

PERFORMANCE SPECIFICATIONS

Frequency Stability	HSO ± 30 ppb From -30 to $+60^{\circ}\text{C}$ Ambient (Ref 25°C) ± 300 ppb Long Term Aging UHSO ± 2 ppb From -30 to $+60^{\circ}\text{C}$ Ambient (Ref 25°C) ± 40 ppb Long Term Aging
Supply Voltage Requirements	$+13.8\text{ V dc} \pm 20\%$
Supply Current Drain	1925 mA, max.
Spurious and Harmonic Emissions	More than 85 dB below carrier (or station spec)
FM Noise with EIA Pre-emphasis	55 dB
DC Deviation Range at F_c	$\pm 3\text{ kHz}$ to $\pm 5\text{ kHz}$
Data Deviation Range at F_c	$\pm 3\text{ kHz}$ to $\pm 5\text{ kHz}$
Data Rise Fall Time	Less than 160 usec
RF Output	0.5 V p-p (loaded by Uniboard)

PAGING SYNTHESIZER INTERFACE REQUIREMENTS

HSO Power Supply Input Voltage	13.8 V dc $\pm 20\%$
HSO Power Supply Output Voltage	12.00 $\pm .25\text{ V}$
HSO Power Consumption	13.5 watts, max. (11 watts nominal)
Synthesizer Board Supply Voltage	13.8 V dc $\pm 20\%$
Synthesizer Board Current Drain	800 mA max.
HSO/UHSO RF Level	More than 0.5 V rms @50 ohms
Synthesizer RF Output Level	More than 0.5 V rms loaded by Uniboard
Data Levels	"1" -- More than 4 V "0" -- Less than 0.7 V
Data Enable Levels	Enable -- More than 7 V Disable -- Less than 0.7 V
Loop Connect Loop Connected Loop Broken	7 V Less than 1 V, $I_{\text{SINK}} 1\text{ mA}$

1. GENERAL DESCRIPTION

Standard paging stations are equipped with an HSO synthesizer. Table 1 shows the model breakdown of all synthesizer chassis'. A UHSO synthesizer is also available and offers increased frequency stability for tone and voice paging applications. Synthesizer board TRN7408A can be used in any *PURC 5000* paging base station provided the jumpers are correctly positioned. Refer to Table 2 for HSO/UHSO option descriptions and jumper position information. The synthesizer also provides high stability by phase locking to 1 MHz, 5 MHz (standard),

or 10 MHz high stability references. Refer to Table 3 for reference input information.

The paging synthesizer provides a NRZ-FSK modulated rf signal to the uniboard located in the rf tray. This digital modulation is made possible by the technique of dual port modulation where dc and low frequency data components are controlled by the data modulation circuitry. The higher frequency components of modulation ($>1\text{ Hz}$) are accommodated by direct Frequency Modulation (FM) of the synthesizer's VCXO Channel Element. The paging synthesizer block diagram and schematic should be referred to in the following descriptions.

Table 1. Tanapa Breakdown

ITEM AND DESCRIPTION								
Kit No.	TKN8631A Cable HSO	TRN5058B Rgltr Bd	TRN7243A Hdw UHSO	TRN7244A Hdw UHSO	TRN7408A Synzer Bd	TRN7568A Hdw HSO	TRN7569A Hdw HSO	TRN9812B HSO/UHSO PS
TLD2781C	X	X		X	X			X
TLD2782C	X	X		X	X			X
TLD3000C	X	X		X	X			X
TLD3121A	X	X			X	X		X
TLD3122A	X	X			X	X		X
TLD3130A	X	X			X	X		X
TLE2621A	X	X	X		X			X
TLE2622A	X	X	X		X			X
TLE2631A	X	X			X		X	X
TLE2632A	X	X			X		X	X
TLF1402D	X	X	X		X			X
TLF1650A	X	X			X		X	X

Table 2. Jumper Positions

Band (MHz)	Tanapa (STND)	Tanapa (OPTN)	JU1	JU2	JU3	JU4	JU5	JU6	JU7	JU8	JU9	JU10	JU11	CE1
VHF I 132–158	TLD3121A HSO	TLD2781C UHSO C777BE	NC	A	A	NC	A	A	B	B	B	B	B	KXN1019B
VHF II 146–174	TLD3122A HSO	TLD2782C UHSO C777BF	NC	A	B	NC	A	B	B	B	B	B	B	KXN1019B
280 276–284	TLD3130A HSO	TLD3000C UHSO C777BG	A	A	A	A	A	A	A	B	A	B	B	KXN1019B
UHF I 403–435	TLE2631A HSO	TLE2621A UHSO C777BH	A	B	A	A	B	A	A	B	A	B	B	KXN1052B
UHF II 435–512	TLE2632A HSO	TLE2622A UHSO C777BH	A	B	B	A	B	B	A	B	A	B	B	KXN1052B
900 928–960	TLF1402D UHSO	TLF1650A or C306AK	B	B	B	B	B	B	A	B	A	B	A	KXN1052B

Table 3. Reference Input

Reference Input	JU12	JU13	JU14	JU15	JU16	ACB HS REF
1 MHz	NC	IN	IN	OUT	A	100 kHz
5 MHz	B	OUT	IN	OUT	A	500 kHz
10 MHz	A	OUT	OUT	IN	A	100 kHz

NOTE: A 5 MHz reference input is standard. JU13–JU15 are zero ohm chip resistors. The reference loop is disconnected when JU16 is in position "B".

2. FUNCTIONAL BLOCK DESCRIPTIONS

2.1 9.6 V AND 5 V REGULATORS (TRN5058B)

The 9.6 V regulator consists of a series pass transistor (Q400) which is driven by regulator IC U400. Regulated 9.6 V is provided to all analog and RF circuits, and is derived from the station A+ supply. (Typically 13.6 V dc).

The 5 V regulator is supplied from the regulated 9.6 V dc supply and provides regulated 5 V dc to the logic circuits requiring 5 V dc. The 5 V regulator consists of a 3-terminal integrated circuit (U401).

2.2 REFERENCE AMPLIFIER AND SWITCH (Q1, Q2) (TRN7408A)

The reference amplifier and switch amplify and shape the high stability oscillator signal to the proper level and shape for application to U2.

2.3 REFERENCE DIVIDER (U4, U2)

The reference divider divides the high stability oscillator frequency down to 100 kHz for use in phase locking U1, the 14.4 MHz oscillator. HSO/UHSO frequencies of 1 MHz, 5 MHz, or 10 MHz can be programmed by setting the status of JU12 through JU15.

2.4 REFERENCE PHASE DETECTOR (U7)

One section of U7, a quad exclusive-or gate is used as a phase detector. The output consists of pulses at 200 kHz (twice the input frequency) having a duty cycle dependent on the phase error between the two input signals.

2.5 REFERENCE LOOP FILTER (Q19 ETC.)

Q19 amplifies the output pulses of U7 to approximately 8 volts peak-to-peak. R17, C11, R13, C15 form an integrator which recovers the dc value of Q19's output pulses for use in controlling the frequency of U1 (the 14.4 MHz VCXO).

2.6 14.4 MHZ VCXO (U1)

U1 is the VCXO which is phase-locked to the HSO/UHSO. Its output (after amplification, etc.) is used to provide one of the phase detector (U7) inputs and to provide an input to the reference modulator.

2.7 REFERENCE LOOP AMPLIFIER (Q21, Q20, Q22)

This amplifier amplifies and shapes the output signal of U1 to the proper logic level for application to U5 and U31.

2.8 REFERENCE LOOP DIVIDER (U5, U6)

U5 and U6 divide the output frequency of Q22 by 144, to produce the 100 kHz signal to phase detector U7 which is compared in phase to the 100 kHz derived from the HSO/UHSO.

2.9 REFERENCE MODULATOR (PULSE INSERTER/BLANKER) (U30, U31, U32, U33)

This circuit frequency modulates Q22's output signal to the "one" and "zero" frequencies upon command of the pulse insertion blanking oscillator dividers U40 through U45.

Pulse insertion results in positive deviation by inserting extra pulses into the 14.4 MHz pulse train at the appropriate rate; this takes place in U32-B.

Pulse blanking, similarly, creates negative deviation by blanking pulses from the 14.4 MHz pulse train at the appropriate rate. This action takes place in U31D and U32D.

Pulse insertion is selected upon command by a data enable and a data "one".

Pulse blanking is selected upon command by a data enable and a data "zero". The appropriate rate of insertion or blanking is determined by:

$$R = \frac{\text{Deviation (Hz)} \times 14.4 \text{ (MHz)}}{\text{Carrier Frequency (MHz)}}$$

The frequency modulated 14.4 MHz is further divided by two to 7.2 MHz in U33 (input pin 11, output pin 9) and serves as the reference input for the main synthesizer loop phase detector U155.

2.10 PULSE INSERTION OSCILLATORS AND DIVIDERS (U60 AND U40-U45)

U60 is a dual timer which serves as two independently settable R-C oscillators. The outputs are frequency divided by U40 through U45 to obtain the pulse insertion and blanking rates mentioned in Paragraph 2.9. These are necessary for (+) and (-) data deviation of the 14.4 MHz signal. R90 and R91 are precision potentiometers for setting the "1" and "0" or (+) and (-) deviations respectively. To obtain the proper deviations, jumpers JU1 through JU11 must be properly installed to set the divider ratios.

The proper U60 output signal is selected by Q53, or Q51 in response to a data "1" or "0" respectively.

Data enable is transformed by Q74 into pulse insertion enable which enables U40 through U45 to divide the pulse inserting/blanking oscillator frequency prior to application to U30 and U33.

2.11 MAIN LOOP DIVIDER IC (U155), ROM (U100)

U155 is used to divide the 7.2 MHz reference input (pin 2) to 2.0833 kHz at the output (pin 5). U155 also divides the 14.4 MHz from CE1 (main loop oscillator) down to 2.0833 kHz (input pin 25; output pin 9). A $\pm 63/\pm 64$ prescaler, internal to U155, is driven by Q130. ROM U100 contains the data required to program U155 to divide the reference input from Q130 to obtain the 2.0833 kHz output. U155 provides an address input (A0–A2) to U100 and reads the data stored in U100 through the data lines (D0–D3).

2.12 SAMPLE AND HOLD PHASE DETECTOR (U150)

Phase detector U150 compares the phase of the loop output and reference output signals from U155 and generates an output on pin 15 that ultimately (after filtering and amplification) controls the frequency of channel element CE1.

2.13 LOOP DC AMPLIFIER (U180A), LOOP FILTER(S) (U170D), AND LOOP SUMMER (U170C)

U180A is a DC amplifier which amplifies the output of U150 and applies it to the loop filter.

The loop filter is composed of R183, R182, C181, C183 and C184. It is a standard lead-lag filter and results in a closed loop band-width of about 2–10 Hz with a damping factor of about 0.65. These parameters determine that the cross-over frequency between pulse insertion/blanking modulation and modulation summed in this loop is approximately 2–10 Hz.

The loop summer (U170D) adds binary modulation to the loop DC control voltage and amplifies the data amplitude by a factor of 2.

Following this is a 3 kHz passive RC low pass filter which has no effect on the DC control voltage, but shapes the data modulation to prevent excessive modulation side-band splatter. This filter consists of R176, R175, R174, C171, C172, C173, and is buffered by unity gain amplifier U170B.

U170A is the loop amplifier which has a voltage gain of two. Its output is applied directly to the Channel Element CE1 modulation port (pin 4) which not only controls the channel element frequency so that it is phase locked to the 7.2 MHz output of the pulse inserter/blanker, but also directly frequency modulates it with splatter-filtered data.

2.14 CHANNEL ELEMENT (CE1)

CE1 serves as the VCXO in the main synthesizer loop, and provides an output signal to the uniboard (reference frequency input).

2.15 BUFFER/SWITCH (Q201, Q202, CR200, CR201)

Q201 and Q202 buffer the output of CE1 to prevent loading by the coaxial cable used to connect it to the uniboard. CR250 and CR201 are PIN diodes used in a series-shunt RF switch to greatly attenuate the signal delivered to the uniboard if the synthesizer is unlocked. The output of the synthesizer (Q201 and Q202 emitters) is the frequency reference for the uniboard phase lock loop.

2.16 FREQUENCY BUFFERS (Q190, Q130)

Q190 is a unity gain amplifier that buffers the output of CE1 for loop feedback. The output signal of Q190 is limited in amplitude by CR130 and CR131 and buffered by Q130 before being applied to U155 (loop input PIN 25).

2.17 PHASE-LOCK CONNECT SWITCH (U120A, B & C)

During alignment of the data modulator, the PLL connect line is pulled low creating two conditions.

The input to the loop filter is switched from the phase-detector output to a constant 4.8 volts. This condition enables DC-coupling of the data modulator to CE1.

The RF pin diode switch is activated and the out-of-lock LED is disabled, regardless of the state of the lock detect circuit.

2.18 LOSS-OF-LOCK DETECTOR (U110, U115, ETC.)

The loss-of-Lock Detector consists of two loss-of-lock detectors which are a reference loop detector and a main loop detector. The outputs of these are combined in U115A and C, DC-amplified by Q103, stored in delay capacitor C102, and used to inhibit transmitter keying by Q101 in the event of loss-of-lock. The delay time constant C102, R109 serves to prevent transmission during acquisition of lock or other transient or oscillatory conditions. Q100 drives DS1 which provides a visual indication of out-of-lock.

The following conditions indicate service is required.

Condition	Remarks
U1 Pin 7 > 3.5 V dc	Loss of HSO signal or misalignment.
U1 Pin 7 oscillating from 0 V to 8 V	HSO not warmed up or defective, possible misalignment.
U180 Pin 1 < 2.5 V	Main loop out-of-lock or misaligned.
U180 Pin 1 > 8.5 V	Main loop out-of-lock or misaligned.

U1 pin 7 is compared to a reference via U110A while U180 pin 1 is compared by U110B & C. A Hi output from U110A, U110B, U110C indicates an out-of-lock condition.

2.19 DATA MODULATOR (Q60–62, Q70–74)

The Data Modulator performs two functions:

- Translates data levels to precise peak voltage levels necessary for modulation of the main synthesizer loop.
- Switches the binary modulation on or off depending upon the voltage level of data enable (high or low respectively).

Q71, 70, 62, 61 and 60 perform the first function by switching R92 or R93 to a fixed high level voltage (data "1") or a fixed low level voltage (data "0"), respectively. R92 or R93 are switched by either Q61 or Q60, but not by both simultaneously. The resistance setting of R92 or R93 along with fixed resistors R68, R65 and R265 determine the voltage amplification of op amp U50B for the data levels.

The circuit composed of Q74, 73, and Q72 gates the data into U50 and resets the pulse dividers U40–45, at the end of the binary mode. Data enable goes high at the beginning of a binary message.

3. SUMMARY

The synthesizer allows digital (binary) modulation of a PURC 5000 Transmitter. It not only provides dc modulation capability, but high stability at the same time. High frequency stability is necessary especially for simulcast system applications.

4. ALIGNMENT PROCEDURE

4.1 GENERAL

Monitor the transmitter output frequency with a frequency counter of adequate accuracy (typically, accurate to ± 1 Hz). The transmitter modulation should be monitored using a Motorola Service Monitor (R1200) with Deviation meter and oscilloscope, or equivalent.

4.2 HIGH/ULTRA HIGH STABILITY OSCILLATOR (HSO/UHSO)

The High Stability Oscillator should be allowed to warm up for at least 30 minutes before proceeding with the alignment procedure. This is necessary for the oven in the oscillator to reach its operating temperature. The adjustment of the HSO frequency should be made following the procedure outlined in paragraph 4.4 and again following the entire procedure, if necessary.

4.3 FREQUENCY ADJUST CIRCUITRY THEORY

The ovenized oscillator supplies $+V_{ref}$ (= 6 V for UHSO, 5.1 V for HSO) and ground reference lines to the EEPOT (U1) located on the HSO/UHSO Power Regulator board (TRN9812B). The EEPOT forms a voltage divider of 100 equal steps with an electronic wiper (controlled by the wattmeter board). This voltage divider provides a frequency steering voltage back to the HSO/UHSO. A change of ± 1 step on the DW/DL display is equivalent to approximately ± 1.5 ppb ($\pm 1.5 \times 10^{-9}$) change in frequency for the Ultra High Stability Oscillator and ± 4.5 ppb for the High Stability Oscillator (1/100 of total electronic steering range). See Table 4 for examples of frequency adjust ranges in the different bands.

NOTE

When the HSO/UHSO is oriented with the BNC RF OUT directly to the right of the pins, pin 1 is the lowest pin. Pin numbering increments clockwise. (See Figure 1.)

HSO/UHSO Pin-Out

Pin Number	Connection
1	N/C
2	N/C
3	GND (BLK 0 pin 2 of conn P1 on regulator board)
4	B+
5	N/C
6	N/C
7	VCXO SUPPLY (ORG – pin 3 of P1)
8	VCXO CONTROL (BRN – pin 1 of P1)

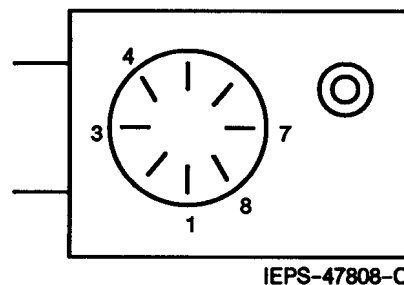


Figure 1. HSO/UHSO Pin-Out

Table 4. Average Frequency Change Per Step

Band	Minimum Change For Single Step		Average Change For Single Step		Average Change For 100 Steps (± 50 Steps)	
	UHSO	HSO	UHSO	HSO	UHSO	HSO
VHF (150 MHz)	0.15 Hz	0.45 Hz	0.225 Hz	0.90 Hz	22.50 Hz	90 Hz
280 MHz	0.28 Hz	0.84 Hz	0.420 Hz	1.68 Hz	42.0 Hz	168 Hz
UHF (450 MHz)	0.45 Hz	1.35 Hz	0.675 Hz	2.70 Hz	67.50 Hz	270 Hz
900 MHz	0.90 Hz	2.70 Hz	1.350 Hz	5.40 Hz	135.0 Hz	540 Hz

4.4 14.4 MHZ VOLTAGE CONTROLLED CRYSTAL OSCILLATOR (VCXO)

(Refer to the Synthesizer Circuit Board Details for alignment and test point locations)

Adjust U1 warp coil for $1.5 \text{ V} \pm 0.1 \text{ V}$ dc at Test Point 1 (junction of C131 and R1). A high resistance (11 Meg-ohm) voltmeter (R1002 or equivalent) must be used at this point.

4.5 CHANNEL ELEMENT (CE1)

(Refer to the Synthesizer Circuit Board Details for alignment and test point locations)

Step 1. Use position "0" of the *PURC 5000* TEST switch.

Step 2. Set CE1 warp capacitor (if not previously adjusted) for $4.7 \text{ V} \pm 0.3 \text{ V}$ dc at Test Point 2 (junction of R190 and C190). Again, a high resistance voltmeter must be used. See top of chassis cover (and circuit board detail) for locations of adjustment.

Step 3. Perform adjustment of high stability oscillator, digital modulator (+Dev and -Dev), and data modulator (+Dev and -Dev) as described in the Alignment section of the Installation/Operation manual.

4.6 OUT-OF-LOCK CHECK

Step 1. Remove power to the synthesizer (or to the station).

Step 2. Reapply power to the synthesizer (or the station). The Out-of-Lock lamp should remain lit for 5 to 20 seconds, if *PURC 5000* TEST switch is in "0" position.

Step 3. The station should not be capable of being keyed while the Out-of-Lock lamp is lit.

5. TROUBLESHOOTING CHART

Symptom	Possible Causes/Solution
1. No RF Output	1. Out-of-lock detected. 2. Q201, Q202 is bad. 3. CR200 is open or CR201 is shorted.
2. Out-of-lock (Main Loop)	1. Bad ROM (U100). 2. Defective Loss-of-Lock Detector circuit.
3. Out-Of-Lock (Reference Loop)	1. U1 not properly tuned. 2. Defective U1. 3. JU12-JU16 improperly installed. 4. Loss of HSO signal (external ref.). 5. Defective amplifier (Q1, Q2). 6. Defective Loss-of-Lock Detector circuit.
4. Distorted Binary Modulation	1. Pulse inserting/blanking not properly set; (adjust R90 for a logic "1" and R91 for a logic "0"). 2. Data Modulator not properly set (R92 and R93), or defective. 3. JU1-JU11 improperly installed. 4. Defective amplifier (Q20, 21, 22). 5. Defective oscillator (U1), etc. 6. Defective (U170). 7. Instantaneous deviation not properly set. 8. Pulse inserting/blanking, data modulation and instantaneous deviation must all be set for the same amount of deviation.
5. Mode Change transients (Binary to voice, etc.)	1. Modulation not properly set or defective. 2. Instantaneous deviation not properly set.
6. Carrier Frequency in error.	1. Defective U100. 2. Defective U155. 3. Defective program stored in U100.

6. OPERATIONAL TESTS

6.1 REGULATORS

Check for $9.6 \text{ V DC} \pm .5 \text{ V}$, and $5 \text{ V DC} \pm .1 \text{ V}$.

6.2 REFERENCE LOOP

Need working HSO/UHSO.

- 100 kHz TTL signal at U7 pin 2
- 100 kHz TTL signal at U7 pin 1
- 14.4 MHz TTL signal at Q22 collector
- U1 steering line (U1 pin 7) set for +1.5 VC (no AC)

6.3 MAIN LOOP

Need working reference loop & input signal, & Channel Element.

- 7.2 MHz TTL signal at U155 pin 2
- 14.4 MHz at U155-25 of 225 mV rms approx.
- 2.083 kHz square wave at U150 pin 2 (4 V p-p)
- 2.083 kHz pulses (2.8 V p-p) at U150 pin 23
- 2.083 kHz truncated ramp at U150 pin 24 (≥ 1.4 V)
- $3\text{ V} \leq V_{U150-15} \leq 8\text{ V}$ (no AC)
- $3\text{ V} \leq V_{CE1-4} \leq 6\text{ V}$ (no AC)

- RF out (ON) 600 mV p-p (loaded) typical
- RF out (OFF) 6 mV p-p typical

6.4 PULSE INSERTING CIRCUIT

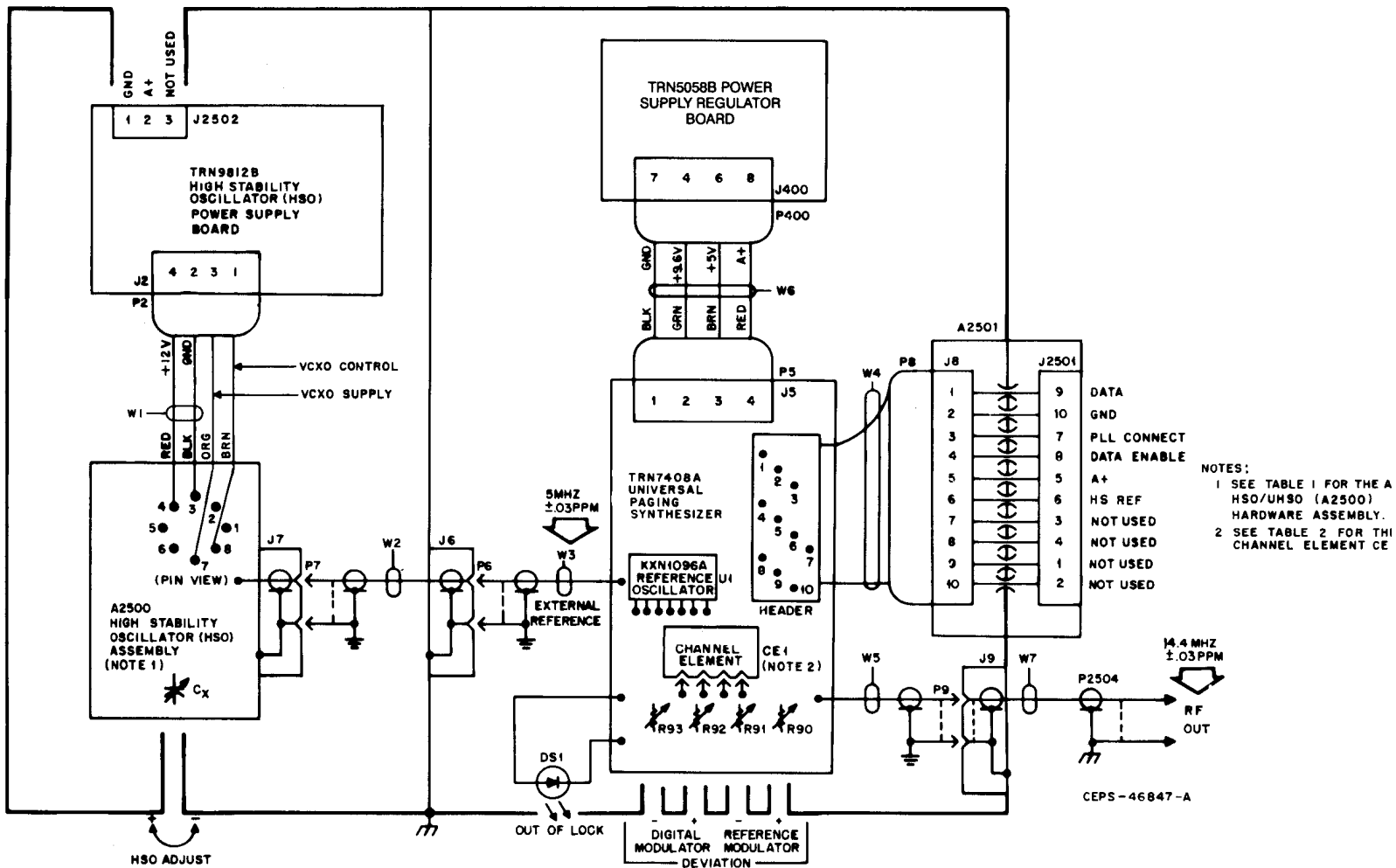
Need all of the above, and *PURC 5000* TEST switch position #5, 4 for Data = 0,1 respectively.

- Approx. 12 kHz at 4 V p-p at U19 pin 14 (Data = "0")
- Approx. 12 kHz at 4 V p-p at U20 pin 14 (Data = "1")
- $FRFOUT = F_x - (\text{approx. } 4\text{ kHz} \div 1\text{ M})$ (Data = "0")
- $FRFOUT = F_x + (\text{approx. } 4\text{ kHz} \div 1\text{ M})$ (Data = "1")
- $M = \text{Frequency carrier (MHz)} \div 14.4\text{ (MHz)}$

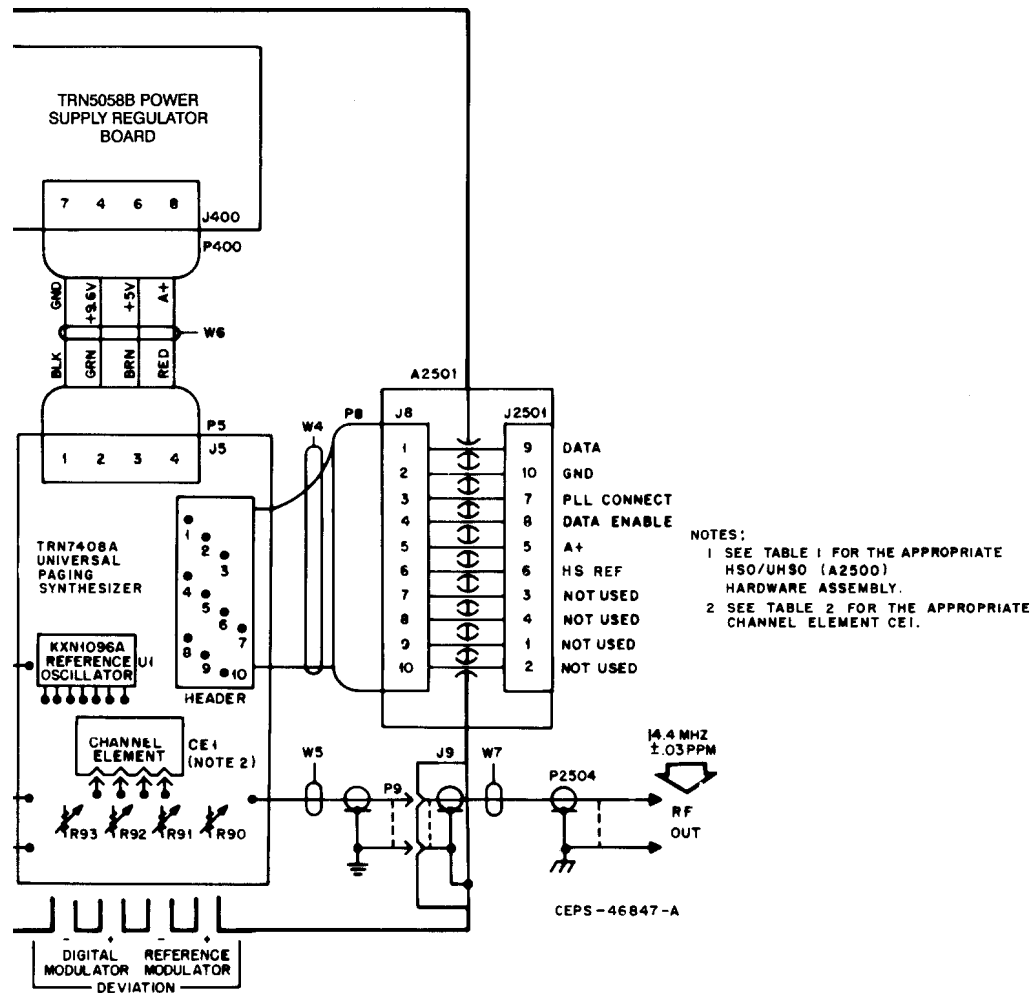
6.5 DATA MODULATOR

Need all of the above, and *PURC 5000* TEST switch position # 8, 7 for Data = 0, 1 respectively.

- $FRFOUT = F_x - (\text{approx. } 4\text{ kHz} - M)$ (Data = "0")
- $FRFOUT = F_x + (\text{approx. } 4\text{ kHz} - M)$ (Data = "1")



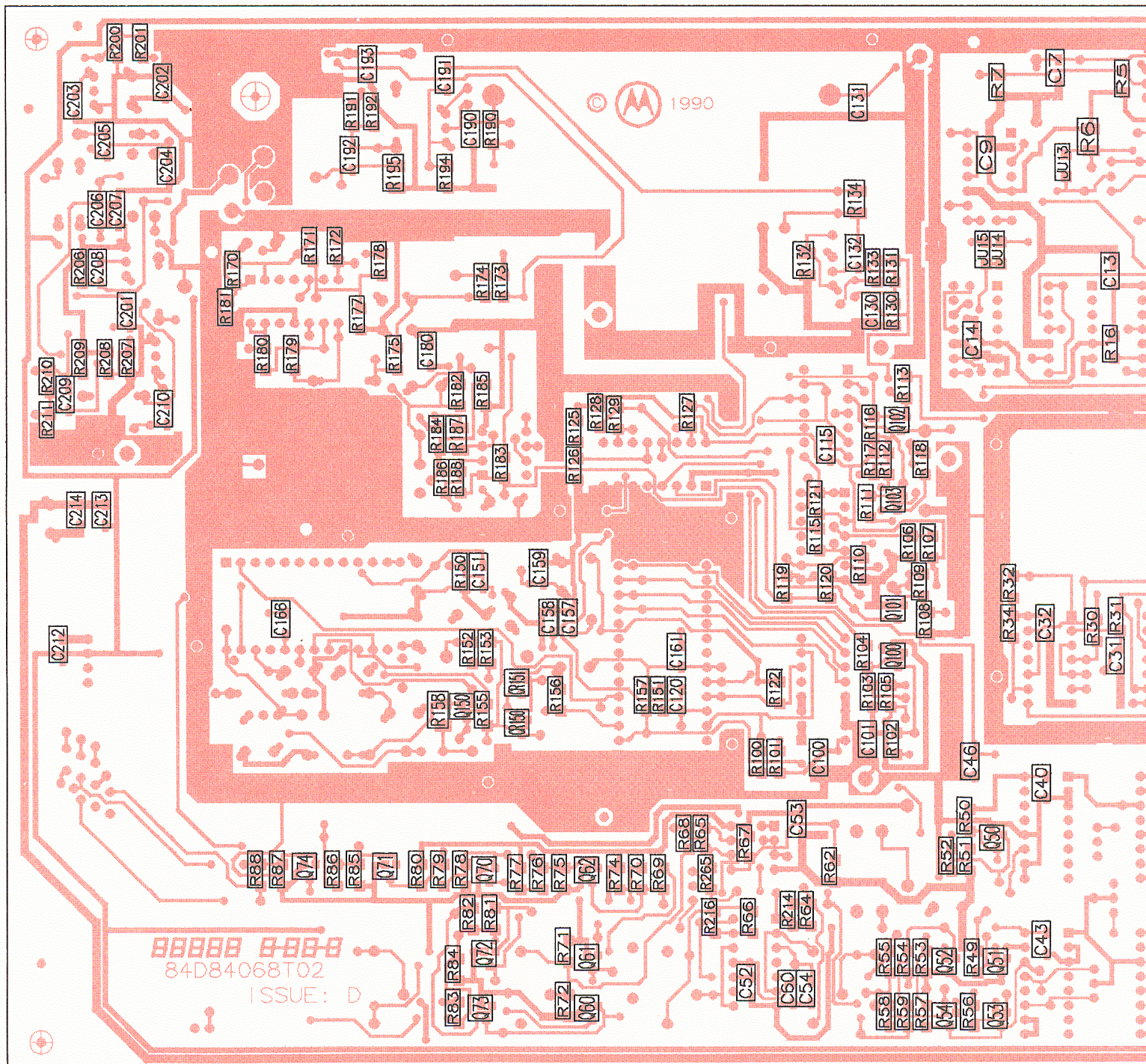
PAGING SYNTHESIZER BLOCK DIAGRAM



HSO/UHSO SYNTHESIZER BOARD

MODEL TRN7408A

CIRCUIT BOARD DETAIL



IESIZER BOARD

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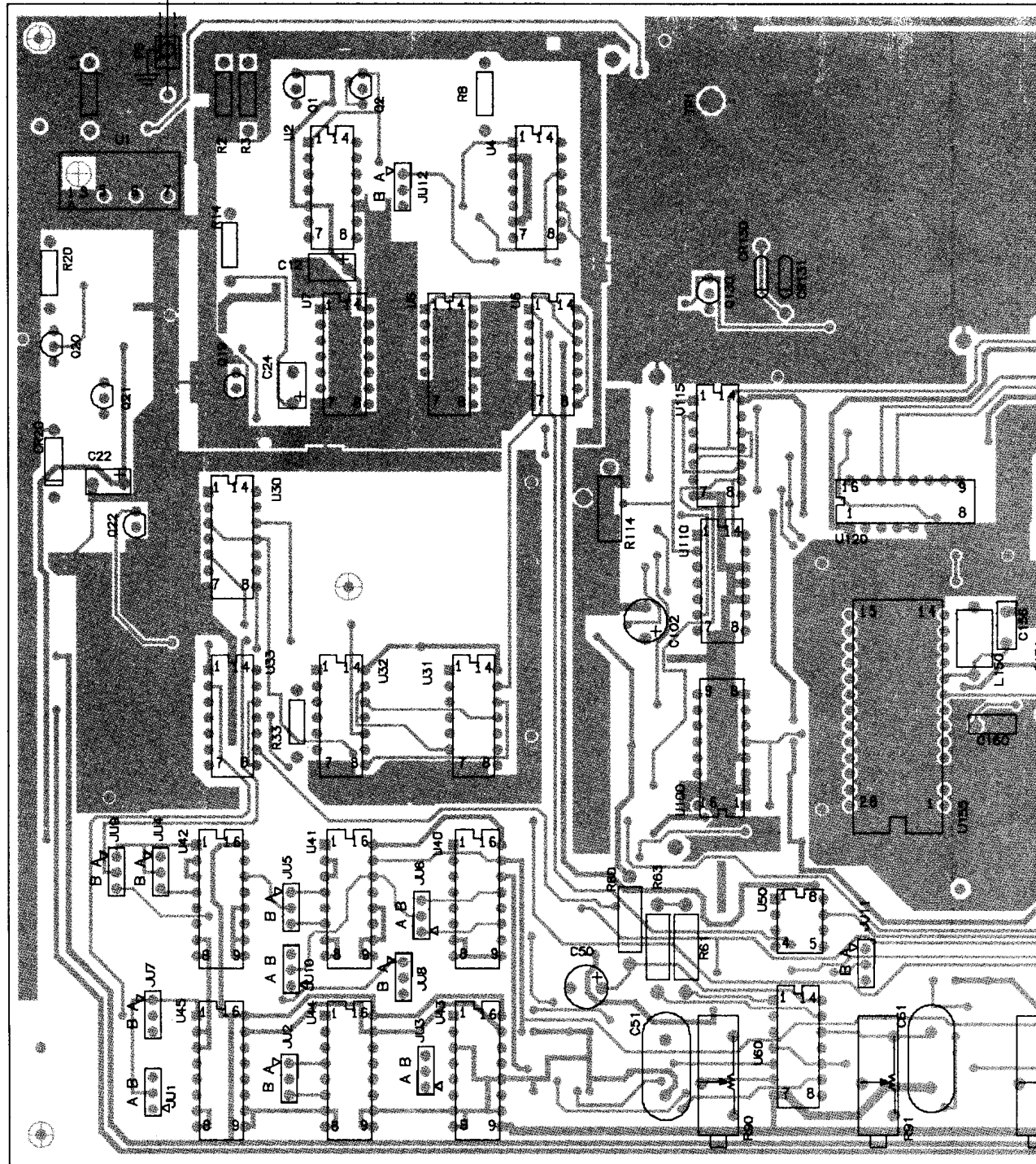
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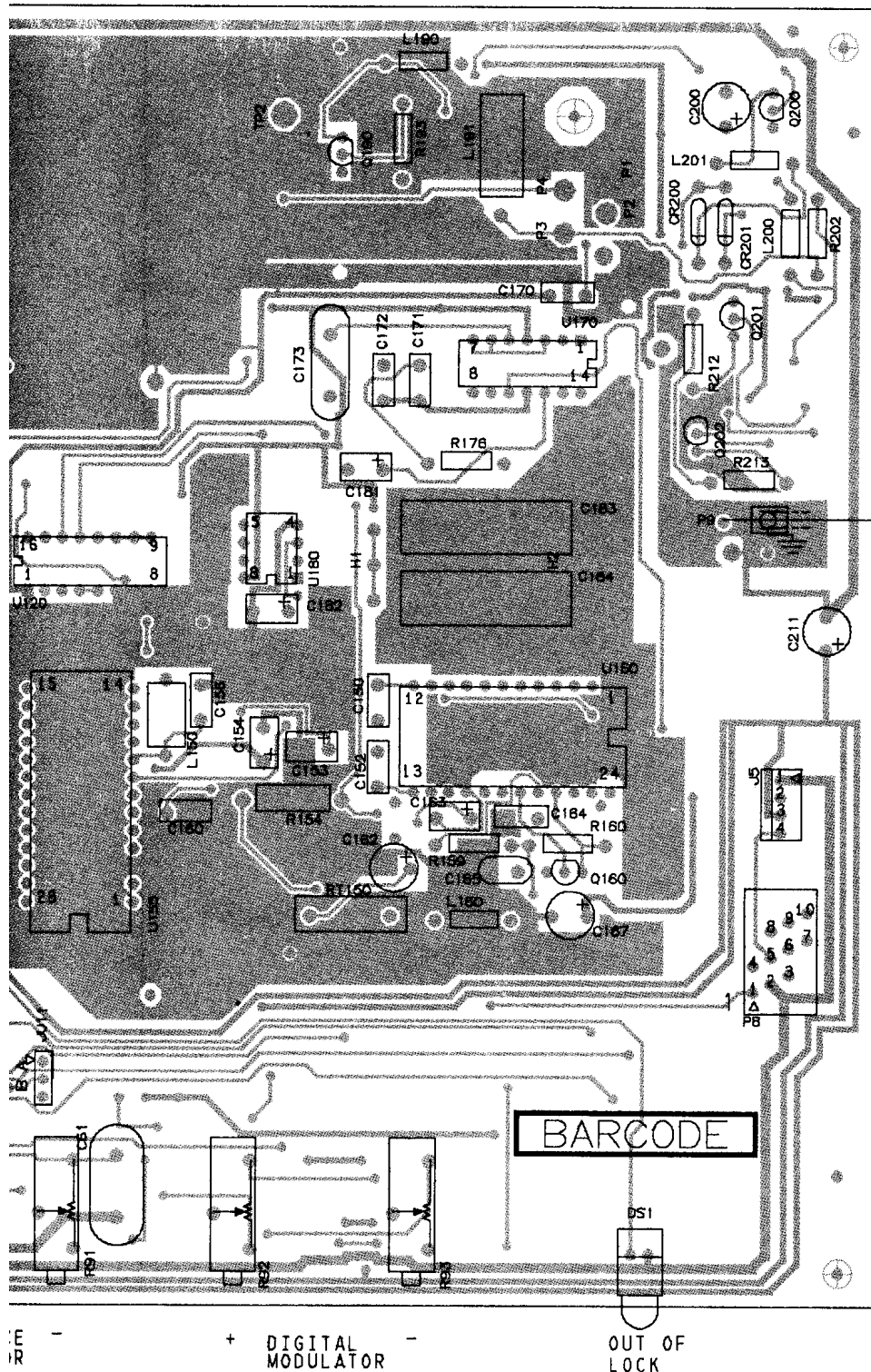
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EXTERNAL
REFERENCE
RF INPUT



+ REFERENCE MODULATOR -



CONNECTOR PIN V1

	01	GND			21	
	02	+9..6V	GND		00	DA
	03	+5V			43	PL
	04	A+	DE		00	
J5			HS_REF		65	A
			NOT USED		87	
			NOT USED		00	NO
					109	NO
					P8	

RF OUT
14.4 MHz

DIODE/TRANSISTOR



CR150-CR151



Q50-Q54 Q100-Q
Q60-Q62 Q150
Q70-Q74

NOTES:

1. Integrated circuits on the board are TTL & CMOS devices.

CAUTION

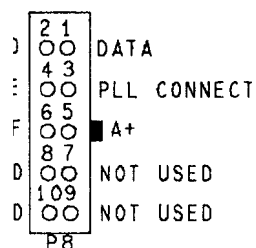
Many of the Integrated circuit devices used in this equipment are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

2. IC types and power connections for this board are provided in the following Table.

3. C1 is mounted on the solder side of the board.

Reference Designation	Type	+ 5 V Pin	+9.6 V Pin	GND Pin	Description
U1	91B01	--	5	1, 6	14.4 MHz Oscillator
U2	61L10	5	--	2, 6, 10	Decade Counter
U4	61L10	5	--	2, 6, 10	Decade Counter
U5, 6	61L85	5	--	6, 7, 10	One divide by 12 Counter
U7	09M79	14	--	7	Quad 2-IN XOR Gate
U30	61L15	14	--	7	Dual Type-D Flip-Flop
U31	27M11	14	--	7	Quad 2-IN NAND Gate
U32	48M23	14	--	7	Quad 2-IN XOR Gate
U33	61L15	14	--	7	Dual Type-D Flip-Flop
U40 thru U45	84L38	16	--	2, 3, 7, 8, 9, 10, 12	Presetable divide by N Counter
U50	29M32	--	8	4	Dual Op-Amplifier
U60	71K76	--	4, 10, 14	7	Dual Timer
U100	25M26	16	--	1, 2, 3, 4, 8, 13, 14, 15	Read Only Memory (ROM)
U110	71K74	--	3	10, 11, 12	Quad Comparator
U115	71K94	14	--	7	Quad 2-IN OR Gate
U120	84L65	16	--	6, 7, 8	Triple 2-Channel Multiplex Switch
U150	77M36	--	14, 18	1, 16	Sample and Hold Phase Detector
U170	29M81	--	4	11	Quad Op-Amplifier
U180	29M32	--	14	4	Dual Op-Amplifier

OR PIN VIEWS



INSISTOR DETAILS



TOP DETAIL



Q100-Q103

Q150

Q1-Q2

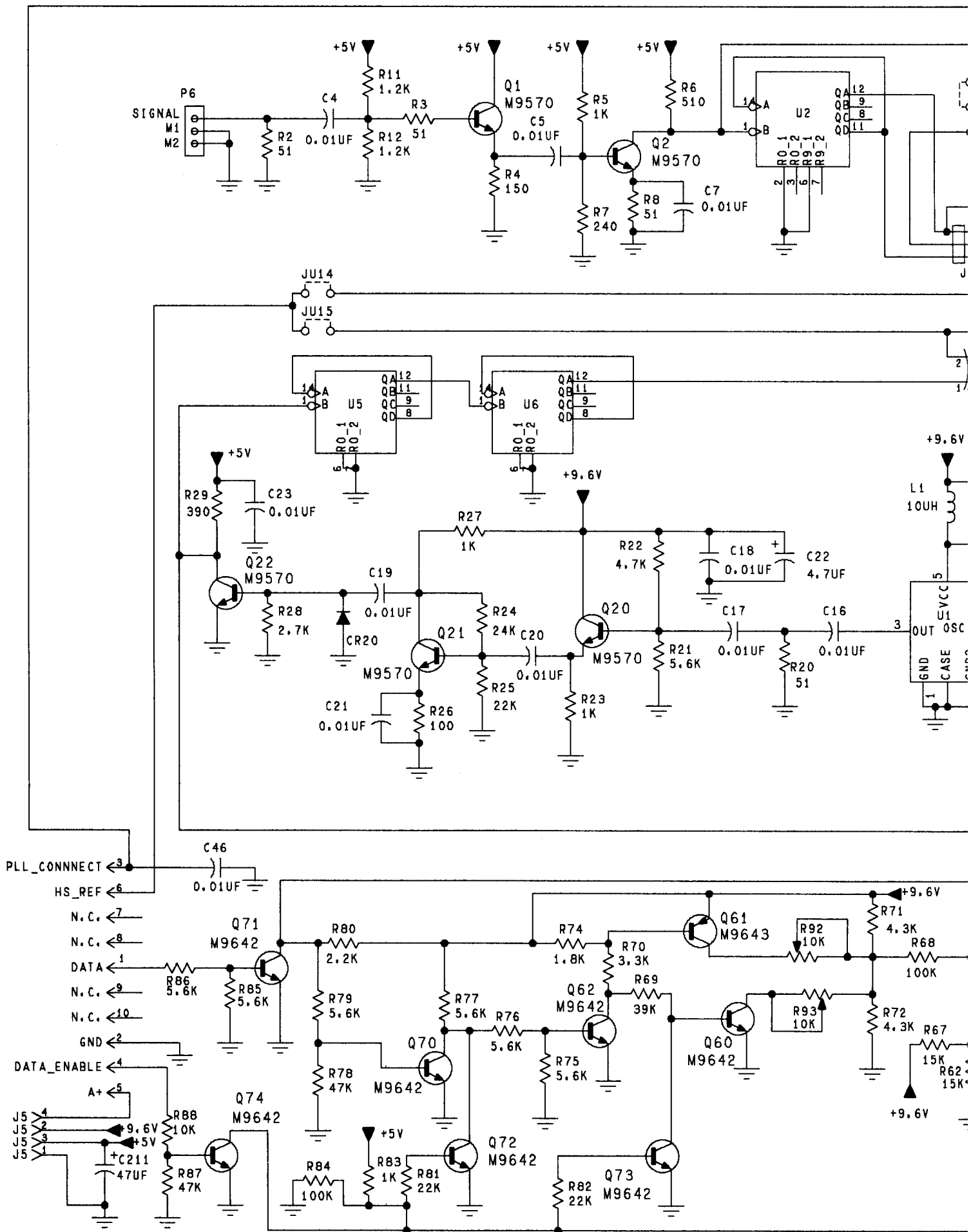
Q19-Q22

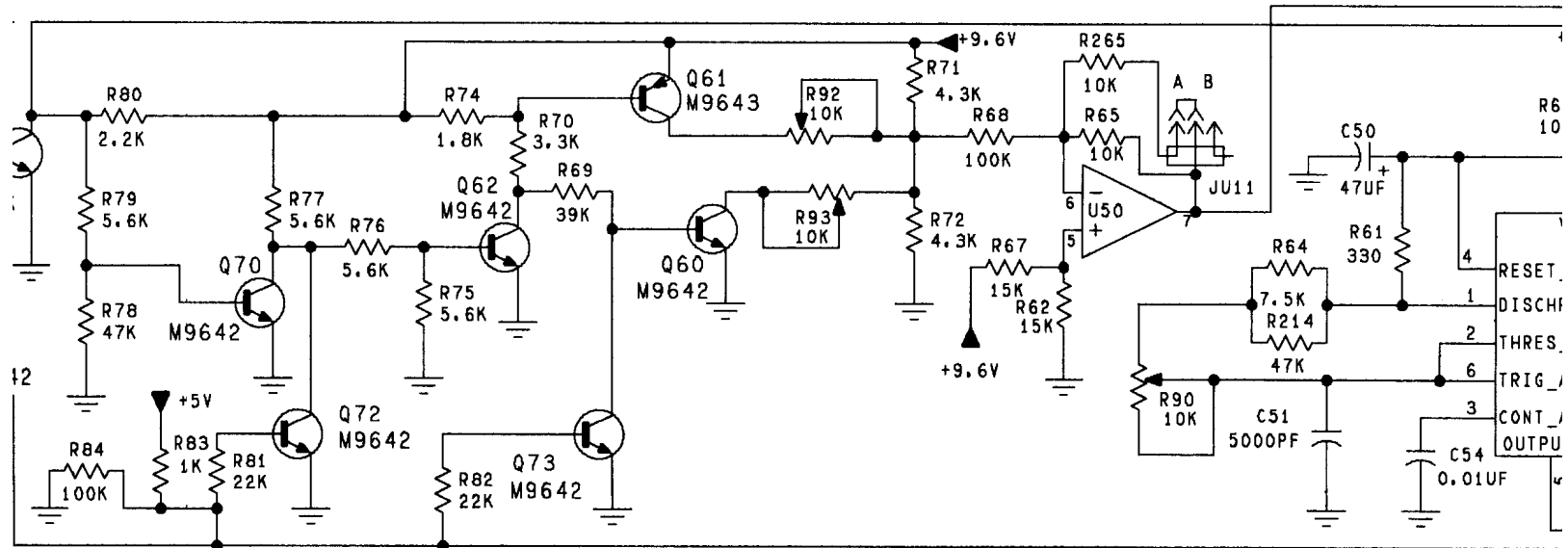
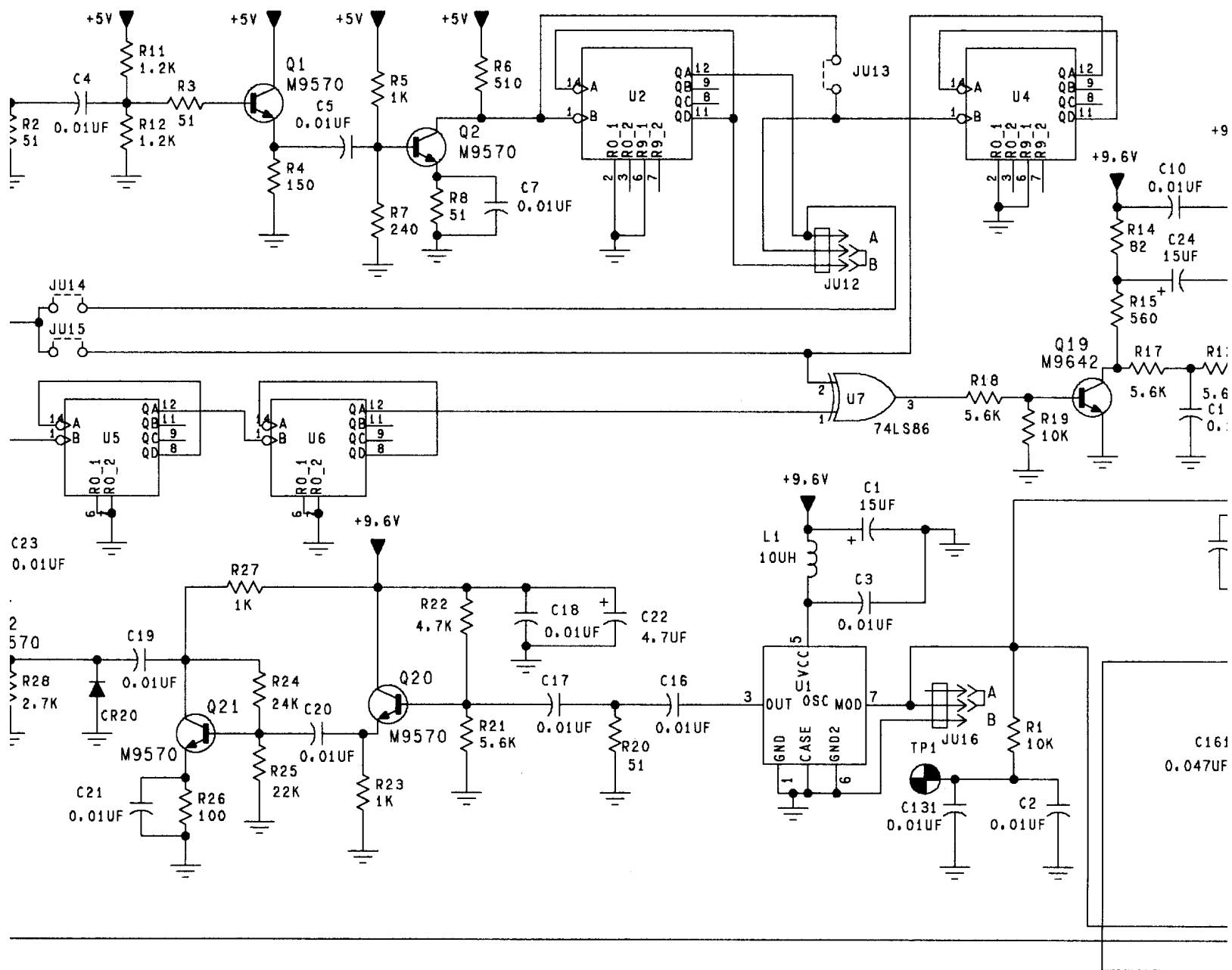
Q130

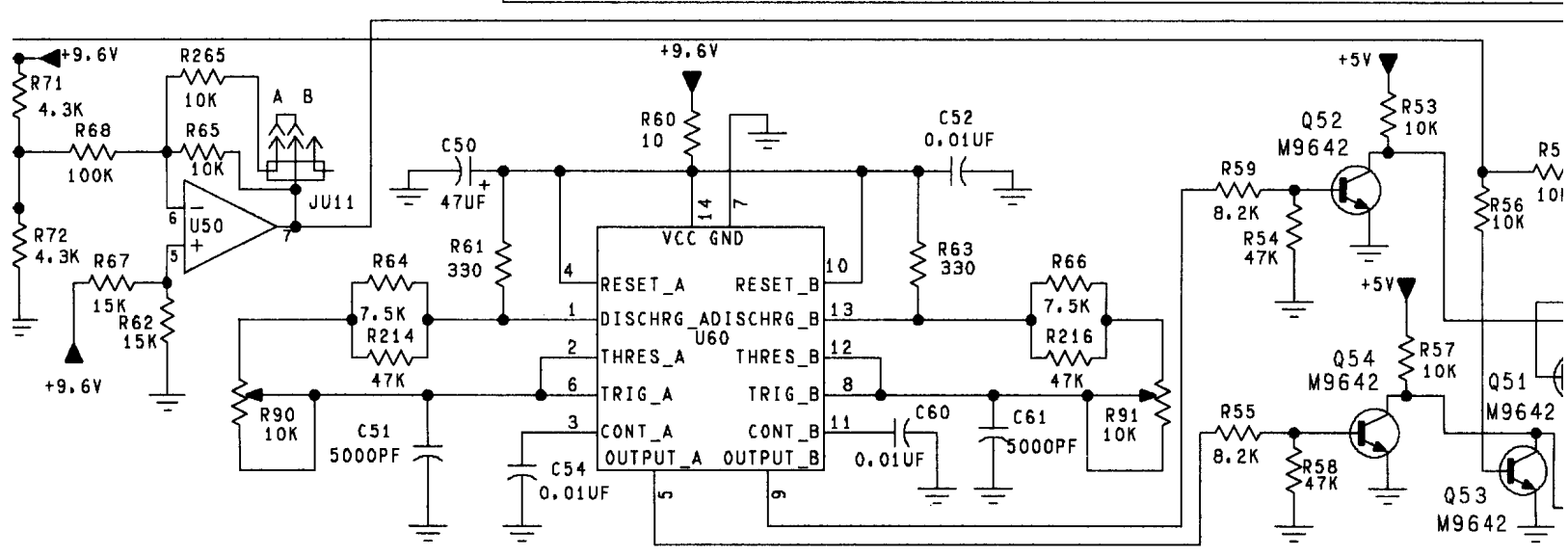
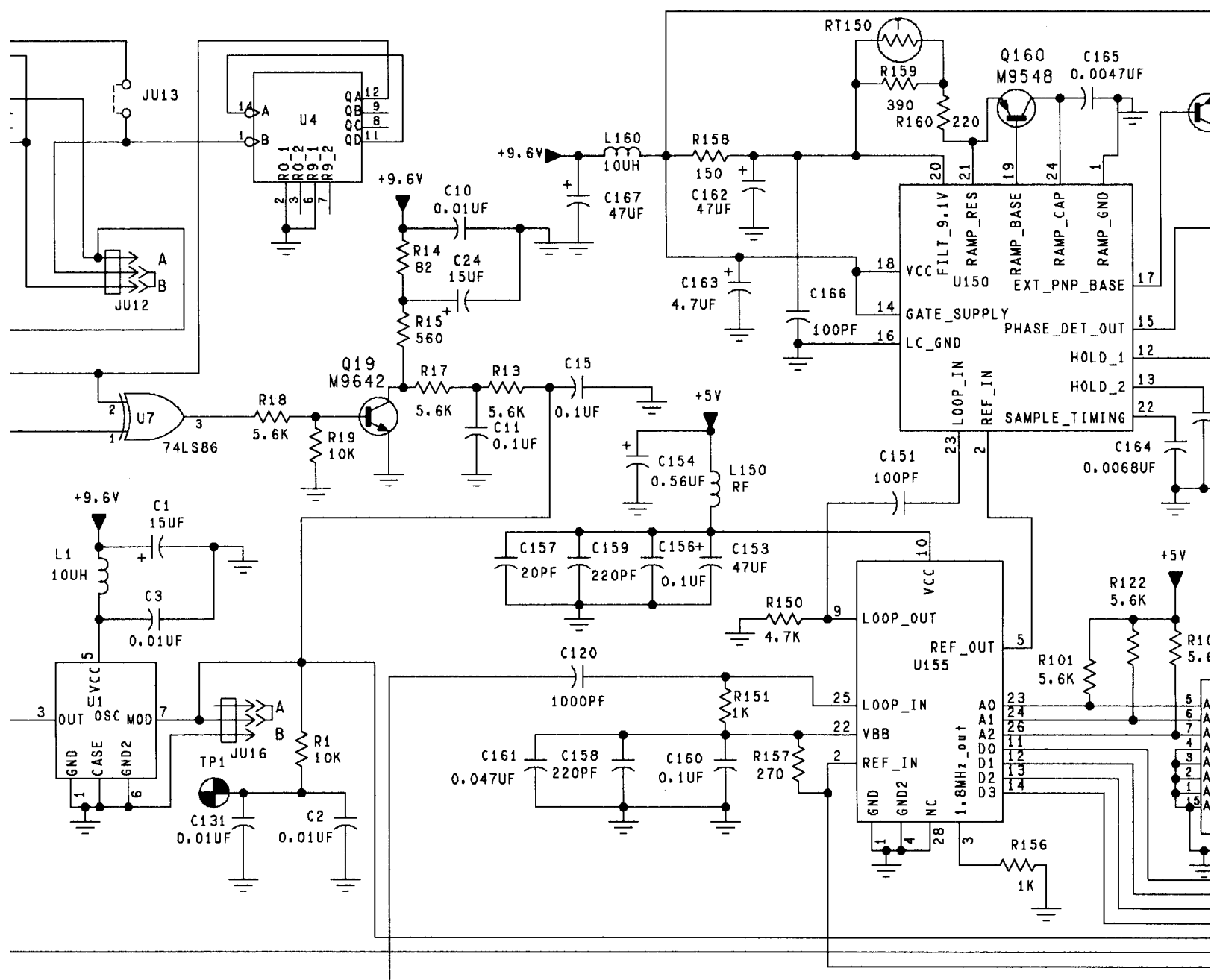
Q160

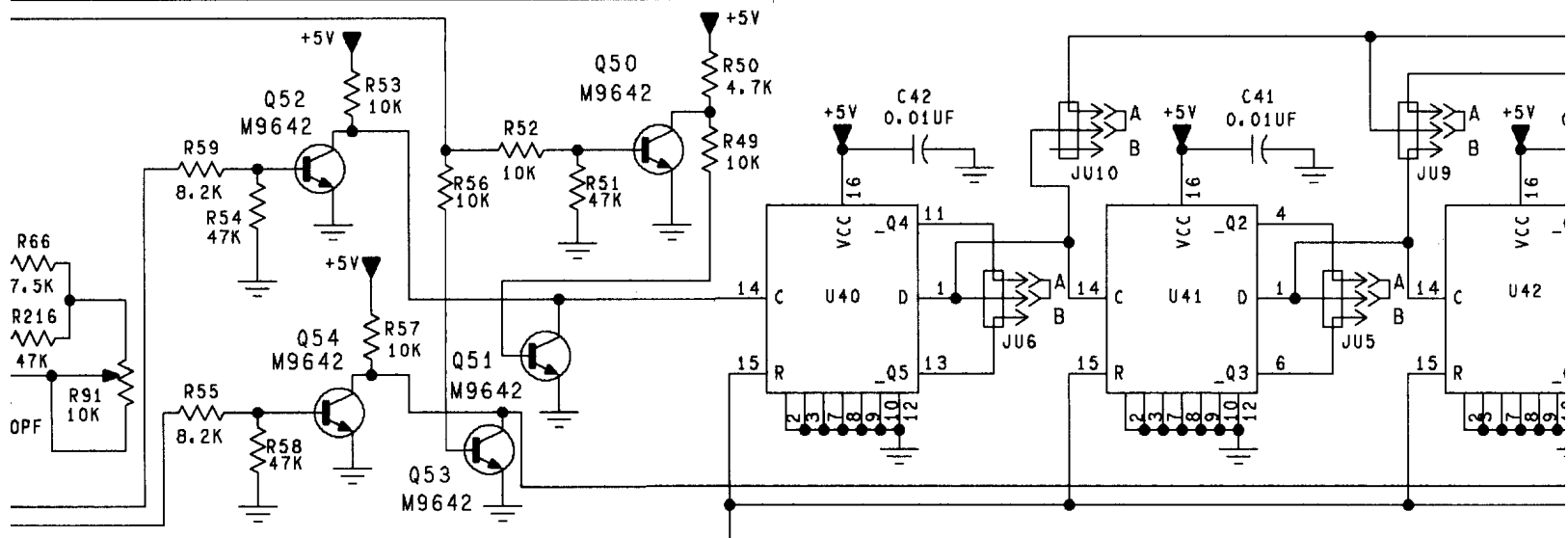
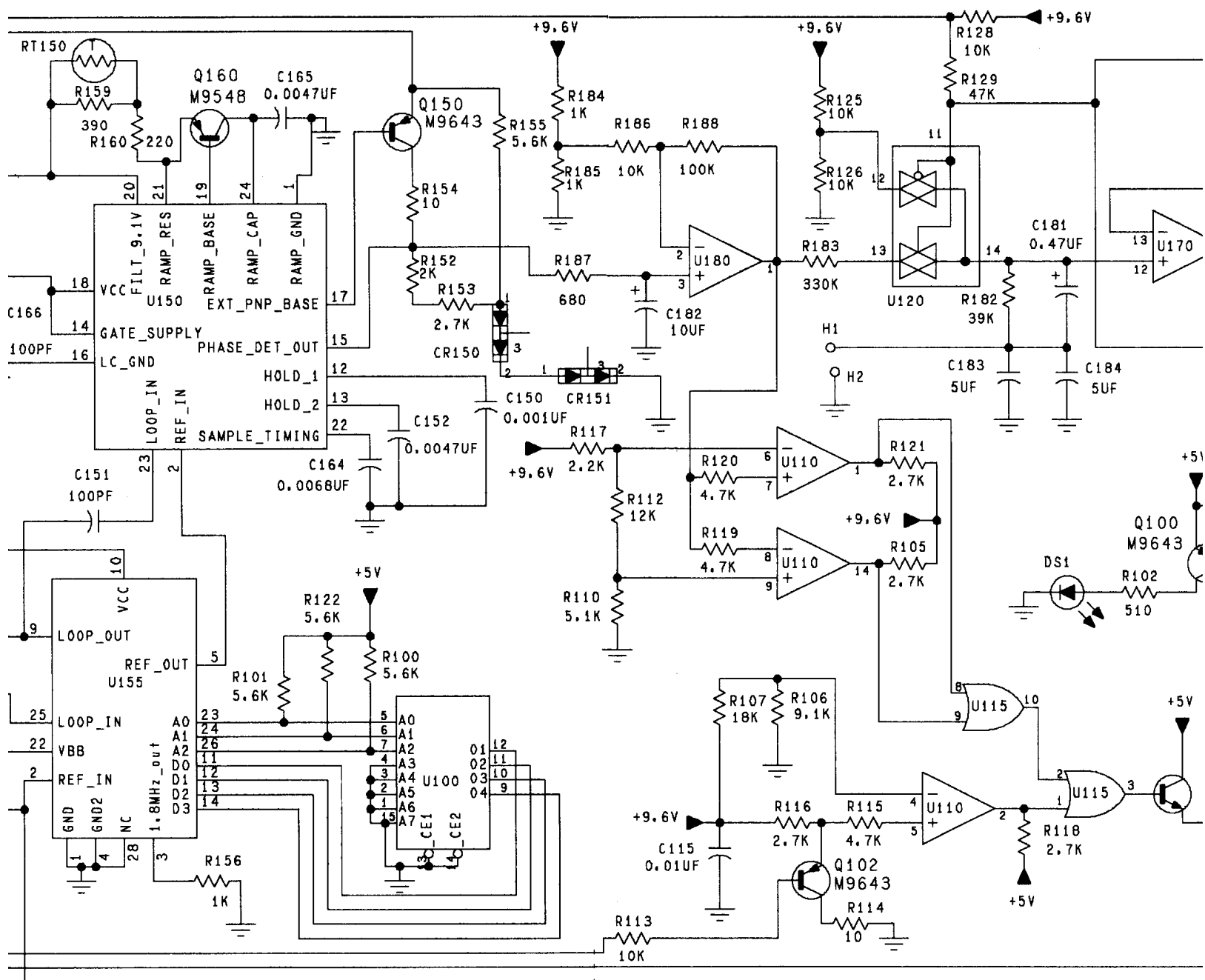
Q190

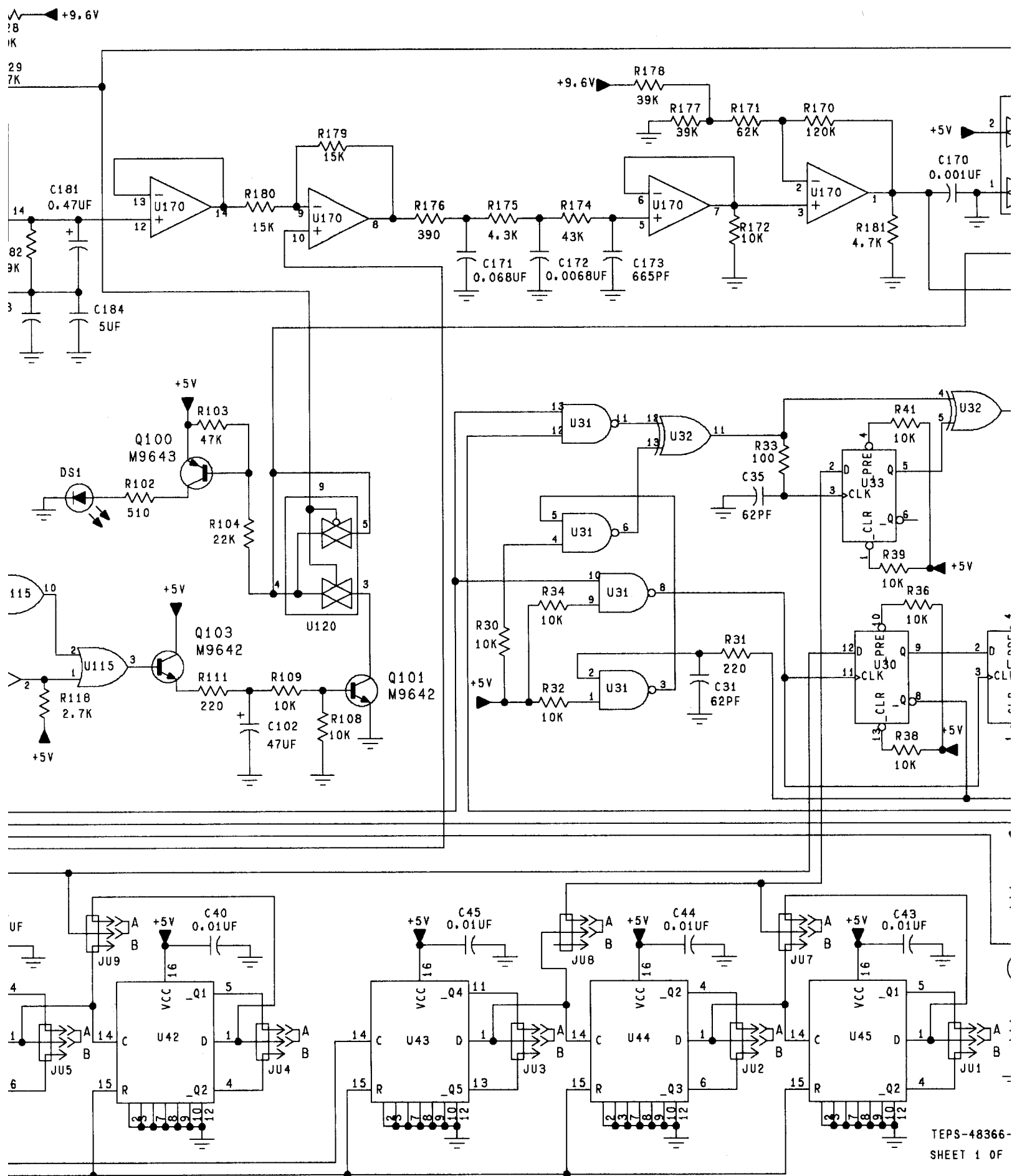
Q200-Q202



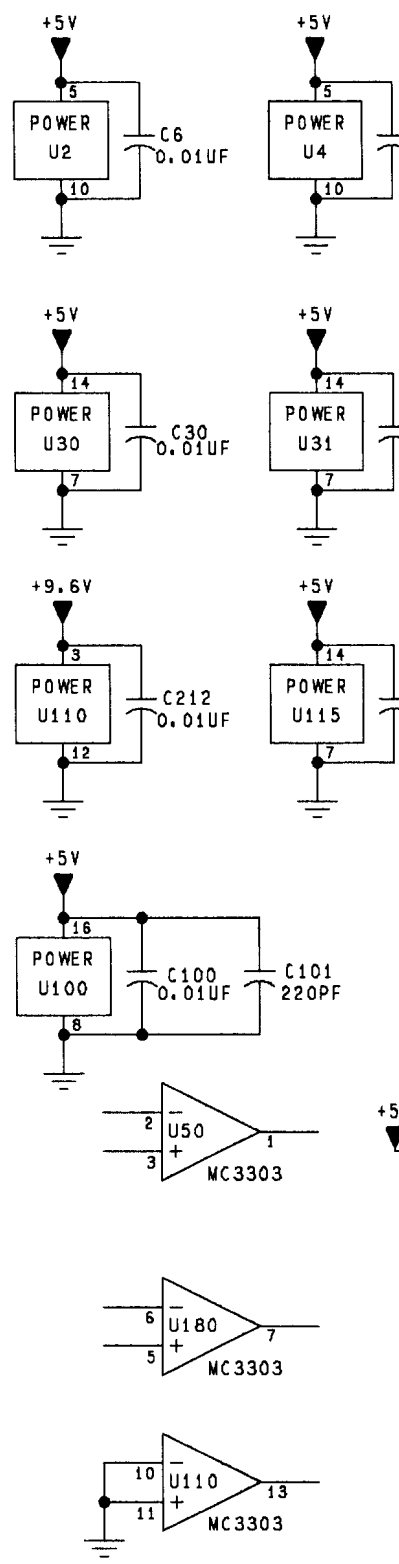




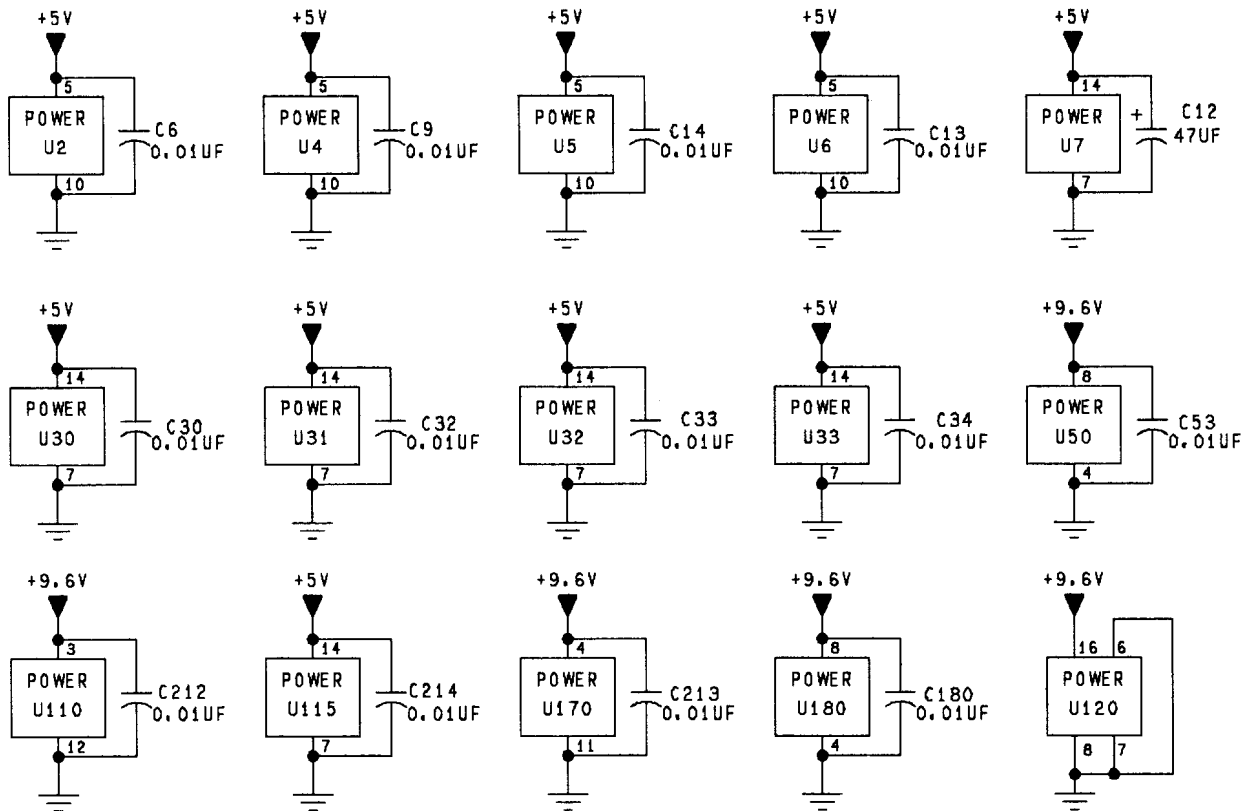




HSO/UHSO SYNTHESIZER BOARD
MODEL TRN7408A
SCHEMATIC DIAGRAM

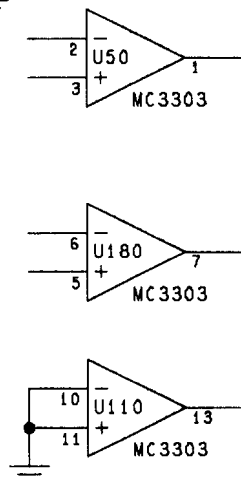


SPARE C

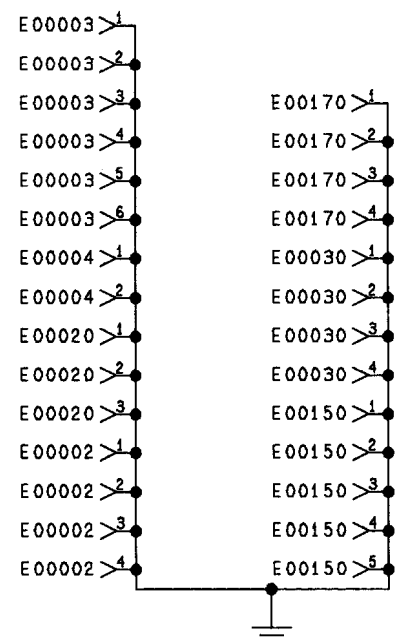
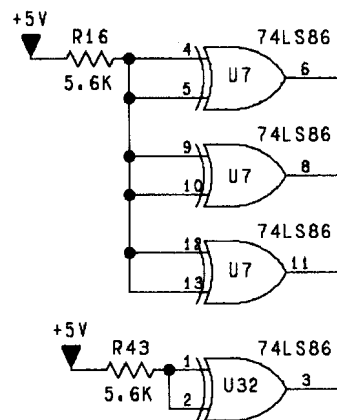


POWER BLOCKS

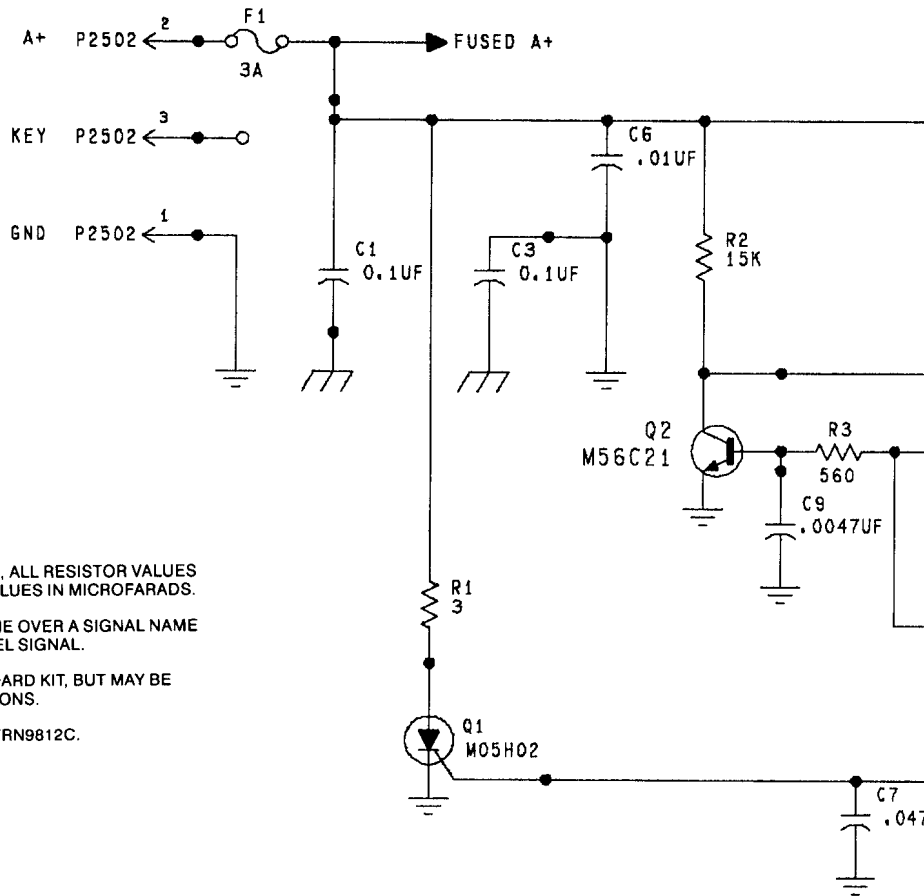
TEPS-48336-0
SHEET 2 OF 2



SPARE CIRCUITS



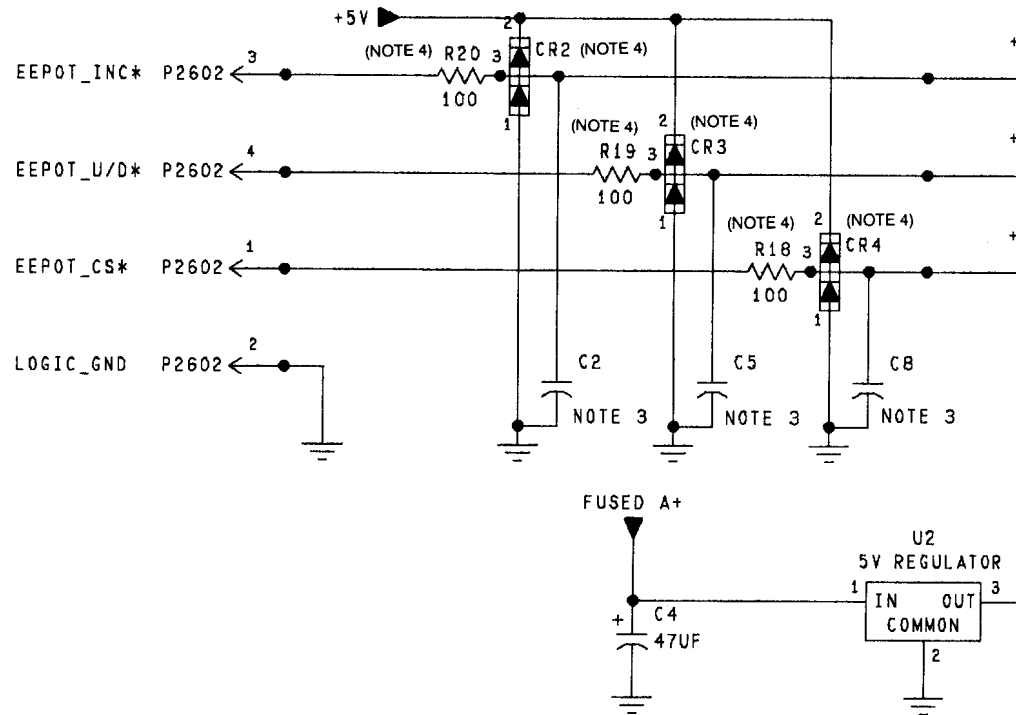
FROM INTERCONNECT BOARD

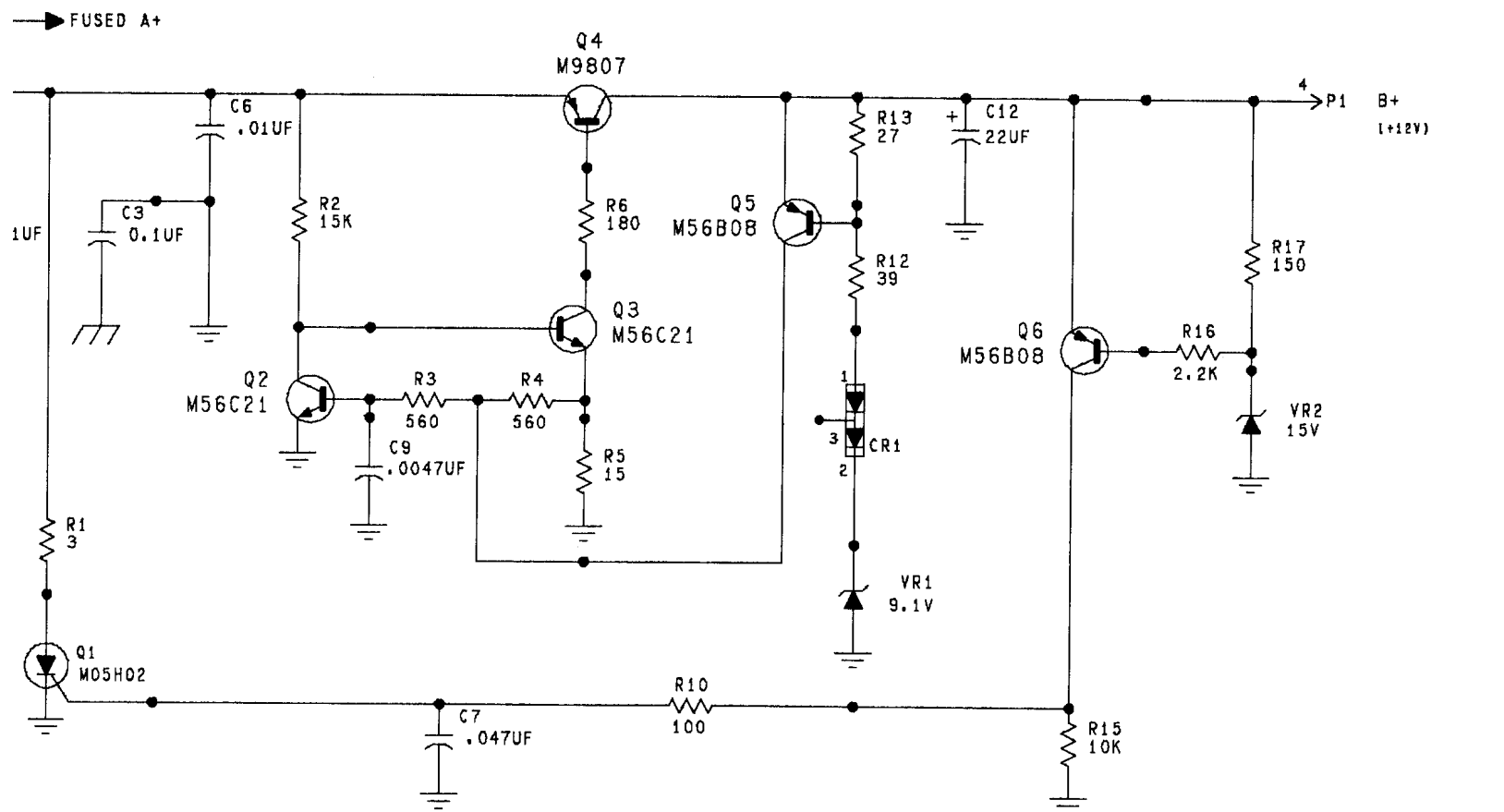


NOTES:

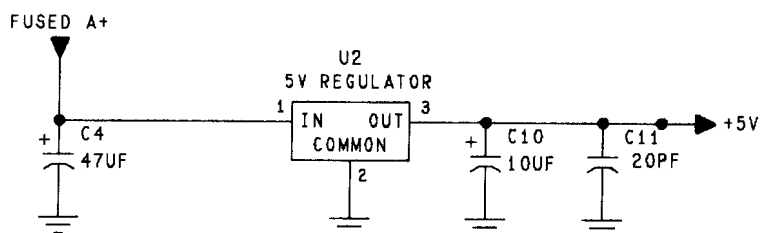
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS AND CAPACITOR VALUES IN MICROFARADS.
2. AN ASTERISK (*) AFTER OR A LINE OVER A SIGNAL NAME INDICATES AN ACTIVE LOW LEVEL SIGNAL.
3. PARTS NOT INCLUDED IN STANDARD KIT, BUT MAY BE ADDED FOR SPECIAL APPLICATIONS.
4. PARTS USED ONLY ON MODEL TRN9812C.

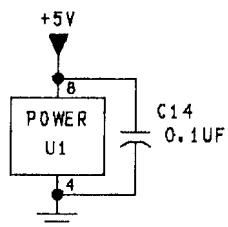
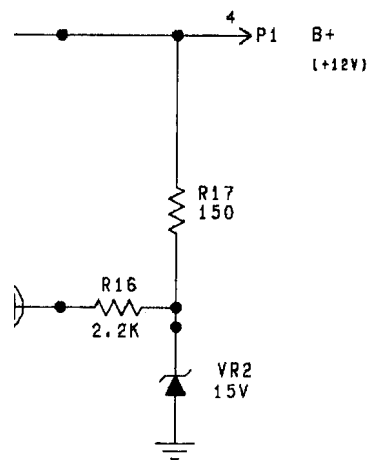
FROM WATTMETER BOARD



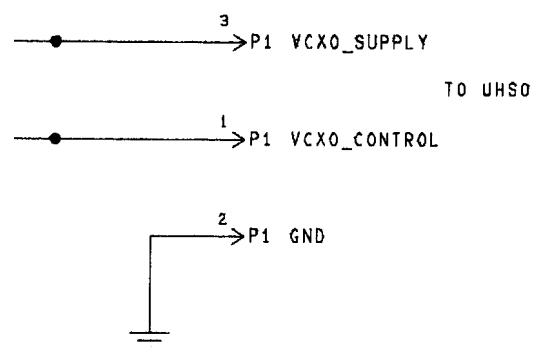


.TEPS-47818-0



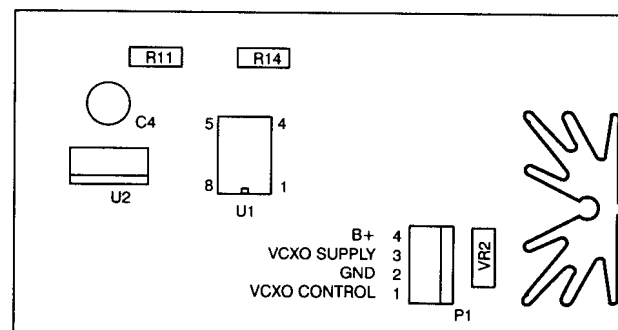


15
OK

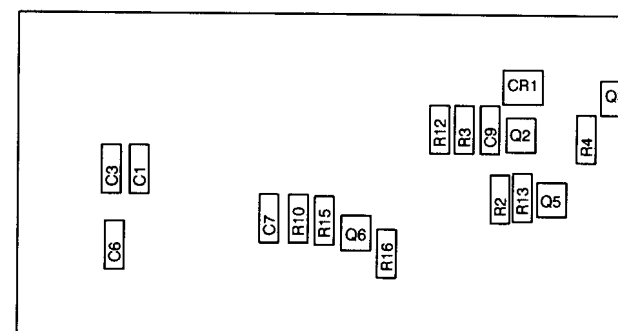


B-0

TRN9812B HSO/UH

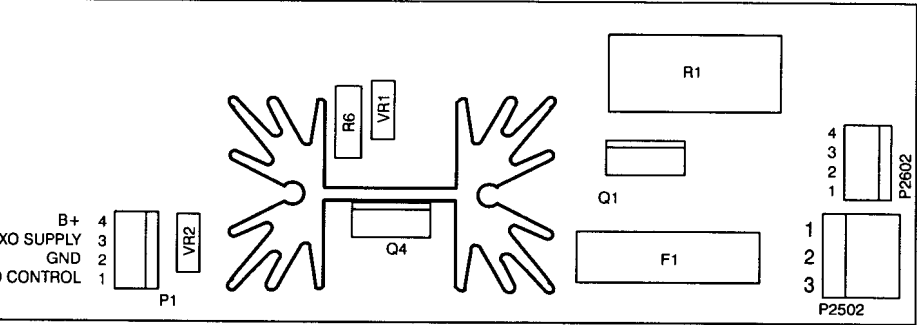


SHOWN FROM C

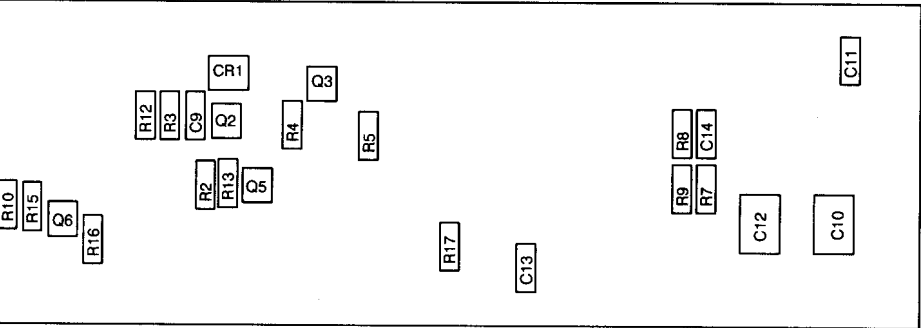


SHOWN FROM S

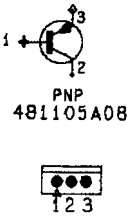
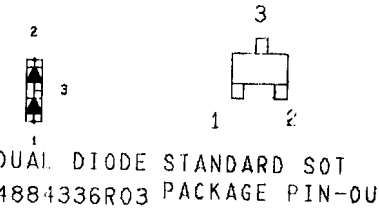
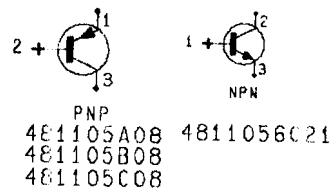
TRN9812B HSO/UHSO POWER SUPPLY



SHOWN FROM COMPONENT SIDE



SHOWN FROM SOLDER SIDE

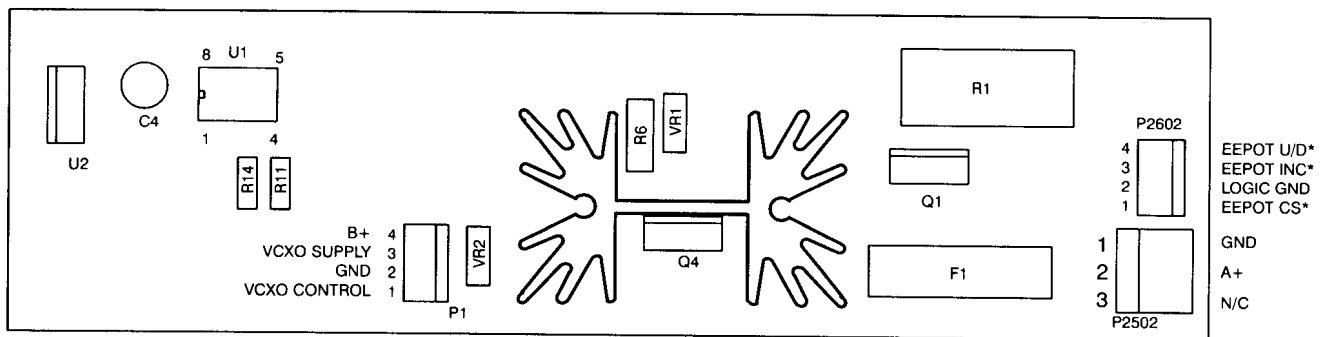


HSO/UHSO POWER SUPPLY

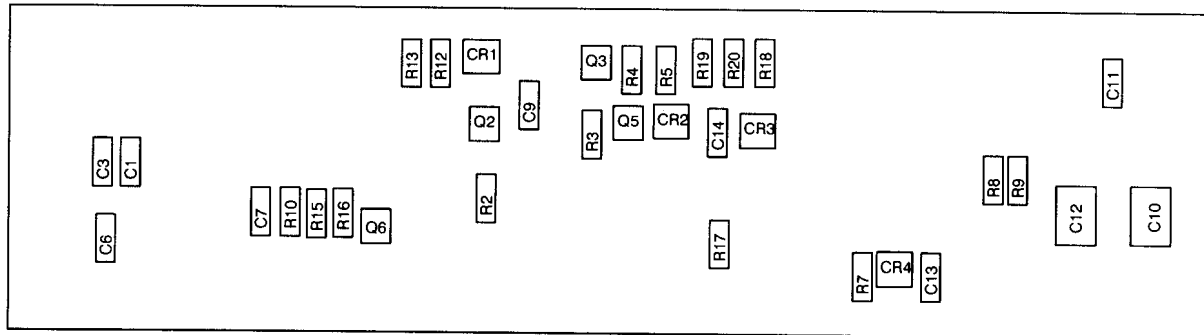
MODEL TRN9812B/TRN9812C

SCHEMATIC DIAGRAM & CIRCUIT BOARD DETAIL

TRN9812C HSO/UHSO POWER SUPPLY



SHOWN FROM COMPONENT SIDE

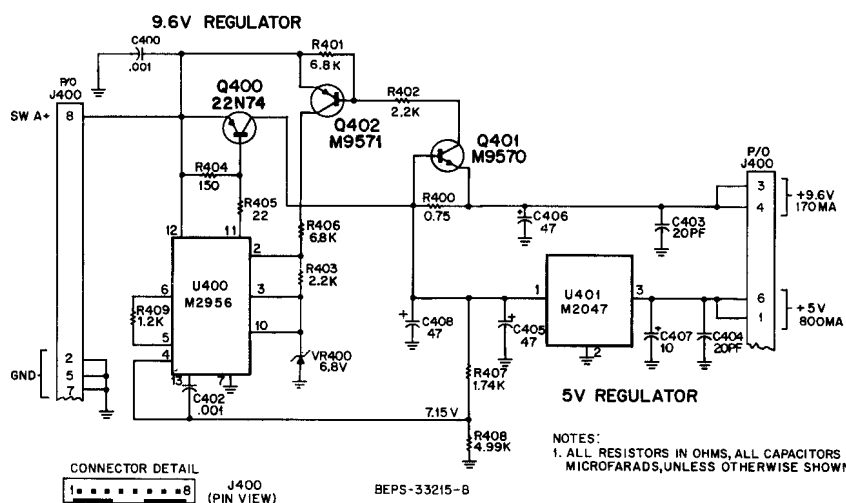


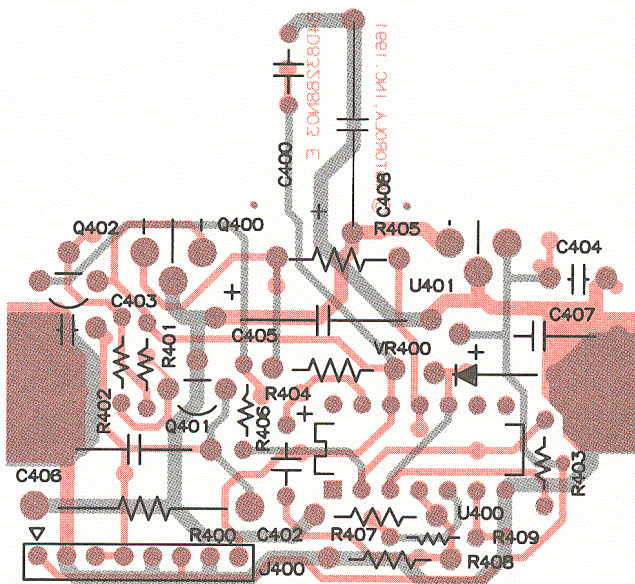
SHOWN FROM SOLDER SIDE

VOLTAGE REGULATOR BOARD

MODEL TRN5058B

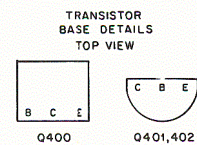
SCHEMATIC DIAGRAM AND CIRCUIT BOARD DETAIL





COMPONENT SIDE BD-CEPS-33216-C
 SOLDER SIDE BD-CEPS-33217-C
 OL-CEPS-33218-D

SHOWN FROM COMPONENT SIDE



parts lists

TRN7408A Universal Paging Synthesizer

REF. SYMBOL	PART NO.	DESCRIPTION
		capacitor, fixed:
C1	2311049A20	15 uF, $\pm 10\%$; 20 V
C2 thru 7	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C9,10	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C11	2113741B69	0.1 uF, $\pm 5\%$; 50 V
C12	2311054A09	47 uF, $\pm 20\%$; 6 V
C13,14	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C15	2113741B69	0.1 uF, $\pm 5\%$; 50 V
C16 thru 21	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C22	2311054E02	4.7 uF, $\pm 20\%$; 15 V
C23	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C24	2311054H10	15 uF, $\pm 10\%$; 25 V
C30	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C31	2113740B44	62 pF, $\pm 5\%$; 50 V
C32 thru 34	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C35	2113740B44	62 pF, $\pm 5\%$; 50 V
C40 thru 46	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C50	2313748G18	47 uF, $\pm 20\%$; 25 V
C51	2182537B45	5000 pF, $\pm 1\%$; 100 V
C52 thru 54	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C60	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C61	2182537B45	5000 pF, $\pm 1\%$; 100 V
C100	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C101	2113740B57	220 pF, $\pm 5\%$; 50 V
C102	2313748G18	47 uF, $\pm 20\%$; 25 V
C115	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C120	2113740B73	1000 pF, $\pm 5\%$; 50 V
C130,131	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C132	2113740B41	47 pF, $\pm 5\%$; 50 V
C150	0811017A01	1000 pF, $\pm 5\%$; 50 V
C151	2113740B49	100 pF, $\pm 5\%$; 50 V
C152	0811017A06	470 pF, $\pm 5\%$; 50 V
C153	2311054A09	47 uF, $\pm 20\%$; 6 V
C154	2311054L03	0.56 uF, $\pm 10\%$; 50 V
C156	0811051A13	0.1 uF, $\pm 5\%$; 63 V
C157	2113740B32	20 pF, $\pm 5\%$; 50 V
C158,159	2113740B57	220 pF, $\pm 5\%$; 50 V
C160	0811051A13	0.1 uF, $\pm 5\%$; 63 V
C161	2113741B61	0.047 uF, $\pm 5\%$; 50 V
C162	2313748G18	47 uF, $\pm 20\%$; 25 V
C163	2311054E02	4.7 uF, $\pm 20\%$; 15 V
C164	0811017A07	6800 pF, $\pm 5\%$; 50 V
C165	2183162H34	0.047 uF, $\pm 10\%$; 50 V
C166	2113740B49	100 pF, $\pm 5\%$; 50 V
C167	2313748G18	47 uF, $\pm 20\%$; 25 V
C170	0811017A01	1000 pF, $\pm 5\%$; 50 V
C171	0811051A12	0.068 uF, $\pm 5\%$; 63 V
C172	0811017A07	6800 pF, $\pm 5\%$; 50 V
C173	2184426B48	665 pF, $\pm 5\%$; 500 V
C180	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C181	2311054L02	0.47 uF, $\pm 10\%$; 50 V
C182	2311054F06	10 uF, $\pm 10\%$; 15 V
C183,184	0880026B05	5 $\pm 10\%$; 50 V
C190	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C191	2113740B41	47 pF, $\pm 5\%$; 50 V
C192	2113740B33	22 pF, $\pm 5\%$; 50 V
C193	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C200	2313748G18	47 uF, $\pm 20\%$; 25 V
C201	2113740B25	10 pF, $\pm 5\%$; 50 V

TRN7408A Universal Paging Synthesizer (Cont'd.)

REF. SYMBOL	PART NO.	DESCRIPTION
C202,203	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C204	2113740B25	10 pF, $\pm 5\%$; 50 V
C205	2113740B49	100 pF, $\pm 5\%$; 50 V
C206,207	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C208	2113740B49	100 pF, $\pm 5\%$; 50 V
C209,210	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C211	2313748G18	47 uF, $\pm 20\%$; 25 V
C212 thru 214	2113741B45	0.01 uF, $\pm 5\%$; 50 V
		diode: (see note)
CR20	4883654H01	silicon
CR130,131	4884616A04	Diode, hot carrier 6 V
CR150,151	4813833C07	Diode, dual 100 W
		light emitting diode: (see note)
DS1	4888245C24	RED
		connector:
J5	2813922A04	plug: 4-contact
		jumper:
JU14	0611077A01	0 ohm, $\pm 5\%$; 0 W
		inductor:
L1	2411047A25	10 UH
L150	2483961B01	CHOKES, RF
L160	2411047A25	10 UH
L190	2411047A25	10 UH
L191	2482060V01	COIL CHOKES
L200	2412015H07	CHOKES 10 UH
L201	2412015H03	CHOKES 23 UH
		connector:
P1 thru 4	2900855943	PIN, terminal
P6	0180782D84	HSO synthesizer rf cabling
P8	3083968P01	CBL w/connector; 10 pin
P9	0180782D84	HSO synthesizer rf cabling
		transistor: (see note)
Q1,2	4813824D13	NPN 25 V
Q19	4813824D06	NPN
Q20 thru 22	4813824D13	NPN 25 V
Q50 thru 54	4813824A10	NPN
Q60	4813824A10	NPN
Q61	4813824A22	PNP
Q62	4813824A10	NPN
Q70 thru 74	4813824A10	NPN
Q100	4813824A22	PNP
Q101	4813824A10	NPN
Q102	4813824A22	PNP
Q103	4813824A10	NPN
Q130	4813824D13	NPN 25 V
Q150	4813824A22	PNP
Q190	4813824D13	NPN 25 V
Q200	4813824D06	NPN
Q201	4813824D13	NPN 25 V
Q202	4813824D10	PNP
		resistor, fixed:
R1	0611077A98	10K, $\pm 5\%$; 1/8 W
R2,3	0611009A18	51 ohms, $\pm 5\%$; 1/4 W
R4	0611077A54	150 ohms, $\pm 5\%$; 1/8 W
R5	0611077A74	1K, $\pm 5\%$; 1/8 W
R6	0611072A42	510 ohms, $\pm 5\%$; 1/4 W
R7	0611077A59	240 ohms, $\pm 5\%$; 1/8 W
R8	0611009A18	51 ohms, $\pm 5\%$; 1/4 W

TRN7408A Universal Paging Synthesizer (Cont'd.)

REF.	SYMBOL	PART NO.	DESCRIPTION
R11,12		0611077A76	1.2K, $\pm 5\%$; 1/8 W
R13		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R14		0611009A23	82 ohms, $\pm 5\%$; 1/4 W
R15		0611072A43	560 $\pm 5\%$; 1/4 W
R16 thru 18		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R19		0611077A98	10K, $\pm 5\%$; 1/8 W
R20		0611009A18	51 ohms, $\pm 5\%$; 1/4 W
R21		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R22		0611077A90	4.7K, $\pm 5\%$; 1/8 W
R23		0611077A74	1K, $\pm 5\%$; 1/8 W
R24		0611077B08	24K, $\pm 5\%$; 1/8 W
R25		0611077B07	22K, $\pm 5\%$; 1/8 W
R26		0611077A50	100 ohms, $\pm 5\%$; 1/8 W
R27		0611077A74	1K, $\pm 5\%$; 1/8 W
R28		0611077A84	2.7K, $\pm 5\%$; 1/8 W
R29		0611077A64	390 ohms, $\pm 5\%$; 1/8 W
R30		0611077A98	10K, $\pm 5\%$; 1/8 W
R31		0611077A58	220 ohms, $\pm 5\%$; 1/8 W
R32		0611077A98	10K, $\pm 5\%$; 1/8 W
R33		0611009A25	100 ohms, $\pm 5\%$; 1/4 W
R34 thru 42		0611077A98	10K, $\pm 5\%$; 1/8 W
R43		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R49		0611077A98	10K, $\pm 5\%$; 1/8 W
R50		0611077A90	4.7K, $\pm 5\%$; 1/8 W
R51		0611077B15	47K, $\pm 5\%$; 1/8 W
R52,53		0611077A98	10K, $\pm 5\%$; 1/8 W
R54		0611077B15	47K, $\pm 5\%$; 1/8 W
R55		0611077A96	8.2K, $\pm 5\%$; 1/8 W
R56,57		0611077A98	10K, $\pm 5\%$; 1/8 W
R58		0611077B15	47K, $\pm 5\%$; 1/8 W
R59		0611077A96	8.2K, $\pm 5\%$; 1/8 W
R62		0611077B03	15K, $\pm 5\%$; 1/8 W
R64		0611077F79	7.5K, $\pm 1\%$; 1/8 W
R65		0611077A98	10K, $\pm 5\%$; 1/8 W
R66		0611077F79	7.5K, $\pm 1\%$; 1/8 W
R67		0611077B03	15K, $\pm 5\%$; 1/8 W
R68		0611077B23	100K, $\pm 5\%$; 1/8 W
R69		0611077B13	39K, $\pm 5\%$; 1/8 W
R70		0611077A86	3.3K, $\pm 5\%$; 1/8 W
R71,72		0611077A89	4.3K, $\pm 5\%$; 1/8 W
R74		0611077A80	1.8K, $\pm 5\%$; 1/8 W
R75 thru 77		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R78		0611077B15	47K, $\pm 5\%$; 1/8 W
R79		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R80		0611077A82	2.2K, $\pm 5\%$; 1/8 W
R81,82		0611077B07	22K, $\pm 5\%$; 1/8 W
R83		0611077A74	1K, $\pm 5\%$; 1/8 W
R84		0611077B23	100K, $\pm 5\%$; 1/8 W
R85,86		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R87		0611077B15	47K, $\pm 5\%$; 1/8 W
R88		0611077A98	10K, $\pm 5\%$; 1/8 W
R90 thru 93		1884143N01	variable; 10K, $\pm 10\%$; 3/4 W
R100,101		0611077A92	5.6K, $\pm 5\%$; 1/8 W
R102		0611077A67	510 ohms, $\pm 5\%$; 1/8 W
R103		0611077B15	47K, $\pm 5\%$; 1/8 W
R104		0611077B07	22K, $\pm 5\%$; 1/8 W
R105		0611077A84	2.7K, $\pm 5\%$; 1/8 W
R106		0611077A97	9.1K, $\pm 5\%$; 1/8 W

TRN7408A Universal Paging Synthesizer (Cont'd.)

REF. SYMBOL	PART NO.	DESCRIPTION
R107	0611077B05	18K, $\pm 5\%$; 1/8 W
R108,109	0611077A98	10K, $\pm 5\%$; 1/8 W
R110	0611077A91	5.1K, $\pm 5\%$; 1/8 W
R111	0611077A58	220 ohms, $\pm 5\%$; 1/8 W
R112	0611077B01	12K, $\pm 5\%$; 1/8 W
R113	0611077A98	10K, $\pm 5\%$; 1/8 W
R115	0611077A90	4.7K, $\pm 5\%$; 1/8 W
R116	0611077A84	2.7K, $\pm 5\%$; 1/8 W
R117	0611077A82	2.2K, $\pm 5\%$; 1/8 W
R118	0611077A84	2.7K, $\pm 5\%$; 1/8 W
R119,120	0611077A90	4.7K, $\pm 5\%$; 1/8 W
R121	0611077A84	2.7K, $\pm 5\%$; 1/8 W
R122	0611077A92	5.6K, $\pm 5\%$; 1/8 W
R125,126	0611077A98	10K, $\pm 5\%$; 1/8 W
R127	0611077B15	47K, $\pm 5\%$; 1/8 W
R128	0611077A98	10K, $\pm 5\%$; 1/8 W
R129	0611077B15	47K, $\pm 5\%$; 1/8 W
R130	0611077A78	1.5K, $\pm 5\%$; 1/8 W
R131	0611077B03	15K, $\pm 5\%$; 1/8 W
R132	0611072A09	22 ohms, $\pm 5\%$; 1/4 W
R133	0611077A72	820 ohms, $\pm 5\%$; 1/8 W
R134	0611072A42	510 ohms, $\pm 5\%$; 1/4 W
R150	0611077A90	4.7K, $\pm 5\%$; 1/8 W
R151	0611077A74	1K, $\pm 5\%$; 1/8 W
R152	0611077A81	2K, $\pm 5\%$; 1/8 W
R153	0611077A84	2.7K, $\pm 5\%$; 1/8 W
R155	0611077A92	5.6K, $\pm 5\%$; 1/8 W
R156	0611077A74	1K, $\pm 5\%$; 1/8 W
R157	0611077A60	270 ohms, $\pm 5\%$; 1/8 W
R158	0611072A29	150 ohms, $\pm 5\%$; 1/4 W
R159	0611009A39	390 ohms, $\pm 5\%$; 1/4 W
R160	0611009A33	220 ohms, $\pm 5\%$; 1/4 W
R170	0611077B25	120K, $\pm 5\%$; 1/8 W
R171	0611077B18	62K, $\pm 5\%$; 1/8 W
R172	0611077A98	10K, $\pm 5\%$; 1/8 W
R173	0611077B11	33K, $\pm 5\%$; 1/8 W
R174	0611077B14	43K, $\pm 5\%$; 1/8 W
R175	0611077A89	4.3K, $\pm 5\%$; 1/8 W
R176	0611009A39	390 ohms, $\pm 5\%$; 1/4 W
R177,178	0611077B13	39K, $\pm 5\%$; 1/8 W
R179,180	0611077B03	15K, $\pm 5\%$; 1/8 W
R181	0611077A90	4.7K, $\pm 5\%$; 1/8 W
R182	0611077B13	39K, $\pm 5\%$; 1/8 W
R183	0611077B35	330K, $\pm 5\%$; 1/8 W
R184,185	0611077A74	1K, $\pm 5\%$; 1/8 W
R186	0611077A98	10K, $\pm 5\%$; 1/8 W
R187	0611072A45	680 ohms, $\pm 5\%$; 1/4 W
R188	0611077B23	100K, $\pm 5\%$; 1/8 W
R190	0611077A98	10K, $\pm 5\%$; 1/8 W
R191	0611077A90	4.7K, $\pm 5\%$; 1/8 W
R192	0611077A78	1.5K, $\pm 5\%$; 1/8 W
R193	0611009A18	51 ohms, $\pm 5\%$; 1/4 W
R194	0611077A54	150 ohms, $\pm 5\%$; 1/8 W
R195	0611072A45	680 ohms, $\pm 5\%$; 1/4 W
R200	0611077A80	1.8K, $\pm 5\%$; 1/8 W
R201	0611077A82	2.2K, $\pm 5\%$; 1/8 W
R202	0611009A35	270 ohms, $\pm 5\%$; 1/4 W
R206	0611077A82	2.2K, $\pm 5\%$; 1/8 W
R207,208	0611077A74	1K, $\pm 5\%$; 1/8 W

TRN7408A Universal Paging Synthesizer (Cont'd.)

REF.	SYMBOL	PART NO.	DESCRIPTION
R209		0611077A86	3.3K, $\pm 5\%$; 1/8 W
R210		0611077A74	1K, $\pm 5\%$; 1/8 W
R211		0611077A86	3.3K, $\pm 5\%$; 1/8 W
R212,213		0611009A35	270 ohms, $\pm 5\%$; 1/4 W
R214		0611077B15	47K, $\pm 5\%$; 1/8 W
R216		0611077B15	47K, $\pm 5\%$; 1/8 W
R265		0611077A98	10K, $\pm 5\%$; 1/8 W
			thermistor:
RT150		0600858402	1K, $\pm 10\%$; 0 W
			integrated circuit: (see note)
U1		5180291B02	referenced oscillator
U2		5184118K31	TTL Logic
U4		5184118K31	TTL Logic
U5,6		5184118K54	Center
U7		5184118K21	TYPE
U30		5184810F09	Dual Edge
U31		5184810F18	QUAD 2-INP
U32		5184810F15	TTL LOGIC
U33		5184810F09	Dual Edge
U40 thru 45		5113806D08	Divide-by-N Counter
U60		5113815J06	Dual 555 Timer
U100		5183802P01	Programmed 256 X 4 PROM
U110		5113820D02	type LM2901N
U115		5184887K79	Quad 2-Input OR Gate
U120		5184887K60	Triple 2-Channel Analog Mux/ Demux
U150		5183977M36	Sample and Hold Phase Detector
U155		5184768F63	Synthesizer
U170		5113819D02	Low Power 14 Dip
U180		5180067C03	Dual Operational Amplifier
			non-referenced items:
		0984181L01	SHORTING JUMPER: 2-contact (used with JU1 thru JU12)
		0984181L01	SHORTING JUMPER: 2-contact (used with JU16)
		0984728L01	Shorting Jumper: 2-contact (used with JU1 thru JU12)
		0984728L01	Shorting Jumper: 2-contact (used with JU16)
		2880001R03	plug: 3-contact (used with JU1 thru JU12)
		2880001R03	plug: 3-contact (used with JU16)
		2880002R03	plug: 3-contact (used with JU1 thru JU12)
		2880002R03	plug: 3-contact (used with JU16)
		2883099K01	plug: BNC type
		2980014A01	CLIP, coaxial (terminal) (used with P6)
		2980014A01	CLIP, coaxial (terminal) (used with P9)
		3083794C01	CABLE, coaxial (14.5 used)

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part number.

TRN5058B Voltage Regulator Board

REF. SYMBOL	PART NO.	DESCRIPTION
		capacitor, fixed:
C400	2183596E13	1000 pF, $\pm 10\%$; 500 V
C402	2183596E13	1000 pF, $\pm 10\%$; 500 V
C403,404	2111014H32	20 pF, $\pm 5\%$; 100 V
C405,406	2383214C31	47 uF, $\pm 20\%$; 15 V
C407	2384762H03	10 uF, $\pm 10\%$; 20 V
C408	2383214C31	47 uF, $\pm 20\%$; 15 V
		connector:
J400	2883323N02	plug: 8-contact
		transistor: (see note)
Q400	4813822D07	PNP
Q401	4813824D13	Transistor NPN 25 V
Q402	4813824D10	PNP
		resistor, fixed:
R400	1782036G13	0.75 ohms, $\pm 5\%$; 2 W
R401	0611041C85	6.8K, $\pm 5\%$; 1/8 W
R402,403	0611041C73	2.2K, $\pm 5\%$; 1/8 W
R404	0611009C29	150 ohms, $\pm 5\%$; 1/4 W
R405	0611009C09	22 ohms, $\pm 5\%$; 1/4 W
R406	0611041C85	6.8K, $\pm 5\%$; 1/8 W
R407	0611049J18	1.74K, $\pm 1\%$; 1/4 W
R408	0611049J62	4.99K, $\pm 1\%$; 1/4 W
R409	0611041C67	1.2K, $\pm 5\%$; 1/8 W
		integrated circuit: (see note)
U400	5183222M07	Voltage Regulator
U401	5113816D01	5 V Positive Regulator
		non-referenced items:
	0180734E02	Component Prep Regulator Board
	4882479V24	Diode Zener 6.8 V

NOTE: For optimum performance, transistors and integrated circuits must be ordered by Motorola part number.

TRN7322A HSO Synthesizer Hardware

REF. SYMBOL	PART NO.	DESCRIPTION
		non-referenced items:
	0200132616	NUT, hex: 6-32 x 1/4 x 3/32 x 1/8" (4 used)
	0310907A28	SCREW, machine: M3.5 x 0.6 x 10 (8 used)
	0310943M16	SCREW, tapping: TT3.5 x 0.6 x 10 (2 used)
	0383497N04	SCREW, machine: M3 x 0.5 x 8 (4 used)
	0384890R01	SCREW, machine: M3.5 x 0.6 (10 used)
	0782475R01	BRACKET, oscillator
	1584835R01	COVER, synthesizer
	1584837R01	COVER, HSO
	2784836R01	CHASSIS, synthesizer
	2883779P01	CONNECTOR, plug: 10-contact
	3282796H01	GASKET, rfi (38 used)
	3700085556	GROMMET rubber (2 used)
	4210217A02	STRAP, tie: .091 x 3.62" lg
	4210347A03	CLAMP, cable
	4283503M01	RETAINER: M3.5, pan head (3 used)
	4283981P01	RETAINER, cable
	4383981N03	SPACER, heatsink

TRN7322A HSO Synthesizer Hardware (Cont'd.)

REF. SYMBOL	PART NO.	DESCRIPTION
	4882437R02	CRYSTAL OSCILLATOR: 5.0 MHZ
	4883808F10	CHANNEL ELEMENT: 14.400 MHZ ±2 PPM
	5483262P01	LABEL, Carrier Frequency Measurement
	7582200H21	PAD, oscillator

TRN7568A VHF/280 HSO Synthesizer Hardware

REF. SYMBOL	PART NO.	DESCRIPTION
non-referenced items:		
	0200132616	NUT, hex: 6-32 x 1/4 x 3/32 x 1/8" (4 used)
	0310907A28	SCREW, machine: M3.5 x 0.6 x 10 (8 used)
	0310943M16	SCREW, tapping: TT3.5 x 0.6 x 10 (2 used)
	0383497N04	SCREW, machine: M3 x 0.5 x 8 (4 used)
	0384890R01	SCREW, machine: M3.5 x 0.6 (10 used)
	0782475R01	BRACKET, oscillator
	1584835R01	COVER, synthesizer
	1584837R01	COVER, HSO
	2784836R01	CHASSIS, synthesizer
	2883779P01	CONNECTOR, plug: 10-contact
	3282796H01	GASKET, rfi (38 used)
	3700085556	GROMMET rubber (2 used)
	4210217A02	STRAP, tie: .091 x 3.62" 1g
	4210347A03	CLAMP, cable
	4283503M01	RETAINER: M3.5, pan head (3 used)
	4283981P01	RETAINER, cable
	4383981N03	SPACER, heatsink
	4882437R02	CRYSTAL OSCILLATOR: 5.0 MHZ
	4883808F11	CHANNEL ELEMENT: 14.400 MHZ ±5 PPM
	5483262P01	LABEL, Carrier Frequency Measurement
	7582200H21	PAD, oscillator

TRN7569A VHF/900 HSO Synthesizer Hardware

REF. SYMBOL	PART NO.	DESCRIPTION
non-referenced items:		
	0200132616	NUT, hex: 6-32 x 1/4 x 3/32 x 1/8" (4 used)
	0310907A28	SCREW, machine: M3.5 x 0.6 x 10 (8 used)
	0310943M16	SCREW, tapping: TT3.5 x 0.6 x 10 (2 used)
	0383497N04	SCREW, machine: M3 x 0.5 x 8 (4 used)
	0384890R01	SCREW, machine: M3.5 x 0.6 (10 used)
	0782475R01	BRACKET, oscillator
	1584835R01	COVER, synthesizer
	1584837R01	COVER, HSO
	2784836R01	CHASSIS, synthesizer
	2883779P01	CONNECTOR, plug: 10-contact
	3282796H01	GASKET, rfi (38 used)
	3700085556	GROMMET rubber (2 used)
	4210217A02	STRAP, tie: .091 x 3.62" 1g

TRN7569A VHF/900 HSO Synthesizer Hardware (Cont'd.)

REF. SYMBOL	PART NO.	DESCRIPTION
	4210347A03	CLAMP, cable
	4283503M01	RETAINER: M3.5, pan head (3 used)
	4283981P01	RETAINER, cable
	4383981N03	SPACER, heatsink
	4882437R02	CRYSTAL OSCILLATOR: 5.0 MHZ
	4883808F10	CHANNEL ELEMENT: 14.400 MHZ ±2 PPM
	5483262P01	LABEL, Carrier Frequency Measurement
	7582200H21	PAD, oscillator

TRN7243A UHSO Synthesizer Hardware

REF. SYMBOL	PART NO.	DESCRIPTION
non-referenced items:		
	0200132616	NUT, hex: 6-32 x 1/4 x 3/32 x 1/8" (4 used)
	0310907A28	SCREW, machine: M3.5 x 0.6 x 10 (8 used)
	0383497N04	SCREW, machine: M3 x 0.5 x 8 (4 used)
	0384890R01	SCREW, machine: M3.5 x 0.6 (10 used)
	1584835R01	COVER, synthesizer
	1584837R01	COVER, HSO
	2784836R01	CHASSIS, synthesizer
	2883779P01	CONNECTOR, plug: 10-contact
	3282796H01	GASKET, rfi (38 used)
	3700085556	GROMMET rubber (2 used)
	4210217A02	STRAP, tie: .091 x 3.62" 1g
	4210347A03	CLAMP, cable
	4283503M01	RETAINER: M3.5, pan head (3 used)
	4283981P01	RETAINER, cable
	4383981N03	SPACER, heatsink
	4883808F10	CHANNEL ELEMENT: 14.400 MHZ ±2 PPM
	4883851N05	5.0 MHZ
	5483262P01	LABEL, Carrier Frequency Measurement
	7582200H21	PAD, oscillator

TRN7244A UHSO Synthesizer Hardware

REF. SYMBOL	PART NO.	DESCRIPTION
non-referenced items:		
	0200132616	NUT, hex: 6-32 x 1/4 x 3/32 x 1/8" (4 used)
	0310907A28	SCREW, machine: M3.5 x 0.6 x 10 (8 used)
	0383497N04	SCREW, machine: M3 x 0.5 x 8 (4 used)
	0384890R01	SCREW, machine: M3.5 x 0.6 (10 used)
	1584835R01	COVER, synthesizer
	1584837R01	COVER, HSO
	2784836R01	CHASSIS, synthesizer
	2883779P01	CONNECTOR, plug: 10-contact
	3282796H01	GASKET, rfi (38 used)
	3700085556	GROMMET rubber (2 used)

TRN7244A UHSO Synthesizer Hardware

REF. SYMBOL	PART NO.	DESCRIPTION
non-referenced items:		
	4210217A02	STRAP, tie: .091 x 3.62" lg
	4210347A03	CLAMP, cable
	4283503M01	RETAINER: M3.5, pan head (3 used)
	4283981P01	RETAINER, cable
	4383981N03	SPACER, heatsink
	4883808F11	CHANNEL ELEMENT: 14.400 MHZ ±5 PPM
	4883851N05	5.0 MHZ
	5483262P01	LABEL, Carrier Frequency Measurement
	7582200H21	PAD, oscillator

TKN8631A Cable, HSO

REF. SYMBOL	PART NO.	DESCRIPTION
non-referenced items:		
	0180730E31	CABLE ASSEMBLY
	0180782D87	CABLE ASSEMBLY, output
	0180782D88	4 PIN MOLEX
	0180782D90	CABLE ASSEMBLY, HSO
	0500136977	Eye .121 x .093
	0984968D01	receptacle: BNC type (2 used)
	1583142M07	HOUSING, connector, recep- tacle: 8-contact
	1583142M08	HOUSING, connector: 4-con- tact (2 used)
	2200400055	Staple, 1/4" L X 1/2" W
	2882331G01	plug: coaxial: phono
	2883099K01	plug: BNC type
	3010286B03	WIRE, 24 stranded (BRN) (9.75 used)
	3010286B04	WIRE, 24 stranded (RED) (9.75 used)
	3010286B07	GRN (9.75 used)
	3010286B88	WIRE BLK (16.75 used)
	3010286B89	RED (7 used)
	3010286H91	WIRE BRN (7 used)
	3010286H92	WIRE ORG (7 used)
	3083794C01	CABLE, coaxial (40.75 used)
	3700132251	tubing polyol. 3/16" (blk) (3 used)
	3982717M01	CONTACT, receptacle (12 used)
	4210217A02	STRAP, tie: .091 x 3.62" lg (3 used)

TRN9812B HSO/UHSO Power Supply

TRN9812C HSO/UHSO Power Supply

REF. SYMBOL	PART NO.	DESCRIPTION
capacitor, fixed:		
C1	2113741B69	0.1 uF, ±5%; 50 V
C3	2113741B69	0.1 uF, ±5%; 50 V
C4	2313748G19	47 uF, ±20%; 35 V
C6	2113741B45	0.01 uF, ±5%; 50 V
C7	2113741B61	0.047 uF, ±5%; 50 V
C9	2113741B37	4700 pF, ±5%; 50 V
C10	2311049A19	10 uF, ±10%; 25 V
C11	2113740B32	20 pF, ±5%; 50 V
C12	2311049A21	22 uF, ±10%; 20 V

TRN9812B HSO/UHSO Power Supply
 TRN9812C HSO/UHSO Power Supply (cont'd)

REF. SYMBOL	PART NO.	DESCRIPTION
C13	2113741B45	0.01 uF, $\pm 5\%$; 50 V
C14	2113741B69	0.1 uF, $\pm 5\%$; 50 V
		diode: (see note)
CR1	4813833C07	Diode, dual 100 W
CR2 thru 4	4813833C07	Diode, dual 100 W (TRN9812C)
		fuse:
F1	6582847N30	2A, 250 V
		connector:
P1	2813922A04	plug: 4-contact
P2502	2880004T03	plug: 3-contact
P2602	2813922A04	plug: 4-contact
		transistor: (see note)
Q1	4882605H02	silicon controlled rectifier
Q2,3	4813824A10	NPN
Q4	4800869807	PNP
Q5,6	4811056A08	PNP
		resistor, fixed:
R1	1782177B01	3 ohms, $\pm 10\%$; 5 W
R2	0611077B03	15K, $\pm 5\%$; 1/8 W
R3,4	0611077A68	560 ohms, $\pm 5\%$; 1/8 W
R5	0611077A30	15 ohms, $\pm 5\%$; 1/8 W
R6	0611086A41	180 ohms, $\pm 5\%$; 1W
R7 thru 9	0611077A90	4.7K, $\pm 5\%$; 1/8 W
R10	0611077A50	100 ohms, $\pm 5\%$; 1/8 W
R11	0611009B23	0 ohm, $\pm 5\%$; 1/4 W
R12	0611077A40	39 ohms, $\pm 5\%$; 1/8 W
R13	0611077A36	27 ohms, $\pm 5\%$; 1/8 W
R14	0611009B23	0 ohm, $\pm 5\%$; 1/4 W
R15	0611077A98	10K, $\pm 5\%$; 1/8 W
R16	0611077A82	2.2K, $\pm 5\%$; 1/8 W
R17	0611077A54	150 ohms, $\pm 5\%$; 1/8 W
R18 thru 20	0611072A25	100 ohms, $\pm 5\%$; 1/4W (TRN9812C)
		integrated circuit: (see note)
U1	5182802R24	IC EEPOT 50K 10% (TRN9812B)
U1	5182335V01	IC EEPOT 50K 10% (TRN9812C)
U2	5113816D01	5 V Positive Regulator
		voltage regulator: (see note)
VR1	4882479V09	Diode, Zener 9.1 V
VR2	4882479V15	Diode, Zener 15 V
		non-referenced items:
	0784178T01	CLIP, mounting (used with Q4)
	0910548A04	Fuse Block (used with F1)
	1483820M02	INSULATOR, heat conductive (used with Q4)
	2684177T01	Heat Sink (used with Q4)

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part number.

TRN7323A HSO Synthesizer Hardware

REF. SYMBOL	PART NO.	DESCRIPTION
non-referenced items:		
	0200132616	NUT, hex: 6-32 x 1/4 x 3/32 x 1/8" (4 used)
	0310907A28	SCREW, machine: M3.5 x 0.6 x 10 (8 used)
	0310943M16	SCREW, tapping: TT3.5 x 0.6 x 10 (2 used)
	0383497N04	SCREW, machine: M3 x 0.5 x 8 (4 used)
	0384890R01	SCREW, machine: M3.5 x 0.6 (10 used)
	0482345A18	WASHER, shoulder
	0782475R01	BRACKET, oscillator
	1484268A01	INSULATOR, transistor
	1584835R01	COVER, synthesizer
	1584837R01	COVER, HSO
	2784836R01	CHASSIS, synthesizer
	2883779P01	CONNECTOR, plug: 10-contact
	3282796H01	GASKET, rfi (38 used)
	3700085556	GROMMET rubber (2 used)
	4210217A02	STRAP, tie: .091 x 3.62" lg
	4210347A03	CLAMP, cable
	4283503M01	RETAINER: M3.5, pan head (3 used)
	4283981P01	RETAINER, cable
	4383981N03	SPACER, heatsink
	4882437R02	CRYSTAL OSCILLATOR: 5.0 MHZ
	4883808F11	CHANNEL ELEMENT: 14.400 MHZ ±5 PPM
	5483262P01	LABEL, Carrier Frequency Measurement
	7582200H21	PAD, oscillator