

## The TiCK-EMB-4

### The TiCK-4 Keyer with Enhanced board & Memory Backup Building and Operations Manual

Version 1.3

Congratulations on your purchase of the Tiny CMOS Keyer-EMB (Enhanced board & Memory Backup) kit. This kit includes the TiCK-4, which features lmbic modes A and B, adjustable speed control, tune function, paddle select, sidetone on/off, straight key mode, (2) 50 character message memories, beacon mode, and non-volatile parameter memory. The TiCK-4 utilizes the latest in RISC-based microcontroller technology. This kit includes all board-mounted parts; the user simply adds a power source and enclosure. The product was designed to run off a DC source of 7-25V-DC, and uses a board mounted 3V lithium battery to power the TiCK when the main power is shut off. In this manner, the TiCK's parameter settings and memory message will stay active. Since the TiCK only draws a few microamps, the lithium cell will last a long time. Finally,

although we believe this kit to be easy to build, we recommend following the steps as listed below, in order to insure a working unit in the shortest period of time.

#### Building the TiCK-EMB

The first step is to inventory all the parts contained in the kit against Table 1. Be sure to check each component, and it will be helpful to tape each component to a piece of paper along with its designation and value. Be extra careful with U1, the PIC microcontroller, as it is susceptible to static damage if mishandled. Be sure to ground yourself before handling U1 by touching a metal object that you know is grounded.

Table 1

DESIGNATION	TYPE	VALUE	MARKED AS
B1	Lithium Battery	3v	CR1225
C2	Tantalum capacitor	1 uF	1.0
C3, C4	capacitor - axial	.1 uF	104
C5, C6, C7, C8	capacitor - axial	.001uF	102
D1	Shottky Diode	1N5817	1N5817
P1, P2	stereo paddle jack		
R1	resistor - 1/4w	4.7K	yellow-violet-red
R2	resistor - 1/4w	27K	red-violet-orange
R3	resistor - 1/4w	1 Meg	brown-black-green
R4, R5, R6	resistor - 1/4w	100	brown-black-brown
Q1	Transistor		PN2222
S1	momentary switch		
U1	PIC microcontroller		PIC12CE674
U2	LDO voltage regulator	+5v	LT1121CZ-5
8 PIN SOCKET			
PC BOARD			EMB-1
PIEZO			AT-12
BATTERY CLIP	9v battery clip		
BATTERY HOLDER	3v lithium cell holder		

Now that you have verified the parts, you can prepare to solder the parts on the board. You'll need a small-to-medium soldering iron, something in the 15-40 watt range. Use rosin core solder; a 60/40 mix of lead/tin is recommended. Radio Shack stores carry all the

soldering supplies you would need to build this kit. Before starting the actual soldering, take a few minutes to look at these assembly instructions. **Make sure to wear safety glasses, and to wash your hands with hot soapy water after handling the solder.**

- (1). Install the 8-pin socket that U1 will use. Notice that one end of the socket has a concave tab, which denotes the pin 1 end. Make sure the tab on the socket matches the silk screen overlay on the circuit board. Solder the socket onto the board, being careful not to apply too much heat and melting the socket. Do not install U1 at this time... it will be installed last.
- (2). Install the lithium battery holder. Be sure to solder the holder in so that it is sitting flush on the surface of the board.
- (3). Install P1 and P2, the board mounted stereo jacks used for paddle input and keyline output, respectively. Be sure to solder these in so that they are sitting flush on the surface of the board, and that the edge of the jack is flush with the board. You may have to adjust them into position, BEFORE soldering.
- (4). Install S1, the momentary, board mounted pushbutton switch. Be sure to press the switch to the board so that it is sitting flush on the board, and even with the edge as in the step above.
- (5). Install capacitor C2. **Note:** C1 is NOT used. These tantalum caps are polarity sensitive, and **MUST BE INSERTED CORRECTLY.** The longer leg of the cap is the **POSITIVE** leg, and should be inserted as shown on the silkscreen. **Note: be sure to orient the positive lead of C2 toward the socket for U1.**
- (6). Install capacitors C5, C6, C7, and C8. Do not install the other capacitors, they will be dealt with later.
- (7). Install resistors R1, R4, R5, and R6. Do not install the other resistors, they will be dealt with later.
- (8). Install Q1, the keyline transistor. Make sure the flat side is oriented correctly.
- (9). Install D1, the Schottky diode. Note that one end of the diode has a band on it. Position this band as shown on the board's silkscreen.
- (10). Install U2, the 5v regulator. Make sure that the regulator is positioned with its flat surface, as shown on the board's silkscreen.
- (11). Beginning with this instruction, there are parts that will be optional, depending on the application you intend for the TiCK-EMB. Take a few minutes to read and consider these instructions before continuing.
- (12). Audio feedback/sidetone:
 

**Piezo Method:** We wanted to make the TiCK-EMB as simple as possible, so we decided to provide a method of audio feedback and/or sidetone that would not require a connection to the radio audio chain. The way this is done is by providing an output for a piezo transducer to connect to. The piezo transducer connects between the two pins of J2. Polarity is not necessary. You will have to place a jumper for R2 and C3, and **NOT POPULATE R3 or C4.** This can be done by using a two small pieces of resistor lead. Bend the leads in a "U" and solder in place of R2 and C3. This jumpers pin 3 of the TiCK to J2 pin 1. There should be continuity between pin 3 of the TiCK and pin 1 of J2. This method allows for the easiest implementation of embedding a keyer into your rig.

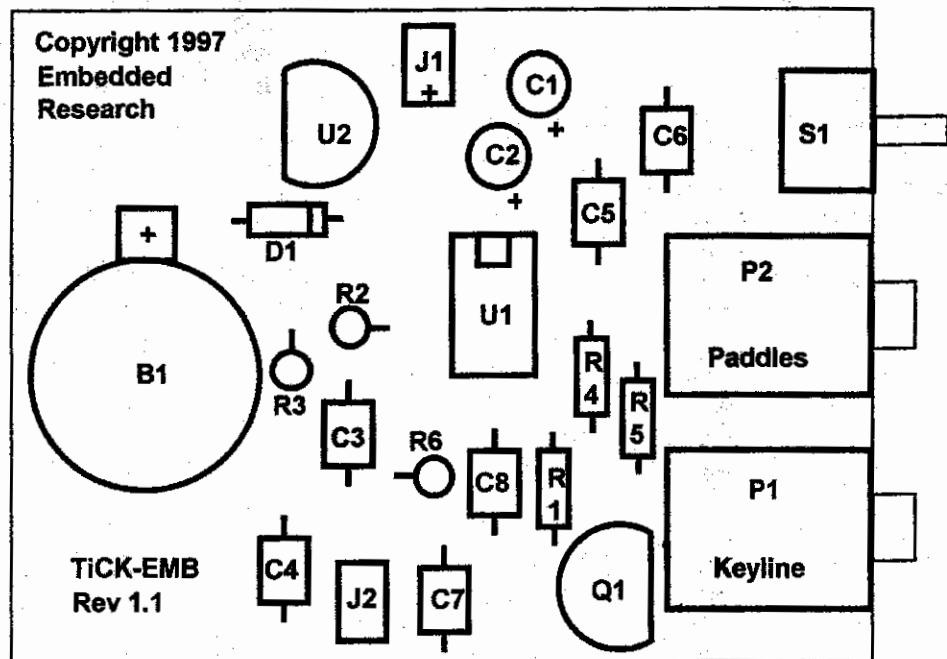
**Internal Audio Chain Method:** We also decided to make it possible to experiment with adding the TiCK-EMB to a radio and integrating it in the audio chain. We have set up the typical arrangement required to integrate the keyer into many rigs. This involves removing the current sidetone circuitry that is generated by your rig, and inputting the sidetone and feedback from the keyer (pin 3 TiCK). We included the following components to reduce the output voltage and couple it to the rig's audio chain: R2, R3, C3, C4. For the Norcal -40&A we have been told that the value for R2 is 27K, and R3 is 1Meg, but we have not tried this implementation. We leave this up to the experimenter to determine values for the rig in question.

***BUT REMEMBER, IF YOU DON'T WANT TO MAKE THIS COMPLICATED, JUST USE THE PIEZO!***

- (13). Now that the components have been placed and soldered on the board, the final wiring can take place.
- (13a). Cut two equal length pieces of wire, to use for connecting a 7-25V DC power source to the TICK-EMB board. It is customary to use RED for the positive lead, and BLACK for the negative (ground) lead. Solder the wires into J1, making sure that the RED wire goes to hole marked with a "+".
- (14). Install U1, the PIC microcontroller. Be careful to discharge yourself of any static electricity before handling the chip. Make sure the tab on the chip matches the location on the silk-screen, thus insuring correct orientation of the chip.
- (15). Install the lithium battery into B1, the battery holder. Note that the battery should be inserted so that the "+" on it's surface is facing UP. At this point, you should hear the letter "B" in Morse code (if you are using the piezo).
- (16). Now plug your paddles into the paddle jack (P2) and supply power (7-25v DC) to the unit. When the paddles are actuated, you should hear the dits/dahs at the piezo. If there is no audic output at the piezo, go back and check for the following:
  - Solder Bridges** - Easily the most common mistake made. Check the bottom of the board for solder blobs that serve to bridge two unconnected points. Use a magnifier and bright light if possible. Also check for unsoldered pins and cold solder joints (these appear dull and somewhat rough).
  - Parts Placement** - Go over the instructions and insure that each part is in its correct position on the board. Something as simple as an incorrectly placed resistor may cause the unit to malfunction. Verify that the microcontroller is oriented correctly, with respect to the tab on it's end.

**Silk Screen and Parts Placement Diagram**

Below is a silk-screen of the Circuit Board, with additional details for construction.



**Notes:**

**Keyer Parameters:** the TiCK-4 uses internal EEPROM (Electrically Erasable Programmable Read-Only Memory) to store its operating parameters such as speed, dit/dah paddles, lambic mode, sidetone on/off, etc. The message memories are stored in RAM, and unlike the parameters described above, will be lost when the keyer is not powered ON. The 3v lithium battery keeps the TiCK powered, even when the main power supply is cycled off, which sustains the TiCK's message memory. **IT IS NOT RECOMMENDED THAT THE TiCK BE POWERED FROM THE ON-BOARD LITHIUM CELL AS THE PRIMARY BATTERY.**

**Power-Up:** upon power up, you should hear the TiCK's start-up audio signal, per the TiCK data sheet. Note that this only occurs when the TiCK is powered up, which includes insertion of the 3v battery.

**Current Usage:** when not receiving input from the pushbutton or paddle inputs, the TiCK will immediately go into "sleep" mode. In this state, the device draws about five microamps of current from the 3v lithium cell. Current is only drawn from the 3v cell when the primary power is not connected.

When the primary source of DC is connected, the TiCK-EMB will draw about 35 microamps from it. So if you use a standard 9v battery to power the 'EMB, it will last a long time! You may even decide to forego an ON/OFF switch!

**Construction notes:**

The TiCK-EMB was designed to mount inside an enclosure just using its front panel jacks. In addition, or alternatively, you may wish to use the (2)) holes provided on the circuit board for mounting with 4/40 screws and standoffs. We offer an EMB Enclosure kit, specifically made for it. Mail us, or visit our webpage for more information.

The TiCK-EMB was designed to be powered with a primary DC supply of 7-25v DC. The 3v lithium battery is optional, and is used to maintain the TiCK's memory and parameters when the primary DC power supply is off.

The voltage regulator used in the TiCK-EMB is a Low Drop Out (LDO), low quiescent current design. Unlike the 78L05 regulator, this one uses MUCH less current when the rig is powered up. Although more costly than the 78L05, we believe these features to be important to those utilizing batteries.

**Do not operate the TiCK-EMB without the main power supplied.** This will greatly reduced the 3V

battery life. The 3V battery's main purpose is to preserve the TiCK's message memory when changing batteries, and when the main power is shutdown. As long as the TiCK is in sleep mode, the 3V lithium battery will keep the TiCK powered for several months, without need for a primary power source.

If you intend to keep a 9v battery attached to the TiCK-EMB all the time, then there is no need to put a switch between the battery and the 'EMB. In this case, the 9v battery will power the 'EMB and the 3v cell will not be utilized. Only when changing batteries will the 3v cell be called upon to power the TiCK and maintain its message memory; the operating parameters, stored in EEPROM, will NOT be effected by power up/down cycles.

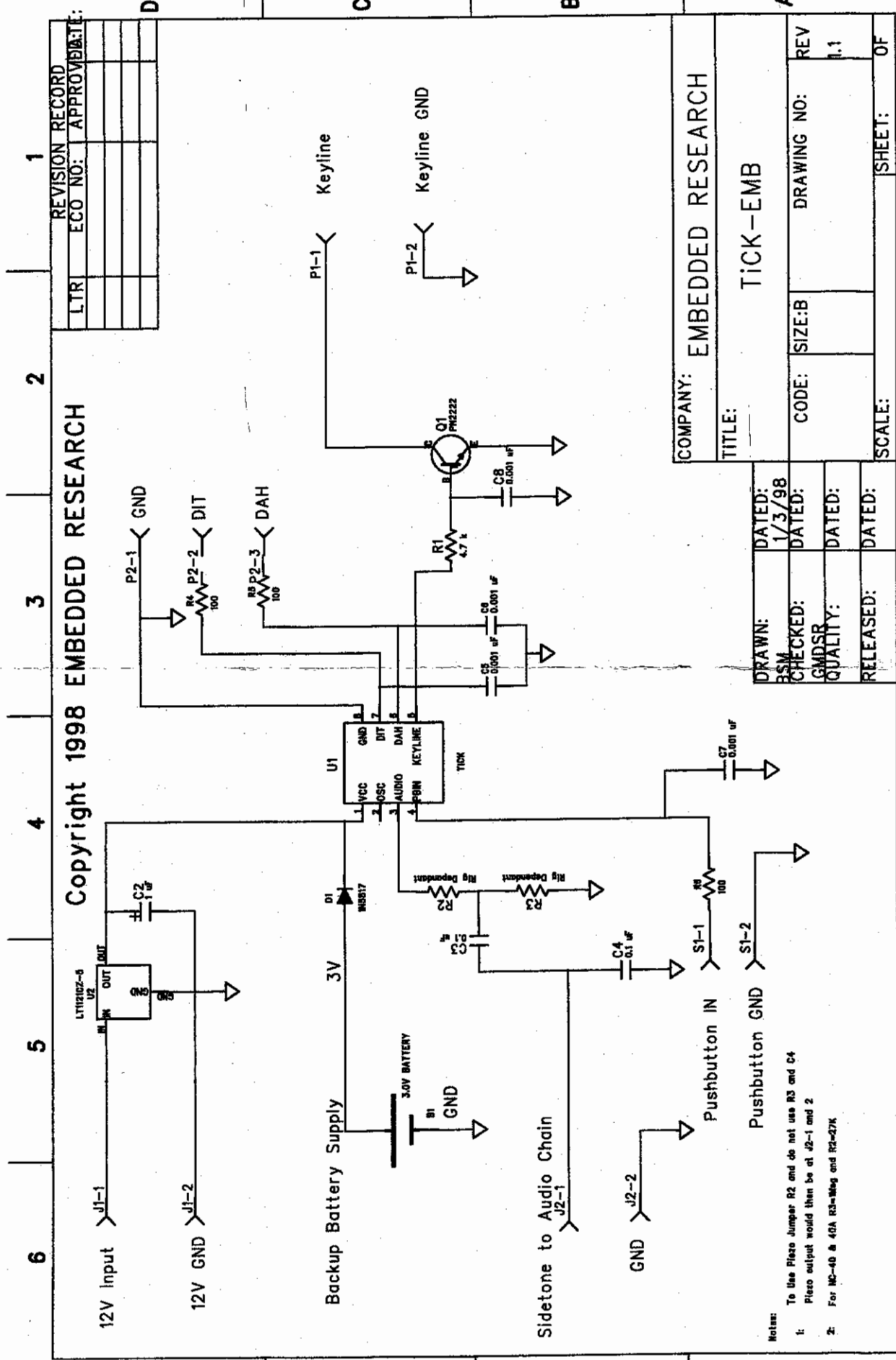
**When removing the main power source, make sure that you are in normal keying mode, and not in one of the menus.** Not doing so will greatly reduce the life of the lithium battery. The TiCK only goes to sleep when it is in normal, operational mode. While inside the menus the TiCK is awake and looking for input. Again, when it is normal operational mode, if there is no input from the paddles or pushbutton, then the TiCK goes to sleep and only draws 5 uA.

**Questions:**

If you should have any questions or comments regarding the TiCK-EMB or if you would like to submit rig modifications for embedding the TiCK-EMB into your favorite rig, contact us via the following:

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REVISION RECORD

LTR	ECO NO:	APPROVAL:

COMPANY: EMBEDDED RESEARCH

TITLE: TICK-EMB

CODE: SIZE:B	DRAWING NO:	REV
		1.1

SCALE: SHEET: OF

DRAWN:	DATED:
BSM	1/3/98
CHECKED:	DATED:
GMDSP	
QUALITY:	DATED:
RELEASED:	DATED:

Notes:

- To Use Piezo Jumper R2 and do not use R3 and C4  
Piezo output would then be at J2-1 and 2
- For MC-40 & 40A RS-Mag and RS-27K