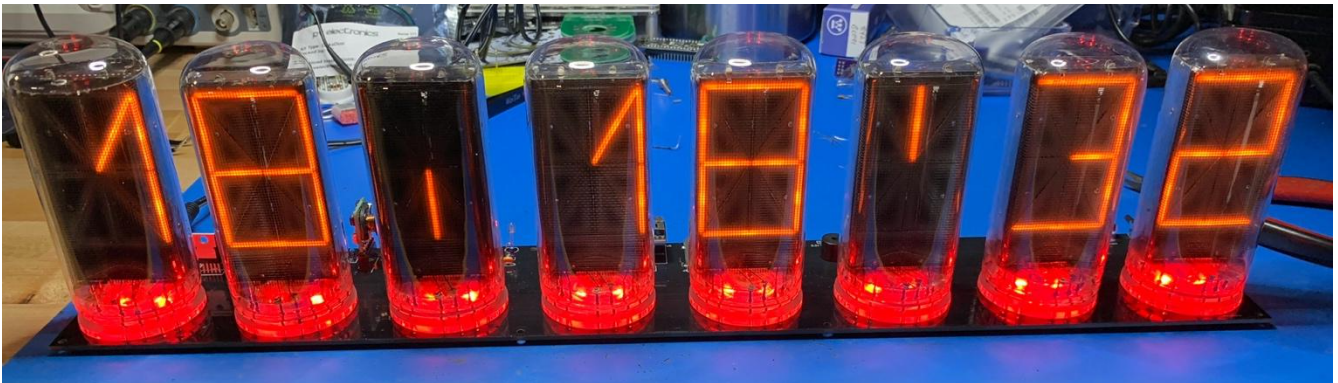




## WordClock 4-6 and WordClock 4-8 Assembly Guide 6 and 8 Tube B7971 Version



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## Introduction

WordClock-4 assembly should be attempted only by experienced builders. Although assembly is straightforward and not difficult for experienced kit builders, there are several surface mount parts that must be carefully soldered to the boards. The kit may be returned for a full refund less shipping within 30 days of purchase, only if assembly has not been attempted.

**SIX OR EIGHT B7971 TUBES ARE REQUIRED AND NOT INCLUDED IN THIS KIT.**

## Assembly

### WARNINGS!

**DRILL HOLES IN THE CASE BASE FIRST. USE THE CIRCUIT BOARD AS A TEMPLATE.**

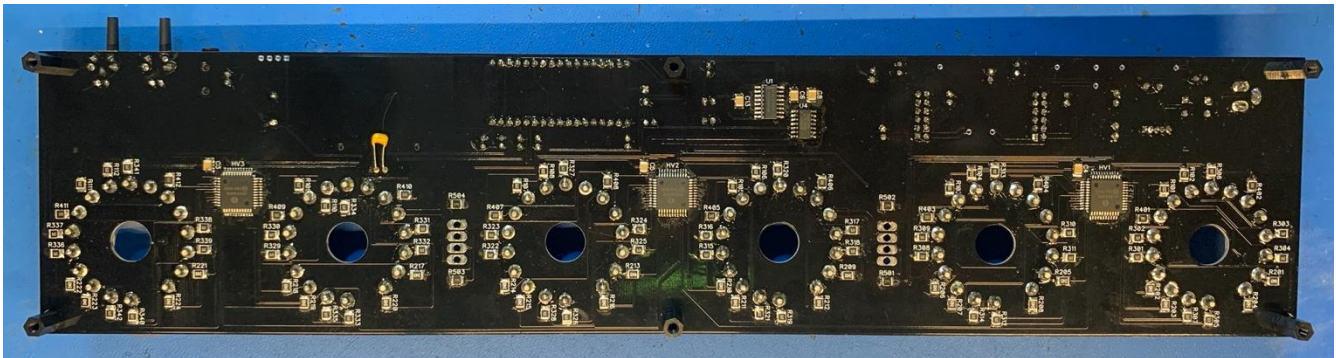
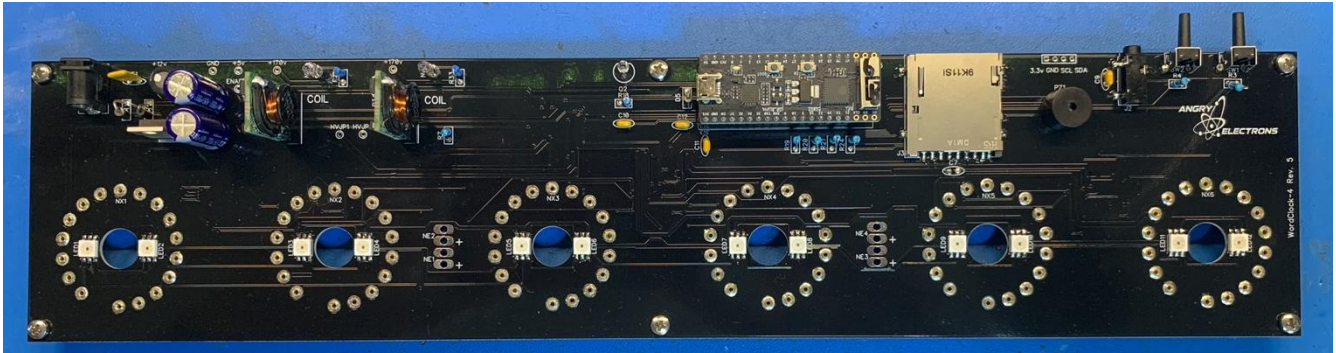
**DO NOT SOLDER THE MICROCONTROLLER DIRECTLY TO THE BOARD, USE HEADERS.**

**USE A GOOD QUALITY, UL LISTED, 12V POWER SUPPLY.**

## Case

If you purchased the optional acrylic case, this would be a good time to mark and drill the holes in the base. It is easiest to use an unpopulated circuit board for this purpose. The board dimensions for the six-digit clock are 380mm wide by 85mm deep. The dimensions of the eight-digit version are 510mm wide x 85mm deep.

## Step 1 – Build the Main Board (6-Tube Board Shown For Reference)



- Install the female pin sockets on top of the board. Use masking tape to hold them in place while soldering on the bottom of the board.
- Cut the single row 40 pin female header into two, 17 pin pieces. Install at the U4 location. Install two, 2x6 female headers at the HVPS1 and HVPS2 locations.

### **DO NOT solder the microcontroller to the board!**

- Build the 5v supply on the main board. Install J1, F1, C1, C2, C3, D1, D2, L1, and U1. Note that C1, C2, D1, and D2 must be installed in the direction noted on the board.
- Connect a 12V-18V power supply with a center positive, 2.1mm connector to J1, and check the test point for 5V. Do not continue assembly if 5V is not present at the test point.
- Build the high voltage supplies. Install R1, R2, R6, R7, R33, R34, NE8, and NE8.

Connect a temporary jumper between ENABLE and +5V. This will turn on the high voltage power supplies. **Do not install the microcontroller while the jumper is in place or while testing the power supplies, or the microcontroller will be damaged!**

- Install one or two TaylorEdge 1363 high voltage power supplies with the coils facing the word, "COIL" on the board. If only one power supply is used, connect a jumper between HVJP1 and HVJP2.
- **There is no load balancing facility available so do not connect this jumper if two power supplies are used.**

Connect the 12V power supply. Both neon bulbs should now be lit. Check one or both +170V test points for approximately +170V.

If the voltages check out and the neon bulbs are lit, remove the power supplies and the ENABLE jumper.

- Install the components on the bottom of the board, starting with the surface mount resistors. Note that each "00" series is the same value, for ease of assembly.
- Install the surface capacitors, followed by the ICs. The line or dot on one side of each chip must be installed toward the cutout on one side of the silkscreened pattern. The best way to install a surface mount chip is to add a very small amount of solder to one of the corner pads on the board. Then quickly and carefully solder the corresponding pin to the pad. Check the alignment of all pins and if correct, solder the opposite corner pin. Check the alignment again, then solder the remaining pins quickly and carefully. Always use a magnifier to check for solder bridges and bad solder joints. The HV5530s are very difficult to solder successfully and must be checked with magnification to ensure that each pin is soldered, and that there are no solder bridges. Use solder braid to easily remove solder bridges.
- Install the SD card connector next. Be sure to solder all leads to the board. Solder quickly and carefully. The plastic chassis can easily be damaged by too much heat. Several pins on one side of the connector are very close to the grounded case. They do not need to be soldered. Then install J3, the GPS connector.
- Install all of the remaining parts on the top of the board. Note that the APA102 RGB LEDs must be installed with the cutout facing the dot on the board.
- The ambient light sensor, Q2, should be installed about 10mm above the board. The shorter lead goes toward the back of the board.



## Step 2 – Final Assembly

- Carefully install the tubes, and reinstall the power supplies. **Make absolutely sure that the ENABLE jumper has been removed.**
- Install the microcontroller board, correctly orienting the USB connector and antenna, with the markings on the board. Install the SD Card.
- Install six, 10mm standoffs into the holes on the bottom of the main board, using six screws (or 8 for the 8-tube version)

This completes WordClock-4 assembly. Refer to the User Manual for setup and operation instructions.

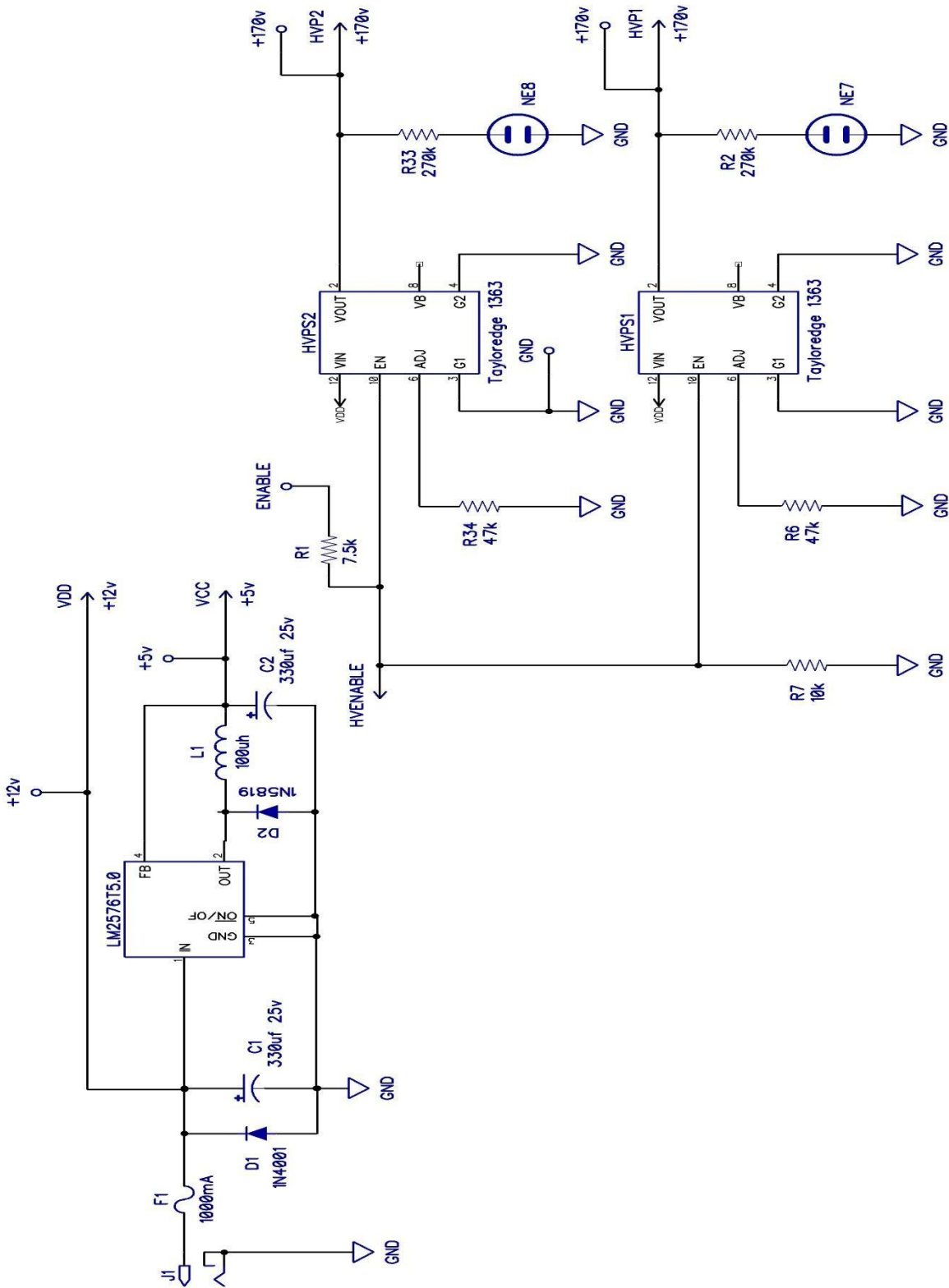
## Bill of Materials

Reference	Qty	Part	Value	Note
C1-C2	2	Capacitor	330uf 25v-50v	Electrolytic
C3-C6, C8, C13	6/7	Capacitor	100nf	Surface mount – C14 for 8 tube
C7, C9-C12	5	Capacitor	100nf	Through hole
D1	1	Diode	1N4007	
D2, D5	2	Diode	1N5819	Schottky
F1	1	Poly Fuse	0.5A – 1A	
J1	1	Power Jack		2.1mm power jack
J2	1	GPS Jack		3.5mm SMD SJ-3523-SMT-TR
J3	1	SD Card Connector		DM1AA-SF-PEJ SD card jack
J4	1	Header		Not Used
L1	1	Inductor	100uh	
LED1-LED12	12/16	RGB LED		APA102
PZ1	1	Buzzer		Buzzer
Q2	1	Sensor	TEPT4400	Light sensor
R1	1	Resistor	7.5k ¼ watt	8 Tube Board only
R3, R4, R7, R19, R20	5	Resistor	10k ¼ watt	Brown-black-orange-gold or brown-black black-red-gold
R2, R33	2	Resistor	270k ¼ watt	Red-violet-yellow-gold or red-violet-black-orange-gold
R5, R8	2	Resistor	330R	8 Tube Board only
R6, R34	2	Resistor	47k ¼ watt	Yellow-violet-orange-gold or yellow-violet-black-red-gold
R18	1	Resistor	120k ¼ watt	brown-red-yellow-gold or brown-red-black-orange-gold

R21, R24	2	Resistor	4.7k ¼ watt	Yellow-violet-red-gold or yellow-violet-black-brown-gold
R100 Series	12/16	Resistor	22k	223 Surface mount 1210/1206
R200 Series	24/32	Resistor	24k	243 Surface mount 1210/1206
R300 Series	42/56	Resistor	27k	273 Surface mount 1210/1206
R400 Series	12/16	Resistor	33k	333 Surface mount 1210/1206
R500 Series	4	Resistor	270k	274 Surface mount 1210/1206 (6 Digit only)
SW1-SW2	2	Button		90 Degree pushbutton
U1	1	IC	CD4504	
U2	1	IC	LM2576	
U3	1	IC	74HC14D	8 Digit clock only
U4	1	IC	74AHC125D	6 Digit clock only
U5	1	Microcontroller	ESP32-PICO-KIT	Programmed with WordClock firmware
	1	Header Strip		Cut into two to mount U5
HV1-HV3	3	IC	HV5530PGG-G	
HV4	1	IC	HV5530PGG-G	8 Digit clock only
	6/8	Screw		M3 8mm
	6/8	Standoff		10mm
	1	SD Card		Programmed with WordClock languages database
	1	Main Board		
	102	Socket pins		6 Digit clock only
	136	Socket pins		8 Digit clock only
	1/2	Female Header	2 x 6	Power supply connectors

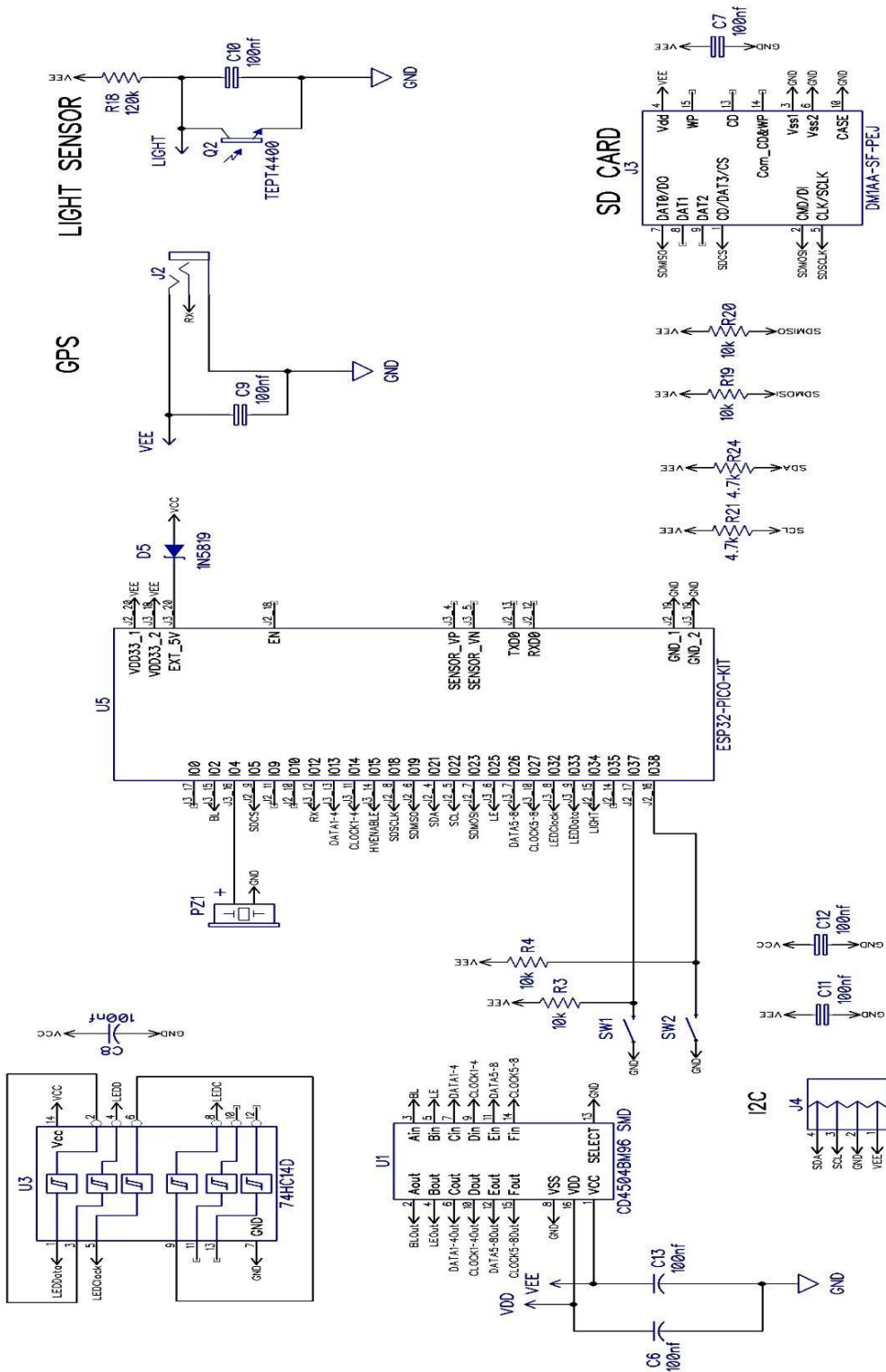
HVPS1, HVPS2	2	Power supply	TaylorEdge 1363 low noise	One may be used for 6-digit clocks, but two are recommended. Two are required for 8-digit clocks.
NE1- NE4,NE7,NE8	6	Neon Bulb		6 Digit clock only
	2	Brass tube	1.5mm x 90mm	6 Digit clock only
	2	Brass tube	1.5mm x 50mm	6 Digit clock only
	6/8	Acrylic diffusers		

# Schematic



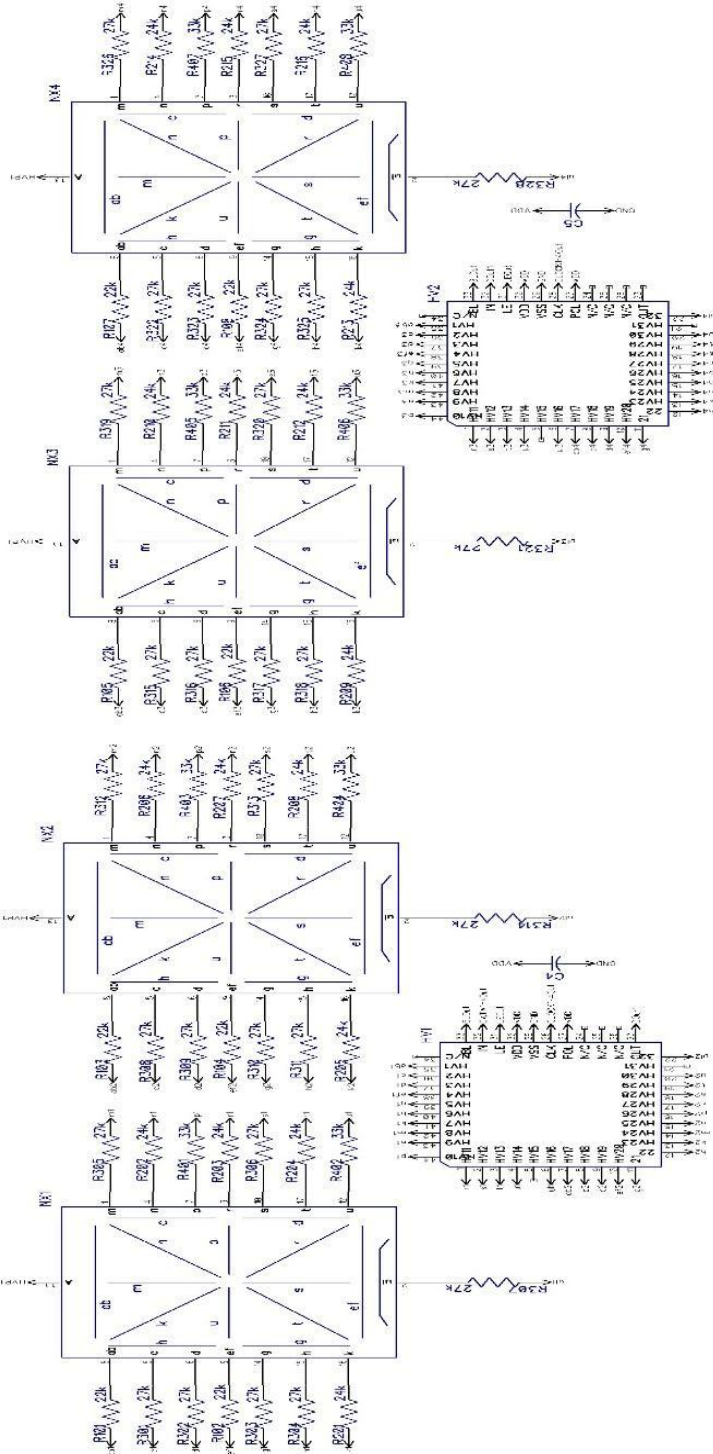
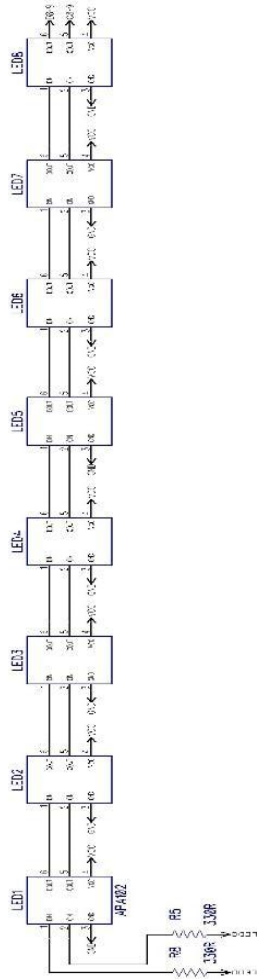
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## WordClock-4 Processor

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## Warranty Terms and Conditions

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