Getting started with the STEVAL-PLC001V1 industrial PLC evaluation board with HMI interface

Introduction

The STEVAL-PLC001V1 evaluation board targets compact programmable logic controller (PLC) applications in the factory automation domain. It features a powerful human machine interface (HMI) thanks to the 3.5" TFT touchscreen mounted on the PCB, which eases interaction with the tool.

The board implements a galvanically isolated PLC control unit with robust digital input, digital output modules, expansion connectivity options, and interfaces.

The control unit consists of a powerful 144-pin STM32F746ZGT7 MCU, which handles the industrial IOs on one side and the TouchGFX display technology on the other side, implementing the ladder logic programming code and several additional options.

Highly robust and reliable industrial digital input and output modules are placed symmetrically on the PCB, making the system a 12+12 PLC, that is, a PLC GUI optimized for STM32 microcontrollers, which manages 12 industrial inputs and 12 industrial outputs.

The 12 industrial inputs have been implemented through the combination of an eight-channel CLT01-38SQ7 and two dual channel CLT03-2Q3 ICs.

The CLT01-38SQ7 features 6.25 MHz SPI with daisy chain capability to connect, in this case, the eight-channel output ISO8200AQ and reverse polarity, whereas the CLT03-2Q3 features two high- and low-side compatible independent channels, which can be powered from the external sensors they interface with, and the capability of running in the 60 V range for fail-safe applications.

The 12 industrial output array consists of an eight-channel ISO8200AQ IC and a four-channel IPS4260L low-side intelligent power switch.

The ISO8200AQ offers a daisy-chain SPI interface and embedded galvanic insulation, separating logic and power side of 4 kV and making the solution cost-effective (no opto-coupler is needed).

The STEVAL-PLC001V1 also features connectivity options typical of commercial PLCs through the morpho connectors mounted on the PCB bottom, ensuring compatibility with STM32 Nucleo expansion boards.

The embedded ICs for industrial IO management allow great flexibility in terms of technical features, protections and embedded diagnostics, when interfacing industrial range inputs (that is, sensors and valves) and outputs (that is, lamps, alarms, and actuators) with the logic side.

The STSW-PLC001 companion software package, freely available on www.st.com, allows experimenting with these advanced features and their combination.

Thanks to this software and the smart user interface offered by the TouchGFX, you can learn how the ICs work and exploit ready-to-use examples as well as ladder logic demonstrations and projects.

UM2933 - Rev 1 - October 2021
For further information contact your local STMicroelectronics sales office.

www.st.com

Figure 1. **STEVAL-PLC001V1 evaluation board**

1 Getting started

1.1 Safety precautions for use

The STEVAL-PLC001V1 evaluation board has a level of radiated emissions that exceeds the limit for class A devices. Therefore, the user must add a proper shielding metal enclosure (Faraday cage) in the setup of the evaluation environment of the board.

There are two peaks exceeding the limit to be observed for EU, FCC and ISED, the first at 324 MHz and the second at 755.94 MHz, respectively exceeding for 11.6 dB μV/m and 1.0 dB μV/m.

Danger:
People with active implanted medical devices shall not use this evaluation kit, as safety related to radiated emissions is not guaranteed.

1.2 Features

- STM32F746ZGT7 high-performance MCU embedding ARM$^®$ 32-bit Cortex$^®$-M7 CPU with FPU, Chrom-ART accelerator, and DSP instructions
- CLT01-38SQ7 octal high-speed digital input current limiter with SPI interface
- CLT03-2Q3 dual-channel self-powered digital input current limiter
- ISO8200AQ galvanic isolated octal high-side smart power solid-state relay with SPI interface
- IPS4260L quad low-side intelligent power switch
- Main supply voltage: 18 - 32 V (24 V nominal)
- STSW-PLC001 firmware package
- 3.5" TFT display with multitouch capability interfaced through dedicated parallel, digital RGB ports and I²C lines
- STLD40DPUR-based display back-light LED driver with controllable intensity
- Morpho connectors for expansion connectivity options
- Screw connectors for safer power supply and industrial IO connections
- USB connector for alternate 5 V source power supply (only for display powering and MCU programming/debug)
- Isolated USART port connector
- SWD connector for debugging and programming
- Status LEDs for inputs, outputs, and various fault conditions
- Debug LEDs
- Reset button
- Protections against surge, EMI, and input reverse voltage connection
- EMC pad and four-layer routing
- On-board RAM and serial Flash (ROM)
- Provision for RTC, USB (with one or more additional components to be mounted)
- Designed to meet IEC industrial standard requirements
- RoHS

1.3 Hardware architecture

The following block diagram shows the STEVAL-PLC001V1 architecture.

Figure 2. STEVAL-PLC001V1 functional block diagram
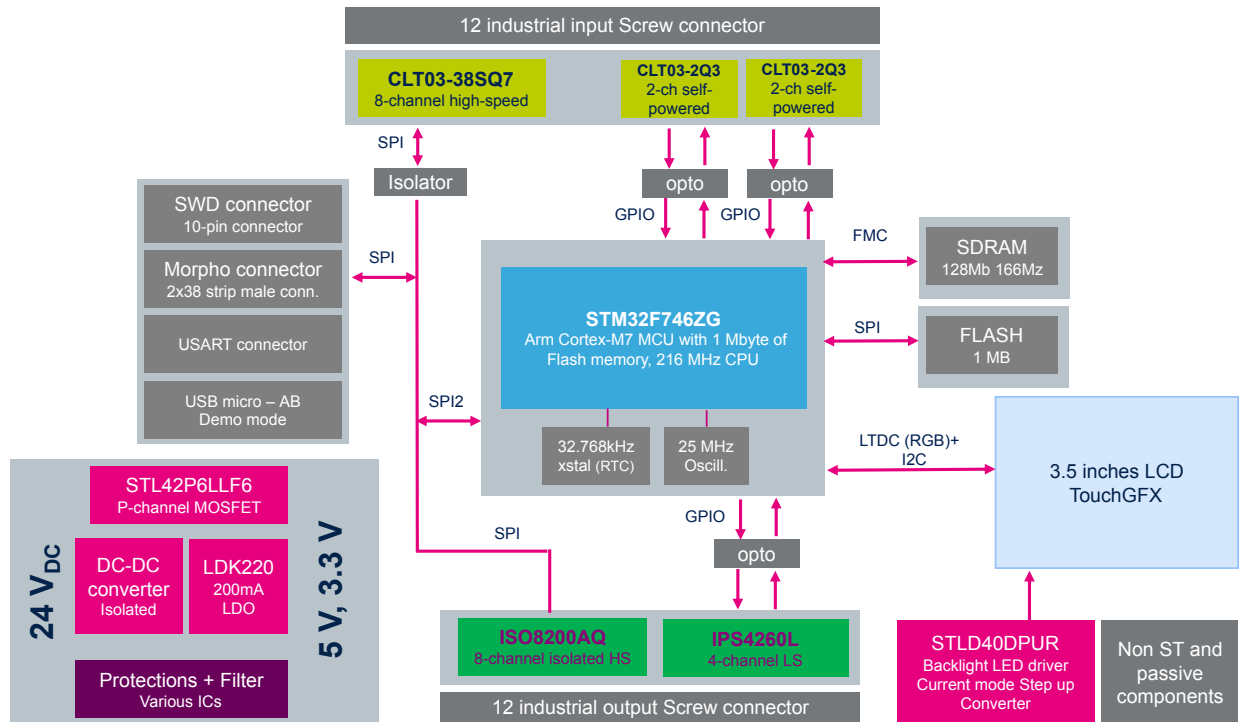
The main blocks are:

- the STM32F746ZGT7 microcontroller;
- twelve industrial inputs managed through the eight-channel CLT01-38SQ7 and the dual channel CLT03-2Q3 mounted twice;
- twelve industrial outputs on the bottom handled by other two dedicated ICs: the eight-channel ISO8200AQ and the four-channel IPS4260L.
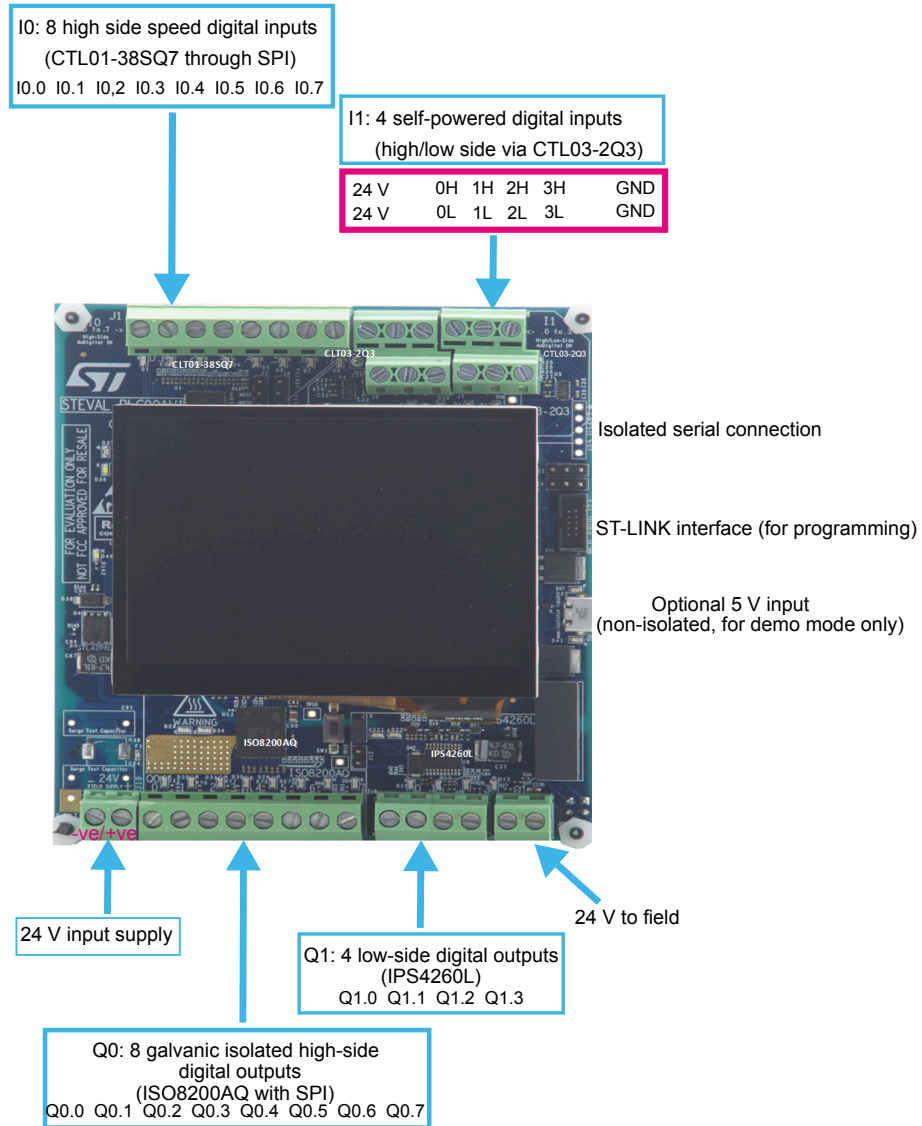
The architecture also includes a 3.5" TFT display powered by the TouchGFX graphics engine for great flexibility in industrial IO management, giving abstraction from the hardware on one side, and full featured use of the ICs on the other side.

The morpho connectors allow connecting expansion boards and the USB connector allows supplying the board in case a 24 V power supply is not available.

Note: *When powered through the USB port, the STEVAL-PLC001V1 has limited functionalities, as it works in demo mode, allowing display management and programming features but not high current rates on the industrial IOs.*

A screw connector in the bottom-left corner is provided to power the board. All other isolated and logic supply voltages derive from this 24 V input after appropriate conditioning.

A P-channel MOSFET ensures reverse polarity protection, while other ICs are for EMI and surge protections.

A screw connector in the bottom-right corner powers field side devices.

1.4 Board connections and components

Figure 3. STEVAL-PLC001V1 external connections

I0: 8 high side speed digital inputs
(CTL01-38SQ7 through SPI)
I0.0 I0.1 I0,2 I0.3 I0.4 I0.5 I0.6 I0.7

I1: 4 self-powered digital inputs
(high/low side via CTL03-2Q3)

| 24 V | 0H | 1H | 2H | 3H | GND |
| 24 V | 0L | 1L | 2L | 3L | GND |

Isolated serial connection

ST-LINK interface (for programming)

Optional 5 V input
(non-isolated, for demo mode only)

24 V to field

24 V input supply

Q1: 4 low-side digital outputs
(IPS4260L)
Q1.0 Q1.1 Q1.2 Q1.3

Q0: 8 galvanic isolated high-side
digital outputs
(ISO8200AQ with SPI)
Q0.0 Q0.1 Q0.2 Q0.3 Q0.4 Q0.5 Q0.6 Q0.7

Figure 4. STEVAL-PLC001V1 top components

1. CLT01-38SQ7 (U1) - high speed 8 digital inputs current limiter on SPI
2. CLT03-2Q3 (U4,U5) - self-powered digital input current limiter
3. EMIF08-LCD04M16 - 8-line L-C EMI filter and ESD protection for display interfaces
4. STL42P6LLF6 (Q4) - P-channel MOSFET (reverse voltage protection)
5. STLD40DPUR (U14) - white LED power supply for large display back-light
6. 40-pin FFC connector for LCD touch display (U15)
7. SM15T33CA (D39) - TVS diode
8. ISO8200AQ (U13) - galvanic isolated octal high side smart power solid state relay with SPI interface
9. IPS4260L (U8)- quad low-side intelligent power switch
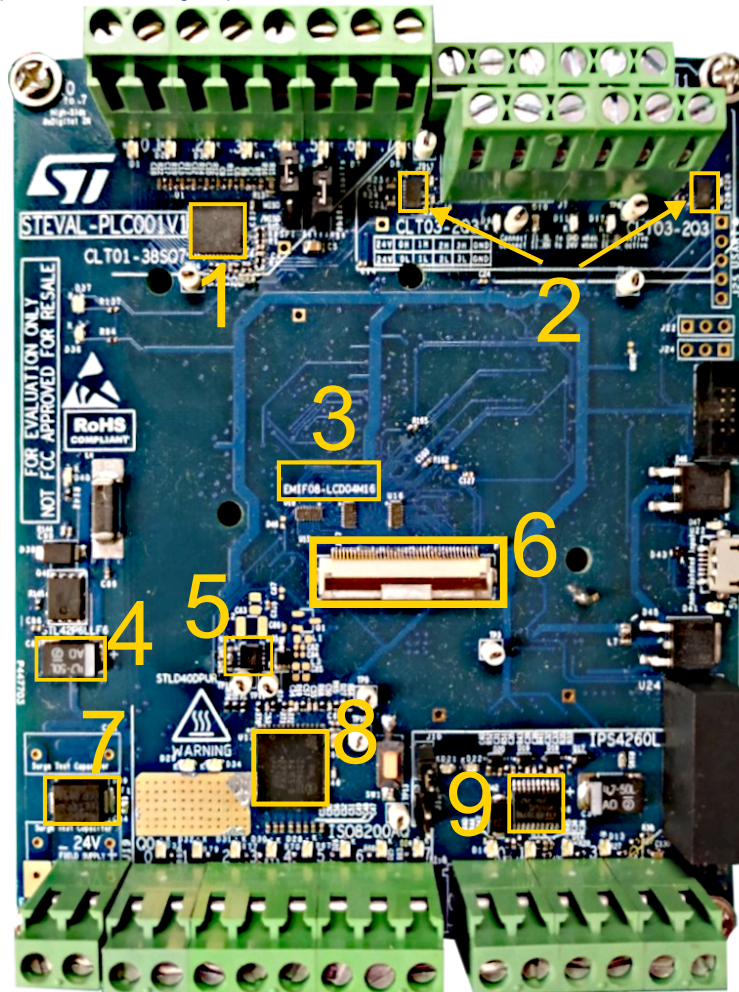
Figure 5. STEVAL-PLC001V1 bottom components

1. Morpho connector
2. Morpho connector
3. STM32F746ZGT7 (U27) - high-performance and DSP with FPU Arm Cortex-M7 MCU
4. RAM
5. Flash memory
6. Isolation boundary
7. MCU reset switch (S2)
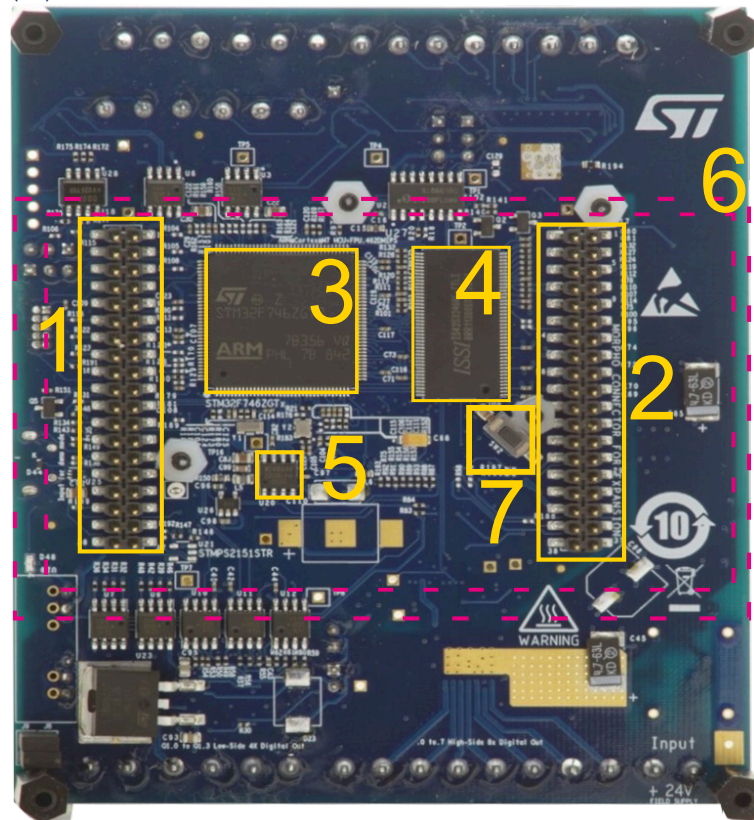
1.5 Main components

1.5.1 CLT01-38SQ7

The CLT01-38SQ7 is the 8-channel current limiter termination with high-speed SPI interface. The STEVAL-PLC001V1 features daisy chain connection via SPI for this IC, the ISO8200AQ on the output side and the morpho connectors. The three peripherals exploit daisy chain connection allowing less wiring on the PCB.

The CLT01-38SQ7 provides an 8-line protected digital input termination with serialized state transfer. It enhances the I/O module density by cutting the dissipation (78 mW per input) and reducing the count of opto-transistors. Its 6.25 MHz SPI peripheral output serializes the input state transfer to the I/O module controller.

Available in a 7x7 QFN package with 48 leads, the device complies with the following standards: IEC61000-4-2 (±8 kV contact discharge and ±15 kV air discharge), IEC61000-4-4 (±4 kV) and IEC61000-4-5 (input = ±1 kV, power supply = ±2.5 kV).

1.5.2 CLT03-2Q3

The CLT03-2Q3 is a digital input current limiter which drastically reduces the power dissipation of digital inputs. It does not require external power supply as the device is activated with the input signal and consumes no power in off state.

The CLT03-2Q3 features two independent channels and is high-side, low-side and reverse plug-in compatible. It can drive opto-couplers or 3.3 V LVTTL circuits.

The STEVAL-PLC001V1 hosts two CLT03-2Q3 in a 16-lead QFN package to reach a 12-input array. The device enables industrial inputs to meet type 1 and 3 characteristic of IEC 61131-2 standard, while the IC complies with the following standards:

- IEC 61000-4-2 level 1: ±4 kV (air discharge)
- IEC 61000-4-2 level 1: ±2 kV (contact discharge)

1.5.3 ISO8200AQ

The ISO8200AQ is a galvanic isolated 8-channel driver featuring a very low supply current. It embeds two independent galvanic isolated voltage domains (V_{CC} and V_{DD} for process and control logic stages, respectively). The IC is designed to drive any kind of load (inductive, resistive or capacitive) with one side connected to ground.

The control logic stage features an 8-bit output status register (where the microcontroller sets the ON/OFF status of the output channels in the process stage) and an 8-bit fault register (where the OVT faults of each channel are stored). The two stages communicate through the galvanic isolation channel via an ST proprietary protocol.

Active channel current limitation (OVL) combined with thermal shutdown (OVT), independent for each channel, protects the device against overload and overtemperature. Additional embedded functions include loss of ground protection, V_{CC} and V_{DD} UVLOs (with hysteresis), watchdog and V_{CC} PGOOD.

An internal circuit provides an OR-wired not latched common (FAULT) indicator signaling the channel OVT. The PGOOD diagnostic pin is activated if V_{CC} falls below the power good internal threshold. Both FAULT and PGOOD pins are open drain, active low, fault indication pins.

The device is UL1577 certified and is designed to meet IEC 61000-4-2, IEC 61000- 4-4, IEC 61000-4-5 and IEC 61000-4-8 standards. The package is TFQFPN32.

1.5.4 IPS4260L

The IPS4260L is a monolithic high speed (F_{SW} up to 250 kHz) device, which can drive four independent capacitive, resistive, or inductive loads with one side connected to the supply voltage. The channels can be paralleled to reduce power dissipation.

When connected to V_{CC} rail, four integrated catch diodes clamp the turn-off transients generated by inductive loads even with huge inductance; combined with proper external TVS connected to V_{CC} or to GND the IC allows fast decay, too. Each channel is protected against overload or short-circuit: the intervention level can be set by an external resistor on I_{LIM} pin (see device data sheet for details). Built-in thermal shutdown protects the chip against overtemperature even in case of short-circuit. If enabled, the integrated cut-off protection features a non-dissipative protection in case of overload; it limits both the output average current value and, consequently, the device overheating.

Cut-off delay/restart can be programmed by external resistors on CoD pin; it can be disabled by shorting CoD to GND. Two common diagnostic open drains pins (OL, for open load and FLT for cut-off and thermal shutdown) together with the four open drain on each INx pin (cut-off and thermal shutdown) feature an extensive diagnostic of the chip.

The package is a miniaturized HTTSSOP20 and is designed to meet IEC 61131-2 standard.

1.5.5 STM32F746ZG

The STM32F746ZG microcontroller is the core of our evaluation board and is responsible for the management of all industrial I/O ICs and for the HMI running on the 3.5 display with the TouchGFX technology.

The STM32F746xx devices are based on the high-performance ARM® Cortex®-M7 32-bit RISC core operating at up to 216 MHz frequency. The Cortex®-M7 core features a single floating point unit (SFPU) precision which supports all ARM® single-precision data-processing instructions and data types. It also implements a full set of DSP instructions and a memory protection unit (MPU) which enhances the application security.

The STM32F746xx devices incorporate high-speed embedded memories with a Flash memory up to 1 Mbyte, 320 Kbytes of SRAM (including 64 Kbytes of Data TCM RAM for critical real-time data), 16 Kbytes of instruction TCM RAM (for critical real-time routines), 4 Kbytes of backup SRAM available in the lowest power modes, and an extensive range of enhanced I/Os and peripherals connected to two APB buses, two AHB buses, a 32-bit multi-AHB bus matrix and a multi-layer AXI interconnect supporting internal and external memories access.

All the MCUs in this family offer three 12-bit ADCs, two DACs, a low-power RTC, thirteen general-purpose 16-bit timers including two PWM timers for motor control and one low-power timer available in stop mode, two general-purpose 32-bit timers, a true random number generator (RNG). They also feature standard and advanced communication interfaces. For further details, see the device data sheet.

The LCD-TFT controller interface with dual-layer support takes advantage of the Chrom-ART Accelerator. This graphics accelerator creates content twice as fast as the core alone and features 2-D raw data copy, image format conversion and image blending.

1.6 Digital inputs and outputs

The 12 digital inputs are arranged in groups of 8 and 4 channels. On the terminal block, they marked as I0 with 8 channels and provide 8 high side inputs to CLT01-38SQ7. Each channel is marked as I0.x (i.e. from I0.0 to I0.7). Four high/low inputs for the two CLT03-2Q3 are accessible in the terminal block I1 (channels I1.0 to I1.3).

The 12 digital outputs are grouped similarly in two terminal blocks. 8 channels from IS08200AQ are marked Q0 on the terminal block, while 4 low side outputs from IPS4260L are in the terminal block Q1.

Input and output terminals are placed symmetrically.

1.7 Power distribution on the board

The STEVAL-PLC001V1 evaluation board is designed to work with 24 V nominal power supply. The MCU and logic circuit are galvanically isolated from the field side circuit.

STL42P6LLF6 P-Channel MOSFET is crucial for the reverse polarity protection circuit ensuring low voltage drop and high current capability in addition to quick response time. The board also provides suitable surge protection and noise filtering.

Figure 6. Power and logic connections
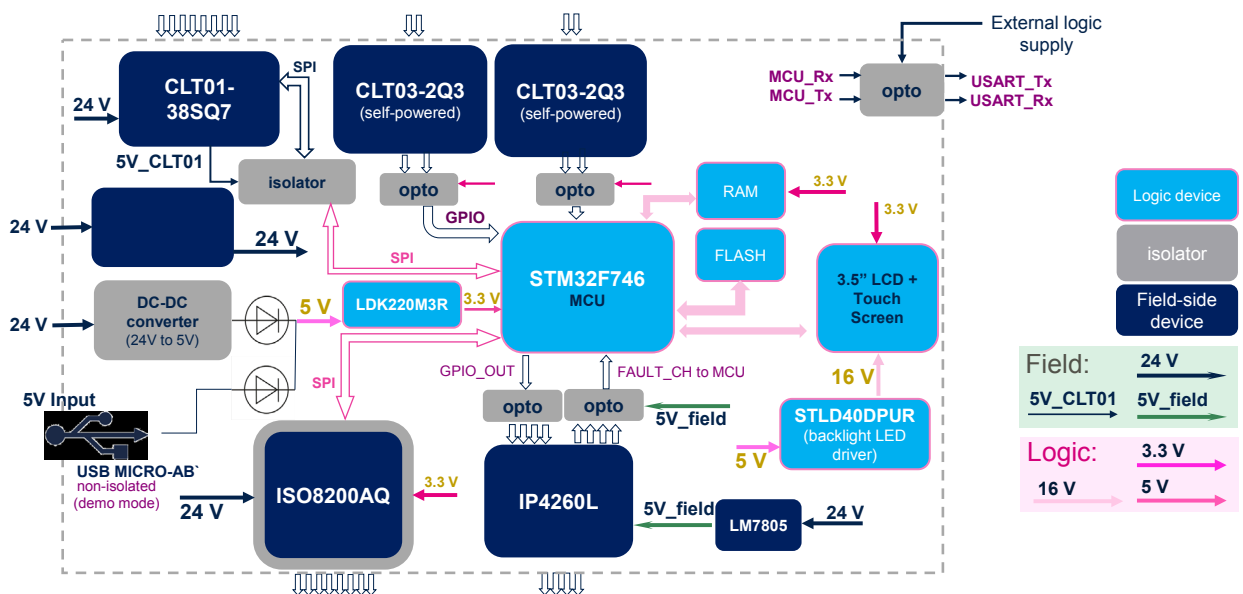
STLD40D is a boost converter (5 V supply to ~18 V) needed for the LCD back-light. The converter is a pulse frequency modulation (PFM) inductor switch that can work in discontinuous mode (DCM). A minimum OFF time of the embedded TSW boost switch is fixed internally and allows limiting the switching frequency. The output current capability is 20 mA with an output voltage of 37 V (maximum rating). The regulation is done by sensing the LED current through a current resistor (R86). The device can be turned ON/OFF through the logic enable signal pin (EN). A low frequency PWM signal is used to dim the LCD back-light.

1.8 MCU interfaces and pin allocation

The SPI-2 interface is shared between CLT01-38SQ7 and ISO8200AQ with separate chip-select lines from the MCU. CLT03-2Q3 and IPS4260L are interfaced through GPIO pins.

The ISO8200AQ and IPS4260L fault indications are interfaced with the MCU through dedicated GPIO inputs. Two debug LEDs (D36, D39) are controlled through GPIO output.

The TFT display is connected through dedicated pins in RGB16 mode. i2C4 is used to interface the touch sensor with the display. The touchscreen resolution is 800x480 while LCD screen resolution is 320x240. Thus, scaling is applied to find the touch corresponding to the point on the LCD.

Morpho connectors (J17, J18) gives provision for connectivity with compatible boards such as STEVAL-IOM001V1 if you want to add IO-Link master capabilities to our PLC.

For further details on MCU interfaces, see Section Appendix A   which summarizes the information contained in the *.ioc* file provided with the STSW-PLC001 firmware and the schematic.

1.9 External memory interface

Serial Flash (U20) interfaces with the MCU via SPI5. The size of the serial flash is 1 Mbits. The address for read/write is in the range of 0x000000 to 0x01FFFF. Sample read/write routines are provided in the firmware.

The FMC controller inside STM32 accesses the SDRAM (U19). In this application, 12 bit addressing is used along with 16-bit data line. The HADDR[28] bit is used to select one of the two memory banks in the example code. However, the memory can be used in 8-bit, 16-bit or 32-bit mode.

1.10 Jumper selection, LED indicators and test points

The recommended jumper settings for default option in the firmware are:

- for module I0: J2 – Pin 1, 2 short (MISO); J4 pin 3-2 short (8-bit mode)
- for module Q1: J10, J12 closed and J8 and J9 open

Table 1. LED indicators

Type	Name	Description
Power indication	D40	Board input power indicator.
Power Good and Fault	D29, D34	Fault indication for ISO8200AQ IC.
Fault and Overload	D21, D22	Fault Indication for IPS4260L.
Debug	D36 (amber), D37 (blue)	To indicate program heartbeat, fault condition, etc. as per use case.
Input status	D1-D8 D9-D12	Status of digital inputs.
Output status	D24-D33 D13-D16	Status of digital outputs.

Note: *D22 is triggered by the OL pin of IPS4260L, which indicates open load condition or short to ground condition. Open load detection feature is activated by placing proper resistors between LOADx and PGND ground plane.*

In the STEVAL-PLC001V1 evaluation board, there are resistors placed for open load detection for the Q1.X four outputs. For Q1.2 and Q1.3, instead, they are activated only if J8 and J9 jumpers are closed. Thus, the Fault LED (D22) might glow when there is no load connection or partial connection to output terminals.

Numerous test points are provided on the board (see Section 4 Schematic diagrams).

2 How to run the evaluation board with the preloaded firmware

To run the STEVAL-PLC001V1 evaluation board with the STSW-PLC001 preloaded firmware, you have two possibilities to power the board up:

1. through the micro-USB connector with an appropriated power supply (i.e. 5 V, 1 A): with this option, you can access limited board functions like programming/debugging through the SWD connector or use the touchscreen display to show the features of the industrial ICs mounted on the board. This mode is intended for demonstration only or to use MCU logic circuit only;

2. through the screw connector (24 V) placed in the bottom-left corner: this option offers the complete experience with the STEVAL-PLC001V1, that is all programming/debugging and display features can be executed, and the industrial I/O can be handled with the highest possible current ratings allowed by the ICs (i.e. you can drive several output loads requiring up to 0.7 A of current each through the output screw connector placed on the bottom side).

STSW-PLC001 provides the framework to use all the STEVAL-PLC001V1 modules including TouchGFX-based HMI. After powering up, you just have to select one of the user modes through the touchscreen.

3 Firmware overview and architecture

The STSW-PLC001 companion software package is available for download at www.st.com. It is designed as a development tool for industrial PLCs.

To use the STEVAL-PLC001V1 board and the associated firmware, power supply the board (24 V or through a portable USB power supply) and play with the user interface powered by the TouchGFX technology featuring HMI capabilities. Freely customizable C-code written examples are also provided to speed up the development time.

Figure 7. STSW-PLC001 block diagram
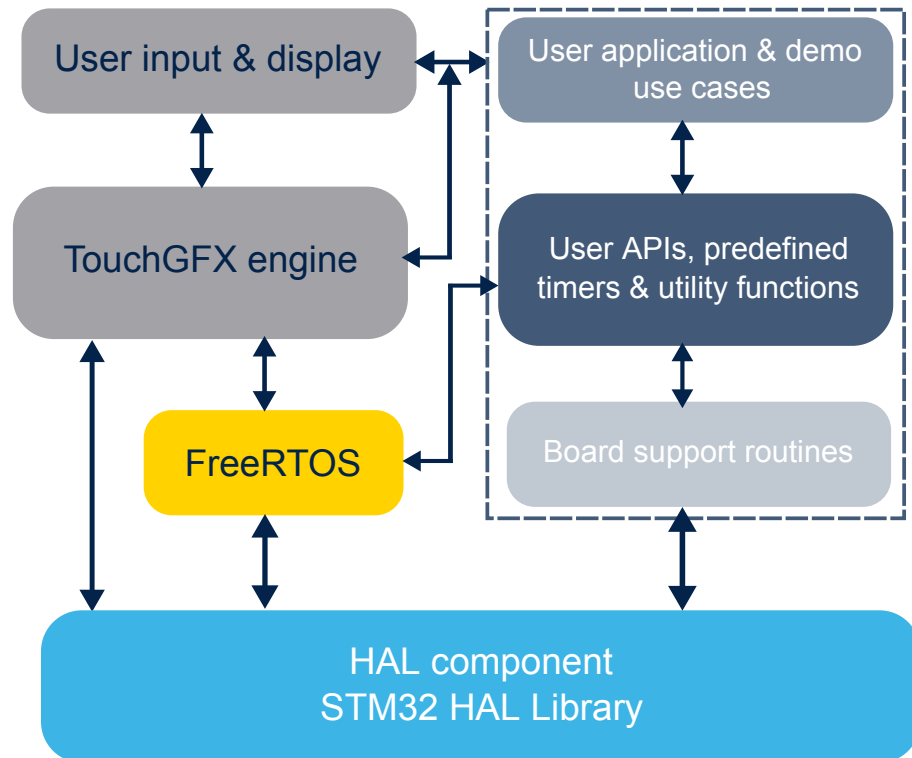
For further details on user APIs, touch display engine and demonstration use-cases, refer to the STSW-PLC001 user manual (UM2938, freely available on www.st.com).
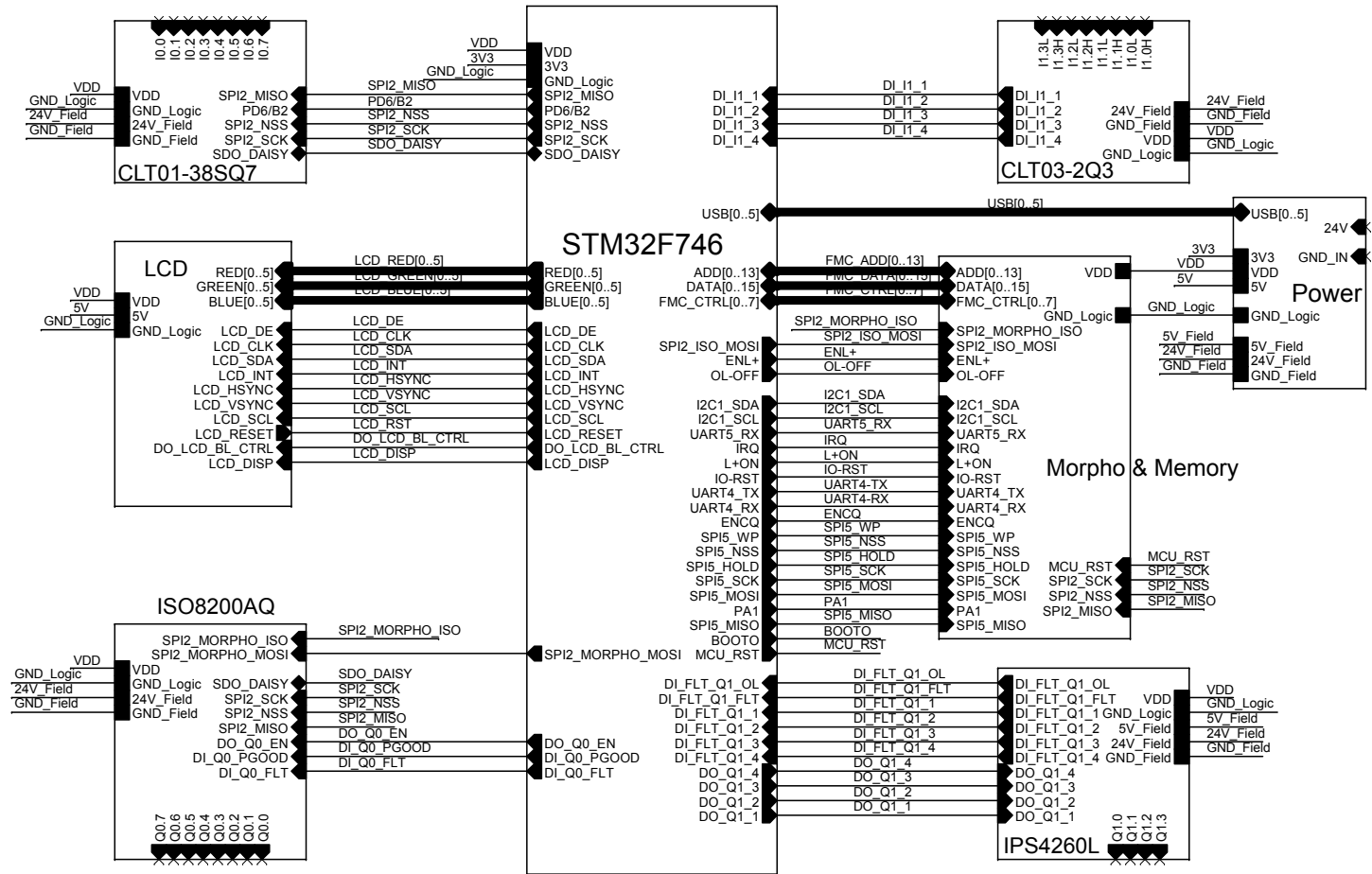
Figure 8. STEVAL-PLC001V1 circuit schematic (1 of 9)

Figure 9. STEVAL-PLC001V1 circuit schematic (2 of 9)

CLT01-38SQ7

INPUT

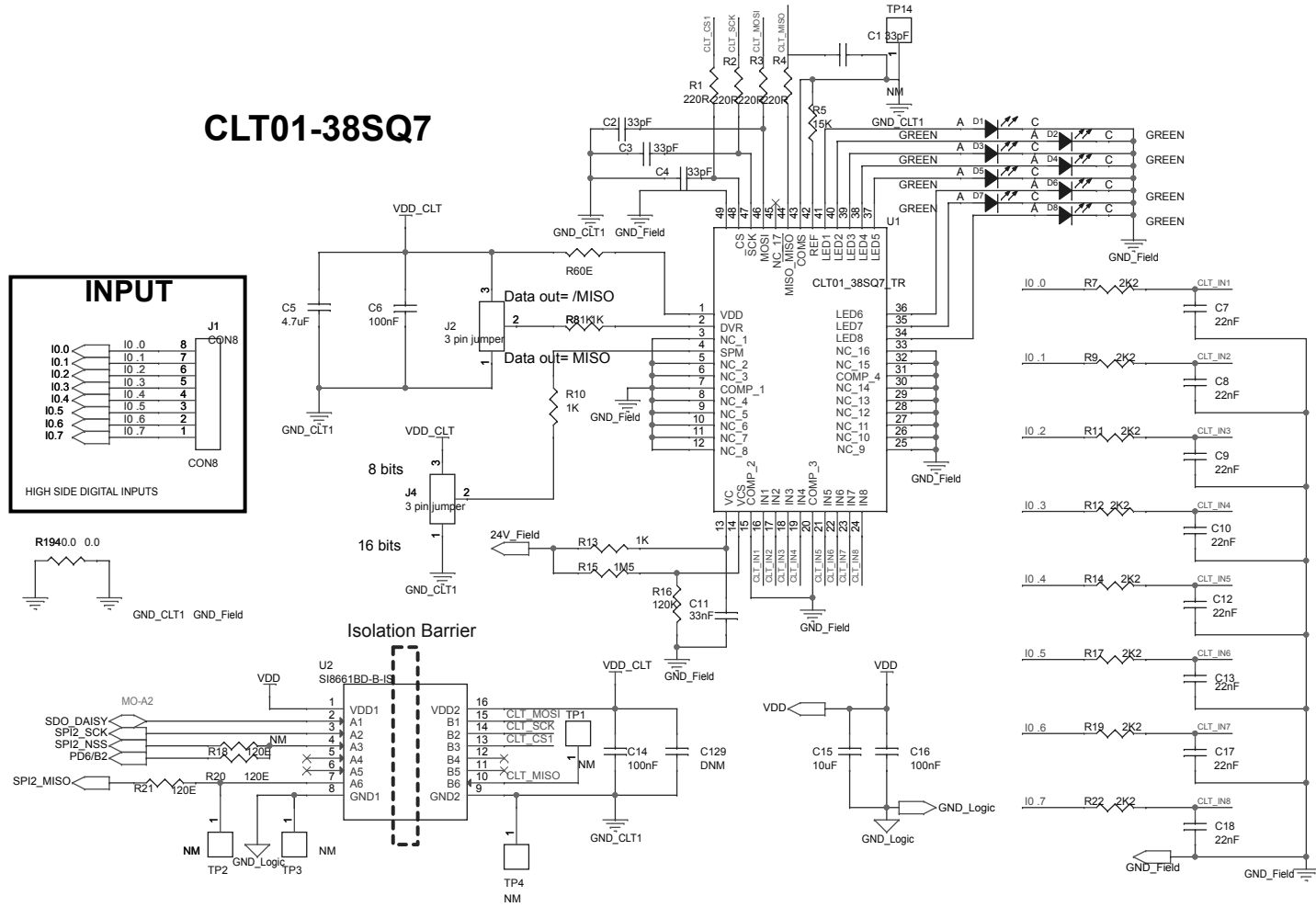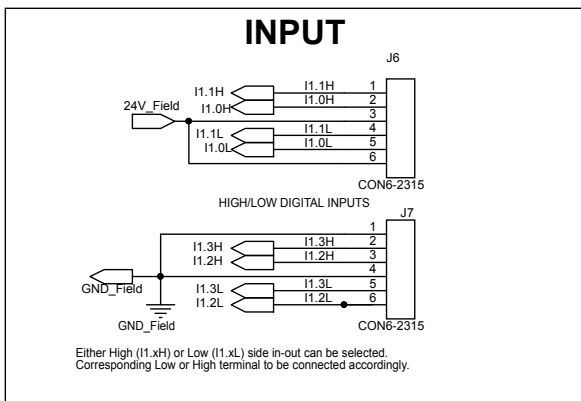HIGH SIDE DIGITAL INPUTS

CON8

Isolation Barrier
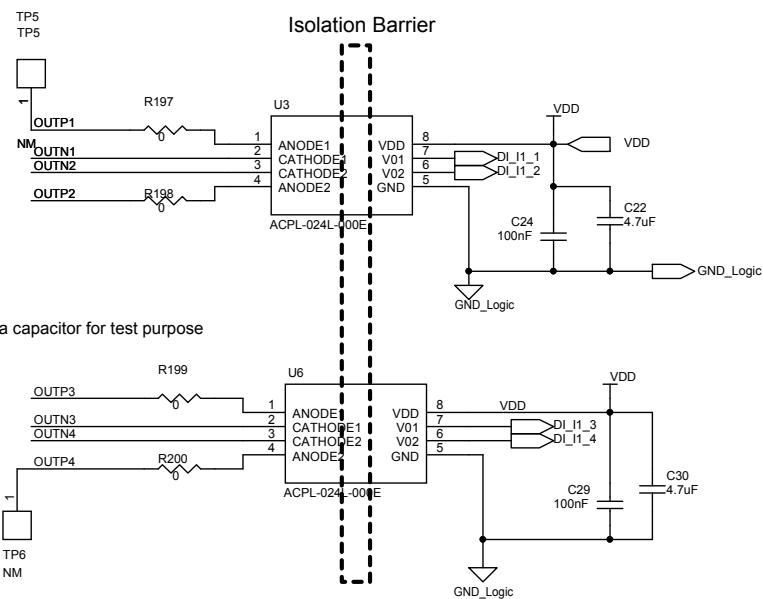
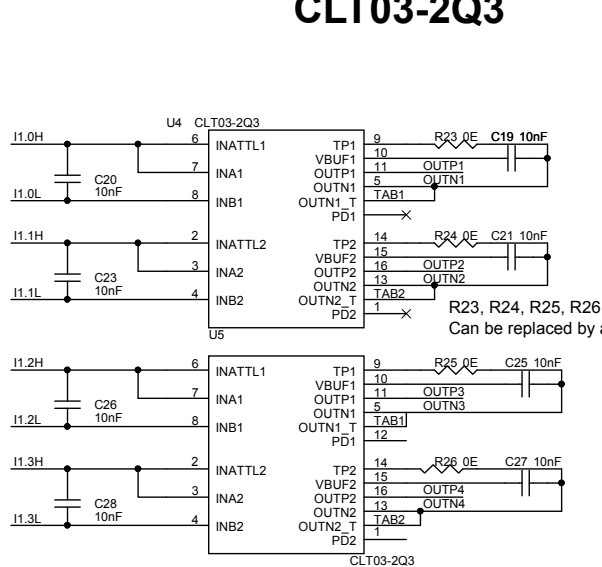**Figure 10. STEVAL-PLC001V1 circuit schematic (3 of 9)**

CLT03-2Q3

Isolation Barrier

R23, R24, R25, R26
Can be replaced by a capacitor for test purpose

INPUT

J6

24V_Field

HIGH/LOW DIGITAL INPUTS

J7

GND_Field

Either High (I1.xH) or Low (I1.xL) side in-out can be selected.
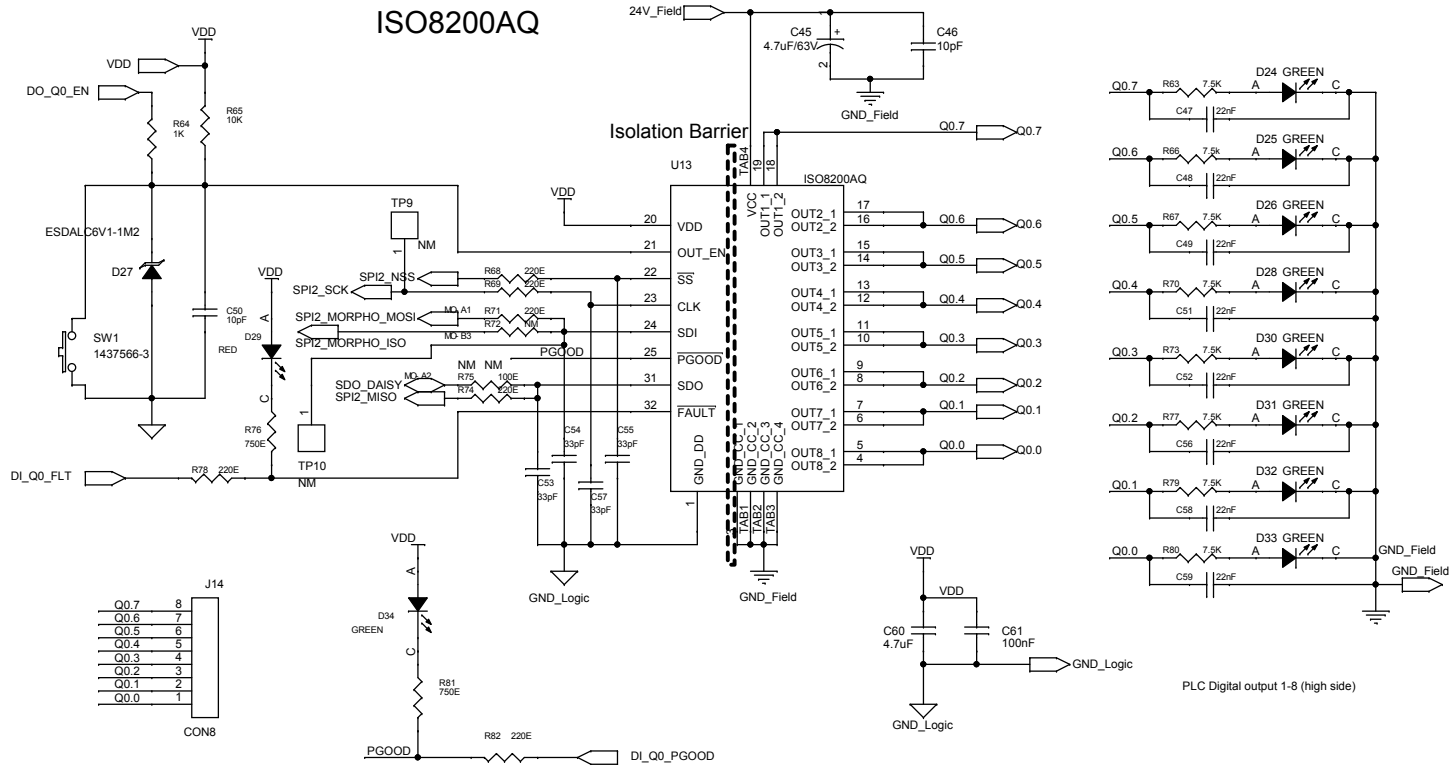Corresponding Low or High terminal to be connected accordingly.
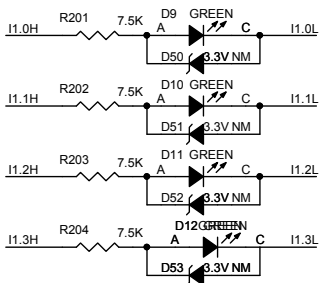
Figure 11. STEVAL-PLC001V1 circuit schematic (4 of 9)

ISO8200AQ

PLC Digital output 1-8 (high side)

Figure 12. STEVAL-PLC001V1 circuit schematic (5 of 9)
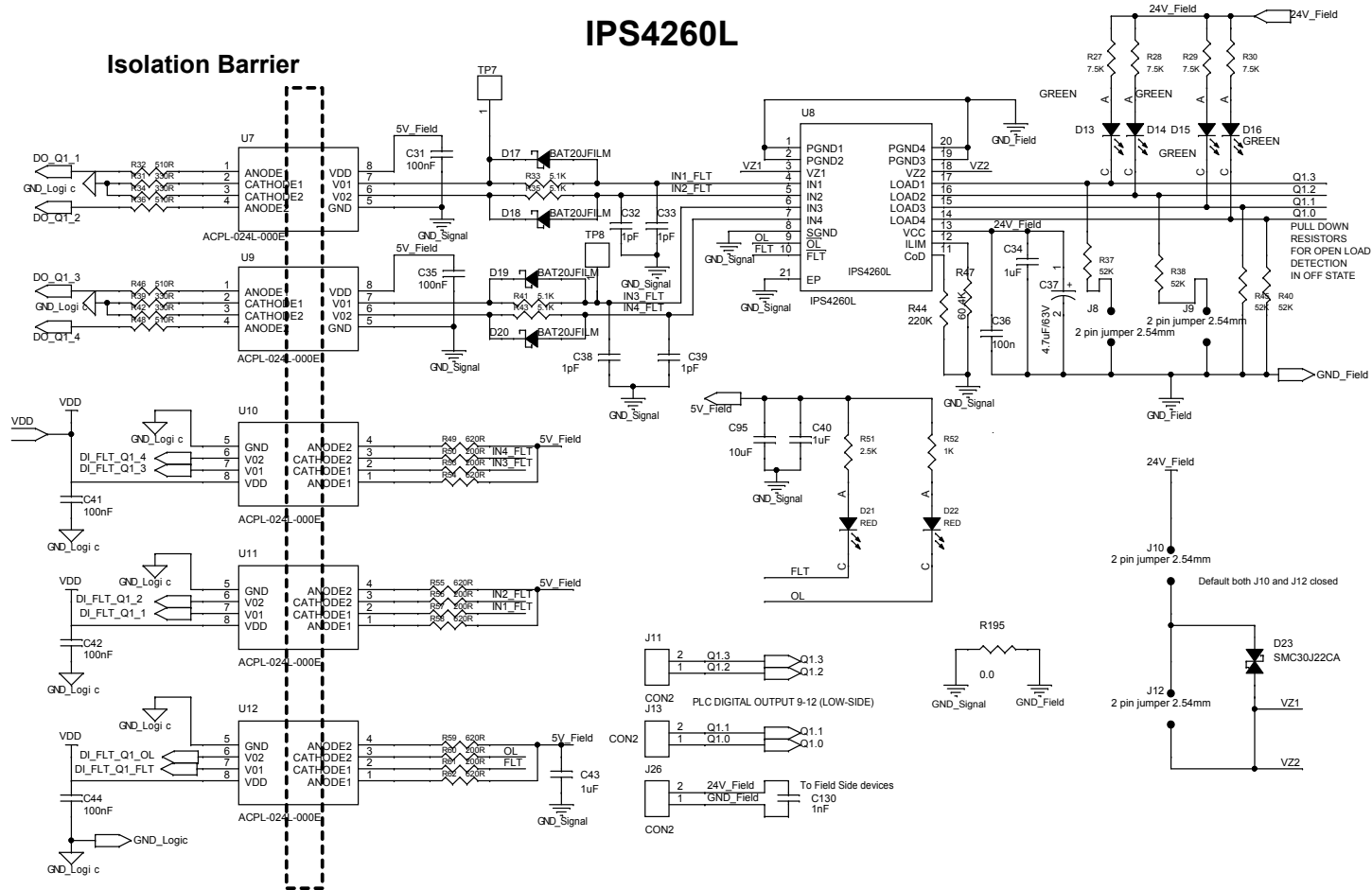
IPS4260L

Isolation Barrier
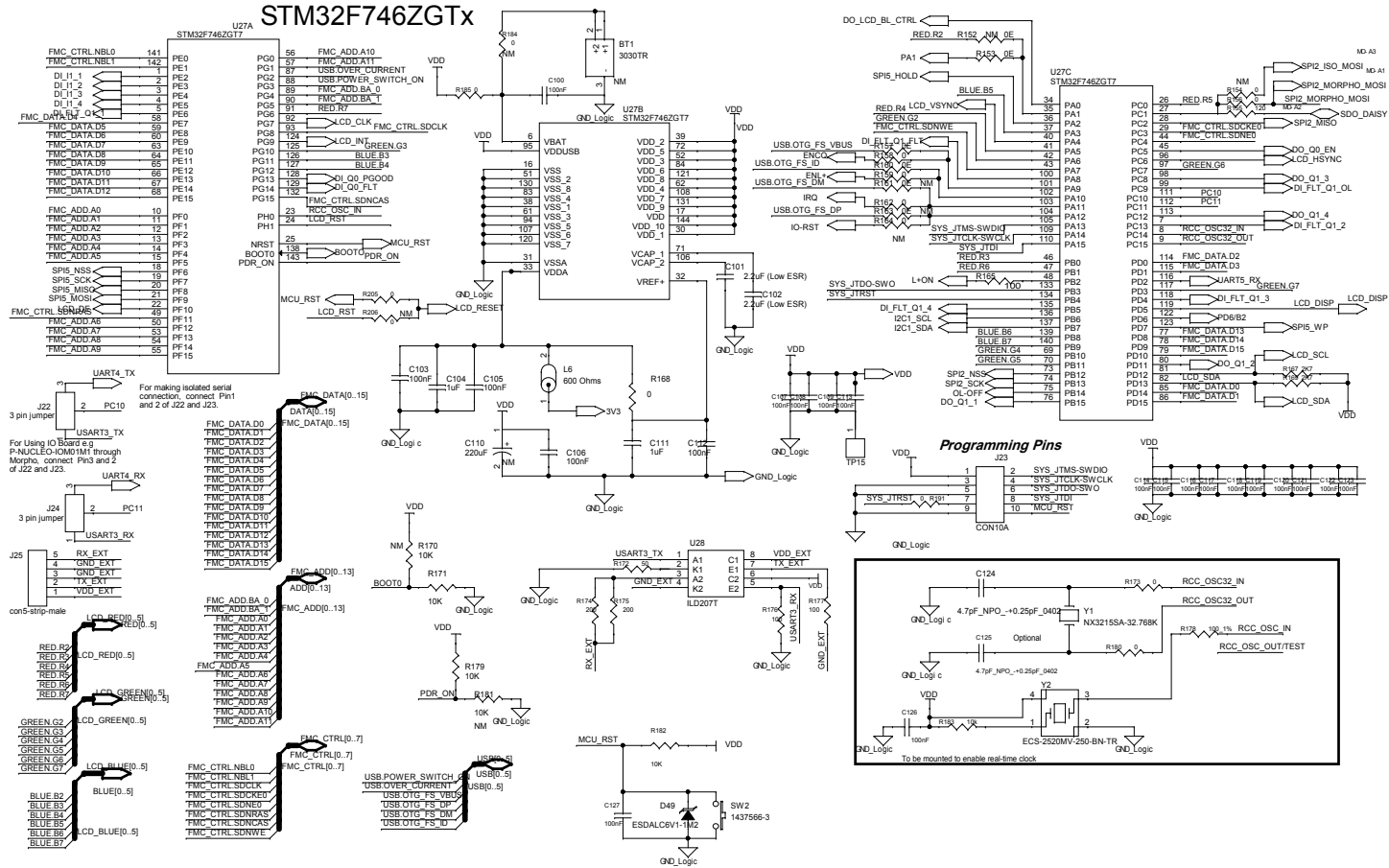
Figure 13. STEVAL-PLC001V1 circuit schematic (6 of 9)

Figure 14. STEVAL-PLC001V1 circuit schematic (7 of 9)

Morpho & Memory

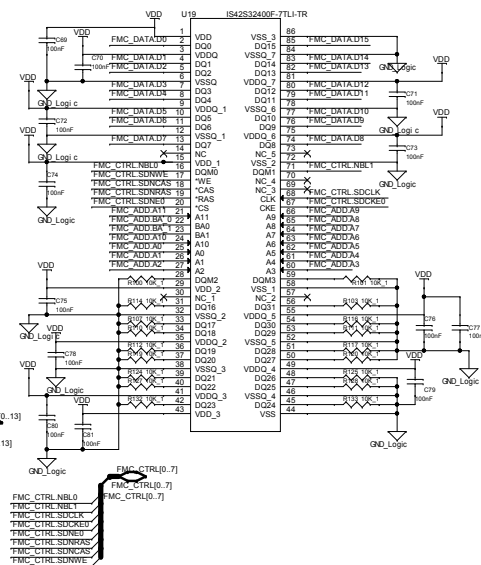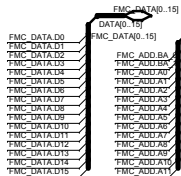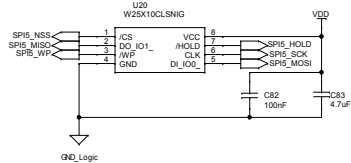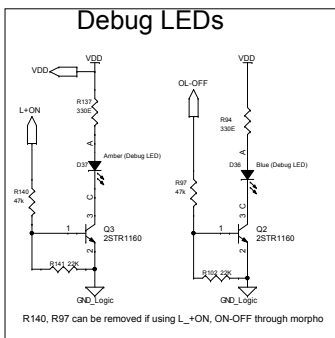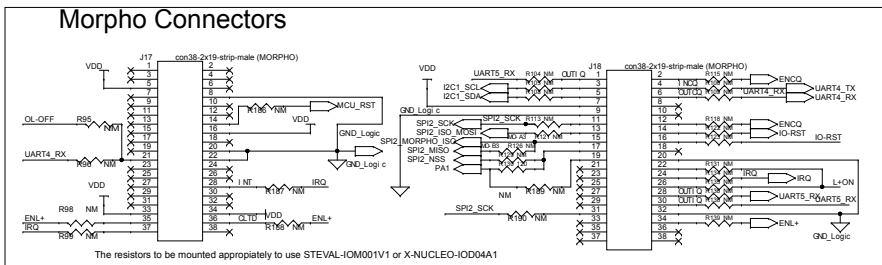## Figure 15. STEVAL-PLC001V1 circuit schematic (8 of 9)

LCD

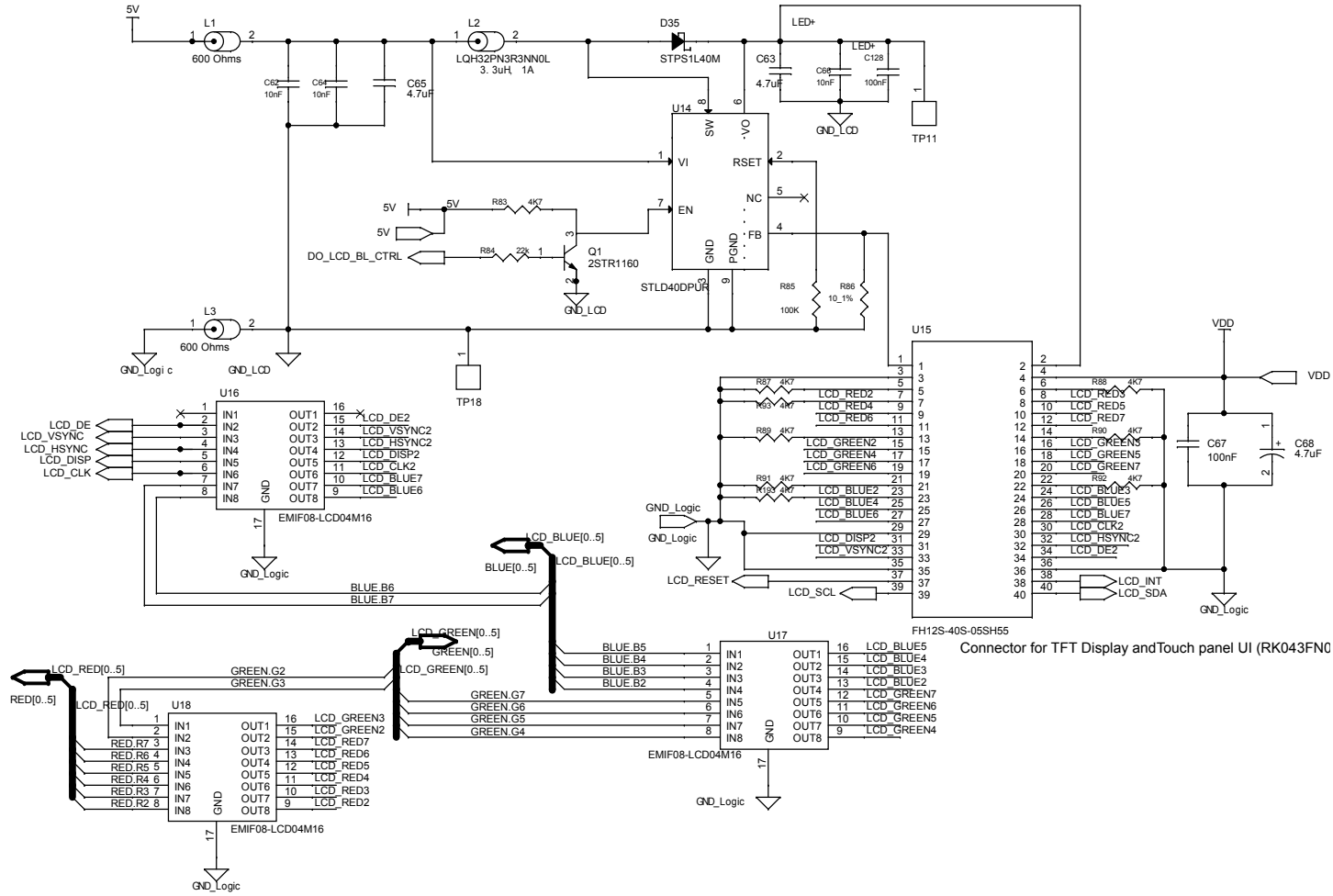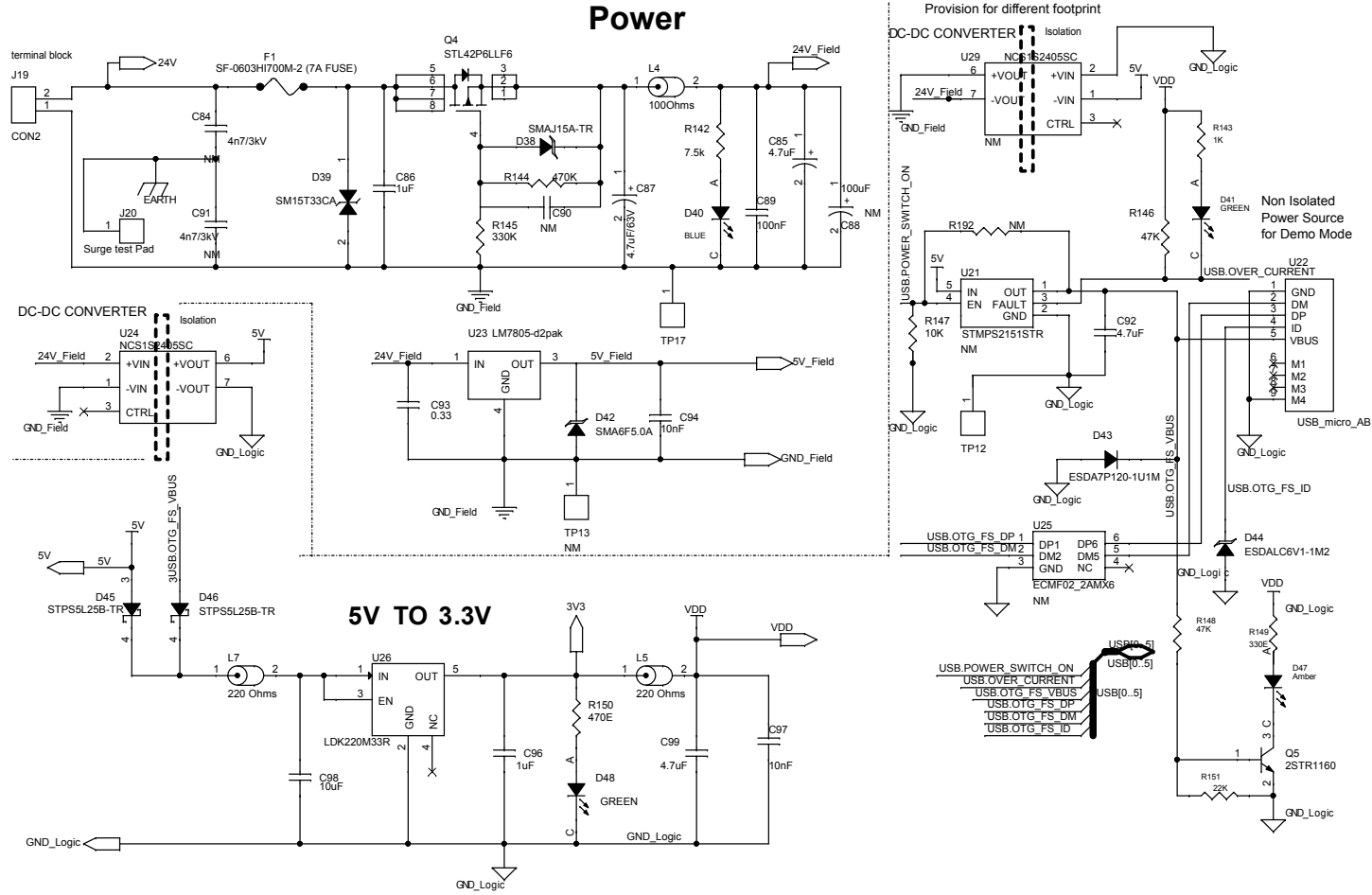**Figure 16. STEVAL-PLC001V1 circuit schematic (9 of 9)**

Power

5 Bill of materials

Table 2. STEVAL-PLC001V1 bill of materials

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
1	1	BT1	3030TR	Battery holder (not mounted)	Keystone Electronics	3030TR
2	8	C1 C2 C3 C4 C53 C54 C55 C57	33 pF, 0402 (1005 Metric), 10 V, +/-5%, SMD	Ceramic capacitors	Wurth Elektronik	885012005028
3	1	C5	4.7 µF, 0805 (2012 Metric), 25 V, +/-20%, SMD	Ceramic capacitor	Wurth Elektronik	885012107018
4	4	C6,C14,C31 C35	100 nF, 0402 (1005 Metric), 10 V, +/-20%, SMD	Ceramic capacitors	Wurth Elektronik	885012105010
5	16	C7 C8 C9 C10 C12 C13 C17 C18 C47 C48 C49 C51 C52 C56 C58 C59	22 nF, 0402 (1005 Metric), 50 V, +/-5%, SMD	Ceramic capacitors	Murata Electronics	GCM155R71H223JA55D
6	1	C11	33 nF, 0402 (1005 Metric), 50 V, +/-10%, SMD	Ceramic capacitor	Murata Electronics	81-GCM155R71H333KE2D
7	43	C16 C24 C29 C41 C42 C44 C61 C67 C69 C70 C71 C72 C73 C74 C75 C76 C77 C78 C79 C80 C81 C82 C100 C103 C105 C106 C107 C108 C109 C112 C113 C114 C115 C116 C117 C118 C119 C120 C121 C122 C123 C126 C127	100 nF, 0402 (1005 Metric), 10 V/6.3 V, +/-10%, SMD	Ceramic capacitors	Wurth Elektronik	885012205018
8	1	C15	10 µF 0603, (1608 Metric), 6.3 V, +/-20%, SMD	Ceramic capacitors	Wurth Elektronik	885 012 106 006
9	7	C19 C21 C25 C27 C62 C64 C97	10nF, 0402 (1005 Metric), 16 V/25 V, +/-10%, SMD	Ceramic capacitors	Wurth Elektronik	885012205031/885012205050
10	1	C66	10 nF, 0402 (1005 Metric), 50 V, SMD	Ceramic capacitor (not mounted)	Wurth Elektronik	
11	4	C20 C23 C26 C28	10 nF, 0402 (1005 Metric), 100 V, +/-10%, SMD	Ceramic capacitors	Yageo	CC0402KRX7R0BB103
12	5	C22 C30 C60 C83 C92	4.7 µF, 0805 (2012 Metric), 6.3 V, +/-10%, SMD	Ceramic capacitors	Wurth Elektronik	885012207002

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
13	4	C32 C33 C38 C39	1 pF, 0402 (1005 Metric), 10 V, SMD	Ceramic capacitors	Wurth Elektronik	885012005001
14	2	C34 C86	1 µF, 0402 (1005 Metric), 50 V, SMD	Ceramic capacitors	Taiyo Yuden	UMK105CBJ105KV-F
15	3	C36 C89 C128	100 nF, 0402 (1005 Metric), 50 V, SMD	Ceramic capacitors	Murata Electronics	GRM155R62A104KE14D
16	4	C37 C45 C85 C87	4.7 µF, 2917 (7343 Metric), 63 V, +/-10%	Capacitors	Vishay / Sprague	293D475X9063D2TE3
17	3	C40 C43 C96	1 µF, 0402 (1005 Metric), 10 V, SMD	Ceramic capacitors	Yageo	CC0402KRX5R6BB105
18	2	C46 C50	10 pF, 0402 (1005 Metric), 50 V, SMD	Ceramic capacitors	Wurth Electronik	885012005055
20	1	C63	4.7 µF, 0805(2012 Metric), 50 V, SMD	Ceramic capacitor	TDK	C2012X7R1H475K125AC
21	2	C65 C99	4.7 µF, 0603 (1608 Metric), 25 V, SMD	Ceramic capacitors	Murata	GRM188R61E475KE11D
22	1	C68	4.7 µF, SMD, 3216-12, 10 V, +/-20%	Capacitor	AVX	TAJS475M010RNJ
23	2	C84 C91	4n7/3kV, radial disc, +/-20%	Safety capacitors (not mounted)	Vishay / BC Components	VY1472M63Y5UQ63V0
25	1	C88	100 µF, radial-SMD, 8x10mm, 50 V	Electrolytic aluminium capacitor (not mounted)	Wurth Elektronik	-
27	1	C90	0402 (1005 Metric), 50V	Ceramic capacitor (not mounted)	Wurth Elektronik	-
28	1	C93	330 nF, 0805 (2012 Metric), 50 V, SMD	Ceramic capacitor	Wurth Elektronik	885012207101
29	1	C94	10 nF, 0402 (1005 Metric), 10 V, SMD	Ceramic capacitor	Wurth Elektronik	885012205012
30	1	C95	10 µF, 0805 (2012 Metric), 10 V, SMD	Ceramic capacitor	Wurth Elektronik	885012107010
31	1	C98	10 µF, 0402 (1005 Metric), 10 V, SMD	Ceramic capacitor	Yageo	CC0402MRX5R6BB106
32	2	C101 C102	2.2 µF (low ESR), 0402 (1005 Metric), 6.3 V, SMD	Ceramic capacitors	TDK	C1005JB0J225M050BC

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
33	1	C110	220 µF SMD, 6032-28, 10 V	Capacitor (not mounted)	Wurth Elektronik	-
34	2	C104 C111	1 µF, 0402 (1005 Metric), 6.3 V, SMD	Ceramic capacitors	Taiyo Yuden	JMK105BJ105KV8F
35	2	C124 C125	4.7 pF NPO - +0.25 pF, 0402 (1005 Metric), 6.3 V, SMD	Ceramic capacitors	Yageo	CC0402CRNPO9BN4R7
36	1	C129	100 nF, 0402 (1005 Metric), 10 V, SMD	Ceramic capacitor (not mounted)	Wurth Elektronik	-
37	1	C130	1 nF 0603, (1608 Metric), 63 V, SMD	Ceramic capacitor	Kemet	C0603C102KMRECAUTO
38	25	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14 D15 D16 D24 D25 D26 D28 D30 D31 D32 D33 D48	Green, 0603 (1608 Metric), 2 V, 5 mA, 30 mW	Standard LEDs	Lumex	SML-LXFP0603SUGCTR
39	1	D41	Green, 0603 (1608 Metric), 1.8 V, 2 mA	Standard LED	Kingbright	APT1608LZGCK
40	4	D17 D18 D19 D20	SC-90, SOD-323F, 23V, 1A	23 V, 1 A general purpose signal Schottky diode	ST	BAT20JFILM
41	3	D21 D22 D29	Red, 0603, (1608 Metric), 2 V (VF), 5 mA, 30 mW	LEDs	Lumex	SML-LXFP0603SIC-TR
42	1	D23	SMC30J22CA, DO-214AB, SMC, VRM, 22 V	3000 W, 22 V TVS in SMC	ST	SMC30J22CA
43	3	D27 D44 D49	ESDALC6V1-1M2, SOD-882, 50 W	Single line low capacitance Transil transient surge voltage suppressor (TVS) for ESD protection	ST	ESDALC6V1-1M2
44	3	D34 D37 D47	Amber, 0603 (1608 Metric), 2 V, 20 mA, 48 mW	Standard LEDs	Wurth Elektronik	150060AS75020
45	2	D36 D40	Blue, 0603 (1608 Metric), 2.8 V, 5 mA	Standard LEDs	Kingbright	APT1608VRCXF/A-5MAV
46	4	D50,D51,D52, D53	SOD-123, 900mv @ 10mA, 7.5uA @1.5 V, 500 mW	Zener diode (not mounted)	ON Semiconductor	MMSZ4684T1G

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
47	1	D35	STPS1L40M, DO-216AA, 460 mV @ 1 A	40 V, 1 A STmite low drop power Schottky rectifier	ST	STPS1L40M
48	1	D38	SMAJ15A-TR, DO-214AC, SMA, 400 W	400 W TVS in SMA	ST	SMAJ15A-TR
49	1	D39	SM15T33CA, DO-214AB, SMC	1500 W, 33 V TVS in SMC	ST	SMCJ33CA-TR
50	1	D42	SMA6F5.0A, DO-221AC, SMA Flat Leads, 5 V, 600 W	600 W, 5 V TVS in SMA Flat	ST	SMA6F5.0A
51	1	D43	ESDA7P120-1U1M, 0603 (1610 Metric), 1400 W, 1.4 kW	High-power transient voltage suppressor	ST	ESDA7P120-1U1M
52	2	D45 D46	STPS5L25B-TR, TO-252-3, DPak (2 Leads + Tab), SC-63, 470 mV @ 5 A	25 V, 5 A low drop power Schottky rectifier	ST	STPS5L25B-TR
53	1	F1	SF-0603HI700M-2 (7 A fuse), 0603 (1608 Metric), 32 V	High inrush multilayer	Bourns Inc.	SF-0603HI700M-2
54	2	J1 J14	CON8, 8P 5.0 8mm 90DEG	Fixed terminal blocks	Wurth Elektronik	691244510008
55	2	J2 J4	3 pin jumper	CONN HEADER .100 STR 3POS	Wurth Elektronik	613 003 111 21
56	2	J6 J7	CON6-2315	6-way PCB terminal block	Wurth Elektronik	691231510006
57	4	J8 J9 J10 J12	2-pin jumper 2.54 mm	Jumpers	Wurth Elektronik	61300211121
58	4	J11 J13 J19 J26	5.08 mm pitch, 250 V, 24 A	Fixed terminal blocks	Phoenix Contact	1711725
59	2	J17 J18	con38-2x19-strip-male (morpho)	Connector headers	Samtec Inc.	TSM-119-01-F-DV
60	1	J20	Surge test Pad	PCB PAD (not mounted)	Sullins Connector Solutions	PRPC001SAAN-RC
61	2	J22 J24	3-pin jumper, 2.54 mm	Connector headers	Wurth Elektronik	61300311121
62	1	J23	CON10A	Connector header	CNC Tech	3220-10-0100-00
63	1	J25	5-pin 2.54 mm	Connector header	Wurth Elektronik	691210910005
64	3	L1 L3 L6	600 Ohms, 0603 (1608 Metric), 400 mA	Ferrite beads	Fair-Rite	2506036017Y0

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
65	1	L2	4.7 µH, 1210 (3225 Metric), 1 A	Fixed inductor	Murata	LQH32PN4R7NN0L
66	1	L4	100 Ohms, 3312 (8530 metric), 10 A, +/-25%	Ferrite bead	Wurth Elektronik	74279225101
67	2	L5 L7	220 Ohms, 0805 (2012 Metric), 2 A	Ferrite beads	Murata	BLM21PG221SN1D
68	4	Q1 Q2 Q3 Q5	2STR1160-SOT23, TO-236-3, SC-59, SOT-23-3, 60V, 1A	Low voltage fast-switching NPN power transistor	ST	2STR1160
69	1	Q4	STL42P6LLF6, 8-PowerVDFN, 100 W (Tc)	P-channel 60 V, 0.023 Ohm typ., 42 A STripFET F6 power MOSFET in a PowerFLAT 5x6 package	ST	STL42P6LLF6
70	10	R1 R2 R3 R4 R68 R69 R71 R74 R78 R82	220E, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W ±1%	Chip resistors	Yageo	AC0402FR-07220RL
71	1	R5	15 K 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/- 1%	Chip resistor	Yageo	RC0402FR-1015KL
72	21	R6 R23 R24 R25 R26 R153 R156 R158 R159 R162 R164 R168 R173 R180 R185 R191 R197 R198 R199 R200 R205	0E 0402, (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-070RL
73	8	R7 R9 R11 R12 R14 R17 R19 R22	2K2, 0402 (1005 Metric), 50 V, 0.125 W, 1/8 W, +/-1%	Chip resistors	Yageo	RC0402FR-7W2K2L
74	4	R8 R10 R64 R143	1K, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-7D1KL
75	1	R13	1K, 0805 (2012 Metric), 50 V, 5 W, +/-5%	Thick film resistor	Panasonic	ERJ-UP6J102V
76	1	R15	1M5, 0402 (1005 Metric), 50 V, 0.125 W, 1/8 W, +/-2%	Thick film resistor	KOA Speer	SG73P1ETTP155G
77	1	R16	120 K, 0402 (1005 Metric), 50 V, 0.125 W, 1/8 W, +/-1%	Thick film resistor	KOA Speer	SG73S1ETTP124J

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
78	2	R18 R130	120E, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors (not mounted)	Yageo	RC0402FR-13120RL
79	3	R20 R21 R155	120E, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistor	Any	Any
80	17	R27 R28 R29 R30 R63 R66 R67 R70 R73 R77 R79 R80 R142 R201 R202 R203 R204	7.5K, 0402 (1005 Metric), 50 V, 0.125 W, 1/8 W, +/-1%	Chip resistors	Yageo	RC0402FR-7W7K5L
81	7	R31 R34 R39 R42 R94 R137 R149	330E, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-13330RL
82	4	R32 R36 R46 R48	510R, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-07510RL
83	4	R33 R35 R41 R43	5.1K, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-075K1L
84	4	R37 R38 R40 R45	56 k, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RT0402FRE0756KL
85	4	R84 R102 R141 R151	22 K, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-0722KL
86	1	R44	220 K, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistor	Yageo	RC0402FR-07220KL
87	1	R47	60.4 K, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistor	Yageo	RC0402FR-0760K4L
88	6	R49 R54 R55 R58 R59 R62	620 R, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-07620RL
89	6	R50 R53 R56 R57 R60 R61	200 R, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-13200RL
90	2	R51 R52	1 k, 0402 (1005 Metric), 50 V, 0.125 W, 1/8 W, +/-1%	Chip resistors	Yageo	RC0402FR-7W1KL

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
91	24	R65 R100 R101 R103 R107 R110 R111 R112 R114 R116 R117 R119 R120 R124 R125 R127 R128 R132 R133 R147 R171 R179 R182 R183	10 K, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-7D10KL
92	35	R72 R75 R95 R96 R98 R99 R104 R105 R106 R108 R109 R113 R115 R118 R121 R122 R123 R126 R129 R131 R134 R135 R136 R138 R139 R154 R157 R170 R181 R186 R187 R188 R189 R190 R192	0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	NM
93	2	R76 R81	750 E, 0402 (1005 Metric), 50 V, 0.125 W, 1/8 W, +/-1%	Chip resistors	KOA Speer	SG73P1ETTP7500F
94	9	R83 R87 R88 R89 R90 R91 R92 R93 R193	4K7, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-7D4K7L
95	1	R85	100 K, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistor	Yageo	RC0402FR-10100KL
96	1	R86	10_1% 0402 (1005 Metric) 50 0.063 W, 1/16 W 1%	Anti sulphur chip resistor	Stackpole Electronics Inc	RMCS0402FT10R0
97	4	R97 R140 R146 R148	47 K 0402 (1005 Metric) 50 V 0.063 W, 1/16 W ±1%	Chip resistors	Yageo	RC0402FR-1347KL
98	1	R144	470 K 0402 (1005 Metric) 50 V 0.063 W, 1/16 W ±1%	Chip resistor	Yageo	RC0402FR-07470KL
99	1	R145	330K 0402 (1005 Metric) 50 V 0.063 W, 1/16 W ±1%	Chip resistor	Yageo	RC0402FR-07330KL
100	1	R150	470 0603 (1608 Metric) 50 V 0.1 W, 1/10 W ±5%	Chip resistor	Yageo	RC0603JR-07470RL

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
101	6	R152 R160 R161 R163 R184 R206	0 0402 (1005 Metric) 50 0.063 W, 1/16 W ±1%	Chip resistors (not mounted)	Yageo	RC0402FR-070RL
102	1	R172	51E, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistor	Yageo	AF0402FR-0751RL
103	4	R165 R178 R177 R176	100E, 0402 (1005 Metric), 50 V, 0.0125 W, 1/8 W, +/-1%	Chip resistors	Yageo	RC0402FR-7D100RL
104	2	R174 R175	200, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-07200RL
105	2	R167 R169	2K7, 0402 (1005 Metric), 50 V, 0.063 W, 1/16 W, +/-1%	Chip resistors	Yageo	RC0402FR-132K7L
106	2	R170 R181	10K, 0402 (1005 Metric), 50V, 0.063W, 1/16W, +/-1%	Chip resistors (not mounted)	Yageo	RC0402FR-7D10KL
107	2	R194 195	0603 (1608 Metric), 50 V, 0.063 W, 1/10 W, +/-1%	Chip resistors	Yageo	RC0603JR-070RL
108	2	SW1 SW2	434121043836, 6.00mm x 3.50mm	Tactile switches	TE Connectivity / Alcoswitch	1437566-3
109	15	TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 TP11 TP12 TP13 TP14 TP18	con1-strip-female	Test points (not mounted)	Keystone	5002
110	2	TP15 TP17	con1-strip-female	Test points	Keystone	5002
111	1	U1	CLT01-38SQ7-TR, 48-VFQFN Exposed Pad	High speed digital input current limiter	ST	CLT01-38SQ7-TR
112	1	U2	SI8661BD-B-IS, 16-SOIC (0.295", 7.50 mm width)	General purpose digital isolator	Silicon Labs	SI8661BD-B-IS
113	1	U27	STM32F746ZGT7, 144-LQFP	High-performance and DSP with FPU Arm Cortex-M7 MCU	ST	STM32F746ZGT7
114	7	U3 U6 U7 U9 U10 U11 U12	ACPL-024L-000E, 8-SOIC (0.154", 3.90mm Width), 2.7 V ~ 5.5 V	Opto-isolators	Broadcom Limited	ACPL-024L-000E
115	2	U4 U5	CLT03-2Q3	Self powered digital input current limiter	ST	CLT03-2Q3

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
116	1	U8	IPS4260L, 20-TSSOP (0.173", 4.40mm Width)	Quad low-side intelligent power switch	ST	IPS4260L
117	1	U13	ISO8200AQ, TFQFPN32	Galvanic isolated octal high side smart power solid state relay with SPI interface	ST	ISO8200AQ
118	1	U14	STLD40DPUR, 8-VDFN Exposed Pad	White LED power supply for large display back-light	ST	STLD40DPUR
119	1	U15	FH12S-40S-05SH 55	Connector	Hirose Electric Co Ltd	FH12S-40S-0.5SH(55)
120	3	U16 U17 U18	EMIF08-LCD04M16, 0.130" L x 0.053" W (3.30 mm x 1.35 mm)	8-line L-C EMI filter and ESD protection for display interfaces	ST	EMIF08-LCD04M16
121	1	U19	IS42S32400F-7TLI-TR, 86-TFSOP (0.400", 10.16 mm Width)	SDRAM memory	Integrated Silicon Solution Inc	IS42S32400F-7TLI-TR
122	1	U20	W25X10CLSNIG, 8-SOIC (0.154", 3.90 mm Width)	Serial Flash memory	Winbond Electronics	W25X10CLSNIG
123	1	U21	STMPS2151STR, SC-74A, SOT-753, SOT23-5L	Enhanced single channel power switches (not mounted)	ST	STMPS2151STR
124	1	U22	USB_micro_AB	Connector receptacle	Molex	0475900001
125	1	U23	LM7805-d2pak, TO-263-3, D²Pak (2 leads + tab), TO-263AB	Positive voltage regulator IC	ST	L7805CD2T-TR
126	1	U24	NCS1S2405SC, 0.86" L x 0.32" W x 0.45" H (21.9 mm x 8.2 mm x 11.3 mm)	DC-DC converter	Murata Power Solutions Inc.	NCS1S2405SC
127	1	U25	ECMF02_2AMX6, 6-UFQFN, 200 mA	Common-mode filter and ESD protection for USB 2.0 and MIPI/MDDI interfaces (not mounted)	ST	ECMF02-2AMX6

Item	Q.ty	Ref.	Value	Description	Manufacturer	Part Number
128	1	U26	LDK220M33R, SC-74A, SOT-753, SOT23-5L	200 mA low quiescent current and low noise LDO	ST	LDK220M33R
129	1	U28	ILD207T, 8-SOIC (0.154", 3.90 mm Width)	Opto-isolator	Vishay Semiconductor Opto Division	ILD207T
130	1	U29	REM2-2405S, 0.86" L x 0.32" W x 0.45" H (21.9 mm x 8.2 mm x 11.3 mm), 400 mA	DC DC CONVERTER 5V /2W (not mounted)	RECOM	REM2-2405S
131	1	Y1	NX3215SA-32.768K, 2-SMD, no lead	Crystal	NDK America, Inc.	NX3215SA-32.768K-EXS00A-MU00003
132	1	Y2	ECS-2520MV-250-BN-TR 4-SMD, No lead	Standard clock oscillator	ECS Inc.	ECS-2520MV-250-CN-TR
133	1	None (Not shown in Schematic)	RK035HQ02-CT814B, 3.5" LCD TFT	3.5" LCD TFT connected via U15	Rocktech Displays Limited	RK035HQ02-CT814B
134	6	None (Not shown in Schematic)	WR-PHD 2.54 mm jumper with test point	Headers and wire housings	Wurth Elektronik	60900213421
135	8	None (Not shown in Schematic)	M3 thread	Nylon stand-off	Keystone Electronics	25505
136	8	None (Not shown in Schematic)	M3 Nylon Nut	Screws and fasteners	Keystone Electronics	4688

6 Regulatory compliance

Formal Notice Required by the U.S. Federal Communications Commission

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.

Formal Product Notice Required by Industry Canada Innovation, Science and Economic Development

Canada compliance:

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).

Formal product notice required by EU

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

7 Board versions

Table 3. STEVAL-PLC001V1 versions

Finished good	Schematic diagrams	Bill of materials
STEVAL$PLC001V1A [1]	STEVAL$PLC001V1A schematic diagrams	STEVAL$PLC001V1A bill of materials

1. This code identifies the STEVAL-PLC001V1 evaluation board first version.

Appendix A MCU interfaces mapped with devices and board terminal blocks

Table 4. List of MCU interfaces mapped with devices and board terminal blocks

Devices	Device pins	Board interface	MCU interface	Other devices	LED	MCU side test point	Device side test point	Jumpers	Jumper description
CLT01_38SQ7	CS,SCK,MOSI, MISO		PB12,PB13,PC1,PC2					J2,J4	J2 - Pin1,2 Short (MISO); J4-pin3-2 short (8 bit mode). J2&J4 pin 1 and 3 are connected to GND,VDD
		I0.0,I0.1,I0.2,I0.3,I0.4,I0.5, I0.6,I0.7							
	LED1,LED2, LED3,LED4, LED5,LED6, LED7, LED8				D1,D2, D3,D4, D5,D6, D7,D8				
			PC2	A6 (U2), GND1 (U2)		TP2- (SPI2_MISO), TP3- Gnd			
	MISO, COMs, REF			B6(U2), GND2(U2)			TP1- (CLT_MISO), TP4 (F.Gnd), TP14- (CLT_MISO)		
	DVR, SPM								
CLT03_2Q3	(OUTP1, OUTN1, OUTP2, OUTN2)- U4 (OUTP3, OUTN3, OUTP4,OUTN4)- U5		PE2 ,PE3, PE4,PE5						
		I1.0H/L-I1.3H/L							
	(INATTL1,INA1, INB1; INATTL2, INA2,INB2)-U5 INATTL1, INA1,INB1; INATTL2,INA2, INB2)-U6				D9,D10, D11,D12				
	OUTP1,OUTP4						TP5 (Near U3), TP6(Near U6)		

Devices	Device pins	Board interface	MCU interface	Other devices	LED	MCU side test point	Device side test point	Jumpers	Jumper description
ISO8200AQ	SPI2_NSS,SPI2_SCK,SPI2_MOSI, SPI2_MISO		PB12,PB13,PC1,PC2						
		Q0.0,Q0.1, Q0.2,Q0.3, Q0.4, Q0.5,Q0.6, Q0.7							
	OUT8_1 & OUT8_2;OUT8_1 & OUT8_2;OUT8_1 & OUT8_2;OUT8_1 & OUT8_2;OUT8_1 & OUT8_2;OUT8_1 & OUT8_2;OUT8_1 & OUT8_2;OUT8_1 & OUT8_2;				D33,D32,D31,D30,D28, D26,D25,D24				
	CLK, SDI					TP9 ,TP10			
IPS4260L	DO_Q0_1--DO_Q0_4		PB15,PD11,PC8,PC12					J8,J9,J10,J12	
		Q1.0,Q1.2, Q1.3,Q1.4							
	LOAD4, LOAD3, LOAD2, LOAD1				D16,D15,D14, D13				
	IN1, IN3						TP7, TP8		
	LOAD1,LOAD2 (VZ1&VZ2)								J8 and J9 open in case of no load. J10 closed and J12 open.
UART			PC10,PC11; for UART5_RX PD2 (Schematic has no information regarding UART5_TX)					J22- Pin 1,2 Short(USART3_TX) & Pin 2,3 Short(UART4_TX); J24- Pin 1,2 Short(USART3_RX) & Pin 2,3 Short(UART4_RX)	J22: Pin1-USART3_TX, Pin2-PC10(MCU), Pin3-UART4_TX; J24:Pin1-USART3_RX, Pin2-PC11(MCU), Pin3-UART4_RX
LCD_DISPLAY	LCD_BL_CTRL		PA0(TIMER 2)	EN(U14 pin 7)					

Devices	Device pins	Board interface	MCU interface	Other devices	LED	MCU side test point	Device side test point	Jumpers	Jumper description
LCD_DISPLAY	RED (R2-R7), GREEN (G2-G7), BLUE (B2-B7)		(PA1,PB0, PA5,PC0, PD1,PG7), (PA6,PG10,PB10,PB11,PC7, PD3), (PG11,PG12,PA3,PB8,PB9)						
	LCD_RST, LCD_INT, LCD_CLK, LCD_HSYNC, LCD_VSYNC, LCD_DISP, LCD_SDA, LCD_SCL, LCD_DE		PH1,PG9, PG7,PC6, PA4,PD5, PD13,PD12,PF10						
				VO(U14 pin 6), GND& PGND(U14 Pin 3,9)			TP11, TP18		
Debug LED			PB14, PB2		D36,D37				

Appendix B Options for customization

The STEVAL-PLC001V1 board can be customized by soldering or changing mounted components and implementing the related changes in the firmware.

B.1 Daisy chain connection on the STM32F746ZG SPI2 peripheral

The STM32F746ZG is the master in a daisy chain connection where the CLT01-38SQ7, the ISO8200AQ and the morpho connectors are connected as slave peripherals.

The default connection uses the same SPI port for communication with I/O devices with different chip selection signals. The figure below shows the options (in dotted lines) to include these devices in a daisy chain connection.

Figure 17. Options to include devices in a daisy chain connection
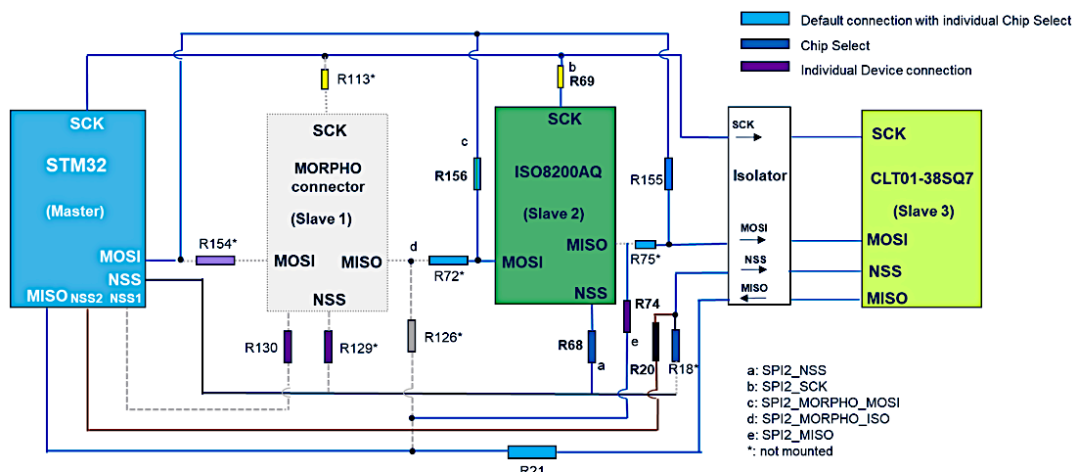
B.2 Possible additions to the board

- A battery holder (BT1) can be added to house a cell to power the MCU real-time clock. R185 has to be unmounted and R184 has to be mounted;
- USB micro-B connector (U22) is provided as an alternative source for powering the logic circuit only. This is not isolated. U21 and U25 have to be mounted for USB connectivity.

Revision history

Table 5. Document revision history

Date	Revision	Changes
25-Oct-2021	1	Initial release.

Contents

List of tables

List of figures

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.