

Intel® Quark™ Microcontroller Developer Kit D2000

User Guide

February 2016



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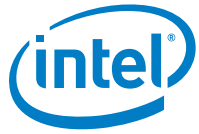
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Revision History

Date	Revision	Description
February 2016	001	Initial release



1.0 Introduction

This document describes Intel® Quark™ Microcontroller Developer Kit D2000 including the board, the hardware contained, and the toolchain required for software development and debugging. The platform consists of a small form-factor board and includes flash storage, a 6-axis compass and accelerometer and an Arduino Uno compatible shields' interface. A USB connection enables programming and debugging (JTAG).

1.1 Terminology

Table 1. Terminology

Term	Description
ADC	Analog-to-Digital conversion
BSP	Board Support Package – Refers to OS + Device Drivers
CRB	Customer Reference Board
ELF	Executable Linkable Format
GDB	GNU Debugger
GPIO	General-Purpose Input / Output
IDE	Integrated Development Environment
I ² C	Inter-Integrated Circuit
JTAG	Joint Test Action Group
MCU	Microcontroller unit
OpenOCD	Open On-Chip Debugger; interfaces with a JTAG port
QFN	Quad Flat No-leads
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver / Transmitter



1.2 Toolchain

The toolchain for programming the D2000 is called *Intel® System Studio for Microcontrollers*.

Intel® System Studio for Microcontrollers is available at the following link:

<https://software.intel.com/en-us/intel-system-studio-microcontrollers>

For more details on the toolchain, see [3.0](#) Software and Tools.

1.3 Reference Documents

This document provides an overview of the setup process. For a successful setup, ensure you have the documents listed in Table 2 available. These documents provide specific information and step-by-step instructions.

Table 2. Reference Documents for This Installation

Document	Document # / Location
Getting Started with Intel® System Studio for Microcontrollers	Distributed in toolchain
Intel® System Studio 2016 for Microcontrollers User and Reference Guide	Distributed in toolchain

Table 3. Additional Reference Documents

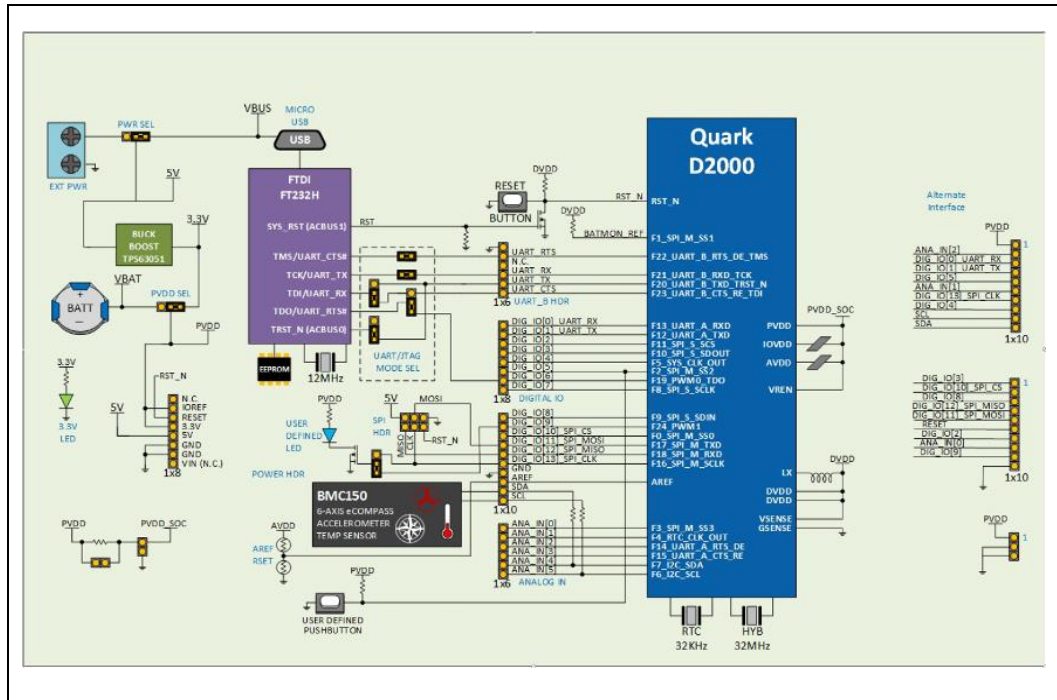
Document	Document # / Location
<i>Intel® Quark™ Microcontroller D2000 Datasheet</i>	www.intel.com/quark/mcu/d2000
<i>Intel® System Studio for Microcontrollers 2016 Release Notes</i>	Included with the S/W Distribution
Intel® Quark™ Microcontroller Software Interface BSP: Release Notes	www.intel.com/quark/mcu/d2000
Intel® Quark™ Microcontroller D2000 Customer Reference Board (CRB) Hardware Manual	www.intel.com/quark/mcu/d2000

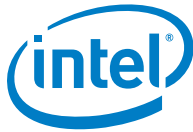
Contact your Intel representative for access to these documents or click on the following link for more information:

<http://www.intel.com/content/www/us/en/embedded/products/quark/mcu/d2000/overview.html>

1.4 Block Diagram

Figure 1. Intel® Quark™ Microcontroller Developer Kit D2000 Block Diagram





2.0 Hardware

The Intel® Quark™ microcontroller D2000 package is shipped as a 40-pin QFN component.

2.1 Board Components

Intel® Quark™ Microcontroller Developer Kit D2000 contains the following items:

Main expansion options:

- “Arduino Uno” compatible SIL sockets (3.3V IO only)
- Booster pack compatible SIL headers (3.3V IO only)

On-board components:

- 6-axis Accelerometer / Magnetometer with temperature sensor
- UART/JTAG to USB convert for USB debug port

Other connectors include:

- 1x USB 2.0 Device Port – micro Type B
- On-board coin cell battery holder (type CR2032)
- 5V input a screw terminal/header (external power or Li-ion)

Power sources for this platform:

- External (2.5V - 5V) DC input
- USB power (5V) – via debug port
- Coin cell battery (type CR2032 not supplied)

Table 3. 3rd Party Board Components: Integrated Circuits¹

Component	Manufacturer	Part Number
6-AXIS E Compass and Accelerometer	Bosch Sensortec GMBH	BMC150
SERIAL_EEPROM	Microchip	93LC56BT-I/OT
USB <--> UART & JTAG	FTDI	FT232HL
SPST Switch	E-Switch	TL1015AF160QG
Connector USB - micro B	TE Connectivity	1981568-1
THM Holder for 20mm Coin Cell Batteries	Keystone Electronics CORP.	3003
Single Inductor Buck-Boost With 1-A Switches and Adjustable Soft Start	Texas Instruments	TPS63051RMWT

1. Other names and brands may be claimed as the property of others.

2.2 Board Photo

Figure 2. Intel® Quark™ Microcontroller Developer Kit D2000 Fab D Board Photo



2.3 Board Jumpers

1. **FTDI UART/JTAG***
 J12 and J13 Jumpers are installed for both JTAG and UART by default.
 To isolate the Intel® Quark™ microcontroller D2000 from the FTDI FT232HL, remove all the sleeves from Jumpers J7, J9, J10, J12, and J13.
 - J7 [2-3] JTAG (Default) [1-2] UART
 - J9 [2-3] JTAG (Default) [1-2] UART
 - J10 [2-3] JTAG (Default) [1-2] UART
2. **Power**
 - Place J19 Jumper at [1-2] (Default) when the USB Port is in use.
 - Place J25 Jumper at [1-2] (Default) when the USB Port is in use.
 - J23 Jumper [1-2] (Default)

***Note:** Debug and firmware loading is currently only supported via JTAG. By using UART_B, your application disables the JTAG interface.



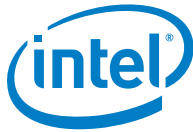
2.4 Board Pinouts

Table 5. Pin Mapping

Pin Label	CRB Pin Usage	Arduino Shield Interface	User Mode0	User Mode1	User Mode2
J2_1	GND				
J2_2	USB port / Hdr		JTAG_TMS	GPIO_22	UART_B_RTS
J2_3	N/C				
J2_4	USB port / Hdr		JTAG_TCK	GPIO_21	UART_B_RXD
J2_5	USB port / Hdr		JTAG_TRS_T_N	GPIO_20	UART_B_TXD
J2_6	USB port / Hdr		JTAG_TDI	GPIO_23	UART_B_CTS
J3_1	DIO_8	DIO_8	GPIO_9	ADC/COMP_9	SPI_S_SDIN
J3_2	DIO_09	DIO_09	GPIO_24	GPIO_24	PWM1
J3_3	SPI_M_SSO	SPI_SS_DIO_10	GPIO_0	ADC/COMP_0	SPI_M_SSO
J3_4	M_MOSI/DIO_11	MOSI/DIO_11	GPIO_17	ADC/COMP_17	SPI_M_DOUT
J3_5	M_MISO/DIO_12	MISO/DIO_12	GPIO_18	ADC/COMP_18	SPI_M_DIN
J3_6	M_SCK/DIO_13	SCK/DIO_13	GPIO_16	ADC/COMP_16	M_SCK/DIO_13
J3_7	GND				
J3_8	AREF				
J3_9	SDA/AIN_04	SDA/AIN_04/DIO_18	GPIO_7	ADC/COMP_7	I2C_SDA
J3_10	SCL/AIN_05	SCL/AIN_05/DIO_19	GPIO_6	ADC/COMP_6	I2C_SCL
J4_1	UART_RXD/DIO_00	UART_RXD/DIO_00	GPIO_13	ADC/COMP_13	UART_A_RXD
J4_2	UART_TXD/DIO_01	UART_TXD/DIO_01	GPIO_12	ADC/COMP_12	UART_A_TXD



Pin Label	CRB Pin Usage	Arduino Shield Interface	User Mode0	User Mode1	User Mode2
J4_3	DIO_02	DIO_02	GPIO_11	ADC/COMP 11	SPI_S_SCS
J4_4	DIO_03	DIO_03	GPIO_10	ADC/COMP 10	SPI_S_SDOUT
J4_5	DIO_04	DIO_04	GPIO_5	ADC/COMP 5	SYS_CLK_OUT
J4_6	DIO_05	DIO_05	GPIO_2	ADC/COMP 2	SPI_M_SS2
J4_7	USB port/DIO_06	DIO_06	JTAG_TDO	GPIO_19	PWM0
J4_8	DIO_07	DIO_07	GPIO_8	ADC/COMP 8	SPI_S_SCLK
J22_1	NC				
J22_2	IOREF				
J22_3	RESET_N	RESET_N	RST_N		
J22_4	3.3V				
J22_5	5V				
J22_6	GND				
J22_7	GND				
J22_8	NC				
J23_1	AIN_00	AIN_00	GPIO_3	ADC/COMP 3	SPI_M_SS3
J23_2	AIN_01	AIN_01	GPIO_4	ADC/COMP 4	RTC_CLK_OUT
J23_3	AIN_02	AIN_02	GPIO_14	ADC/COMP 14	UART_A_RTS
J23_4	AIN_03	AIN_03	GPIO_15	ADC/COMP 15	UART_A_CTS
J23_5	NC				
J23_6	NC				



3.0 *Software and Tools*

3.1 **Intel® System Studio for Microcontrollers**

Intel® System Studio for Microcontrollers is an integrated tool set for developing, optimizing, and debugging systems and applications for the Intel® Quark™ microcontroller D2000.

The suite consists of the following components:

- GCC* Version 5.2.1
 - Linker
 - Assembler
 - C Run-time Libraries
- Intel-enhanced GDB* 7.9
- Intel® Integrated Performance Primitives for Microcontrollers 1.0
- Floating Point Emulation library
- Sample Applications
- Board Support Package (BSP) for the Intel® Quark™ Microcontroller Software Interface (Intel® QMSI)
- OpenOCD* 0.8.0
- TinyCrypt* 0.1.0 (Internet connection required during installation)
- Intel® Quark™ Microcontroller Software Interface 1.0
- Eclipse* Luna 4.4 including Intel® System Studio for Microcontrollers integration
- Python™ 2.7.10
- WinUSB* driver for Intel® Quark™ Microcontrollers

The suite is supported on the following OS hosts:

- Linux (64bit: Versions Ubuntu* 14.04 LTS, Fedora 21)
- Windows* (64bit: Versions 7, 8.1, 10)



3.1.1 Installation

Installing the IDE begins by following the *Intel® System Studio for Microcontrollers 2016 Release Notes*. The release notes contain all system requirements and all prerequisites.

Follow the instructions in:

<i>Intel® System Studio for Microcontrollers 2016 Release Notes</i>	Distributed with toolchain
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Note: The *Intel® System Studio for Microcontrollers 2016 Release Notes* is a separate document and should be followed at this point.

3.1.2 Getting Started Guide

On completing the installation, locate the documentation files in the `docs` folder under the installation path. The `get_started.htm` file provides an easy guide to the set up and use of this tool suite with the *Intel® Quark™ D2000 microcontroller and Eclipse* IDE*.

Follow the instructions in:

<i>Getting Started with Intel® System Studio for Microcontrollers</i>	Distributed in toolchain
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Note: The *Getting Started with Intel® System Studio for Microcontrollers* is a separate document and should be followed at this point.

3.1.3 User and Reference Guide

The *Intel® System Studio 2016 for Microcontrollers User and Reference Guide* located in `issm_user_ref_guide.htm` contains more detailed information about this tool suite, including:

- Developing in the command line
- Using the compiler
- Using Intel® Integrated Performance Primitives for Microcontrollers (Intel® IPP for Microcontrollers)
- Using the Floating Point Library
- Using the TiinyCrypt library

Follow the detailed, step-by-step instructions in:

<i>Intel® System Studio 2016 for Microcontrollers User and Reference Guide</i>	Distributed in toolchain
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Note: The *Intel® System Studio 2016 for Microcontrollers User and Reference Guide* is a separate document and should be followed at this point.



3.2 BSP Release Note

The *Intel® Quark™ Microcontroller Software Interface BSP Release Notes* contain release-specific information, including:

- Notes about the Board Support Package
- Installation instructions
- Details on provided utilities and applications
- Known issues and workarounds.
- Supported features of the release.

3.3 Application Notes

As of the writing of this document, no application notes have been created. As this document gets updated, they will be provided.