"embedded NUC™" Standard

Hardware Specification

Version 1.00   November 06, 2014

STANDARDIZATION
GROUP FOR
EMBEDDED
TECHNOLOGIES

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REVISION HISTORY

Rev	Date	Originator	Notes
0.9	June 25, 2014	Ralf Wardenbach, Martin Steger ies GmbH & Co. KG	Initial release (PRELIMINARY VERSION)
0.91	October 16, 2014	Ralf Wardenbach, Martin Steger ies GmbH & Co. KG	Draft for Specification Workshop on October 23, 2014 (PRELIMINARY VERSION)
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0.95	November 06, 2014	Martin Steger ies GmbH & Co. KG	Preparations for release candidate (PRELIMINARY VERSION)
1.00	November 10, 2014	Karsten Wenke F&S Elektronik GmbH	Release candidate

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1   INTRODUCTION

1.1   General Introduction

The "embedded NUC™" Standard ("embedded Next Unit of Computing") is a versatile small form factor targeting the fast growing markets for multifunctional, small sized and cost effective standardized embedded computer boards.

1.2   embedded NUC™ vs. other small form factors

Unlike other comparable small form factors the embedded NUC™ standard shall not be driven and initiated by a single computer vendor or manufacturer. Defining this standard in the SGET will allow to join a large group of manufacturers and designers from the very beginning - making sure that their design will meet all predefined requirements.

Customers should be able to rely on the embedded NUC™ standardization for expecting a minimum feature set and compatibility.

1.3   Special Word Usage

Mandatory features and characteristics are indicated by the use of the word "**shall**" or black color in pictures.

Recommended features and characteristics are indicated by the use of the word "**should**" or blue color in pictures.

Optional features and characteristics are indicated by the use of the word "**may**" or green color in pictures.

1.4   Purpose of This Document

This document defines all mechanical and technical basic parameters and features to be considered for designing an embedded NUC™ computer board.

1.5   Document and Standards References

- *DisplayPort* and *Embedded DisplayPort* These standards are owned and maintained by VESA ("Video Electronics Standards Association") (**www.vesa.org**)

- *HDMI Specification*, Version 1.3a, November 10, 2006 © 2006 Hitachi and other companies (**www.hdmi.org**)

- *GBE MDI ("Gigabit Ethernet Medium Dependent Interface")* This is defined by IEEE 802.3. The 1000Base-T operation over copper twisted pair cabling is defined by IEEE 802.3ab (**www.ieee.org**)

- *The I2C Specification,* Version 2.1, January 2000, Philips Semiconductor (now NXP) (**www.nxp.com**)

- *JEDEC Specification for mSATA,* Mo-300B (**www.jedec.org**)

- *Serial ATA Revision 3.1*, July 18, 2011, Gold Revision, © Serial ATA International Organization (**www.sata-io.org**)

- *SD Specifications Part 1 Physical Layer Simplified Specification,* Version 3.01, May 18, 2010, © 2010 SD Group and SD Card Association ("Secure Digital") (**www.sdcard.org**)

- *USB Specifications* (**www.usb.org**)

2   BOARD SPECIFICATION OVERVIEW

2.1   Required Features

All embedded NUC™ computer boards shall follow a minimum specification in order to allow easy replacement and migration within the embedded NUC™ family.

All embedded NUC™ boards shall fulfill the specifications regarding the following characteristics:

- PCB outline & PCB mounting concept

- predefined connector areas

- single voltage power supply

- minimum interface and feature set

- minimum environmental conditions

2.2   Optional Features

Above the defined minimum characteristics the embedded NUC™ form factor shall allow any additional interface and feature as desired. There shall be no limitation regarding the use of future architectures, features and interfaces.

2.3   Predefined Board Types

In order to categorize the variety of possible embedded NUC™ computer boards this specification predefines a number of board types for different end user classes and applications. The following table defines the focus and minimum specification for each board type:

Type Number Type Name	Minimum feature set	Recommended feature set	Notes
Type 1 Basic	1 x LAN 2 x USB external single power connector	1x Video out (i.e. HDMI, DP, RGB, LVDS internal or external) 1x intern industrial power connector 1 x SATA 2 x additional USB 1 x SD / mSD socket 2 x UART or COM port 1 x Audio interface 1 x mini PCI express and / or mSATA expansion for mini PCI express slot 5 years of product lifetime after launch Extended temperature range available	The Type 1 variant "Basic" is intended to provide a minimum feature set for all kind of embedded NUC™ boards
Type 2 Connectivity	2 x LAN 2 x USB 1 x mini PCI express and / or mSATA expansion for mini PCI express slot 2 x UART or COM port external single power connector	1x Video out (i.e. HDMI, DP, RGB, LVDS internal or external) 1 x SATA 2 x additional USB 1 x SD / mSD socket 1 x Audio interface 5 years of product lifetime after launch Extended temperature range available	The Type 2 variant "Connectivity" is intended to provide a balanced feature set for customers with a demand for some typical connectivity interfaces

2.4 PCB/Board Specification

2.4.1 Footprint

- PCB outline dimensions: 101.60 mm by 101.60 mm (4.0 inches by 4.0 inches) +/- 0.2mm

- PCB main drill holes: 4 x 3.2 mm plated holes; Holes on connector side connected to shield GND with assembly option

- PCB corner radius: 4 x 5.0 mm
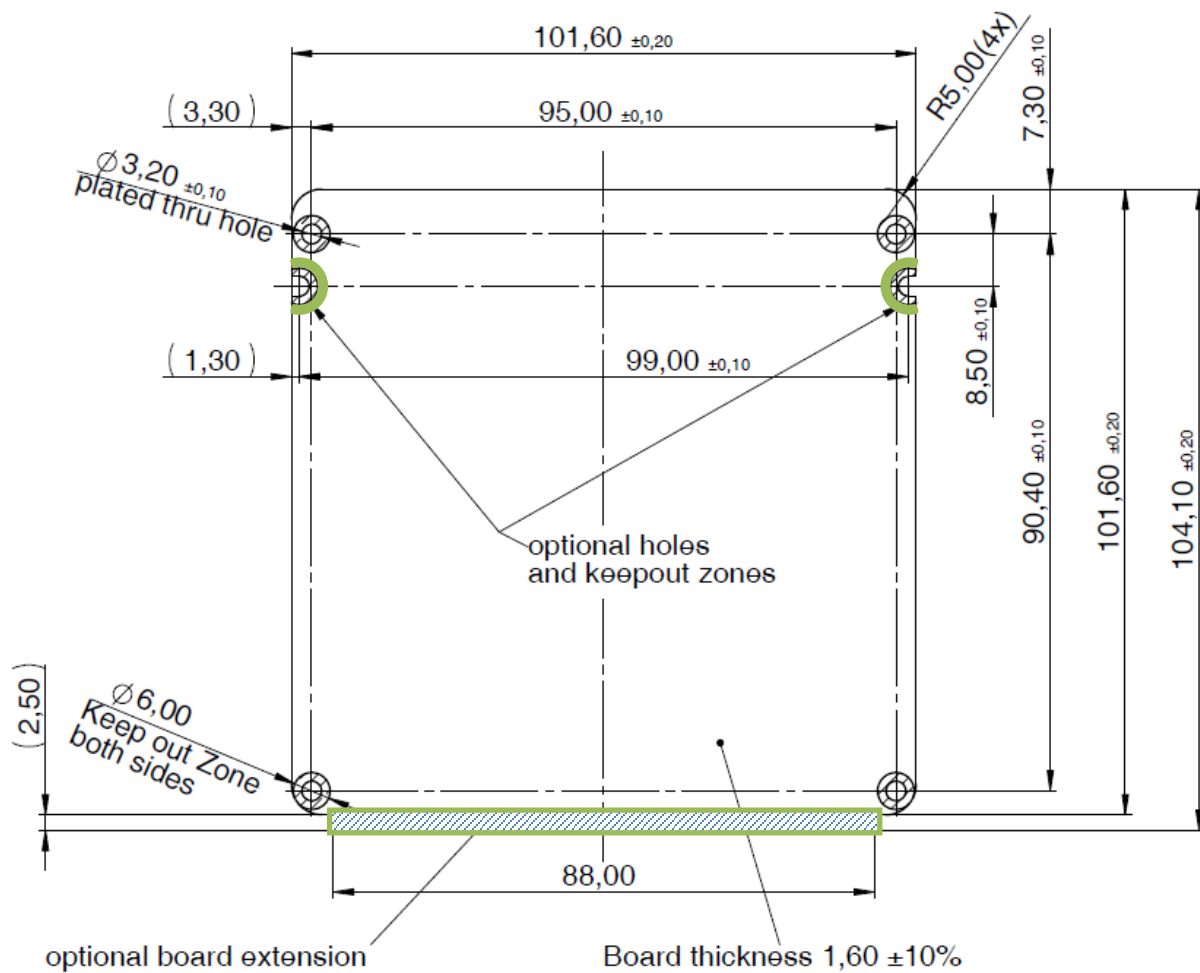
- PCB thickness 1.6mm +/- 10%

Figure 1: board dimensions and drill holes

Please Note: Drill holes and PCB areas marked with an red outline are optional. They may be used to improve the mechanical concept or housing situation.

2.4.2 Height Specification

In order to create an interchangeable ecosystem for embedded NUC™ boards and housings it is necessary to define different height types.

2.4.2.1 Slim Height

- PCB top side: 4 mm ± 0.2 mm maximum height for any assembly

- PCB bottom side: **18,4 mm ± 0.2 mm maximum height for any assembly**

- PCB thickness: 1.6 mm ± 10%

Please Note: Other height definitions are in discussion and do not necessarily violate this embedded NUC™ specification. Due to the big variety of possible cooling and connector concepts other height types may follow

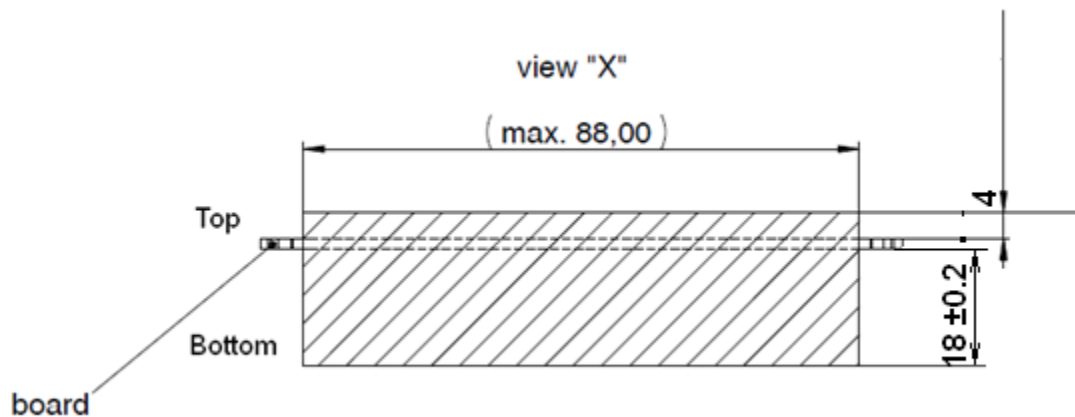- **Connector areas height**: 24.20 mm ± 0.5 mm

Figure 2: connector areas

- **Bracket Concept**: In order to define a suitable mechanical interface between the embedded NUC™ board and housing it is planned to describe and specify an universal **IO-Bracket** concept at a later time.

2.4.3 Cooling Specification

- **PCB top side cooling**:

    - For operation within the specified environmental temperature range the necessary cooling devices on top side can vary in height, design, version and type.

    - The adjustable cooling solution on top side does not need to be part of the predefined scope of delivery.

    - The cooling solution on top side may cover or use the PCB main drill holes - as it might be needed for a suitable heat spreader concept.
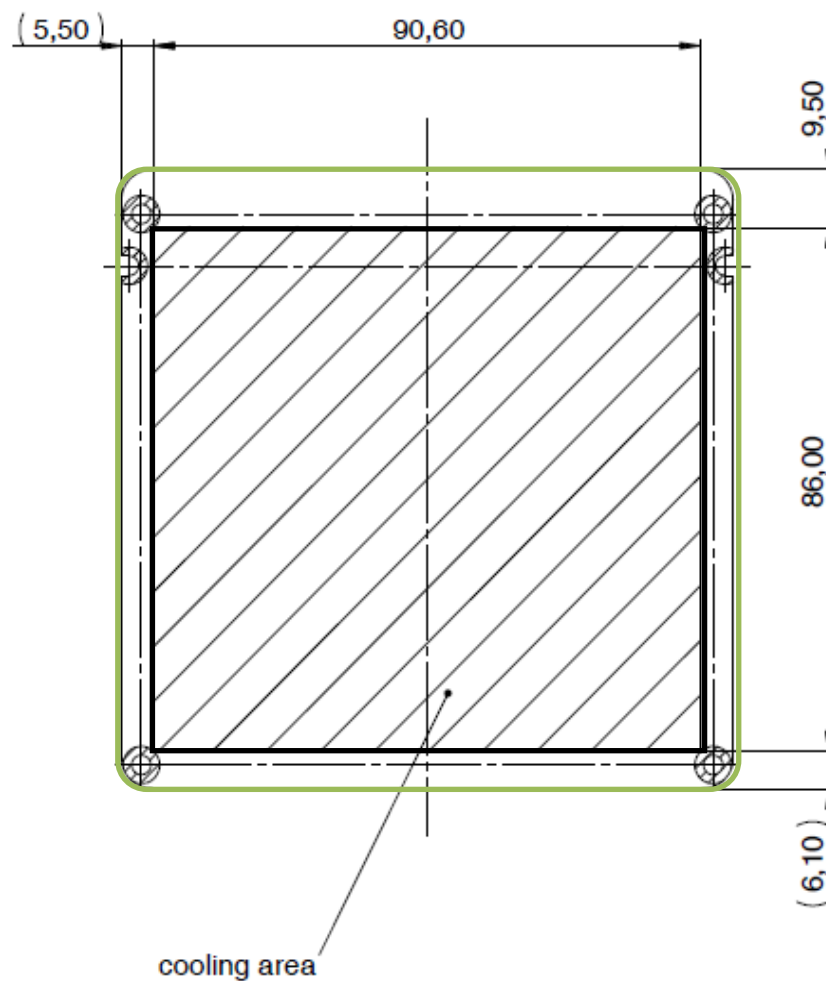
Figure 3: top side cooling area

Please Note: The cooling area outside the inner rectangle of 86 mm x 90.6 mm (black) is the optional cooling area. Heat spreaders or coolers covering the area outside this inner rectangle may use this area due to the mechanical concept or housing situation.

- **PCB bottom side cooling**:

    o   For operation within the specified environmental temperature range all necessary cooling devices on bottom side must be part of the scope of delivery. The customer shall neither need to create nor modify cooling solutions for bottom side components.

    o   All included cooling devices on the PCB bottom side shall not cover the PCB main drill holes.

2.4.4 Connector Area Specification

Generally it should be allowed to place connectors on every location of the board, considering the following guidelines

- The connectors or plugs shall not cover the PCB main drill holes.

- The main feature connectors shall be placed on PCB bottom side within the main connector area

- Further feature connectors should be placed within the optional connector area when the main connector area is completely in use.

- Further feature connectors should be placed anywhere on the PCB when both connector areas are completely in use.
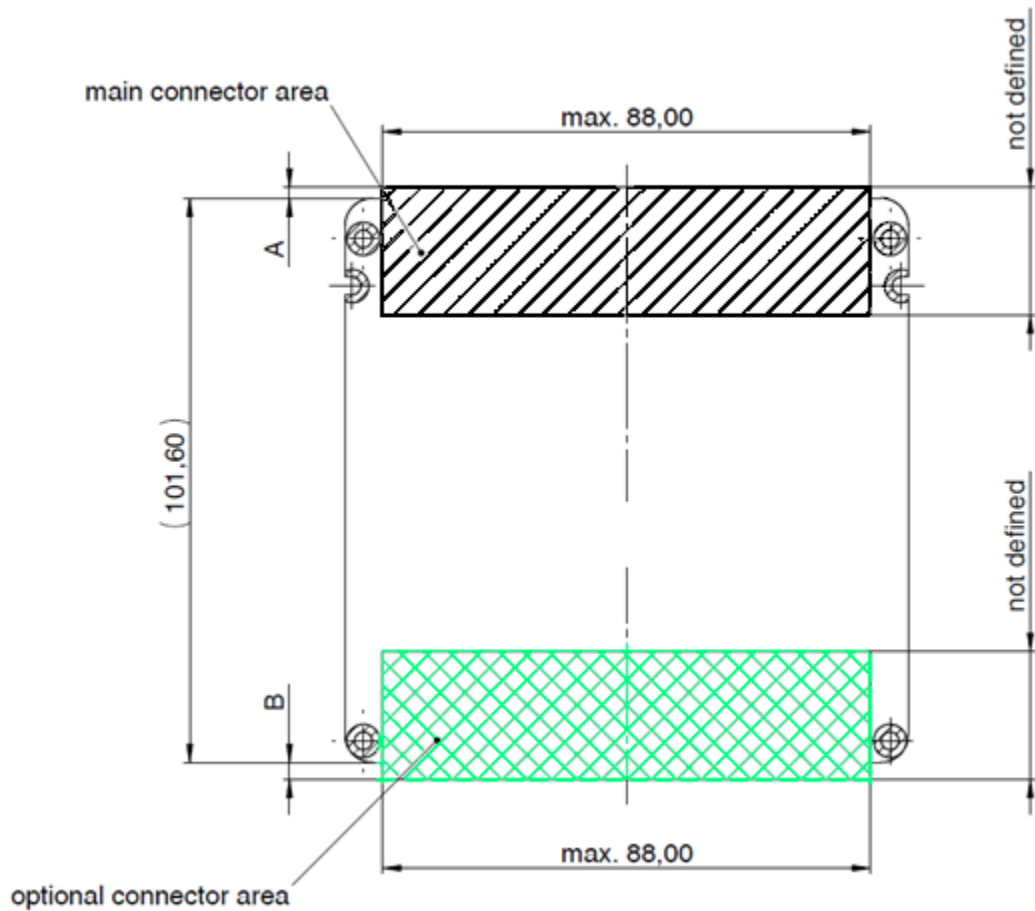

Figure 4: connector areas on bottom side

Dimension	Inner connector distance from board edge	Outer connector distance from board edge
A	≤1 mm for connectors to contact inside the housing	≥ 2 mm for connectors to contact through the housing
B	≤3.5 mm for connectors to contact inside the housing	≥ 4.5 mm for connectors to contact through the housing

2.4.5 Recommended Connector Placements

2.4.5.1 Power Connector Placement

The Power Connector shall be aligned in the same area on all embedded NUC™ boards. Therefore it shall be placed on the left side of the main connector area (seen from bottom side view)
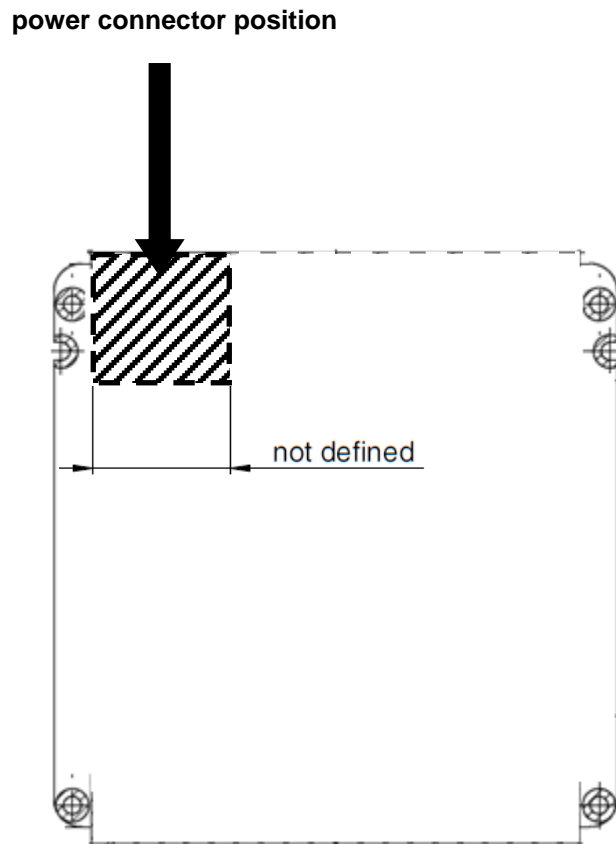
power connector position

Figure 5: power connector placement (from bottom side view)

2.5   Electrical Specification

2.5.1   Power Supply

2.5.1.1   Supply Voltage Range

The board shall have a single voltage power supply with:
- 18…24V ±20% DC

2.5.1.2   Power Connector Type

The type or style of the power supply connector is not defined. The type or style of the supply connector may vary. It shall be implemented for external or / and internal power supply sources.

2.5.2   Power Button

The board shall provide a power button functionality which should be accessible via power button or pin header.

2.5.3   Reset Button

The board shall provide a reset button functionality which should be accessible via reset button or pin header.

2.6   Miscellaneous

2.6.1   Environmental Conditions

2.6.1.1   Operating Temperature

The board shall withstand a predefined board temperature *)1 range using the projected heatspreader and / or cooling concept. Therefore two different environmental temperatures are predefined

- Standard Temperature Range: 0..60°C
- Extended Temperature Range: -40…85°C

*)1 Board temperature means the PCB temperature away from hot components.

2.6.2   Longevity concept

The Embedded NUC™ form factor is designed for the embedded market. All embedded NUC™ boards should have an expected product lifetime of 5 years or more after product launch.

3   HOUSING SPECIFICATION

In order to create an interchangeable ecosystem for embedded NUC™ boards and housings it is planned to describe and specify different housing types for embedded NUC™ boards at a later time.