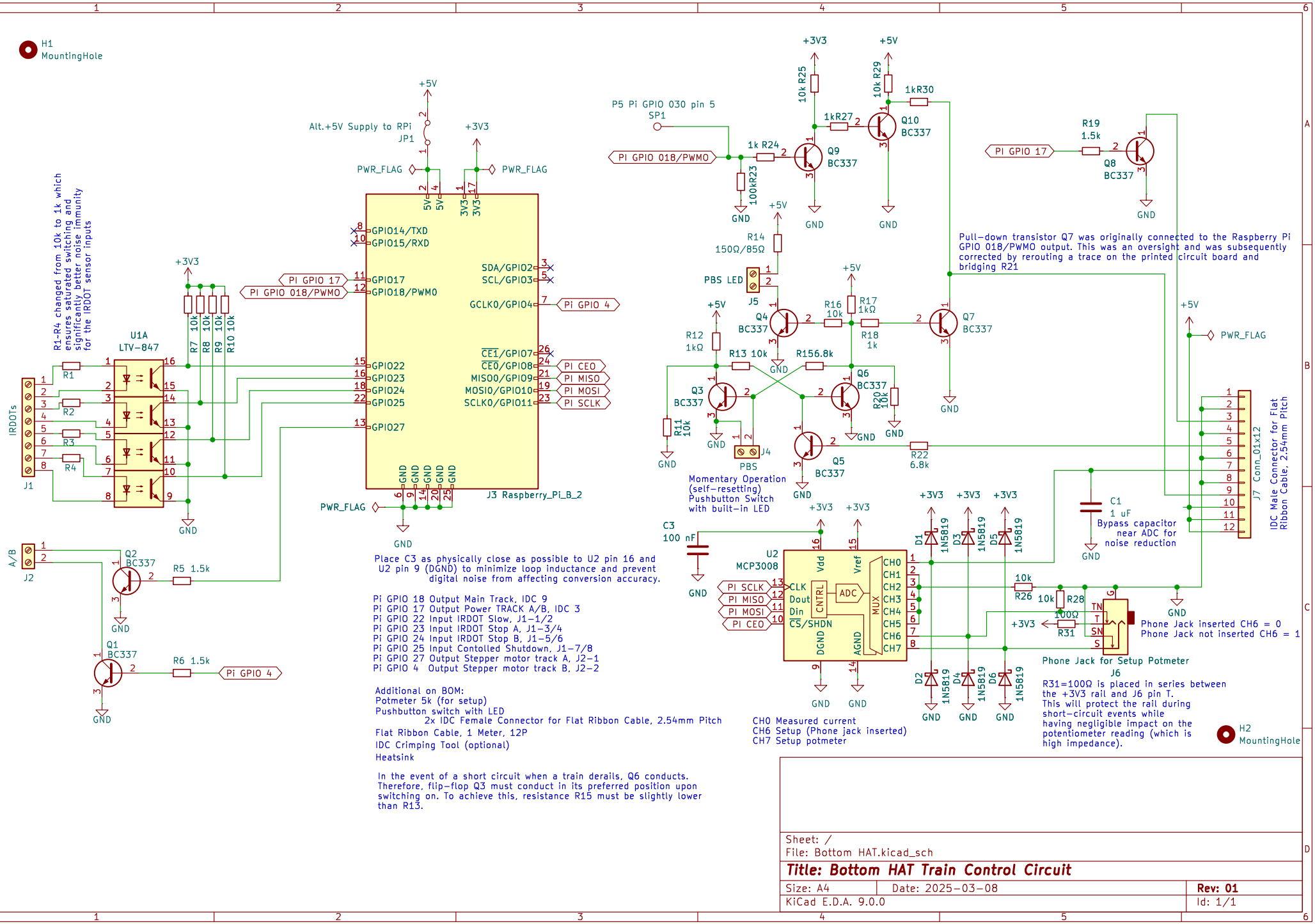

H1
MountingHole
R1-R4 changed from 10k to 1k which ensures saturated switching and significantly better noise immunity for the IRDOT sensor inputs
U1A
LTV-847
IRDOTs
J1
R1
R2
R3
R4
R7 10k
R8 10k
R9 10k
R10 10k
+3V3
GND
A/B
J2
Q2
BC337
R5 1.5k
Q1
BC337
R6 1.5k
Pi GPIO 4
+5V
Alt.+5V Supply to RPi
JP1
PWR_FLAG
PI GPIO 17
PI GPIO 018/PWMO
GPIO14/TXD
GPIO15/RXD
GPIO017
GPIO018/PWM0
GPIO22
GPIO23
GPIO24
GPIO25
GPIO27
SDA/GPIO2
SCL/GPIO3
GCLK0/GPIO4
CE1/GPIO7
CE0/GPIO8
MISO0/GPIO9
MOSI0/GPIO10
SCLK0/GPIO11
PI CEO
PI MISO
PI MOSI
PI SCLK
J3 Raspberry_Pi_B_2
Place C3 as physically close as possible to U2 pin 16 and U2 pin 9 (DGND) to minimize loop inductance and prevent digital noise from affecting conversion accuracy.
Pi GPIO 18 Output Main Track, IDC 9
Pi GPIO 17 Output Power TRACK A/B, IDC 3
Pi GPIO 22 Input IRDOT Slow, J1-1/2
Pi GPIO 23 Input IRDOT Stop A, J1-3/4
Pi GPIO 24 Input IRDOT Stop B, J1-5/6
Pi GPIO 25 Input Contolled Shutdown, J1-7/8
Pi GPIO 27 Output Stepper motor track A, J2-1
Pi GPIO 4 Output Stepper motor track B, J2-2
Additional on BOM:
Potmeter 5k (for setup)
Pushbutton switch with LED
2x IDC Female Connector for Flat Ribbon Cable, 2.54mm Pitch
Flat Ribbon Cable, 1 Meter, 12P
IDC Crimping Tool (optional)
Heatsink
In the event of a short circuit when a train derails, Q6 conducts. Therefore, flip-flop Q3 must conduct in its preferred position upon switching on. To achieve this, resistance R15 must be slightly lower than R13.
P5 Pi GPIO 030 pin 5
SP1
PI GPIO 018/PWMO
1k R24
100kR23
10k R25
1kR27
10k R29
1kR30
Q9
BC337
Q10
BC337
R14
150Ω/85Ω
PBS LED
J5
Momentary Operation
(self-resetting)
Pushbutton Switch
with built-in LED
PBS
J4
R12
1kΩ
R13 10k
R156.8k
R16
10k
R17
1kΩ
R18
1k
R20
10k
R11
10k
R22
6.8k
Q3
BC337
Q4
BC337
Q5
BC337
Q6
BC337
Q7
BC337
PI GPIO 17
R19
1.5k
Q8
BC337
Pull-down transistor Q7 was originally connected to the Raspberry Pi GPIO 018/PWMO output. This was an oversight and was subsequently corrected by rerouting a trace on the printed circuit board and bridging R21
C3
100 nF
U2
MCP3008
Vdd
Vref
CLK
Dout
Din
CS/SHDN
DGND
AGND
CNTRL
ADC
MUX
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
PI SCLK
PI MISO
PI MOSI
PI CEO
D1
D2
D3
D4
D5
D6
1N5819
C1
1 uF
Bypass capacitor
near ADC for
noise reduction
R26
10k
R28
100Ω
R31
Phone Jack for Setup Potmeter
J6
Phone Jack inserted CH6 = 0
Phone Jack not inserted CH6 = 1
R31=100Ω is placed in series between the +3V3 rail and J6 pin T.
This will protect the rail during short-circuit events while having negligible impact on the potentiometer reading (which is high impedance).
CH0 Measured current
CH6 Setup (Phone jack inserted)
CH7 Setup potmeter
J7 Conn_01x12
IDC Male Connector for Flat Ribbon Cable, 2.54mm Pitch
H2
MountingHole
Sheet: /
File: Bottom HAT.kicad_sch
Title: Bottom HAT Train Control Circuit
Size: A4
Date: 2025-03-08
Rev: 01
KiCad E.D.A. 9.0.0
Id: 1/1