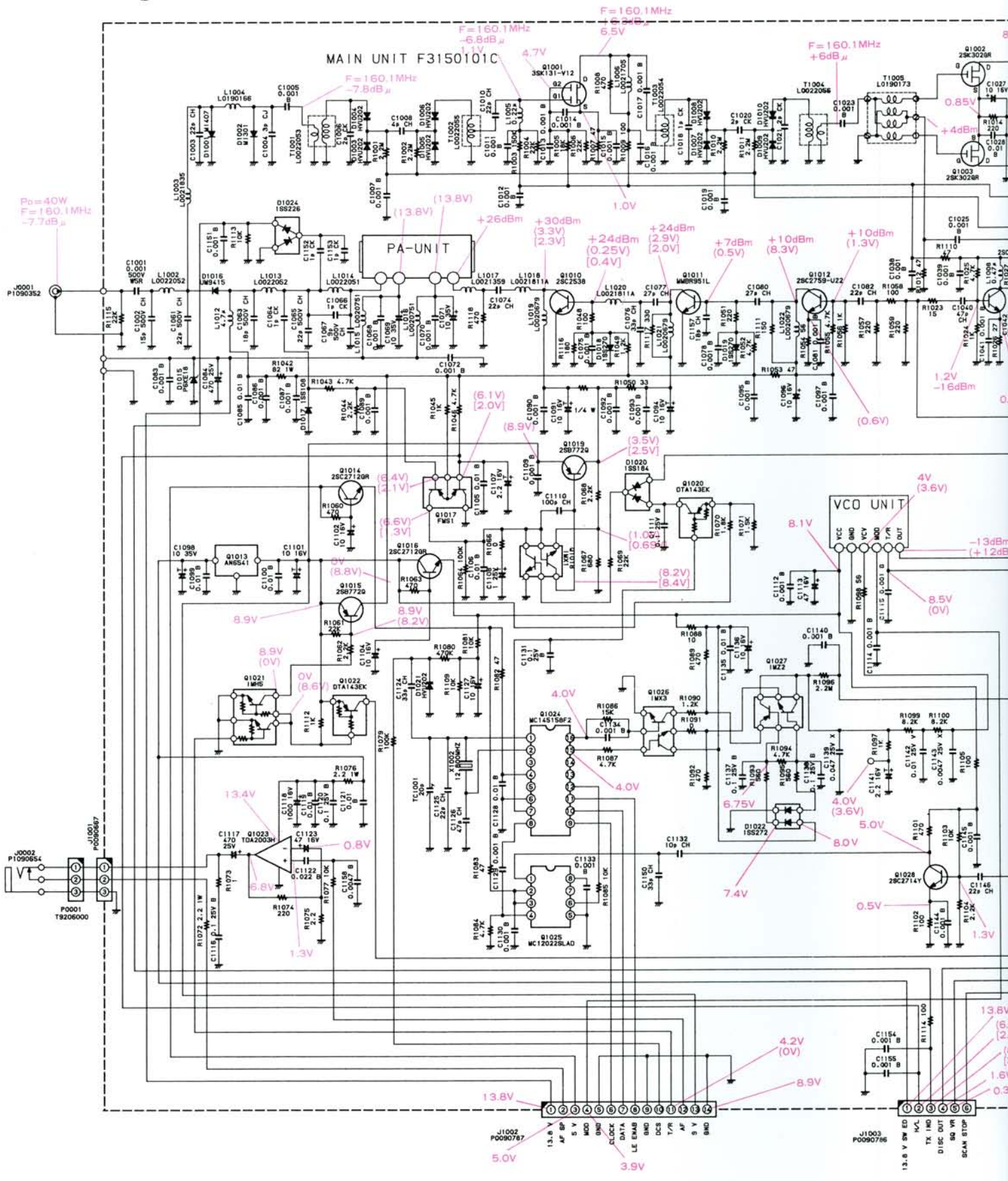
FMS1(S1)(Q1017)

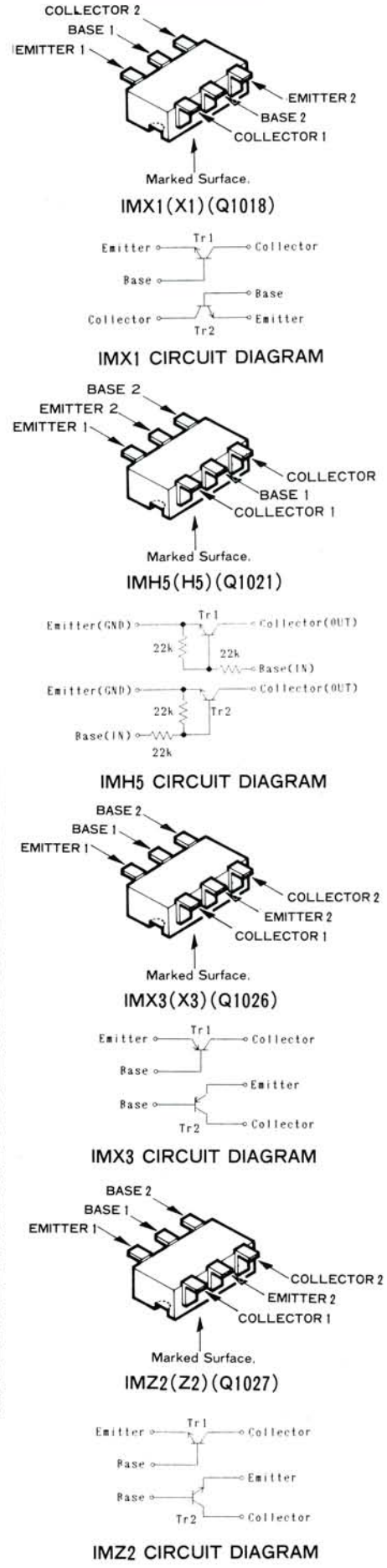
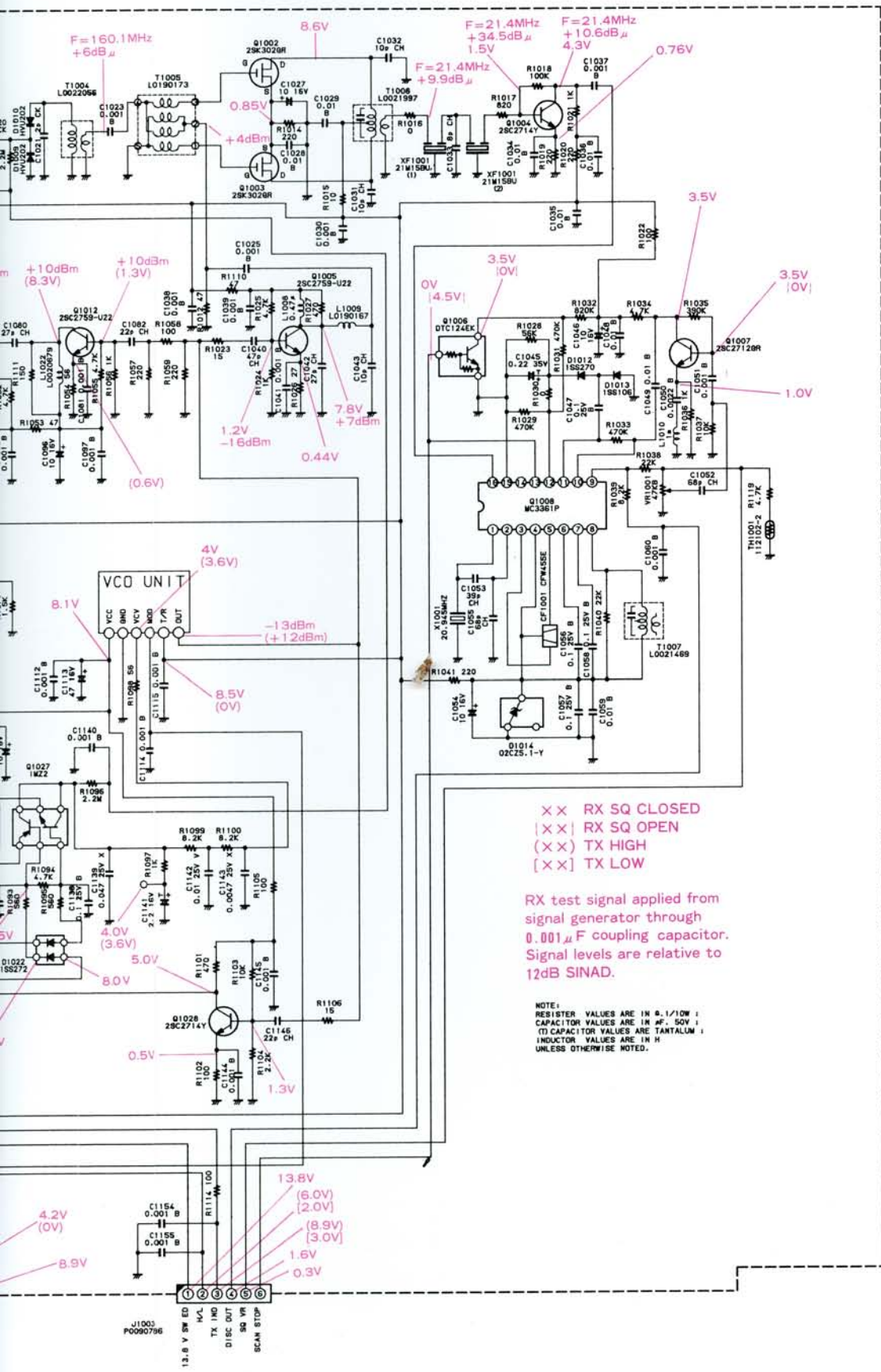


FMS1 CIRCUIT DIAGRAM



# Circuit Diagram







## Parts List

\*\*\* CNTL UNIT \*\*\*

CA0273001 PCB with Components

F3151101B Printed Circuit Board(Lot 2)

F3151101C Printed Circuit Board(Lot 3-)

ADD	CODE NO	DESCRIPTION	DEVICE				LOT NO
BT2001	Q9000390	LITHIUM BATTERY	CR2032-HP4H		3V		
C 2001	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2002	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2003	K22170809	CHIP CAP.	GRM40B222M50PT	0.0022uF	50V	B	
C 2004	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2005	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2006	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2007	K22140810	CHIP CAP.	GRM40B333M25PT	0.033uF	25V	B	
C 2008	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2009	K22170809	CHIP CAP.	GRM40B222M50PT	0.0022uF	50V	B	
C 2010	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2011	K22140810	CHIP CAP.	GRM40B333M25PT	0.033uF	25V	B	
C 2012	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2013	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2014	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2015	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2016	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
C 2017	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2018	K22170813	CHIP CAP.	GRM40B472M50PT	0.0047uF	50V	B	
C 2019	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2020	K22140810	CHIP CAP.	GRM40B333M25PT	0.033uF	25V	B	
C 2021	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V		
C 2022	K46170032	AL. ELECTRO. CAP.	50V3R3M4X7TR2	3.3uF	50V		
C 2023	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2024	K22140810	CHIP CAP.	GRM40B333M25PT	0.033uF	25V	B	
C 2025	K22140810	CHIP CAP.	GRM40B333M25PT	0.033uF	25V	B	
C 2026	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V		
C 2027	K22170813	CHIP CAP.	GRM40B472M50PT	0.0047uF	50V	B	
C 2028	K22170814	CHIP CAP.	GRM40B562M50PT	0.0056uF	50V	B	
C 2029	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
C 2030	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2031	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH	
C 2032	K22170219	CHIP CAP.	GRM40CH220J50PT	22pF	50V	CH	
C 2033	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2034	K76080009	TANTALUM CAP.	TPDNOJ470M8S(MX0)	47uF	6.3V		
C 2036	K22170809	CHIP CAP.	GRM40B222M50PT	0.0022uF	50V	B	
C 2037	K78080021	TANTALUM CHIP CAP.	TESVA0J335M1-8R	3.3uF	6.3V		
C 2039	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2041	K22170823	CHIP CAP.	GRM40B473M50PT	0.047uF	50V	B	
C 2042	K22170806	CHIP CAP.	GRM40B122M50PT	0.0012uF	50V	B	
C 2043	K22170809	CHIP CAP.	GRM40B222M50PT	0.0022uF	50V	B	
C 2044	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
C 2045	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B	
C 2046	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
C 2047	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B	
C 2048	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2049	K46120004	AL. ELECTRO. CAP.	16V100M4X7TR2	10uF	16V		
C 2050	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
C 2051	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
C 2052	K46160005	AL. ELECTRO. CAP.	35V100M5X7TR2	10uF	35V		
C 2053	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B	

C 2054	K22170235	CHIP CAP.	GRM40CH101J50PT	100pF	50V	CH	
C 2055	K22170821	CHIP CAP.	GRM40B223M50PT	0.022uF	50V	B	
C 2056	K22170821	CHIP CAP.	GRM40B223M50PT	0.022uF	50V	B	
C 2057	K78080021	TANTALUM CHIP CAP.	TESVA0J335M1-8R	3.3uF	6.3V		
C 2058	K46120007	AL.ELECTRO.CAP.	16V101M6X7TR2	100uF	16V		
C 2059	K22170821	CHIP CAP.	GRM40B223M50PT	0.022uF	50V	B	
C 2060	K22140810	CHIP CAP.	GRM40B333M25PT	0.033uF	25V	B	
C 2061	K22170235	CHIP CAP.	GRM40CH101J50PT	100pF	50V	CH	
C 2062	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
C 2063	K22170235	CHIP CAP.	GRM40CH101J50PT	100pF	50V	CH	
C 2064	K22170235	CHIP CAP.	GRM40CH101J50PT	100pF	50V	CH	
C 2065	K22170235	CHIP CAP.	GRM40CH101J50PT	100pF	50V	CH	
C 2066	K78080021	TANTALUM CHIP CAP.	TESVA0J335M1-8R	3.3uF	6.3V		
C 2067	K22170208	CHIP CAP.	GRM40CH070D50PT	7pF	50V	CH	
C 2069	K22140811	CHIP CAP.	GRM40B104M25PT	0.1uF	25V	B	
C 2070	K78080021	TANTALUM CHIP CAP.	TESVA0J335M1-8R	3.3uF	6.3V		
C 2071	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B	
C 2072	K22140810	CHIP CAP.	GRM40B333M25PT	0.033uF	25V	B	
C 2073	K22170813	CHIP CAP.	GRM40B472M50PT	0.0047uF	50V	B	
C 2074	K22170817	CHIP CAP.	GRM40B103M50PT	0.01uF	50V	B	
C 2075	K70087106	TANTALUM CAP.	DN0J100M1S	10uF	6.3V		Lot 2
C 2075	K76080005	TANTALUM CAP.	TPDNOJ100M8S(MX0)	10uF	6.3V		Lot 3-
C 2076	K22170805	CHIP CAP.	GRM40B102M50PT	0.001uF	50V	B	
D 2001	G2070003	DIODE	1SS226 TE85R				
D 2002	G2070001	DIODE	1SS181 TE85R				
D 2003	G2070009	DIODE	1SS184 TE85R				
D 2004	G2070003	DIODE	1SS226 TE85R				
D 2006	G2070009	DIODE	1SS184 TE85R				
D 2007	G2070001	DIODE	1SS181 TE85R				
D 2008	G2070003	DIODE	1SS226 TE85R				
D 2009	G2070003	DIODE	1SS226 TE85R				
D 2010	G2070001	DIODE	1SS181 TE85R				
J 2001	P1090142	CONNECTOR	5124-06BHPB				
J 2002	P0090783	CONNECTOR	TXL-P02P-M1				
J 2003	P0090652	CONNECTOR	53022-0710				
J 2004	P0090664	CONNECTOR	53022-0810				
J 2005	P1090678	CONNECTOR	5124-14BHPB				
J 2006	P0090784	CONNECTOR	TXL-P12P-M1				
J 2007	P0090785	CONNECTOR	TXL-P15P-M1				
JP2001	JP1						
JP2002	JP1						
L 2001	L1190389	INDUCTOR	FBA03VA450AB-00				
Q 2001	G3327127G	TRANSISTOR	2SC2712GR TE85R				
Q 2002	G3070002	TRANSISTOR	DTC114EK T96				
Q 2003	G3070027	TRANSISTOR	IMH5 T108				
Q 2004	G3070002	TRANSISTOR	DTC114EK T96				
Q 2005	G1090908	IC	NJM2902M				
Q 2006	G3327127G	TRANSISTOR	2SC2712GR TE85R				
Q 2007	G1090908	IC	NJM2902M				
Q 2008	G1090908	IC	NJM2902M				
Q 2009	G1091154	IC	HD4074808H HY-69				Lot 2
Q 2009	G1091202	IC	HD404808A30H				Lot 3-
Q 2010	G3070026	TRANSISTOR	IMD2 T108				
Q 2011	G1090908	IC	NJM2902M				
Q 2012	G3070002	TRANSISTOR	DTC114EK T96				
Q 2013	G3070002	TRANSISTOR	DTC114EK T96				



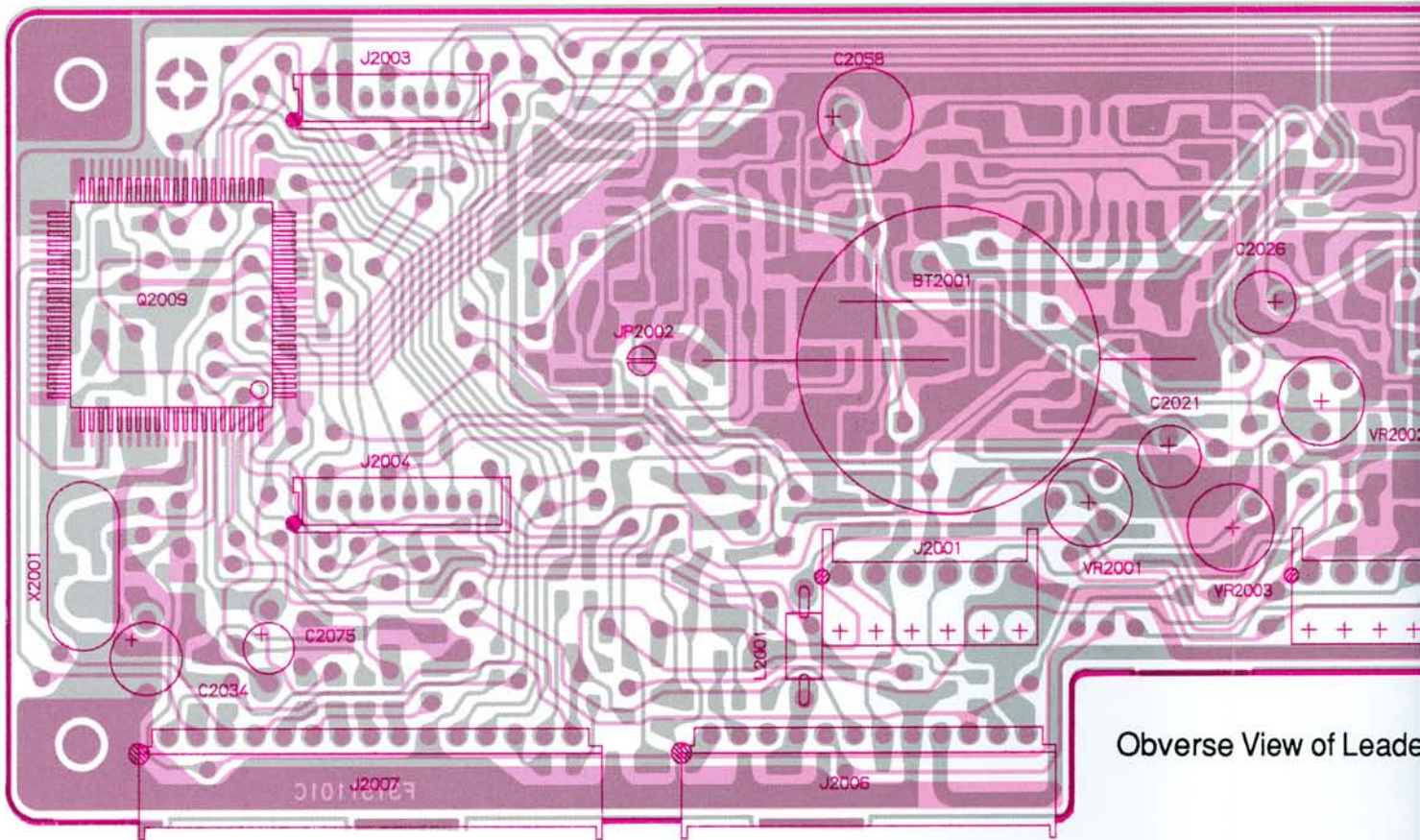
Q 2014	G3070042	TRANSISTOR	DTC323TK T97		
Q 2015	G3070002	TRANSISTOR	DTC114EK T96		
Q 2016	G3070002	TRANSISTOR	DTC114EK T96		
Q 2017	G1091191	IC	BR93C56		
Q 2019	G3070002	TRANSISTOR	DTC114EK T96		
Q 2020	G3111627G	TRANSISTOR	2SA1162GR TE85R		
Q 2021	G1091181	IC	RH5VA32AA-T1		
Q 2022	G3070002	TRANSISTOR	DTC114EK T96		
Q 2023	G1090936	IC	HA17805P		
Q 2024	G3070002	TRANSISTOR	DTC114EK T96		
Q 2025	G3070002	TRANSISTOR	DTC114EK T96		
Q 2026	G3070002	TRANSISTOR	DTC114EK T96		
Q 2027	G3070002	TRANSISTOR	DTC114EK T96		
Q 2028	G3070030	TRANSISTOR	DTA124EK T97		
R 2001	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2002	J24205823	CHIP RES.	RMC1/10T 823J	82K	1/10W
R 2003	J24205393	CHIP RES.	RMC1/10T 393J	39K	1/10W
R 2004	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 2005	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2006	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2007	J24205105	CHIP RES.	RMC1/10T 105J	1M	1/10W
R 2008	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2009	J24205473	CHIP RES.	RMC1/10T 473J	47K	1/10W
R 2010	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 2011	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2012	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2013	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2014	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2015	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 2016	J24205124	CHIP RES.	RMC1/10T 124J	120K	1/10W
R 2017	J24205124	CHIP RES.	RMC1/10T 124J	120K	1/10W
R 2018	J24205153	CHIP RES.	RMC1/10T 153J	15K	1/10W
R 2019	J24205683	CHIP RES.	RMC1/10T 683J	68K	1/10W
R 2020	J24205184	CHIP RES.	RMC1/10T 184J	180K	1/10W
R 2021	J24205393	CHIP RES.	RMC1/10T 393J	39K	1/10W
R 2022	J24205473	CHIP RES.	RMC1/10T 473J	47K	1/10W
R 2023	J24205563	CHIP RES.	RMC1/10T 563J	56K	1/10W
R 2024	J24205683	CHIP RES.	RMC1/10T 683J	68K	1/10W
R 2025	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 2026	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 2027	J24205123	CHIP RES.	RMC1/10T 123J	12K	1/10W
R 2028	J24205393	CHIP RES.	RMC1/10T 393J	39K	1/10W
R 2029	J24205824	CHIP RES.	RMC1/10T 824J	820K	1/10W
R 2030	J24205824	CHIP RES.	RMC1/10T 824J	820K	1/10W
R 2031	J24205334	CHIP RES.	RMC1/10T 334J	330K	1/10W
R 2032	J24205333	CHIP RES.	RMC1/10T 333J	33K	1/10W
R 2033	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 2034	J24205473	CHIP RES.	RMC1/10T 473J	47K	1/10W
R 2035	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2036	J24205474	CHIP RES.	RMC1/10T 474J	470K	1/10W
R 2037	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2038	J24205473	CHIP RES.	RMC1/10T 473J	47K	1/10W
R 2039	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2040	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2041	J24205153	CHIP RES.	RMC1/10T 153J	15K	1/10W
R 2042	J24205333	CHIP RES.	RMC1/10T 333J	33K	1/10W
R 2043	J24205333	CHIP RES.	RMC1/10T 333J	33K	1/10W
R 2044	J24205474	CHIP RES.	RMC1/10T 474J	470K	1/10W
R 2045	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 2046	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W

R 2047	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 2048	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 2049	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 2050	J24205563	CHIP RES.	RMC1/10T 563J	56K	1/10W
R 2051	J24205394	CHIP RES.	RMC1/10T 394J	390K	1/10W
R 2052	J24205394	CHIP RES.	RMC1/10T 394J	390K	1/10W
R 2053	J24205682	CHIP RES.	RMC1/10T 682J	6.8K	1/10W
R 2057	J24205105	CHIP RES.	RMC1/10T 105J	1M	1/10W
R 2058	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2059	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2060	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2061	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2062	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2063	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2064	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2065	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2066	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2067	J24205101	CHIP RES.	RMC1/10T 101J	100	1/10W
R 2068	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 2071	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2072	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2073	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2074	J24205474	CHIP RES.	RMC1/10T 474J	470K	1/10W
R 2075	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 2076	J24205225	CHIP RES.	RMC1/10T 225J	2.2M	1/10W
R 2077	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2078	J24205393	CHIP RES.	RMC1/10T 393J	39K	1/10W
R 2079	J24205225	CHIP RES.	RMC1/10T 225J	2.2M	1/10W
R 2080	J24205333	CHIP RES.	RMC1/10T 333J	33K	1/10W
R 2081	J24205153	CHIP RES.	RMC1/10T 153J	15K	1/10W
R 2082	J24205153	CHIP RES.	RMC1/10T 153J	15K	1/10W
R 2083	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 2084	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 2085	J24205104	CHIP RES.	RMC1/10T 104J	100K	1/10W
R 2086	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2087	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2088	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2089	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2090	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2091	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2092	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2093	J24205271	CHIP RES.	RMC1/10T 271J	270	1/10W
R 2094	J24205562	CHIP RES.	RMC1/10T 562J	5.6K	1/10W
R 2096	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2097	J24205154	CHIP RES.	RMC1/10T 154J	150K	1/10W
R 2098	J24205154	CHIP RES.	RMC1/10T 154J	150K	1/10W
R 2099	J24205223	CHIP RES.	RMC1/10T 223J	22K	1/10W
R 2100	J24205473	CHIP RES.	RMC1/10T 473J	47K	1/10W
R 2101	J24205563	CHIP RES.	RMC1/10T 563J	56K	1/10W
R 2102	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2103	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2104	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2105	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2106	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2107	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2108	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2109	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2110	J24205331	CHIP RES.	RMC1/10T 331J	330	1/10W
R 2111	J24205562	CHIP RES.	RMC1/10T 562J	5.6K	1/10W
R 2112	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2114	J24205681	CHIP RES.	RMC1/10T 681J	680	1/10W

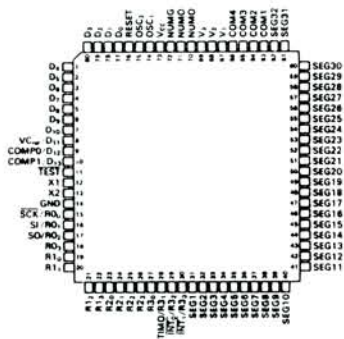


R 2115	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 2116	J24205105	CHIP RES.	RMC1/10T 105J	1M	1/10W
R 2117	J24205224	CHIP RES.	RMC1/10T 224J	220K	1/10W
R 2118	J24205224	CHIP RES.	RMC1/10T 224J	220K	1/10W
R 2119	J24205103	CHIP RES.	RMC1/10T 103J	10K	1/10W
R 2120	J24205222	CHIP RES.	RMC1/10T 222J	2.2K	1/10W
R 2121	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
R 2122	J24205560	CHIP RES.	RMC1/10T 560J	56	1/10W
R 2123	J24205102	CHIP RES.	RMC1/10T 102J	1K	1/10W
R 2124	J24205472	CHIP RES.	RMC1/10T 472J	4.7K	1/10W
VR2001	J51745103	POT.	H0651A013-10KB	10K	B
VR2002	J51745472	POT.	H0651A011-4.7KB	4.7K	B
VR2003	J51745223	POT.	H0651A015-22KB	22K	B
VR2004	J51745103	POT.	H0651A013-10KB	10K	B
X 2001	H0102984	XTAL		4.000MHZ	
	R8118690	SEAL			

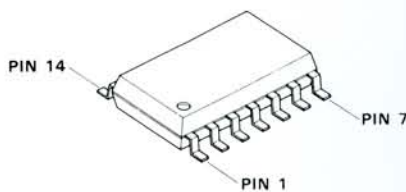
Parts Layout Control Unit (Nos. 2xxx)



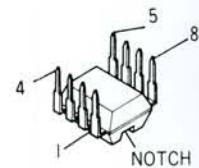
Obverse View of Leads



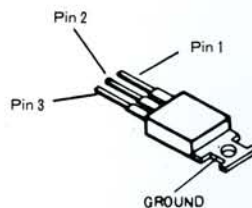
HD4074808H(Q2009): Lot 2  
HD404808A30H(Q2009): Lot 3~



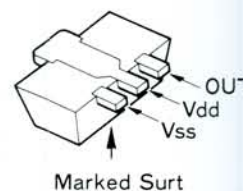
NJM2902M  
(Q2005, 2007, 2008, 2011)



BR93C56(Q2017)

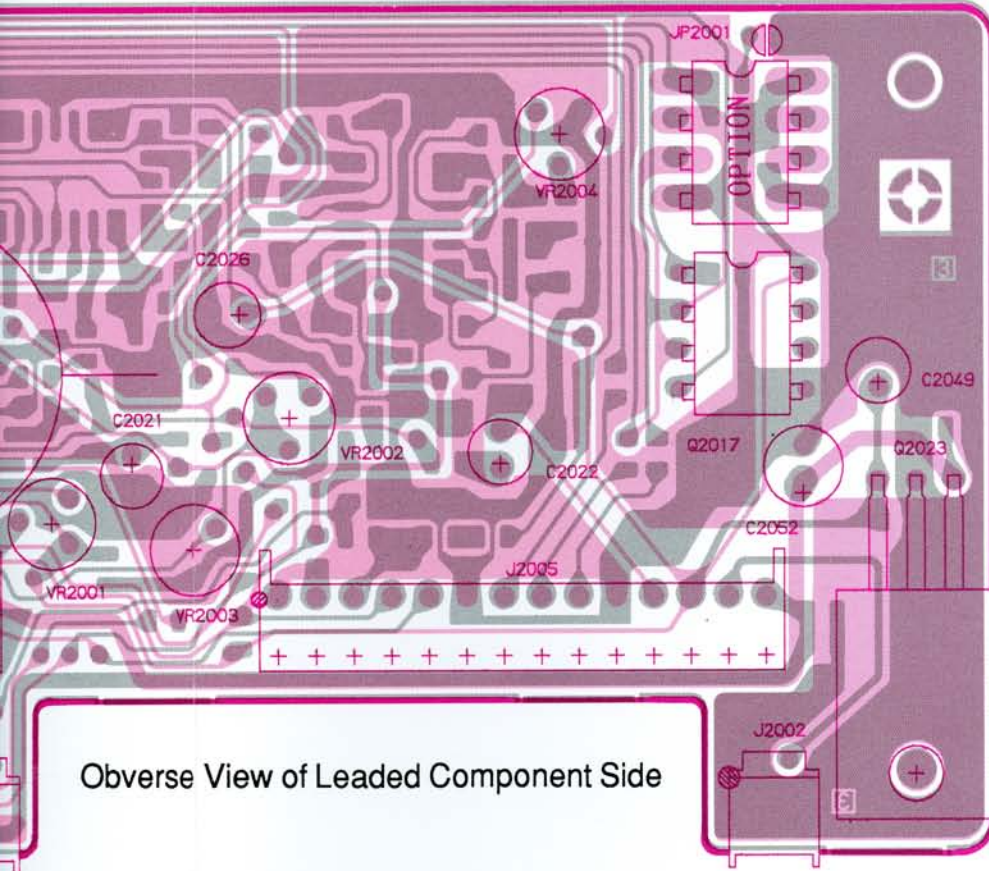


HA17805P(Q2023)

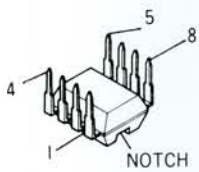


RH5VA32AA(D5) (Q2021)

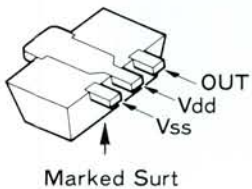




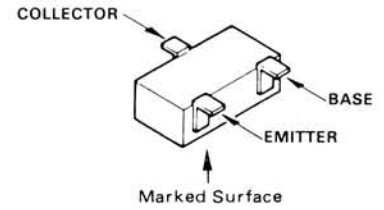
Obverse View of Ledged Component Side



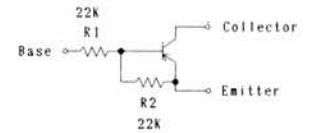
BR93C56 (Q2017)



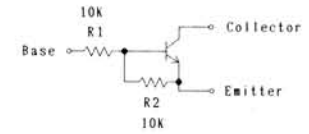
RH5VA32AA(D5) (Q2021)



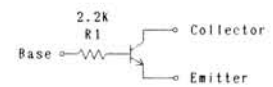
- 2SA1162GR(SG) (Q2020)
- 2SC2712GR(LG) (Q2001, 2006)
- DTA124EK (15) (Q2028)
- DTC114EK (24) [Q2002, 2004, 2012, 2013, 2015, 2016, 2019, 2022, 2024, 2025, 2026, 2027]
- DTC323TK (H02) (Q2014)



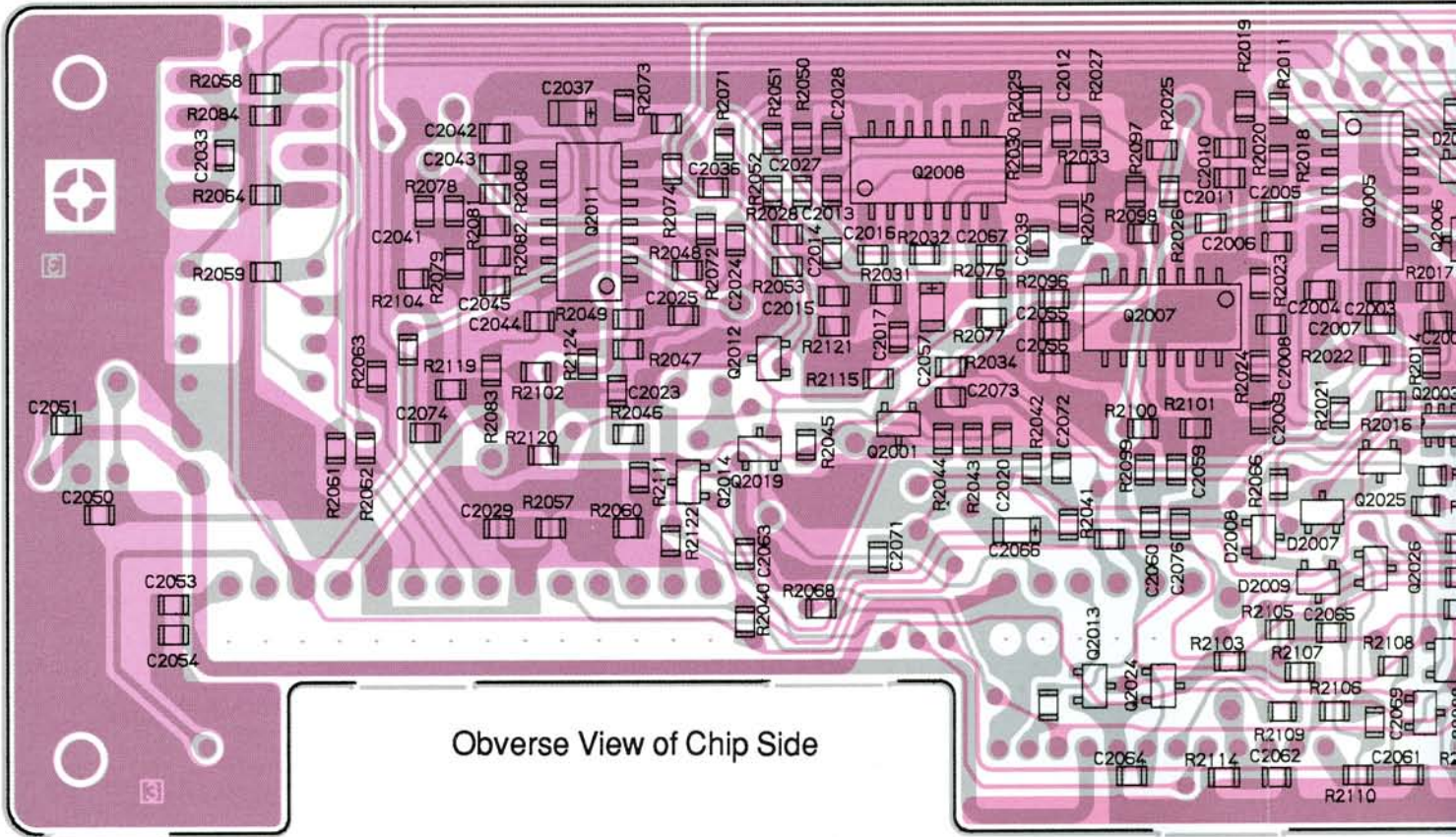
DTA124EK CIRCUIT DIAGRAM



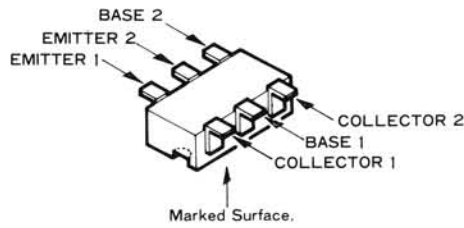
DTC114EK CIRCUIT DIAGRAM



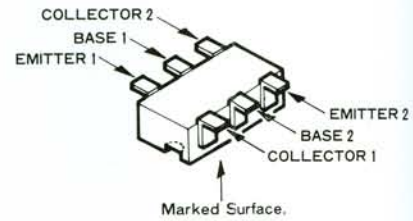
DTC323TK CIRCUIT DIAGRAM



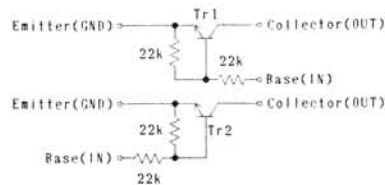
Obverse View of Chip Side



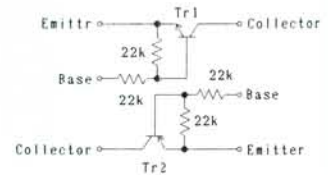
IMH5 (H5) (Q2003)



IMD2 (D2) (Q2010)

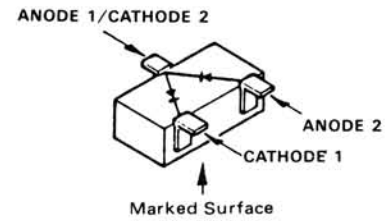
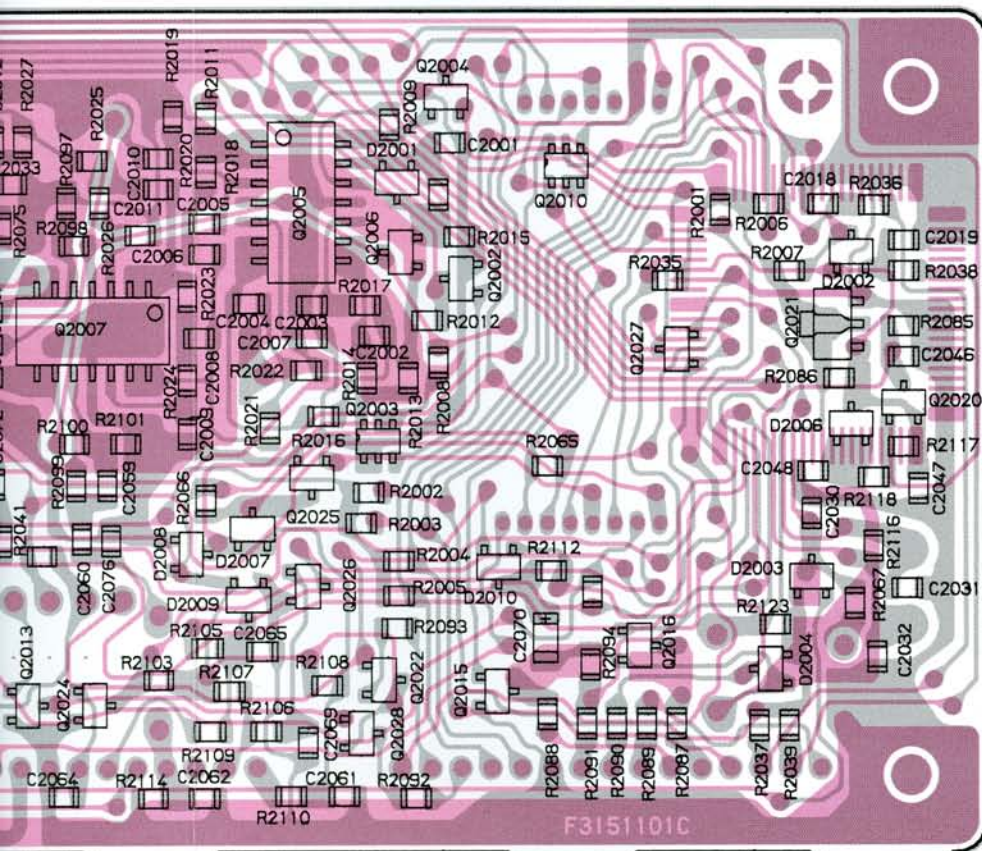


IMH5 CIRCUIT DIAGRAM

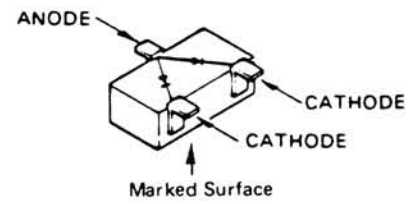


IMD2 CIRCUIT DIAGRAM

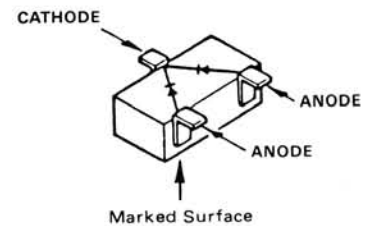




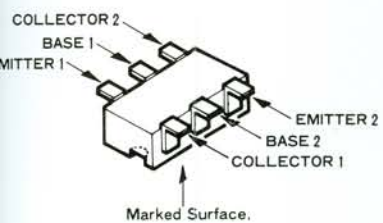
1SS226(C3)  
(D2001, 2004, 2008, 2009)



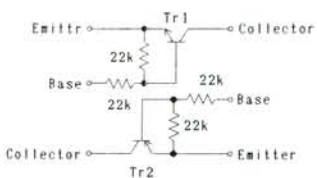
1SS181(A3)  
(D2002, 2007, 2010)



1SS184(B3)  
(D2003, 2006)

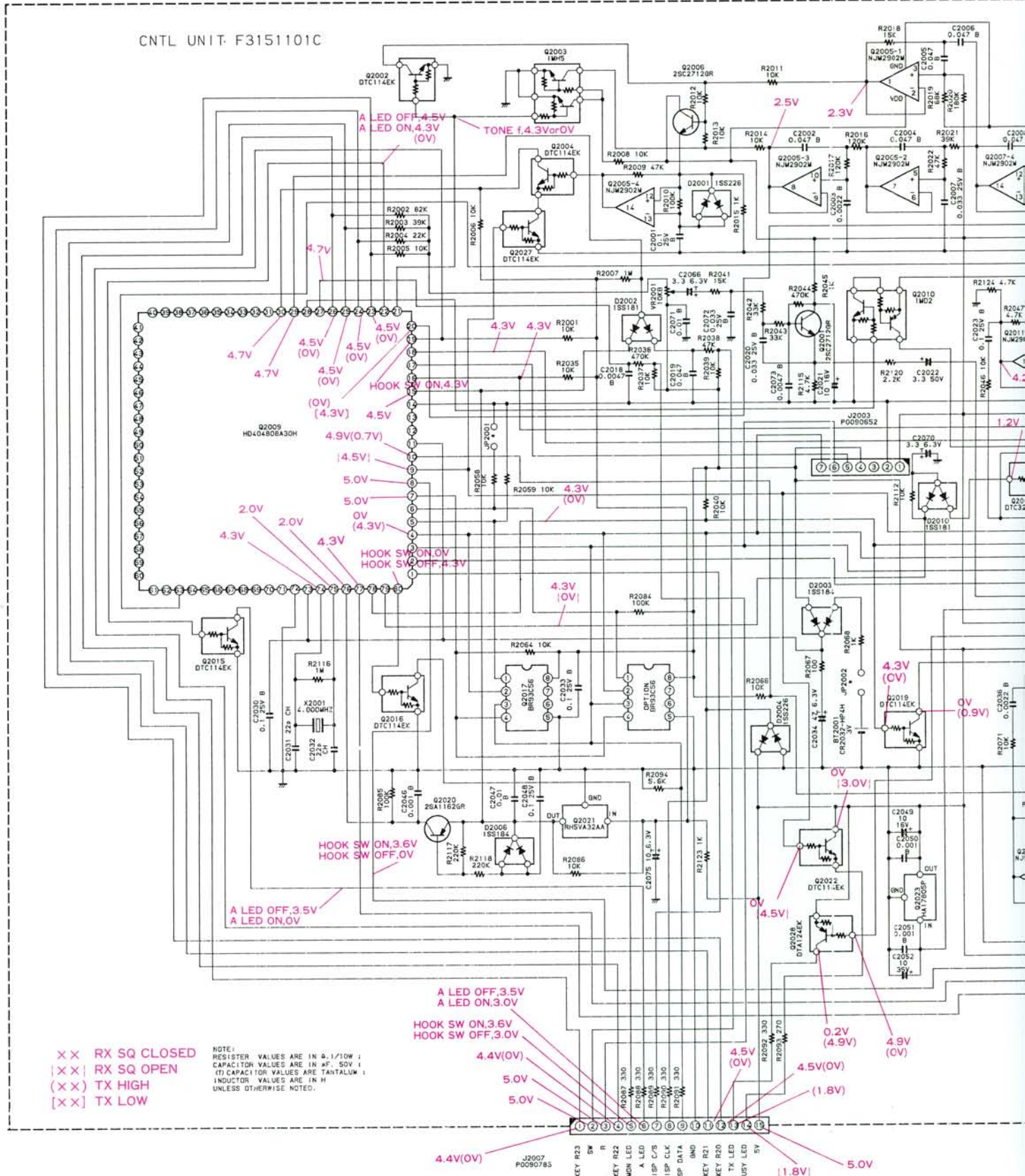


IMD2(D2) (Q2010)



IMD2 CIRCUIT DIAGRAM

# Circuit Diagram







## Component Applications

### Main Unit

Location	Type	Nomenclature	Application
Q1001	FET	3SK131	Receiver RF Amplifier
Q1002 & Q1003	FET	2SK302 × 2	Receiver 1st Mixer
Q1004	Transistor	2SC2714	Receiver 1st IF Amplifier
Q1005	Transistor	2SC2759	Receiver 1st Local Buffer
Q1006	Transistor	DTC124EK	Squelch Switch
Q1007	Transistor	2SC2712	Noise Amplifier
Q1008	Linear IC	MC3361P	NBFM IF Receiver Subsystem
Q1009	(number not used)		
Q1010	Transistor	2SC2538	Transmitter Pre-Driver
Q1011	Transistor	MMBR951L	Transmitter RF Amplifier
Q1012	Transistor	2SC2759	Transmitter RF Amplifier
Q1013	Linear IC	AN6541	9-V Regulator
Q1014	Transistor	2SC2712	5-V PLL Supply Filter
Q1015	Transistor	2SB772Q	Antenna Switch Bias & Transmitter RF Enable
Q1016	Transistor	2SC2712	9-V VCO Supply Filter
Q1017	Dual Transistor	FMS1	Transmitter Auto Power Cntl Differential Amp
Q1018	Dual Transistor	IMX1	DC Amp & Transmit Inhibit Switch
Q1019	Transistor	2SB772Q	Transmitter Power Control DC Amplifier
Q1020	Transistor	DTA143EK	PLL Unlock Transmitter Inhibit Switch
Q1021	Dual Transistor	IMH5	Antenna T/R & Receiver Disable on Transmit
Q1022	Transistor	DTA143EK	Receiver VCO & IF T/R Switch
Q1023	Linear Audio IC	TDA2003H	Receiver Audio Power Amplifier
Q1024	PLL Subsystem IC	MC145158F	PLL
Q1025	Prescaler	MC12022SLAD	PLL Prescaler
Q1026	Dual Transistor	IMX3	VCO VCV Loop Filter Switches
Q1027	Dual Transistor	IMZ2	VCO VCV Loop Filter Switches
Q1028	Transistor	2SC2714	VCO Output Loopback Buffer
D1001	Diode	MI407	Receive Antenna T/R Switch
D1002	Diode	MI301	Receive Antenna T/R Switch
D1003–D1010	Varactor Diodes	HVU202 × 8	Receiver RF Bandpass Filter Auto-Tuning



**Main Unit** (Continued)

Location	Type	Nomenclature	Application
D1011	(number not used)	—	—
D1012	Diode	1SS270	Receiver AF Noise Detector
D1013	Schottky Diode	1SS106	Receiver AF Noise Detector
D1014	Zener Diode	O2Z5.1-Y	Supply Regulator for Receiver Subsystem
D1015	Diode	P6KE18	Main 13.8V DC Supply Clamp
D1016	Diode	UM9415	Transmit Antenna T/R Switch
D1017	Schottky Diode	1SS108	Transmit Reflected Power Detector
D1018	Diode	1SS270	Transmitter Pre-Driver Bias Regulator
D1019	Diode	1SS270	Transmitter RF Amplifier Bias Regulator
D1020	Dual Diode	1SS184	Transmit Disable T/R OR PLL Unlock
D1021	Varactor Diode	HVU202	Modulator for Digitally Coded Squelch Option
D1022	Dual Diode	1SS272	VCO Loop Filter Switching Bias
D1023	(number not used)	—	—
D1024	Dual Diode	1SS226	Transmitter RF Forward Power Detector

**Control Unit**

Location	Type	Nomenclature	Application
Q2001	Transistor	2SC2712	CTCSS Modulation Filter
Q2002	Transistor	DTC114EK	CTCSS Decoder HPF Switch
Q2003	Dual Transistor	IMH5	CTCSS Decoder LPF Switch
Q2004	Transistor	DTC114EK	CTCSS Decoder Limiter
Q2005	Quad Op Amp	NJM2902M	CTCSS Decoder Filters
Q2006	Transistor	2SC2712	CTCSS Decoder Buffer
Q2007	Quad Op Amp	NJM2902M	Microphone HPF & CTCSS Decoder LPF
Q2008	Quad Op Amp	NJM2902M	Rx AF De-Emphasis, HPF and Modulation Limiter
Q2009	Microprocessor	HD404808A30H	Central Processing Unit
Q2010	Dual Transistor	IMD2	Gate for PTT Line to Tone Options
Q2011	Quad Op Amp	NJM2902M	Mic. Amp, Rx AF HPF and Modulation LPF
Q2012	Transistor	DTC114EK	Transmitter High/Low Power Switch
Q2013	Transistor	DTC114EK	Transmit Indicator Switch
Q2014	Transistor	DTC323TK	Squelch Gate
Q2015	Transistor	DTC114EK	“A” LED Driver
Q2016	Transistor	DTC114EK	“MON” LED Driver

**Control Unit** (Continued)

Location	Type	Nomenclature	Application
Q2017	EEPROM	BR93C56	Dealer-Programmable Storage
Q2018	(number not used)		
Q2019	Transistor	DTC114EK	Transmitter Audio Mute Switch
Q2020	Transistor	2SA1162	CPU Reset Switch
Q2021	Voltage Regulator	RH5VA32AA	CPU 5-V Supply Bus Regulator
Q2022	Transistor	DTC114EK	BUSY LED Driver
Q2023	Voltage Regulator	HA17805P	Main 5-V Supply Bus Regulator
Q2024	Transistor	DTC114EK	Programming (Clone) Switch
Q2025	Transistor	DTC114EK	Remote (DCS Option) PTT Switch
Q2026	Transistor	DTC114EK	Microphone Hanger Switch
Q2027	Transistor	DTC114EK	CTCSS Decoder Limiter Switch
Q2028	Transistor	DTC124EK	TX LED Driver
D2001	Dual Diode	1SS226	CTCSS Decoder Limiter
D2002	Dual Diode	1SS181	Channel Selector OR
D2003	Dual Diode	1SS184	CMOS Backup Supply OR
D2004	Dual Diode	1SS226	CPU Output Clock Protector
D2005	(number not used)	—	—
D2006	Dual Diode	1SS184	CPU Reset Reverse Voltage Blocking
D2007	Dual Diode	1SS181	PTT Reverse Voltage Blocking
D2008	Dual Diode	1SS226	PTT Reverse Voltage Blocking
D2009	Dual Diode	1SS226	Programming (Clone) Data Rev. Voltage Blocking
D2010	Dual Diode	1SS181	Squelch Gate Hang Time Rev. Voltage Blocking

**Display Unit (12-channel)**

Location	Type	Nomenclature	Application
Q101	Display LSI	TD62C850N	Display Decoder & 7-Segment LED Driver
D101–D104	Diodes	1SS270 × 4	Switch Debouncers
D105	Yellow LED	TLY208	“MON” LED
D106	Green LED	TLG208	“A” LED
D107	Red/Green Dual LED	TLSG208	“TX/BUSY” LED
DS101	Dual 7-Segment LED	GL7S201	Channel Number Display



**Display Unit (4-channel)**

Location	Type	Nomenclature	Application
Q201	Display LSI	$\mu$ PD4094BC	Display Decoder
Q202 – Q205	Transistors	BA1A4M $\times$ 4	Channel Indicator LED Drivers
D201, D202	Diodes	1SS270 $\times$ 2	Switch Debouncers
D203 – D206	Orange LEDs	TLO208 $\times$ 4	Channel Indicator LEDs
D207	Yellow LED	TLY208	“MON” LED
D208	Green LED	TLG208	“A” LED
D209	Red/Green Dual LED	TLSG208	“TX/BUSY” LED

**VCO Unit**

Location	Type	Nomenclature	Application
Q301	Transistor	MMBR951L	Receiver VCO
Q302	Transistor	DTC124EK	Receiver VCO Enable Switch
Q303	Transistor	MMBR951L	Transmitter VCO
Q304	Transistor	IMH5	Transmitter VCO Disable Switch
Q305	Transistor	2SC2759	T/R VCO Buffer
D301, D302	Varactor Diodes	1T363 $\times$ 2	Receiver VCO Tuning
D303, D304	Varactor Diodes	1T363 $\times$ 2	Transmitter VCO Tuning
D305	Varactor Diode	HVU202	Modulator

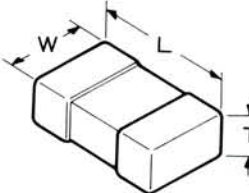
**PA Unit**

Location	Type	Nomenclature	Application
Q901	Transistor	2SC2539	Transmitter RF Driver
Q902	Transistor	2SC2630	Transmitter Final RF Amplifier

### Chip Components

The diagrams below indicate some of the distinguishing features of common chip components.

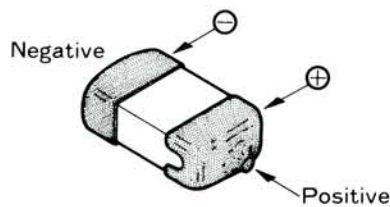
#### Capacitor



(Unit : mm)

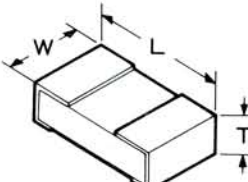
Type	L	W	T
3216	3.2	1.6	0.45~0.60
2125	2.0	1.25	0.35~0.50
1608	1.6	0.8	0.65~0.95

#### Tantalum Capacitor



Polarized, Unmarked  
(determine value from layout and Parts List)

#### Resistors



Type	L	W	T
1/10	2.0	1.25	0.45
1/16	1.6	0.8	0.45

#### INDICATED LETTERS

**1 2 3 4**  
**5 6 7 :**  
**9 0 .**

Type RMC 1/10W,1/16W

Marking\* 100,222,473.....

473		
Ten unit	One unit	Multiplier code
0	0	10 <sup>0</sup>
1	1	10 <sup>1</sup>
2	2	10 <sup>2</sup>
3	3	10 <sup>3</sup>
4	4	10 <sup>4</sup>
5	5	10 <sup>5</sup>
6	6	10 <sup>6</sup>
7	7	10 <sup>7</sup>
8	8	10 <sup>8</sup>
9	9	10 <sup>9</sup>

Examples :

100 = 10Ω

222 = 2.2kΩ

473 = 47kΩ



### Replacing Chip Components

Chip components are installed at the factory by a series of robots, which first place a spot of adhesive resin at the location where each part is to be installed. Then parts are handled and placed using vacuum suction.

For single-sided boards, solder paste is applied and the board is then baked to harden the resin and flow the solder. For double-sided boards, no solder paste is applied, but the board is baked (or exposed to ultraviolet) to cure the resin before dip soldering.

In our laboratory and service shop, chip parts in small quantities are mounted manually by applying a spot of resin, placing with tweezers, and then soldered by dual streams of hot air (without physical contact during soldering). We remove parts by first removing solder using a vacuum suction iron, which applies a light steady vacuum at the iron tip, and then breaking the adhesive with tweezers.

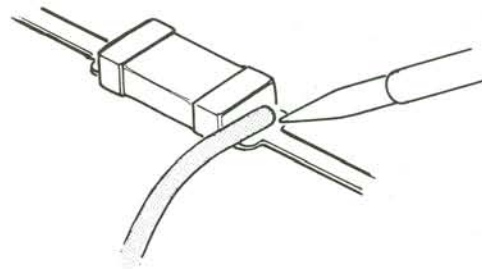
The special vacuum soldering/desoldering equipment is recommended if you expect to do a lot of chip replacements. Otherwise, it is usually possible to remove and replace chip components with only a tapered, temperature-controlled soldering iron, a set of tweezers and braided copper solder wick. Soldering iron temperature should be less than 280°C (536°F).

### Precautions for Chip Replacement

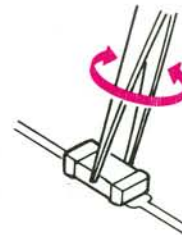
- (1) Do not disconnect a chip forcefully, or the foil pattern may peel off the board.
- (2) Never re-use a chip component. Dispose of all removed chip components immediately to avoid mixing with new parts.
- (3) Limit soldering time to 3 seconds or less to avoid damaging the component and board.

### Removing Chip Components

- (1) Remove the solder at each joint, one joint at a time, using solder wick wetted with non-acidic flux as shown below. Avoid applying pressure, and do not attempt to remove the tinning from the chip's electrode.



- (2) Grasp the chip on both sides with tweezers, and gently twist the tweezers back and forth (to break the adhesive bond) while alternately heating each electrode. Be careful to avoid peeling the foil traces from the board. Dispose of the chip when removed.



- (3) After removing the chip, use the copper braid and soldering iron to wick away any excess solder and smooth the land for installation of the replacement part.

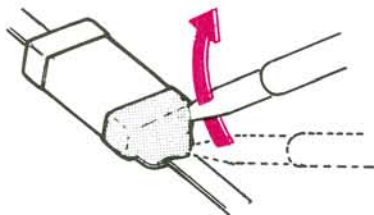
### Installing a Replacement Chip

As the value of some chip components is not indicated on the body of the chip, be careful to get the right part for replacement.

- (1) Apply a small amount of solder to the land on one side where the chip is to be installed. Avoid too much solder, which may cause bridging.



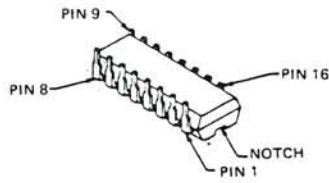
- (2) Hold the chip with tweezers in the desired position, and apply the soldering iron with a motion indicated by the arrow in the diagram below. Do not apply heat for more than 3 seconds.



- (3) Remove the tweezers and solder the electrode on the other side in the manner just described.

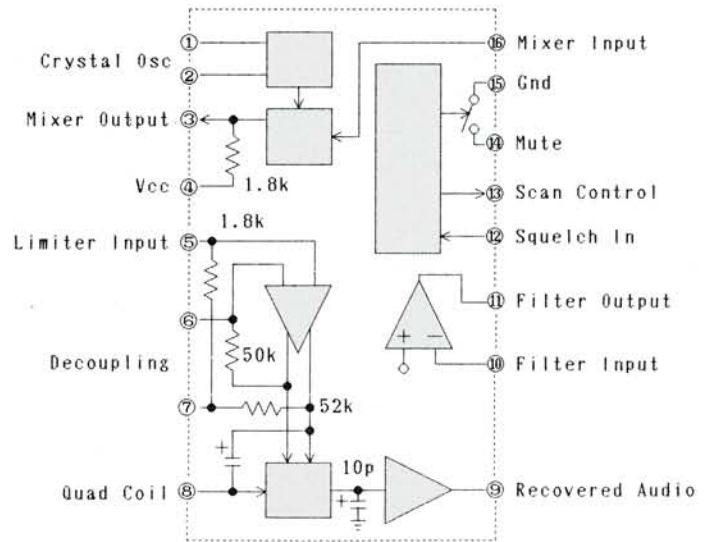


Main Unit(Q1008)MC3361P  
Low Power FM IF



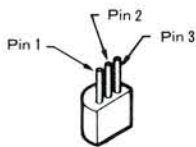
- |                     |                          |
|---------------------|--------------------------|
| Pin 1:Crystal Osc   | Pin 9:Demodulator Output |
| Pin 2:Crystal Osc   | Pin 10:Filter Input      |
| Pin 3:Mixer Output  | Pin 11:Filter Output     |
| Pin 4:Vcc           | Pin 12:Squelch Input     |
| Pin 5:Limiter Input | Pin 13:Scan Control      |
| Pin 6:Decoupling    | Pin 14:Audio Mute        |
| Pin 7:Decoupling    | Pin 15:Gnd               |
| Pin 8:Quad Input    | Pin 16:RF Input          |

PIN ASSIGNMENT



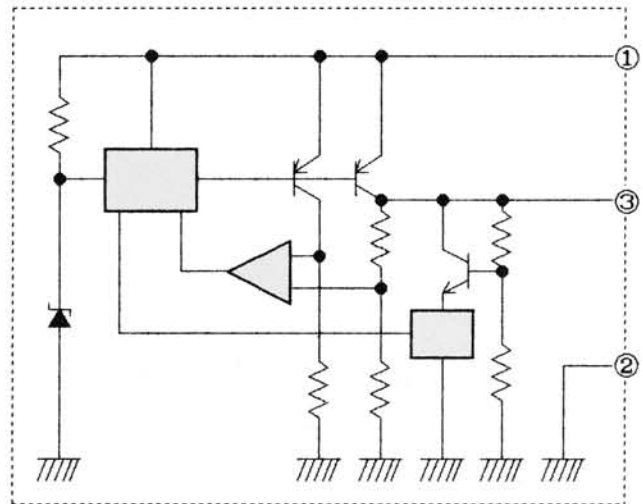
BLOCK DIAGRAM

Main Unit(Q1013)AN6541  
Regulator



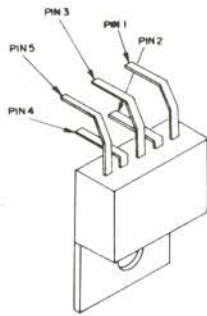
- |              |
|--------------|
| Pin 1:In put |
| Pin 2:Gnd    |
| Pin 3:Output |

PIN ASSIGNMENT



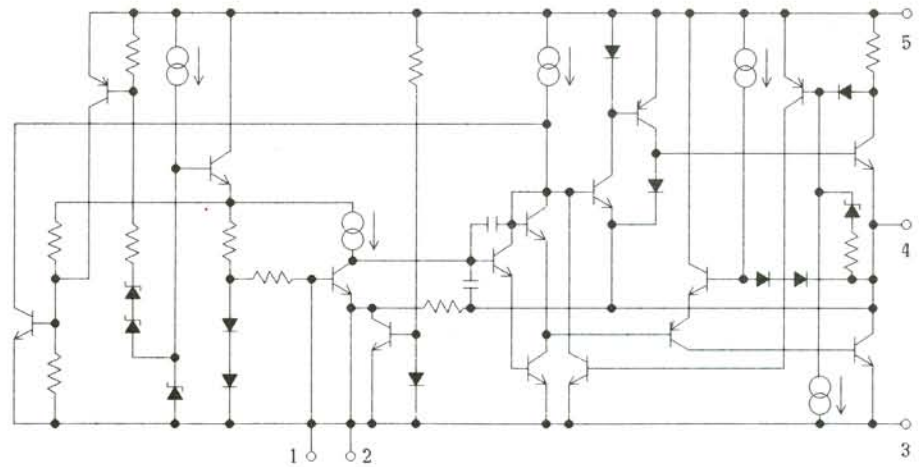
BLOCK DIAGRAM

Main Unit(Q1023)TDA2003H  
Audio Amplifier



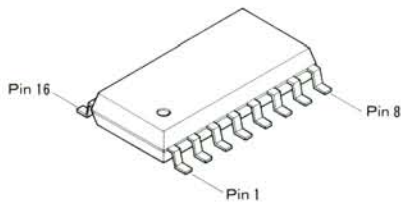
- Pin 1: Non Inverting Input
- Pin 2: Inverting Input
- Pin 3: Gnd
- Pin 4: Output
- Pin 5: Supply Voltage

PIN ASSIGNMENT



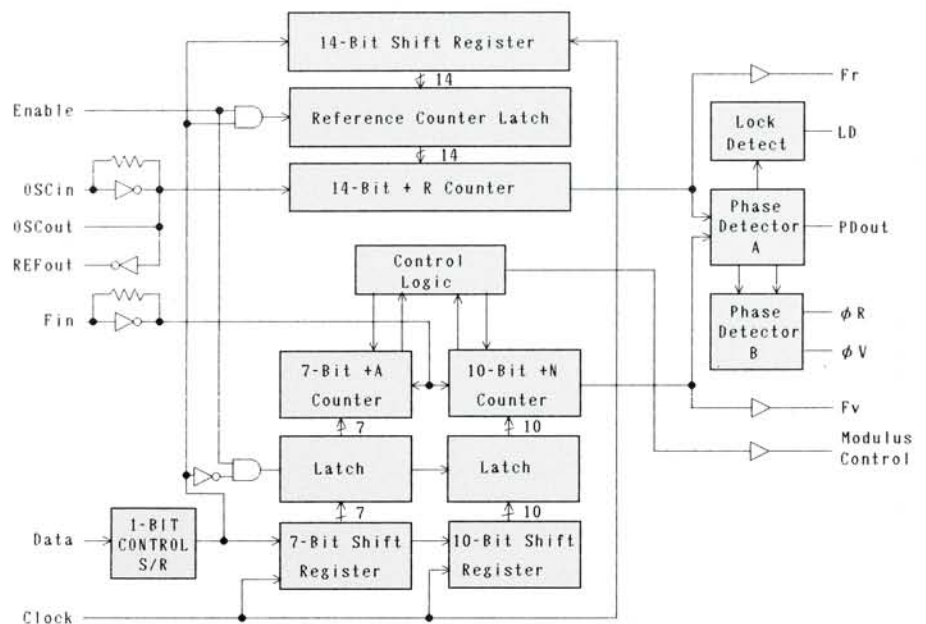
SCHEMATIC DIAGRAM

Main Unit(Q1024)MC145158F  
Serial-Input PLL Frequency Synthesizer



- Pin 1: OSC in
- Pin 2: OSC out
- Pin 3: fv
- Pin 4: Vdd
- Pin 5: PD out
- Pin 6: Vss
- Pin 7: LD
- Pin 8: fin
- Pin 9:  $\phi R$
- Pin 10:  $\phi V$
- Pin 11: REF out
- Pin 12: fr
- Pin 13: MOD Control
- Pin 14: Enable
- Pin 15: Data
- Pin 16: Clock

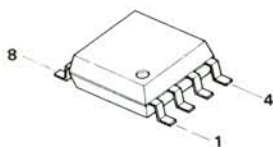
PIN ASSIGNMENT



BLOCK DIAGRAM



Main Unit(Q1025)MC12022SLAD  
Low-Power Two-Modulus Prescaler



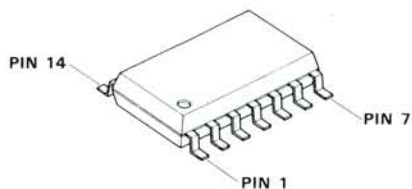
Pin 1:In Pin:Gnd  
Pin 2:Vcc Pin:MC  
Pin 3:sw Pin:NC  
Pin 4:Out Pin:In

PIN ASSIGNMENT

MAXIMUM RATINGS

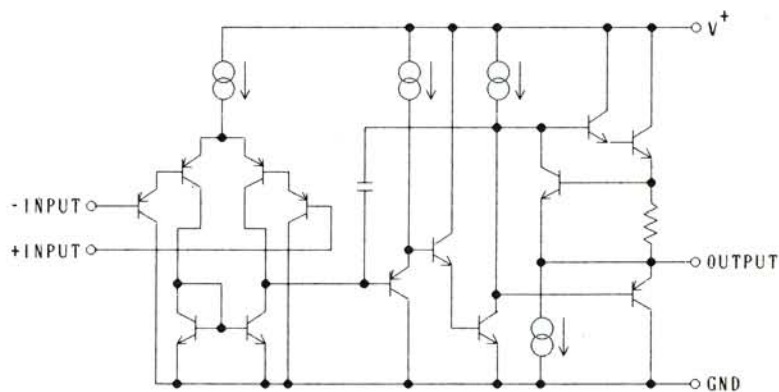
Characteristic	Symbol	Range	Unit
Power Supply Voltage, Pin 2	Vcc	-0.5 to +7.0	Vdc
Operating Temperature Range	T <sub>A</sub>	-40 to +85	°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +150	°C
Modulus Control Input, Pin 6	MC	-0.5 to +6.5	Vdc

Control Unit(Q2005,2007,2008,2009,2011)NJM2902M  
QUAD Single-Supply Operational Amplifier



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

PIN ASSIGNMENT

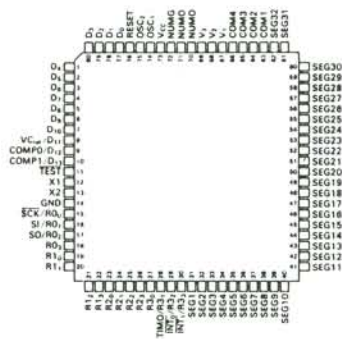


BLOCK DIAGRAM

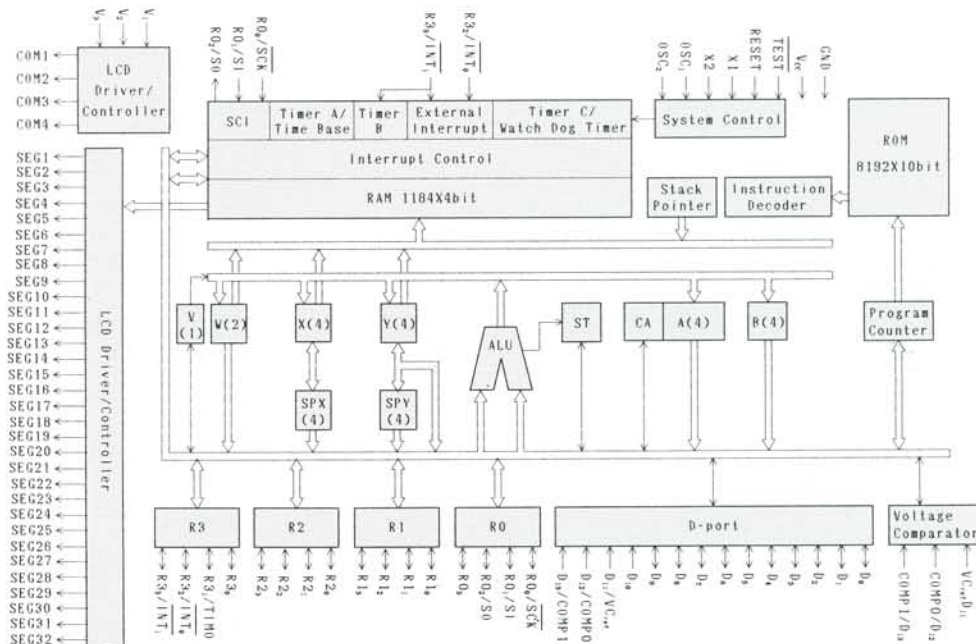
MAXIMUM RATINGS

Rating, Symbol	Value
DC Supply Voltage, V <sup>+</sup>	32V (V <sup>+</sup> / V <sup>-</sup> ±16V)
Input Voltage, V <sub>i</sub>	-0.3 ~ +32V
Power Dissipation, P <sub>d</sub>	300mW
Operating Temperature Range, T <sub>opr</sub>	-40 ~ +85°C
Storage Temperature Range, T <sub>stg</sub>	-50 ~ +125°C

Control Unit(Q2009)HD404808A30H  
Microprocessor

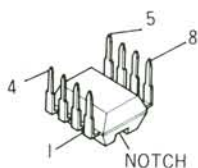


PIN A SSIGNMENT



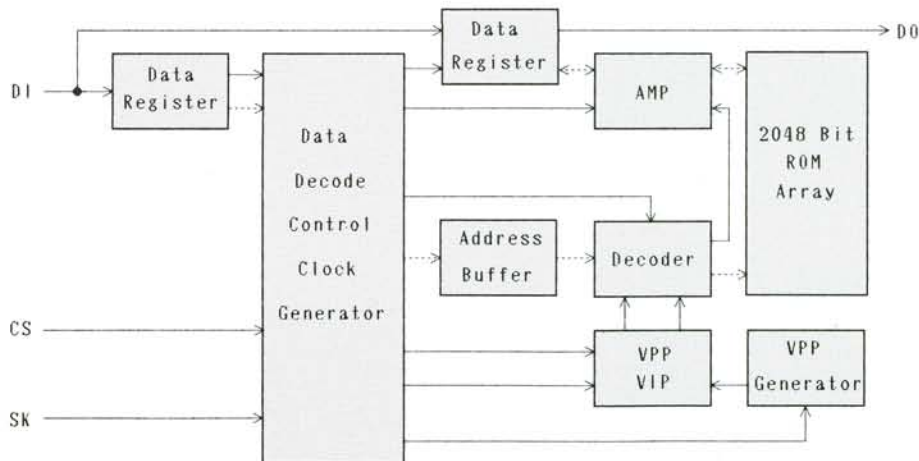
BLOCK DIAGRAM

Control Unit(Q2017)BR93C56  
128 X 16Bit Serial EEPROM



Pin 1:CS Pin 5:GND  
Pin 2:SK Pin 6:NC  
Pin 3:DI Pin 7:NC  
Pin 4:DO Pin 8:Vcc

PIN A SSIGNMENT



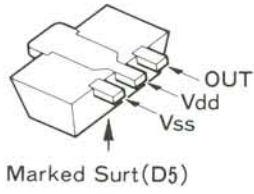
BLOCK DIAGRAM

MAXIMUM RATINGS

Rating, Symbol	Value
Input Voltage, Vcc	-0.3~6.0[V]
Output Voltage, Vout	-0.3~Vcc+0.3[V]
Power Dissipation, Pd	500[mW]
Operating Junction Temperature Range, Topr	-20~70[°C]
Storage Temperature Range, Tstg	-65~125[°C]

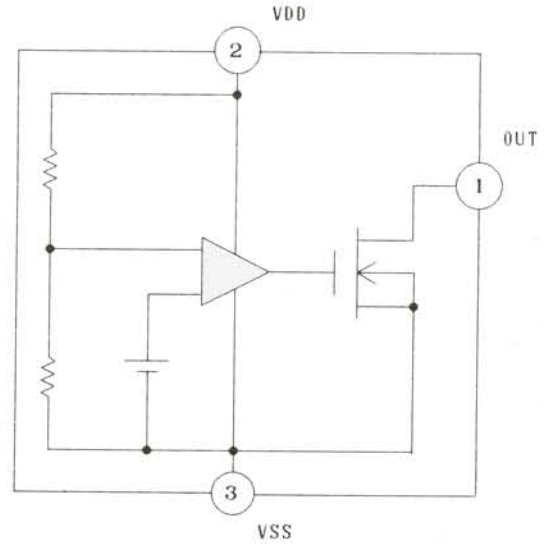


Control Unit(Q2021)RH5VA32AA  
Voltage Detector IC



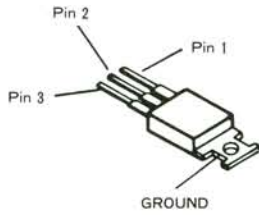
MAXIMUM RATINGS

Rating, Symbol	Value
Input Voltage, Vdd-Vss	12[V]
Output Voltage, Vout	$V_{ss} - 0.3 \sim V_{dd} + 0.3$ [V]
Output Current, Iout	70[mA]
Power Dissipation, Pd	300[mW]
Operating Junction Temperature Range, Topr	-30 ~ +80[°C]
Storage Temperature Range, Tstg	-40 ~ +125[°C]
Detector Voltage, Vdet	3.12 ~ 3.28[V]



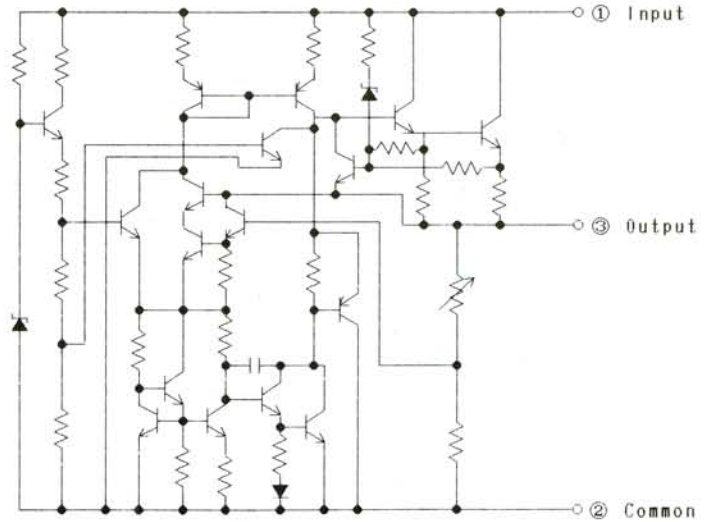
BLOCK DIAGRAM

Control Unit(Q2023)HA17805P  
3-terminal Fixed Voltage Regulator



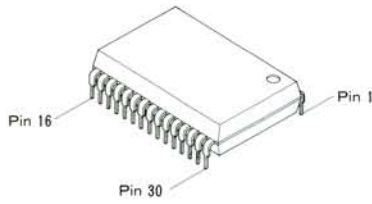
Pin 1: Input  
Pin 2: Gnd  
Pin 3: Output

PIN ASSIGNMENT



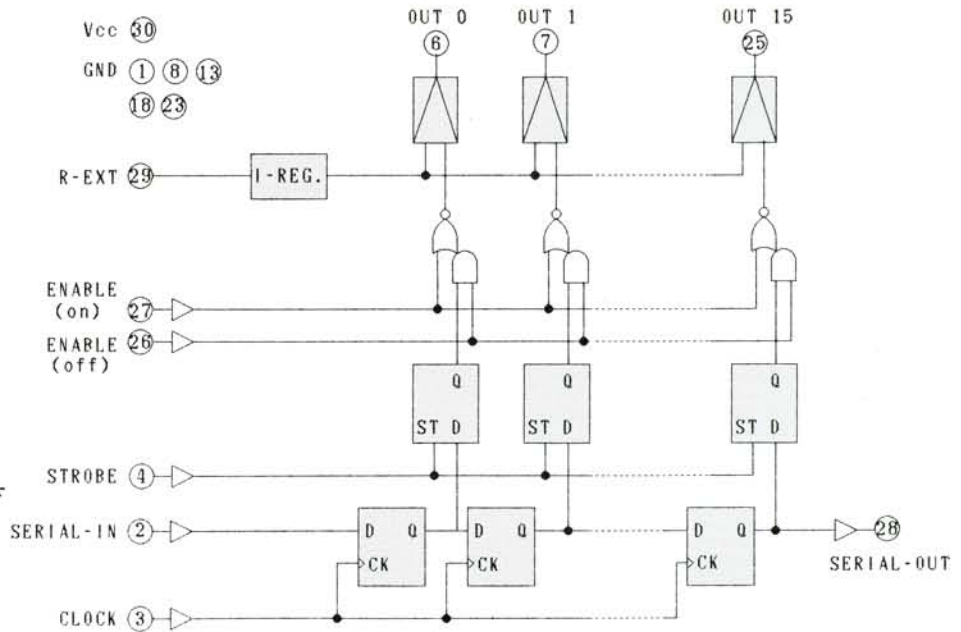
SCHEMATIC DIAGRAM

Display Unit(Q101)TD62C850N  
16 Bit Shift Register/Latch/C-C-Driver



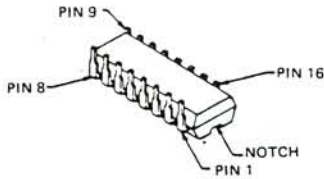
Pin 1:L-GND	Pin 16:OUT 8
Pin 2:SERIAN-IN	Pin 17:OUT 9
Pin 3:CLOCK	Pin 18:P-GND
Pin 4:STOBE	Pin 19:OUT 10
Pin 5:NC	Pin 20:OUT 11
Pin 6:OUT 0	Pin 21:OUT 12
Pin 7:OUT 1	Pin 22:OUT 13
Pin 8:P-GND	Pin 23:P-GND
Pin 9:OUT 2	Pin 24:OUT 14
Pin 10:OUT 3	Pin 25:OUT 15
Pin 11:OUT 4	Pin 26:ENABLE-OFF
Pin 12:OUT 5	Pin 27:ENABLE-ON
Pin 13:P-GND	Pin 28:SERIAL-OUT
Pin 14:OUT 6	Pin 29:R-EXT
Pin 15:OUT 7	Pin 30:V <sub>DD</sub>

PIN A SSIGNMENT



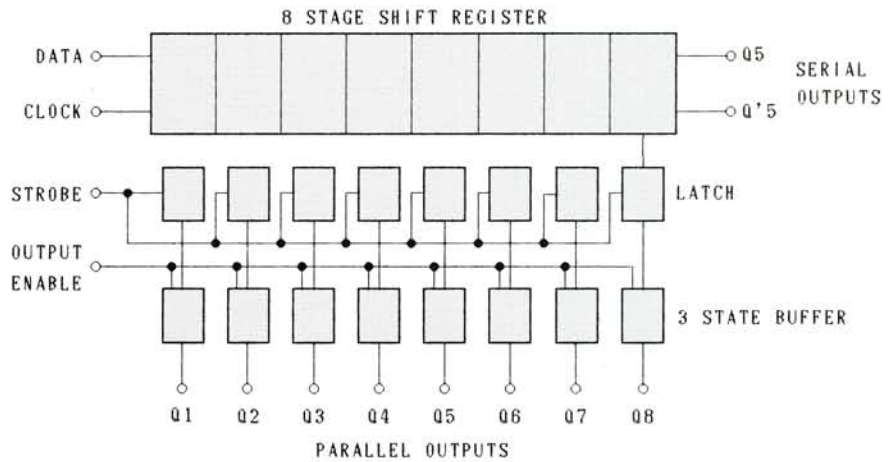
BLOCK DIAGRAM

Display Unit(Q201)μPD4094BC  
8 Stage Shift/Store Bus Register



Pin 1:Strobe	Pin 9:Qs
Pin 2:Data	Pin 10:Q's
Pin 3:Clock	Pin 11:Q8
Pin 4:Q1	Pin 12:Q7
Pin 5:Q2	Pin 13:Q6
Pin 6:Q3	Pin 14:Q5
Pin 7:Q4	Pin 15:Output Enable
Pin 8:V <sub>SS</sub>	Pin 16:V <sub>DD</sub>

PIN A SSIGNMENT



BLOCK DIAGRAM



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# YAESU

*Performance without compromise*

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