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The Rock Legend

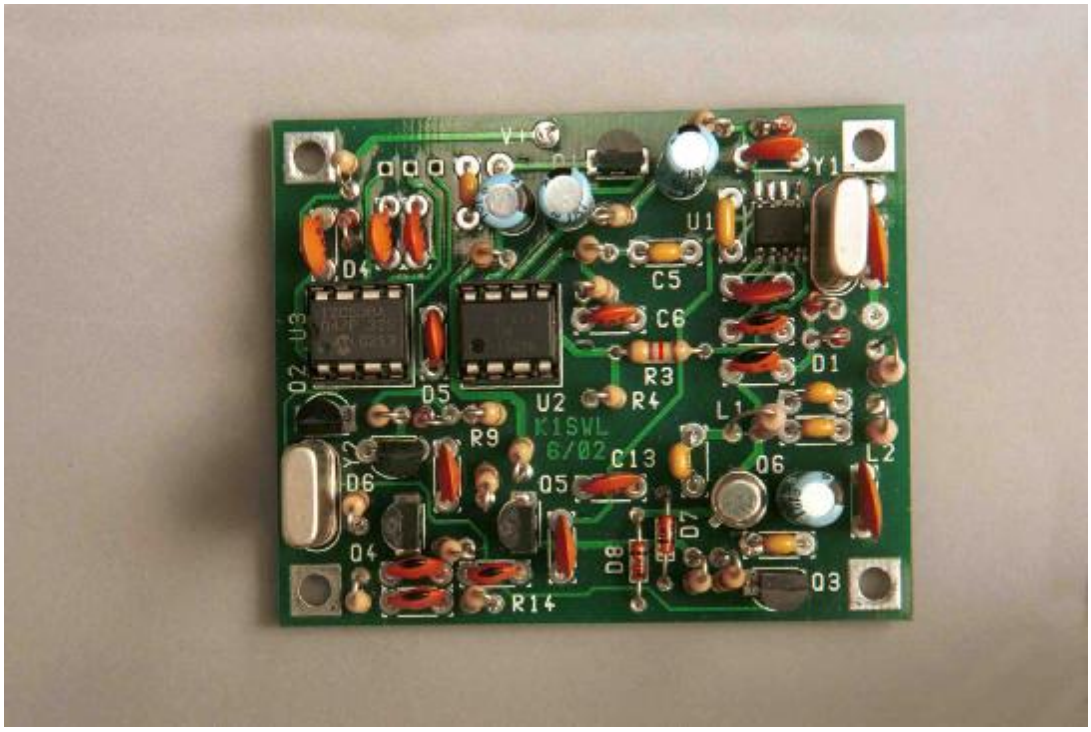
Talking about a legend has never been easy. But it isn't Jimi Hendrix's and his timeless music. I'm talking about a small QRP RTX named Rock-Mite®.

His inventor, Dave Benson K1SWL (former NN1G) studied this wonderful circuit by mixing technology, economy, effectiveness.

When I started building my first Rock-Mite® QRP RTX I thought I should connect it to bandpass or notch filters, and make some alchemy to avoid the stress of Broadcasting leakages.

But the Legend works alone : no filters, only an antenna, adjusted in lenght with the help of my 14 Euros SWR Meter, one 12 Vdc battery, paddles (or key) and phones (or amplifier).

The Rock Mite



Building the Rock-Mite

Rock Mite can be built in a “Altoid-Mint” type box (here in Italy we can use “Liquirizia Amarelli” or similar boxes) or a normal Hammond or Ganzerli box. It can be assembled also in a cutted double face PC board. I used for test purposes a box called “Fantasmino Kinder” wich contains also the 12 Vdc /1,2 Amps sealed battery.

The construction, except the assembling of U1, is easy and well described in the text of RM Instructions, and the RM can be built by Hams having at least some experience, just taking into account that :

- U1 should be soldered first, because his assembling needs some free space around it. It isn’t very simple : I used a small soldering iron and a big light lens.
- U3, Q1, Q2, Q3, are static-sensitive components, (use a grounded soldering iron).
- D3, D4, D5 are easy to be reversed (check the figure : that was my first mistake).
- The original sockets are good quality, but I replaced them with golden-plated ones due to the fact that I live near the Mediterranean Sea and, you know, the salt is terrible for contacts : a little sea drop is able to destroy a contact.
- If you don’t use any socket for the IC’s, and sometimes have to replace U2 or U3, it is better to cut the IC pins and disassemble them, one at time, with soldering iron, then discard the IC body : this simple rule, in case of fail, may be applied to other components.
- Q1 should be DC loaded, no coupling capacitor should be used (this was my 2nd mistake).
- Chokes and ferrite beads on 12 V inlet, phone output and key input are always a good way to reject stronger broadcast signal that can bypass thru phones, power or key lines.

Components

I replaced the original 400 mW PA (2N2222) and his 10 Ω emitter resistor with a 1 W PA 2N3553 and 4.7 Ω resistor : some more dB, for a stronger signal over my poor antenna system.

U3 is a pre-programmed IC used for :

1. Sidetone
2. Frequency Shift between TX and RX
3. Frequency Shift Reverse
4. Built-In Iambic Keyer.

The sidetone is a square wave frequency connected to phone thru C8 (0.1 uF).

The sidetone level depends on C8 reactance, so you can replace this capacitor with a smaller one to decrease the sidetone level, and, if the cap is replaced by rc filter (100 ohms and 0.1 uF

in series and 0.1 uF from Q1 source to gnd, the sidetone will become sine waveform ; final values depend on impedance of phones.

The frequency shift (~0.7 kc) determines the pitch of rx audio signal due to the difference between incoming and LO (Y2) frequencies.

The frequency shift can be reversed, to work another station.

The built-in iambic keyer is default 16 wpm, but can be modified by following the simple instructions.

Grounding the two Xtals is very important to improve their mechanical stability and shielding (Y2) from broadcastings.

Input Filter

Dave (dave@smallwonderlabs.com) solved the problems of the broadcastings by projecting an input xtal filter, composed by Y1, the same frequency of (Y2) LO xtal, and some components.

The loss of Y1 is compensated by U1 (SA612 SMT IC) gain: the result is a 3 x 2.5 cm front end/amplifier/product detector.

Operation *(taken from Dave's description)*

The Rock-Mite is a crystal-controlled direct-conversion transceiver operating on 7040 KHz, the North American 'watering-hole' for QRP activity, or 14060 KHz for the 20M version. It has an 8-pin PIC microcontroller on-board which controls a T-R offset on key-down. A brief tap of a pushbutton control switch reverses the offset to yield a second operating frequency. Pushing and holding on the pushbutton activates the speed adjustment routine for the built-in Iambic keyer. If you'd rather use an external keyer or straight key, there's a 'drop-through' mode which allows use of an external keying source.You'll note in the image above that the Rock-Mite uses two crystals. The first is used in the local oscillator for transmitter and receiver. The second is used as a receiver front-end filter. This crystal significantly reduces the SWBC energy present at the receiver mixer; as a result, unwanted SWBC reception is dramatically reduced.The Rock-mite uses one surface-mount part with fairly large spacing. There are no toroids to wind, so assembly should be a snap! The Rock-Mite uses subminiature epoxy-encapsulated RF chokes instead of toroids- maximum harmonic content is -33 dBc for either 40 or 20M version..

Specifications *(without mods)*

- Double-sided PCB 2.0" x 2.5", plated-thru-holes, solder masked & silkscreened for easy assembly

- 0.5W power output at 12V supply.

- Supply voltage range 8-15V

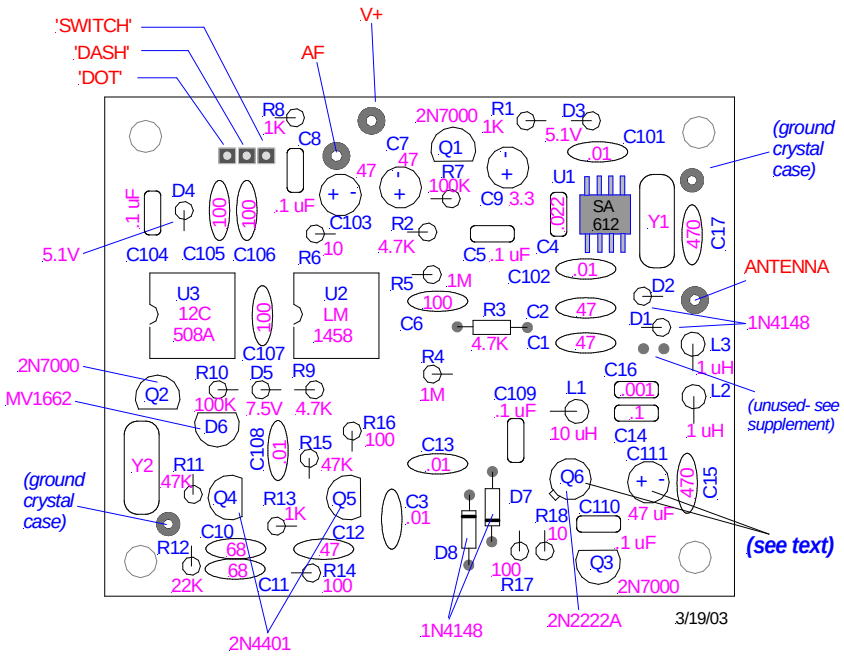
- Tuning: fix-tuned, two frequencies ~7039/7040 Khz (~14060/14061 on 20M)

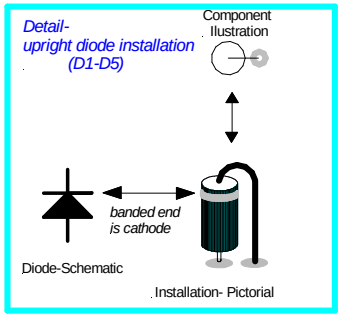
-automatic T/R offset, reversible

-Built-in Iambic keyer, 5-40 WPM

-Built in sidetone, 700 Hz

Layout

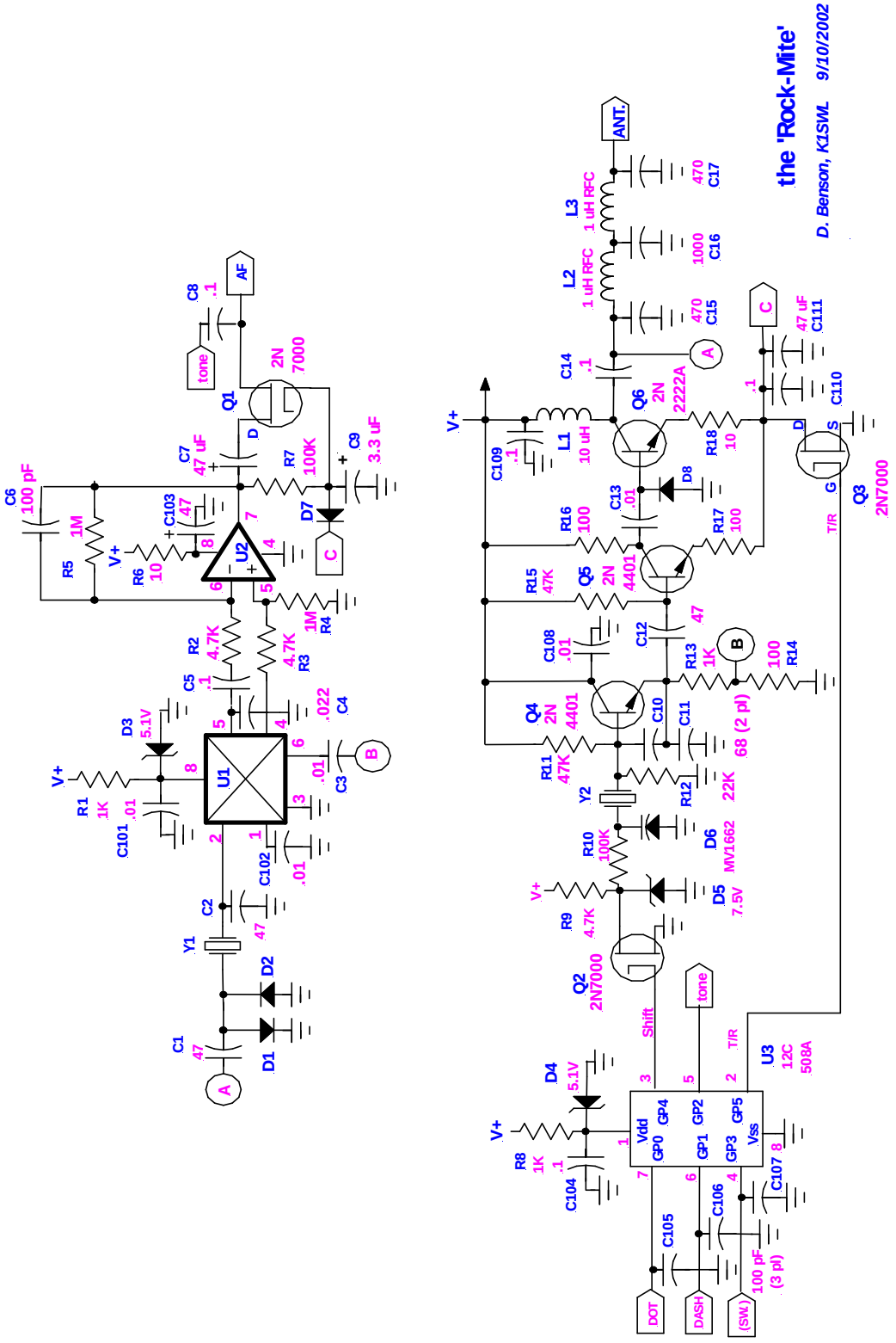




The Rock-Mite-40

rev.3/19/2003

Schematic Diagram



Parts List

Qty.	Ref. Designator	Component	Description
3	C1,C2,C12	47 pF NPO disk cap	'47' or '47J' ceramic
2	C10,C11	68 pF disk or mono. cap	'68' or '68J'
4	C6,C105-107	100 pF disk or mono. cap	'101' or '101J'
2	C15,C17	470 pF disk or mono. cap	'471' or '471J'
1	C16	1000 pF (.001) mono. Cap	'102J'- epoxy case
5	C3,C13,C101,102, 108	.01 uF disk cap	'103', ceramic
1	C4	.022 uF monolithic cap	'223', epoxy case
6	C5,C8,C14,C104,109,110	.1 uF monolithic	'104', epoxy case
1	C9	3.3 uF electrolytic cap	
2	C7,C103	47 uF electrolytic cap	
1	C111	47 uF electrolytic cap	low-profile case
4	D1,D2,D7,D8	1N4148 diode	*In bag-strip*
2	D3,D4	1N5231B diode- 5.1V Zen.	*In bag-strip*
1	D5	1N5236B diode- 7.5V Zen.	*In bag-strip*
1	D6	MV1662 varicap diode	2 leads- stripes only
1	HS1	TO-18 heat sink, anodized	*see text*
1	L1	10 uH RF choke	Brown-blk-blk, *In bag-strip*
2	L2,L3	1 uH RF choke	Brown-blk-gold, *In bag-strip*
2	R6,R18	10 ohm resistor	Brown-blk-blk-gold
3	R14,R16,R17	100 ohm resistor	Brown-blk-brn-gold
3	R1, R8, R13	1K ohm resistor	Brown-blk-red-gold
3	R2,R3,R9	4.7K ohm resistor	Ylw-violet-red-gold
1	R12	22K resistor	Red-red-org-gold
2	R11,R15	47K resistor	Ylw-violet-org-gold
2	R7,R10	100K resistor	Brown-blk-ylw-gold
2	R4,R5	1 M resistor	Brown-blk-green-gold
3	Q1,Q2,Q3	**2N7000 transistor**	(TO-92 package)
2	Q4,Q5	2N4401 transistor	(TO-92 package)
1	Q6	2N2222A transistor	Metal can package
1	U1	SA612/602AD SMT IC	*in semiconductor bag*
1	U2	MC1458, LM1458 IC	8-pin DIP IC
1	U3	**12C508A**	8-pin DIP IC, *pre-programmed*
2	Y1, Y2	7.040 Mhz crystal	
2	- -	8-pin IC socket	(on antistatic foam)
1	- -	2-1/2" RG-174/U coax	
1	- -	Printed circuit board	'K1SWL 9/02'