

A

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



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



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



TSAL Control  
AMU-S12-V00-TSALControl.SchDoc



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



AMS Master  
AMU-S30-V00-AMSMaster.SchDoc



USB-C CANBUS MAIN CANBUS ACC CONTACTOR INTERFACE

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



TSAL SIGNALS

HV IN HV OUT

HV IN HV OUT

SHDN DETECT AMS CHAIN END CHAIN IN CHAIN OUT

IMD OUT SHDN IMD

PDOC Shutdown AMU-S29-V00-PDOCShutdownRelay.SchDoc

CHAIN IN PDOC IN SHDN DETECT PDOC PDOC OUT CHAIN OUT

DAUGHTER Shutdown AMU-S26-V00-DAUGHTERShutdown.SchDoc

SHDN IMD CHAIN IN SHDN DETECT IMD CHAIN OUT

IMD OUT SHDN DETECT IMD CHAIN OUT

IMD OUT

B

B

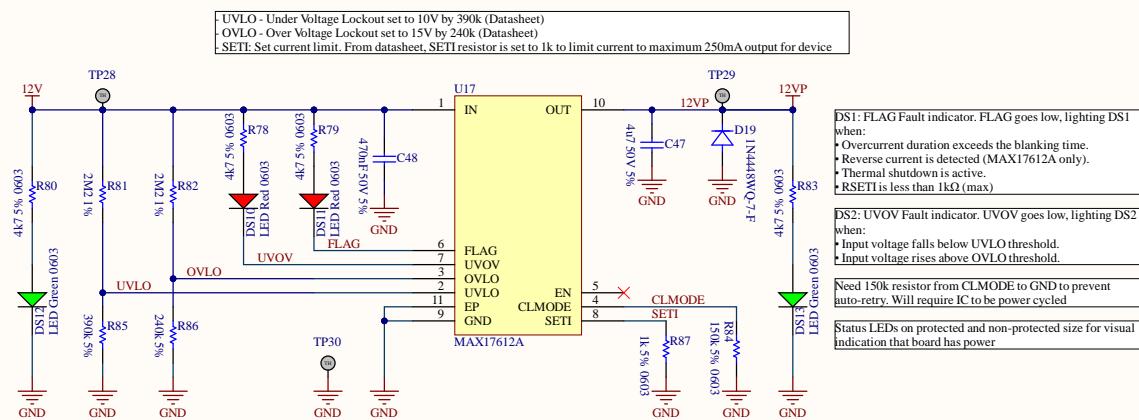
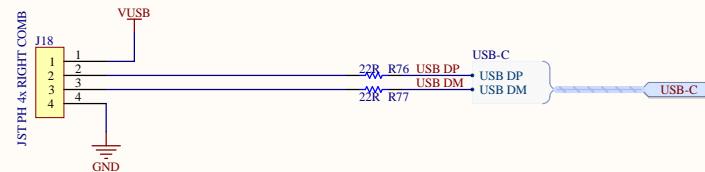
C

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Title AMU Master Board 2021		
Size A3	Number 1	Revision
Date: 2/16/2021	Sheet of	
File: C:\Users...\AMU-S01-V00-Master.SchDoc	Drawn By:	



Title		
Size A3	Number	Revision
Date: 2/16/2021	Sheet of	
File: C:\Users\AMU-S02-V00-12VProtection	Submitted By:	

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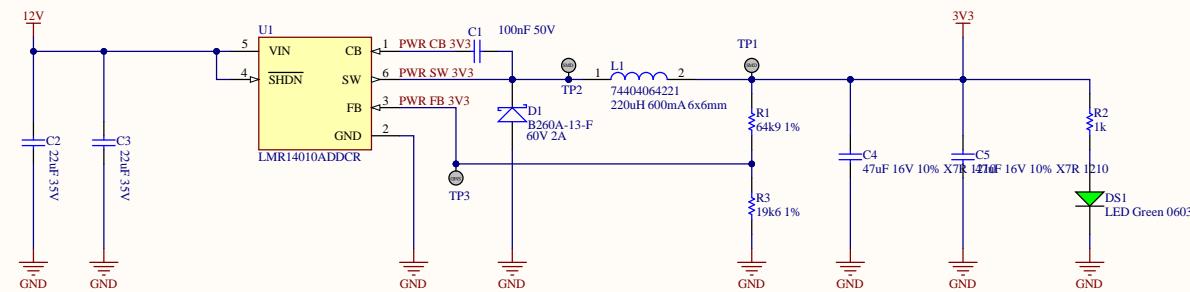
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## Revision History:

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

Size: A3 Number: 2 Version: 01

Revision: 01

Drawn By: Jonn Dillon

Sheet 3 of 27

Print Date: 16/02/2021 Print Time: 11:53:16 AM

Australia

File Name: AMU-S02-V00-PSU3V3.SchDoc

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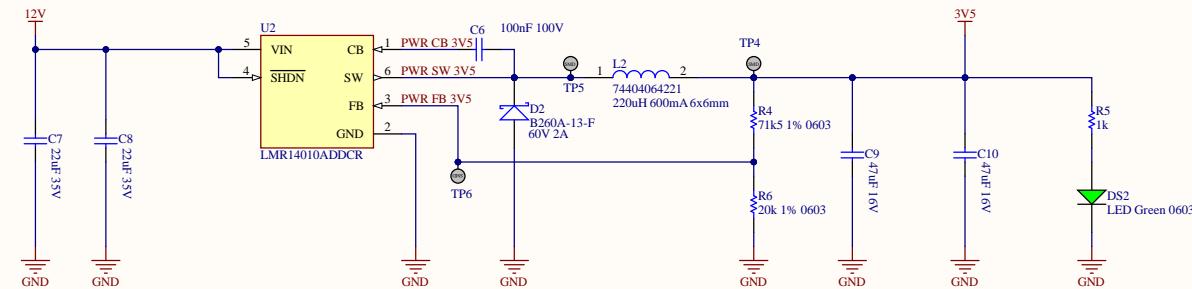
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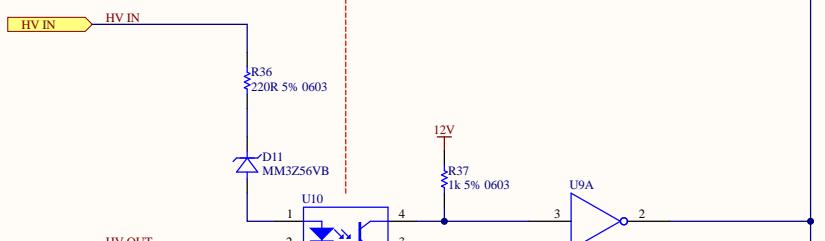
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SheetTitle: <b>Power Supply (20-40V to 3v3 @ 0.1-0.6A)</b>		OUTMotorsport
Project: <b>AMU 2020 (Sourced from BMS 2020)</b>	Version: <b>00</b>	O-120, Gardens Point 2 George Street Brisbane, QLD 4000
Size: A3	Number: <b>3</b>	Revision: <b>*</b>
Drawn By: <b>Jona Dillon</b>	Sheets of <b>4</b>	Sheet <b>4</b> of <b>27</b> Australia
Print Date: <b>16/02/2021</b>	Print Time: <b>11:53:16 AM</b>	File Name: <b>AMU-S03-V00-PSU3V5.SchDwg</b>

A

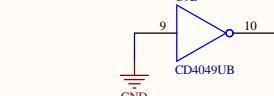
Value experimentation required to get consistent activation at 60V



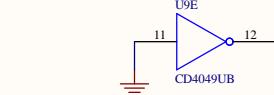
+60V (-58V) Detection and Isolation

Buffer/Re-inversion from optocoupler  
Turns analog signal into digital I/O

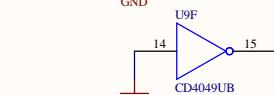
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Buffer/Re-inversion from optocoupler  
Turns analog signal into digital I/O

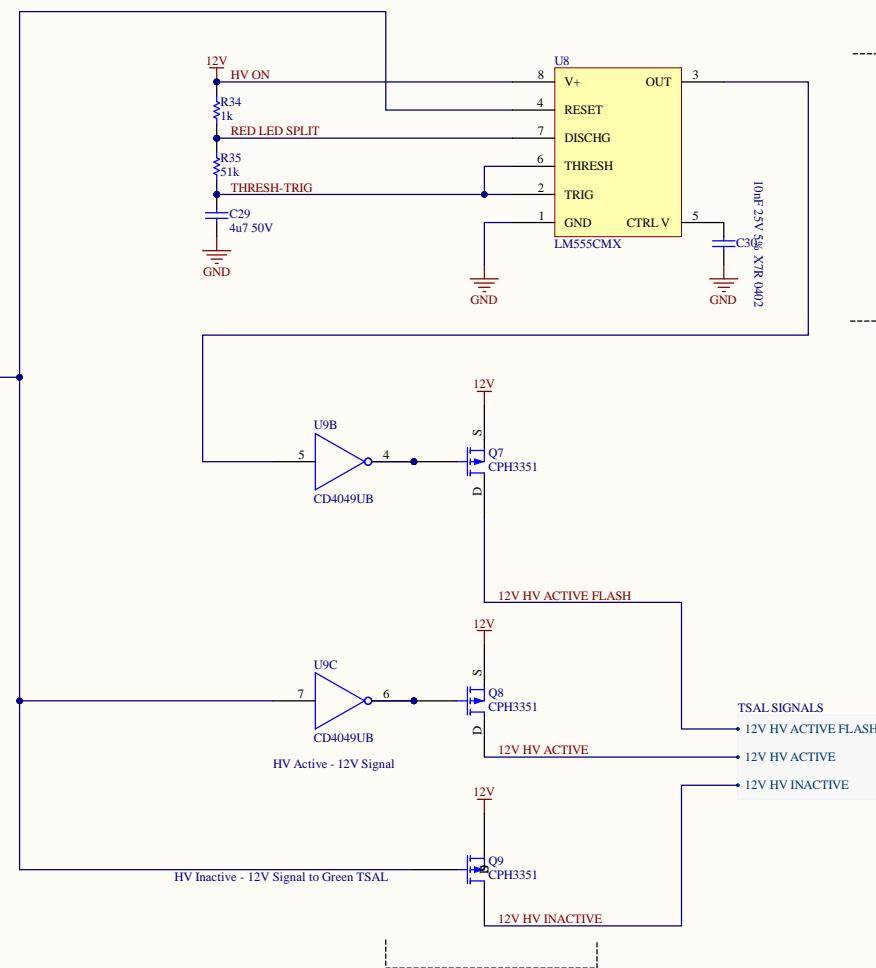
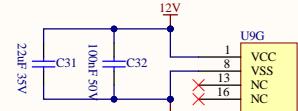
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Grounding unused inverters on CD4049UB



E

Revision History:

Rev	Date	Description

Sheet Title: **TSAL Control**Project: **TSAL**Size: **A3**

Number: \*

Version: \*

Revision: \*

Drawn By: Tom Benedetti

Sheet: **5** of 27

Print Date: 16/02/2021

Print Time: 11:53:16 AM

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

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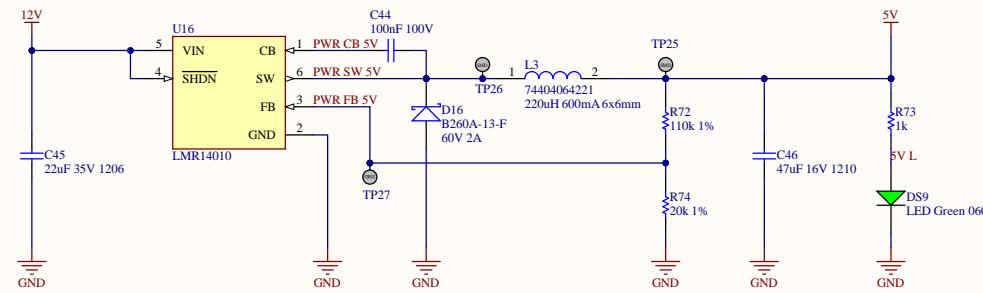
B

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## 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 Sheet: 6 of 27

Print Date: 16/02/2021 Print Time: 11:53:16 AM File Name: AMU-S23-V00-CURRENTPSU5V.SchDoc

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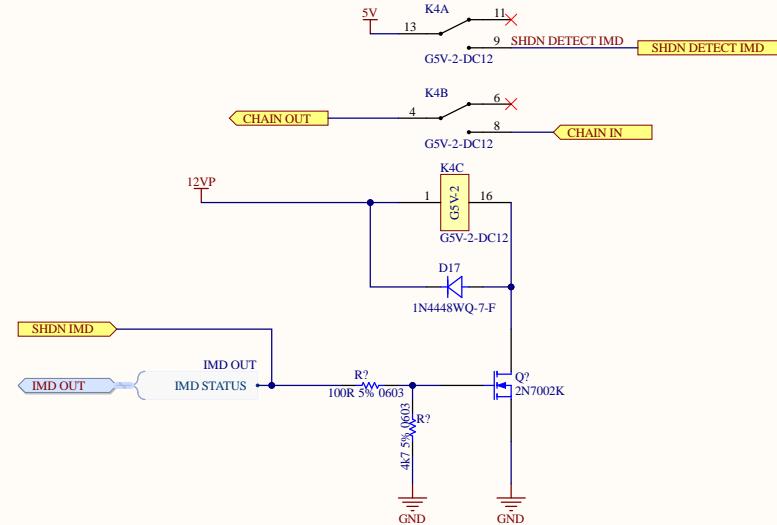
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## Revision History:

Rev Date	Description

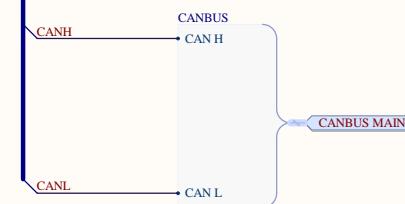
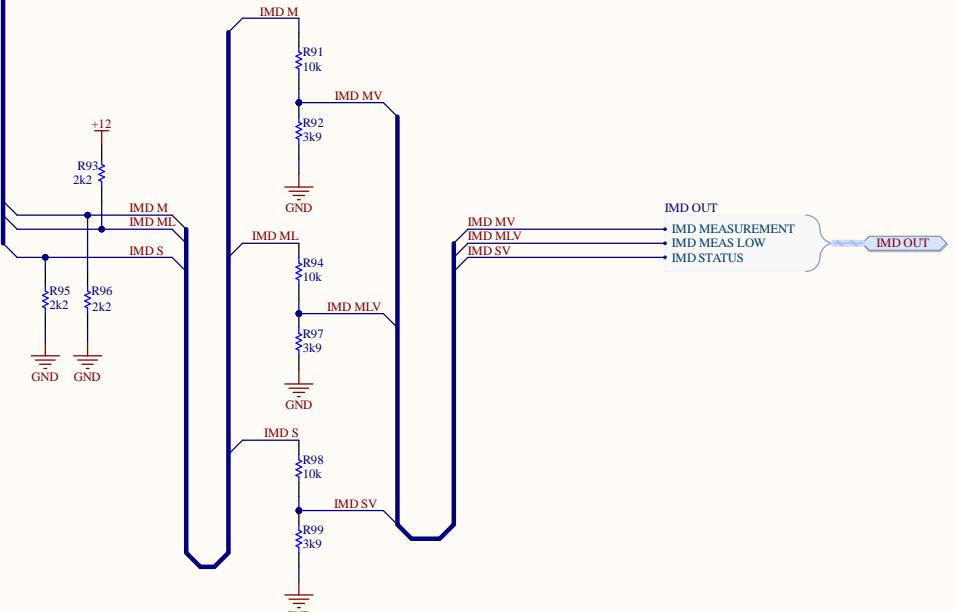
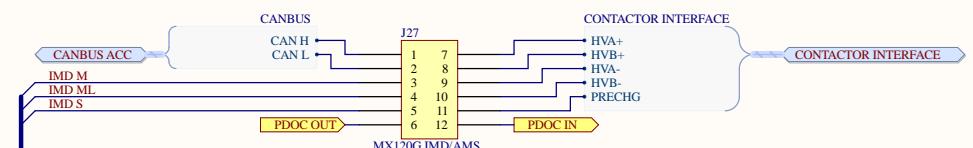
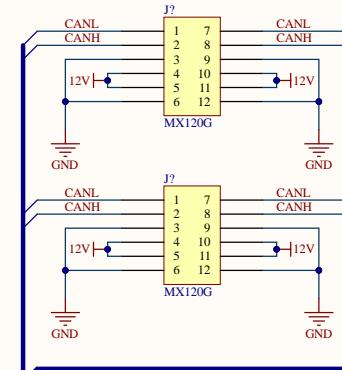
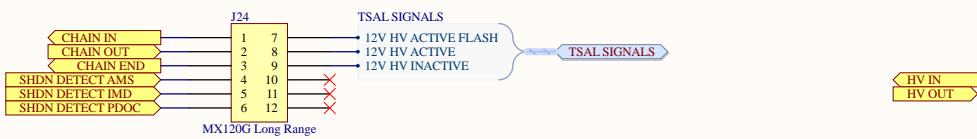
## Sheet Title: Shutdown Chain

Project: IMD Daughter Board 2020

Size: A3 Number: 5 Version: 01  
 Drawn By: Ali Khan Hassan Revision: 00  
 Sheet 7 of 27 Brisbane, QLD 4000  
 Print Date: 16/02/2021 Print Time: 11:53:17 AM File Name: AMU-S26-V00-DAUGHTERShutdown.SchDoc



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Title		
Size	Number	Revision
A3		
Date: 2/16/2021		Sheet of
File: C:\Users...\AMU-S27-V00-MX120G-Interf...Doc		

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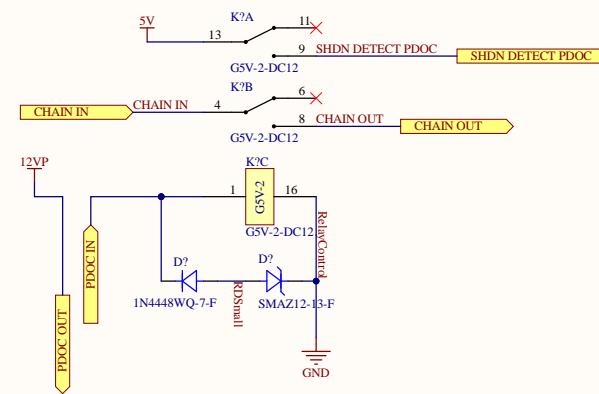
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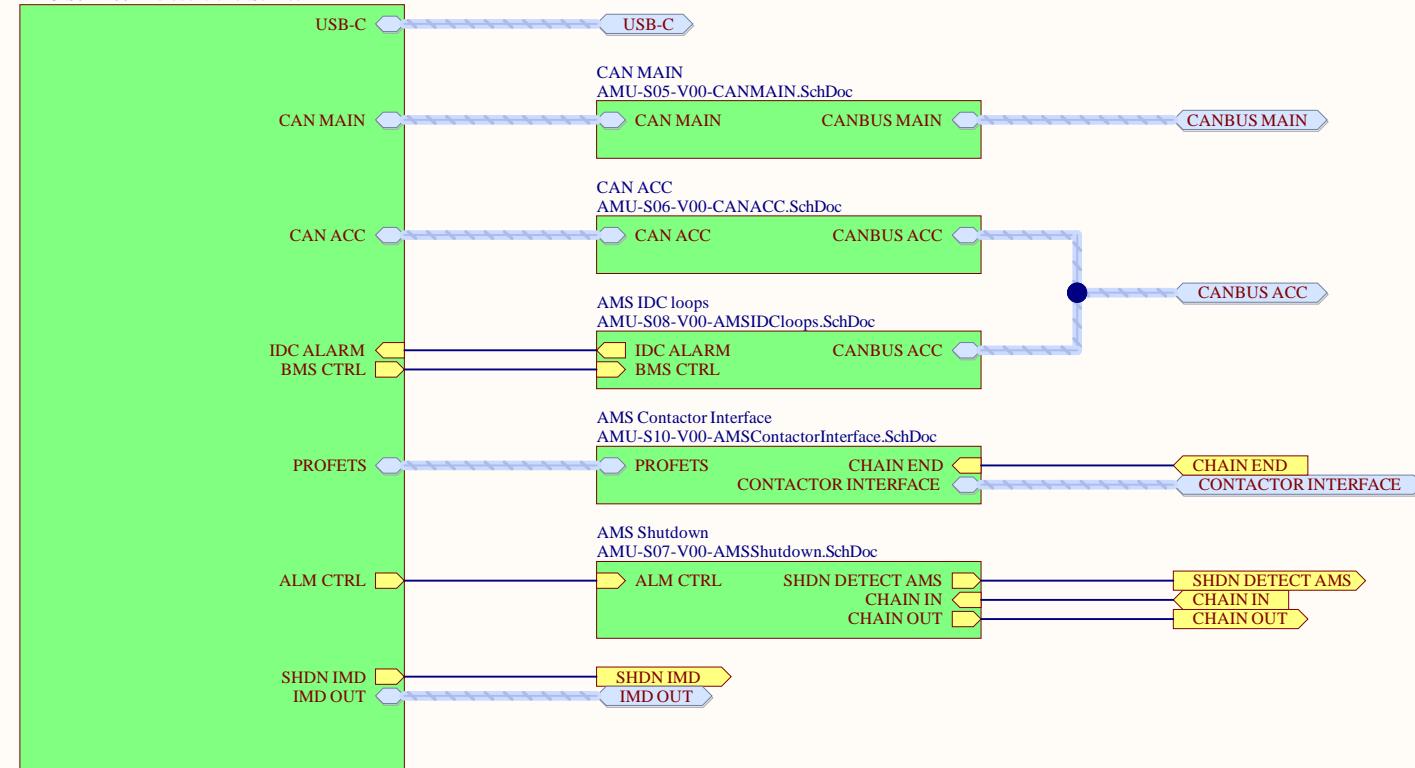


Title			
Size	Number	Revision	
A3			
Date:	2/16/2021	Sheet	of
File:	C:\Users\...\AMU-S29-V00-PDOCSShutdown	DRAFT	ArchDoc

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Microcontroller  
AMU-S04-V00-Microcontroller.SchDoc



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Title

Size

A4

Number

Revision

Date:

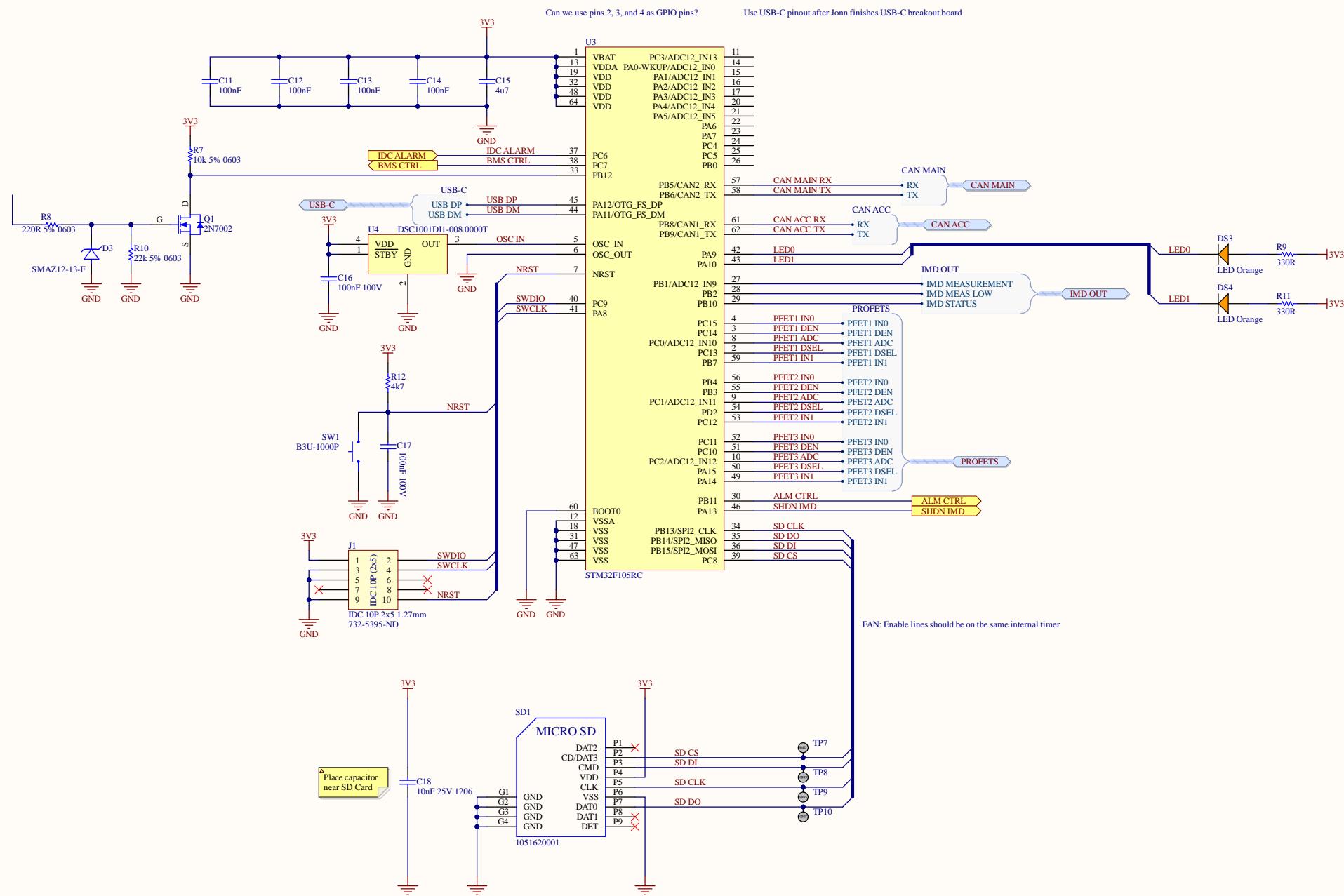
2/16/2021

Sheet of

File:

C:\Users\..\AMU-S30-V00-AMSMaster.SchDoc

Drawn By:



Sheet Title: **AMU Microcontroller**

Project: **AMU 2020**

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



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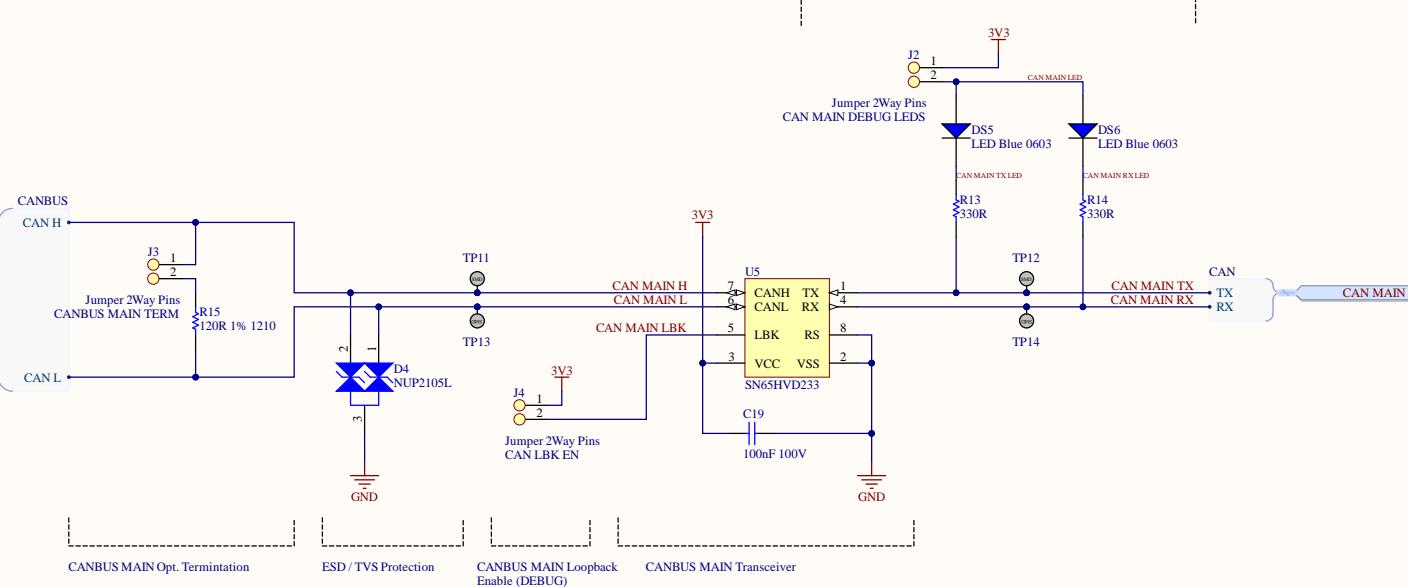
C

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## 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  
 Size: A3 Number: 5 Version: 01  
 Revision: 01  
 Drawn By: Jonn Dillon Sheet 12 of 27 Australia  
 Print Date: 16/02/2021 Print Time: 11:53:17 AM File Name: AMU-S05-V00-CANMAIN.SchDoc



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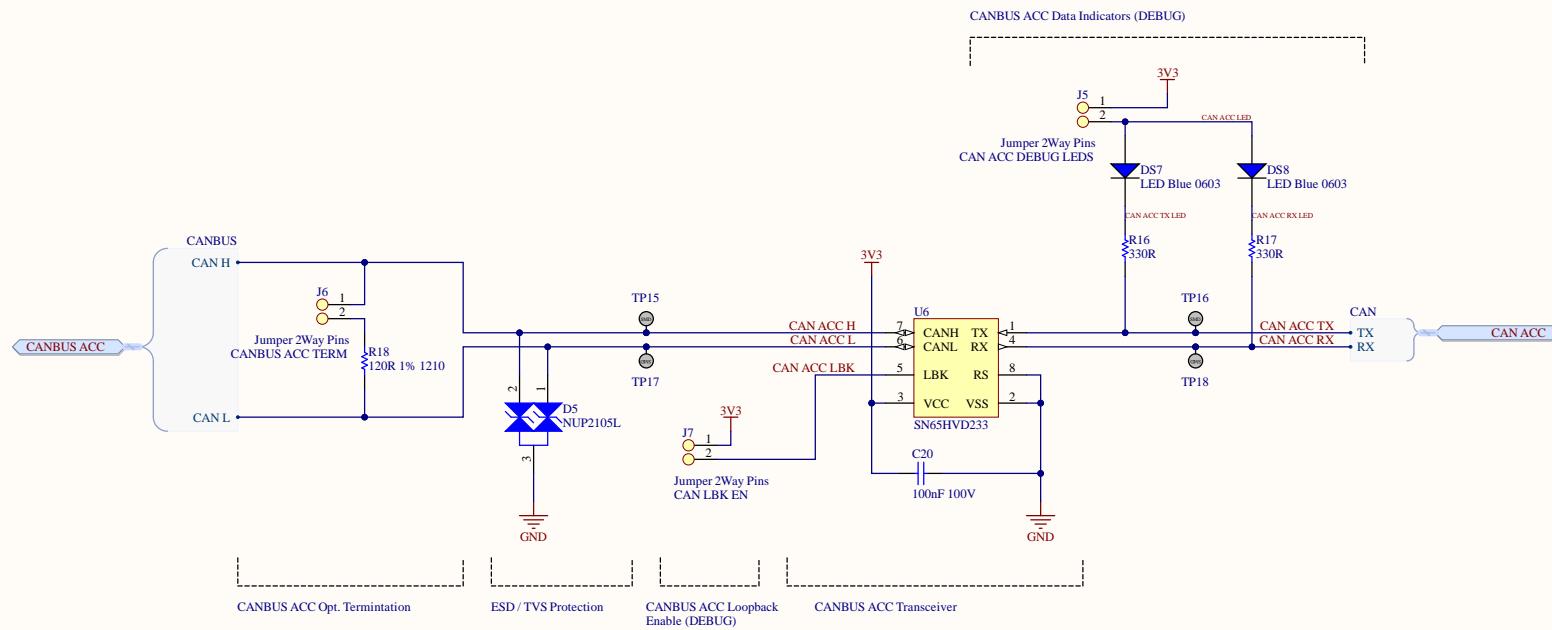
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## Revision History:

Rev Date	Description

Sheet Title: Isolated CANBUS4 3V3

Project: AMU 2020 (Sourced from BMS 2020) QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Size: A3 Number: 6 Version: 01  
Drawn By: Jonn Dillon Revision: 01  
Sheet 13 of 27 Australia  
Print Date: 16/02/2021 Print Time: 11:53:17 AM File Name: AMU-S06-V00-CANACC.SchDoc



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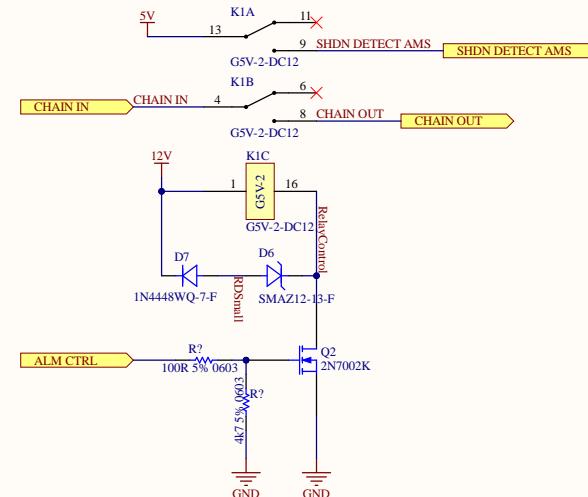
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## Revision History:

Rev	Date	Description

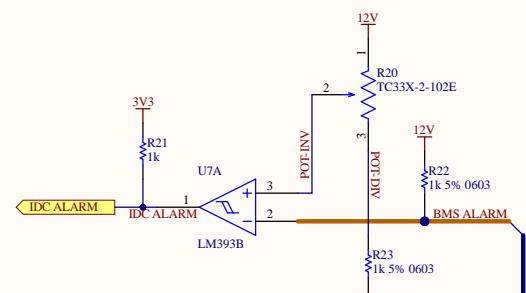
## Sheet Title: Alarm Relay

Project: AMU 2020

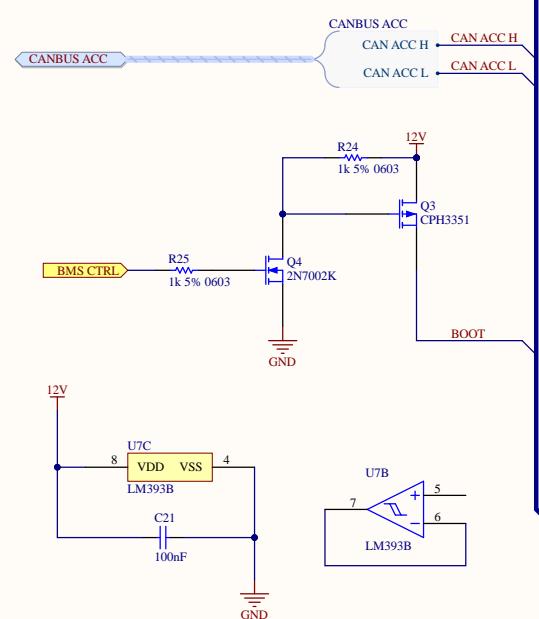
Size: A3	Number: 7	Version: 00	QUT Motorsport O-120, Gardens Point 2 George Street Brisbane, QLD 4000 Australia
Drawn By: Thomas Benedetti	Sheet: 14 of 27		
Print Date: 16/02/2021	Print Time: 11:53:18 AM	File Name: AMU-S07-V00-AMSShutdown.SchDoc	



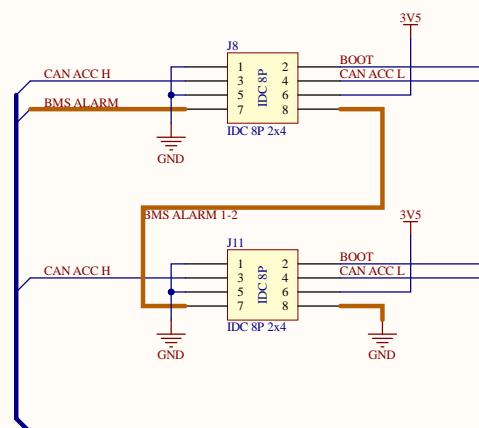
A



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## Revision History:

Rev	Date	Description

## Sheet Title: BMS Interface

Project: AMU 2020

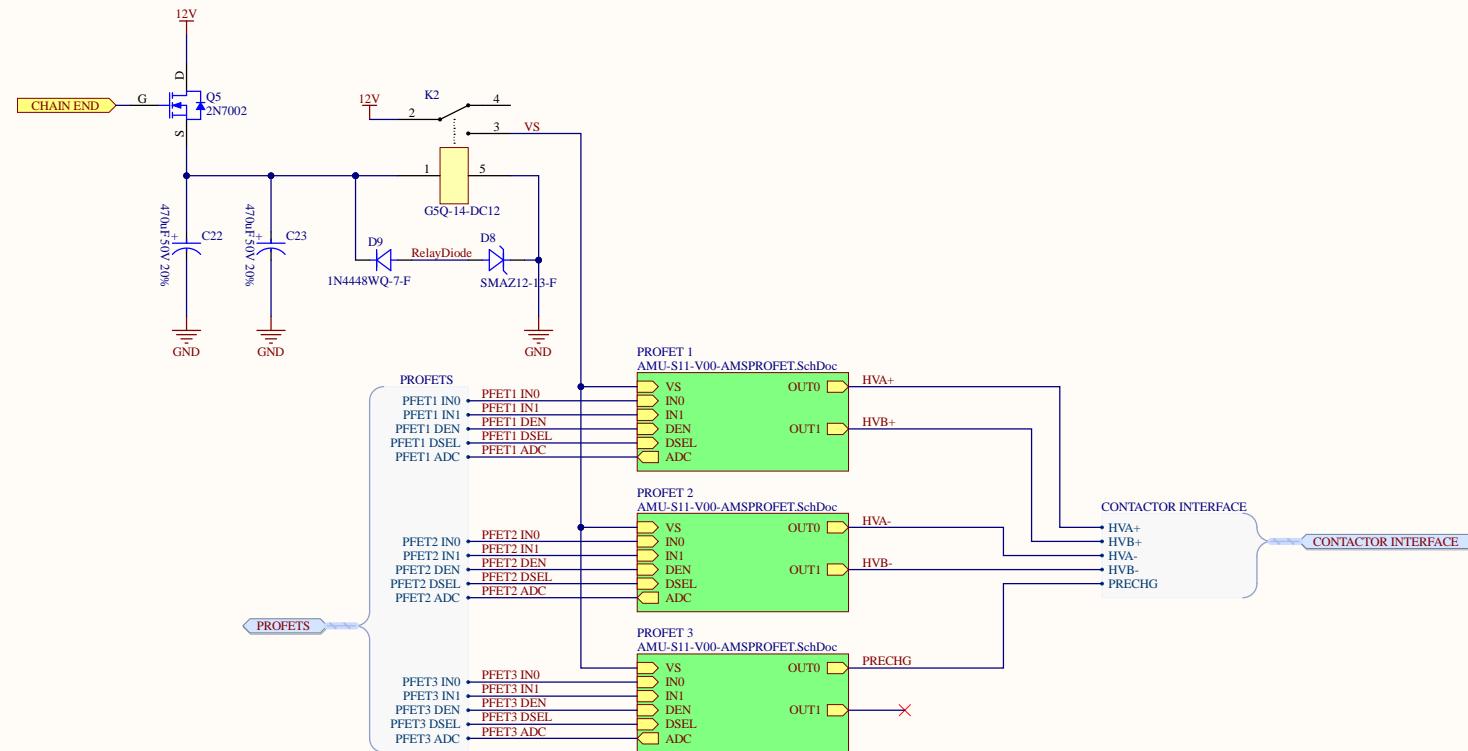
Size: A3 Number: 8

Drawn By: Thomas Benedetti

Print Date: 16/02/2021 Print Time: 11:53:18 AM

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 16 of 27		Brisbane, QLD 4000 Australia
Print Date: 16/02/2021 Print Time: 11:53:18 AM File Name: AMU-S10-V00-AMSContactorInterface.SchDoc		



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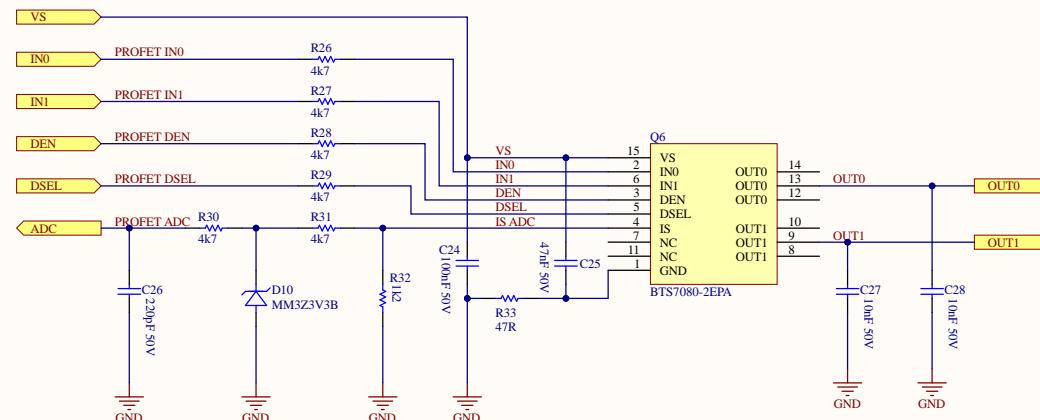
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Sheet Title: *			
Project: #####		QUT Motorsport O-120, Gardens Point 2 George Street Brisbane, QLD 4000	
Size: A3	Number: 12	Version: 00	
		Revision: *	
Drawn By: *		Sheet 17 of 27 Australia	
Print Date: 16/02/2021 Print Time: 11:53:18 AM File Name: AMU-S11-V000-AMSPROFET.schDoc			

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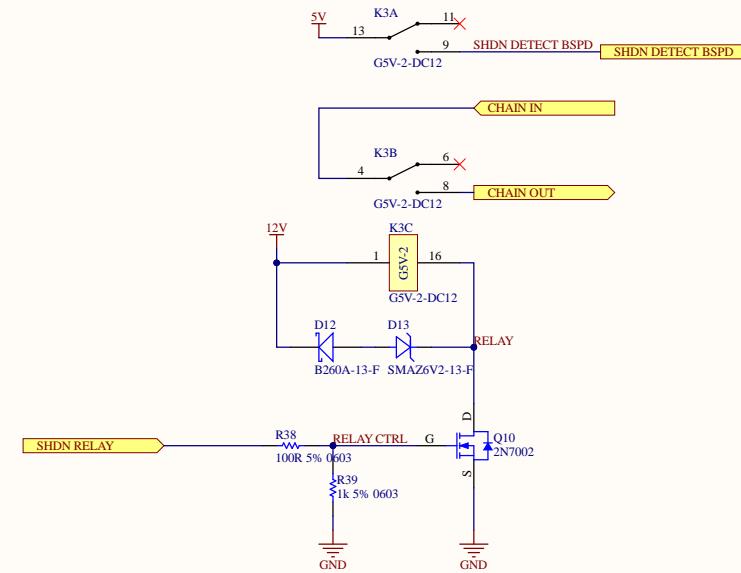
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## Revision History:

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 18 of 27

Print Date: 16/02/2021 Print Time: 11:53:18 AM File Name: AMU-S13-V00-BSPDShutdownRelay.SchDoc

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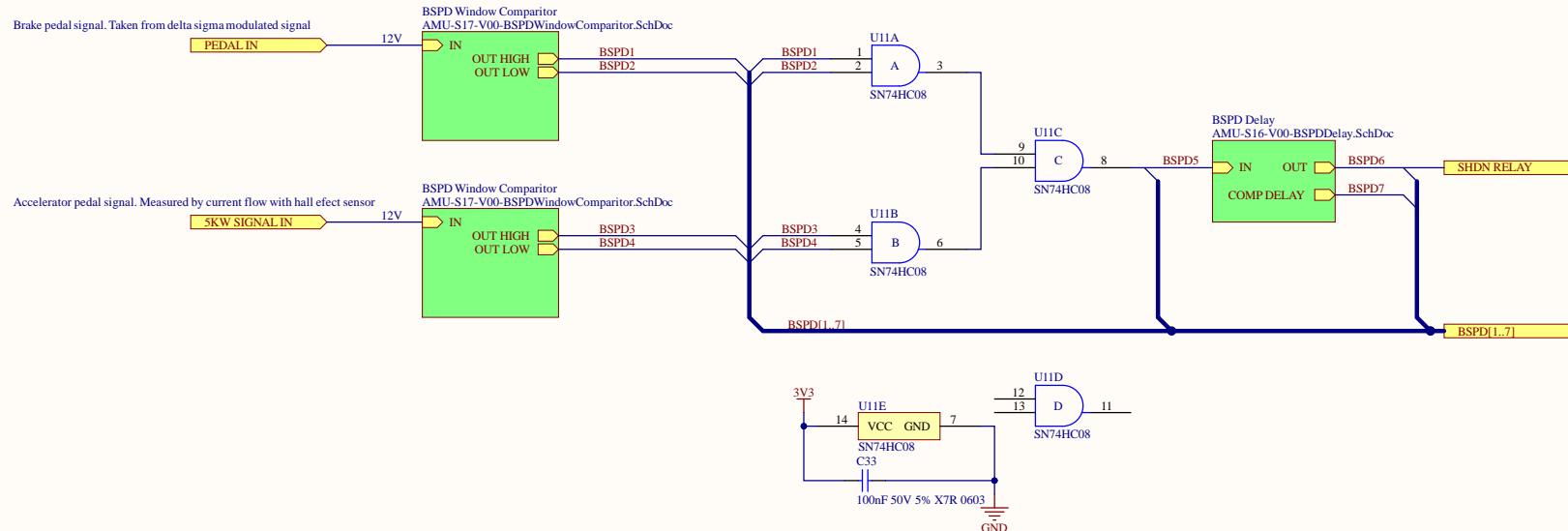
B

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## 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 19 of 27

Print Date: 16/02/2021

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

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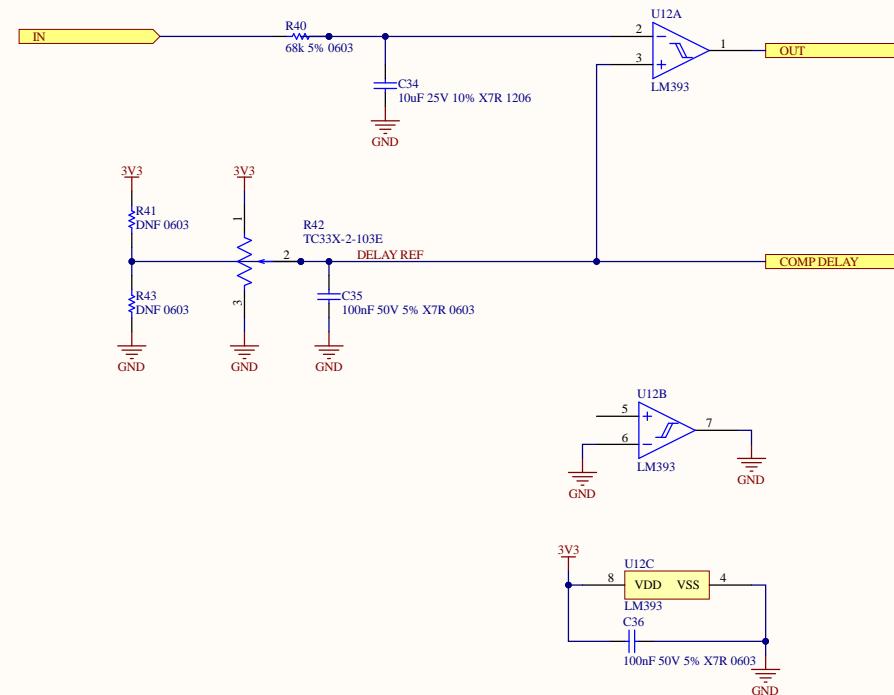
6

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Ex

RC Charging Circuit:  
 50% Charge Voltage Wise at 500ms (to compare at 2V)  
 $500\text{ms} = 0.7T = 0.7 * R * C$   
 $C = 10\mu\text{F} = 0.01\text{F}$   
 $\gg R = 7\text{k}\Omega$

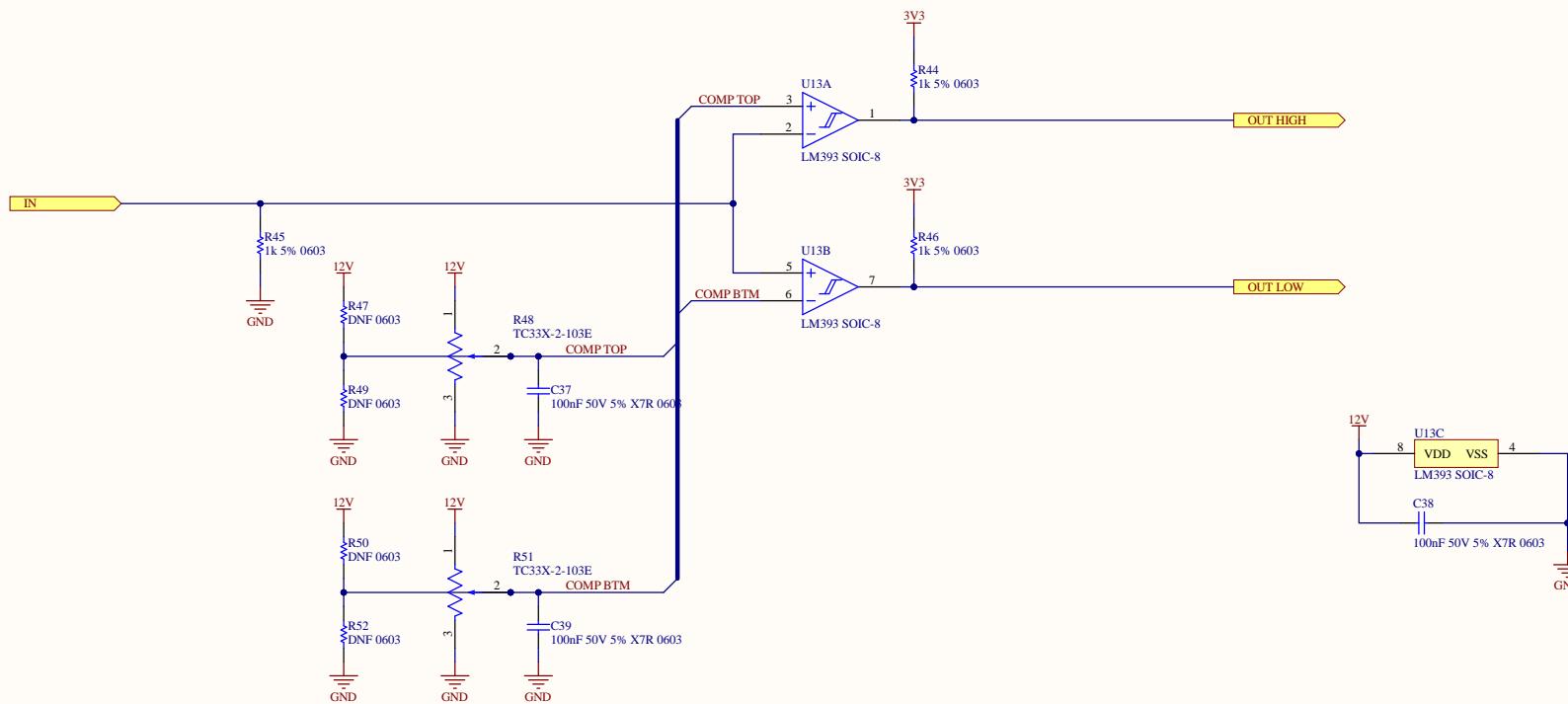


Sheet Title: **RC Charging Delay**

Project:

**QUT Motorsport**  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia  
e: AMU-S16-V00-BSPDDelay.Sch

**QUT  
MOTORSPORT**



## Revision History:

Rev	Date	Description

## Sheet Title: Window Comparator

Project:

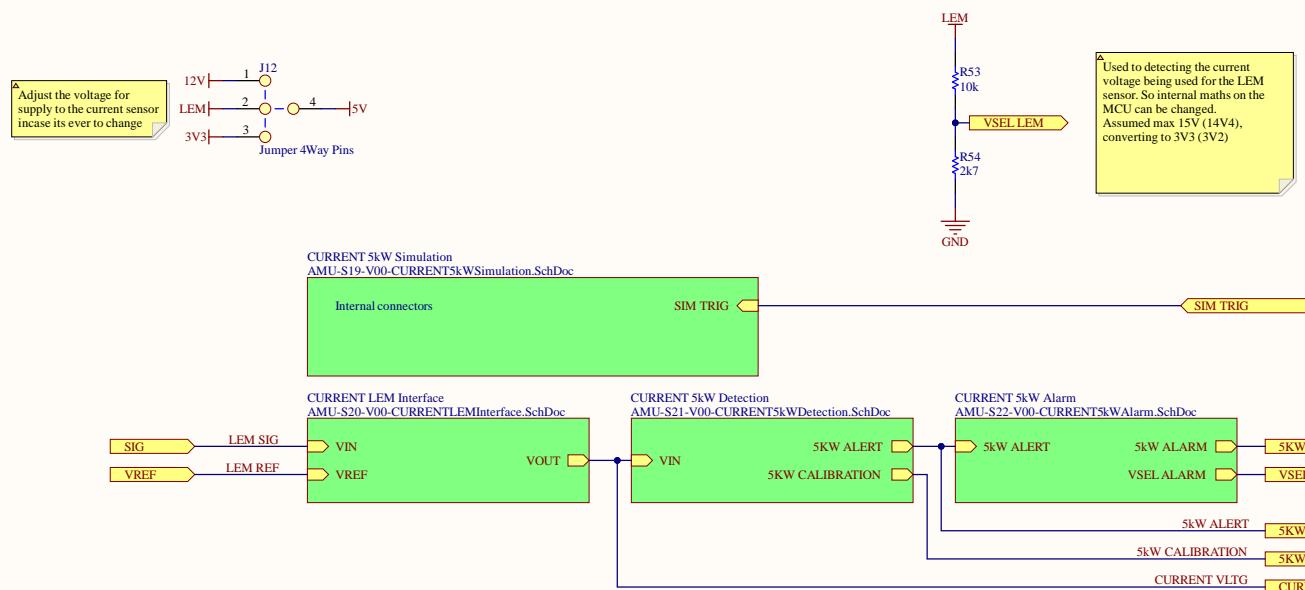
QUT Motorsport  
O-120, Gardens Point  
2 George Street  
Brisbane, QLD 4000  
Australia

Size: A3 Number: 3 Version: 01

Drawn By: Jonn Dillon Sheet: 21 of 27

Print Date: 16/02/2021 Print Time: 11:53:19 AM 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: 22 of 27

Print Date: 16/02/2021 Print Time: 11:53:19 AM File Name: AMU-S18-V00-CURRENTCurrentInterface.SchDoc



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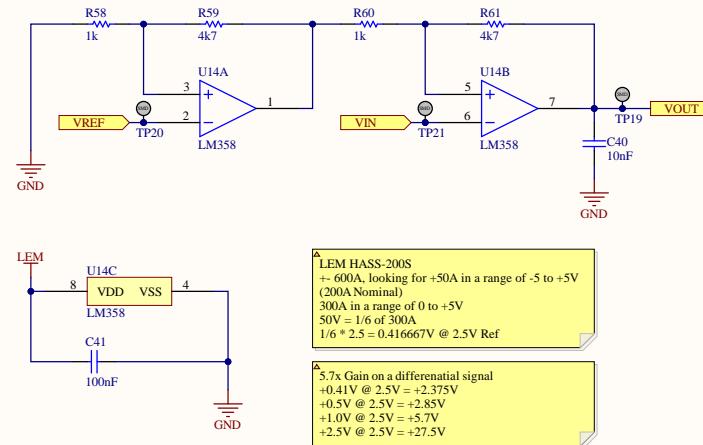
C

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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: 24 of 27

Print Date: 16/02/2021 Print Time: 11:53:19 AM File Name: AMU-S20-V00-CURRENTLEMSInterface.SchDoc

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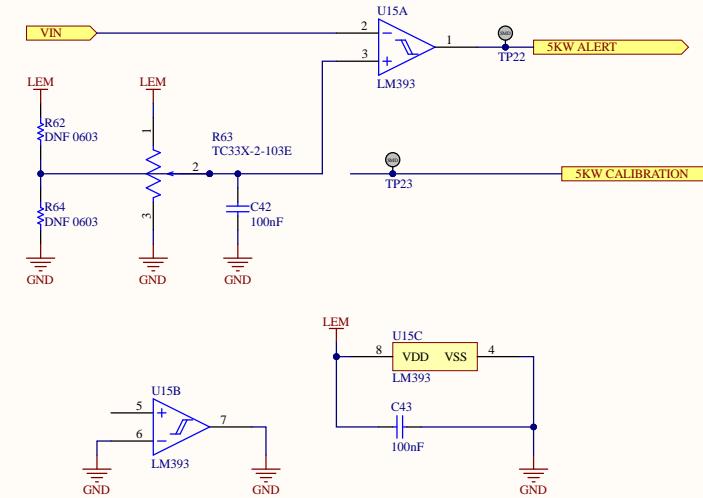
D

LEM HASS-200S  
 ± 600A, looking for +50A in a range of -5 to +5V  
 (200A Nominal)  
 300A in a range of 0 to +5V  
 50V = 1/6 of 300A  
 $1/6 * 2.5 = 0.416667V @ 2.5V \text{ Ref}$

5.7x Gain on a differential signal  
 +0.41V @ 2.5V = +2.375V  
 +0.5V @ 2.5V = +2.85V  
 +1.0V @ 2.5V = +5.7V  
 +2.5V @ 2.5V = +27.5V

Should be calibrated for +2.375V

Resistor Values should be:  
 Top: 10k  
 Btm: 9k1



#### Revision History:

Rev Date	Description

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

Project: Shutdown Current Board 2020

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



Size: A3 Number: 7 Version: \*

Drawn By: Jonn Dillon Sheet 25 of 27

Print Date: 16/02/2021 Print Time: 11:53:20 AM File Name: AMU-S21-V00-CURRENT5kWDetection.SchDoc

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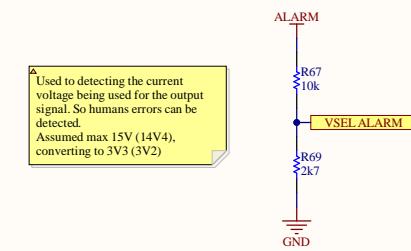
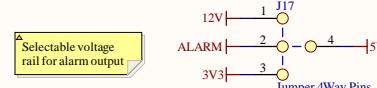
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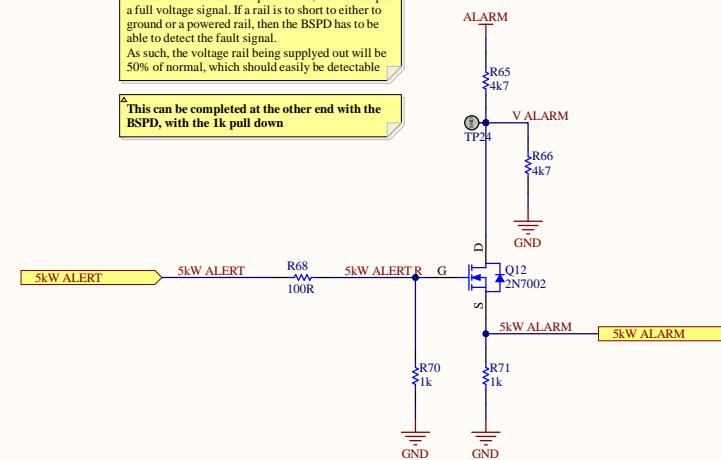
D

D



In order to meet BSPD requirements, we can't output a full voltage signal. If a rail is 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: 26 of 27

Print Date: 16/02/2021 Print Time: 11:53:20 AM File Name: AMU-S22-V00-CURRENT5kWAlarm.SchDoc

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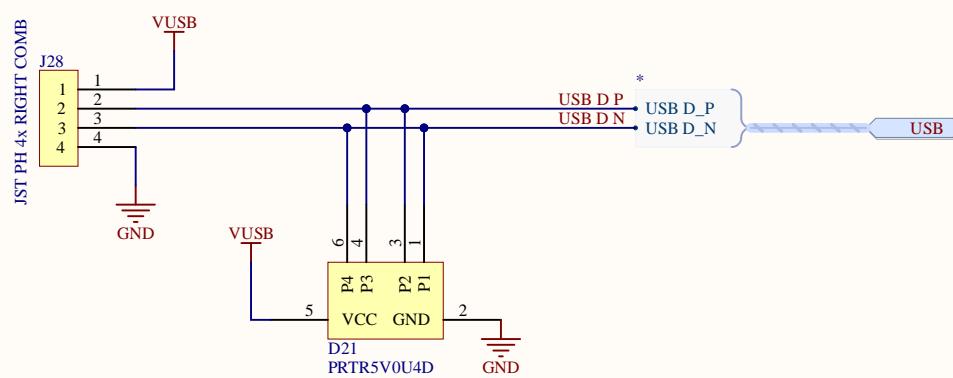
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Title		
Size A4	Number	Revision
Date: 2/16/2021		Sheet of
File: C:\Users\..\AMU-S28-V00-USBCPProtect\dosch\Day:		



# Board Stack Report