

# S32K344

## White Board

Rev. 1.1 — 16 June 2023

User manual  
COMPANY PUBLIC

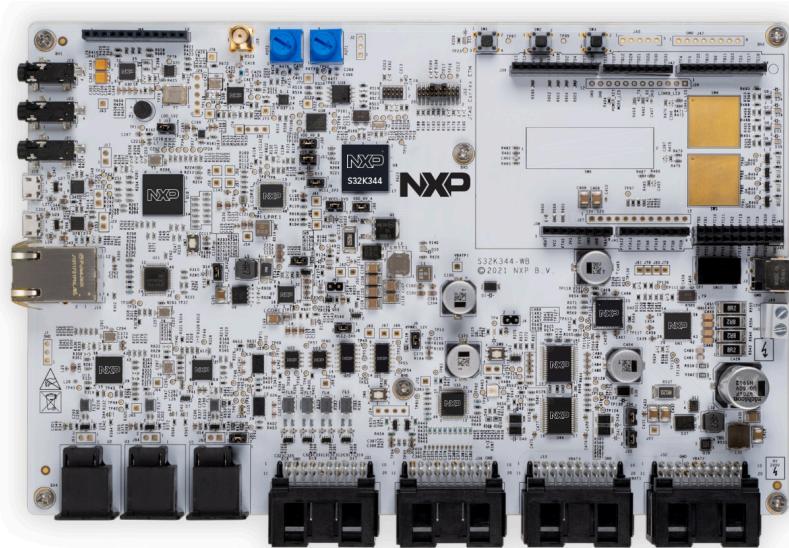


Table 1. Revision history

Revision Number	Date	Changes
Draft 0.6	Dec 2 <sup>nd</sup> , 2020	Initial Version
Draft 0.7	Jan 6 <sup>th</sup> , 2021	Added J86, J87, J88, J89, J90 and SBC debug description based on SCH-47478 rev B.
Draft 0.8	Feb 1 <sup>st</sup> , 2021	Updated the new board picture of rev B PCB. Added power on requirement. Added a few new jumpers and a power switch.
Draft 0.9	Mar 18 <sup>th</sup> , 2021	Updated some detailed descriptions of key features.
1.0	April 7 <sup>th</sup> , 2023	Updated the new BD, deleted the FS26 power up note.
1.1	June 16 <sup>th</sup> , 2023	Updated the new BD, which hides the RF receiver part number.

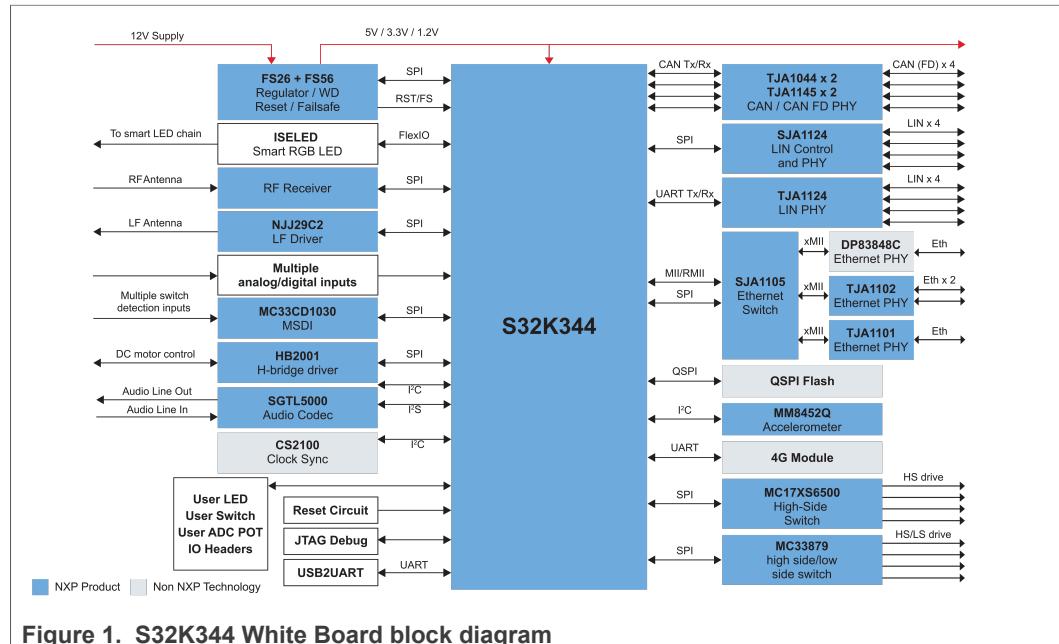


## 1 Introduction

This document introduces the key features of S32K344 White Board, which can be used for various applications evaluation, including Domain Controller, BCM, Gateway, T-box and so on. The block diagram for S32K344 White Board is shown in below figure.

This document illustrates the power supply architecture of the White Board. It also lists the jumpers configuration, connectors/interfaces, and some MCU PINs assignment on the board.

Users can read this manual together with the White Board schematics to better understand the hardware design.



## 2 Features overview

The following figure shows the features of S32K344 White Board. Key features include the following:

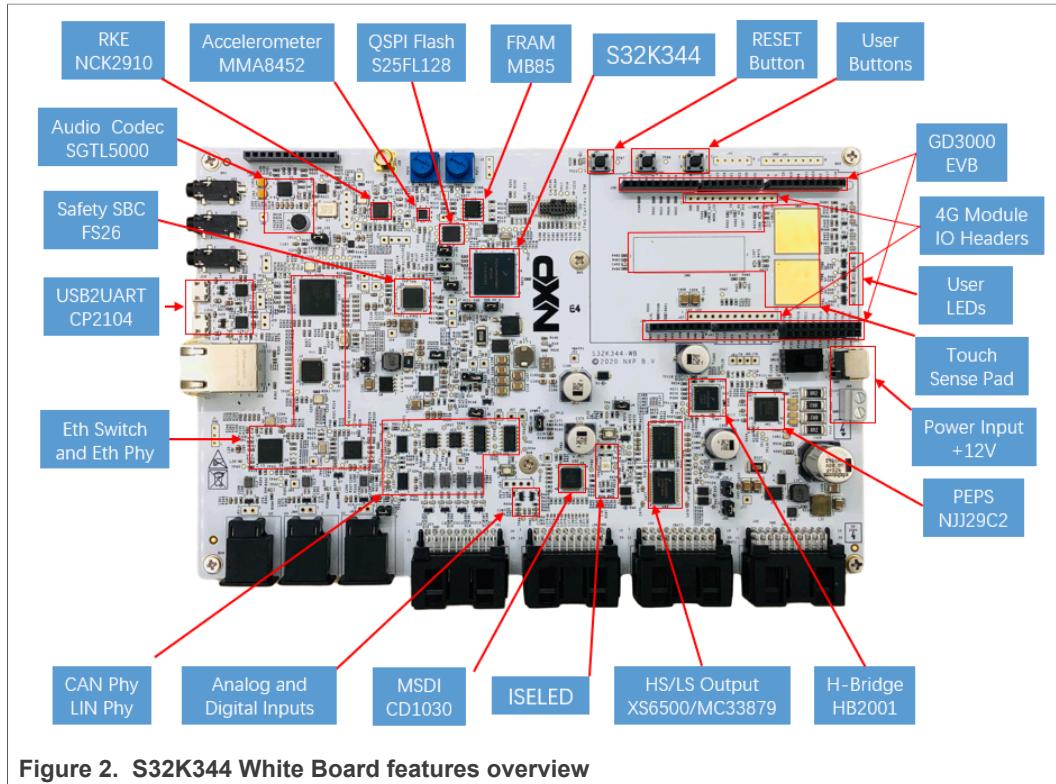


Figure 2. S32K344 White Board features overview

- S32K344 BGA257 secured sample.
- Safety SBC FS26 supplies MCU with 5V, 3.3V, 1.5V and monitors MCU status.
- Ethernet switch SJA1105 and Ethernet phy TJA1101/TJA1102/DP83848C provide 3 channels of automotive ethernet (100BASE-T1) and 1 channel of industrial ethernet (100BASE-TX).
- CAN/CANFD transceivers TJA1044 and TJA1145 provide 4 channels CAN/CANFD.
- LIN controller SJA1124 and LIN transceiver TJA1124 provide 8 channels of LIN.
- QSPI Flash 128Mb.
- I2C FRAM (fast EEPROM) 256 Kb.
- LF driver and RF receiver for car access applications.
- 4 channels high side driver and 8 channels low side driver outputs.
- 2 channels USB-to-UART interfaces.
- 4 channels general purpose analog and digital inputs.
- 12 channels switch-detection inputs through CD1030.
- HB2001 for H-bridge driver.
- Audio Codec SGTL5000 connected to MCU via I2S.
- Accelerometer sensor MMA8452 with I2C interface.
- 10 pin SWD debug interface and 20pin JTAG debug interface with TRACE capability.
- IO Headers for external GD3000 EVB to evaluate motor control use cases.
- 7 User LEDs, 2 user buttons and 2 ADC potentiometers.
- Touch sense pads.

### 3 Connectors and interfaces

The following figure shows the connectors and interfaces of the White Board:

- Four 20-pin connectors J31, J32, J33 and J36 include most general-purpose inputs/outputs and CAN/LIN interfaces.
- Three automotive ethernet interfaces (100BASE-T1);
- One RJ45 can be connected to PC;
- Two USB-to-UART interfaces are used for printing some debug information in MCU;
- ARDUINO shield connectors can be used for compatible EVB installation (such as GD3000 EVB);
- Specific connectors for 4G module communication via UART interface;

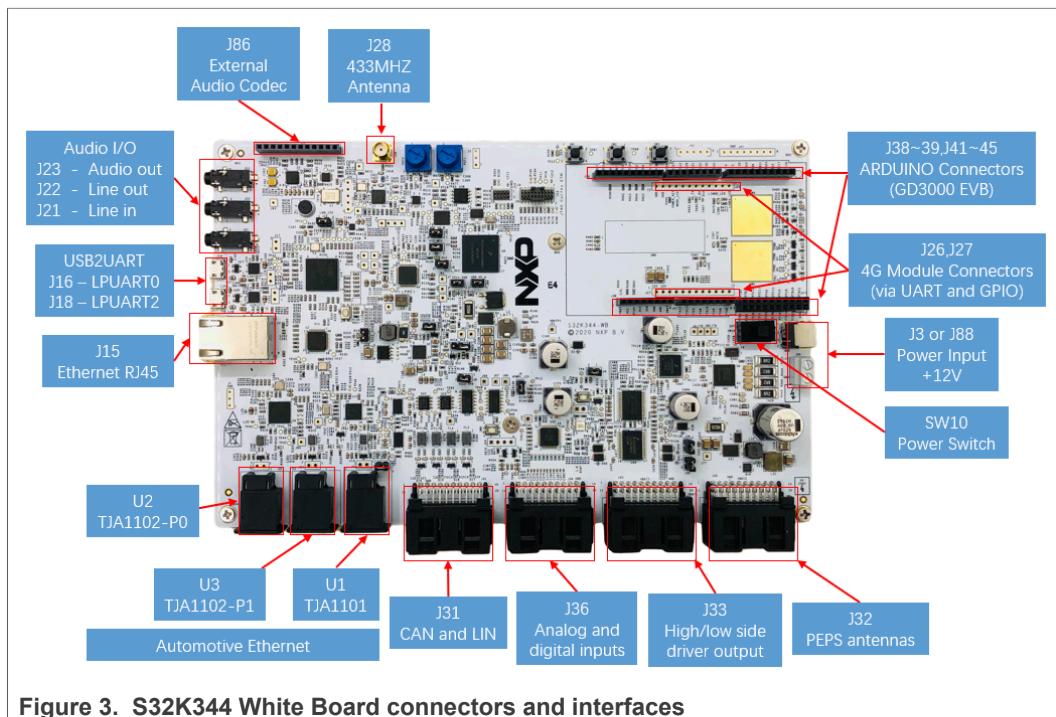


Figure 3. S32K344 White Board connectors and interfaces

The signals definitions of J32 are listed in the following table:

Table 2. Signals definitions of J32

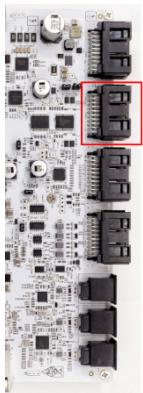
	<b>PIN</b>	<b>Label</b>	<b>Function</b>	<b>PIN</b>	<b>Label</b>	<b>Function</b>
	J32-10	PEPS_TXN5	PEPS antenna	J32-20	PEPS_TXN9	PEPS antenna
	J32-9	PEPS_TXP5	PEPS antenna	J32-19	PEPS_TXP9	PEPS antenna
	J32-8	PEPS_TXN3	PEPS antenna	J32-18	PEPS_TXN7	PEPS antenna
	J32-7	PEPS_TXP3	PEPS antenna	J32-17	PEPS_TXP7	PEPS antenna
	J32-6	VBAT2	12V power	J32-16	NC	NC
	J32-5	VBAT2	12V power	J32-15	NC	NC
	J32-4	PEPS_TXN1	PEPS antenna	J32-14	GND	GND
	J32-3	PEPS_TXP1	PEPS antenna	J32-13	GND	GND
	J32-2	D_IN_4	PEPS wake up	J32-12	HB_OUT1	HB2001 out

Table 2. Signals definitions of J32...continued

	J32-1	D_IN_3	PEPS wake up	J32-11	HB_OUT2	HB2001 out
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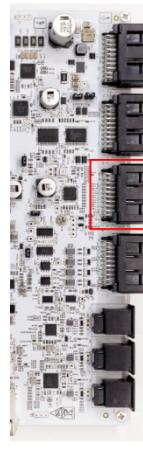
The signals definitions of J33 are listed in the following table:

Table 3. Signals definitions of J33

	PIN	Label	Function		PIN	Label	Function
J33-10	GND	GND		J33-20	VBAT1	12V power	
J33-9	GND	GND		J33-19	VBAT1	12V power	
J33-8	NC	NC		J33-18	LS_DRV_OUT_8	Low side output	
J33-7	NC	NC		J33-17	LS_DRV_OUT_7	Low side output	
J33-6	VBAT3	12V power		J33-16	LS_DRV_OUT_6	Low side output	
J33-5	VBAT3	12V power		J33-15	LS_DRV_OUT_5	Low side output	
J33-4	HS_DRV_OUT4	High side output		J33-14	LS_DRV_OUT_4	Low side output	
J33-3	HS_DRV_OUT3	High side output		J33-13	LS_DRV_OUT_3	Low side output	
J33-2	HS_DRV_OUT2	High side output		J33-12	LS_DRV_OUT_2	Low side output	
J33-1	HS_DRV_OUT1	High side output		J33-11	LS_DRV_OUT_1	Low side output	

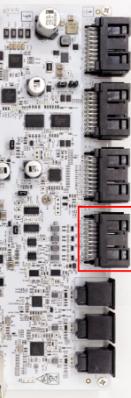
The signals definitions of J36 are listed in the following table:

Table 4. Signals definitions of J36

	PIN	Label	Function		PIN	Label	Function
J36-10	GND	GND		J36-20	+5V_OUT2	+5V power	
J36-9	ISELED_P	ISELED Interface		J36-19	ISELED_N	ISELED Interface	
J36-8	MSDI_SP5	Switch input		J36-18	MSDI SG5	Switch input	
J36-7	MSDI_SP4	Switch input		J36-17	MSDI SG4	Switch input	
J36-6	MSDI_SP3	Switch input		J36-16	MSDI SG3	Switch input	
J36-5	MSDI_SP2	Switch input		J36-15	MSDI SG2	Switch input	
J36-4	MSDI_SP1	Switch input		J36-14	MSDI SG1	Switch input	
J36-3	MSDI_SP0	Switch input		J36-13	MSDI SG0	Switch input	
J36-2	A_IN_2	ADC input		J36-12	D_IN_2	Digital input	
J36-1	A_IN_1	ADC input		J36-11	D_IN_1	Digital input	

The signals definitions of J31 are listed in the following table:

Table 5. Signals definitions of J31



	<b>PIN</b>	<b>Label</b>	<b>Function</b>		<b>PIN</b>	<b>Label</b>	<b>Function</b>
	J31-10	LIN8	LIN interface		J31-20	NC	NC
	J31-9	LIN7	LIN interface		J31-19	NC	NC
	J31-8	LIN6	LIN interface		J31-18	CANL_3	TJA1145 CANL
	J31-7	LIN5	LIN interface		J31-17	CANH_3	TJA1145 CANH
	J31-6	LIN4	LIN interface		J31-16	CANL_2	TJA1145 CANL
	J31-5	LIN3	LIN interface		J31-15	CANH_2	TJA1145 CANH
	J31-4	LIN2	LIN interface		J31-14	CANL_1	TJA1044 CANL
	J31-3	LIN1	LIN interface		J31-13	CANH_1	TJA1044 CANH
	J31-2	GND	GND		J31-12	CANL_0	TJA1044 CANL
	J31-1	KL15_WAKE	SBC wake input		J31-11	CANH_0	TJA1044 CANH

## 4 MCU pins assignments and board resources mapping

The hardware configurations and MCU PINs assignments are listed in below table.

Table 6. White Board resources mapping

Interface	Reference/ Signals	Configuration	Description
Power Input	VBAT1/2/3	12V	12V power supply input for this board
MCU Power Supply	VCC1_5V0 (VDD_HV_A)	5.0V	Some MCU pins are in VDD_HV_A domain
	VCC1_3V3 (VDD_HV_B)	3.3V	Some MCU pins are in VDD_HV_B domain
	VREFH MCU	5.0V	ADC reference voltage
	VCC_1V5	1.5V	MCU Core is supplied by 1.5V from SBC
	V11 MCU	1.1V	MCU generated 1.1V
	V25 MCU	2.5V	MCU generated 2.5V
Other Power Supplies	BUCK_5V0	5.0V	5V to supply some circuits on the board
	BUCK_3V3	3.3V	3.3V to supply ethernet related circuits
	LDO_1V2	1.2V	1.2V LDO to supply ethernet switch core
Ethernet	MCU MAC	Enabled	MCU MAC is connected to ethernet switch SJA1105 MII_0 in RMII mode
	TJA1101	Enabled	SJA1105 MII_1
	DP83848C	Enabled	SJA1105 MII_2
	TJA1102	Enabled	SJA1105 MII_3 and MII_4
SPI	LPSPI_0	PCS0	NCK2910 (RF Receiver)
		PCS2	CD1030(MSDI)
		PCS3	XS6500(High Side Driver)
		PCS4	MC33879 (Low Side Driver)
		PCS5	HB2001(H-Bridge Driver)
	LPSPI_1	PCS0	FS26 (Safety SBC)
	LPSPI_2 (3.3V)	PCS0	SJA1105 (Ethernet Switch)
	LPSPI_3	PCS0	SJA1124 (LIN Ctrl and Phy)
		PCS1	TJA1145 (CAN Phy)
		PCS3	TJA1145 (CAN Phy)
	LPSPI_4	PCS0	IO Header
		PCS1	NJJ29C2 (LF Driver)
	LPSPI_5	PCS0	IO Header
QSPI	QSPI_A	Enabled	QSPI Flash 128Mb

Table 6. White Board resources mapping...continued

I2C	LPI2C0 (3.3V)	Enabled	MMA8452 (Accel Sensor, address 0x1D)
			SGTL5000 (Audio Codec, address 0x0A)
			CS2100 (Clock Multiplier, address 0x4F)
			FRAM (Fast EEPROM, address 0x57)
CAN	CAN_0	TJA1044_1	PTA7_CAN0_TX, PTA6_CAN0_RX
	CAN_1	TJA1044_2	PTA23_CAN1_TX, PTA22_CAN1_RX
	CAN_2	TJA1145_1	PTD18_CAN2_TX, PTD19_CAN2_RX
	CAN_3	TJA1145_2	PTE28_CAN3_TX, PTE29_CAN3_RX
	CAN_4	IO Header	PTG8_CAN4_TX, PTG9_CAN4_RX
LIN	LIN1	SJA1124_LIN1	LIN Controller and Phy controlled by LPSPi3 with PCS0.
	LIN2	SJA1124_LIN2	
	LIN3	SJA1124_LIN3	
	LIN4	SJA1124_LIN4	
	LIN5	TJA1124_LIN1	
	LIN6	TJA1124_LIN2	
	LIN7	TJA1124_LIN3	
	LIN8	TJA1124_LIN4	
UART	LPUART0	CP2104 USB2 UART	PTA27_LPUART0_TX, PTA28_LPUART0_RX
	LPUART2		PTE12_LPUART2_TX, PTD17_LPUART2_RX
	LPUART1	Ext 4G Module	PTB22_LPUART1_TX, PTB23_LPUART1_RX
Audio	SAI0	Enabled	SGTL5000 Audio Codec
User Peripherals	Push Buttons	SW2	PTC20 (high active)
		SW3	PTC21 (high active)
	ADC POT	POT1	PTB13 (ADC0_S8)
		POT2	PTB14 (ADC0_S9)
	User LEDs	LED D28	PTF8 (high active)
		LED D29	PTF9 (high active)
		LED D30	PTF10 (high active)
		LED D31	PTF11 (high active)
		LED D44	PTG0 (low active)

Table 6. White Board resources mapping...continued

	Touch Sense Pad	LED D45	PTG1 (low active)
		LED D46	PTG2 (low active)
		SW4	PTC23, PTE10
		SW5	PTC24, PTE15
		Slider	PTD23, PTA11, PTD24, PTA14
General Purpose Inputs	Analog Inputs	A_IN_1 (0~12V)	PTE21_ADC2_P3
		A_IN_2 (0~12V)	PTE22_ADC2_P4
	Digital Inputs	D_IN_1 (0~12V)	PTC26_ADC0_S21
		D_IN_2 (0~12V)	PTE13_ADC1_S19
General Purpose Outputs	High Side Output	HS_D1	PTG18_EMIOS2_CH18
		HS_D2	PTG19_EMIOS2_CH19
		HS_D3	PTG20_EMIOS2_CH20
		HS_D4	PTG21_EMIOS2_CH21
	Low Side Output	LS_DRV_OUT1	Controlled by LPSPI0 with PCS4
		LS_DRV_OUT2	Controlled by LPSPI0 with PCS4
		LS_DRV_OUT3	Controlled by LPSPI0 with PCS4
		LS_DRV_OUT4	Controlled by LPSPI0 with PCS4
		LS_DRV_OUT5	PTE20_EMIOS1_CH0
		LS_DRV_OUT6	PTE27_EMIOS1_CH7
		LS_DRV_OUT7	Controlled by LPSPI0 with PCS4
		LS_DRV_OUT8	Controlled by LPSPI0 with PCS4
Debug Interface	JTAG	JTAG_TMS	PTA4
		JTAG_TCLK	PTC4
		JTAG_TDO	PTA10
		JTAG_TDI	PTC5
		RESET	PTA5
	TRACE	TRACE_CLKOUT	PTG6
		TRACE_D0	PTG7
		TRACE_D1	PTG15
		TRACE_D2	PTG16
		TRACE_D3	PTF31

## 5 White Board startup

Make sure the jumper J5 is closed and J87 is open so the SBC FS26 can power up in debug mode. Apply 12V to the power supply input. Turn on the switch SW10. Connect debugger to the SWD interface and refer to the White Board quick start guide to start the software development.

The following figure shows the LED indicators for various power supplies on the board.

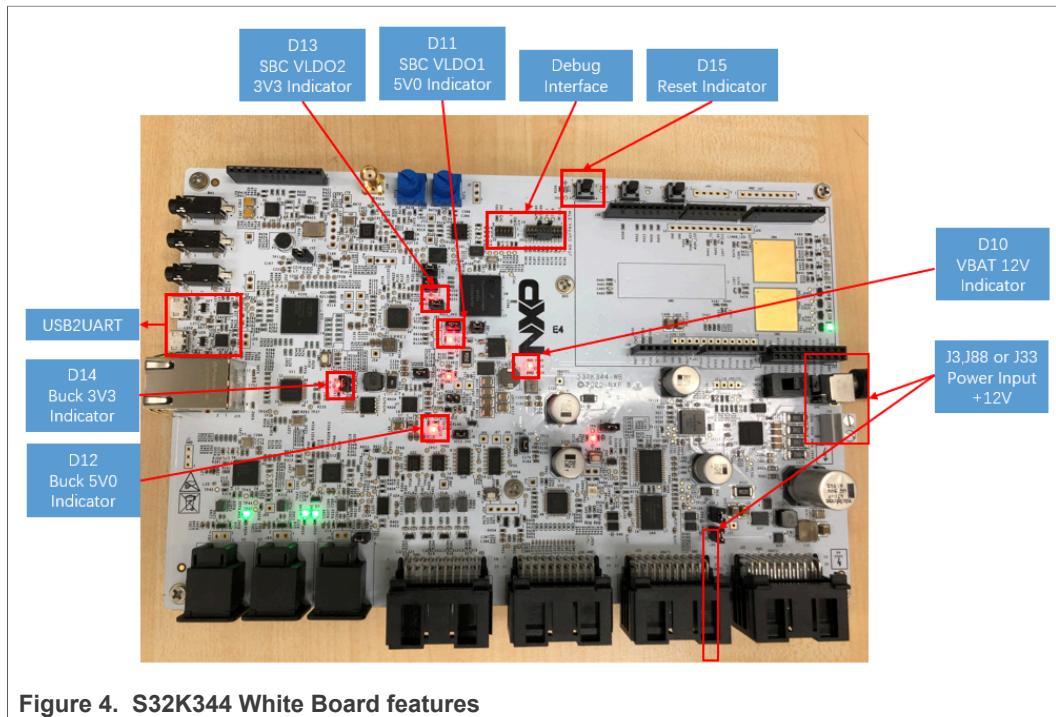


Figure 4. S32K344 White Board features

The 12V can be applied either through the power jack J3, connector J88 or the connector pins J33-9,10(GND)/J33-19,20(VBAT). The LEDs indicate the presence of power supply as following:

- LED D10 – indicates that the 12V is connected to the board correctly;
- LED D11 – indicates that the 5V supply from SBC is ON;
- LED D12 – indicates that the 5V supply from the standalone DC/DC is ON;
- LED D13 – indicates that the 3.3V supply from SBC is ON;
- LED D14 – indicates that the 3.3V supply from standalone DC/DC is ON;
- LED D15 – indicates that the MCU RESET pin is low (MCU in reset status);

The above figure also shows the basic elements to start the White Board:

- 12V power input
- 10-pin Cortex Debug Connector (SWD/JTAG debug interface)
- 20-pin Debug + ETM connector (Debug with trace capability)
- RESET push button and RESET LED indicator
- USB2UART interface

## 6 Power supply

The White Board requires an external power supply of 12V/1A, which is fed to the following devices on the board.

- SBC FS26 – it powers the MCU with 5V (MCU VDD\_HV\_A domain), 3.3V (MCU VDD\_HV\_B domain) and 1.5V (MCU core). See following figure for SBC power supply topology.
  - SBC generates 5V(Tracker1 and Tracker2) to power the CAN phys (optional). The CAN phys are powered by VCC1\_5V0 by default.
- 5V buck circuit – it is used as a backup 5V power supply.
- 3.3V buck circuit – it powers the ethernet switch and ethernet phy circuits.
  - The 3.3V is supplied to the standalone 1.2V LDO, which powers the ethernet switch core.
- High side driver (XS6500) – it requires 12V to operate correctly.
- LF driver (NJJ29C2) – it requires 12V to operate correctly.

Power supply topology of this board is shown in the following two figures.

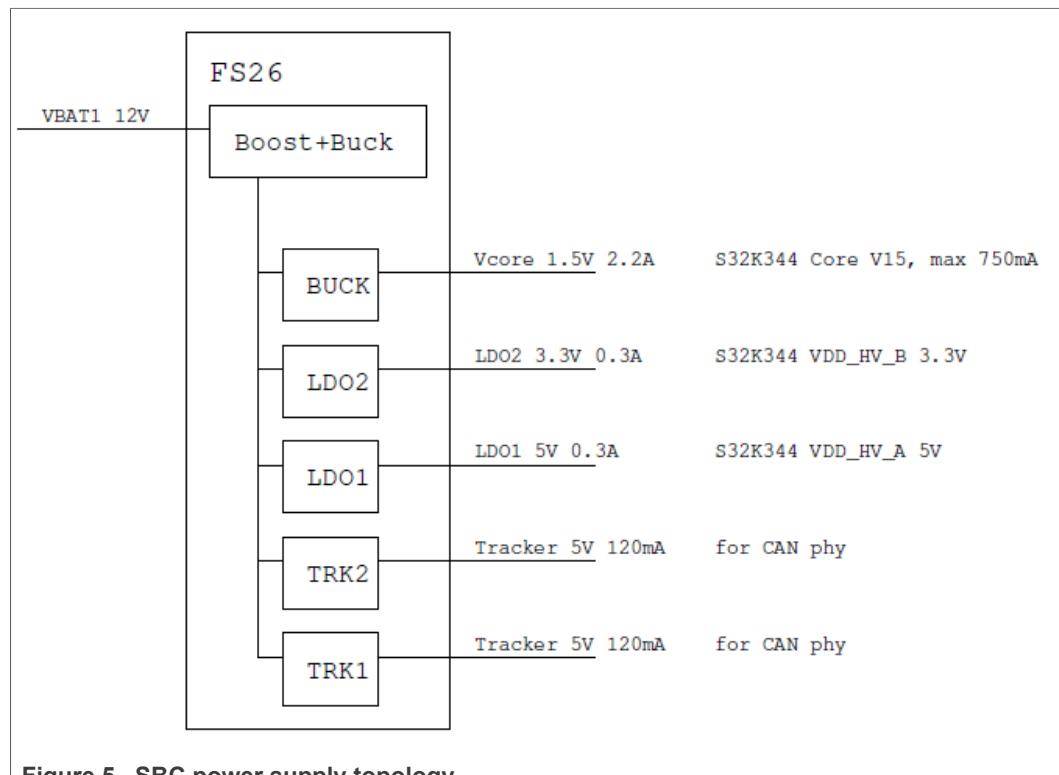


Figure 5. SBC power supply topology

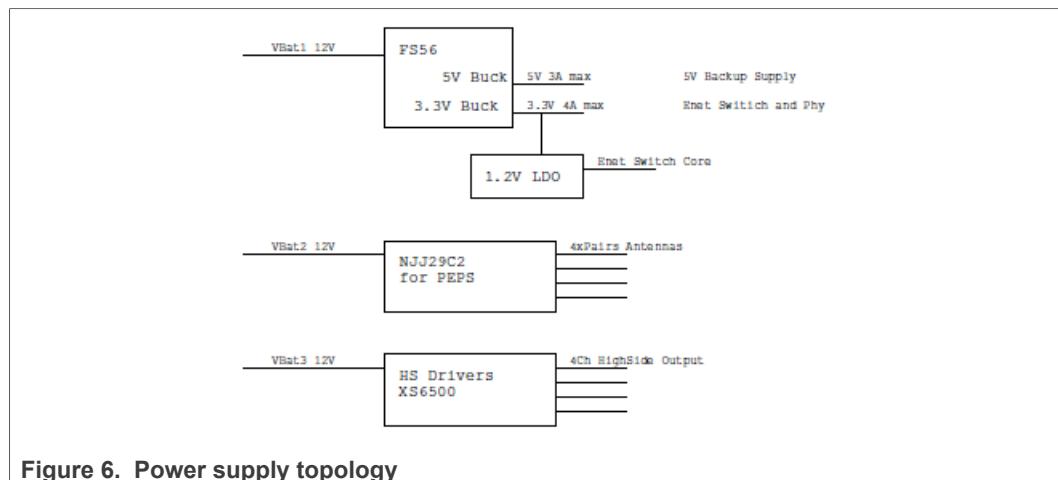


Figure 6. Power supply topology

The MCU has two power domains - VDD\_HV\_A and VDD\_HV\_B. On the white board, VDD\_HV\_A is supplied with 5V and VDD\_HV\_B is supplied with 3.3V and this configuration is fixed on the board. All 5V signals on the MCU are powered by VDD\_HV\_A and all 3.3V signals on MCU are powered by VDD\_HV\_B, so that the use of voltage level shifters is unnecessary.

## 7 Jumper settings

The following jumpers on the board are used for measuring the current consumption of the corresponding power supply:

**Table 7. Jumpers for current measurement**

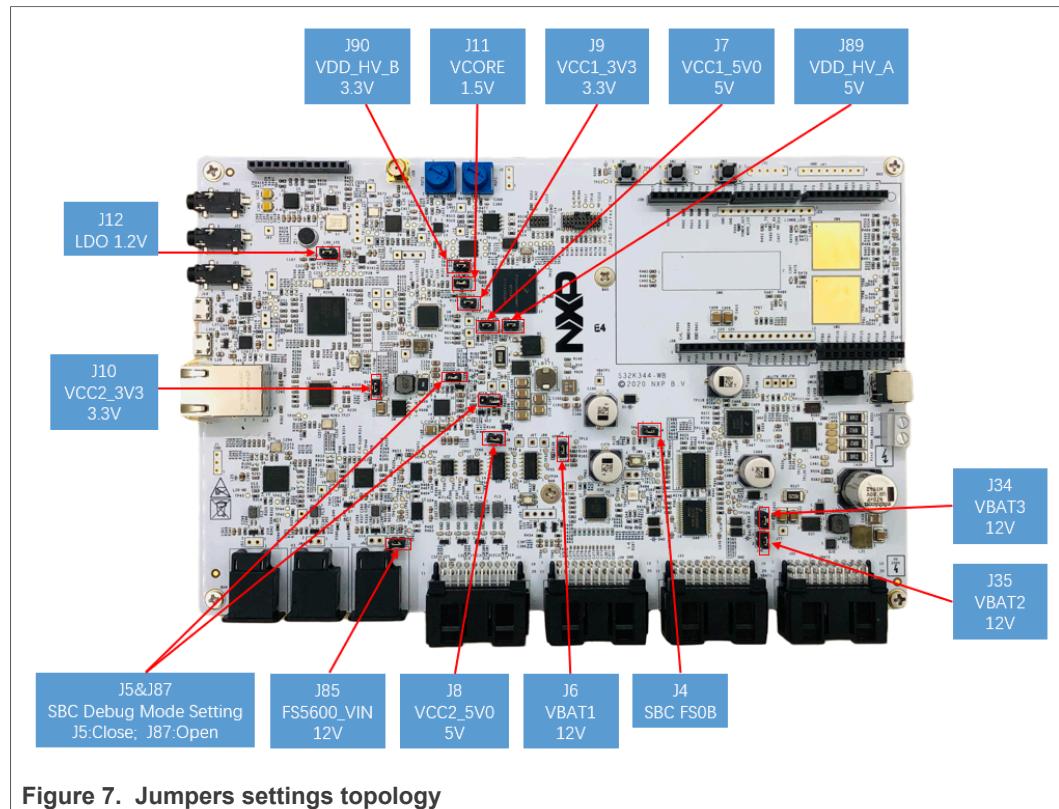
Reference	Position	Description
J6	1-2 Default Closed	12V power input after reverse protection diode
J7	1-2 Default Closed	FS26 LDO1 (5V) output current
J89	1-2 Default Closed	MCU VDD_HV_A current consumption
J8	1-2 Default Closed	Buck 5V output current
J9	1-2 Default Closed	FS26 LDO2 (3.3V) output current
J90	1-2 Default Closed	MCU VDD_HV_B current consumption
J10	1-2 Default Closed	Buck 3.3V output current
J11	1-2 Default Closed	1.5V for MCU core
J12	1-2 Default Closed	1.2V for SJA1105 core
J34	1-2 Default Closed	12V power input for high side driver XS6500
J35	1-2 Default Closed	12V power input for LF driver NJJ29C2
J85	1-2 Default Closed	12V power input for FS5600

Other jumpers on the board are shown in below table:

**Table 8. Jumpers for VBAT power supply source**

Reference	Position	Description
J5 J87	1-2 Default Closed 1-2 Default Open	Enable SBC debug mode, thus watchdog refreshing from SPI is not needed. J5 should be closed and J87 should be open for FS26 entering debug mode.
J4	1-2 Default Closed	Allow SBC FS0B to disable high/low side driver outputs.

The following figure shows the locations of these jumpers on the White Board.



## 8 General functional description

### 8.1 MCU HW configuration

#### 8.1.1 MCU power supply configuration

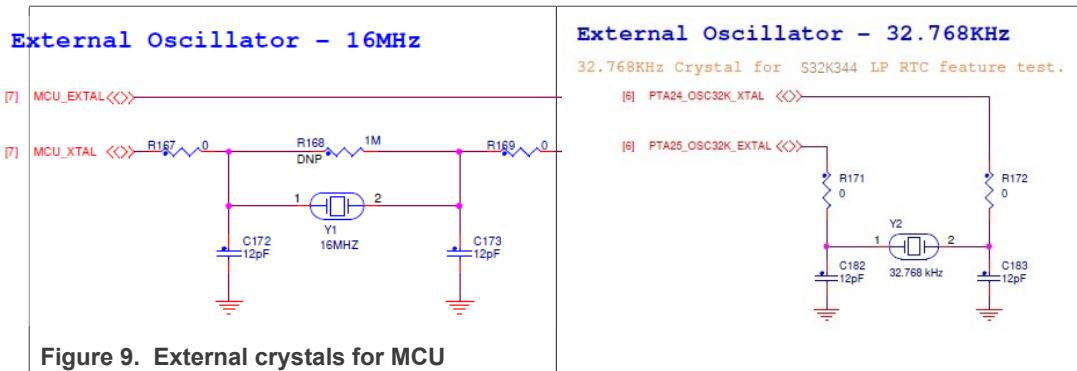
S32K344 has two power domains – VDD\_HV\_A and VDD\_HV\_B. They can be supplied with either 5V or 3.3V. See below figure for PINs distribution for the two domains. The white board optimizes the PINs assignment to minimize the usage of voltage level shifters. VDD\_HV\_A is supplied with 5V and PINs in VDD\_HV\_A domain are mostly used for 5V circuits on the board. VDD\_HV\_B is supplied with 3.3V and PINs in VDD\_HV\_B domain are mostly used for 3.3V circuits on the board.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
A	PTC10	PTA8	PTA5	PTE30	PTE1	PTF0	PTA12	PTE24	PTA13	PTA4	PTA15	PTA16	PTA0	PTB8	PTD27	PTD25	PTG11	A
B	PTA18	<b>VSS</b>	PTA9	PTE31	PTE0	PTF1	PTA11	PTE25	PTE22	PTF2	PTE6	PTC7	PTD28	PTA1	PTF9	<b>VSS</b>	PTF10	B
C	PTA19	PTE16	PTA22	PTE28	PTE29	PTF2	PTF4	PTF5	PTF7	PTE20	PTE19	PTC6	PTD31	PTD29	PTB9	PTD25	PTB11 <th>C</th>	C
D	PTA21	PTE15	PTA23	<b>VSS</b>	PTE26	PTF3	PTF6	PTE23	<b>VSS</b>	PTF8	PTE18	PTE17	PTD30	VDD_HV_A	PTB10	PTD24	PTA2	D
E	PTE11	PTE10	PTD1	PTA20										PTF13	PTF12	PTA9	PTD23	E
F	PTE13	PTE5	PTD0	PTG8		PTA4	PTC4	PTC5	PTE21	PTG27	PTG26	PTG25		PTF15	PTF14	PTD2	PTD3	F
G	PTA24	PTG9	PTG13	PTG4		PTE4	<b>VSS</b>	PTA10	PTE27	VDD_HV_A	<b>VSS</b>	PTG24		PTF17	PTF16	PTD4	PTD22	G
H	PTA25	PTG1	PTG14	PTG5		VREFH	VDD_HV_A	V15	V11	V15	PTF11	PTG23		PTF18	PTD21	PTD13	PTD12	H
J	<b>VSS</b>	PTG0	PTG2	<b>VSS</b>		VREFL	V25	V11	<b>VSS</b>	V11	PTF19	PTG22		<b>VSS</b>	PTF20	PTB15	PTB14	J
K	XTAL	PTG3	PTF30	PTF29		PTG7	PTG6	V15	V11	V15	VDD_HV_A	PTG21		PTF21	PTD20	PTB17	PTB16	K
L	XTAL	PTA26	PTE14	PTD15		PTG15	<b>VSS</b>	VDD_HV_A	PTF31	PTF28	<b>VSS</b>	PTG20		PTC31	PTD19	PTD18	PTA17	L
M	PTE12	PTA27	PTA29	PTD14		PTB22	PTB23	PTG16	PTG17	PTG18	PTG19	PTF24		PTF23	PTA6	PTA2	PTE7	M
N	PTE5	PTA28	PTD17	VDD_HV_B										PTC9	PTC8	PTC29	PTC30	N
P	PTA31	PTD16	PTA30	<b>VSS</b>	PTD18	PTC15	PTB24	PTB25	PTB27	PTB28	PTC12	PTF25	PTF27	<b>VSS</b>	PTC26	PTB6	PTC28	P
R	PTB18	PTB19	PTE9	PTE8	PTD12	PTC17	VDD_HV_B	PTD8	PTB26	VDD_HV_B	PTC13	PTF26	PTC21	PTC25	PTC24	PTC27	PTB1	R
T	PTB20	<b>VSS</b>	PTC5	PTC2	PTD6	PTD10	<b>VSS</b>	PTC3	PTC14	<b>VSS</b>	PTB2	PTC19	PTC20	PTB31	PTC11	<b>VSS</b>	PTC10	T
U	PTB21	PTB5	PTB4	PTD7	PTD5	PTD11	PTC0	PTD9	PTC15	PTB8	PTC18	PTB29	PTB30	PTC23	PTC22	PTF22	PTG12	U
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
<b>MCU Pin Function</b>																		
#Pins																		
VDD_HV_A and VREFH Power Pin																		
6																		
I/Os pins on the VDD_HV_A Power Domain [including JTAG(4) and RESET(1)]																		
166																		
VDD_HV_B Power Pin																		
3																		
I/Os pins on the VDD_HV_B Power Domain																		
52																		
XTAL/EXTAL																		
2																		
V25 Power Pin																		
1																		
V15 Power Pin																		
4																		
V11 Power Pin																		
4																		
VSS and VREFL – Ground pin																		
19																		
TOTAL of pins																		
257																		

Figure 8. Pins distribution for different power domains

#### 8.1.2 MCU clock settings

MCU can generate 320MHz PLL clock based on 16MHz external crystal. And in low-power modes, it can use external 32KHz crystal to minimize the power consumption.



### 8.1.3 MCU reset control

The MCU RESET pin is bidirectional. When acting as input, MCU can be reset either by push button “SW1” on the board or SBC RESET signal. When acting as output, some MCU internal failures (such as watchdog timeout) will pull RESET pin low and SBC can sense the MCU reset event and react accordingly.

### 8.1.4 MCU debug interface

The White Board provides two types of debug interface 10-pin connector (SWD/JTAG) and 20-pin connector (JTAG with ETM). The pins used are listed in below table. JTAG pins are necessary for debugging the MCU and the TRACE pins are optional.

Table 9. Debug interface pins

JTAG	JTAG_TMS	PTA4
	JTAG_TCLK	PTC4
	JTAG_TDO	PTA10
	JTAG_TDI	PTC5
	RESET	PTA5
TRACE	TRACE_CLKOUT	PTG6
	TRACE_D0	PTG7
	TRACE_D1	PTG15
	TRACE_D2	PTG16
	TRACE_D3	PTF31

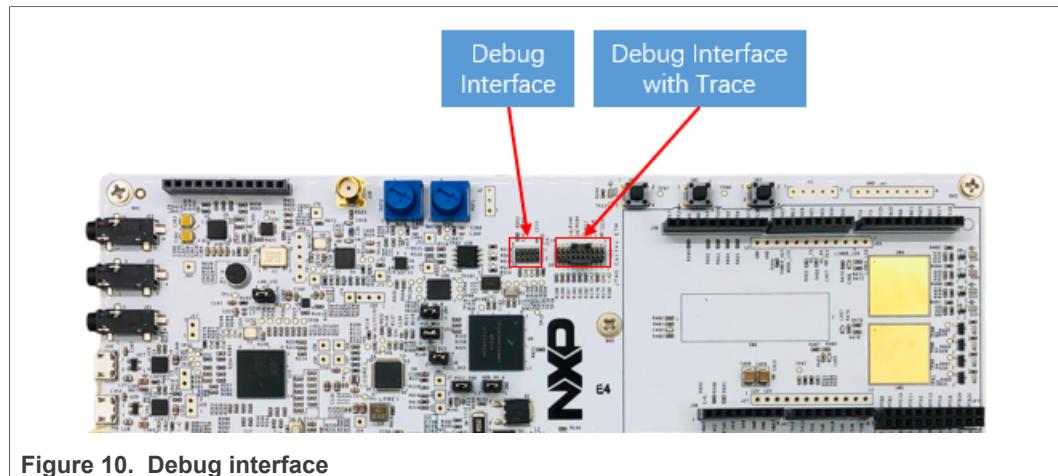


Figure 10. Debug interface

## 8.2 SBC features

### 8.2.1 SBC and MCU connections

The SBC and MCU on the White Board are shown in below figure.

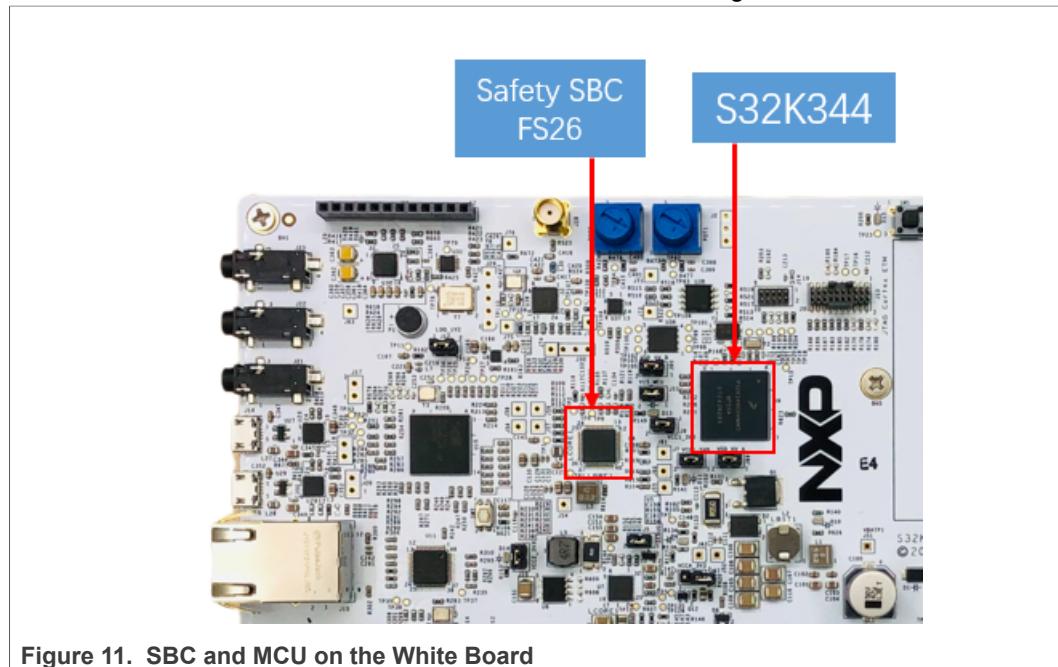


Figure 11. SBC and MCU on the White Board

Connections between SBC and MCU are listed in below table.

Table 10. SBC and MCU connections

SBC	MCU
VLDO1 5V	VDD_HV_A
VLDO2 3.3V irrelevant	VDD_HV_B
VCORE 1.5V	V15
SPI (MOSI, MISO, SCLK, CS)	LPSPI_1 (SOUT, SIN, SCK, PCS0)

Table 10. SBC and MCU connections...continued

VDDIO	VDD_HV_A
RST	PTA5 MCU_RESETB
INT	Interrupt input (PTG3)
FCCU1/FCCU2	FCCU_ERR0 / FCCU_ERR1 (PTF16/PTF14)
MUX-OUT	ADC2_P7 input (PTE25)

### 8.2.2 SBC wakeup function

- Wakeup input by external key-on signal (0V to 12V transition on WAKE1).
  - Push button SW7 on the board can generate such transitions.
- Wakeup input by LIN phy.
- Wakeup input by CAN phy or Ethernet phy.

### 8.2.3 SBC fail-safe outputs

SBC will pull FS0B and FS1B low when it detects certain failures, without MCU intervene.

- FS0B – disable high driver outputs (XS6500).
- FS1B – it's left float and can be routed to customer desired circuit.

FS0B or FS1B assertion is indicated by LED D8 or LED D9 on the White Board. These two signals can be released by special sequence of SPI commands. Refer to FS26 datasheet for details.

### 8.2.4 SBC debug mode

Jumper J5 needs to be closed and J87 to be open for the FS26 debug mode when powering up. In this way the FS26 doesn't need the watchdog refreshing from the MCU by SPI.

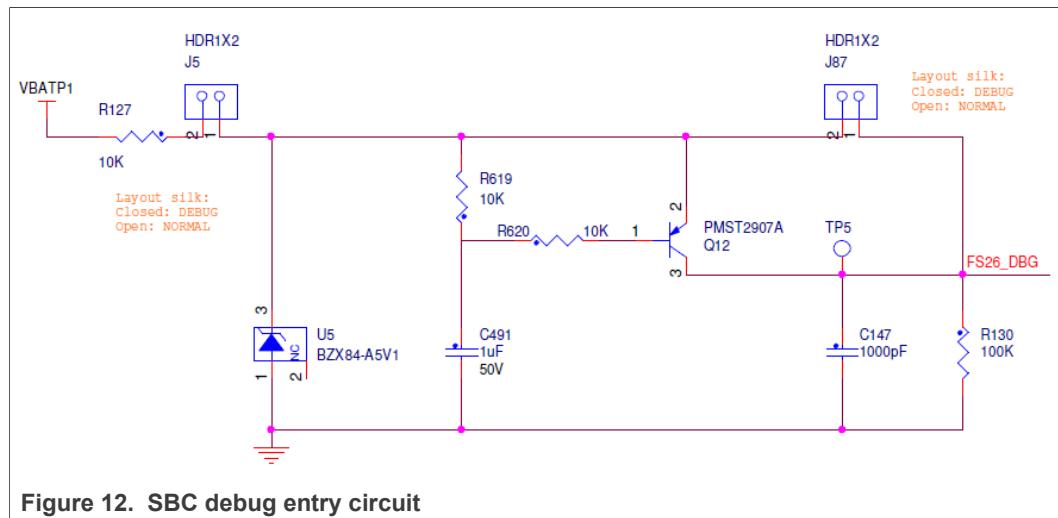


Figure 12. SBC debug entry circuit

According to FS26 datasheet, the FS26 debug mode is entered if ~4V is detected on FS26 DEBUG pin when FS26 is powered up. Then the FS26 starts to supply the MCU when DEBUG pin back to GND. So a 4V pulse is seen during power-up on FS26 DEBUG pin to enter debug mode.

## 8.3 Communication interfaces

### 8.3.1 Ethernet interfaces

The ethernet switch SJA1105 is used and 4 ethernet interfaces are available on the board. One of them is 100BASE-TX which can be connected to PC for diagnostics and test. The other three interfaces are automotive ethernet (100BASE-T1). To meet SJA1105 current consumption requirements, a 3.3V buck circuit from FS56 and a 1.2V LDO is used to supply this device.

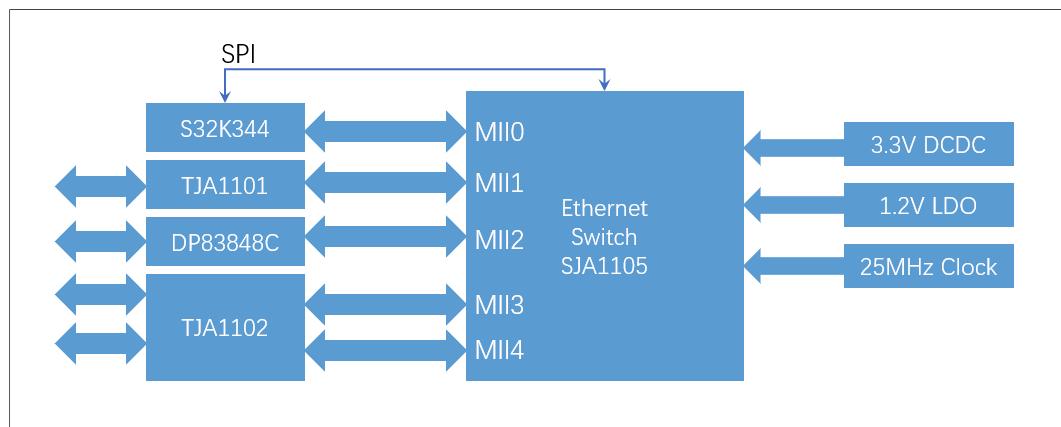


Figure 13. Ethernet circuit block diagram

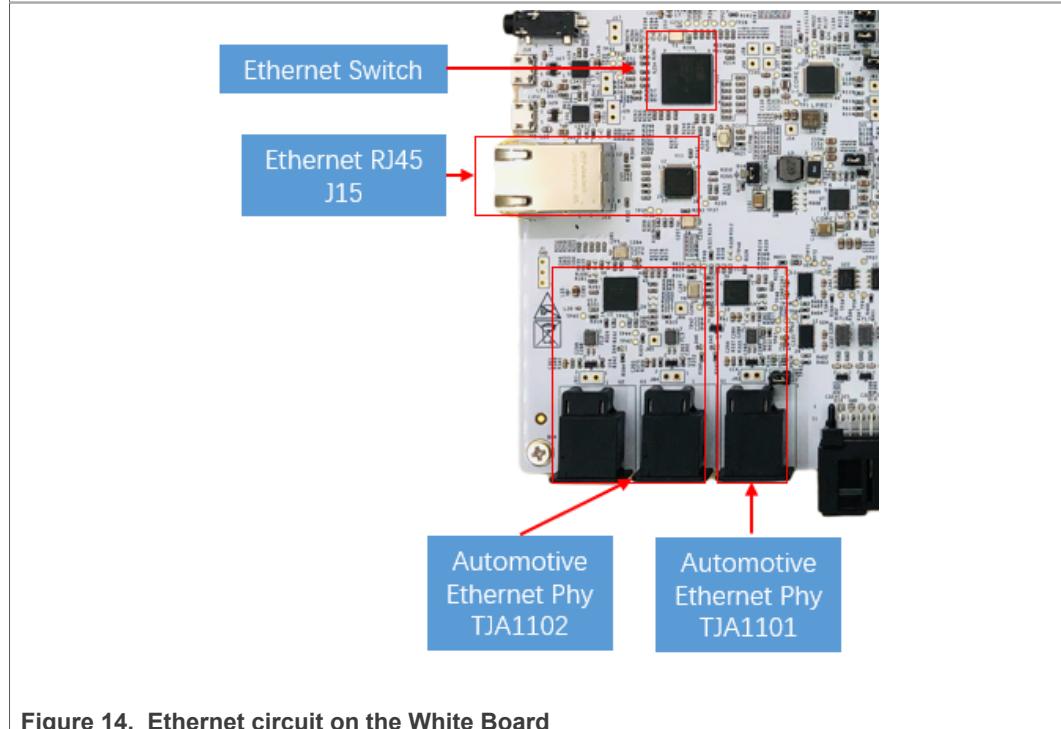


Figure 14. Ethernet circuit on the White Board

### 8.3.2 CAN and LIN interfaces

There are 4 CAN interfaces on this board. The CAN phy TJA1145 is powered from VBAT 12V and can work in sleep mode with only VBAT kept on. External specified CAN

messages can wake up TJA1145. MCU configures TJA1145 operation modes by sending proper SPI commands.

The device SJA1124 is a LIN controller and transceiver. MCU can use one SPI to access this device and generate 4 channels LIN interfaces. The other 4 LINs are linked to 4 LPUART modules on MCU.

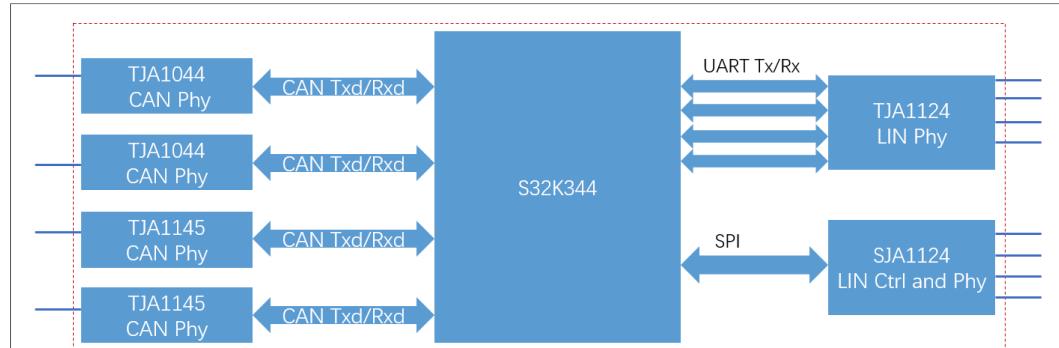


Figure 15. CAN/LIN circuit block diagram

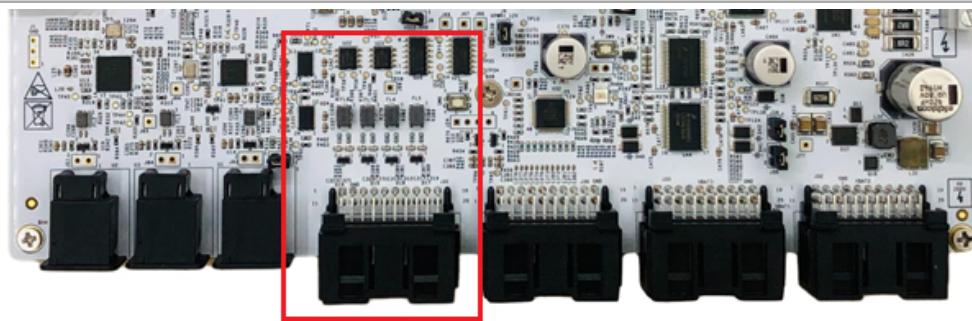


Figure 16. CAN and LIN transceivers on White Board

### 8.3.3 USB to UART interface

Two USB2UART devices CP2104 are included on the board so that debug message can be easily transmitted to PC. LPUART0 and LPUART2 of MCU are connected to the USB2UART interfaces.

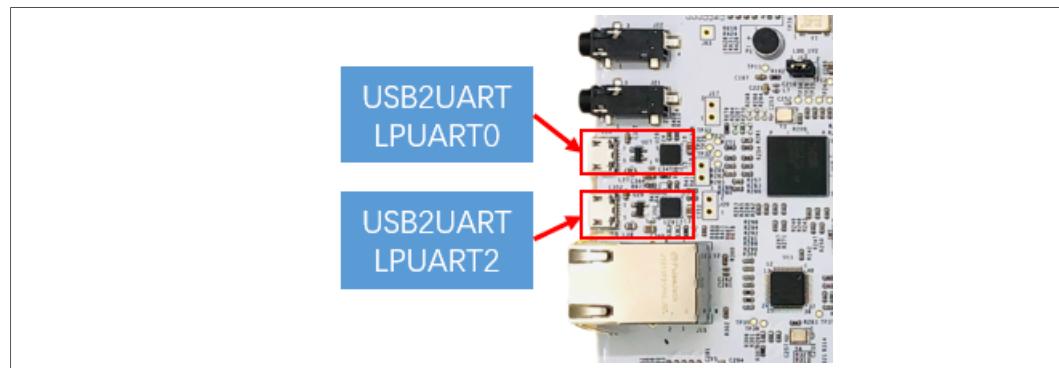


Figure 17. CAN/LIN circuit block diagram/USB to UART circuit on the White Board

## 8.4 General purpose inputs and outputs

#### 8.4.1 Analog and digital inputs

There are 2 general purpose digital inputs and 2 analog inputs on the White Board. Detailed PINs information can be found in [Table 6](#). The analog input voltage can range from 0V~20V. The digital input voltage can range from 0V~20V and they can also be used for analog signals sampling.

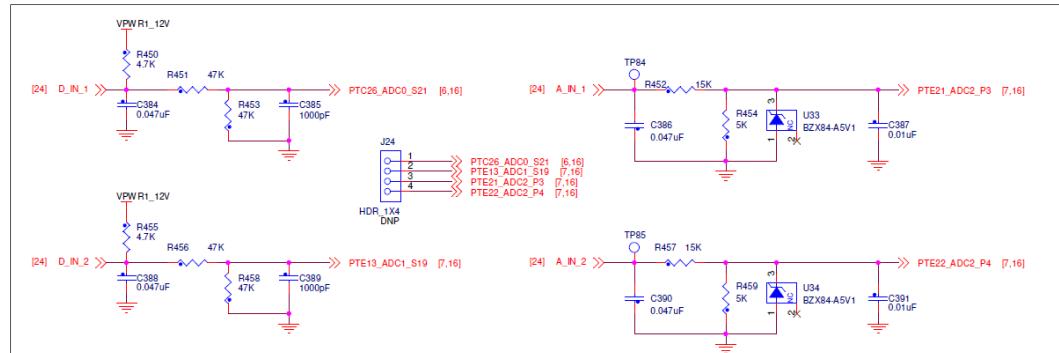


Figure 18. Analog input and digital input circuit

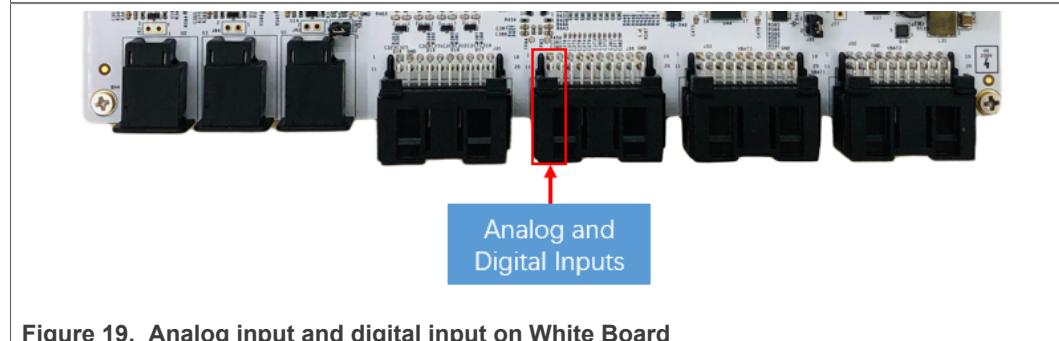


Figure 19. Analog input and digital input on White Board

#### 8.4.2 High side and low side driver outputs

There are 4 channels high side outputs driven by XS6500. They can be controlled by 4 MCU GPIO/PWM PINs or by MCU SPI commands sent to XS6500. There are 8 channels low side outputs through MC33879 and they are controlled by MCU SPI commands. Related MCU PINs details are listed in [Table 6](#).

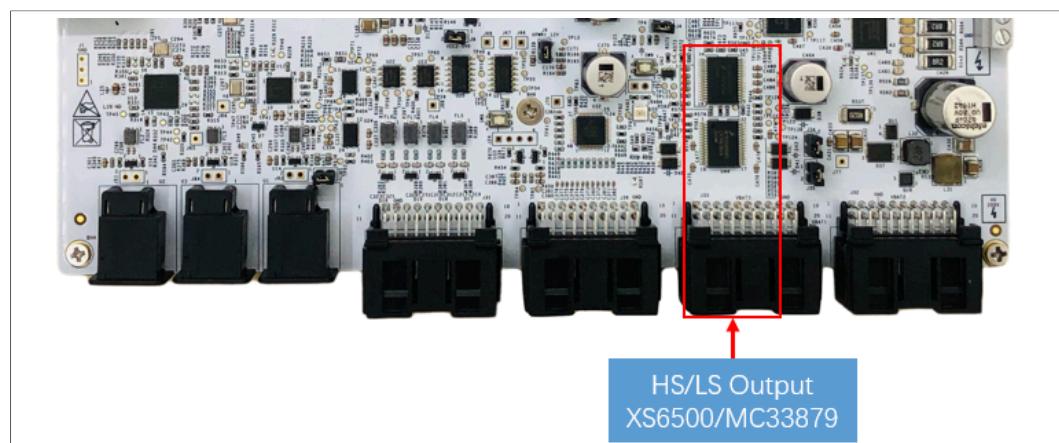


Figure 20. HS/LS outputs on the White Board

## 8.5 H-bridge driver

There is an H-Bridge driver on this board which is controlled by MCU SPI interface. It can be used for brushed DC motor control.

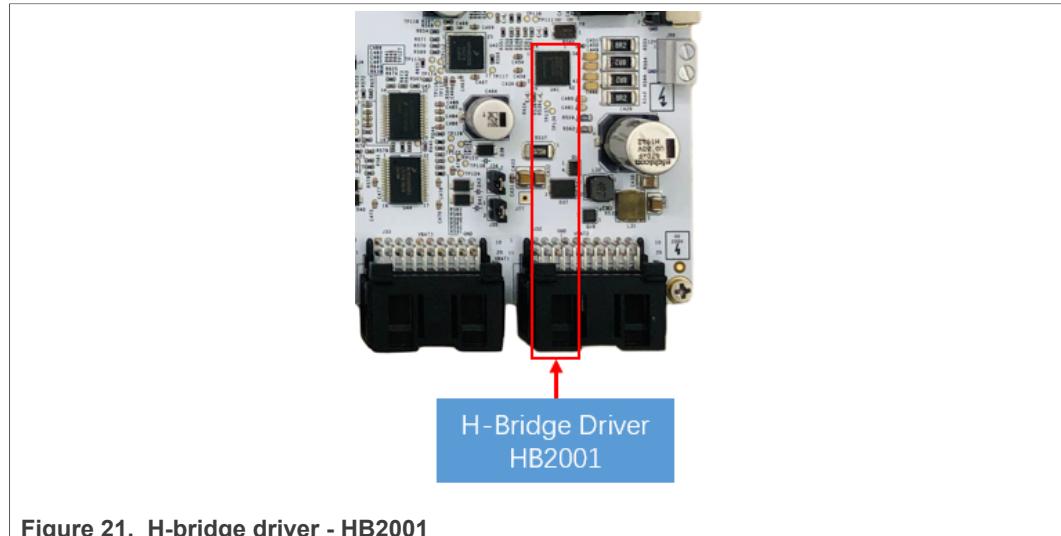


Figure 21. H-bridge driver - HB2001

## 8.6 Switch inputs detection

The MSDI device CD1030 includes 21 switch-to-ground inputs and 12 programmable inputs (switch to battery or ground). There are 6 channels SG (Switch-to-Ground inputs) pins and 6 channels SP (Switch to Programmable input) pins which are implemented on the White Board. The switch status, either open or closed, can be read by MCU through an SPI interface. Two push buttons – SW8 and SW9 – are used to trigger the switch status transition for test purpose.

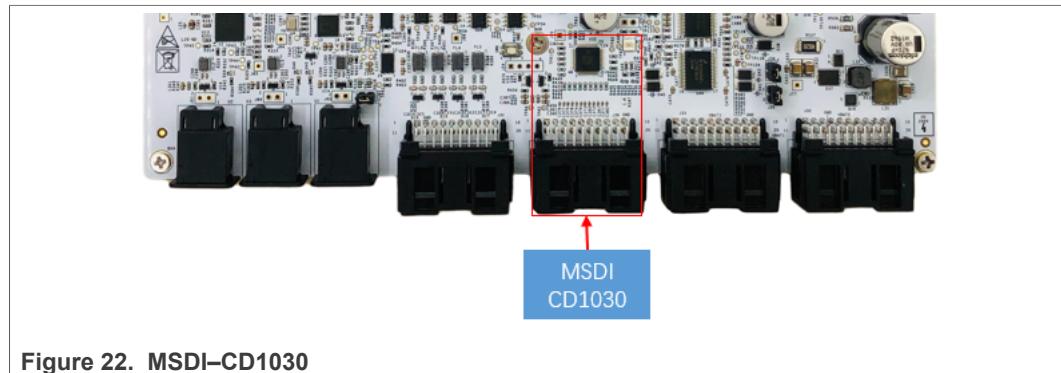


Figure 22. MSDI-CD1030

## 8.7 User peripherals

The user buttons, user LEDs, ADC POTs and touch sense pads on the White Board are shown in below figure. The related MCU PINs information are listed in [Table 6](#).

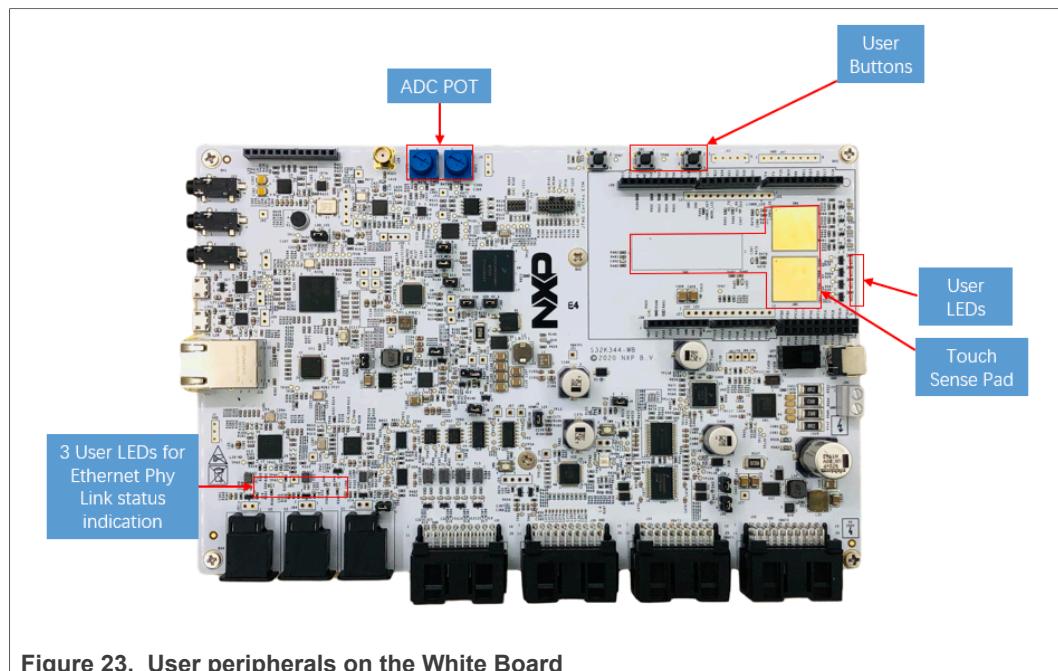


Figure 23. User peripherals on the White Board

### 8.7.1 User buttons

MCU PTC20 and PTC21 are used to monitor the user push buttons state. See the following figure for schematics of related circuits.

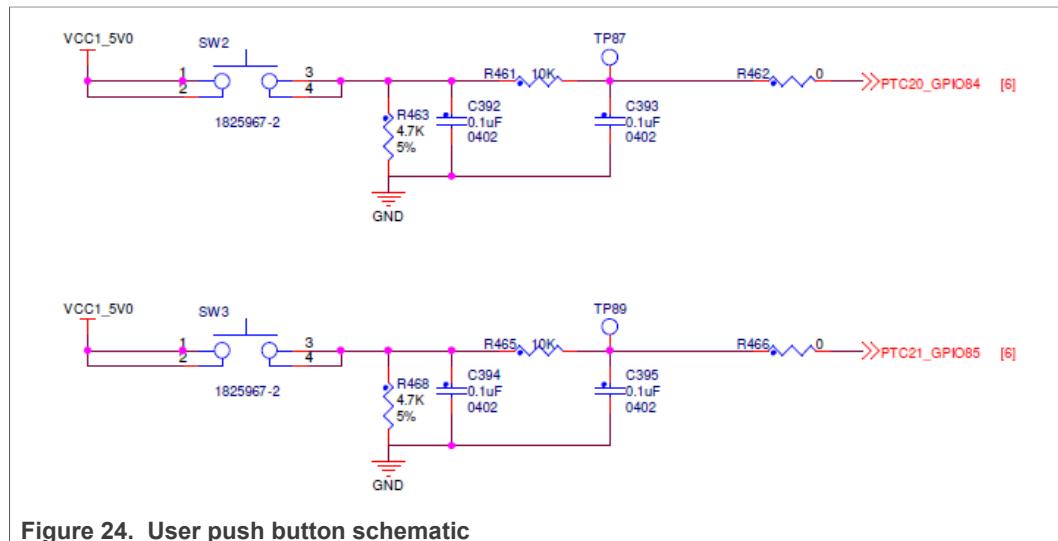


Figure 24. User push button schematic

### 8.7.2 User LEDs

MCU GPIO PTF8, PTF9, PTF10, PTF11 are used to drive the 4 user LEDs, and they are high-active. There are another 3 user LEDs driven by PTG0/PTG1/PTG2 which can be used to indicate the ethernet PHY link status.

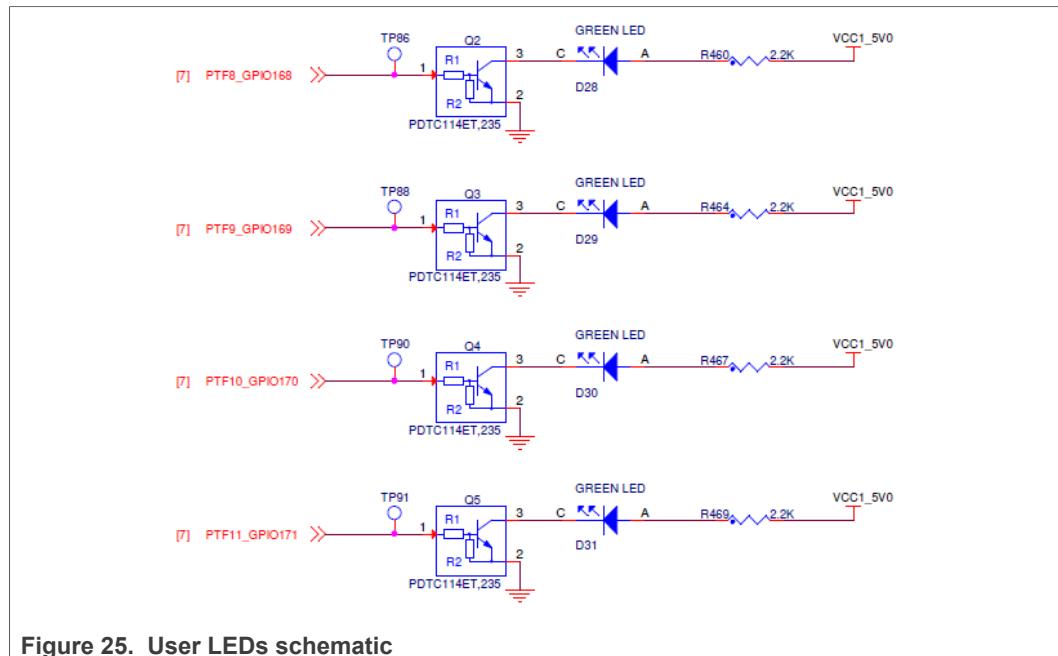


Figure 25. User LEDs schematic

### 8.7.3 ADC rotary potentiometers

The two ADC POTs are linked to MCU PINs PTB13 and PTB14. See following figure for the schematic.

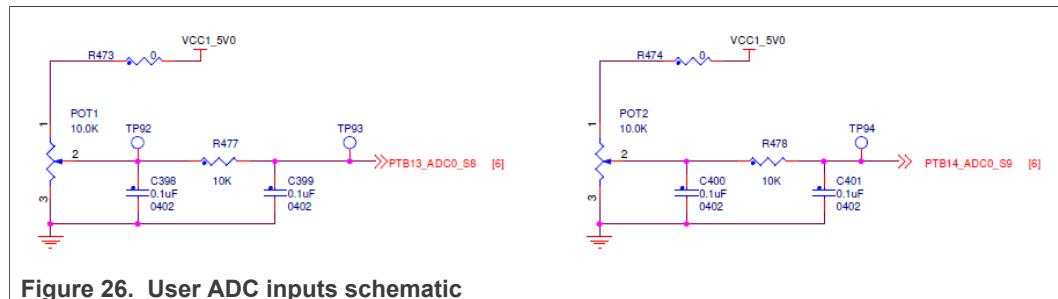


Figure 26. User ADC inputs schematic

### 8.7.4 Touch sense pads

There are two touch sense buttons and one touch sense slider on the White Board. See following figure for the schematic.

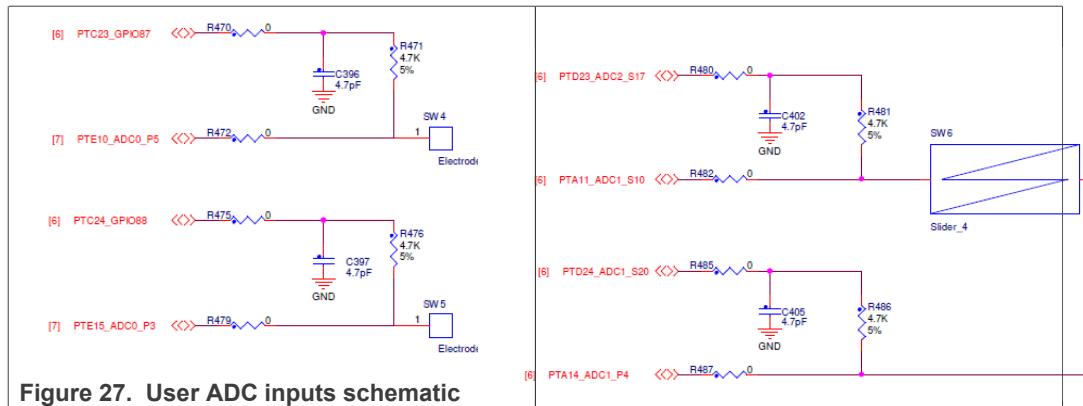


Figure 27. User ADC inputs schematic

## 8.8 IO headers for extension board

There are some IO Headers that can be used for external modules or EVB. See the following figure for these interfaces on the White Board.

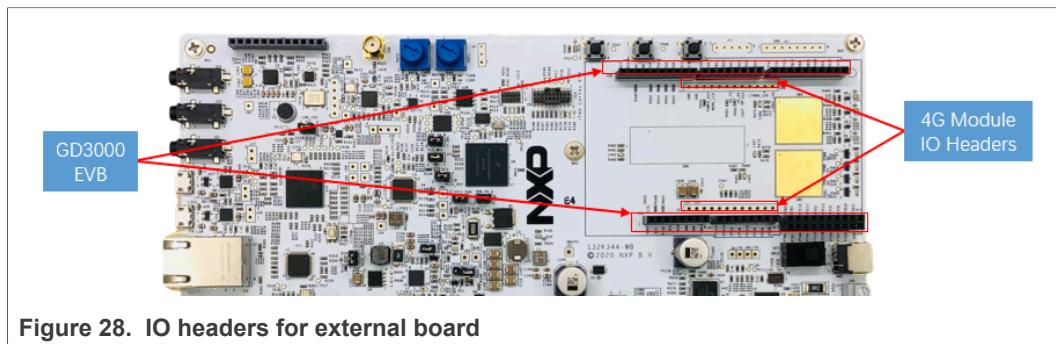


Figure 28. IO headers for external board

### 8.8.1 GD3000 EVB

The IO Headers J38, J39, J41, J42, J43, J44, J45J can be used as ARDUINO shield connectors. It's compatible with GD3000 EVB. Install the GD3000 EVB onto these headers and the White Board can drive a 3-phase PMSM motor. Key signals connections can be found in the White Board schematics.

### 8.8.2 4G module extension

The IO Headers J26 and J27 are used for external 4G Module. The part number is "USR-LTE-7S4".

## 8.9 Car access

The RF receiver NCK2910 and the LF driver NJJ29C2 are used in car access applications. External antennas are required for them to communicate with the KEYs. MCU can control these two devices via SPI interfaces. See below figure for block diagram. NCK2910 and NJJ29C2 are under NDA control. Please contact NXP sales representative and sign NDA if you need details about the two devices.

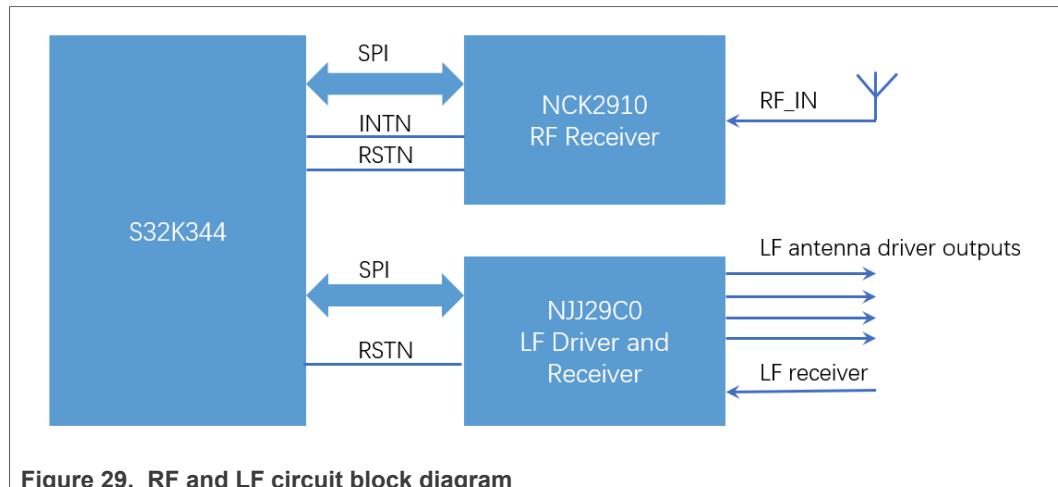


Figure 29. RF and LF circuit block diagram

The RF circuit and LF circuit on the White Board are shown in the following figure.

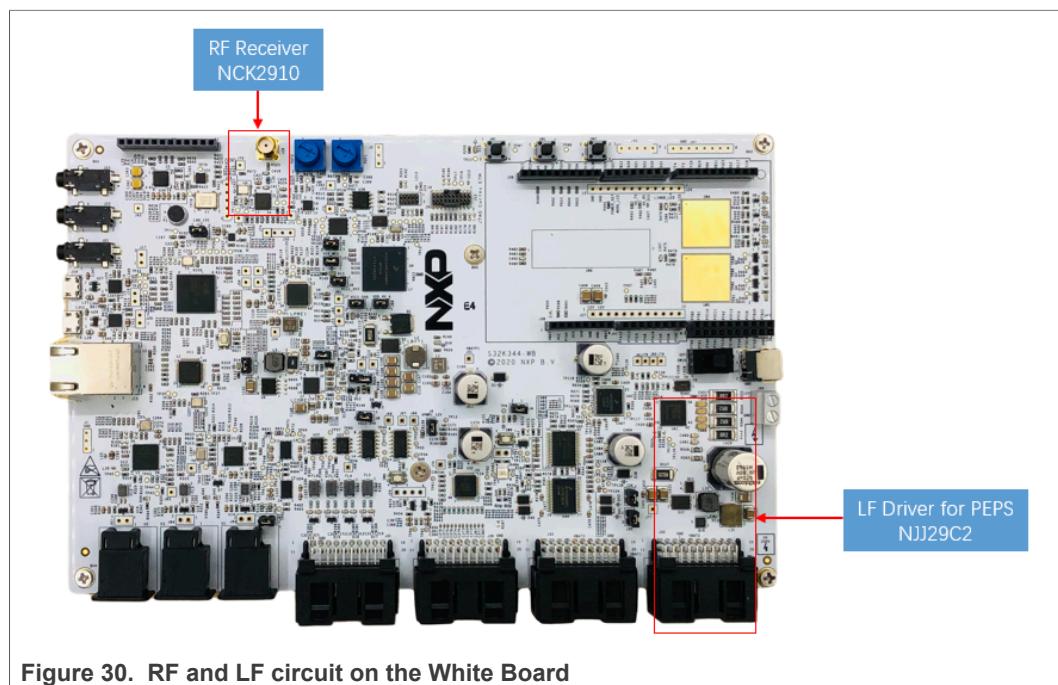


Figure 30. RF and LF circuit on the White Board

## 8.10 Audio

The audio codec SGTL5000 can be used together with ethernet circuits to evaluate AVB application. The device CS2100CP is used to synchronize the clock between MCU and SGTL5000. MCU transmits/receives audio data with SGTL5000 via SAI\_0 interface and configures the audio codec via LPI2C\_0 interface. We provide a 12-pin header for connecting external multiple-channel audio codec.

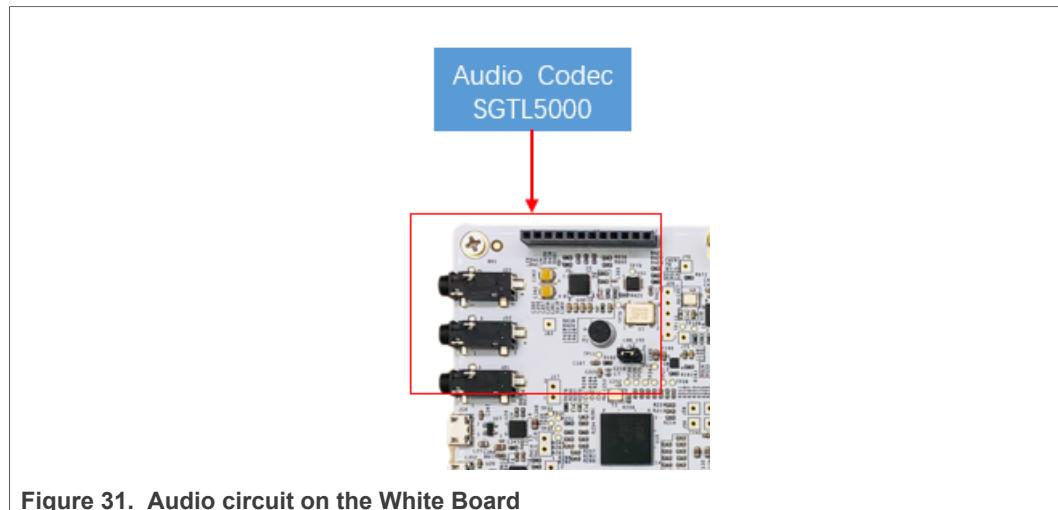


Figure 31. Audio circuit on the White Board

## 8.11 Others

The QSPI Flash (S25FL128L, 128Mbit) on the White Board can be used to store the firmware for S32K344 and other controllers connected to the vehicle network.

The FRAM (MB85RC256VPF, 256Mbit) is used to store some NVM data in case quick write is needed during power down.

The MMA8452Q is a smart, low-power, three-axis, capacitive, micromachined accelerometer with 12 bits of resolution. The device can be configured to generate inertial wakeup interrupt signals from any combination of the configurable embedded functions allowing the MMA8452Q to monitor events while staying in low power mode.

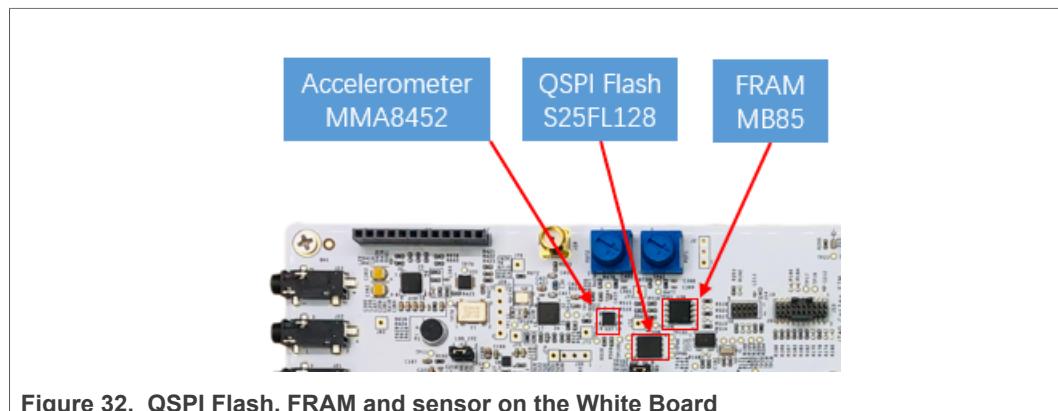


Figure 32. QSPI Flash, FRAM and sensor on the White Board

## 9 Abbreviations used in the document

Table 11. Abbreviations

WB	White Board
BCM	Body Control Module
DCU	Domain Control Unit
GW	Gateway
AVB	Audio Video Bridging
PHY	Physical Layer Transceiver
SBC	System Basis Chip
LF	Low Frequency
MSDI	Multiple Switch Detection Input
HS	High Side Driver
LS	Low Side Driver

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