

## PicPort<sup>®</sup>-X-CL PicPort<sup>®</sup>-X-CL-PMC PicPort<sup>®</sup>-Express-CL

### Frame grabber for

- PCI-Express bus x1 or x4 or PCI/PCI-X  
Bus as standard board or PMC module
- Camera Link cameras
- Up to 2 base or 1 medium cameras
- Input/output for trigger, flash and shaft encoder
- Camera power – PoCL SafePower
- On-board Real-Time Function support
- Up to 512 MB 1 GB/s frame buffer
- Multi-taps/packed pixel reformatting
- 2 hardware LUTs
- LV-SDS and 3<sup>rd</sup> party software support



**Leutron**  
Vision



# Architecture

**PicPort®-Express-CL, PicPort®-X-CL and PicPort®-X-CL-PMC** are members of the LV Camera Link family of products. Each member of this family is a multiple camera frame grabber which supports the Camera Link standard interface. This high-speed board can be used with both line-scan and area-scan Camera Link compatible cameras. It is suitable for both color and monochrome applications and supports high-speed and high-resolution. **PicPort®-CL** family is cost effective, compact and high performance, meeting the demanding requirements of diverse image processing and machine vision applications.

## Overview

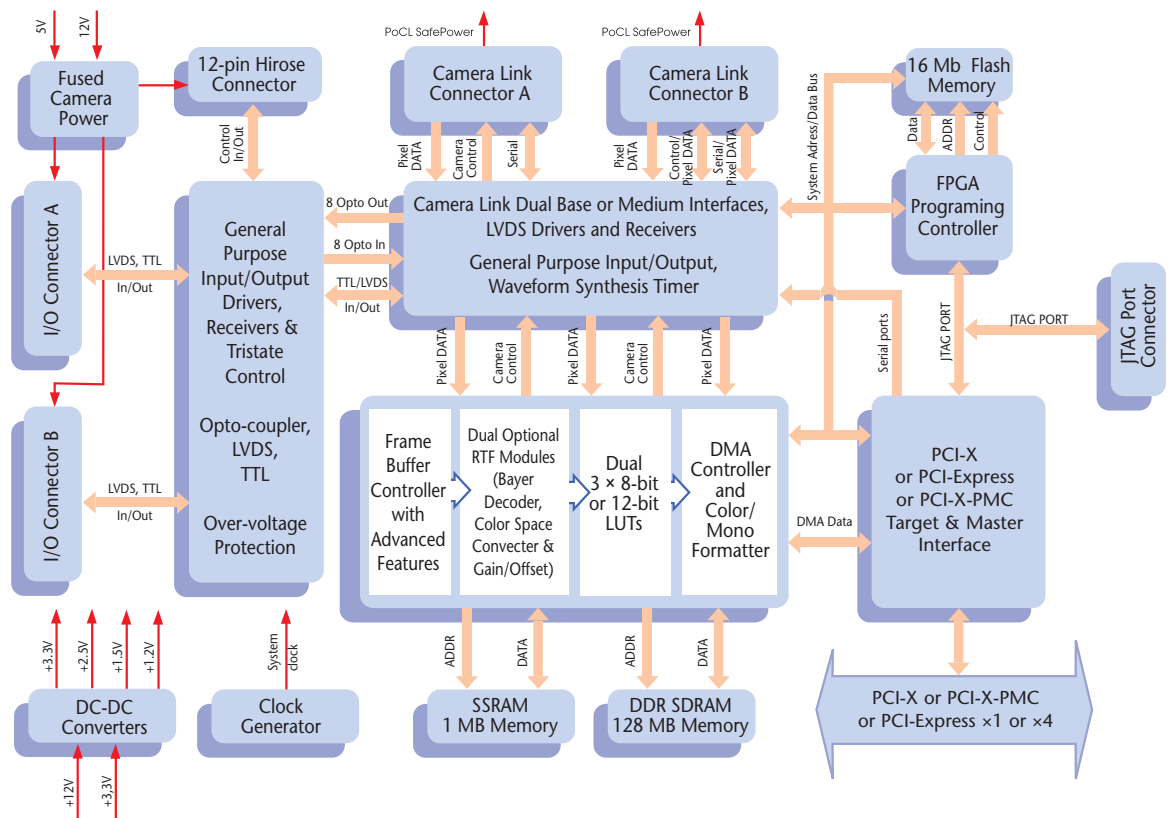
A comprehensive array of on-board features include Camera Link interface for 2 base or 1 medium cameras at up to 85 MHz, large LUTs, Bayer color decoder, Color space matrix converter, 1D/2D gain/offset correction, multi-taps/packed pixel reformatting, color/monochrome format conversion, up to 512 MB 1GB/s frame buffer with advanced features and PCI/PCI Express x1 or x4/PMC bus interface with 4 DMA channels. The frame buffer ensures no data loss under varying

operating system conditions by virtue of its memory size and its ability to generate interrupts to the user application that flag dynamic image buffer watermark depth thresholds.

LV Camera Link frame grabber architecture is user friendly, employing innovative re-programmable flash memory and FPGA (Field Programmable Gate Array) technologies.

This allows the user to reconfigure the on-board hardware via downloadable software updates. The flash memory can also be used for security coding to prevent unauthorized copying of user application proprietary technology.

The **PicPort®-CL** architecture block diagram



# Image Acquisition & Conditioning

## Camera Link Interfaces

Depending on board model, LV Camera Link frame grabber supports 1 or 2 base ( $3 \times 8$ -bit or  $2 \times 8/10/12$ -bit or  $1 \times 8/10/12/14/16$ -bit monochrome or 24-bit RGB) or one medium ( $4 \times 8/10/12$ -bit monochrome or 30/36-bit RGB). Area-scan up to  $64K \times 64K$  and line-scan up to  $64K \times \text{infinity}$  with input frequencies up to 85 MHz.

Camera Link control lines for asynchronous reset and exposure control.

Camera Link serial ports for camera setup and control.

## General Purpose input/output Interfaces

Camera power, LVDS/TTL and opto-coupler input/outputs are accessible via the PCI backplate 12-pin Hirose connector or via two 26-pin header sockets on the PCB top edge. Assemblies consisting of ribbon cable to DB-25 connectors mounted on PCI backplate (these can be disassembled to mount on chassis cut-outs) may also be ordered.

4 LVDS and TTL input/output pairs share the same physical pins. Selection of the desired functionality such as trigger input, flash control output or shaft encoder input is performed via software setup. Facilities are provided for shaft encoder use including negative rotation compensation and input pulse programmable divider, thus avoiding costly additional control hardware. Some of the input/output pairs of the header connectors are replicated on the 12-pin Hirose connector.

8 opto-coupler inputs and 8 outputs are provided on the header connectors. These have built-in resistors to minimize external components.

All I/O pins are protected by over/under voltage protection devices clamping to +5 V and ground.

## Camera Power

PoCL SafePower is supported for each Camera Link connector, providing +12V at up to 400mA on each. PoCL allows the camera to be powered by the frame grabber along the Camera Link cable. This allows a single cable solution to provide power and data, useful in low cost applications.

SafePower is a protocol to prevent the frame grabber from attempting to supply power to a conventional cable or camera.

Camera power is provided for 2 cameras: +12 V factory defaults, while either of the outputs is hardware changeable for +5 V. These are available on both Hirose and header connectors. Resettable fuses of 1 A are provided for both voltages.

## LUTs

2 LUTs are provided for user configuration as dual  $4K \times 12$ -bit or dual  $256 \times 8 \times 3$ .

*Note: only one instead of two LUTs is available for any Mono (PicPort®-X-CL-Mono/PicPort®-Express-CL-Mono/PicPort®-X-CL-Mono-PMC), resulting in half the LUTs mentioned above for this model.*

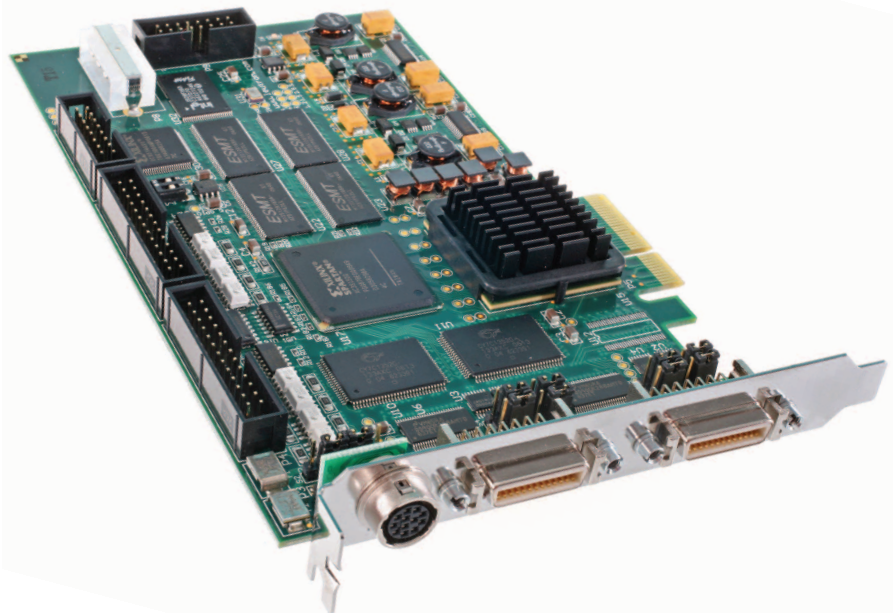
## Real-Time Functions

Real time functions are available in some board configurations.

A **Bayer Color Decoder** provides high-speed decoding of the Bayer pattern output by many color cameras.

A **Color Space Matrix Converter** provides high-speed conversion of RGB color components in order to obtain an optimum color mix for RGB and Bayer color cameras.

**1-Dimensional and 2-Dimensional Gain/Offset Correction** provides high-speed per-pixel correction based on per-pixel gain & offset parameters. Monochrome, Bayer color and RGB color cameras are supported.





# Data Storage and Transfer

## Frame Buffer

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A frame buffer (up to 512 MB) is provided to buffer and reformat the pixel data grabbed from the camera, before passing it to the PCI-X/PCI-Express/PMC bus DMA.

A sophisticated controller facilitates combining of camera taps into a raster output to the PCI-Express DMA. Features include:

- auto line and frame length detection
- multi-tap pixel rasterization
- buffer fill level water mark interrupt
- excellent bandwidth of up to 1 GB/s

## DMA Controller

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Output data from the Frame Buffer is passed to the DMA controller. This innovative design allows up to 4 DMA channels to be user defined, controlling data burst transfers over the PCI-X/PCI-Express/PMC bus. Each DMA channel can also define a Region-Of-Interest within the data stream.

In conjunction with the color/monochrome data format, various formats of the image data can be transferred to host memory or graphic display memory.

## Host Bus Interface

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- PCI-X version of the frame grabber provides interface to the standard PCI bus and PCI-X bus
- PCI-Express version of the frame grabber provides a PCI-Express x1 or x4 interface. This provides hi-end PCI-Express bus bandwidth at an affordable price
- PCI-PMC version of the frame grabber provides interface to the PMC bus (PCI-X)

## Flash Memory Controller

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The on-board flash memory stores the various configurations of the board that are loaded at power-up and also any software technology security information (software dongle).

## Configurations

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PicPort®-X-CL exists in following different fixed configurations:

- **PicPort®-X-CL-Mono:** with one base input
- **PicPort®-X-CL-Stereo:** with 2 base or one medium input
- **PicPort®-X-CL-Mono-RTF:** supports 1 base input with on-board Real-Time Function features
- **PicPort®-X-CL-Stereo-RTF:** supports 2 base or 1 medium input with on-board Real-Time Function features

PicPort®-Express-CL exists in following different fixed configurations:

- **PicPort®-Express-CL-Mono:** with one base input
- **PicPort®-Express-CL-Stereo:** with 2 base or one medium input
- **PicPort®-Express-CL-Mono-RTF:** supports 1 base input with on-board Real-Time Function features
- **PicPort®-Express-CL-Stereo-RTF:** supports 2 base or 1 medium input with on-board Real-Time Function features

PicPort®-X-CL-PMC exists in following different fixed configurations:

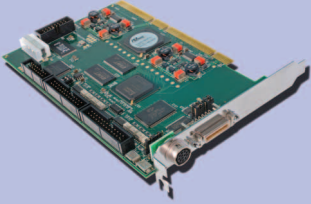
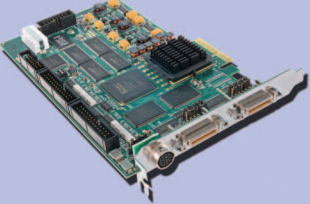

- **PicPort®-X-CL-PMC-Mono:** with one base input
- **PicPort®-X-CL-PMC-Stereo:** with 2 base or one medium input
- **PicPort®-X-CL-PMC-Mono-RTF:** supports 1 base input with on-board Real-Time Function features
- **PicPort®-X-CL-PMC-Stereo-RTF:** supports 2 base or 1 medium input with on-board Real-Time Function features

## Applications

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- industrial image processing
- web inspection
- traffic vision systems
- medical imaging
- and many more...

# PicPort®-CL Family

	PicPort®-X	PicPort®-Express	PicPort®-X-PMC
	Standard PCI Board PCI/PCI-X, 32/64 bit up to 133 MHz	PCI-Express x1 or x4	PMC Module PCI/PCI-X, 32/64 bit up to 133 MHz
			
<b>ALL</b>	<p>24 bit Camera Link-interface with PoCL (Power over Camera Link) capability TTL/LVDS and opto-coupler input/outputs FPGA (software updates) and Flash memory (with capability to use for security coding to prevent unauthorized usage) Frame buffer features:</p> <ul style="list-style-type: none"> <li>• Low-latency input/output</li> <li>• Multi-tap combining</li> <li>• Up to 64k × 64k area-scan</li> <li>• Up to 64k × infinity line-scan</li> <li>• Image fill level interrupt</li> </ul> <p>Hardware LUTs (lookup tables) 100% compatible with all of the Leutron Vision products Windows 2K/XP/Vista (32/64 bit), Linux (32/64 bit) and VxWorks ready 3rd-party development tools ready: Halcon 6, Halcon 7, Halcon 8 (32/64 bit), ActivVisionTools, Neurocheck, Common Vision Blox</p>		
<b>RTF</b>	<p><b>Real Time Functions</b></p> <ul style="list-style-type: none"> <li>• Bayer color decoder (interpolation in 5×5 matrix using a treshold-based variable number of gradients)</li> <li>• Color Space Matrix Converter</li> <li>• 1 and 2-dimensional Gain/Offset Correction</li> <li>• Shading Correction (per pixel)</li> </ul>		
<b>MONO</b>	<ul style="list-style-type: none"> <li>• 1 camera in base mode</li> <li>• single LUT</li> <li>• up to 256 MB (default 32 MB) DDR Sdram, 512 KB SSRAM and 16 Mb flash on-board memory</li> </ul>		
<b>STEREO</b>	<ul style="list-style-type: none"> <li>• 2 cameras in base CL mode or 1 camera in medium CL mode</li> <li>• 2 LUTs</li> <li>• up to 512 MB (default 64 MB) DDR Sdram, 1 MB SSRAM and 16 Mb flash on-board memory</li> </ul>		



# Software

## Driver Software

Leutron Vision Software Development Suite, LV-SDS, is a software development suite (Windows, Linux, VxWorks) that allows full control of all PicPort®/PicSight® (GigE/USB) and PicProdigy® products. The package consists of Daisy – the basic software interface for PicPort®/PicProdigy® cards, Camera Editor – easy interactive setup of standard and non-standard cameras, DRAL – a library for handling specific time-critical tasks, Orchid – high level library (DLL or OCX or .NET) for quick and easy design of PicPort®/PicProdigy®/PicSight® (GigE/USB) applications, TWAIN Driver and Video for Windows – provide a simple interface between Leutron Vision hardware and other office and image manipulation programs (e.g. MS Office, CorelDRAW, etc.).

The software products come complete with a set of demo programs and additional examples with source code as a guide to the programmer in developing particular applications. To obtain more comprehensive information please download the LV-SDS documentation from [www.leutron.com/download](http://www.leutron.com/download).

## Third Party Software

Several well-known third party packages for real-time image processing and analysis are also supported. The packages include HALCON, ActivisionTools, NeuroCheck, and others. Please refer to our detailed software brochure for more details.

# Technical Specifications

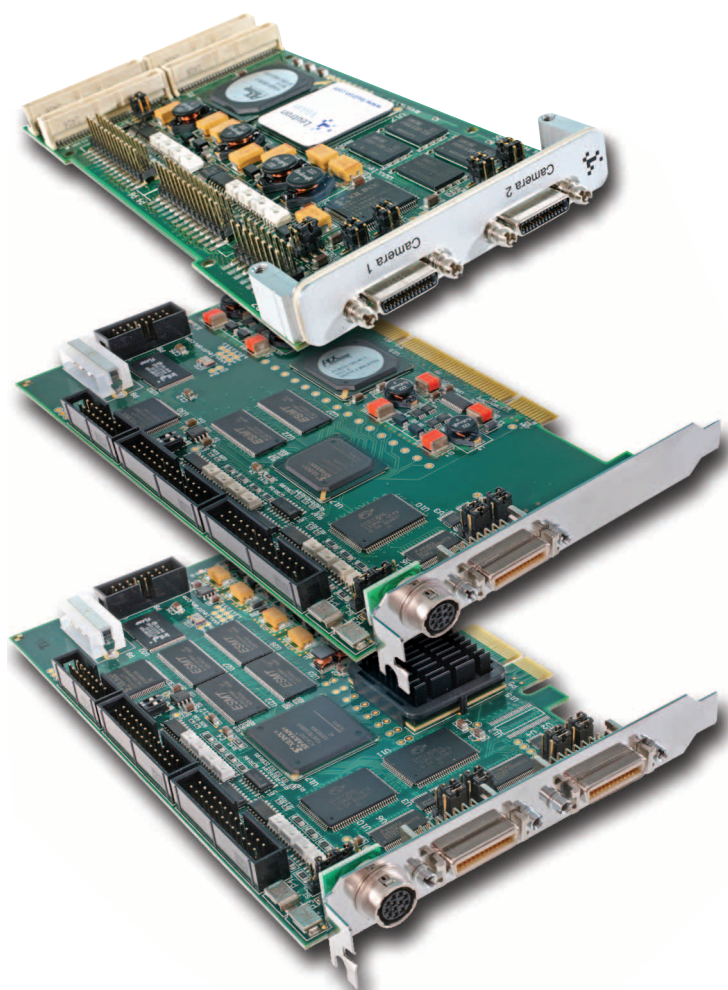
	PicPort®-CL-Mono PicPort®-CL-Mono-RTF	PicPort®-CL-Stereo PicPort®-CL-Stereo-RTF		PicPort®-CL-Mono PicPort®-CL-Mono-RTF	PicPort®-CL-Stereo PicPort®-CL-Stereo-RTF
<b>Camera Link modes</b>	Base		<b>Bayer color decoder</b>	RTF version only	
<b>Multiple Camera Link inputs</b>	1 in base mode	2 in base mode 1 in medium mode	<b>Shading correction (per pixel)</b>	RTF version only	
<b>Camera Link acquisition rate</b>	Up to 85 MHz per input		<b>TTL inputs*</b>	8	
<b>Camera scan modes</b>	Area-scan or line-scan		<b>TTL outputs*</b>	10	
<b>PCI form factor</b>	PCI-X/PCI-Express: PCI short card, PCI-X-PMC: PMC		<b>LVDS inputs*</b>	4	
<b>PCI interface</b>	PCI-X/PCI-X-PMC: PCI-X/PCI 32/64 bit, up to 133 MHz PCI-Express: PCIe x1 or x4		<b>LVDS outputs*</b>	4	
<b>PCI transfer rate</b>	PCI-X/PCI-X-PMC: 533MB/sec. peak, 360MB/sec. sus. PCI-Express: x1: up to 200MB/s, x4: up to 800MB/s		<b>Opto coupled inputs</b>	8	
<b>PCI DMA channels</b>	Up to 4 with independent ROI		<b>Opto coupled outputs</b>	8	
<b>On-board memory</b>	up to 256MB (default 32MB) 512 KB SSRAM 16 Mb flash	up to 512MB (default 64MB) 1 MB SSRAM 16 Mb flash	<b>Camera power</b>	Hirose connector: +12 V @ 1.5A (+5 V option) Camera Link connectors: +12 V @ 400mA PoCL SafePower	
<b>Color/monochrome data conversion</b>	RGB or monochrome target formats with various depths and data packing options		<b>Camera power protection</b>	Hirose connector: resettable fuse Camera Link connectors: PoCL SafePower	
<b>LUTs</b>	Single	Dual	<b>Hardware technology</b>	FPGA user re-programmable	
<b>Frame buffer bandwidth</b>	500 MB/s	1 GB/s	<b>Board power requirements (excluding camera power)</b>	Total 7.62 W (9.24 W for two connected cameras): 3.3 V @ 1000 mA (1200 mA) 12 V @ 360 mA (440 mA)	
<b>Frame buffer features</b>	Low-latency input/output Multi-tap combining, Up to 64Kx64K area-scan Up to 64Kxinfinity line-scan, Image fill level interrupt		<b>Operating temperature range</b>	0 °C to 70 °C	
			<b>Relative humidity</b>	Up to 95% (non-condensing)	
			<b>FCC</b>	Class A	
			<b>CE</b>	Class A	
			<b>Dimensions</b>	PCI, PCIe: 16.5x11 cm, PCI-PMC: 7.5x15 cm	

\* LVDS and TTL inputs and outputs share common pins and hence only one format can be selected for each pair of pins.

# Ordering Information

	PCI	PCI Express ×1	PCI Express ×4	PMC Module
	PCI bus or PCI-X bus	up to 200 MB/s PCI rate	PCI-Express bus ×4	standard PCI bus or PCI-X bus (32 bit/64 bit)
<b>PicPort®-CL-Mono/32/PoCL</b>	11121	11201	11211	-----
	CameraLink Frame grabber, 1 base input, 85MHz, multitap area/linescan, 32MB DDR-SDRAM, 512kB LUT, various TTL, LVDS and optoisolated I/O, PoCL SafePower			
<b>PicPort®-CL-Mono-RTF/32/PoCL</b>	11131	11221	11231	-----
	CameraLink Frame grabber, 1 base input, 85MHz, multitap area/linescan, 32MB DDR-SDRAM, 512kB LUT, various TTL, LVDS and optoisolated I/O, RealTime functions implemented in onboard FPGA, PoCL SafePower			
<b>PicPort®-CL-Stereo/64/PoCL</b>	11141	11251	11261	-----
	CameraLink Frame grabber, 2 base- or 1 medium input, 85MHz, multitap area/linescan, 64MB DDR-SDRAM, 1MB LUT, various TTL, LVDS and optoisolated I/O, PoCL SafePower			
<b>PicPort®-CL-Stereo-RTF/64/PoCL</b>	11151	11271	11281	-----
	CameraLink Frame grabber, 2 base- or 1 medium input, 85MHz, multitap area/linescan, 64MB DDR-SDRAM, 1MB LUT, various TTL, LVDS and optoisolated I/O, RealTime functions implemented in onboard FPGA, PoCL SafePower			
<b>PicPort®-CL-Mono/64-PMC/PoCL</b>	-----	-----	-----	11127
	CameraLink Frame grabber, 1 base input, 85MHz, multitap area/linescan, 64MB DDR-SDRAM, 512kB LUT, various TTL, LVDS and optoisolated I/O, PoCL SafePower, for use as PMC-Module			
<b>PicPort®-CL-Mono-RTF/64-PMC/PoCL</b>	-----	-----	-----	11137
	CameraLink Frame grabber, 1 base input, 85MHz, multitap area/linescan, 64MB DDR-SDRAM, 512kB LUT, various TTL, LVDS and optoisolated I/O, RealTime functions implemented in onboard FPGA, PoCL SafePower, for use as PMC-Module			
<b>PicPort®-CL-Stereo/128-PMC/PoCL</b>	-----	-----	-----	11147
	CameraLink Frame grabber, 2 base- or 1 medium input, 85MHz, multitap area/linescan, 128MB DDR-SDRAM, 1MB LUT, various TTL, LVDS and optoisolated I/O, PoCL SafePower, for use as PMC-Module			
<b>PicPort®-CL-Stereo-RTF/128-PMC/PoCL</b>	-----	-----	-----	11157
	CameraLink Frame grabber, 2 base- or 1 medium input, 85MHz, multitap area/linescan, 128MB DDR-SDRAM, 1MB LUT, various TTL, LVDS and optoisolated I/O, RealTime functions implemented in onboard FPGA, PoCL SafePower, for use as PMC-Module			

All information in this document is subject to change without prior notice.



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