



4D LABS

GOLDELOX-SGC
Intelligent Serial Graphics Controller

Data Sheet

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GOLDELOX-SGC Serial Graphics Controller

Data Sheet

Description



The **GOLDELOX-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 GOLDELOX-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 GOLDELOX-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 8 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).
- Multiple switch/button feature on a single pin.
- Dedicated sound pin with complex sound generation.
- Hardware and software interface for SDHC, SD, micro-SD or MMC memory cards for multimedia storage and data logging purposes.
- Asynchronous hardware serial port with Auto-Baud feature.
- 3.0V to 3.6V range operation.
- Tiny 6mm x 6mm 28pin QFN package.
- RoHS Compliant.

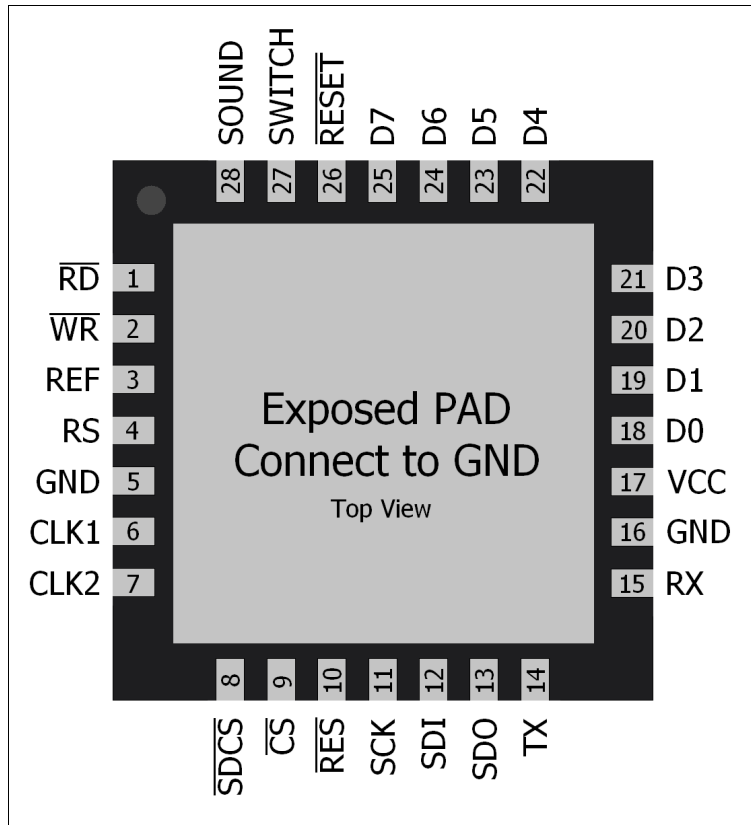
Applications

- Elevator control systems.
- Point of sale terminals.
- Electronic gauges and metres.
- Industrial control, Automotive..
- Medical applications, home appliances, security and gaming equipment.
- Test, measurement and general purpose instrumentation.

Table of Contents

1. Pin Configuration and Summary	4
2. Pin Description	6
2.1 Display Interface.....	6
2.2 SPI Interface – Memory Card	6
2.3 Serial Port - UART	7
2.4 Sound Interface.....	7
2.5 Button-Switch Interface.....	7
2.6 System Pins.....	8
3. Host Interface	9
3.1 Physical Interface - UART.....	9
3.2 Software Interface – Command Set.....	9
3.3 Auto-Baud Setup.....	10
4. Power-Up and Reset	10
4.1 Splash Screen on Power-Up.....	11
4.2 4DSL Memory Card Script Program	11
4.3 Auto-Run Card Script Program	11
5. In Circuit Serial Programming-ICSP	11
6. Supported Displays and Drivers	12
7. Development and Support Tools	13
7.1 PmmC Loader – Software Programming Tool	13
7.2 microUSB – PmmC Programming Hardware Tool.....	13
7.3 Evaluation Display Modules.....	13
7.4 Display Initialisation Setup Personality (DISP) – Software Programming Tool.....	14
7.5 FONT Tool – Software Tool.....	14
7.6 Graphics Composer – Software Tool.....	14
7.7 FAT Controller – Software Test Tool.....	14
8. Reference Design	15
9. Package Details and PCB Land Pattern	17
10. Specifications and Ratings	19
Proprietary Information	20
Disclaimer of Warranties & Limitation of Liability	20

1. Pin Configuration and Summary



Pin	Symbol	I/O	Description
1	RD	O	Display Read strobe signal. GOLDELOX-SGC asserts this signal LOW when reading data from the display. Connect this pin to the Read (RD) signal of the display.
2	WR	O	Display Write strobe signal. GOLDELOX-SGC asserts this signal LOW when writing data to the display. Connect this pin to the Write (WR) signal of 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 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.
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. Connect this pin to the Chip Enable (CS) signal of the memory card.

Pin	Symbol	I/O	Description
9	CS	O	Display Chip Select. GOLDELOX-SGC asserts this signal LOW when accessing the display. Connect this pin to the Chip Select (CS) signal of the display.
10	RES	O	Display RESET. GOLDELOX-SGC initialises the display by strobing this pin LOW. Connect this pin to the Reset (RES) signal of the display.
11	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.
12	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.
13	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.
14	TX	O	Asynchronous Serial port Transmit pin, TX. Connect this pin to host micro-controller Serial Receive (Rx) signal. The host receives data from GOLDELOX-SGC via this pin.
15	RX	I	Asynchronous Serial port Receive pin, RX. Connect this pin to host micro-controller Serial Transmit (Tx) signal. The host transmits data to GOLDELOX-SGC via this pin.
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. Connect a 4.7K resistor from this pin to VCC.
27	SWITCH	I	Multi Button or Joystick switch input pin. Option is available to connect from 1 up to 5 push buttons. This pin also has another feature. If connected to GND on power-up, it will auto-run a script program from the memory card.
28	SOUND	O	Sound generation output pin. Connect this pin to a simple speaker circuit described in section 2.4. Leave open if unused.
PAD	GND	P	Exposed metal pad under the package, must connect to GND.

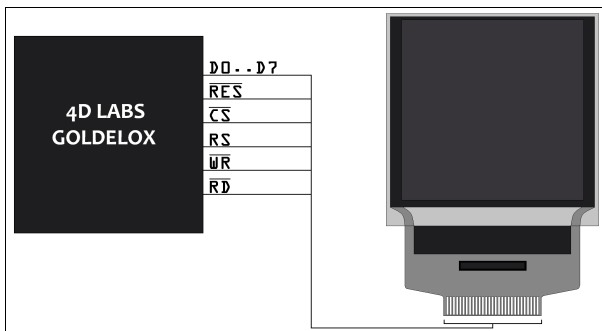
I: Input, O: Output, A: Analogue, P: Power

2. Pin Description

The GOLDELOX-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 GOLDELOX-SGC supports LCD and OLED displays with an 80-Series 8 bit wide CPU data interface. The connectivity to the display is easy and straight forward. The controller generates all of the necessary timing to drive the display.



D0-D7 pins (Display Data Bus):

The Display Data Bus (D0-D7) is an 8 bit bidirectional port and all 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 GOLDELOX-SGC asserts this signal LOW when writing data to the display in conjunction with the display data bus (D0-D7). Connect this pin to the Write (WR) signal of the display.

RD pin (Display Read):

This is the display read strobe signal. The GOLDELOX-SGC asserts this signal LOW when reading data from the display in conjunction with the display data bus (D0-D7). 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. GOLDELOX-SGC initialises the display by strobing this pin LOW. Connect this pin to the Reset (RES) signal of the display. This signal can also be used to control the backlight of the LCD or as the DC/DC converter enable. Refer to the reference design section in this document for an example.

2.2 SPI Interface – Memory Card

The GOLDELOX-SGC supports SDHC, 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 uSD with up to 2GB capacity and for high capacity HC memory cards starting from 4GB and above.

SDI pin (SPI Serial Data In):

The SPI Serial Data Input (SDI). SDHC/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 (SDO). SDHC/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). SDHC/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). SDHC/SD memory card use only. Connect this pin to the Chip Enable (CS) signal of the memory card.

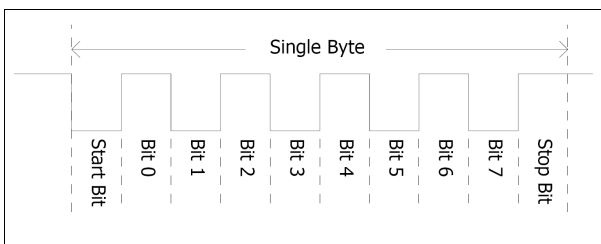
2.3 Serial Port - UART

The GOLDELOX-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 GOLDELOX-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.
- Auto Baud feature.
- Baud rates from 300 baud up to 256K 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 GOLDELOX-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.

TX pin (Serial Transmit):

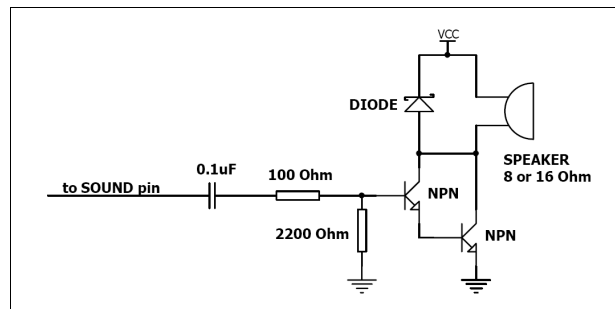
Asynchronous Serial port Transmit pin, TX. Connect this pin to host micro-controller Serial Receive (Rx) signal. The host receives data from GOLDELOX-SGC via this pin.

RX 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 GOLDELOX-SGC via this pin.

2.4 Sound Interface

The GOLDELOX-SGC is capable of generating complex sounds and audio from its SOUND pin. A simple speaker circuit as shown below can be utilised. For a complete list of sound commands please refer to the separate document titled '[GOLDELOX-SGC-COMMANDS-SIS.pdf](#)'.



SOUND pin (Sound-Audio Output):

Sound and audio waveforms are generated from this pin. Connect this pin to a simple speaker circuit detailed above. If unused then this pin must be left open or floating.

2.5 Button-Switch Interface

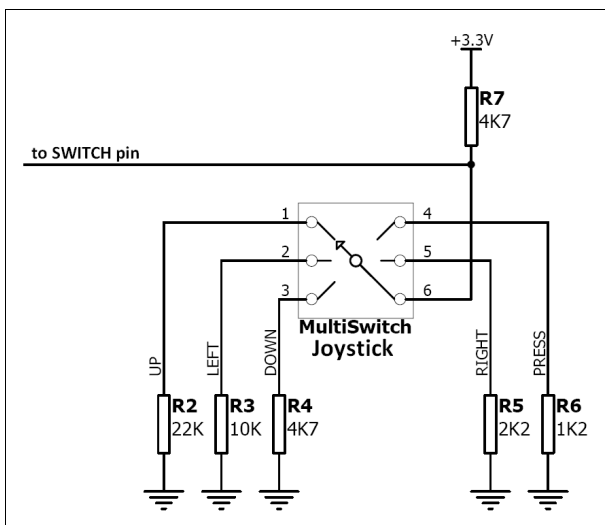
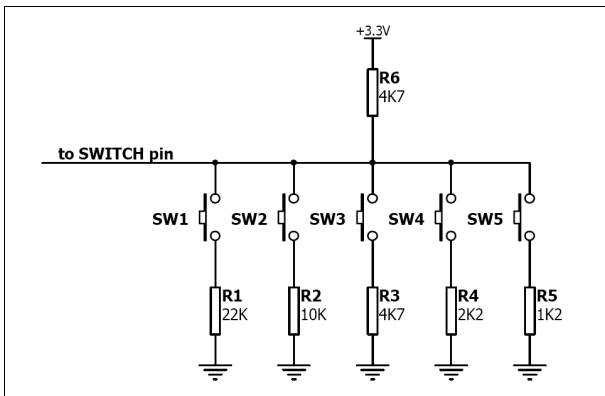
Multiple Buttons can be connected to a single pin on the GOLDELOX-SGC. Up to 5 buttons or a 5 position multi switch connects to a junction of a resistor ladder network that forms a voltage divider. The BUTTON pin internally reads the analogue value and decodes it accordingly.

SWITCH pin (Multiple Button Input):

Connect up to 5 push buttons or a 5 position

multi-switch as shown in the diagrams below. Each consecutive button must be connected to ground via its matching resistor.

Unused buttons do not need resistors to be connected to the circuit. Table below lists the buttons and corresponding resistor values. If no buttons or switches are used then connect this pin to GND.



Number of Buttons	Button Number	Resistor Value
1	SW1	22K
2	SW2	10K
3	SW3	4.7K
4	SW4	2.2K
5	SW5	1.2K

2.6 System Pins

VCC pin (Device Supply Voltage):

Device supply voltage pin. This pin 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, PAD pins (Device Ground):

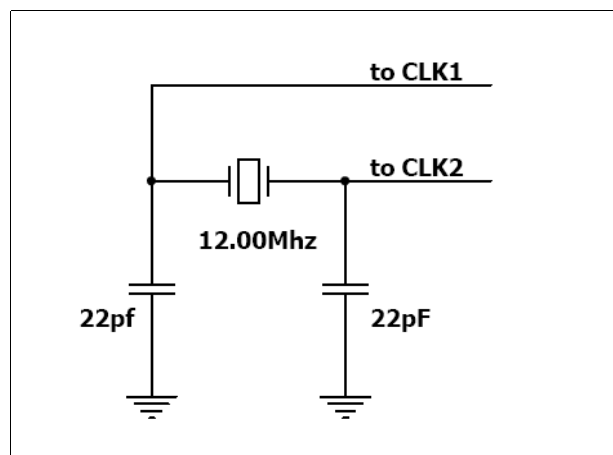
Device ground pins. These pins must be connected to ground.

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.



3. Host Interface

The GOLDELOX-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: 8 Bits, No Parity, 1 Stop Bit.

3.2 Software Interface – Command Set

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

General Commands:

- AutoBaud
- Version-Device Info Request
- Replace Background Colour
- Clear Screen
- Display Control Functions
- Sleep
- Switch-Buttons-Joystick Status
- Wait for Switch-Buttons-Joystick Status
- Sound
- Tune

Graphics Commands:

- Add User Bitmap Character
- Draw User Bitmap Character
- Draw Circle
- Draw Triangle
- Draw Image-Icon
- Set Background Color
- Draw Line
- Draw Pixel
- Read Pixel
- Screen Copy-Paste
- Draw Polygon
- Replace Colour
- Set Pen Size
- Draw Rectangle

Text Commands:

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

SDHC/SD Memory Card Commands

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

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:

“GOLDELOX-SGC-COMMANDS-SIS.pdf”

Each command is made up of a sequence of data bytes. When a command is sent to the module and the operation is completed, the module will always return a response. For a command that has no specific response the module 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 module 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.

3.3 Auto-Baud Setup

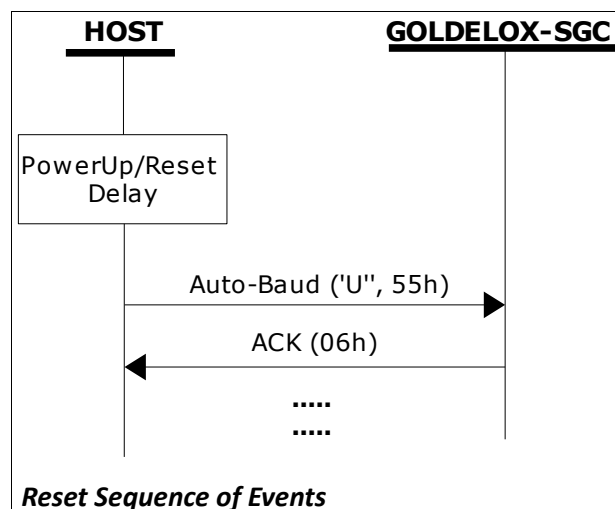
The GOLDELOX-SGC has an auto-baud feature which can automatically detect the host speed and can set its internal baud rate to operate from 300 to 256K baud. Prior to any commands being sent to the device, the host must first initialise it by sending the auto-baud character 'U' (55hex) after any power-up or reset. This will allow the device to determine and lock on to the baud rate of the host automatically without needing any further set-up. Once the GOLDELOX-SGC has locked onto the host baud rate it will respond with an **ACK** byte (06hex).

Auto-Bauding must be performed each time the GOLDELOX-SGC is powered up or reset.

4. Power-Up and Reset

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

- Allow up to 500ms delay after power-up or reset for the module to settle without a uSD card inserted. If a uSD card is inserted the initialisation time of the particular card will need to be added, better quality cards tend to initialise in about 75ms or quicker, lower quality ones can take up to a second. Do not attempt to communicate with the module during this period. The module may send garbage on its TX Data line during this period, the host should disable its Rx Data reception.
- Within 100ms of powering up, the host should make sure it has its Tx line pulled HIGH. If the host Tx (device RX) is LOW or floating after the 100ms period, the device may misinterpret this as the START bit of the auto-baud character and lock onto some undesired baud rate. If the host has a slow wake up time, i.e. less than 100ms, its Tx line maybe floating. This can be easily resolved by adding a pull up resistor on the host Tx line which will ensure the device does not encounter a false start bit. The pull up resistor can be any value within 10K to 100K.
- The host transmits the auto-baud character (capital **U**, 55hex) as the first command so the device can lock onto the host's baud rate.



Once the host receives the ACK the GOLDELOX-SGC is now ready to accept commands from the host.

4.1 Splash Screen on Power-Up

The GOLDELOX-SGC will wait up to 5 seconds for the host to transmit the Auto-Baud command ('U', 55hex). During this period the attached display will remain blank. If the host has not transmitted the Auto-Baud command by the end of this period the GOLDELOX-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 GOLDELOX-SGC 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:

"GOLDELOX-SGC-COMMANDS-SIS.pdf"

4.3 Auto-Run Card Script Program

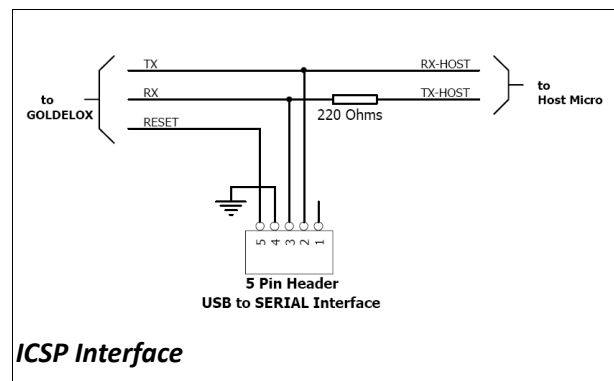
The GOLDELOX-SGC has a feature that will auto run a preloaded script program, on the uSD/uSDHC memory card, on power-up. If the SWITCH input (pin 27) is connected to GND (on power-up) and if there is a script program present in the memory card then the device will auto run the script program. This is a useful feature for those stand alone applications where the device does not require a host controller to play a slide show of images, video clips, etc.

5. In Circuit Serial Programming- ICSP

The GOLDELOX-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 7: Development and Support Tools'**.

6. Supported Displays and Drivers

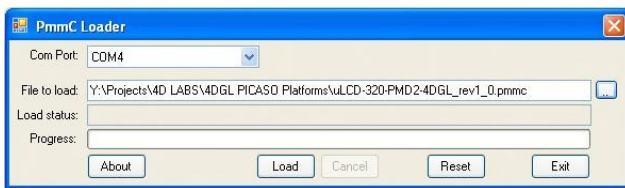
The GOLDELOX-SGC supports most colour displays (CSTN, TFT, OLED) up to 256x256 resolution with an 80-Series 8 bit wide CPU interface. The chip must be initially programmed with all the display characteristics using the DISP software and programming tool. The required characteristics parameters are obtained from the display driver IC data sheet which is available from the display manufacturer.



7. Development and Support Tools

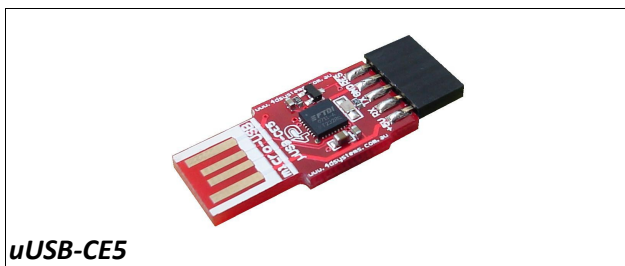
7.1 PmmC Loader – Software Programming Tool

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



7.2 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 GOLDELOX-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. The micro-USB module is an essential hardware tool for all the relevant software support tools to program, customise and test the GOLDELOX-SGC chip.



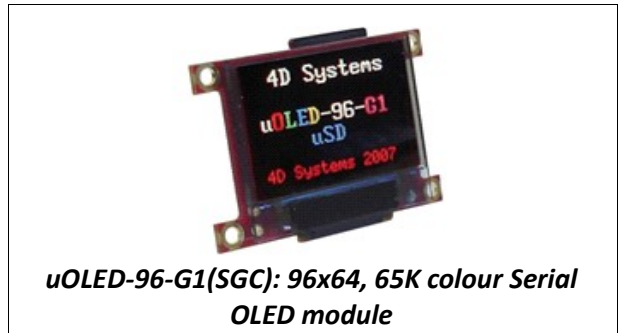
uUSB-CE5



uUSB-MB5

7.3 Evaluation Display Modules

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



uOLED-96-G1(SGC): 96x64, 65K colour Serial OLED module



uOLED-128-G1(SGC): 128x128, 65K colour Serial OLED module



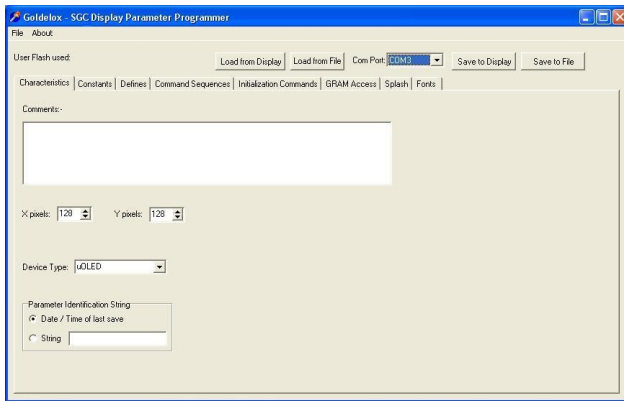
uOLED-160-G1(SGC): 160x128, 65K colour Serial OLED module

7.4 Display Initialisation Setup Personality (DISP) – Software Programming Tool

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

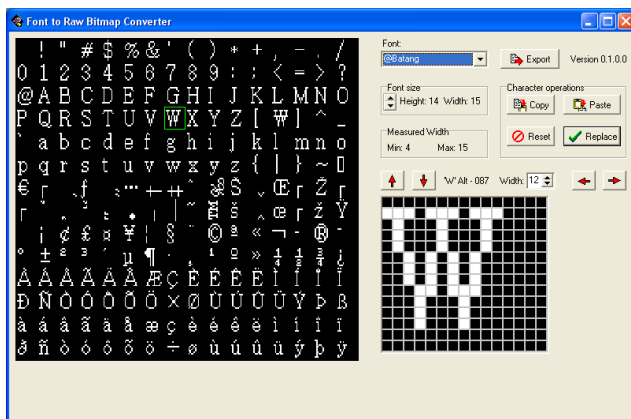
- Configure the GOLDELOX-SGC chip to work with a specific display.
- Modify the way the chip initially sets up the display, e.g. screen saver, brightness, etc.
- Construct the splash screens.
- Replace or modify the embedded fonts.

It is available for download from the 4D Systems website, www.4dsystems.com.au.



7.5 FONT Tool – Software Tool

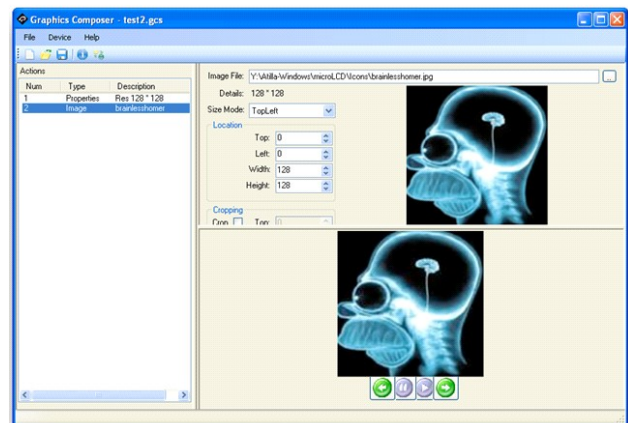
Font-Tool is a free software utility for Windows based PC platforms. This tool can be used to assist in the conversion of standard Windows fonts (including True Type) into the bitmap fonts used by the GOLDELOX-SGC chip.



7.6 Graphics Composer – Software Tool

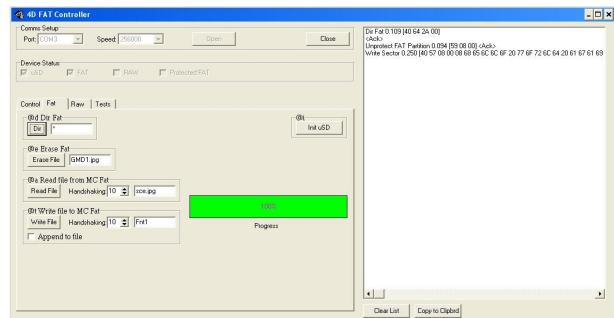
The Graphics Composer is a free software tool for Windows. This software tool is an aid to composing a slide show of images/animations/movie-clips (multi-media objects) which can then be downloaded into the SDHC/SD/uSD/MMC memory card that is supported by the GOLDELOX-SGC. The host simply sends commands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

It is available for download from the 4D Systems website, www.4dsystems.com.au

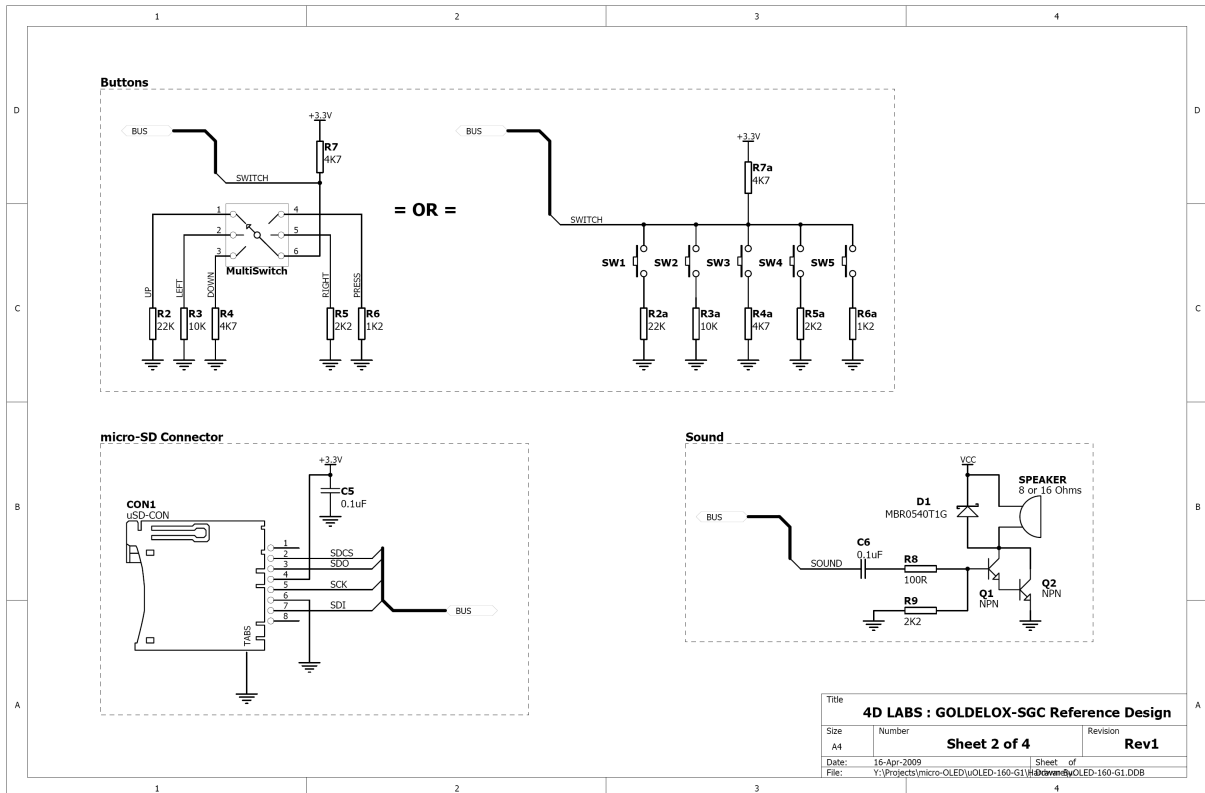
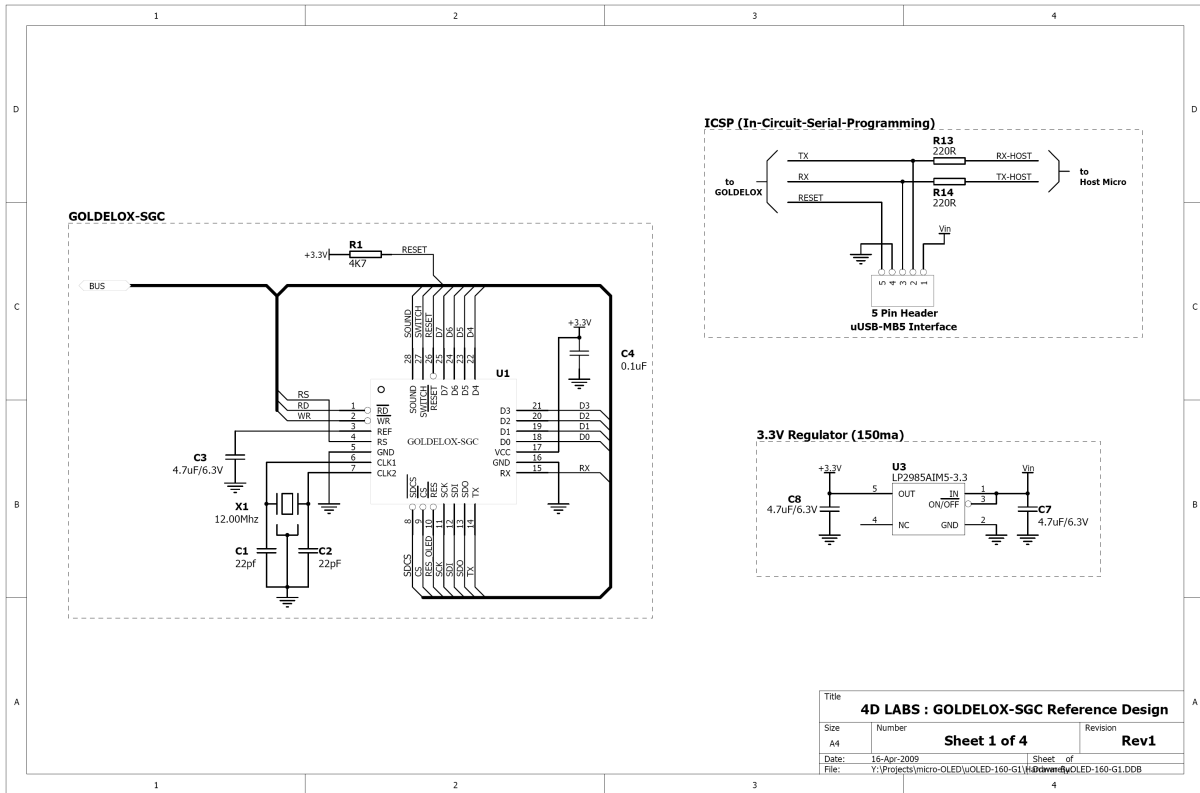


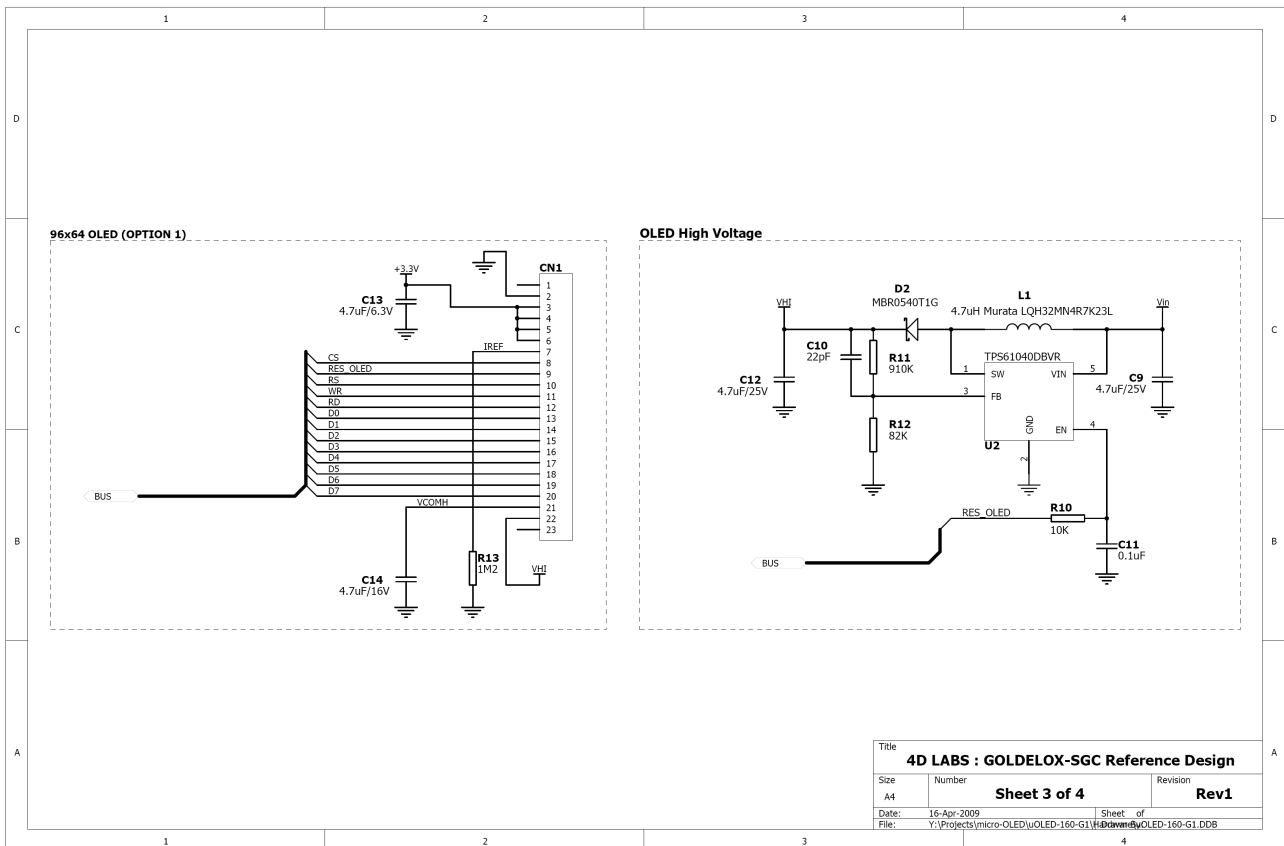
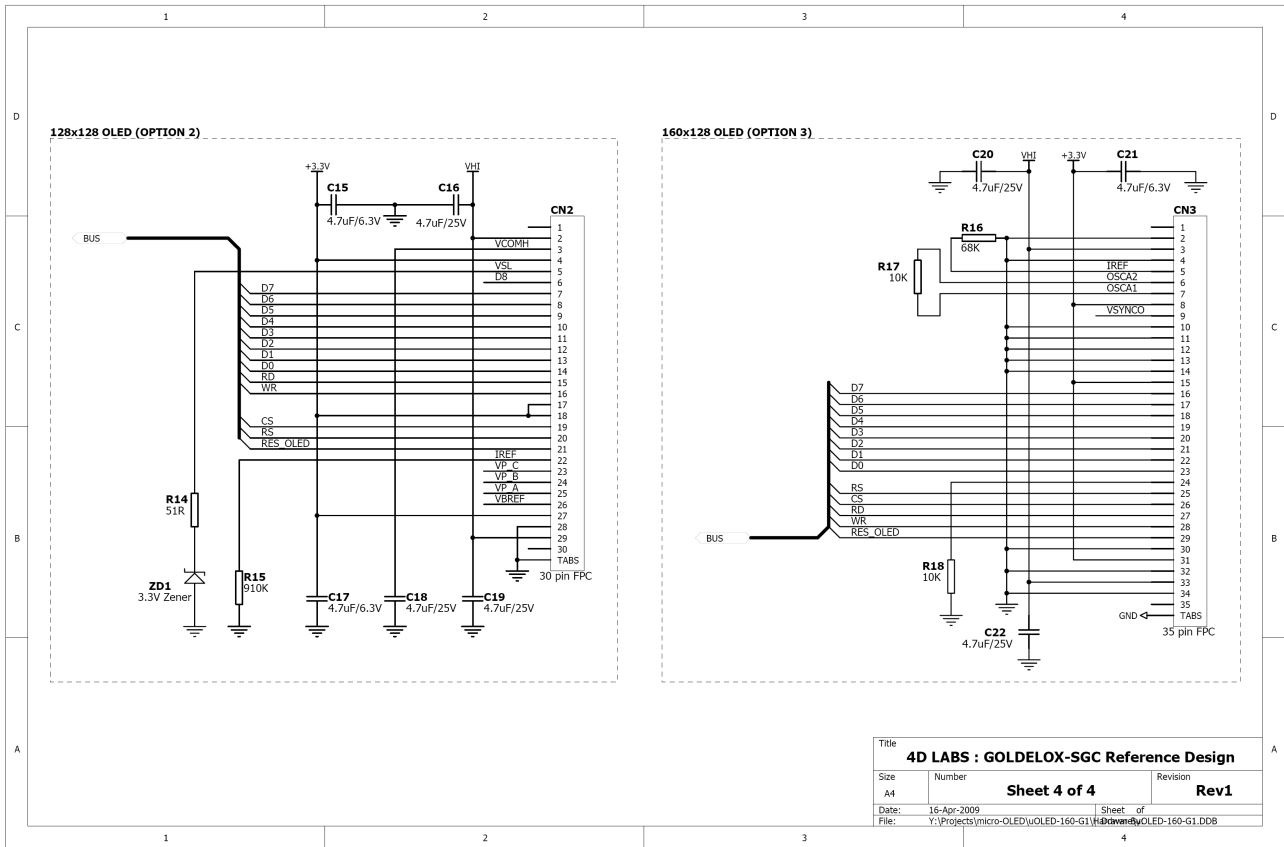
7.7 FAT Controller – Software Test Tool

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.



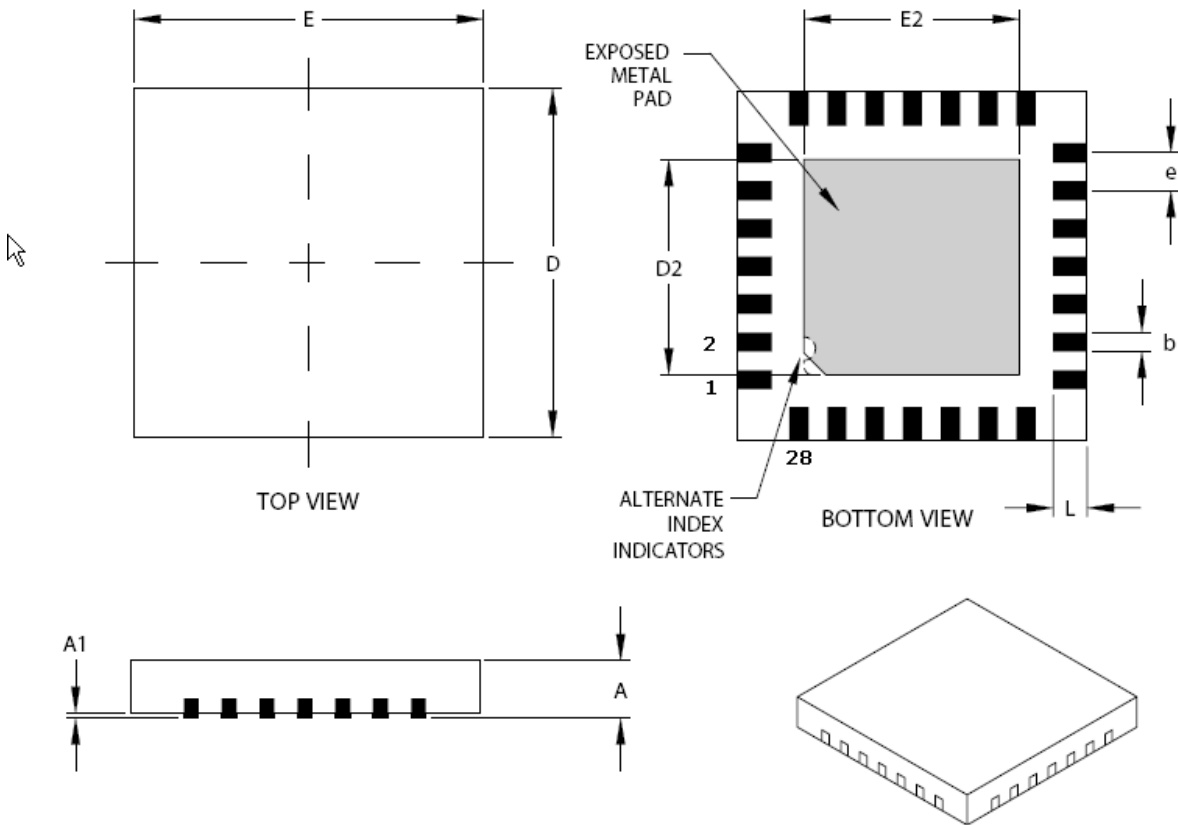
8. Reference Design



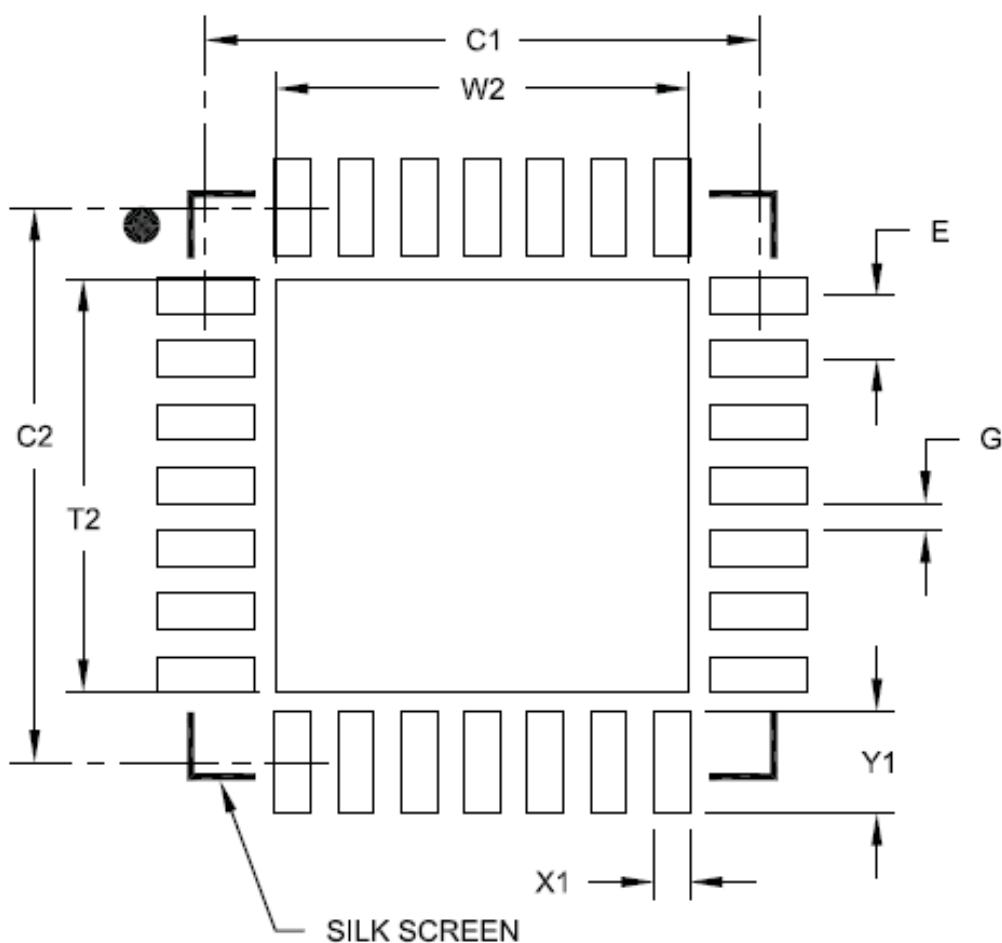


9. Package Details and PCB Land Pattern

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 Limits	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		

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 analogue 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 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	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	--	12	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
A/D Converter Resolution	SWITCH pin	--	8	--	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

Order Code: GOLDELOX-SGC
Package: QFN28, 6mm x 6mm
Packaging: Tubes of 61 pieces

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