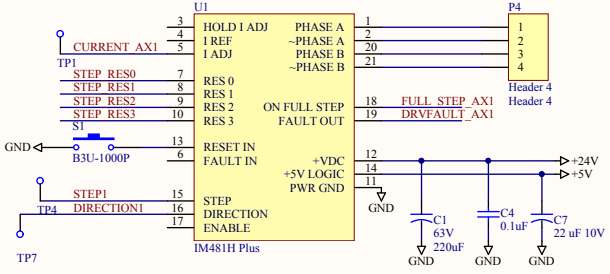
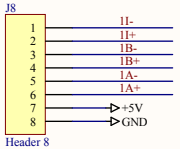
AXIS 1



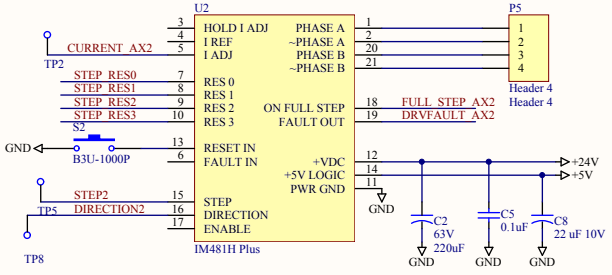


Encoder Axis 1

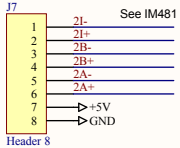
See IM481 Data sheet for cap layout
Need to spec 220 uF 35V (see data sheet in M2 folder)

Motors will always be enabled
All axis will have the same step resolution

AXIS 2



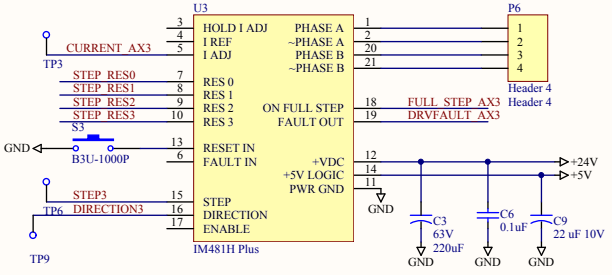
Motor current will be set by watching 'at rest' signal for each axis on the PMD chip. When 'at rest' DAC will go to programmed holding current. When moving, DAC will go to programmed run current. Will not use IREF and HOLD I ADJ pins on driver

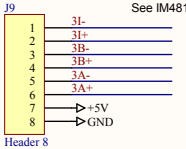


See IM481 Data sheet for cap layout

Encoder Axis 2

AXIS 3

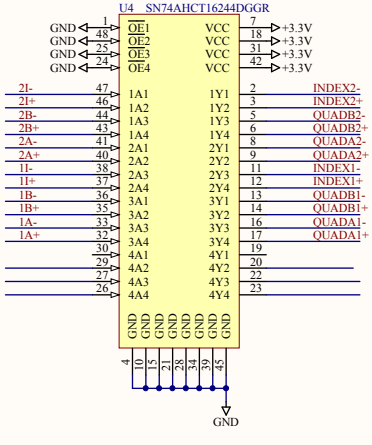


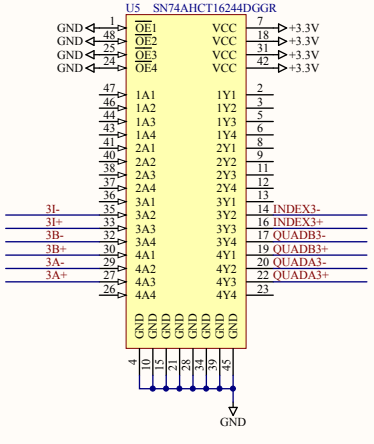


See IM481 Data sheet for cap layout

Encoder Axis 3

Translators +5V to 3.3V





REGARDING MAX POWER DRAWN BY STEP MOTORS:

Linear Actuator: HSI 57KP-3.25-003
Resistance per phase: 0.8 ohm

Power Delivered to each motor:

IMS Driver max current: 2.1A peak or 1.48Arms per phase
Power to each coil of one motor: P = i^2xR = (1.48)^2 x 0.8 = 1.76W
Total power for one motor: 3.53W

Current required for one motor from +24V supply = (3.53W)/(24V) = 0.147A @100% efficiency
+24V current for all motors running full power at the same time: 0.441A

If assume 75% efficiency of IMS motor driver then total current from +24V to run motors = 0.441/.75 = 0.588A

Measured quiescent current draw from +24V = 0.286A (this takes efficiency into account because it is a direct measurement of actual current.

Total current draw from +24V with all motors running a full current = 0.588 + 0.286 = 0.874 A.

Fuse F1 has hold current of 1.1A and trip of 2.2A. Should protect circuit without nuisance trips.

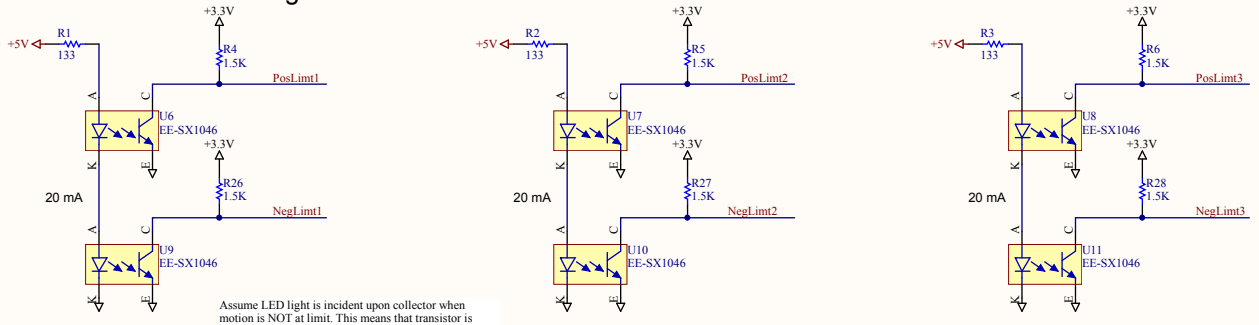
REVISION HISTORY

Rev 1: Generated Document
Rev 2: No Data
Rev 3: No Data
Rev 4: R42 was 182K (2/22/2012, RL)

MOTOR DRIVERS / LINEAR ENCODERS

Title: SCHEMATIC, M2 FOCUS MIRROR		
Size: B	Number: 780-00012	Revision: 4
Date: 8/1/2012	Sheet 1 of	
File: \\..\780-00012-P1, rev4 Sch M2 Focus Drivers.SchDoc	Drawn By:	

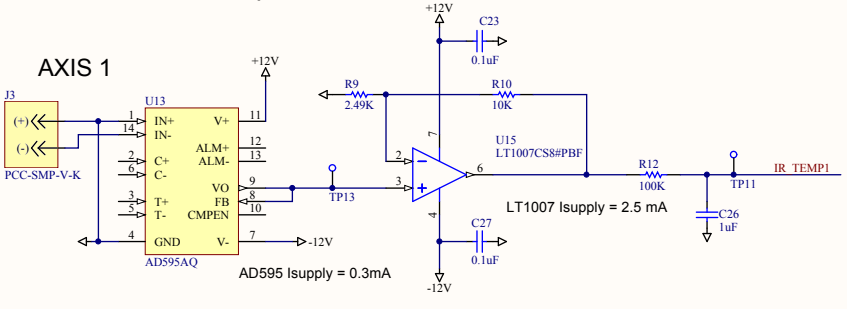
Photosensors / Pos and Neg Limits



Assume LED light is incident upon collector when motion is NOT at limit. This means that transistor is conducting. Opto coupler at SuperFin input has diode COM connected to GND hence they are in parallel with transisitor of photosensor. Superfin has pull-down resistor on emitter of opto transistor. So when photosensor is ON, no current is going through SuperFin opto and PMD chip sees a LOW as it should. When limit is reached, photosensor does not conduct, current goes through SuperFin input diode and input to PMD chip goes HIGH.

Infrared Thermocouple Readout

AXIS 1



AD595 Isupply = 0.3mA

LT1007 Isupply = 2.5 mA

Use PC mount Thermocouple connectors from Omega

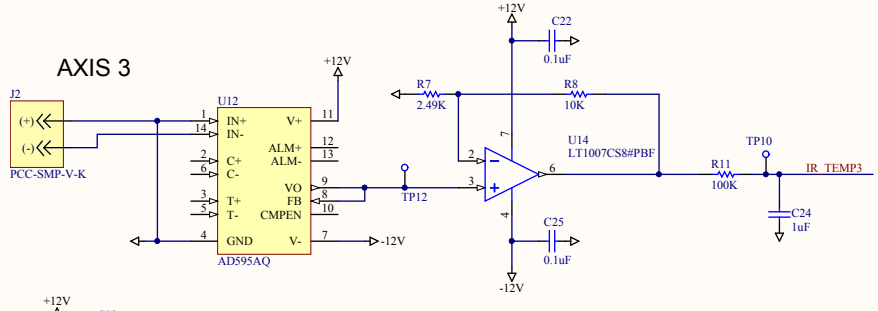
Infrared Thermocouple Probe: Omega OS36-2-K-50F
Specified range 0-80 degF (Ben H)
Design range -13 to +104 degF (-25 to +40 degC)

Output of AD595: = (Type K Voltage + 11 uV) x 247.3 (in mV)
@ -25 degC = -236.7 mV
@ 40 degC = 401.36 mV

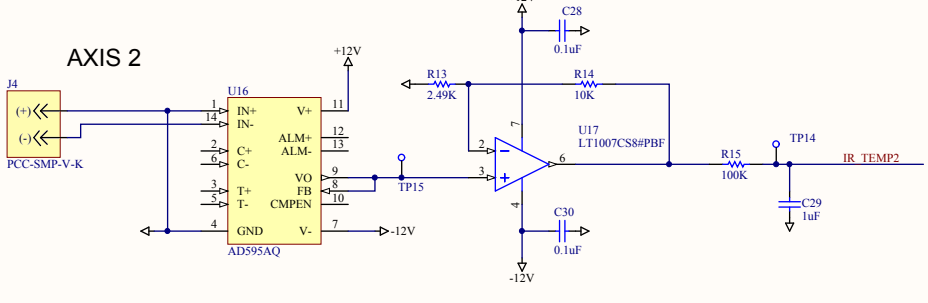
To fit into ADC input range of +/- 2.048 V, maximum post gain is 5.1. Set post gain to x5.016 so that ADC inputs are

@ -25 degC = -1.187 V
@ 40 degC = 2.013 V

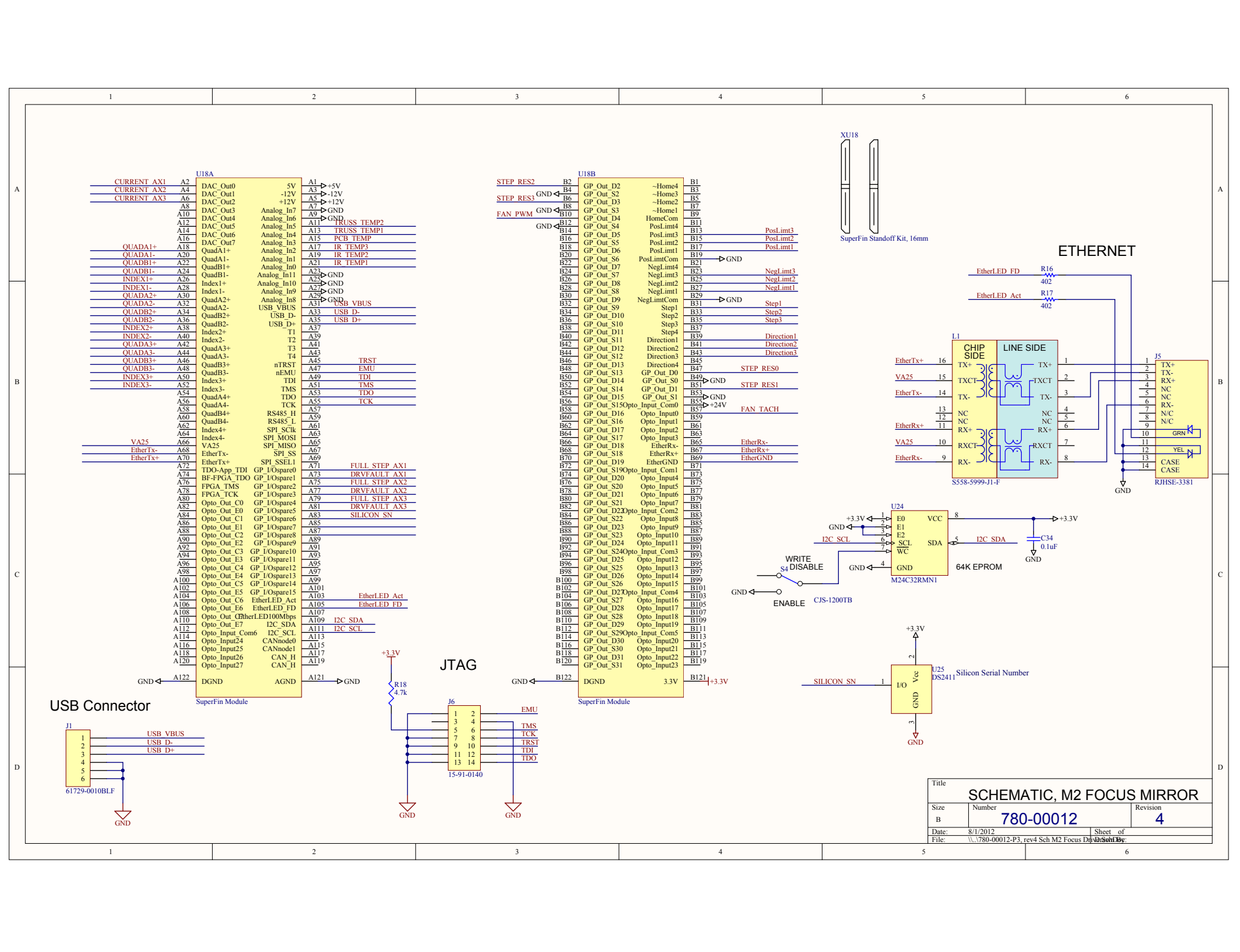
AXIS 3



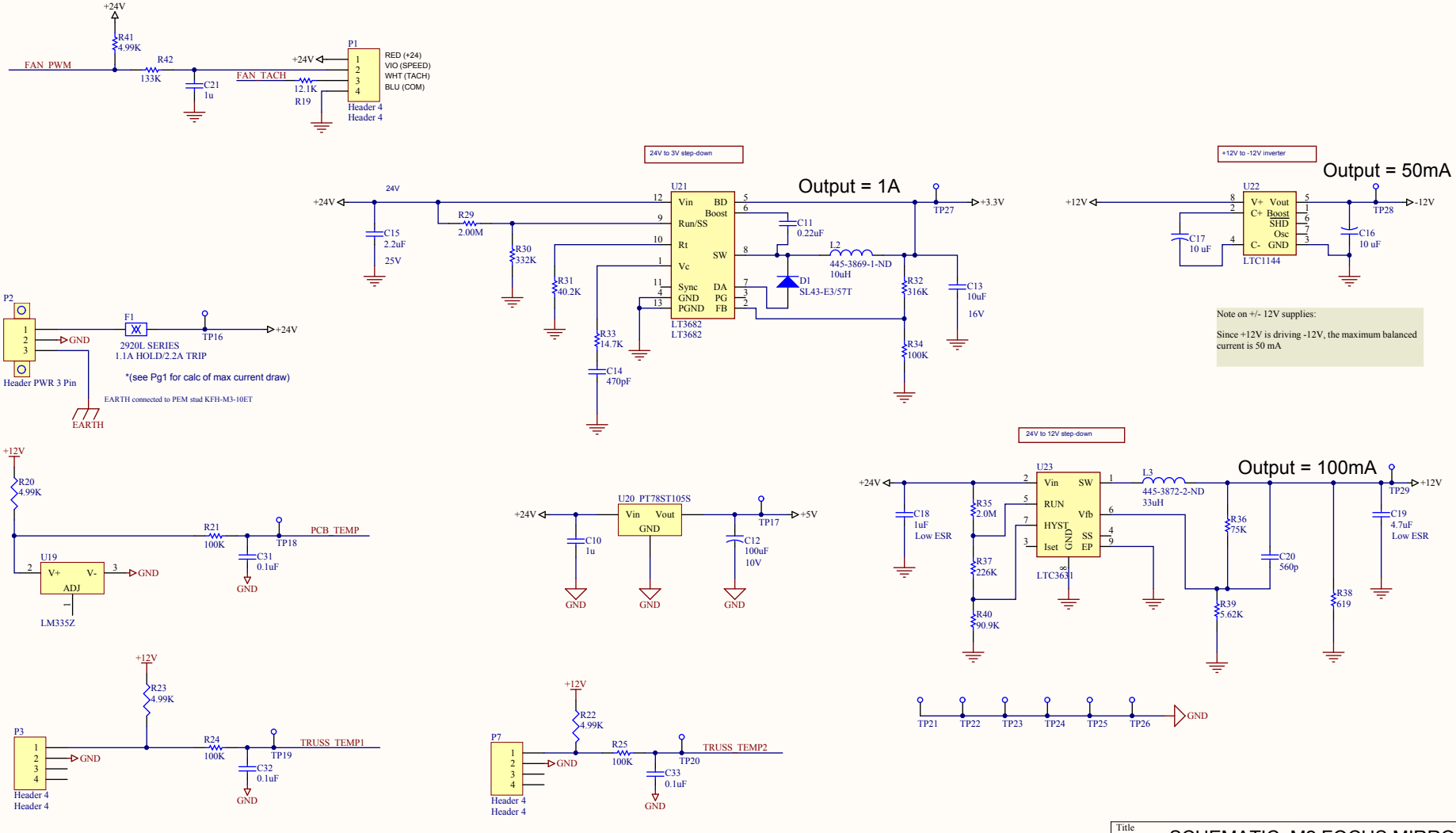
AXIS 2



Title: SCHEMATIC, M2 FOCUS MIRROR		
Size: B	Number: 780-00012	Revision: 4
Date: 8/1/2012	Sheet 2 of	
File: \\..\780-00012-P2, rev4 Sch M2 Focus Drive.SchDoc	Drawn By:	


U18A
SuperFin Module
U18B
SuperFin Module
XU18
SuperFin Standoff Kit, 16mm
ETHERNET
L1
CHIP SIDE
LINE SIDE
S558-5999-J1-F
J5
RJHSE-3381
U24
M24C32RMN1
64K EPROM
WRITE DISABLE
S4
CJS-1200TB
ENABLE
U25
DS2411
Silicon Serial Number
USB Connector
J1
61729-0010BLF
JTAG
J6
15-91-0140
R18
4.7k
Title
SCHEMATIC, M2 FOCUS MIRROR
Size
B
Number
780-00012
Revision
4
Date: 8/1/2012
File: \\..\780-00012-P3, rev4 Sch M2 Focus Drive.SchDoc

TOP FAN DRIVE



Title	SCHEMATIC, M2 FOCUS MIRROR	
Size: B	Number: 780-00012	Revision: 4
Date: 8/1/2012	Sheet of	
File: \\..\780-00012-P4, rev4 Sch M2 Focus Drive.SchDoc	Drawn By:	

NOTES (UNLESS OTHERWISE SPECIFIED):

GENERAL

1) PCB IS 12-LAYER, .062" THICK.
2) CONSTRUCTION IS SOLDER-MASK-OVER-BARE-COPPER (SMOBC).
3) ACCEPTABILITY SHALL BE BASED ON IPC-A-600, CLASS 2.
4) THE FOLLOWING GERBER RS274X PHOTO TOOL FILES SHALL BE USED TO DEFINE ALL CIRCUIT FEATURES:

*.GTL – TOP LAYER GERBER DATA
*.G1 – MID LAYER 1 GERBER DATA
*.GP1 – INTERNAL PLANE LAYER 1 GERBER DATA
*.GP2 – INTERNAL PLANE LAYER 2 GERBER DATA
*.GP3 – INTERNAL PLANE LAYER 3 GERBER DATA
*.GP4– INTERNAL PLANE LAYER 4 GERBER DATA
*.GP5– INTERNAL PLANE LAYER 5 GERBER DATA
*.GP6– INTERNAL PLANE LAYER 6 GERBER DATA
*.GBL – BOTTOM LAYER GERBER DATA
*.GTO – TOP OVERLAY GERBER DATA
*GBO – BOTTOM OVERLAY GERBER DATA
*.GTP – TOP-SIDE SOLDER PASTE MASK
*.GBP – BOTTOM-SIDE SOLDER PASTE MASK
*.GTS – TOP SOLDER MASK GERBER DATA
*.GBS – BOTTOM SOLDER MASK GERBER DATA

5) THE PHOTO TOOL SHALL NOT BE COMPENSATED WITHOUT PRIOR ENGINEERING APPROVAL.
PCB DESIGNER: RICH LOBDILL PH (805) 880-1621 FAX (805) 961-1792.

FABRICATION TOLERANCES

6) END PRODUCT CONDUCTOR WIDTHS AND PAD DIAMETERS SHALL NOT VARY MORE THAN 0.002" FROM THE 1:1 DIMENSIONS OF THE MASTER ARTWORK.
7) THE CONDUCTIVE PATTERN SHALL BE POSITIONED SO THAT THE LOCATION OF ANY PAD OR LAND SHALL BE WITHIN 0.005" DIAMETER TO THE TRUE POSITION OF THE HOLE IT CIRCUMSCRIBES.
8.1) DRILL TOLERANCES +/- 0.003"
8.2) ALL DRILL HOLE SIZES AND TOLERANCES APPLY AFTER PLATING.
9) THE MINIMUM ANNULAR RING SHALL BE 0.005".
10) BOW AND TWIST SHALL NOT EXCEED 0.010" PER INCH.
11) FOR PCB ROUTING DIMENSIONS: .XXX = +/-.005" .XX = +/-.020"

MATERIAL

12) BASE MATERIAL IS FR4 EPOXY FIBERGLASS
13) SEE STACK-UP LEGEND FOR COPPER CLADDING CALL OUTS

PLATING

14) ALL HOLES AND CONDUCTIVE SURFACES SHALL BE PLATED WITH A MINIMUM OF 0.001" COPPER.
15) AFTER SOLDERMASK, ALL EXPOSED HOLES AND CONDUCTIVE SURFACES SHALL BE COATED WITH A GOLD IMMERSION PLATING TO PRESERVE SOLDERABILITY.

COATINGS

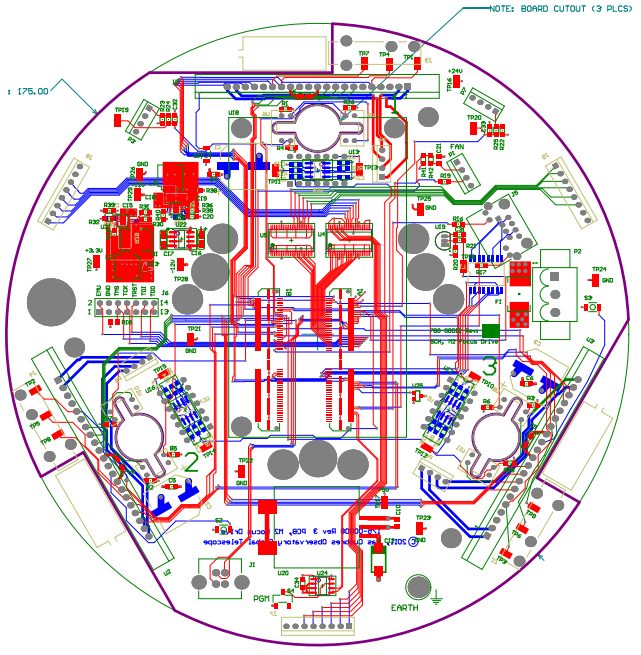
16) THE SOLDERMASK SHALL BE BLACK LIQUID PHOTO-IMAGEABLE PER IPC-SM-840, TYPE-B, CLASS 2.
17) THE SOLDERMASK REGISTRATION ALLOWANCE IS 0.003". THERE SHALL BE NO SOLDERMASK ON ANY SOLDER PAD OR LAND.

MARKING

18) THE LEGEND SHALL BE SCREEN-PRINTED USING PERMANENT YELLOW EPOXY INK.
19) THE SCREEN PRINTING REGISTRATION ALLOWANCE IS 0.007". THERE SHALL BE NO INK ON ANY SOLDER PAD OR LAND.
20) THE VENDOR CODE AND UL FLAMMABILITY RATING MAY BE ETCHED IN THE FOIL OR MARKED IN PERMANENT EPOXY INK (VENDOR'S OPTION).

ELECTRICAL TESTING

21) ALL BOARDS SHALL BE ELECTRICALLY TESTED TO THE SUPPLIED IPC-D-356A NET LIST FOR CONTINUITY, OPENS AND SHORTS.



175-00008 Rev 3, M2 Focus Drive
LAS CUMBRES OBSERVATORY 10/11/2011

*.GTO – MID LAYER OVERLAY GERBER DATA

Layer Stack Up Detail for: 175-00008 rev 1, PCB, M2 Focus Drive.PcbDoc

Layer Name	Copper cladding
Top Layer (*.GTL)	1/2 oz. (1 oz. Finished)
Mid-Layer 1 (*.G1)	1/2 oz
+24V (*.GP1)	1/2 oz
GND (*.GP2)	1/2 oz
+5V (*.GP3)	1/2 oz
+12V (*.GP4)	1/2 oz
-12V (*.GP5)	1/2 oz
+3.3V (*.GP6)	1/2 oz
Bottom Layer (*.GBL)	1/2 oz. (1 oz. Finished)

NOTE: Non-standard board thickness

PRIMARY PCB SPECIFICATIONS

(REFER TO COMPLETE SPEC LISTING AT LEFT FOR FURTHER DETAILS)

NUMBER OF LAYERS	–	9
FINISHED THICKNESS	–	.094
BASE MATERIAL	–	FR4
PLATING TYPE	–	GOLD IMMERSION
SOLDER MASK COLOR	–	BLACK

Las Cumbres Observatory
Global Telescope Network
Las Cumbres Observatory, Inc.
6740 Cortona Dr.
Goleta, CA 93117
www.lcogt.net

DATE	DESIGNED	DRAWN	SCALE
10/11/11	Rich Lobdill	Rich Lobdill	1 : 1

CHECKED/DATE
APPROVED/DATE

TITLE: 175-00008, M2 Focus Drive

SIZE	DOC NO.	REV	SHEET
C	– GPT	3	1 OF 20