This is based on the official Raspberry Pi spec to be able to call an extension board a HAT.
https://github.com/raspberrypi/hats/blob/master/designguide.md

40-Pin HAT Connector

40HAT J3

| P3V3_HAT | 1 | P3V3 | P5V | 2 | P5V_HAT |
GND	3	BCM2	P5V	4	P5V_HAT
	5	BCM3	GND	6	GND
	7	BCM4	BCM14	8	
GND	9	GND	BCM15	10	
	11	BCM17	BCM18	12	
	13	BCM27	GND	14	GND
	15	BCM22	BCM23	16	
P3V3	17	P3V3	BCM24	18	
	19	BCM10	GND	20	GND
	21	BCM9	BCM25	22	
GND	23	BCM11	BCM8	24	
ID_SD_EEPROM	25	GND	BCM7	26	
	27	BCM0	BCM1	28	ID_SC_EEPROM
	29	BCM5	GND	30	GND
	31	BCM6	BCM12	32	
	33	BCM13	GND	34	GND
	35	BCM19	BCM16	36	
GPO26	37	BCM26	BCM20	38	
GND	39	GND	BCM21	40	GPI21

HAT EEPROM

The HAT spec requires this EEPROM with system information
to be in place in order to be called a HAT. It should be set up as write
protected (WP pin held high), so it may be desirable to either put a
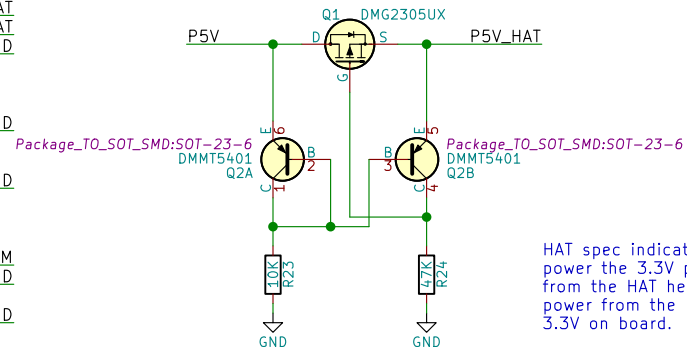jumper as shown to enable writing, or to hook up a spare IO pin to do so.

EEPROM WRITE ENABLE

CAT24C32
U2
A0 VCC
A1
A2
WP GND
SCL ID_SC_EEPROM_pu
SDA ID_SD_EEPROM_pu

P3V3
GND
CONN_01X02
J9
DNP
R11
10K
R29
GND
P3V3
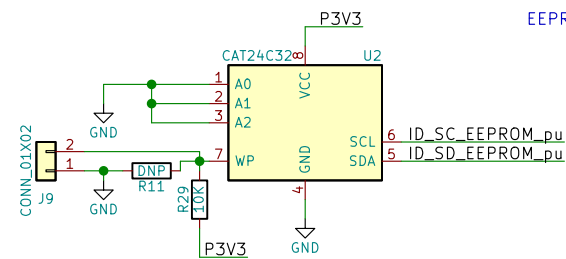
Pullup Resistors

These are just pullup resistors for the I2C bus on the EEPROM.
The resistor values are per the HAT spec.

ID_SD_EEPROM_pu — 3.9k R6 — P3V3
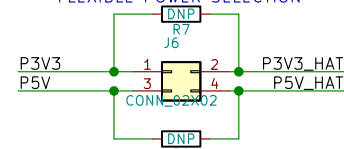ID_SD_EEPROM
ID_SC_EEPROM_pu — 3.9k R8
ID_SC_EEPROM
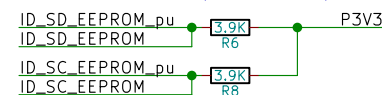
5V Powered HAT Protection

This is the recommended 5V rail protection for
a HAT with power going to the Pi.
See https://github.com/raspberrypi/hats/blob/master/designguide.md#back-powering-the-pi-via-the-j8-gpio-header

Q1 DMG2305UX
P5V D S P5V_HAT

Package_TO_SOT_SMD:SOT-23-6
DMMT5401 Q2A
Package_TO_SOT_SMD:SOT-23-6
DMMT5401 Q2B

GND   GND

HAT spec indicates to NEVER
power the 3.3V pins on the Raspberry Pi
from the HAT header. Only connect the 3.3V
power from the Pi if the HAT does not have
3.3V on board.

IF you are designing a board that could
either be powered by the Pi or from the HAT
the jumpers here can be used.

In most cases, either design the HAT
to provide the 5V to the Pi and use the
protection circuit above OR power the
HAT from the Pi and directly connect
the P3V3 and P5V to the P3V3_HAT and P5V_HAT
pins.

FLEXIBLE POWER SELECTION

DNP
R7
J6
P3V3 — 1 2 — P3V3_HAT
P5V — 3 4 — P5V_HAT
CONN_02X02
DNP
R9

Mounting Holes

H1   H2
3mm_Mounting_Hole   3mm_Mounting_Hole

H3   H4
3mm_Mounting_Hole   3mm_Mounting_Hole

+5V
5V USB SUPPLY PLUGS IN HERE
J1
Conn_Coaxial_Power
GND
C1
C
GND

4 OHM SOUNDER

U4
Sounder
SND 1
SND 2

Binding posts here?
KEY 1
KEY 2
U3
Key

Generate an offset voltage to make sure the comparators are in low state with low input

OFFSET_REF_V   +5V
20.0k R3

SCHOTTKY DIODES   D1 MBR0560
May need only one diode in reference circuit.
D2 MBR0560

Use the HAT 5V supply here, probably cleaner
P5V_HAT
GND   R2 20.0k

R4 20.0 R5 20.0
LOOP_STATE
D3 MBR0560
This diode may not be required.
Q3 2N7002P_215
Intent is to use surface mount SOT-23 for Q3

SOUNDER DRIVER FROM GPO
USE 5V OUTPUT TO OVERCOME VTH

OFFSET_REF_V 2IN- 2OUT U1B
GPO26 2IN+ LM393DR
GND

LM393 is open-collector output, must use pull-ups.

R1 20.0k
KEY STATE TO GPI   P3V3_HAT
3.3V INTERFACE
GPI21 1IN- 1OUT OFFSET_REF_V   R10 20.0k   LOOP_STATE
1IN+
U1A
LM393DR
GND
D4 1N914WT
GND

Gregory Raven
PiKOB Prototype Hat
Sheet: /
File: rpikobhat.sch
Title: Raspberry Pi HAT
Size: A3   Date: 2021-11-08   Rev: P1
KiCad E.D.A. kicad 5.1.10-88a1d61d5888ubuntu18.04.1   Id: 1/1