

Softrock Lite II 03_Divider

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Divider Introduction

General

This stage will actually involve installing the remainder of the bottom-side components. In addition to installing all of the remaining SMT capacitors, you will also install the Mixer IC (U3), as well as the Divider IC (U2).

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Normally, the Mixer chip (U3) would be addressed in a separate "Mixer" Stage. However, due to the close proximity of the pads for the two Ics, U2 and U3, you will install it in this "Dividers" Stage.

The tests for U3 will be postponed until the ["Mixer" Stage](#).

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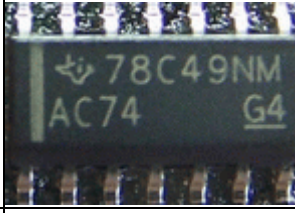
Theory of Operation

The dividers accept as input the output of the local oscillator and divide that down to two signals that are $\frac{1}{4}$ the input frequency and in quadrature (90 ° out of phase with each other).

U2 is wired as a divide-by-4 synchronous divider, clocked by the output from the Local Oscillator. Synchronous clocking means that all stages switch at the same time, potentially offering a reduction of noise generated during switching.

The divider provides two LO outputs which clock Mixer, U3. Proper Operation of the Dividers may be monitored on a CW or SSB receiver tuned to Divider Output Frequency listed in the table below.

Band	Divider Output Freq
160m	1.843 MHz
80m	3.525 MHz
40m	7.056 MHz
30m	3.375 MHz
20m	4.6825 MHz

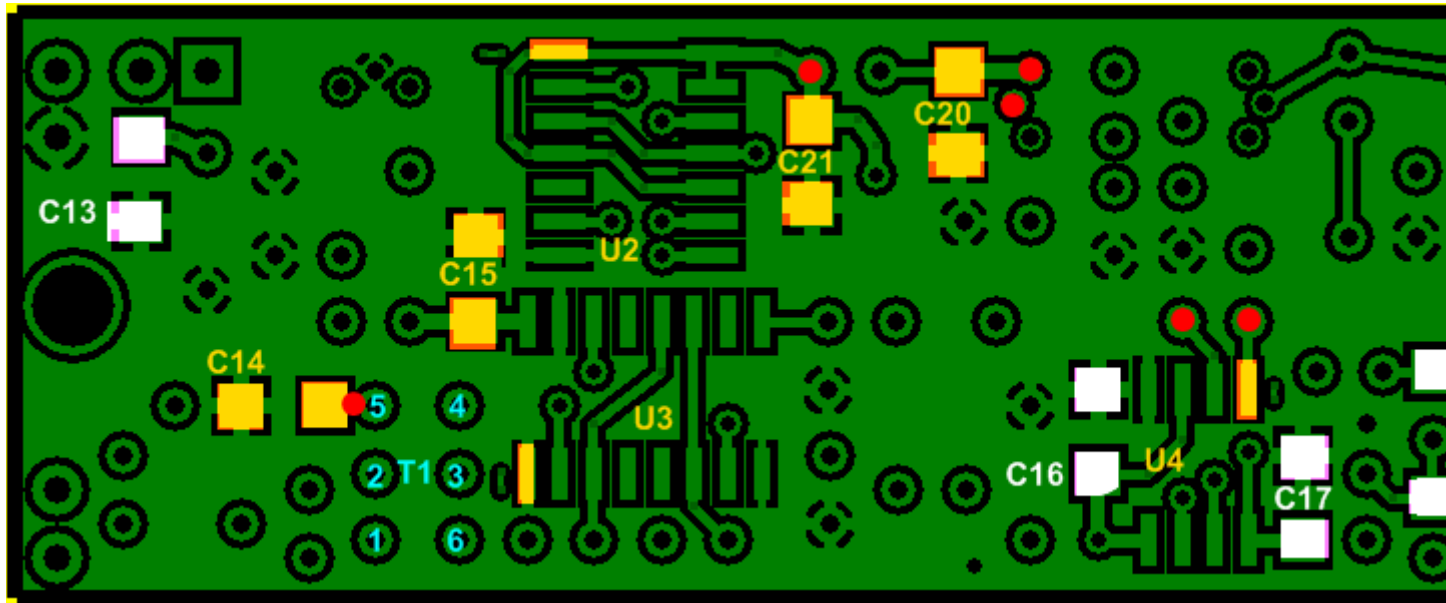
☐	C14	0.01 uF		SMT 1206			Divider
☐	C15	0.01 uF		SMT 1206			Divider
☐	C16	0.1 uF	black stripe 	SMT 1206			Divider
☐	C17	0.1 uF	black stripe 	SMT 1206			Divider
☐	C18	0.1 uF	black stripe 	SMT 1206			Divider
☐	C19	0.1 uF	black stripe 	SMT 1206			Divider
☐	C21	0.01 uF		SMT 1206			Divider
☐	hdw1	#4-40 board mounting hdw		HDW			Divider
☐	hdw2	#4-40 board mounting hdw		HDW			Divider
☐	U2	74AC74 Dual D FF	74AC74 	SOIC-14			Divider
☐	U3	FST3253 mux/demux switch	FST3253 	SOIC-16			Divider

Divider Summary Build Notes

- Install remainder of the SMT Capacitors
- Install U3
- Install U2
- Install Hardware
- [Test the Stage](#)

Divider Detailed Build Notes

Bottom of the Board



Install remainder of the SMT Capacitors

We will use this stage to go ahead and install all of the remaining SMT bypass capacitors.

See [hints on installing SMT Caps.](#)

The pads for the 0.1 uF capacitors are highlighted in white on the board shown above. These capacitors are in carrier strips marked with a black stripe.

The yellow markings pertain to the 0.01 uF capacitors.

Be very careful when soldering the SMT capacitors, so as to avoid solder "splashover" that could clog the thru-holes for components installed later on in the project. The holes that are "at risk" are marked with a red dot on the above graphic. You might want to plug them up temporarily with a fine-pointed toothpick when soldering in their vicinity. The at-risk holes are associated with the following capacitors:

- C14 (the T1 secondary hole to the right of the cap)
- C18 (R9's barrel hole at the bottom right of the cap)
- C19 (R10's barrel hole at the bottom right of the cap)
- C21 (R11's hairpin hole above the cap)

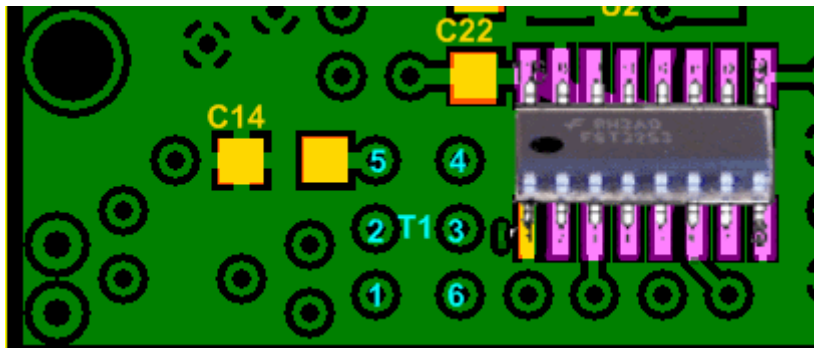
Check	Designation	Component	Marking	Category	Orientation	Notes
☐	C14	0.01 uF		SMT 1206		

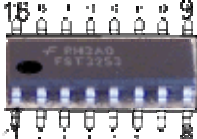
☐	C21	0.01 uF		SMT 1206		
☐	C15	0.01 uF		SMT 1206		
☐	C16	0.1 uF		SMT 1206		
☐	C17	0.1 uF		SMT 1206		
☐	C18	0.1 uF		SMT 1206		
☐	C19	0.1 uF		SMT 1206		

Install U3

You should install U3 BEFORE installing U2, due to layout considerations which could complicate the soldering of the lcs. The mixer will be tested in a [later stage](#).

See [hints on installing SMT ICs](#).

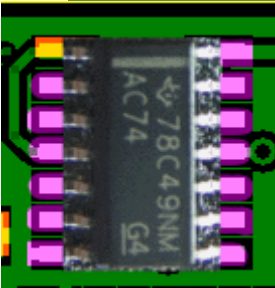


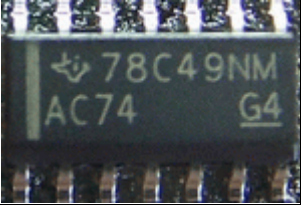
Check	Designation	Component	Marking	Category	Orientation	Notes
☐	U3	FST3253 mux/demux switch		SOIC-16		Take ESD precautions

Install U2

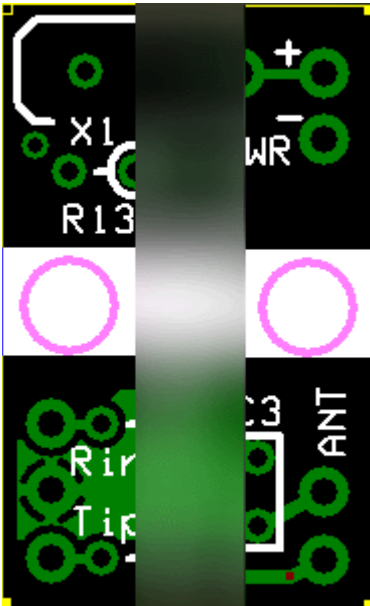
Install 74HC74 (U2) on the SOIC-14 pads on the bottom side of the board. Take ESD precautions

See [hints on installing SMT ICs.](#)



Check	Designation	Component	Marking	Category	Orientation	Notes
☐	U2	74AC74 Dual D FF		SOIC-14		Take ESD precautions

Top of the Board



Install Hardware

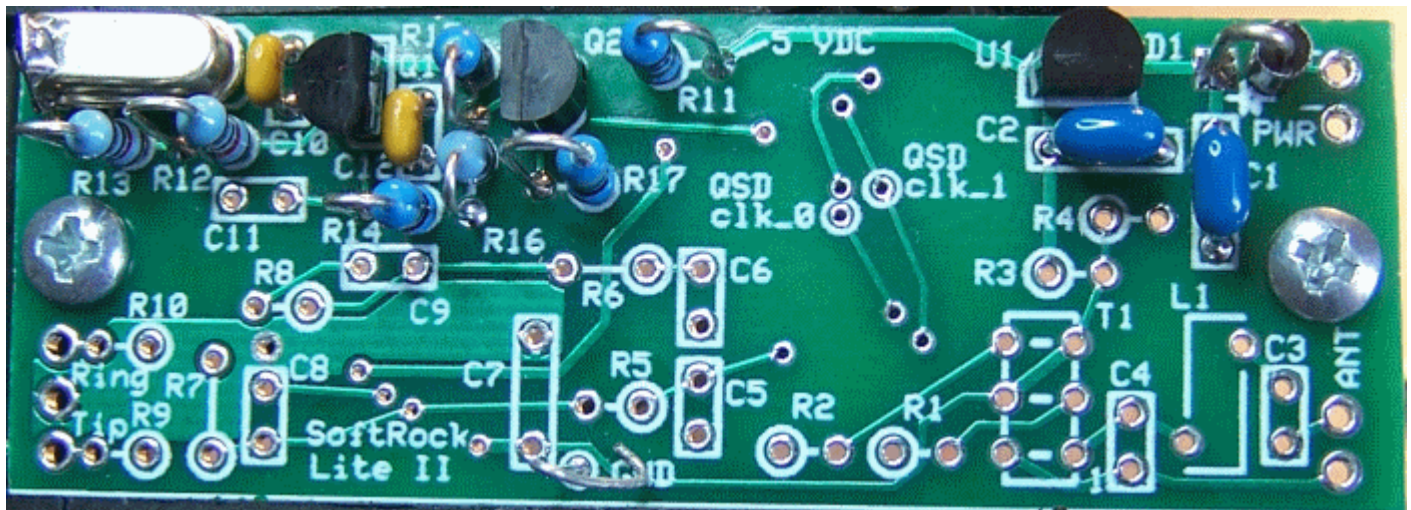
At this point you may install the two mounting screws and their associated hardware.

Install them with the screw head on the topside, then the board, then the spacer, then the washer, and finally the nut.

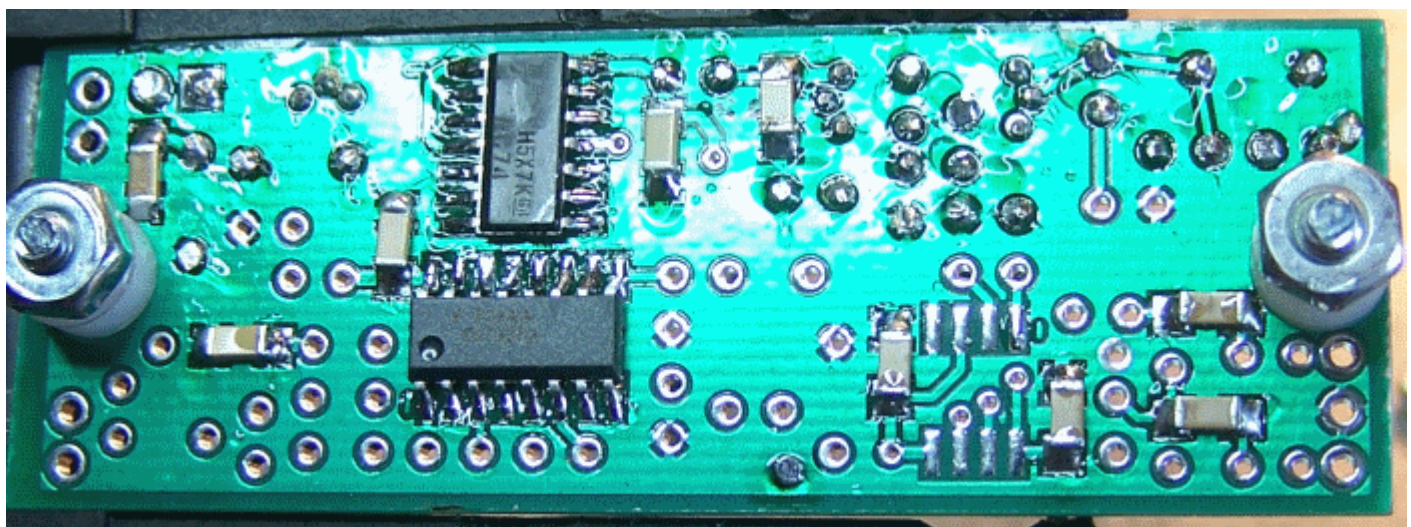
Check	Designation	Component	Marking	Category	Orientation	Notes
☐	hdw1	#4-40 board mounting hdw		HDW		
☐	hdw2	#4-40 board mounting hdw		HDW		

Divider Completed Stage

Top of the Board



Bottom of the Board



Divider Testing

Visual Check

Test Setup

Using very good lighting and magnification, carefully inspect the solder joints to identify bridges, cold joints, or poor contacts.

Pay especial attention to the joints on the divider IC pins. If necessary, touch up the joints with your iron and/or some flux. Wick up any excess.

(measurements courtesy of Leonard KC0WOX)

Current Draw

Test Setup

- connect a 100 ohm resistor in series with the positive power lead
 - apply 12 Vdc and measure the current draw with the limiting resistor in place
 - remove the current limiting resistor
 - apply 12 Vdc and measure the current draw without the limiting resistor

Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
With the 100 ohm current-limiting resistor	mA	< 20	18.0	
Without the limiting resistor	mA	< 25	18.1	

Voltage Tests

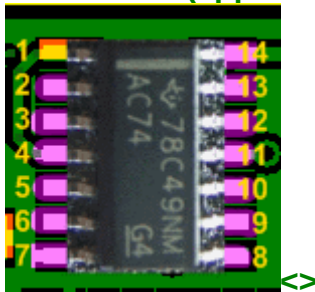
Test Setup

Measure the voltages with respect to ground for each of the pins of U2. Take care to measure at the actual IC pin rather than the pad, so as to ensure you are measuring the PIN voltage

expected voltages are indicated in the table below:

- 5 V (range of 4.5 - 5.4)

- 2.5 V (approx 50% of the 5V rail value)



Test Measurements

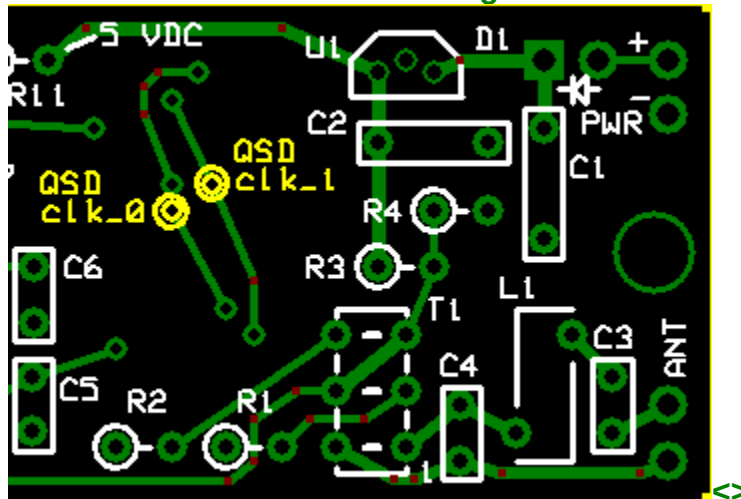
Testpoint	Units	Nominal Value	Author's	Yours
Pin 1	Vdc	5	4.9	_____
Pin 2	Vdc	2.5	2.48	_____
Pin 3	Vdc	3.5 - 4.5	4.1	_____
Pin 4	Vdc	5	4.9	_____
Pin 6	Vdc	2.5	2.47	_____
Pin 7	Vdc	0	0	_____
Pin 8	Vdc	2.5	2.48	_____
Pin 9	Vdc	2.5	2.48	_____
Pin 10	Vdc	5	4.9	_____
Pin 11	Vdc	3.5 - 4.5	4.1	_____
Pin 12	Vdc	2.5	2.47	_____
Pin 13	Vdc	5	4.9	_____
Pin 14	Vdc	5	4.9	_____

Divider Output

Test Setup

- The divider provides the QSD clocking signals for the mixer stage, with the frequency determined by the band for your kit. The bands and their QSD clocking frequencies are:
 - o 160m: 1.8432 MHz
 - o 80m: 3.515 MHz
 - o 40m: 7.056 MHz
 - o 30m: 3.375 MHz (the mixer will actually use the 3rd harmonic, 10.125 MHz)
 - o 20m: 4.6825 MHz (the mixer will actually use the 3rd harmonic, 14.0475 MHz)
 - o 15m: 7.015 MHz (the mixer will actually use the 3rd harmonic, 21.045 MHz)

- o The divider divides the LO frequency by 4, producing 2 frequencies that are at $\frac{1}{4}$ of the LO frequency and are 90° out of phase with each other.
- o Using a ham receiver, dial up the QSD clocking frequency for the band in question and couple a wire from its antenna to point "QSD Clk 1" and then point "QSD Clk2" on the graphic below. You should hear the signal in the receiver.



Mixer Test

Test Setup

The Mixer installation will be tested in a [later stage](#). In the meantime, just carefully examine the soldering and placement of the IC using good magnification and light.

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