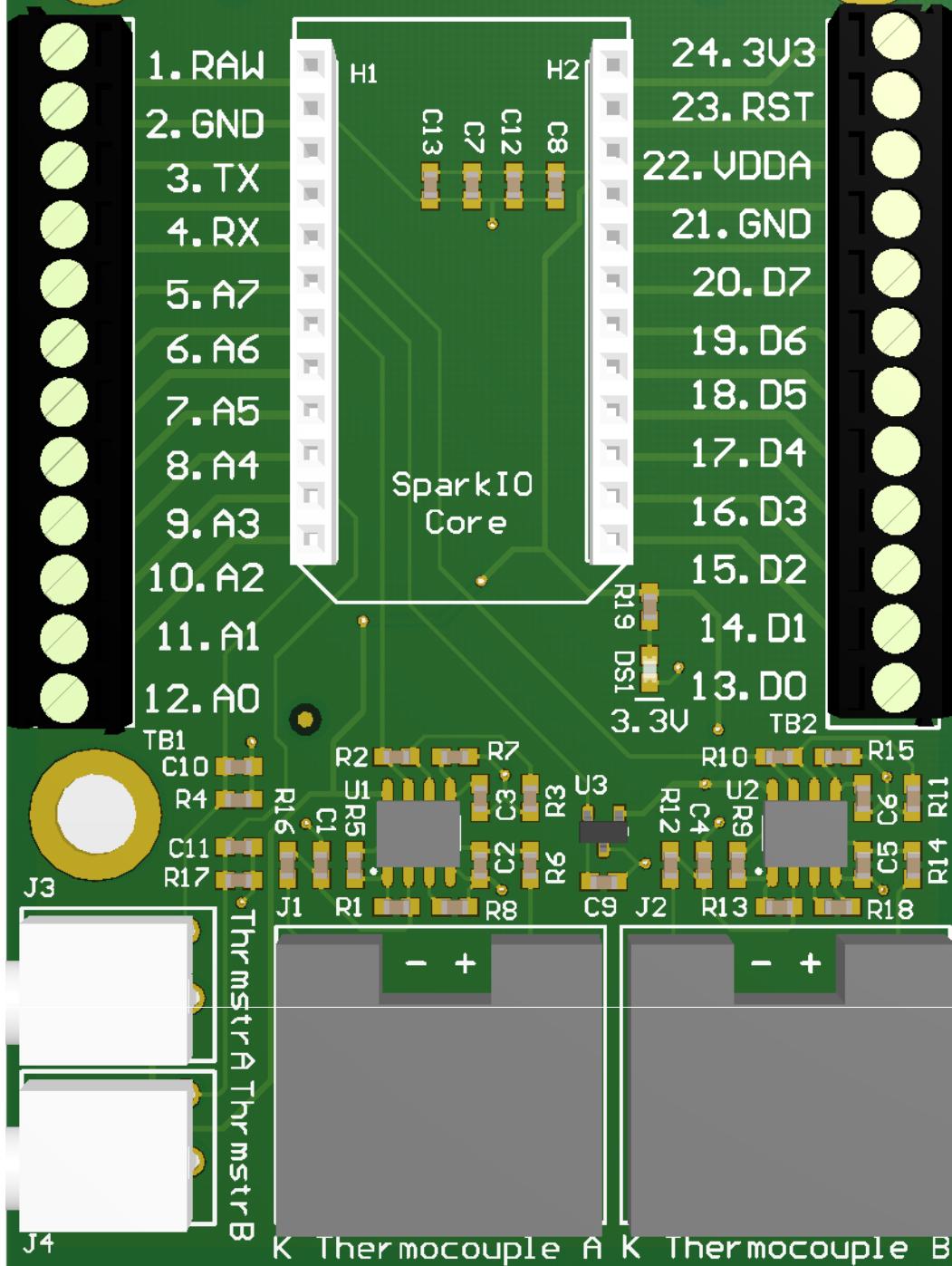
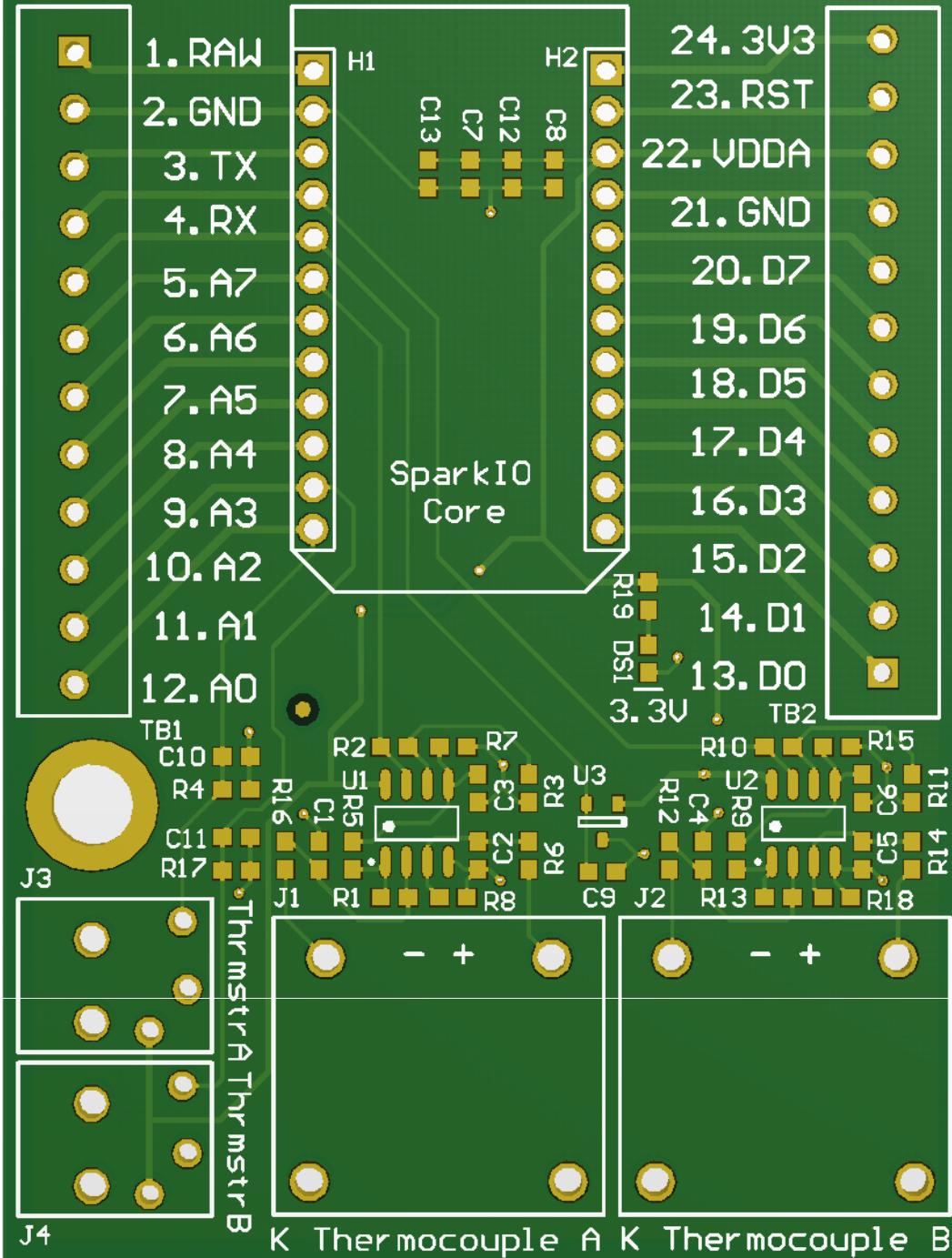
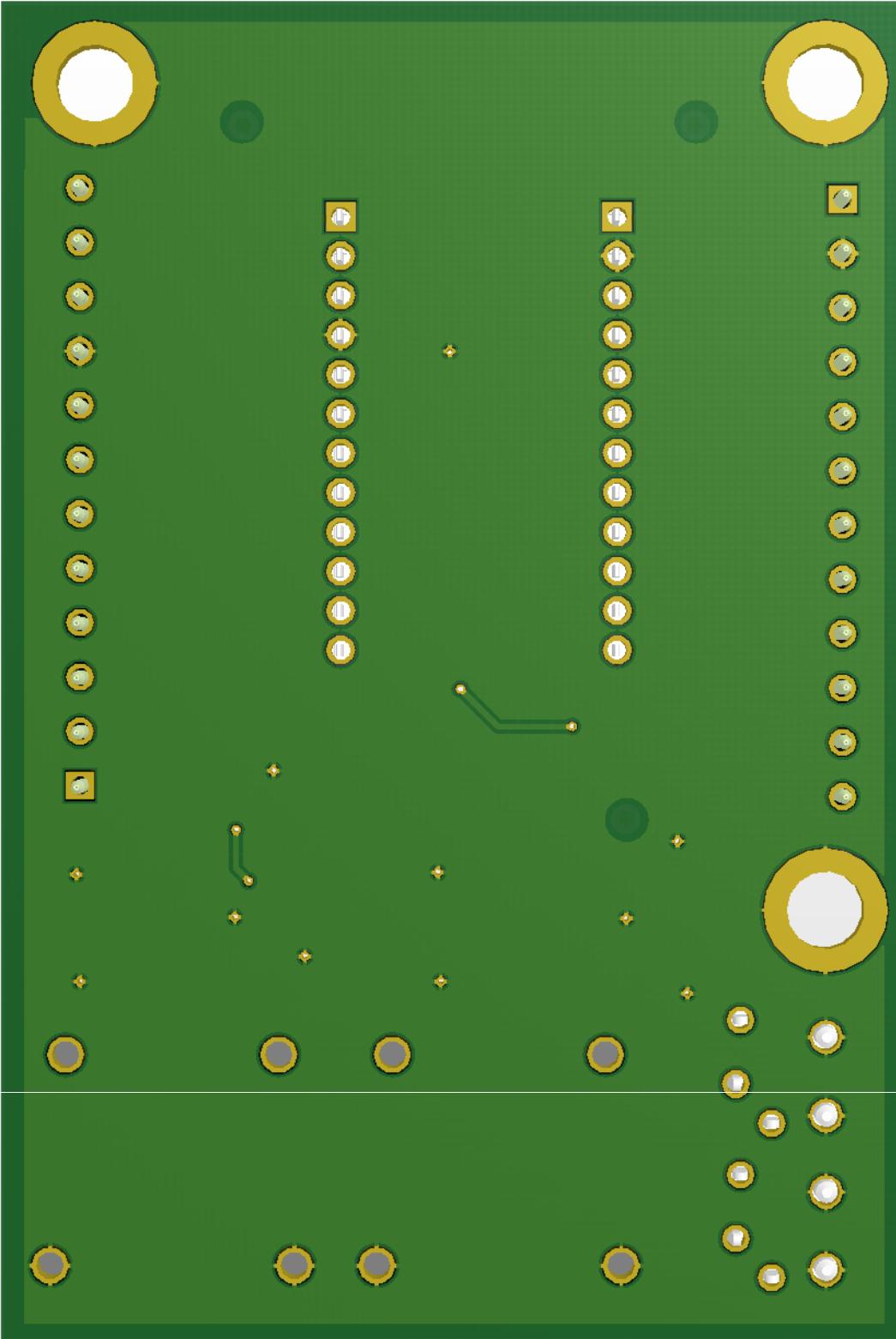


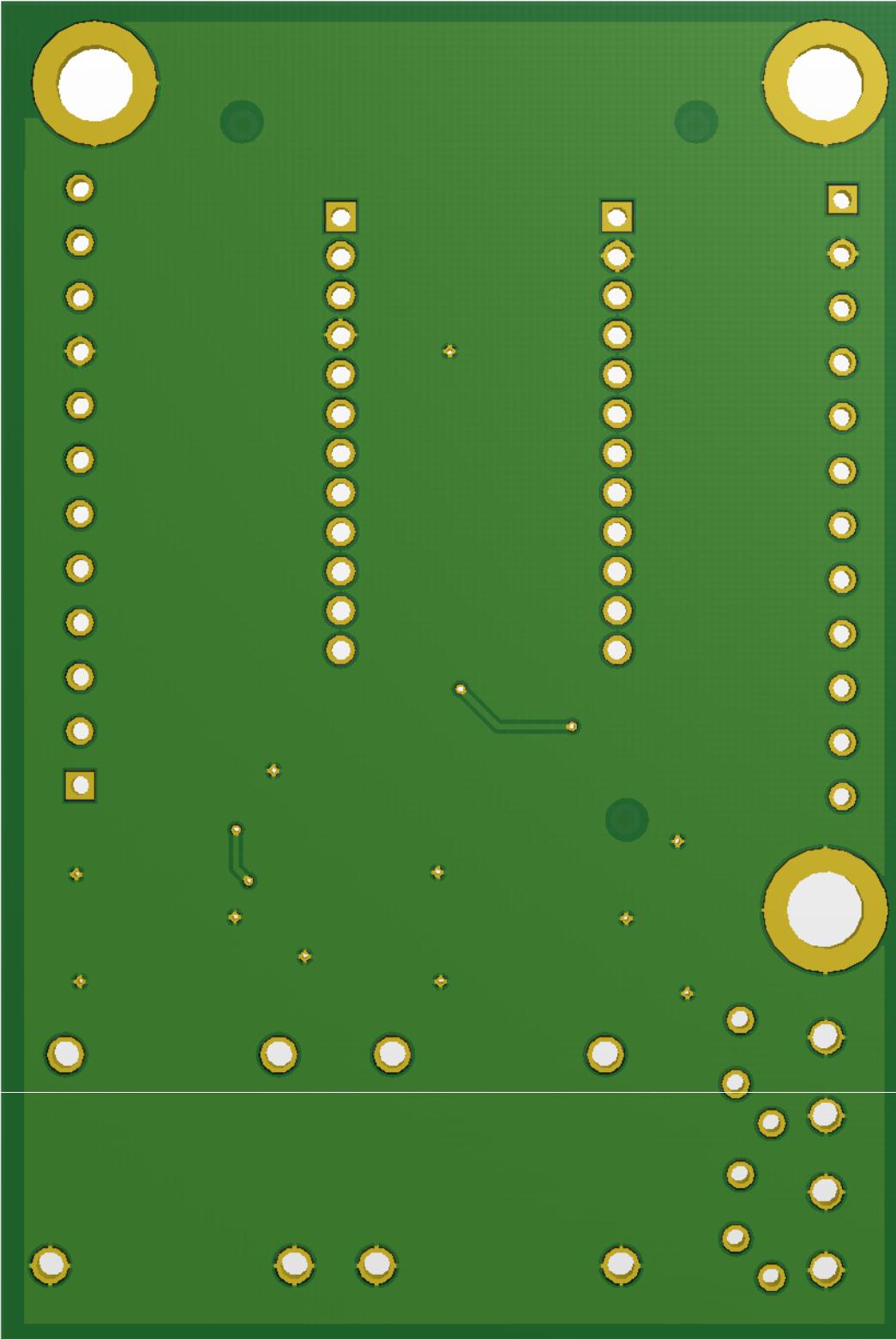
SparkIO Temperature
Sensing Shield
CharPCB Rev A

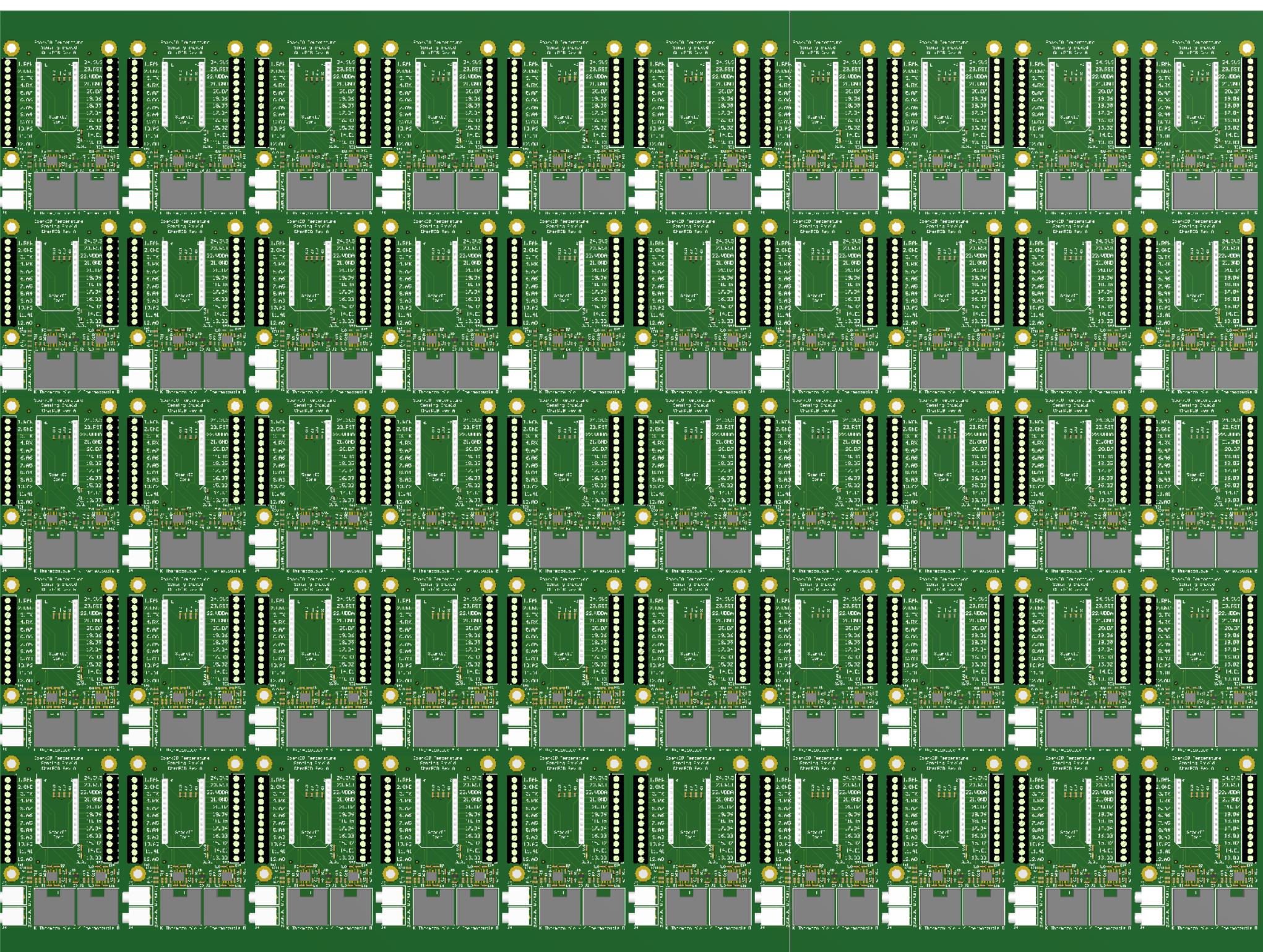


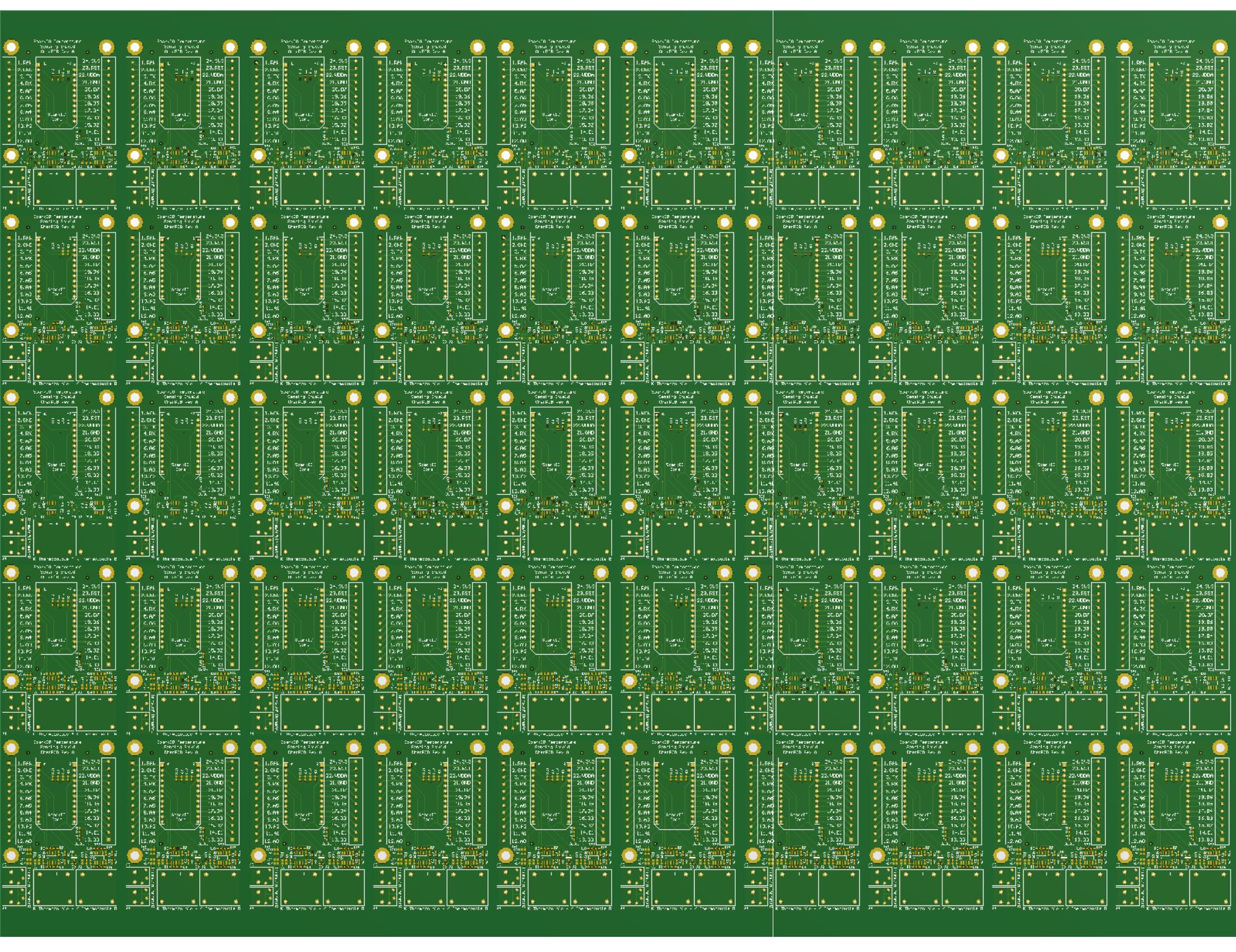
SparkIO Temperature
Sensing Shield
CharPCB Rev A

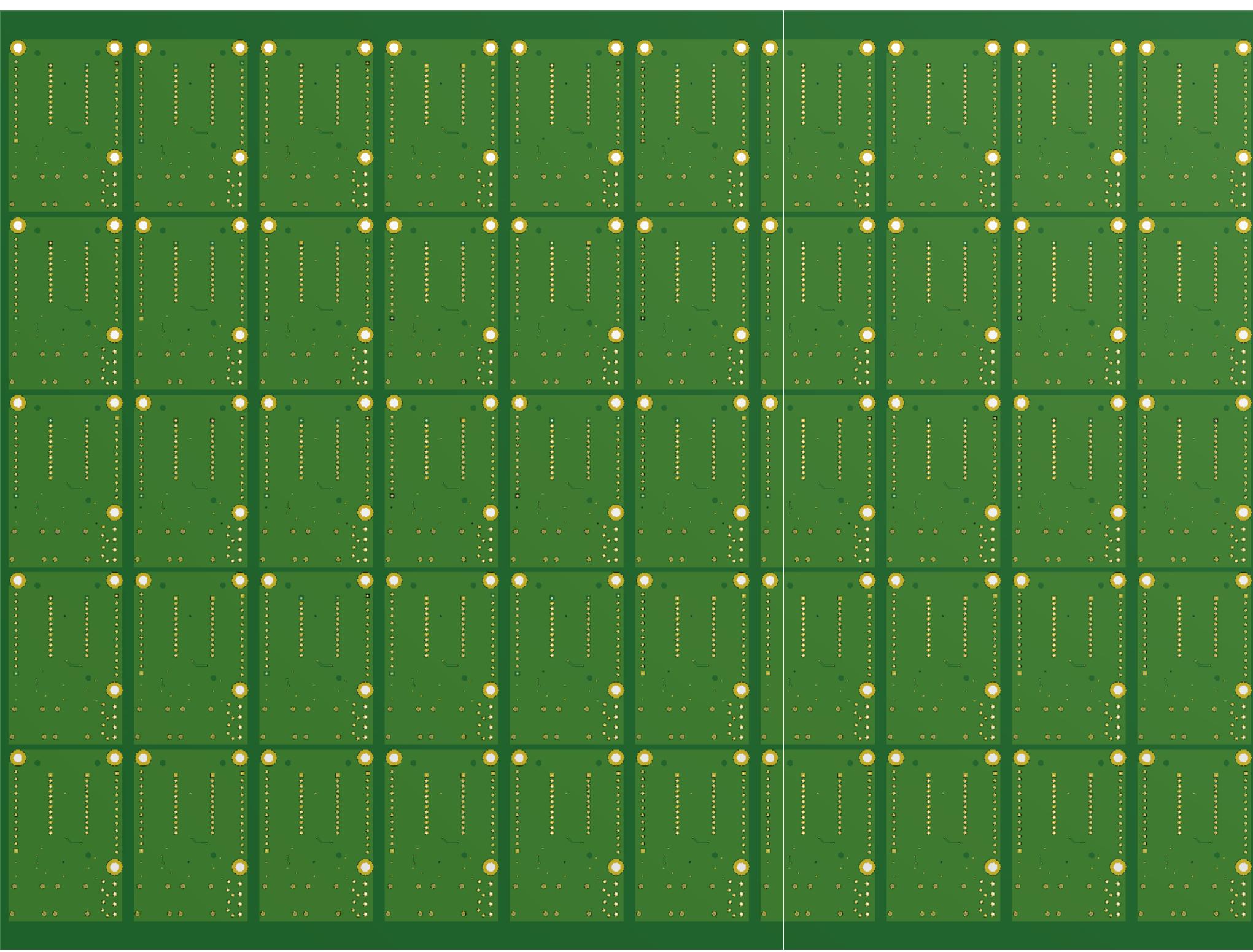


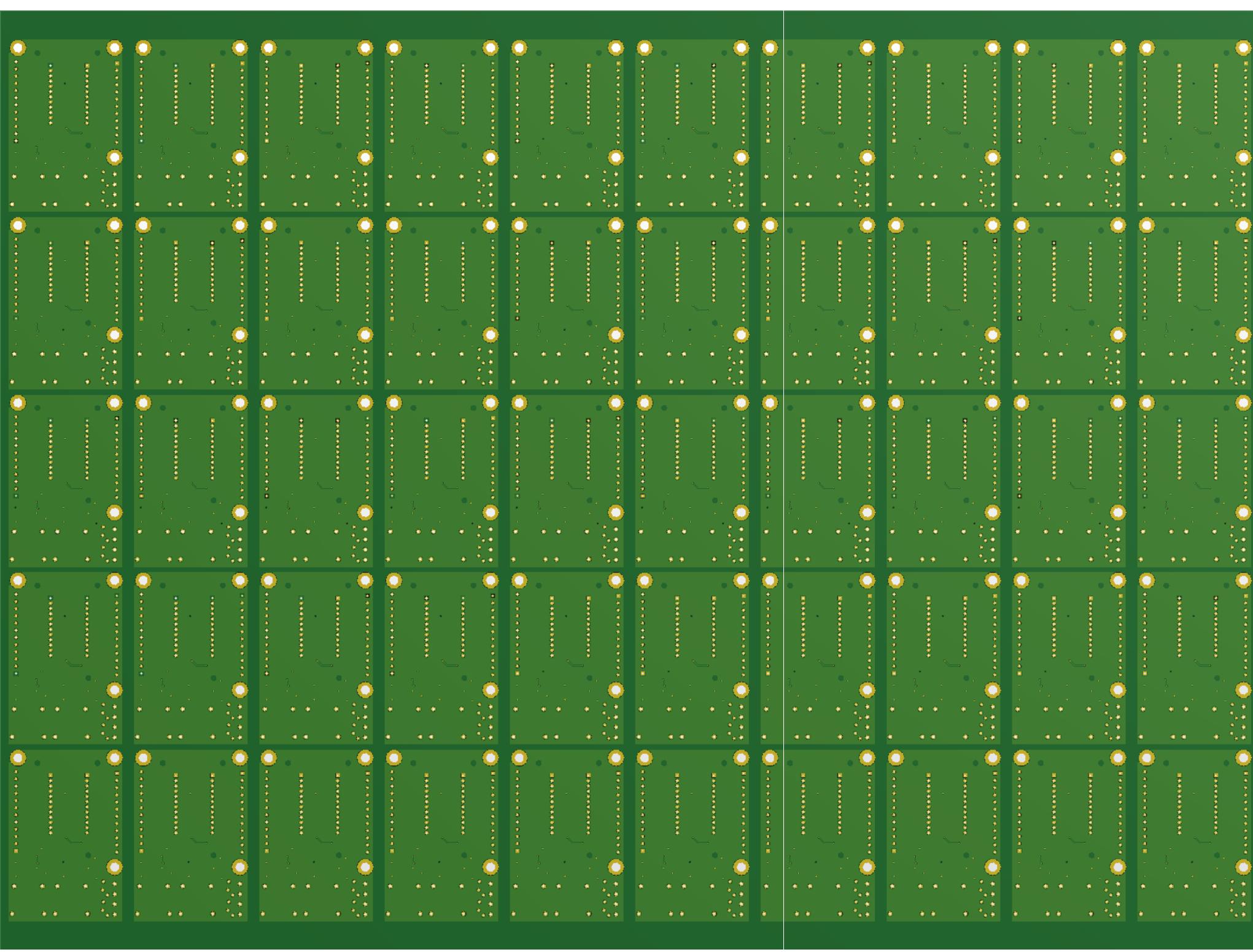


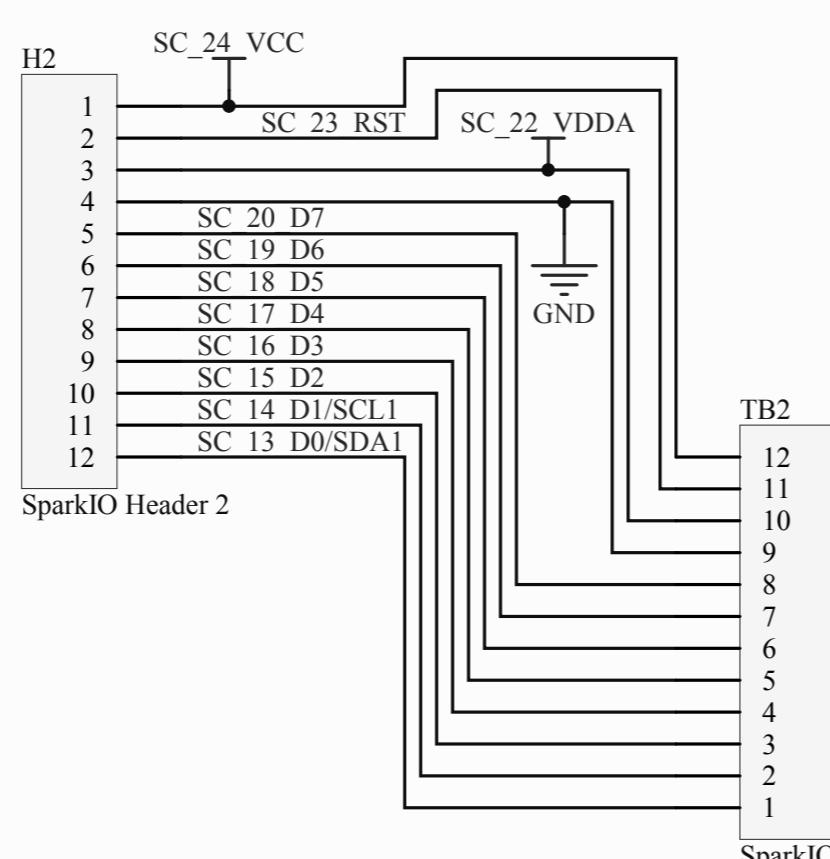
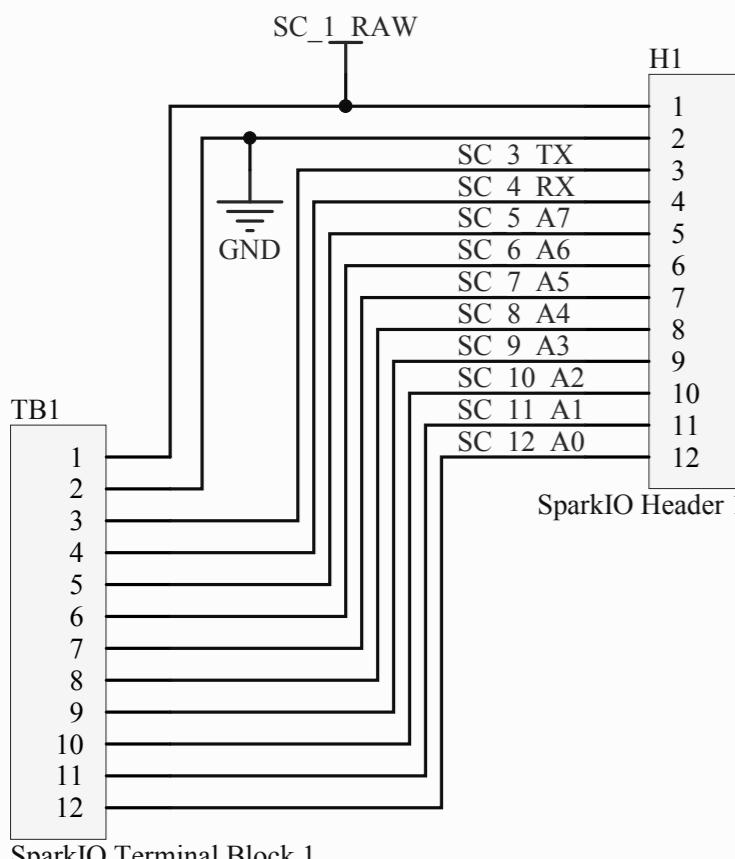












SparkIO Terminal Block 1

*SparkIO Module
RAW = Diode drop down from +5VUSB
VCC = 3.3V, 500mA Max
VDDA = 3.3V through 500mA ferrite, analog VDD
RST = Reset switch on Spark.io Module
Spark Core has male headers - need female headers here

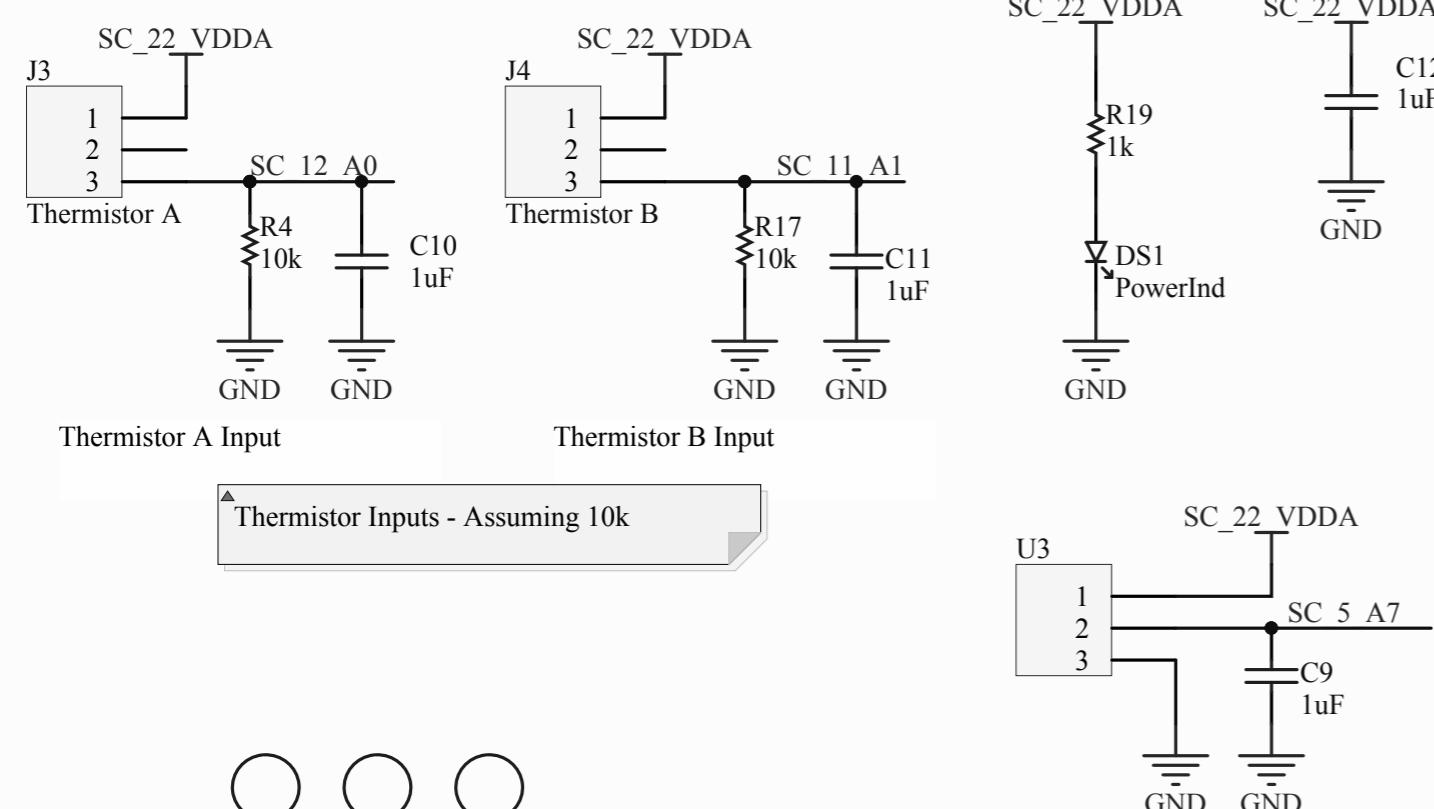
Chose ADC Pins on Core specifically to leave SPI interface and as many timer channels intact as possible.

Op Amp Circuits are a cascaded two stage amplifier:
A Gain = 10 stage followed by a Gain = 22 stage to accomplish overall gain of 220

Linear approximation of a K-type thermocouple is about 40.8uV per degree C from -200C to +1350C
At 25C: V=1020uV = 1.02mV
At 100C, V=4008uV = 4.008mV
At 1000C, V=40.8mV
At 1350C, V=55.08mV

Desired range is roughly up to 600F or 0C to 350C
At 0C: V=0V
At 350C: V=14.28mV

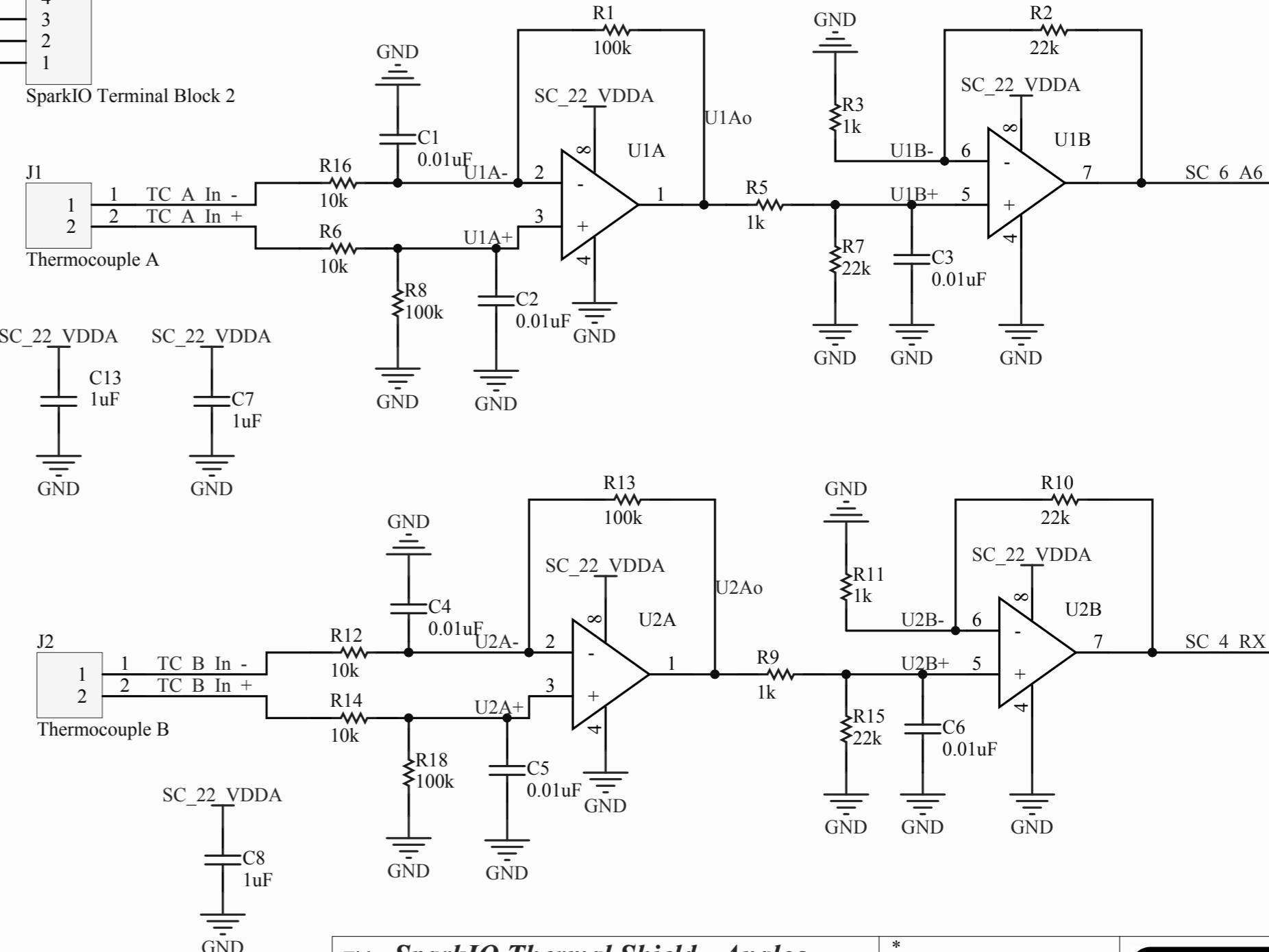
To scale this voltage to 3.2V, gain needed is
 $A = 3.2V/14.28mV = 224$



Thermistor Inputs - Assuming 10k

FID1 FID2 FID3

Cold Junction Temperature Compensation Thermistor
*Must be located very close to thermocouple connectors
U3 is analog thermistor IC



Title **SparkIO Thermal Shield - Analog**

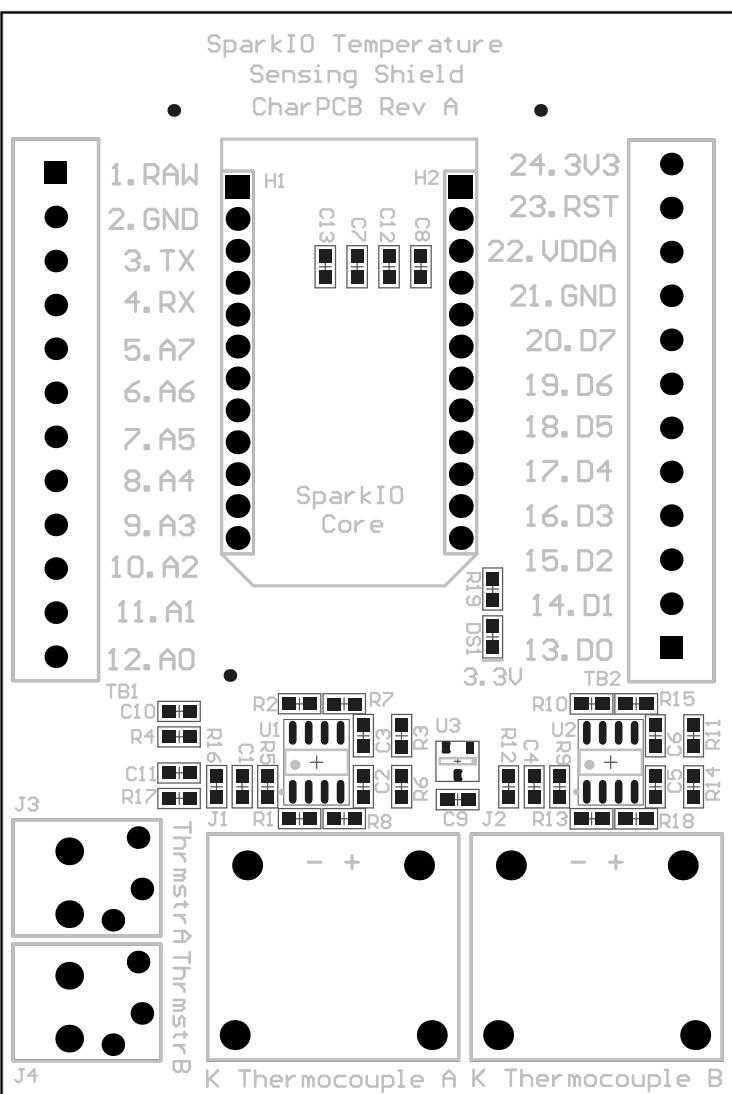
Size: A4 Number: * Revision: A

Date: 8/3/2014 Time: 6:08:54 PM Sheet 1 of 1

File: C:\Users\Jim Griazbacher\Documents\GitHub\probe\SparkIO Thermal Shield\SparkIO Thermal Shield - No Aux ADC.SchD

Altium

Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:08:55 PM



Visible Layer(s)

Top Overlay


[M1] Board Outline

[M15] Top Component Keepout

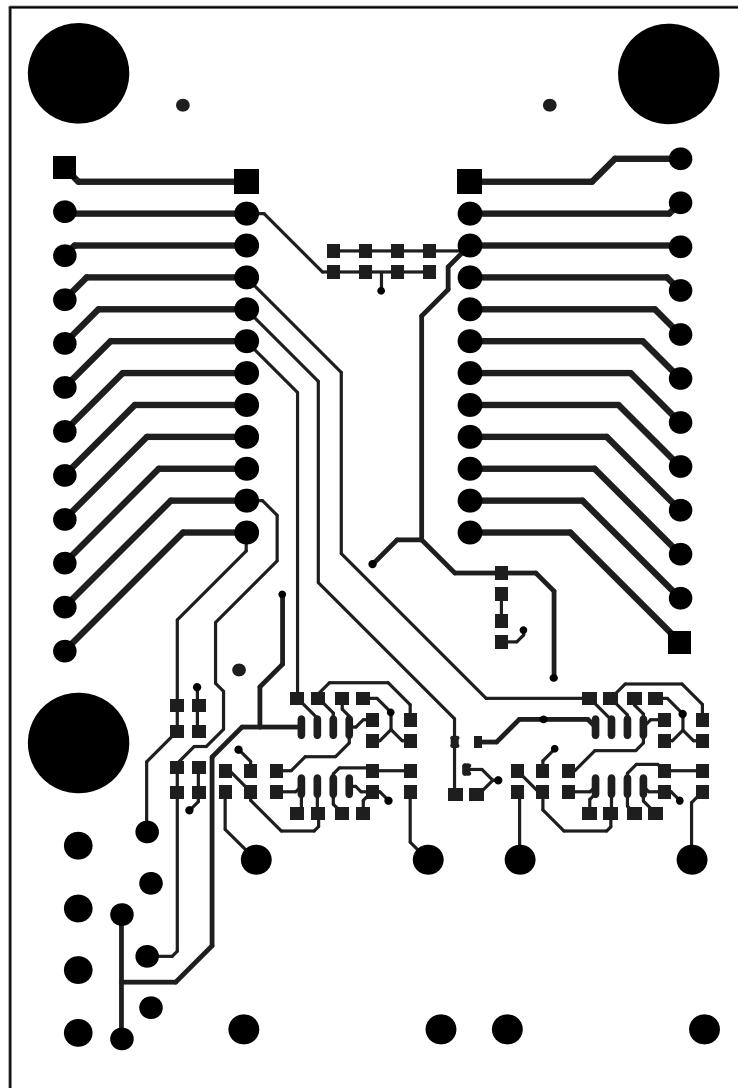
Visible Layer(s)
Top Overlay

[M1] Board Outline

[M15] Top Component Keepout



Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:55 PM

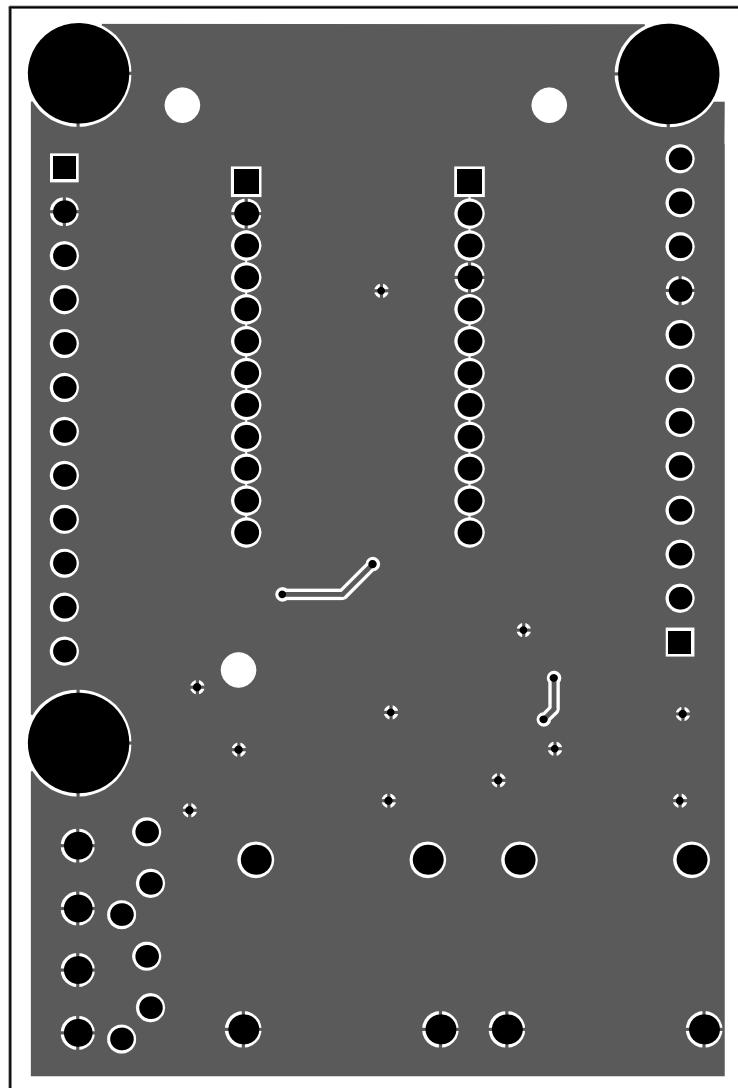


Visible Layer(s)

[1] Top Layer

[M1] Board Outline

Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:56 PM

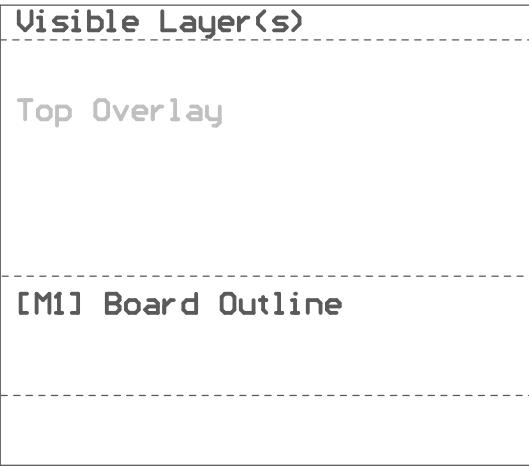
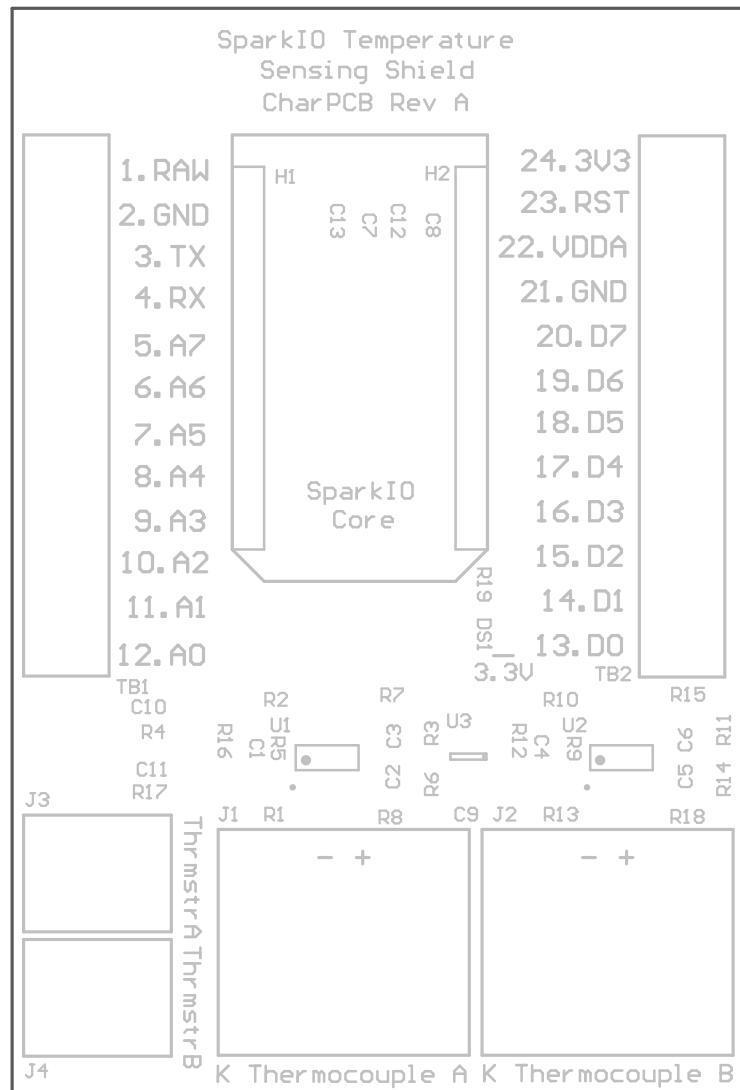


Visible Layer(s)

[2] Bottom Layer

[M1] Board Outline

Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:56 PM

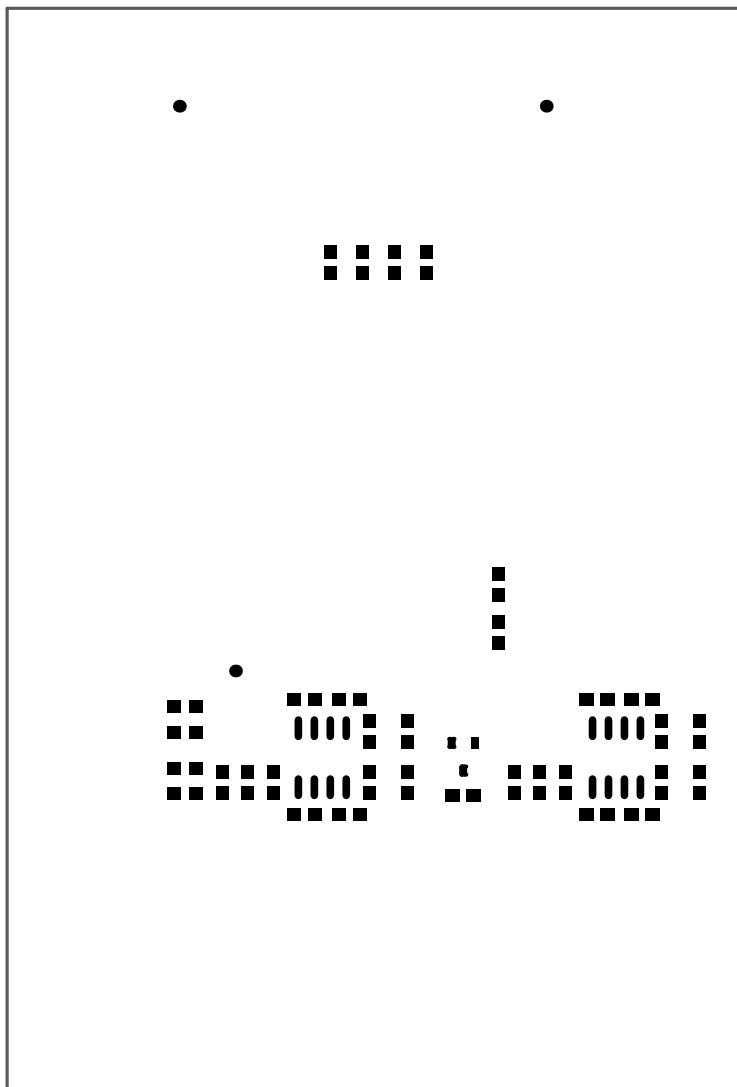


Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:57 PM

Visible Layer(s)

Top Paste

[M1] Board Outline

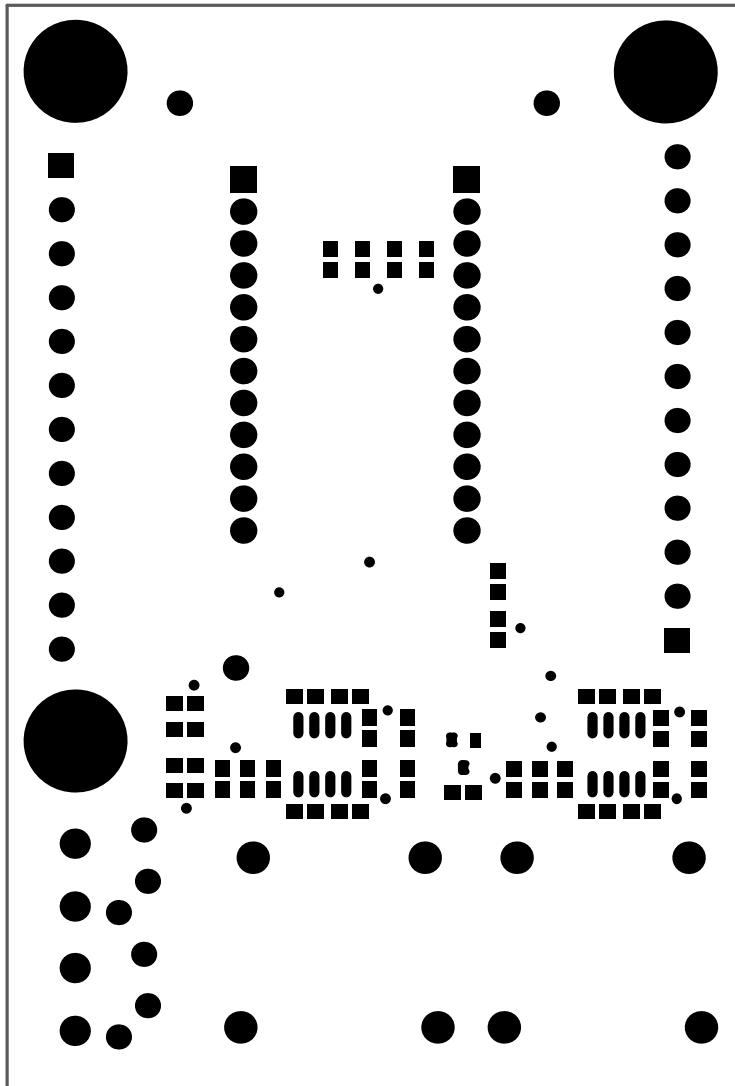


Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:57 PM

Visible Layer(s)

Top Solder

[M1] Board Outline

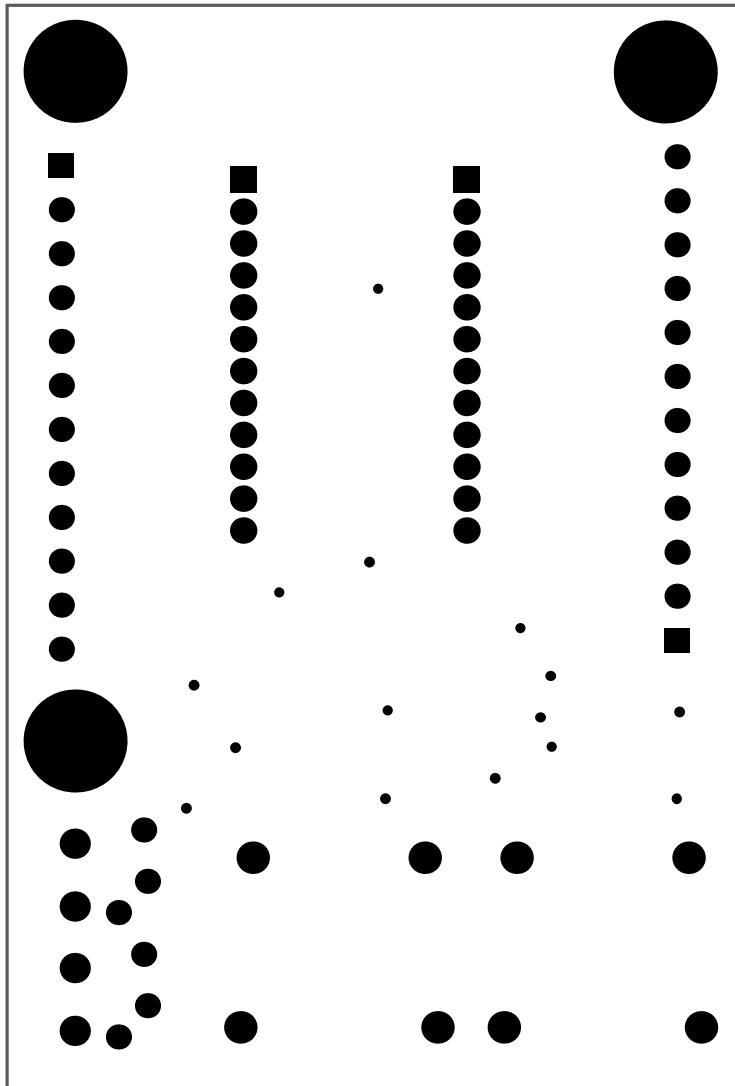


Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:57 PM

Visible Layer(s)

Bottom Solder

[M1] Board Outline

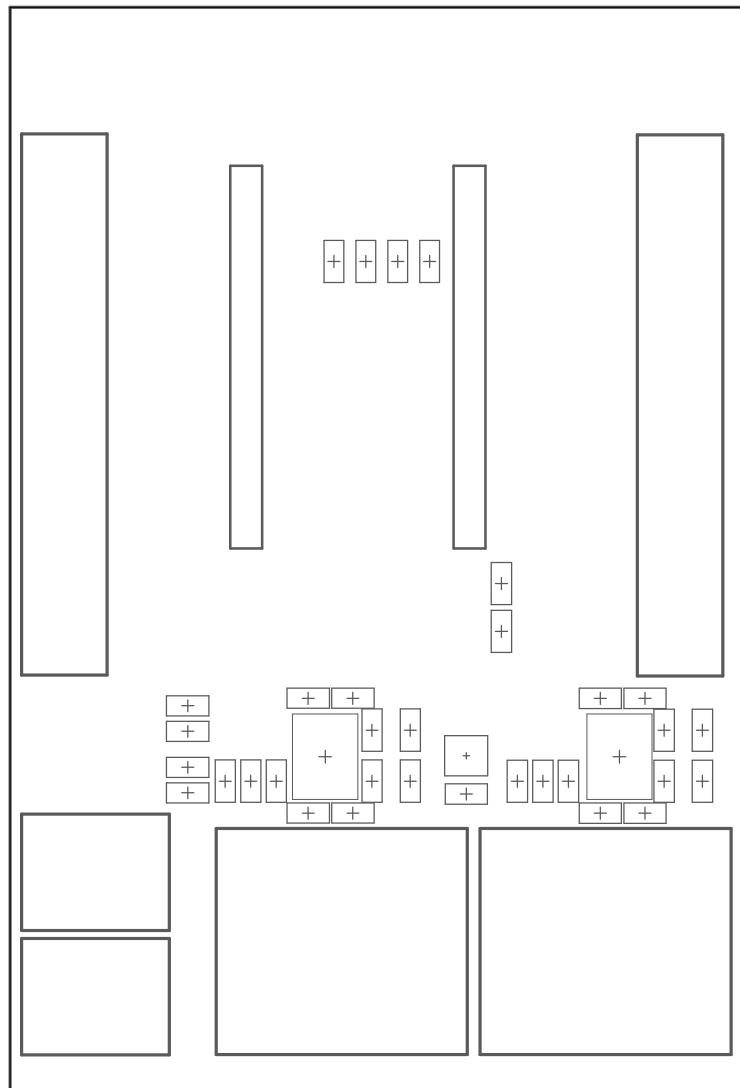


Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:58 PM

Visible Layer(s)

[M1] Board Outline

Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:09:58 PM

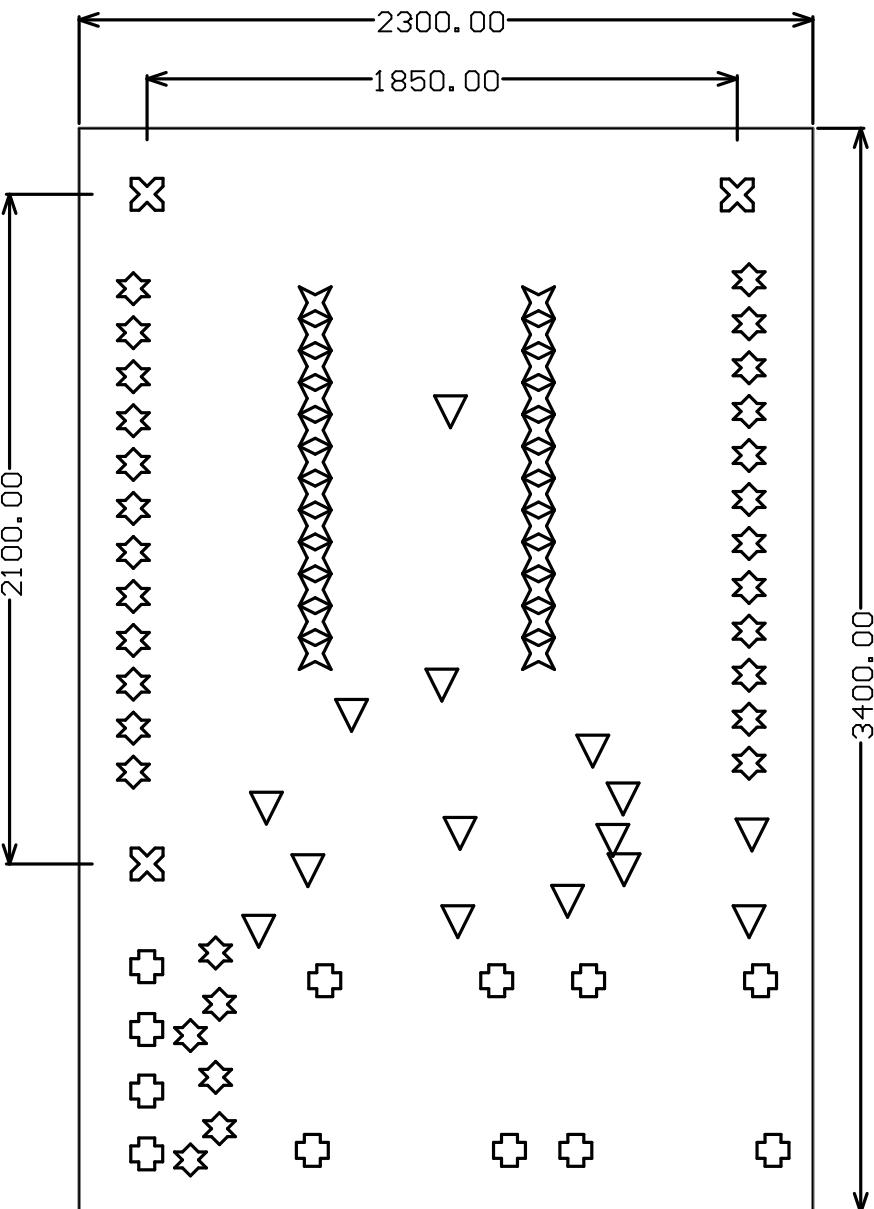


Visible Layer(s)

[M1] Board Outline

[M15] Top Component Keepout

| Layer Stack Up Detail: Final PCB Thickness is 62.0mil | | | | |
|--|-----------------|---------------------------------|-------------------|----------|
| Layer Name | Gerber Document | Copper Thickness (Final Weight) | Dielectric Height | Material |
| Top Solder Mask | (.GTS) | 0.5mil | PSR 4000 Taiyo | |
| Top Layer | (.GTL) | 1.4mil (1oz) | | |
| | | 58.2mil | Lam, 370HR | |
| Bottom Layer | (.GBL) | 1.4mil (1oz) | | |
| Bottom Solder Mask | (.GBS) | 0.5mil | PSR 4000 Taiyo | |



Project: SparkIO Thermal Shield
 Revision: A
 Drawn By: Jim Griszbacher
 Date: 8/3/2014
 Time: 6:09:58 PM

Visible Layer(s)

[M1] Board Outline

Drill Drawing

Fabrication

- i. Green Solder Mask SMOBC, in accordance to IPC-SM-840
- ii. White Silkscreen on Top Side: No ink shall be on exposed pads
- iii. ENIG Surface Finish
- iv. PCB shall be RoHS material and RoHS process compliant, T_(g) > 130C, T_(d)-288 test >5 minutes
- v. PCB is 10mil min trace/space design
- vi. Drill sizes are finished size after plating
- vii. PCB core is 58.2mil thick 370HR material or equivalent


Assembly

- i. RoHS Clean process, in accordance to IPC-A-600 and IPC-A-610 Class II
- ii. Top Side contains through-hole and surface-mount components
- iii. Bottom Side contains no components, design is single sided
- iv. Only populate the components marked as 'Fitted' in the Bill of Materials
- v. No electrical testing required

| Symbol | Hit Count | Finished Hole Size | Plated | Hole Type |
|----------|-----------|---------------------|--------|-----------|
| ✗ | 3 | 196.85mil (5.000mm) | PTH | Round |
| ❖ | 12 | 69.69mil (1.770mm) | PTH | Round |
| ☒ | 24 | 50.00mil (1.270mm) | PTH | Round |
| ✳ | 30 | 47.24mil (1.200mm) | PTH | Round |
| ▽ | 15 | 15.00mil (0.381mm) | PTH | Round |
| 84 Total | | | | |


Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:10:06 PM

Visible Layer(s):
 Top Layer
 Board Outline



Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:10:29 PM

Visible Layer(s):
[2] Bottom Layer
[M1] Board Outline



Visible Layer(s)

[M1] Board Outline




Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:11:11 PM

Visible Layer(s):
Top Paste

[M1] Board Outline




| |
|--------------------|
| Visible Layer(s): |
| Top Solder |
| [M1] Board Outline |



Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:11:42 PM

| |
|--------------------|
| Visible Layer(s): |
| Bottom Solder |
| [M1] Board Outline |




Project: SparkIO Thermal Shield
Revision: A
Drawn By: Jim Griszbacher
Date: 8/3/2014
Time: 6:11:57 PM

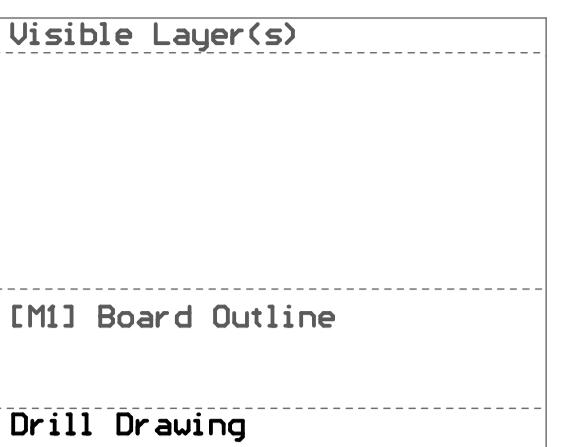
Visible Layer(s).....

[M1] Board Outline



Visible Layer(s):
[M1] Board Outline
[M15] Top Component Keepout

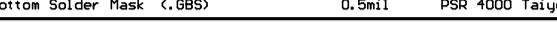
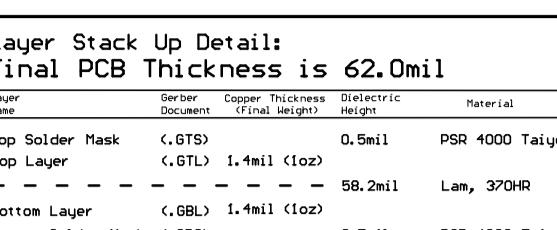





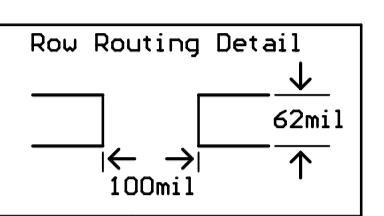
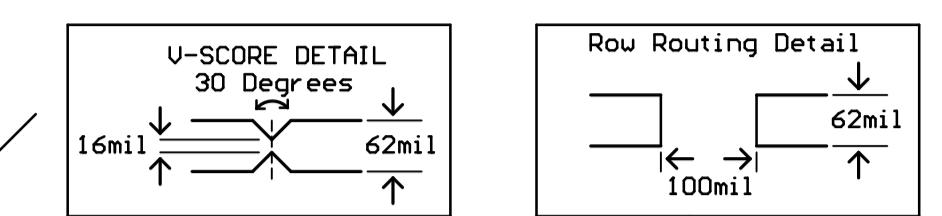
Fabrication
i. Green Solder Mask SH0BC, in accordance to IPC-SH-840
ii. White Silkscreen on Top Side; No ink shall be on exposed pads
iii. PCB shall be RoHS material and RoHS process compliant,
iv. PCB shall be 1.6mil thick 3/0MR material or equivalent
v. PCB is 16mil trace width design
vi. Drill sizes are finished size after plating
vii. Drill size is 68.2mil thick 3/0MR material or equivalent

Panel Design
i. Panel is 18 inches by 24 inches with 500mil width rails
ii. Rous are 5 up with U-Score between each PCB
iii. 10 rous are fitted on the panel, each separated with a 100mil width route

Assembly
i. RoHS Solder process, in accordance to IPC-R-000 and IPC-R-G00 Class II
ii. Top Side contains through-hole and surface-mount components
iii. Bottom Side contains no components, design is single sided
iv. Only populate the components marked as "Fitted" in the Bill of Materials
v. No electrical testing required



| Symbol | Hit Count | Finished Hole Size | Plated | Hole Type |
|------------|-----------|--------------------|--------|-----------|
| x | 150 | 196.85mil (5.00mm) | PTH | Round |
| o | 600 | 69.69mil (1.770mm) | PTH | Round |
| v | 250 | 15.00mil (0.381mm) | PTH | Round |
| x | 1200 | 50.00mil (1.270mm) | PTH | Round |
| o | 1500 | 47.24mil (1.200mm) | PTH | Round |
| 4200 Total | | | | |



| Item # | Designator | Fitted/Not Fitted | Quantity | Manufacturer | Manufacturer Part Number | Name | Supplier 1 | Supplier Part Number 1 |
|--------|--------------------------------|-------------------|----------|----------------------|--------------------------|--|------------|------------------------|
| 1 | C1, C2, C3, C4, C5, C6 | Fitted | 6 | TDK Corporation | C1608X7R1E103K080AA | CAP CER 10000PF 25V 10% X/R 0603 | Digi-Key | 445-5100-1-ND |
| 2 | C7, C8, C9, C10, C11, C12, C13 | Fitted | 7 | TDK Corporation | C1608X7R1C105K080AC | CAP CER 1UF 16V 10% X/R 0603 | Digi-Key | 445-1604-1-ND |
| 3 | DS1 | Fitted | 1 | LiteOn | LST-C190KGKT | Green LED 20mA 2V VF | Digi-Key | 160-1435-1-ND |
| 4 | H1, H2 | Fitted | 2 | Sullins Interconnect | PPTC121LFBN-RC | CONN HEADER FEM 12POS .1" SGL TIN | Digi-Key | S6100-ND |
| 5 | J1, J2 | Fitted | 2 | Omega | PCC-SMP-K | K Type Thermocouple Mini Horizontal TH Connector | Newark | 01H0905 |
| 6 | J3, J4 | Fitted | 2 | CUI Inc | MJ-2509N | 3/32" Mono Audio Jack Right Angle TH | Digi-Key | CP-M2509N-ND |
| 7 | R1, R8, R13, R18 | Fitted | 4 | Vishay | CRCW0603100KFKEA | RES 100K OHM 1/10W 1% 0603 SMD | Digi-Key | 541-100KHCT-ND |
| 8 | R2, R7, R10, R15 | Fitted | 4 | Vishay | CRCW060322K0FKEA | RES 22.0K OHM 1/10W 1% 0603 SMD | Digi-Key | 541-22.0KHCT-ND |
| 9 | R3, R5, R9, R11, R19 | Fitted | 5 | Vishay | CRCW06031K00FKEA | RES 1.00K OHM 1/10W 1% 0603 SMD | Digi-Key | 541-1.00KHCT-ND |
| 10 | R4, R6, R12, R14, R16, R17 | Fitted | 6 | Vishay | CRCW060310K0FKEA | RES 10.0K OHM 1/10W 1% 0603 SMD | Digi-Key | 541-10.0KHCT-ND |
| 11 | TB1, TB2 | Fitted | 2 | On Shore Technology | OSTTE120104 | TERMINAL BLOCK 3.5MM 12POS PCB | Digi-Key | ED2737-ND |
| 12 | U1, U2 | Fitted | 2 | Texas Instruments | OPA2376AIDR | IC Op Amp Dual GBP 5.5MHz 8SOIC | Digi-Key | 296-22564-1-ND |
| 13 | U3 | Fitted | 1 | Microchip | TC1046VNBTTR | Precision Temperature Sensing IC | Digi-Key | TC1046VNBTTRCT-ND |