

EP-11

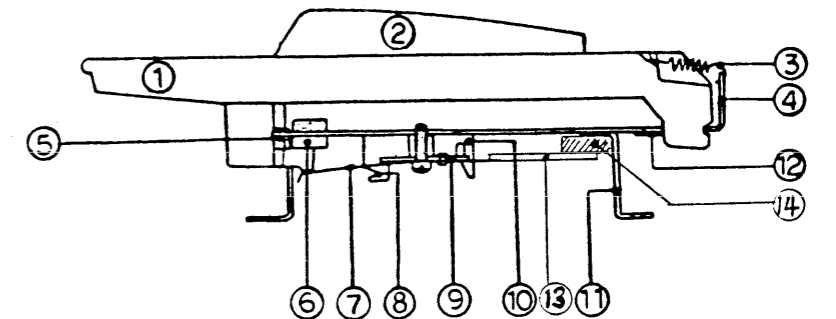
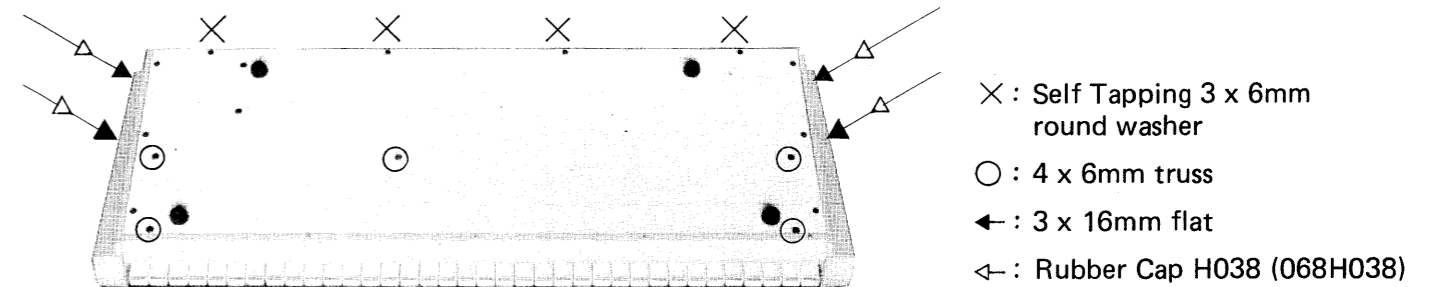
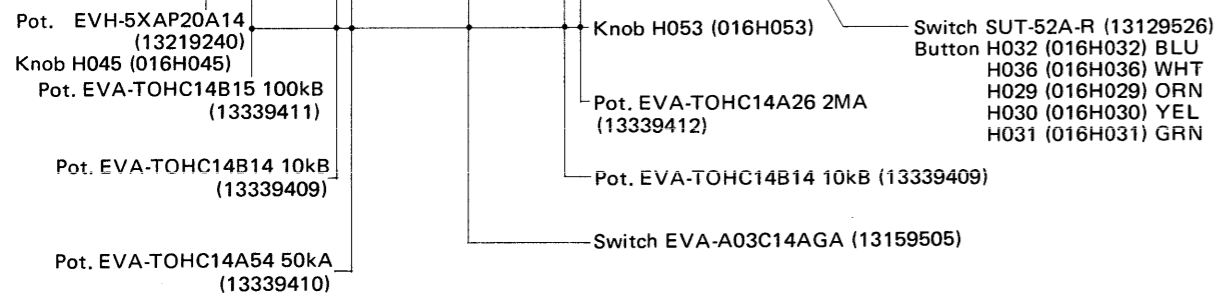
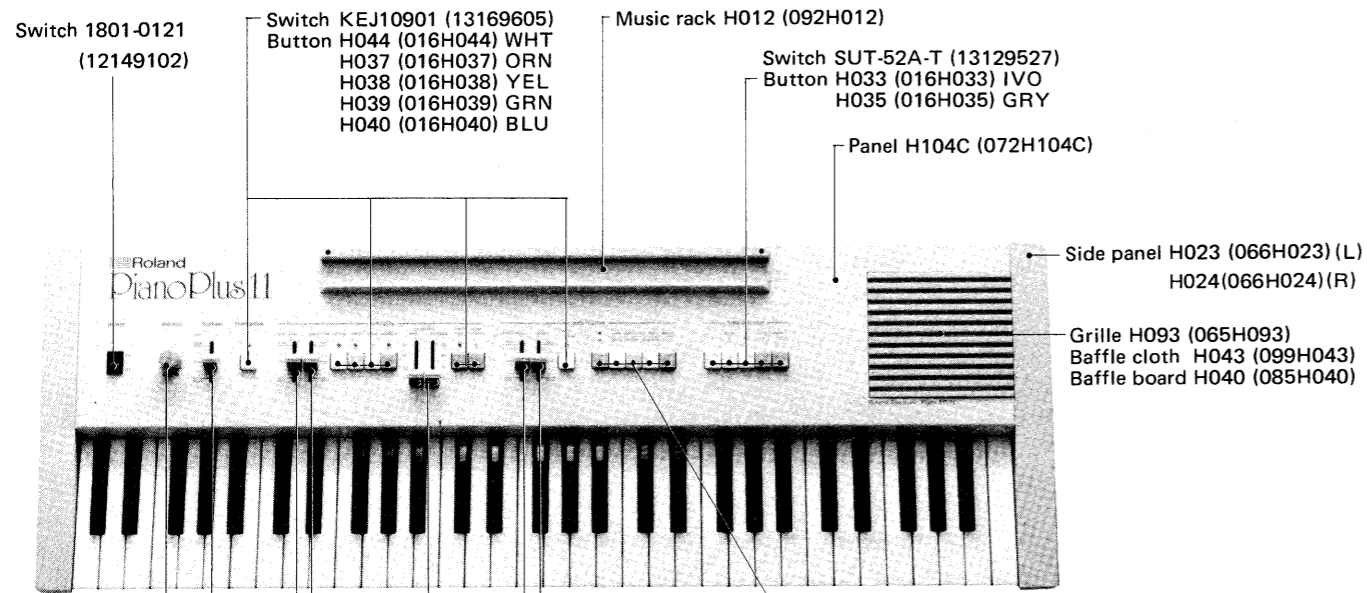
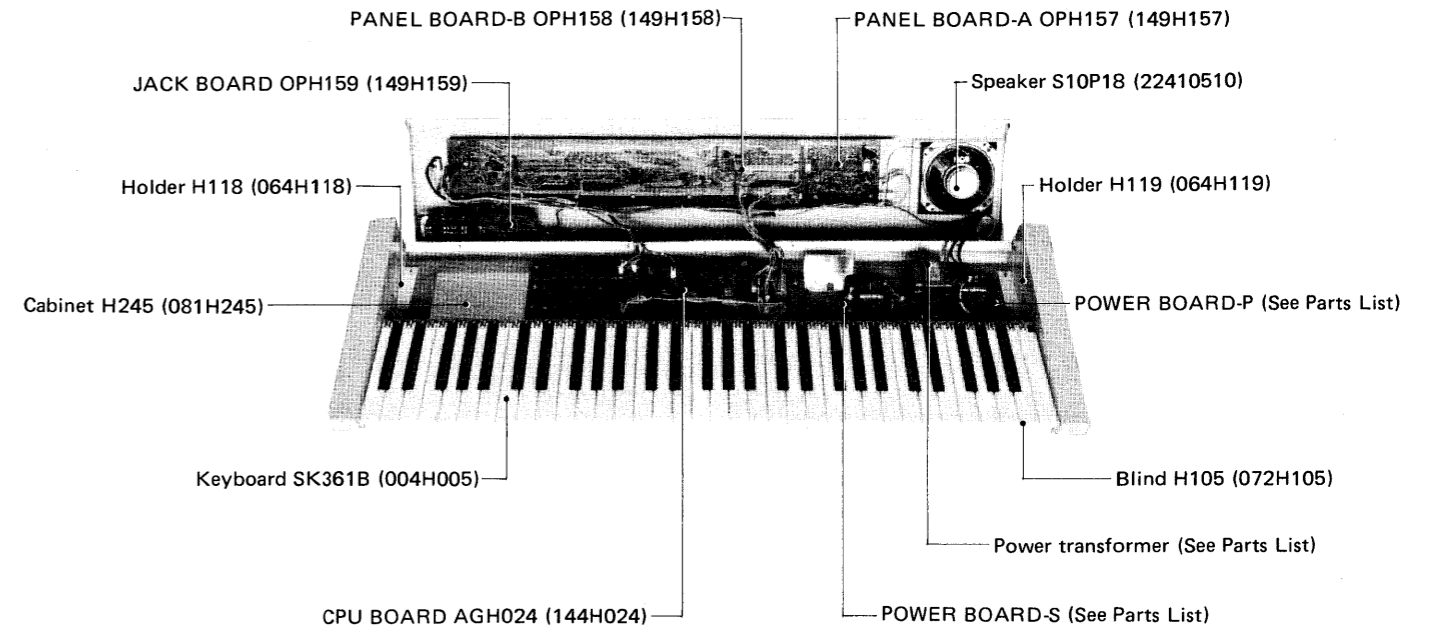
SERVICE NOTES

First Edition

SPECIFICATIONS

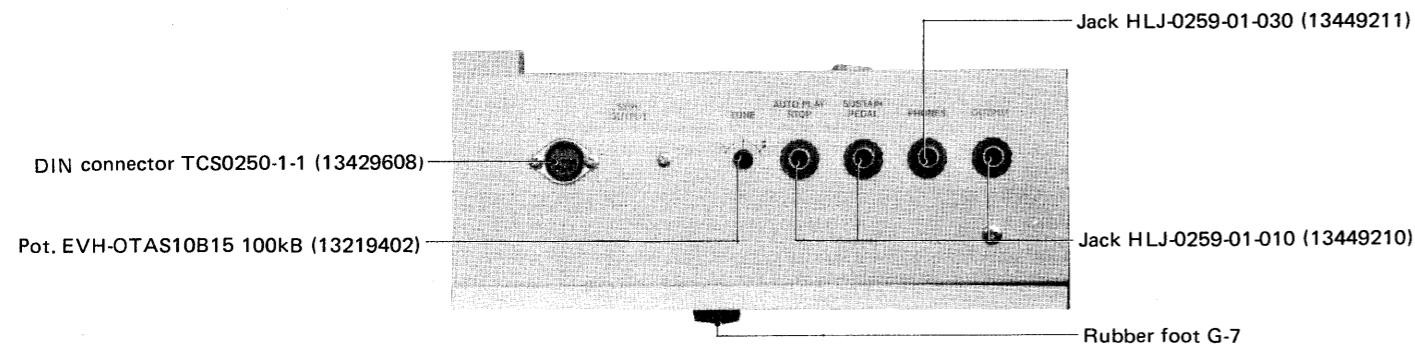
Keyboard	61 keys, 5 octaves	Power Consumption . . .	15 watts
Speaker	10 cm, 2 watts	Dimensions	912(W) x 115(H) x 325(D) mm
Headphone Jack	8 ohms, stereo	Weight	9.2 kg
Tunable range	±50 cents		

ERRATA & SUPPLEMENT is attached at the end of the page.
最終頁に正誤表&追加情報があります。



SK-361B (004H005) KEYBOARD PARTS

NO	PART NO	DESCRIPTION	NO	PART NO	DESCRIPTION
1	106H026	Natural key C F	7	071H044	Contact leaf H44
1	106H027	Natural key D	8	071H051	Busbar 8P H51
1	106H028	Natural key E B		071H054	Busbar 5P H54
1	106H029	Natural key G	9	043H007	Switch unit 12P H7
1	106H030	Natural key A		043H008	Switch unit 13P H8
1	106H031	Natural key C' F'	10	064H093	Busbar holder H93
2	106H032	Sharp key black	11	062H024	Chassis bracket H24
3	070H029	Key spring H29	12	098H006	Key stopper H6
4	061H086A	Chassis H86A	13	052H283-5	Matrix board H283-5
5	068H004	Guide bushing H4	14	107H059	Cushion H59
6	101H141	Level felt H141			



Bass pattern

	Rock	Bossanova
IV		
III		
II		
I		

	Disco	March
IV		
III		
II		
I		

	Swing	Shuffle
IV		
III		
II		
I		

	Slow rock	Waltz
IV		
III		
II		
I		

Rhythm & Chord cutting pattern

BD SD RS C.HH CY

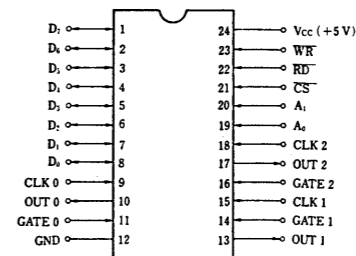
	Rhythm	Chord
Rock		
Bossa Nova		
Disco		
March		
Swing		
Shuffle		
Slow rock		
Waltz		

Arpeggio pattern (with keys C,E and G depressed)

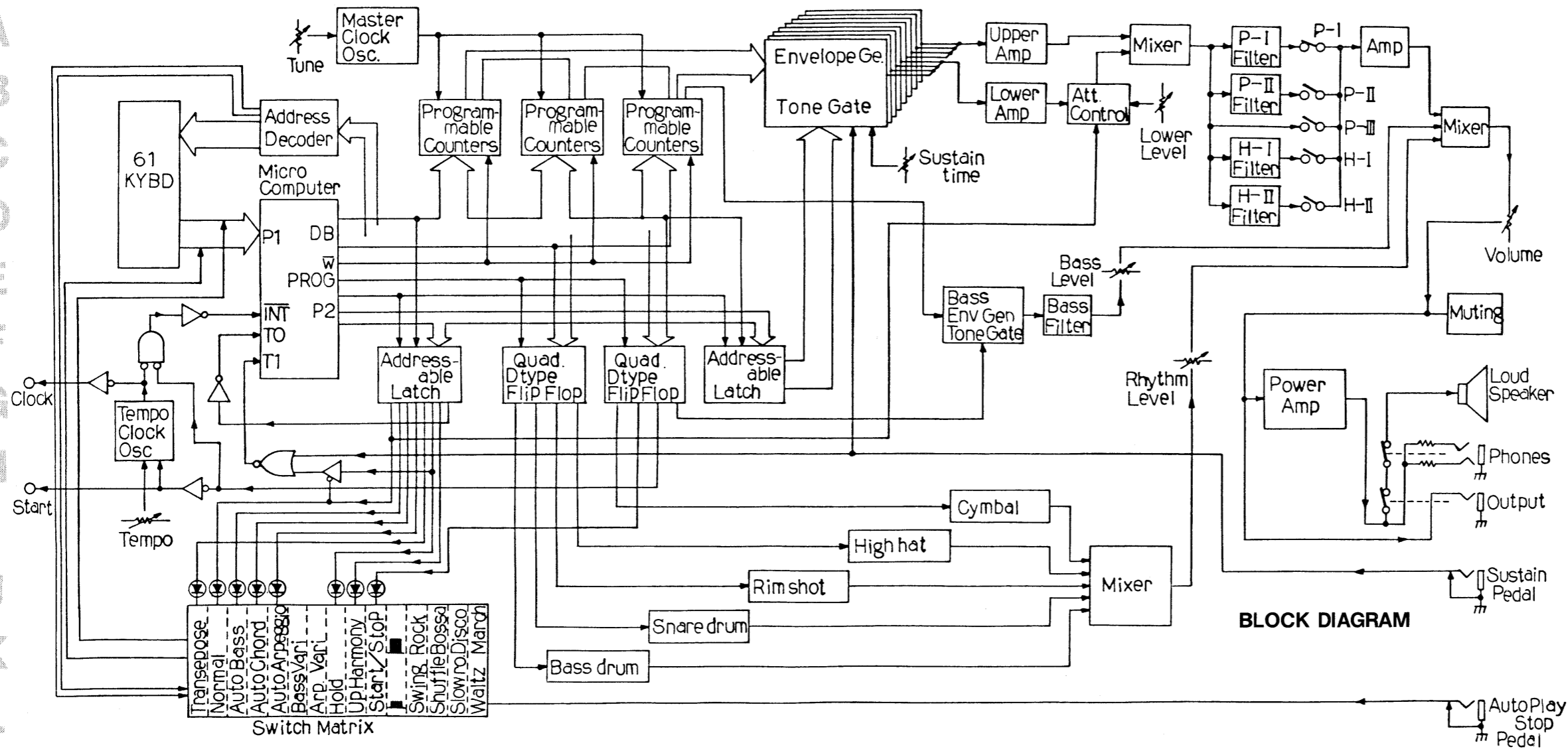
	Rock,Bossanova,Disco, March	Swing,Shuffle
IV		
III		
II		
I		

	Slow rock	Waltz
IV		
III		
II		
I		

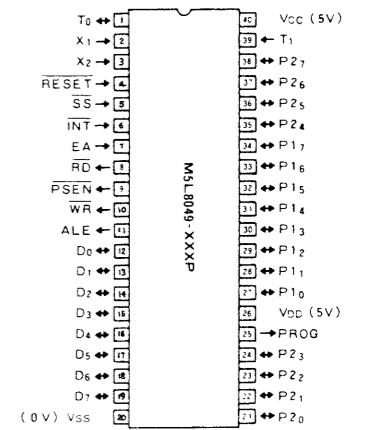
μPD8253C-5
PROGRAMMABLE INTERVAL TIMER
3 Independent 16-Bit Counters



CS	RD	WR	A ₁	A ₀	Function
0	1	0	0	0	Load Counter No. 0
0	1	0	0	1	Load Counter No. 1
0	1	0	1	0	Load Counter No. 2
0	1	0	1	1	Write Mode Word
0	0	1	0	0	Read Counter No. 0
0	0	1	0	1	Read Counter No. 1
0	0	1	1	0	Read Counter No. 2
0	0	1	1	1	No-Operation 3-State
1	X	X	X	X	Disable 3-State
0	1	1	X	X	No-Operation 3-State

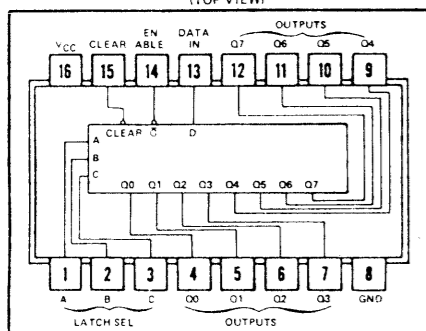


M5L8049-XXXX
SINGLE-CHIP 8-BIT MICROCOMPUTER



BLOCK DIAGRAM

74LS259
8-BIT ADDRESSABLE LATCH
(TOP VIEW)

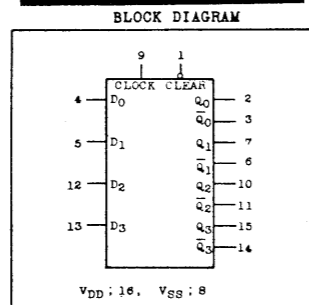


INPUTS	OUTPUT OF ADDRESSABLE LATCH	EACH OTHER OUTPUT	FUNCTION
H L	D	Q ₀	Addressable Latch
H H	Q ₀	Q ₀	Memory
L L	D	L	8-Line Demultiplexer
L H	L	L	Clear

LATCH SELECTION TABLE

SELECT INPUTS	LATCH
C B A	ADDRESSED
L L L	0
L L L	1
L H L	2
L H H	3
H L L	4
H L H	5
H H L	6
H H H	7

TC40175BP
Quad Type Flip-Flop

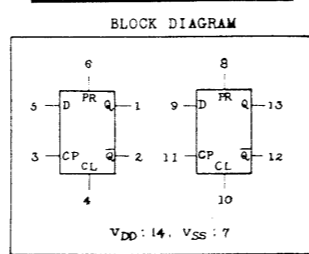


TRUTH TABLE

INPUTS	OUTPUTS
CLOCK	D _n CLEAR Q _n Q _n
↑	H H H L
↑	L H H L
↑	* H H Q _n Q _n
↑	* * L L H

Δ: Level change
 •: No change
 *: Don't care

TC4013BP
Dual "D" Flip-Flop

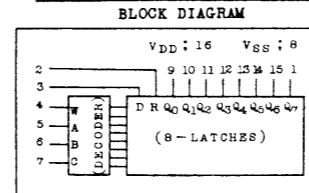


TRUTH TABLE

INPUTS	OUTPUTS
CL PR D Q _{n-1} Q _{n+1}	Q _n Q _n
L H * * H L	H L
H L * * L H	L H
L L * * L H	L H
L L * * L L	L L
L L * * L L	L L

Δ: Level change
 •: No change
 *: Don't care

TC4099BP
8-Bit Addressable Latch

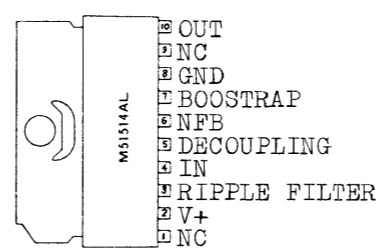


TRUTH TABLE

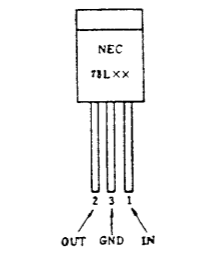
Write Disable	Reset	Addressed Latch	Unaddressed Latch
0	0	Data	Q _n *
0	1	Data	Reset†
1	0	Q _n *	Q _n *
1	1	Reset	Reset

* Q_n is previous state of latch.
 † Reset to zero state.

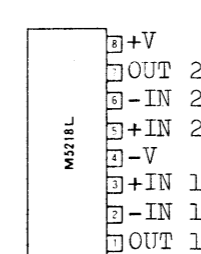
M51514AL



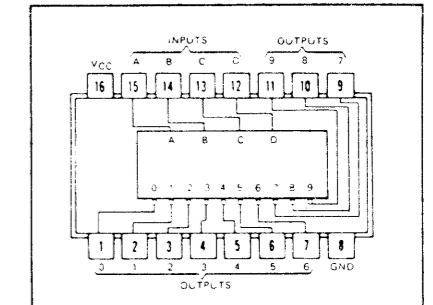
μPC78L
(μPC78L05, μPC78L15)



M5218L



74LS42
ONE-OF-TEN DECODER
(TOP VIEW)



FUNCTION TABLE

NO.	42A, 42L, 42LS42				ALL TYPES									
	D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H
1	L	L	L	L	H	L	H	H	H	H	H	H	H	H
2	L	L	L	H	H	L	H	H	H	H	H	H	H	H
3	L	L	H	L	H	H	L	H	H	H	H	H	H	H
4	L	H	L	L	H	H	H	L	H	H	H	H	H	H
5	L	H	L	H	H	H	H	H	L	H	H	H	H	H
6	L	H	H	L	H	H	H	H	H	L	H	H	H	H
7	L	H	H	H	H	H	H	H	H	H	L	H	H	H
8	H	L	L	L	H	H	H	H	H	H	H	L	H	H
9	H	L	L	H	H	H	H	H	H	H	H	H	L	H
INVALID	H	L	H	L	H	H	H	H	H	H	H	H	H	H
	H	H	L	L	H	H	H	H	H	H	H	H	H	H
	H	H	L	H	H	H	H	H	H	H	H	H	H	H
	H	H	H	L	H	H	H	H	H	H	H	H	H	H
	H	H	H	H	L	H	H	H	H	H	H	H	H	H

CIRCUIT DESCRIPTION

KEYBOARD & FUNCTION SWITCHES SCANNING

The CPU scans the keyboard and the function switches through matrix to know what keys or switches have been pressed and at what position switches are set. One side of the matrix connects to (and through) address decoder IC14 to data bus, the other to port 1 through inverters IC12 and IC13. To read the keyboard, for example — see table below, the CPU places number 0000₍₁₆₎ on the data bus (DB6-DB3). The address decoder IC14 reads the data bits and holds OUT 0 low. Whatever keys in the busbar section are depressed will place high on their connecting port 1 pins. Example, when C2 key has been pressed, Port 1-0 will be H. Next, the CPU holds 0001 on the data bus and reads the matrix output at port 1. And down to 1001.

Input Matrix

BUS 6543	PORT-1							
	0	1	2	3	4	5	6	7
0000	C2	C#	D	D#	E	F	F#	G
0001	G#	A	A#	B	C	C#	D	D#
0010	E	F	F#	G	G#	A	A#	B
0011	C4	C#	D	D#	E	F	F#	G
0100	G#	A(442)	A#	B	C	C#	D	D#
0101	E	F	F#	G	G#	A	A#	B
0110	C	C#	D	D#	E	F	F#	G
0111	G#	A	A#	B	C7	NOT USED	NOT USED	NOT USED
1000	NORMAL	BASS	CHORD	ARPEGGIO	TRANPOSE	HOLD	HARMONY	START/STOP
1001	ARPEGGIO VARIATION		RHYTHM SELECT		BASS VARIATION		NOT USED	

LOWER
UPPER

To read some function switches the CPU needs additional information or subsequent process as below.

TRANPOSE

Together with TRANPOSE, a key to which current scale is to be shifted must be identified by pressing new note higher than middle C on the keyboard.

HOLD. START/STOP

Although these switches are momentarily-closed type, each switch should cause CPU T0 or T1 pin to be kept at the following levels respectively during the mode.

T0 ... RHYTHM: STOP-H; START-L

T1 ... HOLD: OFF-H; ON-L

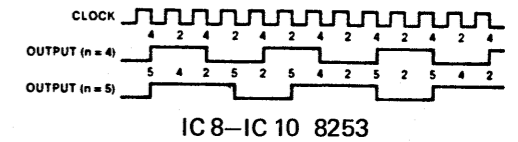
Every time the switch is pressed the CPU latches data into IC15, inverting the signal at the output pin.

Hold signal is sent to T1 via OR gate TR15, and in NORMAL mode, it is disabled by TR19 shorting to ground.

TONE GENERATION

Master oscillator consisting of TR5 and TR7 routes 2.54MHz signal to Programmable Interval Timers IC8-IC10, which being operated in MODE-3 (see Fig. right),

MODE 3: Square Wave Generator



output squarewave with frequency determined by a number "n".

The 8253 is organized as 3 independent 16-bit counters, each counter can divide input (CLOCK) by up to 65535 (FFFF). One of three 8253's is selected by CS and one of three counters by A0 and A1 inputs. The table below lists the assignment of counters to keyboard. When a key is pressed on the EP-11, the CPU refers to "frequency table" stored in on-chip ROM to obtain data corresponding to "n" for that key. Then, the CPU issues 16-bit "n" data on to the data bus in 8-bit x 2 format.

Exp. n = 2873 (B39), counter output = $\frac{2540000}{2873} \div 884\text{Hz}$.

		Normal	Auto Bass	Auto Chord	Auto Arpeggi
8253 IC10	0	Whole 8 notes	Lower	Lower	Lower
	1		4 notes	4 notes	4 notes
	2		(Rhythmic)	(Arpeggio)	
8253 IC9	1	8 notes	Upper	Upper	Upper
	2		4 notes	4 notes	4 notes
8253 IC8	0	8 notes			
	2		Auto Bass	Auto Bass	Auto Bass

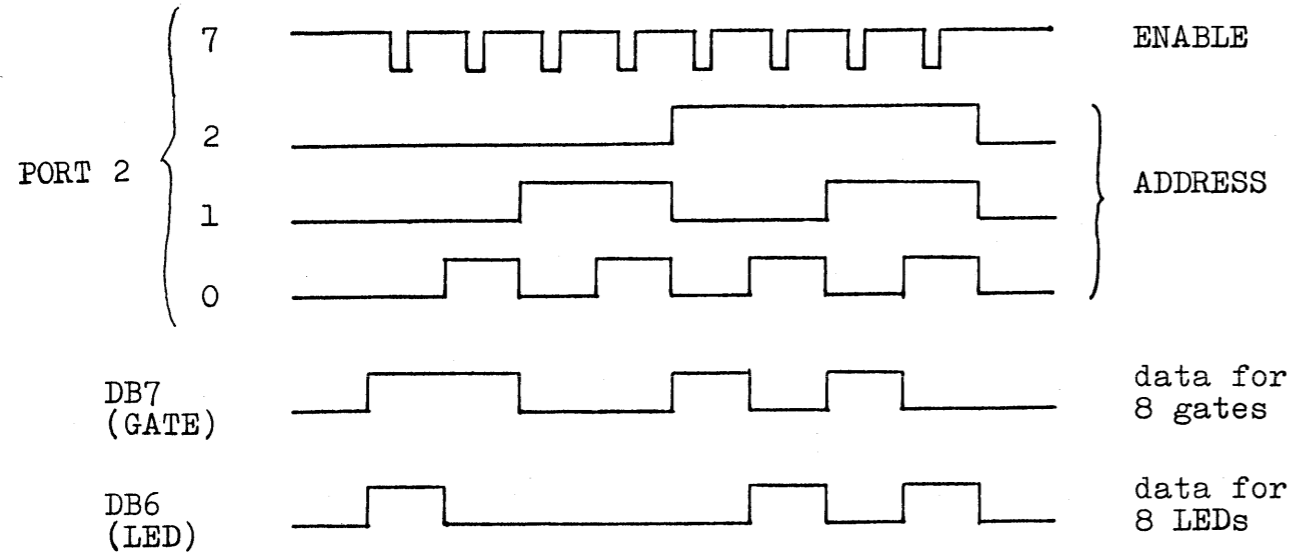
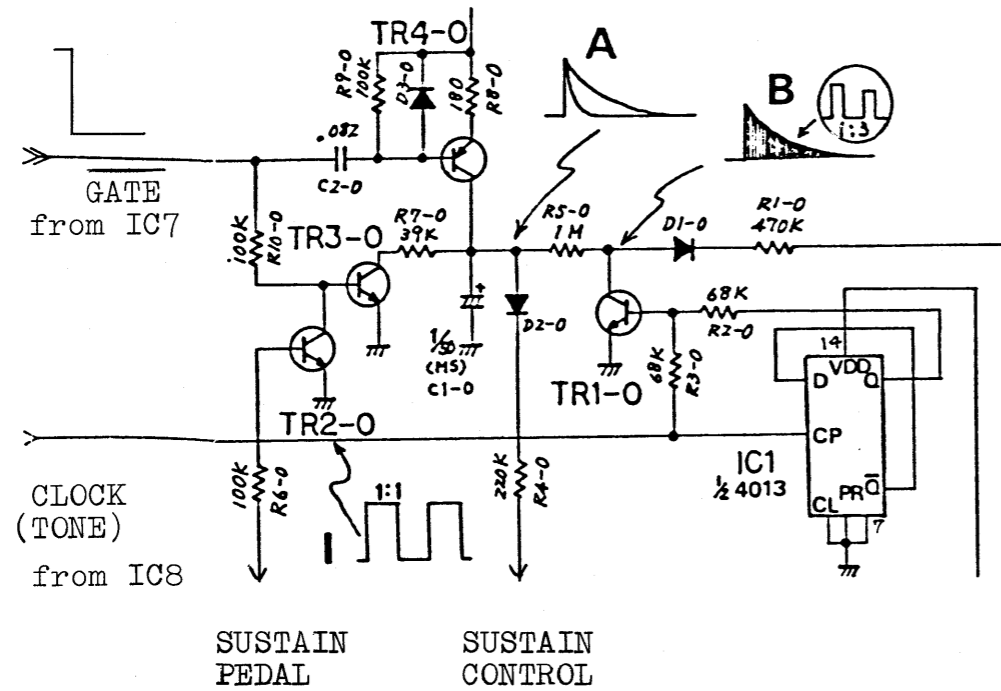
TONE GATE. ENVELOPE

Each output (CLOCK, 50% duty) from the counters in IC8-IC10 is frequency divided by flip-flop 1/2 IC1. Divided waveform is NORed with direct clock signal at the base of TR1 to produce 25% duty cycle squarewave, one-half the input signal in frequency, having waveform suited to bass and piano sounds.

Envelope to be chopped by this base input is developed and fed to TR1 collector as follows.

When key(s) is pressed, CPU transfers serial gate data for that key(s) — maximum 8 keys — through DB7 to D pin of IC7 which, with Enable input, holds output pin(s) (addressed by A, B and C inputs) low in sequence. Called GATE signal.

The negative edge of GATE signal is differentiated by C2 x R9 and forward biases TR4, bringing C1 into full charge. Upon gate OFF, C1 discharges through TR3 which, however, with SUSTAIN ON, is cut off by a ground placed at base through conducting TR2. During Sustain ON C1 discharge rate is controlled by a voltage determined by SUSTAIN control setting.



LED LIGHTING

The function of Latch IC15 is essentially the same as that of Gate latch except the data is supplied from DB6.

RHYTHM TRIGGER. TEMPO LED LIGHTING. BASS GATE. DIN START/STOP

The 8 bits on the data bus, each bit distinctly represents individual data, are latched into independent flip-flops in IC20 and IC21, and from where outputted at the same time.

TEMPO CLOCK OSCILLATOR

The Rhythm clock oscillator is comprised of sawtooth generator (IC12 and TR13) and flip-flop (1/2 IC6) which provides for 24 clocks/quarter note whenever the EP-11 is on. The clock is reset upon "rhythm start ON" and resumes after 5-10ms, allowing for positive synchronization with external instrument being controlled by the EP-11 via DIN socket.

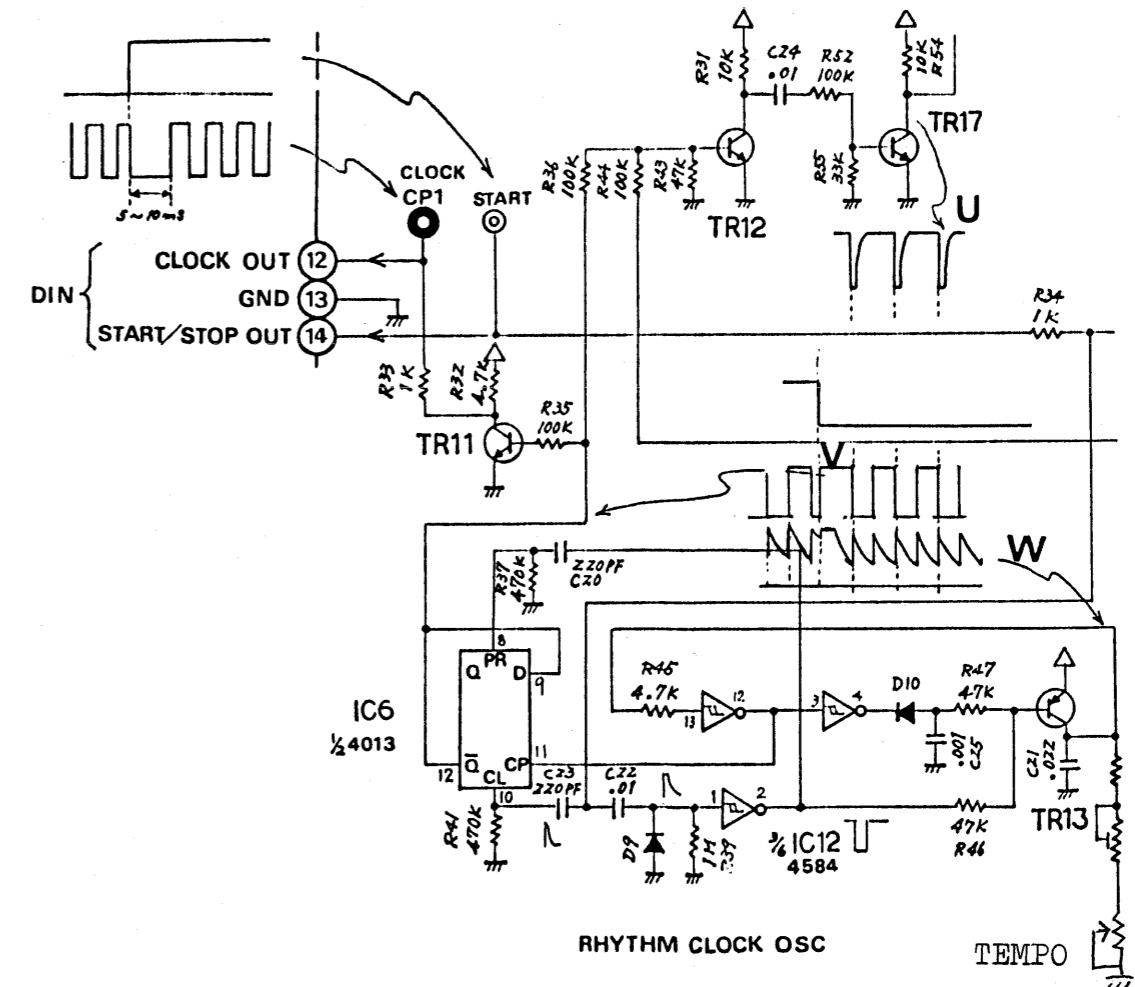
When START/STOP is pressed for running, a low from $\overline{Q2}$ of IC21 is distributed to (a) base of TR12 (discussed later), and TR14 from there (inverted to high) to (b) DIN socket and (c) a node to C22 and C23.

C23 differentiates positive edge of start signal and resets the flip-flop with the pulse. Similarly, with a positive pulse via C22, IC12 swings pin 2 to negative to fire TR13 which in turn rapidly charges C21, keeping pin 13 outside a threshold, thus causing generation to cease for 5-10ms (C22 x R39 time constant).

Rhythm clock is also used to control the EP-11 rhythm tempo and is accepted by the CPU through \overline{INT} pin. However, to reduce interference with the CPU's other operations, it is processed as follows before being fed to \overline{INT} pin.

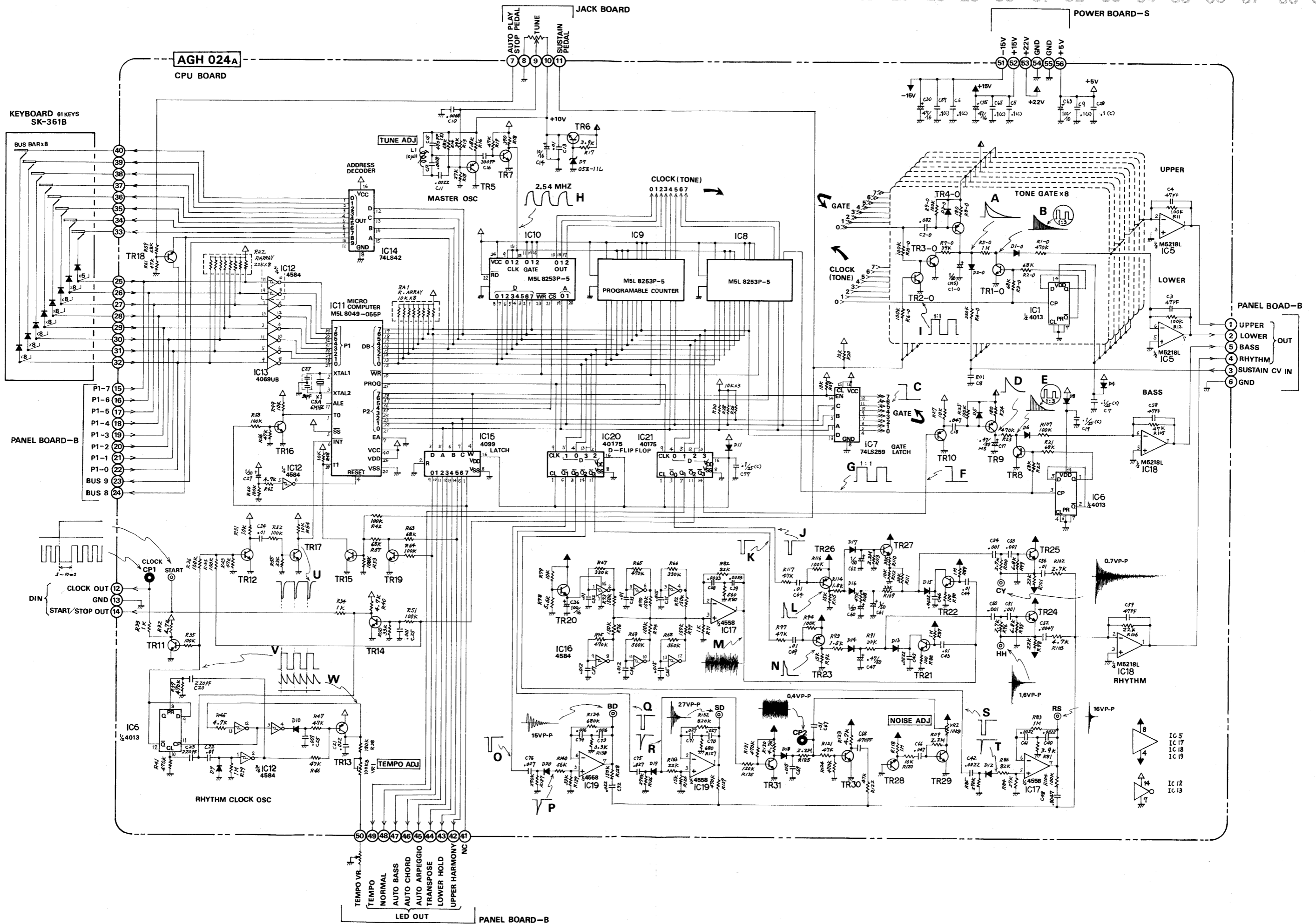
(a) Clock is ANDed with Start signal from $\overline{Q2}$ pin of IC21 at TR12 whose 50% squarewave is differentiated by C24 and converted to 1ms negative going pulse through TR17.

(b) Without Start signal, clock is not allowed to pass through TR12.



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41

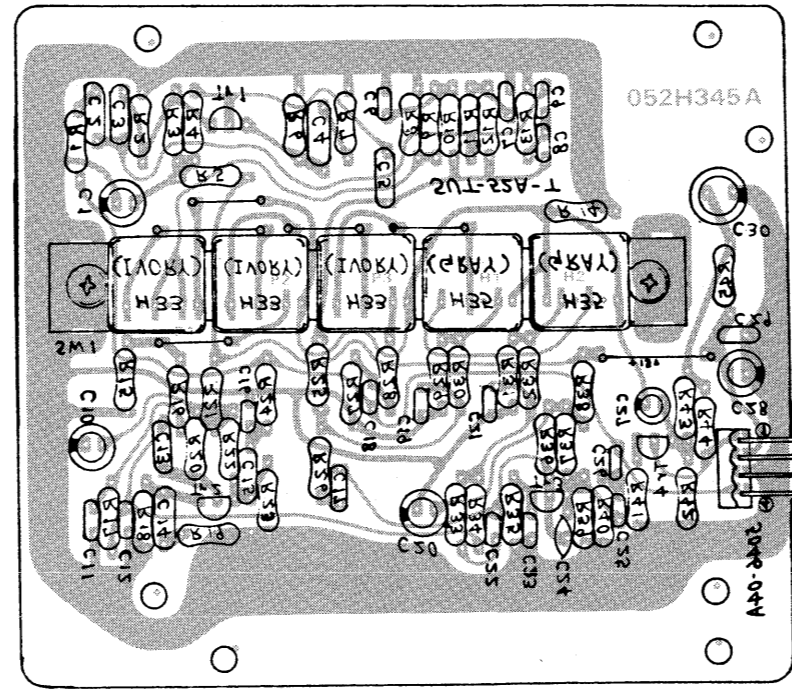
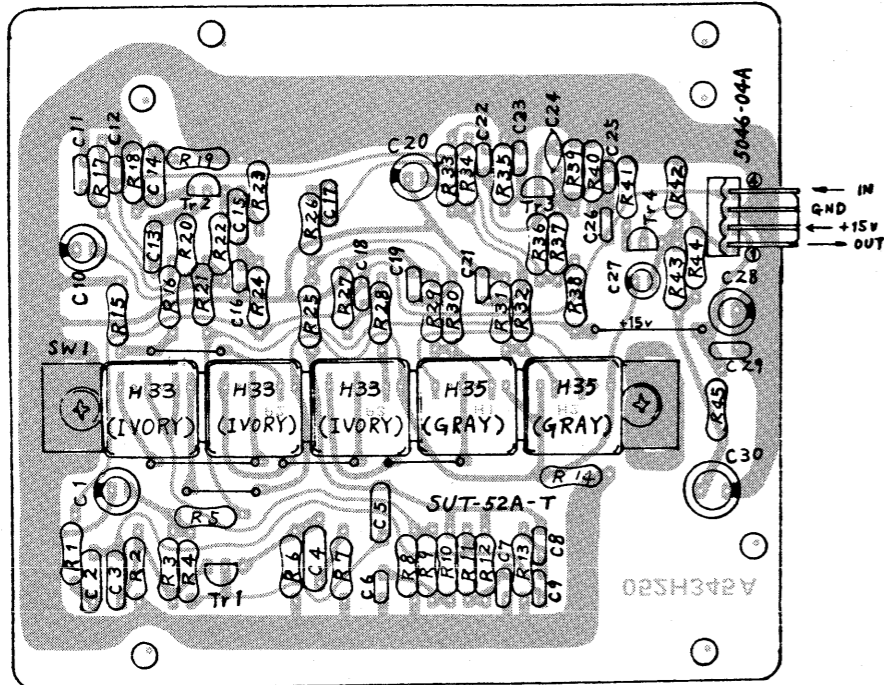
A B C D E F G H I J K L M N O P Q R S T U V



PANEL BOARD-A OPH157A(149H157A)(pcb 052H345A)

Component side

Foil side

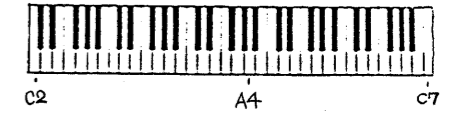


○ : 2SC1815-GR

ADJUSTMENTS

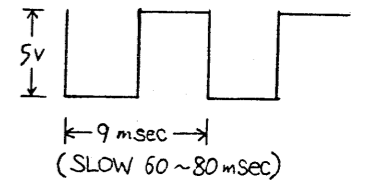
TUNE

1. Set TUNE on rear panel at center.
2. Adjust L1 on CPU BOARD for 442Hz with A4 key holding down.



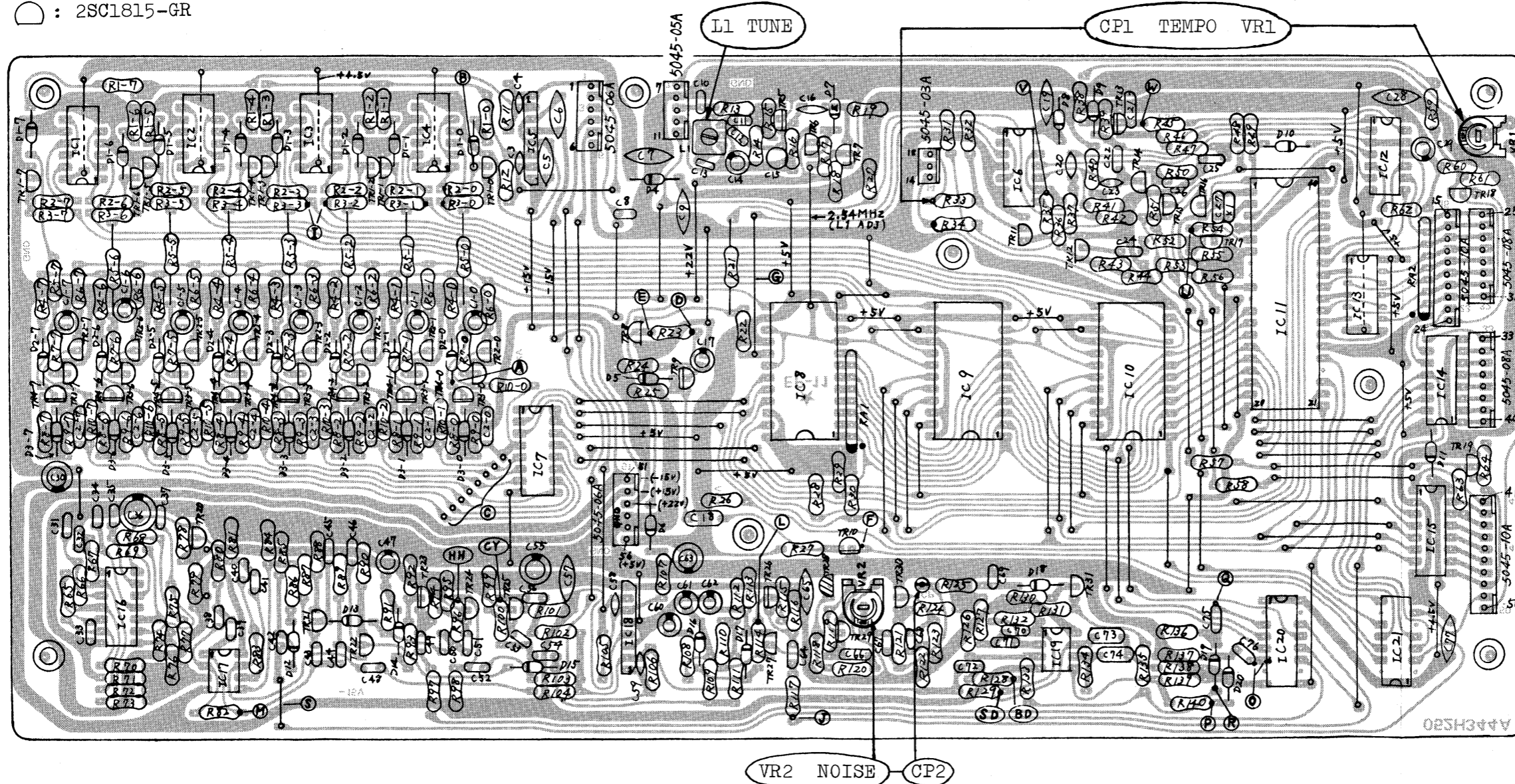
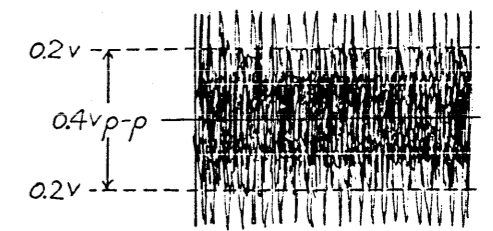
RHYTHM TEMPO

1. Set TEMPO knob to FAST.
2. Connect scope to CP1.
3. Adjust VR1 for 9ms/cycle. With TEMPO set at SLOW, confirm that the period becomes 60-80ms.
4. Also confirm that waveform appears 5-10ms after a key has been pressed.



NOISE

1. Connect scope to CP2.
2. Adjust VR2 for:



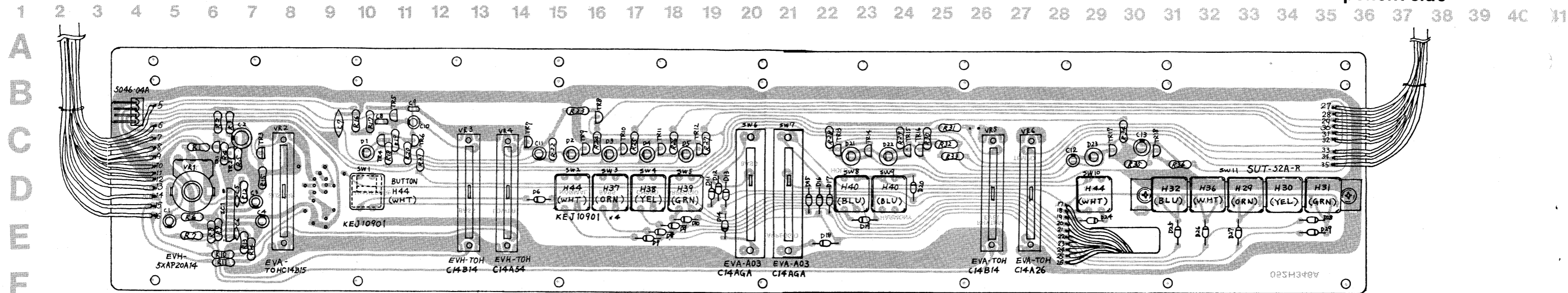
**CPU BOARD
AGH024A
(144H024A)
(pcb 052H344A)**

- IC1, 2, 3, 4, 6: 4013
- IC5, 18 : M5218L
- IC7 : 74LS259
- IC8, 9, 10 : M5L8253-5
- IC11 : M5L8049-055P
- IC12, 16 : 4584
- IC13 : 4069U
- IC14 : 74LS42
- IC15 : 4099
- IC17, 19 : 4558
- IC20, 21 : 40175

- : 2SC1815-GR
- : 2SA1015-GR
- ▨ : 2SC945 noise, selected
- ⊖ : 1S2473

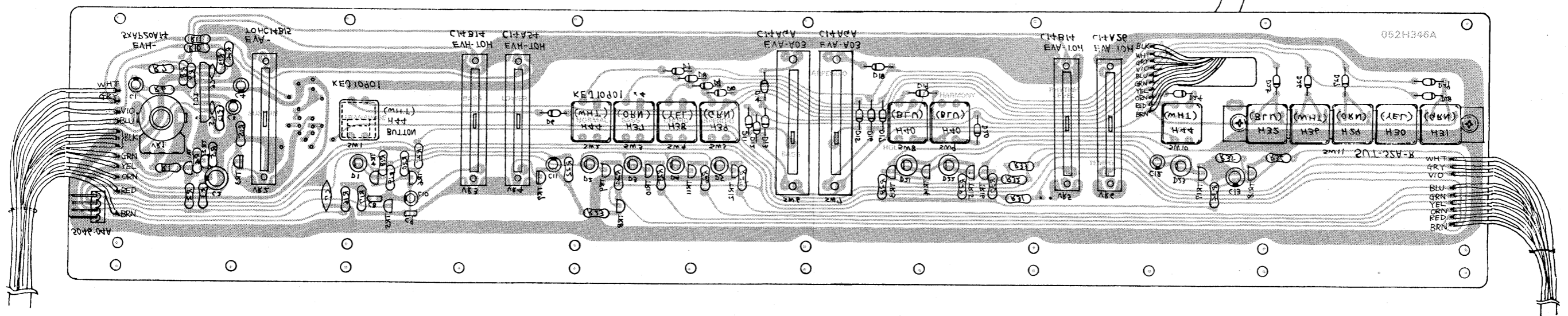
PANEL BOARD B OPH158A(149H158A)(pcb 052H346A)

Component side



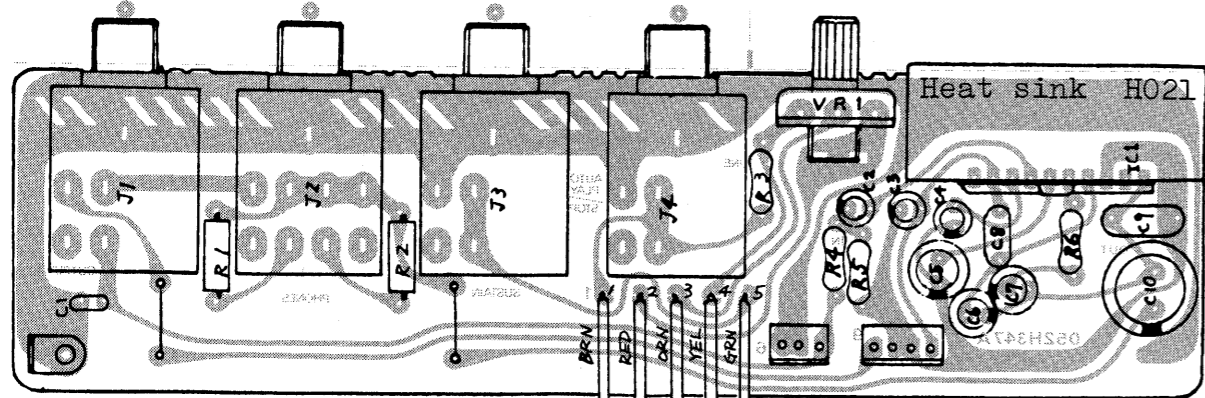
: 2SC1815-GR
 : 2SA1015-GR
 : 1S2473
 : TLR-124

Foil side

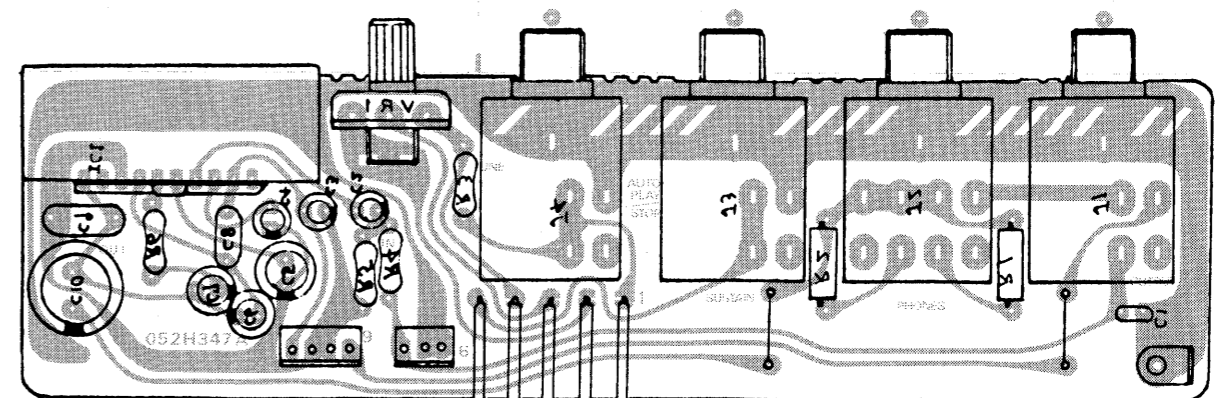


JACK BOARD OPH159A(149H159A)(pcb 052H347A)

HLJ-0259-01-030 HLJ-0259-01-010 HLJ-0259-01-030 HLJ-0259-01-030 EVH-07A S10 B15



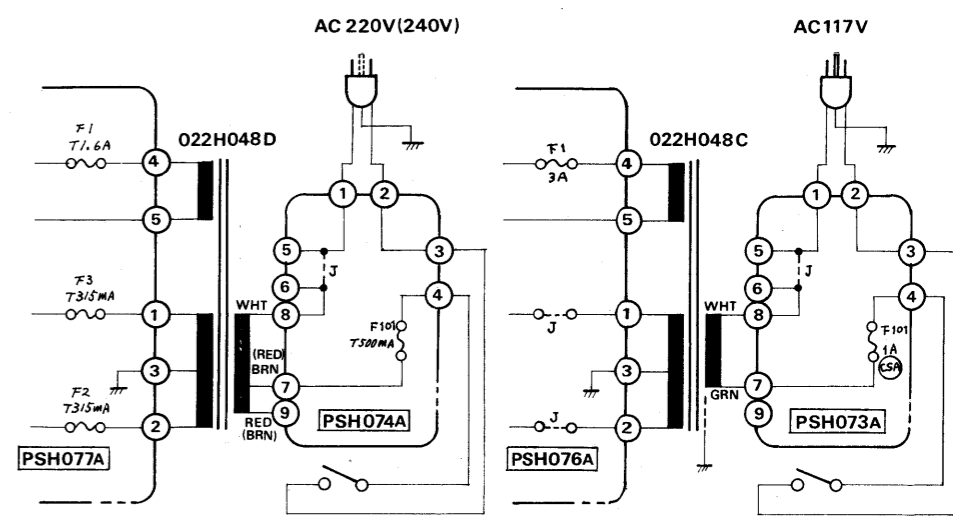
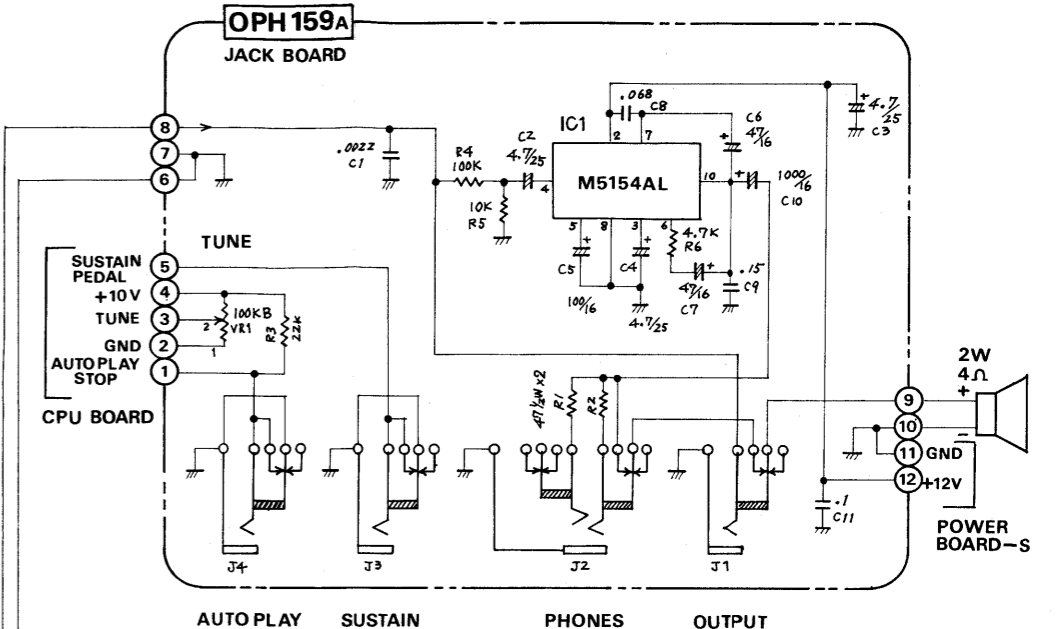
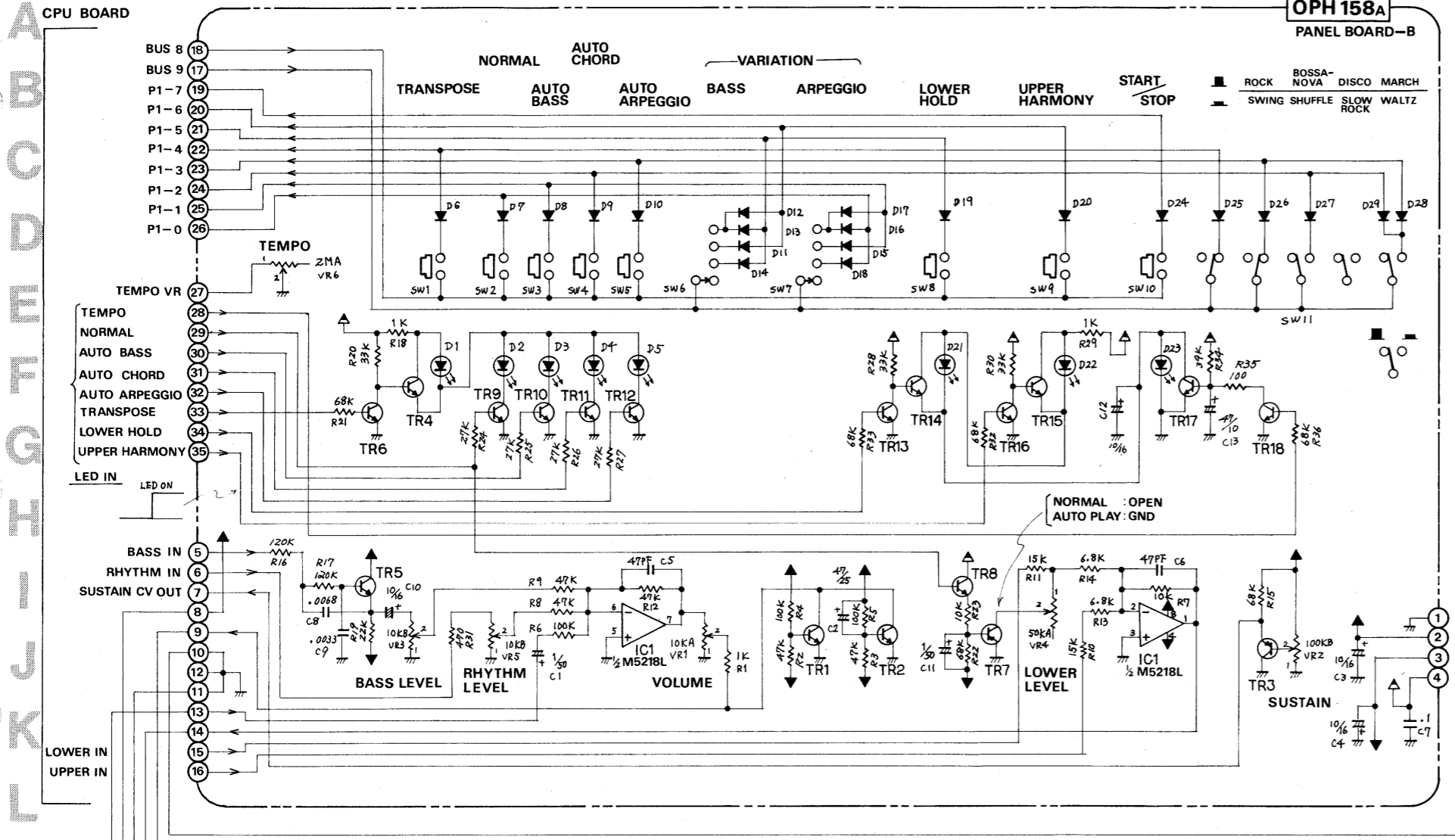
Component side



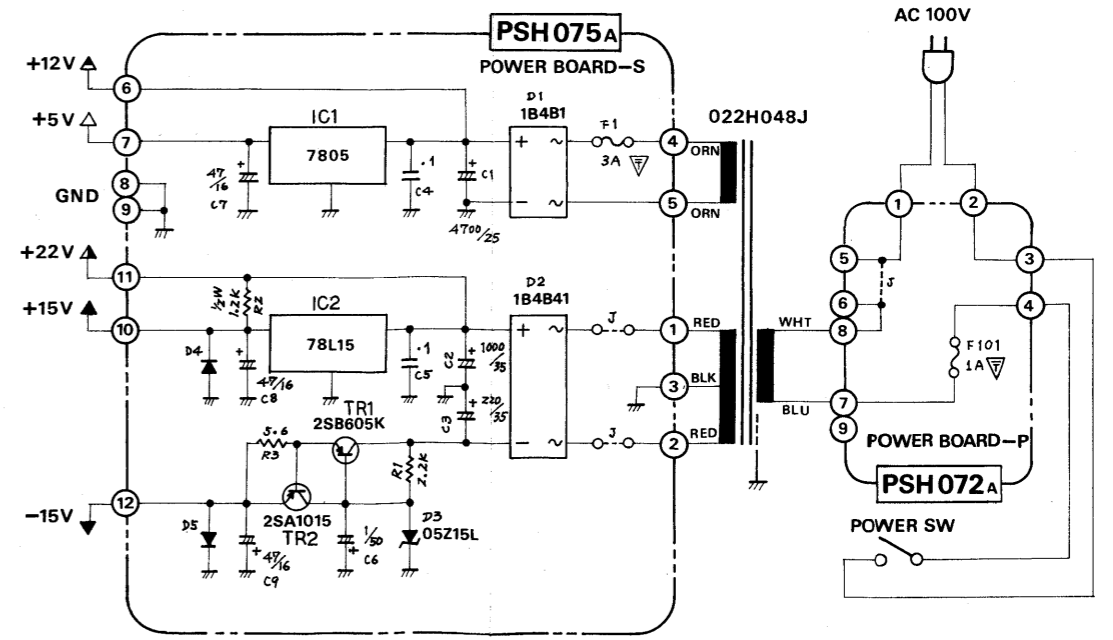
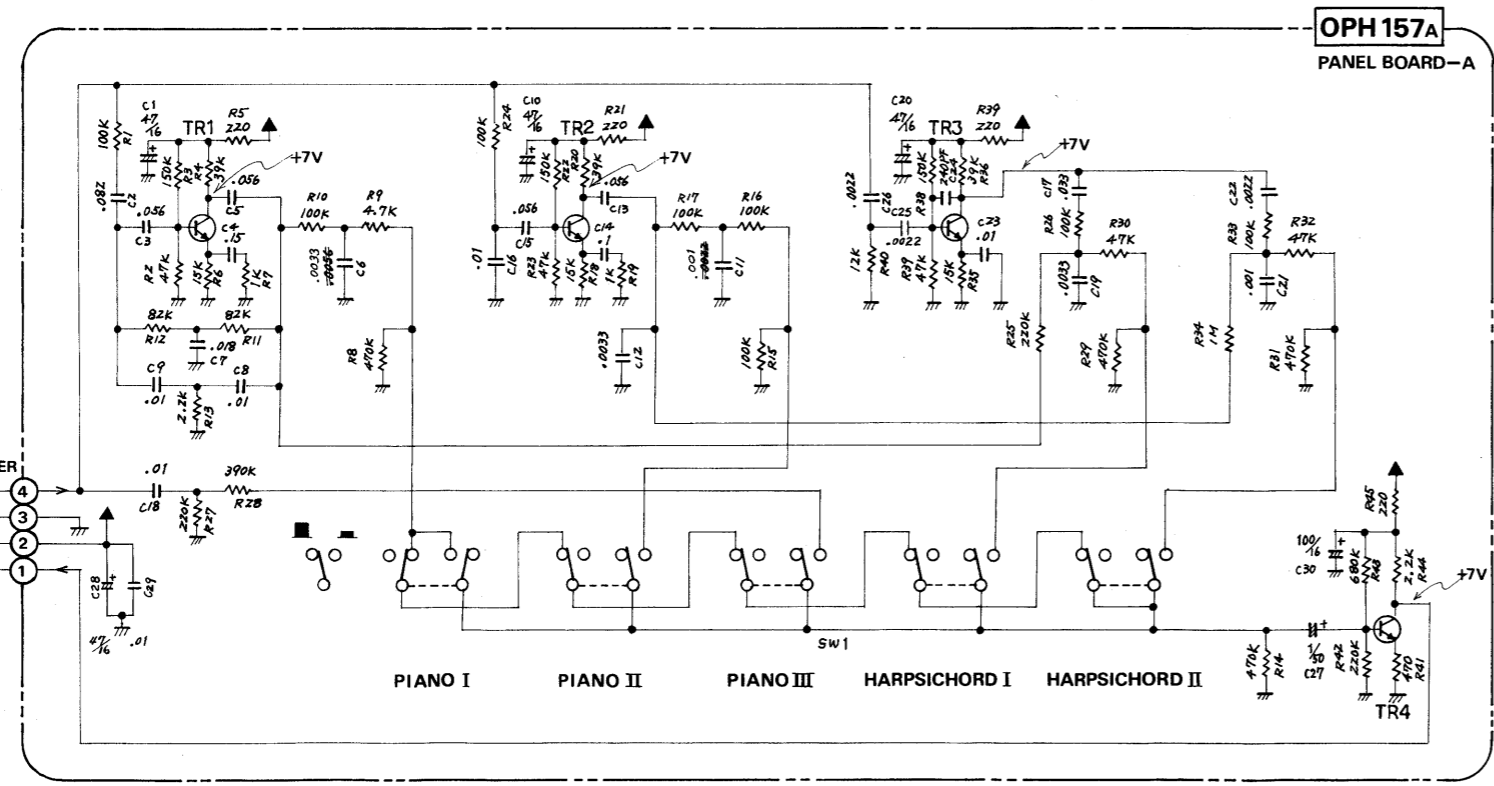
+12V GND SP sig in GND GND

Foil side

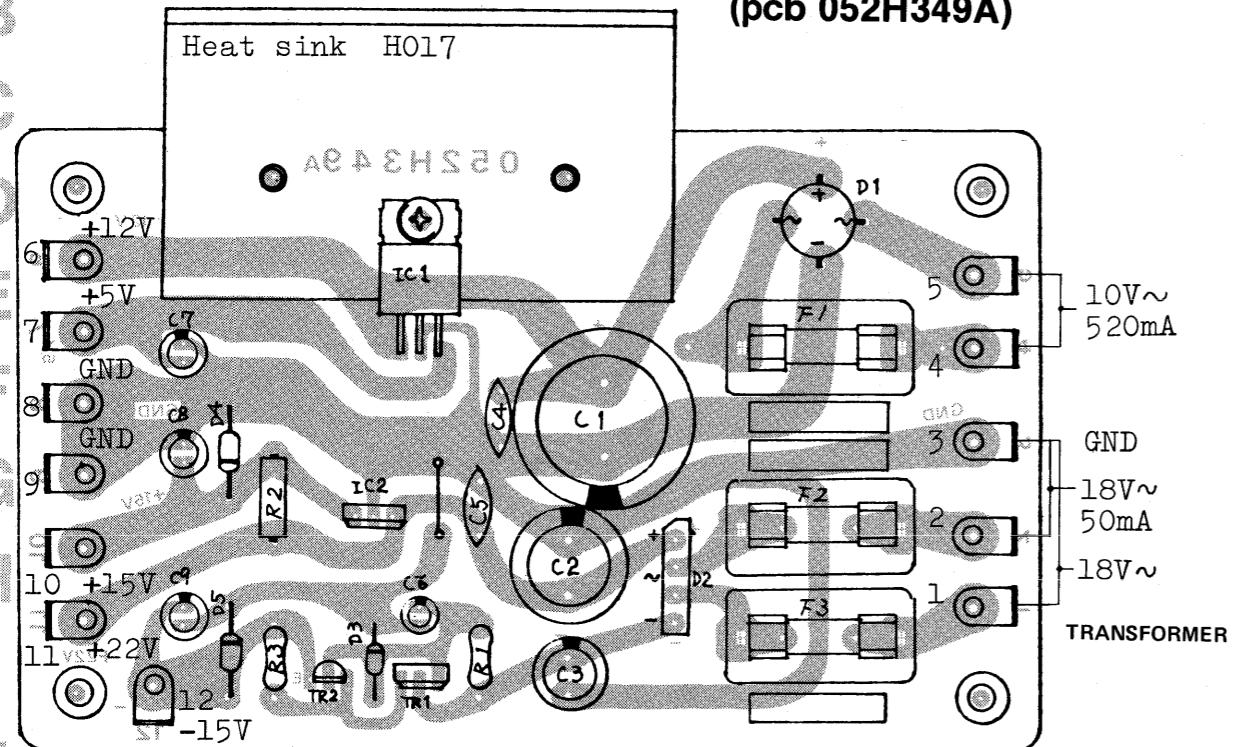
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41



PT secondary ratings:
 21VDC x 2 @ 50mA 470μF IN
 12VDC @ 520mA 4700μF IN



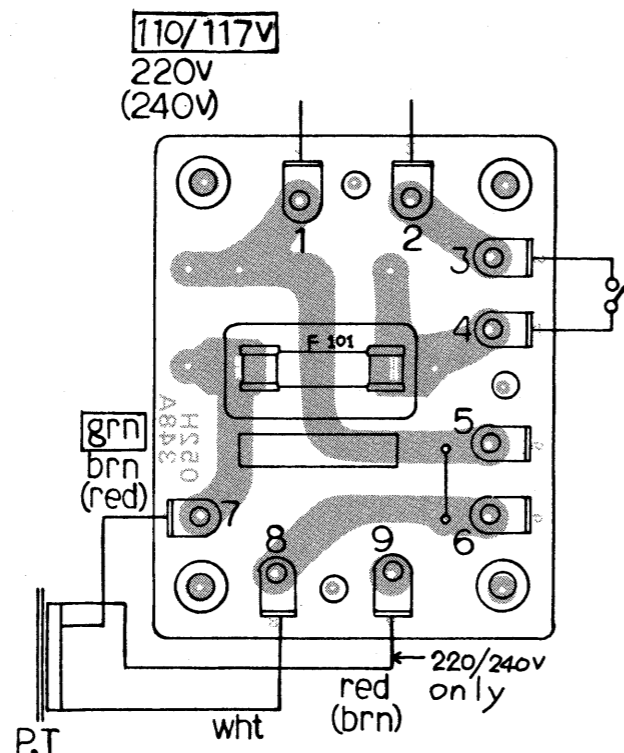
**POWER BOARD-S PSH057A(146H057A)100V
PSH076A(146H076)117V PSH077A(146H077A)220/240V
(pcb 052H349A)**



IC1: TA78005 IC2: TA78L15 TR1: 2SB605-K TR2: 2SA1015-GR

	F U S E			FUSE
	100V	117V	220/240V	
				HOLDER
F101	MGP-1A	MGP-1A CSA	SEMKO T500mA	TF-758
F1	MGP-3A	MGP-3A CSA	SEMKO T1.6A	220/ 240V only
F2, F3	jumper	jumper	SEMKO T315mA	

**POWER BOARD-P
PSH072A(146H072)100V
PSH073A(146H073)117V
PSH074A(146H074)220/240V
(pcb 052H348A)**



PARTS LIST

KEYBOARD

- 004H005 SK361B
- CASE**
- 081H245 Cabinet H245
- 072H104C Panel H104C
- 072H105 Blind H105
- 065H093 Grille H093
- 099H043 Baffle cloth H043
- 085H040 Baffle board H040
- 22410510 Speaker S10P18
- 092H012 Music rack H012
- 066H023/024 Side panel H023-L/024-R
- 068H038 Rubber cap H038 side panel
- 064H118 Holder H118
- 064H119 Holder H119
- Rubber foot G-7

KNOB

- 016H045 H045 rotary
- 016H053 H053 slide

BUTTON (auto rhythm)

- 016H029 H029 orange
- 016H030 H030 yellow
- 016H031 H031 green
- 016H032 H032 blue
- 016H036 H036 white

(auto play)

- 016H037 H037 orange
- 016H038 H038 yellow
- 016H039 H039 green
- 016H040 H040 blue
- 016H044 H044 white

(tone selector)

- 016H033 H033 ivory
- 016H035 H035 gray

SWITCH

- 13149102 1801-0121 power
- 13169605 KEJ10901
- 13129526 SUT-52A-R
- 13129527 SUT-52A-T tone selector
- 13159505 EVA-A03C14AGA slide, vari.

JACK

- 13449211 HLJ-0259-01-030 mono
- 13449210 HLJ-0259-01-010 stereo
- 13429608 DIN connector TCS0250-1-1

COIL, TRANSFORMER

- 12449221 Coil 40M-067-018
- 022H048J PT-H048J 100V
- 022H048C PT-H048C 117V
- 022H048D PT-H048D 220/240V

PCB ASSEMBLY

- 149H157A PANEL BOARD-A OPH157A (pcb 052H345A)
- 149H158A PANEL BOARD-B OPH158A (pcb 052H346A)
- 149H159A JACK BOARD OPH159A (pcb 052H347A)
- 144H024A CPU BOARD AGH024A (pcb 052H344A)
- 146H072A POWER BOARD-P PSH072A (pcb 052H348A) 100V
- 146H073A POWER BOARD-P PSH073A (pcb 052H348A) 117V
- 146H074A POWER BOARD-P PSH074A (pcb 052H348A) 220/240V
- 146H075A POWER BOARD-S PSH075A (pcb 052H349A) 100V
- 146H076A POWER BOARD-S PSH076A (pcb 052H349A) 117V
- 146H077A POWER BOARD-S PSH077A (pcb 052H349A) 220/240V

IC

- 1517921B0 M5L8049-055P Single-Chip 8-Bit Microcomputer
- 15179110 8253 Programmable Interval Timer
- 15169310 74LS42 One-Of-Ten Decoder
- 15169330 74LS259 8-Bit Addressable Latches
- 15159116 4069UB Hex Inverter
- 15159120 4099B 8-Bit Addressable Latch
- 15159121 40175B Quad Type D Flip Flop
- 15159303HO HD14584 Hex Schmitt Trigger
- 15159105 4013B Dual Type D Flip Flop
- 15189105 4558 Dual OP Amp
- 15189136B0 M5218L OP Amp
- 15199507B0 M51514AL Power Amp
- 15199106 7805 Three Terminal Voltage Regulator
- 15199114 78L15 Three Terminal Voltage Regulator

TRANSISTOR

- 15119113 2SA1015-GR
- 15129114 2SC1815-GR
- 151291080A 2SC945-P (NZ, selected)
- 15119601 2SB605-K

DIODE

- 15019103 1S-2473
- 15019208 1SR35-200
- 15019243 1B4B1 rectifier stack
- 15019245 1B4B41 rectifier stack
- 15019619 05Z-15L zener
- 15029103 TLR-124 LED

RESISTOR

- 13829821 RMB-103K 10k x 8 array
- 13910105 RMB-223K 22k x 8 array

CAPACITOR

- 13569154 CQ09S-1H470J05 470pF polystyrene
- 13639261M0 ECEA50M010 1uF/50V electro. M-type
- 13639201M0 ECEA50MR47 0.47uF/50V electro. M-type
- 13659213M0 ECET25R472SW 4700uF/25V

POTENTIOMETER

- 13219402 EVH-OTAS10B15 100kB tune
- 13219240 EVH-5XAP20A14 10kA volume

(Slide)

- 13339411 EVA-TOHC14B15 100kB sustain
- 13339409 EVA-TOHC14B14 10kB bass level, rhythm level
- 13339410 EVA-TOHC14A54 50kA lower level
- 13339412 EVA-TOHC14A26 2MA tempo

(Trimmer)

- 13299129 EVN-42JAA00B14 10kB
- 13299130 EVN-42JAA00B15 100kB

FUSE

- 12559133 MGP-1A prim. 100V
- 12559311 MGP-1A CSA prim. 117V
- 12559137 MGP-3A sec. 100V
- 12559314 MGP-3A CSA sec. 117V
- 12559511 SEMKO T500mA prim. 220/240V
- 12559509 SEMKO T315mA sec. 220/240V
- 12559521 SEMKO T1.6A sec. 220/240V
- 12559519 Fuse holder TF-758

OTHERS

- 048H017 Heat sink HO17
- 048H021A Heat sink HO21
- 12389800 Ceramic resonator CSA6MHz and paired CSC30pF

Page	WRONG 誤 →	CORRECT 正
1	* SWITCH 1801-0121 (12149102) →	SWITCH 1801-0121 (13149102)

Feb.3,1982

EP-11

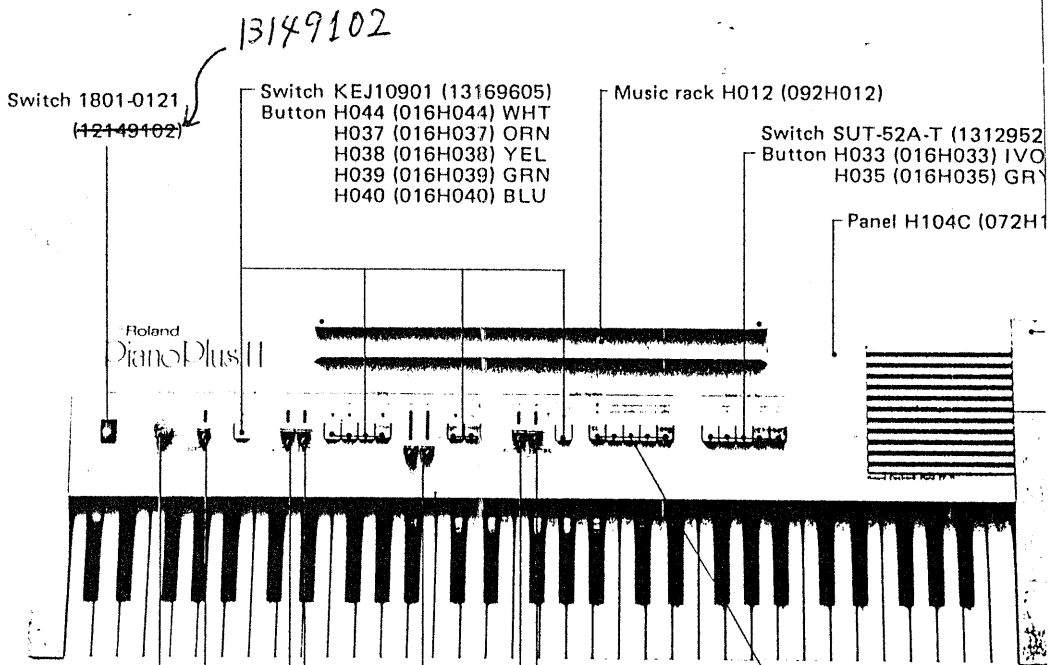
SERVICE NOTES

First Edition

SPECIFICATIONS

Keyboard 61 keys, 5 octaves
 Speaker 10 cm, 2 watts
 Headphone Jack 8 ohms, stereo
 Tunable range ±50 cents

Power Consumption ... 15 v
 Dimensions 912
 Weight 9.2



* Please amend all existing service notes as above.
 * 該当サービスノートを上記のように修正して下さい。