

gen4-ESP32-RGB Series



gen4-ESP32-XX (Non-touch)*

gen4-ESP32-XXT (Resistive touch)*

gen4-ESP32-XXCT (Capacitive touch)*

gen4-ESP32-XXCT-CLB (Capacitive touch w/ Cover Lens Bezel)*

gen4-ESP32-70[T/CT/CT-CLB]-WVA (7.0" Wide Viewing Angle Variants)

* - XX indicates the display size: 43 (4.3"), 50 (5.0") or 70 (7.0")

Datasheet

Revision 1.4

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Content may change at any time. Please refer to the resource centre for latest documentation.

Contents

1. Description	4
2. Features	6
3. Hardware Overview	8
4. Hardware Interface - Pins	10
4.1. Serial Ports - 3.3V TTL	10
4.2. I2C Port - 3.3V TTL	10
4.3. SPI Port - 3.3V TTL	10
4.4. General Purpose I/O	11
4.5. System Pins	15
4.6. Accessing Other GPIO Pins - Hardware Mods Required	16
5. Module Features	18
5.1. ESP32-S3R8 Processor	18
5.2. Chipsets used	18
5.3. SD/SDHC Memory Cards	19
5.4. microSD Socket Usage	20
5.5. FAT16 vs FAT32	21
5.6. Wide Viewing Angle (WVA)	21
6. Display/Module Precautions	22
7. Hardware Tools	23
7.1. 4D-UPA	23
7.2. USB-C Cable	25
8. Software Tools	26
8.1. Workshop4 IDE	26
8.2. Workshop5 IDE	27
8.3. Workshop Built-in Tools	28
9. Programming Language	28
10. ESP-IDF Development	29
11. Display Module Part Numbers	30

12. Cover Lens Bezel - Tape Spec	31
13. FFC Cable	31
14. Starter Kit	33
15. 4.3" Mechanical Details	34
15.1. Non-Touch, Resistive and Capacitive	34
15.2. Capacitive w/ CLB	35
16. 5.0" Mechanical Details	36
16.1. Non-Touch, Resistive and Capacitive	36
16.2. Capacitive w/ CLB	37
17. 7.0" Mechanical Details	38
17.1. Non-Touch, Resistive and Capacitive	38
17.2. Capacitive w/ CLB	39
18. Schematic Circuit Details	40
19. Specifications	41
20. Revision History	45
21. Legal Notice	46
21.1. Proprietary Information	46
21.2. Disclaimer of Warranties & Limitations of Liabilities	46

1. Description

The gen4-ESP32 Series of Intelligent Display Modules, is designed and manufactured by 4D Systems.

These display modules are available in 4.3", 5.0" and 7.0", offering an RGB Interface between the ESP32-S3R8 Processor, and the 800x480 resolution TFT LCD Displays. The 4.3" and 5.0" displays are an IPS TFT LCD's, and the 7.0" is a TN TFT LCD. The 7.0" is also available in WVA (Wide Viewing Angle), which brings IPS like performance to a TN display.

Available in Non-Touch, Resistive Touch, Capacitive Touch, and Capacitive Touch with Cover Lens Bezel (CLB).

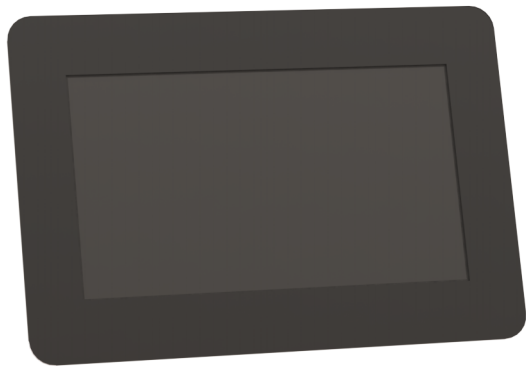
The ESP32-S3R8 Processor makes available multiple GPIO which include UART, SPI, I2C, PWM and Analog functionality, while also serving interfaces for the LCD Touch screen, Real Time Clock, Quad SPI Flash, microSD Card, 8bit IO Expander and Native USB-C.

The user interface to the gen4-ESP32 series is a 30-pin FPC/ZIF socket, designed for a 30-way 0.5mm pitch FFC cable, for easy and simple connection to an application or motherboard, or for connecting to accessory boards for a range of functionality advancements.

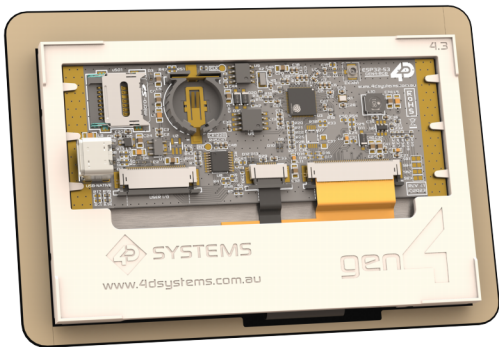
This series of boards is compatible with the 4D Systems Workshop4 IDE, utilising the Espressif compiler and 4D Systems purpose built libraries, allowing a feature rich design and programming experience.

Any code designed and written to run on other 4D Systems display modules, such as modules featuring GOLDELOX, PICASO, PIXXI or DIABLO-16 Graphics Processors, are unfortunately not compatible with the gen4-ESP32 range due to being a totally different processor family. However, please contact 4D Systems Support Team for assistance if you are planning on migrating from a different 4D Systems display model, as there are some similarities between them - such as the graphics, however a majority of the coding will have to be adapted.

From a mechanical perspective, these gen4-ESP32 modules are physically the same mounting size as other gen4 products by 4D Systems. The only difference is the circuitry used. Overall thickness of these gen4-ESP32 modules are greater than other gen4 products, due to the USB-C connector and coin cell battery holder for the RTC. Typically, where ever a different gen4 module had been mounted, a gen4-ESP32 module could fit in the same location.



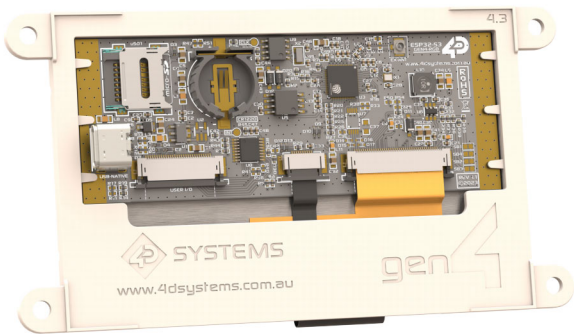
gen4-ESP32-43CT-CLB Front



gen4-ESP32-43CT-CLB Rear



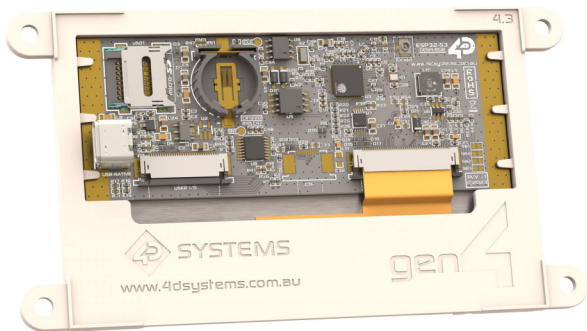
gen4-ESP32-43CT Front



gen4-ESP32-43CT Rear



gen4-ESP32-43T Front



gen4-ESP32-43T Rear

2. Features

- Powerful ESP32 Graphics Processor by Espressif.
- 800x480 resolution displays utilising RGB-565 colours.
- IPS TFT LCD display for 4.3" and 5.0" and TN TFT LCD display for 7.0" (WVA available for 7.0").
- Available in Non-Touch, Resistive Touch, Capacitive Touch, and Capacitive Touch with Cover Lens Bezel (CLB).
- 16MB of External Quad SPI Flash.
- 8MB of Internal Octal SPI PSRAM.
- 2 native GPIO dedicated to I2C only (As they are used internally on the board)(GPIO17/18).
- Up to 17 GPIO of which
 - Up to 8 GPIO via IO Expander capable of Digital Input/Output (EXT-GPIO0 - EXT-GPIO7).
 - 2 of which are unavailable unless Touch Reset/Interrupt is hardware disabled (EXT-GPIO6/7).
 - 4 native GPIO dedicated to SPI (Shared with microSD card) - CS pin (GPIO38) can be GPIO if SPI not used, and all 4 SPI pins can be GPIO if microSD card not utilised (GPIO38, GPIO11/12/13).
 - 2 native GPIO dedicated to Native USB-C functionality (GPIO19/20) unless that is hardware disabled, it is then available as GPIO.
 - 1 native GPIO available after boot (GPIO0), strapping pin.
 - 2 native GPIO available if the UART is not required (GPIO43/44)
- Serial UART (GPIO43/44), and up to 3 more UART's available by utilising available GPIO.
- On-board Real Time Clock with battery backup (CR1220) - *battery not included*
- 30pin FPC connection, for all signals, power, communications, GPIO and UART programming.
- Latch-type micro-SD memory card connector for multimedia storage and data logging purposes.
- Display full colour images, animations, icons and video clips.
- 4.0V to 6.0V range operation (single supply).
- 4x mounting tabs with 4.0mm holes for mechanical mounting using M4 screws (non CLB models only).
- 3M Adhesive around perimeter of Cover Lens Bezel for mounting the CTP-CLB model.
- RoHS and REACH compliant.
- CE/EMC and UKCA compliance pending.
- PCB is UL 94V-0 Flammability Rated.

• Module dimensions:

- (4.3" non-Touch): 127.6 x 69.3 x 11.8mm
- (4.3" Resistive Touch): 127.6 x 69.3 x 12.9mm
- (4.3" Capacitive Touch): 127.6 x 69.3 x 13.2mm
- (4.3" Capacitive Touch w/ CLB): 123.0 x 84.5 x 13.5mm
- (5.0" non-Touch): 142.8 x 77.9 x 11.7mm
- (5.0" Resistive Touch): 142.8 x 77.9 x 12.9mm
- (5.0" Capacitive Touch): 142.8 x 77.9 x 13.4mm
- (5.0" Capacitive Touch w/ CLB): 140.7 x 93.8 x 13.4mm
- (7.0" non-Touch): 187.0 x 102.1 x 12.3mm
- (7.0" Resistive Touch): 187.0 x 102.1 x 13.4mm
- (7.0" Capacitive Touch): 187.0 x 102.1 x 14.0mm
- (7.0" Capacitive Touch w/ CLB): 190.1 x 121.9 x 14.0mm

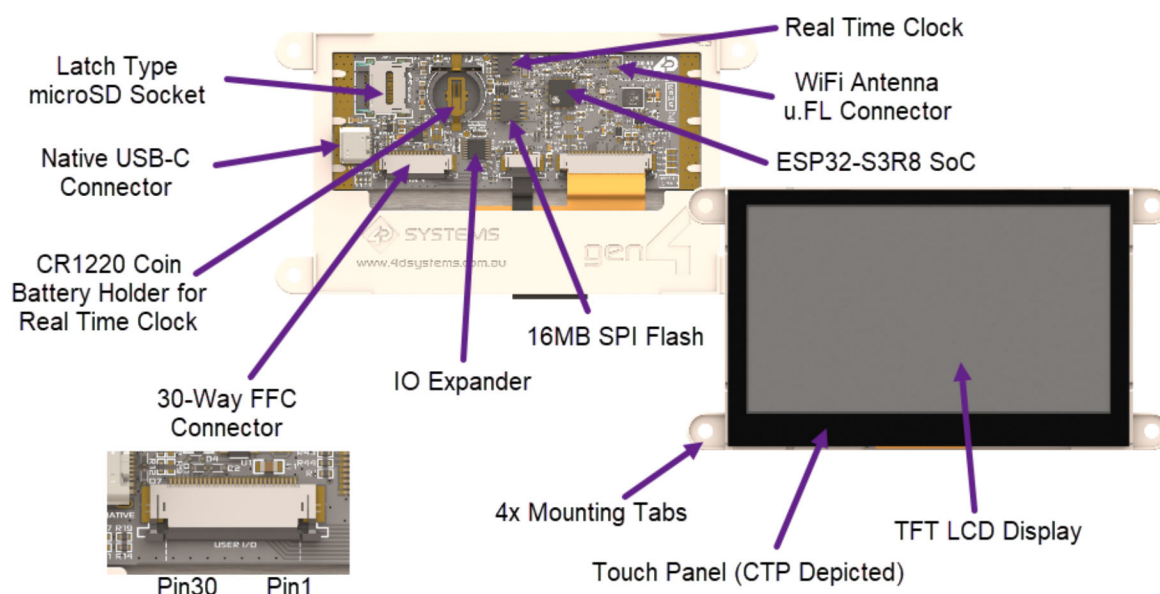
• Weighing (approximately):

- (4.3" non-Touch): ~ 72g
- (4.3" Resistive Touch): ~ 85g
- (4.3" Capacitive Touch): ~ 89g
- (4.3" Capacitive Touch w/ CLB): ~ 93g
- (5.0" non-Touch): ~ 84g
- (5.0" Resistive Touch): ~ 102g
- (5.0" Capacitive Touch): ~ 107g
- (5.0" Capacitive Touch w/ CLB): ~ 112g
- (7.0" non-Touch): ~ 176g
- (7.0" Resistive Touch): ~ 211g
- (7.0" Capacitive Touch): ~ 215g
- (7.0" Capacitive Touch w/ CLB): ~ 228g

 Note

The weights and dimensions provided for 7.0" models applies for both WVA and non-WVA variants.

3. Hardware Overview



Hardware Layout (4.3" CTP Module depicted)

Pin	Symbol	I/O	Description
1	GND	P	Supply Ground
2	I2C-SDA	I/O	Dedicated I2C pin as its also used internally, SDA - 3.3V logic. This module is Master (GPIO17)
3	I2C-SCL	I/O	Dedicated I2C pin as its also used internally, SCL - 3.3V logic. This module is Master (GPIO18)
4	EXT-GPIO0	I/O	General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
5	EXT-GPIO1	I/O	General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
6	EXT-GPIO2	I/O	General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
7	EXT-GPIO3	I/O	General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
8	EXT-GPIO4	I/O	General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
9	EXT-GPIO5	I/O	General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
10	EXT-GPIO6*	I/O	N/C unless hardware mod, then General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
11	EXT-GPIO7*	I/O	N/C unless hardware mod, then General Purpose I/O pin via IO Expander (Digital Input/Output only). This pin has 3.3V logic and is 5V tolerant for Input
12	GPIO38/ SPI-CS	I/O	General Purpose Input/Output, SPI CS capable if using SPI Bus. 3.3V Logic.
13	GPIO11/ SPI-MOSI	I/O/A	SPI-MOSI (shared with uSD card) however if uSD not required this can be a General Purpose Input/Output capable of Analog, 3.3V logic

Pin	Symbol	I/O	Description
14	GPIO12/ SPI-SCLK	I/O/A	SPI-SCLK (shared with uSD card) however if uSD not required this can be a General Purpose Input/Output capable of Analog, 3.3V logic
15	GPIO13/ SPI-MISO	I/O/A	SPI-MISO (shared with uSD card) however if uSD not required this can be a General Purpose Input/Output capable of Analog, 3.3V logic
16	GPIO20*	I/O/A	N/C unless hardware mod, then General Purpose Input/Output pin capable of Analog, 3.3V logic
17	GPIO19*	I/O/A	N/C unless hardware mod, then General Purpose Input/Output pin capable of Analog, 3.3V logic
18	NC	-	Not Connected
19	GPIO0	I/O	Available after boot, GPIO0 is used for Programming and Boot Strapping. General Purpose Input/Output, 3.3V logic
20	3.3V	P	3.3V Output for User, connected to system 3.3V bus. Excessive draw will affect system stability. 100mA-200mA draw is OK
21	GND	P	Supply Ground
22	EN-RST	I	Master Reset/Enable signal. Internally pulled up to 3.3V via a 10K resistor. Low will disable the chip, High will activate the chip. Used by a UART programmer for programming sequence.
23	U0RXD	I	Asynchronous Serial Receive pin, 3.3V TTL level. Connect this pin to the Transmit (Tx) signal of other serial devices. Used in conjunction with the U0TXD pin for UART programming or communications. This pin is 3.3V Logic only. (GPIO44)
24	U0TX0	O	Asynchronous Serial Transmit pin, 3.3V TTL level. Connect this pin to the Receive (Rx) signal of other serial devices. Used in conjunction with the U0RXD pin for UART programming or communications. This pin is 3.3V Logic only. (GPIO43)
25	GND	P	Supply Ground
26	5V IN	P	Main Voltage Supply +ve input pin. Reverse polarity protected. The range is 4.0V to 6.0V, nominal 5.0V.
27	5V IN	P	Main Voltage Supply +ve input pin. Reverse polarity protected. The range is 4.0V to 6.0V, nominal 5.0V.
28	5V IN	P	Main Voltage Supply +ve input pin. Reverse polarity protected. The range is 4.0V to 6.0V, nominal 5.0V.
29	5V IN	P	Main Voltage Supply +ve input pin. Reverse polarity protected. The range is 4.0V to 6.0V, nominal 5.0V.
30	GND	P	Supply Ground

Note

1. **I** = Input, **O** = Output, **P** = Power, **A** = Analog Input
2. It is recommended to connect at least 2 or more 5V IN pins to a stable 5V DC power supply, as well as at least 2 or more GND pins, especially important for the 7" display.
3. Please refer to the Espressif ESP32-S3 datasheet for specific detail on the capability of the native ESP32-S3 GPIO, in conjunction with the schematic of this module. Not all GPIO are native ESP32-S3, some are via a Texas Instruments I2C IO Expander (TCA9554APWR).

4. Hardware Interface - Pins

This section describes in detail the hardware interface pins of the module.

4.1. Serial Ports - 3.3V TTL

The gen4-ESP32 Series has a single serial UART, which is broken out to the 30-way FFC connector on this module (Pins 23 and 24, GPIO43/44). The module is capable of turning the available native GPIO into more serial UART's also, based on the functionality of the ESP32-S3 processor. Please refer to the [Espressif ESP32-S3 Datasheet](#) for more details.

Depending on which on-board peripherals are used, such as the microSD socket, or the native USB-C, up to 3 additional serial UART's could potentially be configured using GPIO38, GPIO11, GPIO12, GPIO13, GPIO20 and GPIO19.

The module can be programmed over UART (rather than native USB-C) utilising the U0RXD/U0TXD pins, in conjunction with EN-RST and GPIO0. Please refer to the 4D-UPA Programmer, in the Hardware Tools section.

4.2. I2C Port - 3.3V TTL

The gen4-ESP32 Series has 2 dedicated I2C pins (Pins 2 and 3) available on the 30-way FFC connector, due to I2C being utilised internally for the Touch, Real Time Clock, and IO Expander. These pins can be utilised by the User for general purpose I2C devices also. The gen4-ESP32 module is Master in terms of the I2C bus, so only Slave I2C devices can be added. High traffic I2C devices may cause issues with on board devices.

4.3. SPI Port - 3.3V TTL

The gen4-ESP32 Series has an SPI Port available to the user, which is shared with the micro-SD connector, however has a dedicated CS pin for the User to connect a single SPI device. Further SPI devices could be added, utilising other spare GPIO to serve as additional CS pins.

4.4. General Purpose I/O

There are up to 17 general-purpose Input/Output (GPIO) pins available to the user. Some of these GPIO are native to the ESP32-S3 processor, and some are via an I2C IO Expander.

ESP32-S3 Pin Configurations GPIO					
GPIO/Pin Name	Digital Input	Digital Output	Analog Read	SPI	UART
EXT-GPIO0	Yes	Yes			
EXT-GPIO1	Yes	Yes			
EXT-GPIO2	Yes	Yes			
EXT-GPIO3	Yes	Yes			
EXT-GPIO4	Yes	Yes			
EXT-GPIO5	Yes	Yes			
EXT-GPIO6	Yes**	Yes**			
EXT-GPIO7	Yes**	Yes**			
GPIO38	Yes	Yes		Yes (CS)	Yes*
GPIO11	Yes*	Yes*	Yes*	Yes (MOSI)	Yes*
GPIO12	Yes*	Yes*	Yes*	Yes (SCLK)	Yes*
GPIO13	Yes*	Yes*	Yes*	Yes (MISO)	Yes*
GPIO20	Yes**	Yes**	Yes**		Yes**
GPIO19	Yes**	Yes**	Yes**		Yes**
GPIO0	Yes	Yes			
GPIO43	Yes*	Yes*			Yes (TX)
GPIO44	Yes*	Yes*			Yes (RX)

Note

1. GPIO marked with * are only available if the hardware is configured to do so, as by default they will have other functions.

2. GPIO marked with ** require hardware modifications to achieve, please refer to the [Hardware Mods section](#) for more detail.

Please refer to the [Espressif ESP32-S3 datasheet](#) for information on how to configure the native GPIO for various functions, such as Digital-Input/Digital-Output, Analog Input and SPI.

EXT-GPIO0

General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

EXT-GPIO1

General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

EXT-GPIO2

General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

EXT-GPIO3

General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

EXT-GPIO4

General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

EXT-GPIO5

General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

EXT-GPIO6

By default, this pin is not available to the User, and is not hardware connected to the 30-way FFC connector. By default, this pin is used internally to serve the Capacitive Touch INT signal. This can however be configured to be connected to the 30-way FFC connector if this feature is not required. When modified in hardware (refer to the [Hardware Mods section](#)), this pin is a General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

EXT-GPIO7

By default, this pin is not available to the User, and is not hardware connected to the 30-way FFC connector. By default, this pin is used internally to serve the Capacitive Touch RESET signal. This can however be configured to be connected to the 30-way FFC connector if this feature is not required. When modified in hardware (refer to the [Hardware Mods section](#)), this pin is a General purpose I/O pin, connected to the ESP32-S3 via an I2C IO Expander. Capable of Digital Input and Output only. 5V tolerant for input, 3.3V logic level output.

GPIO38/SPI-CS

This pin is typically used as a CS select pin for the SPI Bus, however can be used as a GPIO pin. It is a native ESP32-S3 GPIO pin, capable of Digital Input and Output only. It is 3.3V tolerant only and 3.3V logic level.

GPIO11/SPI-MOSI

This pin is shared with the micro-SD connector, and therefore typically must remain as a MOSI SPI pin. Used in conjunction with the GPIO38/SPI-CS pin, this can be fully utilised by the User as an SPI bus for external devices. If the micro-SD card is not required and not utilised, this pin can be utilised as a GPIO pin. It is native to the ESP32-S3 and can be utilised for Digital Input and Output, as well as Analog Input, amongst other native functionality. This pin is 3.3V tolerant only and 3.3V logic level.

GPIO12/SPI-SCLK

This pin is shared with the micro-SD connector, and therefore typically must remain as a SCLK SPI pin. Used in conjunction with the GPIO38/SPI-CS pin, this can be fully utilised by the User as an SPI bus for external devices. If the micro-SD card is not required and not utilised, this pin can be utilised as a GPIO pin. It is native to the ESP32-S3 and can be utilised for Digital Input and Output, as well as Analog Input, amongst other native functionality. This pin is 3.3V tolerant only and 3.3V logic level.

GPIO13/SPI-MISO

This pin is shared with the micro-SD connector, and therefore typically must remain as a MISO SPI pin. Used in conjunction with the GPIO38/SPI-CS pin, this can be fully utilised by the User as an SPI bus for external devices. If the micro-SD card is not required and not utilised, this pin can be utilised as a GPIO pin. It is native to the ESP32-S3 and can be utilised for Digital Input and Output, as well as Analog Input, amongst other native functionality. This pin is 3.3V tolerant only and 3.3V logic level.

GPIO20

By default, this pin is not available to the User, and is not hardware connected to the 30-way FFC connector. By default, this pin is used by the native USB-C port (USB D+). This can however be configured to be connected to the 30-way FFC connector if the USB-C port is not required. When modified in hardware (refer to the [Hardware Mods section](#)), this pin is a General Purpose I/O pin native to the ESP32-S3. It is native to the ESP32-S3 and can be utilised for Digital Input and Output, as well as Analog Input, amongst other native functionality. This pin is 3.3V tolerant only and 3.3V logic level.

GPIO19

By default, this pin is not available to the User, and is not hardware connected to the 30-way FFC connector. By default, this pin is used by the native USB-C port (USB D-). This can however be configured to be connected to the 30-way FFC connector if the USB-C port is not required. When modified in hardware (refer to the [Hardware Mods section](#)), this pin is a General Purpose I/O pin native to the ESP32-S3. It is native to the ESP32-S3 and can be utilised for Digital Input and Output, as well as Analog Input, amongst other native functionality. This pin is 3.3V tolerant only and 3.3V logic level.

GPIO0

Available after boot, GPIO0 is used for Programming via UART and for Boot Strapping. It is a native ESP32-S3 GPIO pin, capable of Digital Input and Output only. It is 3.3V tolerant only and 3.3V logic level.

GPIO43

GPIO43 is used typically as the primary UART, TX pin. If a UART is not required on this pin, then it can be used for GPIO instead. It is a native ESP32-S3 GPIO pin, capable of Digital Input and Output only. It is 3.3V tolerant only and 3.3V logic level.

GPIO44

GPIO44 is used typically as the primary UART, RX pin. If a UART is not required on this pin, then it can be used for GPIO instead. It is a native ESP32-S3 GPIO pin, capable of Digital Input and Output only. It is 3.3V tolerant only and 3.3V logic level.

4.5. System Pins

5V IN (Module Voltage Input):

Module supply voltage input pins. At least two (however ideally four) of these pins should be connected to a stable supply voltage in the range of 4.0 Volts to 5.5 Volts DC. Nominal operating voltage is 5.0 Volts. Utilising 4 pins shares the current over the FFC cable, which is important for the larger size displays.

GND (Module Ground):

Device ground pins. At least two (ideally four) pins should be connected to the ground.

EN-RST (Module Enable/Disable/Reset):

This pin is connected to a 10K pull-up resistor, which is pulling the module to the enabled state by default. Pulling this pin to 0V will disable the module, and put it into a reset state. Pulling the pin High or floating (due to build in pull-up resistor) will enable the module. This pin is utilised when utilising the UART Programming method.

4.6. Accessing Other GPIO Pins - Hardware Mods Required

GPIO19

GPIO19 by default is USB-D-, part of the USB+/USB- combination for the Native USB-C port.

If there is no desire to utilise the onboard USB-C connector, or an external extension is going to be made utilising the 30-way FFC connector, or the pins are desired to be GPIO, it is possible to achieve with a small hardware modification. In order to access this pin on the 30-way FFC, a resistor needs to be removed (R13) and another needs to be added (R8) or a simple solder blob will suffice in this position.

If this is going to be a required modification for your end-product, and it will be used in a production application, it is possible to request 4D Systems to move this by default when you order the product. Please contact our Sales team with your requirements.

GPIO20

GPIO20 by default is USB-D+, part of the USB+/USB- combination for the Native USB-C port.

If there is no desire to utilise the onboard USB-C connector, or an external extension is going to be made utilising the 30-way FFC connector, or the pins are desired to be GPIO, it is possible to achieve with a small hardware modification. In order to access this pin on the 30-way FFC, a resistor needs to be removed (R12) and another needs to be added (R9) or a simple solder blob will suffice in this position.

If this is going to be a required modification for your end-product, and it will be used in a production application, it is possible to request 4D Systems to move this by default when you order the product. Please contact our Sales team with your requirements.

EXT-GPIO6

EXT-GPIO6 is one of the GPIO from the IO Expander, and by default is connected to the Touch Panels INT pin.

If there is no requirement for touch (ie you have a non-Touch module), or this pin is required, and you plan on modifying the code/library to not utilise this pin, it can be redirected to the 30-way FFC by removing resistor R55, and adding it back into the position of R40 (or simply placing a solder blob).

If this is going to be a required modification for your end-product, and it will be used in a production application, it is possible to request 4D Systems to move this by default when you order the product. Please contact our Sales team with your requirements.

EXT-GPIO7

EXT-GPIO7 is one of the GPIO from the IO Expander, and by default is connected to the Touch Panels RESET pin.

If there is no requirement for touch (ie you have a non-Touch module), or this pin is required, and you plan on modifying the code/library to not utilise this pin, it can be redirected to the 30-way FFC by removing resistor R56, and adding it back into the position of R41 (or simply placing a solder blob).

If this is going to be a required modification for your end-product, and it will be used in a production application, it is possible to request 4D Systems to move this by default when you order the product. Please contact our Sales team with your requirements.

5. Module Features

The gen4-ESP32 Series is designed to accommodate a wide variety of applications. Some of the main features of the module are listed below.

5.1. ESP32-S3R8 Processor

The module is designed around the ESP32-S3R8 Processor from Espressif. This model of ESP32-S3 has 8MB of built in Octal SPI PSRAM, and utilises External Quad SPI Flash for application storage. Media is typically stored on a micro-SD card, however some types of media can be stored in SPI Flash, but it is very limited for capacity.

A majority of the ESP32-S3's GPIO pins are utilised for driving the RGB display, so this module features a Texas Instruments I2C IO Expander to provide 8 additional GPIO, 2 of which are used internally and the rest are available for the User.

5.2. Chipsets used

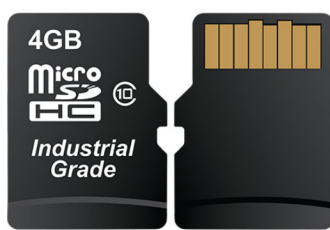
The gen4-ESP32 Series of modules utilises a few chipsets from various manufacturers, in order for these modules to operate. Please refer to the Schematic for connection details.

- The main processor is an Espressif ESP32-S3R8, as mentioned in the previous section.
- The backlight is controlled using an ETA Solutions ETA1611S2G backlight driver, which takes On/Off/PWM input from the ESP32-S3 using GPIO2.
- For Capacitive Touch models, the chipset for the capacitive touch is I2C driven, and the chipset is found on the Display flex itself. These utilise Focaltech FT5446 controllers for 4.3", 5.0" and 7.0" models.
- For Resistive Touch models, the chipset used is the NSIWAY NS2009 Resistive Touch driver, which is a 4-wire controller, and is I2C driven.
- The Real Time Clock utilises the NXP PCF8563T/5 real time clock, which is also I2C driven. This is battery backed up with a CR1220 coin cell battery. *Battery is not included.*
- The IO Expander which provides 8 additional GPIO to the module, is the Texas Instruments TCA9554APWR controller, which is I2C driven.
- The Quad SPI Flash memory used on these modules, is the Giga-Devices GD25Q127C, which is 16MB in capacity, and interfaces to the ESP32-S3 on the same Octal/Quad SPI bus as the PSRAM which is built into the ESP32-S3R8 chipset itself.
- The micro-SD card interface, while not a chipset, is still worthy of note. It utilises a dedicated 1-bit SPI bus from the ESP32-S3, which can be shared with the User if required. The micro-SD cards used must be SPI compatible due to the interface type - more detail below.

5.3. SD/SDHC Memory Cards

The gen4-ESP32 modules use off-the-shelf standard SDHC/SD/microSD memory cards with up to 4GB capacity usable with FAT16 formatting, and much higher with FAT32 formatting. For any FAT file-related operations, before the memory card can be used it must first be formatted. The formatting of the card can be done on any PC system with a card reader.

Cards with a FAT16 formatting (4GB or under partition) are capable of operating faster on this display module, compared to the same card (16GB for example) with a single FAT32 partition, due to the nature of FAT16 vs FAT32 file transfers. If your application media can fit inside a 4GB partition, it is recommended to use FAT16 to gain the maximal speed possible.



RMPET, a 4D Systems Tool found in the Workshop4 IDE, is capable of repartitioning and formatting microSD cards for FAT16, to be the appropriate type and format. This tool should be used for all cards as it also employs an offset which is critical when using Industrial microSD cards which feature Read Disturb Prevention firmware, which is a special firmware inside the microSD card designed to prevent Read Disturb occurring on NAND based Flash media. Further discussed in the note.

Note

1. An SPI Compatible SDHC/SD/microSD card **MUST** be used. The gen4-ESP32 modules requires SPI mode to communicate with the SD card. If a non-SPI compatible SD card is used, then the processor will not be able to mount the card.
2. Read disturbance is a well-known issue with flash memory devices, such as microSD cards, where reading data from a flash cell can cause the nearby cells in the same memory block to change over time. This issue can be prevented by using industrial-grade microSD cards with read disturb protection. Industrial-grade microSD cards have firmware that actively monitors the read operation and refreshes areas of memory that have high traffic and even move data around to prevent read disturb error from occurring. Furthermore, manufacturers may choose to implement read disturb protection on a specific part of the flash memory only, such that the beginning part of the memory might not be protected. The RMPET utility in Workshop4 is designed to create the first partition at an offset from the start of the microSD card to account for this situation. It is therefore recommended to always partition and format an industrial microSD card using the RMPET utility before using it with 4D Systems modules. Many commercial grade cards designed for Cameras etc, do not handle read disturb well at all, and therefore it is always recommended to use an Industrial grade microSD card with 4D modules. 4D offers one that is tried and tested, on our website.