

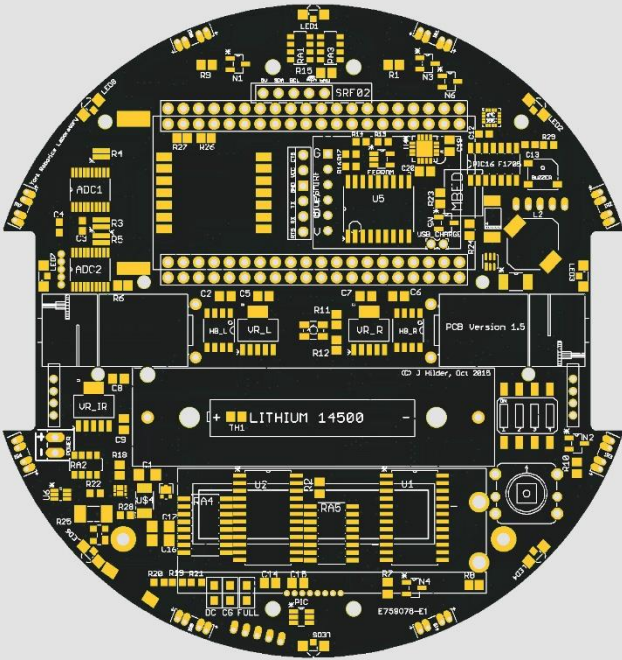
# PSI SWARM ROBOT CONSTRUCTION DOCUMENT

Construction and layout document for Psi Swarm Robot, PCB Version 1.5  
Design and document by James Hilder. Copyright York Robotics  
Laboratory, University of York, November 2015

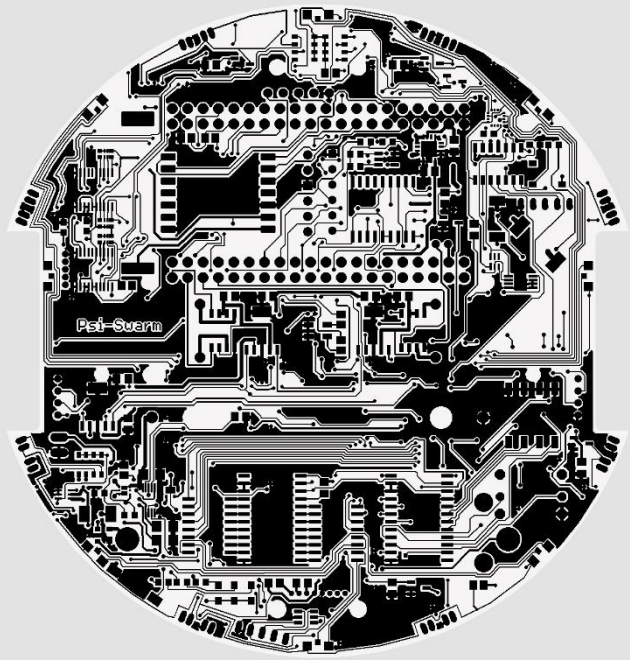
*For PCB Version 1.5*

# PCB Views (Top Side)

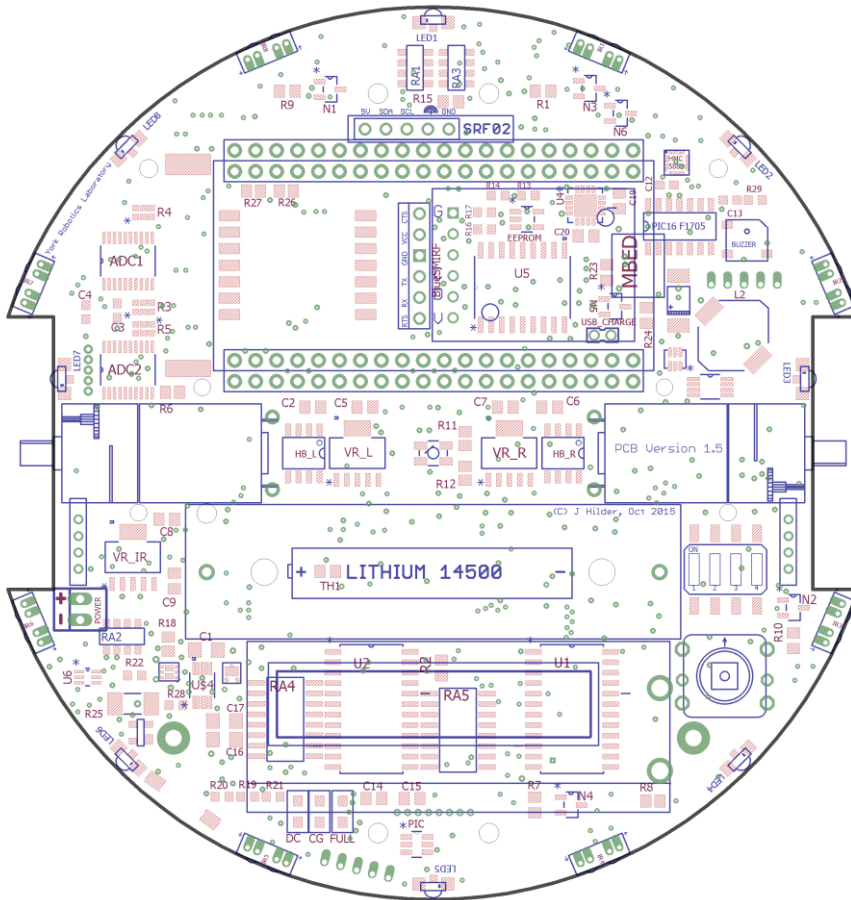
## PCB Image (TOP)



## PCB Copper Layer (TOP)

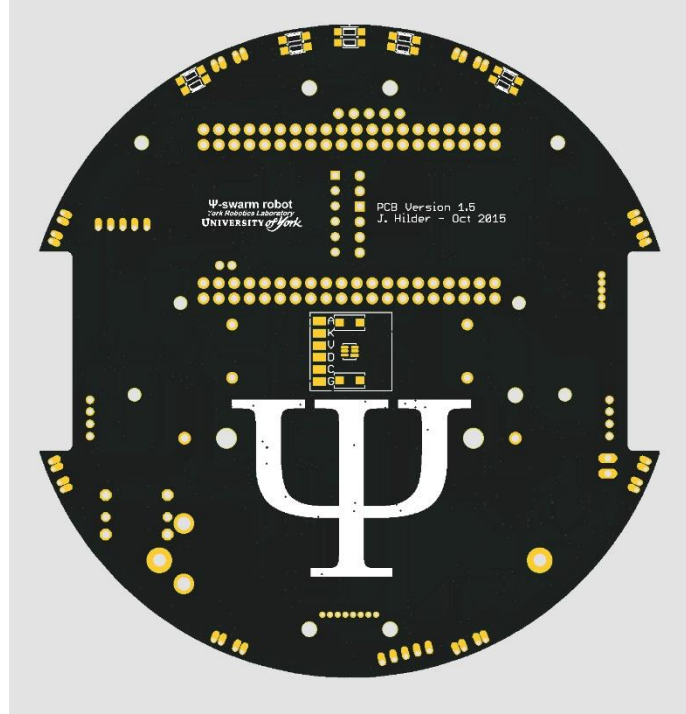


## PCB Silk Screen and Resist Outline (TOP)

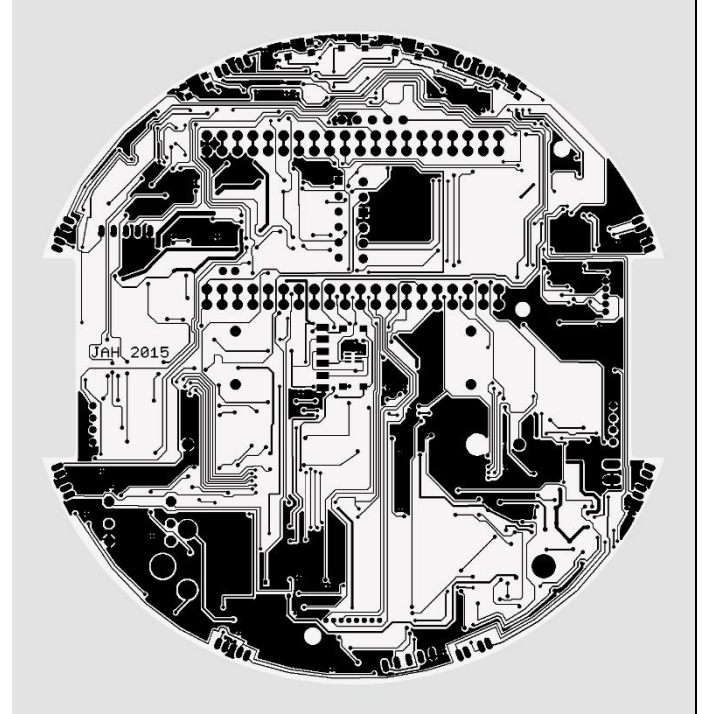


## PCB Views (Bottom Side)

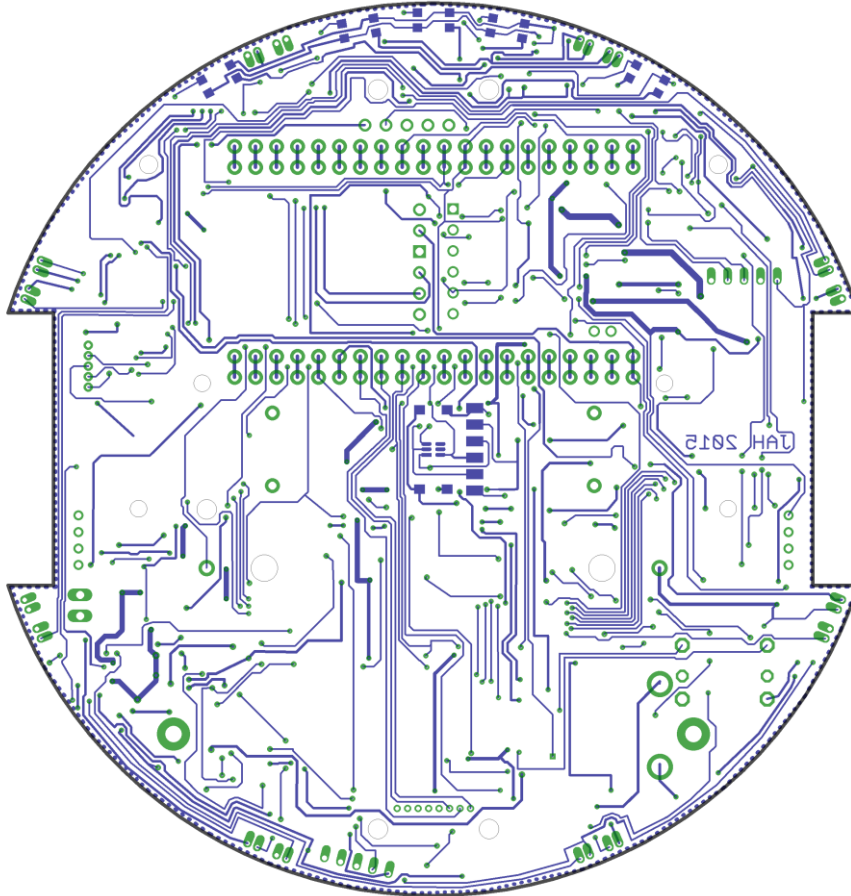
PCB Image (BOTTOM)

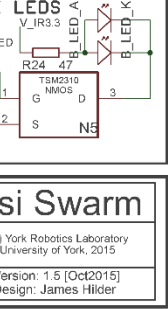
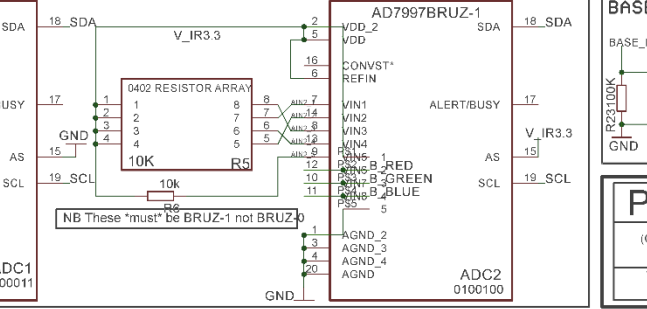
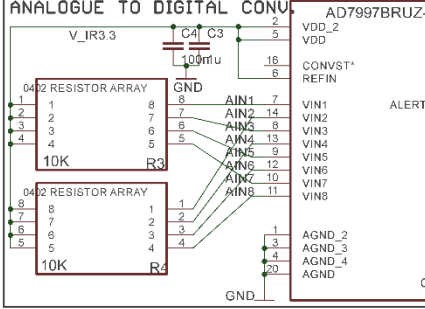
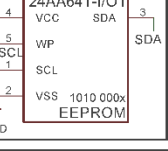
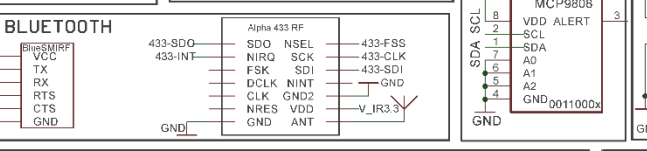
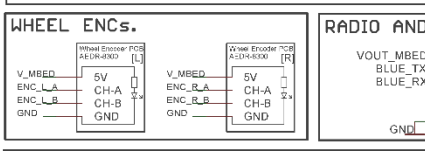
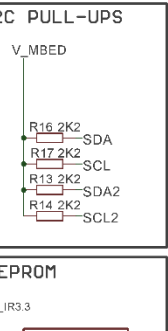
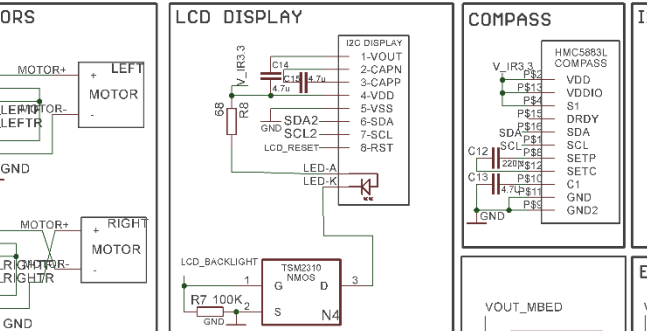
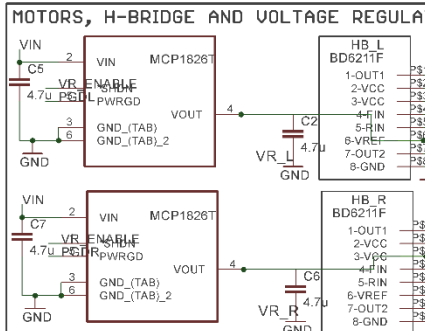
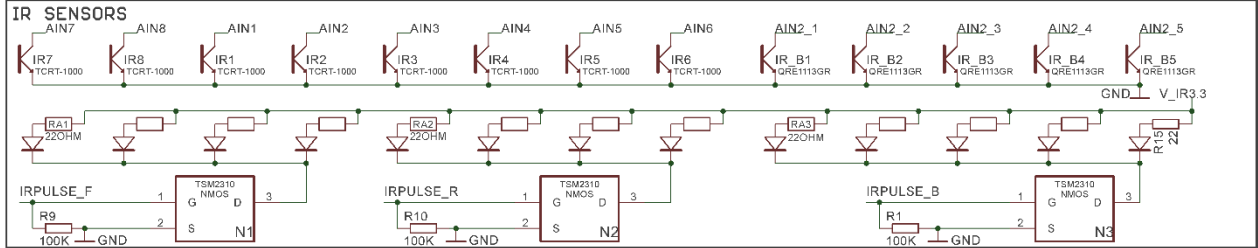
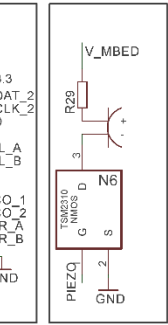
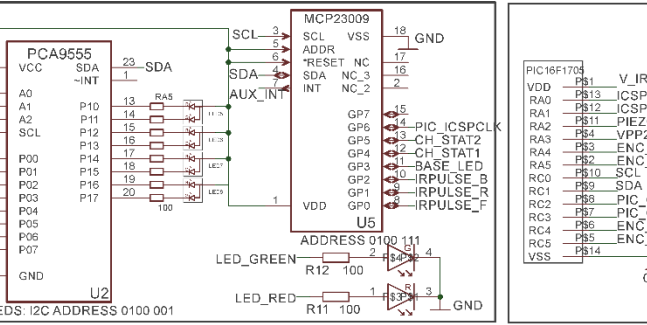
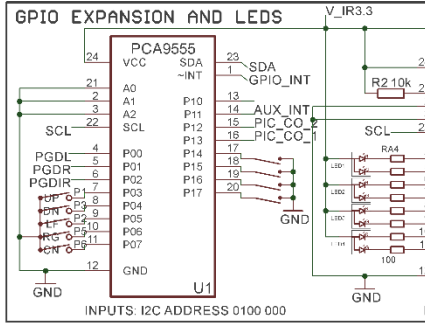
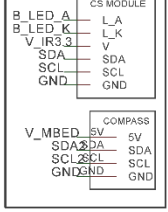
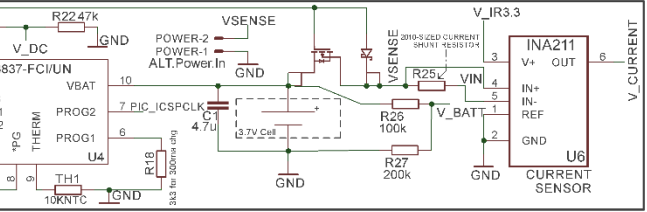
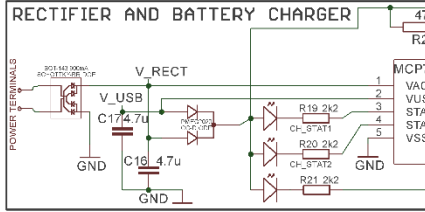
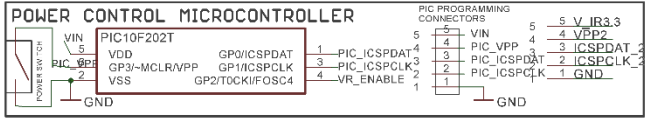
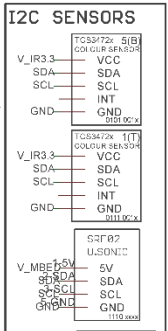
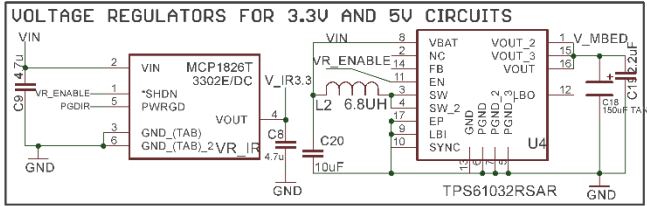
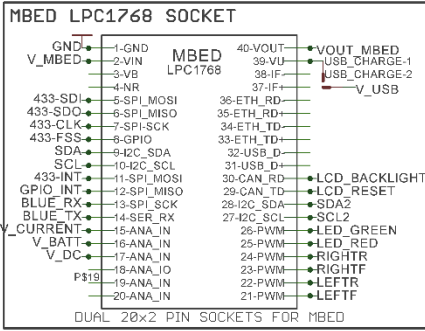


PCB Copper Layer (BOTTOM)



PCB Silk Screen and Resist Outline (BOTTOM)





**Psi Swarm**  
 (C) York Robotics Laboratory  
 University of York, 2015  
 Version: 1.5 [Oct2015]  
 Design: James Hilder

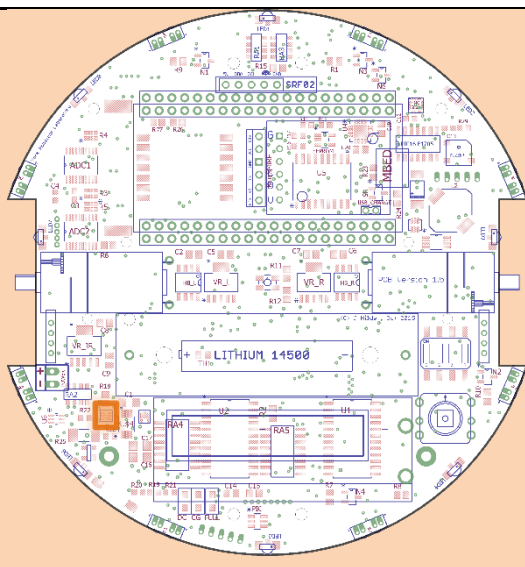
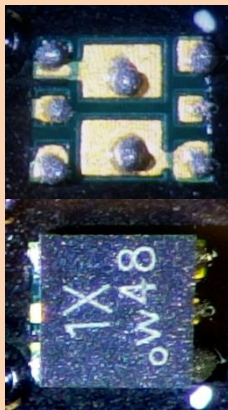
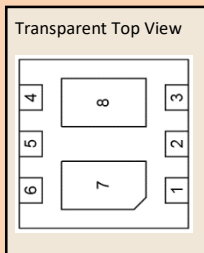


### 1 MS1 – MOSFET-SCHOTTKY PAIR

DESCRIPTION: **NXP PMFPB8032XP**  
 QUANTITY: **1**  
 FARNELL CODE: **2191755**

NOTES: Tricky to place and solder; note layout position in picture to right →

<http://www.farnell.com/datasheets/1758166.pdf>

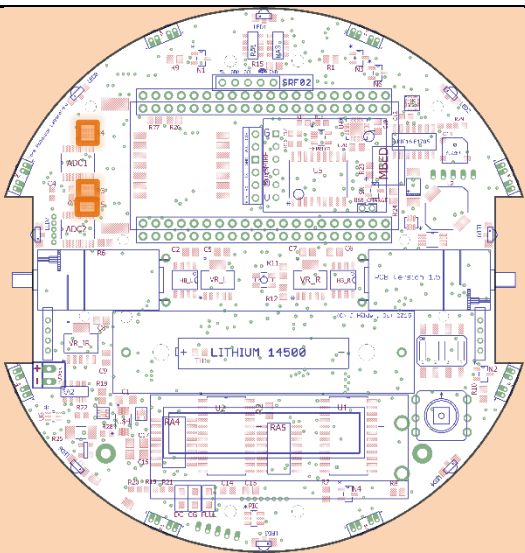
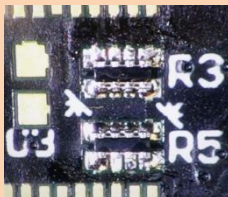


### 2 R3,4,5 10KΩ RESISTOR ARRAYS

DESCRIPTION: **PANASONIC EXB28V1035X**  
 QUANTITY: **3**  
 FARNELL CODE: **2060058**

NOTES: Physically tiny components (0402 4-resistor arrays)  
 Note that all pins at opposite sides to ADC chips are bridged together; bridged joints on the other sides are relatively easy to fix post-soldering by using a fine tipped soldering iron and soldering wick.

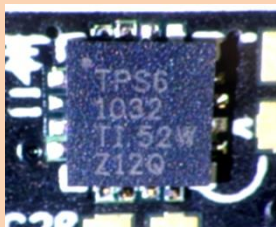
<http://www.farnell.com/datasheets/1480003.pdf>



### 3 VR\_MBED 5V DC/DC SWITCHING REGULATOR

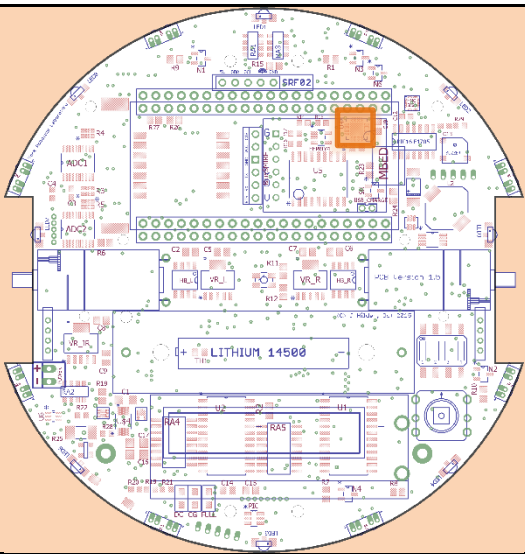
DESCRIPTION: **TPS61032 RSAR**  
 QUANTITY: **1**  
 FARNELL CODE: **2492457**

NOTES:



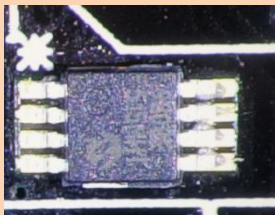
[NB NAME NOT CLEAR ON PCB SILKSCREEN]

<http://www.farnell.com/datasheets/1801519.pdf>

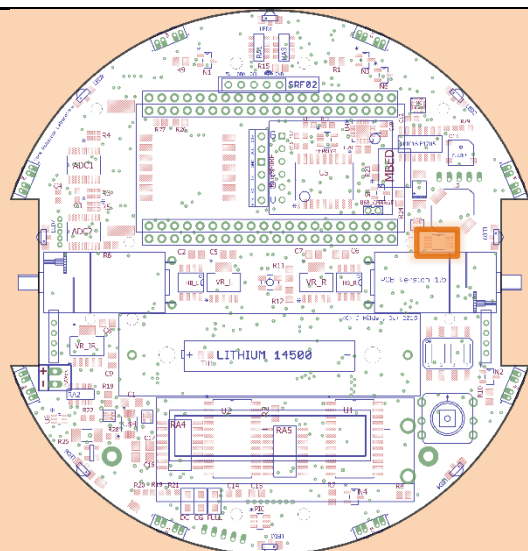


**4 TEMPERATURE SENSOR**DESCRIPTION: **MICROCHIP MCP9808-E/MS**QUANTITY: **1**FARNELL CODE: **2080523**

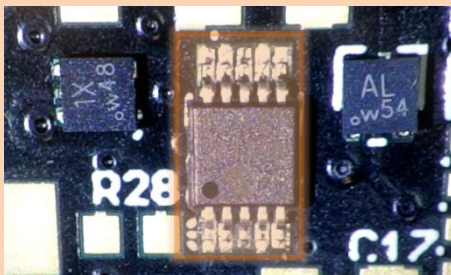
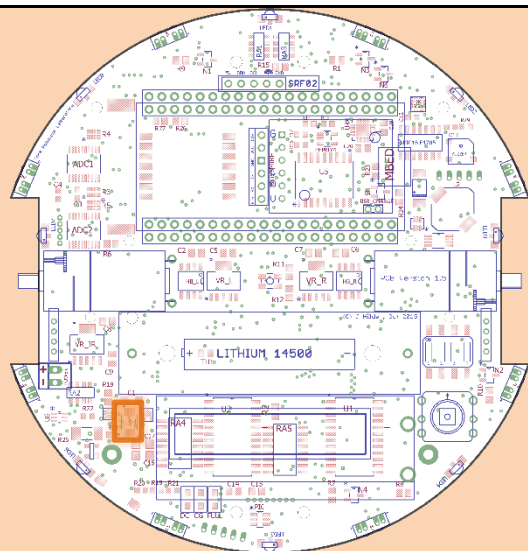
NOTES:



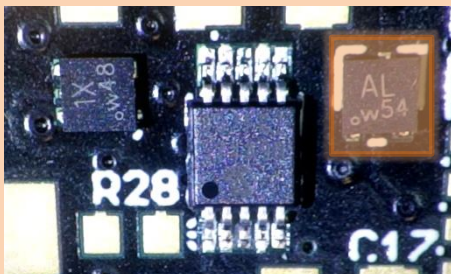
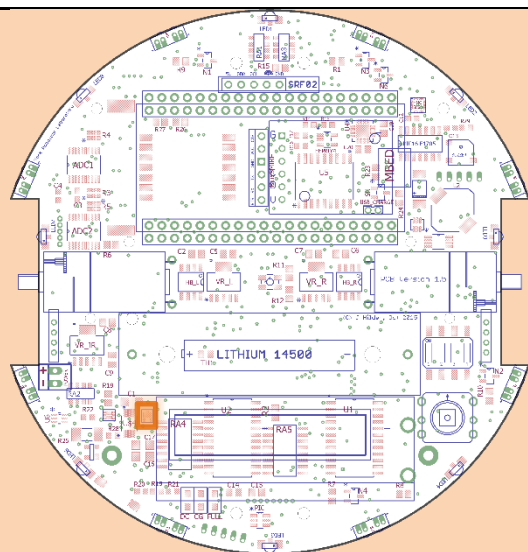
[NB NAME NOT ON PCB SILKSCREEN]

<http://www.farnell.com/datasheets/1522173.pdf>
**5 U4 LI-ION BATTERY CHARGE MANAGER**DESCRIPTION: **MICROCHIP MCP73837-FCI/UN**QUANTITY: **1**FARNELL CODE: **1675426**

NOTES:


<http://www.farnell.com/datasheets/1538062.pdf>
**6 D1 COMMON CATHODE DIODE**DESCRIPTION: **NXP PMEG2020CPA Dual Rectifier Diode**QUANTITY: **1**FARNELL CODE: **1859909**

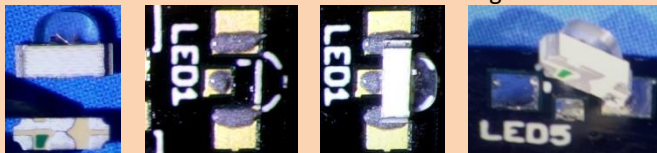
NOTES:


<http://www.farnell.com/datasheets/923218.pdf>


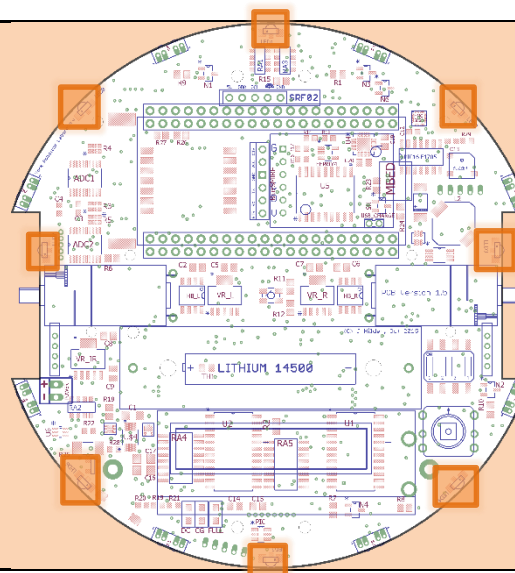
**7 LED1-8 SIDE MOUNT DUAL COLOUR LED**DESCRIPTION: **KINGBRIGHT KPBA-3010ESGC-F01**QUANTITY: **8**FARNELL CODE: **8530165**

NOTES :

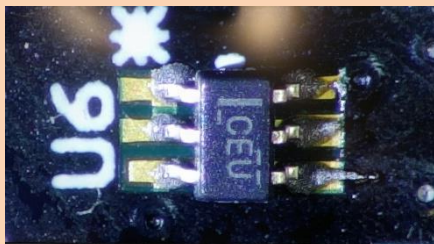
- Rear of LED has green mark indicating polarity; this must always be positioned to the left.
- Paste towards the inner edge of pads. Position LEDs so they are flush with the edge of the PCB, angled correctly.
- Check for tombstoned LEDs after soldering



<http://www.farnell.com/datasheets/55799.pdf>

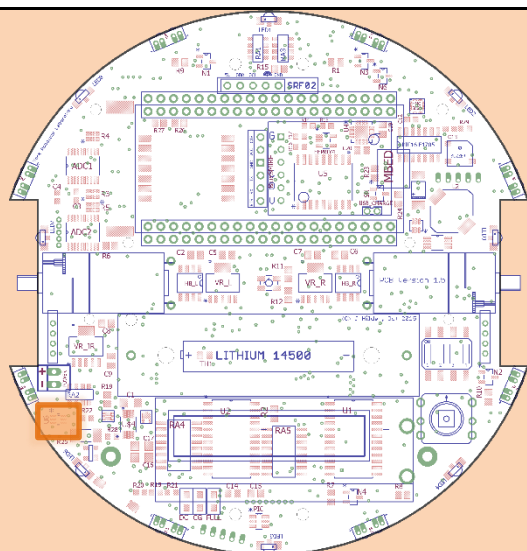
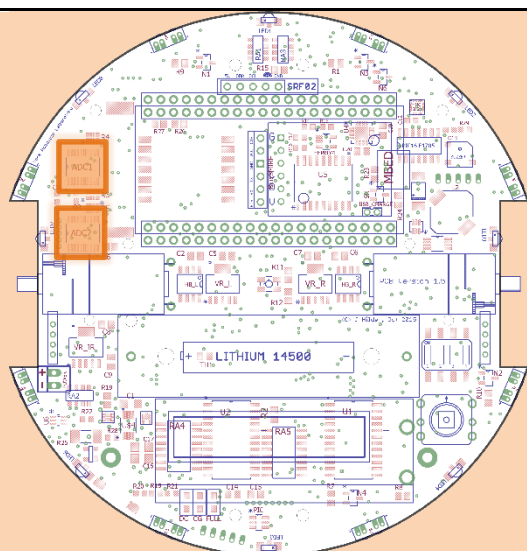
**8 U6 CURRENT SENSE AMPLIFIER**DESCRIPTION: **TEXAS INSTRUMENTS INA211AIDCKT**QUANTITY: **1**FARNELL CODE: **1754838**

NOTES:



Has a line rather than a dot to indicate orientation.

<http://www.farnell.com/datasheets/1848953.pdf>

**9 ADC1,2 ANALOGUE-DIGITAL CONVERTERS**DESCRIPTION: **ANALOG DEVICES AD7997BRUZ-1**QUANTITY: **2**FARNELL CODE: **1078305**NOTES: <http://www.farnell.com/datasheets/92512.pdf>



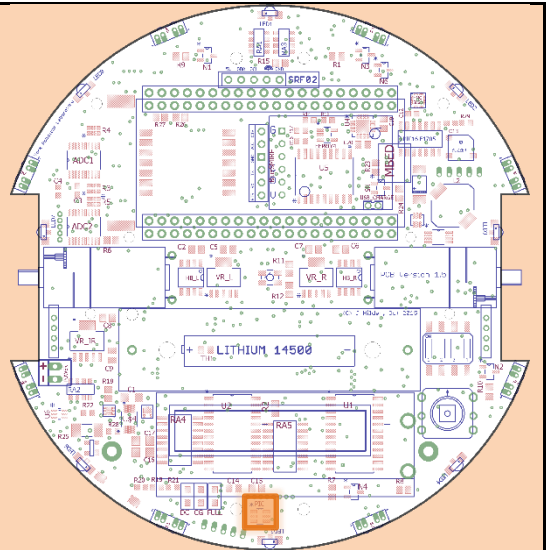
**10 PIC – POWER MICROCONTROLLER**

DESCRIPTION: MICROCHIP PIC10F202T-I/OT

QUANTITY: 1

FARNELL CODE: 9942874

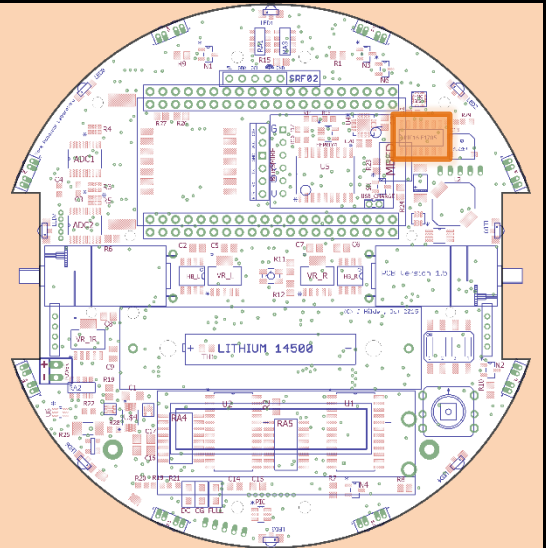
NOTES: Package is marked "02xx"

<http://www.farnell.com/datasheets/131888.pdf>**1 PIC16 CO-CONTROLLER****1**

DESCRIPTION: MICROCHIP PIC16F1705-I/SL

QUANTITY: 1

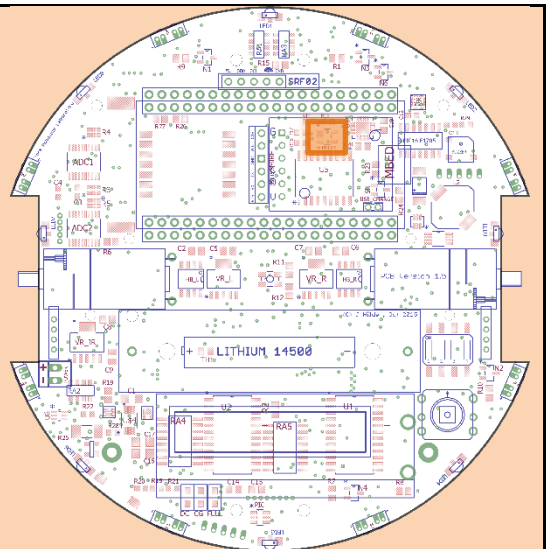
FARNELL CODE: 2422884

NOTES: <http://ww1.microchip.com/downloads/en/DeviceDoc/40001729B.pdf>**12 EEPROM**

DESCRIPTION: MICROCHIP 24AA64T-I/OT

QUANTITY: 1

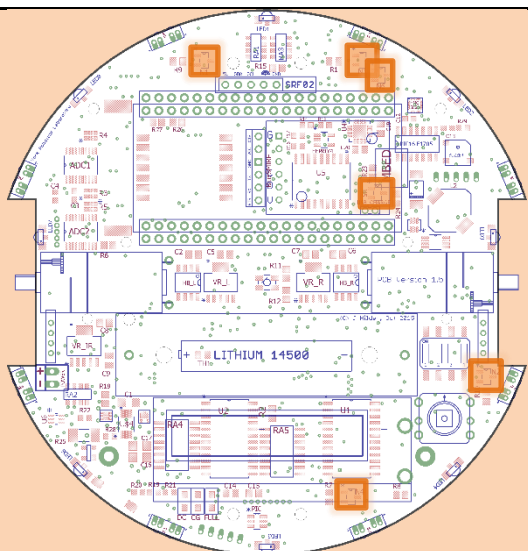
FARNELL CODE: 2101260

NOTES: <http://www.farnell.com/datasheets/1787103.pdf>

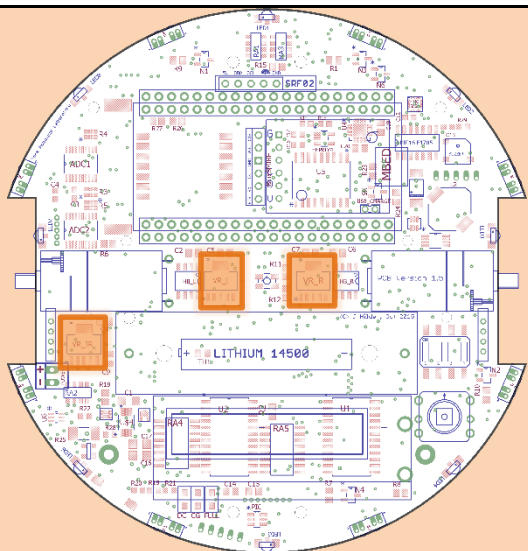


**13 N1-6 N-CHANNEL MOSFET**

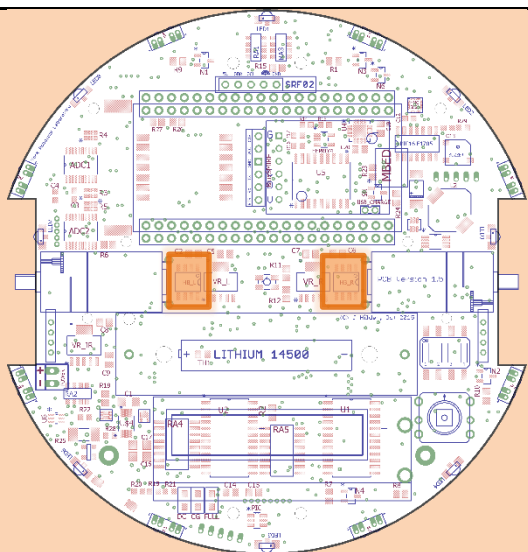
DESCRIPTION: TAIWAN SEMICONDUCTOR TSM2310CX  
 QUANTITY: 6  
 FARNELL CODE: 1864585 [1864589 replacement TSM2314]  
 NOTES: <http://www.farnell.com/datasheets/1060498.pdf>

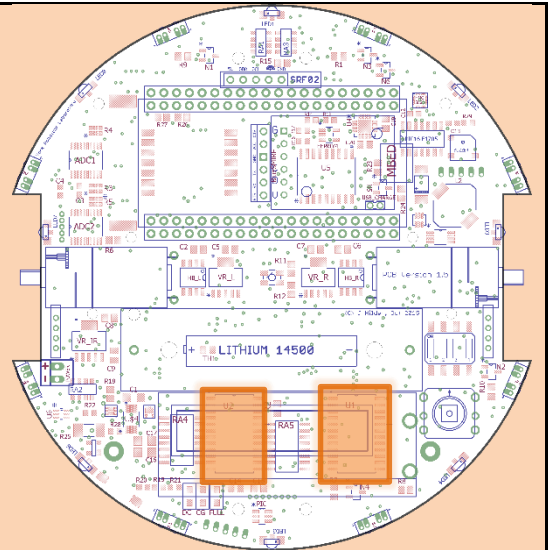
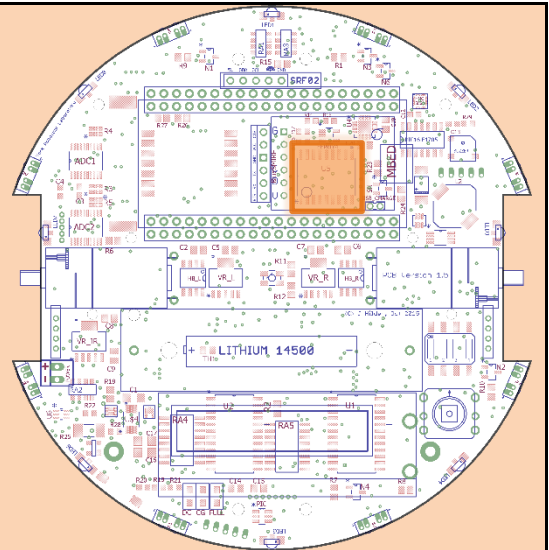
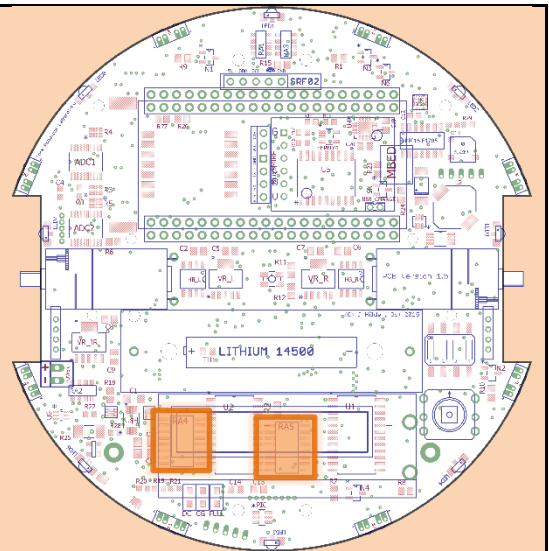
**14 VR\_IR, VR\_L, VR\_R 3.3V LDO VOLTAGE REGULATOR**

DESCRIPTION: MICROCHIP MCP1826T-3302E/DC  
 QUANTITY: 3  
 FARNELL CODE: 1578429  
 NOTES: <http://www.farnell.com/datasheets/1769092.pdf>

**15 HB\_L, HB\_R H-BRIDGE DRIVER**

DESCRIPTION: ROHM BD6211F-E2  
 QUANTITY: 2  
 FARNELL CODE: 1716259  
 NOTES: <http://www.farnell.com/datasheets/389115.pdf>



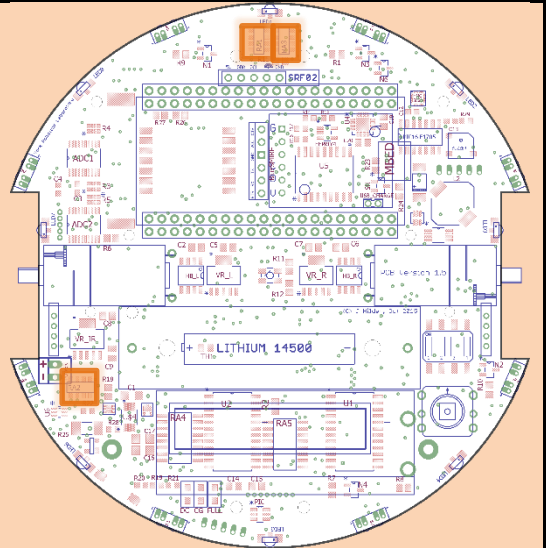
**16 U1, U2 16-BIT GPIO EXPANDER**DESCRIPTION: **TEXAS INSTRUMENTS PCA9555DWR**QUANTITY: **2**FARNELL CODE: **2101298**NOTES: <http://www.farnell.com/datasheets/1863589.pdf>**17 U5 8-BIT GPIO EXPANDER**DESCRIPTION: **MICROCHIP MCP23009-E/SO**QUANTITY: **1**FARNELL CODE: **1699841**NOTES: <http://www.farnell.com/datasheets/887138.pdf>**18 RA4,5 100-OHM RESISTOR ARRAY**DESCRIPTION: **BOURNS 4816P-1-101LF**QUANTITY: **2**FARNELL CODE: **1902652**NOTES: <http://www.farnell.com/datasheets/1912591.pdf>

**19 RA1-3 22-OHM RESISTOR ARRAY**

DESCRIPTION: VISHAY DRALORIC CRA12E08322R0FTR

QUANTITY: 3

FARNELL CODE: 2352773

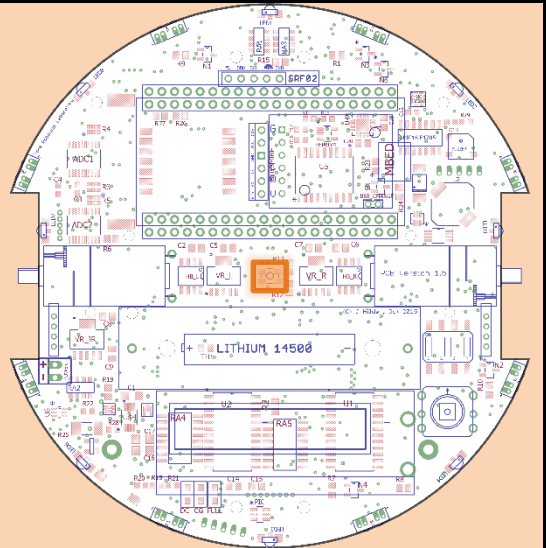
NOTES: <http://www.farnell.com/datasheets/1730409.pdf>**20 CENTER LED**

DESCRIPTION: WURTH ELEKTRONIK 150141RV73100

QUANTITY: 1

FARNELL CODE: 2322113

NOTES: CORNER IDENTATION FACES TOP-LEFT

<http://www.farnell.com/datasheets/1911489.pdf>**21 BR1 SCHOTTKY BRIDGE RECTIFIER**

DESCRIPTION: INFINEON BAS 3007A-RPP E6327

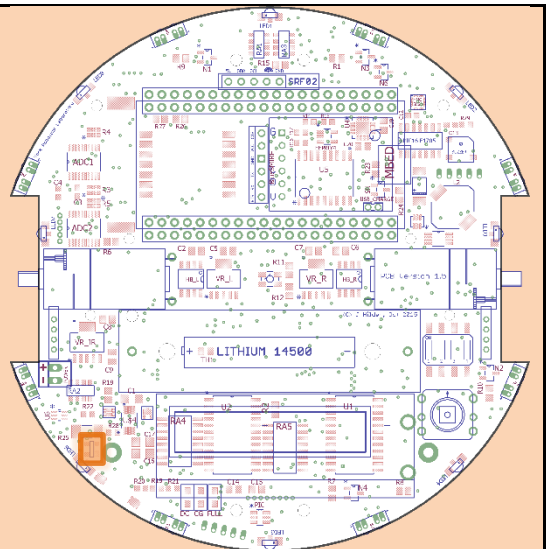
QUANTITY: 1

FARNELL CODE: 1791469

NOTES:



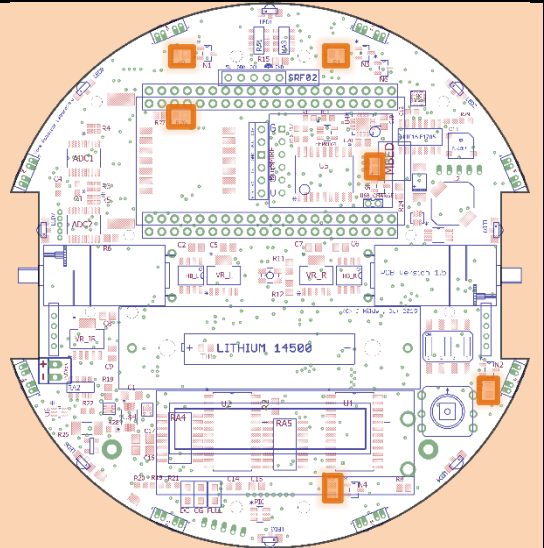
LARGER PIN FACES BOTTOM-RIGHT

<http://www.farnell.com/datasheets/516907.pdf>

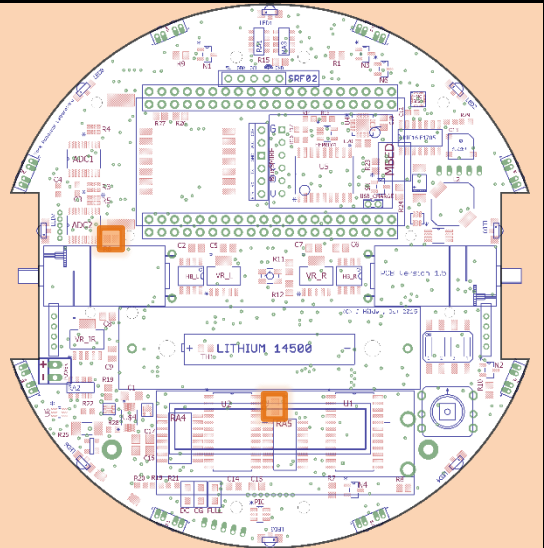


**22 R1,7,9,10,23,26 100KΩ 0805 RESISTOR**DESCRIPTION: **MULTICOMP MCMR08X104**QUANTITY: **6**FARNELL CODE: **2073613**

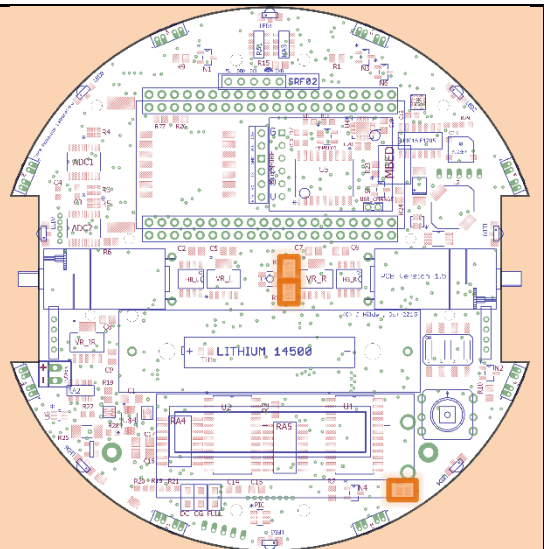
NOTES: Should be labelled either 104 or 1003

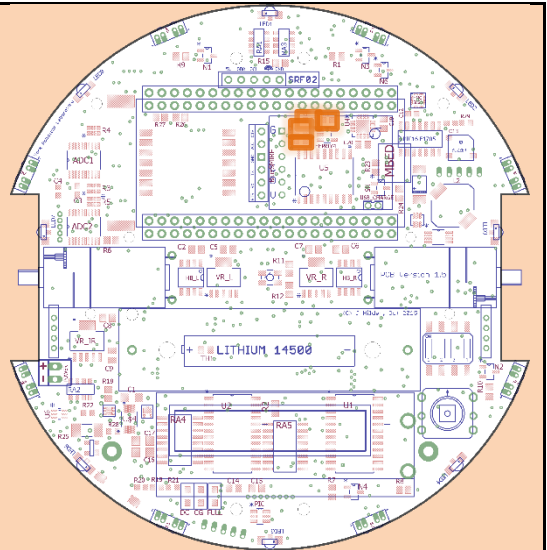
**23 R2,6 10KΩ 0805 RESISTOR**DESCRIPTION: **MULTICOMP MCWR08X1002FTL**QUANTITY: **2**FARNELL CODE: **2447553**

NOTES: Should be labelled either 103 or 1002

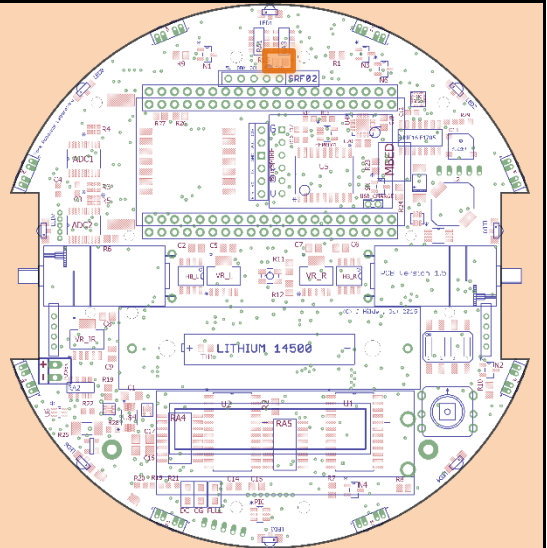
**24 R8,11,12 100Ω 0805 RESISTOR**DESCRIPTION: **MULTICOMP MCWR08X1000FTL**QUANTITY: **3**FARNELL CODE: **2447552**

NOTES: Should be labelled 101 or 1000



**25 R13,14,16,17 2.2KΩ 0603 RESISTOR**DESCRIPTION: **MULTICOMP MCMR06X222 JTL**QUANTITY: **4**FARNELL CODE: **2073436**NOTES: May be labelled 222; these are the I<sup>2</sup>C pull-up resistors**26 R15 22Ω 0805 RESISTOR**DESCRIPTION: **WELWYN WCR0805-22RFI**QUANTITY: **1**FARNELL CODE: **1099789**

NOTES:

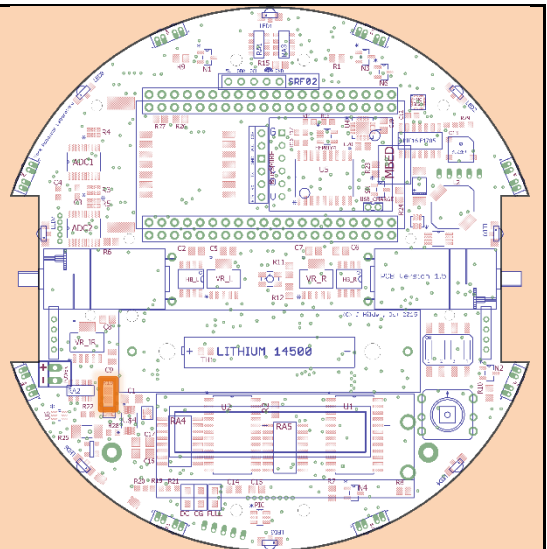
**27 R18 3.3KΩ 0805 RESISTOR**DESCRIPTION: **PANASONIC ERJ6GEYJ332V**QUANTITY: **1**FARNELL CODE: **2057711**

NOTES: Should be labelled 3301 or 332

This resistor sets the charging current for the Li-Ion charger

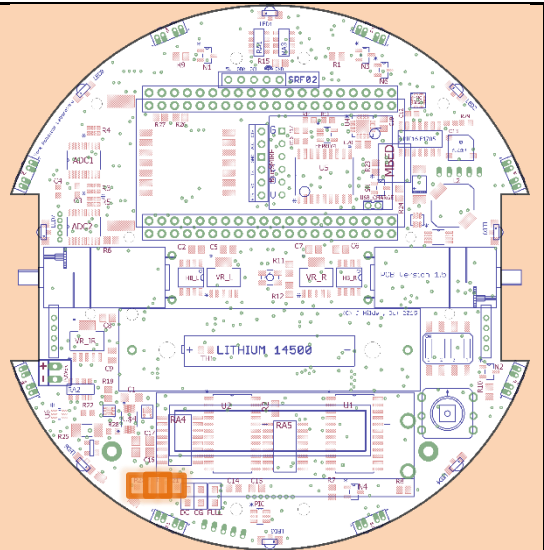
$$I_c = 1000 / R_{18}$$

$$3K3 = 300\text{mA} \quad 2K2 = 450\text{mA}$$

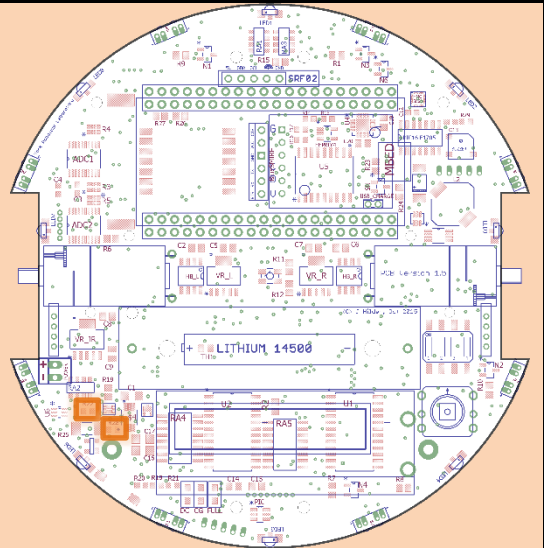


**28 R19,20,21 1K $\Omega$  0603 RESISTOR**DESCRIPTION: **YAGEO RC0603FR-071KL**QUANTITY: **3**FARNELL CODE: **9238484**NOTES: These resistors limit the current for the charge LEDs  
(may be replaced with higher values if needed).

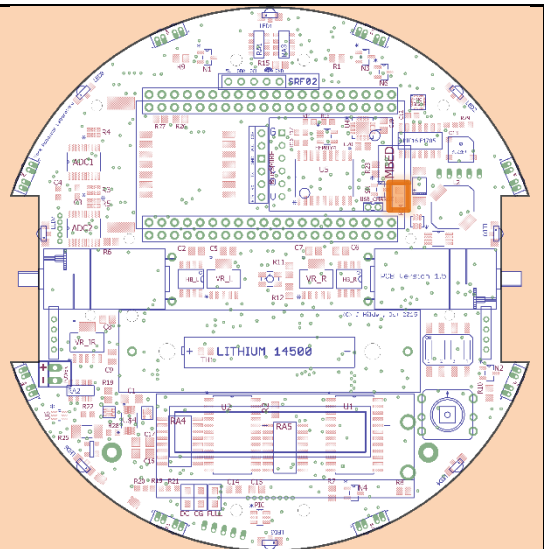
May be labelled 102

**29 R22,28 47K $\Omega$  0603 RESISTOR**DESCRIPTION: **YAGEO RC0603FR-0747KL**QUANTITY: **2**FARNELL CODE: **9238689**

NOTES: May be labelled 473

**30 R24 47 $\Omega$  0805 RESISTOR**DESCRIPTION: **PANASONIC ERJ6ENF47R0V**QUANTITY: **1**FARNELL CODE: **2303405**

NOTES: May be labelled 470





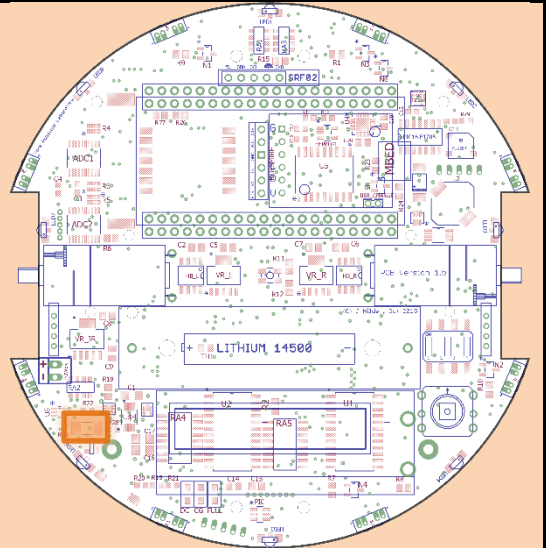
**31 R25 2mΩ CURRENT SENSE RESISTOR**

DESCRIPTION: **TE CONNECTIVITY TLR2H15DR002FTDG 1.5W  
2010**

QUANTITY: **1**

FARNELL CODE: **2332256**

NOTES: <http://www.farnell.com/datasheets/1610596.pdf>

**32 R27 200KΩ 0805 RESISTOR**

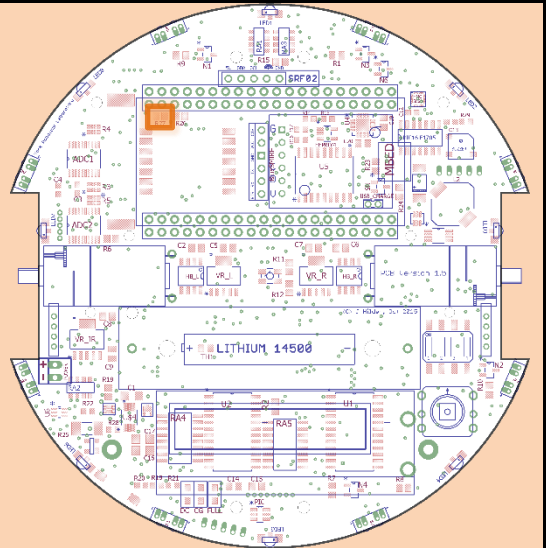
DESCRIPTION: **PANASONIC ERJ6ENF2003V**

QUANTITY: **1**

FARNELL CODE: **2057656**

NOTES: Forms a voltage divider with 100K R26 for measuring  
battery voltage

May be labelled 2003 or 204

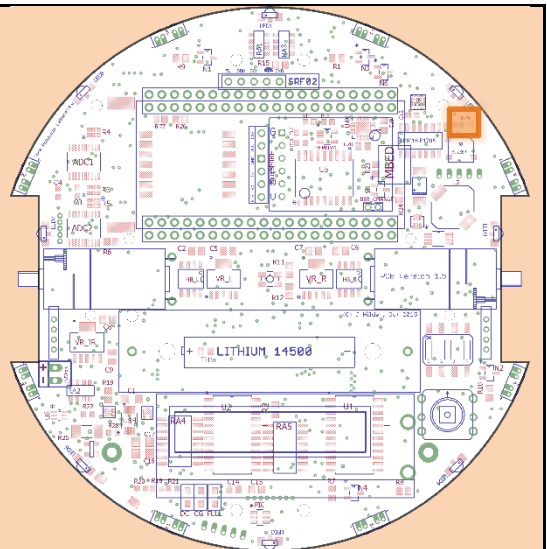
**33 R29 VOLUME LIMITING RESISTOR**

DESCRIPTION:

QUANTITY:

FARNELL CODE:

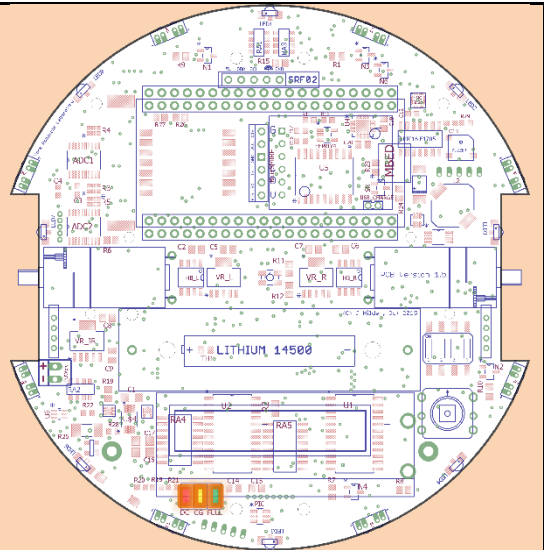
NOTES: To be determined



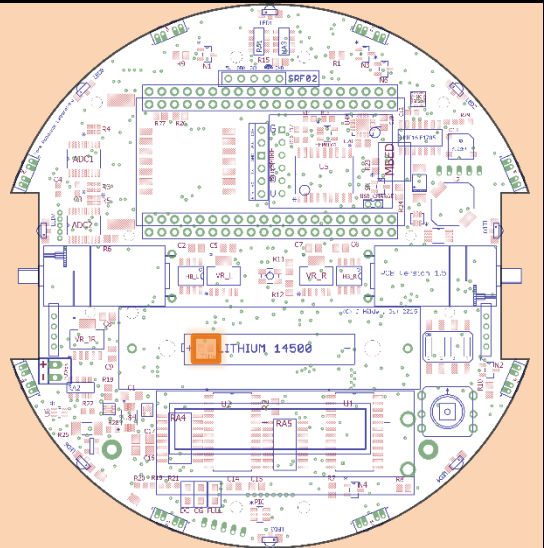
**34 LED\_DC LED\_CG LED\_FULL - 0805 SM LEDs**

DESCRIPTION: **KINGBRIGHT KP-2012 LEDs**  
 QUANTITY: **3 [1 of each colour]**  
 FARNELL CODE: **2335811 [Red – DC]**  
**2335796 [Yellow – CG]**  
**2290331 [Green – FULL]**

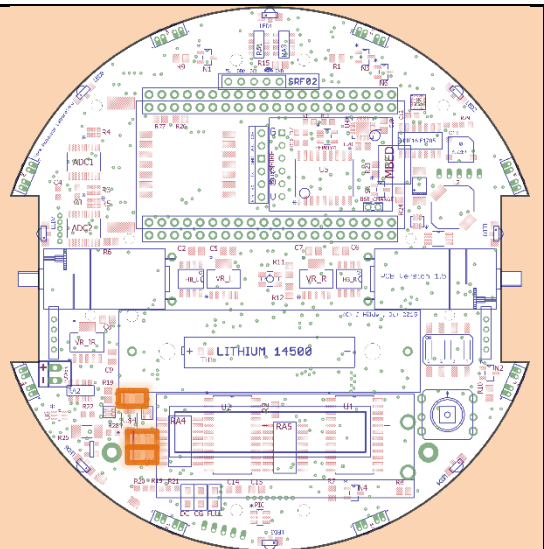
NOTES:

**35 TH1 10KΩ NTC 0805 THERMISTOR**

DESCRIPTION: **VISHAY NTC50805E3103JMT**  
 QUANTITY: **1**  
 FARNELL CODE: **2103177**  
 NOTES:

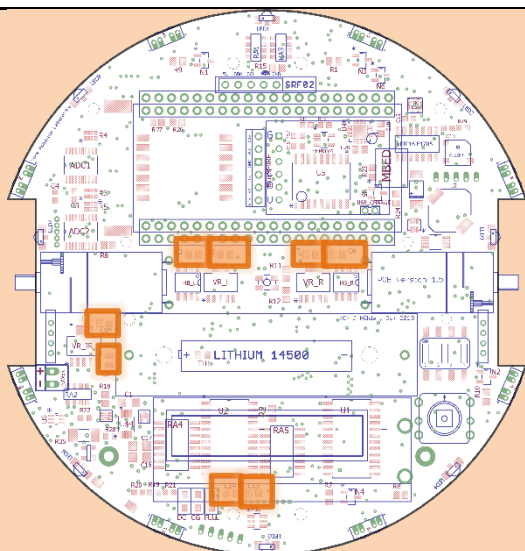
**36 C1,16,17 4.7uF 1206 TANTALUM**

DESCRIPTION: **KEMET T491A475K020AT**  
 QUANTITY: **3**  
 FARNELL CODE: **2283560**  
 NOTES: Observe polarity – anode (denoted by line on capacitor)  
 faces to the left

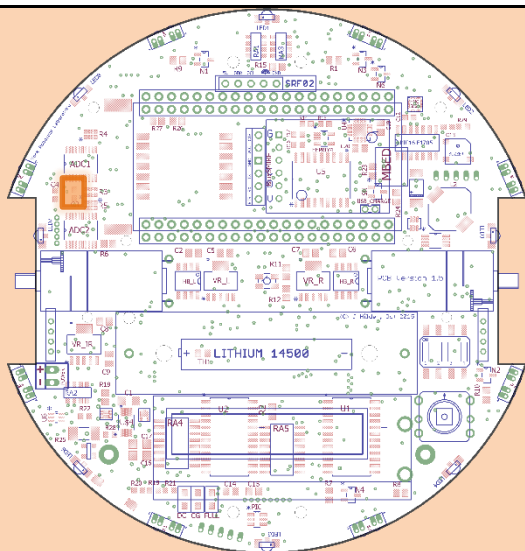


**37 C2,5,6,7,8,9,14,15 4.7uF 0805 CERAMIC**DESCRIPTION: **TDK C2012X7R1A475K125AC X7R 10V**QUANTITY: **8**FARNELL CODE: **2346936**

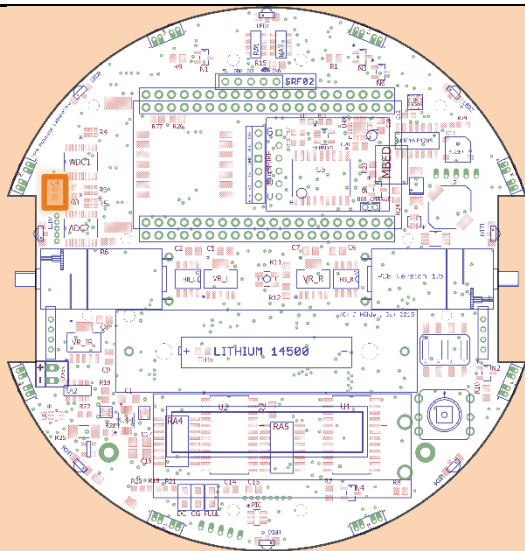
NOTES: Not polarised.

**38 C3 100nF 0603 CERAMIC**DESCRIPTION: **AVX 0603YC104JAT2A X7R 16V**QUANTITY: **1**FARNELL CODE: **1740612**

NOTES:

**39 C4 1uF 0603 CERAMIC**DESCRIPTION: **TDK C1608X7R1C105K080AC X7R 16V**QUANTITY: **1**FARNELL CODE: **1907343**

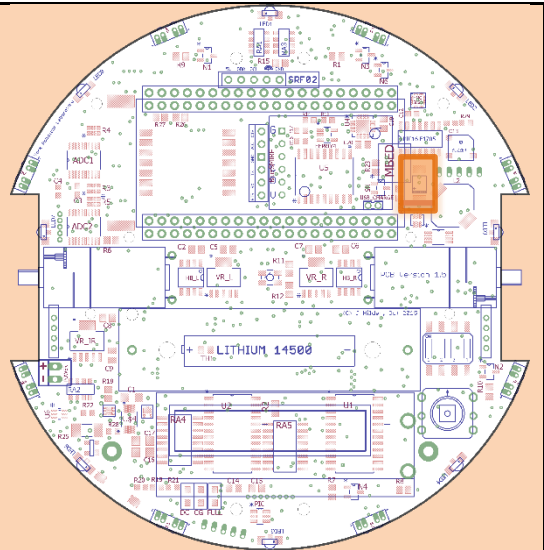
NOTES:



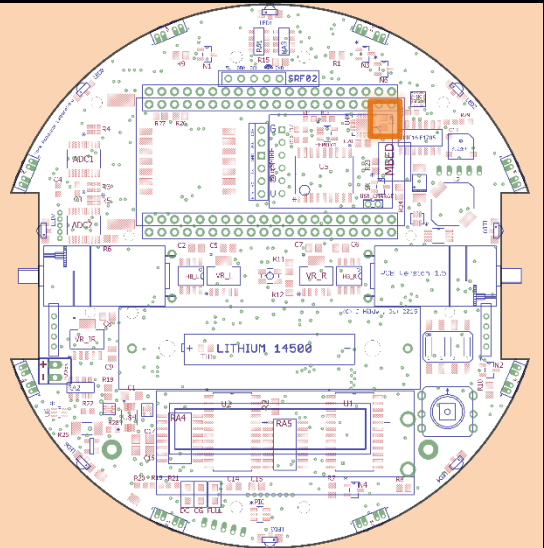


**40 C18 150uF TANTALUM 2917**DESCRIPTION: **AVX TPSD157K010S0050 10V**QUANTITY: **1**FARNELL CODE: **2283870**

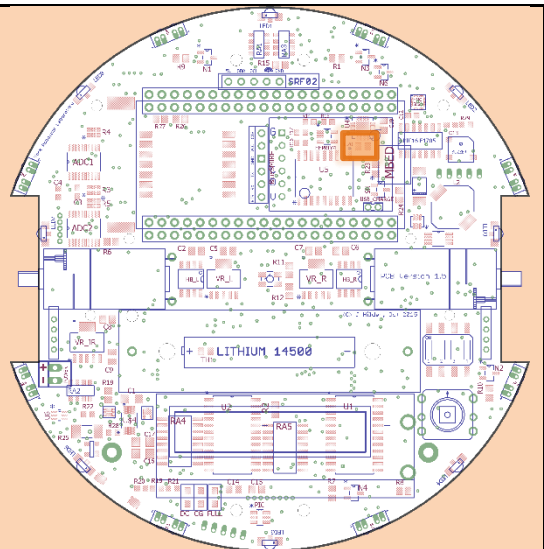
NOTES: Anode (denoted with line) faces down

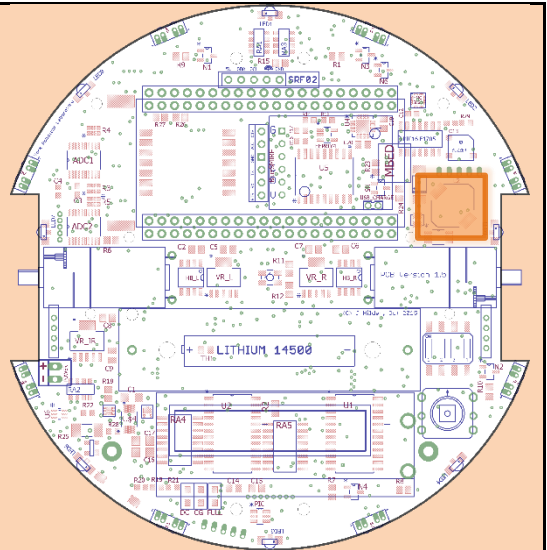
**41 C19 – 2.2uF CERAMIC 0603**DESCRIPTION: **TDK C1608X7R1A225K080AC – X7R 10V**QUANTITY: **1**FARNELL CODE: **2346896**

NOTES:

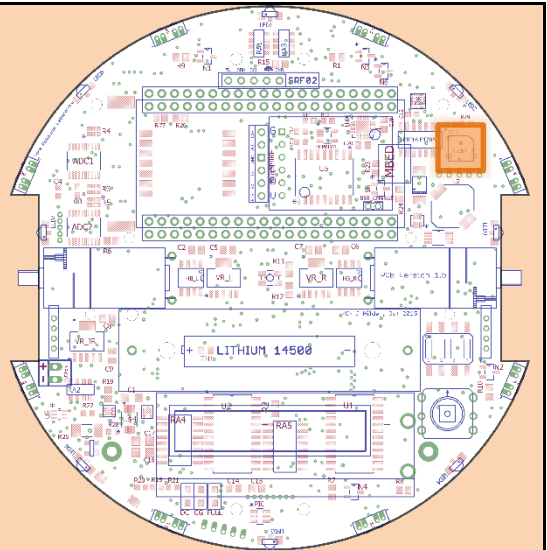
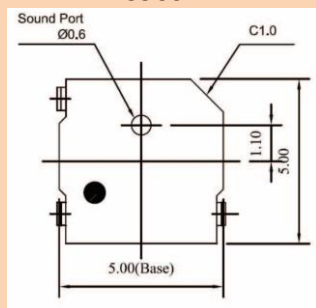
**42 C20 – 10uF CERAMIC 0805**DESCRIPTION: **TDK C2012X7R1A106K125AC – X7R 10V**QUANTITY: **1**FARNELL CODE: **2346934**

NOTES:

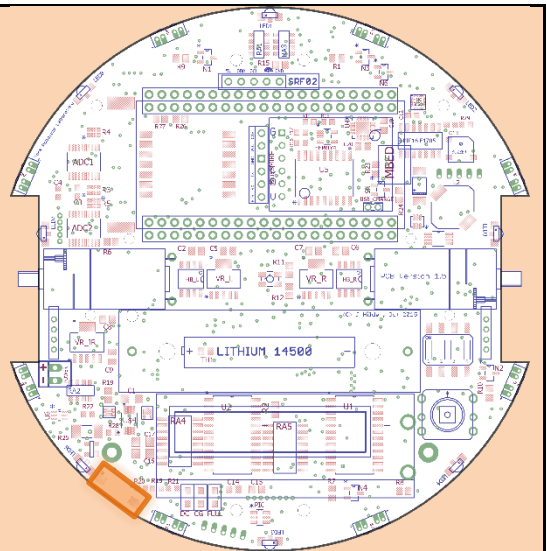


**43 L2 - 6.8  $\mu$ H INDUCTOR**DESCRIPTION: **PANASONIC ELL8TP6R8NB 6.8  $\mu$ H 3.5 A**QUANTITY: **1**FARNELL CODE: **1865671**NOTES: **Alternatively at RS: 749-8457****44 BUZZER**DESCRIPTION: **MULTICOMP MCSMT-G5030A1-3712**QUANTITY: **1**FARNELL CODE: **2396072**

NOTES:

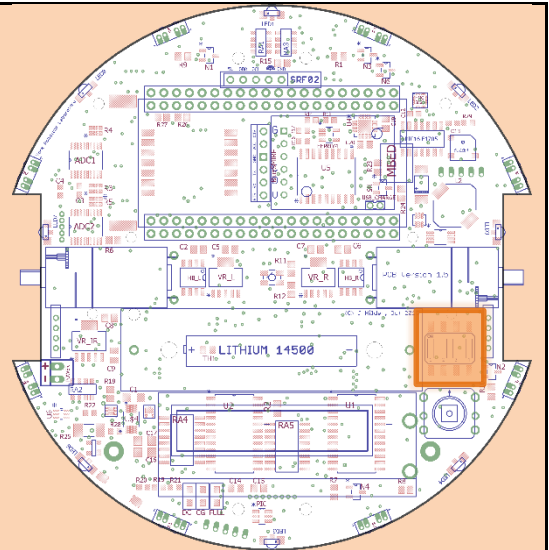
**45 POWER SWITCH**DESCRIPTION: **TE CONNECTIVITY FSM5M SWITCH**QUANTITY: **1**FARNELL CODE: **1703878**

NOTES:



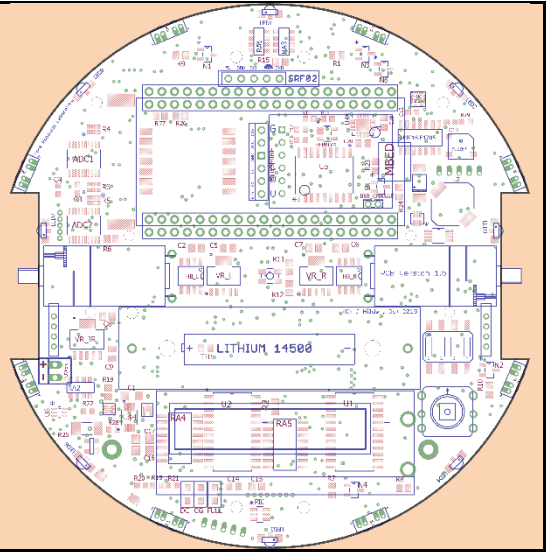
**46 ID SWITCH**DESCRIPTION: **MULTICOMP MCEMR-04-T DIP Switch**QUANTITY: **1**FARNELL CODE: **1524007**

NOTES:

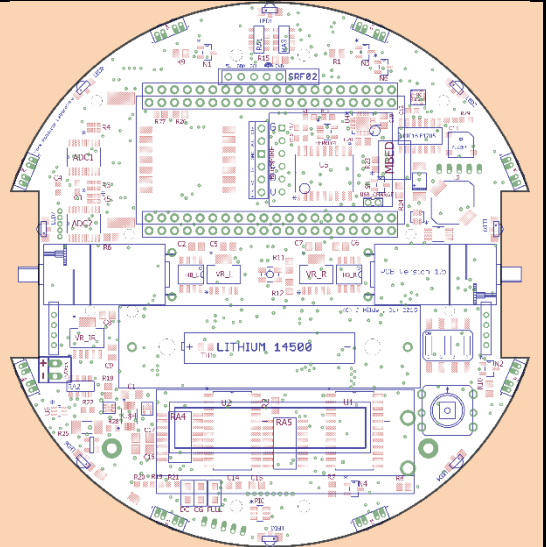


**39 [ID]**

DESCRIPTION: [DESCRIPTION]  
QUANTITY: [QUANTITY]  
FARNELL CODE: [CODE]  
NOTES: [NOTES ABOUT COMPONENT]

**39 [ID]**

DESCRIPTION: [DESCRIPTION]  
QUANTITY: [QUANTITY]  
FARNELL CODE: [CODE]  
NOTES: [NOTES ABOUT COMPONENT]







**1 [ID]**DESCRIPTION: **[DESCRIPTION]**QUANTITY: **[QUANTITY]**FARNELL CODE: **[CODE]**NOTES: **[NOTES ABOUT COMPONENT]**