

# UM11758

## UJA1169A evaluation boards

Rev. 1 — 19 April 2022

User manual

### Revision history

Rev	Date	Description
v.1	20220419	Initial version

### IMPORTANT NOTICE

#### For engineering development or evaluation purposes only



NXP provides the product under the following conditions:

This evaluation kit is for use of **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY**. It is provided as a sample IC pre-soldered to a printed-circuit board to make it easier to access inputs, outputs and supply terminals. This evaluation board may be used with any development system or other source of I/O signals by connecting it to the host MCU computer board via off-the-shelf cables. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application heavily depends on proper printed-circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The product provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end device incorporating the product. Due to the open construction of the product, it is the responsibility of the user to take all appropriate precautions for electric discharge. In order to minimize risks associated with the customers' applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact NXP sales and technical support services.



# 1 Introduction

This document is the user guide for the UJA1169A evaluation boards. It is intended for engineers involved in the evaluation, design, implementation and validation of the UJA1169A 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 UJA1169A evaluation boards are designed to facilitate the testing and evaluation of UJA1169A 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 UJA1169A 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 UJA1169A evaluation board family consists of three variant boards as detailed in [Table 1](#). The entire UJA1169A product family can be evaluated using these three boards, and not just the onboard devices. For example, the UJA1169AF-EVB board (with a UJA1169ATK/F device) can be used to evaluate the UJA1169ATK by setting bit CPNC = 0 in the CAN control register. In the same way, the UJA1169ATK/X and UJA1169ATK/3 devices can be evaluated using the the UJA1169AXF-EVB and UJA1169AF3-EVB boards, respectively.

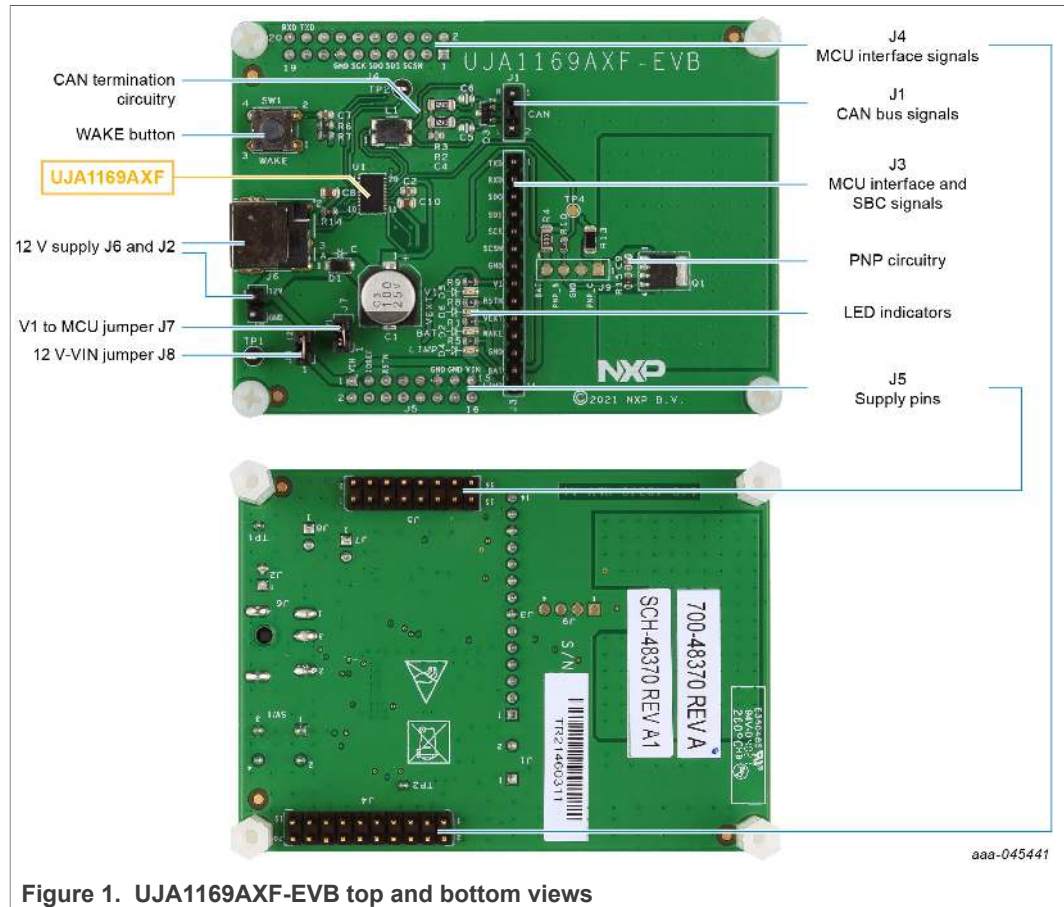
Table 1. UJA1169A evaluation boards and device overview

Evaluation board	On-board device	Modes			Supplies					Host interface		Additional features				Package		
		Normal + Standby modes	Sleep mode	Reset mode	V1: 5 V, $\mu$ C only	V1: 5 V, $\mu$ C and CAN	V1: 3.3 V, $\mu$ C only	V2: 5 V, CAN + onboard loads	VEXT: 5 V, external loads	SPI: for control and diagnosis	RSTN: reset pin	Watchdog	Local WAKE pin	Limp pin	Non-volatile memory	CAN partial networking	CAN FD passive	HVSON20
UJA1169AF-EVB	UJA1169ATK/F	•	•	•	•		•		•	•	•	•	•	•	•	•	•	
UJA1169AXF-EVB	UJA11692ATK/X/F	•	•	•		•		•	•	•	•	•	•	•	•	•	•	•
UJA1169AF3-EVB	UJA1169ATK/F/3	•	•	•			•		•	•	•	•	•	•	•	•	•	•

## 2 Overview of boards

Top and bottom views of the UJA1169AXF-EVB board are illustrated in [Figure 1](#). Unless otherwise stated, the information in this section applies to all UJA1169A evaluation boards.

Board dimensions are 58.5 mm × 81.1 mm. Only components needed to support basic UJA1169A functionality are included. All boards contain circuitry for reverse polarity-protected battery supply, status LEDs for BAT, V1, V2/VEXT and LIMP signals, external PNP transistor for thermal management, local wake-up and CAN bus termination. The boards also provide several header rows (2.54 mm pitch) for connecting MCU interface and application signals. The headers on the bottom are compatible with the Arduino Uno pinout order, allowing the board to be connected directly to a variety of NXP MCU 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
J9-02

## 2.2 Power supply connections

### 2.2.1 Battery connections

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

UJA1169A	UJA1169Ax-EVB
BAT (pin 14)	J2-01 or J6-01: connect to 12 V battery supply; pin BAT on the device is connected via Schottky diode D1. J5-01 and J5-15: pin VIN on the UJA1169Ax-EVB board is connected, by default, to the battery supply 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 UJA1169Ax-EVB 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 UJA1169Ax-EVB board. This feature can be disabled by removing jumper J8, disconnecting the battery supply from pin VIN.

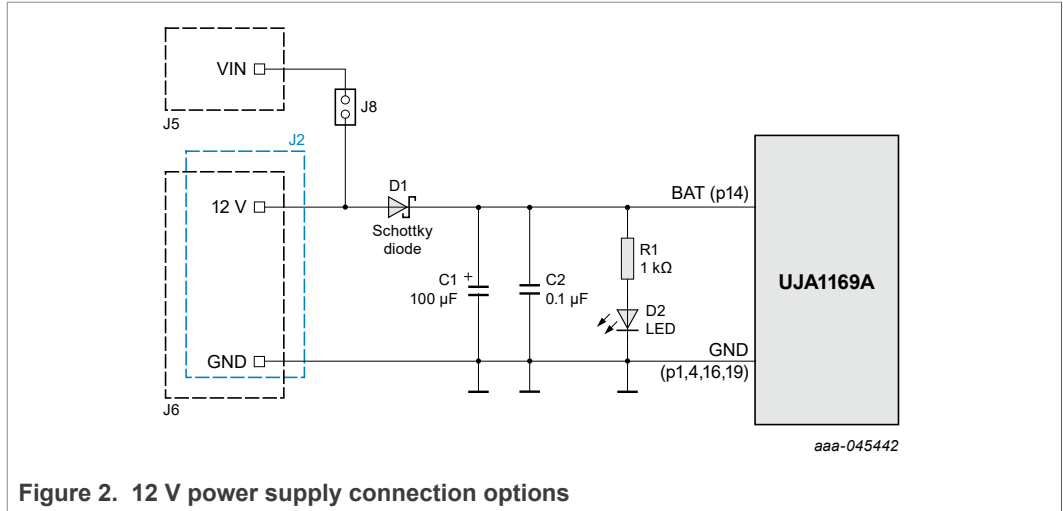


Figure 2. 12 V power supply connection options

2.2.2 V1/PNP connections

The V1 supply voltage is generated by the internal 5 V or 3.3 V regulator, depending on the UJA1169A variant, and is intended to supply the external microcontroller. It also determines the IO reference level.

The V1 output voltage can be accessed at pin 8 on connector J3. Decoupling capacitor C8 is provided to stabilize the output voltage and remove noise. LED D5, connected via resistor R9, indicates the status of V1 (on when V1 active). Jumper J7 can be used to connect V1 to J5-03 if needed as an MCU IO reference voltage. PNP pins can be accessed at connector J9 (see Figure 7).

Table 4. V1/PNP connections

UJA1169A	UJA1169Ax-EVB
V1 (pin 5)	J3-08 provides 3.3 V (UJA1169AF3-EVB only) or 5 V for MCU supply J5-03: pin V1 is connected to the IOREF signal on header J5 via jumper J7, e.g. for the MCU IO supply
VEXCTRL (pin 15)	TP4
VEXCC (pin 6)	J9-01: connected to the collector of the onboard PNP transistor
PNP	UJA1169Ax-EVB
B (pin 4)	J9-03: connected to the base of the onboard PNP transistor
C (pin 5)	J9-01: connected to the collector of the onboard PNP transistor
E (pin 1,2,3)	J9-04: connected indirectly via R4, 0 Ω to emitter of the onboard PNP transistor

The internal V1 voltage regulator on the UJA1169A can deliver up to 250 mA without the need for an external PNP transistor. However, if critical thermal requirements need to be satisfied, it is possible to connect one or more external PNP transistors to share the total V1 load current, and therefore also share the thermal dissipation. The PNP transistor switches on when the load current exceeds the selected PNP activation threshold,  $I_{th(Act)PNP}$ , while the battery supply voltage is above the PNP activation threshold,  $V_{th(Act)PNP}$ . The main regulation loop inside the UJA1169A continues to handle

all dynamic load changes within the package while the external PNP delivers additional supply current to the application.

Detailed information on the functionality and operation of the UJA1169A can be found in the data sheet and application hints (see [Section 7](#)).

**2.2.2.1 UJA1169A with one PNP**

By default, all UJA1169Ax-EVB boards are delivered with an onboard PNP (e.g. PHPT61003PY from Nexperia). A simplified circuit diagram is shown in [Figure 3](#).

Shunt resistor R13 is used to limit the current delivered by the external PNP transistor and to protect the PNP transistor against a V1 short-circuit to GND.

Pull-up resistor R15 is used to pull up the PNP base voltage to prevent it floating (e.g. if R10 has been removed) and therefore ensure that the PNP is turned OFF.

Filter capacitor C9 is needed to protect V1 against an overvoltage during RF-injection on the battery line. For EMI optimization, C9 is placed close to the PNP emitter.

R4 and R10 are provided to allow the PNP to be easily disconnected.

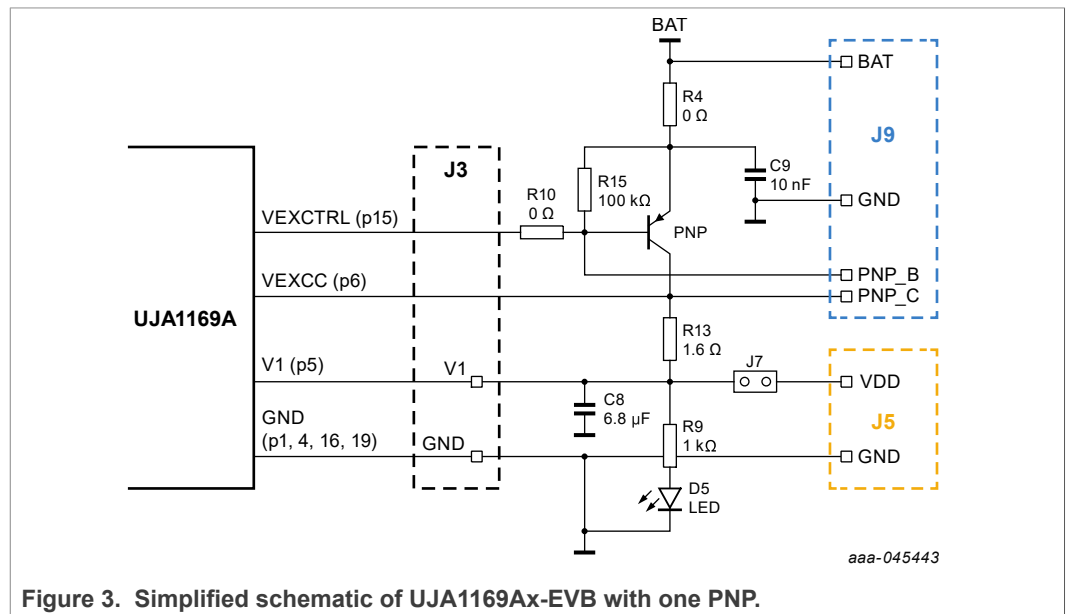


Figure 3. Simplified schematic of UJA1169Ax-EVB with one PNP.

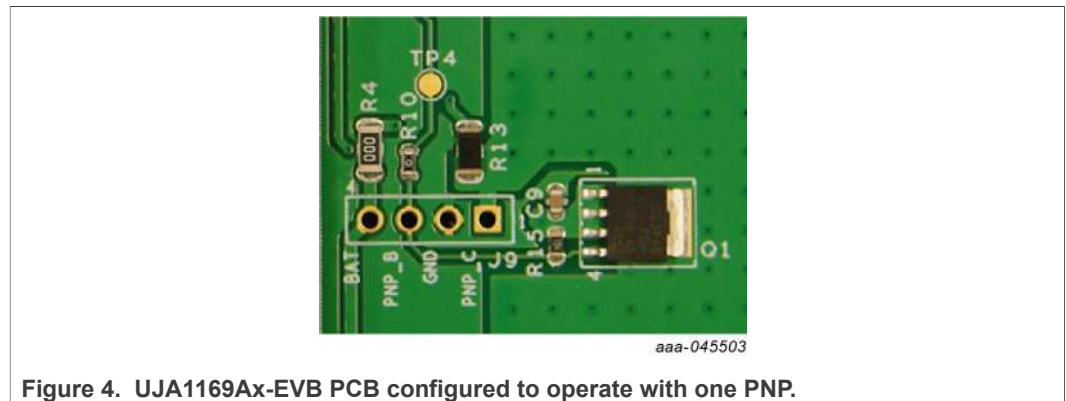


Figure 4. UJA1169Ax-EVB PCB configured to operate with one PNP.

**2.2.2.2 UJA1169A without an external PNP**

As already discussed, the UJA1169Ax-EVB can operate using only the V1 regulator in applications where thermal considerations are not critical. For this option, resistors R4 and R10 must be removed, as illustrated in [Figure 5](#) and [Figure 6](#).

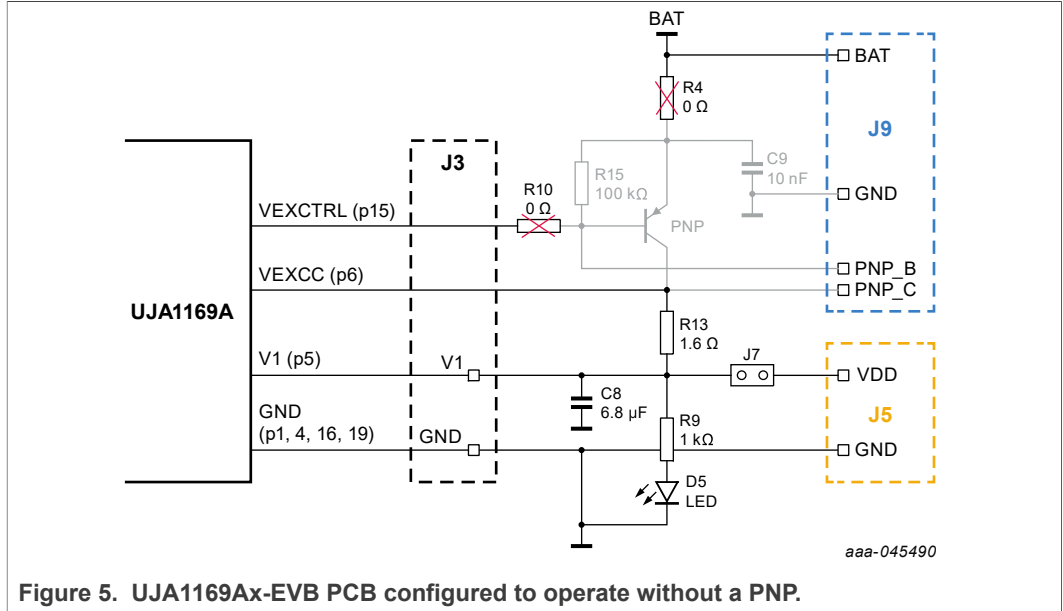


Figure 5. UJA1169Ax-EVB PCB configured to operate without a PNP.

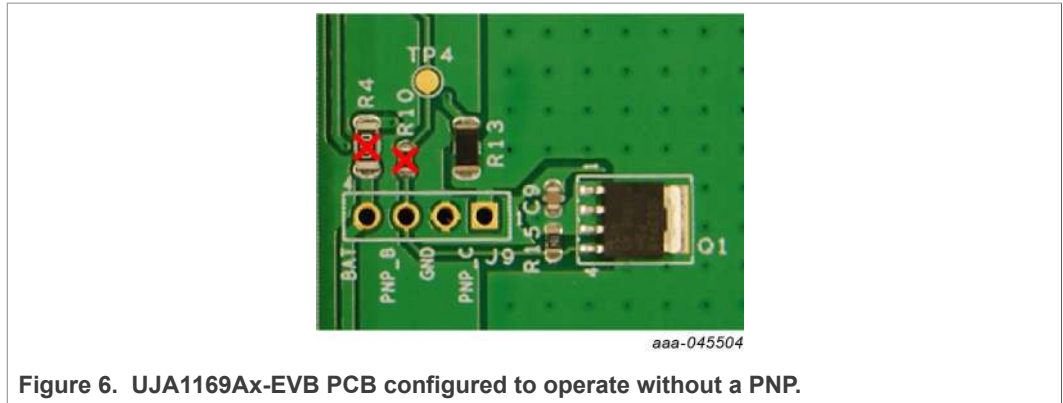


Figure 6. UJA1169Ax-EVB PCB configured to operate without a PNP.

**2.2.2.3 UJA1169Ax-EVB with multiple external PNPs**

If thermal dissipation is so high that it needs to be distributed over a number of components, multiple PNPs can be connected in parallel. A single onboard PNP is included. Additional PNPs can be connected via header J9, as illustrated in [Figure 7](#).

An emitter resistor is needed for each PNP to balance the current between the devices (e.g. 10 Ω). Make sure the resistor selected can handle the expected power dissipation.

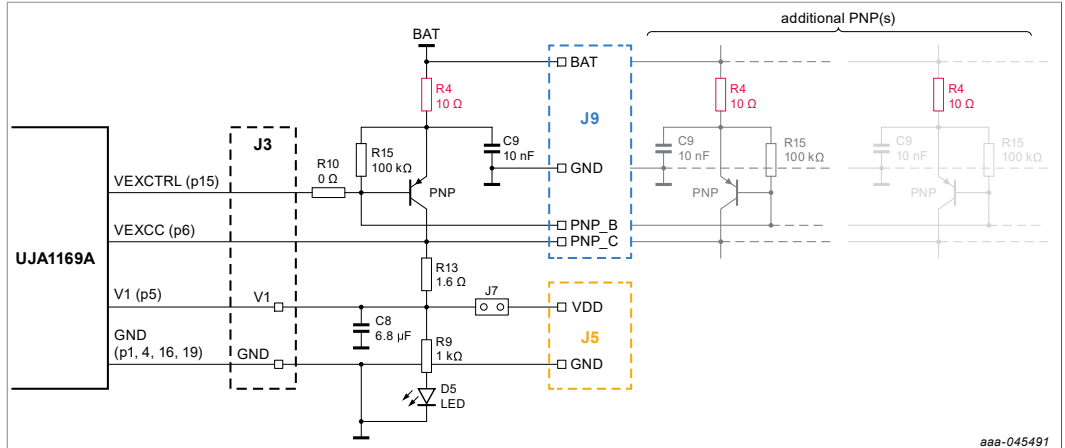


Figure 7. Simplified schematic of UJA1169Ax-EVB with multiple PNPs.

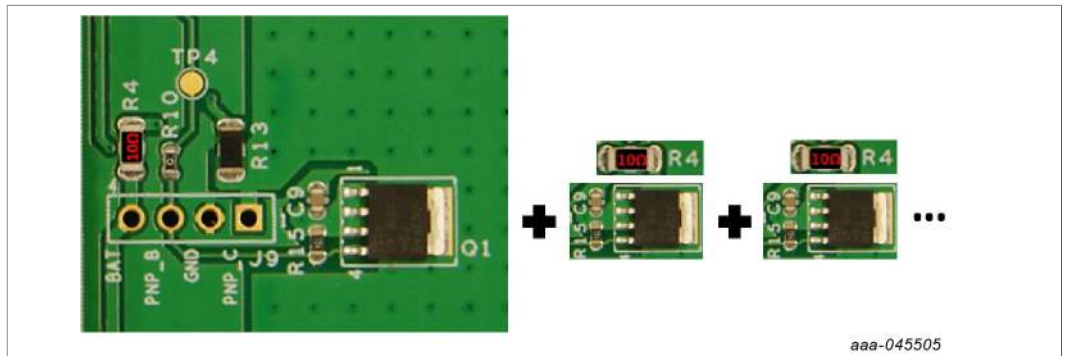


Figure 8. UJA1169Ax-EVB PCB configured to operate with multiple PNPs.



2.2.3 V2/VEXT connection

UJA1169A devices contain a second on-chip 5 V regulator. On the UJA1169ATK, UJA1169ATK/F, UJA1169ATK/3 and UJA1169ATK/F/3 variants, this regulator (V2) supplies the internal CAN transceiver and/or additional onboard hardware. On the UJA1169ATK/X and UJA1169ATK/X/F variants, the second regulator (VEXT) is intended to supply off-board components such as sensors.

Both V2 and VEXT can deliver up to 100 mA. A decoupling capacitor (C10) is connected between the pin and ground on the board. LED D6 lights up when the V2/VEXT output is active.

The V2 (UJA1169AF-EVB and UJA1169AF3-EVB) or VEXT (UJA1169AXF-EVB) output voltage is accessible on connector J3 (pin 10).

Table 5. VEXT connection

UJA1169A	UJA1169Ax-EVB
V2/VEXT (pin 13)	J3-10: provides 5 V supply for internal ECU/external loads

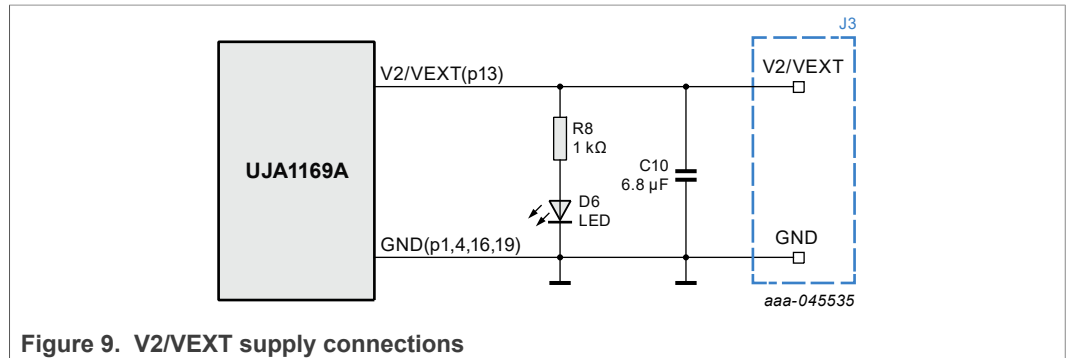


Figure 9. V2/VEXT supply connections

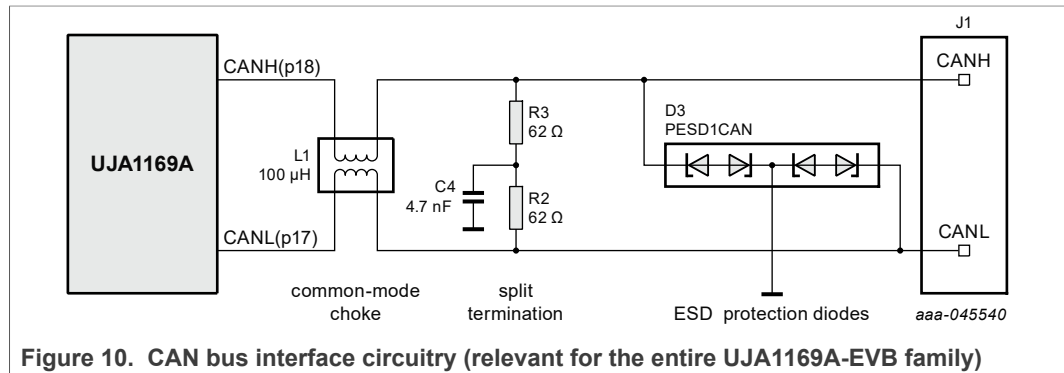
### 2.3 CAN communication circuitry

The UJA1169Ax-EVB evaluation boards contain typical CAN communication circuitry. The CANH and CANL bus signals are output on connector J1.

Table 6. CAN bus line connections

UJA1169A	UJA1169Ax-EVB
CANH (pin 18)	J1-01: connect to HIGH-level CAN bus line
CANL (pin 17)	J1-02: connect to LOW-level CAN bus line

Equipped with termination resistors R2 and R3, the UJA1169Ax-EVB evaluation boards are configured 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.



### 2.4 Wake-up options

All UJA1169A variants 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, or locally via the WAKE pin (details of wake-up functionality can be found in the data sheet and application hints; see [Section 7](#)).

Table 7. WAKE connections

UJA1169A	UJA1169Ax-EVB
WAKE (pin 12)	J3-11: connect to wake-up signal

All three UJA1169A 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. To test local wake-up functionality, local wake-up must first be enabled via the UJA1169A register map (as described in the UJA1169A data sheet [\[1\]](#)).

Regulator V1 on the UJA1169A is intended to supply the MCU. V1 is off in Sleep mode and switches on automatically when a wake-up event is detected.

The WAKE pin can be accessed via header J3 on the top of the board.

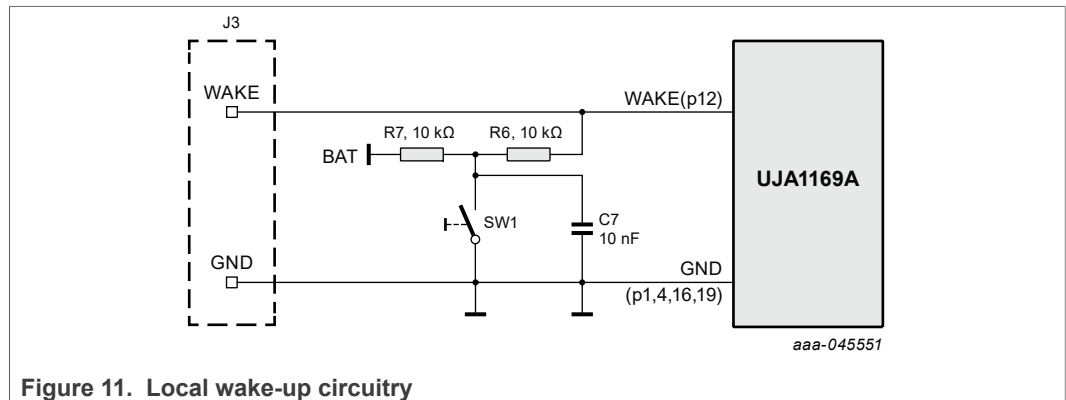


Figure 11. Local wake-up circuitry

## 2.5 LIMP output

The LIMP pin can be accessed on top-side connector J3. It is targeted at applications that need a 'limp home' feature in the event of serious ECU failure. LIMP is an open-drain low-side output. It can be biased to an application-specific voltage level, such as via a pull-up resistor to BAT in the evaluation setup.

Red LED D4, connected in series with resistor R5, turns on when LIMP is triggered.

Table 8. VEXT connection

UJA1169A	UJA1169Ax-EVB
LIMP (pin 11)	J3-14: connect to limp home signal

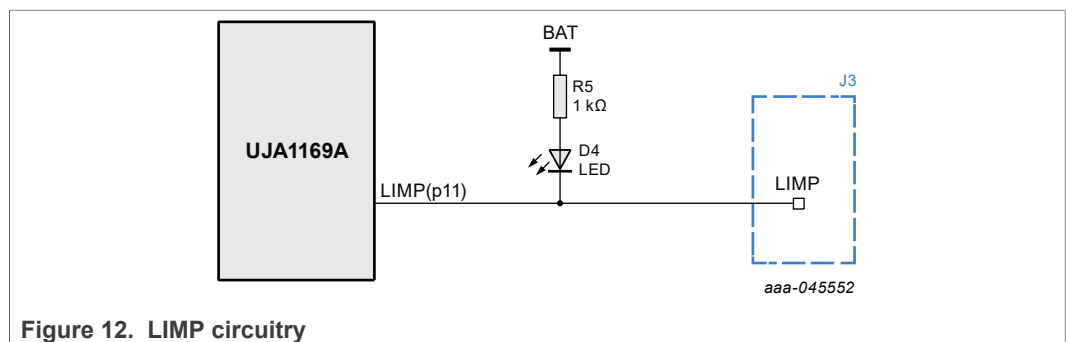


Figure 12. LIMP circuitry

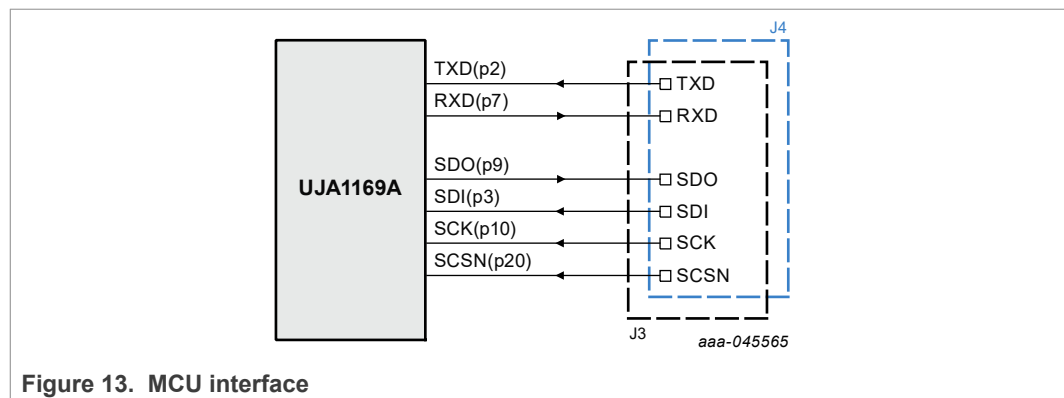
## 2.6 MCU interface

The digital interface pins are located on the top side connector J3, 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 four pins are used for SPI communication with the MCU.

A bidirectional reset signal (connected to the RSTN pin on the UJA1169A) is also accessible on J3 and J5.

Table 9. TXD, RXD and SPI connections

UJA1169A	UJA1169Ax-EVB
TXD (pin 2)	J3-01 or J4-18
RXD (pin 7)	J3-02 or J4-20
SDO (pin 9)	J3-03 or J4-09
SDI (pin 3)	J3-04 or J4-07
SCK (pin 10)	J3-05 or J4-11
SCSN (pin 20)	J3-06 or J4-05



## 2.7 Reset connection

The reset connection is a bidirectional signal between the RSTN pin 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 event is triggered by a LOW level on RSTN. Details of reset functionality can be found in the UJA1169A data sheet [1] and application hints [2].

Table 10. RSTN connection

UJA1169A	UJA1169Ax-EVB
RSTN (pin 8)	J3-09 or J5-05: connect MCU reset signal

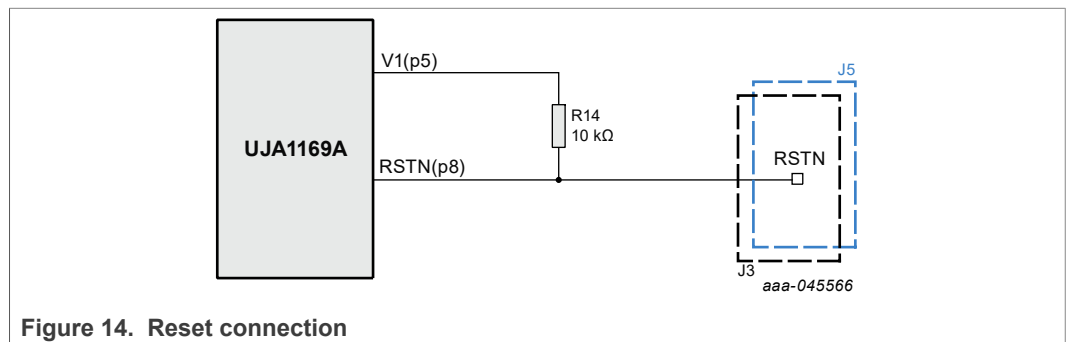


Figure 14. Reset connection

### 3 Connecting the UJA1169Ax-EVB into a CAN network

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) pins to the MCU CAN controller TXD/ RXD pins
- Connect RSTN (J3-09/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
- For the UJA1169AXF-EVB, connect VEXT (J3-10) 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 UJA1169A 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 showing how to connect the UJA1169AXF-EVB between an MCU and the CAN bus is shown in [Figure 15](#).

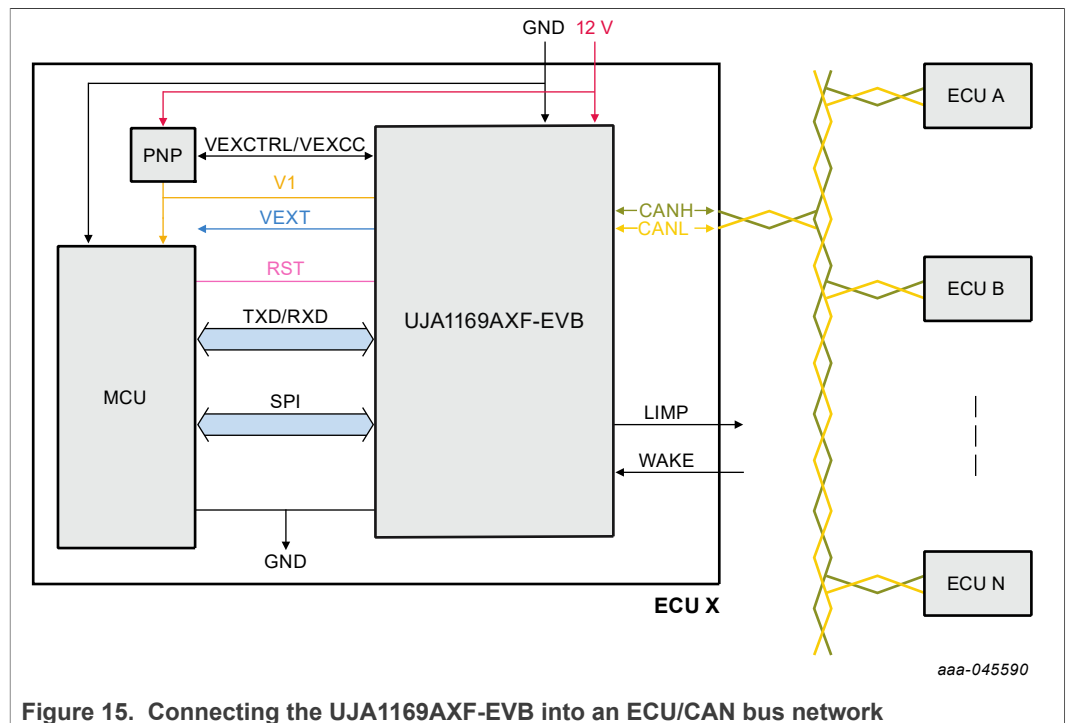
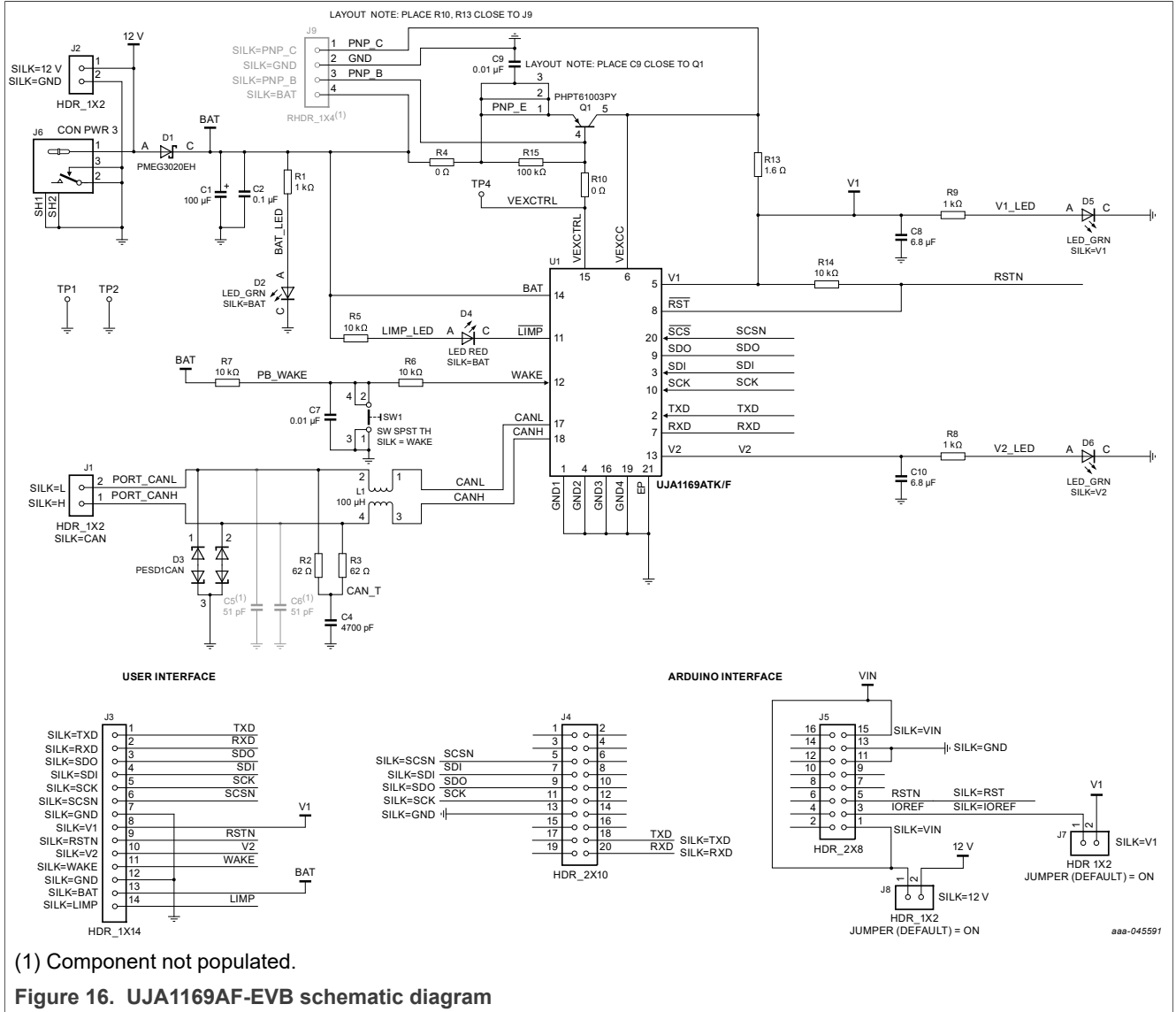
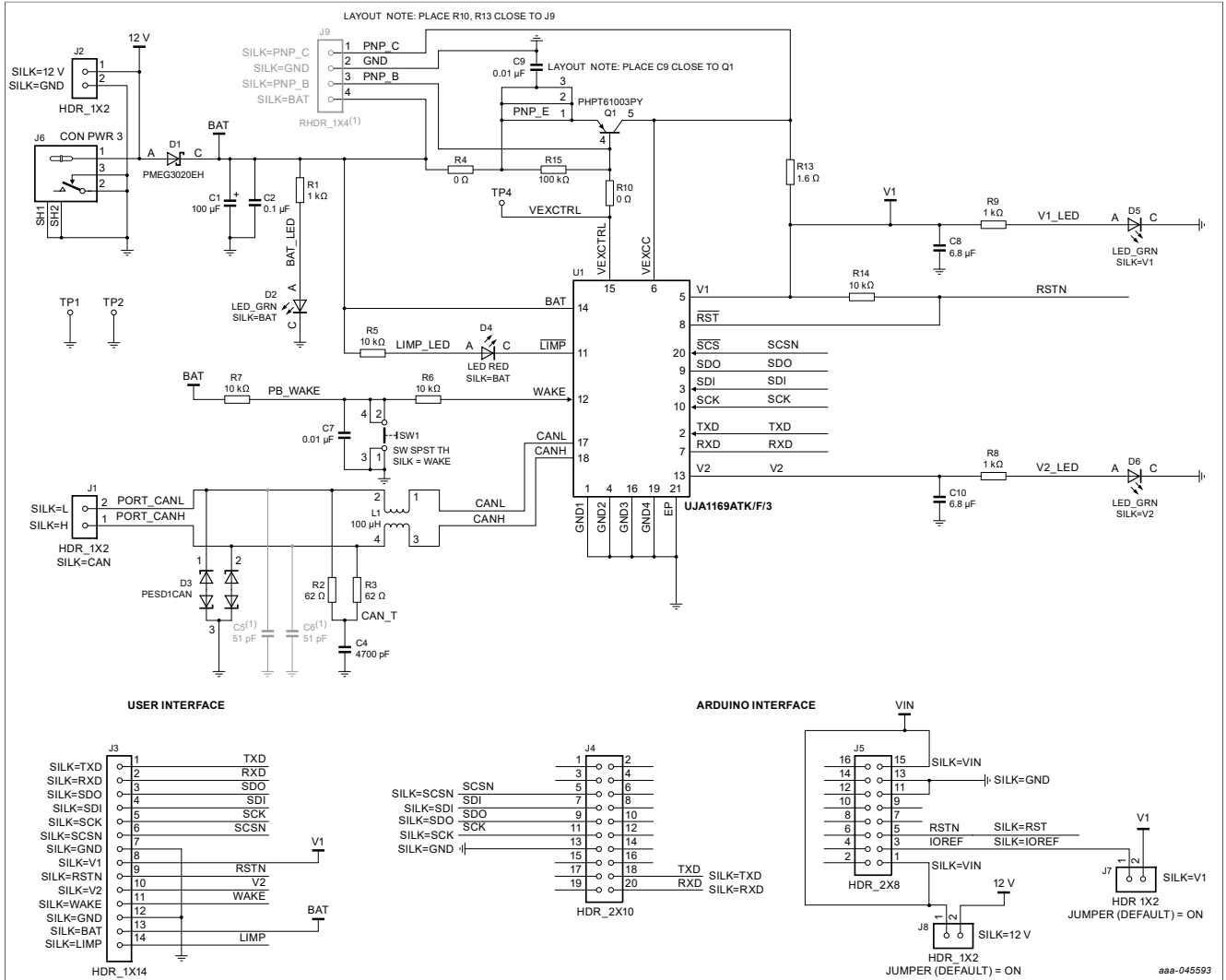


Figure 15. Connecting the UJA1169AXF-EVB into an ECU/CAN bus network

4 Schematic diagrams

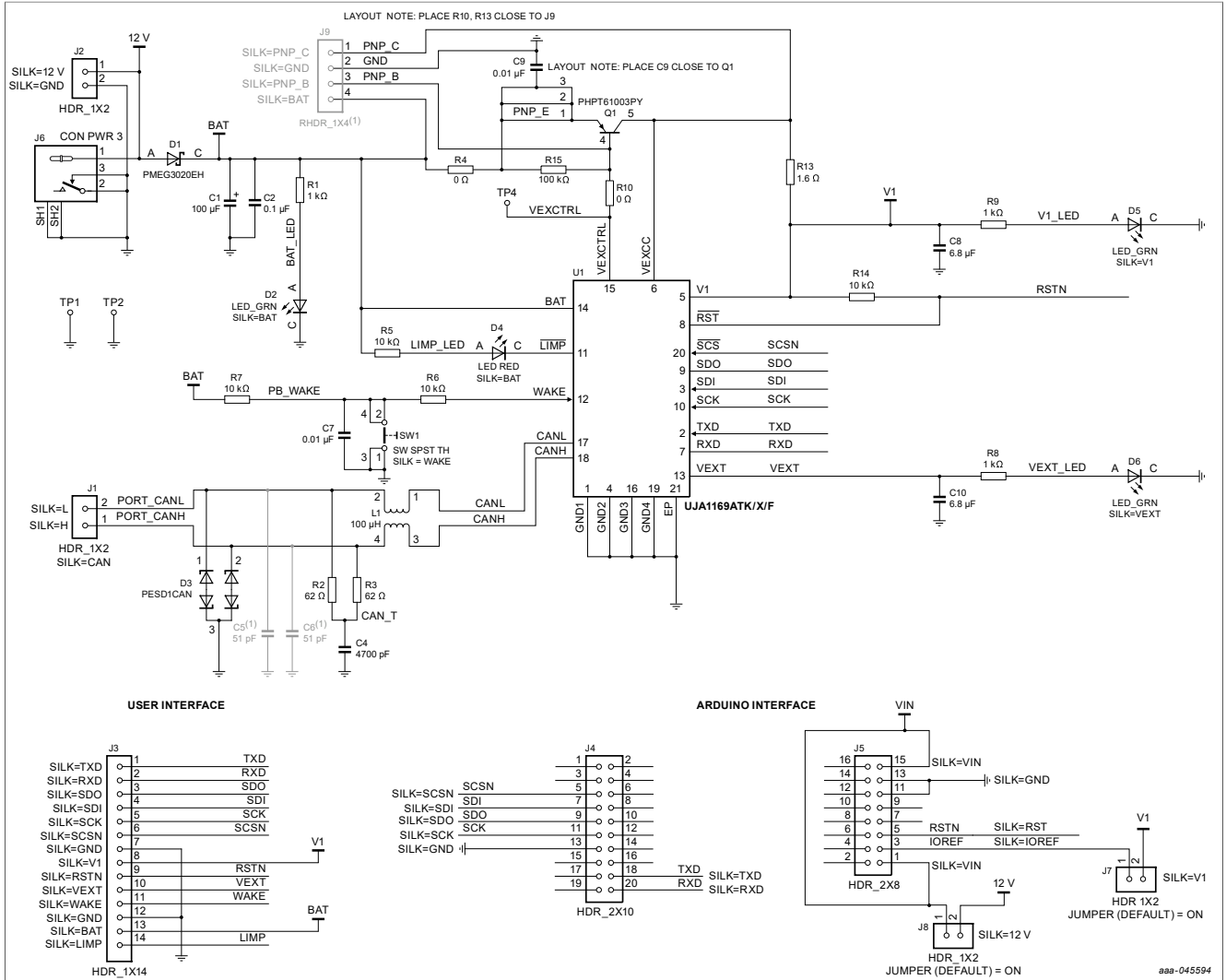






(1) Component not populated.

Figure 17. UJA1169AF3-EVB schematic diagram



(1) Component not populated.

Figure 18. UJA1169AXF-EVB schematic diagram

## 5 Bills of Materials

**Table 11. Bill of Materials - UJA1169AF-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	UJA1169ATK/F	IC SBC XCVR CAN 5 V AEC-Q100 HVSON20	UJA1169ATK/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	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
5	2	C5, C6	51 pF	not populated		
6	1	C7, C9	0.01 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
7	1	C8, C10	6.8 µF	CAP CER 6.8 µF 16 V 10 % X7S AEC-Q200 0805	CGA4J1X7S1C685K125AC	TDK
Diodes						
8	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
9	1	D2, D5, D6	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-Q101 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	EPCOS
Resistors						
13	2	R1, R8, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA ERJ-3GEYJ103V RK73B1JTTD102J	VISHAY INTERTECHNOLOGY (preferred) PANASONIC (alternative) KOA SPEER (alternative)
14	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
15	1	R4	0 Ω	RES MF ZERO Ω 1/4 W 1206	ERJ-8GEY0R00V CR1206J/000ELF CR12064W000T WR12X000 PTL	PANASONIC (preferred) BOURNS (alternative) VENKEL COMPANY (alternative) WALSIN TECHNOLOGY CORP (alternative)
16	3	R5, R6, R7, R14	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V RK73B1JTTD103J	PANASONIC (preferred) KOA SPEER (alternative)
17	1	R10	0 Ω	RES MF ZERO Ω 1/10 W AEC-Q200 0603	ERJ-3GEY0R00V CRCW06030000Z0EA	PANASONIC (preferred) VISHAY INTERTECHNOLOGY (alternative)
18	1	R13	1.6 Ω	RES MF 1.6 Ω 3/4 W 1 % AEC-Q200 1206	CRCW12061R60FKEAHP	VISHAY INTERTECHNOLOGY
19	1	R15	100 kΩ	RES MF 100K 1/10 W 5 % 0603	CR0603-JW-104ELF RK73B1JTTD104J 0603104J ERJ3GEYJ104V RC-0603-104JT CR0603-10W-104JSNT CR0603-10W-104JT CRCW0603100KJNEC WR06X104JTL	BOURNS (preferred) KOA SPEER (alternative) LIKET CORPORATION (alternative) PANASONIC (alternative) SKYMOS VENKEL COMPANY (alternative) VENKEL COMPANY (alternative) VISHAY INTERTECHNOLOGY (alternative) WALSIN TECHNOLOGY CORP (alternative)
Switches, Connectors, Jumpers, and Test Points						
20	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
21	2	J2, J7, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
22	1	J3	HDR_1x14	HDR 1X14 TH 100 MIL SP 350H AU 118L	61301411121	WURTH ELEKTRONIK EISOS GMBH & CO. KG
23	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
24	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
25	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
26	1	J9	HDR_1X4	not populated		
27	1	SW1	SPST_SWITCH	SW SPST PB TACT 50MA 12 V TH	430186070716	WURTH ELEKTRONIK EISOS GMBH & CO. KG
28	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001 TP-105-01-00 151-203-RC	KEYSTONE ELECTRONICS (preferred) COMPONENTS CORPORATION (alternative) KOBICONN (alternative)
29	13	TP4	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

**Table 12. Bill of Materials - UJA1169AF3-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	UJA1169ATK/F/3	IC SBC XCVR CAN 3.3 V AEC-Q100 HVSON20	UJA1169ATK/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	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
5	2	C5, C6	51 pF	not populated		
6	1	C7, C9	0.01 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
7	1	C8, C10	6.8 µF	CAP CER 6.8 µF 16 V 10 % X7S AEC-Q200 0805	CGA4J1X7S1C685K125AC	TDK
Diodes						
8	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
9	1	D2, D5, D6	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-Q101 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	EPCOS
Resistors						
13	2	R1, R8, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA ERJ-3GEYJ103V RK73B1JTTD102J	VISHAY INTERTECHNOLOGY (preferred) PANASONIC (alternative) KOA SPEER (alternative)
14	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
15	1	R4	0 Ω	RES MF ZERO Ω 1/4 W 1206	ERJ-8GEY0R00V CR1206J/000ELF CR12064W000T WR12X000 PTL	PANASONIC (preferred) BOURNS (alternative) VENKEL COMPANY (alternative) WALSIN TECHNOLOGY CORP (alternative)
16	3	R5, R6, R7, R14	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V RK73B1JTTD103J	PANASONIC (preferred) KOA SPEER (alternative)
17	1	R10	0 Ω	RES MF ZERO Ω 1/10 W AEC-Q200 0603	ERJ-3GEY0R00V CRCW06030000Z0EA	PANASONIC (preferred) VISHAY INTERTECHNOLOGY (alternative)
18	1	R13	1.6 Ω	RES MF 1.6 Ω 3/4 W 1 % AEC-Q200 1206	CRCW12061R60FKEAHP	VISHAY INTERTECHNOLOGY
19	1	R15	100 kΩ	RES MF 100K 1/10 W 5 % 0603	CR0603-JW-104ELF RK73B1JTTD104J 0603104J ERJ3GEYJ104V RC-0603-104JT CR0603-10W-104JSNT CR0603-10W-104JT CRCW0603100KJNEC WR06X104JTL	BOURNS (preferred) KOA SPEER (alternative) LIKET CORPORATION (alternative) PANASONIC (alternative) SKYMOS VENKEL COMPANY (alternative) VENKEL COMPANY (alternative) VISHAY INTERTECHNOLOGY (alternative) WALSIN TECHNOLOGY CORP (alternative)
Switches, Connectors, Jumpers, and Test Points						
20	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
21	2	J2, J7, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
22	1	J3	HDR_1x14	HDR 1X14 TH 100 MIL SP 350H AU 118L	61301411121	WURTH ELEKTRONIK EISOS GMBH & CO. KG
23	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC
24	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
25	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
26	1	J9	HDR_1X4	not populated		
27	1	SW1	SPST_SWITCH	SW SPST PB TACT 50MA 12 V TH	430186070716	WURTH ELEKTRONIK EISOS GMBH & CO. KG
28	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001 TP-105-01-00 151-203-RC	KEYSTONE ELECTRONICS (preferred) COMPONENTS CORPORATION (alternative) KOBICONN (alternative)
29	13	TP4	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

**Table 13. Bill of Materials - UJA1169AXF-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	UJA1169ATK/X/F	IC SBC XCVR CAN 3.3 V/5 V AEC-Q100 HVSON20	UJA1169ATK/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	C4	4700 pF	CAP CER 4700 pF 50 V 5 % C0G AEC-Q200 0603	CGA3E2C0G1H472J080AA	TDK
5	2	C5, C6	51 pF	not populated		
6	1	C7, C9	0.01 µF	CAP CER 0.01 µF 50 V 10 % X7R AEC-Q200 0603	CGA3E2X7R1H103K080AA	TDK
7	1	C8, C10	6.8 µF	CAP CER 6.8 µF 16 V 10 % X7S AEC-Q200 0805	CGA4J1X7S1C685K125AC	TDK
Diodes						
8	1	D1	SCH/30 V	DIODE SCH PWR RECT 2A 30 V AEC-Q101 SOD123F	PMEG3020EH,115	NEXPERIA
9	1	D2, D5, D6	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-Q101 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	EPCOS
Resistors						
13	2	R1, R8, R9	1 kΩ	RES MF 1 kΩ 1/10 W 5 % AEC-Q200 0603	CRCW06031K00JNEA ERJ-3GEYJ103V RK73B1JTTD102J	VISHAY INTERTECHNOLOGY (preferred) PANASONIC (alternative) KOA SPEER (alternative)
14	2	R2, R3	62 Ω	RES MF 62 Ω 1/4W 5 % AEC-Q200 1206	CRCW120662R0JNEA	VISHAY INTERTECHNOLOGY
15	1	R4	0 Ω	RES MF ZERO Ω 1/4 W 1206	ERJ-8GEY0R00V CR1206J/000ELF CR12064W000T WR12X000 PTL	PANASONIC (preferred) BOURNS (alternative) VENKEL COMPANY (alternative) WALSIN TECHNOLOGY CORP (alternative)
16	3	R5, R6, R7, R14	10 kΩ	RES MF 10 kΩ 1/10 W 5 % AEC-Q200 0603	ERJ-3GEYJ103V RK73B1JTTD103J	PANASONIC (preferred) KOA SPEER (alternative)
17	1	R10	0 Ω	RES MF ZERO Ω 1/10 W AEC-Q200 0603	ERJ-3GEY0R00V CRCW06030000Z0EA	PANASONIC (preferred) VISHAY INTERTECHNOLOGY (alternative)
18	1	R13	1.6 Ω	RES MF 1.6 Ω 3/4 W 1 % AEC-Q200 1206	CRCW12061R60FKEAHP	VISHAY INTERTECHNOLOGY
19	1	R15	100 kΩ	RES MF 100K 1/10 W 5 % 0603	CR0603-JW-104ELF RK73B1JTTD104J 0603104J ERJ3GEYJ104V RC-0603-104JT CR0603-10W-104JSNT CR0603-10W-104JT CRCW0603100KJNEC WR06X104JTL	BOURNS (preferred) KOA SPEER (alternative) LIKET CORPORATION (alternative) PANASONIC (alternative) SKYMOS VENKEL COMPANY (alternative) VENKEL COMPANY (alternative) VISHAY INTERTECHNOLOGY (alternative) WALSIN TECHNOLOGY CORP (alternative)
Switches, Connectors, Jumpers, and Test Points						
20	1	J1	HDR_1X2	HDR 1X2 TH 200 MIL SP 338H SN 100L	TSW-202-07-T-S	SAMTEC
21	2	J2, J7, J8	HDR_1X2	HDR 1X2 TH 100 MIL SP 338H SN 100L	TSW-102-07-T-S	SAMTEC
22	1	J3	HDR_1x14	HDR 1X14 TH 100 MIL SP 350H AU 118L	61301411121	WURTH ELEKTRONIK EISOS GMBH & CO. KG
23	1	J4	HDR_2X10	HDR 2X10 TH 100 MIL CTR 428H AU 110L	TSW-110-14-G-D	SAMTEC 4
24	1	J5	HDR_2X8	HDR 2X8 TH 100 MIL CTR 433H AU 110L	TSW-108-14-G-D	SAMTEC
25	1	J6	CON 3	CON 3 PWR JACK RA TH 295H -- NI 98L	PJ-051A	CUI INC
26	1	J9	HDR_1X4	not populated		
27	1	SW1	SPST_SWITCH	SW SPST PB TACT 50MA 12 V TH	430186070716	WURTH ELEKTRONIK EISOS GMBH & CO. KG
28	2	TP1, TP2	TEST_040	TEST POINT BLACK 40 MIL DRILL 180 MIL TH 109L	5001 TP-105-01-00 151-203-RC	KEYSTONE ELECTRONICS (preferred) COMPONENTS CORPORATION (alternative) KOBICONN (alternative)
29	13	TP4	TPAD_059	TEST POINT PAD 59 MIL DIA SMT, NO PART TO ORDER	-	-

## 6 FlexGUI: interactive register control via USB

When the UJA1169Ax-EVB is plugged onto a suitable microcontroller evaluation board, the microcontroller board can be used as a USB/SPI interface between the UJA1169Ax-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 UJA1169Ax-EVB currently supports the following evaluation board:

- S32K144EVB, Rev. B ([Figure 19](#))

See [www.nxp.com](http://www.nxp.com) for more information about this board.

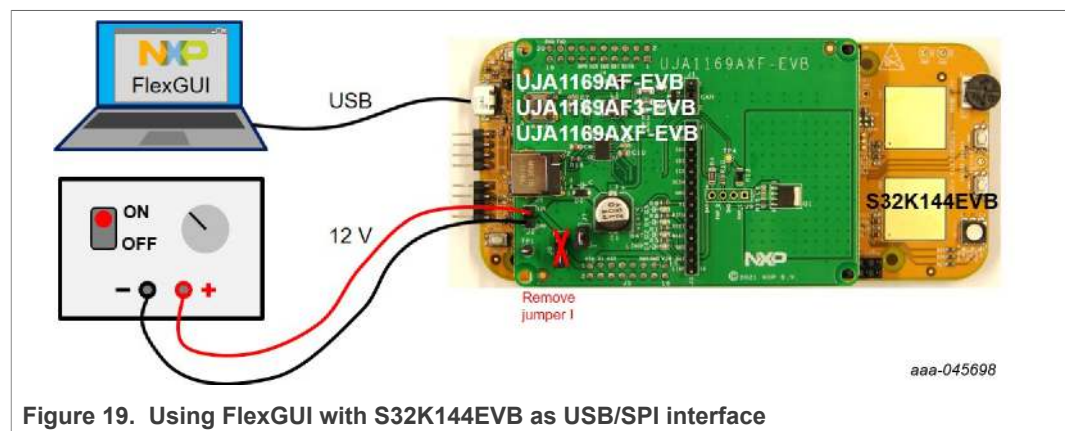


Figure 19. Using FlexGUI with S32K144EVB as USB/SPI interface

### 6.1 FlexGUI software package overview

The FlexGUI SW package for the UJA1169A evaluation boards can be downloaded from [www.nxp.com](http://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](#))

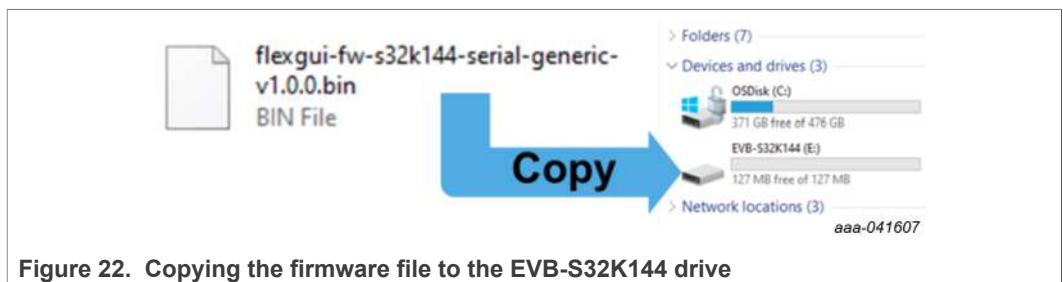
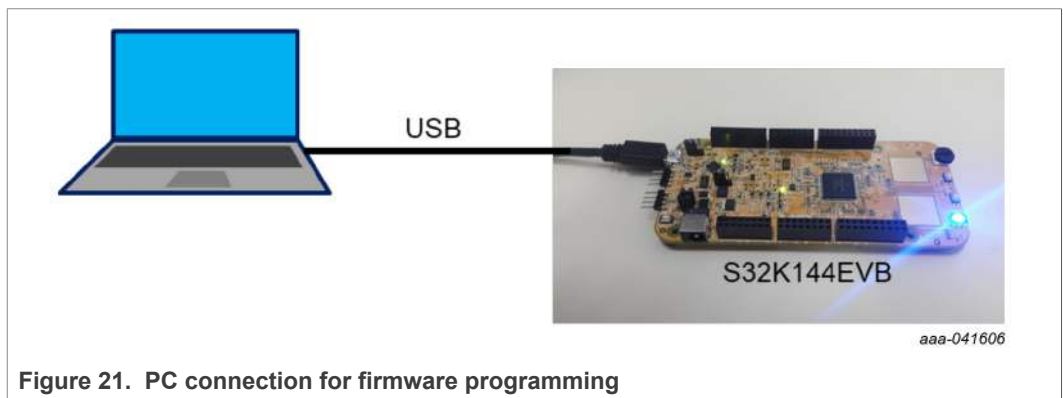
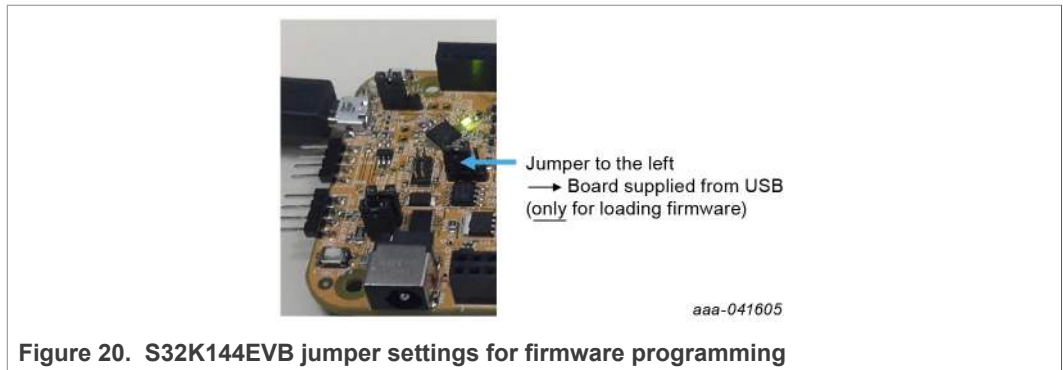
### 6.2 Preparations for using the S32K144EVB as a USB interface

The FlexGUI firmware must be loaded into the S32K144EVB before connecting the UJA1169Ax-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 20](#))
2. Connect the board to the PC with a USB cable ([Figure 21](#))
3. Wait until the PC has launched new drive 'EVB-S32K144' ([Figure 22](#))
4. Copy the firmware file to that drive ([Figure 22](#))

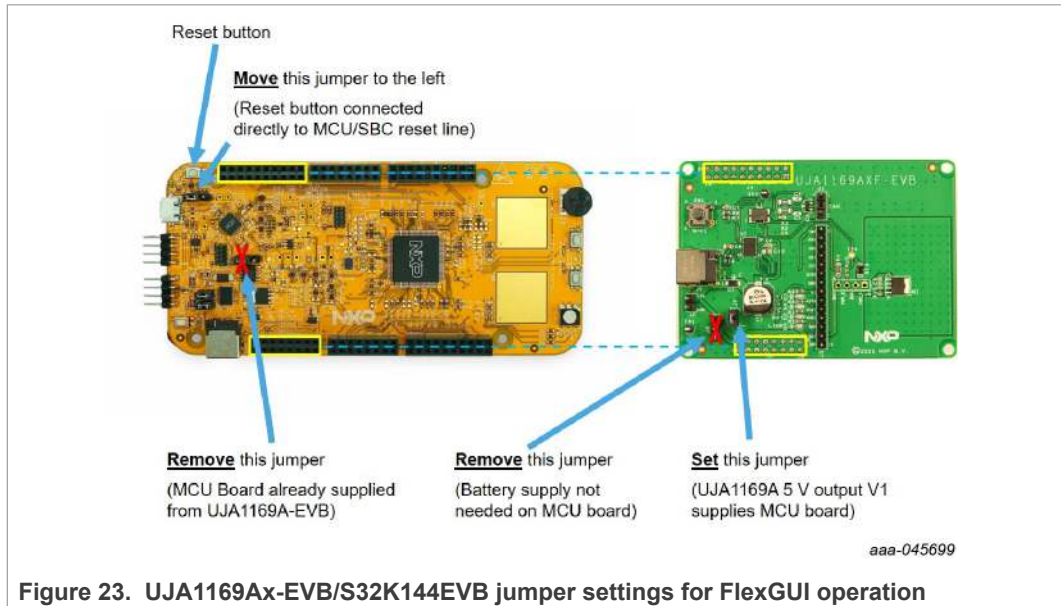


### 6.2.2 HW setup for FlexGUI operation

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 reconnection fails, try again after a power-off/wait-3-seconds/power-on sequence on the UJA1169Ax-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 23](#) before plugging the UJA1169Ax-EVB into the microcontroller board. The resulting supply and data line interconnections between the boards are shown in [Figure 24](#). Note that only the relevant header interconnections are shown in the schematics extract in [Figure 24](#). See the full board schematics for further details.





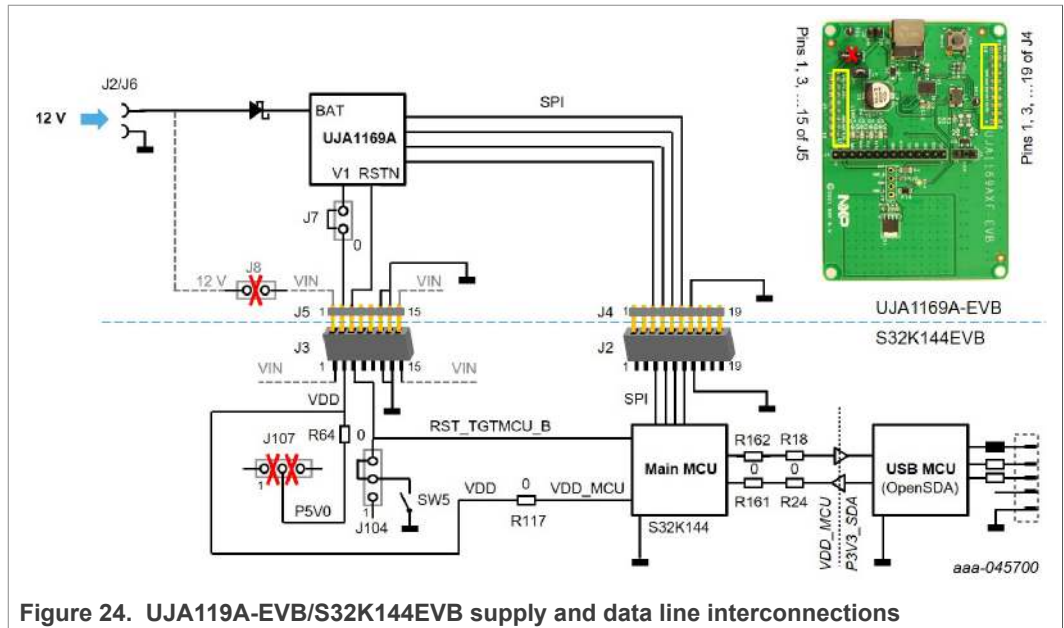


Figure 24. UJA1169A-EVB/S32K144EVB supply and data line interconnections

A 12 V power supply must be connected to header J2 or to jack J6 on the UJA1169A-EVB (see also [Figure 19](#)). It supplies the BAT pin of the SBC via a polarity protection diode.

The 3.3 V or 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 the SBC and the 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. 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 **NXP\_UJA1169Ax\_GUI-1.0.0.msi** to begin the 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 25](#)).



During start-up, the FlexGUI launch window (Figure 26) 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 27). Once loading is complete, the FlexGUI start-up window is displayed (Figure 28). 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.

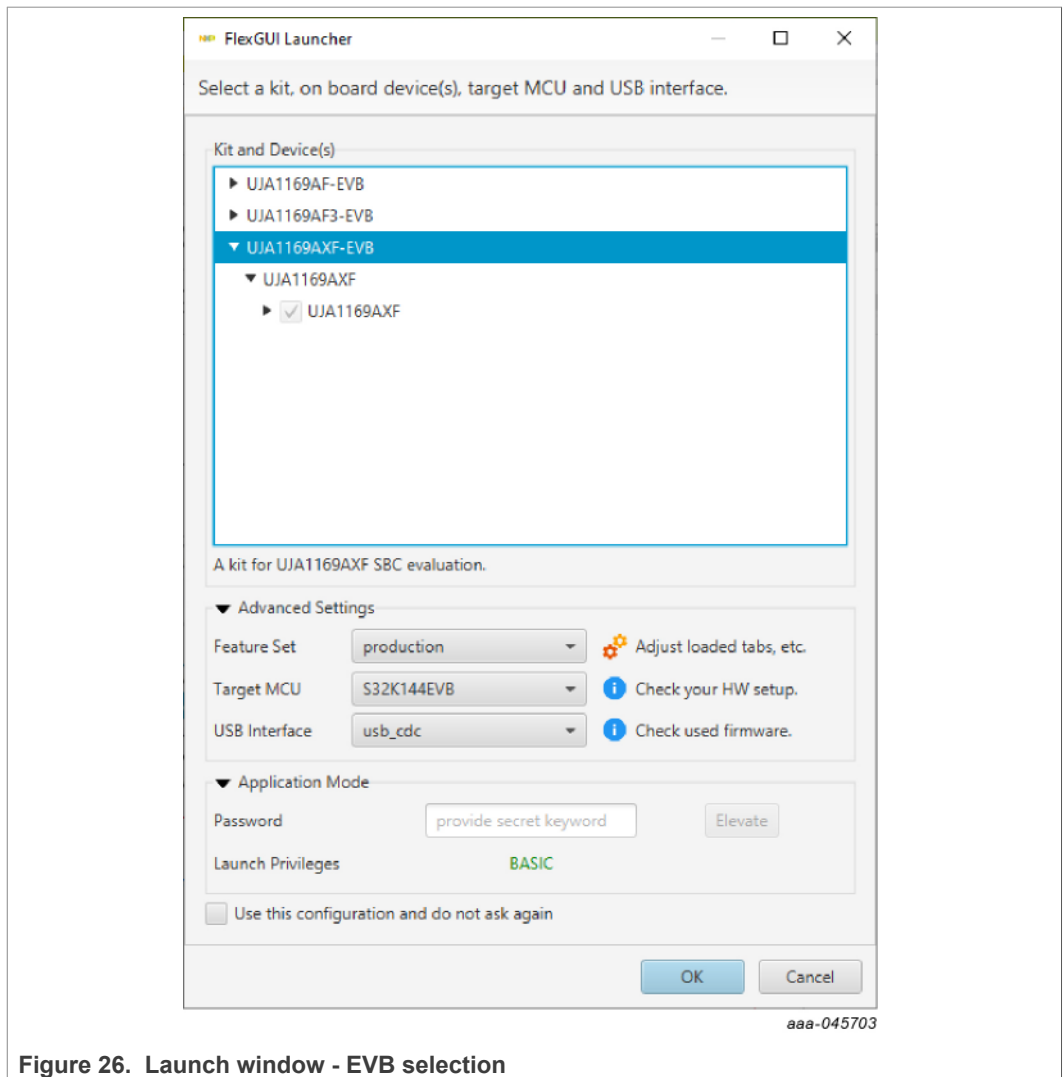




Figure 27. Window displayed during start-up

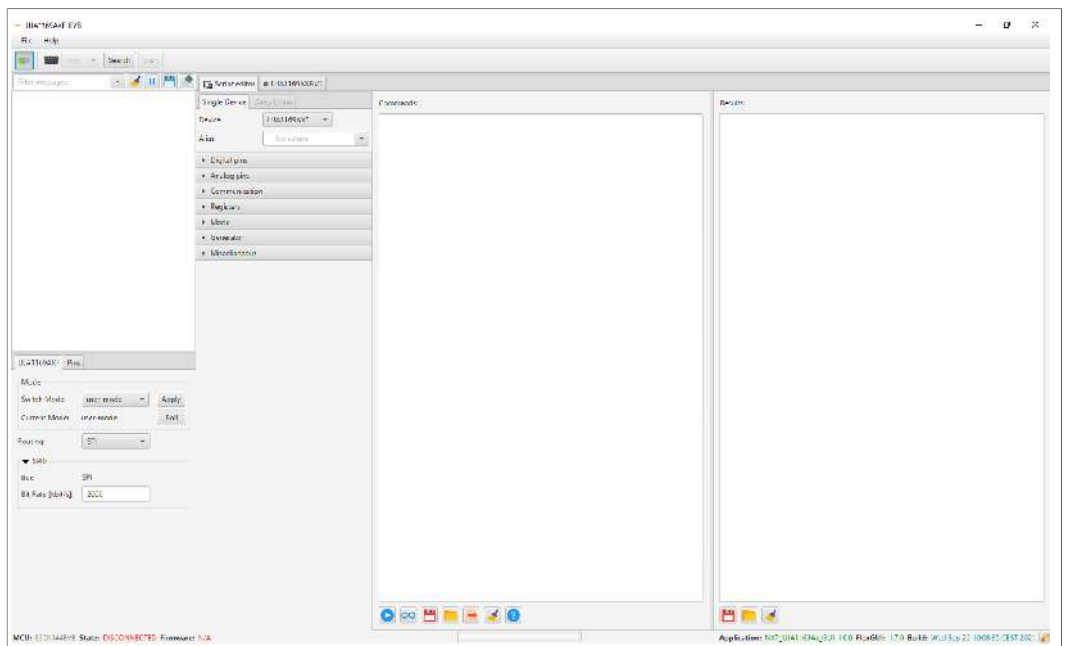


Figure 28. FlexGUI start-up window; boards not yet connected

6.4.2 Establishing a connection between the FlexGUI and the hardware

To establish a connection between the FlexGUI and the hardware, a battery supply must first be provided for the UJA1169Ax-EVB (see [Figure 19](#)) before connecting the microcontroller board to the PC using a USB cable. 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 29](#)). The FlexGUI functionality can now be accessed, as discussed in the following sections.

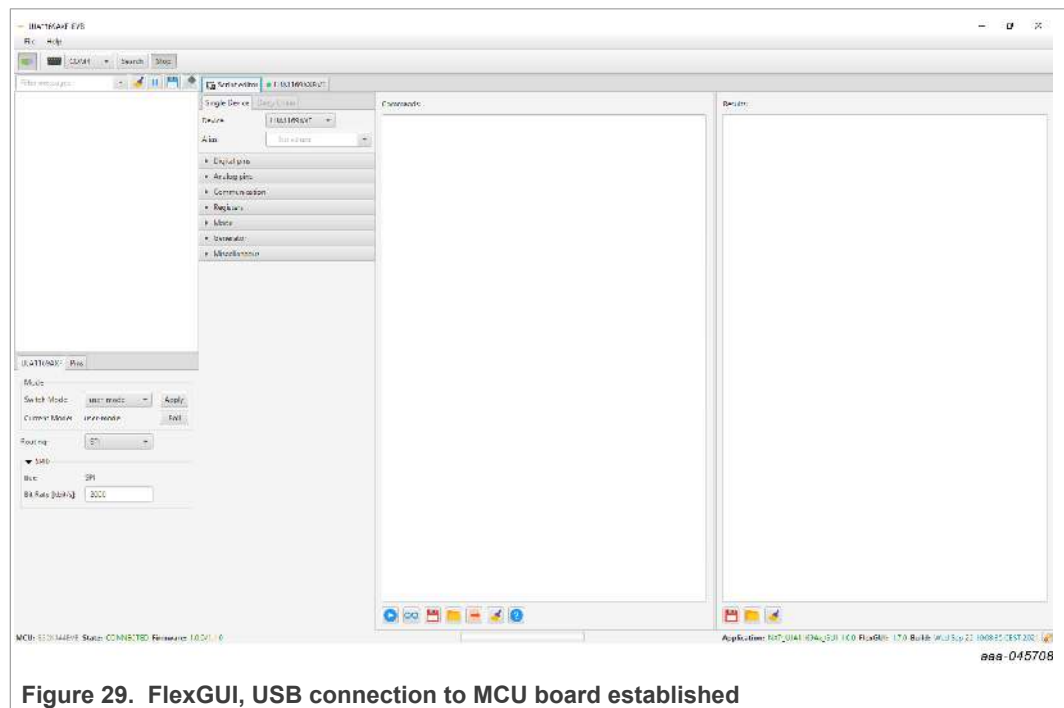


Figure 29. FlexGUI, USB connection to MCU board established

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.

### 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 30](#). 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.

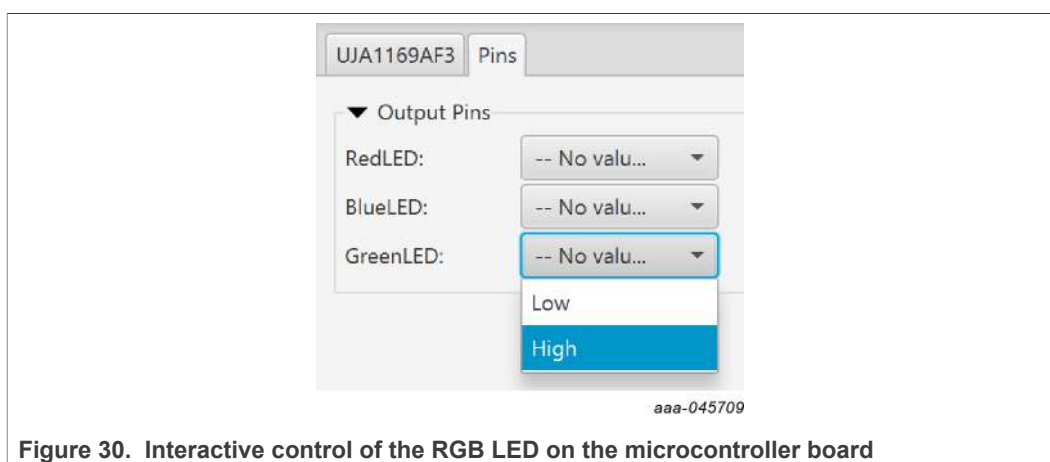


Figure 30. Interactive control of the RGB LED on the microcontroller board

### 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.

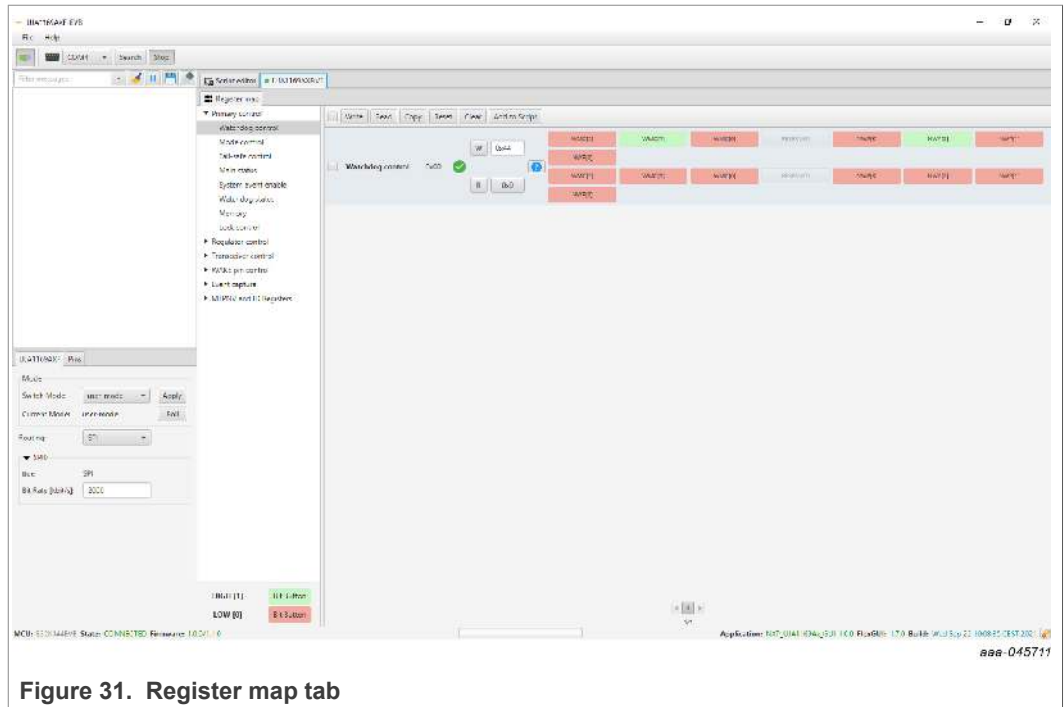


Figure 31. Register map tab

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 32](#)).

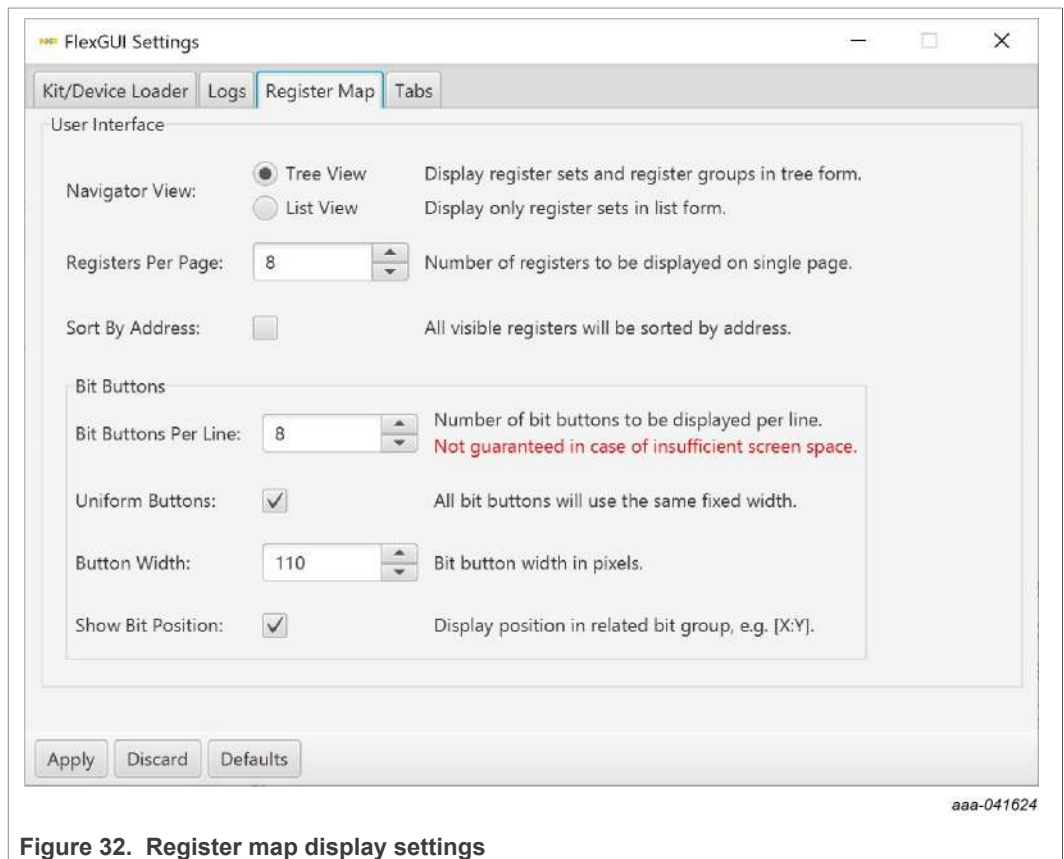


Figure 32. Register map display settings

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 33). 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.

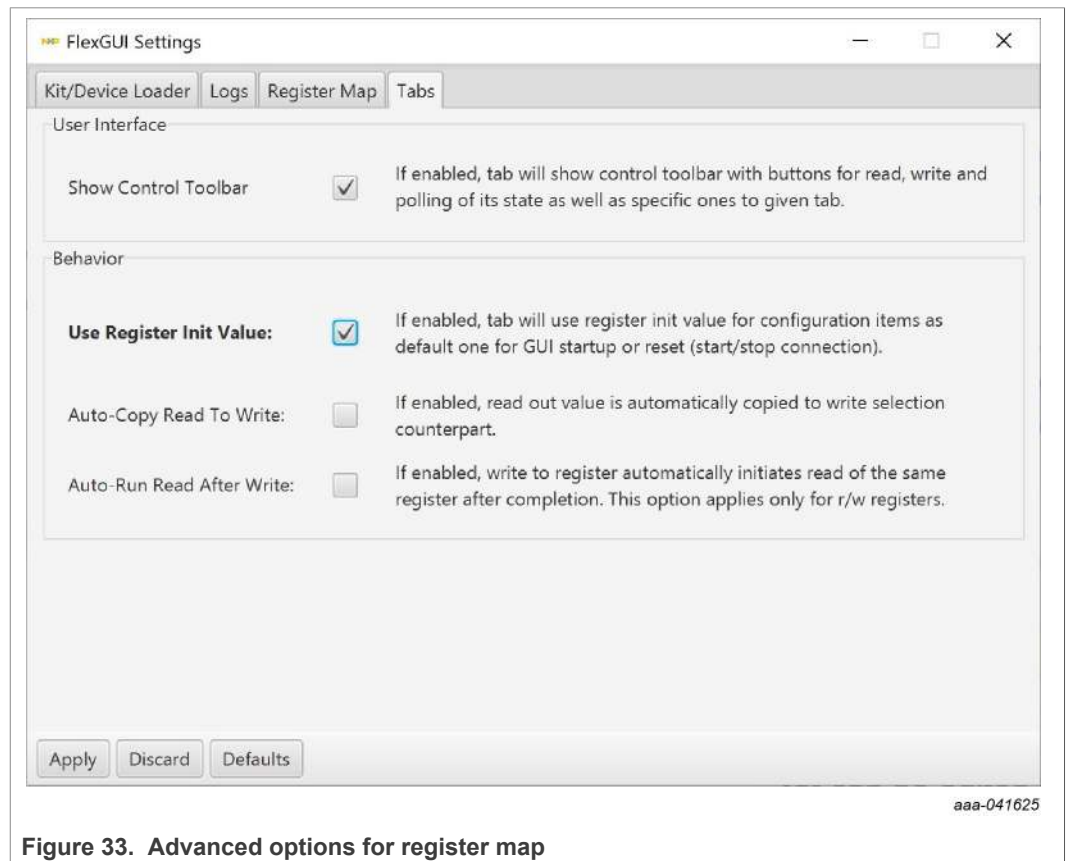


Figure 33. Advanced options for register map

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 31), try de-selecting checkbox **Uniform Buttons** (see Figure 32). The width of the buttons is then minimized to fit the bit names (Figure 34).

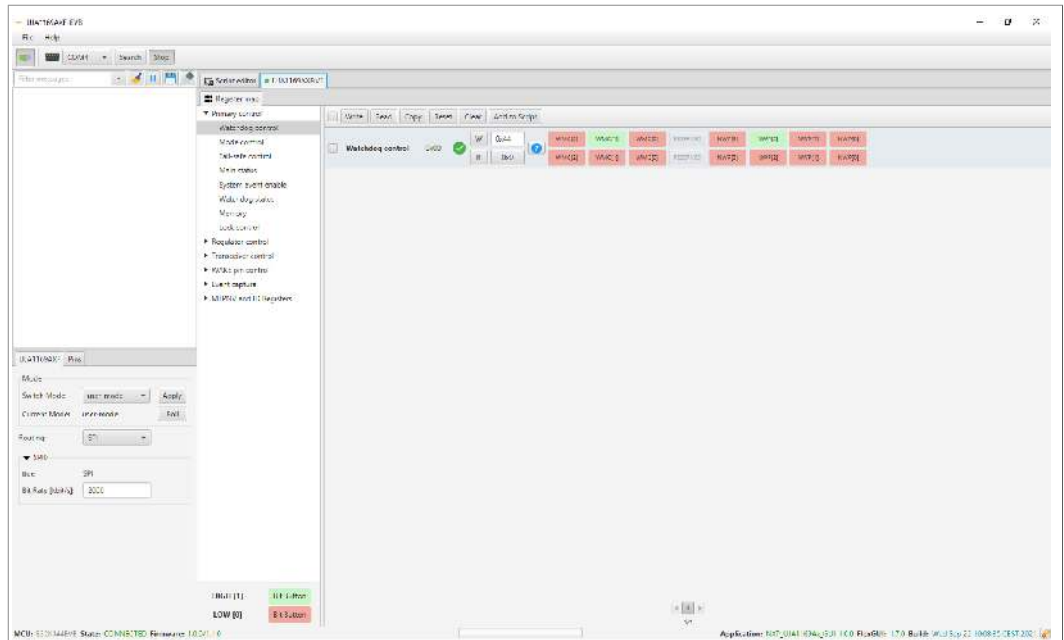


Figure 34. Register map with option 'Uniform Buttons' not selected.

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 32). Figure 35 shows an example Register map view displaying the second page of the Transceiver control register group with 11 registers per page.

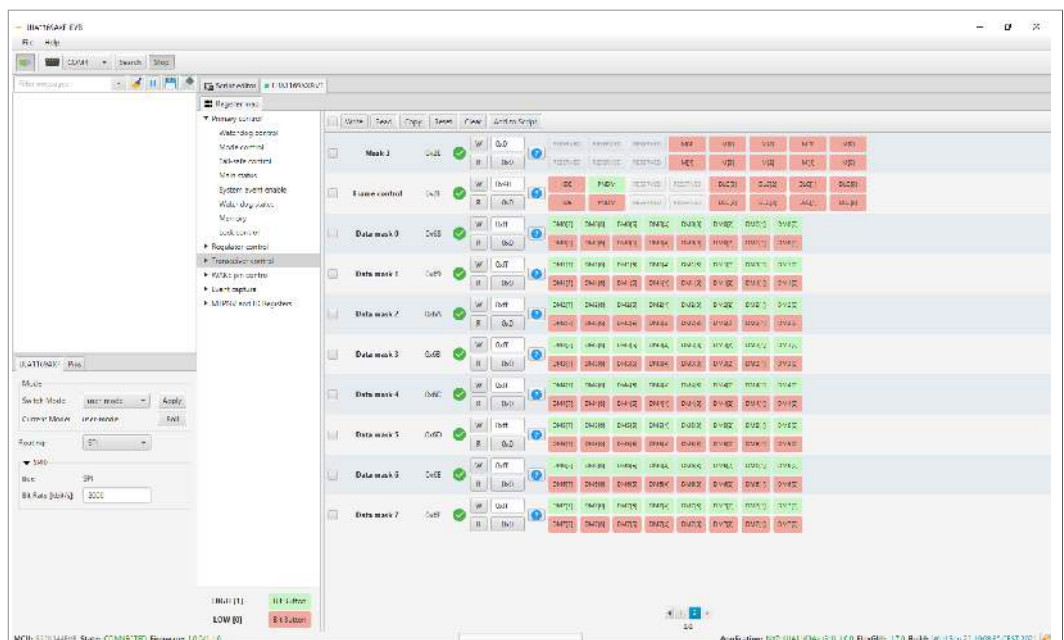


Figure 35. Register map display example with 11 registers per page selected

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 reinitialized (with the default values as selected via the **Use Register Init Value** checkbox; see [Figure 33](#)).

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).

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.

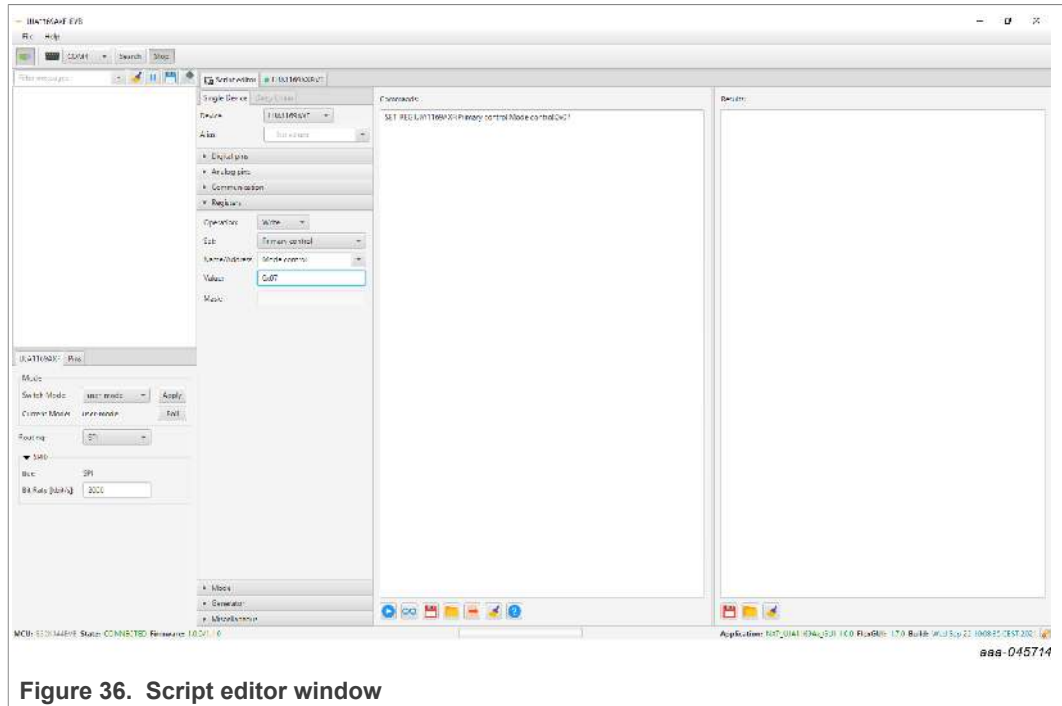




Figure 36. Script editor window

The commands available for the UJA1169Ax-EVB are listed in [Table 14](#). Parameters need to be separated with a colon . 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 ( $\infty$ ) 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  $\infty$  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 14. 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 <sup>[1]</sup>	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 ( $\infty$ ) has been selected.

Example script using all available commands:

```
// This is an example script for UJA1169AXF-EVB
// For UJA1169AF-EVB/UJA1169AF3-EVB replace "UJA1169AXF" with applicable device name

// 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:UJA1169AXF:Primary control:Mode control:0x07

// read Global event status register
GET_REG:UJA1169AXF:Event capture:Global event status

// turn on red LED
SET_DPIN:UJA1169AXF: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:UJA1169AXF:RedLED:HIGH
SET_DPIN:UJA1169AXF:GreenLED:LOW
```

Example script that programs the SBC for Software Development mode:

```
// Script for programming UJA1169AXF SBC MTPNV registers to Software Development mode
// For UJA1169AF-EVB/UJA1169AF3-EVB replace "UJA1169AXF" with applicable device name

// Read MTPNV status register
GET_REG:UJA1169AXF: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
SET_REG:UJA1169AXF:MTPNV and ID Registers:Start-up control:0x00

// Set Software Development mode, allow Sleep mode and set max reset threshold as default
SET_REG:UJA1169AXF:MTPNV and ID Registers:SBC configuration control:0x04

// Enter the CRC code that fits to above selections
SET_REG:UJA1169AXF: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).

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 reconnection fails, try again after a power-off/wait-3-seconds/power-on sequence on the UJA1169Ax-EVB.

### 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 37](#)). 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 38](#)).

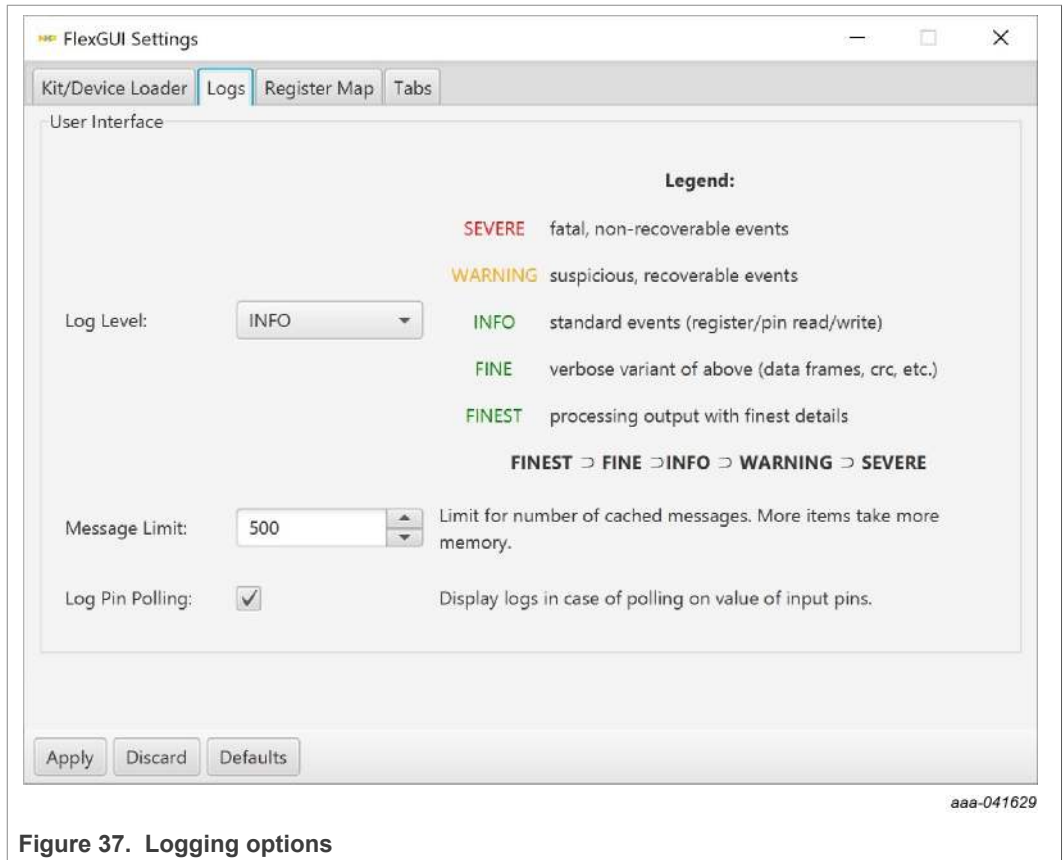


Figure 37. Logging options

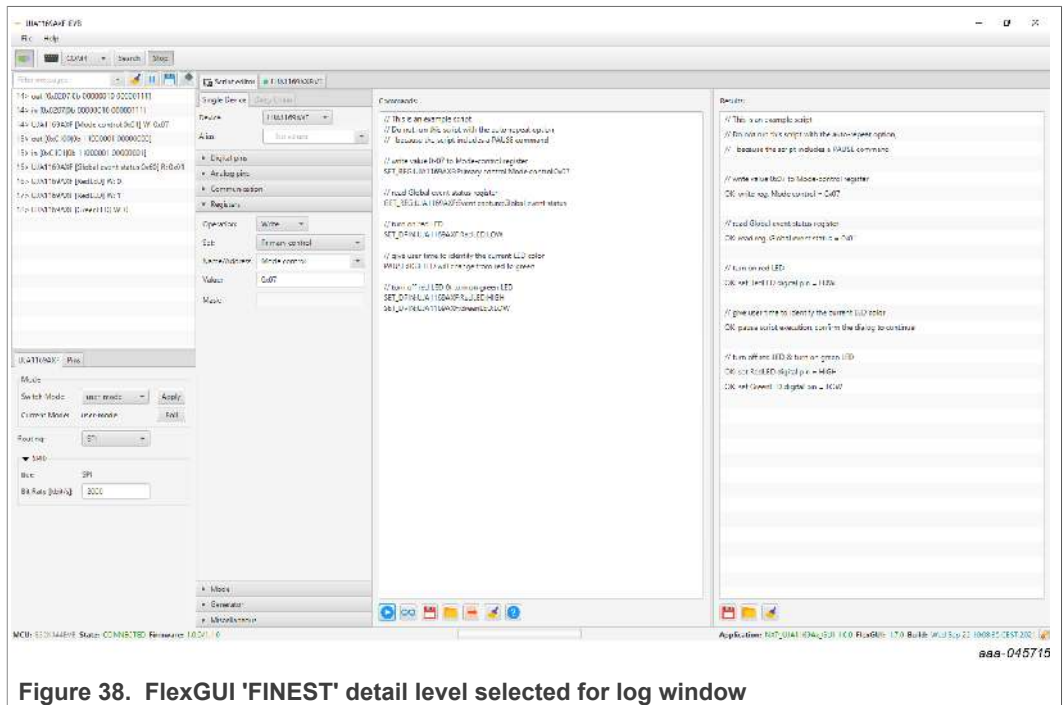


Figure 38. FlexGUI 'FINEST' detail level selected for log window

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

#### 6.4.8 Restrictions on using SBC in Sleep mode

After executing a Sleep mode command successfully, the SBC turns off the 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.

## 7 References

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- [1] **UJA1169A** data sheet — Mini high-speed CAN system basis chip:  
<https://www.nxp.com/docs/en/data-sheet/UJA1169A.pdf>
- [2] **AH1902** application hints — Mini high speed CAN system basis chips UJA116xA, available from NXP Semiconductors

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