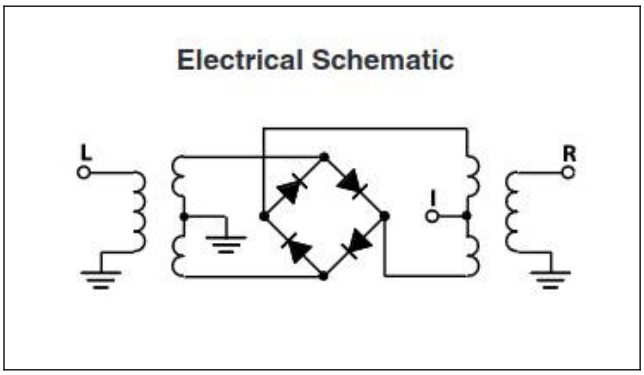
Mostly DIY RF / P3ST Transceiver Kit
VFO Mixer Module

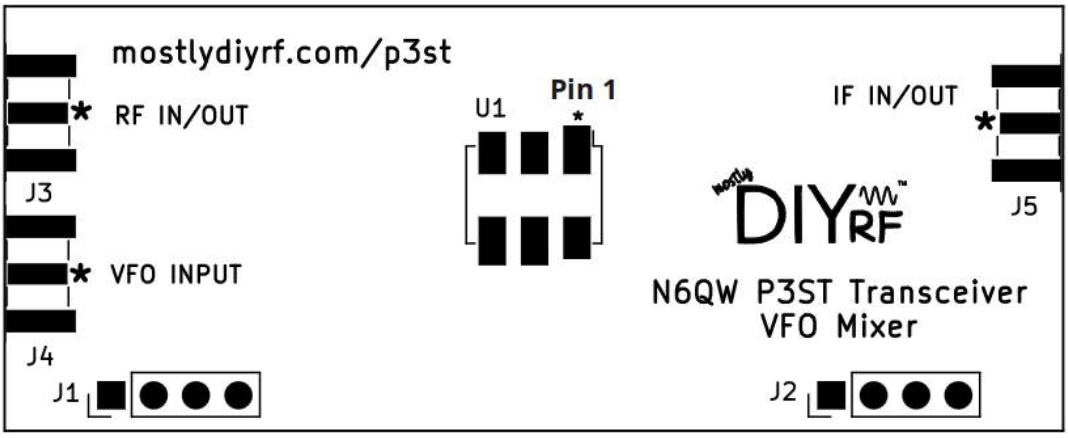
Assembly and Test Instructions

In keeping with the minimal design philosophy employed in the P3ST, the VFO mixer is an ADE-1+, a commercially-available unit from Mini Circuits. It is a double-balanced diode-ring design requiring an LO drive level of +7dBm. Though it is technically a surface-mount part, it is large enough to handle and solder with no difficulty. Here's its internal circuit:



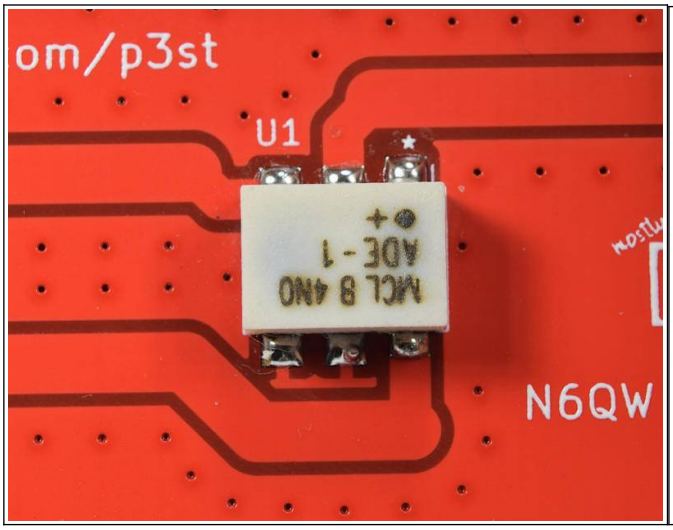
See attached datasheet for more information.

Assembly

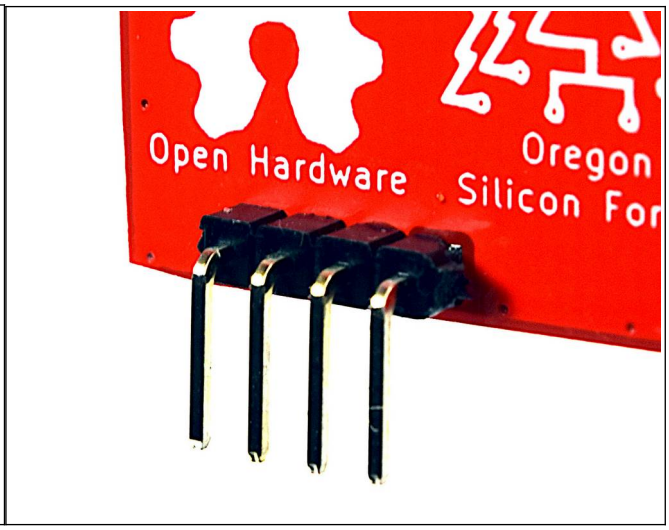


Assembly could hardly be easier. There are only three components to solder to the module board: two right-angle 4-pin headers and the single ADE-1+. Observe Pin 1 orientation as shown above. Though it's a surface-mount part, it is large enough to handle and solder easily. See the video at **https://bit.ly/surface-mount-tips** on SMD soldering. The large "D-PAK" component shown is most similar to the ADE-1+ in size. Easy-peasy.

As with the 4-pin headers on all the modules, install them with the right-angle pins extending out the back side of the PCB. Also as with all the modules, the input and output pads may be used either to attach board-edge-style SMA connectors or, with the help of the thru-holes in the middle of the pads, directly-soldered connections may be made.



ADE-1+ orientation. Yes, it mounts upside-down.



Four-pin right-angle head orientation

Test Procedure

1. Using magnification, visually inspect both sides of the PCB to look for solder bridging or other conductive debris. It's usually best to clean off flux residue first.

2. If you have them, you can test the full operation of the ADE-1+ mixer with a signal generator and spectrum analyzer. For more on doing so, see the video at **https://bit.ly/diode-ring-mixer** and **https://bit.ly/testing_dbms**. In the alternative (or in addition), you can test for "static" (DC) characteristics by ensuring that:

a) there is continuity (a small resistance of approximately 100mΩ) between Audio IN/OUT and GND, and between BFO INPUT and GND.

b) there is an apparent resistance (the result of two diode voltage drops) of approximately 8.9KΩ between the IF IN/OUT and GND.

c) there is full continuity between J1 Pin 4 and GND, and between J2 Pins 3 & 4 and GND.

d) there is **no** continuity between J1 Pins 1, 2, & 3 and GND, or between J2 Pins 1 & 2 and GND. The ADE-1+ does not need power from the motherboard.

Surface Mount

Frequency Mixer

ADE-1+

Level 7 (LO Power +7 dBm) 0.5 to 500 MHz

Generic photo used for illustration purposes only

CASE STYLE: CD636

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Available Tape and Reel at no extra cost

Reel Size	Devices/Reel
7"	20, 50, 100, 200
13"	500, 1000

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	50mW
IF Current	40mA

Permanent damage may occur if any of these limits are exceeded. These electrical ratings are not intended for continuous normal operation.

Pin Connections

LO	6
RF	3
IF	2
GROUND	1,4,5

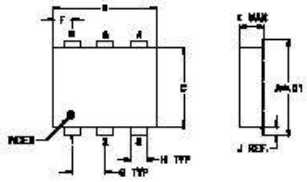
Features

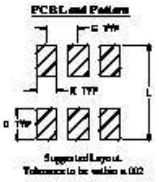
- low conversion loss, 5.0 dB typ.
- excellent L-R isolation, 55 dB typ.
- excellent IP3, 15 dBm typ.
- low profile package
- aqueous washable
- protected by US patent 6,133,525

Applications

- VHF/UHF

Outline Drawing



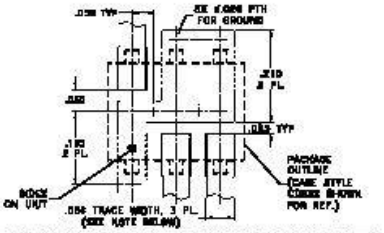


Suggested Layout. Tolerance to be within ±.002

Outline Dimensions (inch / mm)

A	B	C	D	E	F	G
.272	.310	.220	.100	.162	.055	.100
6.91	7.87	5.59	2.54	4.11	1.40	2.54

H	J	K	L	wt
.030	.026	.086	.300	grams
0.76	0.66	1.66	7.62	0.26



NOTES: 1. TRACE WIDTH IS SHOWN FOR BOARDS MANUFACTURED WITH DIELECTRIC THICKNESS .031" ± .003", COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Electrical Specifications

FREQUENCY (MHz)		CONVERSION LOSS (dB)				LO-RF ISOLATION (dB)						LO-IF ISOLATION (dB)						IP3 at center band (dBm)
		Mid-Band m			Total Range	L		M		U		L		M		U		
LO/RF f_L-f_U	IF	$\overline{X}$	σ	Max.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.
0.5-500	DC-500	5.0	0.10	6.5	7.8	70	60	55	35	45	30	66	45	40	25	30	20	15

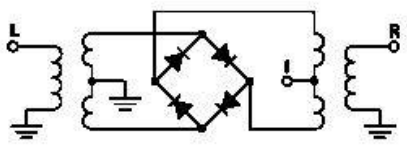
1 dB COMP.: +1 dBm typ.

L = low range [f_L to 10 f_L] M = mid range [10 f_L to f_U/2] U = upper range [f_U/2 to f_U]
m = mid band [2f_L to f_U/2]

Typical Performance Data

Frequency (MHz)		Conversion Loss (dB)	Isolation L-R (dB)	Isolation L-I (dB)	VSWR RF Port (:1)	VSWR LO Port (:1)
RF	LO	LO +7dBm	LO +7dBm	LO +7dBm	LO +7dBm	LO +7dBm
0.50	30.50	5.68	67.49	66.67	1.46	2.51
0.80	30.80	5.66	67.50	66.83	1.32	2.56
1.00	31.00	5.35	67.51	66.67	1.29	2.56
5.00	35.00	5.06	66.17	65.50	1.19	2.51
10.00	40.00	4.95	65.17	64.17	1.18	2.51
20.00	50.00	5.02	63.50	62.17	1.17	2.56
40.00	70.00	4.89	61.00	48.83	1.14	2.51
63.25	93.25	4.93	58.84	46.33	1.11	2.51
84.82	124.82	4.99	58.00	44.34	1.08	2.56
100.00	130.00	5.08	58.00	43.84	1.08	2.56
126.39	156.39	4.96	56.67	42.17	1.08	2.56
167.67	187.67	5.11	54.16	41.16	1.10	2.51
221.12	251.12	5.16	51.84	40.00	1.05	2.67
250.00	280.00	5.10	53.00	38.67	1.03	2.61
284.26	314.26	5.20	48.33	36.50	1.04	2.67
347.41	377.41	5.43	47.66	33.34	1.10	2.56
376.98	406.98	5.33	47.00	30.67	1.16	2.60
410.66	440.66	5.54	46.50	28.17	1.17	2.60
470.00	500.00	5.81	44.67	28.16	1.14	3.01
600.00	630.00	5.91	43.82	26.50	1.23	3.09

Electrical Schematic



Notes

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuits applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

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General Tips and Tricks

■ Save yourself some troubleshooting grief later on: test every part before you install it. Though MDRF uses components only from reputable sources, even those have finite failure rates. Testing is easier than it sounds, and it's quick since you only need to test for part failure.

- **■ Test resistors for continuity and approximate value (±5%)**
- **■ Test capacitors for *no* continuity. DC resistance should be infinite or ultra high after they charge up during testing. Note: this may take several seconds since the current an ohmmeter injects is very low.**
- **■ Test diodes to ensure no reverse continuity.**
- **■ Test transistors for high or infinite collector/drain and emitter/source DC resistance. Use diode test function to test base-emitter junction (base as anode). If you have a dedicated transistor tester, use that.**

■ Double-check component markings and color codes. Pin up a reminder chart nearby. Whether you need it or not, look it over before an assembly session.

■ It's usually easiest to begin stuffing parts in the center of a PCB and work your way out.

■ Insert component leads and bend them about 45 degrees to keep the parts from falling out when you flip the board over to solder on the backside.

■ The PCB holes are "through-plated" (copper plated and solder coated on the insides of the holes) for maximum connectivity and mechanical strength, but this makes rework (removing a part and installing a new one) a little more difficult than with other circuit-board methods. So before soldering, double check the component value and orientation.

■ A good habit is to install components such that they are "right-reading" relative to circuit-board nomenclature. For a resistor, this would mean the color code would read from left to right when the silk-screened legend does. For parts oriented vertically, they should read from top to bottom. For other non-polarized parts (such as ceramic capacitors) it's useful to install so their values can be read at a later time (and not, for instance, obscured by another part).

■ Because the power, input, and output pins are closely-spaced, do not use alligator (a.k.a. crocodile) clips for temporary connections. Dupont-style male jumper leads, however, are very convenient for this purpose.

■ Using magnification, visually inspect both sides of the PCB to look for solder bridging or other conductive debris. It's usually best to clean off flux residue first. Isopropyl alcohol (>90%) is excellent for this purpose as it's cheap and dries quickly.