CURTISS WRIGHT Controls, Inc.
Embedded Computing

DUROS /PMC

Ruggedized High Resolution COTS VGA Graphics Controller

Hardware Features

- Silicon Motion SM731 128-bit 2D/3D graphics controller
- Resolution up to 1600 x 1200
- On-board 32-bit, 33/66 MHz PCI interface
- Pixel size is programmable for 8, 16, 24 bits/pixel
- 16 MB SDRAM Graphics Memory
- Hardware scroll, pan, and cursor
- Field programmable VGA BIOS EEPROM
- Conduction Cooled
- Multiple display options
  - Analog VGA output
  - LVDS output
  - Optional DVI output
  - Optional STANAG 3350 A
  - CCIR, RS-170, RS-343A RGB, NTSC/PAL S-Video formats

Software Features

- Microsoft Windows with DirectX.
- X Windows support (Linux)
- SDL Standard Drawing Library (VxWorks and Linux)
- WindML support (VxWorks)

Curtiss Wright Controls Embedding Computing (CWCEC) Real Time Video and Graphics' Duros/PMC is the first ruggedized graphics controller to feature Silicon Motion's 128-bit SM731 graphics accelerator. Using Silicon Motions's SM731 System On a Chip (SOC) graphics accelerator with 16 MB of on-chip SDRAM, the Duros/PMC supports resolutions up to 1600 x 1200 with up to 16.7 million colors (24 bpp). The Duros/PMC supports multiple display options that are detailed in the Output Configurations table on the following page.

CWCEC's comprehensive selection of PMC, CompactPCI, PCI and VME display solutions are designed to satisfy the product life-cycle requirements demanded by the embedded computing market. Likewise, Silicon Motion, has committed to an extended product life for the SM731.

CWCEC'sextensive graphics product line also includes the commercial grade Stratus/PMC board, which adds NTSC/PAL input/output, High Speed RGB input and DVI I/O. Additional CWCEC products feature:

▶ Dual display 64-bit, 33/66 MHz PMC with optional video inputs and USB 2.0

▶ Single, dual, and quad display-only PMC boards

▶ Single display-only PCI, CompactPCI, and VME boards.

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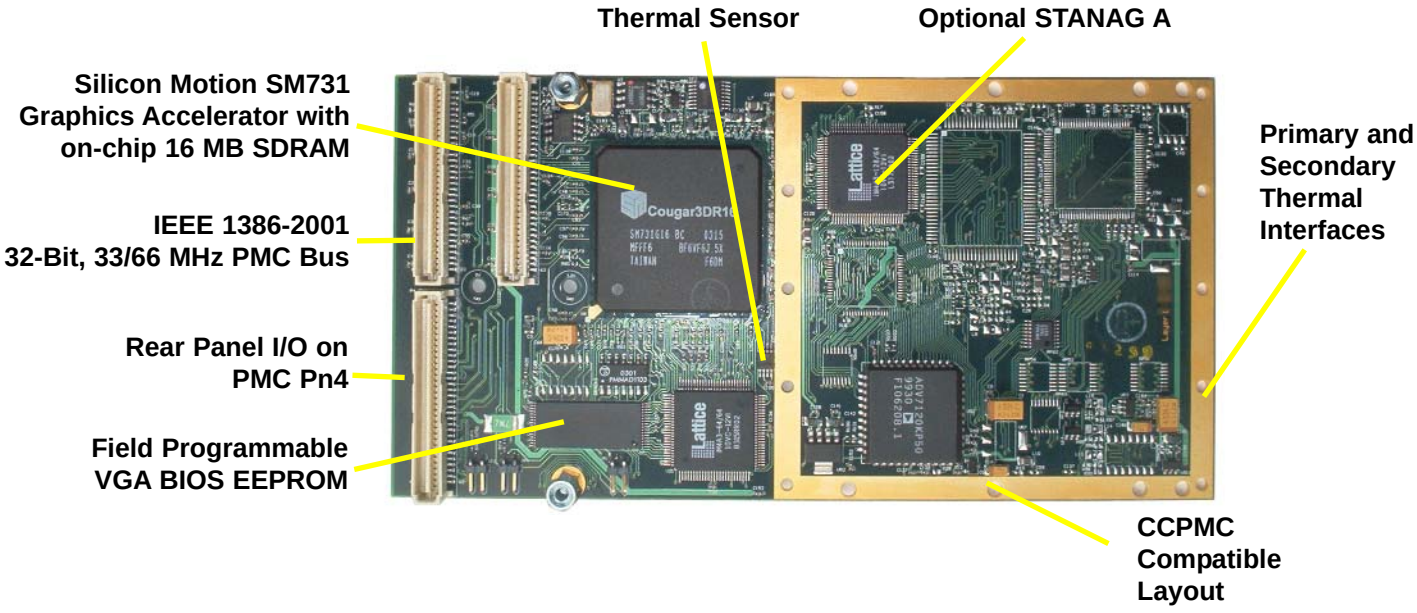
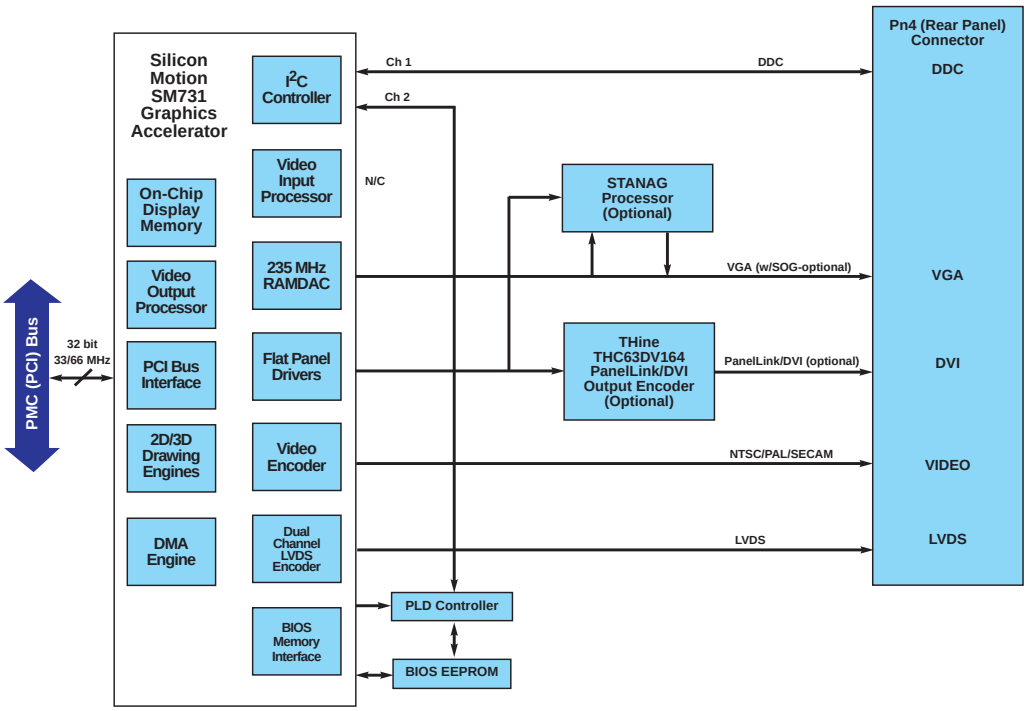


Microsoft® Windows® Embedded Partner

WIND RIVER PARTNER

OpenGL

Duros/PMC Functional Block Diagram



Duros/PMC I/O Standard Configuration

This high performance display controller supports analog VGA, DVI (option) or LVDS output. With the DVI (PanelLink) option, the Duros/PMC can support simultaneous DVI and VGA outputs.

NOTE: A commercial grade version of Duros/PMC, the **Tropos/PMC**, features both front and rear-panel I/O options.

Ruggedization Levels

Class	Grade	Operating Temp.	Storage Temp.	Vibration	Shock	Humidity	Salt Fog	Sockets	Conformally Coated
Class 2	Rugged, Air Force	-40°C to +75°C 600 Linear ft/minute air flow	-55°C to +85°C	Random, $0.04g^2$/Hz from 5 to 2000Hz per MIL-STD-810E	30g peak sawtooth, 11 mS duration	Operating: Up to 90% Non-Condensing	Yes	No	Yes
Class 3	Rugged, Conduction Cooled	-40°C to +85°C at thermal interface	-55°C to +85°C	Random, $0.01g^2$/Hz from 5 to 2000Hz per MIL-STD-810E	40g peak sawtooth, 11 mS duration	Operating: Up to 90% Non-Condensing	Yes	No	Yes

*Class 1 version is **Tropos/PMC**. See Tropos/PMC datasheet for more information. STANAG A not available.

Technical Overview

Introduction

The Duros/PMC contains two functional blocks: a Silicon Motion SM731 graphics controller and the BIOS programmer.

System On a Chip Graphics Accelerator

The Duros/PMC is powered by a Silicon Motion SM731 SOC graphics accelerator. It includes a 32-bit, 33/66 MHz PCI bus, DMA controller, and a 235 MHz RAMDAC. It supports all ACPI power states. The SM731 includes 16 MB of on-chip SDRAM operating at up to 150 MHz. It provides sufficient bandwidth to concurrently support large displays and other graphics and video processing functions.

The chip's 128-bit Drawing Engine supports 3 ROPs, BitBLT, color expansion, and line draw. The SM731 incorporates an IEEE Floating Point Setup engine as well as a complete 3D rendering engine. The 3D pipeline allows setup of 6M triangles/second and rasterization of 125 Mpix/second. The SM731's dual pipe texture engine can output 250 Mtex/second.

The SM731's power management system intelligently manages operating parameters of the chip's major functional blocks. It enables the system to lower the clock frequency and voltage in unused blocks to significantly reduce power consumption, even during during normal operation.

The programmable video timing ranges from 30 to 150 Hz vertical and 15.7 to 100 kHz horizontal refresh rates, with a pixel clock up to 235 MHz, giving display formats up to 1600 x 100 x 24 bpp.

The graphics display output uses an internal RAMDAC which integrates the graphics and 64 x 64 x 2 bit cursor pixels into 24-bit color values (8 bits each of RGB). The analog signals from the RAMDAC are connected to a standard RGBHV (VGA) monitor. I^2C/DDC lines enable the host computer to control the monitor and local peripheral devices.

Field Programmable BIOS

BIOS EEPROM field programming is provided by an on-board PLD. The SM731's auxiliary I^2C port is used to drive the PROM's data and address lines and control the write operation.

Product Specifications

Graphics Controllers	Silicon Motion SM731, 32-bit, 33/66 MHz PCI
Maximum Dot Clock	235 MHz
Horizontal Scan Rates	31.5 to 115 kHz
Display memory	16 MB SDRAM
Display Colors	16.7 Million @ 24-bits, 256 @ 8-bits
Environment	See "Ruggedization Levels" Table
Power Requirements	+3.3V ±5%, 1 A (est), +5V ±5%, .3 A (est)
Compatibility	IEEE 1386-2001, 32-bit, 33/66 MHz Universal PCI Bus signaling (5V and 3.3V)
PCI Device IDs and Interrupts	SM731 IDSEL = PMC IDSEL, INTA LM75 INTB
PCI Subsystem Vendor ID	0x10F0 (Vendor Code)
PCI Subsystem Device ID	0x00C7 (Duros/PMC Identifier)
Dimensions	149 mm x 74 mm
Board Connections	
Rear (PMC Pn4)	64 pin PMC connector
Cautionary Note	**Pn4 off-board connections require inner-layer signal+ground pairs.**
Analog Monitor Support	

Resolution	Vertical Scan Rate	
640 x 480	VGA	150+ Hz
800 x 600	SVGA	150+ Hz
1024 x 768	UVGA	142 Hz
1280 x 1024	SXGA	107 Hz
1600 x 1200	UXGA	91 Hz

STANAG	STANAG 3350 A Analog Video Standard support (option)
Software Support	SDL Subroutine Library Package for Linux and VxWorks. WindML for VxWorks. Windows 2K/XP drivers. XFree86 for Linux
VGA BIOS	Allows board to function as system console.
Maintenance Features	DDC-2B control enables system software to interrogate monitor for type and capabilities; RAMDAC sense function can detect monitor connections; LM75 thermal sensor can report board temp.
Power-management capabilities	Depending on underlying operating system support, most devices can be at least partially powered down.

Ordering Information

Standard Configuration:

Duros/PMC
Silicon Motion SM731 Graphics Accelerator, 16 MB SDRAM, hardware pan, scroll, and zoom, cursor, analog (VGA) and LVDS output.

/R2 (See Ruggedization Levels Table)

/R3 (See Ruggedization Levels Table)

NOTE: Laboratory Grade is **Tropos/PMC**. Features front and rear I/O options. STANAG A not available with Tropos/PMC.

Hardware Option

/STN
STANAG 3350 A Analog Video.

Software:

SDL/Duros
SDL (Standard Drawing Library) Subroutine Library Package with C-callable graphics library for VxWorks, and Linux. Includes BIT and Thermal Sensor support.

DRV/WIN
Driver for Windows systems (2K/XP).

WML
Driver for Wind River's WindML.

XFree86
Linux/XFree86 release.

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