M16C Family
BlueMP3™ reference design for MP3 streaming over Bluetooth

1 Abstract

This application note describes the BlueMP3™ reference design for MP3 streaming over *Bluetooth™* for consumer application.

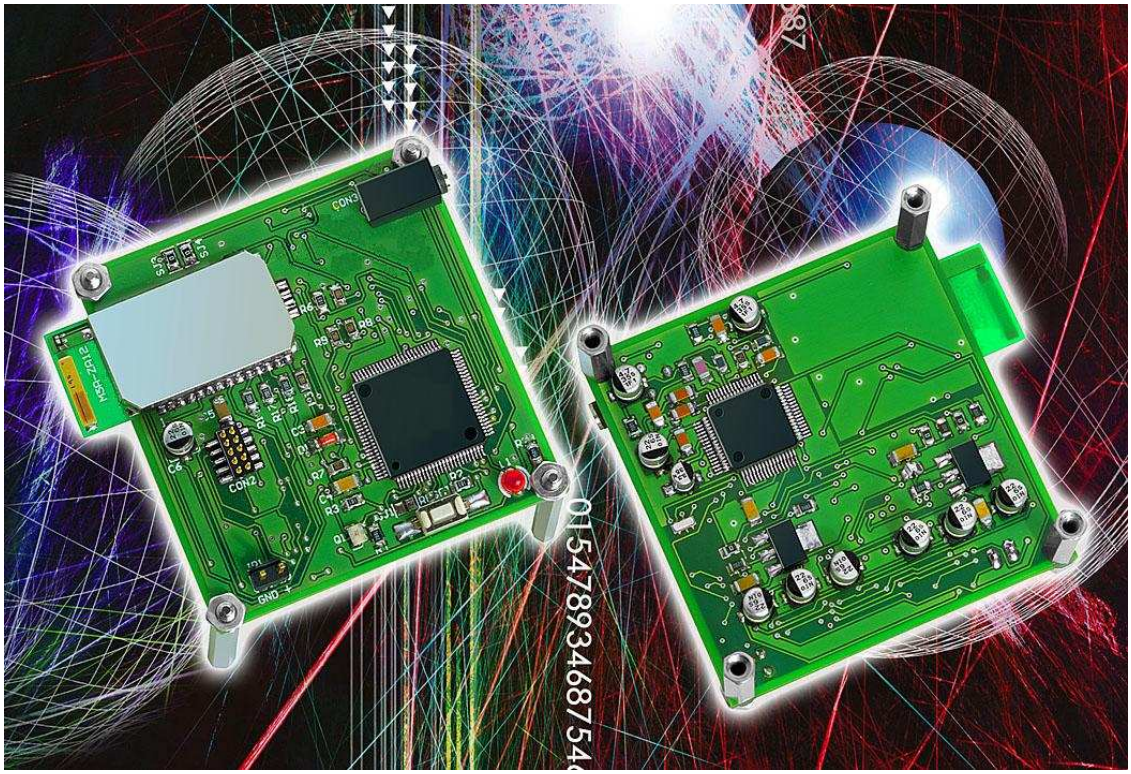

Image1: The BlueMP3™ reference design

2 Contents

3 Introduction

Current wireless audio devices on the market e.g. speakers and headphones leave much to be desired at the sound quality and the possibility of interactivity to the host device.
Those wireless audio limitations are about to vanish, by using the MP3 over *Bluetooth™* * solution of Renesas Technology. The reference design is based on a transmitter side, which actually can be any *Bluetooth™* enabled PC or PDA, where MP3 data is stored. The connection establishment as well as the MP3 file selection can be done from a smart Windows GUI. The counterpart is the receiver, where the streamed MP3 data will be received, decoded and amplified to make it suitable for headphones or further processing e.g. in a home stereo.

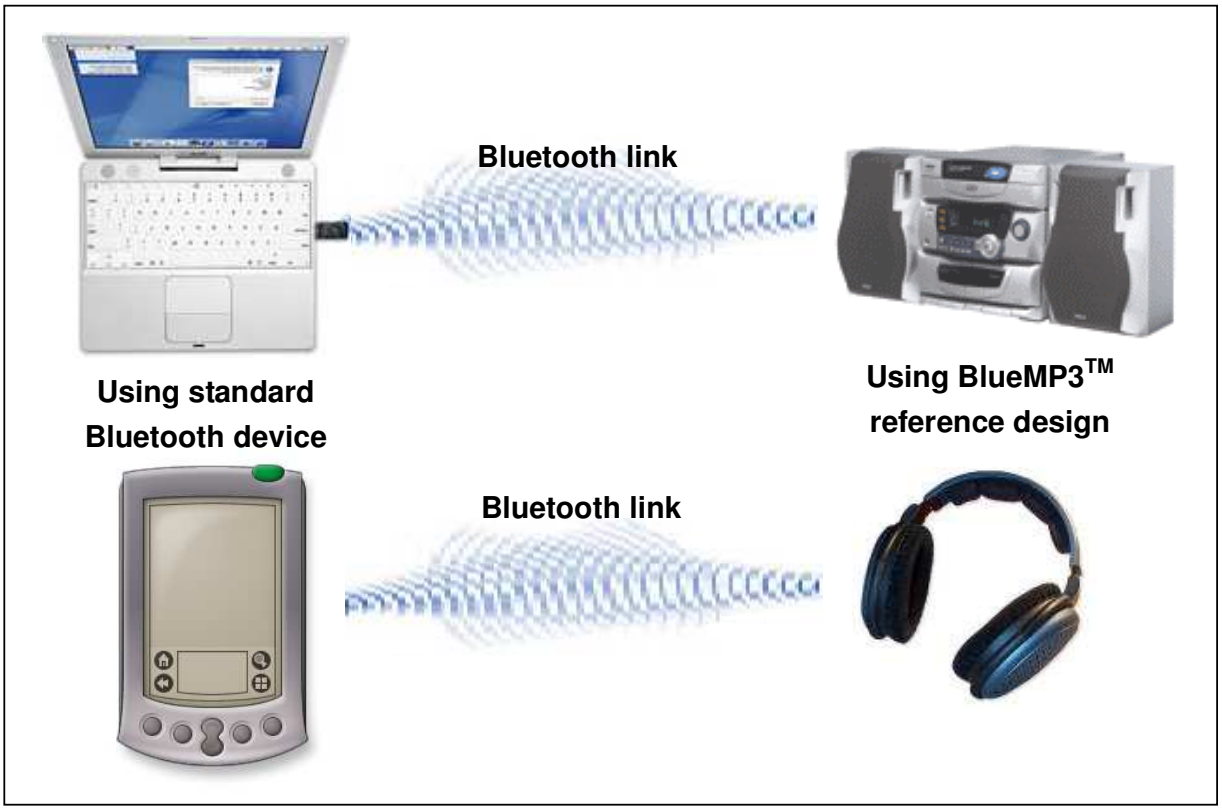

Figure1: Typical applications for the BlueMP3™ reference design

Instead of the *Bluetooth™* Audio/Video Profile (A/V) the Serial Port Profile (SPP) specification is basic of this reference design, which defines a *Bluetooth™* Link for serial data communication. This *Bluetooth™* link provides a bi-directional wireless connection between the transmitter and the BlueMP3™ device, which offers due to the selected profile a flexible,

easy, qualifiable and mature realization with minimized processor resources and the possibility to use standard *Bluetooth™* solutions with Windows OS support on the PC side.

4 Hardware description

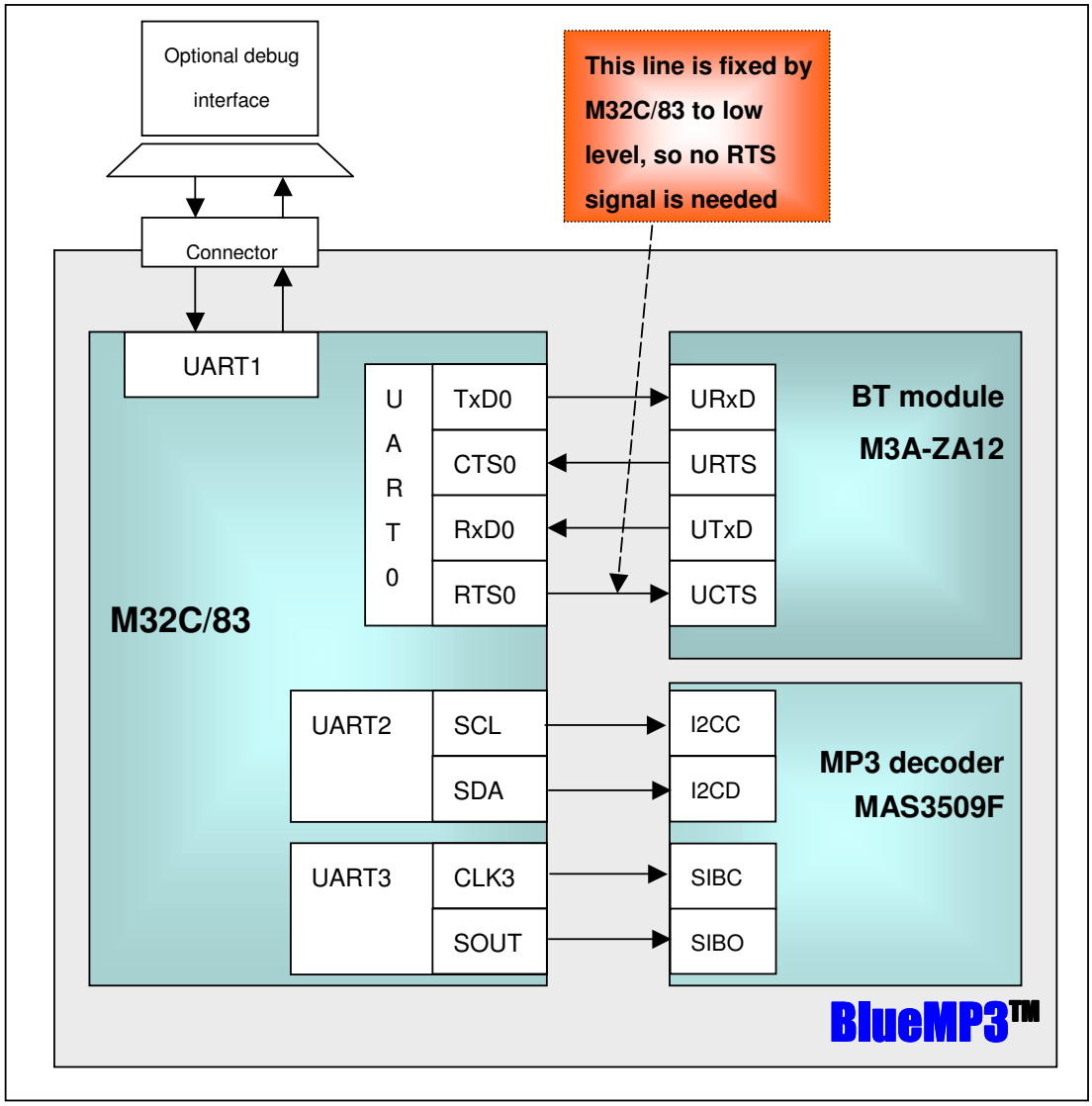

Figure2: Block diagram of BlueMP3™ reference board

The BlueMP3™ embedded receiver side, consists of a Renesas *Bluetooth™* module M3A-ZA12 (including Renesas *Bluetooth™* chipset), a Renesas Microcontroller M32C/83 and a Micronas MP3 decoder IC, whereby these devices are mounted on a smart 5cm x 5cm PCB.

Due to the headset connector and the low power consumption of the complete system, it is suitable for battery driven as well as for the home stereo area application.
The ready to use *Bluetooth™* module M3A-ZA12 is based on the Renesas Technology chipset of baseband IC M64110WG and the RF transceiver IC M64846FP plus an additional SMD antenna.
The MP3 data will be received by the Renesas chip module M3A-Z12, then transmitted by HCI interface to the Microcontroller and finally transferred to the MP3 decoder IC. Furthermore the Microcontroller takes over the control of the decoder by I^2C interface.
A headphone with a 2,5mm stereo jack can be directly connection to the BlueMP3™.

One UART interfaces of the M32C/83 is utilized for external communication.

- **UART1** – Optional debug communication to a PC with KD30xx cable debugger, as well as for flash programming of the M32C/83.

Interface Connector	1	2	3	4	5	6	7	8	9	10
KD30xx	DVcc	NC	NC	RxD1	NC	NC	DGND	/RESET	CNVSS	TxD1

Table1: Pinning of interface connector

Furthermore, three more UART interfaces are used for board internal communication.

- **UART0** – Used as asynchronous HCI interface to the *Bluetooth™* module M3A-ZA12
- **UART2** – Used as I2C interface for MP3 decoder control
- **UART3** – Used as synchronous interface for MP3 data transfer

Interface	M32C/83 pin	M32C/83 name	Direction	BT-Module M3A-ZA12	MP3 decoder
UART0	P6.3	TxD0	→	URxD	
	P6.0	CTS0	←	URTS	
	P6.2	RxD0	←	UTxD	
	P6.1	RTS0	→	UCTS	
UART2	P7.0	SDA	→		I2CD
	P7.1	SCL	→		I2CC
UART3	P9.0	CLK3	→		SIBC
	P9.2	SOUT3	→		SIBD

Table2: Pinning of board internal interface

Please note that the UART0 - RTS0 signal of the M16C/62N is not generated automatically by the MCU, therefore the RTS0 signal is set to fixed low level just by port setting, to show the BT module a continuously ready signal.

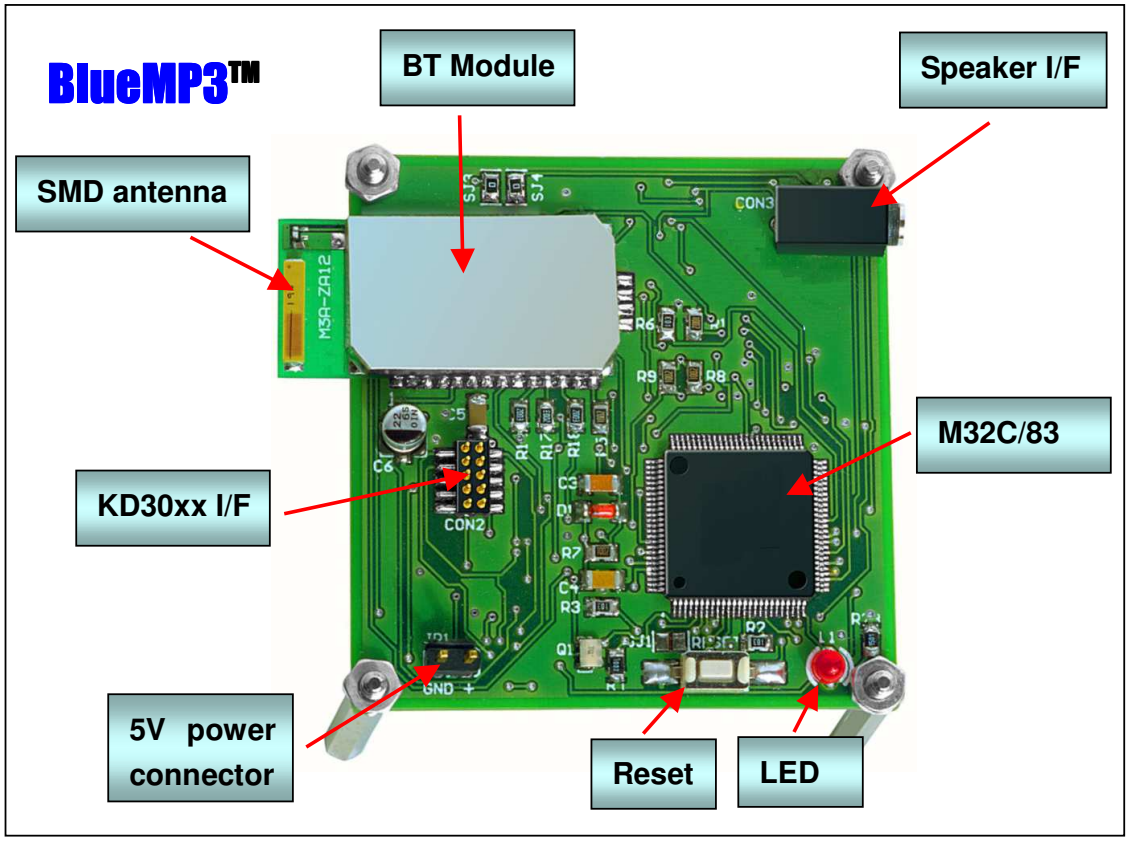

Figure3: Top view of BlueMP3™

The audio connector for speaker can be directly connected to headphone or can be routed to a stereo system for further processing.

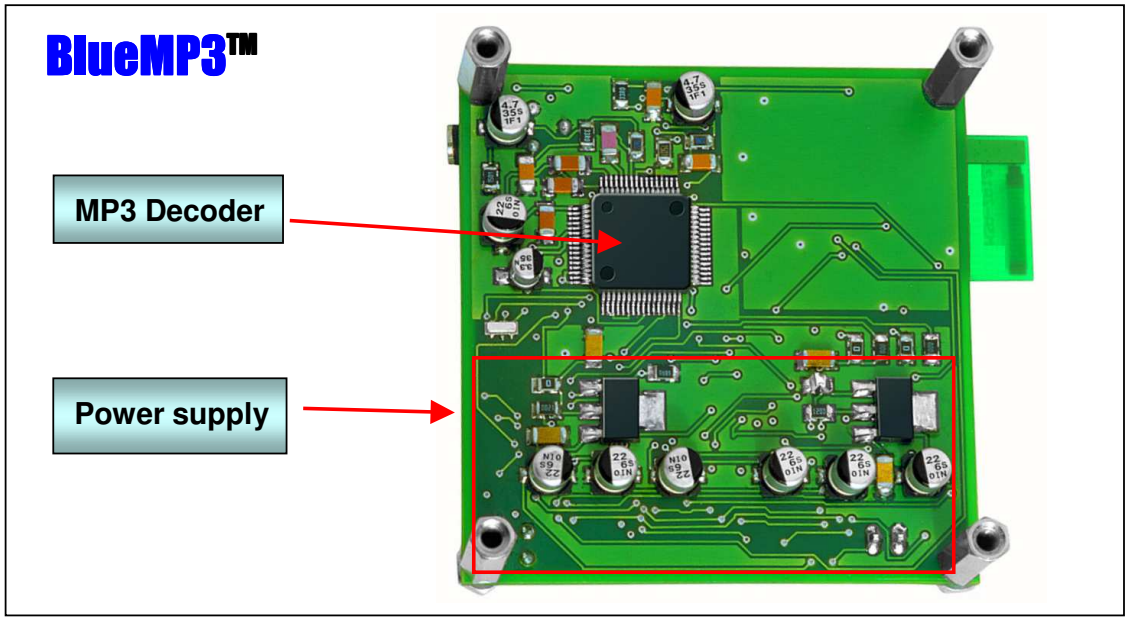

Figure4: Bottom view of BlueMP3™

5 Software description

The M32C software is utilizing the very compact and easy to configure embedded software stack of IAR Systems. The IAR Systems Embedded *Bluetooth™* Protocol Stack is already BQB qualified for Renesas M16C/M32C Microcontroller and supports the *Bluetooth™* Serial Port Profile.

Due to Renesas's MCU family concept you could easily choose another M16C/M32C as host MCU out of the wide range of memory and package variations, as well.

Anyway, to realize a reference setup, a Bluetooth enabled PC with a WinBlueMP3 application is needed.

The WinBlueMP3 application allows the user to find the BlueMP3™ by a *Bluetooth™* Inquire command. A following connection request command for the specified device in the left device list, setup a *Bluetooth™* link between the PC and BlueMP3™ reference design.

If the connection is established the PC will release an acoustic signal, and log info will be displayed in the device message window.

Figure5: The WinBlueMP3 application

By using the “Open” button a MP3 file can be selected from the PC storage. The MP3 file will be automatically transferred to the BlueMP3™ receiver side, whereby the file will be split in several small packets, which will be send by SPP profile to the sink.
For illustration purpose, a “N” will be logged in the device message window, if a packet of MP3 data have been send to the receiver. The receiver automatically starts with the playback. If the file has been completed, a new file can be selected with the “Open” button.

6 Demo Setup

Various peripheries should be connected to be the BlueMP3™ board for the Demo Setup.

- Power Supply
- Loudspeaker or Headset
- PC or PDA by Bluetooth link

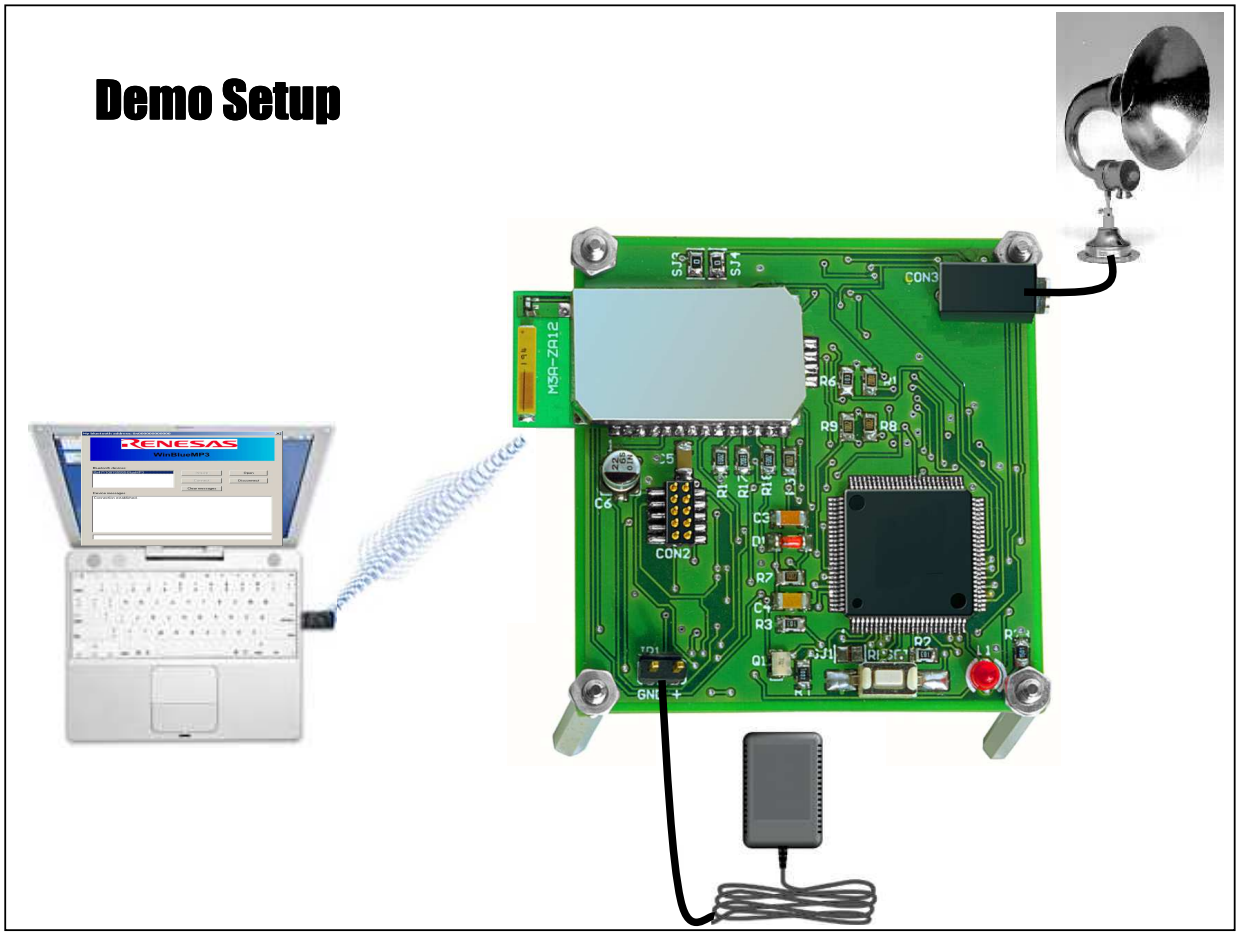

Figure6: Demo Setup for BlueMP3™ demonstration

A detailed overview of the connectors and the related pins can be found in the following figure.

Loudspeaker	Description
Jacket	Standard Stereo 2,5mm jacket

KD30xx I/F	Description
all	Not used for demo setup, pls. refer to chapter 4. Hardware description

Power Supply	Description
+	+5V - 9V
-	GND

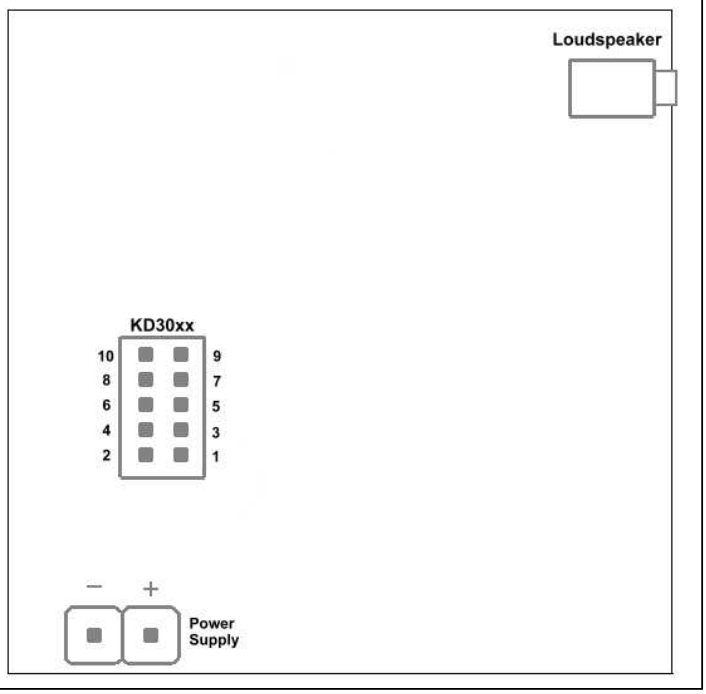

Figure7: Detailed connector plan of BlueMP3™ demo setup

7 Schematic

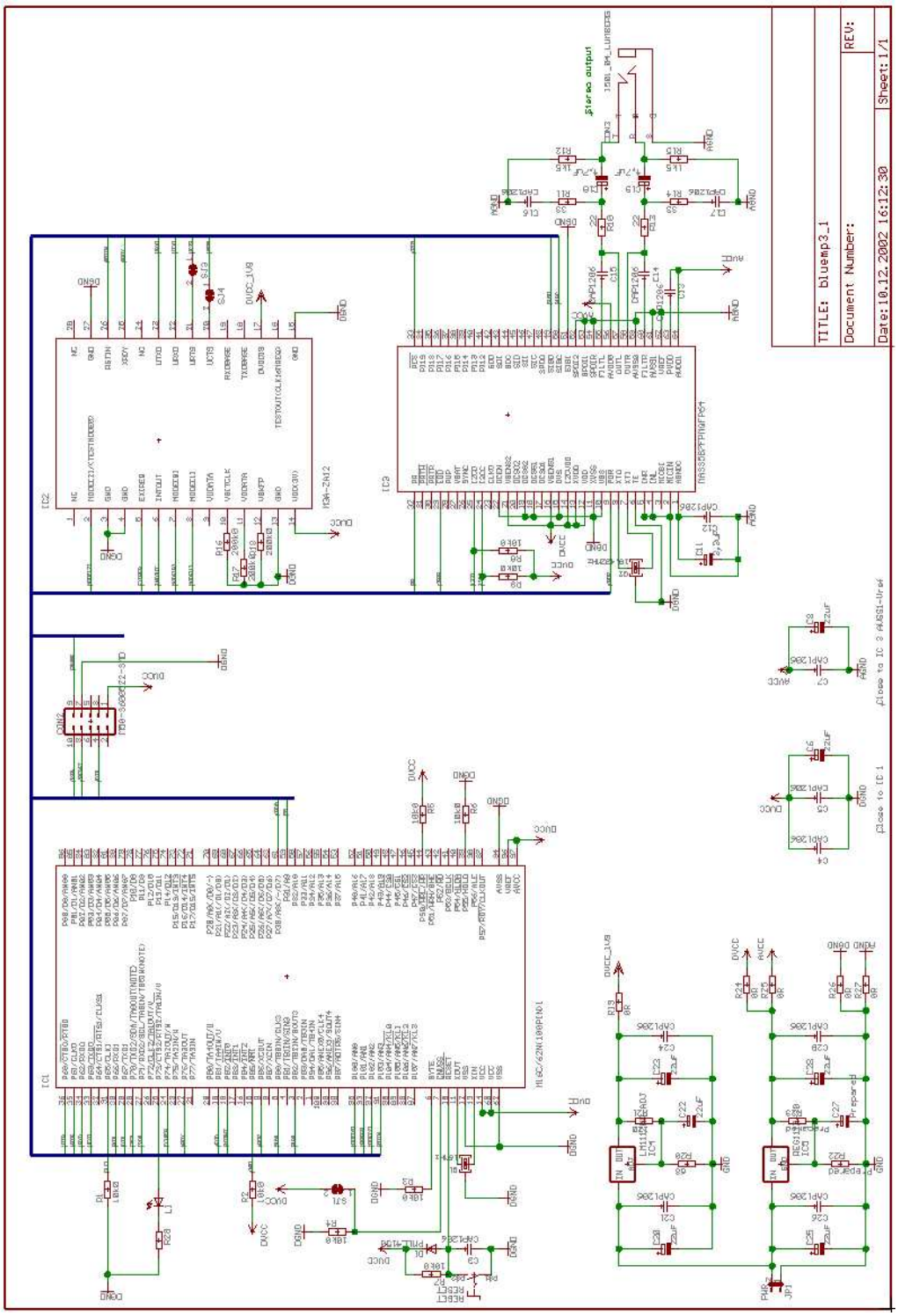

Figure8: Schematic of Microcontroller, *Bluetooth™* module, decoder and power supply

8 Component placement specification

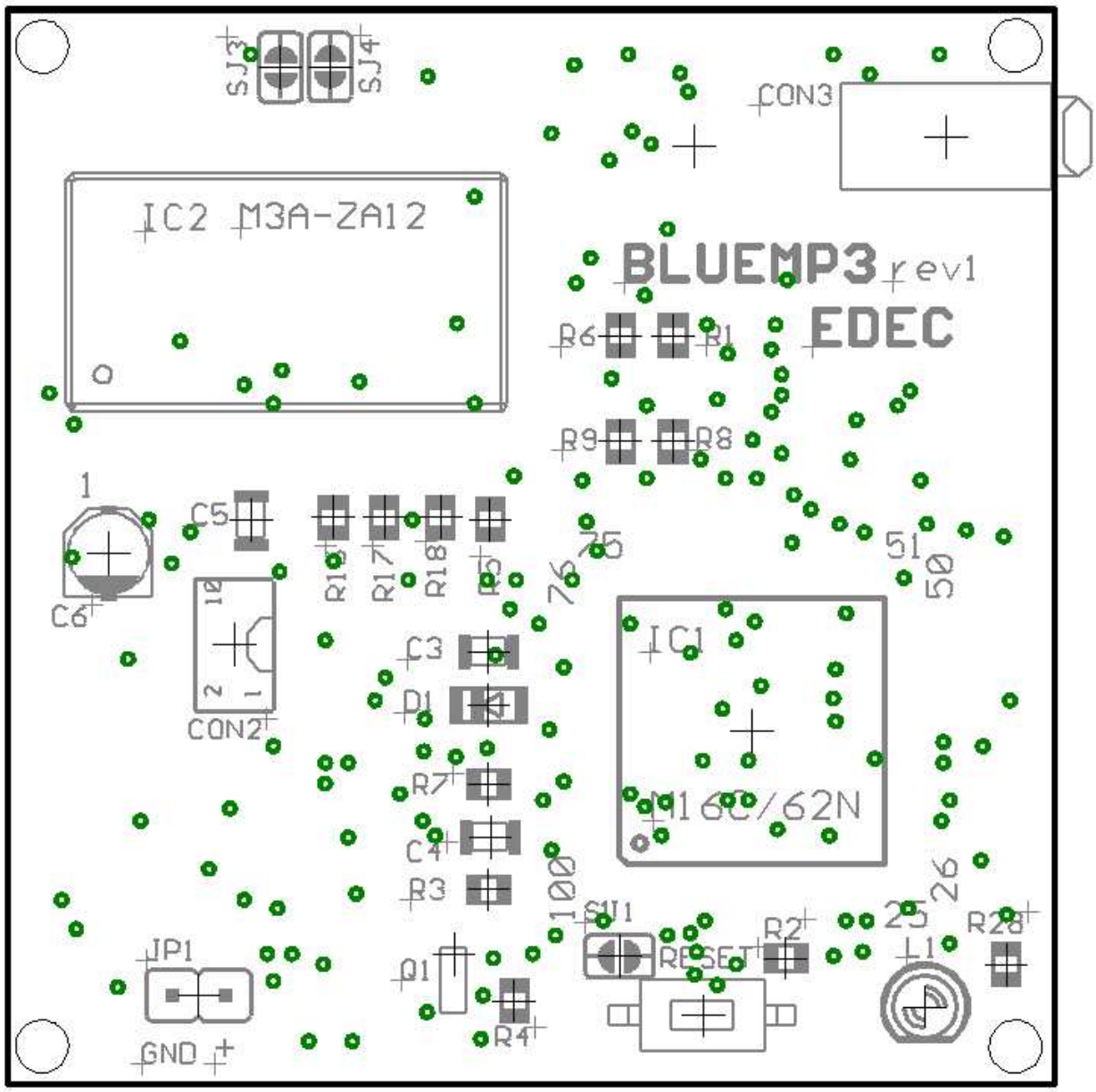

Figure9: Component placement top layer

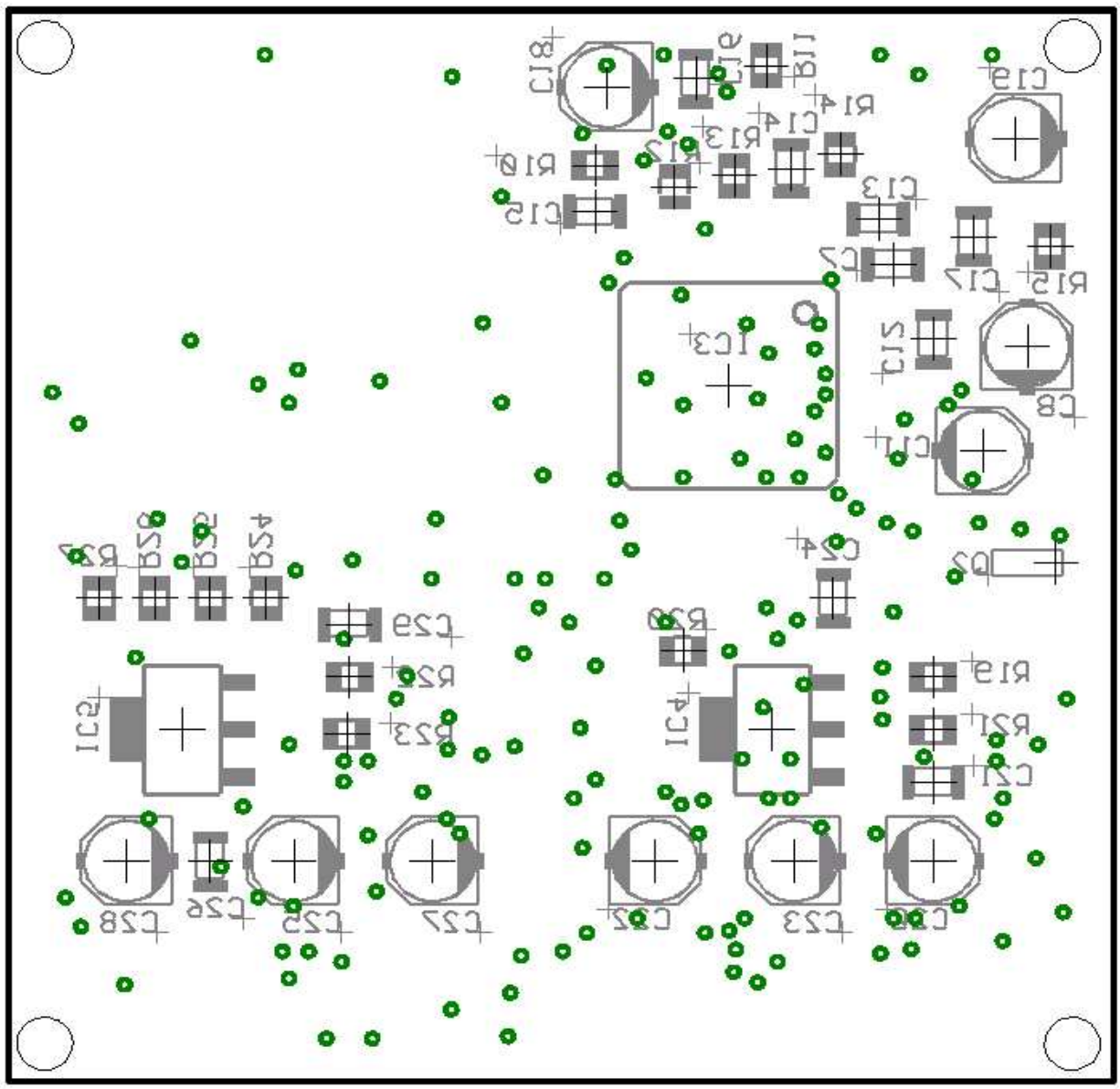

Figure10: Component placement bottom layer

9 Reference

Renesas Technology Corporation Semiconductor Home Page
http://www.renesas.com

Contact for Renesas Technical Support
E-mail: support_apl@renesas.com

Data Sheet & User's Manual
M32C/83 Datasheet, User's Manual, Bluetooth documents
(Use the latest version, please check: http://www.renesas.com)

IAR Systems Embedded *Bluetooth™* Protocol Stack
http://www.iar.com

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