PocketBeagle Command Station Instructions

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Introduction

Through hole version of the PocketBeagle LCC[1]/DCC Command Station. This is a DCC command station that is a LCC node. It implements the OpenLCB train protocol node over LCC and converts that to DCC commands. It includes a booster and puts the DCC signal on the LCC bus (pins 4 and 5). It implements a programming track and implements Railcom. The Command Station uses a PocketBeagle as the processing element and uses the PRUs (Programmable Realtime Units) to generate the DCC signal.

1 Circuit Description

1.1 Section Interconnect

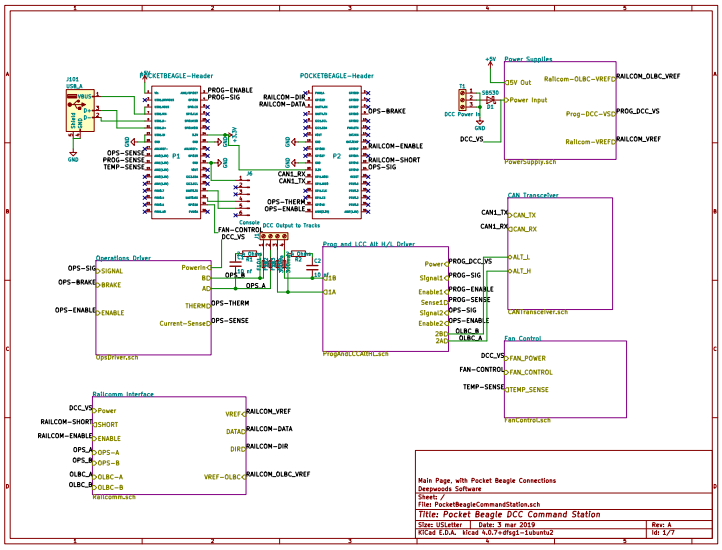

Figure 1: Circuit Diagram of the PocketBeagleCommandStation board, page 1: Main sheet – Section Interconnect

This shows how the various subsections are interconnected.

[1]Layout Command Control, See https://www.nmra.org/lcc for more details and available standards documentation.

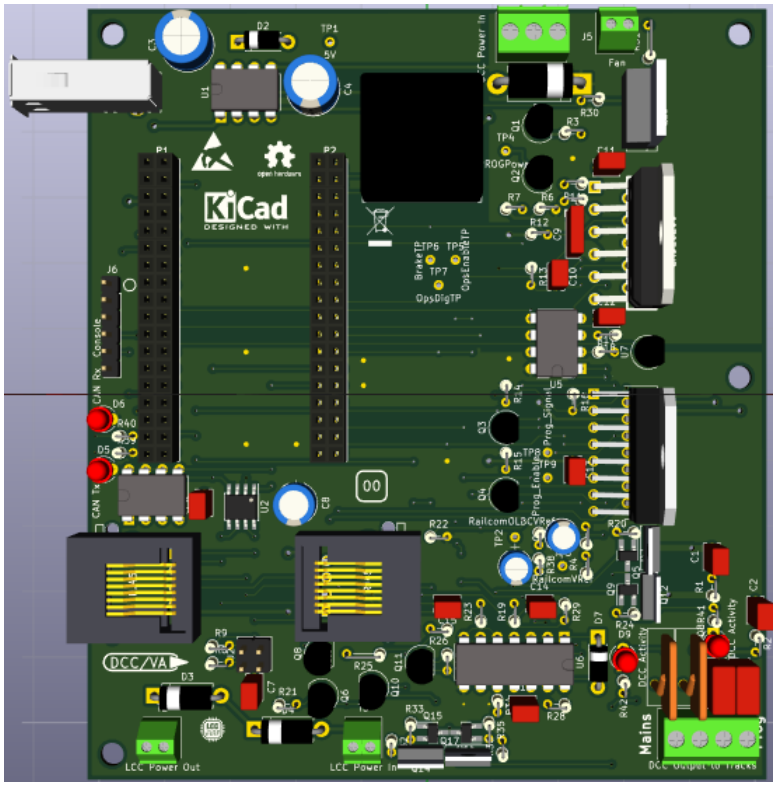

Figure 2: 3D Rendering of the whole board.

1.2 Power Supplies

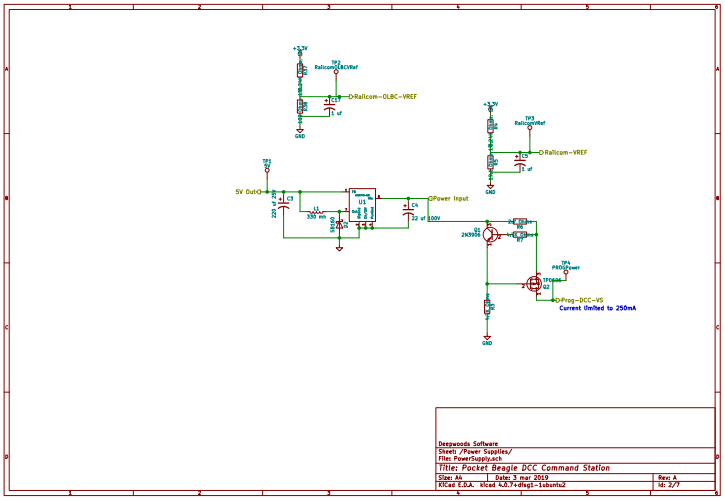

Figure 3: Circuit Diagram of the PocketBeagleCommandStation board, page 2: Power Supplies

This shows the power supply circuits.

1.3 CAN Transceiver

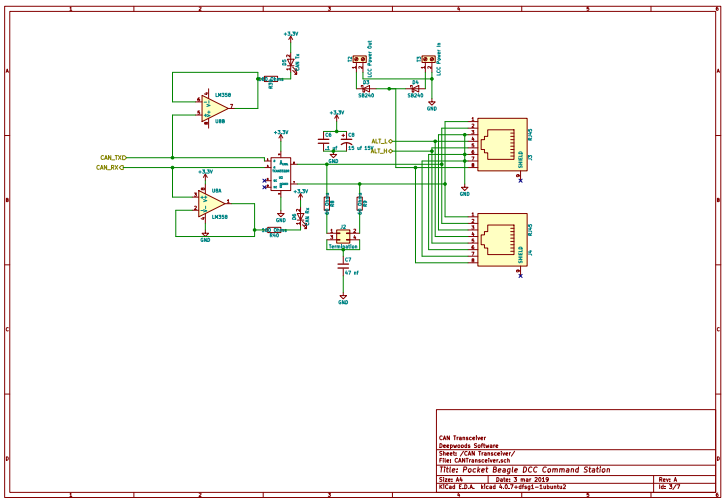

Figure 4: Circuit Diagram of the PocketBeagleCommandStation board, page 3: CAN Transceiver

This shows the CAN Transceiver circuitry.

1.4 OPS DCC Driver

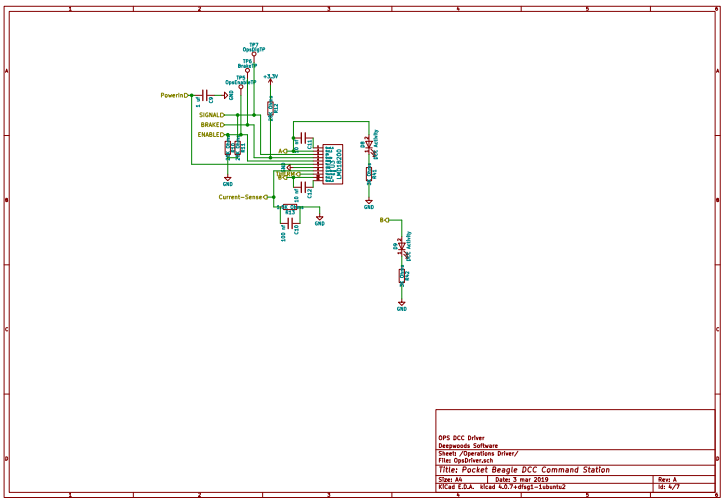

Figure 5: Circuit Diagram of the PocketBeagleCommandStation board, page 4: OPS DCC Driver

This shows the OPS DCC Driver circuitry.

1.5 Programming and Alt drivers

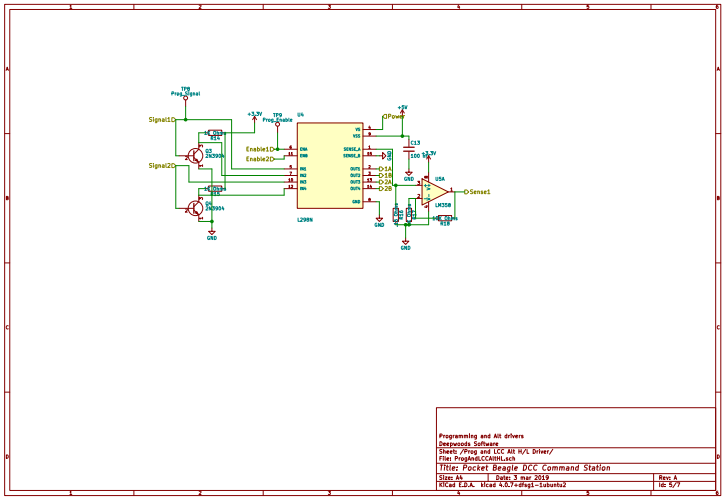

Figure 6: Circuit Diagram of the PocketBeagleCommandStation board, page 5: Programming and Alt. DCC Driver

This shows the Programming and Alt. DCC Driver circuitry.

1.6 Railcom Interface

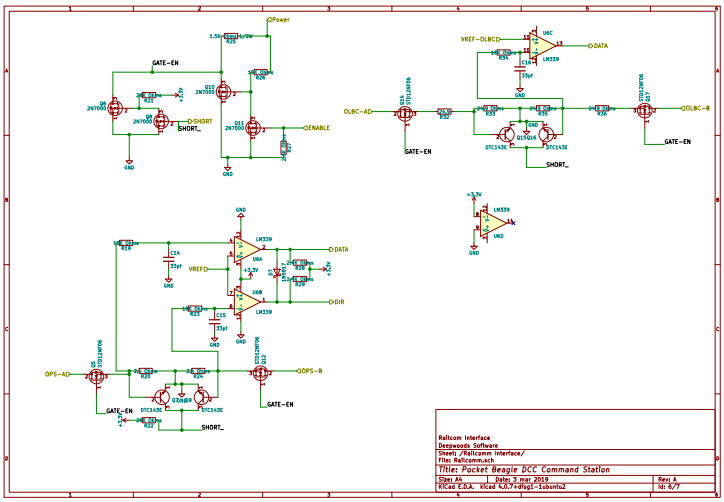

Figure 7: Circuit Diagram of the PocketBeagleCommandStation board, page 6: Railcom Interface

This shows the Railcom Interface circuitry.

1.7 Fan Control

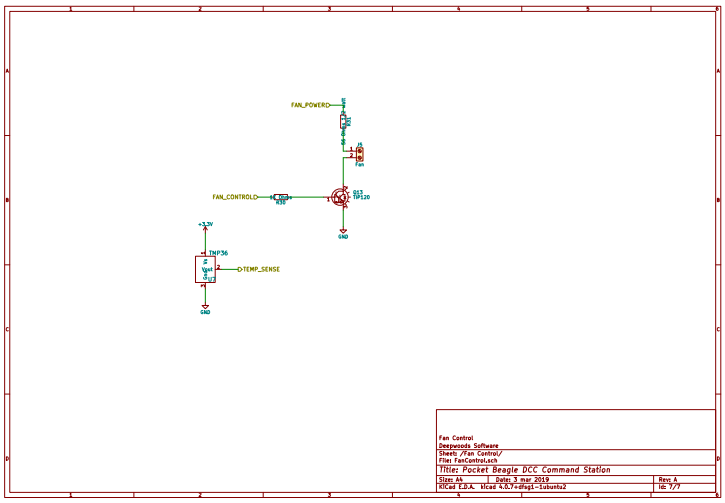

Figure 8: Circuit Diagram of the PocketBeagleCommandStation board, page 7: Fan and temperature control

This shows the Fan and temperature control circuitry.

2 Heatsink and Fan

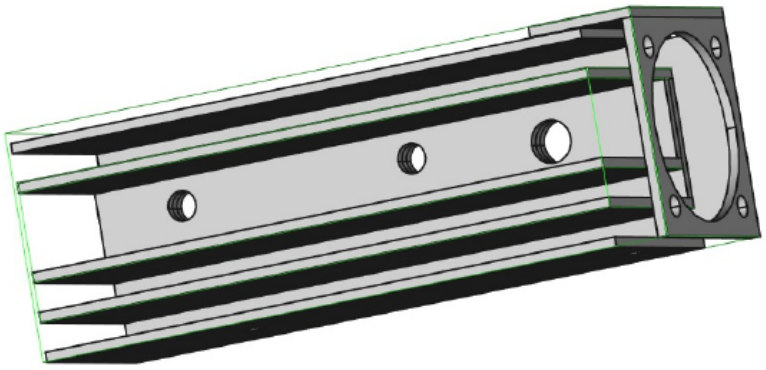

Figure 9: 3D Rendering of the heatsink

A heat sink with fan can be added. There is a temperature sensor to sense the temperature of the heat sink and there is a terminal block for the fan. It is important to insulate the TIP120 – you will need a mica washer between the heat sink and the flange and a fiber sholder washer between the nut and the heat sink. Be sure to smear heat sink compound between all mounting surfaces. This includes on the flat of TMP36 where it is against the heat sink (optionally, you can use thermal epoxy) and between the heat sink fin elements (optionally, you can use thermal epoxy between the elements as well).

3 General Wiring Notes

Wiring the Command Station is pretty straight forward. Near the upper right corner of the PCB are two terminal blocks, a smaller 2 terminal one and a larger 3 terminal one. The smaller one is for the fan (12VDC out) and the larger is the power input (15VDC @ 3Amp). The fan terminal block's terminal closest to the corner is the positive terminal. The center terminal of the power input terminal is positive and the two outer terminals are negative (one of these can be used as system common/ground).

At the bottom right is a terminal block for the output to the tracks. Two terminal screws for the programming track and two for the mains.

At the bottom near the left side are terminal blocks for the LCC power bus. This is where the termination jumper is located.

On the left side is a 6 position header for a TTY console and at the upper left is a female USB A (2.0) host connector. A USB Ethernet or USB WiFi dongle can be plugged in here.

4 Software

The PocketBeagle runs the Linux operating system and runs the BBBCommandStationOpenMRN program. This through-hole PocketBeagle version uses the pb.linux.armv7a target. This code along with the OpenMRN package it depends on is included on the MicroSD card. There are build configuration options in the Hardware.hxx in the pb.linux.armv7a target directory. The built program also has run-time settings in the form of command line options. This is all described in the separate software manual. A brief overview of the software is presented in the following subsections.

4.1 PocketBeagle logon

There is a TTY serial console connector that can be used to connect to the PocketBeagle and then used to configure and administrate the PocketBeagle. The PocketBeagle is also running the SSH server and can be connected to via the network, either via a USB Ethernet or USB WiFi dongle or as 192.168.6.2 or 192.168.7.2 via its Micro-USB connector (Tcp/Ip over USB). The default username:password is [debian:temppwd].

4.2 Configuration

The CDI for the Command Station includes the event ids for short detected and cleared, H-Bridge Shutdown and H-Bridge Shutdown Cleared, and thermal overload flag on and off for both the mains and the programming track. There are temperature settings for both the alarm events and the fan, along with events for fan on and off. The Command Station itself consumes no events only produces the above listed events.

The command station creates virtual LCC nodes for decoders and these LCC nodes have their own CDI's that map to CVs on the decoders.

4.3 WiThrottle

The Command Station starts a WiThrottle server, which is available if the command station is connected to a network with WiFi (eg there is a USB Ethernet or USB WiFi dongle in the USB A (2.0) host connector and is connected to a network).

4.4 Gridconnect Hub server

The Command Station can optionally start a Gridconnect Hub server to allow LCC nodes (like WiFi LCC throttles) to connect to the LCC network.

4.5 Command Station "console" interface.

The Command Station starts a Tcp/IP console server on port 9900 and listens for connections. This server is a simple text-based command-line interface meant to connect to the (separate) GUI program. Generally a PocketBeagle is not really a powerful enough system to run a GUI. A separate computer (such as a Raspberry Pi or really any desktop or laptop) can run the GUI program that is available. This is not needed for the Command Station to work. While the simple text-based command-line interface could be used directly, it is not really meant for human interface.