



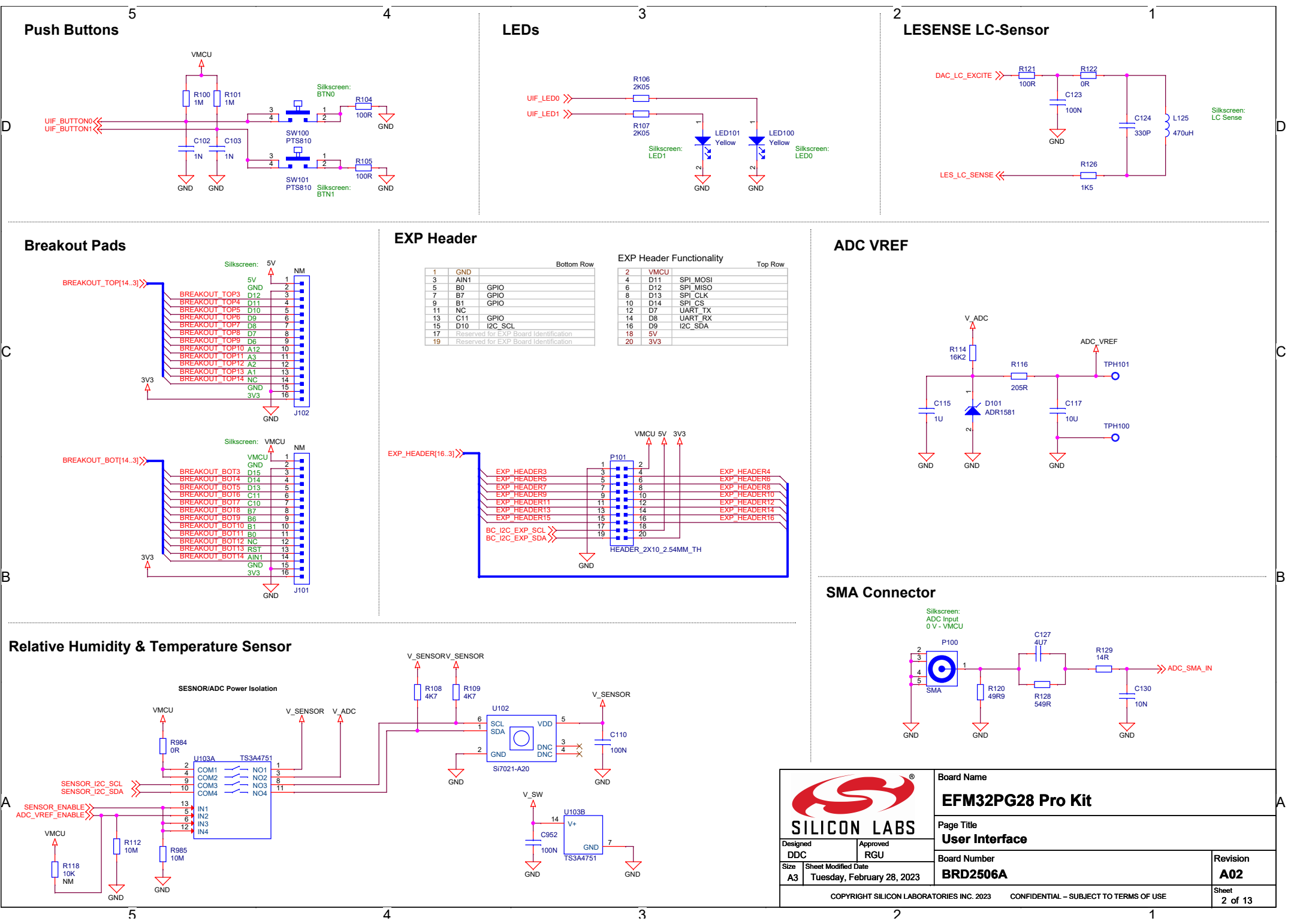
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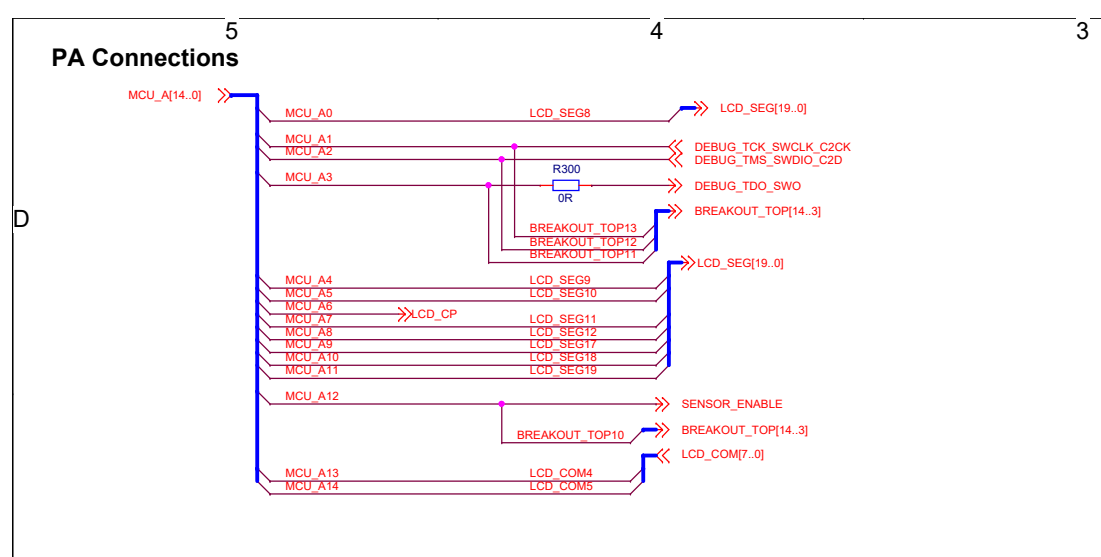


PG28 Pro Kit	
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Revision History	
Rev.	Description
A01	Initial version.
A02	U703 changed to LTC6102CDD#PBF. C501 changed to 4.7uF. R5 is NM,R6 is mounted(DC-DC of U1 enabled).

		Board Name	
		EFM32PG28 Pro Kit	
Designed DDC		Approved RGU	
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[illegible]

PC Connections

MCU_C[11..0]

MCU_C0 LCD_SEG0

MCU_C1 LCD_SEG1

MCU_C2 LCD_SEG2

MCU_C3 LCD_SEG3

MCU_C4 LCD_SEG4

MCU_C5 LCD_SEG5

MCU_C6 LCD_SEG6

MCU_C7 LCD_SEG7

MCU_C8 LCD_SEG15

MCU_C9 LCD_SEG15

LCD_SEG[19..0]

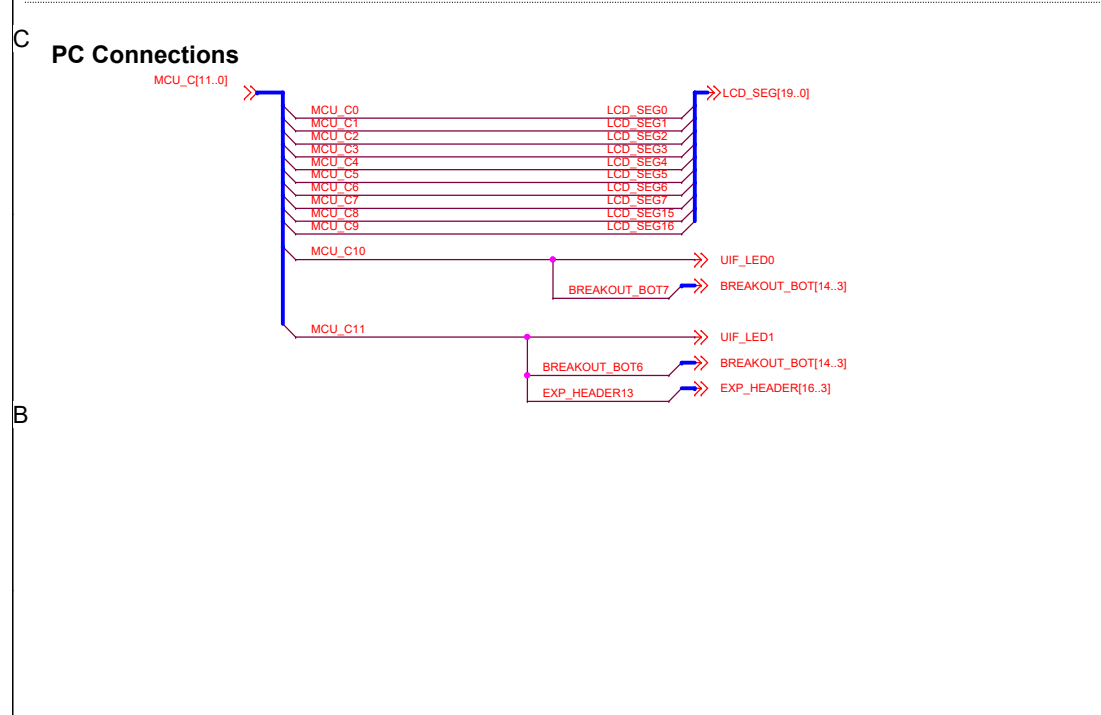
MCU_C10 UIF_LED0

BREAKOUT_BOT7 BREAKOUT_BOT[14..3]

MCU_C11 UIF_LED1

BREAKOUT_BOT6 BREAKOUT_BOT[14..3]

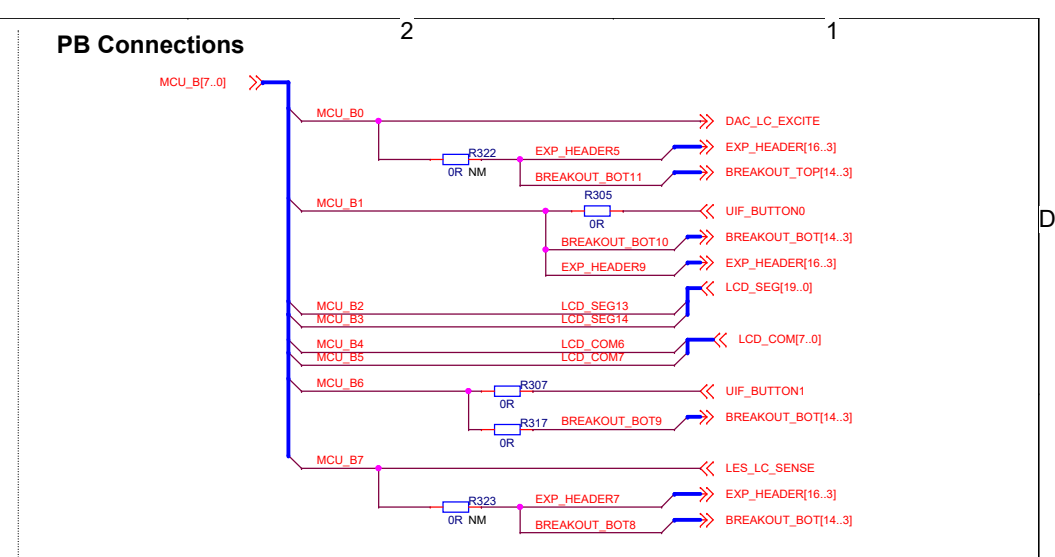
EXP_HEADER13 EXP_HEADER[16..3]



PB Connections

The diagram illustrates the peripheral bus (PB) connections for an 8-bit MCU array, labeled MCU_B[7..0]. The connections are as follows:

- MCU_B0:**
 - Connected to **DAC_LC_EXCITE** (output).
 - Through resistor **R322** (OR NM) to **EXP_HEADERS5** (output) and **BREAKOUT_BOT11** (output).
- MCU_B1:**
 - Through resistor **R305** (OR) to **UIF_BUTTON0** (input).
 - Connected to **BREAKOUT_BOT10** (output) and **EXP_HEADER9** (output).
- MCU_B2:** Connected to **LCD_SEG13** (output).
- MCU_B3:** Connected to **LCD_SEG14** (output).
- MCU_B4:** Connected to **LCD_COM6** (output).
- MCU_B5:** Connected to **LCD_COM7** (output).
- MCU_B6:**
 - Through resistor **R307** (OR) to **UIF_BUTTON1** (input).
 - Through resistor **R317** (OR) to **BREAKOUT_BOT9** (output).
- MCU_B7:**
 - Connected to **LES_IC_SENSE** (input).
 - Through resistor **R323** (OR NM) to **EXP_HEADER7** (output) and **BREAKOUT_BOT8** (output).



PD Connections

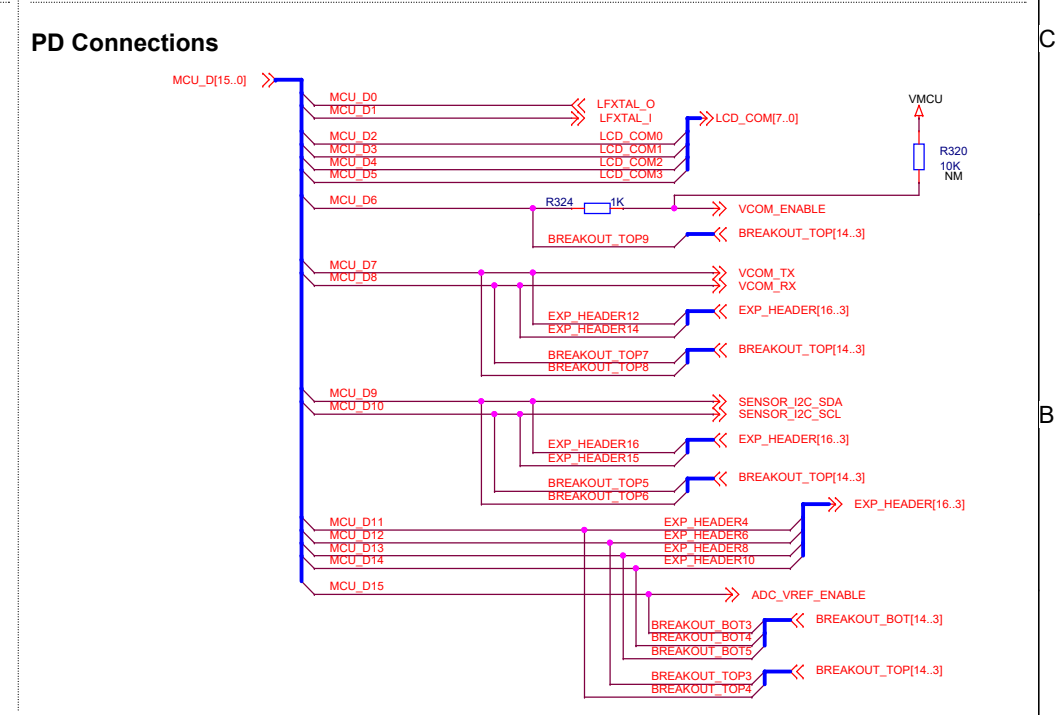
The diagram illustrates the pin connections for the PD (Peripheral Device) from the MCU (Microcontroller Unit). The MCU pins are listed on the left, and the corresponding connections are shown on the right.

- MCU_D[15:0]**: Connected to the LCD_COM[7..0] bus.
- MCU_D0**: Connected to LFX TAL_O.
- MCU_D1**: Connected to LFX TAL_I.
- MCU_D2**: Connected to LCD_COM0.
- MCU_D3**: Connected to LCD_COM1.
- MCU_D4**: Connected to LCD_COM2.
- MCU_D5**: Connected to LCD_COM3.
- MCU_D6**: Connected to VCOM_ENABLE. A 1K resistor (R324) is connected between MCU_D6 and VCOM_ENABLE.
- MCU_D7**: Connected to VCOM_TX.
- MCU_D8**: Connected to VCOM_RX.
- MCU_D9**: Connected to SENSOR_I2C_SDA.
- MCU_D10**: Connected to SENSOR_I2C_SCL.
- MCU_D11**: Connected to EXP_HEADER4.
- MCU_D12**: Connected to EXP_HEADER6.
- MCU_D13**: Connected to EXP_HEADER8.
- MCU_D14**: Connected to EXP_HEADER10.
- MCU_D15**: Connected to ADC_VREF_ENABLE.

Other connections shown include:

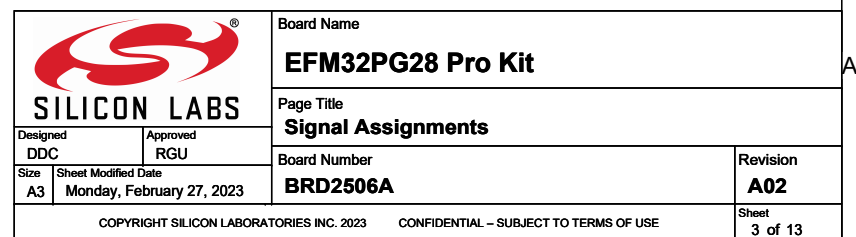
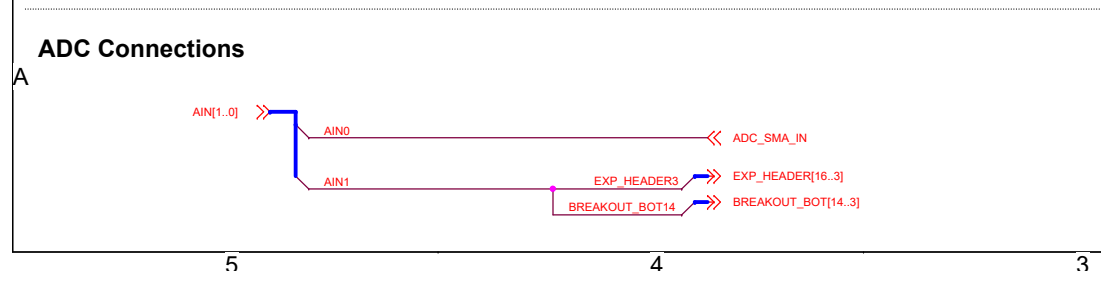
- BREAKOUT_TOP9**: Connected to BREAKOUT_TOP[14..3].
- BREAKOUT_TOP7**: Connected to BREAKOUT_TOP[14..3].
- BREAKOUT_TOP8**: Connected to BREAKOUT_TOP[14..3].
- BREAKOUT_TOP5**: Connected to BREAKOUT_TOP[14..3].
- BREAKOUT_TOP6**: Connected to BREAKOUT_TOP[14..3].
- BREAKOUT_BOT3**: Connected to BREAKOUT_BOT[14..3].
- BREAKOUT_BOT4**: Connected to BREAKOUT_BOT[14..3].
- BREAKOUT_BOT5**: Connected to BREAKOUT_BOT[14..3].
- BREAKOUT_TOP3**: Connected to BREAKOUT_TOP[14..3].
- BREAKOUT_TOP4**: Connected to BREAKOUT_TOP[14..3].


The diagram also shows a VCOM pin connected to VMCU and a 10K resistor (R320) connected between VCOM and VMCU.





ADC Connections


The diagram shows the timing of ADC connections. The horizontal axis represents time, with markers at 5 and 4. The vertical axis is labeled 'A'. The signal AIN[1..0] is shown as a blue step function. AIN0 is connected to ADC_SMA_IN, and AIN1 is connected to EXP_HEADER3 and BREAKOUT_BOT14. The signals EXP_HEADER3 and BREAKOUT_BOT14 are shown as blue step functions. The signals ADC_SMA_IN, EXP_HEADER[16..3], and BREAKOUT_BOT[14..3] are shown as red step functions.





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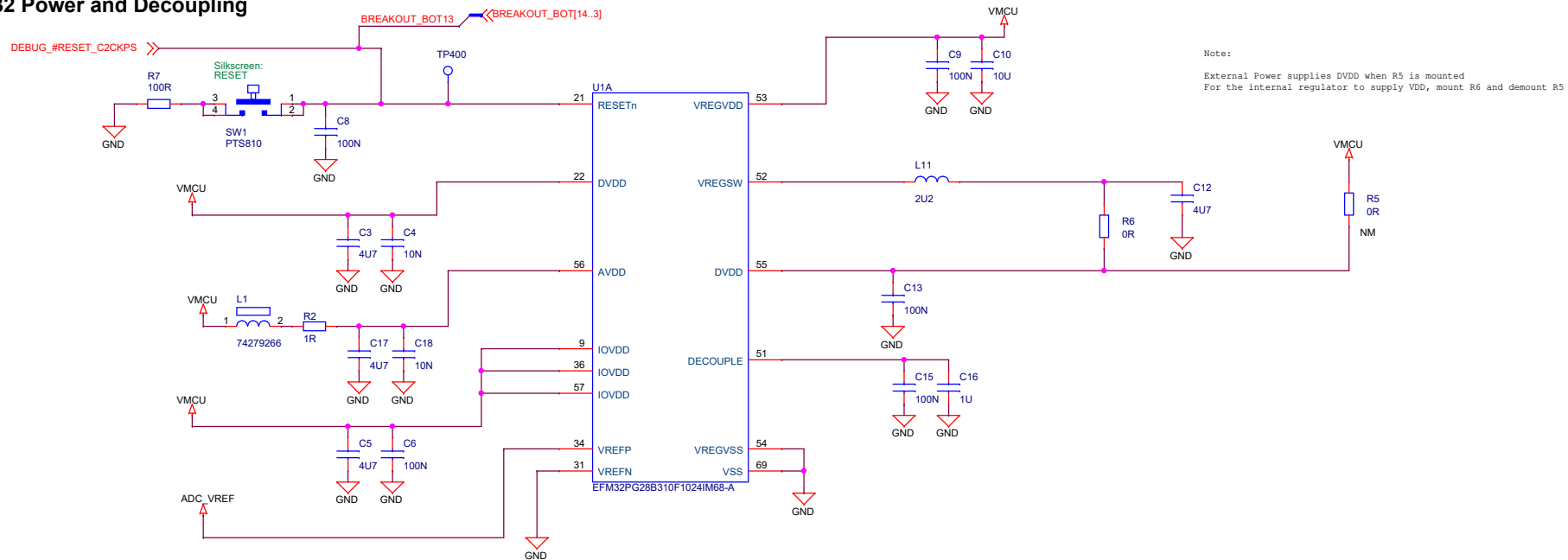
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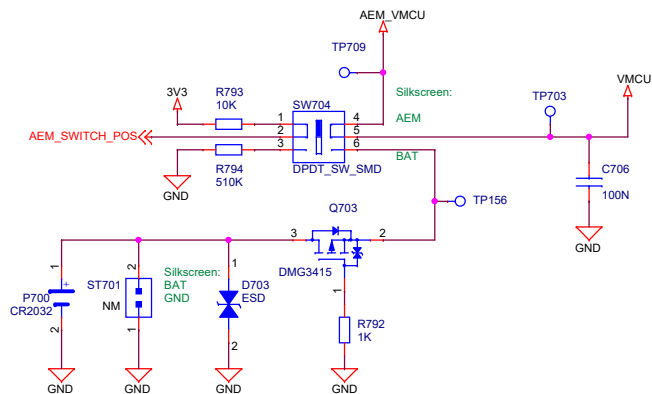
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EFM32 Power and Decoupling



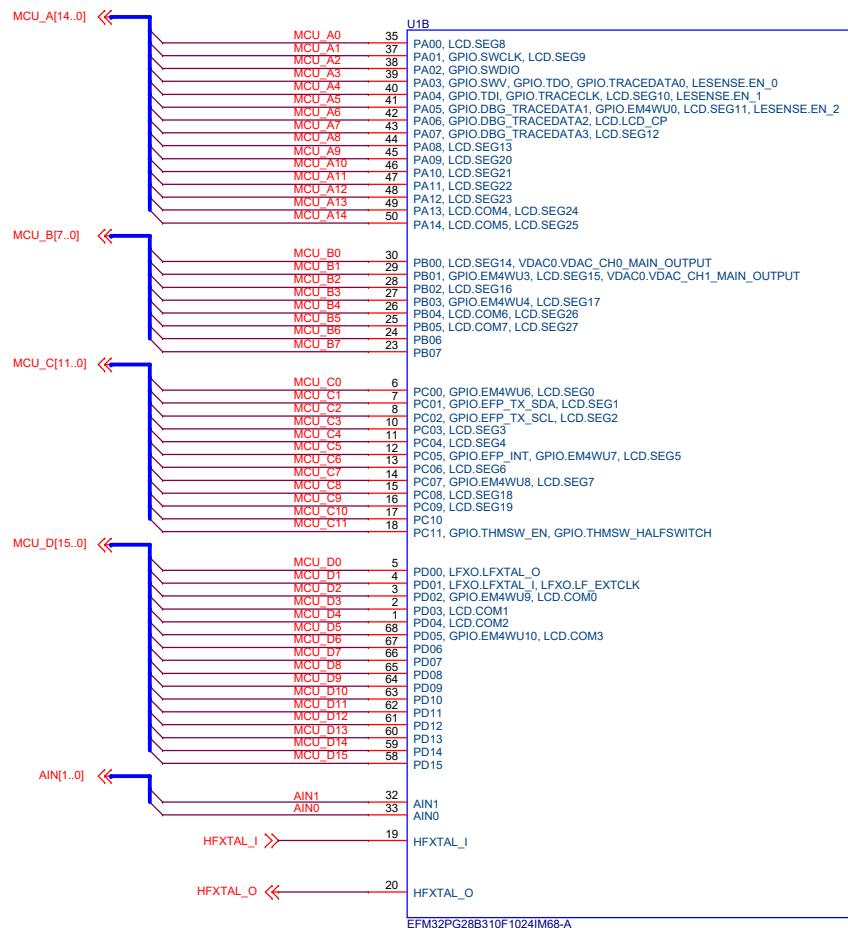
Power Select Switch: AEM/BAT

SWITCH POS	MODE DESCRIPTION
AEM	AEM Enabled, VMCU sourced from external 3.3V LDO powered by BC USB 5V supply
BAT	AEM Disabled, VMCU sourced from coin-cell battery or external power supply

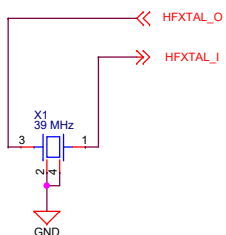


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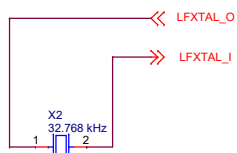
EFM32 MCU



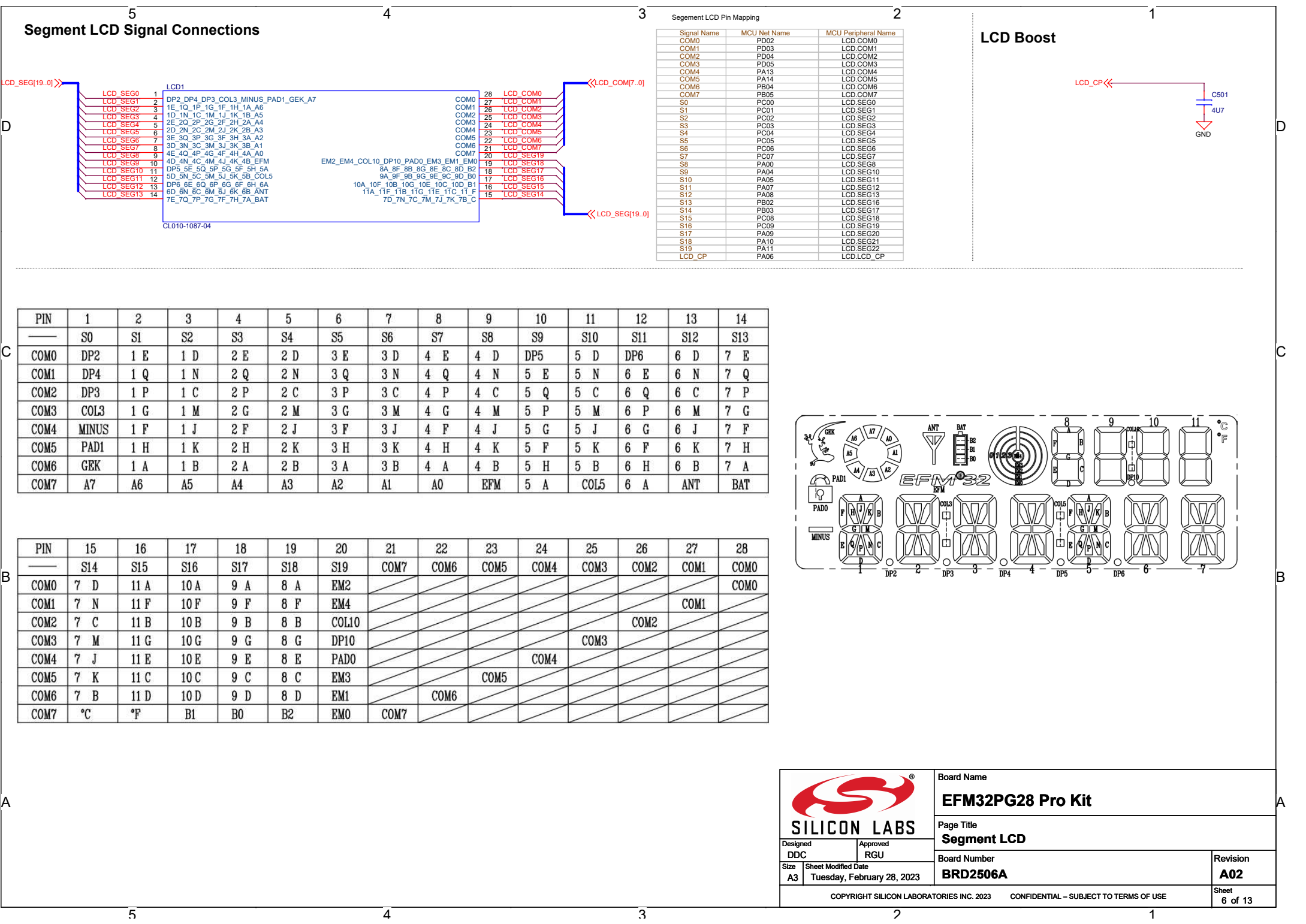
High Frequency Clock



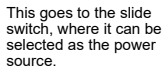
Low Frequency Clock



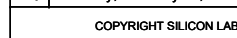
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A



CALIBRATE	Calibration Current
0x1	3.30 uA
0x2	132.5 uA
0x4	323.5 uA
0x6	456.1 uA
0x8	12.36 mA

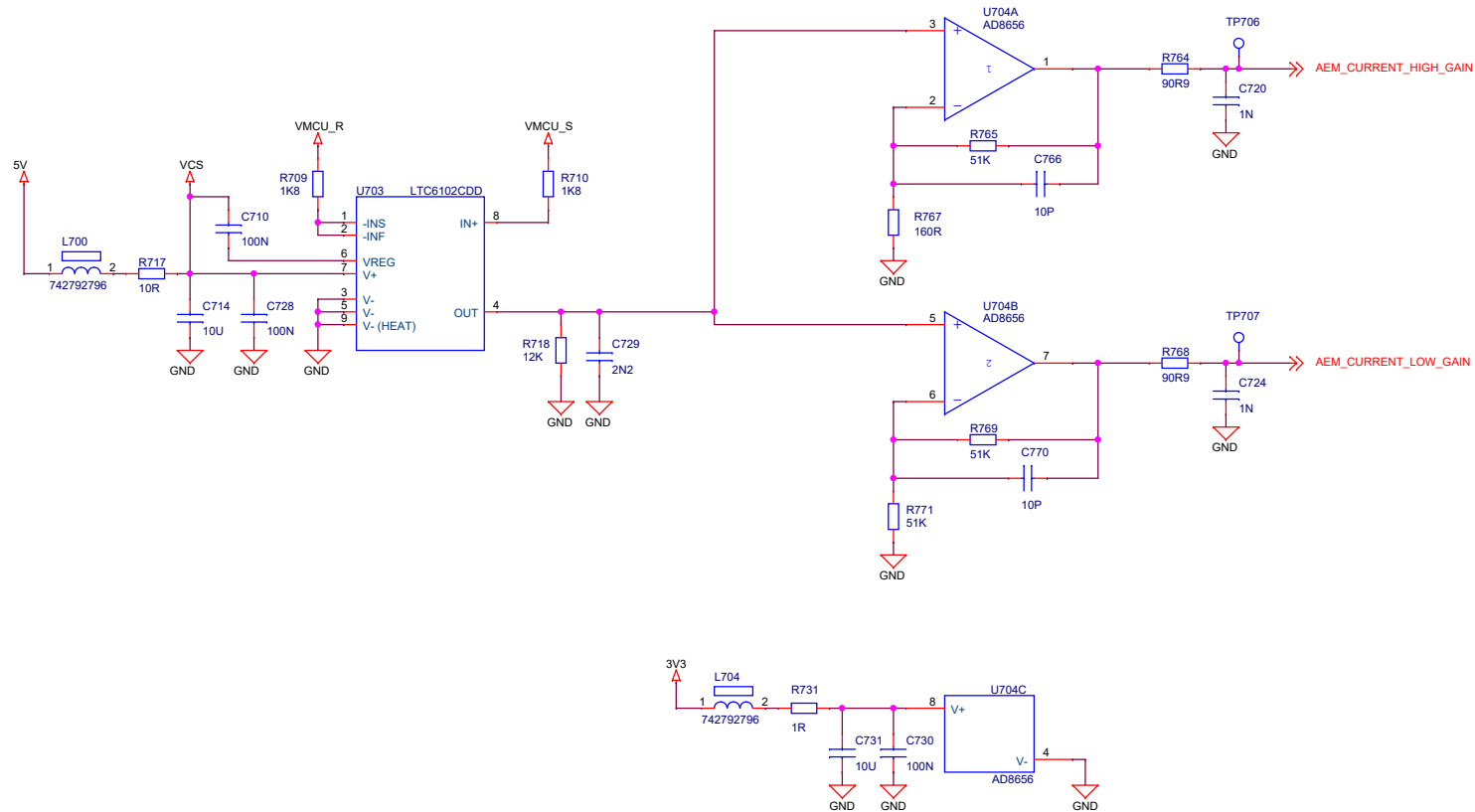


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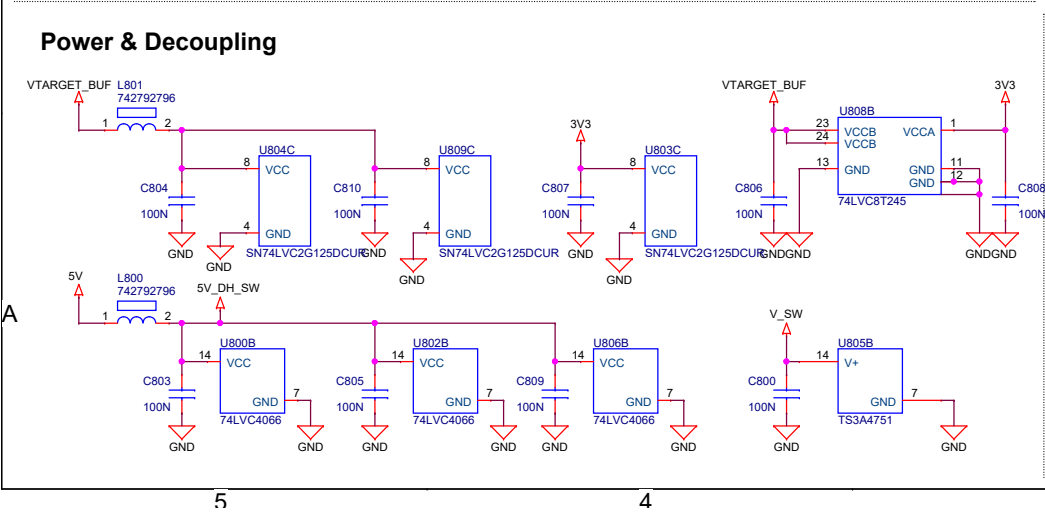
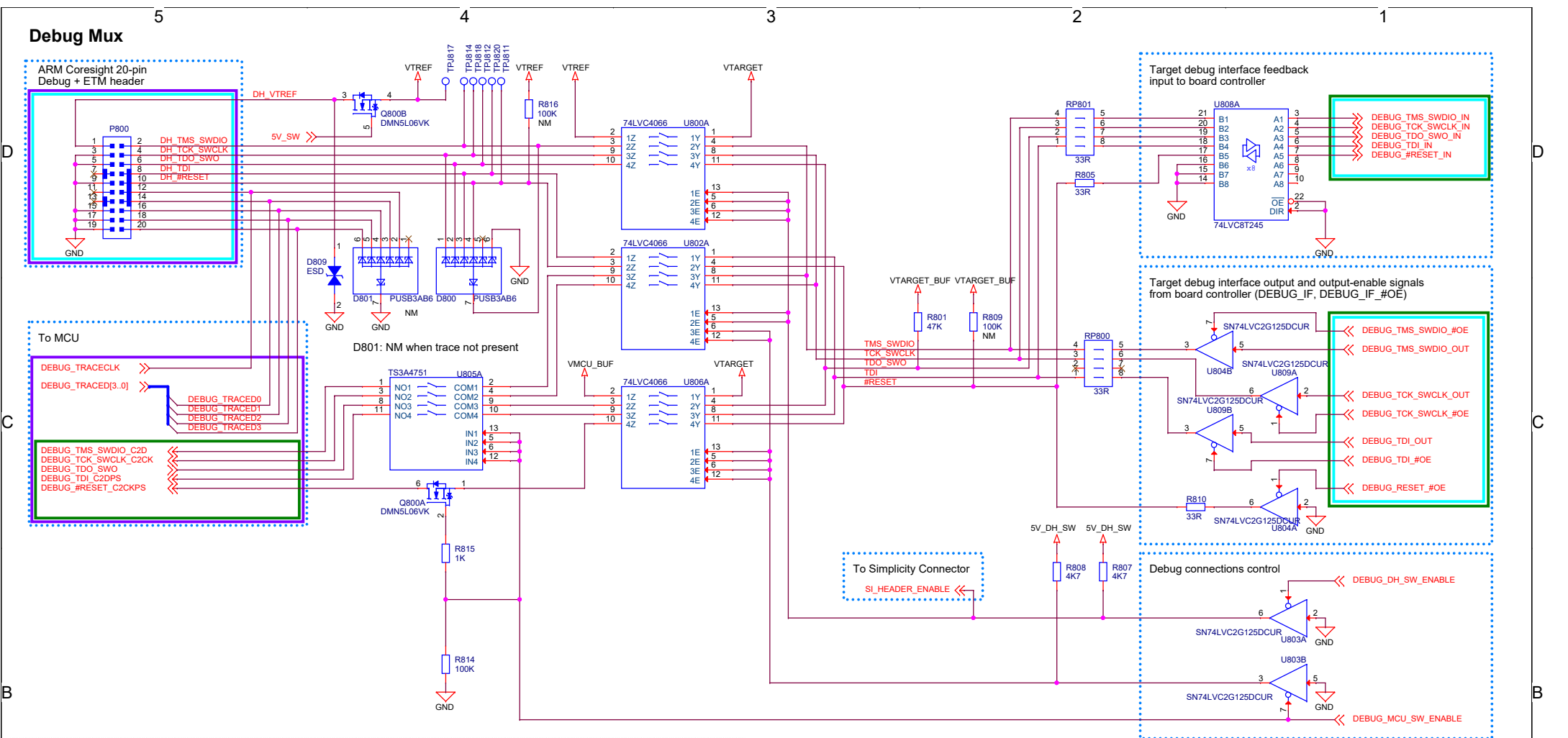
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MCU Current Sense




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Mode	DEBUG_DH_SW_ENABLE	DEBUG_MCU_SW_ENABLE	DEBUG_IF_#OE	VTREF	VTARGET
Debug Out	1	0	0/1	External voltage	External voltage
MCU Debug	0	1	0/1	Disconnected	VMCU
Debug In	1	1	1	VMCU	VMCU
Debug Off	0	0	1	-	-

Color coded frames indicates which groups of signal nodes that are active in a given debug mode



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Debug Interface

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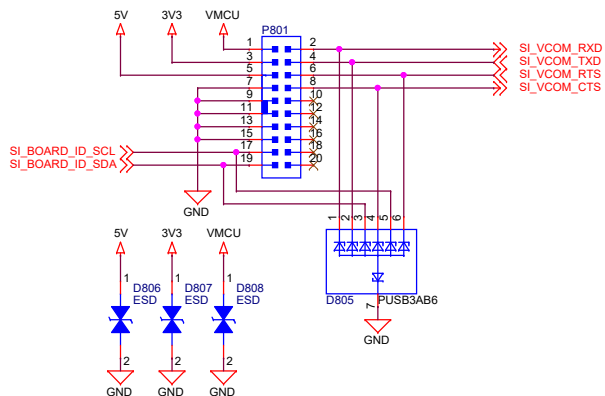
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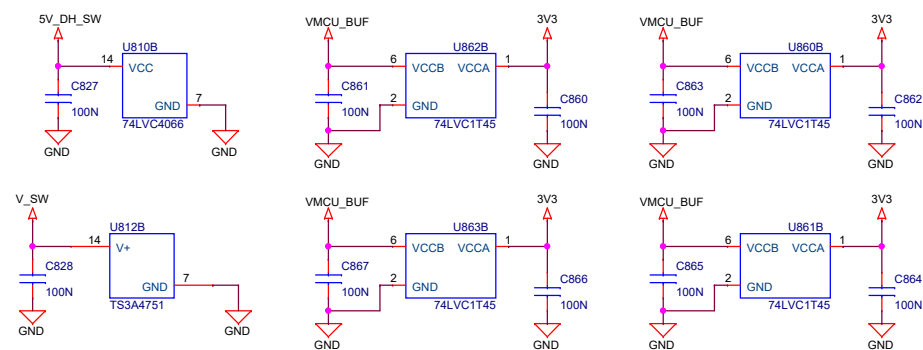
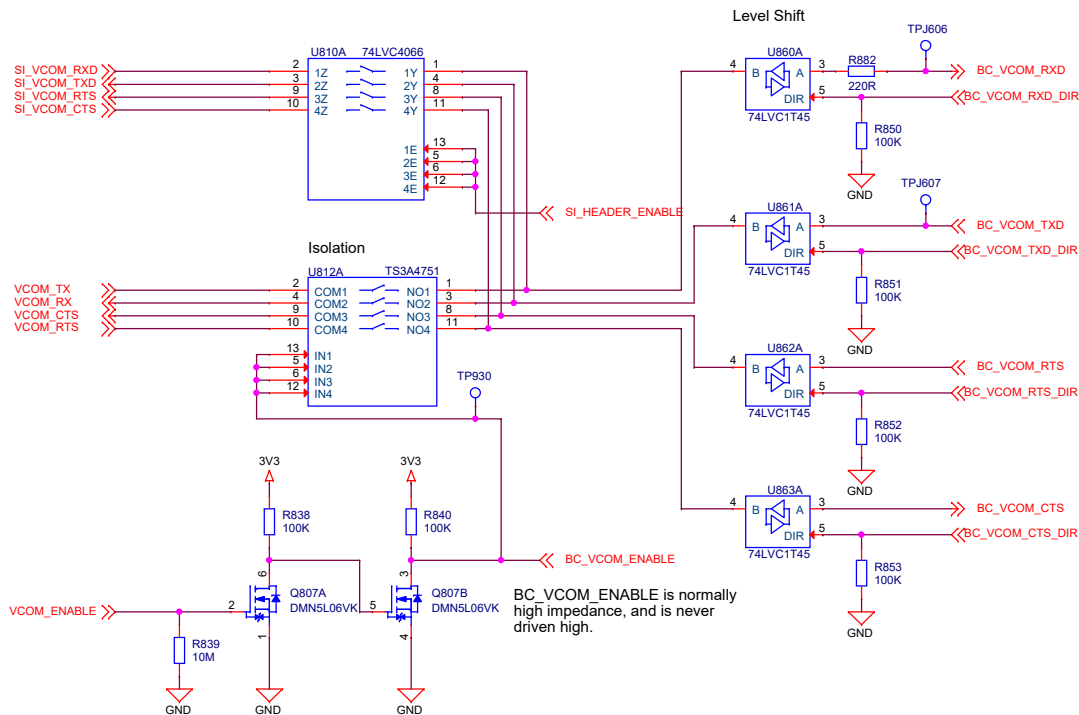
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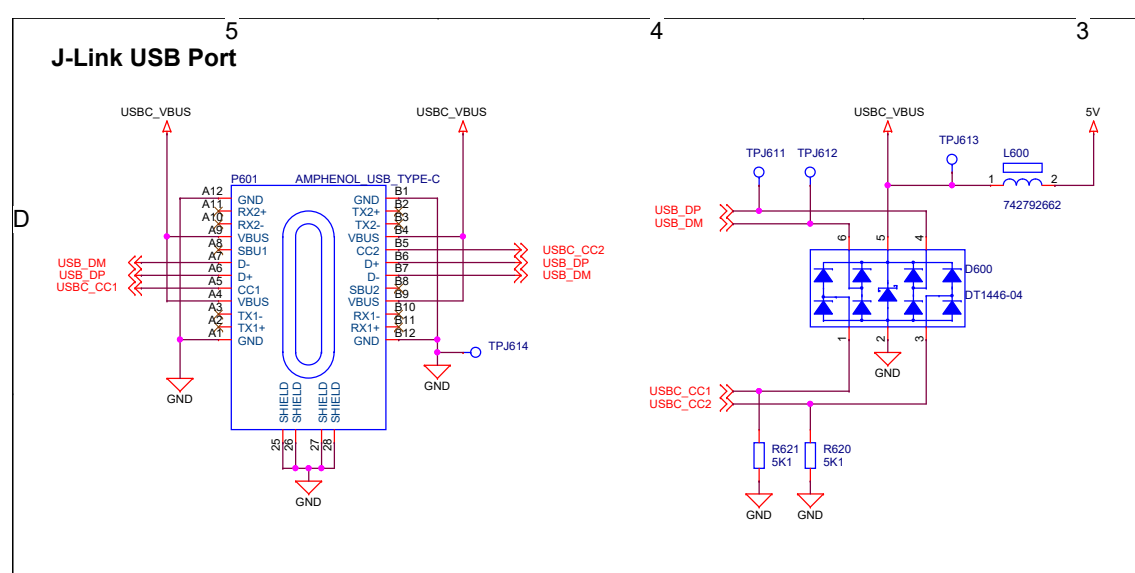
Simplicity Connector



VCOM Interface

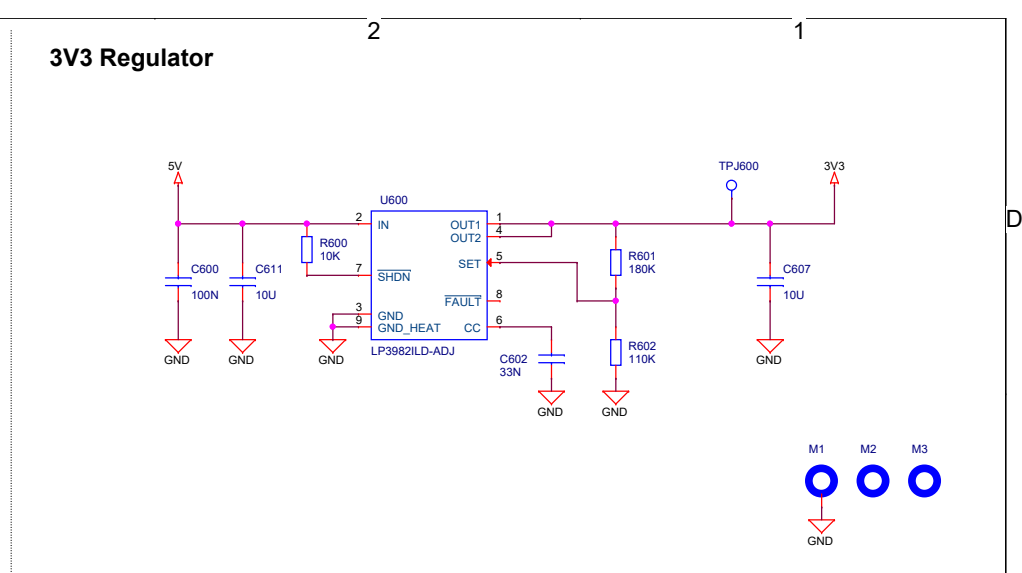


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		Simplicity & VCOM	
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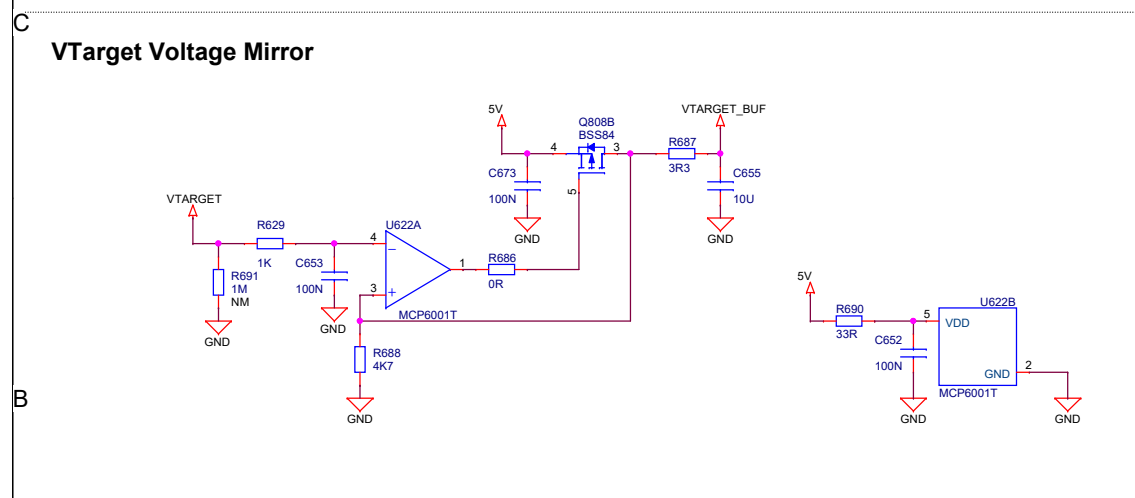
3V3 Regulator

The schematic diagram illustrates a 3V3 Regulator circuit. The central component is the LP3982ILD-ADJ (U600) voltage regulator. The input (IN, pin 2) is connected to a 5V supply through a 100nF capacitor (C600) and a 10uF capacitor (C611). The shutdown pin (SHDN, pin 7) is pulled up to the 5V supply with a 10K resistor (R600). The regulator's ground pins (GND, pin 3; GND_HEAT, pin 9) are connected to ground. The output (OUT1, pin 1) is connected to a 3V3 supply through a 180K resistor (R601). The setpoint pin (SET, pin 5) is connected to ground through a 33nF capacitor (C602). The fault pin (FAULT, pin 8) is connected to ground through a 110K resistor (R602). The output is also filtered with a 10uF capacitor (C607). A test point TPJ600 is located at the output. Three measurement points M1, M2, and M3 are indicated at the output node.



B

VTARGET Voltage Mirror



Power Supply for Analog Switches

Analog switches used for isolation are powered by 3V6_SW when the USB cable is connected, otherwise by VMCU.

J-Link USB Cable	PMOS State	NMOS State	V_SW	VMCU_SENSE
Connected	Off	On	3.6V	VMCU
Disconnected	On	Off	VMCU	Isolated

The diagram illustrates the power supply for analog switches. It shows a 5V input connected to a 47R resistor (R622). The circuit includes three MOSFETs (Q600A, Q600B, Q601A) driving the gates of the switches. The switches are connected to VMCU, V_SW, and 3V6_SW. A 5V_SW output is also shown.

Power Supply for Analog Switches

Analog switches used for isolation are powered by 3V6_SW when the USB cable is connected, otherwise by VMCU.

J-Link USB Cable	PMOS State	NMOS State	V_SW	VMCU_SENSE
Connected	Off	On	3.6V	VMCU
Disconnected	On	Off	VMCU	Isolated

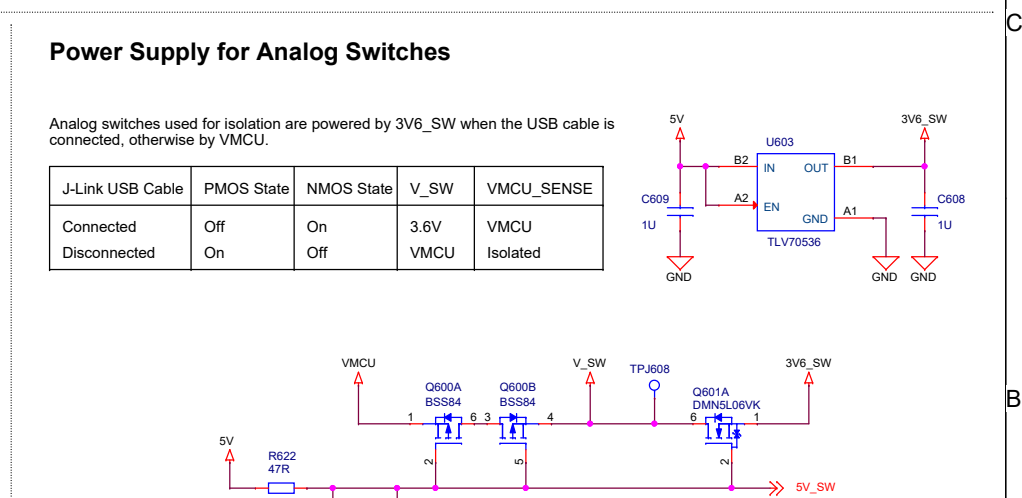
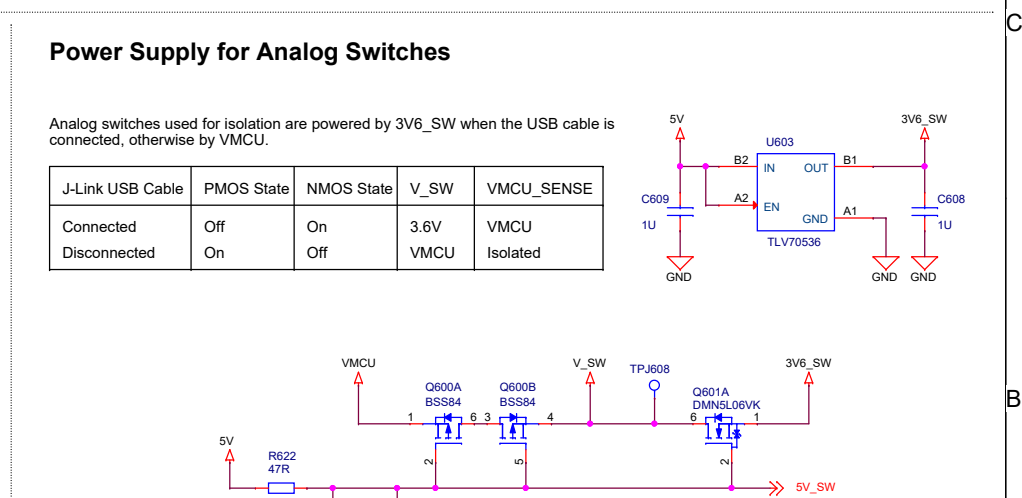
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Power Supply for Analog Switches

Analog switches used for isolation are powered by 3V6_SW when the USB cable is connected, otherwise by VMCU.

J-Link USB Cable	PMOS State	NMOS State	V_SW	VMCU_SENSE
Connected	Off	On	3.6V	VMCU
Disconnected	On	Off	VMCU	Isolated

The diagram illustrates the power supply for analog switches. It shows a 5V input connected to a 47R resistor (R622). The circuit includes three MOSFETs (Q600A, Q600B, Q601A) driving the gates of the switches. The switches are connected to VMCU, V_SW, and 3V6_SW. A 5V_SW output is also shown.



VMCU Voltage Mirror

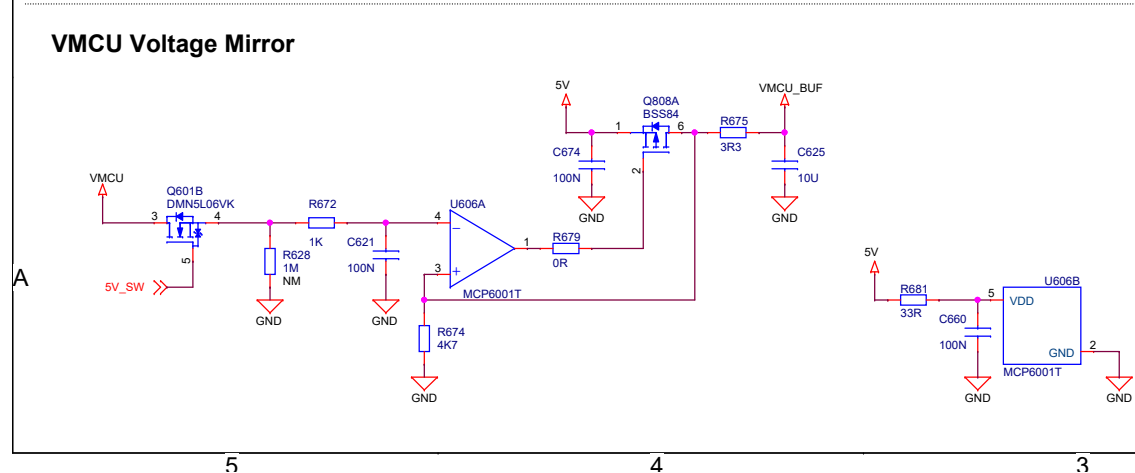
The schematic diagram illustrates the VMCU Voltage Mirror circuit. It features two operational amplifiers, U606A and U606B, both MCP6001T, and a MOSFET, Q808A (BSS84).

U606A (MCP6001T) Configuration:

- Non-inverting Input (Pin 3):** Connected to the VMCU signal through a 1M resistor (R628) and a 100nF capacitor (C621) to ground.
- Inverting Input (Pin 4):** Connected to the output (Pin 1) through a 1k resistor (R672) and to ground through a 4k7 resistor (R674).
- Output (Pin 1):** Connected to the base of the MOSFET (Q808A) through a 0R resistor (R679).
- 5V Supply:** Connected to the MOSFET's gate through a 100nF capacitor (C674) and to the MOSFET's source through a 100nF capacitor (C674).
- MOSFET (Q808A):** Source is connected to ground. Drain is connected to the VMCU_BUF output through a 3R3 resistor (R675).

U606B (MCP6001T) Configuration:

- Non-inverting Input (Pin 3):** Connected to the 5V supply through a 33R resistor (R681).
- Inverting Input (Pin 4):** Connected to the output (Pin 1) through a 100nF capacitor (C660) and to ground through a 4k7 resistor (R674).
- Output (Pin 1):** Connected to the base of the MOSFET (Q808A) through a 0R resistor (R679).
- 5V Supply:** Connected to the MOSFET's gate through a 100nF capacitor (C674) and to the MOSFET's source through a 100nF capacitor (C674).
- MOSFET (Q808A):** Source is connected to ground. Drain is connected to the VMCU_BUF output through a 3R3 resistor (R675).



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Board Controller

The diagram illustrates the internal connections of the Board Controller, featuring three microcontrollers (U900A, U900B, U900C) and various peripheral components.

U900A (Left): Includes a 48MHz crystal (X900) and a 10MHz reference clock input (TPJ912). It is connected to U900B and U900C via various signal lines. Key signals include:

- DEBUG_TMS_SWIDIO_OUT, DEBUG_TCK_SWCLK_OUT, DEBUG_TMS_SWIDIO_OE, DEBUG_RESET_OE, DEBUG_TDO_SWO_IN, DEBUG_TDI_OUT, DEBUG_TDI_OE
- DEBUG_TMS_SWIDIO_IN, DEBUG_TCK_SWCLK_IN
- DEBUG_TDI_IN, DEBUG_RESET_IN, BOARD_VER0, BOARD_VER1, DEBUG_SWCLK_OE
- DEBUG_DH_SW_ENABLE, BC_VCOM_ENABLE, BC_DISP_AVAILABLE, DEBUG_MCU_SW_ENABLE
- BC_BUTTON_ENABLE, BC_VCOM_RXD_DIR, BC_VCOM_TXD_DIR, AEM_CURRENT_LOW_GAIN, BC_DAC_OUT
- BC_TRACED2 (connected to TPJ960)

U900B (Middle): Connected to U900A and U900C. Key signals include:

- BC_VCOM_RTS, BC_VCOM_CTS, BC_VCOM_TXD, BC_VCOM_RXD, BC_VCOM_RTS_DIR, BC_VCOM_CTS_DIR, BOARD_ID_SDA, BOARD_ID_SCL, BOARD_ID_WP
- LED_STATUS_R, BC_DISP_PWR_ENABLE, LED_STATUS_G, BC_DISP_SPI_CS, BC_DISP_SPI_SCLK
- AEM_5V_ENABLE, AEM_SWITCH_POS, AEM_CURRENT_HIGH_GAIN (connected to TPJ905), AEM_SENSE_SELECT, AEM_VMCU_ENABLE, BC_ADC_SPI_COPI, BC_ADC_SPI_CPO, BC_ADC_SPI_SCLK, BC_ADC_SPI_CS
- BC_I2C_EXP_ENABLE (connected to TPJ959), BC_TRACED1 (connected to TPJ959)

U900C (Right): Connected to U900A and U900B. Key signals include:

- AEM_CALIBRATE[3..0], AEM_CALIBRATE0, AEM_CALIBRATE1, AEM_CALIBRATE2, AEM_CALIBRATE3
- TEST_USB_ADDR0, TEST_USB_ADDR1, BC_DISP_COM, TEST_USB_ADDR2, BC_UIF_BUTTON0, BC_UIF_BUTTON1, BC_SPI_COPI, BC_SPI_CPO, BC_SPI_SCLK, BC_SPI_CS, TEST_BC_TXD, TEST_BC_RXD
- BC_DBG_TCK_SWCLK, BC_DBG_TMS_SWIDIO, BC_DBG_TDO_SWO, BC_TRACED3, TEST_MODE, BOOTLOADER_HALT, BC_DISP_SPI_COPI, LED_LINK
- USB_DM, USB_DP (connected to TPJ950), BC_TRACECLK, BC_TRACED0, R902 33R, R904 33R

Power and Ground:

- 3V3 supply connected to TPJ950.
- Ground connections for various components and pins.

Peripheral Components:

- X900: 48MHz crystal.
- TPJ912, TPJ913: 10MHz reference clock input.
- TPJ905, TPJ959, TPJ960: Test points.
- R902, R904: 33R resistors.
- EFM32GG12B410F1024GL120-A: Microcontroller package.

[illegible]

Board ID & Button Isolation

BOARD_ID_SDA
BOARD_ID_SCL
3V3
3V3
R907 4K7
R908 4K7
U901A
SDA
SCL
A0
A1
A2
WP
M24C02
3V3
R909 10K
BOARD_ID_WIP
GND
3V3
3V3
R951 100K NM
R952 100K NM
BC_UIF_BUTTON0
BC_UIF_BUTTON1
BC_I2C_EXP_ENABLE
BC_BUTTON_ENABLE
U950A
COM1
COM2
COM3
COM4
NO1
NO2
NO3
NO4
TPJ650 TPJ651
SI_BOARD_ID_SDA
SI_BOARD_ID_SCL
BC_I2C_EXP_SDA
BC_I2C_EXP_SCL
TPJ652 TPJ653
UIF_BUTTON0
UIF_BUTTON1
TS3A4751
IN1
IN2
IN3
IN4
R981 100K
R950 100K
GND
GND
V_SW
C950 10N
GND
U950B
V+
GND
TS3A4751
7
GND
3V3
C951 100N
GND
U901B
VCC
VSS
M24C02
8
4
GND
GND

BC Serial Flash

3V3
3V3
BC_SPI_COP1
BC_SPI_SCLK
BC_SPI_CS
BC_SPI_CIP0
U902A
SI / SIO0
SCLK
CS#
SO / SIO1
WP# / SIO2
RESET# / SIO3
MX25R8035F
R906 10K
3V3
C914 100N
GND
GND
U902B
VCC
GND
MX25R8035F
8
4
GND
GND

Board Version

BOARD_V0
BOARD_V01
R931 1K
R930 1K
GND
GND

SILICON LABS

Designed DDC	Approved RGU
Size A3	Sheet Modified Date Monday, February 27, 2023
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Board Name EFM32PG28 Pro Kit	
Page Title Board Controller	
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BC Serial Flash

BC_SPI_COP1
BC_SPI_SCLK
3V3
3V3
R906 10K
BC_SPI_CS
BC_SPI_CPO
U902A
SI / SIO0
SCLK
CS#
WP# / SIO2
RESET# / SIO3
SO / SIO1
MX25R8035F
U902B
VCC
GND
C914 100N
GNDGND
R931 1K
R930 1K
BOARD_VER0
BOARD_VER1

Board Version

BOARD_VER0
BOARD_VER1
R931 1K
R930 1K
GND
GND

Name	
M32PG28 Pro Kit	
Title	
Board Controller	
Part Number	Revision
D2506A	A02
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BC Serial Flash

BC_SPI_COP1
BC_SPI_SCLK
3V3
3V3
R906 10K
BC_SPI_CS
BC_SPI_CPO
U902A
SI / SIO0
SCLK
CS#
WP# / SIO2
RESET# / SIO3
MX25R8035F
SO / SIO1
2
1
5
6
3
7
4

3V3
C914 100N
GNDGND
U902B
VCC
GND
MX25R8035F
8
4

BOARD_VER0
BOARD_VER1
R931 1K
R930 1K
GND
GND

Board Version

BOARD_VER0
BOARD_VER1
R931 1K
R930 1K
GND
GND

Name	
M32PG28 Pro Kit	
Title	
Board Controller	
Part Number	Revision
D2506A	A02
INC. 2023	Sheet
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Board Name		A
EFM32PG28 Pro Kit		
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Board Controller		
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Board Name		A
EFM32PG28 Pro Kit		
Page Title		
Board Controller		
Board Number		Revision
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Board Name		A
EFM32PG28 Pro Kit		
Page Title		
Board Controller		
Board Number		Revision
BRD2506A		A02
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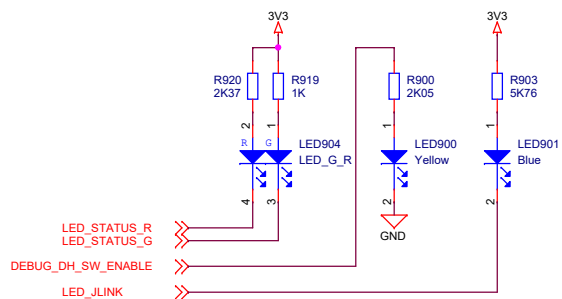
Board Name		A
EFM32PG28 Pro Kit		
Page Title		
Board Controller		
Board Number		Revision
BRD2506A		A02
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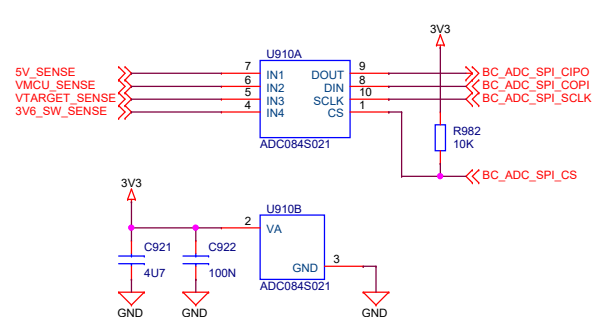
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 SILICON LABS		Board Name	
		EFM32PG28 Pro Kit	
Designed DDC		Approved RGU	
Size A3	Sheet Modified Date Monday, February 27, 2023	Page Title Board Controller	
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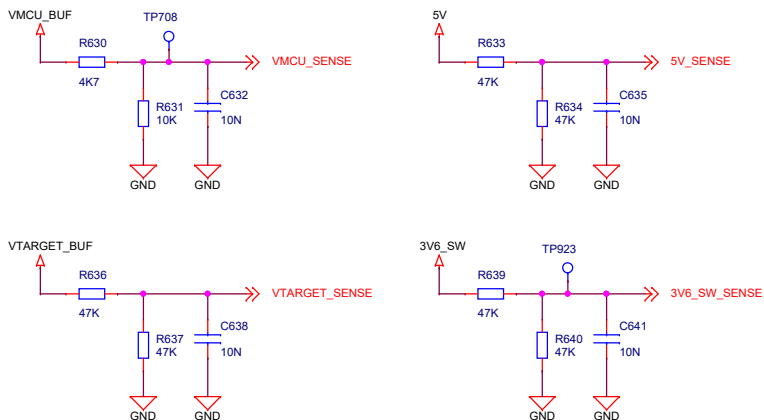
Indicator LEDs



BC Voltage Sense ADC



BC Voltage Sense



 SILICON LABS		Board Name	
		EFM32PG28 Pro Kit	
Designed DDC		Page Title	
Approved RGU		Board Controller Misc	
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