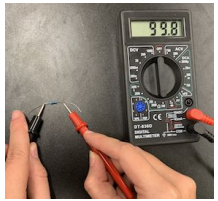
Before you start:

1. Separate all the parts in the kit according to component type.
2. Use a multimeter as shown to measure all the resistors. It is fine if the resistance you measure is within ±5% of the specified value.
3. Arrange the resistors according to their values.



DSO 138 Oscilloscope DIY Kit User's Manual

Assembly Instructions

Adapted from JYE Tech Ltd.

Tools you need:

1. Soldering iron
2. Solder wire
3. Multimeter
4. Screwdriver
5. Flush cutter

Step 1: Assemble Main Board and LCD

1.1. Resistors

R1, R14, R16:	100 kΩ		
R2:	1.8 MΩ	R9, R15, R26:	1 kΩ
R3:	200 kΩ	R10:	3 kΩ
R4:	2 MΩ	R11:	150 kΩ
R5:	20 kΩ	R36:	68 Ω
R6:	300 Ω	R37, R39:	10 kΩ
R7:	180 Ω	R38:	750 Ω
R8, R12, R13:	120 Ω	R28, R40:	470 Ω

1.2. HF-Chokes

L1, L3, L4: 100 µH

1.3. Diodes

D1: 1N5819
D2 Jumper

1.4. Crystal

Y1: 8 MHz

1.5. USB Socket

J4: USB mini B

1.6. Buttons

SW4, SW5, SW6, SW7, SW8: 6x6x5 mm

1.7. Ceramic Capacitors

C1, C9, C10 C11, C14, C15, C16, C17, C18		C3:	3 pF
		C5:	1 pF
C20, C23:	0.1 µF	C7, C8:	120 pF
C12, C13:	22 pF	C2:	330 pF

1.8. LED

D3: 3 mm, green
Solder positive terminal (longer lead) to square pad

1.9. Pin Header

J9: 2 pin

1.10. Transistors

Q1: 8850
Q2: 9014

1.11. Regulator

U4: 79L05
U5: Jumper pads 1 and 3

1.12. Variable Capacitors

C4, C6: 5-30 pF

1.13. Power Inductor

L2: 470µH / 0.5A

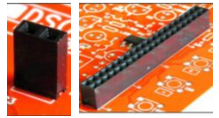
1.14. Electrolytic Capacitors

C19, C21, C22, C24, C25, C26: 100 µF / 16V

1.15. Pin-Header (male)

J5: 1 x 3 pin
J6: 1 x 4 pin

1.16. Pin-Header (female)



J7, J8: 1 x 2 pin
J3: 2 x 20 pin

1.17. Slide Switches

SW1, SW2, SW3: Double pole triple throw

1.18. BNC Connector

J1: BNC
Note: This component takes awhile to heat up while soldering.

1.19. Test Signal Ring

1.Make a small ring with a cut-off lead.

2.Solder the ring into the two holes of J2 as shown.

1.20. JP3

Short the two pads of JP3 together with a solder bridge.

1.21. LCD Board

Note: Install these so that the long side of the pins extends from the back of the LCD.

J3: 2 x 20 pin J7, J8: 1 x 2 pin

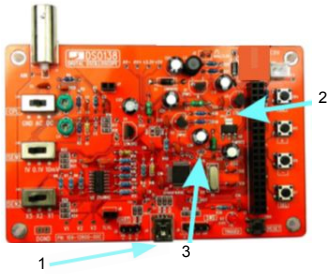
1.22. Jumper

Solder a wire on the back of the board from VBus to the +5V test point.

Step 2: Test and Use

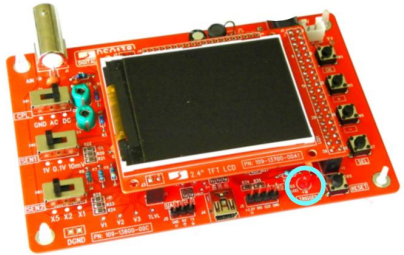
2.1. Check Voltages

1.Plug your 5V battery into the USB connector.
2.Check the voltage at TP 22. It should be around +3.3V.
3.If the voltage at TP 22 is correct, then unplug the battery. Short the two pads of JP4 with a solder bridge.



2.2. Attach LCD Board and Feet

Plug the LCD into female headers J3, J7, and J8 on the main board. Push the plastic feet through the mounting holes at the corners of the board



2.3. Verify

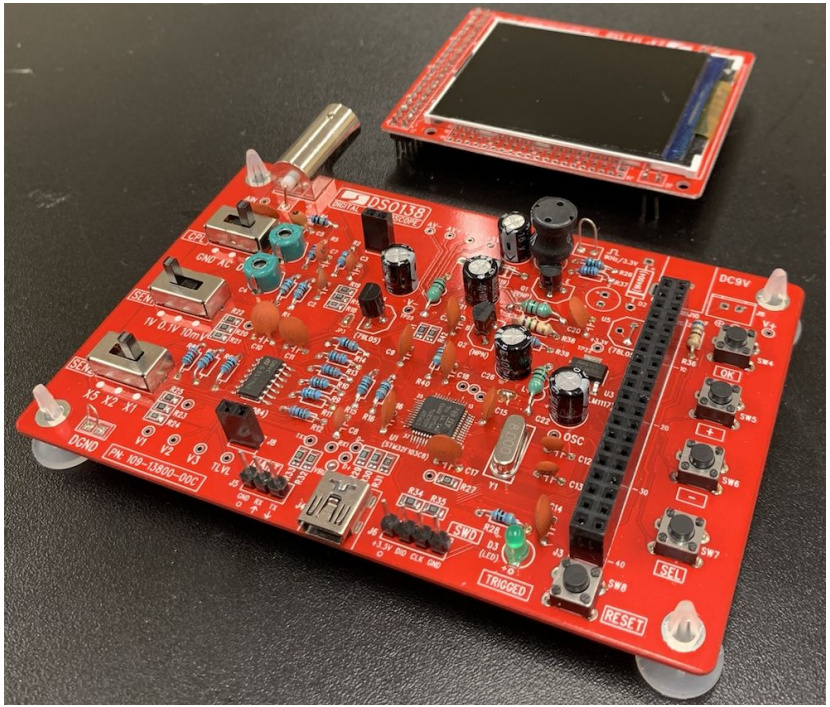
Connect the battery again. The LCD should light up and the oscilloscope display should come on.

This LED should come on when booting up.

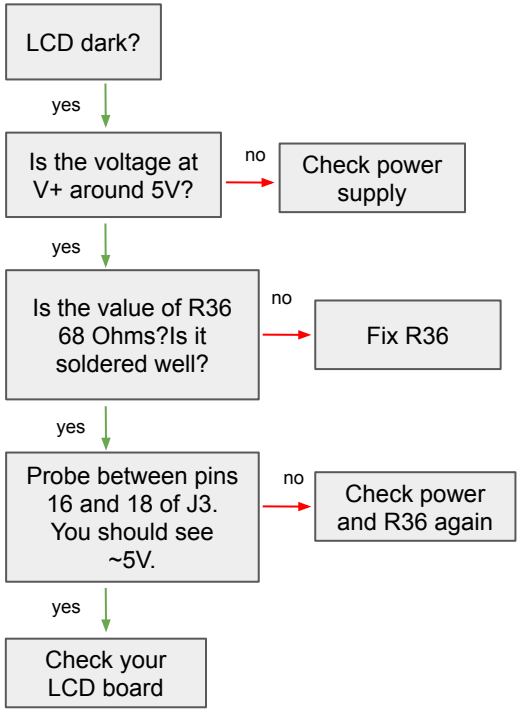
2.4. Probes

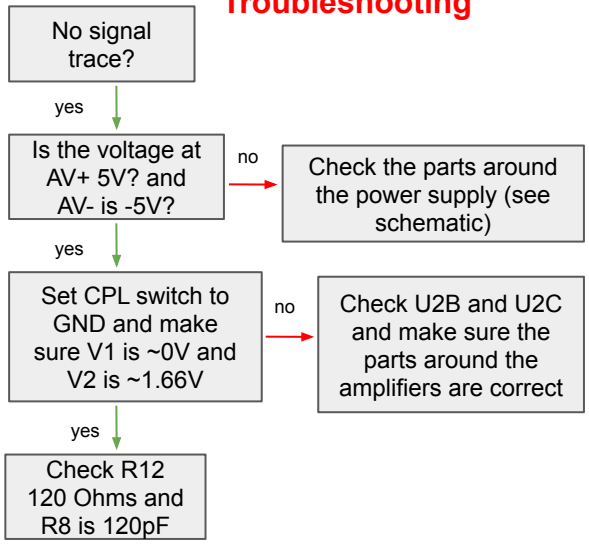
Attach the probe clips to J1, the BNC connector.

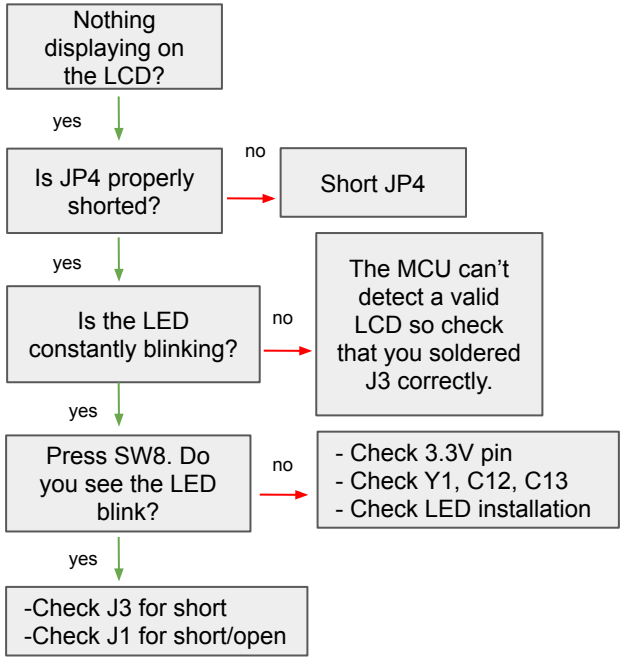
Main Board and LCD with Assembly Finished



Troubleshooting







Test Mode

What it is and how it works

Test Mode is used to find possible open connections (for all port pins) and shorts (for pins PB0 - 15 and PC13-15). When entered, it first checks the PB and PC pins with special patterns to find possible shorts. If found, the LED will blink fast. Otherwise, it generates 3.3V and 0V alternatively at each port pin (PA, PB, PC and PD) in cycle of about 4 seconds. These signals can be used to check for open connections.

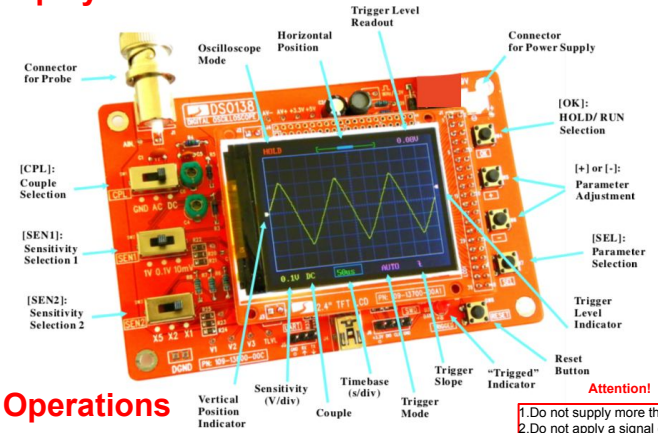
How to use

Hold down SW4 and press RESET to enter Test Mode. If you see the LED blinking fast, that means there are shorts on the PB or PC pins. You will need to find the shorts. If you see the LED blinking slowly, use a volt-meter to check each pin with related connections that could be open. When you don't see a voltage change at a place which might be connected to a port pin, there may be and open connection between the place and the port pin.

Specifications

Max realtime sample rate	1MSa/s
Analog bandwidth	0 -- 200KHz
Sensitivity range	10mV/div - 5V/div 50Vpk
Max input voltage	(1X probe)
Input impedance	1M ohm/20pF
Resolution	12 bits
Record length	1024 points
Timebase range	500s/Div -- 10us/Div
Trigger modes	Auto, Normal, and Single
Trigger position range	50%
Powersupply	9VDC(8–12V) ~120mA
Current consumption	117 x 76 x 15mm
Dimension	70 gram (without probe
Weight	

Display and Controls



Operations

Press the [SEL] button: Selects parameter to be adjusted. The selected parameter will be highlighted.
Press the [+] or [-] button: Adjusts the parameter selected by [SEL] button.
Press the [OK] button: Freezes waveform updating (entering HOLD state). Pressing again will unfreeze.
Change [CPL] switch: Sets coupling to DC, AC, or GND. When GND is selected, the scope input is isolated from input signal and connected to ground (0V input).
Change [SEN1] or [SEN2] switch: Adjusts sensitivity. The [SEN1] and [SEN2] settings vary the actual sensitivity, displayed at the lower-left corner of the panel.
Press the [Reset] button: Performs a system reset and reboots the oscilloscope.

Attention!

1.Do not supply more than 5V.
2.Do not apply a signal of more than 100V peak to peak.

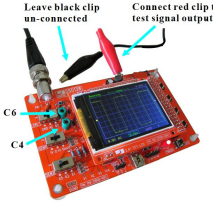
Tips

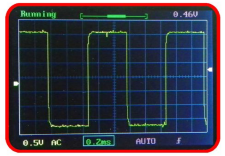
Vpos Alignment
This fixes misalignment between 0V trace and VPos indicator. To do this, set the coupling switch [CPL] to GND position. Press the [SEL] button to highlight the VPos indicator. Hold down the [OK] button for about 2 seconds. You will see the VPos indicator align to the 0V trace when you release the [OK] button. You may see some misalignment remaining at the highest sensitivity settings; this is normal.
Restore Factory Default
Hold down the [+] and [-] buttons simultaneously for 2 seconds.
Auto-center Trigger Level
Highlight the trigger level indicator and hold down the [OK] button for 2 seconds.
Auto-center Horizontal Position
Highlight the HPos indicator and hold down the [OK] button for 2 seconds.

Probe Calibration

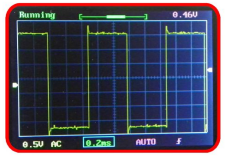
Because there is always some capacitance between the scope input and ground, the probe needs to be calibrated to get better measurement results for high frequency signals. This can be done with the help of the built-in test signal. To do this, please follow the steps below.

1. Connect the red clip to the test signal terminal and leave the black clip unconnected (see photo at right).
2. Set the [SEN1] switch to 0.1V and the [SEN2] switch to X5. Set the [CPL] switch to AC or DC.
3. Adjust the timebase to 0.2ms. You should see a waveform similar to that shown in photos below. If the traces are not stable, adjust the trigger level (the pink triangle on right screen border) until the display is stable.
4. Turn C4 (capacitor trimmer) with a small screwdriver until the waveform has sharp right angles (photo C).
5. Set the [SEN1] switch to 1V and the [SEN2] switch to X1 while keeping all the other settings unchanged. Adjust C6 so that a sharp, right-angled waveform is displayed.

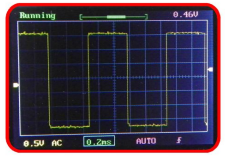




A – Not enough



B – Too much



C – Good

Turn Readouts On/Off

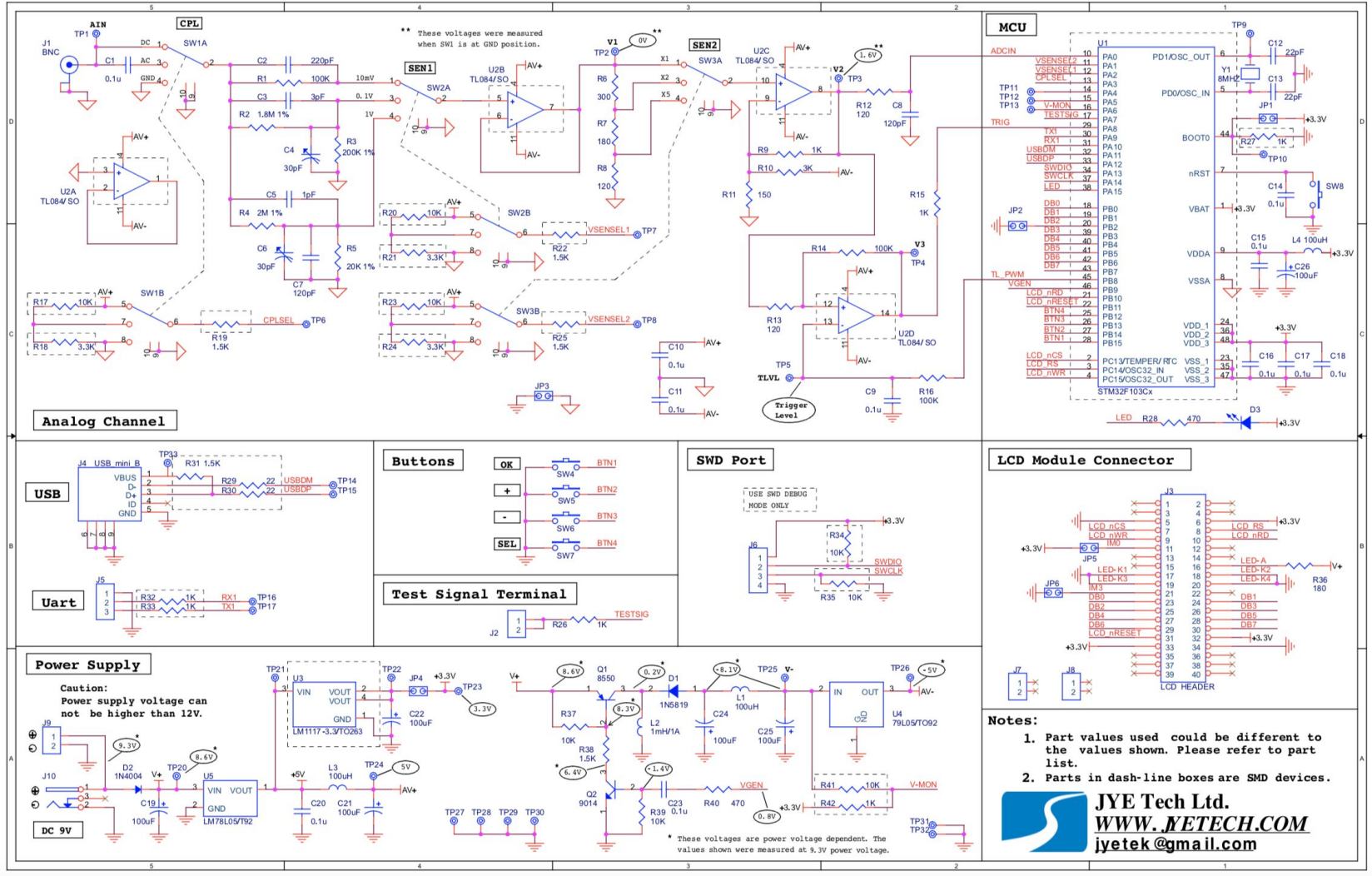
Press [SEL] so that timebase is highlighted. Hold down [OK] button for about 2 seconds. This will turn on/off measurement readouts.

Waveform Save and Recall

Press [SEL] & [+] simultaneously: Saves the currently displayed waveform to non-volatile memory.
Press [SEL] & [-] simultaneously: Recalls the saved waveform.

Triggers and Their Modes

Triggers indicate a signal voltage crossing a set level (trigger level) along a specified direction (trigger slope, rising or falling). The oscilloscope uses triggers as reference points for stable waveform display and measurement.
Auto Mode
In auto mode, the oscilloscope will update the display regardless of whether triggers happen or not. When triggers are detected, the waveform will be displayed with reference to the trigger points. Otherwise, the waveform will be displayed at random reference points.
Normal Mode
In normal mode, the oscilloscope will only update the display when there are triggers. If no triggers happen, the waveform displayed will remain unchanged.
Single Mode
Single mode is the same as normal mode, except that the oscilloscope will enter the HOLD state after a trigger has been detected and the waveform displayed has been updated.
Normal and single modes are useful for capturing sparse or single waveforms.


Analog Channel
MCU
USB
Buttons
SWD Port
LCD Module Connector
Uart
Test Signal Terminal
Power Supply
Caution:
Power supply voltage can not be higher than 12V.
DC 9V
Notes:
1. Part values used could be different to the values shown. Please refer to part list.
2. Parts in dash-line boxes are SMD devices.
* These voltages are power voltage dependent. The values shown were measured at 9.3V power voltage.
** These voltages were measured when SW1 is at GND position.
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