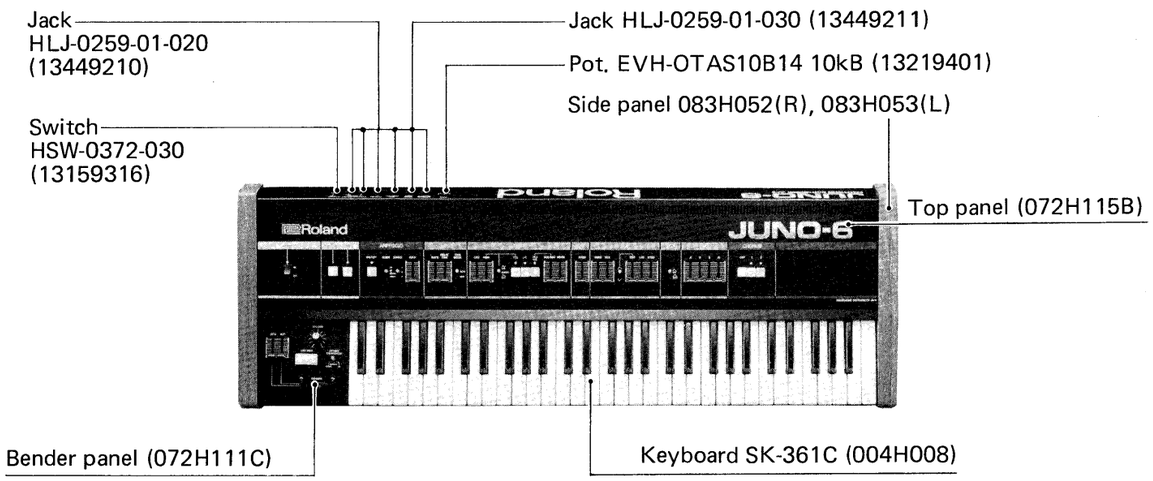
JU-6 SERVICE NOTES

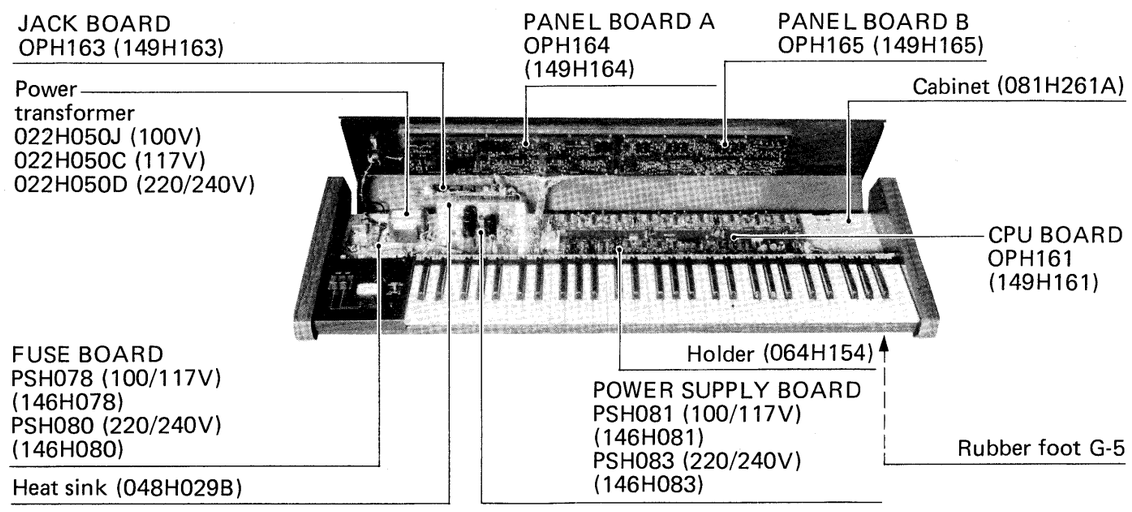
First Edition

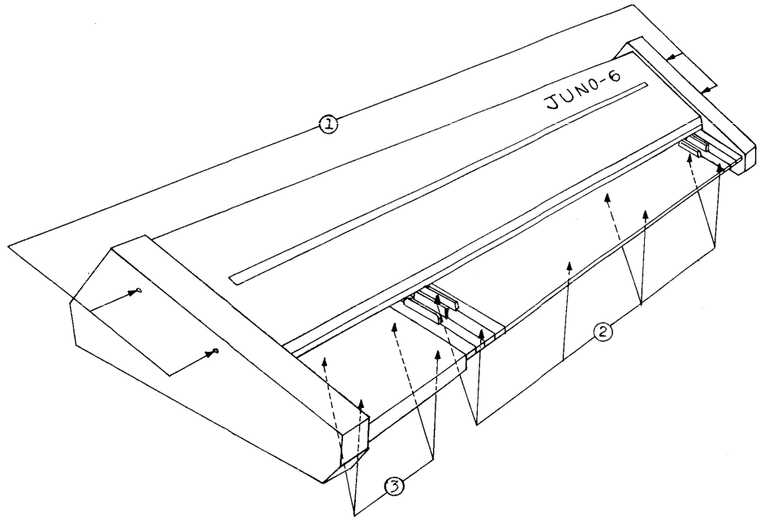
SPECIFICATIONS

Keyboard: 61 Keys (5 octaves) C2-C7
VCF: Cutoff frequency (4Hz-40kHz)
ENV modulation (10 octaves max.)
LFO modulation (6 octaves max.)
Keyboard follow (0-100%)
ENV: Attack time (1ms-3s)
Decay time (2ms-12s)
Sustain level (0-100%)
Release time (2ms-12s)
LFO: Rate (0.3Hz-20Hz)
Delay (0-2.5s)

Arpeggio: Rate (1.5Hz-50Hz)
Bender control range: DCO (±7 keys max.)
VCF (±4 octaves max.)
Output level: L(−30dBm)/M(−15dBm)/H(0dBm)
Output: (mono, stereo)
Tune: (±50cents)
Dimension: 1060(W) x 113(H) x 378(D) mm
Weight: 11kg
Power: 25W



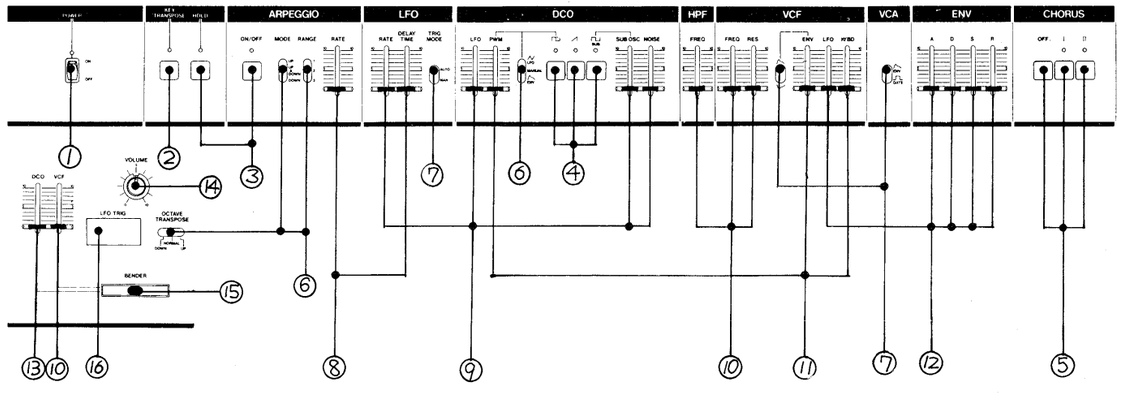




① : Top panel removal screws
Joint 3 x 35mm (116H008)

② : Keyboard removal screws
4 x 15mm truss Fe Br

③ : Bender panel removal screws
TP 3 x 15mm pan Fe Br



1	Switch	1801-0121 (13149102)	
2 3 4 5	Switch Switch Switch Switch	SUT11A-1 (13129321) SUT11A-2 (13129322) SUT32A-1 (13129531) SUT32A-2 (13129532)	Button orange (016H029) yellow (016H030) white (016H036)
6 7	Switch Switch	SLE-623-18P (13139135) SLE-622-18P (13139136)	
8 9 10 11 12 13	Pot. Pot. Pot. Pot. Pot. Pot.	EVA-TOHC14A16 1MA (13339418) EVA-TOHC14A54 50kA (13339410) EVA-TOHC14B54 50kB (13339419) EVA-TOHC14B14 10kB (13339409) EVA-TOHC14B15 100kB (13339411) EVA-TOHC14A14 10kA (13339416)	Knob (016H004)
14	Pot.	EWJ-EJAP20B14 10kB x 2 (13219759)	Knob (22470128)
15	Bender assy	PB-4 (029-022)	
16	Switch w/key top See parts list	KEH10003 (13129717)	
	All LEDs	TLR124 (15029103)	

PARTS LIST

KEYBOARD

004H008	SK-361C	(61 Keys)

CASE

081H261A	Cabinet
083H052	Side panel (right)
083H053	Side panel (left)
072H115B	Top panel
072H111C	Bender panel
064H154	Holder
	Rubber foot G-5

KNOB, BUTTON

22470128	Knob
016H004	Knob
016H029	Button (orange)
016H030	Button (yellow)
016H036	Button (white)
12479703	KT3-2 (Key top) (ivory)

POWER SWITCH

1314910	1801-0121

PUSH SWITCH

13129321	SUT11A-1
13129322	SUT11A-2
13129531	SUT32A-1
13129532	SUT32A-2

LEVER SWITCH

13139136	SLE-622-18P
13139135	SLE-623-18P

SLIDE SWITCH

13159316	HSW-0372-01-030

KEY SWITCH UNIT

13129717	KEH 10003 w/key top KT3-2
13129714	KEH 10903 switch proper
13129719	Guide pin CHC32801A
22269208	Cushion rubber CK42602A

PCB

149H161B	CPU board OPH161B (etch mask 052H370B)
149H164A	PANEL board A OPH164A (etch mask 052H372A)
149H165A	PANEL board B OPH165A (etch mask 052H373A)
149H162A	BENDER board OPH162A (etch mask 052H371A)
149H163A	JACK board OPH163A (etch mask 052H374A)
146H081A	POWER SUPLYboard PSH081A (100/117V)
146H083A	POWER SUPPLY board PSH083A (220/240V) (etch mask 052H369A)
146H078A	FUSE board PSH078A (100/117V)
146H080A	FUSE board PSH080A (220/240V) (etch mask 052H348A)

JACK

13449211	HLJ-0259-01-030 (mono)
13449210	HLJ-0259-01-020 (stereo)

FUSE

12559331	GGS-0.8A prim. (100V/117V)
12559511	CEE T500mA prim. (220/240V)
12559513	CEE T1.0A sec. (220/240V)

BENDER UNIT

029-022	PB-4

POSISTOR

15229909	ERS-B33G561	560Ω
15229910	ERS-B33G122	1.2KΩ

RESISTOR ARRAY

13829821	RGDS8 x 103K	10K x 8
13910113	RGDS4 x 103K	10K x 4
13910114	RGDS4 x 223K	22K x 4

POTENTIOMETER

Slider

13339416	EVA-TOHC14A14	10kA
13339409	EVA-TOHC14B14	10kB
13339410	EVA-TOHC14A54	50kA
13339419	EVA-TOHC14B54	50kB
13339411	EVA-TOHC14B15	100kB
13339418	EVA-TOHC14A16	1MA

Rotary

13219759	EWJ-EJAP20B14	10kB x 2
13219401	EVH-OTAS10B14	10kB

Trimmer

13299134	RVF8P01-502	5kB
13299135	RVF8P01-103	10kB
13299136	RVF8P01-503	50kB
13299137	RVF8P01-104	100kB
13299553	RVS0707V101-102M	1kB
13299554	RVS0707V101-502M	5kB

COIL

022A018	S167999	37μH

TRANSISTOR

15199113	2SA1015-GR
15119805	2SB834-O
15129114	2SC1815-GR
15129108OA	2SC945 (NZ-noise generator)
15129130	2SC1583-F
15129136	2SC2878-A or B
15129117	2SC1923
15129128	2SC752-Y

DIODE

15019103	1S2473
15029103	TLR124 (LED)
15019249	KV1226X (Varicap)
15019245	1B4B41
15019243	1B4B1

POWER TRANSFORMER

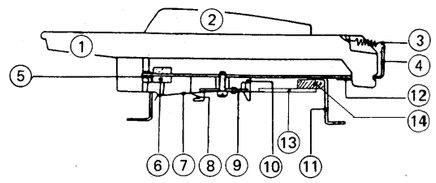
022H050J	(100V)
022H050C	(117V)
022H050D	(220/240V)

IC

15179135	μPD8049C-238	CPU
15159113HO	HD14051BP	Single 8 CH Multiplexer
15159104HO	HD4011BP	Quadruple 2-Input NAND Gate
15159105HO	HD14013BP	Dual D-type Flip-Flop
15159112	TC4049BP	Hex Inverter/Buffer
15159116TO	TC4069UBP	Hex Inverter
15159120TO	TC4099BP	
15179110MO	μPD8253C	Triple Programmable Interval Timers
15229801	IR3109	VCF
15229807	IR3R01	ADSR
15229802	BA662 A or B	VCA
15169117HO	HD7407	Hex Buffers/Drivers
15169310HO	HD74LS42	BCO-TO-Decimal Decoder
15189118HO	TL082	OP Amp
15189142	TA75558S	OP Amp
15189143	TA75559S	OP Amp
15189105	μPC4558C	OP Amp
15189136BO	M5218L	OP Amp
020-215	MN3009	BBD
020-224	MN3101	BBD Driver
15199106TO	μPC7805	5V Voltage Regulator
15199110TO	TA7179P	±15V Voltage Regulator

OTHERS

048H029B	Heat sink	
12389804	Ceramic resonator	CSA11MHz with paired CSC300K
12199515	Fuse holder	TF-758



KEYBOARD PARTS
SK-361C (004H008)

NO	PART NO	DESCRIPTION	
1	106H026	Natural key	C F
1	106H027	Natural key	D
1	106H028	Natural key	E B
1	106H029	Natural key	G
1	106H030	Natural key	A
1	106H031	Natural key	C' F'
2	106H032	Sharp key	black
3	070H029	Key spring	H29
4	061H086A	Chassis	H86A
5	068H004	Guide bushing	H4
6	101H141	Level felt	H141
7	071H044	Contact leaf	H44
8	071H051	Busbar 8P	H51
	071H054	Busbar 5P	H54
9	043H007	Switch unit 12P	H7
	043H008	Switch unit 13P	H8
10	104H029	Busbar holder	H29
11	062H024	Chassis bracket	H24
12	098H006	Key stopper	H6
13	052H283-5	Matrix board	H283-5
14	107H059	Cushion	H59

NOTE:
Although Roland has employed 8-10 digit coding, old ones (6 digit and 6 digit with H) are still applied to some parts.

JUNO-6 Block

PANEL BOARD B
JACK BOARD
Phones
Cutoff Freq.
VR3
SW4 SW5
OFF I II
HPF
IC1
Chorus
IC2, IC5
BENDER
Output
Noise Level
VR7
IC4, IC13
Noise Gen.
DCO LFO
VR4
TUNE
VR1
VR6
SUB OSC LEVEL
SUB ON/OFF
SW10
PWM ON/OFF
SW8
ON/OFF
SW9
Bender
VR5
VCF SENS
DCO SENS
BENDER BOARD
VCF
PANEL B
DCO CV
IC 3 9 15
Flip Flop
SUB
TR3
SW
IC 2,5,8,11,14,17
VCF
IC 19,22,24,25
VCA
IC 23
SUMMING
Master Clock CV
Master Clock OSC
TR58-63
1.902 MHz clock
IC 4 7 10 16 TR5
Sawtooth Shaper
IC 41, 43, 45 Comparator
IC 58
Address Decoder
IC 55 Programmable Counters
IC 54 Programmable Counters
IC 33-35
S/H
IC 35 KCV DMPX
S/H
IC 40 PWM DMPX
IC 47 CV DMPX
S/H
IC 42 44 46
SW
TR7 TR8
IC 26-31 ENV
IC 32 ENV MPX
61 KEYS
P1
DB
IC 56
WR
INT
P2
TØ
T1
IC 52,53 KCV D-A
Anti-Log
TR56
IC 37 Buffer
IC48, 49 GATE
Address-able Latch
IC 50
CPU BOARD
Keytranspose
LED
MULTI PWM CV
MULTI VCF CV
MULTI ENV
VCA ENV Select
VR9 A
VR10 D
VR11 S
VR12 R
SW2
VCA ENV/GATE Select
TOTAL GATE
MULTI KCV
VR4 FREQ
VCF CV Mixer
SW1
KYBD VR8
LFO VR7
IC8
ENV VR6
VCF ENV Amp
BENDER
VCF CONTROL
TRANS-POSE
ARP-MODE
ARP-RANGE
ARP ON/OFF
KEY TRANS
Switch Matrix
TR1
TR2
SW2
HOLD ON/OFF
½ IC1
ARP CLOCK OSC
ARP CLOCK IN
VR1 RATE
JACK BOARD
HOLD
IC2 LFO
SW6 AUTO
MANUAL
RATE VR2
DELAY VR3
LFO TRIG SW1
BENDER
MANU
LFO
SW7
ENV
½ IC3
Pulse Width
VR5
½ IC3
Pulse Width Controller
PANEL BOARD A
PANEL BOARD B

CIRCUIT DESCRIPTION

The JUNO-6 has two circuits not found on the conventional polyphonic synthesizer. They are:
* Digital controlled oscillator
* Multiplexed controlling for VCF and PWM

SOUND SOURCE

MASTER OSCILLATOR

An LC oscillator having variable capacitance diode (D18) to which control voltages from BENDER, LFO and TUNE circuitry, common to all the notes, are supplied.

Variable range:
Bender — ±700 cents LFO — ±300 cents TUNE — ±50 cents

When these voltages are summed together, the maximum shiftable range of the master oscillator is ±1050 cents or from 1MHz to 3.5MHz with the center frequency at approximately 1.9MHz. The output signal is routed to programmable counters IC54 and IC55 through TR63.

PROGRAMMABLE COUNTERS IC54 and IC55

Programmable Counter 8253 consists of three 16-bit counters capable of dividing input signal by up to 65535. When master oscillator output is 1902810Hz and divisor is 4305, the counter develops 442Hz rectangular signals.

Each time key(s) is played, division data to the counters is read from CPU's internal PROM and placed at the CPU data bus in 8 bit x 2 format, then sent to DATA IN of the counters.

KEYBOARD AND SWITCH SCANNING

The CPU applies scanning data (in the left column of the table below) to Address Decoder IC58, setting its appropriate output pin low. The pin is connected to 8 key (function) switches tied together in group. The other poles of these switches are connected to the respective input pins of Inverters IC53 and IC57. Contact in this group, has been closed, removes positive voltage at the input pin of the Inverter, which in turn applies high output to Port 1 of the CPU.

CPU 8049-238 stores two kinds of program for use in different applications, one of which must be selected before starting scanning.

After power on reset, CPU first issues bits 1001 (see bottom of the table) and knows that voices to be assigned to keys played are 6 (L, H, L at P10-P12 of PORT 1) and that the model it is now installed is the JUNO-6 (L at P17 of PORT 1). If the CPU malfunctions, voltages on these pins and associated circuits (including D20) should be checked.

KEY ASSIGNMENT

Six channels are assigned to the keys played in the order CH1-CH6, in the cyclic manner, that is, if the 7th key is played while previously played 6 keys are still held, the 7th key steals the first voice.

Three more assignment modes are provided for test purpose. See Adjustment section of this manual.

BUS 6543	PORT-1 0	1	2	3	4	5	6	7
0000	C	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	C*	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	C	(C#)	(D)	(D#)
1000	TRANSPOSE		ARP & KEY ASSIGN		ARP RANGE		ARP ON	KEYTRANS
1001	L	H	L	not in use				L

Table 1

WAVEFORM CONVERSION

When a key is held down, programmable counters IC54 and IC55 create a series of square waves at output pins for assigned channels. Positive and negative going edges of the square wave are converted into pulses in opposite direction by C6 x R34 time constant and applied to the base of TR5 which discharges C7 on negative going pulse. When TR5 shuts off, C7 charges current flowing from S/H IC35. The charging rate should vary with the discharging rate to maintain the sawtooth amplitude constant. The figure below shows how this is accomplished.

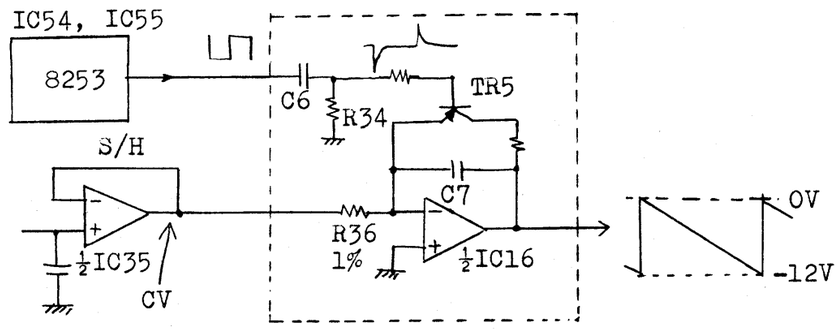


Fig. 1

Analog voltages (a set of 6 key control voltages for 6 channels) from D/A converter change in 0.48V/oct steps as different keys are played. KCVs are combined with voltages from TUNE, LFO and BENDER, if any, and fed to anti-log amplifier TR56. The combined voltage increases or decreases in 1V/oct steps at TR56 output.

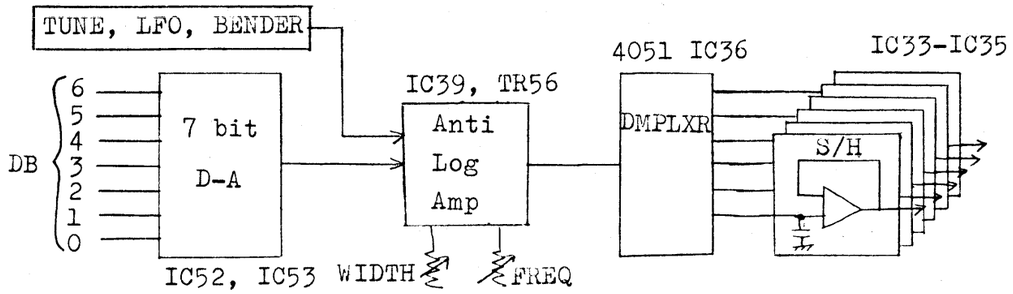


Fig. 2

VARIABLE PULSE WIDTH

Besides its direct application as sound source, sawtooth generator also serves as a source for asymmetrical square wave. Sawtooth wave is routed to (–) pin of comparator/S&H circuit where the voltage on (+) pin determines the sampling period of the sawtooth wave thus duty cycle of the square wave.

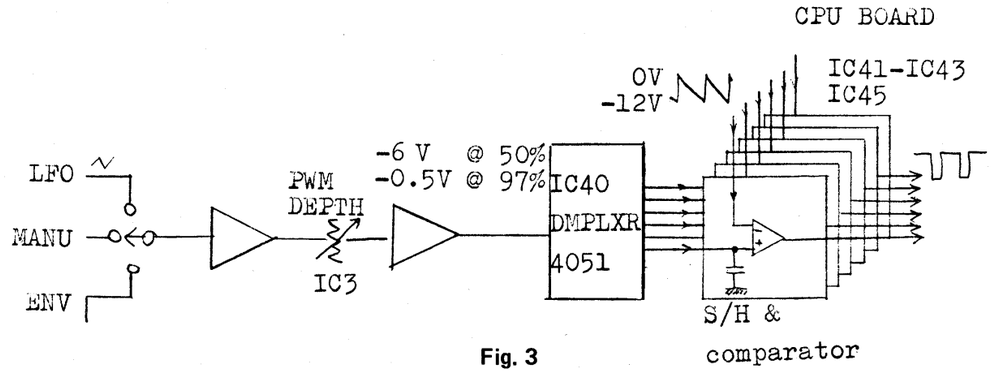


Fig. 3

SUB OSCILLATOR

Square wave from programmable counter is also delivered to flip-flop where it is divided in half, and applied to TR4 base. The amplitude of TR4 output can continuously be varied by setting of SUB VR6 on Panel board A.

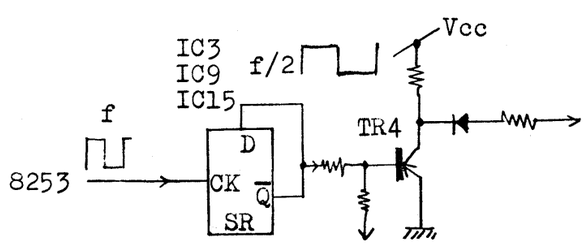


Fig. 4

VCF CONTROL VOLTAGES

While each of 6 contour voltages developed at ENV generator is running to mated VCA on the exclusive line, they are multiplexed and carried through a common bus together with other control signals for VCF application. On the input pin of summing amp., there is another multiplexed voltage KCV from D/A converter IC51-IC53. To prevent garbling of data, de- and multiplexes are synchronized by a clock.

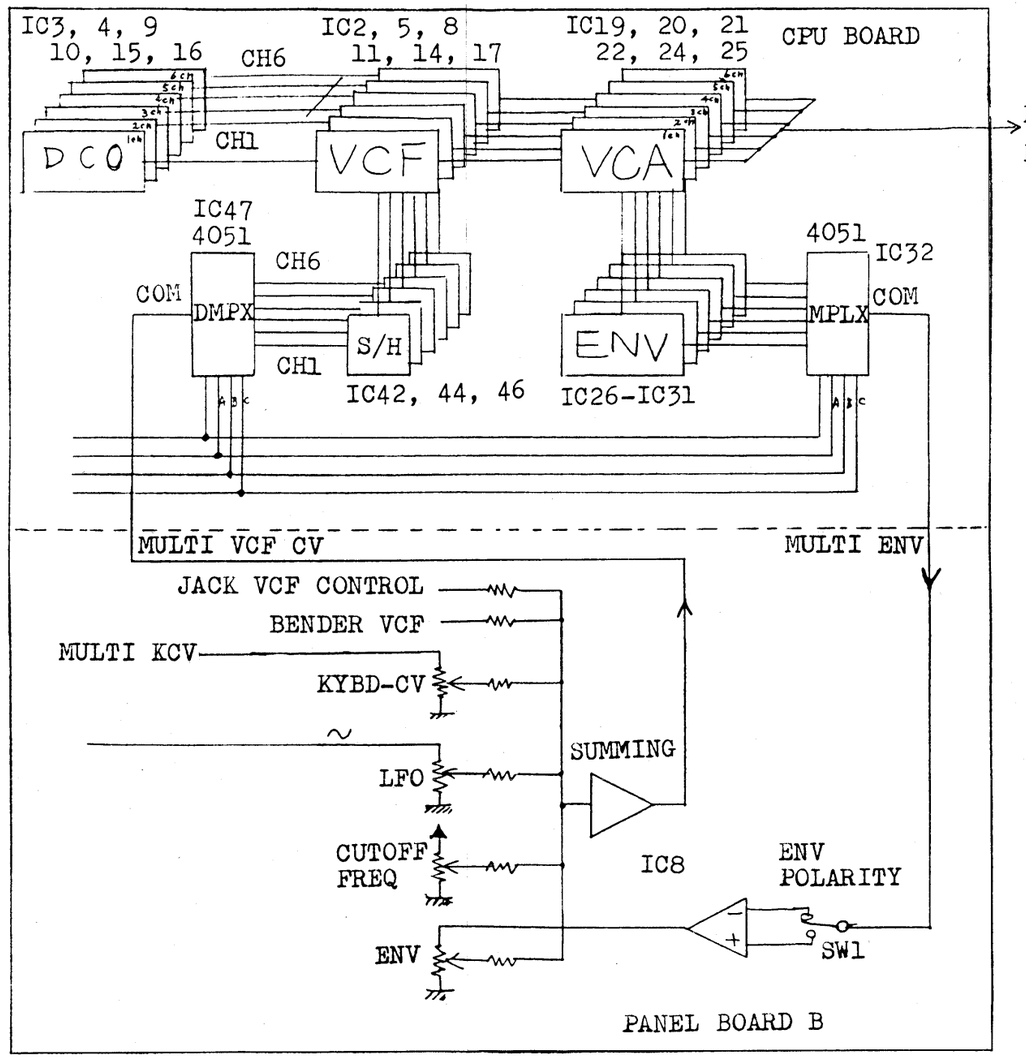
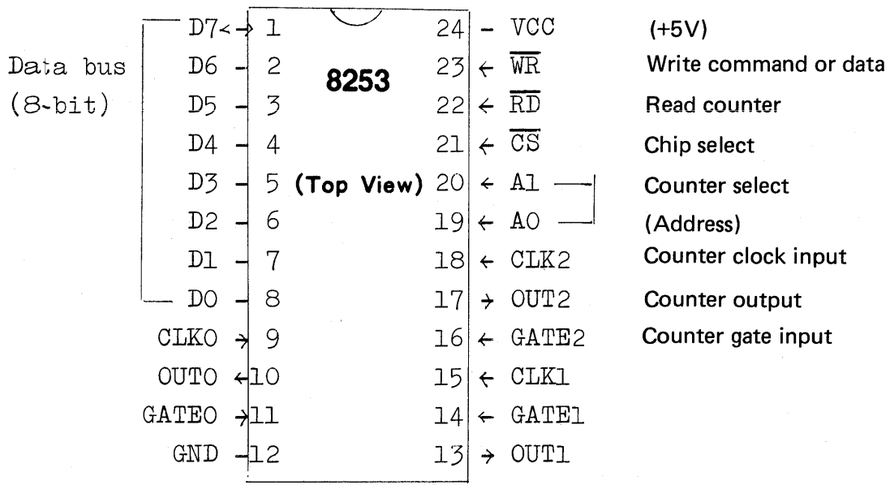


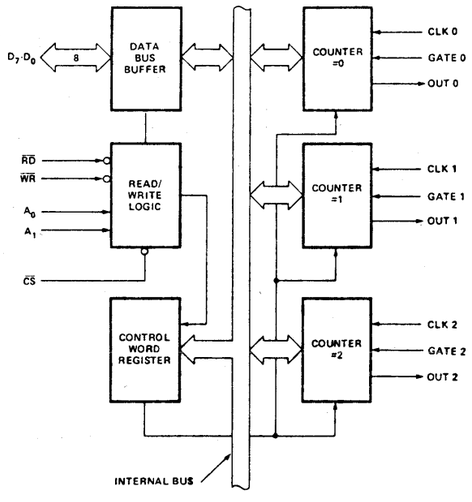
Fig. 5

PROGRAMMABLE INTERVAL TIMER



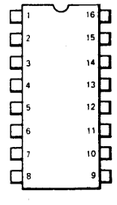
8253

BLOCK DIAGRAM



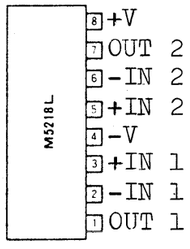
IR3R01

1 MODE INPUT
2 ATTACK TIME INPUT
3 DECAY TIME INPUT
4 RELEASE TIME INPUT
5 SUSTAIN VOLTAGE INPUT
6 COMMON INPUT 0.3V
7 REFERENCE VOLTAGE
8 V_{EE}

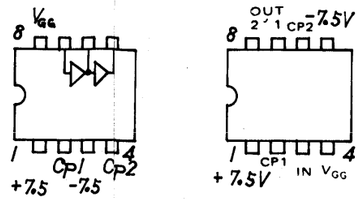


16 V_{CC}
15 RETRIGGER INPUT
14 TRIGGER INPUT
13 GATE INPUT
12 CURRENT INPUT
11 OUTPUT
10 CAPACITOR
9 GROUND

M5218L

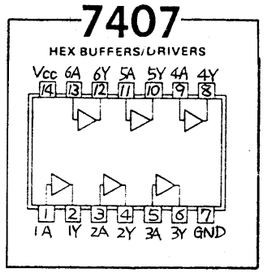


(Top View)



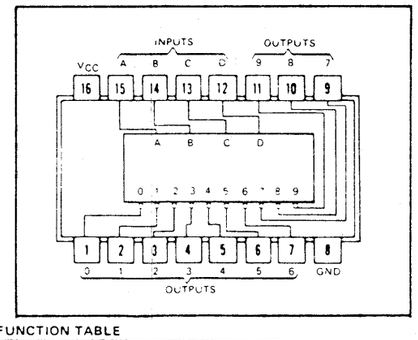
7407

HEX BUFFERS/DRIVERS



74LS42
ONE-OF-TEN DECODER

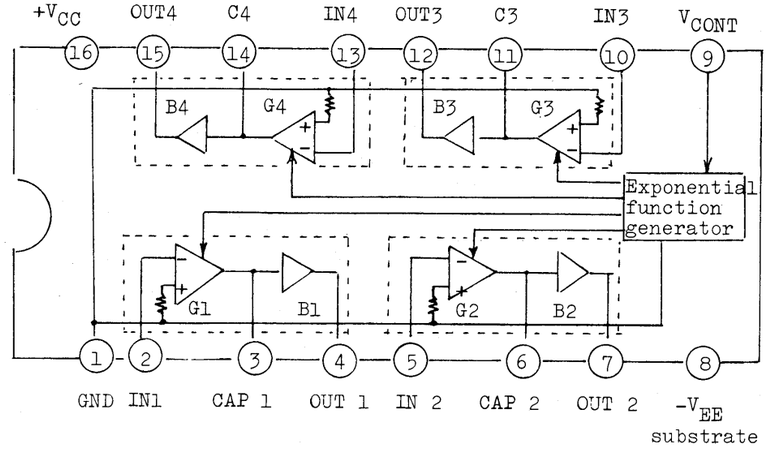
(TOP VIEW)



FUNCTION TABLE

NO.	'42A, 'L42, 'LS42 BCD INPUT				ALL TYPES DECIMAL OUTPUT									
	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	H	H	L	H	H	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H	H	H
3	L	L	H	H	H	H	H	L	H	H	H	H	H	H
4	L	H	L	L	H	H	H	H	L	H	H	H	H	H
5	L	H	L	H	H	H	H	H	H	L	H	H	H	H
6	L	H	H	L	H	H	H	H	H	H	L	H	H	H
7	L	H	H	H	H	H	H	H	H	H	H	L	H	H
8	H	L	L	L	H	H	H	H	H	H	H	H	L	H
9	H	L	L	H	H	H	H	H	H	H	H	H	H	L
INVALID	H	L	H	L	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	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	H	H	H	H	H	H	H	H	H	H

IR3109
(top view),

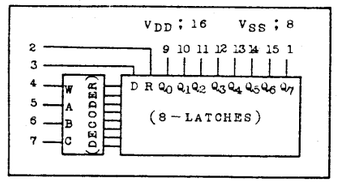


The IR3109 contains four variable transconductance amplifiers designed for VCF applications in electronic musical instruments. The device is equipped with four high input impedance buffers, and anti-log circuitry (V-in to I-out) which controls conductances of four amps.

- wide transconductance variable range (1μ℧–10m℧)
- low input offset voltage (less than ±3mV) (transconductance amplifier)
- high input impedance. MOS P-channel (buffer)

TC4099BP
8-Bit Addressable Latch

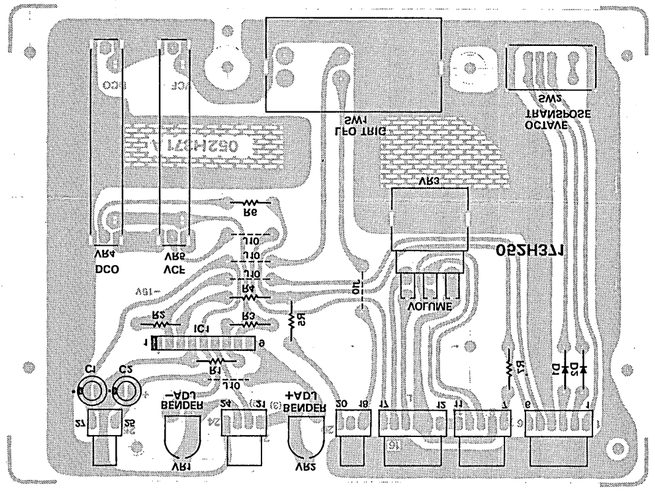
BLOCK DIAGRAM



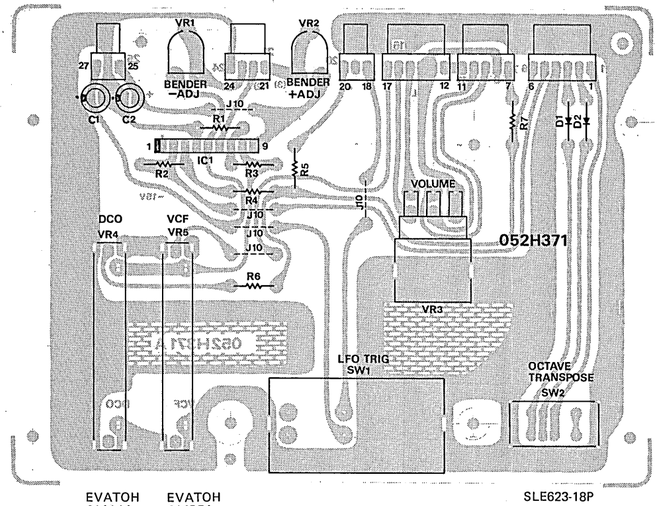
CONTROL INPUTS		ADDRESS INPUTS			OUTPUTS							
RESET	W.DIS.	C	B	A	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7
H	H	✱	✱	✱	L	L	L	L	L	L	L	L
L	H	✱	✱	✱	–	–	–	–	–	–	–	–
H	L	L	L	L	D	L	L	L	L	L	L	L
H	L	L	L	H	L	D	L	L	L	L	L	L
H	L	L	H	L	L	L	D	L	L	L	L	L
H	L	L	H	H	L	L	L	D	L	L	L	L
H	L	H	L	L	L	L	L	L	D	L	L	L
H	L	H	L	H	L	L	L	L	L	D	L	L
H	L	H	H	L	L	L	L	L	L	L	D	L
H	L	H	H	H	L	L	L	L	L	L	L	D
L	L	L	L	L	D	–	–	–	–	–	–	–
L	L	L	L	H	–	D	–	–	–	–	–	–
L	L	L	H	L	–	–	D	–	–	–	–	–
L	L	L	H	H	–	–	–	D	–	–	–	–
L	L	H	L	L	–	–	–	–	D	–	–	–
L	L	H	L	H	–	–	–	–	–	D	–	–
L	L	H	H	L	–	–	–	–	–	–	D	–
L	L	H	H	H	–	–	–	–	–	–	–	D

✱ ; DON'T CARE D ; DATA INPUT
– ; HOLDS PREVIOUS DATA

BENDER BOARD OPH162A (149H162A) (pcb 052H371A)



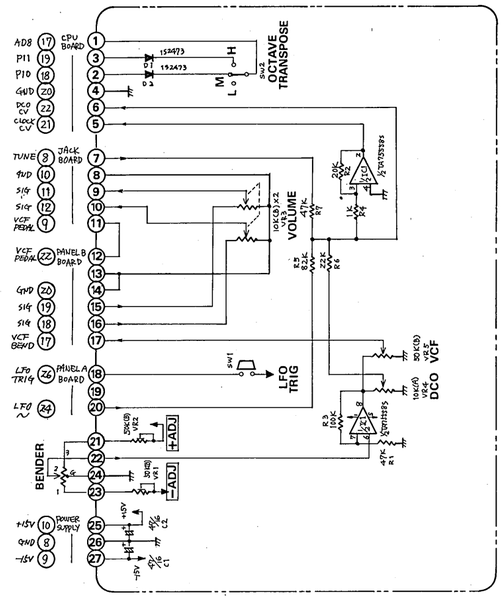
above,bottom view below,top view



VR1, VR2
RVF8P01-503

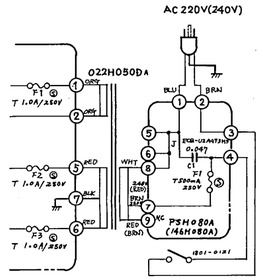
VR3
EWJEJA
P20B14

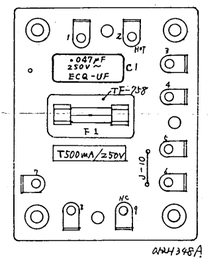
EVATOH C14A14 EVATOH C14B54 SLE623-18P

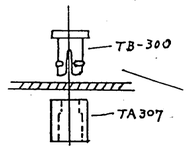


FUSE BOARD 220/240V PSH080A (146H080A)

(pcb 052H348A)

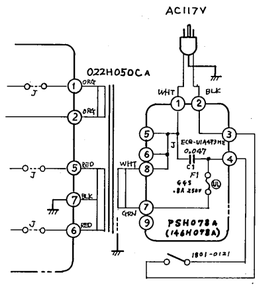


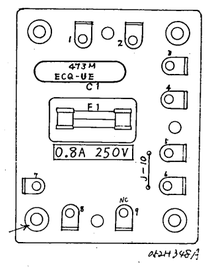




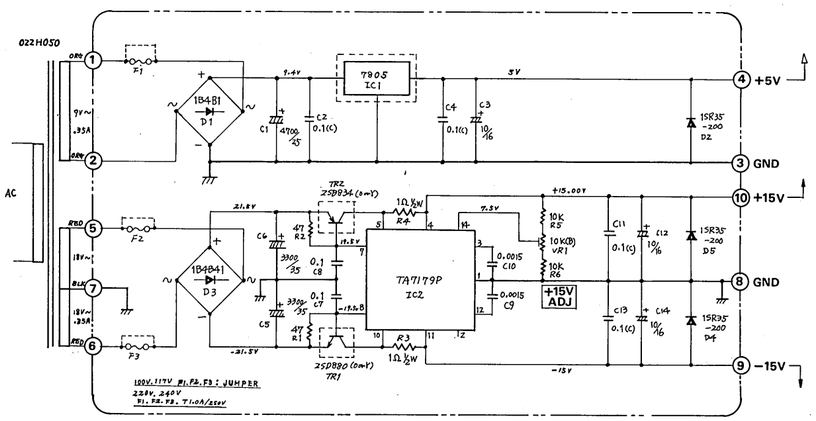
FUSE BOARD 100/117V PSH078A (146H078A)

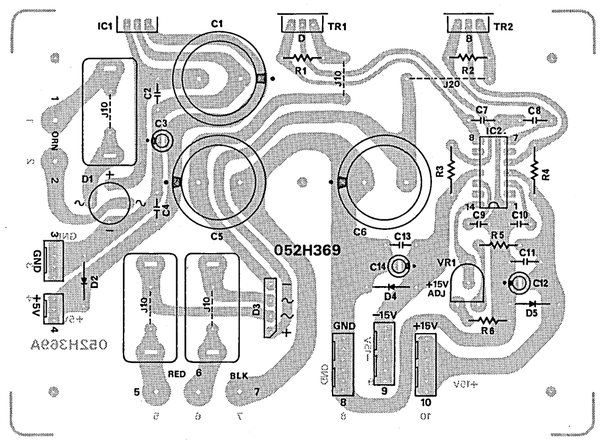
(pcb 052H348A)

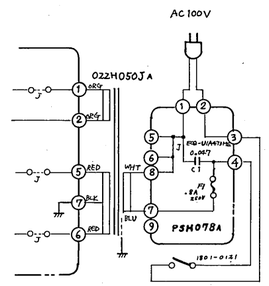


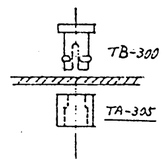


POWER SUPPLY BOARD
PSH081A (146H081A) 100/117V (less fuses)
PSH083A (146H083A) 220/240V
(pcb 052H0369A)

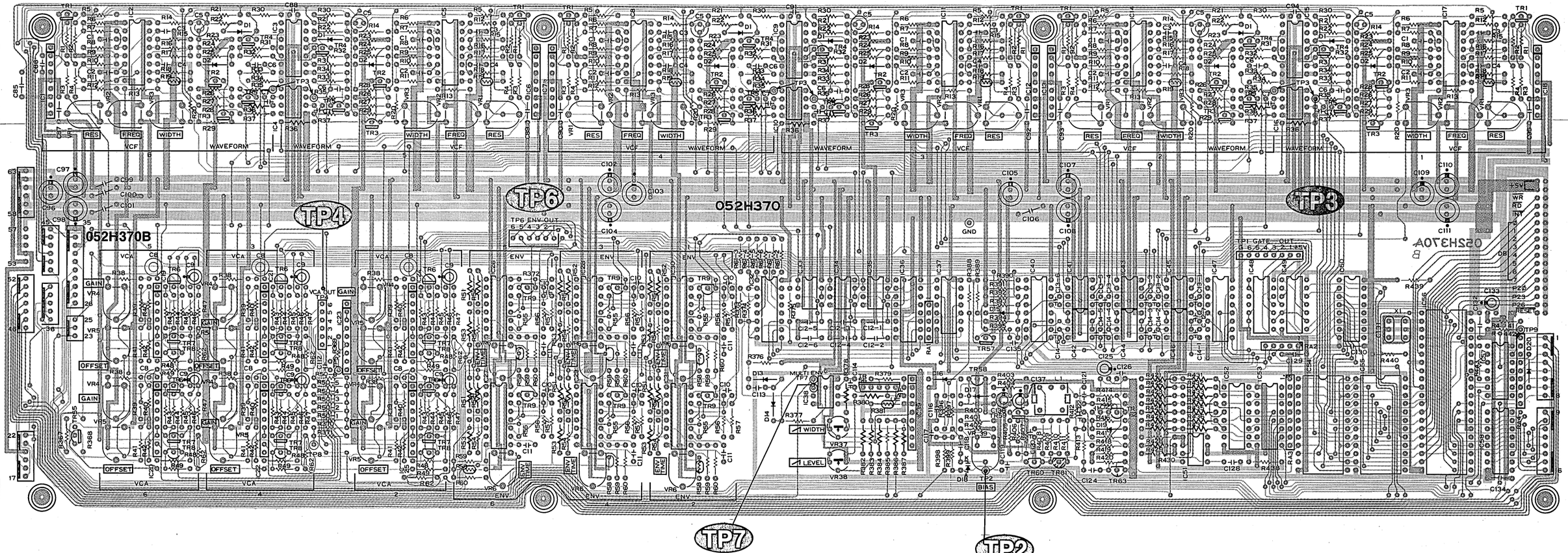








PT secondary ratings
18V x 2 at 0.35A
9.5V x 1 at 0.35A

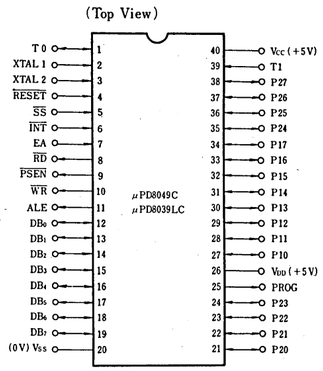


CHANGES IN COMPONENTS

Initial SN	Part	From	To	Reason
150600	IC40, IC47	TC4051BP	HD14051B (only)	increase circuit stability
16800	R372 (IC3R01)	10K	2.7K	increase pin 15 voltage from 5V to 10V
	R389 (TR57)	47K	33K	decrease IC40, IC47 VEE from −12V to −11V
181650	Circuit board	052H370A	052H370B	R62 680K x 4 bottom to top
	R421-R426, R430 R431-R437, R429 R427 (IC52, IC53)	49.5K 100K	75K 150K	increase D/A accuracy 0.48V/oct
	R396 (IC58) R397	1M 33K	680K 22K	balance Bender control voltage

μPD8049C-238

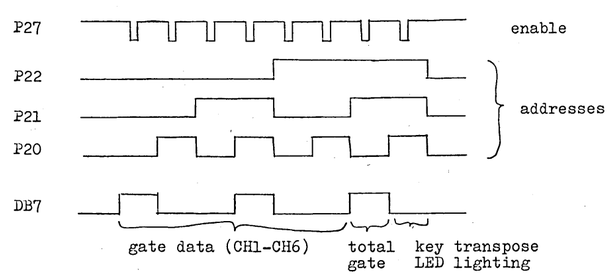
(Top View)



NOTES:

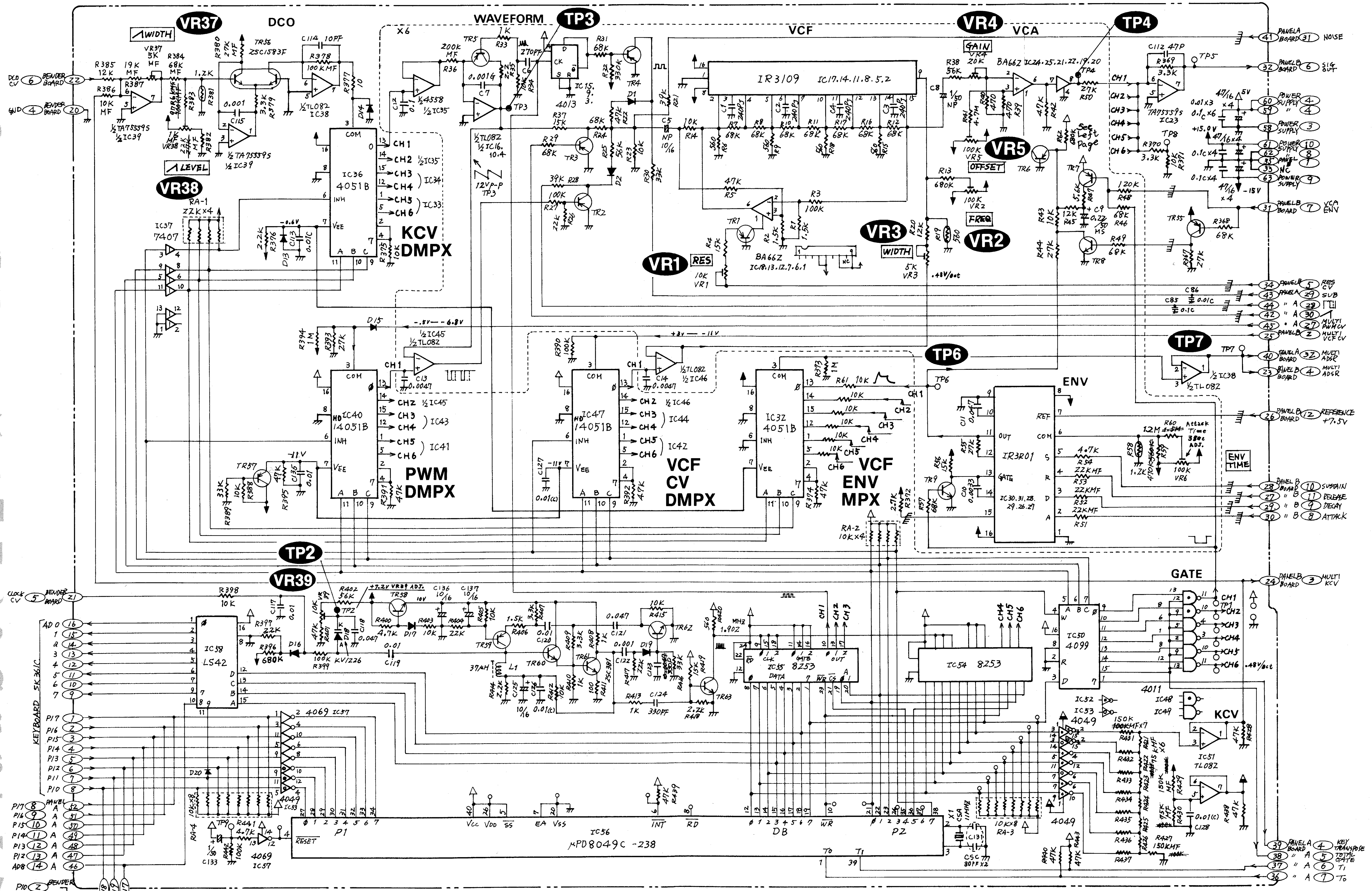
TOTAL GATE ORed 6 gates, issued whenever key(s) has been played after the preceding TOTAL GATE.

INT Must be kept pulled up during operation, otherwise no sound will be generated.



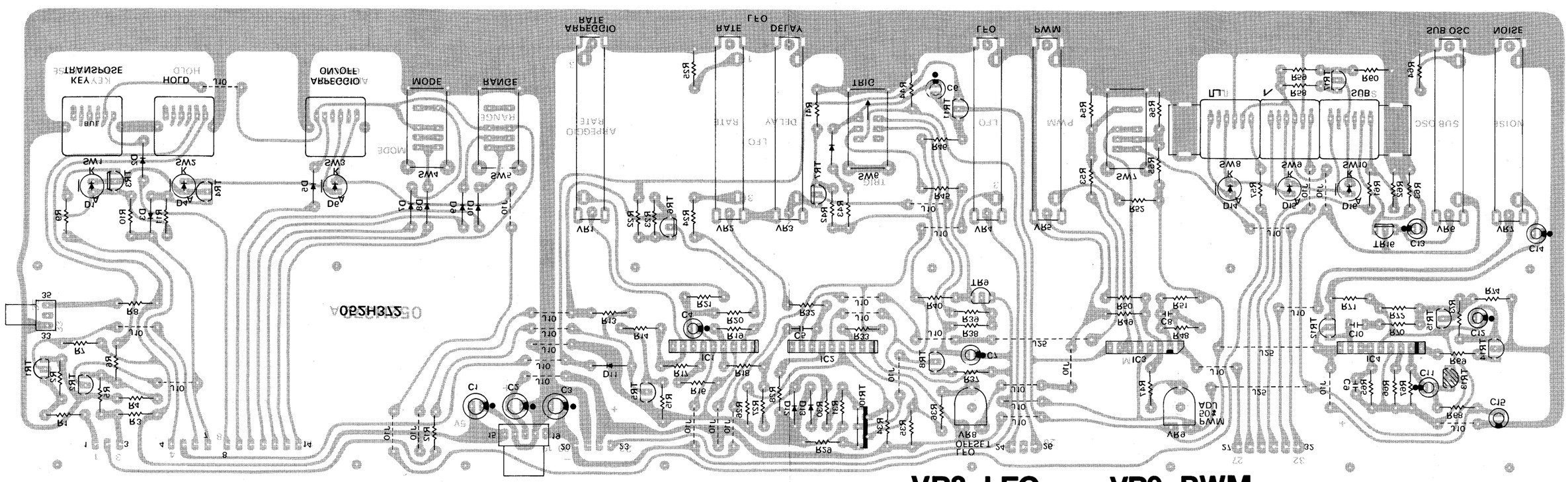
DESIGNATION		PIN NO.	FUNCTION
DB (DATA BUS)	DB 0	12	12 — 8253 (IC54, 55) Division data — 12 — KCV data (in synchronous with KCV and GATE addresses)
	1	13	
	2	14	
	3	15	keyboard and function switches scanning data
	4	16	
	5	17	
	6	18	18
	7	19	19 — GATE, TOTAL GATE, Keytranspose LED (see note)
PORT 1	P10	27	keyboard and function switches scanning data read
	11	28	
	12	29	
	13	30	
	14	31	
	15	32	
	16	33	
	17	34	
PORT 2	P20	21	8253 (IC54, 55) address
	21	22	
	22	23	
	23	24	no in use
	24	35	8253 (IC55) select
	25	36	8253 (IC54) select
	26	37	not in use
	27	38	4099 (IC50), 4051 (IC36, 40, 47) select
T0		2	GATE hold signal input (ON:L OFF:H)
T1		39	ARPEGGIO clock input
WR		10	8253 write pulse

4099 (IC50), 4051 (IC32, 36, 40, 47) — addresses



NOTES: UNLESS OTHERWISE SPECIFIED
1) ALL NPN TRANSISTORS ARE 2SC1815 (GR or Y)
2) ALL PNP TRANSISTORS ARE 2SA1015 (GR or Y)
3). ALL DIODES ARE 1S2473

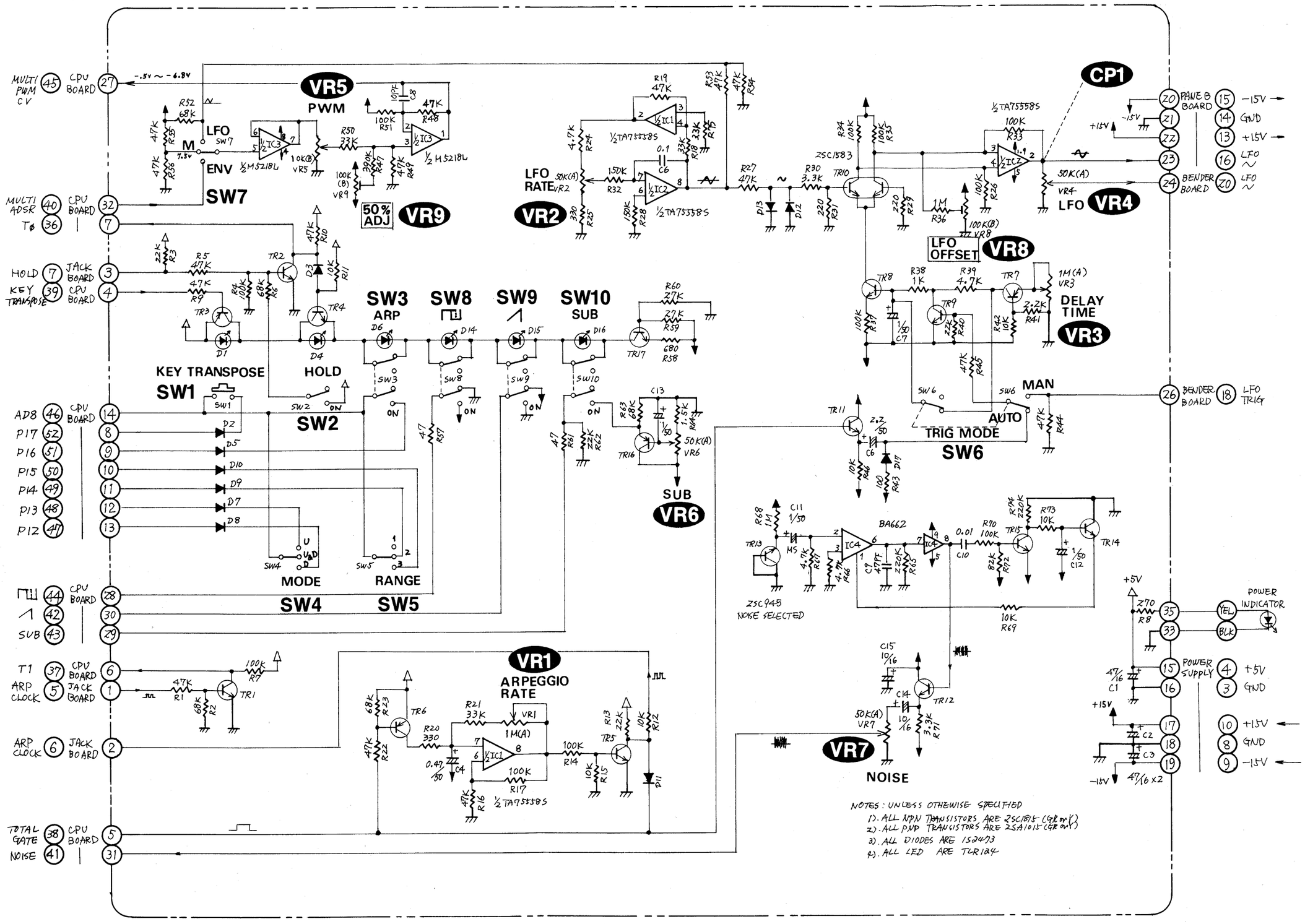
PANEL BOARD A OPH164A(149H164A)(pcb 052H372A)



above bottom view
below top view

SW1:
SUT11A-1
SW2, 3:
SUT11A-2
(push-lock)
SW4, 5, 7:
SLE623-18P
SW6:
SLE622-18P
SW8-10:
SUT32A-1
(gang)
Button:
white H36
orange H29
yellow H30

VR1, 3:
EVA-TOHC14A16
VR2, 4, 6, 7:
EVA-TOHC14A54
VR5:
EVA-TOHC14B14



PANEL BOARD B
OPH165A (149H165A)
(pcb 052H373A)

View from foil side

VR3, 4, 5:
EVA-TOHC14B54

VR6, 8:
EVA-TOHC14B14

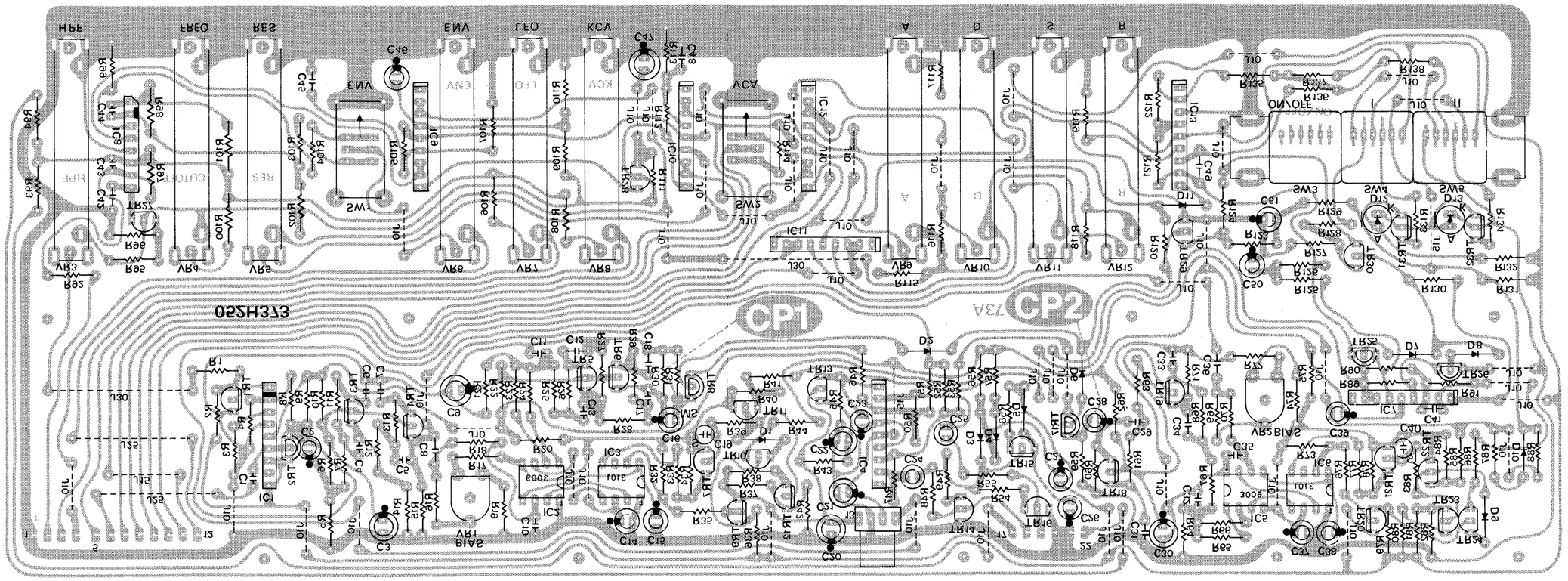
VR7, 9, 10, 11, 12:
EVA-TOHC14B15

SW1, 2:
SLE622-18P

SW3, 4, 5:
SUT32A-2

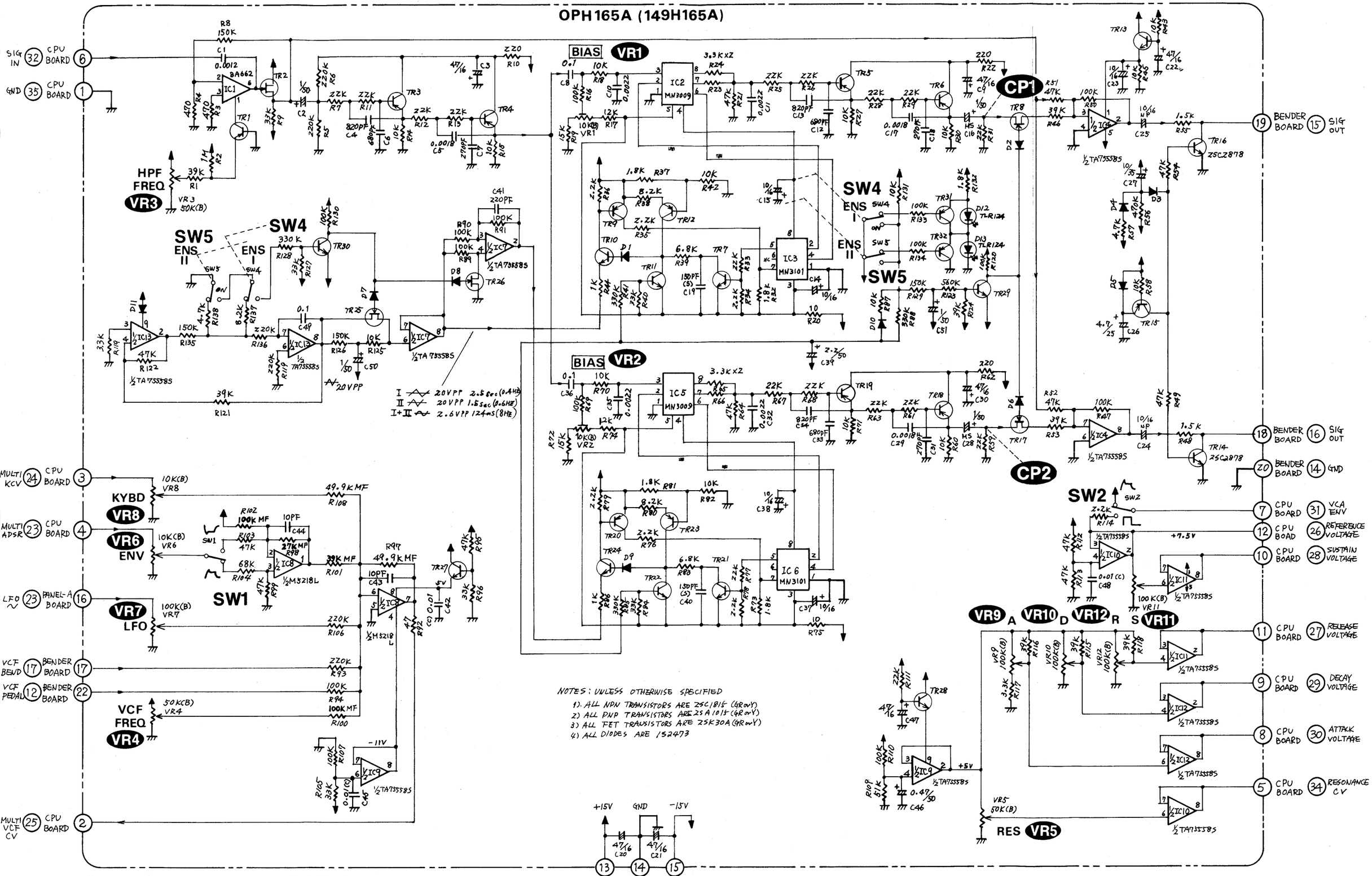
Button:

white	H36
yellow	H30
orange	H29



View from component side

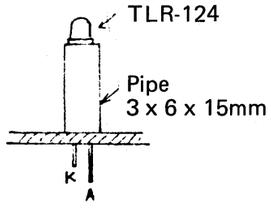
OPH165A (149H165A)



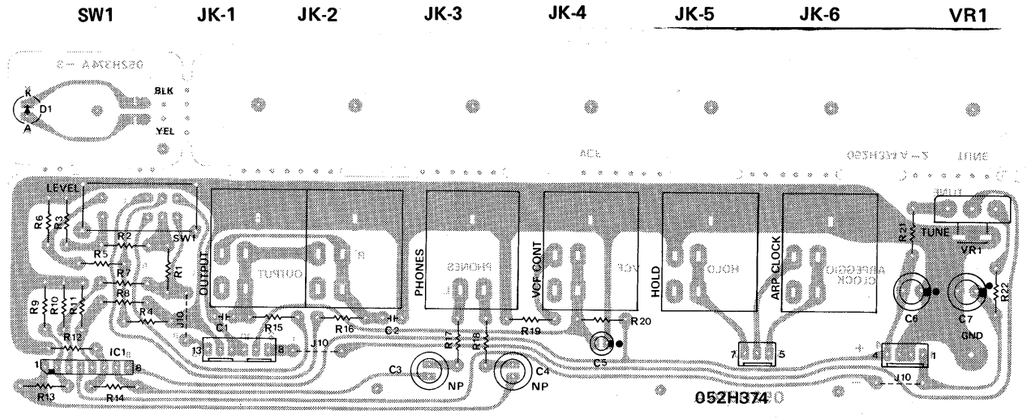
NOTES : UNLESS OTHERWISE SPECIFIED
1). ALL NPN TRANSISTORS ARE 2SC1815 (GR ONLY)
2) ALL PNP TRANSISTORS ARE 2SA1015 (GR ONLY)
3) ALL FET TRANSISTORS ARE 2SK30A (GR ONLY)
4) ALL DIODES ARE 1S2473

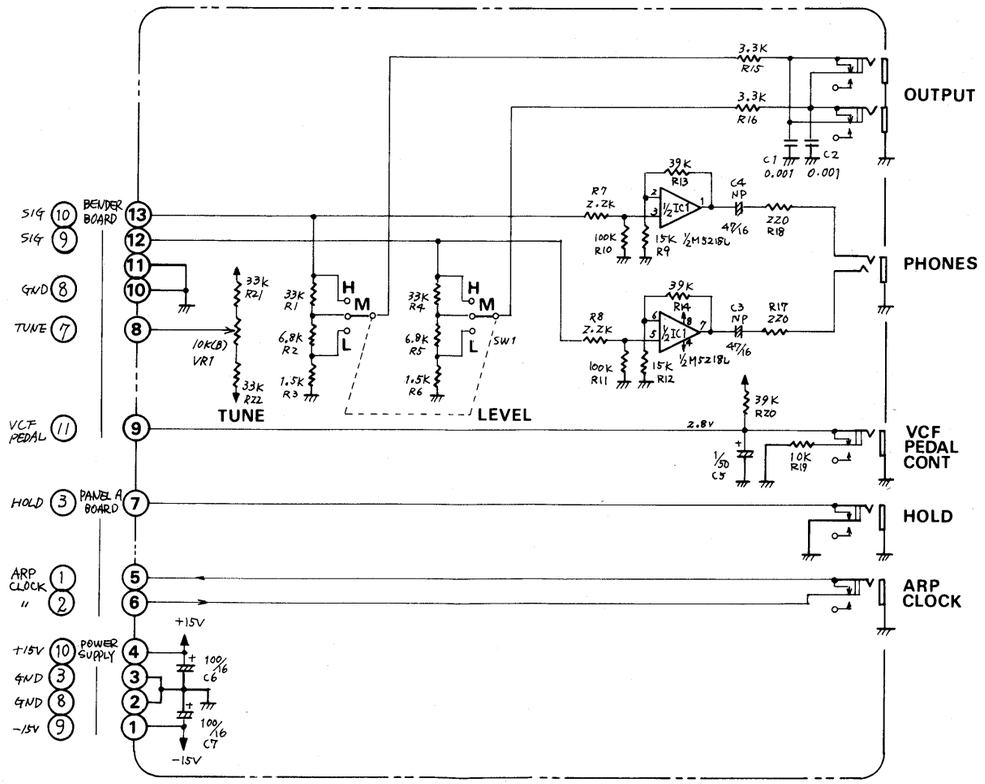
Changes in components SN 181650–
R98, 100, 101, 102 – carbon to metal film (CRB25FX)
R103 – 8K to 47K
R104 – 47K to 68K

JACK BOARD OPH163A(149H163A)(pcb 052H374A)



SW1	HSW0372-01-030	JK-3	HLJ-0259-01-020
VR1	EVH-OTAS10B14	JK-1, 2, 4, 5, 6	HLJ-0259-01-030





ADJUSTMENT SAMMARY

Use OSCILLOSCOPE unless otherwise specified.
No particular channel, test point, trimmer, etc. are defined in the procedures common to sextuple circuits. Begin with channel 1 (CH1).

KEY ASSIGNMENT

Some adjustments need to be done in unique key assign mode available only in TEST MODE.

TEST MODE

To enter test mode hold KEY TRANSPOSE until power is ON.
Select key assign mode through ARPEGGIO MODE selector:

- **UP (UNISON):** six voices sounds simaltenously
- **UP & DOWN (ROTARY):** as the name implies, CPU assigns channels (in the order numbered, example, 1, 2, ... 6, 1) to the keys played (legato or staccato), and remembers the last channel even after the key is released.
  New assignment will start with the next channel. Note that the first key does not always activate CH1.
  The above applies to repeated striking on the same key.
- **DOWN (NON-ROTARY):** The key first played is always assigned CH1. Until the objective channel is assigned, the preceding key(s) can not be released.

To escape TEST MODE turn power OFF. Allow 3 sec for CPU reset circuit before turning on again.

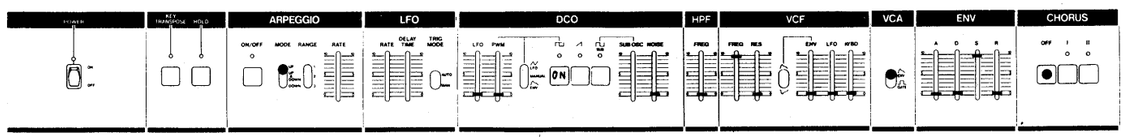
KEY DESIGNATION

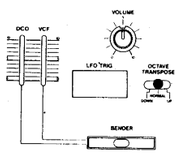
DC SUPPLY VOLTAGE (Power Supply Board)

- **TEST POINTS:** terminal 10 (+15V); terminal 8 (ground) (Connect to digital voltmeter, DVM.)

1. Adjust VR1 for +15±0.01V.
2. Verify voltage of −14.5 to −15.5V at terminal 9 (−15V).

MASTER OSCILLATOR (CPU Board)





- **TEST MODE:** UP (UNISON)
- **CONTROLS:** TUNE (rear panel) at midpoint

BIAS

- **TEST POINT:** TP-2 (VR39 wiper) (Connect to scope or DVM. Do not use low impedance meter.)

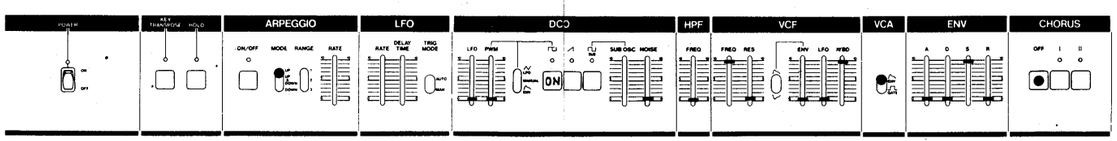
1. Adjust VR39 for 7.2±0.1V.

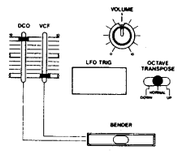
TUNING

- **TEST POINT:** TP-3, pin 10 of IC55 or OUTPUT jack

1. While holding down A4 key, adjust L1 for 442Hz. L1 is very tricky, so readjust VR39 for fine tune, as necessary. This has little effect on BIAS adjustment.

BENDER CONTROL (BENDER Board)





- **TEST MODE:** UP
- **TEST POINT:** same as for TUNING, above

1. Use HOLD function. With E5 note on, tilt and hold BENDER lever at the leftmost position and adjust VR1 so that the frequency is 442Hz (A4 note).
2. HOLD D4 key. With BENDER at the rightmost, adjust VR2 so that frequency is 442Hz.

SAWTHOOTH WIDTH & LEVEL (CPU Board)

- **CONTROLS:** OCTAVE TRANSPOSE at NORMAL
- **TEST POINT:** TP-3
- **TEST MODE:** UP

1. Set VR37 and VR38 at midpoint.
2. Striking C2 and C7 keys alternately (with break between notes), adjust WIDTH VR37 for the same amplitude on both keys.
3. While holding C4 key down, adjust LEVEL VR38 for 12Vp-p. Next, check TP-3 of the remaining channels (2-6) for 12±0.5Vp-p.

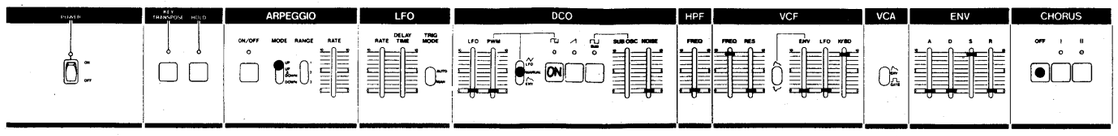
PULSE WIDTH (CPU Board, PANEL BOARD A)

- **CONTROLS:** DCO section – WAVEFORM-PWM; MODE-MANUAL; PWM slider-0
- **TEST POINT:** pin 1 (CH1) of TP-4 (CPU board) (scope – 1V/div, 0.2ms/div)
- **TEST MODE:** UP

1. While holding down B4 key, adjust VR9 of PANEL BRD A for a 496Hz rectangular of duty cycle 50. Check all other channels (pins 2-6) for 48-52 duty cycle.
2. Set PWM slider to 10 and check every pin of TP-4 for 95 to 98% duty cycle.

VCA (CPU Board)

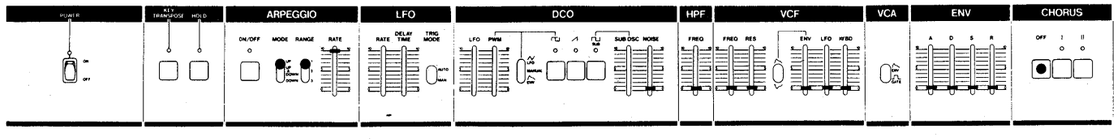
GAIN



- **TEST POINT:** TP-4 (pins 1-6)
- **TEST MODE:** UP

1. Depressing C5 key, adjust VCA GAIN VR4 for 4Vp-p.

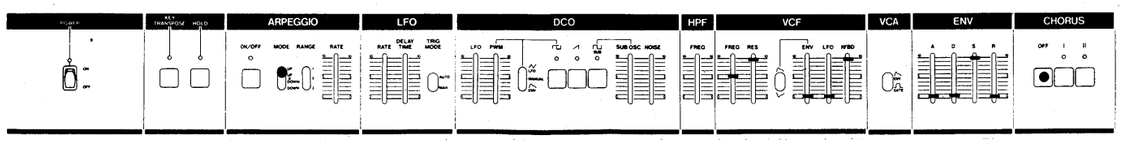
OFFSET

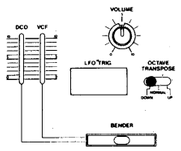


- **TEST POINT:** TP-4 (pins 1-6) (scope 0.2V/div)
- **TEST MODE:** Normal (Push ARPEGGIO. This overrides Test Key Assign Mode until pushed again.)

1. HOLD ON more than one note, 6 channels will be gated in sequence.
2. Adjust OFFSET VR5 for reasonable straightness.

VCF (CPU Board)





- **TEST POINT:** TP-4 (pins 1-6)
- **TEST MODE:** UP

RESONANCE

1. While pressing C4 key, adjust RES VR1 for 4Vp-p regenerating sine wave.

FREQUENCY

1. With C2 key holding down, set VREQ VR2 at the position where the period of the wave is 4.03ms (248Hz, equal to normal B3 note). (Note, KBD control voltage is 0.)

WIDTH

1. While holding C4 key, adjust WIDTH VR3 for 992Hz.

ENVELOPE (CPU Board)

- **CONTROLS:** ENV — A at 10; D, S and R at 0
- **TEST MODE:** UP
- **TEST POINT:** TP-6 (pin 1) (scope 2V/div 0.5s/div)

1. Set ENV TIME VR6 for 3 sec attack time from a key pressing (CH1 only).
2. Shift scope probe to TP-7 or terminal 23. Reset scope timebase to 50μs/div.
3. Holding down any key will display six growing waves on the scope; CH1 being at the extreme left. Align the rise time of the remaining waves to CH1's (coincidental max. to 0 transitions is desired).
4. Check 6 sounds for synchronization in A, D, S and R phases by sweeping respective sliders.

BBD BIAS (CPU Board.PANEL BOARD B)

- **CONTROLS:** CHORUS 1
- **TEST POINT:** CP1 (R31) — PANEL Board B

1. Feed 5Vp-p, 1kHz, sine wave across TP-8 and ground terminal of CPU board.
2. Set BIAS VR1 for distortion-free waveform.
3. Shift scope to CP2 (R59). Adjust BIAS VR2 as in step 2.

LFO OFFSET (PANEL BOARD A)

- **PANEL CONTROLS:** LFO TRIG MODE at MAN (CAUTION: Do not touch LEF TRIG.)
- **TEST POINT:** CP1 (R33) or terminal 23 (scope DC couple)

1. Adjust OFFSET VR8 for 0±10mV.