nanoETXexpress

(a COM Express™ ultra[1] initiative)

Specification

Revision 2.0

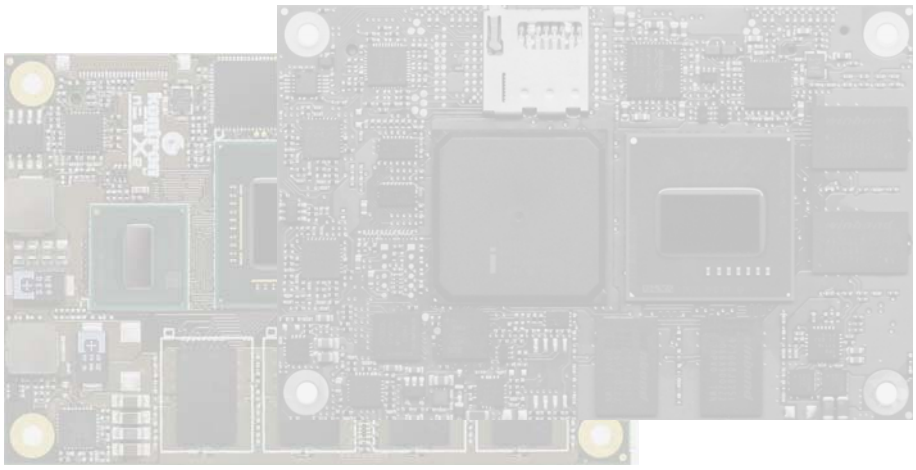

Figure 1 nanoETXexpress COM

[1] COM Express™ ultra with respect to connector location and pin definition

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1. Introduction

1.1 nanoETXexpress Specification and COM Express™ Design Guide

The specification for the COM Express™ ultra*[2] sized nanoETXexpress, is an additional document to the open PICMG® industry standard adopted for Computer-on-Modules (COM). All specification defined in the COM Express™ (COM.0) Rev. 2.0 specification are valid for the COM Express™ ultra* nanoETXexpress Computer-on-Module. All differences are defined in this document.
If no differentiation is needed we'll use the term *COM Express*™ in the following document for all existing revisions.

COM Express™ design guide provides recommendations on designing COM Express™ baseboards to support various features of COM Express™ modules. The COM Express™ Design Guide, based upon the COM Express™ specification, discusses capabilities defined in the specification with schematic examples where applicable and offers ideas to consider for maximum flexibility in designing baseboards.

[2] COM Express™ ultra with respect to connector location and pin definition

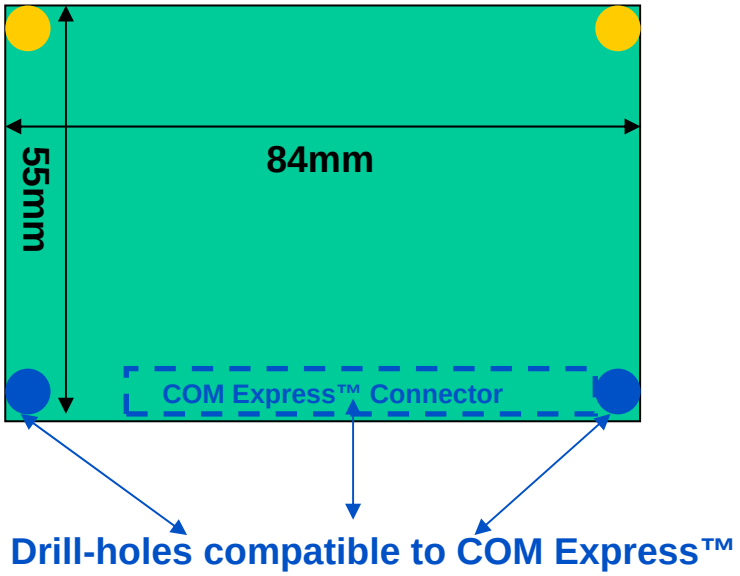
2. Module Configuration

Beside the standard module sizes the basic module and the extended module two more small form factor module sizes are defined. The established compact size and the ultra form factor; all based on the COM Express™ interface specification. The primary difference between the ultra module, the compact module, the basic module and the extended module is the over-all physical size and the performance envelope supported by each. The ultra, compact, basic and extended modules use pin-outs and common mounting-hole positions based on COM Express™.

Up to 440 pins of connectivity are available between COM Express™ modules and the carrier board. Legacy buses such as PCI, parallel ATA, LPC, serial (UART) can be supported as well as new high speed serial interconnects such as PCI Express, Serial ATA, Gigabit Ethernet and digital display interfaces (DDI). To enhance interoperability between COM Express™ modules and carrier boards, seven common signaling configurations (Pin-out Types) have been defined to ease system integration.

Some pin-out type definitions like the Type 1 or 10 require only a single 220-pin connector the others require both 220-pin connectors to supply all the defined signaling.

Figure 2 – nanoETXexpress (COM Express™ ultra*) Footprint
top view (X1 is on bottom side, seen through PCB), all coordinates in mm



3. Module Pin-out Type Definitions

3.1 nanoETXexpress (COM Express™ ultra*) Pin-out definition and compliance

The ultra form factor COM nanoETXexpress is provided with a COM Express™ single connector type pin-out type 1 or pin-out type 10.
Single connector type modules have 220-pin connector, pin row A-B. See PIGMG® COM Express™ module Base Specification for detailed information.

Single connector type modules allow the using of two of the four in the COM express™ defined connector rows. These types represent a basic feature set with the benefit of simplified routing of the carrier board to allow a lower layer count board.

The nanoETXexpress specification Rev.2.0 is compatible with respect to connector location and pin definition. to the COM Express™ Rev 2.0 specification. nanoETXexpress compliant boards shall be designed to be backward compatible to nanoETXexpress Rev. 1.0 (COM Express™ Rev. 1) baseboards.

COM Express™ required and optional features are summarized in the following table. The features identified as minimum (Min.) shall be implemented by all modules. Features identified up to maximum (Max) may be additionally implemented by a module.

3.2 Module Pin-out Type 1 and Type 10 – Required and Optional Features

	COM.0 Rev. 1.0 Type 1 Min / Max	nanoETXexpress Min / Max	COM.0 Rev. 2.0 Type 10 Min / Max	Note
System I/O				
PCI Express Lanes 0 - 5	2/6	1/4	1/4	
LVDS Channel A	0/1	0/1	0/1	
LVDS Channel B	0/1	NA	NA	
VGA Port	0/1	NA	NA	
TV-Out	0/1	NA	NA	
Digital Display Interface	NA	0/1	0/1	See chapter 4.1
Serial Ports	NA	0/2	0/2	See chapter 4.2 / 4.3
SATA / SAS Ports	1/4	1/2	1/2	
HD Audio	0/1	0/1	0/1	
USB 2.0 Ports	4/8	4/8	4/8	
USB client Port	--	0/1	0/1	See chapter 3.5
LAN 0	1/1	1/1	1/1	
Express Card Support	1/2	0/2	0/2	
LPC Bus	1/1	1/1	1/1	
SPI	NA	1/2	1/2	External Boot
System Management				
General Purpose Inputs	4/4	4/4	4/4	
General Purpose Outputs	4/4	4/4	4/4	
SDIO muxed on GPIO	NA	0/1	0/1	See chapter 3.4
SMBus	1/1	1/1	1/1	
I²C	1/1	1/1	1/1	
Watch Dog Timer	0/1	0/1	0/1	
Speaker Out	1/1	1/1	1/1	
External BIOS ROM	0/1	0/2	0/2	
Reset Functions	1/1	1/1	1/1	
Power Management				
Thermal Protection	0/1	0/1	0/1	
Battery Low Alarm	0/1	0/1	0/1	
Suspend / Wake Signals	0/1	0/3	0/3	
Power Button Support	1/1	1/1	1/1	
Power Good	1/1	1/1	1/1	
VCC_5V_SBY Contacts	4/4	4/4	4/4	
Sleep Input	NA	0/1	0/1	
LID Input	NA	0/1	0/1	
Fan Control Signals	NA	0/2	0/2	
TPM present	NA	0/1	0/1	
Power				
VCC_12V Contacts		12/12	12/12	

*3.3 Alternative Pin description for SDIO interfaces (*Secure Digital Input Output.)

Note: This is now part of the COM Express™ specification, for more details please refer to PICMG® COM Express™ Rev. 2.0 specification.

Pin	GPIO	SDIO	Pin	GPIO	SDIO
A54	GPI0	DATA0	B54	GPO1	CMD
A63	GPI1	DATA1	B57	GPO2	WP
A67	GPI2	DATA2	B63	GPO3	CD#
A85	GPI3	DATA3			
A93	GPO0	CLK			

3.4 SDIO Pin description

Signal	Type	Description
SD_DATA[3:0]	I/O CMOS3.3	**SDIO Data lines.** These signals operate in push-pull mode. Maps GPI[0:3]
SD_CMD	I/O CMOS3.3	**SDIO Command/ response.** This signal is used for card initialization and for command transfers. During initialization mode this signal is open drain. During command transfer this signal is in push-pull mode. Maps to GPO1
SD1_CLK	O CMOS3.3	**SDIO Clock.** With each cycle of this signal a one bit transfer on the command and each data line occurs. This signal has maximum frequency of 48 MHz. Maps to GPO0
SD0_WP	I CMOS3.3	**SDIO Write Protect.** This signal denotes the state of the write-protect tab on SD cards. Maps to GPO2
SD1_CD#	I CMOS3.3	**SDIO Card Detect.** This signal indicates when a SDIO/MMC card is present. Maps to GPO3

For more details, please refer to PICMG® COM Express™ and the COM Express™ design guide.

3.5 USB Client Port

Note: This is now part of the COM Express™ specification, for more details please refer to PICMG® COM Express™ Rev. 2.0 specification.

nanoETXexpress defines one USB port for USB client possibilities. COM Express™ USB Port7 is defined for client operation; it can be used either as a USB host or USB client. Please refer to nanoETXexpress board manual for supporting USB client functionality.

3.6 Recommended USB Routing, only for Reference

Onboard Routing				COM.0 pin out	Preferred Use
US15W		PCH EG20			
Ports	Note	Ports	Note		
USB3	USB 2.0 compliant	-------	Not supported	USB6	
USB2	Client/host	client	Client only	USB7	**USB client port**
USB6	no UHCI	USB4		USB4	Internal use
USB7	no UHCI	USB5		USB5	Internal use
USB4	USB 2.0 compliant	USB2		USB2	USB 2.0 compliant
USB5	USB 2.0 compliant	USB3		USB3	USB 2.0 compliant
USB0	USB 2.0 compliant	USB0		USB0	USB 2.0 compliant
USB1	USB 2.0 compliant	USB1		USB1	USB 2.0 compliant

4. New Pin Out COM Express™ Rev. 2.0 Type 10

The COM Express™ Rev. 2.0 defines new features for the pin-out type 10. Below only a few selected one are listed. Please refer to COM Express™ Rev. 2.0 specification for all details.

4.1 DDI (Digital Display Interface)

A70	GND (FIXED)	B70	GND (FIXED)	SDVO	Display Port	TMDS / HDMI
A71	LVDS_A0+	B71	DDI0_PAIR0+	SDVO0_RED+	DP0_LANE0+	TMDS0_DATA2+
A72	LVDS_A0-	B72	DDI0_PAIR0-	SDVO0_RED-	DP0_LANE0-	TMDS0_DATA2-
A73	LVDS_A1+	B73	DDI0_PAIR1+	SDVO0_GRN+	DP0_LANE1+	TMDS0_DATA1+
A74	LVDS_A1-	B74	DDI0_PAIR1-	SDVO0_GRN-	DP0_LANE1-	TMDS0_DATA1-
A75	LVDS_A2+	B75	DDI0_PAIR2+	SDVO0_BLU+	DP0_LANE2+	TMDS0_DATA0+
A76	LVDS_A2-	B76	DDI0_PAIR2-	SDVO0_BLU-	DP0_LANE2-	TMDS0_DATA0-
A77	LVDS_VDD_EN	B77	DDI0_PAIR4+	SDVO0_INT+		
A78	LVDS_A3+	B78	DDI0_PAIR4-	SDVO0_INT-		
A79	LVDS_A3-	B79	LVDS_BKLT_EN			
A80	GND (FIXED)	B80	GND (FIXED)			
A81	LVDS_A_CK+	B81	DDI0_PAIR3+	SDVO0_CK+	DP0_LANE3+	TMDS0_CLK+
A82	LVDS_A_CK-	B82	DDI0_PAIR3-	SDVO0_CK-	DP0_LANE3-	TMDS0_CLK-
A83	LVDS_I2C_CK	B83	LVDS_BKLT_CTRL			
A84	LVDS_I2C_DAT	B84	VCC_5V_SBY			
A85	GPI3	B85	VCC_5V_SBY			
A86	RSVD	B86	VCC_5V_SBY			
A87	RSVD	B87	VCC_5V_SBY			
A88	PCIE_CLK_REF+	B88	BIOS_DIS1#			
A89	PCIE_CLK_REF-	B89	DDI0_HPD		DP0_HDP	HDMI0_HDP
A90	GND (FIXED)	B90	GND (FIXED)			
A91	SPI_POWER	B91	DDI0_PAIR5+	SDVO0_TVCLKIN+		
A92	SPI_MISO	B92	DDI0_PAIR5-	SDVO0_TVCLKIN-		
A93	GPO0	B93	DDI0_PAIR6+	SDVO0_FLDSTALL+		
A94	SPI_CLK	B94	DDI0_PAIR6-	SDVO0_FLDSTALL-		
A95	SPI_MOSI	B95	DDI0_DDC_AUX_SEL			
A96	TPM_PP	B96	RSVD			
A97	TYPE_10#	B97	SPI_CS#			
A98	SER0_TX	B98	DDI0_CTRLCLK_AUX	SDVO0_CTRL_CLK	DP0_AUX+	HDMI0_CTRL_CLK
A99	SER0_RX	B99	DDI0_CTRLDATA_AUX	SDVO0_CTRL_DAT	DP0_AUX-	HDMI0_CTRL_DATA
A100	GND (FIXED)	B100	GND (FIXED)			

4.2 Serial ports

The new COM Express™ Rev 2.0 pin-out type10 defines 2 serial interfaces SER0 and SER1

	A98	**SER0_TX**	**B98**	
	A99	**SER0_RX**	**B99**	
	A100	GND (FIXED)	B100	GND (FIXED)
	A101	**SER1_TX**	**B101**	
	A102	**SER1_RX**	**B102**	

4.3 Optional CAN interface

Optional CAN interface on second serial interface SER1

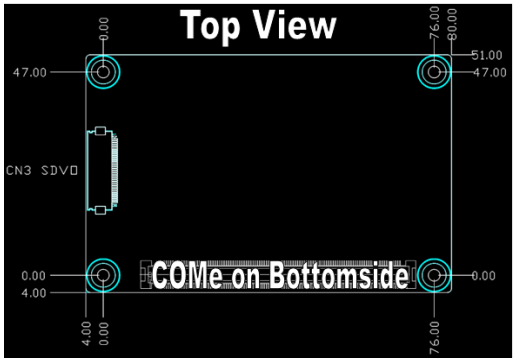
	A100	GND (FIXED)	B100	GND (FIXED)
CAN_AX	**A101**	**SER1_TX**	**B101**	
CAN_RX	**A102**	**SER1_RX**	**B102**	

4.4 Optional SDVO on FFC/FPC Connector for pin-out Type1 Modules

nanoETXexpress defines an optional FFC/FPC for SDVO signals.
Note: No need for pin-out type 10 modules, this pin-out type 10 defines a DDI port on the COM Express™ connector which can be used as SDVO, DP or TMDS signal.

SDVO on FFC/FPC

Hirose FH12-30S-0.5SH(55), 30-pin FFC/FPC Connector or compatible
Position of FFC/FPC connector



Pin Out Description

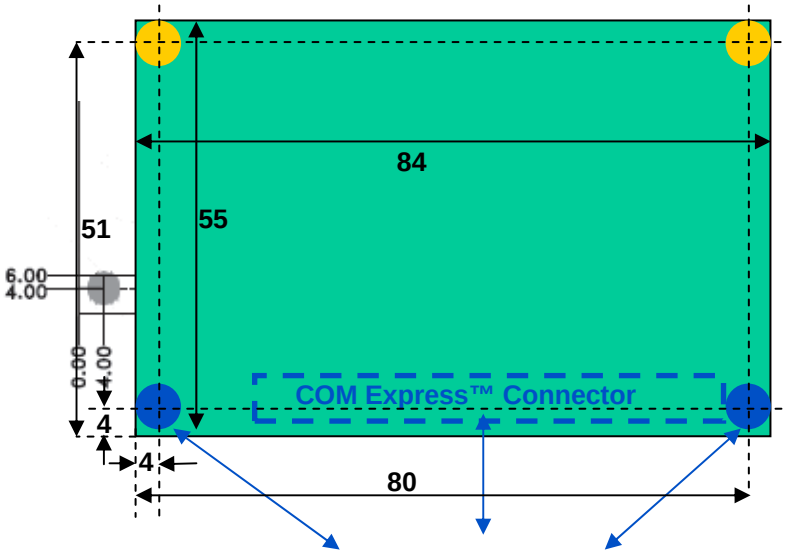
Pin	Signal	Description	I/O
1	GND	Gro□nd	
2	SDVOB_CK-	Serial Digital Video B clock complement.	O
3	SDVOB_CK+	Serial Digital Video B clock .	O
4	GND	Ground	
5	SDVOB_GREEN-	Serial Digital Video B green complement.	O
6	SDVOB_GREEN+	Serial Digital Video B green .	O
7	GND	Ground	
8	SDVOB_INT-	Serial Digital Video input interrupt complement.	I
9	SDVOB_INT+	Serial Digital Video input interrupt.	I
10	GND	Ground	
11	SDVOB_BLU-	Serial Digital Video B blue complement .	O
12	SDVOB_BLU+	Serial Digital Video B blue .	O
13	GND	Ground	
14	SDVOB_RED-	Serial Digital Video B red complement .	O
15	SDVOB_RED+	Serial Digital Video B red.	O
16	GND	Ground	
17	SDVO_FLDSTALL-	Serial Digital Video Field Stall Complement.	I
18	SDVO_FLDSTALL+	Serial Digital Video Field Stall.	I
19	GND	Ground	
20	SDVO_I2C_CK	I2C based control signal (Clock) for SDVO device.	I/O
21	SDVO_I2C_DAT	I2C based control signal (Data) for SDVO device.	I/O
22	RESET#	RESET signal	O
23	+3.3V	Power supply +3.3V	
24	+2.5V	Power supply +2.5V	
25	+5V	Power supply +5V	
26	GND	Ground	
27	SDVO_TVCLKIN-	Serial Digital Video TV-OUT Synchronization Clock	I
28	SDVO_TVCLKIN+	Serial Digital Video TV-OUT Synchronization Clock	I
29	+3.3V	Power supply +3.3V	
30	+5V	Power supply +5V	

5. Mechanical Specification

5.1 Module Size - ultra

The PCB size for the nanoETXexpress module is defined as ultra form factor 55mm x 84mm. The holes shown in this drawing are intended for mounting the module / heat-spreader combination to the carrier board. An independent, implementation specific set of holes and spacers shall be used to attach the heat-spreader to the module.

Figure 3 – nanoETXexpress (COM Express™ ultra*) Dimensions



Drill-holes compatible to COM Express™

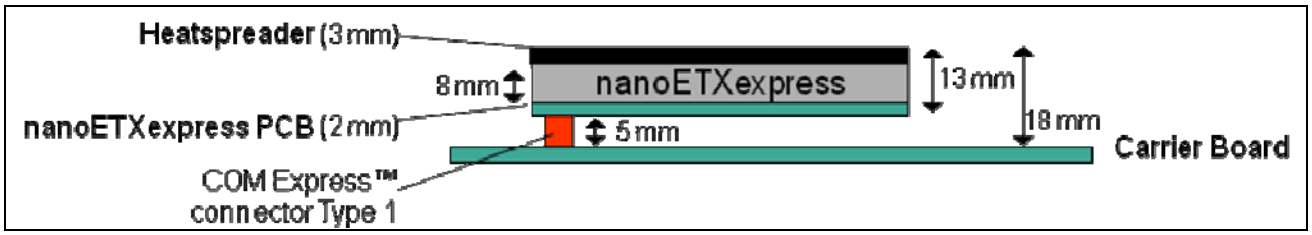
All dimensions are shown in millimeters. Tolerances should be ± 0.25mm [±0.010"], unless noted otherwise. The tolerances on the module connector locating peg holes (dimensions [16.50, 6.00]) should be ± 0.10mm [±0.004"].
The 220 pin connector shall be mounted on the backside of the PCB and is seen “through” the board in this view. The X mounting holes shown should use 6mm diameter pads and should have 2.7mm plated holes, for use with 2.5mm hardware. The pads should be tied to the PCB ground plane.

5.2 Heat-Spreader COM Express™ compliant

Modules should be equipped with a heat-spreader. This heat-spreader by itself does not constitute the complete thermal solution for a COM but provides a common interface between modules and implementation-specific thermal solutions. The overall module height from the bottom surface of the module board to the heat-spreader top surface should be max. 13mm for the ultra form Factor. The COM PCB and heat spreader plate thickness are vendor implementation specific.

A 2mm PCB with a 3mm heat-spreader should be used which allows use of readily available standoffs and to be mechanical compatible to COM Express™ heat spreader solutions.

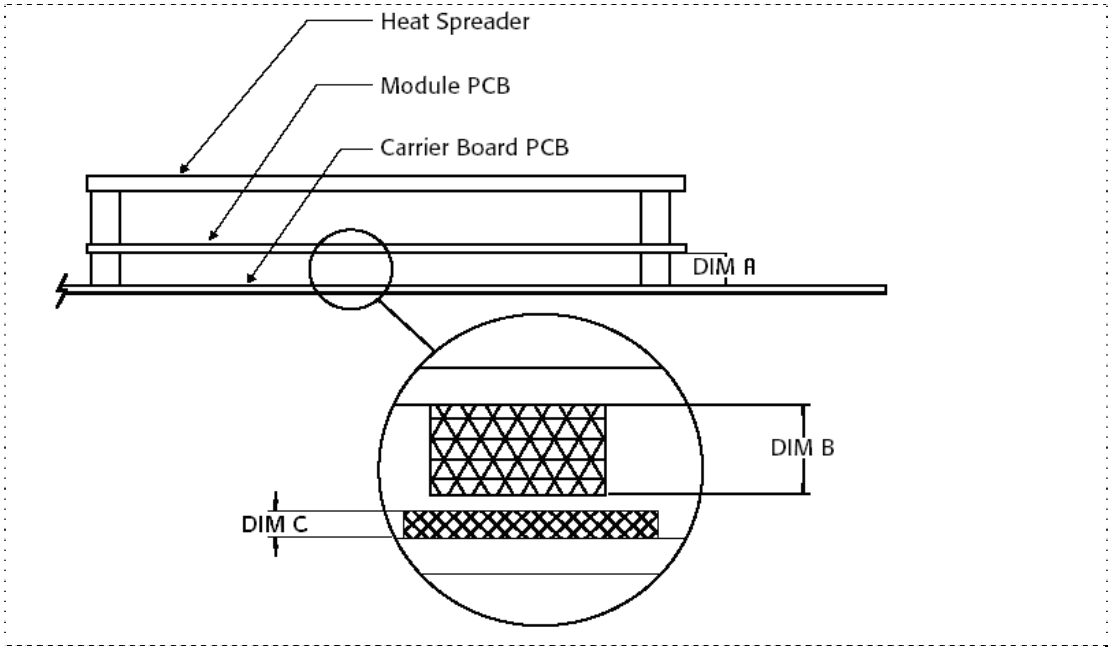
Figure 4 - Maximum Height compatible to COM Express™.



5.3 Component height - COM rear side and Carrier Board upper side

Parts mounted on the backside of the module (in the space between the bottom surface of the module PCB and the carrier board) should have a maximum height of 3.8mm (dimension 'B' in Figure 5).
With the 5mm stack option, the clearance between the carrier board and the bottom surface of the module's PCB is 5mm (dimension 'A' in Figure 5). Using the 5mm stack option, components placed on carrier board topside under the module envelope should be limited to a maximum height of 1mm (dimension 'C' in Figure 5), with the exception of the mating connectors. Using carrier board upper side components up to 1mm allows a gap of 0.2mm between carrier board module bottom side components. This may not be sufficient in some situations. In carrier board applications in which vibration or board flex is a concern, then the carrier board component height should be restricted to a value less than 1mm that yields a clearance that is sufficient for the application.
If the carrier board uses the 8mm stack option (dimension 'A' in Figure 5), then the carrier board upper side components within the module envelope shall be limited to a height of 4mm (dimension 'C' in Figure 5), with the exception of the mating connectors. Using carrier board upper side components up to 4mm allows a gap of 0.2mm between carrier board topside components and module bottom side components. This may not be sufficient in some situations. In carrier board applications in which vibration or board flex is a concern, then the carrier board component height should be restricted to a value less than 4mm that yields a clearance that is sufficient for the application.

Figure 5 - Component Clearances underneath Module



6 Electrical Specifications

6.1 Input Power - General Considerations

The nanoETXexpress modules should follow the COM Express™ power supply specification to use a single main power rail with nominal 12V. Optionally a wide range power supply of 5V -5% to +14V (4,75V to 14V) can be supported.

Two additional rails are specified, a +5V standby power rail and a +3V battery input to power the module real-time clock (RTC) circuit in the absence of other power sources. The +5V standby rail could be left unconnected on the carrier board if the standby functions are not required by the application. Likewise, the +3V battery input may be left open if the application does not require the RTC to keep time in the absence of the main and standby sources. There may be module specific concerns regarding storage of system setup parameters that may be affected by the absence of the +5V standby and / or the +3V battery.

The rationale for this power-delivery scheme is:

- Module pins are scarce. It is more pin-efficient to bring power in on a higher voltage rail.
- Single supply operation is attractive to many users.
- Lithium ion battery packs for mobile systems are most prevalent with a 2 Cell 7,2V (max 8,4V) or 3 Cell 10,8V (max 12,8V) output. This is well suited for the wide range main power rail.
- Contemporary chipsets have no power requirements for +5V other than to provide a reference voltage for +5V tolerant inputs. No COM Express™ pins are allocated to accept +5V except for the +5V standby pins. In the case of an ATX supply, the switched (non standby) +5V line would not be used for the COM Express™ Computer-on-Modules but it might be used elsewhere on the carrier board.

7 Revision History

1.0	26.02.2009	First official revision	VGG
2.0	31.12.2010	update for new COM.0 Rev2.0 specification, Synchronize with COM.0 Rev. 2.0	VGG