

Starboard Headers
Starboard_Headers.SchDoc

SPI_Star

SPI_CLK → SPI_CLK
SPI_MISO → SPI_MISO
SPI_MOSI → SPI_MOSI
SPI_nCS_S → SPI_nCS
SPI_nCS_SD ✕

U_AD7298 12-Bit SPI ADC

nPD/nRST

TSB

VIN[0..7]

VIN[0..7]
VIN0
VIN1
VIN2
VIN3
VIN4
VIN5
VIN6
VIN7

TP101

TP

TP102

TP

TP103

TP

TP104

TP

TP105

TP

TP106

TP

TP107

TP

TP108

TP

T1

Temp_Sensor.SchDoc

V_Temp

T2

Temp_Sensor.SchDoc

V_Temp

T3

Temp_Sensor.SchDoc

V_Temp

PD1

Photodiode_Sun_Sensor.SchDoc

V_Photo

PD2

Photodiode_Sun_Sensor.SchDoc

V_Photo

PD3

Photodiode_Sun_Sensor.SchDoc

V_Photo

Current and Voltage Sensors

Current_Voltage_Sensor.SchDoc

V_buffer_out

I_buffer_out

V_out

V_ref

V_in

VStar+

VStar-

Photovoltaic Array
XTJ-Prime_2S1P.SchDoc

V_PV-

V_PV+

Mechanical Interfacing
Mech_Interface_Starboard.SchDoc

VStar-

Deployment_Star

Deployment_Star

Copyright 2019 Nicholas J. Sorensen, and Erik F. Halliwell

This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0>
Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

Title **Starboard**

University of Alberta
Department of Electrical
and Computer Engineering
Edmonton AB, Canada
T6G 1H9



Size: Letter

Number: 1

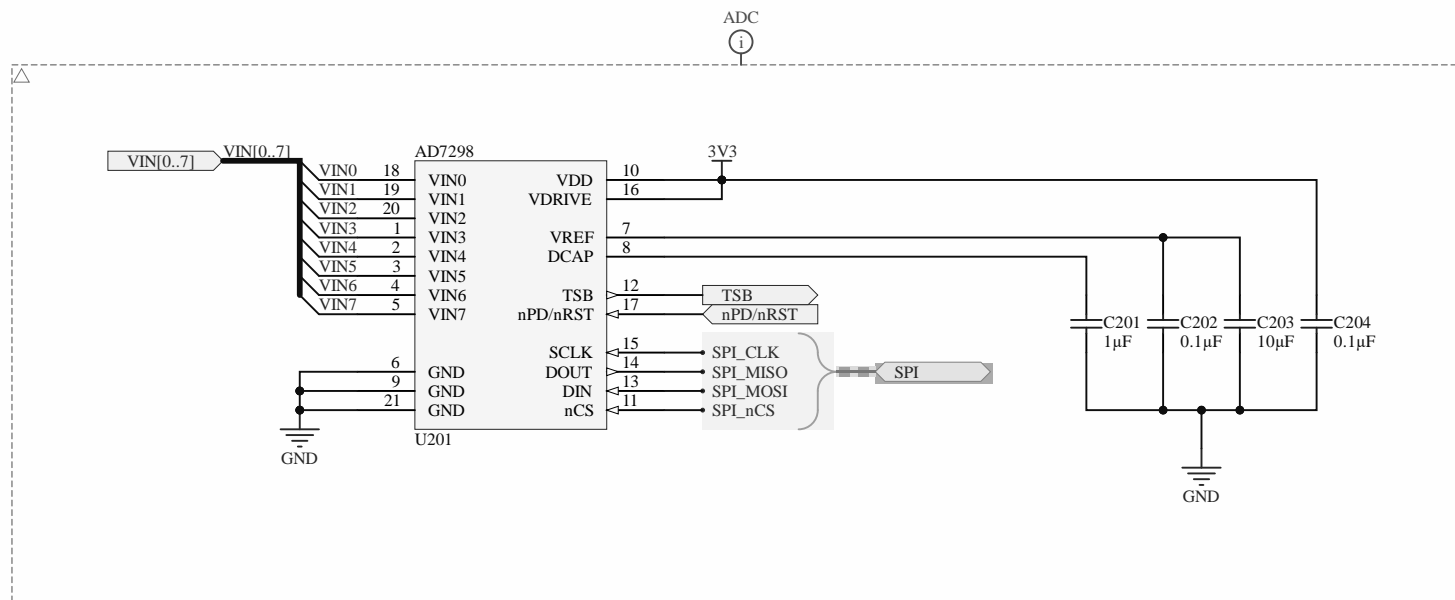
Revision:*

Date: 6/2/2020

Time: 6:58:49 PM

Sheet 1 of 8

File: C:\Users\nicho\AlbertaSat\projects\Hyperion Solar Panels\Starboard\Starboard.SchDoc



Copyright 2019 Nicholas J. Sorensen, and Erik F. Halliwell

This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0>
 Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

Title **AD7298 12-Bit SPI ADC**

University of Alberta
 Department of Electrical
 and Computer Engineering
 Edmonton AB, Canada
 T6G 1H9



Size: Letter

Number: 2

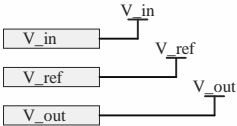
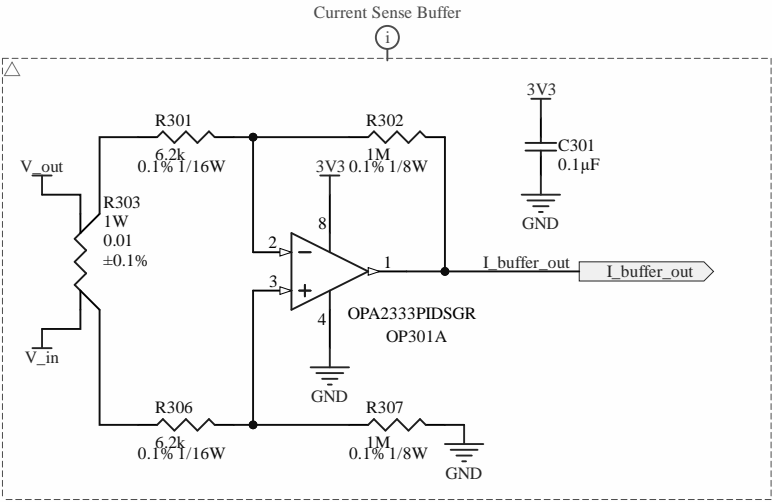
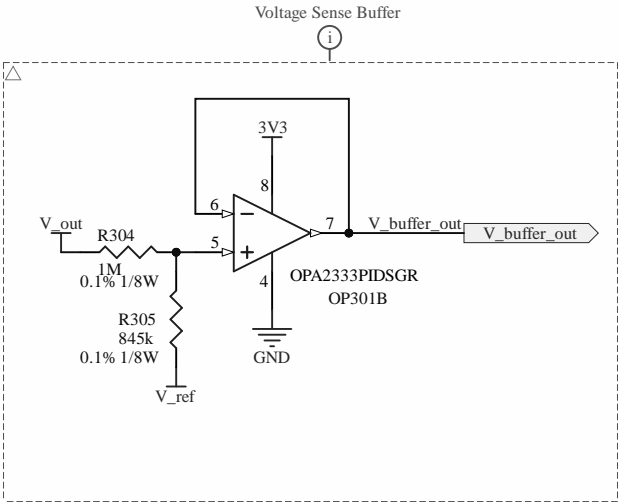
Revision: *

Date: 6/2/2020

Time: 6:58:49 PM

Sheet 2 of 8

File: C:\Users\nicho\AlbertaSat\libraries\Schematic Sheets\AD7298 12-Bit SPI ADC.SchDoc



Voltage Sense Buffer:

$$\begin{aligned} V_{\text{buffer_out}} &= V_{\text{out}} \cdot (R305 / (R305 + R304)) \\ &= 0.458 V_{\text{out}} \\ &\leq 2.49 \text{ V} \end{aligned}$$

Current Sense Buffer:

$$\begin{aligned} V_{\text{sense}} &= V_{\text{in}} - V_{\text{out}} \\ &= I \cdot R303 \\ &\leq 1.5 \text{ A} \cdot 0.01 \text{ Ohm} \\ &\leq 0.015 \text{ V} \\ G_{\text{diff}} &= R304 / R301 \\ &= 1 \text{ M} / 6.2 \text{ k} = 161 \\ G_{\text{cm}} &= 0 \\ I_{\text{buffer_out}} &\leq 2.415 \text{ V} \end{aligned}$$

Copyright Nicholas J. Sorensen, and Erik F. Halliwell

This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0> Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

Title **Current_Voltage_Sensor**

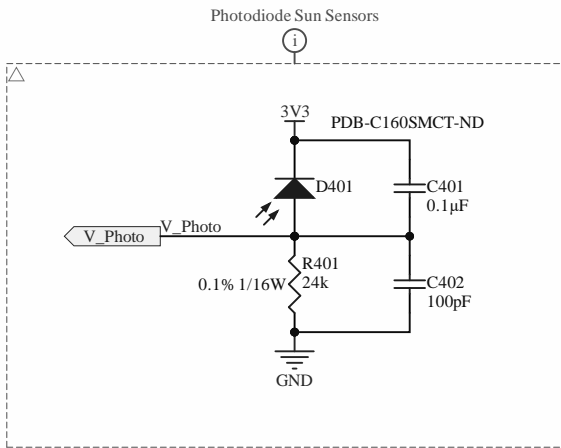
University of Alberta
Department of Electrical
and Computer Engineering
Edmonton AB, Canada
T6G 1H9



Size: Letter Number: 3 Revision: *

Date: 6/2/2020 Time: 6:58:49 PM Sheet 3 of 8

File: C:\Users\nicho\AlbertaSat\projects\Hyperion Solar Panels\Common Schematics\Current_Voltage_Sensor.SchDoc



Photodiode:

$I_{sc} = 80\mu A$; $I_{dark} = 2nA \rightarrow I_{illum} < 100\mu A$


$V_{photo} = I_{illum} R \leq 2.5 V \rightarrow R \geq 25k\Omega$

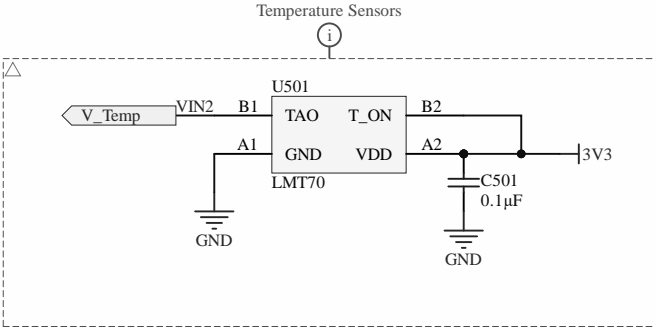
Copyright

Nicholas J. Sorensen, and Erik F. Halliwell

This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.


Title <i>Photodiode_Sun_Sensor</i>			University of Alberta Department of Electrical and Computer Engineering Edmonton AB, Canada T6G 1H9	 UNIVERSITY OF ALBERTA EDMONTON · ALBERTA · CANADA
Size: Letter	Number: 4	Revision: *		
Date: 6/2/2020	Time: 6:58:50 PM	Sheet 4 of 8		
File: C:\Users\nicho\AlbertaSat\projects\Hyperion Solar Panels\Common Schematics\Photodiode_Sun_Sensor.SchDoc				

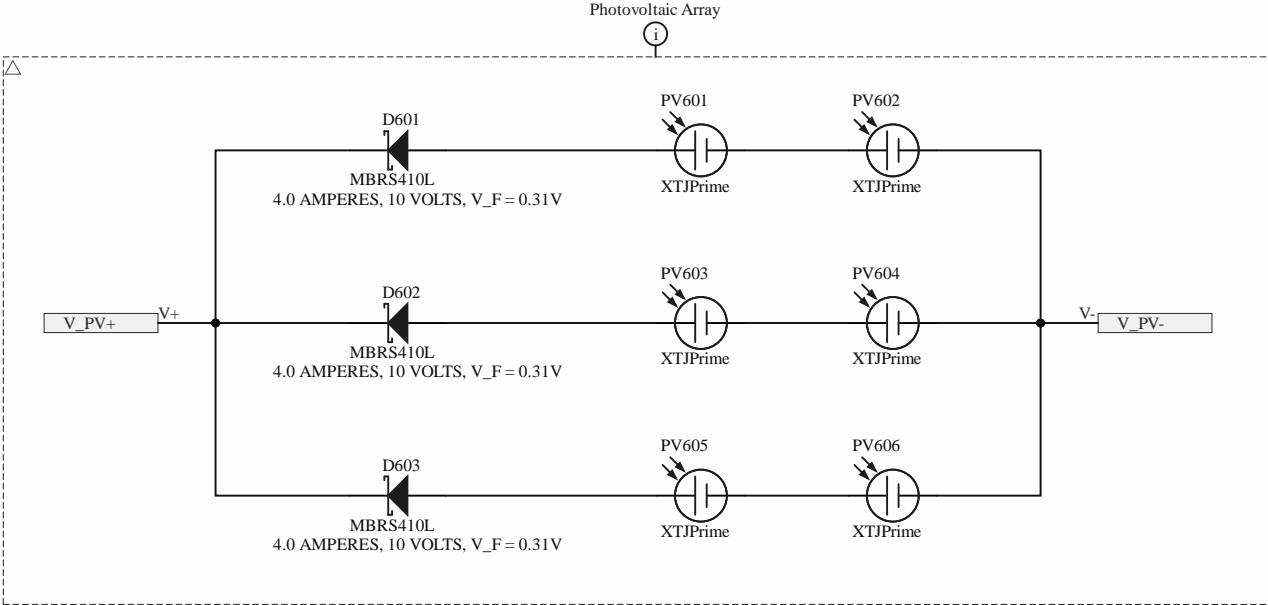


Copyright

Nicholas J. Sorensen, and Erik F. Halliwell


This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0>
Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

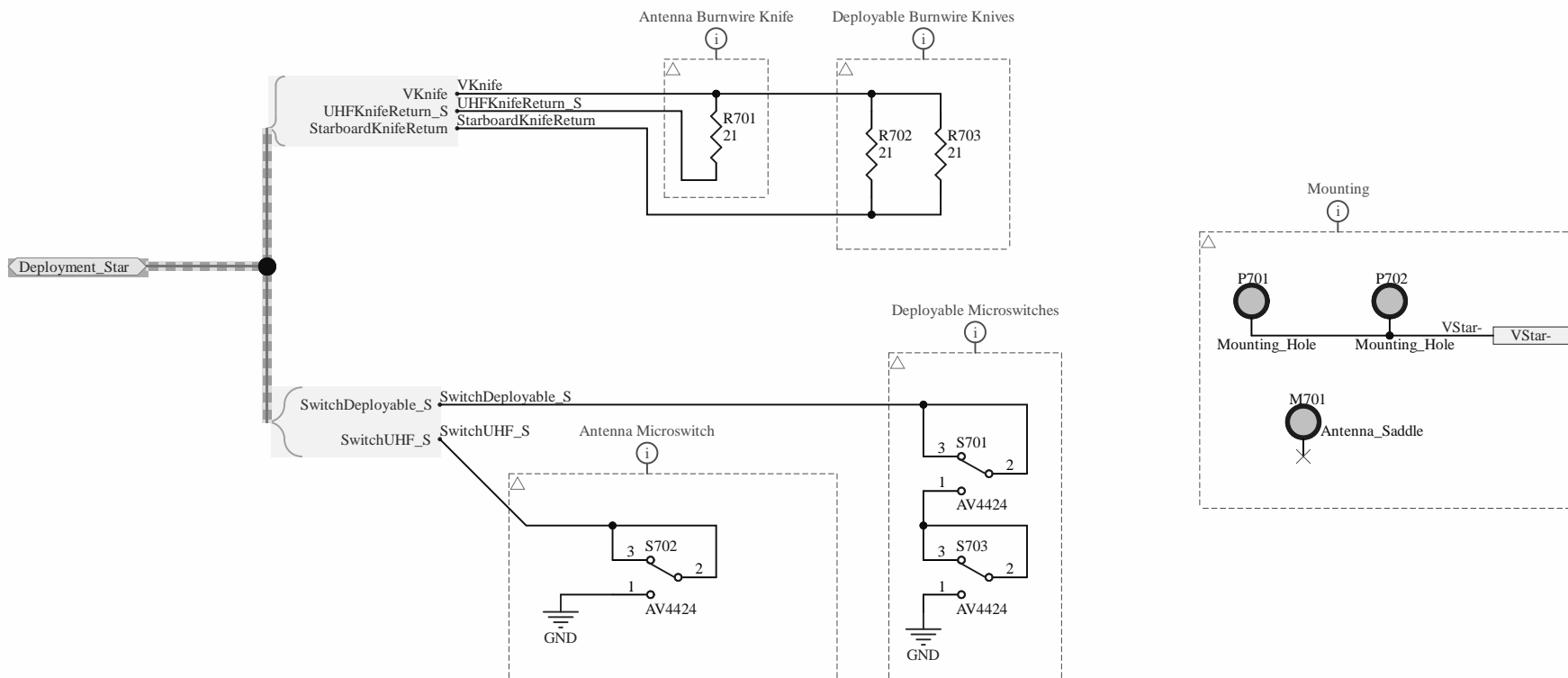
Title <i>Temp_Sensor</i>			<i>University of Alberta Department of Electrical and Computer Engineering Edmonton AB, Canada T6G 1H9</i>	 UNIVERSITY OF ALBERTA EDMONTON · ALBERTA · CANADA
Size: Letter	Number: 5	Revision: *		
Date: 6/2/2020	Time: 6:58:50 PM	Sheet 5 of 8		
File: C:\Users\nicho\AlbertaSat\projects\Hyperion Solar Panels\Common Schematics\Temp_Sensor.SchDoc				



Copyright Nicholas J. Sorensen, and Erik F. Halliwell

This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0>
Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

Title <i>XTJ-Prime_2S2P</i>			University of Alberta Department of Electrical and Computer Engineering Edmonton AB, Canada T6G 1H9	 UNIVERSITY OF ALBERTA EDMONTON · ALBERTA · CANADA
Size: Letter	Number: 6	Revision: *		
Date: 6/2/2020	Time: 6:58:50 PM	Sheet 6 of 8		
File: C:\Users\nicho\AlbertaSat\projects\Hyperion Solar Panels\Common Schematics\XTJ-Prime_2S1P.SchDoc				



Copyright

Nicholas J. Sorensen, and Erik F. Halliwell

This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0> Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

Title ***Mech_Interface_Starboard***

University of Alberta
Department of Electrical
and Computer Engineering
Edmonton AB, Canada
T6G 1H9



Size: Letter

Number: 7

Revision: *

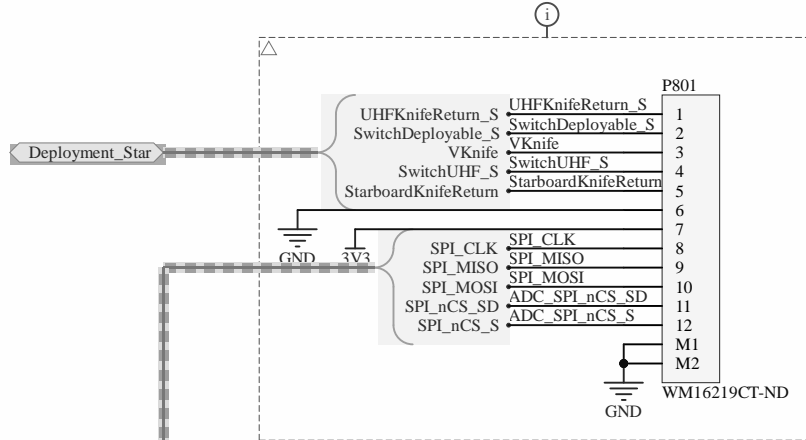
Date: 6/2/2020

Time: 6:58:50 PM

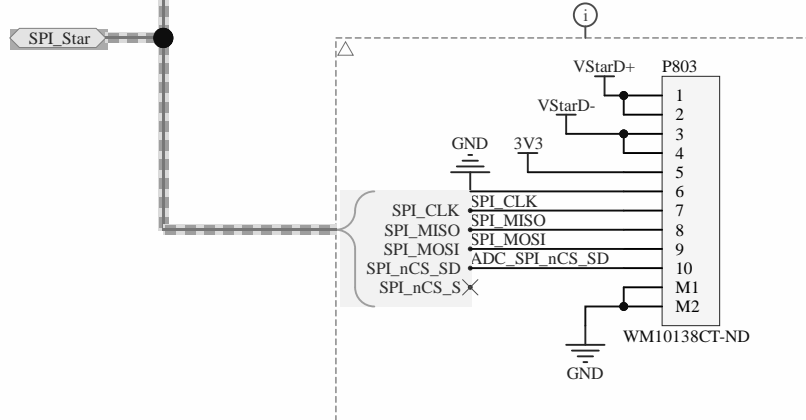
Sheet 7 of 8

File: C:\Users\nicho\AlbertaSat\projects\Hyperion Solar Panels\Starboard\Mech_Interface_Starboard.SchDoc

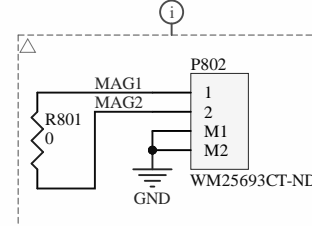
Starboard to Athena Burnwires/SPI



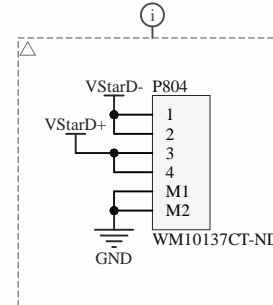
Starboard to Starboard Deployable



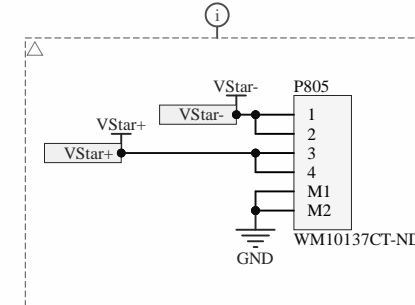
Starboard to Athena Magnetorquers



Starboard Deployable to EPS



Starboard to EPS



Copyright

Nicholas J. Sorensen, and Erik F. Halliwell

This file and the information within it are licensed under the terms of the Apache License, Version 2.0 (the "License"); you may not use or redistribute this file except in compliance with the License. You may obtain a copy of the License at: <http://www.apache.org/licenses/LICENSE-2.0> Unless required by applicable law or agreed to in writing, content distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

Title **Starboard_Headers**

University of Alberta
Department of Electrical
and Computer Engineering
Edmonton AB, Canada
T6G 1H9



Size: Letter

Number: 8

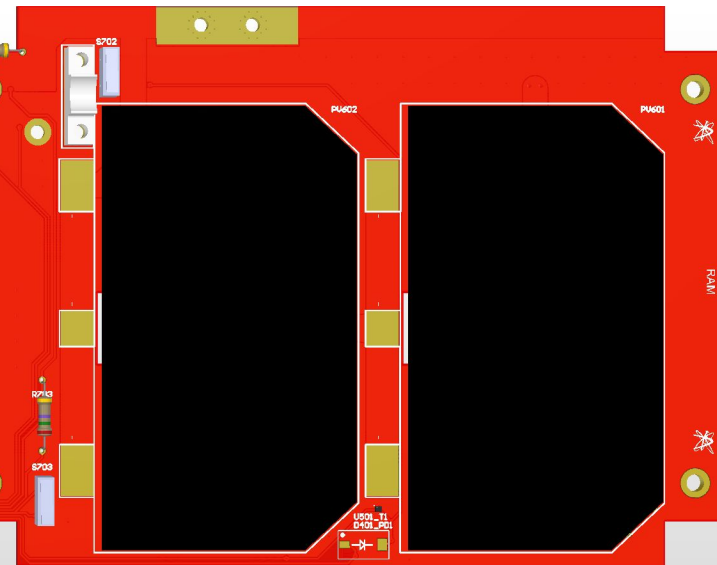
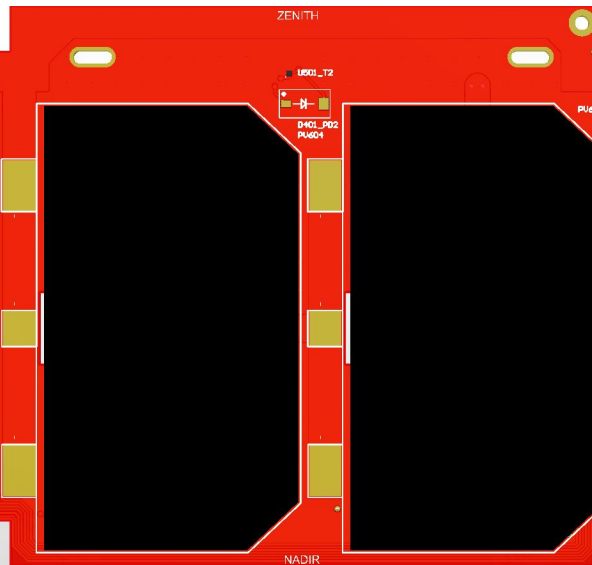
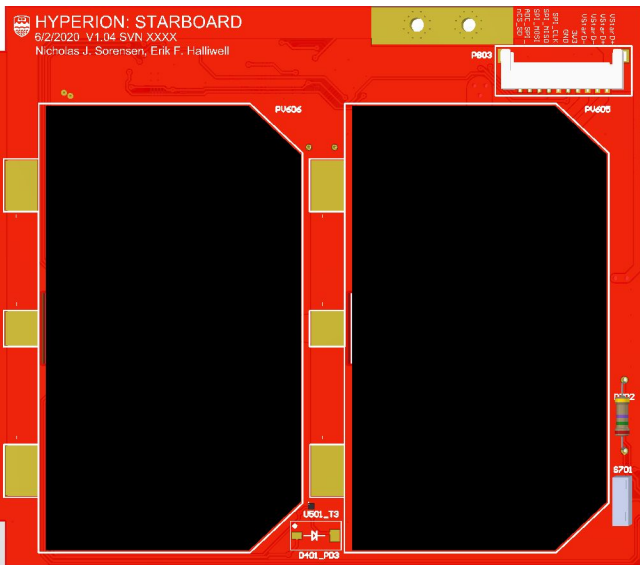
Revision: *

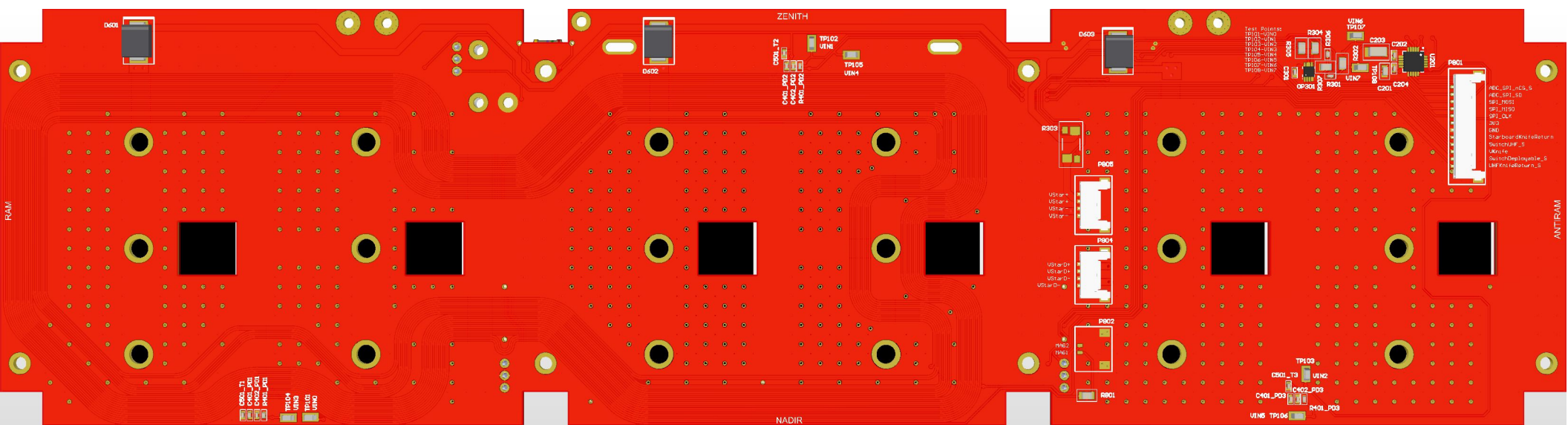
Date: 6/2/2020

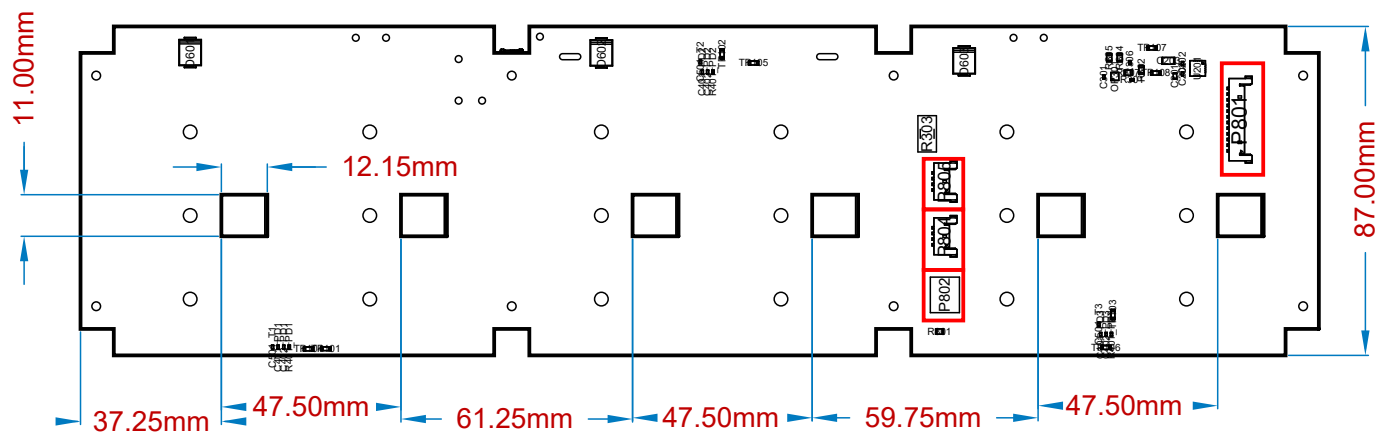
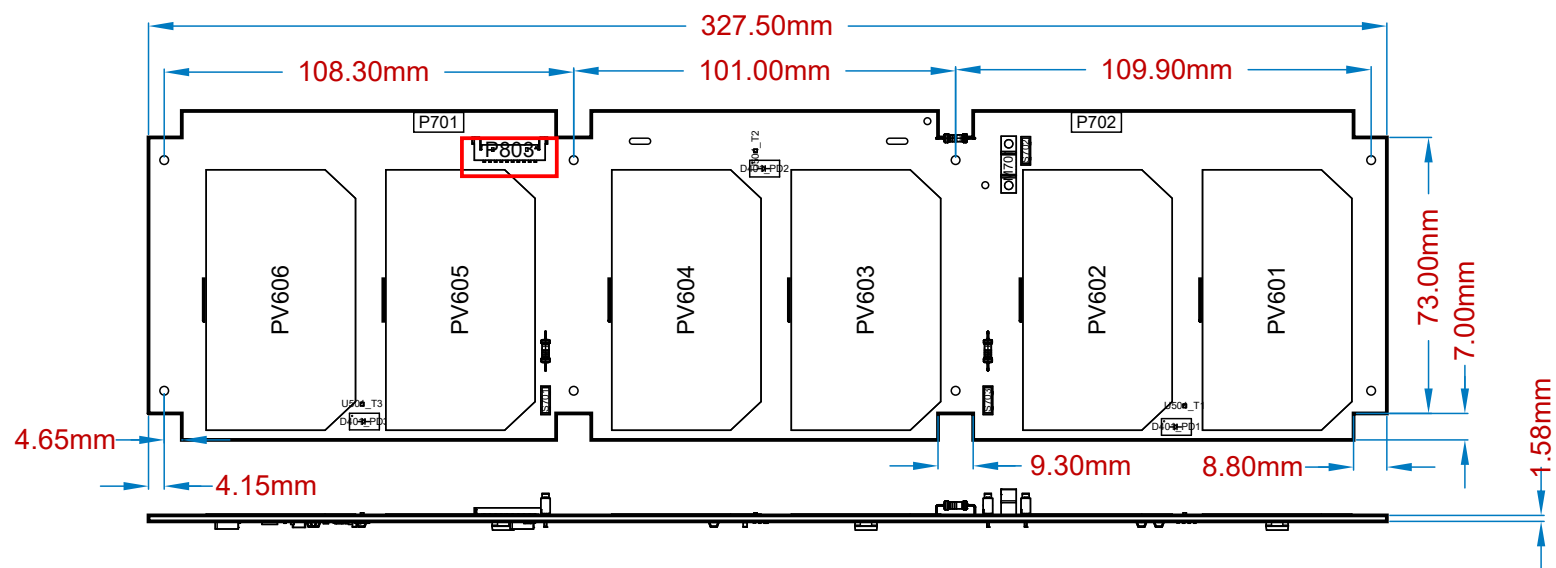
Time: 6:58:50 PM

Sheet 8 of 8

File: C:\Users\nicho\AlbertaSat\projects\Hyperion Solar Panels\Starboard\Starboard_Headers.SchDoc







Description	Designator	LibRef	Quantity	Footprint	Supplier 1	Supplier Link
CAP CER 1UF 25V X7R 0603	C201	PC-TDK-02603	1	TDK-CGA3E	Digi-key	http://www.digikey.ca/product-search/en?keywords=445-6931-1-ND
CAP CER 0.1UF 50V X7R 0402	C202, C204	PC-TDK-02259	2	TDK-CGA2B	Digi-key	http://www.digikey.ca/product-search/en?keywords=445-6899-1-ND
CAP CER 10UF 25V X7R 1206	C203	PC-TDK-02917	1	TDK-CGA5L	Digi-key	http://www.digikey.ca/product-search/en?keywords=445-6990-1-ND
CAP CER 0.1UF 35V X7R 0402, CAP CER 0.1UF 50V X7R 0402, CAP CER 100PF 50V COG 0402	C301, C401_PD1, C401_PD2, C401_PD3, C402_PD1, C402_PD2, C402_PD3, C501_T1, C501_T2, C501_T3	PC-TDK-02255, PC-TDK-02259, PC-TDK-01227	10	TDK-CGA2B	Digi-key	http://www.digikey.ca/product-search/en?keywords=445-6901-1-ND , http://www.digikey.ca/product-search/en?keywords=445-6899-1-ND , http://www.digikey.ca/product-search/en?keywords=445-5596-1-ND
SENSOR PHOTODIODE 850NM 2SMD GW	D401_PD1, D401_PD2, D401_PD3	PXX-ADP-00000	3	PDB-C160SM	Digi-key	
SCHOTTKY BARRIER RECTIFIERS 4.0 AMPERES, 10 VOLTS, V_F = 0.31V	D601, D602, D603	PXX-ONS-00003	3	ONS-875	Digi-key	#https://www.digikey.com/product-detail/en/on-semiconductor/MBRS410LT3G/MBRS410LT3GOSCT-ND/1967073#
	M701	PXX-ABS-00001	1	ANTENNA_SADDLE	Digi-key	
CMOS Amplifier 2 Circuit Rail-to-Rail 8-WSON (2x2)	OP301	73	1	TI-DSG0008A	Digi-Key	#https://www.digikey.ca/product-detail/en/texas-instruments/OPA2333PIDSGR/296-51501-1-ND/9745865#
	P701, P702	PXX-ABS-00004	2	DEPHINGE_MOUNTING_HOLE_BODY	Digi-key	
CONN HEADER SMD R/A 12POS 1.5MM	P801	71	1	MOLX-5040501291	Digi-Key	#https://www.digikey.ca/product-detail/en/molex/5040501291/WM16219CT-ND/6702294#
CONN HEADER SMD R/A 2POS 1.5MM	P802	61	1	MOLX-5040500291	Digi-Key	#https://www.digikey.ca/product-detail/en/molex/5040500291/WM25693CT-ND/9954119#
CONN HEADER SMD R/A 10POS 1.5MM	P803	69	1	MOLX-5040501091	Digi-Key	#https://www.digikey.ca/product-detail/en/molex/5040501091/WM10138CT-ND/4357655#
CONN HEADER SMD R/A 4POS 1.5MM	P804, P805	63	2	MOLX-5040500491	Digi-Key	#https://www.digikey.ca/product-detail/en/molex/5040500491/WM10137CT-ND/4357653#
	PV601, PV602, PV603, PV604, PV605, PV606	PBT-SPEC-00002	6	XTJ Prime	Spectrolab	
RES SMD 6.2K OHM 0.1% 1/16W 0402, RES SMD 24K OHM 0.1% 1/16W 0402	R301, R306, R401_PD1, R401_PD2, R401_PD3	16853, 17830	5	PANA-ERA2A	Digi-Key	http://www.digikey.ca/product-search/en?keywords=P6.2KCNCCT-ND , http://www.digikey.ca/product-search/en?keywords=P24KCNCCT-ND
RES SMD 1M OHM 0.1% 1/8W 0805, RES SMD 845K OHM 0.1% 1/8W 0805	R302, R304, R305, R307	19706, 19643	4	PANA-ERA6A	Digi-Key	http://www.digikey.ca/product-search/en?keywords=P1MDACT-ND , http://www.digikey.ca/product-search/en?keywords=P845KDACT-ND
RES SMD 0.01 OHM 0.1% 1W 2512	R303	PR-VSH-00237	1	VSH-2512R4C	Digi-key	http://www.digikey.ca/product-search/en?keywords=Y1487-.01-ND
21 Ohms ±1% 1W Through Hole Resistor Axial Flame Proof, Moisture Resistant, Safety Metal Film	R701, R702, R703	PR-VSH-00317	3	VSH-CPF1	Digi-key	#https://www.digikey.ca/product-detail/en/vishay-dale/CPF121R000FKEE6/CPF21.0CCT-ND/2713126#
RES SMD 0.0 OHM JUMPER 1/5W 0805	R801	PR-VSH-00003	1	VSH-0805MCU	Digi-key	http://www.digikey.ca/product-search/en?keywords=MCU0805-0.0-ZZCT-ND
SWITCH SNAP ACT SPDT 500MA 30V	S701, S702, S703	20035	3	PANA-AV4424	Digi-Key	#https://www.digikey.com/product-detail/en/panasonic-electric-works/AV4424/255-3743-ND/646766#
PC TEST POINT MINI SMD	TP101, TP102, TP103, TP104, TP105, TP106, TP107, TP108	PTP-KS-00001	8	KS-5017	Digi-key	http://www.digikey.ca/product-detail/en/keystone-electronics/5017/36-5017TR-ND/2217304
IC ADC 12BIT SAR 20LFCSP-WQ	U201	PU-ADI-00007	1	ADI-CP-20-8	Digi-key	#https://www.digikey.ca/product-detail/en/analog-devices-inc/AD7298BCPZ/AD7298BCPZ-ND/2507320#
Temperature Sensor Analog, Local -55°C ~ 150°C 5.194mV/°C 4-DSBGA (0.81x0.81)	U501_T1, U501_T2, U501_T3	70	3	TI-YFQ0004	Digi-Key	#https://www.digikey.ca/product-detail/en/texas-instruments/LMT70YFQR/296-47337-1-ND/7688347#

