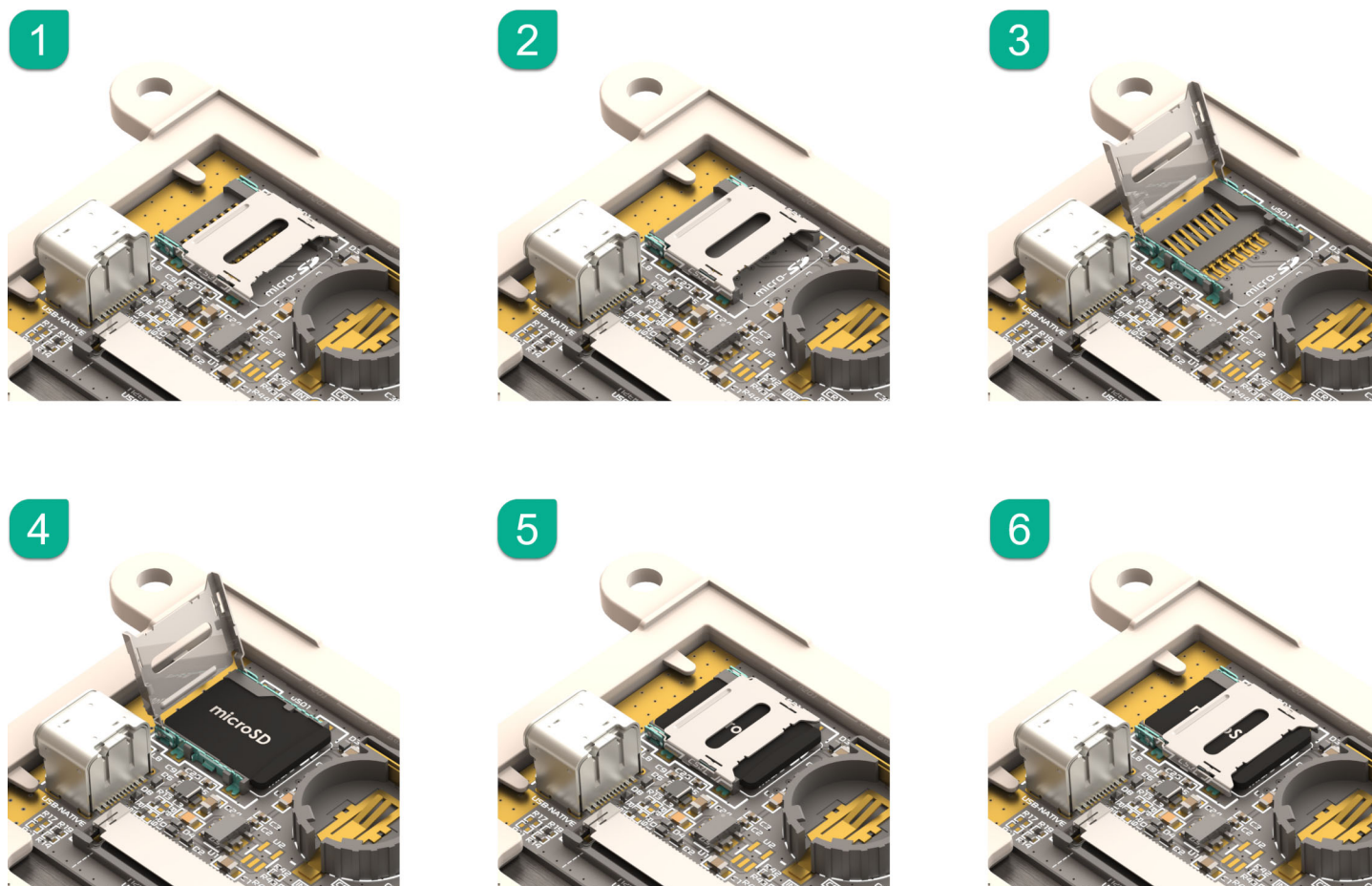


5.4. microSD Socket Usage

On the gen4-ESP32 modules is a Latch-Type microSD socket. To use this socket is simple if you follow these easy steps.

- Unlock the empty socket by sliding/unlocking the socket towards the edge of the PCB (away from the battery holder).
- Lifting the lid of the socket, and hinging it up off the PCB, towards the edge of the module.
- Placing a microSD card into the socket.
- Lowering the lid of the socket back down, by hinging it down towards the PCB again.
- Locking the socket back in place by sliding/locking the socket towards the battery holder.

Please refer to the following diagram for guidance:



5.5. FAT16 vs FAT32

FAT16 is capable of having a partition with up to 4GB capacity usable. While this might seem like a limitation, it still offers the best performance for small processor systems such as the ESP32-S3. Larger partitions are possible with FAT32 formatting, however smaller cluster size results, giving slightly worse performance.

For any FAT file-related operations, before the memory card can be used it must first be formatted correctly. Built into Workshop4 is a tool created by 4D, called RMPET (please refer to the Tools menu, in any Environment, inside the Workshop4 IDE). RMPET allows the User to easily partition and format microSD cards, to make their file system ready to be used with 4D Systems modules. The formatting of the card can be done on any Windows PC system with a card reader.

5.6. Wide Viewing Angle (WVA)

The 7.0" model in this gen4 series has the option to use a WVA-type display, rather than the standard TN display. While WVA is physically still a TN display, it features much wider viewing angles and prevents image inversion when viewing at steep viewing angles. The outcome is a similar effect and visual improvement to an IPS display, while still using a cost-effective TN display technology. Many applications can benefit from wider viewing angles.

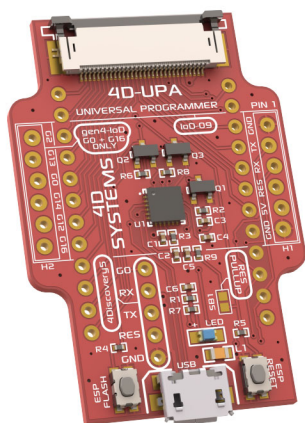
6. Display/Module Precautions

- Avoid having to display the same image/object on the screen for lengthy periods. This can cause a burn-in which is a common problem with all types of display technologies. Blank the screen after a while or dim it very low by adjusting the contrast. Better still; implement a screen saver feature.
- Moisture and water can damage the display. Moisture on the surface of a powered display should not cause any problems, however, if water is to enter the display either from the front or from the rear, or come in contact with the PCB, it will damage. Wipe off any moisture gently or let the display dry before usage. If using this display module in an environment where it can get wet, ensure an appropriate enclosure is used.
- Dirt from fingerprint oil and fat can easily stain the surface of the display. Gently wipe off any stains with a soft lint-free cloth.
- The performance of the display will degrade under high temperatures and humidity. Avoid such conditions when storing.
- Do not tamper with the display flex cable that is connected to the control board. This may affect the connection between the display and the driving circuitry and cause failure.
- Displays are susceptible to mechanical shock and any force exerted on the module may result in deformed zebra stripes, a cracked display cell and a broken backlight.
- Always use the mounting holes on the module's to mount the display where possible, or mount using the CLB for CLB based modules.
- Display modules have a finite life, which is typically dictated by the display itself, more specifically the backlight. The backlight contains LEDs, which fade over time. In the [Specifications section](#) is a figure for the typical life of the display, and the criteria are listed.
- The resistive Touch model features a touch-sensitive film over the display which is sensitive to pressure. When mounting the display module in an enclosure, you should not apply pressure to the surface of the display by the enclosure. It could result in false touches or the touch will simply not function at all.

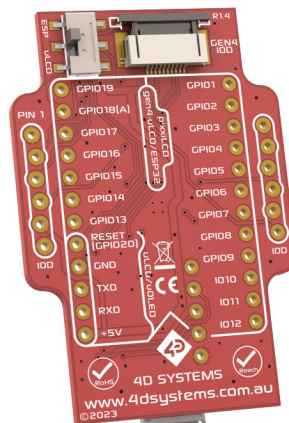
7. Hardware Tools

The following hardware tools are required for full control of the gen4-ESP32 Display Modules.

7.1. 4D-UPA



4D-UPA Front

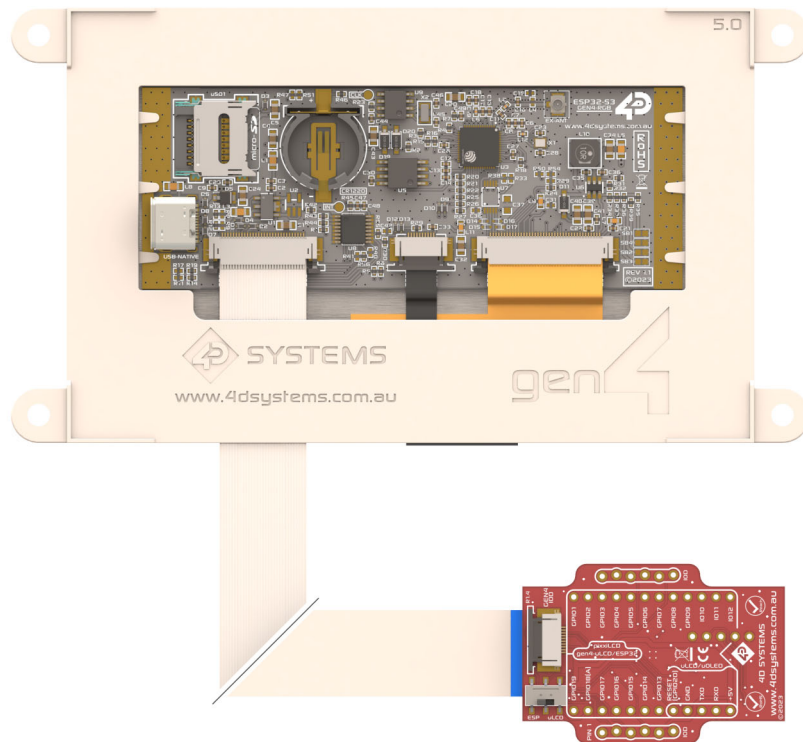


4D-UPA Back

The 4D-UPA minimizes the connections and modules required for programming the gen4-ESP32 series via its UART - creating a single module with a micro USB interface, and DIP style pads for GPIO breakout of all the signals used on the gen4 Display interface, which is useful for development or final product use.

The GPIO naming convention on the 4D-UPA does not reflect the GPIO naming of the actual display module, due to the 4D-UPA being universal and able to be used with many 4D Products. Please review the 4D-UPA datasheet for information on mapping the GPIO naming from this module, with the GPIO naming on the 4D-UPA, to ensure you connect to the correct pins you desire.

Typically, a 4D-UPA should not be required for programming the gen4-ESP32 series of modules, as they have USB-C on board, however if problems occur or situations arise that the USB-C is non-functional, then the 4D-UPA would be required, so it is a good tool to have on hand.



The 4D-UPA is connected to the ESP32 module using the supplied 30-way FFC Cable. The connectors on both the ESP32 module, and the 4D-UPA, are Top-Contact, meaning the FFC cable pins should be facing upwards, and the blue stiffener, should be facing down towards the PCB.

Note

1. 4D-UPA REV 1.4 and higher is required to program a ESP32 processor. Anything < REV 1.4 will not work for programming ESP32 based products. Please be sure to refer to the 4D-UPA Datasheet.
2. If using the 4D-UPA, only the supplied FFC cable (or same type) can be used. The type of cable supplied, as described in the **FFC Cable** section, is an Opposite type (contacts on opposite sides to each other at end end). If a straight cable (contacts on the same side at both ends) is sourced, this will NOT work when connecting to the 4D-UPA, as the connections will be swapped. Please refer to the information provided for more detail.

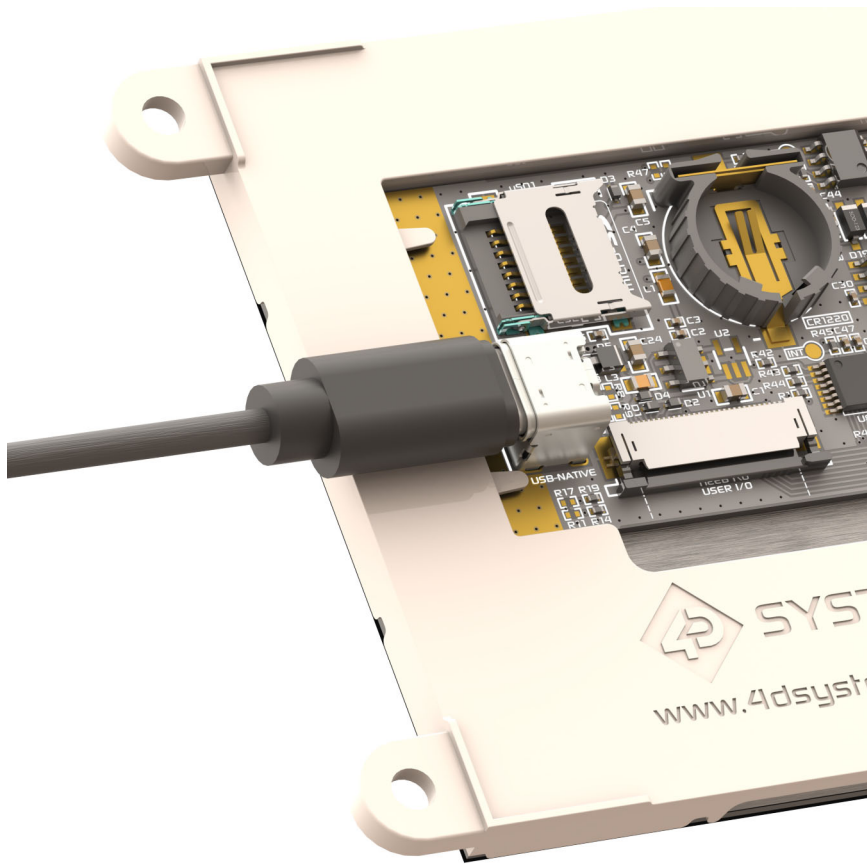
7.2. USB-C Cable

A USB-C Cable is the primary way to program a gen4-ESP32 module from 4D Systems, aside from using a 4D-UPA, as described previously.

A USB-C cable is not supplied with the modules, as they can be sourced from any computer or hardware store, and come with most Cell Phones these days too.

Connection of the USB-C cable to the module is simple, and simply plugs into the USB-C connector on the board, clearing the gen4 plastics on the side.

The USB-C provides power as well as USB Data communications, for while developing software on the module and programming it. The USB-C cable can be used in the end product use if desired, or the use of the FFC-Cable directly to the projects main Application PCB as an alternative.



USB-C Connection

8. Software Tools

8.1. Workshop4 IDE

Workshop4 is a comprehensive software IDE that provides an integrated software development platform for all the 4D family of processors and modules, as well as some 3rd party processors such as the Espressif ESP32.

The IDE provides an Editor and WYSIWYG design area for gen4-ESP32 based modules, to develop complete application code with various widgets and media references as required. All user application code is developed within the Workshop4 IDE, and is easily coupled with graphics and media, so is a one-stop shop for development with these modules.

The Workshop4 IDE utilises the Arduino IDE 2.x CLI to handle the compiling, linking and downloading of ESP32 based projects, using the ESP32 Arduino Core and associated libraries, without having to interface with the Arduino IDE at all.

When using Workshop4, the library **GFX4dESP32** is used. This library maintains compatibility with gen4-IoD (ESP8266) series, through the library **GFX4d**. This means that older gen4-IoD projects can be easily converted to this product line, with minimal to no modifications, as long as the hardware supports all functionality.



Note

Arduino IDE 2.x and Arduino CLI are not included when installing Workshop4 and must be installed separately. For complete development setup instructions, please refer to the [Workshop4 ESP32 Development Manual](#).

8.2. Workshop5 IDE

Workshop5 is the new IDE from 4D Systems, which will eventually take over Workshop4 when it is fully developed. It is still in development, however can be actively used for new applications for many of the 4D Systems modules, including the ESP32-S3 modules. It is a comprehensive software IDE that provides an integrated software development platform for all the 4D family of processors and modules, as well as some 3rd party processors such as the Espressif ESP32, and the Raspberry Pi RP2350 modules.

The IDE provides an Editor and WYSIWYG design area for ESP32-S3 based modules, to develop complete application code with various widgets and media references as required. All user application code is developed within the Workshop5 IDE, and is easily coupled with graphics and media, so is a one stop shop for development with these modules.

The Workshop5 IDE utilises the Arduino IDE 2.x CLI to handle the compiling, linking and downloading of ESP32 based projects, using the Arduino-ESP32 Core and associated libraries, without having to interface with the Arduino IDE at all.

When using Workshop5, the library **Graphics4D** is used. This library maintains compatibility with other Workshop5 compatible products that are programmed in C++, such as the 4D Systems' RP2350B products. This means that C++ graphics code used in Workshop5 project can be easily used to this product line, with minimal to no modifications.

Note

Arduino IDE 2.x and Arduino CLI are included when installing Workshop5, so there is no need to installed these separately. For complete development setup instructions, please refer to the [Workshop5 ESP32 Development Manual](#).

8.3. Workshop Built-in Tools

Built into Workshop4 and Workshop5 are a number of tools which are available to aid the programming of the ESP32-S3 series of displays.

Terminal, as the name implies, is a terminal application that can be used to communicate with the display module and is primarily used for basic debugging. It displays incoming Serial messages from the display module in ASCII and HEX format. It is capable of sending character or hex strings as well as keystrokes to the display.

RMPET is a partitioning and formatting tool, used to correctly set up a micro-SD card for use with 4D Systems products. This is further discussed in the [SD/SDHC Memory Cards section](#)

9. Programming Language

The programming language used in the Workshop4 and Workshop5 IDEs to program the gen4-ESP32 series of modules, is C++, which is the same as native Arduino IDE written code.

The Arduino programming language is a user-friendly coding system tailored for Arduino microcontrollers. It simplifies microcontroller coding, bridging the gap between users and hardware. Its approachability and community support make it ideal for various projects.

10. ESP-IDF Development

While it's recommended to use Workshop4 or Workshop5 IDEs to create applications for these displays, having ESP32-S3 at its core allows any user to develop applications directly through the official development framework from Espressif.

When using ESP-IDF, users can utilise search and utilize various IDF components by searching through the [ESP Component Registry](#). These serves as libraries simplifying development similar to Arduino. However, these are mostly written in C rather than C++.

To aid with setting up our ESP32-S3 RGB displays for ESP-IDF development, here are some recommended components for this product line:

Peripheral	Component
LCD	<i>No external component required. Refer to RGB Interfaced LCD in Espressif Docs</i>
Capacitive Touch	espressif/esp_lcd_touch_ft5x06
Resistive Touch	<i>No available component for NS2009 at time of writing</i>
RTC	esp-idf-lib/pcf8563
I/O Expander	espressif/esp_io_expander_tca9554

Note

For LCD timings, please refer to the 4DLCD datasheets:

- 4DLCD-43800480 - *Please contact 4D Systems support team*
- [4DLCD-50800480](#)
- [4DLCD-70800480](#)
- [4DLCD-90800480](#)

11. Display Module Part Numbers

The following is a breakdown of the part numbers and what they mean.

Examples:

- gen4-ESP32-43T
- gen4-ESP32-50CT
- gen4-ESP32-70CT-CLB-WVA

Example Starter Kits

- SK-gen4-ESP32-43T
- SK-gen4-ESP32-50CT
- SK-gen4-ESP32-70CT-CLB-WVA

where:

SK - Starter Kit (kitting of multiple parts)
gen4 - gen4 Display Range
ESP32 - ESP32 Display Family
43 - Display size (4.3")
50 - Display size (5.0")
70 - Display size (7.0")
T - Resistive Touch
CT - Capacitive Touch
CLB - Cover Lens Bezel
WVA - Wide Viewing Angle display (7.0" only)

Note

- The SK at the start denotes it's a Starter Kit, and the rest of the part number describes the display module in the Starter Kit.
- A product without a T or CT in the part number is a non-touch variant.
- Cover Lens Bezels (CLB) are glass fronts for the display module with overhanging edges, which allow the display module to be mounted directly into a panel using special adhesive on the overhanging glass. This is available for capacitive touch only.
- Resistive Touch models are not available in CLB, as a CLB is made of glass and resistive touch relies on the mechanical flexing of a membrane to trigger touch.
- WVA stands for Wide Viewing Angle and is a special and optional addition to the 7" range of modules, which boosts viewing angles of the display and prevents image inversion when viewing at steep viewing angles. The outcome is a similar effect and visual improvement to an IPS display, however, it uses a TN display. This is only an option for the 7". WVA models are the same physical dimensions as a regular 7".

12. Cover Lens Bezel - Tape Spec

The perimeter of the CLB display modules features double-sided adhesive tape, designed to stick directly onto a panel, enclosure, box etc. without the need for any mounting screws or hardware.

The tape used is 3M 9495LE tape, which uses well-known and strong 3M 300LSE adhesives. The double-sided adhesive has a thickness of 0.175mm once the backing has been removed.

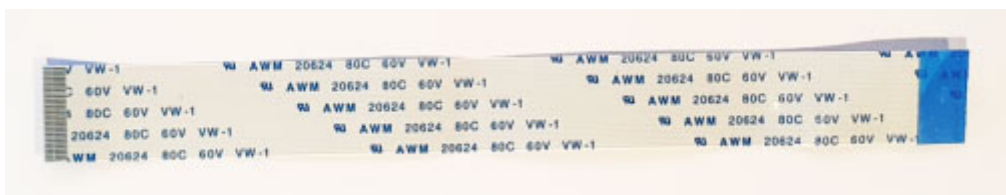
More information on this adhesive can be found on the 3M website.

13. FFC Cable

The FFC cables supplied by 4D Systems (included with products) have the following specifications:

- **30 Pin** Flexible Flat Cable, 150mm Long, 0.5mm (0.02") pitch
- Cable Type: AWM 20624 80C 60V VW-1
- Heat Resistance 80 Degrees Celsius
- Connections on the opposite side at each end (Type B)

You can get different cable lengths from the 4D Systems website.

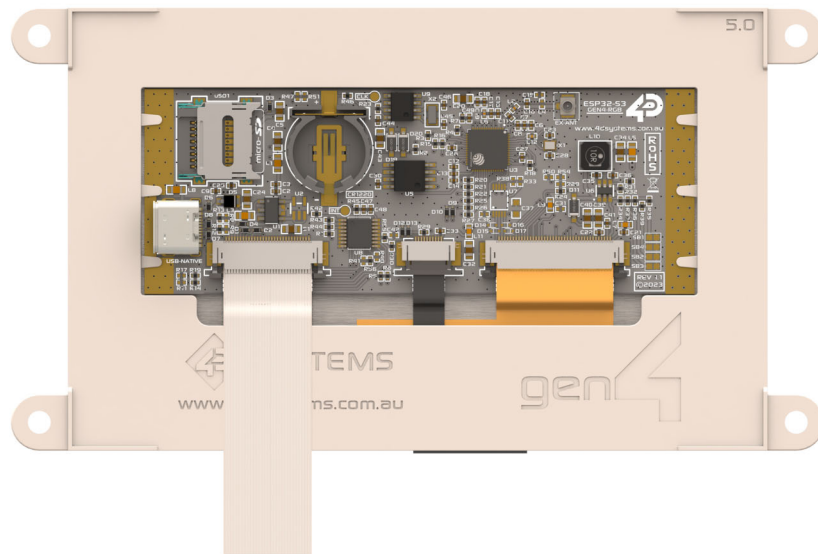


Note

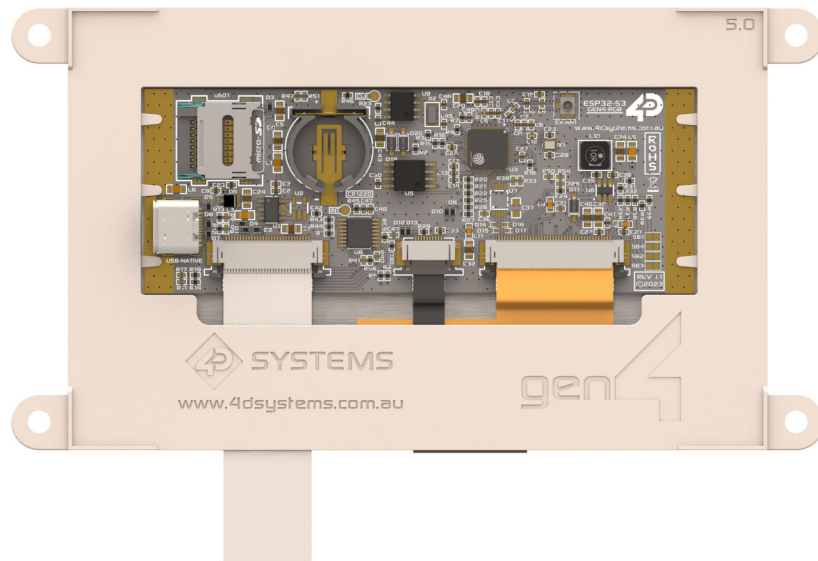
If you are interfacing with this module directly to your product via the 30-way FFC rather than utilising a breakout board or 4D-UPA, suitable connectors are readily available from many electronics suppliers, such as Digikey, Mouser, Farnell, RS, etc.

A standard 30-pin, 0.5mm pitch, 0.3mm thick FFC, FFC connector. They are available in Top Contact and Bottom Contact, so depending how you orientate the cable on your product, will determine which one you need. Please however take care of the pinout and how it flows from the display module, through the FFC and into your product, to ensure Pin1 and Pin30 are where you expect them to be.

The ESP32 modules are designed with gen4 plastics and the FFC cable can either be connected and sit above the plastics, or can thread underneath and out the bottom.



FFC Cable - Over Plastics



FFC Cable - Under Plastics

14. Starter Kit

4D Systems highly recommends all first-time buyers of 4D Systems' displays, to purchase the Starter Kit when purchasing their first 4D Systems display solution.

The Starter Kit provides all the hardware that is required to get the User up and running.

Starter Kits typically include:

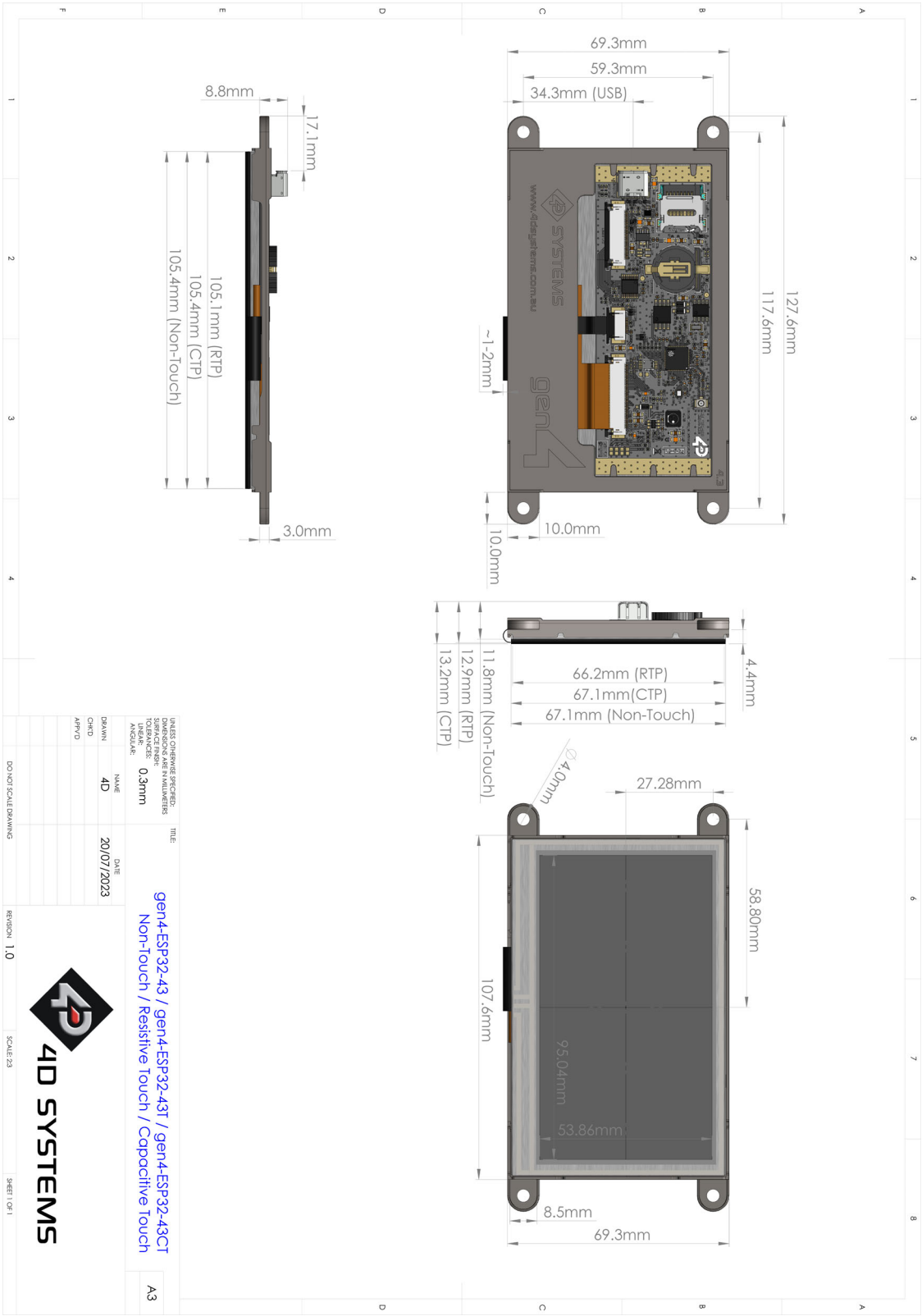
- gen4 ESP32 Display Module
- gen4 Breakout Board (gen4-Breakout)
- 4D Universal Programming Adaptor (4D-UPA REV1.4 or higher)
- 4GB micro-SD Card
- 150mm 30-way FFC cable for connecting display to gen4-Breakout, 4D-UPA, or Users System
- Wi-Fi Antenna (u.FL to SMA, and screw on SMA antenna)

Please refer to the [4D Systems website](#) for the current components included in the Starter Kit.

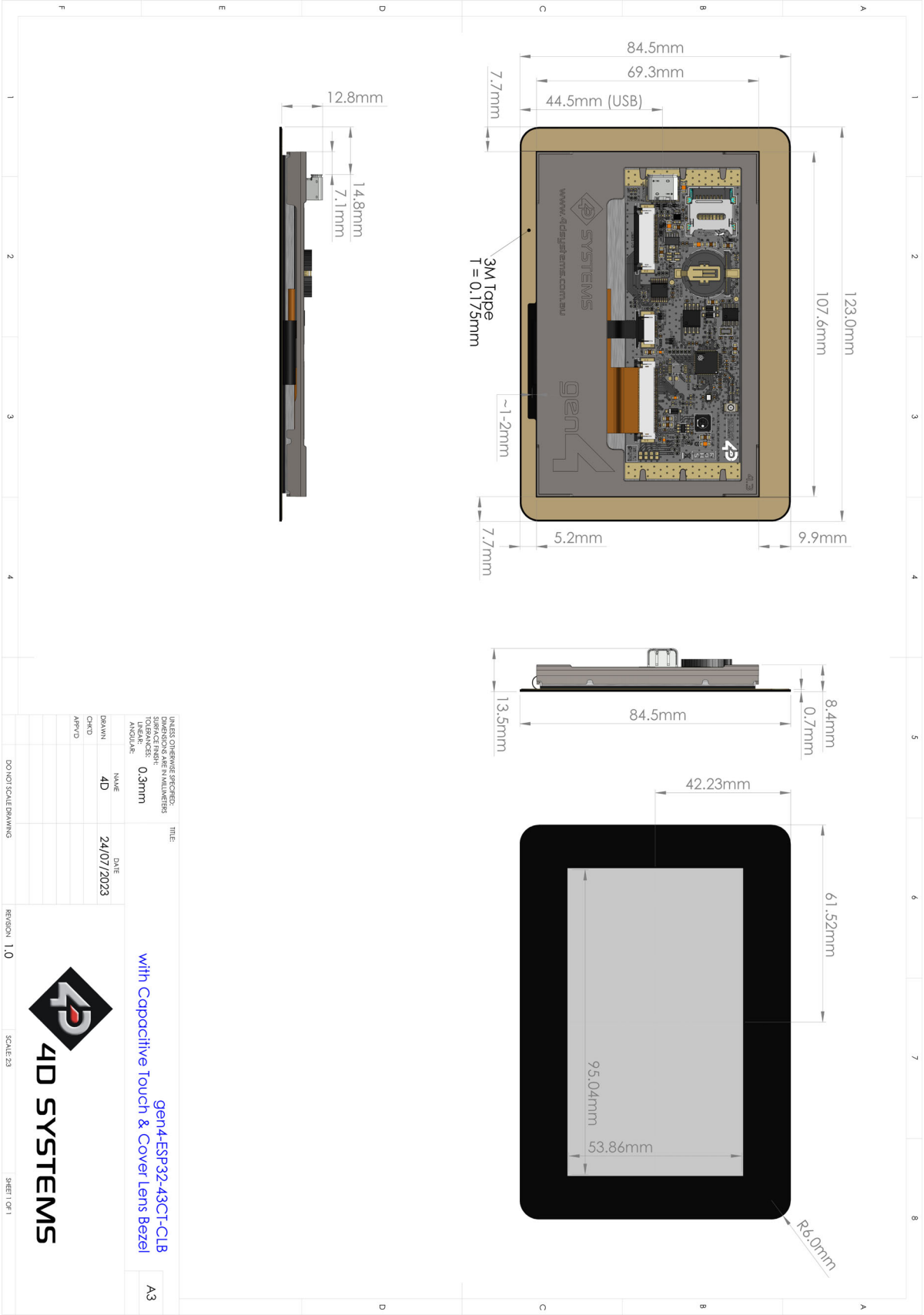
Simply select the Starter Kit option when purchasing the chosen display module on the 4D Systems shopping cart, or from your local distributor.

15. 4.3" Mechanical Details

15.1. Non-Touch, Resistive and Capacitive

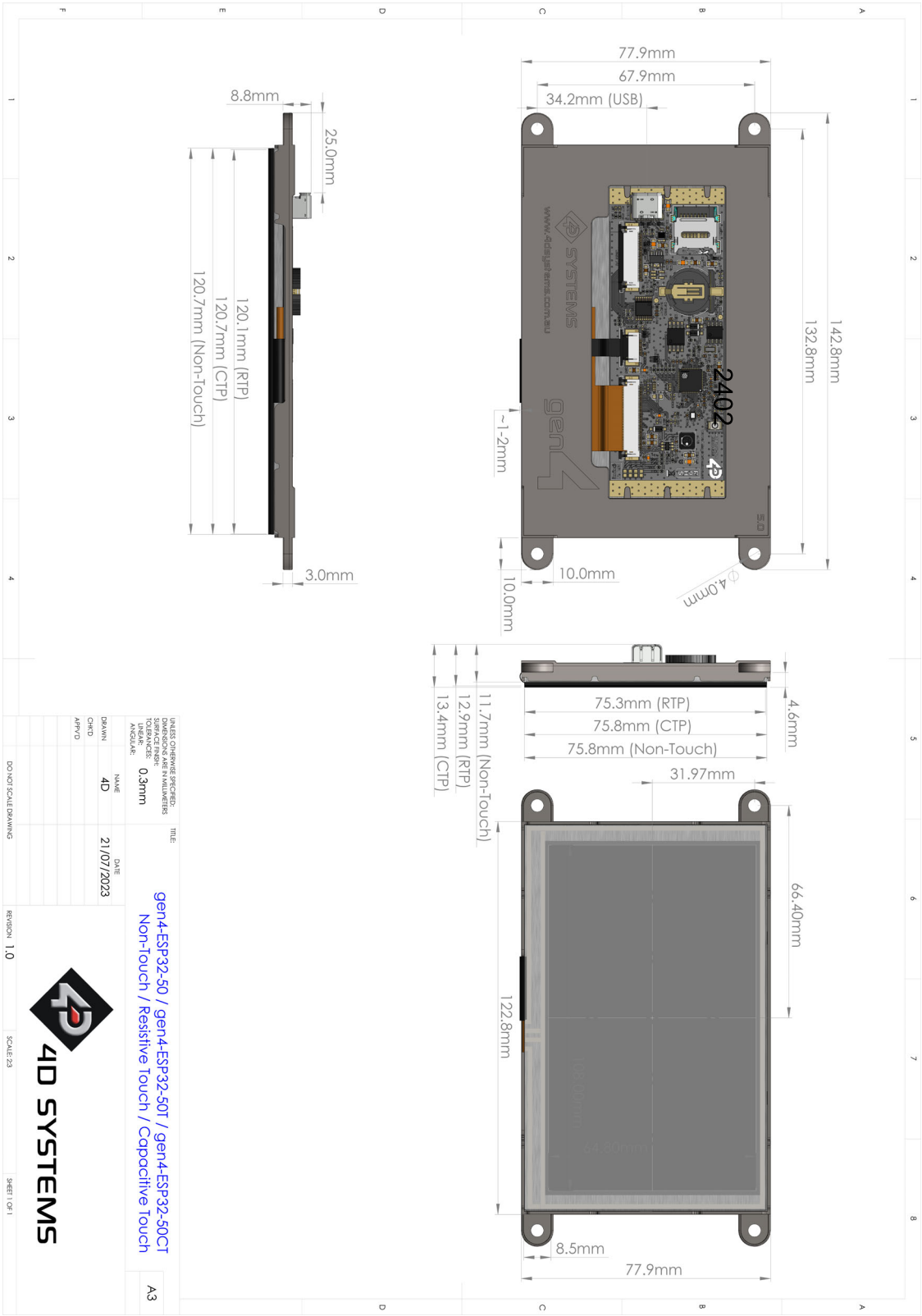


15.2. Capacitive w/ CLB

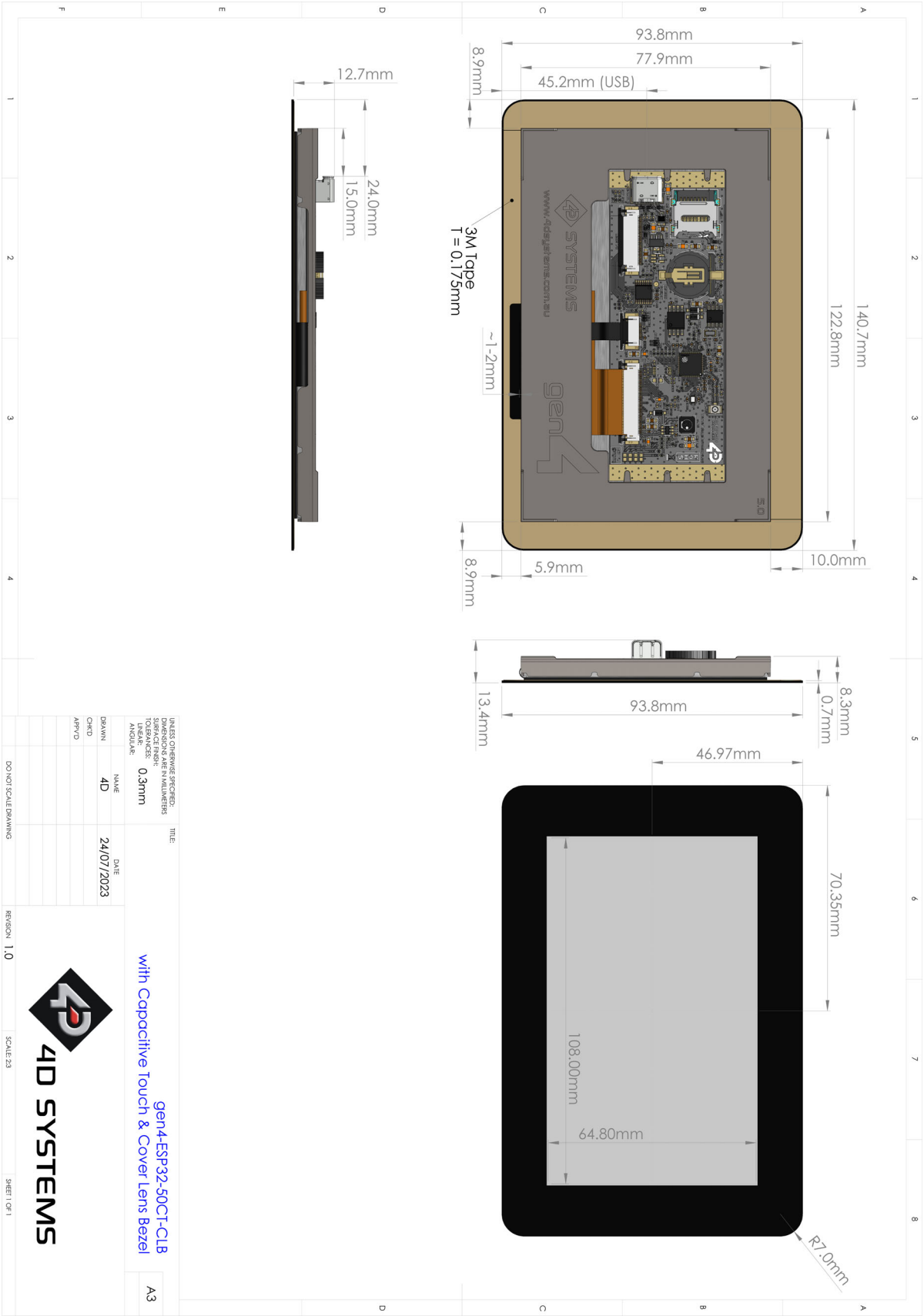


16. 5.0" Mechanical Details

16.1. Non-Touch, Resistive and Capacitive



16.2. Capacitive w/ CLB



17. 7.0" Mechanical Details

17.1. Non-Touch, Resistive and Capacitive



17.2. Capacitive w/ CLB

