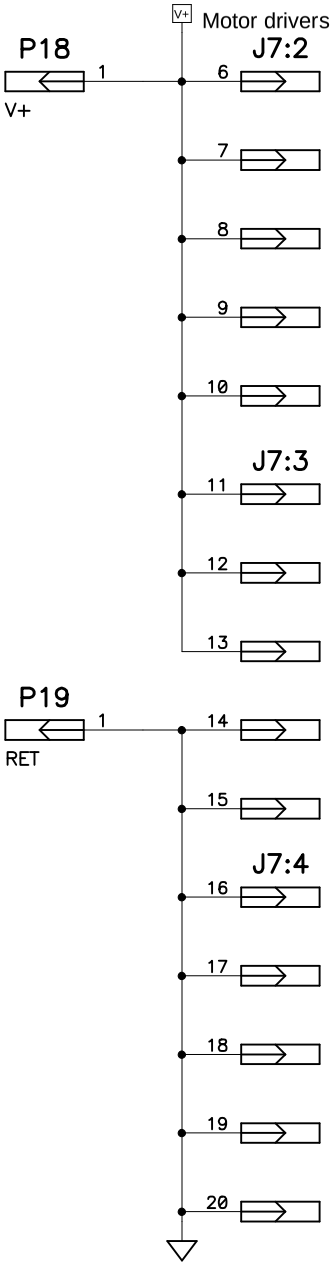
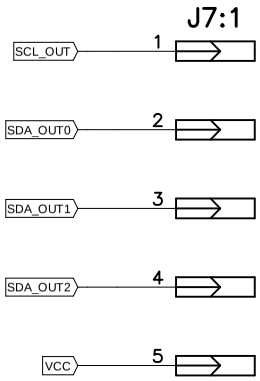


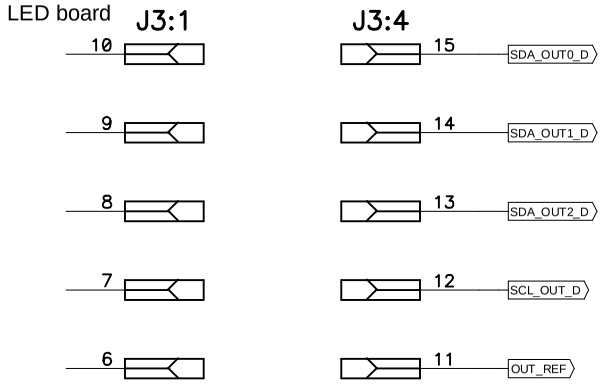
J7 is the stacking connector to the motor driver J2. The current rating is only 0.3A so we parallel pins for the supply. This also minimizes the resistance of the series connection.

WARNING:

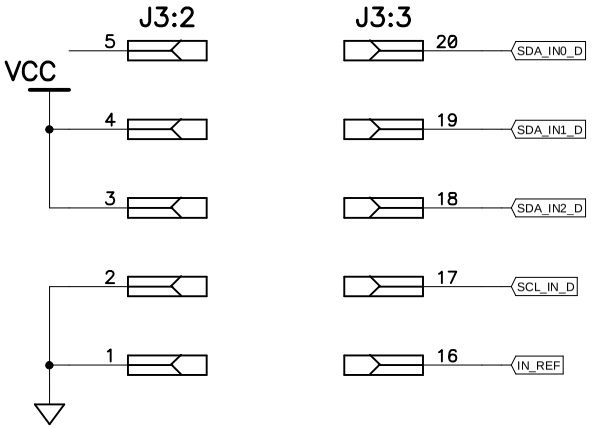
Due to the definition of the stacking connectors as using the same pattern for both male and female, and how they are placed (necessarily flipped, unnecessarily rotated), the mating pins do NOT match number for number. The actual permutation is:
top --> bottom
1:5 --> 10:6
6:10 --> 5:1
11:15 --> 20:16
16:20 --> 15:11
This permutation is finessed by the visually pin-reversed female symbol and the female pin mapping table, which swaps gate locations. Match gate numbers and symbol pin position to get the right mapping. Also, to add a little extra confusion, the boards are built male/female sex opposite to this schematic, which avoids leaving live male pins exposed on the top.



These are the signal pins. We also pass the +3.3V supply in case we want it for temperature sensor or something.



OM-DF12-20DS-05



J3 mates with J2, the top connector on the LED board.

Title	Micron 6DOF handle: line driver board stacking connectors.	
Size: A	Number:	Rev: A
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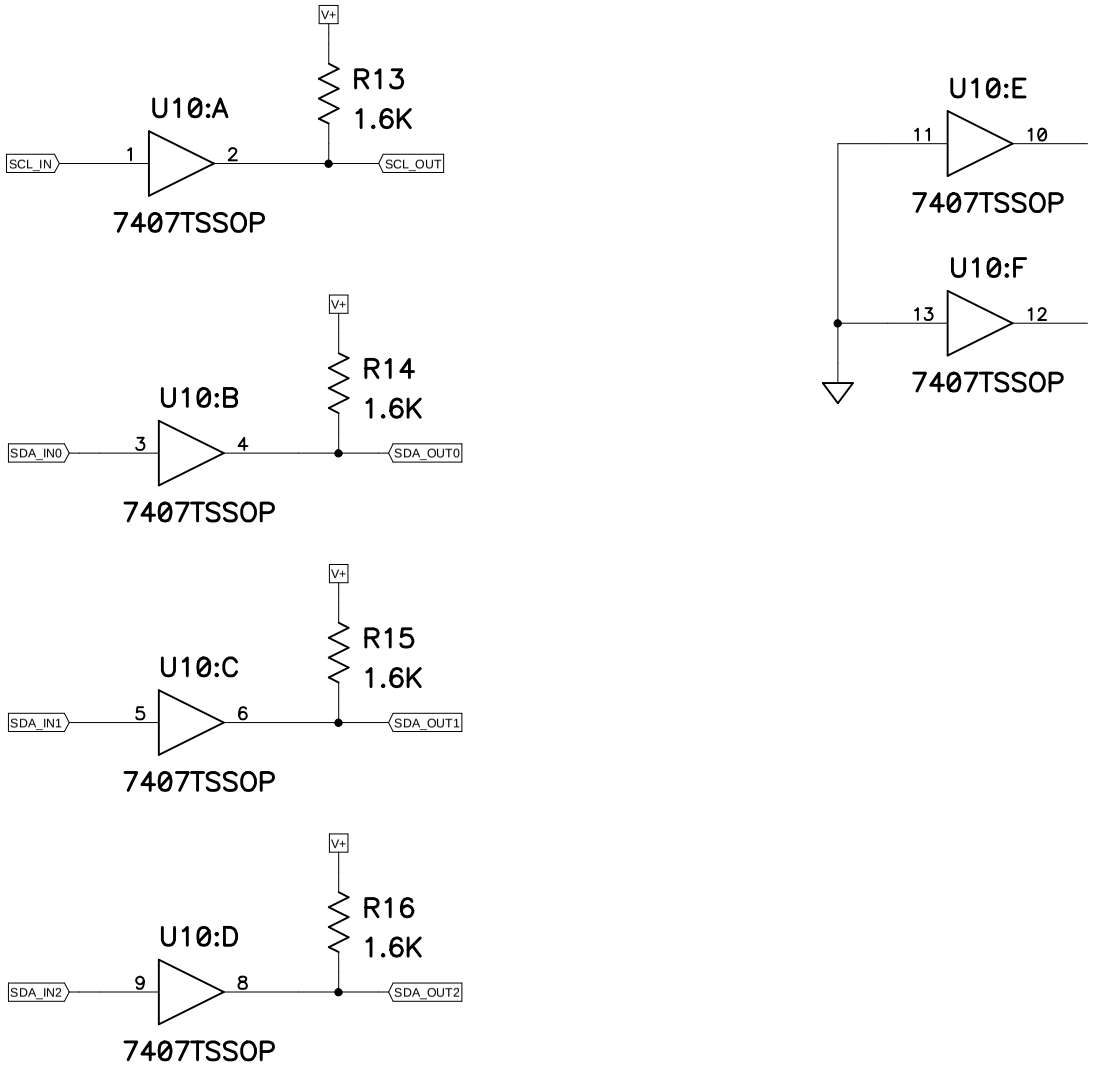

I2C buss is pulled up to V+ (5V nominal) even though U2 runs on 3.3V Vcc. The outputs tolerate this, and it speeds transition to a logic high level.

Title	Micron 6DOF handle: main	
Size: A	Number	Rev: A
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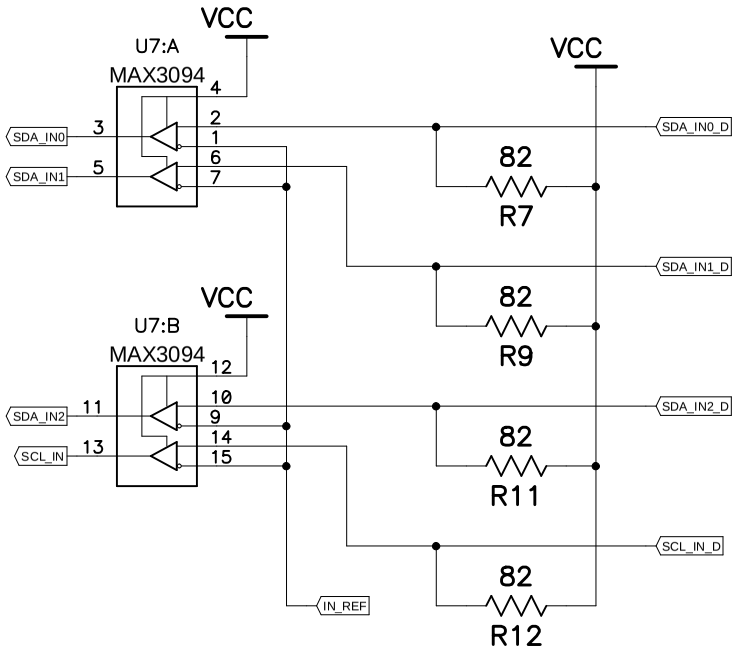
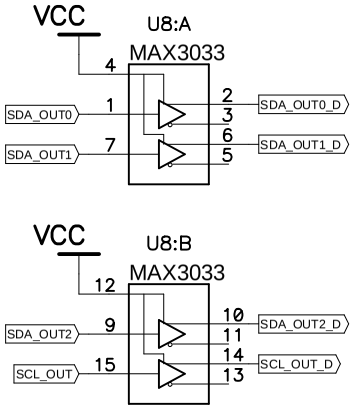
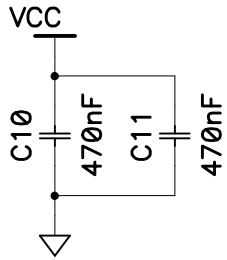
Filename: handle.sch		Sheet 2 of 6

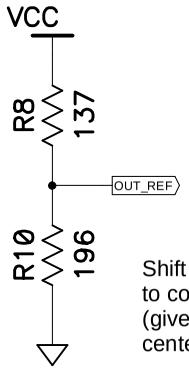


Lines are terminated to Vcc because this is the idle state.



The MAX3033 is slew rate limited to minimize reflections with imperfect impedance matching. 40 ns transition time typical.





Shift ref level approx 300 mV positive to compensate for termination offset (given approx 10 ohm driver output resistance), centering threshold. R8 || R10 = Z0

These drivers are digital interface to the motor driver chips in the handle. The cable is too long for the I2C busses themselves to be routed over it, so a different electrical interface is used in the cable based on RS485. To save wires in the cable, and so the cable doesn't need to have a twisted-pair structure, we use a quasi-differential connection where all of the outgoing signals share a single negative reference at Vcc/2, and similarly all of the incoming signals have a single reference set at the handle end.
Compared to a normal differential connection this halves the noise margin because the differential swing is halved, and also degrades common mode rejection insofar as the interference experienced by the different wires will vary somewhat. It also forgoes the property of the complementary signal acting as a HF return.
All these compromises seem acceptable given that we are primarily concerned with external interference and not crosstalk, since all the digital signals are synchronized (and the LED drive is band-limited.) This also addresses the issue that there may be substantial voltage drops and ground bounce in the motor power return, making it problematic as a signal reference.

Title	Micron 6DOF handlet: Line drivers	
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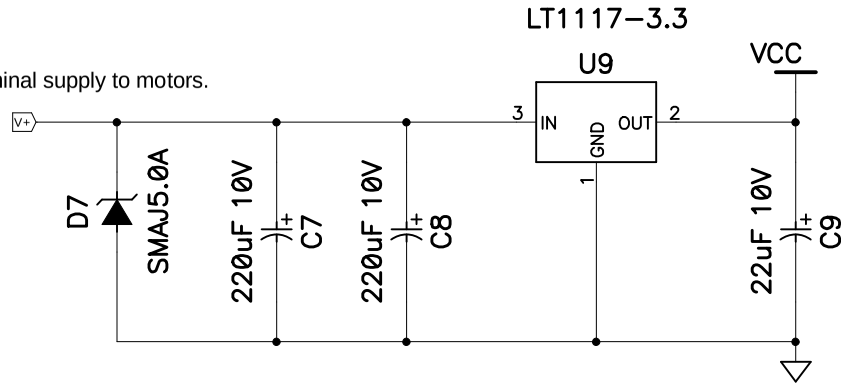
5V nominal supply to motors.



Supply 3.3V to line drivers.

This regulator powers the line drivers and other 3.3 V components, and is located on the LED breakout board. The worst-case current consumption is considerable, > 160 ma, due to the 81 ohm line impedance. Average current should be considerably less when lines are mostly in the high (idle) state. Current could be > 325 ma for 100 ns or more, but this only happens when all inputs are low and all outputs high, which is not a sensible stable state. If inputs are low, outputs should follow, and the OC bus logic should enforce this.

Title: Micron 6DOF handle: Supplies		
Size: A	Number:	Rev: A
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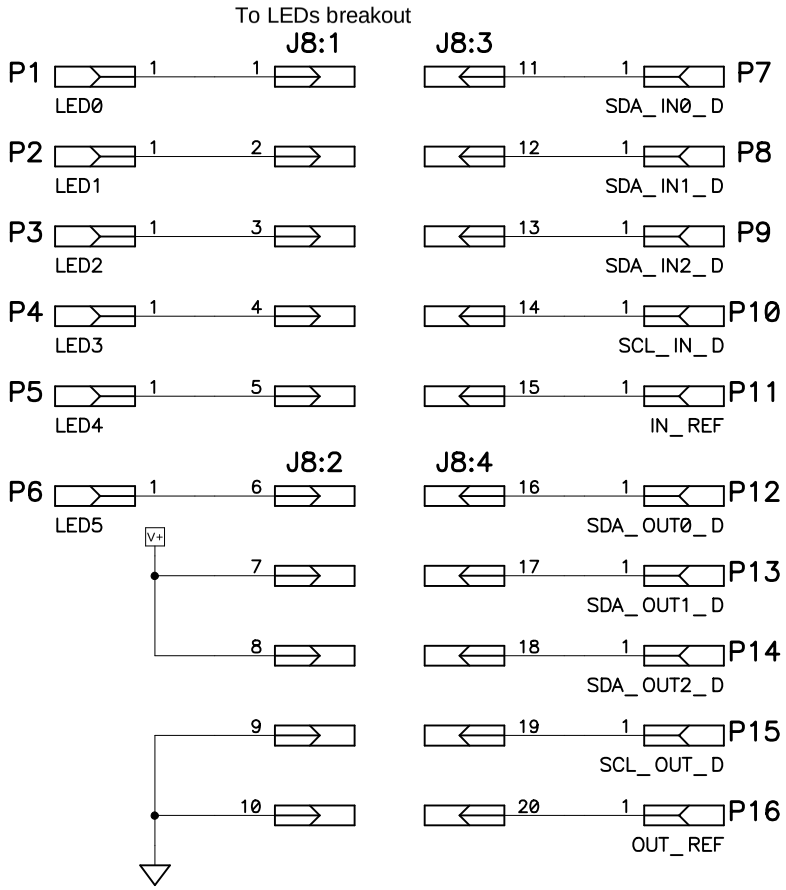
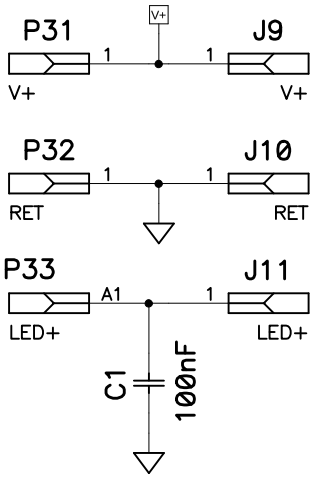
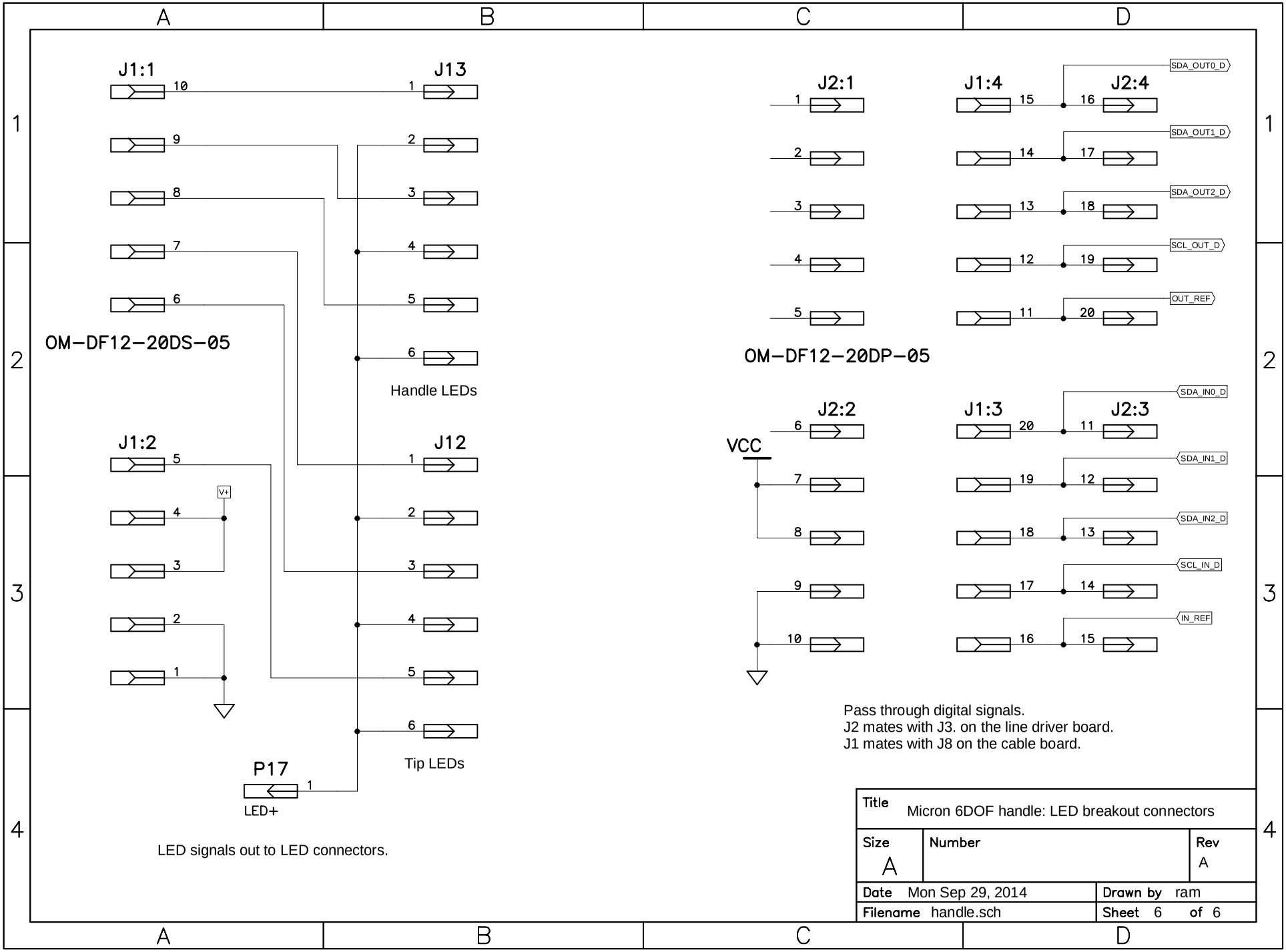
Filename: handle.sch		Sheet 4 of 6





Since LED+ is the shield of the cable, the HF currents of the line drivers must go there, but the drivers are referenced to ground. C1 ensures that LED+ is an AC ground for signals >1 MHz.

Title	Micron 6DOF handle: cable connections	
Size: A	Number	Rev: A
Date: Mon Sep 29, 2014		Drawn by: ram
Filename: handle.sch		Sheet 5 of 6


J1:1
J13
OM-DF12-20DS-05
Handle LEDs
J1:2
J12
V+
P17
LED+
Tip LEDs
LED signals out to LED connectors.
J2:1
J1:4
J2:4
SDA_OUT0_D
SDA_OUT1_D
SDA_OUT2_D
SCL_OUT_D
OUT_REF
OM-DF12-20DP-05
J2:2
J1:3
J2:3
VCC
SDA_IN0_D
SDA_IN1_D
SDA_IN2_D
SCL_IN_D
IN_REF
Pass through digital signals.
J2 mates with J3. on the line driver board.
J1 mates with J8 on the cable board.
Title
Micron 6DOF handle: LED breakout connectors
Size
A
Number
Rev
A
Date
Mon Sep 29, 2014
Drawn by
ram
Filename
handle.sch
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of
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