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MGC3030
Woodstar Development Kit
User's Guide

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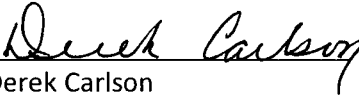
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Derek Carlson
VP Development Tools

16-July-2013
Date

MGC3030 Woodstar Development Kit User's Guide

NOTES:



MGC3030 WOODSTAR DEVELOPMENT KIT USER'S GUIDE

Table of Contents

| | |
|---------------------------------------------------------------------|----------|
| Preface | 7 |
| Introduction..... | 7 |
| Document Layout | 7 |
| Conventions Used in this Guide | 8 |
| Warranty Registration..... | 9 |
| Recommended Reading..... | 9 |
| The Microchip Web Site | 10 |
| Development Systems Customer Change Notification Service | 10 |
| Customer Support | 11 |
| Revision History | 11 |
| Chapter 1. Overview | |
| 1.1 Introduction | 13 |
| 1.2 Woodstar Concept and Deliverables | 13 |
| 1.3 Woodstar Development Kit Package Content | 14 |
| 1.4 GestIC [®] Hardware References | 15 |
| 1.5 Aurea Software Package | 16 |
| 1.6 MGC3030/3130 Software Development Kit (SDK) | 16 |
| Chapter 2. Getting Started | |
| 2.1 Prerequisites | 17 |
| 2.2 Step 1: Development Kit Assembly | 17 |
| 2.3 Step 2: Connecting the Woodstar Development Kit to the PC | 18 |
| 2.4 Step 3: Installing Windows [®] CDC Driver | 18 |
| 2.5 Step 4: Starting Aurea GUI | 18 |
| Chapter 3. Woodstar Boards – Hardware Description | |
| 3.1 Overview | 21 |
| 3.1.1 I ² C [™] to USB Bridge | 21 |
| 3.1.2 MGC3030 Unit | 21 |
| 3.1.3 95x60 mm Reference Electrode PCB | 21 |
| 3.2 The MGC3030 Unit | 22 |
| 3.3 95x60 mm Reference Electrode | 23 |
| 3.4 I ² C [™] to USB Bridge | 25 |
| Chapter 4. System Integration Using Woodstar | |
| 4.1 Introduction | 27 |
| 4.2 Integration Examples | 27 |

MGC3030 Woodstar Development Kit User's Guide

Chapter 5. Troubleshooting

| | |
|-----------------------------------------------------------------|----|
| 5.1 Power LED Does Not Illuminate | 31 |
| 5.2 LED 1 Blinks Fast | 31 |
| 5.3 Signal Streaming Stops | 31 |
| 5.4 Electrode Signals are Zero | 31 |
| 5.5 LED 1 and 2 on I ² C to USB Bridge are OFF | 32 |

Appendix A. Schematics

| | |
|---------------------------------------|----|
| A.1 Introduction | 33 |
| A.2 Bill of Materials | 33 |
| A.3 Board Schematics and Layout | 35 |

Appendix B. Sensitivity Profile and Capacitances

| | |
|--------------------------------|----|
| B.1 Introduction | 39 |
| B.2 Sensitivity Profiles | 39 |
| B.3 Electrode Capacities | 40 |

Appendix C. Driver Installation Manual

| | |
|--------------------------------|----|
| C.1 Open Device Manager | 41 |
| C.2 Select Device | 41 |
| C.3 Locate Driver | 42 |
| C.4 Verify Communication | 42 |

Appendix D. Glossary

| | |
|-----------------------------------|----|
| Worldwide Sales and Service | 45 |
|-----------------------------------|----|



MGC3030 WOODSTAR DEVELOPMENT KIT USER'S GUIDE

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXA", where "XXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MGC3030 Woodstar Development Kit. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Revision History

DOCUMENT LAYOUT

This document describes the installation and use of the MGC3030 Woodstar Development Kit. The document is organized as follows:

- **Chapter 1. "Overview"**
- **Chapter 2. "Getting Started"**
- **Chapter 3. "Woodstar Boards – Hardware Description"**
- **Chapter 4. "System Integration Using Woodstar"**
- **Chapter 5. "Troubleshooting"**
- **Appendix A. "Schematics"**
- **Appendix B. "Sensitivity Profile and Capacitances"**
- **Appendix C. "Driver Installation Manual"**
- **Appendix D. "Glossary"**

MGC3030 Woodstar Development Kit User's Guide

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

| Description | Represents | Examples |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Arial font: | | |
| Italic characters | Referenced books | <i>MPLAB[®] IDE User's Guide</i> |
| | Emphasized text | ...is the <i>only</i> compiler... |
| Initial caps | A window | the Output window |
| | A dialog | the Settings dialog |
| | A menu selection | select Enable Programmer |
| Quotes | A field name in a window or dialog | "Save project before build" |
| Underlined, italic text with right angle bracket | A menu path | <u><i>File>Save</i></u> |
| Bold characters | A dialog button | Click OK |
| | A tab | Click the Power tab |
| N'Rnnnn | A number in verilog format, where N is the total number of digits, R is the radix and n is a digit. | 4'b0010, 2'hF1 |
| Text in angle brackets < > | A key on the keyboard | Press <Enter>, <F1> |
| Courier New font: | | |
| Plain Courier New | Sample source code | #define START |
| | Filenames | autoexec.bat |
| | File paths | c:\mcc18\h |
| | Keywords | _asm, _endasm, static |
| | Command-line options | -Opa+, -Opa- |
| | Bit values | 0, 1 |
| | Constants | 0xFF, 'A' |
| Italic Courier New | A variable argument | <i>file.o</i> , where <i>file</i> can be any valid filename |
| Square brackets [] | Optional arguments | mcc18 [options] <i>file</i> [options] |
| Curly brackets and pipe character: { } | Choice of mutually exclusive arguments; an OR selection | errorlevel {0 1} |
| Ellipses... | Replaces repeated text | var_name [, var_name...] |
| | Represents code supplied by user | void main (void) { ... } |

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use the MGC3030 Woodstar Development Kit. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- “*GestIC[®] Design Guide*” (DS40001716). This document describes the MGC3030/MGC3130 system characteristic parameters and the design process. It enables the user to generate a good electrode design and to parameterize the full GestIC[®] system.
- “*MGC3030/3130 GestIC[®] Library Interface Description User's Guide*” (DS40001718). This document is the interface description of the MGC3030/MGC3130 GestIC Library. It outlines the function of the Library's message interface, and contains the complete message reference to control and operate the MGC3030/MGC3130 system.
- “*MGC3030/3130 3D Gesture Controller Data Sheet*” (DS40001667). Consult this document for information regarding the MGC3030/MGC3130 3D Tracking and Gesture Controller.
- “*Aurea Graphical User Interface User's Guide*” (DS40001681). This document describes how to use the Aurea Graphical User Interface.

MGC3030 Woodstar Development Kit User's Guide

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB[®] C compilers; all MPLAB assemblers (including MPASM[™] assembler); all MPLAB linkers (including MPLINK[™] object linker); and all MPLAB librarians (including MPLIB[™] object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB REAL ICE[™] and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICKit[™] 3 debug express.
- **MPLAB[®] IDE** – The latest information on Microchip MPLAB IDE, the Windows[®] Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART[®] Plus and PICKit 2 and 3.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at:

<http://www.microchip.com/support>.

REVISION HISTORY

Revision A (November, 2014)

Initial release of the document.

Revision B (January, 2015)

Updated the Recommended Reading section; Other minor corrections.

MGC3030 Woodstar Development Kit User's Guide

NOTES:



MGC3030 WOODSTAR DEVELOPMENT KIT USER'S GUIDE

Chapter 1. Overview

1.1 INTRODUCTION

MGC3030 is a product based on Microchip's patented GestIC[®] technology. It is developed as a mixed-signal controller. MGC3030 has one transmit and five very sensitive receive channels that are capable of detecting changes of a transmitted electrical field (E-field) corresponding to capacitive changes in the femtofarad (1 fF = 10⁻¹⁵F) range.

In order to transmit and receive an electrical field, electrodes have to be connected to the transmitting and receiving channels of the MGC3030 controller. The spatial arrangement of the electrodes allows the chip to determine the center of gravity of the electric field distortion, and thus gesture recognition of a user's hand in the detection space.

1.2 WOODSTAR CONCEPT AND DELIVERABLES

The Woodstar Development Kit is designed to support an easy integration of Microchip's MGC3030 3D Gesture Controller into the customer's applications. It provides MGC3030 system setup, related hardware and software references:

- Aurea Software Package with the Aurea Graphical User Interface and GestIC Library
- MGC3030/3130 Software Development Kit (SDK)
- MGC3030/3130 PIC18 Host Reference code

With the help of these tools, the design-in process can be easily performed in five steps:

1. Feature Definition
2. Electrode Design
3. MGC3030 Parameterization
4. Host Application Programming
5. Verification

Tutorial videos for the design-in process can be found on www.microchip.com/video/mid/tutorials.

Woodstar hardware builds a complete MGC3030 reference system consisting of three individual PCBs:

- MGC3030 Unit
- I²C™ to USB Bridge
- Reference Electrode with a 95x60 mm sensitive area

MGC3030 Woodstar Development Kit User's Guide

It can be plugged to a PC via a USB cable and used for evaluation of the MGC3030 chip and the GestIC technology. During the customer's design-in process the individual boards can be combined according to the customer's needs.

Three examples are given below:

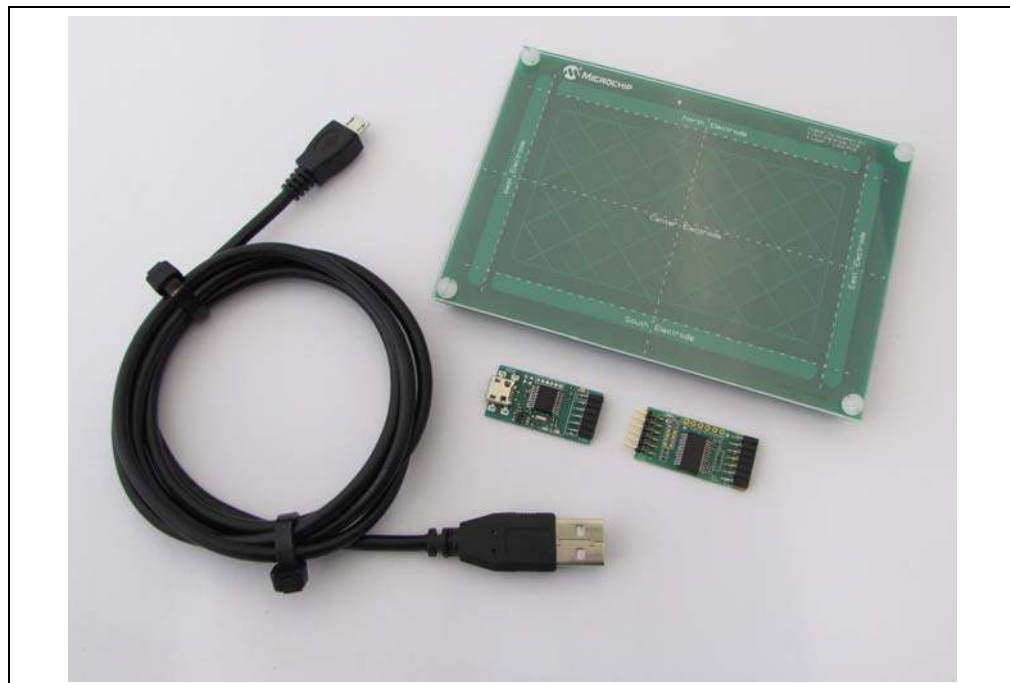
- Combine the MGC3030 unit and the I²C to USB bridge to evaluate customized electrodes
- Use the I²C to USB bridge to parameterize and debug the MGC3030 application circuitry in the customer's design
- Combine the MGC3030 unit and electrodes to develop gesture-driven applications for PC-based or embedded software environments

1.3 WOODSTAR DEVELOPMENT KIT PACKAGE CONTENT

The Woodstar Development Kit package content is listed below:

- MGC3030 Module
- I²C to USB Bridge Module
- Reference Electrode (95x60 mm sensitive area)
- USB Cable for PC Connection

FIGURE 1-1: WOODSTAR DEVELOPMENT KIT



1.4 GestIC[®] HARDWARE REFERENCES

The GestIC Hardware References package contains the PCB layouts (Gerber files) for the MGC3030/3130 development kits (Hillstar and Woodstar) and a collection of electrode reference designs fitting both kits. In addition, the package includes designs, parameter files and host code of various demonstrators which represent complete systems for embedded or PC-based applications.

New designs will be added to the package once they are available. The GestIC Hardware Reference package can be downloaded from Microchip's web site via www.microchip.com/gesticresources.

TABLE 1-1: PACKAGE CONTENT (BASED ON V1.0.6)

| Module Name | Sensitive Area (mm) | Outline (mm) | PCB Layers | Fit to Hillstar | Fit to Woodstar | Parameter File | Host Code |
|---------------------------------------------|---------------------|--------------|------------|-----------------|-----------------|----------------|-----------|
| MGC3130 Unit | — | — | 2 | √ | — | — | — |
| MGC3030 Unit | — | — | 2 | — | √ | — | — |
| I ² C™ to USB Bridge | — | — | 2 | √ | √ | — | (Note 1) |
| Reference Electrode 30x30 2-Layer | 30x30 | 49x49 | 2 | √ | √ | — | — |
| Reference Electrode 30x30 4-Layer | 30x30 | 49x49 | 4 | √ | √ | √ | — |
| Reference Electrode 50x30 2-Layer | 50x30 | 63x47 | 2 | √ | √ | — | — |
| Reference Electrode 80x80 2-Layer | 80x80 | 104x104 | 2 | √ | √ | — | — |
| Reference Electrode 95x60 2-Layer | 95x60 | 120x85 | 2 | √ | √ | — | — |
| Reference Electrode 95x60 4-Layer | 95x60 | 120x85 | 4 | √ | √ | √ | — |
| Reference Electrode 100x50 2-Layer | 100x50 | 128x72 | 2 | √ | √ | — | — |
| Reference Electrode 100x50 4-Layer | 100x50 | 128x72 | 4 | √ | √ | √ | — |
| Reference Electrode 140x90 2-Layer | 140x90 | 168x119 | 2 | √ | √ | — | — |
| Reference Electrode Ring 95x60 | 95x60 | 120x85 | 2 | √ | √ | √ | — |
| Reference Electrode Ring 128x90 | 112x76 | 128x90 | 2 | √ | √ | √ | — |
| GestIC [®] Electrode Prototype Kit | 85x85 | 100x110 | N/A | — | — | — | — |
| MGC3130 Sensor Module 30x30 | 30x30 | 49x49 | 4 | — | — | √ | — |
| MGC3130 Sensor Module 95x60 | 95x60 | 120x85 | 4 | — | — | √ | — |
| MGC3130 Embedded Demo | 42x75 | 60x150 | 2 | — | — | √ | √ |
| MGC3130 Gesture Port Demo | D = 50 | 63.5x63.5 | 4 | — | — | √ | — |

Note 1: Reference code for the PIC18F14K50 on the I²C to USB bridge can be found in the PIC18F14K50 Reference Code package on the Microchip web page.

MGC3030 Woodstar Development Kit User's Guide

1.5 AUREA SOFTWARE PACKAGE

The Aurea Software Package contains all relevant system software and documentation. The Woodstar Development Kit is supported by Aurea Software Package V1.2 onwards.

The package contains:

- Aurea PC Software
- GestIC Library (firmware) Binary File
- GestIC Parameterization Files
- Windows® CDC Driver
- Documentation

The latest Aurea Software Package can be downloaded from Microchip's web site via www.microchip.com/gesticresources.

Please find a collection of GestIC/Aurea tutorial videos at www.microchip.com/video/mid/tutorials.

1.6 MGC3030/3130 SOFTWARE DEVELOPMENT KIT (SDK)

The MGC3030/3130 Software Development Kit (SDK) supports the integration of MGC3030 into a software environment. Thus, it includes a C reference code for GestIC API, a precompiled library for Windows operating systems, and a demo application using the GestIC API interface.

Woodstar Development Kit is supported by MGC3030/3130 SDK V1.1 onwards.

The latest SDK can be downloaded from Microchip's web site via www.microchip.com/gesticresources.

Chapter 2. Getting Started

The Woodstar Development Kit can be used as a stand-alone GestIC system and evaluated in conjunction with the Aurea PC software. This section describes how to get started.

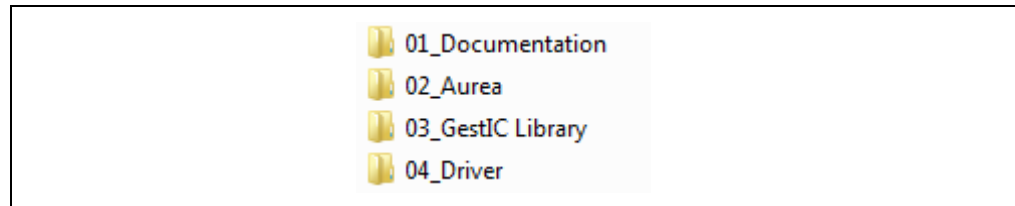
2.1 PREREQUISITES

The following prerequisites have to be fulfilled:

- PC with Windows 7 or Windows 8 operating systems, USB port and minimum screen resolution of 1024x768
- Woodstar Development Kit (MGC3030 unit, I²C to USB bridge, 95x60 mm frame electrode)
- Aurea Software Package V1.2 onwards

The Aurea Software Package is available as .zip file. Unzip the file, run `setup.exe` and install the package to the PC. The folder structure is as shown in [Figure 2-1](#).

FIGURE 2-1: FOLDER STRUCTURE



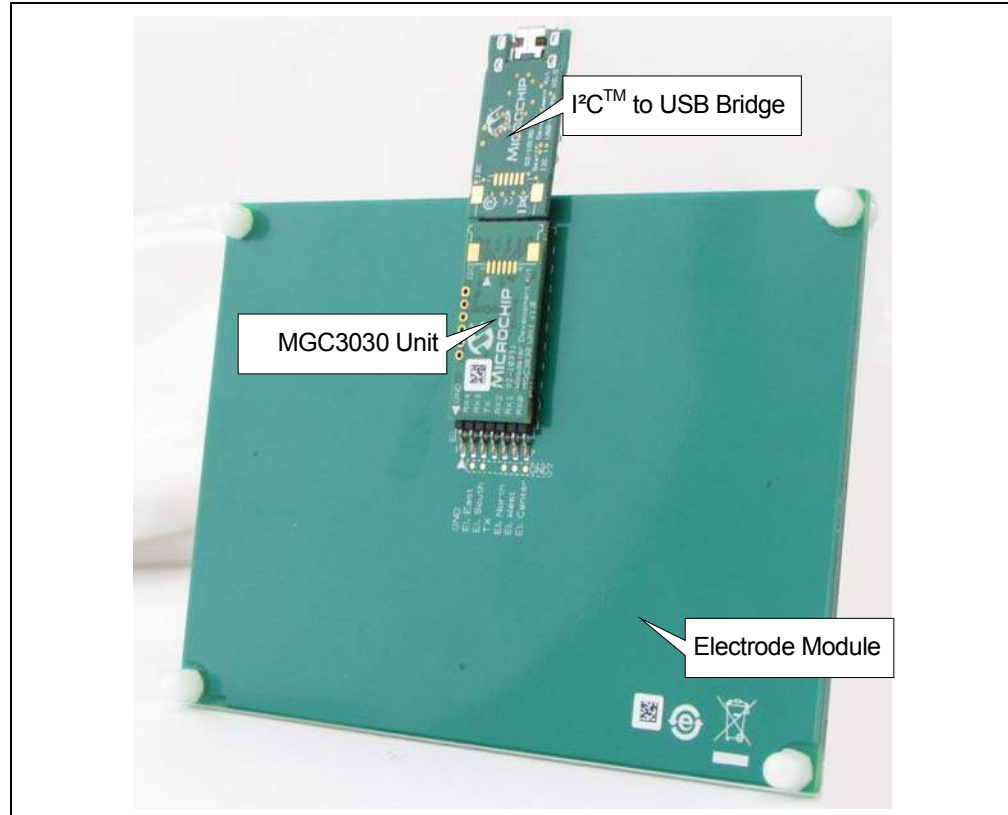
2.2 STEP 1: DEVELOPMENT KIT ASSEMBLY

Connect the electrodes, the MGC3030 unit and the I²C to USB bridge as shown in [Figure 2-2](#).

Note: Make sure the MGC3030 unit and the I²C to USB bridge are already connected before plugging in the USB connection.

MGC3030 Woodstar Development Kit User's Guide

FIGURE 2-2: WOODSTAR DEVELOPMENT KIT ASSEMBLY



2.3 STEP 2: CONNECTING THE WOODSTAR DEVELOPMENT KIT TO THE PC

Use the supplied USB cable to connect the Woodstar Development Kit to your PC. The power LEDs on both the I²C to USB bridge and the MGC3030 unit will illuminate. Furthermore, LED 1 on the I²C to USB bridge will flash very fast (~10 Hz). If LED 1 is flashing slow (~1 Hz), the Windows CDC driver is already installed on your PC. Please skip the next step and go to [Section 2.5 “Step 4: Starting Aurea GUI”](#).

2.4 STEP 3: INSTALLING WINDOWS® CDC DRIVER

The Windows CDC driver can be found in the Aurea Software Package in folder 04_Driver.

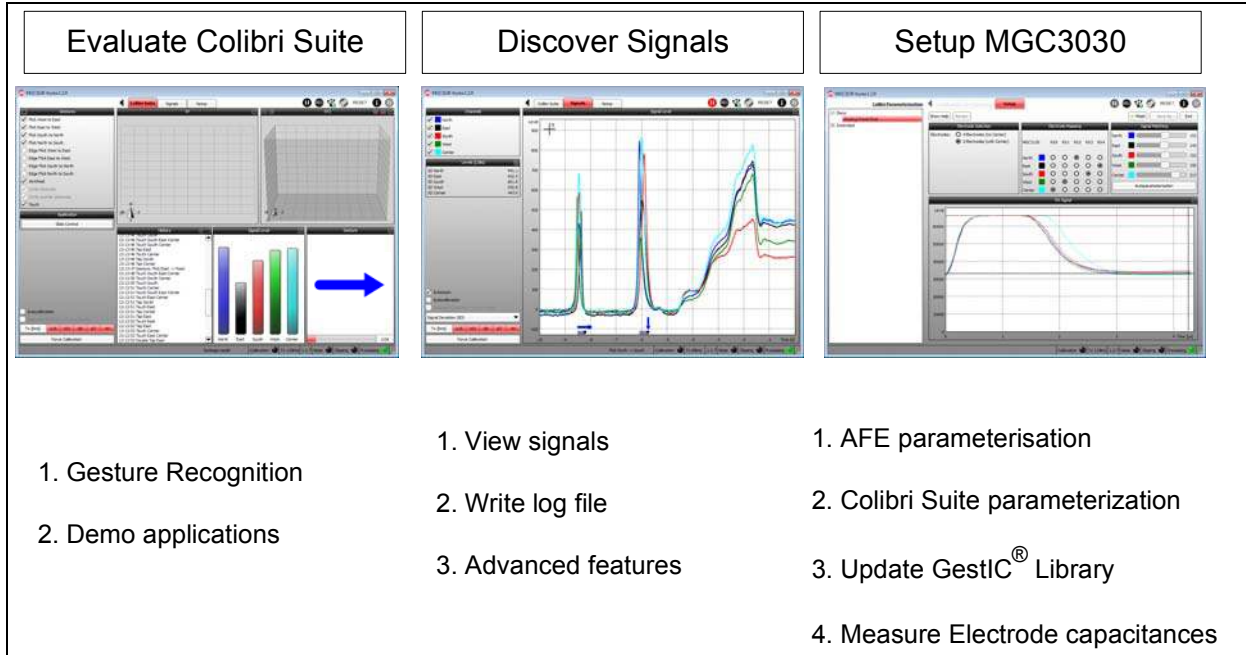
When the Woodstar Development Kit is connected to the PC for the first time, Windows requests the appropriate device driver and guides the user through the installation process. Alternatively, the driver can be installed manually, for example, by using the device manager. An example for Windows 7 is given in [Appendix C. “Driver Installation Manual”](#).

2.5 STEP 4: STARTING AUREA GUI

Aurea Graphical User Interface, shown in [Figure 2-3](#), is included in the Aurea Software Package in folder 02_Aurea.

Open `Aurea.exe`. Aurea automatically detects the connected device and is ready for use.

FIGURE 2-3: AUREA GRAPHICAL USER INTERFACE



MGC3030 Woodstar Development Kit User's Guide

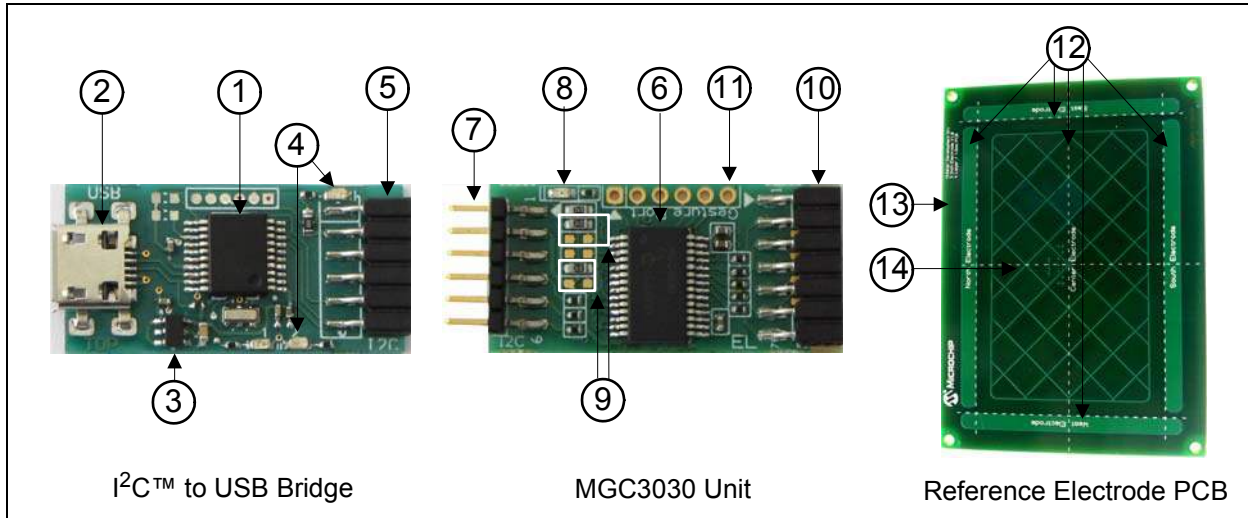
NOTES:

Chapter 3. Woodstar Boards – Hardware Description

3.1 OVERVIEW

The Woodstar key components are listed below and highlighted in [Figure 3-1](#).

FIGURE 3-1: WOODSTAR DEVELOPMENT KIT OVERVIEW



3.1.1 I²C™ to USB Bridge

1. PIC18F14K50 USB microcontroller
2. USB micro-B connector
3. MCP1801T LDO voltage regulator (converts 5V USB to 3.3V board supply)
4. Status LEDs (power, communication status)
5. Data interface: 6-pin socket for data communication and power supply

3.1.2 MGC3030 Unit

6. MGC3030 3D Gesture Controller
7. Data interface: 6-pin header for data communication and power supply
8. Status LED (power)
9. Interface select
10. Electrode interface: 7-pin socket
11. Gesture Port Header

3.1.3 95x60 mm Reference Electrode PCB

12. Receive electrodes
13. Acrylic cover glass (120 x 85 x 2 mm)
14. Electrode interface: 7-pin header (mounted on backside)

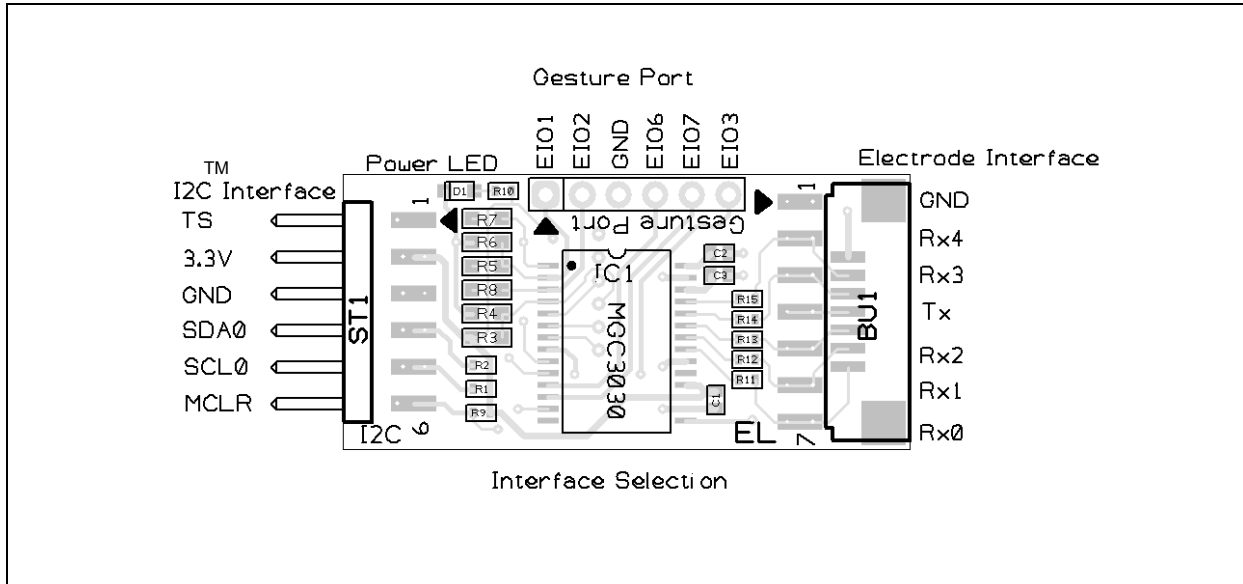
The Gerber data of all Woodstar Development Kit components are included in the GestIC Reference Design package and can be downloaded from Microchip's web site via www.microchip.com/gesticresources.

MGC3030 Woodstar Development Kit User's Guide

3.2 THE MGC3030 UNIT

The key element of the MGC3030 unit is Microchip's MGC3030 3D Gesture Controller. The layout print of the unit is shown in [Figure 3-2](#).

FIGURE 3-2: THE MGC3030 UNIT



The unit provides a 2 mm 7-pin board-to-board connector (socket) to connect the electrode. The interface includes the following signals: GND, Rx4, Rx3, Tx, Rx2, Rx1, and Rx0. Alternatively, the board-to-board connector can be replaced by a 1 mm Flexible Printed Circuitry (FPC) connector which is prepared as a design option. The five Rx channels of the MGC3030 (Rx0...Rx4) are connected to the receive electrodes via 10 kΩ resistors in order to suppress irradiated high-frequency signals (R11, R12, R13, R14, and R15). The MGC3030 signal generator is connected via the Tx signal to the transmit electrode. The access to the MGC3030 Gesture Port pins is provided by six pads at the side of the board (EIO1, EIO2, EIO6, EIO7, EIO3, and GND).

The data connection to the Woodstar I²C to USB bridge is done by a 2 mm 6-pin board-to-board connector (header). The interface includes the following signals: EIO0, 3.3V, GND, SDA0, SCL0, and MCLR. Alternatively, it is possible to use a 1 mm FPC connector which can be assembled to the bottom side.

The MGC3030 unit acts as an I²C slave device. Table 3-1 shows the configuration of the MGC3030 interface selection pins (IS1, IS2), which can be pulled to V_{DD} or to GND via resistors (R3, R4, R5, and R6) to select the I²C slave address. The I²C device address 0x42 is set as default.

TABLE 3-1: MGC3030 UNIT I²C™ INTERFACE SELECTION

| MGC3030 Interface Selection Pins | | Mode (Address) | Assembly Option | | | |
|----------------------------------|-----|--------------------------------------------------|-----------------|-------|------|-------|
| IS2 | IS1 | | R3 | R4 | R5 | R6 |
| 0 | 0 | I ² C™ Slave Address = 0x42 (default) | n.p. | 10 kΩ | n.p. | 10 kΩ |
| 1 | 0 | I ² C™ Slave Address = 0x43 | 10 kΩ | n.p. | n.p. | 10 kΩ |

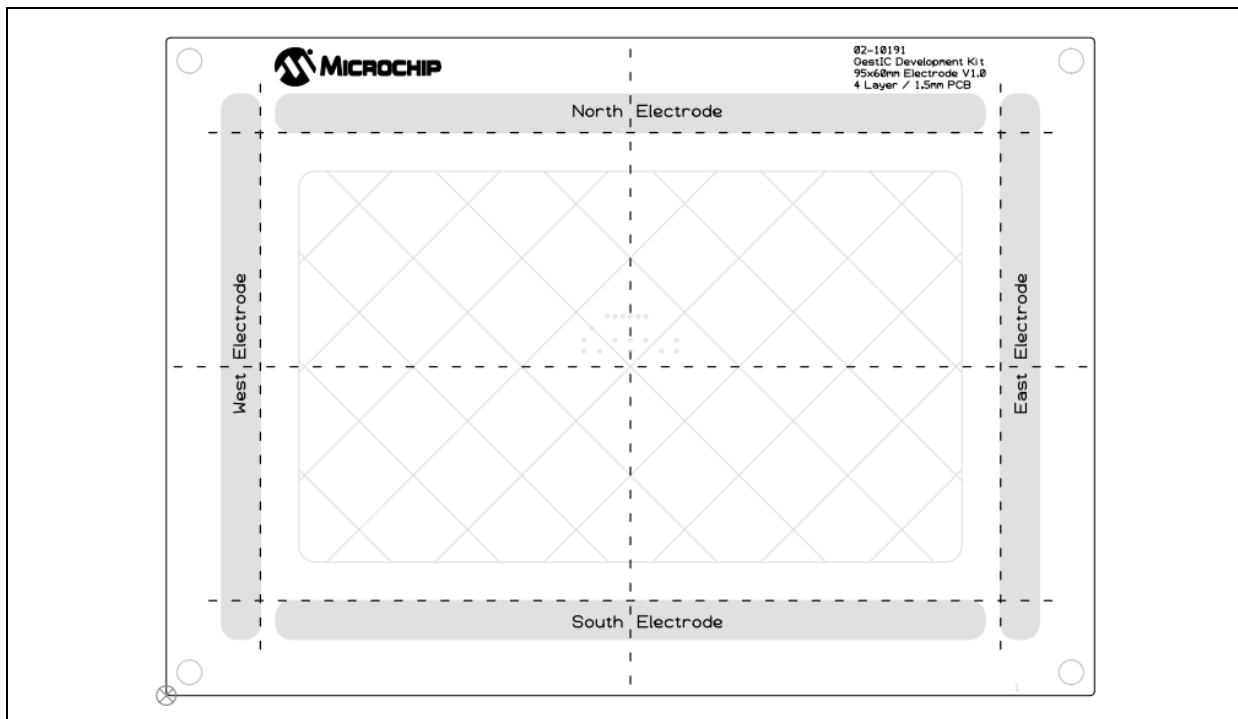
For schematics, layout and bill of material of the MGC3030 unit, please refer to [Appendix A. "Schematics"](#).

Woodstar Boards – Hardware Description

3.3 95x60 mm REFERENCE ELECTRODE

The 95x60 mm reference electrode provided with the Woodstar Development Kit consists of one Tx and a set of five Rx electrodes (north, east, south, west, center), which are placed in two different layers. An additional ground layer is placed underneath the Tx electrode to shield the electrode's back from external influences.

FIGURE 3-3: ELECTRODE LAYOUT



The PCB is connected to the MGC3030 unit by the 2 mm 7-pin board-to-board connector. The interface includes the following signals: GND, Rx4, Rx3, Tx, Rx2, Rx1, and Rx0.

The dimension of the board is 120 x 85 mm; the sensitive area is 95 x 60 mm.

The five Rx electrodes include four frame electrodes and one center electrode, as shown in [Figure 3-3](#). The frame electrodes are named according to their cardinal directions: North, East, South and West. The dimensions of the four Rx frame electrodes define the maximum sensing area. The center electrode is structured (cross-hatched) to get a similar input signal level as the four frame electrodes.

The Tx electrode spans over the complete area underneath the Rx electrodes. It is cross-hatched to reduce the capacitance between Rx and Tx (C_{RxTx}). The Tx area underneath the center electrode covers 50% of the copper plane, the area around the center electrode covers only 20%.

The Rx feeding lines are embedded into the Tx electrode in the third layer (refer to [Figure 3-4](#) and [Figure 3-5](#)). This supports shielding of the feeding lines. Dimensions are given in [Table 3-2](#).

MGC3030 Woodstar Development Kit User's Guide

FIGURE 3-4: ELECTRODE LAYOUT

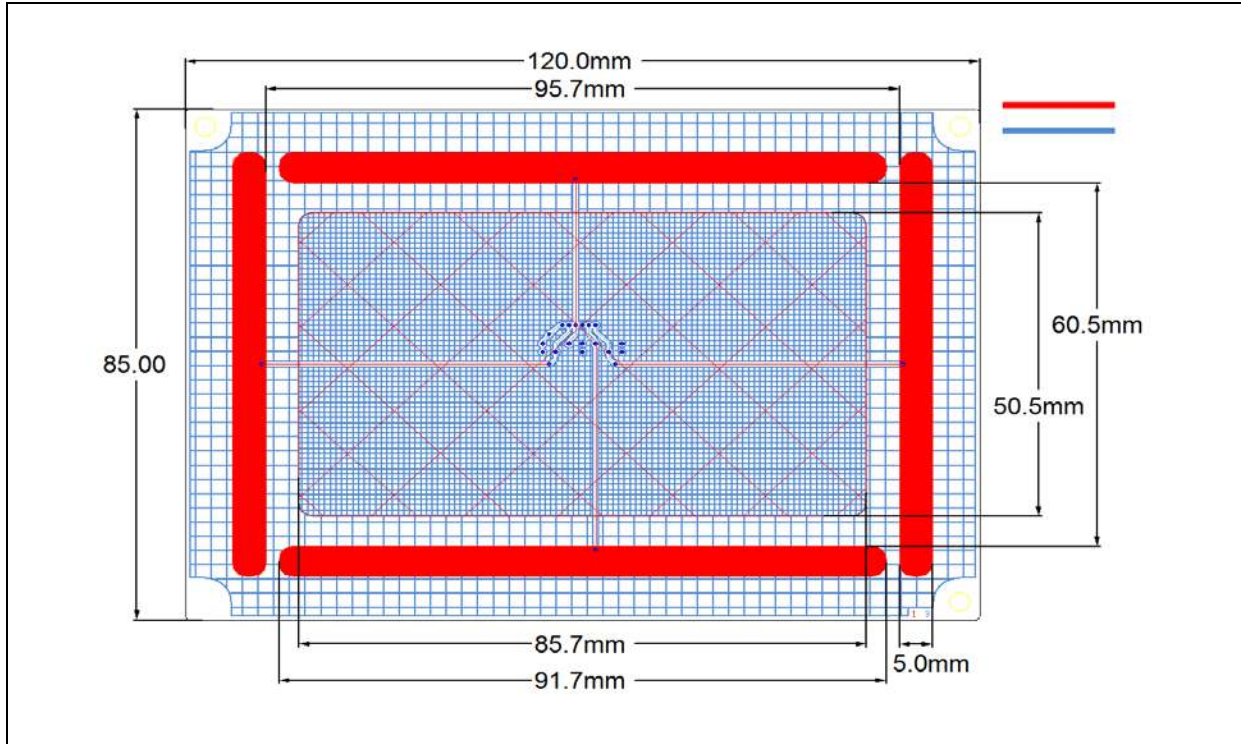


TABLE 3-2: WOODSTAR ELECTRODE DIMENSIONS

| Part | Length | Width | Design |
|------------------------------------|---------|---------|-------------------|
| Horizontal Electrodes (Rx) | 91.7 mm | 5 mm | Solid |
| Vertical Electrodes (Rx) | 70.5 mm | 5 mm | Solid |
| Center Electrode (Rx) | 85.7 mm | 50.5 mm | 3% cross-hatched |
| Tx Electrode (refer to Figure 3-4) | 120 mm | 85 mm | |
| Part I (under center electrode) | 85.7 mm | 50.5 mm | 50% cross-hatched |
| Part II (outside Part I) | 120 mm | 85 mm | 20% cross-hatched |
| Ground Area | 120 mm | 85 mm | Solid |

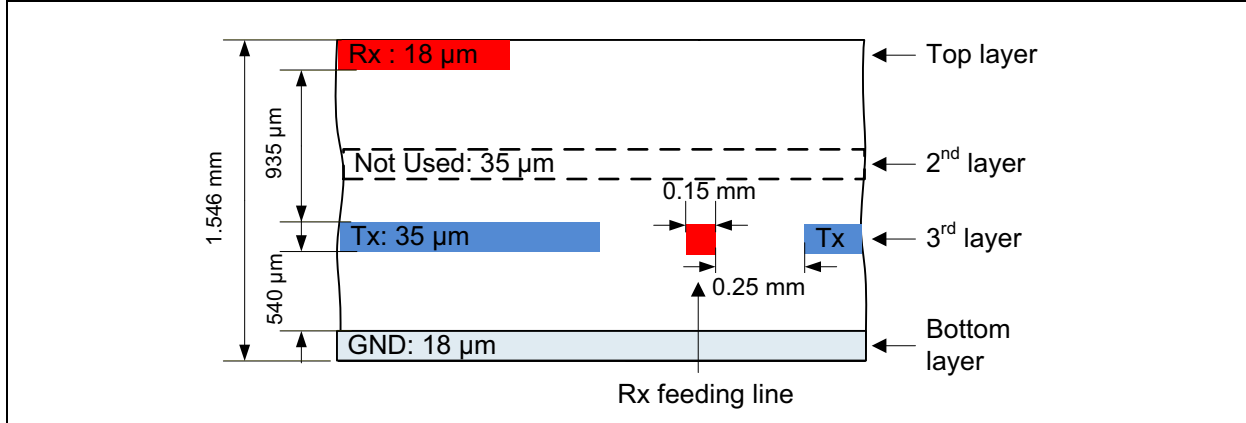
The electrode PCB is based on a 4-layer PCB design using FR4 material. Three functional layers are used:

- Layer 1 (Top): Rx electrodes
- Layer 3: Tx electrode and Rx feeding lines
- Layer 4 (Bottom): Ground

Layer 2 is not used.

Woodstar Boards – Hardware Description

FIGURE 3-5: PCB LAYER STACK



In a target system design the GND layer is not required. It is added for the Woodstar sensing electrode as a shielding layer and shall simulate the presence of static components which are placed in a target device underneath the sensing electrodes.

Note: Please refer to the “*GestIC[®] Design Guide*” for the electrodes equivalent circuitry, capacitances (C_{RxTx} , C_{RxG} , T_{xRxG}) and their typical values.

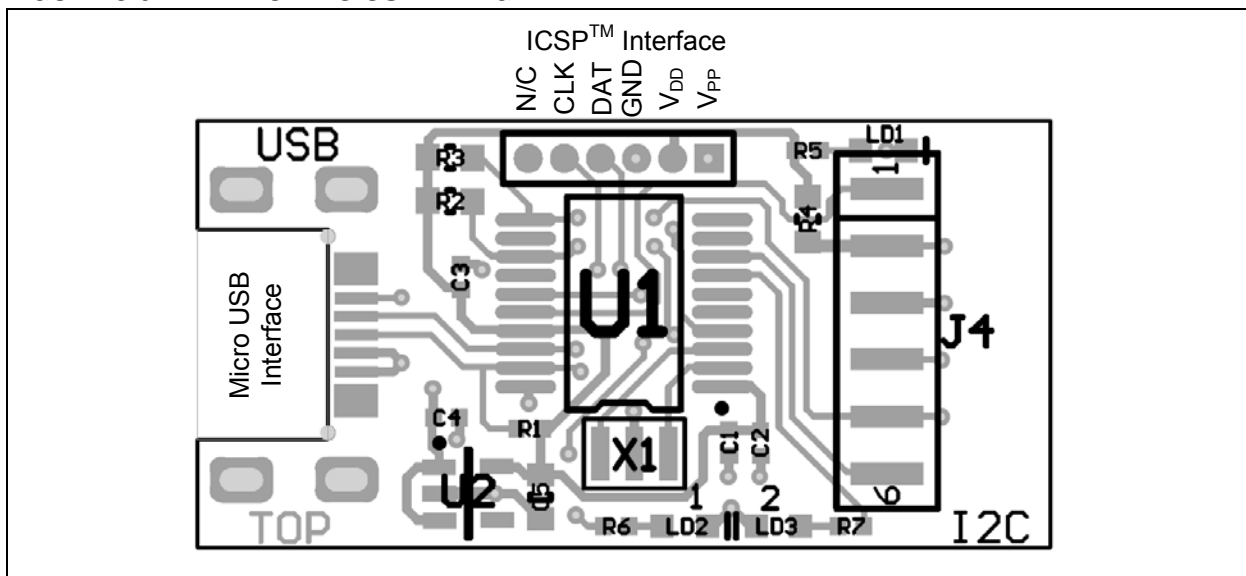
3.4 I²C TO USB BRIDGE

Connecting the MGC3030 unit to a PC requires an I²C to USB bridge. The GestIC bridge works as a composite device class (CDC). It controls the USB transfer towards the host PC and handles the I²C communication with the MGC3030 unit. Moreover, it provides 3.3V power supply and the MCLR signal to the MGC3030 unit.

The bridge function is handled by Microchip’s PIC18F14K50 USB microcontroller.

The board is equipped with a micro-USB connector (Type B) and a 2 mm 6-pin female board-to-board connector for the I²C interface. The interface to the MGC3030 unit includes the following signals: EIO0, 3.3V, GND, SDA0, SCL0, and MCLR. Please refer to [Figure 3-6](#).

FIGURE 3-6: I²C™ TO USB BRIDGE



MGC3030 Woodstar Development Kit User's Guide

The I²C to USB bridge is powered via the USB port. Microchip's Low Dropout (LDO) Voltage Regulator MCP1801 is used to transform the 5V USB power to 3.3V required for the PIC18F14K50. By default, 3.3V are also routed to the MGC3030 unit via the I²C interface. The 3.3V power supply towards the MGC3030 unit can be cut by removing the 0Ω resistor R7.

The LEDs indicate the following:

- Power – signals that the I²C to USB bridge is powered (3.3V)
- LED1 blinks fast (~10 Hz) – indicates that there is no USB connection established
- LED1 blinks slow (~1 Hz) – indicates that the USB connection is established
- LED 2 is ON when there is data on the I²C bus
- LED 2 is OFF when there is no data on the I²C bus

The communication between bridge and the MGC3030 unit is accomplished via a 2-wire I²C compatible serial port. Please refer to [Figure 3-7](#).

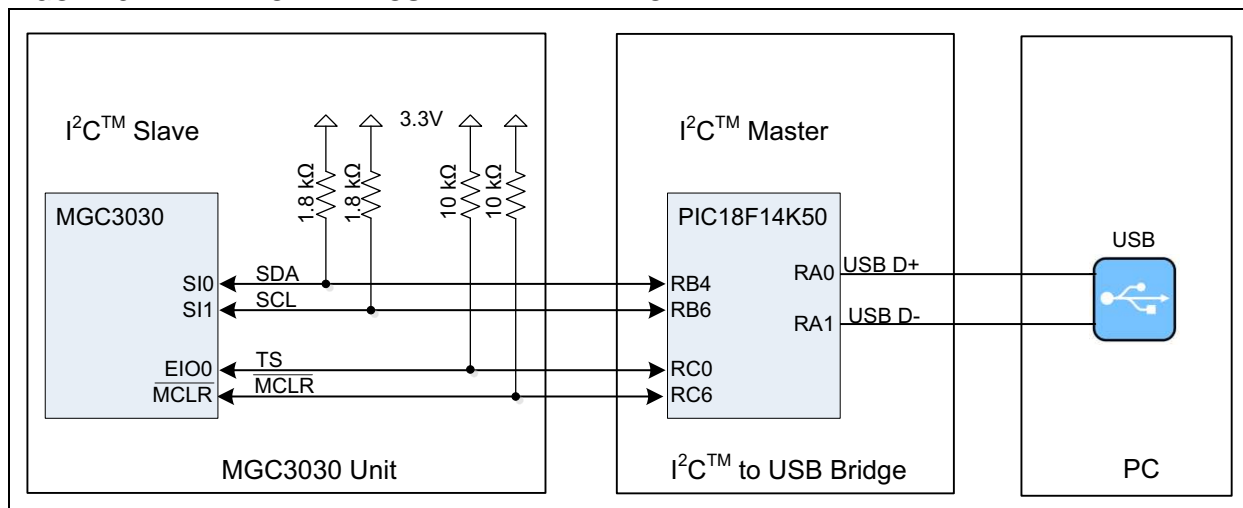
In addition, the Woodstar Development Kit integrates an open-drain transfer status line (TS) and the MGC3030 MCLR signal, according to the MGC3030 reference circuitry. TS is connected to the RC0 pin of the PIC18F14K50 and MCLR to RC6.

For a detailed description of the I²C interface refer to the "MGC3030/3130 3D Gesture Controller Data Sheet" (DS40001667).

The default I²C address of the bridge is set to 0x42 but it can also be switched to 0x43 by changing the firmware running on the PIC18F14K50.

Note: To update the PIC18F14K50 firmware, please refer to the MGC3030/3130 PIC18F14K50 Host Reference Code, available on Microchip's web site via www.microchip.com/gesticresources.

FIGURE 3-7: I²C™ AND USB DATA INTERFACE



For schematics, layout and bill of material of the I²C to USB bridge, please refer to [Appendix A. "Schematics"](#).

Chapter 4. System Integration Using Woodstar

4.1 INTRODUCTION

The Woodstar Development Kit is designed to support an easy integration of Microchip's MGC3030 3D Gesture Controller into the customer's applications.

The three Woodstar PCBs can be plugged to a PC via a USB cable and used for evaluation of the MGC3030 chip and the GestIC technology.

During the customer's design-in process the individual boards can be combined according to the customer's needs.

Three examples are given below:

- Combine MGC3030 unit and I²C to USB bridge to evaluate customized electrodes
- Use I²C to USB bridge to parameterize and debug the MGC3030 application circuitry in the customer's design (in-circuit)
- Combine MGC3030 unit and electrodes to develop gesture-driven applications for PC-based or embedded software environments

For in-circuit parameterization and debugging it is mandatory to control the MGC3030 unit via Aurea Control Software. For that purpose, the customer's application should provide an appropriate hardware or software interface.

4.2 INTEGRATION EXAMPLES

The following figures show typical hardware circuits for the integration of MGC3030 into a customer's application.

[Figure 4-1](#) and [Figure 4-2](#) show the control via I²C and an external PC. The Woodstar I²C to USB bridge acts as an I²C master. The application processor I²C should be:

- Switched OFF – I²C lines configured as high Z (refer to [Figure 4-1](#))
- Switched to Slave or Listen mode
- Disconnected through an external switch (refer to [Figure 4-2](#))

As an alternative, it is also possible to establish a USB connection between the application processor and a PC without using an I²C to USB bridge. Please refer to [Figure 4-3](#).

MGC3030 Woodstar Development Kit User's Guide

FIGURE 4-1: MGC3030 PARAMETERIZATION CIRCUIT WITH INTERNAL SWITCH

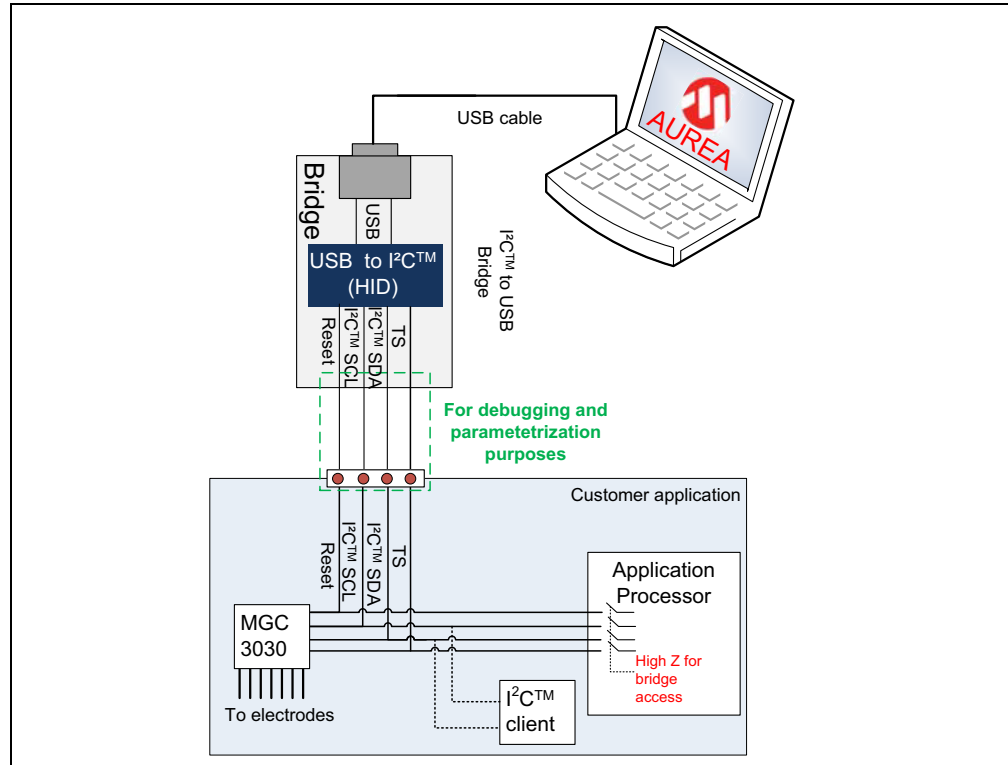
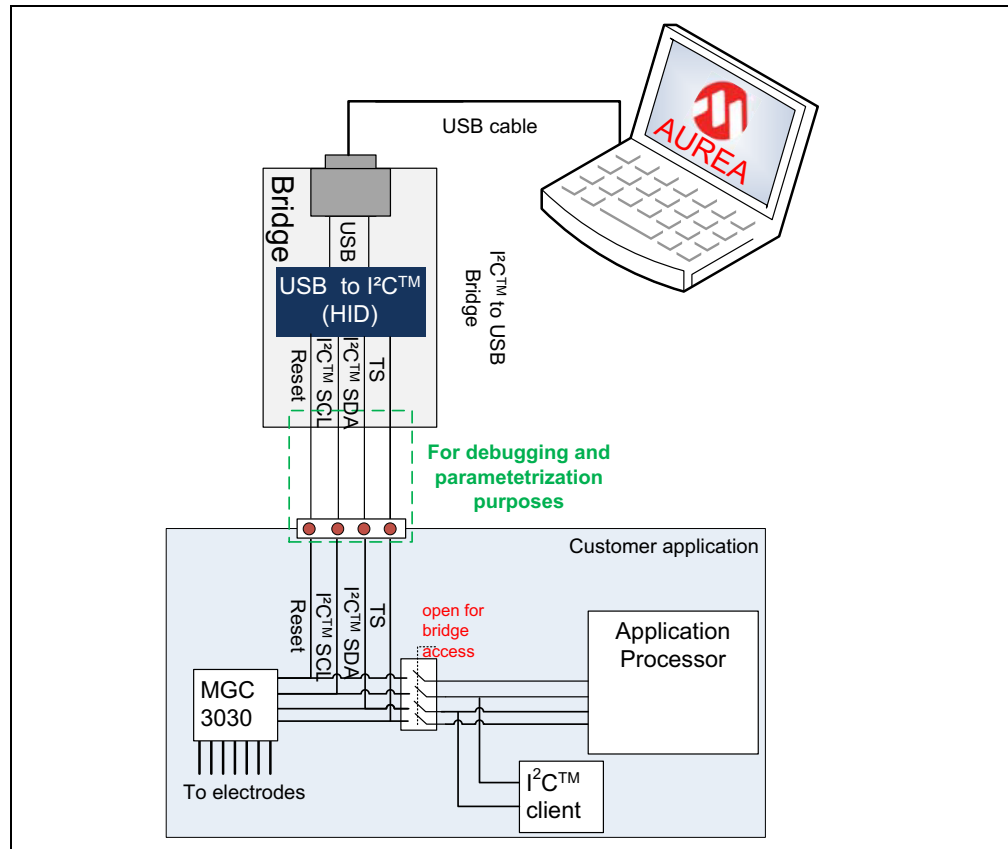


FIGURE 4-2: MGC3030 PARAMETERIZATION CIRCUIT WITH EXTERNAL SWITCH



System Integration Using Woodstar

FIGURE 4-3: MGC3030 PARAMETERIZATION CIRCUIT FOR USB-BASED APPLICATIONS

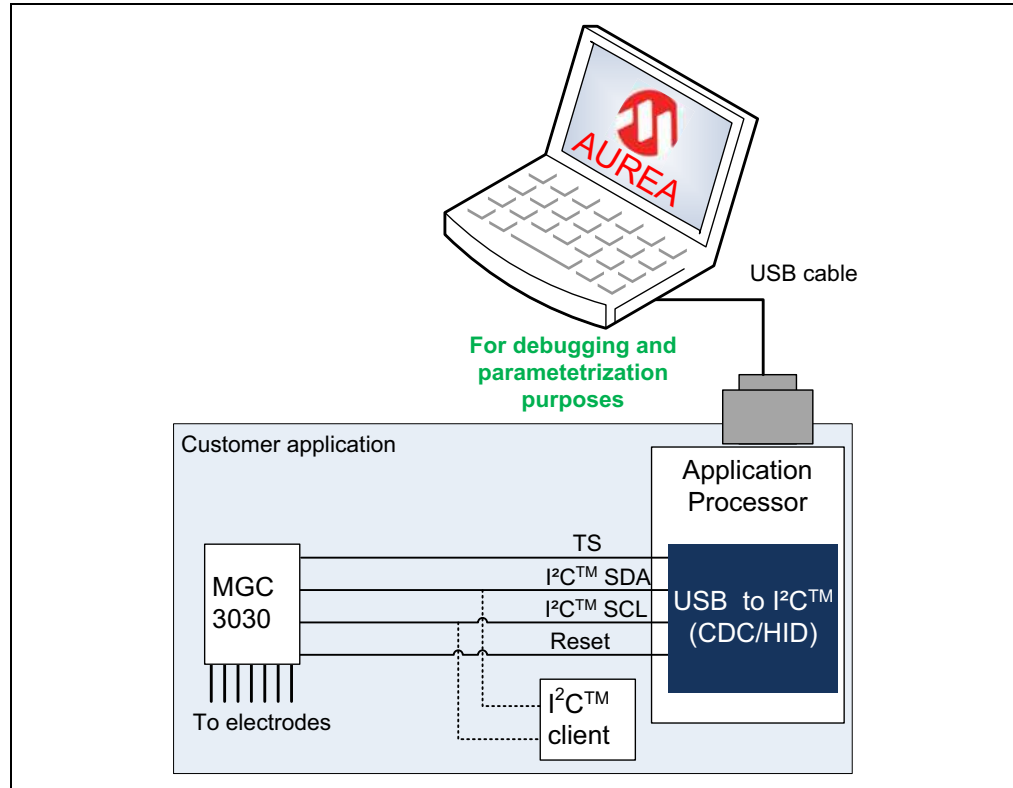


TABLE 4-1: MGC3030 PARAMETERIZATION CIRCUITS COMPARISON

| Parameterization Circuit | Advantages | Drawbacks |
|--------------------------|------------------------------------------------------------------|--------------------------------------------------------|
| With Internal Switch | Easy approach | Processor pins need to be switchable to high Z |
| | Low hardware efforts | No other clients can be controlled during Aurea access |
| With External Switch | Communication to other I ² C™ clients not interrupted | Additional hardware switch |
| USB-Based Applications | No hardware efforts | Additional software efforts |
| | Works if other I ² C™ clients connected to the bus | |

MGC3030 Woodstar Development Kit User's Guide

NOTES:

Chapter 5. Troubleshooting

5.1 POWER LED DOES NOT ILLUMINATE

If the power LED does not illuminate, it is likely that the board is not powered.

Possible solutions:

- Check the board is connected to your PC's USB port.
- Change the USB cable or use a different USB port on your PC.
- Check if the PC is switched on.

5.2 LED 1 BLINKS FAST

When LED 1 blinks fast (~10 Hz), the USB connection is not established towards the PC.

Possible solutions:

- Make sure the Windows CDC driver is installed (refer to [Appendix C. "Driver Installation Manual"](#)).
- Make sure the MGC3030 unit and the I²C to USB bridge are already connected before plugging in the USB connection (refer to [Section 2.2 "Step 1: Development Kit Assembly"](#)).
- Reconnect the board by unplugging the USB connection and plugging it in again.

5.3 SIGNAL STREAMING STOPS

Signal stream in Aurea GUI stops when there is no approach towards the sensing area. This behavior is intended. When using the Aurea GUI, the Wake-up on Approach feature is automatically enabled.

Possible solutions:

Disable the Wake-up on Approach feature in the Real-Time Control bar of Aurea by unchecking the Approach Detection/Power Saving check box for continuous signal streaming.

5.4 ELECTRODE SIGNALS ARE ZERO

Signal matching parameters have been mismatched and accidentally stored into the Flash.

Possible solutions:

- Perform "Autoparameterization" in the AFE Parameterization of the **Aurea Setup** tab. Make sure there is no hand approach towards the electrodes during the autoparamterization process.
- Restore the default Signal Matching parameters by re-flashing the original MGC3030 GestIC Library file.

5.5 LED 1 AND 2 ON I²C TO USB BRIDGE ARE OFF

When LED 1 and LED 2 on the I²C to USB bridge are OFF but the power LED is ON, the PIC18F14K50 is in Bootloader Update mode and therefore not operating code. The PIC18F14K50 will start in Bootloader Update mode in case the MGC3030 unit is not connected to the I²C to USB bridge.

Possible solutions:

- Please disconnect the I²C to USB bridge from the USB. Connect the MGC3030 unit and the I²C to USB bridge first and then plug in the USB connection.

Appendix A. Schematics

A.1 INTRODUCTION

This appendix contains the MGC3030 Woodstar Development Kit schematic and bill of materials.

A.2 BILL OF MATERIALS

TABLE A-1: I²C™ TO USB BRIDGE BILL OF MATERIALS

| Qty. | Description | Name |
|------|-----------------------------------------------------------------|------------|
| 1 | Connector, Micro USB 5-pin Type B, SMD | BU1 |
| 1 | Connector, 2 mm socket 6-pin, SMD | BU2 |
| 1 | Capacitor, 100 nF, 10%, X7R, SMD 0402 | C1 |
| 3 | Capacitor, 1 µF, 10%, X5R, 10 V, SMD 0402 | C2, C3, C5 |
| 1 | Capacitor, 10 µF, 20%, X5R, 6.3 V, SMD 0603 | C4 |
| 3 | LED, 571 nm, green clear, 0603 SMD | D1, D2, D3 |
| 1 | IC, MCP1801T LDO, Voltage Regulator, 3.3V, 150 mA, 5-Pin SOT-23 | IC1 |
| 1 | IC, PIC18F14K50 USB Flash Microcontroller, 20-Pin SSOP | IC2 |
| 3 | Resistor, 1 kΩ, 1%, 1/16W, SMD 0402 | R3, R4, R6 |
| 1 | Resistor, 150 kΩ, 1%, 1/16W, SMD 0402 | R5 |
| 1 | Resistor, 0 kΩ, 1%, 1/16W, SMD 0603 | R7 |
| 1 | Crystal, 12 MHz, 33 pF, SMD | XTAL1 |

TABLE A-2: I²C™ TO USB BRIDGE MOUNTING OPTION

| Qty. | Description | Name |
|------|--------------------------------|------|
| 1 | Connector, 1 mm FPC 6-pin, SMD | ST1 |

MGC3030 Woodstar Development Kit User's Guide

TABLE A-3: MGC3030 UNIT BILL OF MATERIALS

| Qty. | Description | Name |
|------|--------------------------------------------------|--------------------------------|
| 1 | Connector, 2mm socket 7pin, SMD | BU1 |
| 1 | Connector, 2mm header 6pin, SMD | ST1 |
| 1 | Capacitor, 100nF, 10%, X7R, SMD 0402 | C1 |
| 2 | Capacitor, 4.7 μ F, 20%, X5R, 6.3V, SMD 0402 | C2, C3 |
| 1 | LED, 571nm green clear, 0603 SMD | D1 |
| 1 | IC, MGC3030 3D Gesture Controller, 28 Pin SSOP | IC1 |
| 2 | Resistor, 1.8k Ω , 1%, 1/16W, SMD 0402 | R1, R2 |
| 3 | Resistor, 10k Ω , 1%, 1/16W, SMD 0603 | R4, R6, R7 |
| 6 | Resistor, 10k Ω , 1%, 1/16W, SMD 0402 | R9, R11, R12, R13, R14, R15 |
| 1 | Resistor, 1k Ω , 1%, 1/16W, SMD 0402 | R10 |

TABLE A-4: MGC3030 UNIT MOUNTING OPTION

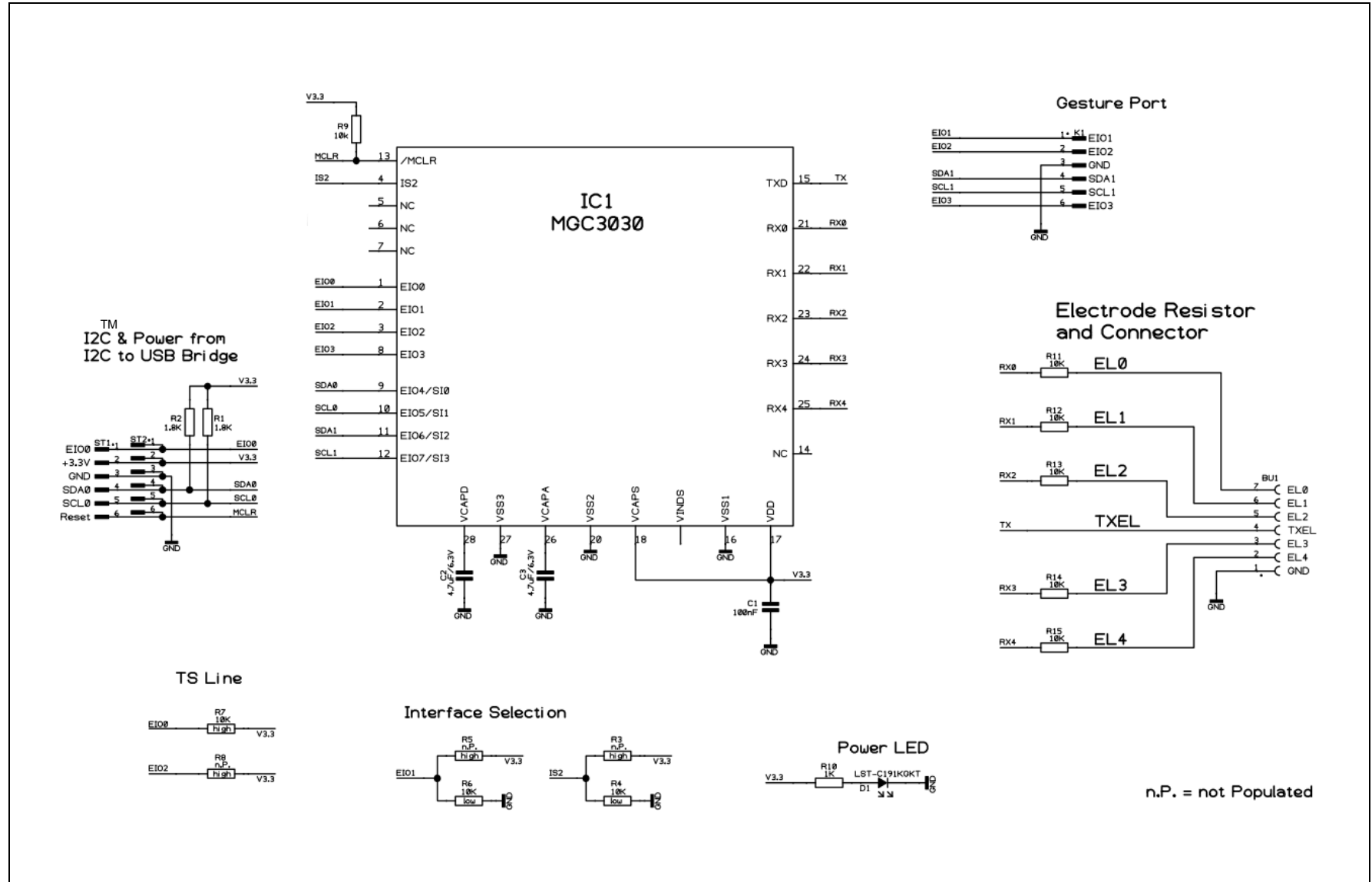
| Qty. | Description | Name |
|------|--------------------------------|------|
| 1 | Connector, 1 mm FPC 6-pin, SMD | ST3 |

TABLE A-5: REFERENCE ELECTRODE BILL OF MATERIALS

| Qty. | Description | Name |
|------|--------------------------------|------|
| 1 | Connector, 1 mm FPC 6-pin, SMD | ST2 |

A.3 BOARD SCHEMATICS AND LAYOUT

FIGURE A-1: MGC3030 UNIT SCHEMATIC



n.P. = not Populated

MGC3030 Woodstar Development Kit User's Guide

FIGURE A-2: ASSEMBLY OF MGC3030 UNIT

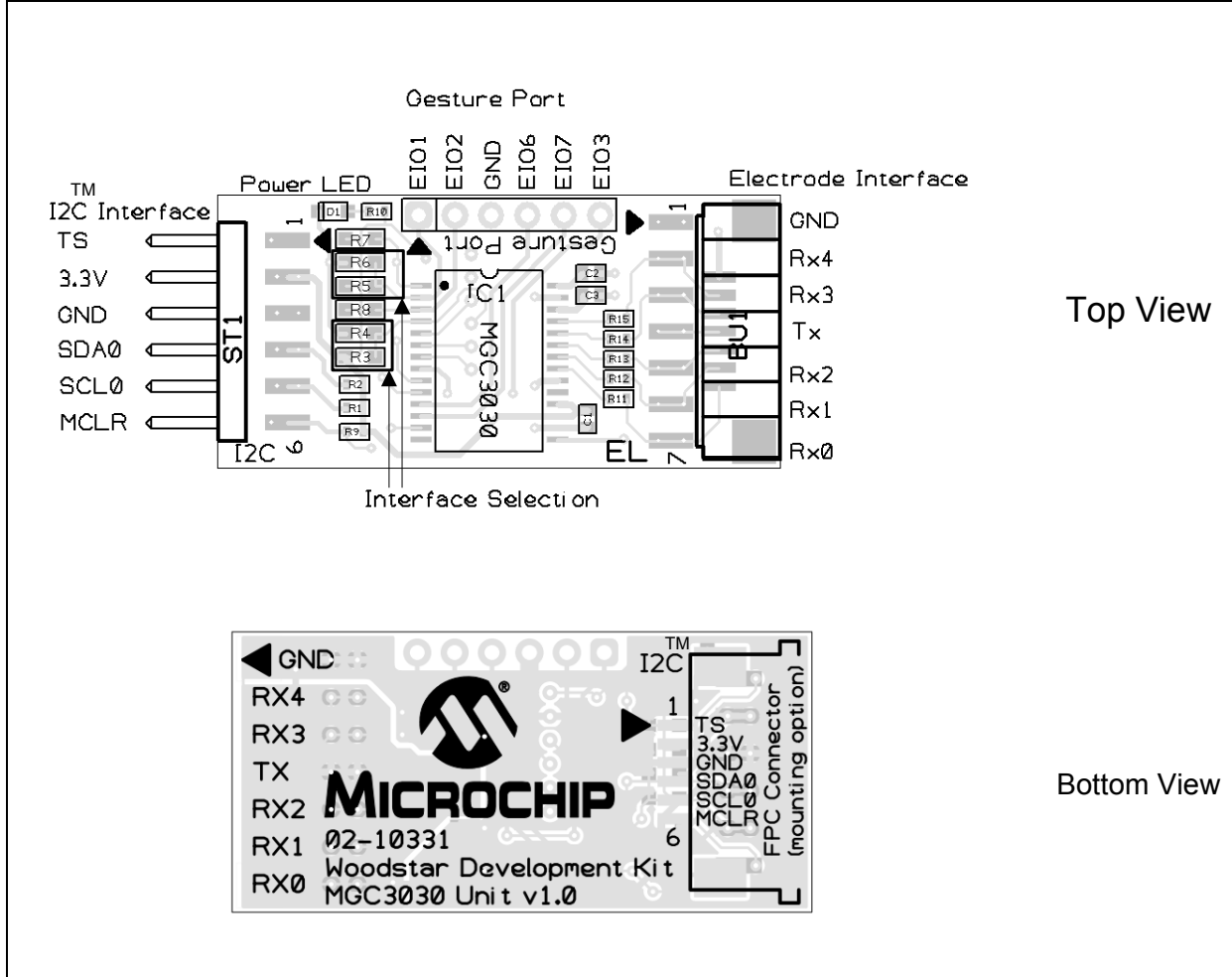
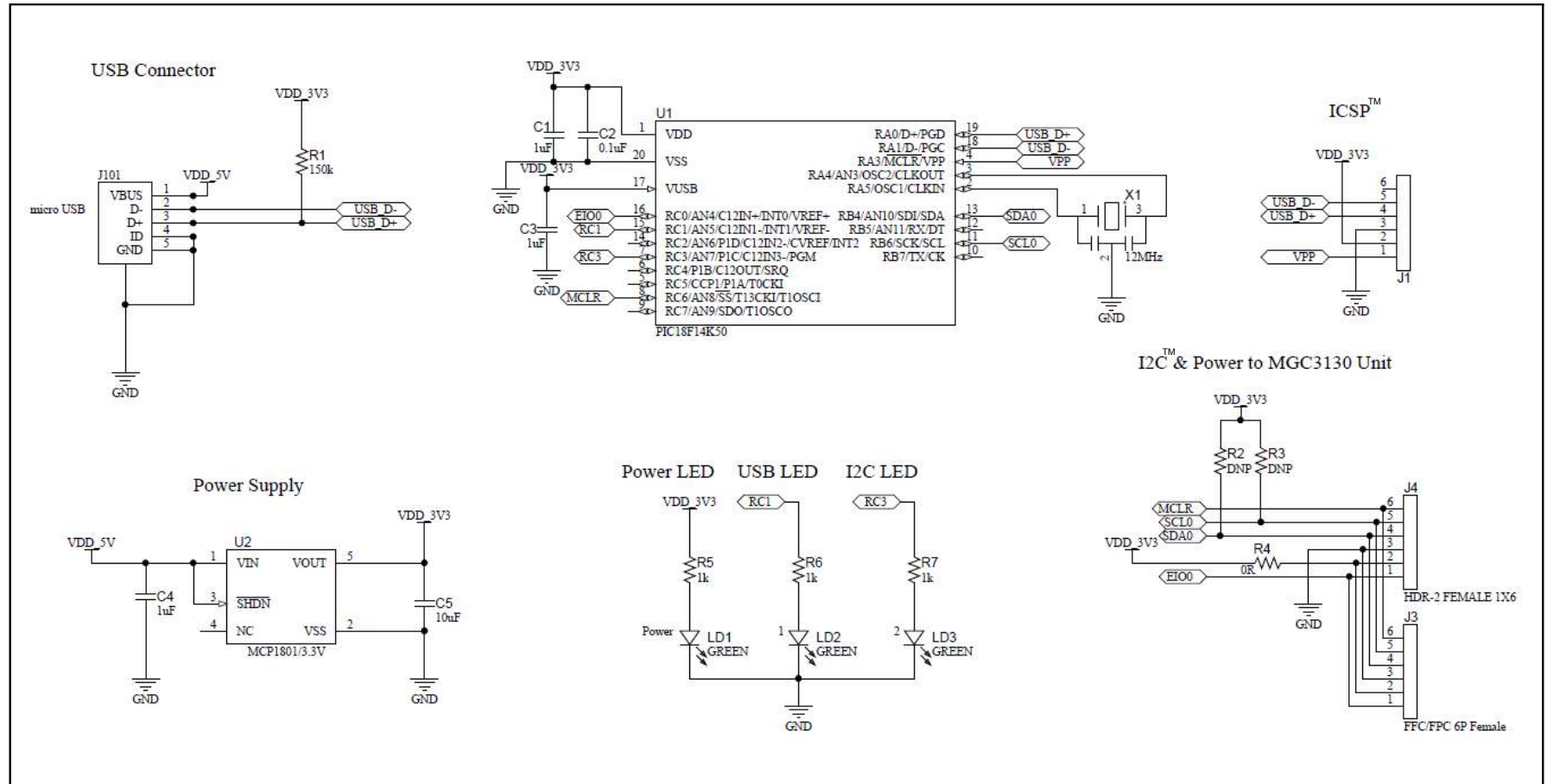
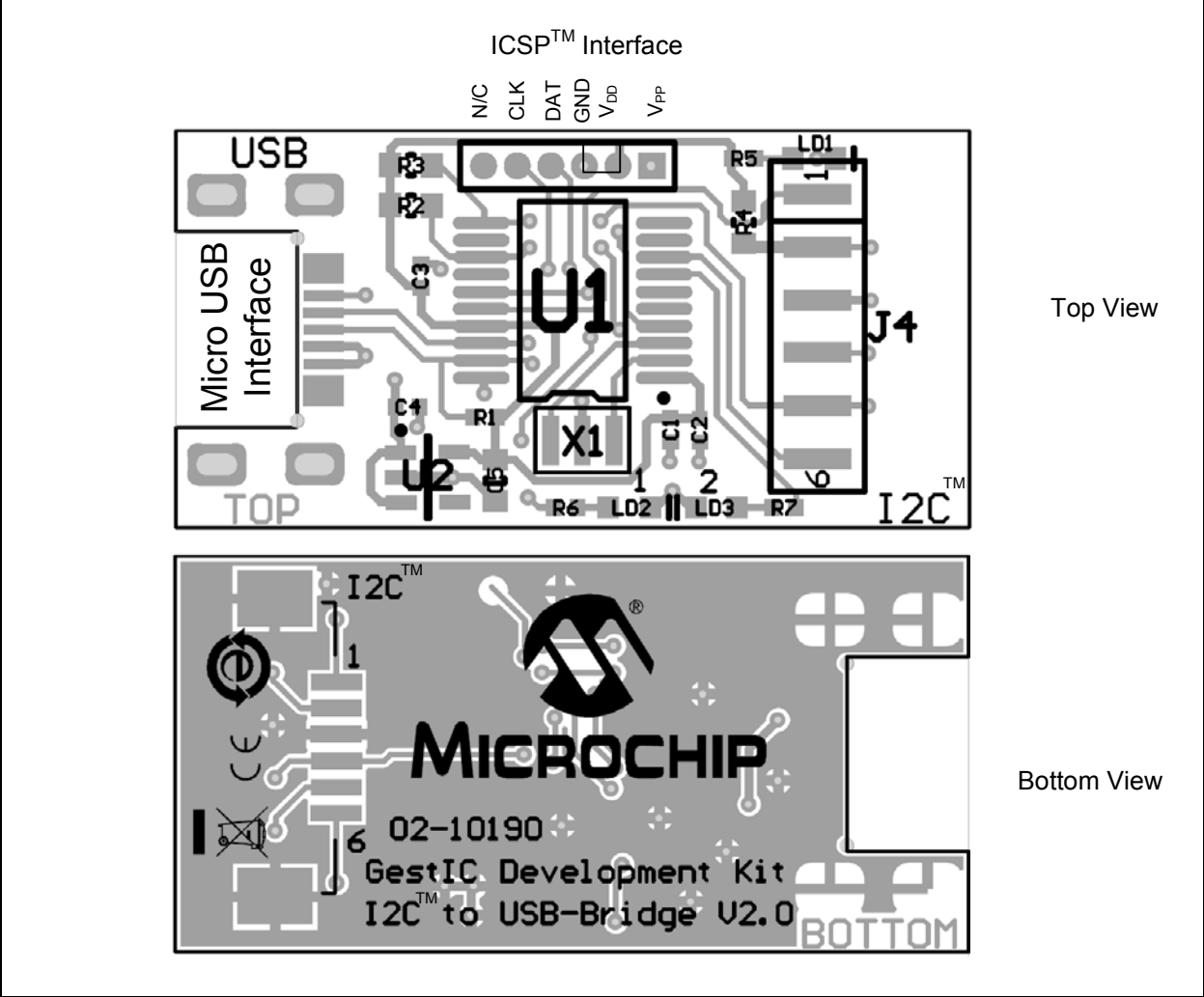


FIGURE A-3: I²C™ TO USB BRIDGE SCHEMATIC



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FIGURE A-4: ASSEMBLY OF I²C™ TO USB BRIDGE



Appendix B. Sensitivity Profile and Capacitances

B.1 INTRODUCTION

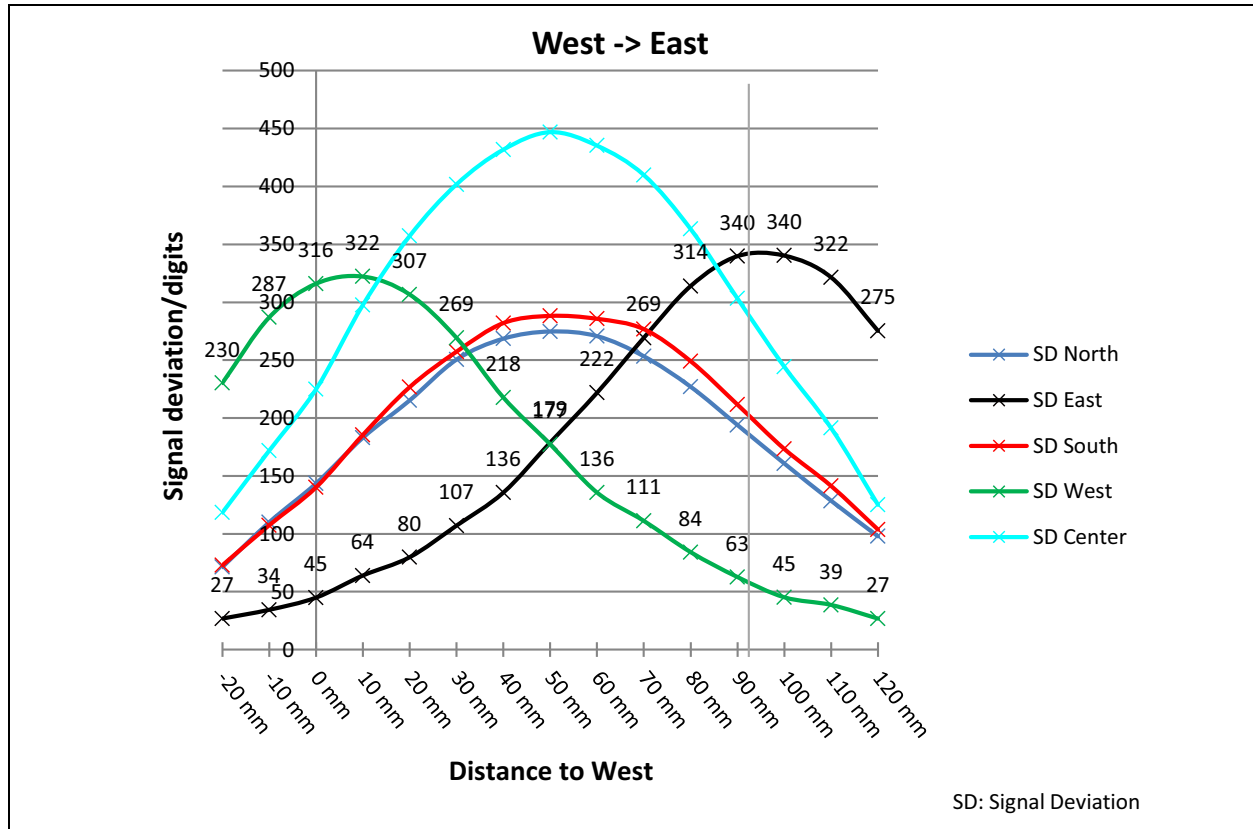
This appendix contains the sensitivity profile and the electrode capacitances of the Woodstar Development Kit hardware.

The measurement procedure of both the sensitivity profile and the electrode capacitances are outlined in "*GestIC® Design Guide*" (DS40001716).

B.2 SENSITIVITY PROFILES

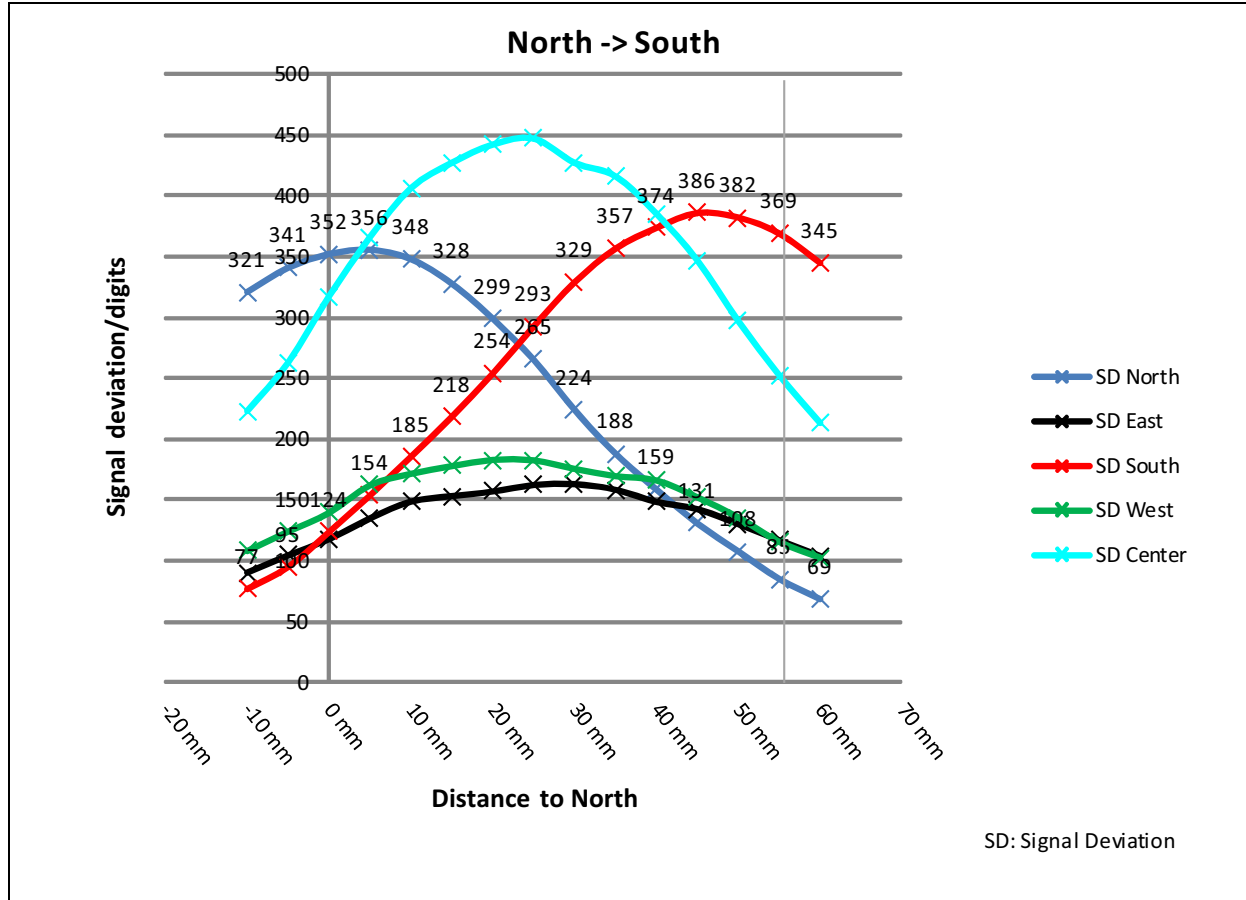
The sensitivity profiles were conducted using a 40x40x70 mm artificial hand at a constant height of 30 mm above the electrode's surface.

FIGURE B-1: SENSITIVITY PROFILE FROM WEST TO EAST



MGC3030 Woodstar Development Kit User's Guide

FIGURE B-2: SENSITIVITY PROFILE FROM NORTH TO SOUTH



B.3 ELECTRODE CAPACITIES

The capacitances between the Rx electrodes and GND (C_{RXG}) do not include the 5 pF input capacitance of the MGC3030 Rx input buffer (C_{Buf}).

TABLE B-1: GestIC® ELECTRODE CAPACITIES⁽¹⁾

| Channel | C_{RXG} | C_{RXTX} |
|---------|-----------|------------|
| North | 9 pF | 20 pF |
| East | 9 pF | 18 pF |
| South | 9 pF | 20 pF |
| West | 8 pF | 18 pF |
| Center | 7 pF | 65 pF |

Note 1: $C_{TXG} = 590$ pF

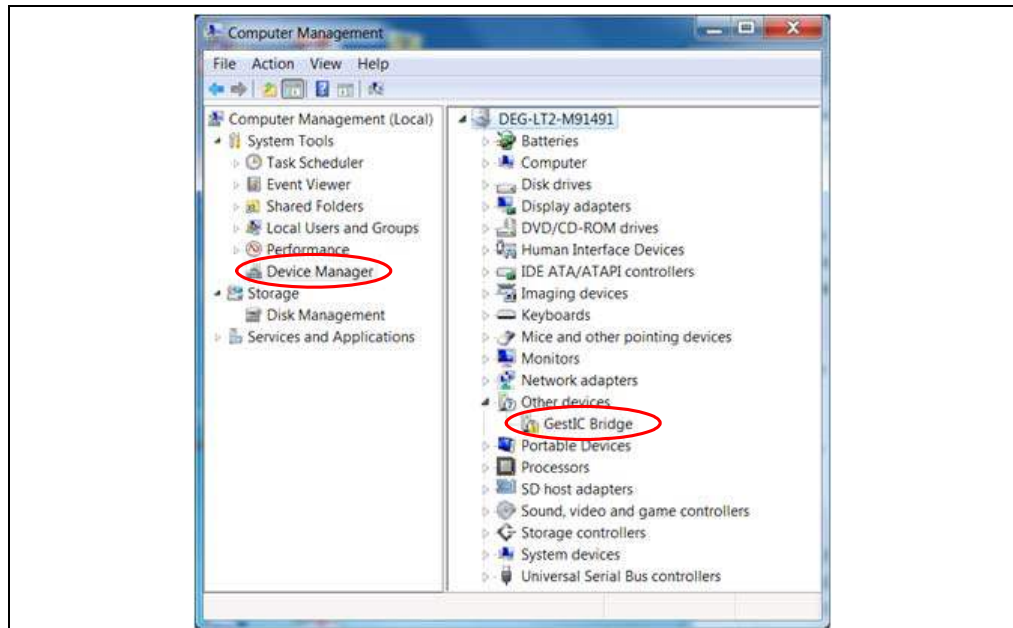
Appendix C. Driver Installation Manual

This section lists the steps to be taken in order to manually install the Windows CDC Driver on the PC.

C.1 OPEN DEVICE MANAGER

While the Woodstar Development Board is connected to the PC press **Start**, right-click on **Computers** and select **Manage**. This will bring up the Computer Management window shown in Figure C-1. On the left sidebar select **Device Manager**.

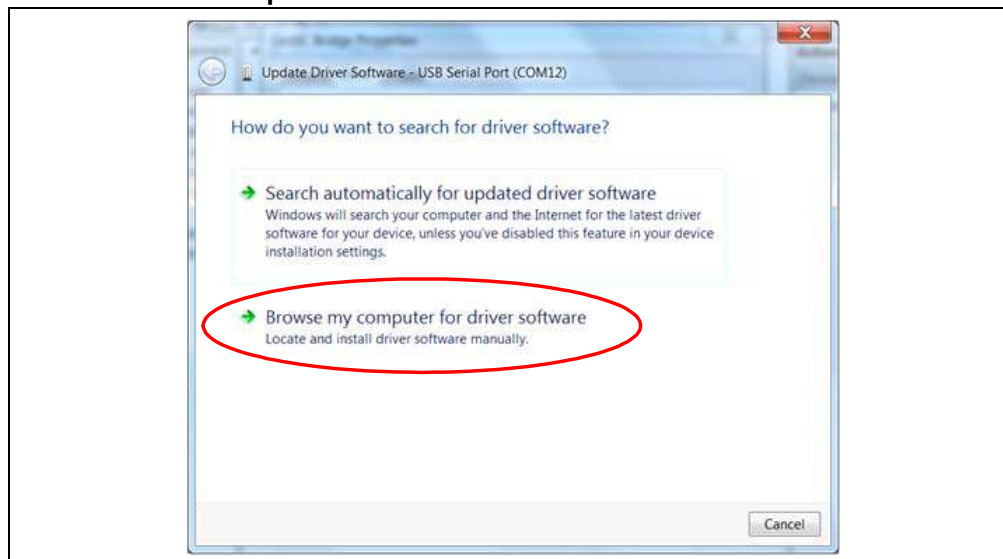
FIGURE C-1: COMPUTER MANAGEMENT



C.2 SELECT DEVICE

1. Right Click on **GestIC Bridge** and select **Update Driver Software**.
2. Select **Search Method**
3. The window shown in Figure C-2 will open. Choose **Browse my Computer** for driver software.

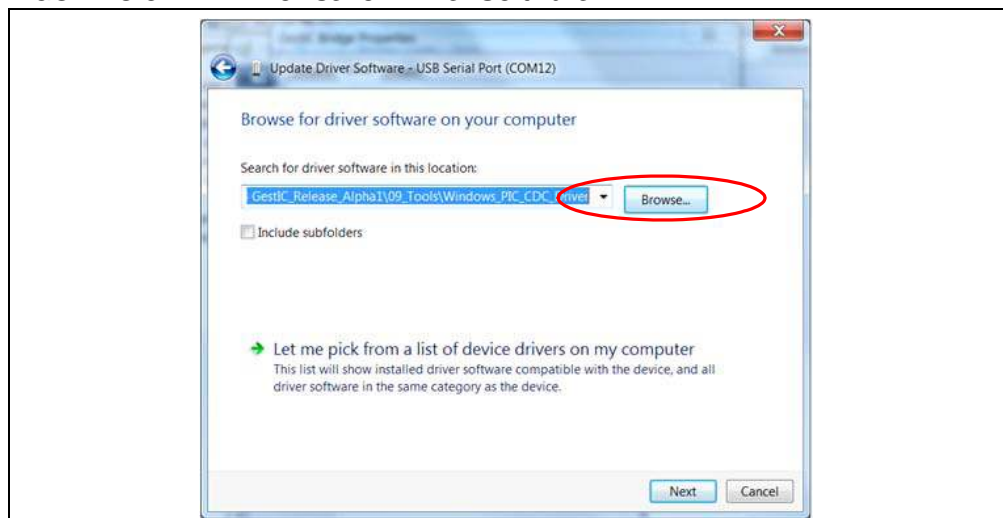
FIGURE C-2: Update Driver Software



C.3 LOCATE DRIVER

1. Click **Browse** and navigate to the driver files on your local drive (refer to Figure C-3).
2. Press **Next** and the driver will be installed.

FIGURE C-3: Browse for Driver Software



C.4 VERIFY COMMUNICATION

The driver is properly installed and the communication between the PC and the Woodstar Development Board is successfully established when LED 1 and LED 2 blink alternatively.

Appendix D. Glossary

TABLE D-1: GLOSSARY

| Term | Definition |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| AFE | Analog Front End |
| Application Host | PC or embedded controller which controls the MGC3030 |
| Aurea | MGC3030/3130 PC control software with graphical user interface |
| Colibri Suite | Embedded DSP suite within the GestIC [®] Library |
| Deep Sleep | MGC3030/3130 Power-Saving mode |
| E-field | Electrical field |
| Frame Electrodes | Rectangular set of four electrodes for E-field sensing |
| GestIC [®] Technology | Microchip's patented technology providing 3D free-space gesture recognition utilizing the principles of electrical near-field sensing |
| GestIC [®] Library | Includes the implementation of MGC3030/3130 features and is delivered as a binary file preprogrammed on the MGC3030 |
| Gesture Recognition | Microchip's stochastic HMM classifier to automatically detect and classify hand movement patterns |
| Gesture Set | A set of provided hand movement patterns |
| HMM | Hidden Markov Model |
| MGC3130 | Single-Zone 3D Gesture and Motion Tracking Controller |
| MGC3030 | Single-Zone 3D Gesture Sensing Controller |
| Position Tracking | GestIC [®] technology feature |
| Self Wake-up | MGC3030/3130 Power-Saving mode |
| Sensing Area | Area enclosed by the four frame electrodes |
| Sensing Space | Space above sensing area |
| Signal Deviation | Term for the delta of the sensor signal on approach of the hand versus non-approach |
| SPU | Signal Processing Unit |
| Approach Detection | GestIC [®] technology feature: Power-Saving mode of the MGC3030/3130 with approach detection |

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NOTES:



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