PAPR v 3.1 PCB Production Tests
9/16/21
Brent Bolton

Introduction

This document describes test to be performed on the PAPR version 3.1 board after assembly but before conformal coating and installation into a fully assembled PAPR unit. This document assumes all components have been tested by their respective manufactures and so does not attempt comprehensive tests of circuit nodes within components.

The object of these tests is to insure that all circuit nodes on the PCB are exercised and checked. Digital circuits will be switched on and off and correct operation in each state verified. Analog circuits will be varied and measured where possible, or measured for correct values if not.

Many tests require support from software that is not written as of the date of this document. Any tests that rely on this code are subject to change. Software needed in blue.

The following tests should be performed in order after pick and place, reflow, and visual inspection of each PCB.

Test 1. Initial bring up power checks.

1) Connect a bench power supply to Charger Connector JP4 pins 2 and 3. 3 is +. Limit current to approximately 100mA and set voltage to 25.5 volts.

2) Read current draw from supply. Should be between xx and yy mA.

3) Using a multimeter or oscilloscope, measure voltages of board power supply test points.

--TP6 should read the same as the bench supply.

--TP3 should be 12 +/- 0.6 volts.

--TP2 should be 5 +/- 0.25 volts.

--TP1 should be same as TP2.

--TP9 should be 3 +/- 0.15 volts.

4) Change supply voltage to 18V. Check that TP3 still in correct voltage range.

Test 2. Program and bring up terminal.

1) *If MCU is unprogrammed:* Increase current limit to 1A. Connect programming cable to JP5 and program. Check that part programs and verifies.

2) Change supply back to 25.5 volts. Disconnect from JP4. Connect to battery connector JP2. Pin 2 is +.

--Check that TP6 is at zero volts.

--Check that TP1 is at 2.6 +0.4, -0.2 volts.

3) Connect device running a serial terminal program to JP6. 1 is serial out, 2 is serial in, 3 is ground. Parameters are xxx-N-8-1.

4) Press and hold power on switch SW2 until board turns on as indicated by LED xx on. If device is newly programmed it should boot into a test mode and so indicate on the serial terminal.

5) Increase supply current limit to 3A for remaining tests. Supply should be connected to battery input.

Test 3. LED's.

1) Enter "1" to invoke LED test. LED's should illuminate sequence one at a time and then all turn on simulaneously followed by all turning off and the test repeating. Check that all LEDs turn on and off and, when all are on, are on at an even brightness. Press "enter" to terminate the test.

Test 4. Fan.

1) Connect fan to JP1.

2) Enter "2" to start the fan test. Fan should turn on at low speed while terminal displays RPM which should be in range xxx to yyy and current which should be in range aaa to bbb. After 3 seconds test repeats at medium speed and then full speed. Medium speed current and rpm should be in <this> range and full speed in <this> range. Sound of the fan should be consistent with reported speeds. Test should turn off fan for 3 seconds and then repeat. Check that fan is fully off. Press "enter" to terminate the test.

Test 5. Speaker.

1) Connect speaker to JP2.

2) Enter "3" to start the speaker test. Speaker should turn on a full volume. Measure with dB meter if unsure -- volume should be xx dB at 20 cm. Current should be below xx mA. Press "enter" to terminate the test. Speaker should then be off.

(Since this might be disturbing on a test floor, it's OK to apply a 100 Ohm load across the speaker terminals and verify the voltage waveform with a scope. The oscilloscope probe should be connected across JP2 pin 1 and ground, not across the JP2 terminals)

Test 6. Pushbuttons.

1) Enter "4" to start the pushbuttons test. When SW1 is pressed LED1 should illuminate. When SW2 is pressed, LED2 should illuminate. SW3 lights LED3 and SW4 lights LED4. Press the switches individually and in all combinations of two and verify that only the selected LEDs are on. Press "enter" to terminate the test.

Test 7. Voltage sensing.

1) Enter "5" to test voltage reference. Terminal should display voltage reference in millivolts. Value should be 2500 +/- xx. Press "enter" to terminate the test.

1) Enter "6" to test battery voltage. Voltage should read the same as the supply +/- xx mV. Vary supply voltage up and down slightly to make sure it tracks. Press "enter" to terminate the test.

Test 8. Charger detect.

1) Enter "7" to test charger detect. Serial connection will be briefly disabled. Short JP4 pins 1 and 2 together with metal tweezers or similar. LEDs 1 and 7 should illuminate. Test will automatically terminate and terminal function will be restored 4 seconds after the last time the pins were shorted.

Test 9. Current sensing.

1) Connect an electronic load to JP4 pins 2 and 3. Set load current to 500mA but leave disabled.

2) Enter "8" to test current sensor. Test will display current in mA on terminal. Turn on load and verify that displayed current is within xx percent of set point. Increase current in 500mA steps up to 2.5A and verify that displayed current tracks. Verify that current is close to zero when load is disabled. Press "enter" to terminate the test.

3) Switch load and supply connections so that load is on battery connector and supply is on charge connector. Set load current to 500mA but leave disabled.

4) Enter "8" to test current sensor. Test will display current in mA on terminal with opposite sign as above. Turn on load and verify that displayed current is within xx percent of set point. Increase current in 500mA steps up to 2.5A and verify that displayed current tracks. Verify that current is close to zero when load is disabled. Press "enter" to terminate the test.

Finish up

If all tests pass, enter "p" for passed. The fact of having passed the tests will be saved to non-volatile memory and all future boots will be normal. Enter "e" for erase to restore boot to test functionality.