S32M27xEVB-L064

Evaluation Board for **S32M27x LIN MCUs**
Hardware User Manual

1. Table of contents

2. Definitions, Acronyms, and Abbreviations

The following list defines the abbreviations used in this document.

BST	Boost
CCM	Counter with CBC MAC (Cipher block chaining message authentication code)
CMOS	Complementary Metal Oxide Semiconductor.
CP	Charge Pump
CPU	Central Processing Unit.
CSPI	Configurable Serial Peripheral Interface.
DDR	Double Data Rate.
DIP	Dual In-line Package.
DPGA	Differential Programmable Gain Amplifier
EEPROM	Electrically Erasable Programmable Read Only Memory.
EPROM	Erasable Programmable Read Only Memory.
FET	Field-Effect Transistor
GCTL	Gate Control
GDU	Gate Driver Unit
GPIO	General Purpose Input/output.
GPO	General Purpose Output.
HG	High-side Gate
HS	High-side Source
HW	Hardware.
HVI	High Voltage Input
HVM	High Voltage Module
I2C	Inter-Integrated Circuit.
I/O	Input/output.
JTAG	Joint Test Access Group.
LED	Light Emitting Diode.
LG	Low-side Gate
LPM	Low-Power Mode
LS	Low-side Source
MB	Megabyte.
MCU	Microcontroller Unit.
MOSFET	Metal-Oxide-Semiconductor Field-Effect Transistor
MS	Memory Stick.
NVRAM	Non-volatile Random-Access Memory.
PCB	Printed Circuit Board.
PHY	Physical interface.
PMC	Power Management Controller
POR	Power-on Reset.
PSRAM	Pseudo Random Access Memory.
PWR	Power.
PWM	Pulse Width Modulation.
RAM	Random Access Memory.
SDRAM	Synchronous Dynamic Random-Access Memory.
TFT	Thin Film Transistor.
UART	Universal Asynchronous Receiver/Transmitter.
USB	Universal Serial Bus.

3. S32M27xEVB-L064 – Block Diagram

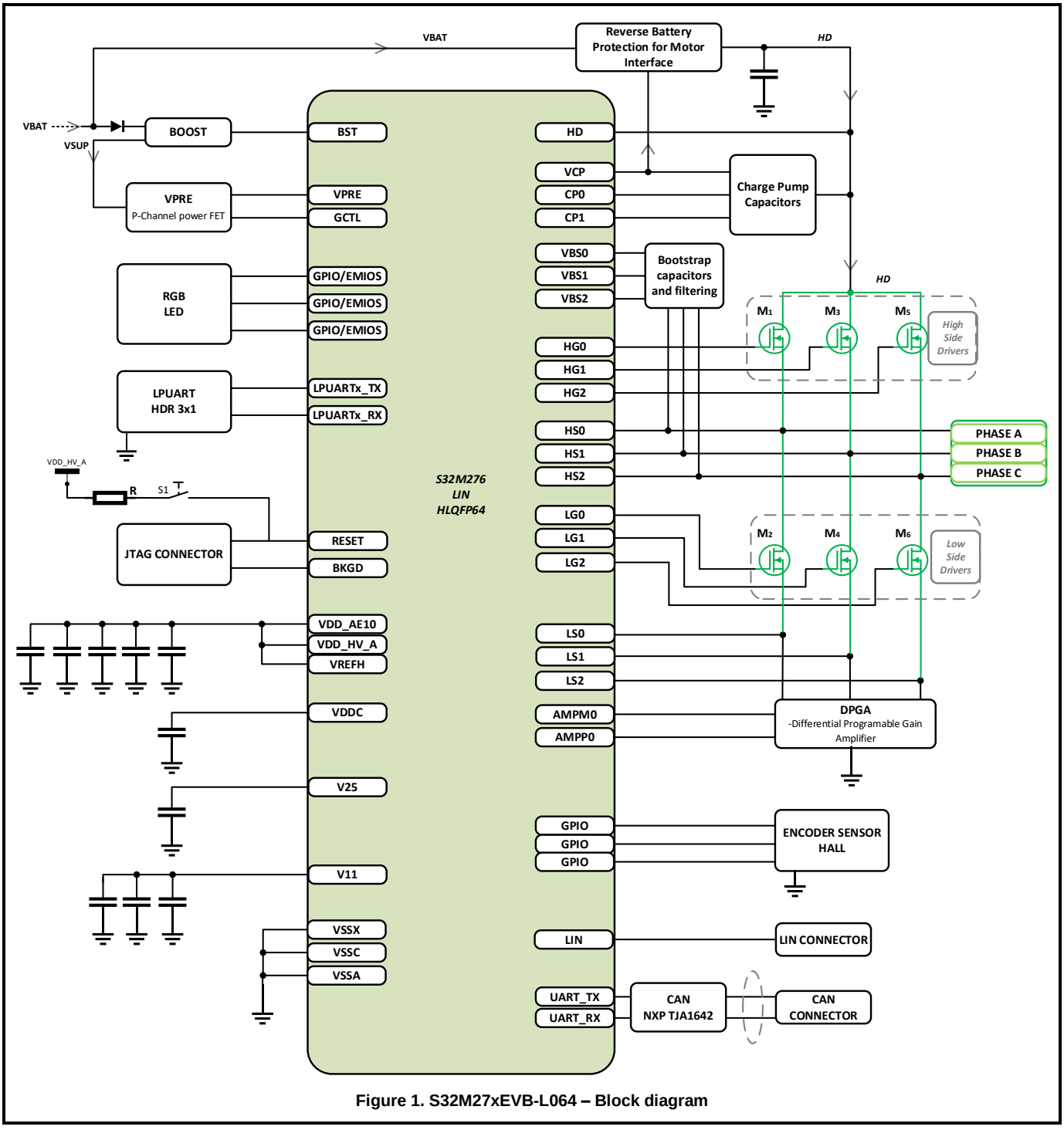


Figure 1. S32M27xEVB-L064 – Block diagram

4. S32M27xEVB-L064 - Features

IMPORTANT

- Verify and download the last version of this document in http://www.nxp.com
- Before the S32M27xEVB-L064 Evaluation board is used or power is applied, please fully read this user manual. An incorrect configuration in the board may cause a irreparable damage on the component, MCU or EVB. Power must be removed from the EVB prior to:
  - Removing or placing some component or measurement
  - Re-configuring the board jumpers

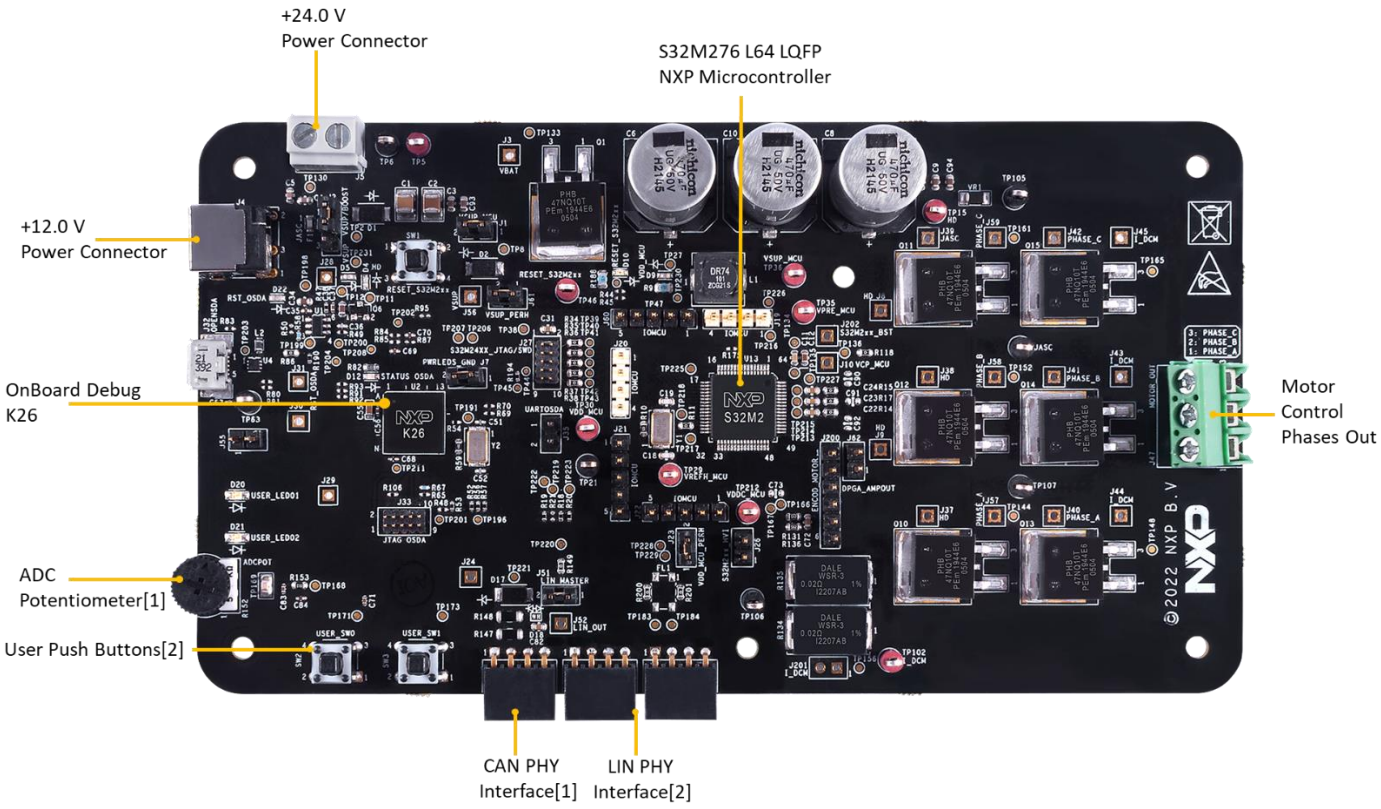


Figure 2. S32M27xEVB-L064– Features

5. S32M27xEVB-L064 – Default Configuration

Table 1. S32M27xEVB-L064 - Default Configuration

Interface	Reference / Signal	Default Configuration	Description/Comment
S32M276 MCU	U13	N/A	S32M276L_64LQFP
OnBoard Debugger	U9	PTC2	PTC2/LPUART0_RX is routed to NTS0102GD terminal B1 for serial interface to MK26FN2M0VMI18
		PTC3	PTC3/LPUART0_TX is routed to NTS0102GD terminal B2 for serial interface to MK26FN2M0VMI18
LIN Interface	Internal LIN	LIN	LIN out is routed to J53 and J54 terminal 2
CAN Interface	U11	CAN0_RX_MCU	PTE15/LPUART3_RX is routed to TJA1462 RX
		CAN0_TX_MCU	PTE16/LPUART3_TX is routed to TJA1462 TX
		CAN0_STB_MCU	PTB5 is routed to TJA1462 STB
		CANH	CANH is routed to J50 terminal 2
		CANL	CANL is routed to J50 terminal 2
User Push Buttons	SW2	PTA15	Active Low,
	SW3	PTD0	Active Low,
User LEDs	D20	PTE15	User Led 1
	D21	PTE16	User Led 2
ADC Potentiometers	ADCPOT	PTE6	ADCPOT0 is routed to PTE6 – USER_ADC

6. S32M27xEVB-L064 – Default Jumpers

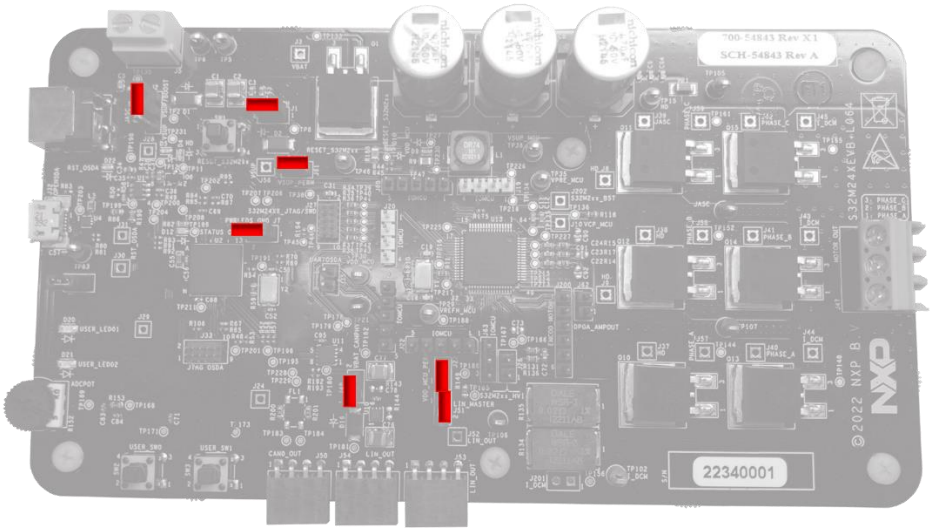


Figure 3. S32M27xEVB-L064– Default jumpers configuration

Table 2. S32M27xEVB-L064 - Default jumpers position.

Interface	Reference	Position	Description / Comments
Power Supply	**J2**	1-2	VBAT is routed to VSUP
	J61	1-2	VSUP is routed to VSUP_PERH
	J1	1-2	VSUP_MCU is routed to VSUP input of MCU
	J7	1-2	Power LEDs to ground connection
Peripherals	**J23**	1-2	VDD_MCU is connected to the VDD_MCU_PERH to supply SW peripherals (leds, buttons, user_adc) and CAN interface
LINPHY	**J51**	1-2	VSUP_PERH connected to give robustness to the LIN interface signal

7. Power Supplies Options – Overview

The EVB requires an external power supply voltage of +12V/⩾2A that can be connected in the connector J4 or J5. This allows the EVB to be easily used in a vehicle if required. The 12V input on the EVB is used to supply the microcontroller directly (VSUP) and the microcontroller generate an internally supply voltage (VDD_AE10, VDD_HV_A) with the input voltage from VPRE.

In this EVB the VSUP pin of the S32M2 is supplied a from VBAT (+12 V) after the protection and filtering phase of the board. VPRE voltage can be generated from VSUP internally or it can be either generated with an external power FET (gate controlled via GCTL pin), this last option was chosen in this EVB in order to reduce the power consumption and reduce the heat on the MCU.

7.1 S32M27xEVB-L064 – Main Power Supply

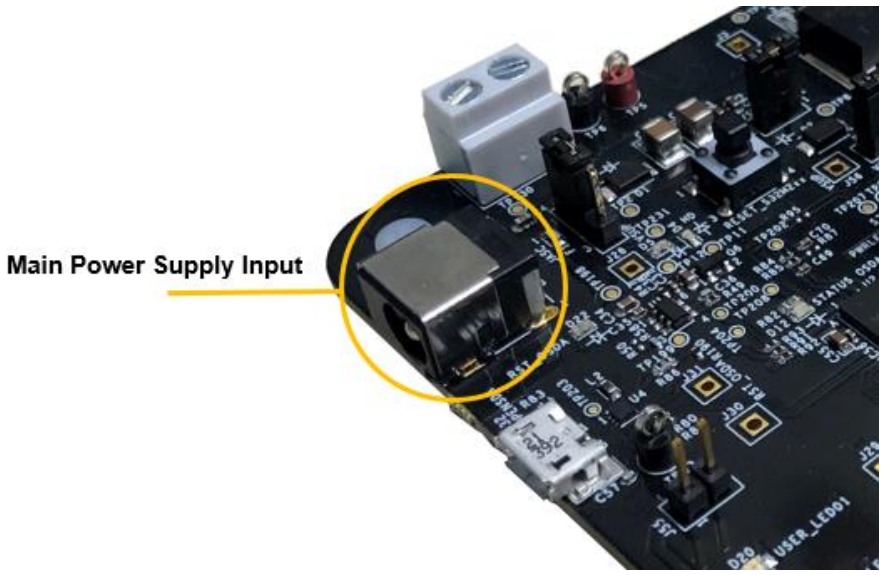
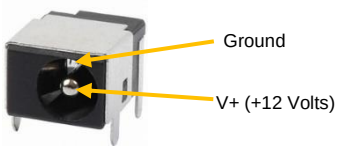


Figure 4.S32M27xEVB-L064– Main power supply input

Table 3. S32M27xEVB-L064 - Main power supply connector

Connector	Description
	**2.1mm Barrel Connector – J4** This connector should be used to connect the supplied wall-plug main adapter. Note if a replacement or alternative adapter is used, care must be taken to ensure the 2.1mm plug uses the correct polarization as shown.
	**2-Way Screw Type Connector – J5** This can be used to connect a bare wire lead to the EVB, typically from a laboratory power supply. Care must be taken to ensure correct connection. For more details consult the schematic

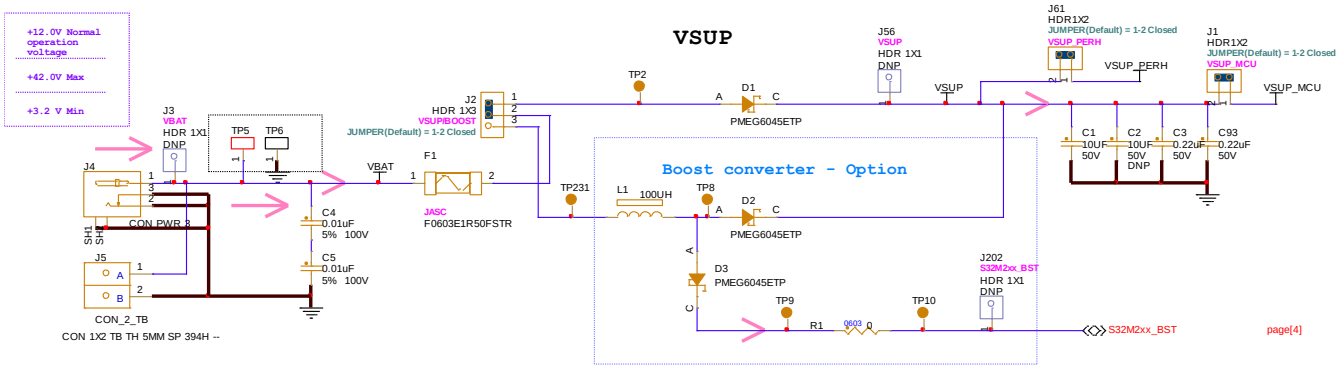


Figure 5. S32M27xEVB-L064– Main power supply input

Table 4. S32M27xEVB-L064 – VSUP jumpers description.

Interface	Reference	Position	Description / Comments
VSUP	**J2**	1-2 (Default)	(Option A) This jumper configuration routes the output from the fuse (VBAT) to a protection diode and then the supply for peripherals and MCU after bulk and decoupling capacitors for the voltage input .
		2-3	(Option B) This jumper configuration routes the output from the fuse (VBAT) to a power boost converter circuit. For more details related to the boost converter circuit consult the S32M2 Hardware Design Guidelines
	J61	1-2 (Default closed)	This header is used to supply the peripherals like RESET LED, LINPHY and USER LEDS.
	J1	1-2	This header is used to supply the VSUP input from the MCU.

7.2 S32M27xEVB-L064 – VPRE

VPRE_MCU is typical 6V and generated from the VSUP_MCU. It can be either generated with an external power FET (gate controlled via GCTL pin) or generated by a PMC internal regulator. VPRE is always powered (FPM and LPM). An external bypass capacitor in the range from 2.2uF to 4.7uF is required.

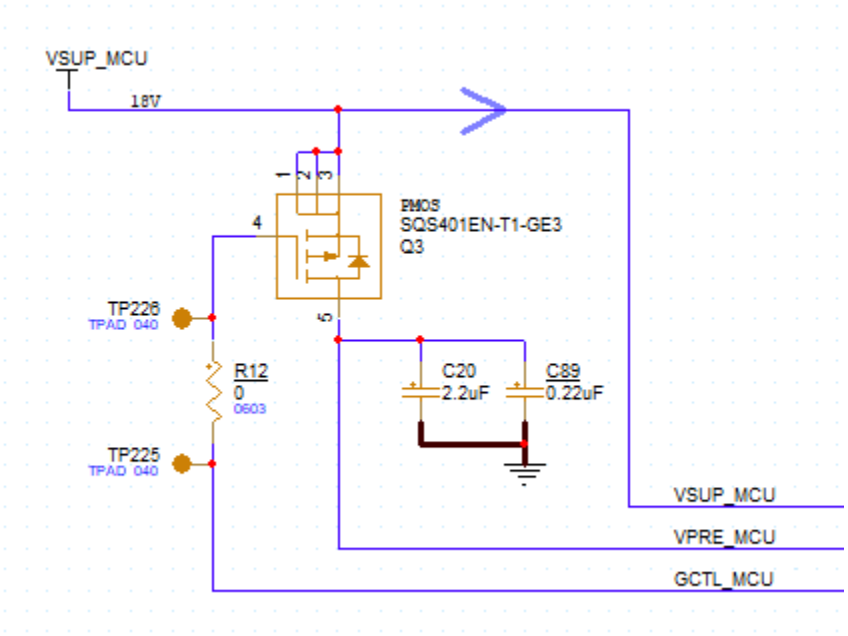


Figure 6. S32M27xEVB-C064– VPRE generated with FET

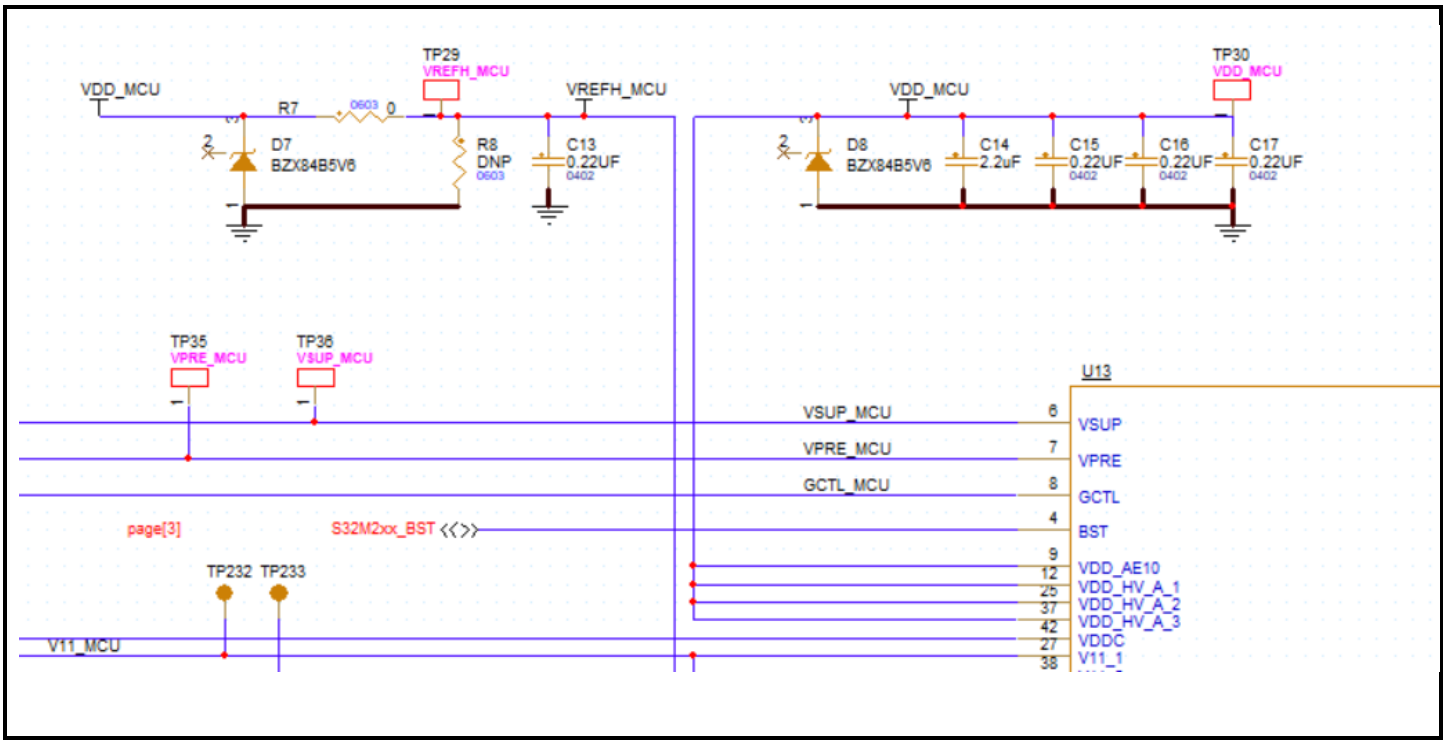
7.3 S32M27XEVB-L064 VDD_HV_A

As previously mentioned, the S32M276 is capable of internally regulating the voltage output of the VDD_HV_A_x pins, however it is mandatory to add an external bulk capacitor and one decoupling capacitor for each supply pin, for more details consult the S32M2XX Hardware Design Guidelines. In addition, the VDD_AE10 must be connected with VDD_HV_A pins to a common reference plane on PCB. The values of the decoupling and bulk capacitors are descripted in the

Table 5Error! Reference source not found.

Table 5. Decoupling and bulk capacitors value for VDD_HV_A pins

Capacitor	Characteristic	Value
Decoupling Capacitor	X7R / X8R Ceramic	100nf - 220nF
Bulk Capacitor	X7R / X8R Ceramic	4.7uF - 2.2uF



8. Motor Control Interface

The S32M27 integrates automotive qualified and application-focused capabilities like MOSFET Gate pre-drivers for motor control with 6 external power MOSFETs for BLDC or PMSM motor drive applications. The above due the S32M2XX MCU integrates a GDU which provides pre-drivers to control three-phase DC motor via external FETs. In order to support this control, it includes a charge pump and boost converter. The above replace a bootstrap circuit for gate driving.

The GDU contains three gate driver instances. Each instance drives 1 high-side FET (HG) and 1 low-side FET (LG). These high-side and low-side drivers support driving the three phases of a brushless DC motor. The primary function of a driver is to switch a MOSFET from off-state to on-state and vice versa. The pre-driver amplifies the control signals to the required levels to drive the power MOSFET. To guarantee reliable operation, the low-side drivers are supplied by the VLS regulator, while the high-side drivers are supplied directly by the bootstrap circuit over the VBS pins internally.

The outputs from the MOSFETs to the motor are connected to J47.

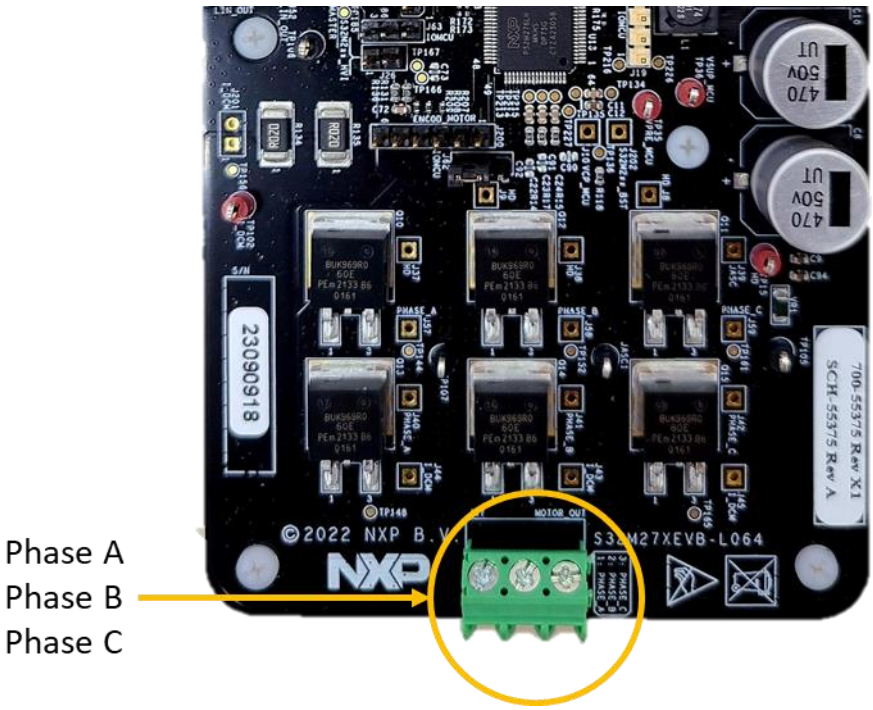
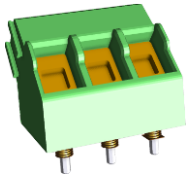


Figure 7.S32M27xEVB-L064– Motor Control Interface

Table 6.- S32M27xEVB-C064 Motor control out

Connector	Reference	Pin Number	Signal/Connection
	J47	1	PHASE A
		2	PHASE B
		3	PHASE C

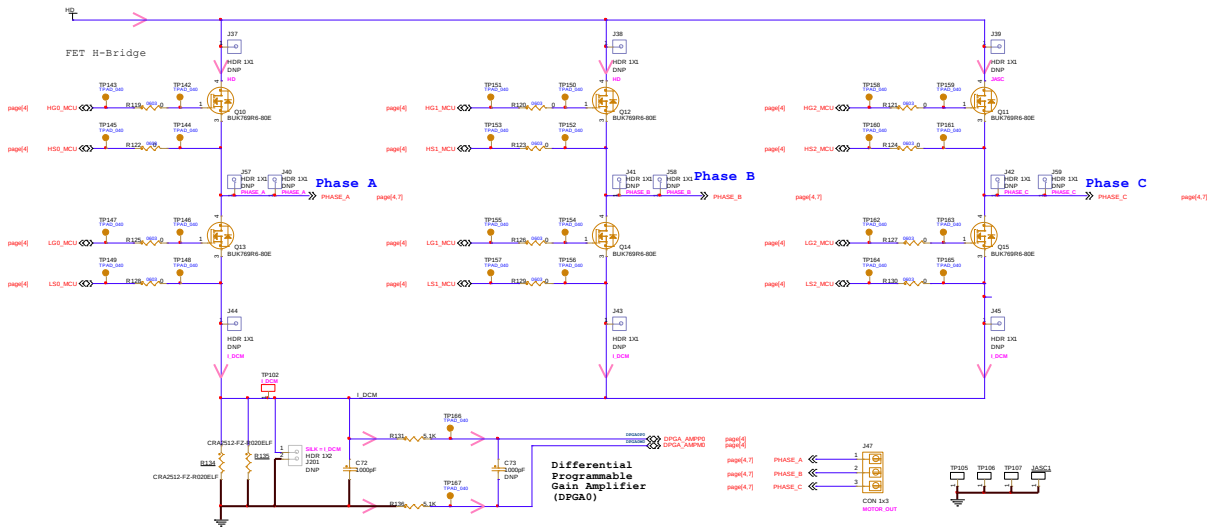


Figure 8. S32M27xEVB-L064– Motor Control Interface

9. S32M27xEVB-L064 – Programming and Debug Interface

9.1 S32M27xEVB-L064 – RESET switch and led indicator

The RESET switch [SW1] provides an input signal for manual application RESET. The S32M2 MCU will drive the RESET signal to the reset pins in the EVB [PTA5 and RESET]. The RESET LED indicator [D10] will be ON for the duration of the RESET signal. This operation indicates the S32M27 MCU is in the RESET state.

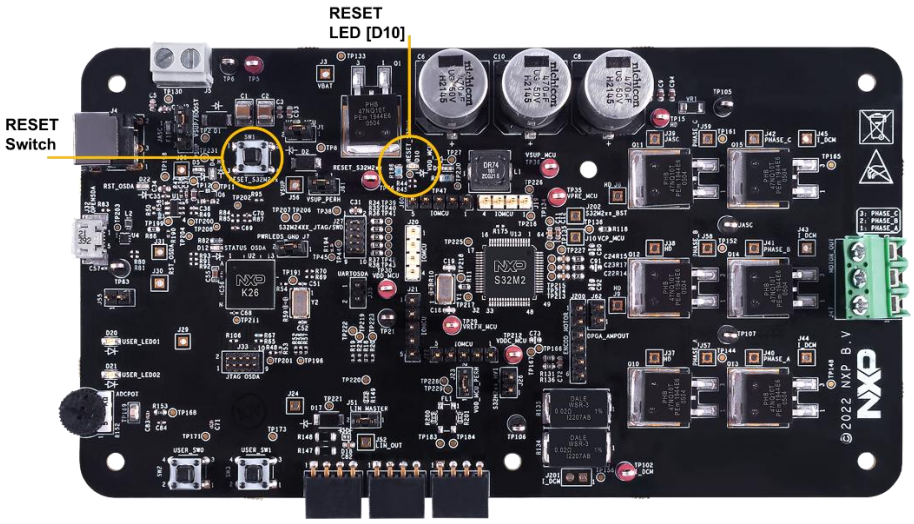


Figure 9. S32M27xEVB-L064– RESET Switch

9.2 S32M27xEVB-L064 – On-board Debugger

The EVB incorporates an On-Board Debugger as well as embedded JTAG connectors. It bridges serial and debug communications between an USB host and an embedded target processor.

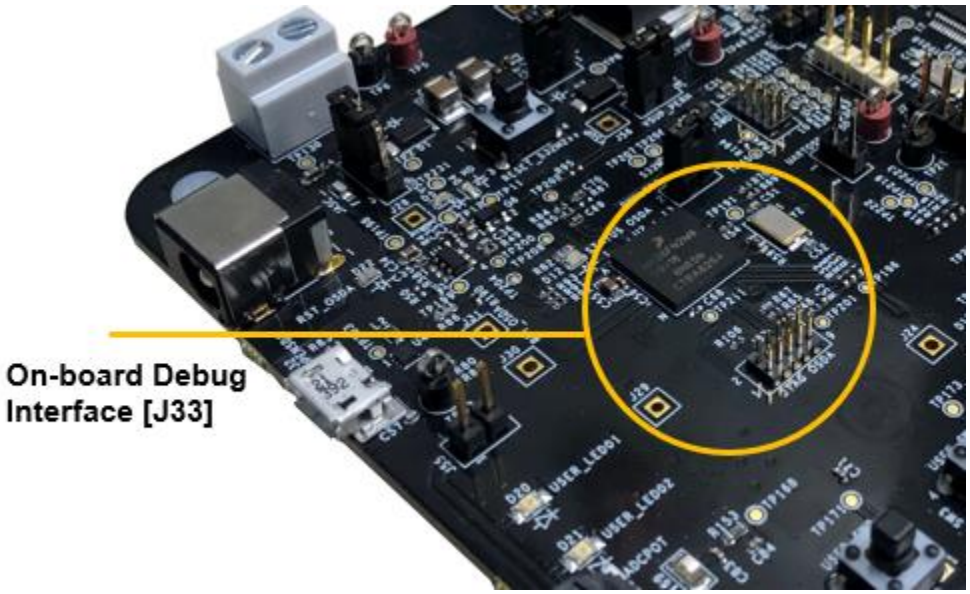


Figure 10. S32M27xEVB-L064– On-board Debugger

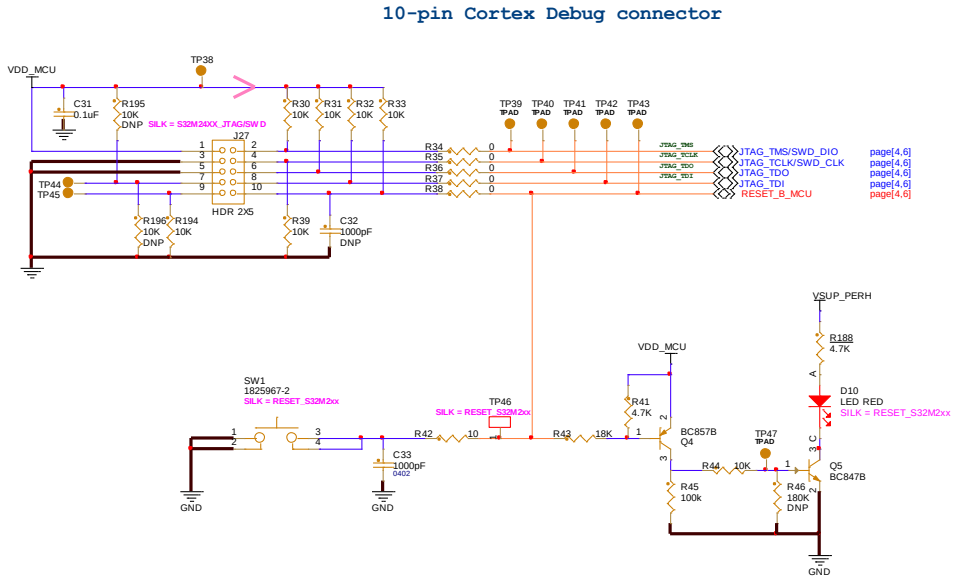


Figure 11. S32M27xEVB-L064– Cortex Debug

Table 7.- S32M27xEVB-C064 Cortex connector

Connector	Reference	Pin Number	Signal/Connection
	J27	1	VDD_MCU
		2	JTAG_TMS/SWD_DIO
		3	GND
		4	JTAG_TCLK/SWD_CLK
		5	GND
		6	JTAG_TDO
		7	DNP
		8	JTAG_TDI
		9	GND
		10	RESET_B_MCU

10. S32M27xEVB-L064 – CAN PHY

The EVB incorporates a CAN interface connected to the S32M27 MCU. Using an NXP can transceiver the TJA1462, supporting both master and slave mode (jumper selectable). The output from the CAN transceiver is connected to J50.

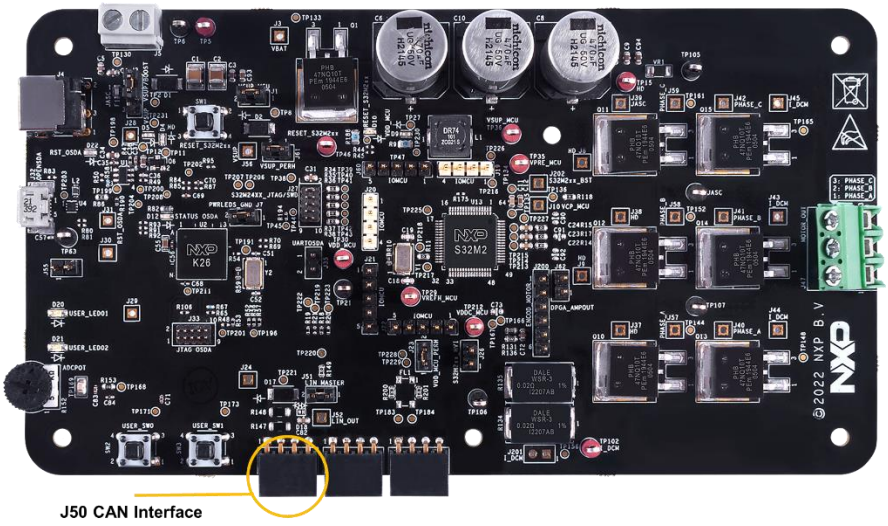


Figure 12. S32M27xEVB-L064– CAN Interface

The pinout of these headers is shown below and is also displayed on the PCB silkscreen.

Table 8.- S32M27xEVB-L064 CAN Connector

Connector	Reference	Pin Number	Signal/Connection
	J50	1	CANL
		2	CANH
		3	GND
		4	NC

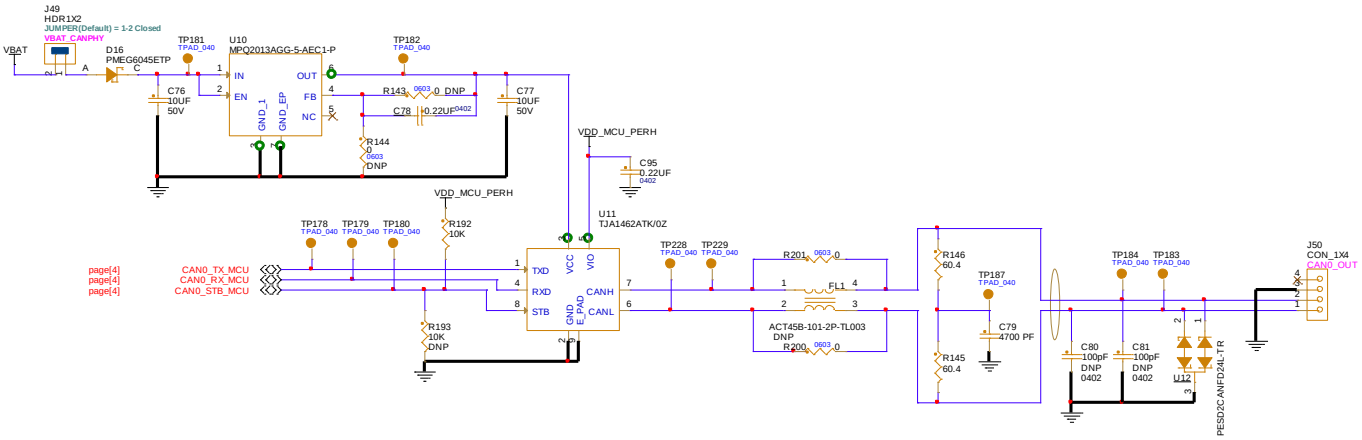


Figure 13. S32M27xEVB-L064– CAN PHY

11. S32M27xEVB-L064 – LIN PHY

The S32M27xEVB-L064 incorporates internally a LIN interface but is necessary connect the required circuitry to configure it as MASTER or SLAVE , the output signal is connected to J50 and J54.

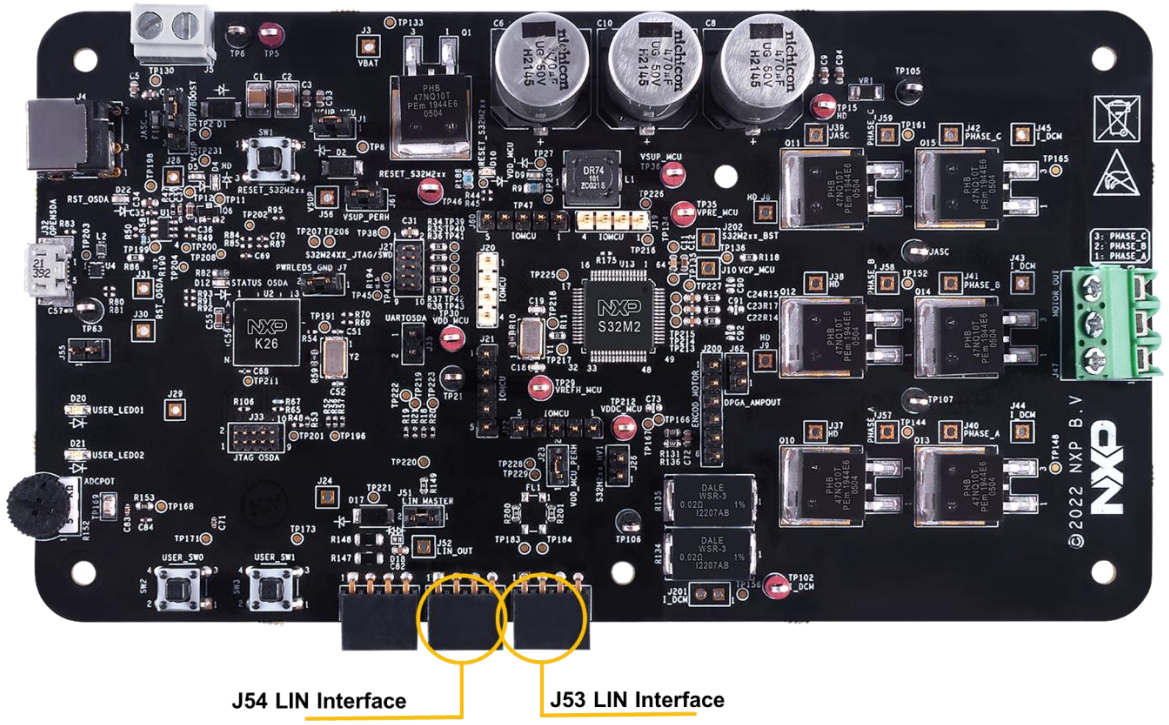


Figure 14. S32M27xEVB-L064– LIN Interface

The pinout of these headers is shown below and is also displayed on the PCB silkscreen.

Table 9.- S32M27xEVB-L064 LIN Connector

Connector	Reference	Pin Number	Signal/Connection
	J50	1	VBAT
		2	LIN
		3	NC
		4	GND
	J54	1	VBAT
		2	LIN
		3	NC
		4	GND

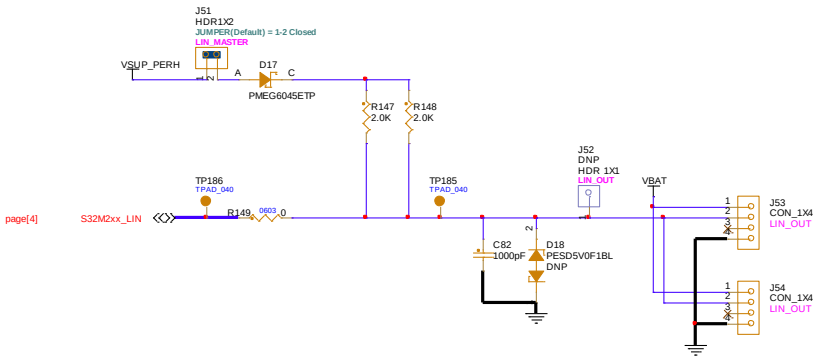


Figure 15. S32M27xEVB-L064– LIN PHY

12. S32M27xEVB-L064 – User Peripherals

12.1 S32M27xEVB-L064 – User Led

The EVB incorporates two red led connected through NPN transistors to the MCU ports. These are connected as follows:

Table 10.- S32M27xEVB-L064 LED connections

Reference	Signal Name	MCU Port Default	Color
D20	USER_LED0	PTD15	Red
D21	USER_LED1	PTD16	Red

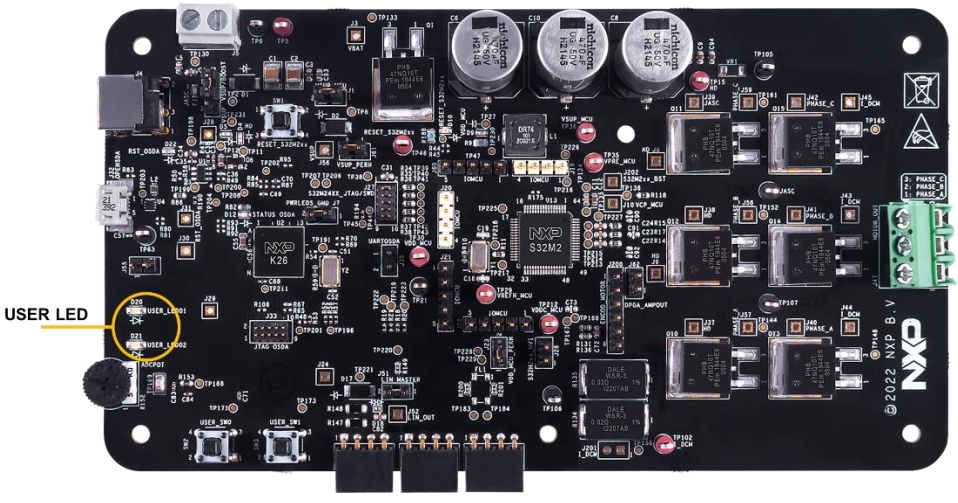


Figure 16. S32M27xEVB-L064– User led indicator

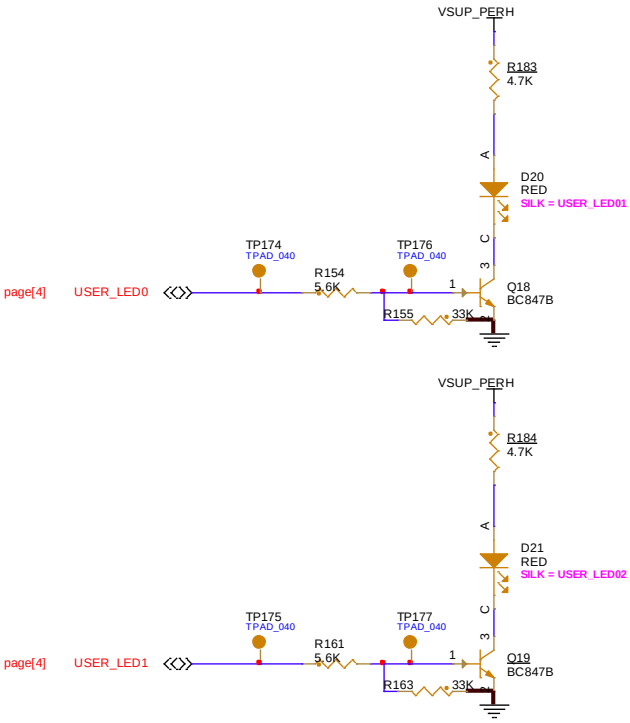


Figure 17. S32M27xEVB-L064– User led indicator

12.2 S32M27xEVB-L064 – User Push buttons

There are 2 push-buttons active high (pulled low, driven to VDD_MCU_PERH), the push button switches (SW2 and SW3) connected to MCU ports. The switches are connected as follows:

Table 11. User Pushbuttons

Reference	Function	MCU Port	Comments
SW2	USER_SW0	PTA15	Enabled
SW3	USER_SW1	PTD0	Enabled

1. There are zero-ohm resistors (R181,R182) on the direct connections between each **USER_SWx** and the MCU pins. These can be removed if required to isolate or change the User Switch from the default MCU pin.

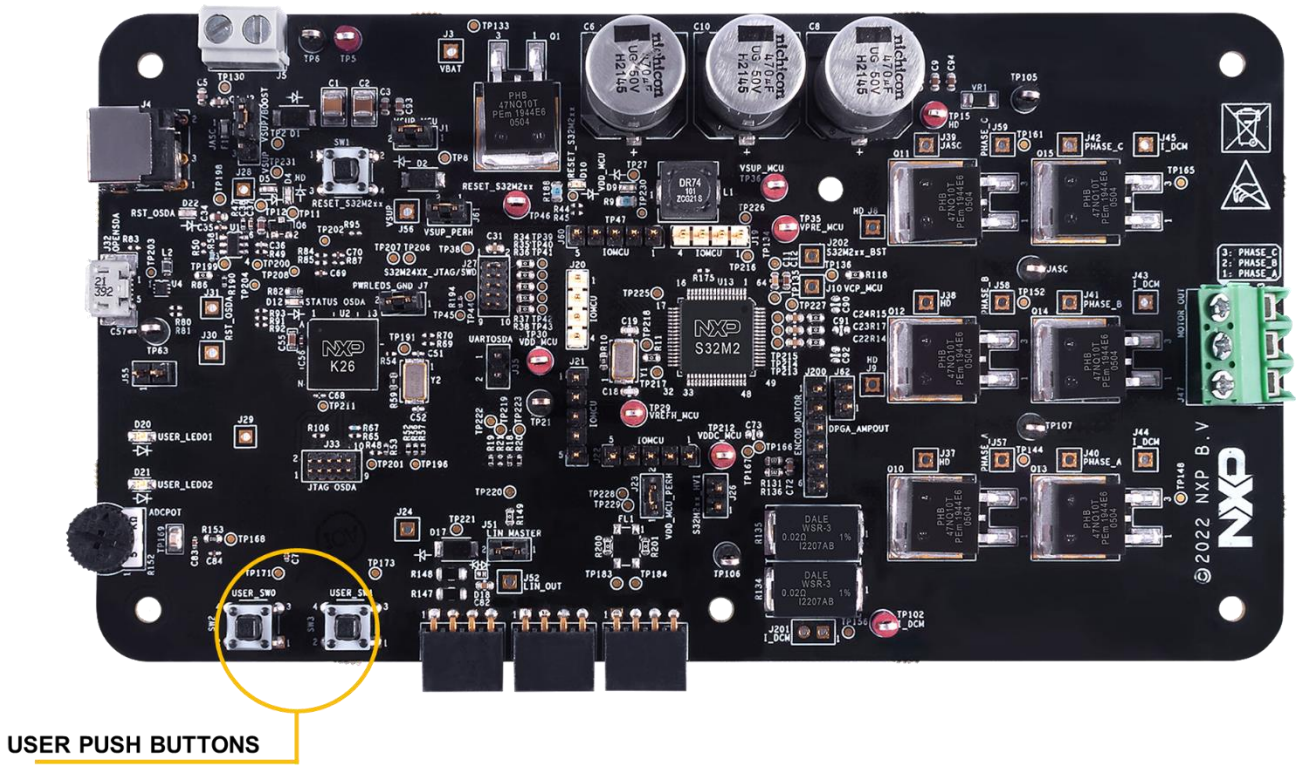


Figure 18. S32M27xEVB-L064– User Push buttons

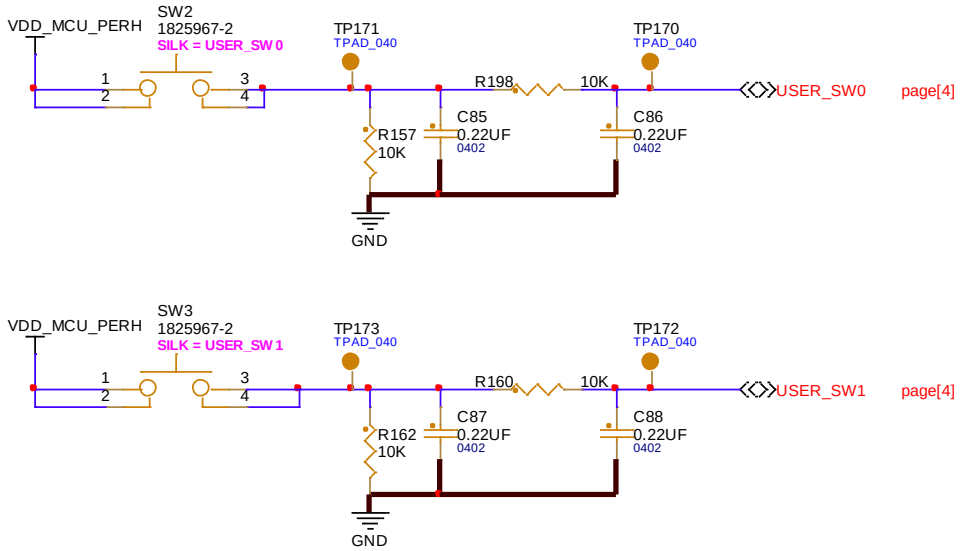


Figure 19. S32M27xEVB-L064– User Push buttons

12.3 S32M27xEVB-L064 – ADC Rotary Potentiometer

The EVB incorporates an ADC Rotary Potentiometer (which routes a voltage between 0v to VDD_MCU_PERH) directly connected to ADC Input Channel of the S32M27 Microcontroller, specifically ADC1_P611.

Table 12. User ADC Potentiometer

Reference	Function	MCU Port	Comments
R152	ADCPOT	PTE6	Enabled

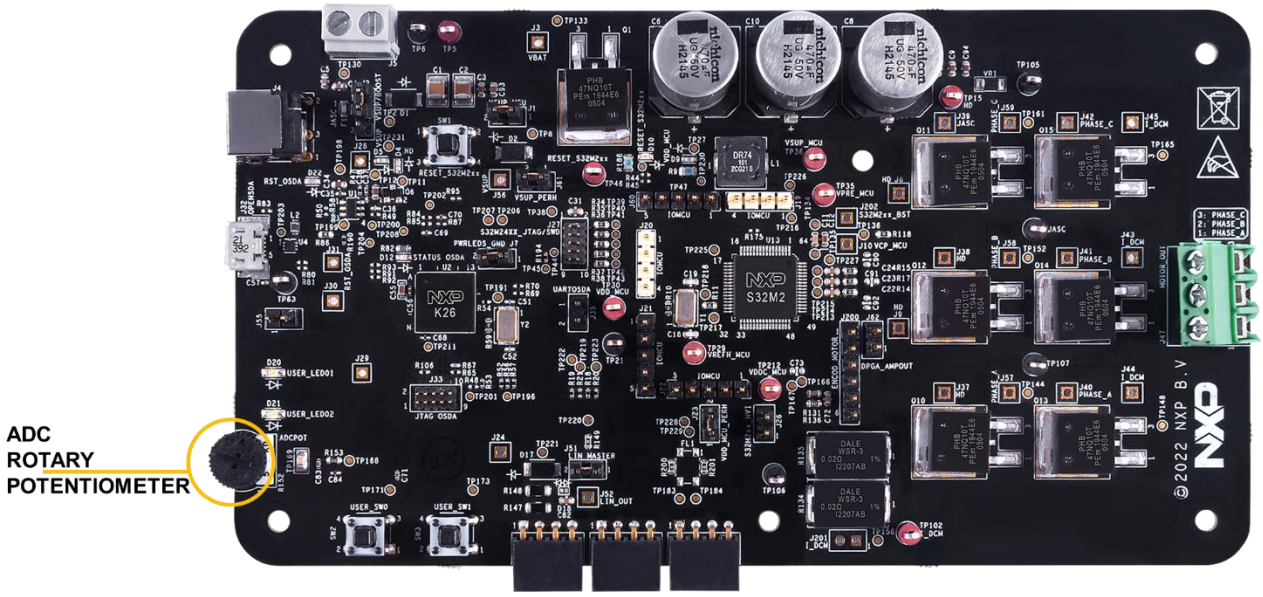


Figure 20. S32M27xEVB-L064– ADC Rotary Potentiometer

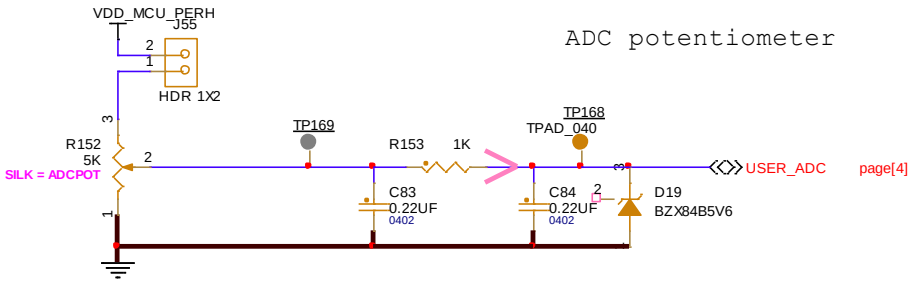


Figure 21. S32M27xEVB-L064– ADC Rotary Potentiometer

13. S32M27xEVB-L064 – Revision history

Table 13. Revision history

Document Revision	Date	Schematic/ Board Number	Schematic/ Board Revision	Changes	Author
A	01/2024	55375	A	Internal version	Luis Rico

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