UM11379

UJA116xA evaluation boards

Rev. 1 — 23 April 2021 **User manual**

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1 Introduction

This document is the user guide for the UJA116xA evaluation boards. It is intended for engineers involved in the evaluation, design, implementation, and validation of the UJA116xA product family. This guide discusses power supply requirements and the MCU and CAN bus interfaces, and describes how to connect the boards into an ECU/CAN network.

The UJA116xA evaluation boards are designed to facilitate the testing and evaluation of UJA116xA product features in a variety of microcontroller IO interface environments. All MCU interface signals can be accessed in two ways: at a header row on the top side and also at header rows on the bottom side that can be plugged directly into many NXP MCU evaluation boards. The UJA116xA evaluation boards are designed to be compatible with the S32K1xx evaluation board series from NXP and to support the use of standard software development tools and drivers.

The UJA116xA evaluation board family consists of seven variant boards as detailed in Table 1. Not just the assembled product, but the entire UJA116xA product family can be evaluated using these seven boards. For example, UJA1167A devices can be evaluated with the UJA1168AF-EVBs and UJA1168AXF-EVB boards by not employing partial networking. UJA1168ATK and UJA1168ATK/X devices can also be evaluated with the UJA1168AF-EVB and UJA1168AXF-EVB boards by keeping CFDC = 0.

Table 1. UJA116xA evaluation board and product overview

		Modes			Supplies					Host interface				Additional features					Package
Evaluation board	Device	Normal + Standby mode	Sleep mode	Reset mode	V1: 5 V, µC and CAN	BUF: 5 V, CAN only	VIO: host interface reference	VEXT: 5 V, external loads	INH: high-voltage output	STBN or SLPN: mode control	SPI: for control and diagnosis	RSTN: reset pin	CTS: CAN transmitter status	Watchdog	Local WAKE pin	Non-volatile memory	CAN partial networking	CAN FD passive	HVSON14
UJA1161A-EVB	UJA1161A	●				●	●			●			●						●
UJA1162A-EVB	UJA1162A	●	●			●	●		●	●			●		●				●
UJA1163A-EVB	UJA1163A	●		●	●					●		●							●
UJA1164A-EVB	UJA1164A	●		●	●						●	●		●		●			●
UJA1166A-EVB	UJA1166A	●	●		●		●		●	●			●		●				●
UJA1168AF-EVB	UJA1168AF	●	●	●	●				●		●	●		●	●	●	●	●	●
UJA1168AXF-EVB	UJA1168AXF	●	●	●	●			●			●	●		●	●	●	●	●	●

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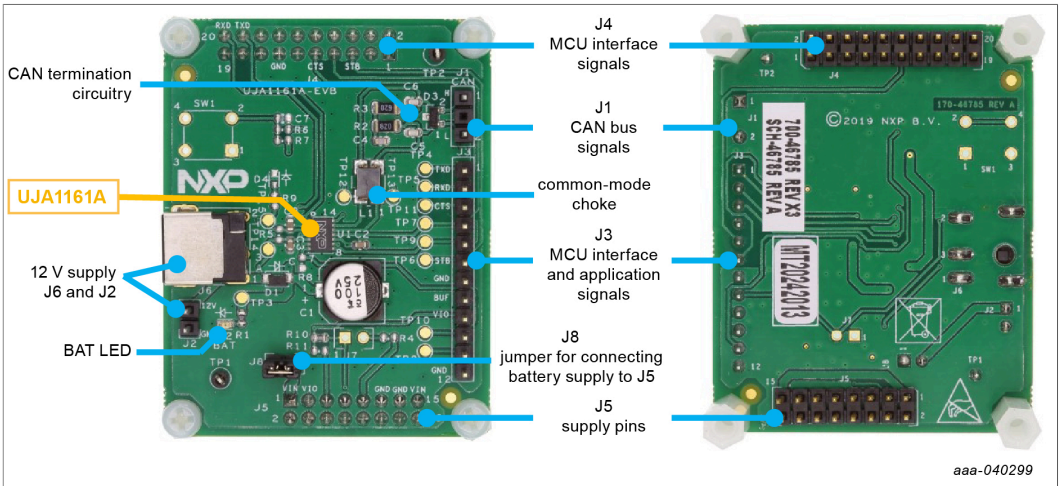
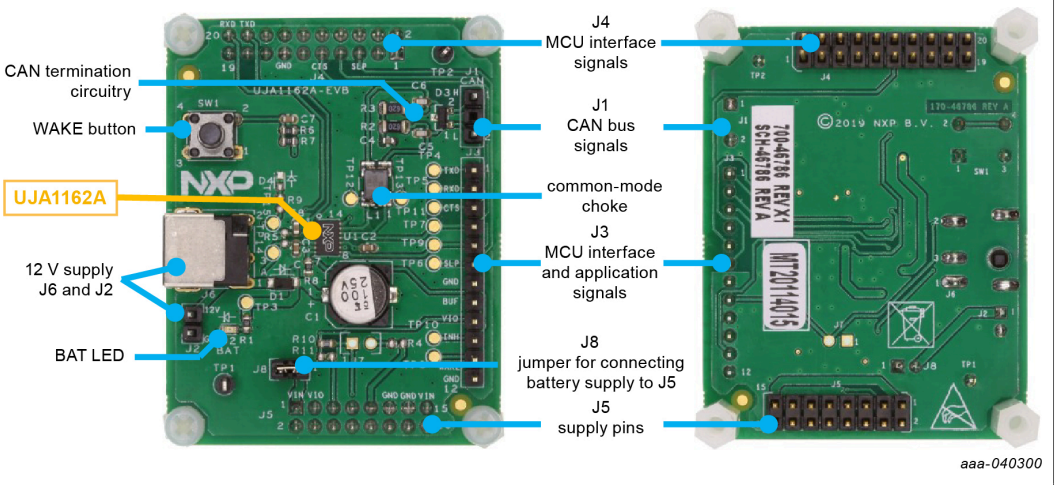
2 Overview of UJA116xA-EVB boards

Top and bottom views of the UJA116xA evaluation boards are illustrated in Figure 1.

Board dimensions are 45.1 mm × 58.4 mm. Only components needed to support basic UJA116xA functionality are included. All boards contain circuitry for reverse polarity-protected battery supply, BAT and V1 signal status LEDs, and CAN bus termination. Wake-up circuitry is included when the UJA116xA device has a WAKE pin. The board also provides several header rows (2.54 mm pitch) for connecting MCU interface and application signals.



UJA1161A-EVB top (left) and bottom (right) views.



UJA1162A-EVB top (left) and bottom (right) views.

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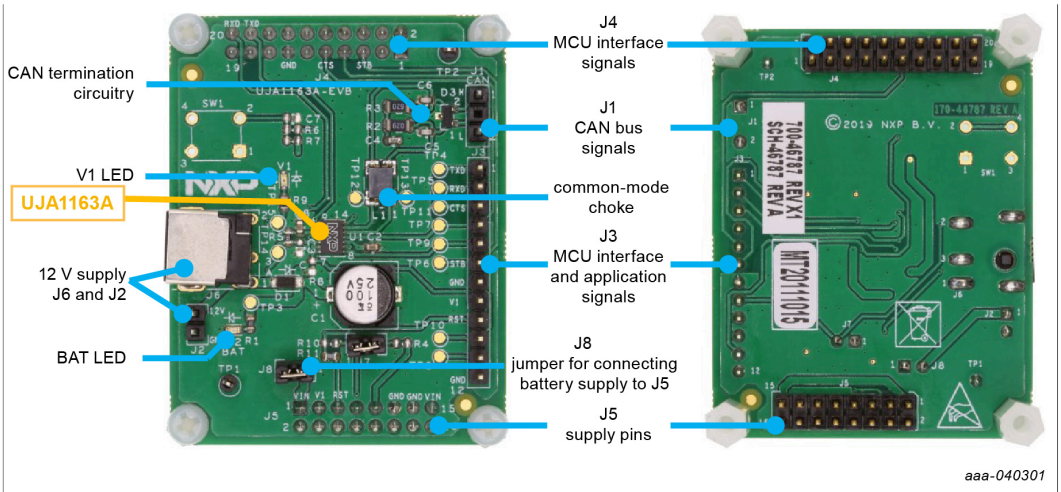
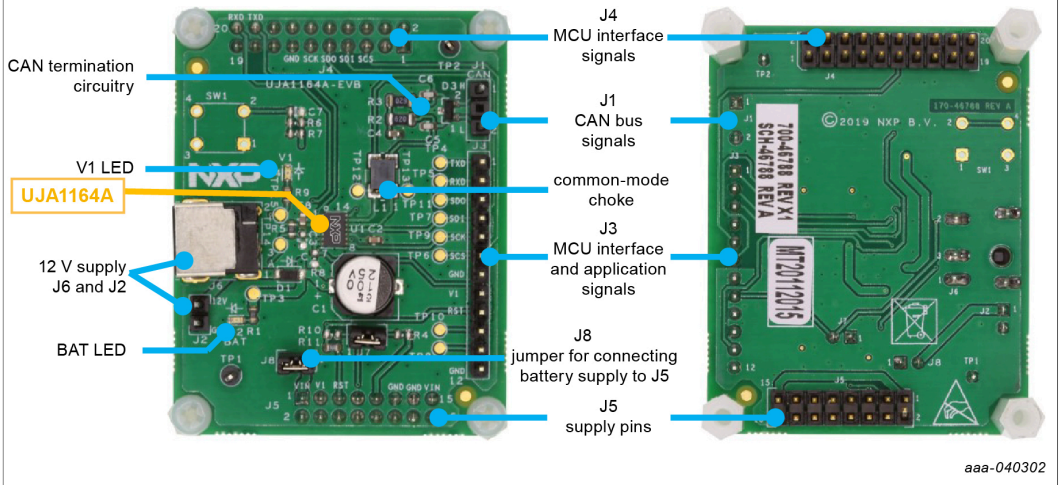
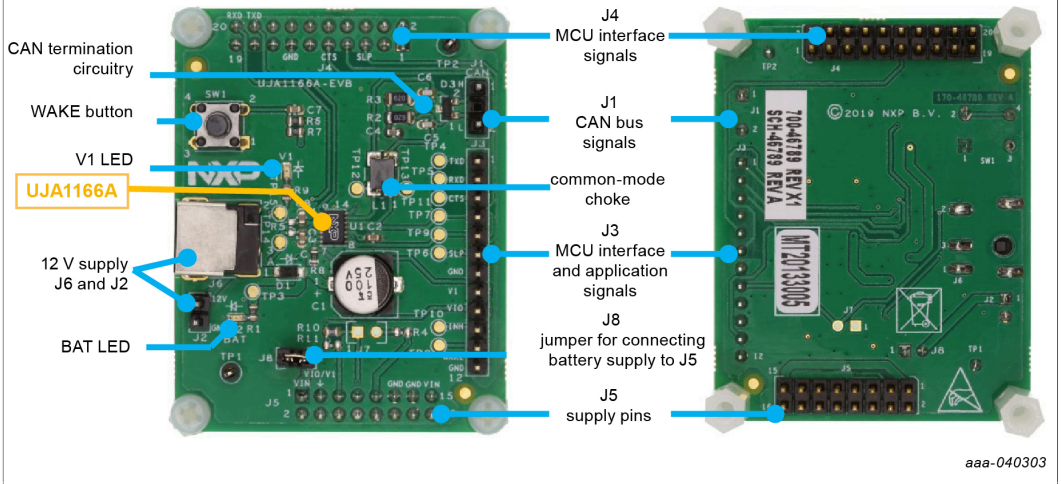


UJA1163A-EVB top (left) and bottom (right) views.



UJA1164A-EVB top (left) and bottom (right) views.



UJA1166A-EVB top (left) and bottom (right) views.

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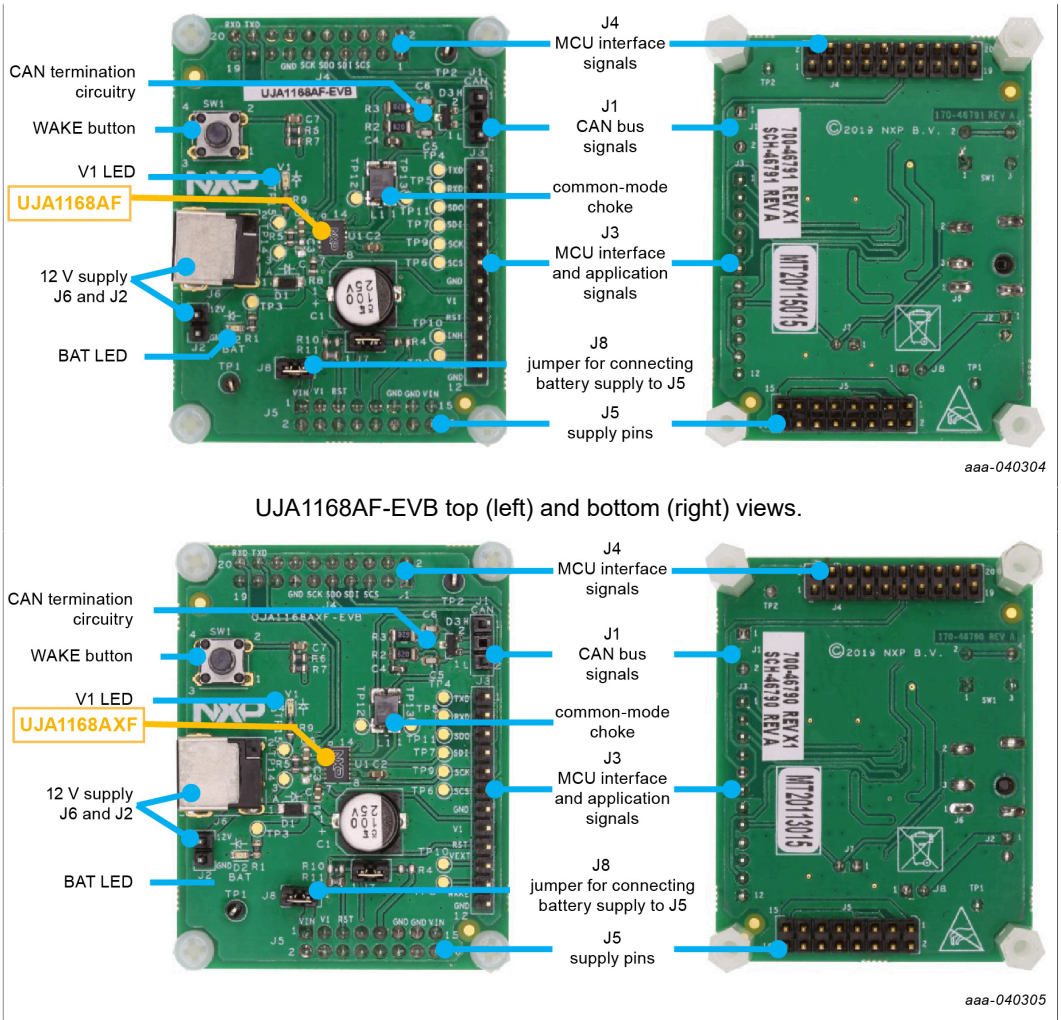

UJA1168AF-EVB top (left) and bottom (right) views.

UJA1168AXF-EVB top (left) and bottom (right) views.

Figure 1. Top and bottom views of evaluation boards

2.1 Ground connections

All ground pins are connected to the ground plane.

Table 2. Ground connections

Ground connections
J2-02
J3-07/12
J4-13
J5-11/13
J6-02/03

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2.2 Power supply connections

2.2.1 Battery connections (all UJA116xA-EVB boards)

An external power supply must be connected to either power jack J6 or 2-pin header J2, as illustrated in Figure 2.

Table 3. BAT/VIN connections

UJA116xA	UJA116xA-EVB
BAT (pin 10)	J2-01 or J6-01: connect to battery supply J5-01 and J5-15: pin VIN on the UJA116xA-EVB board is connected to the battery supply by default via jumper J8; remove jumper J8 to disconnect VIN on J5 from the battery supply

Both supply circuits are routed via polarity protection Schottky diode D1 in order to block reverse currents. Decoupling capacitors C1 and C2 are provided to stabilize the input voltage and remove noise on the battery connection.

Green LED D2 lights up once the 12 V power supply has been connected.

By default, the UJA116xA evaluation board battery supply is routed to the MCU board via pin VIN on the Arduino connector, allowing the supply to the entire module to be managed via the UJA116xA board. This feature can be disabled by removing jumper J8, disconnecting the battery supply from pin VIN.

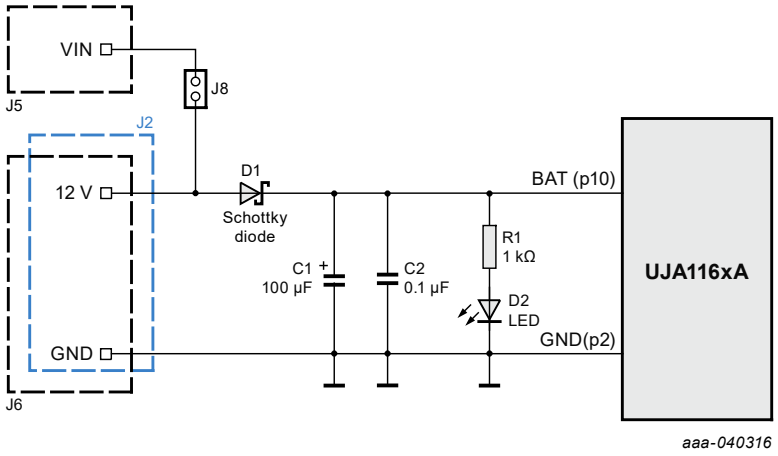

Figure 2. 12 V power supply connection options (relevant for the entire UJA116xA_EVB family)

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2.2.2 VIO/VBUF connections (UJA1161A/62A-EVB)

A V_{IO} supply is needed for the digital IOs. The V_{IO} voltage must be aligned with the MCU interface supply voltage. V_{IO} is not needed in Sleep mode.

The BUF voltage is generated automatically by the internal voltage source when needed for CAN bus communication. Detailed information on the functionality and operation of the UJA1161A and UJA1162A can be found in the data sheets and application hints (see Section 7).

Table 4. VIO/BUF connections

UJA1161A, UJA1162A	UJA1161A-EVB, UJA1162A-EVB
VIO (pin 5)	J3-09 or J5-03: connect MCU-compatible supply voltage
BUF (pin 3)	J3-08: no external supply needed; generated by the device when needed for CAN bus communication

The VIO supply can be connected to either J3 or J5. The BUF signal is available on J3. J3 is located on the top of the evaluation board and J5 is mounted on the bottom. The J5 connector pin arrangement follows the Arduino Uno pinout order, allowing the UJA1161A-EVB and UJA1162A-EVB to be connected directly to a variety of NXP MCU evaluation boards. Decoupling capacitors C3 and C8 are provided to stabilize the voltages on VIO and BUF and to remove noise.

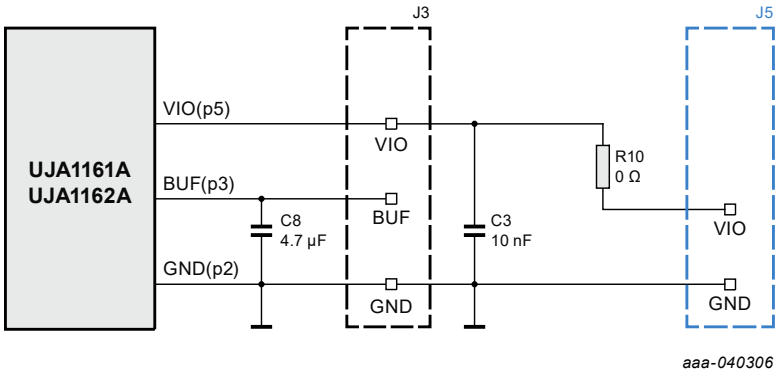

Figure 3. VIO/BUF supply connection options (relevant for UJA1161A/62A only)

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2.2.3 V1/RST connections (UJA1163A/64A/68AF/68AXF-EVB)

The V1 supply voltage is generated by the internal 5 V regulator and is intended to supply the external microcontroller. It also determines the IO reference level. RST is a bidirectional signal between pin RSTN on the SBC and the MCU. It is used to initiate a system reset.

A 10 kΩ pull-up resistor is connected between RSTN and V1 on the evaluation boards. A reset can be triggered by a LOW level on RSTN. Detailed information on the functionality and operation of the UJA1163A, UJA1164A and UJA1168AF/AXF can be found in the data sheets and application hints (see Section 7).

Table 5. V1/RSTN connections

UJA1163A, UJA1164A, UJA1168A	UJA1163A-EVB, UJA1164A-EVB, UJA1168AF-EVB, UJA1168AXF-EVB
RSTN (pin 5)	J3-09 or J5-05: connect MCU RST signal
V1 (pin 3)	J3-08 or J5-03: connect 5 V supply for the MCU

The V1 output and RST signals can be accessed from either J3 or J5. J3 is located on the top of the evaluation board and J5 is mounted on the bottom. Decoupling capacitor C8 is provided to stabilize output voltage on V1 and remove noise.

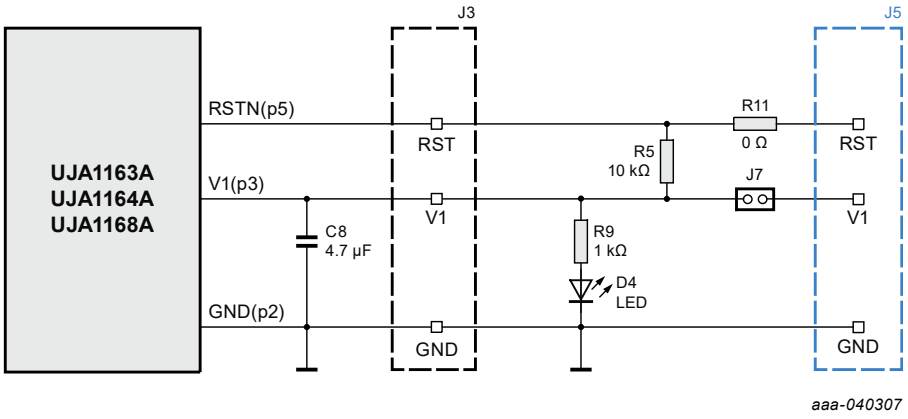

Figure 4. V1 supply and RST connection options (only relevant for UJA1163A/64A/68AF/68AXF-EVB)

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2.2.4 VIO/V1 connections (UJA1166A-EVB)

A V_{IO} supply is needed for the digital IOs. The V_{IO} voltage must be aligned with the MCU interface supply voltage. V_{IO} is not needed in Sleep mode.

The V1 supply voltage is generated by the internal 5 V regulator and is intended to supply peripheral circuitry, e.g. additional CAN transceivers. Detailed information on the functionality and operation of the UJA1166A can be found in the data sheet and application hints (see Section 7).

Table 6. VIO/V1 connections

UJA1166A	UJA1166A-EVB
VIO (pin 5)	J3-09 or J5-05: connect MCU-compatible supply voltage
V1 (pin 3)	J3-08: connect peripherals to be supplied from V1

The V_{IO} supply can be connected to either J3 or J5. The V1 output voltage is available on J3. J3 is located on the top of the evaluation board and J5 is mounted on the bottom. Decoupling capacitor C8 is provided to stabilize output voltage on V1 and remove noise. Red LED D4 lights up once the V1 output is present.

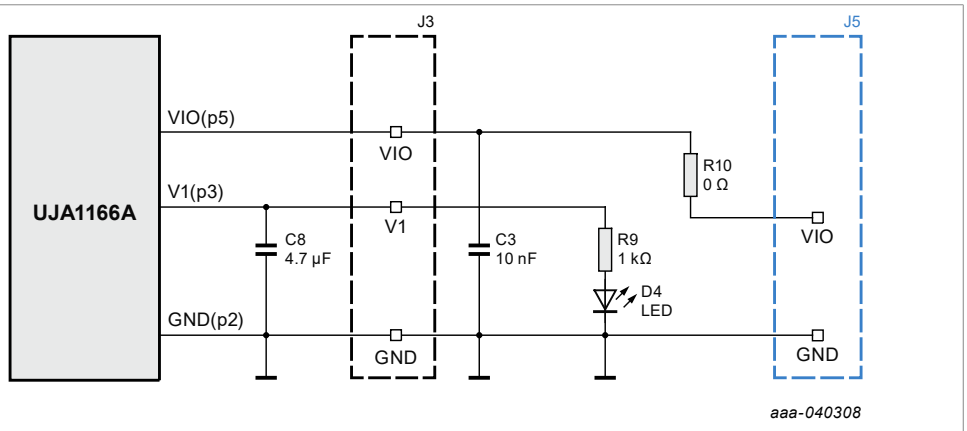

Figure 5. V1 and VIO supply connection options (only relevant for UJA1166A-EVB)

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2.2.5 VEXT connection (UJA1168AXF-EVB)

An additional 5 V regulator output voltage is provided on the UJA1168AXF-EVB. It is intended to supply external components and can deliver up to 30 mA. A decoupling capacitor, C9, is connected between VEXT and GND.

Table 7. VEXT connection

UJA1168AXF	UJA1168AXF-EVB
VEXT (pin 7)	J3-10: outputs 5 V voltage to supply ECU external loads

VEXT can be accessed on J3, on the top of the evaluation board.

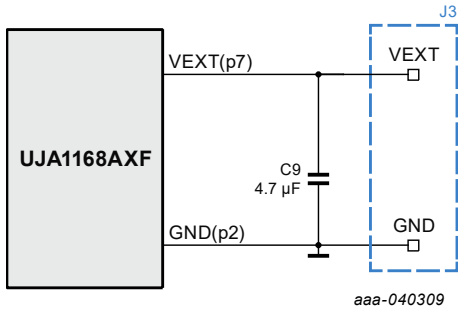

Figure 6. VEXT supply connections (only relevant for UJA1168AXF-EVB)

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2.3 CAN communication circuitry

The UJA116xA evaluation boards contain typical CAN communication circuitry. The CANH and CANL bus signals are output on connector J1.

Table 8. CAN bus line connections

UJA116xA	UJA116xA-EVB
CANH (pin 13)	J1-01: connect to HIGH-level CAN bus line
CANL (pin 12)	J1-02: connect to LOW-level CAN bus line

Equipped with termination resistors R2 and R3, the UJA116xA evaluation boards are pre-prepared to be used as termination nodes in a CAN network. If the CAN network is already terminated at both ends, it is recommended to remove R2 and R3 or replace them with higher value resistors to ensure that the impedance on the bus meets the CAN bus load specification, typically 60 Ω.

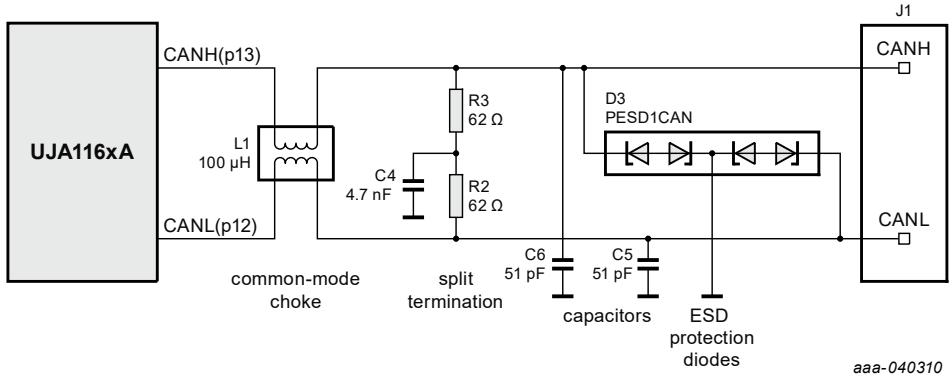

Figure 7. CAN bus interface circuitry (relevant for the entire UJA116xA-EVB family)

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2.4 Wake-up options (UJA1162A/66A/68AF/68AXF-EVB)

The UJA1162A, UJA1166A and UJA1168A support a Sleep mode for use in energy-sensitive applications. Once in Sleep mode, the device will remain in this low-power mode until a wake-up request is received. A wake-up event can be triggered remotely via a standard pattern or dedicated wake-up frame on the CAN bus (UJA1168A only), or locally via the WAKE pin (details of wake-up functionality can be found in the data sheets and application hints; see Section 7).

Table 9. WAKE/INH connections

UJA1162A, UJA1166A, UJA1168A	UJA1162A-EVB, UJA1166A-EVB, UJA1168AF-EVB, UJA1162AXF-EVB
WAKE (pin 9)	J3-11: connect to wake-up signal
INH (pin 7)[1]	J3-10: connect to control input signal from external regulator(s) (not relevant for UJA1168AXF-EVB)

[1] Not valid for the UJA1168ATK/X and UJA1168ATK/XF; pin 7 is VEXT in these devices (see data sheet: Section 7).

The UJA1162A, UJA1166A, UJA1168AF and UJA1168AXF evaluation boards feature local wake-up test circuitry. The WAKE pin is pulled HIGH by default via 10 kΩ resistors R6 and R7. When switch SW1 is pressed, the WAKE pin is pulled LOW. Local wake-up is enabled automatically in the UJA1162A and UJA1166A. It must be enabled via the register map in the UJA1168A (as described in the UJA1168A data sheet).

In the UJA1162A and UJA1166A, pin INH is used to control the supply to the MCU. It is pulled LOW via resistor R8 when the SBC switches to Sleep mode. When a wake-up event is detected, INH is forced HIGH to switch on the voltage regulator supplying the MCU.

In the UJA1168A, the MCU is intended to be supplied via V1. V1 is off in Sleep mode and switches on automatically when a wake-up event is detected. Pin INH in the UJA1168ATK and UJA1168ATK/F can be used to control external voltage regulators and other devices, but is not necessarily relevant for wake-up.

The WAKE and INH pins can be accessed via header J3, on the top of the evaluation board.

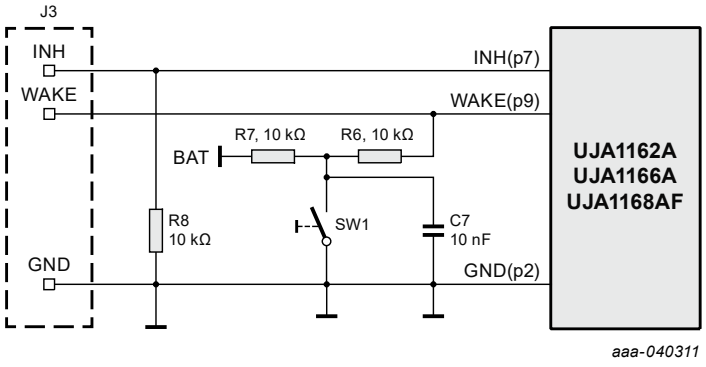

Figure 8. Local wake and INH circuitry

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2.5 MCU interface

The digital interface pins are located on the top side header J3 (J3-01 to J3-06), as well as on the bottom side connector J4. Two of these pins, TXD and RXD, are used for CAN data communication with the MCU. The remaining pins are used for communication with the MCU, either as SPI signals (see Table 10) or as simple control and status signals (see Table 11).

2.5.1 CAN TXD/RXD and SPI connections (UJA1164A/68AF/68AXF-EVB)

For variants with an SPI interface (UJA1164A, UJA1168A), integrated Multiple Time Programmable Non-Volatile (MTPNV) memory cells allow the device to reload previously configured settings at power up. The device boots up in Forced Normal mode when not previously configured. Factory preset values can be restored if certain conditions are met.

Detailed information on the functionality and operation of the UJA1164A and UJA1168A can be found in the data sheets and application hints (see Section 7).

Table 10. TXD, RXD and SPI connections

UJA1164A, UJA1168A	UJA1164A-EVB, UJA1168AF-EVB, UJA1168AXF-EVB
TXD (pin 1)	J3-01 or J4-18
RXD (pin 4)	J3-02 or J4-20
SDO (pin 6)	J3-03 or J4-09
SDI (pin 11)	J3-04 or J4-07
SCK (pin 8)	J3-05 or J4-11
SCSN (pin 14)	J3-06 or J4-05

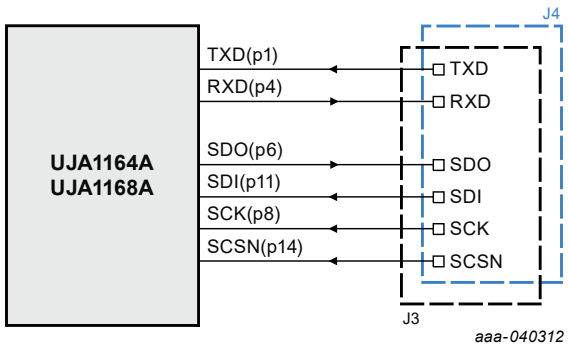

Figure 9. MCU interface

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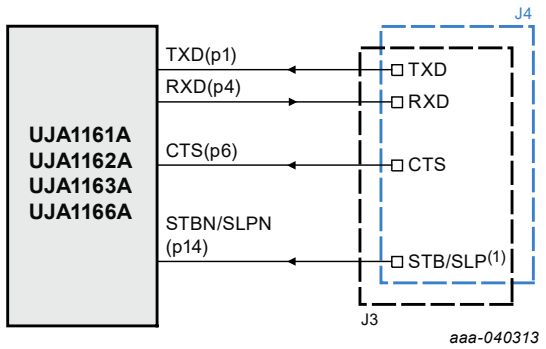
2.5.2 CAN TXD/RXD and mode control connections (UJA1161A, UJA1162A, UJA1163A, UJA1166A)

Table 11. TXD, RXD and mode control connections

UJA1161A, UJA1162A, UJA1163A, UJA1166A	UJA1161A-EVB, UJA1162A-EVB, UJA1163A-EVB, UJA1166A-EVB
TXD (pin 1)	J3-01 or J4-18
RXD (pin 4)	J3-02 or J4-20
CTS (pin 6)	J3-03 or J4-09
STBN (pin 14) - UJA1161A and UJA1163A	J3-06 or J4-05
SLPN (pin 14) - UJA1162A and UJA1166A	



(1) STB on UJA1161A/63A-EVB; SLP on UJA1162A/66A-EVB

Figure 10. MCU CAN and mode control interface

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3 Connecting the UJA116xA to a CAN network

3.1 Connecting boards without an SPI (UJA1161A/62A/63A/66A-EVB)

The following conditions must be met before powering up the system with a 12 V supply.

Common to all boards:

- Connect all boards in the ECU to a common GND
- Connect pin CTS (J3-03, J4-09) to an MCU IO input pin
- Connect pin STBN/SLPN (J3-06, J4-09) to an MCU IO output pin
- Connect TXD/RXD (J3-01/J3-02, J4-18/J4-20) pins to the MCU CAN controller TXD/RXD pins
- Connect CANH and CANL (J1-01/J1-02) to the CAN bus twisted-pair cables

Board specific:

- Connect VIO (J3-09, J5-03) on the UJA1161A-EVB, UJA1162A-EVB and UJA1166A-EVB to the MCU supply unit; VIO shares the MCU IO supply
- Connect RST (J3-09, J5-05) on the UJA1163A-EVB to the MCU CAN controller RSTN pin
- Connect V1 (J3-08, J5-03) on the UJA1163A-EVB to the MCU supply unit
- Connect V1 (J3-08, J5-03) on the UJA1166A-EVB to the application circuit to be supplied from V1
- Connect INH (J3-10) on the UJA1162A-EVB and UJA1166A-EVB to the control/enable pin on the ECU supply unit (optional)

Once the above steps have been completed, the ECU/EVB can be powered up using an external battery supply. The UJA116xA starts up in Standby mode and then switches between Standby/Sleep modes and Normal mode depending on the level on pin STBN/SLPN.

An example of how to connect the UJA1163A-EVB between an MCU and the CAN bus is shown in Figure 11.

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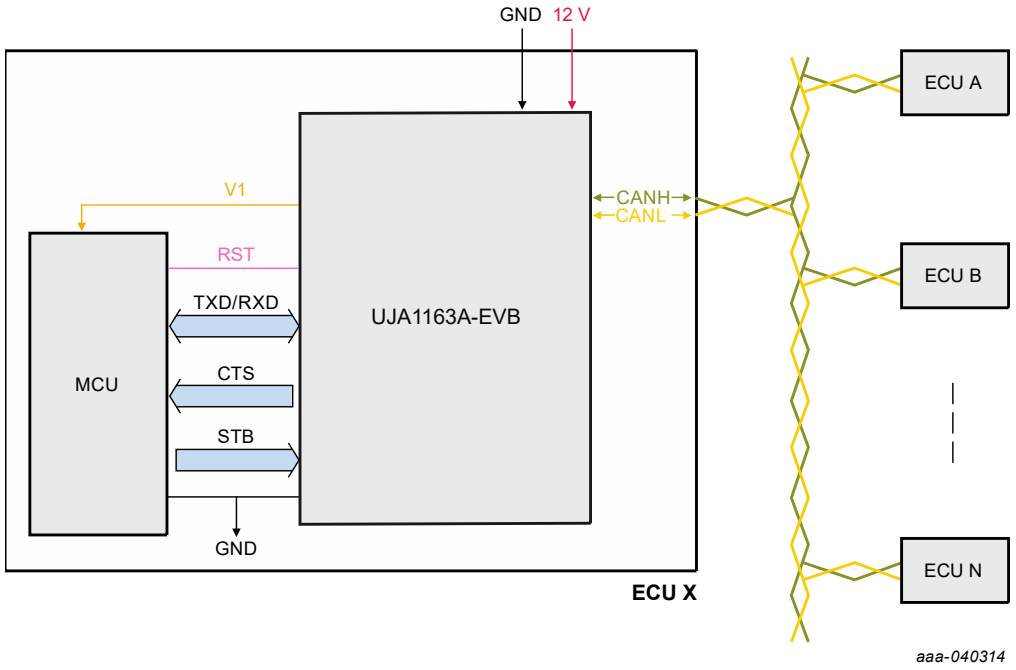

Figure 11. Connecting the UJA1163A-EVB in an ECU/CAN bus network

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3.2 Connecting boards with an SPI (UJA1164A/68AF/68AXF-EVB)

The following conditions must be met before powering up the system with a 12 V supply:

- Connect all boards in the ECU to a common GND
- Connect SPI pins to the MCU SPI master:
  - SDO (J3-03, J4-09) → MISO
  - SDI (J3-04, J4-07) → MOSI
  - SCK (J3-05, J4-11) → SCK
  - SCSN (J3-06, J4-05) → CS
- Connect TXD/RXD (J3-01/J3-02, J4-18/J4-20, J9-09/J5-05) pins to the MCU CAN controller TXD/RXD pins
- Connect RSTN (J9-09/J5-05) to the MCU CAN controller reset pin
- Connect CANH and CANL (J1-01/J1-02) to the CAN bus twisted-pair cables
- Connect V1(J3-08, J5-03) to the MCU supply unit
- Connect INH (J3-10) on the UJA1168AF-EVB to the control/enable pin on the ECU supply unit (optional)
- Connect VEXT (J3-10) on the UJA1168AXF-EVB to the peripheral loads that need a 5 V supply (optional)

Once the above steps have been completed, the ECU/EVB can be powered up using an external battery supply. The UJA116xA starts up in Forced Normal mode (if MTP is not configured) or Standby mode (if MTP configured), awaiting commands from the MCU via the SPI interface.

An example of how to connect the UJA1168AF-EVB between an MCU and the CAN bus is shown in Figure 12.

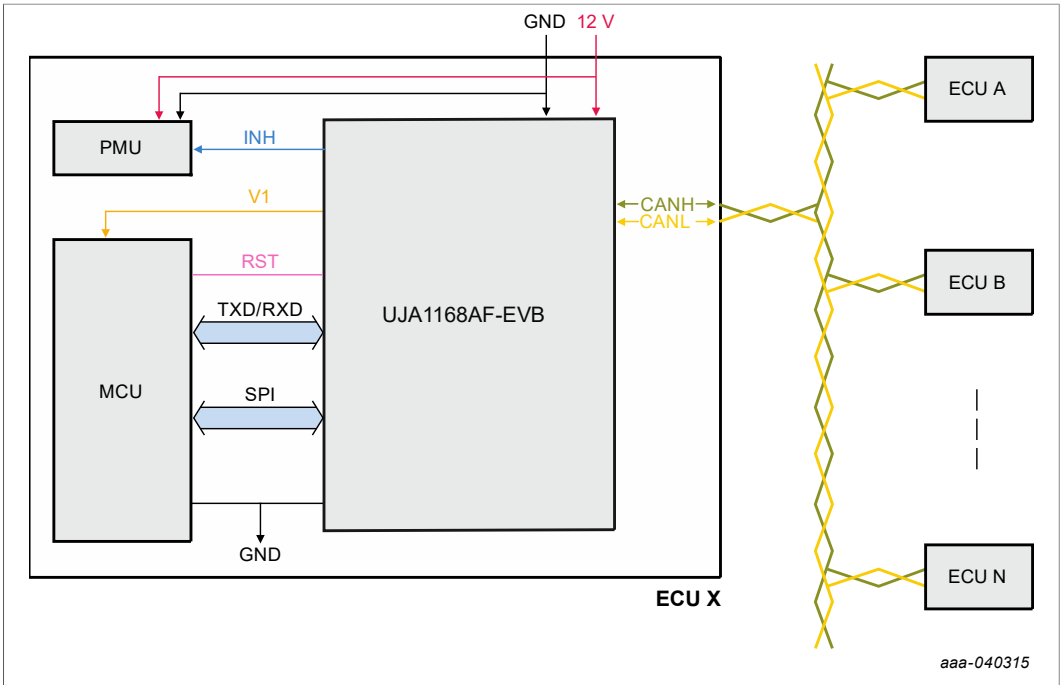

Figure 12. Connecting the UJA1168AF-EVB in an ECU/CAN bus network

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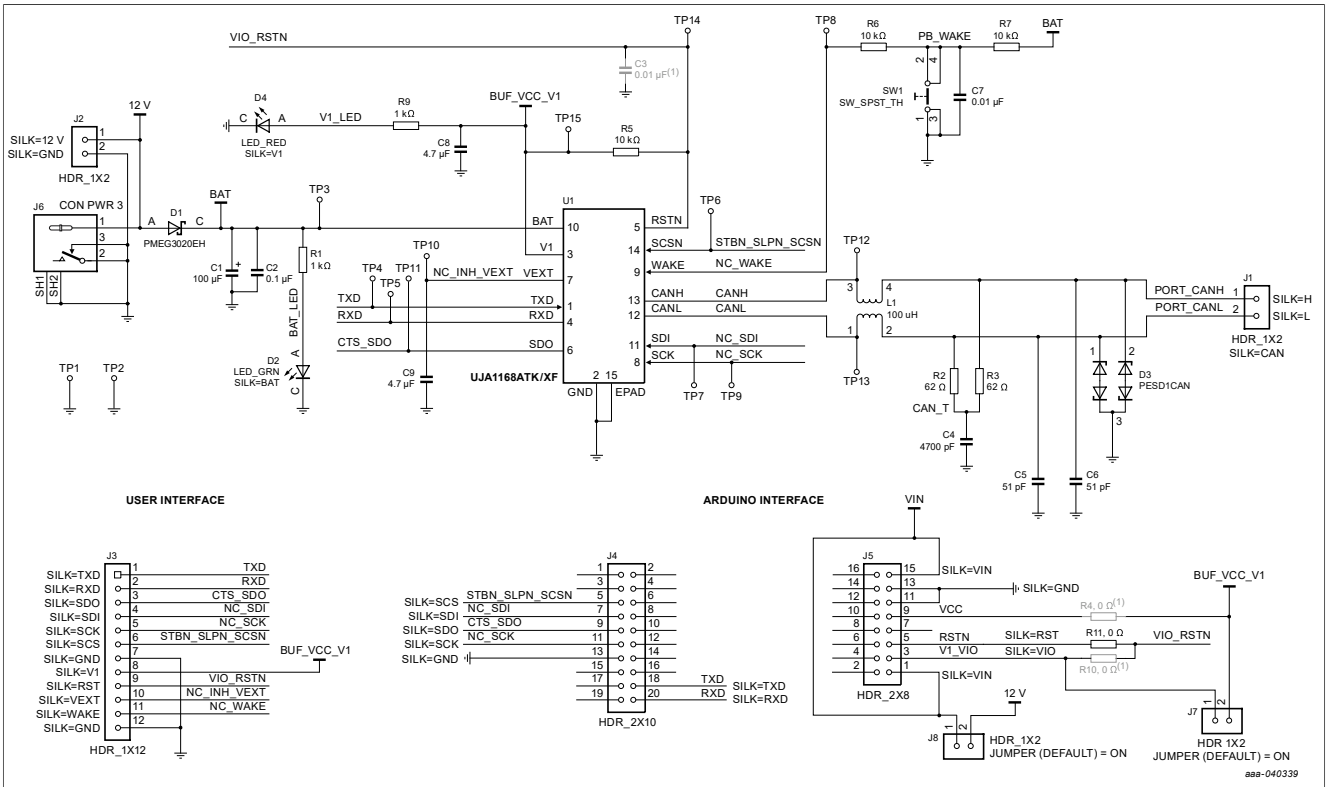
4 Schematic diagrams



(1) Component not populated.

Figure 13. UJA1168AXF-EVB schematic diagram

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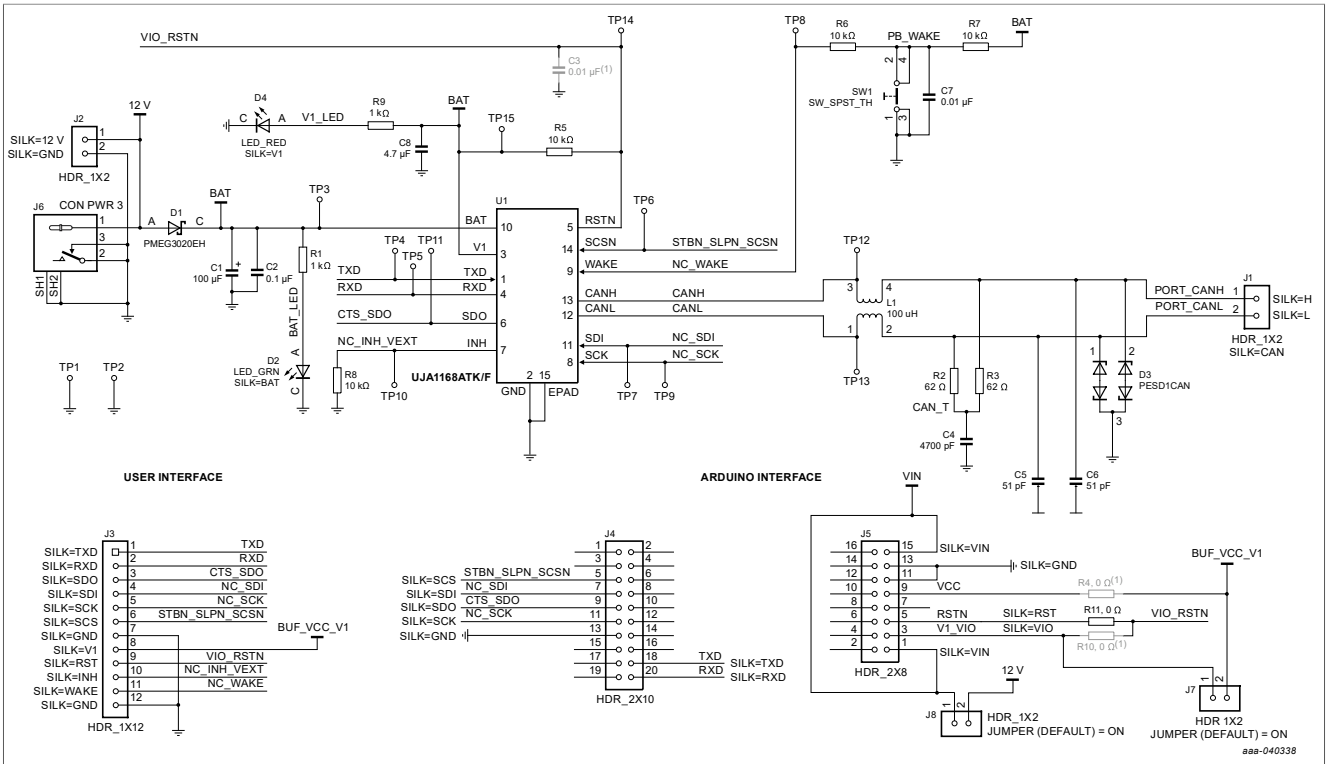
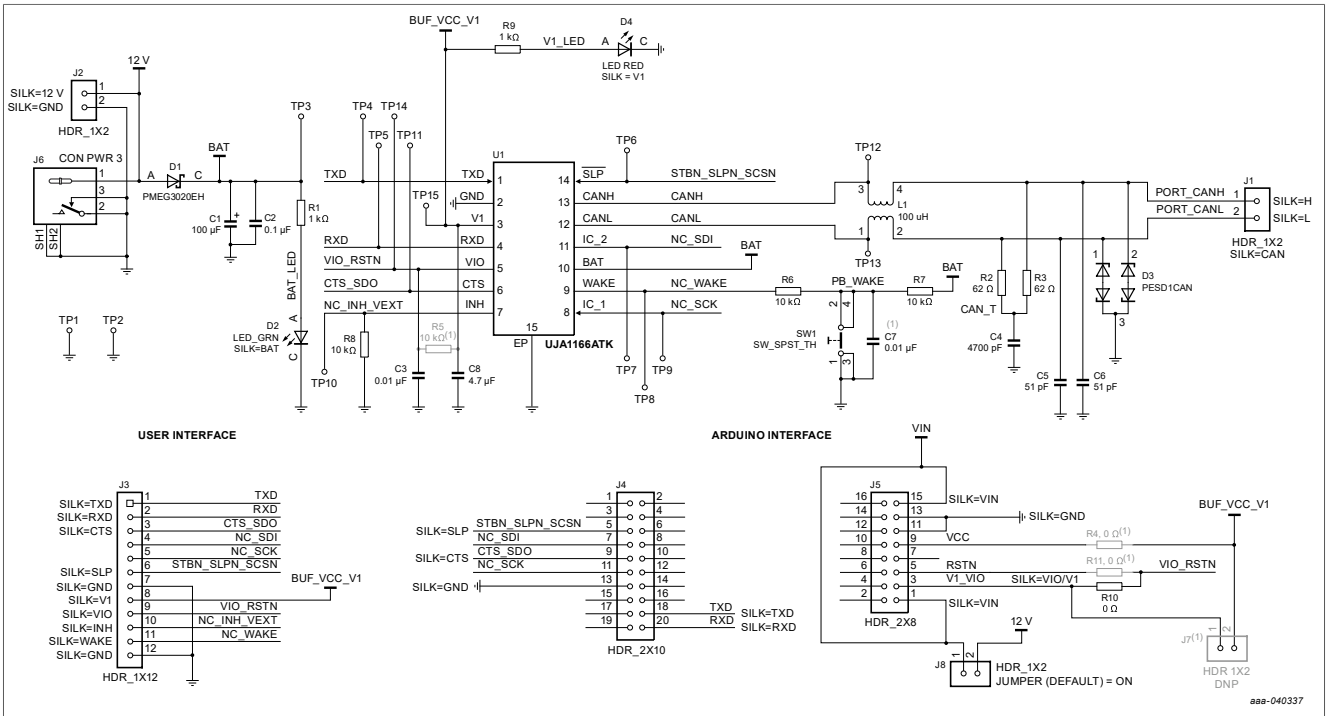


(1) Component not populated.

Figure 14. UJA1168AF-EVB schematic diagram



(1) Component not populated.

Figure 15. UJA1166A-EVB schematic diagram

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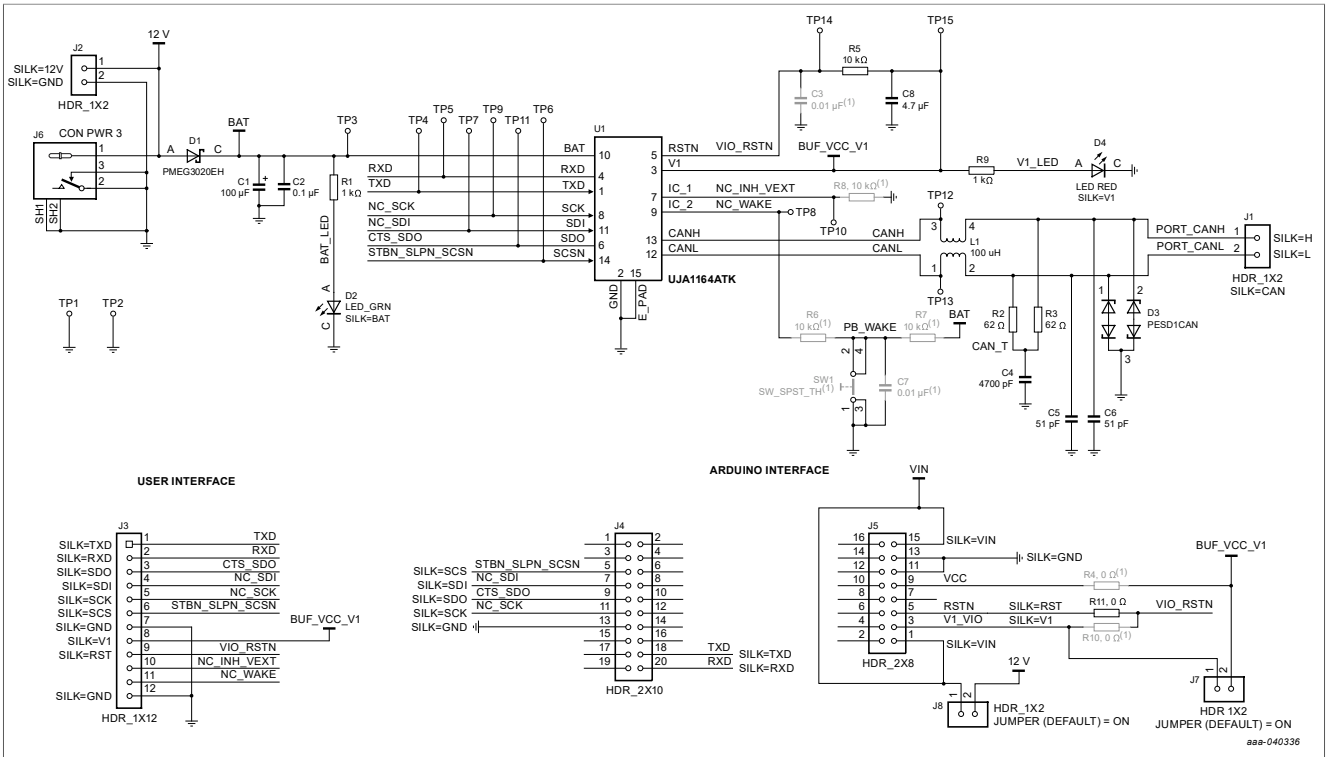
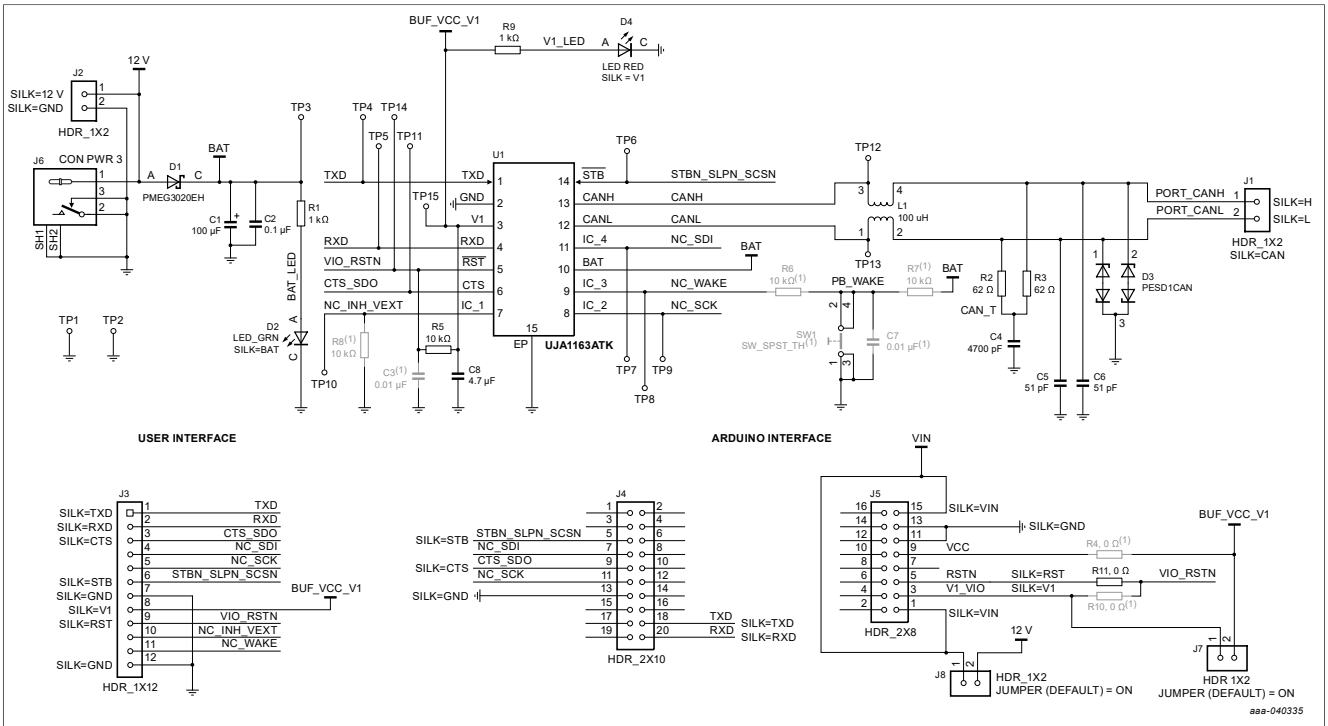


(1) Component not populated.

Figure 16. UJA1164A-EVB schematic diagram



(1) Component not populated.

Figure 17. UJA1163A-EVB schematic diagram

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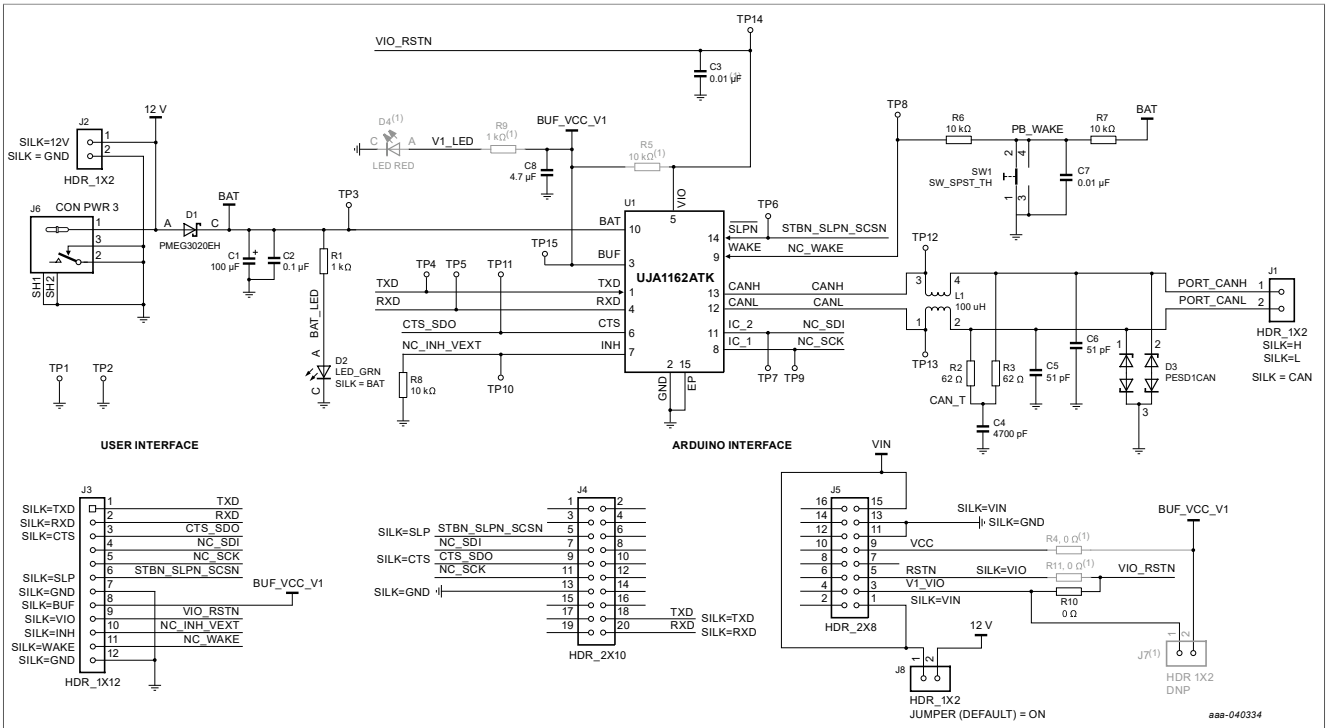
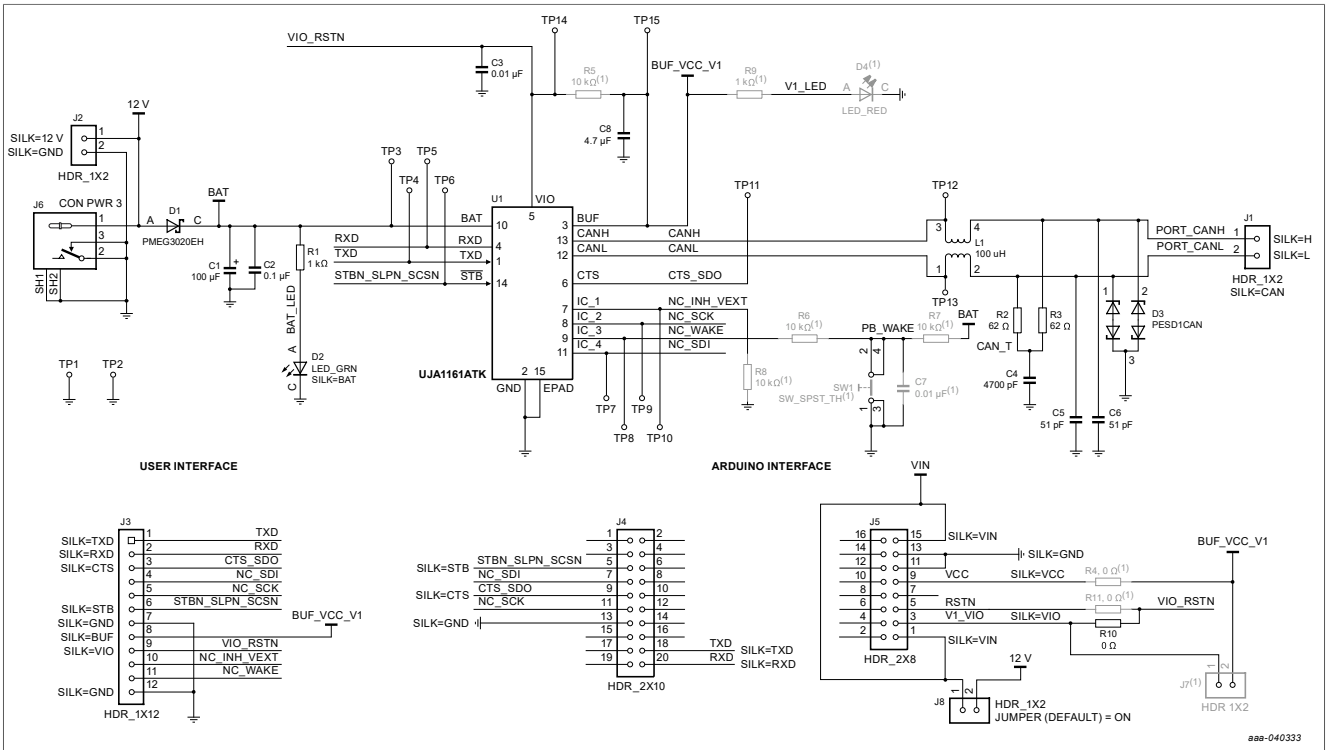


(1) Component not populated.

Figure 18. UJA1162A-EVB schematic diagram



(1) Component not populated.

Figure 19. UJA1161A-EVB schematic diagram

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5 Bills of Materials

Table 12. Bill of Materials - UJA1168AXF-EVB

NXP does not assume liability, endorse, or warrant components from external manufacturers referenced in circuit drawings or tables. While NXP offers component recommendations in this configuration, it is the responsibility of the customer to validate their application.

For critical components, it is vital to use the manufacturer listed.

Item number	Quantity	Schematic label	Value	Description	Part number	Manufacturer name
Active components						
1	1	U1	UJA1168ATK/XF	IC CAN SYSTEM BASIS CHIP 4.5-40 V HVSON14	UJA1168ATK/X	NXP SEMICONDUCTORS
Capacitors						
2	1	C1	100 µF	CAP ALEL 100 µF 25 V 20 % -- SMT	UWX1E101MCL1GB	NICHICON
3	1	C2	0.1 µF	CAP CER 0.1 µF 25 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1E104K080AA	TDK
4	-	C3	not populated			
5	1	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
6	2	C5, C6	51 pF	CAP CER 51 pF ±5 % 50 V Ceramic Capacitor C0G, NP0 0603	CC0603JRNPO9BN510	Yageo
7	1	C7	0.1 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
8	1	C8, C9	4.7 µF	CAP CER 4.7 µF 16 V 10 % X5R 0603	GRM188R61C475KE11D	MURATA
Diodes						
9	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
10	1	D2	LED/GRN	LED BRIGHT GRN SGL 30 mA 0603	150060VS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
11	1	D3	ESD Prot./24 V	DIODE BIDIR CAN BUS ESD PROTECTION 200 W 24 V AEC-Q 101 SOT23	PESD1CAN,215	NEXPERIA
12	1	D4	LED/RED	LED BRIGHT RED CLEAR SGL 2 V 20 mA SMT 0603	150060RS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
Inductors						
13	1	L1	100 µH	IND CHK 100 µH 150 mA -30/+50 % AEC-Q200 1812	B82789C0104N002[1]	EPCOS
Resistors						
14	2	R1, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA	VISHAY INTERTECHNOLOGY (preferred)
					ERJ-3GEYJ103V	PANASONIC (alternative)
					RK73B1JTTD102J	KOA SPEER (alternative)
15	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
16	-	R4, R10	not populated			
17	1	R11	0 Ω	RES MF ZERO Ω 1/10 W -- AEC-Q200 0603	ERJ-3GEY0R00V	PANASONIC (preferred)
					CRCW06030000Z0EA	VISHAY INTERTECHNOLOGY (alternative)
18	3	R5, R6, R7	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V	PANASONIC (preferred)
					RK73B1JTTD103J	KOA SPEER (alternative)
Switches, Connectors, Jumpers, and Test Points						
19	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
20	2	J2, J7, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
21	1	J3	HDR_1x12	HDR 1X12 TH 100 MIL SP 344H AU 118L	6130121112	WURTH ELEKTRONIK EISOS GMBH & CO. KG
22	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
23	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
24	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
25	1	SW1	SPST_SWITCH	SW SPST PB TACT 50MA 12 V TH	430186070716	WURTH ELEKTRONIK EISOS GMBH & CO. KG
26	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001	KEYSTONE ELECTRONICS (preferred)
					TP-105-01-00	COMPONENTS CORPORATION (alternative)
					151-203-RC	KOBICONN (alternative)
27	13	TP3 to TP15	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

[1] NXP used the ACT45B-101-2P from TDK for the latest UJA116xA EMC test report.

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Table 13. Bill of Materials - UJA1168AF-EVB

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For critical components, it is vital to use the manufacturer listed.

Item number	Quantity	Schematic label	Value	Description	Part number	Manufacturer name
Active components						
1	1	U1	UJA1168ATK/F	IC CAN SYSTEM BASIS CHIP 4.5-40V HVSON14	UJA1168ATK/X	NXP SEMICONDUCTORS
Capacitors						
2	1	C1	100 µF	CAP ALEL 100 µF 25 V 20 % -- SMT	UWX1E101MCL1GB	NICHICON
3	1	C2	0.1 µF	CAP CER 0.1 µF 25 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1E104K080AA	TDK
4	-	C3	not populated			
6	1	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
6	2	C5, C6	51 pF	CAP CER 51 pF ±5 % 50 V Ceramic Capacitor C0G, NP0 0603	CC0603JRNPO9BN510	Yageo
7	1	C7	0.1 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
8	1	C8,	4.7 µF	CAP CER 4.7 µF 16 V 10 % X5R 0603	GRM188R61C475KE11D	MURATA
Diodes						
9	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
10	1	D2	LED/GRN	LED BRIGHT GRN SGL 30 mA 0603	150060VS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
11	1	D3	ESD Prot./24 V	DIODE BIDIR CAN BUS ESD PROTECTION 200 W 24 V AEC-Q 101 SOT23	PESD1CAN,215	NEXPERIA
12	1	D4	LED/RED	LED BRIGHT RED CLEAR SGL 2 V 20 mA SMT 0603	150060RS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
Inductors						
13	1	L1	100 µH	IND CHK 100 µH 150 mA -30/+50 % AEC-Q200 1812	B82789C0104N002[1]	EPCOS
Resistors						
14	2	R1, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA	VISHAY INTERTECHNOLOGY (preferred)
					ERJ-3GEYJ103V	PANASONIC (alternative)
					RK73B1JTTD102J	KOA SPEER (alternative)
15	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
16	-	R4, R10	not populated			
17	1	R11	0 Ω	RES MF ZERO Ω 1/10 W -- AEC-Q200 0603	ERJ-3GEY0R00V	PANASONIC (preferred)
					CRCW06030000Z0EA	VISHAY INTERTECHNOLOGY (alternative)
18	3	R5, R6, R7, R8	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V	PANASONIC (preferred)
					RK73B1JTTD103J	KOA SPEER (alternative)
Switches, Connectors, Jumpers, and Test Points						
19	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
20	2	J2, J7, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
21	1	J3	HDR_1x12	HDR 1X12 TH 100 MIL SP 344H AU 118L	6130121112	WURTH ELEKTRONIK EISOS GMBH & CO. KG
22	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
23	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
24	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
25	1	SW1	SPST_SWITCH	SW SPST PB TACT 50MA 12 V TH	430186070716	WURTH ELEKTRONIK EISOS GMBH & CO. KG
26	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001	KEYSTONE ELECTRONICS (preferred)
					TP-105-01-00	COMPONENTS CORPORATION (alternative)
					151-203-RC	KOBICONN (alternative)
27	13	TP3 to TP15	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

[1] NXP used the ACT45B-101-2P from TDK for the latest UJA116xA EMC test report.

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Table 14. Bill of Materials - UJA1166A-EVB

NXP does not assume liability, endorse, or warrant components from external manufacturers referenced in circuit drawings or tables. While NXP offers component recommendations in this configuration, it is the responsibility of the customer to validate their application.
For critical components, it is vital to use the manufacturer listed.

Item number	Quantity	Schematic label	Value	Description	Part number	Manufacturer name
Active components						
1	1	U1	UJA1166ATK	IC CAN SYSTEM BASIS CHIP 4.5-40V HVSON14	UJA1168ATK/X	NXP SEMICONDUCTORS
Capacitors						
2	1	C1	100 µF	CAP ALEL 100 µF 25 V 20 % -- SMT	UWX1E101MCL1GB	NICHICON
3	1	C2	0.1 µF	CAP CER 0.1 µF 25 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1E104K080AA	TDK
4	2	C3, C7	0.1 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
5	1	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
6	2	C5, C6	51 pF	CAP CER 51 pF ±5 % 50 V Ceramic Capacitor C0G, NP0 0603	CC0603JRNPO9BN510	Yageo
7	1	C8,	4.7 µF	CAP CER 4.7 µF 16 V 10 % X5R 0603	GRM188R61C475KE11D	MURATA
Diodes						
8	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
9	1	D2	LED/GRN	LED BRIGHT GRN SGL 30 mA 0603	150060VS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
10	1	D3	ESD Prot./24 V	DIODE BIDIR CAN BUS ESD PROTECTION 200 W 24 V AEC-Q 101 SOT23	PESD1CAN,215	NEXPERIA
11	1	D4	LED/RED	LED BRIGHT RED CLEAR SGL 2 V 20 mA SMT 0603	150060RS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
Inductors						
12	1	L1	100 µH	IND CHK 100 µH 150 mA -30/+50 % AEC-Q200 1812	B82789C0104N002[1]	EPCOS
Resistors						
13	2	R1, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA	VISHAY INTERTECHNOLOGY (preferred)
					ERJ-3GEYJ103V	PANASONIC (alternative)
					RK73B1JTTD102J	KOA SPEER (alternative)
14	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
15	3	R4, R5, R11	not populated			
16	3	R6, R7, R8	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V	PANASONIC (preferred)
					RK73B1JTTD103J	KOA SPEER (alternative)
17	1	R10	0 Ω	RES MF ZERO Ω 1/10 W -- AEC-Q200 0603	ERJ-3GEY0R00V	PANASONIC (preferred)
					CRCW06030000Z0EA	VISHAY INTERTECHNOLOGY (alternative)
Switches, Connectors, Jumpers, and Test Points						
18	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
19	2	J2, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
20	1	J3	HDR_1x12	HDR 1X12 TH 100 MIL SP 344H AU 118L	6130121112	WURTH ELEKTRONIK EISOS GMBH & CO. KG
21	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
22	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
23	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
24	1	J7	not populated			
25	1	SW1	SPST_SWITCH	SW SPST PB TACT 50MA 12 V TH	430186070716	WURTH ELEKTRONIK EISOS GMBH & CO. KG
26	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001	KEYSTONE ELECTRONICS (preferred)
					TP-105-01-00	COMPONENTS CORPORATION (alternative)
					151-203-RC	KOBICONN (alternative)
27	13	TP3 to TP15	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

[1] NXP used the ACT45B-101-2P from TDK for the latest UJA116xA EMC test report.

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Table 15. Bill of Materials - UJA1164A-EVB

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For critical components, it is vital to use the manufacturer listed.

Item number	Quantity	Schematic label	Value	Description	Part number	Manufacturer name
Active components						
1	1	U1	UJA1164ATK	IC CAN SYSTEM BASIS CHIP 4.5-40V HVSON14	UJA1168ATK/X	NXP SEMICONDUCTORS
Capacitors						
2	1	C1	100 µF	CAP ALEL 100 µF 25 V 20 % -- SMT	UWX1E101MCL1GB	NICHICON
3	1	C2	0.1 µF	CAP CER 0.1 µF 25 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1E104K080AA	TDK
4	2	C3, C7	not populated			
5	1	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
6	2	C5, C6	51 pF	CAP CER 51 pF ±5 % 50 V Ceramic Capacitor C0G, NP0 0603	CC0603JRNPO9BN510	Yageo
7	1	C8	4.7 µF	CAP CER 4.7 µF 16 V 10 % X5R 0603	GRM188R61C475KE11D	MURATA
Diodes						
8	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
9	1	D2	LED/GRN	LED BRIGHT GRN SGL 30 mA 0603	150060VS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
10	1	D3	ESD Prot./24 V	DIODE BIDIR CAN BUS ESD PROTECTION 200 W 24 V AEC-Q 101 SOT23	PESD1CAN,215	NEXPERIA
11	1	D4	LED/RED	LED BRIGHT RED CLEAR SGL 2 V 20 mA SMT 0603	150060RS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
Inductors						
12	1	L1	100 µH	IND CHK 100 µH 150 mA -30/+50 % AEC-Q200 1812	B82789C0104N002[1]	EPCOS
Resistors						
13	2	R1, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA	VISHAY INTERTECHNOLOGY (preferred)
					ERJ-3GEYJ103V	PANASONIC (alternative)
					RK73B1JTTD102J	KOA SPEER (alternative)
14	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
15	5	R4, R6, R7, R8, R10	not populated			
16	1	R5	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V	PANASONIC (preferred)
					RK73B1JTTD103J	KOA SPEER (alternative)
17	1	R11	0 Ω	RES MF ZERO Ω 1/10 W -- AEC-Q200 0603	ERJ-3GEY0R00V	PANASONIC (preferred)
					CRCW06030000Z0EA	VISHAY INTERTECHNOLOGY (alternative)
Switches, Connectors, Jumpers, and Test Points						
18	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
19	2	J2, J7, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
20	1	J3	HDR_1x12	HDR 1X12 TH 100 MIL SP 344H AU 118L	6130121112	WURTH ELEKTRONIK EISOS GMBH & CO. KG
21	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
22	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
23	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
24	1	SW1	not populated			
25	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001	KEYSTONE ELECTRONICS (preferred)
					TP-105-01-00	COMPONENTS CORPORATION (alternative)
					151-203-RC	KOBICONN (alternative)
26	13	TP3 to TP15	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

[1] NXP used the ACT45B-101-2P from TDK for the latest UJA116xA EMC test report.

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Table 16. Bill of Materials - UJA1163A-EVB

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Item number	Quantity	Schematic label	Value	Description	Part number	Manufacturer name
Active components						
1	1	U1	UJA1163ATK	IC CAN SYSTEM BASIS CHIP 4.5-40V HVSON14	UJA1168ATK/X	NXP SEMICONDUCTORS
Capacitors						
2	1	C1	100 µF	CAP ALEL 100 µF 25 V 20 % -- SMT	UWX1E101MCL1GB	NICHICON
3	1	C2	0.1 µF	CAP CER 0.1 µF 25 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1E104K080AA	TDK
4	2	C3, C7	not populated			
5	1	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
6	2	C5, C6	51 pF	CAP CER 51 pF ±5 % 50 V Ceramic Capacitor C0G, NP0 0603	CC0603JRNPO9BN510	Yageo
7	1	C8,	4.7 µF	CAP CER 4.7 µF 16 V 10 % X5R 0603	GRM188R61C475KE11D	MURATA
Diodes						
8	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
9	1	D2	LED/GRN	LED BRIGHT GRN SGL 30 mA 0603	150060VS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
10	1	D3	ESD Prot./24 V	DIODE BIDIR CAN BUS ESD PROTECTION 200 W 24 V AEC-Q 101 SOT23	PESD1CAN,215	NEXPERIA
11	1	D4	LED/RED	LED BRIGHT RED CLEAR SGL 2 V 20 mA SMT 0603	150060RS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
Inductors						
12	1	L1	100 µH	IND CHK 100 µH 150 mA -30/+50 % AEC-Q200 1812	B82789C0104N002[1]	EPCOS
Resistors						
13	2	R1, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA	VISHAY INTERTECHNOLOGY (preferred)
					ERJ-3GEYJ103V	PANASONIC (alternative)
					RK73B1JTTD102J	KOA SPEER (alternative)
14	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
15	5	R4, R6, R7, R8, R10	not populated			
16	1	R5	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V	PANASONIC (preferred)
					RK73B1JTTD103J	KOA SPEER (alternative)
17	1	R11	0 Ω	RES MF ZERO Ω 1/10 W -- AEC-Q200 0603	ERJ-3GEY0R00V	PANASONIC (preferred)
					CRCW06030000Z0EA	VISHAY INTERTECHNOLOGY (alternative)
Switches, Connectors, Jumpers, and Test Points						
18	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
19	2	J2, J7, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
20	1	J3	HDR_1x12	HDR 1X12 TH 100 MIL SP 344H AU 118L	6130121112	WURTH ELEKTRONIK EISOS GMBH & CO. KG
21	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
22	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
23	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
24	1	SW1	not populated			
25	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001	KEYSTONE ELECTRONICS (preferred)
					TP-105-01-00	COMPONENTS CORPORATION (alternative)
					151-203-RC	KOBICONN (alternative)
26	13	TP3 to TP15	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

[1] NXP used the ACT45B-101-2P from TDK for the latest UJA116xA EMC test report.

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Table 17. Bill of Materials - UJA1162A-EVB

NXP does not assume liability, endorse, or warrant components from external manufacturers referenced in circuit drawings or tables. While NXP offers component recommendations in this configuration, it is the responsibility of the customer to validate their application.
For critical components, it is vital to use the manufacturer listed.

Item number	Quantity	Schematic label	Value	Description	Part number	Manufacturer name
Active components						
1	1	U1	UJA1162ATK	IC CAN SYSTEM BASIS CHIP 4.5-40V HVSON14	UJA1168ATK/X	NXP SEMICONDUCTORS
Capacitors						
2	1	C1	100 µF	CAP ALEL 100 µF 25 V 20 % -- SMT	UWX1E101MCL1GB	NICHICON
3	1	C2	0.1 µF	CAP CER 0.1 µF 25 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1E104K080AA	TDK
4	2	C3, C7	0.1 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
5	1	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
6	2	C5, C6	51 pF	CAP CER 51 pF ±5 % 50 V Ceramic Capacitor C0G, NP0 0603	CC0603JRNPO9BN510	Yageo
7	1	C8,	4.7 µF	CAP CER 4.7 µF 16 V 10 % X5R 0603	GRM188R61C475KE11D	MURATA
Diodes						
8	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
9	1	D2	LED/GRN	LED BRIGHT GRN SGL 30 mA 0603	150060VS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
10	1	D3	ESD Prot./24 V	DIODE BIDIR CAN BUS ESD PROTECTION 200 W 24 V AEC-Q 101 SOT23	PESD1CAN,215	NEXPERIA
11	1	D4	not populated			
Inductors						
12	1	L1	100 µH	IND CHK 100 µH 150 mA -30/+50 % AEC-Q200 1812	B82789C0104N002[1]	EPCOS
Resistors						
13	1	R1	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA	VISHAY INTERTECHNOLOGY (preferred)
					ERJ-3GEYJ103V	PANASONIC (alternative)
					RK73B1JTTD102J	KOA SPEER (alternative)
14	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
15	4	R4, R5, R9, R11	not populated			
16	3	R6, R7, R8	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V	PANASONIC (preferred)
					RK73B1JTTD103J	KOA SPEER (alternative)
17	1	R10	0 Ω	RES MF ZERO Ω 1/10 W -- AEC-Q200 0603	ERJ-3GEY0R00V	PANASONIC (preferred)
					CRCW06030000Z0EA	VISHAY INTERTECHNOLOGY (alternative)
Switches, Connectors, Jumpers, and Test Points						
18	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
19	2	J2, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
20	1	J3	HDR_1x12	HDR 1X12 TH 100 MIL SP 344H AU 118L	6130121112	WURTH ELEKTRONIK EISOS GMBH & CO. KG
21	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
22	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
23	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
24	1	J7	not populated			
25	1	SW1	SPST_SWITCH	SW SPST PB TACT 50MA 12 V TH	430186070716	WURTH ELEKTRONIK EISOS GMBH & CO. KG
26	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001	KEYSTONE ELECTRONICS (preferred)
					TP-105-01-00	COMPONENTS CORPORATION (alternative)
					151-203-RC	KOBICONN (alternative)
27	13	TP3 to TP15	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

[1] NXP used the ACT45B-101-2P from TDK for the latest UJA116xA EMC test report.

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Table 18. Bill of Materials - UJA1161A-EVB

NXP does not assume liability, endorse, or warrant components from external manufacturers referenced in circuit drawings or tables. While NXP offers component recommendations in this configuration, it is the responsibility of the customer to validate their application.
For critical components, it is vital to use the manufacturer listed.

Item number	Quantity	Schematic label	Value	Description	Part number	Manufacturer name
Active components						
1	1	U1	UJA1161ATK	IC CAN SYSTEM BASIS CHIP 4.5-40V HVSON14	UJA1168ATK/X	NXP SEMICONDUCTORS
Capacitors						
2	1	C1	100 µF	CAP ALEL 100 µF 25 V 20 % -- SMT	UWX1E101MCL1GB	NICHICON
3	1	C2	0.1 µF	CAP CER 0.1 µF 25 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1E104K080AA	TDK
4	1	C3	0.1 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
5	1	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
6	2	C5, C6	51 pF	CAP CER 51 pF ±5 % 50 V Ceramic Capacitor C0G, NP0 0603	CC0603JRNPO9BN510	Yageo
7	1	C7	not populated			
8	1	C8,	4.7 µF	CAP CER 4.7 µF 16 V 10 % X5R 0603	GRM188R61C475KE11D	MURATA
Diodes						
9	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
10	1	D2	LED/GRN	LED BRIGHT GRN SGL 30 mA 0603	150060VS75000	WURTH ELEKTRONIK EISOS GMBH & CO. KG
11	1	D3	ESD Prot./24 V	DIODE BIDIR CAN BUS ESD PROTECTION 200 W 24 V AEC-Q 101 SOT23	PESD1CAN,215	NEXPERIA
12	1	D4	not populated			
Inductors						
13	1	L1	100 µH	IND CHK 100 µH 150 mA -30/+50 % AEC-Q200 1812	B82789C0104N002[1]	EPCOS
Resistors						
14	1	R1	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA	VISHAY INTERTECHNOLOGY (preferred)
					ERJ-3GEYJ103V	PANASONIC (alternative)
					RK73B1JTTD102J	KOA SPEER (alternative)
15	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
16	7	R4, R5, R6, R7, R8, R9, R11	not populated			
17	3	R10	0 Ω	RES MF ZERO Ω 1/10 W -- AEC-Q200 0603	ERJ-3GEY0R00V	PANASONIC (preferred)
					CRCW06030000Z0EA	VISHAY INTERTECHNOLOGY (alternative)
Switches, Connectors, Jumpers, and Test Points						
18	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
19	2	J2, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
20	1	J3	HDR_1x12	HDR 1X12 TH 100 MIL SP 344H AU 118L	6130121112	WURTH ELEKTRONIK EISOS GMBH & CO. KG
21	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
22	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
23	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
24	1	J7	not populated			
23	1	SW1	not populated			
24	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001	KEYSTONE ELECTRONICS (preferred)
					TP-105-01-00	COMPONENTS CORPORATION (alternative)
					151-203-RC	KOBICONN (alternative)
25	13	TP3 to TP15	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

[1] NXP used the ACT45B-101-2P from TDK for the latest UJA116xA EMC test report.

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6 FlexGUI: interactive register control via USB

This section only applies to evaluation boards that feature an SBC with SPI interface:

- UJA1164A-EVB
- UJA1168AF-EVB
- UJA1168AXF-EVB

When the UJA116xA-EVB is plugged onto a suitable microcontroller evaluation board, the microcontroller board can be used as a USB/SPI interface between the UJA116xA-EVB and a PC. After installing the FlexGUI application on a Windows PC (see Section 6.3), the contents of the SBC registers can be viewed and/or changed interactively.

FlexGUI for UJA116xA-EVB currently supports the following evaluation board:

- S32K144EVB, Rev. B (Figure 20)

See www.nxp.com for more information about this board.

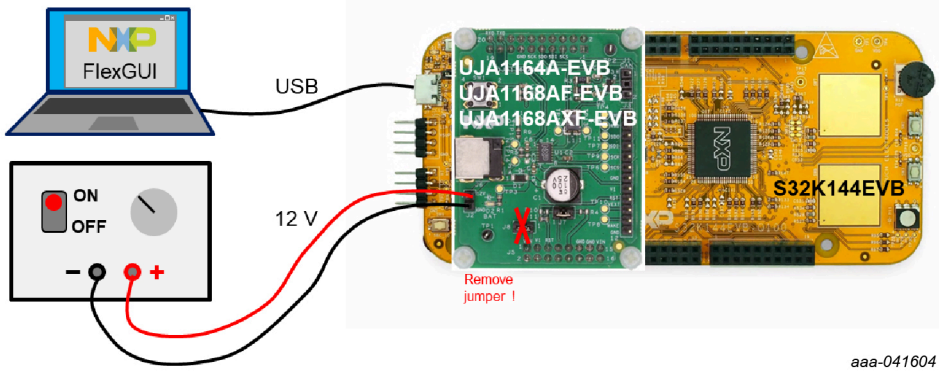

Figure 20. Using FlexGUI with S32K144EVB as USB/SPI interface

6.1 FlexGUI software package overview

The FlexGUI SW package for the UJA116xA-EVB can be downloaded from www.nxp.com. It includes:

- the flexGUI PC installer (see also Section 6.3)
- FlexGUI firmware for all supported microcontroller boards (see also Section 6.2.1)

6.2 Preparations for using the S32K144EVB as a USB interface

The FlexGUI firmware must be loaded into the S32K144EVB before connecting the UJA116xA-EVB. Note that the jumper settings for firmware programming are different to those for FlexGUI usage.

6.2.1 FlexGUI firmware installation on S32K144EVB

Firmware programming in the S32K144EVB is straightforward:

1. Confirm that the jumpers are in the correct position for firmware programming (Figure 21)
2. Connect the board to the PC with a USB cable (Figure 22)

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3. Wait until the PC has launched new drive 'EVB-S32K144' (Figure 23)
4. Copy the firmware file to that drive (Figure 23)

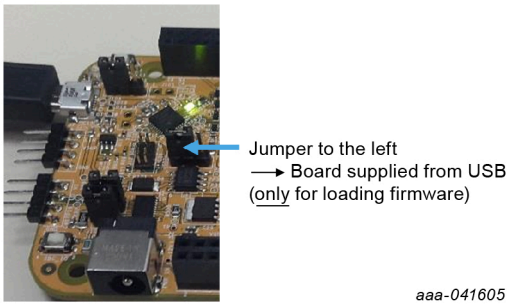

Figure 21. S32K144EVB jumper settings for firmware programming

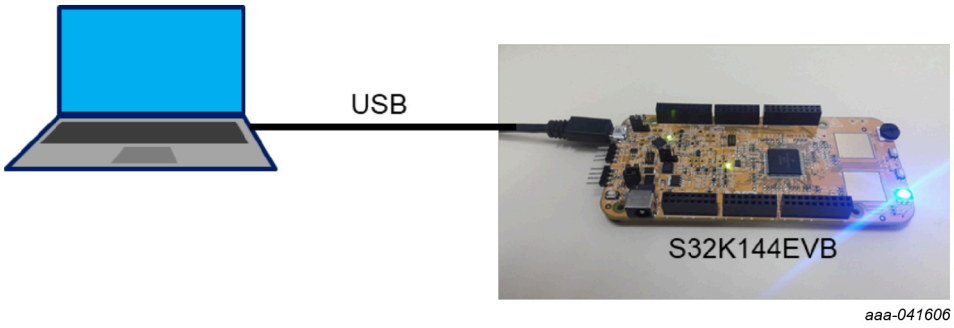

Figure 22. PC connection for firmware programming

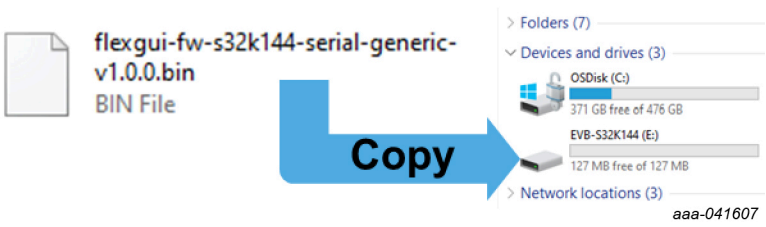

Figure 23. Copying the firmware file to the EVB-S32K144 drive

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6.2.2 HW setup for FlexGUI operation

The watchdog in the SBC must be off while the FlexGUI is running. The watchdog is always off in Forced Normal mode and off by default in Software Development mode (a sample script for switching the device to Software Development mode via the FlexGUI is included in Section 6.4.6).

A system reset is generated after programming the MTPNV memory, after which the connection between the FlexGUI and the board will need to be re-established (see Section 6.4.2). If the re-connection fails, try again after a power-off/wait-3-seconds/ power-on sequence on the UJA116xA-EVB.

Once the FlexGUI firmware has been installed on the microcontroller board, the jumpers on the boards need to be set as illustrated in Figure 24 before plugging the UJA116xA-EVB plugged into the microcontroller board. The resulting supply and data line interconnections between the boards are shown in Figure 25. Note that only the relevant header interconnections are shown in the schematics extract in Figure 25. See the full board schematics for further details.

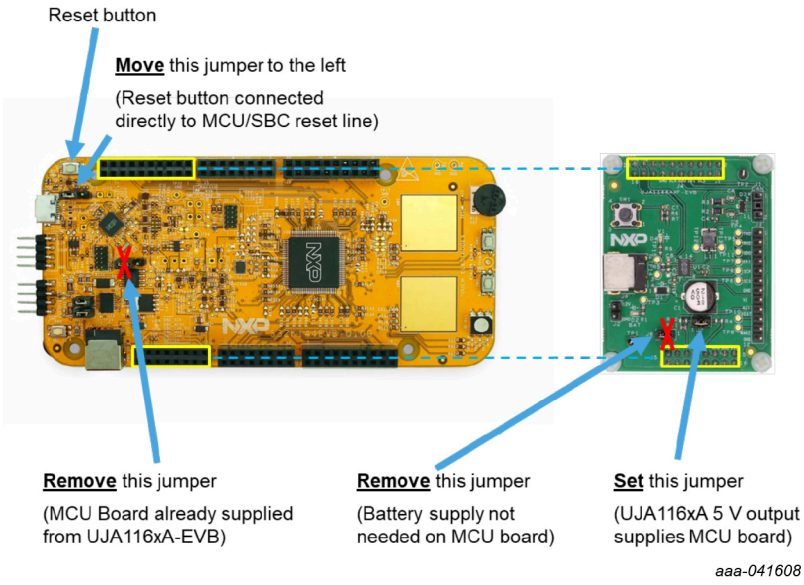

Figure 24. UJA116xA-EVB/S32K144EVB jumper settings for FlexGUI operation

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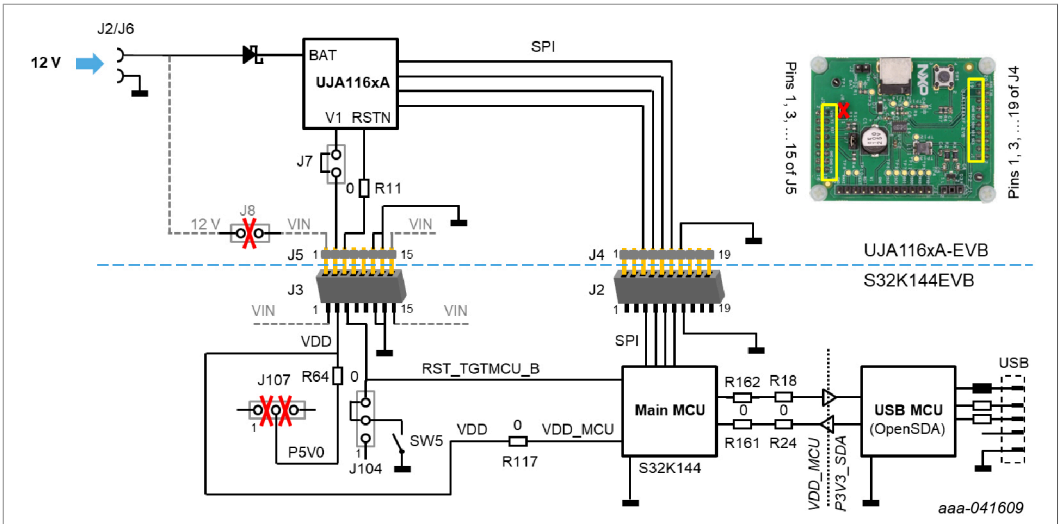

Figure 25. UJA116xA-EVB/S32K144EVB supply and data line interconnections

A 12 V power supply needs to be connected to header J2 or to jack J6 on the UJA116xA-EVB (see also Figure 20). It supplies the BAT pin of the SBC via a polarity protection diode.

The 5 V output from the SBC is routed to the microcontroller board via jumper J7, where it supplies the main MCU.

The SPI signals are routed directly between SBC and main MCU via header J4 and its counterpart J2.

The RSTN signal on the SBC is connected to the reset input on the main MCU via 0 Ω bridge R11. When terminals 2 and 3 of header J104 are connected with a jumper, pushbutton SW5 on the MCU board allows the RSTN signal to be pulled LOW manually. This function could be used, for example, when restoring the MTPNV register factory preset values.

The USB MCU is powered via the USB interface. The signals between main MCU and USB MCU are passed through level shifters that serve as a bridge between the two supply domains.

6.3 Installing the FlexGUI on a PC

Double-click on file **flexgui-app-ivn-uja116x-1.0.0.exe** to begin the installation. The FlexGUI application starts automatically after a successful installation.

6.4 Using the FlexGUI

6.4.1 Starting the FlexGUI application

FlexGUI can be started via the Windows Start menu or the shortcut symbol on the desktop (Figure 26).

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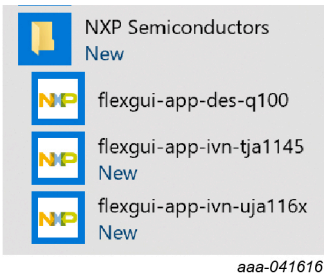

a. Windows Start menu

b. Desktop shortcut

Figure 26. FlexGUI start options

During start-up, the FlexGUI launch window (Figure 27) displays a list of the evaluation boards covered by this FlexGUI installation.

Select the appropriate board and click **OK**. A temporary pop-up window indicates the status while the FlexGUI configuration is being loaded (Figure 28). Once loading is complete, the FlexGUI start-up window is displayed (Figure 29). The red text in the lower left corner of the window indicates that the application has not yet established a logical connection to the board. Section 6.4.2 explains how to establish a connection.

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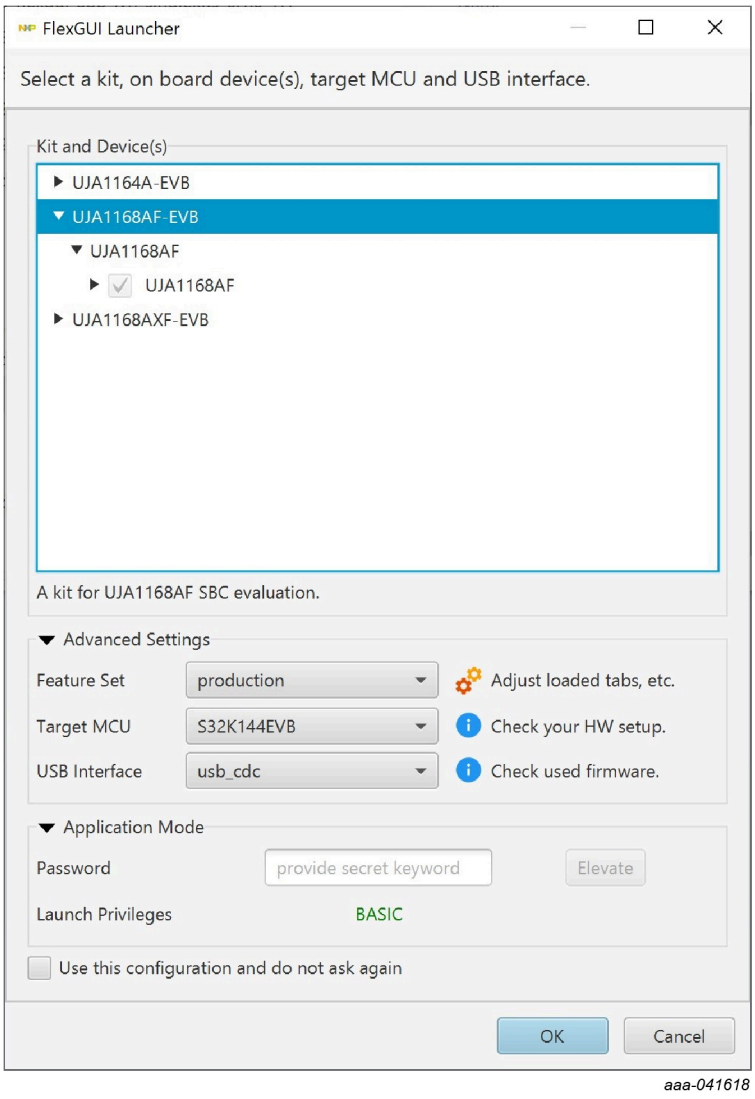

Figure 27. Launch window - EVB selection

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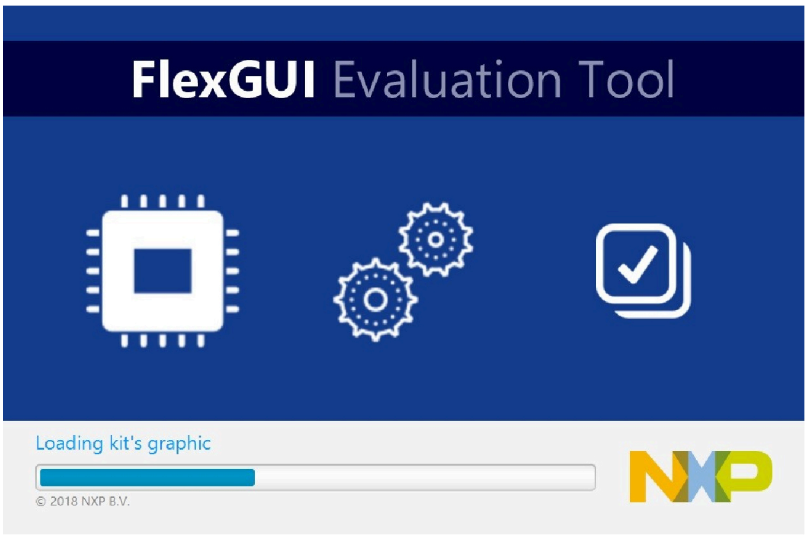

Figure 28. Window displayed during start-up

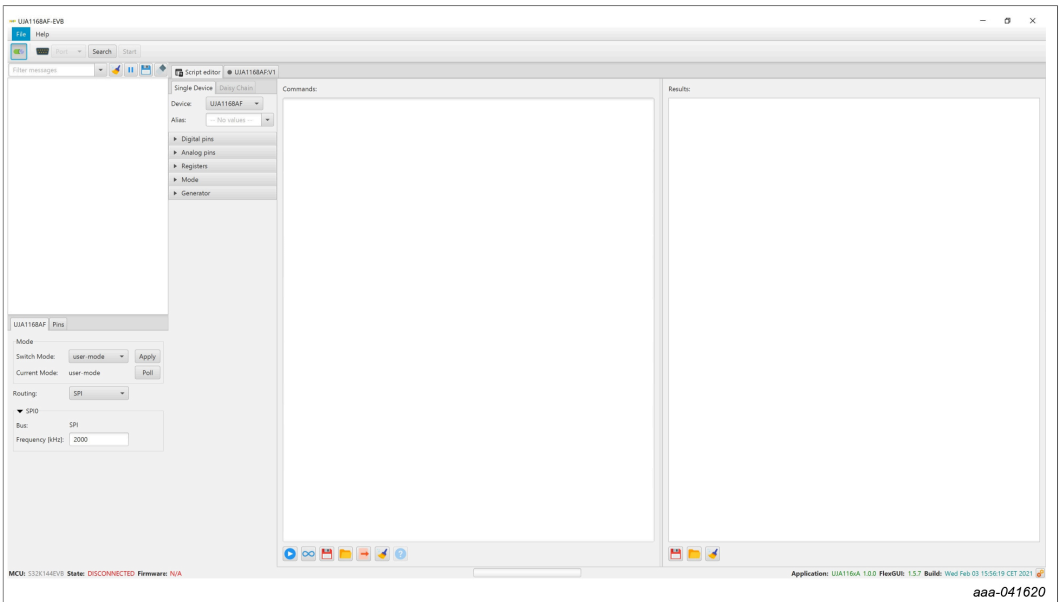

Figure 29. FlexGUI start-up window; boards not yet connected

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6.4.2 Establishing a connection between the FlexGUI and the hardware

To establish a connection between the FlexGUI and the hardware, the microcontroller board needs to be connected to the PC with a USB cable and a battery supply provided for the UJA116xA-EVB (see Figure 20). Note that it may take a few seconds for the PC operating system to detect the connection and locate the appropriate USB driver.

Once the connection has been established, a communication session can be started over the USB link:

- Click the **Search** button to detect all available serial connections.
- Identify and select the COM port of the board. It is usually the last item on the list if no other USB cables were connected to the PC since the board was plugged in.
- Click **Start** to enable the connection.

The text in the lower left corner of the window should turn from red to green, to indicate that the session has started successfully (Figure 30). The FlexGUI functionality can now be accessed, as discussed in the following sections.

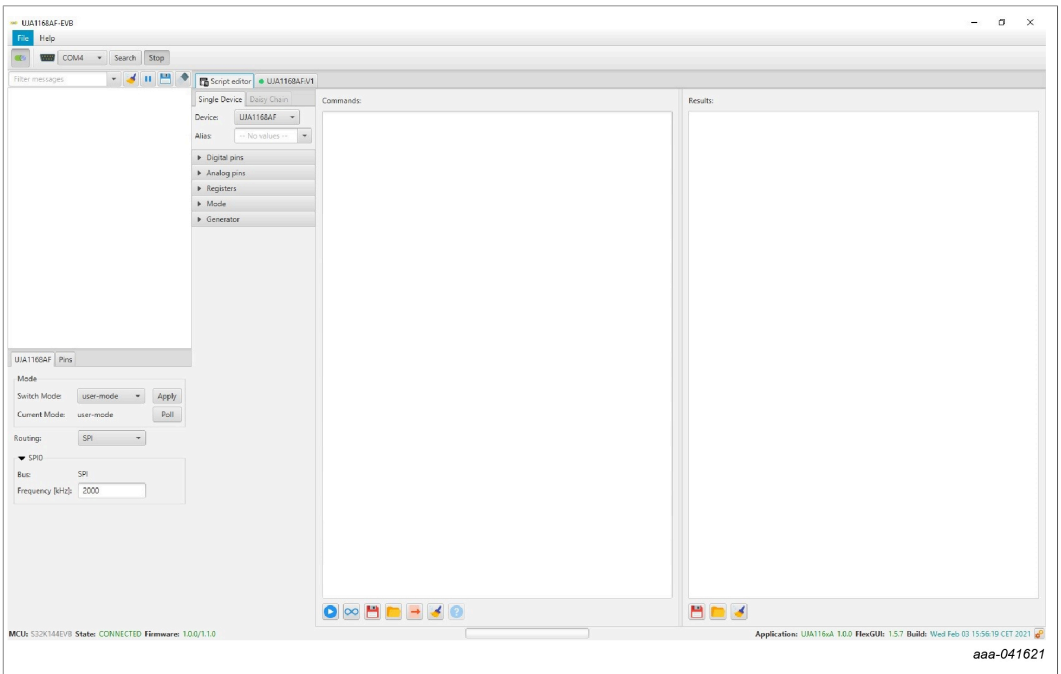

Figure 30. FlexGUI, USB connection to MCU board established

If FlexGUI shuts down during a connection attempt, there may be a conflict due to an obsolete jssc (java simple serial connector) library in the user cache. This problem can be solved by removing that library from the cache, e.g. with the command:

del "%USERPROFILE%\.jssc\windows\jSSC-2.8_x86_64.dll".

When this command is executed (e.g. by double-clicking on a text file that includes this line and has a file extension .cmd), the obsolete library is removed from the cache and a later version of the library is cached the next time FlexGUI starts up.

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6.4.3 SPI speed selection

The SPI speed (frequency) can be specified in the lower-left section of the FlexGUI window (if that section of the window is not visible, click the slider symbol under the 'File' menu).

6.4.4 Interactive control of the RGB LED on the microcontroller board

Select the **Pins** tab in the FlexGUI window to access the drop-down window shown in Figure 31. This window contains selection boxes for the microcontroller pins that control the red, green and blue color components of the RGB LED on the microcontroller board. A 'Low' value selects a component; a 'High' value turns it off.

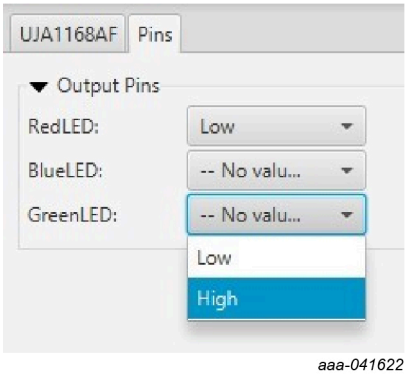

Figure 31. Interactive control of the RGB LED on the microcontroller board

6.4.5 Register map

When the FlexGUI window opens, the 'Script editor' tab is selected by default. Click on the tab to the right to display the register map of the selected board. Device registers can be read or written to interactively via this window.

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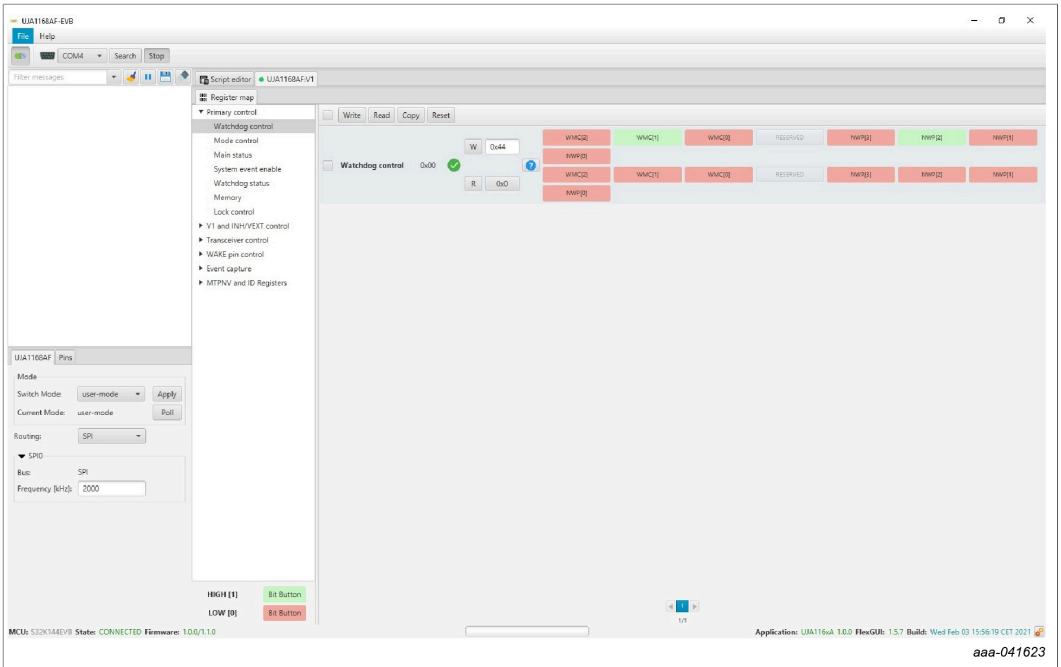

Figure 32. Register map tab

The registers are divided into groups. A register group can be selected in the left column. If option **Tree View** is selected, a single register may be selected (Tree View is selected via the FlexGUI pop up window accessed under File/Settings; see Figure 33).

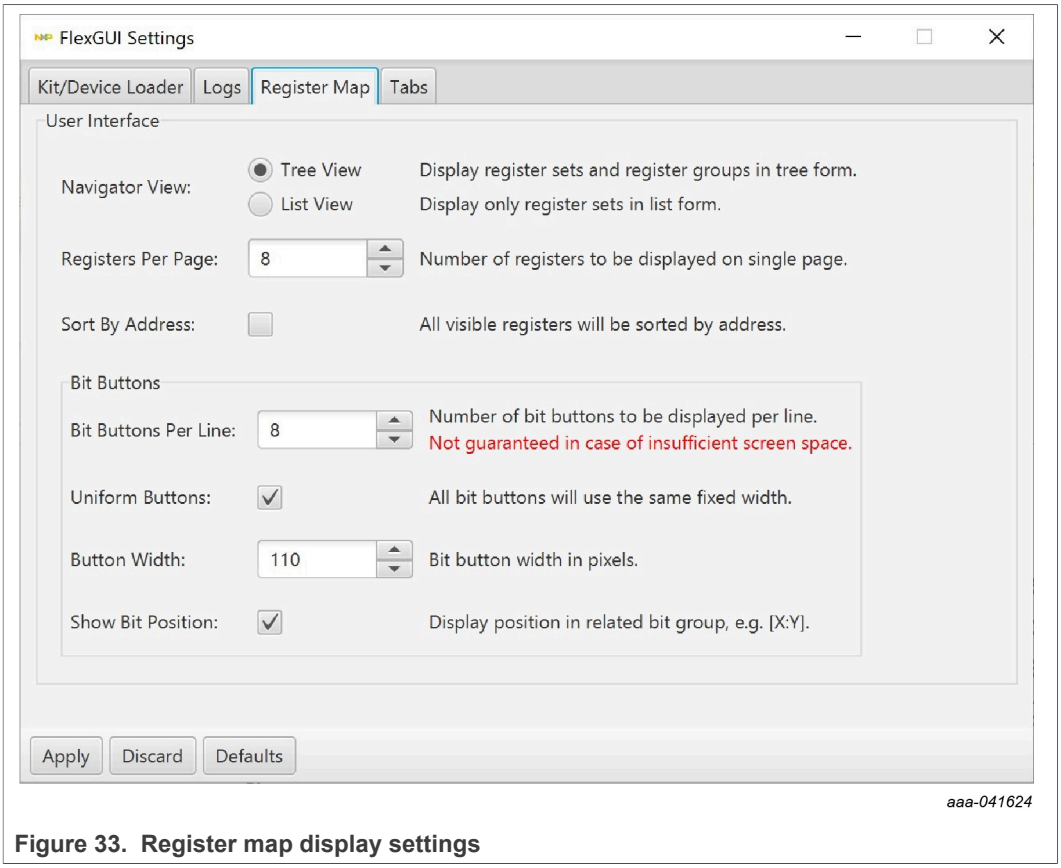

Figure 33. Register map display settings

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The contents of the selected register, or register group, is displayed in the main window. Register data can be edited in the top row in preparation for writing to the register. When option **Use Register Init Value** is selected, the editor is initialized with the default values at start-up and reset (Figure 34). If this option is not selected, all bits will be 0 at start-up and reset.

Actual register contents from a prior read access is shown in the bottom row.

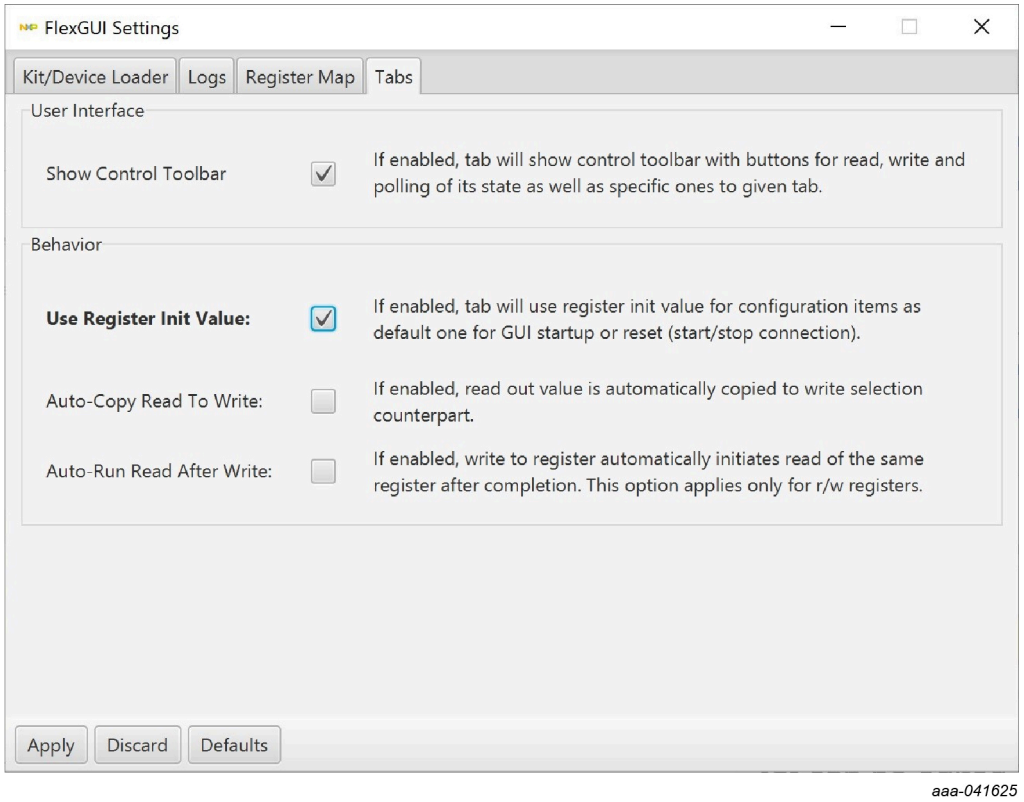

Figure 34. Advanced options for register map

Register data is displayed in three formats:

- As a single hexadecimal value for the entire register
- In text format, when clicking on the question mark symbol
- A color-coded button is provided for each register bit:
  - red = 0
  - green = 1

  When the bit buttons do not fit on a single row (as in Figure 32), try de-selecting checkbox **Uniform Buttons** (see Figure 33). The width of the buttons is then minimized to fit the bit names (Figure 35).

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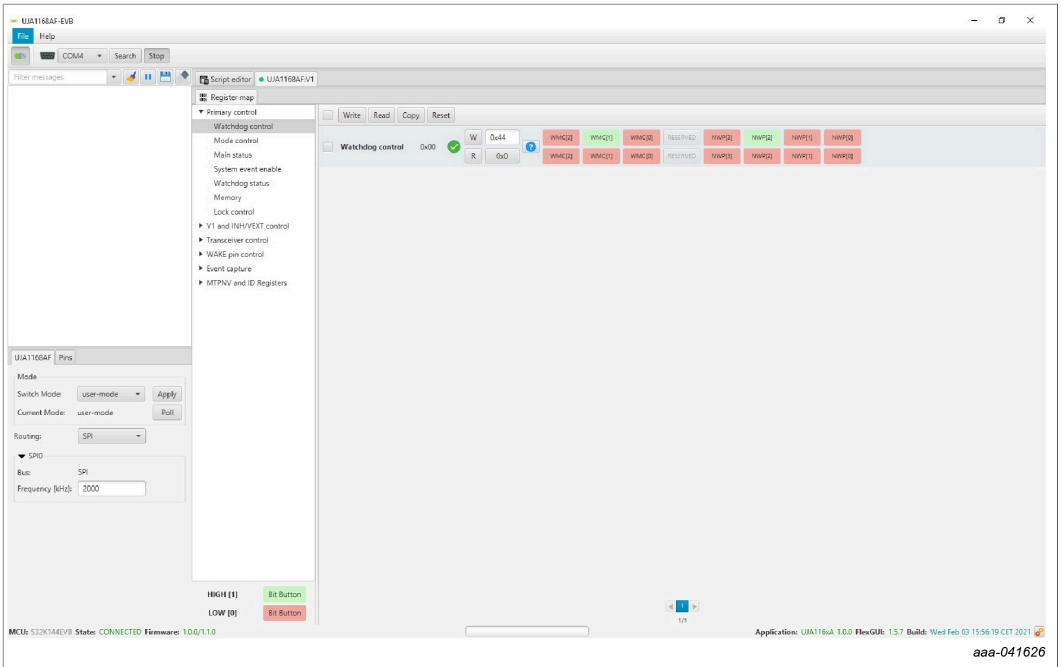

Figure 35. Register map with option 'Uniform Buttons' not selected.

If there are more registers in a group than can be displayed on screen, the registers are distributed over two or more pages and the active page can be selected at the bottom of the main window. The user can also choose the maximum number of registers displayed via control field **Registers Per Page** (see Figure 33). Figure 36 shows an example Register map view displaying the second page of the Transceiver control register group with 11 registers per page.

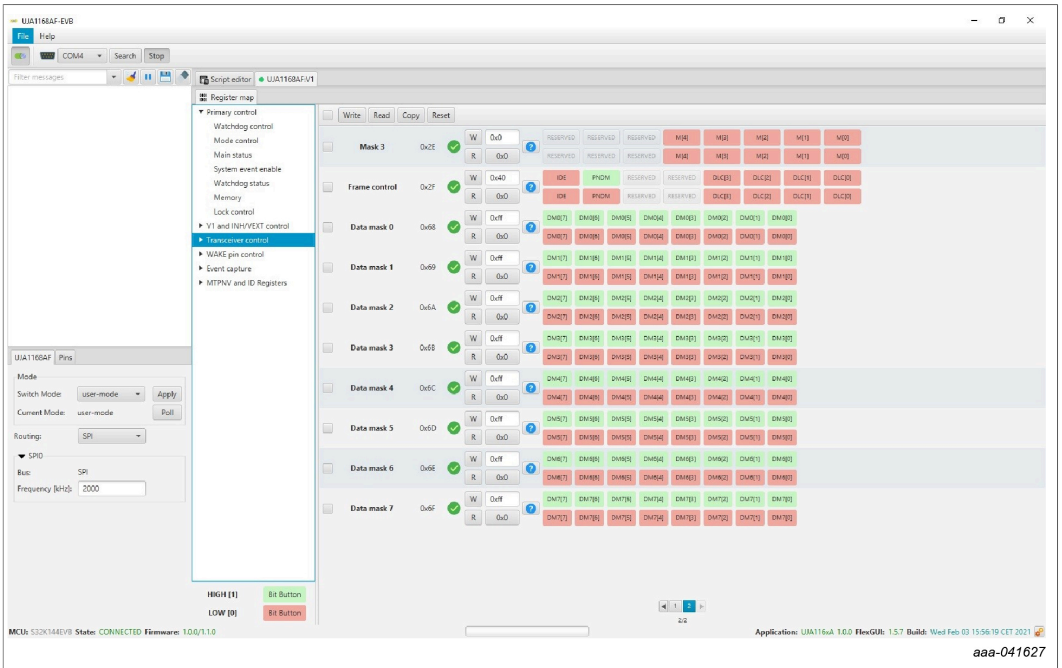

Figure 36. Register map display example with 11 registers per page selected

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For each register, read and write operations can be triggered using the **R** and **W** buttons.

Multiple registers can be selected using the check boxes to the left of the register names. The selected registers will be included in later multi-registers operations. Four associated buttons are provided:

- Write and read operations can be triggered with the **Write** and **Read** buttons.
- The **Copy** button can be used to copy data from the 'read' row(s) to the selected 'write' row(s).
- Clicking the **Reset** button undoes changes made to the 'write' row(s) since the most recently executed write action(s) on the associated register(s). If a register has not been previously written to, the selected rows are re-initialized (with the default values as selected via the **Use Register Init Value** check box; see Figure 34).

For each register, an 'OK' (✓) or 'pencil' (✎) symbol is displayed to the left of the W/R buttons. The ✓ symbol indicates that the data currently in the editable text field matches the data previously written to the register (or the default initialization values if no previous write operation was executed). A ✎ symbol indicates that the data in the editable text field differs from the data previously written to the register (or from the default values).

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6.4.6 Working with the script editor

Selecting tab 'Script editor' opens a tool for creating, executing, loading and saving command sequences ('scripts') used for reading from or writing to registers. RGB LED settings (see Section 6.4.4) can also be included in such scripts.

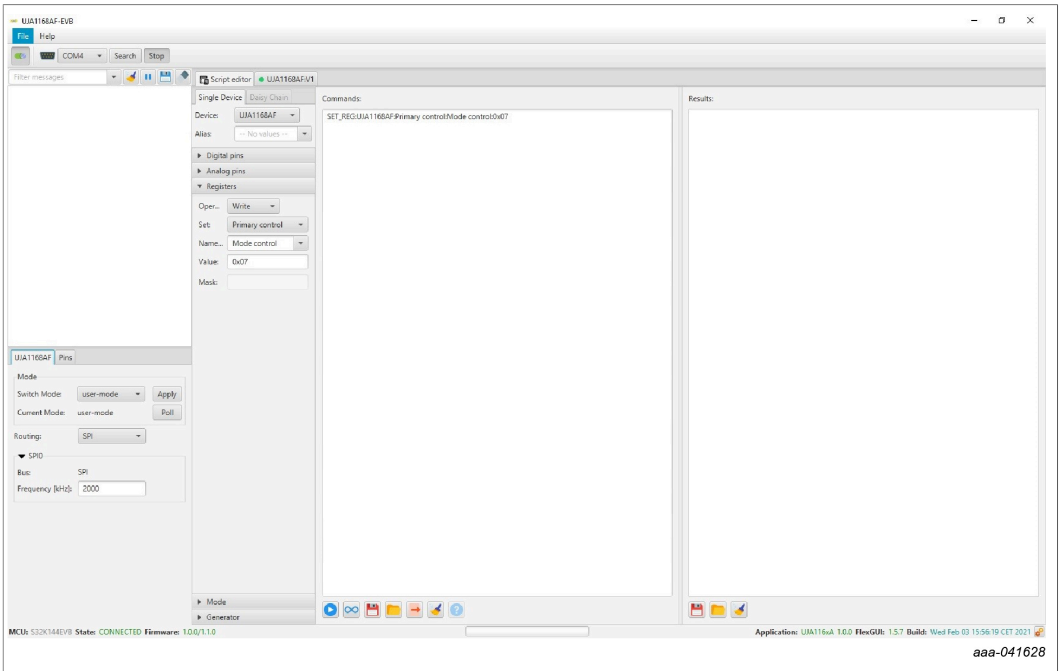

Figure 37. Script editor window

The commands available for the UJA116xA-EVB are listed in Table 19. Commands can be typed directly into the 'Commands' window, or constructed step-by-step using the selector tools in the left column. A script can also be loaded from a file.

Once a script is complete, it can be saved to a file and/or executed once by clicking on the corresponding button (and/or ▸). Help text is displayed when the mouse pointer is hovered above these buttons.

Script execution is logged in the 'Results' window.

If the infinity option (∞) is selected when the script is executed, it runs continuously in a loop. The ▸ button changes to ✋ when a script is running. Execution continues until halted by clicking the ✋ icon. The ∞ option should not be used when the script includes a PAUSE command. If this happens by accident, it may be necessary to abort the FlexGUI application with the help of Windows Task Manager.

Table 19. Syntax for script editor commands

Command	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Purpose
SET_REG	device name	register group	register name	value	write to a register
GET_REG	device name	register group	register name	n/a	read from a register
SET_DPIN	device name	MCU pin name	pin value	n/a	control RGB LED
PAUSE[1]	message text	n/a	n/a	n/a	wait for user
//	comment text	n/a	n/a	n/a	comment

[1] The PAUSE command should not be used when the auto-repeat option (∞) has been selected.

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Example scripts using all available commands:

```
// This is an example script
// Do not run this script with the auto-repeat option,
//   because the script includes a PAUSE command

// write value 0x07 to Mode-control register
SET_REG:UJA1168AF:Primary control:Mode control:0x07

// read Global event status register
GET_REG:UJA1168AF:Event capture:Global event status

// turn on red LED
SET_DPIN:UJA1168AF:RedLED:LOW

// give user time to identify the current LED color
PAUSE:RGB LED will change from red to green

// turn off red LED & turn on green LED
SET_DPIN:UJA1168AF:RedLED:HIGH
SET_DPIN:UJA1168AF:GreenLED:LOW
```

Example script that programs the SBC for Software Development mode:

```
// Script for programming UJA1168AF SBC MTPNV registers to Software Development mode
// For UJA1164A-EVB/UJA1168AXF-EVB replace “UJA1168AF” with applicable device name

// Read MTPNV status register
GET_REG:UJA1168AF:MTPNV and ID Registers:MTPNV status

// The user can now check if device is ready for programming
PAUSE:Only if MTPNV status value was an odd number, programming can be successful

// Set default reset length to maximum and no auto-start of VEXT/INH
SET_REG:UJA1168AF:MTPNV and ID Registers:Start-up control:0x0

// Set Software Development mode, allow Sleep mode and set max reset threshold as default
SET_REG:UJA1168AF:MTPNV and ID Registers:SBC configuration control:0x04

// Enter the CRC code that fits to above selections
SET_REG:UJA1168AF:MTPNV and ID Registers:MTPNV CRC control:0xFB
```

A tool is provided as an attachment to this document to calculate the CRC (see last two lines in above script).

6.4.7 Logging read and write operations

Each executed read or write access is logged in the upper left corner of the FlexGUI window. The logged data can be saved to a log file at any time.

A number of **Log Level** filter options are available to tailor the logged data to the needs of the user (see Figure 38). When 'FINEST' is selected, all bits of signals SDI ('out') and SDO ('in') are displayed for each SPI transfer (see script execution example in Figure 39).

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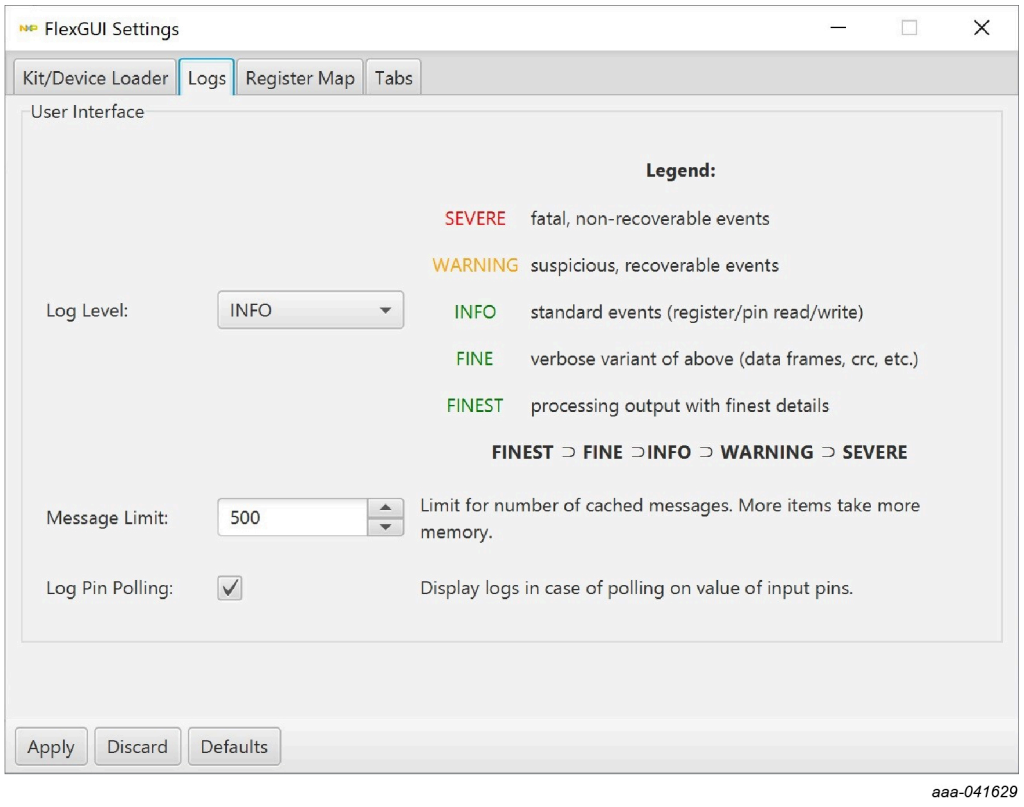
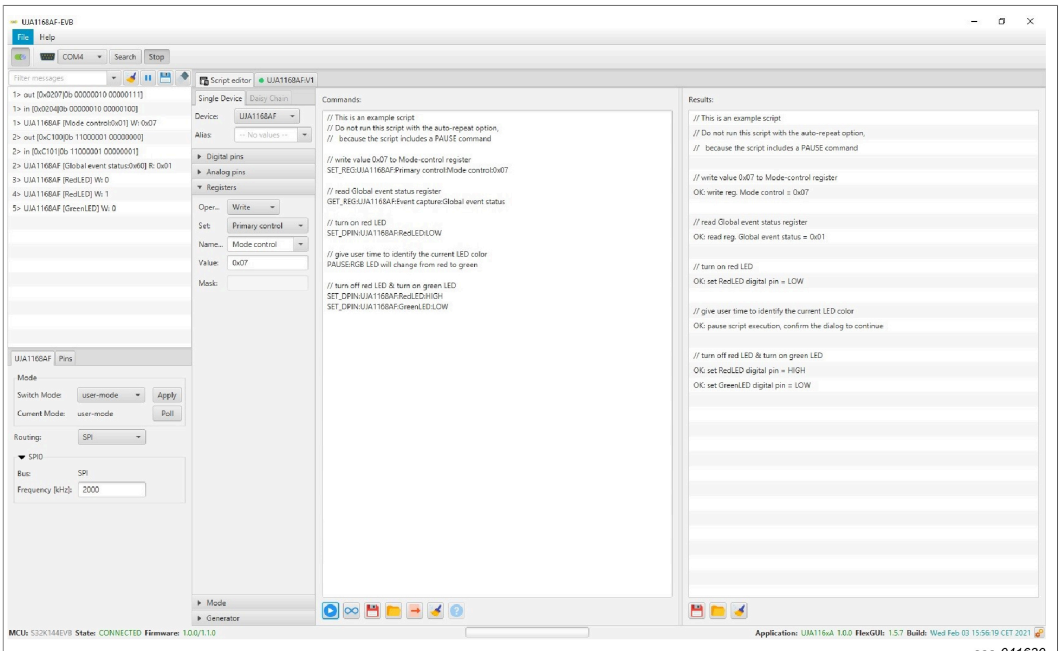


aaa-041629

Figure 38. logging options



aaa-041630

Figure 39. FlexGUI 'FINEST' detail level selected for log window

If the log window is not displayed, click on the slider symbol under the "File' menu.

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6.4.8 Restrictions on using SBC in Sleep mode

After executing a Sleep mode command successfully (UJA1168AF-EVB and UJA1168AXF-EVB only), the SBC turns off the 5 V output on V1 supplying the microcontroller. As a result, the connection between the GUI and the SBC will be lost after a short delay. This needs to be taken into account when testing the Sleep mode command using the Register map tab or when executing scripts that include a Sleep mode command.

To resume GUI operation after the SBC has entered Sleep mode, the SBC must be woken up via an enabled wake source (CAN and/or WAKE pin). The GUI then needs to re-connect to the board.

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7 References

[1] **UJA1161A** data sheet — Self-supplied high-speed CAN transceiver with Standby mode: https://www.nxp.com/docs/en/data-sheet/UJA1161A.pdf

[2] **UJA1162A** data sheet — Self-supplied high-speed CAN transceiver with Sleep mode: https://www.nxp.com/docs/en/data-sheet/UJA1162A.pdf

[3] **UJA1163A** data sheet — Mini high-speed CAN system basis chip: https://www.nxp.com/docs/en/data-sheet/UJA1163A.pdf

[4] **UJA1164A** data sheet — Mini high-speed CAN system basis chip with Standby mode & watchdog: https://www.nxp.com/docs/en/data-sheet/UJA1164A.pdf

[6] **UJA1166A** data sheet — High-speed CAN transceiver with 5 V LDO and Sleep mode: https://www.nxp.com/docs/en/data-sheet/UJA1166A.pdf

[8] **UJA1168A** data sheet — Mini high-speed CAN system basis chip for partial networking: https://www.nxp.com/docs/en/data-sheet/UJA1168A.pdf

[4] **AH1902** application hints — Mini high speed CAN system basis chips UJA116xA, available from NXP Semiconductors

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8 Appendix: UJA116xA evaluation board images

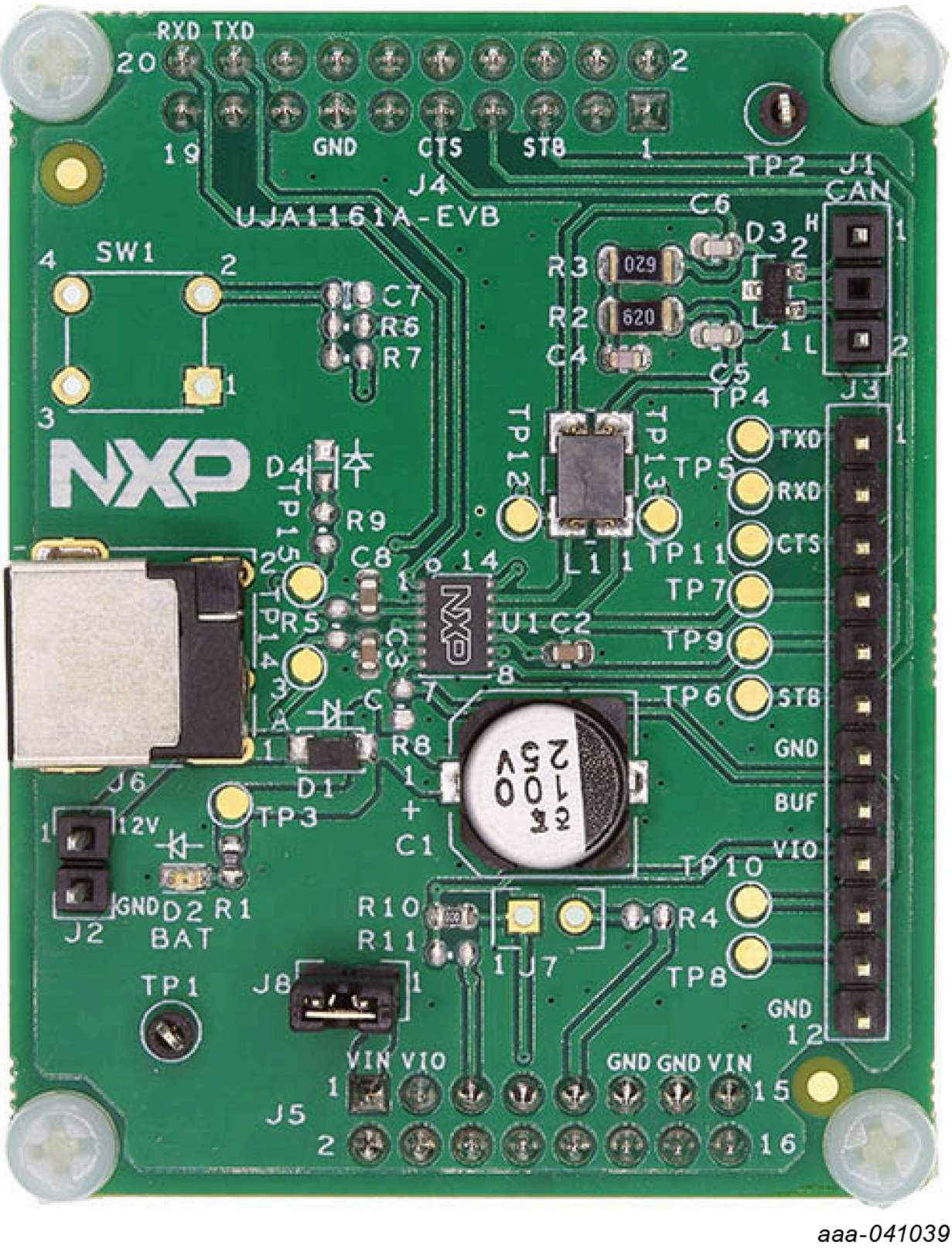

Figure 40. UJA1161A-EVB

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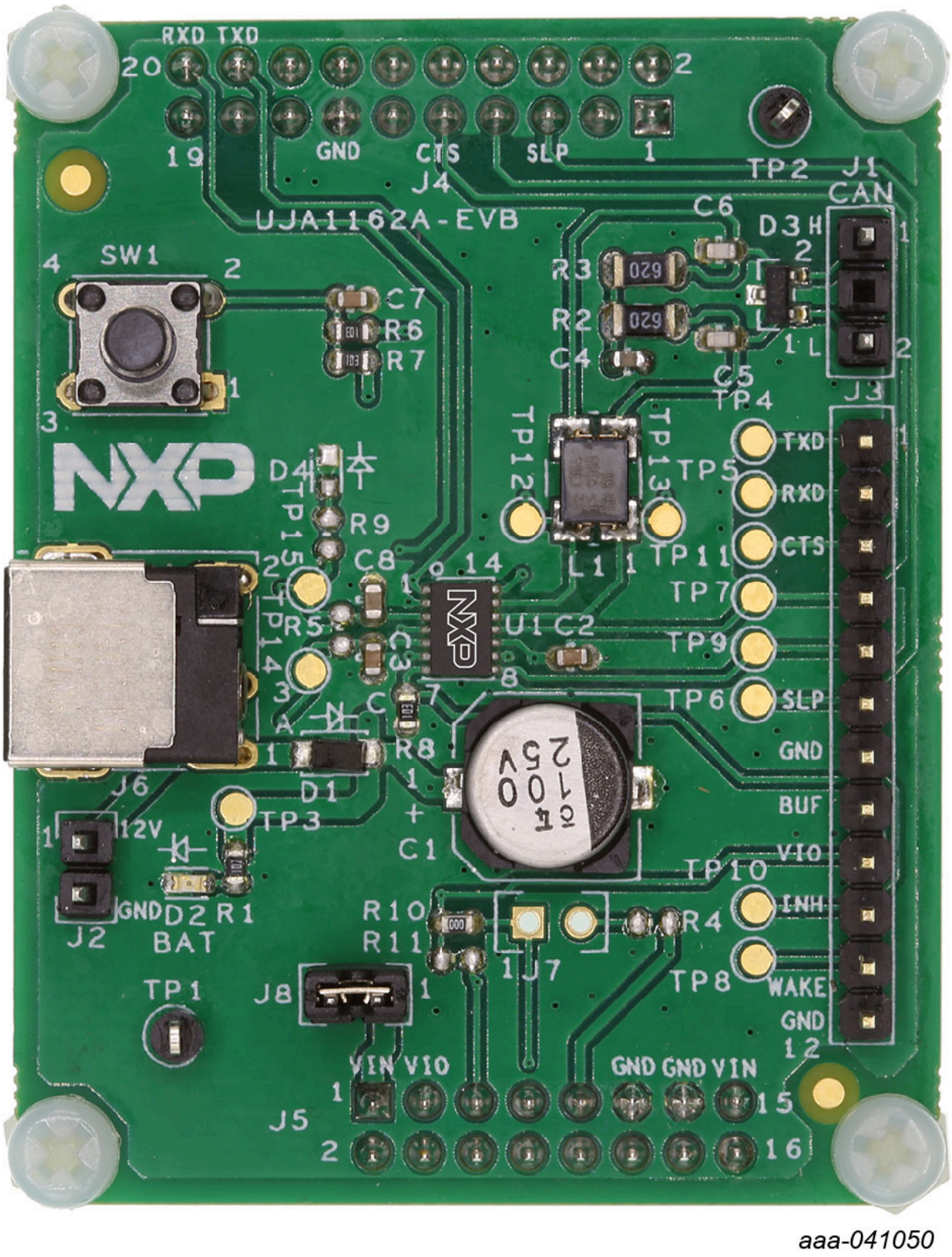

Figure 41. UJA1162A-EVB

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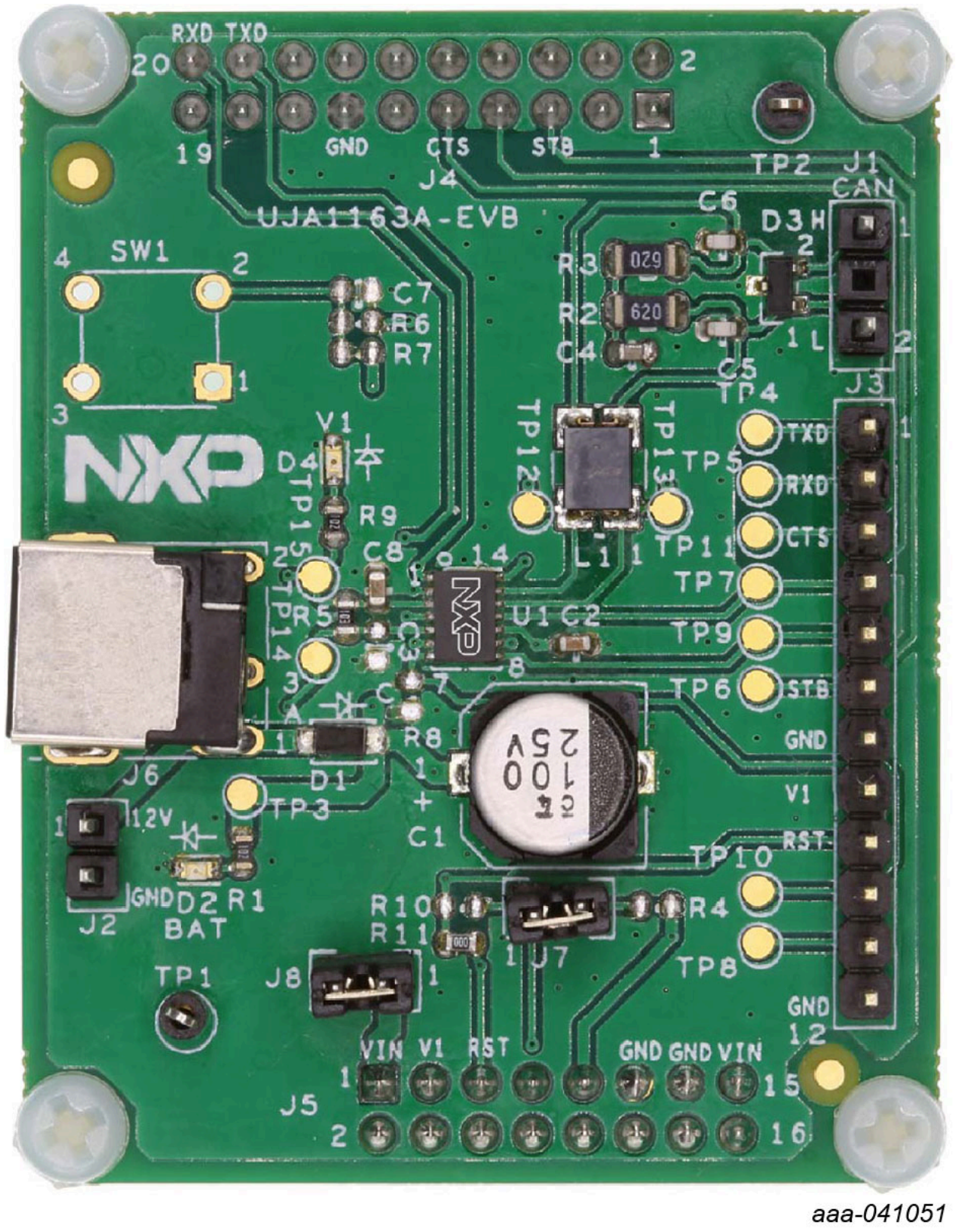

Figure 42. UJA1163A-EVB

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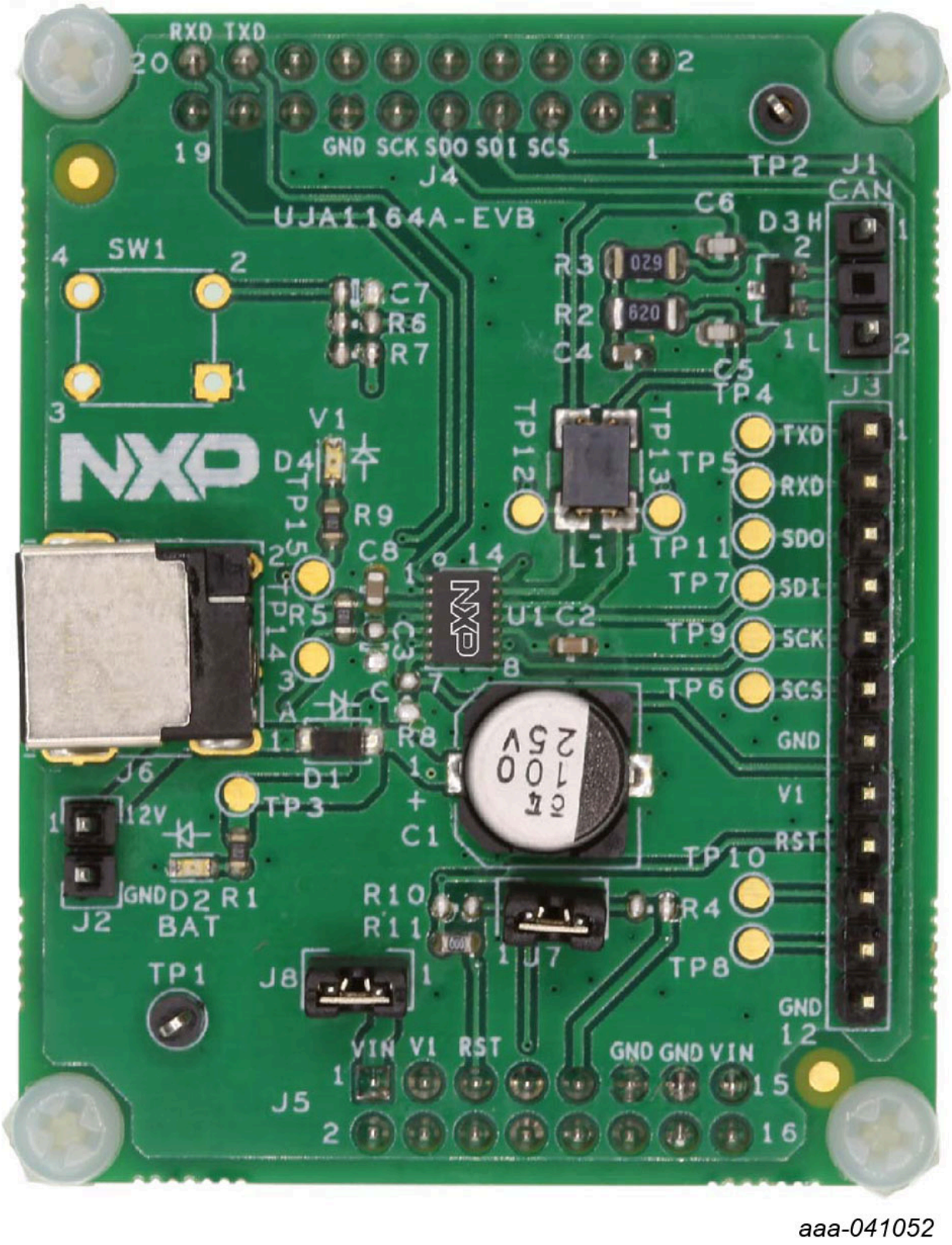

Figure 43. UJA1164A-EVB

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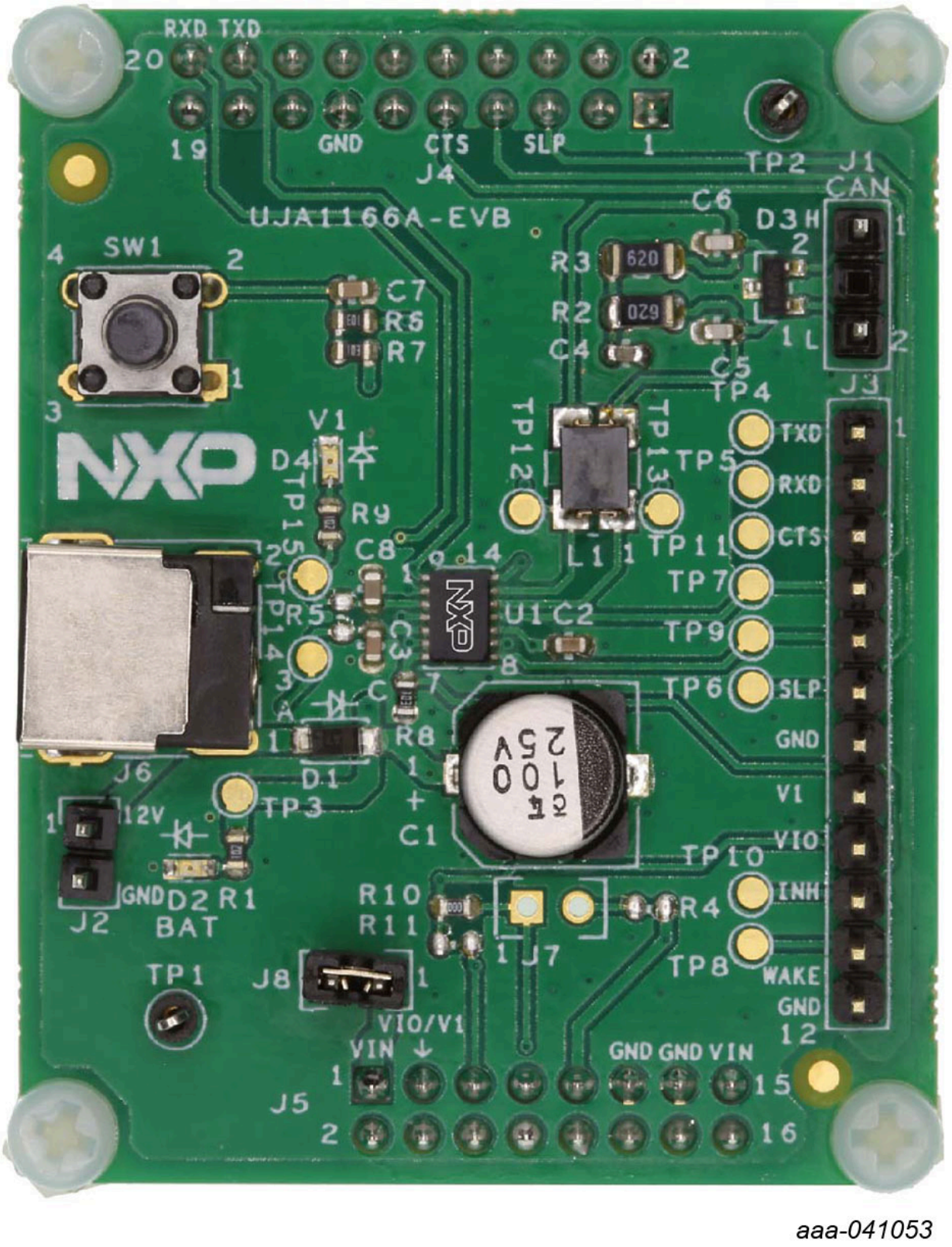

aaa-041053

Figure 44. UJA1166A-EVB

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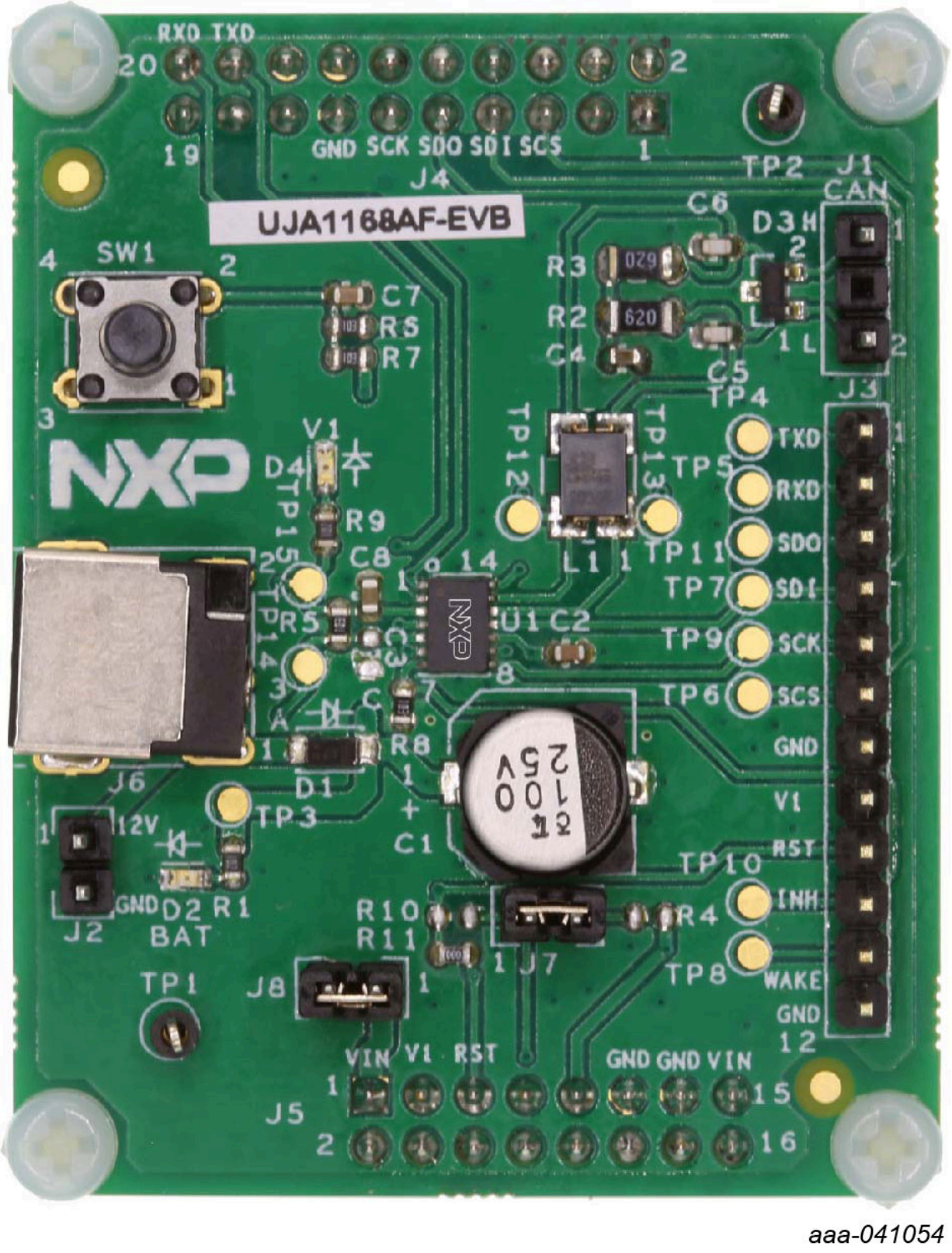

Figure 45. UJA1168AF-EVB

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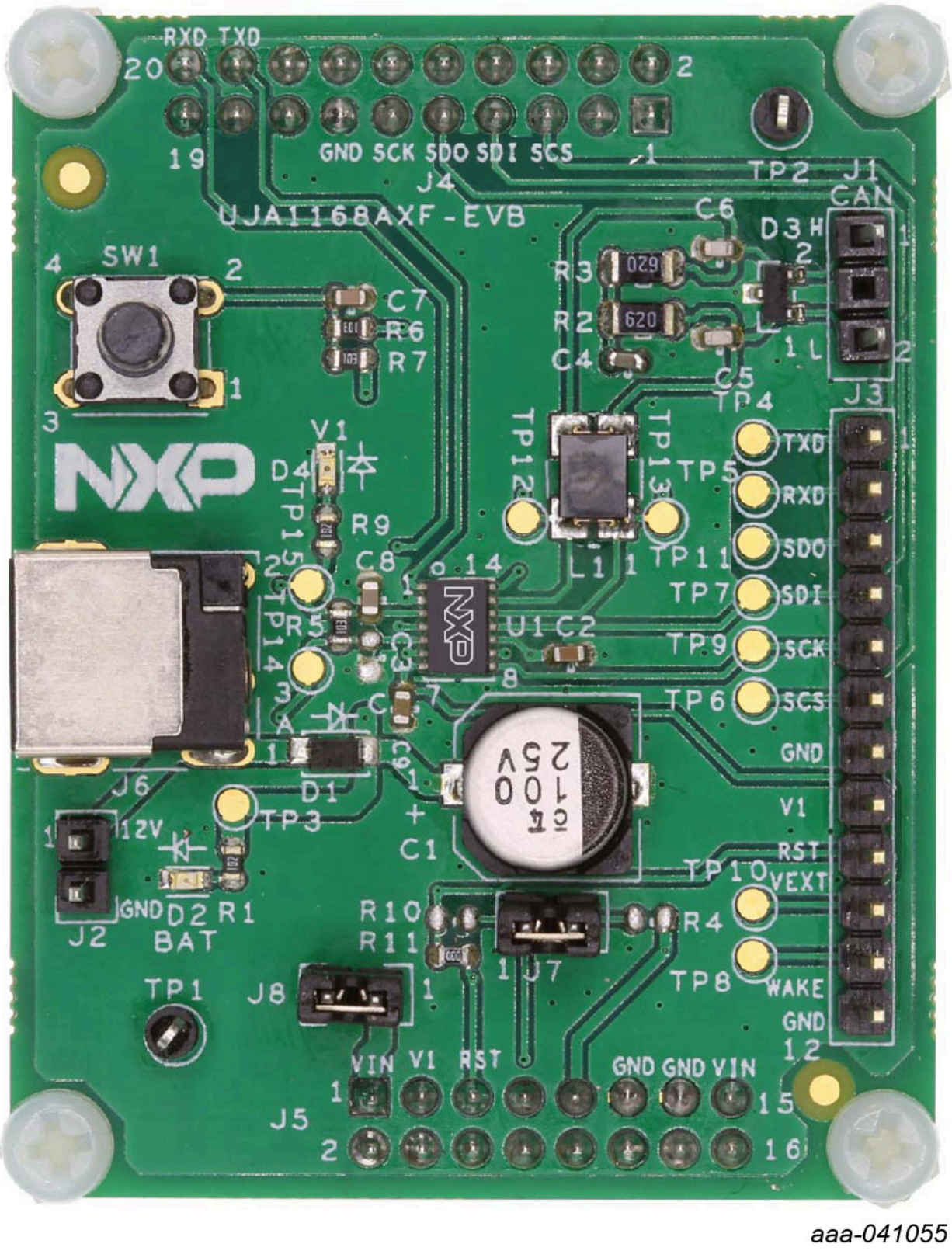

Figure 46. UJA1168AXF-EVB

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9 Revision history

Revision history

Rev	Date	Description
v.1	20210218	Initial version

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