Axiomtek COM Express® Type 6 Product

White Paper

1. Introduction

The COM Express® standard was first released in 2005 as the open industry standard for Computer-On-Module by the PCI Industrial Computer Manufacturers Group (PICMG). The COM Express® standard has worked to provide standardized module interfaces for several different target industries such as industrial automation, gaming, defense and aerospace, medical, retail, advertising, etc.

A COM requires a baseboard to provide I/O functions and to power up. COMs are used to build single board computer solutions and offer OEMs fast time-to-market with reduced development cost. Like integrated circuits, they provide OEMs with significant freedom in meeting form-fit-function requirements. For all these reasons the COM methodology has gained much popularity with OEMs in the embedded industry.

The COM Express® standard has key features including rich high bandwidth serial interfaces such as PCI Express, Serial ATA, USB 3.0 and Gigabit Ethernet. It also supports extensive video port including VGA, LVDS, DP, DVI and HDMI termination drivers plus x16 PEG port to carrier board graphic controller.

Systems based on the COM Express® specification require the implementation of an application-specific carrier board that accepts the module. User-specific features such as external connector choices and locations and peripheral circuits can be tailored to suit the application, so that the OEM can focus on application-specific features rather than CPU board design. The OEM also benefits from a wide choice of modules providing a scalable range of price and performance upgrade options.

2. COM Express® Specification

The COM Express® specification defines requirements for highly integrated slim modules with standard I/O interfaces and connections, which allows interoperability between multi-sourced modules.

Key capabilities defined in the COM Express® specification include support for:

- ➢ PCI Express Bus
- ➢ PCI Express Graphics (PEG)
- ➢ Serial ATA
- ➢ USB 2.0/3.0
- ➢ Gigabit Ethernet
- ➢ DDI interface

The COM Express® specification defines four form factors:

- ➢ Mini (84 x 55 mm) Module
- ➢ Compact (95 x 95 mm) Module
- ➢ Basic (125 x 95 mm) Module
- ➢ Extended (155 x 110 mm) Module

The Mini Module targets the next generation of mobile applications that require energy saving processors, high-end graphics combined with longer battery life. Compact/Basic Modules usually use a single (or two stacked) horizontal mount SO-DIMM. The mechanical envelope for the Basic Module is defined for low-profile, space-constrained applications. Figure 1 shows COM Express® form factors and Axiomtek COM Express modules.
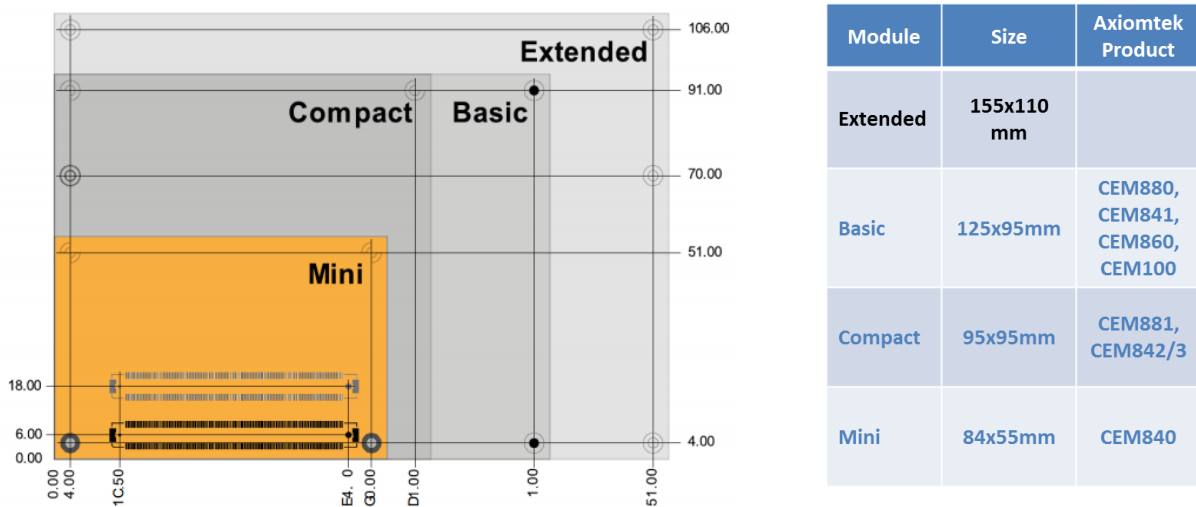

Module	Size	Axiomtek Product
Extended	155x110 mm	
Basic	125x95mm	CEM880, CEM841, CEM860, CEM100
Compact	95x95mm	CEM881, CEM842/3
Mini	84x55mm	CEM840

Figure 1 COM Express® form factors and Axiomtek COM Express modules

3. COM Express® Interface Signals

Axiomtek COM Express Type 6 Modules apply to the Compact and Basic form factors and Type 10 Modules apply to the Mini form factor:

➢ Module Types 2/6 supports two connectors with four rows of pins (440 pins total)

➢ Module Type 10 supports a single connector with two rows of pins (220 pins total)

Connector placement and most mounting holes have transparency between form factors. The features among the Module Type 2/6/10 are summarized in Table 2-1.

Table 2-1   Module Type Summary Features

Types	Connector Rows	PCI Express Lanes	PEG/ SDVO	PCI	IDE Ports	SATA Ports	LAN Ports	USB2.0/ USB3.0	Display Interfaces
Type 2	A-B C-D	Up to 22	1/2	32	1	4	1	8/0	VGA, LVDS, PEG/SDVO
Type 6	A-B C-D	Up to 24	1/NA	-	-	4	1	8/4	VGA, LVDS/EDP, PEG, 3xDDI
Type 10	A-B	Up to 4	-/1	-	-	2	1	8/2	LVDS/EDP, 1xDD1

COM Express® Type 2/6/10 required and optional features are summarized in Table 2-2 and Table 2-3.

Table 2-2   Module pin-out required and optional features A-B connecter

Connector	Feature	Type 2 Min/Max	Type 6 Min/Max	Type 10 Min/Max
A-B	System I/O			
A-B	PCI Express Lanes 0-5	1/6	1/6	1/4
A-B	LVDS Channel A	0/1	0/1	0/1
A-B	LVDS Channel B	0/1	0/1	N/A
A-B	EDP on LVDS CH A pins	NA	0/1	0/1
A-B	VGA Port	0/1	0/1	NA

A-B	TV-Out	N/A	N/A	N/A
A-B	DDI 0	NA	NA	0/1
A-B	Serial Ports 1-2	NA	0/2	0/2
A-B	CAN interface on SER1	NA	0/1	0/1
A-B	SATA/SAS Ports	1/4	1/4	1/2
A-B	AC'97 / HAD Digital Interface	0/1	0/1	0/1
A-B	USB 2.0 Ports	4/8	4/8	4/8
A-B	USB Client	0/1	0/1	0/1
A-B	USB 3.0 Ports	0/2	N/A	N/A
A-B	LAN Port0	1/1	1/1	1/1
A-B	Express Card Support	1/2	1/2	0/2
A-B	LPC Bus	1/1	1/1	1/1
A-B	SPI	1/2	1/2	1/2
A-B	System Management			
A-B	SDIO (muxed on GPIO)	NA	0/1	0/1
A-B	General Purpose I/O	8/8	8/8	8/8
A-B	SMBus	1/1	1/1	1/1
A-B	I²C	1/1	1/1	1/1
A-B	Watchdog Timer	0/1	0/1	0/1
A-B	Speaker Out	1/1	1/1	1/1
A-B	External BIOS ROM Support	0/2	0/2	0/2
A-B	Reset Functions	1/1	1/1	1/1
A-B	Power Management			
A-B	Thermal Protection	0/1	0/1	0/1
A-B	Battery Low Alarm	0/1	0/1	0/1
A-B	Suspend/Wake Signals	0/3	0/3	0/3
A-B	Power Button Support	1/1	1/1	1/1
A-B	Power Good	1/1	1/1	1/1
A-B	VCC_5V_SBY Contacts	4/4	4/4	4/4
A-B	Sleep Input	NA	0/1	0/1
A-B	Lid Input	NA	0/1	0/1
A-B	Fan Control Signals	NA	0/2	0/2
A-B	Trusted Platform Modules	NA	0/1	0/1
A-B	Power			
A-B	VCC_12V Contacts	12/12	12/12	12/12

Table 2-3   Module pin-out required and optional features C-D connecter

Connector	Feature	Type 2 Min/Max	Type 6 Min/Max	Type 10 Min/Max
C-D	System I/O			
C-D	PCI Express Lanes 16-31	0/16	0/16	NA
C-D	PCI Express Graphics (PEG)	0/1	0/1	NA
C-D	Muxed SDVO Channels 1-2	0/2	NA	NA
C-D	PCI Express Lanes 6-15	NA	0/2	NA
C-D	PCI Bus -32 Bit	1/1	NA	NA
C-D	PATA Port	1/1	NA	NA
C-D	DDIs 1-3	NA	0/3	NA
C-D	USB 3.0 Ports	NA	0/4	NA
C-D	Power			
C-D	VCC_12V Contacts	12/12	12/12	NA

4. Axiomtek COM Express® Type 6 Module

Following the COM Express® specification, Axiomtek released two form factors of COM Express® Type 6 Modules. The COM Express® Type 6 Basic Module CEM880 features 5th Generation Intel® quad-core i7 processors (Broadwell) or 4th Generation Intel® quad/dual-core™ i7/i5/i3 or Celeron® processors (Haswell) and Intel® QM87 chipset. The COM Express® Type 6 Compact Module CEM881 features 5th or 4th Generation Intel® quad/dual-core™ i7/i5/i3 or Celeron® processors (Broadwell / Haswell-ULT SoC). Both of them can carry up 4GB onboard memory and support industrial temperature -40°C to +85°C (-40°F to +185°F). With 5th/4th Generation Intel® Core™ or Celeron® processor, the CEM880 and CEM881 are designed to provide excellent graphics and performance, supporting contemporary high bandwidth serial interfaces including PCI Express, SATA, USB 3.0 and Gigabit Ethernet. These rugged SOMs (System on Module) are ideal for graphics-intensive, rich I/O and harsh applications.
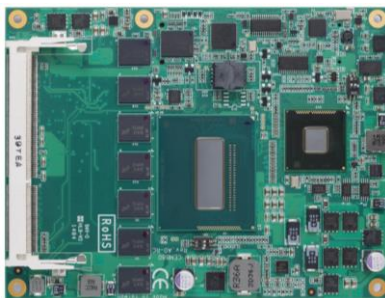
CEM880

COM Express® Type 6 Basic Module
with 5th Generation Intel® Core™ i7
or 4th Generation Intel® Core™ or
Celeron® (Broadwell/Haswell)
Processor and Intel® QM87 Chipset

CEM881

COM Express® Type 6 Compact Module
with 5th or 4th Generation Intel® Core™
i7/i5/i3 or Celeron® Processor
(Broadwell or Haswell ULT SoC)

5. Technical Support by Axiomtek

The Axiomtek design guide for COM Express® carrier boards serves as a general guide for carrier board designs. The design guide focuses on maximum flexibility to accommodate a range of COM Express® Modules. The Axiomtek COM Express® design guide explores the requirements of the COM Express® specification and provides recommendations on how to design COM Express® Baseboards to support features of Axiomtek COM Express® Modules.

The carrier board design guide provides schematic examples and information on standard I/O interfaces, connections, and routing. The guide also offers ideas to maximize the design potential of COM Express® carrier boards to accommodate all Axiomtek COM Express® Modules.

The COM Express® Module user guides documents provide specifications and features for an individual COM Express® Module. You can find all user guides, design guides, mechanical drawings and other technical documents for COM Express® Modules on the Axiomtek Technical Portal (ATP) Website.

Axiomtek's ATP website: http://atp.axiomtek.com.tw/atp/.

Axiomtek's global website: www.axiomtek.com.

About Axiomtek Co., Ltd.

Axiomtek Co. Ltd. is one of the world's leading designers/manufacturers of PC-based industrial computer products. From our roots as a turnkey systems integrator specializing in data acquisition and control systems, Axiomtek has mirrored the PC evolution in various industries by shifting our focus toward the design and manufacture of PC-based industrial automation solutions.

Axiomtek Co., Ltd. established in 1990, has more than 60 distributor partners globally. Axiomtek offers Industrial PCs (IPC), Single Board Computers and System on Modules (slot CPU card, small form factor embedded boards & SoM), Fanless & Rugged Embedded System (eBOX, tBOX and rBOX), Touch Panel Computers (TPC), Medical PCs (MPC), Human Machine Interface (HMI), Digital Signage and Players (DS), Industrial Network and Network Appliances (NA).

As an associate member of the Intel® Internet of Things Solutions Alliance, Axiomtek continuously develops and delivers cutting edge solutions based on the latest Intel® platforms.