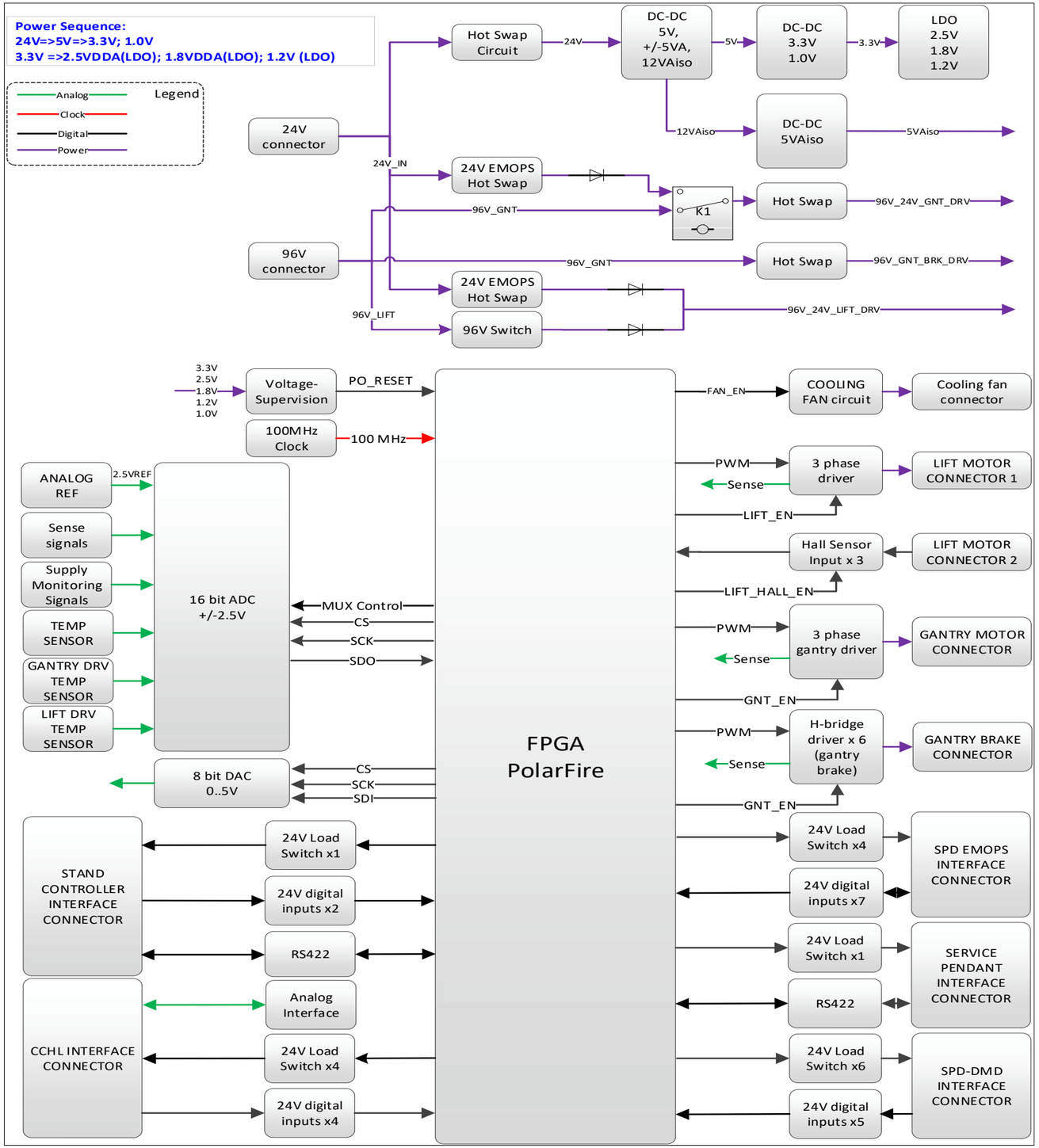
DASH NO.	TYPE OR MODEL	NEXT ASSEMBLY
--	SAPPHIRE	P1060972

DUAL MOTOR DRIVER



NOTES:

1. RESISTANCE VALUES ARE IN OHMS
2. CAPACITANCE VALUES ARE IN MICROFARADS

REFERENCE INFORMATION

TABLE OF CONTENTS

CONNECTOR KEYING TABLE

Jx	TYPE	FUNCTION	KEY
J1	HEADER 13x2 RIBBON	STAND CONTROLLER	8
J6	HEADER 4x2	LIFT HALL SENSOR	NA
J7	HEADER 2x1	COOLING FAN	NA
J8	DSUB 15-R	STAND CONTROL PANEL	2
J9	HEADER 10x2	DMD_24V, SPD DMD IF	18
J10	HEADER 13x2 RIBBON	STAND POWER DISTRIBUTION	11
J11	FTSH-105-01-L-D-K	FPGA JTAG	NA
J12	DSUB 26 HD RECEPTACLE	COUCH CONTROLLER	NA
J17	HEADER 2X3	GANTRY/LIFT 96V INPUT POWER	NA
J18	HEADER 4X1	EMOPS 24V	NA
J19	HEADER 5x2	TEST POINT HEADER	NA
J20	HEADER 5x2	TEST POINT HEADER	NA
J21	HEADER 10x2	TEST POINT / SWITCH HEADER	NA
J22	HEADER 4X1	GANTRY DRIVER OUTPUT	TBD
J23	HEADER 4X1	LIFT DRIVER OUTPUT	3
J24	DSUB 26 HD RECEPTACLE	GANTRY BRAKE	NA

VARIANT01

THE ELECTRONIC SIGNATURE RECORD WILL BE APPENDED TO THE LAST PAGE OF THE SECURED DOCUMENT

DESCRIPTION OF CHANGE

INITIAL RELEASE

-CHANGED TO 7890970571 (CURRENT SENSOR,HE,40A,8-SOIC,ROHS - ALLEGRO MICROSYSTEMS INC ACS723LLCTR-40AU-T): U34
-CHANGED TO 4180200371 (CAP,1000PF,10%,50V,0805,ROHS - AVX/KYOCERA 08055C102KAT2A): C234 C263 C264 C265 C266 C340 C341
-CHANGED TO 4180200171 (CAP,0.1UF,10%,50V,0805,ROHS - AVX/KYOCERA 08055C104KAT2A): C82 C125 C226
-CHANGED TO 3141621371 (RES,1000,1%,1/10W,0603,ROHS - KOA SPEER RK73H1JTTD1001F): R521
-ADDED/CHANGED TO 3141630971 (RES,10.0K,1%,1/10W,0603,ROHS - KOA SPEER RK73H1JTTD1002F): R428 R24 R273 R354 R1000 (ADDED THROUGH REWORK)
-CHANGED TO 3141633871 (RES,20.0K,1%,1/10W,0603,ROHS - KOA SPEER RK73H1JTTD2002F): R351
-CHANGED TO 3141627171 (RES,4.02K,1%,1/10W,0603,ROHS - KOA SPEER RK73H1JTTD4021F): R63 R369 R373

ECO		
REV	A	B

varian

TITLE:

PCB, DUAL MOTOR DRIVER

/

DRAWN:	SHEET	SIZE	DWG NO	REV
Rami A.	1 OF 21	D	P1060973	B
DATE: 06/22/2023	ORCAD CAPTURE			

CM# 000600020609 Released Ver: 01 Rev: B 23. January 2024

Power Sequence: 24V=>5V; 5V=>3.3V, 1.0V; 3.3V =>2.5VDDA(LDO)=>1.8VDDA(LDO), 1.2V

PWR INPUT

CURR LIMIT = 2.5A
I (lim) = (50mV)/Rs
KELVIN SENSE CONNECTION

TOTAL BUS CAPACITANCE 50UF

24V LOGIC
VOLTAGE SOURCE
24V +/- 4V
18V ON, 16V OFF
CURRENT USAGE ~ ??? A
CURRENT LIMIT MAX = 2.5A

TIME IN CURRENT LIMIT: 16 ms
1000 x C (uF) x 4 / 25

Nominal output voltage (ADC input):
24V_MON = 4.00V

Logic +5V DC/DC

Nominal output voltage (ADC input):
5V_MON = 4.55V
5VA_POS_MON = 4.55V

Logic +3.3V DC/DC

Nominal output voltage (ADC input):
3.3V_MON = 3.30V

Io =1.2 A
Vo ripple < 10mVp-p

-5V for OPAMPS

30dB Att MIN @1400kHz

1.0V Core Voltage for FPGA

Nominal output voltage (ADC input):
1.0V_MON = 1.0V

Io =1.2 A
Vo ripple < 10mVp-p

1.8V FPGA Power

33 C/Watt
1.8V out: 125mA - 0.2W.
2.5V out: 100mA - 0.08W
Temp increase 10C

Vo = 1.8V
Max. Io = 0.12A

Rework

2.5V FPGA power for PLLs and clocks

Vo = 2.5V
Max. Io = 0.1A

Nominal output voltages (ADC input):
1.8V_MON = 1.8V
2.5V_MON = 1.67V

2.5V ANALOG REF (Level Shifter)

5V ANALOG REF (ADC)

2.5V DIGITAL REF (Comparators)

Nominal output voltages (ADC inputs):
12V_ISO_MON = 3.89V
5V_ISO_MON = 2.01V
TEMP = 0.75V

5VISO

Vout = 0.8 x (1+ R_top/R_bottom)
= 5.088V

MGND

Mounting Holes (connected to Chassis GND through standoffs)

Install diodes or resistors between IOGND and GND, but not both

Resistors between IOGND and MGND are always installed.

Cooling Fan Connector

Temperature Sensor

Nominal output voltage (ADC input):
TEMP = 0.75V

POWER - DIGITAL

VARIANT01	
varian	SCALE NONE
	SHEET 2 OF 21
DUAL MOTOR DRIVER	
DWG NO P1060973	REV B

CM# 000060020609
Released
Ver: 01
Rev: B
23. January 2024

HIGH CURRENT 40A FROM J17

3,4 96V_GNT

GANTRY EMOPS

HIGH CURRENT 15A

CURRENT LIMIT = 16.7A
I (lim) = (50mV)/Rs = 16.666A

J18
350989-4
24V_IN 2,3,8
GND

2,3,8 24V_IN
R295 0.003 Ohm 3W
24V_GNT_EMOPS
Q37 STH180N10F3-2
24V_GNT_EMOPS_S
C137 0.1 uF
D87 MURS120T3
R297 10.0 Ohm
C467 0.1 uF
Route together
R296 1.00K
C468 4700 pF
24V_GNT_EMOPS_GATE
24V_GNT_EMOPS_HS
24V_GNT_EMOPS_SNS_HS

U67 TPS2491DGSR
VIN SENSE GATE OUT EN VREF PROG TIMER GND PG
18 24V_GNT_EMOPS_EN
R605 2.00K
R606 40.2K
R607 6.65K
C409 0.1 uF
24V_GNT_EMOPS_VREF
24V_GNT_EMOPS_VPROG
24V_GNT_EMOPS_PG 18
<FPGA_IPU_REQUIRED>

V(prog) = 0.568V
P(lim) = 28.4W

Time in Current Limit: 16 ms
1000 x C (uF) x 4 / 25

R171 NI
R219 NI
D63 MBRB20200CTT4G
D62 MBRB20200CTT4G
TP86 24V_GNT_EMOPS

HIGH CURRENT 40A

96V_GNT
24V_GNT_EMOPS
RLY2 HAT901CSDC24-1
24V
TP105 96V_24V_GNT
96V_24V_GNT 3,4
D160 S1B
D161 SMAJ33A-13
K1_COIL_GNT
Q52 BSS123
TP122
18 GNT_EMOPS_EN
R604 2.00K

2,8 2.5Vref_iso
R225 11.8K
R581 10.0K
R583 1.0M
5Viso
C383 0.1 uF
U57 LMV331
R224 200K
R223 10.0K
C384 1000 pF
ISO_GNT_EMOPS_OV_L 4

Set level (high output) at 24.5V
Reset level (low output) at 23.9V

HIGH CURRENT 20A

J17
1720420602
1720420602
96V_LFT 8
96V_GNT 3,4
MGND

HIGH CURRENT 40A

24V_GNT_EMOPS
3,4 96V_GNT
TP45
Finger safe test point

R493 6.04K 1/4W
D52 EMOPS_24V LED-GRN
R220 6.04K 1/4W
R221 6.04K 1/4W
R222 6.04K 1/4W
R265 6.04K 1/4W
D73 96V_GNT LED-GRN
GND
MGND

Nominal output voltages (ADC inputs):

24V_IN_MON = 4.00V
24V_GNT_EMOPS_S_MON = 4.00V
24V_GNT_EMOPS_MON = 4.00V
96V_GNT_MON = 3.86V
96V_24V_GNT_MON = 3.86V

2,3,8 24V_IN
R243 10.0K
C365 1.0 uF
R244 2.00K 1%
24V_IN_MON 17

24V_GNT_EMOPS_S
R240 10.0K
C367 1.0 uF
R241 2.00K 1%
24V_GNT_EMOPS_S_MON 17

24V_GNT_EMOPS
R236 10.0K
C369 1.0 uF
R237 2.00K 1%
24V_GNT_EMOPS_MON 17

AGND

+5VA
C479 0.1 uF
3,4 96V_GNT
R356 200K 1/4W
C482 0.01 uF
R362 8.06K 1%
U99A TLV9064IPWR PACKAGE = 1
R361 499 Ohm
96V_GNT_MON 17
C481 1.0 uF
R626 200K 1/4W
R366 8.06K 1%
C477 0.01 uF

3,4 96V_24V_GNT
R633 200K 1/4W
C483 0.01 uF
R363 8.06K 1%
U99B TLV9064IPWR PACKAGE = 1
R364 499 Ohm
96V_24V_GNT_MON 17
C484 1.0 uF
R359 200K 1/4W
R367 8.06K 1%
C478 0.01 uF

MGND
AGND

GANTRY 96V EMOPS

VARIANT01

varian

SCALE	NONE
SHEET	3 OF 21

DUAL MOTOR DRIVER

DWG NO	REV
P1060973	B

CM# 000060020609 Released Ver: 01 Rev: B 23. January 2024

HIGH CURRENT 40A FROM RLY1

3 96V_24V_GNT
D64 SMAJ130A-13-F
MGND
R183 0.002 Ohm 5W
Kelvin Sense
R555 499 Ohm
R176 100 Ohm
96V_24V_GNT_D
96V_24V_GNT_S
Q22 IPB110N20N3LFATMA1
D149
Q23 MMSZ5246B-7-F IPB110N20N3LFATMA1
R551 10.0 Ohm
D150 MMSZ5246B-7-F
R582 10.0 Ohm
R552 10.0 Ohm
C76 1000uF
C92 1000uF
R550 1.8K
R549 1.8K
MGND

Bleeder resistors to drop 96V to ~48V in 5 sec

Vout = 500mV + 40mV/A

U106 ACS780L_100U
IP+
IP-
VCC
GND
VOUT
96V_24V_GNT_DRV 4,5,9
+5V
C408 0.1 uF
GND
96V_24V_GNT_I
TP95 NI-22-03-2021
R246 1.00K
R565 5.49K
2,4,9 VREF2.5V
R247 1.00K
R249 NI
C363 0.1 uF
GNDGND
R564 499K
3.3V
R251 4.99K
TP117 OC_V_GNT_MOT_DRV
OC_V_GNT_MOT_DRV 18
U63 LMV331
IN+
IN-
Set level (high output) at 62,9A
Reset level (low output) at 59,9A
C361 0.1 uF

UVLO set to ~ 18V
OVLO disabled

C70 0.1 uF 250V
R177 187K
R556 14.3K
96V_24V_GNT_RUN
dV/dt ~ 0.3V/ms
R180 200K
C71 2.2uF
C355 0.15uF
U48 LTC7000EMSE
Vin
Run
OVLO
INP
VCC
VCCUV
SNS+
SNS-
ISET
GND
TIMER
TGUP
TGDN
BST
TS
IMON
FAULT
96V_24V_GNT_TGU
96V_24V_GNT_TGD
96V_24V_GNT_BST
96V_24V_GNT_IMON
96V_24V_GNT_FLT#
4 96V_24V_GNT_EN
R553 2.00K
C73 1 uF 35V
96V_24V_GNT_VCC
R179 113K
R554 150K
C75 2.2uF
R182 100K
Fault Timer set to ~ 30ms
Retry Disabled

VCCUV set to ~ 8V
Iset = 150k * 0.5uA ~ 75mV

+5VAiso
C246 0.1 uF
U11A LMV324IPT
PACKAGE = 1
R48 1.00K
R50 1.00K

IMON = 66.6mV/A
IMON MAX (45A) = 0.002*45*(499/599)*20*2 = 3V

Ilimit = Vsense/R*(599 Ohm/499 Ohm)
Vsense(min) = 90% * Vsense(nom) = 67.5mV, Ilimit = 40.5A
Vsense(nom) = 75mV, Ilimit = 45A
Vsense(max) = 106.7% * Vsense(nom) = 80mV, Ilimit = 48A

4,18 GNT_MOT_PWR_EN
4,18 GNT_BRK_PWR_EN
4,9 WDOK
4,18 GNT_SHUNT_EN
R402 NI
R401 NI
R400 NI
R403 NI
96V_24V_GNT_EN 4
96V_GNT_BRK_EN 4
GNT_PWM_EN 4,5,6,7
GNT_SHUNT_EN_OUT 4

U4 ISO7740FDBQR
VCC1
GND1
INA
INB
INC
IND
NC
VCC2
GND2
OUTA
OUTB
OUTC
OUTD
EN2
3.3V
5Viso
C202 10 uF
C7 0.1 uF
C14 0.1 uF
C245 10 uF
R404 2.00K
R14 2.00K
R13 2.00K
R440 10.0K
96V_24V_GNT_EN 4
96V_GNT_BRK_EN 4
GNT_PWM_EN 4,5,6,7
GNT_SHUNT_EN_OUT 4

U11D LMV324IPT
PACKAGE = 1

U80A TLV9064IPWR
PACKAGE = 2
U80B TLV9064IPWR
PACKAGE = 2
+5VA
C459 0.1 uF
AGND
R627 200K 1/4W
C460 1000 pF
R307 8.06K
R624 200K 1/4W
R309 8.06K
C141 1000 pF
R306 499 Ohm
C140 1.0 uF
96V_24V_GNT_VMON_V 17
Nominal output voltage:
Vin = 96V -> Vout = 3.86V
Vin = 24V -> Vout = 0.96V
R635 10.0K
C461 1000 pF
R308 10.0K
R623 10.0K
R365 10.0K
C476 1000 pF
R360 499 Ohm
C480 1.0 uF
96V_24V_GNT_IMON_V 17

96V_24V_GNT_FLT#
96V_GNT_BRK_FLT#
3,4 ISO_GNT_EMOPS_OV_L
5Viso
R402 NI
R401 NI
R400 NI
R399 NI
GNT_MOT_PWR_FLT# 4,18
GNT_BRK_PWR_FLT# 4,18
GNT_EMOPS_OV_L 4,18
5V_ISO_MON_GNT 4,18

U5 ISO7740FDBQR
R439 2.00K
R56 2.00K
R438 2.00K
R57 2.00K
C244 10 uF
C15 0.1 uF
C8 0.1 uF
C201 10 uF
R15 10.0K
3.3V

NOTE:
When board powers up, 5V_ISO is powered down.
Therefore, 5V_ISO_INTERNAL_MON is low.

HIGH CURRENT 22A FROM J17

Ilimit = Vsense/R * 1.1
Vsense(min) = 67.5 mV, Ilimit = 24.75 A
Vsense(nom) = 75 mV, Ilimit = 27.5 A
Vsense(max) = 80 mV, Ilimit = 29.3. A

OC Threshold ~ 27.5A
27.5A * 0.003Ohm * (1000/1100) = 75mV

Bleeder resistors to drop 96V to ~48V in 5 sec

3 96V_GNT
D136 SMAJ130A-13-F
MGND
R140 0.003 Ohm 3W
Kelvin Sense
R521 100K
96V_GNT_BRK_D
96V_GNT_BRK_S
Q15 IPB110N20N3LFATMA1
D135 MMSZ5246B-7-F
R518 10.0 Ohm
C37 1000uF
R516 1.8K
R489 1.8K
MGND

Vout = 500mV + 100mV/A

U34 ACS723LLCTR-40AU-T
IP+
IP-
VCC
VOUT
BW_SEL
GND
96V_GNT_BRK_DRV 6,7
+5V
C38 0.1 uF
96V_GNT_BRK_I
TP35 NI-22-03-2021
C39 1000 pF
2,4,9 VREF2.5V
R63 4.02K
R428 10.0K
R64 2.00K
R67 NI
C223 0.1 uF
R426 499K
R70 4.99K
TP39 OC_V_GNT_BRK_DRV
OC_V_GNT_BRK_DRV 18
U17 LMV331
Set level (high output) at 30.26A
Reset level (low output) at 29.84A
C221 0.1 uF

UVLO set to ~ 18V
OVLO disabled

C69 0.1 uF 250V
R133 187K
R522 14.3K
96V_GNT_BRK_RUN
dV/dt ~ 0.3V/ms
R135 200K
R519 10.0 Ohm
C296 0.15uF
C34 2.2uF
U33 LTC7000EMSE
R305 200K 1/4W
C455 1000 pF
R313 8.06K
R625 200K 1/4W
R370 8.06K
C473 1000 pF
R621 499 Ohm
C144 1.0 uF
96V_GNT_BRK_VMON_V 17
Nominal output voltage:
Vin = 96V -> Vout = 3.86V

4 96V_GNT_BRK_EN
R139 2.00K
C72 1 uF 35V
R178 113K
R138 121K
C74 2.2uF
R181 100K
Fault Timer set to ~ 30ms
Retry Disabled

VCCUV set to ~ 8V
Iset = 121k * 0.5uA ~ 60mV

U11B LMV324IPT
PACKAGE = 1
R49 1.00K
R51 2.00K

IMON = 163.6mV/A
IMON MAX = (0.003*(1000/1100)*20*3)*27.5 = 4.5V

R358 10.0K
C457 1000 pF
R312 10.0K
R622 10.0K
R310 10.0K
C142 1000 pF
R311 499 Ohm
C143 1.0 uF
96V_GNT_BRK_IMON_V 17

96V_GNT_SH_R1
96V_GNT_SH_R2
96V_GNT_SH_R3
96V_GNT_SH_R4
R19 12.4K
R20 12.4K
R22 12.4K
R23 12.4K
R18 53.6K
R17 4.99K
Q3 ZVNL120GTA
TP6
GNT_SHUNT_ON 18
U7 140106146000
R21 10.0K 3.3V

GANTRY 96V INTERFACE

+96V PROTECTION SHUNT FOR GANTRY
HIGH CURRENT 5A
4,5,9 96V_24V_GNT_DRV
D110 MURS120T3
9 GNT_96VSHUNT-
Q5 FQD12N20LTM
4 GNT_SHUNT_EN_OUT
R88 2.00K

U45 SN74LVC1G123DCUR
A
B
CLR
GND
VCC
Rext/Cext
Cext
Q
3.3V
C283 0.1 uF
R161 10.0K
C282 0.01 uF
TP79
18 WD_TRIG
TP80
WDOK 4,9
R162 392 Ohm
D51 LED-GRN WDOK

3.3V D58 LED-GRN GNT_MOT_PWR_EN R528 392 Ohm
Q31 BSS123
4,18 GNT_MOT_PWR_EN
3.3V D57 LED-GRN GNT_BRK_PWR_EN R529 392 Ohm
Q29 BSS123
4,18 GNT_BRK_PWR_EN

WDOK is enable signal for GANTRY, GANTRY BRAKE and LIFT MOTOR drivers

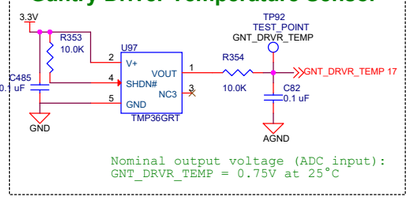
GND MGND MGND MGND GND

VARIAN101	
varian	SCALE NONE
	SHEET 4 OF 21
DUAL MOTOR DRIVER	
DWG NO P1060973	REV B

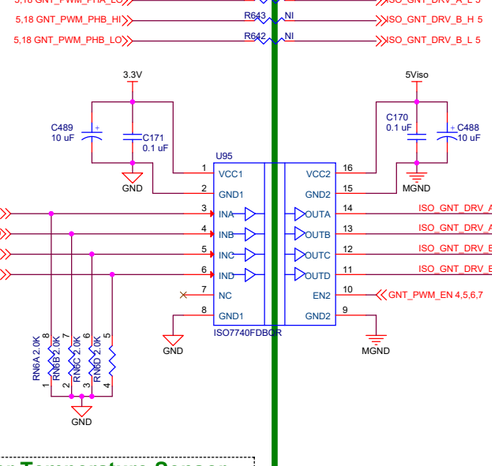
CM# 0002060900
Released
Ver: 01
Rev: B
23. January 2024

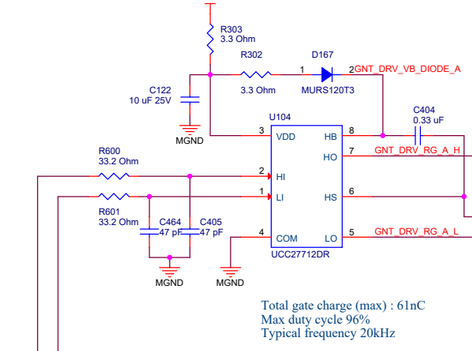
HIGH POWER DRIVER WITH HEATSINKS

Gantry Driver Temperature Sensor

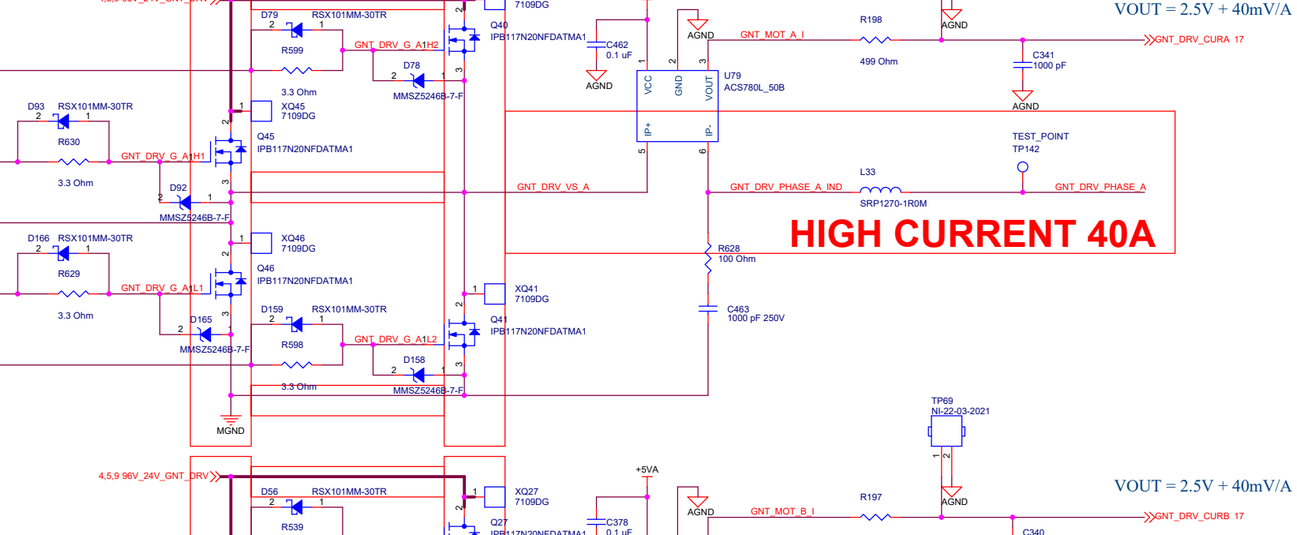


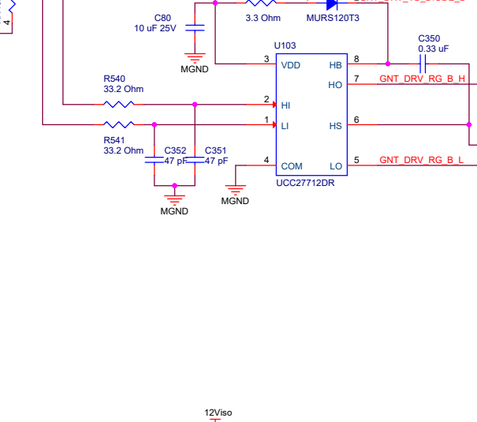
Nominal output voltage (ADC input):
GNT_DRVR_TEMP = 0.75V at 25°C

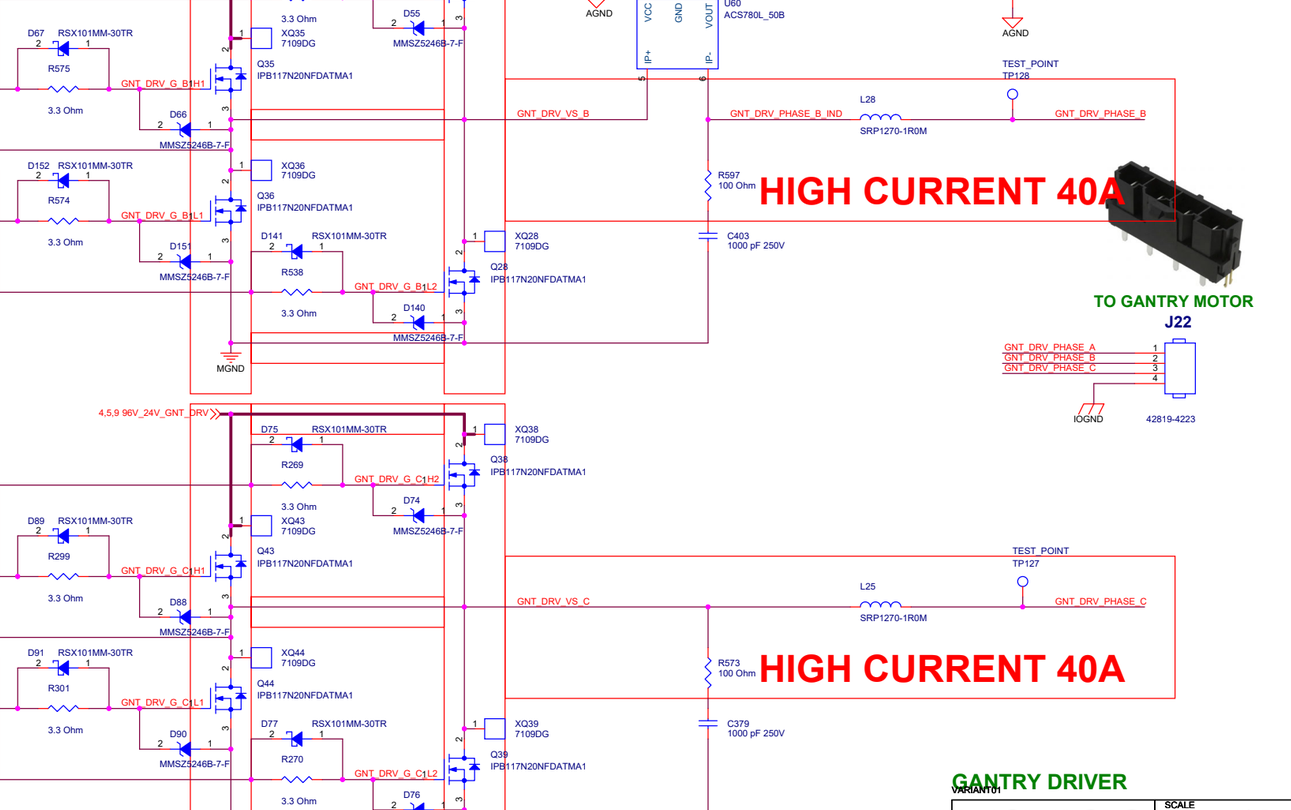




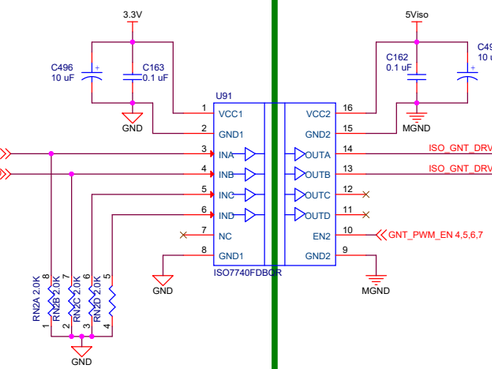
Total gate charge (max) : 61nC
Max duty cycle 96%
Typical frequency 20kHz

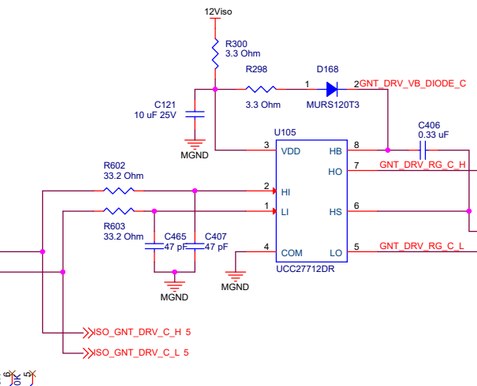






TO GANTRY MOTOR
J22





GND MGND

GANTRY DRIVER
VARIANT01

varian	SCALE NONE
	SHEET 5 OF 21
DUAL MOTOR DRIVER	
DWG NO P1060973	REV B

CM# 0000600020609
Released
Ver: 01
Rev: B
23. January 2024

POWER DRIVER WITHOUT HEATSINKS

HIGH CURRENT 4A

MIGHT MAKE SENSE TO USE UNI-DIR. WOULD BE 500mV + 400mV/A

VOUT = 2.5V + 200mV/A

HIGH CURRENT 4A

VOUT = 2.5V + 200mV/A

GND | MGND

GANTRY BRAKE DRIVER 1 and 2

VARIANT01	
varian	SCALE NONE
	SHEET 6 OF 21
DUAL MOTOR DRIVER	
DWG NO P1060973	REV B

CM# 000600020609 Released Ver: 01 Rev: B 23. January 2024

POWER DRIVER
WITHOUT HEATSINKS

GND

MGND

HIGH CURRENT 4A

HIGH CURRENT 4A
(GNT_BRK1-3, GNT_BRK1-3_RET)

GANTRY BRAKE DRIVER 3 AND FEEDBACK

VOUT = 2.5V + 200mV/A

VARIANT01	
varian	SCALE NONE
	SHEET 7 OF 21
DUAL MOTOR DRIVER	
DWG NO P1060973	REV B

CM# 000060020609 Released Ver: 01 Rev: B 23. January 2024

HIGH CURRENT 20A FROM J17

3,8 96V_LFT

LIFT EMOPS

HIGH CURRENT 15A FROM J18

CURRENT LIMIT = 16.7A
I (lim) = (50mV)/Rs = 16.666A

2,3 24V_IN
R4 0.003 Ohm 3W
24V_LFT_EMOPS_D
Q1 STH180N10F3-2
24V_LFT_EMOPS_S
R8 0
R7 0
D2 MBRB20000CTT4G
D1 MBRB20000CTT4G
TP2 24V_LFT_EMOPS
24V_LFT_EMOPS_HS
C2 0.1 uF
GND
Route together
R5 10.0 Ohm
C4 0.1 uF
D3 MURS120T3
R6 1.00K
C3 4700 pF
24V_LFT_EMOPS_GATE
U1 TPS2491DGSR
VIN SENSE GATE OUT EN VREF PROG TIMER GND PG
18 24V_LFT_EMOPS_EN
R3 2.00K
24V_LFT_EMOPS_VREF
R1 40.2K
R2 6.65K
24V_LFT_EMOPS_VPROG
V(prog) = 0.568V
P(lim) = 28.4W
C1 0.1 uF
Time in Current Limit: 16 ms
1000 x C (uF) x 4 / 25
24V_LFT_EMOPS_PG 18
<FPGA_IPU_REQUIRED>

HIGH CURRENT 20A

96V_LFT
24V_LFT_EMOPS
RLY1 HAT901CSDC24-1
24V
TP60 96V_24V_LIFT
96V_24V_LFT 8,9
D108 S1B
D101 SMAJ33A-13
K1_COIL_LFT
Q2 BSS123
TP3
18 LFT_EMOPS_EN
R414 2.00K
R46 11.8K
2,3 2.5Vref_iso
R445 10.0K
R444 1.0M
5Viso
C250 0.1 uF
U10 LMV331
R47 200K
R443 10.0K
C249 1000 pF
ISO_LFT_EMOPS_OV_L 9
Set level (high output) at 24.5V
Reset level (low output) at 23.9V
MGND
AGND

TP44 Finger safe test point

24V_LFT_EMOPS
3,8 96V_LFT
R523 6.04K 1/4W
R94 6.04K 1/4W
R93 6.04K 1/4W
R91 6.04K 1/4W
R87 6.04K 1/4W
D59 EMOPS_24V LED-GRN
D36 96V_GNT LED-GRN
GND
MGND

Nominal output voltages (ADC inputs):

24V_LFT_EMOPS_S_MON = 4.00V
24V_LFT_EMOPS_MON = 4.00V
96V_LFT_MON = 3.86V
96V_24V_LFT_MON = 3.86V

24V_LFT_EMOPS_S
R108 10.0K
C259 1.0 uF
R106 2.00K 1%
24V_LFT_EMOPS_S_MON 17
24V_LFT_EMOPS
R107 10.0K
C26 1.0 uF
R475 2.00K 1%
24V_LFT_EMOPS_MON 17
AGND

3,8 96V_LFT
R532 200K 1/4W
C371 0.01 uF
R568 8.06K 1%
U61C TLV9064IPWR PACKAGE = 3
R569 499 Ohm
96V_LFT_MON 17
C98 1.0 uF
R571 200K 1/4W
R233 8.06K 1%
C372 0.01 uF

8,9 96V_24V_LFT
R189 200K 1/4W
C343 0.01 uF
R196 8.06K 1%
U61D TLV9064IPWR PACKAGE = 3
R195 499 Ohm
96V_24V_LFT_MON 17
C342 1.0 uF
R533 200K 1/4W
R194 8.06K 1%
C344 0.01 uF

LIFT 96V EMOPS

VARIANT01

varian

SCALE	NONE
SHEET	8 OF 21

DUAL MOTOR DRIVER

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Rev. B
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HIGH CURRENT 20A FROM RLY2

8 96V_24V_LFT
D9 SMAJ130A-13-F
MGND
R92 0.003 Ohm 3W
96V_24V_LFT_D
96V_24V_LFT_S
Q10 IPB110N20N3LFATMA1
D118 MMSZ5246B-7-F
Q14 NI
D134 NI
R490 10.0 Ohm
R517 NI
R491 10.0 Ohm
C20 1000uF
R488 1.8K
R437 1.8K
R492 NI
R86 100 Ohm
C18 0.01 uF
C33 0.1 uF 250V
R132 187K
R520 14.3K
96V_24V_LFT_RUN
96V_24V_LFT_IBIAS
96V_24V_LFT_SNS

UVLO set to ~ 18V
OVLO disabled

dV/dt ~ 0.3V/ms

Bleeder resistors to drop 96V to ~48V in 5 sec

9,18 LFT_MOT_PWR_EN
R411 NI
96V_24V_LFT_EN 9
9,18 LFT_SHUNT_EN
R412 NI
LFT_SHUNT_EN_OUT 9
9 96V_24V_LFT_EN

U32 LTC7000EMSE
Vin
Run
OVLO
INP
VCC
VCCUV
SNS+
SNS-
ISET
GND
TIMER
TGUP
TGDN
BST
TS
IMON
FAULT
96V_24V_LFT_TGU
96V_24V_LFT_TGD
96V_24V_LFT_BST
96V_24V_LFT_IMON
96V_24V_LFT_FLT#
R89 200K
C275 0.15uF
C19 2.2uF
R136 2.00K
C35 1 uF 35V
96V_24V_LFT_VCC
R134 121K
R90 121K
C36 2.2uF
R137 100K

Fault Timer set to ~ 30ms
Retry Disabled

VCCUV set to ~ 8V
Iset = 121k * 0.5uA ~ 60mV

U11C LMV3241PT
PACKAGE = 1
R55 1.00K
R54 2.00K

IMON = 180mV/A
IMON MAX = 0.003*20*20*3 = 3.6V

Ilimit = Vsense/R
Vsense(min) = 54 mV, Ilimit = 18 A
Vsense(nom) = 60 mV, Ilimit = 20 A
Vsense(max) = 64 mV, Ilimit = 21.3 A

U23 ACS723LLCTR-40AU-T
IP+
IP+_2
IP-
IP-_2
96V_24V_LFT_DRV 9,10

VCC
VOUT
BW_SEL
GND
C21 0.1 uF
R95 NI
R96 0.0 Ohm
96V_24V_LFT_I

TP34 NI-22-03-2021
R61 1.00K
R427 5.49K
R425 499K
R69 4.99K
TP38 OC_V_GNT_MOT_DRV
OC_V_LFT_MOT_DRV 18
U16 LMV331
Set level (high output) at 24.608A
Reset level (low output) at 24.5A
2,4 VREF2.5V
R62 1.00K
R66 NI
C222 0.1 uF
C220 0.1 uF

Nominal output voltage:
Vin = 96V -> Vout = 3.86V
Vin = 24V -> Vout = 0.96V

+5VA C374 0.1 uF
R534 200K 1/4W
C376 1000 pF
R530 8.06K
R538 200K 1/4W
R193 8.06K
C345 1000 pF
U61A TLV9064IPWR PACKAGE = 3
R192 499 Ohm
C346 1.0 uF
96V_24V_LFT_VMON_V 17

R190 10.0K
C377 1000 pF
R570 10.0K
R572 10.0K
R232 10.0K
C373 1000 pF
U61B TLV9064IPWR PACKAGE = 3
R231 499 Ohm
C375 1.0 uF
96V_24V_LFT_IMON_V 17

3.3V
C204 10 uF
C5 0.1 uF
5Viso
C12 0.1 uF
C248 10 uF
U2 ISO7740FDBQR
VCC1
GND1
INA
INB
INC
IND
NC
VCC2
GND2
OUTA
OUTB
OUTC
OUTD
EN2
9,18 LFT_MOT_PWR_EN
4 WDOK
9,18 LFT_SHUNT_EN
LFT_PWM_EN 10
LFT_SHUNT_EN_OUT 9
R9 10.0K
R12 2.00K
R11 2.00K
R10 2.00K

96V_24V_LFT_FLT# R410 NI LFT_MOT_PWR_FLT# 9,18
8,9 ISO_LFT_EMOPS_OV_L R409 NI LFT_EMOPS_OV_L 9,18
5Viso R408 NI 5V_ISO_MON_LFT 9,18

5Viso C247 10 uF C13 0.1 uF
3.3V C6 0.1 uF C203 10 uF
U3 ISO7740FDBQR
96V_24V_LFT_FLT#
8,9 ISO_LFT_EMOPS_OV_L
R44 2.00K R52 2.00K R441 2.00K R53 2.00K
R12 10.0K

NOTE:
When board powers up, 5V_ISO is powered down.
Therefore, 5V_ISO_INTERNAL_MON is low.

3.3V D50 LED-GRN LFT_MOT_PWR_EN
R496 392 Ohm
Q30 BSS123
9,18 LFT_MOT_PWR_EN

COMBINED CONNECTOR FOR LIFT AND GANTRY SHUNT

J14 39-29-6048
9,10 96V_24V_LFT_DRV
LFT_96VSHUNT-
96V_24V_GNT_DRV 4,5
GNT_96VSHUNT- 4

HIGH CURRENT 3A
HIGH CURRENT 5A

+96V PROTECTION SHUNT FOR LIFT
HIGH CURRENT 3A

9,10 96V_24V_LFT_DRV
D109 MURS120T3
LFT_96VSHUNT-
9 LFT_SHUNT_EN_OUT
Q4 FQD12N20LTM
R45 2.00K

96V_LFT_SH_R1
96V_LFT_SH_R2
96V_LFT_SH_R3
96V_LFT_SH_R4
R446 12.4K
R449 12.4K
R450 12.4K
R451 12.4K
R448 53.6K
Q6 ZVNL120GTA
R447 4.99K

TP28
U9 140106146000
R452 10.0K 3.3V
LFT_SHUNT_ON 18

GND MGND MGND GND

LIFT 96V INTERFACE

VARIANT01
varian
SCALE NONE
SHEET 9 OF 21
DUAL MOTOR DRIVER
DWG NO P1060973
REV B

CM# 000060020609
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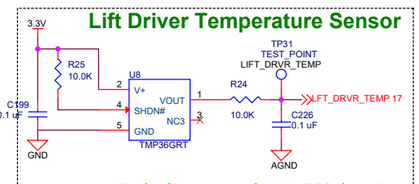
HIGH POWER DRIVER WITH HEATSINKS

Lift Driver Temperature Sensor



Nominal output voltage (ADC input):
LFT_DRVR_TEMP = 0.75V at 25°C

HIGH CURRENT 20A

Total gate charge (max) : 61nC
Max duty cycle 96%
Typical frequency 20kHz

HIGH CURRENT 20A

HIGH CURRENT 20A

VOUT = 2.5V + 100mV/A

VOUT = 2.5V + 100mV/A

GND MGND

CM# 000060020609

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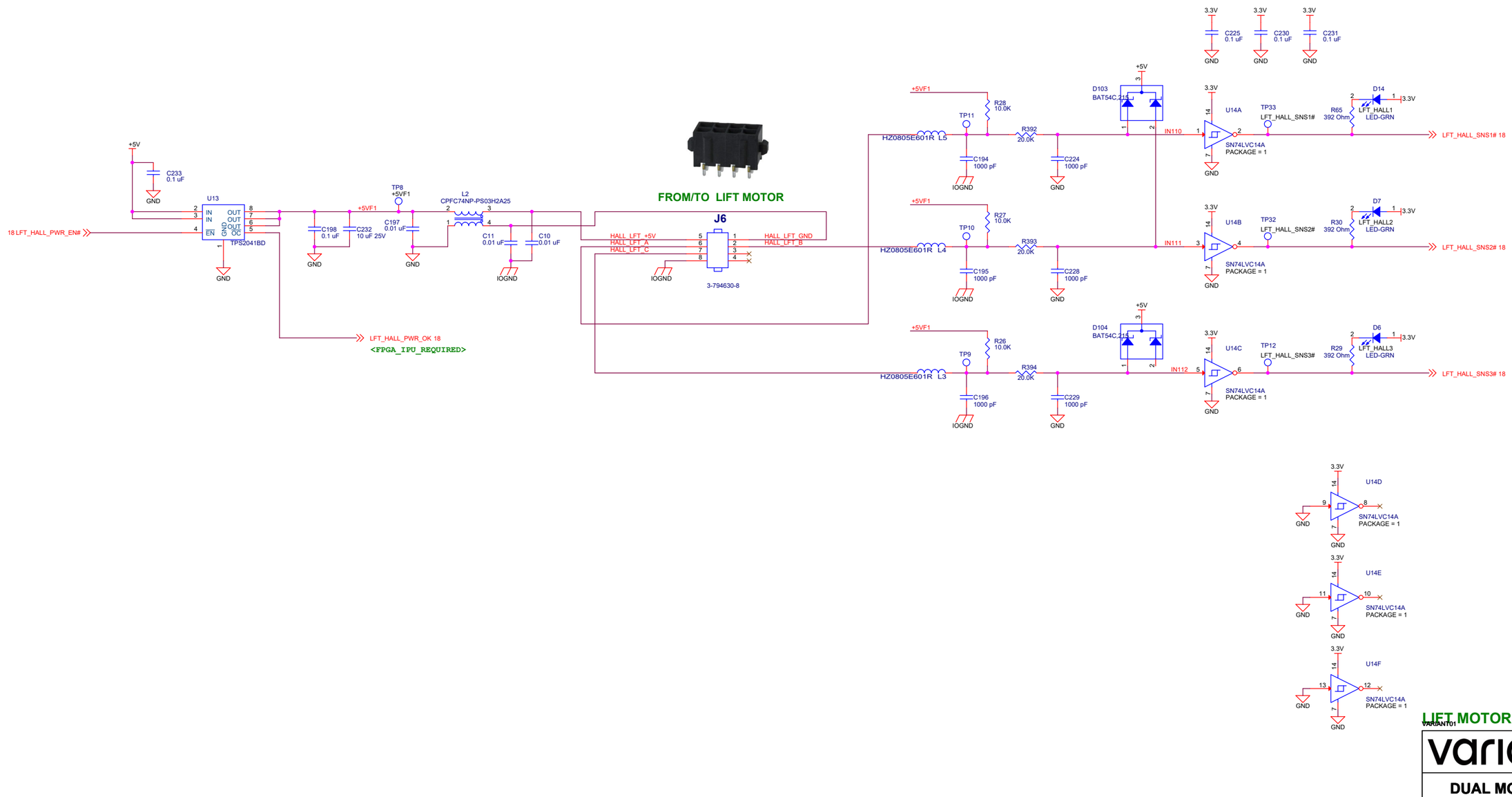
LIFT DRIVER
VARIANT01

varian	SCALE NONE
	SHEET 10 OF 21
DUAL MOTOR DRIVER	
DWG NO P1060973	REV B



LIFT MOTOR HALL SENSOR IF

VARIANT01

varian

SCALE	NONE
SHEET	11 OF 21

DUAL MOTOR DRIVER

DWG NO	REV
P1060973	B

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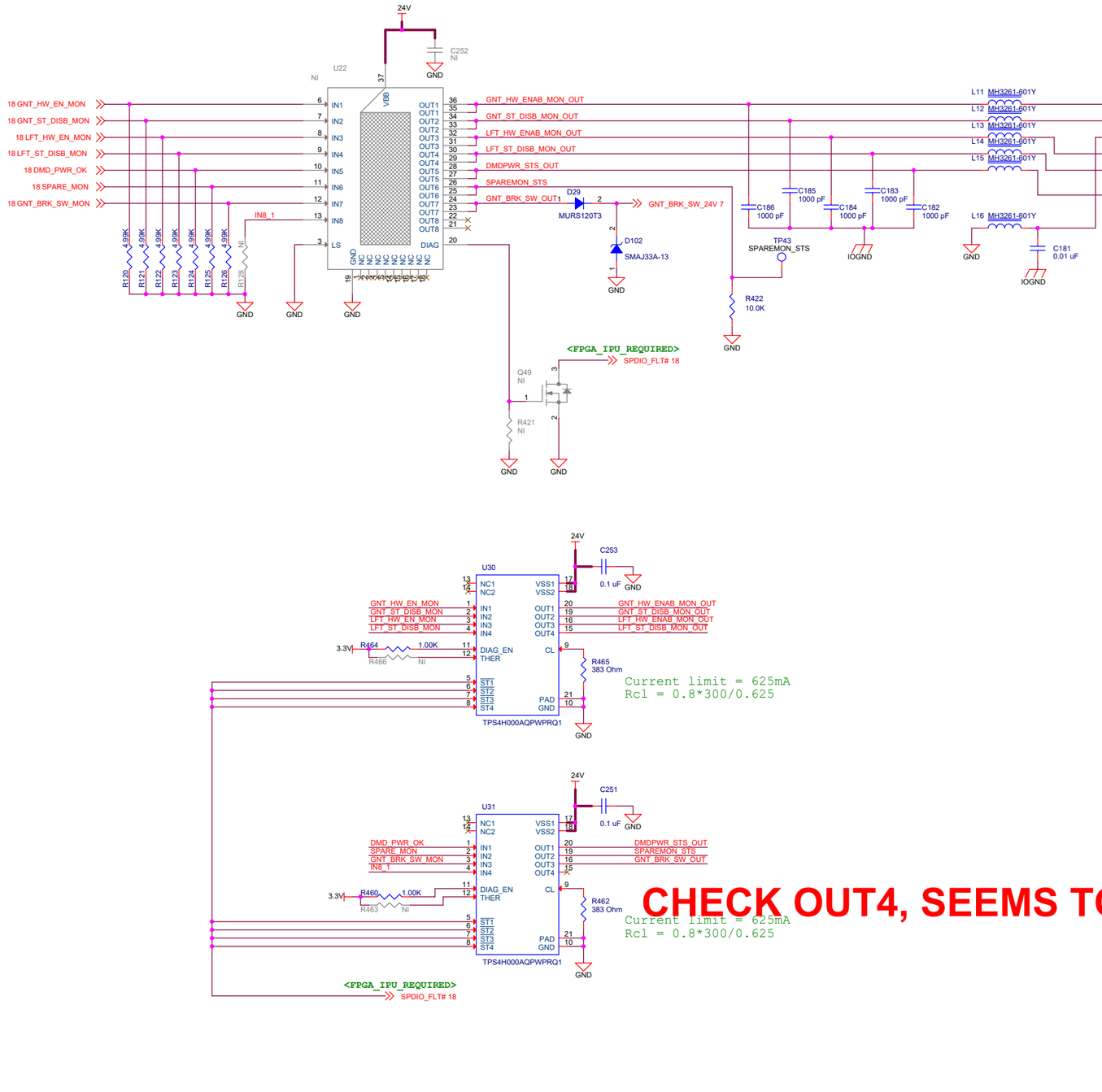

CHECK OUT4, SEEMS TO BE CONNECTED!!!!

SPD DMD INTERFACE

VARIANT01

varian

SCALE	NONE
SHEET	12 OF 21

DUAL MOTOR DRIVER

DWG NO	REV
P1060973	B

CM# 000060020609

Released

Ver: 01

Rev: B

23. January 2024

FROM/TO
STAND POWER DIST

J10

EM_LFT_UP and EM_LFT_DWN are active-low

N3429-6302RB

18 EMOPS_STAT1
18 EMOPS_STAT2
18 SRVC_CCH_GNT#
18 LFT_ROT_BRK_RLS
18 EM_CCH_24V_EN
18 EXOPS_GNT_24V_EN
18 PAN_24V_SW

U18 NI — VBB — DIAG — GND

SPD_EMSTAT1
SPD_EMSTAT2
CCH_GNT#
LFT_ROT_BRK_OVRD
24V_CCH
EXOPS_GNT_24V 14
SRV_PANEL_24V 16

R31 6.04K 1/4W — D16 SPD_EMSTAT1 LED-GRN
R32 6.04K 1/4W — D17 SPD_EMSTAT2 LED-GRN
R68 6.04K 1/4W — D15 CCH_GNT# LED-GRN

TP13 TP14 TP37 TP41

L6 MH3261-601Y
L7 MH3261-601Y
L8 MH3261-601Y
L10 MH3261-601Y
L9 MH3261-601Y

C193 1000 pF
C192 1000 pF
C191 1000 pF
C189 1000 pF
C190 1000 pF
IOGND

SPD_EMSTAT1
SPD_EMSTAT2
SPD_CCH_GNT#
EM_LFT_UP
SPD_EMO_GOOD
EM_LFT_DWN
SPD_SIDE_PANEL_RET
SPD_CCH_LAT_LNG_FLOAT
SPD_CCH_DWN
SPD_SITEPWROK_24
SPD_CCH_MOT_EN
SPD_LFT_ROT_BRK_OVRD
SPD_LAT_LNG_BRK_OVRD
SPD_EM_24V_CCH

R384 100K
C188 0.01 uF100 VDC
C187 1000 pF

<FPGA_IPU_REQUIRED>
SPD_EMOPS_FLT# 18

Q50 NI
R424 NI
R79 6.04K 1/4W — D23 24V_CCH LED-GRN
R78 6.04K 1/4W — D22 LFT_ROT_BRK_OVRD LED-GRN

LAT-LNG BRAKE DRIVER

18 LAT_LNG_BRK_RLS
R423 4.99K
U20 BSP742T
LAT_LNG_BRK_OVRD
C211 0.1 uF
D25 MURS120T3
R80 6.04K 1/4W — D24 LAT_LNG_BRK_OVRD LED-GRN
TP42

U27 TPS4H000AQPWPRQ1
EMOPS_STAT1
EMOPS_STAT2
SRVC_CCH_GNT#
LFT_ROT_BRK_RLS
R472 1.00K
R474 NI
R473 383 Ohm
C256 0.1 uF
SPD_EMSTAT1
SPD_EMSTAT2
CCH_GNT#
LFT_ROT_BRK_OVRD

Current limit = 625mA
Rcl = 0.8*300/0.625

U28 TPS4H000AQPWPRQ1
EM_CCH_24V_EN
EXOPS_GNT_24V_EN
PAN_24V_SW
IN8_2
R469 1.00K
R471 NI
R470 383 Ohm
C254 0.1 uF
24V_CCH
EXOPS_GNT_24V
SRV_PANEL_24V

Current limit = 625mA
Rcl = 0.8*300/0.625

<FPGA_IPU_REQUIRED>
SPD_EMOPS_FLT# 18

D19 BAT54C,215
U21F SN74LVC14A PACKAGE = 3
TP17
R35 10.0K
R389 1.78K
C217 1000 pF
R73 100K
DWN
R420 392 Ohm — D35 EM_LFT_DWN LED-GRN
EM_DOWN_LIMIT 18

C212 0.1 uF
U19A SN74LVC14A PACKAGE = 4
TP16
R34 10.0K
R390 1.78K
C218 1000 pF
R72 100K
UP
R453 392 Ohm — D41 EM_LFT_UP LED-GRN
EM_UP_LIMIT 18

D21 BAT54C,215
U19B SN74LVC14A PACKAGE = 4
TP22
R39 10.0K
R385 1.78K
C213 1000 pF
R77 100K
IN54
R454 392 Ohm — D42 LED-GRN CCH_MOT_EN
CCH_LFT_MOT_EN# 18

D20 BAT54C,215
U19C SN74LVC14A PACKAGE = 4
TP20
R37 10.0K
R387 1.78K
C215 1000 pF
R75 100K
IN53
R455 392 Ohm — D43 CCH_LFT_DWN LED-GRN
CCH_LFT_DWN# 18

U19D SN74LVC14A PACKAGE = 4
TP19
R36 10.0K
R388 1.78K
C216 1000 pF
R74 100K
IN55
R456 392 Ohm — D44 CCH_LAT_LNG_FLOAT LED-GRN
CCH_LAT_LNG_FLOAT# 18

D18 BAT54C,215
U19E SN74LVC14A PACKAGE = 4
TP15
R33 10.0K
R391 1.78K
C219 1000 pF
R71 100K
IN56
R457 392 Ohm — D45 EMOGD LED-GRN
EMO_GOOD# 18

U19F SN74LVC14A PACKAGE = 4
TP21
R38 10.0K
R386 1.78K
C214 1000 pF
R76 100K
IN52
R458 392 Ohm — D46 SITEGD LED-GRN
SITE_24V_PWR_OK# 18

SPD_EMOPS_INTERFACE
VARIANT01

varian	SCALE NONE
	SHEET 13 OF 21
DUAL MOTOR DRIVER	
DWG NO P1060973	REV B

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13 EXOPS_GNT_24V

J1

1	TP40
2	
3	
4	
5	
6	
7	KEY
8	
9	
10	
11	MSSB_TX_P14
12	MSSB_TX_N14
13	
14	
15	MSSB_RX_P14
16	MSSB_RX_N 14
17	
18	
19	
20	
21	
22	CCW_LIMIT_24V#
23	
24	CW_LIMIT_24V#
25	
26	

GND

IOGND

N3429-6302RB

FROM/TO STAND CONT

TP155

R339 10.0K

R611 1.78K

C419 1000 pF

R338 100K

TP154

R337 10.0K

R612 1.78K

C420 1000 pF

R336 100K

3.3V

D162 BAT54C,215

U74A

IN62

SN74LVC14A PACKAGE = 5

GND

R586 392 Ohm

D83 LED-GRN GNT_CCW_LIMIT

GNT_CCW_LIMIT 18

U74B

IN64

SN74LVC14A PACKAGE = 5

R585 392 Ohm

D82 LED-GRN GNT_CW_LIMIT

GNT_CW_LIMIT 18

3.3V

C150 0.1 uF

C151 1 uF

U86 SN65HVD1477DR

14 MSSB_RX_P

14 MSSB_RX_N

18 MSSB_TX

R376 100 Ohm 1/4W

ST_MSSB_RX

R340 33.2 Ohm

MSSB_RX18

MSSB_TX_P14

MSSB_TX_N14

GND

STAND CONTROLLER INTERFACE

VARIANT01

varian

SCALE	NONE
SHEET	14 OF 21

DUAL MOTOR DRIVER

DWG NO	REV
P1060973	B

CM# 0000600020609

Released

Ver: 01

Rev: B

23. January 2024

ANALOG INTERFACE

DAC MONITOR

+5VA
C436 0.1 uF
AGND

TP148 LFT_DAC_VMON
R323 100 Ohm
17 LFT_DAC
LFT_DAC_VMON
U84 OPA743NA
+5VA
-5VA
R324 22.1 Ohm
TP149 LFT_IMON+
L37 DLW44SM851SK2L
C434 22 pF
C437 22 pF
IOGND
AGND
C435 0.1 uF
-5VA
AGND

OPAMP OUT (0..+4.98V)
0V = -20A
2.5V = 0.0A
5.0V = +20A

IMON FEEDBACK DAC
0--> 5.0V

FROM/TO CCHL
J12

LIFT_CURR_CMD_A
LIFT_CURR_CMD_B
LIFT_CURR_FB_A
LIFT_CURR_FB_B
LIFT_GPO1
LIFT_GPI1
LIFT_GPO2
LIFT_GPI2
LIFT_GPI3
LIFT_GPI4
LIFT_LIMIT1
LIFT_LIMIT2
CONN DSUB HD26-S
C177 1000 pF
R375 100K
C178 0.01 uF100 VDC
IOGND
GND

Comment:
LIFT_LIMIT1 and LIFT_LIMIT2
are active-low

DIGITAL OUTPUTS

24V
C391 NI
GND
U76
NI
15,18 LFT_SER_CLK
15,18 LFT_SER_SYNC
15,18 LFT_SER_DATA0
15,18 LFT_SER_DATA1
18 EXT_BRK1_DRV_EN
18 EXT_BRK2_DRV_EN
18 EXT_BRK3_DRV_EN
IN8_3
R592 NI
IN1 IN2 IN3 IN4 IN5 IN6 IN7 IN8 LS
VBB
OUT1 OUT2 OUT3 OUT4 OUT5 OUT6 OUT7 OUT8 DIAG
LIFT_GPI1_Y
LIFT_GPI2_Y
LIFT_GPI3_Y
LIFT_GPI4_Y
EXT_BRK1_DRV_24V 21
EXT_BRK2_DRV_24V 21
EXT_BRK3_DRV_24V 21
C423 1000 pF
C424 1000 pF
C425 1000 pF
C426 1000 pF
IOGND
Q51 NI
LFT_SERIO_FLT# 15,18
<FPGA_IPU_REQUIRED>
R610 NI

L41 MH3261-601Y
L40 MH3261-601Y
L39 MH3261-601Y
L38 MH3261-601Y

1:4 CONFIG

Input Diff. Range: +/-10V
Scaling: 4A/1V

R327 4.99K 1%
R326 3.32K
R325 4.99K 1%
C432 1000 pF
C429 NI
C433 NI
R617 NI
LFT_CURR_CMD_B_IN
LFT_CURR_CMD_A_IN
U85 AD620BR
+5VA
-5VA
C430 0.1 uF
C431 0.1 uF
AGND

2 VREF2.5V
R279 20.0K
R278 20.0K
C400 0.1 uF
U72A TLV9064IPWR PACKAGE = 4
R274 20.0K
R275 20.0K
C402 0.01 uF
C398 0.1 uF
R276 100 Ohm
C401 0.1 uF
TP130 LFT_VIN
0...5V
4A/0.25V
LFT_CURR_CMD 17

TP153 TP152 TP151 TP150
R335 R333 R331 R329 10.0K
R334 R332 R330 R328 100K
R613 R614 R615 R616 1.78K
C421 C422 C427 C428 1000 pF
D163 D164 BAT54C,215
C393 0.1 uF
U74D U74E U74F U74C SN74LVC14A PACKAGE = 5
IN90 9
IN91 11
IN92 13
IN93 5
R524 R525 R557 R558 392 Ohm
D60 LFT_MTN_EN LED-GRN
D61 LFT_SER_PAGE_SEL LED-GRN
D68 LFT_DOWN_LIMIT LED-GRN
D69 LFT_UP_LIMIT LED-GRN
LFT_MTN_EN# 18
LFT_SER_PAGE_SEL# 18
LFT_DOWN_LIMIT 18
LFT_UP_LIMIT 18

U77 U75 TPS4H000AQPWPRQ1
C388 NI
C392 0.1 uF
LFT_SER_CLK
LFT_SER_SYNC
LFT_SER_DATA0
LFT_SER_DATA1
LIFT_GPI1_Y
LIFT_GPI2_Y
LIFT_GPI3_Y
LIFT_GPI4_Y
EXT_BRK1_DRV_EN
EXT_BRK2_DRV_EN
EXT_BRK3_DRV_EN
IN8_3
EXT_BRK1_DRV_24V 21
EXT_BRK2_DRV_24V 21
EXT_BRK3_DRV_24V 21
R287 1.00K
R289 NI
R595 1.00K
R593 NI
R288 383 Ohm
R594 383 Ohm
Current limit = 51mA
Rcl = 0.8*300/0.05
Current limit = 625mA
Rcl = 0.8*300/0.625
<FPGA_IPU_REQUIRED>
LFT_SERIO_FLT# 15,18

R282 10.0K
U72B TLV9064IPWR PACKAGE = 4
R281 8.06K
C396 0.1 uF
R280 100 Ohm
C397 0.1 uF
TP133 LFT_VIN
5VA_NEG_MON 17
U72D TLV9064IPWR PACKAGE = 4

Nominal output voltages (ADC inp.):
5VA_NEG_MON = 4.03V

CCHL INTERFACE

VARIANT=

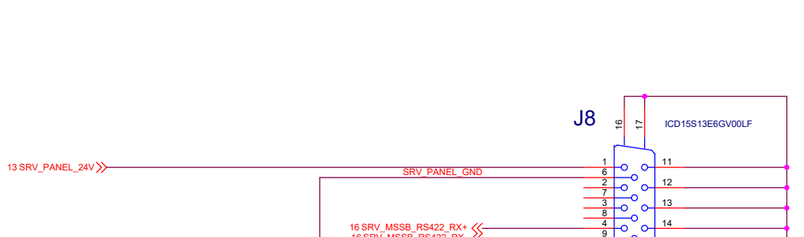
varian

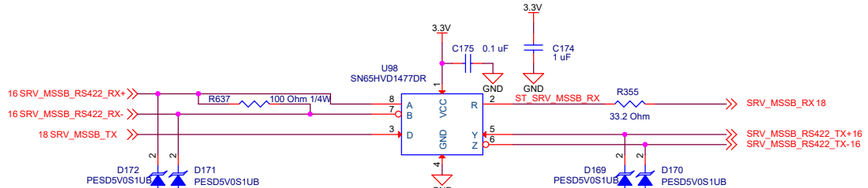
SCALE	NONE
SHEET	15 OF 21

DUAL MOTOR DRIVER
/

DWG NO	REV
P1060973	B

CM# 000060020609
Released
Ver: 01
Rev: B
23. January 2024





SERVICE PENDANT

VARIANT01

varian

SCALE	NONE
SHEET	16 OF 21

DUAL MOTOR DRIVER

DWG NO	REV
P1060973	B

CM# 0000600020609 Released Ver: 01 Rev: B 23. January 2024

Nominal output voltages (ADC inputs):

24V_IN_MON = 4.00V
24V_GNT_EMOPS_S_MON = 4.00V
24V_GNT_EMOPS_MON = 4.00V
96V_GNT_MON = 3.86V
96V_24V_GNT_MON = 3.86V
12V_ISO_MON = 3.89V
5V_ISO_MON = 4.03V
TEMP = 0.75V

- Max. input voltage 5V
- Resolution (typ) = 16-bit
- Analog Input Ragne = 0..4.95V
- LSB = 76.3uV

Note: Keep digital AD-signals inside GND plane region. Do not route into AGND region

5V for compatibility with ADS8339

Nominal output voltage (ADC input):

5VA_POS_MON = 4.55V
5VA_NEG_MON = 4.03V
24V_MON = 4.00V
5V_MON = 4.55V
3.3V_MON = 3.30V
1.8V_MON = 1.80V
2.5V_MON = 2.50V

Nominal output voltage (ADC input):

1.0V_MON = 1.0V
96V_24V_GNT_VMON_V = 3.86V
96V_24V_GNT_IMON_V = 66.6mV/A
96V_GNT_BRK_VMON_V = 3.86V
96V_GNT_BRK_IMON_V = 180mV/A
GNT_DRV_CURA = 2.5V + 40mV/A
GNT_DRV_CURB = 2.5V + 40mV/A
GNT_DRVR_TEMP = 0.75V at 25°C

Nominal output voltage (ADC input):

GNT_BRK1_CUR = 200mV/A
GNT_BRK2_CUR = 200mV/A
GNT_BRK3_CUR = 200mV/A
24V_LFT_EMOPS_S_MON = 4.00V
24V_LFT_EMOPS_MON = 4.00V
96V_LFT_MON = 3.86V
96V_24V_LFT_MON = 3.86V

Nominal output voltage (ADC input):

96V_24V_LFT_IMON_V = 180mV/A
LFT_DRV_CURA = 100mV/A
LFT_DRV_CURB = 100mV/A
LFT_DRVR_TEMP = 0.75V at 25°C
LFT_CURR_CMD = 2.5V + 62.5mV/A
24V_LFT_EMOPS_MON = 4.0V

MOTOR PROGRAMMABLE CURRENT LIMITS

DAC

A/D AND D/A CONVERTERS

VARIANT01

DUAL MOTOR DRIVER

/

DWG NO P1060973

REV B

SCALE NONE

SHEET 17 OF 21

CM# 000060020609 Released Rev. B Ver: 01 23. January 2024

Debug Header
J11

3.3V
R256
2.32K

18 DBUG_HEADER2
18 DBUG_HEADER4
18 DBUG_HEADER6
18 DBUG_HEADER8
18 DBUG_HEADER10

2 4 6 8 10 / 1 3 5 7 9 11

DBUG_SCLK 18
DBUG_MISO 18
DBUG_MOSI 18
DBUG_CS# 18
DBUG_ACTIVE 18

GND GND
87832-1220
HEADER 6x2/SM
R259
2.32K
GND

18 POWER_GOOD
R419
392 Ohm
D34
LED-GRN
POWER_GOOD
GND

18 MSSB_COMM_FAULT
R417
392 Ohm
D32
LED-RED
MSSB_COMM_FAULT
GND

18 HSWAP_FAULT
R418
392 Ohm
D33
LED-RED
HSWAP_FAULT
GND

U54-9

BANK-2

MPF100T-FCG484E

POWER IF
2 P24V_GOOD# — F5 GPIO0PB2
2 FAN_FAIL# — E5 GPIO0NB2

GANTRY 96V EMOPS
2 FAN_EN — D4 GPIO1PB2
2 12V_ISO_EN — C4 GPIO1NB2
3 24V_GNT_EMOPS_PC — F3 GPIO2PB2/DQS
3 24V_GNT_EMOPS_EN — E4 GPIO2NB2/DQS
3 GNT_EMOPS_EN — B4 GPIO3PB2
A5 GPIO3NB2

GANTRY 96V INTERFACE
4 GNT_MOT_PWR_EN — E6 GPIO4PB2
4 GNT_BRK_PWR_EN — D6 GPIO4NB2
4 WD_TRIG
4 OC_V_GNT_MOT_DRV — C5 GPIO5PB2
4 OC_V_GNT_BRK_DRV — B5 GPIO5NB2
4 GNT_MOT_PWR_FLT# — D7 GPIO6PB2
4 GNT_BRK_PWR_FLT# — C7 GPIO6NB2
4 GNT_EMOPS_OV_L — C6 GPIO7PB2
4 5V_ISO_MON_GNT — B7 GPIO7NB2
4 GNT_SHUNT_EN — E8 GPIO8PB2/DQS
4 GNT_SHUNT_ON — D8 GPIO8NB2/DQS
9 5V_ISO_MON_LFT — A6 GPIO9PB2
A7 GPIO9NB2

GANTRY DRIVER
5 GNT_PWM_PHA_HI — E9 GPIO10PB2
5 GNT_PWM_PHA_LO — D9 GPIO10NB2
5 GNT_PWM_PHB_HI — B8 GPIO11PB2
5 GNT_PWM_PHB_LO — A8 GPIO11NB2
5 GNT_PWM_PHC_HI — B12 GPIO12PB2/CLKIN_S_4
5 GNT_PWM_PHC_LO — B13 GPIO12NB2

SPD-DMD IF
12 GNT_HW_EN_MON — C9 GPIO13PB2/CLKIN_S_5
12 LFT_ST_DISB_MON — C10 GPIO13NB2
12 LFT_HW_EN_MON — B9 GPIO14PB2/DQS
12 GNT_ST_DISB_MON — B10 GPIO14NB2/DQS
12 DMD_PWR_OK — C11 GPIO15PB2/CLKIN_S_6
12 SPARE_MON — C12 GPIO15NB2
12 SPDIO_FLT# — A10 GPIO16PB2/LPRB_A
12 SPD2_24V_STATUS# — A11 GPIO16NB2/LPRB_B
12 LFT_ST_DISB — A12 GPIO17PB2/CLKIN_S_7
12 LFT_HW_EN# — A13 GPIO17NB2
12 GNT_ST_DISB — G12 GPIO24PB2
12 GNT_HW_EN# — G13 GPIO24NB2

LIFT MOTOR HALL SENSOR IF
11 LFT_HALL_PWR_EN# — F10 GPIO25PB2
11 LFT_HALL_PWR_OK — E10 GPIO25NB2
11 LFT_HALL_SNS1# — D11 GPIO26PB2/DQS
11 LFT_HALL_SNS2# — D12 GPIO26NB2/DQS
11 LFT_HALL_SNS3# — L7 GPIO125PB4
L8 GPIO125NB4

LIFT 96V INTERFACE
GPIO27PB2 — F13 — 24V_LFT_EMOPS_EN 8
GPIO27NB2 — F12 — OC_V_LFT_MOT_DRV 9
GPIO28PB2 — E11 — LFT_SHUNT_EN 9
GPIO28NB2 — F11 — LFT_SHUNT_ON 9
GPIO29NB2 — E13 — LFT_EMOPS_EN 8
GPIO29PB2 — D13 — LFT_EMOPS_OV_L 9
GPIO30NB2 — E14 — LFT_MOT_PWR_FLT# 9
GPIO30PB2 — D14 — LFT_MOT_PWR_EN 9

SPD_EMOPS_INTERFACE
GPIO31PB2 — C14 — EMOPS_STAT113
GPIO31NB2 — C15 — EMOPS_STAT213
GPIO32PB2/DQS/CCC_SE_PLL0_OUT0 — A17 — LFT_ROT_BRK_RLS 13
GPIO32NB2/DQS — B17 — LAT_LNG_BRK_RLS 13
GPIO33PB2/CLKIN_S_8/CCC_SE_CLKIN_S_8/CCC_SE_PLL0_OUT0 — B14 — EM_DOWN_LIMIT 13
GPIO33NB2/DQS — B15 — EM_UP_LIMIT 13
GPIO34PB2/CCC_SE_PLL0_OUT1 — C16 — CCH_LFT_MOT_EN# 13
GPIO34NB2 — C17 — CCH_LFT_DWN# 13
GPIO35PB2/CLKIN_S_9/CCC_SE_CLKIN_S_9 — A15 — CCH_LAT_LNG_FLOAT# 13
GPIO35NB2 — A16 — EMO_GOOD# 13
GPIO36PB2 — G14 — SITE_24V_PWR_OK# 13
GPIO36NB2 — H13 — SRVC_CCH_GNT# 13
GPIO37PB2 — H15 — EM_CCH_24V_EN 13
GPIO37NB2 — G15 — SPD_EMOPS_FLT# 13

STAND CONTROLLER INTERFACE
GPIO38PB2/DQS/CCC_SE_PLL1_OUT0 — D16 — EXOPS_GNT_24V_EN 13
GPIO38NB2/DQS — D17 — GNT_CCW_LIMIT 14
GPIO39PB2/CCC_SE_CLKIN_S_10/CCC_SE_PLL1_OUT0 — E15 — GNT_CW_LIMIT 14
GPIO39NB2 — E16 — ST_MSSB_TX
GPIO40PB2/CCC_SE_PLL1_OUT1 — G17 — MSSB_RX 14
GPIO40NB2 — F17 — ST_SRV_MSSB_TX

SERVICE PENDANT
GPIO41PB2/CCC_SE_CLKIN_S_11 — F15 — SRV_MSSB_RX 16
GPIO41NB2 — F16 — PAN_24V_SW 13

GPIO142PB2/CCC_SW_CLKIN_S_0 — E1 — MAINS_LEVEL_FB 21
GPIO142NB2 — D1 — POWER_GOOD 18
GPIO143PB2/CCC_SW_CLKIN_S_1 — D2 — MSSB_COMM_FAULT 18
GPIO143NB2 — C2 — HSWAP_FAULT 18

EXT BRAKE DRIVER
GPIO144PB2/DQS/CCC_SW_PLL1_OUT0 — C1 — EXT_BRK1_DRV_EN 15
GPIO144NB2/DQS — B1 — EXT_BRK2_DRV_EN 15
GPIO145PB2/CLKIN_S_2/CCC_SW_CLKIN_S_2/CCC_SW_PLL1_OUT0 — A2 — EXT_BRK3_DRV_EN 15
GPIO145NB2 — A3 — DBUG_HEADER2 18

DEBUG Port
GPIO146PB2/CCC_SW_PLL1_OUT1 — E3 — DBUG_HEADER4 18
GPIO146NB2 — D3 — DBUG_HEADER6 18
GPIO147PB2/CLKIN_S_3/CCC_SW_CLKIN_S_3 — B2 — DBUG_HEADER8 18
GPIO147NB2 — B3 — DBUG_HEADER10 18

U54-10

BANK-4

MPF100T-FCG484E

18 FPGA_100M_CLK — R1 GPIO108PB4/CLKIN_W_7/CCC_NW_CLKIN_W_7/CCC_NW_PLL0_OUT0
T1 GPIO108NB4

GANTRY BRAKE DRIVER
21 PWM_BRK_EXT_FAUL — N1 GPIO109PB4/DQS
21 GNT_BRK_EXT_EN — P1 GPIO109NB4/DQS
12 GNT_BRK_SW_MON
7 GNT_BRK1_FB# — N2 GPIO112PB4
7 GNT_BRK2_FB# — P2 GPIO112NB4
7 GNT_BRK3_FB# — T5 GPIO113PB4
6,21 GNT_BRK1_PWM_HI — T6 GPIO113NB4
6,21 GNT_BRK1_PWM_LO — P4 GPIO114PB4/CLKIN_W_6/CCC_NW_CLKIN_W_6/CCC_NW_PLL0_OUT1
6,21 GNT_BRK1_RET_PWM_HI — R3 GPIO114NB4
6,21 GNT_BRK1_RET_PWM_LO — T2 GPIO115PB4/DQS/CCC_NW_PLL0_OUT0
6 GNT_BRK2_PWM_HI — T3 GPIO115NB4/DQS
6 GNT_BRK2_PWM_LO — N4 GPIO116PB4
6 GNT_BRK2_RET_PWM_HI — P3 GPIO116NB4
6 GNT_BRK2_RET_PWM_LO — R5 GPIO117PB4
7 GNT_BRK3_PWM_HI — R4 GPIO117NB4
7 GNT_BRK3_PWM_LO — P9 GPIO118PB4
7 GNT_BRK3_RET_PWM_HI — R8 GPIO118NB4
7 GNT_BRK3_RET_PWM_LO — P6 GPIO119PB4
R6 GPIO119NB4

8 24V_LFT_EMOPS_PG

LIFT MOTOR INTERFACE
10 LFT_PWM_PHA_HI — P7 GPIO120PB4
10 LFT_PWM_PHA_LO — P8 GPIO120NB4
10 LFT_PWM_PHB_HI — N7 GPIO121PB4/DQS
10 LFT_PWM_PHB_LO — N8 GPIO121NB4/DQS
10 LFT_PWM_PHC_HI — N6 GPIO122PB4
10 LFT_PWM_PHC_LO — N5 GPIO122NB4
TP100 GPIO2 — M8 GPIO123PB4
TP97 GPIO3 — M9 GPIO123NB4

EEPROM INTERFACE
18 EEP_CS# — M3 GPIO124PB4
18 EEP_SI — M2 GPIO124NB4
18 EEP_SCK — L7 GPIO125PB4
18 EEP_SO — L8 GPIO125NB4

GPIO126PB4 — L6 — M7 — GPIO5 — TP98 — RESET# 18
GPIO126NB4

CCHL INTERFACE
GPIO127PB4/DQS — K5 — LFT_SER_CLK 15
GPIO127NB4/DQS — K4 — LFT_SER_SYNC 15
GPIO128PB4 — L3 — LFT_SER_DATA0 15
GPIO128NB4 — M4 — LFT_SER_DATA1 15
GPIO129PB4 — L5 — LFT_SERIO_FLT# 15
GPIO129NB4 — M5 — LFT_MTN_EN# 15
GPIO130PB4 — K1 — LFT_SER_PAGE_SEL# 15
GPIO130NB4 — L1 — LFT_DOWN_LIMIT 15
GPIO131PB4/CLKIN_W_5/CCC_NW_CLKIN_W_5 — J3 — LFT_UP_LIMIT 15
GPIO131NB4 — J2 — AD_SEL0 17

A/D CONVERTER
GPIO132PB4/CLKIN_W_4/CCC_NW_CLKIN_W_4 — K3 — AD_SEL1 17
GPIO132NB4 — L2 — AD_SEL2 17
GPIO133PB4/DQS — H1 — AD_MUX1# 17
GPIO133NB4/DQS — J1 — AD_MUX2# 17
GPIO134PB4 — F2 — AD_MUX3# 17
GPIO134NB4 — F1 — AD_MUX4# 17
GPIO135PB4/CLKIN_W_3/CCC_SW_CLKIN_W_3 — G2 — H2 — ST_DAC_CLK — AD_MUX5# 17
GPIO135NB4

GPIO136PB4/CCC_SW_PLL0_OUT1 — J6 — DAC_SDI 17
GPIO136NB4 — K6 — DAC_CS# 17
GPIO137PB4/CLKIN_W_2/CCC_SW_CLKIN_W_2/CCC_SW_PLL0_OUT0 — H7 — DAC_SDO 17
GPIO137NB4 — J7 — ADC_SDOUT 17
GPIO138PB4/CLKIN_W_1/CCC_SW_CLKIN_W_1 — J8 — GPIO4 — TP99
GPIO138NB4 — K8 — ST_ADC_SCLK
GPIO139PB4/DQS/CCC_SW_PLL0_OUT0 — H4 — ADC_CNVST 17
GPIO139NB4/DQS — J4 — DBUG_MISO 18

DEBUG Port
GPIO140PB4 — H6 — DBUG_MOSI 18
GPIO140NB4 — H5 — DBUG_CS# 18
GPIO141PB4/CLKIN_W_0/CCC_SW_CLKIN_W_0 — J9 — DBUG_SCLK 18
GPIO141NB4 — K9 — DBUG_ACTIVE 18

ST_SRV_MSSB_TX — R164 33.2 Ohm — SRV_MSSB_TX 16
ST_MSSB_TX — R163 33.2 Ohm — MSSB_TX 14
ST_DAC_CLK — R258 33.2 Ohm — DAC_CLK 17
ST_ADC_SCLK — R214 33.2 Ohm — ADC_SCLK 17

3.3V
U55
VCC 4
OE 1
OUT 3
GND 2
C83 0.1uF
100.000MHz
ASDMB-100.000MHZ-LY-T
FPGA_100M_CLK 18
GND

EEPROM
Serial EEPROM
(Board Configuration Parameter)

3.3V
C360 0.1uF
GND
R261 2.32K
R260 2.32K
18 EEP_CS#
18 EEP_SI
18 EEP_SCK
CS 1
WP 3
SI 5
HOLD 7
SCK 6
VCC 8
SO 2
VSS 4
EEP_SO 18
U65
25AA640A-I/SN
GND

Voltage Supervisor and Push-Button Reset

3.3V
C333 0.1uF
GND
2 1.0V_PG
2 1.8V_PG
VCC 5
A 1
B 2
Y 4
GND 3
U53
SN74LVC1G08DCK3
R212 33.2 Ohm
2.5V
3.3V
U47
VCC1 6
VCC2 4
RSTIN 5
MR# 3
VSS 2
RST# 1
STM6719SYWB6F
3.3V
R170 10.0K 1/10 W
TP85 TEST_POINT RESET#
RESET# 18
M_RESET_L
3.3V
R494 10.0K 1/10 W
SW1
B3SN-3012P
C278 0.1uF
C277 0.1uF
C276 0.1uF
GND

JTAG

3.3V
J5
2 4 6 8 10 / 1 3 5 7 9
GND FTSH-105-01-L-D-K
18 RESET#
JTAG_TDO2
R252 22.1 Ohm
JTAG_TCK
JTAG_TDI
JTAG_TDO
JTAG_TMS
R209 1.00K
GND
3.3V
R254 NI
R253 1.00K
JTAG_TRST
GND

U54-6

BANK-3

MPF100T-FCG484E

H9 DEVRST_N
F8 TCK
G8 TDI
F6 TDO
F7 TMS
G7 TRSTB

RESERVED H11
IO_CFG_INTF G9
SPI_EN H10
SCK G3
SDI G10
SDO G5
SS G4

3.3V
R527 10.0K
IO_CFG_INTF
SPI_EN
SCK
SDI
SS
R255 10.0K
R257 10.0K
R213 10.0K
R215 10.0K
GND GND GND GND

FPGA FUNCTIONAL INTERFACE 1

VARIANT01

varian

SCALE	NONE
SHEET	18 OF 21

DUAL MOTOR DRIVER

DWG NO	REV
P1060973	B

CM# 000060020609
Released
Ver: 01
Rev: B
23. January 2024

U54-7

BANK-0

W9	HSIO78PB0/CLKIN_N_5	HSIO96PB0	AB3
Y9	HSIO78NB0	HSIO96NB0	AB4
V9	HSIO79PB0	HSIO97PB0	V6
V10	HSIO79NB0	HSIO97NB0	W6
R9	HSIO80PB0/CLKIN_N_4	HSIO98PB0	AA2
R10	HSIO80NB0	HSIO98NB0	AB2
T10	HSIO81PB0/DQS	HSIO99PB0/DQS	Y4
U10	HSIO81NB0/DQS	HSIO99NB0/DQS	Y5
U8	HSIO82PB0	HSIO100PB0	Y3
U9	HSIO82NB0	HSIO100NB0	AA3
T7	HSIO83PB0	HSIO101PB0	V5
T8	HSIO83NB0	HSIO101NB0	W4
AA8	HSIO90PB0	HSIO102PB0/CLKIN_N_3/CCC_NW_CLKIN_N_3	Y1
Y8	HSIO90NB0	HSIO102NB0	AA1
AA7	HSIO91PB0	HSIO103PB0/CCC_NW_PLL1_OUT1	V4
AB7	HSIO91NB0	HSIO103NB0	W3
W7	HSIO92PB0	HSIO104PB0/CLKIN_N_2/CCC_NW_CLKIN_N_2/CCC_NW_PLL1_OUT0	V1
W8	HSIO92NB0	HSIO104NB0	W1
AA5	HSIO93PB0/DQS	HSIO105PB0/DQS/CCC_NW_PLL1_OUT0	V2
AB5	HSIO93NB0/DQS	HSIO105NB0/DQS	W2
Y6	HSIO94PB0	HSIO106PB0/CCC_NW_CLKIN_N_1	U3
AA6	HSIO94NB0	HSIO106NB0	U2
U7	HSIO95PB0	HSIO107PB0/CCC_NW_CLKIN_N_0	U5
V7	HSIO95NB0	HSIO107NB0	U4

MPF100T-FCG484E

U54-8

BANK-1

T17	HSIO42PB1/CCC_NE_CLKIN_N_11	HSIO54PB1	AA10
U17	HSIO42NB1	HSIO54NB1	AB10
V16	HSIO43PB1/CCC_NE_PLL0_OUT1	HSIO55PB1	Y11
W16	HSIO43NB1	HSIO55NB1	AA11
W17	HSIO44PB1/CCC_NE_CLKIN_N_10/CCC_NE_PLL0_OUT0	HSIO56PB1	V12
V17	HSIO44NB1	HSIO56NB1	W12
AB17	HSIO45PB1/DQS/CCC_NE_PLL0_OUT0	HSIO57PB1/DQS	AB8
AA17	HSIO45NB1/DQS	HSIO57NB1/DQS	AB9
AA16	HSIO46PB1	HSIO58PB1	W11
Y16	HSIO46NB1	HSIO58NB1	Y10
T16	HSIO47PB1	HSIO59PB1	U12
R16	HSIO47NB1	HSIO59NB1	V11
Y15	HSIO48PB1/CLKIN_N_9/CCC_NE_CLKIN_N_9	HSIO66PB1/CLKIN_N_7	T15
AA15	HSIO48NB1	HSIO66NB1	R15
W14	HSIO49PB1/CCC_NE_PLL1_OUT1	HSIO67PB1	T13
Y14	HSIO49NB1	HSIO67NB1	U13
AB14	HSIO50PB1/CLKIN_N_8/CCC_NE_CLKIN_N_8/CCC_NE_PLL1_OUT0	HSIO68PB1/CLKIN_N_6	V15
AB15	HSIO50NB1	HSIO68NB1	U15
AA12	HSIO51PB1/DQS/CCC_NE_PLL1_OUT0	HSIO69PB1/DQS	R13
AB12	HSIO51NB1/DQS	HSIO69NB1/DQS	T12
AA13	HSIO52PB1	HSIO70PB1	R12
AB13	HSIO52NB1	HSIO70NB1	T11
W13	HSIO53PB1	HSIO71PB1	V14
Y13	HSIO53NB1	HSIO71NB1	U14

MPF100T-FCG484E

U54-1

XCVR-0

M22	XCVR_0_RX0_P	XCVR_0_TX0_P	P22
M21	XCVR_0_RX0_N	XCVR_0_TX0_N	P21
T22	XCVR_0_RX1_P	XCVR_0_TX1_P	V22
T21	XCVR_0_RX1_N	XCVR_0_TX1_N	V21
W20	XCVR_0_RX2_P	XCVR_0_TX2_P	Y22
W19	XCVR_0_RX2_N	XCVR_0_TX2_N	Y21
AA20	XCVR_0_RX3_P	XCVR_0_TX3_P	AB22
AA19	XCVR_0_RX3_N	XCVR_0_TX3_N	AB21
R19	XCVR_0A_REFCLK_P		
R20	XCVR_0A_REFCLK_N		

MPF100T-FCG484E

U54-2

XCVR-1

A20	XCVR_1_RX0_P	XCVR_1_TX0_P	B22
A19	XCVR_1_RX0_N	XCVR_1_TX0_N	B21
C20	XCVR_1_RX1_P	XCVR_1_TX1_P	D22
C19	XCVR_1_RX1_N	XCVR_1_TX1_N	D21
F22	XCVR_1_RX2_P	XCVR_1_TX2_P	H22
F21	XCVR_1_RX2_N	XCVR_1_TX2_N	H21
L20	XCVR_1_RX3_P	XCVR_1_TX3_P	K22
L19	XCVR_1_RX3_N	XCVR_1_TX3_N	K21
G19	XCVR_1A_REFCLK_P		
G20	XCVR_1A_REFCLK_N		

MPF100T-FCG484E

U54-11

XCVR EXTERNAL REF CLOCKS

U19	XCVR_0B_REFCLK_P	XCVR_1B_REFCLK_P	J19
U20	XCVR_0B_REFCLK_N	XCVR_1B_REFCLK_N	J20
N19	XCVR_0C_REFCLK_P	XCVR_1C_REFCLK_P	E19
N20	XCVR_0C_REFCLK_N	XCVR_1C_REFCLK_N	E20

MPF100T-FCG484E

FPGA FUNCTIONAL INTERFACE 2

VARIANT01

varian

SCALE	NONE
SHEET	19 OF 21

DUAL MOTOR DRIVER

DWG NO	REV
P1060973	B

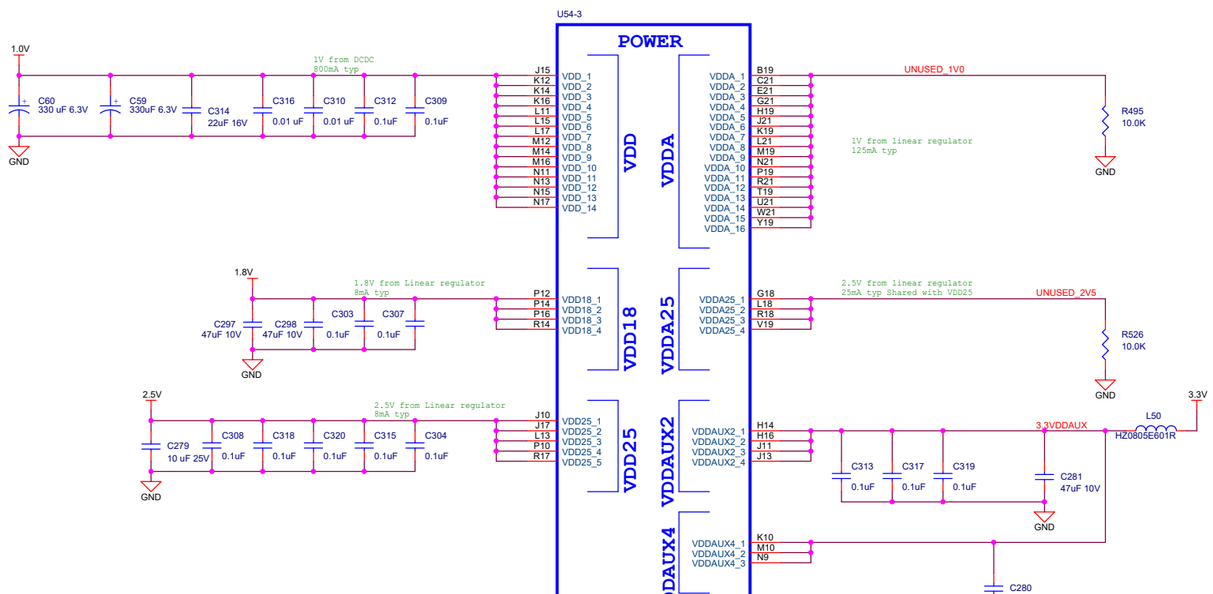
CM# 000060020609

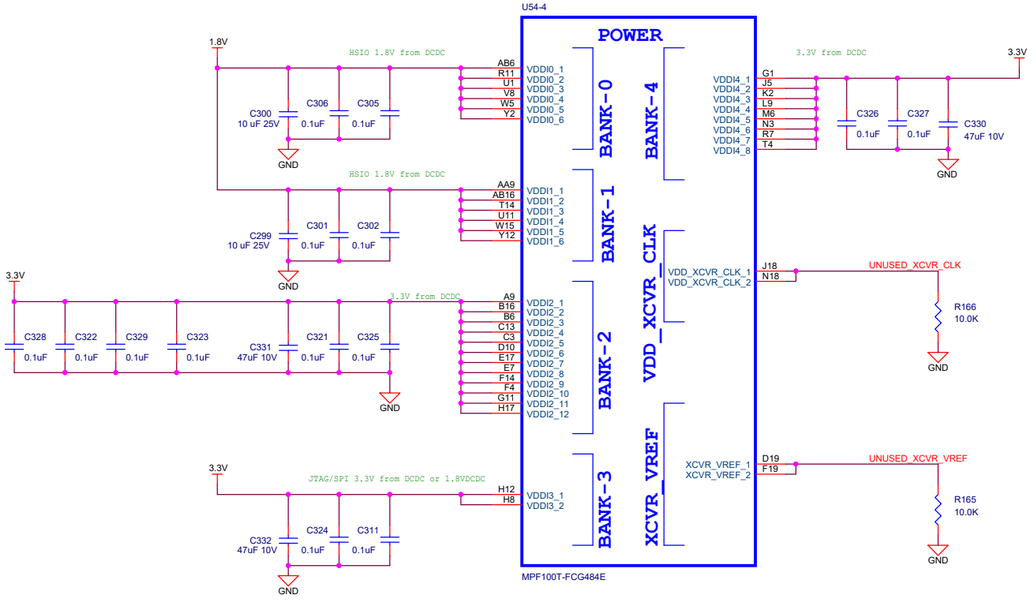
Released

Ver: 01

Rev: B

23. January 2024





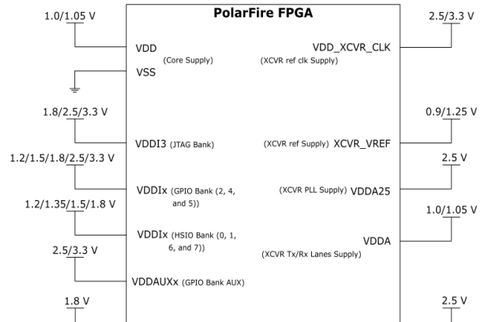


Figure 1 • **Power Supplies**

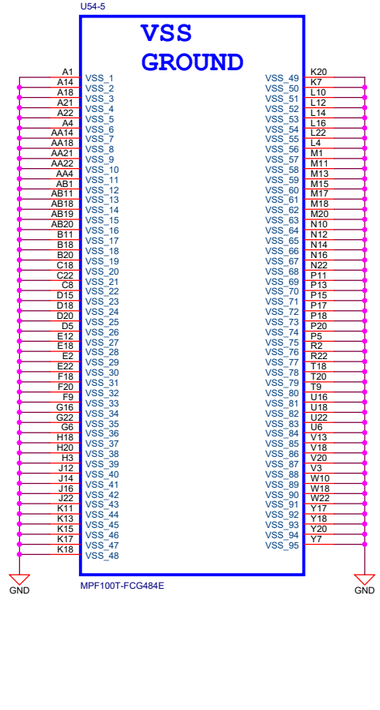


Table 12 • **Power-Supply Decoupling Capacitors—MPF100T - FCG484 (1 mm)**

	Ceramic							Tantalum
Pin Name	**4.7 nF**	**10 nF**	**0.1 µF**	**1 µF**	**4.7 µF**	**10 µF**	**47 µF**	**330 µF**
V_{DD}		2	2					1
V_{DD18}			2				2	
V_{DD25}			5			1		
V_{DDA}	3	1	6				1	
V_{DDA25}			4				1	
V_{DDIO3}			2			1		
V_{DDAUXx}[1]			2				1	
GPIO Bank[2]			2				1	
HSIO Bank[3]			2				1	
VDD_XCVR_CLK			2			1		
XCVR_VREF			2					

1. Required Decoupling Capacitor for each VDDAUXx.
2. Required Decoupling Capacitor for each GPIO bank.
3. Required Decoupling Capacitor for each HSIO bank.

FPGA POWER INTERFACE

VARIANT01

varian

SCALE	NONE
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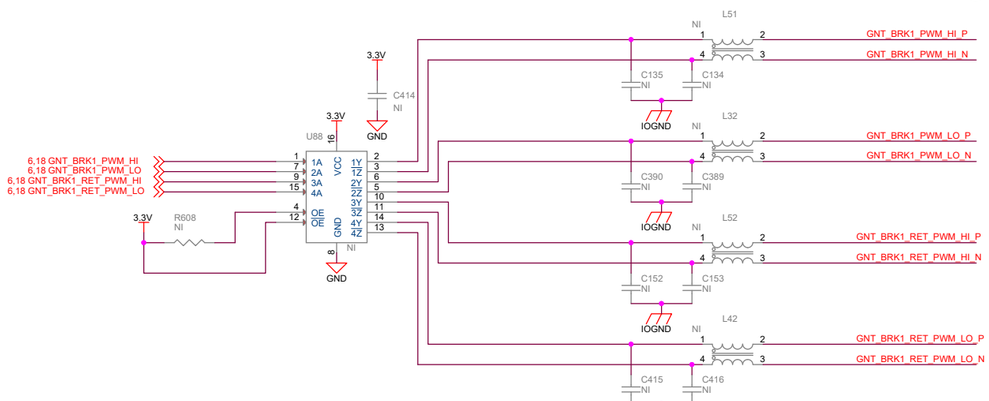

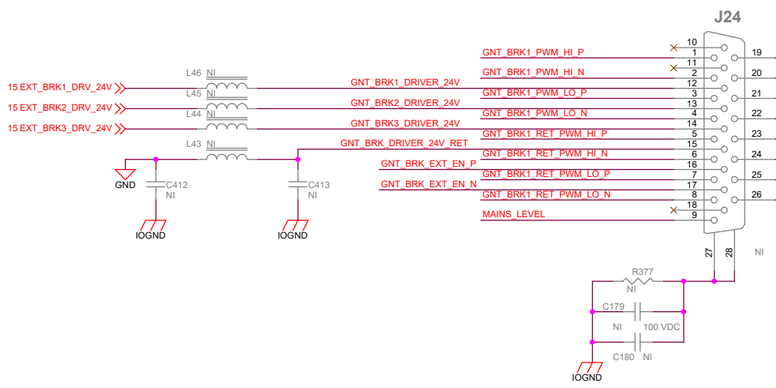

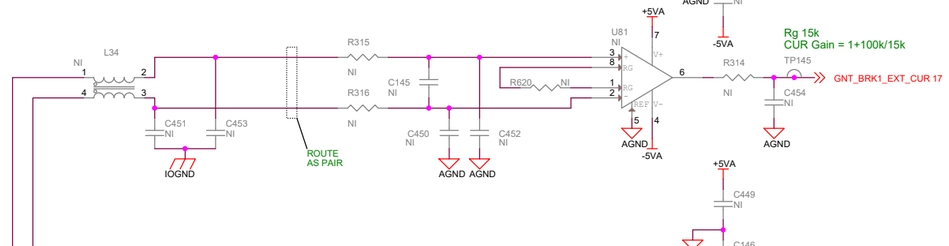

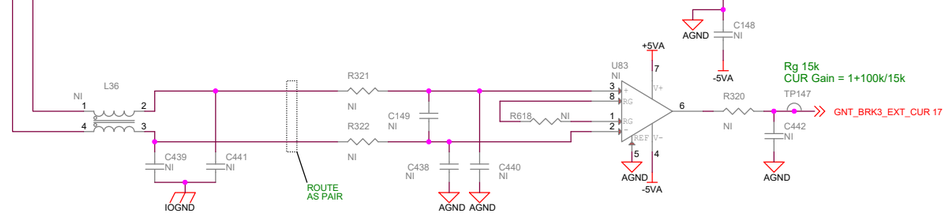

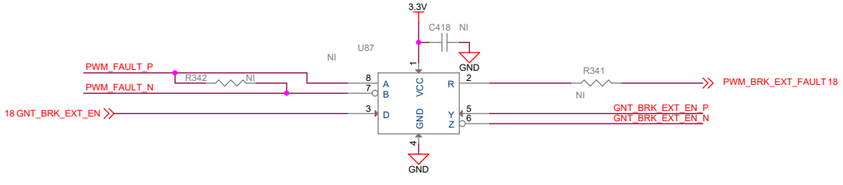

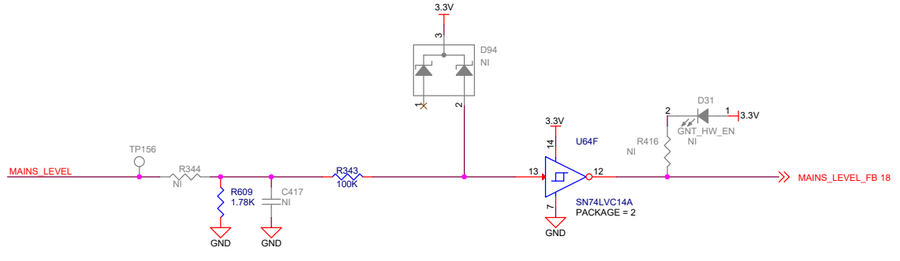

EXTERNAL BRAKE DRIVER IF

VARIANT01

varian

SCALE	NONE
SHEET	21 OF 21

DUAL MOTOR DRIVER

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P1060973	B

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Document: P1060973/SCH/000/01
Description: SCH, DUAL MOTOR DRIVER

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ECN Number: 200109363
ECN Description:

Signature list

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23, January 2024	18:57:04	Gary Yen	Released
23, January 2024	18:56:01	Rami Abdelmotalib	Approved
23, January 2024	03:36:52	Kevin Greenberg	In Eng Approval
09, December 2023	00:06:21	Gary Yen	In Checking
08, December 2023	15:53:01	Gary Yen	In Drafting
17, November 2023	21:16:05	Gary Yen	In Works