

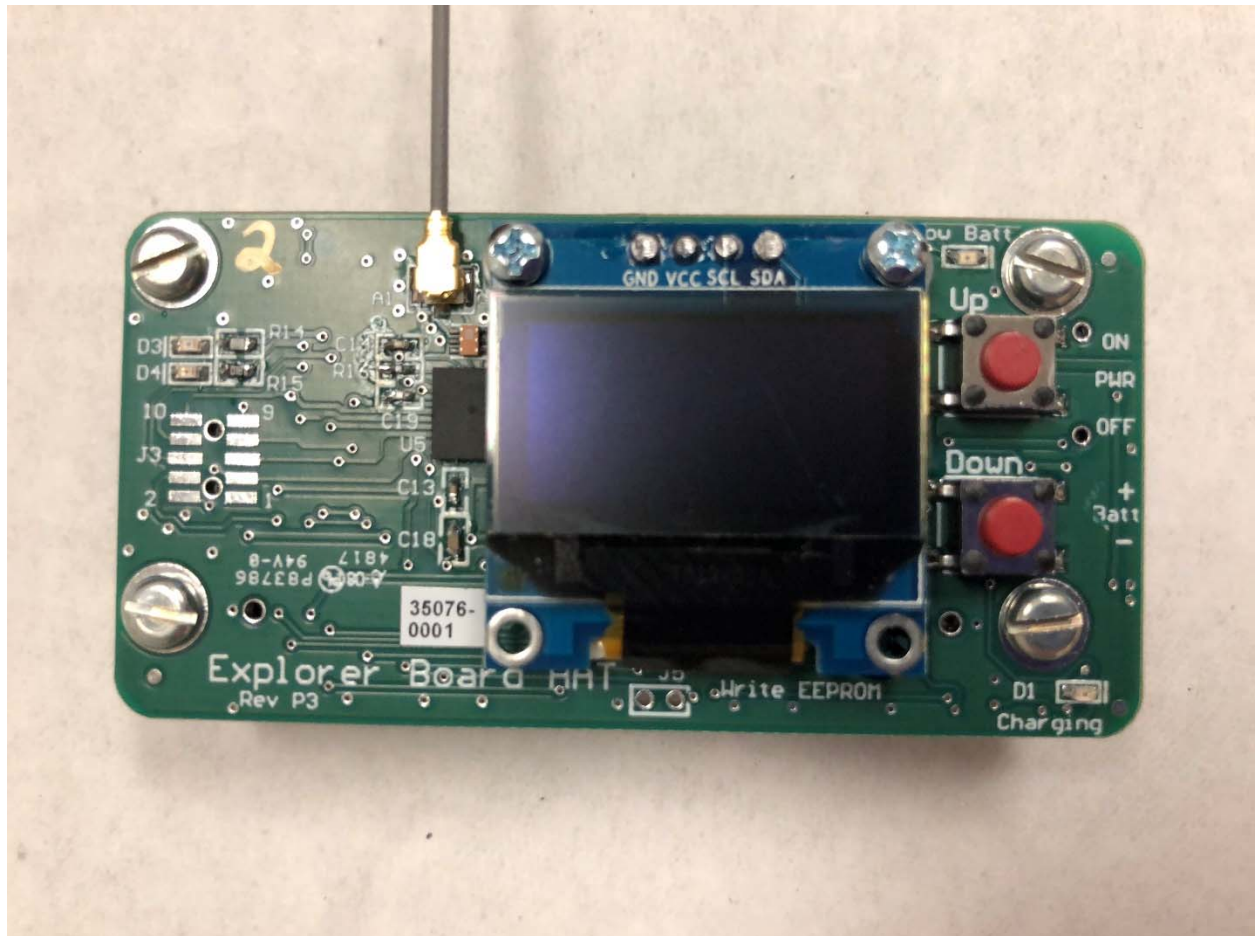
Explorer Board HAT Specification

Patrick Kelly
Jack Kelly
Dec 29, 2017

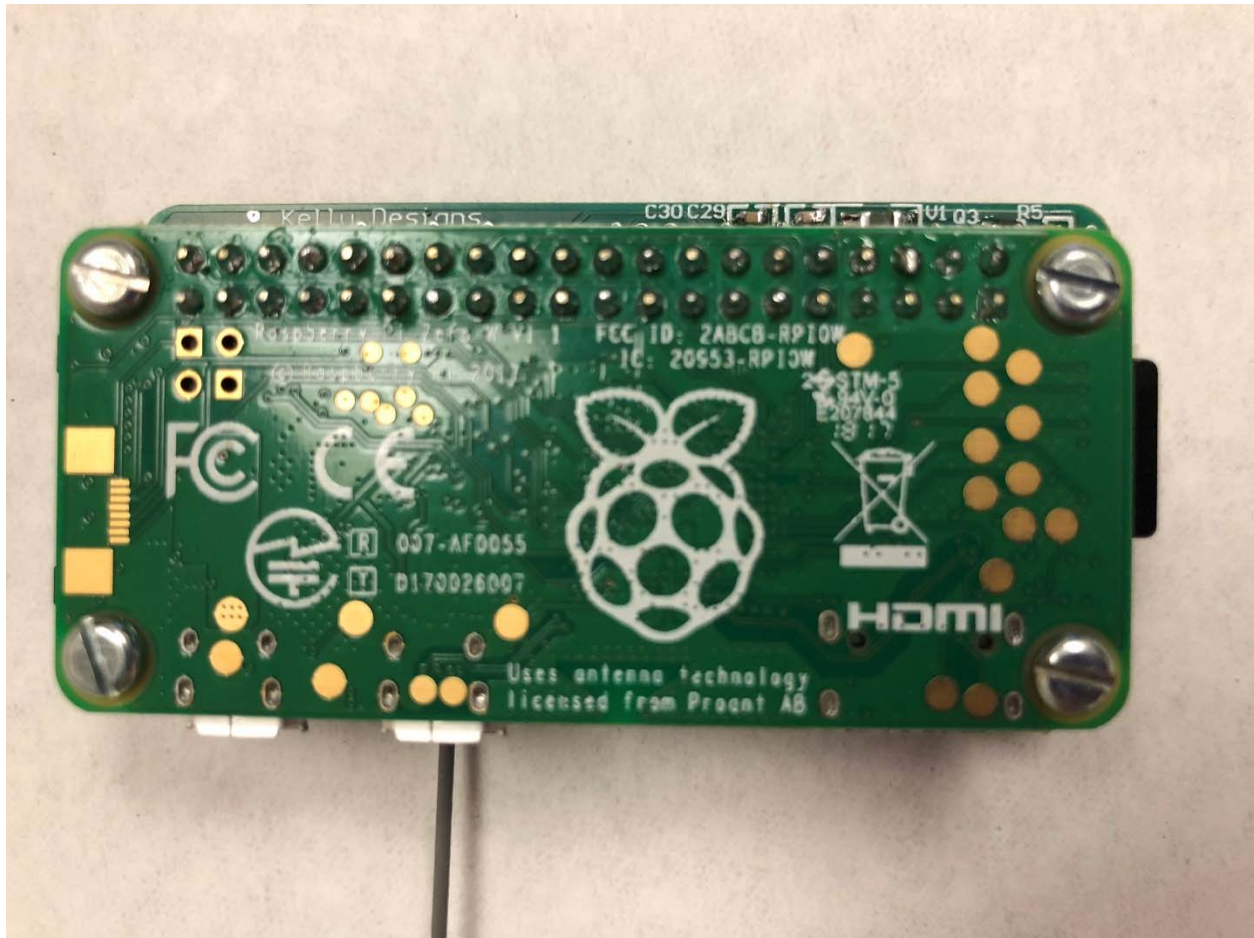
Change History

| Rev | Date | Comments |
|------------|--------------|-----------------|
| 0.1 | Dec 29, 2017 | Initial Draft |
| | | |
| | | |

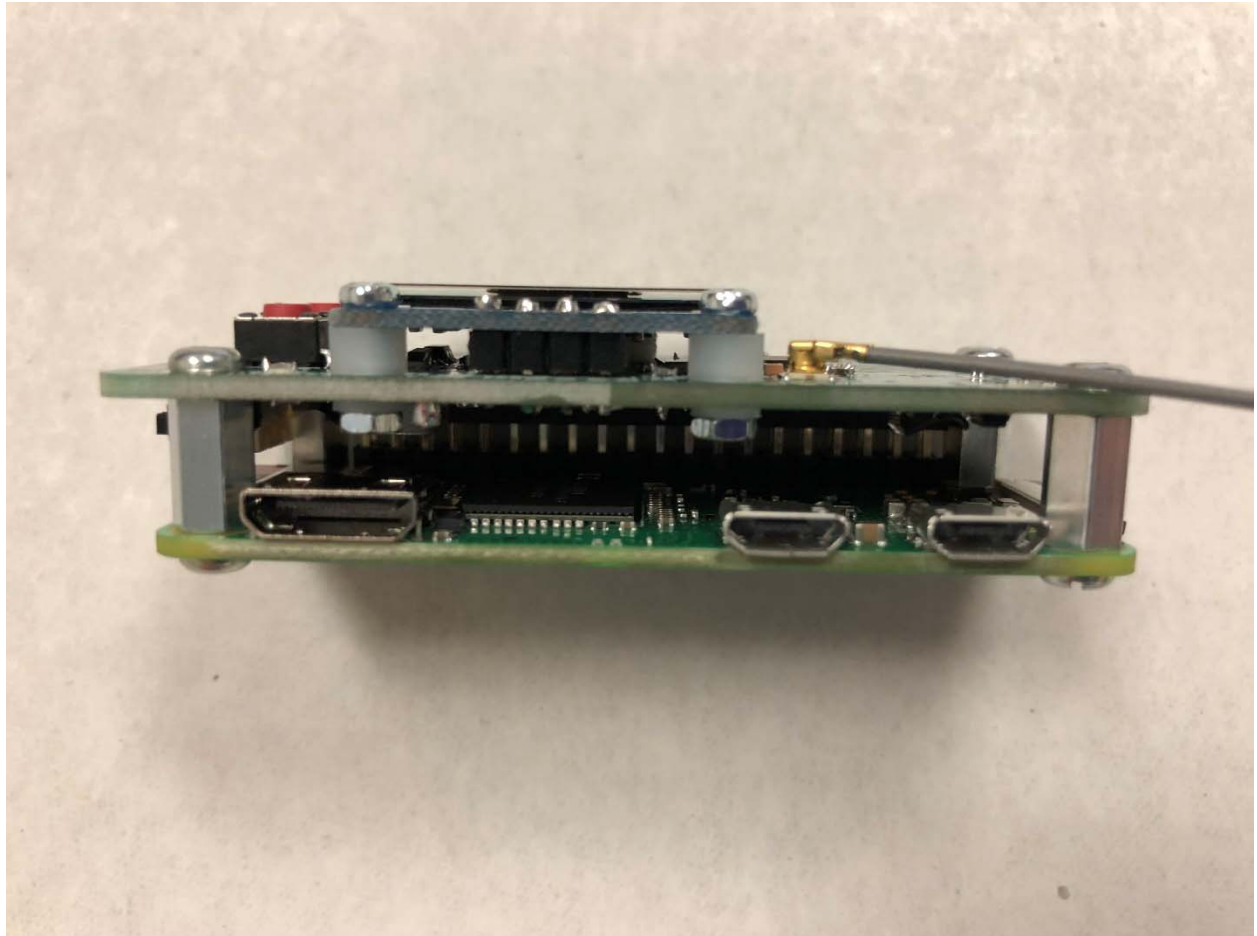
Picture of Raspberry Pi Zero W with Explorer Board HAT
Top View



Picture of Raspberry Pi Zero W with Explorer Board HAT
Bottom View



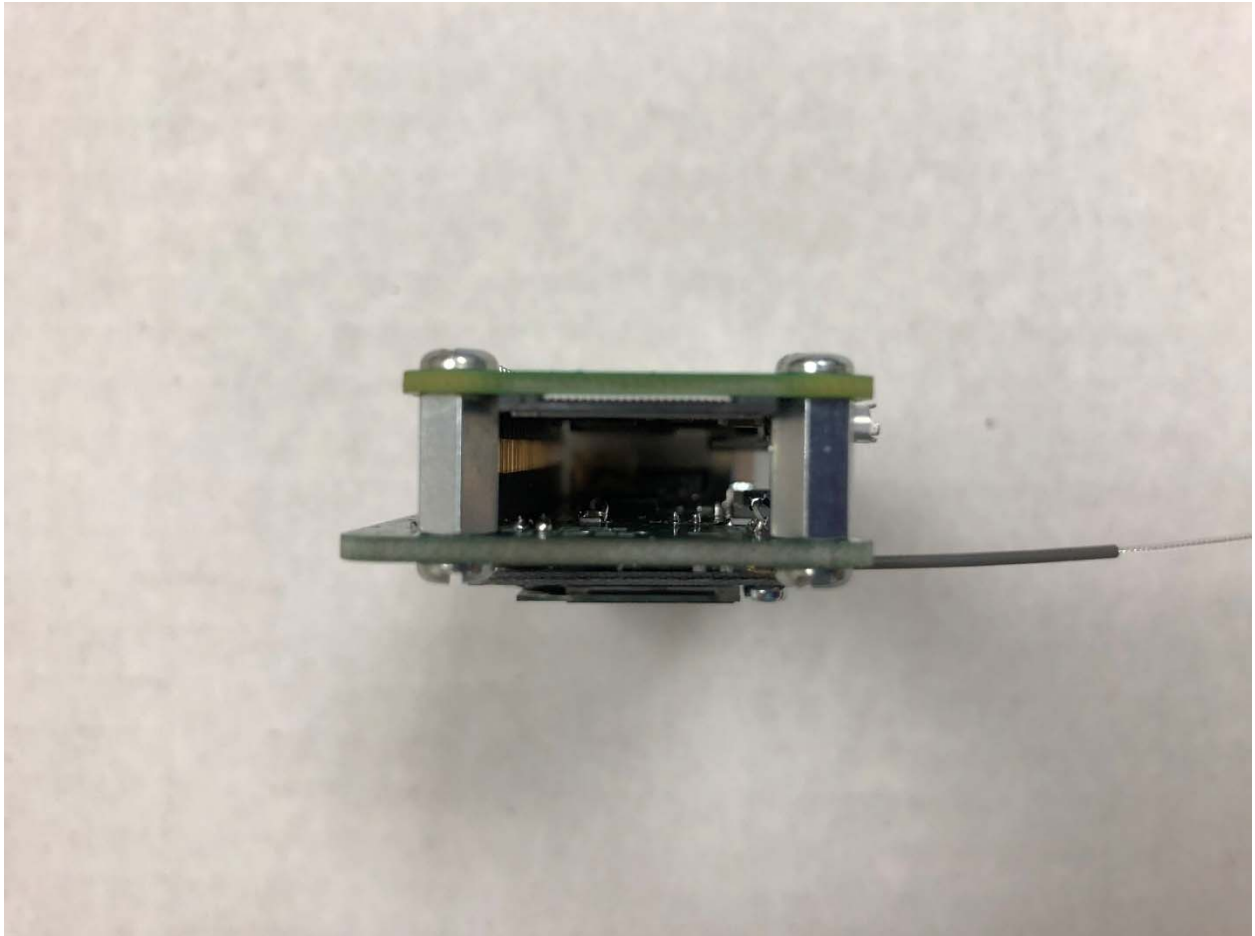
Picture of Raspberry Pi Zero W with Explorer Board HAT
Side Top View



Picture of Raspberry Pi Zero W with Explorer Board HAT
Side Bottom View



Picture of Raspberry Pi Zero W with Explorer Board HAT
End View

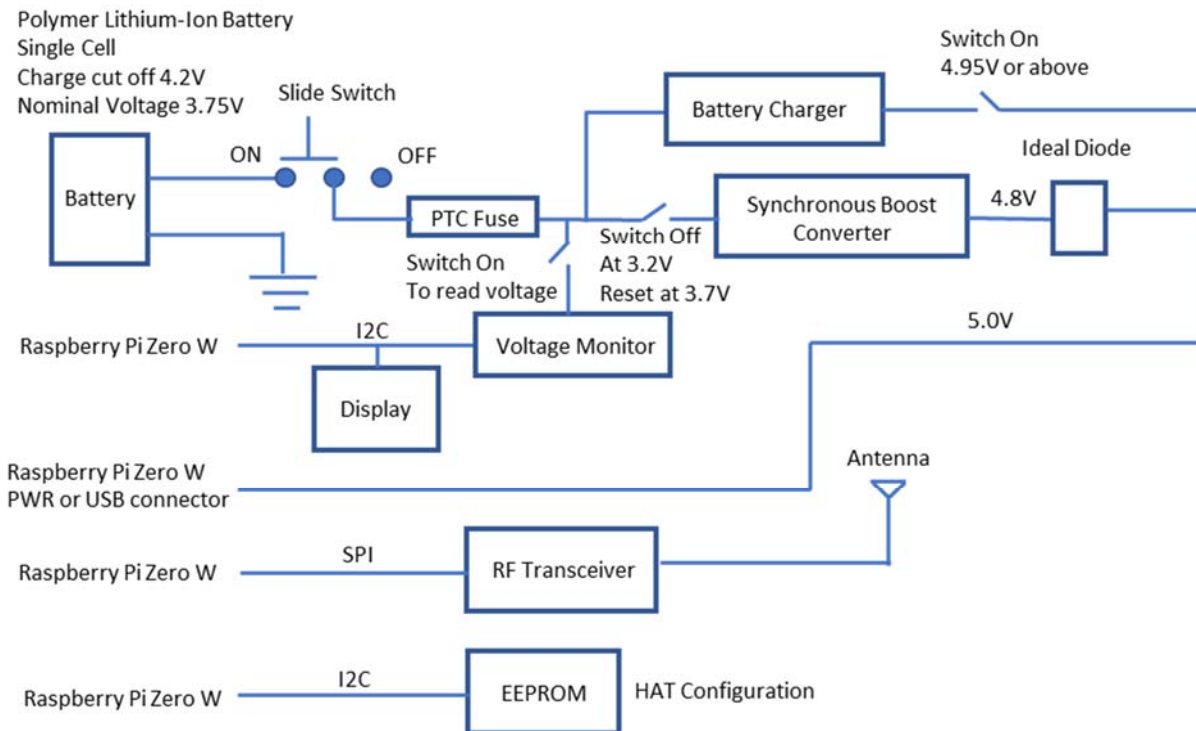


Introduction

The Explorer Board HAT is used with a Raspberry Pi Zero W Board to form a “Rig”. This Rig is used to receive blood glucose readings from a CGM (continuous glucose monitor) and then control an insulin pump.

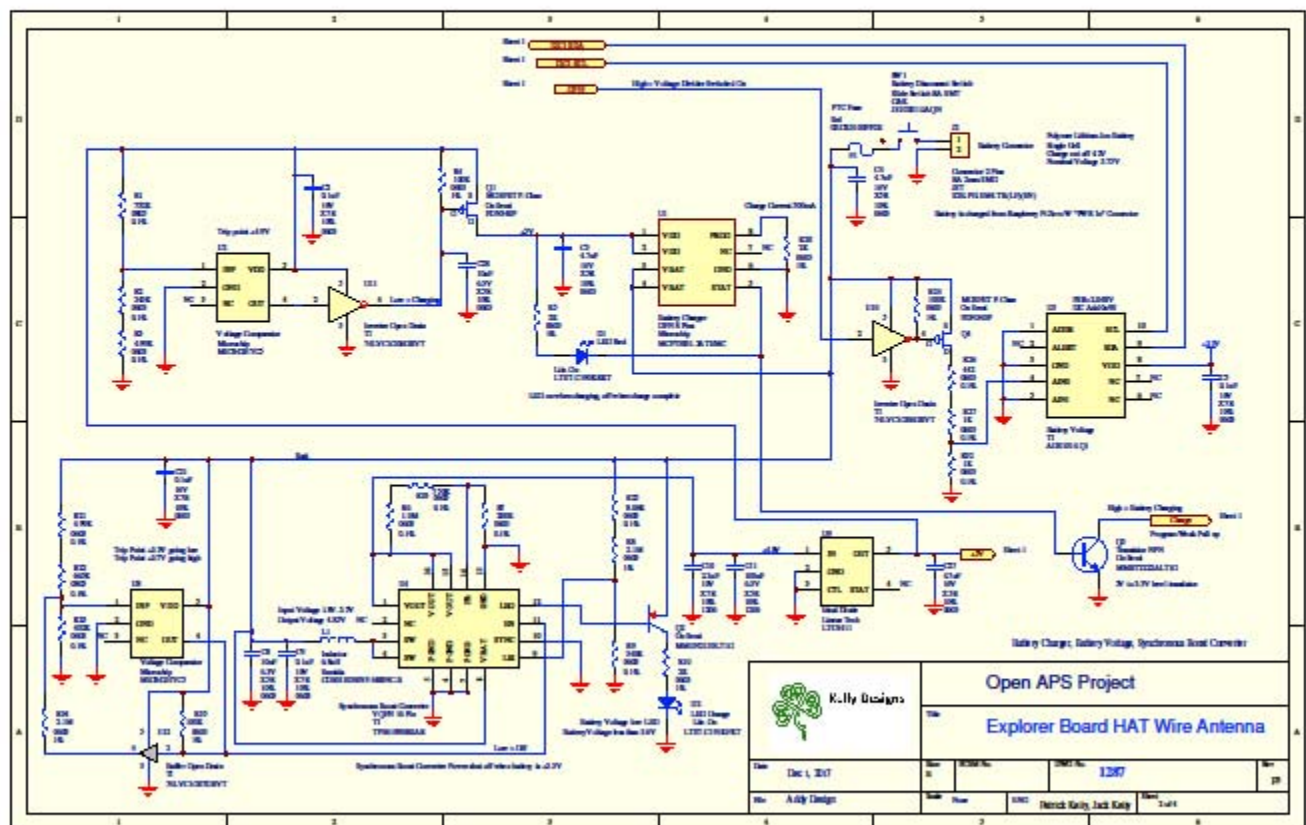
The Rig also sends data to “Night Scout” using a WiFi connection.

The Explorer Board HAT is 68mm long x 33.9mm wide and 1.6mm thick.

Block Diagram

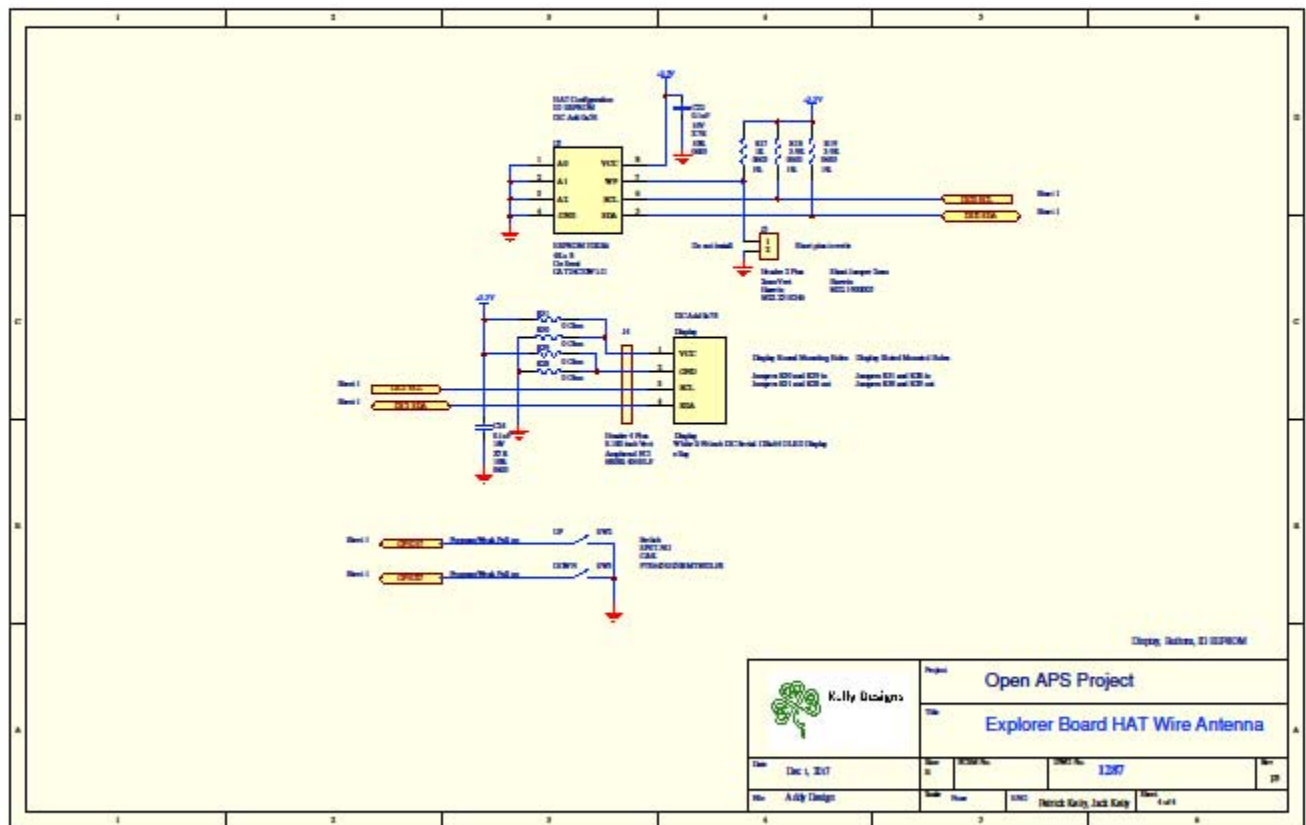
The diagram illustrates the connection of the Explorer Board HAT Wire Antenna to the Raspberry Pi Zero W Core Board. The Raspberry Pi Zero W Core Board is shown with its various components, including the USB Type-C port, 5V regulator, and GPIO pins. The Explorer Board HAT Wire Antenna is connected to the GPIO pins, specifically the 5V, GND, and I2C pins. The antenna is a small circuit board with a micro-USB port and a small antenna element. The diagram shows the connection of the antenna to the Raspberry Pi Zero W Core Board, including the 5V, GND, and I2C pins.

Schematic Drawing (Sheet 2 of 4)

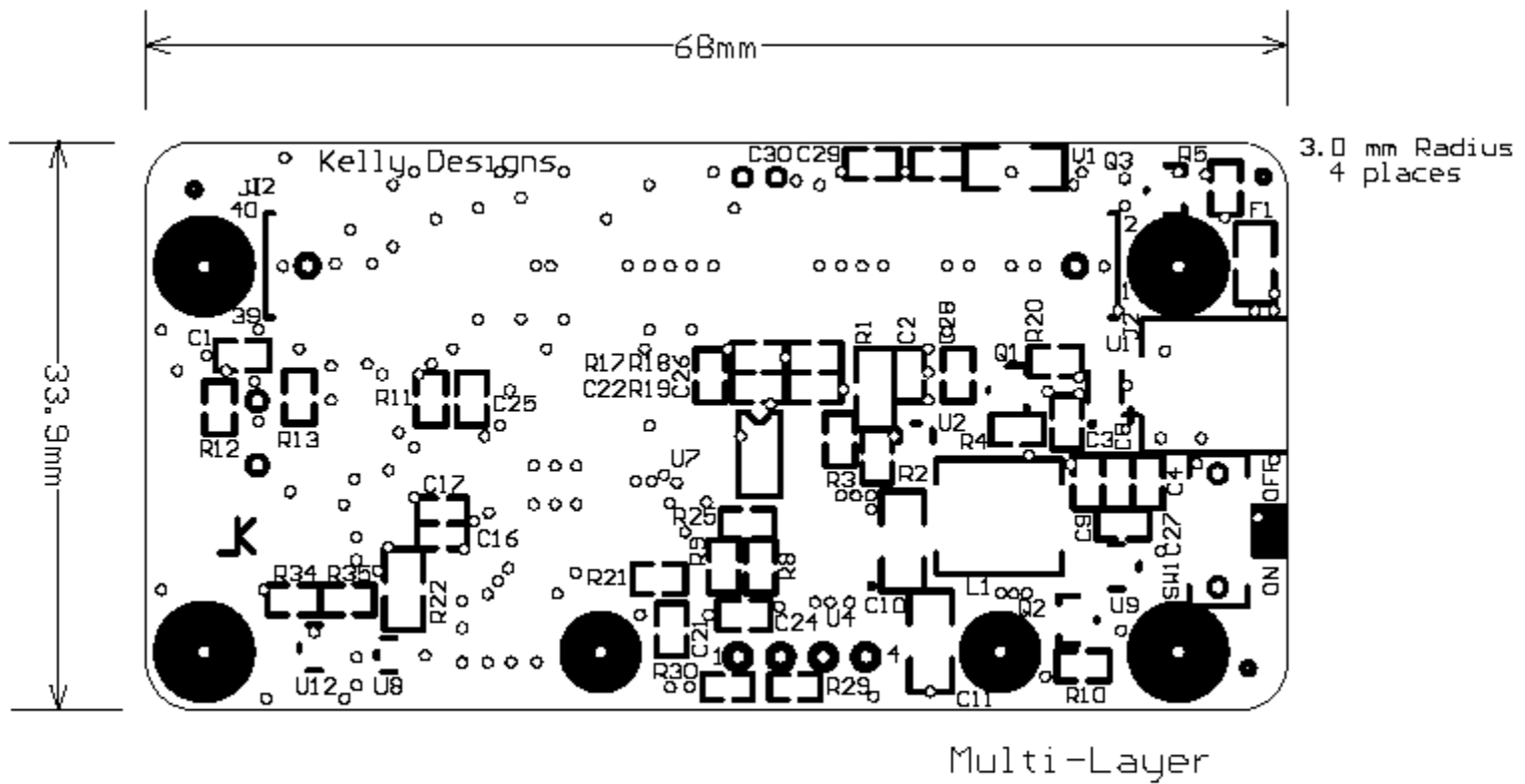


The image shows a detailed PCB layout for the Explorer Board HAT Wire Antenna. The board is populated with an AVR microcontroller, various passive components (resistors, capacitors), and a 7805 voltage regulator. It features a USB Type-A connector, a 5-pin header, and a 2-pin header. The layout includes a top layer (blue) and a bottom layer (green) with various components and traces. A legend in the bottom right corner identifies the project as 'Open APS Project' and the board as 'Explorer Board HAT Wire Antenna'. The layout is dated Dec 1, 2017, and is the 1st of 4 pages.

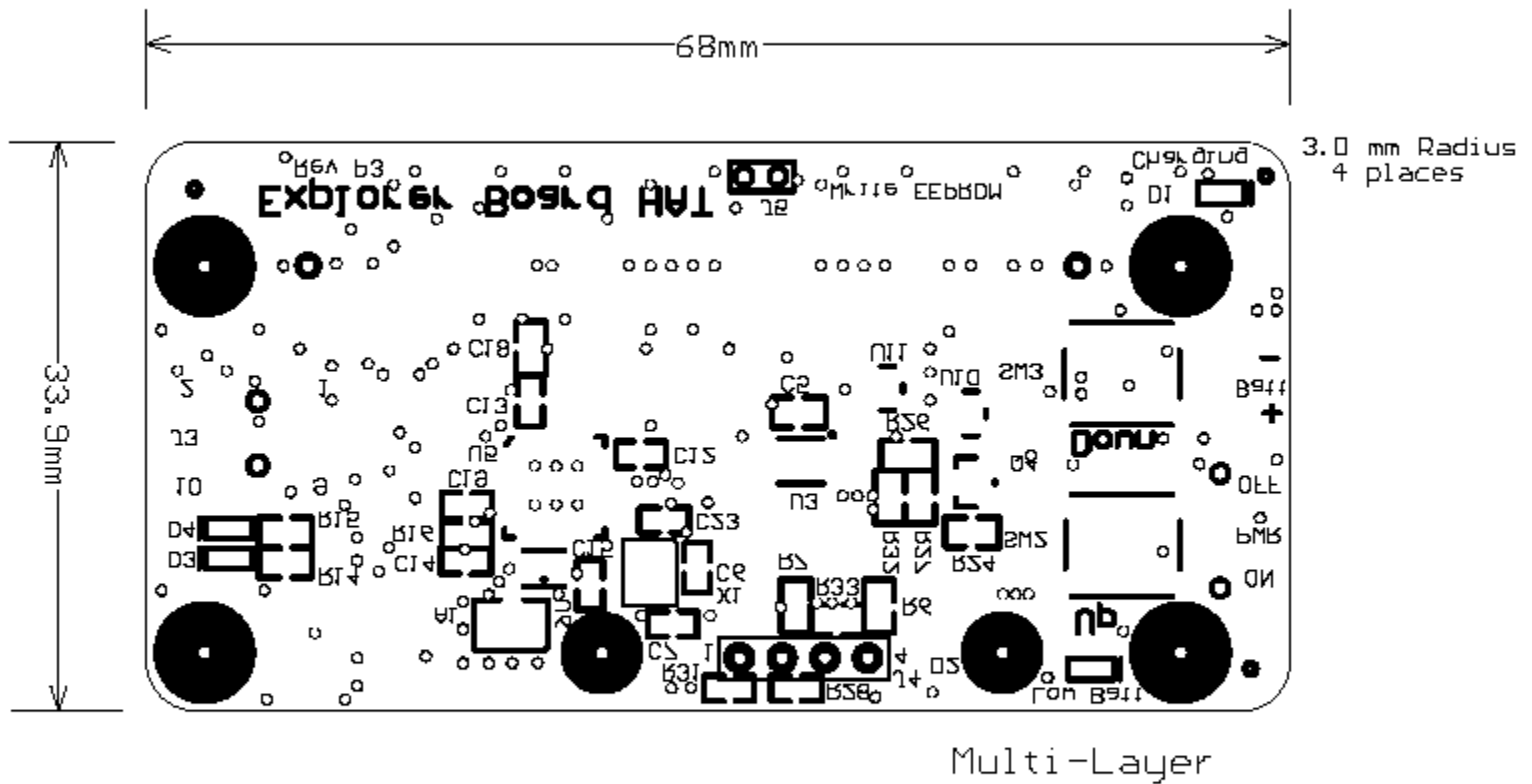
Schematic Drawing (Sheet 4 of 4)



Assembly Drawing (Bottom Side)



Assembly Drawing (Top Side)



Explorer Board HAT Specification

Rev 0.1

Bill of Materials (BOM) Explorer Board HAT



Kelly Designs

Explorer Board HAT (wire antenna)
PN: 1287
Rev P3

As of: 12/21/2017
Patrick Kelly, Jack Kelly
© Copyright 2017

| Item | Qty | Location (bottom) | Mfg Part # | Description | Rating | Footprint | Mfg | Mouser | DigiKey | Notes | \$ each | Total |
|------|-----|------------------------------------|-----------------------|--------------------------------------|--------|-----------|------------|---------------------------|-----------------------|-------|---------|-------|
| 1 | 1 | A1 | 1909763-1 | Conn UMCC Jack Str 50 Ohm SMD | | SMD | TE | 571-1909763-1 | A18077CT-ND | | 0.322 | 0.322 |
| 2 | 2 | C6, C7 | GRM1555C1H180JA01D | Cap Cer 18pF 50V COG 5% 0402 | | COG | 0402 | Murata | 81-GRM1555C1H180JA1D | | 0.006 | 0.012 |
| 3 | 8 | C1, C2, C5, C9, C21, C22, C24, C30 | CC0603KRX7R78B104 | Cap Cer 0.1uF 16V X7R 10% 0603 | | X7R | 0603 | Yageo | 603-CC03KRX7R78B104 | | 0.005 | 0.040 |
| 4 | 7 | C12, C13, C14, C15, C16, C17, C23 | GRM155R71C104KA88J | Cap Cer 0.1uF 16V X7R 10% 0402 | | X7R | 0402 | Murata | 81-GRM155R71C104KA8J | | 0.006 | 0.042 |
| 5 | 3 | C3, C4, C27 | CC0603KRX5R78B475 | Cap Cer 4.7uF 16V X5R 10% 0603 | | X5R | 0603 | Yageo | 603-CC03KRX5R78B475 | | 0.072 | 0.216 |
| 6 | 3 | C8, C28, C29 | GRT188R61C106KE13D | Cap Cer 10uF 6.3V X5R 10% 0603 | | X5R | 0603 | Murata | 81-GRT188R61C106KE3D | | 0.154 | 0.462 |
| 7 | 1 | C10 | CC1206KXX7R68B225 | Cap Cer 2.2uF 10V X7R 10% 1206 | | X7R | 1206 | Yageo | 603-CC1260KXX7R68B225 | | 0.037 | 0.037 |
| 7 | 0 | C10 | GRM31MR71A225KA01L | Cap Cer 2.2uF 10V X7R 10% 1206 | | X7R | 1206 | Murata | 81-GRM426X225KA01L | | 0.118 | 0.000 |
| 7 | 0 | C10 | C1206C225K8ACTU | Cap Cer 2.2uF 10V X7R 10% 1206 | | X7R | 1206 | Kemet | 80-C1206C225K88 | | 0.470 | 0.000 |
| 7 | 0 | C10 | LMK316B7125KLT | Cap Cer 2.2uF 10V X7R 10% 1206 | | X7R | 1206 | Taiyo Yuden | 963-LMK316B7225KLT | | 0.074 | 0.000 |
| 8 | 1 | C11 | GRM31CR60J107KE39L | Cap Cer 100uF 6.3V X5R 10% 1206 | | X5R | 1206 | Murata | 81-GRM31CR60J107KE3L | | 0.290 | 0.290 |
| 8 | 0 | C11 | CL31A107MQHNNNE | Cap Cer 100uF 6.3V X5R 20% 1206 | | X5R | 1206 | Samsung | NA | | 0.261 | 0.000 |
| 8 | 0 | C11 | JMK316B107ML-T | Cap Cer 100uF 6.3V X5R 20% 1206 | | X5R | 1206 | Taiyo Yuden | 963-JMK316B107ML-T | | 0.472 | 0.000 |
| 9 | 3 | C18, C25, C26 | CC0603KRX5R58B475 | Cap Cer 4.7uF 6.3V X5R 10% 0603 | | X5R | 0603 | Yageo | 603-CC03KRX5R58B475 | | 0.025 | 0.075 |
| 10 | 1 | C19 | LMK105B1105KV-F | Cap Cer 1uF 10V X5R 10% 0402 | | X5R | 0402 | Taiyo Yuden | 963-LMK105B1105KV-F | | 0.023 | 0.023 |
| 11 | 2 | D1, D4 | LTST-C190KRKT | LED Red Clear 0603 | | 0603 | Lite-On | 859-LTST-C190KRKT | 160-1436-1-ND | | 0.068 | 0.136 |
| 12 | 1 | D2 | LTST-C191KFKT | LED Orange Clear 0603 | | 0603 | Lite-On | 859-LTST-C191KFKT | 160-1445-1-ND | | 0.068 | 0.068 |
| 13 | 1 | D3 | LTST-C190GKGT | LED Green Clear 0603 | | 0603 | Lite-On | 859-LTST-C190GKGT | 160-1435-1-ND | | 0.068 | 0.068 |
| 14 | 1 | F1 | OZC0K100FF2E | Fuse PTC Resttable 1.0A 6V Chip 0805 | | 0805 | Bel Fuse | 530-OZC0K100FF2E | 507-1815-1-ND | | 0.185 | 0.185 |
| 15 | 1 | J1 | CS25582-40G-M36-0A | Conn Socket 2x20 0.100 inch SMD | | 0.100 | Kawee Tech | (Buy from Adafruit #2387) | NA | | 1.950 | 1.950 |
| 16 | 1 | J2 | S28-PH-SM4-TB(LF)(SN) | Conn Header PH Side 2 Pos 2mm SMD | | SMD | JST | NA | 455-1749-1-ND | | 0.419 | 0.419 |
| 17 | 0 | J3 | 20021121-00010C4LF | Conn Header 10 Pos DL 0.050 in SMD | | SMD | Amphenol | 649-202112100010C4LF | 609-3695-1-ND | | 0.606 | 0.000 |
| 18 | 0 | J5 | M22-2510246 | Header 2 Pos 2mm | | 2mm | Harwin | 855-M22-2510246 | 952-2280-ND | 5,6 | 0.082 | 0.000 |
| 19 | 0 | J5 Shunt | M22-1900005 | Shunt Jumper 2mm | | 2mm | Harwin | 855-M22-1900005 | 952-1305-ND | | 0.215 | 0.000 |
| 20 | 1 | L1 | PA4341.682NLT | Inductor 6.8uH 4.5A 60 Mohm SMD | | | | Pulse | 678-PA4341.682NLT | | 0.702 | 0.702 |
| 20 | 0 | L1 | PA4341.682NLT | Inductor 6.8uH 4.5A 60 Mohm SMD | | | | Pulse | buy from Arrow | | 0.663 | 0.000 |
| 21 | 2 | Q1, Q4 | FDN340P | MOSFET P-Chan 20V 2A SSOT-3 | | SSOT-3 | On Semi | 512-FDN340P | FDN340PCT-ND | | 0.157 | 0.314 |
| 22 | 1 | Q2 | MMUN2133LT1G | Trans Prebias PNP 246mW SOT23-3 | | SOT23-3 | On Semi | 863-MMUN2133LT1G | MMUN2133LT1GOSCT-ND | | 0.039 | 0.039 |
| 23 | 1 | Q3 | MMBT2222ALT1G | Trans NPN 40V 0.6A SOT-23 | | SOT-23 | On Semi | 863-MMBT2222ALT1G | MMBT2222ALT1GOSCT-ND | | 0.034 | 0.034 |
| 24 | 3 | R14, R15, R17 | RC0603FR-071KL | Res 1.0K Ohm 1% Thick Film 0603 | | 1% | 0603 | Yageo | 603-RC0603FR-071KL | | 0.006 | 0.018 |
| 25 | 1 | R1 | RT0805BRD07732KL | Res 732K Ohm 0.1% Thin Film 0805 | | 0.1% | 0805 | Yageo | 603-RT0805BRD07732KL | | 0.114 | 0.114 |
| 26 | 1 | R22 | ERA-6AE6653V | Res 665K Ohm 0.1% Thin Film 0805 | | 0.1% | 0805 | Panasonic | 667-ERA-6AE6653V | | 0.118 | 0.118 |
| 27 | 1 | R7 | RT0603BRD07200KL | Res 200K Ohm 0.1% Thin Film 0603 | | 0.1% | 0603 | Yageo | 603-RT0603BRD07200KL | | 0.127 | 0.127 |
| 28 | 2 | R3, R21 | RT0603BRD074K99L | Res 4.99K Ohm 0.1% Thin Film 0603 | | 0.1% | 0603 | Yageo | 603-RT0603BRD074K99L | | 0.127 | 0.254 |
| 29 | 1 | R2 | ERA-3AE2433V | Res 243K Ohm 0.1% Thin Film 0603 | | 0.1% | 0603 | Panasonic | 667-ERA-3AE2433V | | 0.117 | 0.117 |
| 30 | 1 | R23 | RN73C1402XBTD | Res 402K Ohm 0.1% Thin Film 0603 | | 0.1% | 0603 | TE | 279-RN73C1402XBTD | | 0.437 | 0.437 |
| 31 | 1 | R6 | CPF0603B1M0E1 | Res 1M Ohm 0.1% Thin Film 0603 | | 0.1% | 0603 | TE | 279-CPF0603B1M0E1 | | 0.157 | 0.157 |
| 32 | 1 | R33 | CPF0603B750K1 | Res 750K Ohm 0.1% Thin Film 0603 | | 0.1% | 0603 | TE | 279-CPF0603B750K1 | | 0.199 | 0.199 |
| 33 | 1 | R25 | ERA-3AE8061V | Res 8.06K Ohm 0.1% Thin Film 0603 | | 0.1% | 0603 | Panasonic | 667-ERA-3AE8061V | | 0.117 | 0.117 |
| 34 | 1 | R9 | RN73C1J340KBTD | Res 340K Ohm 0.1% Thin Film | | 0.1% | 0603 | TE | 279-RN73C1J340KBTD | | 0.437 | 0.437 |
| 35 | 0 | R12, R13 | RC0603FR-071KL | Res 1.0K Ohm 1% Thick Film 0603 | | 1% | 0603 | Yageo | 603-RC0603FR-071KL | | 0.006 | 0.000 |
| 36 | 3 | R5, R10, R20 | RC0603FR-072KL | Res 2.0K Ohm 1% Thick Film 0603 | | 1% | 0603 | Yageo | 603-RC0603FR-072KL | | 0.006 | 0.018 |
| 37 | 3 | R4, R24, R35 | RC0603FR-07100KL | Res 100K Ohm 1% Thick Film 0603 | | 1% | 0603 | Yageo | 603-RC0603FR-07100KL | | 0.006 | 0.018 |
| 38 | 2 | R8, R34 | CRCW06032M10FKEA | Res 2.1M Ohm 1% Thick Film 0603 | | 1% | 0603 | Vishay Dale | 71-CRCW06032M10FKEA | | 0.014 | 0.028 |

Bill of Materials (BOM)

Explorer Board HAT

| | | | | | | | | | | | |
|--|---|----------------|----------------------|--|------|----------|--------------|----------------------|------------------------|---------|-------|
| 39 | 2 | R18, R19 | RC0603FR-073K9L | Res 3.9K Ohm 1% Thick Film 0603 | 1% | 0603 | Yageo | 603-RC0603FR-073K9L | 311-3.90KRCCT-ND | 0.006 | 0.012 |
| 40 | 1 | R26 | RT0603BRD07442RL | Res 442 Ohm 0.1% Thin Film 0603 | 0.1% | 0603 | Yageo | 603-RT0603BRD07442RL | YAG4058CT-ND | 0.069 | 0.069 |
| 41 | 1 | R11 | RC0603FR-0710KL | Res 10K Ohm 1% Thick Film 0603 | 1% | 0603 | Yageo | 603-RC0603FR-0710KL | 311-10.0KRCCT-ND | 0.003 | 0.003 |
| 42 | 1 | R16 | RC0402FR-0756KL | Res 56K Ohm 1% Thick Film 0402 | 1% | 0402 | Yageo | 603-RC0402FR-0756KL | 311-56.0KRCCT-ND | 0.005 | 0.005 |
| 43 | 2 | R27, R32 | RT0603BRD071KL | Res 1K Ohm 0.1% Thin Film 0603 | 0.1% | 0603 | Yageo | 603-RT0603BRD071KL | YAG1237CT-ND | 0.069 | 0.138 |
| 44 | 2 | R28, R31 | RC0402JR-070RL | Res 0 Ohm Jumper Thick Film 0402 | | 0402 | Yageo | 603-RC0402JR-070RL | 311-0.0RCCT-ND | 0.003 | 0.006 |
| 45 | 0 | R29, R30 | RC0402JR-070RL | Res 0 Ohm Jumper Thick Film 0402 | | 0402 | Yageo | 603-RC0402JR-070RL | 311-0.0RCCT-ND | 0.003 | 0.000 |
| 46 | 1 | SW1 | JS102011JAQN | Switch Slide SPDT 300mA 6V SMD | | | C&K | 611-VS102011JAQN | CKN10720CT-ND | 0.350 | 0.350 |
| 47 | 2 | SW2, SW3 | PTS6453K43SMT892 LFS | Switch Tactile SPST-NO 0.05A 12V SMT | | | C&K | 611-PTS6453K43SMT892 | CKN9084CT-ND | 0.176 | 0.352 |
| 48 | 1 | U1 | MCP73831-2AT/MC | IC Controller Li-Ion 4.2V 8DFN | | 8DFN | Microchip | 579-MCP73831-2AT/MC | MCP73831-2AT/MC-ND | 0.450 | 0.450 |
| 49 | 2 | U2, U8 | MIC842HYC5-TR | IC Comparator w/Ref Open Drain | | SC-70-5 | Microchip | 998-MIC842HYC5-TR | 579-2826-1-ND | 0.420 | 0.840 |
| 50 | 1 | U3 | ADS1014BQDGSRQ1 | IC ADC 12-Bit 12C SMD | | | TI | 595-ADS1014BQDGSRQ1 | 296-4532-1-ND | 2.170 | 2.170 |
| 51 | 1 | U4 | TPS61090RSAR | IC Reg Boost Adj 2A Sync 16VQFN | | 16VQFN | TI | 595-TPS61090RSAR | 296-15259-1-ND | 1.720 | 1.720 |
| 52 | 1 | U5 | CC110F32RHHT | IC RF TxRx MCU ISM<1GHz 36-VQFN | | 36-VQFN | TI | 595-CC110F32RHHT | 296-38389-1-ND | 4.480 | 4.480 |
| 53 | 1 | U6 | 0896BM15A0001 | RF Balun Filter 863-928 MHz | | 0805 | Johanson | 608-0896BM15A0001E | 712-1474-1-ND | 0.522 | 0.522 |
| 54 | 1 | U7 | CAT24C32WI-G | IC EEPROM 32Kbit 400KHz 8SOIC | | SOIC-8 | On Semi | 698-CAT24C32WI-G | CAT24C32WI-G05-ND | 0.220 | 0.220 |
| 55 | 2 | U10, U11 | SN74LVC1G06DBVR | IC Inverter SGL 1 input SOT23-5 | | SOT23-5 | TI | 595-SN74LVC1G06DBVR | 296-8483-1-ND | 0.134 | 0.268 |
| 56 | 1 | U9 | LTC4411ESS#TRMPBF | IC OR Controller TSOT23-5 | | TSOT23-5 | Linear Tech | NA | L7C4411ESS#TRMPBFCT-ND | 2.328 | 2.328 |
| 57 | 1 | U12 | 74LVC1G07DBVT | IC Buffer Non-Invert 1 input SOT23-5 | | SOT23-5 | TI | 595-SN74LVC1G07DBVT | 296-26590-1-ND | 0.400 | 0.400 |
| 58 | 1 | V1 | VCI120605D150DP | TVS 5.6VDC 150A 1206 | | 1206 | AVX | 361-VCI120605D150DP | 478-2517-1-ND | 0.370 | 0.370 |
| 59 | 1 | X1 | 7V-24.000MAHI-T | Crystal 24.000MHz 18pF SMD | | SMD | TXC Corp | 717-7V-24.000MAHI-T | 887-2580-1-ND | 0.522 | 0.522 |
| 60 | 1 | | | PCB Bare | | | | | | | 0.000 |
| Sub total: | | | | | | | | | | \$22.82 | |
| Assemble Display to Explorer Board HAT and Antenna | | | | | | | | | | | |
| 1 | 1 | Display | NA | Display 128X64 I2C OLED 0.96 inch white | | | eBay | NA | NA | 6.2 | 3.670 |
| 2 | 0 | J4 | 68000-404HLF | Header 4 Pos 0.100 in Str Tin | | 0.100 | Amphenol | 649-68000-404HLF | 609-1526-ND | 6.2 | 0.155 |
| 3 | 2 | M1, M2, M3, M4 | R30-6700394 | Spacer M3 nylon 3mm | | | Harwin | 835-R30-6700394 | 852-1526-ND | 0.127 | 0.254 |
| 4 | 2 | M1, M2, M3, M4 | MPMS 002 0008 PH | Screw Machine Pan M2 x 8 Phillips | | | B&F Fastener | NA | HT38-ND | | 0.070 |
| 5 | 2 | M1, M2, M3, M4 | MHNZ 002 4 | Nut Hex 0.157" M2 | | | B&F Fastener | NA | HT61-ND | | 0.049 |
| 6 | 2 | M1, M2, M3, M4 | 3114 | Washer Flat #2 Nylon | | | Keystone | 334-3114 | 36-3114-ND | | 0.070 |
| 7 | 0 | M1, M2, M3, M4 | 222 (Purple) | Threadlocker 222 tube 6 ml | | | Loctite | (on M2 nut end) | Amazon | | 8.140 |
| 8 | 0 | A1 | 66089-0930 | Antenna U.FL 915MHz 30MM | | | Anaren | 620-66089-0930 | 1173-1135-ND | | 3.560 |
| 8 | 1 | A1 | 66089-0930 | Antenna U.FL 915MHz 30MM | | | Anaren | RichesonRFPD | | | 2.180 |
| 9 | 1 | Under Display | Cat 111-24 | 3M Scotch 111 Heavy Duty 1 inch Mounting Squares | | | Scotch | Amazon | | 4 | 0.100 |
| Sub total: | | | | | | | | | | \$4.30 | |

Notes:

| | |
|---|---|
| 1 | These components should be stocked due to concerns over lead time and/or limited substitutions available. |
| 2 | Cut pins flush to this board (0.030 inch or less) |
| 3 | Do not wash |
| 4 | Stack 2 squares on top of each other, then cut to about 0.5 x 0.33 inch, then place under Display to support it |
| 5 | Leave holes open (do not fill with solder) |
| 6 | Thru-hole component |
| 7 | |

Bill of Materials (BOM)
Explorer Board HAT Pi Zero Kit



Kelly Designs

Explorer Board HAT Pi Zero Kit
PN: 1289 Rev P3

As of: 12/1/2017
Patrick Kelly, Jack Kelly
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| Item | Qty | Location (bottom) | Mfg Part # | Description | Rating | Footprint | Mfg | Mouser | DigiKey | Notes | \$ each | Total |
|--|-----|-----------------------|--------------------|-----------------------------|--------|-----------|---------|-------------------|---------|-------|----------------|--------|
| Parts for the Raspberry Pi Zero W | | | | | | | | | | | | |
| 1 | 1 | Pi Zero W | 3400 | Raspberry Pi Zero W | | | | Buy from Adafruit | | | 10.000 | 10.000 |
| 2 | 1 | Pi Zero Micro SD Card | SDSQUNC-016G-GN6MA | Micro SD Card 16GB Class 10 | | | SanDisk | Buy from Amazon | NA | | 9.950 | 9.950 |
| 3 | 1 | Pi Zero GPIO Conn | 2822 | Header male 2x20 0.100 inch | | 0.100 | | Buy from Adafruit | NA | 6 | 0.950 | 0.950 |
| | | | | | | | | | | | | 0.000 |
| Sub total: | | | | | | | | | | | \$20.90 | |

Notes:

| | |
|---|---|
| 1 | These components should be stocked due to concerns over lead time and/or limited substitutions available. |
| 2 | Cut pins flush to this board (0.030 inch or less) |
| 3 | Do not wash |
| 4 | |
| 5 | Leave holes open (do not fill with solder) |
| 6 | Thru-hole component |
| 7 | |

Bill of Materials (BOM)
Explorer Board HAT Coupling Kit



Kelly Designs

Explorer Board HAT Coupling
Kit
PN: 1278 Rev P3

As of: 12/1/2017
Patrick Kelly, Jack Kelly
© Copyright 2017

| Item | Qty | Location (bottom) | Mfg Part # | Description | Rating | Footprint | Mfg | Mouser | DigiKey | Notes | \$ each | Total |
|------|-----|-------------------|--------------|--|--------|-----------|-------------------|------------|---------------|-------|---------|-------|
| | | | | Assemble Explorer HAT to Raspberry Pi | | | | | | | | |
| 1 | 4 | M1, M2, M3, M4 | 970090151 | Hex Spacer M2.5 threaded Al 9mm | | | Würth | NA | 732-10537-ND | | 0.422 | 1.688 |
| 3 | 8 | M1, M2, M3, M4 | 29300 | Screw Machine Pan M2.5 x 4mm | | | Keystone | 334-29300 | 36-29300-ND | | 0.237 | 1.896 |
| 5 | 0 | M1, M2, M3, M4 | 222 (Purple) | Threadlocker 222 tube 6 ml | | | Loctite | (on screw) | Amazon | | 8.140 | 0.000 |
| | | | | | | | Sub total: | | \$3.58 | | | |

Notes:

| | |
|---|---|
| 1 | These components should be stocked due to concerns over lead time and/or limited substitutions available. |
| 2 | Cut pins flush to this board (0.030 inch or less) |
| 3 | Do not wash |
| 4 | |
| 5 | Leave holes open (do not fill with solder) |
| 6 | Thru-hole component |
| 7 | |

Connector J1 Pin Out (standard Raspberry Pi Pinout)

| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | +3.3V Out | 2 | +5V |
| 3 | I2C1 SDA | 4 | +5V |
| 5 | I2C1 SCL | 6 | GND |
| 7 | GPIO4 | 8 | UART0 TX |
| 9 | GND | 10 | UART0 RX |
| 11 | GPIO17 | 12 | GPIO18 |
| 13 | GPIO27 | 14 | GND |
| 15 | GPIO22 | 16 | GPIO23 |
| 17 | +3.3V Out | 18 | GPIO18 |
| 19 | SPI MOSI | 20 | GND |
| 21 | SPI MISO | 22 | GPIO25 |
| 23 | SPI SCLK | 24 | SPI CS0 |
| 25 | GND | 26 | SPI CS1 |
| 27 | ID_SD | 28 | ID_SC |
| 29 | GPIO5 | 30 | GND |
| 31 | GPIO6 | 32 | GPIO12 |
| 33 | GPIO13 | 34 | GND |
| 35 | GPIO19 | 36 | GPIO16 |
| 37 | GPIO26 | 38 | GPIO20 |
| 39 | GND | 40 | GPIO21 |

The following are some of the IC chips are used on the Explorer Board HAT Board.

| Ref | Part Number | Vendor | Description |
|-----|------------------|-----------|----------------------------------|
| U1 | MCP73831-2ATI/MC | Microchip | IC Controller Li-Ion 4.2V 8DFN |
| U3 | ADS1014BQDGSRQ1 | TI | IC ADC 12-Bit I2C SMD |
| U4 | TPS61090RSAR | TI | IC Sync Boost Adj 2A Sync 16VQFN |
| U5 | CC1110F32RHHT | Ti | IC RF TxRx MCU ISM<1GHz 36-VFQFN |
| U7 | CAT24C32WI-G | On Semi | IC EEPROM 32KBit 400KHz 8SOIC |

Battery

Use a Polymer Lithium-Ion Battery, Single Cell, Charge cut off 4.2V, Nominal Voltage 3.75V.

Slide Switch

The Slide Switch is used to disconnect the battery from the powering the “Rig”. The slide switch has an “ON” and “OFF” position. When the battery is connected, the “Rig” can be powered on or off with the switch.

If the USB cable is connected, the “Rig” will not be powered down with the slide switch. To power down the USB cable must be disconnected and then the slide switch to “OFF”.

PTC Fuse

The PTC Fuse will trip when more than 1A is drawn from the battery. This is to protect the battery from a short. After waiting a couple of minutes, the PTC Fuse will reset, and the battery can now power the “Rig”.

Synchronous Boost Converter

The Synchronous Boost Converter takes the battery voltage and boosts it to 4.8V. The battery voltage can be between 4.2V to 3.2V. The battery voltage is then boosted to 4.8V.

Battery Charger

The Battery Charger uses a fully integrated Li-Ion, Li-Polymer charge management controller. The constant voltage regulation is fixed at 4.2V. The constant current value is set at 500mA. The battery charger controls a red LED (Charging). The red LED is on when the battery is charging. The red LED goes off when the battery is charged.

The battery charging is started by plugging a USB cable into the Raspberry PI Zero W “PWR” or “USB” connector. To start charging the voltage on the USB cable must be 4.95V or greater. Sometimes if the USB cable is too long the voltage will not be high enough. Then try using a shorter USB cable. Also, sometimes an Ethernet switch or USB charger will have a lower than 4.95V output. This lower voltage will not charge the battery (Charging LED will not come on).

Ideal Diode

An Ideal Diode is used to separate the output of the Synchronous Boost Converter (4.8V) and the 5.0V when an external USB power is plugged into the Raspberry Pi Zero W PWR or USB connector.

Voltage Monitor

The Voltage Monitor measures the battery voltage. When the voltage monitor measures the battery voltage a resistor divider is turned on. When the voltage monitor is not measuring the battery voltage then the resistor divider is turned off. In this way the battery is not drained with the resistor divider always connected to the battery.

Display

The Display is an OLED white 128 x 64 dot matrix. The display can show 21 characters across and 8 rows down. The Raspberry Pi controls the display with its I2C port 1 bus.

Up and Down Push Buttons

The Up Push Button when single clicked moves the display cursor up. The Up button when double clicked will move the cursor back one page.

The Down Push Button when single clicked moves the display cursor down. The Down button when double clicked will select the item the cursor is on.

RF Transceiver

The RF Transceiver transmits and receives information from the insulin pump. The Raspberry Pi controls the RF Transceiver using its SPI bus.

Antenna

The antenna is a single wire. This antenna plugs into the A1 connector. This connector is an ultra-miniature coaxial (UMC). North America uses the 915 MHz frequency and Europe uses the 868 MHz frequency.

| Frequency | Anaren Model |
|-----------|--------------|
| 915 MHz | 66089-0930 |
| 868 MHz | 66089-0830 |

EEPROM

The EEPROM stores the HAT configuration. This EEPROM is used by the system. The user software does not use this device. The device is accessed thru I2C port 0.

Low Battery LED

The Low Battery LED is an orange LED. This LED comes on when the Battery is 3.6V. This will still give about 2 hours (??? test this) more time to run the “Rig”.

The “Rig” will automatically shut down when the battery voltage is 3.2V. This is a hardware function and does not depend on the software. This is to protect the battery, so the battery can have a maximum number of charge cycles. The “Rig” will power up again when the voltage is above 3.7V. This hysteresis (3.2V to 3.7V) is there to protect the “Rig” from powering off then powering back on again. Plugging in the USB cable will turn the “Rig” back on.