S32K324 Triple PMSM

Intergrated Thermal Management Controller Demo

Table of Contents

Revisions

Rev	Description	Designer	Date	Approved
X1	Draft	Raymond Tang	2022/4/12	
A	Release	Raymond Tang	2022/8/25	
B	Change U18 to MC33HB2001EK; Rename the net to U10 pin 66; Change U1 to SFS2613BMDFKAD; Change U19 to MC17XSB400DEK; Change net name to PTD20_ADC0_S22; Change net name to PTD4_ADC0_S19; Change U10 to P32K324EHT0VPBST; Set J13, J9 with 1-2 closed; Release	Jianqiu Hu	2023/1/9	
B1	Change U10 to S32K324EHT1VPBST Release	Jianqiu Hu	2023/5/6	

Notes:

- All components and board processes are to be ROHS compliant
- All connectors and headers are denoted Jx/Px and are 2.54mm pitch unless otherwise stated
- All jumpers are denoted Jx. Jumpers are 2mm pitch
- Jumper default positions are shown in the schematics. For 3 way jumpers, default is always posn 1-2.
  2 Pin jumpers generally have the "source" on pin 1.
- All switches are denoted SWx
- All test points (SMT wire loop style) are denoted TPx
- Test point Vias (just through hole pads) are denoted Jx

User notes are given throughout the schematics.

Specific PCB LAYOUT notes are detailed in ITALICS

REF DES	*JUMPER[DEFAULT]*	*PAGE NAME*
J1,J8,J9,J10,J11,J12,J13,J19, J21	1-2	03. POWER SUPPLY FS26

REF DES	*ASSY_OPT*	*PAGE NAME*
J2,J3,J4,J5,J6,J7,J14,J15, J16,J17,J18,J20,R3,R21	DNP	03. POWER SUPPLY FS26
R52	DNP	05. MCU GPIO
C87,R56,R60,R65,R68,R69,R70	DNP	06. MCU DEBUG RESET
C100,R77,R78,R79	DNP	07. GD3000 DRIVER1
C115,R93,R96,R99	DNP	08. GD3000 DRIVER2
C137,R106,R107,R112	DNP	09. GD3000 DRIVER3
C301	DNP	10. POWER INVERTER1
C302	DNP	11. POWER INVERTER2
C303	DNP	12. POWER_INVERTER3
R307,R310,R319	DNP	15. CAN LIN PHY
J25	DNP	16. USB TO SCI
BH1,BH2,BH3,BH4	DNP	18. CONNECTORS

Classification: <FCP> <FIUO> <PUBI>

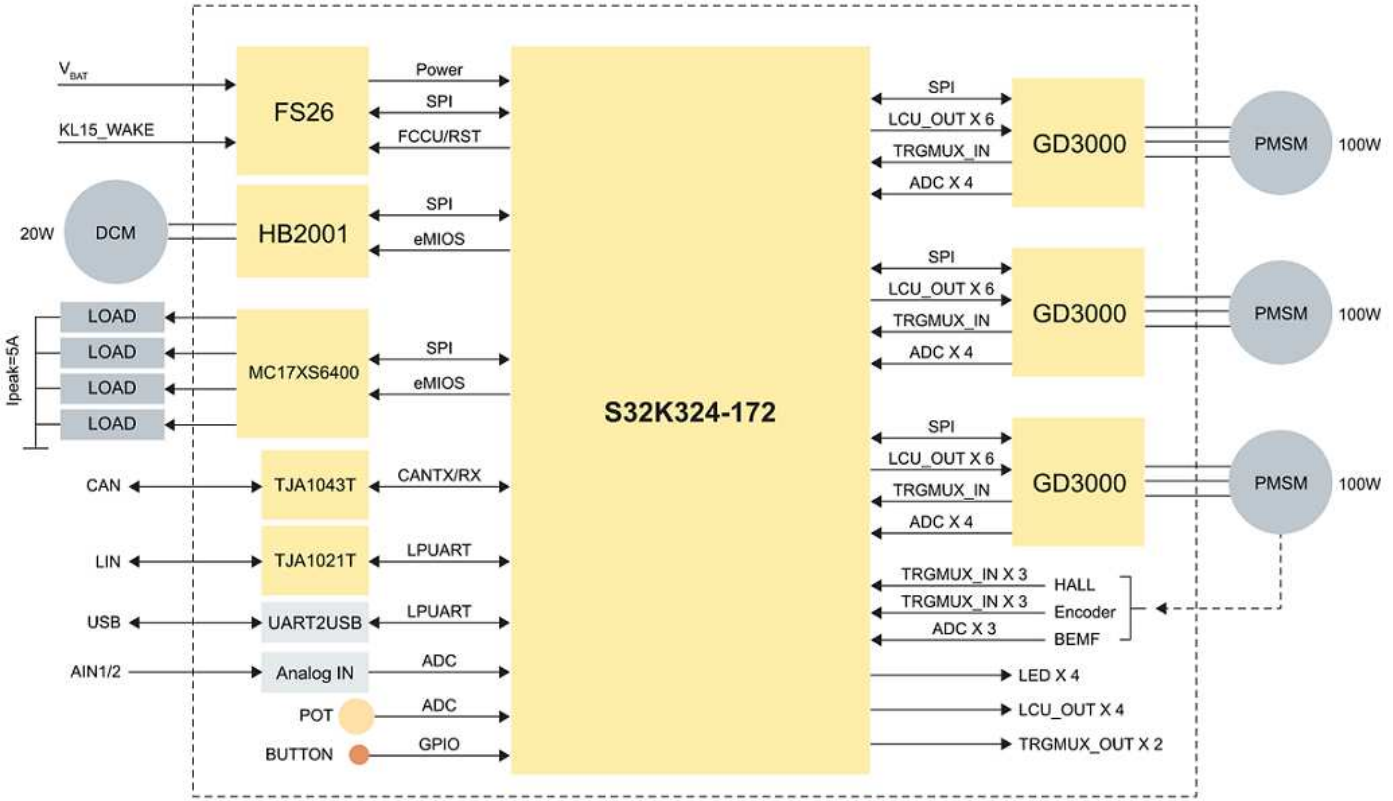
Drawing Title: MCTPTX1AK324

Page Title: Title & Notes

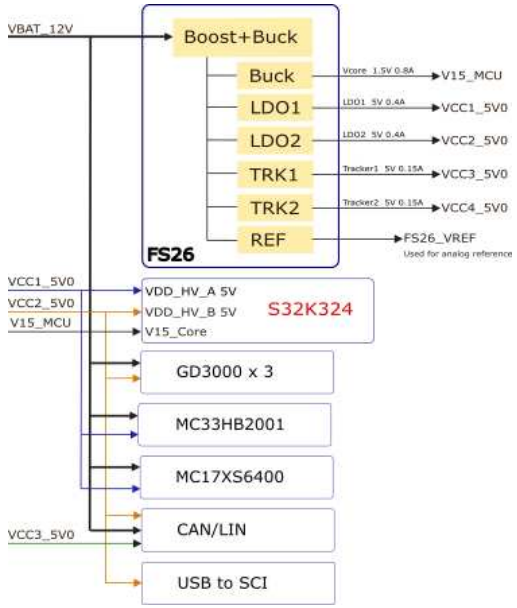
Size	Document Number	Rev
C	SCH-55329 PDF: SPF-55329	B1

Date: Thursday, June 01, 2023 Sheet 1 of 18

ECU Block Diagram



Power Supply Architecture



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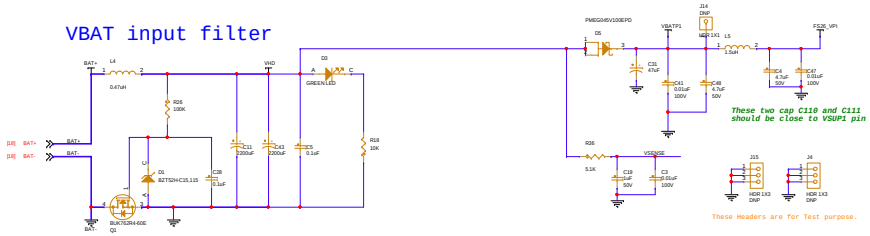
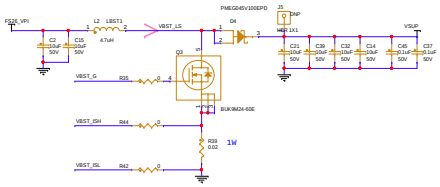
Page Title:	Block Diagram		
Size B	Document Number SCH-55329 PDF: SPF-55329		Rev B1
Date: Thursday, June 01, 2023		Sheet 2 of 18	

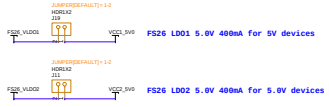
Power Supply FS26

VBAT input filter

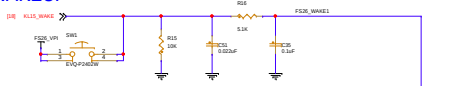


Boost Circuit in Front End mode

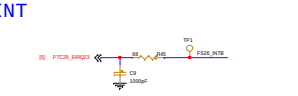




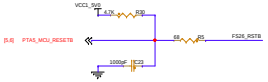
KL15 WAKEUP



MCU INT

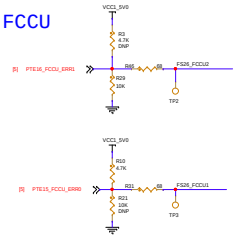


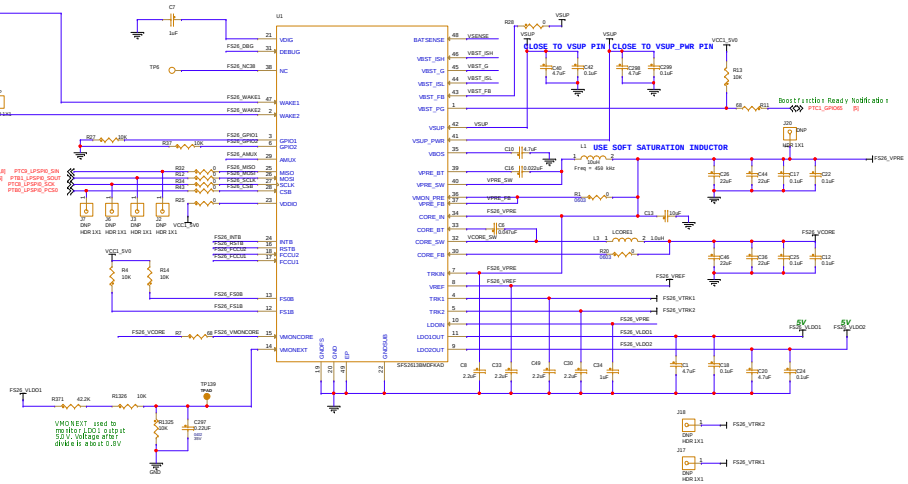
MCU Reset



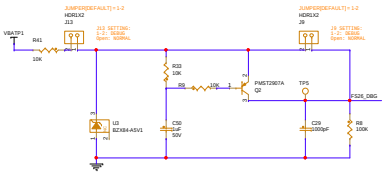
AMUX

MCU FCCU





DEBUG



Power LED Indicator

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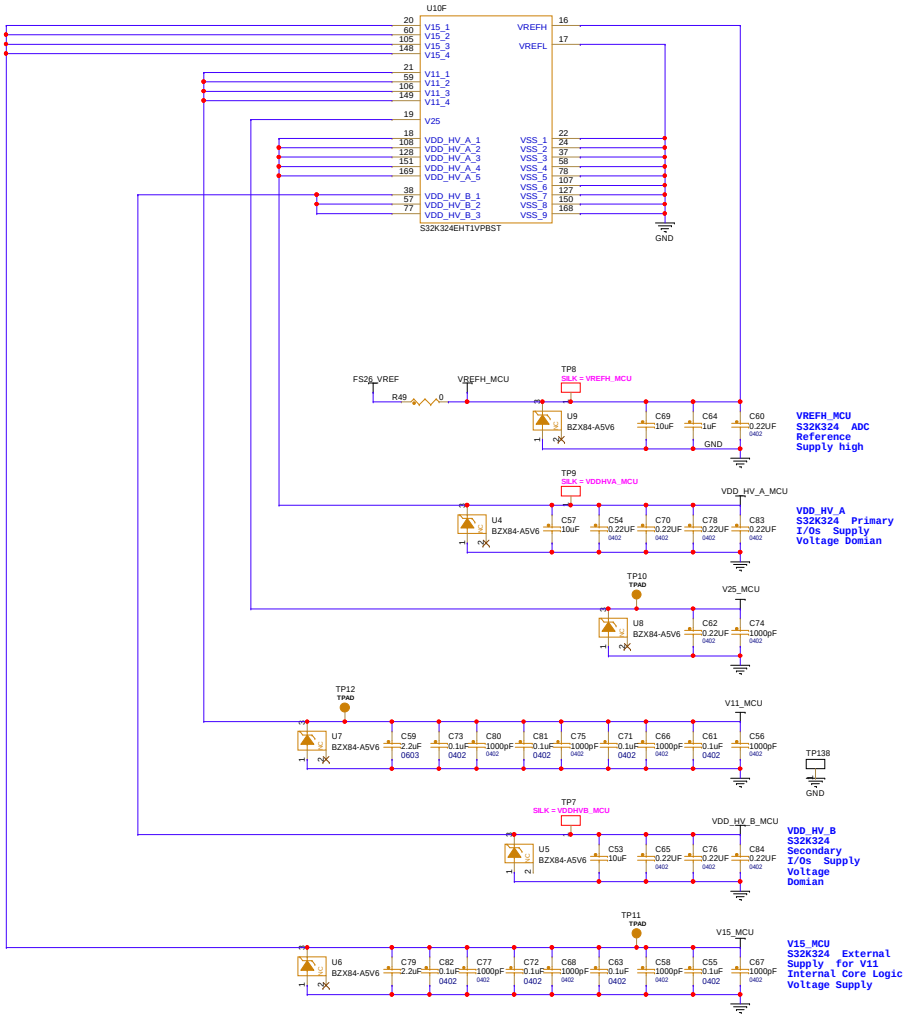
Page Title:	Power Supply FS26
Size: B	Document Number: SCH-55329-PDF-SPF-55329 Rev: B1
Date: Thursday, June 01, 2023	Sheet 3 of 18

S32K324 Microcontroller - 172HDQFP

Power Supply Pins



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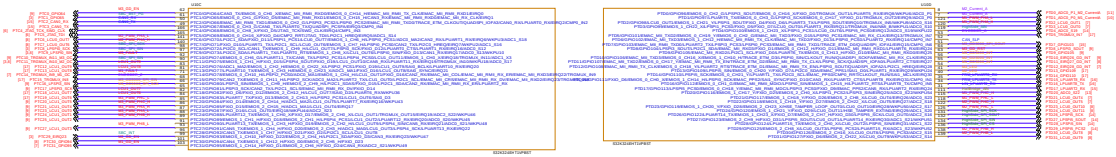
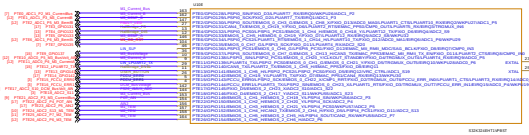
Page Title:	MCU Power Supply		
Size: C	Document Number: SCH-55329 PDF: SPF-55329		Rev: B1
Date: Thursday, June 01, 2023		Sheet 4 of 18	

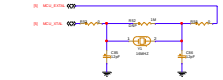
S32K324 Microcontroller - 172HDQFP

Ports A/B/C/D





External Oscillator - 16MHz



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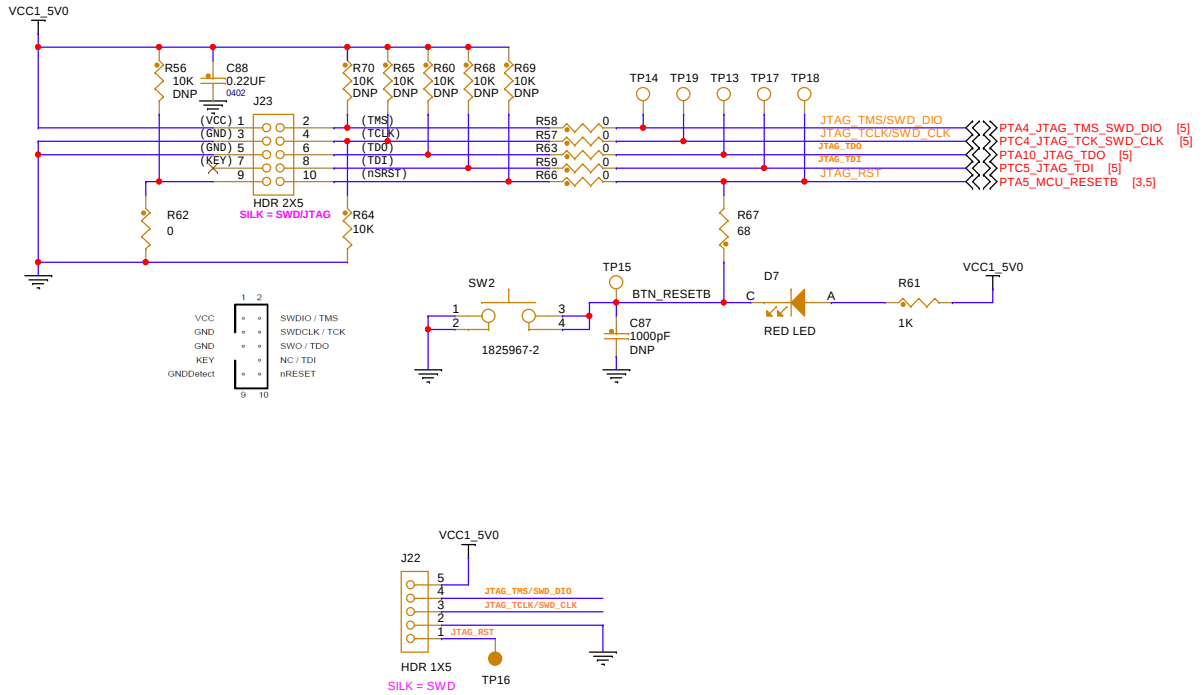
Page Title:	MCU GPIOs		
Size: A	Document Number:	SCH-35239 PDF-SPF-35029	Rev: A1
Date: Thursday, June 03, 2021		Sheet 1 of 18	

10-pin Cortex Debug connector



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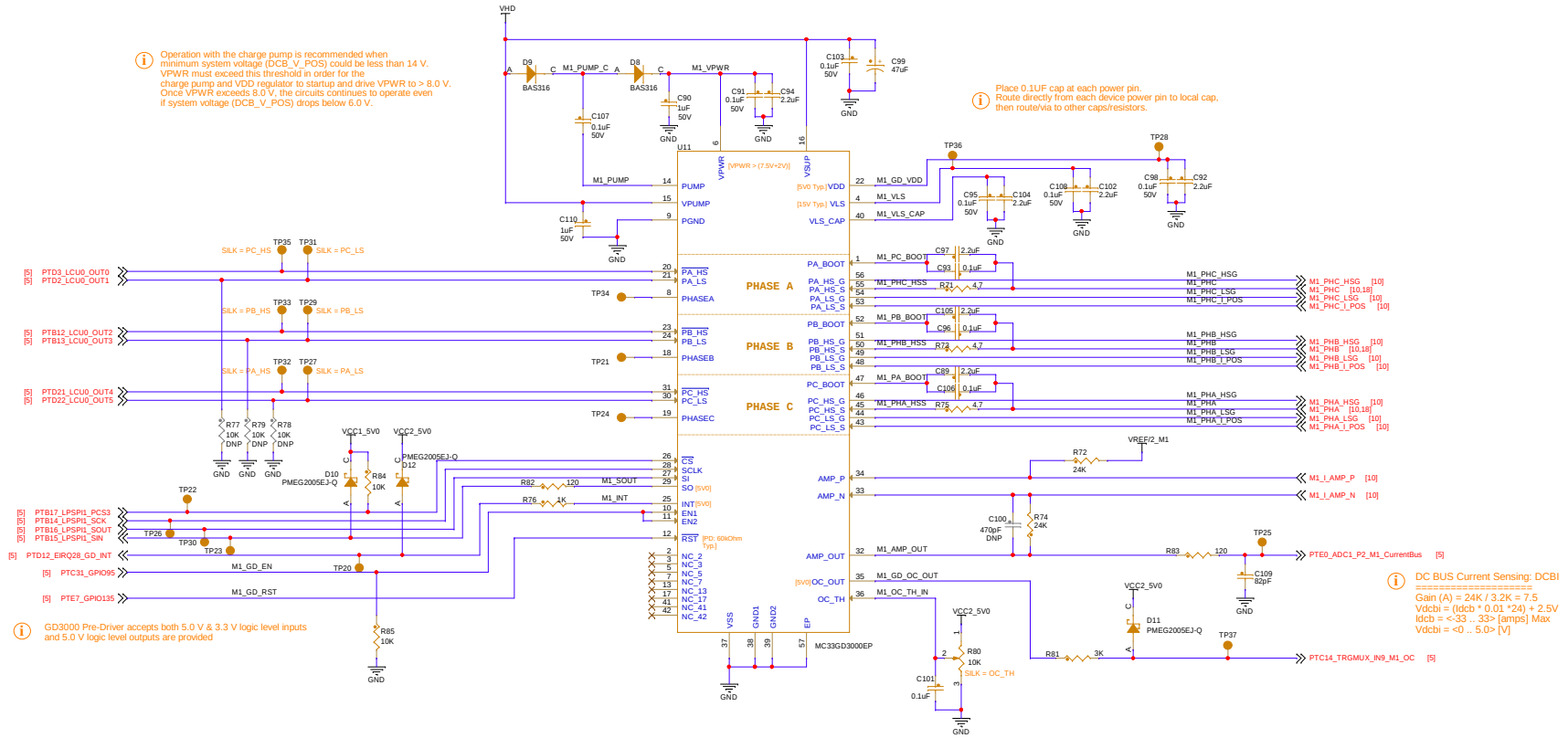
Page Title:	MCU Debug Interface		
Size B	Document Number SCH-55329 PDF: SPF-55329		Rev B1
Date: Thursday, June 01, 2023	Sheet 6 of 18		

M1 - GD3000 - THREE PHASE FET PRE-DRIVER



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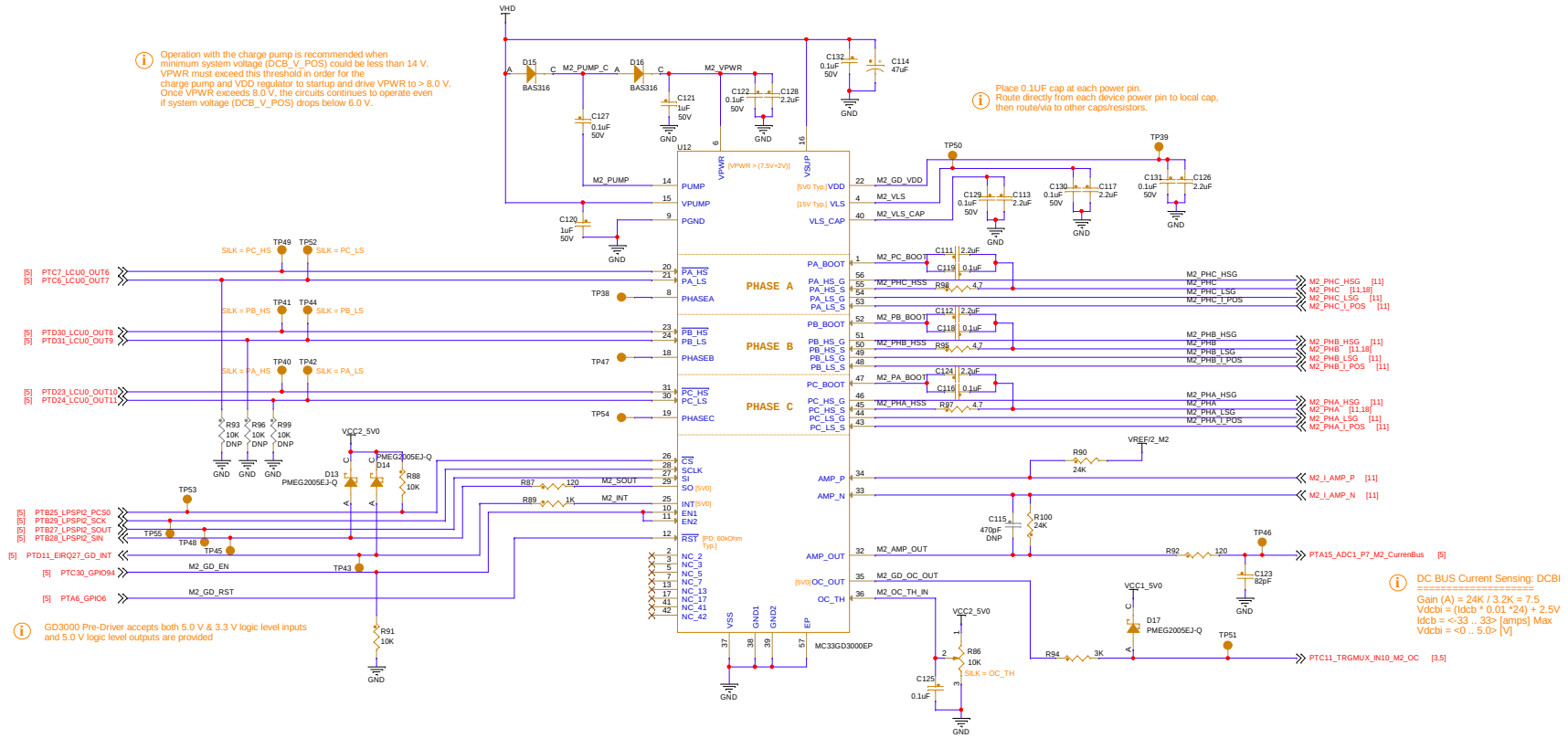
Page Title: GD3000 GateDriver for PMSM1			
Size C	Document Number SCH-55329 PDF: SPF-55329		Rev B1
Date: Thursday, June 01, 2023		Sheet 7 of 18	

M2 - GD3000 - THREE PHASE FET PRE-DRIVER



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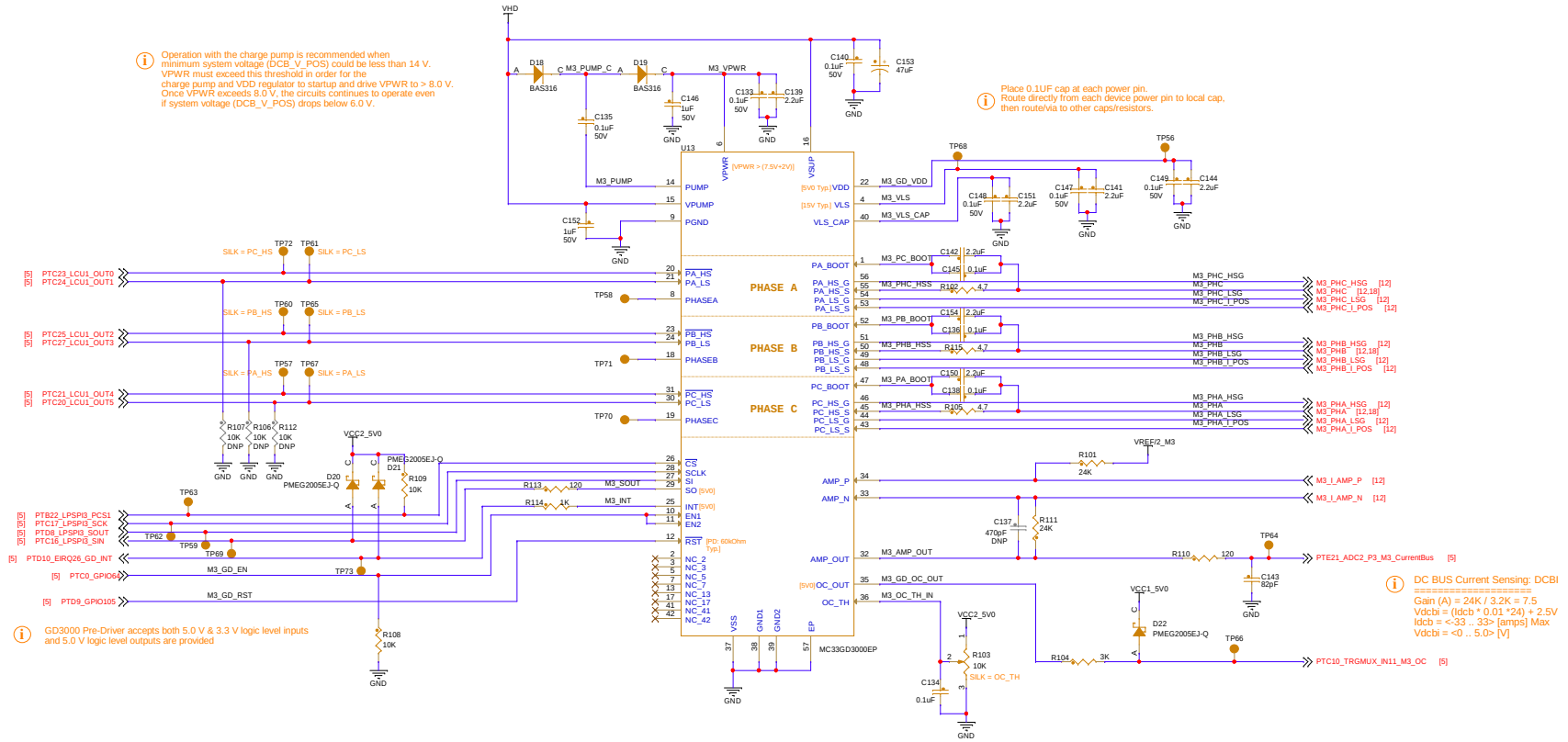
Page Title: GD3000 GateDriver for PMSM2		
Size C	Document Number SCH-55329 PDF: SPF-55329	Rev B1
Date: Thursday, June 01, 2023	Sheet 8 of 18	

M3 - GD3000 - THREE PHASE FET PRE-DRIVER



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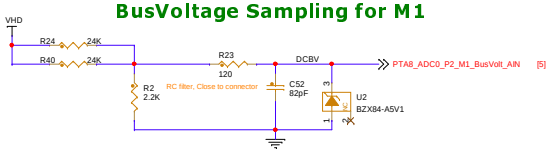
Page Title:	GD3000 GateDriver for PMSM3	
Size: C	Document Number: SCH-55329 PDF: SPF-55329	Rev: B1
Date: Thursday, June 01, 2023	Sheet 9 of 18	

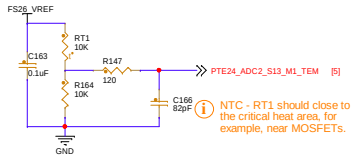
Layout Note:
==========
Single GND in the Design. High Current GND
path to be separated in the Layout by making void.

BusVoltage Sampling for M1



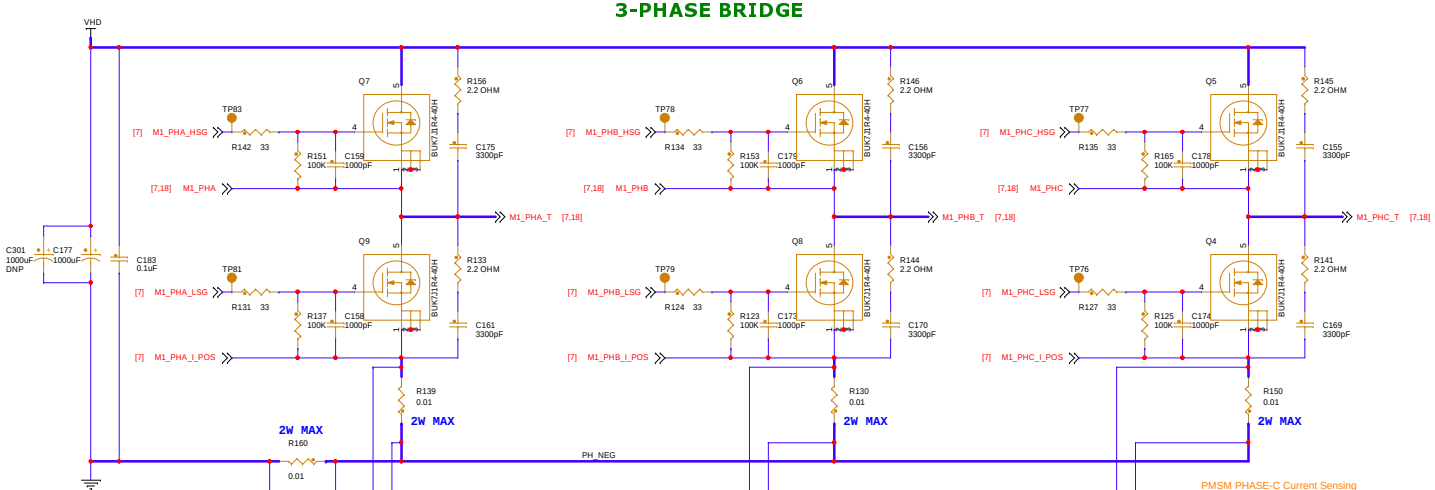
DC BUS Voltage sensing: DCBV
==========
5.0V @ 32.27V *(2.2K/(12K+2.2K))

Temperature Sensing for M1

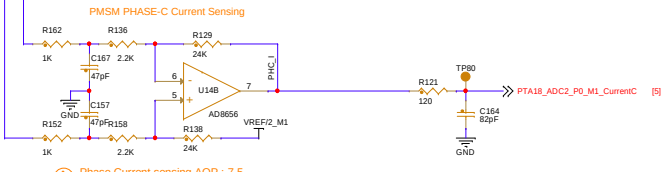


NTC - RT1 should close to the critical heat area, for example, near MOSFETs.

3-PHASE BRIDGE



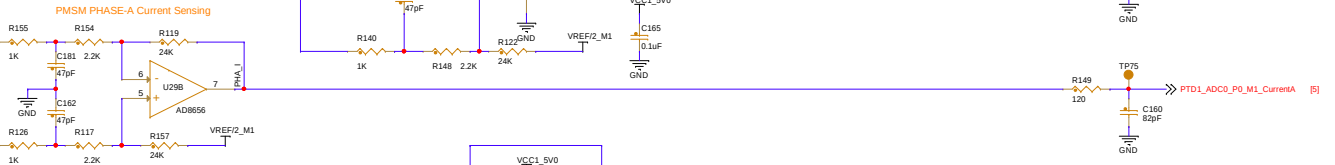
PMSM PHASE-C Current Sensing



PMSM PHASE-B Current Sensing

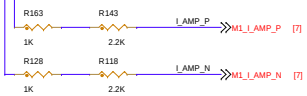
Phase Current sensing AOP : 7.5
==========
Max Current (0 - to - Peak) 33.3A

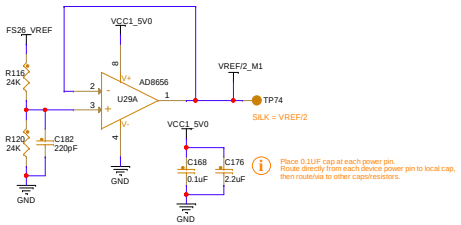
PMSM PHASE-A Current Sensing



PMSM Bus Current Sensing

Close to U1, GD3000





Place 0.1UF cap at each power pin.
Route directly from each device power pin to local cap, then route/via to other caps/resistors.

Classification:	Company Internal/Proprietary
Drawing Title:	MCTPTX1AK324
Page Title:	Power Stage for PMSM1
Size: C	Document Number: SCH-55329 PDF: SPF-55329
Rev: B1	
Date:	Thursday, June 01, 2023
Sheet	10 of 18

Layout Note:
==========
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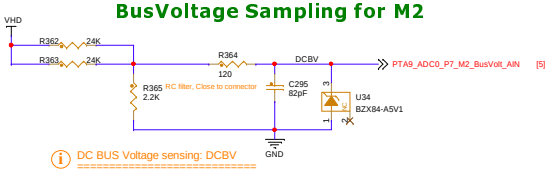
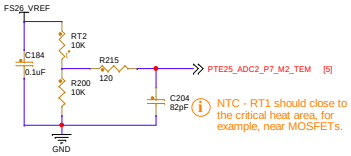
BusVoltage Sampling for M2



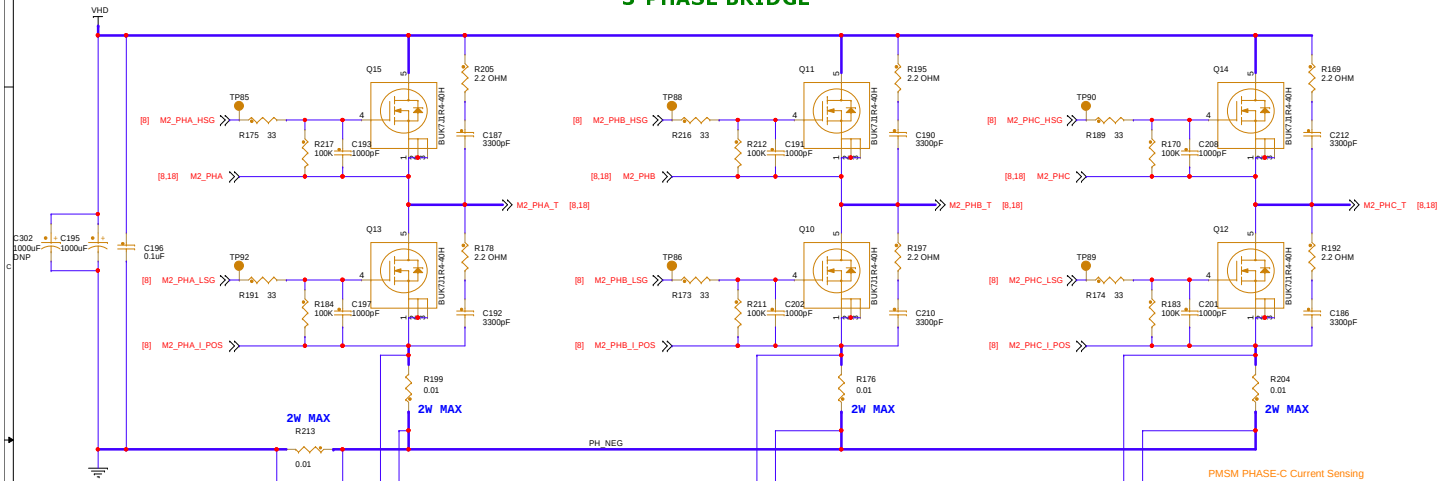
DC BUS Voltage sensing: DCBV
==========
5.0V @ 32.27V *(2.2K/(12K+2.2K))

Temperature Sensing for M2

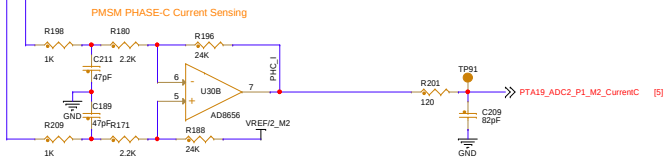


NTC - RT1 should close to the critical heat area, for example, near MOSFETs.

3-PHASE BRIDGE



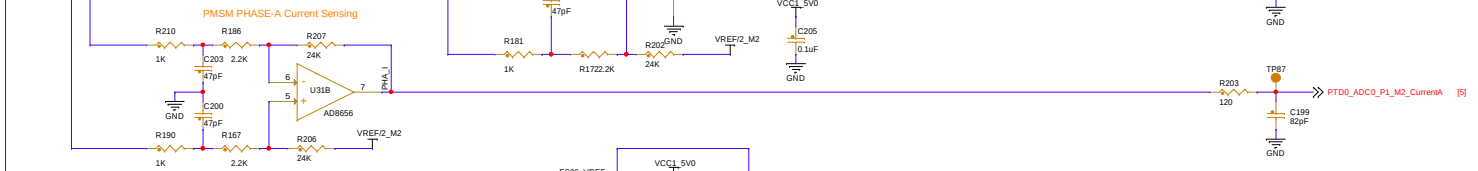
PMSM PHASE-C Current Sensing



PMSM PHASE-B Current Sensing

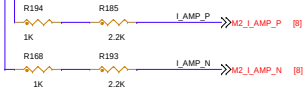
Phase Current sensing AOP : 7.5
==========
Max Current (0 - to - Peak) 33.3A

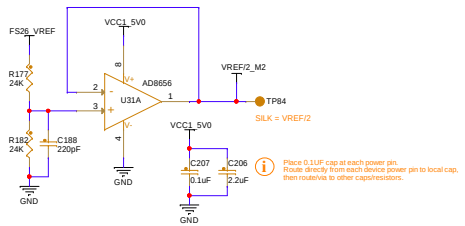
PMSM PHASE-A Current Sensing



PMSM Bus Current Sensing

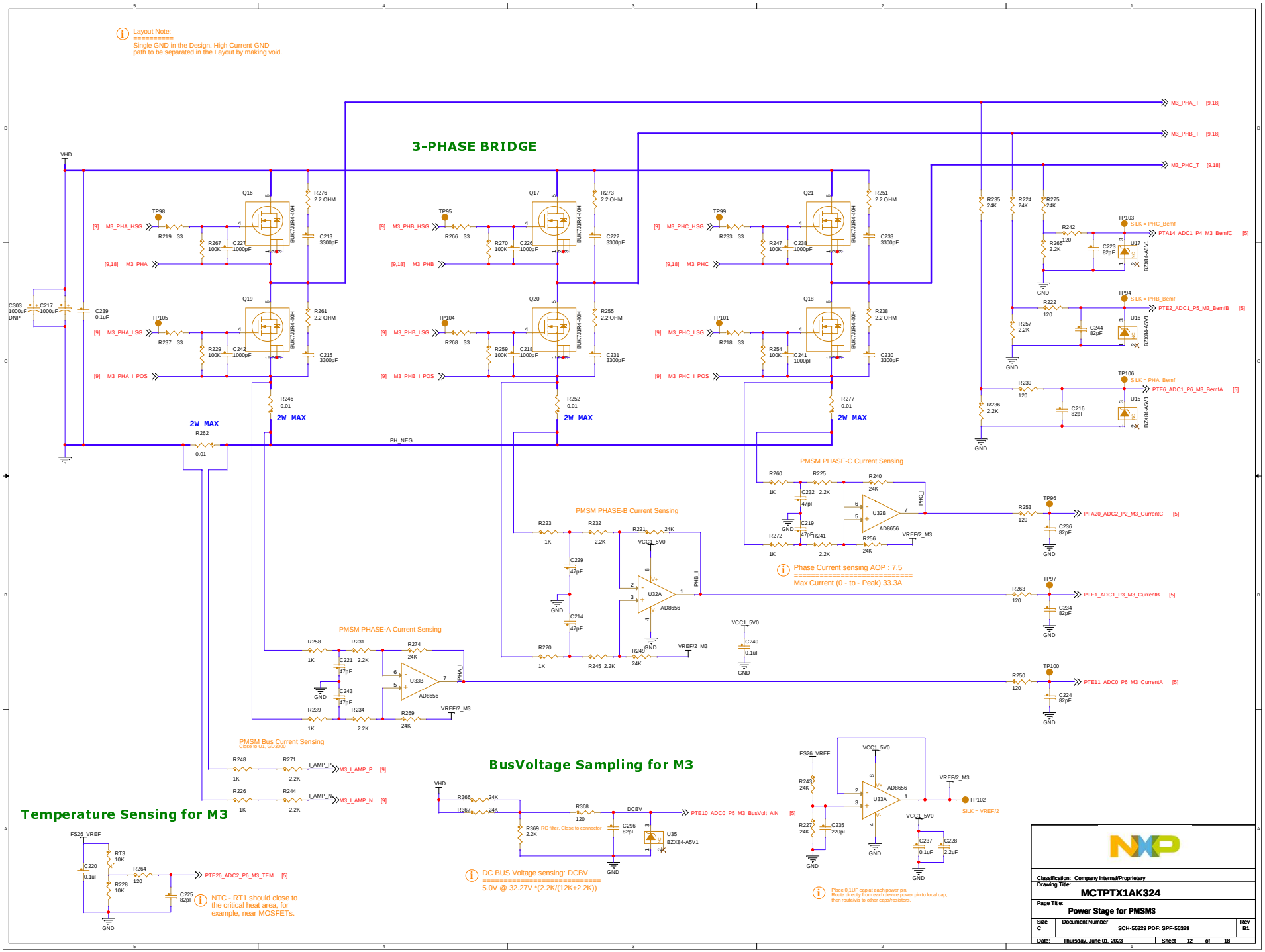
Close to U1, GD3000



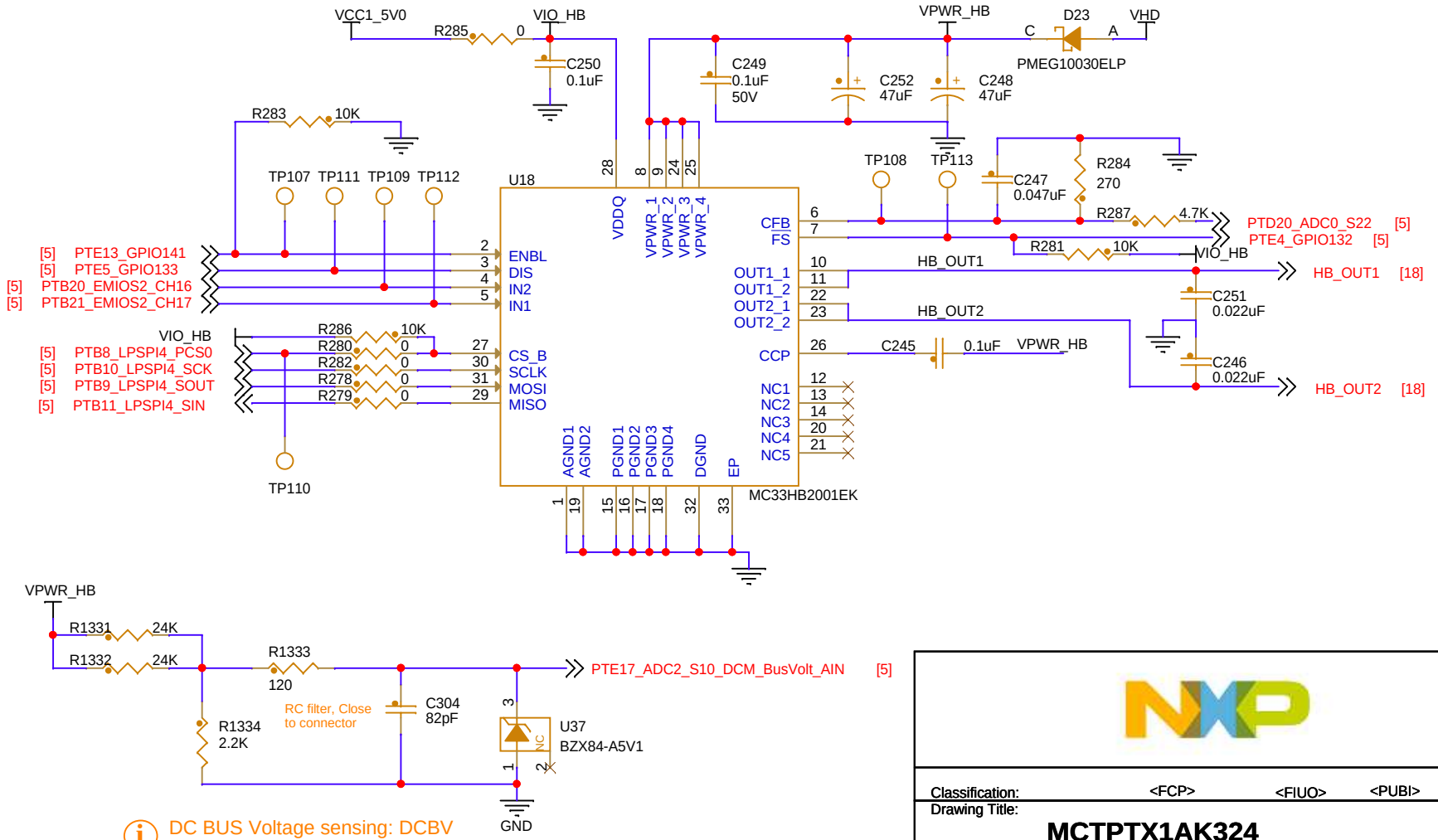


Place 0.1UF cap at each power pin.
Route directly from each device power pin to local cap, then route/via to other caps/resistors.

Classification:	Company Internal/Proprietary
Drawing Title:	MCTPTX1AK324
Page Title:	Power Stage for PMSM2
Size: C	Document Number: SCH-55329 PDF: SPF-55329
Rev: B1	
Date: Thursday, June 01, 2023	Sheet 11 of 18


Layout Note:
Single GND in the Design. High Current GND path to be separated in the Layout by making void.
3-PHASE BRIDGE
VHD
M3_PHA_T [9,18]
M3_PHB_T [9,18]
M3_PHC_T [9,18]
Q16
Q17
Q21
Q19
Q20
Q18
BUK7J1R4-40H
TP98
TP95
TP99
TP105
TP104
TP101
M3_PHA_HSG
M3_PHB_HSG
M3_PHC_HSG
M3_PHA_LSG
M3_PHB_LSG
M3_PHC_LSG
M3_PHA_I_POS
M3_PHB_I_POS
M3_PHC_I_POS
M3_PHA
M3_PHB
M3_PHC
R276 2.2 OHM
R273 2.2 OHM
R251 2.2 OHM
R261 2.2 OHM
R255 2.2 OHM
R238 2.2 OHM
C213 3300pF
C222 3300pF
C233 3300pF
C215 3300pF
C231 3300pF
C230 3300pF
C303 1000uF DNP
C217 1000uF
C239 0.1uF
R246 0.01
R252 0.01
R277 0.01
2W MAX
R262 0.01
PH_NEG
R235 24K
R224 24K
R275 24K
TP103
TP94
TP106
SILK = PHC_Bemf
SILK = PHB_Bemf
SILK = PHA_Bemf
PTA14_ADC1_P4_M3_BemfC [5]
PTE2_ADC1_P5_M3_BemfB [5]
PTE6_ADC1_P6_M3_BemfA [5]
U17
U16
U15
BZX84-A5V1
R242 120
R265 2.2K
R222 120
R257 2.2K
R230 120
R236 2.2K
C223 82pF
C244 82pF
C216 82pF
GND
PMSM PHASE-C Current Sensing
PMSM PHASE-B Current Sensing
PMSM PHASE-A Current Sensing
U32B
U32A
U33B
AD8656
PHC_I
PHB_I
PHA_I
VREF/2_M3
VCC1_5V0
Phase Current sensing AOP : 7.5
Max Current (0 - to - Peak) 33.3A
TP96
TP97
TP100
PTA20_ADC2_P2_M3_CurrentC [5]
PTE1_ADC1_P3_M3_CurrentB [5]
PTE11_ADC0_P6_M3_CurrentA [5]
PMSM Bus Current Sensing
Close to U1, GD3000
I_AMP_P
I_AMP_N
M3_I_AMP_P [9]
M3_I_AMP_N [9]
BusVoltage Sampling for M3
PTE10_ADC0_P5_M3_BusVolt_AIN [5]
DCBV
RC filter, Close to connector
U35
DC BUS Voltage sensing: DCBV
5.0V @ 32.27V *(2.2K/(12K+2.2K))
FS26_VREF
TP102
SILK = VREF/2
Place 0.1UF cap at each power pin.
Route directly from each device power pin to local cap, then routeVia to other caps/resistors.
Temperature Sensing for M3
RT3 10K
R228 10K
R264 120
C220 0.1uF
C225 82pF
PTE26_ADC2_P6_M3_TEM [5]
NTC - RT1 should close to the critical heat area, for example, near MOSFETs.
Classification: Company Internal/Proprietary
Drawing Title:
MCTPTX1AK324
Page Title:
Power Stage for PMSM3
Size C
Document Number SCH-55329 PDF: SPF-55329
Rev B1
Date: Thursday, June 01, 2023
Sheet 12 of 18

H-Bridge Driver - HB2001



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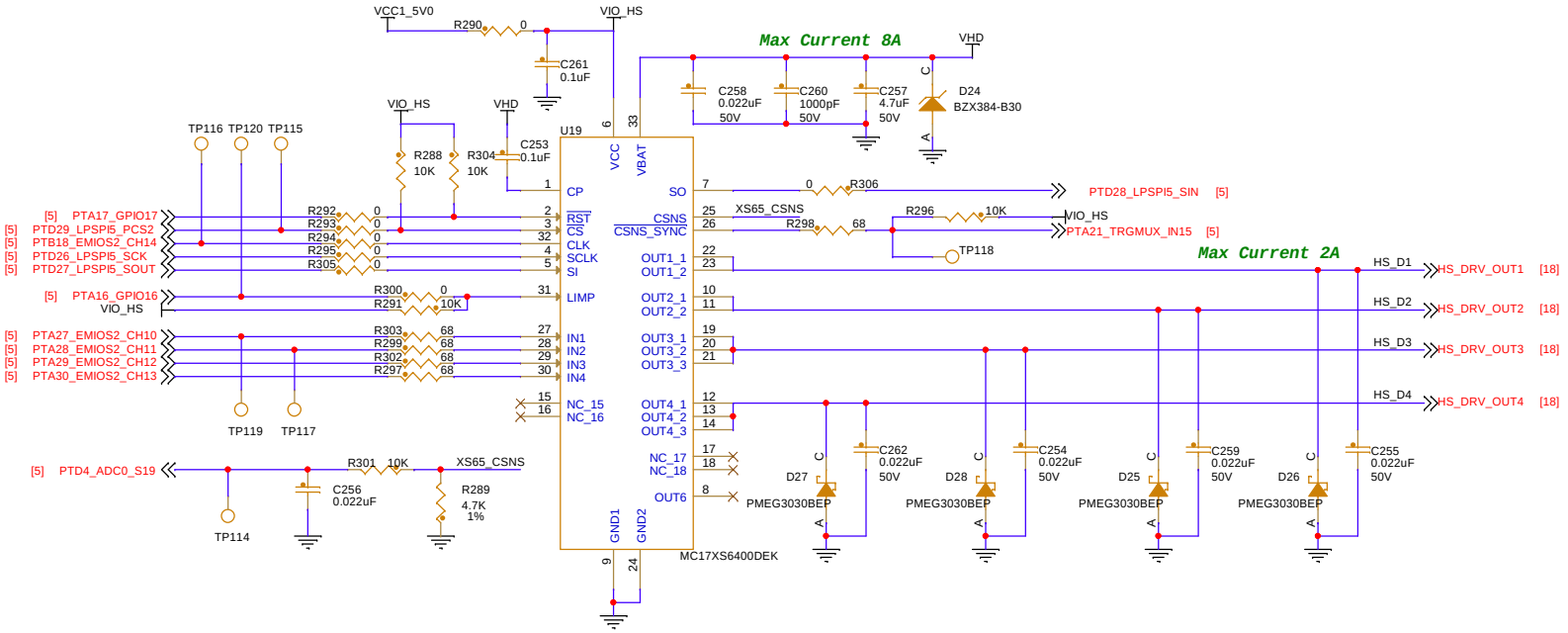
Drawing Title:	**MCTPTX1AK324**		
Page Title:	**H-Bridge**		
Size A	Document Number SCH-55329 PDF: SPF-55329		Rev B1
Date: Thursday, June 01, 2023		Sheet 13 of 18	

High Side Drive



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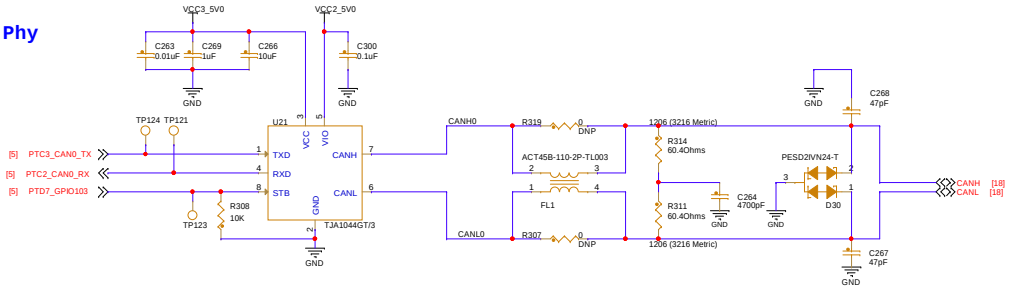
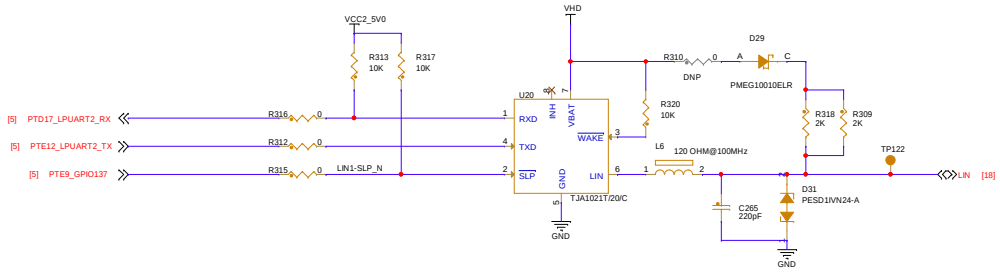
Drawing Title:	MCTPTX1AK324		
Page Title:	High Side Driver		
Size B	Document Number SCH-55329 PDF: SPF-55329		Rev B1
Date: Thursday, June 01, 2023	Sheet 14 of 18		

Single CAN Phy



Single LIN Phy



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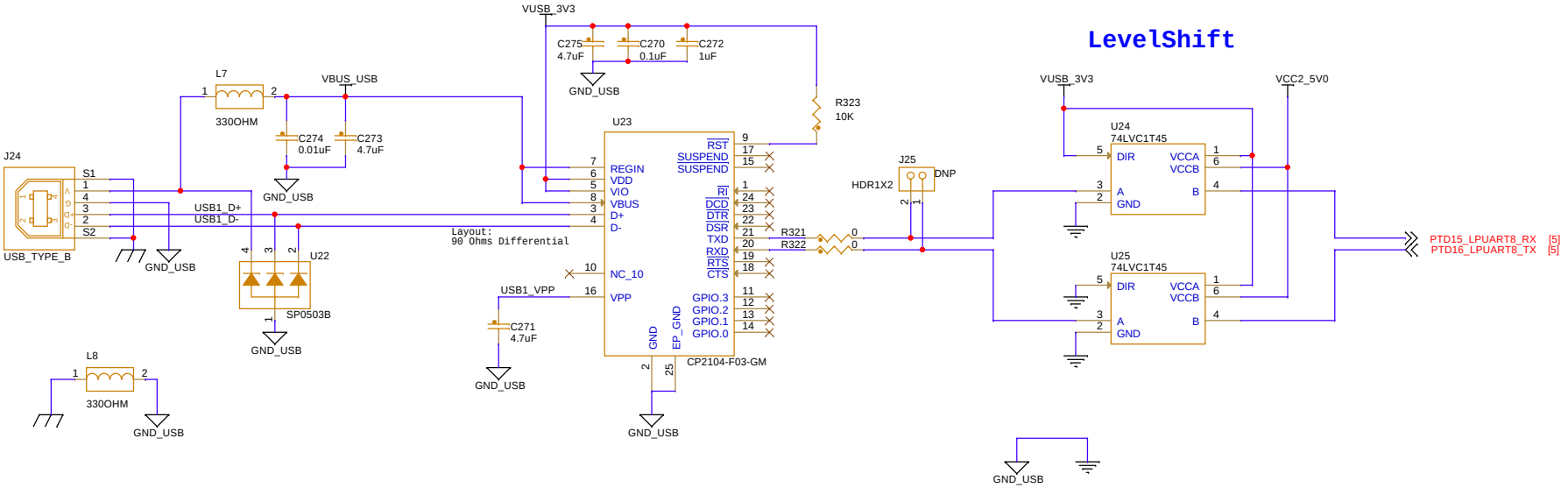
Page Title:	CAN and LIN Phy		
Size: C	Document Number: SCH-55329 PDF: SPF-55329		Rev: B1
Date: Thursday, June 01, 2023		Sheet 15 of 18	

USB to UART



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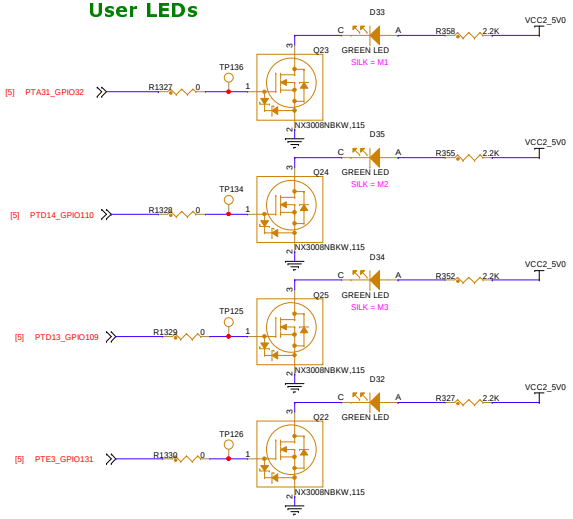
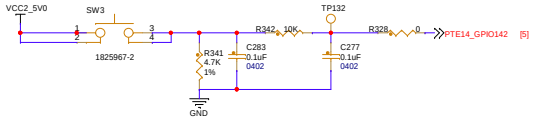
Drawing Title:	MCTPTX1AK324		
Page Title:	USB to UART		
Size B	Document Number SCH-55329 PDF: SPF-55329		Rev B1
Date: Thursday, June 01, 2023	Sheet 16 of 18		

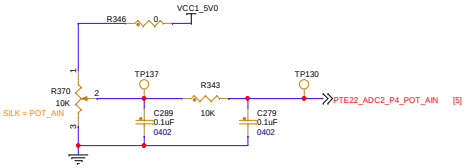
User LEDs



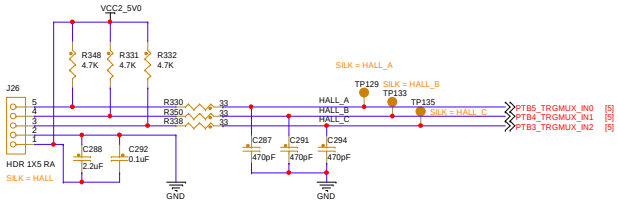
User Push Button - Active HIGH



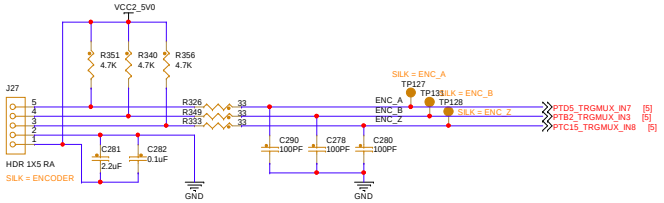
ADC Potentiometer



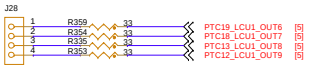
Hall Interface



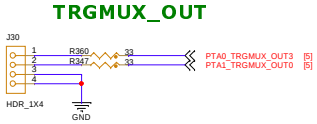
Encoder Interface



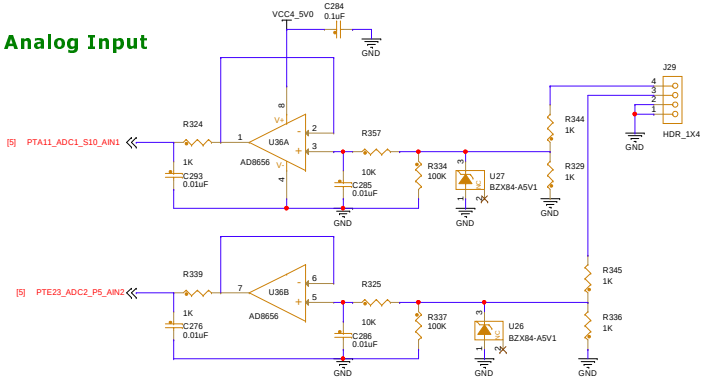
LCU1 - Output



TRGMUX_OUT



Analog Input



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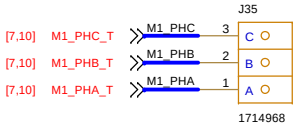
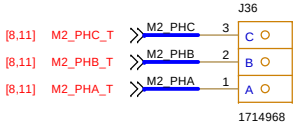
Drawing Title:	MCTPTX1AK324		
Page Title:	User Peripherals		
Size: C	Document Number: SCH-55329 PDF: SPF-55329		Rev: B1
Date: Thursday, June 01, 2023	Sheet 17 of 18		

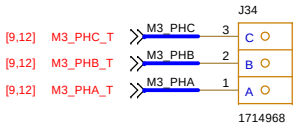
3-Phase Motor Connectors and Power Supply Input



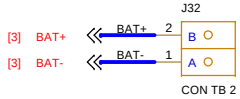
Motor 1



Motor 2

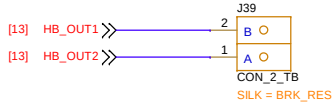


Motor 3

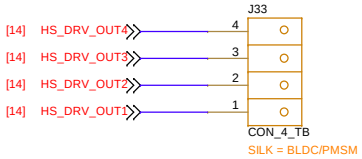


Battery IN

Half Bridge and High Side Drivers

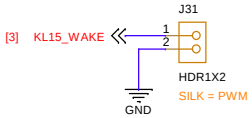


Half-Bridge DCM

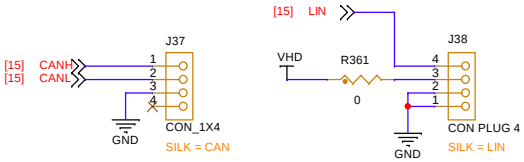


4 Channels HighSide

Wake Up Signal KL15

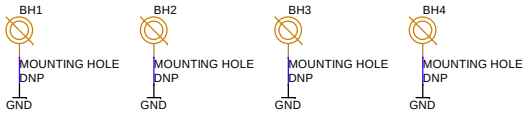


CAN, LIN Communication Connectors



CAN **LIN**

R241 is backup for PCAN LIN interface
PCAN tool need the power supply



These are mounting holes of the PCB

Classification:	<FCP> <FIUO> <PUBI>
Drawing Title:	MCTPTX1AK324
Page Title:	Connectors
Size: B	Document Number: SCH-55329 PDF: SPF-55329 — Rev: B1
Date:	Thursday, June 01, 2023 — Sheet 18 of 18