TADD-3 Mini Assembly and Operation Manual

Four Channel Pulse Distribution Amplifier

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Introduction

The TADD-3 Mini is a four channel pulse distribution amplifier. Its primary purpose is to allow a pulse source such as the pulse-per-second ("PPS") signal from a GPS receiver to drive several high or low impedance loads with high isolation. The input pulse rate can range from as slow as you'd like, up to several MHz. It is available in two versions: Type "S" has SMA connector outputs, while type "B" has BNC connector outputs. Both versions use an SMA connector for signal input.

The board can be configured for either 3.3 volt or 5 volt logic levels (input and output). The maximum DC input is 15 volts. The minimum input voltage is about 2 volts above the selected logic level. Both the power and signal inputs are protected against over-voltage and reverse polarity.

The type "B" circuit board with BNC connectors is 2.5 x 3.75 inches. The type "S" board is 2.5 x 3.0 inches. Apart from the connectors and width, the two boards are identical. Care was taken to equalize the time delay (trace length) from the input to each of the outputs.

Boards of either type may be stacked to create 8 or more outputs from a single input.

Circuit Description

Power from polarized connector J2 goes through resettable PTC fuse F1 to D1 which provides reverse polarity protection, while D2 protects against over-voltage or reverse polarity. J3 sets the output voltage of U1, an AMS-1117 regulator, to either 3.3 or 5 volts. J3 **must** be installed for the unit to operate. **NOTE:** do not change remove the J3 jumper while power is applied; that can send the regulator into an unhappy state. The easiest way to measure the output voltage is at the heatsink tab of U1.

SMA connector J13 is the signal input. R11 provides a 1 megohm load to keep the input from floating in an indeterminate state. R17 limits input current, and BAT45S back-to-back diode D3 protects against input over-voltage and reverse polarity. Jumper J11 provides the choice of a 4.7 kilohm pull-up or pull-down on the input instead of the default 1 megohm impedance. J11 can be left unpopulated if a high input impedance is desired.

U4 is a 74LVC1G17 inverting Schmitt trigger which provides some noise tolerance on the input. It drives U2, U3, and U5. U2 and U3 are 74AC04 hex inverters. Three gates of each paralleled with 22 ohm resistors drive each output. Voltage into 50 ohms is about 60 percent of the unloaded voltage. U5 is a single 74LVC1G04 inverter that can drive an LED or other load through R19 (both provided and installed by the user). When operating at 5 volts, using 470 ohms at R19 provides decent illumination without excessive current. At 3.3 volts, 270 ohms is a better choice. 330 ohms works as a reasonable compromise for either voltage. Note that directly shorting its output can destroy U5; don't do that.

J1 and J12, with associated ground pads, are placed on the board to allow multiple boards to be stacked, either one above the other or back-to-back. Both boards are driven by the same input signal, but each still uses its voltage regulator so must be jumpered for the desired voltage.

Typical Performance

Current Draw

Current drain is largely dependent on the output load. With no outputs connected and no LED, jumper set for 5 volt operation, the current with 8 VDC input is <20 ma. Each output connected to a low impedance load will significantly increase the power required. In one test using 5 volt logic levels, two 50 ohm loads plus an LED drew about 200 ma at 8 volts input to the regulator.

Setting the TERM jumper to HIGH will cause all the outputs to go high when no input is present. If they are all connected to low impedance loads the resting current draw can be significant and the voltage regulator will probably get pretty warm.

Output Waveform

(driving 50 ohm load)

Figure 1: Rise time into 50 ohms – yellow from top and blue from bottom of stacked TADD-3 Mini Type S (200 MHz bandwidth)

Figure 1 shows the output of a pair of TADD-3 Mini type "S" boards stacked together and driven from a common PPS source. The rise time is almost certainly being limited by the 200 MHz bandwidth of the oscilloscope, so is likely faster than shown. Note that the two signals, taken from opposite corners of each board, are matched extremely closely in phase.

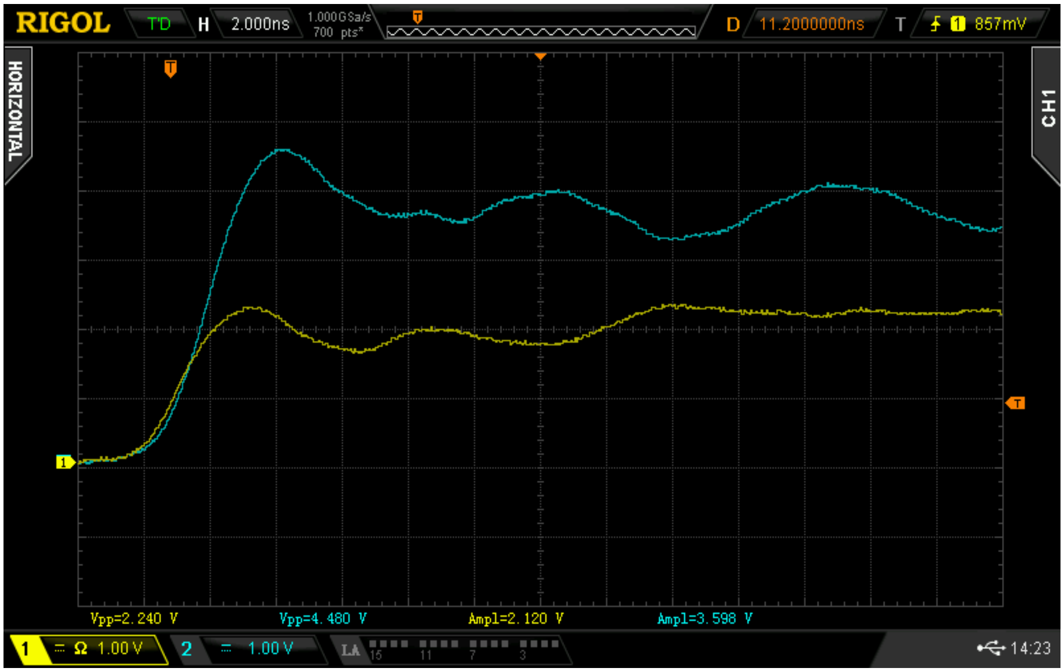

Figure 2: 50 ohm (yellow) vs. High-Z (blue) output level, Vcc = 3.3V

Figure 2 shows the voltage difference between 50 ohm (yellow) and high impedance (blue) output loads. I had to use a 3.3 volt level for this measurement because of equipment limitations. And, again, the actual rise time is more likely that of the 'scope than of the TADD-3 Mini.

Assembly

The TADD-3 Mini package includes the printed circuit board with all SMT components installed, one vertical SMA input connector, and four SMA (for type "S") or BNC (for type "B") connectors for the outputs. In addition, a 2-pin polarized power connector and mating shell/pins, two 3-pin headers, and two shorting blocks are included.

Assembly requires installing the input and output coax connectors, the power connector at J2, and either a header with shorting block, or simply a piece of wire, at J3 to select 3.3V or 5V operation.

A 3-pin header and shorting block may be installed at J11 if you want to use the 4.7 kilohm pull-up or pull-down on the input.

Stacking Boards

The board is laid out so that two or more units may be vertically stacked, secured using the four mounting holes (sized for 4-40 hardware), with short wires running from the "AUX DC" and "PPS IN" pads and associated ground pads from the top of one board to the bottom of the other. One board provides the PPS input and power source for the stack. The second board does not require the pulse input or DC input connector installed. However, each board uses its own voltage regulator, so J3 must be installed on each. If you desire to use the 4.7 kilohm pull-up or pull-down capability, it is recommended to enable that on only one of the boards. If you use both the resistors on the two boards will be in parallel, reducing the input impedance. The boards can be stacked with the component side of each facing up, or may be mounted back-to-back. That allows slightly shorter interconnects and may provide better vertical spacing between the output connectors.

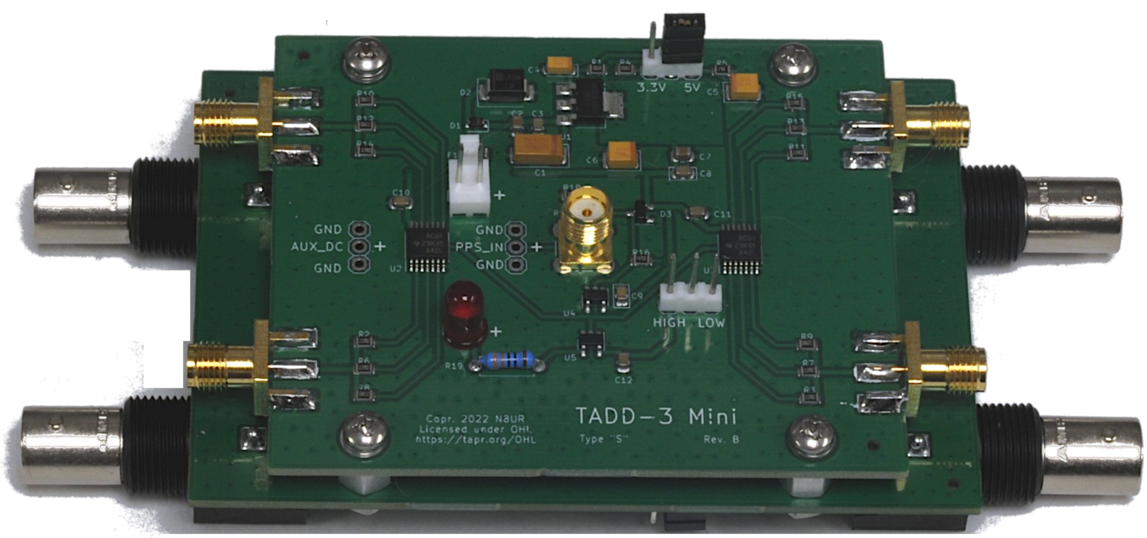

Figure 3: TADD-3 Mini Type "S" and "B" Boards Stacked

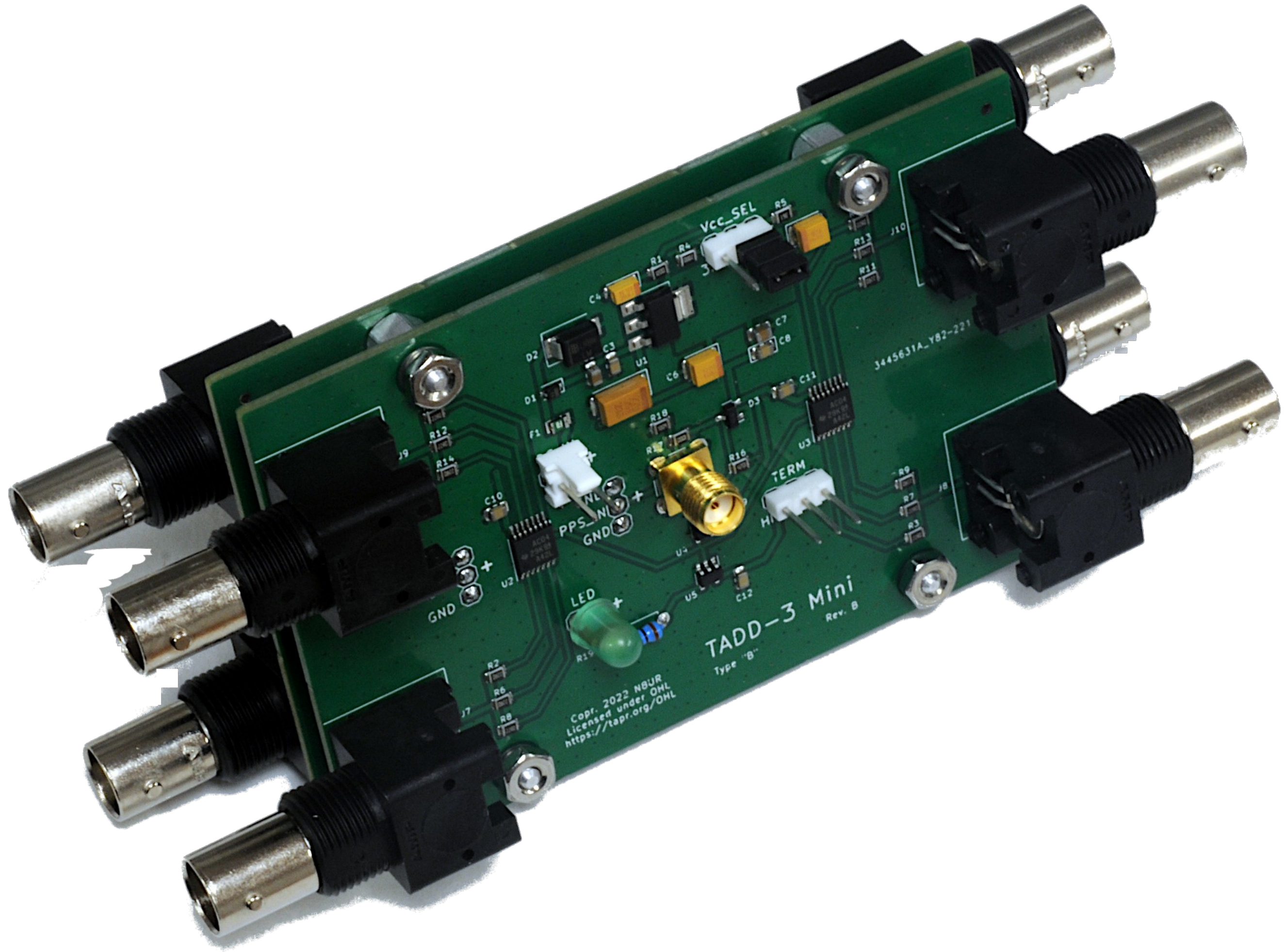

Figure 4: Two stacked TADD-3 Mini Type "B" Boards

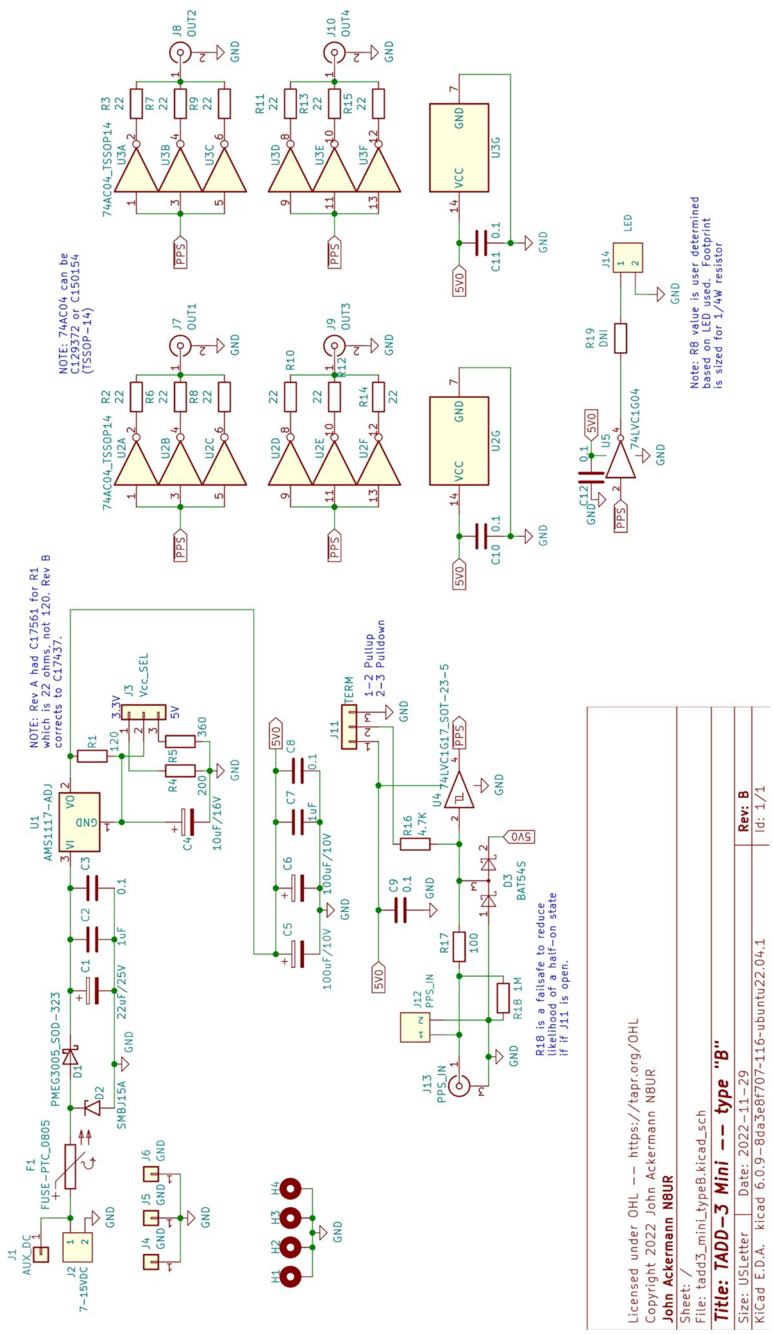

Figure 5: TADD-3 Mini Schematic

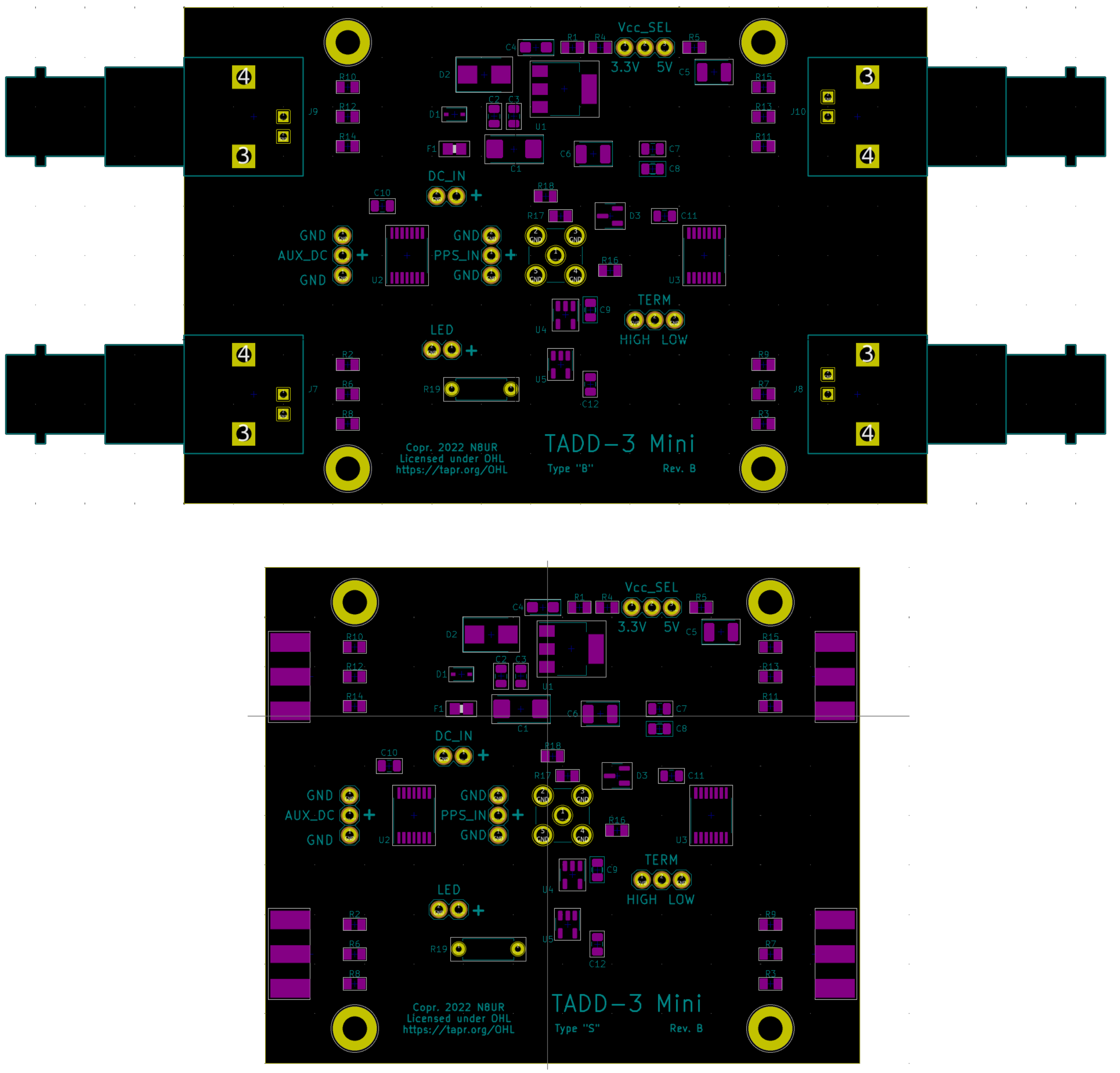

Figure 6: TADD-3 Mini Type B (top) and Type S (bottom) board layout