DIABLO16

Embedded Graphics Processor

4D LABS
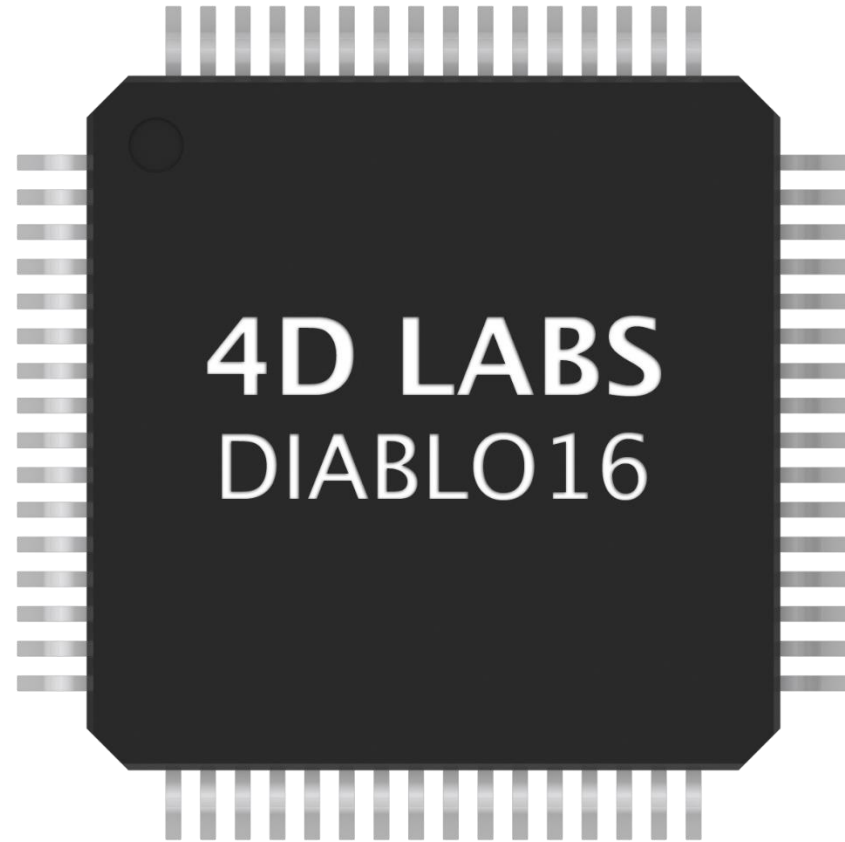DIABLO16

4D SYSTEMS

MESSAGE FROM THE CEO

To our valued customers,

Thank you for your interest in 4D Systems and the products we have to offer.

We are constantly looking for ways to improve our customer experience and it is hoped that a Product Brief such as this, can instil confidence in choosing 4D Systems as your supplier of superior embedded electronic products.

We invite you to showcase our latest release and thank you again for your continued support.

Atilla Aknar
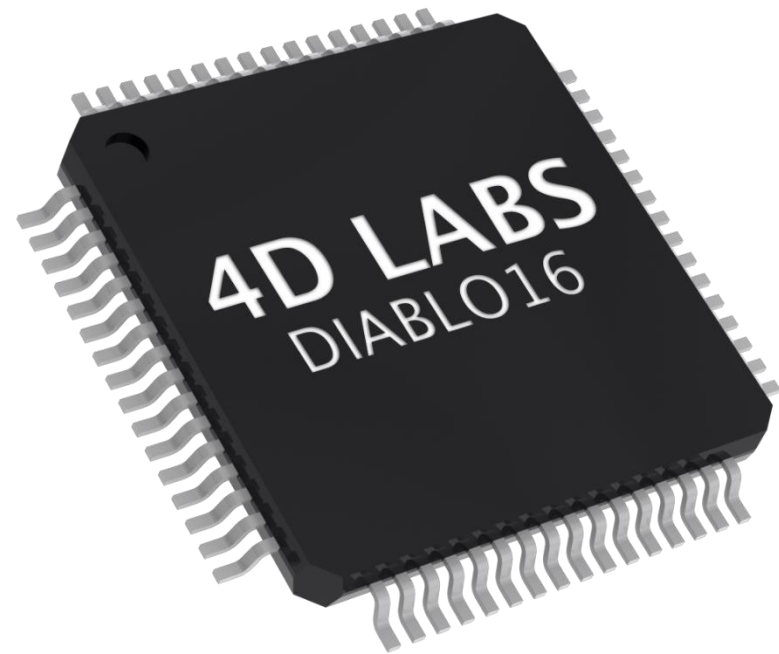Founder & CEO

Table of Contents

1. Overview

The **DIABLO16** Processor is a custom embedded 4DGL graphics controller designed to interface with many popular OLED and LCD display panels.

With its powerful graphics, text, image, and animation abilities built-in, along with numerous more features makes the **DIABLO16** a single chip solution for a wide variety of LCD and OLED display solutions.

The **DIABLO16** offers a simple plug-n-play interface to many 16-bit 80-Series colour LCD and OLED displays, and is designed to work with minimal design effort as all of the data and control signals are provided by the chip to interface directly to the display.

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 **DIABLO16** chip provides 16bit data lines D0-D15, with RES, CS, RS and RD/WR signals to interact with the Display.

The **DIABLO16** processor offers a comprehensive set of I/O features and can interface to SPI, I2C, serial, digital, and analog devices, and provides a wealth of features such as PWM, Quadrature, PulseOut and Pin Counter functions. Provision is also made for a dedicated PWM audio output that supports audio WAV files and complex sound generation.

With its specially designed 4DGL high-level graphics language, and its highly optimised soft core virtual engine called EVE, development of graphics applications has never been easier.
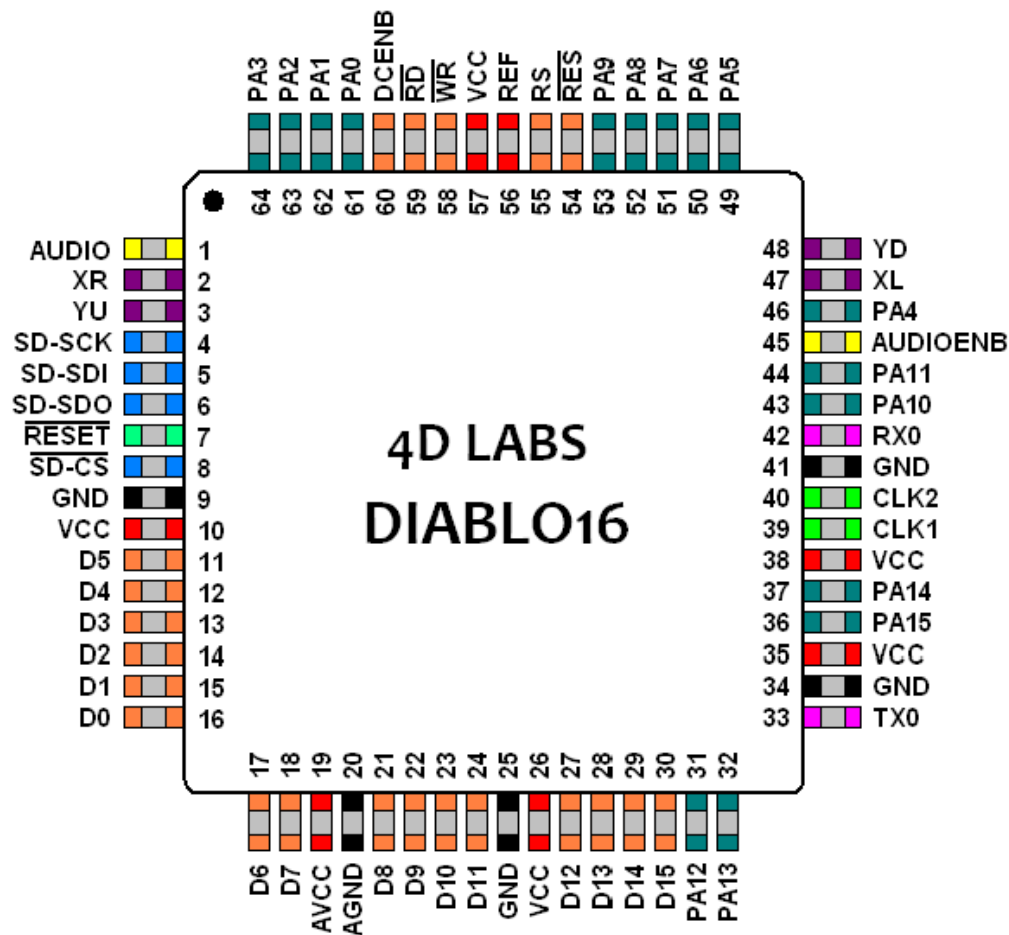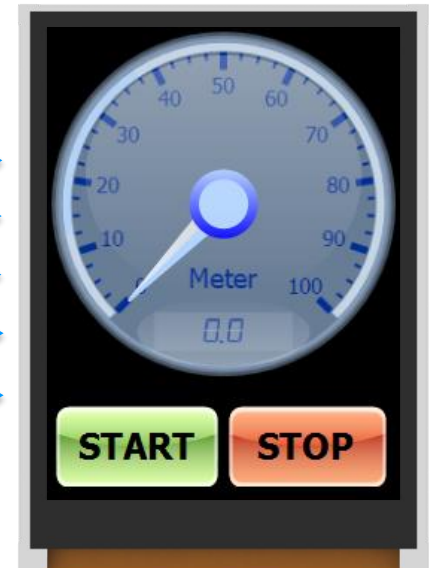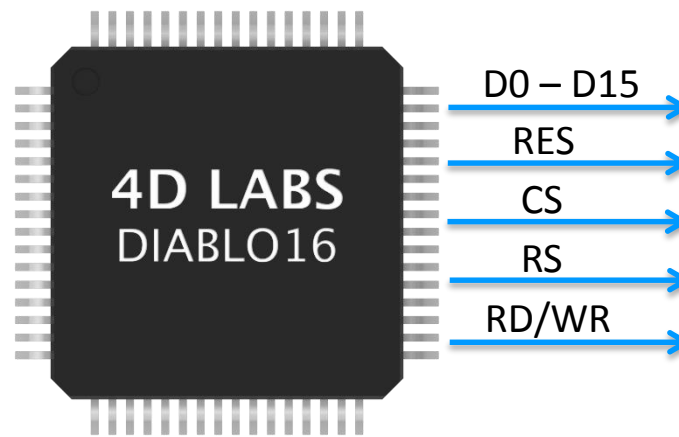
3. Display Interface

The **DIABLO16** makes light work for connecting up 16bit displays, due to it being designed specifically for display interface and graphics.

The **DIABLO16** chip is designed to work with minimal design effort and 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 **DIABLO16** on your application board. This offers enormous advantage to the designer at development time, saving time and money, and takes away all of the burden of low level design.

D0 – D15
RES
CS
RS
RD/WR

4. DIABLO16 Features

01 Supports 80-Series 16 bit wide CPU interface OLED/LCD displays

02 6 banks of 32KB FLASH Memory, 32KB User RAM + 12KB System RAM

03 EVE uses ~1/10th of the code-space compared to most other processor implementations

04 Up to 4 Asynchronous hardware serial ports

05 Up to 4 SPI Channels with 1 dedicated to Memory Card

06 Up to 3 I^2C Channels

07 micro-SD/SDHC card support

08 DOS compatible file access (FAT16)

09 Dedicated 16-bit PWM audio output to play WAV files

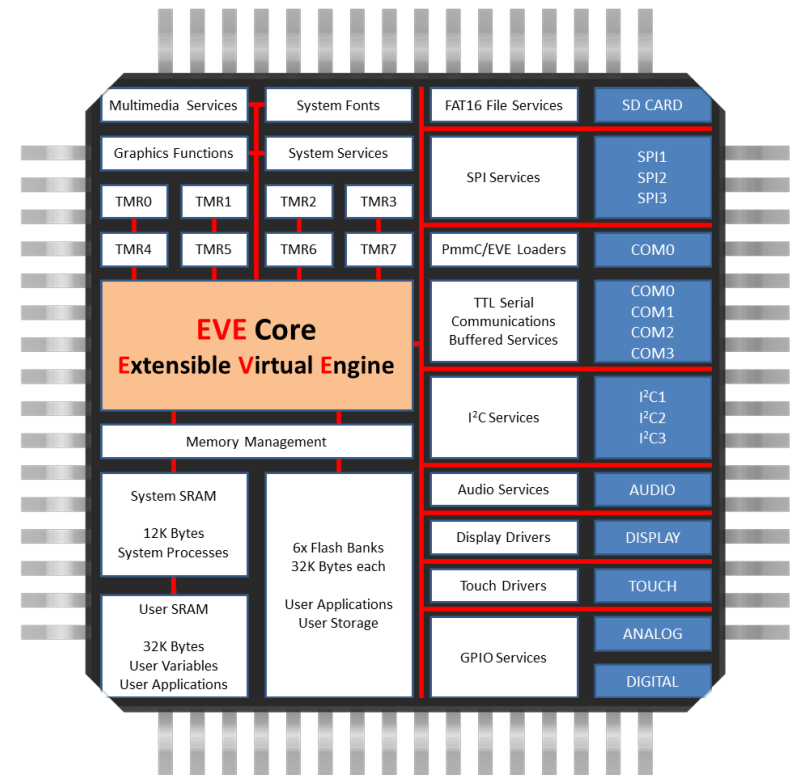10 4-Wire Resistive Touch panel interface

11 16 General Purpose I/O including 4 12-bit Analog Inputs

12 PWM (Simple and Servo) along with Quadrature Input

13 Pin Counters, Pulse Out and Parallel BUS support

14 8 x 16 bit timers with 1ms resolution

15 450+ High Level Internal Functions

5. Getting Started

4D Programming Adaptor

4D Programming Cable
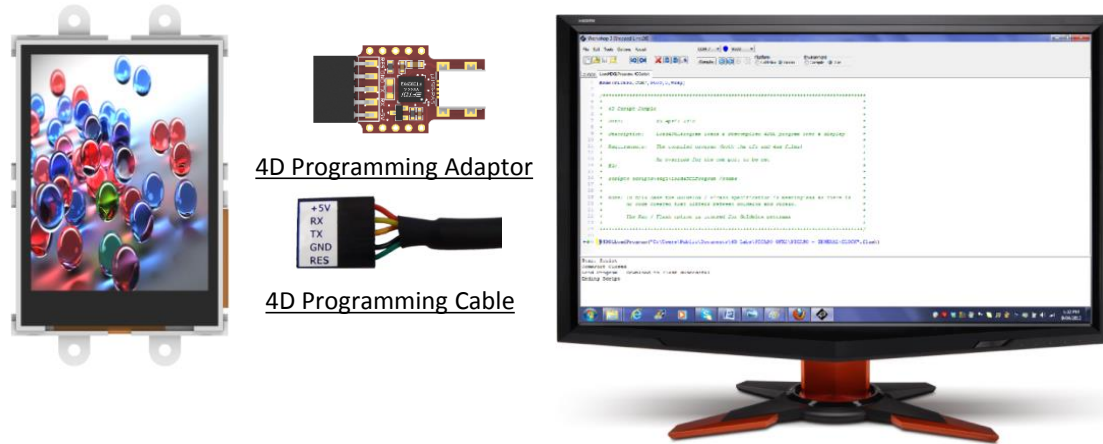
Getting started with a **DIABLO16** Display Module is as simple as connecting the 4D Programming Cable or adaptor to the Display Module, and choosing your Product and Development Environment in the 4D Workshop4 IDE.

4D Workshop4 IDE guides you through the relevant Aid Tools with adequate explanation to get your Application up and running in no time.

6. Development Environment

Workshop4 is a comprehensive software IDE tool suite that provides an integrated software development platform for all of the 4D family of processors and modules. The Workshop4 IDE supports four different **Development Environments** for the user using a DIABLO16, to cater for different requirements and skill level.

Designer: The Designer environment enables the user to write 4DGL code in its natural form to program the µLCD-35DT.

ViSi: A visual programming experience, suitably called ViSi, enables drag-and-drop type placement of objects to assist with 4DGL code generation and allows the user to visualise how the display will look while being developed.

ViSi-Genie: An advanced environment called ViSi-Genie doesn't require any 4DGL coding at all, it is all done automatically for you. Simply lay the display out with the objects you want, set the events to drive them and the code is written for you automatically. ViSi-Genie provides the latest rapid development experience from 4D Systems.

Serial: A Serial environment is also provided to transform the µLCD-70DT into a slave serial module, allowing the user to control the display from any host microcontroller or device with a serial port.

7. 4DGL Language

DIABLO16 driven by **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. Programmers familiar with these languages will feel comfortable 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.

```
#platform "uLCD-32DT"

#inherit "4DGL_16bitColours.fnc"

func main()

    gfx_ScreenMode(PORTRAIT) ; // Orientation

    print("Hello World") ;     // Simple Print Statement

    var rad, colour;

    repeat                       // Main Loop
        rad := 5;
        while(rad < 60)
            colour := RAND();
            gfx_Circle(90, 74, rad, colour);
            gfx_Rectangle(5, 5, rad, rad++, BLUE);
            gfx_Line(90, 74, 20, rad, RED);
            rad := rad + 8;
            pause(20);
        wend
    forever                      // End of Main Loop

endfunc
```
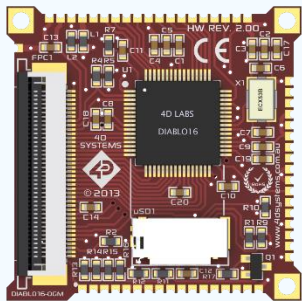
8. Display Modules

4D Systems offers a growing range of display modules in the microLCD range, driven by the DIABLO16 Processor. Details on individual modules could be found from their Product Brief, Datasheet or from the 4D Systems website.

microLCD Range

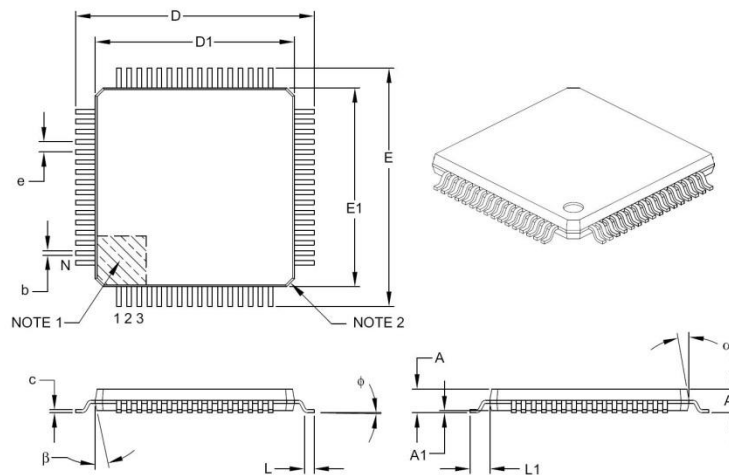DIABLO16-OGM
(Available only via RFQ with MOQ)

µLCD-35DT

µLCD-70DT

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

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

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

    BSC: Basic Dimension. Theoretically exact value shown without tolerances.
    REF: Reference Dimension, usually without tolerance, for information purposes only.

Proprietary Information

The information contained in this document is the property of 4D Systems Pty. Ltd. and may be the subject of patents pending or granted, and must not be copied or disclosed with out prior written permission.

4D Systems endeavours to ensure that the information in this document is correct and fairly stated but does not accept liability for any error or omission. The development of 4D Systems products and services is continuous and published information may not be up to date. It is important to check the current position with 4D Systems. 4D Systems reserves the right to modify, update or makes changes to Specifications or written material without prior notice at any time.

All trademarks belong to their respective owners and are recognised and acknowledged.

Disclaimer of Warranties & Limitation of Liability

4D Systems makes no warranty, either express or implied with respect to any product, and specifically disclaims all other warranties, including, without limitation, warranties for merchantability, non-infringement and fitness for any particular purpose. Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications.

In no event shall 4D Systems be liable to the buyer or to any third party for any indirect, incidental, special, consequential, punitive or exemplary damages (including without limitation lost profits, lost savings, or loss of business opportunity) arising out of or relating to any product or service provided or to be provided by 4D Systems, or the use or inability to use the same, even if 4D Systems has been advised of the possibility of such damages.

4D Systems products are not fault tolerant nor designed, manufactured or intended for use or resale as on line control equipment in hazardous environments requiring fail – safe performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines or weapons systems in which the failure of the product could lead directly to death, personal injury or severe physical or environmental damage ('High Risk Activities'). 4D Systems and its suppliers specifically disclaim any expressed or implied warranty of fitness for High Risk Activities.

Use of 4D Systems' products and devices in 'High Risk Activities' and in any other application is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless 4D Systems from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any 4D Systems intellectual property rights.

For additional information on DIABLO16 Processor, please refer to the DIABLO16 Datasheet or visit 4D Systems website at www.4dsystems.com.au

If you require specific help with a 4D Systems product, information can be sourced from the FAQ and relevant forum threads on the website, or by contacting a direct member of our Tech Support team at 4D Systems at support@4dsystems.com.au

For enquiries regarding sales, distributors, or business relations, please contact Sales at sales@4dsystems.com.au