



**4D LABS**

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**PICASO-SGC**  
**Intelligent Serial Graphics Controller**

**Advance Information**

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**4D LABS**

## PICASO-SGC Serial Graphics Controller

### Advance Information

#### Description



The **PICASO-SGC** is an intelligent Serial Graphics Controller designed to interface with many popular OLED and LCD display panels. Powerful graphics, text, image, animation and countless more features are built right inside the chip. It offers a simple yet effective serial interface to any host micro-controller that can communicate via a serial port. All screen related functions are sent using a simple protocol via the serial interface.

Serial commands may comprise of a single byte or multiple bytes of data depending on the command type. The serial platform allows users to develop their application using their favourite micro-controller and software development tools. In short, it offers one of the most flexible Graphics controllers available that will run 'out of the box'.

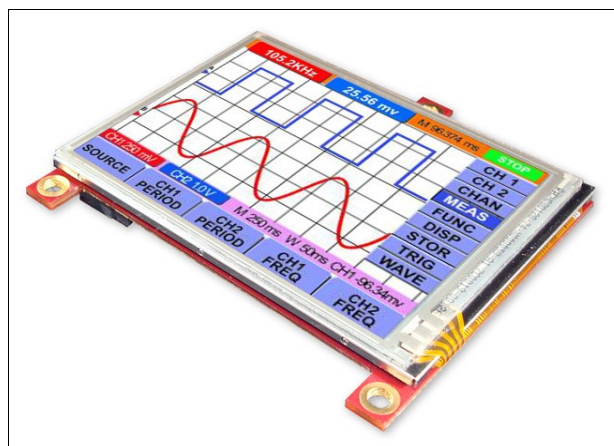
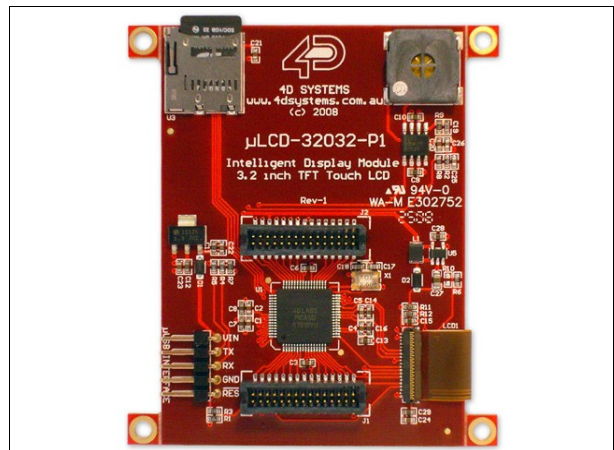
All of the data and control signals are provided by the chip to interface directly to the display. Simply choose your display and interface it to the PICASO-SGC beside your host controller on your application board. This offers enormous advantage to the designer in development time and cost saving and takes away all of the burden of low level design. The PICASO-SGC can be considered to be another Black Box which the designer knows will work and therefore more design emphasis can be put into the final User Interface and overall high level design criteria.

#### Features

- Low-cost OLED/LCD display graphics user interface solution.
- Ideal as an embedded slave graphics processor.
- Serial interface to any host micro-controller.
- Connect to any colour display that supports an 80-Series 16 bit wide CPU interface. All data and control signals are provided.
- Comprehensive set of built in high level graphics functions and algorithms that can draw lines, circles, text, and much more.
- Display full colour images, animations, icons and video clips.
- Supports all available Windows fonts and characters (imported as external fonts).
- 16 x General Purpose I/O pins. Upper 8 bits can be used as an I/O Bus for fast 8-bit parallel data transfers.
- Dedicated PWM Audio pin supports FAT16 audio wave files and complex sound generation.
- Hardware and software interface for SD, micro-SD or MMC memory cards for multimedia storage and data logging purposes. HC memory card support is also available for HC cards larger than 4Gb.
- DOS compatible file access (FAT16 format) as well as low level access to card memory.
- Asynchronous hardware serial port.
- 4-Wire resistive touch panel interface.
- 3.0V to 3.6V range operation.
- Available in a 64 pin TQFP 10mm x 10mm package.
- RoHS Compliant.

## Applications

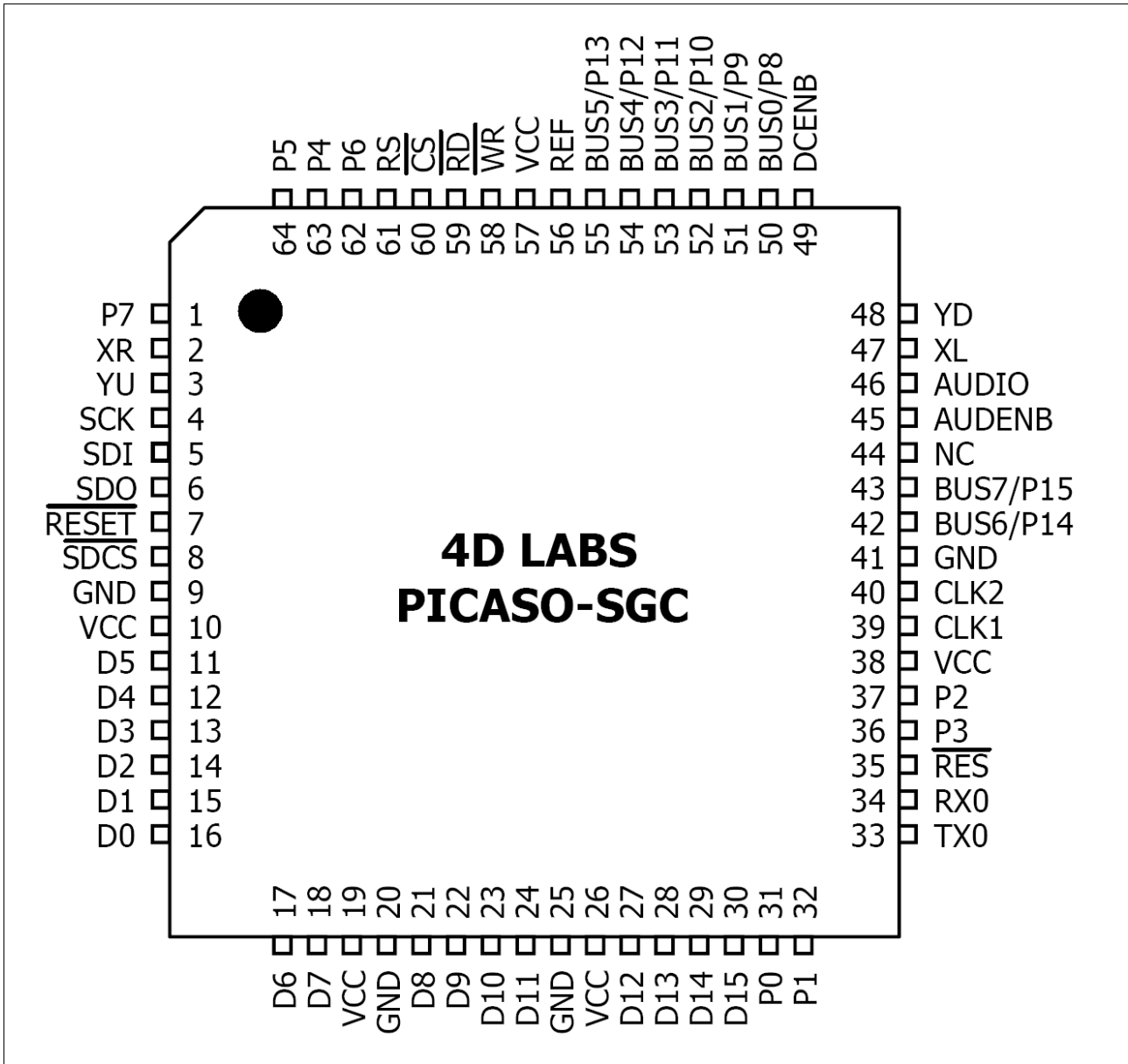
- General purposes embedded graphics.
- Elevator control systems.
- Point of sale terminals.
- Electronic gauges and metres.
- Test and measurement and general purpose instrumentation.
- Industrial control and Robotics.
- Automotive system displays.
- GPS navigation systems.
- Medical Instruments and applications.
- Home appliances.
- Smart Home Automation.
- Security and Access control systems.
- Gaming equipment..
- Aviation systems.
- HMI with touch panels.



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**1. Pin Configuration and Summary**



Pin	Symbol	I/O	Description
1	P7	I/O	General Purpose I/O Port, bit 7. This pin is 5.0V tolerant.
2	XR	A	4-Wire Resistive Touch Screen Right signal. Connect this pin to XR or X+ signal of the touch panel.
3	YU	A	4-Wire Resistive Touch Screen Up signal. Connect this pin to YU or Y+ signal of the touch panel.
4	SCK	O	SPI Serial Clock output. SD memory card use only. Connect this pin to the SPI Serial Clock (SCK) signal of the memory card.
5	SDI	I	SPI Serial Data Input. SD memory card use only. Connect this pin to the SPI Serial Data Out (SDO) signal of the memory card.

Pin	Symbol	I/O	Description
6	SDO	O	SPI Serial Data Output. SD memory card use only. Connect this pin to the SPI Serial Data In (SDI) signal of the memory card.
7	RESET	I	Master Reset signal. Connect a 4.7K resistor from this pin to VCC.
8	SDCS	O	SD Memory-Card Chip Select. SD memory card use only. Connect this pin to the Chip Enable (CS) signal of the memory card.
9, 20, 25, 41	GND	P	Device Ground.
10, 19, 26, 38, 57	VCC	P	Device Positive Supply.
11	D5	I/O	Display Data Bus bit 5.
12	D4	I/O	Display Data Bus bit 4.
13	D3	I/O	Display Data Bus bit 3.
14	D2	I/O	Display Data Bus bit 2.
15	D1	I/O	Display Data Bus bit1.
16	D0	I/O	Display Data Bus bit 0.
17	D6	I/O	Display Data Bus bit 6.
18	D7	I/O	Display Data Bus bit 7.
21	D8	I/O	Display Data Bus bit 8.
22	D9	I/O	Display Data Bus bit 9.
23	D10	I/O	Display Data Bus bit 10.
24	D11	I/O	Display Data Bus bit 11.
27	D12	I/O	Display Data Bus bit 12.
28	D13	I/O	Display Data Bus bit 13.
29	D14	I/O	Display Data Bus bit 14.
30	D15	I/O	Display Data Bus bit 15.
31	P0	I/O	General Purpose I/O Port, bit 0. This pin is 5.0V tolerant.
32	P1	I/O	General Purpose I/O Port, bit 1. This pin is 5.0V tolerant.
33	TX0	O	Asynchronous Serial port Transmit pin, TX. Connect this pin to host micro-controller Serial Receive (Rx) signal. The host receives data from PICASO-SGC via this pin. This pin is 5.0V tolerant.
34	RX0	I	Asynchronous Serial port Receive pin, RX. Connect this pin to host micro-controller Serial Transmit (Tx) signal. The host transmits data to PICASO-SGC via this pin. This pin is 5.0V tolerant.
35	RES	O	Display RESET. PICASO-SGC initialises the display by strobing this pin LOW. Connect this pin to the Reset (RES) signal of the display.
36	P3	I/O	General Purpose I/O Port, bit 3. This pin is 5.0V tolerant.
37	P2	I/O	General Purpose I/O Port, bit 2. This pin is 5.0V tolerant.
39	CLK1	I	Device Clock input 1 of a 12Mhz crystal.
40	CLK2	O	Device Clock input 2 of a 12Mhz crystal.
42	P14/BUS6	I/O	General Purpose I/O Port, bit 14. This pin is also the bit 6 of Parallel IO Bus (BUS0..7). This pin is 5.0V tolerant.
43	P15/BUS7	I/O	General Purpose I/O Port, bit 15. This pin is also the bit 7 of Parallel IO

Pin	Symbol	I/O	Description
			Bus (BUS0..7). This pin is 5.0V tolerant.
44	NC	--	No Connect.
45	AUDENB	O	Audio Enable. Connect this pin to amplifier control. <b>LOW</b> : Enable external Audio amplifier. <b>HIGH</b> : Disable external Audio amplifier.
46	AUDIO	O	Pulse Width Modulated (PWM) Audio output. Connect this pin to a 2 stage low pass filter then into an audio amplifier.
47	XL	O	4-Wire Resistive Touch Screen Left signal. Connect this pin to XL or X-signal of the touch panel.
48	YD	O	4-Wire resistive touch screen bottom signal. Connect this pin to YD or Y- signal of the touch panel.
49	DCENB	O	DC-DC high voltage enable signal. This maybe the high voltage that drives the LCD backlight or the OLED panel supply. <b>High</b> : Enable DC-DC converter. <b>Low</b> : Disable DC-DC converter.
50	P8/BUS0	I/O	General Purpose I/O Port, bit 8. This pin is also the bit 0 of Parallel IO Bus (BUS0..7). This pin is 5.0V tolerant.
51	P9/BUS1	I/O	General Purpose I/O Port, bit 9. This pin is also the bit 1 of Parallel IO Bus (BUS0..7). This pin is 5.0V tolerant.
52	P10/BUS2	I/O	General Purpose I/O Port, bit 10. This pin is also the bit 2 of Parallel IO Bus (BUS0..7). This pin is 5.0V tolerant.
53	P11/BUS3	I/O	General Purpose I/O Port, bit 11. This pin is also the bit 3 of Parallel IO Bus (BUS0..7). This pin is 5.0V tolerant.
54	P12/BUS4	I/O	General Purpose I/O Port, bit 12. This pin is also the bit 4 of Parallel IO Bus (BUS0..7). This pin is 5.0V tolerant.
55	P13/BUS5	I/O	General Purpose I/O Port, bit 13. This pin is also the bit 5 of Parallel IO Bus (BUS0..7). This pin is 5.0V tolerant.
56	REF	P	Internal voltage regulator filter capacitor. Connect a 4.7uF to 10uF capacitor from this pin to Ground.
58	WR	O	Display Write strobe signal. PICASO-SGC asserts this signal LOW when writing data to the display. Connect this pin to the Write (WR) signal of the display.
59	RD		Display Read strobe signal. PICASO-SGC asserts this signal LOW when reading data from the display. Connect this pin to the Read (RD) signal of the display.
60	CS	O	Display Chip Select. PICASO-SGC asserts this signal LOW when accessing the display. Connect this pin to the Chip Select (CS) signal of the display.
61	RS	O	Display Register Select. <b>LOW</b> : Display index or status register is selected. <b>HIGH</b> : Display GRAM or register data is selected. Connect this pin to the Register Select (RS or A0 or C/D or similar naming convention) signal of the display.

Pin	Symbol	I/O	Description
62	P6	I/O	General Purpose I/O Port, bit 6. This pin is 5.0V tolerant.
63	P4	I/O	General Purpose I/O Port, bit 4. This pin is 5.0V tolerant.
64	P5	I/O	General Purpose I/O Port, bit 5. This pin is 5.0V tolerant.

I: Input, O: Output, A: Analogue, P: Power

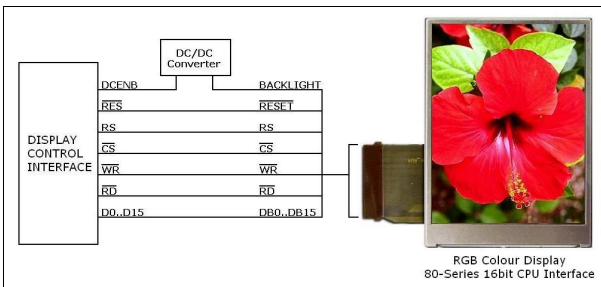


## 2. Pin Description

The PICASO-SGC provides both a hardware and a software interface. This section describes in detail the hardware interface pins to the display and the host controller.

### 2.1 Display Interface

The PICASO-SGC supports LCD and OLED displays with an 80-Series 16-bit wide CPU data interface. The connectivity to the display is easy and straight forward. The PICASO-SGC generates all of the necessary timing to drive the display.



#### D0-D15 pins (Display Data Bus):

The Display Data Bus (D0-D15) is a 16-bit bidirectional port and all display data writes and reads occur over this bus. Other control signals such as RW, RD CS, and RS synchronise the data transfer to and from the display.

#### WR pin (Display Write):

This is the display write strobe signal. The PICASO-SGC asserts this signal LOW when writing data to the display in conjunction with the display data bus (D0-D15). Connect this pin to the Write (WR) signal of the display.

#### RD pin (Display Read):

This is the display read strobe signal. The PICASO-SGC asserts this signal LOW when reading data from the display in conjunction with the display data bus (D0-D15). Connect this pin to the Read (RD) signal of the display.

#### RS pin (Display Register Select):

The RS signal determines whether a register command or data is sent to the display.

**LOW:** Display index or status register is

selected.

**HIGH:** Display GRAM or register data is selected.

Connect this pin to the Register Select (RS) signal of the display. Different displays utilise various naming conventions such as RS, A0, C/D or similar. Be sure to check with your display manufacturer for the correct name and function.

#### CS pin (Display Chip Select):

The access to the display is only possible when the Display Chip Select (CS) is asserted LOW. Connect this pin to the Chip Select (CS) signal of the display.

#### RES pin (Display Reset):

Display RESET. PICASO-SGC initialises the display by strobing this pin LOW. Connect this pin to the Reset (RES) signal of the display.

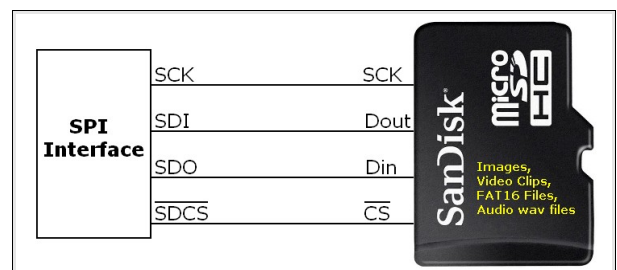
#### DCENB pin (External DC/DC Enable):

DC-DC high voltage enable signal. This maybe the high voltage that drives the LCD backlight or the OLED panel supply.

### 2.2 SPI Interface – Memory Card

The PICASO-SGC supports SD, micro-SD and MMC memory cards via its hardware SPI interface. The memory card is used for all multimedia file retrieval such as images, animations and movie clips and the SPI interface is dedicated for this purpose only. The memory card can also be used as general purpose storage for data logging applications. Support is available for normal and HC memory cards.

**Note:** The PICASO-SGC also supports high capacity HC memory cards (4Gb and above).



**SDI pin (SPI Serial Data In):**

The SPI Serial Data Input (SDI). SD memory card use only. Connect this pin to the SPI Serial Data Out (SDO) signal of the memory card.

**SDO pin (SPI Serial Data Out):**

The SPI Serial Data Output (SDI). SD memory card use only. Connect this pin to the SPI Serial Data In (SDI) signal of the memory card.

**SCK pin (SPI Serial Clock):**

The SPI Serial Clock output (SCK). SD memory card use only. Connect this pin to the SPI Serial Clock (SCK) signal of the memory card.

**SDCS pin (SD Memory Card Chip Select):**

SD Memory-Card Chip Select (SDCS). SD memory card use only. Connect this pin to the Chip Enable (CS) signal of the memory card.

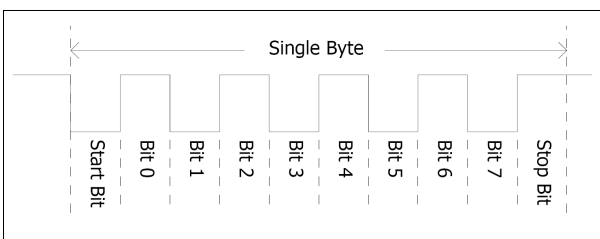
**2.3 Serial Port - UART**

The PICASO-SGC has a dedicated hardware UART that can communicate with a host micro-controller via its serial port. This is the main interface used by the host micro-controller to communicate with the PICASO-SGC to send commands and receive back data.

The primary features are:

- Full-Duplex 8 bit data transmission and reception through the TX and RX pins.
- Data format: 8 bits, No Parity, 1 Stop bit.
- Baud rates from 300 baud up to 256K baud (power/reset default at 9600 baud).

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.



The Serial port is also the primary interface for updating and programming the PICASO-SGC with specific display drivers and for future serial command upgrades and enhancements. Please refer to **Section 5. In-Circuit-Serial-Programming (ICSP)** for more details.

**TX0 pin (Serial Transmit):**

Asynchronous Serial port Transmit pin, TX. Connect this pin to host micro-controller Serial Receive (Rx) signal. The host receives data from PICASO-SGC via this pin. This pin is 5.0V tolerant.

**RX0 pin (Serial Receive):**

Asynchronous Serial port Receive pin, RX. Connect this pin to host micro-controller Serial Transmit (Tx) signal. The host transmits data to PICASO-SGC via this pin. This pin is 5.0V tolerant.

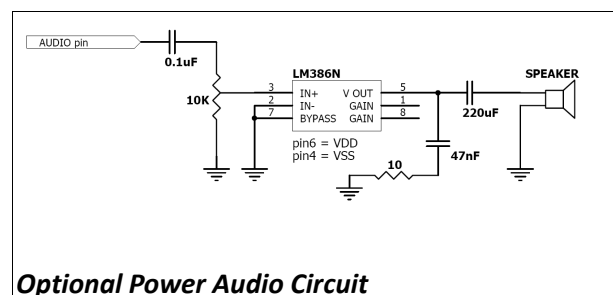
**2.4 Audio Interface**

The exclusive audio support in the PICASO-SGC makes it better than its peers in the Graphics processor range. PWM ensures better sound quality with a volume range of 8 to 127. A simple instruction empowers the user to execute the audio files. Audio operation can be carried out simultaneously with the execution of other necessary instructions.

For a complete list of audio commands please refer to the separate document titled '**PICASO-SGC-COMMANDS-SIS.pdf**'.

**AUDIO pin (Audio PWM output):**

External Amplifier Output pin. This pin provides a 16-bit DAC/PWM audio output to use with an external audio amplifier. Example circuit below provides a low cost implementation. If unused then this pin must be left open or floating.



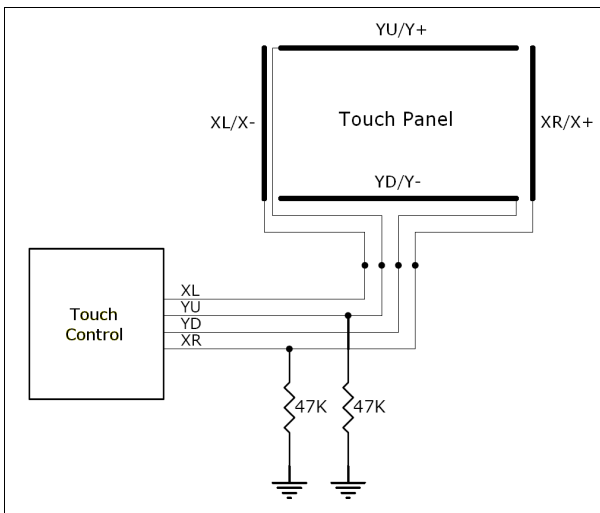
**AUDENB pin (Audio Enable output):**

External Amplifier enable pin. This pin provides ON/OFF amplifier control. If unused then this pin must be left open or floating.

- LOW:** Enable external Audio amplifier.
- HIGH :** Disable external Audio amplifier.

**2.5 Touch Screen Interface**

The PICASO-SGC supports 4-Wire resistive touch panels. The diagram below shows a simplified interface between the PICASO and a touch panel.



**XR pin (Touch Panel X-Read input):**

4-Wire Resistive Touch Screen X-Read analog signal. Connect this pin to XR or X+ signal of the touch panel.

**XL pin (Touch Panel X-Drive output):**

4-Wire Resistive Touch Screen X Drive signal. Connect this pin to XL or X- signal of the touch panel.

**YU pin (Touch Panel Y-Read input):**

4-Wire Resistive Touch Screen Y-Read analog signal. Connect this pin to YU or Y+ signal of the touch panel.

**YD pin (Touch Panel Y-Drive output):**

4-Wire Resistive Touch Screen Y Drive signal. Connect this pin to YD or Y- signal of the touch panel.

**2.6 System Pins**

**VCC pins (Device Supply Voltage):**

Device supply voltage pins. These pins must be connected to a regulated supply voltage in the range of 3.0 Volts to 3.6 Volts DC. Nominal operating voltage is 3.3 Volts.

**GND pins (Device Ground):**

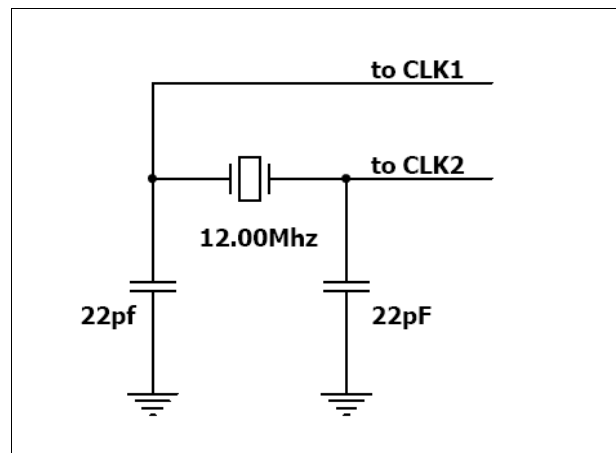
Device ground pins. These pins must be connected to system ground.

**RESET pin (Device Master Reset):**

Device Master Reset pin. An active low pulse of greater than 2 micro-seconds will reset the device. Connect a resistor (1K through to 10K, nominal 4.7K) from this pin to VCC. Only use open collector type circuits to reset the device if an external reset is required. This pin is not driven low by any internal conditions.

**CLK1, CLK2 pins (Device Oscillator Inputs):**

CLK1 and CLK2 are the device oscillator pins. Connect a 12.00Mhz AT strip cut crystal with 22pf capacitors from each pin to GND as shown in the diagram below.



**2.7 GPIO - General Purpose IO Interface**

There are 16 general purpose Input/Output (GPIO) pins available to the host micro-controller. These are grouped as P0..P15. Each individual GPIO pin can be set as an INPUT or an OUTPUT. The upper 8 bits (P8..P15) are also labelled as BUS0..BUS7 and these 8-bits provide a fast parallel data transfer to and from external

devices. For detailed usage refer to the separate document titled:

'*PICASO-SGC-COMMANDS-SIS.pdf*'.

**P0-P15 pins (16 x GPIO Signals):**

General purpose I/O pins. Each pin is individually set for INPUT or an OUTPUT. Power-Up Reset default is all INPUTS.

**BUS0-BUS7 pins (GPIO 8-Bit Bus):**

8-bit parallel General purpose I/O Bus.

**Note:** All GPIO pins are 5.0V tolerant.

## 3. Host Interface

The PICASO-SGC provides both a physical and a software interface to its host.

### 3.1 Physical Interface - UART

The physical interface to the host is provided by the UART and the host communicates to the device via this serial link. The host uses this physical interface to send commands and data.

**Serial Data Format:**

**9600, 8 Bits, No Parity, 1 Stop Bit.**

### 3.2 Software Interface – Command Set

The software interface provided by the PICASO-SGC device is a set of easy to use serial commands. The command set is grouped into following sections:

**General Commands:**

- AutoBaud
- Set new Baud-Rate
- Version-Device Info Request
- Replace Background Colour
- Clear Screen
- Display Control Functions
- Set Volume
- Sleep (Low Power Mode)
- Read GPIO Pin
- Write GPIO Pin
- Read GPIO Bus
- Write GPIO Bus

**Graphics Commands:**

- Add User Bitmap Character
- Draw User Bitmap Character
- Draw Circle
- Draw ellipse
- Draw Triangle
- Draw Rectangle
- Draw Image-Icon
- Set Background colour
- Draw Line
- Draw Pixel

- Draw Polygon
- Read Pixel
- Screen Copy-Paste
- Replace Colour
- Set Pen Size

**Text Commands:**

- Set Font
- Set Transparent-Opaque Text
- Draw "String" Text (graphics format)
- Draw ASCII Char (text format)
- Draw "String" Text (text format)
- Draw ASCII Char (graphics format)
- Draw Text Button

**Touch Screen Commands:**

- Get Touch Coordinates
- Detect Touch Region
- Wait Until Touch

**SD Memory Card Commands (Low-Level/RAW)**

- Initialise Memory Card
- Set Address Pointer of Card
- Read Byte Data from Card
- Write Byte Data to Card
- Read Sector Block from Card
- Write Sector Block to Card
- Screen Copy-Save to Card
- Display Image-Icon from Card
- Display Object from Card
- Display Video-Animation Clip from Card
- Run Script (4DSL) Program from Card

**SD Memory Card Commands (FAT-Level/DOS)**

- Initialise Memory Card
- Read File from Card (FAT)
- Write File to Card (FAT)
- Erase file from Card (FAT)
- List Directory from Card (FAT)
- Screen Copy-Save to Card (FAT)
- Display Image-Icon from Card (FAT)
- Play Audio WAV file from Card (FAT)
- Run Script (4DSL) Program from Card (FAT)

**4DSL - Scripting Language Commands**

- Delay
- Set Counter
- Decrement Counter
- Jump to Address If Counter Not Zero

- Jump to Address
- Exit-Terminate Script Program

For a complete detailed list of commands refer to the separate document titled:

***"PICASO-SGC-COMMANDS-SIS.pdf"***

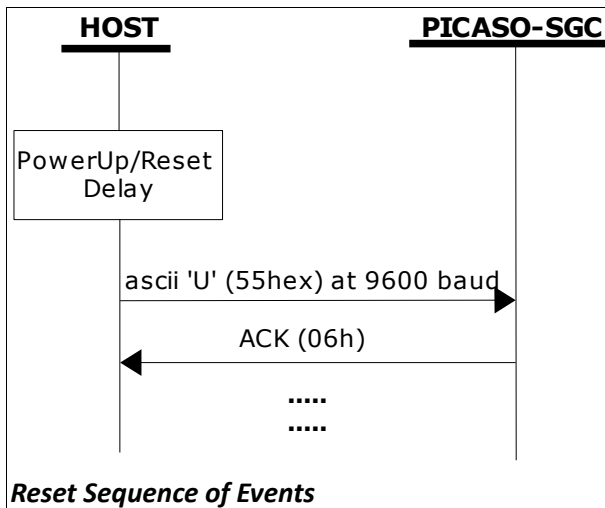
Each command is made up of a sequence of data bytes. When a command is sent to the device and the operation is completed, the device will always return a response. For a command that has no specific response the device will send back a single acknowledge byte called the ACK (06hex), in the case of success, or NAK (15hex), in the case of failure.

Commands having specific responses may send back varying numbers of bytes, depending upon the command and response. It will take the device a certain amount of time to respond, depending on the command type and the operation that has to be performed. If the device receives a command that it does not understand it will reply back with a negative acknowledge called the **NAK** (15hex). Since a command is only identified by its *position* in the sequence of data bytes sending incorrect data can result in wildly incorrect operation.

## 4. Power-Up and Reset

When the PICASO-SGC comes out of a power up or external reset, a sequence of events must be observed before attempting to communicate with the device:

- Allow up to 500ms delay after power-up or reset for the device to settle. Do not attempt to communicate with the device during this period. The device may send garbage on its TX Data line during this period, the host should disable its Rx Data reception.  
**Note:** For applications that utilise memory cards with large capacity, allow up to 3 seconds for the card initialisation.
- The host must send the ascii 'U' (55hex) command at 9600 baud and wait for an ACK (06hex). The default baud rate of the PICASO-SGC is 9600 bps and the host must communicate initially with the device at this speed. The **“Set new Baud-Rate”** command can then be used to change to a different baud-rate if desired.



### 4.1 Splash Screen on Power Up

The PICASO-SGC will wait up to 5 seconds with its screen blank for the host to transmit the Auto-Baud command ('U', 55hex). If the host has not transmitted the Auto-Baud command by the end of this period the PICASO-SGC will display a built-

in splash screen. If the host has transmitted the Auto-Baud command, the screen will remain blank. This wait period is for those customer specific applications where the splash screen is undesired.

### 4.2 4DSL Memory Card Script Program

The complete command summary for the PICASO-SGC device is listed in the previous section 3 of this document. The command execution is not only limited to the host sending these via the serial interface. The majority of them can be composed as a script and written into memory card. A 4DSL script program is a sequence of those commands that reside and can be executed from inside the memory card and these can be a combination of graphics, text, image, video and audio commands. Complete list of commands available for the scripting program is listed in a separate document titled:

**“PICASO-SGC-COMMANDS-SIS.pdf”**

### 4.3 Auto-Run Card Script Program

The PICASO-SGC has a feature that will auto run a preloaded script program on power-up. The PICASO-SGC device is equipped to accept memory cards and when using the FAT file system, upon power-up, if a 4DSL script program file called 'autoexec.4ds' exists on the memory card, the PICASO-SGC will automatically run this script program. This is a useful feature for those stand alone applications where the device does not require a host controller to send commands to the PICASO-SGC to play a slide show of images, video clips, etc.

The user will have to create and upload a slide show composition to the card to benefit from this auto play feature.

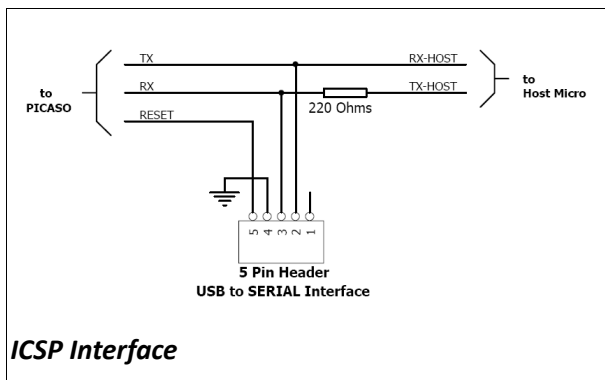
Refer to **'Section 4: Appendix B'** at the end of the separate document titled: **“PICASO-SGC-COMMANDS-SIS.pdf”** for a quick guide to creating scripting files using the FAT-Controller software tool available from 4D Systems.

## 5. In Circuit Serial Programming-ICSP

The PICASO-SGC is a custom graphics controller. 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.

A PmmC file also 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.

A PmmC file can only be programmed into the device via its serial port and an access to this must be provided for on the target application board. This is referred to as In Circuit Serial Programming (ICSP). Figure below provides a typical implementation for the ICSP interface.



The PmmC file is programmed into the device with the aid of "**PmmC Loader**", a PC based software tool. To provide a link between the PC and the ICSP interface a USB to Serial converter is required. A range of custom made micro-USB devices such as the uUSB-MB5 and the uUSB-CE5 are available from 4D Systems.

For further details refer to: '**Section 8: Development and Support Tools**'.

## 6. Memory Cards – FAT16 Format

The PICASO-SGC uses off the shelf standard SD/microSD memory cards with up to 2Gb capacity. For any FAT file related operations, before the memory card can be used it must first be formatted with FAT16 option. The formatting of the card can be done on any PC system with a card reader. Select the appropriate drive and choose the FAT16 (or just FAT in some systems) option when formatting. The card is now ready to be used in the PICASO-SGC based application.



The PICASO-SGC 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.

The FAT partition is always first (if it exists) and can be up to the maximum size permitted by FAT16. Windows will format FAT16 up to 2Gb and the Windows command prompt will format FAT16 up to 4Gb.

For the RAW partition, byte reads and writes can access  $2^{32}$  (i.e. 4gb) of the card, Sector reads and writes can access  $2^{24}$  sectors (of 512 bytes, i.e. 8gb).

The total amount of the card usable is the sum of the FAT and RAW partitions.

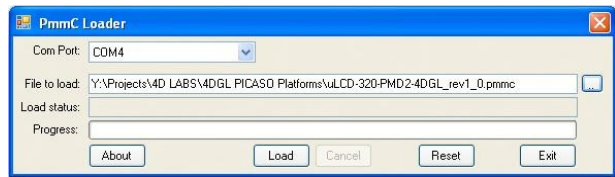
## 7. Supported Displays and Drivers

The PICASO-SGC supports most colour displays (CSTN, TFT, OLED) up to 640x480 resolution with an 80-Series 16 bit wide CPU interface. The chip must be initially programmed with all the display characteristics using the DISP software programming tool. The required characteristics parameters are obtained from the display driver IC data sheet which is available from the display manufacturer.

## 8. Development and Support Tools

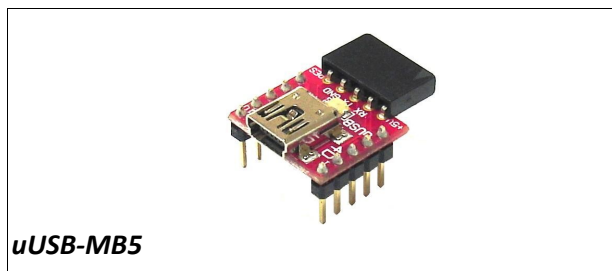
### 8.1 PmmC Loader – PmmC Programming Software Tool

The ‘PmmC Loader’ is a free software tool for Windows based PC platforms. Use this tool to program the latest PmmC file into the PICASO-SGC chip embedded in your application board. It is available for download from the 4D Systems website, [www.4dsystems.com.au](http://www.4dsystems.com.au)



### 8.2 microUSB – PmmC Programming Hardware Tool

The micro-USB module is a USB to Serial bridge adaptor that provides a convenient physical link between the PC and the PICASO-SGC device. A range of custom made micro-USB devices such as the uUSB-MB5 and the uUSB-CE5 are available from 4D Systems [www.4dsystems.com.au](http://www.4dsystems.com.au). The micro-USB module is an essential hardware tool for all the relevant software support tools to program, customise and test the PICASO-SGC chip.



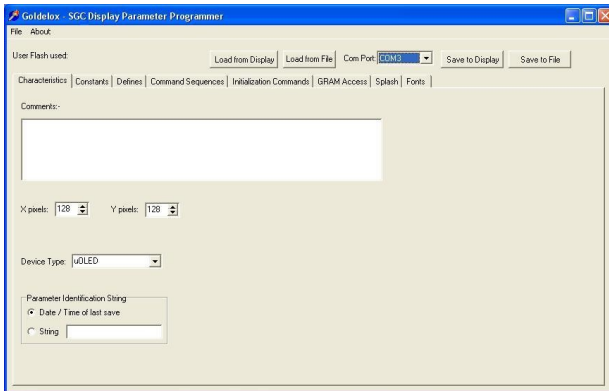


### 8.3 Display Initialisation Setup Personality (DISP) – Software Tool

DISP is a free software tool for Windows based PC platforms. Use this tool to:-

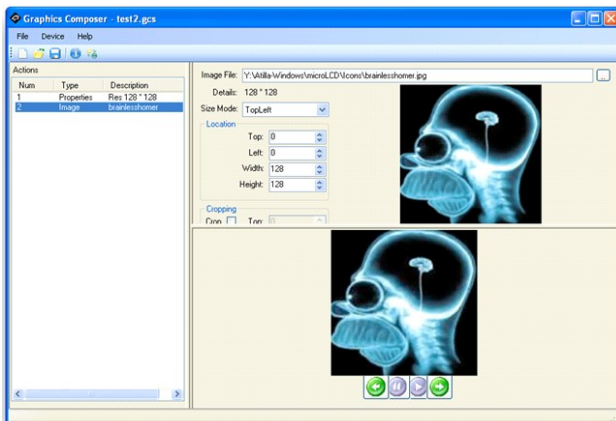
- Configure the PICASO-SGC chip to work with a specific display.
- Modify the way the chip initially sets up the display, e.g. screen saver, brightness, etc.
- Construct the splash screens.
- Replace or modify the embedded fonts.

It is available for download from the 4D Systems website, [www.4dsystems.com.au](http://www.4dsystems.com.au).



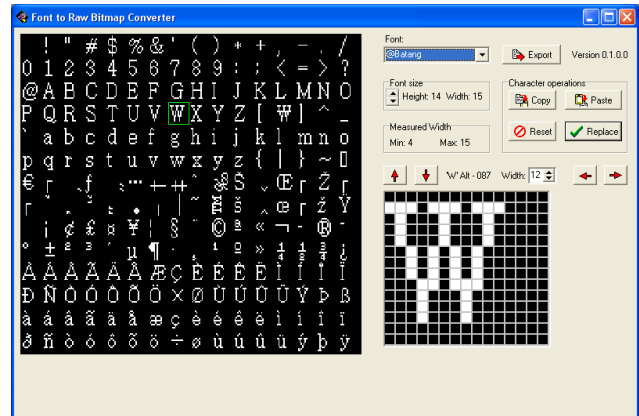
### 8.4 Graphics Composer – Software Tool

The Graphics Composer is a free software tool for Windows. This software tool is an aid to composing a slide show of images/animations/movie-clips (multi-media objects) which can then be downloaded into the SDHC/SD/uSD/MMC memory card that is supported by the PICASO-SGC. The host simply sends commands to the PICASO-SGC to display the multimedia objects.



### 8.5 FONT Tool – Software Tool

Font-Tool is a free software utility for Windows based PC platforms. This tool can be used to assist in the conversion of standard Windows fonts (including True Type) into the bitmap fonts used by the PICASO-SGC chip.

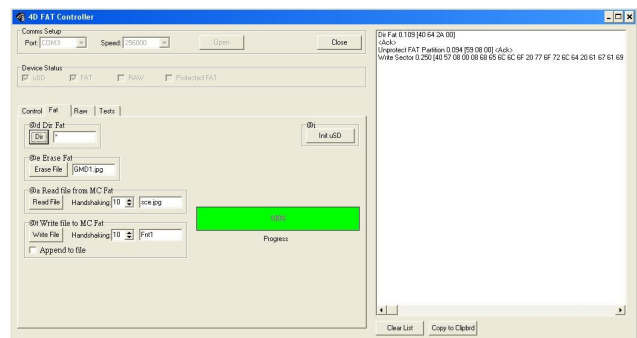


It is available for download from the 4D Systems website, [www.4dsystems.com.au](http://www.4dsystems.com.au).

Disclaimer: Windows fonts may be protected by copyright laws. This software is provided for experimental purposes only.

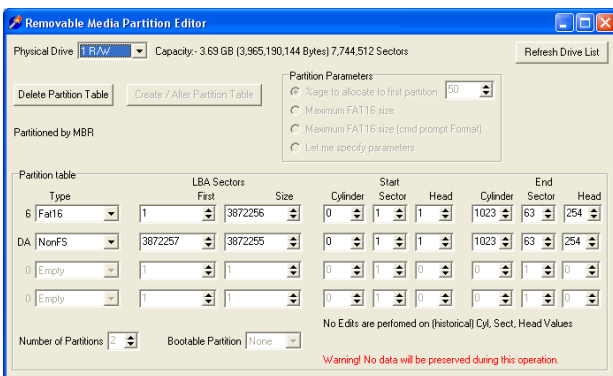
### 8.6 FAT Controller – Software Test Tool

The 4D FAT Controller is a free software tool to test all of the functionality of the GOLDELOX-DOS, GOLDELOX-SGC and the PICASO-SGC devices and their respective modules. It is useful in learning about how to communicate with the chips and the modules. For the GOLDELOX-SGC and the PICASO-SGC it can also simulate most of the operation of the device and assist in the creation of simple scripts, either simulating the execution of those scripts and / or downloading them into a uSD/uSDHC card for execution on the display.



### 8.7 RMPET – Software Tool

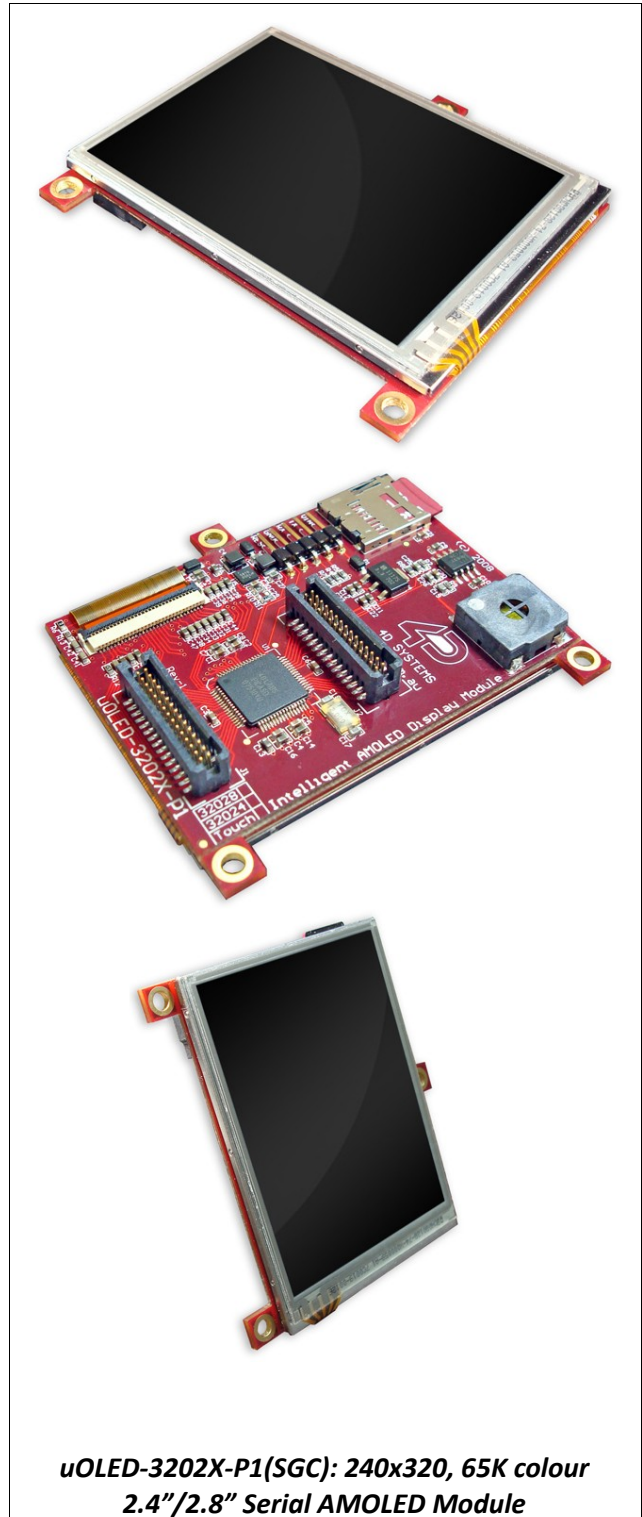
uSD/SD/SDHC memory cards nearly always come pre-partitioned with a single partition. Windows only accesses the first partition on the card and ignores any other partitions. Removable Media Partition Edit Tool (RMPET) can split a large card into two partitions, the first partition for use as a FAT16 partition and the second partition for use as a RAW partition. RMPET allows setting of the first partition to a percentage of the card, the 2Gb maximum of the FAT16 Windows format program, or the 4Gb maximum of FAT16 when the command prompt format command is used.



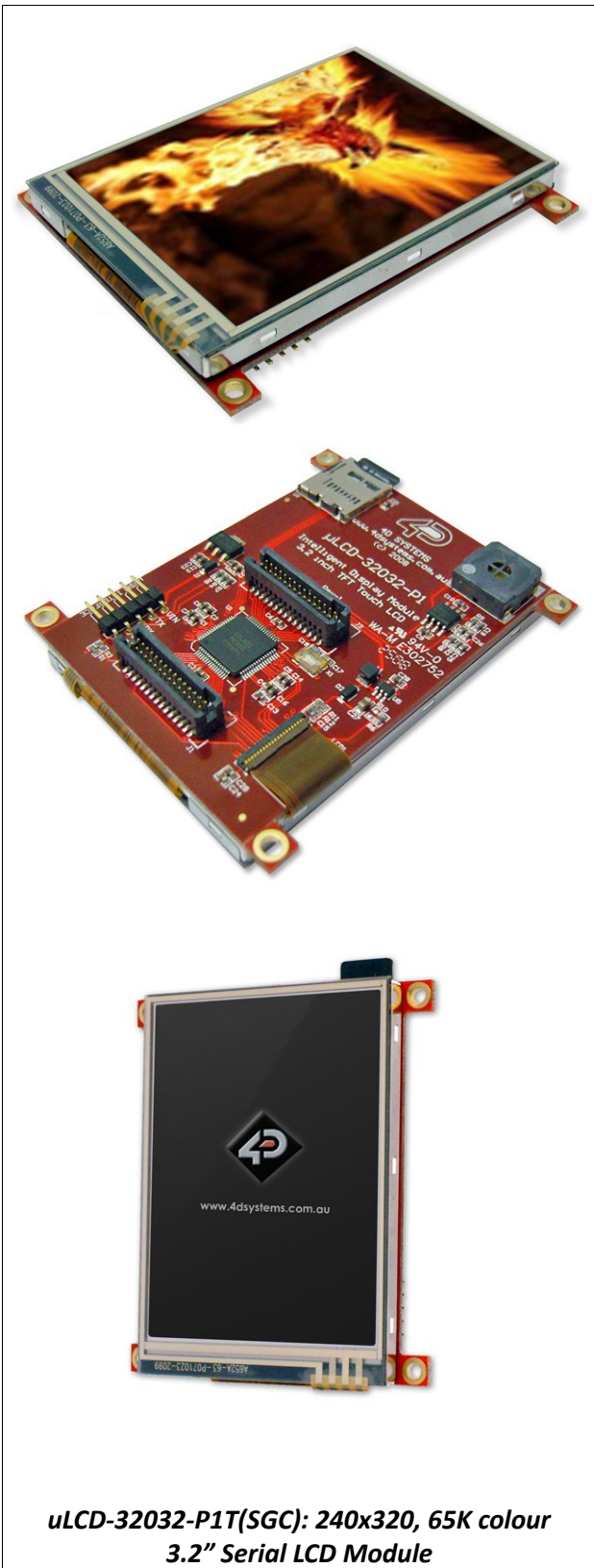
It is available for download from the 4D Systems website, [www.4dsystems.com.au](http://www.4dsystems.com.au).

### 8.8 Evaluation Display Modules

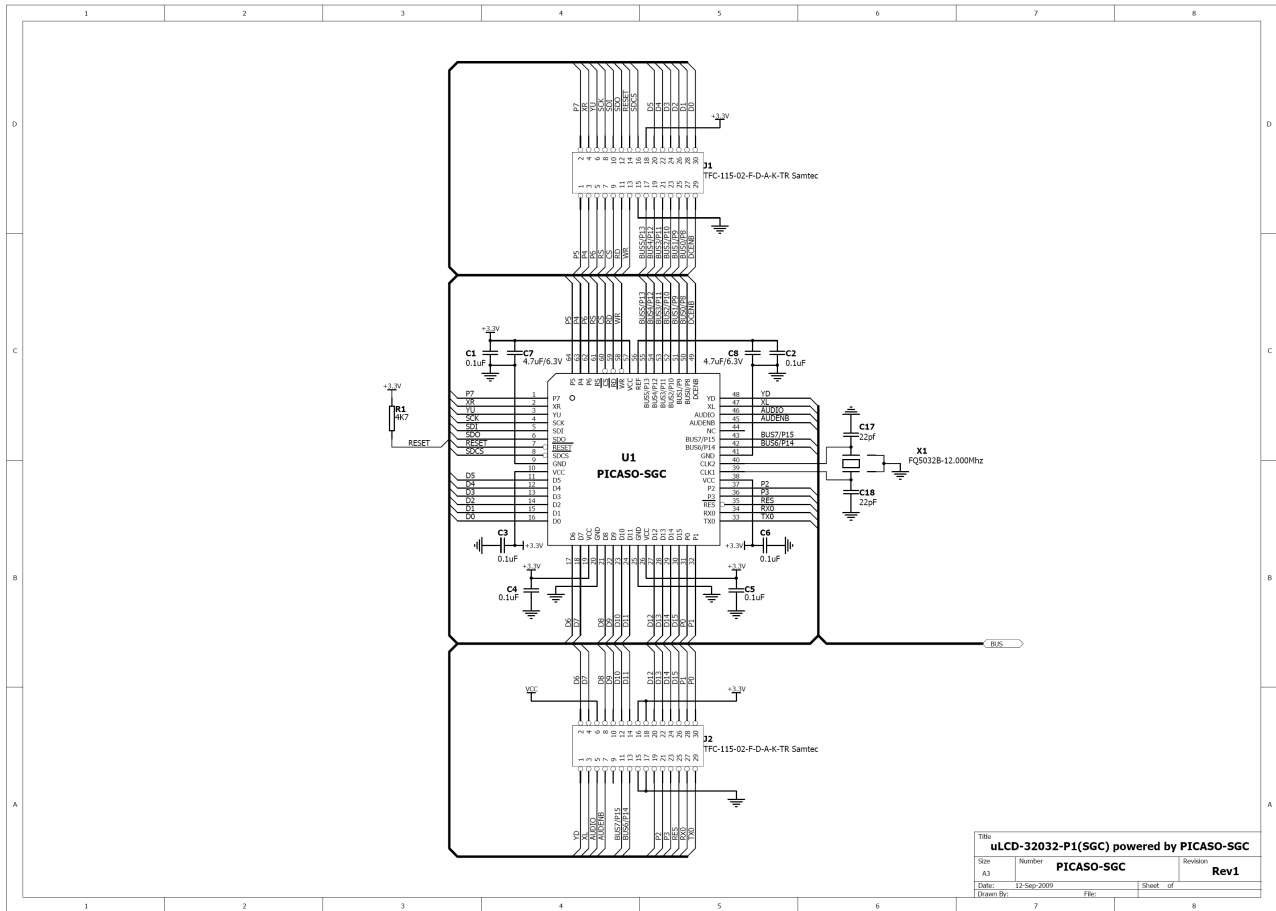
The following modules, available from 4D Systems, can be used for evaluation purposes to discover what the PICASO-SGC processor has to offer.

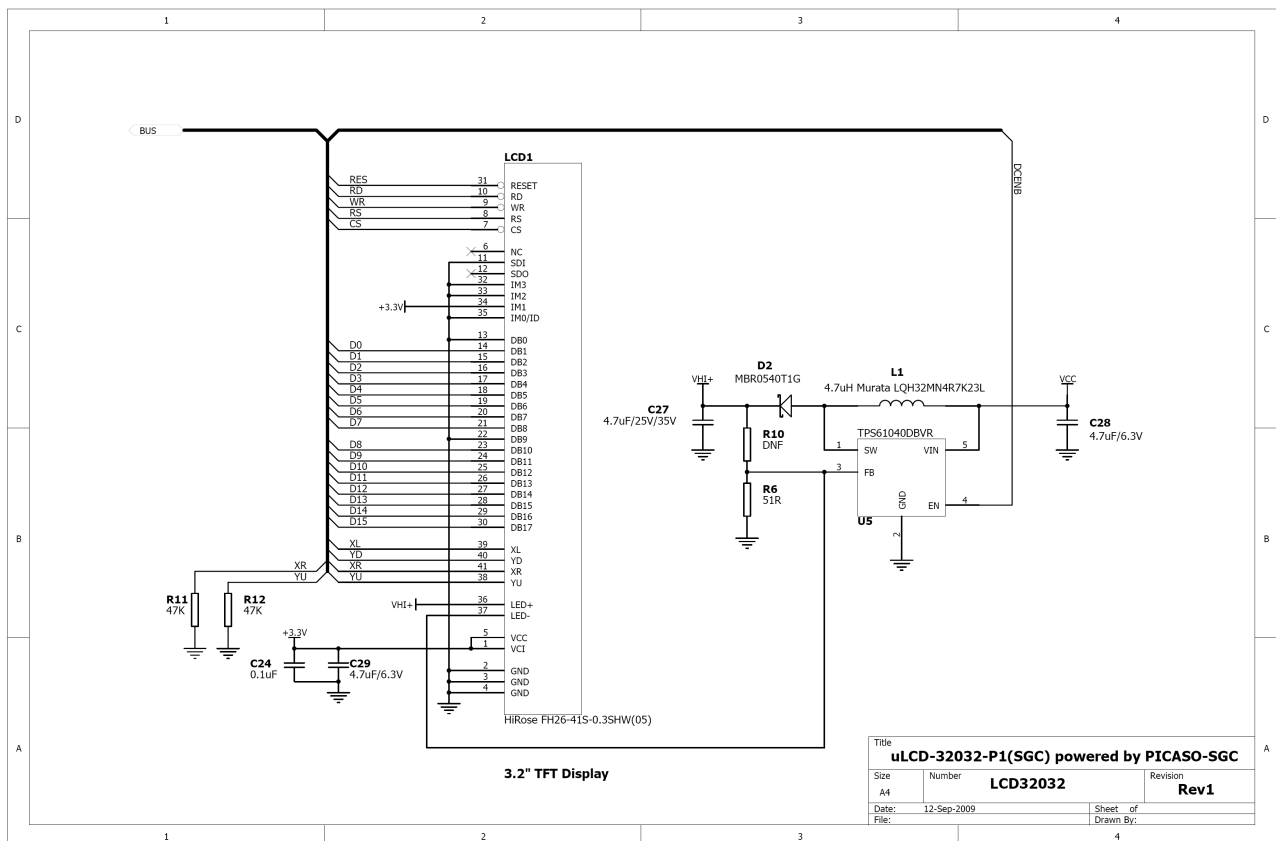
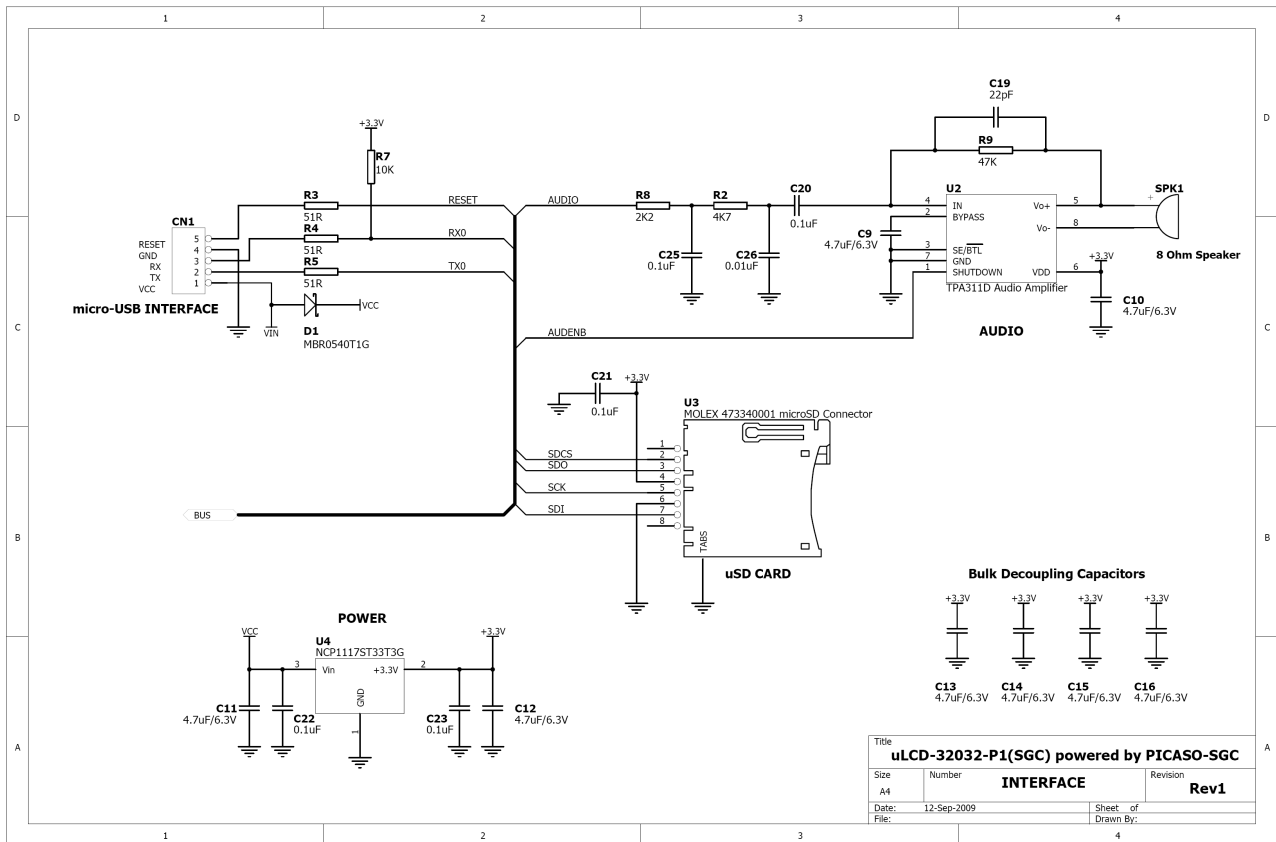


**uOLED-3202X-P1(SGC): 240x320, 65K colour  
2.4"/2.8" Serial AMOLED Module**



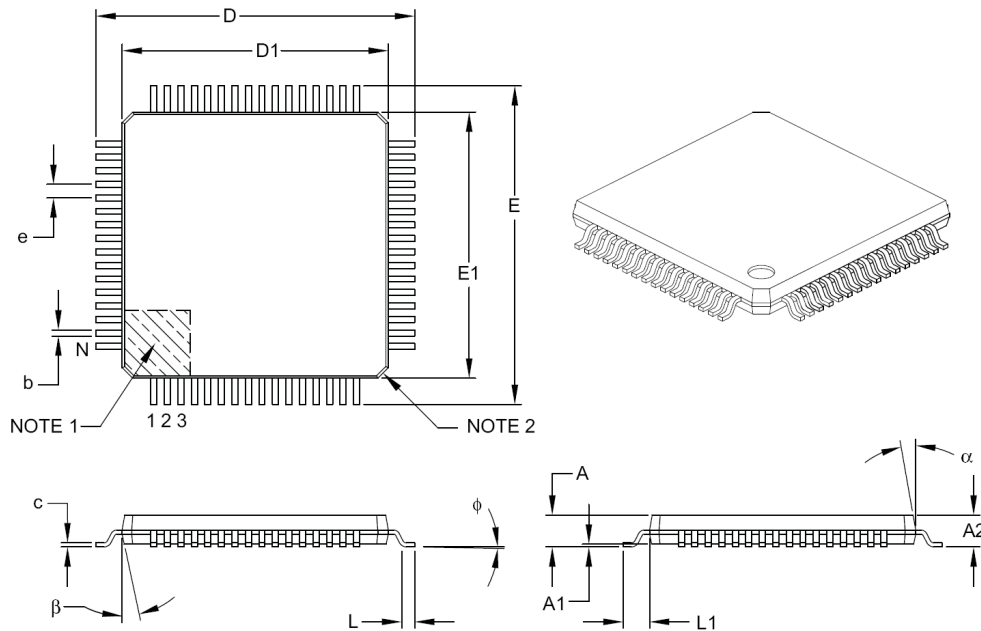
9. Reference Design





**10. Package Details and PCB Land Pattern**

**64-Lead Plastic Thin Quad Flatpack (PT) – 10x10x1 mm Body, 2.00 mm [TQFP]**



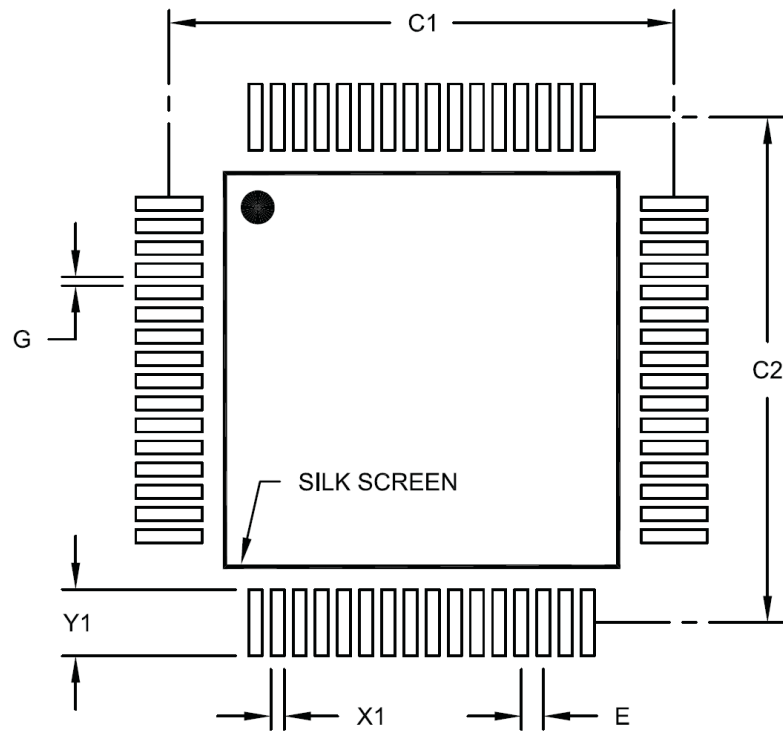
Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Leads	N	64		
Lead Pitch	e	0.50 BSC		
Overall Height	A	–	–	1.20
Molded Package Thickness	A2	0.95	1.00	1.05
Standoff	A1	0.05	–	0.15
Foot Length	L	0.45	0.60	0.75
Footprint	L1	1.00 REF		
Foot Angle	$\phi$	0°	3.5°	7°
Overall Width	E	12.00 BSC		
Overall Length	D	12.00 BSC		
Molded Package Width	E1	10.00 BSC		
Molded Package Length	D1	10.00 BSC		
Lead Thickness	c	0.09	–	0.20
Lead Width	b	0.17	0.22	0.27
Mold Draft Angle Top	$\alpha$	11°	12°	13°
Mold Draft Angle Bottom	$\beta$	11°	12°	13°

**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Chamfers at corners are optional; size may vary.
- Dimensions D1 and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.



RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Contact Pad Spacing	C1		11.40	
Contact Pad Spacing	C2		11.40	
Contact Pad Width (X64)	X1			0.30
Contact Pad Length (X64)	Y1			1.50
Distance Between Pads	G	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

## 11. Specifications and Ratings

Absolute Maximum Ratings	
Operating ambient temperature .....	-40°C to +85°C
Storage temperature .....	-65°C +150°C
Voltage on any digital input pin with respect to GND .....	-0.3V to 5.6V
Voltage on analogue pin with respect to GND .....	-0.3V to (VCC + 0.36V)
Voltage on VCC with respect to GND .....	-0.3V to 4.0V
Maximum current out of GND pin .....	300mA
Maximum current into VCC pin .....	250mA
Maximum output current sunk/sourced by any pin .....	4.0mA
Total power dissipation .....	1.0W

**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)		3.0	3.3	3.6	V
Operating Temperature		-40	--	+80	°C
External Crystal (Xtal)		--	12.00	--	Mhz
Input Low Voltage (VIL)	VCC = 3.3V, all pins	VGND	--	0.2VCC	V
Input High Voltage (VIH)	VCC = 3.3V, non 5V tolerant pins	0.8VCC	--	VCC	V
Input High Voltage (VIH)	All GPIO pins, RX0 and TX0 pins	0.8VCC	--	5.5	V

Global Characteristics based on Operating Conditions					
Parameter	Conditions	Min	Typ	Max	Units
Supply Current (ICC)	VCC = 3.3V	--	50	90	mA
Internal Operating Frequency	Xtal = 12.00Mhz	--	48.00	--	Mhz
Output Low Voltage (VOL)	VCC = 3.3V, IOL = 3.4mA	--	--	0.4	V
Output High Voltage (VOH)	VCC = 3.3V, IOL = -2.0mA	2.4	--	--	V
A/D Converter Resolution	XR, YU pins	8	--	10	bits
Capacitive Loading	CLK1, CLK2 pins	--	--	15	pF
Capacitive Loading	All other pins	--	--	50	pF
Flash Memory Endurance	PmmC Programming	--	1000	--	E/W

Ordering Information
<b>Order Code:</b> PICASO-SGC
<b>Package:</b> TQFP-64, 10mm x 10mm
<b>Packaging:</b> Trays of 160 pieces



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