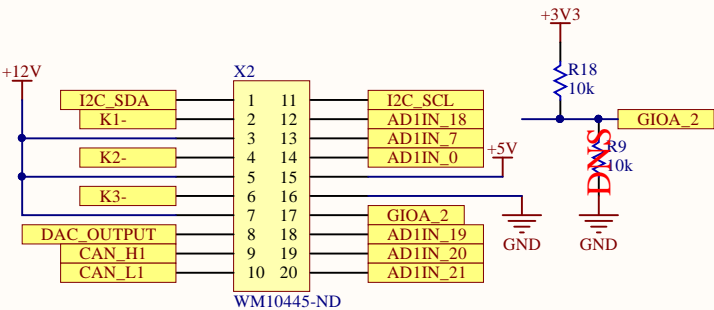
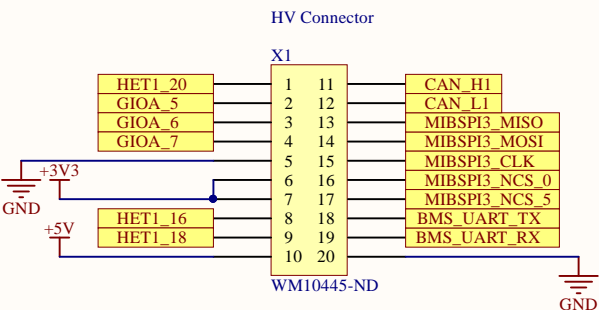


# CONNECTORS

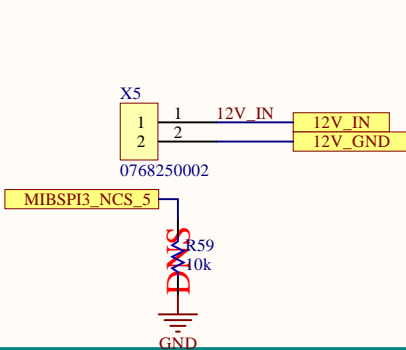
## DASHBOARD & FOOT PEDAL CONNECTOR



## HIGH VOLTAGE CONNECTOR

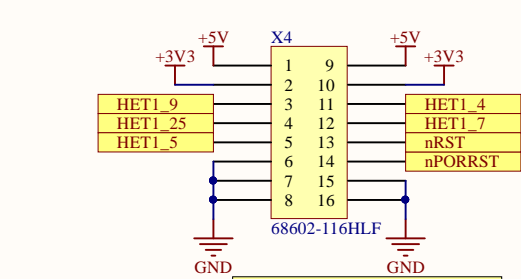


## LOW VOLTAGE POWER IN



GPIO PIN MUX : ----- VCU		
(INPUT)	GIOA[2] :	RTDS
(OUTPUT)	GIOA[5] :	(Pre_Charge)
(OUTPUT)	GIOA[6] :	(High_Voltage)
(OUTPUT)	GIOA[7] :	(Ground)
HET : -----		
HET1_4		
HET1_5		
HET1_7		
HET1_9		
HET1_20		
HET1_25		
ADC : -----		
AD1IN_0		
AD1IN_7		
AD1IN_18		
AD1IN_19		
AD1IN_20		
AD1IN_21		

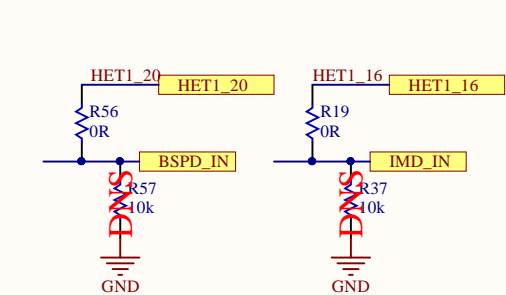
## SIGNAL BREAKOUT CONNECTOR



**DESIGN NOTE:**  
Breaking out rails to power external components (Voltage Transducer, Current Transducer, LCDs, Enable Switches)

Add more analog inputs here

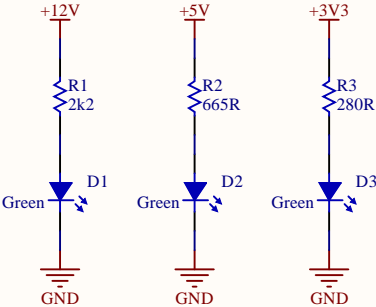
## SIGNAL VOLTAGE DIVIDERS



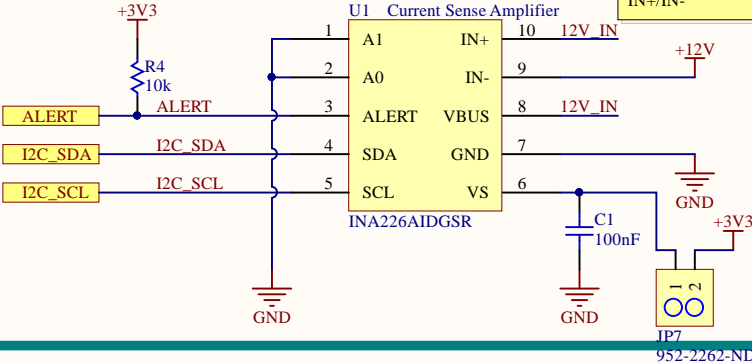
Title		
Size	Number	Revision
A4		
Date:	2020-11-22	Sheet of
File:	C:\Users\...\Connectors.SchDoc	Drawn By:

# POWER & CURRENT SENSING

## POWER GOOD LEDs



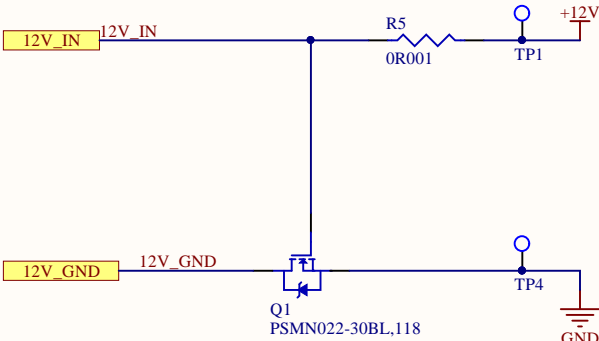
## LOW VOLTAGE POWER MONITOR



### LAYOUT NOTE:

Place sensing wires (IN+, IN-) in a Kelvin connection to the shunt resistor  
Route sensing wires as a differential pair

## 12V REVERSE POLARITY PROTECTION & SENSE RESISTOR



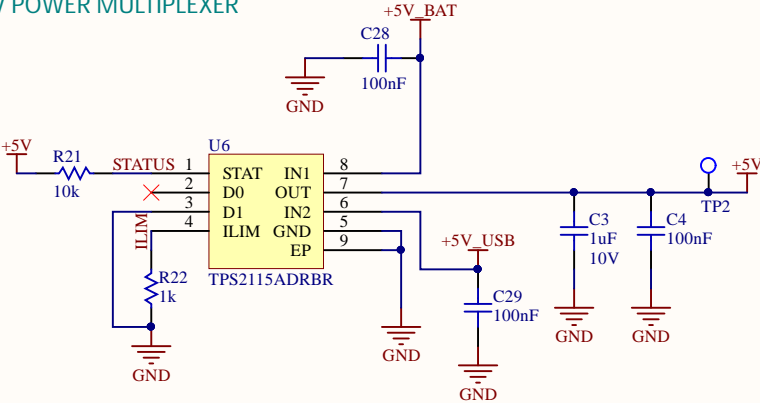
### LAYOUT NOTE:

Place N-FET close to 24V\_GND input connector

### DESIGN NOTE:

N-FET placed for reverse polarity protection. Will conduct at correct 12V input polarity, will not conduct when polarity reversed.

## 5V POWER MULTIPLEXER



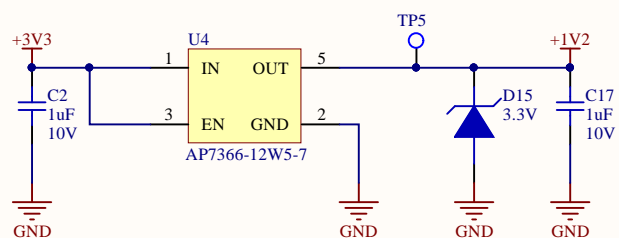
### DESIGN NOTE:

Autoswitching power mux, 5V from the power supply / battery will be automatically prioritized over 5V from USB. When 5V from supply is no longer present, USB power will take over

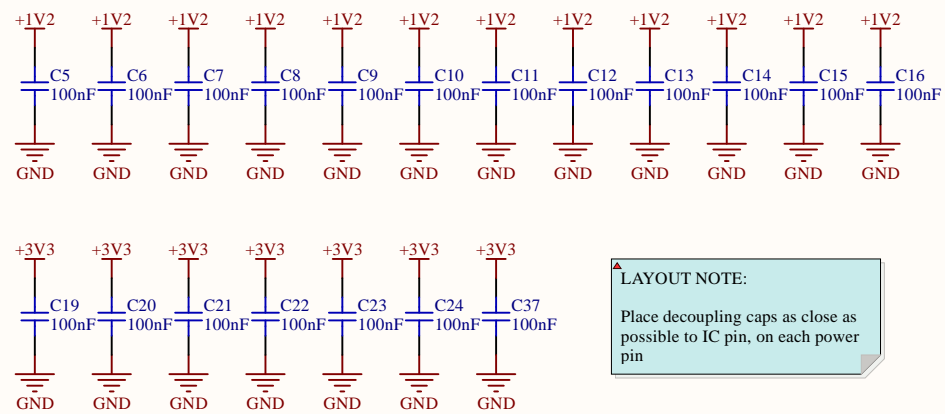
Title		
Size	Number	Revision
A4		
Date:	2020-11-22	Sheet of
File:	C:\Users\...\Power_Sensing.SchDoc	Drawn By:

# TMS570 POWER

## 1V2 LDO: 600mA



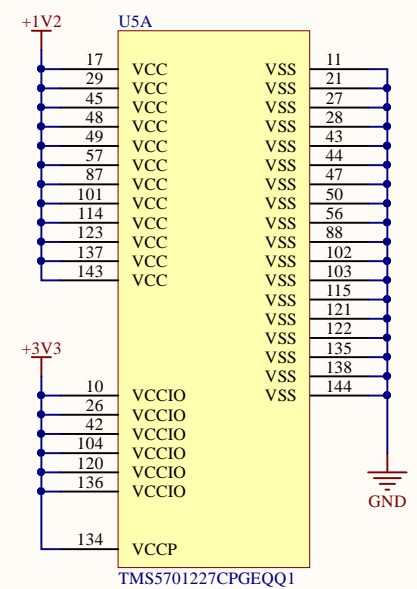
## DECOUPLING CAPACITORS



**LAYOUT NOTE:**  
Place decoupling caps as close as possible to IC pin, on each power pin

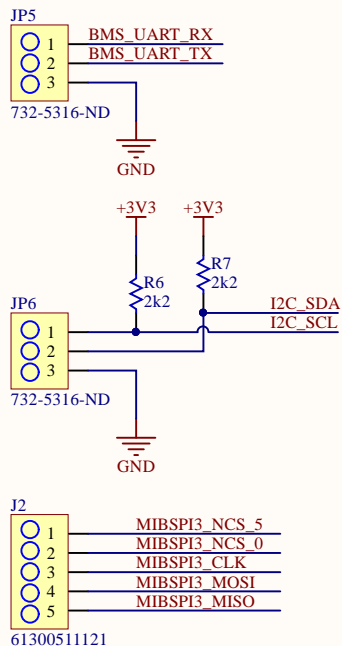
**DESIGN NOTE:**  
Decoupling capacitors help reduce the transients seen by the MCU on the power input pins

## MICROCONTROLLER POWER PINS



Title		
Size	Number	Revision
A4		
Date:	2020-11-22	Sheet of
File:	C:\Users\...\Power_MCU.SchDoc	Drawn By:

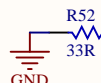
## COMMUNICATION TEST POINTS



## TMS570 SIGNALS

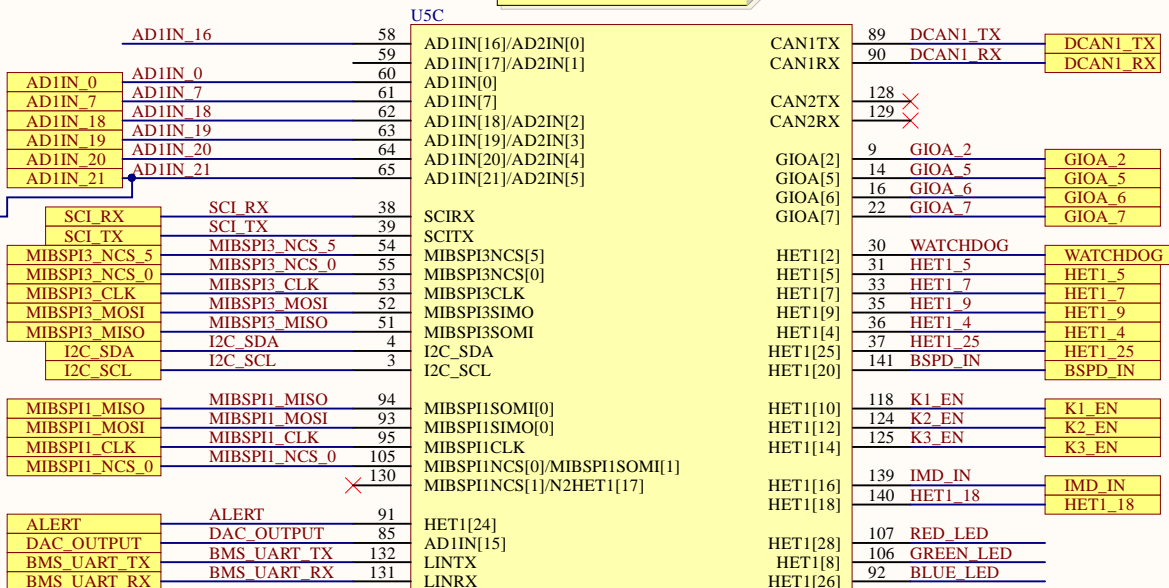
### DESIGN NOTE:

Extra resistor for current transducers that output a current instead of a voltage



### DESIGN NOTE:

LIN module used as SCI for BMS UART communication to slaves

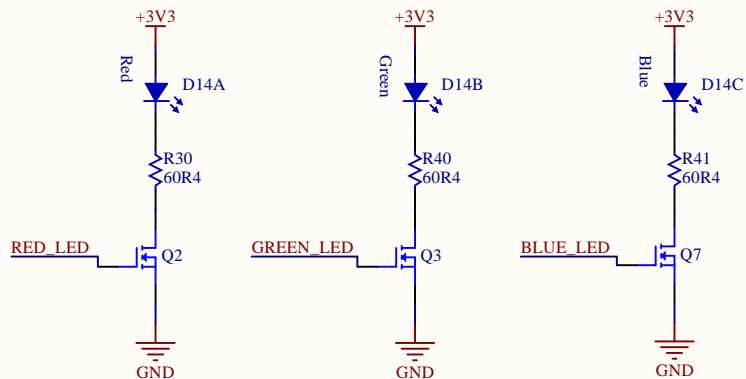


### NOTE:

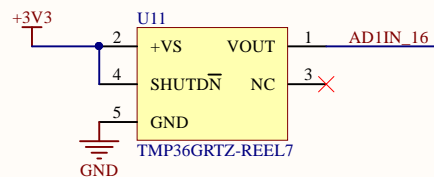
GIOB[2] is only capable of input, it is meant to read interrupts from the system

TMS5701227CPGEQ01

## RGB STATUS LEDs



## ONBOARD TEMP SENSOR



Title		
Size	Number	Revision
A4		
Date:	2020-11-22	Sheet of
File:	C:\Users\...\VCU_Schematic.SchDoc	Drawn By:

The diagram illustrates the JTAG connection for the FTSH-105-01-F-DV-K microcontroller. The JTAG 10-pin 0.050 inch pitch connector is connected to the JTAG adapter (D11) and the JTAG cable (PUSB3FR6Z). The adapter has pins 1-10 labeled: 1 CH1, 2 GND, 3 CH2, 4 CH3, 5 CH6, 6 CH5, 7 CH4, 8 CH3, 9 CH4, 10 CH5. The microcontroller has pins 1-10 labeled: 1 VTref, 2 TMS, 3 GND, 4 TCK, 5 GND, 6 TDO, 7 GND, 8 TDI, 9 Key, 10 nTRST. The microcontroller is also connected to a 3V3 supply, a GND, a +5V\_DEBUGGER supply, and a +5V\_USB supply. A 47k resistor (R47) is connected between the +5V\_DEBUGGER supply and the nTRST pin. A 10k resistor (R8) is connected between the TDI pin and GND. A design note states: 'JTAG connection allows programming & debugging the MCU'.

5V used as analog input voltage reference.  
Inputs allowed from 0 - 5V

USB

108 TMS  
112 TCK  
111 TDO  
110 TDI  
109 NTRST  
113 RTCK

46 nPORRST  
116 NRST

117 nERROR  
34 TEST

18 OSCIN  
19 KELVIN\_GND  
20 OSCOUT

66 +5V  
67 GND  
69 +5V  
68 GND

18 GND  
19 KELVIN\_GND  
20 GND

OSCIN  
OSCOUT

C25 100nF  
C39 33pF  
C40 33pF

XTAL1

ABLS2-16.000MHZ-D4Y-T

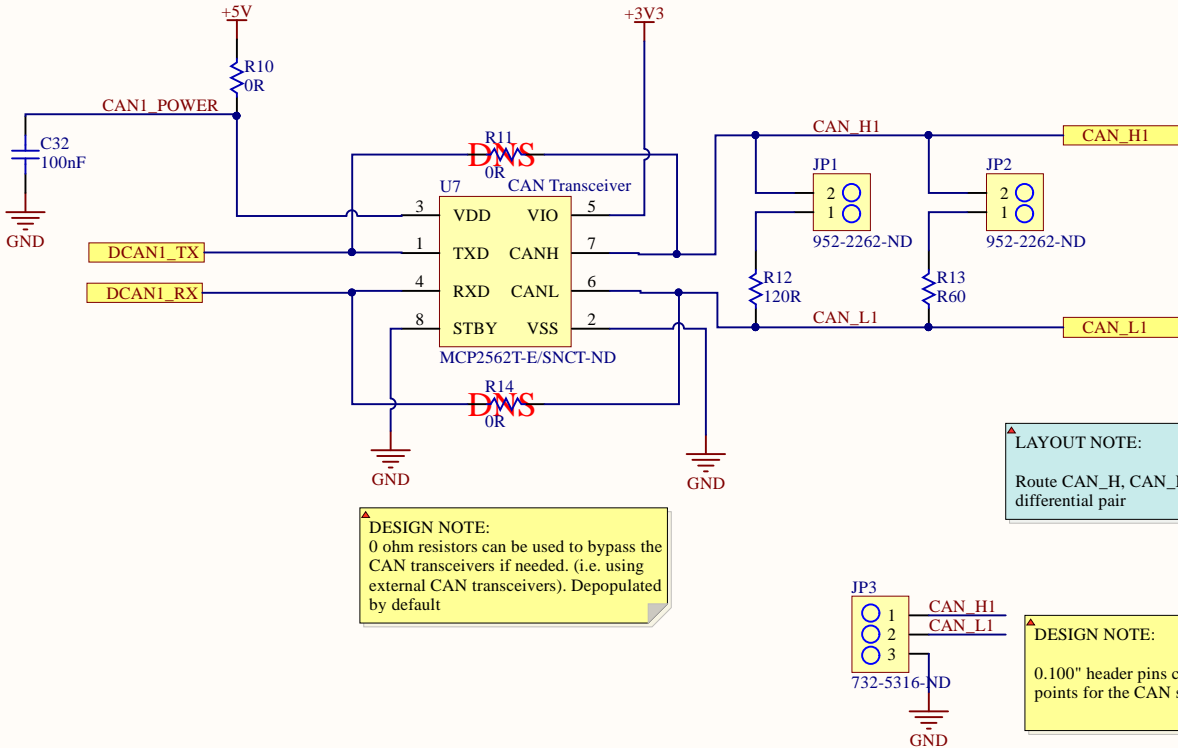
TMS5701227CPGEQQ1

The schematic diagram illustrates the USB to UART converter circuit. It features a Micro USB Connector (X7) connected to a USB to UART Converter (U9). The connector pins are: 1 (USBVDD), 2 (D-), 3 (D+), 4 (ID), and 5 (USBVSS). The converter has pins for VCCIO, VCC, TXD, RXD, RTS#, CTS#, USBDM, USBDP, RESET#, GND, and CBUS0-CBUS3. It is powered by a +5V\_USB source through a 23R resistor (FB1) and a 10uF capacitor (C61). The converter's output is connected to an FT230XL-QR module, which has pins for TXD, RXD, RTS#, CTS#, RX\_LED\_N, TX\_LED\_N, and GND. The module is also powered by a +5V\_USB source through a 23R resistor (FB2) and a 10uF capacitor (C61). The module's output is connected to an SCL\_RX and SCL\_TX signal line.

The schematic diagram illustrates the USB interface circuit. A +5V\_USB input is connected to a network of capacitors (C27, C18) leading to USBSS. The USBSS is connected to the USB\_P and USB\_N pins of the PHDM12AB4Z connector. The connector also shows pins 1 (LINE1), 2 (LINE2), 3 (GND), 4 (LINE3), and 5 (LINE4) which are not connected (N.C.).

Title			
Size A4	Number		Revision
Date:	2020-11-22	Sheet	of
File:	C:\Users\...\MCU_Signals.SchDoc	Drawn By:	

# CAN TRANSCEIVER



**DESIGN NOTE:**

0 ohm resistors allow IC's to be unpowered and unused if needed. (i.e. don't need them or they draw too much power)

▲ LAYOUT NOTE:

Place decoupling caps as close as possible to IC pin

**LAYOUT NOTE:**

Route CAN\_H, CAN\_L signals as differential pair

**DESIGN NOTE:**

0.100" header pins can be used as test points for the CAN signals

Title			
Size A4	Number		Revision
Date:	2020-11-22	Sheet	of
File:	C:\Users\...\CAN.SchDoc	Drawn By:	

# LOW SIDE SWITCHING

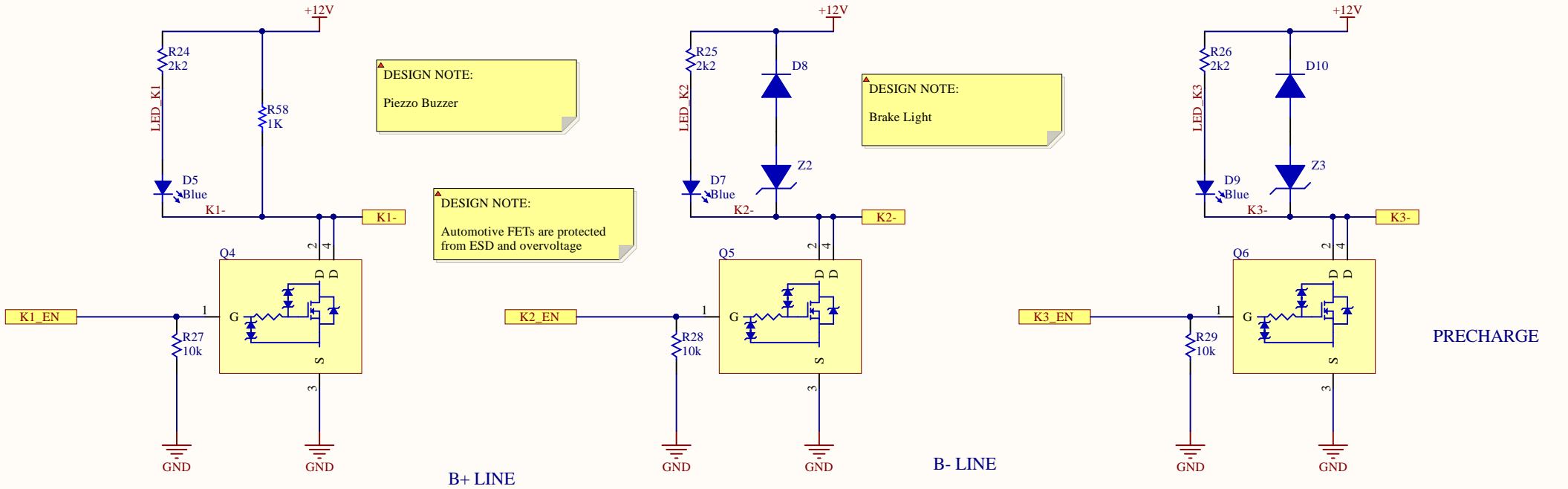
DESIGN NOTE:  
Diode-Zener snubber acts as a good way to dissipate inductive voltage kicks when the contactor opens

DESIGN NOTE:  
These low-side switches go out to the rest of the shutdown circuit. The snubber circuit and LED remain for backwards compatibility with the go kart, where the contactors connect directly to the VCU.

DESIGN NOTE:  
Piezzo Buzzer

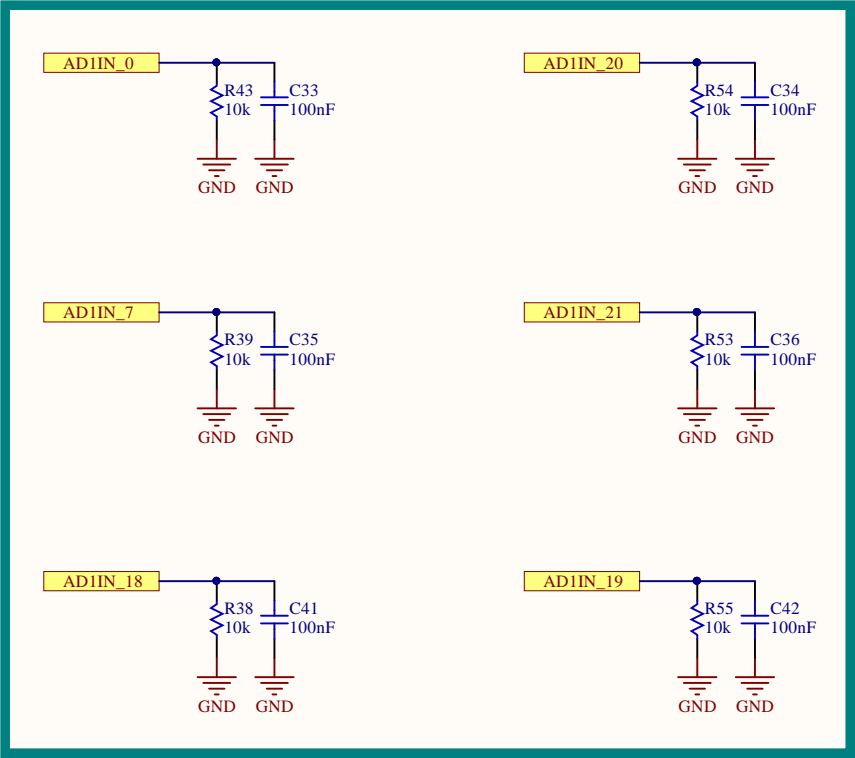
DESIGN NOTE:  
Brake Light

DESIGN NOTE:  
Automotive FETs are protected from ESD and overvoltage



Title		
Size A4	Number	Revision
Date: 2020-11-22	Sheet of	
File: C:\Users\...\Contactor_Switching.SchDoc	Drawn By:	

# ADC DECOUPLING & PULL DOWN

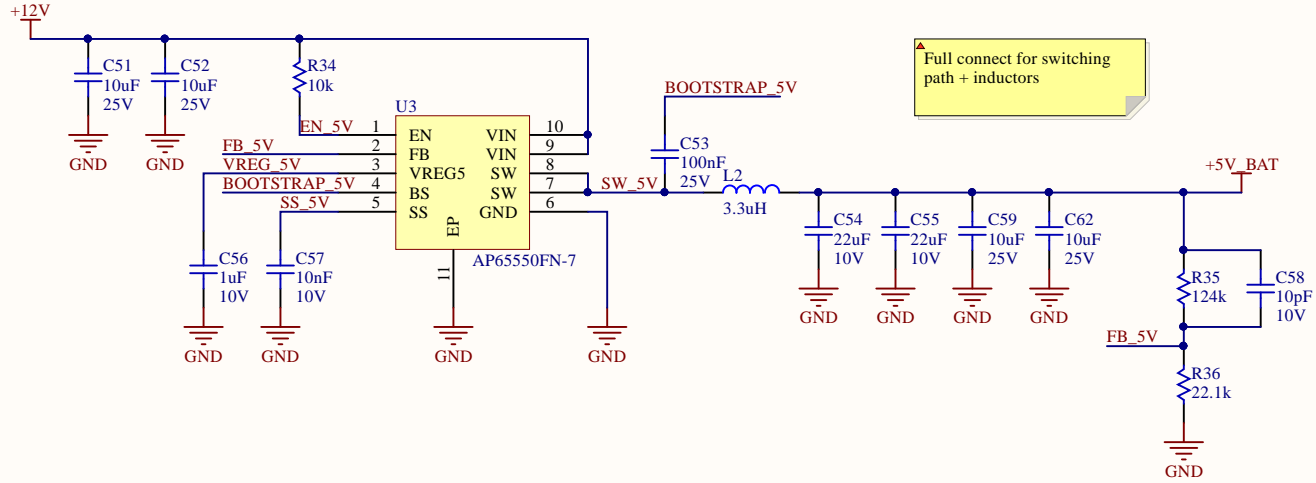


**LAYOUT NOTE:**  
Place analog input capacitors near microcontroller pins

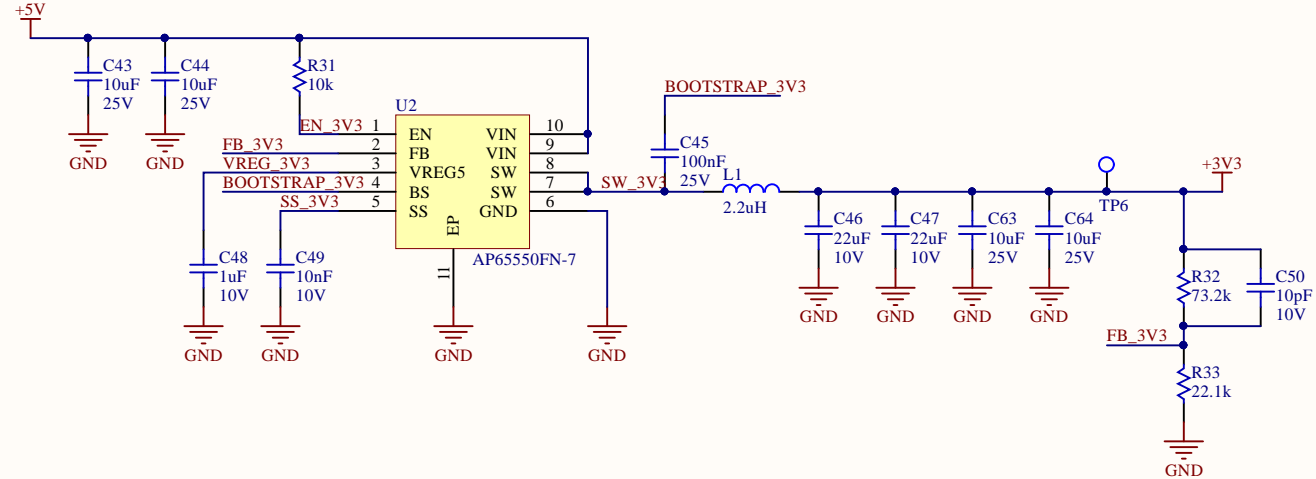
Title		
Size A4	Number	Revision
Date:	2020-11-22	Sheet of
File:	C:\Users\...\ADC_Decoupling.SchDoc	Drawn By:



### 5V 5A BUCK REGULATOR



### 3V3 5A BUCK REGULATOR



Title		
Size	Number	Revision
A4		
Date:	2020-11-22	Sheet of
File:	C:\Users\...BUCK_CONVERTERS.SchDoc	
Drawn By:		

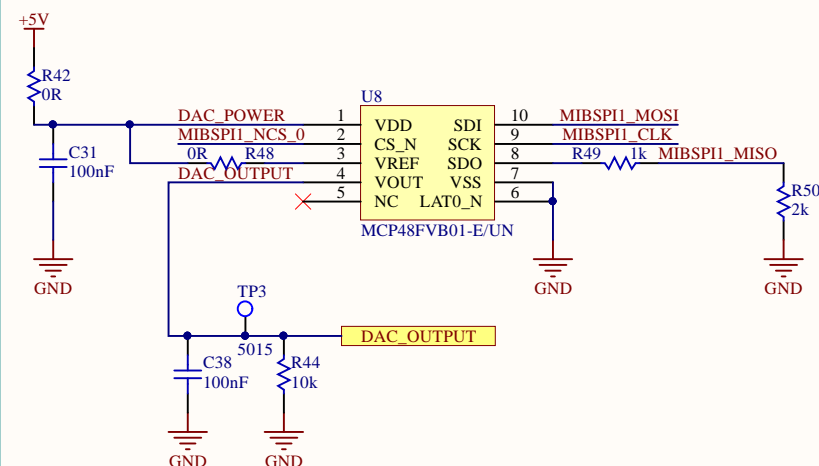
▲ DESIGN NOTE:

0 ohm resistors allow IC's to be unpowered and unused if needed. (i.e. don't need them or they draw too much power)  
They also provide a footprint for a resistor, in case an RC filter is needed

▲ LAYOUT NOTE:

Place decoupling caps as close as possible to IC pin

### DIGITAL TO ANALOG CONVERTER



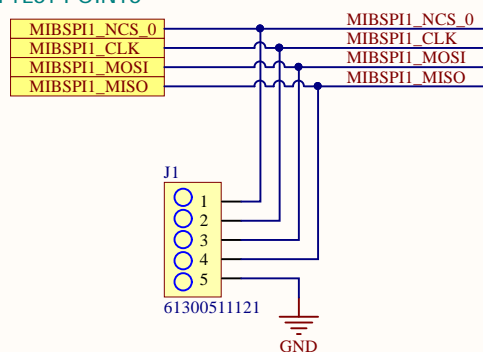
▲ DESIGN NOTE:

Unstuffing the 0 ohm resistors can also allow for current to be measured using a DMM

▲ LAYOUT NOTE:

Place output filter cap near connector

### SPI TEST POINTS



Title		
Size A4	Number	Revision
Date: 2020-11-22	Sheet of	
File: C:\Users\...\DAC.SchDoc	Drawn By:	

