

STEVAL-SILKT01 safe-ready industrial PLC evaluation kit

Introduction

The **STEVAL-SILKT01** is an evaluation kit designed to implement a PLC solution with hardware architecture oriented to get the safety integrity level SIL3.

The kit is composed by the main **STEVAL-SILKTA01** board based on the **STM32H743ZG** and two **STEVAL-SILKTB01** daughterboards based on the **STM32G431RB**.

The dual microcontroller architecture is one of the main features in promoting the system for the SIL3 level (refer to IEC 61508). In addition to this, there are other aspects on the hardware architecture, in relation to digital input/output management, diagnostic functions, power management block, isolation, and redundancy on input and output.

The embedded isolation barrier based on the **STISO621** is available on the **STEVAL-SILKTA01** and on the **STEVAL-SILKTB01** to ensure galvanic isolation with a voltage robustness up to 6 kV, and it is necessary to protect the user interface (MCU level) from the hazard sections of the board such as the digital input/output section. As such, an isolated communication layer has been developed between the **STM32G431RB** and the **STM32H743ZG** microcontrollers.

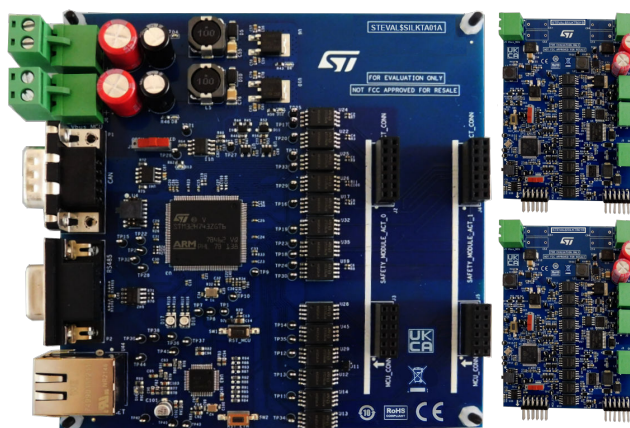
The signals involved in this galvanic isolation are:

- Serial communication between **STM32H743ZG** and **STM32G431RB**
- Digital inputs pulsed waveform generated by the single channel input **CLT03-1SC3**
- Digital outputs driving signals coming from **STEVAL-SILKTA01** and **STEVAL-SILKTB01**
- Diagnostic warnings for overload and overtemperature using the embedded diagnostic function in the intelligent power switches (IPS) output devices, and feedback circuits on the output path

The complete kit can be connected with the host unit thanks to the availability of the three communication channels, using different technologies, serial differential, and Ethernet real-time available on the **STEVAL-SILKTA01**, and enable the system to support Ethernet/IP, Modbus, and CANopen protocol stack.

The hardware is supported by the firmware package **STSW-SILKT01** compliant with the STM32Cube framework.

Figure 1. STEVAL-SILKT01



Note: Represented boards are not to scale.

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1 Overview

The [STEVAL-SILKT01](#) evaluation kit is composed by a main board STEVAL-SILKTA01 and two STEVAL-SILKTB01 actuation boards.

This evaluation kit makes it easier to develop industrial PLC systems having the target of obtaining the safety integrity level SIL3.

The hardware architecture offers a diagnostic coverage $DC > 90\%$, a digital I/O stage on the STEVAL-SILKTB01, able to detect input signals from the industrial sensors providing signals in the range 0-24 V or emergency button or from analog sensors providing 4-20 mA sensors, and actuate a system managing the safe torque off safety function.

The STEVAL-SILKTA01 is designed to be powered with a supply voltage in the range from 24 to 36 V_{DC} with max. overvoltage robustness of 60 V_{DC}.

A dedicated DC-DC switching converter in buck configuration generates the low voltage references needed for: data communication with the STEVAL-SILKTB01 and STEVAL-SILKTA01 actuation board; digital I/O signals; transceiver RS485 and CAN, external memory for Ethernet/IP protocol stack.

The power management architecture has been defined considering the voltage reference needed in the application and the block functions.

In the STEVAL-SILKTA01 it is possible to identify two main blocks, the first one represented by the communication that is not safety related, the second one represented by data processing and isolation.

With reference to the STEVAL-SILKTB01, all the hardware blocks such as data processing, isolation, and digital input/output are safety related.

Data processing units are built around an STM32 microcontroller: [STM32H743ZG](#) for the STEVAL-SILKTA01, managing communication and parts of the functional safety features, and [STM32G431RB](#), managing functional safety features and an SPI communication.

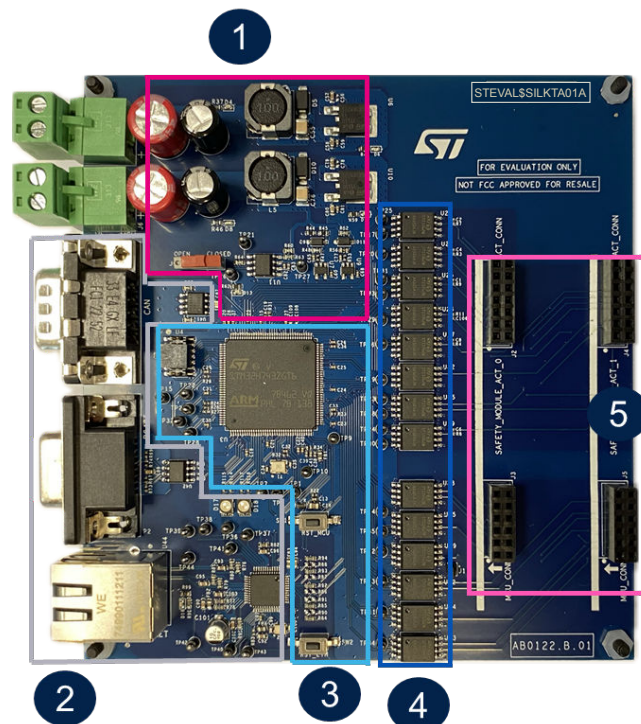
The communication channels available are RS485 to support Modbus protocol, CAN to support CANopen protocol, and Ethernet real-time to support Ethernet/IP protocol, all of these are available on the STEVAL-SILKTA01 board.

2 Application boards

2.1 STEVAL-SILKTA01

1. Power management
2. Connectivity
3. Data processing
4. Isolators
5. Expansion connector for STEVAL-SILKTB01 board

Figure 2. STEVAL-SILKTA01



2.1.1 Power management

This block includes two power management circuits, one for the connectivity section and one for the safety related blocks.

The entire system solution STEVAL-SILKTA01 and STEVAL-SILKTB01 have operating supply voltage, working in the range from 24 to 36 V, with operating current depending on the functions for each block.

2.1.1.1 Power management for safety related blocks

The power management unit is characterized by a switching converter based on the [L7987L](#) in buck configuration to generate the 3.5V_MCU reference from the supply.

A post regulation is available using the low drop voltage regulator [LD39150DT](#) 3.3 V_MCU for microcontroller supply and isolators.

In accordance with IEC61508, the microcontroller supply has to be monitored to protect the system against data loss in case of undervoltage on this line; to do this, the voltage supervisor device [STM802RM6F](#) is used.

The [STM802RM6F](#) monitors the microcontroller supply not with a direct check of the 3.3V_MCU but monitoring the 3.5 V_MCU.

The 3.5 V_MCU voltage is partitioned with a voltage divider to have a slower dynamic with respect to the actual voltage variation.

When the partitioned voltage level achieves 1.23 V, the device toggles the VFAIL pin connected to the microcontroller, from high to low, generating an interrupt where the related routine manages the system data storage in flash.

The **STM802RM6F** offers another feature, the watchdog function, which is used to take out the microcontroller by a stuck condition with a hardware reset.

To let the supervisor operate in this direction, the microcontroller has to generate a PWM signal with a period lower than 1.6 s, to reset the internal counter of the supervisor.

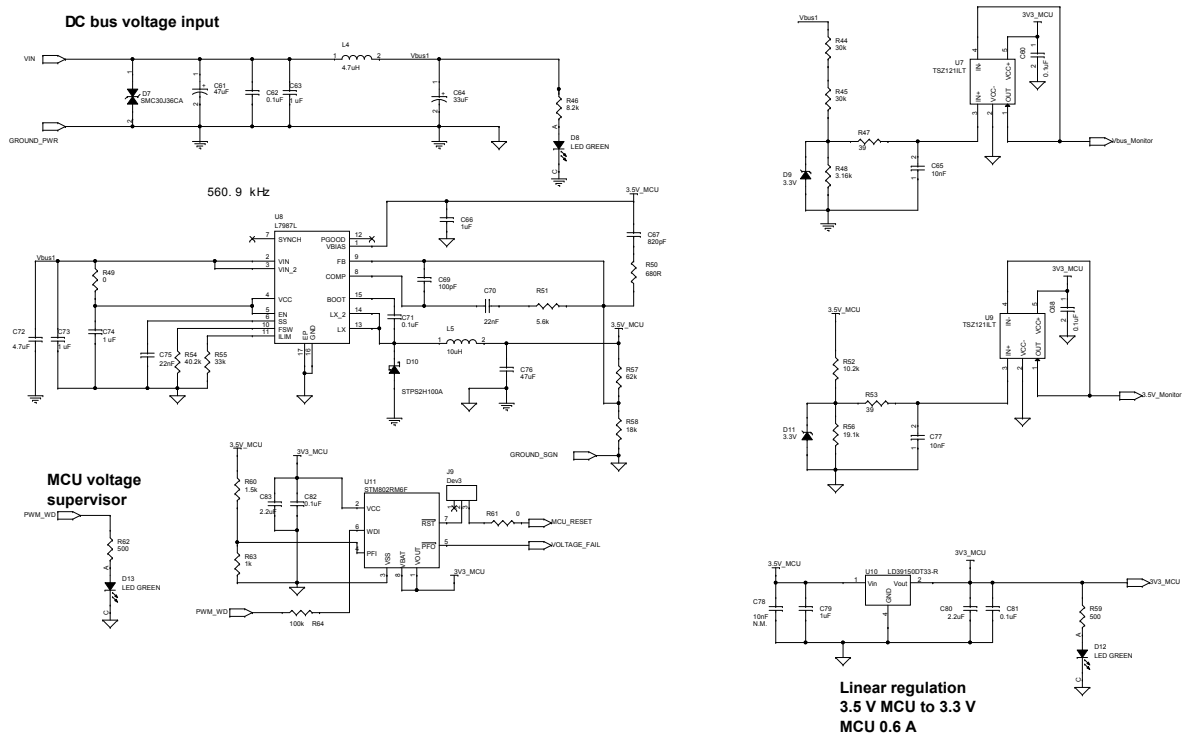
If the PWM is not provided by the microcontroller, or its period is out of the expected range, the counter is no longer reset and a reset event is generated by the supervisor on the microcontroller reset pin toggling the supervisor reset pin.

The voltage supervisor circuit is not the only diagnostic feature necessary for the power management.

The IEC61508 also requires other diagnostic features to detect undervoltage and overvoltage events; for this reason on the main voltage line Vbus1 and on the 3.5 V_MCU, two sensing circuits using op amp **TSZ1211YLT** have been implemented, one for the bus and one for the 3.5 V_MCU.

The output of each op amp is monitored using the dedicated ADC channels; if the measured voltage is going over the guard limits (firmware setup) for the fault identification, the system is driven to the safe state condition.

Figure 3. Power management safety related circuits



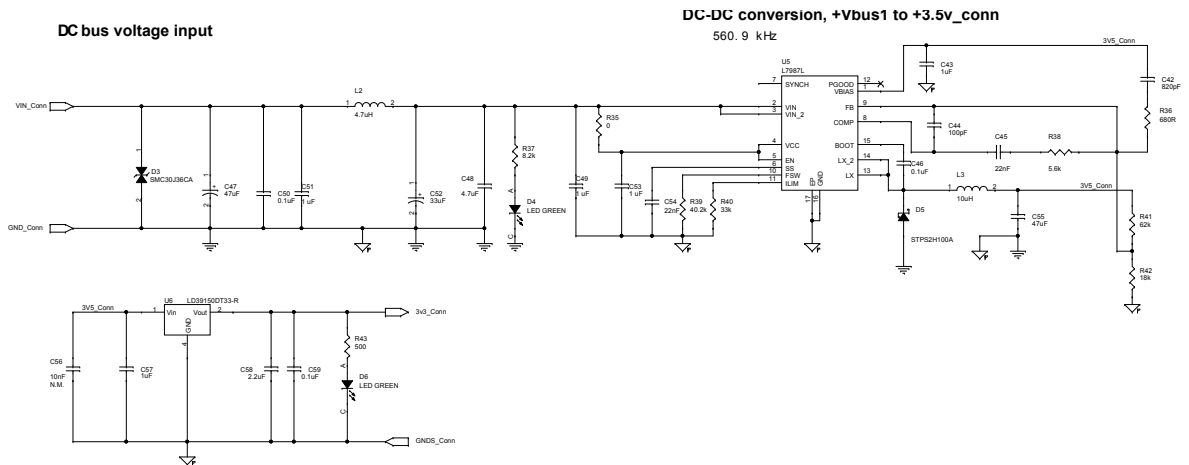
2.1.1.2 Power management for connectivity blocks

The circuitry of this block has been designed to generate, from the operating voltage 24–36 V, the low voltage reference 3V5_Conn and 3V3_Conn.

The power management unit is characterized by a switching converter based on the **L7987L**, in buck configuration to generate from the supply, the 3V5_Conn reference, and by a post regulation using the low drop voltage regulator **LD39150DT** the 3V3_Conn, to supply the transceivers used for Ethernet communication, Modbus, and CANopen.

Despite the power management being designed for the safety related blocks, no diagnostic circuit is implemented.

Figure 4. Power management connectivity



2.1.2

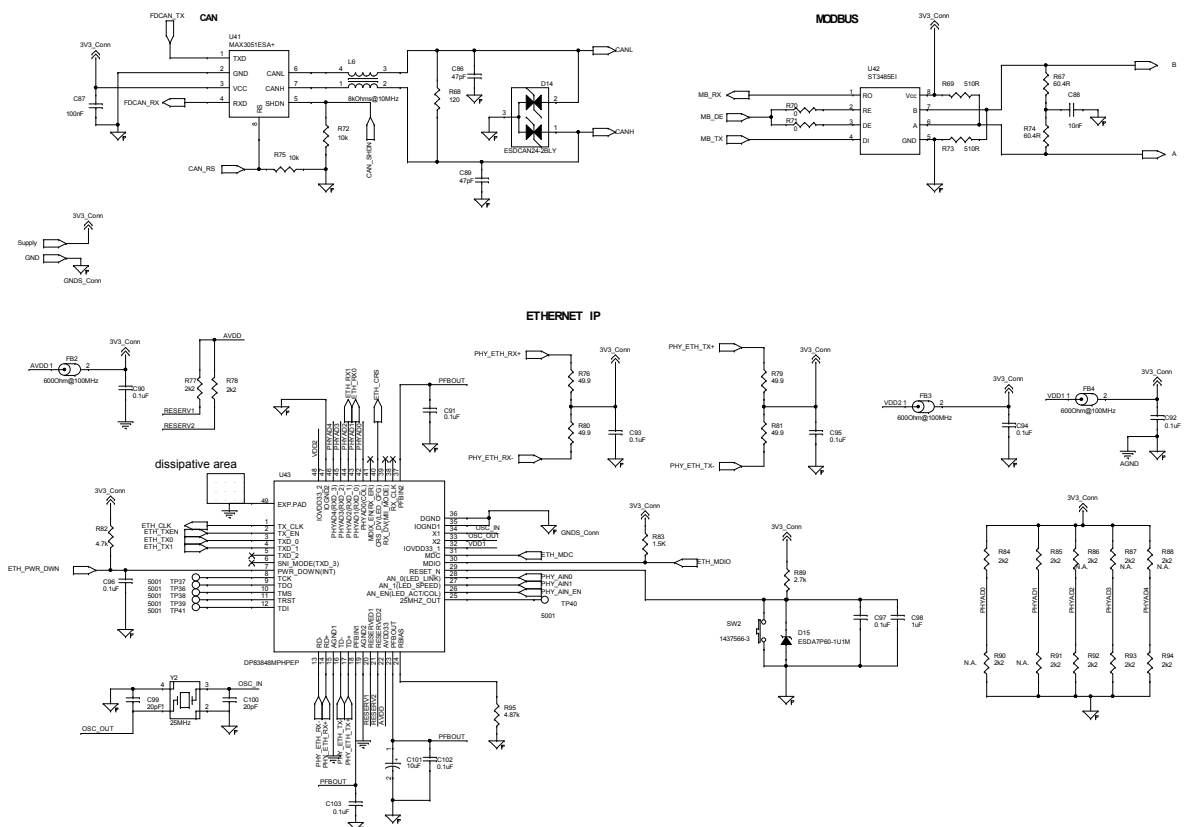
Connectivity

The connectivity block includes three communication channels: Ethernet real-time supporting Ethernet/IP, serial differential communication RS485 to support Modbus-RTU, and CAN to support CAN open protocol.

All the communication interfaces are supplied using the same power management unit, based on switching converter L7987L with, in series, a low drop linear regulator to generate the 3V3_Conn.

The hardware architecture is based on several transceivers supporting the different connectivity options like the differential serial transceiver ST3485EI for the RS485 communication, CAN transceiver, and Ethernet transceiver. For physical connection an RJ45 connector with integrated common chock transformer to reduce the common-mode noise, and two DB9 connectors female and male, to connect respectively Modbus-RTU and CANopen cables, are available.

Figure 5. Connectivity



2.1.3 Data processing

The data processing unit is powered by the 32-bit microcontroller [STM32H743ZG](#) Arm Cortex®-M7. It is in charge of data communication with the host unit, using Ethernet real-time communication or the RS485 interface, CAN, and functional safety features such as safety function execution to de-energize the load, and diagnostic functions for voltage monitoring, output driving feedback, and temperature monitoring.

The voltage monitoring is implemented on the main 24 V and the regulated 3v5_MCU and 3v3_MCU, using dedicated sensing circuits to generate, in the range 0–3.3 V, scaled voltage values that are read using three ADC channels, with injected conversion; the read value is compared at firmware level and if it is out of the range defined at firmware level, the execution of the safety function is activated.

In parallel to the voltage monitoring, the microcontroller also verifies the correct generation of pulsed signals provided by the single channel [CLT03-1SC3](#); the signals check is done measuring the related period by use of timers in input capture mode, if voltage monitoring and pulsed period are as expected, the [STM32H743ZG](#) drives the signals used for [IPS1025H](#) and [IPS4260L](#) activation and for N-channel MOSFET activation.

The [STM32H743ZG](#) on the STEVAL-SILKTA01, after the system is activated and working, monitors the feedback signals received from the actuation board through the isolators.

If for any reason there is a mismatch between the driving signals and the feedback, the [STM32H743ZG](#) activates the safety function de-energizing the load connected to the actuation side.

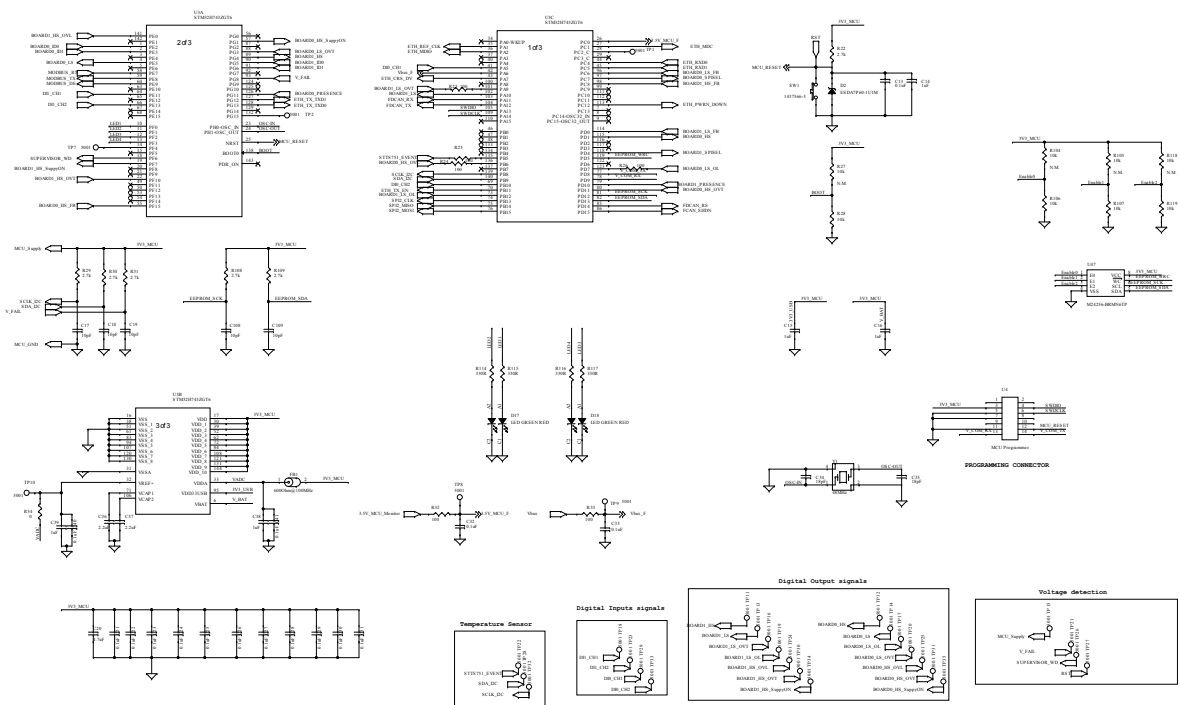
The digital temperature sensor [STTS751](#) monitors the temperature of the data: it is programmed with an allowed operating temperature range, if for any reason the microcontroller temperature goes out of this range, the EVENT pin is driven from high to low triggering an interrupt event in the microcontroller and then the activation of the safety function.

The diagnostic fault signalization is available in the [IPS1025H](#) (high_side switch) and [IPS4260L](#) (low_side switch) for overload and overtemperature. If a fault event is detected on output, the safety function is activated.

As required by the IEC61508, the connections between the microcontroller and the devices have been designed to the following design rules:

1. Avoiding the use of the same GPIOs port for the same device
2. Avoiding the use of the same ADC peripherals to monitor different voltage reference ADC
3. Avoiding the use of the same timer to measure the period of different pulsed signals received by digital input devices

Figure 6. Data processing



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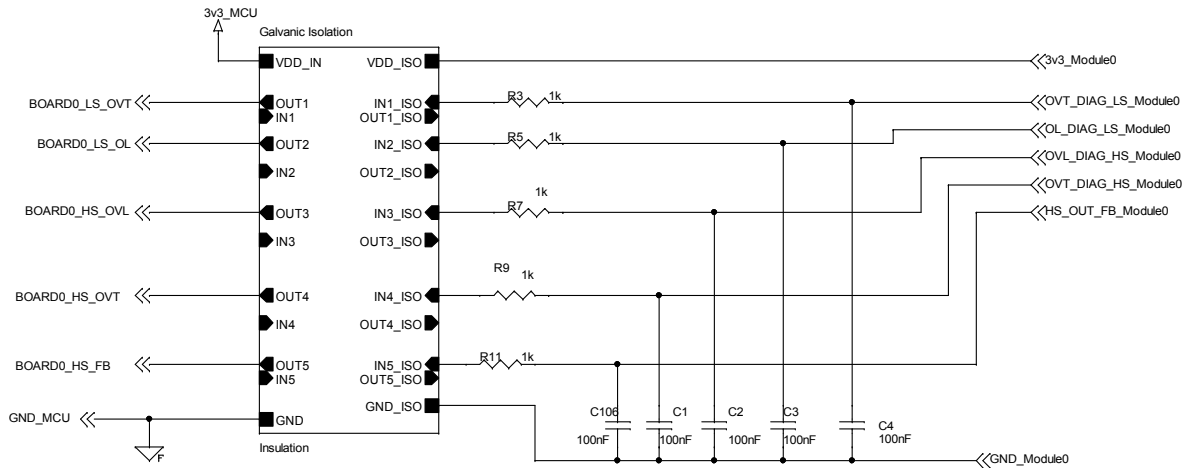
2.1.4 Isolators

The protection on board between the user side and the hazard zone is guaranteed with the use of the galvanic isolation barrier, using the dual channel isolator **STISO621** able to guarantee an isolation voltage level of 6 kV. These devices are used to isolate data transmission between the STEVAL-SILKTA01 and STEVAL-SILKTB01, to manage the pulsed signals provided by **CLT03-1SC3** available on the STEVAL-SILKTB01, **IPS1025H**, and **IPS4260L** driving signals and diagnostic, and the feedback circuits.

As required by the **IEC61508** standard and substandard, isolator connection is done avoiding the use of one isolator for the same device; for example, considering the driving signals for the **IPS1025H** and the related diagnostic signal, the connection with the microcontroller, has been managed using two isolators, one for driving and one for diagnostic.

The supply voltage for the barriers of 3.3 V on both sides, based on the signals, has to be managed on the actuation side. The supply is 3v3_Modulex, whereas on the MCU side it is 3v3_MCU.

Figure 7. Isolation



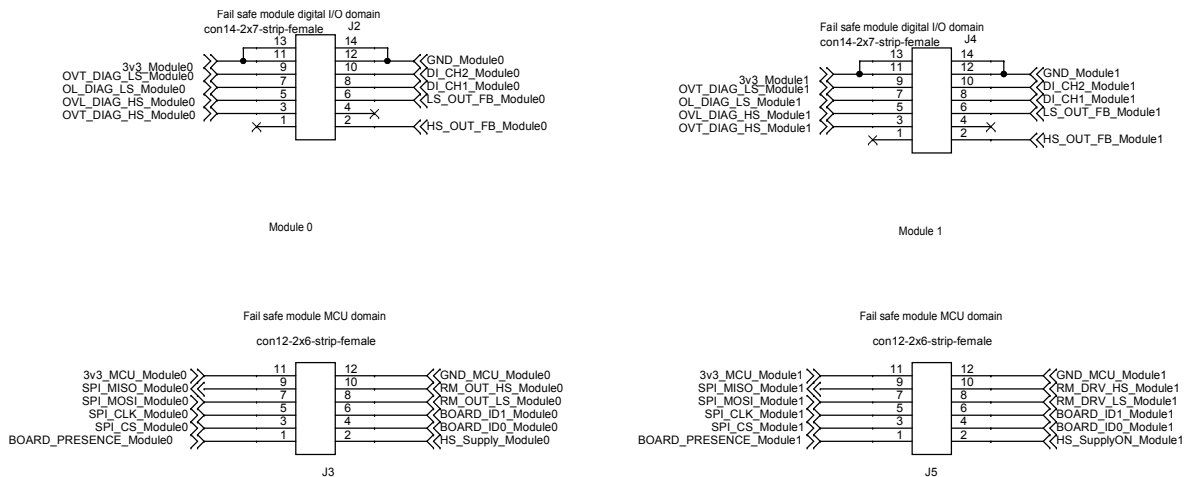
2.1.5 Expansion connectors

The connection with the two STEVAL-SILKTB01 and the STEVAL-SILKTA01 is possible using the two expansion connectors.

The first connector is used to isolate the signals provided by digital I/O and digital output feedback.

The second connector is used to interface the two MCUs and to manage the driving signals used as remote control for the IPS.

Figure 8. Expansion connectors

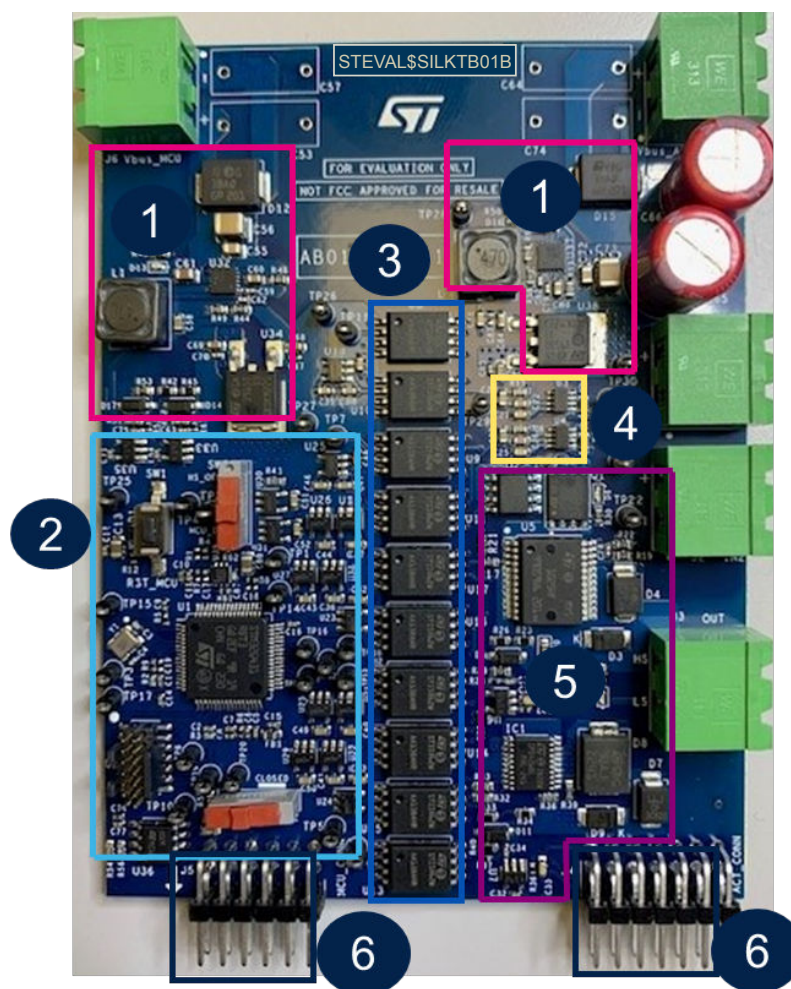


2.2 STEVAL-SILKTB01

Figure 9 explains where the different sections are located in the STEVAL-SILKTB01 actuation board:

1. Power management
2. Data processing
3. Isolators
4. Digital inputs
5. Digital outputs
6. Expansion connectors

Figure 9. STEVAL-SILKTB01



2.3 Power management

The STEVAL-SILKTB01 is equipped with two power management units. The power management units are mainly based on the switching converter in buck configuration, to generate a 3v5_MCU and with post regulation, the 3v3_MCU used for MCU and isolator supply voltage.

The devices used for this circuitry are the [L7983PUR](#) adjustable version for the 3v5_MCU regulation and the low drop voltage regulator [LD39150DT33-R](#).

The hardware architecture is equipped for the microcontroller power management circuit with voltage diagnostic circuits. It monitors the voltage level to detect overvoltage and undervoltage events. The voltage value is monitored using a dedicated ADC channel.

If the value is out of the range defined at firmware level, a fault event is detected and the execution of the safety function is put in place de-energizing the load.

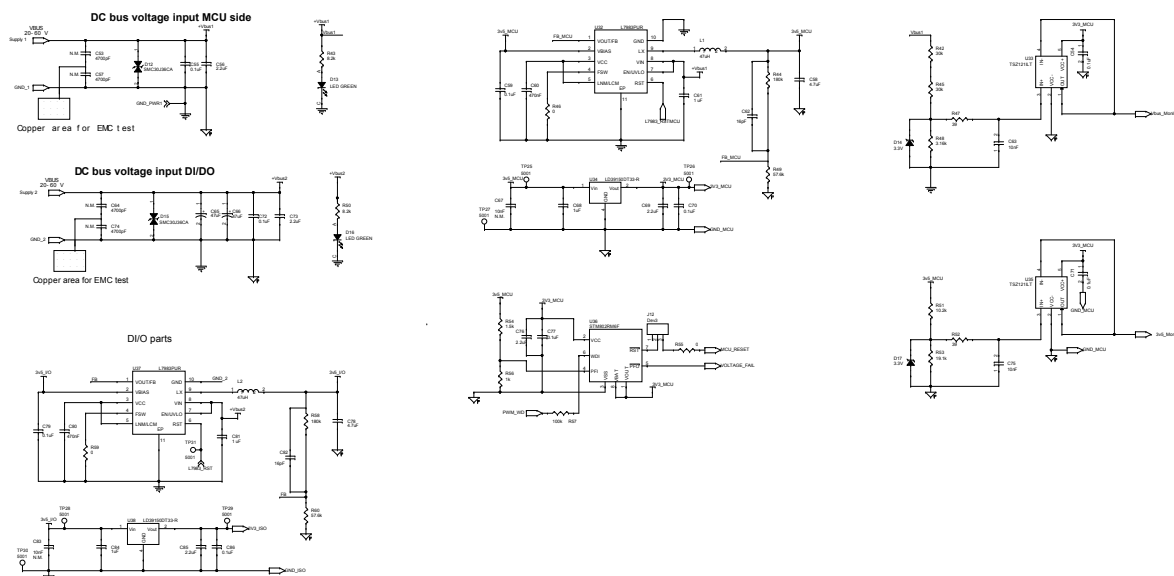
Diagnostic on the voltage path also highlights the use of the voltage supervisor [STM802RM6F](#), used to monitor the 3v5_MCU to detect undervoltage phenomena on it and prevent data loss due to 3v3_MCU voltage loss.

When the voltage value on the PFI pin is higher than 1.23 V, the supervisor provides a high level on the VFAIL pin. If due to a failure event the voltage on the PFI is lower than 1.23 V, the device provides a low level on the VFAIL pin.

The transition on this signal is detected on the microcontroller side and an interrupt is generated driving the execution of safety functions.

The power management of the digital input/output section has no diagnostic circuit, as in this case an undervoltage/overvoltage event has no impact on the execution of the safety function.

Figure 10. STEVAL-SILKTB01 power management

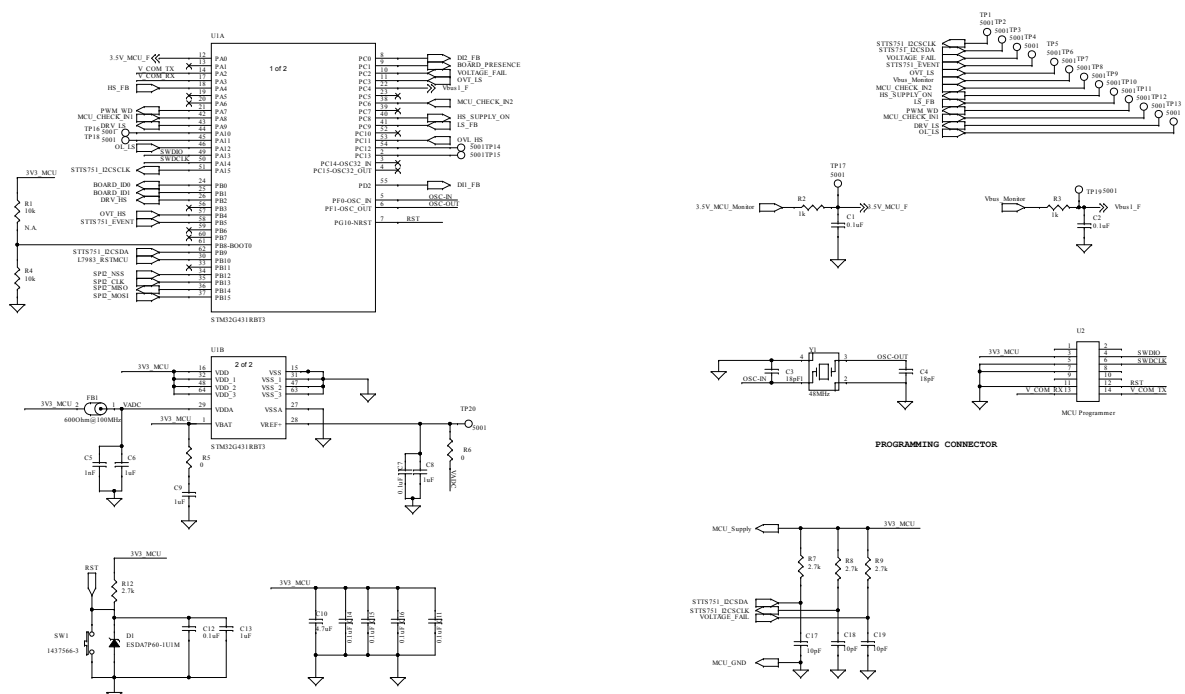


2.3.1 Data processing

The data processing section is based on the **STM32G431RB** Arm Cortex®-M4 microcontroller, and is programmed to satisfy the requirements of the functional safety aspect according to the IEC61508 standard, implementing the following diagnostic functionalities:

1. **Overvoltage/undervoltage detection event:**
 The voltage monitoring is implemented using the dedicated channels of the ADC. The measured value is compared at firmware level with a fixed threshold (min, max) defined in the firmware. If the measured value is out of the range, a fault condition is detected, and the execution of the safety function is performed de-energizing the output.
2. **Status data loss avoidance when the supply voltage of the microcontroller drops to the operating minimum voltage, thanks to the voltage supervisor usage:**
 Continuous monitoring of the 3v5_MCU voltage is performed by the voltage supervisor device; if the value drops to a 1.23 V threshold, a fault event is signaled to the microcontroller.
3. **Correct IPS driving monitoring by continuous check and comparison between the digital output driving signals and the feedback of digital output load track:**
 Continuous monitoring of the output line using feedback signals, and comparison of these signals with the IPS input; if a mismatch is detected, the safety function is activated de-energizing the load by the N-channel MOSFET turn-off.
4. **Digital input detection using input capture timer feature:**
 The microcontroller also monitors the pulsed signals provided by CLT03-1SC3, using the input capture features of the timers to verify if the signal period is in the expected range. If this condition is not satisfied or the signal is not triggered by the timer, the microcontroller triggers a fault event and the execution of the safety function is activated.
 Vice versa if the period is as expected, the microcontroller drives the IPS input signals. These signals in AND logic with the rectified digital input waveform and the remoted driving signals provided by the microcontroller on the main board, enable the output load driving path.

Figure 11. STEVAL-SILKTB01 data processing



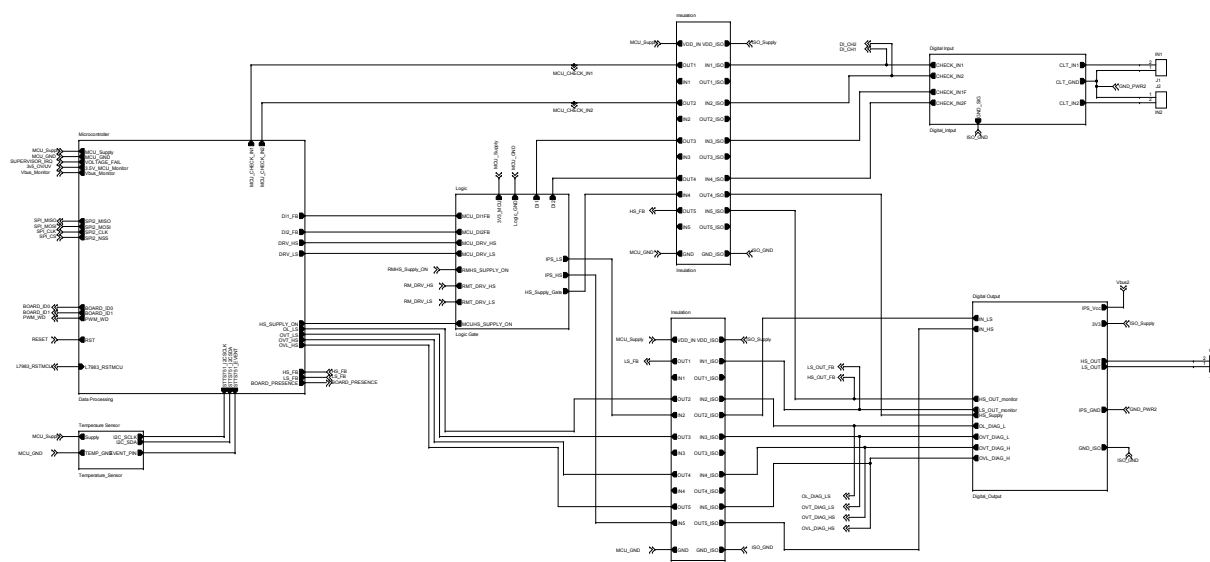
2.3.2 Isolators

The protection on board between the user side and the hazard zone is guaranteed with the use of the galvanic isolation barrier, using the dual channel isolators STISO621 able to guarantee 6 kV isolation voltage level. These ICs are used to isolate the load actuation section by the data processing, involving digital input pulsed signal, digital outputs driving, diagnostic, and output feedback.

As required by the IEC61508 standard and substandard, isolator connection is done avoiding the use of one isolator for the same device; for example, considering the driving signals for the IPS1025H and the related diagnostic signal, the connection with the microcontroller has been managed using two isolators, one for driving and one for diagnostic.

The supply voltage for the barriers is 3v3_MCU on the microcontroller side and 3v3_ISO on the digital output side.

Figure 12. STEVAL-SILKTB01 isolators



2.3.3 Digital input

The digital input stage is powered by the single channel device [CLT03-1SC3](#). This section expects the detection of two digital signals provided by the sensors, or by an emergency button in the range 0-24 V.

The digital input ICs are properly equipped with the capacitor on the TP pin (as in the use cases of this solution), to transduce the steady voltage level in the input, in a pulsed waveform with a period value dependent on the capacitor value populated on board.

The pulsed waveforms are transferred through the isolation barrier to the [STM32G431RB](#) and detected using timers input capture features to validate the correct signal period (for more details refer to the [CLT03-1SC3](#) datasheet DS12302). The same pulsed signals are transferred to the [STM32H743ZG](#) for a double verification as required by the safety standard IEC61508 to achieve the SIL3 level.

The verification of the period is managed in a different way by the H7 and G4 microcontroller. The [STM32H743ZG](#) in the STEVAL-SILKTA01 enables the safety function if the period of at least one of the pulsed signals is not as expected.

In the STEVAL-SILKTB01, the pulsed signals are detected by the timer in input capture mode, rectified with a dedicated RC network and sent in input to two logic gates. The logic gate compares the rectified signals and the feedback signals generated by the [STM32G431RB](#) providing a high or low level according to the inputs.

These feedback signals provided by the MCU are high if the period of the pulsed wave detected by the timer is in line with expectation, or it is low in the other case. The output of each logic AND is in AND with the driving signal of each IPS switch provided by the [STM32G431RB](#). The output of this first stage is then put in AND with the other driving signals received by the STEVAL-SILKTA01.

This architecture allows to manage the execution of the safety function at the hardware level.

2.3.4 Digital output

The digital output stage has been designed to drive any kind of load with a max. operating current of 2 A. The hardware architecture is designed considering not only the load driving but also the functional safety requirements, with a focus on:

1. Redundancy, that is why the load is driven using high-side **IPS1025H** and low-side **IPS4260L** switches
2. Interruption of the supply voltage path for IPS devices, to remove the supply of each **IPS1025H** and **IPS4260L** and then to the load. For this purpose P-channel MOSFET **STL42P6LLF6** and N-channel MOSFET **STS8N6LF6AG** have been used. The driving signals of the N-channel MOSFET are managed through AND logic gates, controlling the signals provided by the **STM32H743ZG** and **STM32G431RB**, according to the driving of this MOSFET the supply voltage connected to the P-channel MOSFET is passed to both IPS
3. Diagnostic functions, using the embedded signalization for overload and overtemperature; feedback signal on output

The achievement of the SIL3 safety level is linked to the possibility of managing the safety of the system through two microcontrollers, for this reason, the signals provided by the two STM32, used to drive the high-side and low-side switches, are managed using dedicated logic circuit based on AND logic gates.

Through the logic gates are also processed the rectified pulsed signals provided by the **CLT03-1SC3**, and the feedback signals provided by the MCU, one for each pulsed signal received by the **CLT03-1SC3**, each of these signals is high if the period of the corresponding pulsed signals is correct and low in the other case.

Figure 15. STEVAL-SILKTB01 digital output and supply voltage interruption circuit

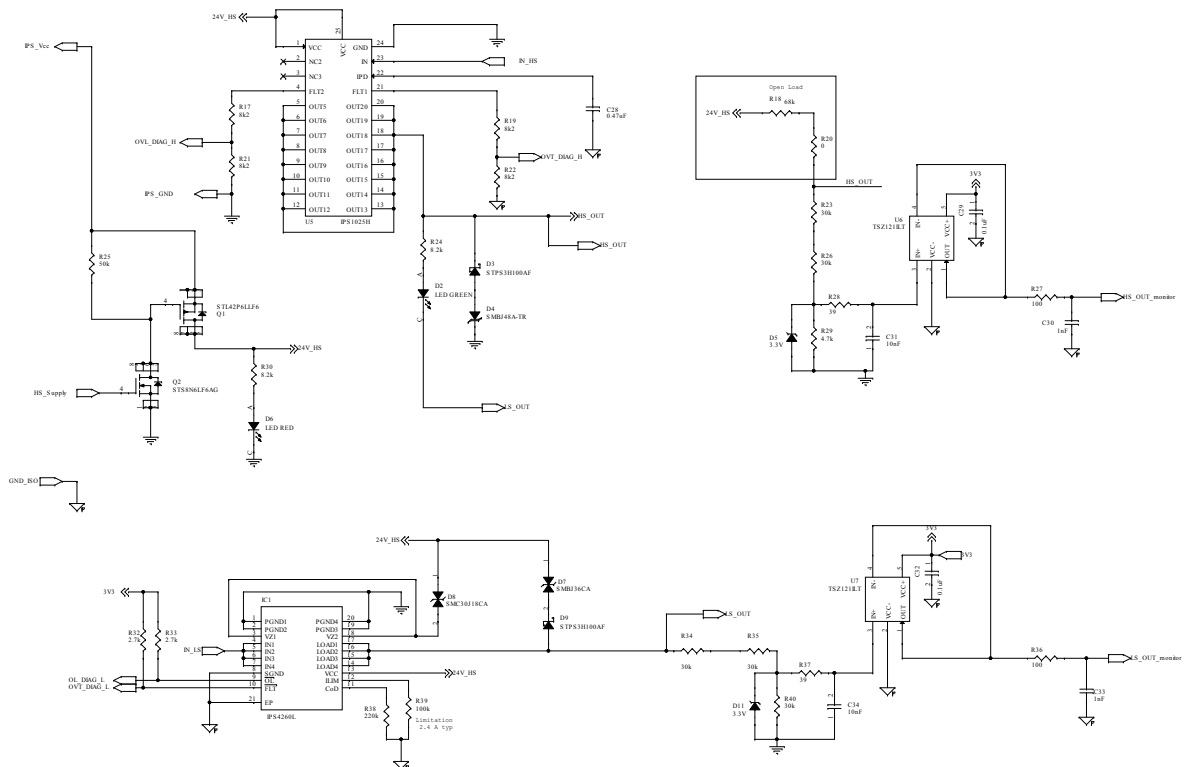
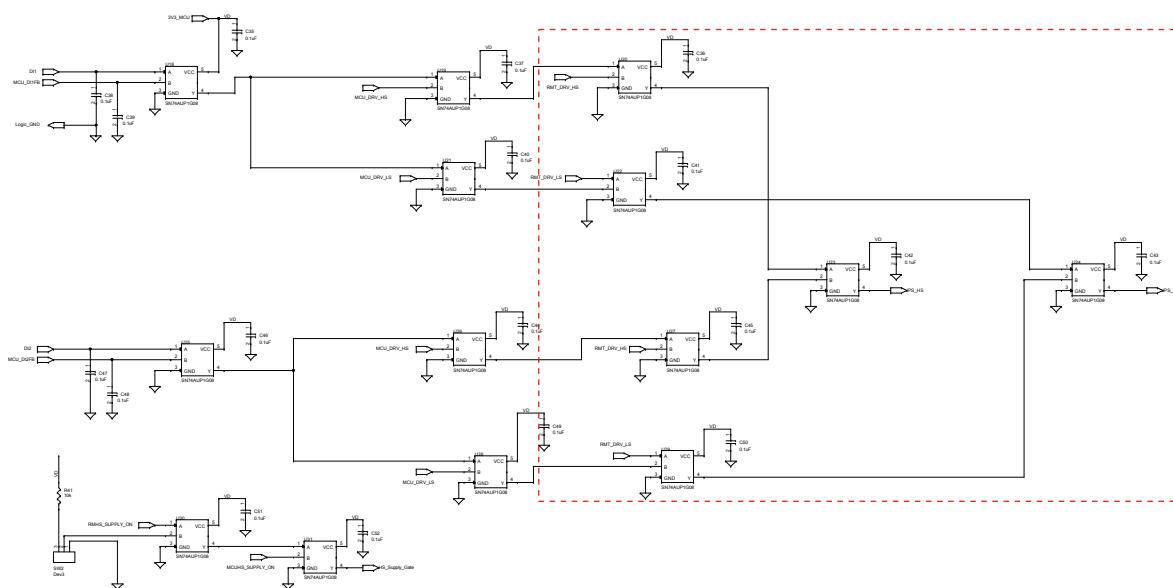


Figure 16. STEVAL-SILKTB01 driving output signals in AND logic



3 How to use the STEVAL-SILKT01

The system is designed to implement a PLC with embedded safety blocks and diagnostic functions, to achieve a safety integrity level SIL3: it works with operating voltage in the range 24–36 Vdc and needs an isolated voltage to maintain the correct isolation between the actuation side and the user side.

The **STEVAL-SILKT01** evaluation system must be assembled connecting the STEVAL-SILKTA01 with the two STEVAL-SILKTB01 using the expansion connector available on the **STEVAL-SILKT01**. Connect the supply voltage using different power supplies. Connect to the digital input of the two STEVAL-SILKTB01 a sensor or a contact N.O. to provide a voltage reference 0-24 V to the digital input connectors of each actuation board.

After this connection, plug on each output connector a load that could be a generic load or a servo drive board, using the output of PLC for the STO signals; to finalize the system, connect the kit with a host unit using Ethernet/IP, Modbus or CAN interface for data exchange.

Once the kit is completely assembled, provide the supply voltage to each board as well as the digital input voltage level, move the red switch on each board into the close position, and if everything works properly, the loads are activated; to verify the execution of the safety function, it is enough to remove one or both digital inputs in one STEVAL-SILKTB01 to perform it.

3.1 Supply voltage connection

The STEVAL-SILKTB01 must be supplied using the two screw connectors J6 and J7, whereas the STEVAL-SILKTA01 must be supplied using the connectors J6 and J1. The voltage rail for both boards is in the range 24-36 V.

3.2 Digital input connections

The digital input section on the STEVAL-SILKTB01 expects two screw connectors J1 and J2, where it is necessary to connect emergency button wires or output sensors. In both cases, the voltage range admitted is in the range 24-36 V for operating condition.

3.3 Digital output connections

The digital output section available on the STEVAL-SILKTB01 has a screw connector with one pole connected to the high-side device. The other pole is connected to the low-side device.

The load has to be connected directly to this connector without any other connection to the ground.

3.4 Run the system

After all the connections are done, to run the system it is necessary to power the system, programming all the boards (if they are not already programmed), reset the system starting with the STEVAL-SILKTB01, and then proceeding with the STEVAL-SILKTA01.

If the system works properly, the loads on both boards are powered, and it is possible to verify the safety function execution, removing the digital input signals according to the architecture selected, sensor or push button.

Figure 17. STEVAL-SILKTA01 circuit schematic (1 of 21)

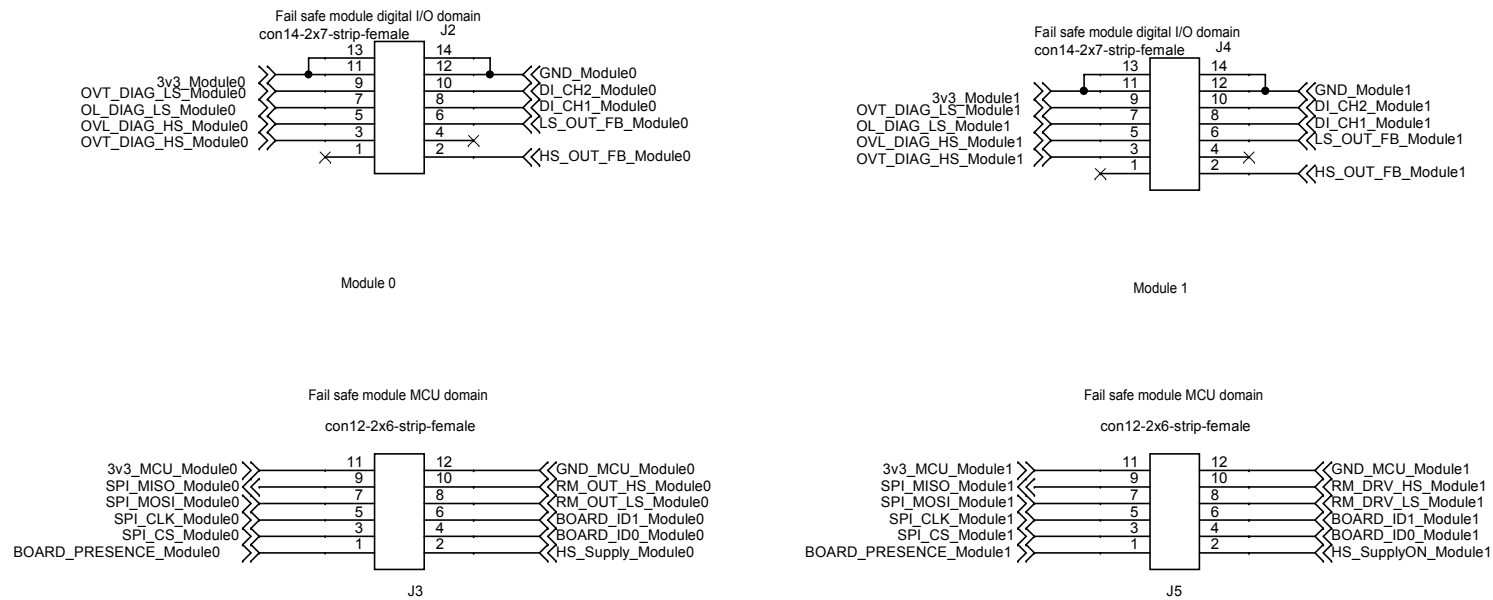


Figure 18. STEVAL-SILKTA01 circuit schematic (2 of 21)

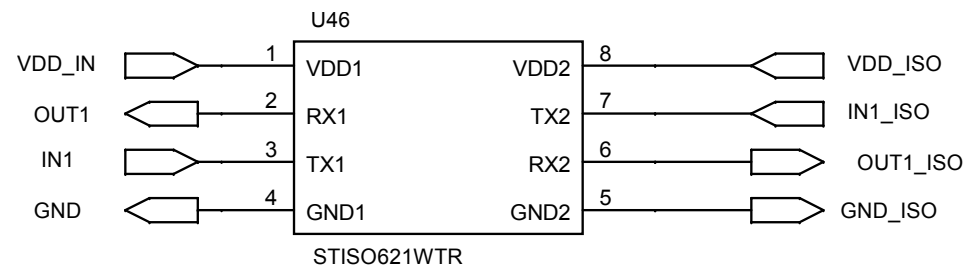


Figure 19. STEVAL-SILKTA01 circuit schematic (3 of 21)

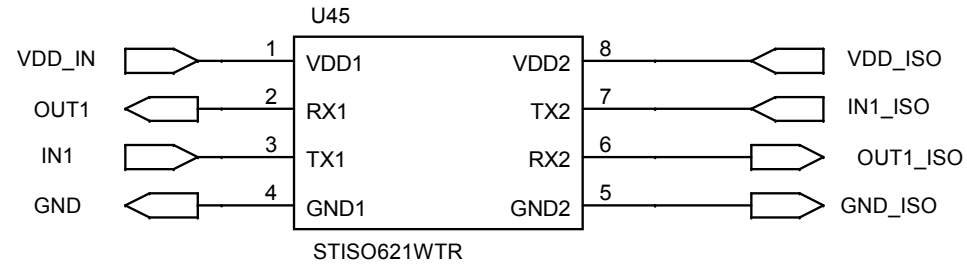


Figure 20. STEVAL-SILKTA01 circuit schematic (4 of 21)

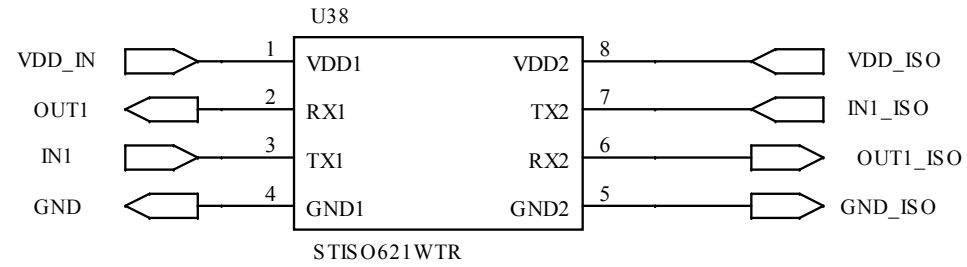
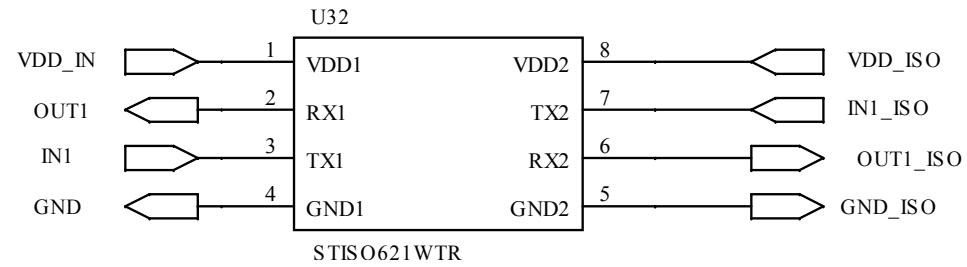


Figure 21. STEVAL-SILKTA01 circuit schematic (5 of 21)



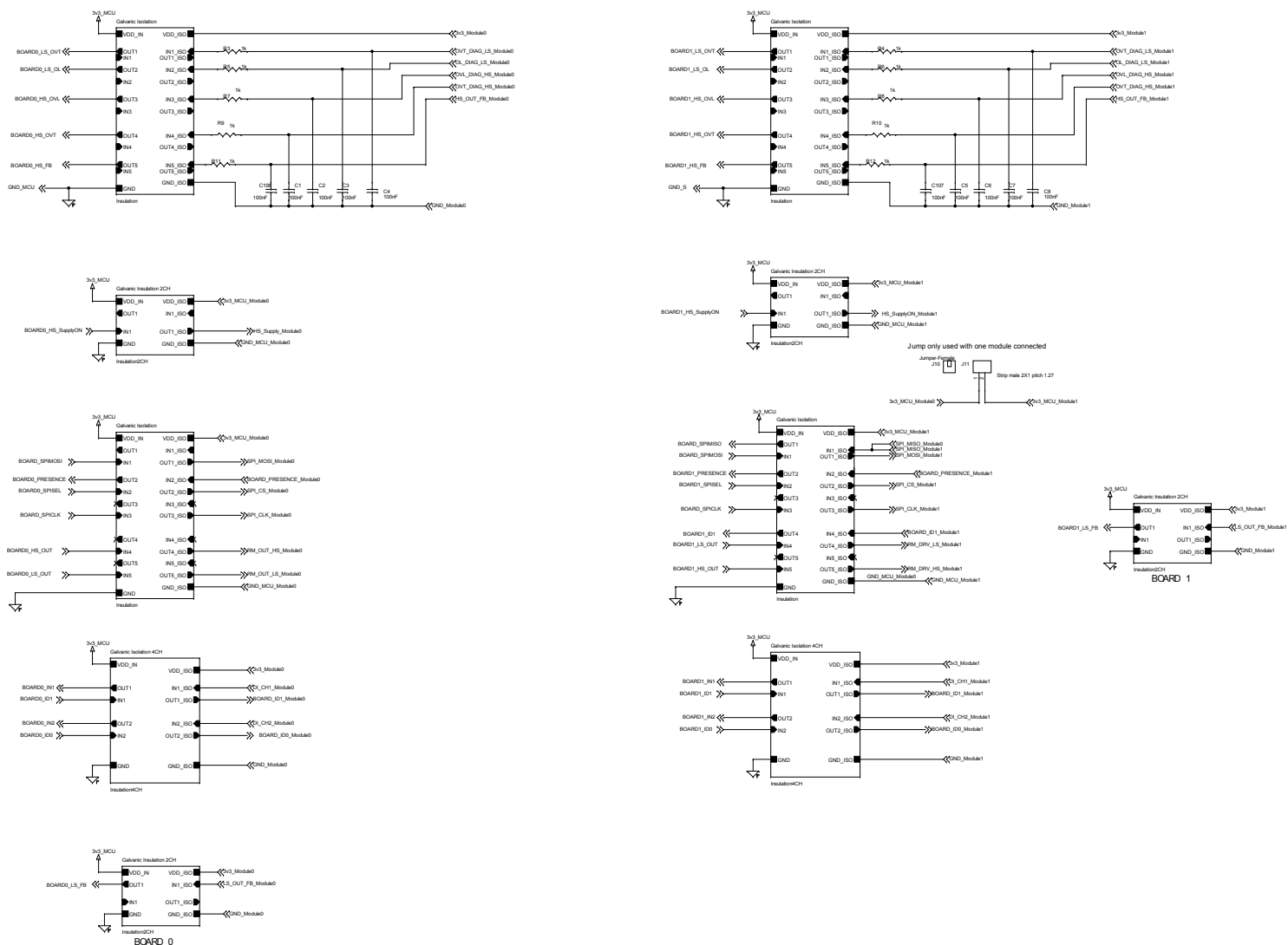
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Schematic diagrams

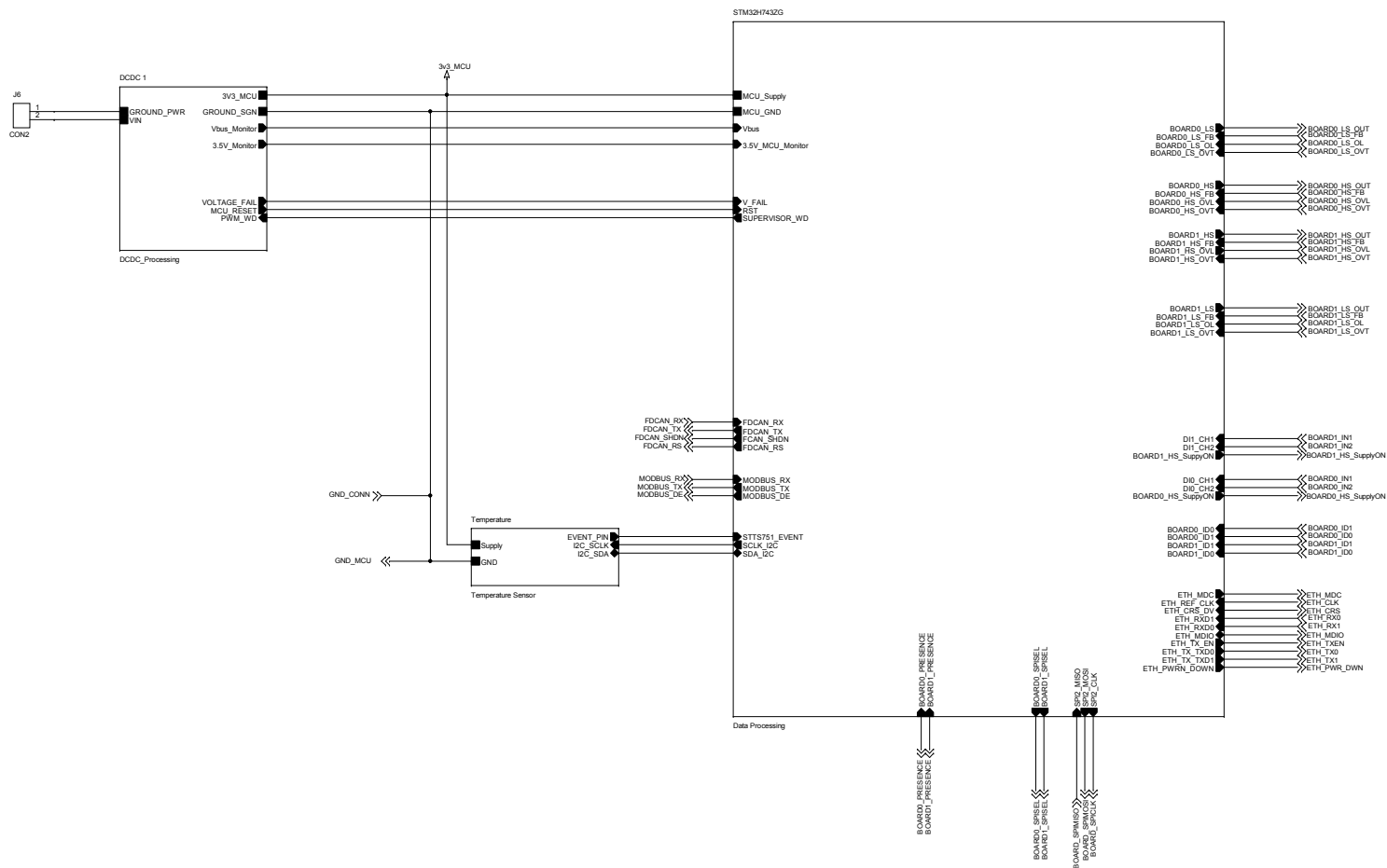


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Schematic diagrams



UM3263
Schematic diagrams



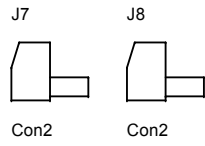


Figure 25. STEVAL-SILKTA01 circuit schematic (9 of 21)

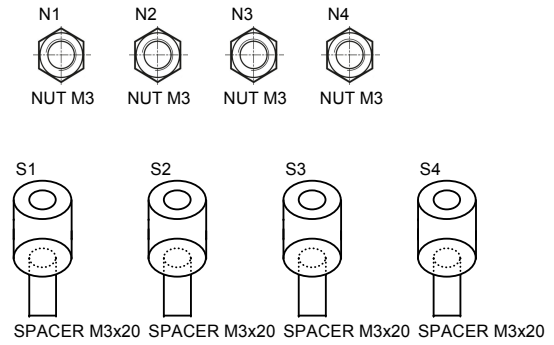


Figure 26. STEVAL-SILKTA01 circuit schematic (10 of 21)

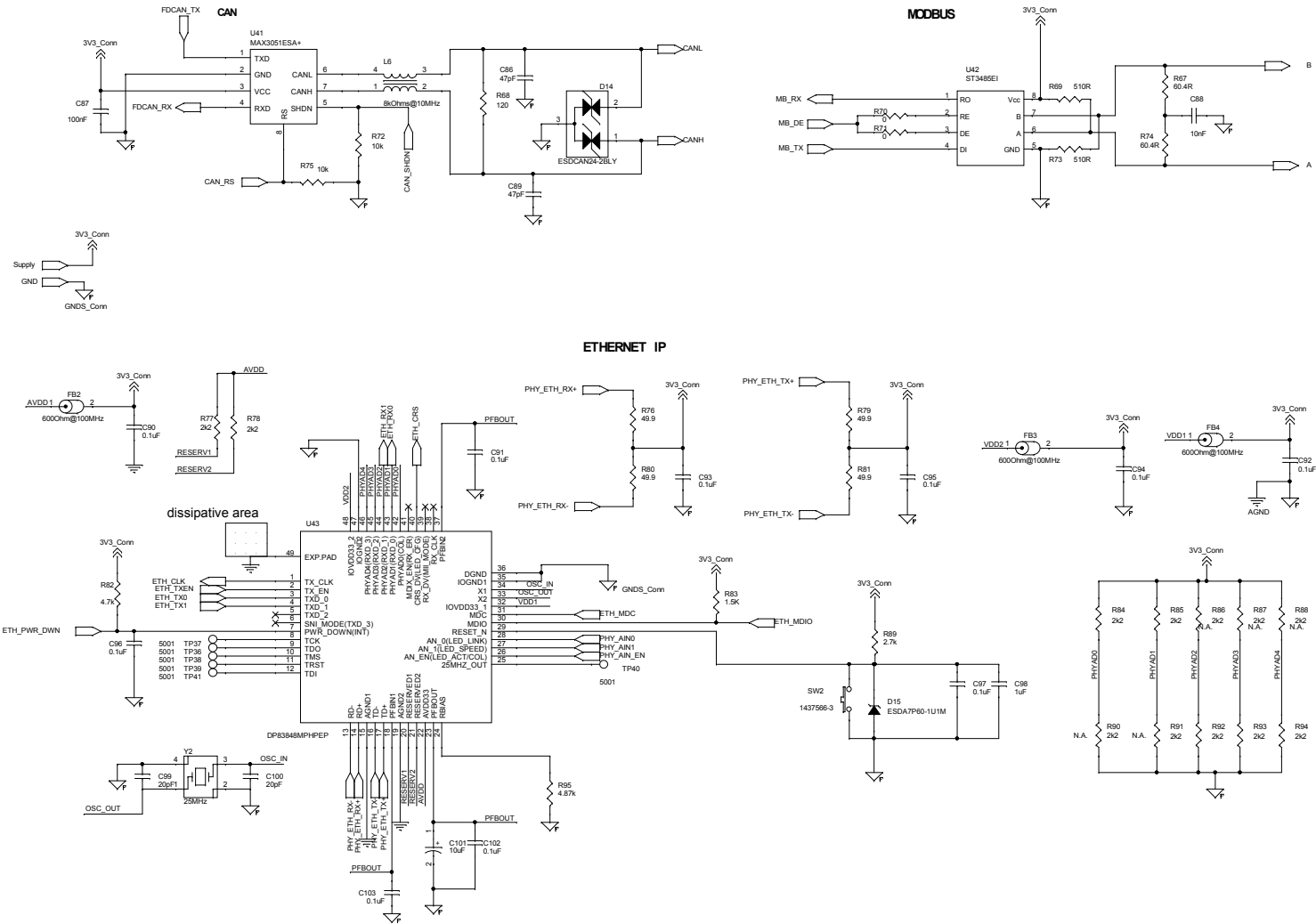


Figure 27. STEVAL-SILKTA01 circuit schematic (11 of 21)

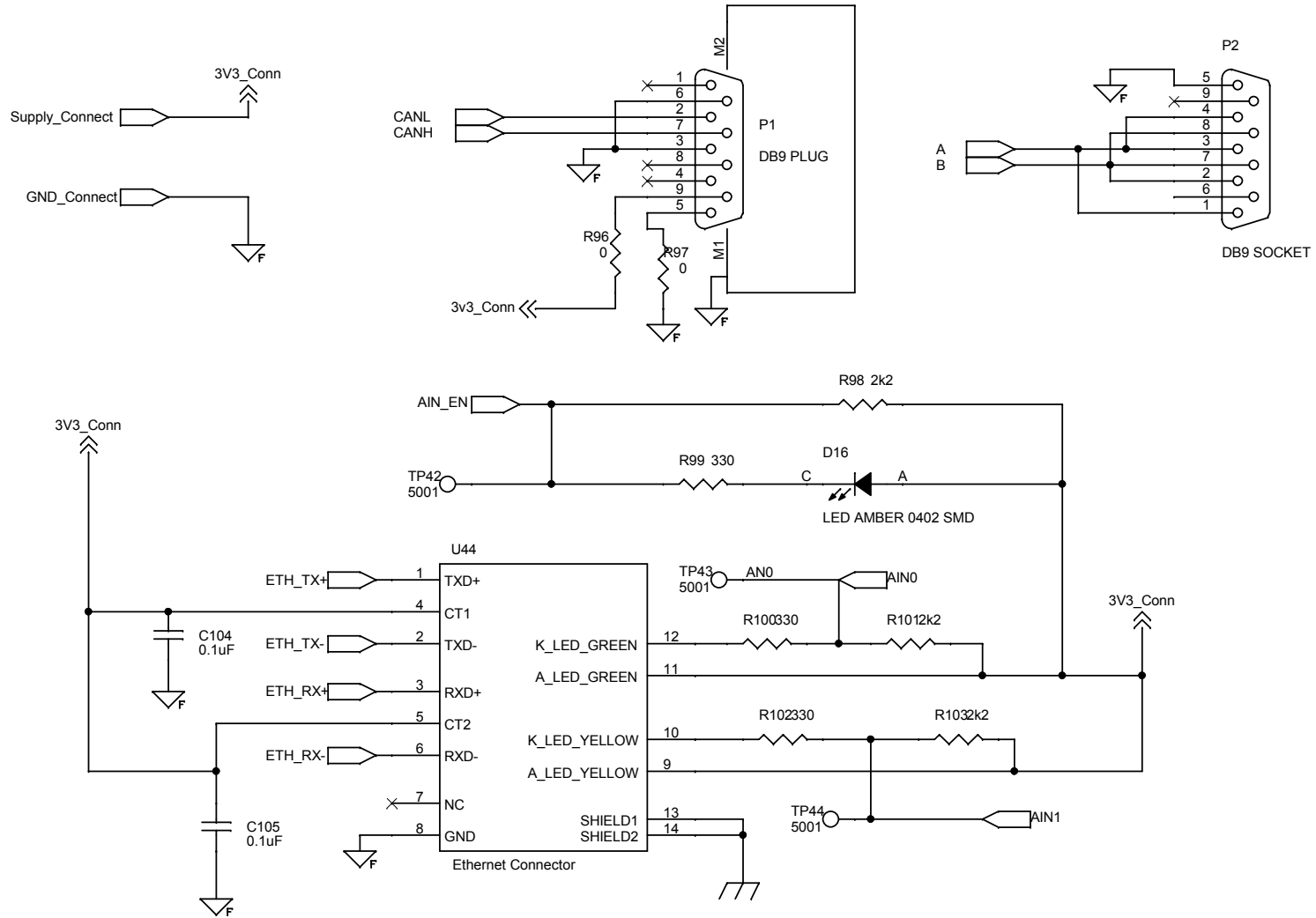
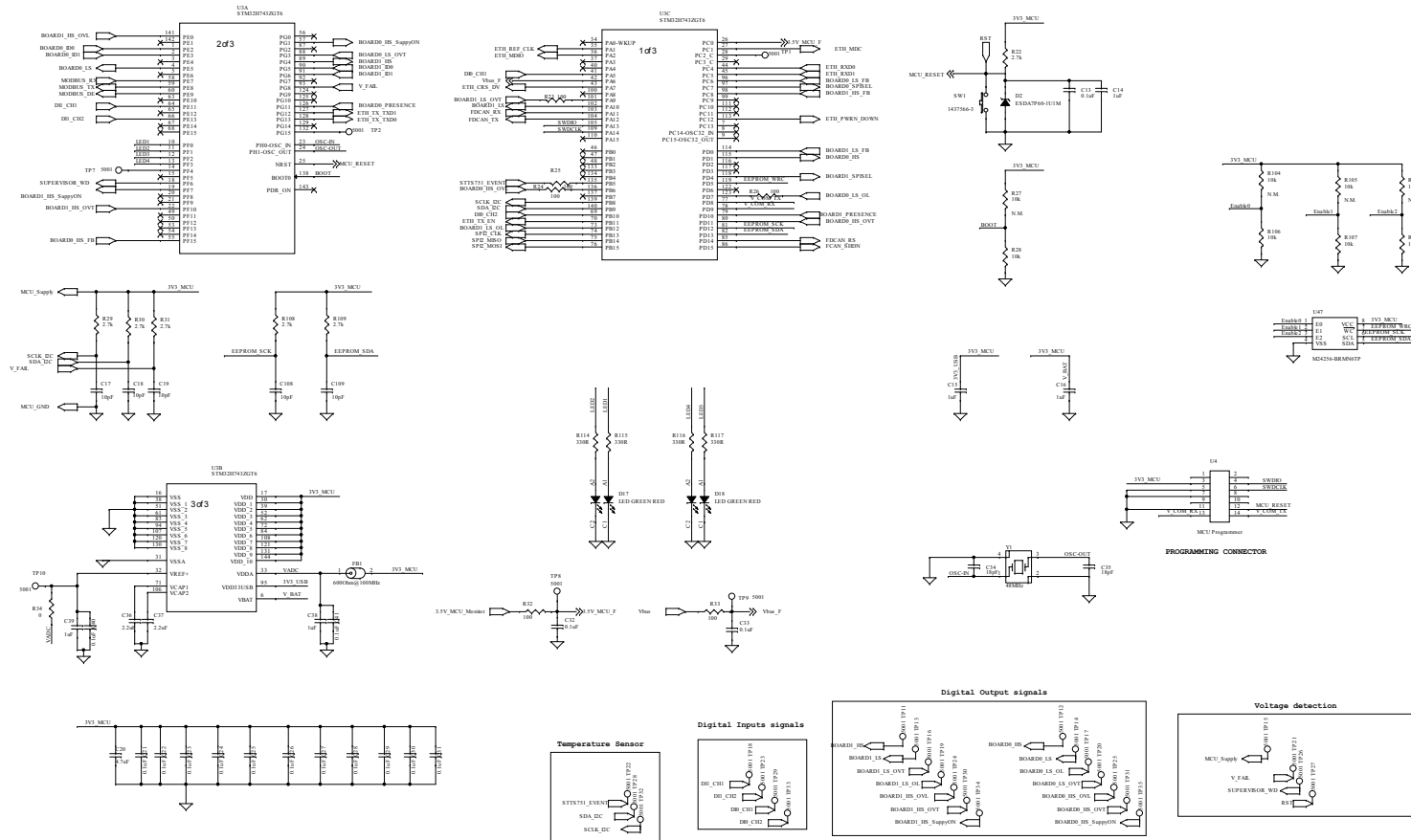


Figure 28. STEVAL-SILKTA01 circuit schematic (12 of 21)



STMicroelectronics and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. STMicroelectronics and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. STMicroelectronics and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.



Figure 29. STEVAL-SILKTA01 circuit schematic (13 of 21)

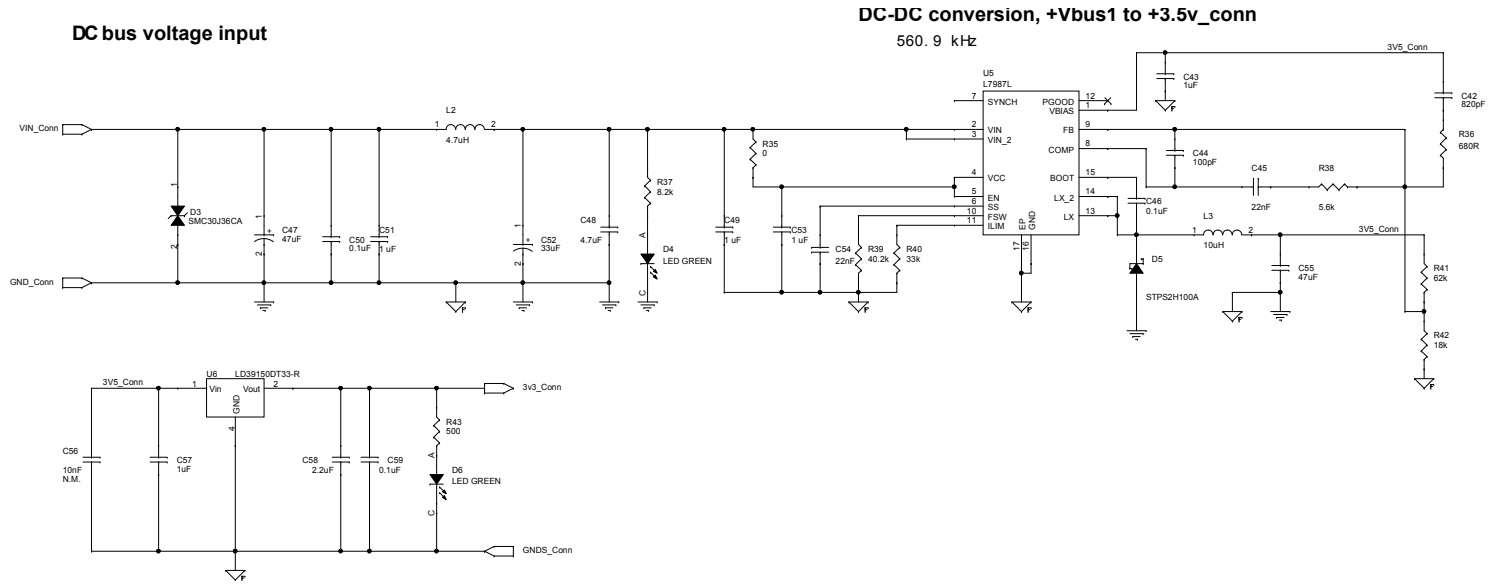


Figure 30. STEVAL-SILKTA01 circuit schematic (14 of 21)

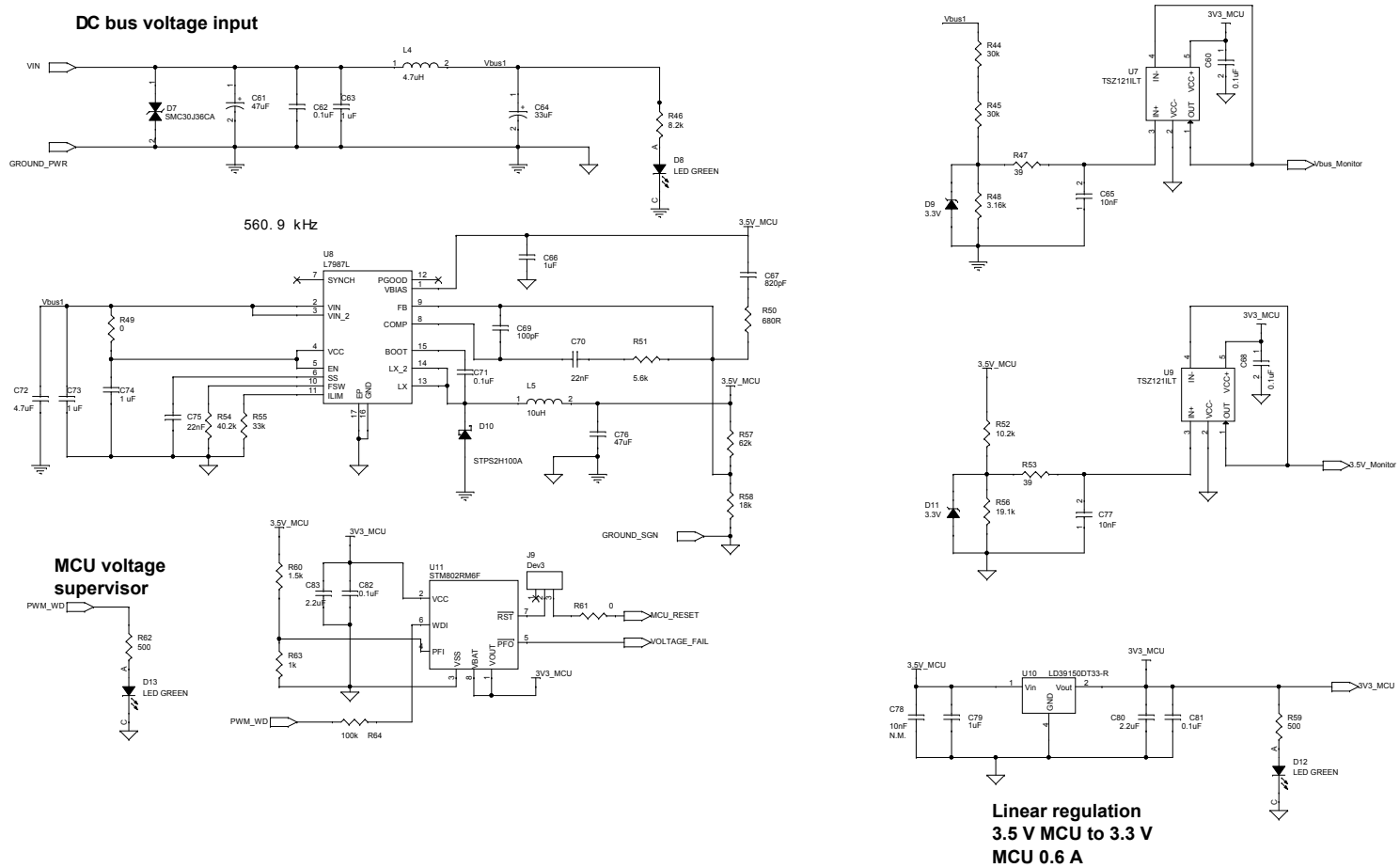


Figure 31. STEVAL-SILKTA01 circuit schematic (15 of 21)

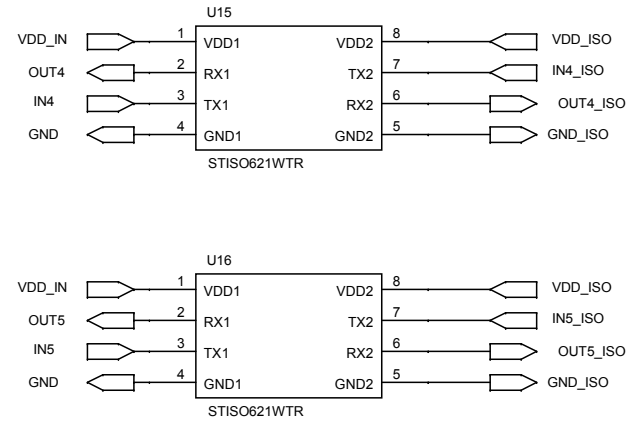
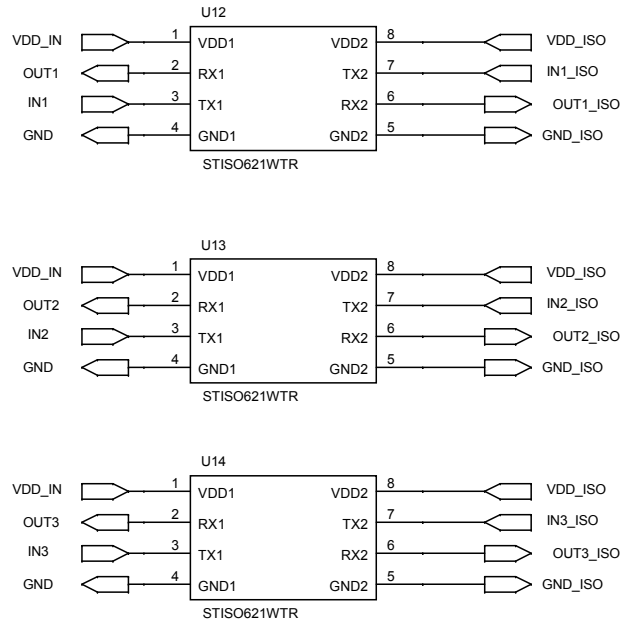


Figure 32. STEVAL-SILKTA01 circuit schematic (16 of 21)

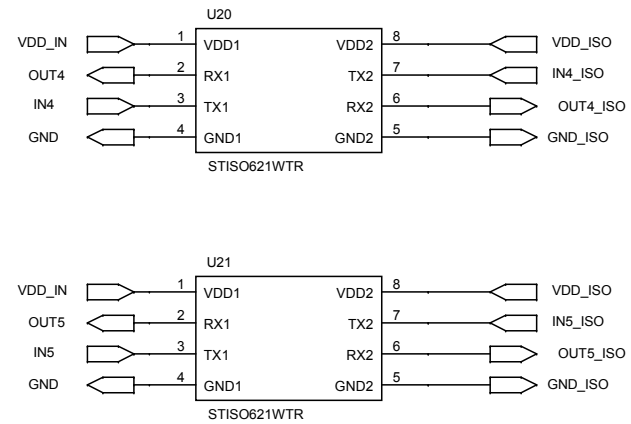
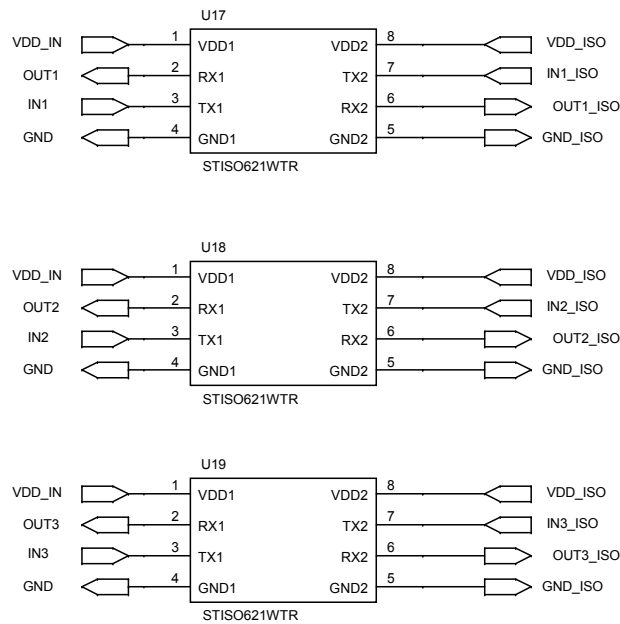


Figure 33. STEVAL-SILKTA01 circuit schematic (17 of 21)

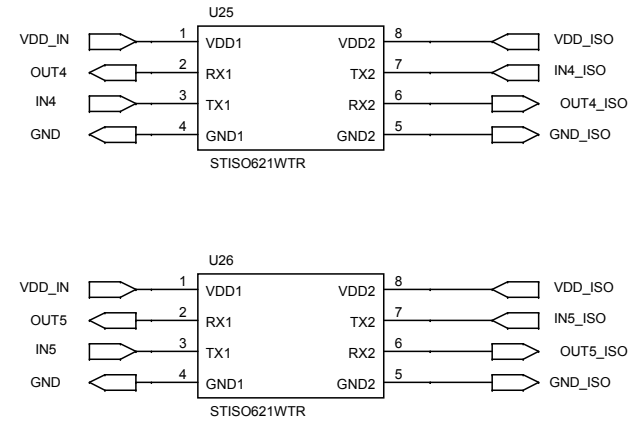
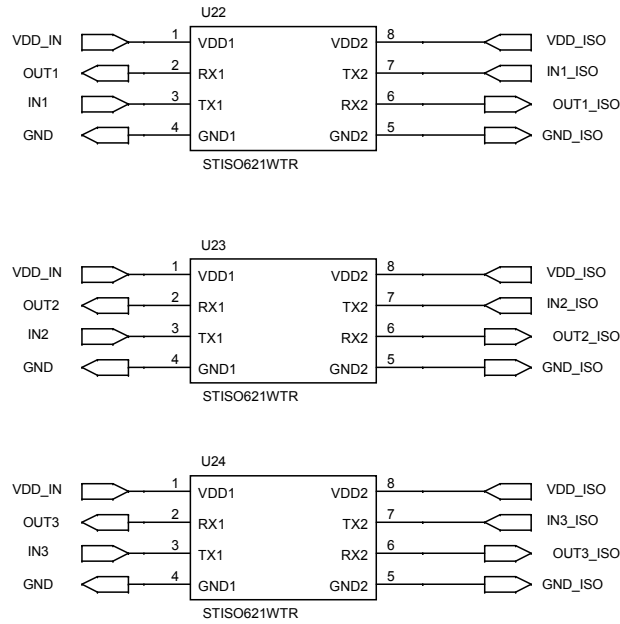


Figure 34. STEVAL-SILKTA01 circuit schematic (18 of 21)

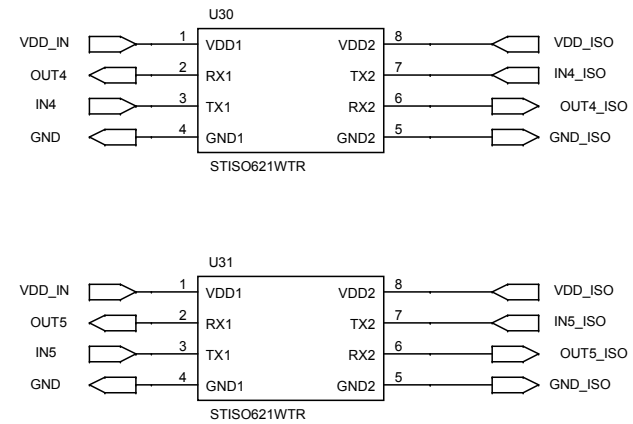
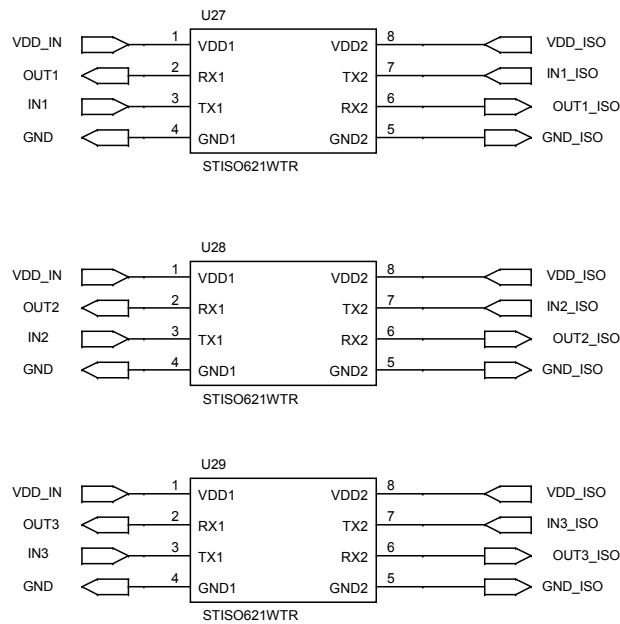


Figure 35. STEVAL-SILKTA01 circuit schematic (19 of 21)

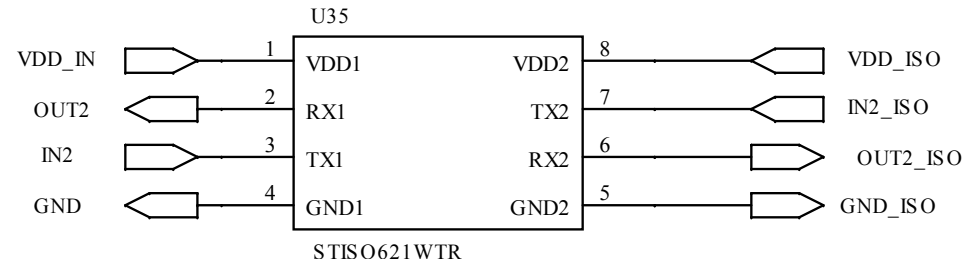
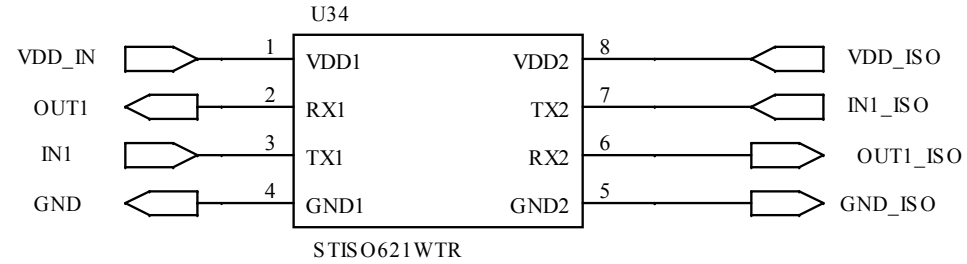
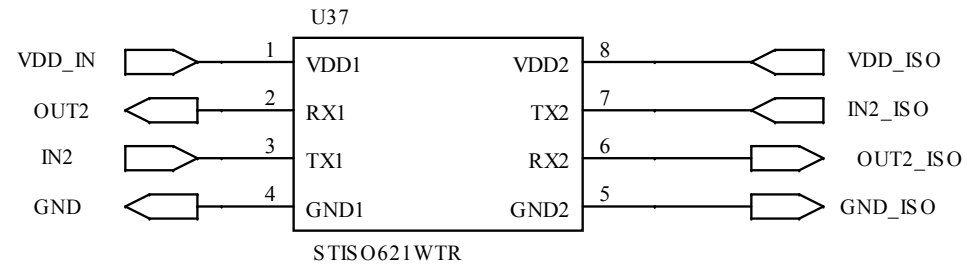
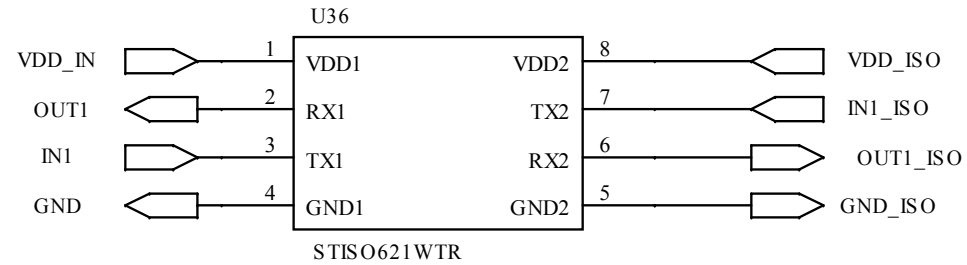


Figure 36. STEVAL-SILKTA01 circuit schematic (20 of 21)



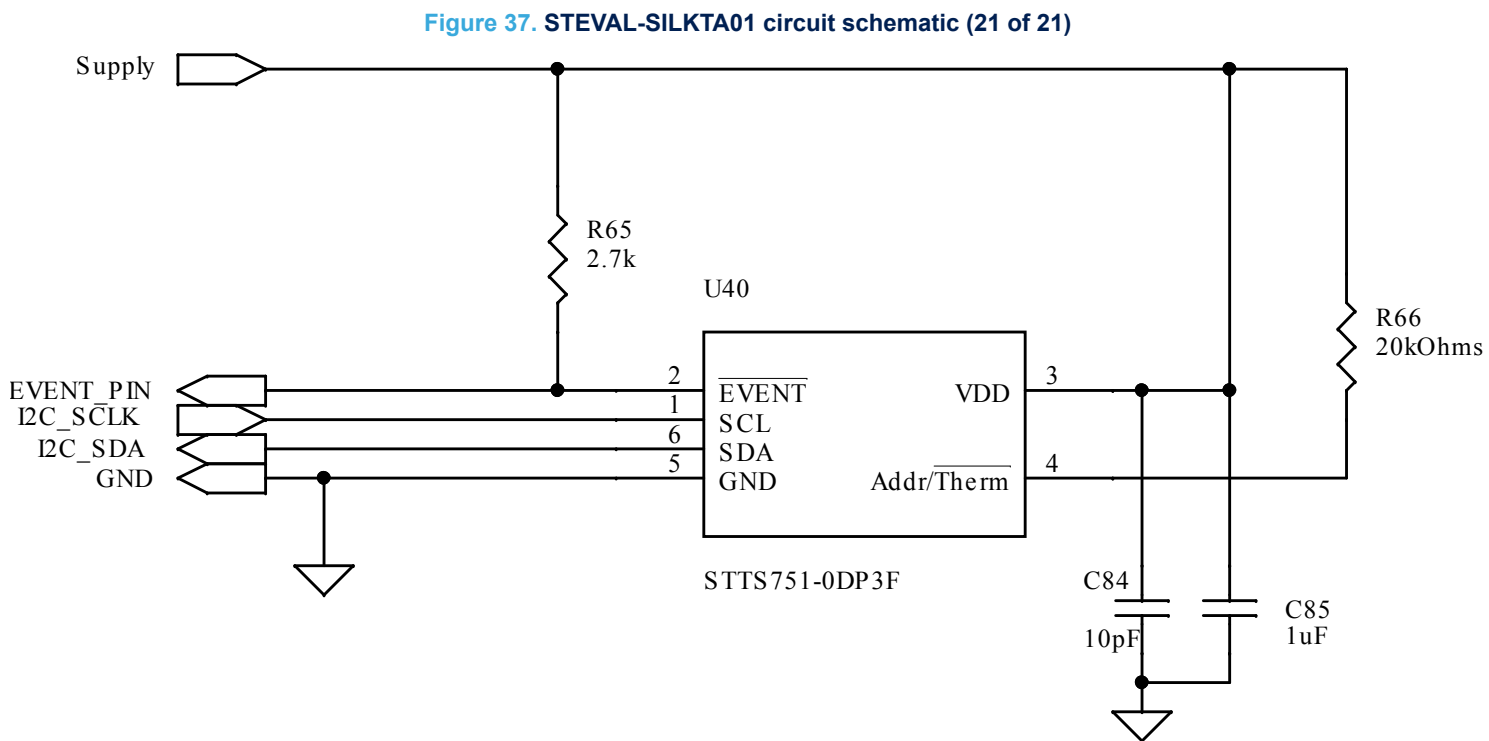


Figure 38. STEVAL-SILKTB01 circuit schematic (1 of 12)

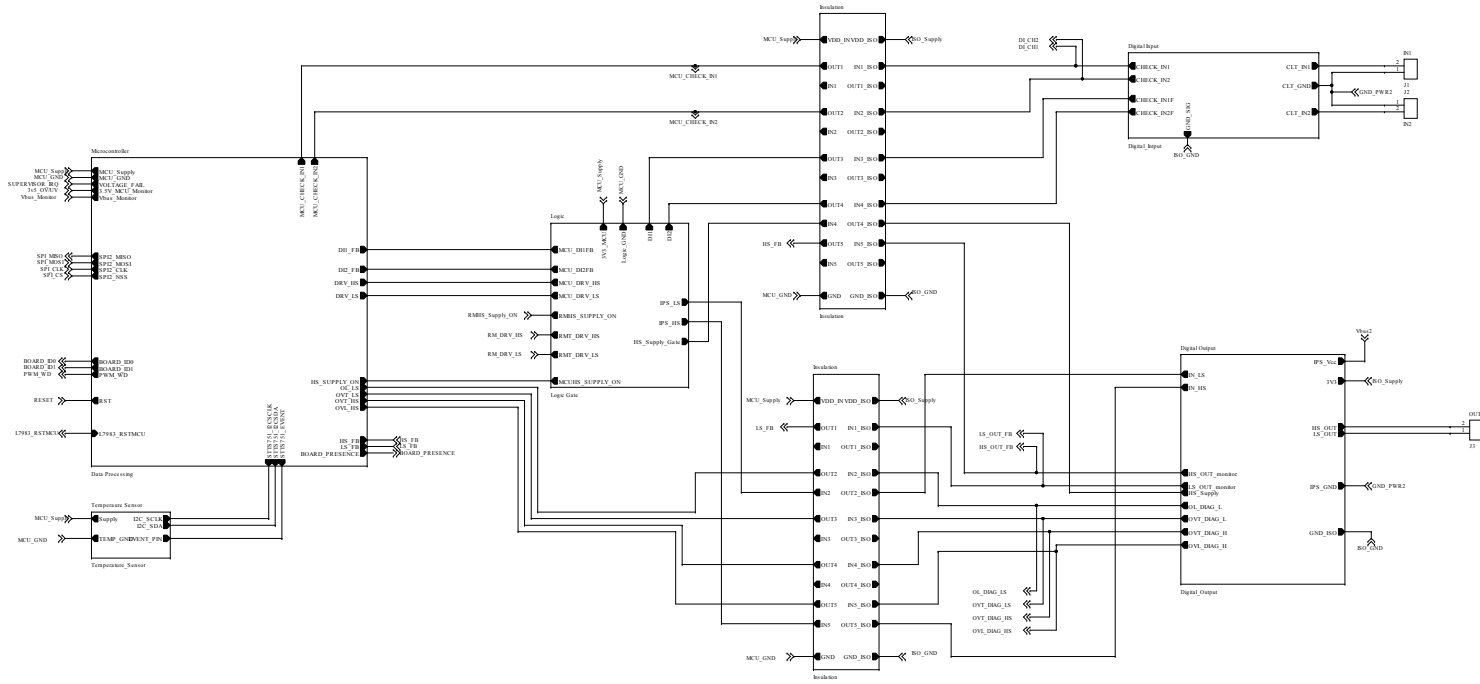


Figure 39. STEVAL-SILKTB01 circuit schematic (2 of 12)

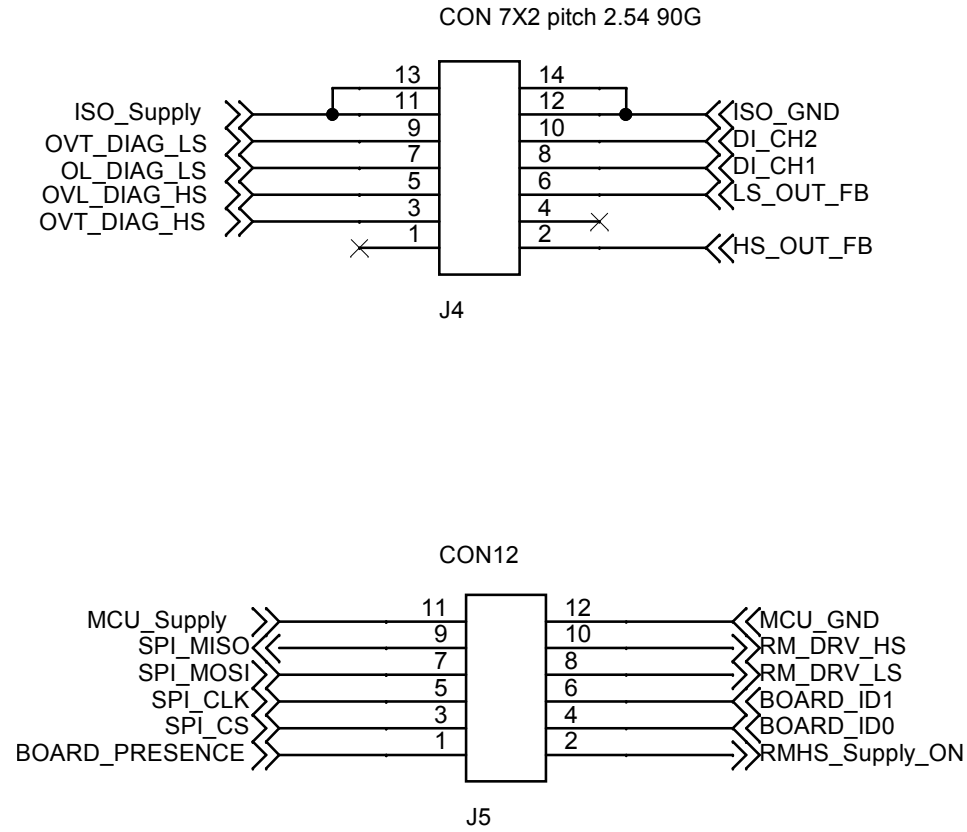


Figure 40. STEVAL-SILKTB01 circuit schematic (3 of 12)

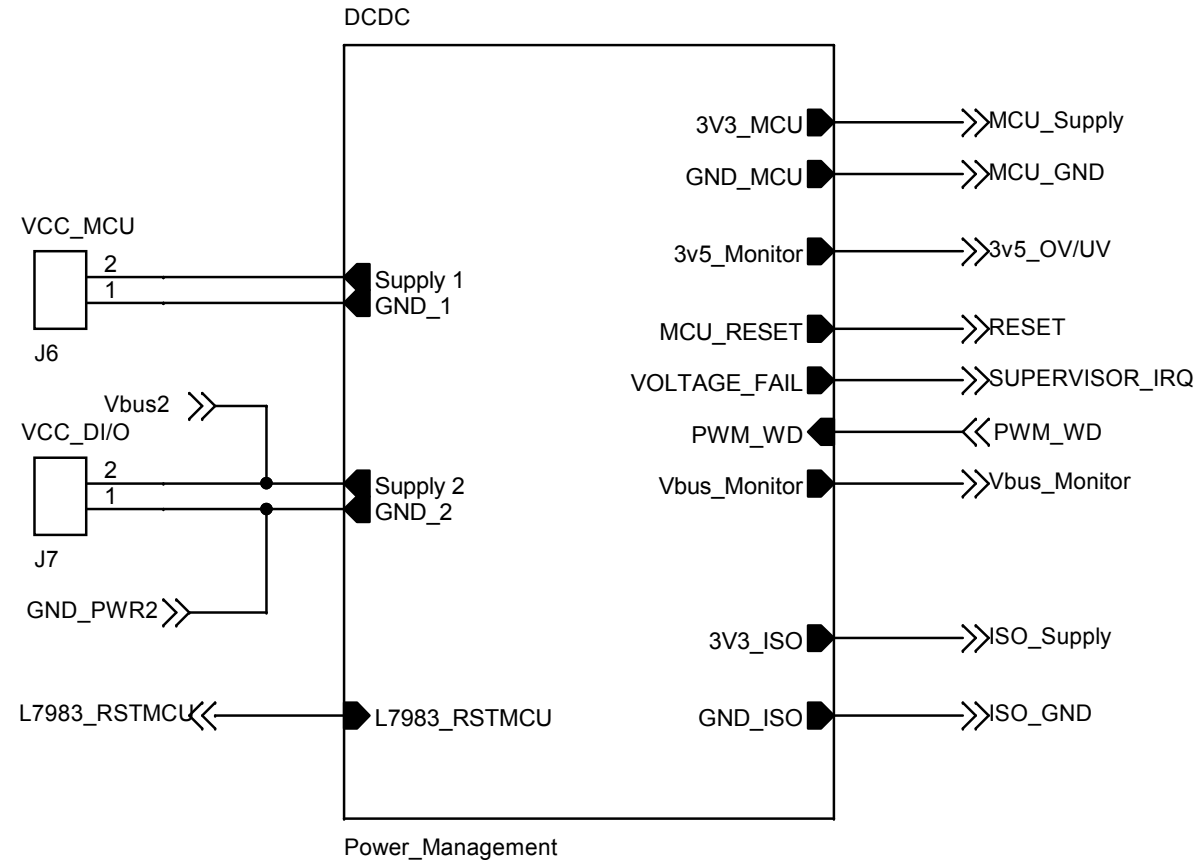


Figure 41. STEVAL-SILKTB01 circuit schematic (4 of 12)

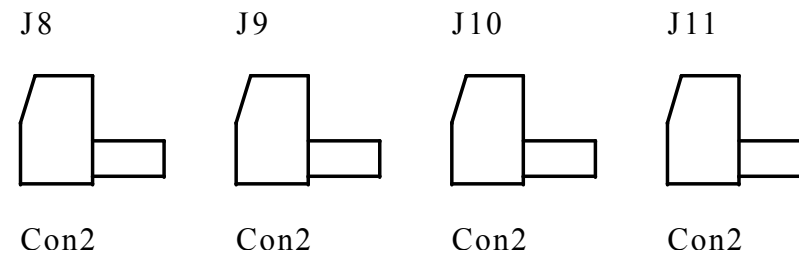


Figure 42. STEVAL-SILKTB01 circuit schematic (5 of 12)

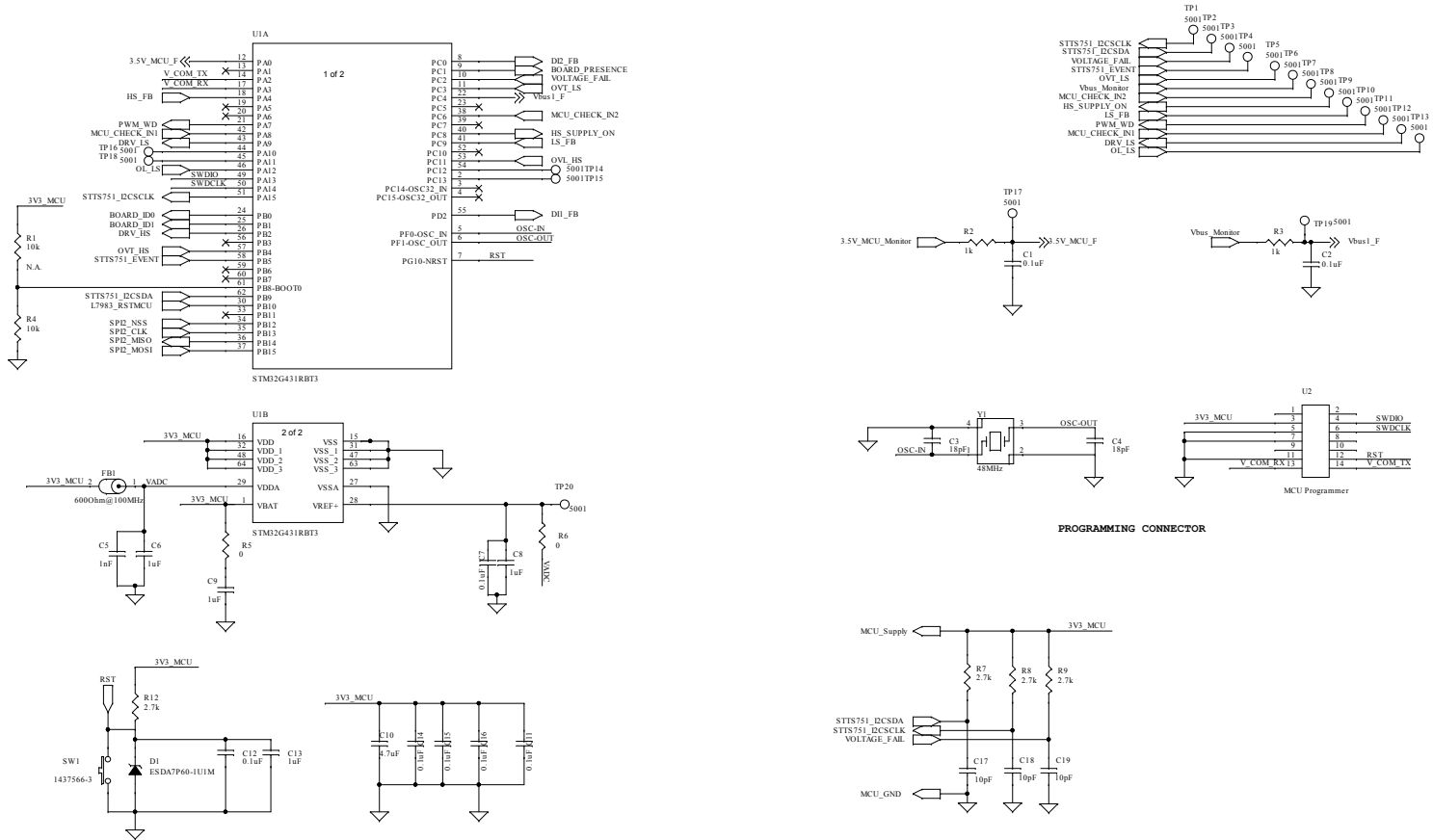


Figure 43. STEVAL-SILKTB01 circuit schematic (6 of 12)

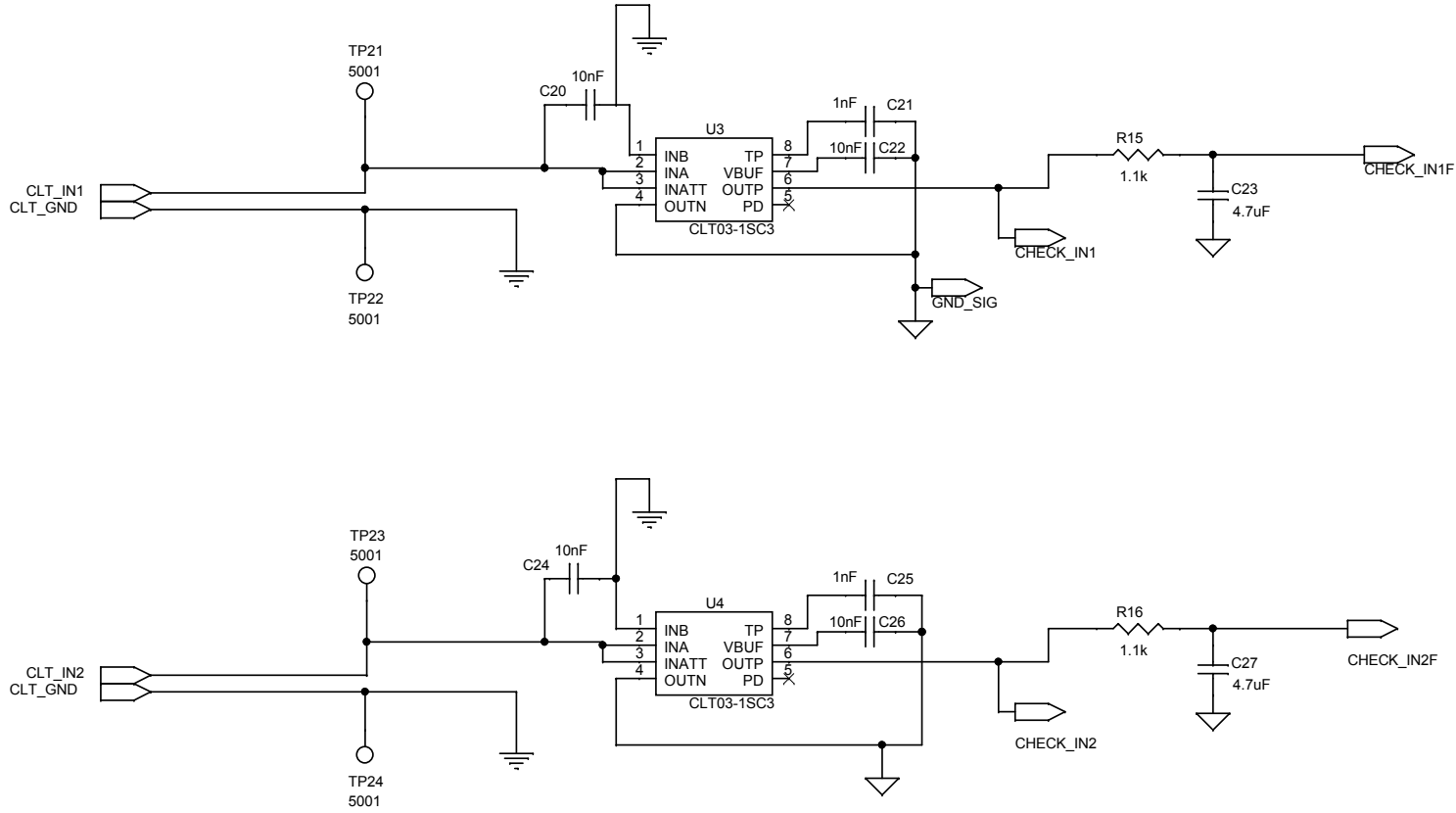


Figure 44. STEVAL-SILKTB01 circuit schematic (7 of 12)

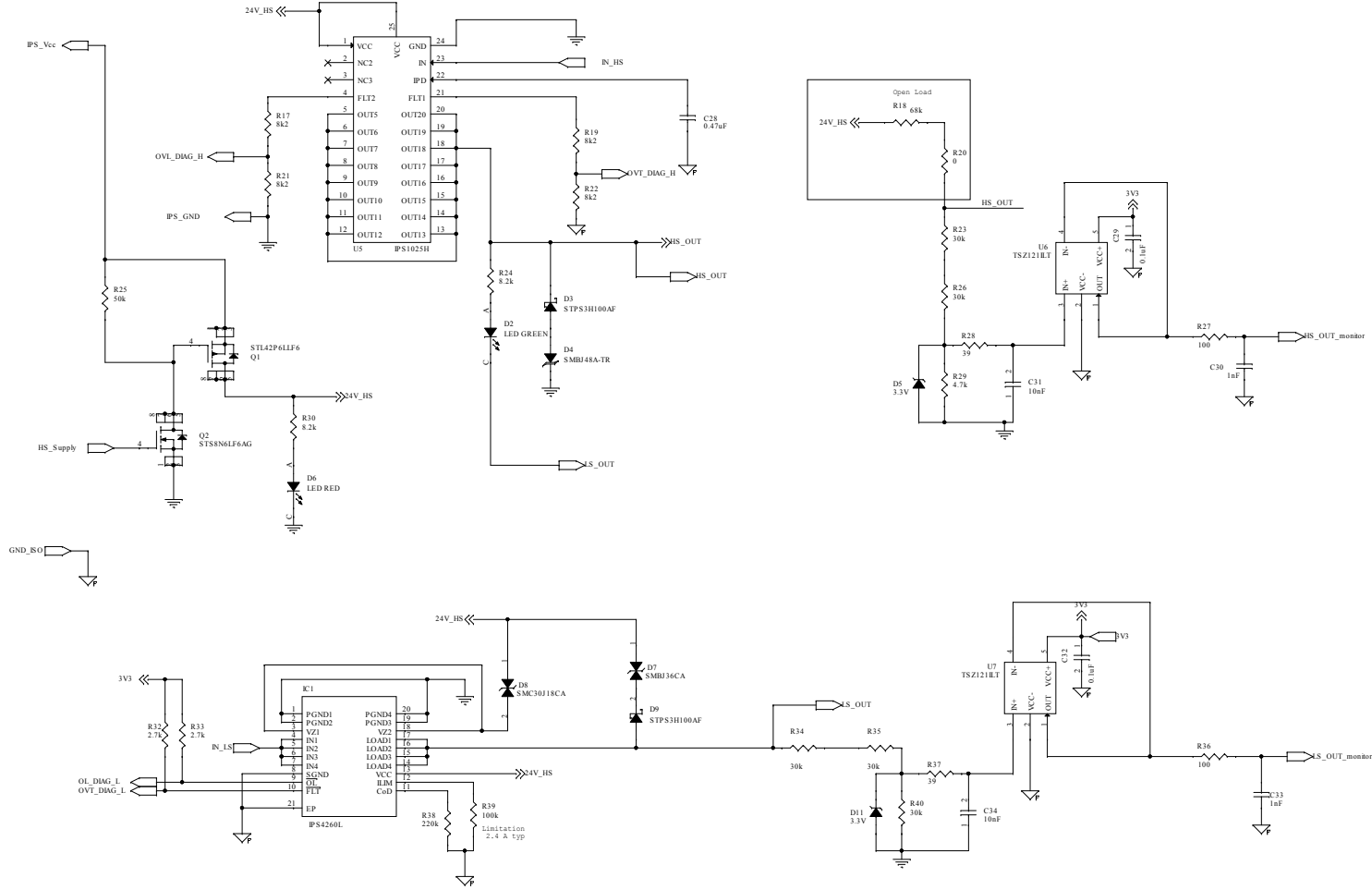


Figure 45. STEVAL-SILKTB01 circuit schematic (8 of 12)

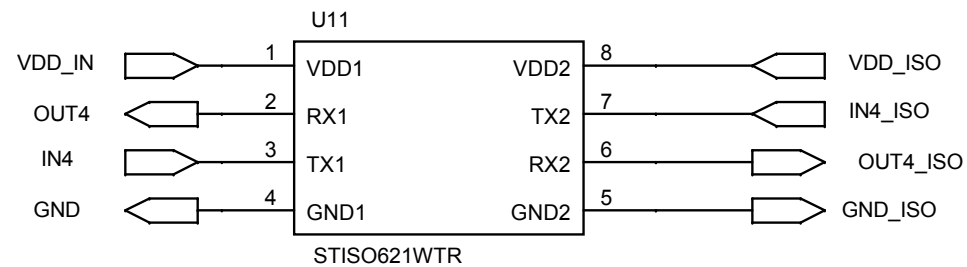
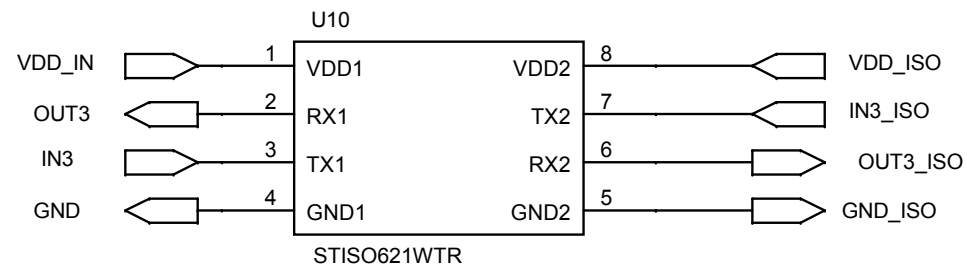
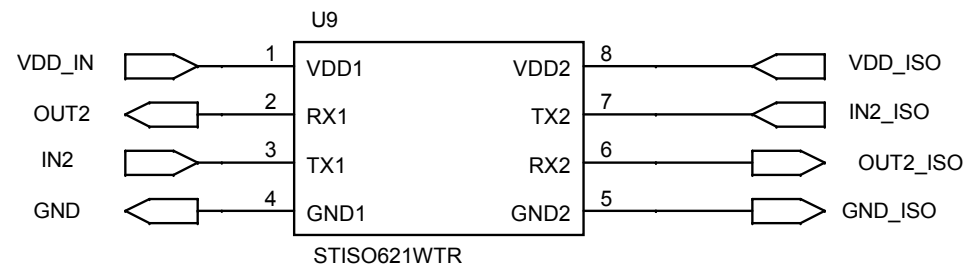
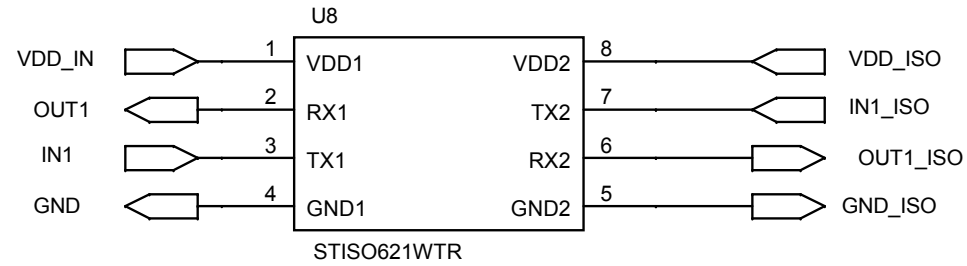
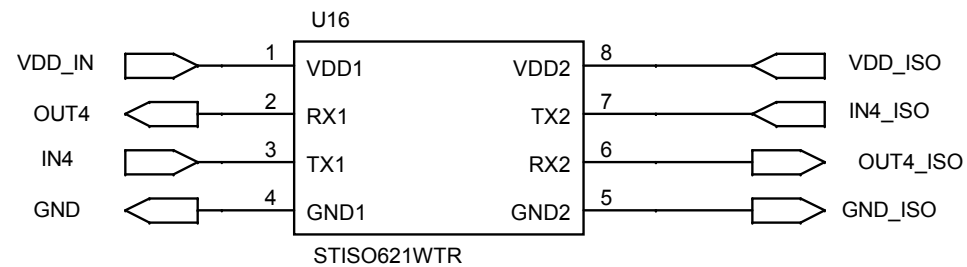
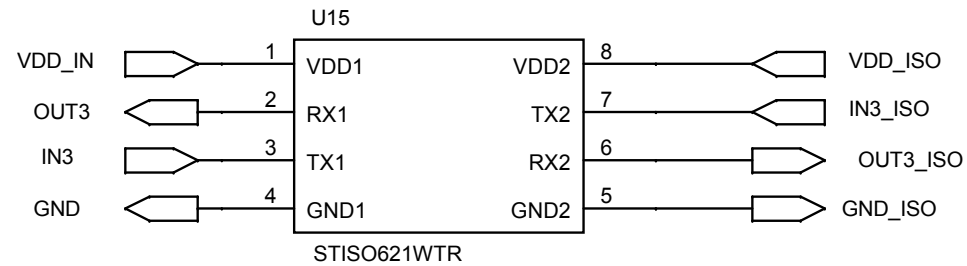
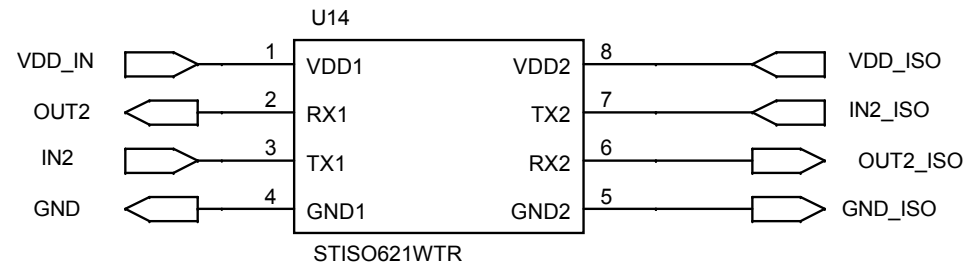
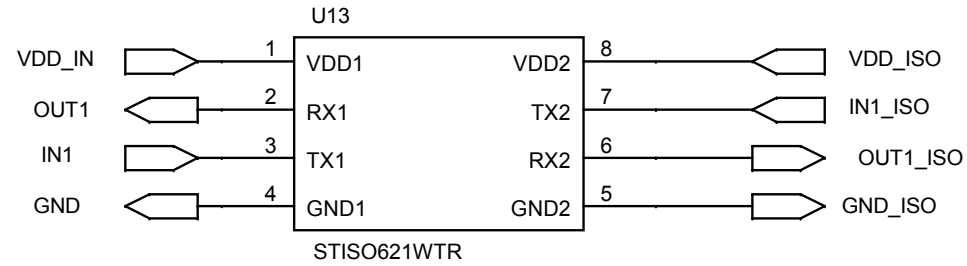


Figure 46. STEVAL-SILKTB01 circuit schematic (9 of 12)



UM3263
Schematic diagrams

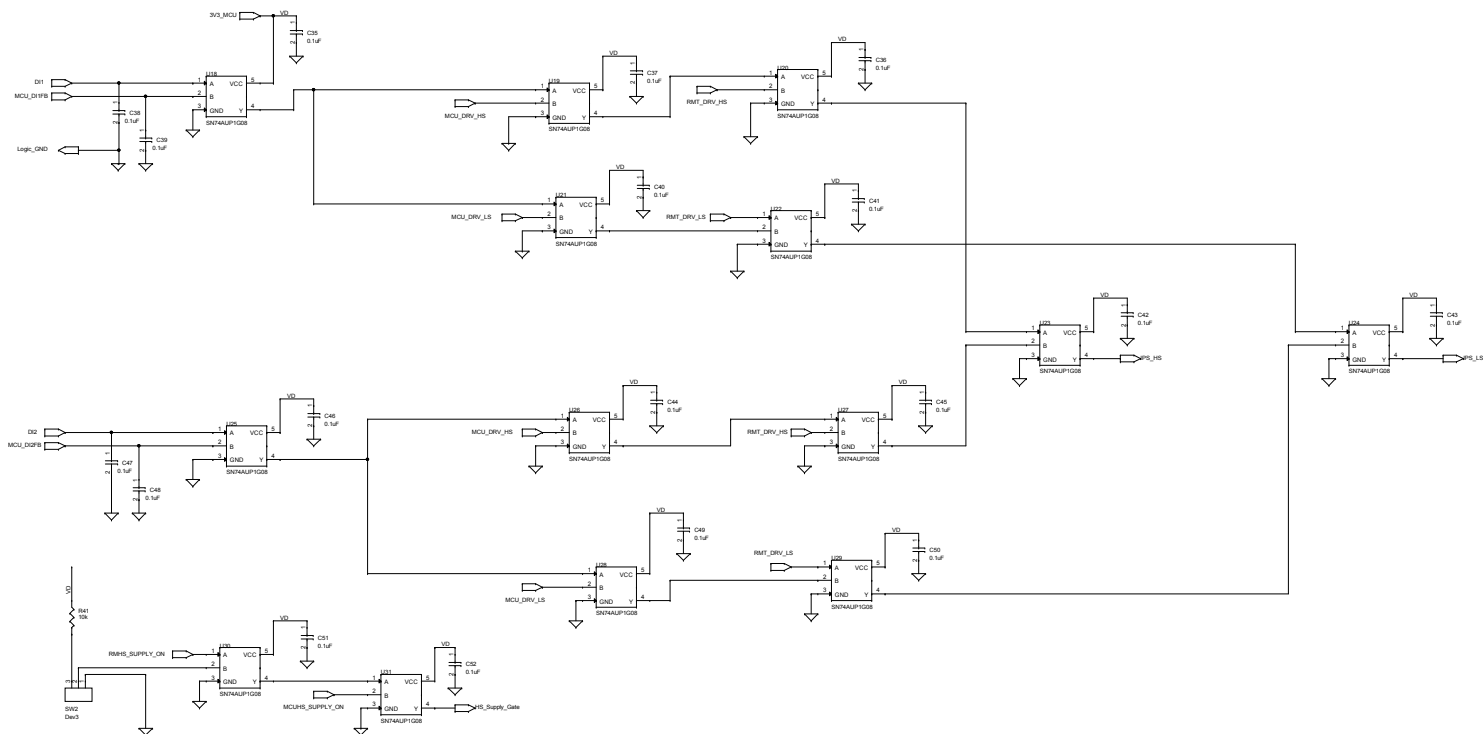
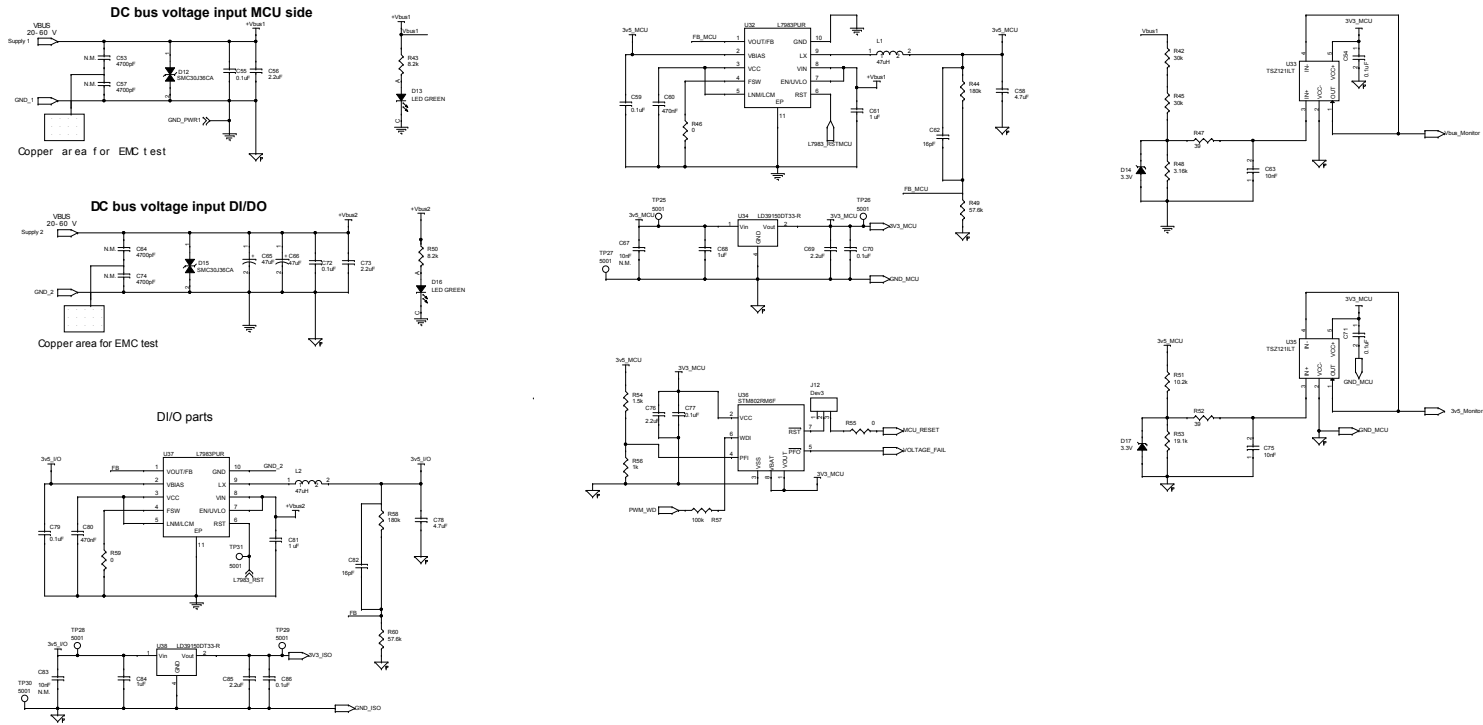
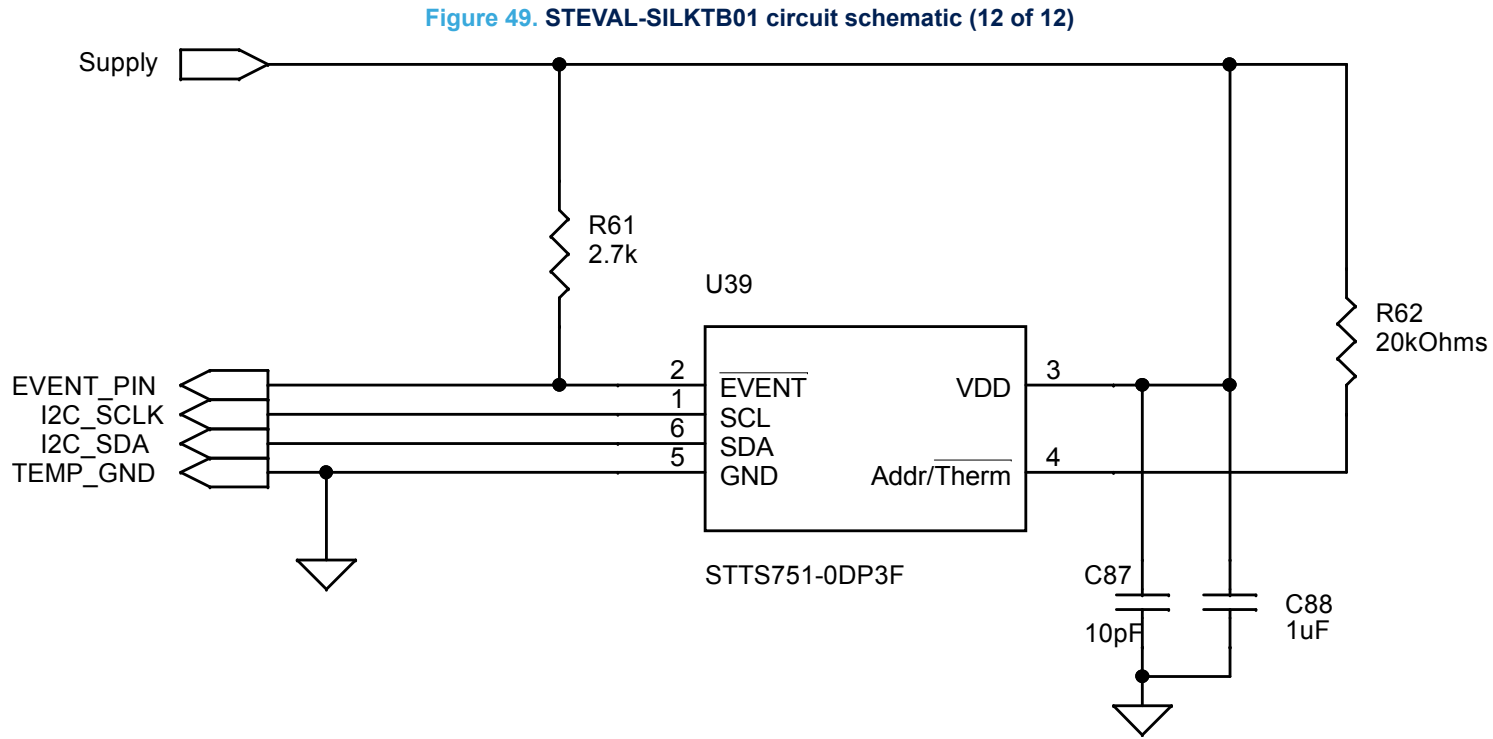


Figure 48. STEVAL-SILKTB01 circuit schematic (11 of 12)





5 Bill of materials

Table 1. STEVAL-SILKT01 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	1	Table 2. STEVAL-SILKTA01	-	Main board	STMicroelectronics	Not available for separate sale
2	2	Table 3. STEVAL-SILKTB01	-	Daughterboard	STMicroelectronics	Not available for separate sale

Table 2. STEVAL-SILKTA01 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	10	C1 C2 C3 C4 C5 C6 C7 C8 C106 C107	100nF, 0402 (1005 Metric), 6.3V, +/-10%	CAP CER 0.1UF 6.3V X5R 0402+F8:F29F 98F8:F26F8:F8 :F110	Murata Electronics	GRM155R60J104KA01D
2	22	C13 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C40 C41 C59 C60 C68 C81 C82 C97	0.1uF, 0402 (1005 Metric), 16V, +/-10%	CAP CER 0.1UF 16V X7R 0402	Würth Electronics Inc.	885012205037
3	3	C14 C85 C98	1uF, 0805 (2012 Metric), 16V, +/-10%	CAP CER 1UF 16V X7R 0805	KEMET	C0805C105K4RACTU
4	4	C15 C16 C38 C39	1uF, 0402 (1005 Metric), 6.3V, +/-10%	CAP CER 1UF 6.3V X5R 0402	Taiyo Yuden	JMK105BJ105KV-F
5	5	C17 C18 C19 C108 C109	10pF, 0402, (1005 Metric), 16V, +/-5%	CAPACITOR CERAMIC SMD 0402 (not mounted)	Yageo	CC0402KRNPO7BN100
6	1	C20	4.7uF, 0402 (1005 Metric), 10V, +/-20%	CAP CER 4.7UF 10V X5R 0402	Murata Electronics	GRM155R61A475MEAAD
7	2	C34 C35	18pF, 0402 (1005 Metric), 50V, +/-5%	CAP CER 18PF 50V C0G/NPO 0402	Yageo	CC0402JRNPO9BN180
8	3	C36 C37 C83	2.2uF, 0402 (1005 Metric), 10V, +/-20%	CAP CER 2.2UF 10V X5R 0402	Würth Electronics Inc.	885012105013
9	2	C42 C67	820pF, 0402 (1005 Metric), 50V, +/-5%	Multilayer Ceramic Capacitor MLCC, 0402 (1005M), 820pF, ±5%, 50V cc, SMD, C0G	TDK Corporation	CGA2B2C0G1H821J050B A
10	2	C43 C66	1uF, 0402 (1005 Metric), 25V, +/-10%	CAP CER 1UF 25V X5R 0402	Murata Electronics	GRM155R61E105KA12D
11	2	C44 C69	100pF, 0402 (1005 Metric), 10V, +/-5%	CAP CER 100PF 10V C0G/NPO 0402	Würth Electronics Inc.	885012005013

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
12	4	C45 C54 C70 C75	22nF, 0402 (1005 Metric), 25V, +/-10%	CAP CER 0.022UF 25V X7R 0402	Würth Electronics Inc.	885012205052
13	2	C46 C71	0.1uF, 0603 (1608 Metric), 16V, +/-10%	CAP CER 0.1UF 16V X7R 0603	Würth Electronics Inc.	885012206046
14	2	C47 C61	47uF, Radial, Can 100V, +/-20%	CAP 47 UF 20% 100 V	Würth Electronics Inc.	860040875002
15	2	C48 C72	4.7uF, 1210 (3225 Metric), 100V, +/-10%	CAP CER 4.7UF 100V X7R 1210	Samsung Electro- Mechanics	CL32B475KCVZW6E
16	6	C49 C51 C53 C63 C73 C74	1 uF, 0805 (2012 Metric), 100V, +/-10%	CAP CER 1UF 100V X7S 0805	TDK Corporation	C2012X7S2A105K125AB
17	2	C50 C62	0.1uF, 0805 (2012 Metric), 100V, +/-10%	CAP CER 0.1UF 100V X7R 0805	Würth Electronics Inc.	885012207128
18	2	C52 C64	33uF, Radial, 8x11.5mm, 100V, +/-20%	CAP ALUM 33UF 20% 100V RADIAL	Panasonic Electronic Components or Würth Electronics Inc.	ECA-2AHG330 or 870055975003
19	2	C55 C76	47uF, 1210 (3225 Metric), 16V, +/-10%	CAP CER 47UF 16V X5R 1210	Murata Electronics	GRM32ER61C476KE15K
20	2	C56 C78	10nF, 0402 (1005 Metric), 16V, +/-10%	CAP CER 10000PF 16V X7R 0402 (not mounted)	Würth Electronics Inc.	885012205031
21	2	C57 C79	1uF, 0603 (1608 Metric), 16V, +/-10%	CAPACITOR CERAMIC SMD 0603	Samsung Electro- Mechanics	CL10A105KO8NNNC
22	2	C58 C80	2.2uF, 0603 (1608 Metric), 25V, +/-10%	Multilayer Ceramic Capacitors MLCC - SMD/SMT 0603 25VDC 2.2uF 10% B(JIS)	Murata Electronics	GRM188B31E225KA12D
23	2	C65 C77	10nF, 0402 (1005 Metric), 16V, +/-10%	CAP CER 10000PF 16V X7R 0402	Würth Electronics Inc.	885012205031
24	1	C84	10pF, 0402 (1005 Metric), 10V, +/-5%	CAP CER 10PF 10V C0G/NP0 0402	Würth Electronics Inc.	885012005007
25	2	C86 C89	47pF, 0603 (1608 Metric), 10V, +/-5%	CAPACITOR CERAMIC SMD 0603	Murata	GRM1885C1H470JA01D
26	1	C87	100nF, 0603 (1608 Metric), 10V, +/-10%	CAPACITOR CERAMIC SMD 0603	AVX	06033C104JAT2A
27	1	C88	10nF, 0603 (1608 Metric), 16V, +/-10%	CAPACITOR CERAMIC SMD 0603	AVX	06033C103KAT2A

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
28	11	C90 C91 C92 C93 C94 C95 C96 C102 C103 C104 C105	0.1uF, 0603 (1608 Metric), 100V, +/-10%	CAP CER 0.1UF 100V X7S 0603	TDK Corporation	CGA3E3X7S2A104K080A B
29	2	C99 C100	20pF, 0402 (1005 Metric), 16V, +/-1%	CAP CER 0402 20PF 16V ULTRA STAB	KEMET	C0402C200F4HACAUTO
30	1	C101	10uF, Radial, Can - SMD 16V, +/-20%	CAP ALUM 10UF 20% 16V SMD	Panasonic Electronic Components	EEE-FC1C100R
31	2	D2 D15	ESDA7P60-1U 1M, 2-UDFN	TVS DIODE 5VWM 11.6VCL 1610	ST	ESDA7P60-1U1M
32	2	D3 D7	SMC30J36CA, DO-214AB, SMC, 3000W (3kW)	TVS DIODE 36VWM 58.1VC SMC	ST	SMC30J36CA
33	5	D4 D6 D8 D12 D13	LED GREEN, 0402 (1005 Metric), 20mA	LED GREEN CLEAR 0402 SMD	Würth Electronics Inc.	150040VS73240
34	2	D5 D10	STPS2H100A, DO-214AC, SMA, 2A	DIODE Schottky 100V 2A SMA	ST	STPS2H100A
35	2	D9 D11	3.3V, SOD-123, 900mV @ 10mA, 7.5uA @ 1.5V, 500mW	DIODE ZENER 3.3V 500MW SOD123	ON Semiconductor	MMSZ4684T1G
36	1	D14	ESDCAN24-2B LY, TO-236-3, SC-59, SOT-23-3	TVS DIODE 24VWM 40VC SOT23-3L	ST	ESDCAN24-2BLY
37	1	D16	LED AMBER 0402 SMD, 0402 (1005 Metric), 20mA	LED AMBER 0402 SMD	Würth Electronics Inc.	150040AS73240
38	2	D17 D18	LED GREEN RED, 4-PLCC, 20mA Green, 20mA Red	LED GREEN/RED CLEAR 4PLCC SMD	Würth Electronics Inc.	150141RV73100
39	4	FB1 FB2 FB3 FB4	600Ohm@100 MHz, 0603 (1608 Metric)	FERRITE BEAD 600 OHM 0603 1LN	Würth Electronics Inc.	742863160
40	2	J1 J6	CON2	TERM BLOCK HDR 2POS 90DEG 5.08MM	Würth Electronics Inc.	691313510002
41	2	J3 J5	con12-2x6- strip-female	CONN HEADER FEMALE .100 DUAL STR 12POS	Adimpex	LF006212-R
42	2	J2 J4	con14-2x7- strip-female	CONN HEADER FEMALE .100 DUAL STR 14POS	Adimpex	LF006214-R

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
43	1	J7	Con2	TERM BLOCK PLUG 2POS 5.08MM	Würth Electronics Inc.	691351500002
44	1	J8	Con2	TERM BLOCK PLUG 2POS 5.08MM (not assembled)	Würth Electronics Inc.	691351500002
45	1	J9	Dev3 500mA (DC)	SWITCH SLIDE SPDT 500MA 12V	Würth Electronics Inc.	450301014042
46	1	J10	Jump Female		Sullins Connector Solutions	NPB02SVAN-RC
47	1	J11	CON2	CONN HEADER VERT 2POS 1.27MM	Harwin	M50-3530242
48	2	L2 L4	4.7uH, 1212 (3030 Metric), 1.9 A, +/-20%	FIXED IND 4.7UH 1.9A 158MOHM SMD	Würth Electronics Inc.	74438336047
49	2	L3 L5	10uH, Non- standard, 4.3 A, +/-20%	FIXED IND 10UH 4.3A 27 MOHM SMD	Würth Electronics Inc.	7447714100
50	1	L6	8kOhms@10M Hz, Horizontal, 4 PC Pad, 150mA	CMC 100UH 150MA 2LN 8 KOHM SMD	Würth Electronics Inc.	744235101
51	4	N1 N2 N3 N4	NUT M3	HEX NUT 0.217" NYLON M3	Adimpex	VA080390-R
52	1	P1	DB9 PLUG	CONN D-SUB PLUG 9POS R/A SLDR	Amphenol ICC (FCI)	D09P33E4GX00LF
53	1	P2	DB9 SOCKET	CONN D-SUB RCPT 9POS R/A SLDR	Parallax Inc. or Norcomp	452-00005 or 182-009-213R531
54	10	R3 R4 R5 R6 R7 R8 R9 R10 R11 R12	1k, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	RES SMD 1K OHM 5% 1/16W 0402	Yageo	RC0402JR-071KL
55	2	R22 R89	2.7k, 0402 (1005 Metric) 0.063W, 1/16W, +/- 5%	CHIP RESISTOR SMD 5% 1/16W 0402	Yageo	RC0402FR-072K7L
56	6	R23 R24 R25 R26 R32 R33	100, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	CHIP RESISTOR SMD 5% 1/16W 0402	Rohm	MCR01MZPJ101
57	4	R27 R104 R105 R118	10k, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	CHIP RESISTOR SMD 5% 1/16W 0402 (not mounted)	Yageo	RC0402JR-0710KL
58	4	R28 R106 R107 R119	10k, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	CHIP RESISTOR SMD 5% 1/16W 0402	Yageo	RC0402JR-0710KL

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
59	5	R29 R30 R31 R108 R109	2.7k, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	CHIP RESISTOR SMD 1% 1/16W 0402	Yageo	RC0402FR-072K7L
60	3	R34 R70 R71	0402 (1005 Metric), 0.063W, 1/16W Jumper	RES SMD 0 OHM JUMPER 1/16W 0402	Vishay	CRCW04020000Z0ED
61	2	R35 R49	0603 (1608 Metric), 0.1W, 1/10W Jumper	RES SMD 0 OHM JUMPER 1/10W 0603	Panasonic Electronic Components	ERJ-3GEY0R00V
62	2	R36 R50	680R, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	Thick film Vishay SMD resistor, 680O, 0402 (1005M), ±1%, 0.063W, serie CRCW	Vishay	CRCW0402680RFKED
63	2	R37 R46	8.2k, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Vishay	CRCW06038K20FKEA
64	2	R38 R51	5.6k, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	Thick film Vishay SMD resistor, 5.6kO, 0402 (1005M), ±1%, 0.2W, serie CRCW- HP	Vishay	CRCW04025K60FKEDHP
65	2	R39 R54	40.2k, 0402 (1005 Metric), 0.1W, 1/10W, +/-1%	RES SMD 40.2K OHM 1% 1/10W 0402	Panasonic Electronic Components	ERJ-2RKF4022X
66	2	R40 R55	33k, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	CHIP RESISTOR SMD 1% 1/16W 0402	TE Connectivity	CRG0402F33K
67	2	R41 R57	62k, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	CHIP RESISTOR SMD 1% 1/16W 0402	Yageo	RC0402FR-0762KL
68	2	R42 R58	18k, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	RES SMD 18K OHM 1% 1/16W 0402	Yageo	RC0402FR-0718KL
69	3	R43 R59 R62	499, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Vishay	CRCW0603499RFKEA
70	2	R44 R45	30k, 0603 (1608 Metric), 0.1W, 1/10W, +/- 1%	CHIP RESISTOR SMD 1% 1/10W 0603	Vishay	CRCW060330K0FKEA
71	2	R47 R53	39, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	CHIP RESISTOR SMD 1% 1/16W 0402	Vishay	CRCW040239R0FKED

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
72	1	R48	3.16k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-073K16L
73	1	R52	10.2k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-0710K2L
74	1	R56	19.1k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Bourns	CR0603-FX-1912ELF
75	1	R60	1.5k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	RES SMD 1.5K OHM 1% 1/10W 0603	Yageo	RC0603FR-071K5L
76	1	R61	0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Panasonic	ERJ-3GEY0R00V
77	1	R63	1k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Multicomp	MCHP03W8F1001T5E
78	1	R64	100k, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Yageo	RC0603JR-07100KL
79	1	R65	2.7k, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	RES SMD 2.7K OHM 1% 1/16W 0402	Yageo	RC0402FR-072K7L
80	1	R66	20kOhms - 50 V, 62.5 mW, (1/16 W), +/- 1%	Thick Film Resistors - SMD 20K OHM 1%	Yageo	RC0402FR-0720KL
81	2	R67 R74	60.4R, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	RES 60.4 OHM 1% 1/16W 0402	Stackpole Electronics Inc	RMCF0402FT60R4
82	1	R68	120, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-07120RL
83	2	R69 R73	510R, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	CHIP RESISTOR SMD 1% 1/16W 0402	Walsin	WR04X5100FTL
84	2	R72 R75	10k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	RS Pro	3008048921
85	4	R76 R79 R80 R81	49.9, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	RES SMD 49.9 OHM 1% 1/10W 0603	Yageo	RC0603FR-0749R9L

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
86	10	R77 R78 R84 R85 R92 R93 R94 R98 R101 R103	2k2, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Yageo	RC0603JR-072K2L
87	1	R82	4.7k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Stackpole Electronics Inc	RMCF0603FT4K70
88	1	R83	1.5K, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	RES SMD 1.5K OHM 5% 1/16W 0402	Yageo	RC0402JR-071K5L
89	5	R86 R87 R88 R90 R91	2k2, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603 (not mounted)	Yageo	RC0603JR-072K2L
90	1	R95	4.87k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Multicomp	MCWR06X4871FTL
91	1	R96	0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603 (not mounted)	Panasonic	ERJ-3GEY0R00V
92	1	R97	0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Panasonic	ERJ-3GEY0R00V
93	3	R99 R100 R102	330, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Vishay	CRCW0603330RJNTA
94	4	R114 R115 R116 R117	330R, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	CHIP RESISTOR SMD 1% 1/16W 0402	Yageo	RC0402FR-07330R
95	4	S1 S2 S3 S4	SPACER M3x20	PLASTIC SPACER STUD METRIC THREA	Würth Electronics Inc.	971200365
96	2	SW1 SW2	1437566-3, 6.00mm x 3.50mm	SWITCH TACTILE SPST-NO 0.05A 24V	TE Connectivity ALCOSWITCH Switches	1437566-3 (FSMSMTR)
97	40	TP1 TP2 TP7 TP8 TP9 TP10 TP11 TP12 TP13 TP14 TP15 TP16 TP17 TP18 TP19 TP20 TP21 TP22 TP23 TP24 TP25 TP26 TP27 TP28 TP29 TP30 TP31 TP32 TP33 TP34 TP35 TP36 TP37 TP38 TP39 TP40 TP41 TP42 TP43 TP44	5001, 0.100" Dia x 0.180" L (2.54mm x 4.57mm)	TEST POINT PC MINI .040"D BLACK	Keystone Electronics	5001

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
98	1	U3	STM32H743ZGT6, 144-LQFP	IC MCU 32BIT 1MB flash 144LQFP	STMicroelectronics	STM32H743ZGT6
99	1	U4	MCU Programmer	CONN HEADER SMD 14POS 1.27MM	Samtec Inc.	FTSH-107-01-L-DV-K
100	2	U5 U8	L7987LTR, 16-TSSOP (0.173", 4.40mm Width) Exposed Pad	IC REG BCK ADJ 2A ASYNCR 16HTSSOP	STMicroelectronics	L7987LTR
101	2	U6 U10	LD39150DT33-R, TO-252-3, DPAK, SC-63	IC REG LINEAR 3.3V 1.5A DPAK	STMicroelectronics	LD39150DT33-R
102	2	U7 U9	TSZ121ILT, SC-74A, SOT-753	IC OP AMP ZRO-DRFT 400KHZ SOT23-5	STMicroelectronics	TSZ121ILT
103	1	U11	STM802RM6F, 8-SOIC (0.154", 3.90mm Width)	IC SUPERVISOR 1 CHANNEL 8SOIC	STMicroelectronics	STM802RM6F
104	28	U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U34 U35 U36 U37 U38 U45 U46	STISO621WTR, 8-SOIC (0.295", 7.50mm Width)	DUAL CHANNEL DIGITAL ISOLATOR	STMicroelectronics	STISO621WTR
105	1	U40	STTS751-0DP3F, 6-UDFN	SENSOR TEMPERATUR E SMBUS 6UDFN	STMicroelectronics	STTS751-0DP3F
106	1	U41	MAX3051ESA+, 8-SOIC (0.154", 3.90mm Width)	IC TRANSCEIVE R HALF 1/1 8SOIC	Maxim Integrated	MAX3051ESA+
107	1	U42	ST3485EI	3.3 V RS-485/ RS-422 Transceiver - SOIC-8	STMicroelectronics	ST3485EIDT
108	1	U43	DP83848MPHP EP, 48-PowerTQFP	IC TRANSCEIVE R 1/1 48HTQFP	Texas Instruments	DP83848MPHPEP
109	1	U44	Ethernet Connector	CONN JACK 1PORT 100 BASE-T PCB	Würth Electronics Inc.	74990111211
110	1	U47	M24256-BRMN6TP, 8-SOIC (0.154", 3.90mm Width)	IC EEPROM 256KBIT I ² C 1MHZ 8SO	STMicroelectronics	M24256-BRMN6TP
111	1	Y1	48MHz 4-SMD, No Lead	CRYSTAL 48.000MHZ 18PF SMD	Abracon LLC	ABM8-48.000MHZ-B2-T
112	1	Y2	25MHz 4-SMD, No Lead	XTAL OSC XO 25.000MHZ CMOS SMD	ECS Inc.	ECS-2520MV-250-CN-TR

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
113	1	PCB not reference	4-layer-TG140, 135.5 x 128.5x 1.55mm	4 layer TG 150- Impedence controller zone, All copper thickness 35 micron	Massive PCB Technologies LTD	User interface AB0122.B.01

Table 3. STEVAL-SILKTB01 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	17	C1 C2 C7 C11 C12 C14 C15 C16 C29 C32 C54 C59 C70 C71 C77 C79 C86	0.1uF, 0402 (1005 Metric), 16V, +/-10%	CAP CER 0.1UF 16V X7R 0402	Wurth Electronics Inc.	885012205037
2	2	C3 C4	18pF, 0402 (1005 Metric), 50V, +/-5%	CAP CER 18PF 50V C0G/NPO 0402	Yageo	CC0402JRNPO9BN180
3	1	C5	1nF, 0402 (1005 Metric), 16V, +/-10%	CAP CER 1000PF 16V X7R 0402	Wurth Electronics Inc.	885012205025
4	3	C6 C8 C9	1uF, 0402 (1005 Metric), 6.3V, +/-10%	CAP CER 1UF 6.3V X5R 0402	Taiyo Yuden	JMK105BJ105KV-F
5	1	C10	4.7uF, 0402 (1005 Metric), 10V, +/-20%	CAP CER 4.7UF 10V X5R 0402	Murata Electronics North America	GRM155R61A475MEAAD
6	2	C13 C88	1uF, 0805 (2012 Metric), 16V, +/-10%	CAP CER 1UF 16V X7R 0805	KEMET	C0805C105K4RACTU
7	3	C17 C18 C19	10pF, 0402 (1005 Metric), 16V, +/-5%	CAPACITOR CERAMIC SMD 0402 (not mounted)	Murata	GRM1555C1E100JA01D
8	4	C20 C22 C24 C26	10nF, 0603 (1608 Metric), 100V, +/-20%	CAP CER 10000PF 100V X7R 0603	TDK Corporation	C1608X7R2A103M080AA
9	4	C21 C25 C30 C33	1nF, 0603 (1608 Metric), 25V, +/-10%	CAP CER 1000PF 25V X7R 0603	Samsung Electro- Mechanics	CL10B102KA8NNNC
10	2	C23 C27	4.7uF, 0603 (1608 Metric), 10V, +/-20%	CAP CER 4.7UF 10V X5R 0603	Wurth Electronics Inc.	885012106012
11	1	C28	0.47uF, 0402 (1005 Metric), 10V, +/-10%	CAP CER 0.47UF 10V X5R 0402	Murata Electronics North America	GRM155R61A474KE15D
12	4	C31 C34 C63 C75	10nF, 0402 (1005 Metric), 16V, +/-10%	CAP CER 10000PF 16V X7R 0402	Wurth Electronics Inc.	885012205031
13	18	C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48 C49 C50 C51 C52	0.1uF, 0603 (1608 Metric), 50V, +/- 10%	CAP CER 0.1UF 50V X7R 0603	KEMET	C0603C104K5RACTU

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
14	4	C53 C57 C64 C74	4700pF, +/-20%	Safety Capacitors 4700pF X760 Y500VAC 20% Y5U (not mounted)	Vishay / BC Components	VY1472M63Y5UQ63V0
15	2	C55 C72	0.1uF, 0805 (2012 Metric), 100V, +/-10%	CAP CER 0.1UF 100V X7R 0805	Würth Electronics Inc.	885012207128
16	2	C56 C73	2.2uF, 1210 (3225 Metric), 100V, +/-10%	CAP CER 2.2UF 100V X7R 1210	Würth Electronics Inc.	885382209002
17	2	C58 C78	4.7uF, 0603 (1608 Metric), 16V, +/-10%	CAP CER 4.7UF 16V X5R 0603	Murata Electronics	GRM188R61C475KAAJD
18	2	C60 C80	470nF, 0603 (1608 Metric), 25V, +/-10%	CAP CER 0.47UF 25V X7R 0603	Würth Electronics Inc.	885012206075
19	2	C61 C81	1 uF, 0805 (2012 Metric), 100V, +/-10%	CAP CER 1UF 100V X7S 0805	TDK Corporation	C2012X7S2A105K125AB
20	2	C62 C82	16pF, 0402 (1005 Metric), 50V, +/-5%	CAP CER 16PF 50V C0G/NP0 0402	Murata Electronics North America	GRM1555C1H160JA01D
21	2	C65 C66	47uF, Radial, Can 100V, +/-20%	CAP 47 UF 20% 100 V	Würth Electronics Inc.	860040875002
22	2	C67 C83	10nF, 0402 (1005 Metric), 16V, +/-10%	CAP CER 10000PF 16V X7R 0402 (not mounted)	Würth Electronics Inc.	885012205031
23	2	C68 C84	1uF, 0603 (1608 Metric), 16V, +/-10%	CAPACITOR CERAMIC SMD 0603	Samsung Electro-Mechanics	CL10A105KO8NNNC
24	2	C69 C85	2.2uF, 0603 (1608 Metric), 25V, +/-10%	Multilayer Ceramic Capacitors MLCC - SMD/SMT 0603 25VDC 2.2uF 10% B(JIS)	Murata Electronics	GRM188B31E225KA12D
25	1	C76	2.2uF, 0402 (1005 Metric), 10V, +/-20%	CAP CER 2.2UF 10V X5R 0402	Würth Electronics Inc.	885012105013
26	1	C87	10pF, 0402 (1005 Metric), 10V, +/-5%	CAP CER 10PF 10V C0G/NP0 0402	Würth Electronics Inc.	885012005007
27	1	D1	ESDA7P60-1U 1M, 2-UDFN	TVS DIODE 5VWM 11.6VCL 1610	STMicroelectronics	ESDA7P60-1U1M
28	3	D2 D13 D16	LED GREEN 0402, (1005 Metric), 20mA	LED GREEN CLEAR 0402 SMD	Würth Electronics Inc.	150040VS73240
29	2	D3 D9	STPS3H100AF, SOD-128, 760mV @ 3A, 3A	DIODE Schottky 100V 3A SOD128	STMicroelectronics	STPS3H100AF

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
30	1	D4	SMBJ48A-TR, DO-214AA, SMB, 600W	TVS DIODE 48V 100V SMB	STMicroelectro nics	SMBJ48A-TR
31	4	D5 D11 D14 D17	3.3V, SOD-123, 900mV, @ 10mA, 7.5uA, @ 1.5V, 500mW	DIODE ZENER 3.3V 500MW SOD123	ON Semiconductor	MMSZ4684T1G
32	1	D6	LED RED, 0402 (1005 Metric), 20mA	LED RED CLEAR 0402 SMD	Würth Electronics Inc.	150040RS73240
33	1	D7	SMBJ36CA DO-214AA, SMB, 600W	TVS DIODE 36V 58.1V DO214AA	Littelfuse Inc.	SMBJ36CA
34	1	D8	SMC30J18CA, DO-214AB, SMC, 3000W (3kW)	TVS DIODE 18VWM 29.2VC SMC	STMicroelectro nics	SMC30J18CA
35	2	D12 D15	SMC30J36CA, DO-214AB, SMC, 3000W (3kW)	TVS DIODE 36VWM 58.1VC SMC	STMicroelectro nics	SMC30J36CA
36	1	FB1	600Ohm@100 MHz, 0603 (1608 Metric)	FERRITE BEAD 600 OHM 0603 1LN	Würth Electronics Inc.	742863160
37	1	IC1	IPS4260L, 20- TSSOP (0.173", 4.40mm Width)	QUAD LOW- SIDE INTELLIGENT POWER	STMicroelectro nics	IPS4260L
38	1	J1	IN1	TERM BLOCK HDR 2POS 90DEG 5.08MM	Würth Electronics Inc.	691313510002
39	1	J2	IN2	TERM BLOCK HDR 2POS 90DEG 5.08MM	Würth Electronics Inc.	691313510002
40	1	J3	OUT	TERM BLOCK HDR 2POS 90DEG 5.08MM	Würth Electronics Inc.	691313510002
41	1	J4	CON 7X2 pitch 2.54 90G	CONN HEADER R/A 14POS 2.54MM	Samtec Inc.	TSW-107-08-T-D-RA
42	1	J5	CON12	CONN HEADER R/A 12POS 2.54MM	Samtec Inc.	TSW-106-08-T-D-RA
43	1	J6	VCC_MCU	TERM BLOCK HDR 2POS 90DEG 5.08MM	Würth Electronics Inc.	691313510002
44	1	J7	VCC_DI/O	TERM BLOCK HDR 2POS 90DEG 5.08MM	Würth Electronics Inc.	691313510002

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
45	2	J8 J10	Con2	TERM BLOCK PLUG 2POS 5.08MM	Würth Electronics Inc.	691351500002
46	2	J9 J11	Con2	TERM BLOCK PLUG 2POS 5.08MM (not assembled)	Würth Electronics Inc.	691351500002
47	2	J12 SW2	Dev3 500mA (DC)	SWITCH SLIDE SPDT 500MA 12V	Würth Electronics Inc.	450301014042
48	2	L1 L2	47uH, Non- standard, +/-20%	FIXED IND 47UH 1.03A 260MOHM SMD	Würth Electronics Inc.	7447779147
49	1	Q1	STL42P6LLF6, 8-PowerVDFN, 100W (Tc)	MOSFET P-CH 60V 42A 8POWERFLAT	STMicroelectro nics	STL42P6LLF6
50	1	Q2	STS8N6LF6AG , 8-SOIC (0.154", 3.90mm Width), 3.2W (Ta)	MOSFET N- CHANNEL 60V 8A 8SO	STMicroelectro nics	STS8N6LF6AG
51	1	R1	10k, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	CHIP RESISTOR SMD 5% 1/16W 0402 (not mounted)	Yageo	RC0402FR-0710KL
52	2	R2 R3	1k, 0402 (1005 Metric), 0.063W, 1/16W, +/- 5%	CHIP RESISTOR SMD 5% 1/16W 0402	Vishay	CRCW04021K00FKED
53	1	R4	10k, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	CHIP RESISTOR SMD 5% 1/16W 0402	Yageo	RC0402FR-0710KL
54	2	R5 R6	0402 (1005 Metric), 0.063W, 1/16W Jumper	RES SMD 0 OHM JUMPER 1/16W 0402	Yageo	RC0402JR-070RL
55	3	R7 R8 R9	2.7k, 0402 (1005 Metric), 0.063W, 1/16W, +/- 1%	CHIP RESISTOR SMD 1% 1/16W 0402	Yageo	RC0402FR-072K7L
56	1	R12	2.7k, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	CHIP RESISTOR SMD 5% 1/16W 0402	Yageo	RC0402FR-072K7L
57	2	R15 R16	1.1k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-071K1L
58	4	R17 R19 R21 R22	8k2, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Panasonic Electronic Components	RMCF0603FT8K20
59	1	R18	68k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	RES SMD 68K OHM 1% 1/10W 0603	Yageo	RC0603FR-0768KL

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
60	1	R20	0603, 0.1W, 1/10W Jumper	0 OHM JUMPER 0603	Yageo	RC0603JR-070RL
61	7	R23 R26 R34 R35 R40 R42 R45	30k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Vishay	CRCW060330K0FKEA
62	4	R24 R30 R43 R50	8.2k, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Panasonic Electronic Components	RMCF0603FT8K20
63	1	R25	49.9k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Vishay	CRCW060349K9FKEA
64	2	R27 R36	100, 0402 (1005 Metric), 0.063W, 1/16W, +/-5%	CHIP RESISTOR SMD 5% 1/16W 0402	Vishay	RC0402FR-07100R
65	4	R28 R37 R47 R52	39, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	CHIP RESISTOR SMD 1% 1/16W 0402	Vishay	CRCW040239R0FKED
66	1	R29	4.7k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Stackpole	RMCF0603FT4K70
67	2	R32 R33	2.7k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	RES SMD 2.7K OHM 1% 1/10W 0603	Yageo	RC0603FR-072K7L
68	1	R38	220k, 0603 (1608 Metric), 0.1W, 1/10W, +/-0.1%	RES SMD 220K OHM 0.1% 1/10W 0603	Panasonic Electronic Components	ERA-3AEB224V
69	1	R39	100k, 0603 (1608 Metric), 0.1W, 1/10W, +/-0.1%	RES SMD 62K OHM 0.1% 1/10W 0603	Yageo	RT0603BRD07100KL
70	1	R41	10k, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Panasonic Electronic Components	ERJ3GEYJ103V
71	2	R44 R58	180k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-07180KL
72	2	R46 R59	0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603JR-070RL
73	1	R48	3.16k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-073K16L
74	2	R49 R60	57.6k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-0757K6L

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
75	1	R51	10.2k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-0710K2L
76	1	R53	19.1k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Bourns	CR0603-FX-1912ELF
77	1	R54	1.5k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	RES SMD 1.5K OHM 1% 1/10W 0603	Yageo	RC0603FR-071K5L
78	1	R55	0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Yageo	RC0603JR-070RL
79	1	R56	1k, 0603 (1608 Metric), 0.1W, 1/10W, +/-1%	CHIP RESISTOR SMD 1% 1/10W 0603	Yageo	RC0603FR-071KL
80	1	R57	100k, 0603 (1608 Metric), 0.1W, 1/10W, +/-5%	CHIP RESISTOR SMD 5% 1/10W 0603	Yageo	RC0603JR-07100KL
81	1	R61	2.7k, 0402 (1005 Metric), 0.063W, 1/16W, +/-1%	RES SMD 2.7K OHM 1% 1/16W 0402	Yageo	RC0402FR-072K7L
82	1	R62	20kOhms, 50 V, 62.5 mW (1/16 W), +/-1%	Thick Film Resistors - SMD 20K OHM 1%	Yageo	RC0402FR-0720KL
83	1	SW1	1437566, 3 6.00mm x 3.50mm	SWITCH TACTILE SPST-NO 0.05A 24V	TE Connectivity ALCOSWITCH Switches	1437566-3 (FSMSMTR)
84	31	TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 TP11 TP12 TP13 TP14 TP15 TP16 TP17 TP18 TP19 TP20 TP21 TP22 TP23 TP24 TP25 TP26 TP27 TP28 TP29 TP30 TP31	5001, 0.100" Dia x 0.180" L (2.54mm x 4.57mm)	TEST POINT PC MINI .040"D BLACK	Keystone Electronics	5001
85	1	U1	STM32G431RB T3, 64-LQFP	IC MCU 32BIT 128KB flash 64LQFP	STMicroelectro nics	STM32G431RBT3
86	1	U2	MCU Programmer	CONN HEADER SMD 14POS 1.27MM	Samtec Inc.	FTSH-107-01-L-DV-K
87	2	U3 U4	CLT03-1SC3, SOT-23-8	SINGLE LINE SELF POWERED DIGITAL	STMicroelectro nics	CLT03-1SC3

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
88	1	U5	IPS1025H, PSSO24	High-side switch with smart driving for capacitive loads	STMicroelectro nics	IPS1025H
89	4	U6 U7 U33 U35	TSZ121ILT, SC-74A, SOT-753	IC OP AMP ZER-DRIFT 1CIRC SOT23-5	STMicroelectro nics	TSZ121ILT
90	10	U8 U9 U10 U11 U12 U13 U14 U15 U16 U17	STISO621WTR , 8-SOIC (0.295", 7.50mm Width)	DUAL CHANNEL DIGITAL ISOLATOR	STMicroelectro nics	STISO621WTR
91	14	U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31	SN74AUP1G08 SC-74A, SOT-753	IC GATE AND 1CH 2-INP SOT23-5	Texas Instruments	SN74AUP1G08DBVT
92	2	U32 U37	L7983PUR, 10- WDFDN Exposed Pad	60 V 300 MA SYNCHRONO US STEP-DOW	STMicroelectro nics	L7983PUR
93	2	U34 U38	LD39150DT33- R, TO-252-3, DPAK, SC-63	IC REG LINEAR 3.3V 1.5A DPAK	STMicroelectro nics	LD39150DT33-R
94	1	U36	STM802RM6F, 8-SOIC (0.154", 3.90mm Width)	IC SUPERVISOR 1 CHANNEL 8SOIC	STMicroelectro nics	STM802RM6F
95	1	U39	STTS751-0DP3 F, 6-UDFN	SENSOR TEMPERATUR E SMBUS 6UDFN	STMicroelectro nics	STTS751-0DP3F
96	1	Y1	48MHz 4-SMD, No Lead	CRYSTAL 48.0000MHZ 18PF SMD	Abracon LLC	ABM8-48.000MHZ-B2-T
97	1	PCB not reference	4-layer-TG140, 78.00 x 103.5 x 1.55mm	4 layer TG 150- Impedence controller zone, All copper thickness 35 micron	Massive PCB Technologies LTD	ACTUATION AB0123.B.01

6 Kit versions

Table 4. STEVAL-SILKT01 versions

PCB version	Schematic diagrams	Bill of materials
STEVAL\$SILKT01B ⁽¹⁾	STEVAL\$SILKT01B schematic diagrams	STEVAL\$SILKT01B bill of materials

1. This code identifies the STEVAL-SILKT01 evaluation kit second version. The kit consists of the STEVAL-SILKTA01 main board whose version is identified by the code STEVAL\$SILKTA01A and two STEVAL-SILKTB01 actuation boards whose version is identified by the code STEVAL\$SILKTB01B.

7 Regulatory compliance information

Notice for US Federal Communication Commission (FCC)

For evaluation only; not FCC approved for resale

FCC NOTICE - This kit is designed to allow:

(1) Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine

whether to incorporate such items in a finished product and

(2) Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter 3.1.2.

Notice for Innovation, Science and Economic Development Canada (ISED)

For evaluation purposes only. This kit generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to Industry Canada (IC) rules.

À des fins d'évaluation uniquement. Ce kit génère, utilise et peut émettre de l'énergie radiofréquence et n'a pas été testé pour sa conformité aux limites des appareils informatiques conformément aux règles d'Industrie Canada (IC).

Notice for the European Union

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2015/863/EU (RoHS).

Notice for the United Kingdom

This device is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK S.I. 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK S.I. 2012 No. 3032).

Revision history

Table 5. Document revision history

Date	Revision	Changes
26-Jun-2024	1	Initial release.
15-Jan-2025	2	Updated Figure 1. STEVAL-SILKT01, Figure 15. STEVAL-SILKTB01 digital output and supply voltage interruption circuit, Section 4: Schematic diagrams and Section 6: Kit versions.

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