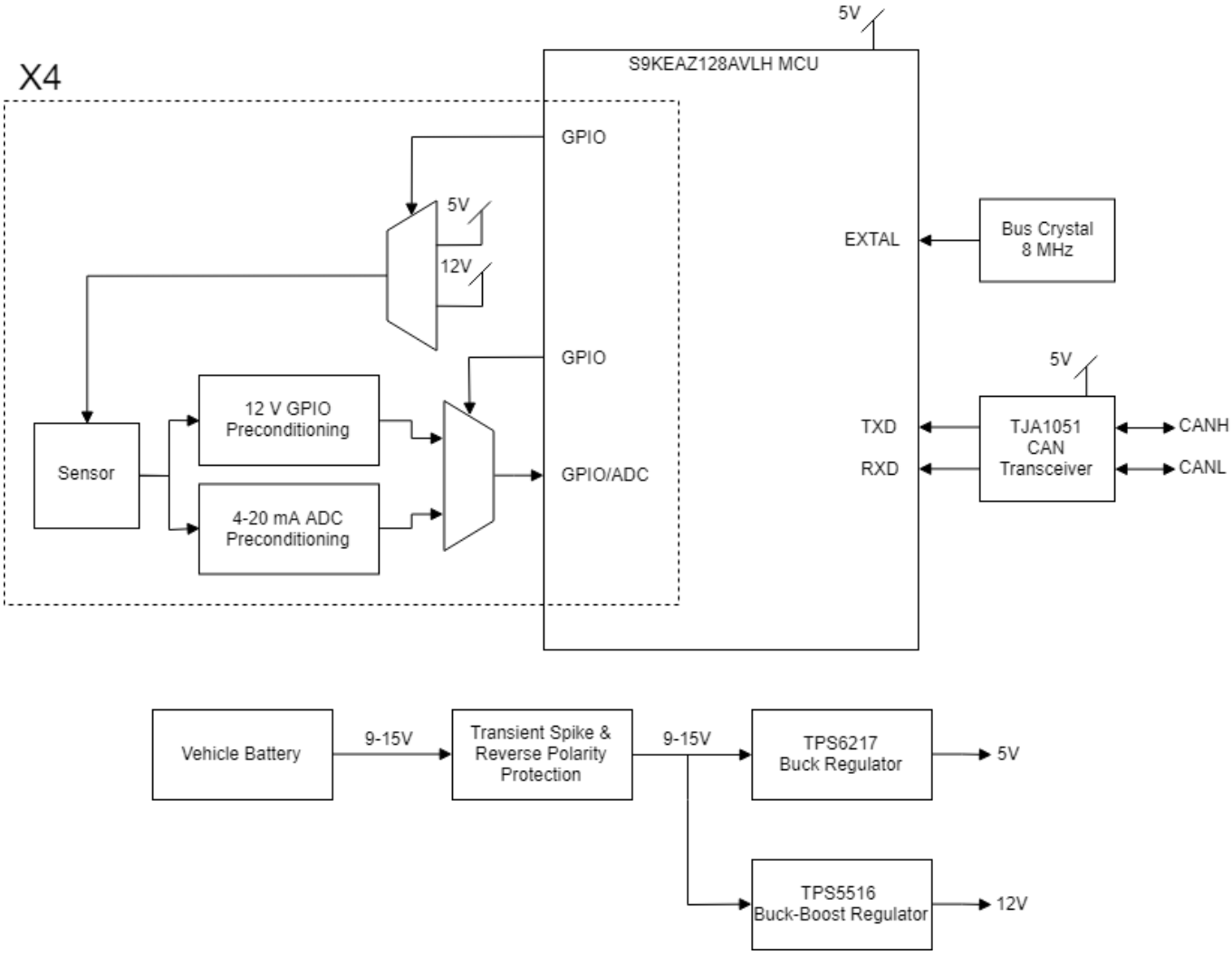
Formula SAE DAQ

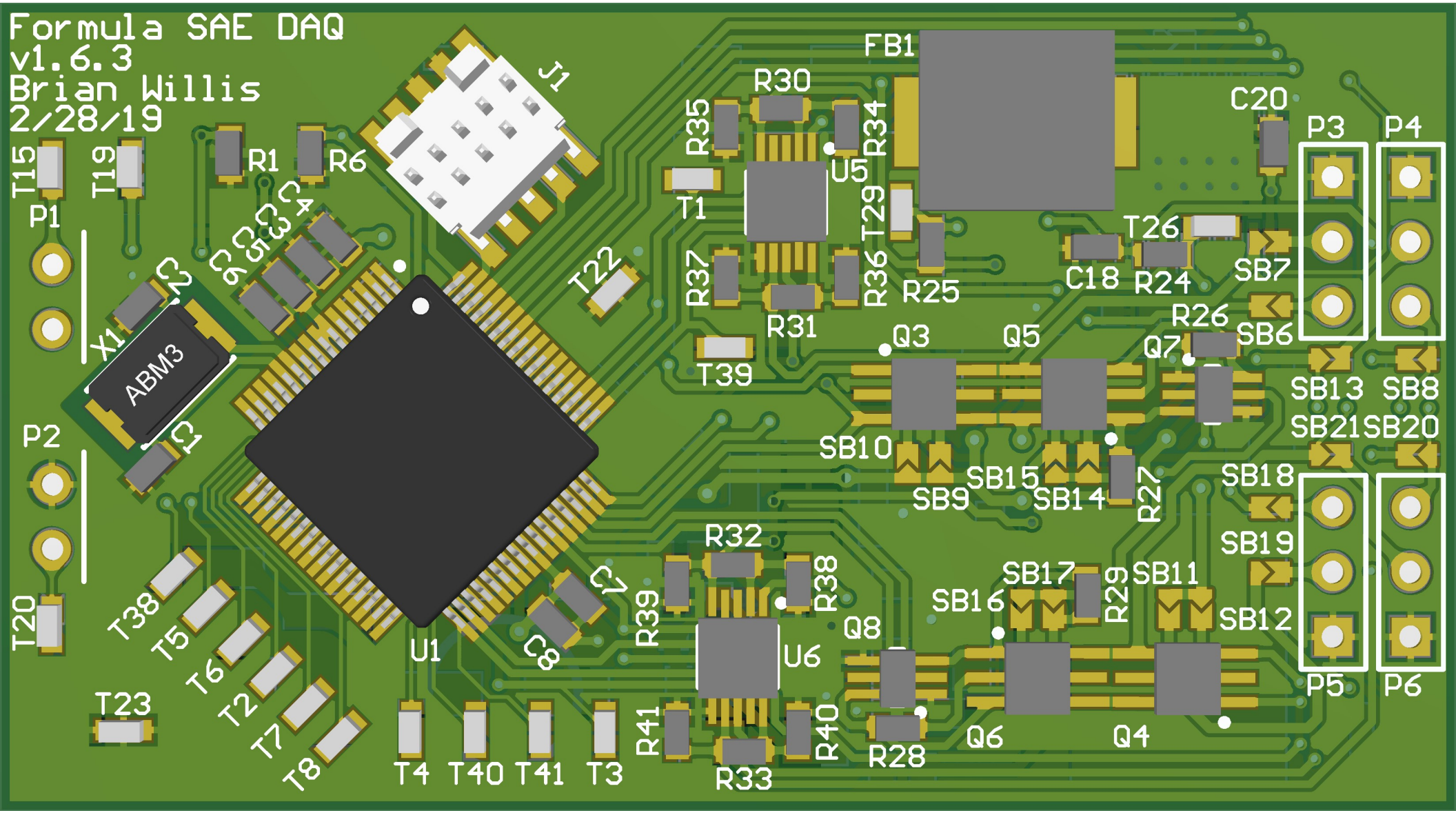
In-Progress EE Capstone Project with WWU Formula SAE Team

- Proposed the design of CAN-enabled embedded DAQ module on Formula-style racecar.
- Meet with Formula students to discuss needs and define/refine user requirements.
- Completed peer-reviewed schematic, PCB layout, and BOM for all hardware aspects of design.
- Creating comprehensive hardware and software package: PCB, casing, RTOS library, and operational manual.
- Implementing ISO 11898-2 high-speed CAN, IP67 protection, software configurability for 5 V 4-20 mA and 12 V digital sensors, and transient power spike/reverse polarity protection.



System-Level Diagram for DAQ

Build of Materials							
Comment	Description	Designator	Value	Footprint	LibRef	Qty	Supplier Link
Cap Semi	Capacitor (Semiconductor SIM Model)	C1, C2, C3, C4,	4pF, 1uF, 0.1uF	1608[0603]	Cap Semi	18	
TAJB106K025RNJ	Tantalum Capacitor, 10 uF, +/- 20%, 25	C12	10uF	KEMT-520-B-2_L	CMP-1664-00002-2	1	https://www.digikey.com/produ
EEEFK1H100P	Aluminum Electrolytic Capacitor, 10 uF,	C13	10uF	PNSC-FK-V-D_V	CMP-2000-06207-1	1	https://www.digikey.com/produ
CL31A106KBHNNNE	CAP CER 10UF 50V X5R 1206	C14	10uF	CAPC1206(3216)100_M	CMP-1037-00567-1	1	https://www.digikey.com/produ
B530C-13-F	Surface Mount Schottky Barrier Rectifier	D1		DIOD-SMC-2_V	CMP-1693-00001-3	1	https://www.digikey.com/produ
SMAZ5V6	Zener Diode, 1 W, 5.6 V, -65 to 150 deg	D2, D5		DIOD-SMA-2_V	CMP-2000-07092-1	2	https://www.digikey.com/produ
SMAZ36-13-F	DIODE ZENER 36V 1W SMA	D3		SMAZ36-13-F	SMAZ36-13-F	1	https://www.digikey.com/produ
ZTL431A	IC VREF SHUNT ADJ SOT23-3	D4		ZTL431AFTA	ZTL431AFTA	1	https://www.digikey.com/produ
SRP7028A-4R7M	FIXED IND FERRITE BEAD 4.7UH 5.5A 40	FB1		SRP7028A-4R7M	SRP7028A-4R7M	1	https://www.digikey.com/produ
FTSH-105-01-L-DV-K	10 pin 0.05" pitch header for JTAG	J1		FTSH-105-01-L-DV-K	JTAG 10 PIN HEADER	1	https://www.digikey.com/produ
Inductor	Inductor	L1	2.2uH	0806	Inductor	1	https://www.digikey.com/produ
99-9207-090-03	Binder 3 Lead Male Connector	P1, P2		2_PIN 99-9207-090-03	Header 3H	2	https://www.binder-
99-9207-090-03	Binder 3 Lead Male Connector	P3, P4, P5, P6		HDR1X3	Header 3H	4	https://www.binder-
SFT1342-TL-W	MOSFET P-CH 60V 12A TP-FA	Q1		SFT1342-TL-W	SFT1342-TL-W	1	https://www.digikey.com/produ
IRF840	N-Channel 500V 8A (Tc) 3.1W (Ta), 125V	Q2		IRF840SPBF	IRF840SPBF	1	https://www.digikey.com/produ
FDC6312P	P-Channel MOSFET, 20 V, 2.3 A, 115 mC	Q3, Q4, Q5, Q		SuperSOT-6	FDC6312P	4	https://www.digikey.com/produ
DMN63D8LDW-7	N-Channel MOSFET, 30 V, 220 mA, 2.8 C	Q7, Q8		SOT363	DMN63D8LDW-7	2	https://www.digikey.com/produ
Res3	Resistor	R1, R2, R3, R4,	20k, 60.4, 10k,	J1-0603	Res3	40	
CRCW25122R00FKEG	8M66 1W 1% 2512 (6432 Metric) SMD	R17	2	RESC2512(6432)_N	CMP-1018-00955-1	1	https://www.digikey.com/produ
SOLDER_BRIDGE_0603	Solder bridge for circuit separation, 060	SB1, SB3, SB4,		SOLDER_BRIDGE_0603	SOLDER_BRIDGE_0603	20	
TAP	Test Point, TH, Miniature, Black	T1, T2, T3, T4,		TAP_0603	TAP	41	https://www.digikey.com/produ
S9KEAZ128AVLH	ARM Cortex-M0+ Kinetis KEAZ Microco	U1		NXP-LQFP64_A-160_M	S9KEAZ128AVLH-64	1	https://www.digikey.com/produ
TJA1051T/3,118	High-Speed CAN Transceiver, 3 to 5 V, 8	U2		NXP-SOIC-8_L	CMP-2000-07245-1	1	https://www.digikey.com/produ
TPS55165QPWPRQ1	Buck-boost DC-DC converter, 36 V, 1 A,	U3		PWP20-3005X2005TP	TPS55165QPWPRQ1	1	https://www.digikey.com/produ
TPS62173DSGR	Buck Step Down Regulator with 3 to 17	U4		DSG0008A_V	CMP-0323-00320-3	1	https://www.digikey.com/produ
NLAS4684MR2G		U5, U6		846B-03	NLAS4684MR2G	2	https://www.digikey.com/produ
8MHz	Miniature Ceramic Crystal, 8 MHz, +/- 5	X1		ABRA-ABM3_V	CMP-2000-05729-1	1	https://www.digikey.com/produ


Formula SAE DAQ
v1.6.3
Brian Willis
2/28/19
J1
FB1
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R35
R34
U5
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R36
R31
R25
T39
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C20
P3
P4
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C18
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SB7
R26
SB6
Q3
Q5
Q7
SB13
SB8
SB21
SB20
SB10
SB15
SB9
SB14
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SB18
SB19
SB17
SB11
SB16
R29
SB12
Q8
R32
R39
R38
U6
R41
R40
R28
R33
Q6
Q4
P5
P6
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R6
P1
X1
ABM3
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C5
C6
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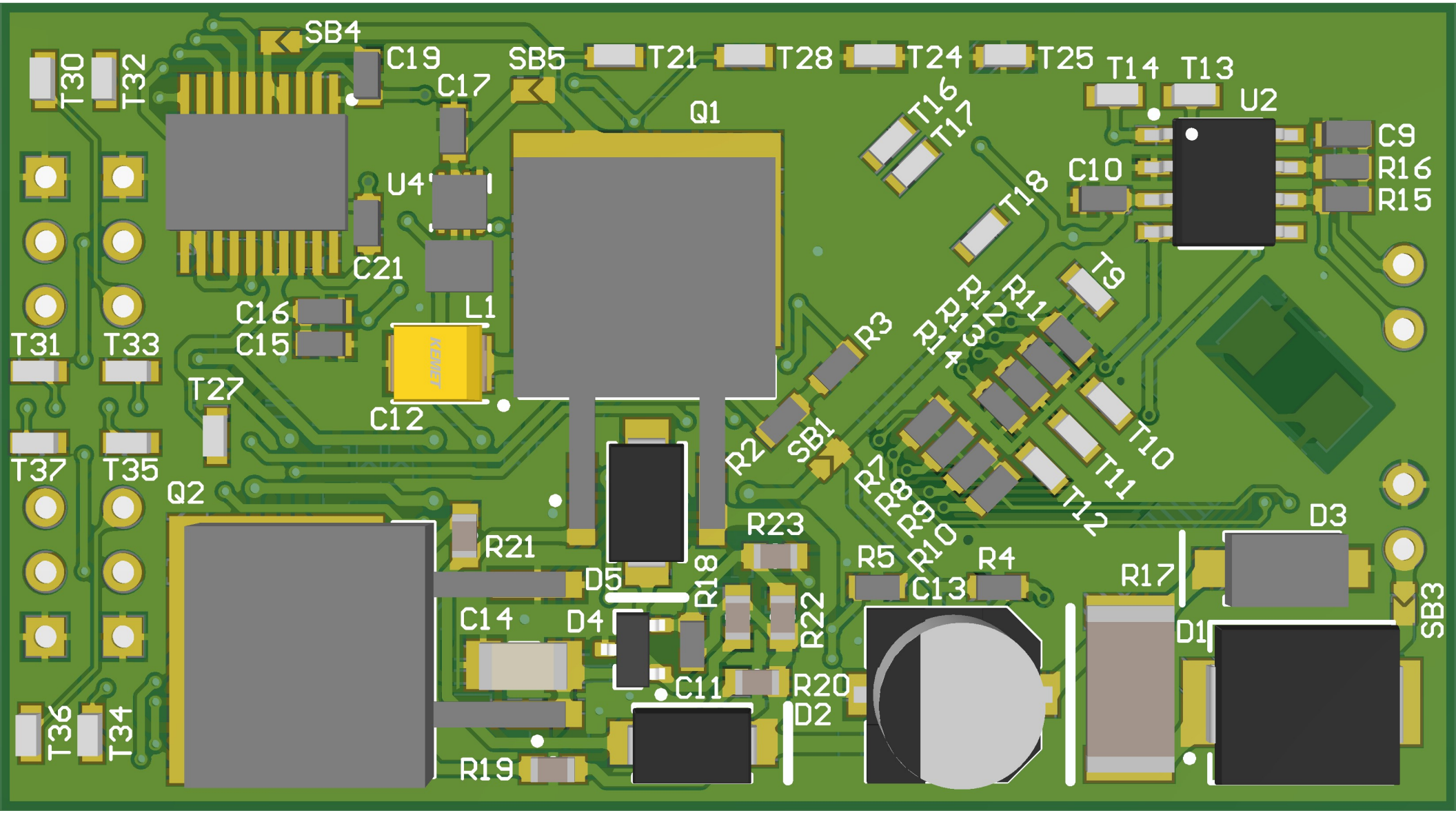
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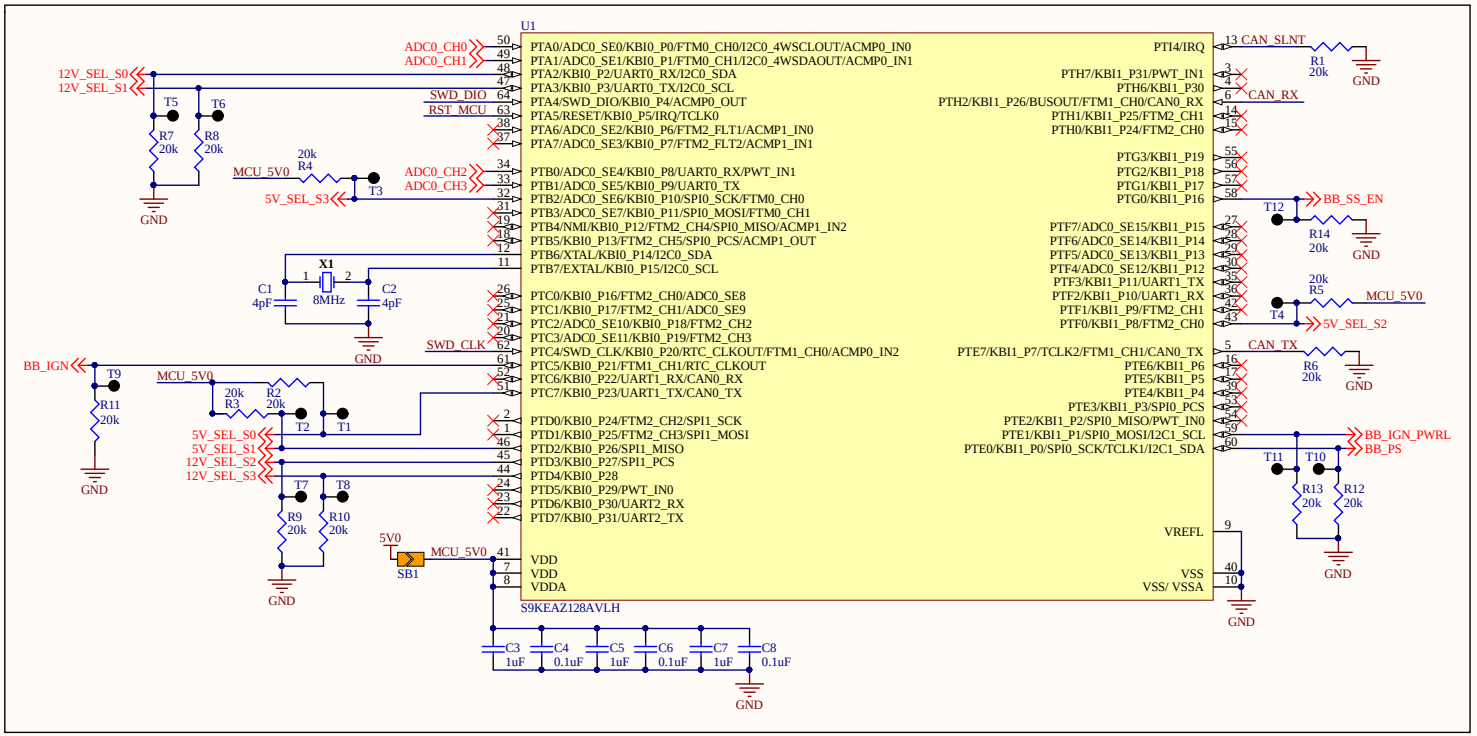
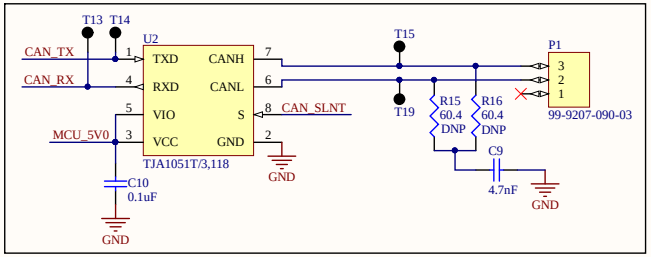
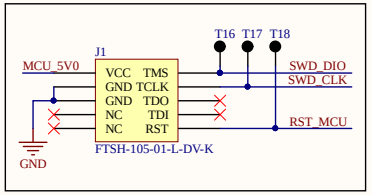
MCU



CAN Transceiver



SWD



Project Title: **Formula SAE CAN-Enabled DAQ**			
Sheet Title: **MCU**			
Engineer: **Brian Willis**			
Draftsman: **Brian Willis**			
Date: **2/22/2019**	Size: **B**	Revision: **1.6.3**	Sheet: **1** of **3**

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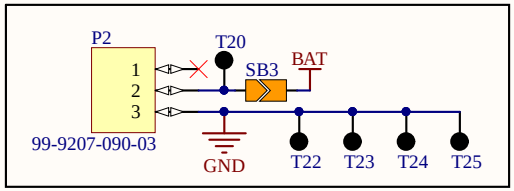
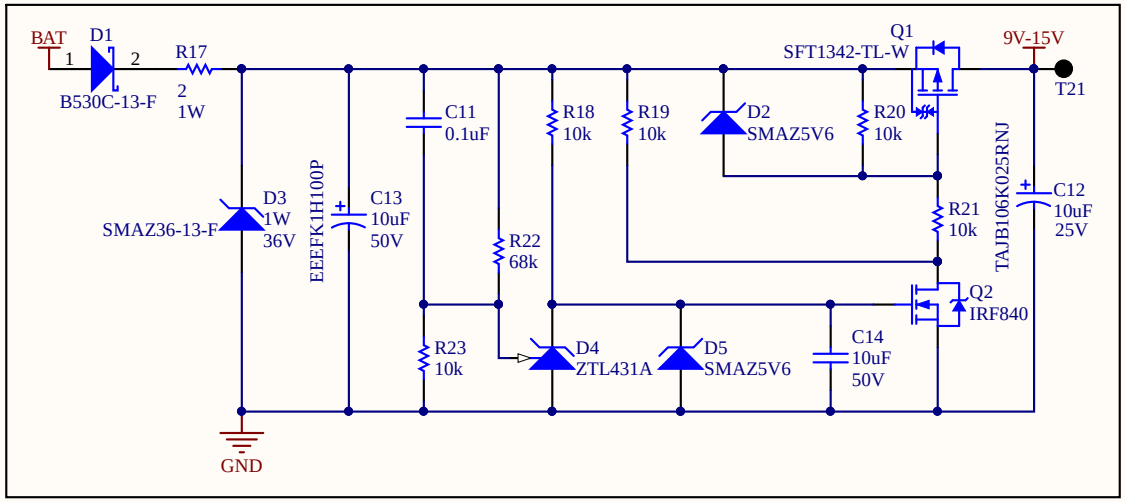
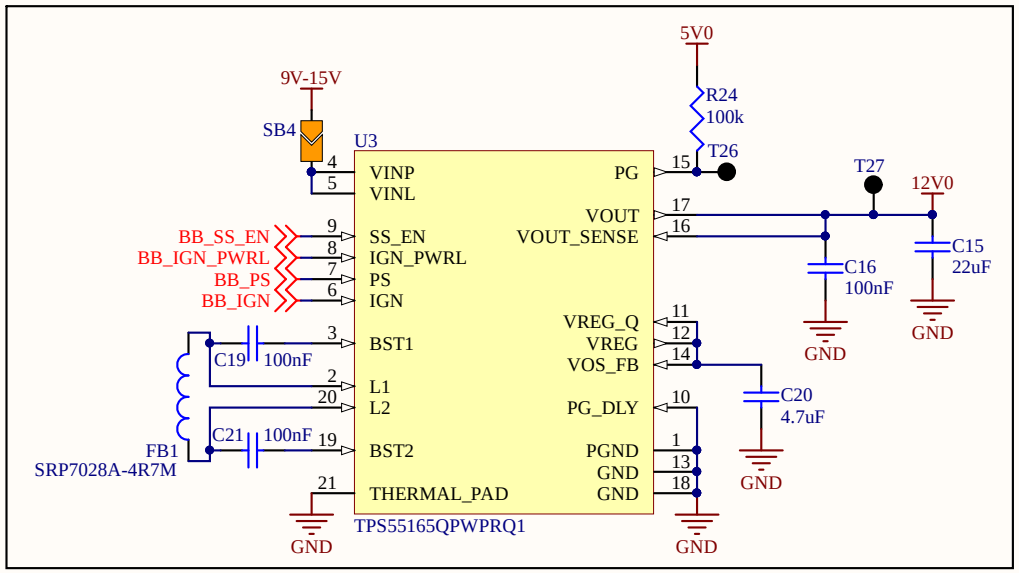
Vehicle Battery



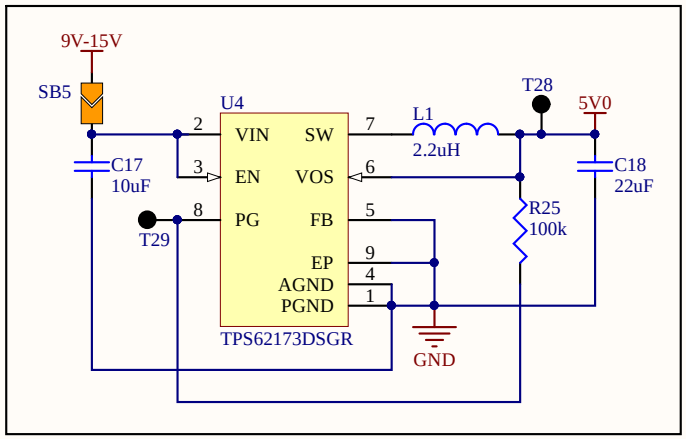
Transient Spike & Reverse Polarity Protection



12V Buck-Boost Regulator



5V Buck Regulator



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Sheet Title: **Power Input**			
Engineer: **Brian Willis**			
Draftsman: **Brian Willis**			
Date: **2/22/2019**	Size: **A**	Revision: **1.6.3**	Sheet: **2** of **3**

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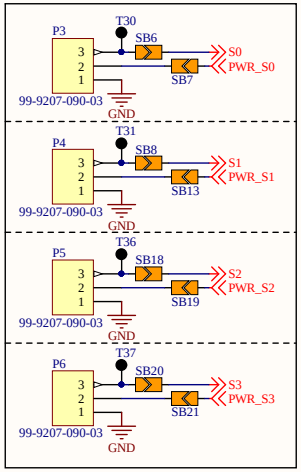
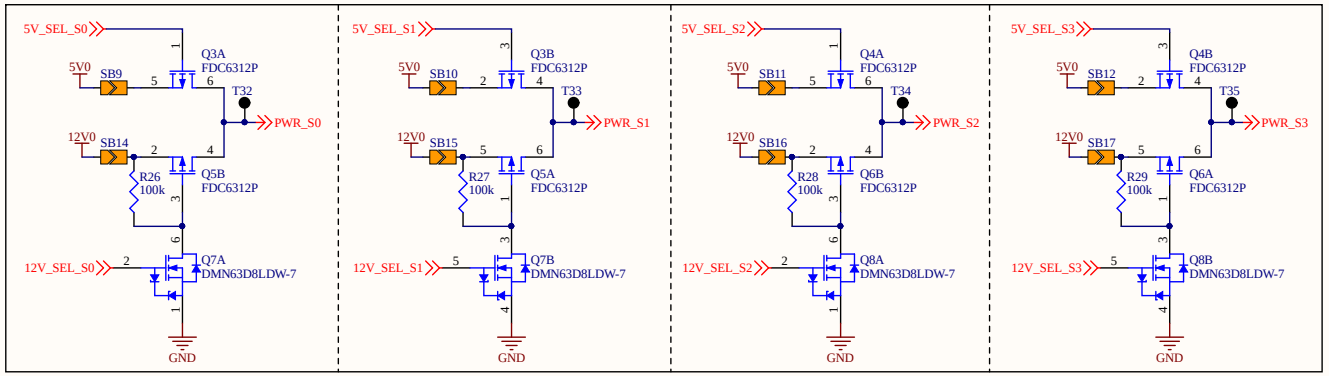
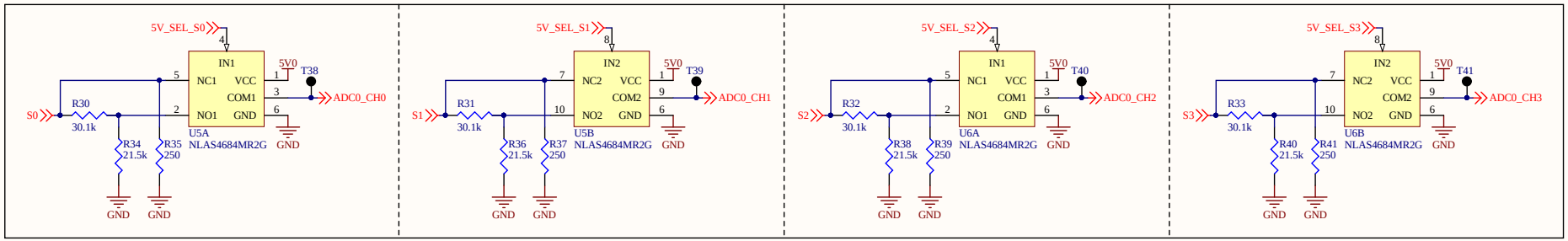
Sensors



Sensor Power Selection



Sensor Preconditioning



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Sheet Title: **Sensors**			
Engineer: **Brian Willis**			
Draftsman: **Brian Willis**			
Date: **2/22/2019**	Size: **B**	Revision: **1.6.3**	Sheet: **3** of **3**

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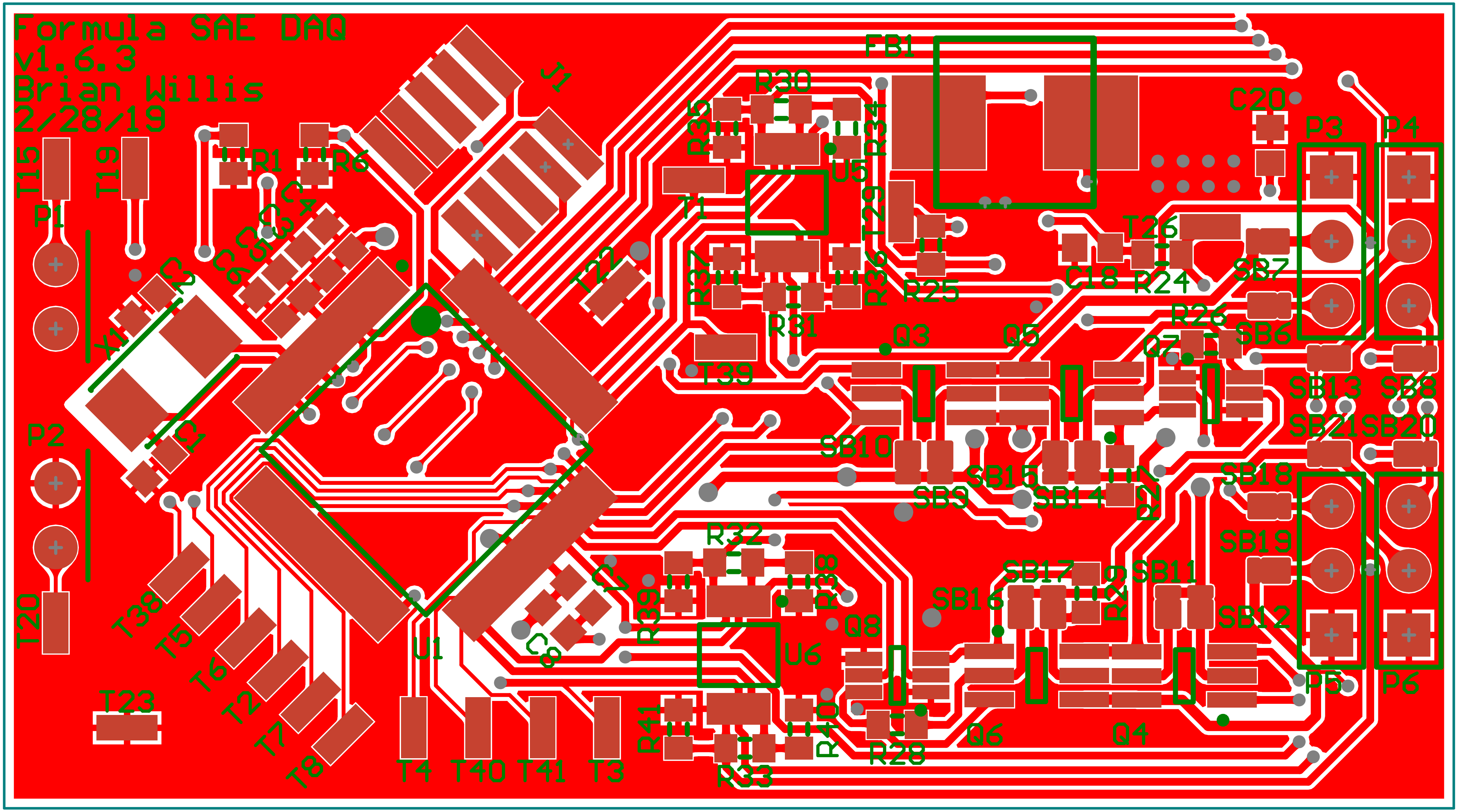

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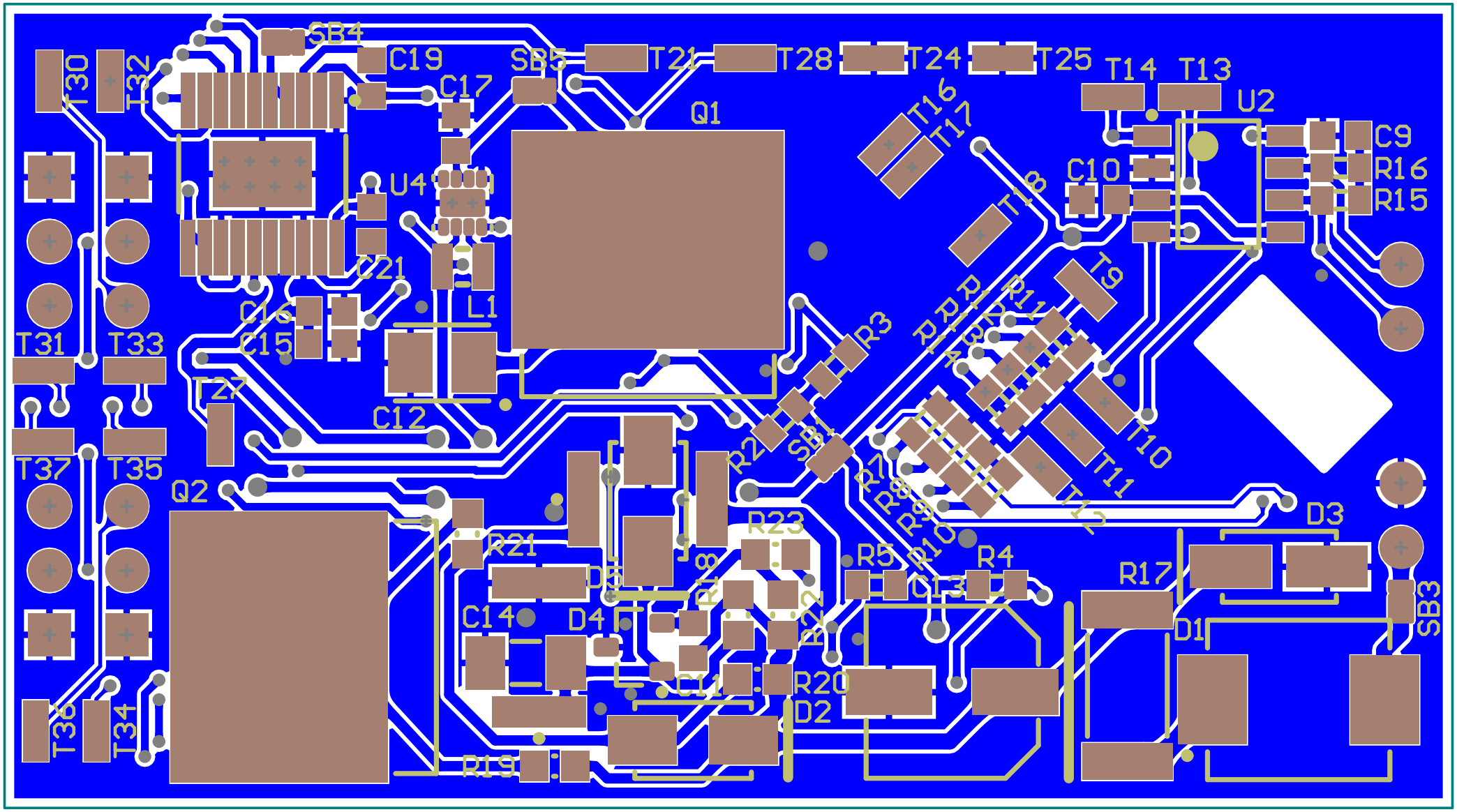
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