4D SYSTEMS

µLCD43(GFX)
4.3" LCD Display Module
Data Sheet

Document Date: 7th June 2012
Document Revision: 4.0

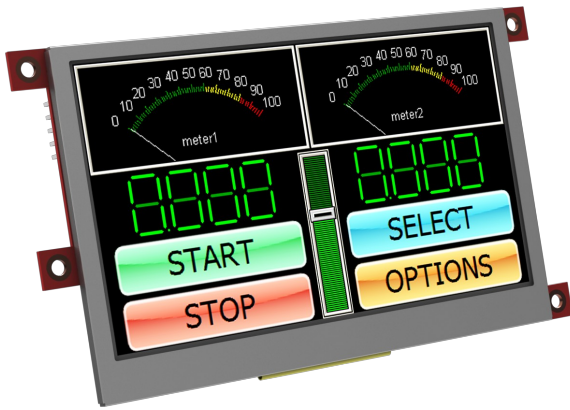# 4D SYSTEMS

Description

The µLCD43(GFX) is an intelligent graphics display, that harnesses the power to deliver a diverse range of features, in a single and compact cost effective unit. Embedded at the heart of the design is the PICASO-GFX2 processor, which is driven by a highly optimised virtual core engine; EVE (Extensible Virtual Engine). An extensive range of hardware and software peripherals have been integrated into the design, to give the user freedom to adapt the module to suit their application. Features include; a 4.3'' TFT 480x272 touch screen display, audio, micro-SD card connector, an expansion port along with a series of GPIO, I2C pins and serial comms. The µLCD43(GFX) serves as the perfect solution to be deployed at the forefront of any product design, requiring a brilliance of colour, animation or images on a 4.3'' widescreen display.

Features

- Low-cost 4.3" LCD-TFT display graphics user interface solution.

- 480x272 resolution, RGB 65K true to life colours, TFT screen.

- There are three different modules available in the µLCD43(GFX) range:

  - **µLCD-43P(GFX)** – Non Touch

  - **µLCD-43PT(GFX)** – 4-Wire Resistive Touch (least sensitive; best used with stylus touch).

  - **µLCD-43PCT(GFX)** – Capacitive Touch (most sensitive; best used with finger touch).

- Easy 5 pin interface to any host device:
  VCC, TX, RX, GND, RESET.

- Powered by the 4D-Labs PICASO-GFX2 processor (also available as separate OEM IC for volume users).

- 14KB of Flash memory for user code storage and 14KB of SRAM for user variables.

- 2 x Asynchronous hardware serial ports (COM0, COM1), TTL interface, with 300 baud to 256K baud.

- 1 x I2C interface (Master).

- 8 x 16 bit timers with 1 millisecond resolution.

- 13 x General Purpose I/O pins. Upper 8 bits can be used as an I/O Bus for fast 8-bit parallel data transfers.

- On-board micro-SD memory card adaptor for multimedia storage and data logging purposes. HC memory card support is also available for cards larger than 4GB.

- DOS compatible file access (FAT16 format) as well as low level access to card memory.

- Dedicated PWM Audio pin supports FAT16 audio WAV files and complex sound generation.

- On-board audio amplifier with a tiny 8Ω speaker

for sound generation and WAV file playback.

- Built in extensive 4DGL graphics and system library functions. For all available features and functions under the 4DGL programming language.

- Display full colour images, animations, icons and video clips.

- Supports all available Windows fonts and characters.

- 2 x 15 pin header for I/O expansion and future plug-in daughter boards.

- 4.0V to 5.5V range operation (single supply).

- Module dimensions: 105.5 x 67.0 x 14.7mm (not including mounting tabs).

- Display Viewing Area: 95.0 x 53.9mm

- 4 x mounting tabs with 3mm holes for mechanical support.

- 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

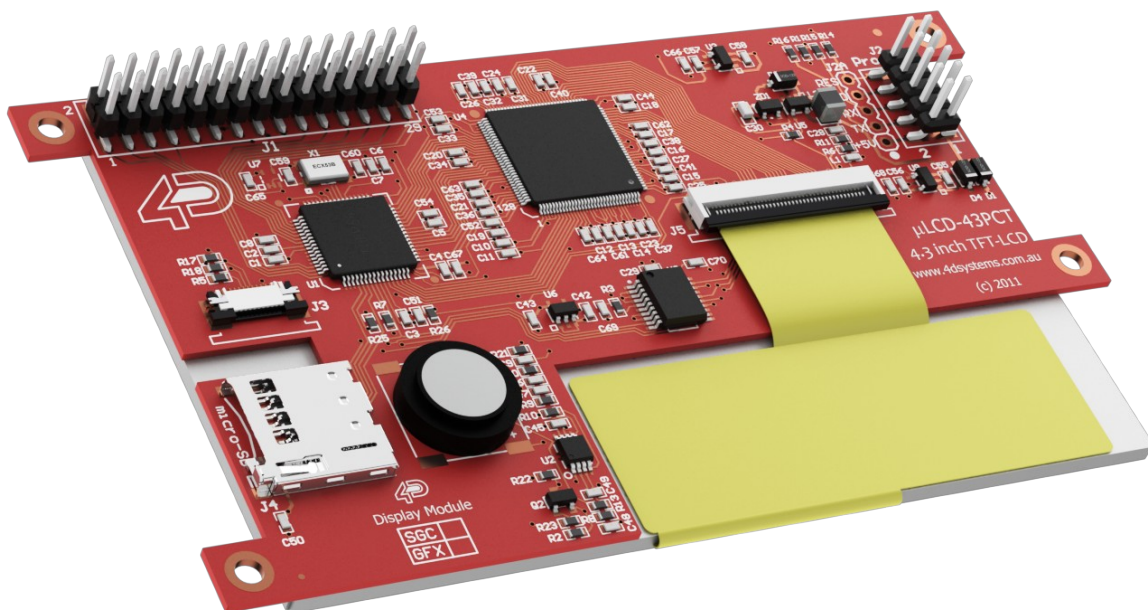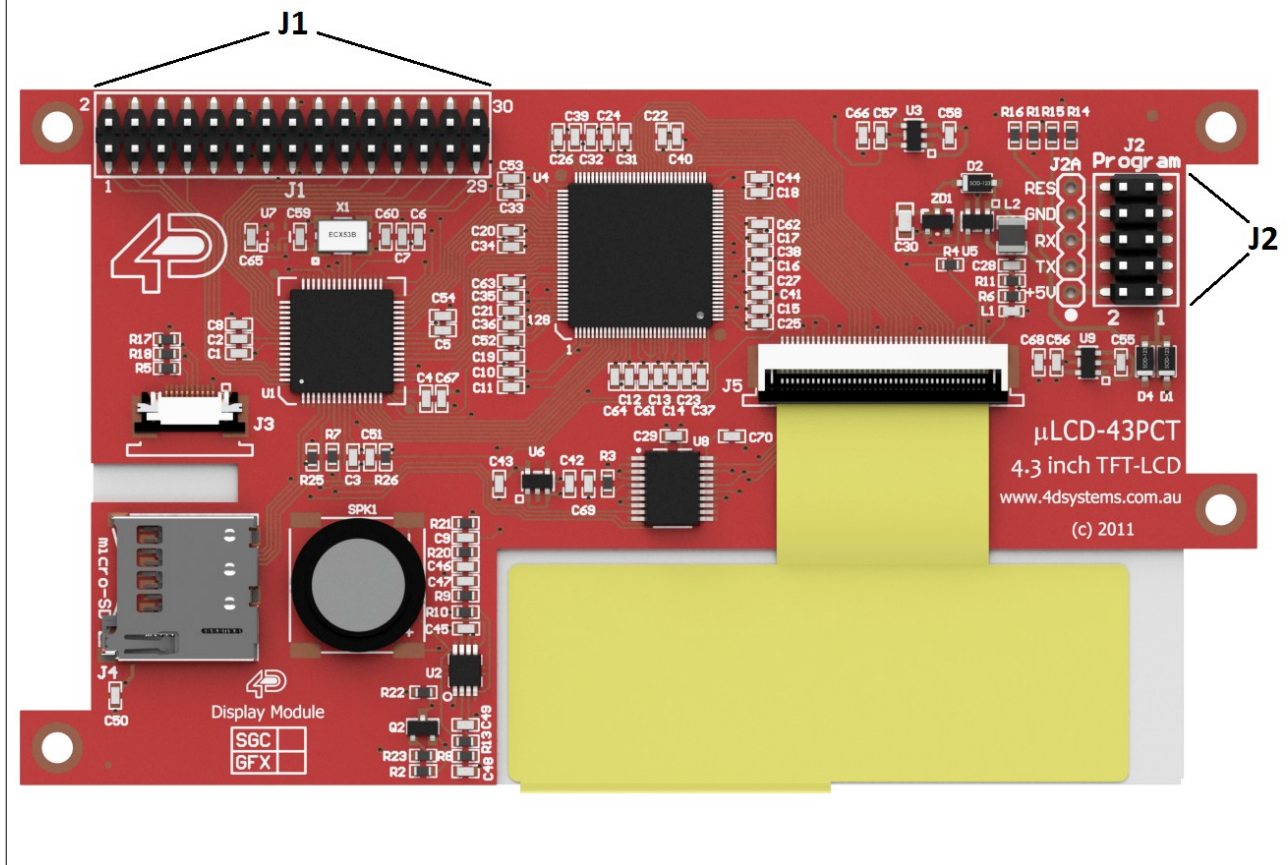- Aviation systems

- HMI with touch panels

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1. Pin Configuration and Summary

J2 Program Pin Outs (User Interface):			
Pin	**Symbol**	**I/O**	**Description**
1, 2	Vin	P	Main Voltage Supply +ve input pin. Reverse polarity protected. Range is 4.0V to 5.5V, nominal 5.0V.
3, 4	TX	O	Asynchronous Serial Transmit pin. Connect this pin to host micro-controller Serial Receive (Rx) signal. The host receives data from the display module via this pin. This pin is tolerant up to 5.0V levels.
5, 6	RX	I	Asynchronous Serial Receive pin. Connect this pin to host micro-controller Serial Transmit (Tx) signal. The host transmits commands and data to the display module via this pin. This pin is tolerant up to 5.0V levels.
7, 8	GND	P	Supply Ground.
9, 10	RES	I	Master Reset signal. Internally pulled up to 3.3V via a 4.7K resistor. An active Low pulse greater than 2.0μs will reset the module. If the module needs to be reset externally, only use open collector type circuits. This pin is not driven low by any internal conditions. The host should control this pin via one of its port pins using an open collector/drain arrangement.

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

J1 Pin Outs (Expansion Port):

Pin	Symbol	I/O	Description
1	IO1	I/O	General Purpose Input Output 1
3	IO2	I/O	General Purpose Input Output 2
4	SCL	O	I2C clock output
5	IO3	I/O	General Purpose Input Output 3
6	SDA	I/O	I2C bi-directional data
7	IO4/BUS_RD	I/O	General Purpose Input Output 4/Bus Read
9	IO5/BUS_WR	I/O	General Purpose Input Output 5/Bus Write
11	GND	P	Supply Ground
12	VCC	P	Main Voltage Supply +ve input pin 4.5Volts to 5.5Volts. Nominal @ 5Volts
13	GND	P	Supply Ground
15	BUS7	I/O	IO Bus bit 7 (BUS0..7)
16	RESET	I	Master RESET. Pull this pin Low for 2.0µs or longer to Reset the module
17	BUS6	I/O	IO Bus bit 6 (BUS0..7)
19	BUS5	I/O	IO Bus bit 5 (BUS0..7)
20	3.3V	P	Regulated 3.3 Volts output, maximum available current 400mA
21	BUS4	I/O	IO Bus bit 4 (BUS0..7)
23	BUS3	I/O	IO Bus bit 3 (BUS0..7)
24	RX0	I	Asynchronous serial port 0 Receive Pin. COM0 Rx
25	BUS2	I/O	IO Bus bit 2 (BUS0..7)
26	TX0	O	Asynchronous serial port 0 Transmit Pin. COM0 Tx
27	BUS1	I/O	IO Bus bit 1 (BUS0..7)
28	TX1	O	Asynchronous serial port 1 Transmit Pin. COM1 Tx
29	BUS0	I/O	IO Bus bit 0 (BUS0..7)
30	RX1	I	Asynchronous serial port 1 Receive Pin. COM1 Rx
NC	NC	--	Following Pins are Not Used: 2, 8, 10, 14, 18, 22

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

Note: The expansion port **J1**, is suitable for connectivity with any female header that has 2x15 pin rows at 2.54mm (0.1'') pitch spacing.

2. Hardware Interface - Pins

The µLCD43(GFX) provides both a hardware and a software interface. This section describes in detail the hardware interface pins of the device.

2.1 Serial Ports - COM0, COM1 UARTS

The **PICASO-GFX2** has two dedicated hardware Asynchronous Serial ports, that can communicate with external serial devices. These are referred to as the **COM0** and **COM1** serial ports.

The primary features are:

- Full-Duplex 8 bit data transmission and reception.
- Data format: 8 bits, No Parity, 1 Stop bit.
- Independent Baud rates from 300 baud up to 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 any of the serial ports. This frees up the application to service other tasks.
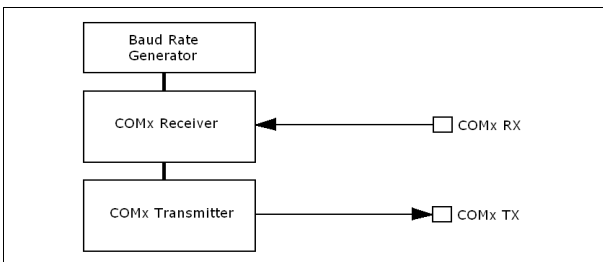
A single byte serial transmission consists of the start bit, 8-bits of data followed by the stop bit. The start bit is always 0, while a stop bit is always 1. The LSB (Least Significant Bit, Bit 0) is sent out first following the start bit. The figure below shows a single byte transmission timing diagram.
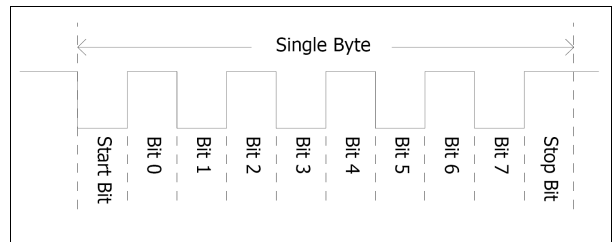
COM0 is also the primary interface for 4DGL user program downloads and chip configuration PmmC programming. Once the compiled 4DGL application program, (EVE byte-code) is downloaded and the user code starts executing, the serial port is then available to the user application. Refer to **Section 5; In-Circuit-Serial-Programming (ICSP)** for more details on PmmC programming.

TX0 pin (Serial Transmit COM0):
Asynchronous Serial port COM0 transmit pin, TX0. Connect this pin to external serial device receive (Rx) signal. This pin is 5.0V tolerant.

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

TX1 pin (Serial Transmit COM1):
Asynchronous Serial port COM1 transmit pin, TX1. Connect this pin to external serial device receive (Rx) signal. This pin is 5.0V tolerant.

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

2.2   GPIO - General Purpose IO Interface

There are 13 general purpose Input/Output (GPIO) pins available to the user. These are grouped as IO1..IO5 and BUS0..BUS7. The five I/O pins (IO1..IO5), provide flexibility of individual bit operations while the eight pins (BUS0..BUS7), known as GPIO BUS, serve collectively for byte wise operations. IO4 and IO5 also act as strobing signals to control the GPIO Bus. The GPIO Bus can be read or written, by strobing a low pulse (50ns duration or greater) the IO4/BUS_RD or IO5/BUS_WR for read or write respectively. For detailed usage refer to the document listed below:
'*PICASO-GFX2-4DGL-Internal-Functions.pdf*'.

IO1-IO3 pins (3 x GPIO pins):
General purpose I/O pins. Each pin can be individually set for INPUT or an OUTPUT. Power-Up Reset default is all INPUTS.

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

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

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

Note: All GPIO pins are 5.0V tolerant.

2.3   System Pins

VCC (Module Voltage Input), J1 pins 1/2, J2 pin12:
Module supply voltage input pin. This pin must be connected to a regulated supply voltage in the range of 4.0 Volts to 5.5 Volts DC. Nominal operating voltage is 5.0 Volts.

3.3Vout (3.3V Regulated Output), J2 pin 20:
External circuitry that requires a regulated 3.3V supply can be powered up via this pin. Maximum available current is 400mA.

GND (Module Ground), J1 pins 7/8, J2 pins 11/13:
Device ground pins. These pins must be connected to ground.

RESET (Module Master Reset), J1 pins 9/10, J2 pin 16:
Module Master Reset pin. An active low pulse of greater than 2.0µs will reset the module. Internally pulled up to 3.3V via 4.7K resistor. Only use open collector type circuits to reset the device, if an external reset is required.

3. Software Platform - 4DGL

The PICASO-GFX2 belongs to a family of processors powered by a highly optimised soft core virtual engine, EVE (Extensible Virtual Engine).

EVE is a proprietary, high performance virtual processor with an extensive byte-code instruction set, optimised to execute compiled 4DGL programs. 4DGL (4D Graphics Language) was specifically developed from ground up, for the EVE engine core. It is a high level language which is easy to learn and simple to understand, yet powerful enough to tackle many embedded graphics applications.

4DGL is a graphics oriented language allowing rapid application development. The syntax structure was designed using elements of popular languages such as C, Basic and Pascal amongst others. Programmers familiar with these languages will feel right at home with 4DGL. It includes many familiar instructions such as IF..ELSE..ENDIF, WHILE..WEND, REPEAT..UNTIL, GOSUB..ENDSUB, GOTO, PRINT as well as some specialised instructions SERIN, SEROUT, GFX_LINE, GFX_CIRCLE and many more. This section only covers the syntax of the available instructions and functions. For a more in depth study, refer to the following documents:
"4DGL-Programmers-Reference-Manual.pdf"
"PICASO-GFX2-4DGL-Internal-Functions.pdf"

The following is a brief outline of 4DGL instructions and functions available for the PICASO-GFX2 device.

GPIO Functions:
- pin_Set(mode, pin)
    - OUTPUT, INPUT
- pin_HI(pin)
- pin_LO(pin)
- pin_Read(pin)
- bus_In()
- bus_Out("var")
- bus_Set("var")
- bus_Write("var")
- bus_Read("var")

System Memory Access Functions:
- peekW(address)
- pokeW(address, word_value)

Maths Functions:
- ABS(value)
- MIN(value1, value2)
- MAX(value1, value2)
- SWAP(&var1, &var2)
- SIN(angle)
- COS(angle)
- RAND()
- SEED(number)
- SQRT(number)
- OVF ()

Text and String Functions:
- txt_MoveCursor(line, column)
- putch(char)
- putstr(pointer)
- putnum(format, value)
- print(...)
- to(outstream)
- charwidth('char')
- charheight('char')
- strwidth(pointer)
- strheight()
- strlen(pointer)
- txt_Set(function, value)
    txt_Set shortcuts:
    - txt_FGcolour(colour)
    - txt_BGcolour(colour)
    - txt_FontID(id)
    - txt_Width(multiplier)
    - txt_Height(multiplier)
    - txt_Xgap(pixelcount)
    - txt_Ygap(pixelcount)
    - txt_Delay(millisecs) [deprecated]
    - txt_Opacity(mode)
    - txt_Bold(mode)
    - txt_Italic(mode)
    - txt_Inverse(mode)
    - txt_Underlined(mode)
    - txt_Attributes(value)
    - txt_Wrap(value)

CType Functions:
- isdigit(char)
- isxdigit(char)
- isupper(char)
- islower(char)
- isalpha(char)
- isalnum(char)
- isprint(char)
- isspace(char)
- iswhite(char)
- toupper(char)
- tolower(char)
- LObyte(var)
- HIbyte(var)
- ByteSwap(var)

Graphics Functions:
- gfx_Cls()
- gfx_ChangeColour(oldColour, newColour)
- gfx_Circle(x, y, radius, colour)
- gfx_CircleFilled(x, y, radius, colour)
- gfx_Line(x1, y1, x2, y2, colour)
- gfx_Hline(y, x1, x2, colour)
- gfx_Vline(x, y1, y2, colour)
- gfx_Rectangle(x1, y1, x2, y2, colour)
- gfx_RectangleFilled(x1, y1, x2, y2, colour)
- gfx_Polyline(n, vx, vy, colour)
- gfx_Polygon(n, vx, vy, colour)
- gfx_Triangle(x1, y1, x2, y2, x3, y3, colour)
- gfx_Dot()
- gfx_Bullet(radius)
- gfx_OrbitInit(&x_dest, &y_dest)
- gfx_Orbit(angle, distance)
- gfx_PutPixel(x, y, colour)
- gfx_GetPixel(x, y)
- gfx_MoveTo(xpos, ypos)
- gfx_MoveRel(xoffset, yoffset)
- gfx_IncX()
- gfx_IncY()
- gfx_LineTo(xpos, ypos)
- gfx_LineRel(xpos, ypos)
- gfx_BoxTo(x2, y2)
- gfx_SetClipRegion()
- gfx_Ellipse(x, y, xrad, yrad, colour)
- gfx_EllipseFilled(x, y, xrad, yrad, colour)
- gfx_Button(state, x, y, buttonColour, textColour, font, textWidth, textHeight, text)
- gfx_Panel(state, x, y, width, height, colour)
- gfx_Slider(mode, x1, y1, x2, y2, colour, scale, value)
- gfx_ScreenCopyPaste(xs, ys, xd, yd, width, height)
- gfx_RGBto565(RED, GREEN, BLUE)
- gfx_332to565(COLOUR8BIT)
- gfx_Selection(index, backcolor, textcolor)
- gfx_TriangleFilled(x1, y1, x2, y2, x3, y3, colr)
- gfx_PolygonFilled(n, &vx, &vy, colr)
- gfx_Origin(x, y)
- gfx_Get(mode)
- gfx_ClipWindow(x1, y1, x2, y2)
- gfx_Set(function, value)
  gfx_Set shortcuts:
  - gfx_PenSize(mode)
  - gfx_BGcolour(colour)
  - gfx_ObjectColour(colour)
  - gfx_Clipping(mode)
  - gfx_TransparentColour(colour)
  - gfx_Transparency(mode)
  - gfx_FrameDelay(delay)
  - gfx_ScreenMode(delay)
  - gfx_OutlineColour(colour)
  - gfx_Contrast(value)
  - gfx_LinePattern(pattern)
  - gfx_ColourMode(mode)
  - gfx_BevelWidth(mode)
  - gfx_BevelShadow(value)
  - gfx_Xorigin(offset)
  - gfx_Yorigin(offset)

Display I/O Functions:
- disp_SetReg(register, data)
- disp_setGRAM(x1, y1, x2, y2)
- disp_WrGRAM(colour)
- disp_WriteControl(value)
- disp_WriteWord(value)
- disp_ReadWord()

Media Functions (SD/SDHC memory Card or Serial Flash chip):
- media_Init()
- media_SetAdd(HIword, LOword)

- media_SetSector(HIword, LOword)
- media_RdSector(Destination_Address)
- media_WrSector(Source_Address)
- media_ReadByte()
- media_ReadWord()
- media_WriteByte(byte_val)
- media_WriteWord(word_val)
- media_Flush()
- media_Image(x, y)
- media_Video(x, y)
- media_VideoFrame(x, y, frameNumber)

Flash Memory chip Functions:
- flash_SIG()
- flash_ID()
- flash_BulkErase()
- flash_BlockErase(blockAddress)

SPI Control Functions:
- spi_Init(speed,input_mode,output_mode)
- spi_Read()
- spi_Write(byte)
- spi_Disable()

Serial (UART) Communications Functions:
- setbaud(rate)
- com_SetBaud(comport, baudrate/10)
- serin() or serin1()
- serout(char) or serout1(char)
- com_Init(buffer, buffsize, qualifier) or com1_Init(buffer, buffsize, qualifier)
- com_Reset() or com1_Reset()
- com_Count() or com1_Count()
- com_Full() or com1_Full()
- com_Error() or com1_Error()
- com_Sync() or com1_Sync()
- com_TXbuffer(buf, bufsize) or com1_TXbuffer(buf, bufsize)
- com_TXcount() or com1_TXcount()
- com_TXemptyEvent(function) or com1_TXemptyEvent(function)

I2C BUS Master Function
- func I2C_Open(Speed)
- func I2C_Close()
- func I2C_Start()
- func I2C_Stop()
- func I2C_Restart()

- func I2C_Read()
- func I2C_Write(byte)
- func I2C_Ack()
- func I2C_Nack()
- func I2C_AckStatus()
- func I2C_AckPoll(control)
- func I2C_Idle()
- func I2C_Gets(buffer, size)
- func I2C_Getn(buffer, size)
- func I2C_Puts(buffer)
- func I2C_Putn(buffer,count)

Timer Functions:
- sys_T()
- sys_T_HI()
- sys_SetTimer(timernum, value)
- sys_GetTimer(timernum)
- sys_SetTimerEvent("timernum","functin")
- sys_EventQueue()
- sys_EventsPostpone()
- sys_EventsResume()
- sys_Sleep(units)
- iterator(offset)

FAT16 File Functions:
- file_Error()
- file_Count(filename)
- file_Dir(filename)
- file_FindFirst(fname)
- file_FindNext()
- file_Exists(fname)
- file_Open(fname, mode)
- file_Close(handle)
- file_Read(destination, size, handle)
- file_Seek(handle, HiWord, LoWord)
- file_Index(handle,Hisize,Losize,recrdnum)
- file_Tell(handle, &HiWord, &LoWord)
- file_Write(Source, size, handle)
- file_Size(handle, &HiWord, &LoWord)
- file_Image(x, y, handle)
- file_ScreenCapture(x, y, width, height, handle)
- file_PutC(char, handle)
- file_GetC(handle)
- file_PutW(word, handle)
- file_GetW(handle)
- file_PutS(source, handle)

- file_GetS(*String, size, handle)
- file_Erase(fname)
- file_Rewind(handle)
- file_LoadFunction(fname.4XE)
- file_Run(fname..4XE, arglistptr)
- file_Exec(fname..4XE, arglistptr)
- file_LoadImageControl(fname1, fname2, mode)
- file_Mount()
- file_Unmount()
- file_PlayWAV

Sound Control Functions:
- Snd_Volume(var)
- Snd_Pitch(pitch)
- Snd_BufSize(var)
- Snd_Stop()
- Snd_Pause()
- Snd_Continue()
- Snd_Playing()

String Class Functions:
- str_Ptr(&var)
- str_GetD(&ptr, &var)
- str_GetW(&ptr, &var)
- str_GetHexW(&ptr, &var)
- str_GetC(&ptr, &var)
- str_GetByte(ptr)
- str_GetWord(ptr)
- str_PutByte(ptr, val)
- str_PutWord(ptr, val)
- str_Match(&ptr, *str)
- str_MatchI(&ptr, *str)
- str_Find(&ptr, *str)
- str_FindI(&ptr, *str)
- str_Length(ptr)
- str_Printf(&ptr, *format)
- str_Cat(&destination, &Source)
- str_CatN(&ptr, str, count)

Touch Screen Functions:
- touch_DetectRegion(x1, y1, x2, y2)
- touch_Set(mode)
- touch_Get(mode)

Image Control Functions:
- img_SetPosition(handle, index, xpos, ypos)

- img_Enable(handle, index)
- img_Disable(handle, index)
- img_Darken(handle, index)
- img_Lighten(handle, index)
- img_SetWord(handle, index, offset, word)
- img_GetWord(handle, index, offset)
- img_Show(handle, index)
- img_SetAttributes(handle, index, value)
- img_ClearAttributes(handle, index, value)
- img_Touched(handle, index)

Memory Allocation Functions:
- mem_Alloc(size)
- mem_Allocv(size)
- mem_Allocz(size)
- mem_Realloc(ptr, size)
- mem_Free(allocation)
- mem_Heap()
- mem_Set(ptr, char, size)
- mem_Copy(source, destination, count)
- mem_Compare(ptr1, ptr2, count)

General Purpose Functions:
- pause(time)
- lookup8 (key, byteConstList)
- lookup16 (key, wordConstList)

To assist with the development of 4DGL applications, the 4DWorkshop3 IDE combines a full-featured editor, a compiler, a linker and a down-loader into a single PC-based application. It's all you need to code, test and run your applications.

4. PmmC programming

The PICASO-GFX2, used in the μLCD43(GFX) module, 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 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 customisation, as well as upgrading it with future enhancements.

4D Programming Cable
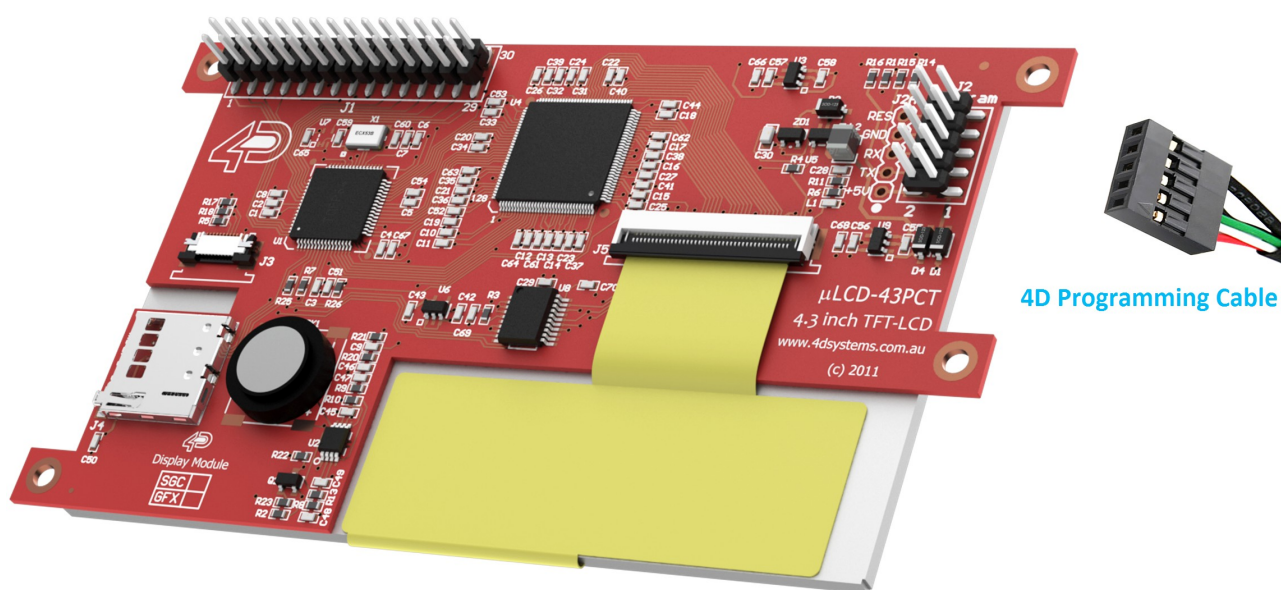
A PmmC file can only be programmed into the device via its COM0 serial port. The figure above provides a typical implementation for the PmmC programming interface.

The PmmC file is programmed into the device with the aid of the "***PmmC Loader***"; a PC based software tool. To provide a link between the PC and the ICSP interface, a 4D Programming Cable is required. It can be found on the website:
www.4dsystems.com.au

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

Warranty Note: PmmC or 4DGL programming should only be carried out using any one of the 4D Programming modules (4D Programming Cable, uUSB-MB5, uUSB-CE5). Any malfunction because of custom or third party USB to Serial converters or Serial(RS232) to Serial(TTL) level converters will void the warranty.

It also applies to all 4D products which require an interface from the PC to the module for testing using 4D Software Test Tools.

This applies to all the purchases on or after 1st of July 2011.

5. Module Features

The µLCD43(GFX) module is equipped to accommodate a diverse range of applications. Some of the main features of the module include;

- 4.3'' TFT Touch Screen Display, with 480x272 resolution
- PICASO-GFX2 Processor
- micro-SD Memory Card
- Audio

5.1 Display – 4.3" TFT

The µLCD43(GFX) module is equipped with a 4.3" TFT display. Details of the display is listed below:

- Screen Size: 4.3" diagonal
- Screen Dimensions: 105.4 x 67.1 x 2.9mm
- Viewing Area: 95.04 x 53.86mm
- Integrated Touch Screen
- Pixel Size: 0.153 x 0.153mm
- Surface Luminosity: 250 cd/m^2
- Contrast Ratio: 300:1
- Viewing Angle: 45 degrees
- 5 x 2 Parallel LEDs for Backlighting
- Non-Touch, 4-Wire Resistive Touch or Capacitive Touch panels available

Note: The Screens used are the highest rated 'Grade A' Displays which allow for 0-4 defective pixels. A defective pixel could be solid Black(Dead), White, Red, Green or Blue. Note that a single pixel is 0.153x0.153mm.

• Units shown are in millimetres

LED Source (CIRCUIT DIAGRAM)
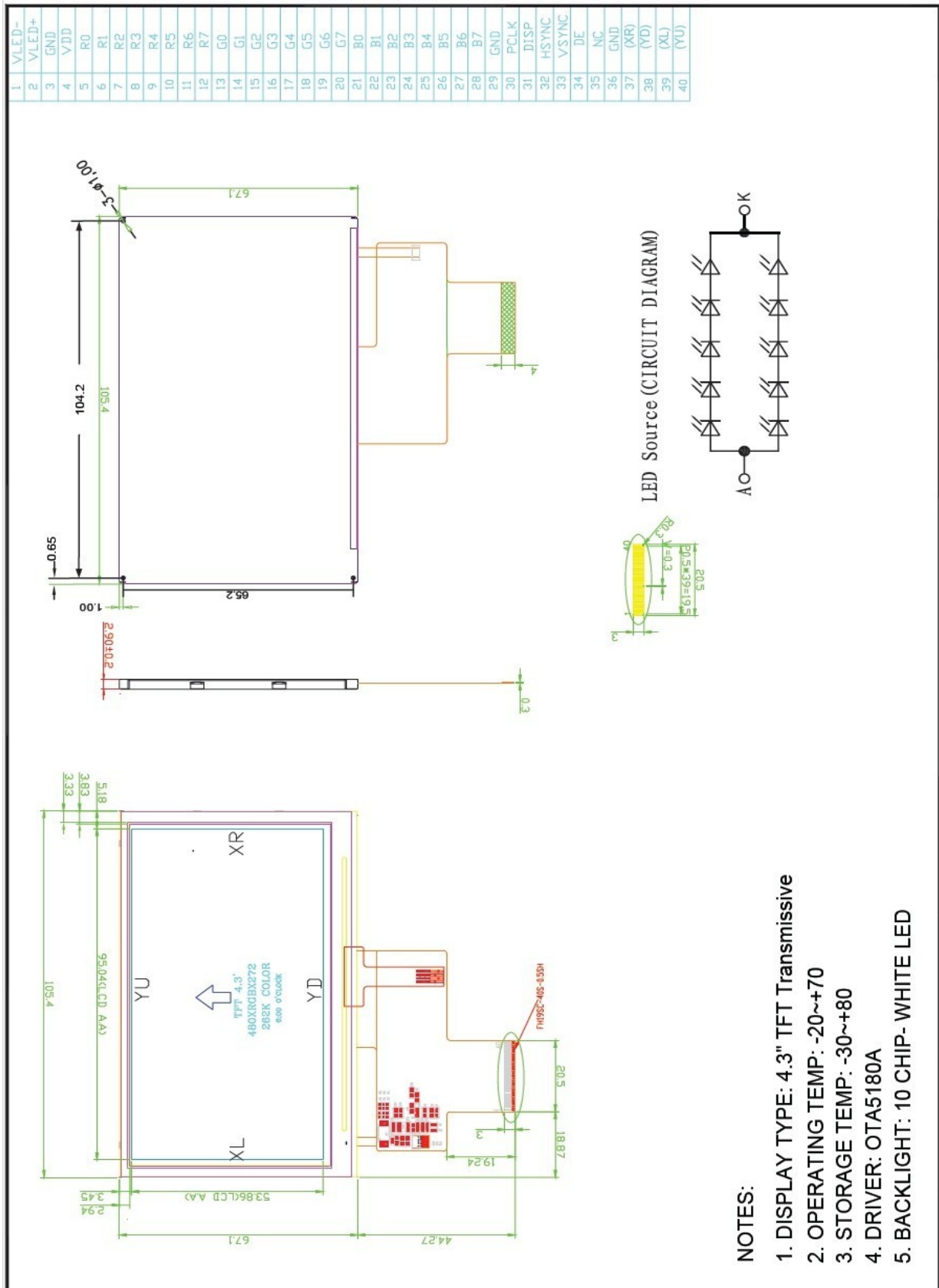
NOTES:

1. DISPLAY TYPE: 4.3" TFT Transmissive
2. OPERATING TEMP: -20~+70
3. STORAGE TEMP: -30~+80
4. DRIVER: OTA5180A
5. BACKLIGHT: 10 CHIP- WHITE LED

5.2   PICASO-GFX2 Processor

The module is designed around the PICASO-GFX2 Graphics Controller from 4D-Labs.

The **PICASO-GFX2** is a smart Controller and the interface to the TFT- LCD displays is virtually plug-n-play. All of the data and control signals are provided by the chip to interface directly to the display.

Powerful graphics, text, image, animation and countless more features are built right inside the chip. It offers a simple yet effective serial interface to any external micro-controller, that can communicate via a serial port.

The data sheet for the chip is available from the www.4dsystems.com.au website:
"PICASO-GFX2-DS-revx.pdf"

5.3   micro-SD Memory Card

The module supports micro-SD memory cards via the on-board micro-SD connector. The memory card is used for all multimedia file retrieval; such as images, animations and movie clips. The memory card can also be used as general purpose storage for data logging applications. Support is available for off the shelf micro-SD and high capacity HC memory cards (4GB and above).

Note: The module also supports FAT file formats.

5.4   Audio

The exclusive audio support in the PICASO-GFX2, makes it better than it's 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-GFX2-4DGL-Internal-Functions.pdf*'

Note: The on-board speaker is a small device. It is not very loud by itself; it needs an enclosure with a resonating audio cavity.

6. Memory Cards – FAT16 Format

The PICASO-GFX2 uses off the shelf standard SDHC/SD/micro-SD memory cards, with up to 2GB capacity usable with FAT16 formatting. For any FAT file related operations, the memory card must first be formatted with the 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-GFX2 based application.

The PICASO-GFX2 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. Display Precautions

- Avoid having to display the same image/object on the screen for lengthy periods of time. This will cause a burn-in, which is a common problem with all types of display technologies. Blank the screen after a while or dim it very low by adjusting the contrast. Better still; implement a screen saver feature.

- Moisture and water can damage the display. Moisture on the surface of a powered display will cause the electrodes to corrode. Wipe off any moisture gently or let the display dry before usage.

- Dirt from fingerprint oil and fat can easily stain the surface of the display. Gently wipe off any stains with a soft lint-free cloth.

- The performance of the display will degrade under high temperature and humidity. Avoid such conditions at all times.

- Do not tamper with the display flex cable that is connected to the control board. This may effect the connection between the display and the driving circuitry and cause failure.

- Displays are susceptible to mechanical shock. Any force exerted on the module may result in deformed zebra strips, a cracked display cell or broken backlight.

- Always use the mounting holes on the module's printed circuit board to mount the display.

8. Development and Support Tools

8.1   4D-Workshop3 IDE

The **4D-Workshop3 IDE** provides an integrated software development environment for all of the 4D family of processors and modules. The IDE combines the Editor, Compiler, Linker and Down-Loader to develop complete 4DGL application code. All user application code is developed within the Workshop3 IDE.
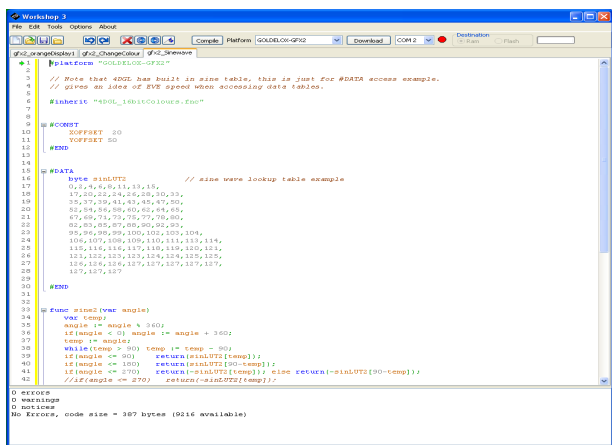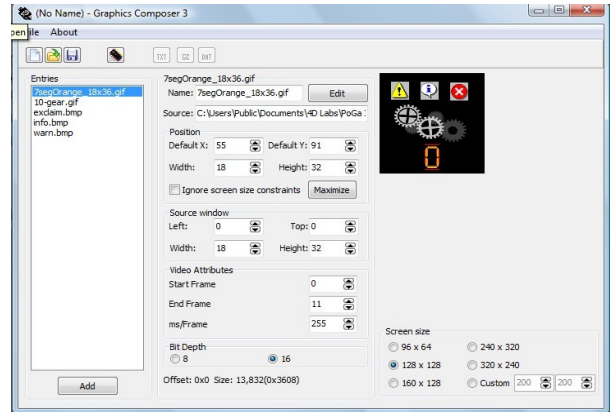

The 4D Workshop3 IDE also includes;

- *PmmC Loader*
- *Graphics Composer*

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-GFX2 chip embedded in the µLCD43(GFX) module.
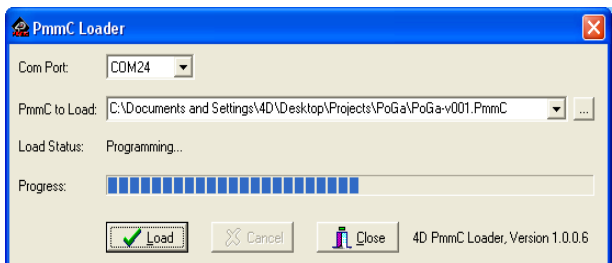
The **Graphics Composer** is a free software tool for Windows. It is an essential tool for composing a slide show of images, animations, movie-clips (multi-media objects), which can then be downloaded into the micro-SD memory card. 4DGL commands can then be used to display the multimedia objects.

By downloading the 4D-Workshop3 IDE from; www.4dsystems.com.au, it will include the PmmC Loader and Graphics Composer Tools and is therefore unnecessary to download these separately.

### 8.2   Programming and PC Connectivity

In order to develop applications with the µLCD43(GFX), it is essential to use a **4D Programming Cable** to connect to a PC. All the relevant software support tools to program, customise and test the µLCD43(GFX) module, must be done using this cable. It is available from the 4D Systems website; www.4dsystems.com.au

4D Programming Cable

8.3 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-GFX2 chip.
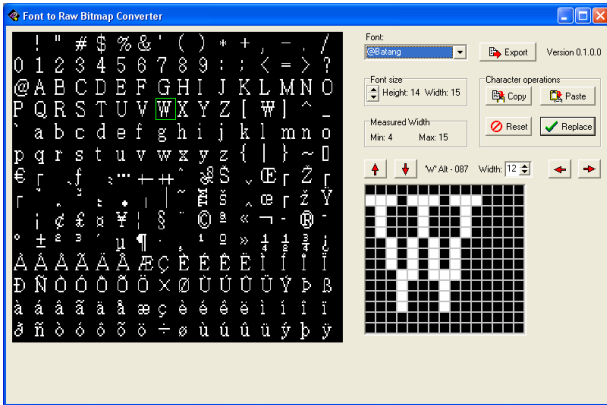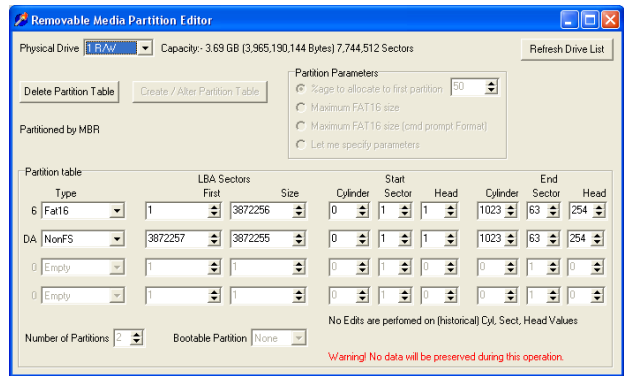

It is available for download from the 4D Systems website, www.4dsystems.com.au

Disclaimer: Windows fonts may be protected by copyright laws. This software is provided for experimental purposes only.
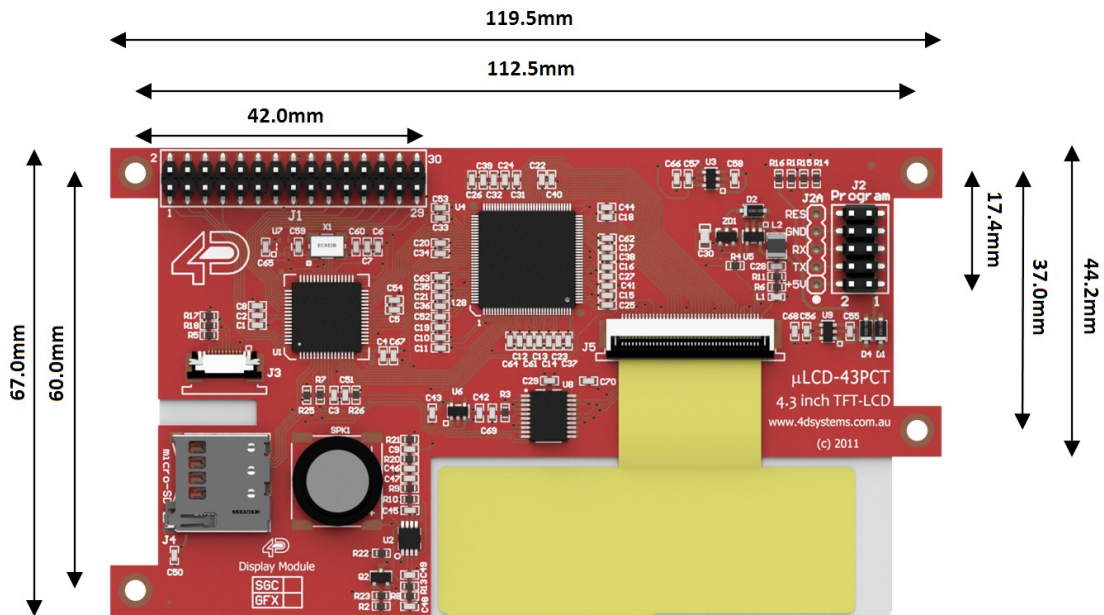
8.4 RMPET – Software Tool

micro-SD/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. **RMPET** (Removable Media Partition Edit Tool), can split a large card into two partitions. The first partition is used as a FAT16 partition whilst the second partition is used as a RAW partition. RMPET allows allocation of a percentage of the card for the first partition. This will be 2GB maximum for the FAT16 Windows format program, or 4GB maximum of FAT16 when the command prompt format command is used.
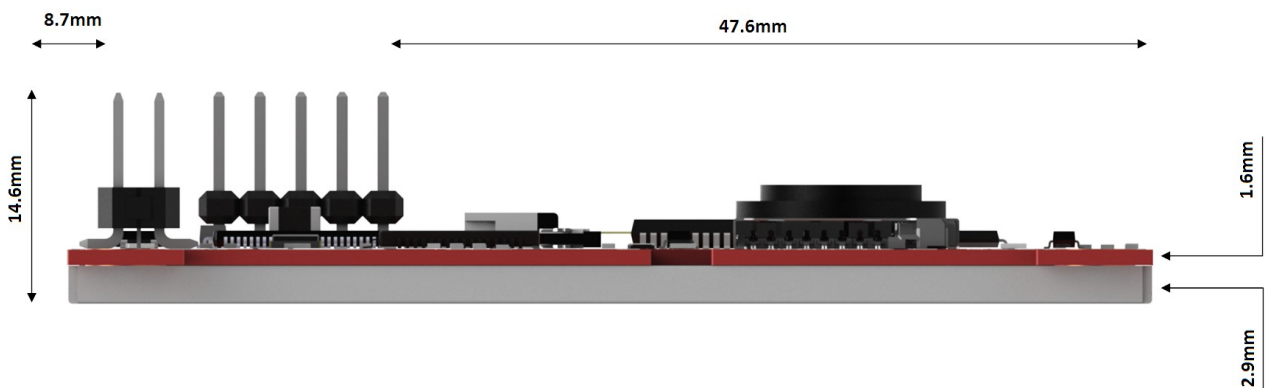

It is available for download from the 4D Systems website, www.4dsystems.com.au
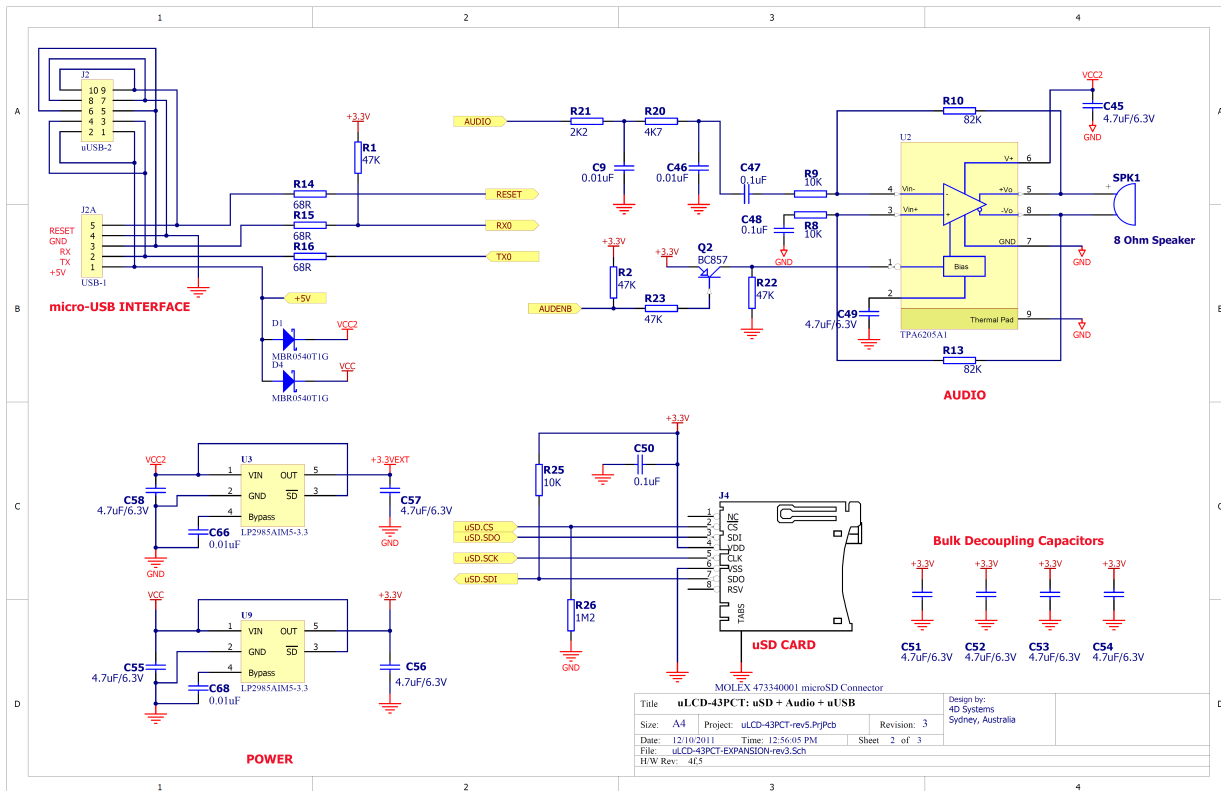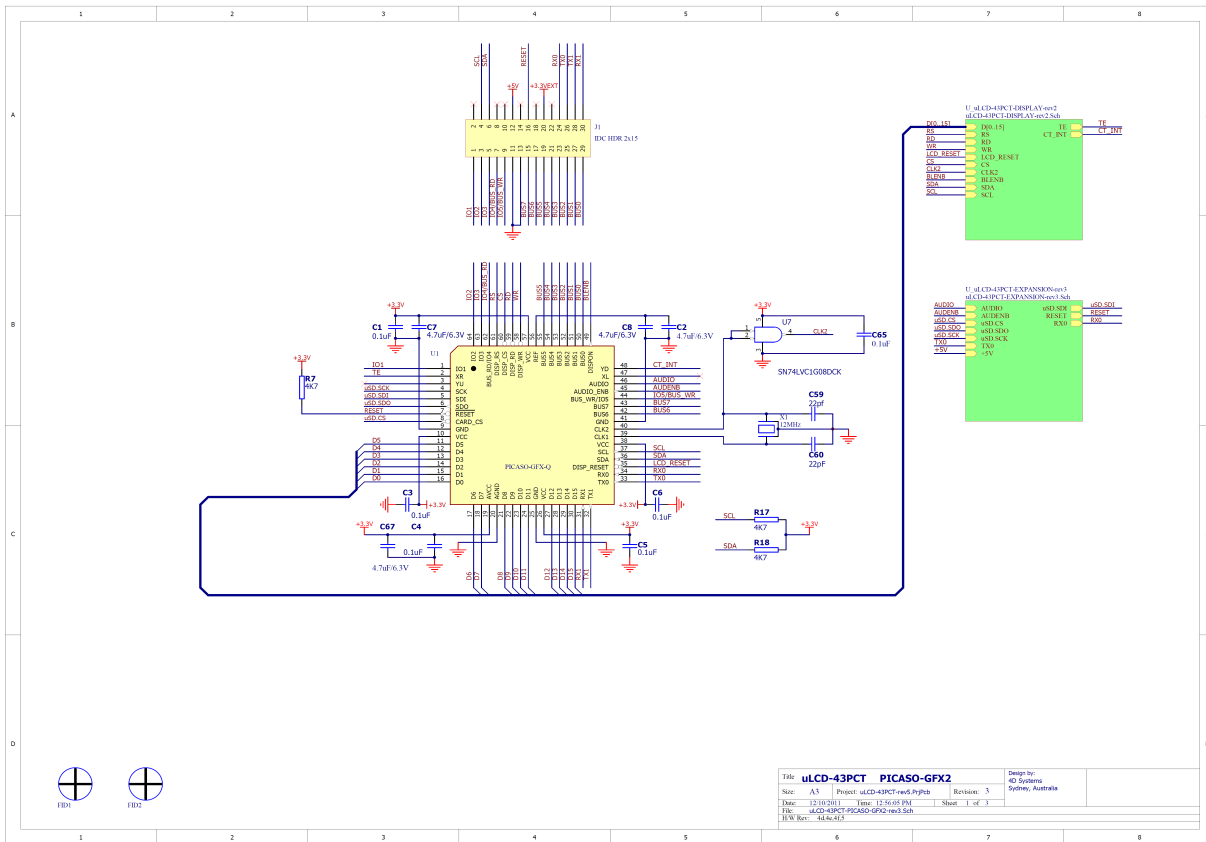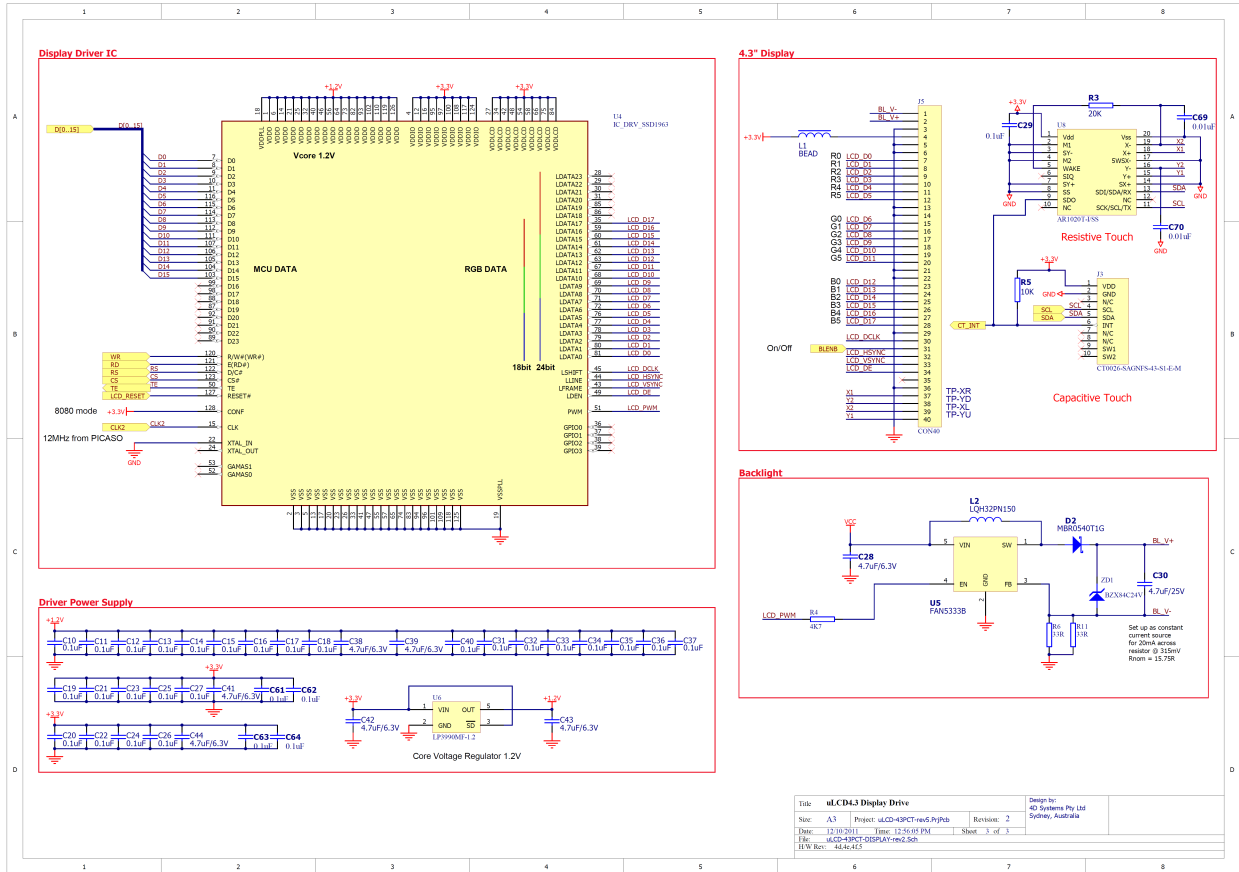
9. Mechanical Details

Backside View

Side On View

10. Reference Design

11. Specifications and Ratings

Absolute Maximum Ratings	
Operating ambient temperature	-15°C to +65°C
Storage temperature	-30°C +70°C
Voltage on any digital input pin with respect to GND	-0.3V to 6.0V
Voltage on SWITCH pin with respect to GND	-0.3V to 6.0V
Voltage on VCC with respect to GND	-0.3V to 6.0V

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)		4.0	5.0	5.5	V
Operating Temperature		-10	--	+60	°C
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
Reset Pulse	External Open Collector	2.0	--	--	µs
Operational Delay	Power-Up or External Reset	500	--	3000	ms

Global Characteristics based on Operating Conditions					
Parameter	**Conditions**	**Min**	**Typ**	**Max**	**Units**
Supply Current (ICC)	VCC = 5.0V, heavily depends on screen usage conditions, sleep mode	4	150	170	mA
Output Low Voltage (VOL)	VCC = 5.0V, IOL = 3.4mA	--	--	0.4	V
Output High Voltage (VOH)	VCC = 5.0V, IOL = -2.0mA	2.4	--	--	V
Capacitive Loading	All pins	--	--	50	pF
Flash Memory Endurance	PICASO-GFX2 PmmC Programming	--	10000	--	E/W

Touch Screen Characteristics					
Parameter	**Conditions**	**Min**	**Typ**	**Max**	**Units**
Linearity		--	--	<1.5	%
Terminal Resistance X	X film side	200	--	850	Ohm
Terminal Resistance Y	Y film side	150	--	580	Ohm
Durability – Scratch Test	Stylus Pen or Finger Sliding	100	--	--	K
Durability – Tap Test	Stylus Pen or Finger Press	1	--	--	Million
Transparency	Non Glare	82	--	--	%

Optical Characteristics						
Parameter		Condition	Min	Typ	Max	Unit
Contrast ratio(Centre point)		Back-light On	250	300	--	-
Luminance of white (Centre point)			250	--	--	cd/m^2
Surface Brightness Uniformity			80	--	--	%
Response time	Rising + Falling (Tr + Tf)		--	30	--	ms
Colour Chromaticity (CIE 1931)	White, Wx		0.25	0.275	0.32	
	White, Wy		0.25	0.275	0.32	
	Red, Rx		0.25	0.275	0.32	
	Red, Ry		0.25	0.275	0.32	
	Green, Gx		0.25	0.275	0.32	
	Green, Gy		0.25	0.275	0.32	
	Blue, Bx		0.25	0.275	0.32	
	Blue, By		0.25	0.275	0.32	
Viewing Angle	Left	Contrast Ratio $\geq$ 5	-	45	-	Degrees
	Right		-	45	-	
	Up		-	50	-	
	Down		-	20	-	

Ordering Information
Ordering Codes: • µLCD-43P(GFX) – Non Touch   • µLCD-43PT(GFX) – 4-Wire Resistive Touch (least sensitive; best used with stylus touch).   • µLCD-43PCT(GFX) – Capacitive Touch (most sensitive; best used with finger touch).   **Package:** 120mm x 170mm (ZIP Bag dimensions).   **Packaging:** Module sealed in antistatic padded ZIP bag.

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