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Embedded - Microcontrollers - Application Specific: Tailored Solutions for Precision and Performance

Embedded - Microcontrollers - Application Specific represents a category of microcontrollers designed with unique features and capabilities tailored to specific application needs. Unlike general-purpose microcontrollers, application-specific microcontrollers are optimized for particular tasks, offering enhanced performance, efficiency, and functionality to meet the demands of specialized applications.

What Are Embedded - Microcontrollers - Application Specific?

Application specific microcontrollers are engineered to

Details	
Product Status	Active
Applications	Graphics Processor
Core Processor	EVE
Program Memory Type	FLASH (14kB)
Controller Series	-
RAM Size	14K x 8
Interface	I²C, LCD, OLED, SD/SDHC, SPI, TFT, TTL, UART
Number of I/O	13
Voltage - Supply	3V ~ 3.6V
Operating Temperature	-40°C ~ 80°C
Mounting Type	Surface Mount
Package / Case	64-TQFP
Supplier Device Package	64-TQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/4d-systems/picaso

1. Description

The PICASO Processor is a custom embedded 4DGL 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 plug-n-play interface to many 16-bit 80-Series colour LCD and OLED displays.

The 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 PICASO on your application board. This offers enormous advantage to the designer in development time and cost saving and takes away all of the burden of low level design.

The PICASO 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.

The device offers modest but comprehensive I/O features and can interface to I2C, serial, digital, buttons, joystick and many more. Provision is also made for a dedicated PWM audio output that supports audio WAV files and complex sound generation.

All of the display 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.

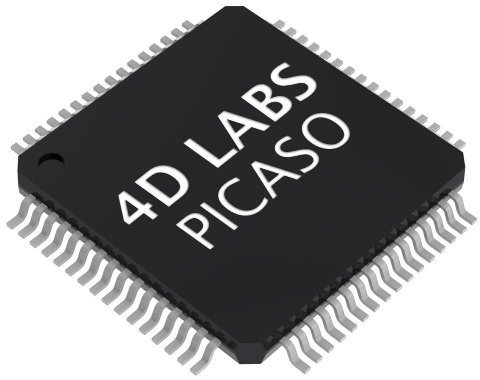
4D Systems software development IDE called Workshop 4 is FREE and there are no licensing requirements.

The PICASO Processor offers one of the most flexible embedded graphics solutions available.

2. Features

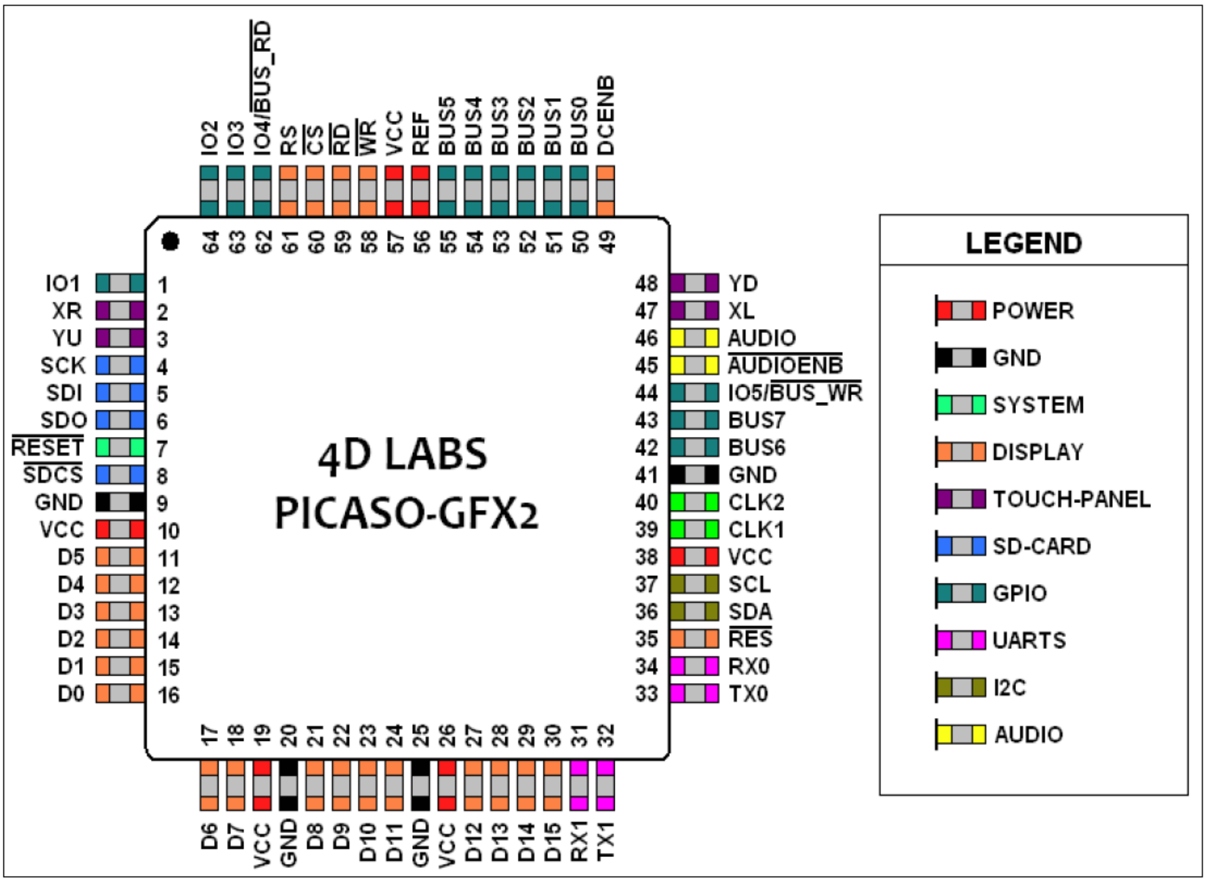
- Low-cost OLED, LCD and TFT display graphics user interface solution.
- Ideal as a standalone embedded graphics processor or interface to any host controller as a graphics co-processor.
- Connect to any colour display that supports an 80-Series 16 bit wide CPU interface. All data and control signals are provided.
- Built in high performance virtual processor core (EVE) with an extensive byte-code instruction set optimised for 4DGL, the high level 4D Graphics Language.
- Comprehensive set of built in graphics and multimedia services.
- Display full colour images, animations, icons and video clips.
- 14KB of Flash memory for user code storage and 14KB of SRAM for user variables.
- 13 Digital I/O pins.
- I2C interface (Master).
- D0….D15, RD, WR, RS, CS – Display interface
- FAT16 file services.
- 2 Asynchronous hardware serial ports with Auto-Baud feature.
- SPI interface support for SDHC/SD memory card for multimedia storage and data logging purposes (micro-SD with up to 2GB and SDHC memory cards starting from 4GB and above).
- 4-Wire Resistive Touch panel interface.
- Audio support for wave files and complex sound generation with a dedicated 16-bit PWM audio output.
- 8 x 16 bit timers with 1 millisecond resolution.
- Single 3.3 Volt Supply @25mA typical.
- Available in a 64 pin TQFP 10mm x 10mm package.
- RoHS compliant.

3. 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 and Smart Home Automation.
- Security and Access control systems.
- Gaming equipment..
- Aviation systems.
- HMI with touch panels.

4. Pin Configuration and Summary



PICASO Processor Pin Out			
Pin	**Symbol**	**I/O**	**Description**
1	IO1	I/O	General Purpose IO1 pin. This pin is 5.0V tolerant.
2	XR	A	4-Wire Resistive Touch Screen Right signal. Connect this pin to XR or X+ signal of the touch panel.
3	YU	A	4-Wire Resistive Touch Screen Up signal. Connect this pin to YU or Y+ signal of the touch panel.
4	SCK	O	SPI Serial Clock output. SD memory card use only. Connect this pin to the SPI Serial Clock (SCK) signal of the memory card.
5	SDI	I	SPI Serial Data Input. SD memory card use only. Connect this pin to the SPI Serial Data Out (SDO) signal of the memory card.
6	SDO	O	SPI Serial Data Output. SD memory card use only. Connect this pin to the SPI Serial Data In (SDI) signal of the memory card.
7	RESET	I	Master Reset signal. Connect a 4.7K resistor from this pin to VCC.
8	SDCS	O	SD Memory-Card Chip Select. SD memory card use only. Connect this pin to the Chip Enable (CS) signal of the memory card.
9, 20, 25, 41	GND	P	Device Ground.
10, 19, 26, 38, 57	VCC	P	Device Positive Supply.

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

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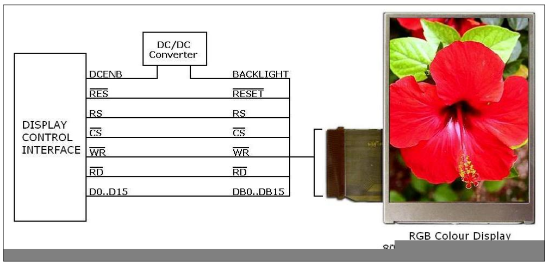
5. Pin Description

The PICASO Processor provides both a hardware and a software interface. This section describes in detail the hardware interface pins of the device.

5.1. Display Interface

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



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 Register or GRAM Data
1	X	X	X	No Operation

Display Operation Table

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

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.

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.

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

DCENB pin (External DC/DC Enable):
DC-DC high voltage enable signal. This maybe the high voltage that drives the LCD backlight or the OLED panel supply.

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

Item	Sym	Min	Typ	Max	Unit
Write Low Pulse	tWL	50	-	-	ns
Write High Pulse	tWH	50	-	-	ns
Write Bus Cycle Total	tWT	100	-	-	ns
Write Data Setup	tDS	25	-	-	ns

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

for more details on PmmC/Firmware programming.

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

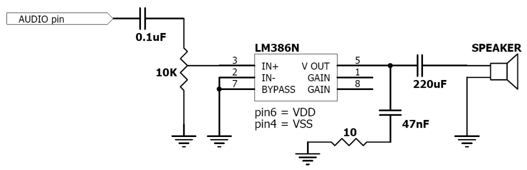
Asynchronous Serial port COM0 receive pin, RX0. Connect this pin to external serial device transmit (Tx) signal. This pin is 5.0V tolerant.

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

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

The exclusive audio support in the PICASO Processor makes it better than its peers in the Graphics processor range. PWM ensures better sound uality 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-4DGL-Internal-Functions.pdf*.

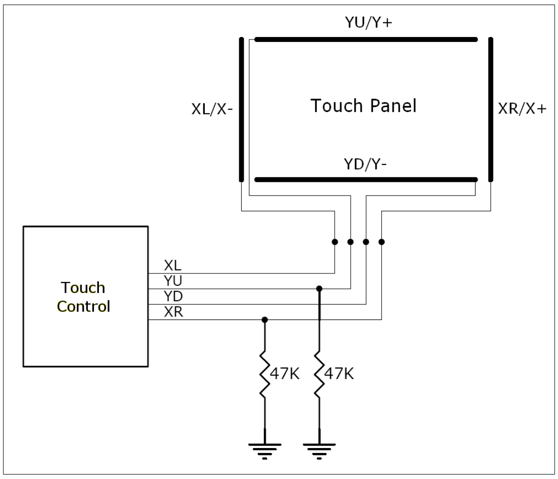
External Amplifier Output pin.This pin provides a 16-bit DAC/PWM audio output to use with an external audio amplifier. Example circuit below provides a low cost implementation. If unused then this pin must be left open or floating.



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

: Enable external Audio amplifier.
: Disable external Audio amplifier.

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



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

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

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

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

There are 13 general purpose Input/Output (GPIO) pins available to the user. These are grouped as IO1..IO5 and BUS0..BUS7. The 5 I/O pins (IO1..IO5), provide flexibility of individual bit operations while the 8 pins (BUS0..BUS7), known as GPIO BUS, serve collectively for byte wise operations. The IO4 and IO5 also act as strobing signals to control the GPIO Bus. GPIO Bus can be read or written by strobing a low pulse (50 nsec duration or greater)