



# Pico-ITX

## **VIA Pico-ITX Form Factor**

**“Small is Beautiful”**

Ultra Compact Mainboard Form Factor  
for a New Generation of Small Footprint  
Embedded PCs, Systems and Appliances

**Mainboard Specification  
White Paper**

VIA Technologies, Inc.  
April 2007

## Contents

<b>1. Introduction</b> .....	<b>3</b>
<b>2. Pico-ITX Mainboard Form Factor Overview</b> .....	<b>3</b>
2.1 Pico-ITX Mainboard Form Factor Features and Benefits .....	3
2.2 Pico-ITX Mainboard Form Factor Product Applications .....	5
2.3 Pico-ITX Board Dimensions .....	6
2.4 Pico-ITX Chassis Mounting .....	6
2.5 Pico-ITX Power Specifications .....	6
2.6 Pico-ITX Power Supply Connector .....	7
<b>3. VIA VT6047 Pico-ITX Mainboard Reference Design</b> .....	<b>8</b>
3.1 VIA VT6047 Pico-ITX Mainboard Reference Design Overview .....	8
3.2 VIA VT6047 Pico-ITX Mainboard Reference Design Specification .....	9
3.2 VIA VT6047 Pico-ITX Mainboard Power Requirements .....	10
3.3 VIA VT6047 Pico-ITX Mainboard Reference Design Layout .....	10
<b>4. Conclusion</b> .....	<b>13</b>
<b>5. Contacts</b> .....	<b>13</b>

## Tables

Table 1: Pico-ITX Mainboard Feature & Benefit Summary .....	4
Table 2: Mainboard Dimensions Comparison Chart .....	6
Table 3: Pico-ITX Switching Power Supply DC Output .....	7
Table 4: VIA VT6047 Pico-ITX Mainboard Reference Design Specification .....	9

## Figures

Figure 1: Embedded PC Reference Design .....	5
Figure 2: 12-pin Pico-ITX Power Supply Connector .....	7
Figure 3: VIA VT6047 Pico-ITX Mainboard Reference Design .....	8
Figure 4: VIA VT6047 Pico-ITX Mainboard PCB Layout: Top .....	10
Figure 5: VIA VT6047 Pico-ITX Mainboard PCB Layout: Underside .....	11
Figure 6: VIA VT6047 Pico-ITX Mainboard Mechanical Specifications .....	12
Figure 7: VIA Technology Leadership in Mainboard Design .....	13



## 1. Introduction

This document defines Pico-ITX, the IT industry's smallest mainboard form factor specification, developed by VIA Technologies, Inc. as part of its "Small is Beautiful" strategy of shrinking the x86 platform in order to inspire innovative system design and to make x86 accessible for a new generation of smaller computing and connecting devices.

In addition to describing the main features and applications for Pico-ITX form factor mainboards, this document also includes information about the VIA VT6047 Pico-ITX mainboard reference design, a working version of the board with suggested components and layout.

## 2. Pico-ITX Mainboard Form Factor Overview

### 2.1 Pico-ITX Mainboard Form Factor Features and Benefits

The new Pico-ITX mainboard form factor provides system developers and OEMs with a standardized, ultra compact yet highly integrated platform that can be utilized across multiple embedded PC, system and appliance designs. From car PCs embedded within dashboards and in-flight entertainment systems to industrial automation systems and even ultra portable devices, the Pico-ITX can enable the design of full x86 computing devices in previously impractical locations and applications.

Measuring just 10cm x 7.2cm, the Pico-ITX is currently the smallest complete x86 mainboard in the industry, smaller than all existing ATX, BTX and ITX form factors. It is the latest advance in mainboard design, and the third generation of platform size reduction from VIA:

VIA Form Factor	Dimensions	Announced
Mini-ITX	17cm x 17cm	November 2001
Nano-ITX	12cm x 12cm	March 2004
Pico-ITX	10cm x 7.2cm	April 2007

Remarkably, a board area reduction of exactly 50% has occurred at each stage of miniaturization, and the overall reduction in size over this period, between the Mini-ITX and the Pico-ITX is greater than 75%.

Achieving these levels of miniaturization has been made possible by VIA's principal product design strategy, which has focused on enhancing power efficiency, thermal management and feature integration across the silicon and the platform level. Only by developing smaller, cooler-running silicon components have these size reductions in board design become technologically feasible.

Principal among these advances has been VIA's processor platforms, which has seen an area reduction of 82% over a five-year timeframe, from the Socket 370 package of 50mm x 50mm to the current nanoBGA2 package of the VIA C7 processor family of just 21mm x 21mm, while seeing significant increases in speed and performance. The



VIA VT6047 Pico-ITX mainboard reference design has been specifically developed to be powered by the energy efficient VIA processor platforms, such as the VIA C7 or fanless VIA Eden processor.

The VIA VT6047 Pico-ITX mainboard reference design also features another significant silicon miniaturization advance: one of the new breed of VIA's system media processors, all-in-one digital media IGP chipsets with a powerful array of core logic, multimedia, connectivity and storage technologies within a very highly integrated single-chip package.

Table 1 provides a summary of the main features and benefits of the Pico-ITX mainboard form factor.

**Table 1: Pico-ITX Mainboard Feature & Benefit Summary**

Features	Benefits
Ultra-compact 10cm x 7.2cm Board Size	Enables small footprint system designs Reduces overall system costs
Rich I/O Integration	Support for complete range of I/O standards: ▪ USB, COM, DVI, LVDS, 10/100Mbps Ethernet, etc Reduces overall system costs
VIA Processor Platform	Ultra low power consumption Passive (fanless) cooling Enables more compact system designs
Slimline 30W Power Supply	Saves system space Enables fanless silent PC designs due to its low heat characteristics Reduces overall system costs Enhances reliability



## 2.2 Pico-ITX Mainboard Form Factor Product Applications

The Pico-ITX mainboard form factor opens up a new world of possibilities for system design, with the potential for x86 device across the commercial, industrial, medical, retail, agricultural, travel, utility or personal space. Standard PC computing and communicating functionality for business, academic and personal use can be catered for in smaller than ever packages with the Pico-ITX, even into portable devices for the handbag or briefcase.

The Pico-ITX mainboard form factor was also designed to bring the performance of x86 to the very broad field of embedded design, which underpins almost every aspect of daily life. Automation, display, retail management, casino gaming, traffic management, productivity, signage and many more embedded information and entertainment applications can be given higher levels of intelligence, and can now be built into smaller chassis with the Pico-ITX.

The new Pico-ITX mainboard form factor has been specifically designed for integration in ultra small footprint chassis, including a growing number of embedded PC reference systems, such as that shown in Figure 1.

**Figure 1: Embedded PC Reference Design**



The Embedded PC reference design is a small, quiet and inexpensive entry-level computing platform spanning price points from US\$299 to US\$499. It is optimized for mainstream Internet applications and services as well as common productivity, education, storage and entertainment applications. The Embedded PC is fully compatible with standard x86 hardware and software, thus offering the advantage of flexibility, connectivity, upgrade-ability, and, with the VIA C7 processor, quiet operation.

## 2.3 Pico-ITX Board Dimensions

Table 2 below compares the dimensions of the Pico-ITX with those of other common mainboard form factors used in the PC and embedded industries. As can be seen, the Pico-ITX is the smallest available form factor on the market.

**Table 2: Mainboard Dimensions Comparison Chart**

	Maximum Width (mm)	Maximum Depth (mm)	Maximum Area (mm <sup>2</sup> )	% Larger than Pico-ITX
<b>Pico-ITX</b>	100	72	7,200	-
<b>PC/104</b>	95.9	90.2	8,650	20%
<b>ETX</b>	95	114	10,830	50%
<b>Nano-ITX</b>	120	120	14,400	100%
<b>Mini-ITX</b>	170	170	28,900	301%
<b>FlexATX</b>	229	191	43,739	507%
<b>PicoBTX</b>	266.7	203.2	54,193	652%
<b>MiniATX</b>	284	208	59,072	720%
<b>MicroATX</b>	244	244	59,536	727%
<b>NanoBTX</b>	266.7	223.5	59,607	728%
<b>MicroBTX</b>	266.7	264.2	70,441	878%
<b>BTX</b>	266.7	325.1	86,704	1104%

## 2.4 Pico-ITX Chassis Mounting

The Pico-ITX mainboard form factor was designed specifically for small footprint appliances such as the Embedded PC, Digital Signage, Thin Client, KIOSK, or Set Top Box currently being promoted by VIA Technologies, Inc. It needs a new mounting mechanism for a new chassis design.

## 2.5 Pico-ITX Power Specifications

The Pico-ITX compliant power supply is designed with several space, energy and noise reduction features in mind. The typical physical dimensions (see Table 3 below) are very compact compared to other standard power supplies such as ATX. The options of AC 100 – 240V and 50 – 60Hz auto switching are fully supported.

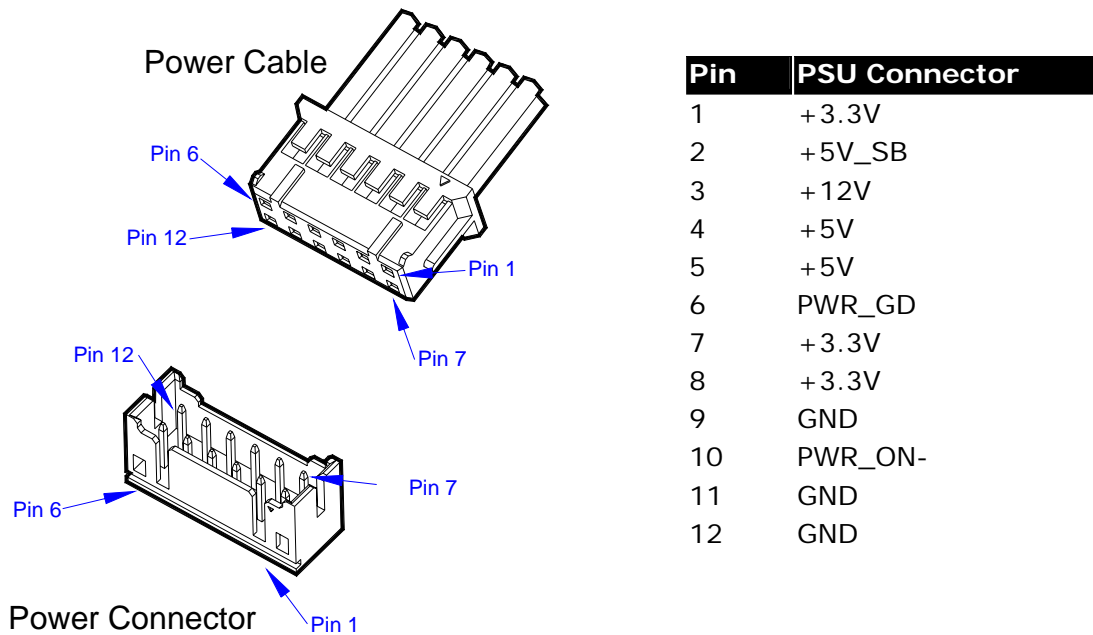
The onboard VIA processor in the nanoBGA2 package leverages its small die size and highly efficient CoolStream architectural design to deliver power consumption to below one watt when running in optimized low voltage mode.



## 2.6 Pico-ITX Power Supply Connector

The Pico-ITX power specification uses an industry standard 12-pin main connector to the power supply as shown in Figure 2.

**Figure 2: 12-pin Pico-ITX Power Supply Connector**



**Table 3: Pico-ITX Switching Power Supply DC Output**

Output Voltage	Load Range		Peak 3 Sec.	Voltage Tolerance	Ripple & Noise (p-p)	Over Voltage Protection
	Min.	Max.				
5V_SB	0.1A	0.5A	0.8A	±5%	100mV	5.5V
+3.3V	0.5A	3.5A	4.0A	±5%	100mV	3.63V
+5V	0.1A	3.5A	4.5A	±5%	100mV	5.5V
+12V	0.01A	0.1A	0.5A	±5%	200mV	13.6V
Total Power: Max 22W, Peak 25W						

## 3. VIA VT6047 Pico-ITX Mainboard Reference Design

### 3.1 VIA VT6047 Pico-ITX Mainboard Reference Design Overview

The VIA VT6047 Pico-ITX mainboard reference design provides developers with a standard platform for designing and building truly cost effective, ultra compact, scalable mainboards incorporating a myriad of features not previously possible using such a small form factor. With an onboard processor and all essential components, the VIA VT6047 Pico-ITX reference design is a complete system on motherboard.

Designed specifically for the energy efficient range of VIA processors such as the VIA C7 processor, the VIA VT6047 is built around one of VIA's highly integrated system media processors, the VIA VX700, an all-in-one digital media IGP chipset, and features one So-DIMM slot, as well as a combination of IDE and SATA connectors, 10/100Mbps Ethernet, and on-board LVDS and DVI interface to provide a highly flexible and cost effective platform that can be scaled to meet a range of product requirements and feature sets.

**Figure 3: VIA VT6047 Pico-ITX Mainboard Reference Design**



The VIA VT6047 Pico-ITX mainboard reference design is ideal for embedded systems, since the embedded market demands much higher levels of energy efficiency and miniaturization than the PC industry, as well as greater product reliability and compatibility. Like its forerunners, the Mini- and Nano-ITX form factors, the VIA VT6047 provides a standardized, off-the shelf platform with full hardware compatibility to minimize development and testing time and to speed time to market.





## 3.2 VIA VT6047 Pico-ITX Mainboard Reference Design Specification

The VIA VT6047 Pico-ITX mainboard reference design configuration specifies the combination of features as shown in Table 4 below.

**Table 4: VIA VT6047 Pico-ITX Mainboard Reference Design Specification**

Item	Description
Processor	VIA C7/VIA Eden V4 bus processor <ul style="list-style-type: none"> <li>• NanoBGA2 package up to 1.5GHz</li> <li>• 128K L1 and 128K L2 cache</li> </ul>
Core Logic	VIA VX700 all-in-one system media processor
Main Memory	<ul style="list-style-type: none"> <li>• 1 DDR2 400/533 So-DIMM socket</li> <li>• Up to 1GB memory size</li> </ul>
Graphics	<ul style="list-style-type: none"> <li>• Integrated VIA UniChrome™ Pro II 3D/2D AGP graphics with MPEG-2/4 and WMV9 video decoder</li> <li>• Integrated LVDS and DVI interface</li> <li>• VIP port for video overlay function</li> </ul>
Storage (ATA)	<ul style="list-style-type: none"> <li>• UltraDMA 133/100/66/33</li> <li>• One 44-pin right-angle IDE connector</li> <li>• One SATA connector</li> </ul>
Audio System	VIA VT1708A <ul style="list-style-type: none"> <li>• 7.1 channels high definition audio codec</li> <li>• 7.1 channels audio out and SPDIF in header</li> <li>• Sound Blaster, Sound Blaster Pro compatible</li> </ul>
Ethernet (LAN)	VIA VT6106S <ul style="list-style-type: none"> <li>• 10/100Mbps Ethernet Controller</li> </ul>
TV Out	VIA VT1625M TV Encoder integrated (optional) <ul style="list-style-type: none"> <li>• Integrated Macro Vision 7.01</li> <li>• High quality scaling and filtering</li> <li>• S-Video or Composite video output</li> <li>• Support NTSC/PAL TV</li> </ul>
On-board I/O Ports	<ul style="list-style-type: none"> <li>• One USB header for four USB 2.0 ports.</li> <li>• One Front audio header for 7.1 audio, Line-in, and Mic-in</li> <li>• One LVDS and DVI connector</li> <li>• One PS/2 mouse/keyboard header</li> <li>• One COM port header</li> <li>• One Pico-ITX power connector</li> <li>• One optional multi-media connector for HDTV and capture port expansion</li> </ul>
Rear I/O Ports	<ul style="list-style-type: none"> <li>• One RJ45 Ethernet port</li> <li>• One CRT connector</li> </ul>



### 3.2 VIA VT6047 Pico-ITX Mainboard Power Requirements

The VIA VT6047 Pico-ITX mainboard reference design can support both ITX and ATX compliant power supplies. The VIA 60W DC to DC converter PWB-N550 daughterboard is recommended to support 12V output. There is an AC adapter, which is popular in the market place.

### 3.3 VIA VT6047 Pico-ITX Mainboard Reference Design Layout

Figures 4 and 5 outline the basic placement of components on the VIA VT6047 Pico-ITX mainboard reference design layout, while Figure 6 specifies the board dimensions.

Figure 4: VIA VT6047 Pico-ITX Mainboard PCB Layout: Top

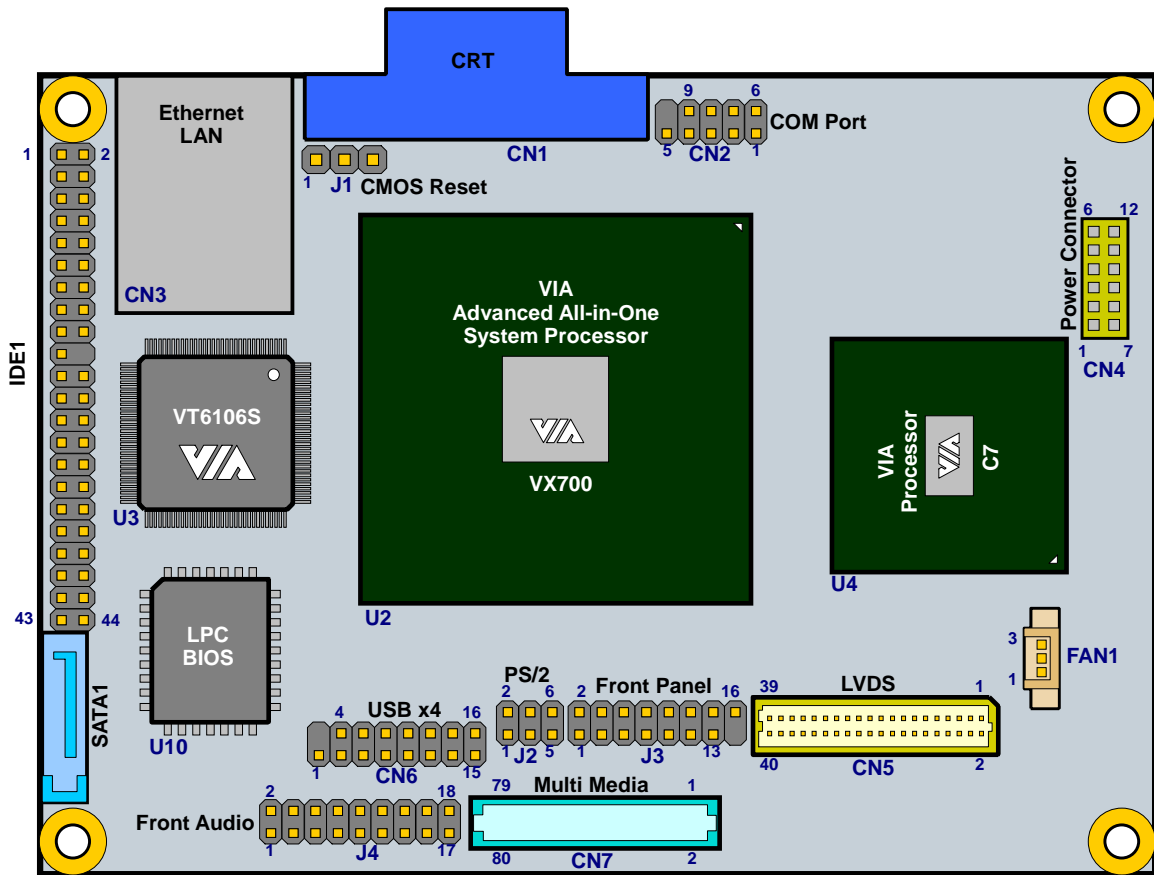
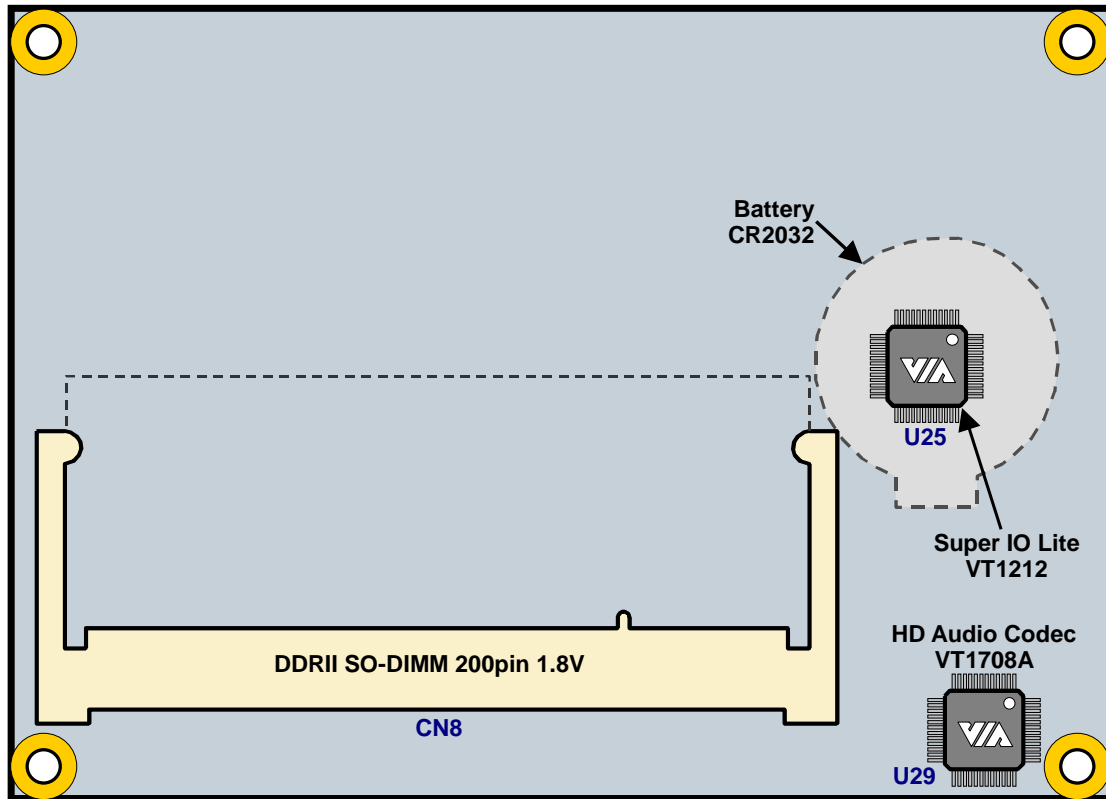
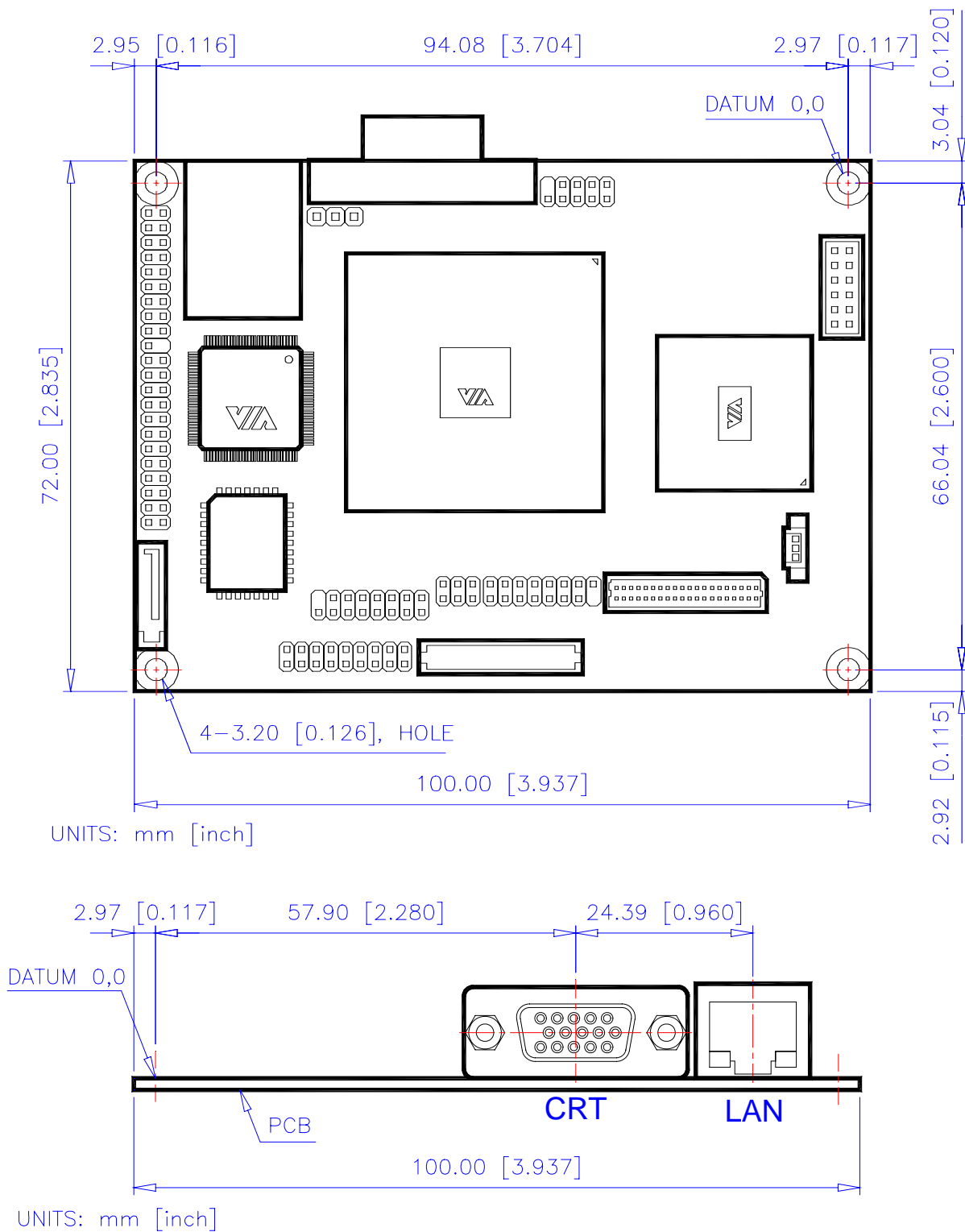


Figure 5: VIA VT6047 Pico-ITX Mainboard PCB Layout: Underside



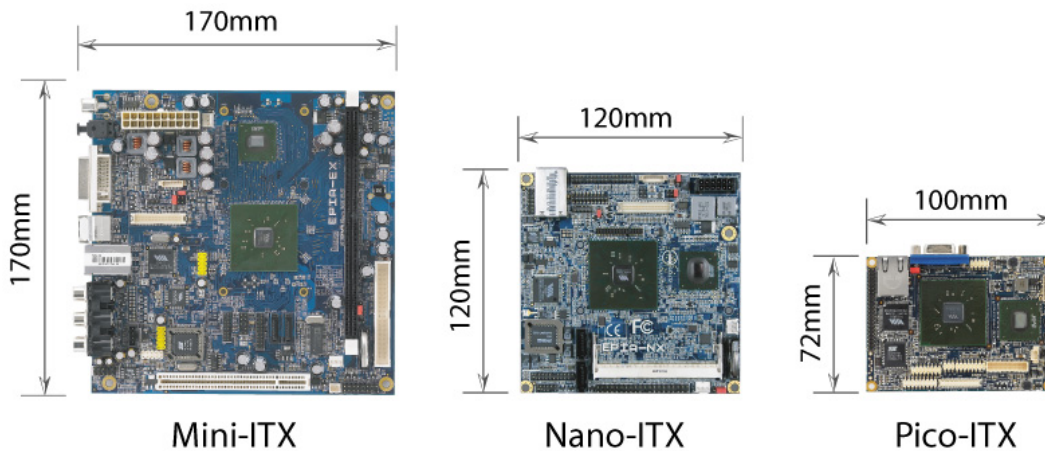
**Figure 6: VIA VT6047 Pico-ITX Mainboard Mechanical Specifications**



## 4. Conclusion

The introduction of the Pico-ITX form factor builds on VIA's tradition of technology leadership at the platform level. VIA's Mini-ITX form factor, which celebrated its 5<sup>th</sup> anniversary of commercial availability as the first VIA EPIA mainboard in February of this year, has been enthusiastically adopted by both developers and hobbyists alike and fostered a whole community dedicated to small form factor design, with multiple vendors offering this form factor in both the PC and embedded industries, and a broad and mature infrastructure in place for chassis and other accessories. The Nano-ITX is following in its footsteps, having been well received by the embedded market. Now, the Pico-ITX takes over the mantle as the smallest x86 platform for innovation.

**Figure 7: VIA Technology Leadership in Mainboard Design**



## 5. Contacts

For more information on the Pico-ITX form factor specification, please contact Richard Brown or Robert Kuo, VIA Technologies, Inc, or access the VIA corporate website at [www.viatech.com](http://www.viatech.com).

- 1) Marketing Contact: Richard Brown, RIBrown@via.com.tw
- 2) Technical contact: Robert Kuo, RobertKuo@via.com.tw

# Pico-ITX

