4D SYSTEMS

TURNING TECHNOLOGY INTO ART

DATASHEET

*gen*4 Display Module Series

2.8” Picaso Integrated Display Module

gen4-uLCD-28PT Resistive touch

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1. Description

The gen4 2.8” Picaso Integrated Display Module is part of the latest gen4 series of modules Designed and Manufactured by 4D Systems.

The gen4 series was designed specifically for ease of integration and use, with careful consideration for space requirements and functionality.

This specific gen4 module features a 2.8” colour TFT LCD display, with resistive touch. It is powered by the well-known 4D Systems Picaso Graphics Processor, which offers an array of functionality and options for any Designer / Integrator / User.

The Picaso processor features include 13 customisable GPIO, 2 Serial ports, and a Master I2C interface.

The 2.8” Picaso Integrated Display Module features a TFT LCD Display, is capable of Touch Detection, microSD memory Storage, GPIO and Communications, along with multiple millisecond resolution timers, and Audio Generation.

The gen4 Series is 100% compatible with the Workshop4 IDE and its 4 different development environments, providing the User with a wealth of options for programming and controlling their system.

Anything designed to run on other 4D Systems display modules featuring Picaso Graphic Processors can be run on this gen4 Integrated Display Module, with little or no required modifications. Please contact 4D Systems Support Team for assistance if migrating from a previous model.

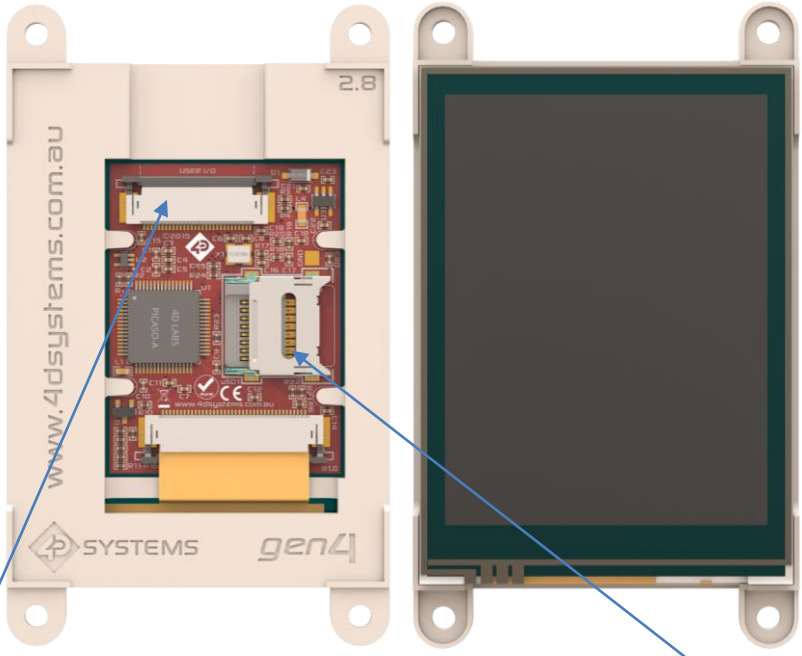
The gen4 series of Integrated Display Modules features a 30 pin ZIF socket, designed for a 30 pin FPC cable, for easy and simple connection to an application or mother board, or for connecting to accessory boards for a range of functionality advancements.

The gen4 series of modules has been designed to minimise the impact of display related circuitry, and provide a platform suitable for integration into a product. Application boards can sit flush on the back of the gen4 if required, as the display related electronics sit inside the plastic mounting base, leaving the application board surface clear for User circuitry.

2. Features

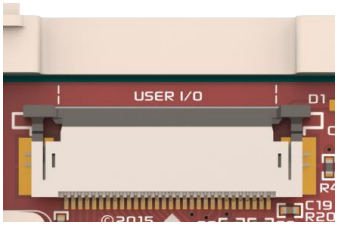
- Universal 2.8” Intelligent LCD-TFT display module powered by the Picaso Processor.
- 240 x 320 Resolution, RGB 65K true to life colours, TFT Screen with integrated 4-wire Resistive Touch Panel.
- 14KB of Flash memory for User Application Code and Data.
- 14KB of SRAM for user variables, or 14KB shared user code and program variables.
- 2 x Asynchronous hardware serial ports (COM0, COM1), TTL interface, with 300 to 600K baud.
- 1 x I^2C interface (Master).
- 8 x 16 bit timers with 1 millisecond resolution.
- 13 x General Purpose I/O pins. Supports fast 8-bit parallel data transfer through Upper 8 bits.
- 30pin FPC connection, for all signals, power, communications, GPIO and programming.
- On-board latch type micro-SD memory card connector for multimedia storage and data logging purposes.
- DOS compatible file access (FAT16 format) as well as low level access to card memory.
- Dedicated PWM Audio pin driven by WAV files from micro-SD card, and for sound generation, for an external amplifier.
- Built in extensive 4DGL graphics and system library functions.
- Display full colour images, animations, icons and video clips.
- Supports all available Windows fonts.
- 4.0V to 5.5V range operation (single supply).
- Module dimensions: 87.3 x 52.1 x 7.3mm.
- Weighing ~30 g.
- Display Viewing Area: 57.6 x 43.2mm.
- 4x mounting tabs with 3.2mm holes for mechanical mounting using M3 screws.
- RoHS and REACH compliant.
- CE Compliant – please ask for CE declarations from our Support Team.

3. Hardware Overview



USER I/O – 30 way ZIF Socket
0.5mm pitch Upper Contact
15.5mm wide FPC Cable

PIN 1 PIN 30



Latch Type microSD Socket

USER I/O – 30 Way FPC			
Pin	Symbol	I/O	Description
1	GND	P	Supply Ground
2	IO1	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
3	IO2	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
4	IO3	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
5	IO4	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant. Also used for Bus Read
6	BUS5	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
7	BUS4	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
8	BUS3	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
9	BUS2	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
10	BUS1	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
11	BUS0	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
12	BUS6	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
13	BUS7	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant
14	IO5	I/O	General Purpose Input/Output, 3.3V Level - 5V Tolerant. Also Bus Write

Continued overleaf...

USER I/O – 30 Way FPC (continued)			
Pin	Symbol	I/O	Description
15	RX1	I	Asynchronous Serial Receive COM1, TTL level. Connect this pin to the Transmit (TX) signal of other serial devices. Used in conjunction with the TX1 pin. This pin is tolerant up to 5.0V levels.
16	TX1	O	Asynchronous Serial Transmit COM1, TTL level. Connect this pin to the Receive (RX) signal of other serial devices. Used in conjunction with the RX1 pin. This pin has a 3.3V Level output.
17	I2C SCL	O	I2C Interface, SCL pin.
18	I2C SDA	I/O	I2C Interface, SDA pin.
19	AUDIO_OUT	O	Audio Output, PWM, to feed into external amplifier via filter network
20	AUDENB	O	Audio Amplifier Enable, to enable/disable external amplifier
21	GND	P	Supply Ground
22	RESET	I	Master Reset signal. Internally pulled up to 3.3V via a 10K resistor. An active Low pulse greater than 2 micro-seconds will reset the module. If the module needs to be reset externally, only use open collector type circuits. This pin is not driven low by any internal conditions. The host should control this pin via one of its port pins using an open collector/drain arrangement.
23	RX0	I	Asynchronous Serial Receive COM0, TTL level. Connect this pin to the Transmit (TX) signal of other serial devices. Used in conjunction with the TX0 pin for programming this module. This pin is tolerant up to 5.0V levels.
24	TX0	O	Asynchronous Serial Transmit COM0, TTL level. Connect this pin to the Receive (RX) signal of other serial devices. Used in conjunction with the RX0 pin for programming this module. This pin has a 3.3V Level output.
25	GND	P	Supply Ground
26	5V IN	P	Main Voltage Supply +ve input pin. Reverse polarity protected. Range is 4.0V to 5.5V, nominal 5.0V.
27	5V IN	P	Main Voltage Supply +ve input pin. Reverse polarity protected. Range is 4.0V to 5.5V, nominal 5.0V.
28	NC	-	Not Connected
29	NC	-	Not Connected
30	GND	P	Supply Ground

I = Input, O = Output, P = Power

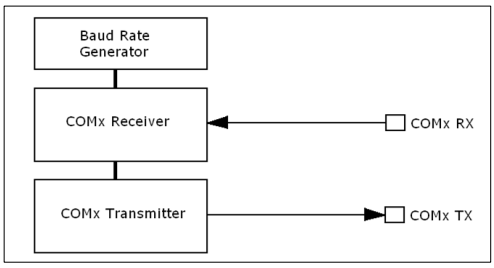
4. Hardware Interface - Pins

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

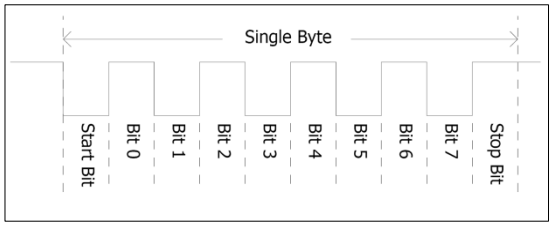
4.1. Serial Ports – TTL Level Serial

The Picaso Processor has two dedicated hardware Asynchronous Serial ports that can communicate with external serial devices. These are referred to as the COM0 and the COM1 serial ports.
The primary features are:

- Full-Duplex 8 bit data transmission and reception.
- Data format: 8 bits, No Parity, 1 Stop bit.
- Independent Baud rates from 300 baud up to 600K baud.
- Single byte transmits and receives or a fully buffered service. The buffered service feature runs in the background capturing and buffering serial data without the user application having to constantly poll any of the serial ports. This frees up the application to service other tasks.



A single byte serial transmission consists of the start bit, 8-bits of data followed by the stop bit. The start bit is always 0, while a stop bit is always 1. The LSB (Least Significant Bit, Bit 0) is sent out first following the start bit. Figure below shows a single byte transmission timing diagram.



COM0 is also the primary interface for 4DGL user program downloads and chip configuration (PmmC programming). Once the compiled 4DGL application program (EVE byte-code) is downloaded and the user code starts executing, the serial port is then available to the user application. Refer to Section 5. 'Firmware / PmmC Programming' for more details on this subject.

TX0 pin (Serial Transmit COM0):
Asynchronous Serial port COM0 transmit pin, TX0. Connect this pin to external serial device receive (Rx) signal. This pin outputs at 3.3V Level.

RX0 pin (Serial Receive COM0):
Asynchronous Serial port COM0 receive pin, RX0. Connect this pin to external serial device transmit (Tx) signal. This pin is native 3.3V level, but 5.0V tolerant.

TX1 pin (Serial Transmit COM1):
Asynchronous Serial port COM1 transmit pin, TX1. Connect this pin to external serial device receive (Rx) signal. This pin outputs at 3.3V Level.

RX1 pin (Serial Receive COM1):
Asynchronous Serial port COM1 receive pin, RX1. Connect this pin to external serial device transmit (Tx) signal. This pin is native 3.3V level, but 5.0V tolerant.

Please refer to the '***PICASO-4DGL-Internal-Functions.pdf***' document for more information.

Serial ports output at the level of TTL 3.3V, however are 5V tolerant, so can accept communications from 5V devices.

4.2. General Purpose I/O

There are 13 general purpose Input/Output (GPIO) pins available to the user. These are grouped as IO1 → IO5 and BUS0 → BUS7. Power-Up Reset default is all INPUTS.

The 5 I/O pins (IO1 → IO5), provide flexibility of individual bit operations while the 8 pins (BUS0 → BUS7), known as GPIO BUS, serve collectively for byte wise operations. The IO4 and IO5 also act as strobing signals to control the GPIO Bus. GPIO Bus can be read or written by strobing a low pulse (50ns duration or greater) the IO4/BUS_RD or IO5/BUS_WR for read or write respectively. For detailed usage refer to the separate document titled:
"***PICASO-4DGL-Internal-Functions.pdf***"

IO1-IO5 pins:
General purpose I/O pins. Each pin can be individually set for INPUT or an OUTPUT.
Power-Up Reset default is all INPUTS. Digital GPIO can source/sink 4mA.
For more information, see the Specifications section.

IO4/BUS_RD pin (GPIO IO4 or BUS_RD pin):
General Purpose IO4 pin. Also used for BUS_RD signal to read and latch the data in to the parallel GPIO BUS0..BUS7.

IO5/BUS_WR pin (GPIO IO5 or BUS_WR pin):
General Purpose IO5 pin. Also used for BUS_WR signal to write and latch the data to the parallel GPIO BUS0..BUS7.

BUS0-BUS7 pins (GPIO 8-Bit Bus):
8-bit parallel General purpose I/O Bus.

Note: GPIO pins are 5.0V tolerant. All pins output at 3.3V levels.

4.3. System Pins

+5V IN (Module Voltage Input)
Module supply voltage input pins. Both 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. Note backlight brightness will be lower for voltages under 5.0V.

GND (Module Ground)
Device ground pins. At least two pins should be connected to ground.

RESET (Module Master Reset)
Module Master Reset pin. An active low pulse of greater than 2µs will reset the module. Internally pulled up to 3.3V via a 10K resistor. Only use open collector type circuits to reset the device if an external reset is required.

AUDENB (Audio Enable Output)
Output dedicated to enable or disable and external amplifier, where required.

AUDIO (PWM Audio Output)
Output specifically for Audio. This pin is a PWM output from the Picaso Processor. This pin is a 3.3V level PWM output to drive an external amplifier with Picaso generated Audio, via an external filtering circuit to turn digital PWM into Analog. Note that AUDENB must be enabled in Picaso for any input signal to be heard.

4.4. I2C

There is one I^2C Master Channel on the Picaso processor. The I^2C channel is Master only, and cannot be configured to be a slave at this time.

To setup the I^2C Channel the following 4DGL function is used:

I2C_Open(Speed);

Where 'Speed' is the desired I2C Bus speed. There are then an array of functions, typical of any I2C capable processor, such as Close, Start, Stop, Restart, Read, Write, Ack, Nack, etc…

Please refer to the separate document titled ***'Picaso 4DGL Internal Functions'*** for more information on how to use the I^2C functions, along with the separate document titled ***'Picaso-Processor Datasheet'***.

5. Module Features

The gen4 series of Integrated Display Modules are designed to accommodate most applications. Some of the main features of the module are listed below.

5.1. Picaso Processor

The module is designed around the Picaso Graphics Controller from 4D-Labs.

The Picaso is a smart Controller and the interface to the TFT- LCD displays is almost plug-n-play.

All of the data and control signals are provided by the chip to interface directly to the display.

Powerful graphics, text, image, animation and countless more features are built right inside the chip.

The data sheet for the processor is available from the http://www.4dsystems.com.au website:
"Picaso Processor Datasheet"

5.2. Audio

Audio playback support in the Picaso Processor enables this module to play audio WAV files stored in the micro-SD memory card. PWM audio is generated and made available on the AUDIO pin of the 30 way ZIF connector, ready to interface with an audio amplifier on your application board.

A simple instruction enables the user to play/pause/stop audio files while continuing the execution of the user application code, such as display updates, touch recognition, communications, etc. The audio system also allows real time pitch change of audio samples.

For a complete list of audio commands please refer to the separate document titled:
"Picaso 4DGL Internal Functions"

5.3. SD/SDHC Memory Cards

The module supports micro-SD memory cards via the on-board latch type micro-SD connector. The memory card is used for all multimedia file retrieval such as images, animations and movie clips. The memory card can also be used as general purpose storage for data logging applications. Support is available for off-the-shelf micro-SD (< 4GB) and high capacity HC memory cards (4GB and above). Memory cards up to 32GB is size can be used, however it must be noted that only a portion of this can be utilised by the FAT16 file system. See section below for more details.

Note: A microSD card capable of SPI is a requirement for all 4D Systems' display modules powered by Goldelox, Picaso or Diablo16 Processors. If a non-SPI compatible card is used, it will simply fail to mount, or may cause intermittent issues resulting in lock ups and crashing of the application. Please refer to the 4D Systems website for microSD cards offered by 4D Systems.

5.4. FAT16

All 4D Systems display modules featuring 4D Labs processors use off-the-shelf standard SDHC/SD/micro-SD memory cards (SPI Compatible Only) with up to 4GB capacity usable with FAT16 formatting.

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 PC system with a card reader.

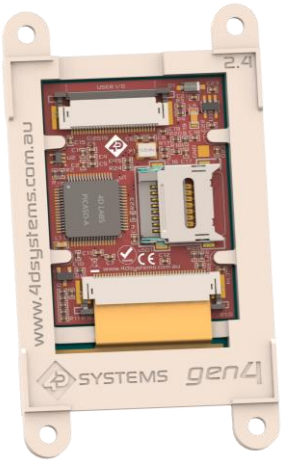
The Picaso Processor also supports high capacity HC memory cards (4GB and above). The available capacity of SD-HC cards varies according to the way the card is partitioned and the commands used to access it. Refer to the 4D Systems RMPET tool in the Workshop4 IDE.

A Max of 4GB can be utilised by the FAT16 file system. The FAT partition is always first (if it exists). Any space larger than 4GB will be RAW, and can still be utilised by your 4D Systems module, using different functions. Please refer to Application Notes.

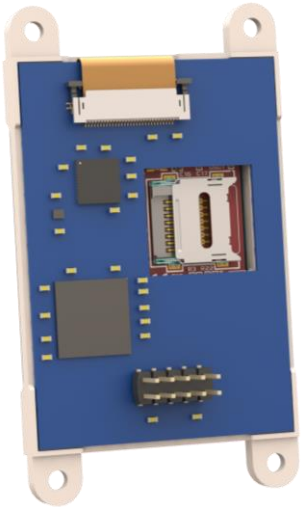
5.5. Application PCB Support

The gen4 2.8” Picaso Integrated Display Module is designed to accommodate a range of applications, and therefore is suited for those wanting to make a customised module, without the need for piggy-back or daughter boards mounted on headers.

On the back of the gen4 module, the display related circuitry will be found, which is recessed into the plastic. The level of the plastic on the back of the gen4 module is higher than the tallest component on the display circuit PCB, meaning an Application PCB can be mounted on the back of the gen4, without affecting the display related circuitry.



The image below (2.4” model depicted) shows a mock Application PCB on the back of the gen4 display (Blue area). It features a cut-out in the PCB so access to the micro-SD socket on the gen4’s display board is possible, however this may or may not be required depending on the application and if the micro-SD socket is utilised or requiring access once the Application PCB is applied.



The micro-SD socket is a latch type, so it is accessible from the top, rather than a push/push or push/pull style which is accessible from the side.

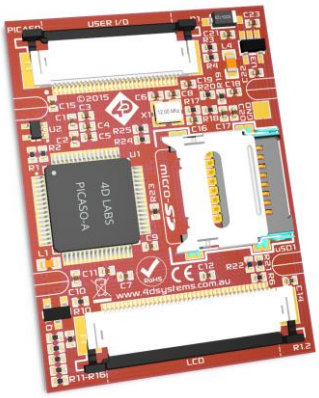
5.6. RF / EMI Shielding Support

As per what is written in section 5.5 (Application PCB Support), there is an option for extended RF shielding and EMI protection on this module.

On the back of the gen4’s display PCB, are grounded plated ‘X pads’, which make contact with the metal housing of the display.

Where the Application PCB is shown to sit in Section 5.5, can house a small metal shield of the same size. This shield is used instead of, or underneath an Application PCB, to aid the on-board electronics in the prevention from potential RF or EMI signals.

On the top of the display PCB is another GND pad, which can have a pogo pin or similar device mounted on it, which can make contact with this metal shield.



The display electronics are then sandwiched between the display’s metal housing, and the metal shield, all connected together with a common ground.

NOTE: There are no guarantees these steps will increase chances or grant access to EMI related certifications, however the gen4 has the capability to utilise shielding of the modules electronics, should the need arise. This may or may not assist the User with protecting the device against EMI/EMF/RF type noise, depending on the source, strength and type of noise present, however should aid in the protection.

6. Display/Module Precautions

- Avoid having to display the same image/object on the screen for lengthy periods of time. 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, damage will certainly occur. 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 temperature 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 broken backlight

- Always use the mounting holes on the module's corner plates to mount the display where possible.

- Display modules have a finite life, which is typically dictated by the display itself, more specifically the backlight. The backlight contains LED's, which fade over time. In the Specifications section is a figure for the typical life of the display, and the criteria are listed.

- Resistive Touch model features a touch sensitive film over the display which is sensitive to pressure. Take note when mounting the display module in an enclosure that pressure is not applied to the surface of the display by the enclosure, or false touches will occur, or the touch will simply not function at all.

7. Hardware Tools

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

7.1. 4D Programming Cable/Adaptor

The 4D Programming Cable and uUSB-PA5 Programming Adaptor are essential hardware tools to program, customise and test the Picaso Processor.

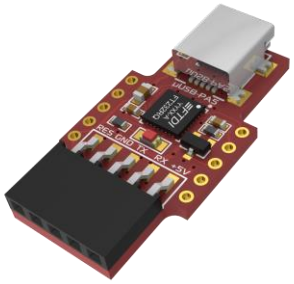
Either the 4D Programming Cable or the uUSB-PA5 Programming Adaptor can be used for the gen4 series of Display Modules.

The 4D programming interfaces are used to program a new Firmware/PmmC and for downloading compiled 4DGL code into the processor. They even serve as an interface for communicating serial data to the PC.

The 4D Programming Cable and uUSB-PA5 Programming Adaptor are available from 4D Systems, www.4dsystems.com.au

Using a non-4D programming interface could damage your processor, and **void your Warranty.**

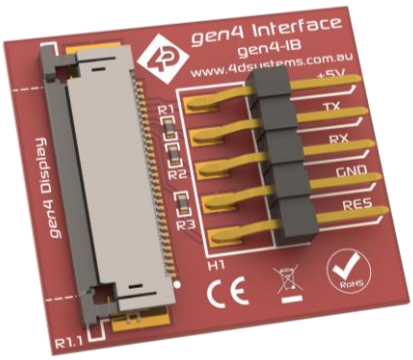
4D Programming Cable



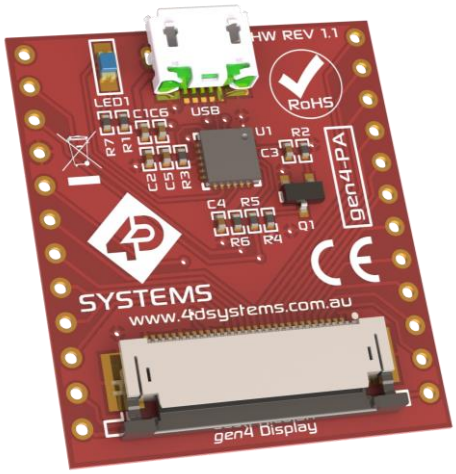
uUSB-PA5 Programming Adaptor

Please note, in conjunction with a Programming Cable or a Programming Adaptor, the gen4 series of Display Modules requires a simple interface board (gen4-IB), as there is no 5 way male header on gen4 modules like other 4D Systems modules.

Gen4 Interface boards (Gen4-IB) ship with each gen4 Display Module unless otherwise stated. Simply connect the supplied 30 way FPC cable into the ZIF connector on the gen4 Interface Board, and connect the Programming Cable or Adaptor into the 5-way header on the Interface Board. You are now ready to program using a 4D Programming Cable or 4D Programming Adaptor (uUSB-PA5 or uUSB-PA5-II). This can also be used to interface to other devices such as a 4D Arduino Adaptor Shield, breadboard etc.



An alternative to using a Gen4-IB and a 4D Programming Cable, or uUSB-PA5 Programming Adaptor, is a single all in one board called the gen4-PA (gen4 Programming Adaptor), which can be used instead.



The gen4-PA incorporates the uUSB-PA5-II and gen4-IB together essentially, creating a single module with microUSB 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. Standard 2.54mm (0.1") male pin headers can be mounted so the module signals can be interfaced to easily.
Please refer to the gen4-PA Datasheet for more information.

8. Software Overview - Language

The Picaso processor belongs to a family of processors powered by a highly optimised soft core virtual engine called EVE (Extensible Virtual Engine). EVE was designed and created by 4D Systems in the early 2000's, and should not be confused by FTDI's solution of EVE, which was developed a decent decade or so later.

EVE is a proprietary, high performance virtual-machine with an extensive byte-code instruction set optimised to execute compiled 4DGL programs.

4DGL (4D Graphics Language) was specifically developed from ground up for the EVE engine core. It is a high level language which is easy to learn and simple to understand yet powerful enough to tackle many embedded graphics applications.

4DGL is a graphics oriented language allowing rapid application development, and the syntax structure was designed using elements of popular languages such as C, Basic, Pascal and others.

Programmers familiar with these languages will feel right at home with 4DGL. It includes many familiar instructions such as IF..ELSE..ENDIF, WHILE..WEND, REPEAT..UNTIL, GOSUB..ENDSUB, GOTO, PRINT as well as some specialised instructions SERIN, SEROUT, GFX_LINE, GFX_CIRCLE and many more.

For detailed information pertaining to the 4DGL language, please refer to the following documents:
"4DGL Programmers Reference Manual"
"Picaso 4DGL Internal Functions"
These are both available for download on the Workshop4 Product Page of the 4D Systems website.

To assist with the development of 4DGL applications, the Workshop4 IDE combines a full-featured editor, a compiler, a linker and a downloader into a single PC-based application. It's all you need to code, test and run your applications.

4DGL is available to be written in two of the four environments offered by the Workshop 4 IDE, Designer and ViSi. The other two environments, Serial and ViSi-Genie do not directly use 4DGL by the User (Except in Workshop4 Pro, for ViSi-Genie), however it is present in the background. Serial is an application which runs, and that is written in 4DGL. ViSi-Genie automatically generates 4DGL itself based on what is configured in the GUI. More information about each follows.

9. 4D Systems - Workshop 4 IDE

Workshop 4 is a comprehensive software IDE that provides an integrated software development platform for all of the 4D family of processors and modules. The IDE combines the Editor, Compiler, Linker and Downloader to develop complete 4DGL application code. All user application code is developed within the Workshop 4 IDE.

The Workshop 4 IDE supports multiple development environments for the user, to cater for different user requirements and skill levels.

- The **Designer** environment enables the user to write 4DGL code in its natural form to program the range of 4D Systems intelligent displays.
- A visual programming experience, suitably called **ViSi**, enables drag-and-drop type placement of objects to assist with 4DGL code generation and allows the user to visualise how the display will look while being developed.
- An advanced environment called **ViSi-Genie** doesn’t require any 4DGL coding at all, it is all done automatically for you. Simply lay the display out with the objects you want, set the events to drive them and the code is written for you automatically. This can be extended with additional features when a Workshop4 PRO license is purchased from the 4D Systems website. Extended Advanced features for Visi-Genie are available in PRO version of WS4. Further details explained in section 9.3.
- A **Serial** environment is also provided to transform the display module into a slave serial module, allowing the user to control the display from any host microcontroller or device with a serial port.

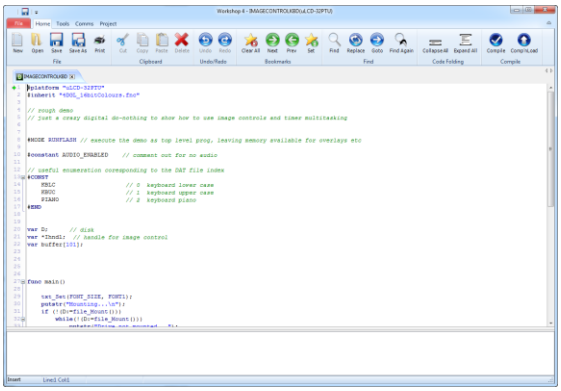
The Workshop 4 IDE is available from the 4D Systems website. www.4dsystems.com.au

For comprehensive manuals on the Workshop 4 IDE Software, the language, and its environments, refer to the documentation from the 4D Systems website, on the Workshop 4 product page.

9.1. Workshop4 - Designer

Choose the Designer environment to write 4DGL code in its raw form.

The Designer environment provides the user with a simple yet effective programming environment where pure 4DGL code can be written, compiled and downloaded to the range of 4D Systems intelligent display modules.

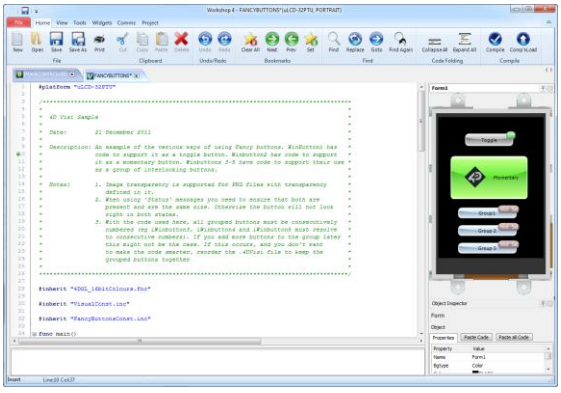


Designer is a very powerful environment, for those use to developing without any form of GUI aid, or for those developing complex systems where no aid is required.

9.2. Workshop4 – ViSi

ViSi was designed to make the creation of graphical displays a more visual experience.

ViSi is a great software tool that allows the user to see the instant results of their desired graphical layout. Additionally, there is a selection of inbuilt dials, gauges and meters that can simply be placed onto the simulated module display. From here each object can have its properties edited, and at the click of a button all relevant 4DGL code associated with that object is produced in the user program. The user can then write 4DGL code around these objects to utilise them in the way they choose.



9.3. Workshop4 – ViSi Genie

ViSi-Genie is a breakthrough in the way 4D Systems' graphic display modules are programmed. It is an environment like no other, a code-less programming environment that provides the user with a rapid visual experience, enabling a simple GUI application to be 'written' from scratch in literally seconds.

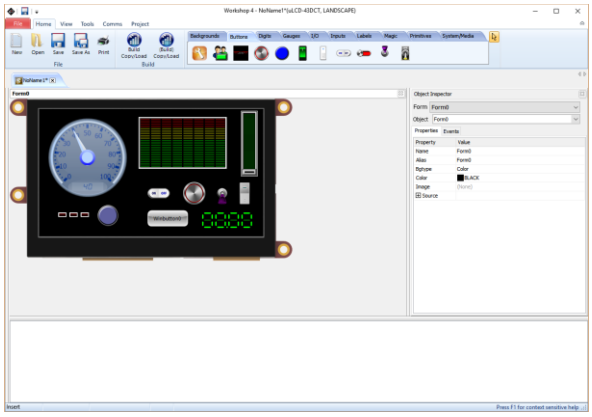
ViSi-Genie does all the background coding, no 4DGL to learn, it does it all for you.

Pick and choose the relevant objects to place on the display, much like the ViSi Environment yet without having to write a single line of code. Each object has parameters which can be set, and configurable events to animate and drive other objects or communicate with external devices.

Simply place an object on the screen, position and size it to suit, set the parameters such as colour, range, text, and finally select the event you wish the object to be associated with, it is that simple.

In seconds you can transform a blank display into a fully animated GUI with moving sliders, animated press and release buttons, and much more. All without writing a single line of code!

ViSi-Genie provides the user with a feature rich rapid development environment, second to none.



ViSi-Genie's functionality can be extended with the purchase of a Workshop4 PRO License.

Workshop4 PRO adds a professional set of features to the Visi-Genie environment called Genie-Magic. The added features allow the user to add in 4DGL scripts, which can be activated from the display itself, from an interfacing Host, or from an external sensor or device.

These PRO set of features of Genie-Magic allow the User to create an immensely powerful GUI system with a fraction of the effort required by other systems.

9.4. Workshop4 – Serial

The Serial environment in the Workshop 4 IDE provides the user the ability to transform a 4D Systems Intelligent Display, into a slave serial graphics controller.

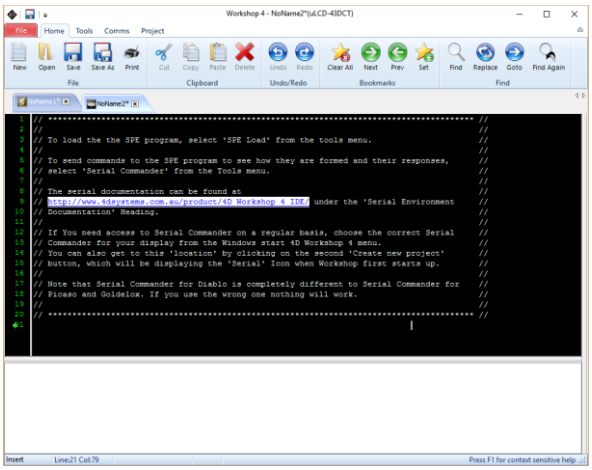
This enables the user to use their favourite microcontroller or serial device as the Host, without having to learn 4DGL or program in a separate IDE.

Once the display module is configured by the Serial Environment (by downloading what is called the SPE application to the module), commands can be sent from the users host microcontroller to display primitives, images, sound and video, and can even be used to display ViSi generated graphics and widgets.

The Serial Environment should not be taken as being basic in terms of its capabilities, as it has the full 4DGL command set behind it, but available from the Host rather than from programming the display module itself using the Workshop4 IDE.

Virtually anything created in Designer or ViSi, can be designed or controlled from the Serial Environment.

Please refer to the ***"Picaso Serial Command Set Reference Manual"*** from the Workshop 4 product page on the 4D Systems website for a complete listing of all the supported Serial commands



9.5. PmmC/Firmware Programming

The Picaso processor is a custom graphics processor. All functionality including the high level commands are built into the chip. This chip level configuration is available as a PmmC (Personality-module-micro-Code) file, which can be likened to traditional Firmware..

A PmmC file contains all of the low level micro-code information (analogy of that of a soft silicon) which define the characteristics and functionality of the device. The ability of programming the device with a PmmC file provides an extremely flexible method of customising as well as upgrading it with future enhancements.

It also contains the initialisation and parameters associated with the particular display that is to be connected to the Picaso processor, along with product specific settings and parameters.

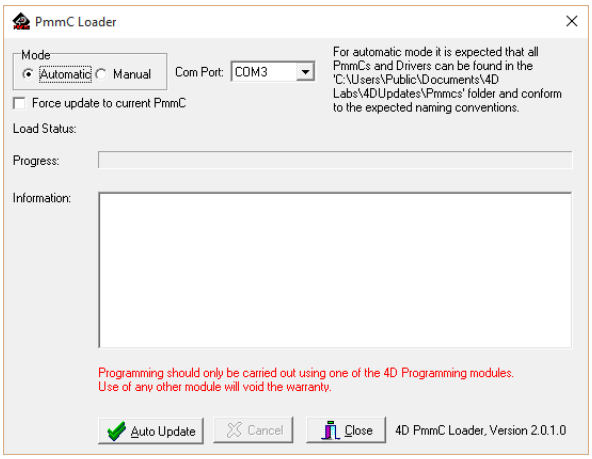
The PmmC file can only be programmed into the device via the COM0 serial port with the aid of Workshop 4, the 4D Systems IDE software.

Solutions, which remove the need to use Workshop4 to program the display modules, are available for commercial customers requiring batch programming or production line programming. These solutions are practical for production staff and minimize the chance of unwanted or unauthorised modifications on the production line.

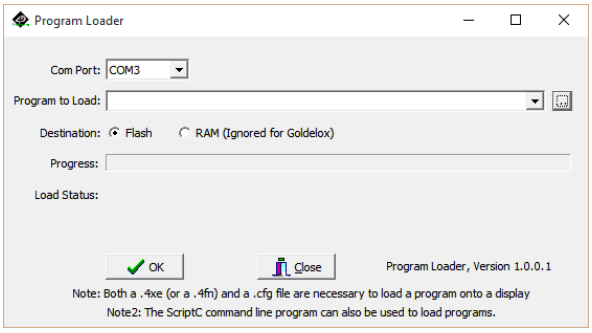
Three solutions come with the Workshop4 IDE, which can be separated out for production line computers if required, **ScriptC**, **PmmC Loader** and **Program Loader**.

ScriptC is a command line interface which can be controlled from a Batch Script or similar, useful for repetitive loading or when controlled from an external application. Example scripts are provided, showing how to load PmmC and Applications using a batch script.

PmmC Loader is a GUI interface designed to download PmmC’s in to a 4D Systems Processor. It has the ability to automatically update existing PmmC’s present on a module, or to manually change or force download to a blank processor or module, overwriting anything written in previously.



Program Loader is a GUI interface designed to download Applications to either Flash or RAM, useful for testing or production loading, without the need for Workshop4 itself.



Please contact our Support Team for more information on what we can provide. Some solutions also exist for external processor based loading, if there is a requirement for that. This solution is available under NDA.

Using a non-4D programming interface could damage your module, and **void your Warranty.**

10. 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.

Not all development environments and features will be needed by every User. However, by purchasing the display solution in a Starter Kit allows you to take full advantage of all of the features of the 4D Systems Display Solution and try out each of the 4D Woskshop4 Environments prior to settling with the preferred feature-set.

The **Designer** environment can utilise every feature of the display, however depending on the user requirements, a micro-SD (uSD) card may not be required. The uSD card is used when displaying images/video/sound, along with datalogging to uSD, and a programming cable or adaptor is required for downloading compiled code and PmmC/Firmware updates.

The **ViSi** environment is the same as Designer in terms of feature utilisation, but is image based so requires a uSD card, along with a programming cable.

The **ViSi-Genie** environment is also image based, and therefore requires a uSD card and programming cable also.

The **Serial** environment does not require either a uSD or Programming cable to be used once the module has been configured as a Serial device, however can utilise both depending on the user requirements. The uSD card can be used for such things as storage and display of multimedia files, datalogging, and the Programming cable for PmmC/Firmware updates, or changing to one of the other three programming environments.

Starter Kits typically include:

- Gen4 Integrated Display Module
- Gen4 Interface Module (gen4-IB)
- Gen4 Programming Adaptor (gen4-PA)
- 4GB micro-SD Card
- 150mm 30 way FFC Cable
- 150mm 5-way ribbon cable for easy connection to a breadboard or host via the gen4-IB
- Quick Start Guide

Please refer to the 4D Systems website for 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.

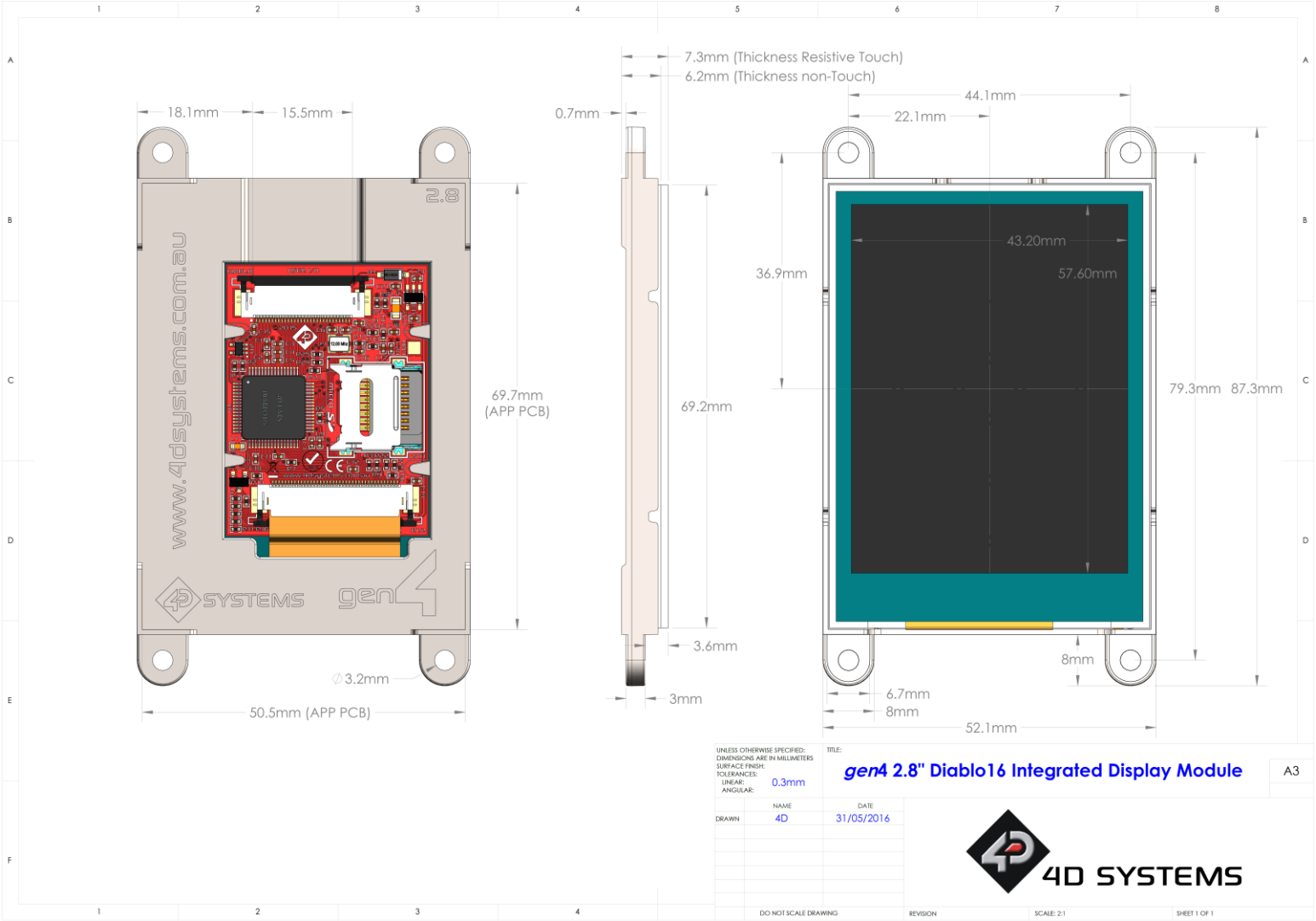
11. Display Module Part Numbers

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

Example:
gen4-uLCD-28PT

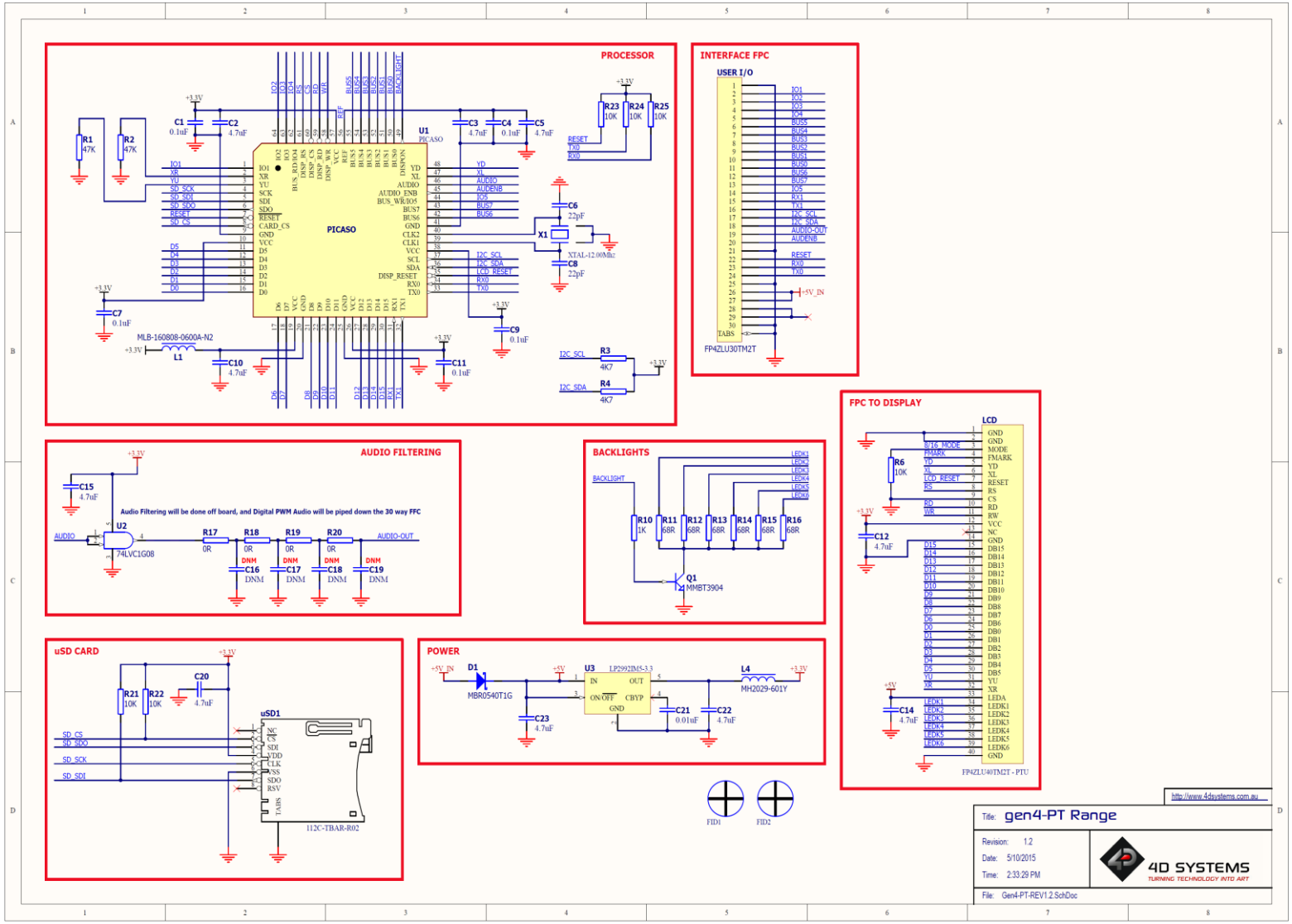
gen4	- gen4 Display Range
uLCD	- microLCD Display Family
28	- Display size (2.8”)
P	- Picaso Processor
T	- Resistive Touch.

12.Mechanical Details



NOTE: DRAWING IS FOR DIABLO VERSION, HOWEVER DIMENSIONS ARE THE SAME. WILL BE UPDATED NEXT RELEASE.

13. Schematic Details



14. Specifications

ABSOLUTE MAXIMUM RATINGS	
Operating ambient temperature	-15°C to +65°C
Storage temperature	-30°C +70°C
Voltage on any digital input pin with respect to GND	-0.3V to 6.0V
Voltage on VCC with respect to GND	-0.3V to 6.0V
Maximum current sunk/sourced by any pin	4.0mA
Maximum current sunk/sourced by all ports	200.0mA

NOTE: Stresses above those listed here may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the recommended operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS					
Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage (VCC)	Stable external supply required	4.0	5.0	5.5	V
Operating Temperature		-10	--	+60	°C
Input Low Voltage (VIL)	3.3V, all pins	0	--	0.2VCC	V
Input High Voltage (VIH)	3.3V, non 5V tolerant pins	0.8VCC	--	3.3	V
Input High Voltage (VIH)	All GPIO pins, RX0 and TX0 pins	0.8VCC	--	5.5	V
Reset Pulse	External Open Collector	2.0	--	--	µs
Operational Delay	Power-Up or External Reset	500	--	3000	ms

GLOBAL CHARACTERISTICS BASED ON OPERATING CONDITIONS					
Parameter	Conditions	Min	Typ	Max	Units
Supply Current (ICC)	5V Supply	--	150	--	mA
Display Endurance	Hours of operation, measured to when display is 50% original brightness	30000	--	--	H
Touch Screen Endurance	Number of touches/hits with a 12.5mm tip at a rate of 2x per second with 250gf force	--	1M	--	Touches
	Slide stylus on screen, 100gf force, 60mm/s speed with a 0.8mm polyacetal tip stylus pen	--	100K	--	Slides
Touch Screen Transparency		80	--	--	%
Touch Screen Operational Force	Only use Finger or Stylus, do not use anything sharp or metal	20	--	100	gf

LCD DISPLAY INFORMATION		
Parameter	Conditions	Specification
Display Type		TFT Transmissive LCD
Display Size		2.8” Diagonal
Display Resolution		240 x 320 (Portrait View)
Display Brightness	5V Supply – Resistive-Touch	140cd/m2
Display Contrast Ratio	Typical	500:1
Display Viewing Angles	Above Centre	35 Degrees
	Below Centre	55 Degrees
	Left of Centre	55 Degrees
	Right of Centre	55 Degrees
Display Viewing Direction		6 o’clock Display (Optimal viewing is from below when in Portrait mode)
Display Backlighting	White LED Backlighting	1x4 Parallel LED’s
Pixel Pitch		0.18 x 0.18mm (Square pixels)
Pixel Density	Number of pixels in 1 row in 25.4mm	141 DPI/PPI

15.Hardware Revision History

Revision Number	Date	Description
0.1	xx/xx/2015	Internal Use Only
1.0	09/12/2015	Initial Public Release Version
1.1	22/12/2015	Cosmetic Changes to gen4 Datasheet range
1.2	13/16/2016	Finalising of specifications, ready for release

16.Legal Notice

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