

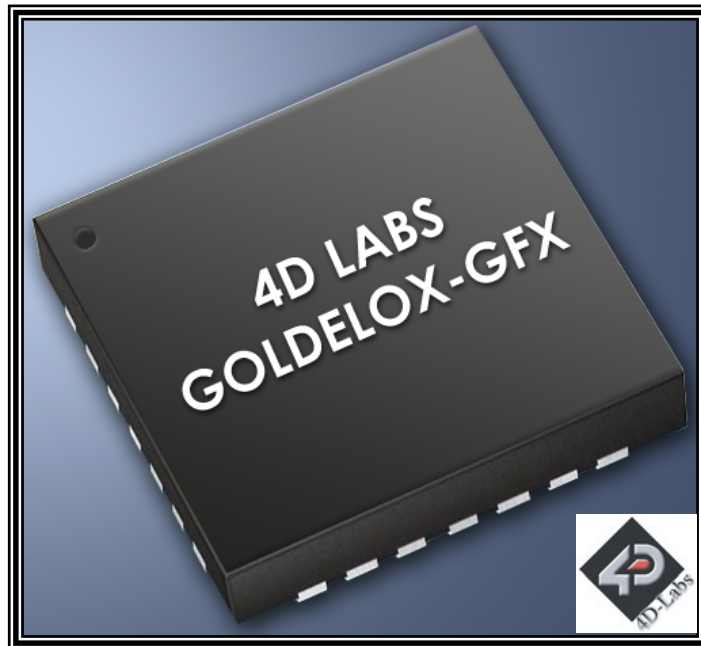
# GOLDELOX-GFX

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EMBEDDED GRAPHICS PROCESSOR  
LCD-OLED ONE-CHIP SOLUTION

## Data Sheet

Preliminary Information Rev1B



**4D Systems**

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# 1. Introduction

The **GOLDELOX-GFX** Graphics Processor is an exciting new concept introduced by **4D Labs** to the industry. It is completely configurable and will interface with many popular LCD and OLED displays and implements a set of integrated high-level graphics and I/O functions controlled by **E.V.E.** (**E**xtensible **V**irtual **E**ngine).

**EVE** is a proprietary, high performance virtual processor implemented across a variety of architectures to provide a single unified platform. This enables the same application code developed for the GOLDELOX-GFX to run on any other 4D custom processor (with EVE implementation) such as the **PICASO-GFX**. You will never again need to worry about selecting third party C source libraries, or which microcontroller to use. Just simply choose your display, interface it to the GOLDELOX-GFX on a PCB and add some I/O depending on your application. Finally select the PmmC file that matches your display driver IC (e.g. GOLDELOX-GFX-1339.pmmc for the SSD1339 display IC from Solomon) and download this into the GOLDELOX-GFX chip via the serial port and you have a powerful single chip graphics user interface solution. You are now ready to write your code in **4DGL** (a high level 4D Graphics Language) using the **4D Workshop** (editor and compiler) and save weeks even months of development time on your next embedded graphics project. 4DGL is a graphics oriented language allowing the developer to write applications in a high level language, syntax similar to popular languages such as BASIC, C and Pascal.

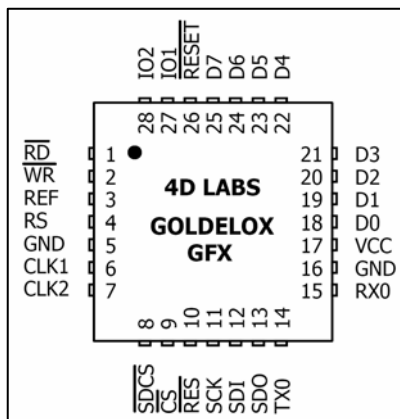
In simple applications, the GOLDELOX-GFX may be all you need as its modest but comprehensive I/O features can interface to serial, analogue, digital, sound generation and Dallas 1-wire devices. In more complex applications, you can offload most of your graphics overhead to the GOLDELOX-GFX and just send serial commands to perform the required actions from your favourite host processor.

All of the LCD and OLED built-in driver libraries implement and share the same high-level function interface. This allows your GUI application to be portable to different display controller types.

The software development tools such **4DGL Workshop** and **Graphics Composer** is **FREE** and there are no licensing requirements.

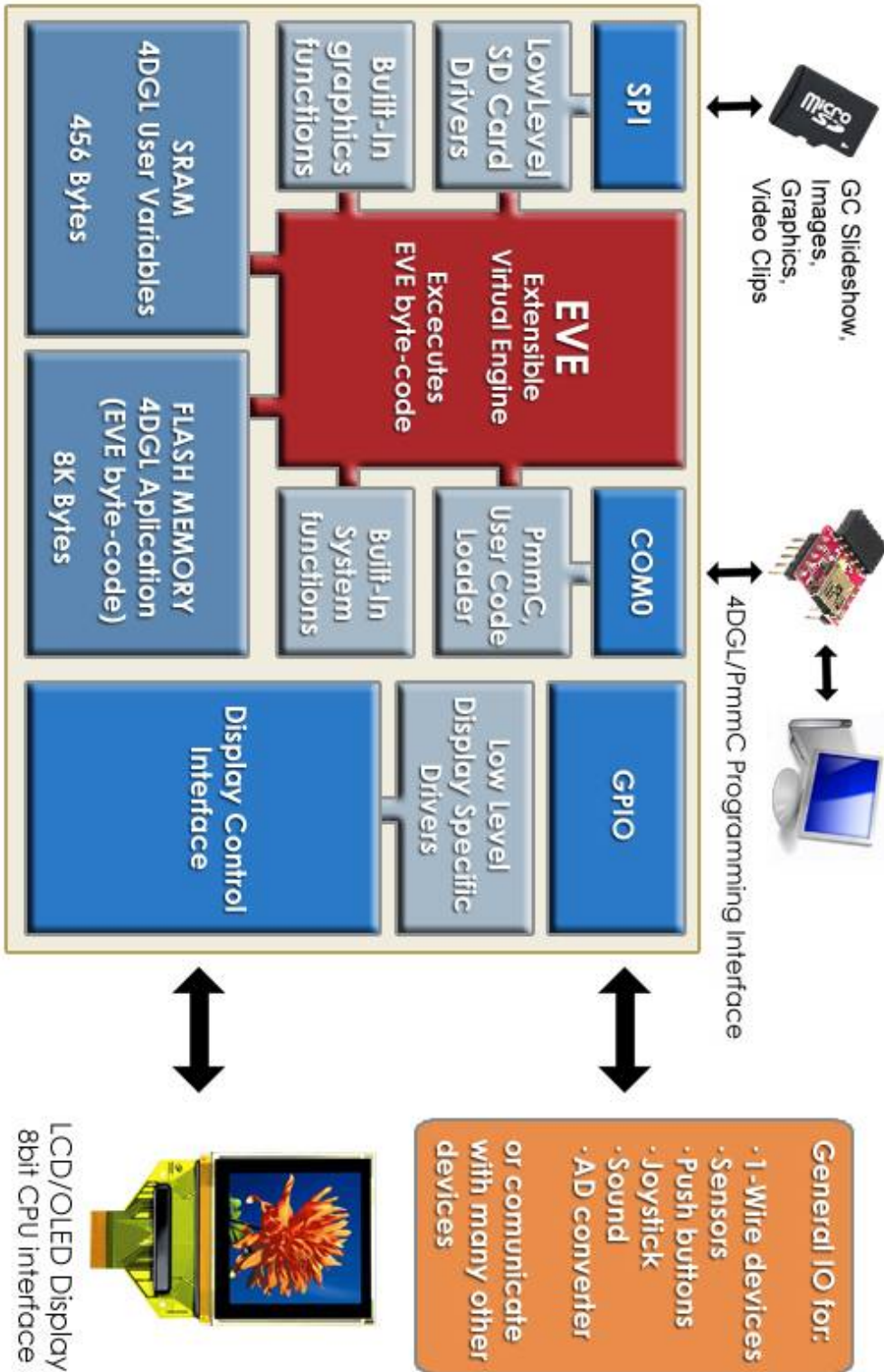
Your development is supported by an ever increasing range of modules and prototyping boards to provide a rapid aid to development.

The **GOLDELOX-GFX** is available in a tiny 28 pin QFN package.





## 2. Block Diagram





### 3. Features

- Low-cost OLED, LCD and TFT display graphics user interface solution.
- Ideal as a stand alone embedded graphics processor or interface to any host controller as a graphics co-processor.
- Connect to any colour display that supports an 80-Series 8 bit wide CPU interface. All data and control signals are provided.
- Built in high performance virtual processor engine (EVE) with an extensive byte-code instruction set optimised for 4DGL, the high level 4D Graphics Language.
- Comprehensive set of built in graphics functions and algorithms that can draw LINES, CIRCLES, TEXT and much more.
- Display full colour images, animations, icons and video clips.
- Digital I/O ports.
- Analogue to Digital converter with 8 or 10 bit resolution.
- Complex sound generation.
- External 1-Wire device support.
- 16 bit free running timer with 1msec resolution.
- Hardware interface support for SD, micro-SD or MMC memory cards for multimedia storage and data logging purposes.
- Asynchronous hardware serial port with Auto-Baud feature.
- 8K bytes of flash memory for user code storage and 456 bytes of RAM for user variables.
- Single 3.3 Volt Supply @15mA typical.
- Available in a tiny 6mm x 6mm 28pin QFN package.

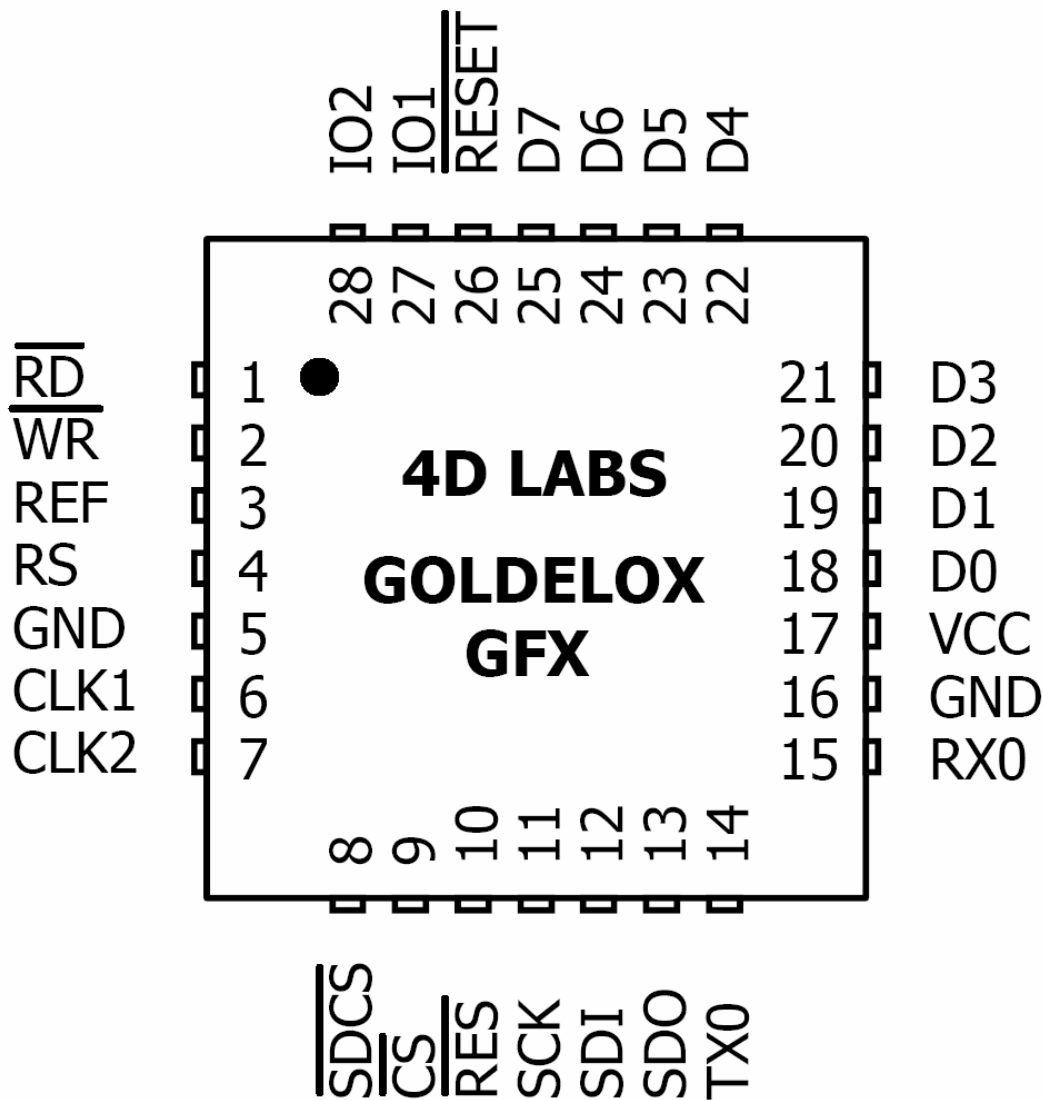
### 4. Applications

- Industrial (general).
- Test and Measurement equipment.
- Elevator Control Systems.
- Point of Sale Terminals.
- Home Appliances (general).
- Security Systems.
- Access Control Systems.
- Air-conditioning Control Systems.
- Universal Remote Control.
- Automotive (general).
- Electronic Gauges and Meters.
- Portable ECG Systems.
- Portable Blood Pressure Monitors.
- Aviation (general).
- Gaming and Slot Machines.



## 5. Pin Description

The **GOLDELOX-GFX** is only available in a 28 pin QFN package.





Pin	Symbol	I/O	Description
1	RD	O	Display read strobe signal. GOLDELOX-GFX asserts this signal LOW when reading data from the display.
2	WR	O	Display write strobe signal. GOLDELOX-GFX asserts this signal LOW when writing data to the display.
3	REF	P	Internal voltage regulator filter capacitor. Connect a 4.7uF to 10uF capacitor from this pin to Ground.
4	RS	O	Display register select. LOW: Display index or status register is selected. HIGH: Display control register is selected.
5	GND	P	Ground.
6	CLK1	I	System clock input 1 of a 12Mhz crystal.
7	CLK2	O	System clock input 2 of a 12Mhz crystal.
8	SDCS	O	SD Memory-Card chip select. SD memory card use only for multimedia objects.
9	CS	O	Display chip select. LOW: Display is selected and accessible. HIGH: Display is not selected and not accessible.
10	RES	O	Display RESET. GOLDELOX initialises the display by strobing this pin LOW.
11	SCK	O	SPI serial clock output. SD memory card use only for multimedia objects.
12	SDI	I	SPI serial data input. SD memory card use only for multimedia objects.
13	SDO	O	SPI serial data output. SD memory card use only for multimedia objects.
14	TX0	O	Asynchronous serial port transmit pin. COM0 TX.
15	RX0	I	Asynchronous serial port receive pin. COM0 RX.
16	GND	P	Ground.
17	VCC	P	Positive supply with respect to GND pin.
18	D0	I/O	Display data bus bit 0.
19	D1	I/O	Display data bus bit 1.
20	D2	I/O	Display data bus bit 2.
21	D3	I/O	Display data bus bit 3.
22	D4	I/O	Display data bus bit 4.
23	D5	I/O	Display data bus bit 5.
24	D6	I/O	Display data bus bit 6.
25	D7	I/O	Display data bus bit 7.
26	RESET	I	Master reset signal.
27	IO1	I/O	General purpose I/O1 pin.
28	IO2	I/O	General purpose I/O2 pin.
PAD	GND	P	Exposed metal pad under the package, must connect to GND.

**P** : Power, **I** : Input, **O** : Output, **I/O** : Input or Output, **A** : Analogue



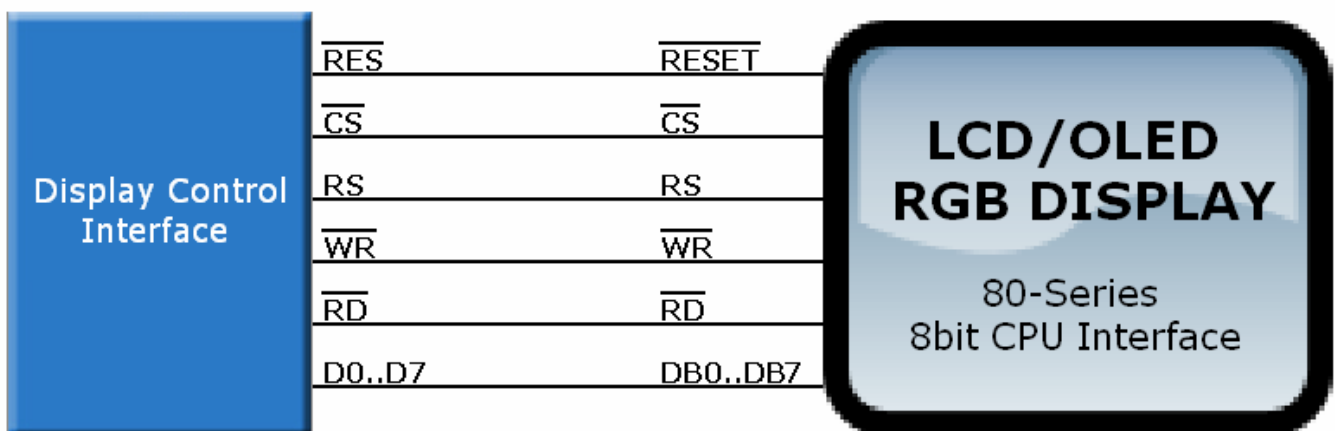
## 6. Functional Description

The **GOLDELOX-GFX** is highly integrated and configurable; it is a customised processor. The pins and internal control blocks have a specific purpose which makes board level design and integration almost plug-n-play. The low level timing, instruction set, power-up reset initialisation, hardware peripherals and associated registers are all controlled and supervised by **EVE** 'under the hood'. This makes development and board level implementation extremely efficient, fast and easy, taking most of the low level burden away from the designer.

### 6.1 - Display Control Interface

The **GOLDELOX-GFX** supports all LCD and OLED display types with an 80-Series 8 bit wide CPU data interface. The connectivity to the display is easy and straight forward. The Display Control block generates the necessary timing to drive the display. All data writes and reads occur over the 8 bit data bus (D0..D7) and various control signals synchronise the data transfer as illustrated below. The low level drivers to suit a specific display driver IC are available via the matching PmmC file and most popular ones are supported. If a PmmC is not available or supported for a specific driver IC then 4D will implement this to suit the customer's requirement.

CS	RS	RD	WR	Operation
0	0	0	1	Read display Status register.
0	0	1	0	Write display Index register.
0	1	0	1	Read display GRAM data.
0	1	1	0	Write display register or GRAM data.
1	X	X	X	No Operation.

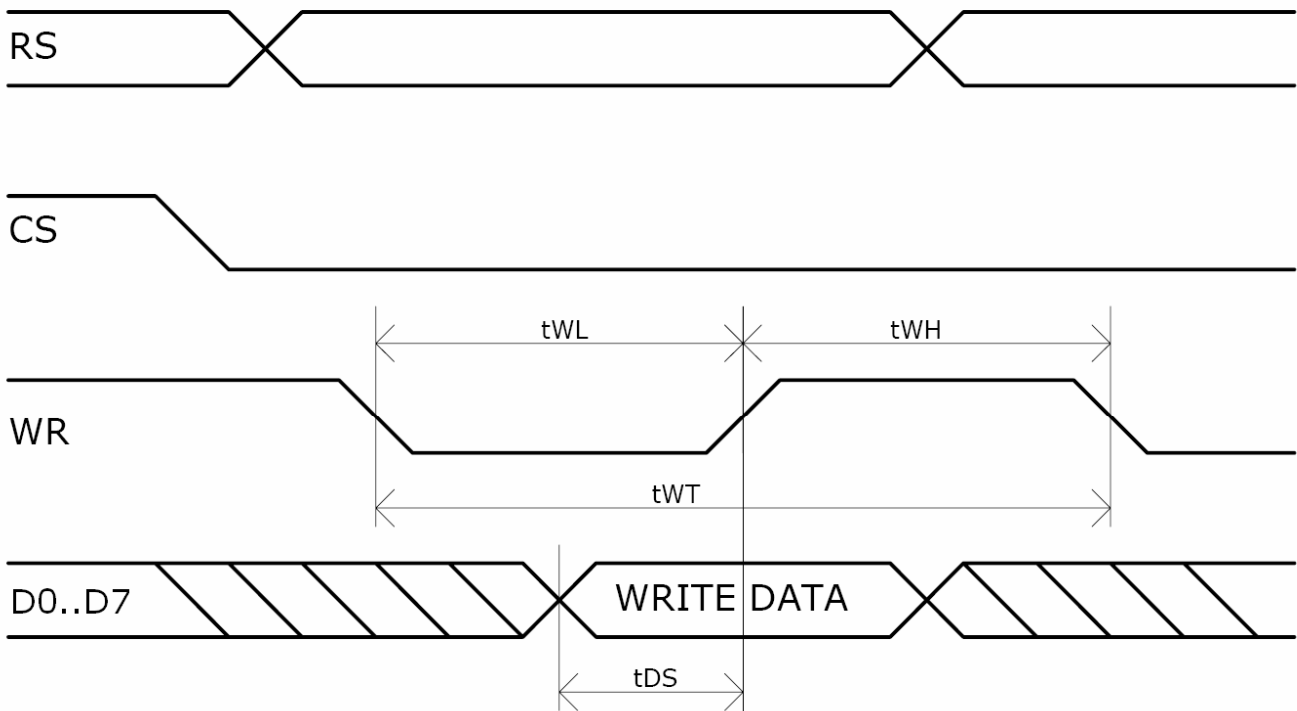






DISPLAY WRITE CYCLE TIMING					
Item	Symbol	Min.	Typ.	Max.	Unit
Write Low Level Pulse Width	tWL	170	-	-	ns
Write High Level Pulse Width	tWH	85	-	-	ns
Write Bus Cycle Total	tWT	255	-	-	ns
Write Data Setup	tDS	85	-	-	ns

**Note:** The timing provided here is indicative only. The actual timing will vary from display to display.

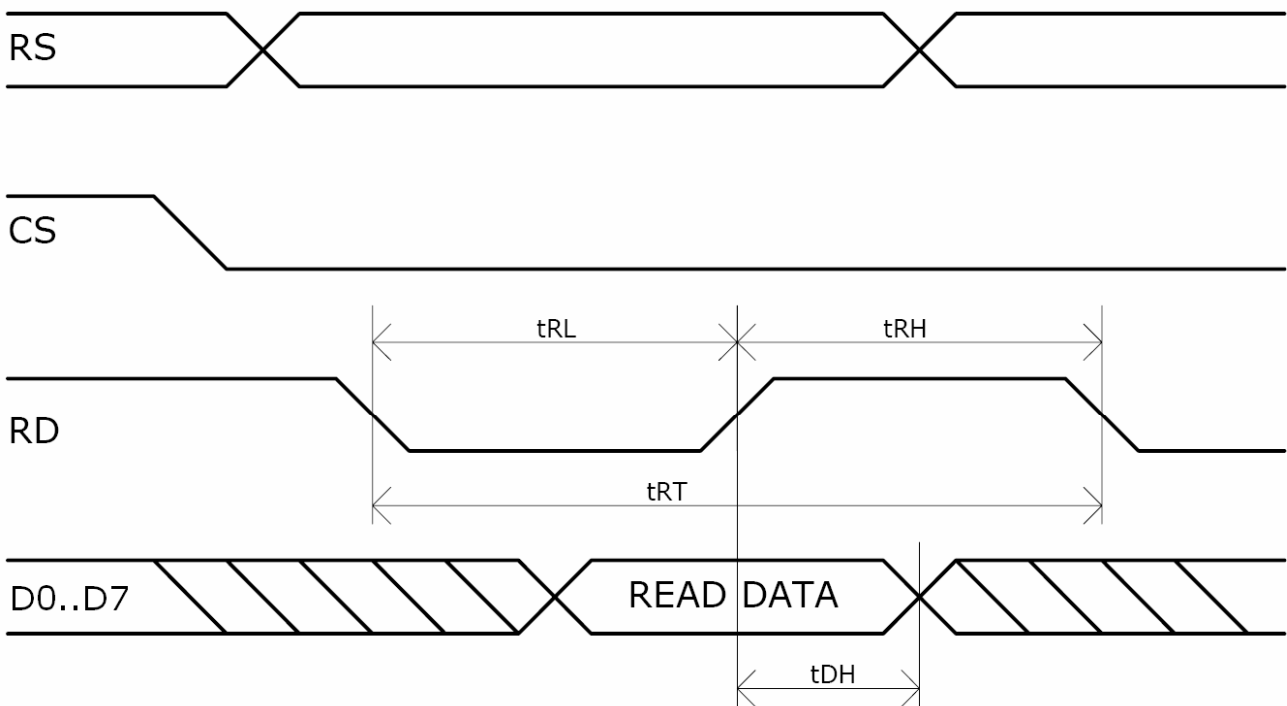


WRITE DATA TIMING



DISPLAY READ CYCLE TIMING					
Item	Symbol	Min.	Typ.	Max.	Unit
Read Low Level Pulse Width	tRL	300	-	-	ns
Read High Level Pulse Width	tRH	300	-	-	ns
Read Bus Cycle Total	tRT	600	-	-	ns
Read Data Hold	tDH	150	-	-	ns

**Note:** The timing provided here is indicative only. The actual timing will vary from display to display.



READ DATA TIMING



Display Interface Pins			
Pin	Symbol	I/O	Description
18	D0	I/O	Display data bus bit 0.
19	D1	I/O	Display data bus bit 1.
20	D2	I/O	Display data bus bit 2.
21	D3	I/O	Display data bus bit 3.
22	D4	I/O	Display data bus bit 4.
23	D5	I/O	Display data bus bit 5.
24	D6	I/O	Display data bus bit 6.
25	D7	I/O	Display data bus bit 7.
1	RD	O	Display read strobe signal. GOLDELOX-GFX asserts this signal LOW when reading data from the display.
2	WR	O	Display write strobe signal. GOLDELOX-GFX asserts this signal LOW when writing data to the display.
9	CS	O	Display chip select. LOW: Display is selected and accessible. HIGH: Display is not selected and not accessible.
4	RS	O	Display register select. LOW: Display index or status register is selected. HIGH: Display control register is selected.
10	RES	O	Display RESET. GOLDELOX-GFX initialises the display by strobing this pin LOW.

**Related 4DGL Instructions:**

[gfx\\_Cls](#)  
[gfx\\_PutPixel](#)  
[gfx\\_GetPixel](#)  
[gfx\\_Circle](#)  
[gfx\\_Ellipse](#)  
[gfx\\_Line](#)  
[gfx\\_Rectangle](#)  
[gfx\\_Triangle](#)  
[gfx\\_Polygon](#)  
[gfx\\_Polyline](#)  
[gfx\\_Plot](#)  
[gfx\\_Button](#)  
[gfx\\_Slider](#)  
[gfx\\_ScreenCopyPaste](#)  
[gfx\\_ClipWindow](#)  
[gfx\\_Bitmap](#)  
[gfx\\_MoveTo](#)  
[gfx\\_IncX](#)  
[gfx\\_IncY](#)



gfx\_Dot  
gfx\_Bullet  
gfx\_LineTo  
gfx\_LineRel  
gfx\_OrbitInit  
gfx\_Orbit  
gfx\_BoxTo  
gfx\_RGBto565  
gfx\_Set  
gfx\_Get  
txt\_MoveCursor  
txt\_Set

For further usage and details please refer to the 4DGL page at the link below:

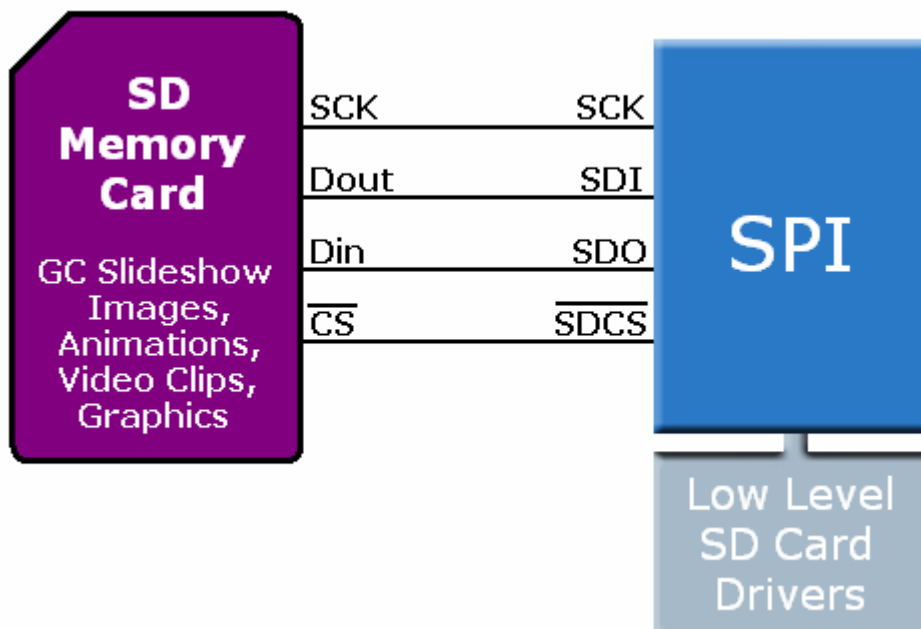
[www.4dsystems.com.au/developers/](http://www.4dsystems.com.au/developers/)



## 6.2 - SPI Interface (SD/MMC Card use only)

The **GOLDELOX-GFX** supports SD, micro-SD and MMC memory cards via its hardware SPI interface. The memory card is used within 4DGL 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. Related pins and connections are illustrated below.

SPI Interface Pins (SD Card use only)			
Pin	Symbol	I/O	Description
8	SDCS	O	SD Memory-Card chip select. SD memory card use only for multimedia objects.
11	SCK	O	SPI serial clock output. SD memory card use only for multimedia objects.
12	SDI	I	SPI serial data input. SD memory card use only for multimedia objects.
13	SDO	O	SPI serial data output. SD memory card use only for multimedia objects.



### Related 4DGL Instructions:

[uSD\\_Init](#)  
[uSD\\_SetAdd](#)  
[uSD\\_RdByte](#)  
[uSD\\_SetSector](#)



uSD\_Image  
uSD\_Video  
uSD\_Frame  
copyScreen2uSD  
copyuSD2Screen

For further usage and details please refer to the 4DGL page at the link below:  
[www.4dsystems.com.au/developers/](http://www.4dsystems.com.au/developers/)



### 6.3 – COM0: Asynchronous Serial Port

The **GOLDELOX-GFX** has a dedicated Asynchronous Serial hardware port that can communicate with external serial devices. This is referred to as the COM0 module.

The primary features are:

- Full-Duplex 8 bit data transmission and reception through the TX0 and RX0 pins.
- Data format: 8 bits, No Parity, 1 Stop bit.
- Auto Baud feature.
- Baud rates from 300 baud up to 256K 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 the serial port. This frees up the application to service other tasks.

COM0 is also the primary interface for user program and PmmC downloads. Once the compiled 4DGL application program (EVE byte-code) is downloaded, the serial port is then available for the user application.

COM0 Serial Port Pins			
Pin	Symbol	I/O	Description
14	TX0	O	Asynchronous serial port transmit pin. COM0 TX.
15	RX0	I	Asynchronous serial port receive pin. COM0 RX.

#### **Related 4DGL Instructions:**

[serin](#)  
[serout](#)  
[setbaud](#)  
[com\\_AutoBaud](#)  
[com\\_Init](#)  
[com\\_Full](#)  
[com\\_Count](#)  
[com\\_Reset](#)  
[com\\_Sync](#)  
[com\\_Error](#)

For further usage and details please refer to the 4DGL page at the link below:

[www.4dsystems.com.au/developers/](http://www.4dsystems.com.au/developers/)



## 6.4 – GPIO: General Purpose Input/Output

There are only 2 GPIO pins available. Each GPIO has a multitude of high level functions associated with it. The GPIO Functions table below lists the available features.

GPIO Pins			
Pin	Symbol	I/O	Description
27	IO1	I/O	General purpose I/O1 pin.
28	IO2	I/O	General purpose I/O2 pin.

GPIO Functions		
Function	IO1	IO2
Digital Input	√	√
Digital Output	√	√
Analog to Digital Converter 8/10 bits	√	--
Dallas 1-Wire	√	√
Complex Sound Generation (RTTTL Tunes)	√	√
Joystick – 5 position multi way switch	√	--

### Related 4DGL Instructions:

pin\_Set  
pin\_Hi  
pin\_Lo  
pin\_Read  
OW\_Reset  
OW\_Read  
OW\_Read9  
OW\_Write  
tune\_Play  
tune\_Pause  
tune\_Continue  
tune\_Playing  
tune\_Stop  
tune\_End

For further usage and details please refer to the 4DGL page at the link below:  
[www.4dsystems.com.au/developers/](http://www.4dsystems.com.au/developers/)





## 6.5 - System TIMER: 16 bit Free Running 1ms Counter

The system timer (TIMER) is a 16 bit free running counter that continuously increment in 1msec steps until it reaches 65,535. The next count will then force the timer to overflow to 0. The timer register can be written to and read.

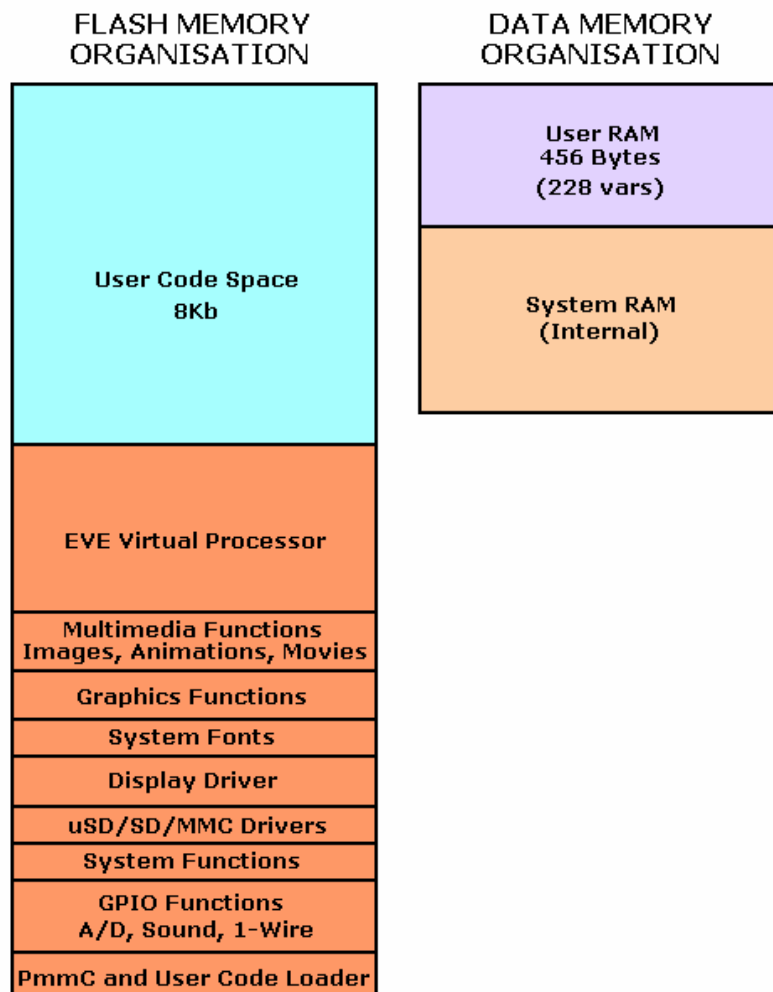
### **Related 4DGL Instructions:**

[sys\\_Set](#)  
[sys\\_Get](#)

For further usage and details please refer to the 4DGL page at the link below:  
[www.4dsystems.com.au/developers/](http://www.4dsystems.com.au/developers/)

## 6.6 – Memory Organisation

The figure below illustrates how the GOLDELOX-GFX internal memory is organised.





## 6.7 – EVE: Extensible Virtual Engine

**EVE** is a proprietary, high performance virtual processor engine with an extensive byte-code instruction set optimised to execute compiled 4DGL programs. It is the heart of the GOLDELOX-GFX processor and other family of custom processors available from 4D. This implementation across a variety of architectures provides a single unified platform. The same application code developed under 4DGL for the GOLDELOX-GFX can run on any other 4D custom processor (with EVE implementation) such as the PICASO-GFX.

EVE has a rich set of instructions and is the product of many years of research by the team at 4D Labs, the research and development arm of 4D Systems.

**NOTE:** EVE byte-code instruction set is not available and is not necessary for a complete application development. The user application developed in 4DGL high level language is compiled to produce low level EVE byte-code that is then downloaded into the GOLDELOX-GFX.

## 6.8 – Built-in Library Functions and Low Level Drivers

The GOLDELOX-GFX has a wealth of graphics, audio, multimedia and system related functions built in. It also has the necessary drivers for the specific display panel controller ICs. This results in small sized and very efficient application code.

## 6.9 – PmmC: Personality-module-micro-Code

The combined blocks of EVE, the built-in library functions and the low level drivers, make up and define the personality of the highly integrated GOLDELOX-GFX processor. This is referred to as the **Personality-module-micro-Code** or **PmmC** for short. Future enhancements to any of the functional blocks or a specific display driver IC support can easily be accommodated with a new PmmC file which can then be uploaded into the GOLDELOX-GFX by the user. This is what makes the GOLDELOX-GFX so configurable.

**NOTE:** The PmmC file and the compiled 4DGL application code are separate entities and should not be confused. The PmmC files can only be generated and available from 4D Labs and 4D Systems whereas the 4DGL application code is generated by the user.

The PmmC files are named as "GOLDELOX-GFX-XXXX.pmmc" where the '-XXXX' suffix will vary according to the specific display driver IC. For example the GOLDELOX-GFX-1339.pmmc is the matching PmmC file for the SSD1339 display driver IC. The table below outlines the display drivers currently supported.



Supported OLED Drivers and Equivalent PmmC Files					
PmmC File <sup>(2)</sup>	Driver IC	Display <sup>(1)</sup>			
		Type	Res.	Size	Colour
GOLDELOX-GFX-1331.pmmc	SSD1331	OLED	96x64	0.96"	RGB, 65K
GOLDELOX-GFX-1332.pmmc	SSD1332		96x64	0.96"	
GOLDELOX-GFX-114A.pmmc	SEPS114A		96x96	1.1"	
GOLDELOX-GFX-1338.pmmc	SSD1338		128x128	1.5"	RGB, 262K
GOLDELOX-GFX-1339.pmmc	SSD1339		128x96	1.27"	
			128x128	1.28"	
GOLDELOX-GFX-1351.pmmc	SSD1351		128x128	1.5"	
			128x96	1.27"	
GOLDELOX-GFX-S525.pmmc	SEPS525		160x128	1.45"	
				1.69"	
GOLDELOX-GFX-S225.pmmc	SEPS225		128x128	1.28"	
				1.5"	
			256x64	3.32"	

**Note1:** A driver IC used by display manufacturers may support various panel sizes, resolutions and configurations. The above table is for exemplary purposes only.

**Note2:** The Pmmc files are available from 4D Systems. The range of supported display drivers is constantly updated and added to the list. Please check with your distributor for the latest updates.

A range of OLED displays are also available from 4D Systems. Please follow the link:  
<http://www.4dsystems.com.au/products.php?cat=7>



Supported LCD-TFT Drivers and Equivalent PmmC Files					
PmmC File <sup>(2)</sup>	Driver IC	Display <sup>(1)</sup>			
		Type	Res.	Size	Colour
GOLDELOX-GFX-7628.pmmc	ST7628	CSTN	96x64	1.0"	RGB, 65K
GOLDELOX-GFX-7637.pmmc	ST7637		128x128	1.44"	
GOLDELOX-GFX-7669.pmmc	ST7669V		128x160	1.72"	
GOLDELOX-GFX-8310.pmmc	HX8310		128x160	1.1"	
GOLDELOX-GFX-7A66.pmmc	HD667A66		128x128	1.5"	
GOLDELOX-GFX-1771.pmmc	TL1771	TFT	128x128	1.1"	
				1.5"	
			128x160	1.66"	

**Note1:** A driver IC used by display manufacturers may support various panel sizes, resolutions and configurations. The above table is for exemplary purposes only.

**Note2:** The Pmmc files are available from 4D Systems. The range of supported display drivers is constantly updated and added to the list. Please check with your distributor for the latest updates.

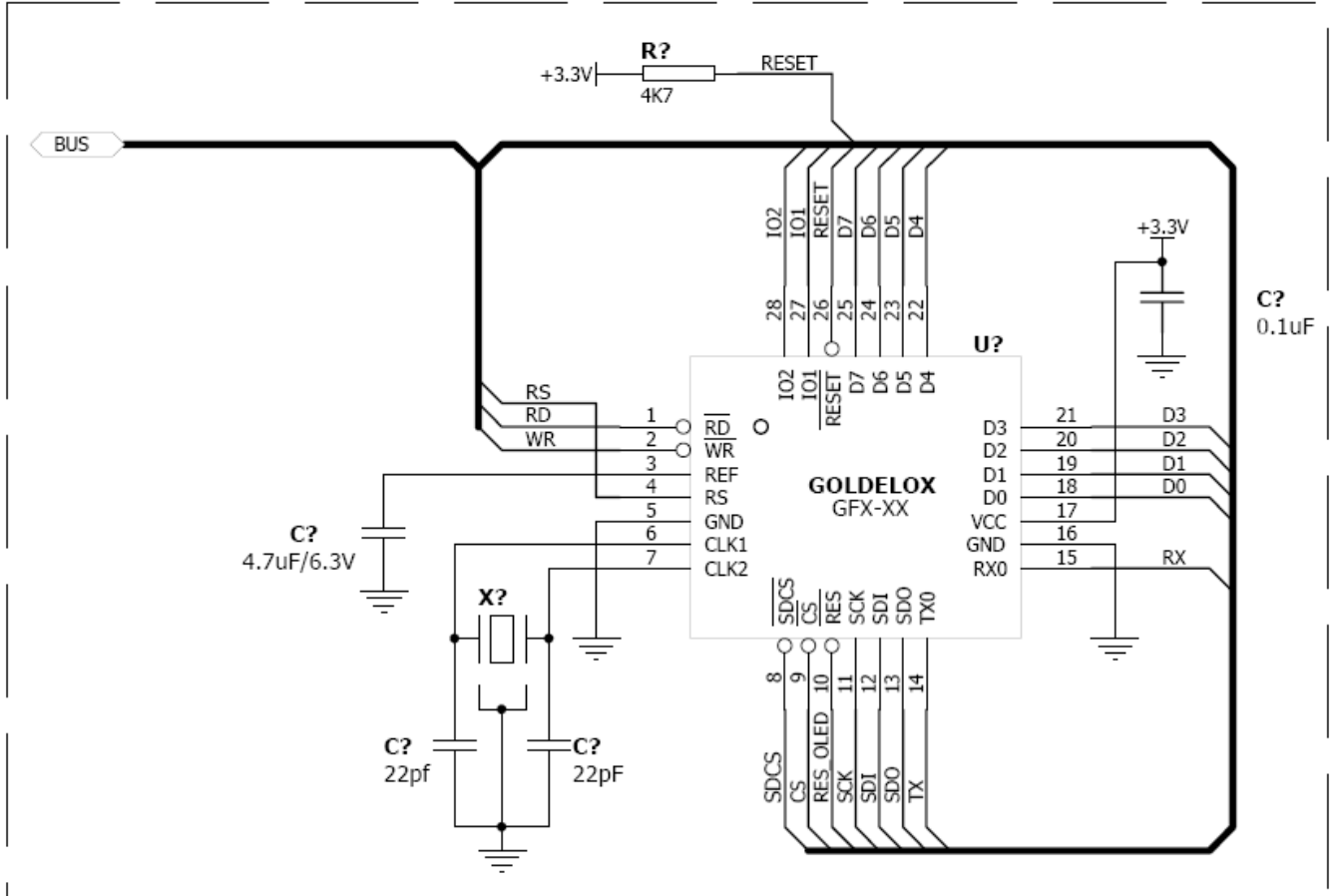
A range of LCD displays are also available from 4D Systems. Please follow the link:  
<http://www.4dsystems.com.au/products.php?cat=6>



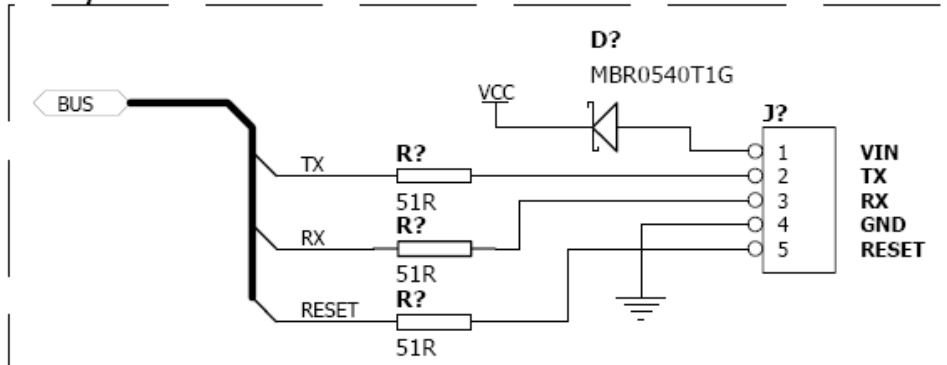
## 7. Reference Design

The circuits provided here are for guidance only. These circuits are used in the GOLDELOX-GFX based display modules available from 4D Systems.

### GOLDELOX-GFX

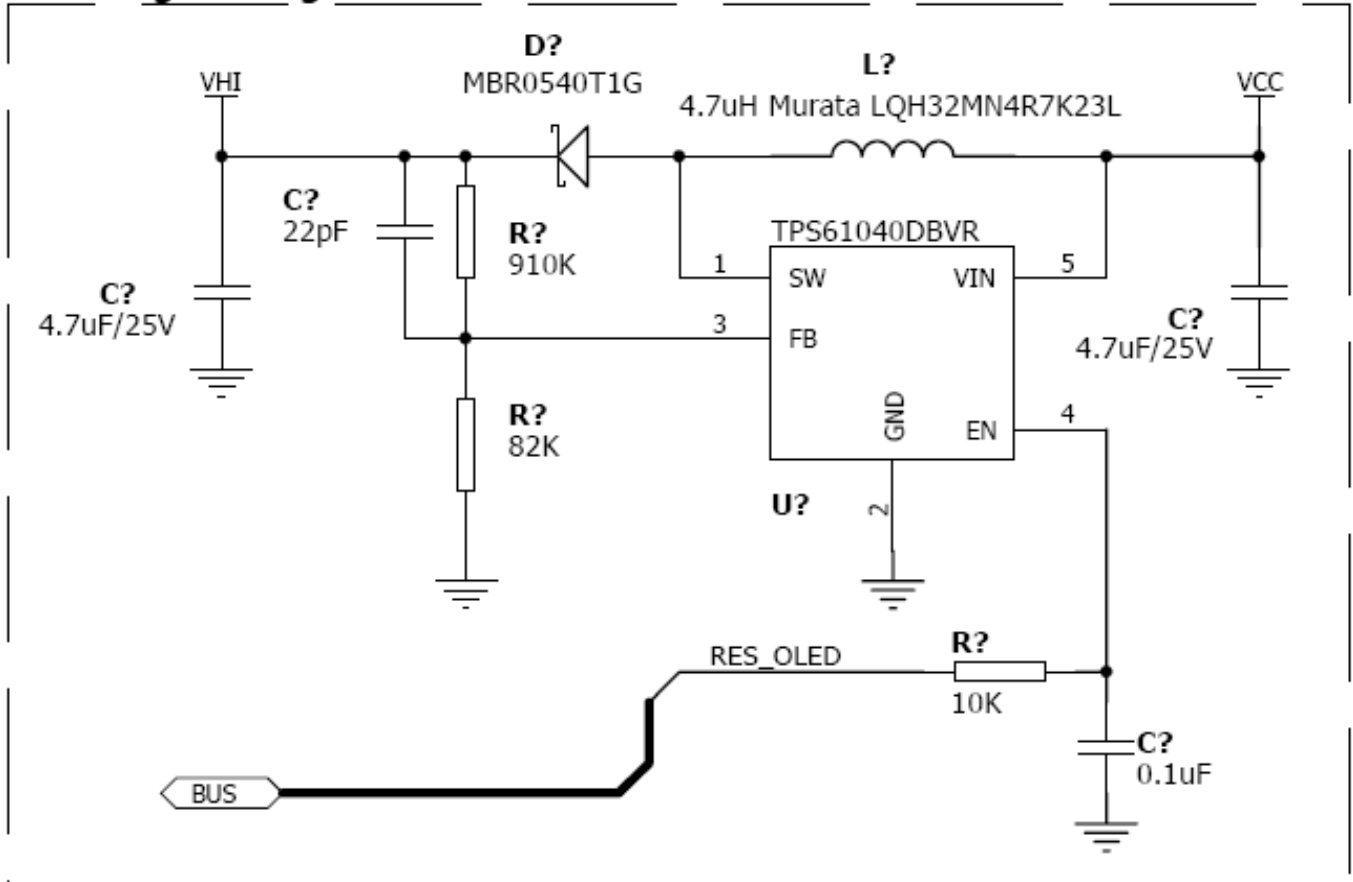


### uUSB/User Interface

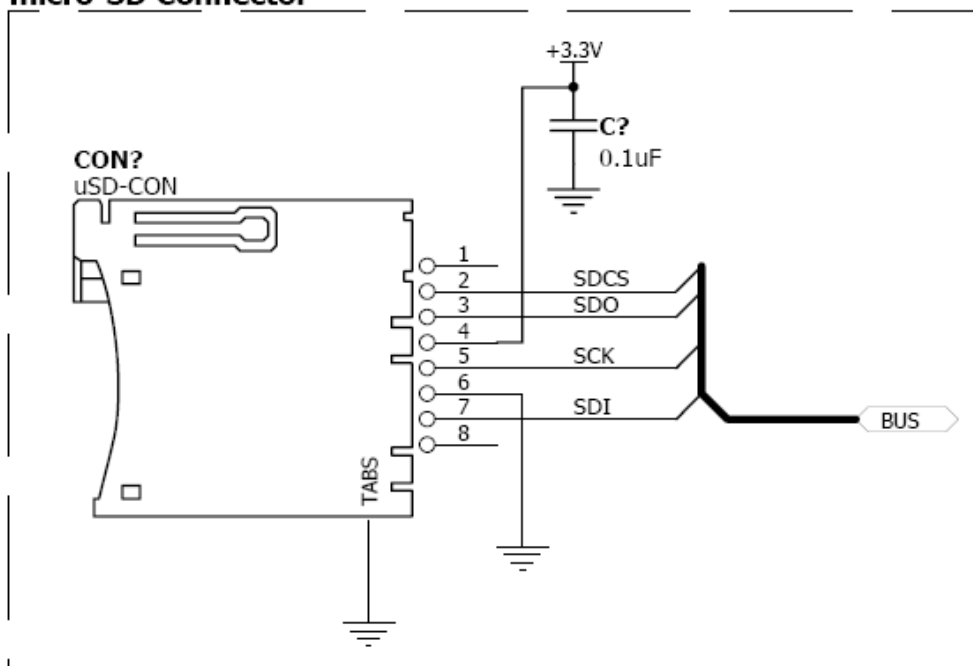




### OLED High Voltage

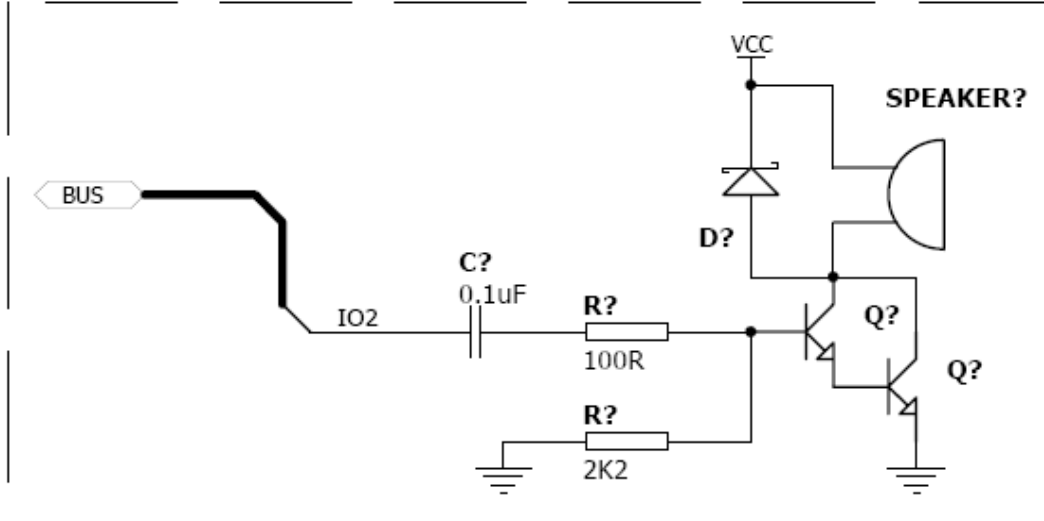


### micro-SD Connector

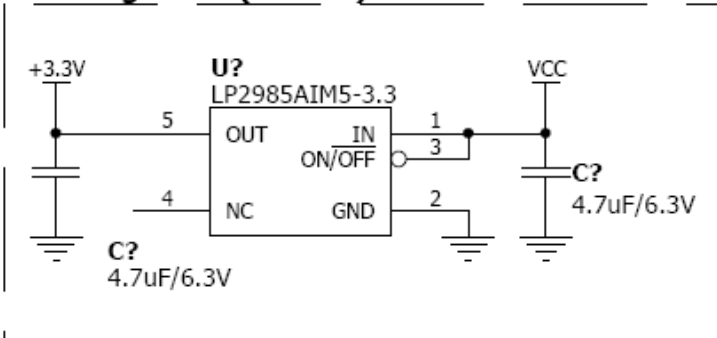




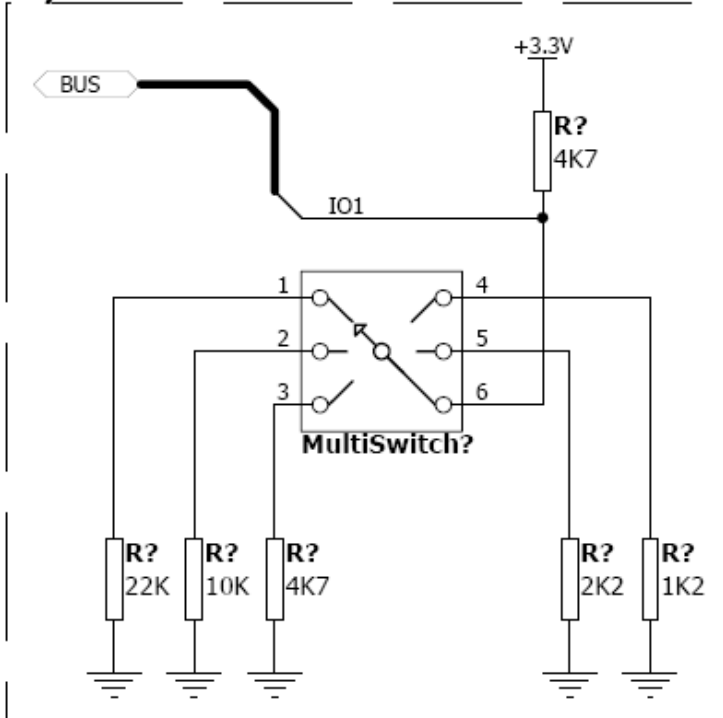
### Sound



### 3.3V Regulator (150ma)

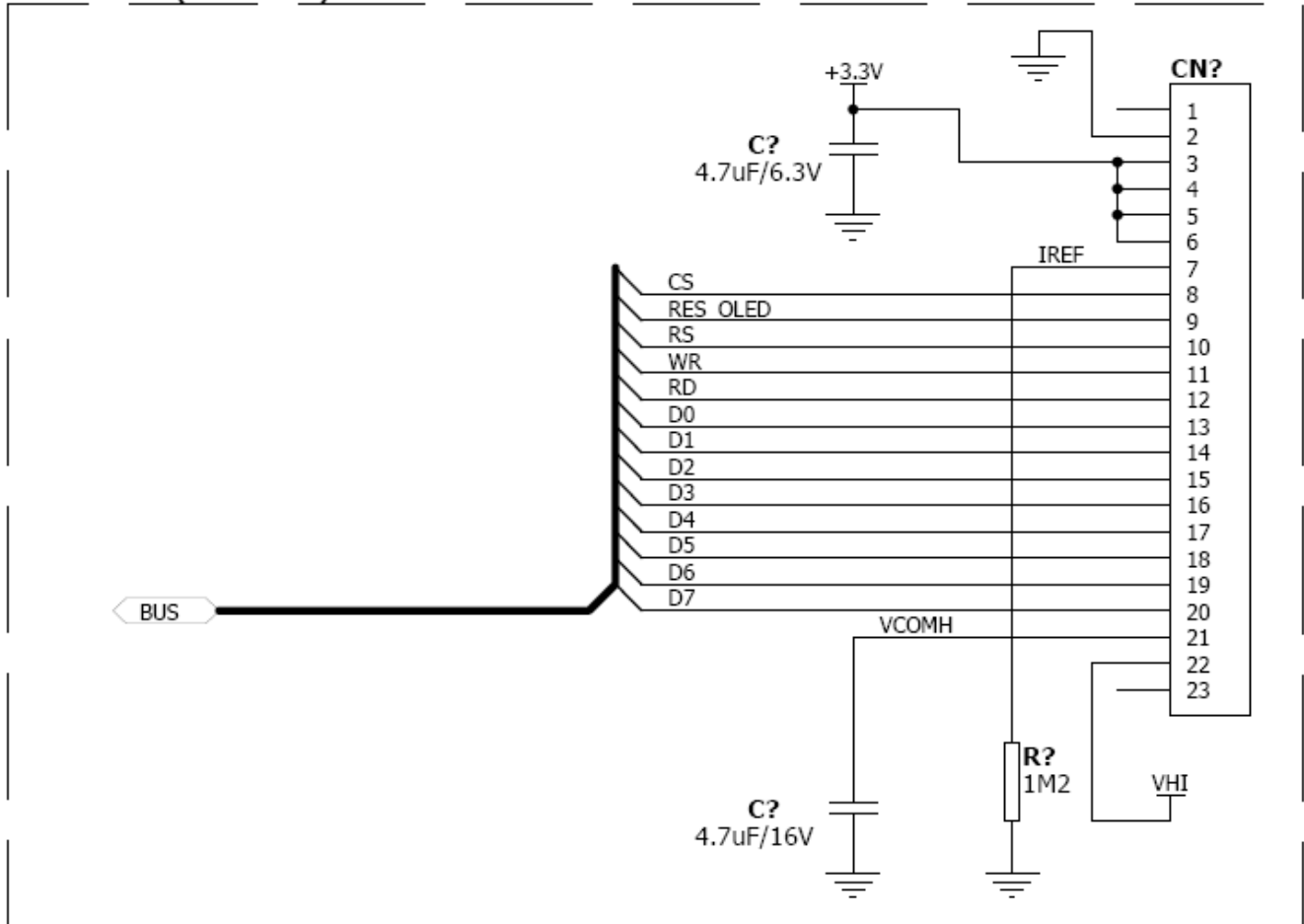


### Joystick





96x64 OLED (OPTION 1)

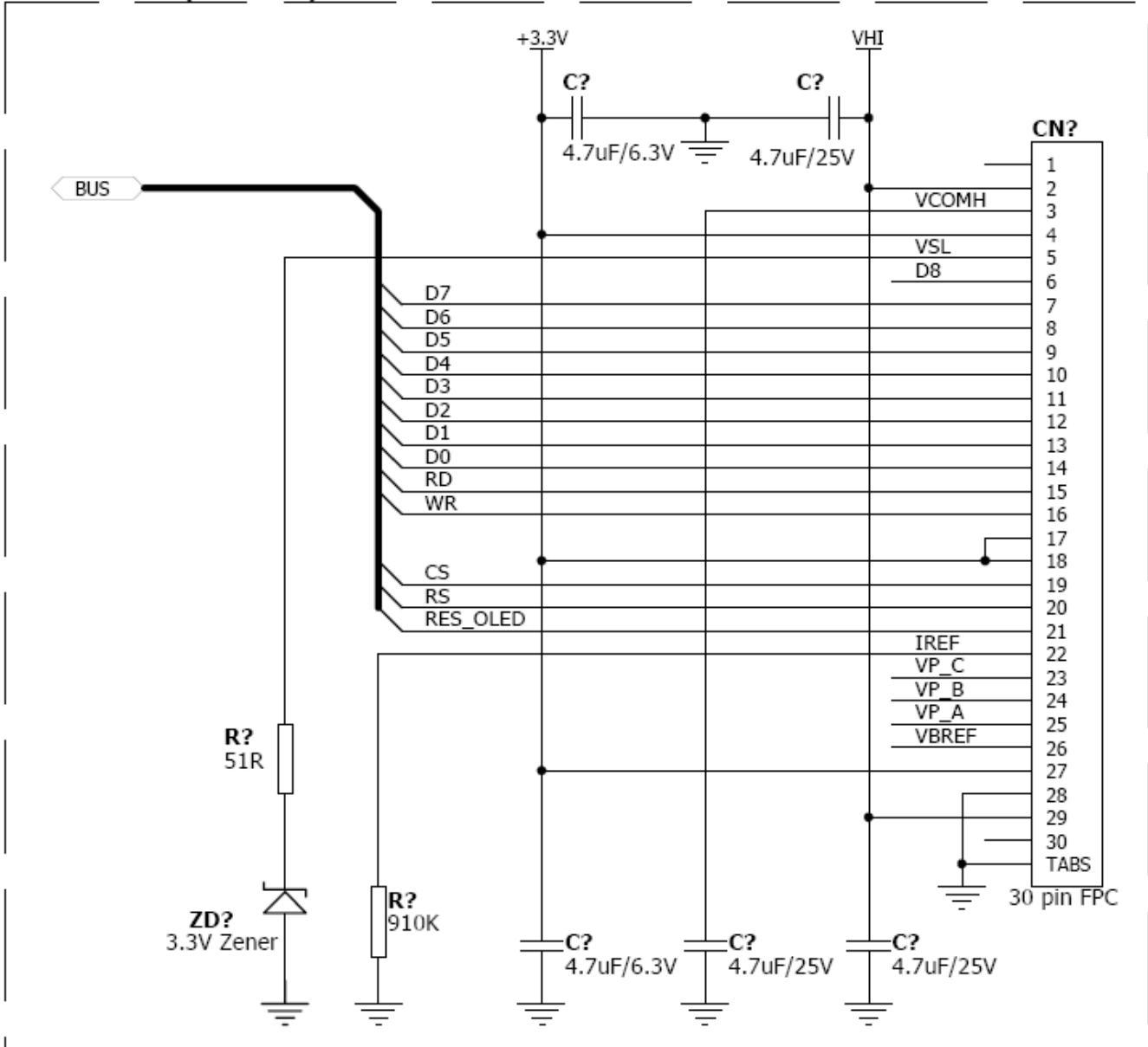


**NOTE:** The display interface above is an example only. Your display interface may vary. Please refer to the recommended circuit provided in the display data sheet or consult your display manufacturer.





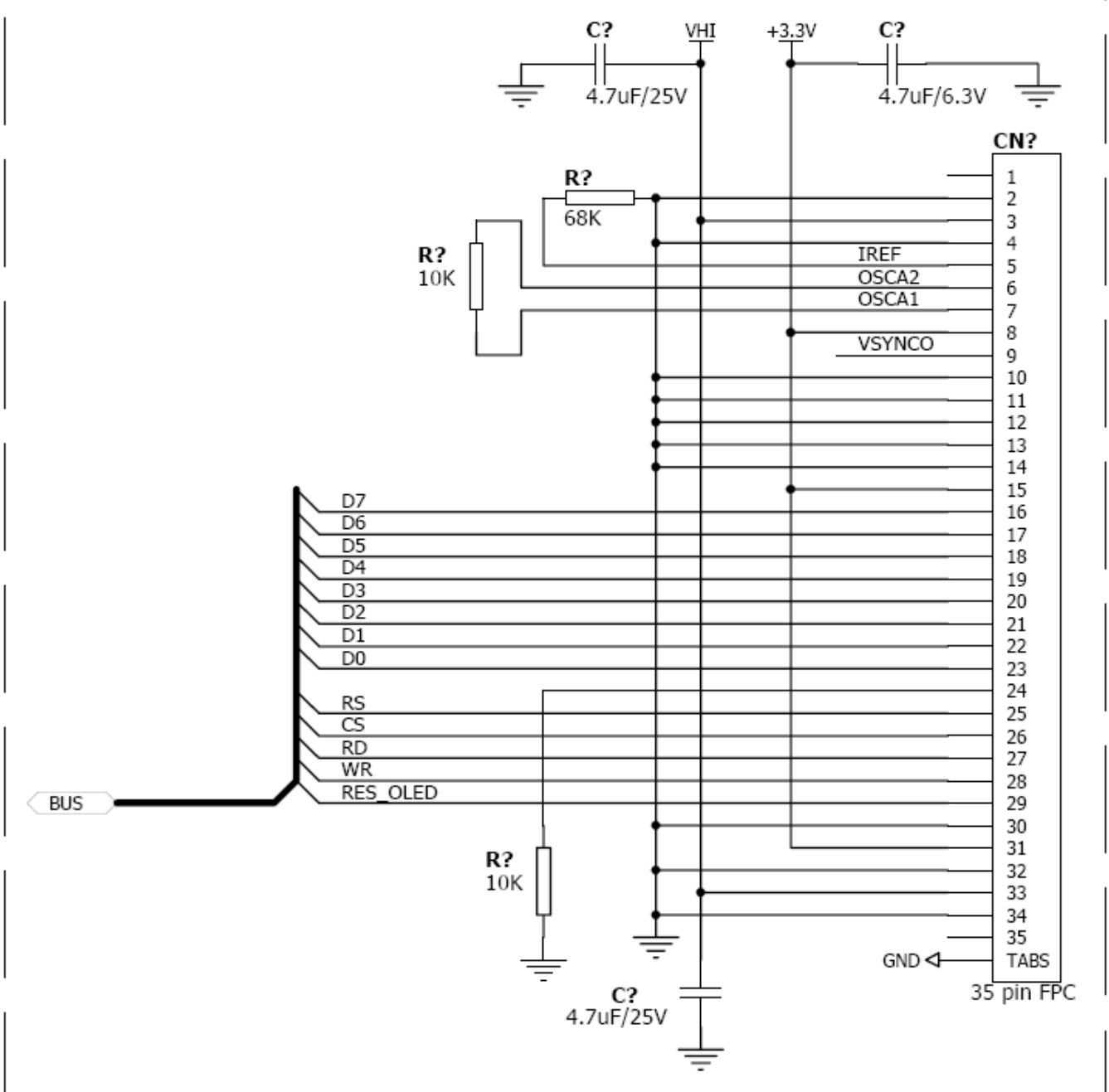
128x128 OLED (OPTION 2)



**NOTE:** The display interface above is an example only. Your display interface may vary. Please refer to the recommended circuit provided in the display data sheet or consult your display manufacturer.



160x128 OLED (OPTION 3)

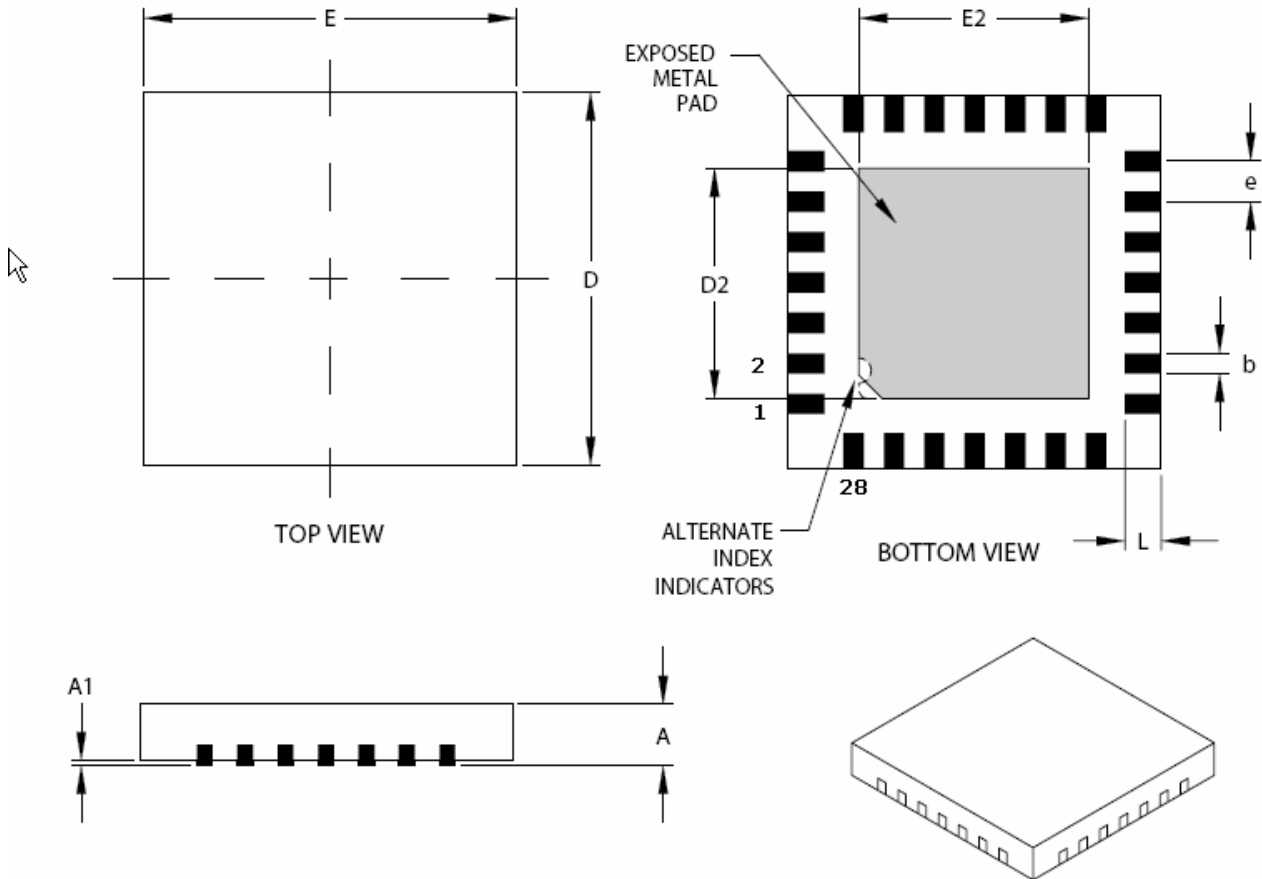


**NOTE:** The display interface above is an example only. Your display interface may vary. Please refer to the recommended circuit provided in the display data sheet or consult your display manufacturer.

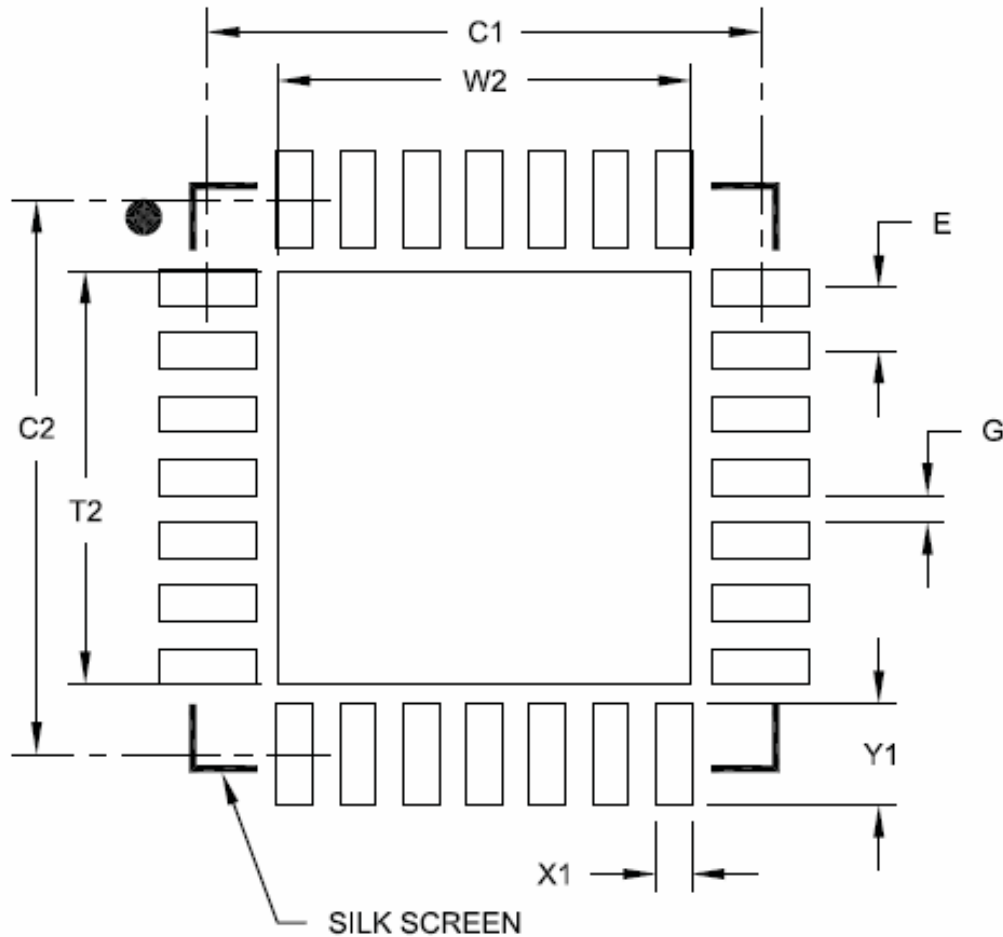


## 8. Package Details and PCB Land Pattern

### 28 Pin QFN28 JEDEC MO-220



Dimension Limits	Units	INCHES			MILLIMETERS		
		MIN	NOM	MAX	MIN	NOM	MAX
Pitch	e	.026 BSC			0.65 BSC		
Overall Height	A	.031	.035	.039	0.80	0.90	1.00
Standoff	A1	.000	.001	.002	0.00	0.02	0.05
Contact Thickness	A3	.008 REF			0.20 REF		
Overall Width	E	.232	.236	.240	5.90	6.00	6.10
Exposed Pad Width	E2	.140	.146	.152	3.55	3.70	3.85
Overall Length	D	.232	.236	.240	5.90	6.00	6.10
Exposed Pad Length	D2	.140	.146	.152	3.55	3.70	3.85
Contact Width	b	.009	.011	.013	0.23	0.28	0.33
Contact Length	L	.018	.022	.024	0.45	0.55	0.65



RECOMMENDED LAND PATTERN

Dimension	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.65 BSC		
Optional Center Pad Width	W2			4.25
Optional Center Pad Length	T2			4.25
Contact Pad Spacing	C1		5.70	
Contact Pad Spacing	C2		5.70	
Contact Pad Width (X28)	X1			0.37
Contact Pad Length (X28)	Y1			1.00
Distance Between Pads	G	0.20		



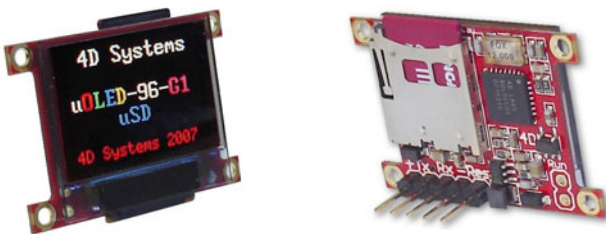
## 9. Development and Support Tools

### 9.1 – Evaluation and Hardware Modules

The following modules can be used for evaluation purposes to discover what the GOLDELOX-GFX processor has to offer. They can also be used for 4DGL application code development.

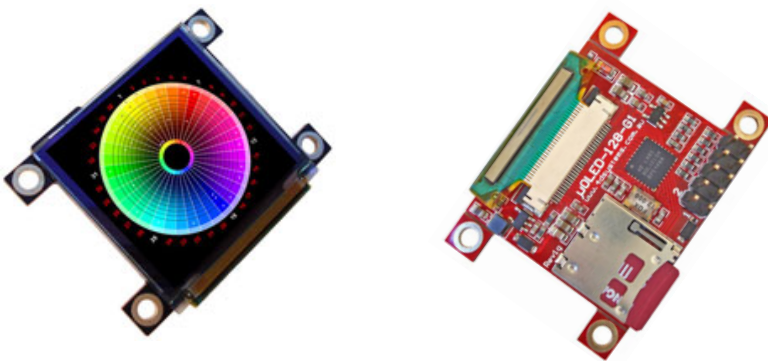
#### **μOLED-96-G1**

Product details are available here: [www.4dsystems.com.au/prod.php?id=9](http://www.4dsystems.com.au/prod.php?id=9)



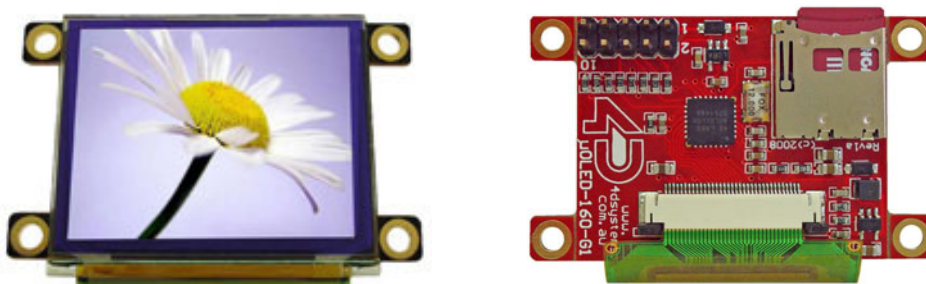
#### **μOLED-128-G1**

Product details are available here: [www.4dsystems.com.au/prod.php?id=28](http://www.4dsystems.com.au/prod.php?id=28)



#### **μOLED-160-G1**

Product details are available here: [www.4dsystems.com.au/prod.php?id=29](http://www.4dsystems.com.au/prod.php?id=29)





**DEVBOARD-G1**

Product details are available here: [www.4dsystems.com.au/prod.php?id=30](http://www.4dsystems.com.au/prod.php?id=30)



**μUSB-MB5**

Product details are available here: [www.4dsystems.com.au/prod.php?id=18](http://www.4dsystems.com.au/prod.php?id=18)



**μUSB-CE5**

Product details are available here: [www.4dsystems.com.au/prod.php?id=19](http://www.4dsystems.com.au/prod.php?id=19)





## 9.2 – 4DGL-Workshop: Integrated Development Environment

The 4DGL-Workshop IDE provides an integrated software development environment for all of the 4D family of processors and modules. The IDE combines the Editor, Compiler and Downloader to develop complete 4DGL code applications. All user application code is developed within the Workshop IDE. A sample application code is listed below.

```
4DGL Workshop 2.0.0.0 - [PROJECT NAME = Goldelox - uOLED96] [File = G96_Rectangles.4dg]
File Edit Colors Window Help Tools
Files Editor Errors Map Compile COM 3 Download Debug View Platform uOLED
1 #platform "GOLDELOX-GFX"
2
3
4 // random rectangles demo
5
6 #constant WHITE 65535
7 #constant BLACK 0
8
9 func main()
10
11     gfx_Cls();
12
13     gfx_Set(PEN_SIZE, OUTLINE);      // rectangles as outlines
14
15     while(1)
16         gfx_Set( OUTLINE_COLOUR, RAND() );
17         gfx_Set( OUTLINE_COLOUR, 1 );
18         gfx_Rectangle(ABS(RAND()%95), ABS(RAND()%63), ABS(RAND()%95), ABS(RAND()%63), RAND());
19         gfx_Circle(35, 35, 15, BLACK);
20         pause(20);
21     wend
22
23 endfunc
24
25
26
27
```

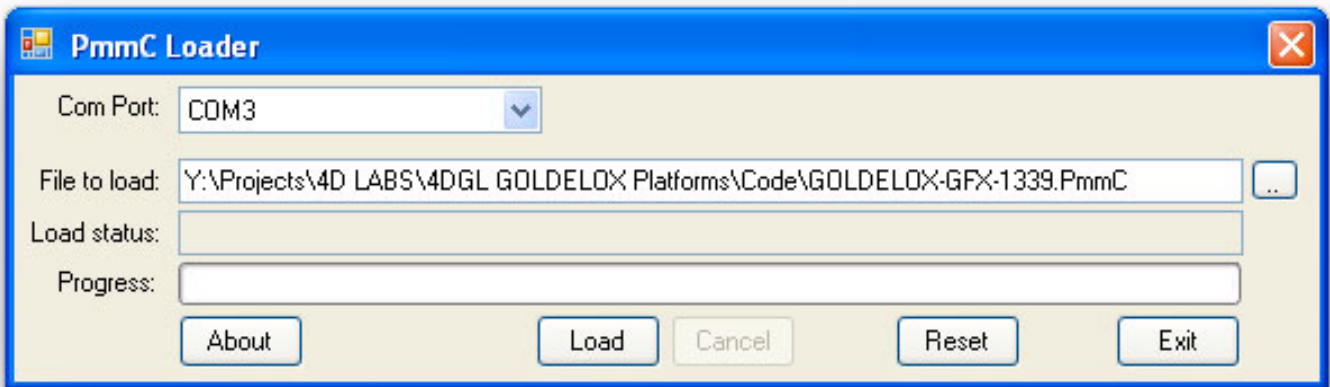
The 4DGL-Workshop IDE is provided free and the latest version can be downloaded from: [www.4dsystems.com.au/developers/](http://www.4dsystems.com.au/developers/)



### 9.3 – PmmC Loader: Free PC Software Tool

The 'PmmC Loader' is a free software tool for Windows. Use this tool to download the latest PmmC file, into the GOLDELOX-GFX, that supports your display driver IC. The latest version can be downloaded from:

[www.4dsystems.com.au/downloads/PmmC-Loader/](http://www.4dsystems.com.au/downloads/PmmC-Loader/)



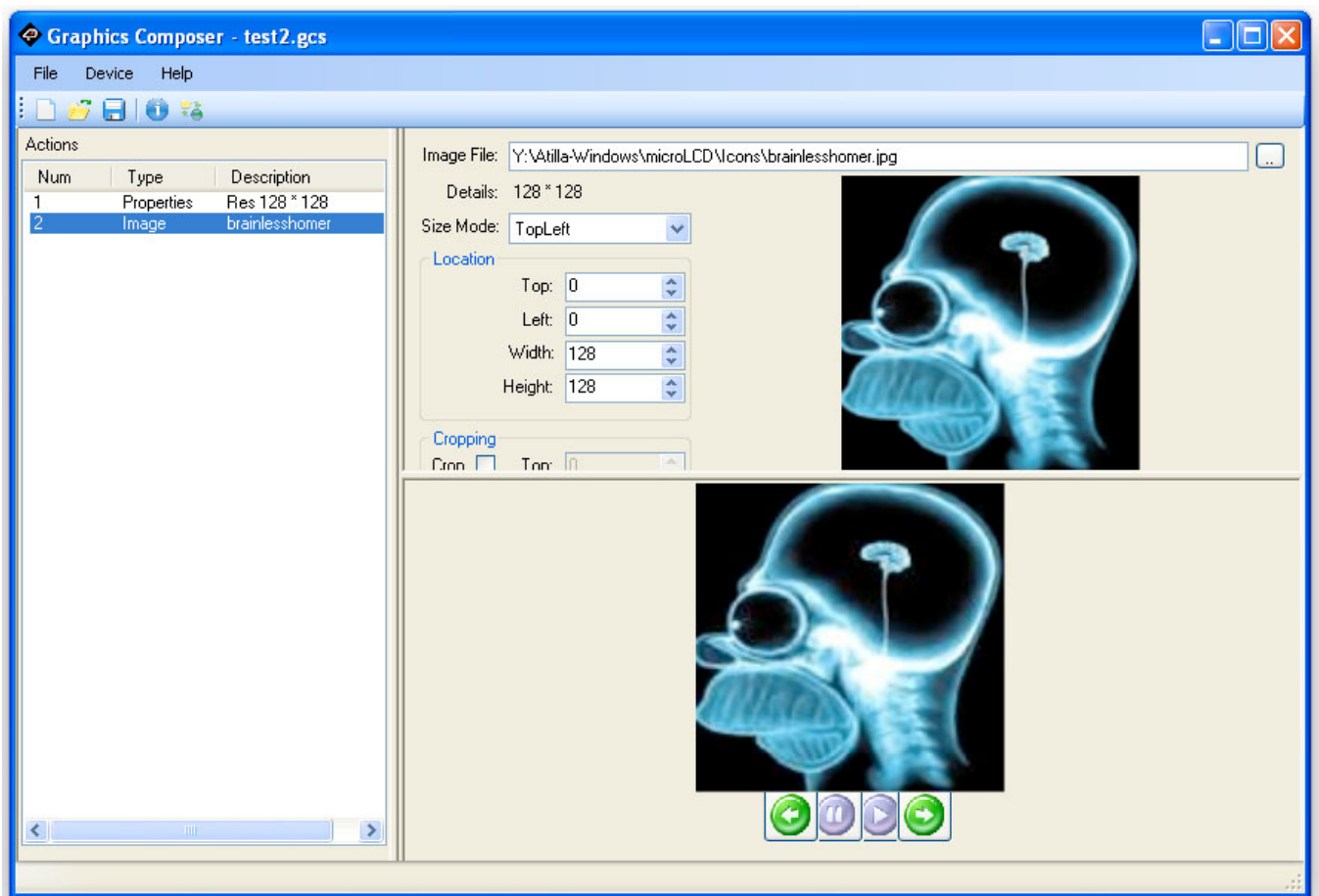




## 9.4 – Graphics Composer: Free PC Software Tool

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 SD/uSD/MMC memory card. The multimedia objects can then be used within the 4DGL application code. The latest version can be found here:

[www.4dsystems.com.au/downloads/Graphics\\_Composer/](http://www.4dsystems.com.au/downloads/Graphics_Composer/)





## 10. Specifications and Ratings

Absolute Maximum Ratings	
Operating ambient temperature .....	-40°C to +100°C
Storage temperature .....	-65°C +150°C
Voltage on any digital input pin with respect to GND .....	-0.3V to 6.0V
Voltage on analog pin with respect to GND .....	-0.3V to 6.0V
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 IO1 or IO2 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	VGND	--	0.8	V
Input High Voltage (VIH)	Vcc = 3.3V	2.0	--	Vcc	V

Global Characteristics based on Operating Conditions					
Parameter	Conditions	Min	Typ	Max	Units
Supply Current (Icc)	Vcc = 3.3V	--	15	26	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
Analog Converter Resolution	IO1 pin	8	--	10	bits
Capacitive Loading	CLK1, CLK2 pins	--	--	15	pF
Capacitive Loading	All other pins	--	--	50	pF
Flash Memory Endurance		--	1000	--	E/W



**Ordering Information**

**Order Code:** GOLDELOX-GFX

**Package:** QFN28, 6mm x 6mm

**Storage:** Tubes of 71 pieces



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