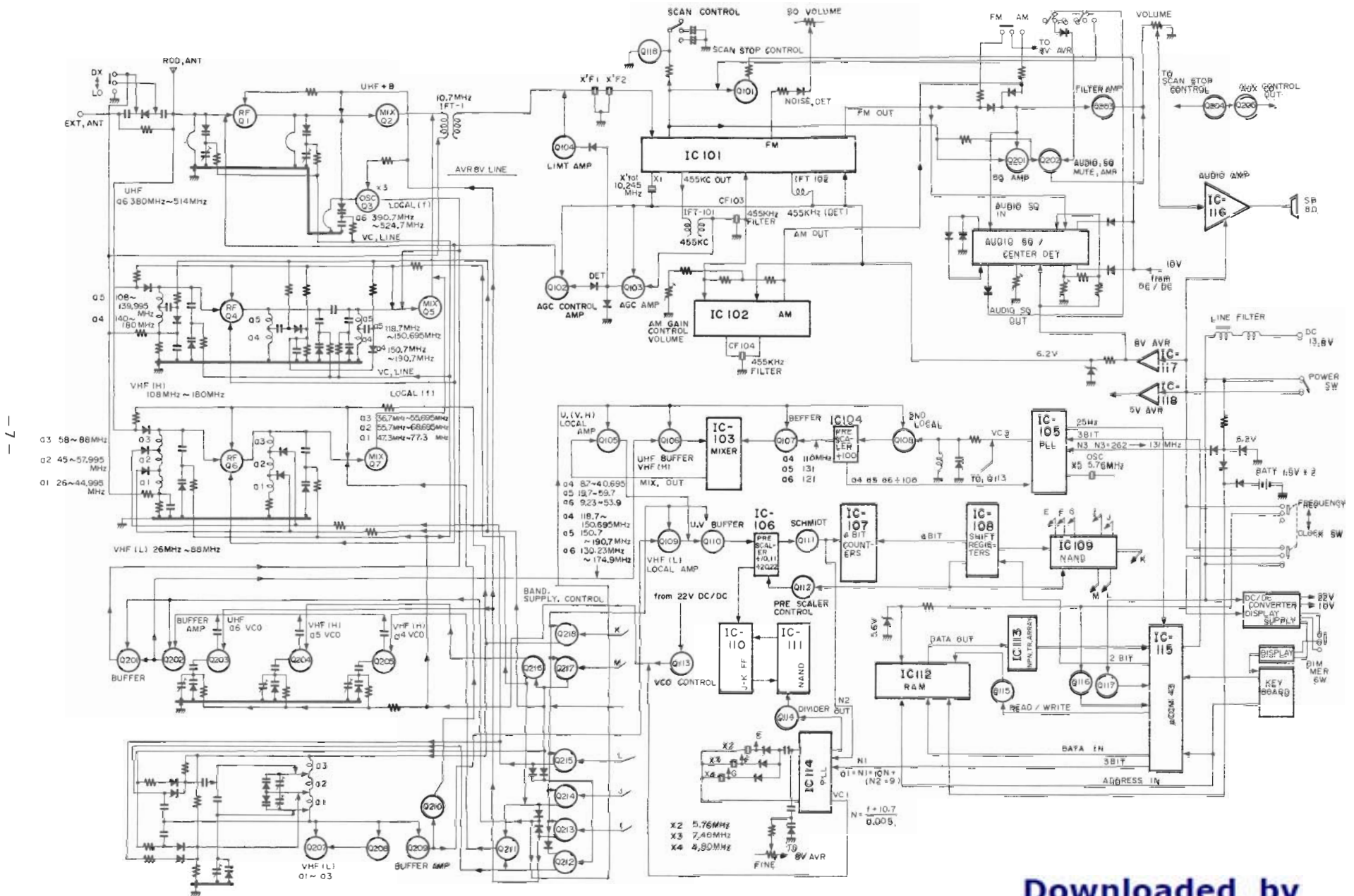
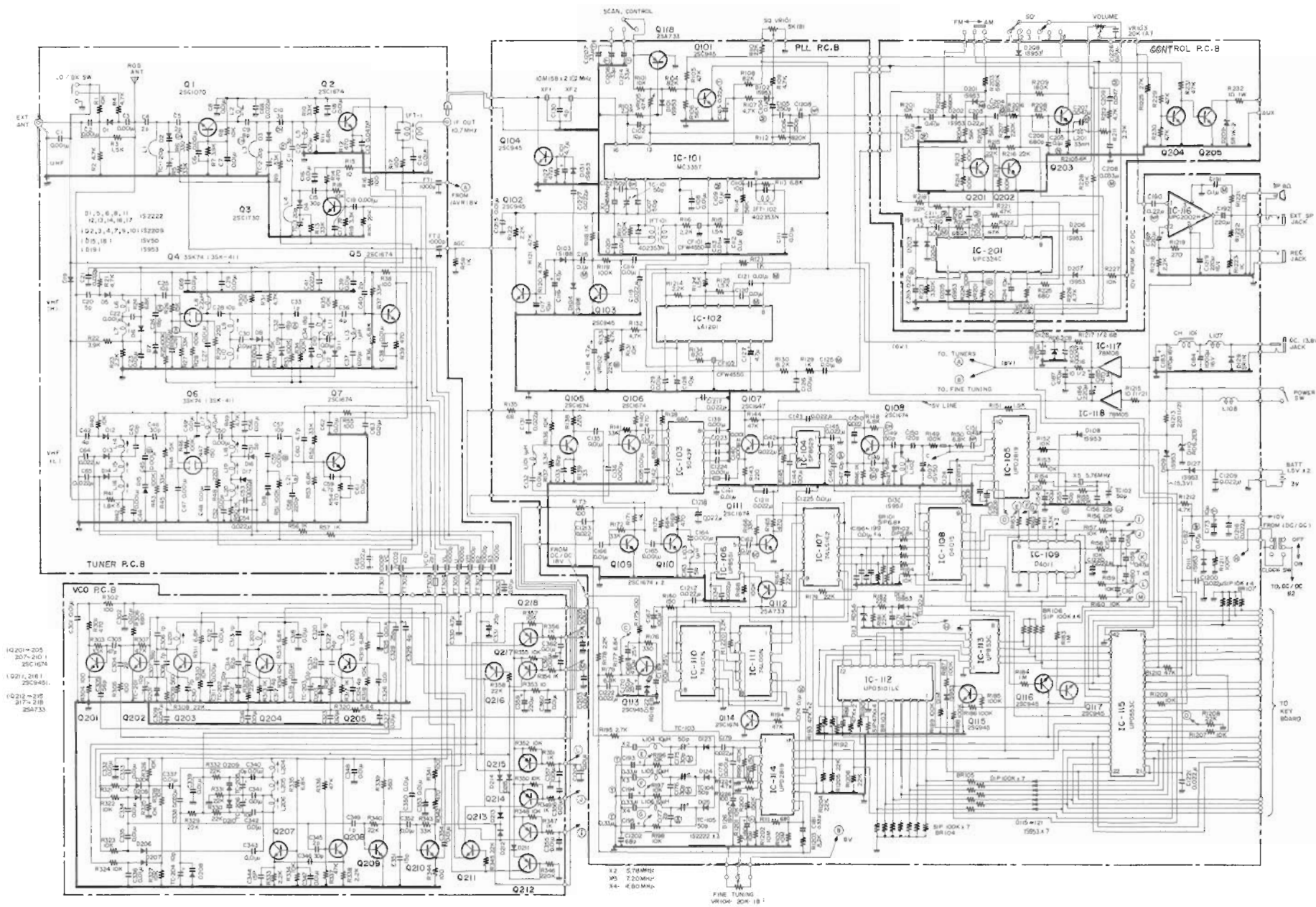


BLOCK DIAGRAM Fig. 4

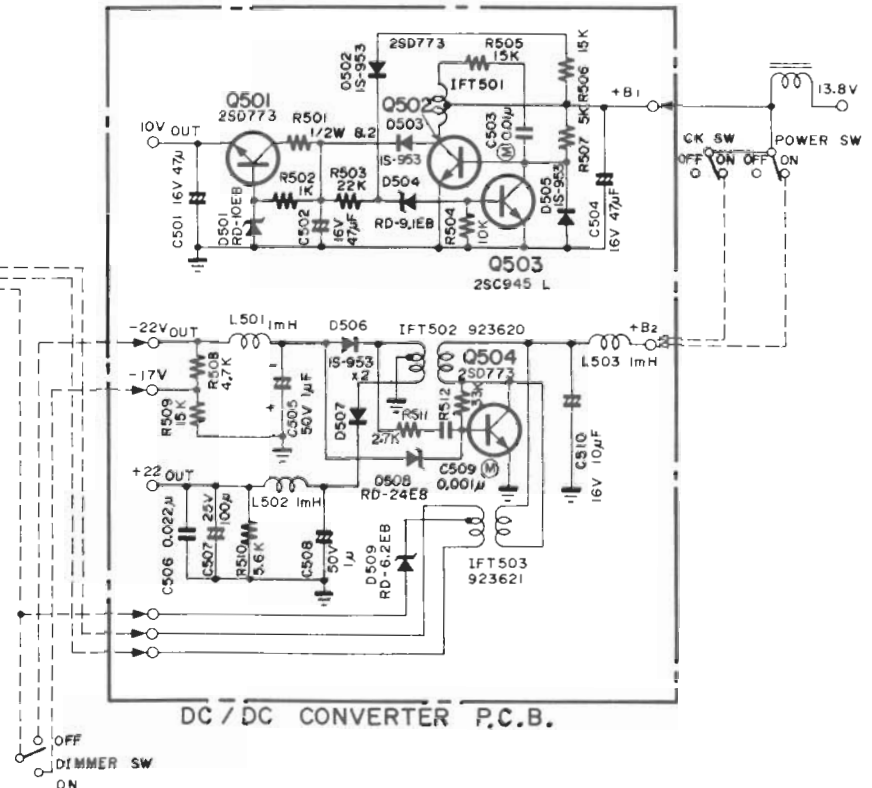
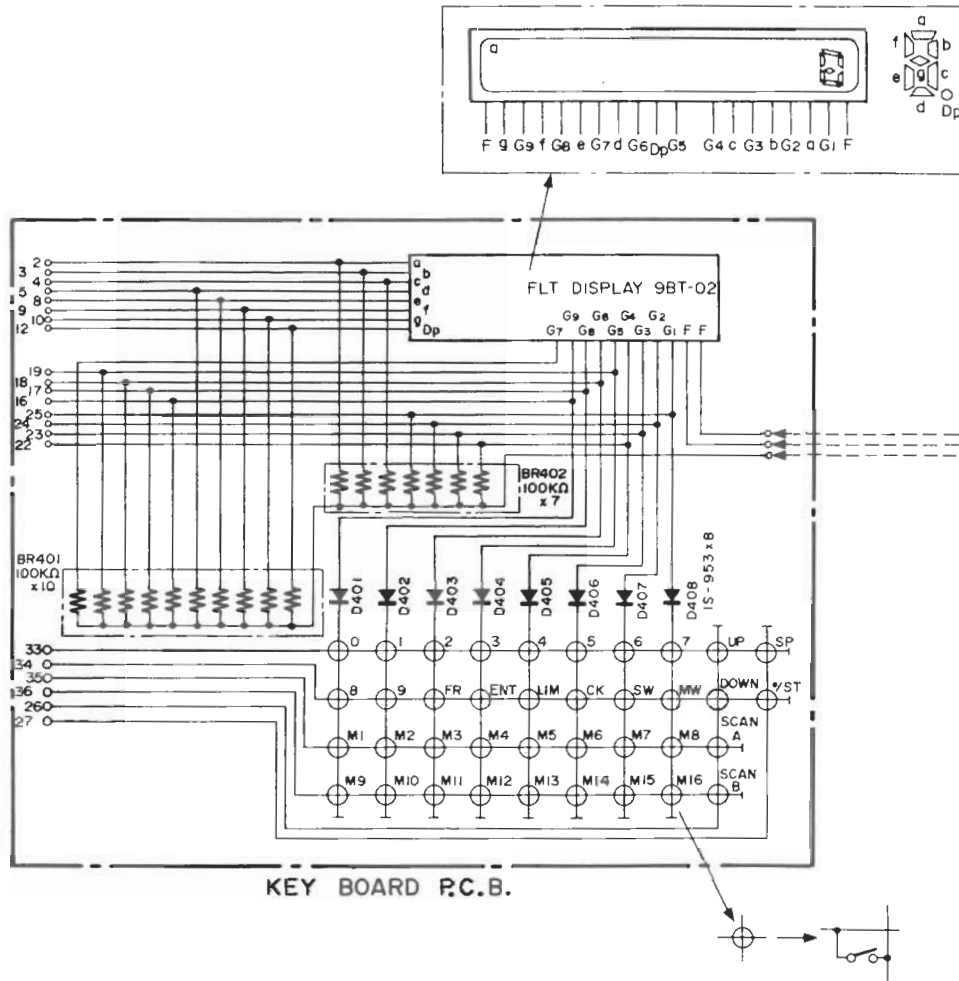


SCHEMATIC DIAGRAM (PLL, TUNER, VCO, CONTROL.) Fig. 5

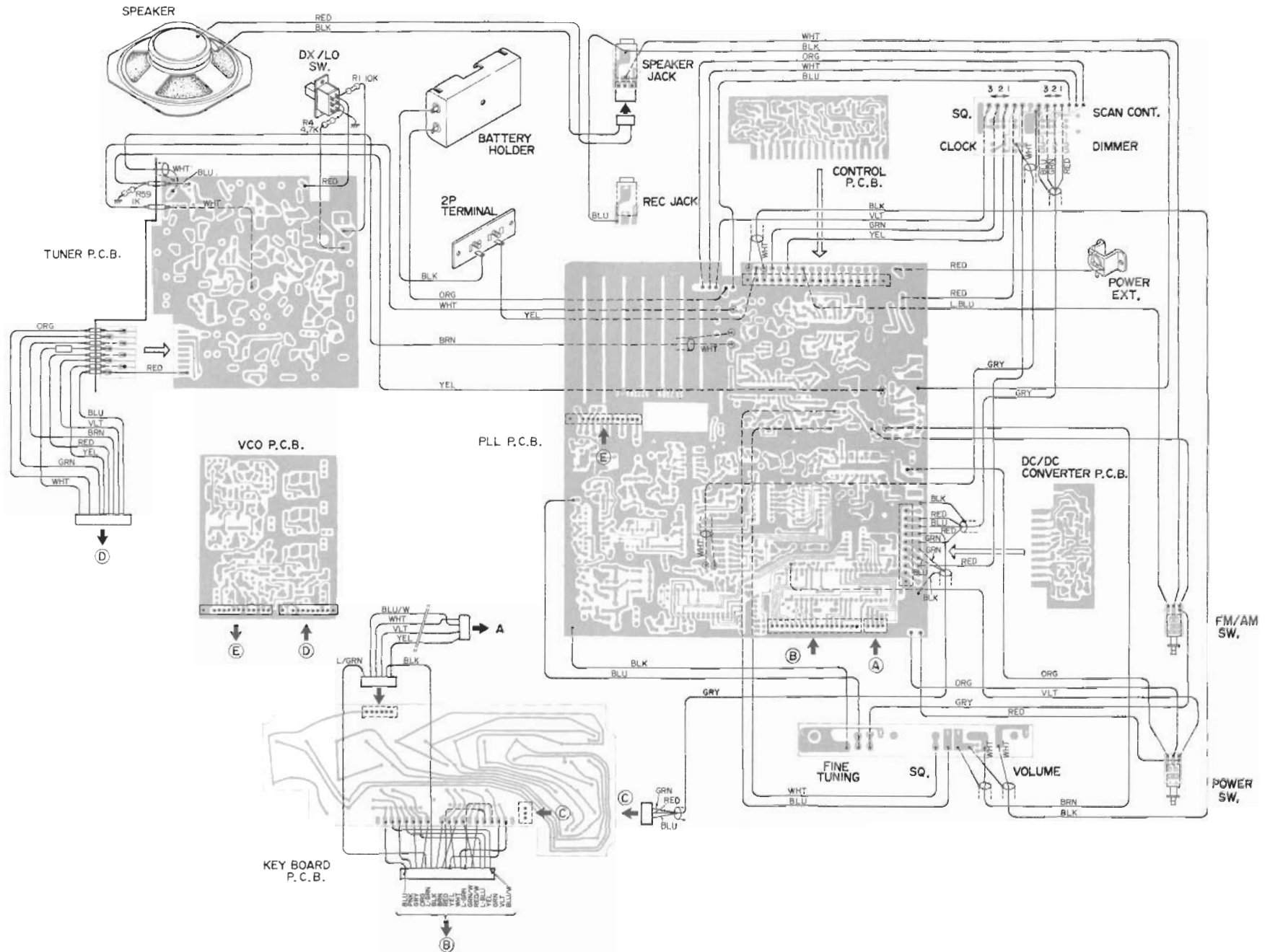


SCHMATIC DIAGRAM (KEYBOARD & DC-DC CONVERTER) Fig. 6

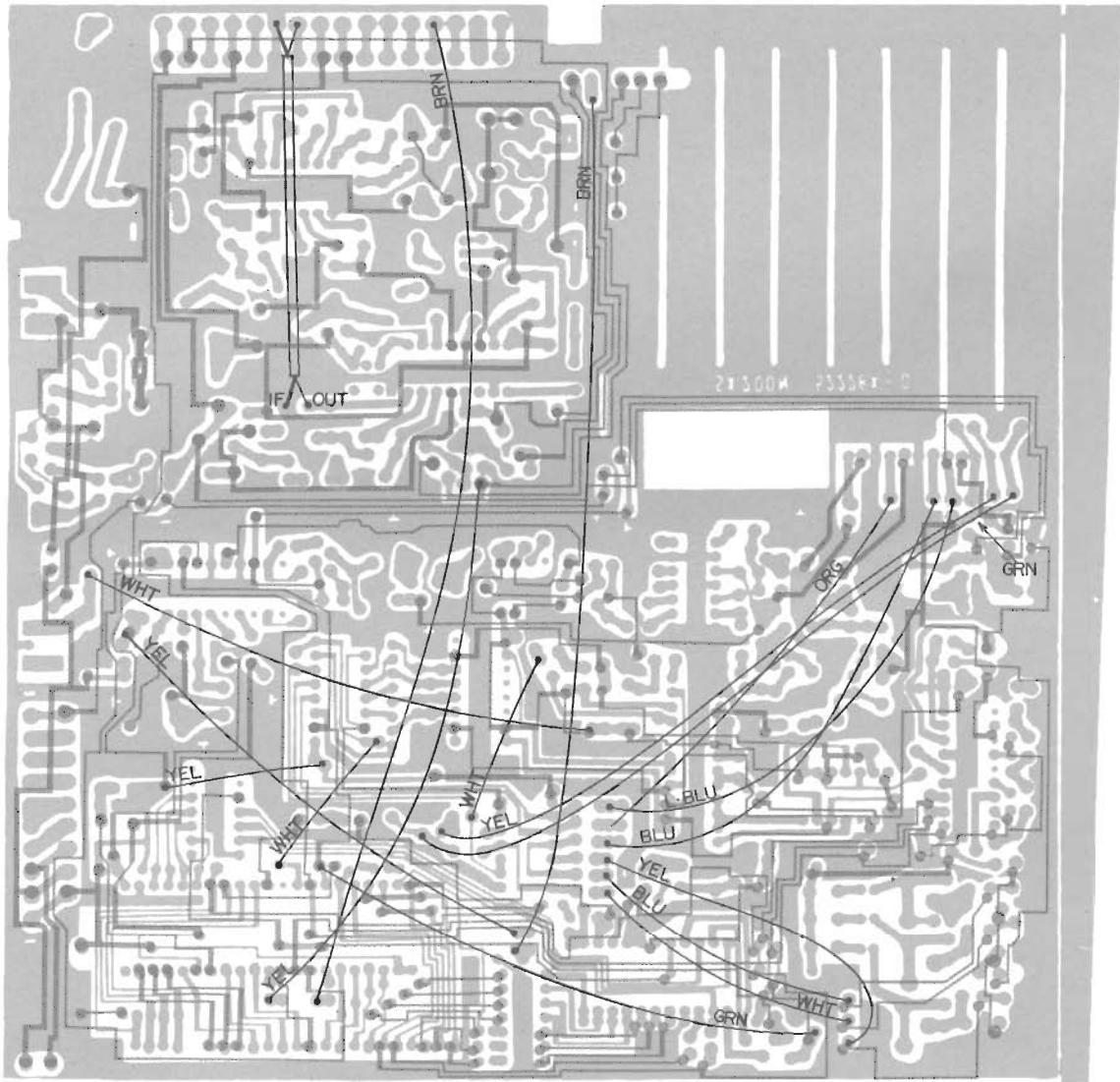
--19--



WIRING DIAGRAM Fig. 7



WIRING, PLL P.C. BOARD Fig. 8



# PART LOCATION

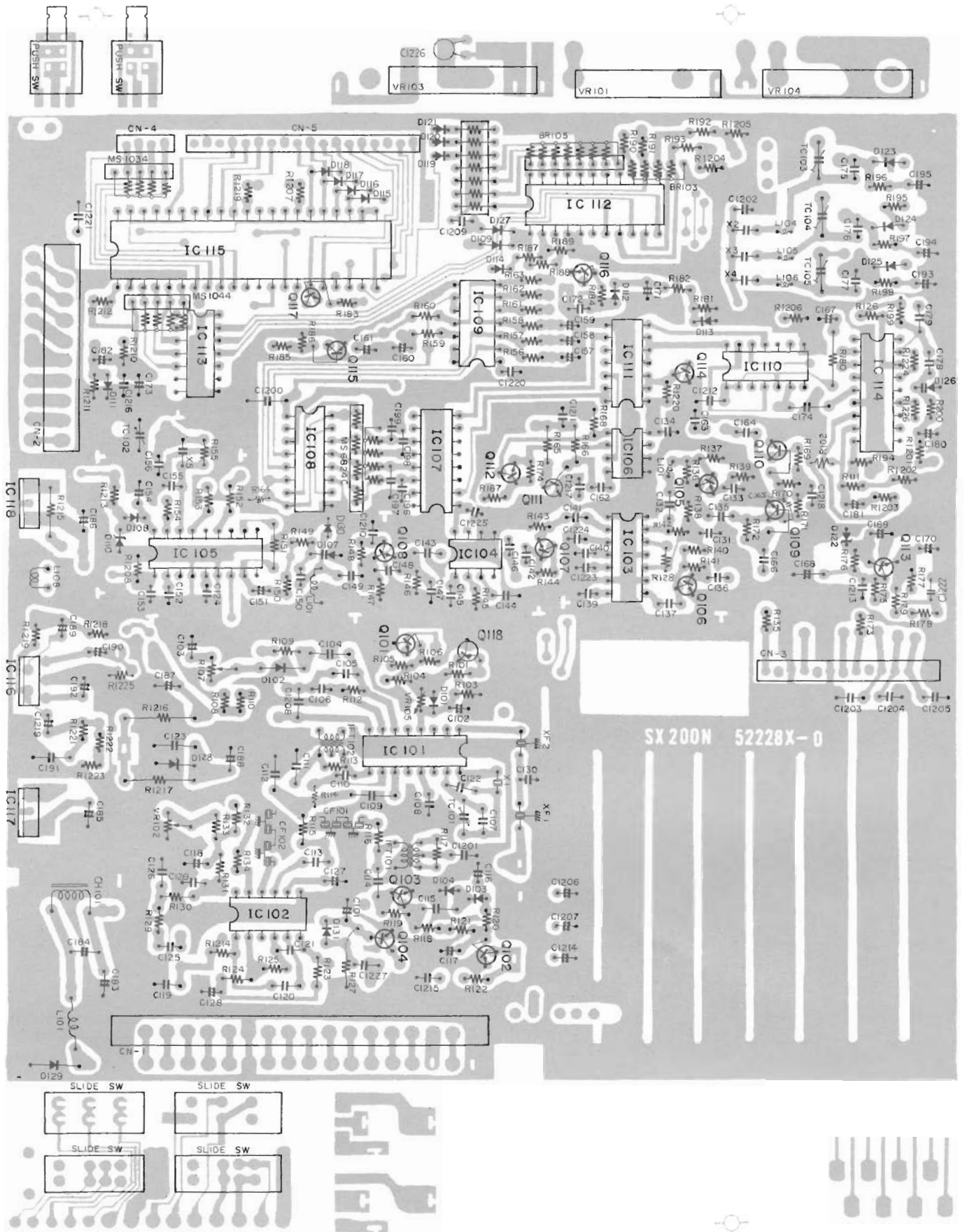


Fig. 9  
PLL P.C. BOARD, WIRING SIDE

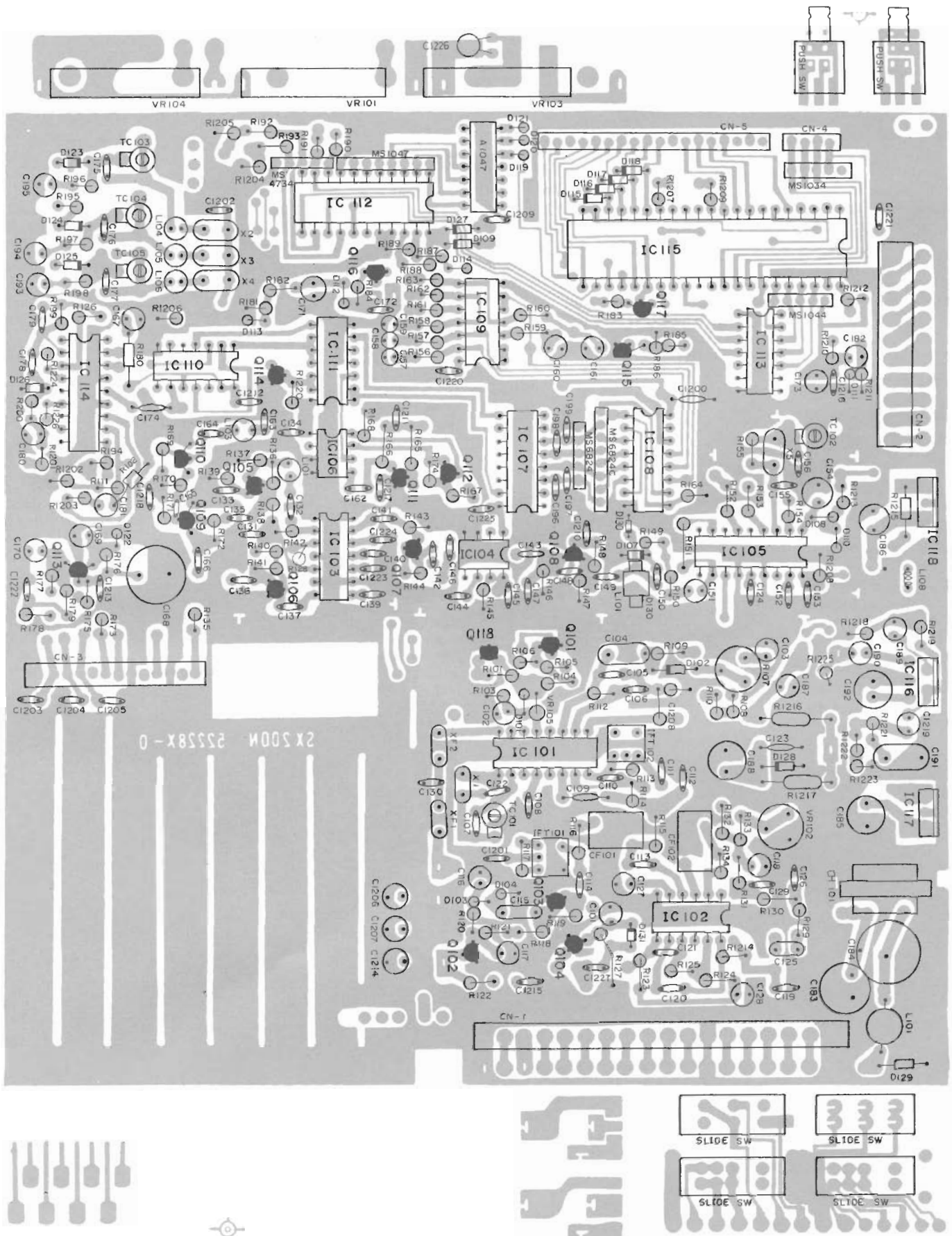


Fig. 10  
PLL P.C. BOARD, COMPONENT SIDE

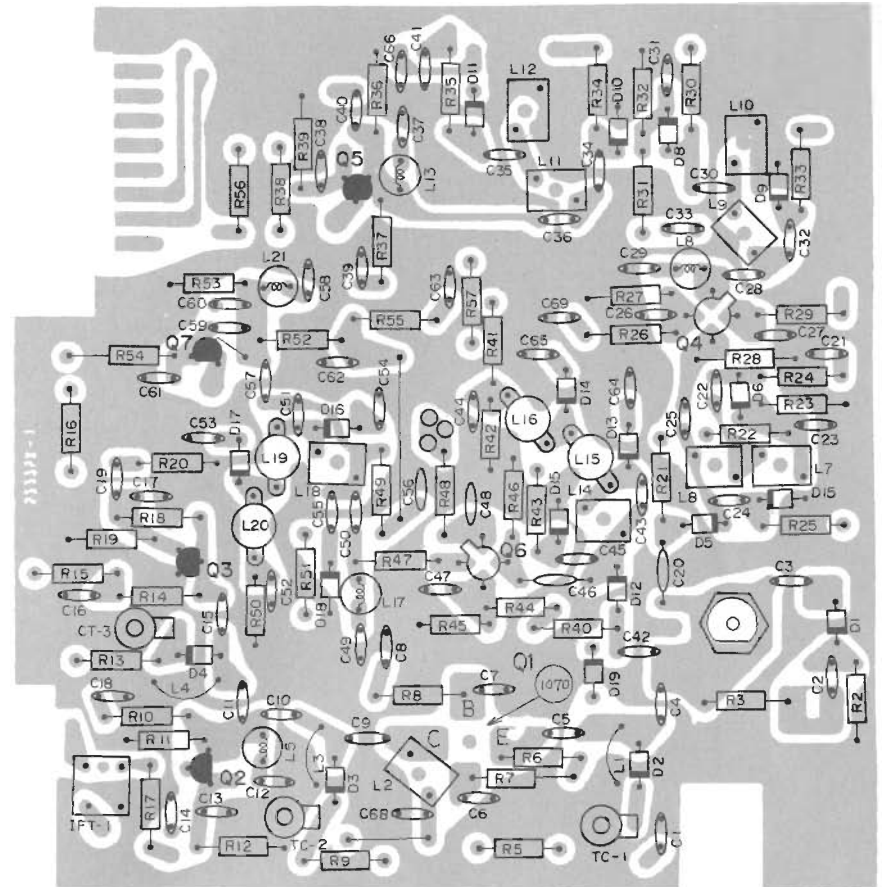
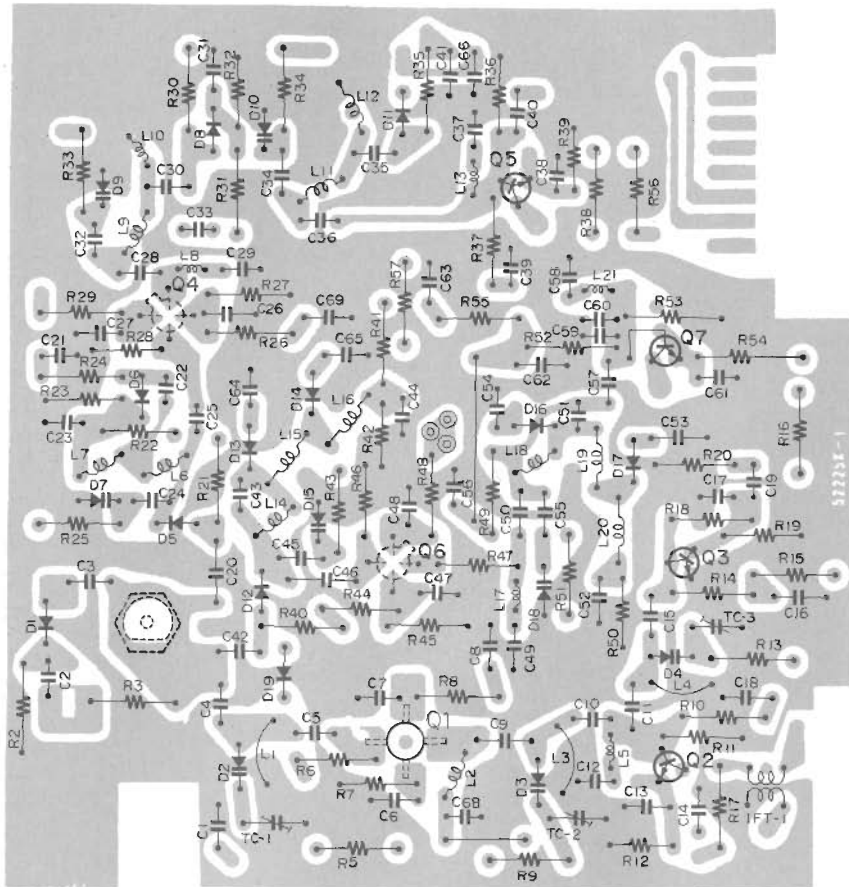


Fig. 11  
TUNER P.C. BOARD, COMPONENT/WIRING SIDES





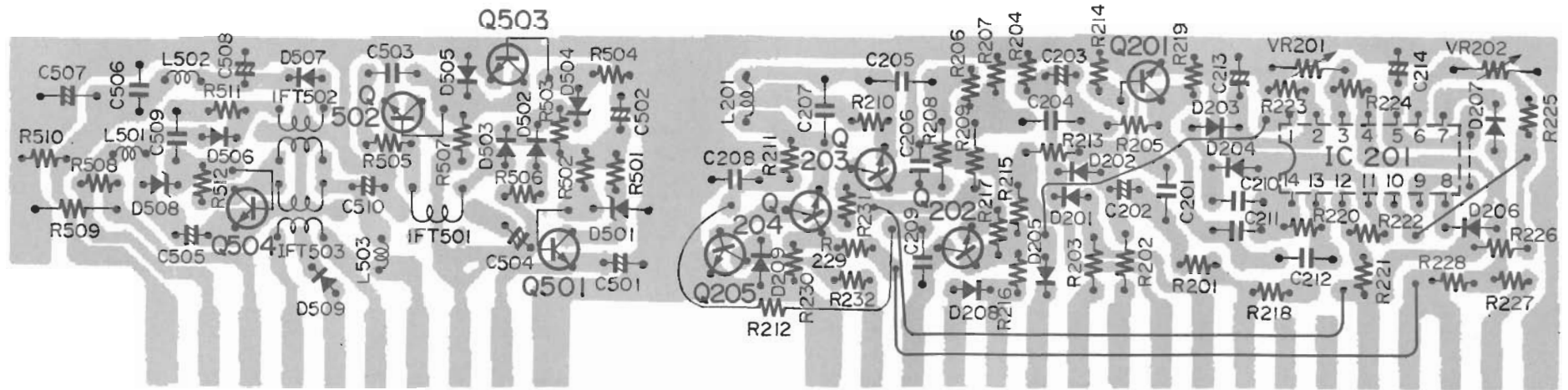
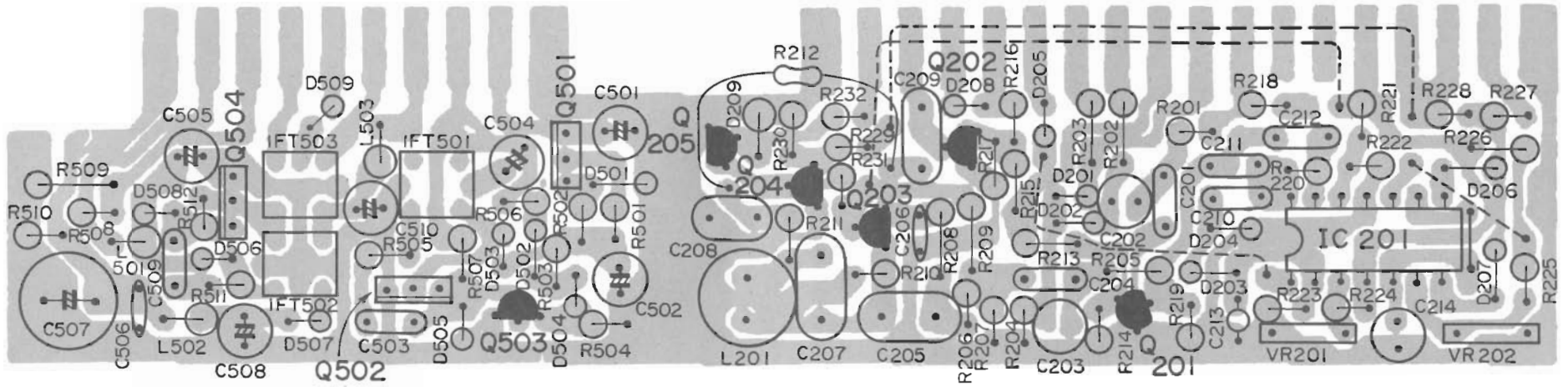
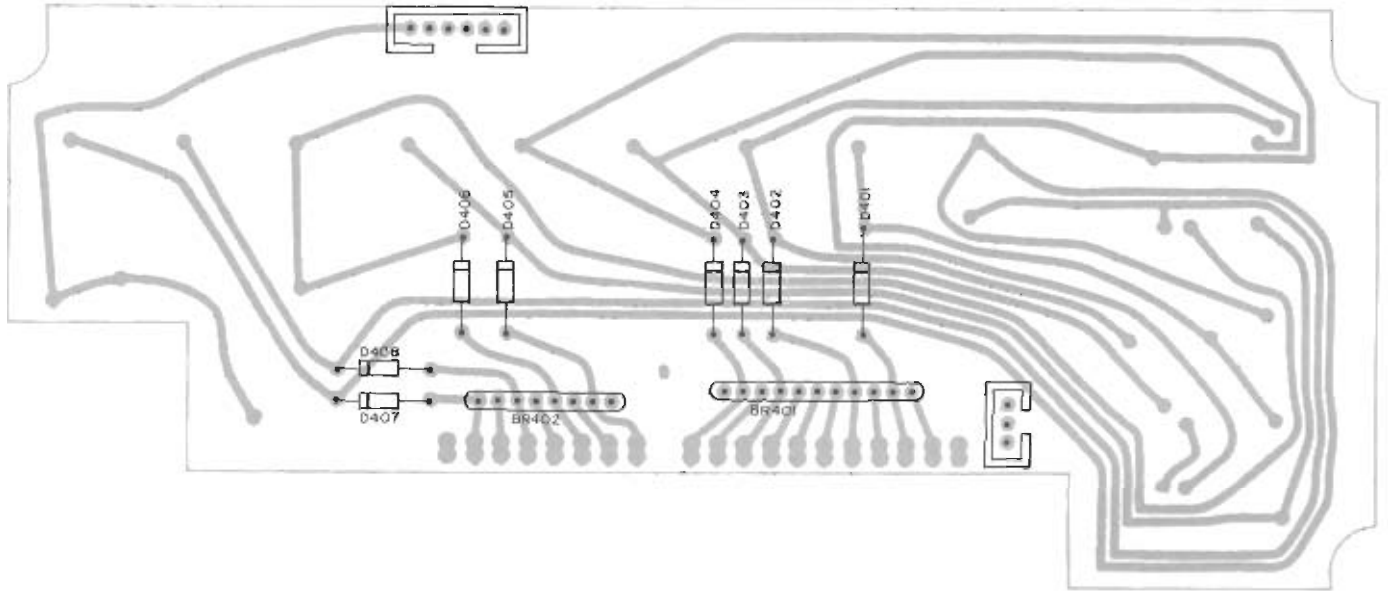


Fig. 13  
 CONTROL P.C. BOARD, COMPONENT/WIRING SIDES  
 DC-DC CONVERTER P.C. BOARD, COMPONENT/WIRING SIDES



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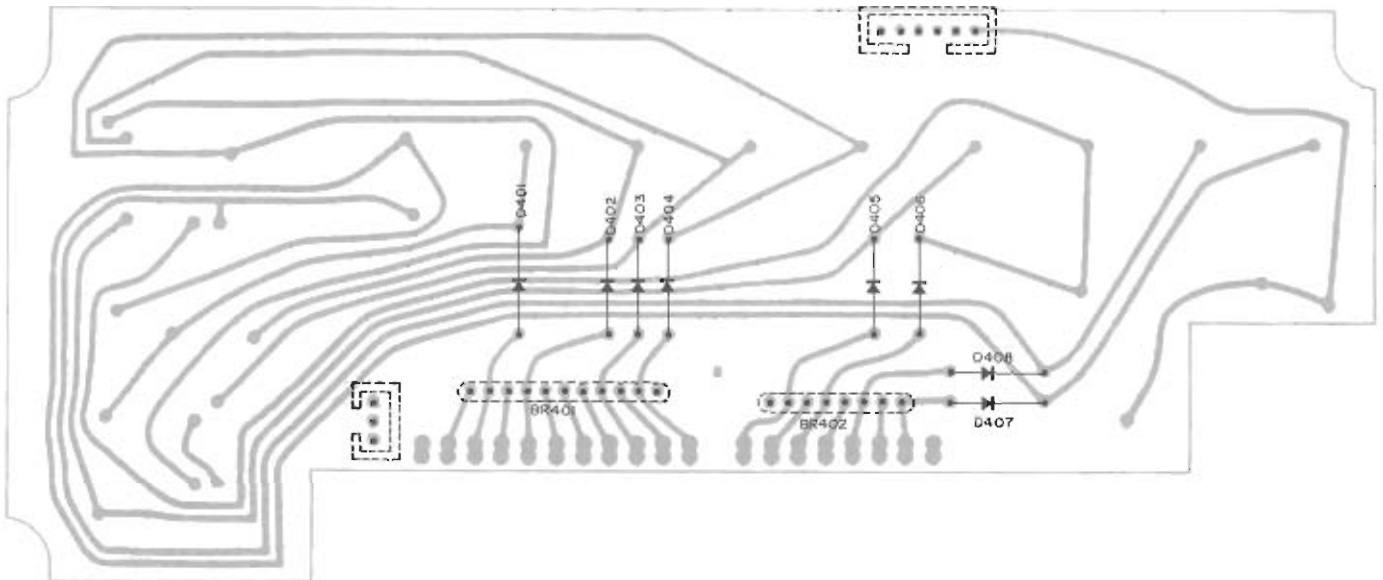


Fig. 14  
KEYBOARD P.C. BOARD, COMPONENT/WIRING SIDES

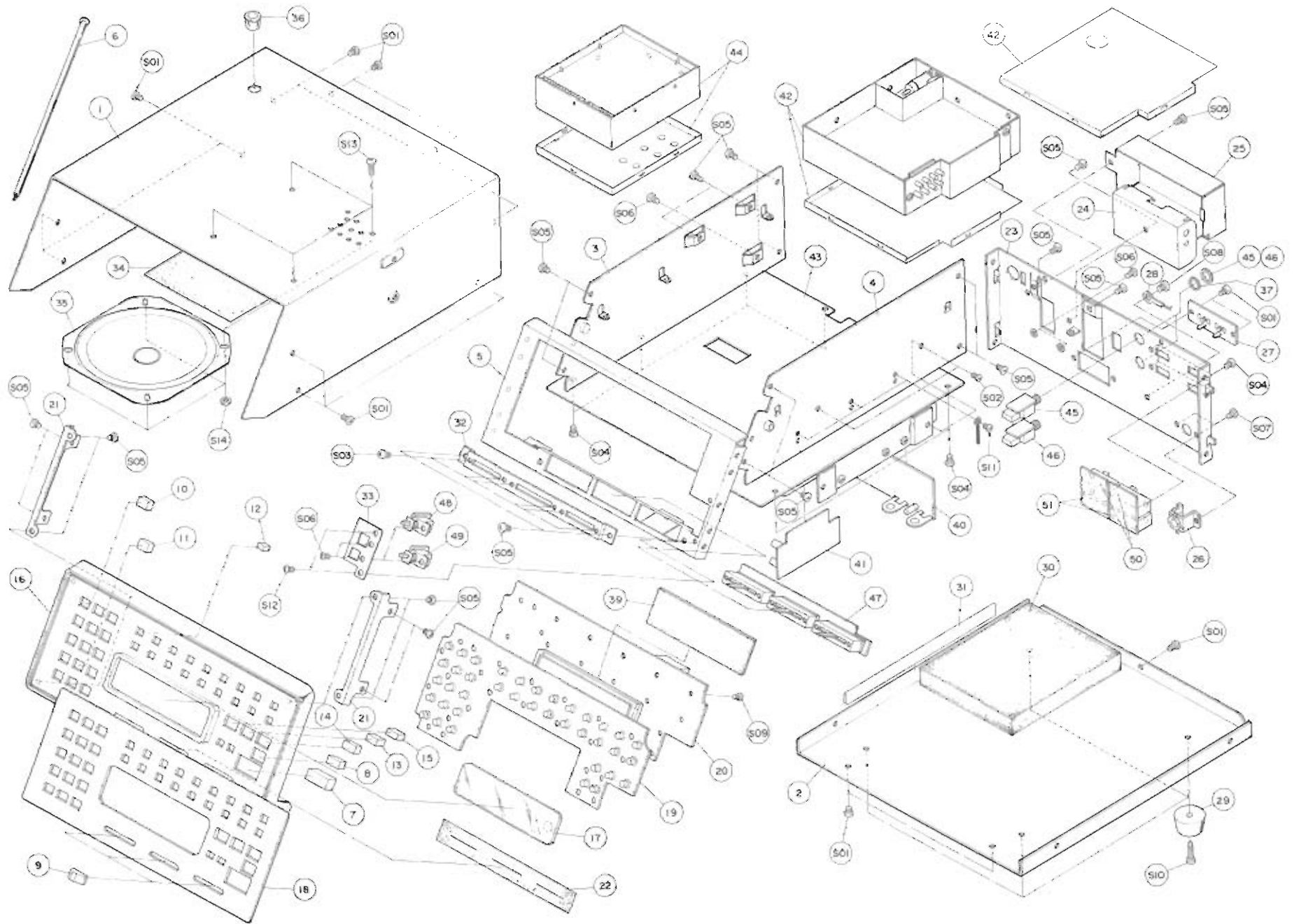


Fig. 15  
ASSEMBLING LAYOUT (Final Assembling)

COMPONENT LIST (FINAL ASSEMBLING)

Ref. No.	Part No.	Description	Q'ty	Ref. No.	Part No.	Description	Q'ty
1	46588	Case, Top	1	34	46594	Dust Cover, Speaker	1
2	45897	Case, Bottom	1	35	924003	Speaker	1
3	46587	Side Plate, Left	1	36	923681	Bushing, Antenna	1
4	46586	Side Plate, Right	1	37	46595	Jack Spacer	2
5	46303	Case, Front	1	38		No component	
6	924029	Antenna	1	39	42239	Foam Rubber	1
7	45901	Knob, Push (POWER)	1	40	31589-1	Control P.C. Board Ass'y	1
8	46301	Knob, FM-AM	1	41	31589-2	DC/DC Converter P.C. Board Ass'y	1
9	45783	Knob, Slide (FINE TUNING/ SQUELCH/VOLUME)	3	42	31590	Tuner P.C. Board Ass'y	1
10	45920	Knob, Channel A, FIGURES 0 thru. 9	10	43	31591	PLL P.C. Board Ass'y	1
11	46534	Knob, Channel B, ST/FR/LIM/ENT/SP	5	44	31592	VCO P.C. Board Ass'y	1
12	45782	Knob, Memory/SW-W/MW-H/ UP-DOWN Seek	20	45	924004	External Speaker Jack	1
13	46601	Knob, SCAN A	1	46	924004	REC Jack	1
14	46602	Knob, SCAN B	1	47		Volume Board Ass'y	1
15	46300	Knob, CK	1			Consists of 915581 (Volume)	
16	45741	Escutcheon	1			915580 (Fine Tuning)	
17	45910	Window	1			915594 (Squelch)	
18	46302	Plate, Escutcheon	1	48	912122	Push Switch, FM-AM	1
19	45780	Rubber Contact	1	49	912122	Push Switch, POWER	1
20	32667	Print Board, Keyboard	1	50	912123	Slide Switch, SCAN CONT./SQ.	1
	923553	Digitron 9BT-02A	1	51	912124	Slide Switch, DIMMER/CLOCK	1
21	45903	Bracket, Escutcheon	2	S01	023154	Screw M3 x 4, BH	15
22	45911	VR Shield Plate	1	S02	023143	Screw 3 x 8, RH Tapping	2
23	46585	Rear Plate	1	S03	022027	Screw M2 x 4, BH	6
24	923907	Battery Holder	1	S04	022655	Screw M2.6 x 4, Truss	10
25	46589	Battery Cover	1	S05	023055	Screw M3 x 4, BH	22
26	923629	External Power Supply Jack	1	S06	022655	Screw M2.6 x 4, Truss	5
27	923908	2P Screw Terminal	1	S07	022046	Screw M2 x 4, RH	2
28	922439	Ground Lead Wire	1	S08	024021	Screw M4 x 4, BH	1
29	922163	Rubber Foot	4	S09	021702	Screw 1.7 x 4.6, BH	24
30	46600	Cushion Rubber	1	S10	023108	Screw M3 x 8, BH	4
31		Tape	2	S11	022602	Screw M2.6 x 4, RH	3
32	45902	Bracket, VR	1	S12	022678	Screw M2.6 x 3, Truss	2
33	46304	Bracket, Switch	1	S13	023145	Screw M3 x 6, BH	4
				S14	013003	Nut M3, Chrome	4

ELECTRICAL COMPONENT LIST

1. CONTROL P.C. BOARD

Ref. No.	Part No.	Description	Q'ty	Ref. No.	Part No.	Description	Q'ty
<b>SEMI-CONDUCTORS &amp; COIL</b>							
IC201	916228	IC uPC324C	1	R212	915327	4.7K ohm	1
Q201, 202, 203	916158	Silicon Transistor 2SC945L	3	R213, 214	915039	100K "	2
Q204, 205	916162	Silicon Transistor 2SC2001	2	R215, 216	915342	22K "	2
D201 thru. 208	923147	Diode 1S953	8	R217	915039	100K "	1
D209	923817	Diode SR1K-2	1	R218	915342	22K "	1
L201	913622	Micro inductor 33mH	1	R219	915039	100K "	1
<b>RESISTORS, all are 1/8 watt 10% tolerance unless otherwise specified.</b>				R220	915483	680K "	1
R201	915015	10K ohm	1	R221, 222	915343	47K "	2
R202, 203	915483	680K "	2	R223	915443	330K "	1
R204, 205	915372	56K "	2	R224	915039	100K "	1
R206	915055	8.2K "	1	R225	915337	680 "	1
R207	915344	220K "	1	R226	915327	4.7K "	1
R208	915055	8.2K "	1	R227, 228	915015	10K "	2
R209	915450	180K "	1	R229, 230, 231	915343	47K "	3
R210	915409	5.6K "	1	R232	915106	1 " (J) 1/2 watt	1
R211	915007	2.2K "	1	<b>CAPACITORS, all are in 50 working voltage unless otherwise specified.</b>			
				C201	913020	Mylar 0.01uF	1
				C202	913110	Electrolytic 0.47uF	1
				C203	913583	Electrolytic 0.22uF (NP)	1

# ELECTRICAL COMPONENT LIST (Cont'd)

## 1. CONTROL P.C. BOARD

Ref. No.	Part No.	Description	Q'ty
C204	913044	Mylar 0.047uF	1
C205	913021	Mylar 0.1uF	1
C206	913162	Ceramic 680pF	1
C207	913044	Mylar 0.047uF	1
C208	913550	Mylar 0.033uF	1
C209	913044	Mylar 0.047uF	1
C210	913020	Mylar 0.01uF	1
C211	913210	Mylar 0.0015uF	1

Ref. No.	Part No.	Description	Q'ty
C212	913220	Mylar 0.015uF	1
C213	913509	Aluminum 0.22uF	1
C214	913175	Electrolytic 10uF	1
VR201	915464	Semi-Fixed Volume 100 ohm (B)	1
VR202	915585	Semi-Fixed Volume 10K ohm (B)	1

## 2. DC-DC CONVERTER P.C. BOARD & KEYBOARD

Ref. No.	Part No.	Description	Q'ty
<b>SEMI-CONDUCTORS &amp; COILS</b>			
Q501, 502	916234	Silicon Transistor 2SD773	2
Q503	916158	Silicon Transistor 2SC945	1
Q504	916234	Silicon Transistor 2SD773	1
D501	923687	Diode RD10EB	1
D502, 503	923147	Diode IS953	2
D504	923586	Diode RD9.1B	1
D505, 506, 507	923147	Diode IS953	3
D508	923587	Diode RD24EB	1
D509	923588	Diode RD6.2EB	1
D401 thru. 408	923147	Diode IS953 (Kyeboard)	8
L501, 502, 503	913623	Micro Inductor 1mH	3
IFT501	923952	Coil 7BR-4824N	1
IFT502	923620	Coil L-5K7H5	1
IFT503	923621	Coil L-5K7H5	1
<b>RESISTORS, all are 1/8 watt 10% tolerance unless otherwise specified.</b>			
R501	915322	8.2 ohm 1/2 watt	1
R502	915003	1K "	1
R503	915342	22K "	1
R504	915015	10K "	1

Ref. No.	Part No.	Description	Q'ty
R505	915335	390 ohm	1
R506, 507	915341	15K "	2
R508	915327	4.7K "	1
R509	915341	15K "	1
R510	915170	5.6K " 1/4 watt	1
R511	915053	2.7K "	1
R512	915052	33K "	1
<b>CAPACITORS, all are in 50 working voltage unless otherwise specified.</b>			
C501, 502	913180	Electrolytic 47uF 16V	2
C503	913020	Mylar 0.01uF	1
C504	913180	Electrolytic 47uF 16V	1
C505	913349	Electrolytic 1uF (NP)	1
C506	913125	Ceramic 0.022uF	1
C507	913174	Electrolytic 100uF 25V	1
C508	913349	Electrolytic 1uF (NP)	1
C509	913071	Mylar 0.001uF	1
C510	913175	Electrolytic 10uF 16V	1
BR401 (Keyboard)	915519	Block Resistor 100K ohm x 10 MS10410	1
BR402 ( " )	915518	Block Resistor 100K ohm x 7 MS1047	1

## 3. TUNER P.C. BOARD

Ref. No.	Part No.	Description	Q'ty
<b>SEMI-CONDUCTORS &amp; COILS</b>			
Q1	916176	Silicon Transistor 2SC1070	1
Q2	916116	Silicon Transistor 2SC1674 or 2SC2786	1
Q3	916173	Silicon Transistor 2SC1730	1
Q4	916233	Silicon Transistor 3SK74 or 3SK41	1
Q5	916116	Silicon Transistor 2SC1674	1
Q6	916233	Silicon Transistor 3SK74 or 3SK41	1
Q7	916116	Silicon Transistor 2SC1674	1
D1	923395	Diode IS-2222	1
D2, 3, 4	923416	Diode IS-2209	3
D5, 6	923395	Diode IS-2222	2
D7	923416	Diode IS-2209	1
D8	923395	Diode IS-2222	1
D9, 10	923416	Diode IS-2209	2
D11 thru. 14	923395	Diode IS-2222	4
D15	923211	Diode ISV-50	1

Ref. No.	Part No.	Description	Q'ty
D16, 17	923395	Diode IS-2222	2
D18	923211	Diode ISV-50	1
D19	923147	Diode IS953	1
IFT1	922501	IFT 10741	1
L1	924020	Coil, UHF 1/2t	1
L2	923923	Coil, VHF MC108 5-1/2t	1
L3	924021	Coil, UHF 1/2t	1
L4	924022	Coil, UHF 1/2t	1
L5	913624	Micro Inductor 1uH	1
L6, 7	923922	Coil, VHF MC108 3-1/2t	2
L8	913216	Micro Inductor 2.2uH	1
L9	923922	Coil, VHF MC108 3-1/2t	1
L10	923923	Coil, VHF MC108 5-1/2t	1
L11	923922	Coil, VHF MC108 3-1/2t	1
L12	923923	Coil, VHF MC108 5-1/2t	1
L13	913624	Micro Inductor 1uH	1
L14	923923	Coil, VHF MC108 5-1/2t	1
L15	923926	Coil, VHF MC116 5-1/2t	1
L16	923929	Coil, VHF MC116 9-1/2t	1

ELECTRICAL COMPONENT LIST (Cont'd)

3. TUNER P.C. BOARD

Ref. No.	Part No.	Description	Q'ty
L17	913572	Micro Inductor 4.7uH	1
L18	923923	Coil, VHF MC108 5-1/2t	1
L19	923926	Coil, VHF MC116 5-1/2t	1
L20	923929	Coil, VHF MC116 9-1/2t	1
L21	913624	Micro Inductor 1uH	1
TC-1, 2, 3	913530	Trimmer Condenser 20pF 5p	3
<b>RESISTORS, all are 1/8 watt 10% tolerance unless otherwise specified.</b>			
R1	915015	10K ohm	1
R2	915327	4.7K "	1
R3	915001	1.5K "	1
R4	915327	4.7K "	1
R5	915052	33K "	1
R6	915351	330 "	1
R7	915325	3.9K "	1
R8	915015	10K "	1
R9, 10	915052	33K "	2
R11	915340	6.8K "	1
R12	915057(J)	470 "	1
R13	915052	33K "	1
R14	915057(J)	470 "	1
R15	915060	10 "	1
R16, 17	915009	100 "	2
R18	915015	10K "	1
R19	915004	3.3K "	1
R20	915342	22K "	1
R21	915327	4.7K "	1
R22	915325	3.9K "	1
R23	915007	2.2K "	1
R24	915340	6.8K "	1
R25	915039	100K "	1
R26	915341	15K "	1
R27	915052	33K "	1
R28	915039	100K "	1
R29	915336	220 "	1
R30	915015	10K "	1
R31	915327	4.7K "	1
R32	915001	1.5K "	1
R33, 34	915039	100K "	2
R35	915015	10K "	1
R36	915340	6.8K "	1
R37	915052	33K "	1
R38	915009	100 "	1
R39	915057(J)	470 "	1
R40	915015	10K "	1
R41	915339	1.8K "	1
R42	915003	1K "	1
R43	915039	100K "	1
R44	915341	15K "	1
R45	915052	33K "	1
R46	915039	100K "	1
R47	915354	150 "	1
R48	915336	220 "	1
R49	915327	4.7K "	1
R50	915003	1K "	1
R51	915039	100K "	1
R52	915052	33K "	1
R53	915340	6.8K "	1
R54	915057(J)	470 "	1
R55	915009	100 "	1
R56, 57	915003	1K "	2
R58		No component	

Ref. No.	Part No.	Description	Q'ty
R59	915003	1K ohm	1
<b>CAPACITORS, all are in 50 working voltage unless otherwise specified.</b>			
C1	913051	Ceramic 0.001uF	1
C2	913051	Ceramic 0.001uF	1
C3	913051	Ceramic 0.001uF	1
C4	913076	Ceramic 2pF	1
C5	913132	Ceramic 2pF (CH)	1
C6	913051	Ceramic 0.001uF	1
C7, 8	913060	Ceramic 0.01uF	2
C9	913330	Ceramic 6pF (CH)	1
C10	913294	Ceramic 3pF (CH)	1
C11	913629	Fixed 3pF	1
C12	913060	Ceramic 0.01uF	1
C13	913063	Ceramic 0.047uF	1
C14	913060	Ceramic 0.01uF	1
C15	913171	Ceramic 30pF	1
C16	913060	Ceramic 0.01uF	1
C17	913122	Ceramic 7pF	1
C18	913060	Ceramic 0.01uF	1
C19	913051	Ceramic 0.001uF	1
C20	913053	Ceramic 5pF	1
C21	913125	Ceramic 0.022uF	1
C22	913051	Ceramic 0.001uF	1
C23	913060	Ceramic 0.01uF	1
C24	913427	Ceramic 18pF (CH)	1
C25	913052	Ceramic 10pF	1
C26	913051	Ceramic 0.001uF	1
C27	913060	Ceramic 0.01uF	1
C28	913052	Ceramic 10pF	1
C29, 30, 31	913060	Ceramic 0.01uF	3
C32	913427	Ceramic 18pF (CH)	1
C33	913081	Ceramic 1pF	1
C34	913427	Ceramic 18pF (CH)	1
C35	913060	Ceramic 0.01uF	1
C36	913076	Ceramic 4pF	1
C37, 38, 39	923060	Ceramic 0.01uF	3
C40	913076	Ceramic 2pF	1
C41	913125	Ceramic 0.022uF	1
C42	923078	Ceramic 4pF	1
C43	913052	Ceramic 10pF	1
C44	913051	Ceramic 0.001uF	1
C45	913625	Ceramic 0.001uF (B)	1
C46	913171	Ceramic 30pF	1
C47	913053	Ceramic 0.001uF	1
C48, 49	913060	Ceramic 0.01uF	2
C50	913051	Ceramic 0.001uF	1
C51	913053	Ceramic 5pF	1
C52	913060	Ceramic 0.01uF	1
C53, 54	913125	Ceramic 0.022uF	2
C55	913625	Ceramic 0.001uF (B)	1
C56	913060	Ceramic 0.01uF	1
C57	913052	Ceramic 10pF	1
C58	913077	Ceramic 220pF	1
C59	913075	Ceramic 4.7pF	1
C60	913075	Ceramic 4.7pF	1
C61, 62, 63	913060	Ceramic 0.01uF	3
C64, 65, 66	913125	Ceramic 0.022uF	3
C67		No component	
C68	913125	Ceramic 0.022uF	1
C69	913060	Ceramic 0.01uF	1

ELECTRICAL COMPONENT LIST (Cont'd)

4. PLL P.C. BOARD

Ref. No.	Part No.	Description	Q'ty	Ref. No.	Part No.	Description	Q'ty
<b>SEMI-CONDUCTORS &amp; COIL</b>							
IC101	916218	IC MC3357P	1	BR107	915591	Block Resistor MS1034	1
IC102	916221	IC LA1201	1	VR101	915594	Slide Volume 5K (B), SQ	1
IC103	916223	IC SO42P	1	VR102	915595	Solid Volume 22K (B)	1
IC104	916219	IC SP8629	1	VR103	915581	Slide Volume 20K (A), VOLUME	1
IC105	916225	IC uPD2819C	1	VR104	915580	Slide Volume 20K (B), Fine Tuning	1
IC106	916185	IC uPB551C	1	VR105	915596	Solid Volume 47K	1
IC107	916182	IC SN74LS162N	1	X1	923945	Crystal Unit 10.245 MHz	1
IC108	916229	IC uPD4015C	1	X2	923943	Crystal Unit 5.76 MHz	1
IC109	916228	IC uPD4011C	1	X3	923944	Crystal Unit 7.20 MHz	1
IC110	916238	IC SN74LS107AN	1	X4	923942	Crystal Unit 4.80 MHz	1
IC111	916184	IC SN74LS00N	1	X5	923943	Crystal Unit 5.76 MHz	1
IC112	916227	IC uPD5101LC	1	<b>RESISTORS, all are 1/8 watt 10% tolerance unless otherwise specified.</b>			
IC113	916198	IC uPA53C	1	R101	915015	10K ohm	1
IC114	916225	IC uPD2819C	1	R102	915343	10M "	1
IC115	916224	IC uPD553C	1	R103	915007	2.2K "	1
IC116	916239	IC uPC2002	1	R104	915427	82K "	1
IC117	916241	IC 78M08 AVR	1	R105	915343	47K "	1
IC118	916240	IC 78M05 AVR	1	R106	915372	56K "	1
Q101 thru. 104	916158	Silicon Transistor 2SC945L	4	R107	915327	4.7K "	1
Q105 thru. 111	916116	Silicon Transistor 2SC1674	7	R108	915427	82K "	1
Q112	916194	Silicon Transistor 2SA733	1	R109	915327	4.7K "	1
Q113	916158	Silicon Transistor 2SC945L	1	R110	915342	22K "	1
Q114	916116	Silicon Transistor 2SC1674	1	R111	915337	680 "	1
Q115, 116, 117	916158	Silicon Transistor 2SC945L	3	R112	915473	820K "	1
Q118	916194	Silicon Transistor 2SA733	1	R113	915340	6.8K "	1
D101, 102	923147	Diode IS953	2	R114	915372	56K "	1
D103, 104	922604	Diode IS188	2	R115	915001	1.5K "	1
D105, 106		No component		R116	915007	2.2K "	1
D107	923211	Diode ISV-50, Varactor	1	R117	915039	100K "	1
D108, 109	923147	Diode IS953	2	R118	915003	1K "	1
D110	923588	Diode RD6.2EB, Zener	1	R119	915039	100K "	1
D111, 112	923147	Diode IS953	2	R120	915327	4.7K "	1
D113	923793	Diode RD5.6EB, Zener	1	R121	915343	47K "	1
D114 thru. 121	923147	Diode IS953	8	R122	915007	2.2K "	1
D122	924009	Diode RD18EB, Zener	1	R123	915003	1K "	1
D123, 124, 125	923395	Diode IS2222	3	R124, 125	915001	1.5K "	2
D126	923211	Diode ISV-50, Varactor	1	R126	915354	150 "	1
D127	923147	Diode IS953	1	R127	915198	47 "	1
D128	923588	Diode RD6.2EB, Zener	1	R128	915337	680 "	1
D129	923817	Diode SR1K-2	1	R129	915003	1K "	1
D130, 131	923147	Diode IS953	2	R130	915055	8.2K "	1
L101	913624	Micro Inductor 1uH	1	R131	915015	10K "	1
L102	913627	Coil L-IS6B R-12NNO419	1	R132, 133	915327	4.7K "	2
L103	913624	Micro Inductor 1uH	1	R134	915047	820 "	1
L104, 105, 106	913630	Micro Inductor 10uH	3	R135	915356	68 "	1
L107, 108	914020	Filter Choke	2	R136	915015	10K "	1
CH101	914028	Choke Coil 4028	1	R137	915004	3.3K "	1
IFT101, 102	922838	IFT M402 353N	2	R138	915336	220 "	1
XF1, 2	924026	Crystal Filter 10.7MHZ	2	R139	915366	33 "	1
CF101	923555	Ceramic Filter CFW455D	1	R140	915057	470 "	1
CF102	924007	Ceramic Filter CFW455G	1	R141	915052	33K "	1
TC101 thru. 105	913519	Trimmer Condenser 50pF 7φ	5	R142	915337	680 "	1
BR101	915592	Block Resistor MS6824	1	R143	915336	220 "	1
BR102	915586	Block Resistor MS6824C	1	R144	915343	47K "	1
BR103	915590	Block Resistor MS4734	1	R145	915052	33K "	1
BR104	915518	Block Resistor MS1047	1	R146	915003	1K "	1
BR105	915588	Block Resistor DIP1047	1	R147, 148	915340	6.8K "	2
BR106	915589	Block Resistor MS1044	1	R149	915039	100K "	1



ELECTRICAL COMPONENT LIST (Cont'd)

4. PLL P.C. BOARD

Ref. No.	Part No.	Description	Q'ty	Ref. No.	Part No.	Description	Q'ty
R150	915340	6.8K ohm	1	C105, 106	913107	Ceramic 250pF	2
R151	915001	1.5K "	1	C107	913452	Ceramic 50pF (SH)	1
R152, 153	915015	10K "	2	C108	913060	Ceramic 0.01uF	1
R154	915336	220 "	1	C109	913021	Mylar 0.1uF	1
R155	915367	470K "	1	C110	913151	Ceramic 10pF (SH)	1
R156 thru. 160	915015	10K "	5	C111	913060	Ceramic 0.01uF	1
R161, 162, 163	915004	3.3K "	3	C112	913021	Mylar 0.1uF	1
R164	915015	10K "	1	C113, 114	913060	Ceramic 0.01uF	2
R165	915057	470 "	1	C115	913021	Mylar 0.1uF	1
R166	915052	33K "	1	C116	913180	Electrolytic 47uF 16V	1
R167	915342	22K "	1	C117	913175	Electrolytic 10uF 16V	1
R168	915039	100K "	1	C118	913148	Electrolytic 4.7uF 16V	1
R169	915057	470 "	1	C119	913125	Ceramic 0.022uF	1
R170	915368	68K "	1	C120, 121	913020	Mylar 0.01uF	2
R171	915003	1K "	1	C122	913452	Ceramic 50pF (SH)	1
R172	915052	33K "	1	C123	913063	Ceramic 0.047uF	1
R173	915009	100 "	1	C124	913631	Ceramic 0.001uF	1
R174	915342	22K "	1	C125	913020	Mylar 0.01uF	1
R175	915009	100 "	1	C126	913060	Ceramic 0.01uF	1
R176	915351	330 "	1	C127	913148	Electrolytic 4.7uF 16V	1
R177	915340	6.8K "	1	C128	913175	Electrolytic 10uF 16V	1
R178	915007	2.2K "	1	C129	913060	Ceramic 0.01uF	1
R179	915340	6.8K "	1	C130	913078	Ceramic 4pF	1
R180	915354	150 "	1	C131	913125	Ceramic 0.022uF	1
R181, 182	915342	22K "	2	C132	913060	Ceramic 0.01uF	1
R183, 184	915386	1M "	2	C133	913266	Ceramic 82pF	1
R185 thru. 189	915039	100K "	5	C134	913125	Ceramic 0.022uF	1
R190 thru. 194	915343	47K "	5	C135	913060	Ceramic 0.01uF	1
R195	915053	2.7K "	1	C136	913051	Ceramic 0.001uF	1
R196, 197, 198	915015	10K "	3	C137	913060	Ceramic 0.01uF	1
R199	915367	470K "	1	C138		No component	
R200	915412	150K "	1	C139, 140	913051	Ceramic 0.001uF	2
R1201	915015	10K "	1	C141	913060	Ceramic 0.01uF	1
R1202	915573	10M "	1	C142, 143	913125	Ceramic 0.022uF	2
R1203	915055	8.2K "	1	C144	913060	Ceramic 0.01uF	1
R1204, 1205, 1206	915342	22K "	3	C145	913125	Ceramic 0.022uF	1
R1207	915015	10K "	1	C146	913051	Ceramic 0.001uF	1
R1208	915342	22K "	1	C147	913151	Ceramic 10pF (SH)	1
R1209	915015	10K "	1	C148	913482	Ceramic 30pF (SH)	1
R1210	915343	47K "	1	C149	913376	Ceramic 50pF (CH)	1
R1211	915039	100K "	1	C150	913115	Ceramic 120pF	1
R1212	915327	4.7K "	1	C151	913348	Electrolytic 0.47uF (NP)	1
R1213	915336	220 " 1/2 watt	1	C152, 153	913077	Ceramic 220pF	2
R1214	915007	2.2K "	1	C154	913097	Electrolytic 100uF 16V	1
R1215, 1216	915091	10 " 1/2 watt	2	C155	913082	Ceramic 50pF (UJ)	1
R1217	915051	68 " "	1	C156	913072	Ceramic 22pF (UJ)	1
R1218	915007	2.2K "	1	C157 thru. 161	913436	Tantalum 0.47uF 16V	5
R1219	915360	270 "	1	C162	913331	Semi-Con. 0.1uF (SC)	1
R1220	915007	2.2K "	1	C163	913276	Ceramic 5pF (CH)	1
R1221	915523	1 "	1	C164, 165	913051	Ceramic 0.001uF	2
R1222	915015	10K "	1	C166	913060	Ceramic 0.01uF	1
R1223	915003	1K "	1	C167	913097	Electrolytic 100uF 16V	1
R1224	915327	4.7K "	1	C168	913062	Electrolytic 470uF 25V	1
R1225	915395	27K "	1	C169, 170	913174	Electrolytic 100uF 25V	2
R1226	915039	100K "	1	C171	913097	Electrolytic 100uF 16V	1
C101	913148	Electrolytic 4.7uF 16V	1	C172	913125	Ceramic 0.022uF	1
C102	913175	Electrolytic 10uF 16V	1	C173	913626	Tantalum 10uF 16V	1
C103	913627	Tantalum 0.22uF 16V	1	C174	913331	Semi-Con. 0.1uF	1
C104	913021	Mylar 0.1uF	1	C175, 176	913482	Ceramic 30pF (SH)	2
				C177	913461	Ceramic 2pF	1
				C178	913051	Ceramic 0.001uF	1
				C179	913125	Ceramic 0.022uF	1
				C180	913626	Tantalum 10uF 16V	1
				C181		Film Con. 0.33uF	1

CAPACITORS, all are in 50 working voltage unless otherwise specified.

ELECTRICAL COMPONENT LIST (Cont'd)

4. PLL P.C. BOARD

Ref. No.	Part No.	Description	Q'ty	Ref. No.	Part No.	Description	Q'ty
C182	913348	Electrolytic 0.47uF	1	C1206, 1207	923480	Tantalum 33uF 16V	2
C183	913030	Electrolytic 470uF 16V	1	C1208	913594	Electrolytic 1uF (NP)	1
C184	913061	Electrolytic 1000uF 16V	1	C1209 thru. 1213	913125	Ceramic 0.022uF	5
C185	913030	Electrolytic 470uF 16V	1	C1214	913480	Tantalum 33uF 16V	1
C186	913069	Electrolytic 220uF 16V	1	C1215	913060	Ceramic 0.01uF	1
C187, 188	913030	Electrolytic 470uF 16V	2	C1216, 1217, 1218	913125	Ceramic 0.022uF	3
C189	913069	Electrolytic 220uF 16V	1	C1219	913069	Electrolytic 220uF 16V	1
C190	913592	Electrolytic 0.22uF (NP)	1	C1220, 1221, 1222	913125	Ceramic 0.022uF	3
C191	913021	Mylar 0.1uF	1	C1223, 1224	913051	Ceramic 0.001uF	2
C192	913069	Electrolytic 220uF 16V	1	C1225, 1226	913060	Ceramic 0.01uF	2
C193, 194, 195	913435	Tantalum 0.33uF 16V	3	C1227	913125	Ceramic 0.022uF	1
C196 thru. 199	913060	Ceramic 0.01uF	4				
C1200	913125	Ceramic 0.022uF	1				
C1201	913060	Ceramic 0.01uF	1				
C1202	913183	Ceramic 68pF	1				
C1203, 1204, 1205	913060	Ceramic 0.01uF	3				

5. VCO P.C. BOARD

Ref. No.	Part No.	Description	Q'ty	Ref. No.	Part No.	Description	Q'ty
<b>SEMI-CONDUCTORS &amp; COILS</b>				R310	915015	10K ohm	1
Q201 thru. 205	916116	Silicon Transistor 2SC1674	5	R310	915340	6.8K "	1
Q206		No component		R312	915342	22K "	1
Q207 thru. 210	916116	Silicon Transistor 2SC1674	4	R313	915003	1K "	1
Q211	916158	Silicon Transistor 2SC945L	1	R314	915015	10K "	1
Q212 thru. 215	916194	Silicon Transistor 2SA733	4	R315	915340	6.8K "	1
Q216	916158	Silicon Transistor 2SC945L	1	R316	915342	22K "	1
Q217, 218	916194	Silicon Transistor 2SA733	2	R317	915003	1K "	1
D201	923211	Diode ISV-50, Varactor	1	R318	915015	10K "	1
D202, 203	923416	Diode IS-2209, "	2	R319	915340	6.8K "	1
D204 thru. 207	923395	Diode IS-2222	4	R320	915409	5.6K "	1
D208, 209, 210	923211	Diode ISV-50, Varactor	3	R321 thru. 328	915015	10K "	8
D211 thru. 215	923147	Diode IS953	5	R329 thru. 332	915342	22K "	4
L201, 202	923930	Coil MC108 2-1/2t	2	R333	915007	2.2K "	1
L203	923922	Coil " 3-1/2t	1	R334	915015	10K "	1
L204	923926	Coil MC116 5-1/2t	1	R335	915340	6.8K "	1
L205	923927	Coil " 6-1/2t	1	R336, 337	915343	47K "	2
L206	923928	Coil " 8-1/2t	1	R338	915007	2.2K "	1
TC201 thru. 206	913529	Trimmer Condenser 10pF 5p	6	R339	915410	560 "	1
RESISTORS, all are 1/8 watt 10% tolerance unless otherwise specified.				R340	915342	22K "	1
R301	915057(J)	470 ohm	1	R341	915009	100 "	1
R302	915009	100 "	1	R342	915057(J)	470 "	1
R303	915052	33K "	1	R343	915052	33K "	1
R304, 305	915009	100 "	2	R344	915009	100 "	1
R306	915337	680 "	1	R345	915342	22K "	1
R307	915343	47K "	1	R346	915344	220K "	1
R308	915342	22K "	1	R347	915003	1K "	1
R309	915410	560 "	1	R348	915015	10K "	1
				R349	915003	10K "	1
				R350	915015	10K "	1
				R351	915003	1K "	1
				R352	915015	10K "	1
				R353	915010	10 " 1/4 watt	1
				R354	915003	1K "	1
				R355	915015	10K "	1
				R356	915003	1K "	1
				R357	915015	10K "	1
				R358	915342	22K "	2

ELECTRICAL COMPONENT LIST (Cont'd)

5. VCO P.C. BOARD

Ref. No.	Part No.	Description	Q'ty
<b>CAPACITORS, all are in 50 working voltage unless otherwise specified.</b>			
C301, 302	913060	Ceramic 0.01uF	2
C303	913268	Ceramic 47pF	1
C304	913076	Ceramic 2pF	1
C305	913265	Ceramic 56pF	1
C306	913081	Ceramic 1pF	1
C307	913172	Ceramic 39pF	1
C308	913122	Ceramic 7pF	1
C309	913063	Ceramic 0.047uF	1
C310	913122	Ceramic 7pF	1
C311	913051	Ceramic 0.001uF	1
C312	913060	Ceramic 0.01uF	1
C313	913081	Ceramic 1pF	1
C314	913266	Ceramic 82pF	1
C315	913078	Ceramic 4pF	1
C316	913060	Ceramic 0.01uF	1
C317	913078	Ceramic 4pF	1
C318, 319	913060	Ceramic 0.01uF	2
C320	913081	Ceramic 1pF	1
C321	913266	Ceramic 82pF	1
C322	913078	Ceramic 4pF	1
C323	913060	Ceramic 0.01uF	1
C324	913078	Ceramic 4pF	1

Ref. No.	Part No.	Description	Q'ty
C325, 326, 327	913060	Ceramic 0.01uF	3
C328	913093	Ceramic 25pF	1
C329	913078	Ceramic 4pF	1
C330	913336	Electrolytic 4.7uF 25V	1
C331	913093	Ceramic 25pF	1
C332 thru. 337	913060	Ceramic 0.01uF	6
C338	913125	Ceramic 0.022uF	1
C339 thru. 343	913060	Ceramic 0.01uF	5
C344	913080	Ceramic 15pF	1
C345	913076	Ceramic 2pF	1
C346	913171	Ceramic 30pF	1
C347, 348	913060	Ceramic 0.01uF	2
C349	913081	Ceramic 1pF	1
C350	913060	Ceramic 0.01uF	1
C351	913080	Ceramic 15pF	1
C352 thru. 357	913060	Ceramic 0.01uF	6
C358		No component	
C359	913069	Electrolytic 220uF 16V	1
C360 thru. 363	913060	Ceramic 0.01uF	4

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# Low Power Narrowband FM IF

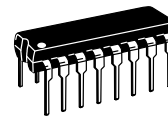
... includes Oscillator, Mixer, Limiting Amplifier, Quadrature Discriminator, Active Filter, Squelch, Scan Control, and Mute Switch. The MC3357 is designed for use in FM dual conversion communications equipment.

- Low Drain Current (3.0 mA (Typical) @  $V_{CC} = 6.0$  Vdc)
- Excellent Sensitivity: Input Limiting Voltage – (-3.0 dB) = 5.0  $\mu$ V (Typical)
- Low Number of External Parts Required
- Recommend MC3372 for Replacement/Upgrade

## MC3357

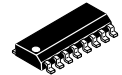
### LOW POWER FM IF

#### SEMICONDUCTOR TECHNICAL DATA

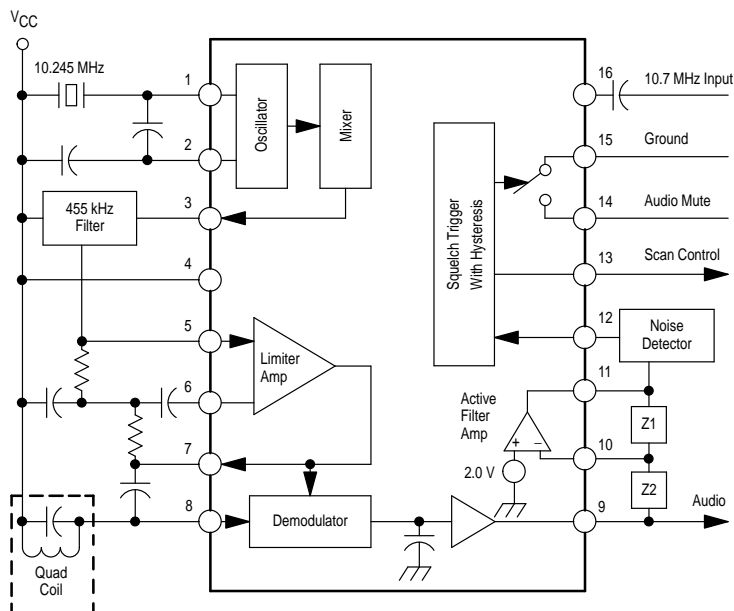


**P SUFFIX**  
PLASTIC PACKAGE  
CASE 648

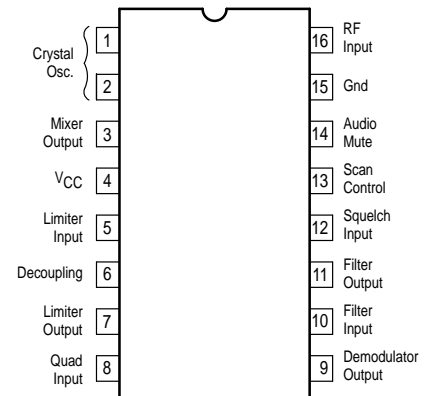
**D SUFFIX**  
PLASTIC PACKAGE  
CASE 751B  
(SO-16)



**Figure 1. Representative Block Diagram**



#### PIN CONNECTIONS



#### ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC3357D	$T_A = -30$ to $+70^\circ\text{C}$	SO-16
MC3357P		Plastic DIP

# MC3357

## MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise noted)

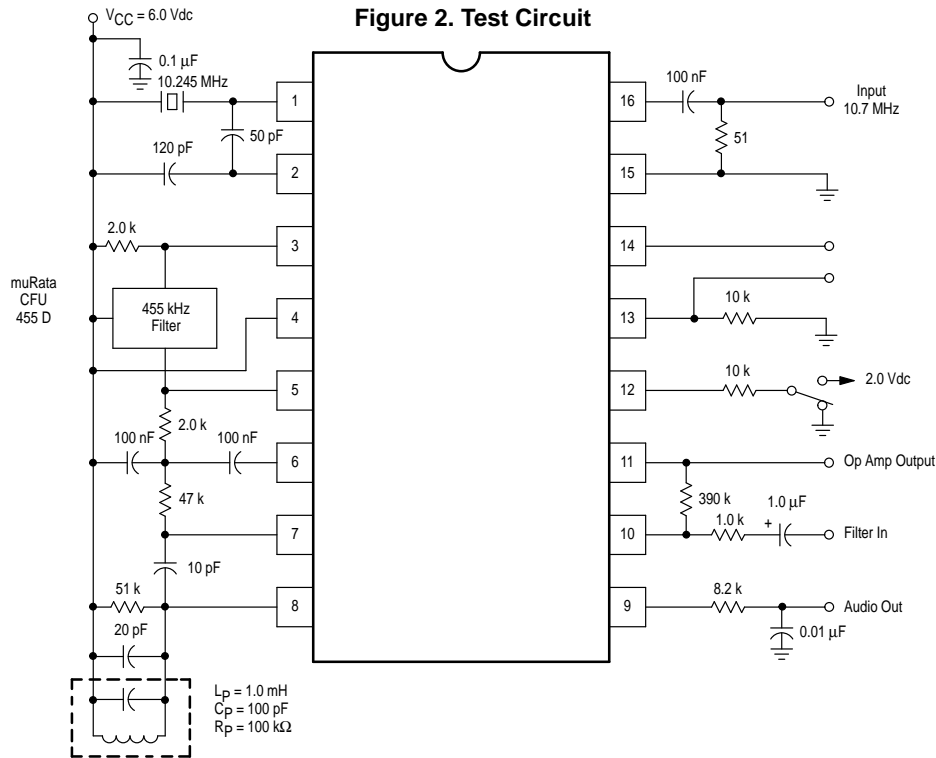
Rating	Pin	Symbol	Value	Unit
Power Supply Voltage	4	V <sub>CC(max)</sub>	12	Vdc
Operating Supply Voltage Range	4	V <sub>CC</sub>	4 to 8	Vdc
Detector Input Voltage	8	–	1.0	V <sub>p-p</sub>
Input Voltage (V <sub>CC</sub> ≥ 6.0 Volts)	16	V <sub>16</sub>	1.0	V <sub>RMS</sub>
Mute Function	14	V <sub>14</sub>	–0.5 to 5.0	V <sub>pk</sub>
Junction Temperature	–	T <sub>J</sub>	150	°C
Operating Ambient Temperature Range	–	T <sub>A</sub>	– 30 to + 70	°C
Storage Temperature Range	–	T <sub>stg</sub>	– 65 to + 150	°C

## ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 6.0 Vdc, f<sub>o</sub> = 10.7 MHz, Δf = ± 3.0 kHz, f<sub>mod</sub> = 1.0 kHz, T<sub>A</sub> = 25°C, unless otherwise noted.)

Characteristic	Pin	Min	Typ	Max	Unit
Drain Current Squelch Off	4	–	2.0	–	mA
Drain Current Squelch On	4	–	3.0	5.0	mA
Input Limiting Voltage (– 3 dB Limiting)	16	–	5.0	10	μV
Detector Output Voltage	9	–	3.0	–	Vdc
Detector Output Impedance	–	–	400	–	Ω
Recovered Audio Output Voltage (V <sub>in</sub> = 10 mV)	9	200	350	–	mVrms
Filter Gain (10 kHz) (V <sub>in</sub> = 5 mV)	–	40	46	–	dB
Filter Output Voltage	11	1.8	2.0	2.5	Vdc
Trigger Hysteresis	–	–	100	–	mV
Mute Function Low	14	–	15	50	Ω
Mute Function High	14	1.0	10	–	MΩ
Scan Function Low (Mute Off) (V <sub>12</sub> = 2 Vdc)	13	–	0	0.5	Vdc
Scan Function High (Mute On) (V <sub>12</sub> = Gnd)	13	5.0	–	–	Vdc
Mixer Conversion Gain	3	–	20	–	dB
Mixer Input Resistance	16	–	3.3	–	kΩ
Mixer Input Capacitance	16	–	2.2	–	pF

# MC3357

Figure 2. Test Circuit



## CIRCUIT DESCRIPTION

The MC3357 is a low power FM IF circuit designed primarily for use in voice communication scanning receivers.

The mixer-oscillator combination converts the input frequency (e.g., 10.7 MHz) down to 455 kHz, where, after external bandpass filtering, most of the amplification is done. The audio is recovered using a conventional quadrature FM detector. The absence of an input signal is indicated by the presence of noise above the desired audio frequencies. This "noise band" is monitored by an active filter and a detector. A squelch trigger circuit indicates the presence of a noise (or a tone) by an output which can be used to control scanning. At the same time, an internal switch is operated which can be used to mute the audio.

The oscillator is an internally-biased Colpitts type with the collector, base, and emitter connections at Pins 4, 1, and 2 respectively. A crystal can be used in place of the usual coil.

The mixer is doubly-balanced to reduce spurious responses. The input impedance at Pin 16 is set by a 3.0 kΩ internal biasing resistor and has low capacitance, allowing the circuit to be preceded by a crystal filter. The collector output at Pin 3 must be dc connected to B+, below which it can swing 0.5 V.

After suitable bandpass filtering (ceramic or LC), the signal goes to the input of a five-stage limiter at Pin 5. The output of the limiter at Pin 7 drives a multiplier, both internally directly,

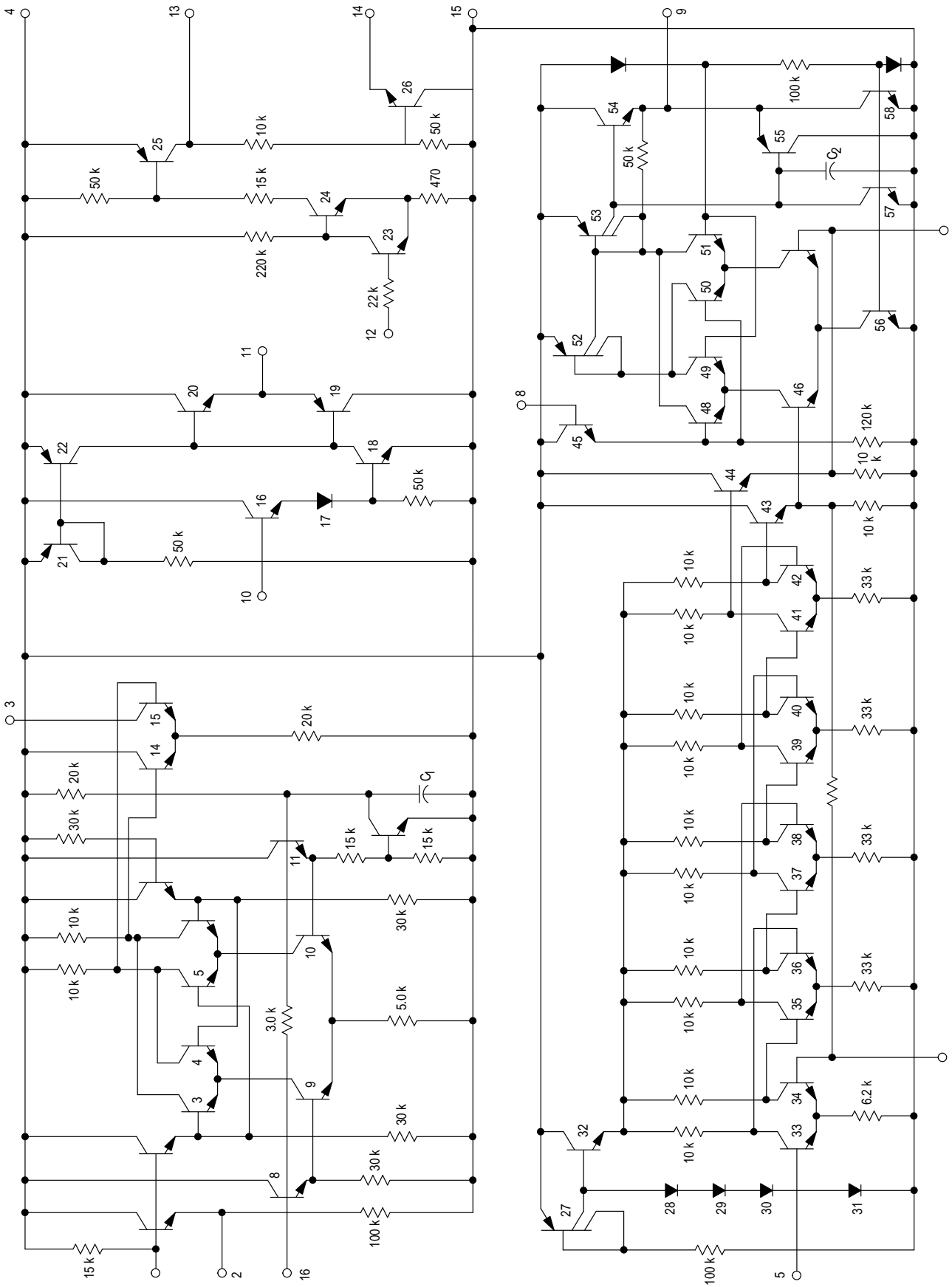
and externally through a quadrature coil, to detect the FM. The output at Pin 7 is also used to supply dc feedback to Pin 5. The other side of the first limiter stage is decoupled at Pin 6.

The recovered audio is partially filtered, then buffered, giving an impedance of around 400 Ω at Pin 9. The signal still requires de-emphasis, volume control and further amplification before driving a loudspeaker.

A simple inverting op amp is provided with an output at Pin 11 providing dc bias (externally) to the input at Pin 10 which is referred internally to 2.0 V. A filter can be made with external impedance elements to discriminate between frequencies. With an external AM detector, the filtered audio signal can be checked for the presence of noise above the normal audio band, or a tone signal. This information is applied to Pin 12.

An external positive bias to Pin 12 sets up the squelch trigger circuit such that Pin 13 is low at an impedance level of around 60 kΩ, and the audio mute (Pin 14) is open circuit. If Pin 12 is pulled down to 0.7 V by the noise or tone detector, Pin 13 will rise to approximately 0.5 Vdc below supply where it can support a load current of around 500 μA and Pin 14 is internally short-circuited to ground. There is 100 mV of hysteresis at Pin 12 to prevent jitter. Audio muting is accomplished by connecting Pin 14 to a high-impedance ground-reference point in the audio path between Pin 9 and the audio amplifier.

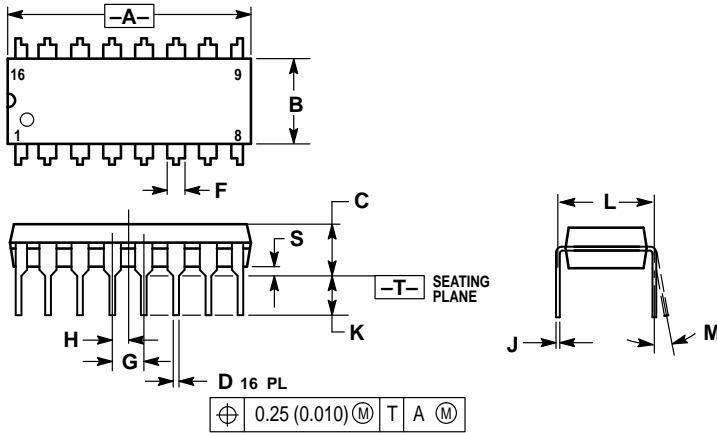
Figure 3. Circuit Schematic



# MC3357

## OUTLINE DIMENSIONS

### P SUFFIX PLASTIC PACKAGE CASE 648-08 ISSUE R

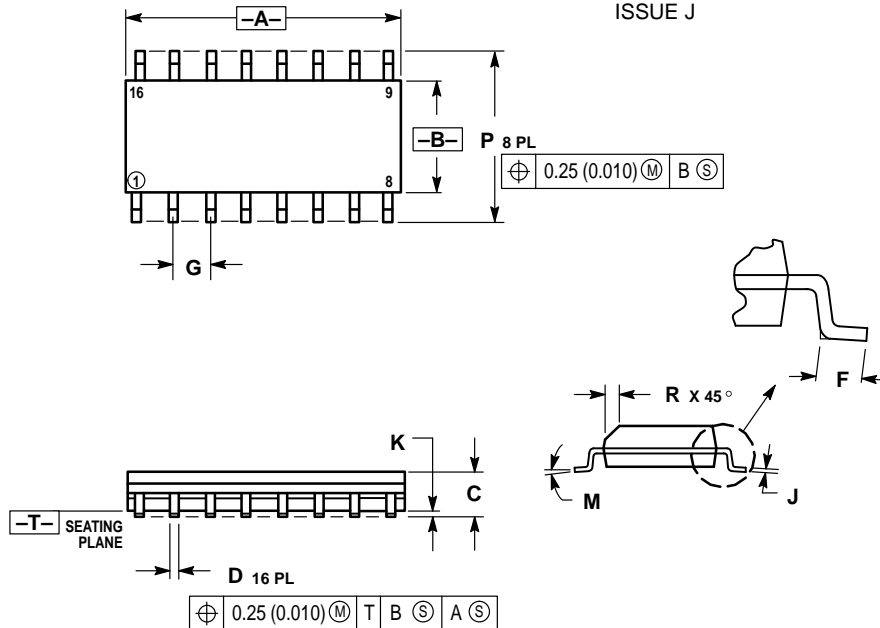


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

### D SUFFIX PLASTIC PACKAGE CASE 751B-05 (SO-16) ISSUE J




**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
R	5.80	6.20	0.229	0.244
	0.25	0.50	0.010	0.019



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No.495

4090

# LA1201

## モノリシックリニア集積回路 FM/AM IF 増幅器

三洋モノリシック リニア集積回路 LA1201は FM/AM の中間周波増幅用として設計されたもので、その構成は4個の独立した増幅回路と定電圧電源回路から成っている(⊙ASI構成: Amp Array System Integration)。AM 受信時の電力消費は 21.5mW ( $V_{CC}=5.0V$  の場合) とひじょうに小さいので 電池を電源とするセットなどに消費電力を押える必要のある場合に ひじょうに有効となる。

- 特長
- 4個の個別アンプからなっている。
  - 低電力消費である。
  - 高利得である。
  - AGC特性がすぐれている。

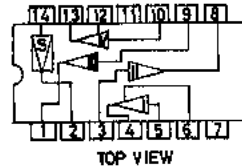
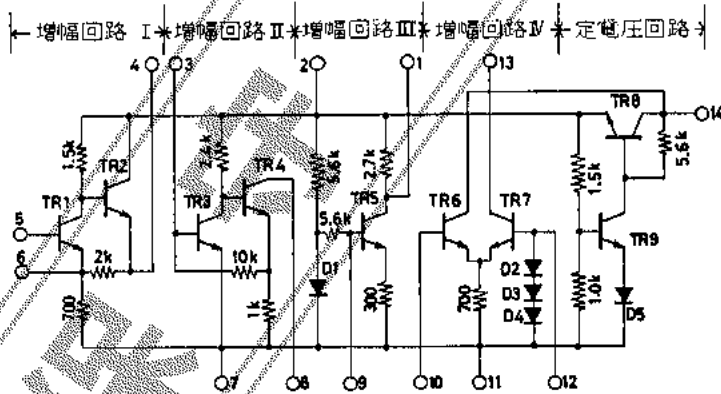
絶対最大定格 /  $T_a=25^\circ C$

				unit
最大電源電圧	$V_{CC}$ max	ピン14	10.0	V
最大供給電圧	$V_B, V_{13}$	ピン8,13	10.0	V
動作周囲温度	$T_{opg}$		-20 ~ +75	$^\circ C$
保存周囲温度	$T_{stg}$		-40 ~ +125	$^\circ C$

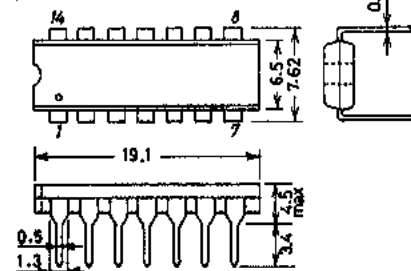
推奨動作条件 /  $T_a=25^\circ C$

			unit
推奨電源電圧	$V_{CC}$		6.0 V

### 等価回路



外形図 3003  
(unit: mm)



動作特性 /  $T_a=25^\circ\text{C}$ , 指定測定回路において,  $V_{cc}=5.0\text{V}$ 

項目	記号	条件	AM(455kHz)			FM(10.7MHz)			単位
			min	typ	max	min	typ	max	
無信号電流	$I_{cc0}$		2.7	4.2	6.3	4.5	6.8	9.0	mA
AM 検波出力	$V_o$	入力 60dB	70	115	160				mV
全高調波ひずみ率	THD1	入力 60dB		0.8	2.0				%
大入力ひずみ率	THD2	入力 80dB		1.8	3.0				%
差動対電流	$I_{13}$	ピン13				0.75	1.0	1.25	mA
定電圧出力	$V_2$	ピン2	2.7	3.0	3.3	2.7	3.0	3.3	V
総合利得※	$V_G$	入力 AM: 20dB, FM: 50dB	70		87	82		98	dB

(注) 総合利得※: LA1201 が高利得 IC のため FM の利得の測定は, 段間で利得を 40 dB 程度押えた回路 (p10参照) で, 検波出力値を  $1\mu\text{V}=0\text{ dB}$  として示してあり, 実際の応用回路における場合と相関が取れるようになっている。応用例を参照したい。

なお AM については実際の応用回路と同一の回路で測定している。

[参考] 各段ごとの利得配分, あるいはセラミックフィルタ使用時のように 抵抗負荷で使用する場合の利得については次の値を参照しない。

	増幅回路 I	増幅回路 II	増幅回路 III	増幅回路 IV	単位
AM (455kHz)	30	35	-14	-	dB
FM (10.7MHz)	25	30	-	20	dB

増幅回路 II, IV の  $R_L=1k\Omega$  とする。

#### LA1201 の構成

##### ・増幅回路 I (可変利得段: AGC)

これは被 AGC 段で増幅回路 III の AM 検波段から AGC 直流電圧を得て利得を制御している。直流的に正帰還をかけて TR1 のエミッタ電位を一定に保ち, さらに抵抗比を適当に選ぶことによって AGC 電圧とり出し口のレベルと整合させているので 効率のよい AGC 特性が得られる。

##### ・増幅回路 II (固定利得段)

固定利得段で, 回路構成は典型的な負帰還回路であるため 温度特性は良好でバラツキの少ない安定な利得が得られる。増幅回路 I のエミッタフォロワによる 低出力インピーダンスと合わせて回路 II の入力インピーダンスが低いいため外乱による影響が少なくなる。出力端子ピン 8 は FM RF への必要な AGC 電圧にしたがって 定電圧端子ピン 2, または電源供給端子ピン 14 に接続する。

##### ・増幅回路 III (AM 検波段)

AM 検波増幅段で, ここではトランジスタ検波を採用しているため微小入力でも ひずみが少なく, また AGC ループゲインが大きく取れ, 良好な AGC 特性が得られる。増幅回路 I の回路の AGC 特性とあいまって 2 段に AGC をかけたのと同等の AGC 特性が得られる。またエミッタに局部帰還をかけてひずみ率の向上を図っている。整合の

とれたダイオード接続のトランジスタをバイアス回路に用いることによって、温度特性を向上させながらバラツキも防いでいる。コレクタの直流レベル変化を直接用いてチューニングインジケータを付加することも可能である(応用技術資料No.5参照)。

・増幅回路Ⅳ (FM リミタ・増幅段)

差動増幅のリミタアンプで構成され、この段は整合したトランジスタ対によって 1mA ずつ均等に流れる。負荷インピーダンスを  $V_{cc}$  に応じて適当に選ぶことにより電流リミタがかかり、リミタアンプとしてすぐれた特性が得られる。またベース端子ピン 12 の電位を適当なスイッチング回路を用いて下げることにより、すぐれたミューティング特性が得られる。

・定電圧回路

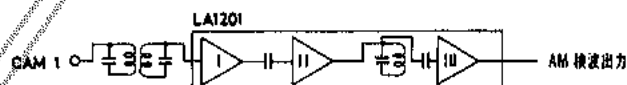
帰還型の安定化電源で、入力電圧の変動に対しても消費電流はあまり変化せず安定な出力電圧が得られる。増幅回路Ⅰ～Ⅳはすべてこの安定化電源によって 4.0～9.0 V の間ではほとんどその特性は変わらず、-10 dB 低下点は 3.5 V になっている。また定電圧出力端子 ピン 2 を FM チューナ、FM コンバータに利用する(最大 3mA まで可)と、それぞれ安定な性能を得られるように設計できる。

使用上の注意事項

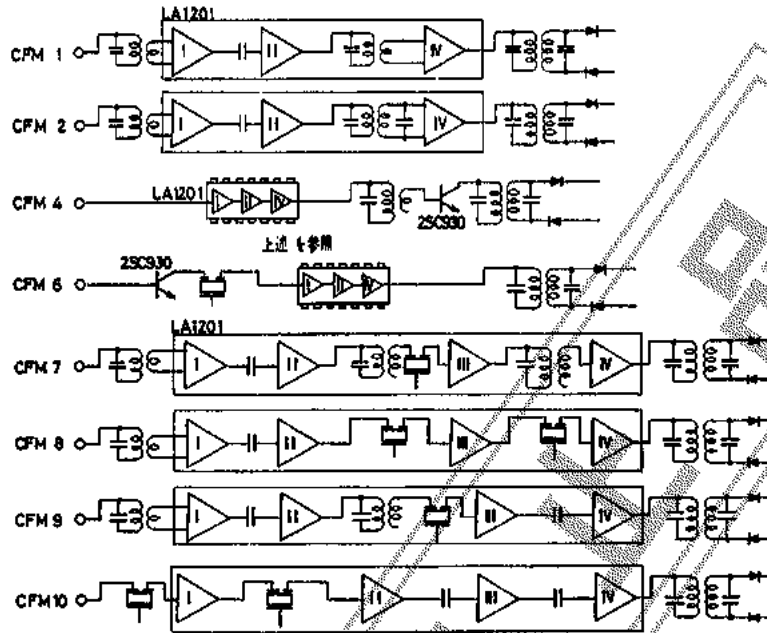
- (1) 波形観測や電圧チェックの際、誤って端子 3～4 間、端子 2～3 間を短絡すると、過大電流が流れ破壊に至ることがあるので注意したい。
- (2) 端子 8, 13, 14 間には回路動作的にも 10 V 以上かからないように設計する。
- (3) 増幅回路Ⅰのバイアス調整は、端子 4 と端子 6 間の電圧  $V_{4-6}$  が無信号時に 0.5 V になるように調整、設定する。この場合内部抵抗が 50 k $\Omega$  以上の直流電圧計を使用する。また FM または AM のいずれかの利得が最大になるように調整、設定することもできる。この場合の入力信号レベルは、検波出力 10 mV 程度が適当である。
- (4) 笛音妨害を少なくするためには、フェライトパーアンテナの軸方向を LA1201 の長軸方向と直角になるように配置する。また局部発振電圧の IP 段への漏れにも注意したい。
- (5) 特に 3 V くらいの低電源電圧で使用するときには、端子 2 と 14 を短絡して電源供給端子として使用する。この場合定電圧回路は動作しませんが減電圧特性以外は同じ特性が得られる。

LA1201 を応用した IP 増幅段の基本回路構成

(1) AM IP 段の構成例



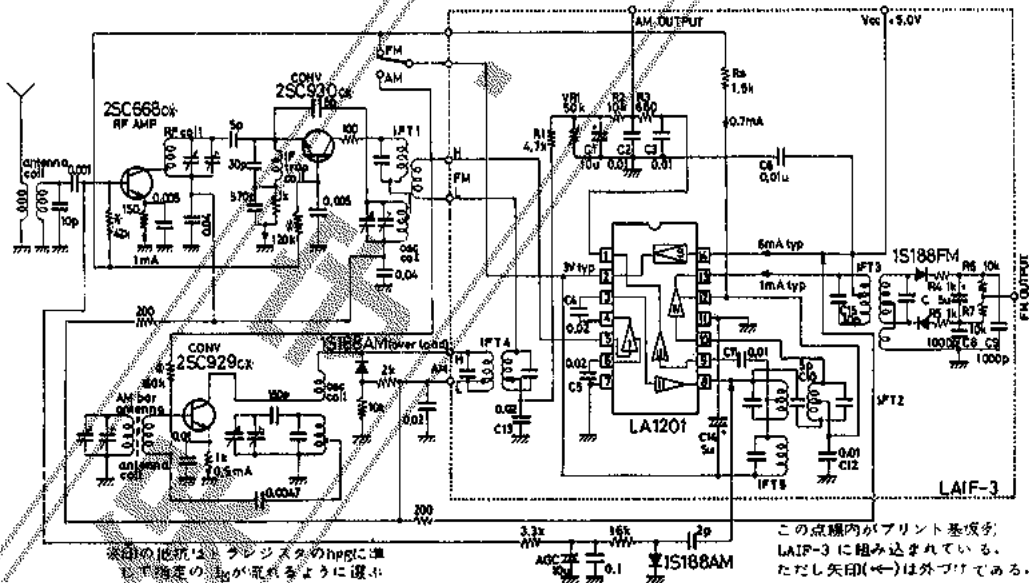
(2) FM IF 段の構成例 (IFT をセラミックフィルタに変更しただけのものは省いた)。



応用例 1. FM/AM ラジオ高周波回路

1. 回路図: CFM-2

FM IF 段に前項の構成例の CFM-2, AM IF 段に CAM-1 で構成した例を示す。



※印の抵抗はトランジスタのh<sub>FE</sub>に準じて指定の値が得られるように選小

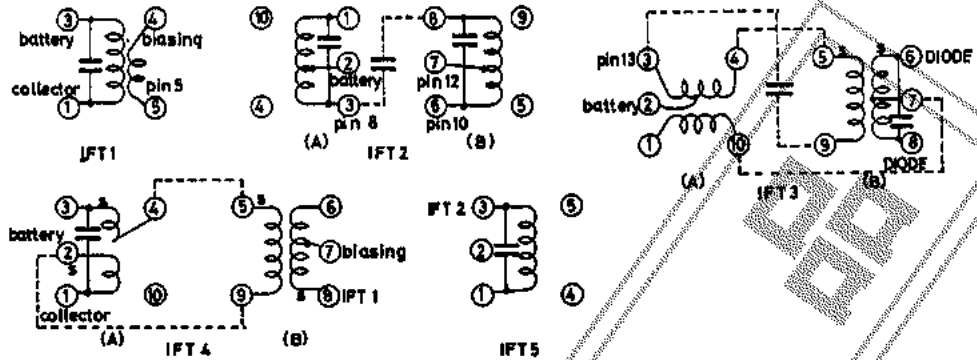
この点線内がプリント基板で LAIF-3 に組み込まれている。ただし矢印(←)は外づけである。

2. トランス関係仕様

- FM アンテナコイル      8T: 5T, バイファイラ巻, 5mmφ 空心
- FM RP コイル            4T (タップ=アースから 1T), 5mmφ 空心
- FM IF トラップコイル   12 1/2 T, 5mmφ 空心
- FM 発振コイル          3T (タップ=アースから 2T)

・ IFT の仕様

この回路に使用される IFT の仕様を示す。IFT はすべて 7mm 角である。



IFT1: 巻数 ① - ③ 7T, ④ - ⑤ 1T.  $f=10.7\text{MHz}$ ,  $Q_0=80$ ,  $0.09\text{mm}\phi$  UEW,  $C=200\text{pF}$

IFT2: 巻数 ① - ② 6T, ② - ③ 10T, ⑦ - ⑧ 3T, ⑥ - ⑦ 13T.  
 $f=10.7\text{MHz}$ ,  $Q_0=80$ ,  $0.09\text{mm}\phi$  UEW,  $C=50\text{pF}$ , 結合容量 ③ - ⑧ 5pF

IFT3: 巻数 ③ - ④  $20\frac{1}{2}$ T, ② - ③ 11T, ① - ②  $5\frac{1}{2}$ T, ④ - ⑦ 8T, ⑦ - ⑧ 8T, ④ - ⑤ 16T, ⑤ - ⑥  $\frac{1}{4}$ T.  
 $f=10.7\text{MHz}$ ,  $Q_0=80$  (1次), 100 (2次),  $0.09\text{mm}\phi$  UEW,  $C=30\text{pF}$  (1次, 外づけ ③④間), 50pF (2次).

IFT4: 巻数 ① - ② 29T, ③ - ④  $134\frac{1}{2}$ T, ⑤ - ⑥ 171T, ⑥ - ⑦ 159T, ⑦ - ⑧ 12T, ⑤ - ⑨ 1T.  
 $f=455\text{kHz}$ ,  $Q_0=105$  (1次), 120 (2次),  $0.06\text{mm}\phi$  UEW,  $C=180\text{pF}$ .

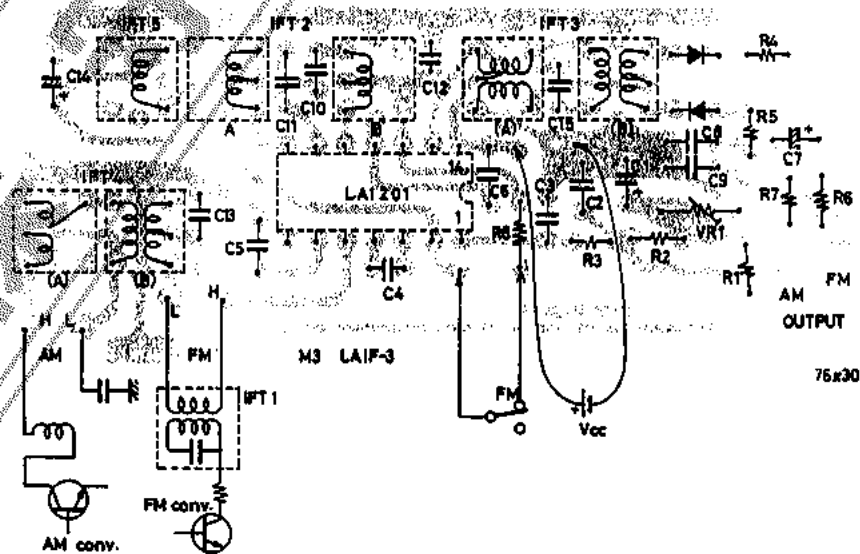
IFT5: 巻数 ① - ③ 170T.  $f=455\text{kHz}$ ,  $Q_0=110$ ,  $0.06\text{mm}\phi$  UEW,  $C=180\text{pF}$ .

その他のコイル仕様 (線径はすべて  $0.6\text{mm}\phi$ )

・ AM アンテナコイル: 1次側インダクタンス  $695\mu\text{H}$ , 巻線比 100T : 8T.

・ AM 発振コイル: earth ③, collector ④, base ②, VC ①, IFT4 ⑥.  
 インダクタンス  $360\mu\text{H}$ ,  $Q_0=100$   
 巻線比 ① - ② 94T, ② - ③ 2T, ④ - ⑤ 5T.

3. IF プリント基板の例 (銅ハク面)



前ページのプリント基板図は IF プリントパターン設計の参考にしたい。なおこの基板図は IF 部だけで FM / AM チューナ部分は含まれていない。

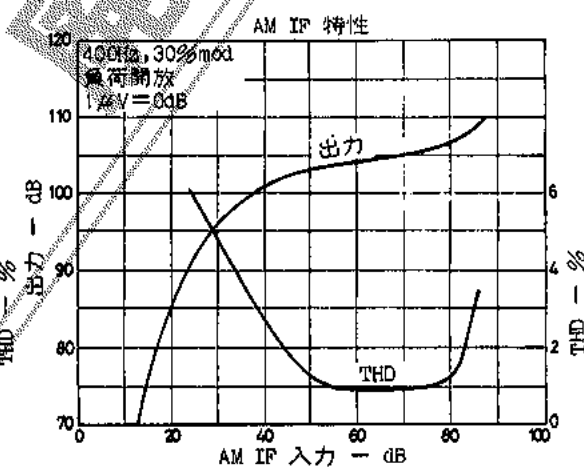
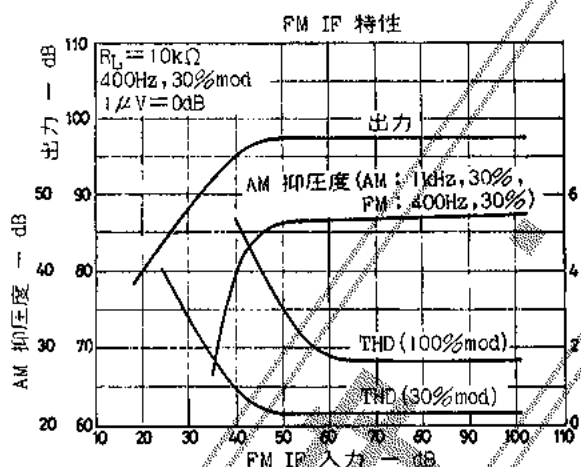
[調整法] VR1 50kΩ は 無信号時に  $V_4$ -6 (すなわち ④ - ⑥ 間の直流電圧) = 0.5V になるように調整設定するか または FM あるいは AM の利得が最大になるように調整、設定する。このとき 局部発振電圧の IF 段への漏れに注意したい。この漏れによって AM バンド内での利得差や 笛音等が悪化することがある。

4. IF 部分の電気的特性

前項 3. のプリントパターン例 LAIF-3 は 1. 回路図の点線内に相当する。このプリントパターンで IF 部分のみの特性をチェックする場合は FM H-L 間に 50Ω, AM L-アース間に 0.02μF を付加する。

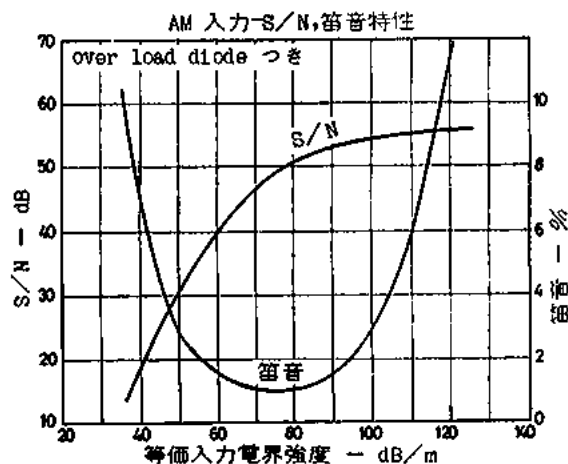
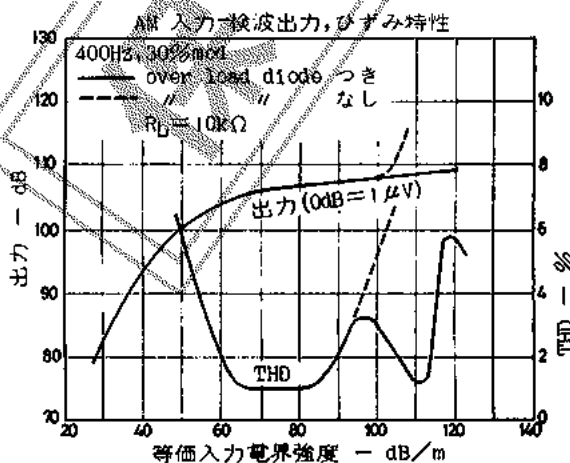
この回路は LA1201 の特性を生かすため 次の点に考慮を払っている。

- (1) AM 受信時に R8 (1.5kΩ) を切り離して 増幅回路 IV をガットオフにし 電流消費の低減を図っている。
- (2) 定電圧出力  $V_2$  をチューナ部のベースバイアスに用い 電流変動に対する安定化を図っている。
- (3) 笛音妨害を少なくするために AM フェライト アンテナは LA1201 と直角になるように配置し そのうえで フェライト コアの位置を検討する。



5. セットに応用した場合の総合特性

- (1) AM 特性 / 検波出力 10mV ( $R_L = 10k\Omega$ ) を基準出力とする。[0dB = 1μV]



## • 感度

周波数	最大感度	実用感度
600 kHz	26 dB/m	43.5 dB/m
1000 kHz	26 dB/m	44.5 dB/m
1400 kHz	27 dB/m	44.5 dB/m

## • 選択度

1000 kHz	+10 kHz	23 dB
	-10 kHz	24 dB

(2) FM 特性 / 検波出力 10mV ( $R_L=10k\Omega$ ) を基準出力とする。0 dB = 1 $\mu$ V

## • 感度

周波数	最大感度	実用感度	-3dB リミチング感度	IHFPM実用感度
76 MHz	-1 dB	3.5 dB	13 dB	23 dB
83	-1	4.0	12	20
90	0	3.0	10	21

## • 3 dB 帯域幅

200 kHz

## • 検波出力

60 mV

## • ひずみ率

0.4 % / 入力 60 dB, 400 Hz, 22.5 kHz dev.

1.4 % / " 60 dB, 400 Hz, 75 kHz dev.

[参考] 以上の応用例に掲げた IFT の購入については 下記メーカーを照会したい。

スミダ電機(株) 本社：東京都葛飾区金町 2-1279 電話 03-607-5111

東光(株) 本社：東京都大田区東雪谷 2-1-17 電話 03-727-1161

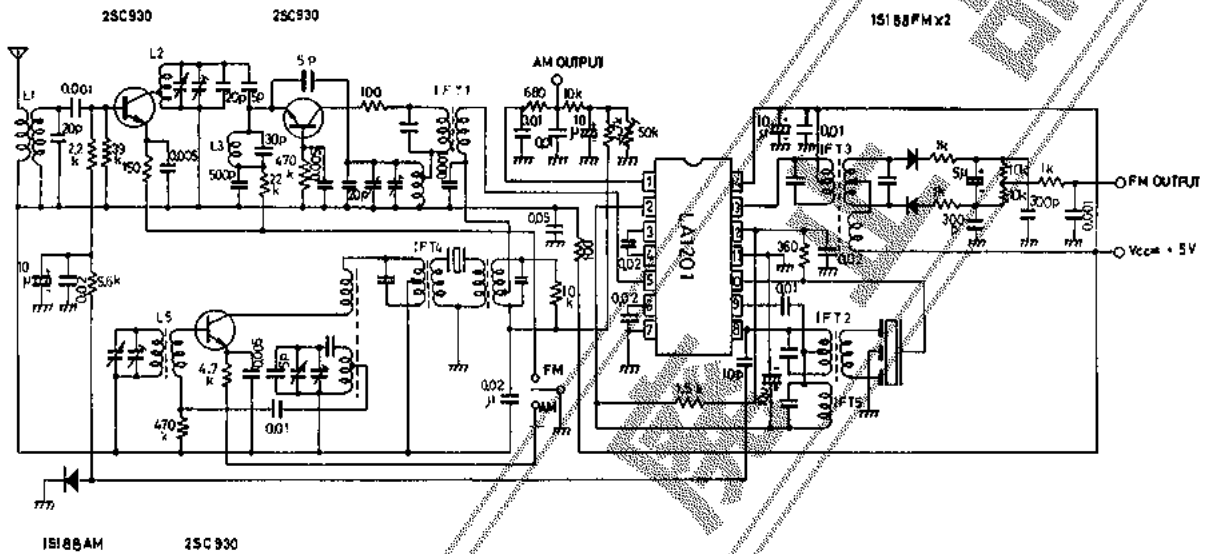
IFT 試作番号	スミダ電機	東光コイル
IFT1		85AC-3725BM2 (黒)
IFT2 (A/B)	7SP01 / 7SP02 (緑) (黒)	85AC-3726PAB2 / 85AC-3727SGP2 (黄) (赤)
IFT3 (A/B)	7SP03 / 7SP04 (桃) (青)	85AN-3728PZ2 / 85AC-3729SAG2 (桃) (青)
IFT4 (A/B)	7SA01 / 7SA02 (橙) (青)	LWC-5054PAR2 / LWC-5055SLQ2 (白) (緑)
IFT5	7SA03 (黒)	LWC-5053HM2 (橙)



応用例 2. セラミックフィルタ使用 FM/AM ラジオ高周波回路

FM/AM ラジオで IF 増幅部として LA1201 を使い、選択性素子として変形ヤウマン型セラミックフィルタを用いた例を示している。LC フィルタに比べて FM の -3dB リミテイング感度はやや劣っているが優れた実効(2信号)選択特性が得られる。

1. 回路図



2. 総合特性

AM 主要特性

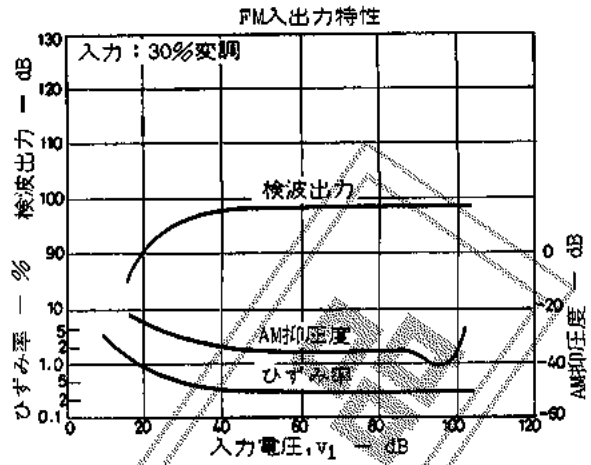
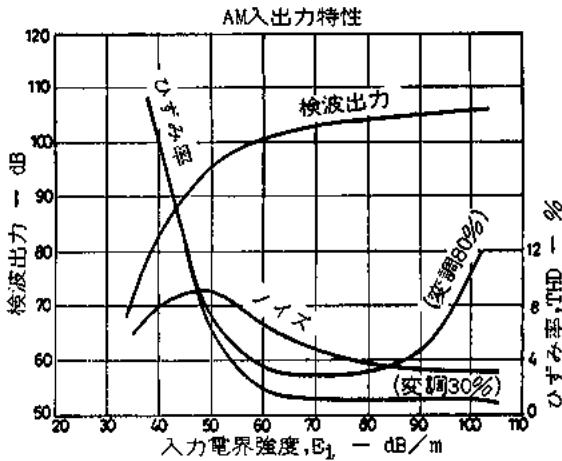
項目および測定条件	高波数	測定値
受信周波数範囲		530~1660 kHz
最大感度 (検波出力 3mV時)	600kHz	32 dB/m
	1000kHz	33 dB/m
	1400kHz	30 dB/m
実用感度 (S/N=20dB)	600kHz	47 dB/m
	1000kHz	47 dB/m
	1400kHz	46 dB/m
AOC-FOM (入力100dB/m時の出力から出力が-10dBまでの入力差)	600kHz	51 dB
	1000kHz	51 dB
	1400kHz	53 dB
ひずみ率 (入力74dB 30%変調 80%変調)	1000kHz	1 %
	1000kHz	3.2 %
帯域幅(最大感度時)	1000kHz	5 kHz
選択度(最大感度時)	+10kHz	26 dB
	1000kHz	
	-10kHz	27 dB
S/N (入力74dB時)	1000kHz	43 dB

(1μV=0 dB)

FM 主要特性

項目および測定条件	周波数	測定値
受信周波数範囲		85~109 MHz
最大感度 (検波出力 3mV時)	88 MHz	0 dB
	98 MHz	2 dB
	108 MHz	3 dB
実用感度 (S/N=30dB)	88 MHz	10 dB
	98 MHz	10 dB
	108 MHz	11 dB
3dB limiting感度	88 MHz	26 dB
	98 MHz	28 dB
	108 MHz	29 dB
ひずみ率 (入力52dB 30%変調 100%変調)	98 MHz	0.3 %
	98 MHz	1.2 %
6dB down帯域幅	98 MHz	200 kHz
実効(2信号)選択度 (入力=40dB)	+400kHz	30 dB
	98 MHz	
	-400kHz	28 dB
AM抑圧比(入力54dB)	98 MHz	34 dB
S/N (入力=54dB)	98 MHz	53 dB

(1μV=0 dB)

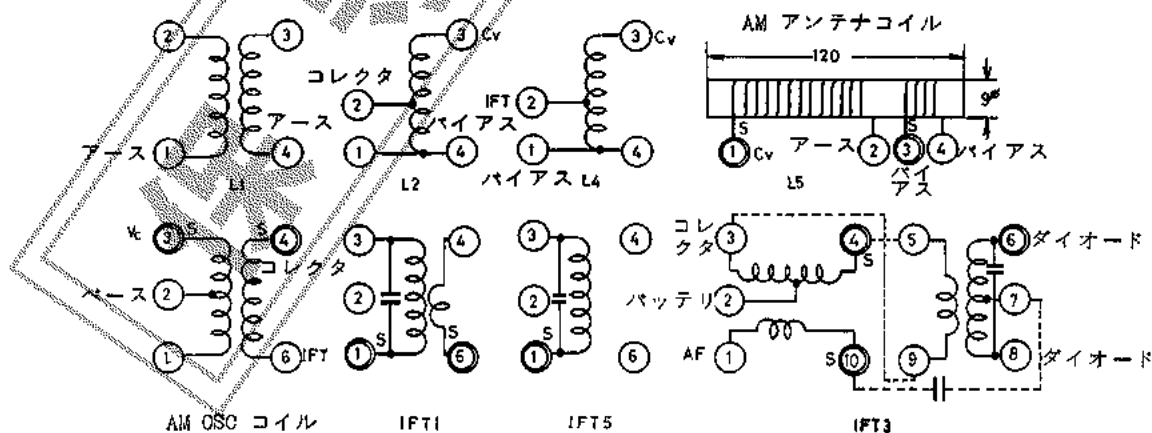


コイルデータ

- L1 FMアンテナコイル 0.6φ線, 5φ空心, バイファイラ巻, 巻数: 1-2 7T, 3-4 5T.
- L2 FM RFコイル 0.6φ線, 5φ空心, 巻数: 1-2 1T, 3-4 4T.
- L3 IFトラップコイル 0.6φ線, 5φ空心, 巻数: 12 1/2T.
- L4 FM OSC コイル 0.6φ線, 5φ空心, 巻数: 1-2 2T, 3-4 3T.
- L5 AMアンテナコイル 0.07φ線×4本のリッツ線, 12φ心, 巻数: 1-2 92T, 3-4 12T.  $L=690\mu H$  (600~780 $\mu H$ ),  $Q_0 \geq 200 / f = 796kHz$ .
- AM OSC コイル 巻数: 1-3 108T, 1-2 2T, 4-6 2T,  $Q_0 \geq 110$ ,  $L=365\mu H$ ,  $f=765kHz$ .
- IPT1 FM 1st IFT 0.12mmφ線, 巻数: 1-3 7T, 4-6 1T,  $Q_0 = 89 \pm 15\%$ ,  $f=10.7MHz$ , 同調容量 200 $\pm 20\%$ . (スミタ電機 試作番号 02K-542 タイダイ)
- IPT3 巻数: 3-4 20 1/2T, 2-3 11T, 1-10 5 1/2T, 6-7 8T, 7-8 8T, 6-8 16T, 5-9 1/4T,  $f=10.7MHz$ ,  $Q_0=80$  (1次), 100 (2次), 0.09mmφ UESW, C=30pF (1次, 外付け 3-9間), 50pF (2次) (スミタ電機 7SP03, Q4)
- IPT5 巻数 1-3 170T.  $f=455kHz$ ,  $Q_0=110$ , 0.06mmφ UESW, C=180pF. (スミタ電機 7SP03)
- IPT2 FMセラミックフィルタ (村田 SPL-10.7MA)
- IPT4 AMセラミックフィルタ (東光 OFT-455A)
- バリコン (マツミ RVC-2FXD)

	AM	FM	単位
$C_{min}$	5 $\pm 1.5$	4.5 $\pm 1.5$	pF
変化範囲	130	20	pF

トリマ容量  $\geq 5$  pF  
 $Q_0 \geq 150 / FM 100MHz, 10pF$ .



# LA1201

◎ LA1201 関係の技術資料には 次のようなものがある。

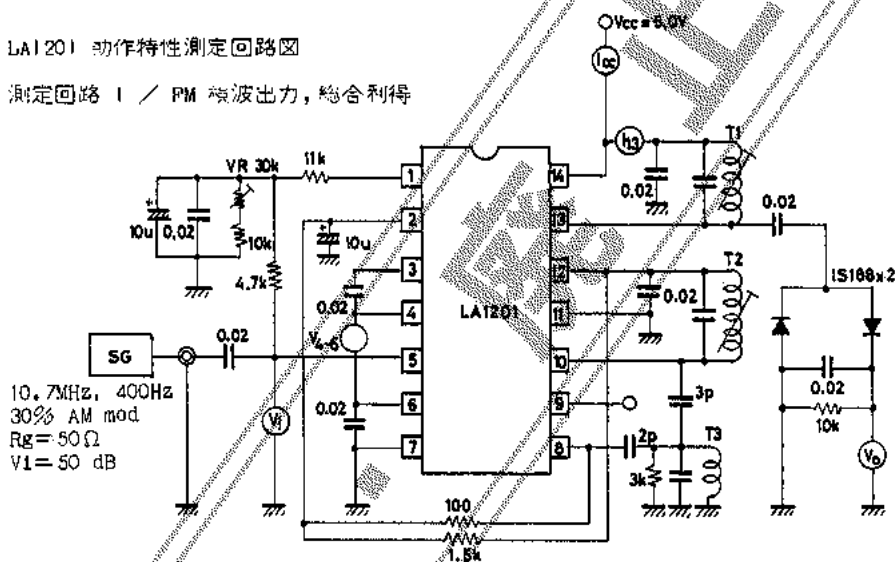
- LA1201 FM/AM ラジオ (CFM-1)
- (CFM-2)
- (CFM-4)
- (セラミック フィルタ 使用)
- LA1201+LA3301 ホームステレオ
- 2SC930+LA1201+LA3301 マルチつき カーステレオ
- LA1201+LA3310+LA4032 // ホームステレオ
- LA1201 FM/AM ラジオ
- LA1201, 3155, 3350, 4201 使用中級 2.5W ステレオ 総合アンプの設計

- 応用技術資料 No.4
- このカタログ応用例 1
- 応用技術資料 No.5
- このカタログ応用例 2
- 応用技術資料 No.27A
- 応用技術資料 No.38
- 応用技術資料 No.44
- 応用技術資料 No.56

以上 1977年 7月現在。

[参考] p2 LA1201 動作特性測定回路図

(1) 測定回路 1 / PM 検波出力, 総合利得



(2) 測定回路 2 / AM 総合利得, 検波出力, 歪み率

