72000 Bluetooth Development Kit

User's Guide

94001620000
Rev. 1.2 TR special, 2002-12-06

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Contents

Chapter 1
Introduction

NOTE:

You must not make changes or modify the device in any way.

The 72000 Development Kit for the Bluetooth Platform Solution from Motorola is a unique demonstration and development tool.

This product contains all of the hardware, software, and documentation needed to evaluate the functionality of the following Motorola Bluetooth platform solution IC's:

- MC72000 Bluetooth Baseband Controller and Transceiver IC
- MC13181 Wireless Power Management IC

Also, you can develop software and hardware solutions around the platform chipset. The 72000 Development Kit makes it possible to easily and quickly set up and start demonstrating a Class 2 Bluetooth solution, and it provides an efficient layout for the baseband and RF on an FR4 PCB substrate.

The primary applications of the 72000 Development Kit are:

- Evaluation of the platform chipset and its features
- Porting of a user Bluetooth stack to the Motorola Bluetooth hardware
- Prototyping of a Bluetooth-enabled host device
- Reference design for quick layout of a Bluetooth solution based on the MC71000 and MC13180 chipset

The 72000 Development Kit is Bluetooth 1.1 qualified and type approved in a great number of countries. See Chapter 5, "Regulatory".

For detailed information on the MC72000 and MC13181 IC's, please refer to the technical brief for each. These are included on the Development Kit CD.

1.1 About This Guide

This user's guide will help you get started with the 72000 Development Kit. The guide covers a large number of aspects of using the 72000 Development Kit, including:

- Overview of the 72000 Development Kit and accompanying documentation
- Instructions on setting up the hardware and software
- Descriptions of the various elements making up the 72000 Development Kit

The following is an overview of the various sections of this user's guide and a brief description of each section:

- Chapter 1, "Introduction" contains an overview of the user's guide and additional documents available from the CD. The introduction is also where to find information on support, system requirements, and a list of the acronyms used in this guide.
- Chapter 2, "Product Overview" provides an overview of the 72000 Development Kit with brief descriptions of the various elements making up the product.
- Chapter 3, "Setup" explains how to set up the hardware and software to get the 72000 Development Kit running.
- Chapter 4, "Hardware" describes the various aspects of the 72000 Development Kit hardware
- Chapter 5, "Regulatory" contains regulatory statements, a list of the countries where the 72000 Development Kit has obtained type approval or may be shipped as a prototype, and information on what is needed to obtain type approval for new products.
- Appendix A, "Board Diagrams", contains 72000 development board schematic and component placement.
- Appendix B, "Bill of Material", shows the BOM for the current 72000 development board.
- Appendix C, "100 mm² Module Diagram" contains schematic of the module that serves as a demonstration of the space efficiency of the MC72000 Bluetooth solution.

1.2 Additional Documents

In addition to this user's guide, the documentation for the 72000 Development Kit includes the following documents. These are all accessible from the document overview on the CD.

- User's Guides for various elements of the 72000 Development Kit:
  - Bluetooth HCI Terminal
  - Configuration Manager
  - DemoBench
  - RadioTest
  - Bluetooth Platform Solution Embedded System
- *System Overview of the Bluetooth Platform Solution from Motorola* providing a detailed overview of the platform.
- Technical briefs for the various elements of Motorola's Bluetooth platform solution:
  - 72000 Bluetooth Development Kit
  - MRFIC2408 External Power Amplifier IC
  - MC13180 Bluetooth Low Power Wireless Data Transceiver IC
  - MC13181 Wireless Power Management IC
  - MC71000 Bluetooth Baseband Controller IC
  - MC72000 Bluetooth Baseband Controller and Transceiver IC
  - 71000 Bluetooth Development Kit

- Application notes for the following:
  - Bluetooth Audio Signal Processor (BTASP) for High-Quality Audio Performance
  - Motorola's Bluetooth Solution to Interference Rejection and Coexistence with 802.11
  - Enhancing ISM Band Performance Using Adaptive Frequency Hopping
- Data sheets and information for components on the 72000 Development Kit:
  - CODEC
  - UART Level Converter
  - EEPROMs
  - Crystals
- Bluetooth Core Specification v1.1

1.3 Downloads and Support

For Development Kit software and documentation downloads, up-to-date information, support questions, FAQs, etc., go to the following website: http://www.btpo.net

In addition, you may find useful information on the following websites: http://www.motorola.com and http://www.motorola.com/semiconductor/bluetooth

For additional support on your Development Kit, if necessary, please contact your local FAE.

1.4 System Requirements

To install and use the 72000 Development Kit, you will need the following:

- A PC equipped with Windows® 98/98 SE/2000
- A 600 MHz processor (or higher)

1.5 Acronyms and Abbreviations

Throughout this guide, the following acronyms and abbreviations are used:

EEPROM	Electrically Erasable/Programmable Read Only Memory
Rx	Receive(r)
SEEPROM	Serial Electrically Erasable/Programmable Read Only Memory
SPI	Serial Peripheral Interface The SPI Bus made by Motorola handles all serial communication with a number of different RF front ends and SEEPROMs.
SSI	Synchronous Serial Interface
Tx	Transmit(ter)
UART	Universal Asynchronous Receiver Transmitter

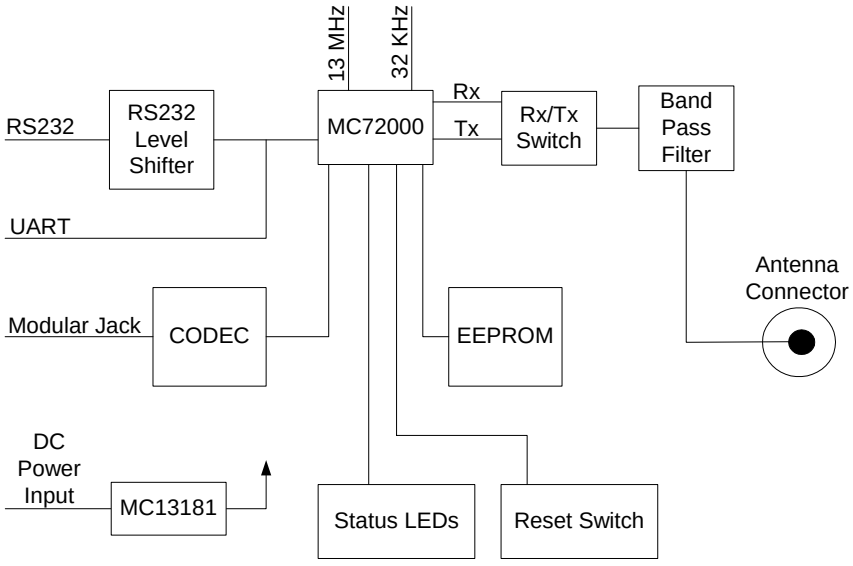
Chapter 2
Product Overview

This section contains a brief overview of the 72000 Development Kit. More detailed information on the various elements is included in later sections and in the separate user's guides included on the CD.

2.1 Block Diagram

The following figure shows the 72000 Development Kit block diagram:

Figure 2-1. Block Diagram



2.2 Interfaces

The 72000 Development Kit features the following interfaces:

- RS232 interface: Programmable baud rate from 1200 to 921 Kbit.
- UART interface: 5-pin header with RxD, CTS, RTS, and GND, 3.3 V signaling, programmable baud rate from 1200 to 921 Kbit, HCI UART transport layer.

NOTE:

The UART and RS232 interfaces cannot operate simultaneously.

- Audio connections, with audio routed to the CODEC.

2.3 ICs

The 72000 Development Kit is supplied with the following Bluetooth ICs from Motorola:

- MC72000 Bluetooth Baseband Controller and Transceiver IC
- MC13181 Wireless Power Management IC

The 72000 Development Kit uses an Atmel SEEPROM (AT25HP512).

2.4 Software Tools

The 72000 Development Kit is accompanied by the following software tools:

- Bluetooth HCI Terminal
- Configuration manager
- DemoBench
- RadioTest

The following sections describe briefly each of the software tools. A separate user's guide for each tool is included on the Development Kit CD.

2.4.1 Bluetooth HCI Terminal

With the Bluetooth HCI Terminal you can interact with your Bluetooth hardware. The interface is similar to that of an AT Terminal application when communicating with a modem. The Bluetooth HCI Terminal makes it easy to send HCI commands from a computer to a Bluetooth device. Likewise, it is easy to receive HCI responses from a Bluetooth device. Consequently, you can get hands-on experience with the HCI. Or you can test your own Bluetooth hardware.

2.4.2 Configuration Manager

The Configuration Manager is an application that allows you to handle the Development Kit file system. With this tool, you can download firmware patches and set up a number of baseband and radio parameters to exercise the board. All parameters are restorable and default settings are stored automatically.

2.4.3 DemoBench

The DemoBench is a demonstration tool that can be used for a number of purposes. You can send a file to another Bluetooth device, “chat” with another Bluetooth device, and view link and packet statistics in a real-time application.

2.4.4 RadioTest

The RadioTest application allows you to test all aspects of your Bluetooth hardware. This application lets you control your hardware so as to carry out any test required for development purposes and when preparing for production. Testing is both fast and simple; you can do all your testing with one and the same program. In addition, you can create your own test system as desired without losing any of the benefits of the Radio Test application. Finally, the application allows for simultaneous testing of several units using the same equipment.

Chapter 3
Setup

This section explains how to set up the 72000 Development Kit hardware and software. Do the following:

1. Attach external antenna to the 50 ohm connector on the development board.
2. Attach the development board to your computer using the UART (RS232) cable.
3. Attach power supply to DC connector on board and connect to main electricity supply.
4. Insert the CD in the CD-ROM drive of your computer and follow the onscreen instructions to install the software and documentation.
5. Launch the Configuration Manager and make sure it is the only Development Kit application running.
6. Select the "72000 - UART Application - Audio through Codec" configuration in the Configuration Manager and click the Make Active button.

You can now use UART or RS232, however not simultaneously.

NOTE:

The first time the Configuration Manager is attached to a board, it will advise you to make a backup of the configuration on the board. A backup is necessary to save the board's original settings. The backup will be called Factory Settings for device XXXXXXXXXXXX.

Chapter 4
Hardware

This section provides information on various aspects of the 72000 Development Kit hardware. In addition, Appendix A, “Board Diagrams“, contains the development board schematic and component placement, and Appendix B, “Bill of Material“, contains the BOM.

4.1 Signal and Connection Descriptions

The 72000 Development Kit contains the following connections, switches, and indicators:

- Power supply input
- Modular jack 4/4 connector for mono-audio speaker and microphone (headset application)
- RS232 interface
- UART interface
- Antenna connector
- JTAG allowing interface to MC72000 production test
- Reset button
- Three control buttons for future applications
- On/off switch
- Status LEDs
- Software download switch

The power supplied for the 72000 Development Kit is DC with the ratings stated in the specifications.

An analog audio signal to be transmitted over the Bluetooth connection can be fed into the 72000 Development Kit via the modular jack or as streaming audio through the host interface. It will be converted to digital data and transmitted through the Bluetooth link. A digital audio signal received from a connected Bluetooth device will be converted to an analog audio signal and available at the modular jack or as streaming audio through the host interface (UART, SSI, SPI). The MC72000 has a Bluetooth Audio Signal Processor (BTASP) for superior audio performance.

The RS232/UART interfaces can be used to transfer data and audio between a host and the Bluetooth device. The firmware of the 72000 Development Kit can be upgraded through the RS232/UART interface.

The CODEC is attached to the MC72000 via SSI interface.

The antenna connector is an SMA 50 ohm connection.

The reset button can be activated to re-initialize the entire system.

Three buttons are provided for future embedded applications.

Four status LEDs are provided:

- One application-specific LED
- 24 MHz/32 kHz
- RX/TX
- Power on

4.2 Environmental

This section contains system level environmental information about the development board::

- Storage temperature (degrees centigrade):
  - Min. -40
  - Max +125
- Operating temperature (degrees centigrade):
  - Min. 0
  - Max +85

4.3 Mechanical

This section contains system level mechanical information:

- Length: 75mm
- Width: 50 mm
- Height (PCB with components):
  - Excluding legs: 18 mm
  - Including legs: 25 mm
- Layout, FR4, 4 layer: 1 mm

4.4 Electrical

This section contains electrical information:

- Input power supply requirements: 3.5-6.5 VDC
- Audio input: 65m Vpp
- Audio output: 1.6 Vpp, modular jack 4/4 connector

The following table shows the current consumption measurements of the circuits of the MC72000 Bluetooth Baseband Controller and Transceiver IC.

Table 1: Current Consumption Measurements of MC72000

Type	Average Current	Description
DH5 asymmetric RX	57 mA	TX rate 57.6 kbits RX rate 723.2 kbits
DH5 asymmetric TX	55.5 mA	TX rate 723.2 kbits RX rate 57.6 kbits
DH5 symmetric	57.5 mA	TX rate 433.9 kbits RX rate 433.9 kbits
HV1	54.8 mA	
HV3	TDB	
Total system in low-power mode	TDB	

Note that the table contains typical values.

4.4.1 Power Supply

The board is fed with power from on-board standard regulators.

The on-board power supply regulators should be fed with the supply provided, which generates the following voltages for the board:

- 1.85 V
- 2.65 V
- 3.0V

4.4.2 Reset Circuit

The board includes a push button for full system reset of the MC72000 and all peripherals.

4.4.3 Clocks

The clocks in the system are as follows:

- External crystal: 13 MHz
- Sleep mode clock: 32.768 kHz
- Active mode clock: 24 MHz

The MC72000 includes an internal oscillator circuit for the 32.768 kHz sleep mode clock and the 24 MHz active mode clock. Only two external crystals and a few other components are needed.

4.4.4 Memory

The MC72000 has embedded memory of 256 Kbytes of ROM and 64 K of RAM. The file system and application can be uploaded from a host system, or a low-cost serial EEPROM (four-wire connection). For more information on the contents and structure of the MC72000 memory, please refer to the *Bluetooth Platform Solution Embedded System User's Guide.* This is accessible from the document overview on the Development Kit CD.

4.4.5 UART Interface

The UART interface is embedded in the MC72000. However, an external level converter is needed. For this purpose, the MAX3237 1.0 Mbit level converter is used. The level converter is connected to the MC72000 and a female 9-pin D-sub. The connection between the level converter and the MC72000 is passed through a jumper block in order to aid debugging, and, if ever needed, to use a different type of level converter.

4.4.6 CODEC Interface

The audio interface consists of the Motorola MC145483 CODEC, a 4-pin header and a 4/4p amp connector. Sampling rate is configured at 7.8125 kHz.

4.4.6.1 Codec Setup and Configuration

In the current (Motorola CODEC) configuration for the 72000 Development Kit, the CODEC can only be configured as a slave, which is done by the application at startup. Therefore, the MC72000 IC will be configured as the SSI master, meaning that the MC72000 IC generates all SSI control signals. In practice, the CODEC bit clock is tied electrically to the master clock.

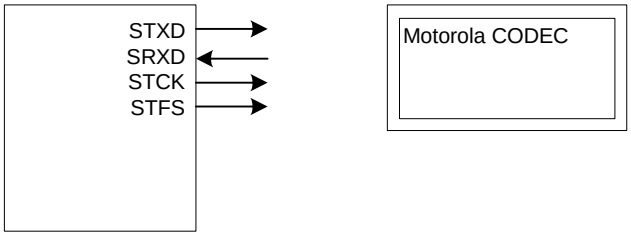
There are certain constraints on the available clock frequencies; specifically, the frequency can only be integer factors of the baseband's master clock, which is 24 MHz. The Motorola CODEC expects a 2.048 MHz master clock, but due to these limitations, none of the available integral frequencies fit the CODEC exactly. Therefore, a slight mismatch in the order of two per cent exists. To be exact, the CODEC expects a 2.048 MHz master clock, but gets 2.000 MHz.

The frame sync generated by the MC72000 IC can only by an integer factor of the master clock (bit clock), and is selected as 1/256th, resulting in:

- Frame sync: 2000 kHz / 256 = 7.8125 kHz

This slight mismatch does not cause any audio degredation. Interpolation copes with the synchronization seamlessly. The degradation of the frequency characteristic of the system from runnning on a slightly lower sample frequency is not significant. (The pass-band upper frequency is 3.9 kHz instead of 4.0 kHz).

Figure 4-1. SSI Signals from Baseband to CODEC



4.4.7 Antenna

The 72000 Development Kit contains an SMA 50 ohm antenna connector.

4.4.8 100 mm² Module

A six-layer HDI PCB with an area of 100mm² has been populated with an MC72000 IC and all the necessary external components for a host-based solution, where the reference oscillator signals are provided by the host. This serves as a demonstration of the space efficiency of the MC72000 Bluetooth solution. This PCB has been fitted with pads to resemble a QFN package and has been mounted on the motherboard.

For a diagram of this module, see Appendix C, “100 mm² Module Diagram“.

Chapter 5
Regulatory

This section contains regulatory statements, a list of the countries where the 72000 Development Kit has obtained type approval or may be shipped as a prototype, and information on what is needed by developers to obtain type approval for their products.

NOTE:

This device is intended for evaluation and development purposes by professionals only and is NOT for re-sale.

5.1 Regulatory Statements

This section contains the regulatory statements that apply to the 72000 Development Kit.

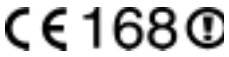
NOTE:

Users are not permitted to make changes or modify the system in any way. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

5.1.1 General

This product complies with any mandatory product specification in any country where the product is sold.

5.1.2 European Union (EU) and EFTA



This equipment complies with the R&TTE directive 1999/5/EC and has been provided with the CE mark accordingly.

5.1.3 France

This equipment may only be used as a Class 2 device, not as a Class 1 device. Note also that only indoor use is allowed.

5.1.4 United States of America and Canada

Tested to comply with FCC Standards FOR HOME OR OFFICE USE. See FCC 47CFR part 15.19(b)(2)

This device complies with part 15 of the FCC rules and with RSS-210 / RSS-139 of the Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. See FCC regulation CFR47 sec. 15.19(3).

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

In order to comply with FCC RF Exposure requirements, a minimum separation distance of 20 cm must always be maintained between the transmitter antenna and all persons during normal operation.

Note that any changes or modifications to this equipment not expressly approved by the manufacturer may void the FCC authorization to operate this equipment. See FCC regulation CFR47 sec. 15.21.

5.1.5 Canada Compliance (Industry Canada)

To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment that is installed outdoors is subject to licensing.

In French: **Pour empêcher un brouillage radioélectrique au service faisant l'objet d'une licence, cet appareil doit être utilisé à l'interieur et loin des fenêtres afin de founir un écran de blindage maximal. Au cas aù un installation en plain air, le materiel doit faire l'objet d'une licence.**

This device has been designed to operate with an antenna having a maximum gain of 5.00 dBi. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

The term "IC:" before the radio certification number only signifies that Industry Canada technical specifications were met.

5.1.6 Taiwan

臺灣

依據低功率射頻電機管理辦法，製造、輸入或販賣低功率射頻電機者應加印第十四條、第十七條及第二十條之規定內容。

第十四條
經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十七條
低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

第二十條
輸入、製造低功率射頻電機之公司、商號或其使用者違反本辦法規定，擅自使用或變更無線電頻率、電功率者，除依電信法規定處罰外，電信總局並得撤銷其型式認證證明或型式認證標籤。

5.2 Development Kit Approval

5.2.1 Type Approval

In the following countries, the 72000 Development Kit has obtained type approval:

- Europe (EU and EFTA countries)
- USA
- Canada
- Japan*

* The equipment will be tested at accredited in-country test house. However, actual application will not be submitted as the 72000 development board has no enclosure, which is requested for approval in Japan.

5.2.2 Prototype Shipment

In the following countries, the 72000 Development Kit has not been typed approved but prototypes may be shipped:

- China
- Taiwan
- Israel**
- Hong Kong
- Korea (South)
- Singapore
- Brazil
- Mexico**

** Awaiting new regulations.

5.3 Obtaining Type Approval

Customers of Motorola Bluetooth chipsets will face some Bluetooth qualification and regulatory requirements for their products. The following lists the requirements for the major markets as defined by Motorola as tier 1 countries: Australia, Canada, Europe (15 + 4 EFTA countries), Japan, New Zealand and the US. A number of other countries worldwide will accept the test reports made for Europe and/or US approval; for more information, please go to: http://www.bluetooth.org/member/regulatory.

Motorola chipsets (radio/baseband) are pre-qualified as Bluetooth components; for more information, please go to: http://qualweb.opengroup.org/Template2.cfm?LinkQualified=QualifiedProducts. Also any variants of Motorola software stacks will be pre-qualified. The assumption of pre-qualification provides that customers will implement the radio module (radio chip including surrounding components and print layout) without any changes.

5.3.1 Requirements for Bluetooth Qualification

Baseband chipset will be used as a pre-qualified component and do not require re-testing.

Any incorporated variant of Motorola software stack will be used as a pre-qualified component and do not require re-testing.

Radio will need to be re-tested in the product layout for the 8 (of 16) test cases listed in the following table. (For more information, see “The Bluetooth Qualification Program Reference Document (BQ PRD)” on the Bluetooth Qualification Program Website: http://qualweb.bluetooth.org/Template2.cfm.)

Table 5-1.

TRM/CA/04/E	TX Output Spectrum-Frequency range
TRM/CA/08/E	Initial Carrier Frequency Tolerance
TRM/CA/09/E	Carrier Frequency Drift
TTRC/CA/01/E	Out-of-Band Spurious Emissions-**radiated**
RCV/CA/02/E	Sensitivity-multi-slot packets
RCV/CA/03/E	C/I performance
RCV/CA/04E	Blocking performance
TP/PHYS/TRX/BV-05-C	Symbol rate

If changes are made to the 72000 Development Kit radio module BOM or layout, all 16 Bluetooth test cases will be required to be re-tested. Depending on the nature of changes to the radio, re-testing might only be necessary in normal temperature. This has to be decided by the BQB in each case.

5.3.2 Requirements for Regulatory Type Approval

The following regulatory testing needs to be made:

- For CE-marking: EN 300 328-2 (emission), EN 301 489-17 (EMC), EN 60950 (safety)
- For Japan approval: ARIB T-66.
- For FCC grant: CFR47 part 15.205, 15.209 and 15.247 (except 15.247e: processing gain)

NOTE:

As Motorola radios will be approved by FCC as radio modules and the FCC testing can be avoided for regulatory purposes for radio modules, provided no changes are made to the radio module BOM or layout, it will still be necessary to perform the Out-of-Band Spurious Emissions-radiated-test of part 15.209.

The product might be subject to additional product specific regulations, such as PSTN regulations and other.

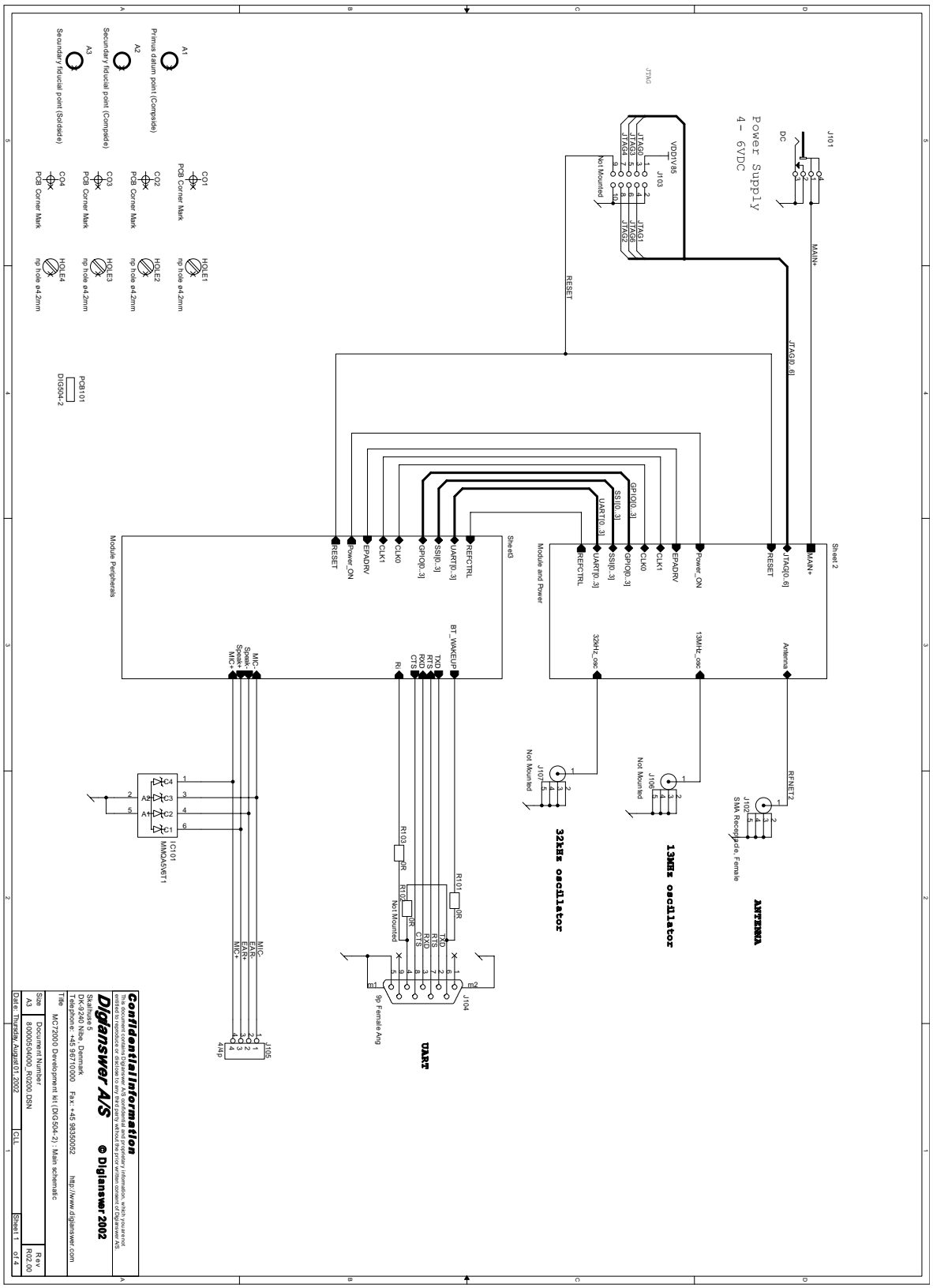
Type approval applications have to be filed to the national authorities for each product.

Documentation submitted for type approval can vary from country to country, but will in general include: test reports, pictures, BOM, schematics, PCB layouts, product descriptions (block diagrams), antenna information, SAR statements (see below), label/manual information (legal text) and manufacturer information.

Both in Europe and US regulators are currently working on new sets of rules for combined radio equipment as well as rules for SAR. Test requirements for SAR (including combined radio) will most likely be topical within the next year.

Appendix A
Board Diagrams

The following pages show the 72000 development board schematic and component placement.


Power Supply
4 - 6VDC
J101
DC
MAIN+
JTAG
VDD1V85
J103
JTAG0
JTAG1
JTAG2
JTAG3
JTAG4
JTAG5
Not Mounted
RESET
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13MHz_osc
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UART[0..3]
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BT_WAKEUP
TXD
RTS
RXD
CTS
RI
MIC-
Speak-
Speak+
MIC+
A1
Primus datum point (Composite)
A2
Secundary fiducial point (Composite)
A3
Secundary fiducial point (Solidsole)
CO1
CO2
CO3
CO4
PCB Corner Mark
HOLE1
HOLE2
HOLE3
HOLE4
np hole ø4.2mm
PCB101
DIG504-2
C4
C3
C2
C1
IC101
MMDA5V6T1
R103
0R
R102
Not Mounted
R101
J104
9p Female Arg
UART
J105
4/4p
J107
Not Mounted
32kHz oscillator
J106
Not Mounted
13MHz oscillator
REFNET2
J102
SMA Receptacle, Female
ANTENNA
Confidential Information
Digianswer A/S
© Digianswer 2002
Size
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Document Number
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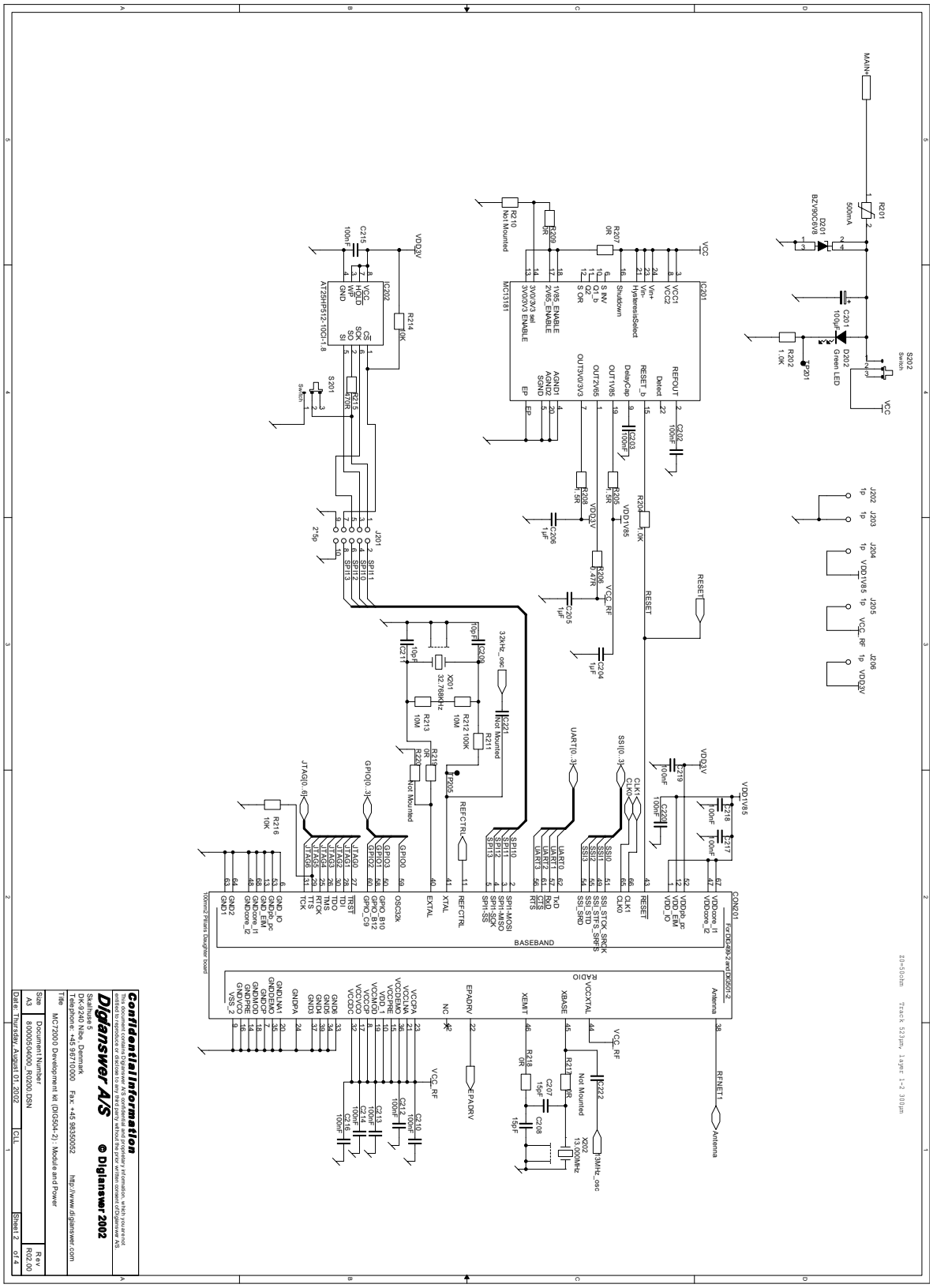
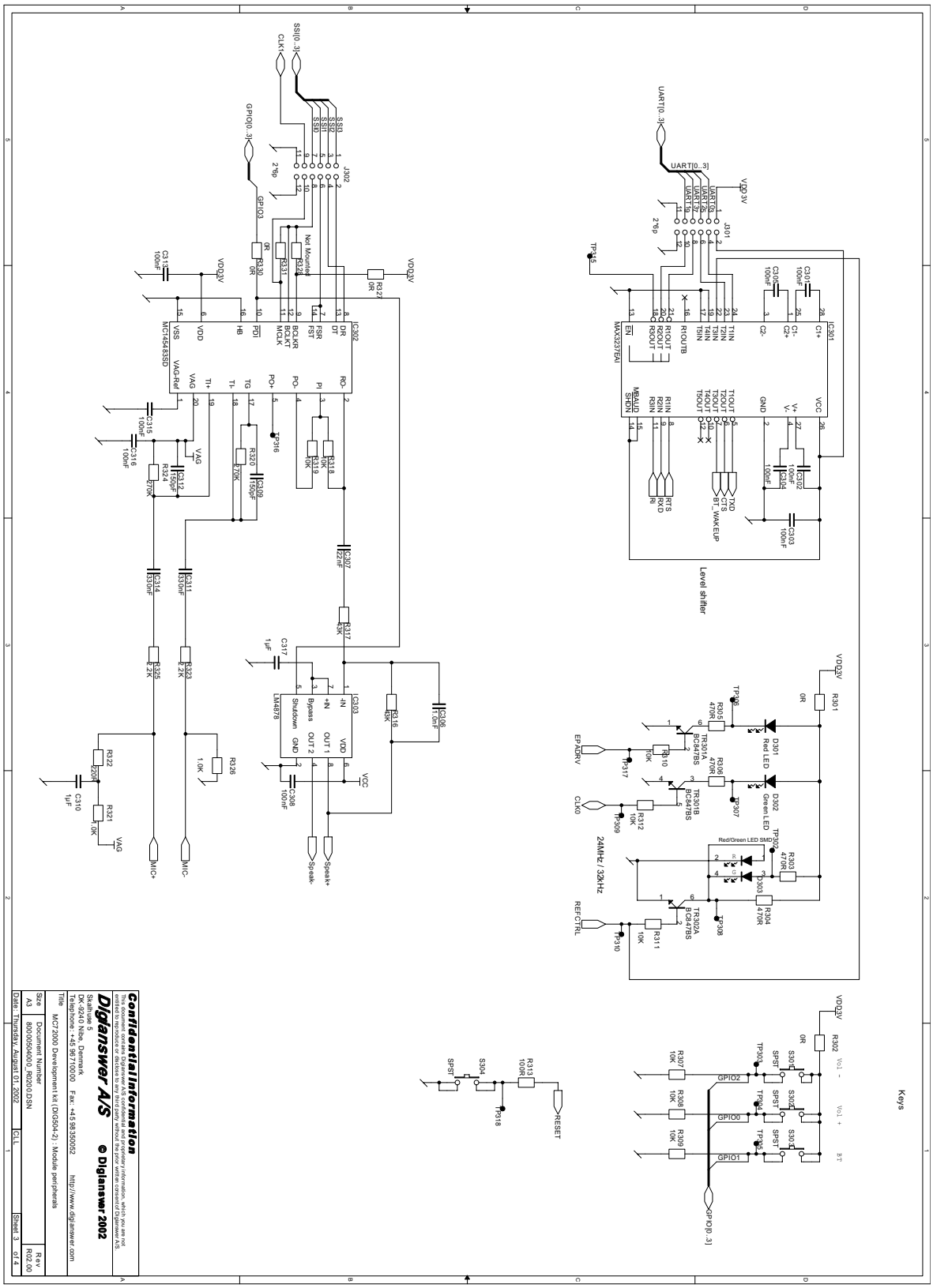
Rev
R02.00
Date: Thursday, August 01, 2002
Sheet 1 of 4




Level shifter
Keys
24MHz / 32kHz
Red/Green LED SMD
Confidential Information
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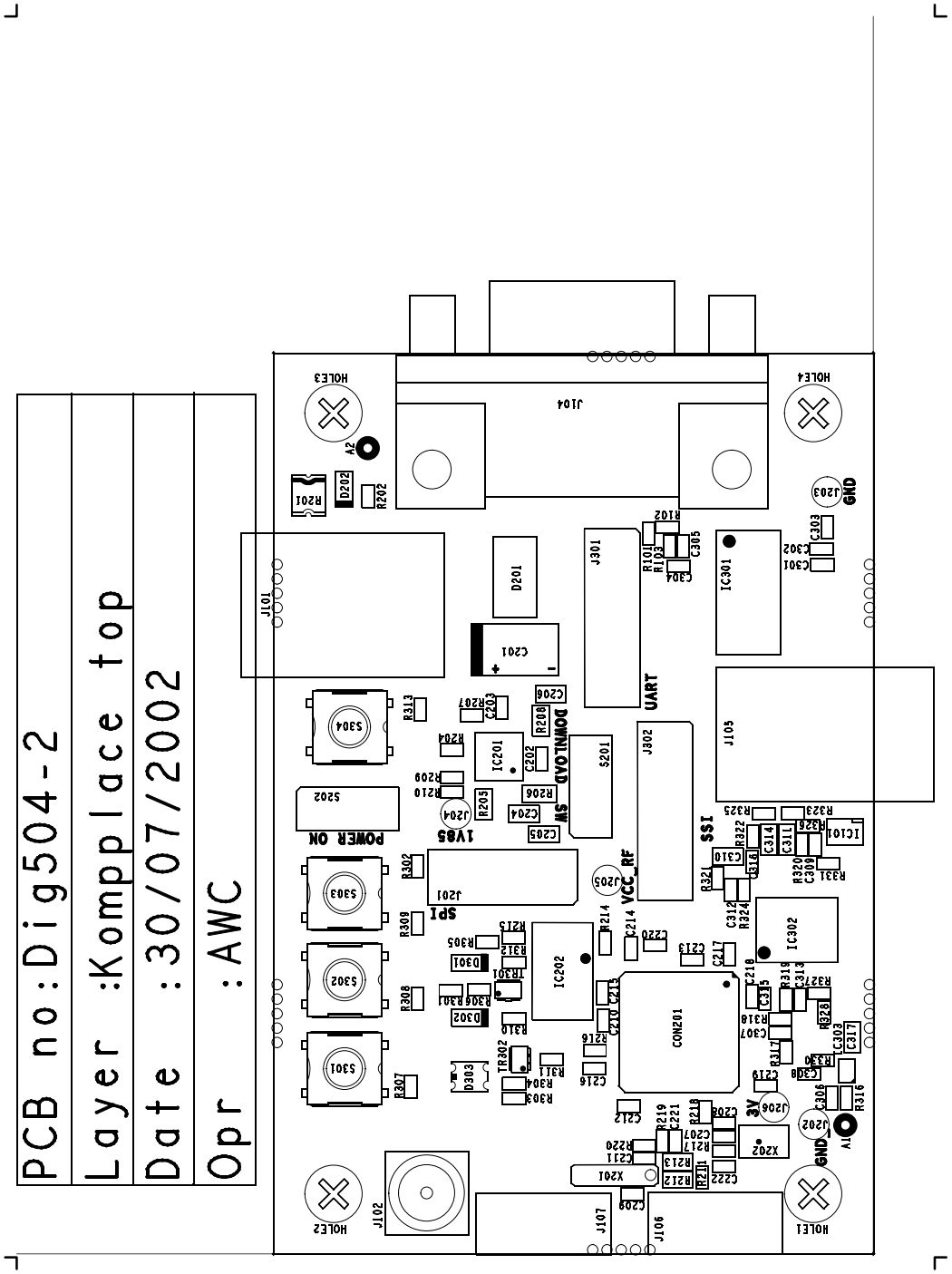
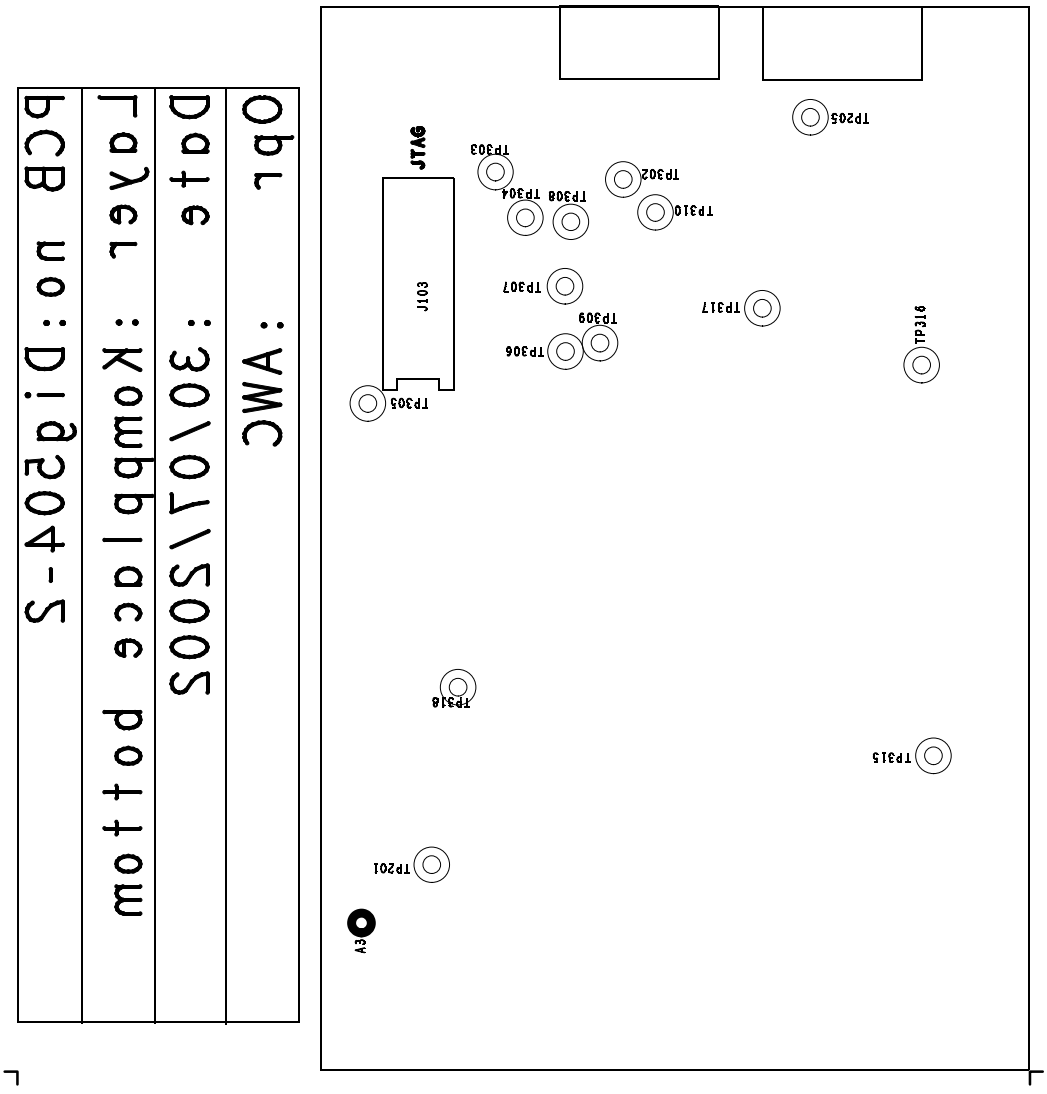
Title
MC72000 Development kit (DIG504-2) : Module peripherals
Size
A3
Document Number
80000504000_R0200.DSN
Rev
R02.00
Date: Thursday, August 01, 2002
Sheet 3 of 4



Physical Layer 1



Physical Layer 2

Appendix B
Bill of Material

This appendix shows the Bill of Material for the 72000 Development Kit PIN 80000504000 Rev. R02.00.

Table B-1.

Item	Value	Rating	Tolerance	Manufacturer	Manufacturer's Part Number	Part Reference
1	100µF	10V	20%	AVX	TPSD107MOlOR0150	C201
2	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C202
3	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C203
4	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C210
5	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C212
6	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C213
7	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C214
8	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C215
9	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C216
10	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C217
11	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C218
12	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C219
13	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C220
14	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C301
15	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C302
16	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C303
17	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C304
18	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C305
19	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C308
20	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C313
21	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C315

Table B-1.

Item	Value	Rating	Tolerance	Manufacturer	Manufacturer's Part Number	Part Reference
22	100nF	6.3V	10% X513	Murata	GRP155R60J104KA01E	C316
23	1µF	6.3V	10% X513	Murata	GRM188R60J105K	C204
24	1µF	6.3V	10% X513	Murata	GRM188R60J105K	C205
25	1µF	6.3V	10% X513	Murata	GRM188R60J105K	C206
26	1uF	6.3V	10% X513	Murata	GRM188R60J105K	C310
27	1uF	6.3V	10% X513	Murata	GRM188R60J105K	C317
28	15pF	50V	5% NPO	Murata	GRM36COG15OJ50PT	C207
29	15pF	50V	5% NPO	Murata	GRM36COG15OJ50PT	C208
30	10pF	50V	5% NPO	Murata	GRM36COGlOOD50PT	C209
31	10pF	50V	5% NPO	Murata	GRM36COGlOOD50PT	C211
32	1.0nF	50V	5% X713	Murata	GRM36X7R102K50PT263	C306
33	22nF	16V	10% X713	AVX-Kyocera	0402YC223KAT2A	C307
34	150pF	50V	5% X713	Murata	GRM36COG151J50PT263	C309
35	150pF	50V	5% X713	Murata	GRM36COG151J50PT263	C312
36	330nF	6.3V	10% X513	AVX-Kyocera	06036D334KAT2A	C311
37	330nF	6.3V	10% X513	AVX-Kyocera	06036D334KAT2A	C314
38	100mm2 daughter board			Digianswer	80000501000	CON201
39	BZV90C6V8			Philips	BZV90C6V8	D201
40	Green LED			Citizen	CL-170G-CD-T	D202
41	Green LED			Citizen	CL-170G-CD-T	D302
42	Red LED			Citizen	CL-170R-CD-T	D301
43	Red/Green LED SMD			Kingsbright Electronic	KPB-3025ESGC	D303
44	MMQA5V6T1	5.6V/24W		Motorola	MMQA5V6T1	IC101
45	MC13181			Motorola	PC13181	IC201
46	AT25HP512-10CI-1.8			ATMEL	AT25HP512-10CI-1.8	IC202
47	MAX3237EAI			MAXIM	MAX3237EAI	IC301

Table B-1.

Item	Value	Rating	Tolerance	Manufacturer	Manufacturer's Part Number	Part Reference
48	MC145483SD			Motorola	MC145483SD	IC302
49	LM4878			NATIONAL	LM48781BP	IC303
50	DC			Roka	5202550	1101
51	SMA Receptacle, Female			Telegärtner	J01151AO931	J102
52	9p Female Ang			AMP	747844-5	J104
53	4/4p			AMP	215875-1	J105
54	2*5p			AMP	826632-5	J201
55	1p			AMP	826629-1	J202
56	1p			AMP	826629-1	J203
57	1p			AMP	826629-1	J204
58	1p			AMP	826629-1	J205
59	1p			AMP	826629-1	J206
60	2*6p			AMP	1-826632-2	J301
61	2*6p			AMP	1-826632-2	J302
62	DIG504-2					PCB101
63	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R101
64	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R103
65	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R207
66	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R209
67	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R217
68	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R218
69	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R219
70	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R301

Table B-1.

Item	Value	Rating	Tolerance	Manufacturer	Manufacturer's Part Number	Part Reference
71	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R302
72	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R327
73	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R330
74	OR	62.5mW/50V	5 %	Phycomp	2322 705 91001	R331
75	500mA			Raychem	microSMD050-2	R201
76	1.0K	62.5mW/50V	1 %	ROHM	MCR01MZSF1001	13202
77	1.0K	62.5mW/50V	1 %	ROHM	MCR01MZSF1001	13204
78	1.0K	62.5mW/50V	1 %	ROHM	MCR01MZSF1001	13321
79	1.0K	62.5mW/50V	1 %	ROHM	MCR01MZSF1001	13326
80	1.513	100mW/50V	1%	Phycomp	2322 704 61508	13205
81	1.513	100mW/50V	1%	Phycomp	2322 704 61508	13208
82	0.4713	100mW/150V	5 %	KOA Speer Electronics Inc.	SR73K2ATDJ OE47	13206
83	100K	62.5mW/25V	5%	YAGEO	RC02104JR	13211
84	10M	100mW/50V	5%	YAGEO	RC0603JRF0710M	13212
85	10M	100mW/50V	5%	YAGEO	RC0603JRF0710M	13213
86	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13214
87	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13216
88	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13307
89	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13308

Table B-1.

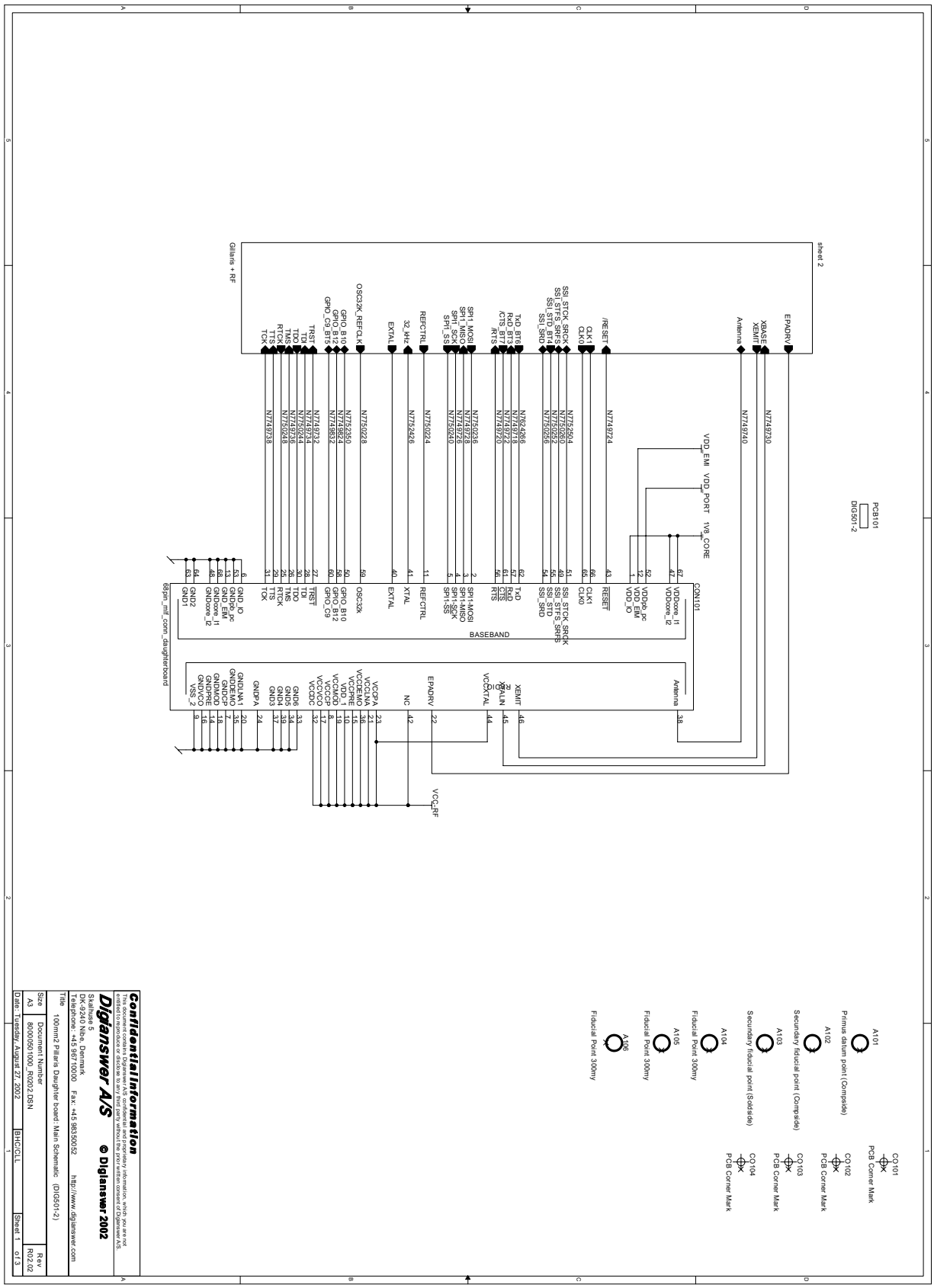
Item	Value	Rating	Tolerance	Manufacturer	Manufacturer's Part Number	Part Reference
90	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13309
91	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13310
92	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13311
93	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13312
94	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13318
95	10K	62.5mW/25V	5%	YAGEO	RC02103JR	13319
96	47013	63mW/50V	5 %	KOA Speer Electronics Inc.	RK73B1 ETP470J	13215
97	47013	63mW/50V	5 %	KOA Speer Electronics Inc.	RK73B1 ETP470J	13303
98	47013	63mW/50V	5 %	KOA Speer Electronics Inc.	RK73B1 ETP470J	13304
99	47013	63mW/50V	5 %	KOA Speer Electronics Inc.	RK73B1 ETP470J	13305
100	47013	63mW/50V	5 %	KOA Speer Electronics Inc.	RK73B1 ETP470J	13306
101	10013	62.5mW/25V	5%	YAGEO	RC02101JR	13313
102	43K	62.5mW/50V	1 %	ROHM	MCR01MZSF4302	13316
103	43K	62.5mW/50V	1 %	ROHM	MCR01MZSF4302	13317
104	270K	62.5mW/50V	1 %	ROHM	MCR01MZSF2703	13320
105	270K	62.5mW/50V	1 %	ROHM	MCR01MZSF2703	13324
106	22013	62.5mW/25V	5%	YAGEO	RC02221JR	13322
107	2.2K	62.5mW/50V	1 %	ROHM	MCR01MZSF2201	13323
108	2.2K	62.5mW/50V	1 %	ROHM	MCR01MZSF2201	13325

Table B-1.

Item	Value	Rating	Tolerance	Manufacturer	Manufacturer's Part Number	Part Reference
109	Switch			ALPS	SSSS210800	S201
110	Switch			ALPS	SSSS210800	S202
111	SPST			Alps Electronic Co., LTD.	SKHUAD	S301
112	SPST			Alps Electronic Co., LTD.	SKHUAD	S302
113	SPST			Alps Electronic Co., LTD.	SKHUAD	S303
114	SPST			Alps Electronic Co., LTD.	SKHUAD	S304
115	BC847BS			Philips	9340 425 20115	TR301
116	BC847BS			Philips	9340 425 20115	TR302
117	32.768KHz			Epson	MC-14632.7680K-A5	X201
118	13.000MHz		10ppm	NDK-NIHON DEMPA KOGYO CO., LTD	IW-168-179	X202

Appendix C
100 mm² Module Diagram

The following pages show the 72000 100 mm² module schematic. This module serves as a demonstration of the space efficiency of the MC72000 Bluetooth solution.


PCB101
DIG501-2
sheet 2
Gillaris + RF
EPADRV
XBASE
XEMIT
Antenna
N7749730
N7749740
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CLK1
CLK0
SSI_STCK_SRCK
SSI_STFS_SRFS
SSI_STD_BT4
SSI_SRD
TXD_BT6
RXD_BT7
/CTS_BT5
/RTS
SPI1_MOSI
SPI1_MISO
SPI1_SCK
SPI1_SS
REFCTRL
32_kHz
EXTAL
OSC32K_REFCLK
GPIO_B10
GPIO_B12
GPIO_C9_BT5
TRST
TDI
TDO
TMS
RTCK
TTS
TCK
N7749724
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N7752502
N7750252
N7750256
N7752426
N7749718
N7749722
N7749720
N7750216
N7750218
N7749728
N7750240
N7750224
N7752426
N7750228
N7752430
N7749824
N7749832
N7749712
N7749734
N7750244
N7749736
N7750248
N7749738
VDD_EMI
VDD_PORT
1V8_CORE
CON101
VDDcore_i1
VDDcore_i2
VDDpb_pc
VDD_EMI
VDD_D
RESET
CLK1
CLK0
SSI_STCK_SRCK
SSI_STFS_SRFS
SSI_STD
SSI_SRD
TXD
RXD
CTS
RTS
SPI1-MOSI
SPI1-MISO
SPI1-SCK
SPI1-SS
REFCTRL
XTAL
EXTAL
OSC32k
GPIO_B10
GPIO_B12
GPIO_C9
TRST
TDI
TDO
TMS
RTCK
TTS
TCK
GND_ID
GNDpb_pc
GND_EMI
GNDcore_i1
GNDcore_i2
GND2
GND1
68pin_mil_comn_daughterboard
BASEBAND
Antenna
XEMIT
BALUN
VCCEXTAL
EPADRV
NC
VCCPA
VCCLNA
VCCLOMOD
VCCPRE
VDD_1
VCCMOD
VCCVCO
VCCDIG
GND5
GND5
GND4
GND3
GNDPA
GNDLNA1
GNDLNA2
GNDCP
GNDMOD
GNDPRE
GNDVCO
VSS_2
VCC_RF
A101
Primus datum point (Solderside)
A102
Secundary fiducial point (Componside)
A103
Secundary fiducial point (Solderside)
A104
Fiducial Point 300my
A105
Fiducial Point 300my
A106
Fiducial Point 300my
CO101
PCB Corner Mark
CO102
PCB Corner Mark
CO103
PCB Corner Mark
CO104
PCB Corner Mark
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Telephone: +45 9671 0000 Fax: +45 9830 5052 http://www.digianswer.com
Title 100mm2 Pillars Daughter board: Main Schematic (DIG501-2)
Size A3
Document Number 80000560 1000_R0202.DSN
Rev R02.02
Date: Tuesday, August 27, 2002
Sheet 1 of 3