



VEX-6254

DM&P Vortex86EX 400MHz

CPU Module

**with 4S/2USB/AUDIO/LAN/GPIO/I²C/CAN BUS/
AUDIO/AD/eMMC or SD Card Slot**

128MB DDR3 Onboard

User's Manual

(Revision 1.0A)

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Chapter 1

Introduction

1.1 Packing List

Product Name	Package
VEX-6254	● Embedded Vortex86EX CPU Board ● RS232 cable x 4 ● GPIO cable x 1 ● USB cable x 1 (USB port x 2) ● LAN cable x 1 ● AUDIO cable x2 ● PS/2 Mouse cable x 1 ● PS/2 Keyboard cable x 1 ● Screw Kit x 1

1.2 Ordering Information

- **VEX-6254-S** Vortex86EX CPU Module with 128MB DDR3 and SD Card slot
- **VEX-6254-E** Vortex86EX CPU Module with 128MB DDR3 and 512MB eMMC onboard
- **MINIPCIE-9160** Mini PCI-E VGA Module for VEX CPU Module only
- **MINIPCIE-8111F** RTL8111F Mini PCI-E Gigabit LAN Module

1.3 Product Description

The VEX-6254 family of low-power x86 embedded controller is designed to meet PC/104 specification, and integrated with the following features.

- 400 MHz Vortex86EX SoC
- 128MB DDR3 system memory
- 10/100Mbps Ethernet
- 3 USB 2.0 (host)
- Up to 4 serial ports
- Audio
- 16-bit GPIO
- Onboard 8MB SPI Flash
- Mini PCI-E interface
- 2 watchdog timer
- Coreboot BIOS
- Single voltage +5V DC
- Support extended operating temperature range of -20°C to +70°C

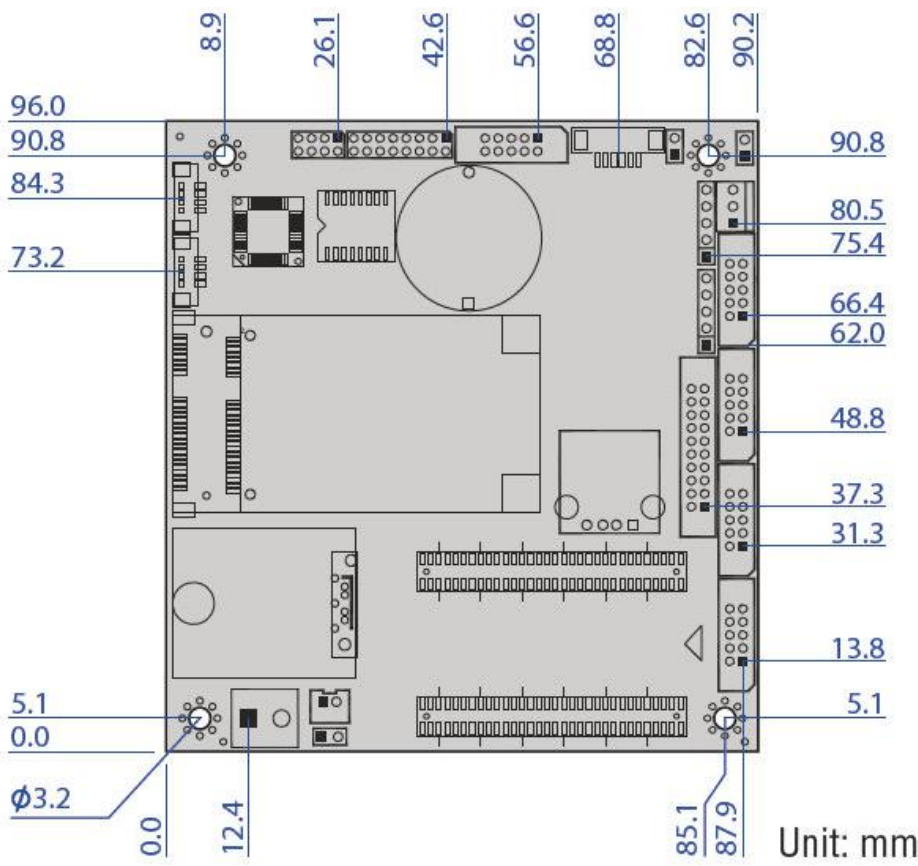
The Vortex86EX series is the newest member of ICOP family with compact size and ultra-low power consumption. It packs 16KB write through 4-way L1 cache, 128KB write through/write back 4-way L2 cache, 2.5Ghz PCI-E Bus, DDR3, ROM controller, I²C, SPI, Fast Ethernet, FIFO UART, USB2.0 Host, CAN, and SD/SATA controllers.

With DDR3 RAM alongside, 400MHz Vortex86EX delivers equivalent calculating power of familiar DX series. In addition, its distinguishing characteristic of extremely lower power consumption also makes it a great solution for relatively simple application such as data collection.

1.4 Specifications

Features	VEX-6254
CPU	DM&P SoC CPU Vortex86EX- 400MHz Real Time Clock with Lithium Battery Backup
Cache	L1:16K I-Cache 16K D-Cache, L2:256KB Cache
BIOS	Coreboot BIOS
System Memory	128MB DDR3 Onboard
Watchdog Timer	Software programmable from 30.5 μ sec.to 512 sec. x2 sets (Watchdog 1 fully compatible with M6117D)
LAN	Integrated 10/100M Ethernet
AUDIO	ALC 262 (HD Audio)
I/O Interface	➊ SATA 7P Connector x1 ➋ RS-232 port x4 (RS-485 x1) ➌ USB port x2 (USB 2.0 version) ➍ 16-bit GPIO port x1 ➎ I²C Connector x1 ➏ CAN BUS x1 ➐ A/D port x1 ➑ 10/100Mbps Ethernet port x1
Connectors	➊ SATA 7P for SATA x 1 ➋ 2.00 mm $\varnothing$ 20-pin box header for 16-bit GPIO x1 ➌ 2.00 mm $\varnothing$ 10-pin box header for USB x1 ➍ 2.00 mm $\varnothing$ 10-pin box header for RS-232 x4 ➎ 2.00 mm $\varnothing$ 8-pin header for Ethernet x 1 ➏ 2.54 mm $\varnothing$ 5-pin header for Keyboard x1 ➐ 2.54 mm $\varnothing$ 5-pin header for Mouse x1 ➑ 2.54 mm $\varnothing$ 3-pin header for CAN Bus x1 ➒ 2.54 mm $\varnothing$ 2-pin header for Reset x1 ➓ 1.25 mm $\varnothing$ 6-pin Wafer for JTAG x1 ➓ 1.25 mm $\varnothing$ 6-pin Wafer for I²C x1 ➓ 1.25 mm $\varnothing$ 4-pin Wafer for Line-out/MIC-in x2 ➓ 0.80 mm $\varnothing$ 52-pin Mini PCI-E connector x1
Flash Disk Support	Onboard 8MB SPI Flash Disk (Drive A, FreeDOS preinstalled) Onboard eMMC 512MB (Optional) SD Card slot SATA DOM
Power Requirement	Single Voltage +5V @400mA
Weight	63g
Board Dimension	90.2 X 96mm (3.55 x 3.77 inches)
Operating Temperature	-20°C ~ +70°C -40°C ~ +85°C (Optional)
Operating System Support	Free DOS, DOS 6.22, PCDOS 7.1, DR-DOS, x-DOS, OS/2, CE6.0, x-Linux, QNX, Vxworks and FreeBSD.

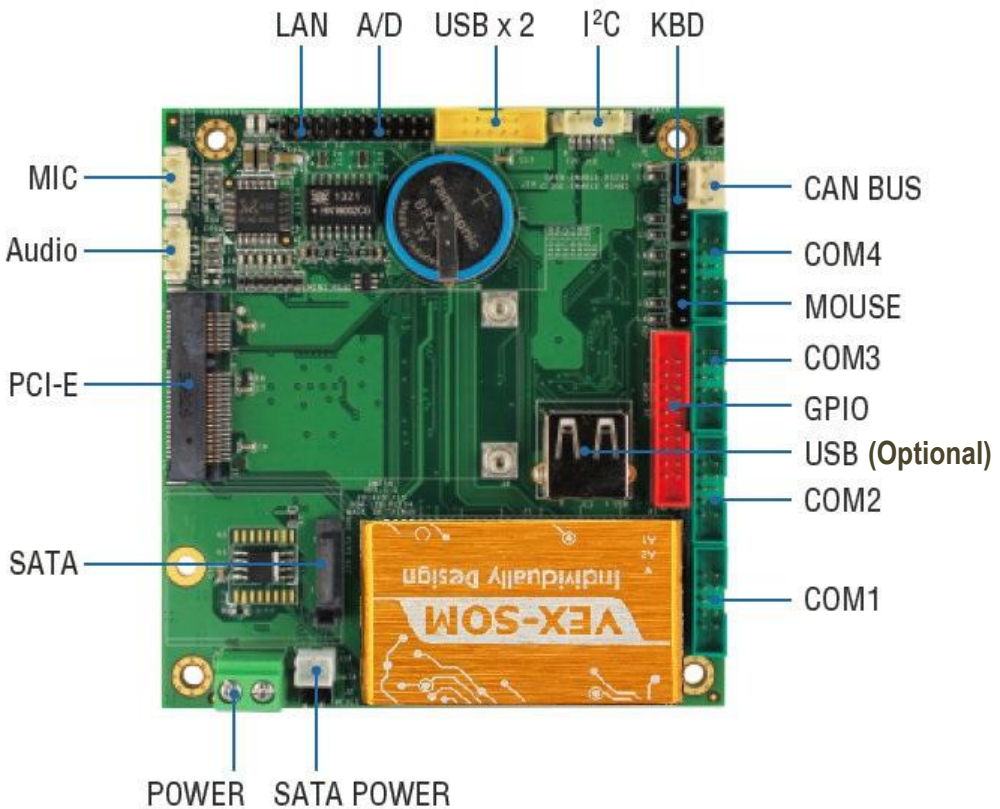
1.5 Board Dimension



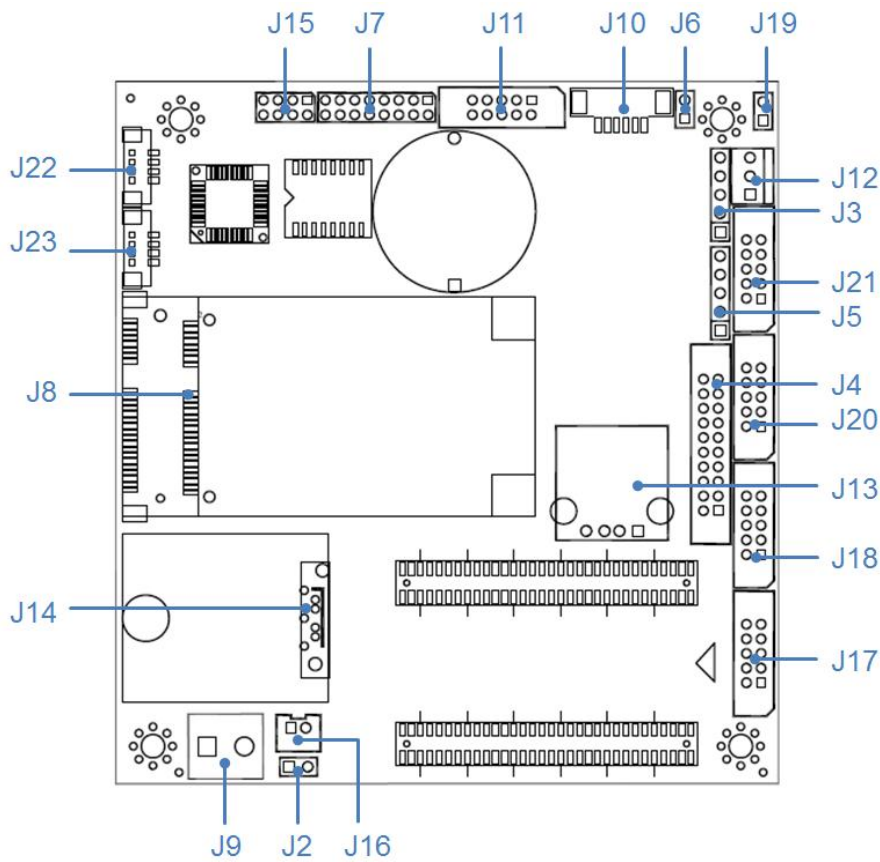
Chapter 2

Installation

2.1 Board Outline



2.2 Connectors Location



2.3 Connectors & Jumpers Summary

Summary Table			
Nbr	Description	Type of Connections	Pin nbrs.
J2	Reset	Pin Header, 2.54Ø, 1x2	2-pin
J3	PS/2 Keyboard	Pin Header, 2.54Ø, 1x5	5-pin
J4	GPIO (Port 6 / 7)	Box Header, 2.0Ø, 10x2	20-pin
J5	PS/2 Mouse	Pin Header, 2.54Ø, 1x5	5-pin
J6	Buzzer	Pin Header, 2.54Ø, 1x2	2-pin
J7	A/D	Pin Header, 2.00Ø, 8x2	16-pin
J8	Mini PCI-E	Pin Header, 2.0Ø, 5x2	10-pin
J9	Power Connector	Terminal Block 5.0Ø, 2x1	2-pin
J10	I ² C	Wafer, 1.25Ø, 6x1	6-pin
J11	USB1	Box Header, 2.00Ø, 5x2	10-pin
J12	CAN BUS	Molex Header, 2.54Ø, 3x1	3-pin
J13	USB2 (Optional)	USB connector	6-pin
J14	SATA DOM	SATA 7P Connector	7-pin
J15	10/100 Ethernet LAN	Pin Header, 2.00Ø, 4x2	16-pin
J16	SATA DOM Power	Box Header, 2.0Ø, 1x2	2-pin
J17	COM1(RS232 or TTL/P0)	Box Header, 2.0Ø, 5x2	10-pin
J18	COM2(RS232/485 or TTL/P1)	Box Header, 2.0Ø, 5x2	10-pin
J19	COM2 RS232/485 Select	Pin Header, 2.54Ø, 1x2	2-pin
J20	COM3(RS232 or TTL/P2)	Box Header, 2.0Ø, 5x2	10-pin
J21	COM4(RS232 or TTL/P3)	Box Header, 2.0Ø, 5x2	10-pin
J22	MIC-IN	Wafer, 1.25Ø, 4x1	4-pin
J23	LINE-OUT	Wafer, 1.25Ø, 4x1	4-pin
LED 1	LAN Link/Active LED(Green)	LED-SMD	
LED 2	LAN Duplex LED(Yellow)	LED-SMD	

2.4 Pin Assignments & Jumper Settings

J2: RESET

Pin #	Signal Name	Pin #	Signal Name
1	RST_SW	2	GND

J3: PS/2 Keyboard

Pin #	Signal Name	Pin #	Signal Name
1	KBCLK	2	KBDAT
3	NC	4	GND
5	VCC		

J4: GPIO (Port 6/7)

Pin #	Signal Name	Pin #	Signal Name
1	GND	2	VCC
3	GP60	4	GP70
5	GP61	6	GP71
7	GP62	8	GP72
9	GP63	10	GP73
11	GP64	12	GP74
13	GP65	14	GP75
15	GP66	16	GP76
17	GP67	18	GP77
19	VCC	20	GND

J5: PS/2 Mouse

Pin #	Signal Name	Pin #	Signal Name
1	MSCLK	2	MSDATA
3	NC	4	GND
5	VCC		

J6: Buzzer

Pin #	Signal Name	Pin #	Signal Name
1	Buzzer	2	VCC

J7: A/D (See section 2.9 for detail)

Pin #	Signal Name	Pin #	Signal Name
1	ADC_0	2	AGND
3	ADC_1	4	AGND
5	ADC_2	6	AGND
7	ADC_3	8	AGND
9	ADC_4	10	AGND
11	ADC_5	12	AGND
13	ADC_6	14	AGND
15	ADC_7	16	AGND

J8: Mini PCI-E (USBD3 Optional)

Pin #	Signal Name	Pin #	Signal Name
1	VCC3	2	VCC3
3	NC	4	GND
5	NC	6	NC
7	NC	8	NC
9	NC	10	NC
11	PE0_CLK-	12	NC
13	PE0_CLK+	14	NC
15	GND	16	NC
17	NC	18	GND
19	NC	20	W_DIS
21	GND	22	PCIRST-
23	PE0_RX-	24	VCC3
25	PE0_RX+	26	GND
27	GND	28	NC
29	GND	30	NC
31	PE0_TX-	32	NC
33	PE0_TX+	34	GND
35	GND	36	LUSBD3-
37	NC	38	LUSBD3+
39	NC	40	GND
41	NC	42	NC
43	NC	44	NC
45	NC	46	NC
47	NC	48	NC
49	NC	50	GND
51	NC	52	VCC3

J9: Power Connector (Terminal Block 5.0mm)

Pin #	Signal Name
1	+5V
2	GND

J10: I²C

Pin #	Signal Name	Pin #	Signal Name
1	VCC	2	GND
3	SCL	4	SDA
5	NC	6	VCC3

J11: USB1 (1 & 2)

Pin #	Signal Name	Pin #	Signal Name
1	VCC	2	VCC
3	LUSBD1-	4	LUSBD2-
5	LUSBD1+	6	LUSBD2+
7	GND	8	GND
9	GGND	10	GGND

J12: CAN BUS

Pin #	Signal Name	Pin #	Signal Name
1	CAN_H	2	CAN_L
3	GND		

J13: USB2 (Optional: USB2 will be occupied while been used)

Pin #	Signal Name	Pin #	Signal Name
1	VCC	2	LUSBD4-
3	LUSBD4+	4	GND
5	GND	6	GND

J14: SATA DOM

Pin #	Signal Name	Pin #	Signal Name
1	GND	2	TX+
3	TX-	4	GND
5	RX-	6	RX+
7	GND		

J15: LAN

Pin #	Signal Name	Pin #	Signal Name
1	LTX+	2	LTX-
3	LRX+	4	DUPLEX
5	LED0+	6	LRX-
7	LED1+	8	LINK/ACTIVE

J16: SATA DOM POWER

Pin #	Signal Name	Pin #	Signal Name
1	VCC	2	GND

J17: COM1 RS232 (Optional: TTL / GPIO-P0)

Pin #	Signal Name	Pin #	Signal Name
1	DCD1	2	RXD1
3	TXD1	4	DTR1
5	GND	6	DSR1
7	RTS1	8	CTS1
9	RI1	10	NC

J18: COM2 RS232 / 485 (Optional: TTL / GPIO-P1)

Pin #	Signal Name	Pin #	Signal Name
1	DCD2	2	RXD2
3	TXD2	4	DTR2
5	GND	6	DSR2
7	RTS2	8	CTS2
9	RI2	10	NC

J19: COM2 RS232 / 485 Select

Pin #	Signal Name
OPEN	RS232
CLOSE	RS485

J20: COM3 RS232 (Optional: TTL / GPIO-P2)

Pin #	Signal Name	Pin #	Signal Name
1	DCD3	2	RXD3
3	TXD3	4	DTR3
5	GND	6	DSR3
7	RTS3	8	CTS3
9	RI3	10	NC

J21: COM4 RS232 (Optional: TTL / GPIO-P3)

Pin #	Signal Name	Pin #	Signal Name
1	DCD4	2	RXD4
3	TXD4	4	DTR4
5	GND	6	DSR4
7	RTS4	8	CTS4
9	RI4	10	NC

J22: MIC-IN

Pin #	Signal Name	Pin #	Signal Name
1	MIC_IN_R	2	GND
3	GND	4	MIC_IN_L

J23: LINE OUT

Pin #	Signal Name	Pin #	Signal Name
1	LOUT_R	2	GND
3	GND	4	LOUT_L

2.5 System Mapping

System Mapping

Memory Mapping

Address	Description	Usage
0000:0000-9000:FFFF	System RAM	Yes
A000:0000-A000:FFFF	EGA/VGA Video Memory	
B000:0000-B000:7FFF	MDA RAM, Hercules graphics display RAM	
B000:8000-B000:FFFF	CGA display RAM	
C000:0000-C000:7FFF	EGA/VGA BIOS ROM	
C000:8000-C000:FFFF	Boot ROM enable	
D000:0000-D700:FFFF	Expansion ROM space	
D800:0000-DB00:FFFF	SPI FLASH Emulation Floppy A Enable	Yes
DC00:0000-DF00:FFFF	Expansion ROM space	
E000:0000-E000:FFFF	Motherboard BIOS	Yes
F000:0000-F000:FFFF	Motherboard BIOS	Yes

I/O Mapping

I/O Address	Owner	Usage
0000h - 000Fh	DMA 8237-1	Yes
0010h - 0017h	COM9	
0018h - 001Fh	Empty	

0020h - 0021h	PIC 8259-1	Yes
0022h - 0023h	6117D configuration port	Yes
0024h - 002Dh	Empty	
0030h - 003Fh	Empty	
0040h - 0043h	Timer counter 8254	Yes
0044h - 0047h	Empty	
0048h - 004Bh	PWM counter 8254	Yes
004Ch - 004Dh	Empty	
0050h - 005Fh	Empty	
0060h	Keyboard data port	Yes
0061h	Port B + NMI control port	Yes
0062h - 0063h	8051 download 4K address counter	Yes
0064h	Keyboard status port	Yes
0065h	WatchDog0 reload counter	Yes
0066h	8051 download 8bit data port	Yes
0067h	WatchDog1 reload counter	Yes
0068h - 006Dh	WatchDog1 control register	Yes
006Eh - 006Fh	Empty	
0070h - 0071h	CMOS RAM port	Yes
0072h - 0075h	MTBF counter	Yes
0076h - 0077h	Empty	
0078h	GPIO data port 0	Yes
0079h	GPIO data port 1	Yes

007Ah – 007ch	GPIO data port 2,3,4	
007Dh - 007Fh	Empty	
0080h - 008Fh	DMA page register	Yes
0090h - 0091h	Empty	
0092h	System control register	Yes
0093h – 0097h	GPIO direction address Port 6,7,8,9,A	
0098h	GPIO direction address Port 0	Yes
0099h	GPIO direction address Port 1	Yes
009Ah	GPIO direction address Port 2	
009Bh	GPIO direction address Port 3	
009Ch	GPIO direction address port 4	
009Dh	GPIO direction address Port 5	
00A0h - 00A1h	PIC 8259-2	Yes
00A2h - 00BFh	Empty	
00C0h - 00DFh	DMA 8237-2	Yes
00E0h - 00FFh	Empty	
0100h	GPIO data address Port 5	
0101h	GPIO data address Port 6	
0102h	GPIO data address Port 7	
0103h	GPIO data address Port 8	
0104h	GPIO data address Port 9	
0105h	GPIO data address Port A	
0170h - 0177h	IDE1 (IRQ 15)	Yes

01F0h - 01F7h	IDE0 (IRQ 14)	Yes
02E8h - 02EFh	COM4 (IRQ 11)	Yes
02F8h - 02FFh	COM2 (IRQ 3)	Yes
0376h	IDE1 ATAPI device control write only register	Yes
0378h - 037Fh	Printer port (IRQ 7 , DMA 0)	
03E8h - 03EFh	COM3 (IRQ 10)	Yes
03F0h - 03F7h	Floppy Disk (IRQ 6 , DMA 2)	
03F6h	IDE0 ATAPI device control write only register	Yes
03F8h - 03FFh	COM1 (IRQ 4)	Yes
0480h - 048Fh	DMA High page register	Yes
0490h - 0499h	Instruction counter register	Yes
04D0h - 04D1h	8259 Edge / level control register	Yes
0CF8h - 0CFFh	PCI configuration port	Yes
1000h - 10FFh	on board LAN	Yes
FC00h - FC05h	SPI Flash BIOS control register	Yes
FC08h - FC0Dh	External SPI BUS control register (output pin configurable GPIO3[0-3])	Yes

IRQ Mapping		
IRQ#	Description	Usage
IRQ0	System Timer	Yes
IRQ1	Keyboard Controller	Yes
IRQ2	Cascade for IRQ8 - 15	Yes
IRQ3	Serial Port 2	Yes

IRQ4	Serial Port 1	Yes
IRQ5	USB / RT0 / RT1 / RT2 / RT3	Yes
IRQ6	Ethernet (10M / 100M)	Yes
IRQ7	CAN Bus / HD Audio / SPI1 / I2C / GPIO0 / GPIO1	Yes
IRQ8	Real Time Clock	Yes
IRQ9	ACPI	Yes
IRQ10	Serial Port 3	Yes
IRQ11	Serial Port 4	Yes
IRQ12	PS2 Mouse	Yes
IRQ13	Math Coprocessor	Yes
IRQ14	Hard Disk Controller#1	Yes
IRQ15	Hard Disk Controller#2 / PIEDIRQ	Yes

DMA Mapping

DMA#	Description	Usage
DMA0		
DMA1		
DMA2	Floppy Disk Controller	
DMA3		
DMA5		
DMA6		
DMA7		

2.6 Watchdog Timer

There are two watchdog timers in Vortex86SX/DX/DX2/EX CPU. One is compatible with M6117D watchdog timer and the other is new. The M6117D compatible watchdog timer is called WDT0 and new one is called WDT1.

We also provide DOS, Linux and WinCE example for your reference. For more technical support, please visit: <http://dmp.com.tw/tech>.

2.7 GPIO (General Purpose Input / Output)

20 GPIO pins (16 channels without VCC and Ground) are provided by the Vortex86EX-6254 for general usage in the system. All GPIO pins are independent and can be configured as inputs or outputs, with or without pull-up/pull-down resistors.

16 channels GPIO of VDX2-6254 are associated with GPIO port 6 and port 7.

Here are registers information of GPIO Port 6 / 7 for your reference.

Port 6		Port 7	
Data Register:	101H	Data Register:	102H
Direction Register:	93H	Direction Register:	94H

We also offer DOS, Linux and WinCE example for your reference. For more technical support, please visit: <http://www.dmp.com.tw/tech>.

2.8 SPI flash (Serial Peripheral Interface)

SPI Flash (Serial Peripheral Interface) offers many benefits including: reduced controller pin count, smaller and simpler PCBs, reduced switching noise, less power consumption, and lower system cost.

If users are considering using a formatted SPI flash to boot the system or emulate SPI flash as Floppy (A: Driver or B: Driver), changing CMOS Setup will be required. Boot up under DOS 6.22, X-DOS, DR-DOS or Free DOS is recommended.

For more technical support, please visit: <http://dmp.com.tw/tech>.

2.9 A/D (Analog-to-Digital) Converter

Onboard ADC is an 11-bit, 100kS/s analog-to-digital converter. This ADC adopts successive approximation register (SAR) architecture which using a 9-bit charge scaling sub-DAC for MSB and a 2-bit voltage scaling sub-DAC for LSB. The input range is between 0 and VCCA (3.3V).

Features

- 11-bit, 100kS/s SAR A/D Converter
- 8-channel input
- Input signal range: 0V~VCC33A(3.3V)
- Operating voltage range: 2.93V~3.63V

Chapter 3

Driver Installation

LAN

The Vortex86EX processor integrates 10/100Mbps Ethernet controller that supports both 10/100BASE-T and allows direct connection to your 10/100Mbps Ethernet based Local Area Network for full interaction with local servers as well as wide area networks such as the Internet.

The controller supports: Half / Full-Duplex Ethernet function to double channel bandwidth, auto media detection.

HD Audio

The Vortex86EX processor integrates an ALC 262 HD Audio controller.

Operating system support

The VEX-6254 CPU board supports embedded software: Free DOS, DOS 6.22, PC DOS 7.1, DR-DOS, x-DOS, OS/2, Windows CE 6.0, x-Linux, QNX, Vxworks and FreeBSD.

For drivers, please visit DMP official website: <http://dmp.com.tw/tech>, and if you cannot locate them, please mail us at info@icop.com.tw.

VEX-6254 also supports most of the popular Linux distributions, for more detail information, please also visit DMP official website: <http://dmp.com.tw/tech>.

Appendix

A. TCP/IP library for DOS real mode

DSock is a TCP/IP library for DOS real mode, which is used by RSIP. It provides simple C functions for programmer to write Internet applications. ICOP also provide Internet examples using DSock: BOOTP/DHCP, FTP server, SMTP client/server, HTTP server, TELNET server, Talk client/server, etc.

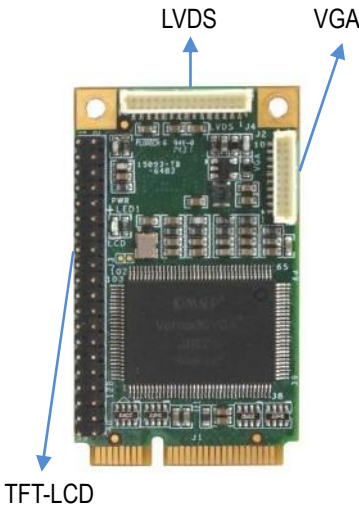
DSock provides a lot of example source code. Programmer can add Internet functions to their project easily and save development time. With a utility "MakeROM", programmer also can make a ROM image to fit their application, those examples can be seen in the following Application systems: Mity-Mite Serial Server, Web Camera Tiny Server and RSIP Serial Server.

DSock is free for all ICOP customers who are using M6117D/ Vortex86/ Vortex86SX/ Vortex86DX/ Vortex86DX2/ Vortex86EX CPU. ICOP also provides the business version, software charge required, of DSock for those customers who are using other x86 CPUs. If you would like to use DSock or business version of DSock, please contact info@icop.com.tw or your regional sales representative.

Please download the trial DSock software and Utilities from our website:
<http://www.dmp.com.tw/tech/dmp-lib/dsock/>.

B. MINIPCI-E-9160

Mini PCI-E VGA Module for VEX CPU Module only



Chipset: Vortex86VGA
Interface support: VGA, TFT/LCD, and 24-bit LVDS
Maximum Resolution: 1024 x 768 @ 60Hz
VESA DDC Support
Operating Temperature: -20°C ~ +70°C

TFT-LCD
(Optional)

Pin#	Single Name	Pin #	Single Name
1.	VDD	2	VDD
3	G4	4	G5
5	G6	6	G7
7	R0	8	R1
9	R2	10	R3
11	R4	12	R5
13	R6	14	R7
15	VSS	16	/
17	/	18	/
19	/	20	VSS
21	B0	22	B1
23	B2	24	B3
25	B4	26	B5
27	B6	28	B7
29	G0	30	G1
31	G2	32	G3
33	VSS	34	VSS
35	DEN	36	XCLK
37	ADJ	38	HSYNC
39	VDDEN	40	VSUNC

24-bit LVDS
(Optional)

Pin#	Single Name
1	VCC3
2	VCC3
3	Y0P
4	Y0M
5	GND
6	Y1P
7	Y1M
8	GND
9	Y2P
10	Y2M
11	GND
12	CLKOUTP
13	CLKOUTM
14	Y3P
15	Y3M

VGA
(Default)

Pin#	Single Name
1	ROUT
2	GND
3	GOUT
4	GND
5	BOUT
6	GND
7	HSYNC
8	GND
9	VSUNC
10	GND

MINIPCIE-8111F

RTL8111F Mini PCI-E Gigabit LAN Module



Pin#	Single Name
1	GTX+1
2	GTX-1
3	GRX+1
4	GTXC+1
5	GTXC-1
6	GRX-1
7	GRXD+1
8	GRXD-1
9	LED0+1
10	LED1+1
11	LED01
12	LED1/EESK1

Warranty

This product is warranted to be in good working order for a period of one year from the date of purchase. Should this product fail to be in good working order at any time during this period, we will, at our option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster. Vendor assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, originality to use this product. Vendor will not be liable for any claim made by any other related party. Return authorization must be obtained from the vendor before returned merchandise will be accepted. Authorization can be obtained by calling or faxing the vendor and requesting a Return Merchandise Authorization (RMA) number. Returned goods should always be accompanied by a clear problem description.