YAMAHA

COMBO SYNTHESIZER

CS-60



SERVICE MANUAL

001081

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YAMAHA COMBO SYNTHESIZER CS-60 SERVICE MANUAL

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SPECIFICATIONS

KEYBOARD
61 Keys C ~ c4 (5 octaves)

TONE SELECTORS

STRING 1	HARPSICHORD
STRING 2	GUITAR 1
BRASS 1	GUITAR 2
BRASS 2	FUNKY 1
FLUTE	FUNKY 2
ELECTRIC PIANO	MEMORY
CLAVICHORD	PANEL

TONE SET LEVERS
a. VCO: SPEED, PWM, PW, ⊓, ⟍, NOISE
b. VCF: HPF, RESH, LPF, RESL, IL, AL, A, D,R
c. VCA: VCF LEVER, ~, A, D, S, R, LEVEL

EFFECT CONTROLS
a. RING MODULATOR : ATTACK TIME, DECAY TIME, DEPTH, SPEED, MODULATION
b. SUB OSCILLATOR : FUNCTION, SPEED, VCO, VCF, VCA
c. RESONANCE
d. BRILLIANCE
e. TRANSPOSITION: 2 OCT DOWN, 1 OCT DOWN, NORMAL, 1 OCT UP
f. TOUCH RESPONSE: VCO, VCF, BRILLIANCE, LEVEL
g. KEYBOARD CONTROL: BRILLIANCE LOW, HIGH
h. FINGER BOARD
i. FOOT SWITCH CONTROL : SUSTAIN, PORTAMENTO, GLISSANDO
j. SUSTAIN I/SUSTAIN II : SUSTAIN TIME
k. PORTAMENTO/GLISSANDO: PORTAMENTO, GLISSANDO TIME

OTHER CONTROLS
PITCH
POWER SWITCH
MASTER VOLUME
FOOT CONTROLLER (Pedal)
FOOT SWITCH

OTHER FITTINGS
Head Phone Jack
EXT. IN (LEVEL)
OUTPUT Jack (HIGH/LOW Switch)
FOOT SWITCH Jack

CIRCUITRY
Power Comsumption : 85W
Power Source : 50/60Hz, AC

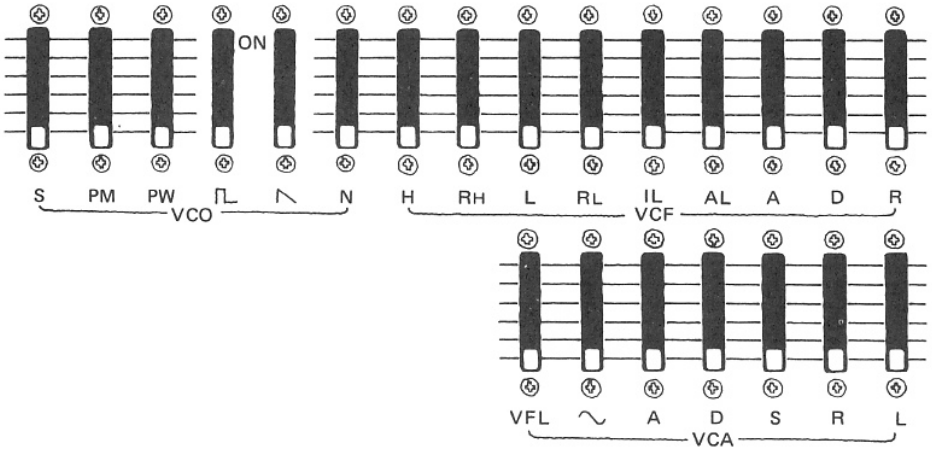
DIMENSIONS
Width : 1108 mm (43-5/8")
Depth : 527.5 mm (20-3/4")
Height : 255 mm (10")

WEIGHT: 40 kg (88 lbs)

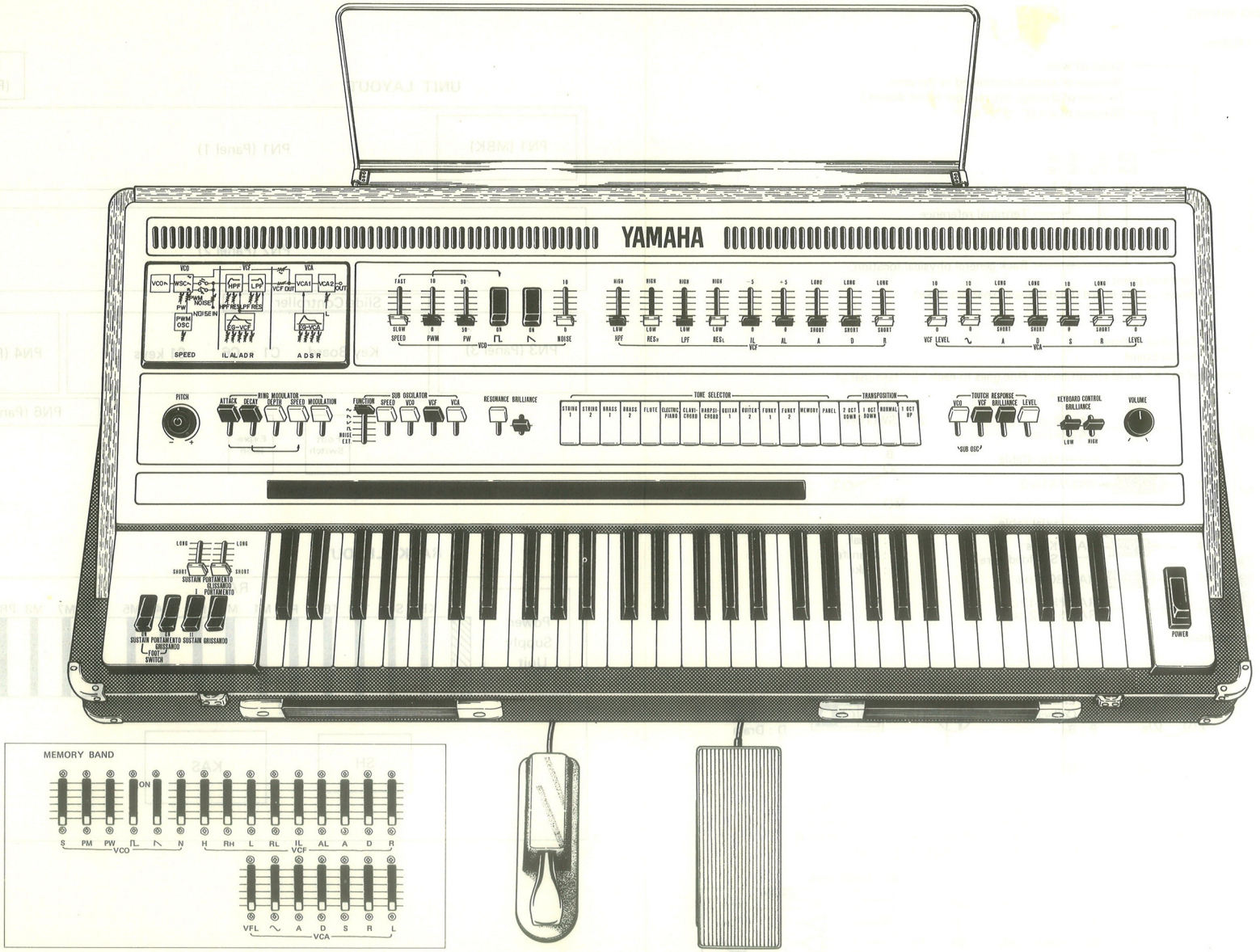
FINISH Black Leatherette

Specifications subject to change without notice.

MEMORY BAND



Panel Layout

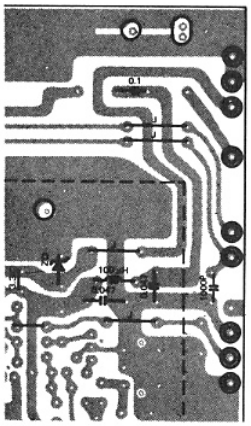


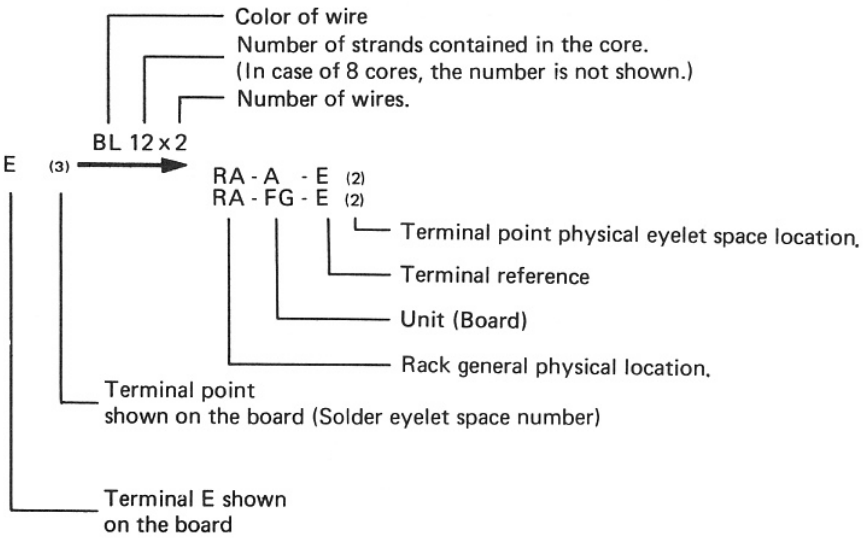
CORDING GUIDE

1) CIRCUIT BOARD AND WIRING

The coding system is as follows

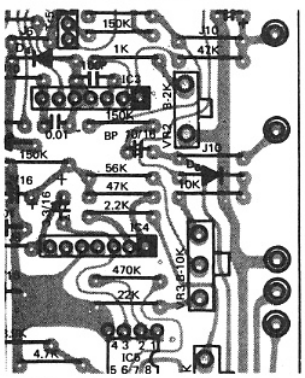
M Circuit Board

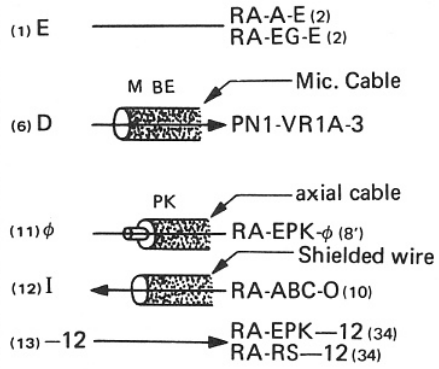




Two (2) black wires are connected to "E" on M circuit board. One goes to each "E" terminal of A and FG boards.

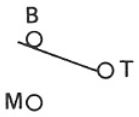
Circuit Board





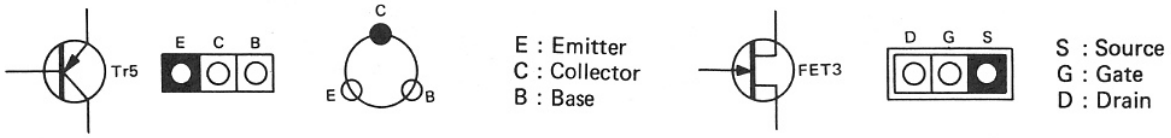
(View from the side points mounted)

2) SWITCH



B : Break
T : Transfer
M : Make

3) Transistor and FET



4) ABBREVIATIONS OF WIRE COLOR IN ELECTONE

BL ..... BLACK	BR ..... BROWN	RE ..... RED	OR ..... ORANGE
YE ..... YELLOW	GR ..... GREEN	BE ..... BLUE	VI ..... VIOLET
GY ..... GRAY	WH ..... WHITE	GG ..... GRASS GREEN	SB ..... SKY BLUE
PK ..... PINK	TR ..... TRANSPARENT	TP ..... TIN PLATED WIRE	

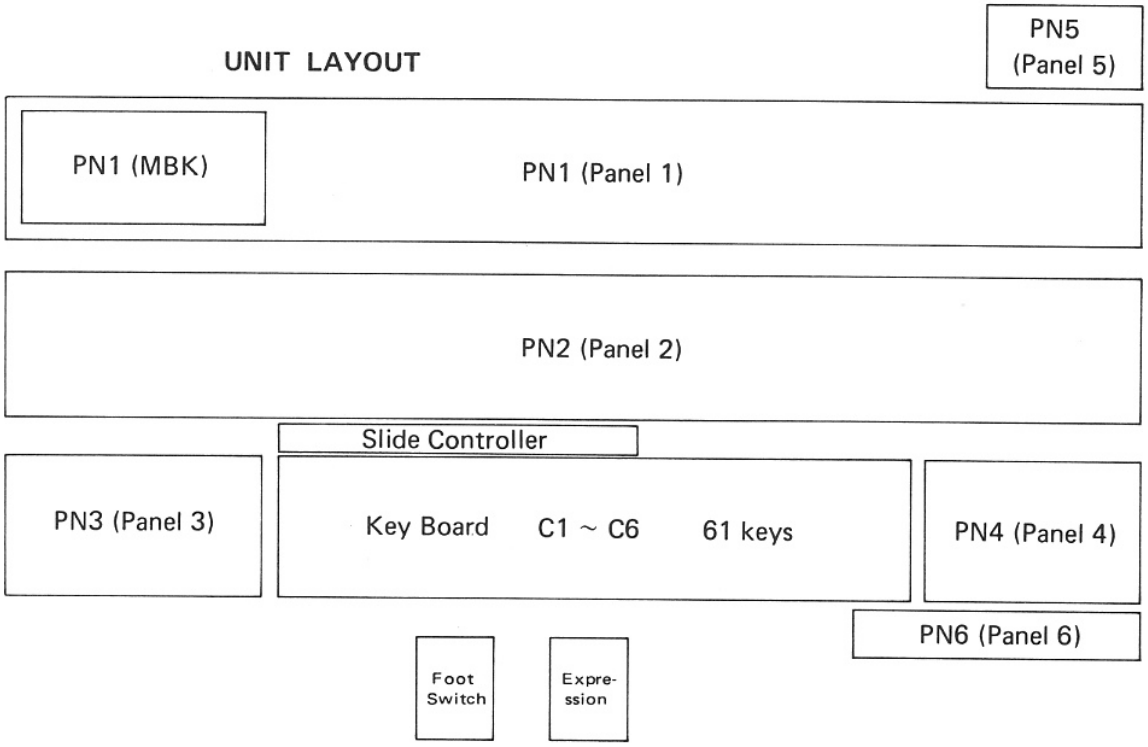
5) WIRE COLOR — Musical Note indication

C	C#	D	D#	E	F	F#	G	G#	A	A#	B
BR	RE	OR	YE	GR	BE	VI	GY	WH	GG	SB	PK

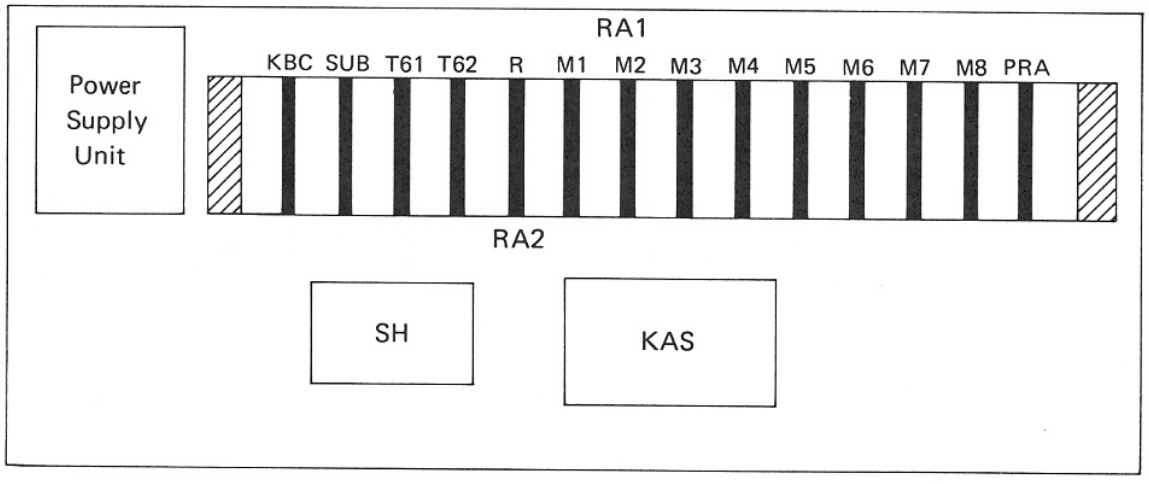
6) Logic Mark

FUNCTION	LOGIC MARK	
	MIL	YAMAHA
NOT (INVERTER)		
NOR		
NAND		

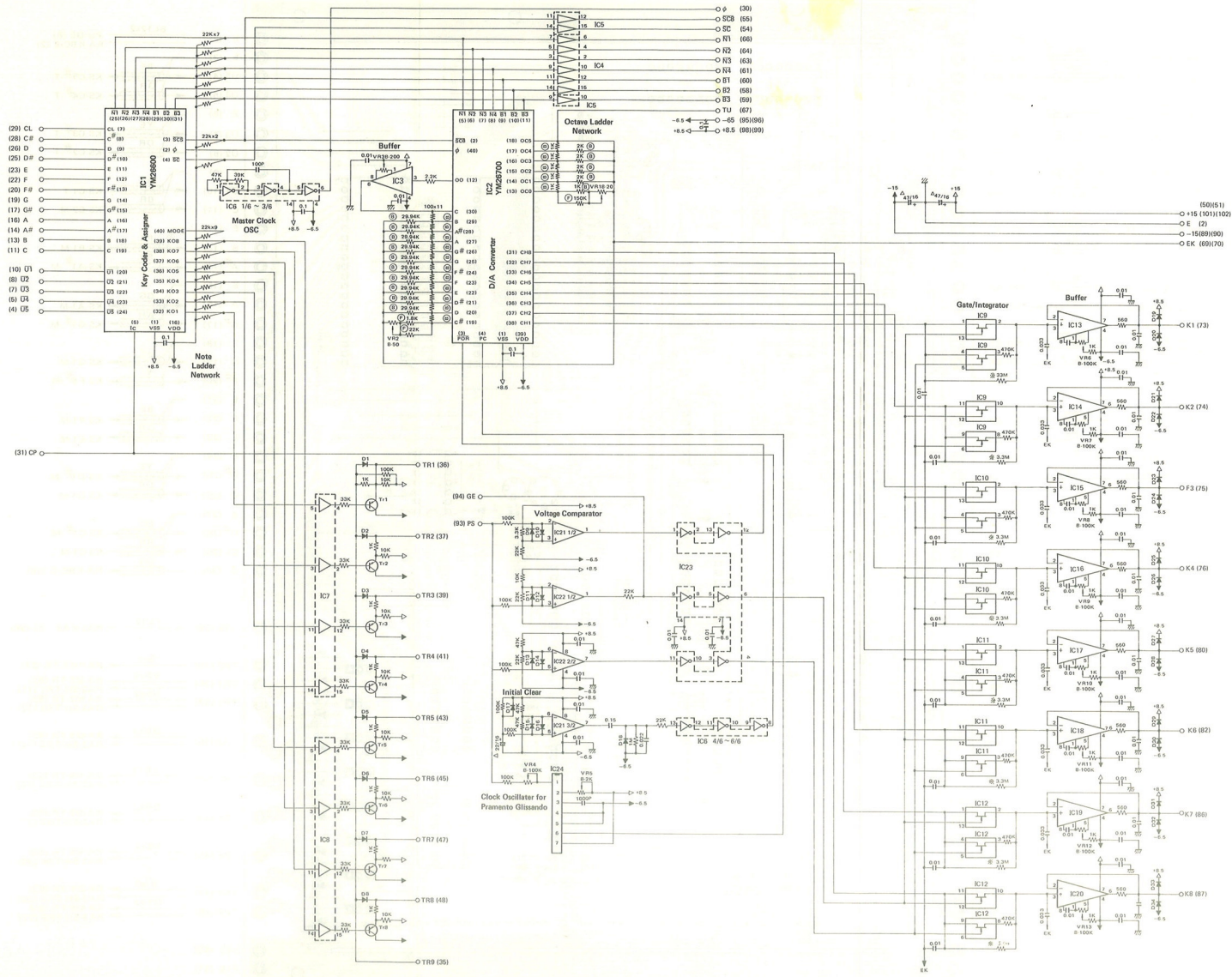
UNIT LAYOUT



RACK LEYOUT



KAS (Key Assigner) Circuit



Note) 1. IC1 : YM26600 (Dual 40P)
IC2 : YM26700 (Dual 40P)
IC3 : LM310 (Can 8P)
IC4,5,7,8 : TC4050P (Dual 16P)
IC6,23 : TC4069P (Dual 14P)
IC9~12 : TC4016P (Dual 14P)
IC13~20 : CA3140T (Can 8P)
IC21,22 : NJM4558D (Dual 8P)
IC24 : BA617 (Single 7P)

2. Transistor
Tr1~8 : 2SA561 (O)(Y)

3. Volume
VR1~3,6~13 : 3321H
VR4,5 : V10K4A-5-2

4. Resistor
Ⓑ Mark : ±0.1%
Ⓕ Mark : ±1%
※ Mark : Solid Resistor

5. Capacitor
0.1 : Ceramic Capacitor
△ Mark : Tantalum Capacitor

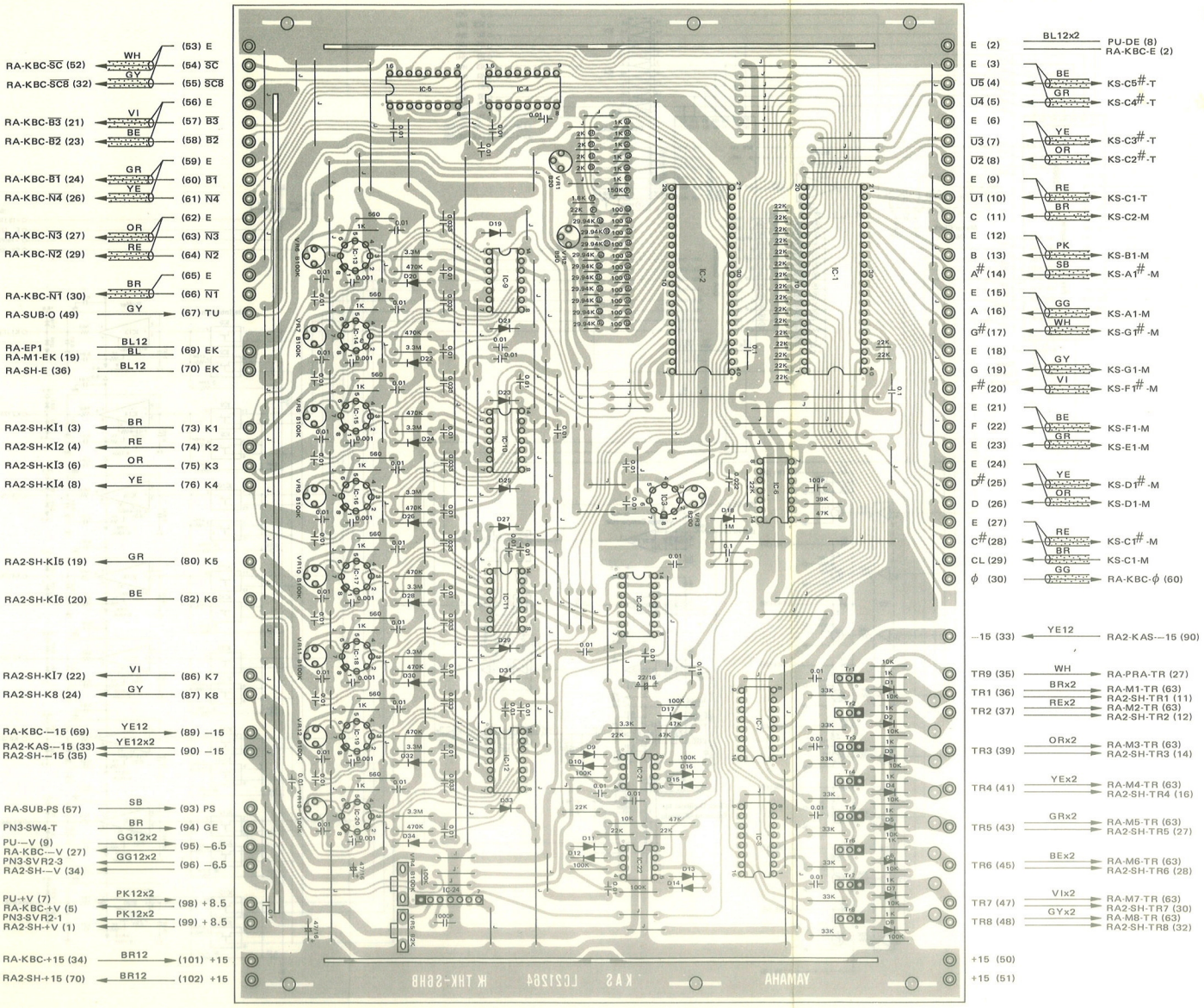
6. Diode
D : 1S1555

7. Power Supply
Dual 14P 14 .....+8.5
7 .....−6.5
Dual 16P 1 ..... +8.5
8 ..... −6.5

8. Connect 3, 5, 7 pins of IC5 to −6.5
Connect 7, 9 pins of IC7 to −6.5
Connect 7, 9 pins of IC8

9. Connect arrow-marks in this circuit as below
Mark to +15
Mark to −15

KAS Circuit Board



Note) 1. IC1 : YM26600 (Dual 40P)
IC2 : YM26700 (Dual 40P)
IC3 : LM310 (Can 8P)
IC4,5,7,8 : TC4050P (Dual 16P)
IC6,23 : TC4069P (Dual 14P)
IC9～12 : TC4016P (Dual 14P)
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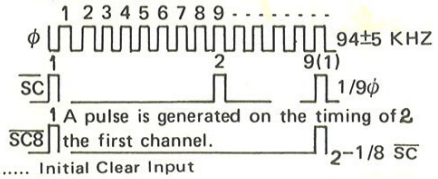
2. Transistor
Tr1～8 : 2SA561 (O)(Y)
3. Volume
VR1～3,6～13 : 3321H
VR4～5 : V10K4A-5-2
4. Resistor
Ⓑ : ±0.1%
Ⓕ : ±1%
: Solid Resistor
5. Capacitor
△Mark: Tantalum Capacitor
0.1 : Ceramic Capacitor
6. Diode
D : 1S1555

KEY CODER & KEY ASSIGNER LSI (YM26600)

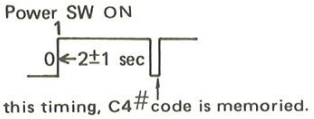
The LSI detects what keys are held down by judging the pulse combination of the octave and note.
It also generates the seven bit key code, which is processed by time sharing, in accordance with the key held down.

Pin. No. — Pin Name

1. VSS .....+8.5V Power Supply
2. ϕ ..... Master Clock Input
3. $\overline{SC}$ ..... Synchro-clock Output
4. $\overline{SC8}$ ..... Synchro-clock Output on the first channel.



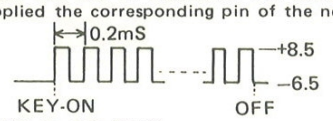
5. IC ..... Initial Clear Input



On this timing, C4# code is memoried.

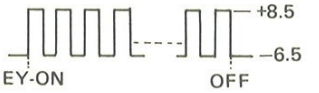
6. VDD .....–6.5V Power Supply Input
7. CL
8. C# .... Note on data input
19. C

When the key is depressed, the pulse is supplied the corresponding pin of the note.



20. V1
24. V5 .... Octave on data input

When the key is depressed, the pulse is supplied to the corresponding pin of the octave.



25. $\overline{N1}$
28. $\overline{N4}$ .... Note code data output

1: –6.5V 0: +8.5V

	C#	D	D#	E	F	F#	G	G#	A	A#	B	C
N1	1	0	1	1	0	1	1	0	1	1	0	1
N2	1	1	0	1	1	0	1	1	0	1	1	0
N3	1	1	1	0	0	0	1	1	1	0	0	0
N4	1	1	1	1	1	1	0	0	0	0	0	0

29. B1
31. B3 .... Octave Code Data Output

1: –6.5V 0: +8.5V

	C2	C2#~C3	C3#~C4	C4#~C5	C5#~C6
B1	0	1	0	1	0
B2	1	0	0	1	1
B3	1	1	1	0	0

32. KO1
39. KO8 .... Key on Data Output



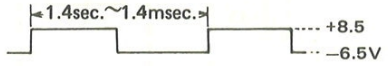
The number of note sounded is variable by using this pin.
i.e.) Up to 4 notes: Supply –6.5V to $\overline{KO5}$.
Up to 3 notes: Supply –6.5V to $\overline{KO4}$.

40. Mode .... Switching output for sound model
For 8 notes .... Supply –6.5V (1)
For 7 notes .... Supply +8.5V (0)

D-A CONVERTER LSI (YM26700)

The time shared key data is supplied to the LSI. Analog DC voltage is produced in corporation with key by the data and supplied to each channel.

1. VSS ..... +8.5V Power Supply
2. $\overline{SC8}$ ..... Synchro-clock input on the first channel.
3. $\overline{POR}$ ..... Portamento and Glissando operation. When the portament VR is turned on, +8.5V is supplied to the pin and actuate.
4. PC ..... Clock input for Portament and Glissando operation.



The frequency is variable by Changing the portamento VR.

5. $\overline{N1}$
8. $\overline{N4}$ ..... Note code data input
Note code data is supplied to the pins from key coder LSI.
9. $\overline{B1}$
11. $\overline{B3}$ ..... Octave code data input
Octave code data is supplied to the pins from key coder LSI.
12. OO ..... Output for octave key voltage. (8ch time sharing)
Provided the output key voltage for the octave selected from octave code.
13. OCT0
18. OCT5 ..... Input for octave key voltage.

* TU pin: 4.0V

	OCT0	OCT1	OCT2	OCT3	OCT4	OCT5
Voltage	0.25V	0.5V	1.0V	2.0V	4.0V	4.0V

The voltage of TU line is divided by the ladder composed resistors and supplied to each pin constantly.

19. C#
30. C .... Input for note key voltage

OO pin: 4.0V

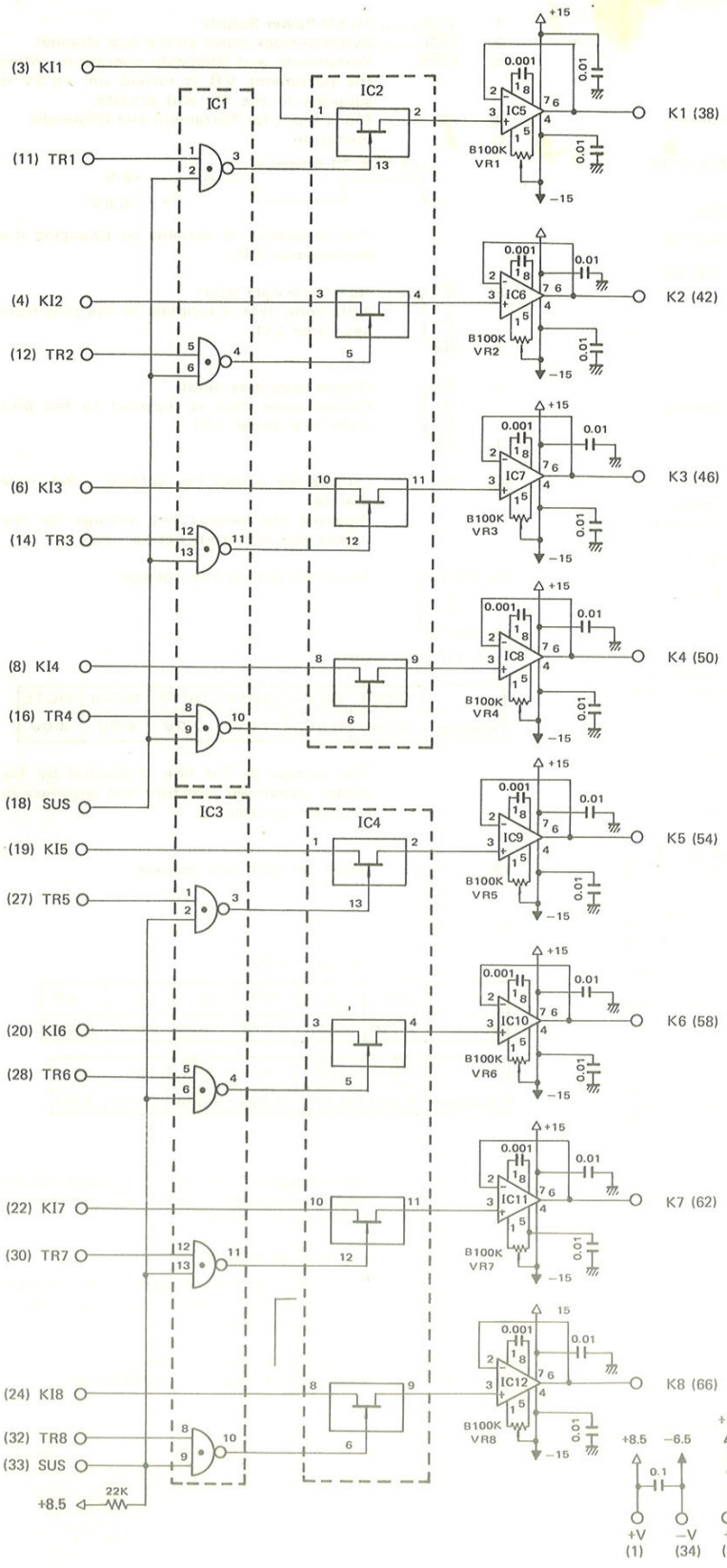
	C#	D	D#	E	F	F#
Voltage	2.119	2.245	2.378	2.520	2.670	2.828

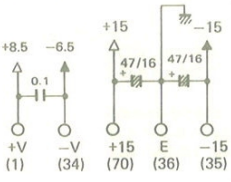
	G	G#	A	A#	B	C
Voltage	2.997	3.175	3.364	3.564	3.775	4.0V

The voltage of OO line is divided by the ladder composed resistors and supplied to each pin constantly.

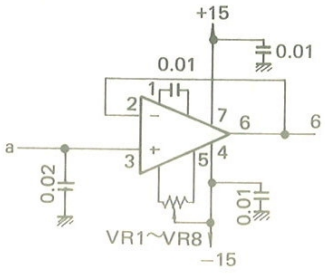
31. CH8
38. CH1 .... Key voltage output
The output of voltage determined by each key is provided in accordance with the channel key code.
39. VDD .... –6.5V Power Supply, Input
40. ϕ ..... Master Clock Input f=94±5KHz

SH (Sample Hold) Circuit





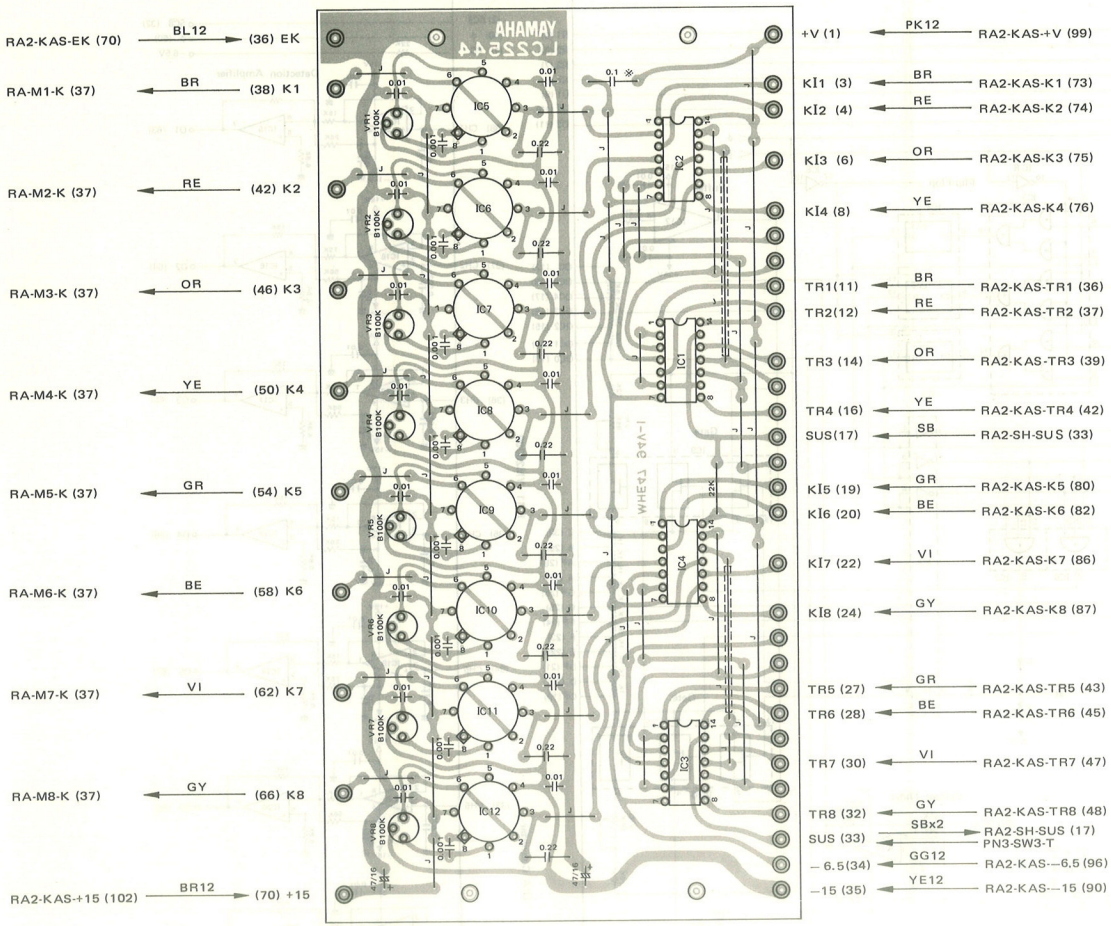
Note) 1. IC5~IC12 :CA4016P



2. IC1,3: TC4011P
   IC2,4: TC4016P
   Power supply of IC
   7 Pin ..... −6.5
   14 Pin ..... +8.5

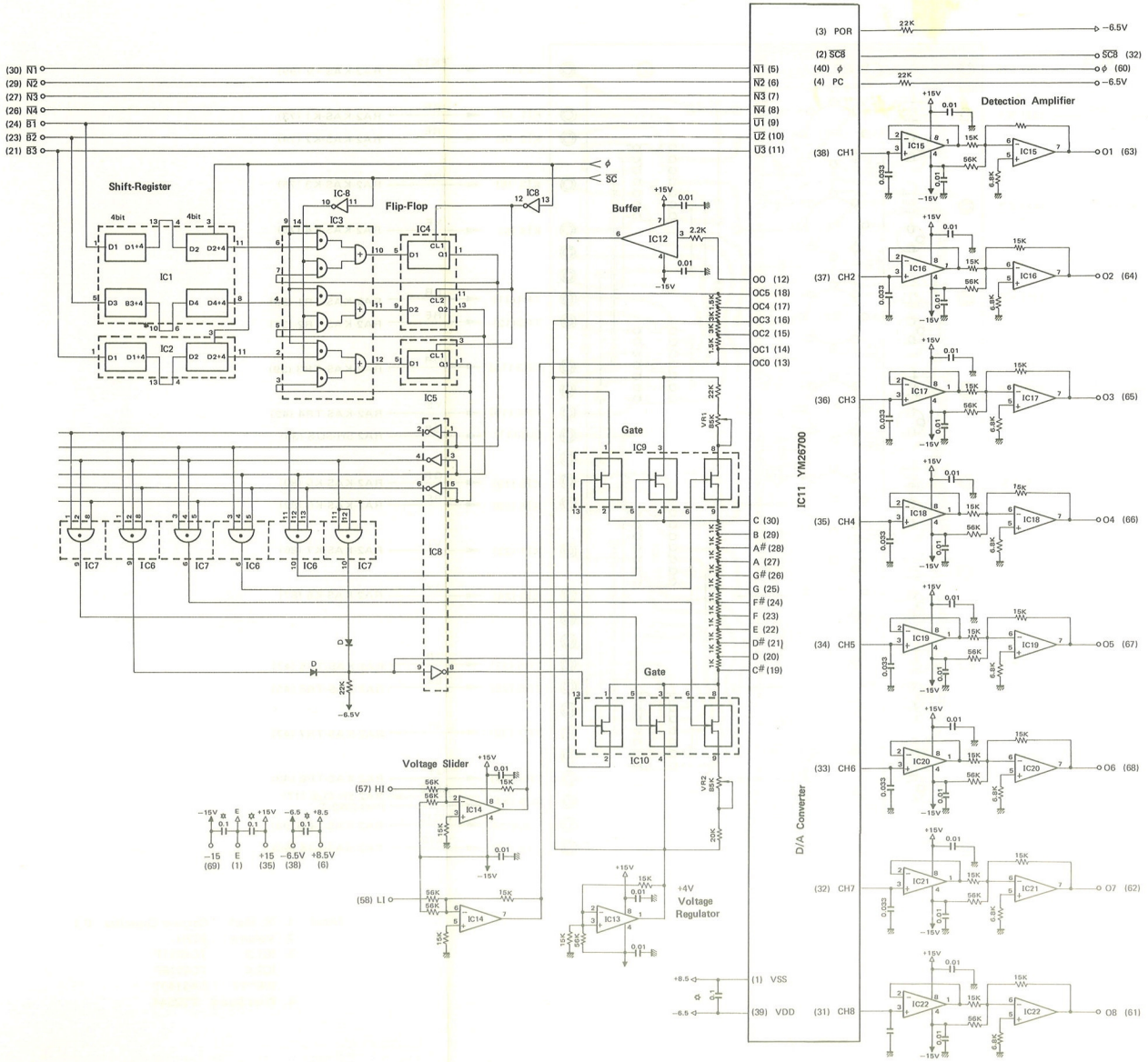
   IC5~ IC12 : CA3140T
3. Capacitor
   0.1 ..... Ceramic Capacitor
   0.22 .... Mylar Capacitor
   47/16 ... Electrolytic Capacitor

SH Circuit Board



Note) 1. ※ Mark : Ceramic Capacitor 0.1
2. Volume : 332H
3. IC1,3 : TC4011P
IC2,4 : TC4016P
IC5～12 : CA3140T
4. Print Board #22544

KBC Circuit



Note) 1. IC1, 2 : CD4006AE (14)
IC3 : TC4019P (16)
IC4,5 : TC4013P (14)
IC6,7 : TC4073P (14)
IC8 : TC4069P (14)
IC9,10 : TC4016P (14)
IC11 : YM26700 (40)
IC12 : LM310 (CAN 8)
IC13~22 : NJM4558 (DUAL8)

2. Diode
1S1555

3. Capacitor
☆Mark : Ceramic Capacitor
Other : Mylar Capacitor

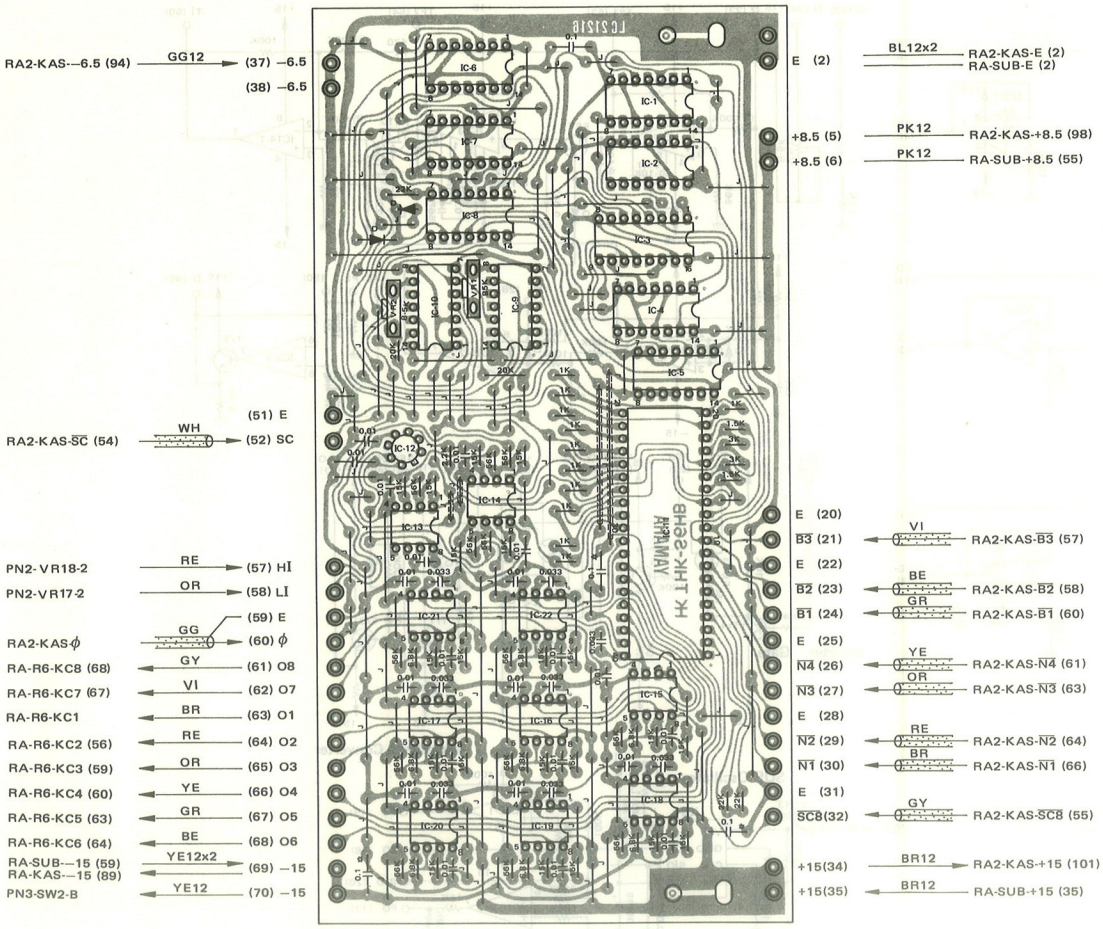
4. Resistor
22K : ± 5%
Other : ± 2%

5. VR

6. Power Supply
14 pin (7 .....–6.5V
14 .....+8.5V
16 pin (8 .....–6.5V
16 .....+8.5V

7. Connect to –6.5V
IC2 ..... 5, 6
IC3 ..... 1, 15
IC4 ..... 4, 6, 8, 10
IC5 ..... 4, 6, 8, 9, 10, 11
IC9,10 12

KBC Circuit Board



Note) 1. Print Board LC21216
2. Resistor
22K : ±5%
Other : ±1%
3. Diode 1S1555
4. VR1,2 (V10K4A-5-2)
5. IC1, 2 : CD4006AE
IC3 : TC4019P
IC4,5 : TC4013P
IC6,7 : TC4073P
IC8 : TC4069P
IC9,10 : TC4016P
IC11 : YM26700
IC12 : LM310
IC13～22 : NJM4558
6. ☆Mark : Ceramic Capacitor
Other : Mylar Capacitor

D-A CONVERTER LSI (YM26700)

The time shared key data is supplied to the LSI. Analog DC voltage is produced in corporation with key by the data and supplied to each channel.

1. VSS ..... +8.5V Power Supply
2. $\overline{SC8}$ ..... Synchro-clock input on the first channel.
3. $\overline{POR}$ ..... Portamento and Glissando operation. When the portament VR is turned on, +8.5V is supplied to the pin and actuate.
4. PC ..... Clock input for Portament and Glissando operation.



The frequency is variable by Changing the portamento VR.

5. $\overline{N1}$ ..... Note code data input
8. $\overline{N4}$ Note code data is supplied to the pins from key coder LSI.

9. $\overline{B1}$ ..... Octave code data input
11. $\overline{B3}$ Octave code data is supplied to the pins from key coder LSI.

12. OO ..... Output for octave key voltage. (8ch time sharing)
Provided the output key voltage for the octave selected from octave code.

13. OCT0 ..... Input for octave key voltage.
18. OCT5

* TU pin: 4.0V

	OCT0	OCT1	OCT2	OCT3	OCT4	OCT5
Voltage	0.25V	0.5V	1.0V	2.0V	4.0V	4.0V

The voltage of TU line is divided by the ladder composed resistors and supplied to each pin constantly.

19. C# .... Input for note key voltage
30. C

OO pin: 4.0V

	C#	D	D#	E	F	F#
Voltage	2.119	2.245	2.378	2.520	2.670	2.828

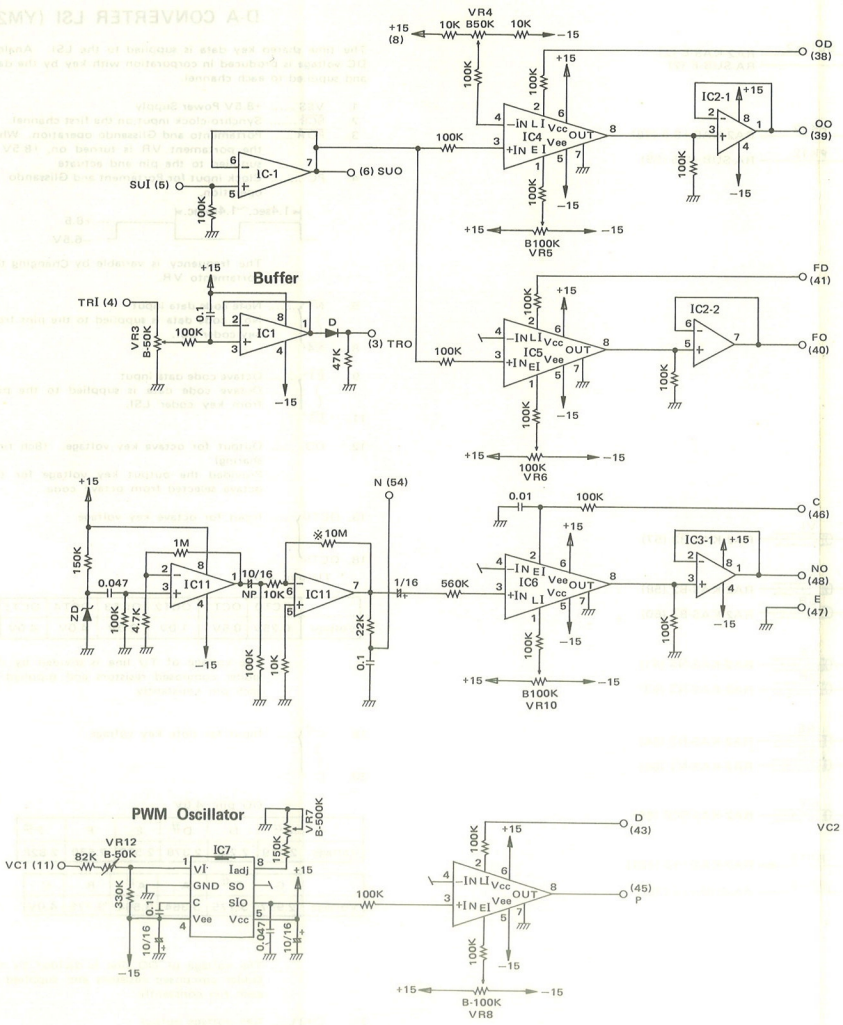
	G	G#	A	A#	B	C
Voltage	2.997	3.175	3.364	3.564	3.775	4.0V

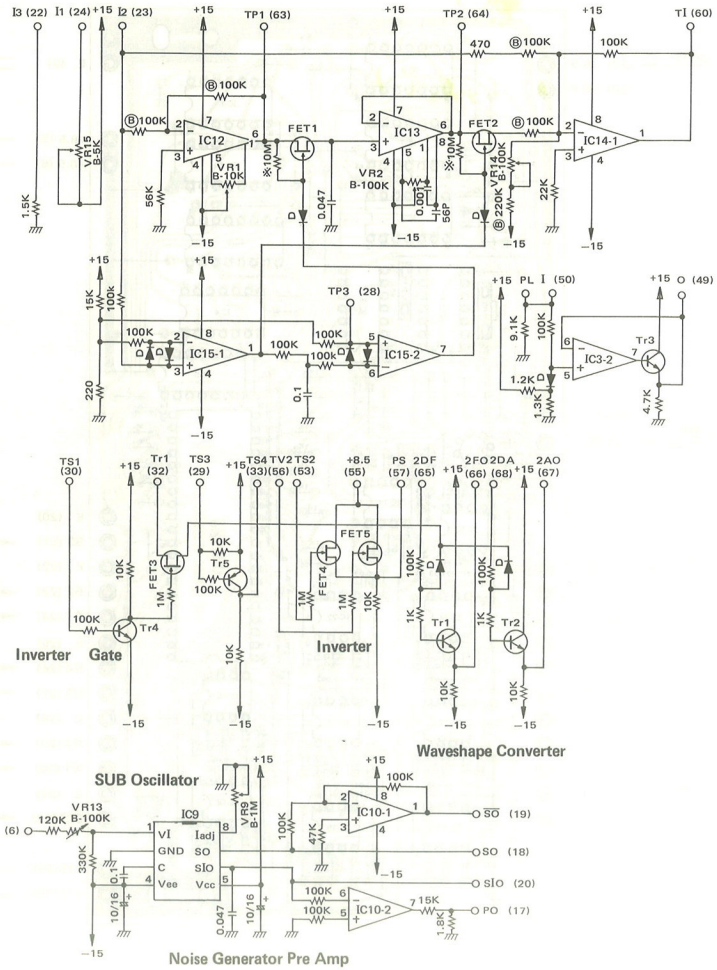
The voltage of OO line is divided by the ladder composed resistors and supplied to each pin constantly.

31. CH8 .... Key voltage output
38. CH1 The output of voltage determined by each key is provided in accordance with the channel key code.

39. VDD .... —6.5V Power Supply, Input
40. φ ..... Master Clock Input f=94±5KHz

SUB (Sub Oscillator) Circuit





Note) 1. Transistor
Tr1~ Tr4 : 2SC458 (C)(D)
Tr5 : 2SA561 (Y)(O)
FET1~5 : 2SK30A (Y)

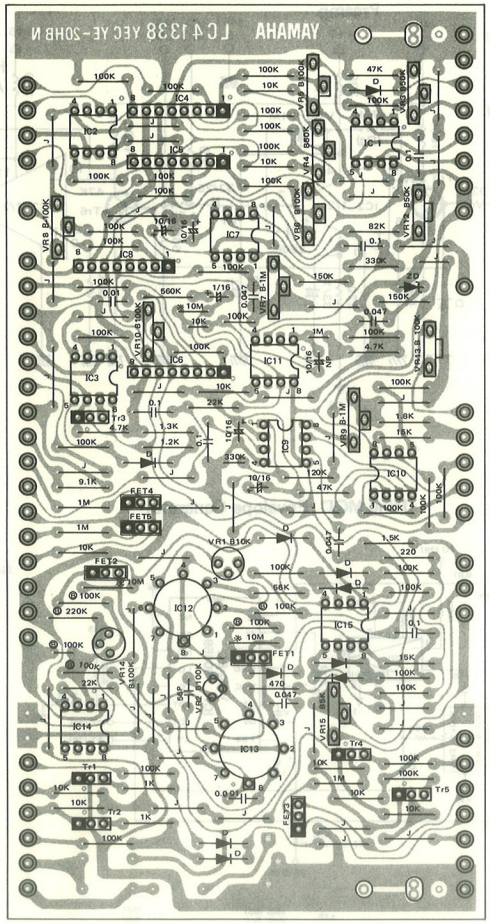
2. Diode
D : 1S1555
ZD : 1S1715P

3. Resistor
B Mark : 0.1% Metal Film Resistor
Mark : Solid Resistor

4. Volume
VR1,2,12 : 3321H
Other : 10KVR

5. IC
IC12 : TA7504M
IC13 : CA3140T (RCA)
IC1~3,10,11,14,15 : NJM4558D
IC4,5,6,8 : IG00151 (A)(B)
IC7,9 : IG00150

SUB Circuit Board



PN2-VR13-2	OR	(38) OD
RA-R6-V2	BE	(39) OO
RA-R6-VCF (70)	BR	(40) FO
PN2-VR14-2	RE	(41) FD
RA-T61-b (32)	RE	(43) D
RA-M1-PWM (41)	YE	(45) P
RA-T61-f (28)	BE	(46) C
		(47) E
RA-M1-NI (43)	BR	(48) NO
RA-KAS-TU (67)	GY	(49) O
PN2-VR1A-2	BR	(50) I
		(51) E
PN2-VR1A-1	OR	(52) PL
PN3-SW2-T	GR	(53) TS2
PN2-SW1-5	WH	(54) N
RA-KBC-+8.5(6)	PK12	(55) +8.5
PN3-SVR2-2	VI	(56) TV2
RA2-KAS-PS (93)	SB	(57) PS
PU-—15S (4)	YE12x2	(58) —15
PU-—15 (5)		
RA-M1-—15 (39)	YE12x2	(59) —15
RA-KBC-—15 (69)		
PN2-VR1B-3	WH	(60) TI
		(63) TP1
		(64) TP2
RA-T61-O (17)	OF	(65) 2DF
RA-M1-RF (60)	BE	(66) 2FO
RA-M1-RA (65)	RE	(67) 2AO
RA-T61-U (10)	WH	(68) 2DA

E (1)		
E (2)	BL12x2	RA-KBC-E (2) RA-EP2
TRO(3)	BR	PN2-VR13-3
TRI (4)	RE12	TS-4
SUI (5)	OR	PN2-SW1-7
SUO (6)	YE	PN2-VR8-3
+15 (7)		
+15 (8)		
VC1 (11)	BR	RA-T61-a (33)
VC2 (16)	RE	PN2-VR7-2
PO (17)	GR	PN2-SW1-4
SO (18)	YE	PN2-SW1-2
SO (19)	GY	PN2-SW1-3
SIO (20)	BE	PN2-SW1-1
I3 (22)	OR	SC-I3
I2 (23)	RE	SC-I2
I1 (24)	BR	SC-I1
TP3		
TS3 (29)	VI	PN5-EJ3-1
TS1 (30)	BE	PN3-SW1-T
SUS (31)		
TV1 (32)	GR	PN3-SVR1-2
TS4 (33)	VI	PN3-SW1-M
+15 (34)		
+15 (35)	BR12x2	RA-M1-+15 (35) RA-KBC-+15 (35)

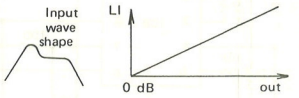
Note) 1. Print Board LC41338
2. Transistor
Tr1,2,3,4; 2SC458
Tr5 : 2SA561
FET1～5: 2SK30A
3. Diode
D : 1S1555
ZD : 1S1715P
4. Volume
VR1,2,14: 3321H
Other : 10KVR
5. IC
IC12 : TA7504M
IC13 : CA3140T(RCA)
IC1～3,10,11,14,15 : NJM4558D
IC4 ～6, 8 : IG00151
IC7,9 : IG00150
6. Resistor
Ⓑ Mark : 0.1% Metal Film Resistor
※ Mark : Solid Resistor

VCA IC (IG00151)

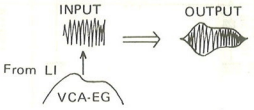
1. EI ..... Input voltage for level control.
Input of the control voltage is provided for changing the level expotenentially.



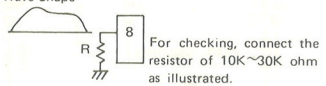
2. LI ..... Input of level control voltage.
Input of the control voltage is provided for linear change of the level.



3. +IN ..... Input
Input of the level modulated signal is provided.



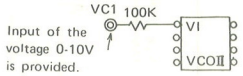
4. —IN ..... Negative feed back.
Normally unused.
5. Vee ..... —15V input power source.
6. Vcc ..... +15V input power source.
7. GND ..... Earth
8. OUT ..... Output
Output of the following wave shape is produced.



For checking, connect the resistor of 10K～30K ohm as illustrated.

VCOII IC (IG00150)

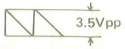
1. VI ..... Input of the control voltage.
The frequency is variable in accordance with the voltage supplied.



2. GND ..... Earth
3. C ..... Capacitor for determination of the frequency.
4. Vee ..... —15V input power source.
5. Vcc ..... +15V input power source.
6. SIO ..... Output of sine wave.

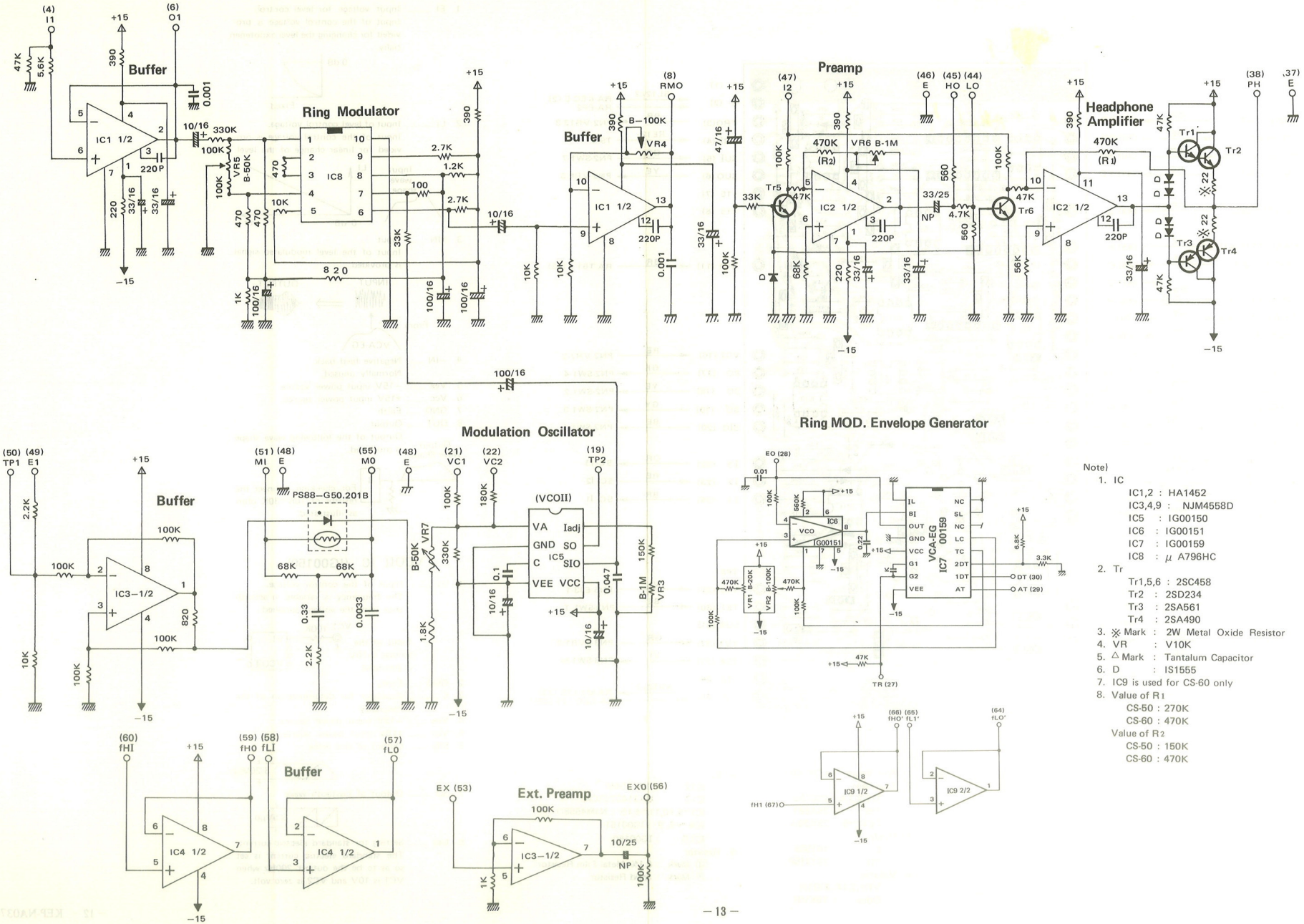


7. SO ..... Output of sawtooth wave



8. Iadj ..... Setting for standard electric current.
The standard electric current is set so as to be the output 200Hz when VC1 is 10V and VC2 is zero volt.

PRA (Pre-Amp) Circuit

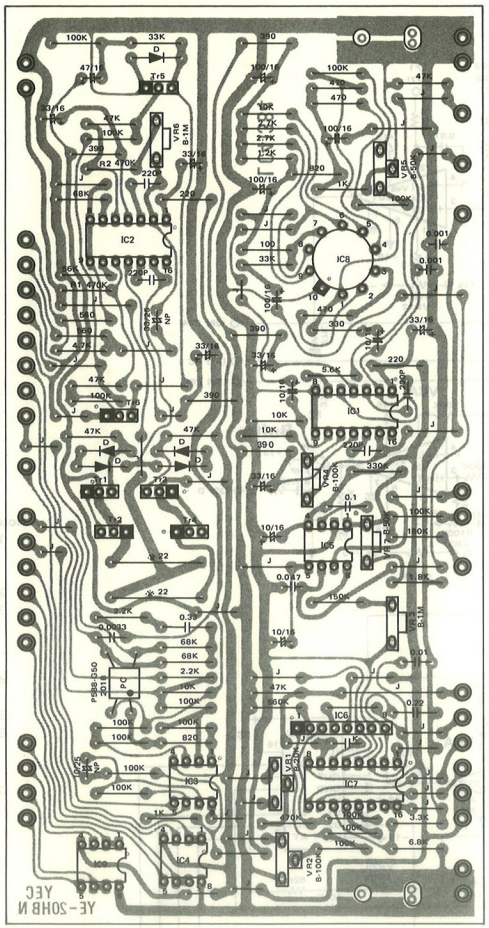


Note)

1. IC
   - IC1,2 : HA1452
   - IC3,4,9 : NJM4558D
   - IC5 : IG00150
   - IC6 : IG00151
   - IC7 : IG00159
   - IC8 : μ A796HC
2. Tr
   - Tr1,5,6 : 2SC458
   - Tr2 : 2SD234
   - Tr3 : 2SA561
   - Tr4 : 2SA490
3. ※ Mark : 2W Metal Oxide Resistor
4. VR : V10K
5. △ Mark : Tantalum Capacitor
6. D : IS1555
7. IC9 is used for CS-60 only
8. Value of R1
   - CS-50 : 270K
   - CS-60 : 470K

   Value of R2
   - CS-50 : 150K
   - CS-60 : 470K

PRA Circuit Board



PN6-1 ← OR ← (37) E / (38) PH

PN5-SW-M ← RE ← (44) LO
PN5-SW-B ← OR ← (45) HO
PN2-VR19-6 ← BL12 ← (46) E
PN2-VR19-2 ← BR ← (47) I2
(48) E
PN5-EJ2-1 ← BE12 ← (49) EI
(50) TP1
PN2-VR6-2 ← BR ← (51) MI
PN5-VR-2 ← OR ← (53) EXI

PN2-VR19-3 ← RE ← (55) MO
PN2-SW1-6 ← VI ← (56) EXO
RA-T61-9 (23) ← BE ← (57) fLO
PN1-VR7-2 ← (58) fLI
RA-T61-7 (26') ← SB ← (59) fHO
PN1-VR5-2 ← VI ← (60) fHI

RA-T62-9 (23') ← RE ← (64) fLO'
PN1-MVR7-2 ← WH ← (65) fLI'
RA-T62-7 (26) ← OR ← (66) fHO'
PN1-MVR5-2 ← VI ← (67) fHI'

E (1)
E (2) ← BL12 ← RA-M8-E (2)
I1 (4) ← WH ← RA-M8-O (33)
O1 (6) → VI → PN2-VR6-1
RMO (8) → GY → PN2-VR6-3

TP2 (19)
VC1 (20) ← BE ← PN2-VR5-2
VC2 (22) ← GR ← PN2-VR4-2

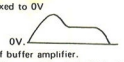
TR (27) ← WH ← RA2-KAS-TR9 (35)
EO (28) ← YE ← PN2-VR4-3
AT (29) ← RE ← PN2-VR2-2
DT (30) ← OR ← PN2-VR3-2
−15 (31)
−15 (32) ← YE12x2 ← RA-M8-−15 (38) / PN5-EJ2-2

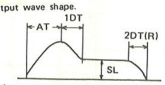
+15 (34)
+15 (35) ← BR12 ← RA-M8-+15 (35)

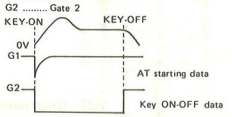
Note) 1. Print Board LC41384
2. Transistor
Tr1, 5, 6 : 2SC458
Tr2 : 2SD234
Tr3 : 2SA561
Tr4 : 2SA490
3. IC
IC1, 2 : MA1452
IC3,4,9 : NJM4558
IC5 : IG00150
IC6 : IG00151
IC7 : IG00159
IC8 : μA796HC
4. Diode
D : 1S1555
5.
※Mark : 2W Metal Film Resistor
△Mark : Tantalum Capacitor

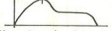
VCA-EG IC (IG00159)

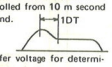
This IC generates envelope wave shape which is supplied to VCA and control the tone volume.

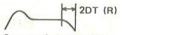
1. IL ..... Input of initial level.
Fixed to 0V


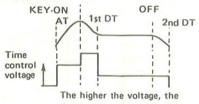
2. BI ..... Input of buffer amplifier.
3. OUT .... The buffer amplifier is built in for the purpose of matching inpedance.
Output wave shape.


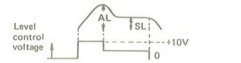
4. GND ..... Earth
5. Vcc ..... +15V input power source.
6. G1 ..... Gate 1
7. G2 ..... Gate 2


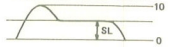
8. Vee ..... +15V input power source.
9. AT ..... Input of buffer voltage for determination of attack time.
Input of the voltage between zero V and 10V is provided and the attack time is controlled from 1 mS until 1S.


10. 1DT ..... Input of buffer voltage for determination of decay time.
Input of the voltage between zero V and 10V is provided and the decay time is controlled from 10 m second until 10 second.


11. 2DT ..... Input of buffer voltage for determination of release time.
Input of the voltage between zero V and 10V is provided and the time key-off untill release is controlled from 10 mS until 10 S.


12. TC ..... Output of time control.
Output of the DC voltage is produced so that the each time of Attack, 1st Decay and 2nd Decay are controlled.


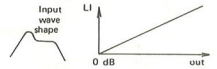
The higher the voltage, the shorter the time and the lower the voltage, the longer the time.
13. LC ..... Output of level control


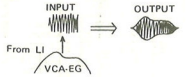
Output of the DC voltage for AL and SL control is provided.
The higher the voltage , the higher the level and the lower the voltage, the lower the level.
14. NC..... Not connected.
15. SL ..... Input of buffer voltage for determination of the sustain level.
Input of the voltage between zero V and 10V is provided so that the sustain level can be controlled.


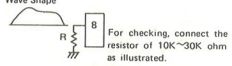
16. NC ..... Not connected.

VCA IC (IG00151)

1. EI ..... Input voltage for level control.
Input of the control voltage is provided for changing the level expotenentially.

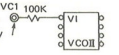

2. LI ..... Input of level control voltage.
Input of the control voltage is provided for linear change of the level.


3. +IN ..... Input
Input of the level modulated signal is provided.


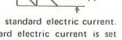
4. −IN ..... Negative feed back.
Normally unused.
5. Vee ..... −15V input power source.
6. Vcc ..... +15V input power source.
7. GND ..... Earth
8. OUT ..... Output
Output of the following wave shape is produced.


For checking, connect the resistor of 10K~30K ohm as illustrated.

VCOII IC (IG00150)

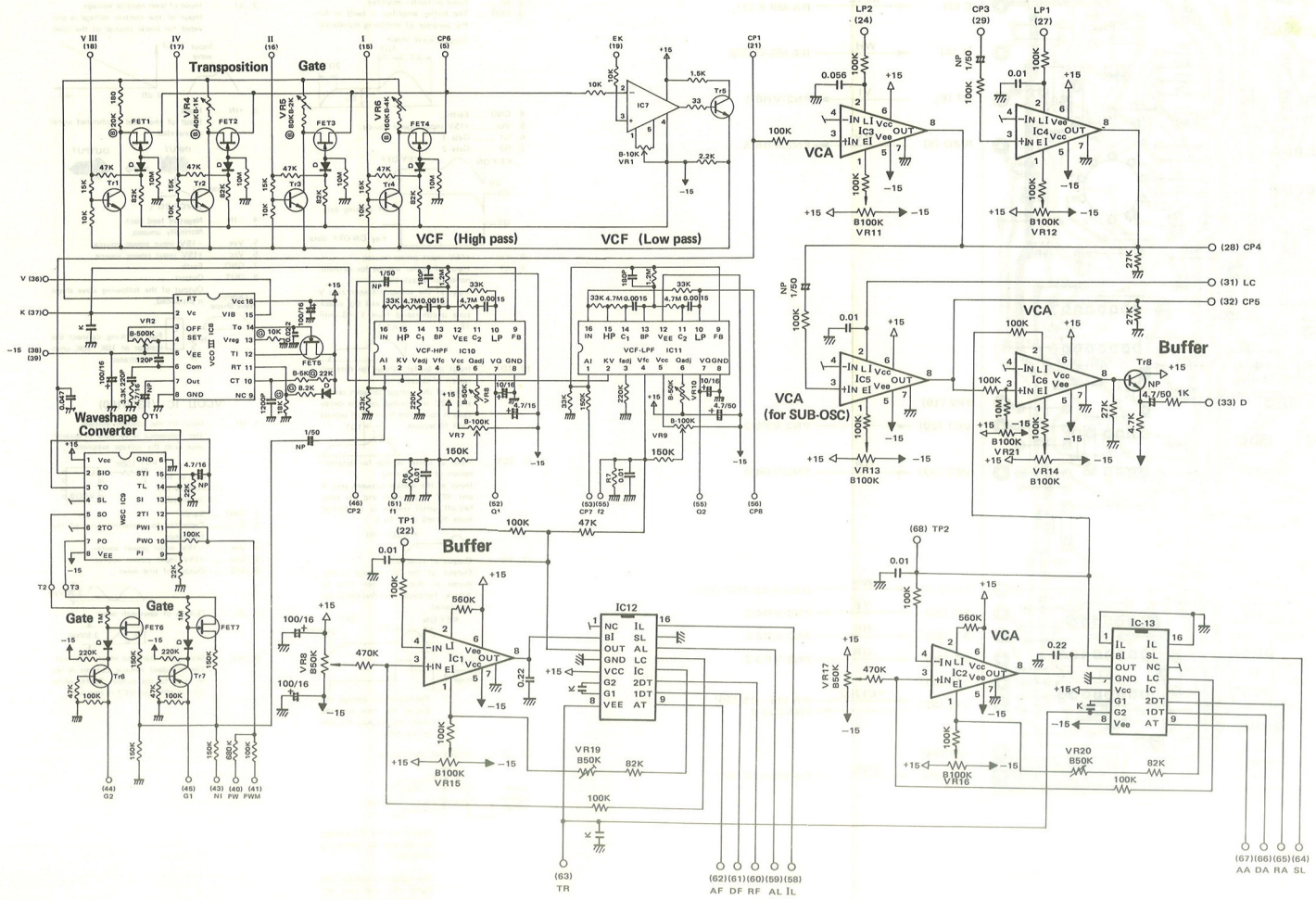
1. VI ..... Input of the control voltage.
The frequency is variable in accordance with the voltage supplied.


2. GND ..... Earth
3. C ..... Capacitor for determination of the frequency.
4. Vee ..... −15V input power source.
5. Vcc ..... +15V input power source.
6. SIO ..... Output of sine wave.


7. SO ..... Output of sawtooth wave


8. Iadj ..... Setting for standard electric current.
The standard electric current is set so as to be the output 200Hz when VC1 is 10V and VCZ is zero volt.

M (Master) Circuit



	CS-80	CS-60,50
R1	Ⓑ 10K	Ⓑ 20K
R2	Ⓑ 20K	Ⓑ 40K
R3	Ⓑ 40K	Ⓑ 80K
R4	Ⓑ 80K	Ⓑ 160K
R5	100	180
VR4	B-500	B-1K
VR5	B-1K	B-2K
VR6	B-2K	B-5K

Note)

1. Tr1~Tr5,Tr8 : 2SC458
   Tr6, Tr7 : 2SA561
   FET1~7 : 2SK30
2. D : IS1555
3. VR1 : 3321H type
   VR3 : 3006 type
   Other VR : V10K8-1-2 (3 terminals)
   : V10K4A-5-2 (2 terminals)
4. Ⓖ Mark : Metal Film Resistor (2%)
   Ⓑ Mark : " (0.1%)
5. K Mark : Ceramic Capacitor (1000P)
6. IC
   IC views show the pin disposition looked from upper. (Opposite to Pattern)
7. IC
   IC1~6: IG00151 (VCA)
   IC7 : TA7504M
   IC8 : IG00153 (VCOIII)
   IC9 : IG00158
   IC10,11: IG00156
   IC12 : IG00152
   IC13 : IG00159

Constant value of R6, R7 in IC10,11 according to rank

	CS80	CS50,60	
A	2.7K	2.7K	R6
B	2.2K	2.2K	
C	1.8K	1.8K	
A	3.3K	3.0K	R7
B	2.7K	2.4K	
C	2.2K	2.0K	

VCO III IC (IG00153)

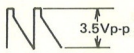
This IC is used for voltage controlled oscillator.
Many defferent frequencies are produced by the voltage supplied.

1. FT ..... Resistor for determination of the feet. The electric current is provided to the pin from transposition changing circuit so that the octave can be determined.
2. KV ..... Input of the key voltage
   The input of the voltage is provided to the pin in corporation with the keys held down.
   High voltage ..... High frequency
   Low voltage ..... Low frequency

Input Voltage	Output Frequency
0.250V	130.8Hz (C2)
0.500V	261.6Hz (C3)
1.000V	523.2Hz (C4)
2.000V	1046.0Hz (C5)
4.000V	2093.0Hz (C6)

Transposition "normal"

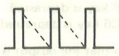
3. } OFF-SET .... Zero adjustment of input buffer circuit
4. }
5. Vee ..... −15V input power source.
6. Com .... Phase compensation for input buffer amplifier.
   Normally, the output (KV + 1V) is supplied to the pin.
7. OUT .... Output



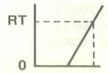
As to the frequency, refer to the Pin No.2 (KV).

8. GND ..... Earth
9. Vref ..... Input of the standard voltage.
10. CT ..... Circuit for time constant.

The following wave shape is produced.



11. RT ..... Circuit for time constant.

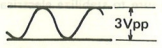


Determines the discharging voltage level.

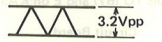
12. T1 ..... Input for the comparator.
    Input of the wave shape ( ) is provided. from the pin no. 14 (TO).
13. Iref ..... Input of the standard electronic current
14. TO ..... Output from time constant circuit.
    The following wave shape is produced.
15. VIB ..... Input for vibrato control wave.
    Input of the control wave is provided by VCO lever of SUB-OSC.
16. Vcc ..... +15V input power source.

WSC IC (IG00158)

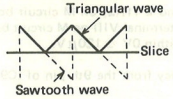
1. Vcc ..... +15V input power source
2. SIO ..... Output of the sine wave



3. TO ..... Output of triangular wave.



4. SL ..... Input of slice level.
   Input of the DC voltage is provided to the pin for determination of the inverting level which makes triangular wave from sawtooth wave.



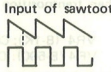
5. $\overline{SO}$ ..... Output of the inverter wave
   Output of inverted sawtooth wave is produced.



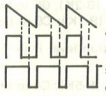
6. 2TO ..... Output of double triangle wave
   Double triangle wave is produced from triangle wave.
7. PO ..... Output of pulse wave.



8. Vee ..... −15V input power source.
9. PI ..... Input of pulse wave
   Input of sawtooth wave is provided.



10. PWO ..... Output of OP amplifier.
11. PWI ..... Input of OP amplifier.



Input of the voltage is provided for determination of the sensitivity of PWM lever so that the pulse width is changed.

12. 2TI ..... Input of triangular wave for producing double triangular wave shape.



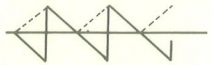
Input of triangular wave (TO) is provided for making double triangular wave shape.

13. $\overline{SI}$ ..... Input of the pulse for producing inverted sawtooth wave.



Input of the sawtooth wave is provided from VCO III for producing inverted sawtooth wave shape.

14. TI ..... Input of the wave is provided for producing triangular wave shape.



15. STI ..... Input of the wave for producing sine wave.

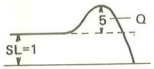


Input of the triangular wave (TO) is provided for producing sine wave.

16. GND ..... Earth

VCF IC (IG00156)

1. AI ..... Signal Input
   Input signals from VCO and WSC are provided to this pin.
2. KV ..... Key voltage input
   In order to change the tone color according to the tone range of keyboard, the degignated voltage of the key will supplied to the pin. (0.25-4.0V)
3. fc ..... Adjustment of the cut off frequency.
   Set the control currency of the cut off frequency.
4. Vf ..... Input of the cut off voltage.
   Input voltage of cut off frequency is supplied to this pin so that the tone color can be changed. The center point of the cut off frequency can be also set.
   When the VK is 0.25V and Vf is 5V, the cut off frequency is set to just 1KHz.
5. Vcc ..... +15V input power source
6. Q0 ..... Q adjustment.
   The Q control current sets the Q equal to 5, when VQ is 0 volt.



7. VQ ..... Input of the voltage for Q control.
   Q is variable according to the control voltage supplied.
   When the control voltage is 0V (Max.), Q=5
   When the control voltage is 10V (Min.), Q=0.5
8. GND .... Earth
9. FB ..... Q feed back
   This is the feed back output pin for the Q control by which the Q is determined.
10. LP ..... Low-pass output



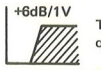
The output of lower frequencies are produced.

11. C2 ..... C pin for determination of the cut off frequency.
12. Vee ..... −15V power source.
13. BP ..... Band-pass output.



The output of intermediate frequences are produced.

14. C1 ..... C pin for determination of the cut off frequency.
15. HP ..... Hi-pass output



The output of higher frequencies are produced.

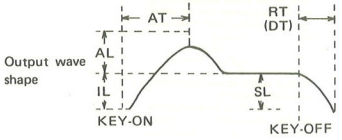
16. IN ..... Input of feed back
    The input signal for determination of cut off frequency.

VCF-EG IC (IG00152)

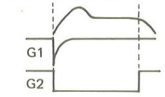
This IC generates envelope wave shape which is supplied to VCF and control the tone color.

1. NC ..... Not connected
2. BI ..... Input of buffer amplifier.
3. OUT .... Output of buffer amprifier.

The buffer amplifier is built in for the purpose of matching inpedance.



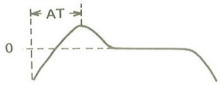
4. GND .... Earth
5. Vcc ..... +15V input power source.
6. G1 ..... Gate 1
7. G2 ..... Gate 2



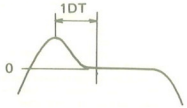
AT starting data

Key ON-OFF data

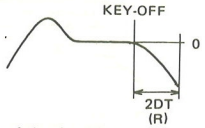
8. Vee ..... −15V input power source.
9. AT ..... Input of buffer voltage for determination of the attack time.
   Input of the voltage between zero V and 10V is provided and the attack time is controlled from 1 mS until 1S.



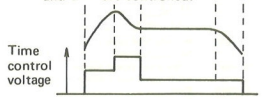
10. 1DT ..... Input of buffer voltage for determination of the decay time.
    Input of the voltage between zero V and 10V is provided and the first decay time is controlled from 10mS until 10 S.



11. 2DT ..... Input of buffer voltage for determination of the release time.
    Input of the voltage between zero V to 10V is provided and the time from KEY-ON until release is controlled from 10m second until 10 second.

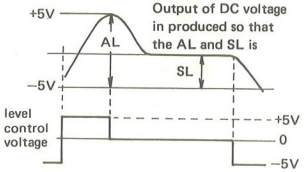


12. TC ..... Output of the time control.
    Output of DC voltage is produced so that the each time of attack, 1DT and 2DT are controlled.



The higher the voltage, the shorter the time and the lower the voltage the longer the time.

13. LC ..... Output of level control.



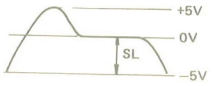
Output of DC voltage in produced so that the AL and SL is

The higher the voltage, the higher the level and the lower the voltage the lower the level.

14. AL..... Input of butter voltage for determination of attack level.
    Input of the voltage between (0V~ 10V is provided and the attack level is controlled from 0V until +5V.



15. SL ..... Input of buffer voltage for determination of the sustain level.
    Normally fixed to zero(0) volt.



16. IL ..... Input of buffer voltage for determination of the initial level.
    Input of the voltage between zero 0V and ten 10V is provided and the initial level is controlled from zero to minus 5 volt.

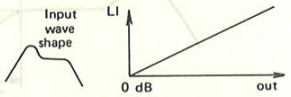


VCA IC (IG00151)

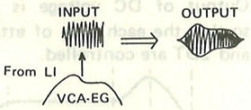
1. EI ..... Input voltage for level control.
   Input of the control voltage is provided for changing the level expotenentially.



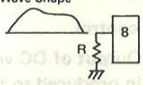
2. LI ..... Input of level control voltage.
   Input of the control voltage is provided for linear change of the level.



3. +IN ..... Input
   Input of the level modulated signal is provided.



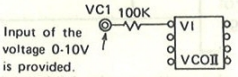
4. −IN ..... Negative feed back.
   Normally unused.
5. Vee ..... −15V input power source.
6. Vcc ..... +15V input power source.
7. GND ..... Earth
8. OUT ..... Output
   Output of the following wave shape is produced.



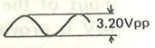
For checking, connect the resistor of 10K~30K ohm as illustrated.

VCOII IC (IG00150)

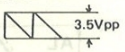
1. VI ..... Input of the control voltage.
   The frequency is variable in accordance with the voltage supplied.



2. GND ..... Earth
3. C ..... Capacitor for determination of the frequency.
4. Vee ..... −15V input power source.
5. Vcc ..... +15V input power source.
6. SIO ..... Output of sine wave.



7. SO ..... Output of sawtooth wave

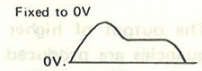


8. Iadj ..... Setting for standard electric current.
   The standard electric current is set so as to be the output 200Hz when VC1 is 10V and VC2 is zero volt.

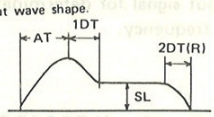
VCA-EG IC (IG00159)

This IC generates envelope wave shape which is supplied to VCA and control the tone volume.

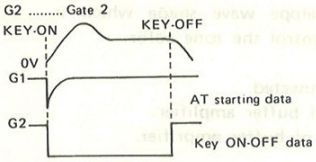
1. IL ..... Input of initial level.



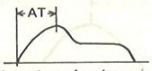
2. BI ..... Input of buffer amplifier.
3. OUT .... The buffer amplifier is built in for the purpose of matching inpedance.
   Output wave shape.



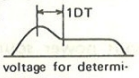
4. GND ..... Earth
5. Vcc ..... +15V input power source.
6. G1 ..... Gate 1
7. G2 ..... Gate 2



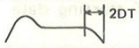
8. Vee ..... +15V input power source.
9. AT ..... Input of buffer voltage for determination of attack time.
   Input of the voltage between zero V and 10V is provided and the attack time is controlled from 1 mS until 1S.



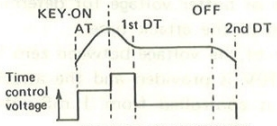
10. 1DT ..... Input of buffer voltage for determination of decay time.
    Input of the voltage between zero V and 10V is provided and the decay time is controlled from 10 m second until 10 second.



11. 2DT ..... Input of buffer voltage for determination of release time.
    Input of the voltage between zero V and 10V is provided and the time key-off untill release is controlled from 10 mS until 10 S.

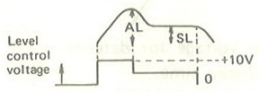


12. TC ..... Output of time control.
    Output of the DC voltage is produced so that the each time of Attack, 1st Decay and 2nd Decay are controlled.



The higher the voltage, the shorter the time and the lower the voltage, the longer the time.

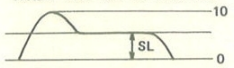
13. LC ..... Output of level control



Output of the DC voltage for AL and SL control is provided.

The higher the voltage, the higher the level and the lower the voltage, the lower the level.

14. NC..... Not connected.
15. SL ..... Input of buffer voltage for determination of the sustain level.
    Input of the voltage between zero V and 10V is provided so that the sustain level can be controlled.



16. NC ..... Not connected.

Pitch Adjustment

*Before carring out pitch adjustment, be sure to stabilize electrical circuits of your synthesizer more than 10 minutes after power switch is turned on.

1. Adjust the following variable resistors, when tuning knob on the panel is in the center position, so that the voltage of TU terminal is +4V ± 0.1% between the terminals TU (67) and E on KAS circuit board.

	Circuit Board	VR No.	
CS-50	SUB	VR11	B-200Ω
CS-60	SUB	VR14	B-100KΩ
CS-80	BA	VR3	B-100KΩ

*Make sure, all the levers on the panel are in "OFF" position.

2. Short circuit terminals EK (19) and E (1)(2) on M circuit board when tone selector is set to "FLUTE" and transposition lever is in OCT-UP (2' on CS-80) (+15V, terminal VIII on M circuit board) position. Then, adjust VR1 (B-10K) on M circuit board so that the voltage of terminal Cp (5) is within 0V ±120μV.

3. With checking the output frequency from the 9th pin of IC9 (WSC) on M circuit board, adjust the VR3 (B-5K) to have the certain highest note.

CS-50, 60 ..... C7 to be 4186 Hz ± 1 cent when C6 key is depressed.
CS-80 ..... C8 to be 8372 Hz ± 1 cent when C6 key is depressed.

In the same manner, set the lowest note by adjusting the VR2 (B-500) as follows.
CS-50 ..... C3 to be 261.6Hz ± 1 cent when C2 key is depressed.
CS-60 ..... C2 to be 130.8Hz ± 1 cent when C1 key is depressed.
CS-80 ..... C3 to be 261.6Hz ± 1 cent when C1 key is depressed.

Note:
(1) You can easily find out which M circuit board is corresponding to the key depressed by hearing the subtle change of the tone with hum modulation when you are adjusting VR2 on A M circuit board.
(2) The order the possible sounds when keys are depressed in turn is:
① → ② → ③ → ④ → ⑤ → ⑥ → ⑦ → ①
When keys are depressed at a time:
① → ② → ③ → ④ → ⑤ → ⑥ → ⑦ → ⑧ → ①
Therefore, when you adjust the M8 circuit board, depress the 8th key while 7th key is holding down, then release the 7th key. In this way, you can take out the sound of 8th key depressed.

4. Adjust the following variable resisters, when transposition lever is in "NORMAL" ("4'" on CS-80) position (+15V at terminal IV) as below.

CS-50, 60 ..... VR4 (B-1K); C6 to be 2093Hz ± 1 cent when C6 key is depressed.
CS-80 ..... VR4 (B-500): C7 to be 4186Hz ± 1 cent when C6 key is depressed.

5. Adjust the following variable resistors, when transposition lever is in "1 OCT-DOWN" ("8'" on CS-80) position (+15V at terminal II) as below.

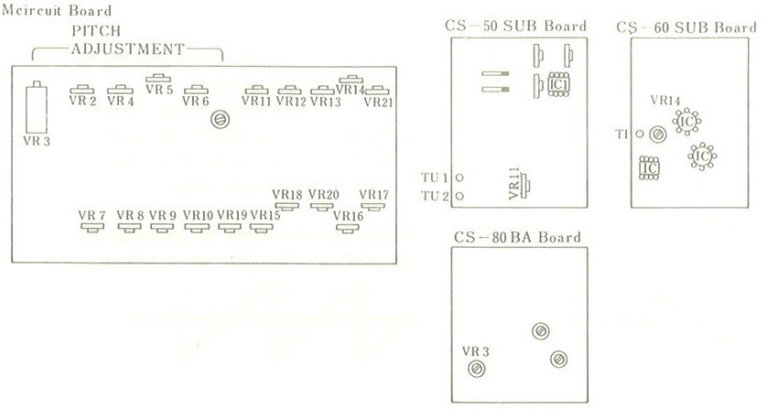
CS-50, 60 ..... VR5 (B-2K); C5 to be 1046Hz ± 1 cent when C6 key is depressed.
CS-80 ..... VR5 (B-1K); C6 to be 2093Hz ± 1 cent when C6 key is depressed.

6. Likewise, adjust the followings, when transposition lever is in "2 OCT-DOWN" ("16'" on CS-80) position (+15V at terminal I) as below.

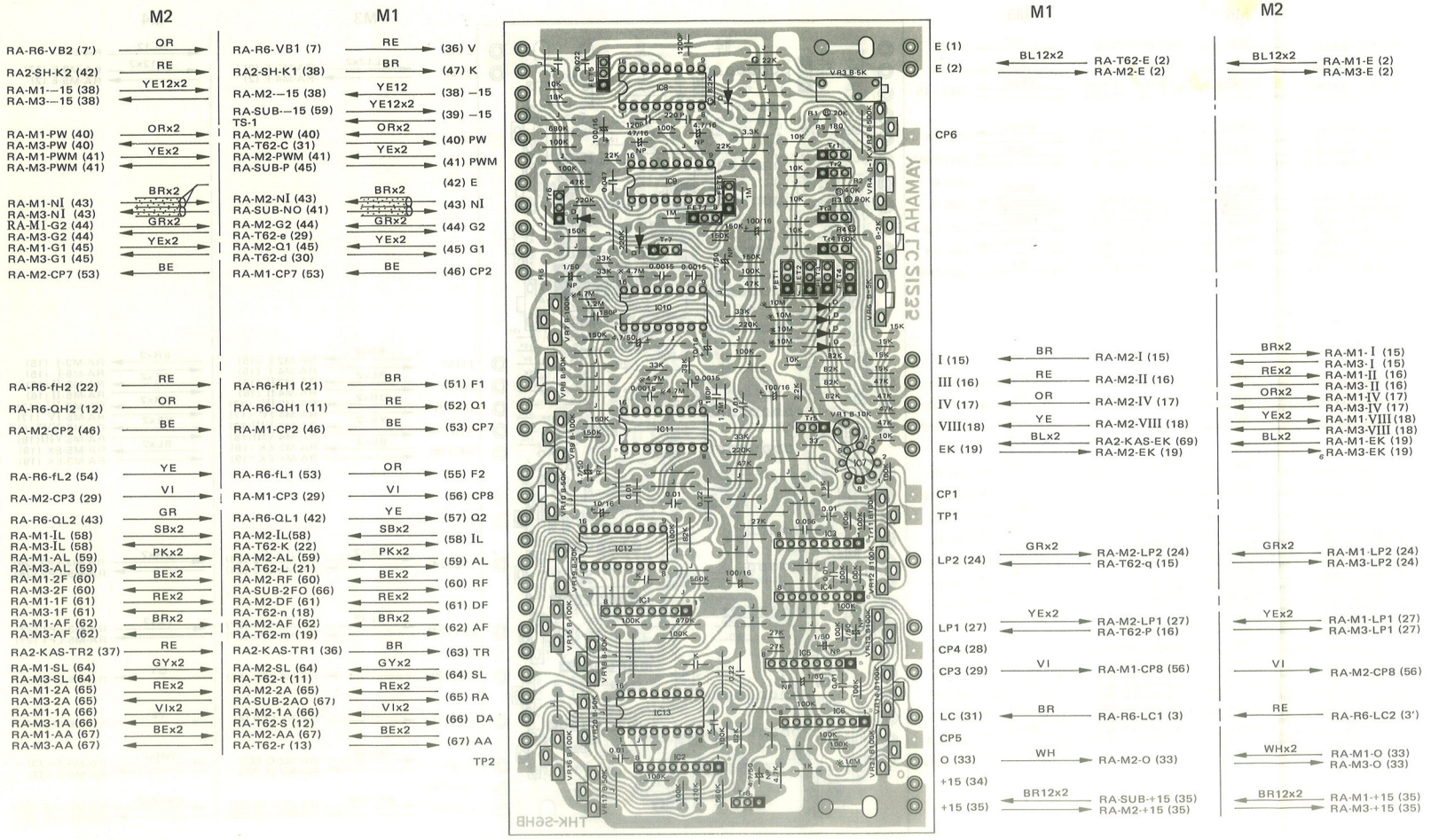
CS-50, 60 ..... VR6 (B-5K); C4 to be 523.2Hz ± 1 cent when C6 key is depressed.
CS-80 ..... VR6 (B-2K); C5 to be 1046.4Hz ± 1 cent when C6 key is depressed.

7. Finally, adjust the generating circuit for tuning standard voltage, when A3 key is depressed, so that the output is 443 Hz.

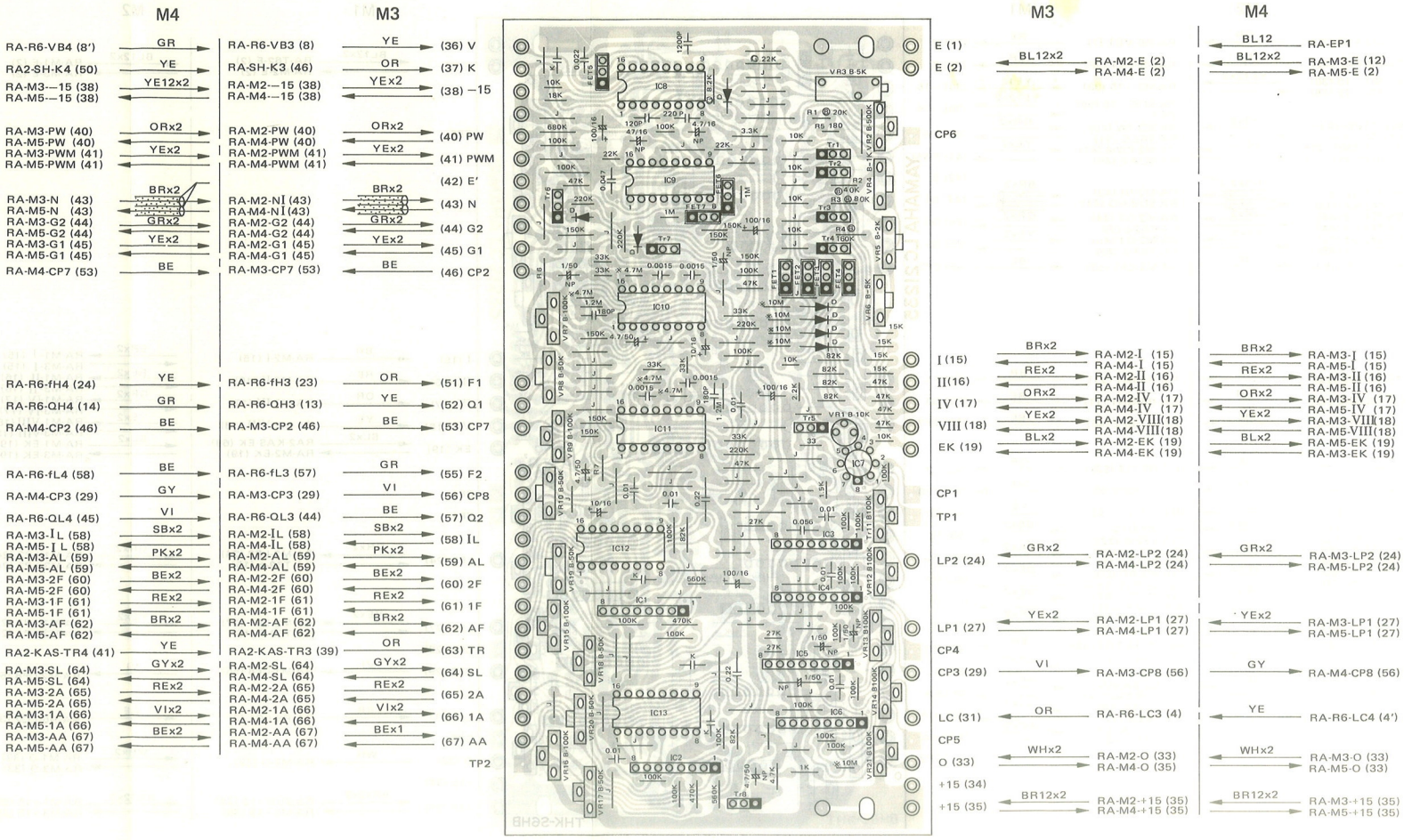
	Circuit Board	VR. No.	
CS-50	SUB	VR11	B-200 Ω
CS-60	SUB	VR14	B-100 Ω
CS-80	BA	VR3	B-100K Ω



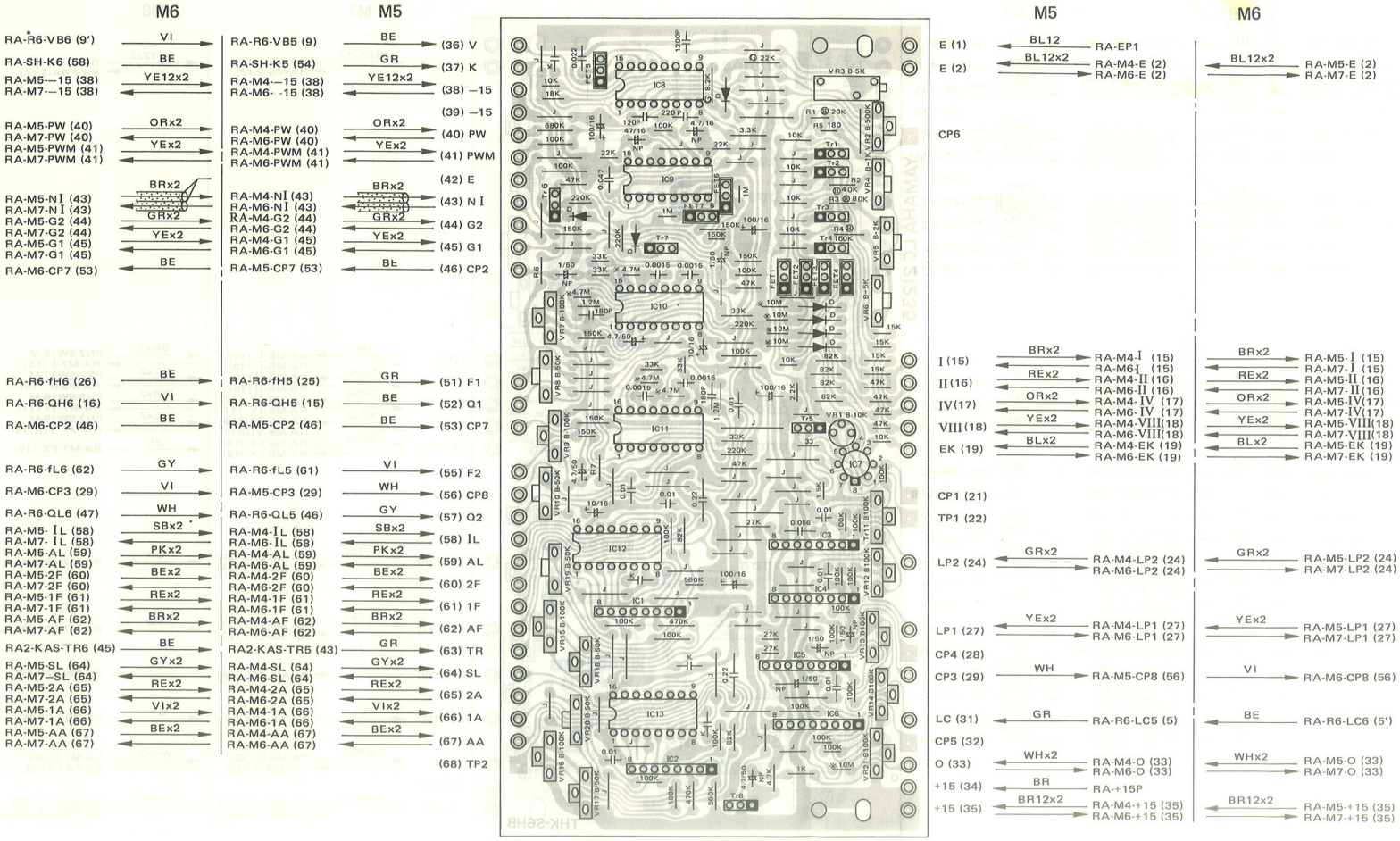
M1, M2 Circuit Board



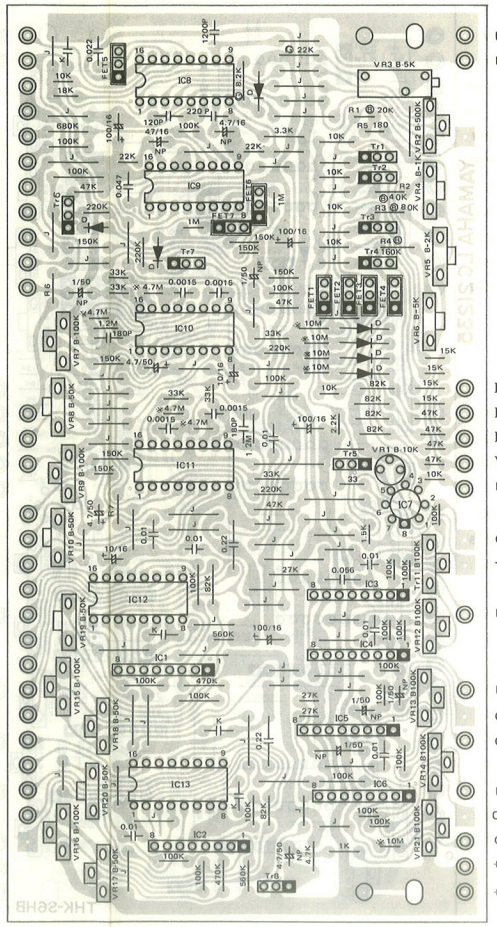
M3, M4 Circuit Board



M_5, M_6 Circuit Board



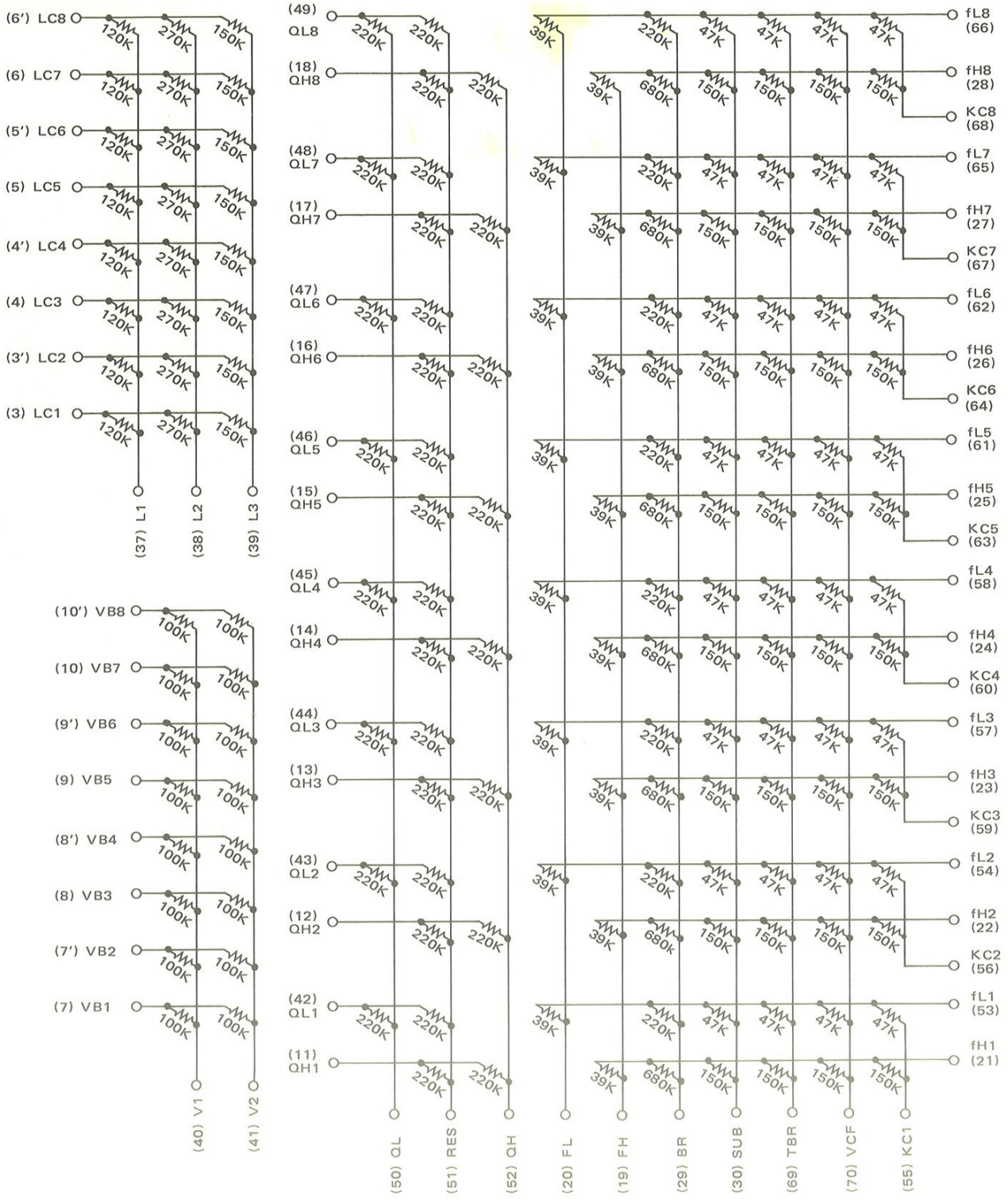
M7, M8 Circuit Board



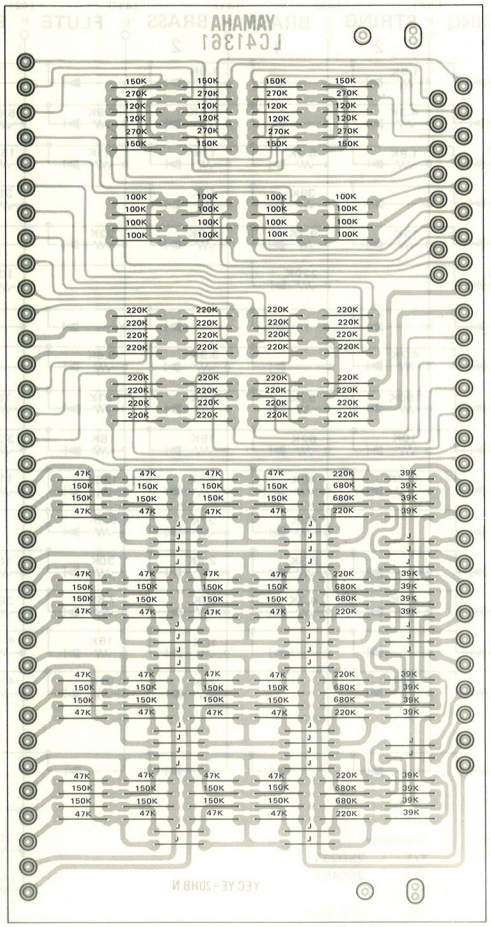
M8		M7	
RA-R6-VB8 (10')	WH	RA-R6-VB7 (10)	GY → (36) V
RA2-SH-K8 (66)	GY	RA2-SH-K7 (62)	VI → (37) K
RA-M7—15 (38)	YE12x2	RA-M6—15 (38)	YE12x2 → (38) —15
RA-PRA -15 (32)		RA-M8—15 (38)	
PN2-VR17-1	YE12		(39) —15
RA-M7-PW (40)	OR	RA-M6-PW (40)	ORx2 → (40) PW
		RA-M8-PW (40)	
RA-M7-PWM (41)	YE	RA-M6-PWM (41)	YEx2 → (41) PWM
		RA-M8-PWM (41)	
			(42) E
RA-M7-NI (43)	BR	RA-M6-NI (43)	BR → (43) NI
		RA-M8-NI (43)	
RA-M7-G2 (44)	GR	RA-M6-G2 (44)	GRx2 → (44) G2
		RA-M8-G2 (44)	
RA-M7-G1 (45)	YE	RA-M6-G1 (45)	YEx2 → (45) G1
		RA-M8-G1 (45)	
RA-M8-CP7 (53)	BE	RA-M7-CP7 (53)	BE → (46) CP2
RA-R6-fH8 (28)	GY	RA-R6-fH7 (27)	VI → (51) F1
RA-R6-QH8 (18)	WH	RA-R6-QH7 (17)	GY → (52) Q1
RA-M8-CP2 (46)	BE	RA-M7-CP2 (46)	BE → (53) CP7
RA-R6-fL8 (66)	GG	RA-R6-fL7 (65)	WH → (55) F2
RA-M8-CP3 (29)	VI	RA-M7-CP3 (29)	VI → (56) CP8
RA-R6-QL8 (49)	PK	RA-R6-QL7 (48)	GG → (57) Q2
RA-M7-IL (58)	SB	RA-M6-IL (58)	SBx2 → (58) IL
		RA-M8-IL (58)	
RA-M7-AL (59)	PK	RA-M6-AL (59)	PKx2 → (59) AL
		RA-M8-AL (59)	
RA-M7-2F (60)	BE	RA-M6-2F (60)	BEx2 → (60) 2F
		RA-M8-2F (60)	
RA-M7-1F (61)	RE	RA-M6-1F (61)	REx2 → (61) 1F
		RA-M8-1F (61)	
RA-M7-AF (62)	BR	RA-M6-AF (62)	BRx2 → (62) AF
		RA-M8-AF (62)	
RA2-KAS-TR8 (48)	GY	RA2-KAS-TR7 (47)	VI → (63) TR
RA-M7-SL (64)	GY	RA-M6-SL (64)	GYx2 → (64) SL
		RA-M8-SL (64)	
RA-M7-2A (65)	RE	RA-M6-2A (65)	REx2 → (65) 2A
		RA-M8-2A (65)	
RA-M7-1A (66)	VI	RA-M6-1A (66)	VIx2 → (66) 1A
		RA-M8-1A (66)	
RA-M7-AA (67)	BE	RA-M6-AA (67)	BEx2 → (67) AA
		RA-M8-AA (67)	
			TP2

	M7	M8
E (1)	BL12x2 → RA-M6-E (2)	BL12x2 → RA-M7-E (2)
E (2)	← RA-M8-E (2)	← RA-PRA-E (2)
I (15)	BRx2 → RA-M6-I (15)	BRx2 → PN2-SW16-M
	← RA-M8-I (15)	← RA-M7-I (15)
II (16)	REx2 → RA-M6-II (16)	REx2 → PN2-SW17-M
	← RA-M8-II (16)	← RA-M9-II (16)
IV (17)	ORx2 → RA-M6-IV (17)	ORx2 → PN2-SW18-M
	← RA-M8-IV (17)	← RA-M7-IV (17)
VIII (18)	YEx2 → RA-M6-VIII (18)	YEx2 → PN2-SW19-M
	← RA-M8-VIII (18)	← RA-M7-VIII (18)
EK (19)	BLx2 → RA-M6-EK (19)	BL → RA-M7-EK (19)
	← RA-M8-EK (19)	
CP1		
TP1		
LP2 (24)	GRx2 → RA-M6-LP2 (24)	GR → RA-M7-LP2 (24)
	← RA-M8-LP2 (24)	
LP1 (27)	YEx2 → RA-M6-LP1 (27)	YE → RA-M7-LP1 (27)
	← RA-M8-LP1 (27)	
CP4		
CP3 (29)	VI → RA-M7-CP8 (56)	VI → RA-M8-CP8 (56)
LC (31)	VI → RA-R6-LC7 (6)	GY → RA-R6-LC8 (6')
CP5		
O (33)	WHx2 → RA-M6-O (33)	WHx2 → RA-M7-O (33)
	← RA-M8-O (33)	← RA-PRA-I1 (4)
+15 (34)		
+15 (35)	BR12x2 → RA-M6-+15 (35)	BR12x2 → RA-M7-+15 (35)
	← RA-M8-+15 (35)	← RA-PRA-+15 (35)

R6 (Registor) Circuit



R6 Circuit Board



PN2-VR10-2	RE	(37) L1
RA-T62-V (9)	GG	(38) L2
PN2-VR16-2	GR	(39) L3
PN2-VR8-2	GY	(40) V1
RA-SUB-OO (39)	BE	(41) V2
RA-M1-Q2 (57)	YE	(42) QL1
RA-M2-Q2 (57)	GR	(43) QL2
RA-M3-Q2 (57)	BE	(44) QL3
RA-M4-Q2 (57)	VI	(45) QL4
RA-M5-Q2 (57)	GY	(46) QL5
RA-M6-Q2 (57)	WH	(47) QL6
RA-M7-Q2 (57)	GG	(48) QL7
RA-M8-Q2 (57)	PK	(49) QL8
RA-T62-J (23)	GG	(50) QL
PN2-VR11-2	WH	(51) RSE
RA-T62-h (25)	GY	(52) QH
RA-M1-F2 (55)	OR	(53) fL1
RA-M2-F2 (55)	YE	(54) fL2
RA-KBC-O1 (63)	BR	(55) KC1
RA-KBC-O2 (64)	RE	(56) KC2
RA-M3-F2 (55)	GR	(57) fL3
RA-M4-F2 (55)	BE	(58) fL4
RA-KBC-O3 (65)	OR	(59) KC3
RA-KBC-O4 (66)	YE	(60) KC4
RA-M5-F2 (55)	VI	(61) fL5
RA-M6-F2 (55)	GY	(62) fL6
RA-KBC-O5 (67)	GR	(63) KC5
RA-KBC-O6 (68)	BE	(64) KC6
RA-M7-F2 (55)	WH	(65) fL7
RA-M8-F2 (55)	GG	(66) fL8
RA-KBC-O7 (62)	VI	(67) KC7
RA-KBC-O8 (61)	GY	(68) KC8
PN2-VR15-2	YE	(69) TBR
RA-SUB-FO (40)	BR	(70) VCF

LC1 (3)	BR	RA-M1-LC (31)
LC3 (4)	OR	RA-M3-LC (31)
LC5 (5)	GR	RA-M5-LC (31)
LC7 (6)	VI	RA-M7-LC (31)
VB1 (7)	RE	RA-M1-V (36)
VB3 (8)	YE	RA-M3-V (36)
VB5 (9)	BE	RA-M5-V (36)
VB7 (10)	GY	RA-M7-V (36)
QH1 (11)	RE	RA-M1-Q1 (52)
QH2 (12)	OR	RA-M2-Q1 (52)
QH3 (13)	YE	RA-M3-Q1 (52)
QH4 (14)	GR	RA-M4-Q1 (52)
QH5 (15)	BE	RA-M5-Q1 (52)
QH6 (16)	VI	RA-M6-Q1 (52)
QH7 (17)	GY	RA-M7-Q1 (52)
QH8 (18)	WH	RA-M8-Q1 (52)
FH (19)	VI	RA-T62-g (27)
FL (20)	WH	RA-T62-i (24)
fH1 (21)	BR	RA-M1-F1 (51)
fH2 (22)	RE	RA-M2-F1 (51)
fH3 (23)	OR	RA-M3-F1 (51)
fH4 (24)	YE	RA-M4-F1 (51)
fH5 (25)	GR	RA-M5-F1 (51)
fH6 (26)	BE	RA-M6-F1 (51)
fH7 (27)	VI	RA-M7-F1 (51)
fH8 (28)	GY	RA-M8-F1 (51)
BR (29)	GG	PN2-VR12-2
SUB (30)	VI	PN2-VR9-2

LC2 (3')	RE	RA-M2-LC (31)
LC4 (4')	YE	RA-M4-LC (31)
LC6 (5')	BE	RA-M6-LC (31)
LC8 (6')	GY	RA-M8-LC (31)
VB2 (7')	OR	RA-M2-V (36)
VB4 (8')	GR	RA-M4-V (36)
VB6 (9')	VI	RA-M6-V (36)
VB8 (10')	WH	RA-M8-V (36)

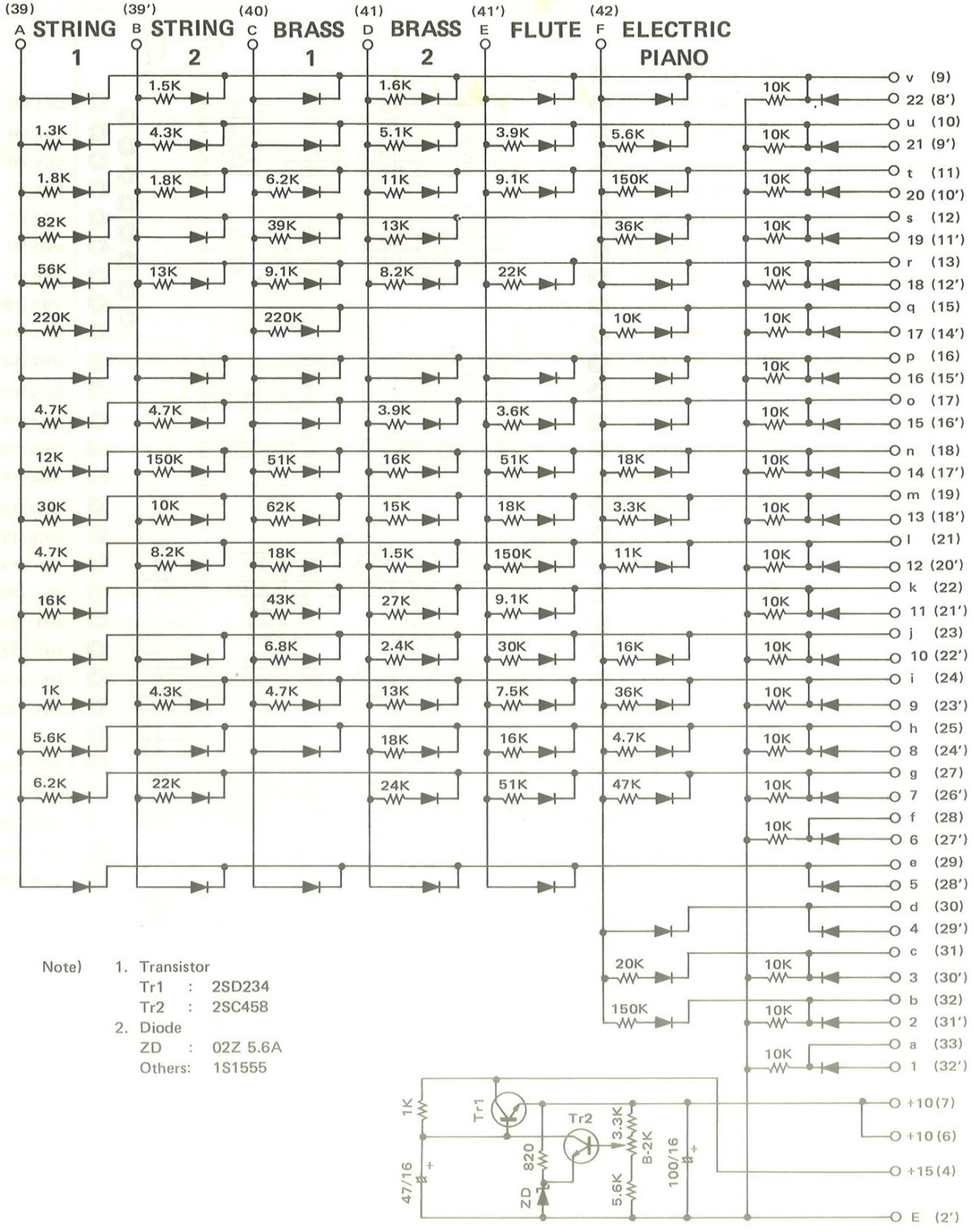
Note) 1. Print Board LC41361

INPUT: 10V

	out / in	a (33)	b (32)	c (31)	d (30)	e (29)	f (28)	g (27)	h (25)	i (24)	j (23)	k (22)	l (21)	m (19)	n (18)	o (17)	p (16)	q (15)	r (13)	s (12)	t (11)	u (10)	v (9)
STRING 1	A (39)	0	0	0	0	9.3	0	3.2	5.3	7.2	9.4	3.5	5.5	2.3	4.2	6.4	9.4	0.4	1.4	1.0	7.9	8.3	9.4
STRING 2	B (39')	0	0	0	0	9.4	0	1.2	9.4	4.0	9.4	0	4.1	4.7	0.6	6.4	9.4	0	4.0	9.4	7.1	6.5	7.9
BRASS 1	C (40)	0	0	0	0	9.4	0	0	9.4	3.8	4.9	1.6	2.5	1.3	1.6	9.4	9.4	0.4 4	4.9	1.9	5.8	9.4	9.4
BRASS 2	D (41)	0	0	0	0	9.3	0	1.1	2.7	1.9	7.1	2.4	7.6	3.7	3.6	6.7	9.4	0	5.1	4.0	4.5	6.2	7.8
FLUTE	E (41')	0	0	0	0	9.4	0	0.5	3.0	2.8	1.9	4.8	0.4	3.3	1.6	6.9	9.4	0	2.9	0	4.9	6.8	9.4
ELECTRIC PIANO	F (42)	0	0.6	2.9	9.3	0	0	0.6	5.7	0.7	3.0	0	3.4	7.0	3.3	9.4	9.4	3.6	9.4	2.0	0.6	6.0	9.4

(Unit: V)

T61 (Tone Preset 1) Circuit

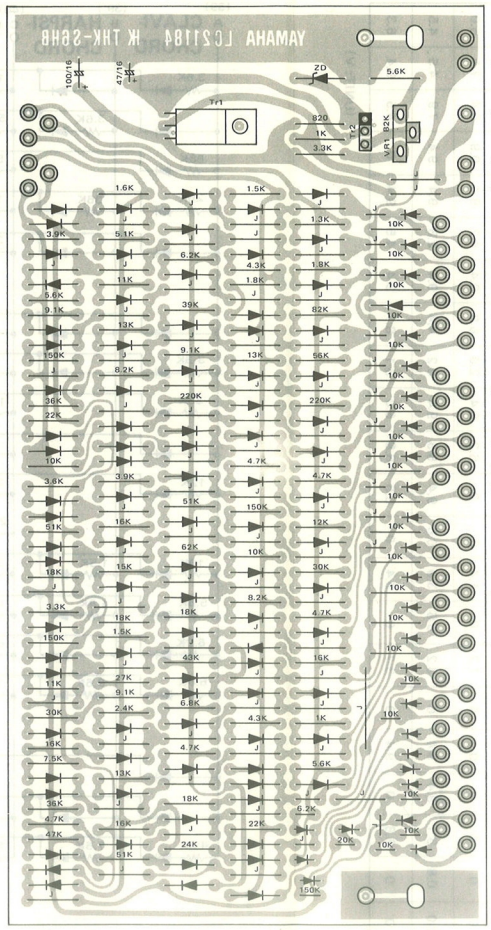


Note) 1. Transistor
Tr1 : 2SD234
Tr2 : 2SC458
2. Diode
ZD : 02Z 5.6A
Others: 1S1555

T61 Circuit Board

PN2-SW3-M3 —RE→ (39') B
PN2-SW6-M1 —GR→ (41') E

PN2-SW3-B1 —BR→ (39) A
PN2-SW4-M1 —OR→ (40) C
PN2-SW5-M1 —YE→ (41) D
PN2-SW7-M1 —BE→ (42) F



E (2) —BL12→ RA-T62-E (2)
+15 (4) ←BR12— RA-+15P
+10 (6) —OR12→ PN2-VR11-1
+10 (7) —OR12→ PN3-SVR1-1

V (9) —GG→ RA-T62-V (9)
u (10) —WHx2→ RA-T62-u (10), RA-SUB-2DA (68)
t (11) —GY→ RA-T62-t (11)
S (12) —VI→ RA-T62-S (12)
r (13) —BE→ RA-T62-r (13)

q (15) —GR→ RA-T62-q (15)
P (16) —YE→ RA-T62-P (16)
O (17) —ORx2→ RA-T62-O (17), RA-SUB-2DF (65)
n (18) —RE→ RA-T62-n (18)
m (19) —BR→ RA-T62-m (19)

L (21) —PK→ RA-T62-L (21)
K (22) —SB→ RA-T62-K (22)
J (23) —GG→ RA-T62-J (23)
i (24) —WH→ RA-T62-i (24)
h (25) —GY→ RA-T62-h (25)

g (27) —VI→ RA-T62-g (27)
f (28) —BEx2→ RA-SUB-c (46), RA-T62-f (28)
e (29) —GR→ RA-T62-e (29)
d (30) —YE→ RA-T62-d (30)
c (31) —OR→ RA-T62-C (31)
b (32) —REx2→ RA-SUB-D (43), RA-T62-b (32)
a (33) —BRx2→ RA-SUB-VC1 (11), RA-T62-a (33)

22 (8') —GG→ PN1-VR20-2
21 (9') —WH→ PN1-VR19-2
20 (10') —GY→ PN1-VR18-2
19 (11') —VI→ PN1-VR17-2
18 (12') —BE→ PN1-VR16-2

17 (14') —GR→ PN1-VR15-2
16 (15') —YE→ PN1-VR14-2
15 (16') —OR→ PN1-VR13-2
14 (17') —RE→ PN1-VR12-2
13 (18') —BR→ PN1-VR11-2

12 (20') —PK→ PN1-VR10-2
11 (21') —SB→ PN1-VR9-2
10 (22') —GG→ PN1-VR8-2
9 (23') —BE→ RA-PRA-fLO (57)
8 (24') —GY→ PN1-VR6-2

7 (26') —SB→ RA-PRA-fHO (59)
6 (27') —BE→ PN1-VR4-2
5 (28') —GR→ PN1-SW2-T
4 (29') —YE→ PN1-SW1-T
3 (30') —OR→ PN1-VR3-2
2 (31') —RE→ PN1-VR2-2
1 (32') —BR→ PN1-VR1-2

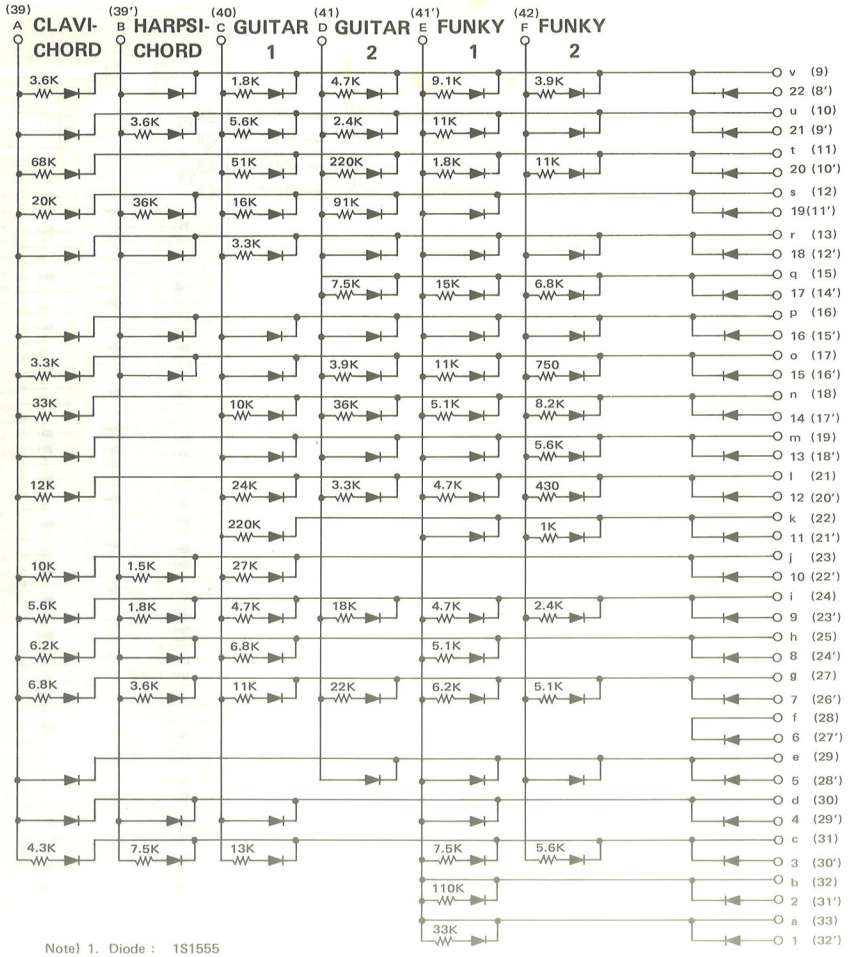
Note) 1. Print Board LC21184
2. Transistor
Tr1 : 2SD234
Tr2 : 2SC458
3. Diode
ZD : 02Z5.6A
Other : 1S1555

(UNIT: V)

out \ in		a (33)	b (32)	c (31)	d (30)	e (29)	f (28)	g (27)	h (25)	i (24)	j (23)	k (22)	l (21)	m (19)	n (18)	o (17)	p (16)	q (15)	r (13)	s (12)	t (11)	u (10)	v (9)
CLAVI-CHORD	A (39)	0	0	6.4	9.4	9.4	0	3.0	5.0	3.5	4.0	0	3.3	9.4	2.2	7.0	9.4	0	9.4	3.0	1.2	9.4	6.5
HARPSI-CHORD	B (39')	0	0	5.1	9.4	0	0	4.5	9.4	6.1	7.8	0	0	0	0	0	9.4	0	9.4	2.0	0	6.9	9.4
GUITAR 1	C (40)	0	0	3.9	9.4	4.9	0	2.1	4.9	3.9	2.0	0.2	2.0	9.4	4.7	9.4	9.4	0	7.0	3.6	1.6	6.0	7.7
GUITAR 2	D (41)	0	0	0	0	9.4	0	1.2	0	1.4	0	0	6.2	9.4	2.0	6.8	9.4	4.2	9.4	0.9	0.4	7.5	6.0
FUNKY 1	E (41')	2.0	0.8	5.1	9.4	9.4	0	3.2	5.6	3.9	0.6	9.4	5.5	9.4	6.2	4.4	9.4	2.8	9.4	9.4	7.9	4.5	4.5
FUNKY 2	F (42)	0	0	5.8	0	9.4	0	3.7	0	5.4	0	8.5	8.8	6.0	5.1	8.7	9.4	4.5	9.4	0	4.5	9.4	6.3

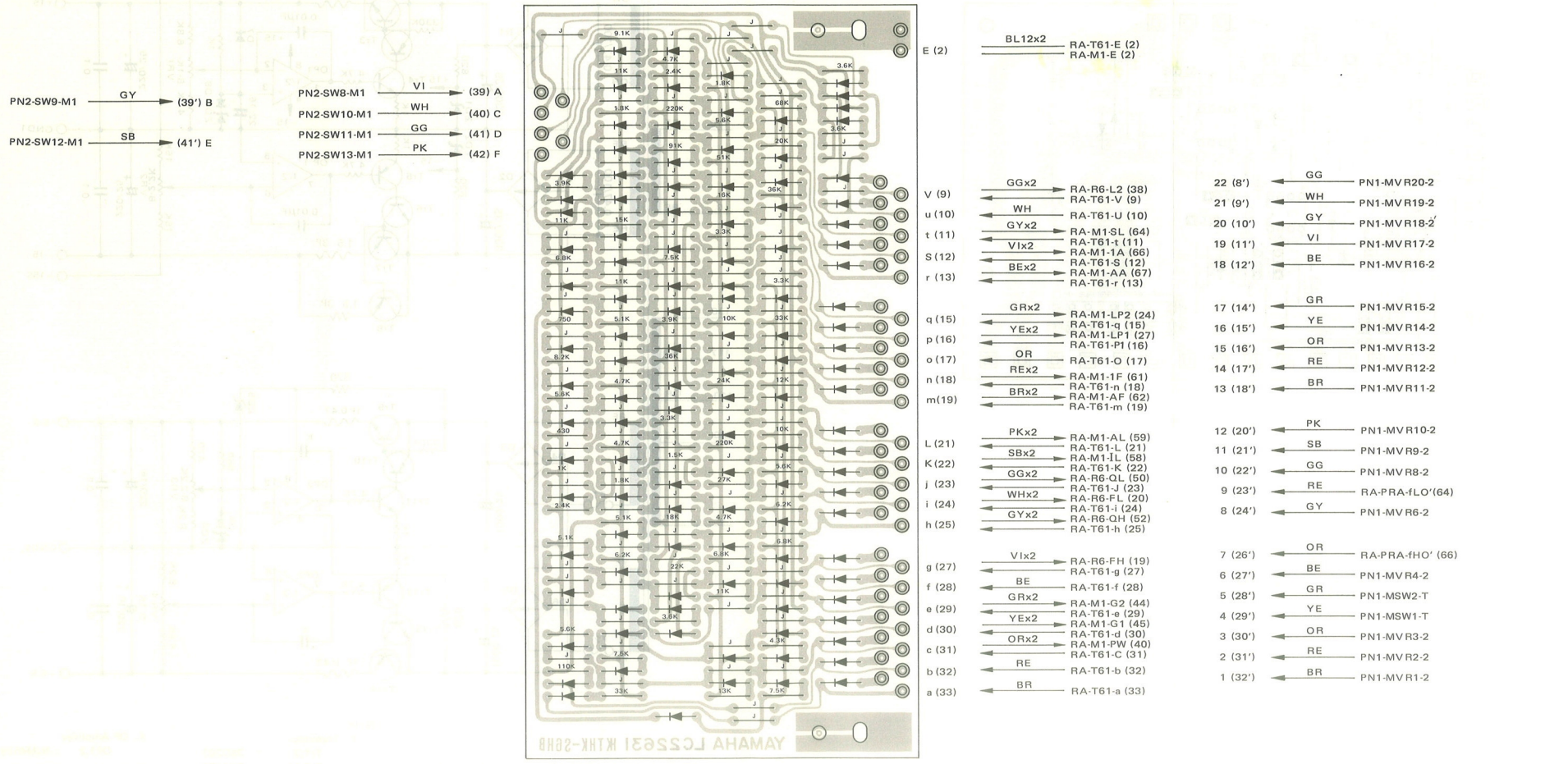
INPUT: 10

T62 (Tone Preset 2) Circuit



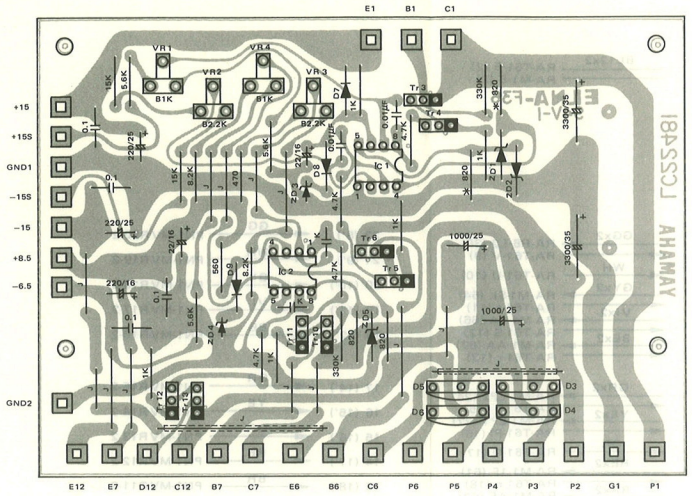
Note) 1. Diode : 1S1555

T62 Circuit Board

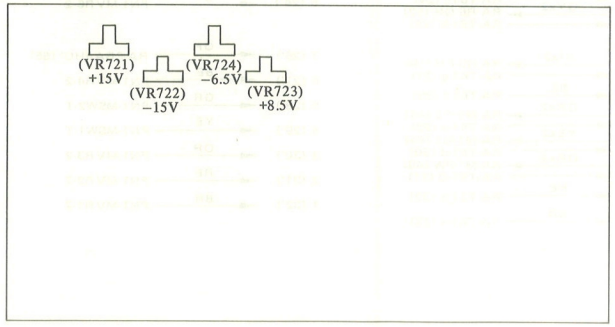


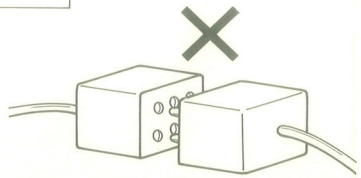
Note) 1. Print Board LC22631
2. Diode
D : 1S1555

SVU Circuit Board



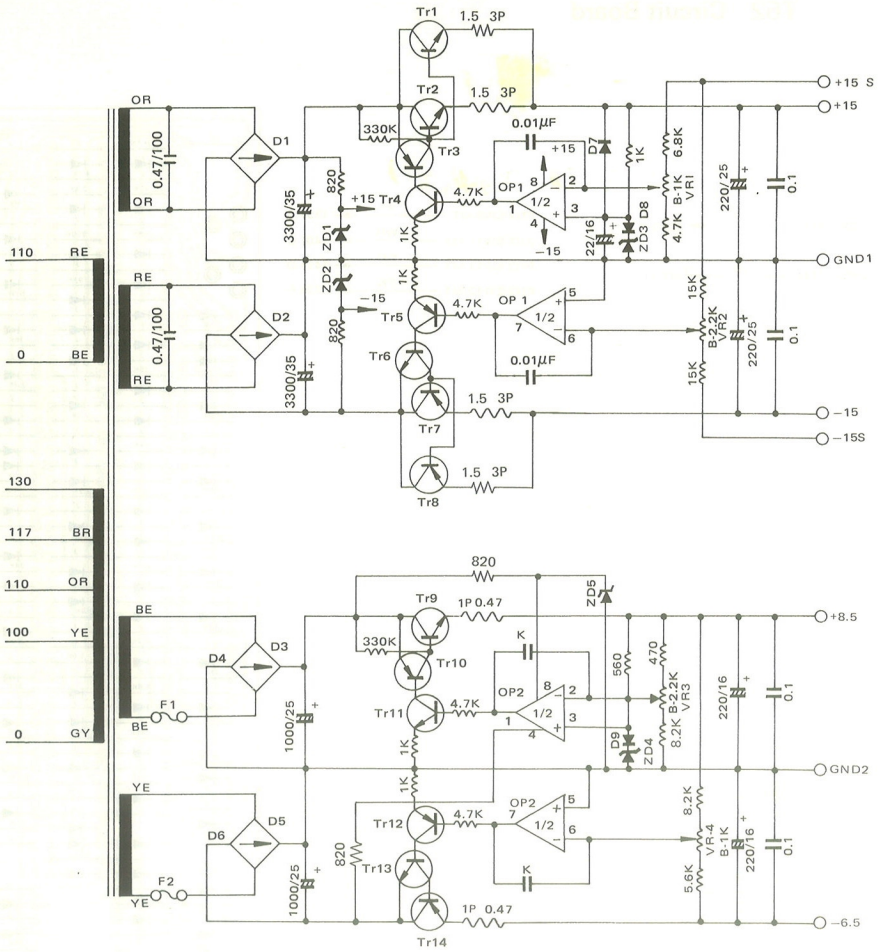
Adjustment





NA03769-6Y

SVU Circuit



[Caution]

When you carry out inspection on Power Supply Unit, be sure to make complete connection of the connector or Short Circuit both +15↔+15S and −15↔−15S. Otherwise, the circuit can break with the power on.

〔注意〕

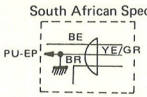
電源ユニットの点検などで、コネクターを取外したままで電源を入れますと回路を壊わす恐れがありますのでコネクターを取付けたまま、又は＋15↔＋15Ｓ、−15↔−15Ｓをショートさせて点検を行なう様お願いします。

Note)

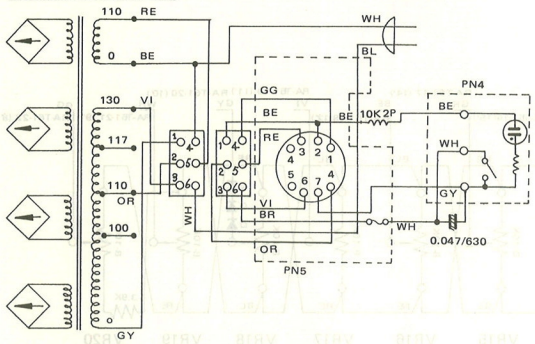
1. Transistor
   - Tr1,2 : 2SD203
   - Tr3,14 : 2SA490
   - Tr4,11,13 : 2SC828
   - Tr5,10,12 : 2SA561
   - Tr6,9 : 2SD234
   - Tr7,8 : 2SA745
2. Diode
   - D1,D2 : 5B2
   - D3,D5 : 10DC-4
   - D4,D6 : 10DC-4R
   - D7~D9 : 1S1555
3. Zener Diode
   - ZD1,2,5 : WZ150
   - ZD4 : 1S1715
   - ZD3 : 02Z5.6A
4. OP Amplifier
   - OP1,2 : NJM4558
5. Fuse
   - F1 : 0.5A
   - F2 : 0.5A
6. VR : SR-29D

Power Supplv NP0013Z (Primary) Circuit

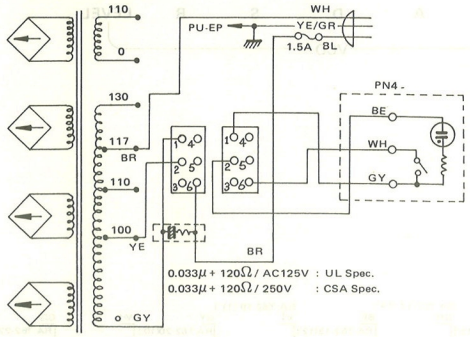
South African Spec.



General · South African Spec.

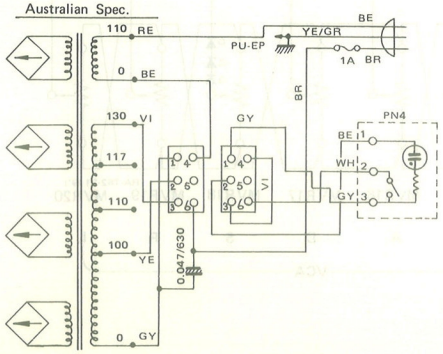


UL · CSA Spec.

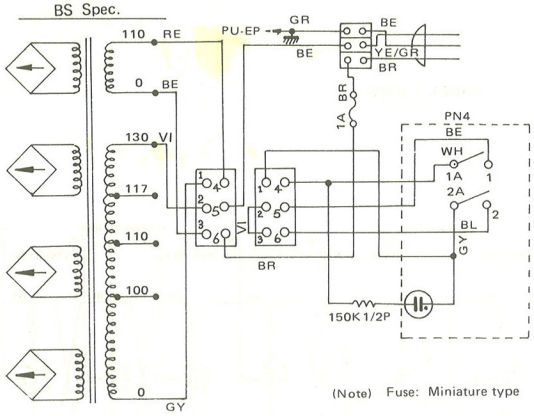


0.033μ + 120Ω / AC125V : UL Spec.
0.033μ + 120Ω / 250V : CSA Spec.

Australian Spec.

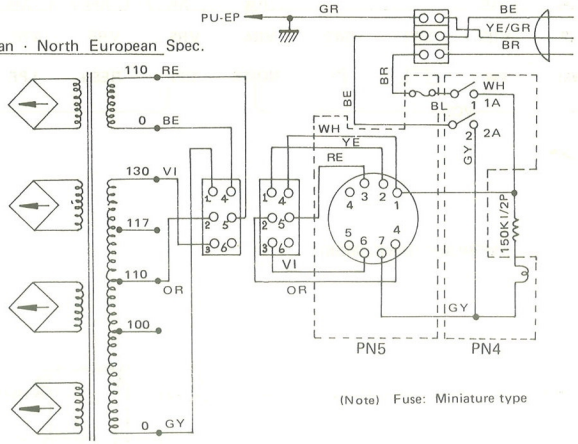


BS Spec.



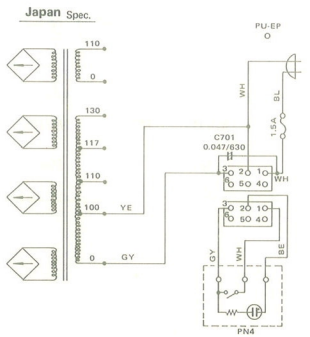
(Note) Fuse: Miniature type

European · North European Spec.



(Note) Fuse: Miniature type

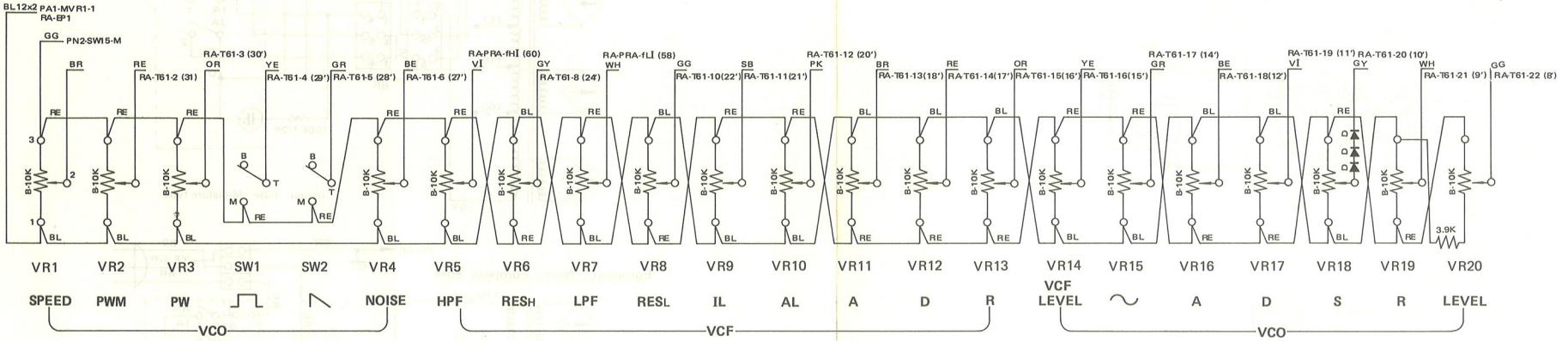
Japan Spec.



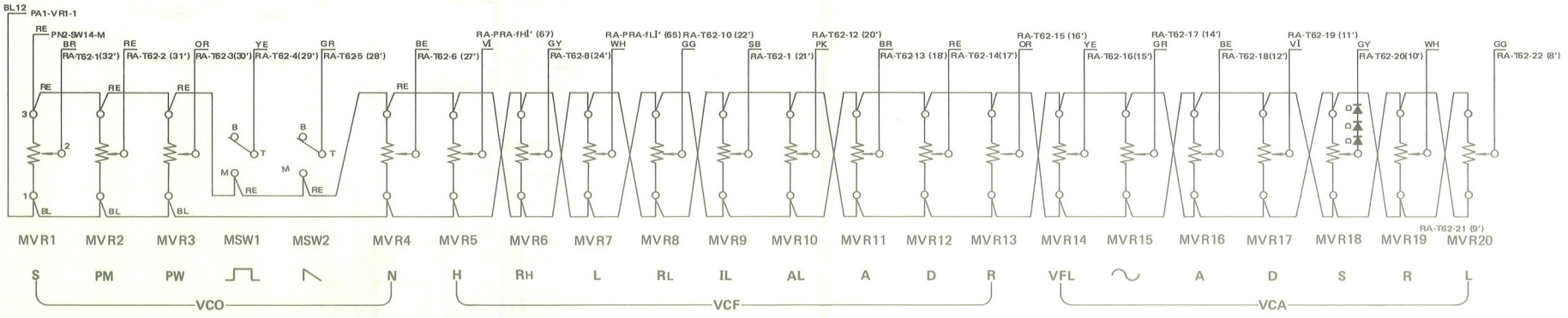
(Note) Fuse: Miniature type

PN1 (Panel 1) Circuit

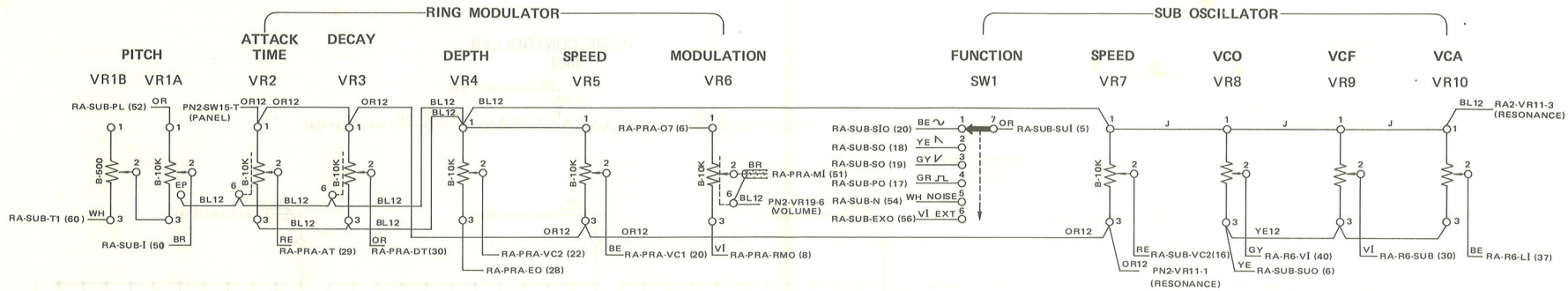
PANEL 1 (PN1)

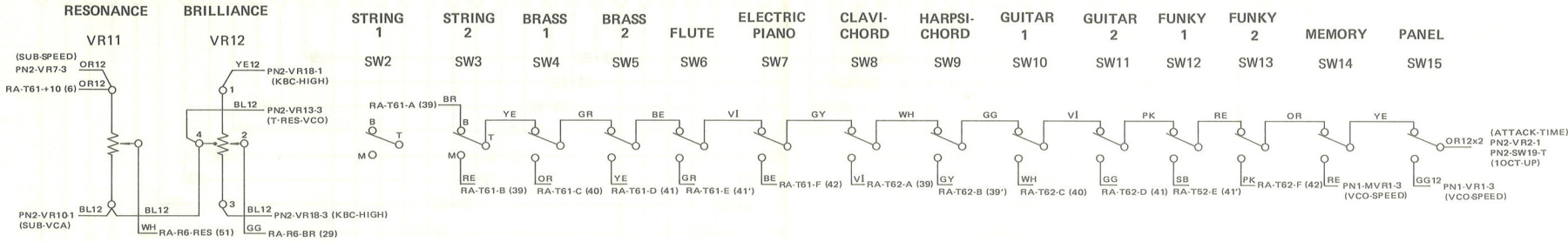


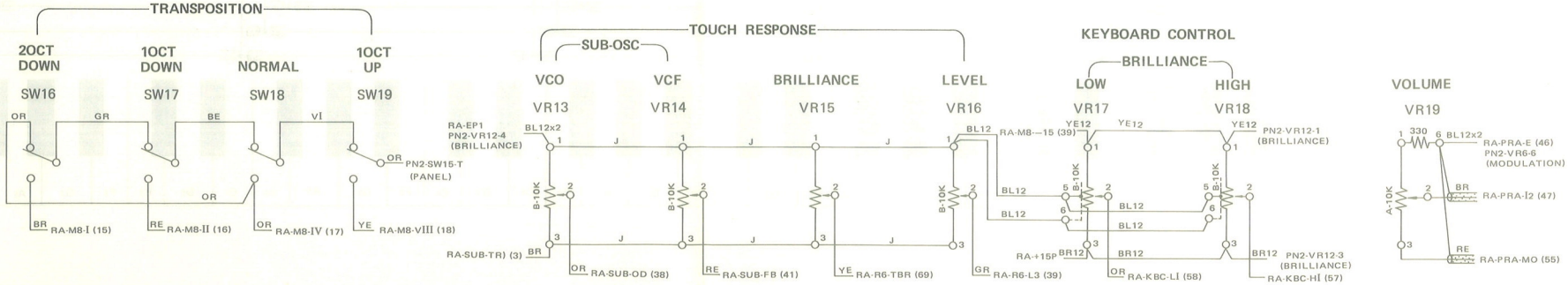
MEMORY BANK (MBK)



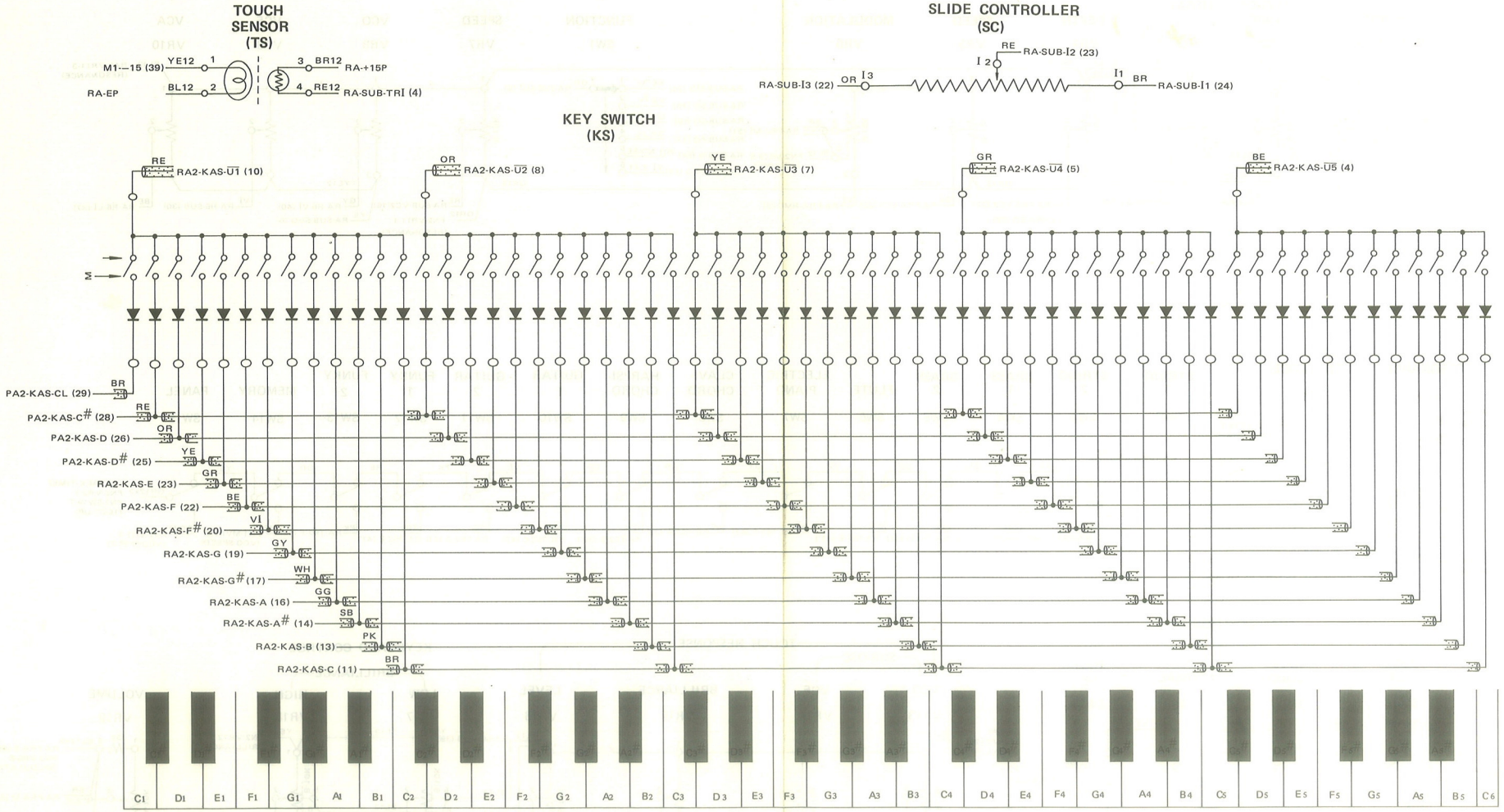
PN2 (Panel 2) Circuit



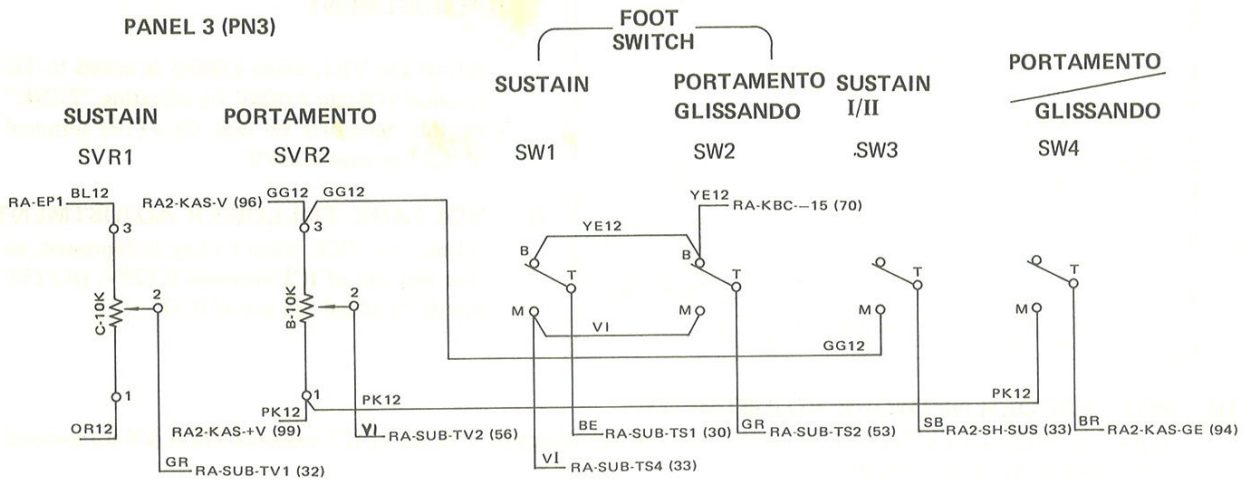


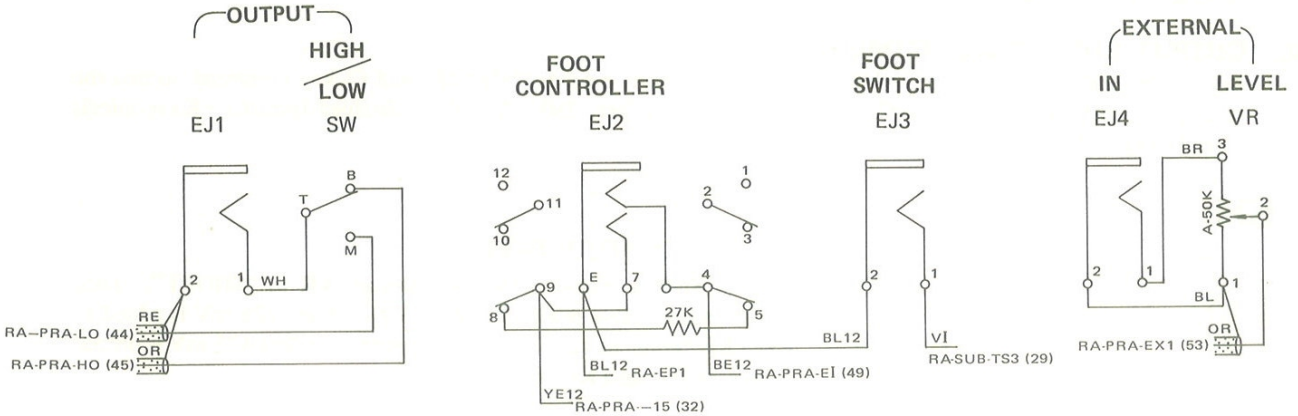


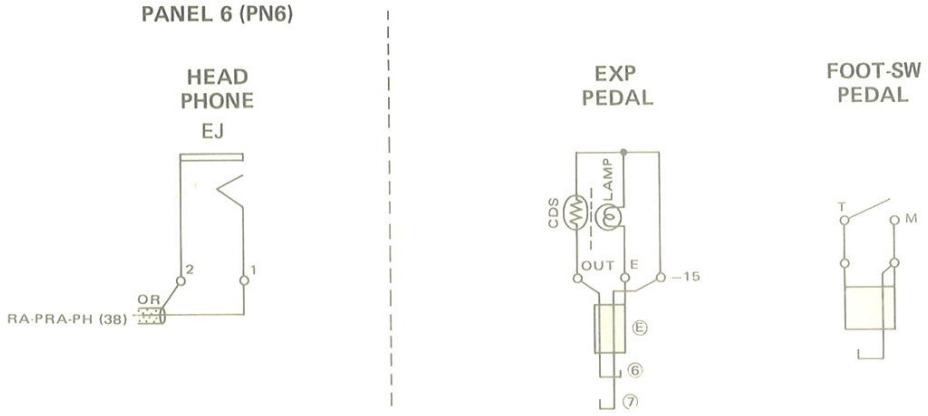
KS (Key Switch) Circuit



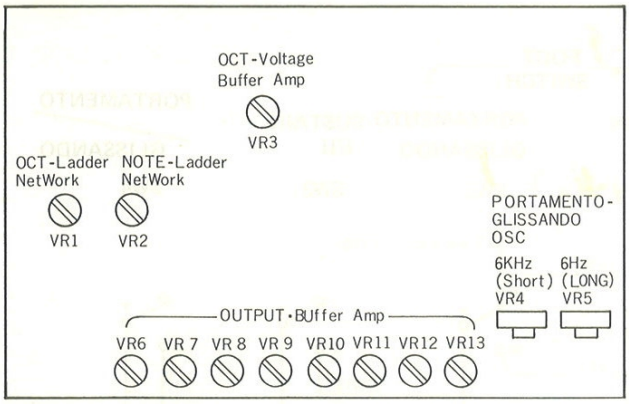
PN3, PN5, PN6, PU, EXP, FOOT SW







KAS



I. OCTAVE LADDER NETWORK ADJUSTMENT

Adjust the VR1, when 4.000V is added to TU terminal (Obtain 4.000V by adjusting "TUNE" variable resistor.) so that OC_0 (13) terminal of IC2 becomes 0.125V.

II. VOLTAGE FOLLOWER ADJUSTMENT

Adjust the VR3, when C_1 key is depressed, so that 6th pin of IC3 becomes 0.125V. (0.125V should be added 3rd pin of IC3)

III. NOTE LADDER NETWORK ADJUSTMENT

Adjust the VR2, when $C^{\#}_1$ key is depressed, so that the voltage of 38th pin of IC2 becomes 132.4 mV for 8-sound and 264.8 mV for 4-sound Synthesizer.

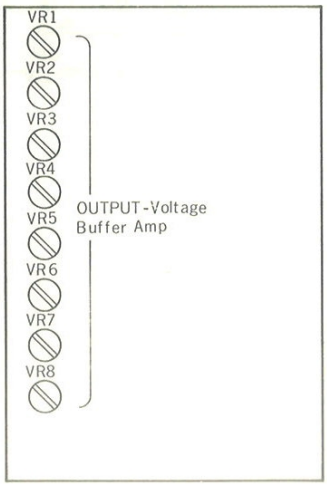
IV. PORTAMENTO (GLISSANDO) CLOCK ADJUSTMENT

Adjust the VR4, when Sliding volume of Portamento-Glissando is set to "SHORT", so that 6th pin of IC24 becomes 6 KHz (0.16 mS). Moreover, adjust VR5, when the sliding volume is set to "LONG", so that the 6th pin of IC24 becomes 6 Hz (0.16S).

V. OUTPUT BUFFER ADJUSTMENT

Adjust the variable resistors VR6 ~VR13, when Portamento is set to "SHORT" and C_1 key depressed, so that the terminals $K_1 \sim K_8$ become 125 mV. (On 4-sound Synthesizer, 250 mV will be obtained from $K_1 \sim K_4$ terminals when C_2 key is depressed.).

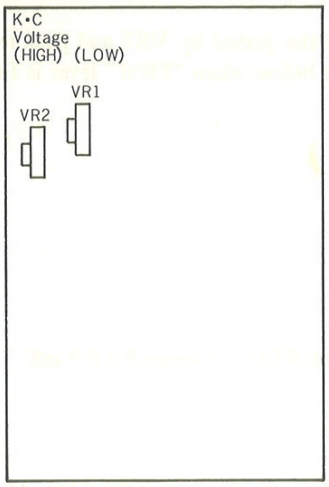
SH



SAMPLE HOLD ADJUSTMENT

Set the Sustain mode to "II" and Sustain VR to "SHORT". Then adjust each variable resistors (VR1 ~ VR8), when 125 mV is added to $KI_1 \sim KI_8$ terminals and C_1 key is depressed, so that 125 mV is output from each terminal $K_1 \sim K_8$.

KBC

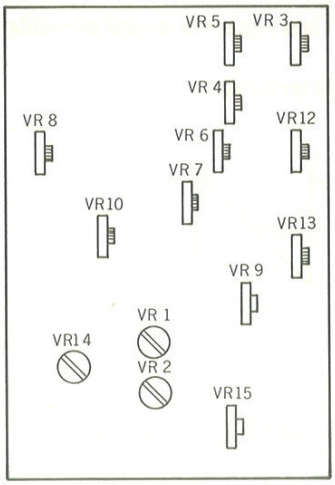


VOLTAGE ADJUSTMENT

LOW ..... Adjust the VR1, when "LOW" lever of KEYBOARD CONTROL is fully lowered (–15V is input into LI terminal) and C2 key is depressed, so that the O1~O8 terminals become –2.76 ± 0.12V. Also make certain that those terminals become +2.76V when the lever is fully raised (+15V is input).

HIGH ..... Adjust the VR2, when "HIGH" lever of KEYBOARD CONTROL is fully lowered (–15V is input into HI terminal) and C5# key is depressed, so that the O1~O8 terminals become –2.76 ± 0.12V. Also make certain that those terminals become +2.76V when the lever is fully raised (+15V is input).

SUB



I. SLIDE CONTROL ADJUSTMENT

1. Adjust VR1, when slide control is turned on and 2.000±0.001V is fed into the I2 (23) terminal, so that the voltage of TP1 (63) terminal becomes –2.000 ± 0.002V.
2. Adjust VR2 so that the same voltage of TP2 (64) terminal is obtained that of TP1 (63).
3. Adjust VR14 so that TI (60) terminal becomes 6.15V ±0.05V. Then, make certain that the voltage fluctuation of the TI terminal is within ± 20 mV when Slide control is repeatedly switched to ON and OFF.
4. Adjust VR15 so that the voltage of I1 (24) terminal becomes 9.5V± 0.1V.

II. TOUCH RESPONSE AMPLIFIER CIRCUIT

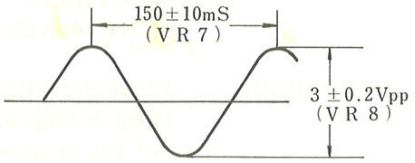
Adjust VR3, when keys are hardly pressed, so that the voltage of TRO (3) terminal becomes 6V.

III. TOUCH RESPONSE CON" OL CIRCUIT

1. First of all, make sure that 100 ± 1 Hz and 3 ± 0.1V is added to SUI (5) terminal by moving "SPEED" lever when SUB-OSC "FUNCTION" is set to "∿".
2. Adjust VR5, when 6 ± 0.1V is added to OD (38) terminal, so that the output from OO (39) terminal becomes 3 ± 0.1V.
3. Moreover, adjust VR4, so that the center voltage of OO output terminal becomes 0.5 ± 0.1V.
4. With the above situation, adjust VR6, when 6 ± 0.1V is added to FD (41) terminal through Touch Response "VCF" lever, so that the output from FO (40) terminal becomes 3 ± 0.1V.

IV. PWM CIRCUIT

1. Add 5 ±0.1V to VC1 (11) terminal with PWM "SPEED" lever. Then adjust the period by VR7 and peak level by VR8, so that the output from P (45) terminal has the waveform shown below when "PWM" lever is fully raised and 10 ± 0.1V is added to D (43) terminal.



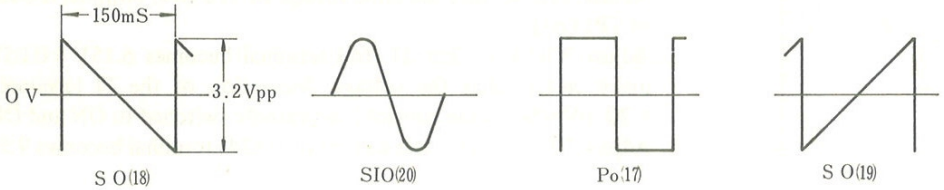
2. Adjust VR12, when PWM "SPEED" lever is fully raised, so that the output from P (45) becomes 5 ± 0.5 mS.

NOISE GENERATOR CIRCUIT

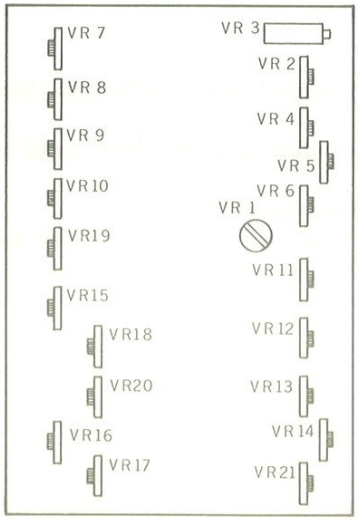
Adjust VR10, when "NOISE" lever is fully raised [10 ± 0.1V is given to C (40) terminal], so that the 3 Vpp Noise wave is output from NO (48) terminal.

OSCILLATOR CIRCUIT FOR MODULATION

Add 5 ± 0.1V to VC2 (16) terminal by moving "SPEED" lever of SUB-OSC. Then adjust the period of oscillation waveform of SO (18) terminal with VR9 as follows.
At the same time, make sure the waveform of each SIO (20), PO (17) and $\overline{SO}$ (19) terminals.



M

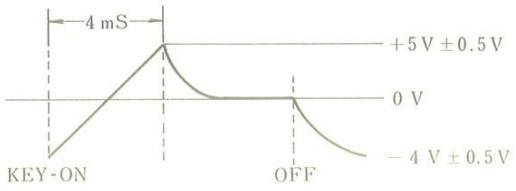


I. PITCH ADJUSTMENT

VR1~ VR6 (Refer to "PITCH ADJUSTMENT" on page 17

II. EG-VCF CIRCUIT

1. Set the preset button to "PANEL". Add 10V to terminals AL, IL, DF, RF and 8V to AF (62) terminal. Depress a key and adjust attack time of the waveform of TP1 (22) terminal as follows.



2. With the above mentioned setting, when 3V is fed into AF terminal, adjust VR19 to the direction the time is lengthened if the attack time is longer than 125 m seconds and vice versa. Then carry out the adjustment stated in item 1 again.
3. Adjust the VR18, when key is depressed, so that output voltage of TP1 (22) terminal becomes 0 ± 0.01V.

III. VCF–HPF CIRCUIT

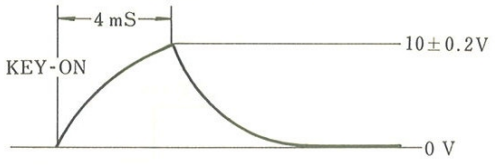
Set preset tone to "PANEL". Turn on the switch "⎍". Set the "HPF" lever to the center position. Then, place the levers "LPF", "RESL" and RESH" in the High position. Adjust VR7 for cut off frequency and VR8 for Q so that the tone color of the M circuit board may be the same as that of other M circuit boards.

IV. VCF–LPF CIRCUIT

In the same manner, set preset tone to "PANEL" and "LPF" to center position and levers "RESL", "HPF" "RESH" to Low, then adjust VR9 for Q so that the tone color of the M circuit may be the same as that of ther M circuit board.

V. EG–VCA CIRCUIT

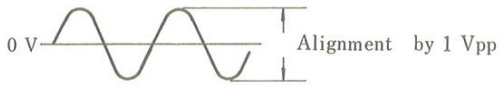
1. Set preset tone to "PANEL". Depress a key and adjust the VR17, when 10V is fed into the terminals AA, DA, RA and 0V to SL through each volume of VCA section, so that the DC voltage of TP2 (68) terminal becomes −200 ± 20 mV.
2. Likewise, add 8V to AA terminal and 10V to DA, RA terminals as well as 0V to SL terminal.
   Depress a key and adjust the attack time of the waveshape appeared on TP2 (68) terminal as below.



3. With the above mentioned setting (item 2), when 3V is fed into AA (67) terminal, adjust VR20 to the direction the time is lengthened if the attack time is longer than 125 mS and vice versa. Then carry out the adjustment stated in item 1 again.

VI. VCA CIRCUIT

1. Set the transposition lever to "2 OCT-DOWN" (16' for CS-80) and preset button to "PANEL". Adjust the VR11, when "∿" is set to 10 [10V is added to LP2 (24) terminal] and key is depressed, so that the output waveform from CP4 (28) becomes 1 Vp-p.

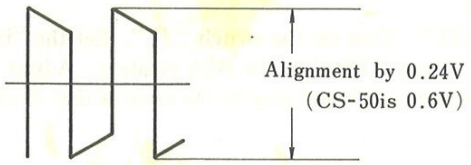


2. Set the transposition lever to "NORMAL" (8' for CS-80) and preset button to "PANEL". Turn the switch "⎍" on and set "VCF LEVEL" lever to 10. Then, set the levers "RESH" and "RESL" to Low position and "LPF" to High position. Depress a key and adjust the VR12 so that the output of the terminal CP4 (28) becomes the following waveshape with the rated output level.



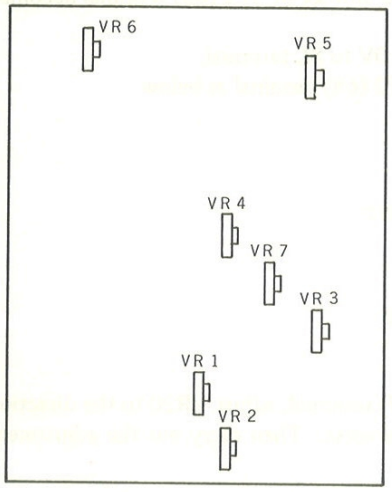
3. With the above condition, adjust the VR3, when "LEVEL" is set to 10, so that the output waveform of CP5 (32) terminal becomes as follow.

4. Leave the setting of item 3 as it is, set each "A", "D", "S" and "R" to Short or 10. Depress a key and adjust Output waveform level with VR14 as follows.



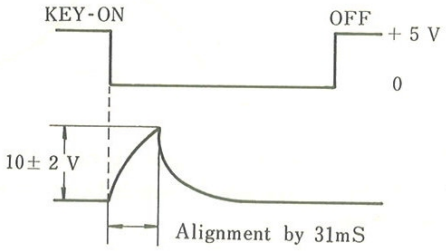
5. Return only "LEVEL" lever to 0 with other condition remaining unchanged from item 4. Adjust VR21, when key is depressed, so that the output of O terminal becomes minimum level.

PRA



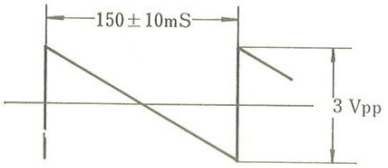
I. ENVELOPE GENERATOR CIRCUIT

1. Move the levers "ATTACK TIME" and "DECAY TIME" on the RING-MOD so as the voltage of terminals AT (29) and DT (30) to be 10V ± 0.1V (on SHORT side).
2. Then adjust the VR1, when key is pressed on, so that the voltage of EO (28) terminal becomes 0± 0.01V.



II. RING MODULATOR CIRCUIT

1. Add 5 ± 0.1V to the terminal VC1 (20) by moving the "SPEED" lever of RING-MOD. Then adjust VR3, when "DEPTH" lever is "0" (VC2 (22) terminal is 0 volt.), so that the output frequency and waveform of TP2 (19) become as follows.



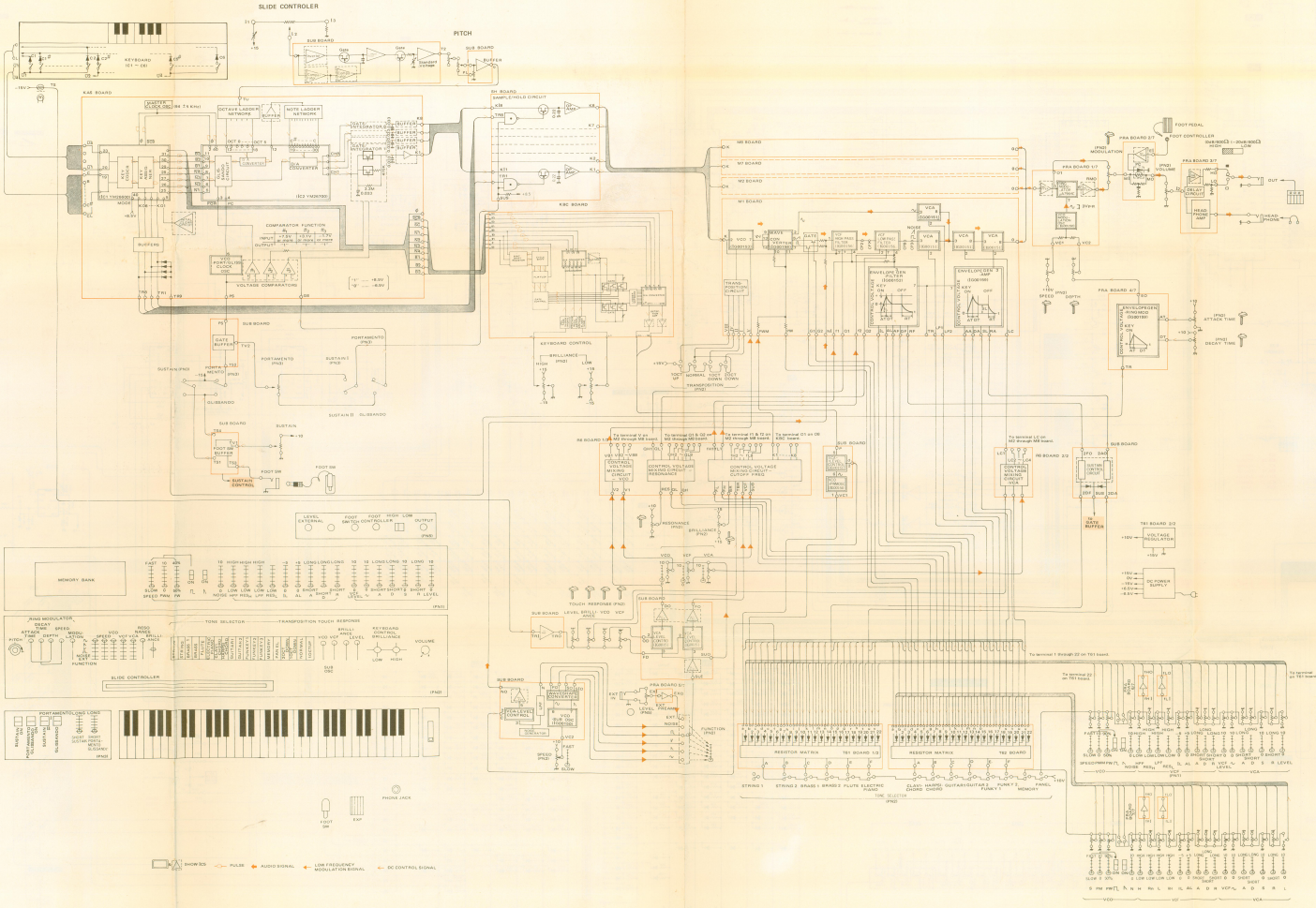
Moreover, adjust VR7, when "SPEED" lever is in MAX (VC1 terminal is 10V) position, so that the period of the above waveform becomes 5 ± 1 mS.

2. Adjust VR5, when only "MODULATION" and "SPEED" are in MAX position, so that the signal leak level of RMO (8) terminal is within 3 mV.

III. OUTPUT AMPLIFIER CIRCUIT

Adjust VR6, when "∿", "S" and "LEVEL" in VCA block is in MAX position and "PANEL" is set during all keys are pressed, so that the output of OUT JACK becomes 0 ± 1 dBm.

YAMAHA CS-60 SYNTHESIZER BLOCK DIAGRAM



CS-60 OVERALL CIRCUIT DIAGRAM

