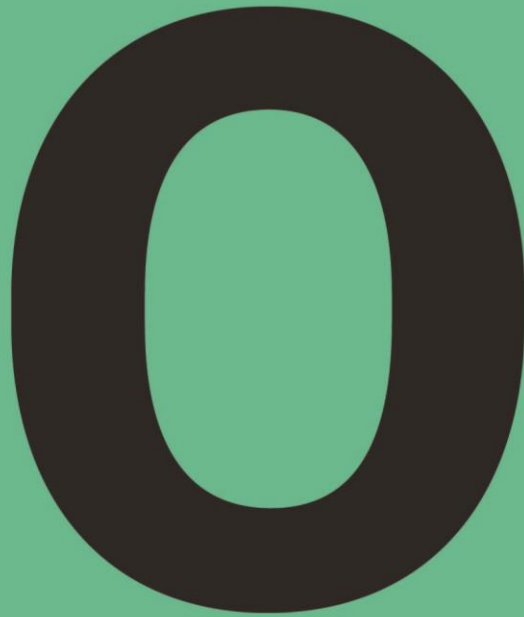




SAMSUNG
ARTIKTM Modules



053 Development Board User Guide

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VERSION HISTORY

Revision	Date	Description	Maturity
V0.1	03/20/2017	First Draft ARTIK 053 Development Board User Guide.	Pre Alpha
V0.11	03/21/2017	Created Mechanical Dimensions section	Pre Alpha
V0.12	03/23/2017	Updated Table Layout of 2, 3, 4, 5, 18.	Pre Alpha
V0.13	3/27/2017	Updated Figure 2. Updated Table 2,3 Created Table 15, 16. Updated Figure 19. Created Table 17, Table 18.	Pre Alpha
V0.14	3/31/2017	Updated Table 8.	Pre Alpha
V0.15	4/6/2017	Updated Figure 1 updated Figure 5. Figure 6, Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, Figure 16, Figure 17, Figure 18. Created Figure 19, Figure 20. Updated Figure 21. Updated Table 19.	Pre Alpha
V0.16	4/6/2017	Updated Template.	Pre Alpha
V0.17	4/6/2017	Updated Figure 21.	Pre Alpha

STARTER KIT OVERVIEW

FEATURES

The ARTIK 053 Starter Kit consists of a Starter Board an Interposer Board and an ARTIK 053 Module. The ARTIK 053 Module is plugged into the Interposer Board. The Interposer Board in turn is plugged into the Starter Board.

The ARTIK 053 Starter Kit is an affordable approach for developing an IoT solution. *Figure 1* shows a picture of the ARTIK 053 Starter Kit that includes the Starter Board, the Interposer Board and the ARTIK 053 Module.

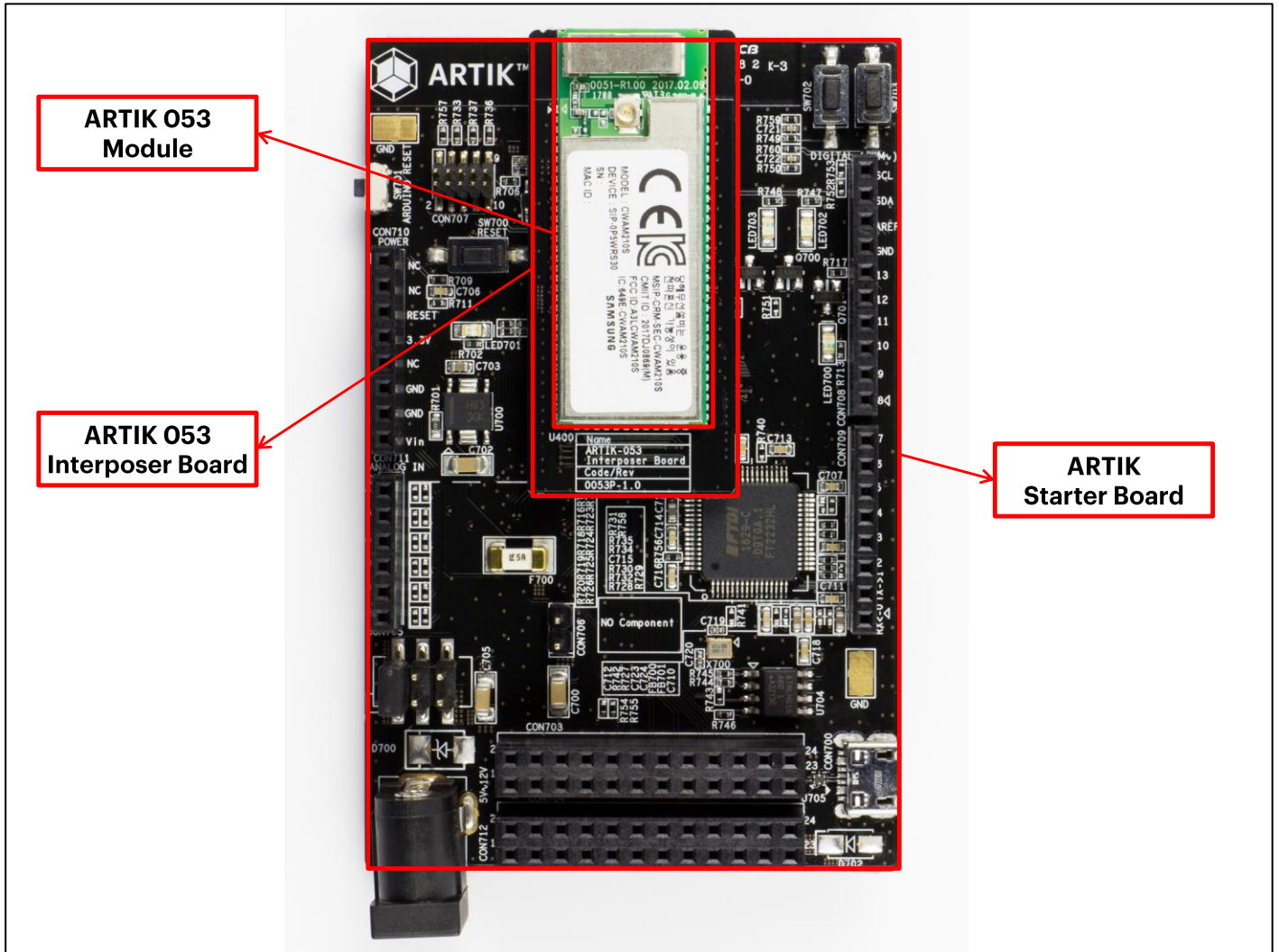


Figure 1. Preview of the ARTIK 053 Starter Kit

BLOCK DIAGRAM

Figure 2 shows the block diagram of the ARTIK 053 Starter Kit. For more information on the ARTIK 053 Module please consult the ARTIK 053 Module Datasheet.

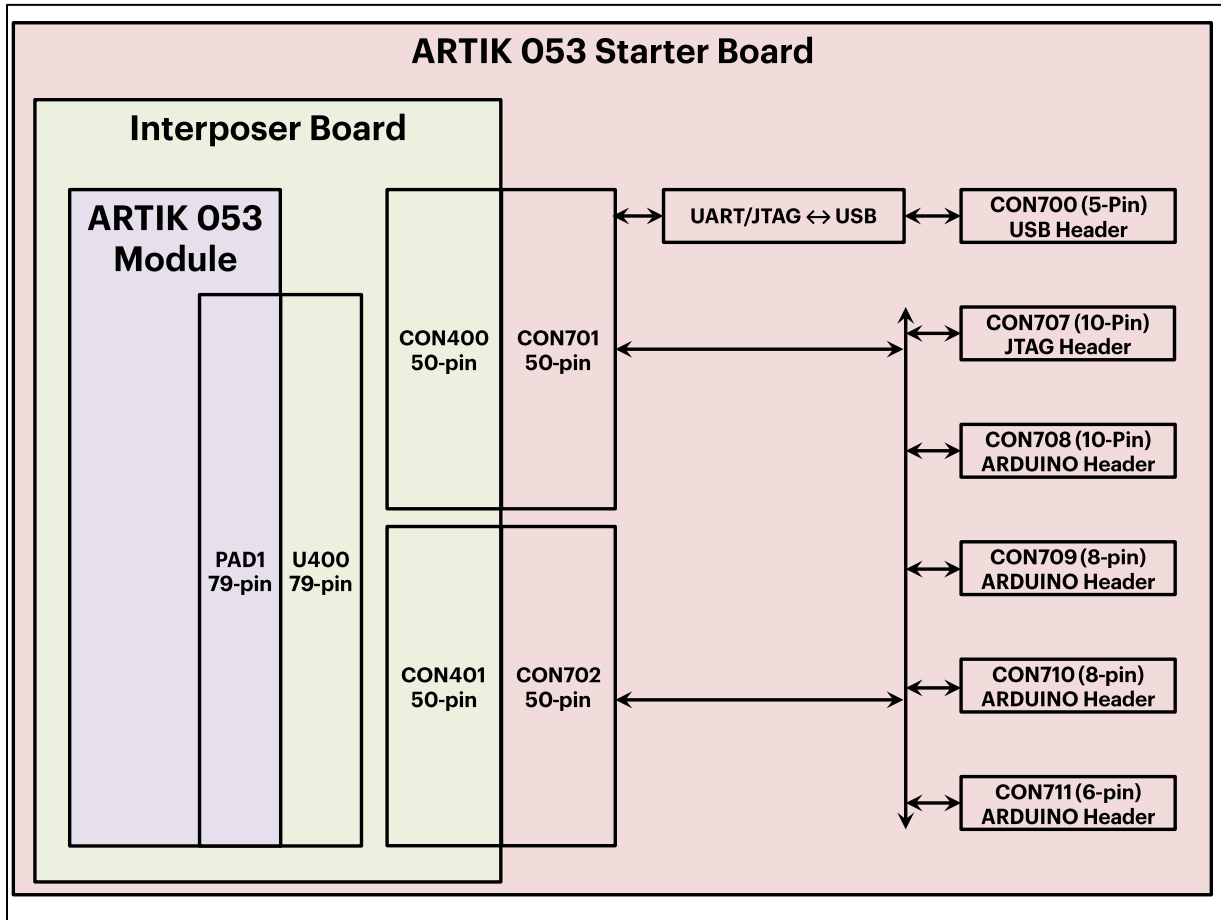


Figure 2. ARTIK 053 Starter Kit block diagram

MECHANICAL DIMENSIONS

Figure 3 and Figure 4 show the mechanical dimensions of the ARTIK 053 Starter Kit and the Interposer Board.

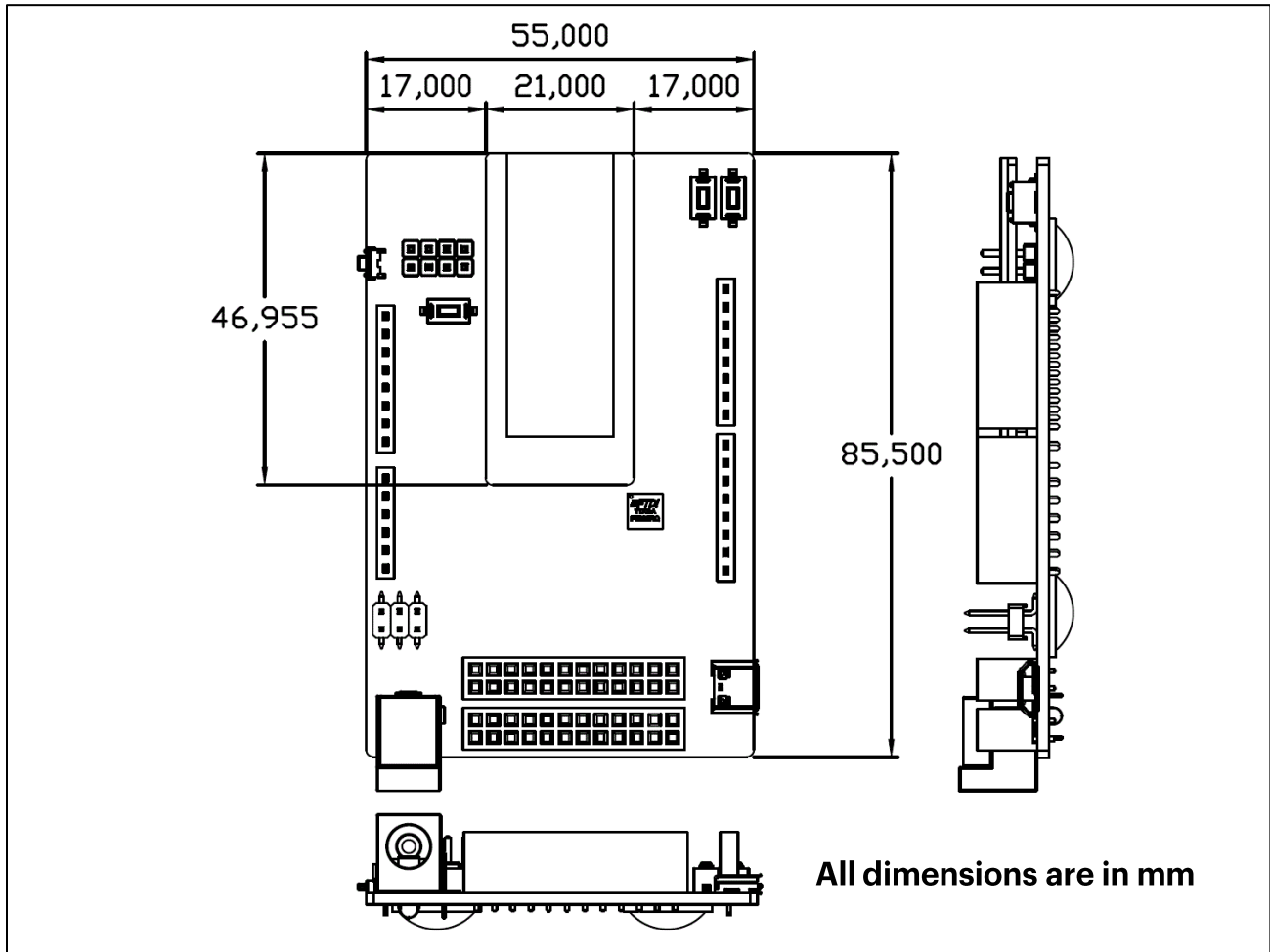


Figure 3. Mechanical Dimensions ARTIK 053 Starter Kit

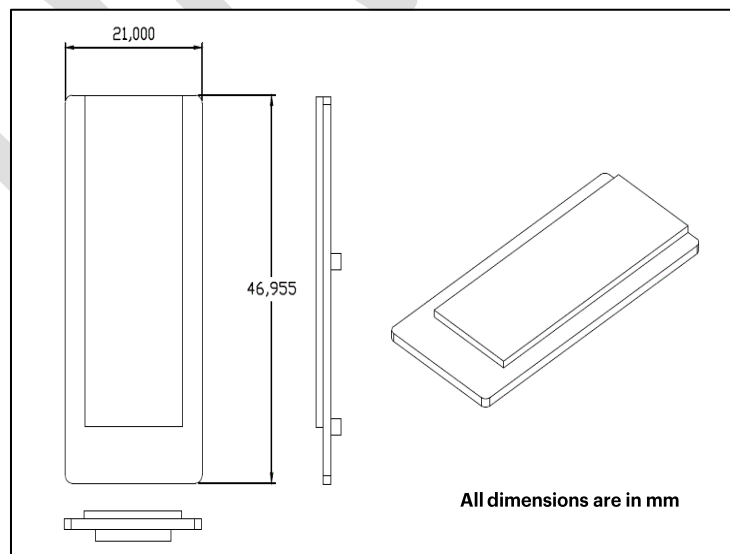


Figure 4. Mechanical Dimensions Interposer Board

STARTER BOARD HEADER LOCATIONS

The Starter Board that hosts the ARTIK 053 Module through the Interposer Board as depicted in *Figure 5*, also provides a number of headers tailored specifically for development.

In subsequent sections the functionality of the various headers and the ARTIK 053 Module will be explained in greater detail.

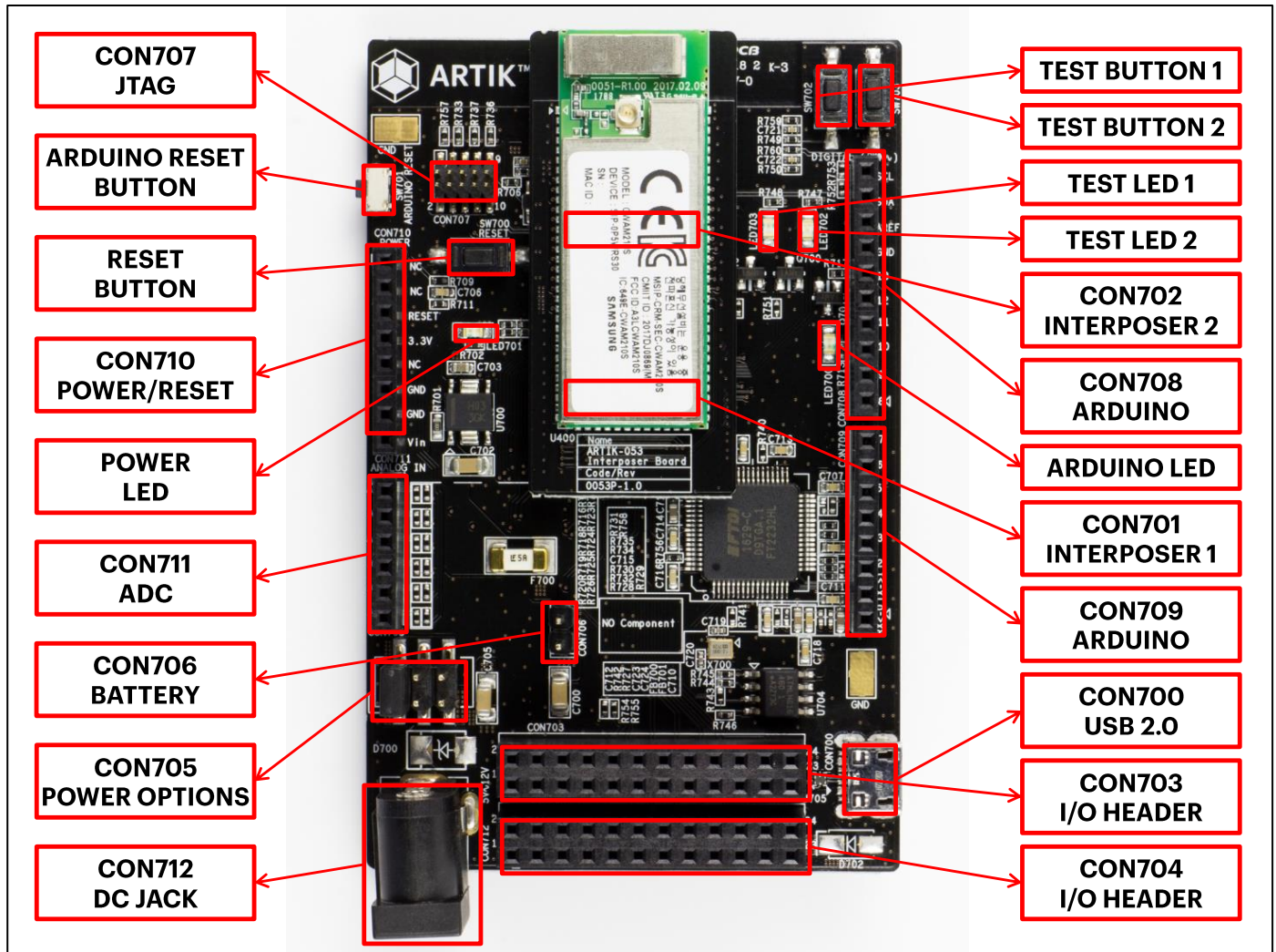


Figure 5. ARTIK 053 Starter Kit component placement

HEADER AND CONNECTOR DESCRIPTIONS

This section will describe all the headers, buttons and switches that are available on the Starter Kit.

CON700 HEADER SIGNALS

Table 1. CON700 signal description

Header CON700 (USB2.0)		
Pin Name	Signal	Description
1	VBUS	VCC_USB5P0 Power
2	D-	Data Minus
3	D+	Data Plus
4	NC	Not Connected
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	GND	Ground

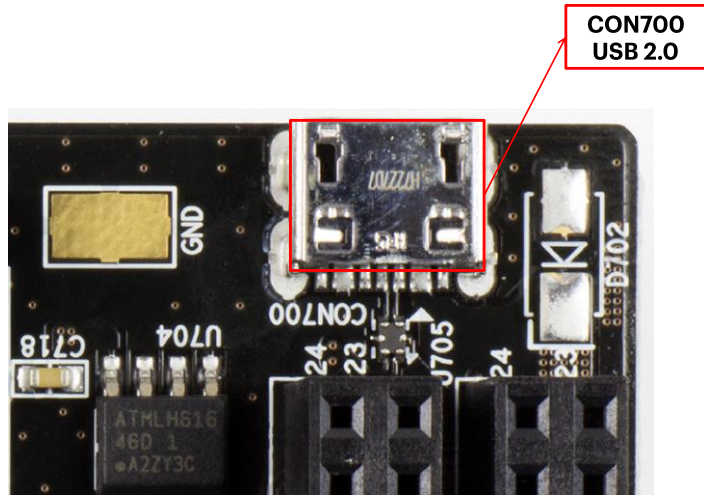


Figure 6. USB 2.0 interface connector location

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CON701 HEADER SIGNALS

The following signals as depicted in [Table 2](#) can be found on connector 701. This connector, together with CON702 connects the ARTIK 053 Module with the Interposer Board.

Table 2. CON701 signal description

Connector CON701 (CON400 on Interposer)			
Pin Name	Description	Pin Name	Description
1	XGPIO26	2	XSPI1_CSN
3	XGPIO25	4	XSPI1_MOSI
5	XGPIO24	6	XSPI1_CLK
7	XGPIO21	8	XSPI1_MISO
9	XGPIO19	10	GND
11	XGPIO18	12	Not Connected
13	XGPIO17	14	XGPIO3
15	XGPIO14	16	XGPIO1
17	XGPIO13	18	GND
19	XGPIO16	20	XSPI2_CS
21	XGPIO15	22	XSPI2_CLK
23	XGPIO20	24	XGPIO2
25	GND	26	XSPI2_MOSI
27	XADC0	28	XGPIO8
29	XADC1	30	XSPI2_MISO
31	XADC2	32	GND
33	XADC3	34	XGPIO11
35	GND	36	XGPIO9
37	XGPIO23	38	XGPIO10
39	XGPIO22	40	XGPIO12
41	XADC6	42	GND
43	XADC7	44	XUART3_TXD
45	GND	46	XUART3_RXD
47	GND	48	GND
49	GND	50	GND

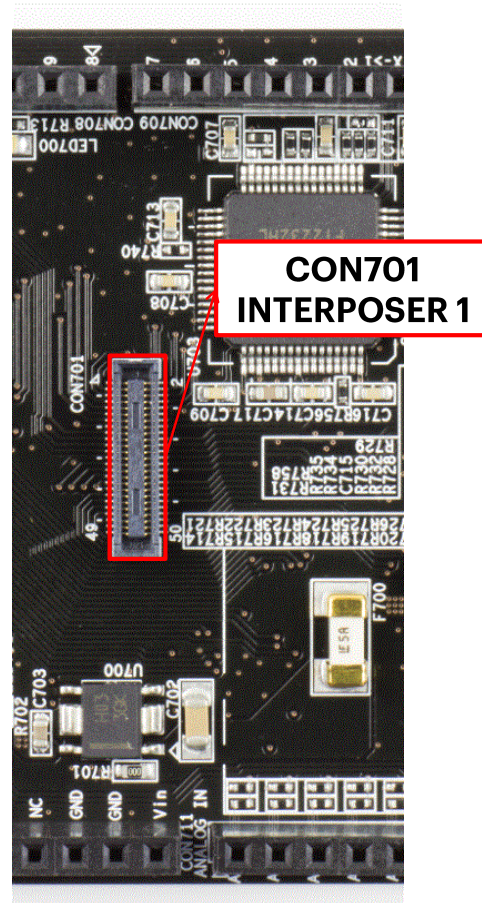


Figure 7. Interposer connector location

When mounting an ARTIK 053 Module on the Starter Board, make certain that you orient the ARTIK 053 Module such that the ARTIK 053 Module Antenna structure is closest to the Samsung ARTIK™ logo located on the Starter Board. See [Figure 5](#) for details.

CON702 HEADER SIGNALS

The following signals as depicted in *Table 3* can be found on connector 702. This connector, together with CON701 connects the ARTIK 053 Module with the Interposer Board.

Table 3. CON702 signal description

Connector CON702 (CON401 on Interposer)			
Pin Name	Description	Pin Name	Description
1	XRESET_N	2	XUART2_TXD
3	XJTAG_TMS	4	XUART2_RXD
5	XJTAG_TDI	6	XUART1_RXD
7	XJTAG_TCK	8	XUART1_TXD
9	XJTAG_TDO	10	GND
11	XJTAG_TRST_N	12	XSPI0_CLK
13	GND	14	XSPI0_MOSI
15	XEINT0	16	XSPI0_CS
17	XEINT2	18	XSPI0_MISO
19	XEINT1	20	GND
21	N19099929 (XRESET_N)	22	XUART0_RX
23	XI2C0_SCL	24	XUART0_TX
25	XI2C0_SDA	26	GND
27	XI2C1_SCL	28	XPWM3_OUT
29	XI2C1_SDA	30	XPWM2_OUT
31	GND	32	XPWM6_OUT
33	XDEBUG_TXD	34	XPWM0_OUT
35	XDEBUG_RXD	36	XPWM1_OUT
37	XADC4	38	XPWM5_OUT
39	XADC5	40	Not Connected
41	Not Connected	42	GND
43	VCC_EXT5P0	44	GND
45	VCC_EXT5P0	46	GND
47	VCC_EXT5P0	48	GND
49	VCC_EXT5P0	50	GND

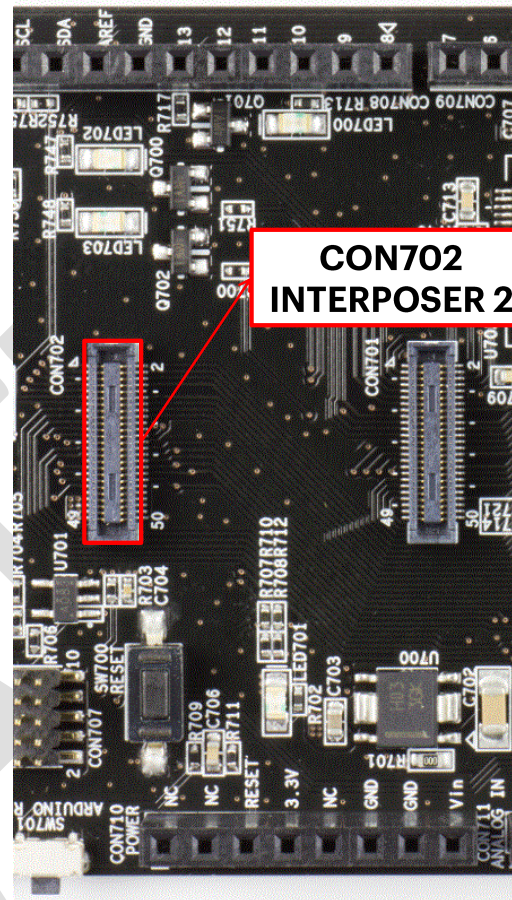


Figure 8. Interposer connector location

When mounting an ARTIK 053 Module on the Starter Board, make certain that you orient the ARTIK 053 Module such that the ARTIK 053 Module Antenna structure is closest to the Samsung ARTIK™ logo located on the Starter Board. See Figure 5 for details.

CON703 HEADER SIGNALS

The following signals as depicted in *Table 4* can be found on header CON703. CON703 together with CON704 are both catch-all connectors providing SPI, PWM, ADC, I²C, UART and GPIO functionality.

Table 4. CON703 header signal description

Header CON703 (Catch-All 1)			
Pin Name	Description	Pin Name	Description
1	XPWM1_OUT	2	VCC_EXT3P3
3	XPWM2_OUT	4	XADC6
5	XPWM3_OUT	6	XADC7
7	XPWM0_OUT	8	XI2C1_SCL
9	XUART1_RXD	10	XI2C1_SDA
11	XUART1_TXD	12	GND
13	XGPIO26	14	VCC_EXT3P3
15	XGPIO25	16	XSPI0_CLK
17	XGPIO24	18	XSPI0_CS
19	XGPIO23	20	XSPI0_MISO
21	XGPIO22	22	XSPI0_MOSI
23	XEINT0	24	GND

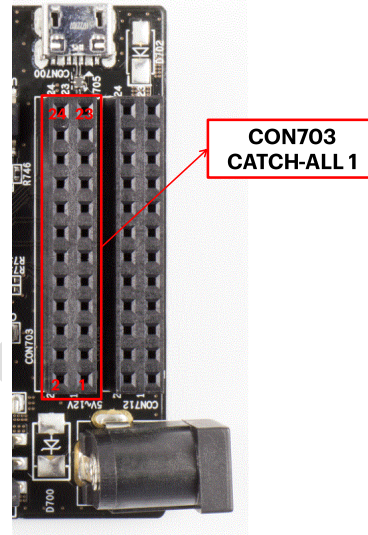


Figure 9. Catch-All 1 connector location

CON704 HEADER SIGNALS

The following signals as depicted in *Table 5* can be found on header CON704. CON704 together with CON703 discussed above are both catch-all connectors providing SPI, PWM, ADC, I²C, UART and GPIO functionality.

Table 5. CON704 header signal description

Header CON704 (Catch-All 2)			
Pin Name	Description	Pin Name	Description
1	XPWM5_OUT	2	VCC_EXT3P3
3	XPWM6_OUT	4	XUART2_RXD
5	XEINT2	6	XUART2_TXD
7	XEINT1	8	XUART3_RXD
9	XGPIO12	10	XUART3_TXD
11	XGPIO10	12	GND
13	XGPIO9	14	VCC_EXT3P3
15	XGPIO11	16	XSPI2_CLK
17	XGPIO8	18	XSPI2_CS
19	XGPIO2	20	XSPI2_MISO
21	XGPIO1	22	XSPI2_MOSI
23	XGPIO3	24	GND

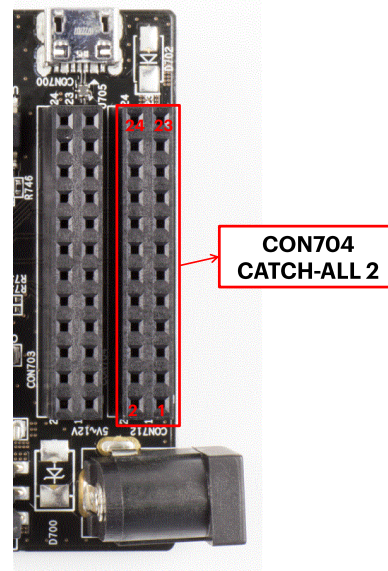


Figure 10. Catch-All 2 connector location

CON705 HEADER SIGNALS

Power to the ARTIK 053 Starter Kit can be sourced from either a USB (default) connector, a 5-12V DC-Jack or an alternate power source like 4x AA batteries. [Table 6](#) shows the correct jumper settings to select each of the power sources.

Table 6 CON705 header signal description

Header CON705 (DC-Jack Control)		
Pin Name	Description	Comment
1	VCC_USB5P0	Use USB Power Source, when Pin 1 is connected to Pin 2 using a jumper.
2	Power Source	Depending on jumper setting, either USB, DC Jack or Battery powered.
3	DC Jack	Use DC Jack Power Source, when Pin 3 is connected to Pin 4 using a jumper.
4	Power Source	Depending on jumper setting, either USB, DC Jack or Battery powered.
5	Battery	User Battery Power Source, when battery is connected to CON706 and Pin 5 is connected to Pin 6 using a jumper.
6	Power Source	Depending on jumper setting, either USB, DC Jack or Battery powered.

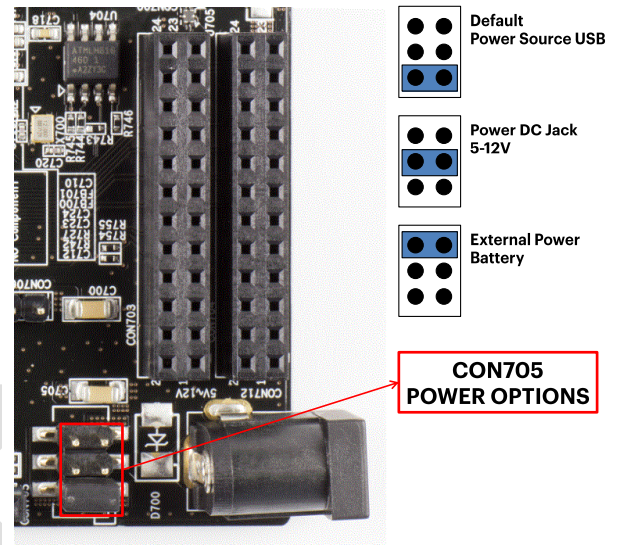


Figure 11. Power settings jumper location

CON706 HEADER SIGNALS

Because Pin 5 and Pin 6 of CON705 are bridged by default with a jumper (see [Figure 11](#)), an external power source can be connected to CON706. [Table 7](#) and [Figure 12](#) show the details.

Table 7 CON706 header signal description

Header CON706 (Battery Power Connector)		
Pin Name	Description	Comment
1	Plus (Circle)	When using Battery power provide 5.6-6.4V. For instance use 4x AA batteries.
2	Ground (Square)	When using Battery power

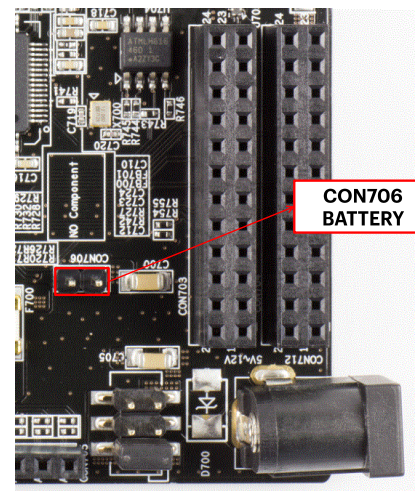


Figure 12. Battery connector location

CON707 HEADER SIGNALS

CON707 provides a JTAG interface that is described in detail in *Table 8* and *Figure 13*. In addition *Figure 14* shows the JTAG to SWD interface cable, available from Adafruit®.

Table 8 CON707 header signal description

Header CON707 (JTAG Header)			
Pin Name	Description	Pin Name	Description
1	VCC_EXT3P3	2	XJTAG_TMS
3	GND	4	XJTAG_TCK
5	GND	6	XJTAG_TDO
7	NC	8	XJTAG_TDI
9	GND	10	XJTAG_TRST_N

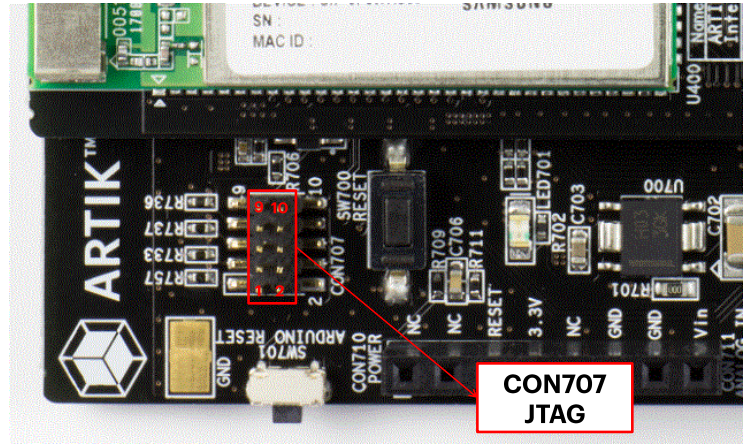


Figure 13. JTAG connector location

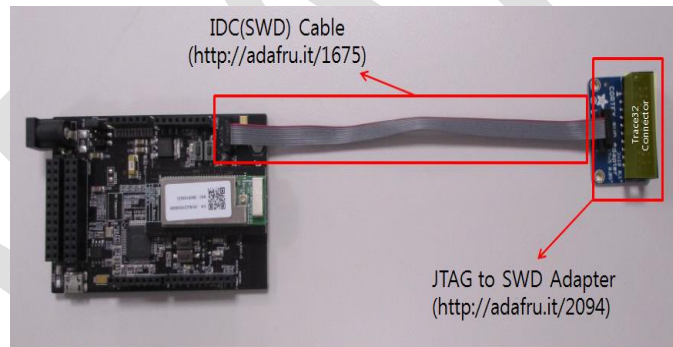


Figure 14. JTAG to SWD adapter

CON708-CON709 HEADER SIGNALS

CON708 and CON709 carry the standard Arduino® interface. Details can be found in [Table 9](#), [Table 10](#) and [Figure 15](#).

Table 9. CON708 header signal description

Header CON708 (Arduino 1)	
Pin Name	Description
1	XGPIO21
2	XPWM5_OUT
3	XSPI1_CSN
4	XSPI1_MOSI
5	XSPI1_MISO
6	XSPI1_CLK
7	GND
8	TP701
9	XI2C0_SDA
10	XI2C0_SCL

Table 10. CON709 header signal description

Header CON709 (Arduino 2)	
Pin Name	Description
1	ARD_XUART0_RX
2	ARD_XUART0_TX
3	XGPIO17
4	XPWM0_OUT
5	XGPIO18
6	XPWM1_OUT
7	XPWM2_OUT
8	XGPIO19

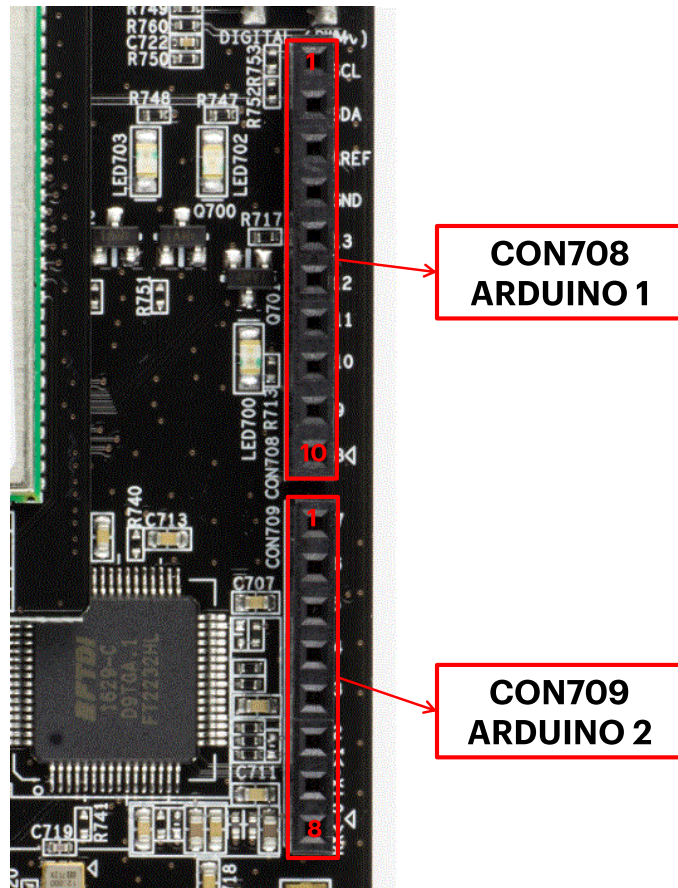


Figure 15. Arduino connectors location

CON710-CON711 HEADER SIGNALS

Table 11. CON710 header signal description

Header CON710 (Reset)	
Pin Name	Description
1	NC
2	NC
3	RESET
4	VCC_EXT3P3
5	NC
6	GND
7	GND
8	NC

Table 12. CON711 header signal description

Header CON711 (ADC)	
Pin Name	Description
1	XADC0
2	XADC1
3	XADC2
4	XADC3
5	XADC4
6	XADC5

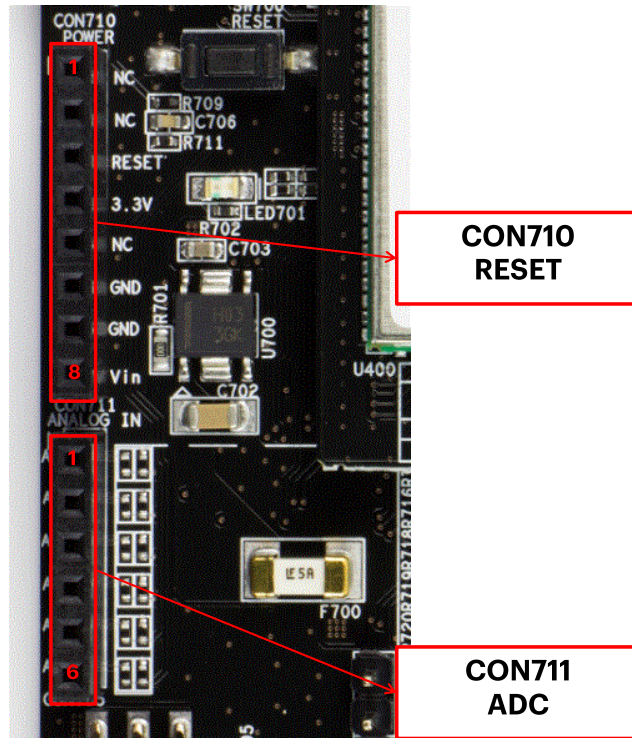


Figure 16. Reset and ADC connector location

CON712 HEADER SIGNALS

Table 13 CON712 header signal description

Header CON712 (DC Jack Connector)		
Pin Name	Description	Comment
1	Plus	When using DC Jack power provide 5V/5A
2	Ground	When using Battery power
3	Ground	When using Battery power

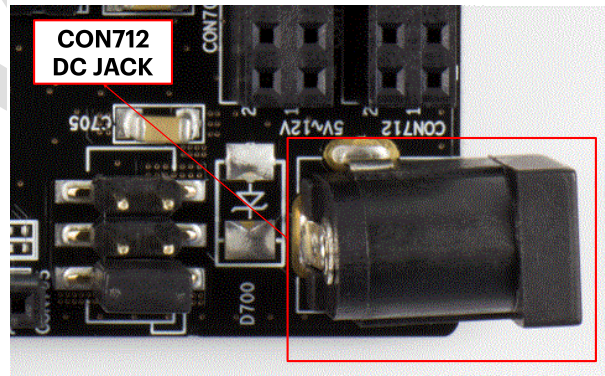


Figure 17. DC Jack connector location

SWITCHES

Table 14. Switch signal descriptions

Switches		
Switch Name	Description	Comment
SW700	Reset Switch	When SW700 is pressed the XRESET_N signal will be low on CON702 (pin:1, pin:21). See Table 3 for more details.
SW701	Reset Switch	This switch provides reset signaling for the Arduino environment. The reset signal is part of CON710. See Table 11 for more details.
SW702	Test LED Switch	When SW702 is pressed, the red LED703 will be activated.
SW703	Test LED Switch	When SW703 is pressed, the Blue LED702 will be activated.

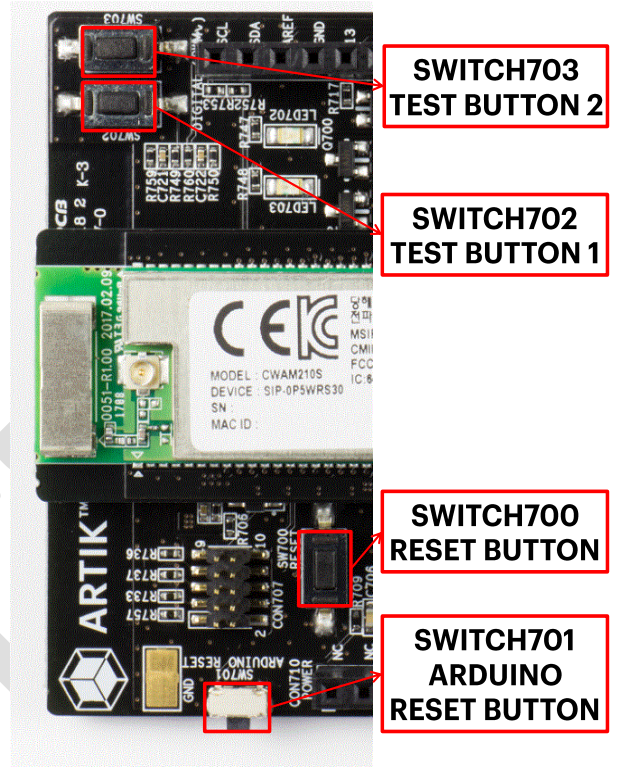


Figure 18. Switches location

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INTERPOSER BOARD HEADER DESCRIPTION

The Interposer Board is the bridge between the Starter Board and the ARTIK 053 Module. CON400 and CON401 located on the Interposer Board are connected to CON701 and CON702 of the Starter Board. On the other side U400 located on the Interposer Board is connected to PAD1 on the ARTIK 053 Module.

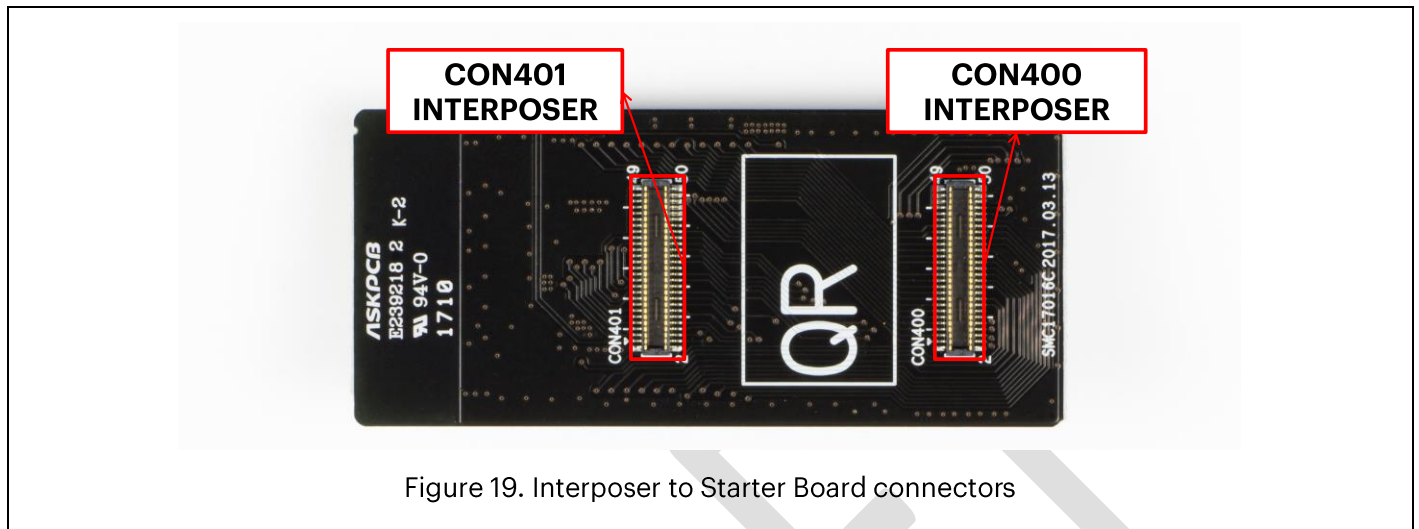


Figure 19. Interposer to Starter Board connectors

Table 15. CON400 signal description

Connector CON400			
Pin Name	Description	Pin Name	Description
1	XGPIO26	2	XSPI1_CSN
3	XGPIO25	4	XSPI1_MOSI
5	XGPIO24	6	XSPI1_CLK
7	XGPIO21	8	XSPI1_MISO
9	XGPIO19	10	GND
11	XGPIO18	12	XGPIO0
13	XGPIO17	14	XGPIO3
15	XGPIO14	16	XGPIO1
17	XGPIO13	18	GND
19	XGPIO16	20	XSPI2_CS
21	XGPIO15	22	XSPI2_CLK
23	XGPIO20	24	XGPIO2
25	GND	26	XSPI2_MOSI
27	XADC0	28	XGPIO8
29	XADC1	30	XSPI2_MISO
31	XADC2	32	GND
33	XADC3	34	XGPIO11
35	GND	36	XGPIO9
37	XGPIO23	38	XGPIO10
39	XGPIO22	40	XGPIO12
41	Not Connected	42	GND
43	Not Connected	44	XUART3_TXD
45	GND	46	XUART3_RXD
47	GND	48	GND
49	GND	50	GND

Table 16. CON401 signal description

Connector CON401			
Pin Name	Description	Pin Name	Description
1	XRESET_N	2	XUART2_TXD
3	XJTAG_TMS	4	XUART2_RXD
5	XJTAG_TDI	6	XUART1_RXD
7	XJTAG_TCK	8	XUART1_TXD
9	XJTAG_TDO	10	GND
11	XJTAG_TRST_N	12	XSPI0_CLK
13	GND	14	XSPI0_MOSI
15	XEINT0	16	XSPI0_CS
17	XEINT2	18	XSPI0_MISO
19	XEINT1	20	GND
21	PWR_RST	22	XUART0_RX
23	XI2C0_SCL	24	XUART0_TX
25	XI2C0_SDA	26	GND
27	XI2C1_SCL	28	XPWM3_OUT
29	XI2C1_SDA	30	XPWM2_OUT
31	GND	32	XPWM6_OUT
33	XDEBUG_TXD	34	XPWM0_OUT
35	XDEBUG_RXD	36	XPWM1_OUT
37	Not Connected	38	XPWM5_OUT
39	Not Connected	40	XPWM4_OUT
41	Not Connected	42	GND
43	DC_5V	44	GND
45	DC_5V	46	GND
47	DC_5V	48	GND
49	DC_5V	50	GND

Table 17, describes signals located on U400 of the Interposer Board, and Table 18 describes signals of PAD1 located on the ARTIK 053 Module. Note that PAD1 will be plugged into U400, but signal names can be different!

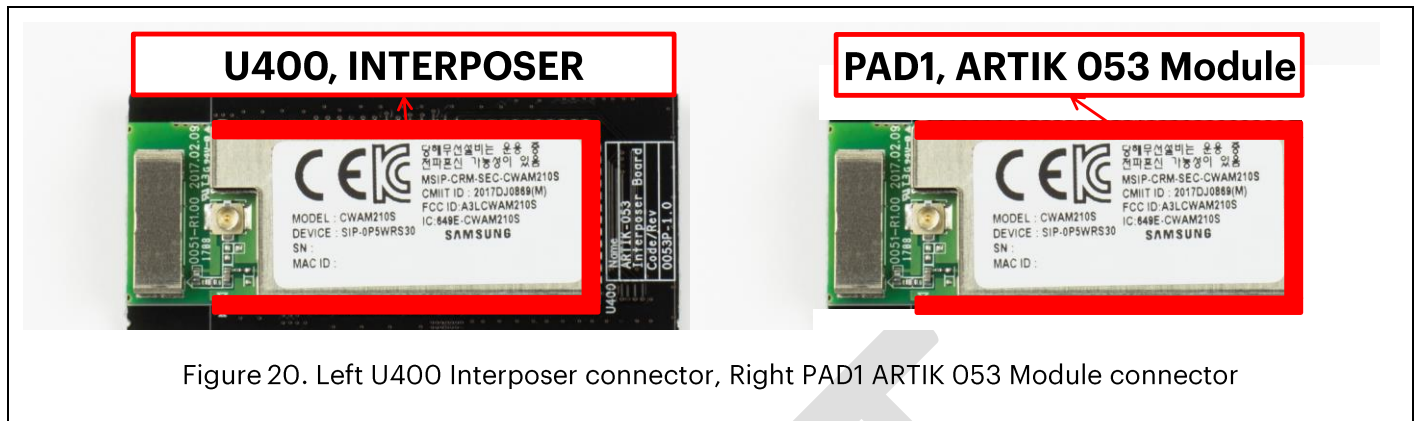


Figure 20. Left U400 Interposer connector, Right PAD1 ARTIK 053 Module connector

Table 17. U400 signal description

Connector U400 (Interposer Board)			
Pin Name	Description	Pin Name	Description
1	GND	2	XGPIO26
3	XGPIO25	4	XGPIO24
5	XGPIO21	6	XGPIO19
7	XGPIO18	8	XGPIO17
9	XGPIO14	10	XGPIO13
11	XGPIO16	12	XGPIO15
13	XGPIO20	14	XADC0
15	XADC1	16	XADC2
17	XADC3	18	XGPIO23
19	XGPIO22	20	GND
21	XRESET_N	22	XJTAG_TMS
23	XJTAG_TDI	24	XJTAG_TCK
25	XJTAG_TDO	26	XJTAG_TRST_N
27	Not Connected	28	XEINT0
29	XEINT2	30	XEINT1
31	PWR_RST	32	DC_5V
33	XI2C0_SCL	34	XI2C0_SDA
35	XI2C1_SCL	36	XI2C1_SDA
37	XDEBUG_TXD	38	XDEBUG_RXD
39	XPWM4_OUT	40	XPWM5_OUT
41	XPWM1_OUT	42	XPWM0_OUT
43	XPWM6_OUT	44	XPWM2_OUT
45	XPWM3_OUT	46	XUART0_TX
47	XUART0_RX	48	XSPI0_MISO
49	XSPI0_CS	50	XSPI0_MOSI
51	XSPI0_CLK	52	XUART1_TXD
53	XUART1_RXD	54	XUART2_RXD
55	XUART2_TXD	56	XUART3_RXD
57	XUART3_TXD	58	XGPIO12
59	XGPIO10	60	XGPIO9
61	XGPIO11	62	XSPI2_MISO
63	XGPIO8	64	XSPI2_MOSI
65	XGPIO2	66	XSPI2_CLK
67	XSPI2_CS	68	XGPIO1
69	XGPIO3	70	XGPIO0
71	XSPI1_MISO	72	XSPI1_CLK
73	XSPI1_MOSI	74	XSPI1_CSN
75	Not Connected	76	GND
77	GND	78	GND
79	GND		

Table 18. PAD1 signal description

Connector PAD1 (ARTIK 053 Module)			
Pin Name	Description	Pin Name	Description
1	GND	2	XGPIO26
3	XGPIO25	4	XGPIO24
5	XGPIO21	6	XGPIO19
7	XGPIO18	8	XGPIO17
9	XGPIO14	10	XGPIO13
11	XGPIO16	12	XGPIO15
13	XGPIO20	14	XADC0AIN_1
15	XADC0AIN_0	16	XADC0AIN_2
17	XADC0AIN_3	18	XGPIO23
19	XGPIO22	20	GND
21	XRESET_N	22	XJTAG_TMS
23	XJTAG_TDI	24	XJTAG_TCK
25	XJTAG_TDO	26	XJTAG_TRST_N
27	3V3_EXT_LDO2	28	XEINT0
29	XEINT2	30	XEINT1
31	PWR_RST	32	DC_5V_12V
33	XI2C0_SCL	34	XI2C0_SDA
35	XI2C1_SCL	36	XI2C1_SDA
37	XDEBUG_TXD	38	XDEBUG_RXD
39	XGPIO28	40	XPWMTOUT_4
41	XPWMTOUT_1	42	XPWMTOUT_0
43	XPWMTOUT_5	44	XPWMTOUT_2
45	XPWMTOUT_3	46	TXD0
47	RXD0	48	XSPI0_MISO
49	XSPI0_CSN	50	XSPI0_MOSI
51	XSPI0_CLK	52	XUART1_TXD
53	XUART1_RXD	54	XUART2_RXD
55	XUART2_TXD	56	XUART3_RXD
57	XUART3_TXD	58	XGPIO12
59	XGPIO10	60	XGPIO9
61	XGPIO11	62	XGPIO6
63	XGPIO8	64	XGPIO7
65	XGPIO2	66	XGPIO4
67	XGPIO5	68	XGPIO1
69	XGPIO3	70	XGPIO0
71	XSPI1_MISO	72	XSPI1_CLK
73	XSPI1_MOSI	74	XSPI1_CSN
75	XGPIO27	76	GND
77	GND	78	GND
79	GND		

ARTIK 053 MODULE HEADER DESCRIPTION

This section provides a high level overview of the ARTIK 053 Module. For more detailed information consult the ARTIK 053 Module Datasheet.

ARTIK 053 MODULE SPECIFICATIONS

The high level specifications of the ARTIK 053 Module are provided in [Table 19](#).

Table 19. ARTIK 053 Module specifications

Processor	
WLAN CPU	ARM® Cortex® R4, 32-bit with 32KB I-Cache and 32KB D-Cache @ 320MHz
Memory	
Embedded ROM	64KB
User Embedded RAM	1280KB 128KB (Shared)
FLASH	8MB SPI FLASH on Module
Security	
Secure Element	Secure point to point authentication and data transfer
Radio	
WLAN	IEEE802.11™ b/g/n 2.4GHz radio
Power Management	
Single Supply	Provides all power of the ARTIK 053 Module using on board bucks and LDO's
Interfaces	
Digital I/O	UART, I ² C, SPI, PWM, ADC, Tick counter and GPIO

ARTIK 053 MODULE EDGE CONNECTOR

The ARTIK 053 Module utilizes 79 signal and ground pins providing all the relevant signaling. *Figure 21* shows how the Edge Connector is oriented and how signal-coordinates are assigned to the edge of the ARTIK 053 Module. *Table 18* describes the relation between the edge coordinates and the signal names.

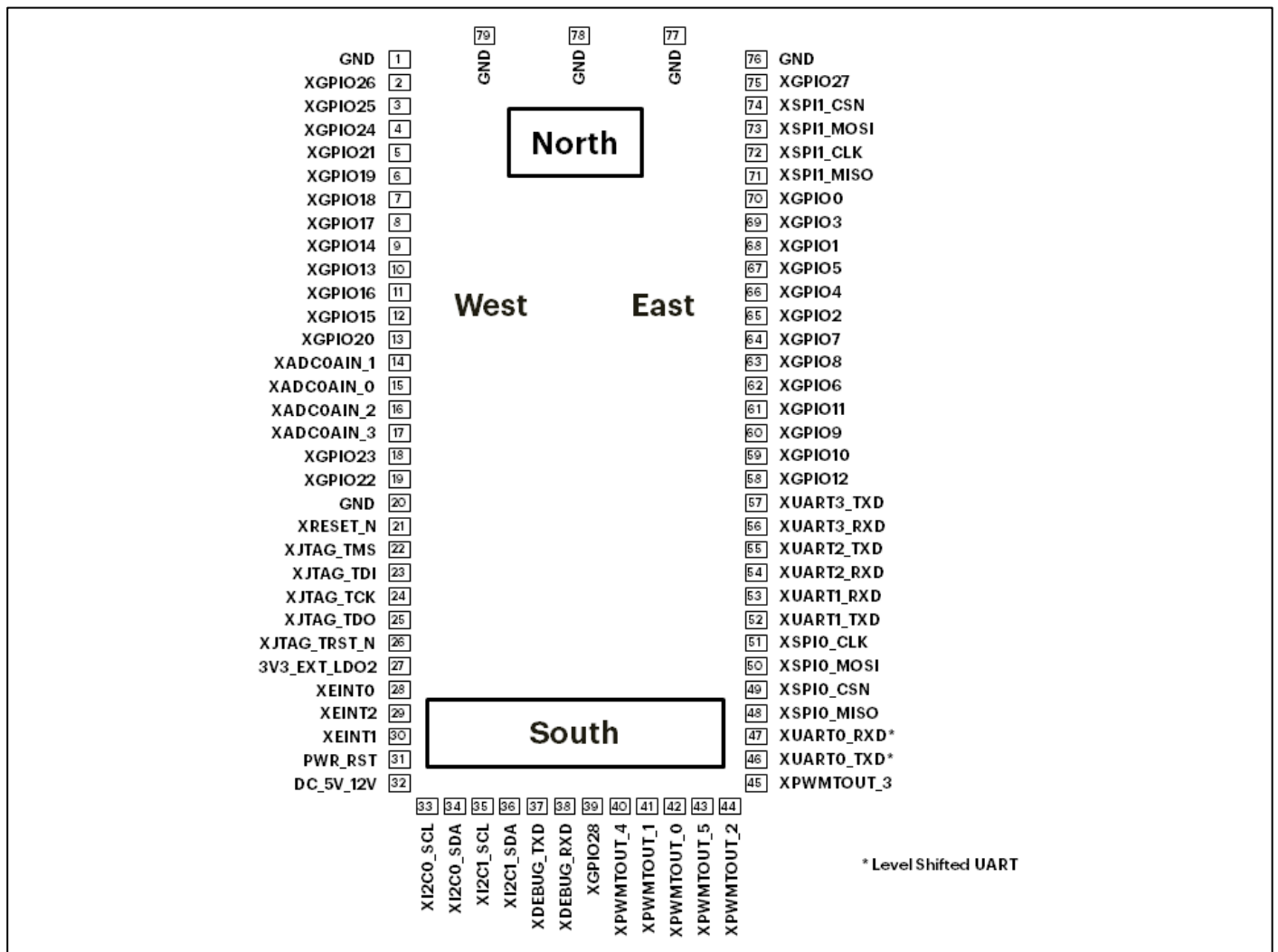


Figure 21. ARTIK 053 Module Edge Connector

ARTIK 053 STARTER KIT BOOTING

This section will describe how to start working with your ARTIK 053 Starter Kit by setting up a connection between your development PC and the ARTIK 053 Starter Kit.

For development purposes the Development machine can be either a Windows® or a Linux® (for instance Ubuntu) environment. In this guide the Windows® path is explained. For further information on developing on a Linux® platform, please consult the ARTIK 053 Software User Guide.

Follow the steps depicted below to setup a connection between the development PC (Windows®) and the ARTIK 053 Starter Kit:

Plug an USB Cable into the ARTIK 053 Starter Kit (CON4, *Figure 5*) and your development PC

Power up the Board

Press Switch 2 (Power Reset)

The USB driver from FTDI will be installed automatically. If not go to the FTDI website at (<http://www.ftdichip.com/FTDrivers.htm>)

If the FTDI driver is installed properly, go to your Windows® device manager to check USB status.



If your ARTIK 053 Starter Kit is recognized, development can start.

Software development for the ARTIK 053 Starter Kit is using the 'OpenOCD' toolkit. For further information on how to start a project using the ARTIK 053 Starter Kit with the 'OpenOCD' development environment, please consult the ARTIK 053 Software User Guide.

HANDLING GUIDE

Precaution against Electrostatic Discharge

When using the ARTIK 053 Starter Kit, ensure that the environment is protected against static electricity:

Contamination

Do not use the ARTIK 053 Starter Kit in an environment exposed to dust or dirt adhesion.

Temperature/Humidity

The ARTIK 053 Starter Kit is sensitive to:

- Environment
- Temperature
- Humidity

High temperature or humidity deteriorates the characteristics of ARTIK 053 Starter Kit, therefore, do not store or use the ARTIK 053 Starter Kit under such conditions.

Mechanical Shock

Do not to apply excessive mechanical shock or force to the ARTIK 053 Starter Kit.

Chemical

Do not expose the ARTIK 053 Starter Kit to chemicals. Exposure to chemicals leads to reactions that deteriorate the characteristics of the ARTIK 053 Starter Kit.

EMS (Electro Magnetic Susceptibility)

Strong electromagnetic waves or magnetic fields may affect the characteristics of the ARTIK 053 Starter Kit during the operation under insufficient PCB circuit design for Electro Magnetic Susceptibility (EMS).

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