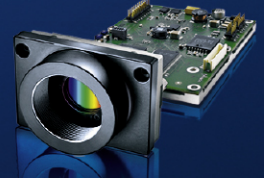


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Components

The Smart Camera People

VCSBC Quadro Single Board Operating Manual

**Hardware specifications and special software functions of SBC
Quadro Single Board Smart Camera**

Revision 1.2 – 10 Apr 2014

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Foreword and Disclaimer

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Please also consult the following resources for further reference:

“[Knowledge Base / FAQ](#)” for a searchable data base of SW and HW questions / answers

Description	Title on Website	Download Area on VC website
 Quick start Manual for VC camera set up and programming	 Getting Started VC Smart Cameras with TI DSP	Service & Support > Download Center
 Schnellstart VC – deutsche Version of „Getting Started VC“.	 Schnellstart VC Smart Kameras	Service & Support > Download Center
Introduction to VC Smart Camera programming	 Programming Tutorial for VC20XX and VC40XX Cameras	Service & Support > Download Center
Demo programs and sample code used in the Programming Tutorial	 Tutorial Code	Service & Support > Download Center
VC40xx Hardware Manual	 VC40XX Smart Cameras Hardware Documentation	Service & Support > Download Center
VCRT Operation System Functions Manual	 VCRT 5.0 Software Manual	Service & Support > Download Center
VCRT Operation System TCP/IP Functions Manual	 VCRT 5.0 TCP/IP Manual	Service & Support > Download Center
VCLIB 2.0 /3.0 Image Processing Library Manual	 VCLIB 2.0/ 3.0 Software Manual	Service & Support > Download Center



- The Light bulb highlights hints and ideas that may be helpful for a development.



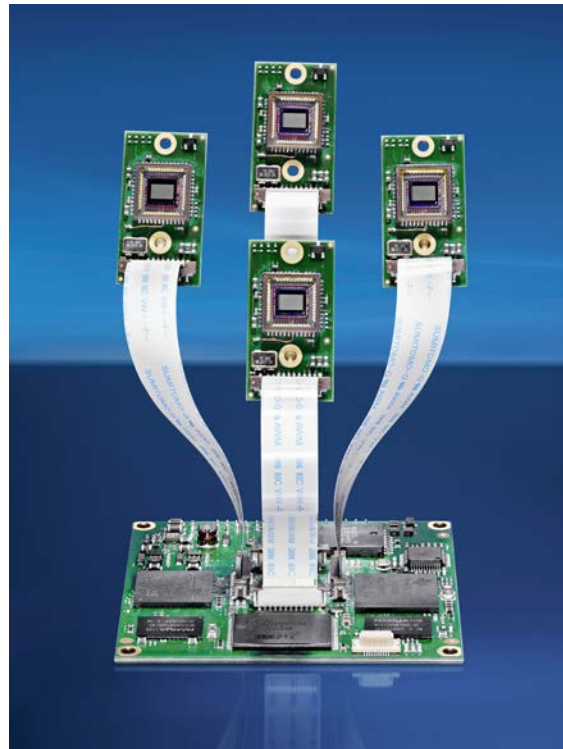
- This warning sign alerts of possible pitfalls to avoid. Please pay careful attention to sections marked with this sign.

Author: VC Support, <mailto:support@vision-comp.com>

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1 General Information



VCSBC Quadro Smart Camera

The **VCSBC Quadro Smart Camera** have been designed for high resolution image processing with a very small form factor. They are the ideal compromise between high performance and low system costs, and thus especially suited for high volume OEM applications. This makes them viable to use a smart camera in even more products than before.

Employing 1 to 4 CMOS sensors, the image resolution can be changed to the ROI required.

Like with all VC Smart Cameras with Texas Instruments DSP, the operation system VCRT allows multi-tasking. This means for instance that user interface commands can execute in parallel without stopping the inspection process. It is also possible to transfer live images via TCP/IP using a background task.

The **VCSBC Quadro Series Smart Cameras** offer an inexpensive entrance into the world of the high performance intelligent cameras. It has a video output onto a PC via 100MBit Ethernet interface, a high speed trigger input and output, 3.3V digital Inputs and outputs.

The low power consumption of only 3.5W makes this camera ideally suitable for use in mobile devices.

2 Technical Specifications

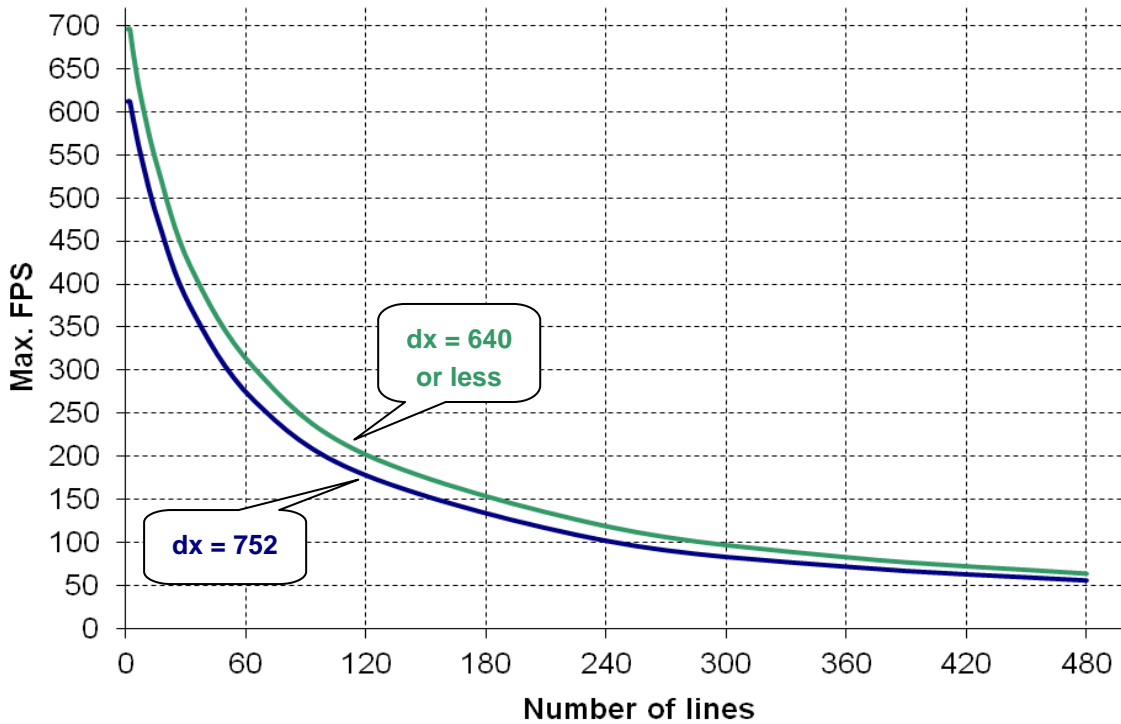
2.1 Technical Specifications VCSBC Quadro 6210

Component / Feature	Specification
CMOS Sensor:	1x - 4x 1/3" Aptina MT9V034 - also available with color sensor (Bayer Filter)
Active pixels:	752(H) x 480(V) (Wide VGA)
Pixel size:	6.0(H) x 6.0(V) μm
Active imager size:	4.51(H) x 2.88(V) mm
High-speed shutter:	34 μs + steps of 34 μs
Low-speed shutter:	up to 2 sec. adjustable integration time
Integration:	Global shutter
Picture taking:	program-controlled or external high speed trigger, full-frame (55 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	27 MHz / 10 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6435 "Da Vinci" DSP 700 MHz, 5600MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 300 full-size grey value images in format 752 x 480
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
LVC MOS IOs:	4 Inputs, 4 Outputs, trigger Input, flash output
Ethernet interface:	10/100 Mbit
Serial interface:	Yes
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0... +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V DC, max. 300 mA
Power Consumption	$\approx 3.5\text{W}$

The following diagram shows the **maximum** reachable (with the shortest shutter time) framerate according to the number of captured lines for the **VCSCB6210 Quadro**, in 2 cases:

- with an image width of 752 pixels
- with an image width of 640 pixels or less

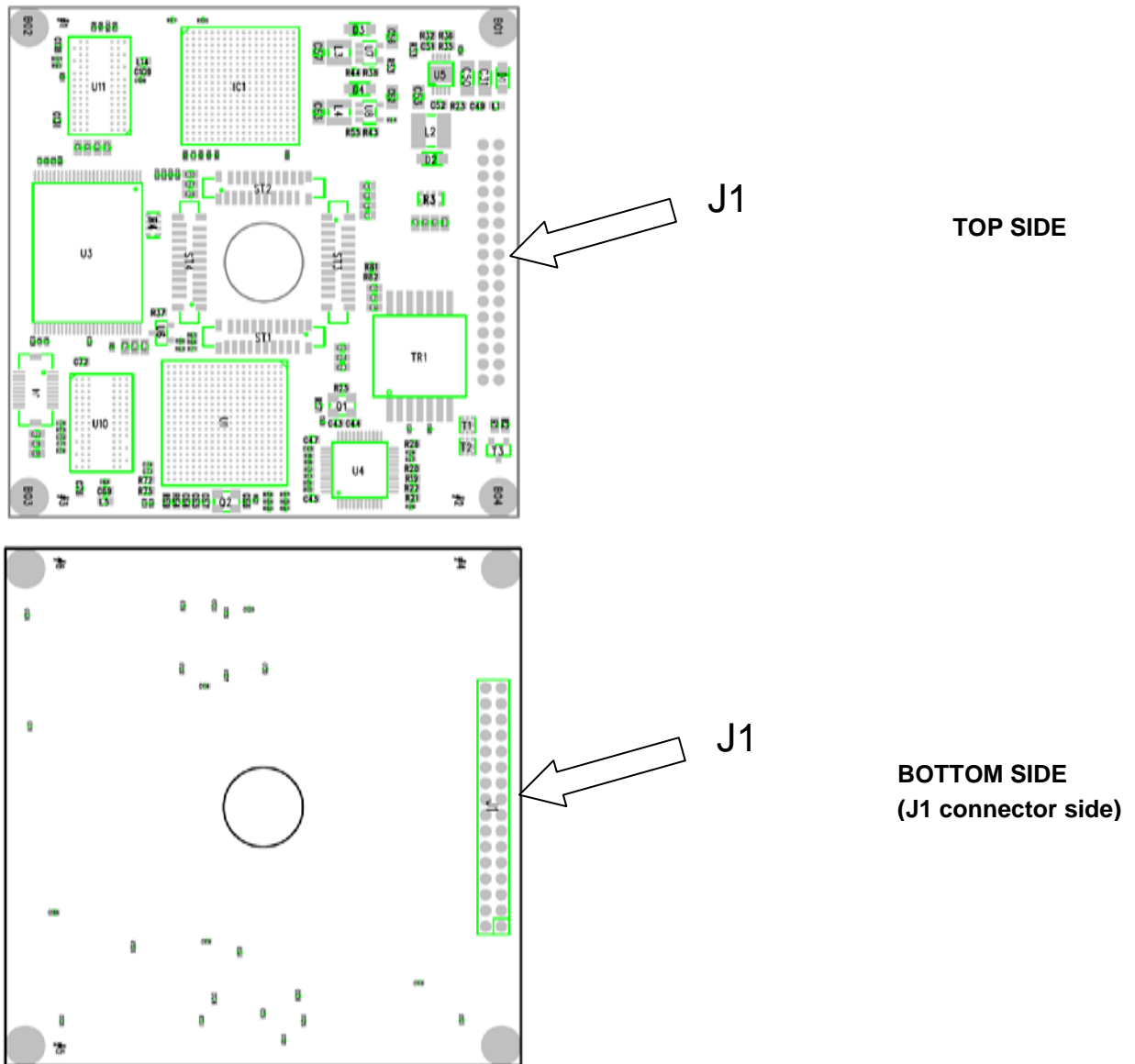
The FPS values are reached with up to 4 sensors.



The following table gives some example values.

Number of lines	Max. framerate (FPS) dx = 752	Max. framerate (FPS) dx = 640 or less
480	56	64
360	72	83
240	102	119
120	178	202
64	265	303
32	375	422
16	475	535
8	545	612
4	588	664
2	612	696
1	612	696

3 Camera Interfaces



The **VCSCB Quadro** Series camera board incorporates one connector interface:

J 1: Power, IO, Ethernet and RS232 Connector

The SBC Quadro series are available with one to four sensor heads.

The pin assignments, electrical specifications as well as available accessories are shown for each interface connector in the following sections.

3.1 J1: Power Supply and IO Interface

3.1.1 Pin Assignments J1 camera socket

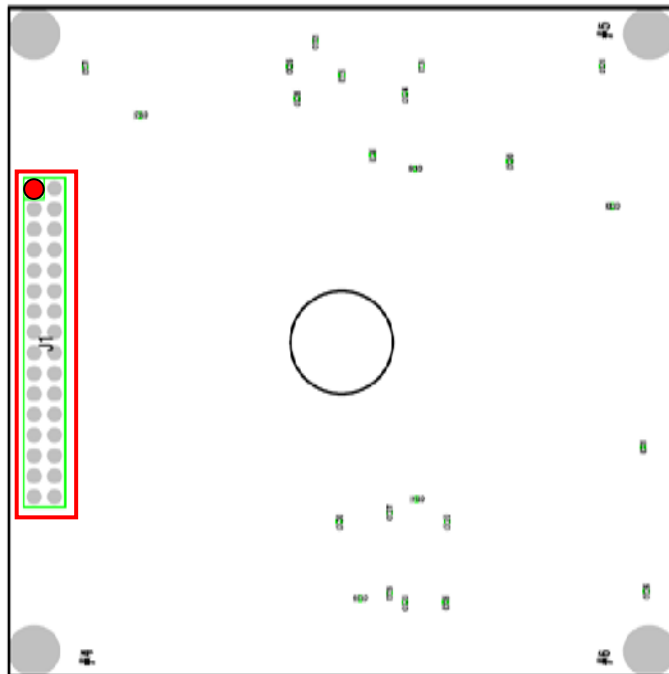
Pin Number	Signal	Core Color	
1	CTS		RS232 interface (LVCMOS)
2	RTS		
3	RX		
4	TX		
5	Trigin		Trigger input and output (LVCMOS)
6	Trigout		
7	OUT0		4 inputs and 4 outputs (LVCMOS)
8	IN0		
9	OUT1		
10	IN1		
11	OUT2		
12	IN2		
13	OUT3		
14	IN3		
15	TxP		Ethernet interface
16	TxN		
17	GND		
18	GND		
19	RxP		DO NOT CONNECT
20	RxN		
21	Power_en		
22	GND		SPI interface not available
23	Power 3V3		
24	Power 24V		
25	3.3V out		
26	GND		
27	SPI_DX		
28	SPI_FSX		
29	SPI_FSR		
30	SPI_clk		
31	SPI_DR		
32	GND		

Pin Locations



1 ●	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32

If board orientation as shown below (**BOTTOM SIDE**):



3.1.2 Electrical specifications of the VCSBC Quadro Series Power Supply

Nominal Voltage:	5V – 30V
Nominal Power Consumption ¹ :	3.5W
Minimum nominal Operating voltage and corresponding current:	5V 700 mA ²
Maximum nominal Operating voltage and corresponding current:	30V 117 mA ³
3.3V output maximum current	50 mA

¹ Typical power consumption without using the onboard 3.3V supply.

² Current drawn from the 3.3V on board signal needs to be added to these figures.



Camera power is regulated, so only an unregulated power source of 5V to 30V is required. The camera is, however, very sensitive to power supply interruption. Please make sure, **that the voltage never exceeds the limits of < 5V, > 30V even for a short period of time**. In case of trouble it is recommended to backup the power supply by a capacitor or a battery large enough to prevent power interruptions.

3.1.3 Electrical specifications J1 camera socket

All Signals are **Low Voltage CMOS (3.3V)**, not opto isolated (so special care must be taken or Isolation has to be done externally!).

LVC MOS IOs Specifications:

The board features LVC MOS IOs, including a dedicated fast trigger input (for use as image capture trigger) and a fast trigger output (as strobe-light trigger). Since all signals are fast at a very low noise margin, it is recommended to keep the cable as short as possible. Use twisted pair or even coaxial cable for this purpose. The trigger input assures a constant image capture delay without jitter.

Electrical Specification of inputs:

input voltage: Signal LOW	0V – 0.8V (LVC MOS)
Input voltage: Signal HIGH	2V – 3.3V (LVC MOS)
Pull-up resistor:	None

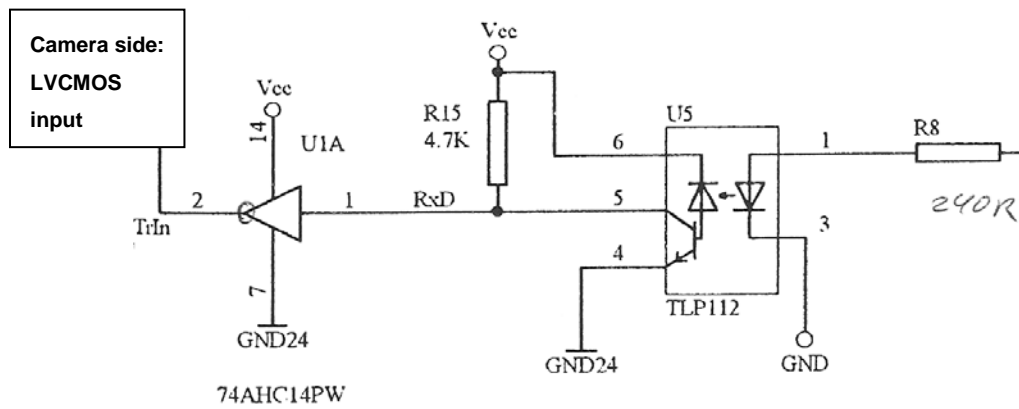
Image trigger on rising or falling input signal works as before – see section 5.5.4 for details.



The LVC MOS inputs and outputs are very sensitive and not galvanically separated. Opto isolation of the driving circuit is therefore strongly recommended. The following page shows suitable circuits for LVC MOS inputs and outputs.

Please note that inputs and outputs are not protected against over current. The outputs are neither protected against short circuit nor reverse voltage spikes from inductive loads.

Possible driving circuit for the LVC MOS inputs (also trigger input):

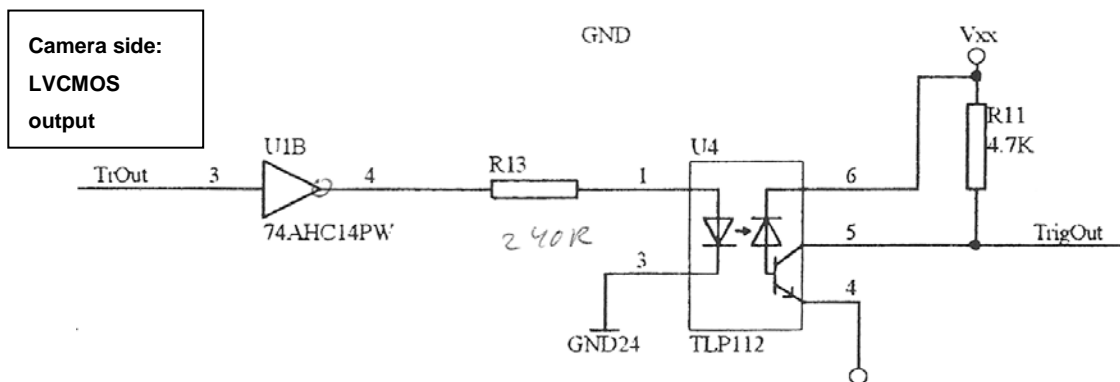


Electrical Specification of LVC MOS outputs (also trigger output):

output voltage signal LOW:	0.4 V with 2mA output current 0.2 V with 1mA output current
output voltage signal HIGH:	2.9 V with 8mA output current 3.1 V with 1mA output current max. 3 V LVTTTL
Maximum output current:	max. 8 mA (high), 2mA (low)
pull-up resistor:	none

Caution: Place the connectors at the correct position – not reversed or shifted.

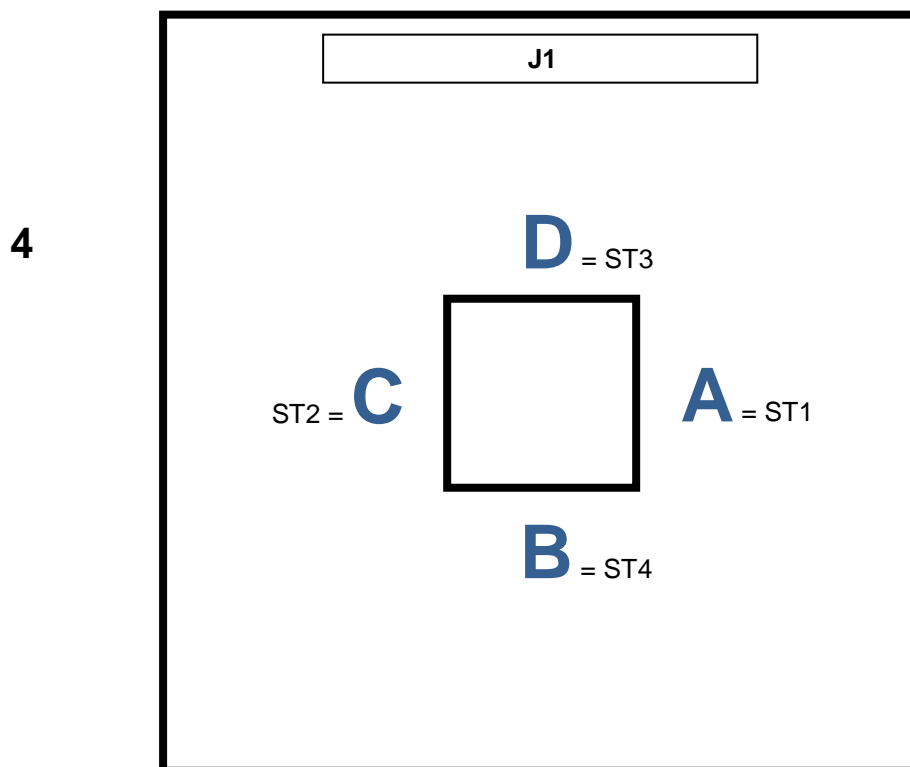
Possible driving circuit for LVC MOS outputs (also trigger output):



3.2 Connection of the sensor heads

Each sensor head is identified by the letter **A, B, C or D** and must be plugged into the corresponding connector.

The following **TOP VIEW** of the camera shows the correct sensor head positions.



Accessories

For interface cables and connectors available also consult the corresponding section in chapter 2.2 of this manual.

4.1 Camera and Lens holder order numbers:

Product / Service description	Order Number
VCSBC Quadro Smart Camera <i>without</i> lens holder, b/w sensor	VK002011
VCSBC Quadro Smart Camera <i>without</i> lens holder, Bayer sensor	VK001266
VCSBC Quadro 360 Smart Camera <i>without</i> lens holder, Bayer sensor	VK001263

4.2 Further accessories available for VCSBC Quadro Smart Cameras

Product description	Order Number
Power adapter for rail mounting, Input Voltage 100 – 240VAC 50/60 Hz Output Voltage DC 24V +/-5%, max. 300 mA (7.5 W) Equipped with connecting clamps for AC input and 24V output, CE cert.	VK000036
Power Supply and IO Interface cable	VK000173
Ethernet OEM Cable (0.5m length, 4 single cores)	VK000206
Ethernet testing Cable (2.5m length, other end with RJ45 connector)	VK000251
Cable set for VCSBC4012nano (contains VK000206 and VK000173)	VK000229

All cable lengths are 0.5m unless stated otherwise.

Please also refer to the VC website www.vision-components.com for an up to date list of accessories.

5 Programming VCSBC Quadro Smart Cameras

5.1 General settings

Programming the VCSBC Quadro requires at least the VCRT library version 5.30.9.

5.2 Compiling and linking with the VCSBC Quadro

It is advised to build your C-code as **relocatable code** (standard setting in the VC template Code Composer project files from VCRT 5.29). In this case VCRT manages the program memory allocation by itself (see Programming Tutorial for more details).

For customers who prefer absolute linking, please pay attention to the fact that the memory start address of the VCSBC6xxx nano / VCSBC Quadro has changed in comparison to previous VC cameras. In your link file, replace the memory section with this one:

```
MEMORY
{
    PMEM:    o = 080100000h  l = 100000h  /* intended for initialization */
    BMEM:    o = 080090000h  l = 40000h   /* .bss, .system, .stack, .cinit */
}
```

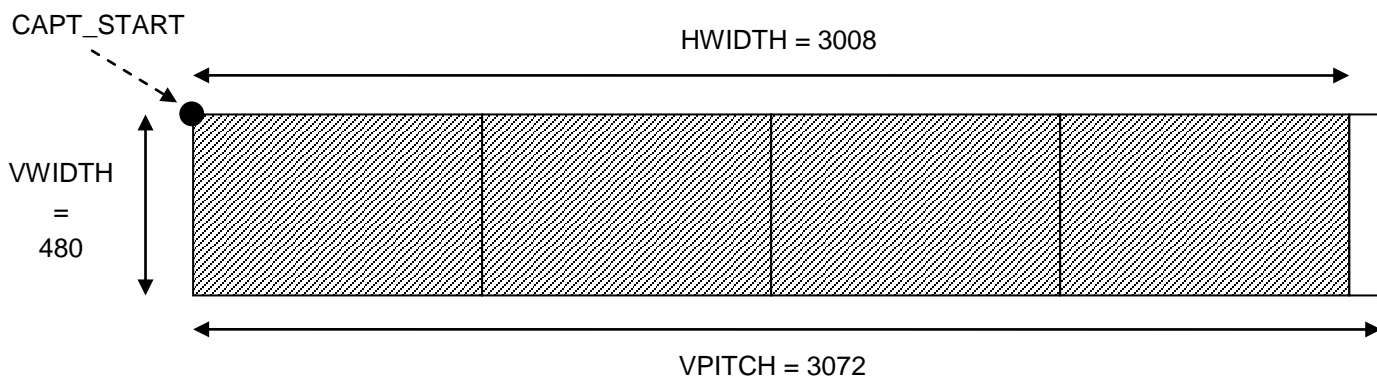
5.3 Image Acquisition

The CMOS sensors of the VCSBC Quadro Series cameras allow extra features like:

- partial scanning
- 2x / 4x image binning

For demo programs showing those features, please have a look at the [Demo Programs section](#) in the Download Center of our website, or contact our support at support@vision-components.com.

In case of 2, 3 or 4 connected sensor heads, image acquisition is always synchronized (also with external trigger signal), and shutter and gain values are identical for both sensors. In the case of 4 heads, the image in memory looks like this:



5.4 Trigger Functions

The trigger works like with the VC4XXX cameras.

Please refer to the VCRT5.pdf manual – available from the download area of the VC website.

To query the trigger input, use the following command, valid for all VCSBC nano cameras (see demo program trigin.c):

```

if (TRIGINP_PIN)
    print("external trigger = 1\n");
else
    print("external trigger = 0\n");
    
```

A capture can be triggered on rising edge with TRIGINP_POS() and on falling edge with TRIGINP_NEG().

Signal	Trigger Mode
	TRIGINP_POS() Rising Edge Trigger Signal
	TRIGINP_NEG() Falling Edge Trigger Signal

The trigger output can be set to exposure controlled mode – for instance to control a light source. With TRIGOUT_EXP() combined with TRIGOUT_POS(), the trigger output is high during exposure. TRIGOUT_EXP() combined with TRIGOUT_NEG(), the trigger output is low during exposure.

	Trigger Output Signal in Exposure Controlled Mode: TRIGOUT_EXP(); AND Trigger output set positive: TRIGOUT_POS();
--	---

The trigger macros are also described in our programming tutorial.

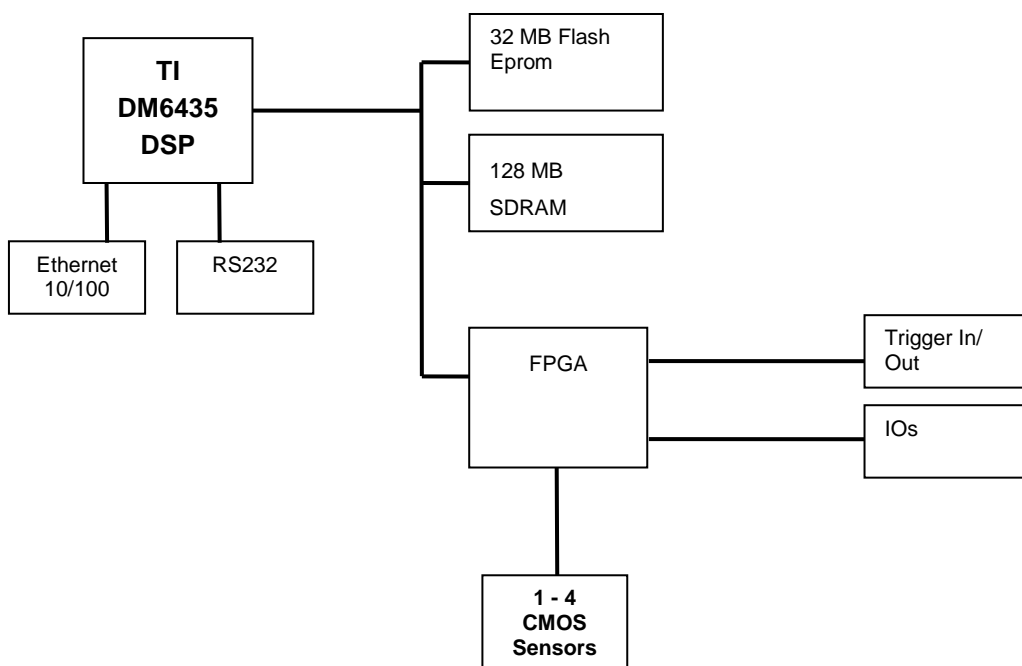
Appendix A: Block diagram VCSBC nano Series

The image is formed by 1 to 4 Wide-VGA CMOS sensor. The image is then stored in SDRAM memory of 128 MB.

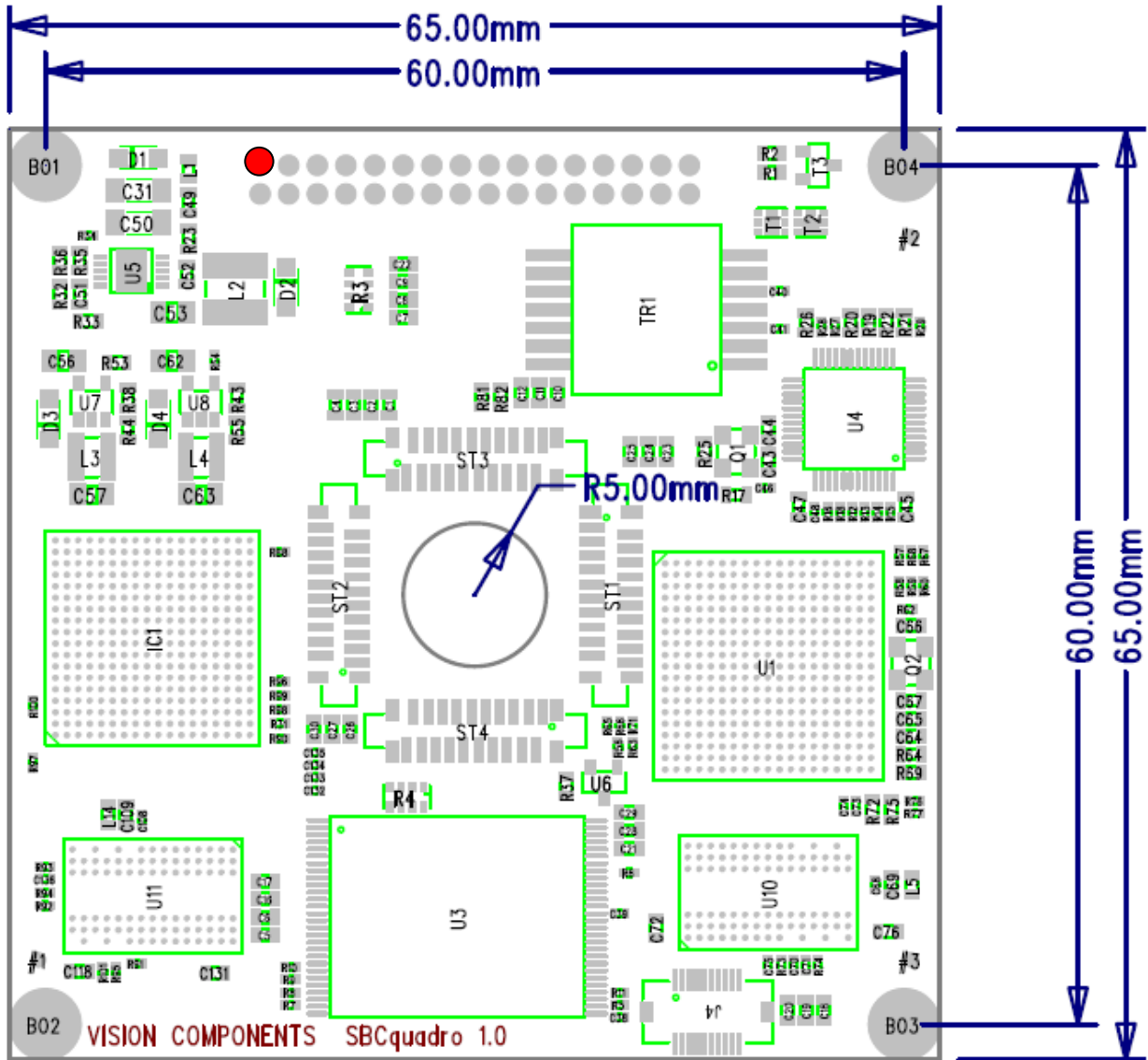
The VCSBC Quadro Series cameras do not have a direct video output. However if monitoring of the camera image is required, this can be done by downloading via Fast Ethernet port to PC and display on screen (available in the download area of the VC website).

The TMS320DM6435 DSP is one of the fastest 32bit DSPs. It features a RISC-like instruction set, up to 8 instructions can be executed in parallel, two L1 cache memories (16 Kbytes each) and a 128 Kbytes L2 cache on chip. Its high speed 64-channel DMA controller gives additional performance. The DSP uses fast external SDRAM as main memory. A flash EPROM provides non-volatile memory.

Block diagram VCSBC Quadro



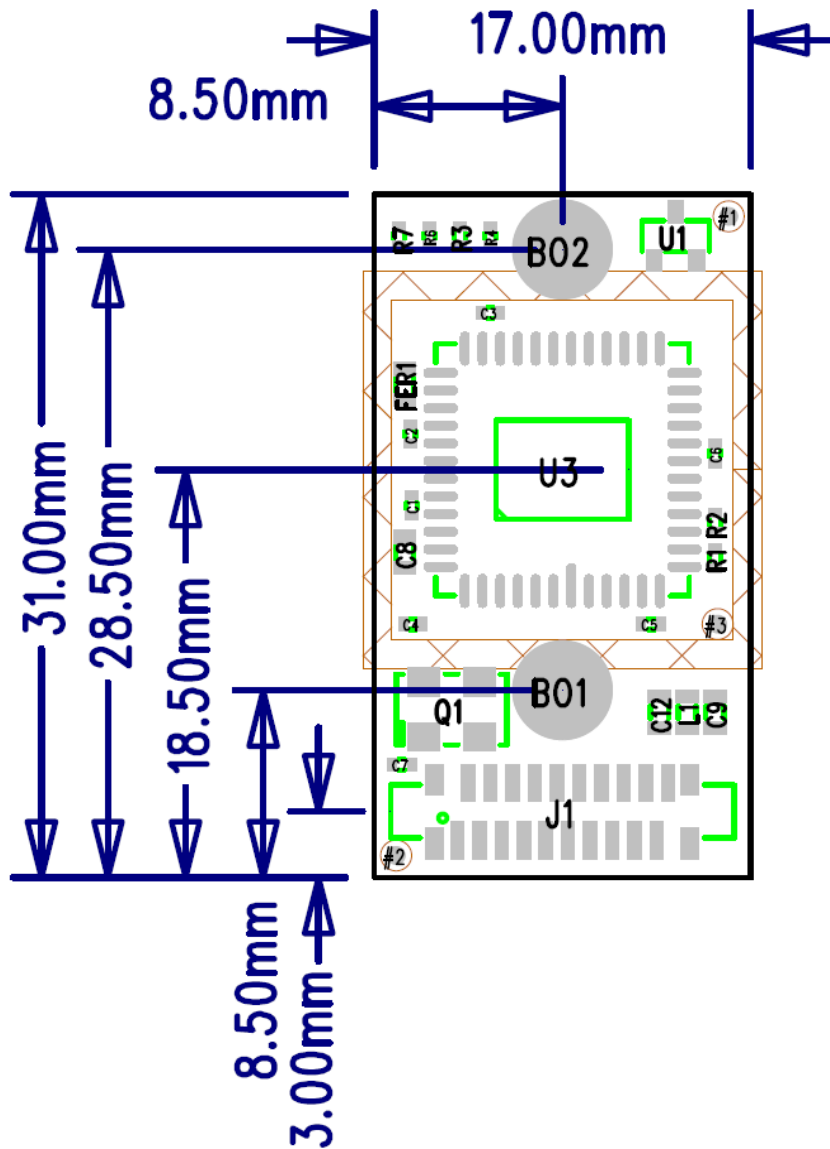
Appendix B: Drawing Circuit Board VCSCB Quadro Series



The red dot  marks the Pin 1 position of each connector.

Tolerances: All circuit board dimensions: +/- 0.1mm

Appendix C: Drawing Sensor Board VCSBC Quadro Series



Tolerances: All circuit board dimensions: +/- 0.1mm

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Contact	Contact Vision Components
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Documentation (User Registration required)	<ul style="list-style-type: none"> - Product Brochures - Camera Manuals - Getting Started - Programming Manuals - Training Manuals and Demo Code - Software Updates (VCRT & Libs) - Demo Code - Software utilities
Software (User- and SW License Registration required)	
Tech News	Tech News – new SW and Documentation
Knowledge Base / FAQ	FAQ Database with programming Examples and Demo Code
Return / Repair Service	Form for Allocation of Repair Numbers.
Loan systems	Info about VC loan cameras