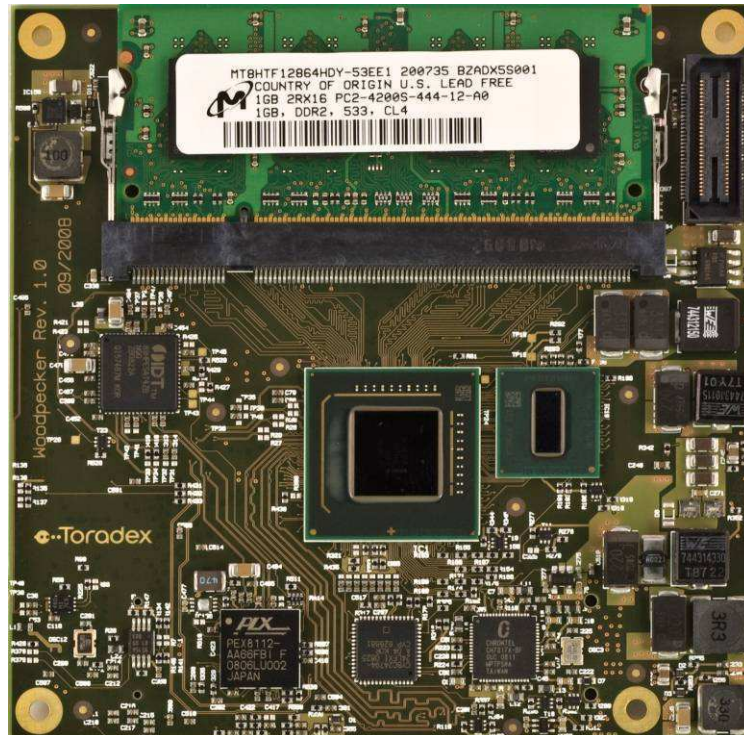


# Woodpecker Z5xx

## Datasheet



### Revision History

Date	Doc. Rev.	Woodpecker Version	Changes
08-Sept-08	Rev. 0.1	V1.0	Preliminary Release
09-Sept-08	Rev. 0.2	V1.0	Improve image quality of block diagram
08-Jan-09	Rev. 0.3	V1.0	Add front image, update power consumption
20-Aug-09	Rev. 1.0	V1.1	Update EC Feature Report, add Power Supply section, Update COM Express USB PIN assignment, add Watchdog description
01-Feb-2011	Rev. 1.1	V1.1	Add Boot_Mode[5] in section 6.5.1 Update Memory organization in section 4.1 chapter LPC + note for LPC_CLK New Disclaimer



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# 1. Introduction

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Woodpecker Z530 and Z510 are embedded Micro COM Express™ computer modules based on the Intel® Atom™ Z530 and Z510 processors and the Intel® System Controller Hub US15W. The Intel® Atom™ Z530 processor runs at 1.6GHz and is designed for high performance computing with low power consumption. The low cost module Woodpecker Z510 features the Intel® Atom™ Z510 processor which runs at 1.1GHz.

Woodpecker Z530 offers 2 PCI Express x1 lanes, PCI interface and up to 6 High Speed USB ports for fast signal connectivity. One USB port can be configured as USB client. The module features in the standard configuration a dual independent graphic output with SDVO and LVDS output, or alternatively a VGA and LVDS interface.

Woodpecker provides a wide range of interfaces for mass storage device. A master and slave PATA interface supports up to two IDE devices. Additionally, two SATA interfaces are available. A microSD card slot is provided on the module for convenient memory extension. A 30 pin FFC connector features two additional SDIO channels for SD cards, MMC cards, WLAN adaptors, Bluetooth adaptors, modems, IrDA adapters, RFID readers or GPS modules.

## 1.1. Reference Documents

For detailed technical information about the components of the Woodpecker module and the COM Express™ standard, please refer to the documents listed below.

### 1.1.1 COM Express™ Design Guide

Guidelines for designing a COM Express™ carrier board

[http://www.comexpress-pnp.org/uploads/media/COMExpressPnP\\_DG\\_09.pdf](http://www.comexpress-pnp.org/uploads/media/COMExpressPnP_DG_09.pdf)

### 1.1.2 COM Express™ Reference Board Schematics

Schematic diagrams of the COM Express™ evaluation carrier board

[http://www.comexpress-pnp.org/uploads/media/CEVAPnP\\_SAA0\\_09.pdf](http://www.comexpress-pnp.org/uploads/media/CEVAPnP_SAA0_09.pdf)

### 1.1.3 Programming Guide to the Oak Sensor Family

Application note regarding the access of the Woodpecker Embedded Controller (which is software compatible with the Toradex Oak Sensor Family of Toradex)

[http://www.toradex.ch/@api/deki/files/89/=Oak\\_ProgrammingGuide\\_V0100.pdf](http://www.toradex.ch/@api/deki/files/89/=Oak_ProgrammingGuide_V0100.pdf)

### 1.1.4 Cypress CY8C24794

Embedded Controller

[http://download.cypress.com.edgesuite.net/design\\_resources/datasheets/contents/cy8c24794\\_8.pdf](http://download.cypress.com.edgesuite.net/design_resources/datasheets/contents/cy8c24794_8.pdf)

### 1.1.5 Chrontel CH7022

SDVO to VGA converter with TV output

<http://www.chrontel.com/pdf/7021-7022ds.pdf>

### 1.1.6 Chrontel CH7317A

SDVO to VGA converter

<http://www.chrontel.com/pdf/7317ds.pdf>

### 1.1.7 PLX PEX8112

PCI Express to PCI bridge

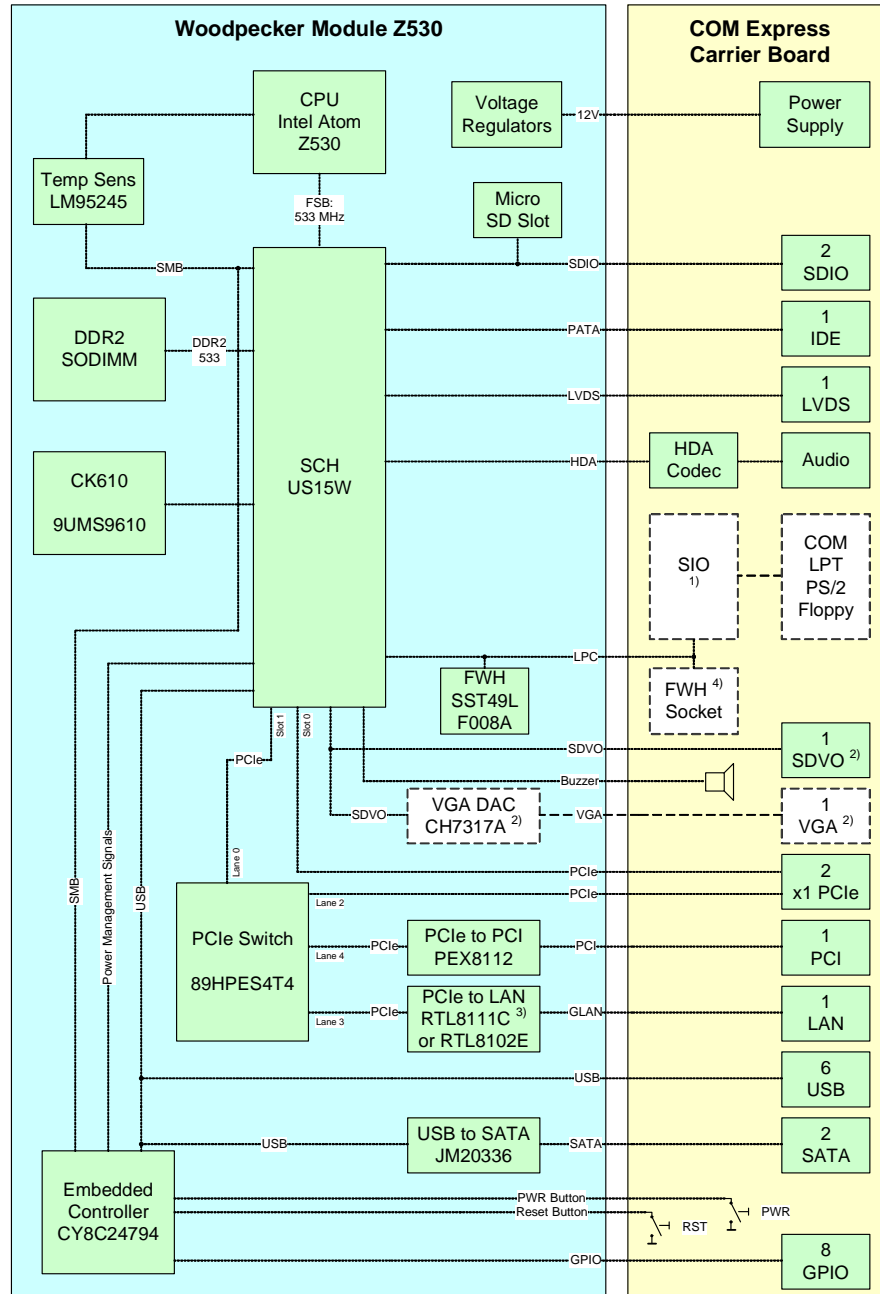
[http://www1.plxtech.com/TEMP/117341/PEX\\_8112AA\\_data\\_book\\_v1.1\\_20Nov07.pdf](http://www1.plxtech.com/TEMP/117341/PEX_8112AA_data_book_v1.1_20Nov07.pdf)



## 2. Features

### 2.1. Block Diagram

#### 2.1.1 Woodpecker Z530

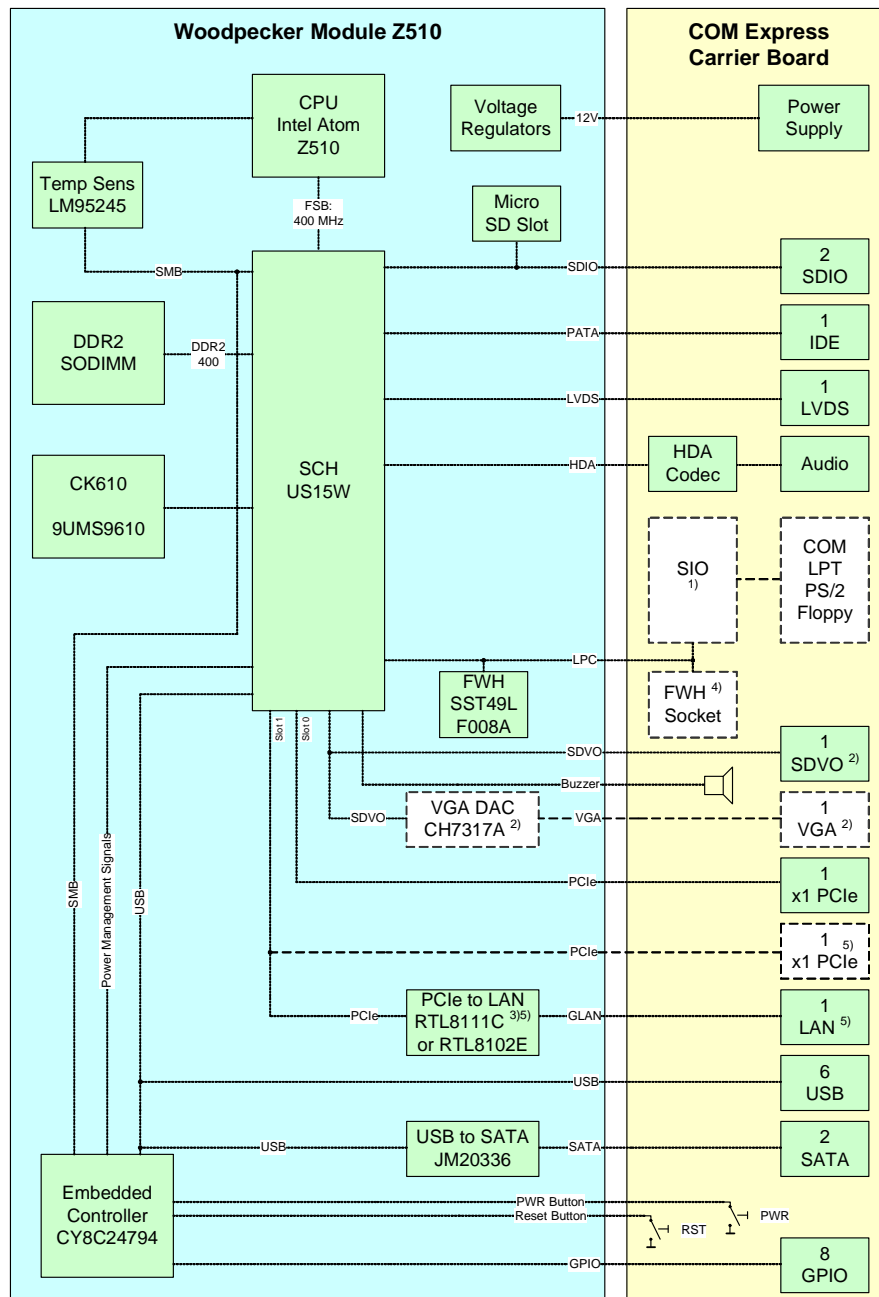


#### Notes:

- 1) Super IO is supported only by the newest BIOS versions. Please contact Toradex for more information.
- 2) Assembly option for higher volumes: Chrontel CH7022 or CH7317A for VGA/TV output instead of SDVO output.
- 3) Assembly option for higher volumes: Realtek RTL8102E Fast Ethernet controller instead of Realtek RTL8111C Gigabit Ethernet controller.
- 4) Optional firmware hub on base board. Onboard FWH can be disabled.



## 2.1.2 Woodpecker Z510



### Notes:

- 1) Super IO is supported only by the newest BIOS versions. Please contact Toradex for more information.
- 2) Assembly option for higher volumes: Chrontel CH7022 or CH7317A for VGA/TV output instead of SDVO output.
- 3) Assembly option for higher volumes: Realtek RTL8102E Fast Ethernet controller instead of Realtek RTL8111C Gigabit Ethernet controller.
- 4) Optional firmware hub on base board. Onboard FWH can be disabled.
- 5) Assembly option for higher volumes: if LAN is not assembled, 2 PCI Express x1 are available.



## 2.2. CPU, Chipset and Memory

	Woodpecker Z530	Woodpecker Z510
Processor	Intel® Atom™ Z530	Intel® Atom™ Z510
CPU Clock	1.6 GHz	1.1 GHz
Front Side Bus	533MHz	400MHz
Instruction Cache	32kByte	32kByte
L1 Cache	24kByte	24kByte
L2 Cache	512kByte	512kByte
Hyper Thread	Yes	No
Chipset	Intel® System Controller Hub US15W	Intel® System Controller Hub US15W
Memory	SO-DIMM connector for up to 2GB 1xDDR2 533	SO-DIMM connector for up to 2GB 1xDDR2 400
Video Controller	Integrated Intel® Graphics, Intel® GMA 500, HDTV/HD capable Decoder for MPEG2(HD) /H2.64	Integrated Intel® Graphics, Intel® GMA 500, HDTV/HD capable Decoder for MPEG2(HD) /H2.64

## 2.3. Interfaces

	Woodpecker Z530	Woodpecker Z510
PCI Express	2 PCIe x1	1 PCIe x1 <sup>1)</sup>
ExpressCard	1 Supported	1 Supported
PCI	Yes	No
Ethernet	10/100/1000 Mbit LAN <sup>4)</sup>	10/100/1000 Mbit LAN <sup>1) 4)</sup>
Audio	Intel® High Definition Audio (24bit/96kHz)	Intel® High Definition Audio (24bit/96kHz)
Serial ATA	2 (USB bridge) <sup>2)</sup>	2 (USB bridge) <sup>2)</sup>
Parallel ATA	1 (Master and Slave)	1 (Master and Slave)
USB	6x USB 2.0 (1 channel configurable as client)	6x USB 2.0 (1 channel configurable as client)
SD Memory Card	MicroSD slot on board	MicroSD slot on board
SDIO	2 on separate FFC connector (4/8bit)	2 on separate FFC connector (4/8bit)
LVDS	Single Channel 18/24 bit WXGA 1366x768	Single Channel 18/24 bit WXGA 1366x768
SDVO	2048x1152 <sup>3)</sup>	2048x1152 <sup>3)</sup>
Analog VGA	No <sup>3)</sup>	No <sup>3)</sup>
LPC	Yes	Yes
SMB	Yes	Yes
I <sup>2</sup> C	Yes (over USB controller)	Yes (over USB controller)
GPIO	8 (over USB controller)	8 (over USB controller)

### Notes:

- 1) Assembly option for higher volumes: if LAN is not assembled, 2 PCI Express x1 are available.
- 2) Assembly option for higher volumes: version without SATA interface.
- 3) Assembly option for higher volumes: Chronitel CH7022 or CH7317A for VGA/TV output instead of SDVO output.
- 4) Assembly option for higher volumes: Realtek RTL8102E Fast Ethernet controller instead of Realtek RTL8111C Gigabit Ethernet controller.

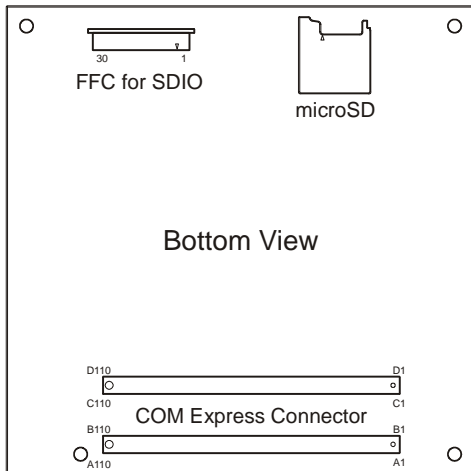


## 3. Woodpecker Connectors

### 3.1. Physical Location

The Woodpecker Z530 and Z510 computer modules are fully COM Express™ pin out type 2 compatible. In addition to the two 220 pin COM Express™ connectors, a 30 pin FFC connector featuring two SDIO channels are available.

All connectors are located on the bottom side of the board.



### 3.2. Signal Notation

#### 3.2.1 Signal Types

Type	
I	Input to the module
O	Output from the module
IO	Bi-directional input/output signal
OD	Open drain bi-directional
ODI	Open drain input
ODO	Open drain output
NC	Not Connected
REF	Reference Signal

Note: A “#” symbol after a signal name refers to an active low signal, indicating a signal is in the active state when driven to a low level.

#### 3.2.2 Signal Voltage Rail

Rail	
5	5V
3.3	3.3V
3.3/5	Nominal 3.3V; 5V tolerant input
2.5	2.5V
A	Analog





Rail	
PWR	Power supply and ground
LVDS	Low voltage differential signaling
PCIe	PCI Express differential signaling
SATA	Serial ATA differential signaling

### 3.3. Assignment of COM Express Connector

The following pin assignment is related to the standard assembly configuration of the Woodpecker Z530 module. Signals that are not available in the standard configuration of the Woodpecker Z510 are marked with \*).

Pin	Signal	Type	Rail	Description
A1	GND		PWR	Ground
A2	GBE0_MDI3-	IO	A	Gigabit LAN pair 3 (negative); not used for fast Ethernet
A3	GBE0_MDI3+	IO	A	Gigabit LAN pair 3 (positive); not used for fast Ethernet
A4	GBE0_LINK100#	O	3.3	LED LAN speed 100Mbps
A5	GBE0_LINK1000#	O	3.3	LED LAN speed 1Gbps
A6	GBE0_MDI2-	IO	A	Gigabit LAN pair 2 (negative); not used for fast Ethernet
A7	GBE0_MDI2+	IO	A	Gigabit LAN pair 2 (positive); not used for fast Ethernet
A8	GBE0_LINK#	O	3.3	LED LAN link indicator
A9	GBE0_MDI1-	IO	A	Gigabit LAN pair 1 (negative); fast Ethernet RX-
A10	GBE0_MDI1+	IO	A	Gigabit LAN pair 1 (positive); fast Ethernet RX+
A11	GND		PWR	Ground
A12	GBE0_MDI0-	IO	A	Gigabit LAN pair 0 (negative); fast Ethernet TX-
A13	GBE0_MDI0+	IO	A	Gigabit LAN pair 0 (positive); fast Ethernet TX+
A14	GBE0_CTREF	REF	A	Reference voltage for the magnetic center tap. Woodpecker: not connected.
A15	SUS_S3#	O	3.3	Indicates the system is suspended to RAM
A16	SATA0_TX+	O	SATA	Serial ATA transmit channel 0 (positive)
A17	SATA0_TX-	O	SATA	Serial ATA transmit channel 0 (negative)
A18	SUS_S4#	O	3.3	Indicates the system is suspended to disk. Note: Woodpecker does not distinguish suspend state S4 and S5
A19	SATA0_RX+	I	SATA	Serial ATA receive channel 0 (positive)
A20	SATA0_RX-	I	SATA	Serial ATA receive channel 0 (negative)
A21	GND		PWR	Ground
A22- A23	NC	NC		Not Connected
A24	SUS_S5#			Indicates the system is in SoftOff state. Can be used to control an ATX power supply. Note: Woodpecker does not distinguish suspend states S4 and S5
A25- A26	NC	NC		Not Connected
A27	BATLOW#	ODI	3.3	Indicates that the external battery is low, 47kΩ pull-up on module
A28	ATA_ACT#	O	3.3	LED indicator for the activity of SATA
A29	AC_SYNC	O	3.3	48kHz audio codec synchronization signal
A30	AC_RST#	O	3.3	Reset output for audio codec



Pin	Signal	Type	Rail	Description
A31	GND		PWR	Ground
A32	AC_BITCLK	IO	3.3	12.228MHz audio codec serial clock
A33	AC_SDOOUT	O	3.3	Serial data output to the audio codec
A34	BIOS_DISABLE#	ODI	3.3	Module BIOS disable. Pull low to disable BIOS on module, 10kΩ pull-up on module
A35	THRMTRIP#	O	3.3	Indicates the entering of the CPU in thermal shutdown
A36- A37	NC	NC		Not Connected
A38	USB_6_7_OC#	ODI	3.3	USB Over current channels 6 and 7, 10kΩ pull-up on module
A39	USB4-	IO	3.3	USB channel 4 (negative); only High Speed capable
A40	USB4+	IO	3.3	USB channel 4 (positive) ; only High Speed capable
A41	GND		PWR	Ground
A42	USB2-	IO	3.3	USB channel 2 (negative)
A43	USB2+	IO	3.3	USB channel 2 (positive)
A44	USB_2_3_OC#	ODI	3.3	USB Over current channels 2 and 3, 10kΩ pull-up on module
A45	USB0-	IO	3.3	USB channel 0 (negative)
A46	USB0+	IO	3.3	USB channel 0 (positive)
A47	VCC_RTC	I	PWR	RTC battery input, nominal 3.0V
A48	EXCD0_PERST#	O	3.3	ExpressCard card 0 reset signal
A49	EXCD0_CPPE#	I	3.3	ExpressCard card 0 request signal
A50	LPC_SERIRQ	IO	3.3	LPC serial interrupt
A51	GND		PWR	Ground
A52- A53	NC	NC		Not Connected
A54	GPIO			
A55- A56	NC	NC		Not Connected
A57	GND		PWR	Ground
A58- A59	NC	NC		Not Connected
A60	GND		PWR	Ground
A61- A62	NC	NC		Not Connected
A63	GPI1	IO	3.3	General purpose input/output 1, default configuration: input
A64	*) PCIE_TX1+	O	PCIe	PCI Express transmit pair 1 (positive)
A65	*) PCIE_TX1-	O	PCIe	PCI Express transmit pair 1 (negative)
A66	GND		PWR	Ground
A67	GPI2	IO	3.3	General purpose input/output 2, default configuration: input
A68	PCIE_TX0+	O	PCIe	PCI Express transmit pair 0 (positive)
A69	PCIE_TX0-	O	PCIe	PCI Express transmit pair 0 (negative)
A70	GND		PWR	Ground
A71	LVDS_A0+	O	LVDS	LVDS channel A signal pair 0 (positive)



Pin	Signal	Type	Rail	Description
A72	LVDS_A0-	O	LVDS	LVDS channel A signal pair 0 (negative)
A73	LVDS_A1+	O	LVDS	LVDS channel A signal pair 1 (positive)
A74	LVDS_A1-	O	LVDS	LVDS channel A signal pair 1 (negative)
A75	LVDS_A2+	O	LVDS	LVDS channel A signal pair 2 (positive)
A76	LVDS_A2-	O	LVDS	LVDS channel A signal pair 2 (negative)
A77	LVDS_VDD_EN	O	3.3	LVDS panel power enable
A78	LVDS_A3+	O	LVDS	LVDS channel A signal pair 3 (positive)
A79	LVDS_A3-	O	LVDS	LVDS channel A signal pair 3 (negative)
A80	GND		PWR	Ground
A81	LVDS_A_CK+	O	LVDS	LVDS channel A clock (positive)
A82	LVDS_A_CK-	O	LVDS	LVDS channel A clock (negative)
A83	LVDS_I2C_CK	ODO	3.3	LVDS I <sup>2</sup> C Clock (DDC)
A84	LVDS_I2C_DAT	OD	3.3	LVDS I <sup>2</sup> C Data (DDC)
A85	GPI3	IO	3.3	General purpose input/output 3, default configuration: input
A86	KBD_RST#	ODI	3.3	Reset input from optional keyboard controller, 47kΩ pull-up on module
A87	KBD_A20GATE	ODI	3.3	A20 gate input from optional keyboard controller, 10kΩ pull-up on module
A88	PCIE0_CK_REF+	O	PCIe	PCI Express clock reference output for all PCIe lanes (positive)
A89	PCIE0_CK_REF-	O	PCIe	PCI Express clock reference output for all PCIe lanes (negative)
A90	GND		PWR	Ground
A91- A92	NC	NC		Not Connected
A93	GPO0	IO	3.3	General purpose input/output 0, default configuration: output
A94- A95	NC	NC		Not Connected
A96	GND		PWR	Ground
A97- A99	VCC_12V		PWR	Primary power input: 12V nominal
A100	GND		PWR	Ground
A101- A109	VCC_12V	I	PWR	Primary power input: 12V nominal
A110	GND		PWR	Ground
B1	GND		PWR	Ground
B2	GBE0_ACT#	O	3.3	LAN activation indicator LED
B3	LPC_FRAME#	O	3.3	Indicates the start of an LPC cycle
B4	LPC_AD0	IO	3.3	LPC multiplexed address, command and data bus 0
B5	LPC_AD1	IO	3.3	LPC multiplexed address, command and data bus 1
B6	LPC_AD2	IO	3.3	LPC multiplexed address, command and data bus 2
B7	LPC_AD3	IO	3.3	LPC multiplexed address, command and data bus 3
B8-B9	NC	NC		Not Connected
B10	LPC_CLK	O	3.3	LPC clock output, 33MHz, usage of a clock repeater in case of external BIOS not allowed
B11	GND		PWR	Ground



Pin	Signal	Type	Rail	Description
B12	PWRBTN#	ODI	3.3	Power button input (active on falling edge), 47kΩ pull-up on module
B13	SMB_CK	OD	3.3	SMBus clock
B14	SMB_DAT	OD	3.3	SMBus data
B15	SMB_ALERT#	ODI	3.3	SMBus Alert, can be used to generate an SMI# or to wake the system, 10kΩ pull-up on module
B16	SATA1_TX+	O	A	Serial ATA transmit channel 1 (positive)
B17	SATA1_TX-	O	A	Serial ATA transmit channel 1 (negative)
B18	SUS_STAT#	O	3.3	Indicates imminent suspend operation, used to notify LPC devices
B19	SATA1_RX+	I	A	Serial ATA receive channel 1 (positive)
B20	SATA1_RX-	I	A	Serial ATA receive channel 1 (negative)
B21	GND		PWR	Ground
B22- B23	NC	NC		Not Connected
B24	PWR_OK	I	3.3	Power OK from main power supply
B25- B26	NC	NC		Not Connected
B27	WDT	O	3.3	Indicates that a watchdog time-out event has occurred. The pin remains high until the software clears the bit.
B28	NC	NC		Not Connected, assembly option for higher volumes: Pin B28 instead of B29 for digital input 1 of audio codec
B29	AC_SDIN1	I	3.3	Serial data input 1 from the audio codec
B30	AC_SDIN0	I	3.3	Serial data input 0 from the audio codec
B31	GND		PWR	Ground
B32	SPKR	O	3.3	Speaker output
B33	I2C_CK	OD	3.3	General purpose I <sup>2</sup> C clock, on the module provided by EC
B34	I2C_DAT	OD	3.3	General purpose I <sup>2</sup> C data, on the module provided by EC
B35	THRM#	ODI	3.3	Over temperature indication input from off-module temperature sensor, 47kΩ pull-up on module
B36	USB7-	IO	3.3	USB channel 7 (negative); configurable as USB client <sup>4)</sup>
B37	USB7+	IO	3.3	USB channel 7 (positive); configurable as USB client <sup>4)</sup>
B38	USB_4_5_OC#	ODI	3.3	USB Over current channels 4 and 5, 10kΩ pull-up on module
B39- B40	NC	NC		Not Connected
B41	GND		PWR	Ground
B42	USB3-	IO	3.3	USB channel 3 (negative)
B43	USB3+	IO	3.3	USB channel 3 (positive)
B44	USB_0_1_OC#	ODI	3.3	USB Over current channels 0 and 1, 10kΩ pull-up on module
B45	USB1-	IO	3.3	USB channel 1 (negative)
B46	USB1+	IO	3.3	USB channel 1 (positive)
B47- B48	NC	NC		Not Connected
B49	SYS_RESET#	ODI	3.3	Reset button input (active low), 47kΩ pull-up on module



Pin	Signal	Type	Rail	Description
B50	CB_RESET#	O	3.3	Reset output of the module for the carrier board
B51	GND		PWR	Ground
B52- B53	NC	NC		Not Connected
B54	GPO1	IO	3.3	General purpose input/output 1, default configuration: output
B55- B56	NC	NC		Not Connected
B57	GPO2	IO	3.3	General purpose input/output 2, default configuration: output
B58- B59	NC	NC		Not Connected
B60	GND		PWR	Ground
B61- B62	NC	NC		Not Connected
B63	GPO3	IO	3.3	General purpose input/output 3, default configuration: output
B64	*) PCIE_RX1+	I	PCIe	PCI Express receive pair 1 (positive)
B65	*) PCIE_RX1-	I	PCIe	PCI Express receive pair 1 (negative)
B66	WAKE0#	ODI	3.3	PCI Express wake up input, 1kΩ pull-up on module
B67	WAKE1#	ODI	3.3	General purpose wake up input, 47kΩ pull-up on module
B68	PCIE_RX0+	I	PCIe	PCI Express receive pair 0 (positive)
B69	PCIE_RX0-	I	PCIe	PCI Express receive pair 0 (negative)
B70	GND		PWR	Ground
B71- B78	NC	NC		Not Connected
B79	LVDS_BKLT_EN	O	3.3	Backlight enable for LVDS display
B80	GND		PWR	Ground
B81- B82	NC	NC		Not Connected
B83	LVDS_BKLT_CTRL	O	3.3	Backlight brightness control for LVDS display
B84- B87	VCC_5V_SBY	I	PWR	Optional standby power input, 5V nominal
B88	NC	NC		Not Connected
B89	NC/VGA_RED	O	A	(Red monitor output) only available as assembly option for higher volumes
B90	GND		PWR	Ground
B91	NC/VGA_GRN	O	A	Standard configuration: NC Assembly option for higher volumes: Green monitor output
B92	NC/VGA_BLU	O	A	Standard configuration: NC Assembly option for higher volumes: Blue monitor output
B93	NC/VGA_HSYNC	O	3.3	Standard configuration: NC Assembly option for higher volumes: Horizontal sync output for monitor
B94	NC/VGA_VSYNC	O	3.3	Standard configuration: NC Assembly option for higher volumes: Vertical sync output for monitor
B95	NC/VGA_I2C_CK	ODO	3.3	Standard configuration: NC



Pin	Signal	Type	Rail	Description
				Assembly option for higher volumes: DDC clock output
B96	NC/VGA_I2C_DAT	OD	3.3	Standard configuration: NC Assembly option for higher volumes: DDC data output
B97	TV_DAC_A	O	3.3	Standard configuration: NC Assembly option for higher volumes: TV DAC channel A
B98	TV_DAC_B	O	3.3	Standard configuration: NC Assembly option for higher volumes: TV DAC channel B
B99	TV_DAC_C	O	3.3	Standard configuration: NC Assembly option for higher volumes: TV DAC channel C
B100	GND		PWR	Ground
B101- B109	VCC_12V	I	PWR	Primary power input: 12V nominal
B110	GND		PWR	Ground
C1	GND		PWR	Ground
C2	IDE_D7	IO	3.3/5	IDE bus data
C3	IDE_D6	IO	3.3/5	IDE bus data
C4	IDE_D3	IO	3.3/5	IDE bus data
C5	IDE_D15	IO	3.3/5	IDE bus data
C6	IDE_D8	IO	3.3/5	IDE bus data
C7	IDE_D9	IO	3.3/5	IDE bus data
C8	IDE_D2	IO	3.3/5	IDE bus data
C9	IDE_D13	IO	3.3/5	IDE bus data
C10	IDE_D1	IO	3.3/5	IDE bus data
C11	GND		PWR	Ground
C12	IDE_D14	IO	3.3/5	IDE bus data
C13	IDE_IORDY	IO	3.3/5	IDE device IO ready input
C14	IDE_IOR#	IO	3.3/5	IO read line to IDE device
C15	*) PCI_PME#	I	3.3/5	PCI power management event: PCI peripherals drive PME# to wake system from low power states S1-S3
C16	*) PCI_GNT2#	O	3.3/5	PCI bus master grant output line
C17	*) PCI_REQ2#	I	3.3/5	PCI bus master request input line
C18	*) PCI_GNT1#	O	3.3/5	PCI bus master grant output line
C19	*) PCI_REQ1#	I	3.3/5	PCI bus master request input line
C20	*) PCI_GNT0#	O	3.3/5	PCI bus master grant output line
C21	GND		PWR	Ground
C22	*) PCI_REQ0#	I	3.3/5	PCI bus master request input line
C23	*) PCI_RESET#	O	3.3/5	PCI reset output
C24	*) PCI_AD0	IO	3.3/5	PCI bus multiplexed address and data lines
C25	*) PCI_AD2	IO	3.3/5	PCI bus multiplexed address and data lines
C26	*) PCI_AD4	IO	3.3/5	PCI bus multiplexed address and data lines
C27	*) PCI_AD6	IO	3.3/5	PCI bus multiplexed address and data lines
C28	*) PCI_AD8	IO	3.3/5	PCI bus multiplexed address and data lines
C29	*) PCI_AD10	IO	3.3/5	PCI bus multiplexed address and data lines
C30	*) PCI_AD12	IO	3.3/5	PCI bus multiplexed address and data lines
C31	GND		PWR	Ground



Pin	Signal	Type	Rail	Description
C32	*) PCI_AD14	IO	3.3/5	PCI bus multiplexed address and data lines
C33	*) PCI_C/BE1#	IO	3.3/5	PCI bus byte enable line
C34	*) PCI_PERR#	IO	3.3/5	Parity error: an external PCI device drives PERR# when it receives data that has a parity error
C35	*) PCI_LOCK#	IO	3.3/5	PCI lock control line
C36	*) PCI_DEVSEL#	IO	3.3/5	PCI bus device select
C37	*) PCI_IRDY#	IO	3.3/5	PCI bus initiator ready control line
C38	*) PCI_C/BE2#	IO	3.3/5	PCI bus byte enable line
C39	*) PCI_AD17	IO	3.3/5	PCI bus multiplexed address and data lines
C40	*) PCI_AD19	IO	3.3/5	PCI bus multiplexed address and data lines
C41	GND		PWR	Ground
C42	*) PCI_AD21	IO	3.3/5	PCI bus multiplexed address and data lines
C43	*) PCI_AD23	IO	3.3/5	PCI bus multiplexed address and data lines
C44	*) PCI_C/BE3#	IO	3.3/5	PCI bus byte enable line
C45	*) PCI_AD25	IO	3.3/5	PCI bus multiplexed address and data lines
C46	*) PCI_AD27	IO	3.3/5	PCI bus multiplexed address and data lines
C47	*) PCI_AD29	IO	3.3/5	PCI bus multiplexed address and data lines
C48	*) PCI_AD31	IO	3.3/5	PCI bus multiplexed address and data lines
C49	*) PCI_IRQA#	I	3.3/5	PCI interrupt request line
C50	*) PCI_IRQB#	I	3.3/5	PCI interrupt request line
C51	GND		PWR	Ground
C52	SDVO_TVCLKIN+	I	PCIe	Serial digital video TVOut synchronization clock (positive)
C53	SDVO_TVCLKIN -	I	PCIe	Serial digital video TVOut synchronization clock (negative)
C54	TYPE0#	O	3.3	The type pin indicates to the carrier board the pin-out type that is implemented on the COM Express module. Woodpecker type 2: TYPE0# open
C55	SDVO_INT+	I	PCIe	Serial digital video interrupt input (positive)
C56	SDVO_INT -	I	PCIe	Serial digital video interrupt input (negative)
C57	TYPE1#	O	3.3	The type pin indicates to the carrier board the pin-out type that is implemented on the COM Express module. Woodpecker type 2: TYPE1# open
C58	SDVO_STALL+	I	PCIe	Serial digital video field stall input (positive)
C59	SDVO_STALL -	I	PCIe	Serial digital video field stall input (negative)
C60	GND		PWR	Ground
C61- C70	NC	NC		Not Connected
C70	GND		PWR	Ground
C71- C72	NC	NC		Not Connected
C73	SDVO_DATA	OD	2.5	SDVO I <sup>2</sup> C data line, 3.3kΩ pull-up on module
C74- C75	NC	NC		Not Connected
C76	GND		PWR	Ground
C77- C79	NC	NC		Not Connected
C80	GND		PWR	Ground



Pin	Signal	Type	Rail	Description
C81- C83	NC	NC		Not Connected
C84	GND		PWR	Ground
C85- C86	NC	NC		Not Connected
C87	GND		PWR	Ground
C88- C89	NC	NC		Not Connected
C90	GND		PWR	Ground
C91- C92	NC	NC		Not Connected
C93	GND		PWR	Ground
C94- C95	NC	NC		Not Connected
C96	GND		PWR	Ground
C97- C99	NC	NC		Not Connected
C100	GND		PWR	Ground
C101- C102	NC	NC		Not Connected
C103	GND		PWR	Ground
C104- C109	VCC_12V	I	PWR	Primary power input: 12V nominal
C110	GND		PWR	Ground
D1	GND		PWR	Ground
D2	IDE_D5	IO	3.3/5	IDE bus data
D3	IDE_D10	IO	3.3/5	IDE bus data
D4	IDE_D11	IO	3.3/5	IDE bus data
D5	IDE_D12	IO	3.3/5	IDE bus data
D6	IDE_D4	IO	3.3/5	IDE bus data
D7	IDE_D0	IO	3.3/5	IDE bus data
D8	IDE_REQ	I	3.3/5	IDE device DMA request, is asserted by the IDE device to request a data transfer
D9	IDE_IOW#	O	3.3/5	IO write line to IDE device, data latched on trailing (rising) edge
D10	IDE_ACK#	O	3.3/5	IDE device DMA acknowledge
D11	GND		PWR	Ground
D12	IDE_IRQ	I	3.3/5	Interrupt request from IDE device
D13	IDE_A0	O	3.3/5	Address line to IDE device
D14	IDE_A1	O	3.3/5	Address line to IDE device
D15	IDE_A2	O	3.3/5	Address line to IDE device
D16	IDE_CS1#	O	3.3/5	IDE device chip select for 1F0h to 1FFh range
D17	IDE_CS3#	O	3.3/5	IDE device chip select for 3F0h to 3FFh range
D18	IDE_RESET#	O	5	Reset output to IDE device
D19	*) PCI_GNT3#	O	3.3/5	PCI bus master grant output line
D20	*) PCI_REQ3#	I	3.3/5	PCI bus master request input line
D21	GND		PWR	Ground





Pin	Signal	Type	Rail	Description
D22	*) PCI_AD1	IO	3.3/5	PCI bus multiplexed address and data lines
D23	*) PCI_AD3	IO	3.3/5	PCI bus multiplexed address and data lines
D24	*) PCI_AD5	IO	3.3/5	PCI bus multiplexed address and data lines
D25	*) PCI_AD7	IO	3.3/5	PCI bus multiplexed address and data lines
D26	*) PCI_C/BE0#	IO	3.3/5	PCI bus byte enable line
D27	*) PCI_AD9	IO	3.3/5	PCI bus multiplexed address and data lines
D28	*) PCI_AD11	IO	3.3/5	PCI bus multiplexed address and data lines
D29	*) PCI_AD13	IO	3.3/5	PCI bus multiplexed address and data lines
D30	*) PCI_AD15	IO	3.3/5	PCI bus multiplexed address and data lines
D31	GND		PWR	Ground
D32	*) PCI_PAR	IO	3.3/5	PCI bus parity
D33	*) PCI_SERR#	OD	3.3/5	System error: SERR# may be pulsed active by any PCI device that detects a system error condition
D34	*) PCI_STOP#	IO	3.3/5	PCI bus stop control line
D35	*) PCI_TRDY#	IO	3.3/5	PCI bus target ready control line
D36	*) PCI_FRAME#	IO	3.3/5	PCI bus frame control line
D37	*) PCI_AD16	IO	3.3/5	PCI bus multiplexed address and data lines
D38	*) PCI_AD18	IO	3.3/5	PCI bus multiplexed address and data lines
D39	*) PCI_AD20	IO	3.3/5	PCI bus multiplexed address and data lines
D40	*) PCI_AD22	IO	3.3/5	PCI bus multiplexed address and data lines
D41	GND		PWR	Ground
D42	*) PCI_AD24	IO	3.3/5	PCI bus multiplexed address and data lines
D43	*) PCI_AD26	IO	3.3/5	PCI bus multiplexed address and data lines
D44	*) PCI_AD28	IO	3.3/5	PCI bus multiplexed address and data lines
D45	*) PCI_AD30	IO	3.3/5	PCI bus multiplexed address and data lines
D46	*) PCI_IRQC#	I	3.3/5	PCI interrupt request line
D47	*) PCI_IRQD#	I	3.3/5	PCI interrupt request line
D48	NC	NC		Not Connected
D49	*) PCI_M66EN	I	3.3/5	Indicates whether an off-module PCI device is capable of 66MHz operation. Pulled to GND by carrier board device or slot card if the devices are not capable of 66MHz
D50	*) PCI_CLK	O	3.3/5	PCI 33MHz clock output
D51	GND		PWR	Ground
D52	SDVO_RED+	O	PCIe	Serial digital video red output (positive)
D53	SDVO_RED-	O	PCIe	Serial digital video red output (negative)
D54	NC	NC		Not Connected
D55	SDVO_GREEN+	O	PCIe	Serial digital video green output (positive)
D56	SDVO_GREEN-	O	PCIe	Serial digital video green output (negative)
D57	TYPE2#	O	3.3	The type pin indicates to the carrier board the pin-out type that is implemented on the COM Express module. Woodpecker type 2: TYPE2# open
D58	SDVO_BLUE+	O	PCIe	Serial digital video blue output (positive)
D59	SDVO_BLUE-	O	PCIe	Serial digital video blue output (negative)
D60	GND		PWR	Ground



Pin	Signal	Type	Rail	Description
D61	SDVO_CLK+	O	PCIe	Serial digital video clock output (positive)
D62	SDVO_CLK-	O	PCIe	Serial digital video clock output (negative)
D63- D66	NC	NC		Not Connected
D67	GND		PWR	Ground
D68- D69	NC	NC		Not Connected
D70	GND		PWR	Ground
D71- D72	NC	NC		Not Connected
D73	SVDO_CLK	ODO	2.5	SDVO I <sup>2</sup> C clock line, 3.3kΩ pull-up on module
D74- D75	NC	NC		Not Connected
D76	GND		PWR	Ground
D77	IDE_CBLID#	I	3.3	Input from off-module hardware indicating the type of the IDE cable being used. High indicates a 40-pin cable, low indicates a 80-pin cable with interleaved grounds.
D78- D79	NC	NC		Not Connected
D80	GND		PWR	Ground
D81- D83	NC	NC		Not Connected
D84	GND		PWR	Ground
D85- D86	NC	NC		Not Connected
D87	GND		PWR	Ground
D88- D89	NC	NC		Not Connected
D90	GND		PWR	Ground
D91- D92	NC	NC		Not Connected
D93	GND		PWR	Ground
D94- D95	NC	NC		Not Connected
D96	GND		PWR	Ground
D97- D99	NC	NC		Not Connected
D100	GND		PWR	Ground
D101- D102	NC	NC		Not Connected
D103	GND		PWR	Ground
D104- D110	VCC_12V	I	PWR	Primary power input: 12V nominal
D110	GND		PWR	Ground



### 3.4. Assignment of Additional FFC Connector

Connector: FFC 30 pins, 0.5 mm pitch, bottom contact (example MOLEX 52437-3072)

Pin	Signal	Type	Rail	Description
1	SDIO2_CLK	O	3.3	SDIO channel 2 clock, 24 MHz for SD and SDIO, 48 MHz for MMC
2	GND		PWR	Ground
3	SDIO2_CMD	OD/IO	3.3	SDIO channel 2 command, used for card initialization and transfer of commands, 39kΩ pull-up on module
4	SDIO2_LED	O	3.3	SDIO channel 2 LED output, can be used to drive an external LED over a transistor to indicate transfer on the bus
5	SDIO2_CD#	ODI	3.3	SDIO channel 2 card detect, the present of the card is signaled by pulling the signal to ground, 10kΩ pull-up on module
6	SDIO2_WP	ODI	3.3	SDIO channel 2 write protect, denote the state of the write-protect tab on SD card, pull signal to ground to enable writing, 10kΩ pull-up on module
7	SDIO2_PWR#			SDIO channel 2 power enable, can be used to enable the power being supplied to an SDIO/MMC device
8	VCC_3.3S_OUT	O	PWR	3.3V power output for powering a SDIO device. The power rail is only available in S0 state. Note: maximum current load is TBD (pin 8 and 19 together)
9	SDIO2_DATA0	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
10	SDIO2_DATA1	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
11	GND		PWR	Ground
12	SDIO2_DATA2	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
13	SDIO2_DATA3	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
14	SDIO2_DATA4	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
15	SDIO2_DATA5	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
16	GND		PWR	Ground
17	SDIO2_DATA6	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
18	SDIO2_DATA7	IO	3.3	SDIO channel 2 data line (channel 2 is 8 bit capable)
19	VCC_3.3S_OUT	O	PWR	3.3V power output for powering a SDIO device. The power rail is only available in S0 state. Note: maximum current load is TBD (pin 8 and 19 together)
20	USB_CLIENT_DET	I	3.3	USB client connect detection, indicates connection to an external USB host has been established, needs voltage level shifter
21	SDIO0_LED	O	3.3	SDIO channel 0 LED output, can be used to drive an external LED over a transistor to indicate transfer on the bus
22	SDIO0_DATA0	IO	3.3	SDIO channel 0 data line
23	SDIO0_DATA1	IO	3.3	SDIO channel 0 data line
24	GND		PWR	Ground
25	SDIO0_DATA2	IO	3.3	SDIO channel 0 data line
26	SDIO0_DATA3	IO	3.3	SDIO channel 0 data line
27	SDIO0_WP	ODI	3.3	SDIO channel 0 write protect, denote the state of the write-protect tab on SD card, pull signal to ground to enable writing, 10kΩ pull-up on module



Pin	Signal	Type	Rail	Description
28	SDIO0_CMD	OD/ IO	3.3	SDIO channel 0 command, used for card initialization and transfer of commands, 39kΩ pull-up on module
29	SDIO0_CD#	ODI	3.3	SDIO channel 0 card detect, the presence of the card is signaled by pulling the signal to ground, 10kΩ pull-up on module
30	SDIO0_CLK	O	3.3	SDIO channel 0 clock, 24 MHz for SD and SDIO, 48 MHz for MMC

## 4. Signal Description

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### 4.1. System Memory

The Woodpecker computer modules feature a SO-DIMM connector for up to 2GB of DDR2 memory modules. Suitable memory modules must fit the following parameters:

Attribute	Value
SO-DIMM organization	x64 bits
Dimensions (nominal)	30.0mm high, 67.60mm wide / MO-224 variation of CB
Pin count	200
SDRAM supported	512Mb, 1Gb and 2Gb
Capacity	512MB, 1GB and 2GB
Serial present detect	Consistent with JEDEC rev 1.1
Voltage	1.8V
Interface	SSTL_18
Minimum speed	533MT/s / 400MT/s
Memory organization	x16 bits, x8bits

Suitable memory modules are for example:

- Micron MT8HTF12864HDY (1GB capacity)
- Samsung M470T2864QZ3-CF7 (1GB capacity)
- Swissbit SEN01G64E1CE2MT-30R (1GB capacity)
- Micron MT4HTF6464HY (512MB capacity)

### 4.2. Serial ATA

The two Serial ATA interfaces are provided through the JM20336 USB 2.0 to SATA Bridge from JMicron. The hi-speed USB controller supports the USB mass storage class. For common operating systems no additional driver is needed for the SATA interface.

### 4.3. Parallel ATA

The woodpecker module provides one Parallel ATA interface on the COM Express™ connector. The interface can be used for interfacing two IDE devices (master and slave).



## 4.4. USB Interface

The US15W (System Controller Hub on the Robin Module) features Enhanced Host Controller Logic with 8 USB ports. All 8 ports support USB high speed (480Mbit/s) capable. But only 6 of them are fully USB 2.0 compliant since they support also full speed (12Mbit/s).

6 USB ports are available through the COM Express™ connector. The port 5 of the US15W is used for communication with the Robin Embedded Controller. The port 7 of the US15W is used for the SATA interface bridge. These USB ports are therefore not available on the module connector.

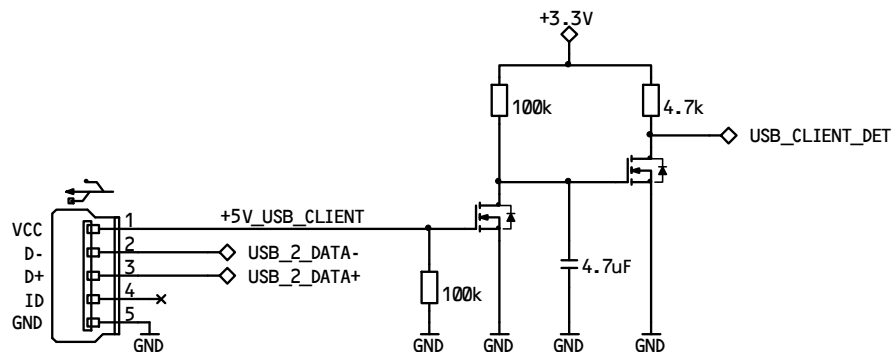
### 4.4.1 USB mapping

The following table shows how the US15W USB signals are mapped to the COM Express USB channels.

COM Express™ Connector USB channel	US15W USB Port
0	0
1	1
2	3
3	4
4	6 (480MBit only)
5	Not available
6	Not available
7 (client)	2 (client)

### 4.4.2 USB client

USB port 7 on the connector can be configured as client. For detecting the presence of a host computer on the client connector, the USB bus voltage coming from the host computer has to be detected. The detection can be implemented using a level-shifter to the USB\_CLIENT\_DET signal on pin 20 of the FFC connector of the Woodpecker module.



## 4.5. Ethernet Controller

The Woodpecker module features an onboard RTL8111C gigabit Ethernet controller from Realtek. On the Woodpecker Z530 module, the controller is connected to a PCI Express x1 lane via the PCI Express switch to the US15W. On the Woodpecker Z510 module, the controller is directly connected to the PCI Express interface of the US15W. The Ethernet controller supports a 10/100/1000 Base-T interface. The device auto-negotiates the use of the different speeds. The network controller features for example crossover detection with auto-correction, polarity correction and cross-talk cancellation.



For high volumes RTL8102E can be assembled instead of the RTL8111C controller. This offers a suitable solution for very price sensitive projects deploying a 10/100 Base-T fast Ethernet controller (please contact Toradex for further information).

#### 4.6. PCI Express

The US15W chipset features only two x1 PCI Express lanes. Therefore the Woodpecker Z530 has a PCI Express switch on the module. The first PCI Express lane of the US15W is directly available at the COM Express™ connector, whereas the second lane is connected to the switch. The outputs of the PCI Express switch are used by the PCI Bridge and the Ethernet controller. A third output of the switch is available on the COM Express™ connector.

Since the Woodpecker Z510 is a low cost module, the PCI switch is not assembled. The second lane of the US15W is connected directly to the Ethernet controller on this module. For high volumes, the Ethernet controller can be unpopulated. Without the Ethernet controller the second PCI Express lane is directly available at the COM Express™ connector (please contact Toradex for further information).

#### 4.7. ExpressCard

The Woodpecker computer module supports the two additional signals for the ExpressCard (card detect and card reset). The card is connected to the system using a USB port and/or a single PCI Express lane.

#### 4.8. PCI Bus

Since the US15W does not provide a PCI interface, a PCI Express to PCI Bridge is on the Woodpecker module. The interface is able to run in 66MHz mode. The PCI signals are at 3.3V logic level but 5V tolerant. Up to 4 PCI cards can be connected to the PCI bus provided by the Woodpecker computer module.

#### 4.9. SDIO, SD Card and MMC

The Intel® US15W features up to 3 SDIO slots. The SDIO slots can be used for SD cards, MultiMediaCards (MMC), as SDIO interface or CE-ATA interface. The SD card and the SDIO interface can run in 1 bit or 4 bit mode, whereas the MMC supports an additional 8 bit transfer. Only SDIO slot 2 of the US15W is 8 bit capable, whereas the other two are only 4bit capable.

SDIO slot 1 is available on the Woodpecker module as MicroSD card holder. The other two SDIO slots are available on an additional 30 pin FFC connector. This connector features a 3.3V power supply for SD cards and MMCs. Since the maximum current consumption of the 3.3V on this connector is limited, an additional power supply might be needed if SDIO devices with higher power needs are used.

#### 4.10. VGA

For high volumes the CH7022 SDVO to VGA converter from Chrontel can be assembled. If this device is populated the SDVO signal is not available on the COM Express™ connector. Please contact Toradex for further information about the assembly options.

#### 4.11. LPC

The LPC interface is a Low Pin Count PCI bus. Components on the carrier board like Super IO or a base board BIOS are connected to this bus.

**Note for external BIOS:** Don't use a clock repeater on the carrier board for the clock signal of the LPC.



## 5. Power Supply

### 5.1. Power States

State	Common Names	Behavior
G3	Mechanical Off	All power supplies except the RTC battery are removed. The power consumption of the system is almost zero, the only the RTC circuit consumes a little power
S5	Soft Off	The system is off except the embedded controller on the module. The embedded controller waits for pressing the power button for starting the system. The power consumption in this state is very low.
S4	Suspend to Disk Hibernation	The content of RAM is written to a non-volatile storage (e.g. hard disc). This allows a recovery of the system to the previous state. From the hardware point of view this state is equal to S5. The system is off except the embedded controller on the module. The embedded controller waits for pressing the power button for restarting the system. The power consumption in this state is very low. The Woodpecker hardware does not distinguish between S4 and S5.
S3	Suspend to RAM Stand by, Sleep	The RAM subsystem is powered for a fast recovery of the system. Not necessary voltage rails are switched off. The module features wake on LAN in this state. Therefore, the network system is powered. The Woodpecker Module needs the 12V main power for powering the suspend voltage rails.
S0	On	The system is working. All power rails are switched on. The power consumption depends on the CPU and peripheral load.

The COM Express Connector features 3 signals for signaling the different states to the baseboard. Since the hardware of the Woodpecker Module does not distinguish between S4 and S5 state, the SUS\_S4# and SUS\_S5# signal are equal.

State	SUS_S5#	SUS_S4#	SUS_S3#
G3	NA	NA	NA
S5	Low	Low	Low
S4	Low	Low	Low
S3	High	High	Low
S0	High	High	High

### 5.2. Power Supply Configurations

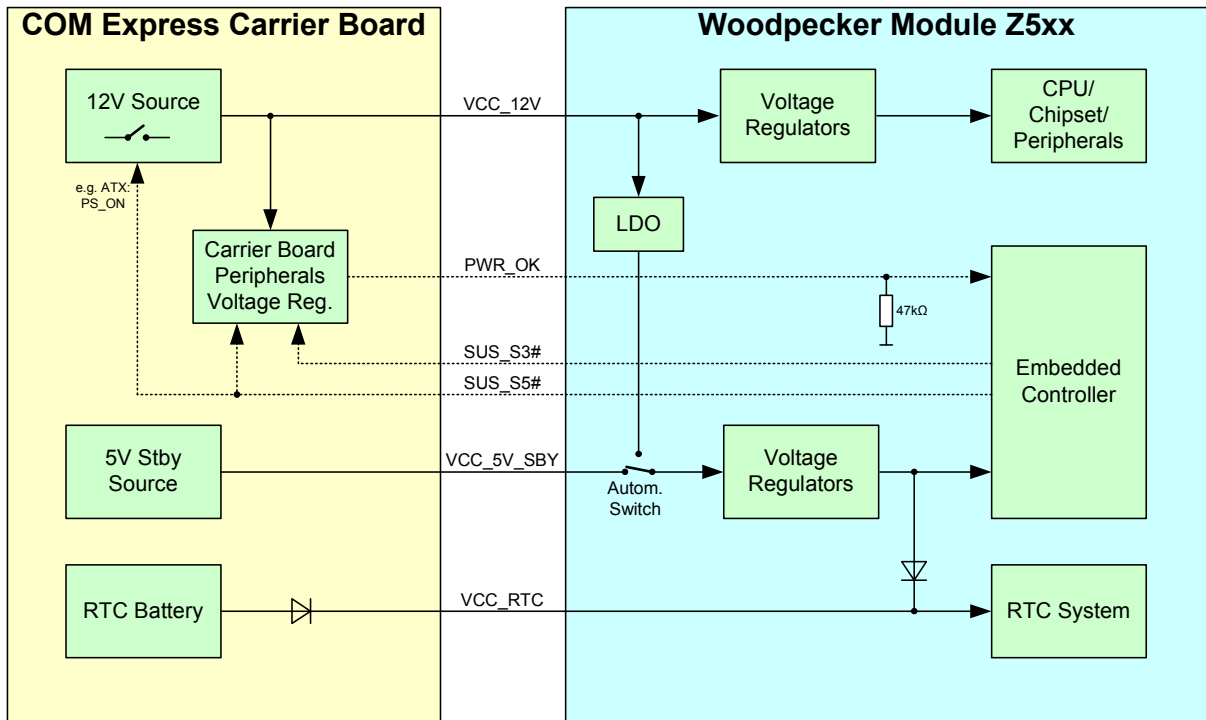
The Woodpecker modules are designed running off a single power supply at nominal +12V. The other two power rails are optionally: a +5V standby power rail and a +3V battery input (powering the real-time clock on the module).

If the 5V standby power is not provided from the base board, the Woodpecker module generates the internal standby power from the standard 12V rail using a linear voltage regulator. Therefore the Woodpecker supports the S4 and S5 state even if 5V standby is absent as long as the 12V rail is present.

The RTC power rail is in parallel powered by the 5V standby rail as well as the 12V rail. Therefore the real-time clock is running as long as either one of the 3V battery, the 5V standby or the 12V main power is active. Important: a diode must be placed between RTC Battery and the RTC Voltage pin of the module connector.



## 5.2.1 ATX-Like Configuration using SUS\_S5# as PS\_ON



If the carrier board features a 5V standby power supply, the 12V main power rail can be switched off in the S5 and S4 state. The SUS\_S5# or SUS\_S4# signal is used for switching the main power. If the carrier board features an ATX Power supply, the SUS\_S5# signal is used to drive through a level shifter the PS\_ON pin of the ATX power supply. The Power good signal from the ATX power supply can be used directly without level shifter as PWR\_OK signal for the module.

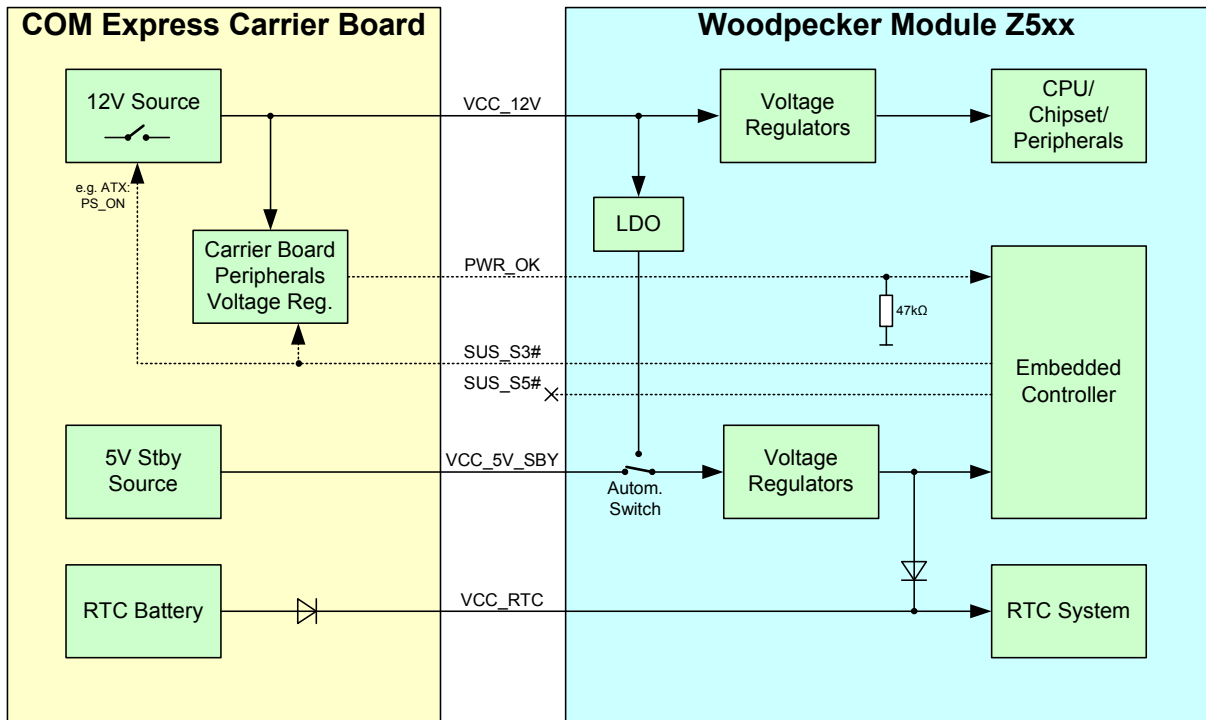
The carrier board has to process the following power sequence:

1. Module de-asserts the SUS\_S5# and SUS\_S4# signal.
2. The baseboard has to switch on the 12V main power rail and the necessary S3 power supplies for the peripherals.
3. If all necessary power rails on the baseboard are stable, the baseboard has to return the PWR\_OK signal to the module. The baseboard has to return the PWR\_OK signal within 15 seconds after the de-asserting of the SUS\_S5# signal. Otherwise the Module returns to the S5 state (power fail). The embedded controller can be configured to retry the power up sequence after 1 minute (see section 6.5.1).
4. The module ramps up all the necessary power supplies for the S3 mode and de-asserts the SUS\_S3# signal.
5. The baseboard switches on the additional peripheral power supplies for the S0 state.
6. The module ramps up all the rest of the power supplies, releases the reset signal and boots.





## 5.2.2 ATX-Like Configuration using SUS\_S3# as PS\_ON



Some of the available carrier boards on the market are using the SUS\_S3# signal for switching the 12V main power rail. The Woodpecker Module needs an embedded controller hack (S3 Signalization Mode) for running on such a carrier board. This hack de-asserts the SUS\_S3# signal at the same time as the SUS\_S5# signal is de-asserted. Section 6.5.2 describes the enabling of this hack. It can also be done by using the Toradex Z5xx Tweaker Tool.

For new designs, Toradex does not recommend such a power configuration, because due to the necessary SUS\_S3# signaling together with the SUS\_S5# signal, the carrier board loses the information of being in the S3 State.

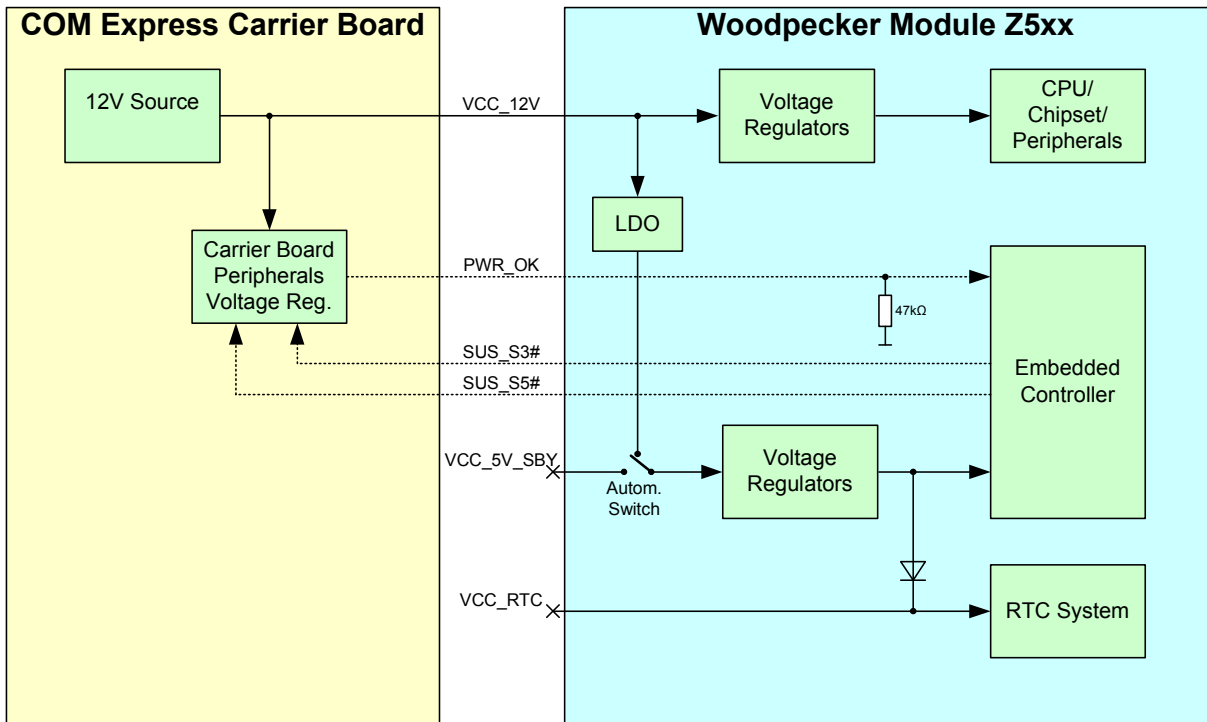
The carrier board has to process the following power sequence:

1. Module de-asserts the SUS\_S5# and SUS\_S4# signal. If the S3 Signalization Mode is set to 1, the module de-asserts also the SUS\_S3# signal.
2. The baseboard has to switch on the 12V main power rail and all power supplies for the peripherals on the baseboard.
3. If all necessary power rails on the baseboard are stable, the baseboard has to return the PWR\_OK signal to the module. The baseboard has to return the PWR\_OK signal within 10 seconds after the de-asserting of the SUS\_S5# signal. Otherwise, the module de-asserts also the SUS\_S3# signal. This allows to boot the module once for setting the S3 Signalization Mode correctly. It is very important to set the S3 Signalization Mode, because otherwise the Should-down and Suspend mode are not working correctly! After other 5 seconds without the PWR\_OK signal, the Module returns to the S5 state (power fail). The embedded controller can be configured to retry the power up sequence after 1 minute (see section 6.5.1).
4. The module ramps up all the necessary power supplies for the S3 mode.
5. The module ramps up all the rest of the power supplies, releases the reset signal and boots.





### 5.2.4 Minimum Power Configuration



In the minimum configuration, the baseboard provides only the 12V main power rail. As long as the main power is available, the real time clock is running. Such a configuration could be suitable for battery powered systems with non removable main battery, or for systems without need for the system clock. The power sequence is equal to the sequence described in section 5.2.3.

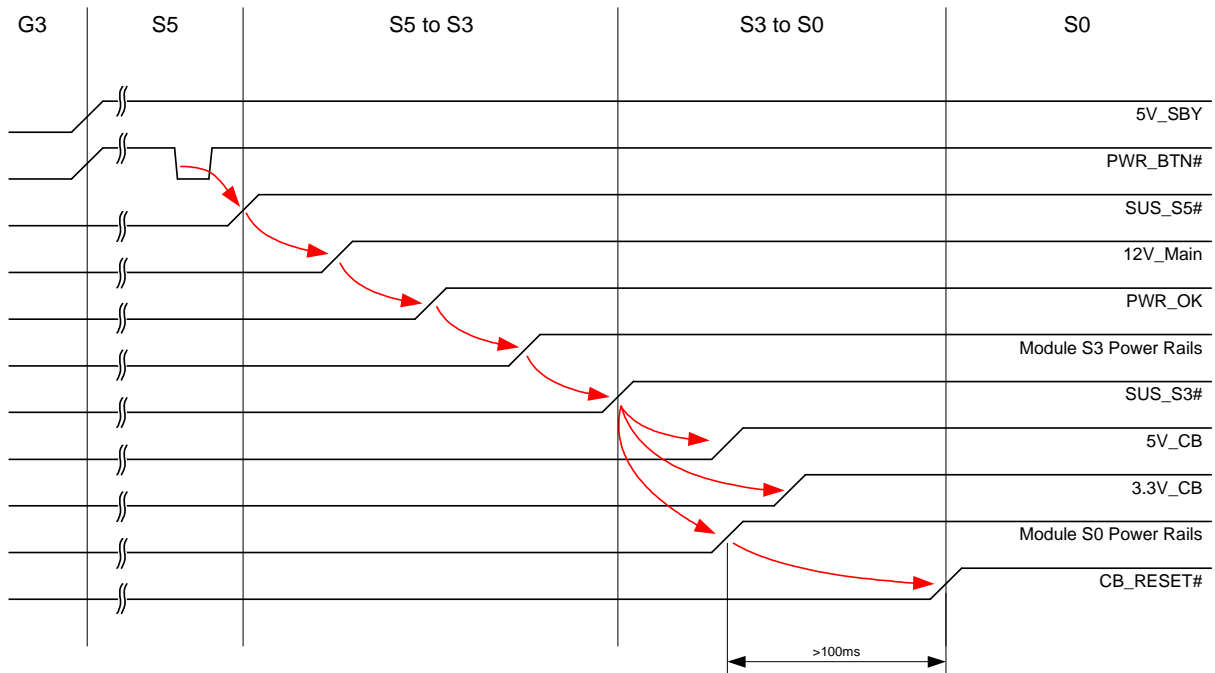
### 5.3. Power Sequences

The following signals are shown in the power sequence diagrams:

Name	Module Direction	Description
5V_SBY	Input	Standby voltage
PWR_BTN#	Input	Power button
SUS_S5#	Output	Module output that indicates the system is in SoftOff state
12V_Main	Input	Primary power input: 12V nominal
PWR_OK	Input	Power OK from main power supply
Module S3 Power Rails		Module power rails that are used in S3 state (no need by carrier board)
SUS_S3#		Indicates the system is suspended to RAM
5V_CB		Carrier board 5V supply (no need by module)
3.3V_CB		Carrier board 3.3V supply (no need by module)
Module S0 Power Rails		Module power rails that are used in S0 state (no need by carrier board)
CB_RESET#	Output	Reset output of the module for the carrier board

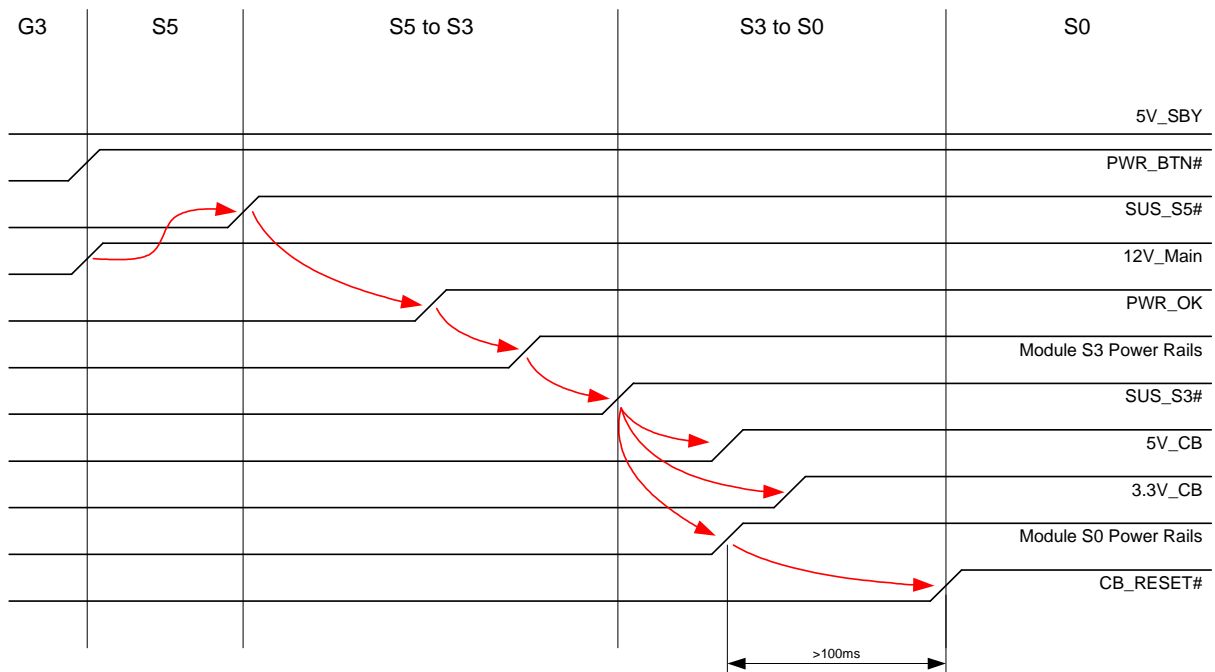


### 5.3.1 G3 to S0 controlled by Power Button



The diagram shows the behavior if the boot mode is set to automatic and the stand by voltage is ramping up before the main power supply. Please refer section 6.5.1 for more information to the boot modes.

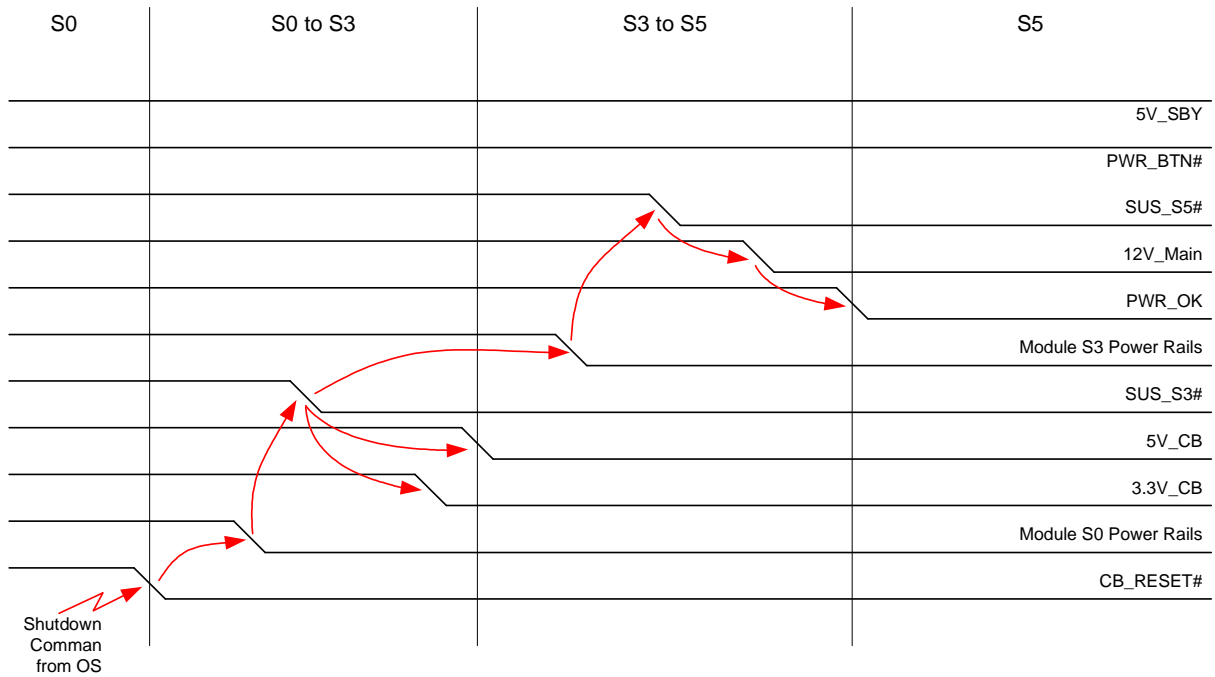
### 5.3.2 G3 to S0 without Waiting for Power Button



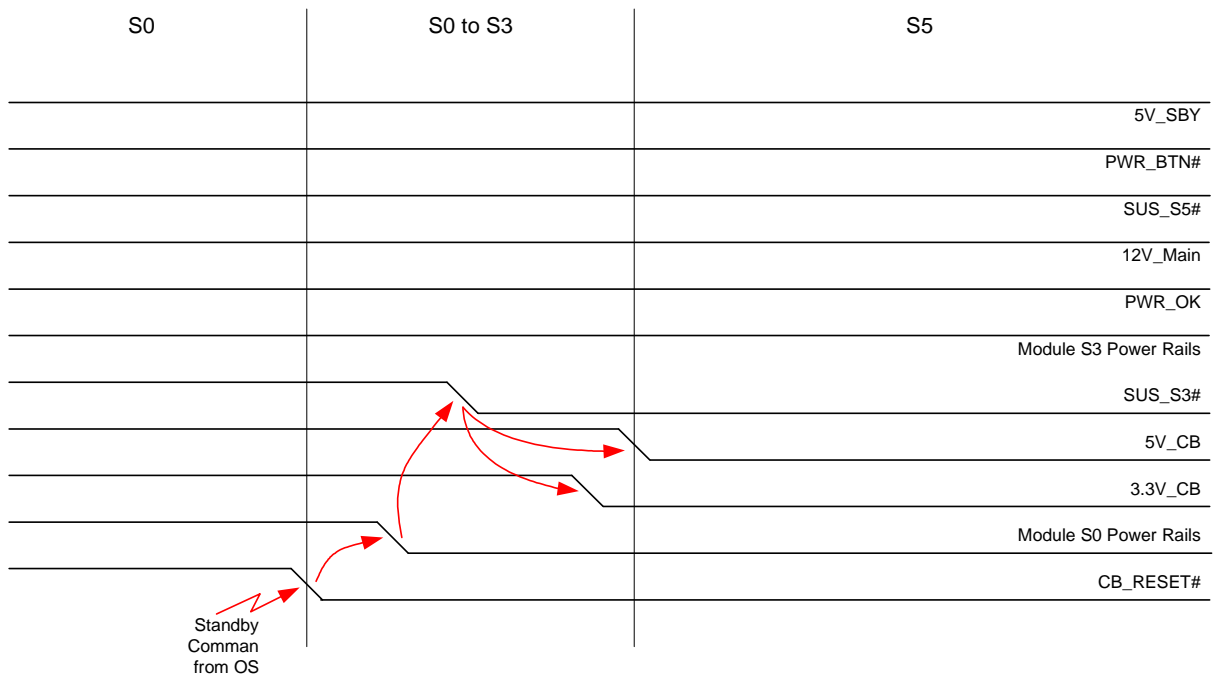
The diagram shows the behavior if the boot mode is set to automatic and the main power voltage is ramping up with no standby voltage available. If boot mode is set to boot always, the same behavior can be achieved even if standby voltage is available. Please refer section 6.5.1 for more information to the boot modes.



### 5.3.3 S0 to S5 Shutdown



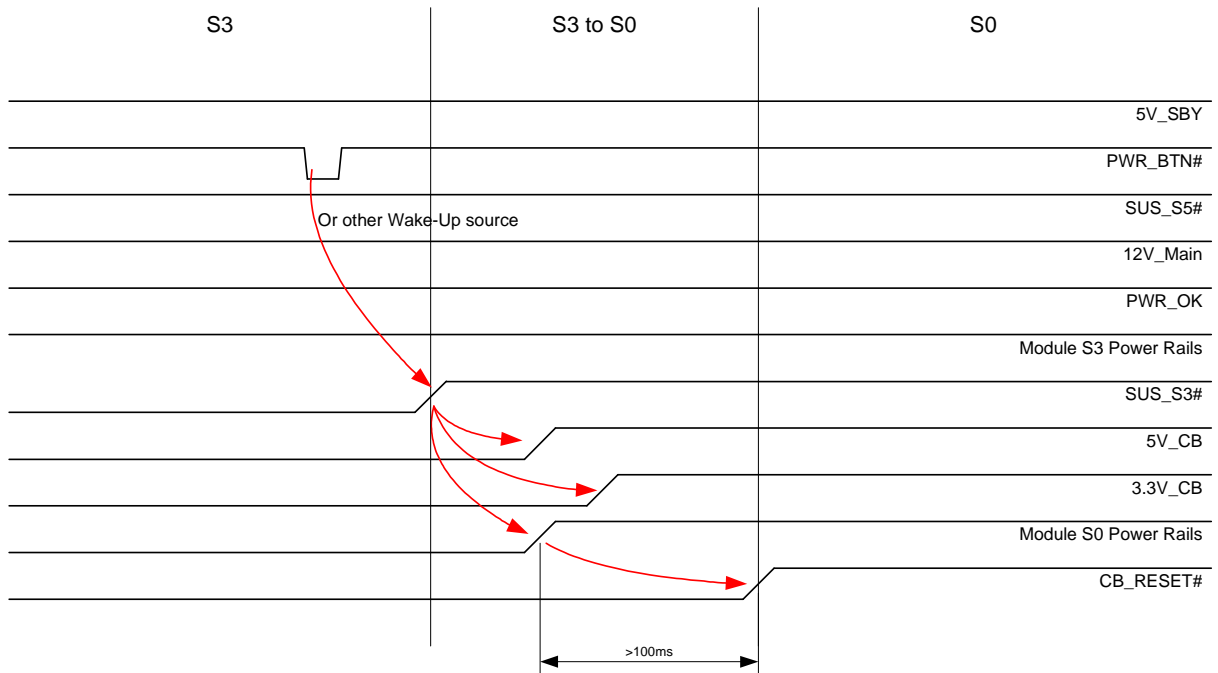
### 5.3.4 S0 to S3 Suspend to RAM



Some power supplies of the carrier board should might not switched off, if a wakeup source uses them.

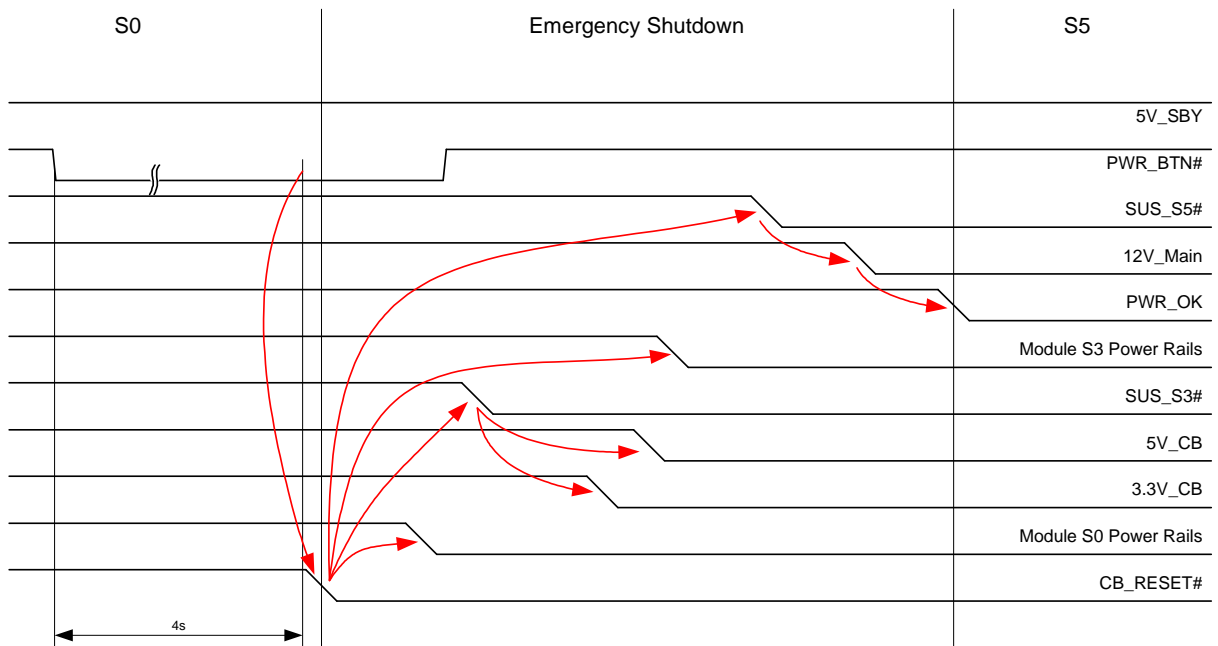


### 5.3.5 S3 to S0 Resume



The diagram uses the power button as wake-up source. Please refer to section 5.4 for other wake-up sources.

### 5.3.6 Power Button Emergency Shutdown



For emergency reasons, the system can be shutdown by pressing the power button more than 4 seconds. The shutdown proceeds without waiting for a proved shutdown of the prior voltage rail.



## 5.4. Wakeup Events

The following wake-up sources are available for waking up the system from the S3 state:

- Power Button
- Wake on LAN signal (WOL)
- WAKE0# (Pin B66) PCI Express wake up signal
- WAKE1# (Pin B67) General purpose wake up signal

The following wake-up sources are available for waking up the system from the S5 and S4 state:

- Power Button
- Ramping up of main power or standby voltage in combination with the according boot mode setting (see section 6.5.1).

## 6. Woodpecker Embedded Controller

The embedded controller on the Woodpecker computer module is a PSoC CY8C24794 from Cypress. The PSoC is a powerful 8 bit microcontroller with USB interface and analog user blocks. The major tasks of the embedded controller are the power management, watchdog functionality, user GPIO system and dedicated I2C interface.

The firmware of the Woodpecker Embedded Controller is compatible with the Toradex Oak Sensor family. For the major functions the same libraries can be used. The embedded controller appears in the operating system as standard USB Human Interface Device (HID). Therefore no additional drivers are necessary in all major operating systems. The communication to the embedded controller knows three different report modes. INTERRUPT OUT reports are used for the GPIO data transmitting and watchdog serving in real time with a maximum latency of 1ms. INTERRUPT IN is the real time transmitting channel for GPIO data from the embedded controller to the main processor. The third communication channel is the FEATURE report. This channel is independent from the interrupt reports and is used as bidirectional non real time communication channel for all the power management, watchdog and GPIO settings.

### 6.1. INTERRUPT OUT Report Contents (Real time data)

The interrupt out report contains two commands for switching the 8 I/O channels, watchdog serving information and I<sup>2</sup>C commands.

Byte Position	Size [Bit]	Name	Function
0	8	OUT1CMD	Command 1 for I/O port bit[7..0]
1	8	OUT2CMD	Command 2 for I/O port bit[7..0]
2	8	WDS	Watchdog serving
3	8	I2C_ID	Number to identify the I <sup>2</sup> C message
4	8	I2C_CMD	Command for the I <sup>2</sup> C Interface
5	8	I2C_ADDR	Slave Address for I <sup>2</sup> C command
6	8	I2C_COUNT	Number of Bytes to send/receive (I <sup>2</sup> C)
7... 11	5 x 8	I2C_DATA_OUT0 ... I2C_DATA_OUT4	I2C Data to send (payload 5 bytes)



### 6.1.1 GPIO Command

The output report for the I/O consists of two commands. The following table explains the usage of these commands.

OUT2CMD[x]	OUT1CMD[x]	Function
0	0	Set pin[x] to 0
0	1	Set pin[x] to 1
1	0	Toggle pin[x]
1	1	Hold previous state of pin[x]

### 6.1.2 Watchdog

With the WDS byte, the watchdog can be served. An interrupt out report with WDS value unequal to the previous sent value serves the watchdog. The application software should send a counter value or a toggle signal to the WDS byte if the watchdog is activated.

### 6.1.3 I<sup>2</sup>C interface

**I2C\_ID:** Identification number. This ID will be copied to the Interrupt In report, if the I<sup>2</sup>C where successfully read from the I<sup>2</sup>C slave device. This number can be used to identify the Interrupt In report with the according I<sup>2</sup>C CMD.

**I2C\_CMD[1..0]:** 0x0 = Perform complete transfer from Start to Stop (standard transfer)  
0x1 = Send Repeat Start instead of Start (used for combined transfer)  
0x2 = Execute transfer without a Stop (use for combined transfer)

**I2C\_CMD[2]:** 0 = Write to the slave device  
1 = Read from the slave device

**I2C\_CMD[3]:** 0 = Executes no I<sup>2</sup>C transfer  
1 = Executes an I<sup>2</sup>C transfer

**I2C\_ADDR:** Address of the I2C slave device. Valid addresses are from 0 to 127

**I2C\_COUNT:** Number of byte to send or receive to the device. The maximum number is 5 for sending data and 4 for receiving data. If more bytes have to be send/received, a combined transfer can be used.

**I2C\_DATA\_OUT:** Payload data for sending to the slave device (maximum 5 bytes)





## 6.2. INTERRUPT IN Report Contents (Real time data)

Byte Position	Size [Bit]	Name	Function
0	16	FRAME	Frame Number in 10 <sup>-3</sup> s
2	8	IO_DATA	GPIO values
3	8	I2C_ID	Number to identify the I <sup>2</sup> C message
4	8	I2C_COUNT	Number of Bytes received (I <sup>2</sup> C)
5... 8	4 x 8	I2C_DATA_IN0 ... I2C_DATA_IN3	Received I2C Data (payload 4 bytes)
9	8	STATE	Status of the System

### 6.2.1 Frame Number

The frame number is a millisecond counter that counts up to 2048. The USB host controller polls the embedded controller every millisecond. In this query, the USB host controller adds a frame number. The embedded controller copies this frame number to the interrupt in report for identifying the message. The frame number can be used for measuring the time between two reports or gives information about lost messages.

### 6.2.2 GPIO Values

This byte contains the actual state of all 8 GPIOs.

### 6.2.3 I<sup>2</sup>C interface

**I2C\_ID:** Identification number. This ID is copied from the Interrupt Out report, if the I<sup>2</sup>C where successfully read from the I<sup>2</sup>C slave device. This number can be used to identify the Interrupt In report with the according I<sup>2</sup>C CMD.

**I2C\_COUNT:** The COUNT contains the number of receive from the device if a new I2C message is available. If no new message is received from the device, the COUNT is set to 0.

**I2C\_DATA\_OUT:** Payload received from the slave device (maximum 4 bytes)

### 6.2.4 System Status

**STATE[0]:** SATA\_ENABLED: This bit represents the actual state of the SATA interface. If the bit is 1, the power of the SATA interface is enabled.

**STATE[1]:** BATLOW#: This bit represents the actual state of the BATLOW# pin of the COM Express connector (pin A27).

**STATE[2]:** WDT: This bit represents the actual state of the WDT pin on the COM Express connector (pin B27). This pin is set to high, if a watchdog event was occurred.

**STATE[3]:** reserved

**STATE[4]:** THERMTRIP#: This bit represents the actual state of the THRMTRIP pin on the COM Express connector (pin A35). This pin is low if the system was shut down due to an over temperature event.

**STATE[5]:** PWRBTN#: This bit represents the actual state of the PWRBTN# pin on the COM Express connector (pin B12). The bit can be used to read the state of the power button in the application program.

**STATE[6]:** reserved



STATE[7]: 5V\_STBY\_AV: This bit is high if the standby voltage rail on the COM Express connector is available.

### 6.3. FEATURE Report Commands for GPIO

The feature report commands are used for writing and reading the settings of the embedded controller. The settings can be written into the RAM or flash of the embedded controller. The settings in the RAM are volatile and will be lost when 12V main power and 5V standby power are disconnected. Please also refer to the “Programming Guide to the Oak Sensor Family” for a detailed description of using the feature reports.

#### 6.3.1 Report Mode

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x00	0x00	RPTMODE

- GnS: 0 = Set  
1 = Get
- Tgt 0 = RAM  
1 = Flash
- RPTMODE: 0 = After Sampling (factory default)  
1 = After Change

#### 6.3.2 Sample Rate

This is the actual sample rate the device is working on. If Report Mode = 0 (After Sampling) this is the rate at which the device reports values to the host PC.

Byte#	0	1	2	3	4	5	6
Content	GnS	Tgt	0x02	0x01	0x00	SampRate LSB	SampRate MSB

- GnS: 0 = Set  
1 = Get
- Tgt 0 = RAM  
1 = Flash
- SampRate: Sample Rate [ms] (factory default 50 ms)

#### 6.3.3 GPIO Direction

This configures the pins of the GPIO as inputs or outputs.

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x01	0x00	DIR7..DIR0

- GnS: 0 = Set  
1 = Get
- Tgt 0 = RAM  
1 = Flash
- DIR7..DIR0: 0 = Configures pin as input (factory default for Pin 3 to 0)  
1 = Configures pin as output (factory default for Pin 7 to 4)

#### 6.3.4 GPIO Output Mode

This configures the pins of the GPIO as CMOS compatible push-pull or open drain output.

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x02	0x00	OM7..OM0



- GnS:           0 = Set  
              1 = Get
- Tgt            0 = RAM  
              1 = Flash
- OM7..OM0:    0 = Configures pin as CMOS compatible push-pull output (factory default)  
              1 = Configures pin as open drain output  
              This setting is ignored, if the pin is configured as input

### 6.3.5 Standby Configuration

This configures the behavior of the GPIO pins that are configured as output in the S3, S4 and S5 state.

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x03	0x00	StbB7.. StbB0

- GnS:           0 = Set  
              1 = Get
- Tgt            0 = RAM  
              1 = Flash
- StbB7..StbB0: 0 = Configures pin as high Z during standby (factory default)  
              1 = Configures pin to do not change state for standby

**Note:** For power saving set all pins to the standby configuration “high Z during standby”. Otherwise, depending on the external circuit, the board can consume more current in standby mode than specified.

## 6.4. FEATURE Report Commands for Watchdog

### 6.4.1 Watchdog mode

Please change the settings of the watchdog **carefully**. You can test the settings by writing them only in the RAM. If the settings are not changed in the flash, the factory default can be restored by unplugging all power supplies.

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x05	0x00	WDT_M

- GnS:           0 = Set  
              1 = Get
- Tgt            0 = RAM  
              1 = Flash
- WDT\_M:        0 = Watchdog is switched off (factory default)  
              1 = Watchdog initiates a system reset if the/a watchdog event occurs.  
                  The embedded controller switches off the watchdog after the fifth system reset without any serving of the watchdog timer in the meantime. This breaks fatal settings of the watchdog (e.g. a too short enable delay time).  
              2 = Only the WDT pin on the COM Express™ will be asserted when a watchdog event occurs, the system will not be reset.

### 6.4.2 Strobe Interval

The strobe interval defines the allowed maximum interval between two serves of the watchdog without occurrence of the watchdog event.

Byte#	0	1	2	3	4	5	6
Content							



Content	GnS	Tgt	0x02	0x02	0x00	WDT_Int LSB	WDT_Int MSB
---------	-----	-----	------	------	------	----------------	----------------

GnS: 0 = Set  
1 = Get

Tgt 0 = RAM  
1 = Flash

WDT\_Int: Strobe interval [ $10^{-1}$ s] (Factory Default 100 = 10s)  
minimum value: 0.1s, maximum value: 100min

### 6.4.3 Watchdog Enable Delay

This defines a delay time before the watchdog has to be served the first time after a system start. Please set this value very **careful** and try the value first by changing them only in the RAM of the embedded controller.

Byte#	0	1	2	3	4	5	6
Content	GnS	Tgt	0x02	0x03	0x00	WDT_Dly LSB	WDT_Dly MSB

GnS: 0 = Set  
1 = Get

Tgt 0 = RAM  
1 = Flash

WDT\_Dly: Watchdog enable delay [ $10^{-1}$ s] (factory default 1200 = 2min)  
minimum value: 1s, maximum value: 100min

### 6.4.4 Watchdog Source

This configures the source of the watchdog serving.

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x06	0x00	WDT_Source

GnS: 0 = Set  
1 = Get

Tgt 0 = RAM  
1 = Flash

WDT\_Source[0]: 0 = USB Interrupt out report not used for serving  
1 = USB Interrupt out report used for serving (factory default)

WDT\_Source[1]: 0 = USB feature report not used for serving  
1 = USB feature report used for serving (factory default)

WDT\_Source[2]: 0 = USB host polling not used for serving (factory default)  
1 = USB host polling used for serving

WDT\_Source[3]: 0 = US15W GPIO not used for serving (factory default)  
1 = US15W GPIO used for serving

WDT\_Source [7..4]: Must be set to 0

### 6.4.5 Serve Watchdog

This feature report command serves the watchdog.

Byte#	0	1	2	3	4
Content	0x00	0x80	0x00	0x01	0x00



## 6.4.6 Reset Watchdog Pin

This feature report command clears the watchdog indication pin on the COM Express™ connector.

Byte#	0	1	2	3	4
Content	0x00	0x80	0x00	0x02	0x00

## 6.5. FEATURE Report Commands for Power Management

### 6.5.1 Boot Mode

This feature sets the behavior of the module when the 5V standby voltage and/or 12V main voltage ramp up.

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x07	0x00	Boot_Mode

GnS:           0 = Set  
                1 = Get

Tgt            0 = RAM  
                1 = Flash

Boot\_Mode [1..0]: 0x0 = Automatic Boot Mode detection (factory default).  
 The module goes into standby (S5) if the 5V standby voltage is available before the 12V main supply and waits for the power button. If the 12V main power ramps up without availability of the 5V standby voltage, the module boots up without waiting for the power button.  
 0x1 = The module waits in S5 state for the power button when the voltages ramp up.  
 0x2 = System boots if the 5V standby or the 12V main power ramped up without waiting for the power button.

Boot\_Mode [2]: 0x0 = No reboot after power fail (factory default).  
 0x1 = Reboots 10 seconds after a power fail

Boot\_Mode [3]: 0x0 = No reboot after an over temperature event (factory default).  
 0x1 = Reboots 1 minute after an over temperature event

Boot\_Mode [4]: 0x0 = Disable USB to SATA bridge (saves energy if bridge is not used)  
 Shout down and reboot the system after a change of this setting  
 0x1 = Enable USB to SATA bridge (factory default).  
 Shout down and reboot the system after a change of this setting

Boot\_Mode [5]: 0x0 = PWR\_OK signal is used to signalize that the S3 power rails of the baseboard are ready (factory default).  
 0x1 = PWR\_OK signal is used to signalize that the S0 power rails of the baseboard are ready.

Boot\_Mode [7..6]: Must be set to 0

### 6.5.2 S3 Signalization Mode

This feature is needed for signalizing the SUS\_S3# together with SUS\_S5# if on a baseboard the SUS\_S3# is used for switching the 12V Main power supply (see chapter 5.1).

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x04	0x00	S3_Sig

GnS:           0 = Set  
                1 = Get

Tgt:           0 = RAM  
                1 = Flash



- S3\_Sig                    0 =    SUS\_S3# signal is independent of SUS\_S5# signal and is low if the system is in S3 state or S4/S5 (factory default).  
                              1 =    SUS\_S3# signal is a copy of the SUS\_S5# signal. It is low only in the S4/S5 state of the system

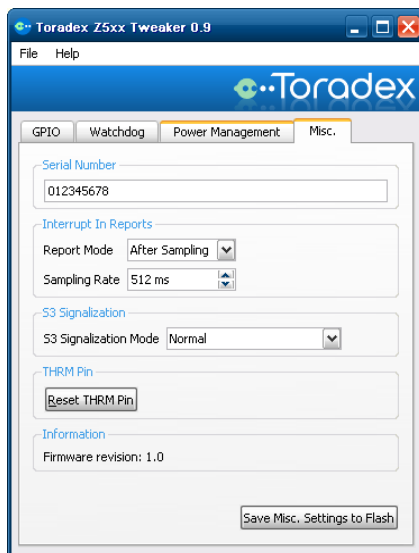
### 6.5.3 Reset THRM Pin

This feature report command clears the thermal shut down indication pin on the COM Express™ connector.

Byte#	0	1	2	3	4
Content	0x00	0x80	0x00	0x00	0x00

## 6.6. Toradex Z5xx Tweaker Tool

The Toradex Z5xx Tweaker Tool is a powerful tool for setting the embedded controller functions. The program is divided into 4 function blocks: GPIO, Watchdog, Power Management and Miscellaneous. The tool reads the current settings of the embedded controller during the start of the program. Every change that is done in the program is directly written to the volatile memory of the embedded controller. If the settings have to be persistent, there is a save-to-flash-button for every function block available.

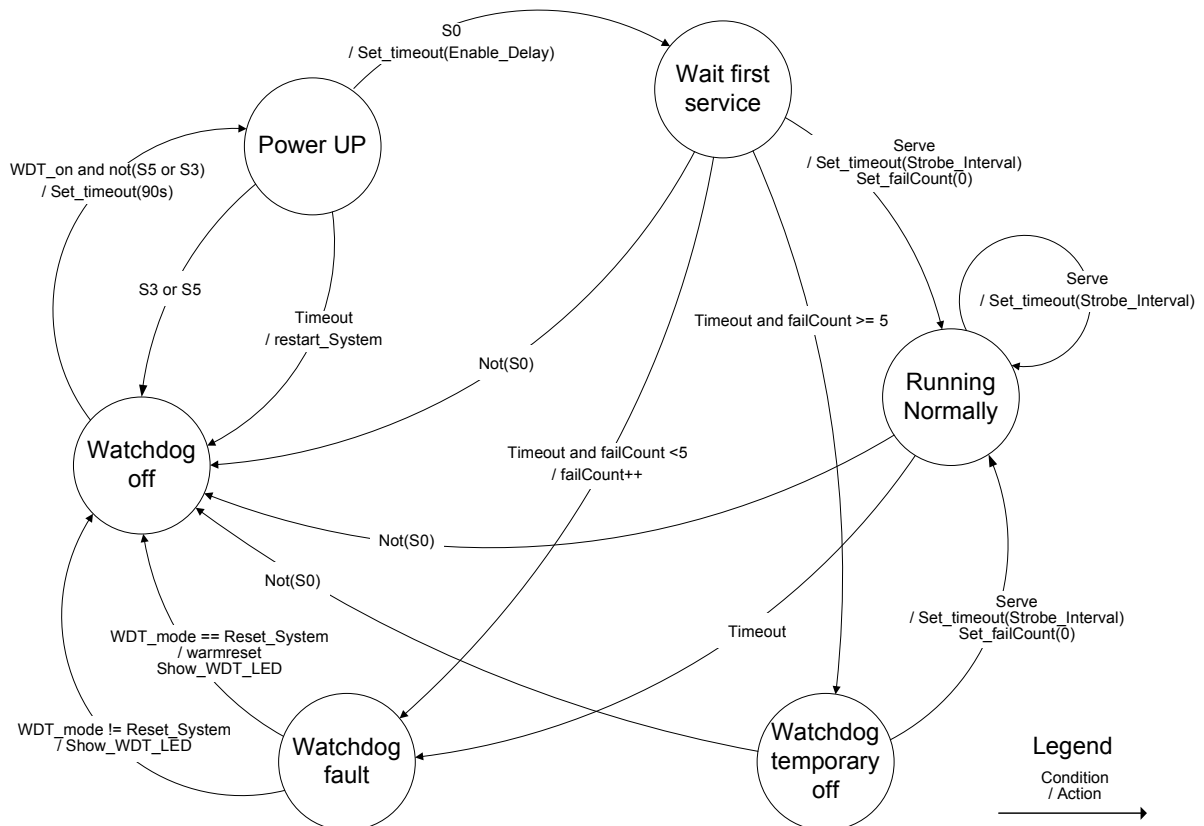


Additional to the feature report settings described in section 6.3, the Tweaker Tool allows the changing of the embedded controller serial number. The customer is allowed to change the serial number according to his needs. This serial number is not used by Toradex to identify the production of the module.



## 7. Watchdog

The watchdog is implemented in the embedded controller of the module. It is designed to monitor and solve hanging and deadlocks of the operating system or application software. The watchdog either restarts the system or only signals the event only to the baseboard. In this case the baseboard can initialize the solving of the problem. The configuration of the watchdog is described in section 6.4. The following figure shows the Mealy Finite State Machine of the watchdog.



- **Watchdog off:** If the system is in the S5, S4 or S3 state, the watchdog is in this state. The FSM is also in this state, if the watchdog is switched off.
- **Power UP:** This state monitors malfunctions in the power up sequence. If the power up to S0 takes more than 90 seconds, the watchdog initialize a restart of the power up sequence. Important: this function monitors only the hanging of the power up sequence. If a power supply that was ramping up correctly fails later in the sequence, the watchdog does not restart the sequence. If the system needs to restart after such a power fail, the boot mode has to be set to reboot (see section 6.5.1)
- **Wait first service:** After the correct power up sequence, the watchdog waits in this state. The timeout in this state is normally higher for allowing the operating system and the application to start. As soon as the watchdog is served for the first time, the watchdog goes into the normal running state. If a timeout occurs before the first serving, the watchdog goes into the fault state. If the watchdog went from the "Wait first service" into the "Watchdog fault" state more than 5 times without serving, it goes into the "Watchdog temporary off" state.
- **Running Normally:** The system is in the normal running state and the watchdog monitors the correct working. If the watchdog is not served within the strobe interval time, the watchdog goes into the fault state.



- **Watchdog temporary off:** All timeout counters are switched off in this state. If the watchdog is in this state, the application was more than 5 times not able to serve the watchdog the first time before the enable delay timeout was occurred. This means the either the enable delay time is set too short or the booting of the system takes more time than planned. The intention of this watchdog state is to solve the problem.
- **Watchdog fault:** Depending on the set mode, the watchdog restarts the system. Independent of the setting, the WDT signal (COM Express Connector Pin B27) is set to high. This signalsizes the Watchdog event to the baseboard. This pin has to be cleared by a USB feature report.

## 8. Technical Specification

### 8.1. Electrical Characteristics

Symbol	Description	Woodpecker Z530			Woodpecker Z510			Unit
		Min	Typ	Max	Min	Typ	Max	
VCC_12V	Main power supply	11.0	12.0	15.0	11.0	12.0	15.0	V
VCC_5V_SBY	Optional standby power supply	4.65	5.0	5.25	4.65	5.0	5.25	V
VCC_RTC	Optional RCT battery supply	2.0	3.0	3.6	2.0	3.0	3.6	V
IDD_DOS	Main power supply current consumption in DOS prompt modus <sup>1)</sup>		0.53			0.35		A
P_DOS	Power consumption in DOS prompt mode <sup>1)</sup>		6.4			4.2		W
IDD_LOAD	Main power supply current consumption with heavy CPU load <sup>2)</sup>		0.66			0.43		A
P_LOAD	Power consumption with heavy CPU load <sup>2)</sup>		7.9			5.2		W
IDD_IDLE	Main power supply current consumption in Windows XP idle state		0.45			0.29		A
P_IDLE	Power consumption in Windows XP idle state		5.4			3.5		W
IDD_S3	Main power supply current consumption in suspend to RAM state (S3)		0.033			0.033		A
P_S3	Power consumption in suspend to RAM state (S3)		0.4			0.4		W
IDD_S5	Main power supply current consumption in standby state (S5) without standby power supply		TBD			TBD		A
P_S5	Power consumption in standby state (S5) without standby power supply		TBD			TBD		W
IDD_5V_S5	Standby power supply current consumption in standby state (S5) with standby power supply		TBD			TBD		A
P_5V_S5	Power consumption in standby state (S5) with standby power supply		TBD			TBD		W
I_RTC	Current consumption of the RTC battery			3.5			3.5	μA

#### Notes:

During the various power consumption tests the Woodpecker module is equipped with a 1GB memory module. The main power supply is 12V. A single LVDS Display with a resolution of 800 x 480 is used.

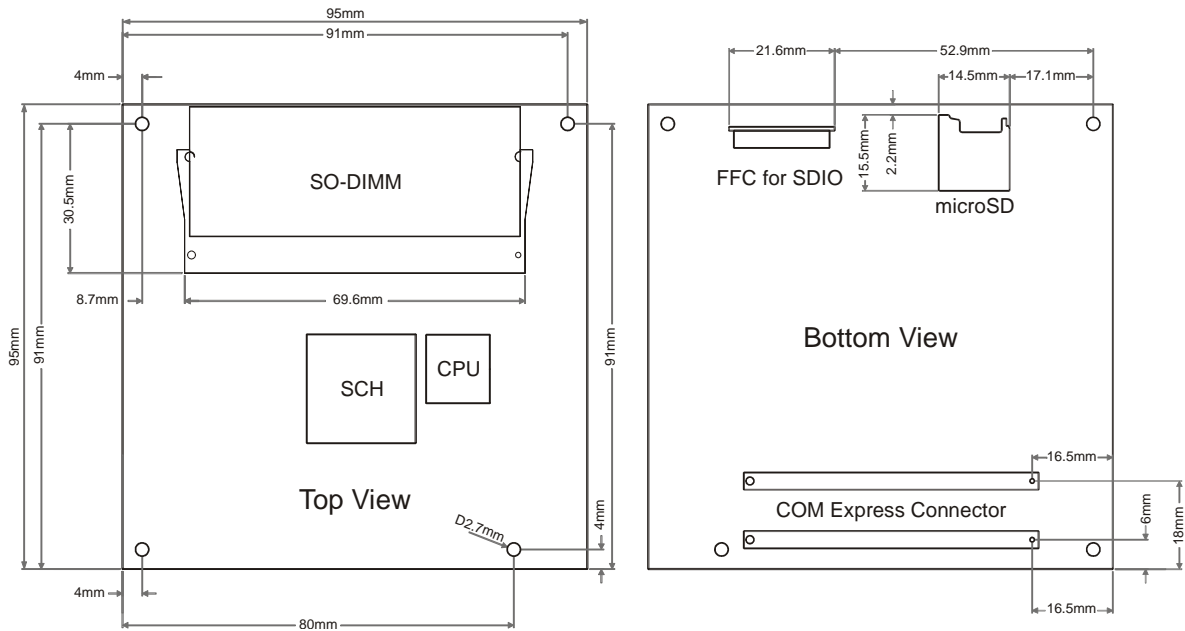
- 1) Software: DOS prompt state.
- 2) Software: Bench mark test program with 100% CPU load and maximum CPU frequency. Network, Micro SD Card and 1 SATA Hard Disc is in use.





## 8.2. Mechanical Characteristics

The Woodpecker modules are mechanically and electrically fully compatible with the micro COM Express Type 2 specifications.



## 8.3. Temperature Range

Description	Woodpecker Z530			Woodpecker Z510			Unit
	Min	Typ	Max	Min	Typ	Max	
Operation Temperature	0		60	0		60	°C
Storage Temperature	-10		85	-10		85	°C

## 8.4. RoHS Compliance

The Woodpecker Z530 and Z510 modules comply with the European Union's Directive 2002/95/EC: "Restrictions of Hazardous Substances"

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