

# MiniPCI-VGA

## Mini PCI Extension Board

### Technical Manual



## *Technical Manual MiniPCI-VGA*

LiPPERT Document: TME-MPCI-VGA-R0V1 Revision 0.1

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## Acronyms

ACPI	Advanced Configuration and Power Management Interface
AES	Advanced Encryption Standard
APM	Advanced Power Management
ATA	Advanced Technology Attachment
BIOS	Basic Input Output System
BPP	Bits Per Pixel
CD	Compact Disc
COM	Communication Equipment
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CXR	Cool XpressRunner
DAC	Digital-to-Analog-Converter
DDR	Double Data Rate
DMA	Direct Memory Access
DOT	Dynamic Overclocking Technology
EIDE	Enhanced Integrated Device Electronics
EMC	Electromagnetic Compatibility
ETH	Ethernet
FIFO	First In First Out
FPU	Floating Point Unit
FWH	Firmware Hub
GPIO	General Purpose Input Output
HDD	Hard Disk Drive
I <sup>2</sup> C	Inter-Integrated Circuit
IP	Internet Protocol
LCD	Liquid Crystal Display
LEMT	LiPPERT Enhanced Management Technology
LED	Light Emitting Diode
LPC	Low Pin Count
LVDS	Low Voltage Differential Signaling
MAC	Media Access Control
MMU	Memory Management Unit
PCI	Peripheral Component Interconnect
PHY	Physical Interface
PLL	Phase-Locked Loop
PWR	Power
SMB	System Management Bus
SMC	System Management Controller
SPI	Serial Peripheral Interface
SSD	Solid State Drive
SVGA	Super Video Graphics Array
TCP	Transmission Control Protocol
TLB	Translation Look-aside Buffer
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
UDMA	Ultra-Direct Memory Access
UDP	User Datagram Protocol
VGA	Video Graphics Array
WDOG	Watchdog

# 1. Overview

## 1.1 Introduction

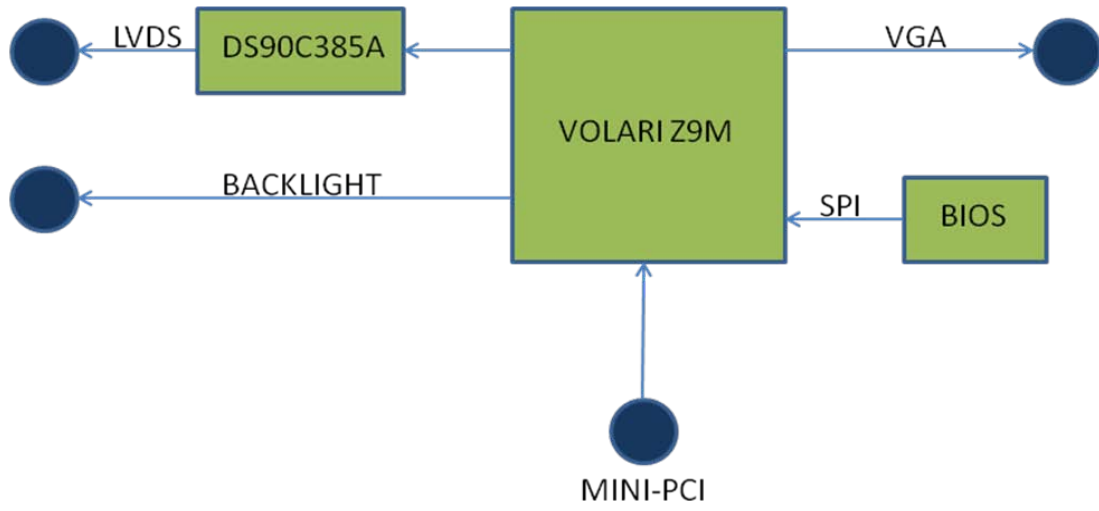
The MiniPCI board MiniPCI-VGA is designed as a VGA extension board for x86 CPU boards without graphics controller or low graphics performance. The x86 CPU board must have a MiniPCI extension slot and must support external VGA bios extension.

The MiniPCI-VGA is designed by using an embedded graphics controller from XGI, the VOLARI Z9M with integrated memory, ensuring long time availability.

### *Features*

- **MiniPCI Bus Interface**  
Supports 32-bit PCI bus standard Revision 2.2 compliant  
Supports 33Mhz PCI operation
- **High Performance 2D Accelerator**  
Built-in hardware command queue, Direct Draw Accelerator, GDI 2000 Accelerator  
Built-in an 1T pipelined 64-bit BITBLT graphics engine with the following functions:
  - 256 raster operations
  - Rectangle fill
  - Color expansion
  - Enhanced color expansion
  - Line-drawing with styled pattern
  - Built-in bytes pattern registers
  - Built-in 8x8 mask registers
  - Rectangle clipping
  - Transparent BitBlit with source and destination keys
  - Source data in command queue BitbltSupports memory-mapped, zero wait-state, burst engine write  
Built-in 64x64x2 bit-mapped mono hardware cursor  
Maximum 256MB frame buffer with linear addressing  
Built-in source read-buffer to minimize engine wait-state  
Built-in destination read-buffer to minimize engine wait-state
- **High Efficient BroadBahn™ Memory Architecture**  
Integrated 8 MByte DDR SDRAM memory
- **VGA Interface**  
Supports 230 MHz pixel clock  
Supports VESA standard super high resolution graphics modes up to 1600x1200x16@60NI
- **High Performance LVDS Interface**  
Supports graphics mode up to 1600x1200@60NI 16M colors  
Built-in power sequencing control outputs  
Supports 18-bit digital interface  
LVDS transmitter National DS90C385A
- **Resolution, Color & Frame Rate**  
Supports 230 MHz pixel clock  
Supports VESA standard super high resolution graphics modes up to
- **Multimedia Application**  
Supports DDC1, DDC2B and DDC 3.0 specifications

*Block Diagram*



## 1.2 Ordering Information

### *MiniPCI-VGA Models*

<b>Order number</b>	<b>Description</b>
706-0017-10	MPCI-VGA MiniPCI VGA board with XGI VOLARI Z9M, 8 MB RAM onboard, VGA output. Operating temp. range: -0°C ... +60°C
806-0017-10	MPCI-VGA MiniPCI VGA board with XGI VOLARI Z9M, 8 MB RAM onboard, VGA output. Operating temp. range: -20°C ... +60°C
906-0017-10	MPCI-VGA MiniPCI VGA board with XGI VOLARI Z9M, 8 MB RAM onboard, VGA output. Operating temp. range: -40°C ... +85°C

## 1.3 Specifications

### *Electrical Specifications*

Supply voltage	+5 V DC, +3.3 V DC from MiniPCI Bus
Rise time	< 10 ms
Supply voltage tolerance	± 5% *
Inrush current	600 mA
Supply current	+ 5 V DC maximal 50 mA + 3.3 V DC maximal 550 mA depending on operating system and connected peripherals

### *Environmental Specifications*

#### *Operating:*

Temperature range	0 ... 60 °C (standard version, models with part numbers 7xx-xxxx-xx) -20 ... 60 °C (industrial version, models with part numbers 8xx-xxxx-xx) -40 ... 85 °C (extended version, models with part numbers 9xx-xxxx-xx)
Temperature change	max. 10K / 30 minutes
Humidity (relative)	10 ... 90 % (non-condensing)
Pressure	450 ... 1100 hPa

#### *Non-Operating/Storage/Transport:*

Temperature range	-40 ... 85 °C
Temperature change	max. 10K / 30 minutes
Humidity (relative)	5 ... 95 % (non-condensing)
Pressure	450 ... 1100 hPa

### *Mean Time Between Failures*

MTBF at 25°C	TBD.
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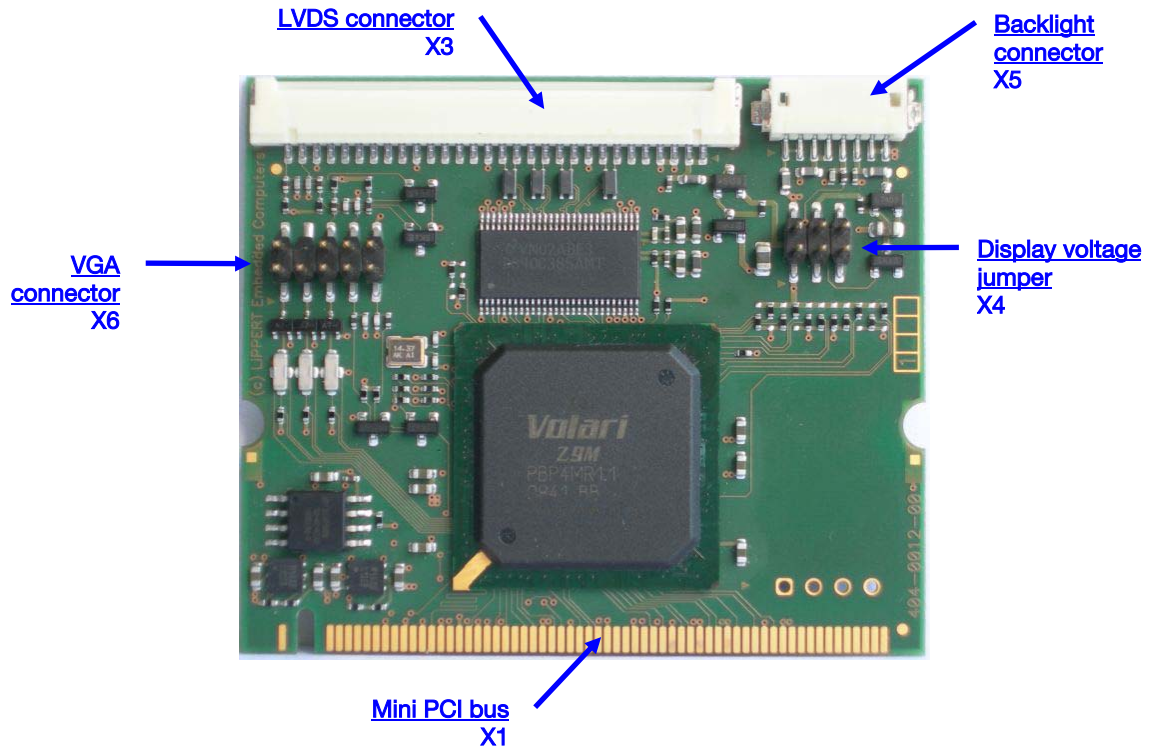
## 1.4 Mechanical

Dimensions (L x W)	59.75 mm x 50.95 mm
Height	max. 6.5 mm on top side above PCB max. 0.2 mm on bottom side above PCB
Weight	10 g
Mounting	Inserted into MiniPCI socket

## 2. Getting Started

### 2.1 Connector and Jumper Locations

*Top*



*Bottom*



## 2.2 Hardware Setup

Installing the MiniPCI-VGA is very straightforward. First, unpack the board observing the usual electrostatic discharge (ESD) precautions.

---



### **Caution**

Before you touch the board, make sure that you have discharged yourself and your gear towards a grounded terminal. Damages due to ESD are usually not immediately visible and will only show up later as failures in the field.

---

Please make sure that your CPU board is supporting external VGA boards on the MiniPCI bus. If necessary change the bios setting of the CPU board accordingly.

### ***Inserting the card***

Insert the card at an angle of about 45 degrees. Then push it towards your CPU board until it snaps into the two latches at the left and the right.

Use the cable provided by LiPPERT to connect a VGA monitor to the MiniPCI-VGA. Make sure the pins match their counterparts correctly and are not bent! Switch the power of the CPU board on.

### ***Removing the card***

Push the latches –one after another– to the outside carefully. The card can be removed easily now.

## 3. Module Description

### 3.1 Graphics Processor

Volari™ Z9M GPU is the extreme programmable GPU of the XGI™ 2D GPU family that comes in a 297-ball, 23mmx23mm BGA package (lead-free). The Volari™ Z9M integrates a PCI 2.2 controller and a 64-bit 2D graphics engine. It integrates a 16-bit DDR memory. The Z9M also incorporates a configurable 3.3V/2.5V DVO digital interface to support a third party LVDS/TMDS transmitter. It can achieve high 2D performance with a memory interface supporting a bandwidth of up to 0.33 GB/s (DDR @166MHz).

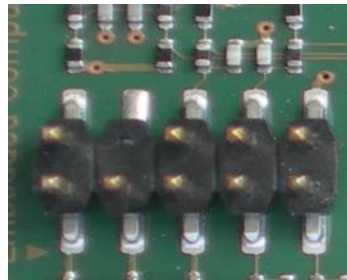
Volari™ Z9M GPU Features:

- PCI Bus Interface
- High Performance 2D Accelerator
- High Efficient BroadBahn™ Memory Architecture
- High Performance Flat Panel Display Interface
- High Integration
- Resolution, Color & Frame Rate
- Power Management
- Multimedia Application

### 3.2 VGA Connector

Connector type: IDC10 pin header 2.0 mm  
Matching connector: IDC10 pin female header (use the included adapter cable to DSUB15 female)

Pin	Signal	Pin	Signal
1	RED	2	GND
3	GREEN	4	Reserved
5	BLUE	6	DDC-CLOCK
7	HSYNC	8	DDC_DATA
9	VSYNC	10	GND



---

#### **Note**



The LVDS and VGA port are using same timing and resolution parameters. The VGA controller does not support using both interfaces at the same time, either VGA is active (standard) or LVDS is active (optional). Therefore the LVDS port is intended to be used in special consumer applications only. Please contact us regarding a special offer for a necessary VGA bios adaption if the LVDS port is planned to be used.



#### **Note**

Position 1 of the connectors are marked with an arrow on the PCB. We recommend to use the included adapter cable from IDC10 to standard DSUB15 VGA female connector.

---

### 3.3 LVDS Connector

The LVDS interface support 18 Bit LVDS displays.

Connector type: Hirose DF14 30 pin header 1.25 mm, single row  
Matching connector: Hirose DF14-30S-1.25C, Part number 538-0012-3 00

Pin	Signal	Pin	Signal
1	VCC_LCD	2	VCC_LCD
3	GND	4	GND
5	NC-	6	NC
7	TXCLK-	8	TXCLK+
9	GND	10	TX2-
11	TX2+	12	TX1-
13	TX1+	14	TX0-
15	TX0+	16	GND
17	NC	18	NC
19	NC	20	NC
21	GND	22	NC
23	NC	24	NC
25	NC	26	NC
27	NC	28	GND
29	DDC_CLOCK	30	DDC_DATA

**Caution:** Maximum current on all supply pins is 1A!

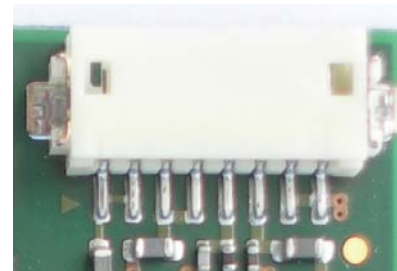


### 3.4 Display Backlight Connector

Connector type: Hirose DF13 8 pin header 1.25 mm  
Matching connector: Hirose DF13-8S-1.25C, part number 536-0007-0 00

Pin	Signal
1	+12V input for VCC_BL
2	+12V input for VCC_BL
3	+5V from MiniPCI bus for VCC_BL
4	+5V from MiniPCI bus for VCC_BL
5	EN Backlight enable signal (3.3. volt)
6	VCC_BL (switched backlight voltage)
7	GND
8	GND

**Caution:** Maximum current on all supply pins is 1A!  
 VCC\_BL is switched Inverter Power.  
 EN is Backlight Enable Signal with 3.3V leveling.



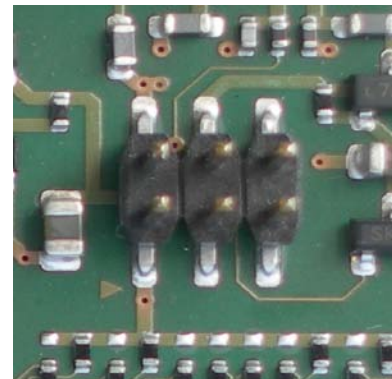
### 3.5 Display Voltage Selector

Jumper for voltage selection of LVDS panels and backlight.

Connector type: IDC6 pin header 2.0 mm  
Matching connector: 2.0 mm jumper

Use a jumper between 1-3 or 3-5 to select the backlight voltage.

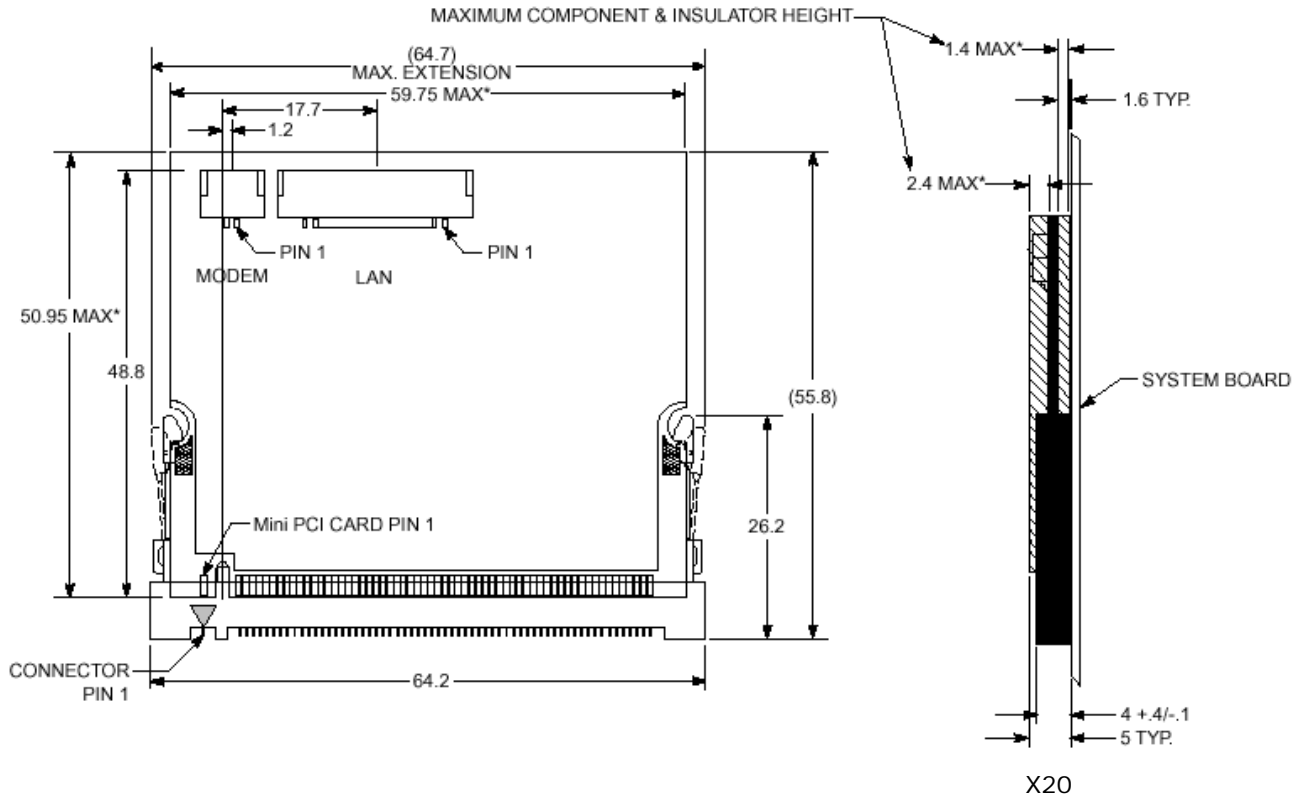
Use a jumper	Signal	Pin	Signal
1	+12V	2	+5V
3	Backlight Voltage	4	Display Voltage
5	+5V	6	+3,3V



**Default jumper setting** is 3,3V for LVDS display and 12V for the inverter.

### 3.6 Mini-PCI BUS connector

The Mini-PCI specification defines a small form factor daughter card for the 32bit PCI bus that can be used on CPU-boards in which standard PCI cards cannot be used due to mechanical constraints. A CPU board with such a card can easily be enhanced with new functionality.



## Mini-PCI Connector (X1)

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	n.c.	2	n.c.	69	GND	70	3.3V
...	n.c.	16	n.c.	71	PCI_PERR#	72	PCI_DEVSEL#
17	PCI_INTA#	18	5V	73	PCI_C/BE1#	74	GND
19	3.3V	20	PCI_INTB#	75	PCI_AD14	76	PCI_AD15
21	n.c.	22	n.c.	77	GND	78	PCI_AD13
23	GND	24	3.3V SBY	79	PCI_AD12	80	PCI_AD11
25	CLK_33_MPCI_R	26	PCI_RST#	81	PCI_AD10	82	GND
27	GND	28	3.3V	83	GND	84	PCI_AD09
29	REQ1_MPCI#	30	GNT1_MPCI#	85	PCI_AD08	86	PCI_C/BE0#
31	3.3V	32	GND	87	PCI_AD07	88	3.3V
33	PCI_AD31	34	PME#	89	3.3V	90	PCI_AD06
35	PCI_AD29	36	n.c.	91	PCI_AD05	92	PCI_AD04
37	GND	38	PCI_AD30	93	n.c.	94	PCI_AD02
39	PCI_AD27	40	3.3V	95	PCI_AD03	96	PCI_AD00
41	PCI_AD25	42	PCI_AD28	97	5V	98	n.c.
43	n.c.	44	PCI_AD26	99	PCI_AD01	100	n.c.
45	PCI_C/BE3#	46	PCI_AD24	101	GND	102	GND
47	PCI_AD23	48	PCI_AD23	103	n.c.	104	GND
49	GND	50	GND	105	n.c.	106	n.c.
51	PCI_AD21	52	PCI_AD22	107	n.c.	108	n.c.
53	PCI_AD19	54	PCI_AD20	109	n.c.	110	n.c.
55	GND	56	PCI_PAR	111	n.c.	112	n.c.
57	PCI_AD17	58	PCI_AD18	113	GND	114	GND
59	PCI_C/BE2#	60	PCI_AD16	115	n.c.	116	n.c.
61	PCI_IRDY#	62	GND	117	GND	118	GND
63	3.3V	64	PCI_FRAME#	119	GND	120	GND
65	n.c.	66	PCI_TRDY#	121	n.c.	122	n.c.
67	PCI_SERR#	68	PCI_STOP#	123	5V	124	n.c.

## 4. Using the Module

### 4.1 BIOS

The MiniPCI-VGA is delivered with a standard VGA bios. Display output is set to VGA connector only. For special customer purpose it is possible to modify the bios for the usage of a LVDS display. Please contact our support or sales department for this option.

The BIOS can be easily updated on board with software under DOS.

### 4.2 Drivers

Graphic drivers for different operating systems are available for the MiniPCI-VGA. These drivers can be downloaded from LiPPERT's website <http://www.lippertembedded.com>.

Follow the installation instructions that come with the drivers.

## 5. Address Maps

This section describes the mapping of the graphics memory and graphic bios into the address spaces of the CPU board.

### 5.1 Memory Address Map

Address Range (Hex)	Description
000A0000-000BFFFF	Graphics Controller memory
000C0000-000C7FFF	VGA Bios

## 6. Troubleshooting

First steps if the board does not boot or no display output is shown:

- Check the power connectors to the board, monitor and additional devices.
- Is the BIOS of the CPU board setup correctly to support external VGA boards ?
- Are all cables plugged on the correct connector and in the correct orientation? The board may not boot if some of the cables are not plugged in correctly!
- Check the power supply. Is the supply voltage correct for the board? If you are not sure, read the manual. Try plugging in a different power supply or multi-meter to check the power a wrong supply voltage can easily FRY a computer and other electrical devices.
- Is your display ok? Is the monitor powered on? Is the monitor's video cable plugged into the video connector? Double-check the brightness and contrast settings. Plug the monitor into another computer if possible to verify the monitor is not the problem.
- Remove all additional devices from the system. Only the processor board, power supply, monitors and the keyboard should remain in the system.
- If all else has failed, replace the CPU Board or the MPCI-VGA board itself.

If you need to send the board to LiPPERT for repair, be sure you get a Return Material Authorization number (RMA) first.

Check also Appendix B (Getting Help).

## Appendix A, Contact Information

### *Headquarters*

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Website [www.lippertembedded.com](http://www.lippertembedded.com)

## Appendix B, Getting Help

Should you have technical questions that are not covered by the respective manuals, please contact our support department at [support@lippertembedded.com](mailto:support@lippertembedded.com).

Please allow one working day for an answer!

Technical manuals as well as other literature for all LiPPERT products can be found in the *Products* section of LiPPERT's website [www.lippertembedded.com](http://www.lippertembedded.com). Simply locate the product in question and follow the link to its manual.

### Returning Products for Repair

To return a product to LiPPERT for repair, you need to get a Return Material Authorization (RMA) number first. Please fill in the RMA Request Form at <http://www.lippertembedded.com/service/repairs.html> and send it to us. We will return it to you with the RMA number.

Deliveries without a valid RMA number are returned to sender at his own cost!

LiPPERT has a written Warranty and Repair Policy, which can be retrieved from <http://www.lippertembedded.com/service/warranty.html>

It describes how defective products are handled and what the related costs are. Please read this document carefully before returning a product.

## Appendix C, Further Resources

<http://www.lippertembedded.com>

LiPPERT Embedded Computers' website with news and detailed information.

<http://www.xgitech.com>

Information about the Volari Z9M Graphics controller.

## Appendix D, Revision History

Filename	Date	Edited by	Change
TME-MPCI-VGA-R0V0	2010-09-21	Matthias Fellhauer	Draft
TME-MPCI-VGA-R0V1	2010-09-23	Matthias Fellhauer	Update front cover picture