

Iridium 9603N Beacon

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.

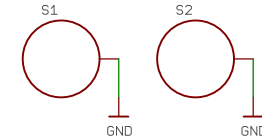
Page 4:

With grateful thanks to:
Sparkfun for the MPL3115A2 Breakout
<https://www.sparkfun.com/products/11084>
https://github.com/sparkfun/MPL3115A2-Breakout/tree/U_H1.1_L1.2.0
The hardware is released under Creative Commons ShareAlike 4.0 International.

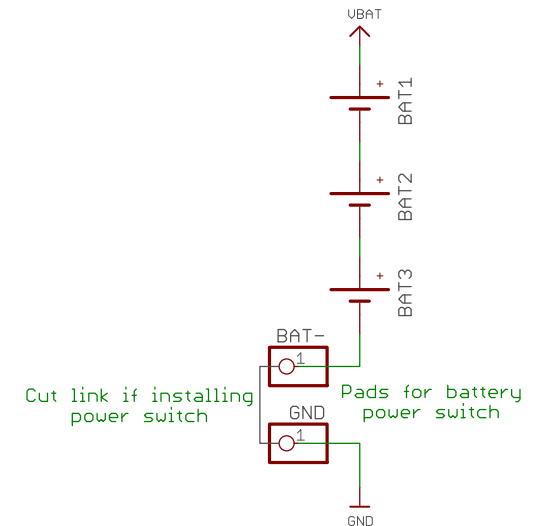
Page 5:

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

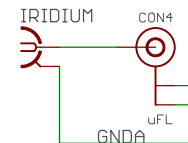
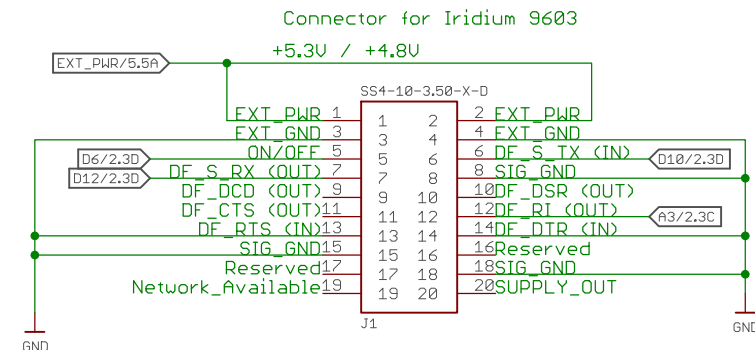
Mounting holes for Iridium 9603
2 x McMaster 95117A411 Press-In Nuts



3 x AA Energiser Ultimate Lithium
in Keystone Electronics 92 clips



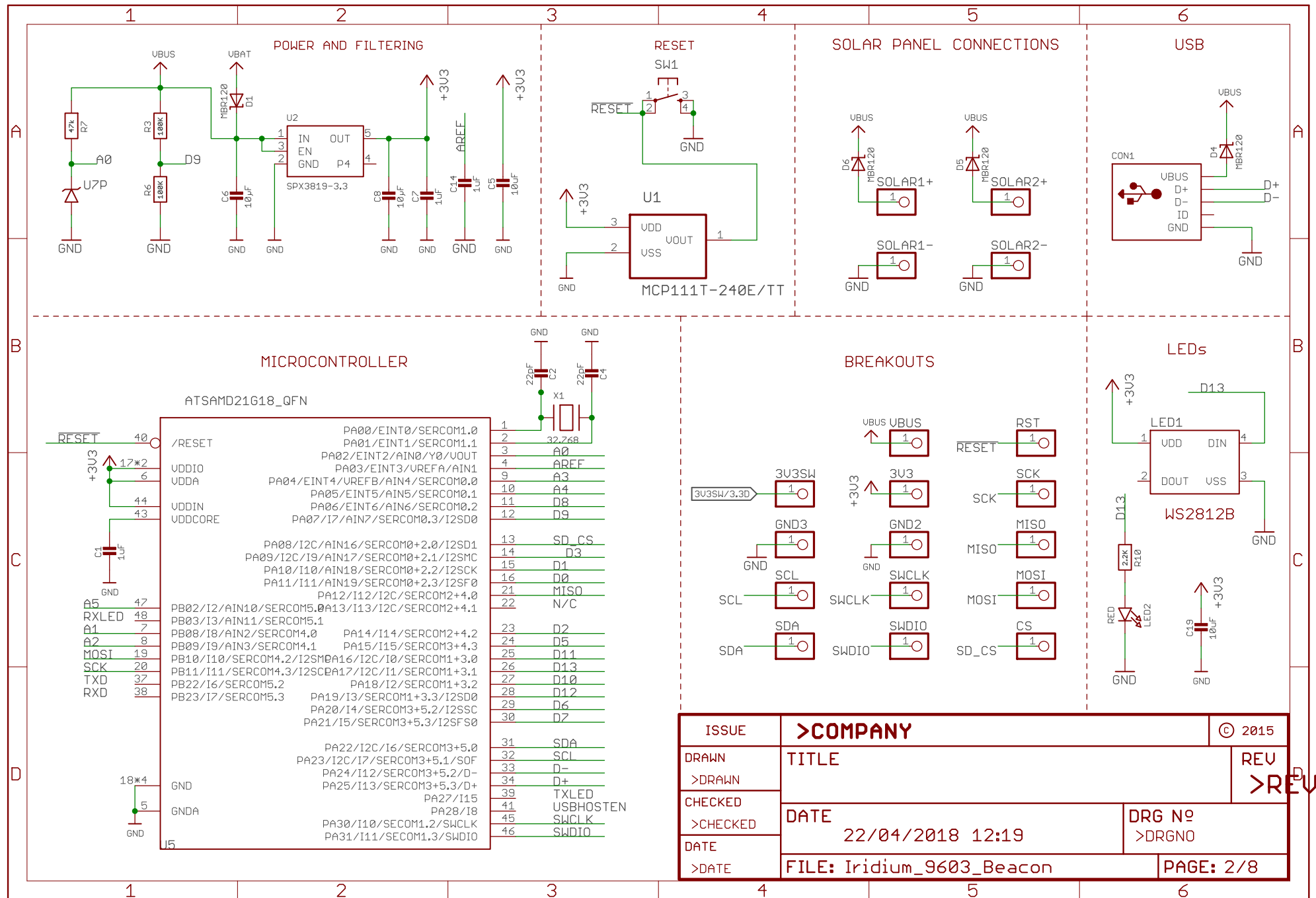
Fiducials



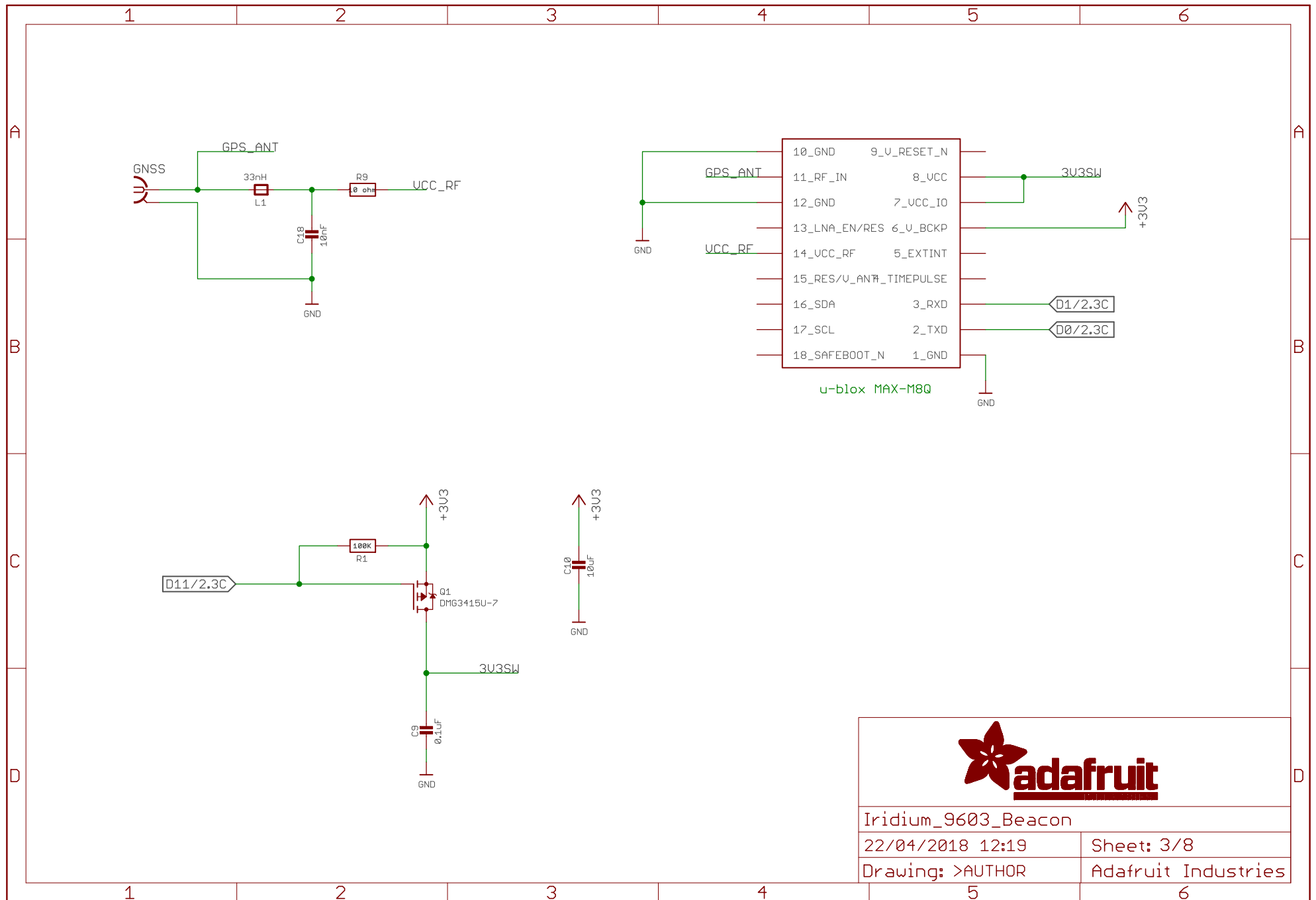
Iridium_9603_Beacon

22/04/2018 12:19

Sheet: 1/8



ISSUE	>COMPANY		© 2015
DRAWN	TITLE		REV
>DRAWN			>REV
CHECKED	DATE		DRG N°
>CHECKED	22/04/2018 12:19		>DRGNO
DATE	FILE: Iridium_9603_Beacon		PAGE: 2/8
>DATE			



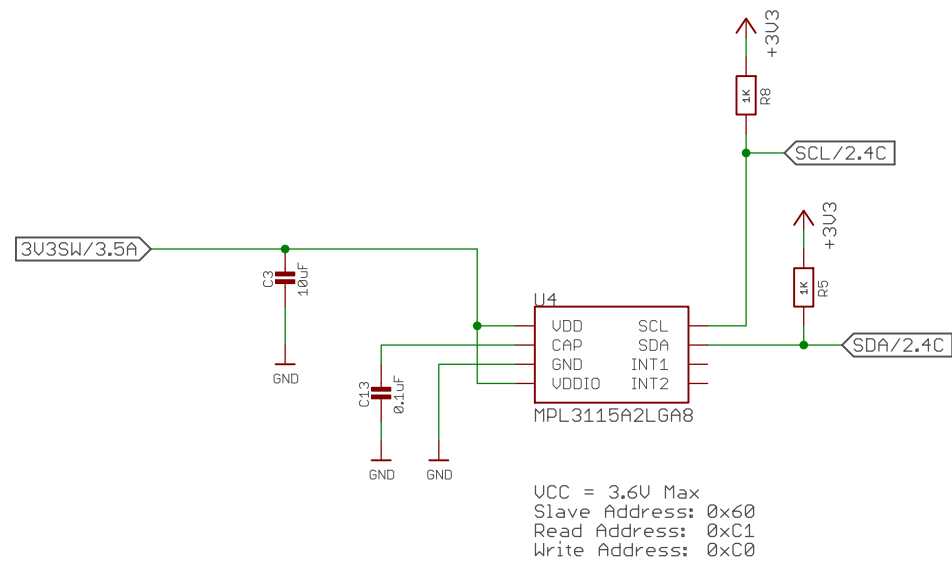
Iridium_9603_Beacon

22/04/2018 12:19

Sheet: 3/8

Drawing: >AUTHOR

Adafruit Industries



A.Weiss

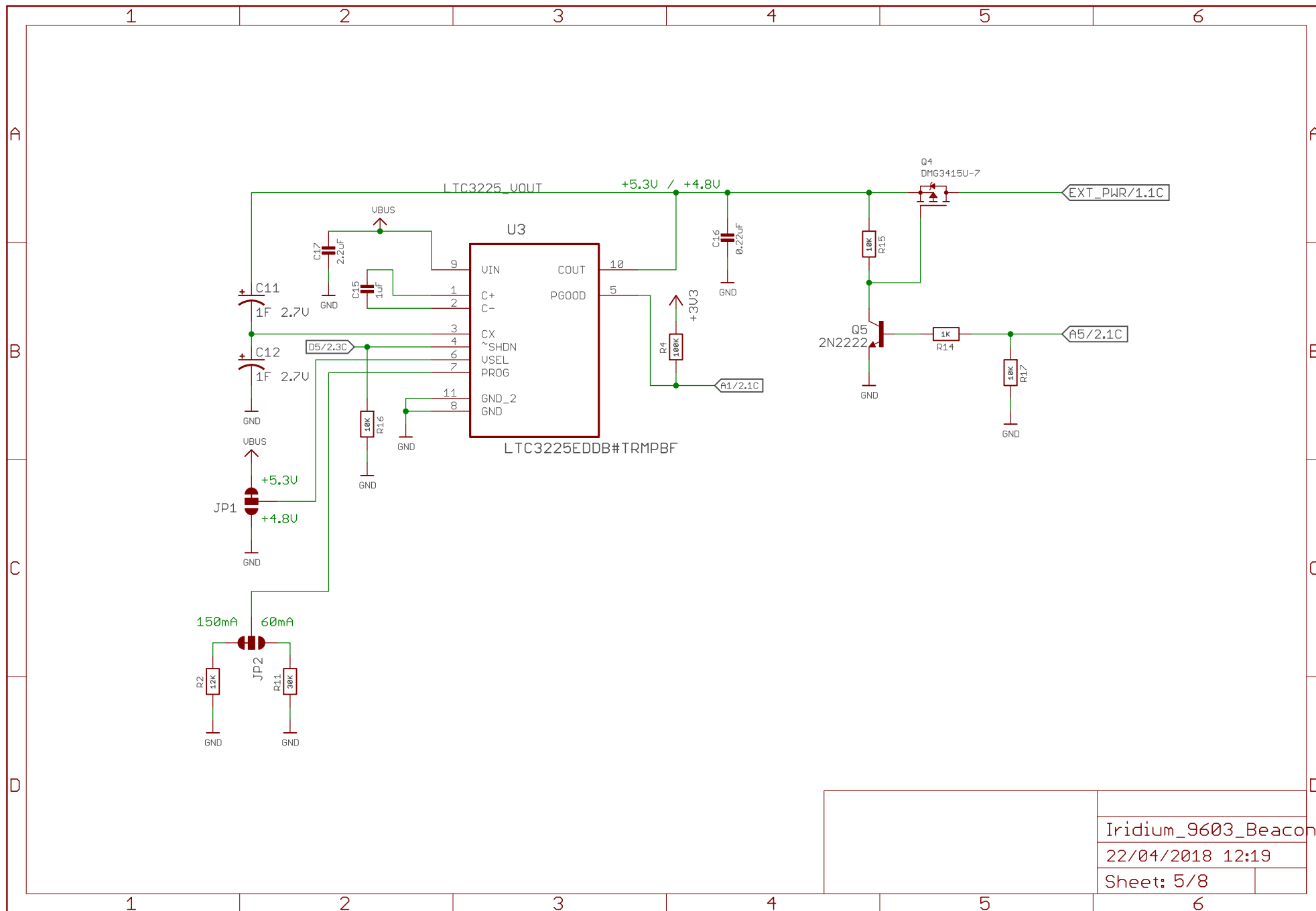
TITLE: Iridium_9603_Beacon

Document Number:

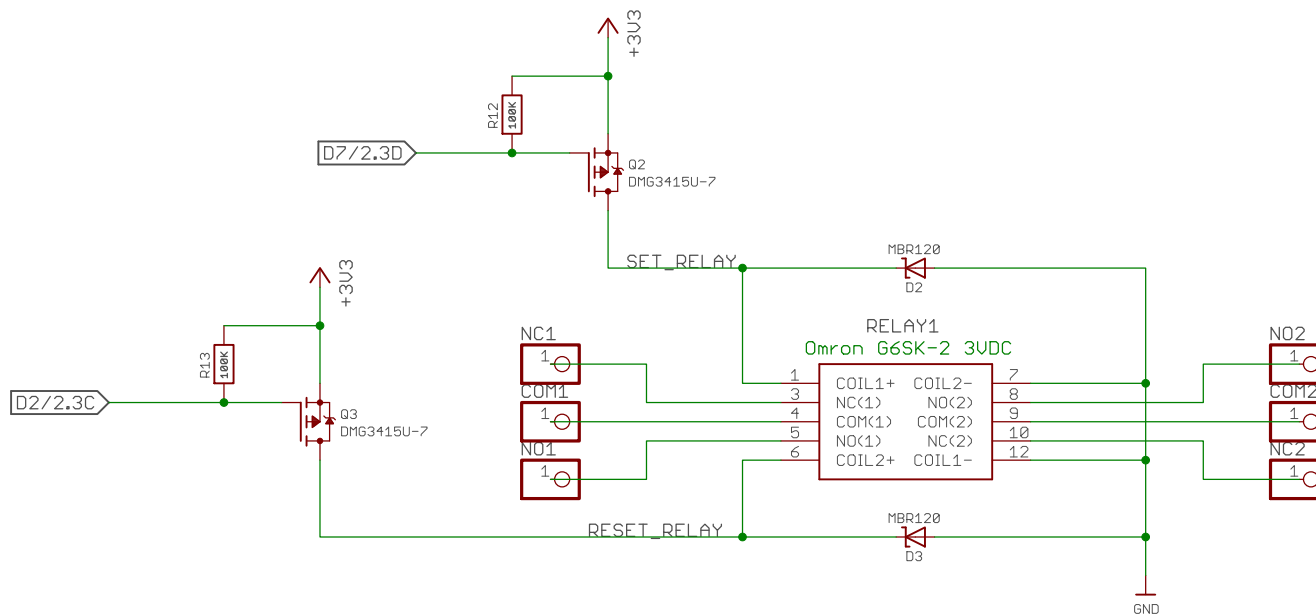
REV:

Date: 22/04/2018 12:19

Sheet: 4/8



Iridium_9603_Beacon
22/04/2018 12:19
Sheet: 5/8



TITLE: Iridium_9603_Beacon

Document Number:

REV:

Date: 22/04/2018 12:19

Sheet: 6/8

	1	2	3	4	5	6
A	Iridium 9603 Beacon Change Log					
	<p>U2:</p> <p>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</p>					
B	<p>U3:</p> <p>Added connections and protection diodes for two PowerFilm MPT3.6-150 solar panels Replaced GlobalTop FGPM00PA6H 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</p>					
C	<p>U4:</p> <p>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</p>					
D	<p>U5:</p> <p>Added a dual coil latching DPDT relay (Omron G6SK-2 3VDC; enabled via D2 and D7) Solar pins have been moved to make room for the relay Isolated the Iridium antenna ground 9603N EXT_PWR is now switched via Q4 and Q5 (enabled via A5/D19) Added a pull-down resistor for LTC3225 ~SHDN R1 now pulls up (not down) A3 now connects to 9603N Ring Indicator (not Network Available) Added a pad for an external reset switch Added a pad for a battery power switch</p>					
	1	2	3	4	5	6

Iridium_9603_Beacon

22/04/2018 12:19

Sheet: 7/8

Iridium 9603 Beacon Notes

Notes on power voltages:

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

MBR120 diode plus SPX3819-3.3 regulator have a combined voltage drop of approx.:
0.22V at 12mA
0.36V at 170mA

Regulator 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).

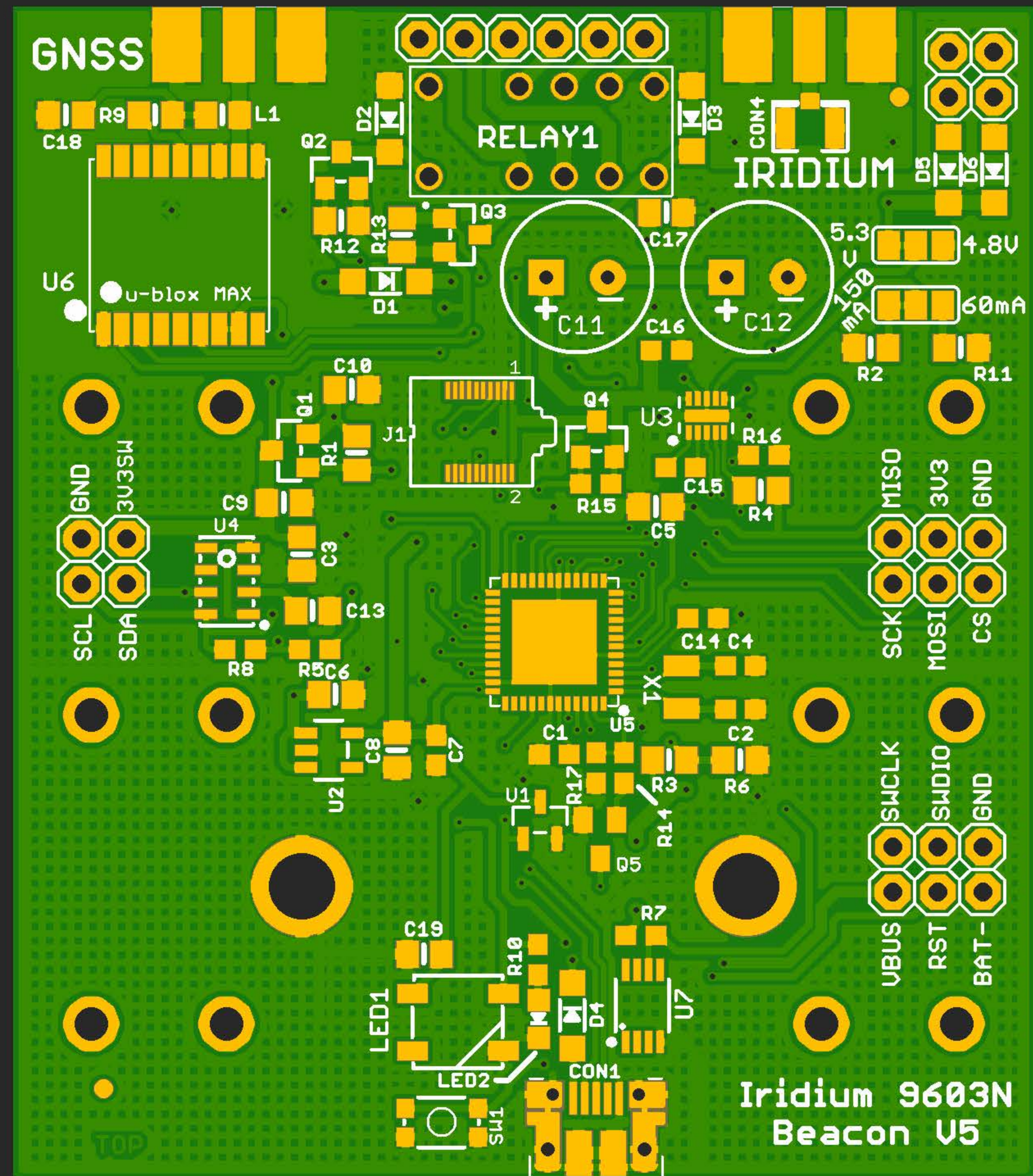
Solar panel must not produce more than 6V (open circuit) under full sun.
Quoted open circuit voltage for PowerFilm Solar MPT3.6-150 is 4.8V.

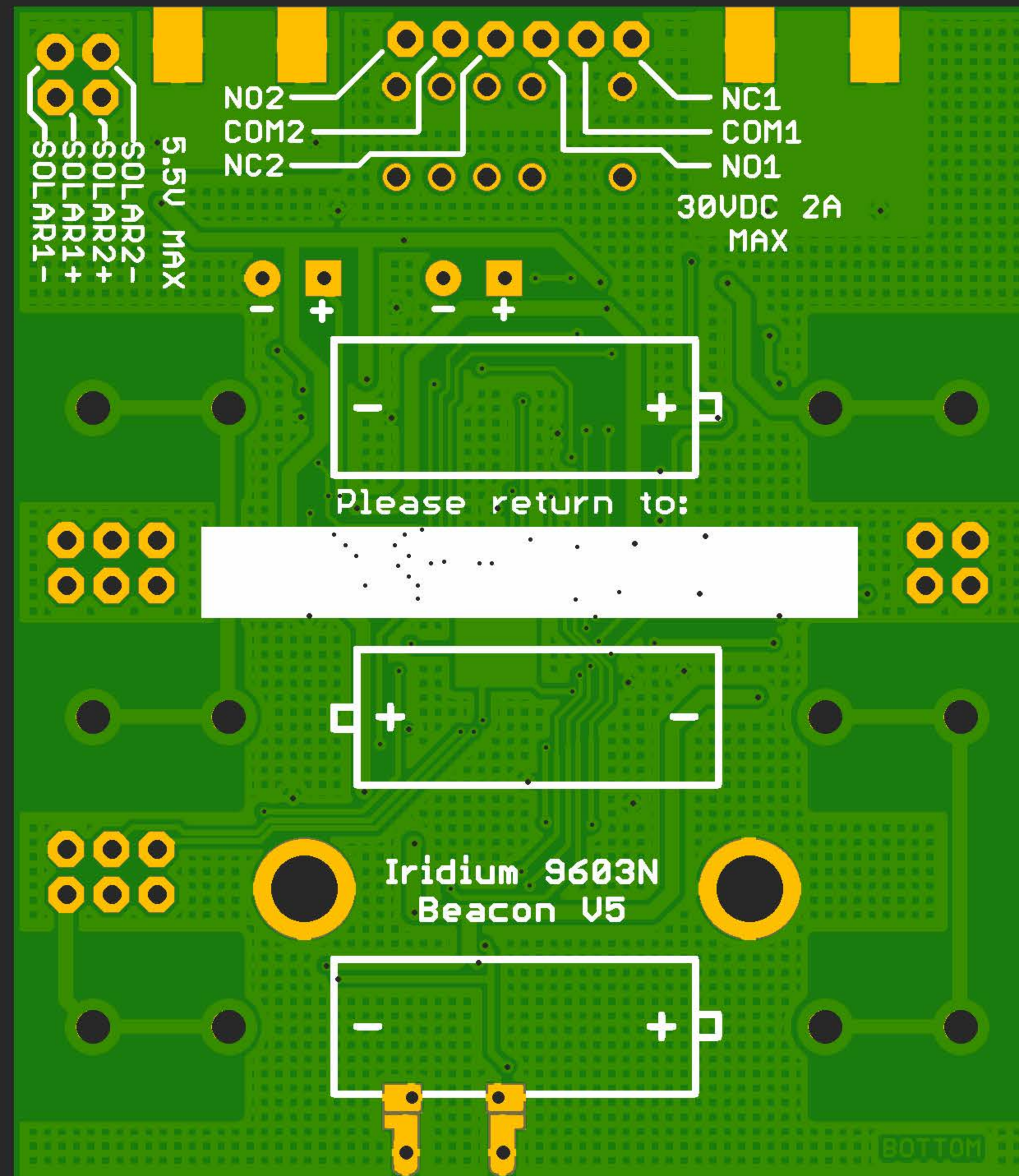
Omron relay will draw 67mA for ≥ 10 msec. When operating on solar power, only energise the relay when both the GNSS and supercapacitor charger have been disabled.

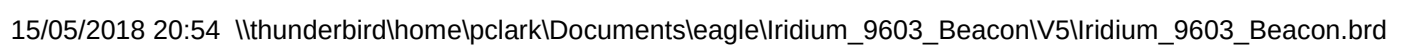
Iridium_9603_Beacon

22/04/2018 12:19

Sheet: 8/8







Part	X	Y	Angle	Package	Value	Manufacturer	Manufacturer Part No	Farnell Part No	Mouser Part No	McMaster Part No	Description	Alternative Part
Dimensions	57.56	66.04										
Fiducials - for solder paste mask alignment:												
FD1	5.08	5.08	0								Fiducial 1mm	
FD2	49.94	60.96	0								Fiducial 1mm	
Surface Mount Components:												
C1	30.48	23.91	180	0603	1uF	Walsin	0603X105K100CT	2496916			MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R	1uF 50V ±10% 0603 Samsung
C7	23.81	24.16	270	0603	1uF	Walsin	0603X105K100CT	2496916			MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R	1uF 50V ±10% 0603 Samsung
C14	38.86	31.59	0	0603	1uF	Walsin	0603X105K100CT	2496916			MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R	1uF 50V ±10% 0603 Samsung
C15	37.59	40.10	0	0603	1uF	Walsin	0603X105K100CT	2496916			MultiLayer Ceramic Capacitor; 1uF; 10V; 0603; X5R	1uF 50V ±10% 0603 Samsung
C2	40.96	26.45	0	0603	12pF	Walsin	0603N120J500CT	2496884			MultiLayer Ceramic Capacitor; 12pF; 50V; 0603	12pF 50V ±5% 0603 Samsung
C4	40.96	28.92	0	0603	12pF	Walsin	0603N120J500CT	2496884			MultiLayer Ceramic Capacitor; 12pF; 50V; 0603	12pF 50V ±5% 0603 Samsung
C3	16.26	35.21	270	0805	10uF	Walsin	0805F106Z100CT	2496998			MultiLayer Ceramic Capacitor; 10uF; 10V; 0805	10uF 16V ±10% 0805 Samsung
C5	36.20	37.88	180	0805	10uF	Walsin	0805F106Z100CT	2496998			MultiLayer Ceramic Capacitor; 10uF; 10V; 0805	10uF 16V ±10% 0805 Samsung
C6	18.16	27.30	0	0805	10uF	Walsin	0805F106Z100CT	2496998			MultiLayer Ceramic Capacitor; 10uF; 10V; 0805	10uF 16V ±10% 0805 Samsung
C8	21.59	24.16	270	0805	10uF	Walsin	0805F106Z100CT	2496998			MultiLayer Ceramic Capacitor; 10uF; 10V; 0805	10uF 16V ±10% 0805 Samsung
C10	19.05	44.48	0	0805	10uF	Walsin	0805F106Z100CT	2496998			MultiLayer Ceramic Capacitor; 10uF; 10V; 0805	10uF 16V ±10% 0805 Samsung
C19	23.15	12.67	180	0805	10uF	Walsin	0805F106Z100CT	2496998			MultiLayer Ceramic Capacitor; 10uF; 10V; 0805	10uF 16V ±10% 0805 Samsung
C9	15.24	38.13	0	0805	0.1uF	Walsin	0805B104K500CT	2496944			MultiLayer Ceramic Capacitor; 0.1uF; 50V; 0805; X7R	100nF 50V ±10% 0805 Samsung
C13	16.86	32.04	0	0805	0.1uF	Walsin	0805B104K500CT	2496944			MultiLayer Ceramic Capacitor; 0.1uF; 50V; 0805; X7R	100nF 50V ±10% 0805 Samsung
C16	36.77	46.70	0	0603	0.22uF	Multicomp	MC0603F224Z160CT	1759019			MultiLayer Ceramic Capacitor; 0.22uF; 16V; 0603	220nF 25V ±10% 0603 Samsung
C17	36.80	54.45	0	0805	2.2uF	Multicomp	MCTT21X225K100CT	1759477			MultiLayer Ceramic Capacitor; 2.2uF; 10V; 0805; X5R	2.2uF 25V ±10% 0805 Samsung
C18	2.95	59.94	180	0805	10nF	Walsin	0805B103K500CT	2496939			MultiLayer Ceramic Capacitor; 10nF; 50V; 0805; X7R	10nF 50V ±5% 0805 Samsung
CON1	32.83	2.99	0		Micro_USB	Amphenol_FCI	10103594	2293752			Amphenol FCI 10103594 Micro USB Type B	A01S87X4X1821-167 Micro USB 5S 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	50.58	180	SOD-123	MBR120	ON SEMICONDUCTOR	MBR120VLSFT1G	1431044			Schottky Rectifier; 20V; 1A; SOD-123	
D2	21.18	59.75	90	SOD-123	MBR120	ON SEMICONDUCTOR	MBR120VLSFT1G	1431044			Schottky Rectifier; 20V; 1A; SOD-123	
D3	38.23	59.79	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	
D5	52.67	56.86	90	SOD-123	MBR120	ON SEMICONDUCTOR	MBR120VLSFT1G	1431044			Schottky Rectifier; 20V; 1A; SOD-123	
D6	55.28	56.86	90	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	LQW2BHN33NJ03L Murata
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	Würth Elektronik	150080RS75000	2322077	710-150080RS75000		LED; Red; 20mA; 2V; 2.0x1.25mm	Replaces Multicomp 703-0107
Q1	15.56	41.05	90	SOT23	DMG3415U-7	Diodes Inc.	DMG3415U-7	1843688			MOSFET; P Channel; SOT23-WIDE	
Q2	18.48	56.86	0	SOT23	DMG3415U-7	Diodes Inc.	DMG3415U-7	1843688			MOSFET; P Channel; SOT23-WIDE	
Q3	25.27	53.21	270	SOT23	DMG3415U-7	Diodes Inc.	DMG3415U-7	1843688			MOSFET; P Channel; SOT23-WIDE	
Q4	32.89	41.69	0	SOT23	DMG3415U-7	Diodes Inc.	DMG3415U-7	1843688			MOSFET; P Channel; SOT23-WIDE	
Q5	33.05	49.15	180	SOT23	2N2222	Fairchild	MMBT2222A	9846700			Bipolar (BJT) Single Transistor, NPN, 40 V, 350 mW, 1 A	
R1	19.37	40.93	270	0805	100k	Multicomp	MC01W08051100K	9332405			Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW	100K ±1% 0805 RoyalOhm
R3	36.96	23.59	180	0805	100k	Multicomp	MC01W08051100K	9332405			Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW	100K ±1% 0805 RoyalOhm
R4	42.13	38.80	0	0805	100k	Multicomp	MC01W08051100K	9332405			Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW	100K ±1% 0805 RoyalOhm
R6	40.96	23.59	180	0805	100k	Multicomp	MC01W08051100K	9332405			Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW	100K ±1% 0805 RoyalOhm
R12	18.48	54.01	0	0805	100k	Multicomp	MC01W08051100K	9332405			Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW	100K ±1% 0805 RoyalOhm
R13	21.88	53.21	270	0805	100k	Multicomp	MC01W08051100K	9332405			Chip Resistor; Thick Film; 100k; 150V; 0805; 100mW	100K ±1% 0805 RoyalOhm
R2	48.32	46.86	0	0805	12K	Panasonic	ERJ6ENF1202V	2303661			Chip Resistor; Thick Film; 12k; 150V; 0805; 125mW	12K ±1% 0805 RoyalOhm
R5	16.95	29.85	0	0603	1K	Multicomp	MCWR06X1001FTL	2447272			Chip Resistor; Thick Film; 1k; 50V; 0603; 100mW	1K ±1% 0603 RoyalOhm
R8	12.76	29.85	180	0603	1K	Multicomp	MCWR06X1001FTL	2447272			Chip Resistor; Thick Film; 1k; 50V; 0603; 100mW	1K ±1% 0603 RoyalOhm
R10	29.56	12.35	270	0603	1K	Multicomp	MCWR06X1001FTL	2447272			Chip Resistor; Thick Film; 1k; 50V; 0603; 100mW	1K ±1% 0603 RoyalOhm
R14	34.42	23.18	270	0603	1K	Multicomp	MCWR06X1001FTL	2447272			Chip Resistor; Thick Film; 1k; 50V; 0603; 100mW	1K ±1% 0603 RoyalOhm
R7	35.37	13.72	0	0603	47k	Multicomp	MCWR06X4702FTL	2447376			Chip Resistor; Thick Film; 47k; 50V; 0603; 100mW	47K ±1% 0603 RoyalOhm
R9	8.00	59.98	180	0805	10 ohm	Multicomp	MC01W0805110R	9332421			Chip Resistor; Thick Film; 10 ohm; 150V; 0805; 100mW	10R ±1% 0805 RoyalOhm
R11	53.40	46.86	180	0805	30K	Panasonic	ERJ6EYJ303V	2323830			Chip Resistor; Thick Film; 30k; 150V; 0805; 125 mW	30K ±1% 0805 RoyalOhm
R15	32.83	39.18	180	0603	10K	Multicomp	MCWR06X1002FTL	2447230			Chip Resistor; Thick Film; 10k; 50V; 0603; 100mW	10K ±1% 0603 RoyalOhm
R16	42.26	40.80	0	0603	10K	Multicomp	MCWR06X1002FTL	2447230			Chip Resistor; Thick Film; 10k; 50V; 0603; 100mW	10K ±1% 0603 RoyalOhm
R17	32.83	23.18	270	0603	10K	Multicomp	MCWR06X1002FTL	2447230			Chip Resistor; Thick Film; 10k; 50V; 0603; 100mW	10K ±1% 0603 RoyalOhm
SW1	24.13	3.18	180	4.6x2.8	Tactile Switch	MCIPTG23K-V		1605470			Tactile Switch; 4.6x2.8mm; 50mA; 12V	
U1	29.69	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	
Press-In Nuts for Iridium 9603N:												
S1	16.27	16.50			Press-In Nut	McMaster-Carr	95117A411			95117A411	Press-In Nut; 2-56	
S2	41.27	16.50			Press-In Nut	McMaster-Carr	95117A411			95117A411	Press-In Nut; 2-56	
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	
CON2					SMA Jack	Johnson	142-0711-821	1019328			SMA End Launch Jack	
CON3					SMA Jack	Johnson	142-0711-821	1019328			SMA End Launch Jack	
RELAY1					DPDT Latching	Omron	G6SK-2 3VDC		653-G6SK-2DC3		DPDT Latching Relay (Dual Coil) 3VDC	
Iridium 9603N:												
9603N						Iridium	9603N				https://www.iridium.com/products/iridium-9603/	
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	
SMA 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.												