NTX SYSTEMS

ORBIT-Q

Modular Embedded Workstation

Data-Sheet

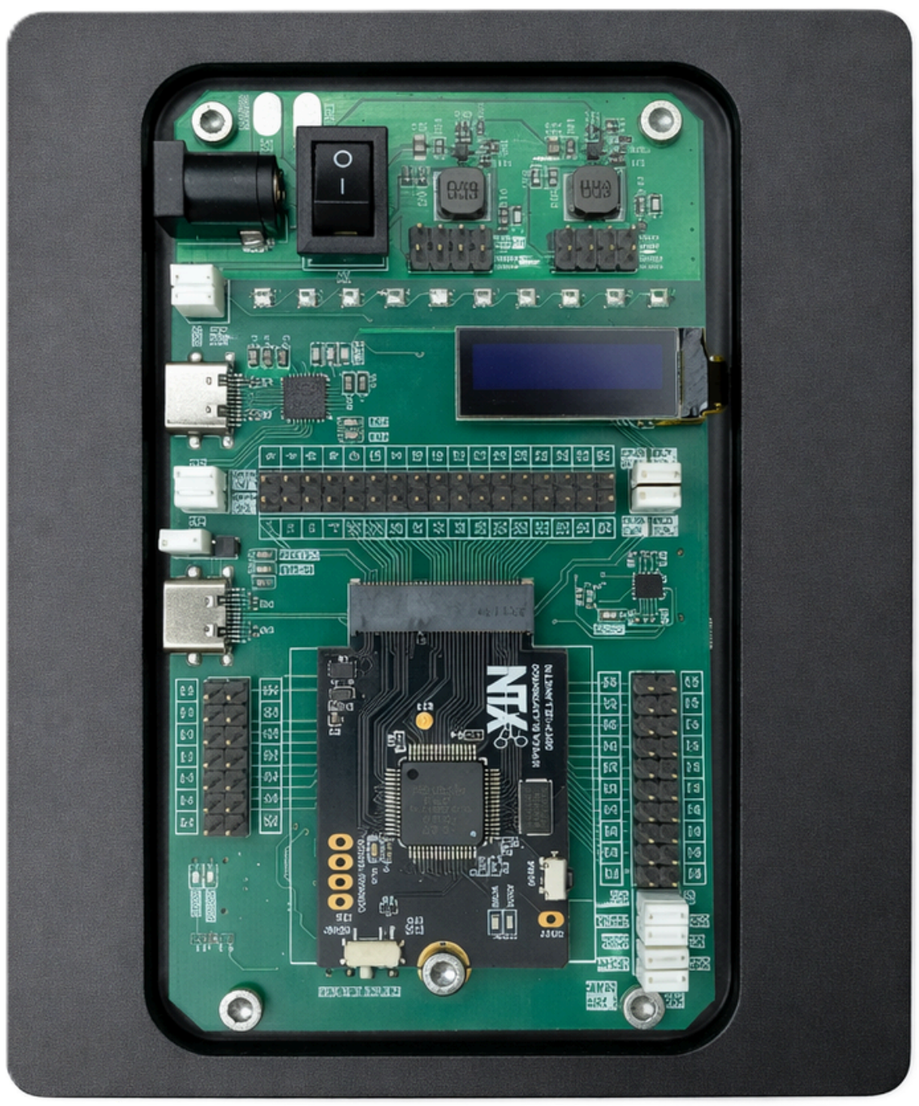
ORBIT-Q

DATASHEET

Modular Development Board Version 1.0

Overview

ORBIT-Q is a modular development platform designed for M.2 E-Key microcontroller modules. It integrates power management, debugging, communication interfaces, storage, and user peripherals into a compact development board for rapid prototyping and embedded application development.



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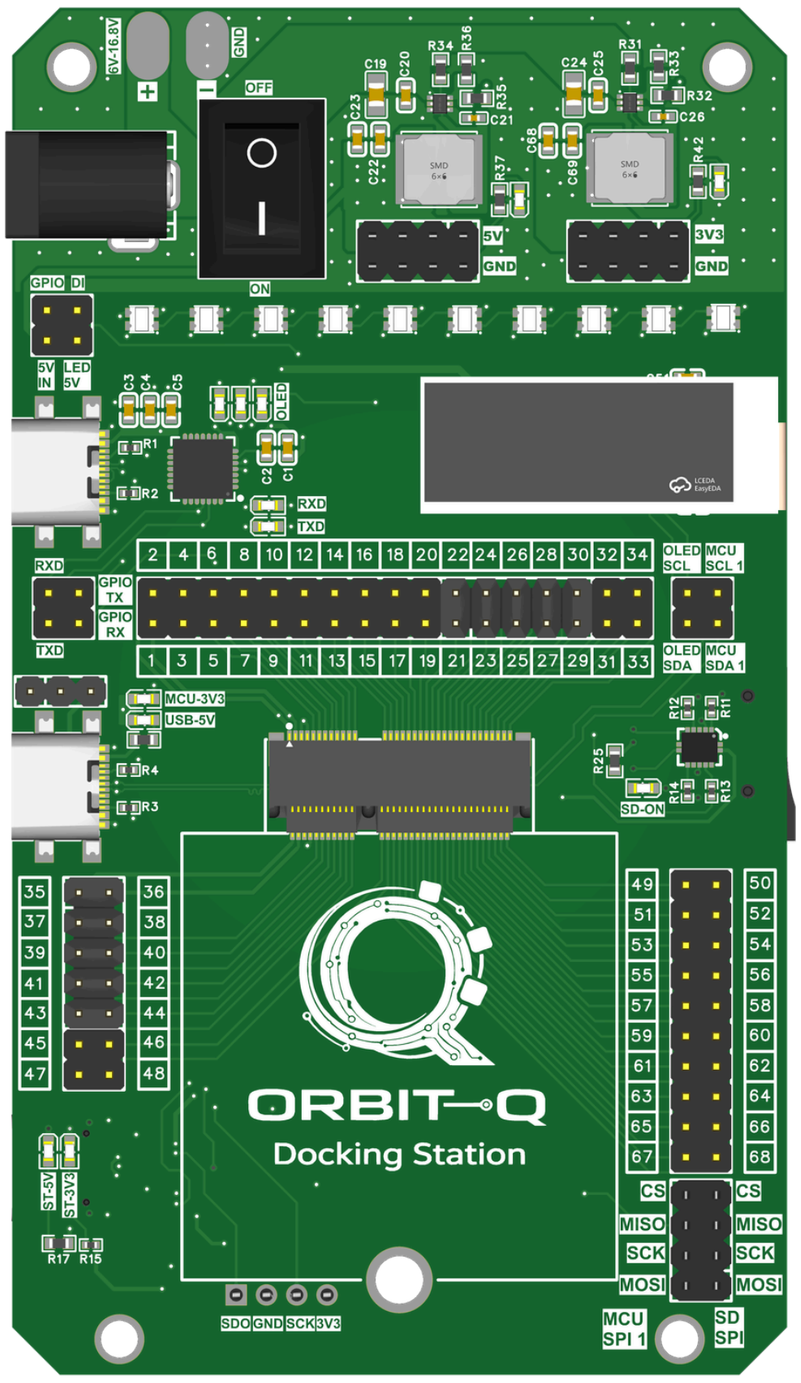
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Features

The ORBIT-Q Modular Development Platform integrates power management, debugging, communication interfaces, storage, and user peripherals into a single compact development board for M.2 E-Key microcontroller modules. Designed for embedded software development, rapid prototyping, and hardware validation, ORBIT-Q provides direct access to essential interfaces while minimizing external wiring and setup time.



Power Management

- Wide input voltage range: 6 V to 16.8 V DC
- Dual high-efficiency switching regulators
  - 5 V @ 3 A
  - 3.3 V @ 3 A
- DC barrel jack and battery solder pad power inputs
- Dedicated power output headers for external peripherals
- Individual status indicators for each power rail

User Interfaces

- 128 × 32 monochrome OLED display
- Ten individually addressable WS2812B RGB LEDs
- On-board microSD card socket
- User-configurable peripheral connections

Expansion

- M.2 E-Key connector for compatible microcontroller modules
- 68 GPIO signals available through three expansion headers
- Dedicated 5 V and 3.3 V power output headers
- Standard 2.54 mm headers for prototyping and expansion

Board Features

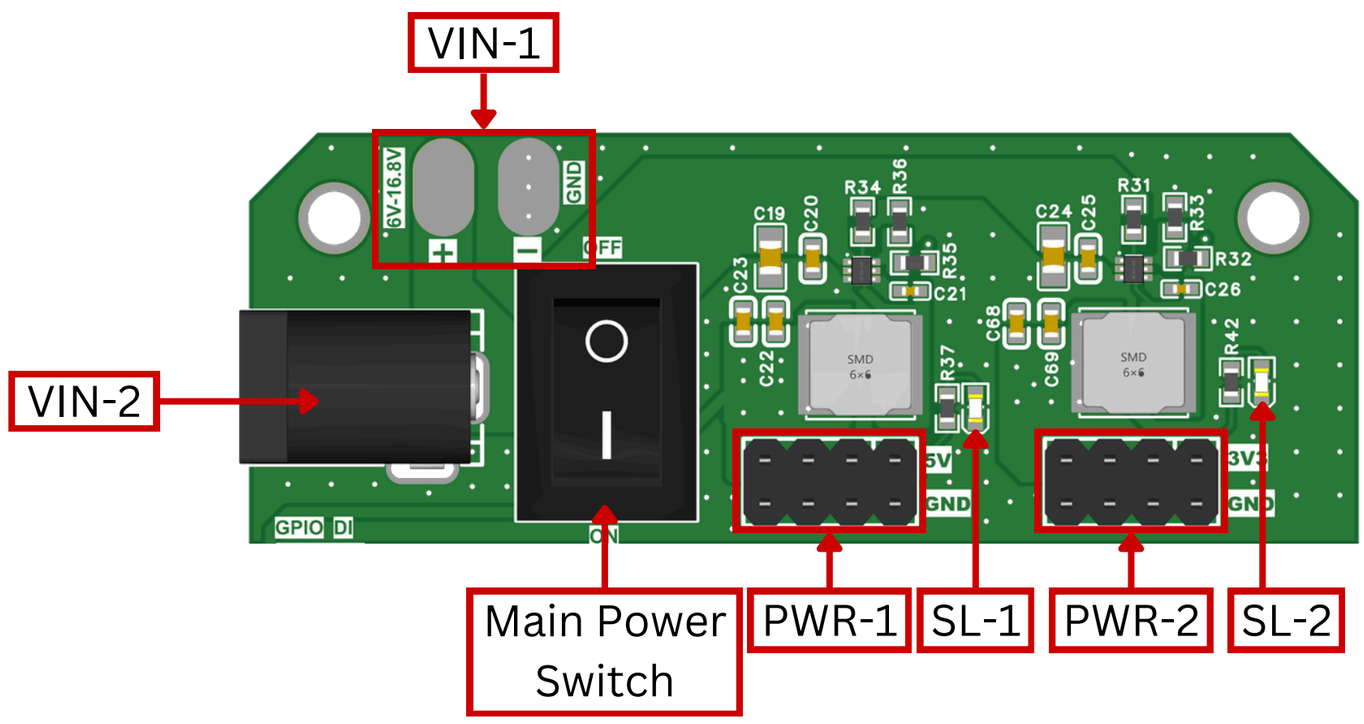
- Modular hardware architecture
- Clearly separated functional subsystems
- Distributed power and status indicators
- Flexible jumper-based peripheral configuration
- Designed for rapid prototyping and embedded development

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1. **Power Management**

The ORBIT-Q Power Management subsystem provides regulated 5 V and 3.3 V power rails for the development board and connected peripherals. The board accepts power from either a DC barrel jack or external battery connection and distributes power through two high-efficiency buck converters.

Two dedicated power output headers provide regulated voltages for external circuits and expansion hardware.
Important: Only one input source shall be connected at any time. Simultaneously connecting the DC barrel jack and the battery input may permanently damage the board.



1.1 **Power Inputs**

The board supports two independent power input methods.

- **VIN-1 : Battery Input Pads**

A pair of solder pads is provided for direct battery or external DC power connection.
Input Voltage Range
·Minimum: 6.0 V
·Recommended: 12.0 V
·Maximum Operating: 16.8 V

- **VIN-2 : DC Barrel Jack**

A standard DC barrel jack provides convenient external power input using an AC/DC adapter or bench power supply.
Recommended Supply

- 12 V DC
- 2.5 Amp or greater

1.2 **Main Power Switch**

The master power switch disconnects the input supply from the onboard regulators.
When the switch is in the ON position, power is supplied to both voltage regulators and all onboard peripherals.

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1. Power Management

1.3 Regulated Power Rail

Generated by a dedicated high-efficiency switching regulator.

- **PWR-1**

Parameter	Value
Output Voltage	5.0V
Maximum Continous Current	3.0 Amp

PWR-1 Rail Powers Linear Voltage Regulators on

- WS2812B RGB LED strip
- Oled Display
- SD-Card Slot
- M.2 E-Key Connector

This Output Header can also be used to power external modules that are connected to the board for interface.

- **PWR-2**

Generated by an independent switching regulator.

Parameter	Value
Output Voltage	3.30V
Maximum Continous Current	3.0 Amp

PWR-2 is not internally connected to the board, and is not used to power anything on the board, this output is available for external modules that are connected for interface.

1.4 Status Indicator

Two status LEDs provide immediate visual confirmation of regulator operation.

Indicator	Discription
SL-1	Illuminates when the 5 V regulator is active.
SL-2	Illuminates when the 3.3 V regulator is active.

1.5 Electrical Specification

Parameter	Minimum	Typical	Maximum
Input Voltage	6.0V	12.0 V	16.8 V
Absolute maximum Input	-	-	20.0 V
PWR-1 5.0V Output	-	-	3 Amp
PWR-2 3.3 V Output	-	-	3 Amp
Recommended Input	30 Watt.	36 Watt.	-

CAUTION

The battery input pads and DC barrel jack are electrically connected to the same input power rail. Never apply power to both inputs simultaneously, as this may result in permanent damage to the onboard power circuitry.

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2. **RGB LED Interface**

The ORBIT-Q development platform integrates a 10-element WS2812B individually addressable RGB LED array for visual feedback, diagnostics, status indication, and user-defined applications.

The LED array is powered from the onboard 5 V power rail and communicates using a single-wire digital data interface. A dedicated configuration header allows the data signal and power supply to be connected or isolated without modifying the PCB.



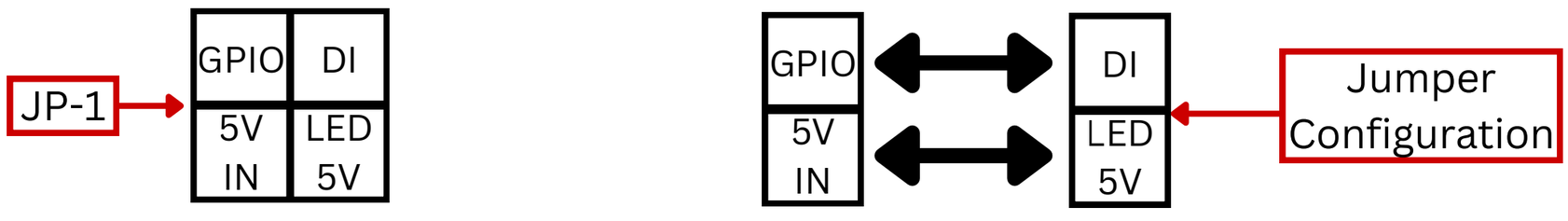
2.1 **Overview**

Parameter	Specification
LED Device	WS2812B
Number of LEDs	10
Supply Voltage	5.0 V
Control Interface	Single Wire DI (Data Input) Pin

2.2 **Configuration Header**

JP1 is a 2 × 2 configuration header used to connect the LED array to the microcontroller and onboard power supply.

Two jumper caps are required for normal operation.



2.3 **JP-1 Pin Details**

GPIO - This Pin is internally connected to PIN 59.
DI - This is Data-In Pin for WS2812b LED.
5V IN - This Pin is Internally connected to PWR-1 5V power supply.
LED 5V - this Pin serves as VIN Pin for WS2812b LED, requires 5V for standard operation.

Operation

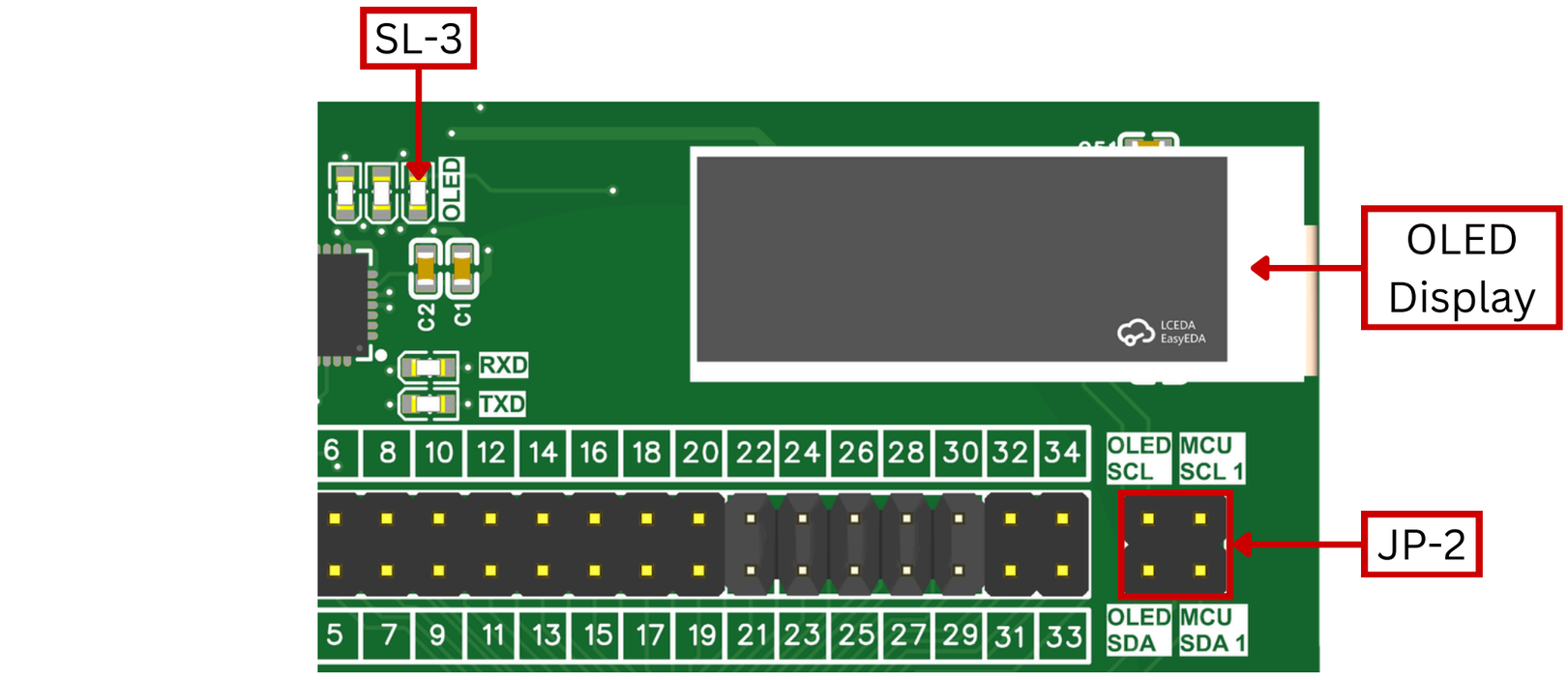
The LED array receives serial data from the microcontroller through the GPIO-to-DI connection established by JP1.
Power is supplied from the onboard 5 V regulator through the 5V IN-to-LED 5V connection.
Both connections must be present for normal operation.

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3. OLED Display Interface

The ORBIT-Q development platform includes an onboard 128 × 32 monochrome OLED display connected through an I²C interface. The display provides a compact user interface for displaying text, graphics, menus, sensor data, and system status information.

A dedicated configuration header allows the I²C signals to be connected or isolated from the M.2 microcontroller module without modifying the PCB.



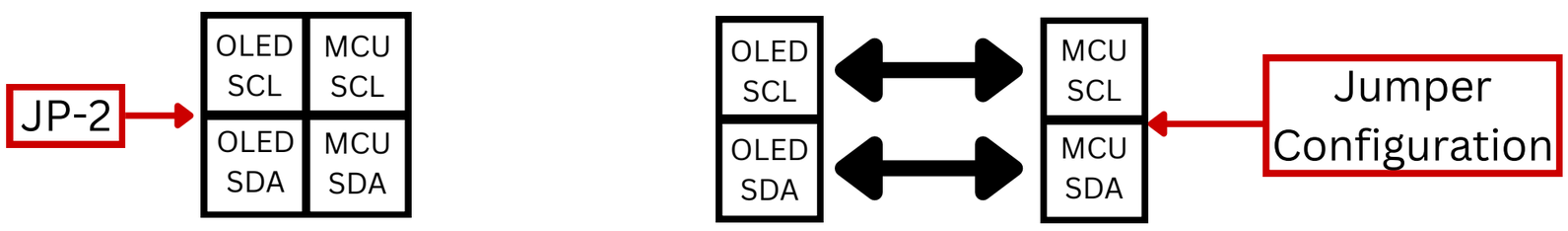
3.1 Overview

Parameter	Specification
Display Type	WS2812B
Resolution	128 X 32 Pixel
Interface	I2C
Default I2C Address	0X3C
Supply Voltage	3.3 V

3.2 Configuration Header

JP-2 is a 2 × 2 configuration header used to connect the OLED display to the M.2 microcontroller module.

Two jumper caps are required for normal operation.



3.3 JP-2 Pin Details

OLED SCL - OLED Display Serial Clock.
OLED SDA - OLED Display Serial Data.
MCU SCL - I²C Clock provided by the M.2 microcontroller module.
MCU SDA- I²C Data provided by the M.2 microcontroller module.

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3. OLED Display Interface

3.4 Power and Operation

The OLED display receives regulated 3.3 V power from the onboard power management subsystem.

Communication with the display is performed through the I²C interface after the corresponding jumper connections are installed on JP2.

The display is intended for user applications such as:

- System status indication
- Menu interfaces
- Sensor readouts
- Debug messages
- User-defined graphics

3.5 Status Indicator

A dedicated status LED indicates that power is available to the OLED display from it’s 3.3v Linear Voltage Regulator (LDO).

Indicator	Description
SL-3	Illuminates when the OLED display power rail is active.

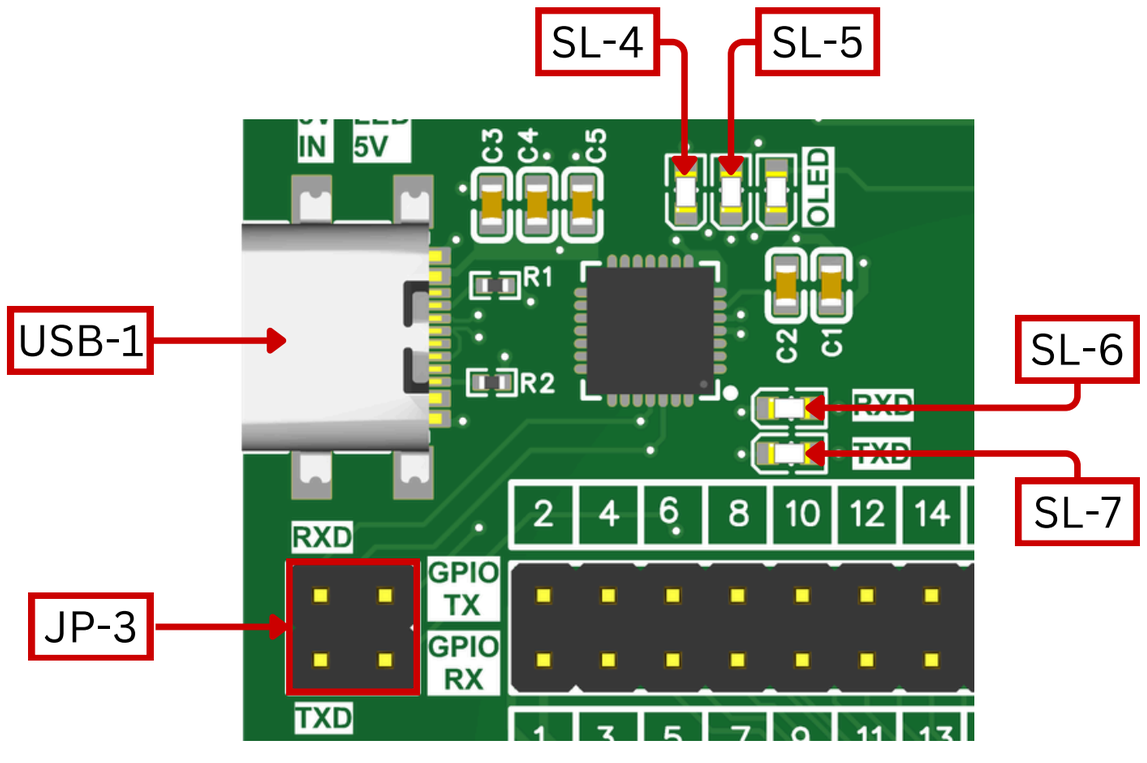
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4. USB-to-UART Bridge

The ORBIT-Q development platform integrates a CP2102 USB-to-UART bridge to provide a convenient USB serial interface between a host computer and the installed M.2 microcontroller module.

The interface enables firmware logging, serial communication, command-line interaction, and debugging through a standard USB Type-C connection.

A dedicated configuration header allows the UART signals to be connected or isolated from the M.2 module without modifying the PCB.



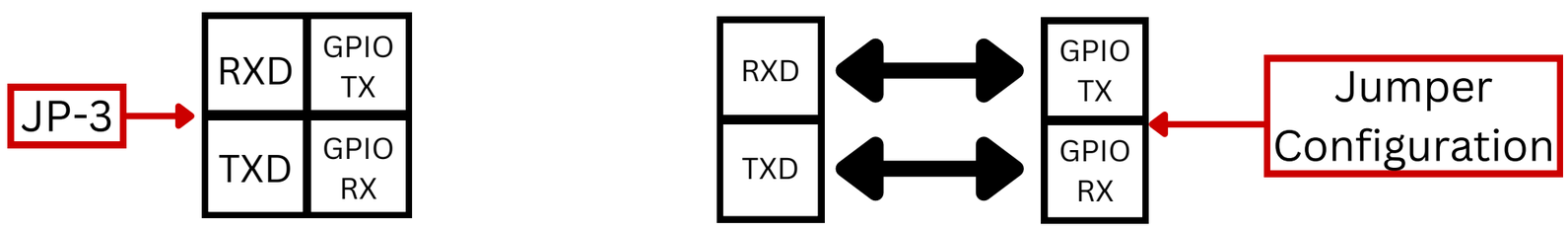
4.1 Overview

Parameter	Specification
USB Bridge IC	CP2102-GMR
USB Connector	USB Type-C
Interface	USB 2.0 Full Speed
Communication	UART (TX/RX)
Logic Voltage	3.3 V

4.2 Configuration Header

JP-3 is a 2 × 2 configuration header used to connect the OLED display to the M.2 microcontroller module.

Two jumper caps are required for normal operation.



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4. USB-to-UART Bridge

4.3 JP-3 Pin Details

RXD- UART Receive input of the CP2102.
TXD- UART Transmit output of the CP2102.
GPIO TX - UART transmit signal from the M.2 module.
GPIO RX- UART receive signal to the M.2 module.

4.4 Status Indicators

Indicator	Description
SL-4	Indicates that USB power is present and the CP2102 is powered.
SL-5	Indicates that the CP2102 internal 3.3 V regulator is operating correctly.
SL-6	Flashes while data is being received from the host computer.
SL-7	Flashes while data is being transmitted to the host computer.

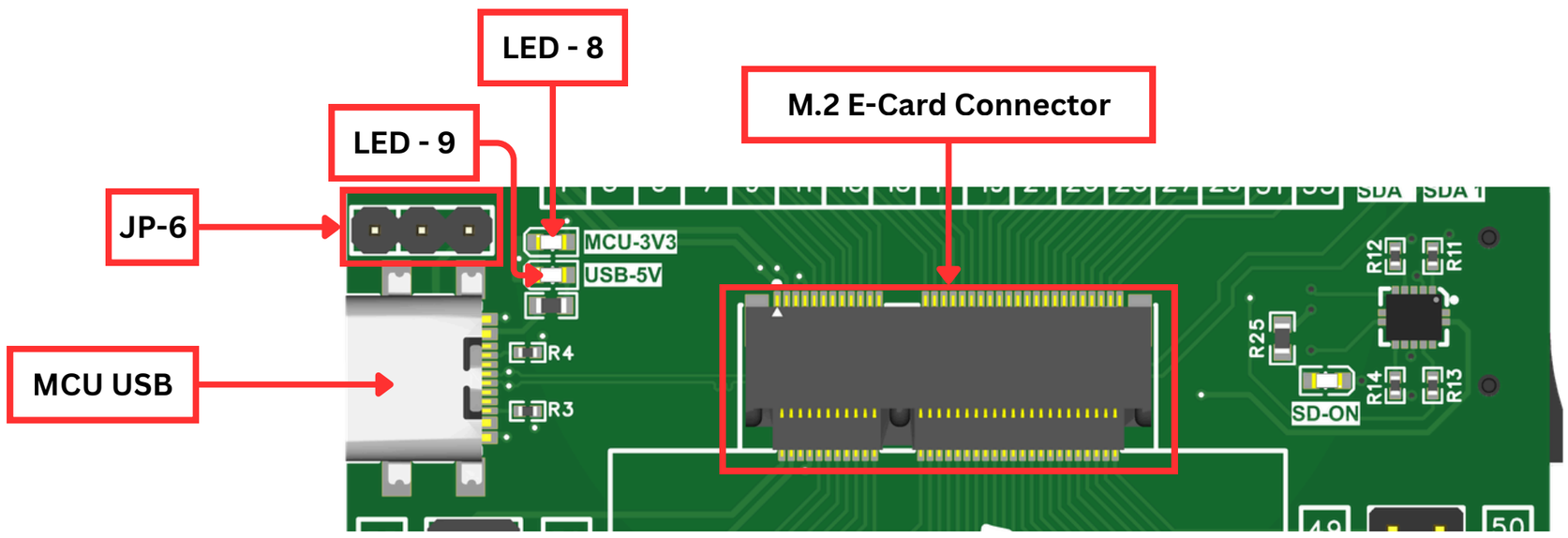
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5. M.2 E-Key Connector

The ORBIT-Q development platform is built around a 75-position M.2 E-Key connector, which serves as the primary interface for compatible microcontroller modules.

The connector provides power, communication interfaces, debugging signals, and general-purpose input/output (GPIO), allowing the installed module to access all onboard peripherals and expansion interfaces.

The M.2 connector is the central interface of the development platform, with all onboard subsystems communicating through the installed module.



Onboard 3.3 V Regulator

A dedicated 3.3 V Low Dropout (LDO) regulator supplies power to the installed M.2 module.

The regulator input is selected using JP6, allowing the module to operate from one of two available 5 V sources.

This arrangement provides flexibility during development when an external power supply is unavailable.

Power Source Selection (JP6)

JP-6 is a 3-pin, 2.54 mm jumper header used to select the input source for the onboard 3.3 V regulator supplying the M.2 connector.

JP-6 - Header

+5V	MCU VIN	USB 5V

Jumper Positions

JP6 is a 3-pin, 2.54 mm jumper header used to select the input source for the onboard 3.3 V regulator supplying the M.2 connector.

Jumper position	Function
+5V ⟷ MCU VIN	Powers the M.2 module from the onboard 5 V buck regulator.
MCU VIN ⟷ USB 5V	Powers the M.2 module directly from the MCU USB Type-C connector.

Only one jumper position shall be selected at any time.

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5. M.2 E-Key Connector

Power Modes

Normal Operating Mode

JP-6: **+5V ⟷ MCU VIN**

The M.2 module is powered from the onboard 5 V buck regulator through the dedicated 3.3 V LDO.

In this mode:

- All onboard peripherals are operational.
- OLED display is powered.
- RGB LED interface is powered.
- microSD interface is powered.

This is the recommended operating mode.

USB-Powered Development Mode

JP-6: **MCU VIN ⟷ USB 5V**

The M.2 module receives power directly from the MCU USB Type-C connector.

In this mode:

- The M.2 module remains fully operational.
- Only the M.2 power domain is energized.
- Onboard peripherals remain unpowered.
- OLED display is disabled.
- RGB LED interface is disabled.
- microSD interface is disabled.

This mode allows firmware development and code testing without requiring an external power adapter or battery.

Status Indicators

Two LEDs provide visual indication of the M.2 power system.

Indicator	Description
LED-8	Illuminates when the onboard 3.3 V LDO is supplying power to the M.2 connector.
LED-9	Illuminates when 5 V is present on the MCU USB connector.

MCU USB Connector

The MCU USB Type-C connector is connected directly to the USB D+ and USB D− signals of the M.2 connector.

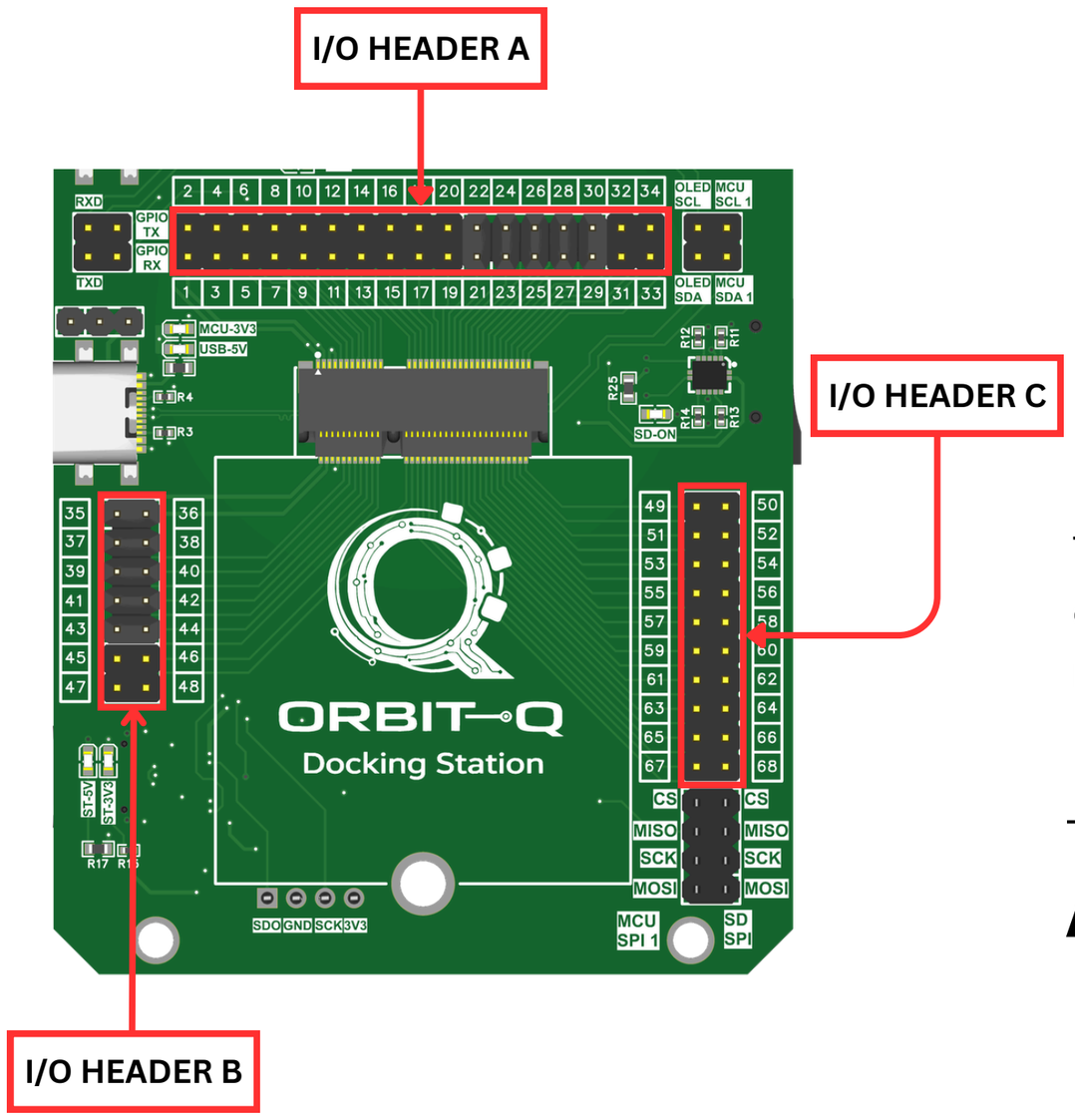
When JP-6 is configured for USB-powered operation, the connector also supplies 5 V to the onboard LDO regulator, allowing the installed module to operate without an external supply.

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6. I/O EXPANSION HEADER

The ORBIT-Q development platform provides direct access to the installed M.2 microcontroller module through three GPIO expansion headers.

Together, the headers expose 68 I/O signals, allowing external hardware, sensors, actuators, and prototype circuits to be connected directly to the development platform.



Header Overview

Header	Description
I/O Header A	I/O PIN 1 TO 34
I/O Header B	I/O PIN 35 TO 48
I/O Header C	I/O PIN 49 TO 68

The three headers together provide access to the complete GPIO interface of the installed M.2 module.

Available Signals

- Digital GPIO
- UART
- SPI
- I2C
- PWM
- ADC
- USB
- SWD
- Power
- Ground

Signal Routing

Peripherals	Connected Through
RGB LED Interface	I/O PIN Header C, PIN 59
OLED Display	SCL - PIN 56, SDA - PIN 54 on I/O PIN Header C
USB to UART Bridge	GPIO TX - PIN 66, GPIO RX - PIN 65 on I/O PIN Header C
Micro SD-Card Interface	CS - PIN 14, MISO - PIN 12, SCK - PIN 13, MOSI - PIN 11 on PIN Header C.
ST-LINK Connection	SWCLK - PIN 5, SWDIO - PIN 6 on I/O PIN Header A
MCU USB-C	DP - PIN 8, DN - 9 on I/O PIN Header A

Detailed signal mapping is provided in the pin assignment tables.

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6. I/O PIN Header Assignments

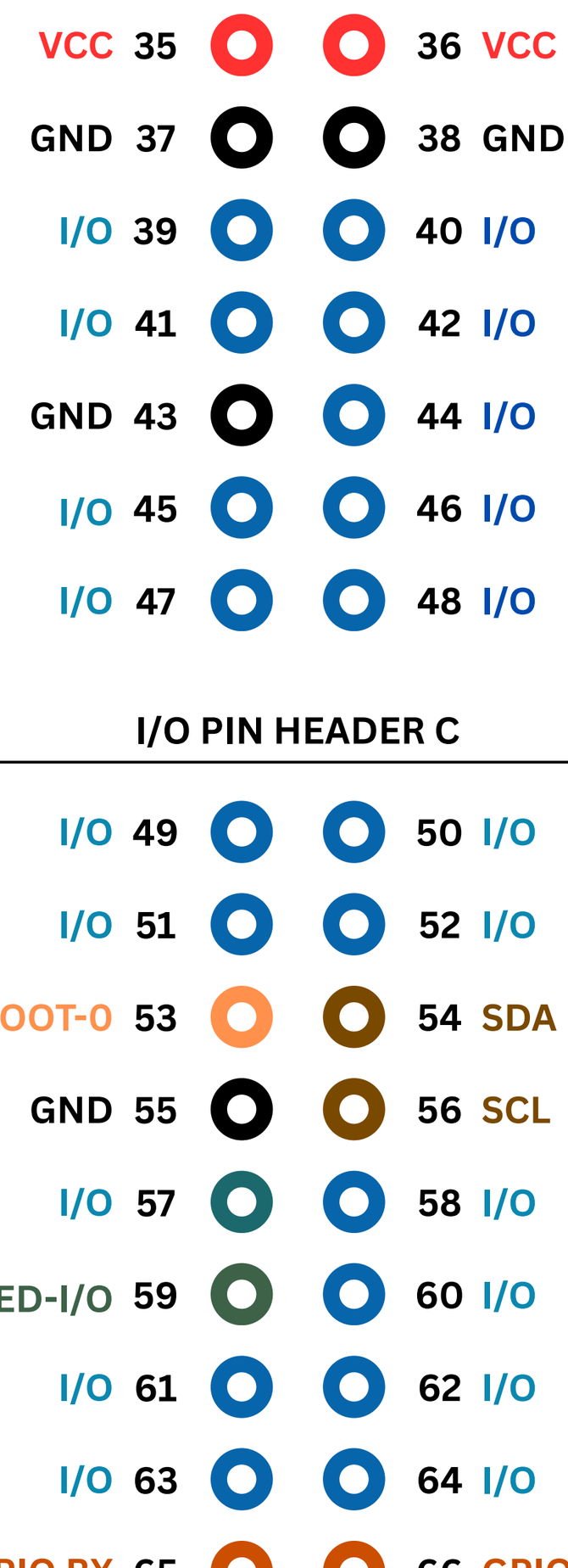
The following pages contain the complete pin assignments for:

- I/O PIN Header A
- I/O PIN Header B
- I/O PIN Header C

I/O PIN HEADER A



I/O PIN HEADER B



I/O PIN HEADER C

Notes

- GPIO availability depends on the installed M.2 Micro-Controller module.
- Some GPIO signals are shared with onboard peripherals, these PIN’s are listed down below.
- Refer to the individual subsystem chapters for jumper configuration and peripheral operation.
- Avoid exceeding the voltage limits specified by the installed microcontroller module.

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6. I/O PIN Header Assignments

- POWER - 3V3
- Ground
- Serial wire Debugger
- USB DP & DN
- SPI - Serial Periferal Interface
- I2C - Inter-Integrated Circuit
- Serial wire Debugger
- UART - Recieve & Transmitt
- LED DATA PIN

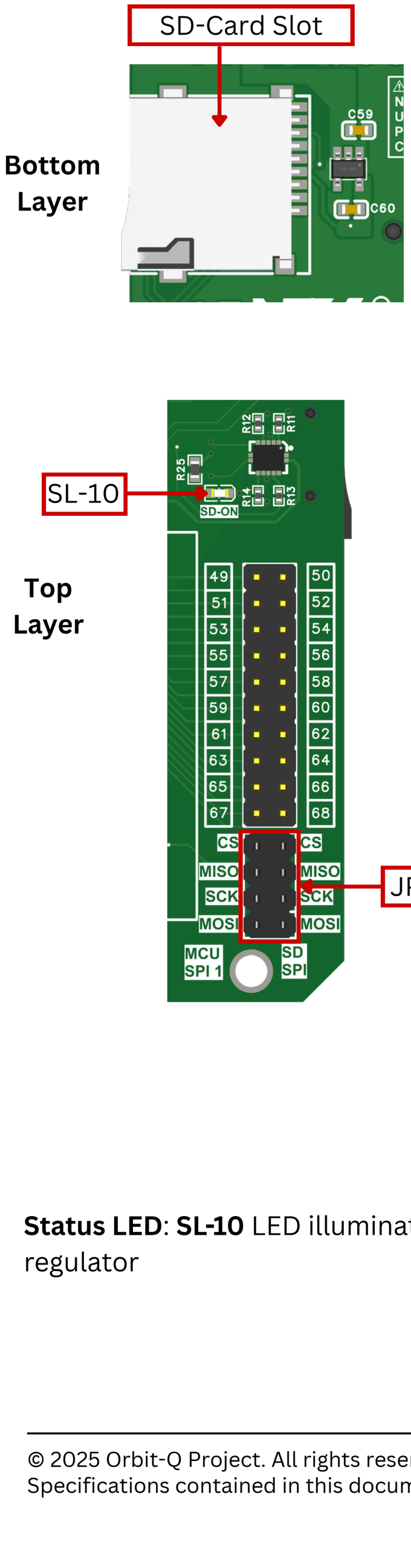
Signals shared with onboard peripherals can be identified in the pin assignment tables. Where applicable, jumper headers allow selected peripherals to be electrically isolated without modifying the PCB.

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7. Micro SD-Card Interface

The ORBIT-Q development platform includes an onboard microSD card socket for removable storage applications. The interface communicates with the installed M.2 microcontroller module using the Serial Peripheral Interface (SPI) protocol and is intended for data logging, firmware storage, configuration files, and general-purpose removable storage.

The microSD socket is permanently connected to the onboard SPI interface and requires no jumper configuration for normal operation.



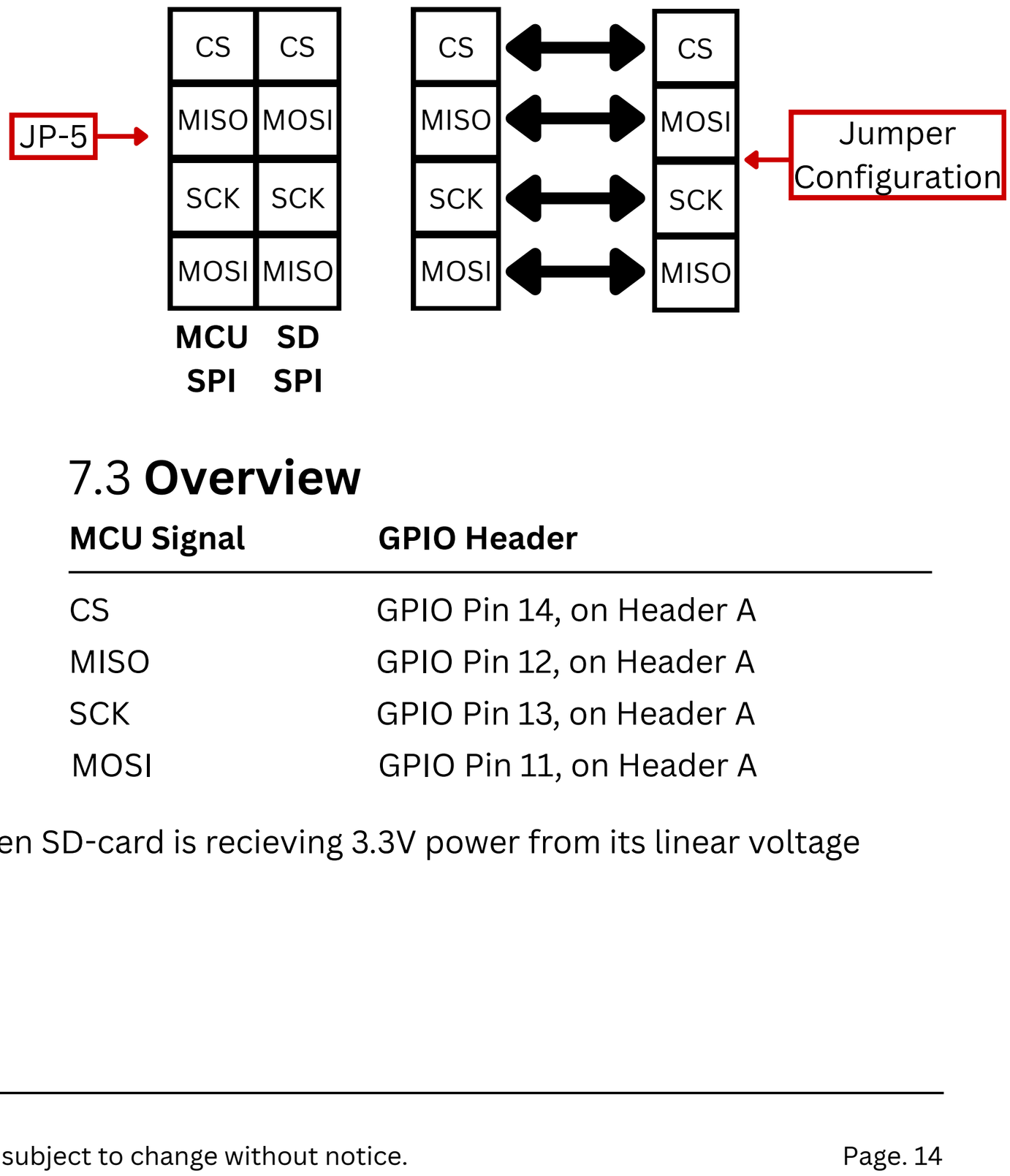
7.1 Overview

Parameter	Description
Card Type	Micro SD
Interface	SPI
Operating Voltage	3.3V

7.2 Configuration Header

JP-5 is a 4 × 4 configuration header used to connect the SD-Card to the M.2 microcontroller module.

Four jumper caps are required for normal operation.



7.3 Overview

MCU Signal	GPIO Header
CS	GPIO Pin 14, on Header A
MISO	GPIO Pin 12, on Header A
SCK	GPIO Pin 13, on Header A
MOSI	GPIO Pin 11, on Header A

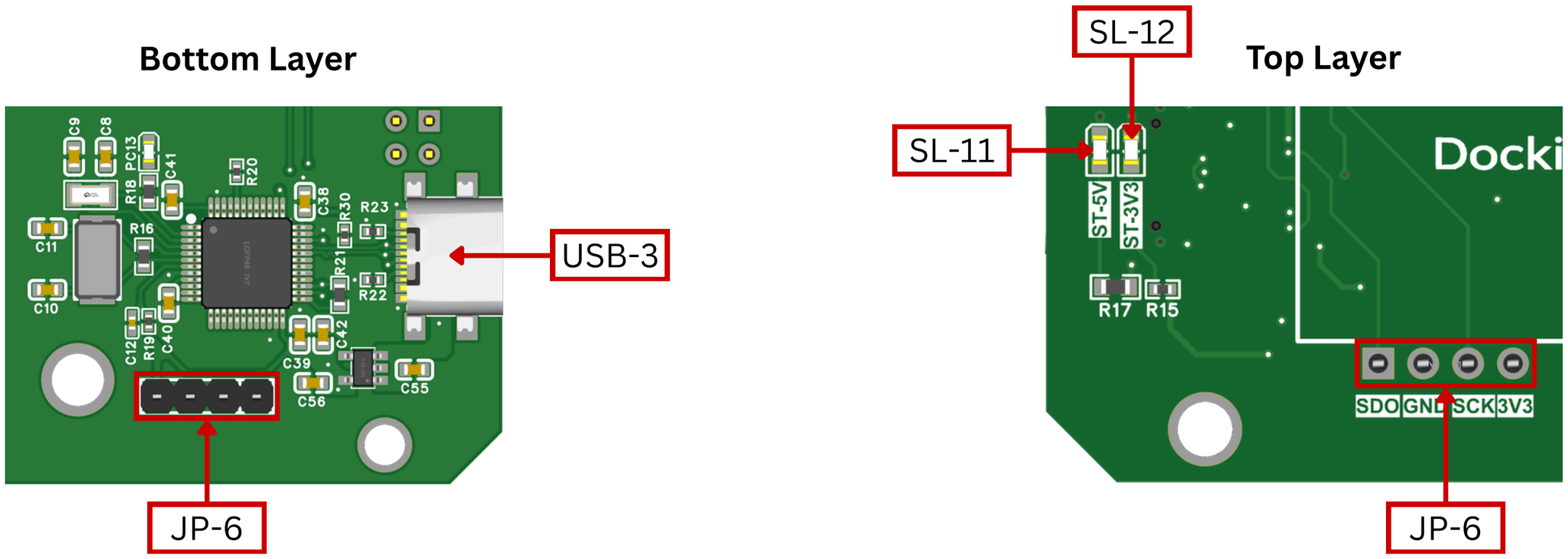
Status LED: **SL-10** LED illuminates when SD-card is recieving 3.3V power from its linear voltage regulator

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8. **ST-Link Debugger**

The ORBIT-Q development platform includes an onboard ST-LINK debugger based on the STM32F103 microcontroller. The debugger provides a dedicated programming and debugging interface for the installed M.2 microcontroller module using the Serial Wire Debug (SWD) protocol.

The debugger is connected through a dedicated USB Type-C connector and operates independently of the USB-to-UART bridge and the MCU USB interface.



8.1 **Overview**

Parameter	Specification
Debugger	ST-Link Compatible
Controller	STM32F103
USB Connector	USB Type-C
Debug Interface	Serial Wire Debug
Target Voltage	3.3V

8.2 **Target Interface**

The ORBIT-Q development platform includes an onboard ST-LINK debugger based on the STM32F103 microcontroller. The debugger provides a dedicated programming and debugging interface for the installed M.2 microcontroller module using the Serial Wire Debug (SWD) protocol.

The Serial Wire Debugg lines are internally connected:
SWCLK - PIN 5, on Header A
SWDIO - PIN 6, on Header A

No jumper configuration is required during normal operation.

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8. **ST-Link Debugger**

8.3 **Target Interface**

JP-4 provides direct access to the onboard **STM32F103** debugger for firmware maintenance and recovery.

The header exposes the programming interface required to update or restore the debugger firmware.

8.4 **Header Signals**

Signal	Description
SWDIO	Serial Wire Debug Data
GND	Ground Reference
SWCLK	Serial Wire Debug Clock
3V3	Target Supply Reference

8.5 **Status Indicator**

Two status LEDs provide visual feedback for the debugger subsystem.

Indicator	Description
SL-11	Indicates that USB power is present and the debugger is active.
SL-12	Indicates that the debugger’s internal 3.3 V regulator is operating correctly.

8.6 **Operation**

Connect USB-3 to the host computer using a USB Type-C cable.

The onboard ST-LINK debugger will be detected by supported development environments, allowing the installed M.2 microcontroller module to be programmed and debugged without additional hardware.

The debugger operates independently of the USB-to-UART bridge, allowing both interfaces to be used simultaneously when supported by the target application.

CAUTION

JP-4 provides direct access to the onboard STM32F103 debugger microcontroller.
Programming this device with incompatible or modified firmware may render the onboard debugger inoperable.
Update the debugger firmware only when required and only with firmware intended for the onboard ST-LINK implementation.

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