

CURRENT PSU 5V  
AMU-S23-V00-CURRENTPSU5V.SchDoc

PSU 3V5  
AMU-S03-V00-PSU3V5.SchDoc

PSU 3V3  
AMU-S02-V00-PSU3V3.SchDoc

Microcontroller  
AMU-S04-V00-Microcontroller.SchDoc

TSAL Control  
AMU-S12-V00-TSALControl.SchDoc

MX120G Interface  
AMU-S27-V00-MX120G-Interface.SchDoc

BSPD[1..7]

BSPD System  
AMU-S15-V00-BSPDSystem.SchDoc

PEDAL IN

HV IN  
HV OUT

BSPD Shutdown Relay  
AMU-S13-V00-BSPDshutdownRelay.SchDoc

SHDN RELAY

TSAL SIGNALS

BSPD Shutdown Relay  
AMU-S13-V00-BSPDshutdownRelay.SchDoc

PEDAL IN

SHDN DETECT BSPD

VSEL LEM  
VSEL ALARM  
5KW ALERT  
5KW CALIBRATION  
CURRENT VLTG

CURRENT Current Interface  
AMU-S18-V00-CURRENTCurrentInterface.SchDoc

SHDN SIGNAL IN

PEDAL IN

VSEL LEM  
VSEL ALARM  
5KW ALERT  
5KW CALIBRATION  
CURRENT VLTG

SIM TRIG

SHDN DETECT BSPD

AMS Shutdown  
AMU-S07-V00-AMSShutdown.SchDoc

SIM TRIG

SIM TRIG

ALM CTRL

12V Protection  
AMU-S02-V00-12VProtection.schdoc

SIG

SIG

USB-C  
CAN MAIN

USB-C  
CAN MAIN

VREF

VREF

CAN ACC

CAN ACC

CHAIN IN

CHAIN IN

IDC ALARM  
BMS CTRL

AMS IDC loops  
AMU-S08-V00-AMSIDCloops.SchDoc

CHAIN OUT

CHAIN OUT

PROFETS

AMS Contactor Interface  
AMU-S10-V00-AMSContactorInterface.SchDoc

CONTACTOR INTERFACE

CONTACTOR INTERFACE

SHDN IMD

DAUGHTER Shutdown  
AMU-S26-V00-DAUGHTERShutdown.SchDoc

IMD OUT

IMD OUT

IMD OUT

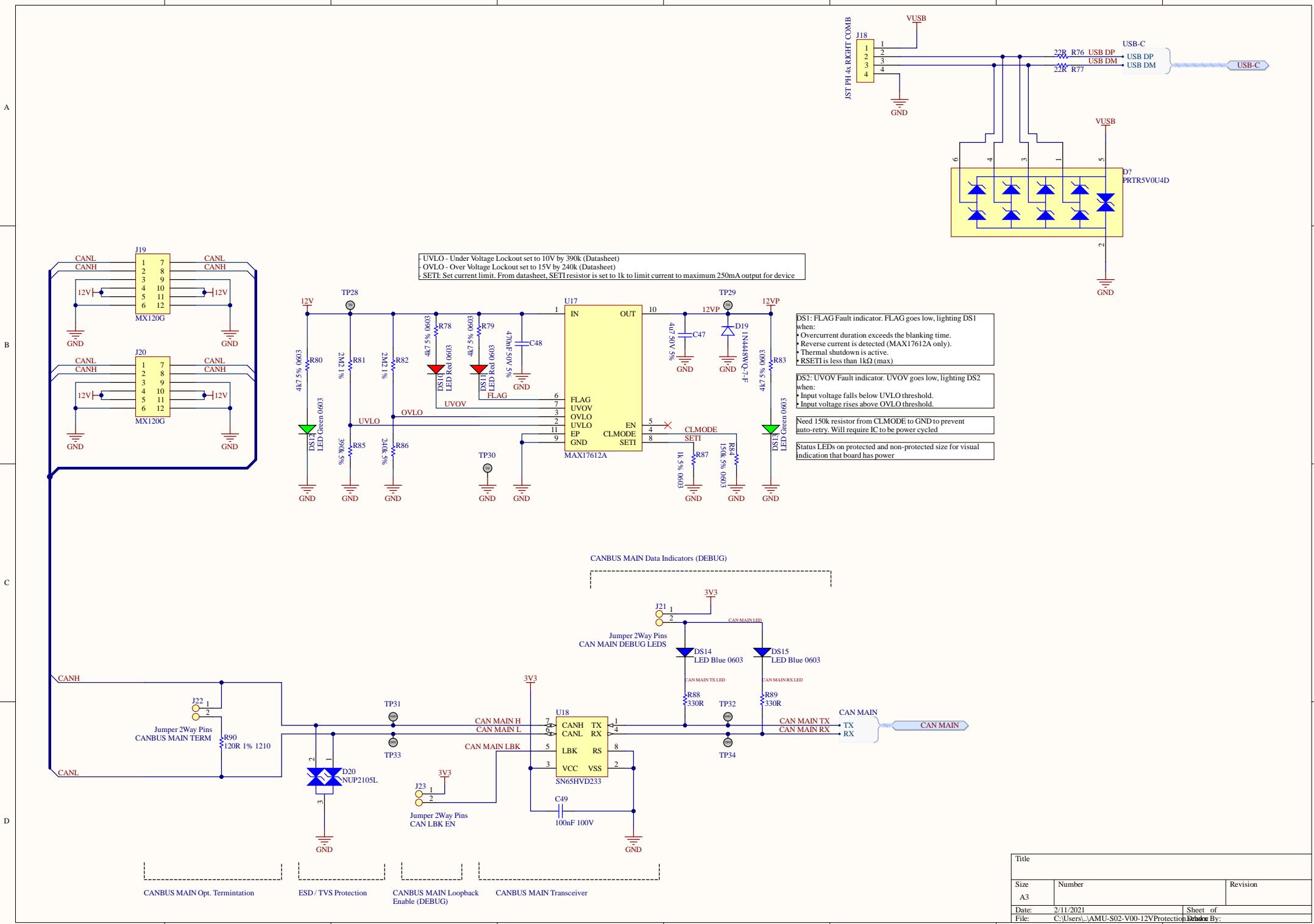
SHDN IMD

SHDN DETECT IMD

SHDN DETECT IMD

Title  
AMU Master Board 2021

Size	Number	Revision
A3	1	
Date:	2/11/2021	Sheet of
File:	C:\Users...\AMU-S01-V00-Master.SchDoc	Drawn By:



A

A

B

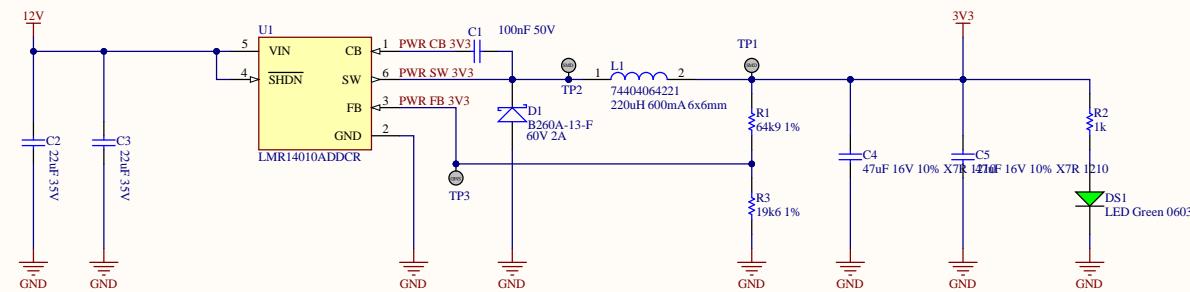
B

C

C

D

D



## Revision History:

Rev Date	Description

Sheet Title: Power Supply (20-40V to 3v3 @ 0.1-0.6A)

Project: AMU 2020 (Sourced from BMS 2020)

QUT Motorsport  
O-120, Gardens Point2 George Street  
Brisbane, QLD 4000

Australia

Sheet 3 of 25

Print Date: 11/02/2021 Print Time: 1:45:12 PM File Name: AMU-S02-V00-PSU3V3.SchDoc

A

A

B

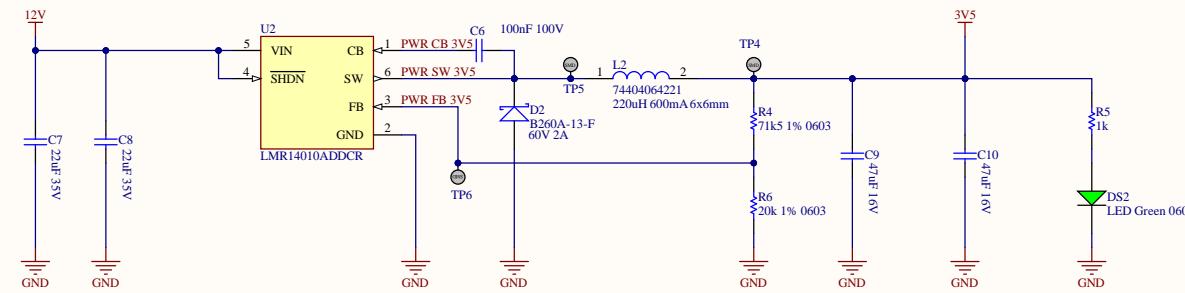
B

C

C

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D



## Revision History:

Rev Date	Description

Sheet Title: Power Supply (20-40V to 3v3 @ 0.1-0.6A)

Project: AMU 2020 (Sourced from BMS 2020)

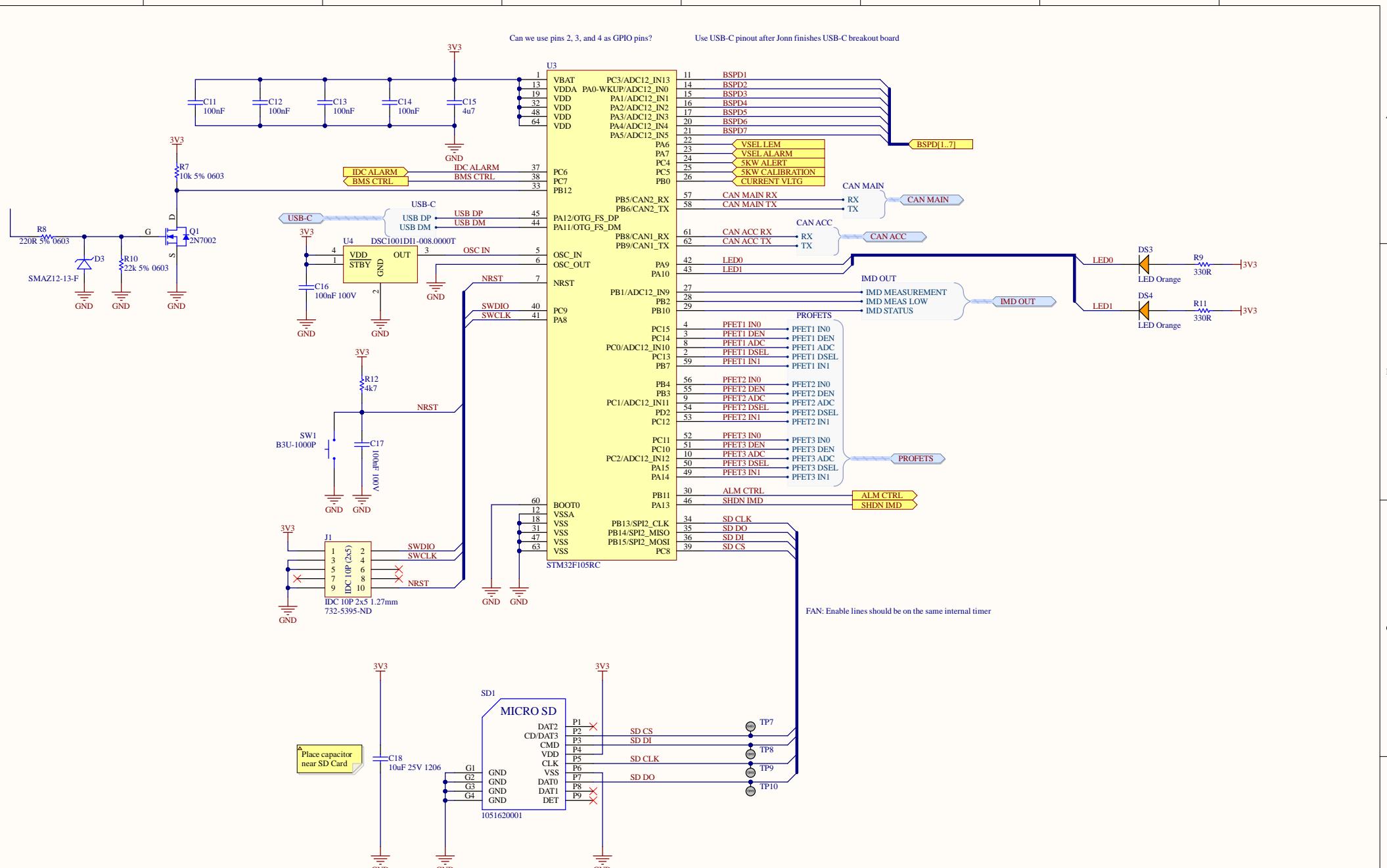
QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3 Number: 3 Version: 00 Revision: \*

Drawn By: Jonn Dillon Sheet 4 of 25

Print Date: 11/02/2021 Print Time: 1:45:12 PM File Name: AMU-S03-V00-PSU3V5.SchDoc



## Revision History:

Rev	Date	Description

## Sheet Title: AMU Microcontroller

Project: AMU 2020

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Print Date: 11/02/2021 Print Time: 1:45:12 PM

File Name: AMU-S04-V00-Microcontroller.SchDoc

A

A

B

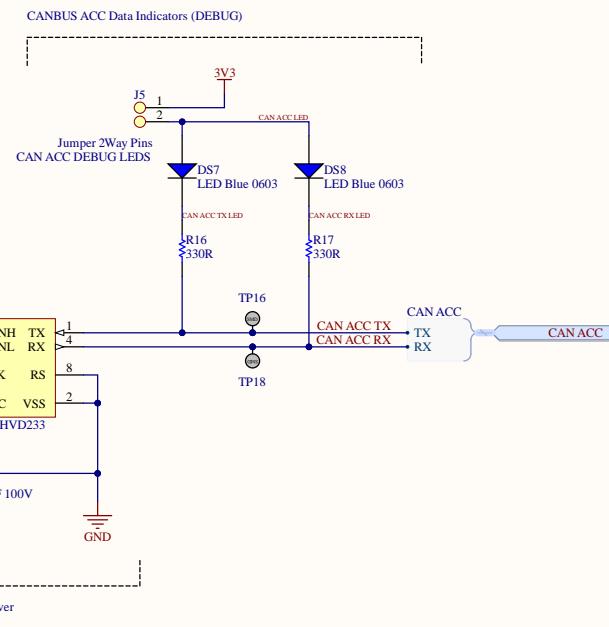
B

C

C

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D



CANBUS ACC Opt. Termination

ESD / TVS Protection

CANBUS ACC Loopback  
Enable (DEBUG)

CANBUS ACC Transceiver

Sheet Title: Isolated CANBUS4 3V3

Project: AMU 2020 (Sourced from BMS 2020)

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia

## Revision History:

Rev Date	Description

Size: A3 Number: 6 Version: 01

Drawn By: Jonn Dillon Revision: 01

Print Date: 11/02/2021 Print Time: 1:45:13 PM Sheet: 6 of 25

File Name: AMU-S06-V00-CANACC.SchDoc

A

A

B

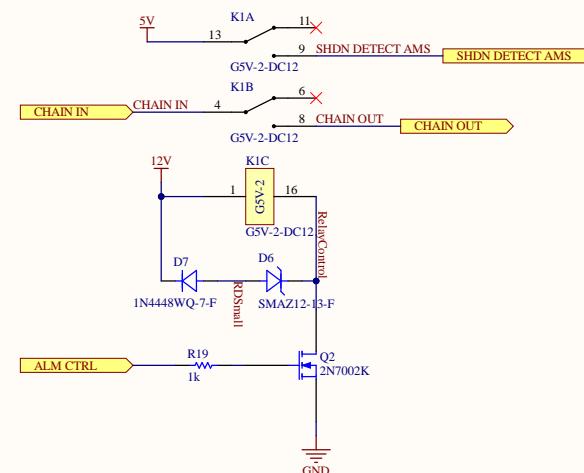
B

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D



## Revision History:

Rev	Date	Description

Sheet Title: Alarm Relay

Project: AMU 2020

Size: A3 Number: 7

Version: 00 Revision: \*

Drawn By: Thomas Benedetti

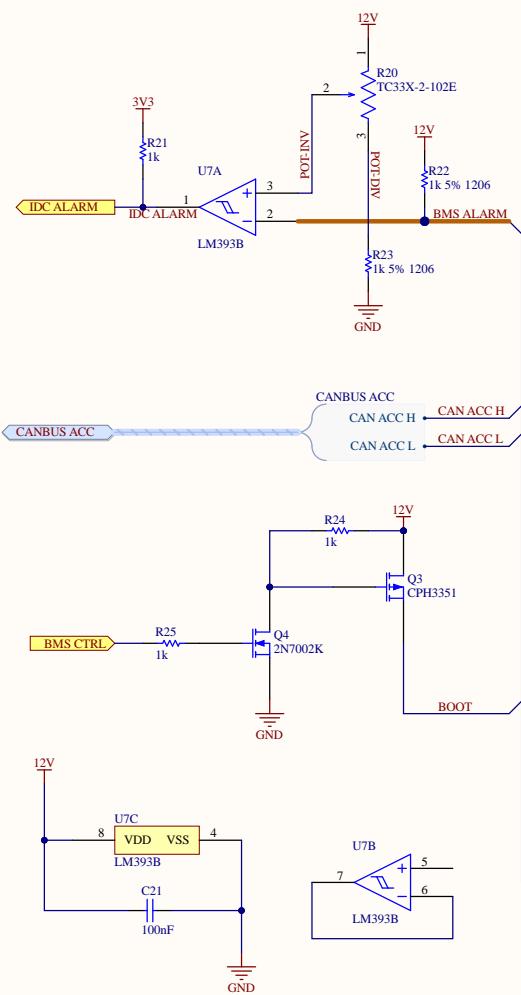
Sheet 7 of 25

Print Date: 11/02/2021 Print Time: 1:45:13 PM

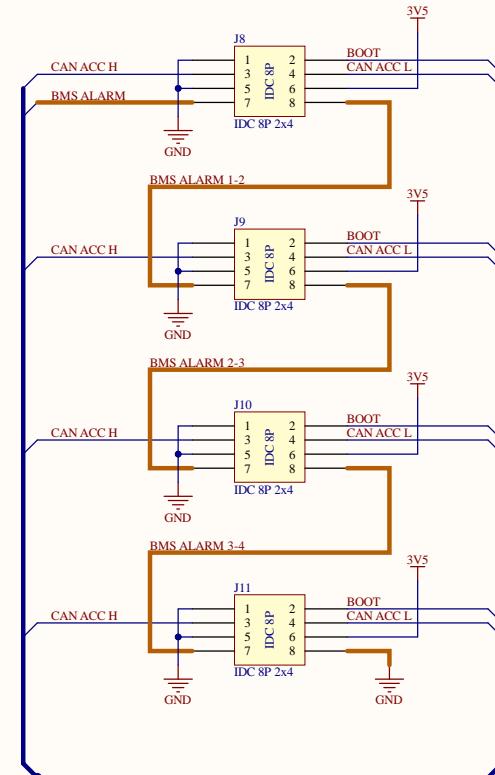
QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



A



B



C

Revision History:	
Rev	Date

Sheet Title: BMS Interface

Project: AMU 2020

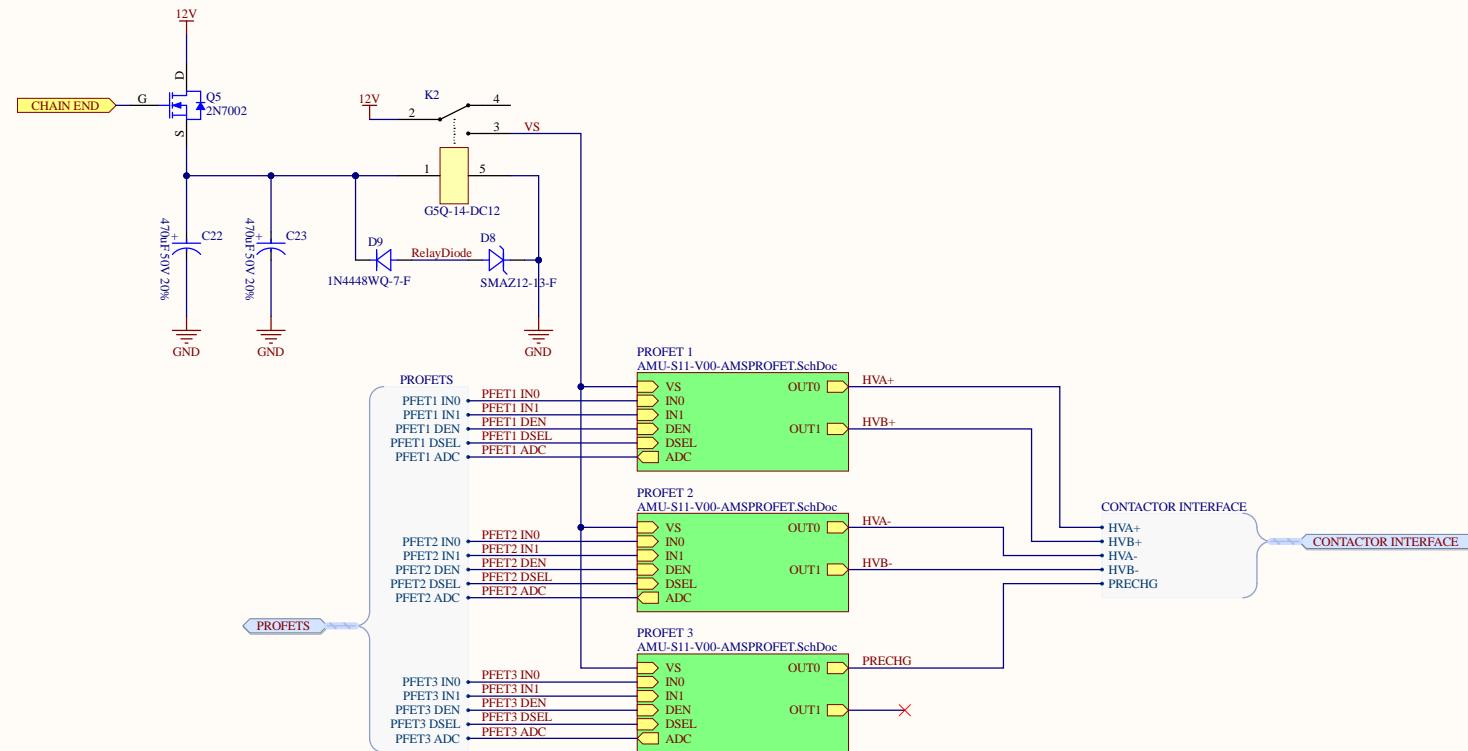
Size: A3 Number: 8

Drawn By: Thomas Benedetti

Print Date: 11/02/2021 Print Time: 1:45:13 PM

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia





## Revision History:

Rev	Date	Description

## Sheet Title: Contactor Interface

Project: AMU 2020

Size: A3 Number: 11 Version: 00  
 Drawn By: Thomas Benedetti Revision: \* Sheet 9 of 25  
 Print Date: 11/02/2021 Print Time: 1:45:13 PM File Name: AMU-S10-V00-AMSContactorInterface.SchDoc



A

A

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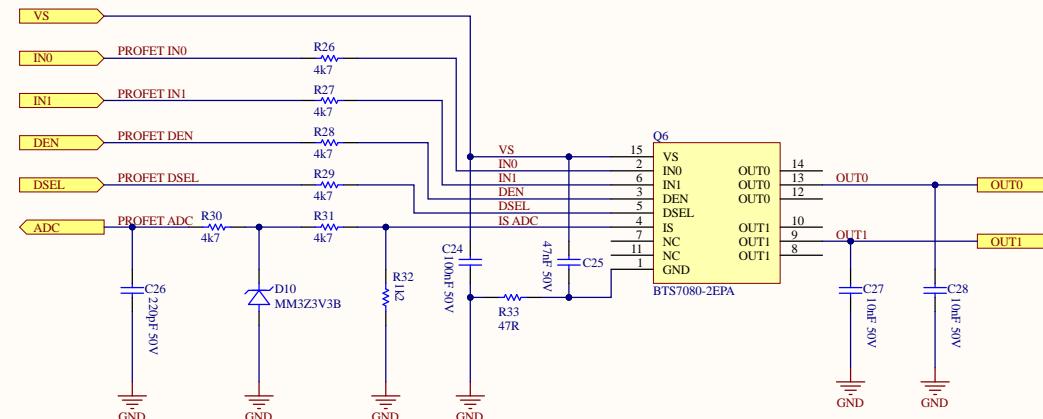
B

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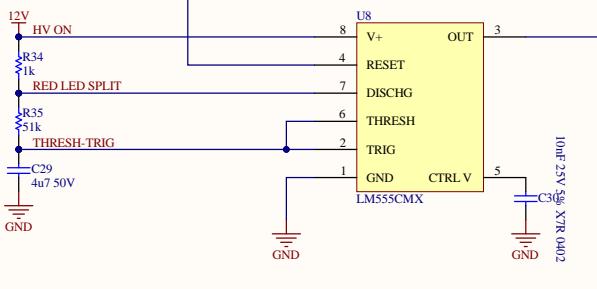
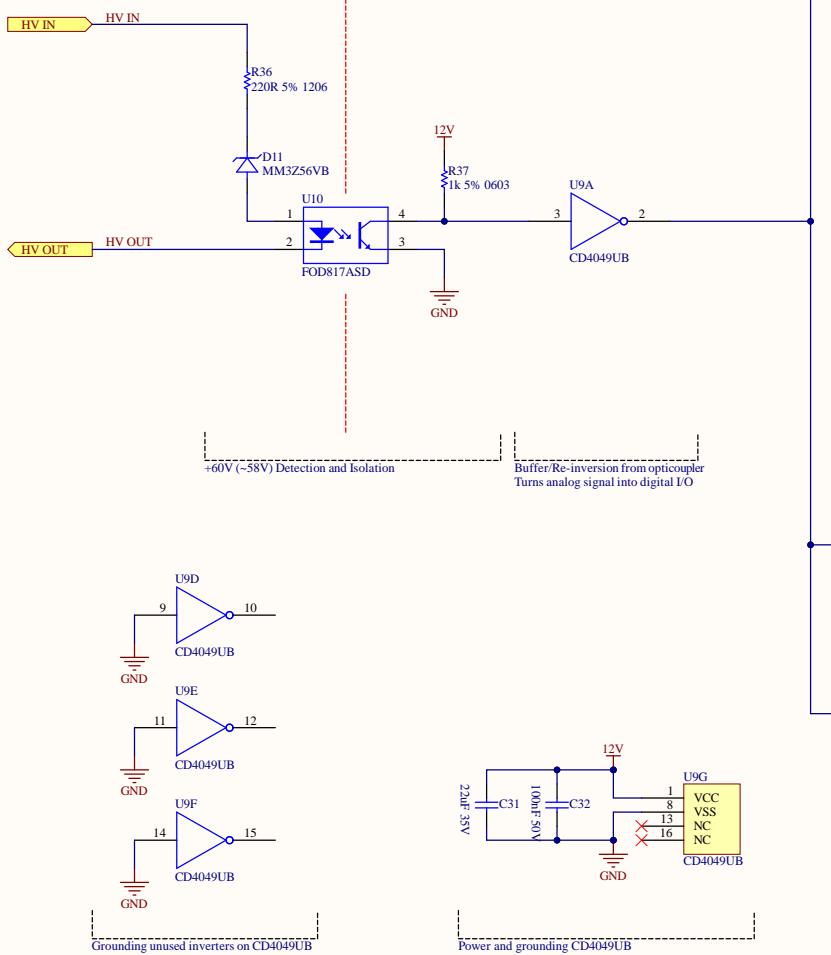
## Revision History:

Rev	Date	Description

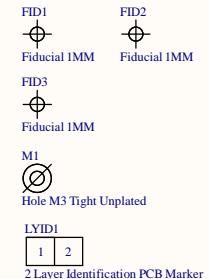
Sheet Title: *	Project: #####	QUT Motorsport O-120, Gardens Point 2 George Street Brisbane, QLD 4000 Australia	<b>QUT MOTORSPORT</b>
Size: A3	Number: 12	Version: 00	
Drawn By: *	Sheet 10 of 25	Revision: *	
Print Date: 11/02/2021	Print Time: 1:45:13 PM	File Name: AMU-S11-V00-AMSPROFET.schDoc	

A

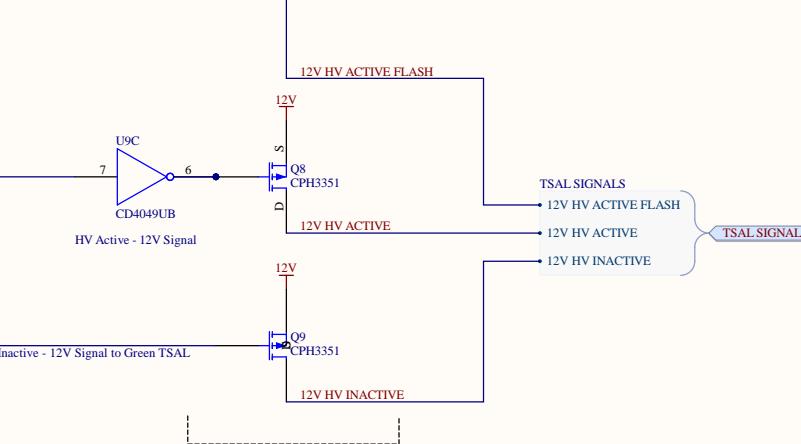
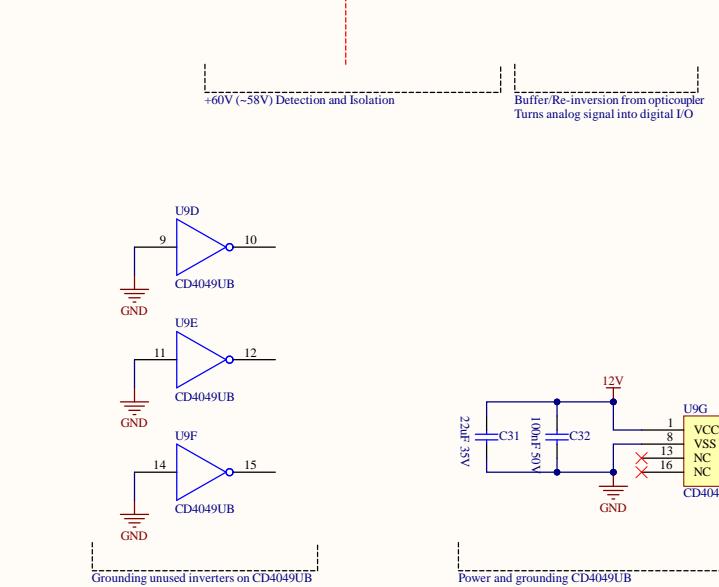
Value experimentation required to get consistent activation at 60V



HV Active - Red TSAL Flashing functionality circuit



B



C

## Revision History:

Rev	Date	Description

## Sheet Title: TSAL Control

Project: TSAL

Size: A3 Number: \*

Version: 00 Revision: \*

Drawn By: Tom Benedetti Sheet 11 of 25

Print Date: 11/02/2021 Print Time: 1:45:13 PM

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia

File Name: AMU-S12-V00-TSALControl.SchDoc

A

A

B

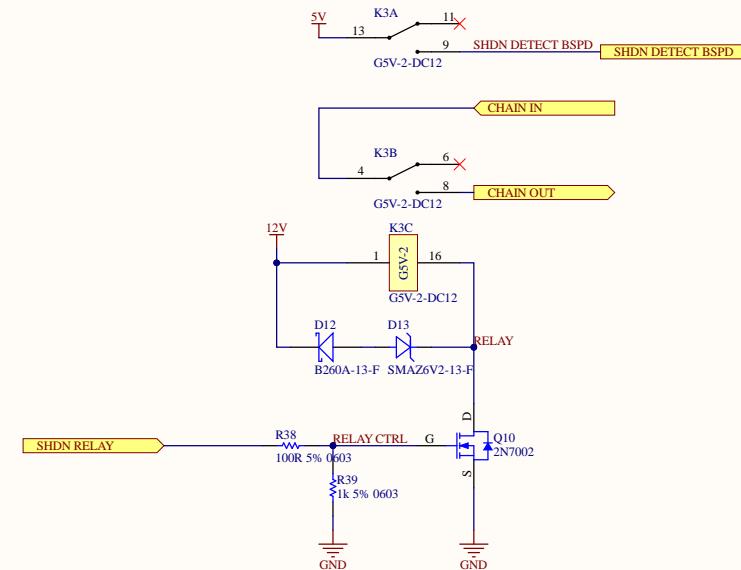
B

C

C

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D



## Revision History:

Rev	Date	Description

## Sheet Title: Shutdown Relay

Project:

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3

Number: 9

Version:

01

Drawn By: Jonn Dillon

Sheet 12 of 25

Print Date: 11/02/2021

File Name: AMU-S13-V00-BSPDShutdownRelay.SchDoc

A

A

B

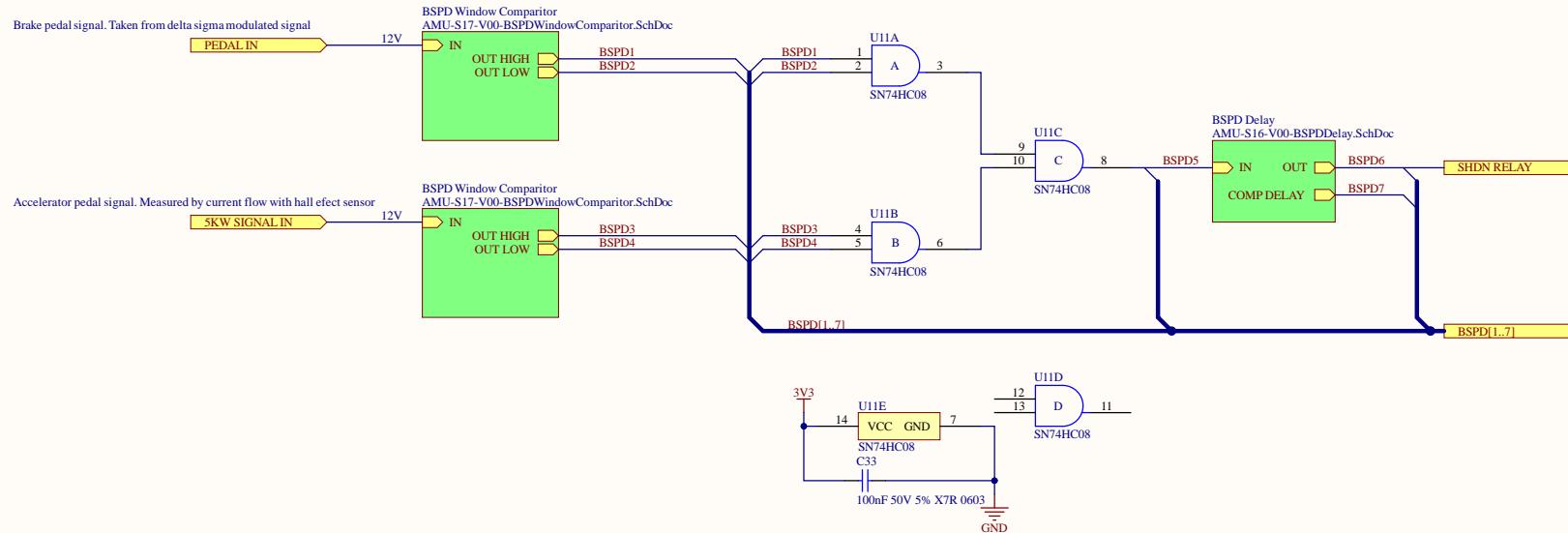
B

C

C

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D



## Revision History:

Rev	Date	Description

Sheet Title: **BSPD System**

Project:

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3

Number: 2

Version:

01

Drawn By: Jonn Dillon

Sheet 13 of 25

Print Date: 11/02/2021

File Name: AMU-S15-V00-BSPDSystem.SchDoc

A

A

B

B

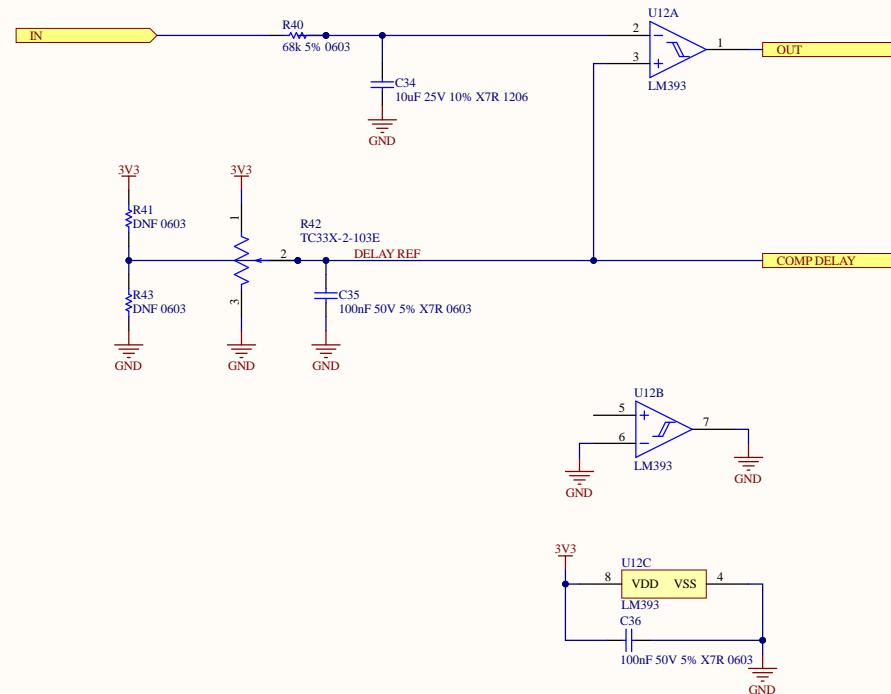
C

C

D

D

RC Charging Circuit:  
 50% Charge Voltage Wise at 500ms (to compare at 2V5)  
 $500\text{ms} = 0.7T = 0.7 * R * C$   
 $C = 10\mu\text{F} = 0.01\text{F}$   
 $\gg R = 71\text{k}\Omega$



## Revision History:

Rev	Date	Description

Sheet Title: RC Charging Delay

Project:

QUT Motorsport  
 O-120, Gardens Point  
 2 George Street  
 Brisbane, QLD 4000  
 Australia



Size: A3

Number: 4

Version:

01

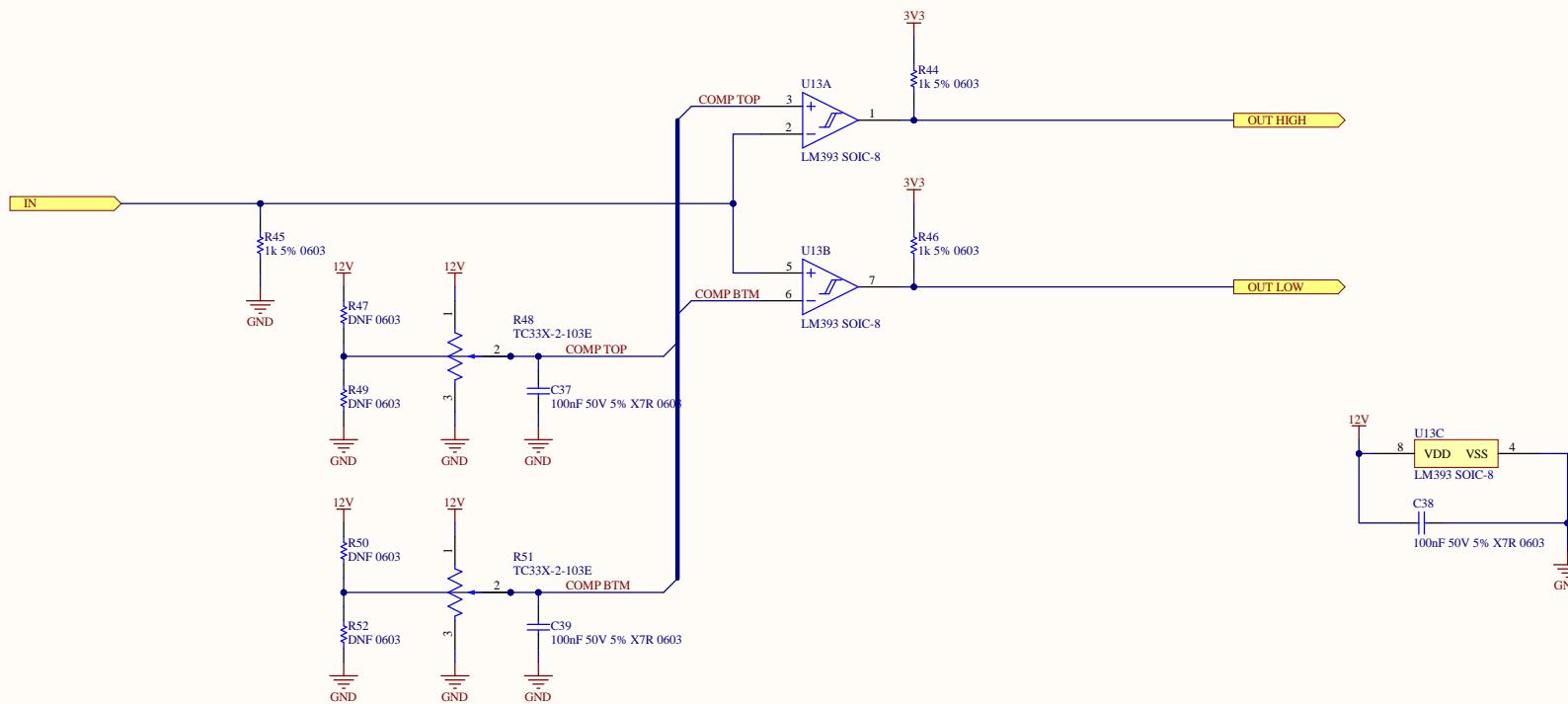
Drawn By: Jonn Dillon

Sheet 14 of 25

Print Date: 11/02/2021

Print Time: 1:45:14 PM

File Name: AMU-S16-V00-BSPDDelay.SchDoc



## Revision History:

Rev	Date	Description

## Sheet Title: Window Comparator

Project:

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3

Number: 3

Version:

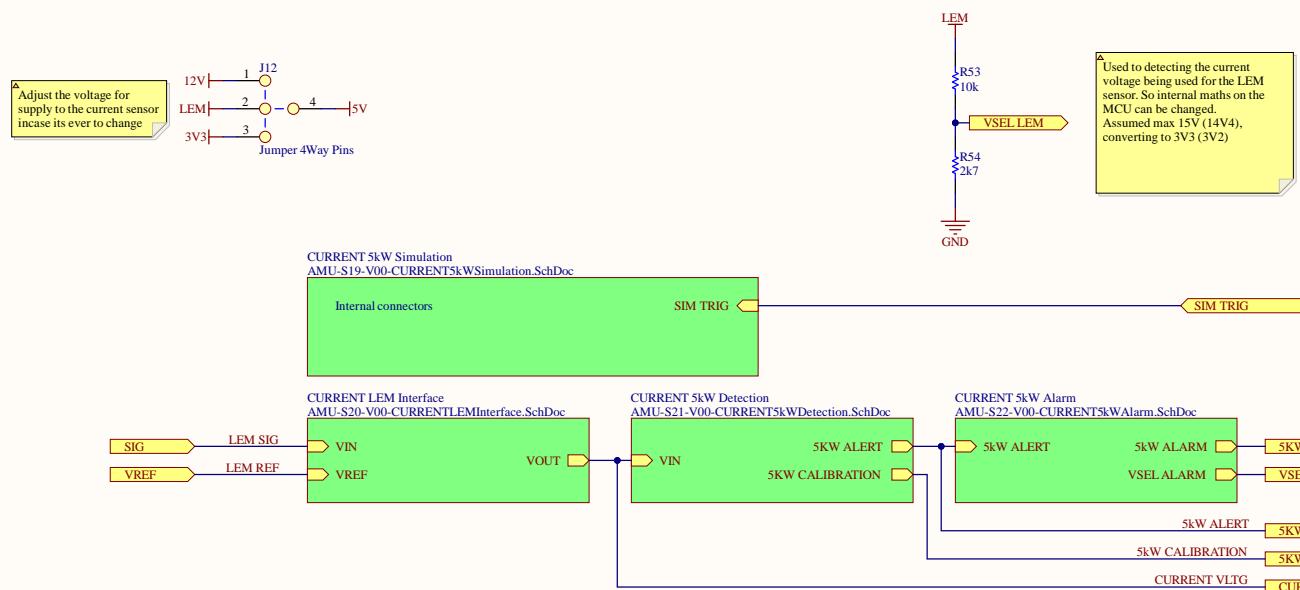
01

Drawn By: Jonn Dillon

Sheet 15 of 25

Print Date: 11/02/2021

File Name: AMU-S17-V00-BSPDWindowComparator.SchDoc



## Revision History:

Rev Date	Description

## Sheet Title: Current Sensor Circuitry

Project: Shutdown Current Board 2020

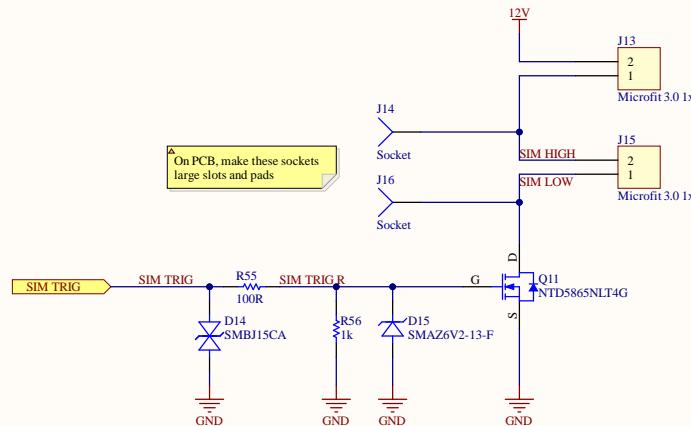
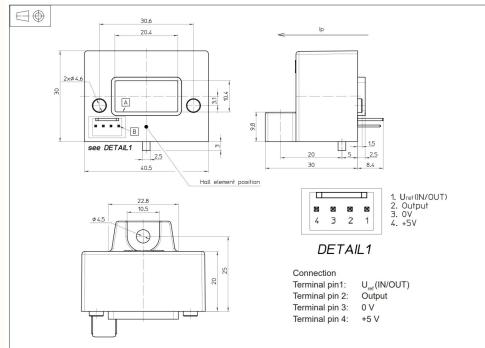
QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3 Number: 4 Version: \*

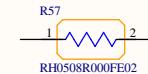
Drawn By: Jonn Dillon Sheet: 16 of 25

Print Date: 11/02/2021 Print Time: 1:45:14 PM File Name: AMU-S18-V00-CURRENTCurrentInterface.SchDoc



Current Generation Resistor Selection (5kW Sim) 5kW @ 100V (Nominal) = 50A					
Turns	Required Current	Resistance @ 12V	Wattage @ 12V	Resistance @ 14.4V	Wattage @ 14.4V
1	.50A	0.24Ω	600	0.288Ω	720
2	25A	0.48Ω	300	0.576Ω	360
5	10A	1.2Ω	120	1.44Ω	144
10	5A	2.4Ω	60	2.88Ω	72
20	2.5A	4.8Ω	30	5.76Ω	36
50	1A	12Ω	30	14.4Ω	14.4
75	660mA	18Ω	8	21.6Ω	9.6
100	500mA	24Ω	6	28.8Ω	7.2
125	400mA	30Ω	4.6	36Ω	5.76
150	333mA	36Ω	4	43.2Ω	4.8
200	250mA	48Ω	3	57.6Ω	3.6

During layout many provisions must be made:  
Chassis Mount Resistor is to be mounted to PCB  
- Appropriate holes must be made for mounting  
- Silkscreen outline  
- Holes for string / zip ties to tie down flying wires  
Addition of big pads and solderable slots for wires  
- The addition of the second lower microfit is incade there needs to be an externally attached chassis resistor



Sheet Title: 5kW Simulation			
Project: Shutdown Current Board 2020		QUT Motorsport O-120, Gardens Point 2 George Street Brisbane, QLD 4000 Australia	
Size: A3	Number: 5	Version: *	Revision: * Drawn By: Jonn Dillon Sheet 17 of 25 Print Date: 11/02/2021 Print Time: 1:45:15 PM File Name: AMU-S19-V00-CURRENT5kWSimulation.SchDoc

## Revision History:

Rev Date	Description

A

A

B

B

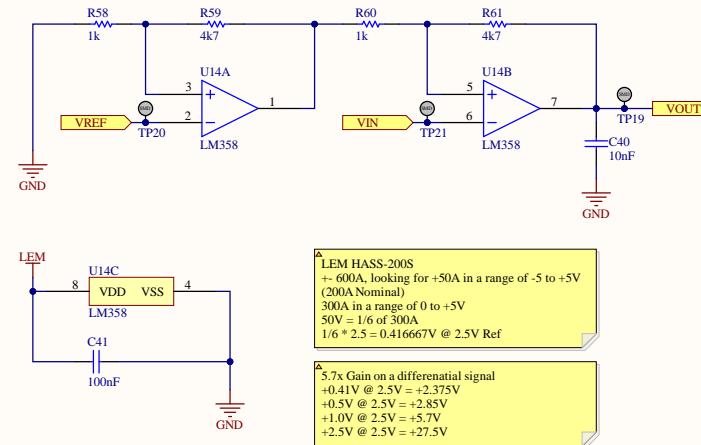
C

C

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D

Op Amps For Everyone  
A.3.11 - High Input Impedance Differential Amplifier  
Page 417



## Revision History:

Rev	Date	Description

## Sheet Title: Current Sensor Interface

Project: Shutdown Current Board 2020

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3 Number: 6 Version: \*

Drawn By: Jonn Dillon Sheet: 18 of 25

Print Date: 11/02/2021 Print Time: 1:45:15 PM File Name: AMU-S20-V00-CURRENTLEMSInterface.SchDoc

A

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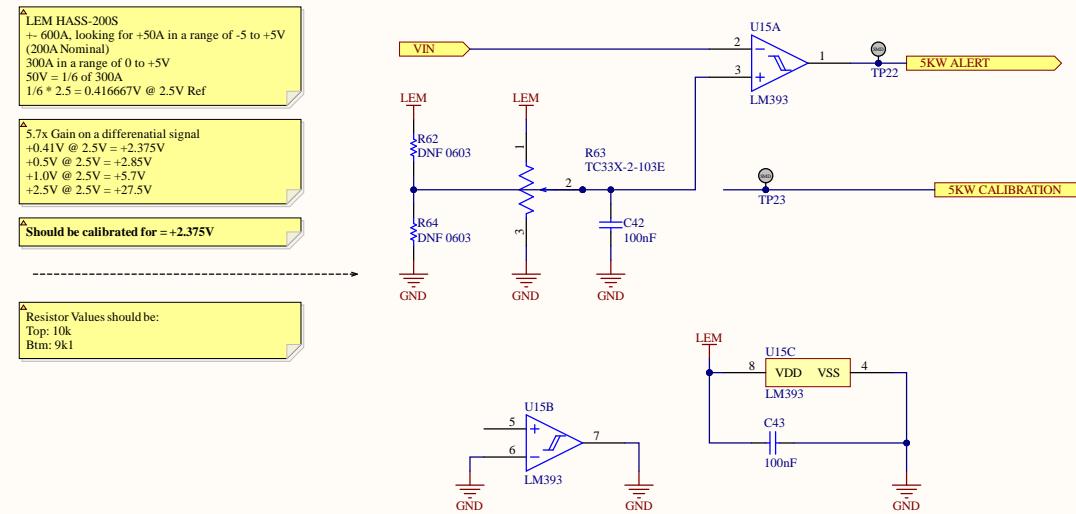
10

6

1

1

1



---

1

100

4

5

6

IC. 1.4.

## Electio

Sheet Title: **5kW Detection / Comparison**

Project: Shutdown Current Board 2020

**QUT Motorsport**  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia

**QUTH**  
**MOTORSPORT**

A

A

B

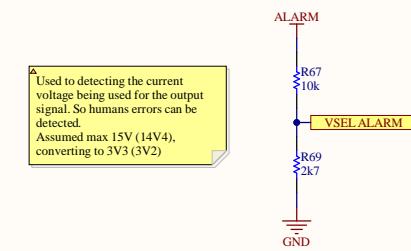
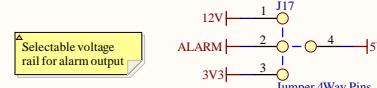
B

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C

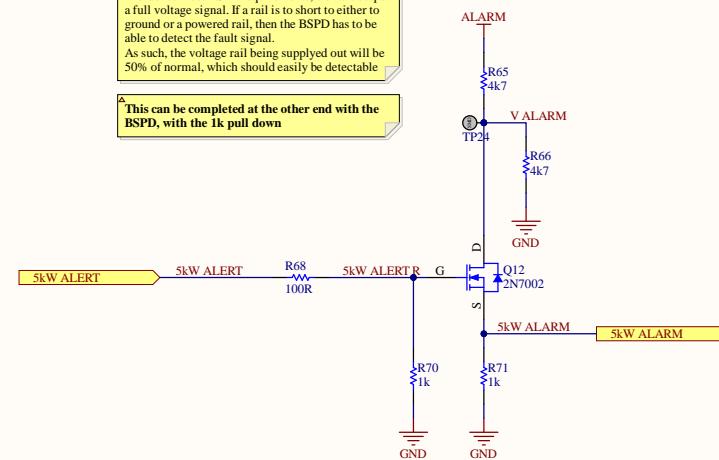
D

D



In order to meet BSPD requirements, we cant output a full voltage signal. If a rail is to short to either to ground or a powered rail, then the BSPD has to be able to detect the fault signal.  
As such, the voltage rail being supplied out will be 50% of normal, which should easily be detectable

This can be completed at the other end with the BSPD, with the 1k pull down



#### Revision History:

Rev	Date	Description

#### Sheet Title: 5kW Alarm

Project: Shutdown Current Board 2020

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3 Number: 10 Version: \*

Drawn By: Jonn Dillon Sheet: 20 of 25

Print Date: 11/02/2021 Print Time: 1:45:16 PM File Name: AMU-S22-V00-CURRENT5kWAlarm.SchDoc

A

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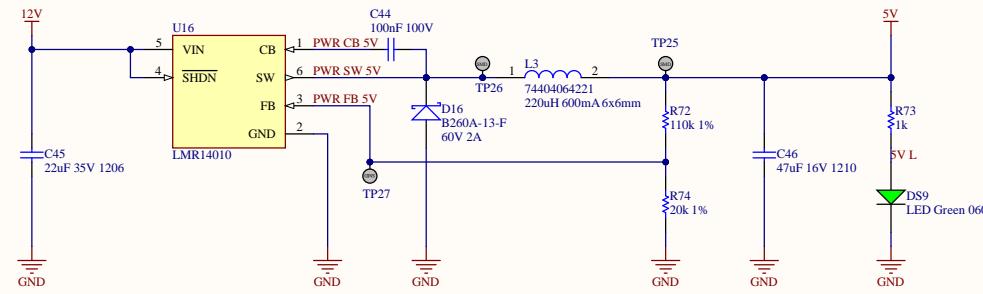
B

C

C

D

D



## Revision History:

Rev	Date	Description

Sheet Title: Power Supply (9-25V to 5V @ 0.1-0.3A)

Project: Shutdown Current Board 2020

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia



Size: A3 Number: 9 Version: 01

Drawn By: Jonn Dillon Revision: 01

Print Date: 11/02/2021 Print Time: 1:45:16 PM

File Name: AMU-S23-V00-CURRENTPSU5V.SchDoc

A

A

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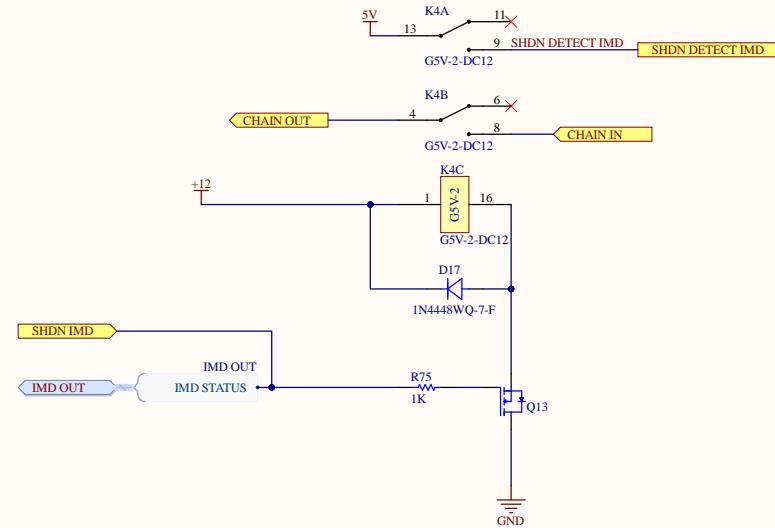
B

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D



## Revision History:

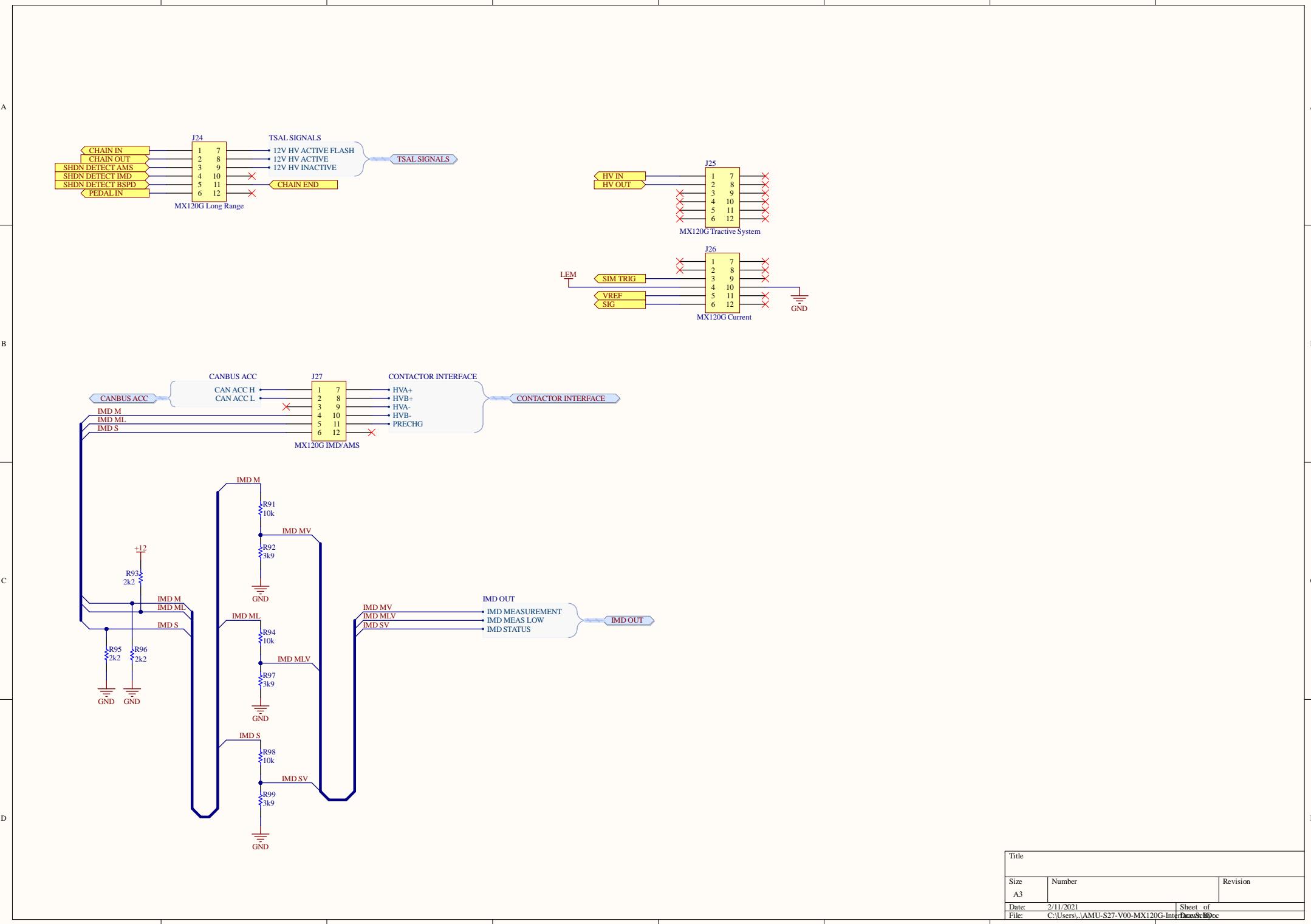
Rev Date	Description

## Sheet Title: Shutdown Chain

Project: IMD Daughter Board 2020

Size: A3 Number: 5 Version: 01  
 Drawn By: Ali Khan Hassan Revision: 00  
 Sheet 22 of 25 Brisbane, QLD 4000  
 Print Date: 11/02/2021 Print Time: 1:45:16 PM File Name: AMU-S26-V00-DAUGHTERShutdown.SchDoc





A

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B

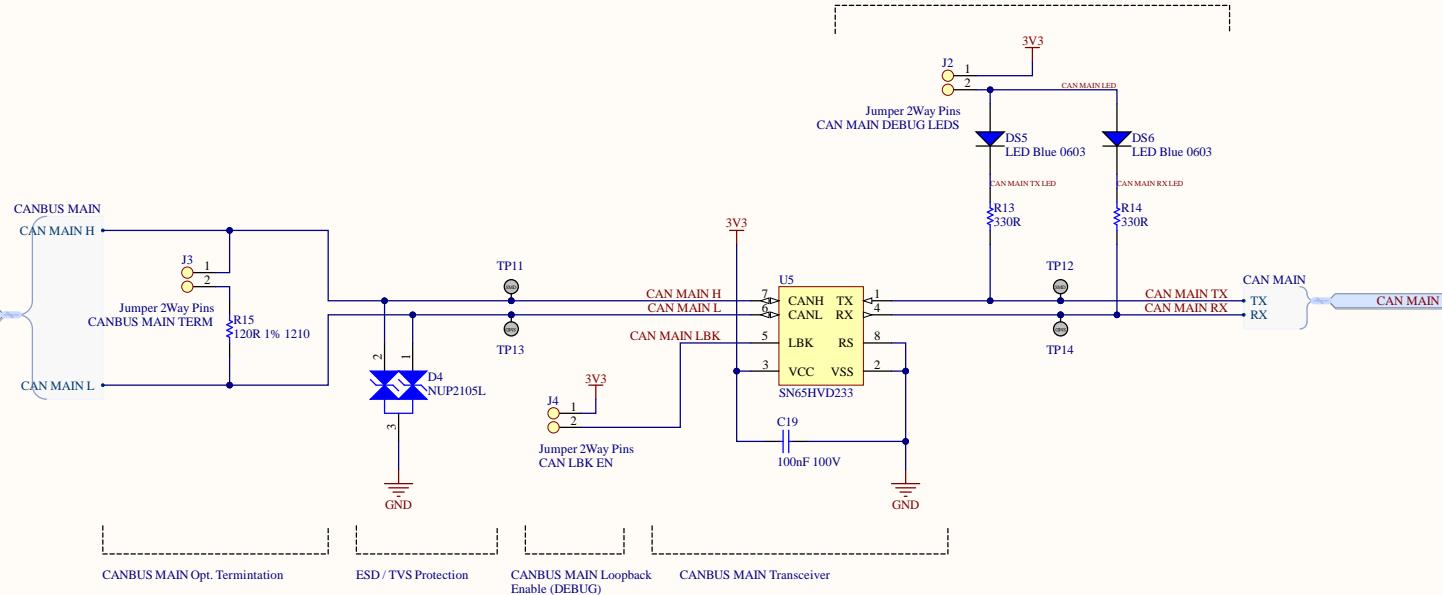
C

C

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D

## CANBUS MAIN Data Indicators (DEBUG)



## Revision History:

Rev Date	Description

Sheet Title: Isolated CANBUS2 3V3

Project: AMU 2020 (Sourced from BMS 2020)

QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia

Size: A3 Number: 5 Version: 01  
Drawn By: Jonn Dillon Revision: 01  
Sheet 24 of 25  
Print Date: 11/02/2021 Print Time: 1:45:16 PM File Name: AMU-S05-V00-CANMAIN.SchDoc



A

A

B

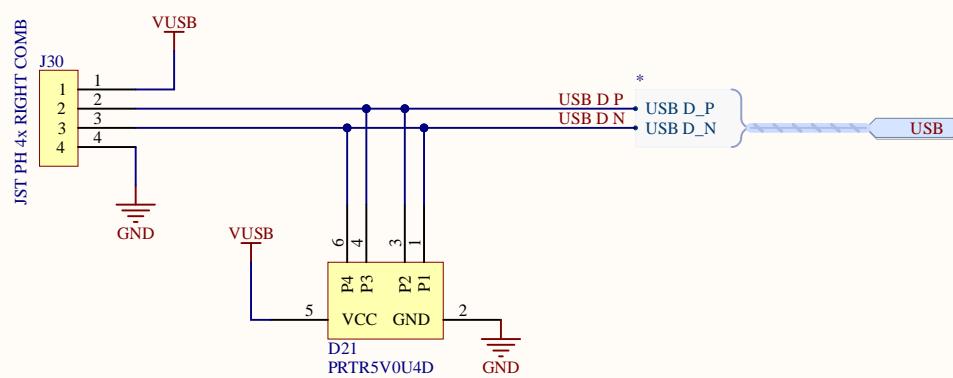
B

C

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D



Title		
Size	Number	Revision
A4		
Date: File:	2/11/2021 C:\Users\...\AMU-S28-V00-USBCProtect\dosch\Day:	Sheet of 1



# Board Stack Report