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REVISION	DESCRIPTION	DATE	APPROVED

IGB Power Connector
IGB_Power_Conn.SchDoc
P375V
HV_RTN
HV_RTN

Input Current Limit
Input_Current_Limit.SchDoc
P375_IN
P375_OUT
HAS-FAULTED
LV_ISNS_P12V
LV_P5V
INPUT-FAULT-RESET
GND
LV_GND

POSITIVE HIGHSIDE

Designator
Interface_Channels_Main.SchDoc
P375_IN
HV_RTN
HV_RTN
UPSTREAM-FAULT
LV_P24V
SYS_24V
LV_ISNS_P12V
LV_P5V
GND
LV_GND
CHA_P375_OUT
CHA_RTN
CHB_P375_OUT
CHB_RTN
CHC_P375_OUT
CHC_RTN
CHD_P375_OUT
CHD_RTN
CHA_FET_EN
CHA_RLY_EN
CHA_CURRENT_SET
FAULT_SENSE_IN1
CHA_I
CHB_FET_EN
CHB_RLY_EN
CHB_CURRENT_SET
FAULT_SENSE_IN2
CHB_I
CHC_FET_EN
CHC_RLY_EN
CHC_CURRENT_SET
FAULT_SENSE_IN3
CHC_I
CHD_FET_EN
CHD_RLY_EN
CHD_CURRENT_SET
FAULT_SENSE_IN4
CHD_I

External Interface Connectors
External_Interface_Conn.SchDoc
CHA_P375_OUT
CHA_RTN
CHB_P375_OUT
CHB_RTN
CHC_P375_OUT
CHC_RTN
CHD_P375_OUT
CHD_RTN

LV_IGB_P24V
Local Low Voltage Power Supplies
Local_Power_Supplies.SchDoc
24VIN
SYS_24V
LV_P12V
LV_ISNS_P12V
LV_P5V
GND
LV_GND
LV_P24V
LV_P12V
LV_ISNS_P12V
LV_P5V

FAULT_SENSE_IN0

Mezzanine Connector
Mezzanine_Conn.SchDoc
LV_IGB_P24V
IGB_RAW_24V
CHA_CURRENT_SET
CHB_CURRENT_SET
CHC_CURRENT_SET
CHD_CURRENT_SET
CHA_I
CHB_I
CHC_I
CHD_I
CHA_FET_EN
CHA_RLY_EN
CHB_FET_EN
CHB_RLY_EN
CHC_FET_EN
CHC_RLY_EN
CHD_FET_EN
CHD_RLY_EN
LV_GND

Mechanical
Mechanical.SchDoc

FAULT_SENSE_IN5
FAULT_SENSE_IN6
FAULT_SENSE_IN7
R95 0
R96 0
R97 0
LV_GND

LV_P5V
Fault Multiplexer
Fault_Sensing.SchDoc
RESET
INPUT-FAULT-RESET
FAULT_SENSE
FAULT_MUX_A
FAULT_MUX_B
FAULT_MUX_C
FAULT_MUX_D
BOARD_TEMP
P5VIN
FAULT_SENSE
FAULT_MUX_A
FAULT_MUX_B
FAULT_MUX_C
FAULT_MUX_D
FAULT_SENSE_IN[7..0]
GND
FAULT_SENSE_IN[7..0]
LV_GND

U1
AD590KRZ-RL
NC
NC
NC
V-
NC
NC
NC
V+
LV_P5V

BOARD_TEMP
R1
1%
0603
51.1
Approx. 100nF at 2Vdc
C1
100nF
0603
10%
50V
R2
1%
7.15k
0603
LV_GND
LV_GND

Board Temperature - General
AD590KF Provide 1uA /Kelvin
Voutput = 7.15mV/C
Vout(25C) = 2.13V
Vout(80C) = 2.52V
HF Noise Filter (-3dB) = Approx 31Khz

LOW VOLTAGE NETCLASS

APPROVALS		DATE
ENG:	BSALMI	2024-09-03
DSN:	BSALMI	2024-09-03
CHK:	BSALMI	2024-09-03

REFERENCE DOCUMENTS	
BOM:	89566
ASSY DWG:	89565
FAB DWG:	89567
PCB DWG:	89564

PROJECT
MARS2 LVPS

APPLIED PHYSICS LAB
UNIVERSITY OF WASHINGTON
1013 NE 40TH STREET
SEATTLE, WA 98105

TITLE
MARS2 LVPS - Instrument Power Board

SIZE	CAGE CODE	DWG NO.	REV
B	98514	89568	2.0

FILE NAME Top.SchDoc
SHEET 1 OF 23

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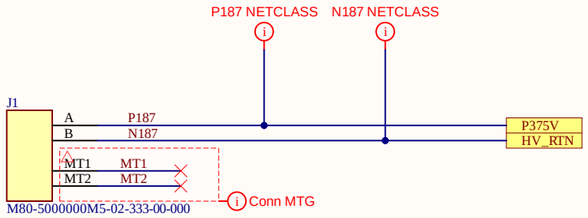

PROJECT	MARS2 LVPS
	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105
TITLE	MARS2 - IPB - IGB Power Conn
SIZE	B
CAGE CODE	98514
DWG NO.	89568
REV	2.0
FILE NAME	IGB_Power_Conn.SchDoc
SHEET	2 OF 23

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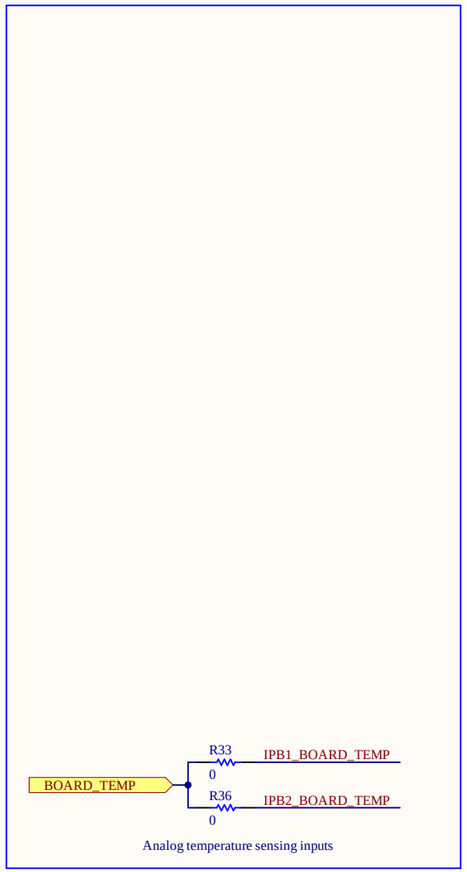
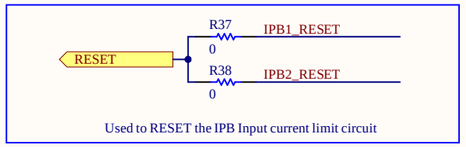
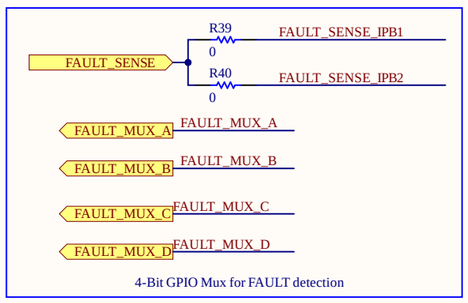


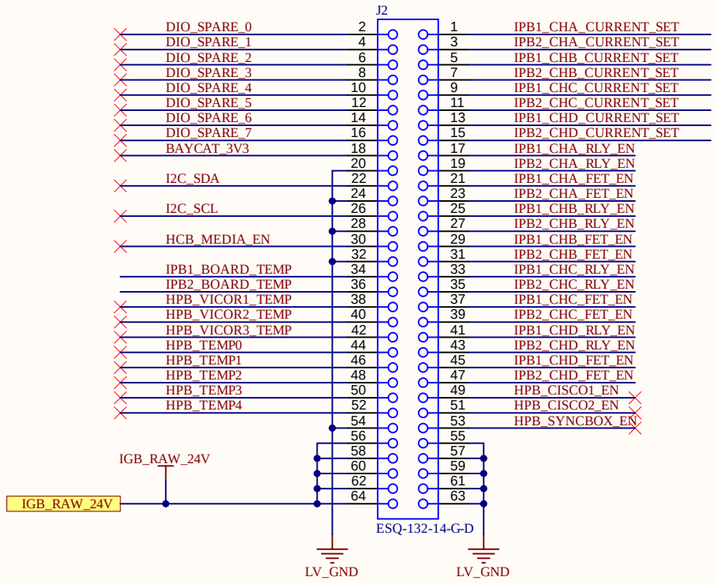
Analog temperature sensing inputs

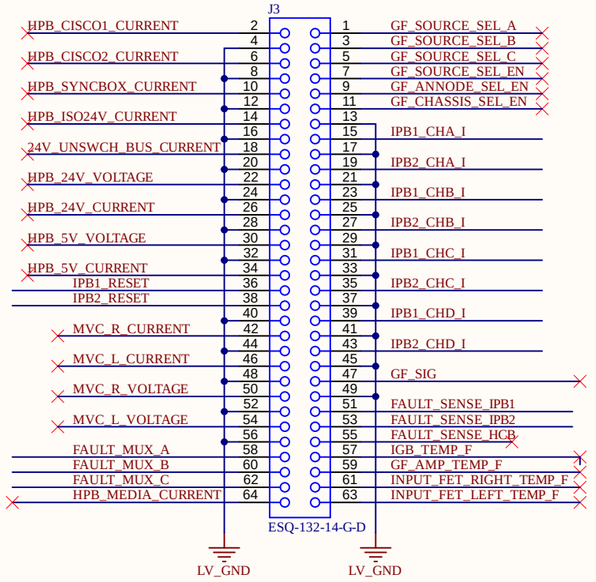


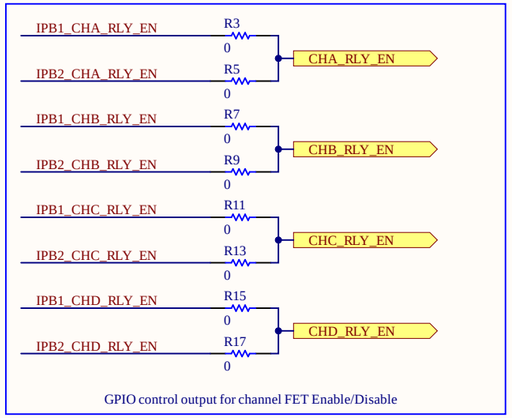
Used to RESET the IPB Input current limit circuit



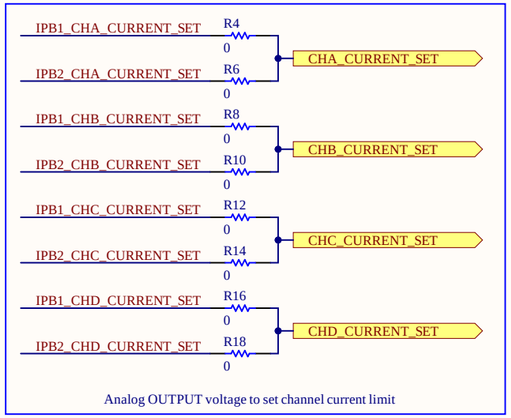
4-Bit GPIO Mux for FAULT detection



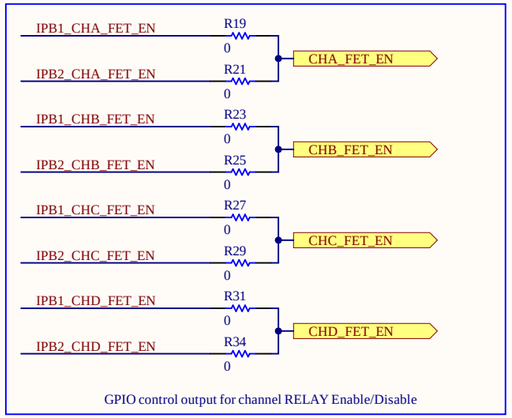




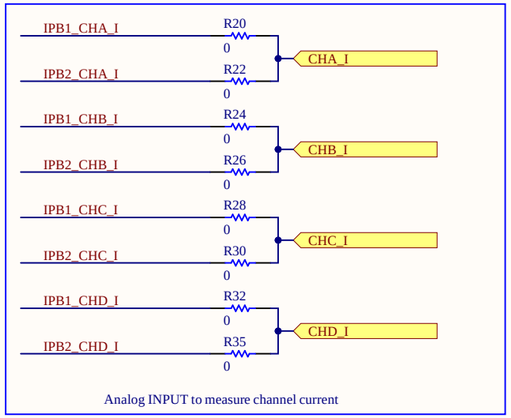
GPIO control output for channel FET Enable/Disable



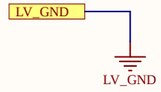
Analog OUTPUT voltage to set channel current limit



GPIO control output for channel RELAY Enable/Disable



Analog INPUT to measure channel current



PROJECT	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105
MARS2 LVPS	
TITLE	MARS2 - IPB - Mezzanine Connector
SIZE B / CAGE CODE 98514 / DWG NO. 89568 / REV 2.0	
FILE NAME Mezzanine_Conn.SchDoc / SHEET 3 OF 23	

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P187 NETCLASS

P375_IN

Current Sense
Current_Sense.SchDoc
P375_IN
P375_OUT

P187 NETCLASS

P375_OUT

LV_ISNS_P12V

12V to 5V (Linear) - ISNS Power
12V_to_5V_ISNS_REFOUT.SchDoc
VIN
P5V_REFOUT
GND

EMI Filter to attenuate DC/DC Ripple
Current sense poor PSSR in the Fsw range

GND

LV_ISNS_P5V

LV_ISNS_P5V_IN
LV_GND
LV_V_ISNS

GND

P5V

Current Limit - Configurable
Analog_Current_Limit.SchDoc
P5VIN
V_ISNS
V_ISET
FAULT-INJECT
V_DELAY
GND
FAULT

V_ISET

V_DELAY

GND

FAULT INJECTION TEST POINT
TP1
5002
White

R41
0805
0

P5V

Channel Logic
FET_CH_Digital_Logic.SchDoc
P5VIN
CH-FAULT
CH-CNTL
UPSTREAM-FAULT
HAS-FAULTED
CH-ENABLE
CH-ENABLEn
FAULT-RESET
GND

HAS-FAULTED

P5V

R42
0805
0

C2
100nF
50V

INPUT-FAULT-RESET

GND

GND

LV_ISNS_P12V

LV_ISNS_P12V
P5V
LV_P5V
GND

GND

LV_ISNS_P5V

LV_ISNS_P5V

Place near op-amp
[IDEAL] V_ISET(4A) = 4.1V
[REAL] V_ISET(4A) = 4.096V

R44
0603
10k
1%

R46
1%
45.3k

C3
C0G, NPO
5%
50V
0603
1nF

GND

GND

LV_ISNS_P5V

R43
8.25k

U2A
TLV2452AIDR
VDD
GND

Vcc=5V
VOH=4.85V
VOL=0.16V
Voffset=1.3mV
Ibias=7nA

TP2
5002
White

R45
0805
0

V_ISET

FAULT CURRENT INJECTION TEST POINT

GND

LOW VOLTAGE NETCLASS

LV_ISNS_P5V

Place near op-amp
Vdelay = ~1.25V = ~10ms Delay

R48
0603
3.32k
1%

R50
10k
1%
0603

C6
C0G, NPO
5%
50V
0603
1nF

GND

GND

R47
2.49k

U2B
TLV2452AIDR

TP3
5002
White

R49
0805
0

V_DELAY

FAULT DELAY INJECTION TEST POINT

LV_ISNS_P5V

Place near Op-Amp VDD

C4
C0G, NPO
50V
10nF
0603
5%

C5
10%
16V
1µF

GND

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Input Current Limit			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Input_Current_Limit.SchDoc		SHEET: 4	OF: 23

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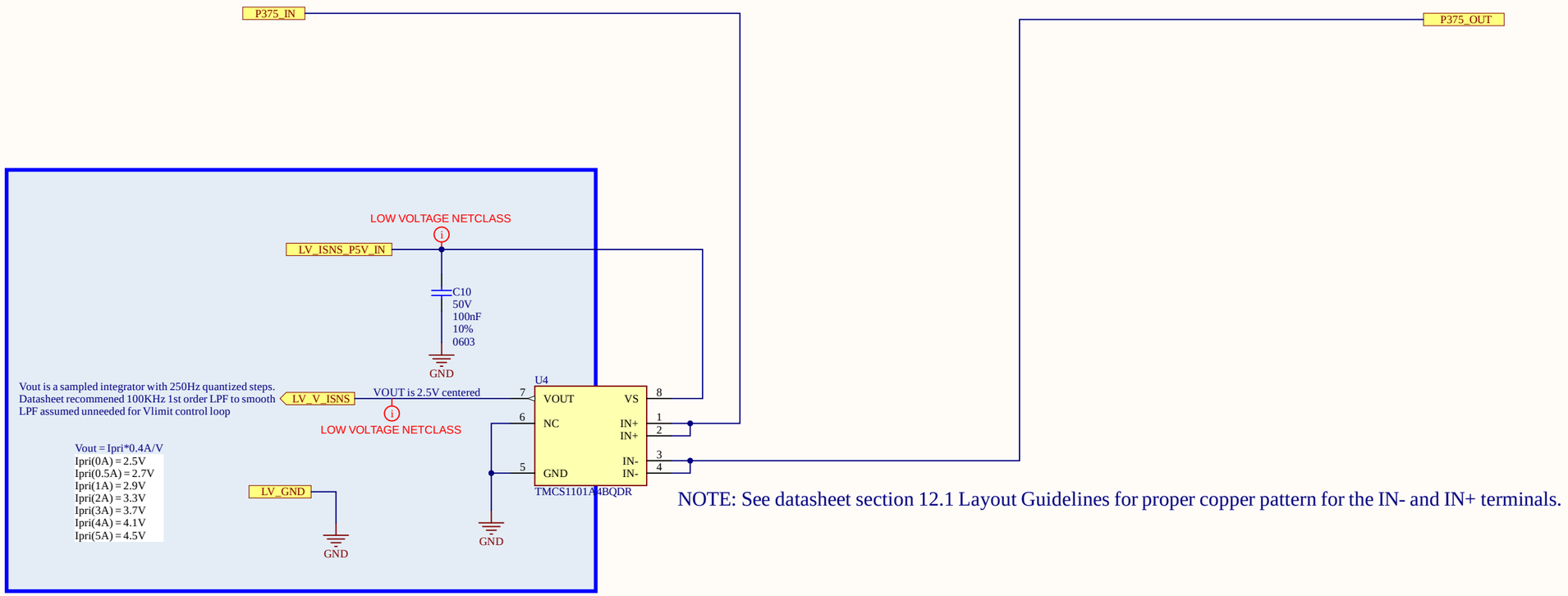

NOTE: See datasheet section 12.1 Layout Guidelines for proper copper pattern for the IN- and IN+ terminals.

Isolated HALL Effect current sensor

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Current Sense			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Current_Sense.SchDoc		SHEET: 5	OF: 23

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P5V

Place near Op-Amp VDD

C22
C0G, NPO
50V
10nF
0603
5%

C23
10%
16V
1µF

GND

V_DELAY

FAULT-INJECT

F(-3dB)=100KHz LPF

V_ISET

R66
1.65k
1%
0603

C24
C0G, NPO
5%
50V
0603
1nF

GND

P5V

U7A
TLV3202AIDR

Fault Delay (RC Time Constant)

R67
499

D5
1N4148WS
SOD-323

R68
1%
332k
0603

C25
100nF
50V

GND

Discharge diode greatly increased discharge rate.

U7B
TLV3202AIDR

TLV2452 is a nA input bias op-amp - Negligable input impedance bias error

5V TTL

U8A
SN74LVC1G17QDCKRQ1

NC

5V TTL

FAULT

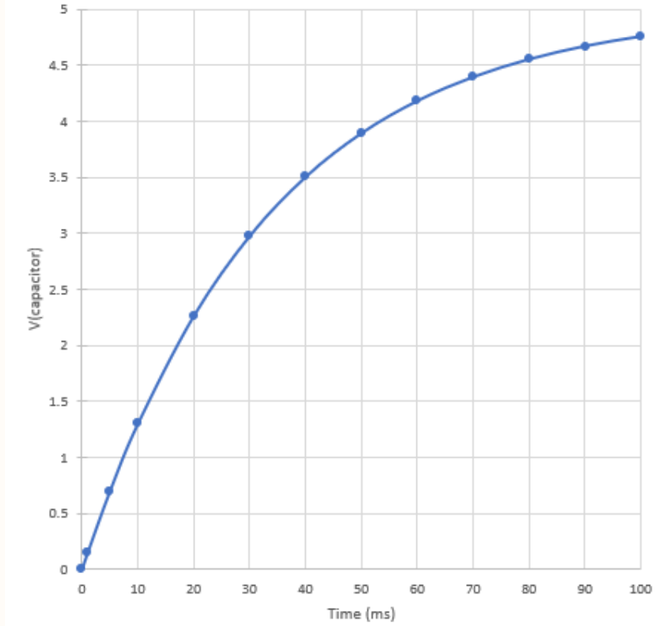
F(-3dB)=100KHz LPF

V_ISNS

R69
1.65k
1%
0603

C26
C0G, NPO
5%
50V
0603
1nF

GND



V_Delay Voltage Vs. Time (Approximate)

P5V

P5VIN

GND

GND

P5V

U8B

Place near Schmitt Trigger

C27
100nF
50V

VCC
GND

SN74LVC1G17QDCKRQ1

GND

GND

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Analog Current Limit			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Analog_Current_Limit.SchDoc		SHEET: 6 OF 23	

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UPSTREAM-FAULT
U9B
SN74LVC3G14DCTR
UPSTREAM-FAULTn
CH-ENABLE
P5V
U10A
SN74LVC1G11MDCKREP
R70
0603
49.9k
1%
GND
U9A
SN74LVC3G14DCTR
CH-ENABLEn
CH-ENABLEn
CH-ENABLE
R73
0603
49.9k
1%
GND
CH-FAULT
ACTIVE-FAULT
U11A
SN74LVC1G175DCKT
R71
0603
49.9k
1%
GND
P5V
R72
1%
332k
0603
C28
100nF
50V
GND
RC Time Constant = 33ms (2.2V)
Vih U11 = 2Vmin
U12A
SN74LVC3G14DCTR
CH-ENABLEBUF
HAS-FAULTEDn
P5V
U13A
SN74LVC1G11MDCKREP
CH-CNTL
FAULT-RESET
R74
0603
49.9k
1%
GND
FAULT_RESET
CH-CNTLn
HAS-FAULTED
HAS-FAULTED
U14A
SN74LVC1G11MDCKREP
U9C
SN74LVC3G14DCTR
U12B
SN74LVC3G14DCTR
P5VIN
GND
P5V
U10B
SN74LVC1G11MDCKREP
C32
X7R
50V
100nF
0603
10%
U13B
SN74LVC1G11MDCKREP
C34
X7R
50V
100nF
0603
10%
U14B
SN74LVC1G11MDCKREP
C35
X7R
50V
100nF
0603
10%
U9D
SN74LVC3G14DCTR
C29
X7R
50V
100nF
0603
10%
U11B
SN74LVC1G175DCKT
C30
X7R
50V
100nF
0603
10%
U12D
SN74LVC3G14DCTR
C31
X7R
50V
100nF
0603
10%
U12C
SN74LVC3G14DCTR
R75
0603
49.9k
1%

PROJECT	MARS2 LVPS
	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105
TITLE	MARS2 - IPB - Channel Digital Logic
SIZE	B
CAGE CODE	98514
DWG NO.	89568
REV	2.0
FILE NAME	FET_CH_Digital_Logic.SchDoc
SHEET	7 OF 23

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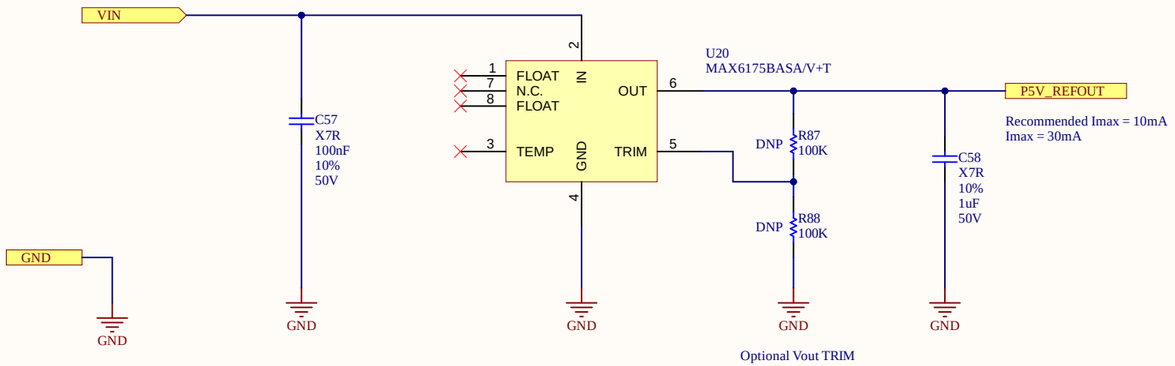

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - 12V to 5V Clean Power			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: 12V_to_5V_ISNS_REFOUT.SchDoc		SHEET: 8 OF 23	

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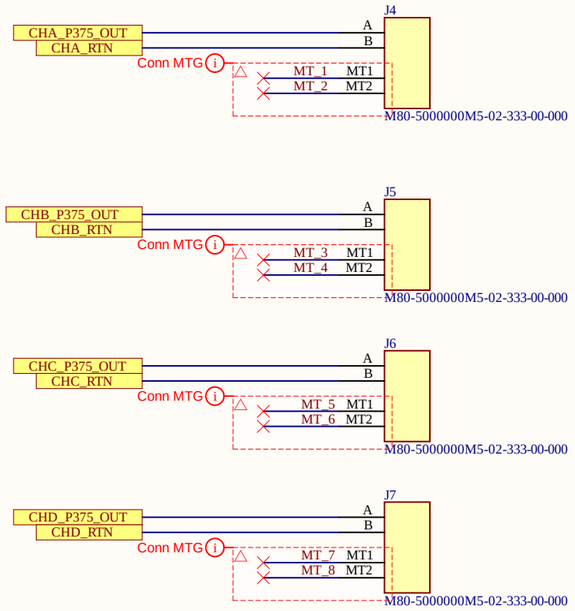

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Instrument Channel Conn			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: External_Interface_Conn.SchDoc		SHEET: 9	OF: 23

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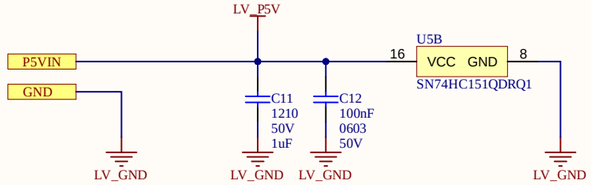

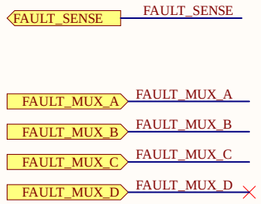

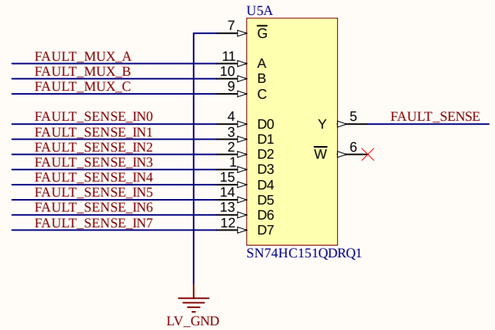

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Fault Multiplexing			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Fault_Sensing.SchDoc		SHEET: 10 OF 23	

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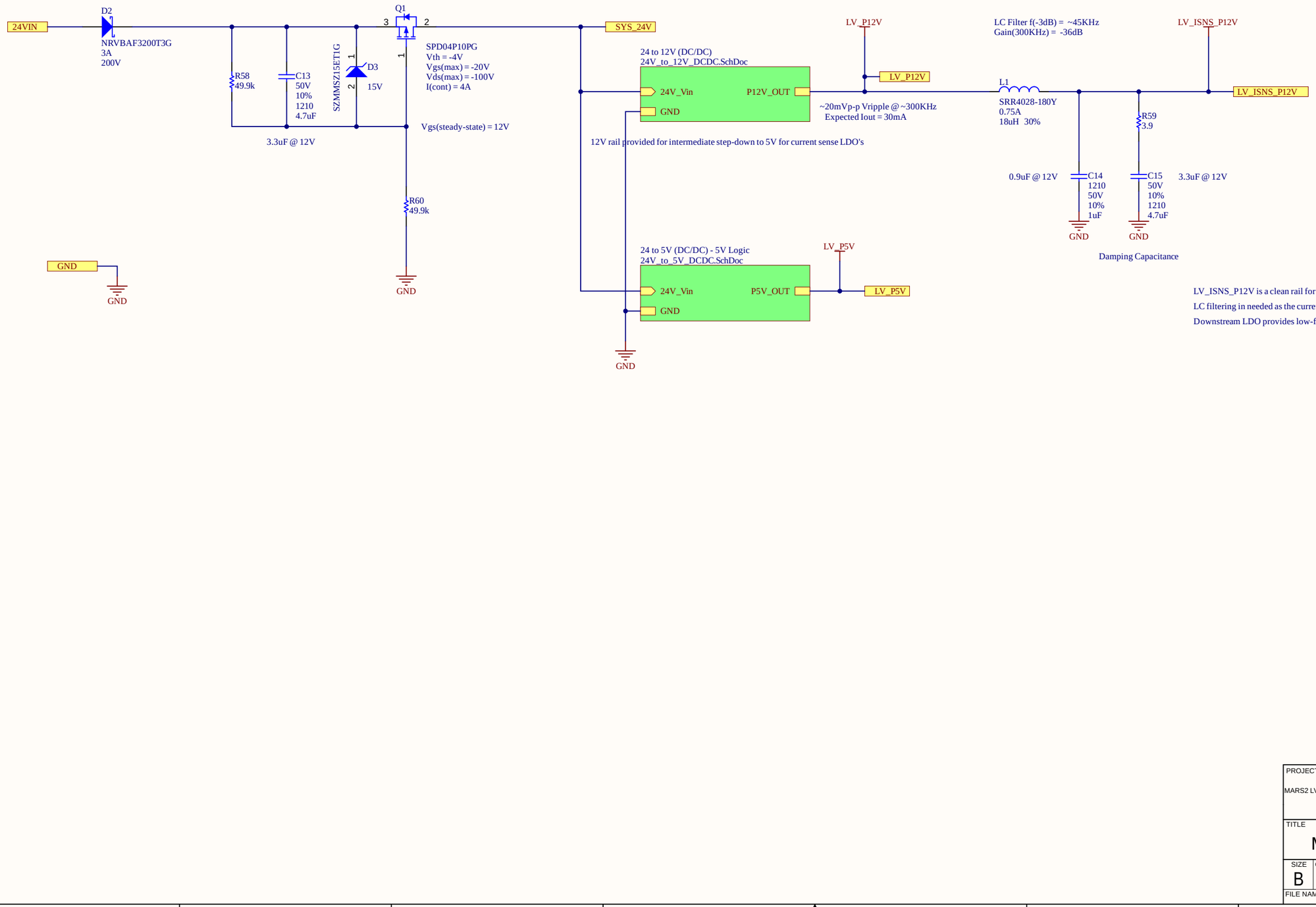
Regulated 24V power from IGB PCBA

In-Rush Current Limit Circuit
Approx 2ms soft-start



LV_ISNS_P12V is a clean rail for use only with the current sensors. This filtering provides clean HF filtering.
LC filtering in needed as the current sensor exhibits poor PSRR at the ~300KHz DC/DC switching frequency
Downstream LDO provides low-frequency filtering and final 12V to 5V regulation.

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Local Power Supplies			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Local_Power_Supplies.SchDoc		SHEET: 11 OF 23	

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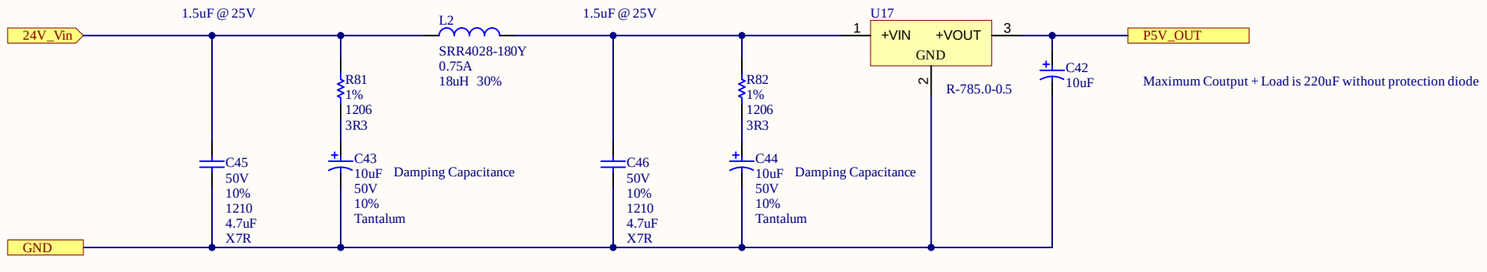

LC Filter f(-3dB) = ~24KHz
Gain(300KHz) = -40dB
Damping provide for entire PI filter - Peaks approximately 2dB

PROJECT: MARS2 LVPS			
TITLE: MARS2 - IPB - 24V to 5V DC/DC			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: 24V_to_5V_DCDC.SchDoc		SHEET: 12 OF 23	

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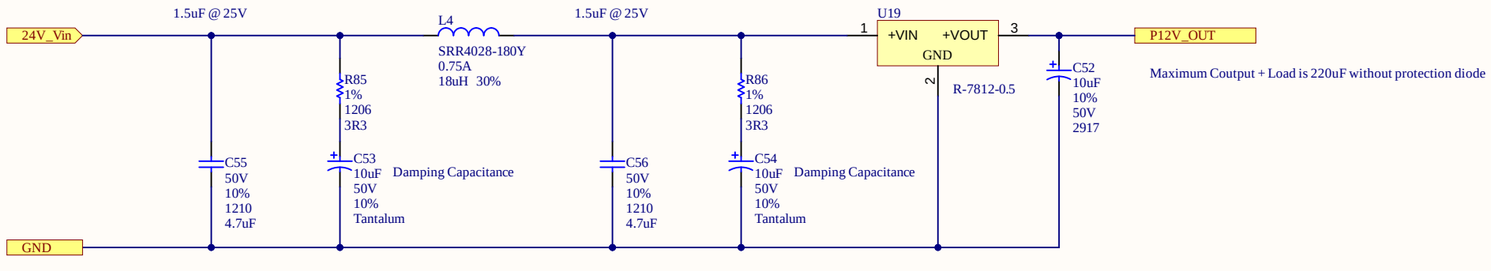
12V POWER SUPPLY

MTBF: 26162x10^3hr
f = 280kHz-380kHz
Max Power Dissipation: 0.52W



LC Filter f(-3dB) = ~24KHz
Gain(300KHz) = -40dB
Damping provide for entire PI filter - Peaks approximately 2dB

PROJECT: MARS2 LVPS			
TITLE: MARS2 - IPB - 24V to 12V DC/DC			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: 24V_to_12V_DCDC.SchDoc		SHEET: 13 OF 23	

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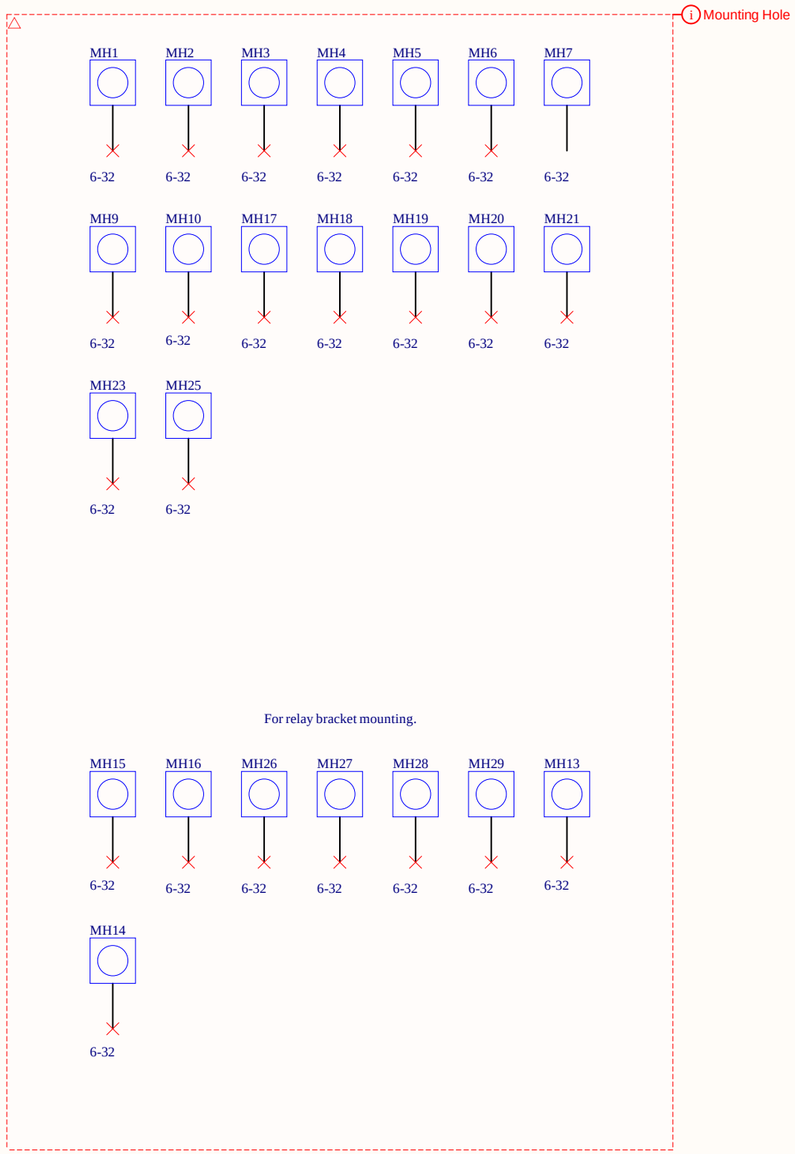

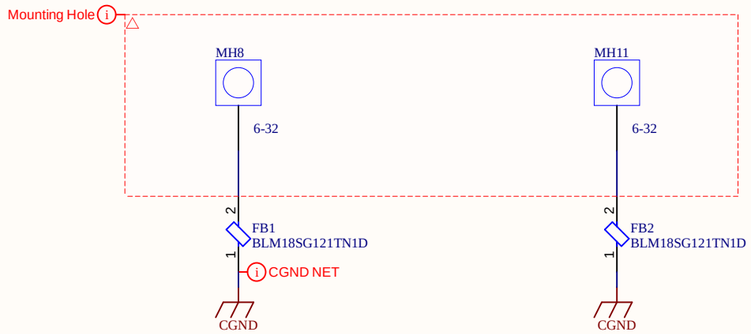

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Mechanicals			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Mechanical.SchDoc		SHEET: 14 OF 23	

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SYS_24V — LV_P24V
LV_ISNS_P12V — LV_ISNS_P12V
LV_P5V — LV_P5V
GND — LV_GND

Interface Channel A
Interface_Channel.SchDoc

P375_IN — P375_IN
HV_RTN — HV_RTN
UPSTREAM-FAULT — UPSTREAM-FAULT
CHA_FET_EN — CH-FET_EN
CHA_RLY_EN — CH-RLY_EN
CHA_CURRENT_SET — CH-ISET
CH-HAS-FAULTED — FAULT_SENSE_IN1
CH-I — CHA_I

P375_OUT — CHA_P375_OUT
CH_RTN — CHA_RTN
LV_P24V — LV_P24V
LV_ISNS_P12V — LV_ISNS_P12V
LV_P5V — LV_P5V
LV_GND — LV_GND

Interface Channel B
Interface_Channel.SchDoc

P375_IN — P375_IN
HV_RTN — HV_RTN
UPSTREAM-FAULT — UPSTREAM-FAULT
CHB_FET_EN — CH-FET_EN
CHB_RLY_EN — CH-RLY_EN
CHB_CURRENT_SET — CH-ISET
CH-HAS-FAULTED — FAULT_SENSE_IN2
CH-I — CHB_I

P375_OUT — CHB_P375_OUT
CH_RTN — CHB_RTN
LV_P24V — LV_P24V
LV_ISNS_P12V — LV_ISNS_P12V
LV_P5V — LV_P5V
LV_GND — LV_GND

Interface Channel C
Interface_Channel.SchDoc

P375_IN — P375_IN
HV_RTN — HV_RTN
UPSTREAM-FAULT — UPSTREAM-FAULT
CHC_FET_EN — CH-FET_EN
CHC_RLY_EN — CH-RLY_EN
CHC_CURRENT_SET — CH-ISET
CH-HAS-FAULTED — FAULT_SENSE_IN3
CH-I — CHC_I

P375_OUT — CHC_P375_OUT
CH_RTN — CHC_RTN
LV_P24V — LV_P24V
LV_ISNS_P12V — LV_ISNS_P12V
LV_P5V — LV_P5V
LV_GND — LV_GND

Interface Channel D
Interface_Channel.SchDoc

P375_IN — P375_IN
HV_RTN — HV_RTN
UPSTREAM-FAULT — UPSTREAM-FAULT
CHD_FET_EN — CH-FET_EN
CHD_RLY_EN — CH-RLY_EN
CHD_CURRENT_SET — CH-ISET
CH-HAS-FAULTED — FAULT_SENSE_IN4
CH-I — CHD_I

P375_OUT — CHD_P375_OUT
CH_RTN — CHD_RTN
LV_P24V — LV_P24V
LV_ISNS_P12V — LV_ISNS_P12V
LV_P5V — LV_P5V
LV_GND — LV_GND

PROJECT	MARS2 LVPS
	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105
TITLE	Interface Channel - High Level
SIZE	B
CAGE CODE	98514
DWG NO.	89568
REV	2.0
FILE NAME	Interface_Channels_Main.SchDoc
SHEET	15 OF 23

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Overcurrent Current Sense
Current_Sense.SchDoc

P187 NETCLASS

POSITIVE HIGHSIDE

+187V to GND

Solid State Switches
Solid_State_Switch.SchDoc

P375_IN

P375_OUT

RELAY INPUT

K1

RELAY-TOP-NC

COIL_DRV_HIGH

COIL_RTN_HIGH

G41C

RELAY OUTPUT

D1
VS-8EWS16SLHM3

R99
1M

R100
1M

R101
1M

R103
1M

COIL_DRV_LOW

COIL_RTN_LOW

K2

RELAY-BOTTOM-NC

N187 NETCLASS

HV_RTN

CH_RTN

EMI Filter to attenuate DC/DC Ripple
Current sense poor PSSR in the Fsw range

12V to 5V (Linear) - ISNS Power
12V_to_5V_ISNS_REFOUT.SchDoc

LV_ISNS_P12V

VIN

P5V_REFOUT

GND

LV_GND

LV_ISNS_P5V_IN

LV_V_ISNS

CH-I

Anti-Alias Filter
Anti_Alias_Filter.SchDoc

SIG-IN

SIG-OUT

P5VIN

LV_P5V

-187V to GND

LV_P24V

LV_P5V

Current Limit - Configurable
Analog_Current_Limit.SchDoc

CH-ISET

V_ISET

FAULT

FAULT-INJECT

V_DELAY

Channel Logic
FET_CH_Digital_Logic.SchDoc

CH-FAULT

CH-CNTL

UPSTREAM-FAULT

HAS-FAULTED

CH-HAS-FAULTED

CH-FET_EN

CH-ENABLE

CH-ENABLEn

Disabling channel resets fault

FAULT-RESET

SHORT-FAULT-OC

G41C Contactor

26.5V Nominal
Vpickup = 16V
Vdropout = 1-10V
Rcoil = 290 Ohms (91.4mA, 2.42W)

Open-Collector pulls V_ISET to approx 0V which is -4A ensuring a normal FAULT

Place near Op-Amp VDD

Place near op-amp U15

C7
C0G, NPO
50V
10nF
0603
5%

C8
10%
16V
1µF

R52
0603
10k

R54
0603
8.45k

C9
1nF
10%
50V

U3A
TLV2452AIDR

R51
4.53k

R53
0805
0

TP4
5002
White

Vcc=5V
VOH=4.85V
VOL=0.16V
Voffset=1.3mV
Ibias=7nA

U3B
TLV2452AIDR

R55
0603
10k

R56
0603
10k

R57
0603
10k

Place near op-amp U15
Vdelay = ~2.3V = ~20ms Delay
Delay provides fault slow-blow

Contactor Driver
Relay_Driver.SchDoc

CH-RLY_EN

EN

GND

COIL_DRV

COIL_RTN

COIL_DRV_HIGH

COIL_RTN_HIGH

COIL_DRV_LOW

COIL_RTN_LOW

Flyback diode included in driver
82mA Nominal

APPLIED PHYSICS LAB
UNIVERSITY OF WASHINGTON
1013 NE 40TH STREET
SEATTLE, WA 98105

PROJECT: MARS2 LVPS

TITLE: MARS2 - IPB - Instrument Channel

SIZE: B | CAGE CODE: 98514 | DWG NO.: 98568 | REV: 2.0

FILE NAME: Interface_Channel.SchDoc | SHEET 16 OF 23

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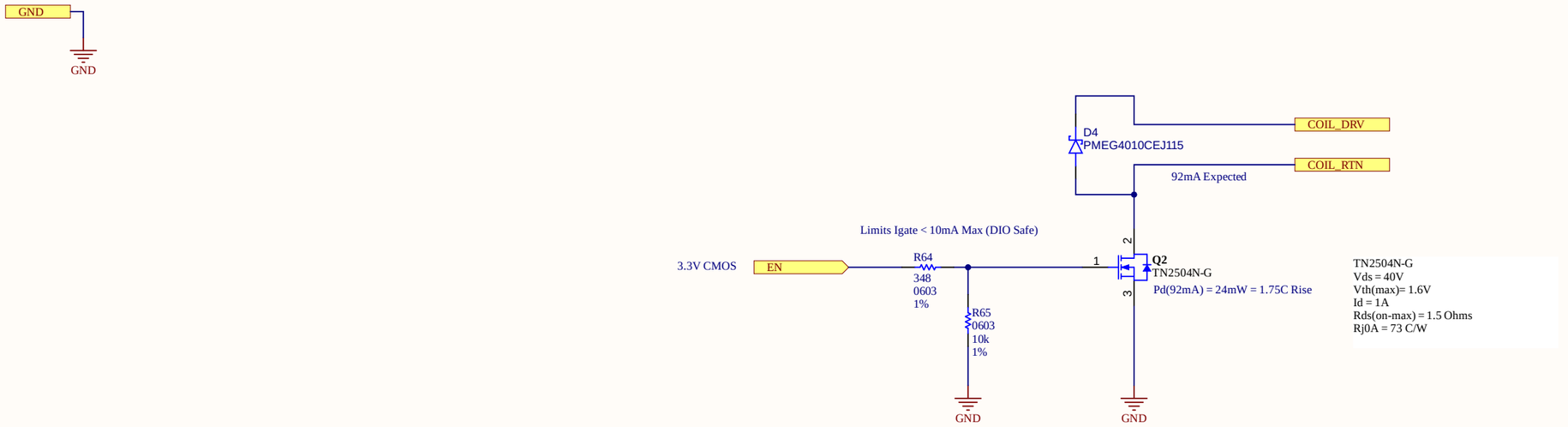

G41C Contactor

26.5V Nominal
Vpickup = 16V
Vdropout = 1-10V
Rcoil = 290 Ohms (91.4mA, 2.42W)

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Relay Driver			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Relay_Driver.SchDoc		SHEET: 17 OF 23	

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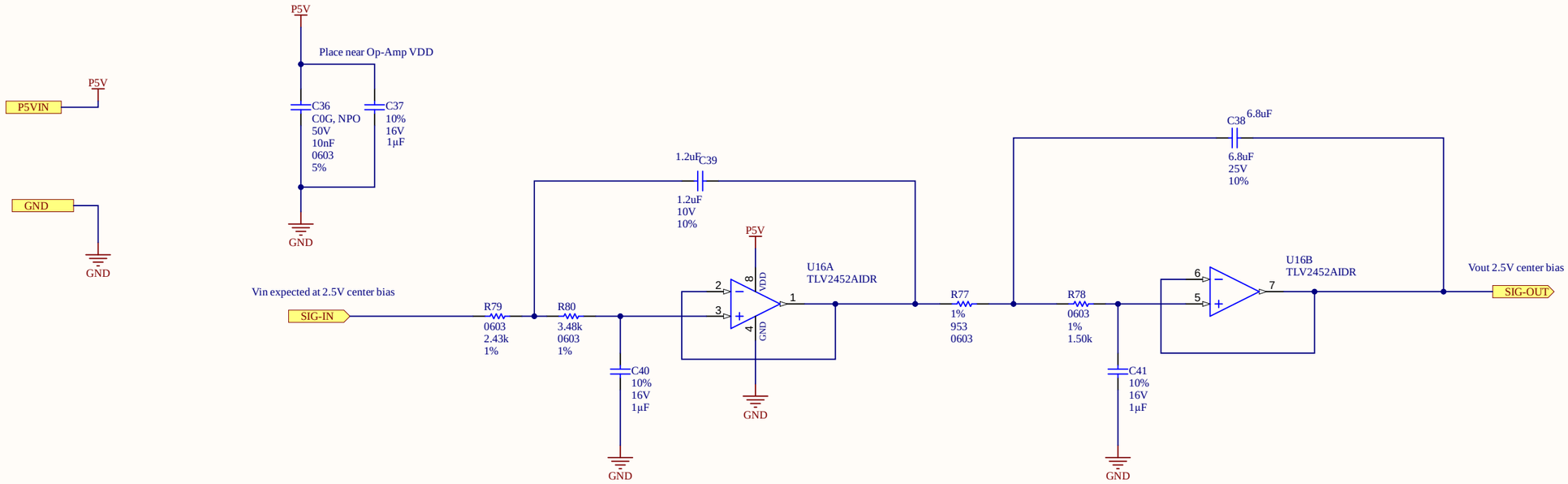

4th Order Butterworth Active Filter with Unity Gain Output
TLV2452A Vout(LOW) @ 10mA = 0.5V
TLV2452A Vout(HIGH) @ 10mA = 4.5V
F(-3dB) = 50Hz
Av(300Hz) = -61dB

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Anti-Alias Filter			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Anti_Alias_Filter.SchDoc		SHEET: 18 OF 23	

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P187 NETCLASS
C59
22nF
R104
220R
INA310 current sense amplifier operates up to -4V Vcm
P187 NETCLASS
MOSFET INPUT
IXFN66N85X
Q3
MOSFET OUTPUT P187 NETCLASS
P375_IN
D
S2
S1
G
D6
SZMMSZ15ET1G
Short Circuit Current Sense
IN310_ISNS.SchDoc
P187 NETCLASS
P375_OUT
RSNS_P
RSNS_N
ISO-GND
HV_P5V
P5V-IN
FAULT
GND
RESETn
U22A
FAULT-BUF
TP5
5001
FAULT Output
NC
SN74LVC1G17QDCKRQ1
GATE_DRV_HIGH
D7
1N4148WS
SOD-323
R89
110
Zener keeps the Gate within +15V of Source
MOSFET OUTPUT
R91
910
MOSFET OUTPUT
ISO-GND
Has pullup to 5V
Pull to GND to RESET a FAULT
LV_P24V
LV_P5V
LV_GND
P187 NETCLASS
P187 NETCLASS
Isolated Gate Drive Power - HIGH
Isolated_Gate_Power_Supplies.SchDoc
P24VIN
ISO-P12V
ISO-P5V
ISO-RTN
GND
HV_P12V
HV_P5V
ISO_RTN
ISO-GND
Short Circuit Logic Intergration
Short-Circuit-Logic-Integration.SchDoc
HV_P12V
HV_P5V
P12V
P5V
GATE_DRV_HIGH
FAULT
CH-EN
RESETn
GND
ISO-GND
CH-CNTL
R63
768
Q4
CH-EN
140357145100
ISO-GND
HV_P5V
U22B
VCC
GND
SN74LVC1G17QDCKRQ1
C61
ISO-GND
SHORT-FAULT-OC
Q8
R83
768
FAULT-BUF
140357145100
ISO-GND

PROJECT	MARS2 LVPS
	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105
TITLE	MARS2 - IPB - HV Solid State Switches
SIZE	B
CAGE CODE	98514
DWG NO.	89568
REV	2.0
FILE NAME	Solid_State_Switch.SchDoc
SHEET	19 OF 23

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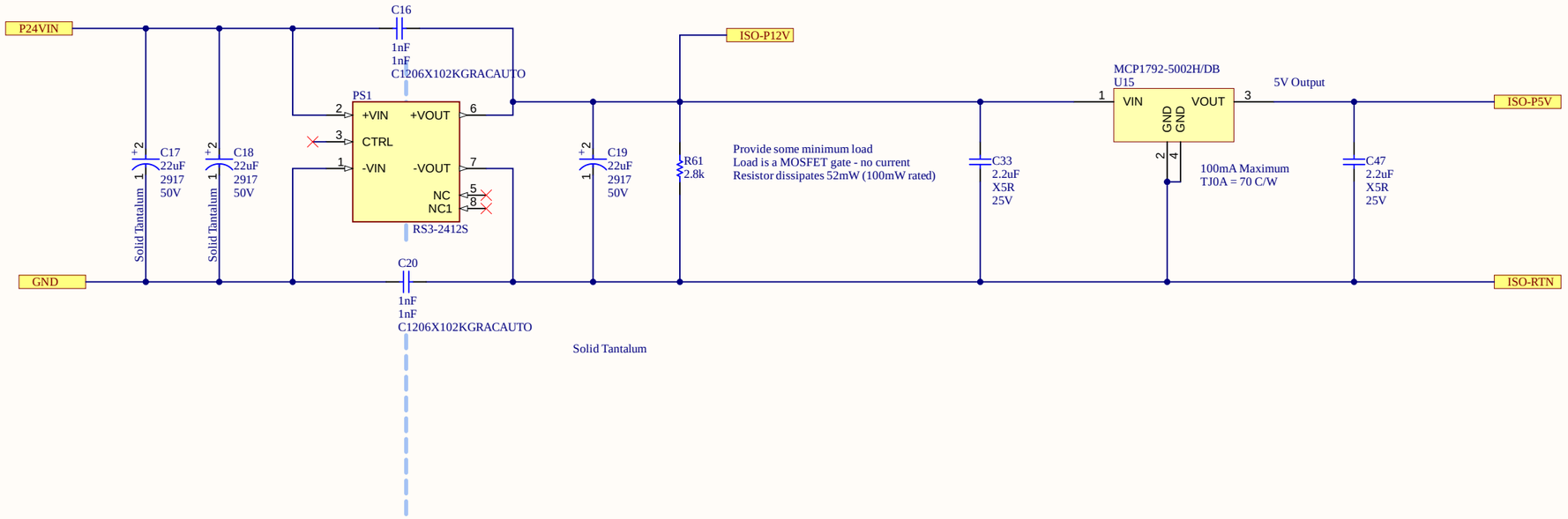
24V LOW VOLTAGE POWER DOMAIN

ISOLATED HIGH VOLTAGE FET DRIVER POWER DOMAIN



PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - HV ISO Gate PSU			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Isolated_Gate_Power_Supplies.SchDoc		SHEET: 20 OF 23	

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P5V

P5V-IN

GND

GND

R102

RSNS_P

RSNS_N

5mR
2W
75ppm/°C
1%
Vishay Dale

Use kelvin connection

P5V

C49
25V
100nF

C50
0805
25V
1uF

GND

P5V

R62
4.99k

U18

1 VS

2 OUT

3 CMP_IN

5 RSTn

4 GND

8 IN+

7 IN-

6 CMP_OUT

INA310A1IDGKR

R94
6.8k

R98
3.32k

RESETn

C48
25V
100nF

GND

GND

Vcmp = 0.6V
Threshold set to ~18A

FAULT

Place close to IN310 RSNS_N

D8
1N4148WS
SOD-323

GND

P5V

R93
4.99k

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: INA310 Latching Current Sense Amplifier			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: IN310_ISNS.SchDoc		SHEET: 21 OF 23	

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P12V
P12V
P5V
P5V
GND
GND

P5V
PNP
MMBT3906LT1G
Q5
Supplies 5V to MOSFET Driver anode when CH-EN is HIGH
LED Current Limiter
R76
294
If = 12.5mA
MOSFET HIGH Driver
Gate_Driver.SchDoc
ANODE
CATHODE
P12V
GATE
P12V_RTN
P12V
P187 NETCLASS
GATE_DRV_HIGH
GATE_DRV_HIGH

R84
4.99k
U21A
2
1
NC
4
RESETn
Pulls RESETn to GND when CH-EN is OFF
SN74LVC1G17QDCKRQ1

FAULT
FAULT
1
3
2
Q6
BSS138P,215
R90
49.9k

CH-EN
R92
4.99k
1
3
2
Q7
MMBT3904LT1G
NPN

HFE ~ 30 minimum
Ib = ~882uA
Ic = ~26mA
GND
GND
GND
GND
GND

INA310 FAULT causes 5V MOSFET driver to turn off FAST
INA310 will remain OFF until RESETn is driven LOW

P5V
U21B
5
3
VCC
GND
SN74LVC1G17QDCKRQ1
C51
25V
100nF
X7R
GND
GND

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: Short Circuit System Integration			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Short-Circuit-Logic-Integration.SchDoc		SHEET: 22 OF 23	

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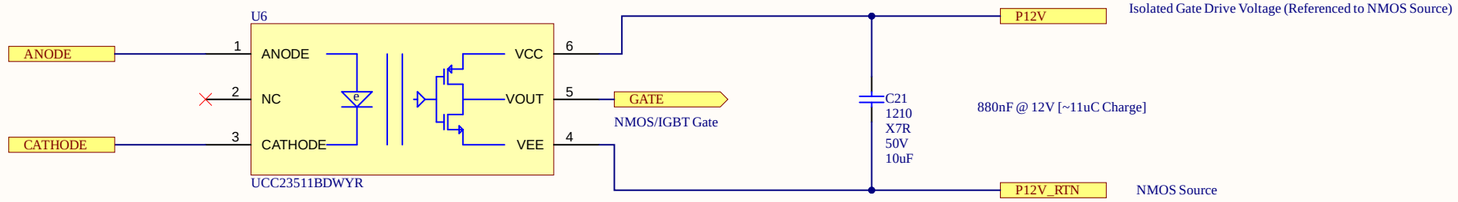

eDiode Ith = 7-16mA (Recommended 10mA)
VF = 1.8V to 2.4V at typ 2.1V (1.35mV/C)

Vf nom= 2.1V -> 290 Ohms for 10mA

If(Vf=1.8V) = 11.0mA
If(Vf=2.4V) = 8.8mA

PROJECT: MARS2 LVPS	APPLIED PHYSICS LAB UNIVERSITY OF WASHINGTON 1013 NE 40TH STREET SEATTLE, WA 98105		
TITLE: MARS2 - IPB - Isolated Gate Driver			
SIZE: B	CAGE CODE: 98514	DWG NO.: 89568	REV: 2.0
FILE NAME: Gate_Driver.SchDoc		SHEET: 23 OF 23	