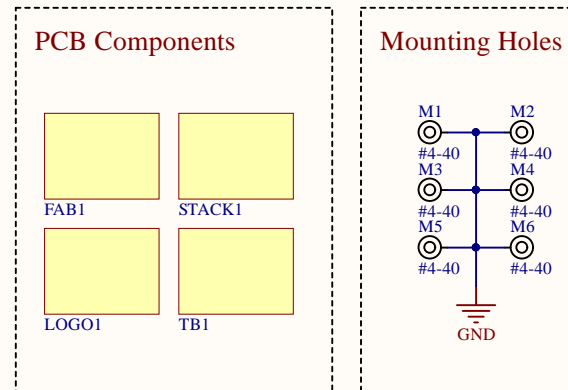
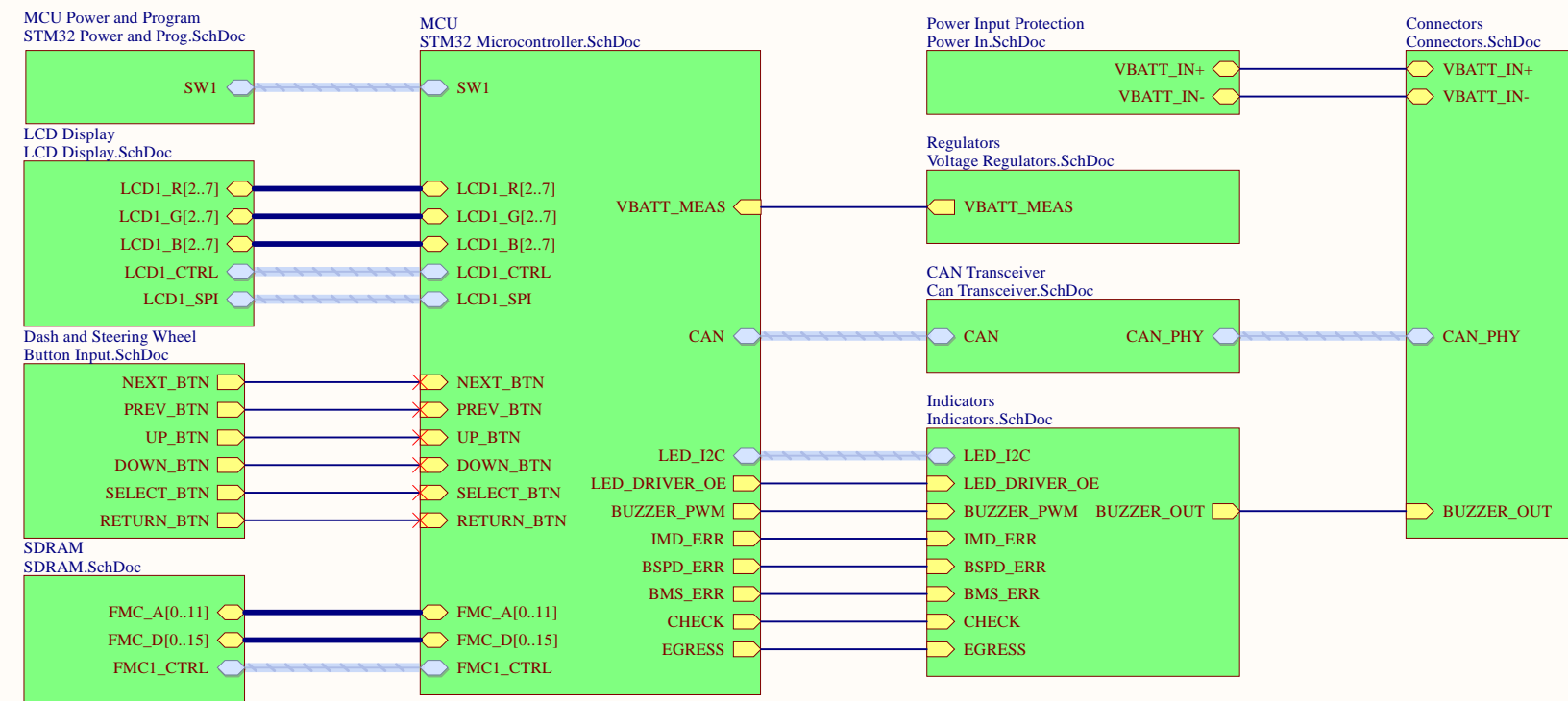
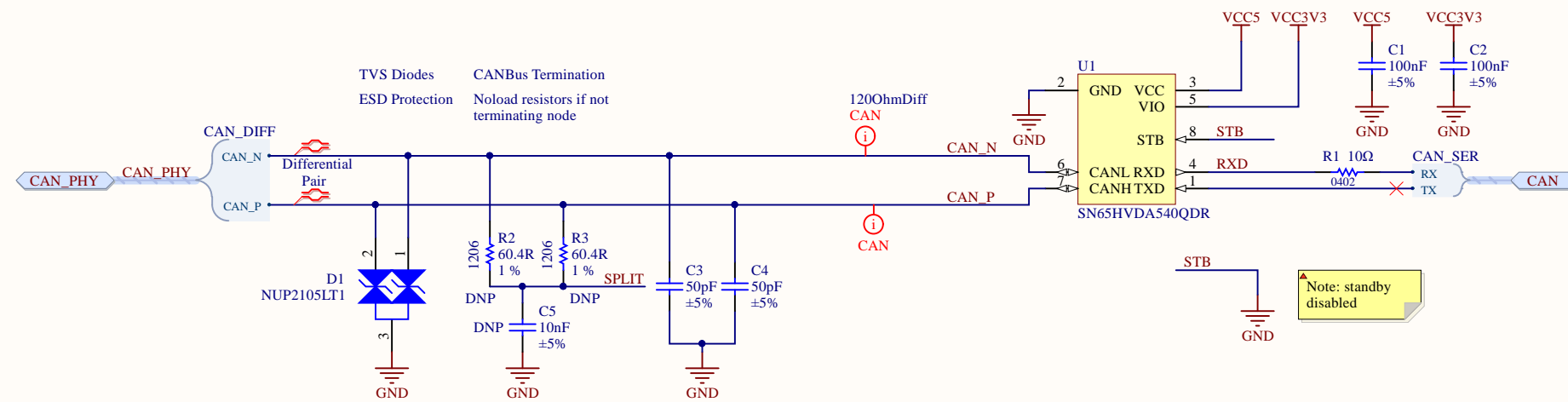


Driver Interface Module



Title: Driver Interface Module - Main		
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	Carnegie Mellon Racing © 2015
Date: 4/5/2016	Sheet: 1 of 13	

CAN



Termination Resistor Sizing

<http://tinyurl.com/qf5f7hk>
- Recommends 0.25W termination resistors

<http://tinyurl.com/oldntqy>
- Explains why 0.25W termination resistors are recommended for 5V CAN networks

1206 SMT resistors handle 0.25W

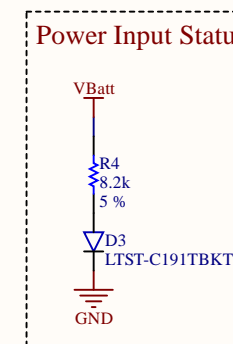
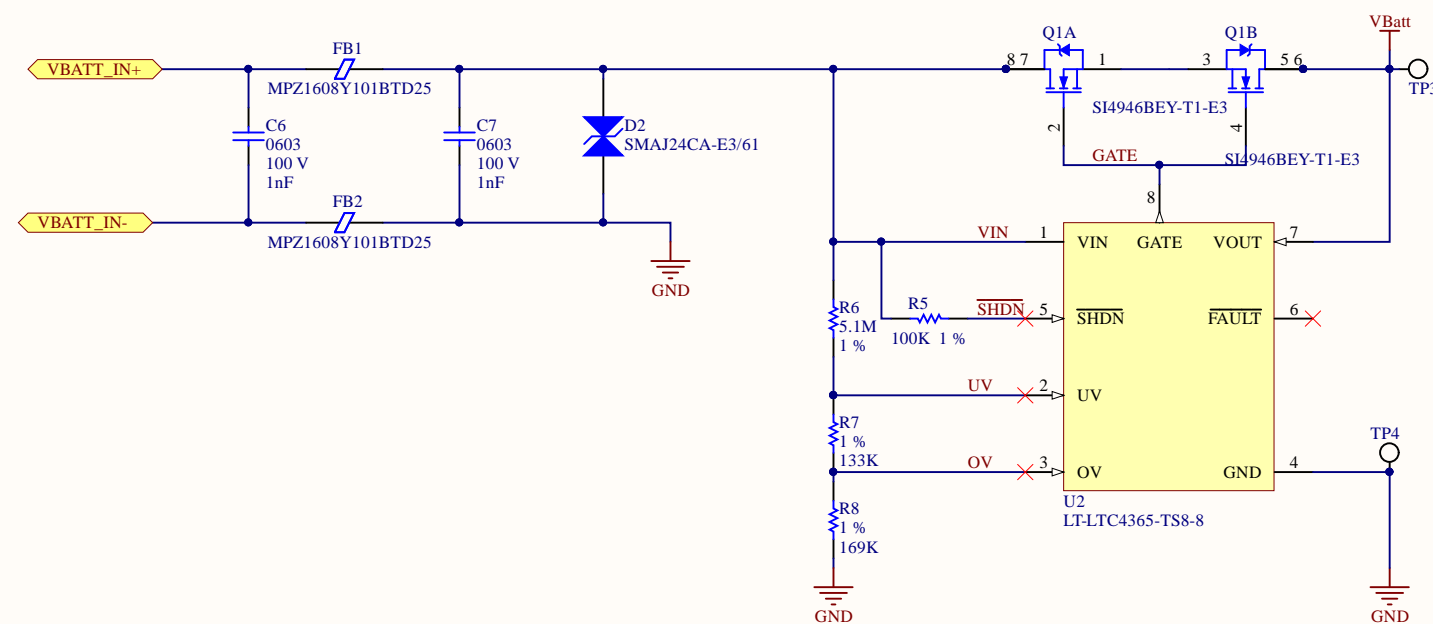
ESD Protection Capacitors


http://www.nxp.com/documents/application_note/AN10211.pdf
- Recommends <=100pF caps

Title: Driver Interface Module - CAN	
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00
System: GLV	Rev: 2.0
Date: 4/5/2016	Sheet: 2 of 13

Power In

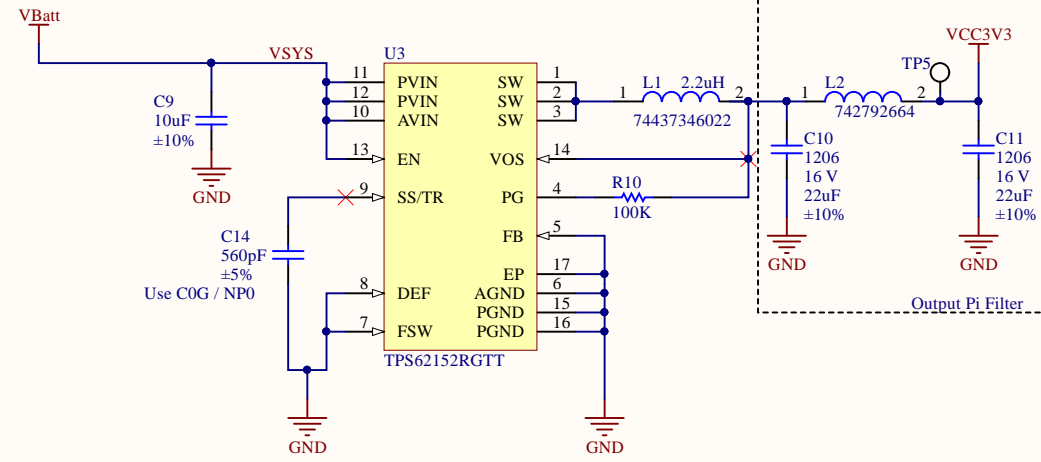
Under / Over / Reverse Voltage Protection



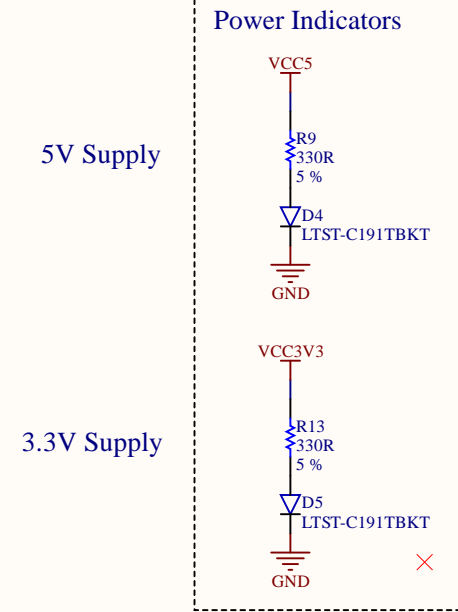
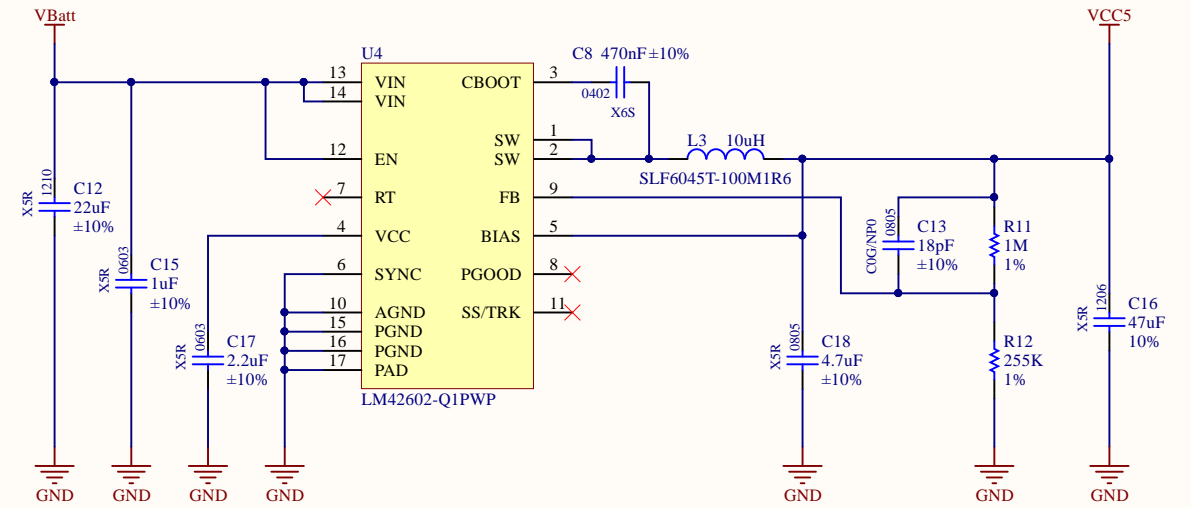
Title: Driver Interface Module - Power In		 Carnegie Mellon Racing © 2015
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	
Date: 4/5/2016	Sheet: 3 of 13	

Power

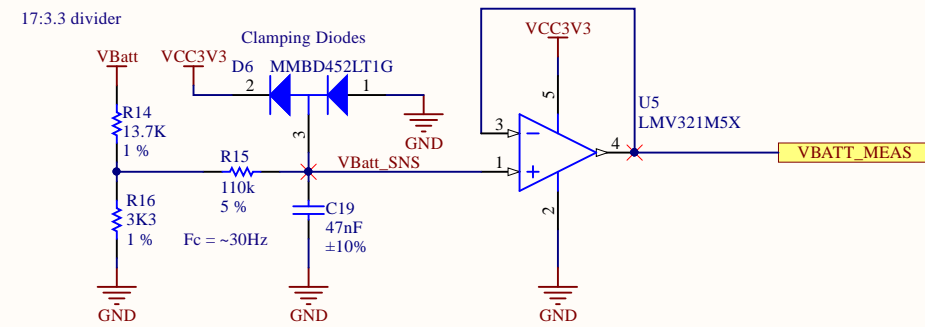
Switching Regulator, 3-17V input 3.3V output



Switching Regulator, 3.5-36V input 5V 2A output



Unity Gain Buffer



Clamping Diodes & Voltage Divider

Clamping diodes max If (forward current) = 120mA
 Vf (forward voltage) = 1V max at 120mA

Voltage between divider resistors: 5V + Vf = 6V

Maximum over/undervoltage with 1kohm resistor at 120mA:
 (Vmax - 6V) / 10K = 120mA; Vmax = 126V (really high)

So, limiting factor in resistors is current leakage from VBatt to AGND in sensing.

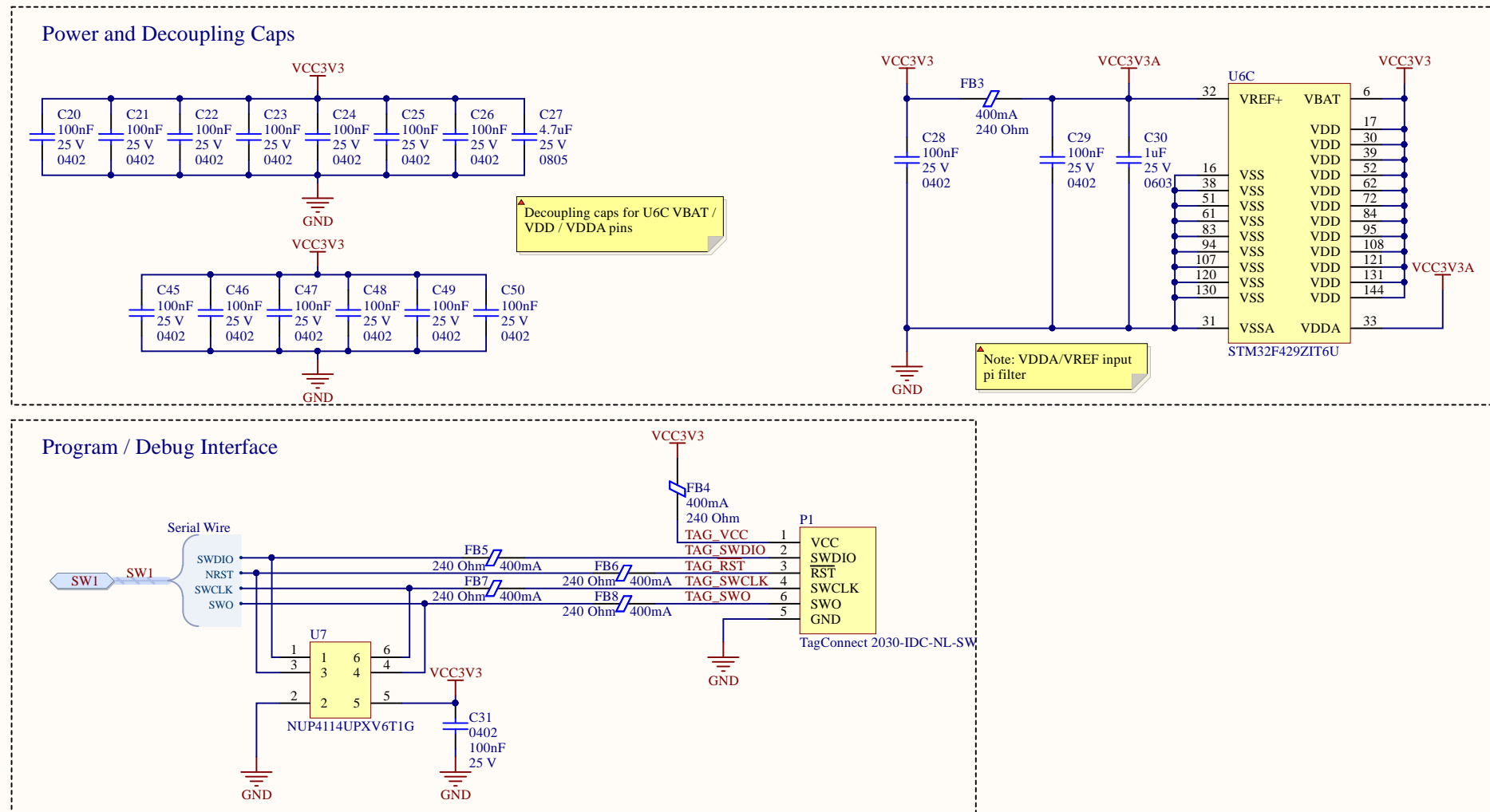
1mA leakage to ground: 17V (worst case) / 1mA = 17kohm, so use resistor total > 17kohm for leakage less than 1mA.

12K / 5K yields 17:5 divider ratio, adding up to 17kohm.

VCC12 / GND		VCC5 / GND		AVCC5 / AGND	
Device	Current Draw (max)	Device	Current Draw (max)	Device	Current Draw (max)
PUMP_L_PWR	3 A	CAN Trans.	70 mA	MCU	30 mA
PUMP_R_PWR	3 A	L_Pump Switch	1.3 mA	VREF	20 mA
FAN_PWR	5.5 A	R_Pump Switch	1.3 mA	ADC Cond.	60 mA
BRAKE_PWR	300 mA	Fan Switch	3.3 mA	(est)	
VCC5	53.1 mA	Brake Switch	1.6 mA	Diag LEDES	50 mA
		Diag LEDES	50 mA	(est)	
		(est)		Sensors (est.)	1A
Total (max)	11.85 A	Total	127.5 mA @ 5v = .6375 W	Total	1.16 A

Title: Driver Interface Module - Regulators		
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	Carnegie Mellon Racing © 2015
Date: 4/5/2016	Sheet: 4 of 13	

STM32 Power and Programming

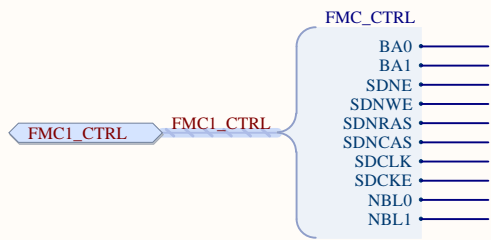


Title: Driver Interface Module - MCU PWR/PROG	
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00
System: GLV	Rev: 2.0
Date: 4/5/2016	Sheet: 5 of 13

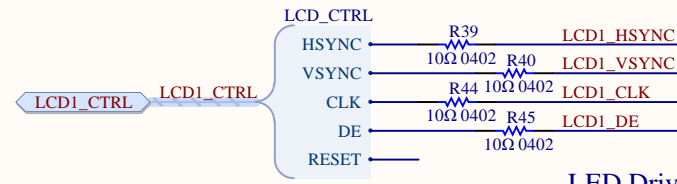
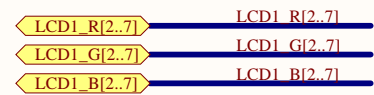


Microcontroller

SDRAM

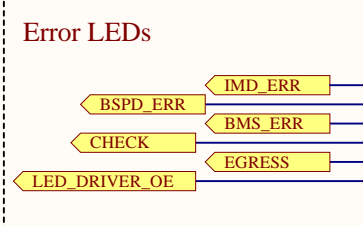
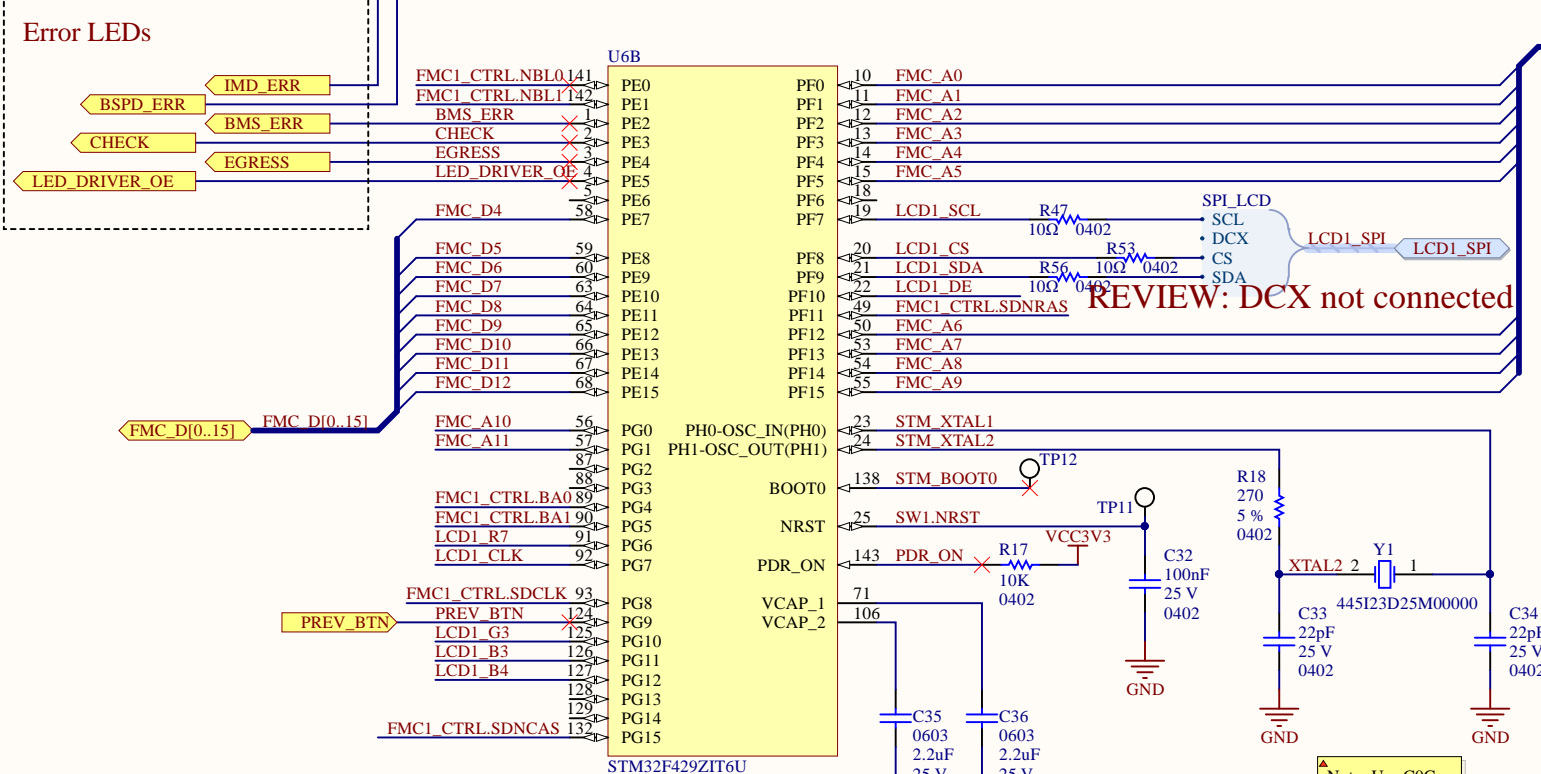
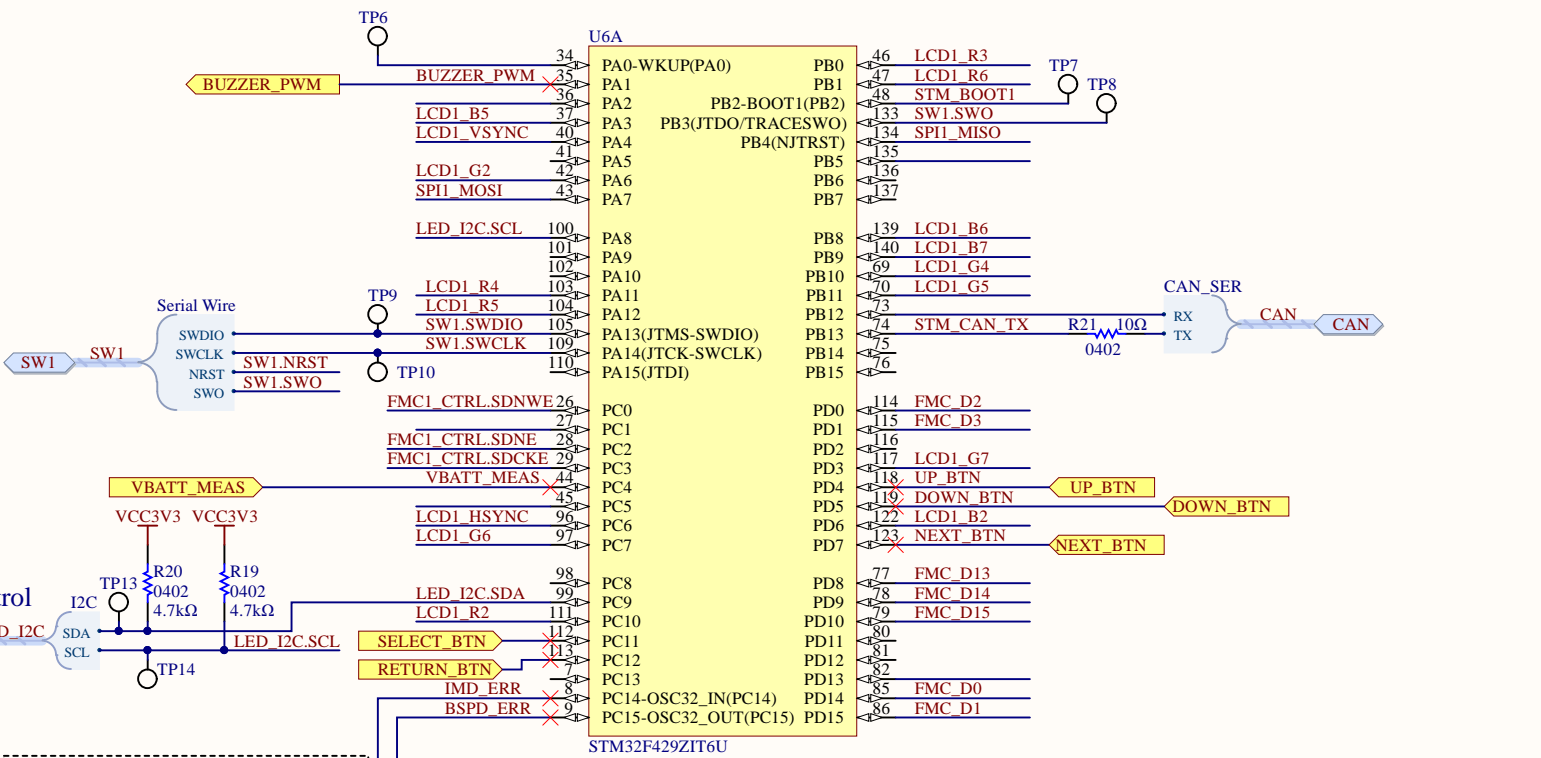


LCD



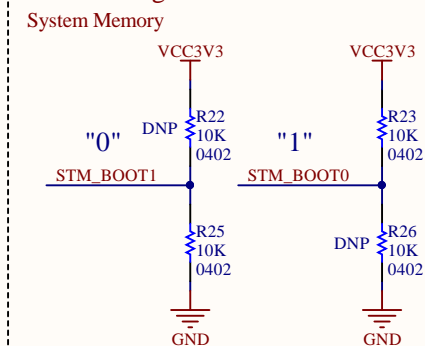
REVIEW: reset not hooked up

LED Driver Control

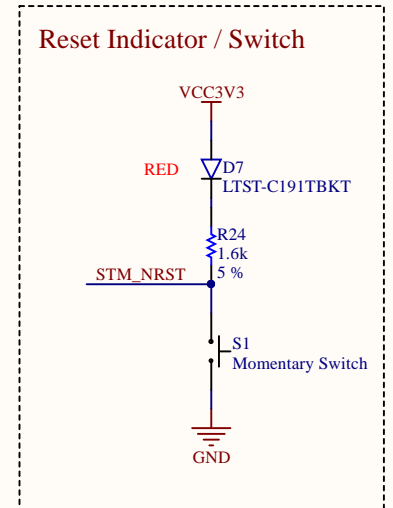


REVIEW: DCX not connected

Boot Configuration



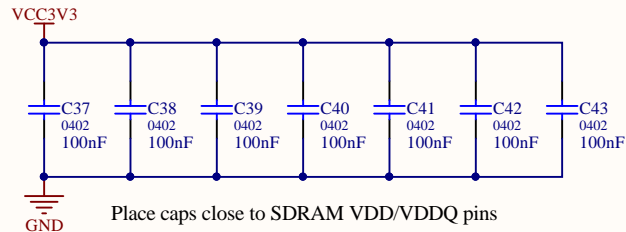
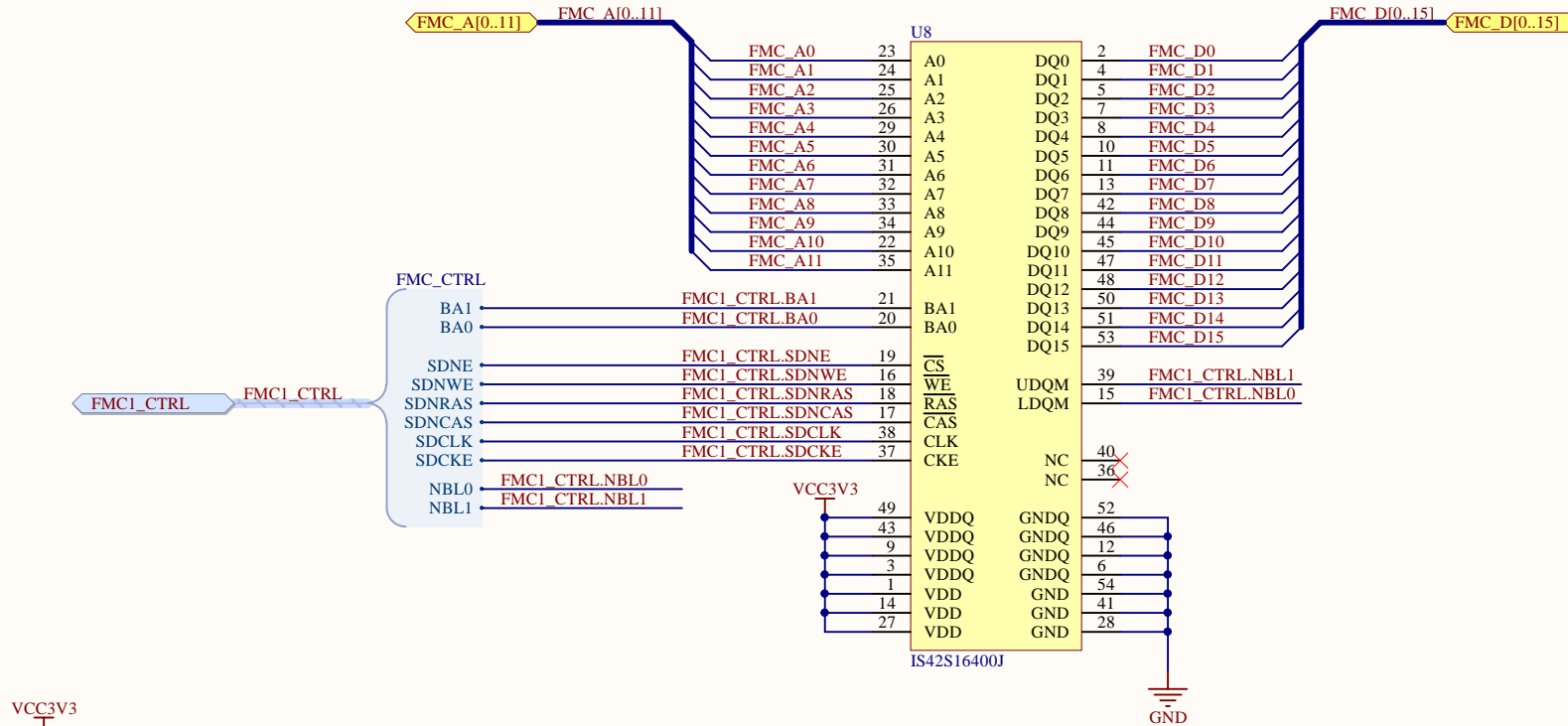
BOOT1	BOOT0	Boot mode
X	0	User Flash memory
0	1	System memory (bootloader)
1	1	Embedded SRAM




Note: Use X7R caps for VCAP_1/2 < 2 Ohm ESR
Note: Use C0G caps for C7, C7, low esr

Title: Driver Interface Module - MCU		
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	Carnegie Mellon Racing © 2015
Date: 4/5/2016	Sheet: 6 of 13	

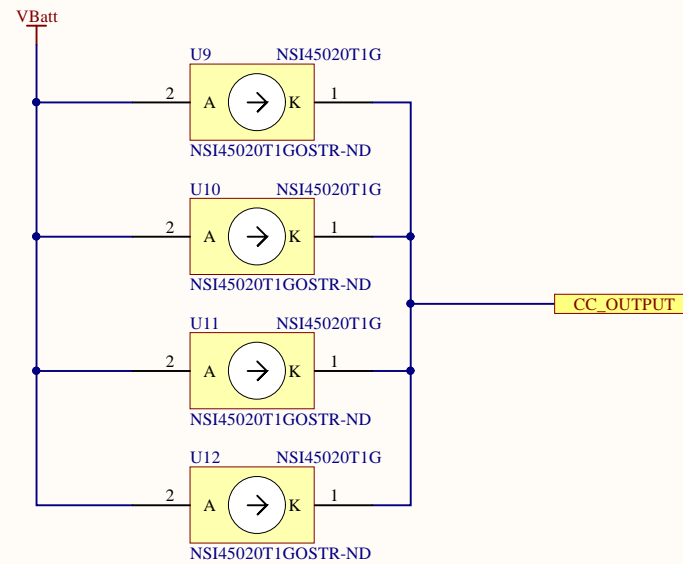
SDRAM




Title: Driver Interface Module - SDRAM		
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	Carnegie Mellon Racing © 2015
Date: 4/5/2016	Sheet: 7 of 13	

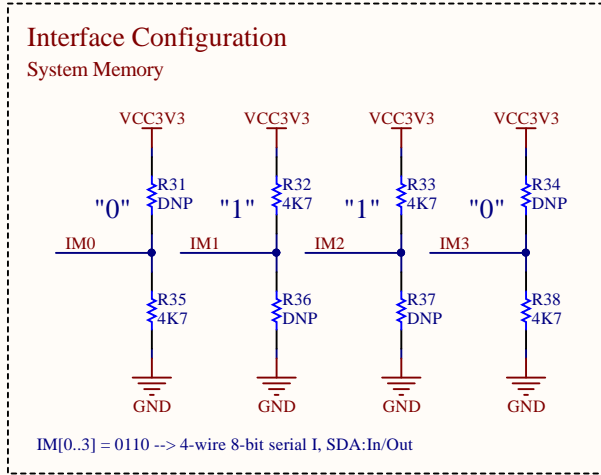
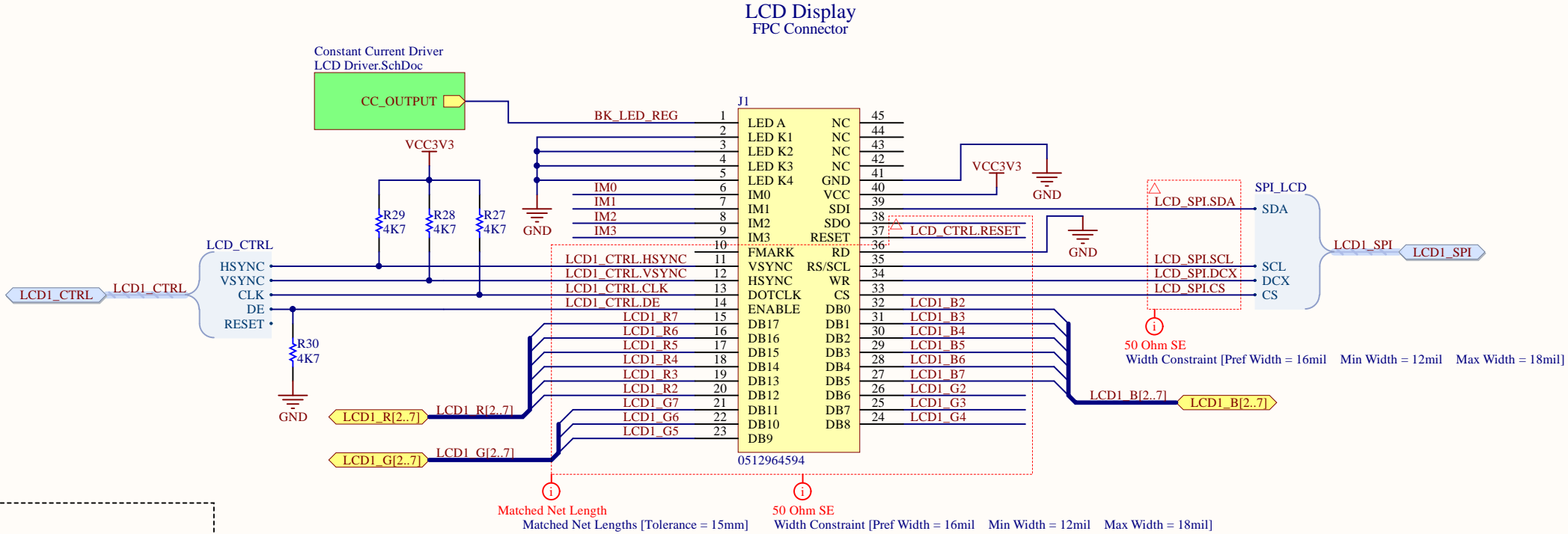
Constant Current Driver

80mA Output



Title: Driver Interface Module - LCD Driver		
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	Carnegie Mellon Racing © 2016
Date: 4/5/2016	Sheet: 8 of 13	

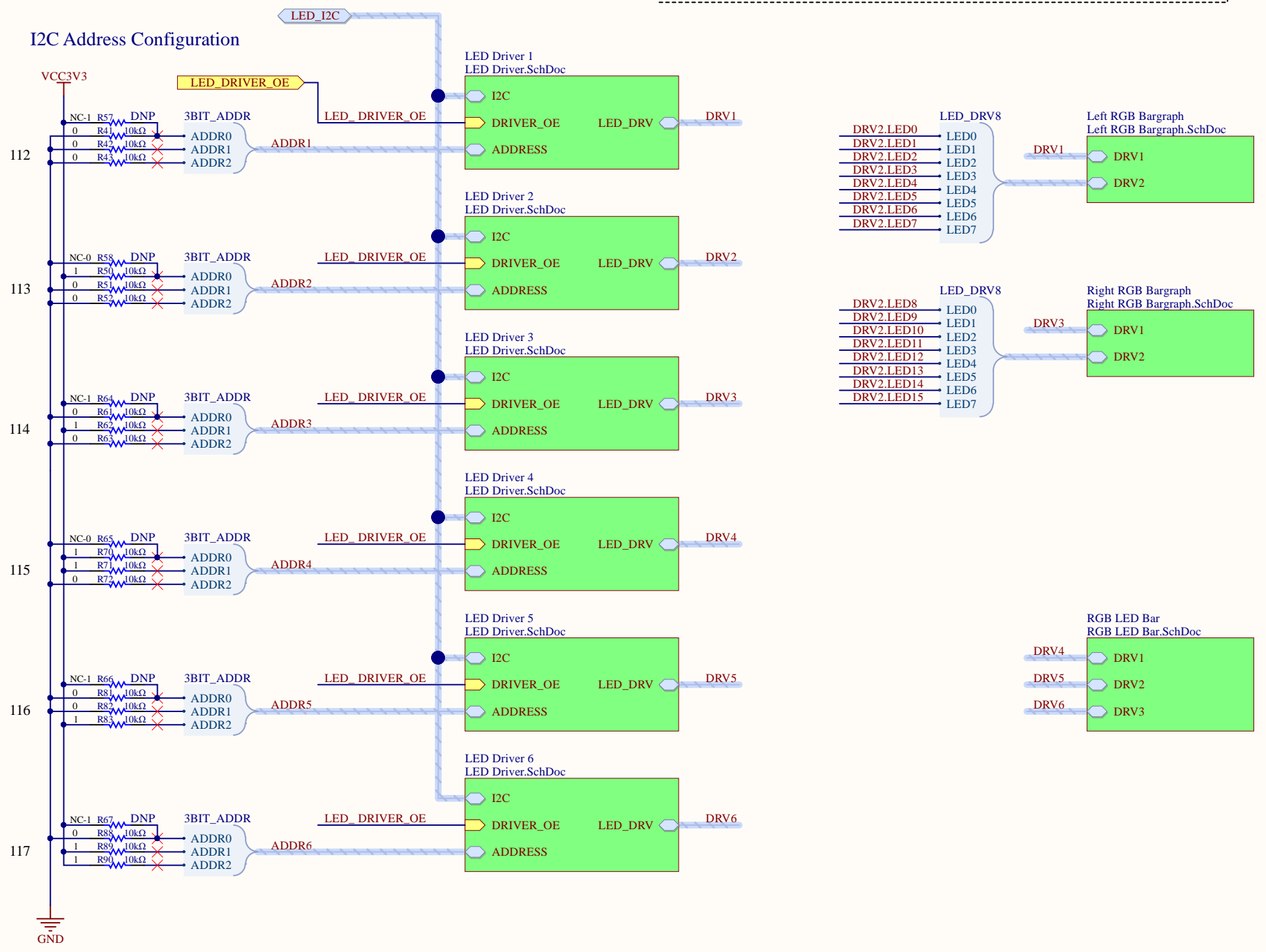
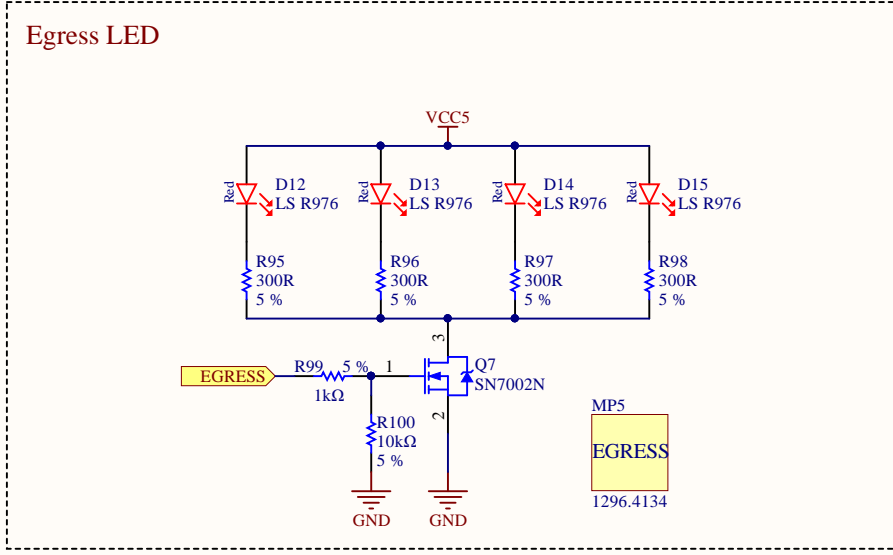
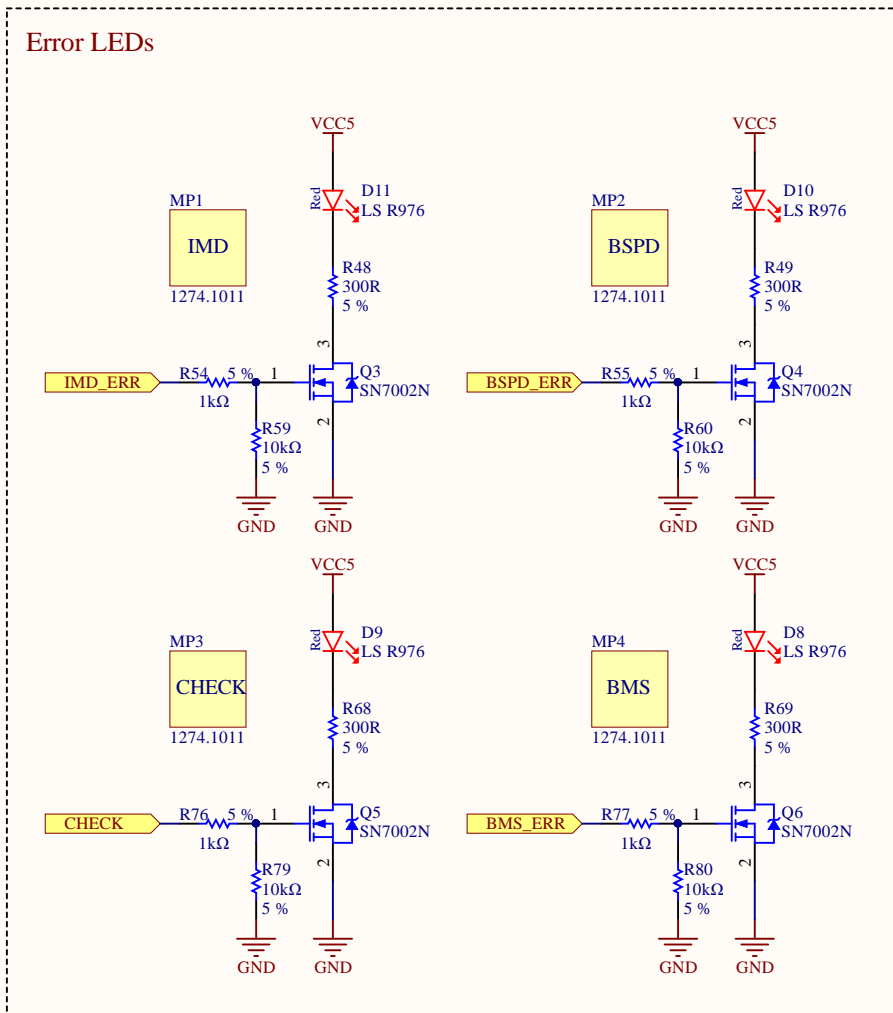
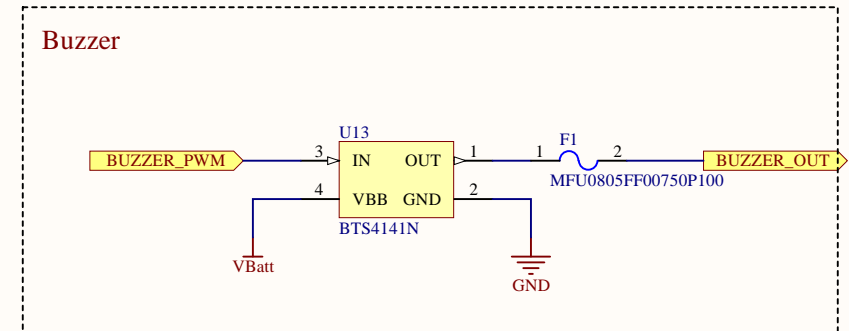
LCD Display



Title: Driver Interface Module - LCD Display	
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00
System: GLV	Rev: 2.0
Date: 4/5/2016	Sheet: 8 of 13

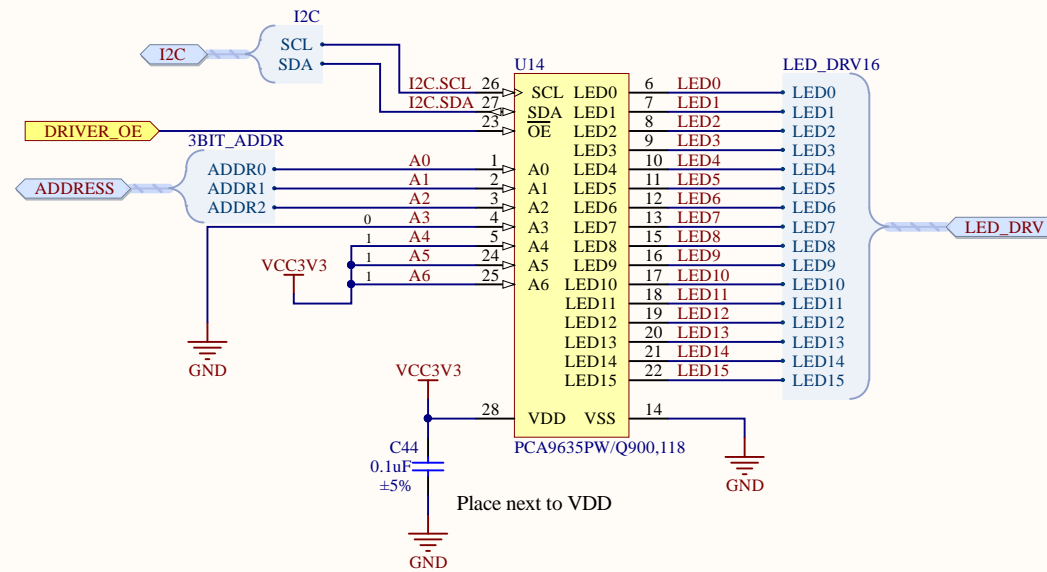


Indicators




Title: Driver Interface Module - Indicators		
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	Carnegie Mellon Racing © 2015
Date: 4/5/2016	Sheet: 9 of 13	

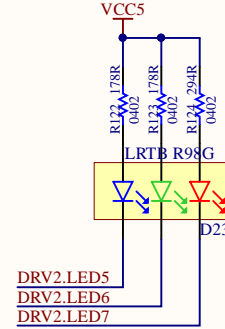
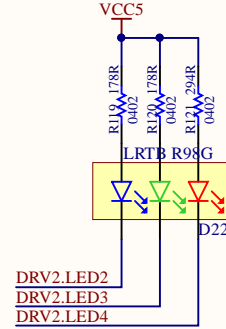
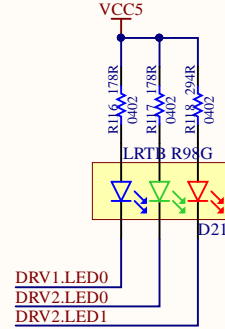
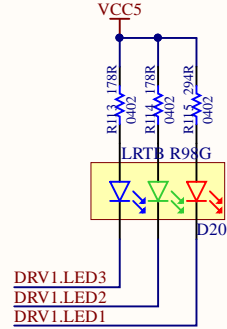
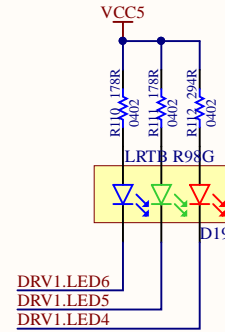
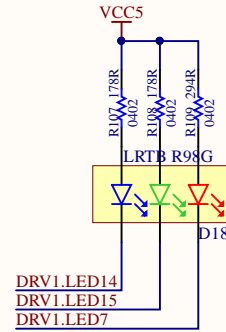
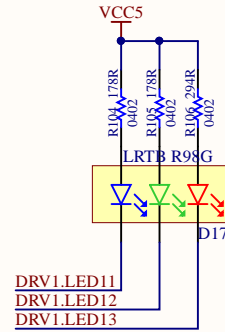
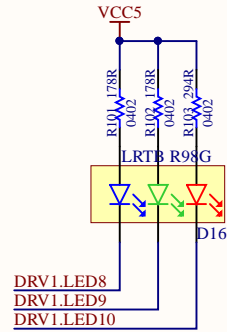
LED Driver



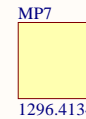
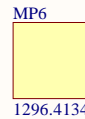
Note: The ground pin on these ICs can sink up to 400mA on full power. Lay out accordingly

Title: Driver Interface Module - LED Driver		 Carnegie Mellon Racing © 2015
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV Date: 4/5/2016	Rev: 2.0 Sheet: 10 of 13	

Right RGB Bargraph



Light Guides

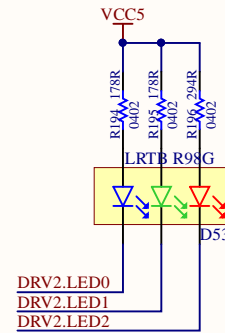
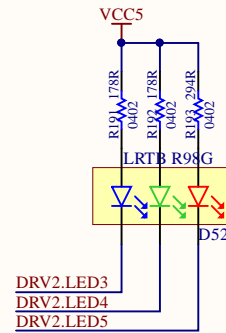
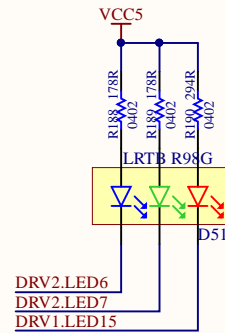
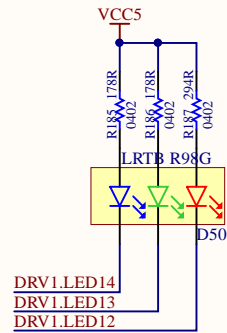
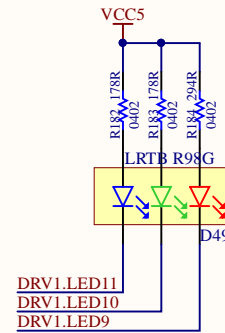
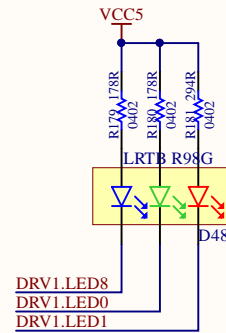
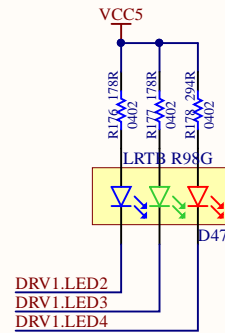
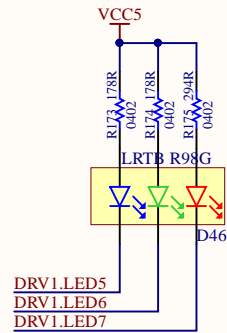


Title: Driver Interface Module - RGB Bargraph	
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00
System: GLV	Rev: 2.0
Date: 4/5/2016	Sheet: 1 of 13

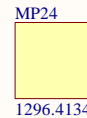



Carnegie Mellon Racing © 2015

Left RGB Bargraph

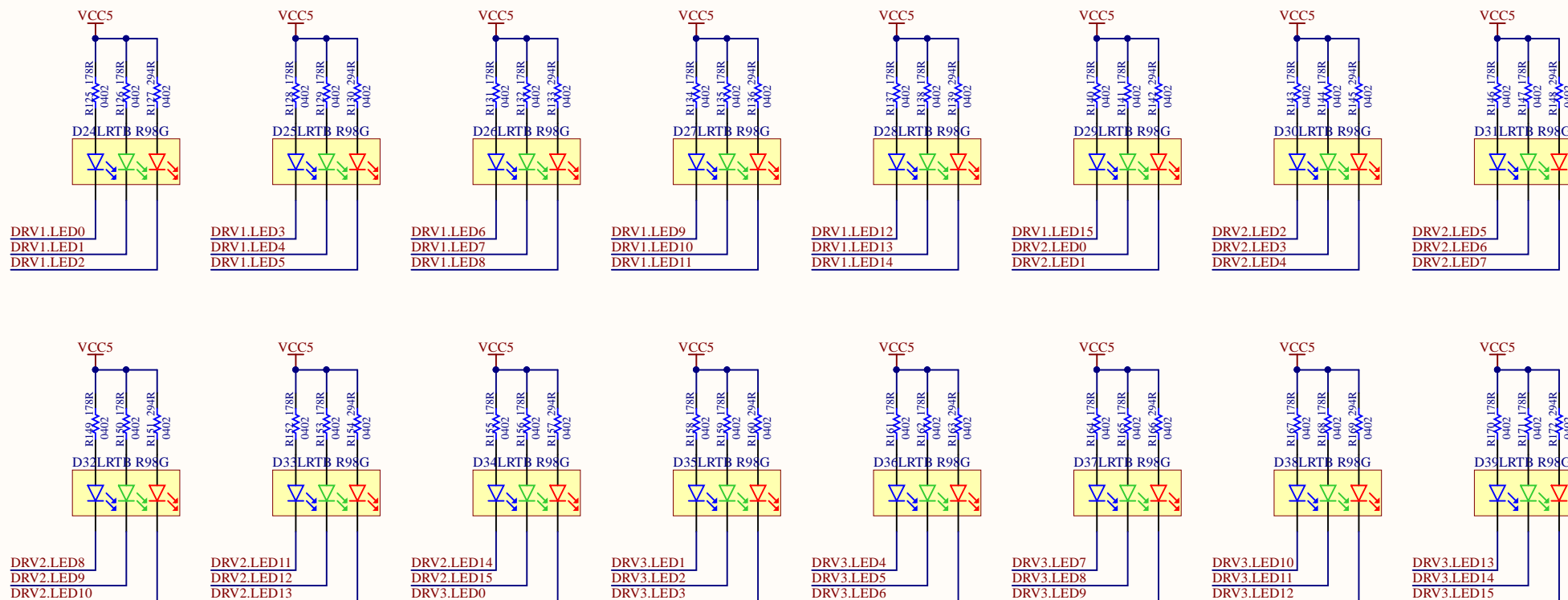


Light Guides

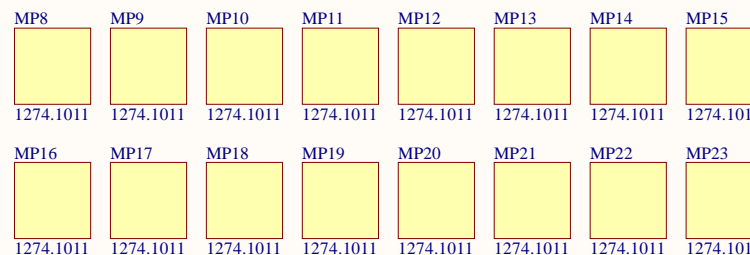


Title: Driver Interface Module - RGB Bargraph		 Carnegie Mellon Racing © 2015
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	
Date: 4/5/2016	Sheet: 1 of 13	

RGB LED Bar



Light Guides

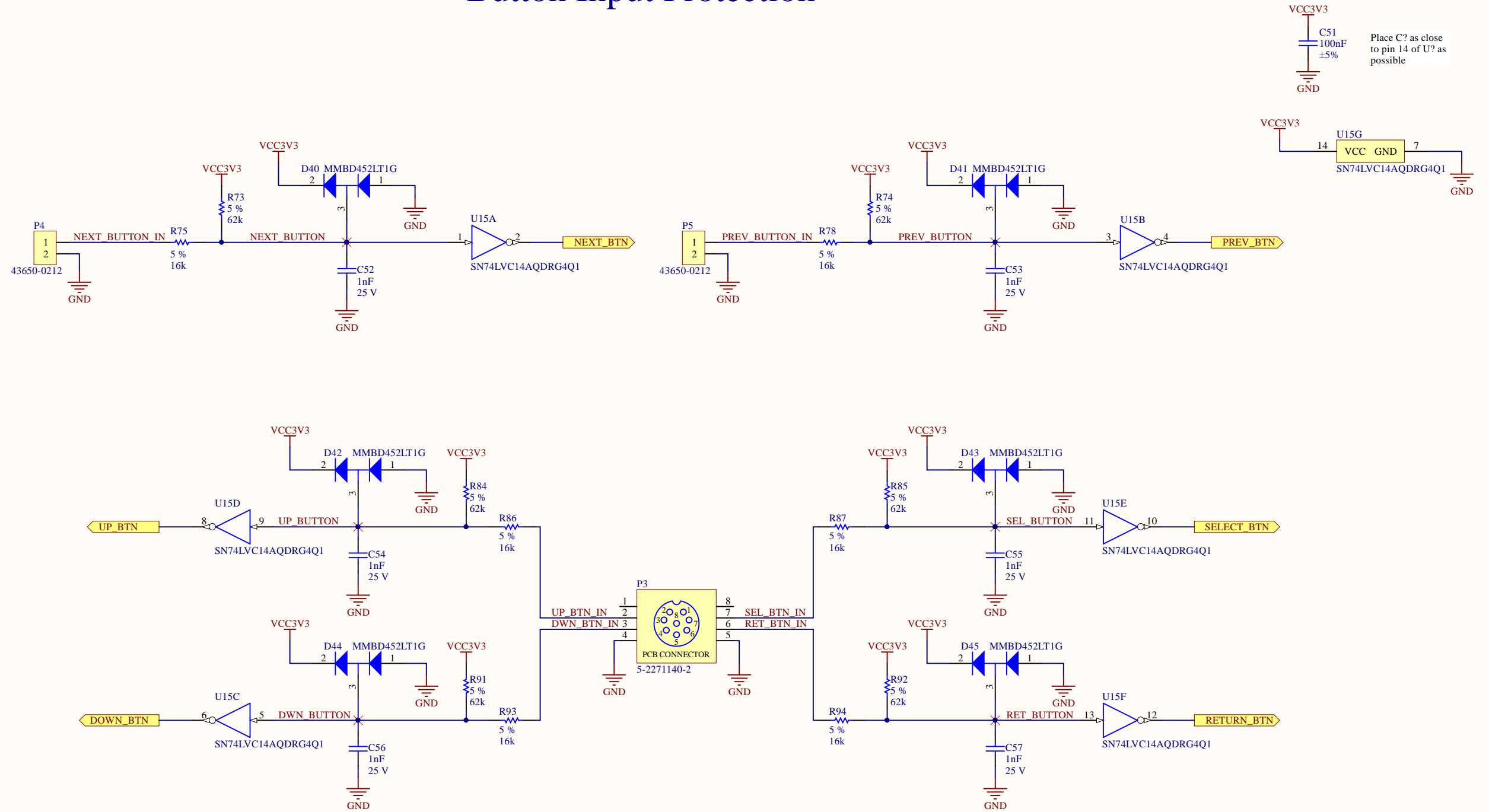



Title: Driver Interface Module - RGB LED Bar	
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00
System: GLV	Rev: 2.0
Date: 4/5/2016	Sheet: 12 of 13



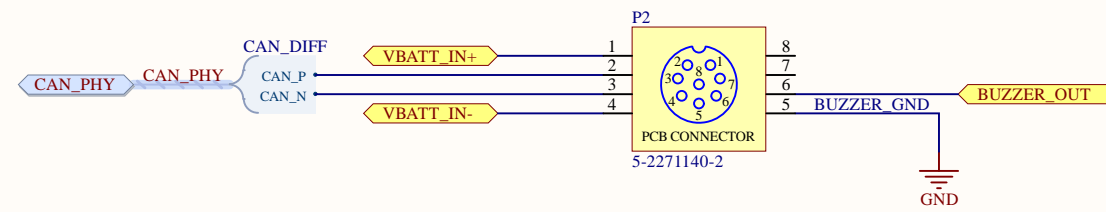
Carnegie Mellon Racing © 2015

Button Input Protection




Title: Driver Interface Module - Conditioning		 Carnegie Mellon Racing © 2015
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	
Date: 4/5/2016	Sheet: 13 of 13	

Connectors



Cannot open file C:\Users\Daniel Haddox\Documents\CMR Altium Repository 2015-2016\GLV\Driver Interface Module\Design\circ_pinout1.PNG

Cannot open file C:\Users\Daniel Haddox\Documents\CMR Altium Repository 2015-2016\GLV\Driver Interface Module\Design\circ_pinout2.PNG

Title: Driver Interface Module - Connectors		
Engineer: Tom Eliot Shepard Emerson Daniel Gorziglia Daniel Haddox	P/N: DIM20-00	
System: GLV	Rev: 2.0	Carnegie Mellon Racing © 2015
Date: 4/5/2016	Sheet: 13 of 13	

