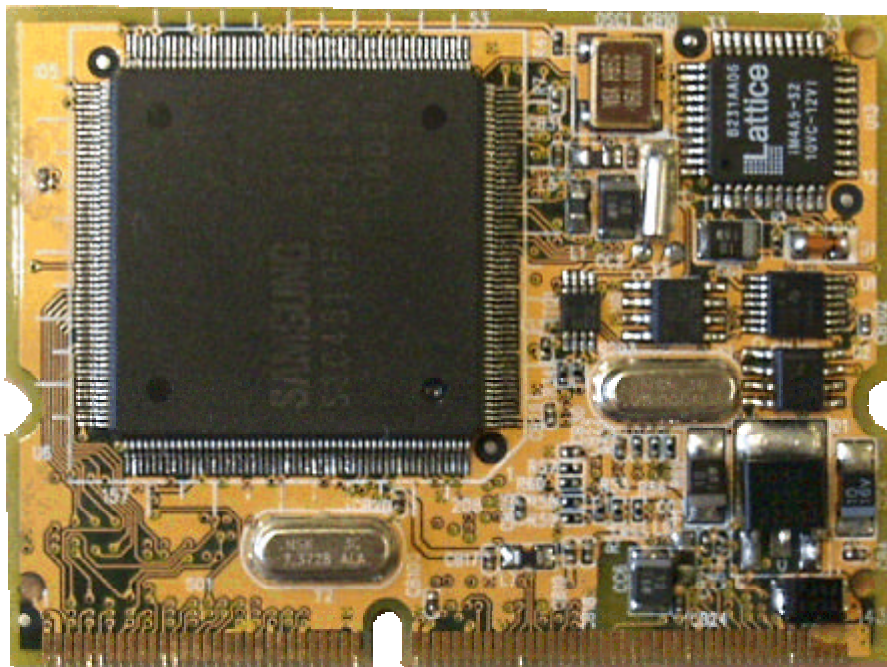


ARM Industrial Module AIM 711 Hardware Manual



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General

Nowadays the demands on Microcontrollers are raised. Memory and computing power are the most increased demands. Further the support on networks, especially Ethernet and TCP/IP. Reactions in real time are demanded more and more frequently. At the same time the hardware should remain as compact as possible. And also, licence fees are not desired.

An answer on these requests is the ARM Industrial Module AIM 711 of Vision System GmbH. With dimensions of $67.6 \times 50 \text{ mm}^2$ it is not even hand plate large. Equipped with a 32 bit RISC processor the module operates under the real time operating system eCos. Two MByte Flash memory offer space for the system, together with the application of the customer, and in addition yet for its data. The SDRAM memory of eight MByte permits extensive operations.

The integrated Ethernet controller permits the connection to a modern 100BaseTx LAN. eCos of course offers support for Ethernet protocols up to TCP/IP. This is freely available software.

To connect existing standard devices, two serial interfaces are available. An asynchronous external bus permits the connection of any additional controllers for special tasks.

In the case of a malfunction, the module simply is to be exchanged. This does not require any special tool. Nevertheless, the SODIMM connector guarantees good contacts to the environment, and a firm fixing.

System Core

Dimensions

The module is 67.6 mm wide, and 50 mm deep. Including the components the height is still less than 5 mm.

Processor

32 bit RISC CPU S3C4510B (Low Power) with integrated Ethernet Interface. The processor is based on an ARM 7 core and operates at a frequency of 50 MHz. It provides an Address space of 64 MB size. Therein DRAM and Flash/ROM/SRAM can be installed. Next to an efficient RISC-command set, the processor incorporates a direct memory interface. Moreover there are integrated interfaces for Ethernet, I²C as well as several serial interfaces and Digital I/O connections.

Memory

Data are addressed Big Endian, a variant of the AIM 711 for Little Endian Mode is available.

Flash

The AIM 711 is equipped with 2 MB Flash Memory. This is accessed 8 bit wide.

DRAM

The AIM 711 is equipped with 8 MB SDRAM. It is connected to the processor with an 32 bit wide bus for optimal Performance.

EEPROM

To save any kind of information on non-volatile memory, the AIM 711 provides an EEPROM, the size is 2 kbit. This space is completely available to the customers application.

Time

In addition the AIM 711 provides a real time clock. If this clock is served by a battery or a different suitable power source, the time is buffered reliably.

Interfaces

Ethernet

The ARM 7 has an internal Ethernet interface. This is available on the connector. The core of AIM 711 realizes the MAC layer. So the physical connection is realized by the application of the customer. Connections with 100 Mbps, and also with 10 Mbps are possible. Example schematics are included in this manual.

Serial

On the AIM 711, two different asynchronous serial interfaces are realized. Both operate with signals on TTL level. Therefore the external connection is determined by the customer and realized with his components.

COM1:

This interface is based on a 16C550C, with additional control logic. The well known Modem control- and status-signals are available. There is an extra signal which indicates if the UART is currently transmitting data. Using these signals, a wide range of applications may be realized. This includes a data transmission in RS485 mode, using automatic direction switching. There is also an example schematics. The base address of this interface is 0x07df0008.

COM2:

This interface is made available through the processor directly. The data signals TxD and RxD are available, driven on TTL-level. This interface is configurable for the infrared-transmission definition.

Digital In/Out

The AIM 711 offers four *Digital Out* signals GPO 0/1/2/3, and also four *Digital In* GPI 0/1/2/3. The input signals GPI 2/3 are usable as interrupt sources.

External Bus

To allow the connection of customer specific periphery, the AIM 711 provides a data bus with 8 bits width. This bus serves an address space of 16 KB. Both *Digital In* signals GPI 2/3 are usable as interrupt sources in the basic configuration. If additionally required the signal pairs GPI/GPO 0 and GPI/GPO 1 can be configured as DMA channels. The included firmware does not support such configuration. For technical details please consult the data sheet of S3C4510B from Samsung.

All data lines are buffered (74LS373, bidirectional), and operate on TTL level. They tolerate signals with 3.3V level. The Address lines are not buffered. Vision System GmbH explicitly recommends to buffer these signals, to support further components. For limit values of the addresses please also consult the data sheet of the S3C4510B.

The external bus operates asynchronous, the protocol is designed for simple connection of further components. Therefore it offers flexibility. More details below in the "Timings" section. The external components are accessible in the address range 0x07fd8000 to 0x07fdbfff.

External connected components may operate on 5V signal level, as well as others based on 3.3V level.

Service Connector

There are special service signals and a suitable connector. In normal situations it is not necessary for the customer to connect components here. The connector contains a JTAG-interface, more exact data about that are found in the Manual of S3C4510B by Samsung. Excerpts of these can be made available.

Supported by drivers in the firmware is a third serial interface. The AIM 711 sends Debug- and Log-data through that. This interface is also available to the customers application.

In addition the connector provides three outputs for LEDs. Their status can be controlled by the application via a driver.

Power Source

Operating Voltage

The AIM 711 requires a regulated voltage of 5V (4.8V up to 5.2V) at max. 500 mA current. From that a voltage of 3.3V is derived internally as supply to the processor. The optional Basis board provides such a regulated supply.

Power LED

A connector for a LED to signal the power supply is also available. The AIM 711 delivers the current, the LED must be placed between the connection and GND.

RTC-Backup

In order to run the real time clock even when the device is turned off, a backup power of 3V is required. Such power is provided by a standard Lithium cell. The function of the clock is stable down to a voltage of 2.2V, then the battery has to be changed.

Of course other power sources may be used, for example an accumulator. In this case the real time clock can recharge the accumulator, if configured to do that. The delivered firmware does not support accumulators.

Supply of external components

The AIM 711 can also supply electric power to external components in a limited way. Especially the regulated voltage of 3.3V may be burdened externally with up to 50 mA.

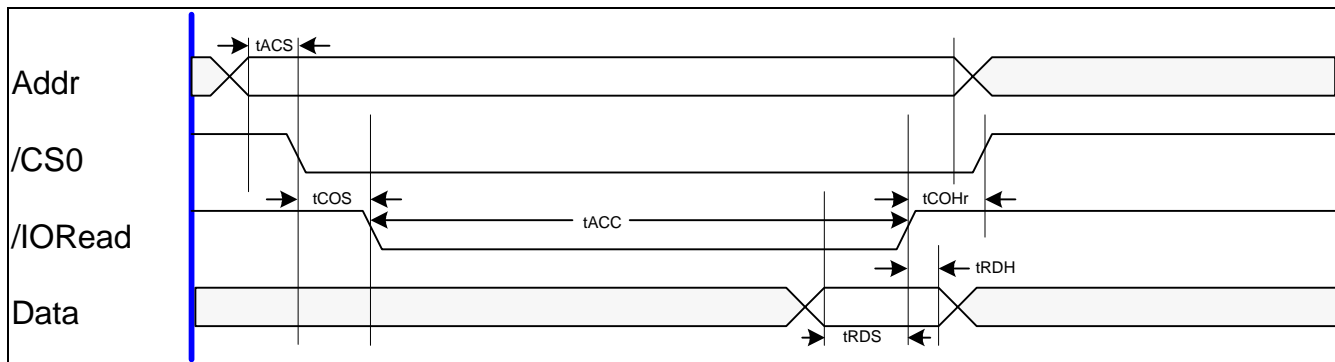
Connections

The development of the AIM 711 targets on a compact module, with a common connector. Therefore all signals and power supplies have been placed on a SODIMM 144 connector. This type of connector is generally known and maintenance friendly. A module is replaced in a few seconds.

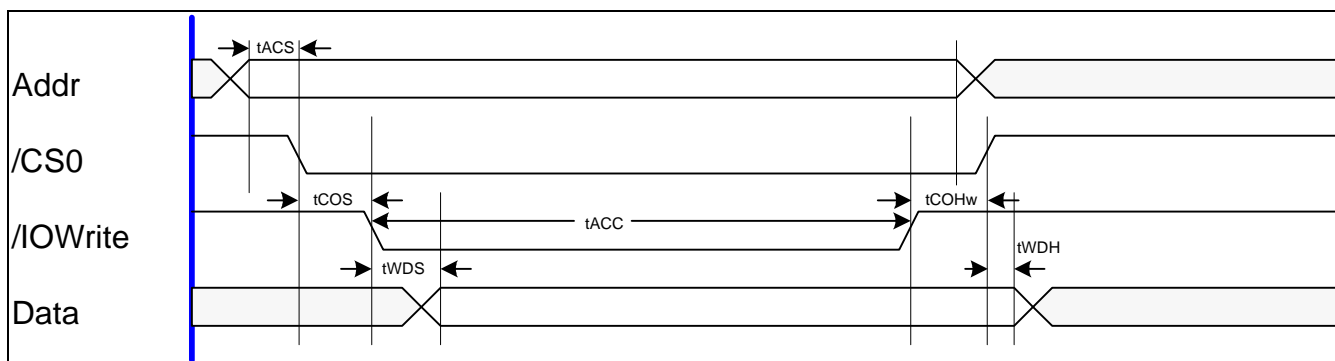
Capabilities

Description	Name	Pin		Pin	Name	Description
	GND	2		1	GND	
	VCC	4		3	VCC	
External data bus D0..D7	D0	6		5	Reset	Reset to the bus
	D1	8		7	A0	External Address bus A0..A13 (16 KB Address range)
	D2	10		9	A1	
	D3	12		11	A2	
	D4	14		13	A3	
	D5	16		15	A4	
	D6	18		17	A5	
	D7	20		19	A6	
	GND	22		21	A7	
Chip Select 0	/CS0	24		23	A8	
	GND	26		25	A9	
External Write	/IOWrite	28		27	A10	
External Read	/IORead	30		29	A11	
	GND	32		31	A12	
Digital In 0	GPI0	34		33	A13	
	GND	36		35	GND	
Digital Out 0	GPO0	38		37	GND	
	GND	40		39	GND	
Digital In 1	GPI1	42		41	/IOWait	Wait signal
	GND	44		43	GND	
Digital Out 1	GPO1	46		45	/IRQ0	External Interrupt sources 0&1
	GND	48		47	/IRQ1	
		50		49	GND	
		52		51		
		54		53		
		56		55		
	VCC	58		57	VCC	
	GND	60		59	GND	
Encoding gap of SO-DIMM 144						
	GND	62		61	GND	
	VCC	64		63	VCC	
		66		65		
		68		67		
		70		69		
	GND	72		71	GND	

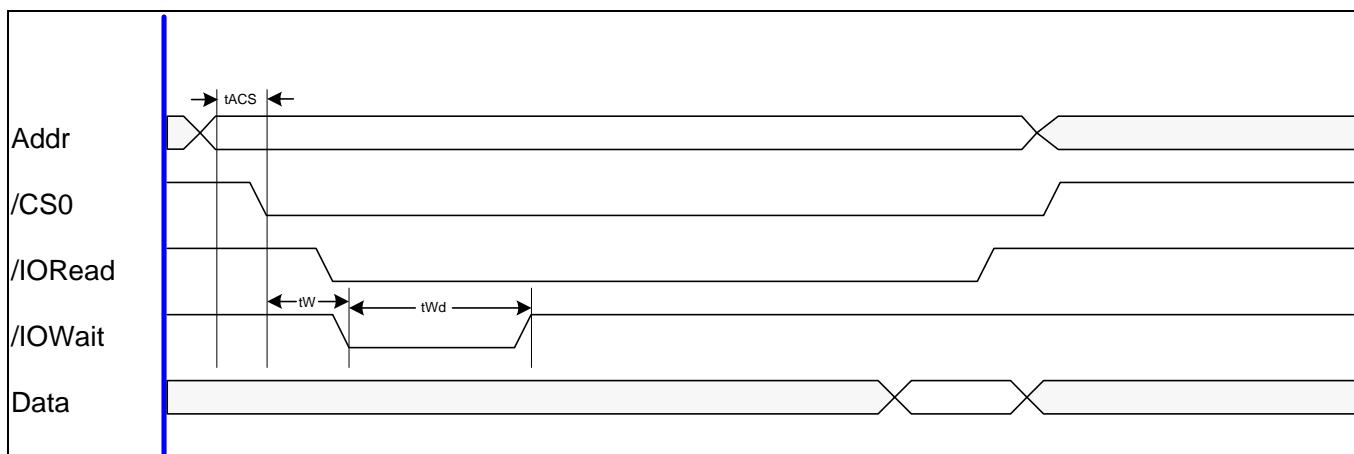
Digital Out 2	GPO2	74	73	RxD2	Serial Port (COM2)
Digital Out 3	GPO3	76	75	TxD2	
	GND	78	77	GND	
Serial Port (COM1)	RI1	80	79	DCD1	Serial Port (COM1)
	DTR1	82	81	RxD1	
	CTS1	84	83	TxD1	
	RTS1	86	85	DSR1	
	GND	88	87	Trans1	
		90	89		
		92	91		
		94	93	Link	LED f. Link/Data
Ethernet Tx- Signal	Tx-	96	95		
Ethernet Tx+ Signal	Tx+	98	97		
		100	99	Speed	LED f. 100Mbps
Ethernet Rx+ Signal	Rx+	102	101		
Ethernet Rx- Signal	Rx-	104	103		
		106	105		
		108	107		
		110	109		
		112	111		
		114	113	Pwr LED	To ext. Power LED
	GND	116	115	GND	
Serial Port for Debug	D-TxD	118	117	P0	BIOS Status/Error Codes (LED)
	D-RxD	120	119	P1	
JTAG Connector with Power, Reset and Data-/Control-Signal	VCC-J	122	121	P2	EPLD Connector with Data-/Control- Signal
	JTDI	124	123	ETDI	
	JTMS	126	125	ETMS	
	JTCK	128	127	ETCK	
	JTDO	130	129	ETDO	Ext. 5V supply
	JRST	132	131	VDDD	
Reset from external	/Reset-In	134	133	VCC3	Ext. 3.3V supply
	GND	136	135	VBat	3V Power for RTC
Mass for power supply	GND 5V	138	137	VCC 5V	Stabilized 5V $\pm 5\%$, 500 mA power supply
		140	139		
		142	141		
		144	143		

Bus protocol

Read access



Write access



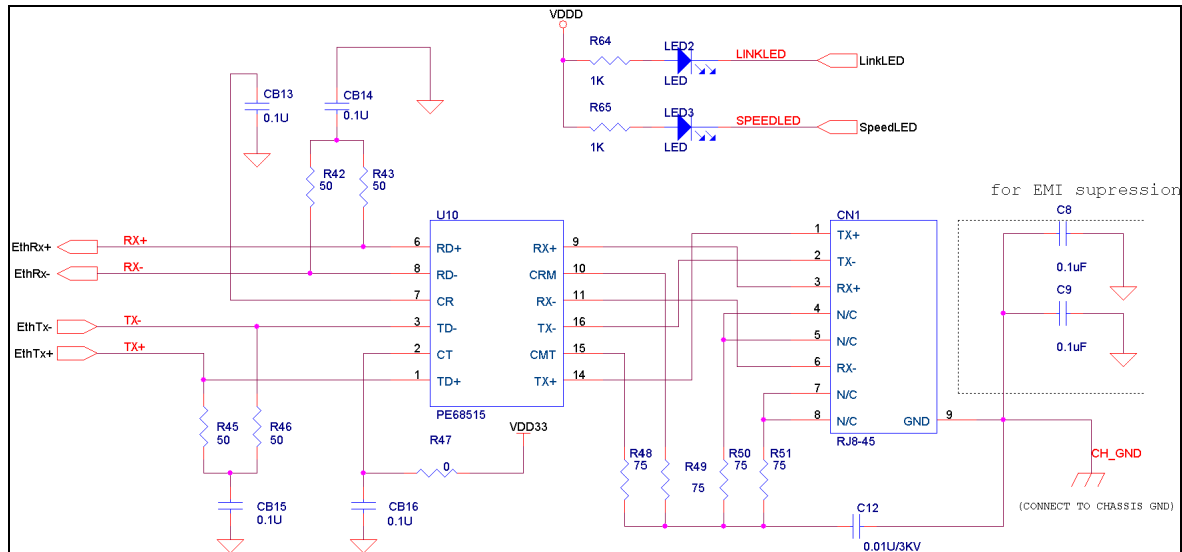
Read access with /IOWait

The asynchronous bus operates with a cycle of 140ns length. First the addresses are set, about 20ns later CS0 becomes active. A possibly required Wait-signal should be generated now. After further 20ns, the actual access is begun through the Read- respectively Write-Command. This lasts for ca. 60ns. The data are accepted with the end of the Command (in both directions). In a Write access, the data lines are not yet valid at the start of the /IOWrite. After the IORead/IOWrite, addresses and CS0 are still valid for ca. 20 up to 30ns.

An /IOWait can extend the Command-phase, if required.

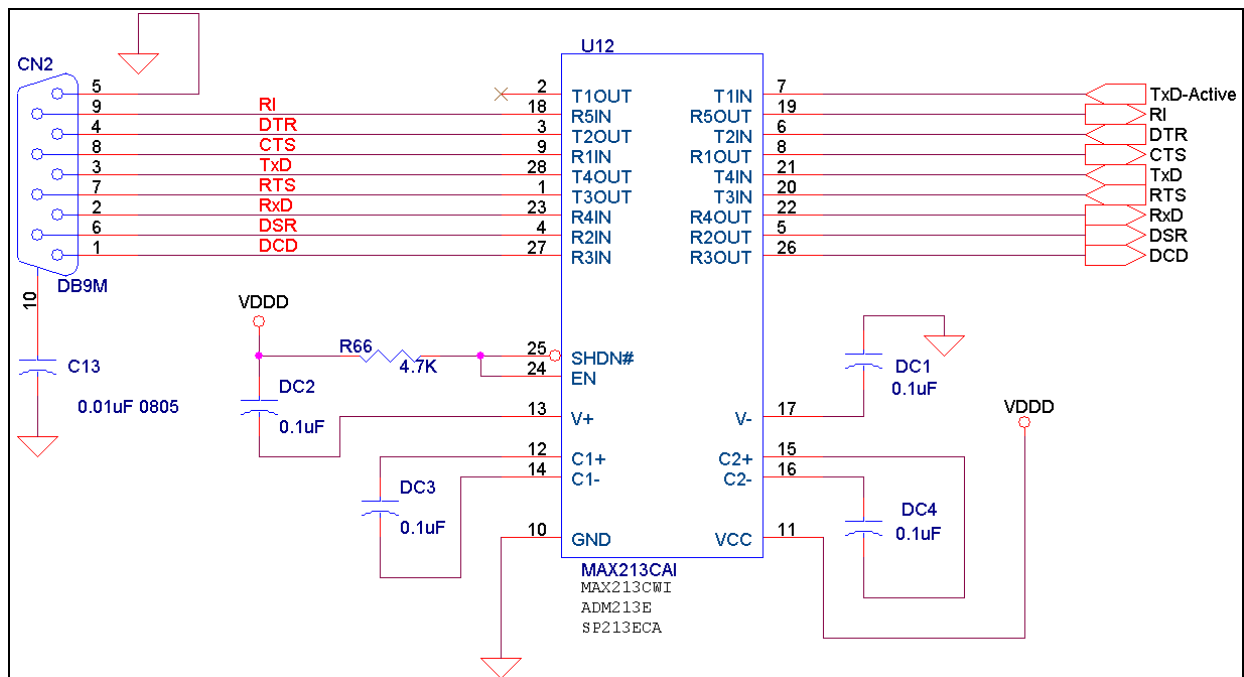
Example Schematics

Ethernet:

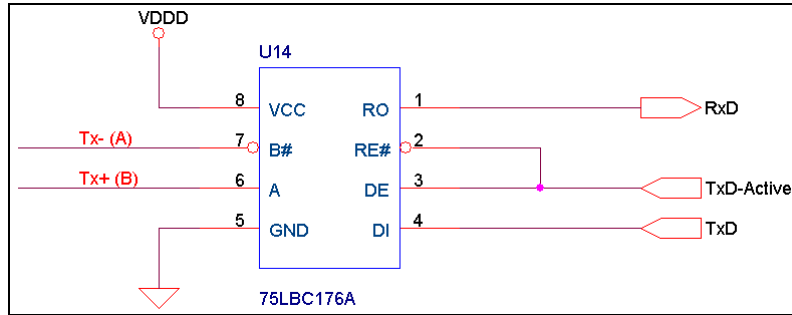


One of the options to realize the Ethernet connection with RJ45. On the left are the transformers, to the right the Ethernet-socket.

RS232:



Connection DB9 male. The Driver/Receiver generates the required voltages for RS232 independent from the normal supply voltage. The reached level is doubly as high as the supply. From +5V supply ±10V signals are delivered.

RS485:

Realized here the usual half-Duplex solution over one line pair as well as the signal mass. TxD-Active switches the data direction. Other variants with half- or-full-Duplex or with echo are to be realized similarly simply.

Basis board for development

For the AIM 711, a small development board is available as an option. This board realizes the available connections to the regulated power supply and Power LED, Ethernet, COM1 and COM2, moreover another serial interface for Debug-output. In addition a battery CR2032 to backup the real time clock, and a Reset key. Finally there is the service connector and the external bus.