FT-709R
TECHNICAL SUPPLEMENT

This booklet contains supplemental technical information related to the FT-709R for use with the FT-709R Operating Manual. Service or repairs to the FT-709R transceiver should be performed by qualified technicians only.

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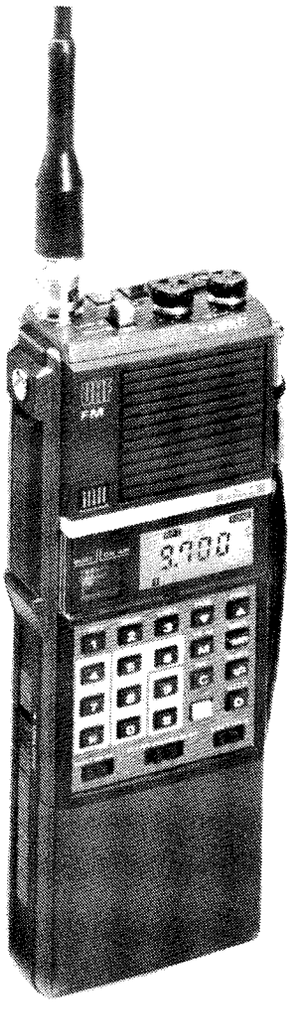
FT-709R
TECHNICAL SUPPLEMENT



This manual is intended to serve as a supplement to the FT-709R Operating Manual. Detailed information regarding functions, specifications, options and operation has been provided in the Operating Manual, and is not reprinted herein. Therefore, this supplement is not intended to serve as an independent reference, but to be used in conjunction with the information provided in the Operating Manual.

Because of the compactness and complexity of the double-sided glass-epoxy circuit boards used in the FT-709R, four layout diagrams are provided for each board. Each side of the board is identified by the type of the majority of components installed on that side. In most cases one side has only chip components, and the other has either a mixture of both chip and lead components (trimmers, coils, electrolytic capacitors, packaged ICs, etc.), or lead components only. The two "obverse" views depict the board as it is seen when viewed directly with the eye, while the two "reverse" views depict the unseen side of the board as it would appear if one were to peer through the board from the other side without seeing the components and tracks on the near side.

While we believe the technical information in this manual is correct, Yaesu assumes no liability for damage that may occur as a result of typographical or other errors that may be present. Your cooperation in pointing out any inconsistencies in the technical information would be appreciated.

Yaesu Musen reserves the right to make changes in the circuitry of this transceiver, in the interest of technological improvement, without notification of the owners.

CHIP COMPONENT INFORMATION

While chip components are generally more reliable and enduring than lead components, they are much more difficult to replace. The chip placement robots at the factory set the components into place on a small spot of resin adhesive before soldering, and this adhesive provides rigid mechanical support for the component independently of the solder joints. Once the resin has been cured there is no way to remove it. Therefore, to remove a chip component, it is necessary to first remove all of the solder at each connection and then forcefully break the adhesive bond. This must be done very carefully, both to avoid overheating the board and lifting tracks when desoldering, and to avoid damaging the board or underlying tracks when breaking off the component. Removed components should never be reused, as they are bound to be unreliable after removal.

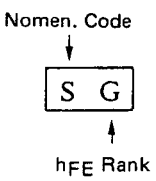
In spite of the following information on labelling, some chip components may have no markings at all (especially resistors and capacitors, indicated with asterisks "*" below). In this case, to identify the component, refer to the part location in the layout diagrams, note the location number, and then refer to the Parts List to determine the value or nomenclature and type.

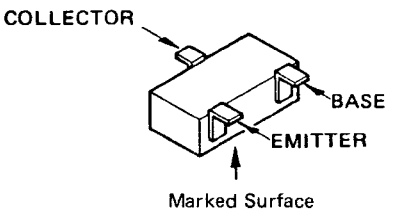
Bipolar Transistors

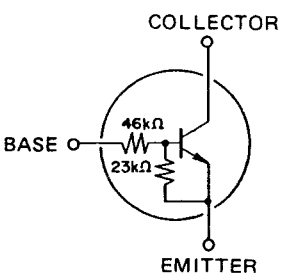
Part (Location) No.	Nomenclature	Marking
Q2014,2016,2019	2SA812(M6/M7)	M6/M7
Q1014,1016,1018, 2018,2020	2SA1162GR	SG
Q1004,1005,1008, 1009,1012,1013, 1015,1017,2001, 2003,2015,2017, 2021	2SC2712GR	LG
Q2005,2008,2009, 2010	2SC2759	U22
Q1001,1002	2SC3356	R22
Q4002,4004	2SC3397*	DY

* Bias resistors included

Example:





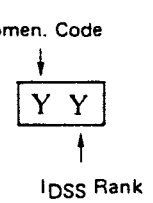


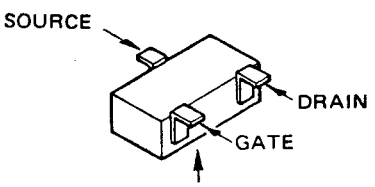
* 2SC3397(DY)

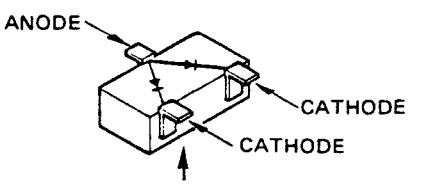
FET

Q2004	2SK210Y	YY

Example:

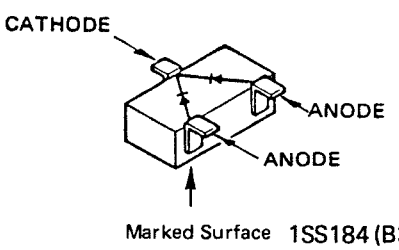




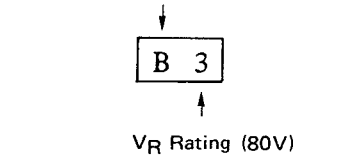


Dual Diodes

D1009,2009,2010, 2011	1SS184	B3
D1001,1008	1SS226	C3
D4002,4004	DCA015	A4



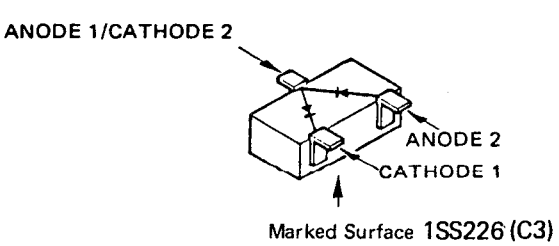
Example:



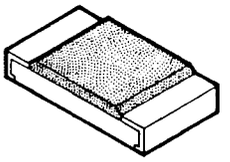
B1 = 1SS182 (30V)
B2 = 1SS183 (50V)
B3 = 1SS184 (80V)

C1 = 1SS224 (30V)
C2 = 1SS225 (50V)
C3 = 1SS226 (80V)

A4 = DCA015



Resistors



Type RMC 1/10W

Marking* A1 ..... Z6

Value code

A	1.0	N	3.3
B	1.1	P	3.6
C	1.2	Q	3.9
D	1.3	R	4.3
E	1.5	S	4.7
F	1.6	T	5.1
G	1.8	U	5.6
H	2.0	V	6.2
J	2.2	W	6.8
K	2.4	X	7.5
L	2.7	Y	8.2
M	3.0	Z	9.1

Multiplier code

0	1
1	10^1
2	10^2
3	10^3
4	10^4
5	10^5
6	10^6

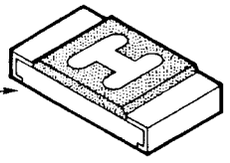
Examples:

A1 = 10Ω

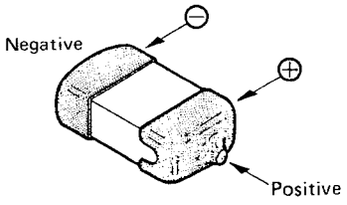
J3 = 2.2kΩ

S4 = 47kΩ

Jumper (0Ω) Chip

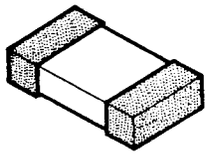


Tantalum Capacitor



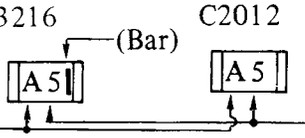
Polarized, Unmarked
(determine value from layout and Parts List)

Ceramic Capacitors



Types: C2012
C3216

Marking* C3216 (Bar) C2012



Value code

A	1.0	M	3.0	Y	8.2
B	1.1	N	3.3	Z	9.1
C	1.2	P	3.6	a	2.5
D	1.3	Q	3.9	b	3.5
E	1.5	R	4.3	d	4.0
F	1.6	S	4.7	e	4.5
G	1.8	T	5.1	f	5.0
H	2.0	U	5.6	m	6.0
J	2.2	V	6.2	n	7.0
K	2.4	W	6.8	t	8.0
L	2.7	X	7.5	y	9.0

Multiplier code

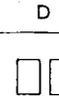
0	1
1	10^1
2	10^2
3	10^3
4	10^4
5	10^5
6	10^6
7	—
8	10^{-2}
9	10^{-1}

C3216 types use a bar marking for either thermal coefficient or tolerance ranking, (according to capacitance value range) as below

Temperature Compensating Types (low values) No bar = SL-type

NPO(CH)	N150(PH)	N220(RH)	N330(SH)	N470(TH)	N750(UJ)
					

Dielectric Constant (Hi K) Types (high values)

B	D
	

No bar = F

Examples:

$\overline{A1}$ = 10pF NPO

J3| = 0.0022μF D

|A3 = 0.001μF B

Cap. Tolerance

B = 10%

D = 20%

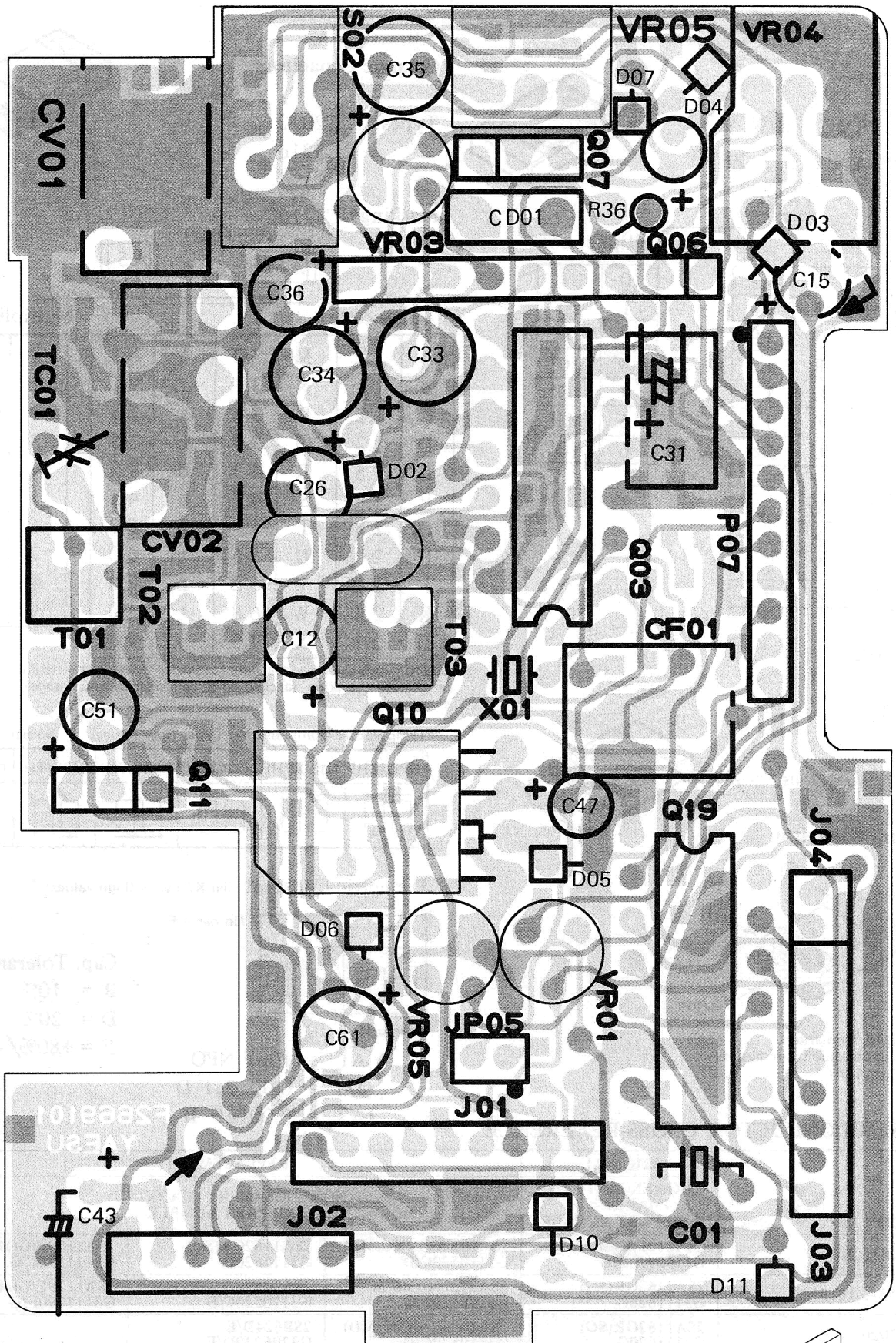
F = +80%/−20%

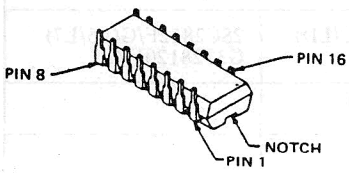
CHIP SEMICONDUCTOR CROSS-REFERENCE

PART LOCATION No.	ORIGINAL	REPLACEMENT		
	NOMENCLATURE (MARKING) AND PART NUMBER	NOMENCLATURE (MARKING) AND PART NUMBER		
Q2014,2016,2019	2SA812F/G(M6/M7) G3108120F/G	2SA1052C/D(MC/MD) G3110520C/D	2SA1162GR(SG) G3111620G	2SA1179F/G(M6/M7) G3111790F/G
Q1014,1016,1018	2SA1162GR(SG) G3111620G	2SA812F/G(M6/M7) G3108120F/G	2SA1052C/D(MC/MD) G3110520C/D	2SA1179F/G(M6/M7) G3111790F/G
Q2018,2020	2SA1162GR(SG) G3111620G	2SA1052C/D(MC/MD) G3110520C/D	2SB624D/E G3206240D/E	
Q1004,1005,1008,1009,1012, 1013,1015,1017,2001,2003, 2015,2017,2021	2SC2712GR/BL(LG/LL) G3327120G/B	2SC1623F/G(L6/L7) G3316230F/G	2SC2462C/D(LC/LD) G3324620C/D	2SC2812F/G(L6/L7) G3328120F/G
D1009,2009,2010,2011	1SS184(B3) G2070009	1S2838(A6) G2070018	DCB015TA(A6) G2070021	
D1001,1008	1SS226(C3) G2070003	1SS123(A7) G2070020		

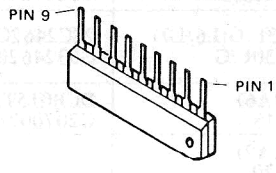
* Semiconductors not listed above may be replaced only with original types.

RX UNIT (obverse view of "component" side)

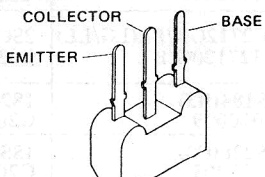




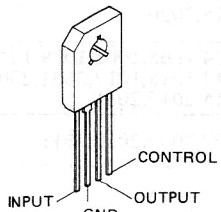
TK10420 (Q1003)
LA4087 (Q1019)



LA4145 (Q1006)

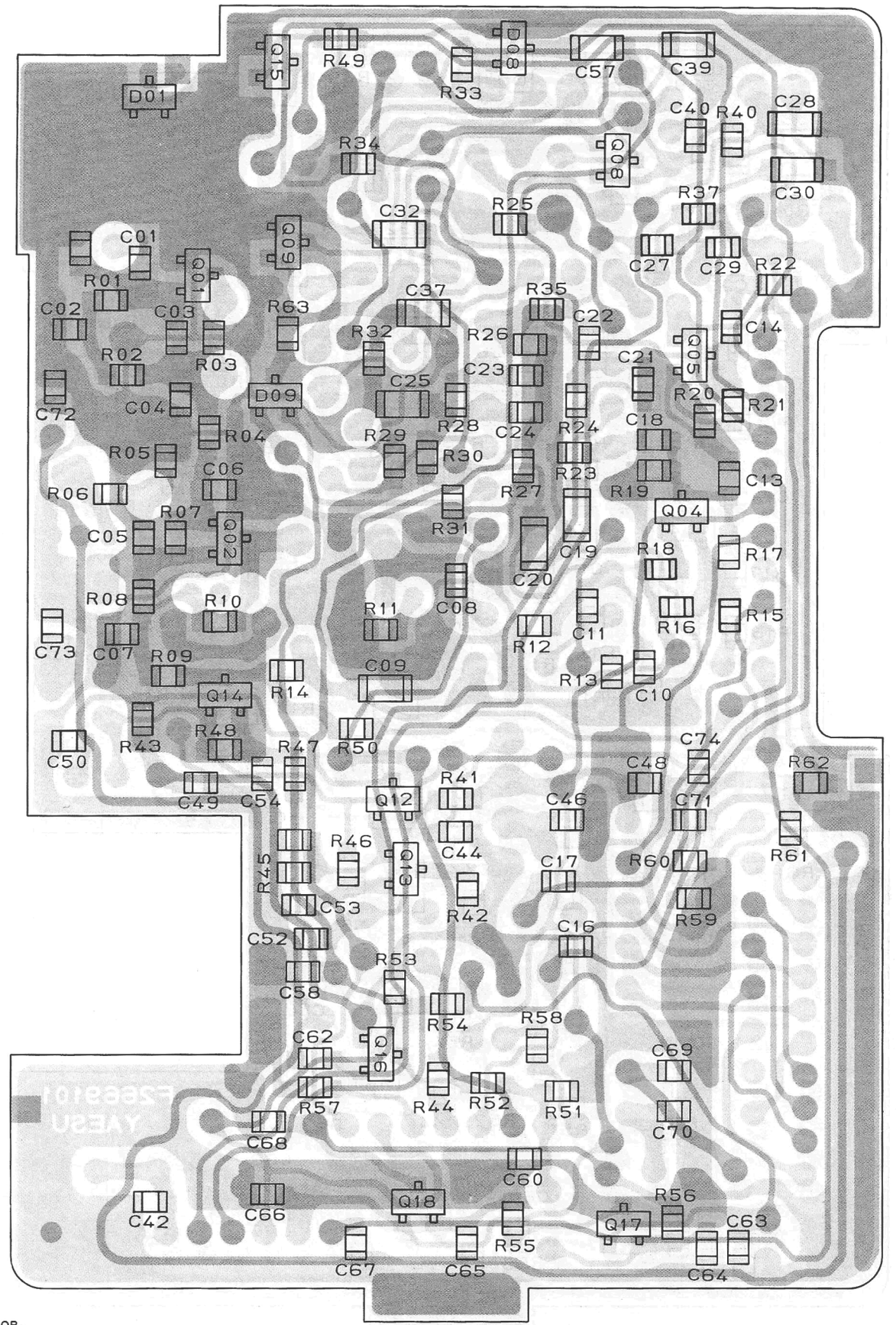


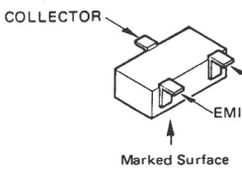
2SB793R (Q1007,1011)



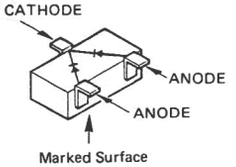
LA5005H (Q1010)

RX UNIT (reverse view of "chip-only" side)

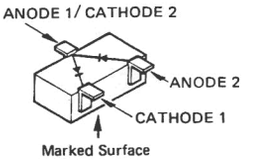




2SA1162GR(SG) (Q1014,1016,1018)
2SC2712GR(LG) (Q1004,1005,1008, 1009,1012,1013, 1015,1017)
2SC3356(R22) (Q1001, 1002)

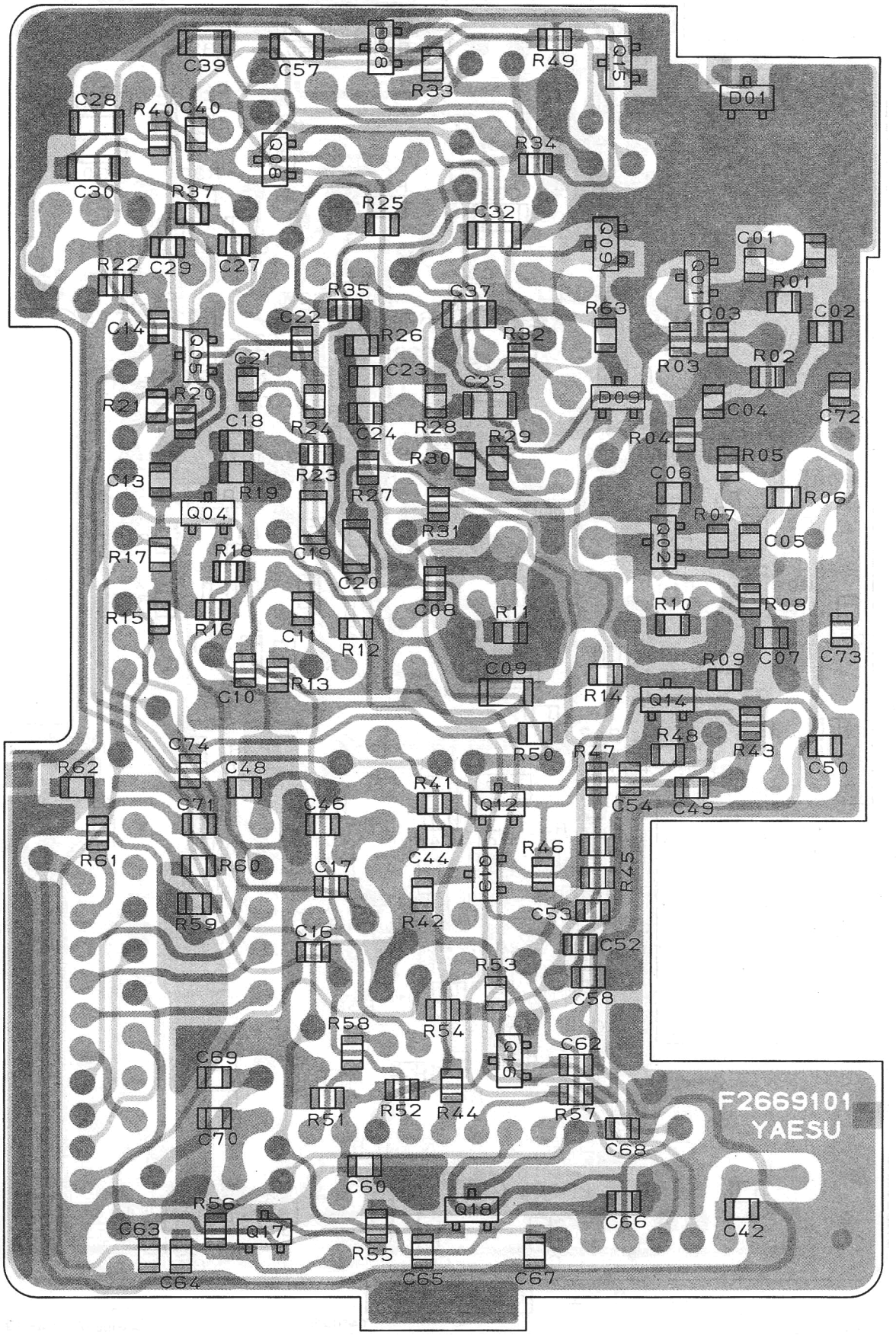


1SS184(B3) (D1009)

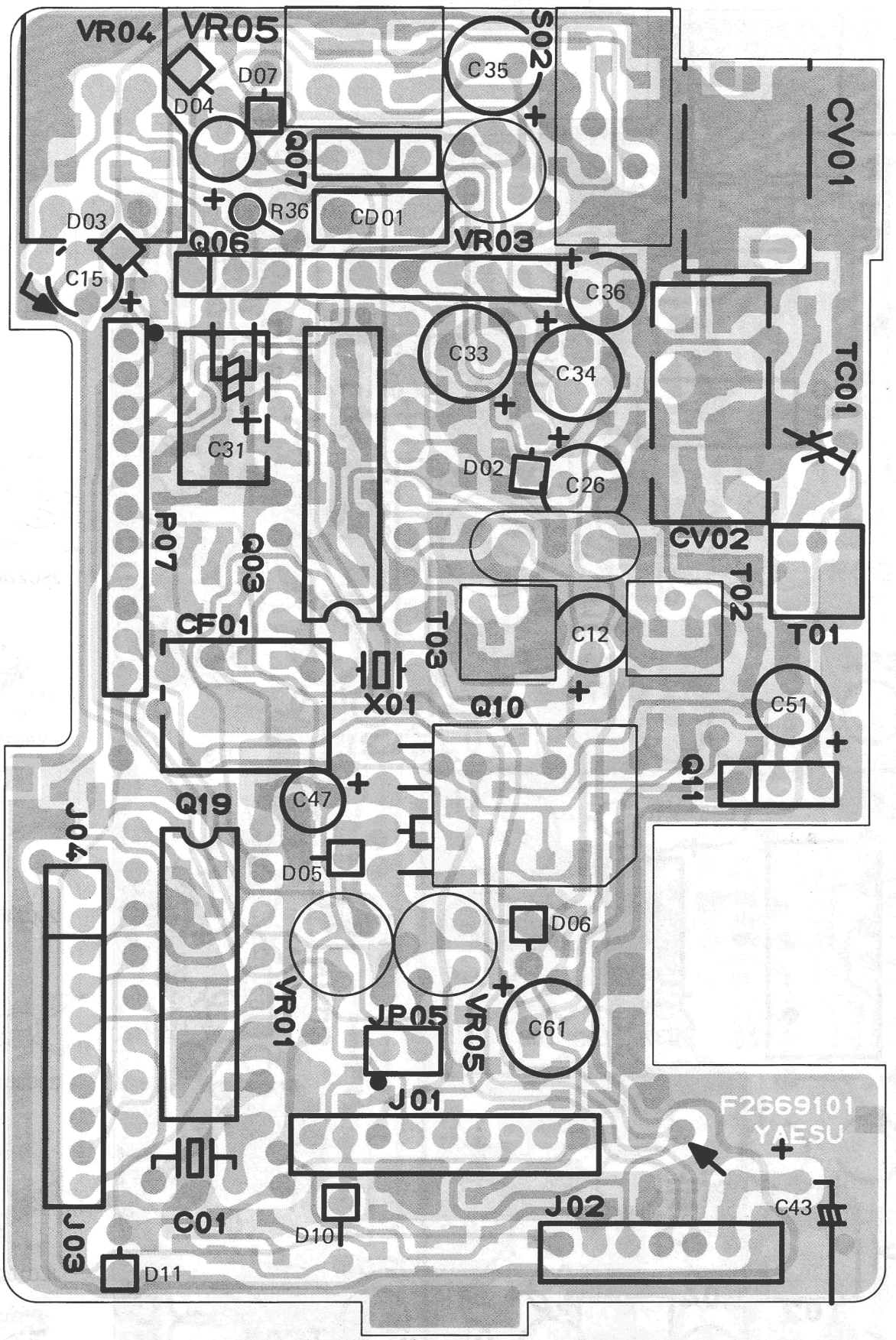


1SS226(C3) (D1001, 1008)

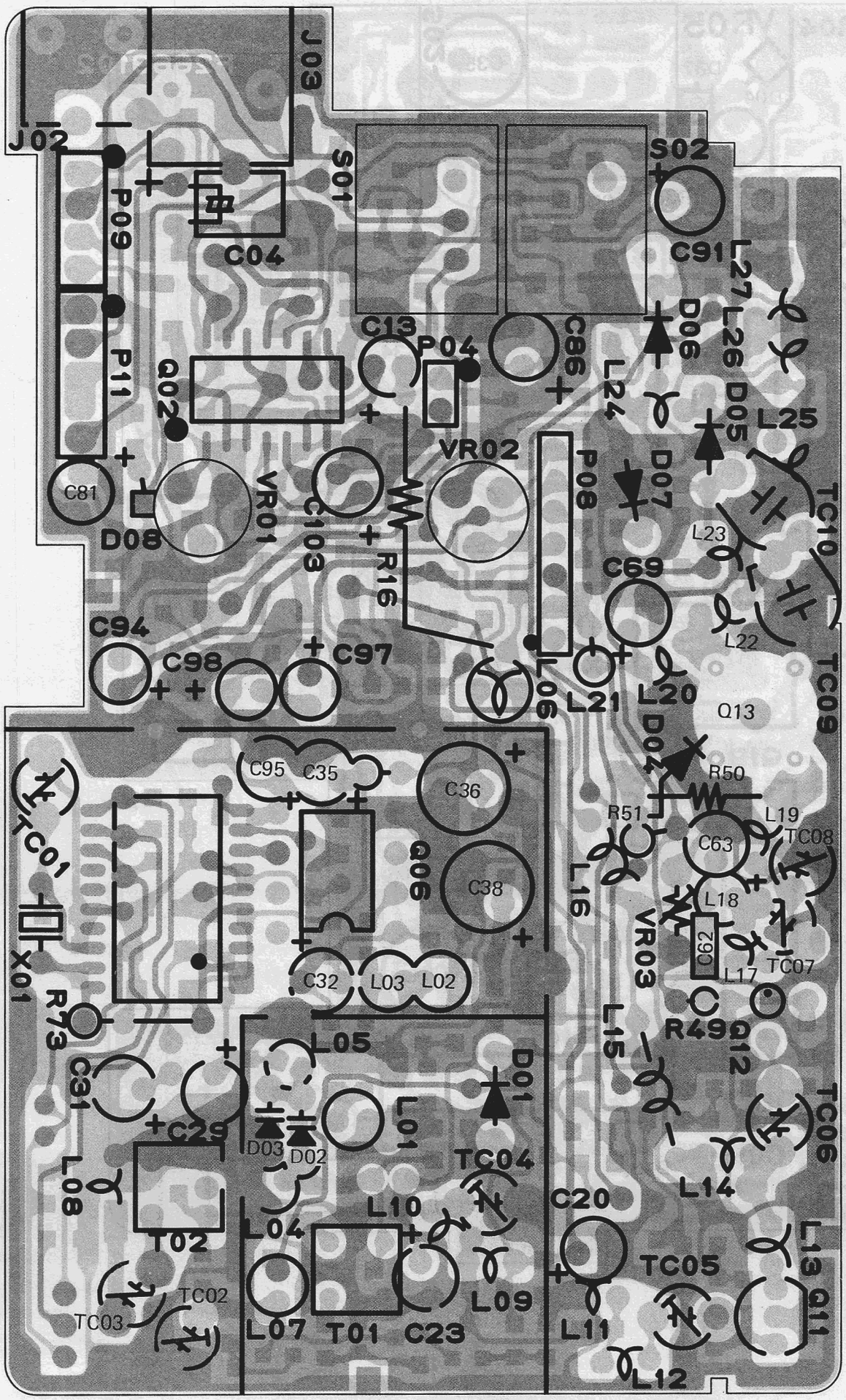
RX UNIT (obverse view of "chip-only" side)

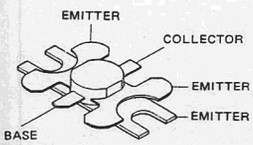


RX UNIT (reverse view of "component" side)

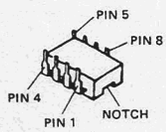


PLL UNIT (obverse view of "component" side)

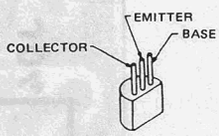




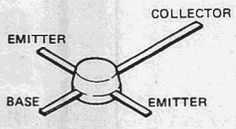
2SC2283 (Q2013)



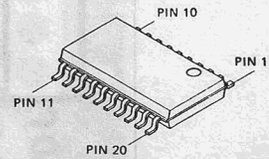
μPB571 (Q2006)



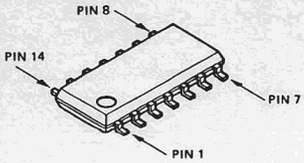
2SC2407 (Q2011)



2SC3019 (Q2012)

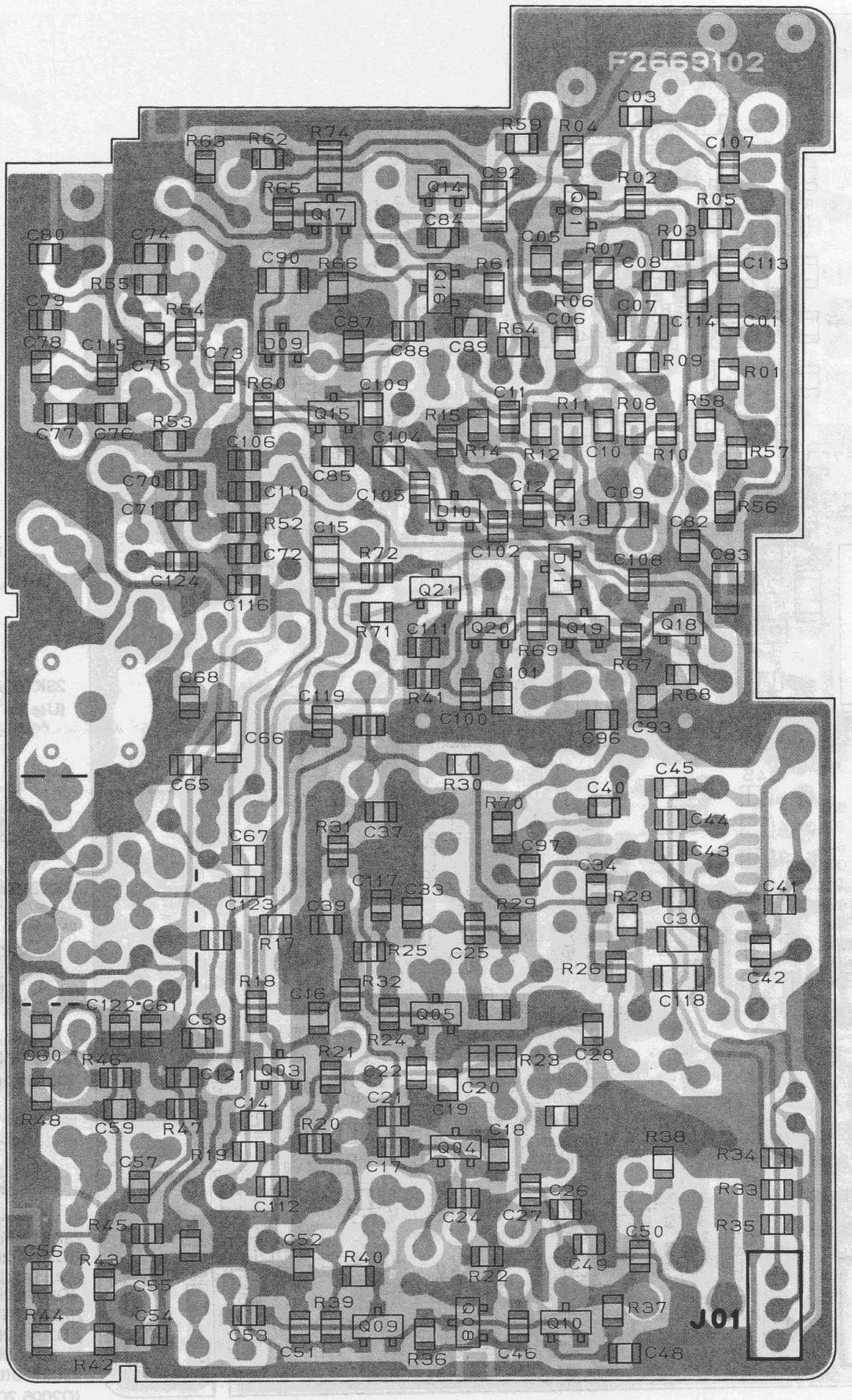


JLC1007P (Q2007)

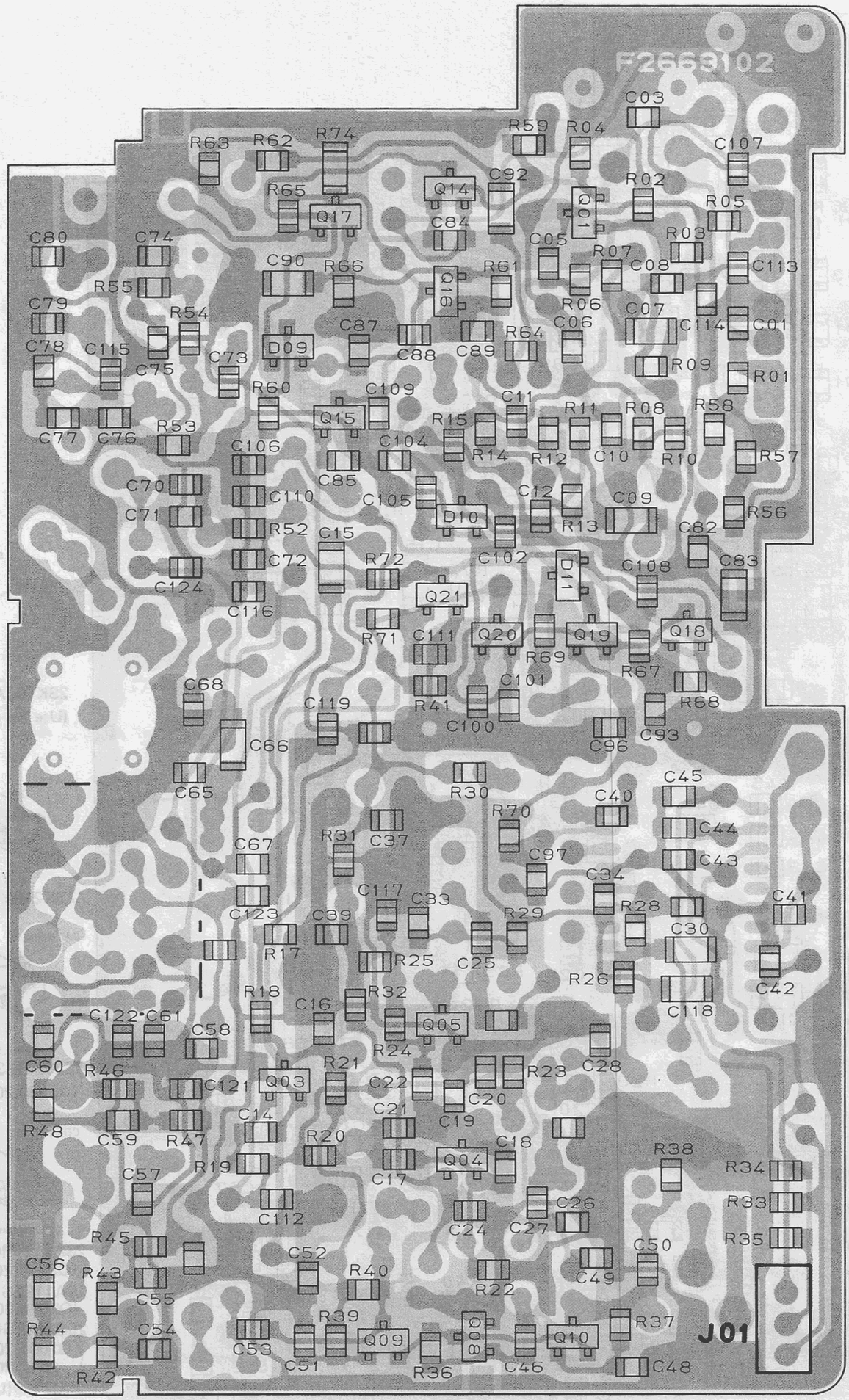


LA6324M (Q2002)

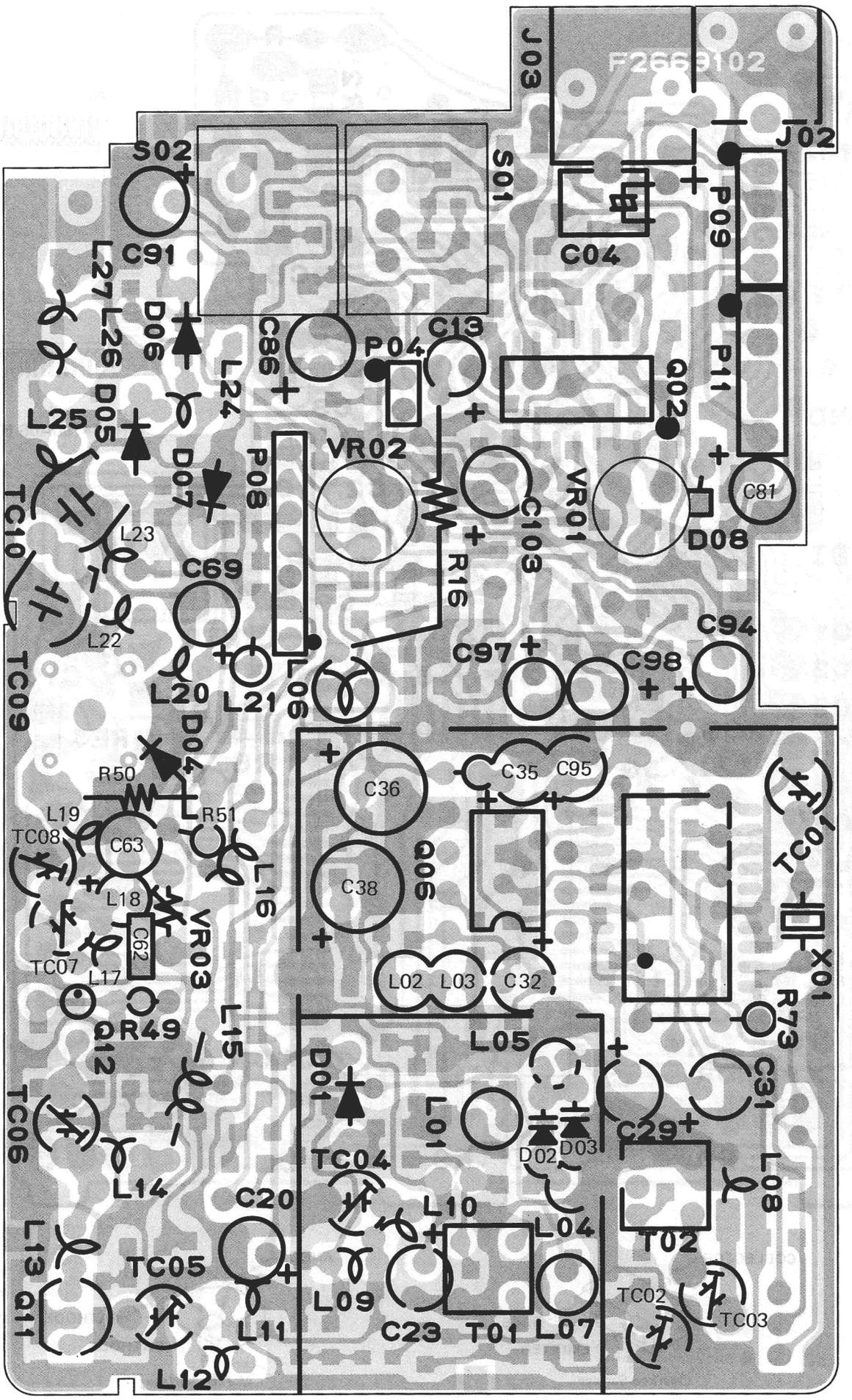
PLL UNIT (obverse view of "chip-only" side)



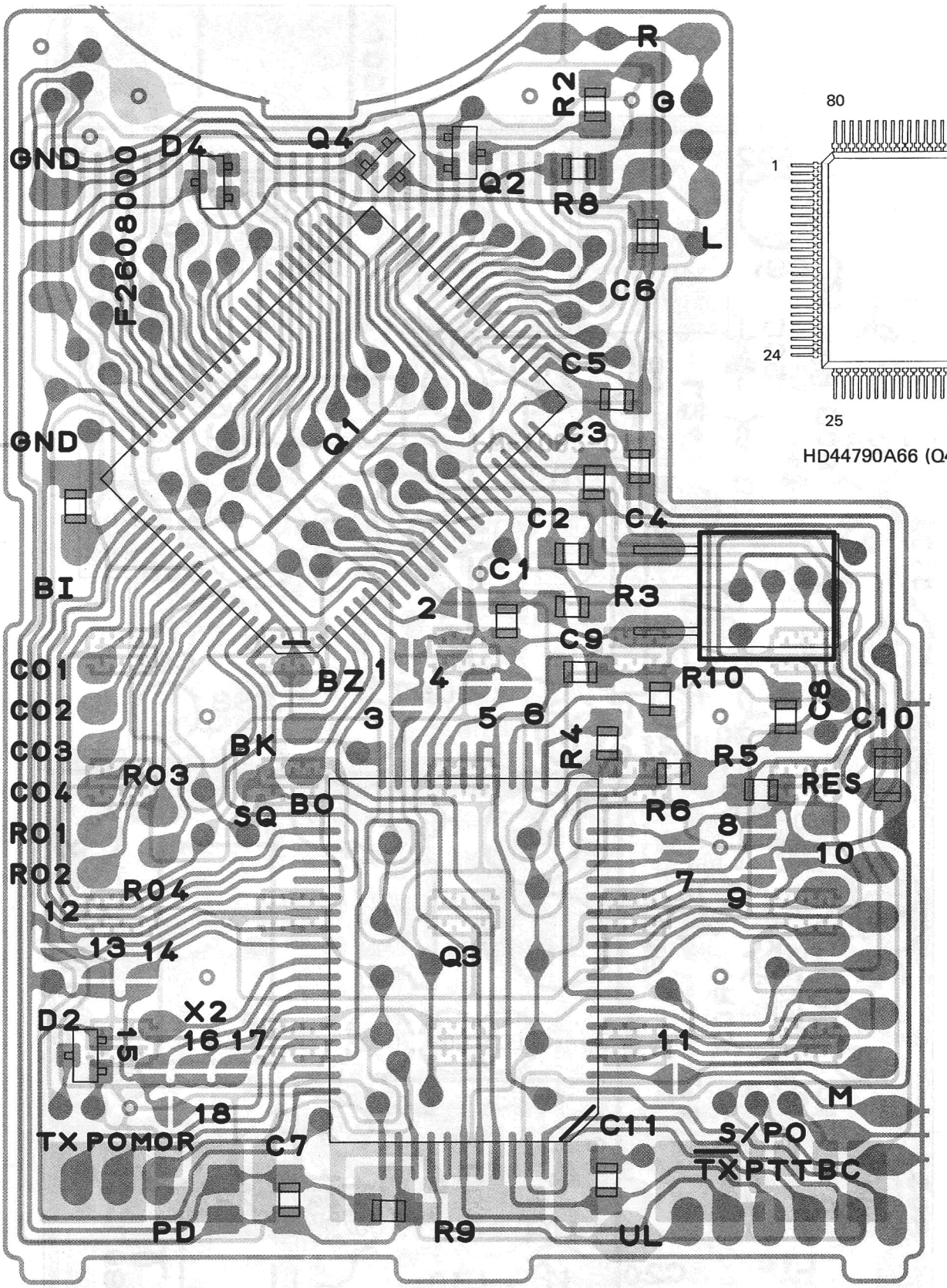
PLL UNIT (obverse view of "chip-only" side)



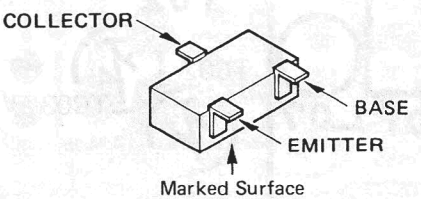
PLL UNIT (reverse view of "component" side)



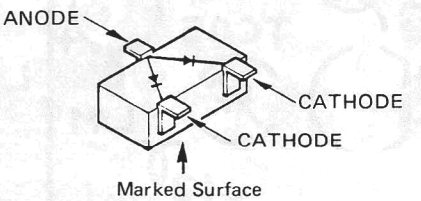
CONTROL UNIT (IC side)



HD44790A66 (Q4001)

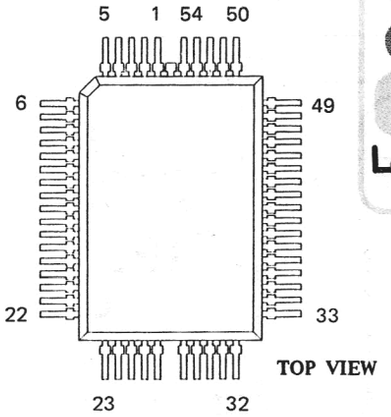


2SC3397(DY) (Q4002,4004)



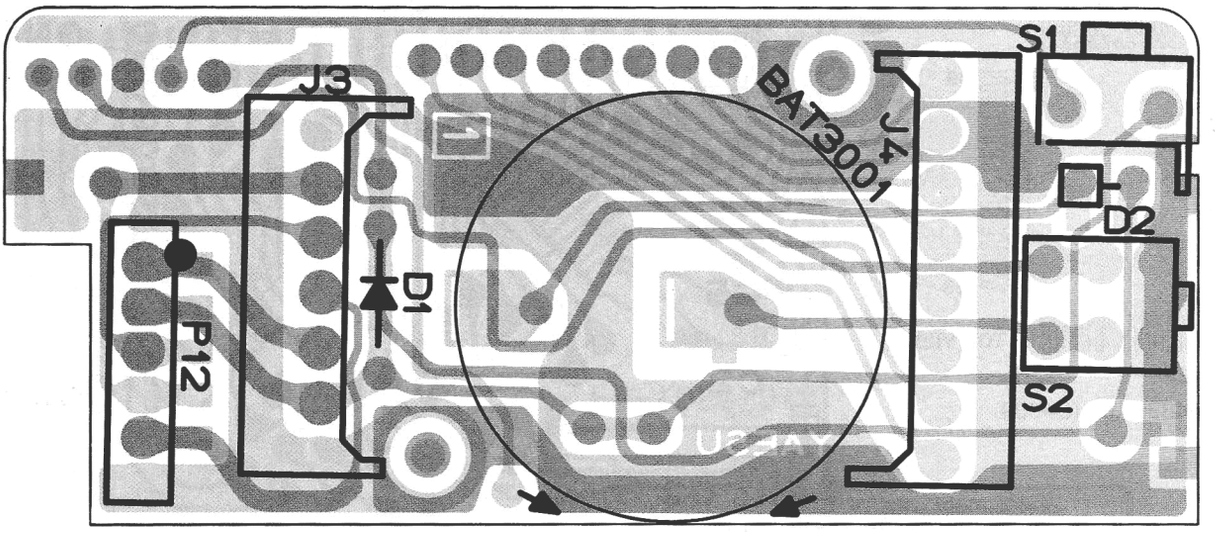
DAC015(A4) (D4002,4004)

CONTROL UNIT (key sw side)

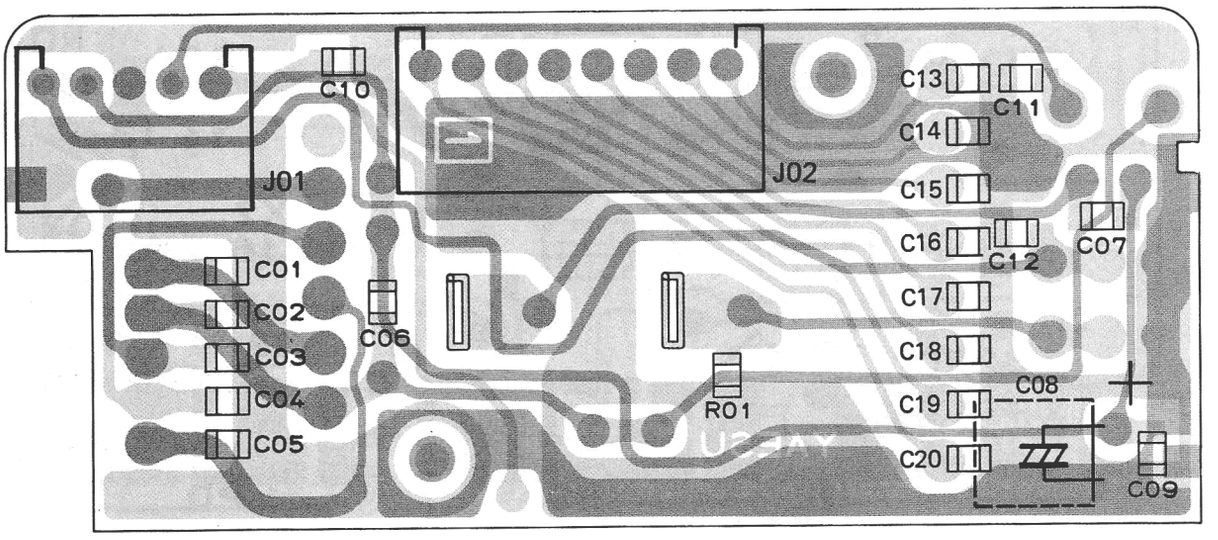


HD44860A56 (Q4003)

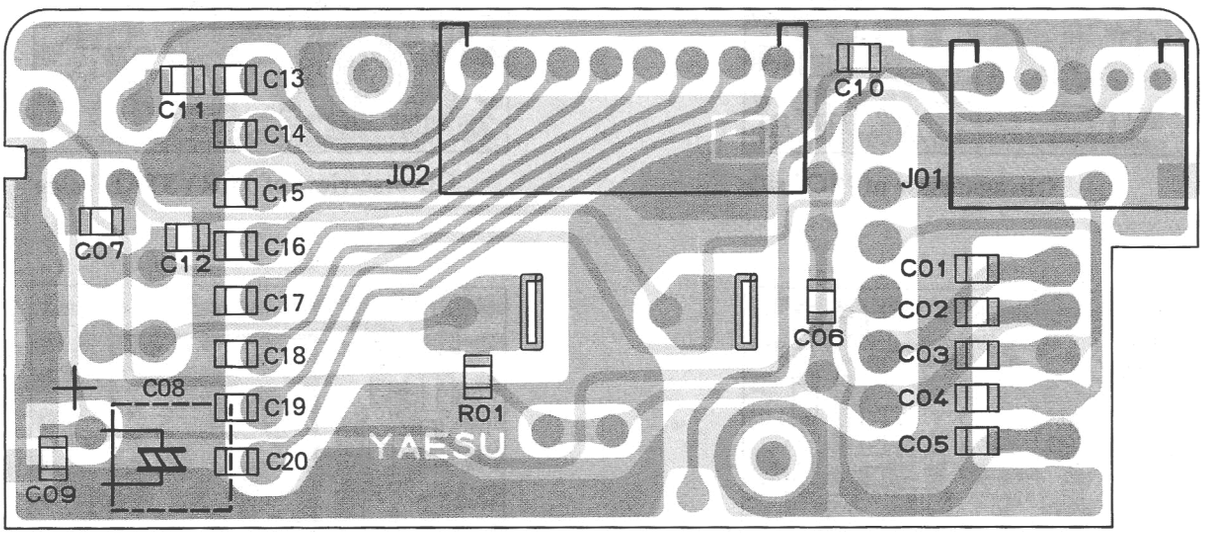
CONNECTOR UNIT (obverse view of battery side)



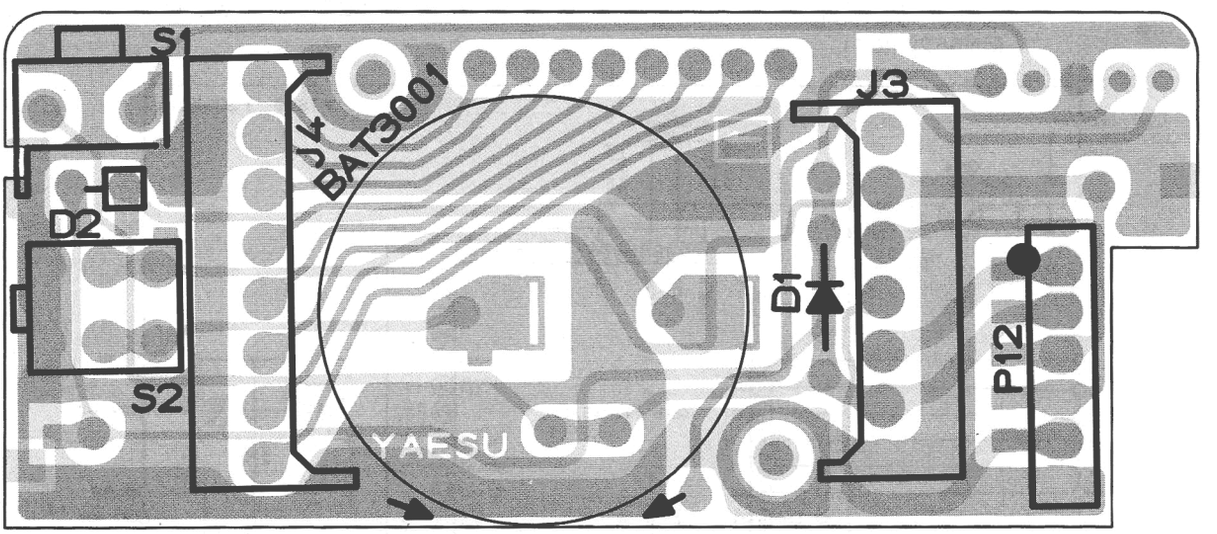
CONNECTOR UNIT (reverse view of chip side)

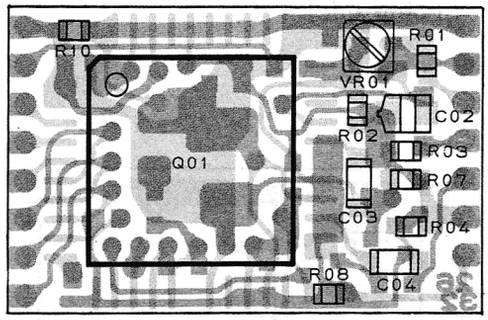


CONNECTOR UNIT (obverse view of chip side)

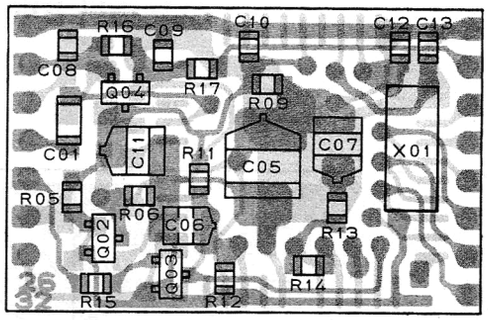


CONNECTOR UNIT (reverse view of battery side)

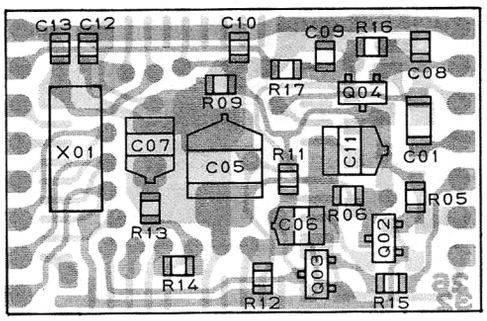




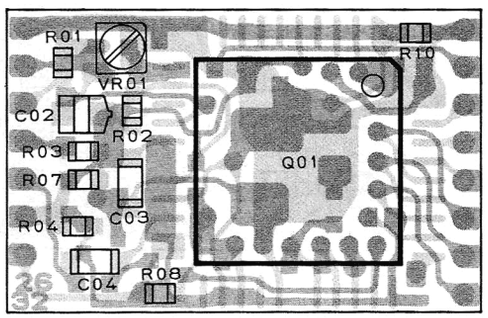
Obverse view of "IC" side



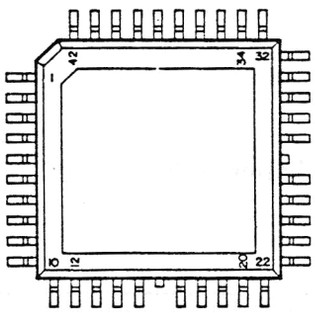
Obverse view of "CRYSTAL" side



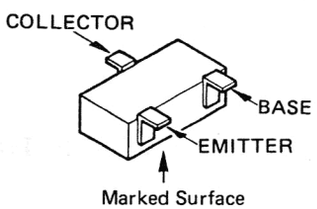
Reverse view of "CRYSTAL" side



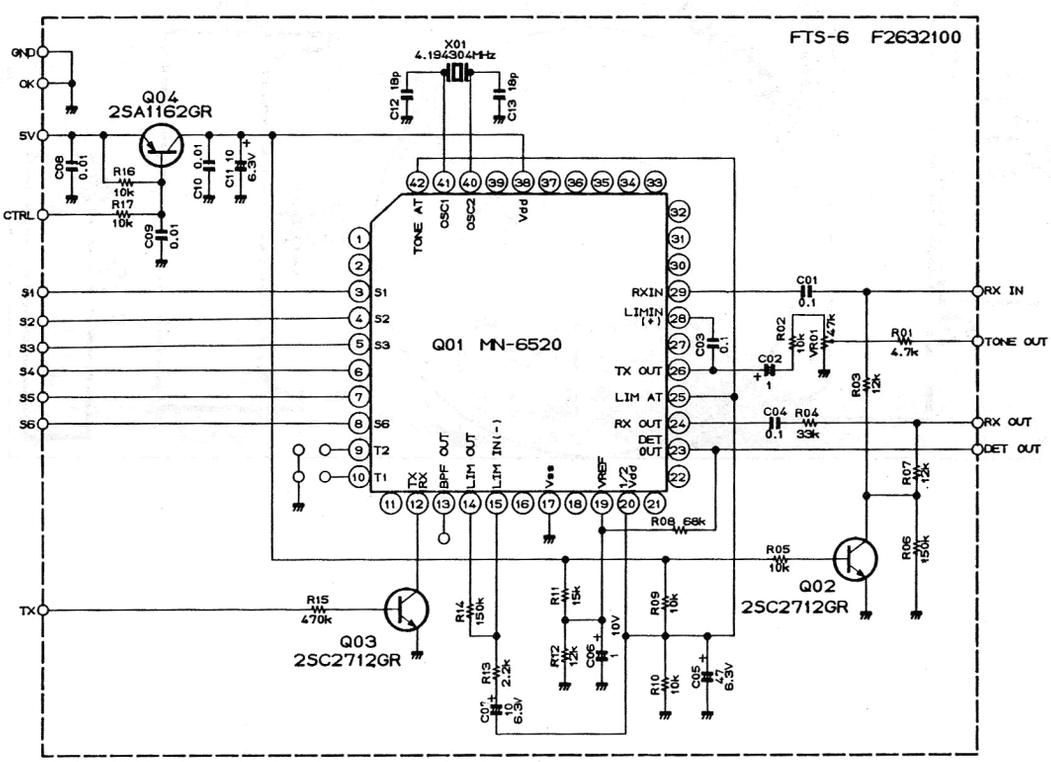
Reverse view of "IC" side



MN6520 (Q1)



2SA1162GR(SG) (Q04)
2SC2712GR(LG) (Q02, 03)



CASE DISASSEMBLY

As there are many fine interconnecting wires inside the FT-709R, extreme care must be exercised whenever the case is open to avoid damaging the connections. We recommend that the exploded view be studied carefully before beginning disassembly of the case.

1. Remove the battery pack and the four screws affixing the battery mounting track.

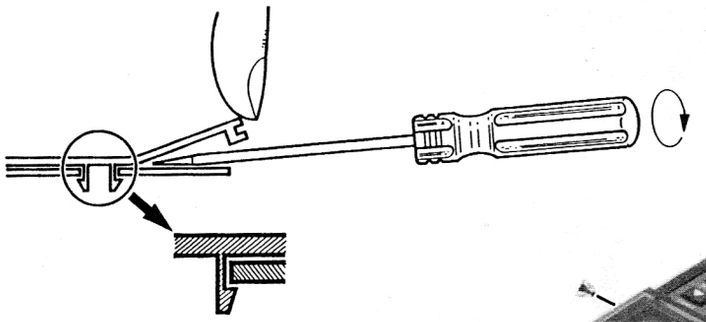
2. Remove the strap mounting screw with its washer, and the strap mounting dummy screw.

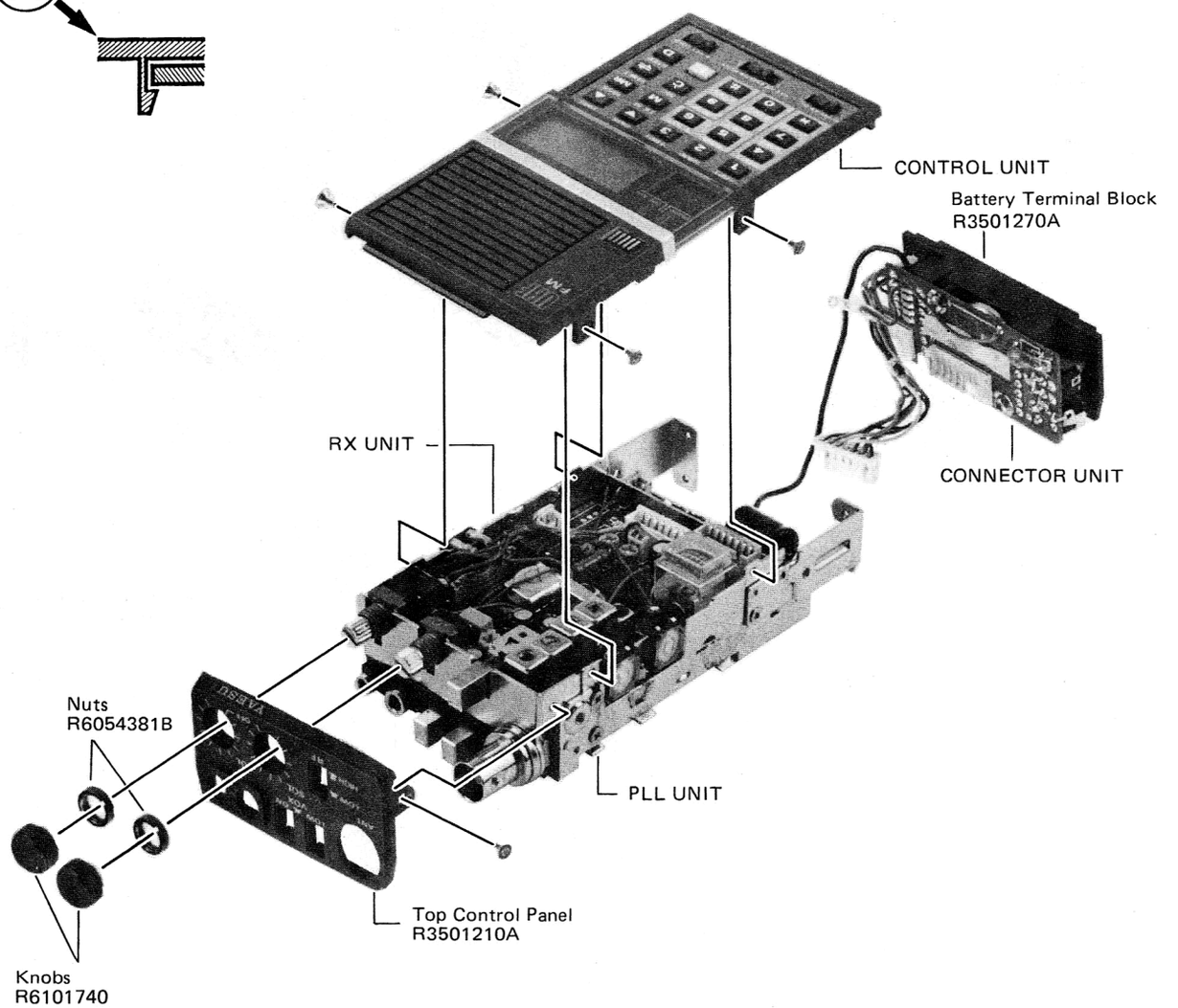
3. Using a small screwdriver as shown below, gently pry off the right side cover of the case (the one that includes the LAMP button), while observing how the button is hinged.

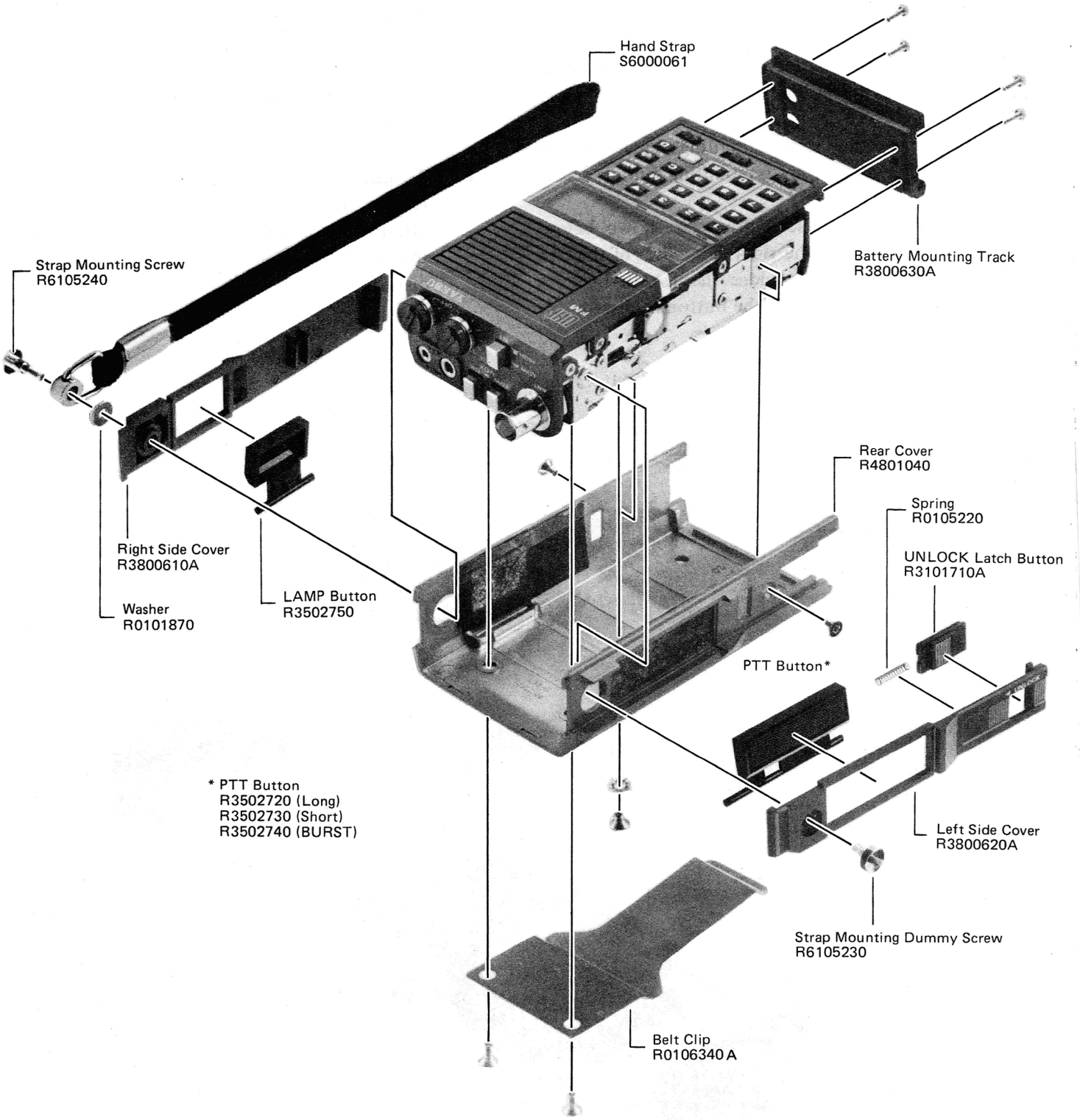
4. Remove the two screws affixing the belt clip to the rear cover, and also remove the one other screw on the rear cover.

5. Now slowly separate the rear cover and remaining side cover from the transceiver, noting the location and method of positioning of the PTT switch and the UNLOCK button and spring. The PLL Unit will now be exposed.

6. To gain access to the Control and RX Units, remove the four screws (2 on each side) affixing the front cover, and slowly separate the front cover and Control Unit (without disturbing the interconnecting wiring).






Hand Strap
S6000061
Strap Mounting Screw
R6105240
Battery Mounting Track
R3800630A
Rear Cover
R4801040
Spring
R0105220
UNLOCK Latch Button
R3101710A
Right Side Cover
R3800610A
LAMP Button
R3502750
Washer
R0101870
PTT Button*
* PTT Button
R3502720 (Long)
R3502730 (Short)
R3502740 (BURST)
Left Side Cover
R3800620A
Strap Mounting Dummy Screw
R6105230
Belt Clip
R0106340A

ALIGNMENT

Alignment preparation and precautions

Because of several thermally sensitive interactive components in the transceiver, particular attention must be paid to assure a constant ambient temperature around the transceiver during alignment. If the transceiver temperature is different than that of the alignment environment, allow sufficient time for complete thermal equalization before proceeding. Alignment temperature must remain constant and be within the range of 20 to 30°C (68 to 86°F).

Furthermore, proper alignment requires that the shield cover above the VCO, and shield plate beneath, be in place; and that the circuit boards be mounted in place on the chassis.

Alignment voltage is 10.8 VDC for the FT-709R, except where specifically indicated otherwise.

The frequencies associated with the upper and lower band limits and band center referred to in the alignment procedures are indicated in the following chart for the various model versions.

Alignment Equipment

DC voltmeter (at least 20-kilohms/volt impedance)
DC Ammeter (to 10A)
AF Millivoltmeter
450 MHz standard signal generator (SSG) with calibrated level and modulation (see note below)
AF signal generator (AG)
SINAD meter (SINADDER)
FM linear detector (deviation meter)
CM coupler (directional coupler)
RF wattmeter (5W, ±5% @ 450 MHz)
50-ohm non-reactive (@ 450 MHz) dummy load
Frequency counter (100 Hz resolution at 450 MHz)
Oscilloscope

Note:

SSG levels referred to in the alignment procedure are based on 0 dBμ = 0.5 μV.

ALIGNMENT FREQUENCY (MHz)

Version	Lower Band Limit	Band Center	Upper Band Limit
A	440.000	445.000	449.975
B, C, X	430.000	435.000	439.975

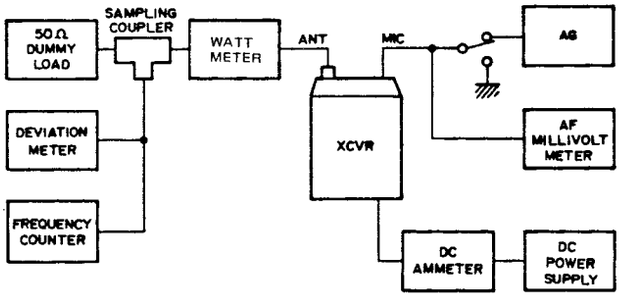
PLL Circuit

The varactor control voltage is carefully set using a special test jig and adjusting T_{2001} at the factory, and should not require realignment. However, the voltage should be checked prior to alignment. Connect the DC voltmeter to pin 11 of Q_{2007}, tune the transceiver to the upper band limit, and check for 4.0 V DC. DC.

Then retune to the lower band limit, and check for at least 0.5 V DC.

Transmitter

Connect the test equipment for transmitter alignment as shown below. Make certain that the 50-ohm dummy load is connected to the antenna jack at all times during alignment; do not make any adjustments using the antenna.



Test Equipment Connections for Transmitter Alignment

A. Transmitter Resonant Circuits

1. Set the transceiver to band center, close the PTT and adjust TC_{2004} – TC_{2010} for maximum output power on the watt meter (at least 3W).

2. Check the power output at both band limits (at least 2.5W). Supply current should be less than 800 mA.

B. Low Power Set

1. With the RF HI/LOW switch set to LOW, set the transceiver to band center and adjust VR_{2003} for 400 mW power output. Now set the transceiver to first the lower and then the upper band limits, and check for output within the range of 300–700 mW.

C. Master Oscillator (PLL) Frequency

Ground the external MIC jack (so that there is no modulation), and set the transceiver to band center. Close the PTT and adjust TC_{2001}, if necessary, so that the output is within ±100 Hz of the displayed frequency.

D. PO Meter Calibration

With the transceiver set to band center, the HI/LOW switch set to HI and the meter switch set to S/PO, close the PTT and adjust VR_{1001} on the RX Unit, if necessary, so that the meter indicates "8" on the PO scale.

E. Modulator Deviation

Set the AF oscillator (connected to the MIC jack) for 1 kHz at 25 mV, and adjust VR_{2001}, if necessary, for ±4.5 kHz deviation. Now reduce the level of the modulating tone until the deviation meter shows ±3.5 kHz deviation, and check that the audio generator output level is between 2 and 4 mV.

F. Tone Encoder Output Level
(if optional FTS-6 is installed)

With the transceiver set to band center, on the keypad press [3] [0] [F] [6] [F] [5], and then close the PTT and adjust VR_{2002}, if necessary, for ±0.5 kHz deviation (with no external modulation).

G. DTMF Modulation Check

With the transceiver set to band center, on the keypad press [1], [C], and check for ±2.0 – ±3.5 kHz deviation on the deviation meter.

H. Battery Condition Meter Function

Set the meter switch to BC, reduce the supply voltage to 6V, and adjust VR_{1005}, if necessary, so that the meter is centered on the red/green border. Return the supply voltage to normal.

I. VOX Sensitivity Check

With the audio generator tuned to 1 kHz and connected to the MIC jack, note the generator output level at which the VOX activates. This should be within 3 to 6 mV when the VOX HI/LOW switch is in the HI position, and within 6 to 10 mV in the LOW position.

Receiver

Connect the test equipment as shown for receiver alignment.

A. Resonant Circuits

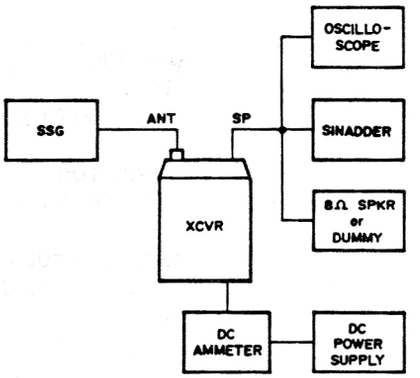
1. With the transceiver set to band center and the meter switch set to S/PO, set the RF signal generator to the point where S meter indicates "4" at the same frequency with no modulation, and adjust CV_{1001}, CV_{1002}, TC_{2002}, TC_{2003} and TC_{1001} for peak indication on the S-meter (set the SSG level as necessary to keep reading on scale).

2. Adjust T_{1002} and T_{1003} for peak S-meter deflection and minimum distortion on the oscilloscope. Adjust the generator level as necessary to keep S-meter indications on scale.

3. Confirm at least 12 dB SINAD at 0.2 μV or less generator output on each 1 MHz through the range of the transceiver.

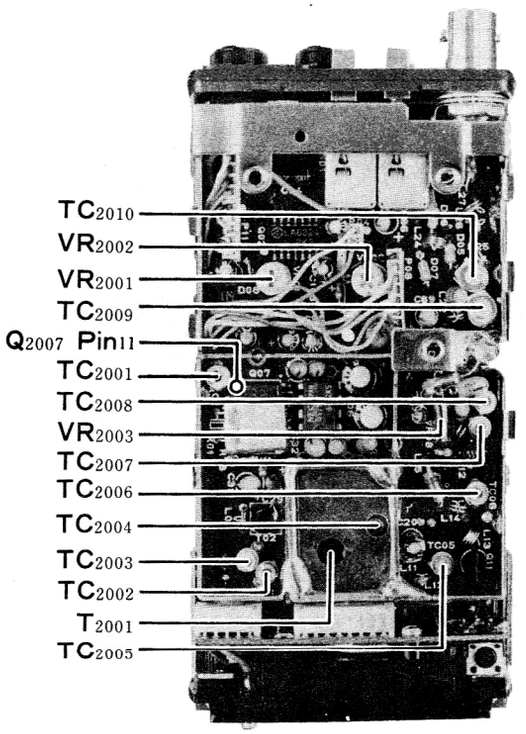
B. Squelch Threshold Preset

Set the transceiver to band center, and the SQL control to mid-range. With no input at the antenna jack, adjust VR_{1003}, if necessary, so that the squelch just closes.

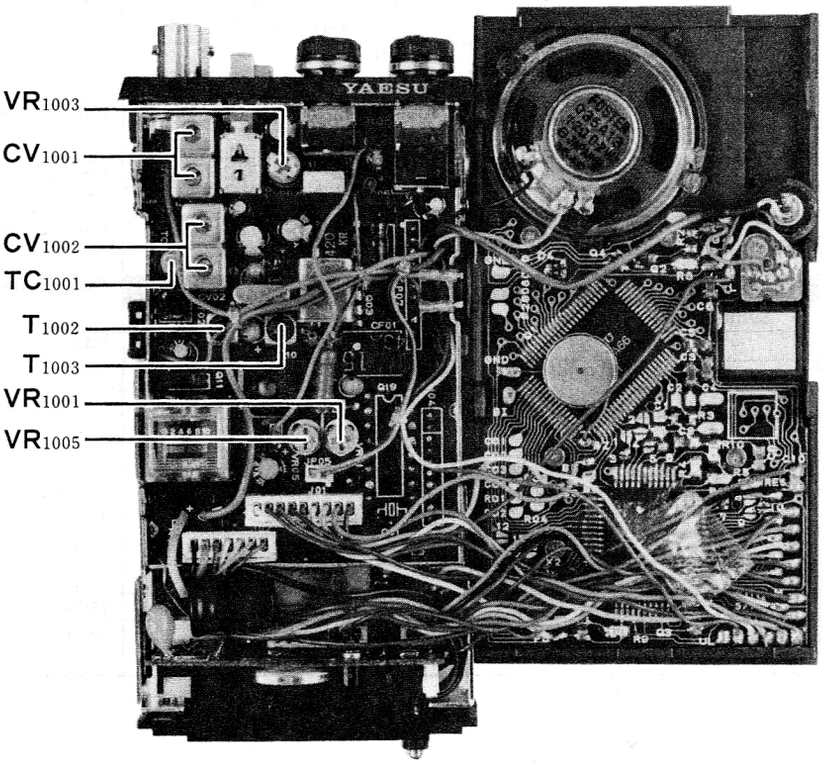


Test Equipment Connections for Receiver Alignment

PLL UNIT ALIGNMENT POINTS



RX UNIT ALIGNMENT POINTS



PARTS LIST

MAIN CHASSIS

Symbol No.	Part No.	Description
		CAPACITORS
C2	K02173100	Ceramic disc 50WV 10pF CH (DD104CH100D50V)
		METER
M1	M0290044	MH-42F
		SWITCHES
S1,2,3*	N4090040	KHG10901 PTT,LAMP,BURST*
		CONNECTOR
J1	P1090376	BNC-R (050-1400)
		MISCELLANEOUS
	R3501210A	Top Control Panel
	–	Front Cover (See Control Unit Assy)
	R4801040	Rear Cover w/o label, belt clip
	R8102190	Trim band
	R3800620A	Left Side Cover (PTT) or (PTT and BURST)
	R3800610A	Right side Cover (LAMP)
	R3502720	PTT Button (long) Versions A, X & F
	R3502730	" " (short) Versions B & C
	R3502740	BURST Button Versions B & C
	R3502750	LAMP Button
	R3101710A	UNLOCK Latch Button
	R0105220	Spring
	R3800630A	Battery Mounting Track
	R6101740	Knob 11TS (VOL and SQL)
	R3102070	Push Button (VOX and VOX H/L)
	R3102080	" " (Power H/L)
	R6105230	Strap Mounting Dummy Screw
	R6105240	Strap Mounting Screw
	R0101870	Washer
	R0105250	Inner Frame C
	R0106340A	BELT CLIP
	S6000061	HAND STRAP

CONTROL UNIT

Symbol No.	Part No.	Description
		CONTROL UNIT ASSY
	Q9000296	Version A
	Q9000297	Versions B & C
	Q9000298	Version F
	F2608000	Control Board
		ICs
Q4001	G1090580	HD44790A66
Q4003	G1090581	HD44860A56
Q4002,4004	G3333970	2SC3397 (DY)
		DIODES
D4002,4004	G2070011	Si DCA015(A4)
D4001	G2090243	LED TLR210
D4003	G2090288	" TLG210
		LIQUID CRYSTAL DISPLAY
DS4001	G6090034	LS109-A
		CERAMIC RESONATOR
CO4001	H7900190	CSB390 390kHz (Versions B, C & E)
		BUZZER
BZ4001	M4290001	EFBRE-25D02
		MICROPHONE
MIC4001	M3290005	EM-78C
		SPEAKER
SP4001	M4090063	CO35A13
	R3502500	Cover
		RESISTORS
R4008	J23205331	Chip RMC-1/10B 331J 330Ω
R4002	J23205152	" " 152J 1.5kΩ
R4006	J23205332	" " 332J 3.3kΩ
R4005	J23205103	" " 103J 10kΩ
R4009,4010	J23205473	" " 473J 47kΩ
R4004	J23205513	" " 513J 51kΩ
R4003▲	J23205823	" " 823J 82kΩ
R4003*	J23205105	" " 105J 1MΩ
		CAPACITORS
C4001*,4008	K22170801	Chip 50WV 470pF B (C2012B1H471MFA)
C4002*,4011, 4012*,4013,4014	K22170805	" " 0.001μF " (C2012B1H102MFA)
C4007,4009	K22171004	" " 0.01μF F (C2012F1H103ZFA)
C4003–4006	K22141904	" " 0.1μF D (C3216D1E104KFA)
C4010	K78080002	Tantalum 6.3WV 4.7μF (F950J475MAA)
		CONNECTORS
P1 (with wire)	T9204820	
P2 (")	T9204821A	
P3 (")	T9204822A	
P5▲(")	T9204824A	Versions A, X & F
P6▲(")	T9204827	Versions A & X
P6*(")	T9204826	Versions B & C

▲ Versions A & X
* Versions B & C

P7,8,9 (with wire)	T9204828	
P11 ( )	T9204830	
P12,13( )	T9204819	

RX UNIT

Symbol No	Part No.	Description
	F2669101	Printed Circuit Board
		PCB with Components w/o Frame
		ICs
Q1003	G1090617	TK10420
Q1006	G1090558	LA4145
Q1010	G1090609	LA5005H
Q1019▲	G1090508	LR4087
		TRANSISTORS
Q1014,1016,1018	G3111620G	2SA1162GR(SG)
Q1007,1011	G3207930R	2SB793R
Q1004,1005,1008, 1009,1012,1013, 1015,1017	G3327120G	2SC2712GR(LG)
Q1001,1002	G3333560	2SC3356(R22)
		DIODES
D1002	G2015550	Si 1S1555
D1003	G2090244	Schottky 1SS106
D1004	G2090183	Zener HZ9A2L
D1009	G2070009	Si 1SS184(B3)
D1011	G2090294	Zener HZ4BLL
D1005–1007,1010	G2090027	Si 1SS53
D1001,1008	G2070003	" 1SS226(C3)
D1012	G2090277	" 1SS205
		CRYSTAL
X1001▲	H0102608	HC-49/T 22.055MHz Versions A & X
X1001*	H0102615	HC-49/T 21.145MHz Versions B & C
X1001(F)	H0102406	HC-18/T 16.445MHz
		CERAMIC RESONATOR
CQ1001▲	H7900120	R3.58M 3.579545MHz
		MONOLITHIC FILTER
XF1001	H1102088	21P15A (2 pcs; matched pair)
XF1001(F)	H1102033	16M15A
		CERAMIC FILTER
CF1001	H3900360	LF-K15X
		CERAMIC DISCRIMINATOR
CD1001	H7900180	CDB455C7

		RESISTORS
R1039	J20306689	Metallic film 1W 6.8Ω
R1018	J24205100	Chip RMC1/10T 100J 10Ω
R1058	J24205220	" " 220J 22Ω
R1068	J24205680	" " 680J 68Ω
R1009,1014,1050, 1057	J24205101	" " 101J 100Ω
R1004	J24205221	" " 221J 220Ω
R1003,1005,1015	J24205471	" " 471J 470Ω
R1002,1006,1010, 1023,1029,1042	J24205102	" " 102J 1kΩ
R1025	J24205152	" " 152J 1.5kΩ
R1010(F)	J24205182	" " 182J 1.8kΩ
R1013,1022,1033, 1059▲	J24205222	" " 222J 2.2kΩ
R1019	J24205272	" " 272J 2.7kΩ
R1007,1021,1043	J24205332	" " 332J 3.3kΩ
R1027	J24205392	" " 392J 3.9kΩ
R1032,1034	J24205472	" " 472J 4.7kΩ
R1016,1045	J24205562	" " 562J 5.6kΩ
R1011,1026	J24205682	" " 682J 6.8kΩ
R1008,1035,1041, 1046,1047,1048, 1052,1055	J24205103	" " 103J 10kΩ
R1012,1017,1040, 1044,1053	J24205223	" " 223J 22kΩ
R1036*	J24205273	" " 273J 27kΩ
R1001,1011(F), 1037,1065	J24205333	" " 333J 33kΩ
	J24205393	" " 393J 39kΩ
R1024,1031,1056	J24205473	" " 473J 47kΩ
R1054,1060▲	J24205563	" " 563J 56kΩ
R1062▲	J24205683	" " 683J 68kΩ
R1030,1049, 1061*,1062*, 1063	J24205104	" " 104J 100kΩ
R1051	J24205224	" " 224J 220kΩ
R1028	J24205474	" " 474J 470kΩ
R1020	J24205564	" " 564J 560kΩ
R1067	J01215101	Carbon film 1/8W TJ 100Ω
R1064	J01215273	" " " 27kΩ
		POTENTIOMETERS
VR1001,1005	J51745103	H0651A013-10KB 10kΩB
VR1003	J51745104	H0651A019-100KB 100kΩB
VR1002	J60800111	K0911000Z-5KB 5kΩB (SQL)
VR1004	J60800105	K0911100B-5R1111-20KA 20kΩA(VOL)
		CAPACITORS
C1076	K22170202	Chip 50WV 1pF CH (C2012CH1H010CFA)
C1003	K22170204	" " 3pF CH (C2012CH1H030CFA)
C1011(F)	K22170221	" " 27pF CH (C2012CH1H270JFA)
C1069▲,1070▲	K22170323	" " 33pF UJ (C2012UJ1H330JFA)
C1001	K22170225	" " 39pF CH (C2012CH1H390JFA)
C1004,1011	K22170227	" " 47pF CH (C2012CH1H470JFA)

▲ Versions A & X
* Versions B & C
(F) Version F

C1022	K22170229	Chip 50WV 56pF CH (C2012CH1H560JFA)	
C1010(F)	K22170235	" " 100pF CH (C2012CH1H101JFA)	
C1010	K22170237	" " 120pF CH (C2012CH1H121JFA)	
C1013,1018,1021	K22170239	" " 150pF CH (C2012CH1H151JFA)	
C2023	K22170243	" " 220pF CH (C2012CH1H221JFA)	
C1002,1005,1006, 1024,1029,1040, 1046, 1048–1050, 1053, 1073–1075,1058	K22170805	" " 0.001μF B (C2012B1H102MFA)	
C1007,1016,1017, 1042,1052,1054, 1060,1062–1068	K22171004	" " 0.01μF F (C2012F1H103ZFA)	
C1008,1027,1044, 1071	K22171004	" " 0.01μF B (C2012B1H103MFA)	
C1014	K22171008	" " 0.047μF F (C2012F1H473ZFA)	
C1009,1019,1020, 1025,1028,1030, 1032,1036,1037, 1039,1057	K22141904	" " 0.1μF D (C3216D1E104KFA)	
C1026	K70100002	Tantalum 10WV 4.7μF (489D475X0010A1)	
C1012,1047	K70080006	" 6.3WV 47μF (489D476X0010D1)	
C1015,1031,1041, 1051	K40129012	Electrolytic 16WV 10μF (ECE-A1CK100)	
C1016	K40129028	" " 47μF (ECE-A1CK470)	
C1033–1035	K40109015	" 10WV 100μF (ECE-A1AK101)	
C1061	K40129028	" 16WV 47μF (ECE-A1CK470)	
C1038	K40129020	" 16WV 100μF (16RC101)	
C1043	K40129006	" " 470μF (16RE470)	
		TRIMMER CAPACITOR	
TC1001	K91000104	ECR-GA003A30 3pF	
		TRANSFORMERS	
T1001	L0021507		
T1002,1003	L0021452		
T1002(F),1003(F)	L0021521		
		CAVITIES	
CV1001,1002	Q9000114	CV-441B	
		SWITCHES	
S1001	–	with VR1004	
S1002	N4090091	SPJ422N26	
		CONNECTORS	
J1001	P0090376	5403-09CPB	
J1002	P0090374	5403-07CPB	
J1003▲	P0090375	5403-08CPB	
J1004*	P0090369	5403-02CPB	
P10 (with wire)	T9204829		
	R0501240A	Inner Frame A	
	R0108330	Shield Rear	

PLL UNIT

Symbol No.	Part No.	Description
	F2669102	Printed Circuit Board
		PCB with components w/o Frame
		ICs
Q2002	G1090559	LA6324M
Q2006	G1090498	μPB571C
Q2007	G1090637	JLC1007P
		FET
Q2004	G3801921Y	2SK192AY
		TRANSISTORS
Q2014,2016,2019	G3108120F	2SA812(M6)
Q2018,2020	G3111620G	2SA1162GR(SG)
Q2011	G3324070	2SC2407
Q2013	G3322830	2SC2283
Q2001,2003,2015, 2017,2021	G3327120G	2SC2712GR(LG)
Q2005,2008–2010	G3327590	2SC2759(U22)
Q2012	G3330190	2SC3019
		DIODES
D2001	G2090297	Si 1SS110
D2002,2003	G2090271	Varactor 1T33
D2004	G2015550	Si 1S1555
D2005,2006,2008	G2090027	" 1SS53
D2007	G2090244	Schottky 1SS106
D2009–2011	G2070009	Si 1SS184(B3)
X2001	H0102610	HC-18/T 12.8MHz Versions A,B,C,X
X2001	H0102609	" 10.24MHz Version F
		RESISTORS
R2049	J00215479	Carbon film 1/8W 4.7Ω VJ
R2073	J01215100	" " 10Ω TJ
R2050	J01215330	" " 33Ω "
R2051	J00215331	" " 330Ω VJ
R2027	J01215272	" " 2.7kΩ TJ
R2075	J01215103	" " 10kΩ "
R2016	J01215223	" " 22kΩ "

▲ Versions A & X
* Versions B & C
(F) Version F

R2029,2030,2044	J24205100	Chip RMC 1/10T 100J 10Ω			C2018,2073	K22170211	Chip 50WV 10pF CH (C2012CH1H100DFA)
	J24205680	" " 680J 68Ω					
R2028,2031,2032, 2041,2045,2047	J24205101	" " 101J 100Ω			C2027,2080	K22170213	" " 12pF " (C2012CH1H120JFA)
R2023	J24205151	" " 151J 150Ω			C2074,2079	K22170215	" " 15pF " (C2012CH1H150JFA)
R2040,2048	J24205221	" " 221J 220Ω					
R2004,2055	J24205331	" " 331J 330Ω			C2041	K22170225	" " 39pF " (C2012CH1H390JFA)
R2042,2052,2056, 2072	J24205471	" " 471J 470Ω			C2042	K22170227	" " 47pF " (C2012CH1H470JFA)
R2046	J24205561	" " 561J 560Ω					
R2017	J24205681	" " 681J 680Ω			C2005	K22170801	" " 470pF B (C2012B1H471MFA)
R2043,2062	J24205102	" " 102J 1kΩ					
R2057	J24205152	" " 152J 1.5kΩ			C2001,2003,2006, 2008,2010,2012, 2014,2016,2020, 2024,2028,2034, 2037,2039, 2043–2045, 2048,2049,2051, 2052, 2055–2061, 2065,2067,2068, 2072,2075,2082, 2084,2085,2087, 2088,2093,2096, 2097,2100, 2104–2114, 2116,2117,2119, 2121–2124	K22170805	" " 0.001μF B (C2012B1H102MFA)
R2001,2025	J24205222	" " 222J 2.2kΩ					
R2063	J24205272	" " 272J 2.7kΩ					
R2038	J24205332	" " 332J 3.3kΩ					
R2067,2069	J24205472	" " 472J 4.7kΩ					
R2020	J24205562	" " 562J 5.6kΩ					
R2021	J24205682	" " 682J 6.8kΩ					
R2005,2018,2026, 2036,2058,2059, 2071,2074	J24205103	" " 103J 10kΩ					
R2009,2039,2061	J24205153	" " 153J 15kΩ					
R2011–2013	J24205223	" " 223J 22kΩ					
R2006	J24205333	" " 333J 33kΩ					
R2002,2064,2065, 2070	J24205473	" " 473J 47kΩ			C2011	K22170813	" " 0.0047μF B (C2012B1H472MFA)
R2008	J24205683	" " 683J 68kΩ			C2040,2089	K22170817	" " 0.01μF B (C2012B1H103MFA)
R2003,2019,2022, 2024, 2033–2035, 2037,2053,2054, 2066,2068	J24205104	" " 104J 100kΩ			C2033,2101,2102	K22171004	" " 0.01μF F (C2012F1H103ZFA)
					C2007,2009,2030, 2066,2083,2090, 2092,2118, 2015(▲,F)	K22141904	" 25WV 0.1μF D (C3216D1E104KFA)
R2007,2015	J24205124	" " 124J 120kΩ					
R2060	J24205224	" " 224J 220kΩ					
R2010	J24205105	" " 105J 1MΩ					
R2014	J24205225	" " 225J 2.2MΩ			C2029	K70140003	Tantalum " 0.22μF (489D224X0025A1)
					C2086,2091	K70140007	" " 1μF (489D105X0025A1)
		POTENTIOMETERS					
VR2001	J51745472	H0651A011-4.7KB 4.7kΩB			C2031,2032,2035, 2095	K70100002	" 10WV 4.7μF (489D475X0010A1)
VR2003	J50765471	P6-S2Z-471 470ΩB					
VR2002(A,X,F)	J51745473	H0651A017-47KB 47kΩB			C2063,2069	K70120002	" 16WV 10μF (489D106X0016C1)
					C2023	K70080002	" 6.3WV 10μF (489D106X0006B1)
		CAPACITORS					
C2125	K02172040	Ceramic 50WV 4pF CH (DD104CH040C50)			C2128	K70080006	" " 47μF (489D476X0006D1)
C2127	K02173070	" " 7pF CH (DD104CH070D50)			C2004	K40179002	Electrolytic 50WV 0.1μF (ECE-A1HK0R1)
C2062	K12171102	" " 0.001μF E (DD104E102P50V)			C2013	K40179001	" " 1μF (ECE-A1HK010)
C2070	K22170201	Chip " 0.5pF CH (C2012CH1H0R5CFA)			C2081,2094,2098, 2099,2103,2120, 2129	K40129012	" 16WV 10μF (ECE-A1CK100)
C2019,2022,2115, 2017(F),2021(F)	K22170203	" " 2pF " (C2012CH1H020CFA)			C2036,2038	K40109015	" 10WV 100μF (ECE-A1AK101)
C2017,2021,2053, 2071	K22170204	" " 3pF " (C2012CH1H030CFA)					
C2026,2076,2077, 2019(F)	K22170205	" " 4pF " (C2012CH1H040CFA)					**TRIMMER CAPACITORS**
C2025,2054,2078	K22170206	" " 5pF " (C2012CH1H050CFA)			TC2002,2003	K91000105	ECR-GA006A30 6pF
					TC2009,2010	K91000101	ECR-GA010D30 10pF
C2050	K22170207	" " 6pF " (C2012CH1H060DFA)			TC2001	K91000107	ECR-GA015E30 15pF
					TC2005,2008	K91000100	ECR-GA020E30 20pF
C2046	K22170209	" " 8pF " (C2012CH1H080DFA)			TC2006	K91000102	ECR-GA035M30 35pF

▲ Versions A & X
(F) Version F

		INDUCTORS
L2001	L1190105	FL3H1R0M 1μH
L2002,2003,2007, 2023	L1190113	FL3HR22M 0.22μH
L2004,2005	L1190231	FL3H2R2M 2.2μH
L2006	L1190017	FL5H102K 1mH
L2018	L1190113	FL3HR22M 0.22μH
L2008	L0020916	
L2009–2012	L0020876	
L2013	L0020748	
L2014,2017,2020, 2022,2025–2027	L0020875A	
L2015,2016,2021	L1020677	
L2019	L0020916	
L2024	L0020766	
		TRANSFORMERS
T2001	L0021508	
T2002	L0021507	
		SWITCHES
S2001,2002	N4090092	SPJ512E
		CONNECTORS
J2001	P0090370	5403-03CPB
J2002	P1090369	HSJ0838-01-010
J2003	P1090370	HSJ0836-01-010
P4 (with wire)	T9204823	
		FERRITE BEADS
	L9190001	Ri 3x3x1
	R0800650	Inner Frame B
	R0501260	Shield Plate A
	R0102230	" " B
	R0105270	" Cover
	R0105280	" Rear
	R7105310	Insulator Sheet
	R7105320	" "
	R0105300	Plate

CONNECTOR UNIT

Symbol No.	Part No.	Description
	F2614103	Printed Circuit Board
		PCB with Components w/o BATTERY (BAT3001)
		DIODES
D3001	G2015550	Si 1S1555
D3002	G2090118	Schottky 1SS97
		RESISTORS
R3001	J24205333	Chip RMC 1/10T 333J 33kΩ
R3002▲	J24205273	Chip RMC 1/10T 273J 27kΩ
		CAPACITORS
C3001–3007, 3009,3010, 3012–3020	K22170805	Chip 50WV 0.001μF B (C2012B1H102MFA)
C3008	K70080004	Tantalum 6.3WV 22μF (489D226X0006C1)
		SWITCHES
S3001	N5090018	KHH15951
S3002	N4090093	SPH2-TYPE B
		CONNECTORS
J3001	P0090413	S5B-PH
J3002	P0090416	S8B-PH (A,X,F)
J3003	P1090395	5143-07CPB (")
J3004	P1090396	5143-08CPB (")
		BATTERY
BAT3001	Q9000268	CR2032
	R3501270A	CAVITY ASSY (Battery Terminal Block)

ACCESSORIES

Symbol No.	Part No.	Description
		* Optional some models
		ANTENNA
	Q3000042	YHA-44A
		Ni-Cd BATTERY PACK*
	D3000315	FNB-3
	D3000316	FNB-4
		DRY BATTERY CASE*
	D3000317	FBA-5
		CHARGER FOR FNB-3*
	Q9000070	NC-9A 100VAC
	Q9000071	NC-9B 117VAC
	Q9000072	NC-9C 220–234VAC
		CHARGER FOR FNB-4*
	Q9000279	NC-18A 100VAC
	Q9000280	NC-18B 117VAC
	Q9000281	NC-18C 220–234VAC
		CARRYING CASE*
	D3000354	CSC-10(B) use w/FNB-3
	D3000357	CSC-11(B) use w/FNB-4

▲ Versions A & X

FTS-6 TONE ENCODER/DECODER (D3000320)

Symbol No.	Part No.	Description
	F2632100	Printed Circuit Board
		IC
Q1001	G1090577	MN6520
		TRANSISTORS
Q1004	G3111620G	2SA1162GR(SG)
Q1002,1003	G3327120G	2SC2712GR(LG)
		CRYSTAL
X1001	H0102571	MS41F 4.194304MHz
		RESISTORS
R1013	J24205222	Chip RMC 1/10T 222J 2.2kΩ
R1001	J24205472	" " 472J 4.7kΩ
R1002,1005,1009, 1010,1016,1017	J24205103	" " 103J 10kΩ
R1003,1007,1012	J24205123	" " 123J 12kΩ
R1011	J24205153	" " 153J 15kΩ
R1004	J24205333	" " 333J 33kΩ
R1008	J24205683	" " 683J 68kΩ
R1006,1014	J24205154	" " 154J 150kΩ
R1015	J24205474	" " 474J 470kΩ
		POTENTIOMETER
VR1001	J51750473	H0423A047-47KB 47kΩB
		CAPACITORS
C1012,1013	K22170217	Chip 50WV 18pF CH (C2012CH1H180JFA)
C1008–1010	K22171004	" " 0.01μF F (C2012F1H103MFA)
C1001,1003,1004	K22141904	" " 0.1μF D (C3216D1E104KFA)
C1002,1006	K72100001	Tantalum 10WV 1μF (F951A105MA1)
C1007,1011	K72080003	" 6.3WV 10μF (F950J106MC1)
C1005	K72080006	" 10WV 47μF (F950J476MG1)