Iridium 9603N Beacon

See Page 6 for Change Log

Page 2:

With grateful thanks to:
Adafruit for the Feather M0 Adalogger
https://www.adafruit.com/products/2796
https://github.com/adafruit/Adafruit-Feather-M0-Adalogger-PCB
Adafruit invests time and resources providing this open source design,
please support Adafruit and open-source hardware by purchasing products from Adafruit
Designed by Adafruit Industries.

Page 3:

With grateful thanks to:
Adafruit for the Ultimate GPS FeatherWing
https://www.adafruit.com/products/3133
https://github.com/adafruit/Adafruit-Ultimate-GPS-FeatherWing-PCB
Adafruit invests time and resources providing this open source design,
please support Adafruit and open-source hardware by purchasing products from Adafruit
Designed by Adafruit Industries.

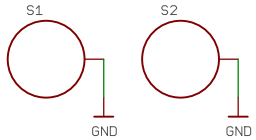
Page 4:

With grateful thanks to:
Sparkfun for the MPL3115A2 Breakout
https://www.sparkfun.com/products/11084
https://github.com/sparkfun/MPL3115A2_Breakout/tree/V_H1.1_L1.2.0
The hardware is released under Creative Commons ShareAlike 4.0 International.

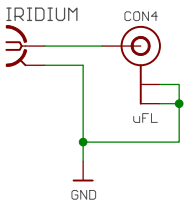
Page 5:

LTC3225EDDB SuperCapacitor Charger
Based on Linear Technology DC1220B
and Element14's LTC Library

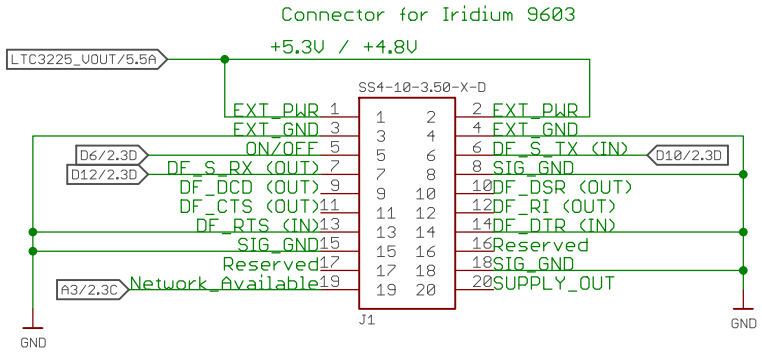
Mounting holes for Iridium 9603
2 x McMaster 95117A411 Press-In Nuts



3 x AA Energiser Ultimate Lithium
in Keystone Electronics 92 clips



Connector for Iridium 9603



Fiducials

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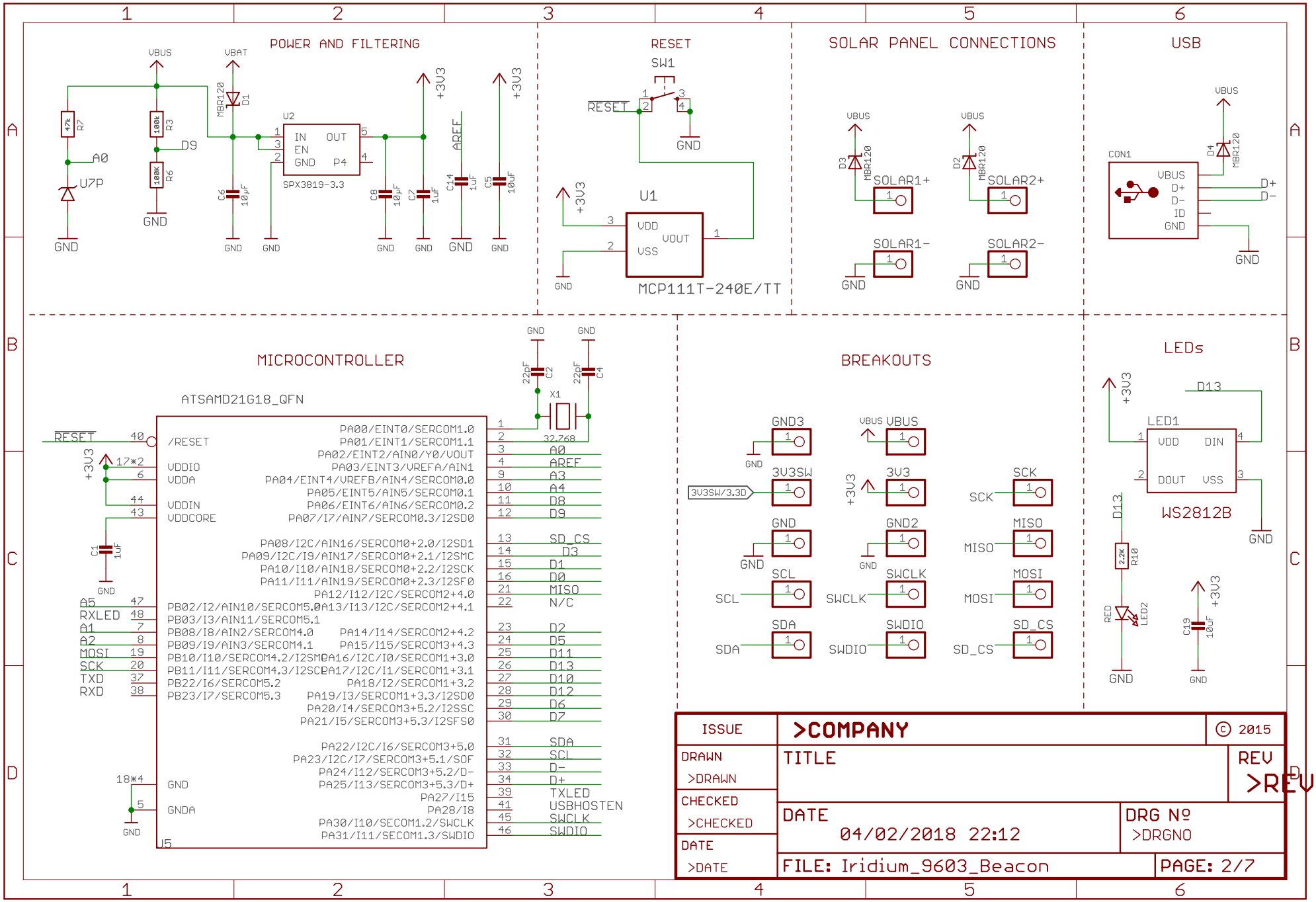

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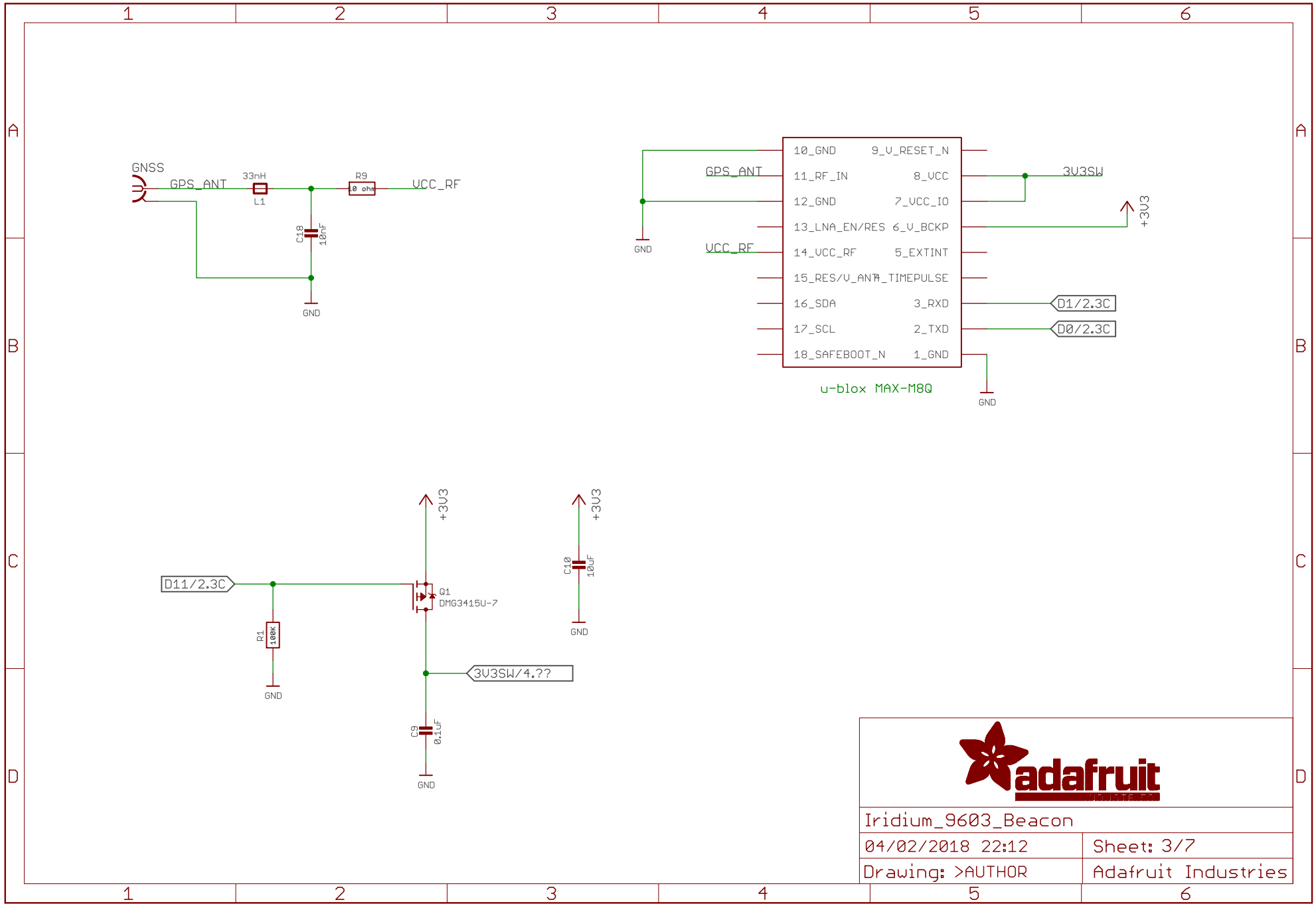

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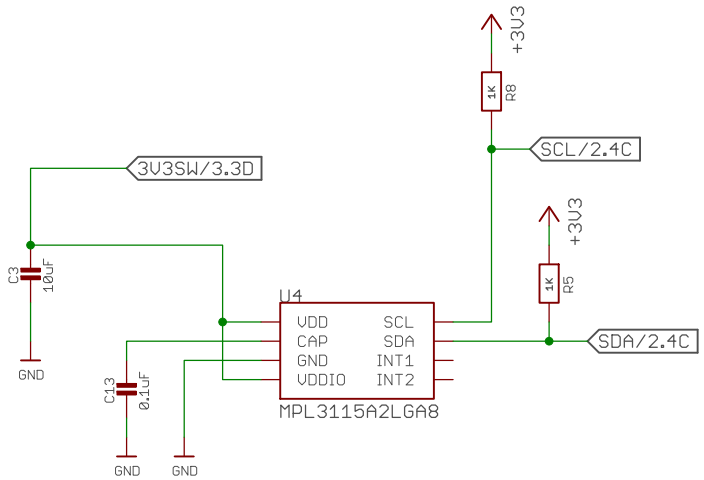

A.Weiss

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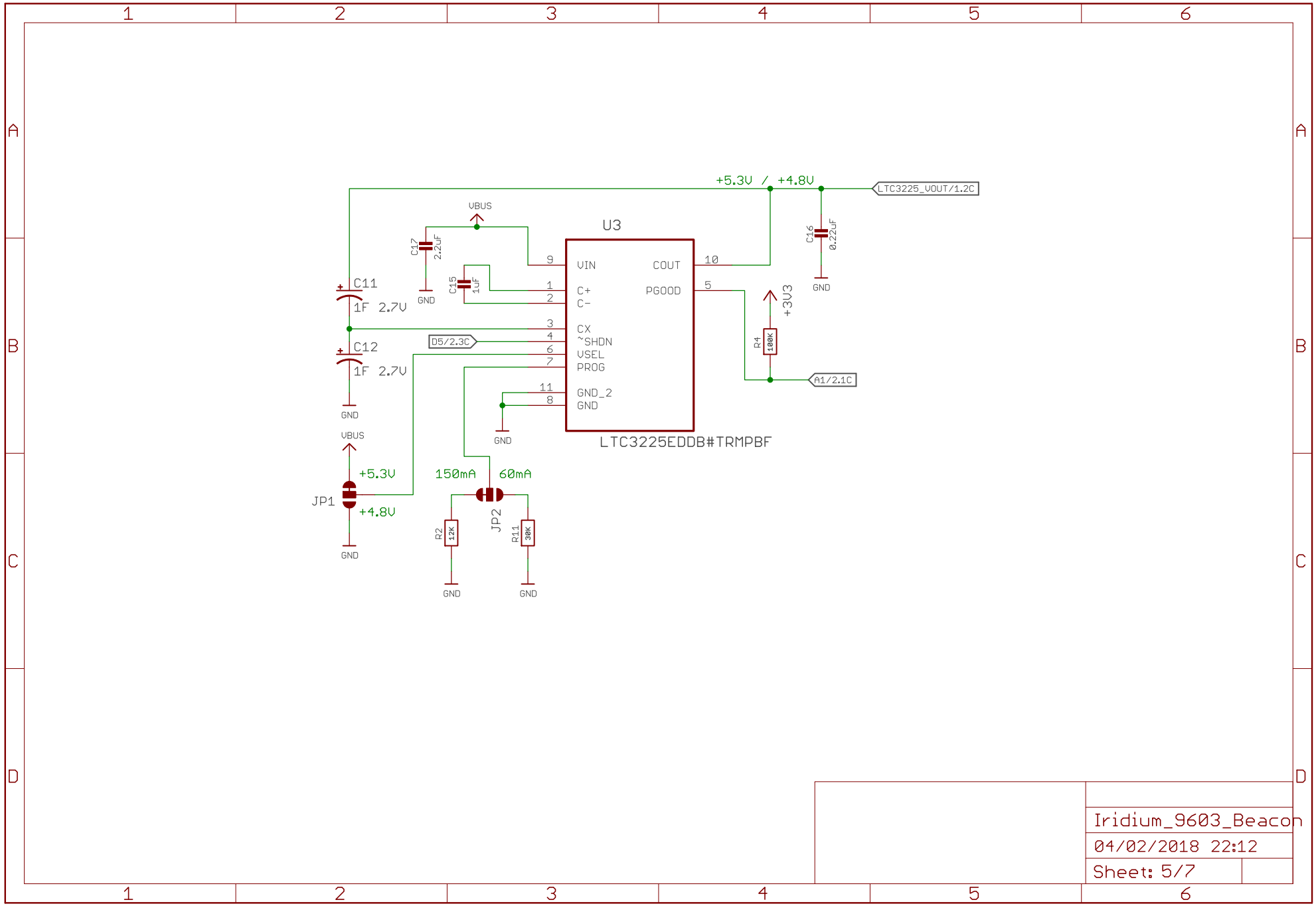

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Iridium 9603 Beacon Change Log

V2:

Changed C13 to 0603
Added pull-up resistors for SCL and SDA
Changed the 3V3 pin adjacent to SCL/SDA to 3V3SW
Moved the origin to board bottom-left corner

V3:

Added connections and protection diodes for two PowerFilm MPT3.6-150 solar panels
Replaced GlobalTop FGPMMOPA6H GPS with u-blox SAM-M8Q
Added split pad to select LTC3225EDDB output voltage. Default is now 5.3V
Replaced R2 with 30K to set supercapacitor charge current to 60mA
LTC3225EDDB is now powered from VBUS instead of VBAT
R3+R6 now monitor VBUS instead of VBAT
Added reset supervisor U1

V4:

Power: 3 x AA batteries in Keystone 92 clips
GNSS: u-blox MAX-M8Q with SMA antenna
SMA antenna for 9603N
Added WS2812B LED
Added LT1634-1,25BMCMS8 voltage reference to allow low battery voltages to be measured
Added protection diode for USB power
Added split pad to select supercapacitor charge current

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	Sheet: 6/7

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Iridium 9603 Beacon Notes

Notes on power voltages:

MBR120 diode has a forward voltage drop of approx.:
0.26V at 170mA
0.19V at 12mA

MBR120 diode plus SPX3819-3.3 regulator have a combined voltage drop of approx.:
0.22V at 12mA; 0.36V at 170mA.
Output starts to collapse when 'solar' voltage drops below approx.: 3.65V at 12mA; 3.80V at 170mA.
Reported voltage on A7 will bottom out at 3.38V / 3.43V even though the actual voltage is lower than this.
Hence the need for the LT1634-1,25BMCMS8 1.25V voltage reference.

Processor requires: 1.62V to 3.3V (max 3.63V).

Reset supervisor will reset processor when 3.3V rail drops below approx. 2.35V.

MAX-M8Q requires: 2.7V to 3.0V (max 3.6V).

MPL3115A2 requires 1.95V to 3.6V.

LTC3225 requires 3V to 5.5V (absolute max 6V).

Solar panel must not produce more than 6V (open circuit) under full sun.
(Quoted open circuit voltage for PowerFilm Solar MPT3.6-150 is 4.8V)

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	Sheet: 7/7

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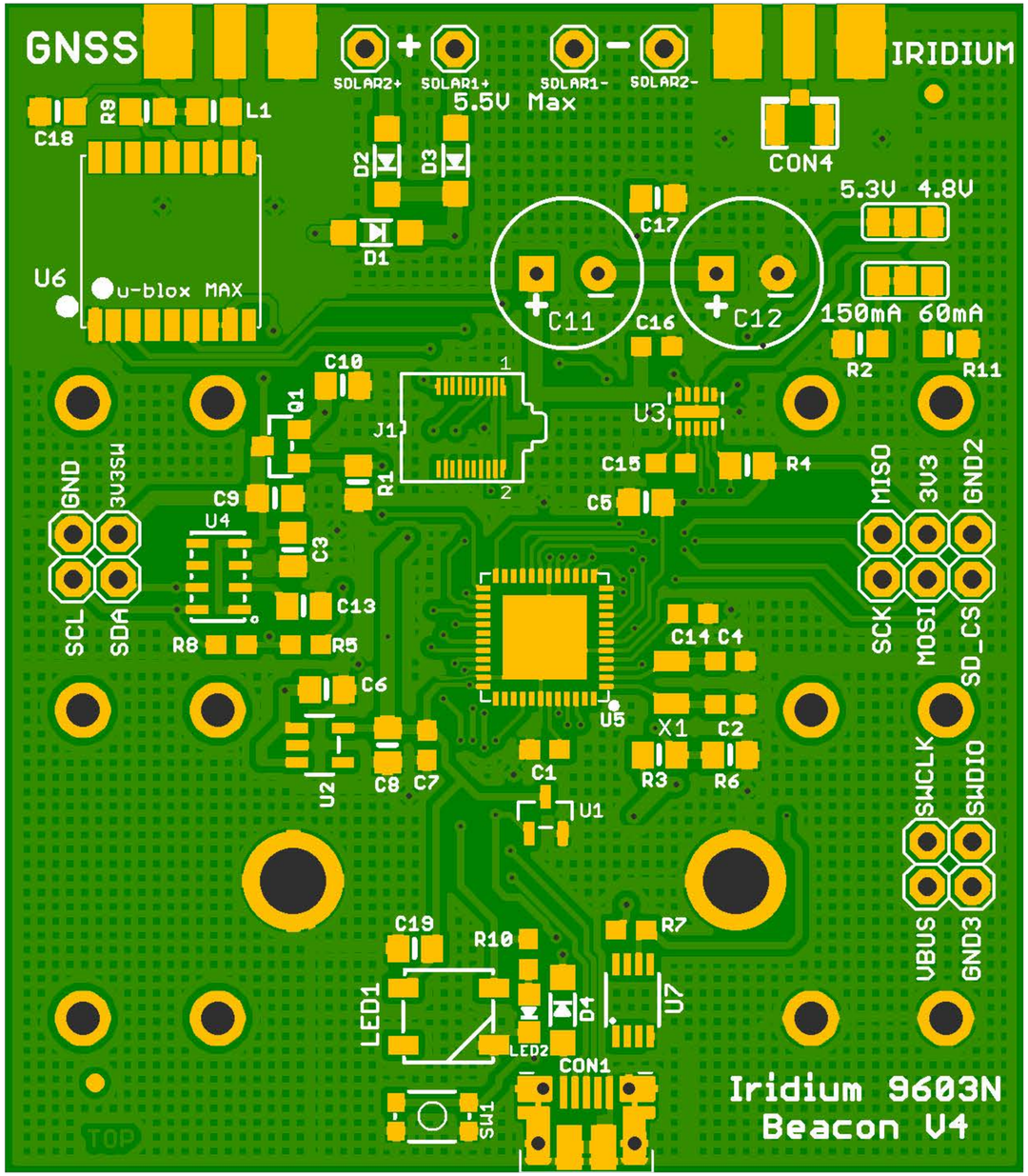
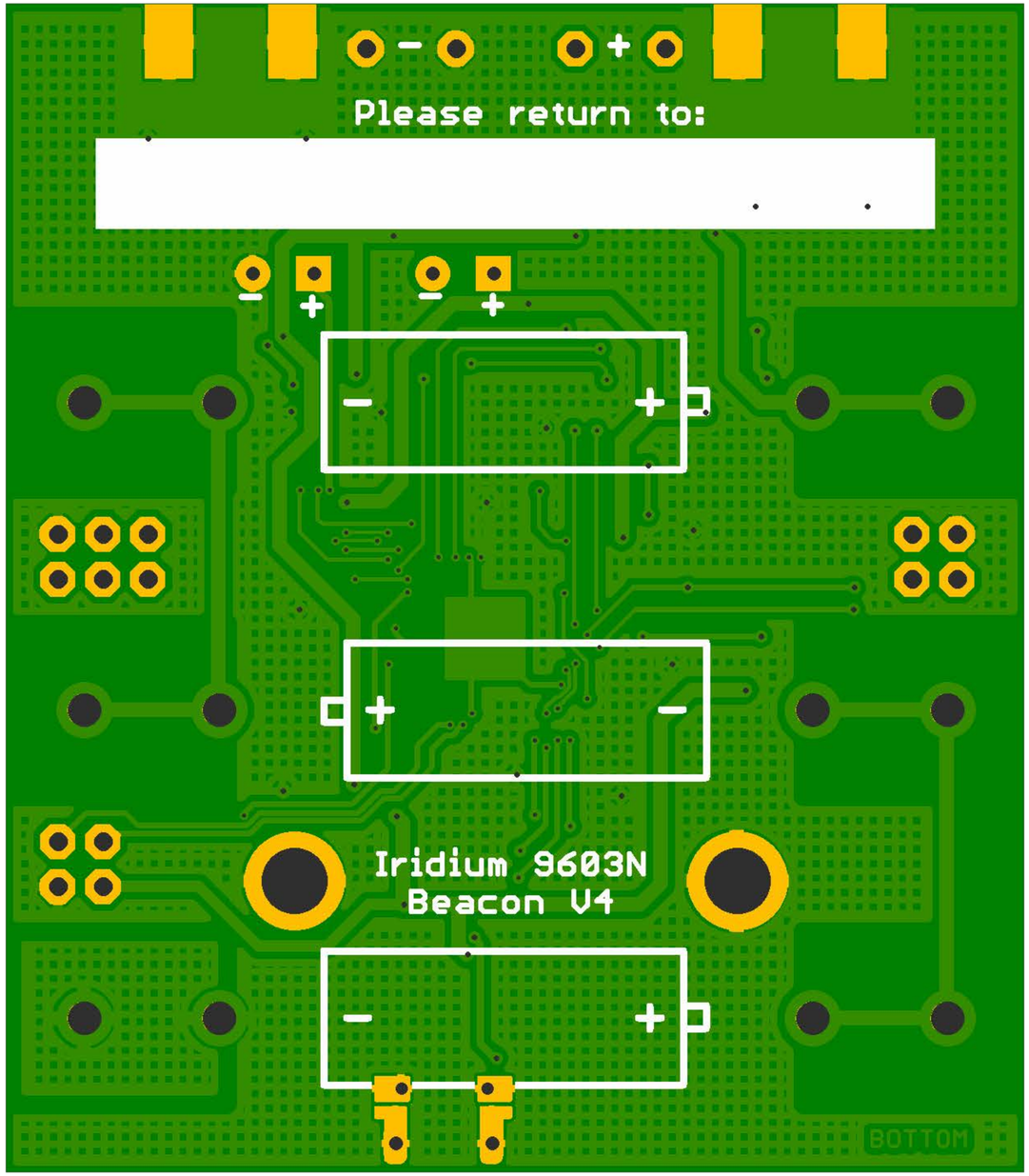

GNSS
IRIDIUM
SOLAR2+
SOLAR1+
SOLAR1-
SOLAR2-
5.5V Max
CON4
5.3V
4.8V
150mA
60mA
C18
R9
L1
D2
D3
D1
C17
C11
C12
C16
U6
u-blox MAX
R2
R11
C10
Q1
J1
U3
C15
R4
C5
R1
C9
U4
C3
GND
3V3SW
MISO
3V3
GND2
SCL
SDA
C13
R8
R5
C6
C14
C4
U5
SCK
MOSI
SD_CS
X1
C2
U2
C8
C7
C1
R3
R6
U1
SWCLK
SWDIO
VBUS
GND3
C19
R10
R7
LED1
D4
U7
LED2
CON1
SW1
TOP
Iridium 9603N
Beacon V4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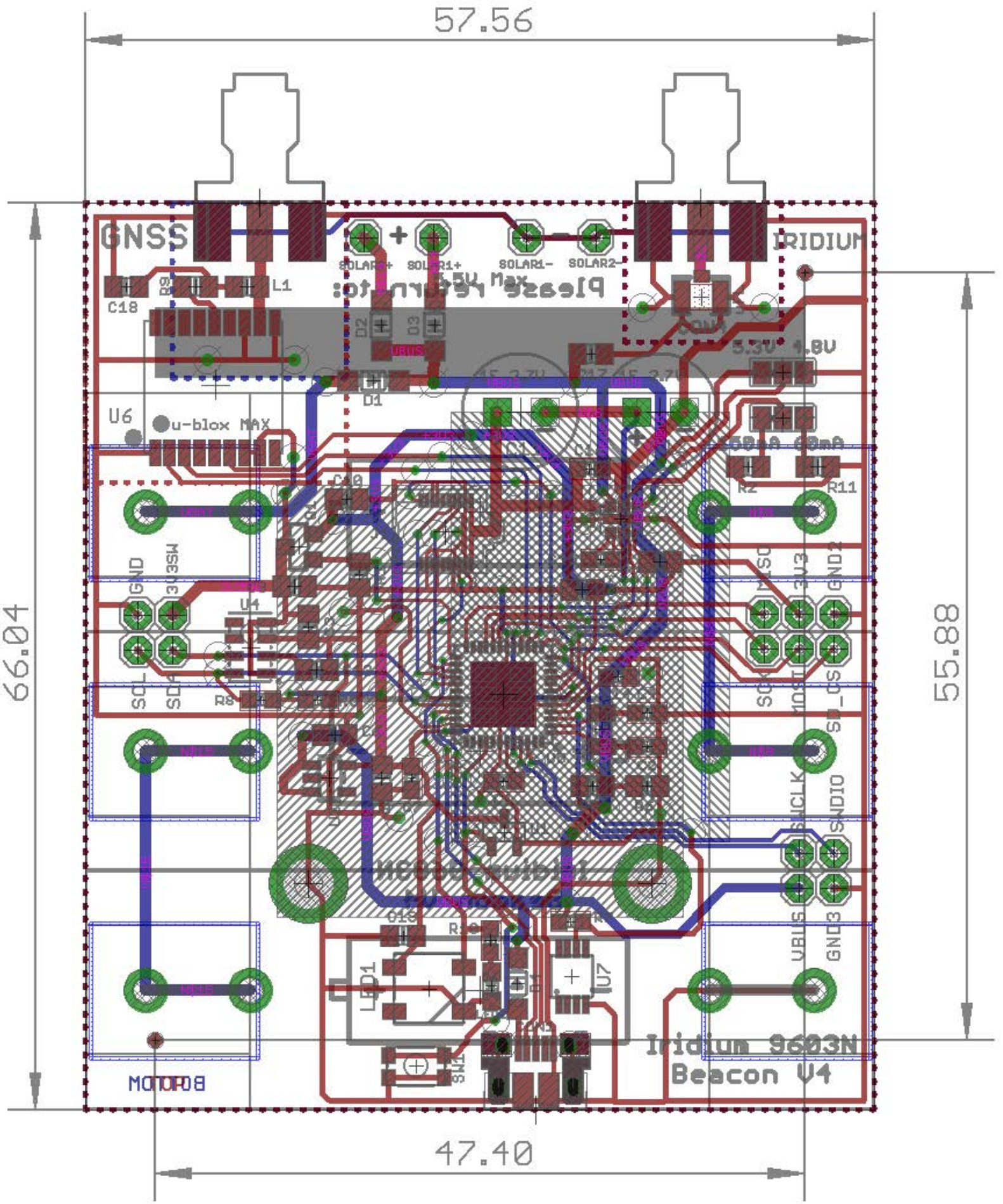
57.56
66.04
55.88
47.40
GNSS
IRIDIUM
SOLAR0+
SOLAR1+
SOLAR1-
SOLAR2-
5V Max
C18
L1
D1
D2
D3
U6
u-blox MAX
5.3V
4.8V
R2
R11
GND
3V3SW
SCL
SDA
RST
MISO
3V3
GND1
MOSI
SD_CS
SWCLK
SWDIO
VBUS
GND3
LED1
U7
SW1
Iridium 9603N
Beacon V4
MOTOR08

Part	X	Y	Angle	Package	Value	Manufacturer	Manufacturer Part No	Farnell Part No	Mouser Part No	Description
FD1	5.08	5.08	0							Fiducial 1mm
FD2	52.48	60.96	0							Fiducial 1mm
C1	30.48	23.91	180	0603	1uF	Walsin	0603X105K100CT	2496916		MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R
C2	40.96	26.45	0	0603	12pF	Walsin	0603N120J500CT	2496884		MultiLayer Ceramic Capacitor; 12pF; 50V; 0603
C3	16.26	35.21	270	0805	10uF	Walsin	0805F106Z100CT	2496998		MultiLayer Ceramic Capacitor; 10uF; 10V; 0805
C4	40.96	28.92	0	0603	12pF	Walsin	0603N120J500CT	2496884		MultiLayer Ceramic Capacitor; 12pF; 50V; 0603
C5	36.20	37.88	180	0805	10uF	Walsin	0805F106Z100CT	2496998		MultiLayer Ceramic Capacitor; 10uF; 10V; 0805
C6	18.16	27.30	0	0805	10uF	Walsin	0805F106Z100CT	2496998		MultiLayer Ceramic Capacitor; 10uF; 10V; 0805
C7	23.81	24.16	270	0603	1uF	Walsin	0603X105K100CT	2496916		MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R
C8	21.59	24.16	270	0805	10uF	Walsin	0805F106Z100CT	2496998		MultiLayer Ceramic Capacitor; 10uF; 10V; 0805
C9	15.24	38.13	0	0805	0.1uF	Walsin	0805B104K500CT	2496944		MultiLayer Ceramic Capacitor; 0.1uF; 50V; 0805; X7R
C10	19.05	44.48	0	0805	10uF	Walsin	0805F106Z100CT	2496998		MultiLayer Ceramic Capacitor; 10uF; 10V; 0805
C13	16.86	32.04	0	0805	0.1uF	Walsin	0805B104K500CT	2496944		MultiLayer Ceramic Capacitor; 0.1uF; 50V; 0805; X7R
C14	38.86	31.59	0	0603	1uF	Walsin	0603X105K100CT	2496916		MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R
C15	37.59	40.10	0	0603	1uF	Walsin	0603X105K100CT	2496916		MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R
C16	36.77	46.70	0	0603	0.22uF	Multicomp	MC0603F224Z160CT	1759019		MultiLayer Ceramic Capacitor; 0.22uF; 16V; 0603
C17	36.86	55.05	0	0805	2.2uF	Multicomp	MCTT21X225K100CT	1759477		MultiLayer Ceramic Capacitor; 2.2uF; 10V; 0805; X5R
C18	2.95	59.94	180	0805	10nF	Walsin	0805B103K500CT	2496939		MultiLayer Ceramic Capacitor; 10nF; 50V; 0805; X7R
C19	23.15	12.67	180	0805	10uF	Walsin	0805F106Z100CT	2496998		MultiLayer Ceramic Capacitor; 10uF; 10V; 0805
CON1	32.83	2.99	0		Micro_USB	Amphenol_FCI	10103594	2293752		Amphenol FCI 10103594 Micro USB Type B
CON4	44.89	59.98	90	uFL	uFL	Hirose	U.FL-R-SMT(01)	3908021		HIROSE U.FL-R-SMT(01); U.FL Coaxial; Straight Jack; 50 ohm
D1	20.99	53.12	180	SOD-123	MBR120	ON SEMICONDUCTOR	MBR120VLSFT1G	1431044		Schottky Rectifier; 20V; 1A; SOD-123
D2	21.56	57.15	90	SOD-123	MBR120	ON SEMICONDUCTOR	MBR120VLSFT1G	1431044		Schottky Rectifier; 20V; 1A; SOD-123
D3	25.43	57.18	90	SOD-123	MBR120	ON SEMICONDUCTOR	MBR120VLSFT1G	1431044		Schottky Rectifier; 20V; 1A; SOD-123
D4	31.50	9.21	270	SOD-123	MBR120	ON SEMICONDUCTOR	MBR120VLSFT1G	1431044		Schottky Rectifier; 20V; 1A; SOD-123
J1	26.27	42.10	0		SS4-10-3.50	Samtec	SS4-10-3.50-L-D-K-TR	2085336		Samtec SS4-10-3.50-L-D-K-TR
L1	11.78	59.98	0	0805	33nH	Coilcraft	0805HT-33NTGLB	2286465		Surface Mount High Frequency Inductor; 0805; 33 nH; 600 mA
LED1	25.05	8.83	0		WS2812B	Sparkfun / Worldsemi	WS2812B		474-COM-13667	RGB LED with Driver
LED2	29.59	9.02	180	2.0x1.25	RED	Multicomp	703-0107	2112119		LED; Red; 20mA; 2.2V; 2.0x1.25mm
Q1	15.56	41.05	90	SOT23	DMG3415U-7	Diodes Inc.	DMG3415U-7	1843688		MOSFET; P Channel; SOT23-WIDE
R1	19.94	39.02	90	0805	100k	Multicomp	MC01W08051100K	9332405		Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW
R2	48.32	46.86	0	0805	12K	Panasonic	ERJ6ENF1202V	2303661		Chip Resistor; Thick Film; 12k; 150V; 0805; 125mW
R3	36.96	23.59	180	0805	100k	Multicomp	MC01W08051100K	9332405		Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW
R4	41.91	39.97	0	0805	100k	Multicomp	MC01W08051100K	9332405		Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW
R5	16.95	29.85	0	0603	1K	Multicomp	MCWR06X1001FTL	2447272		Chip Resistor; Thick Film; 1k; 50V; 0603; 100mW
R6	40.96	23.59	180	0805	100k	Multicomp	MC01W08051100K	9332405		Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW
R7	35.37	13.72	0	0603	47k	Multicomp	MCWR06X4702FTL	2447376		Chip Resistor; Thick Film; 47k; 50V; 0603; 100mW
R8	12.76	29.85	180	0603	1K	Multicomp	MCWR06X1001FTL	2447272		Chip Resistor; Thick Film; 1k; 50V; 0603; 100mW
R9	8.00	59.98	180	0805	10 ohm	Multicomp	MC01W0805110R	9332421		Chip Resistor; Thick Film; 10 ohm; 150V; 0805; 100mW
R10	29.56	12.35	270	0603	1K	Multicomp	MCWR06X1001FTL	2447272		Chip Resistor; Thick Film; 1k; 50V; 0603; 100mW
R11	53.40	46.86	180	0805	30K	Panasonic	ERJ6GEYJ303V	2323830		Chip Resistor; Thick Film; 30k; 150V; 0805; 125 mW
SW1	24.13	3.18	180	4.6x2.8	Tactile Switch	Multicomp	MCIPTG23K-V	1605470		Tactile Switch; 4.6x2.8mm; 50mA; 12V
U1	30.54	20.22	0	SOT23-3	MCP111T-240E/TT	Microchip	MCP111T-240E/TT	1627192		Reset Supervisor; SOT23-3; 2.40V; Open Drain; Active Low
U2	17.78	24.16	270	SOT23-5	SPX3819-3.3	Exar	SPX3819M5-L-3-3/TR		701-SPX3819M5-L-33TR	LDO Voltage Regulator; 500mA; SOT-23-5
U3	39.05	43.02	90	DFN-10	LTC3225EDDB	Linear Technology	LTC3225EDDB#TRMPBF	1715231		Supercapacitor Charger
U4	12.03	33.69	180	LGA8	MPL3115A2	NXP	MPL3115A2	2009084		Pressure Sensor
U5	30.48	30.26	90	TQFN48	ATSAMD21G18A	Atmel	ATSAMD21G18A-MF	2460544		ATSAMD21G18A-MF; QFN48
U6	9.41	52.63	270		MAX-M8Q	u-blox	MAX-M8Q			https://www.u-blox.com/en/product/max-m8-series
U7	35.46	9.75	0	MSOP8	LT1634BCMS8-1.25	Linear Technology	LT1634BCMS8-1.25	2252797	584-1634BCMS8-1.25PF	1.25V Precision Voltage Reference
X1	37.66	27.72	270	3.2x1.5	32.768	Epson	Q13FC13500004	1278036		Crystal; 32.768kHz; 12.5pF; 3.2 x 1.5mm

Part	Value	Manufacturer	Manufacturer Part No	Farnell Part No	Mouser Part No	McMaster Part No	Description
Non-surface mount components:							
BAT1	AA-Clip_Pair	Keystone Electronics	92	908733			Keystone Electronics 92 AA Battery Clip (Pair)
BAT2	AA-Clip_Pair	Keystone Electronics	92	908733			Keystone Electronics 92 AA Battery Clip (Pair)
BAT3	AA-Clip_Pair	Keystone Electronics	92	908733			Keystone Electronics 92 AA Battery Clip (Pair)
C11	1F 2.7V	Bussmann	HV0810-2R7105-R	2148482			Supercapacitor; 1F; 2.7V; +30%, -10%; 3.5mm Pitch
C12	1F 2.7V	Bussmann	HV0810-2R7105-R	2148482			Supercapacitor; 1F; 2.7V; +30%, -10%; 3.5mm Pitch
S1	Press-In Nut	McMaster-Carr	95117A411			95117A411	Press-In Nut; 2-56
S2	Press-In Nut	McMaster-Carr	95117A411			95117A411	Press-In Nut; 2-56
CON2	SMA Jack	Johnson	142-0711-821	1019328			SMA End Launch Jack
CON3	SMA Jack	Johnson	142-0711-821	1019328			SMA End Launch Jack
Mounting hardware for Iridium 9603N:							
SPACERS_x2						94669A100	4.5mm OD x 6mm Spacers for Iridium Module
SCREWS_x2						92185A081	2-56 x 7/16 Screws for Iridium Module
Cable for Iridium 9603N:							
CABLE		HIROSE (HRS)	U.FL-2LP-088K1T-A-50	1688071			HIROSE u.FL - u.FL cable 50ohm 50mm
Antennas:							
Iridium		Maxtena	M1621HCT-SMA	2281619			Iridium Passive Antenna with SMA connector
GNSS		Maxtena	M1516HCT-P-SMA	2484960			GPS / Glonass Passive Antenna with SMA connector

For solar operation:

Don't install BAT1-BAT3 battery clips

Replace C11 and C12 with 10F capacitors. Install these flat against the underside of the PCB, carefully bending the legs to fit.

C11 & C12	10F 2.7V	Bussmann	HV1030-2R7106-R	2148486		Supercapacitor; 10F; 2.7V; +30%, -10%; 5.0mm Pitch

Connect two PowerFilm MPT3.6-150 solar panels to the SOLAR+/- terminals. Be careful with the panel polarity.

Set the supercapacitor charge current to 60mA via the split pads. Carefully cut the track between the 150mA pads and solder across the 60mA pads.