Application Note

BMF055 Extension Board – User guide

Bosch Sensortec



Application Note:	BMF055 Extension Board – User guide
Document Revision	1.0
Document Release	October 2015
Document Number	BST-BMF055-AN001-00
Technical Reference	0 273 141 235
Notes	Data in this document are subject to change without notice. Product photos and pictures are for illustration purposes only and may differ from the real product's appearance.



Contents

1	Pref	ace	3
2	Con	ponents	.4
	2.1	Power	5
	2.2	Arduino	5
	2.3	Customization	5
3	Nec	essary Connections	. 6
	3.1	Shuttle board	6
	3.2	Power	6
	3.3	Power jumper	6
	3.4	Programmer/ debugger connection	6
4	Con	nections for Reference Examples	. 7
5	Qui	ck Setup for Reference Examples	. 8
	5.1	Software and Extensions	8
	5.2	Hardware	8
	5.3	Run the Project	9
	5.4	Check the Use-case	9
6	BMF	055 Shuttle Board	11
	6.1	Power	12
	6.2	Programming/ Debugging	12
7	Refe	rences	13
8	Leg	al disclaimer	14
	8.1	Engineering samples	14
	8.2	Product Use	14
	8.3	Application Examples and Hints	14
9	Doc	ument History and Modifications	15

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015

[©] Bosch Sensortec GmbH reserves all rights even in the event of industrial property rights. We reserve all rights of disposal such as copying and passing on to third parties. BOSCH and the symbol are registered trademarks of Robert Bosch GmbH, Germany. Note: Specifications within this document are subject to change without notice.



1 Preface

This document is a user guide to setup the BMF055 application board. It describes the modules on the board and shows the necessary connections to program the chip and run the reference examples provided by Bosch Sensortec. The examples can be downloaded on Atmel Gallery.

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015



2 Components

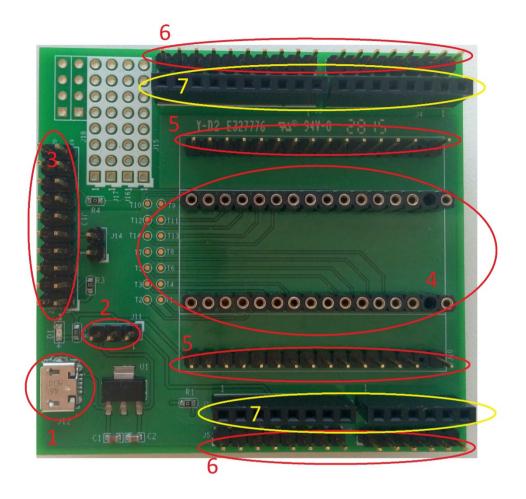


Figure 1 - BMF055 application board's compinents

- 1-USB Power Connecter
- 2 Power source selection pins (USB/ Arduino)
- 3 Programmer/ Debugger JTAG Connector
- 4 BMF055 shuttle board connector
- 5 Customization pins connected to shuttle board connector
- 6 Customization pins connected to Arduino pins
- 7 Arduino Connector

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015

Bosch Sensortec



2.1 Power

The board can be powered either via a USB cable or an Arduino board. In the former case a jumper should connect pins number 2 and 3 of the power source selection pins. In the latter case a connection between pins 1 and 2 are required.

2.2 Arduino

BMF055 application board can be connected to an Arduino board as a shield. The male connectors at the bottom side provide this possibility. As shown in Figure 2 further shields can also be connected to the female connectors.



Figure 2 - Connected to Arduino UNO and another shield

2.3 Customization

The only connections to the Arduino and Shuttle board connectors on the board are VDD and GND. The other pins are left unconnected so that users can customize how they desire. There are the two sets of male connectors available on the board: The inner set (Number 5 in Figure 1) is connected to the shuttle board pins in a one-to-one manner and the outer one (Number 6 in Figure 1) is connected to the Arduino pins in the same manner. These connectors can be used for the customization.



3 Necessary Connections

3.1 Shuttle board

The BMF055 shuttle board should be plugged in to the socket on the application board in a way that pin number 1 of the shuttle is connected to the pin number 1 of the socket.

3.2 Power

Either a USB connection or a connection to an Arduino board is required to provide power for the board.

3.3 Power jumper

If the application board's power is provided by an Arduino board the jumper J11 must connect pins number 1 and 2.

Otherwise, if a USB cable provides the power, the jumper J11 must connect pins number 3 and 2.

3.4 Programmer/ debugger connection

To program the microcontroller in BMF055 a programmer/ debugger is required. The board has a standard JTAG connector to for this purpose.



4 **Connections for Reference Examples**

In the reference examples provided by BST, the chip uses a USART interface to communicate to a host computer or another MCU. It receives commands and sends messages via USART. The pin assignment is given in Table 1.

Table	1 -	USART	Pin	Assignment
-------	-----	-------	-----	------------

Shuttle Board Pin #	Description	
17	Tx	
18	Rx	

Figure 3 shows the necessary connections to power-on and program the sensor to run all reference examples. For more information refer to the examples' application notes.

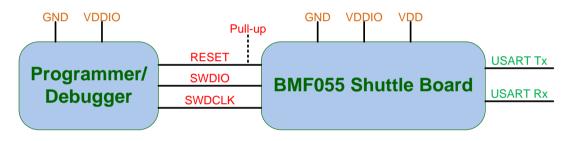


Figure 3 - Minimum Necessary Connections



Figure 4 - Necessary connections to run reference examples

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015



5 Quick Setup for Reference Examples

This chapter gives step by step instructions on how to start running this example on a BMF055 Shuttle Board.

5.1 Software and Extensions

- 1. Install the latest version of Atmel Studio from Atmel website
 - Open Atmel Studio
- 2. Go to "Tools -> Extension Manager" and install the latest version of Atmel Software Framework (Version used in this extension is 3.26.0)
- 3. Go to "Tools -> Extension Manager" and search for "BMF055 Shuttle Board *[Example]*" extension from Bosch Sensortec GmbH (BST) and install it
- 4. Go to "Tools -> Extension Manager" and search for "Terminal for Atmel Studio" extension from Atmel and install it (It is not necessary to install this extension if you are going to use another terminal software)
- 5. Restart Atmel Studio
- 6. Go to "File -> New -> Example Projects"
- 7. "Below BST Bosch Sensortec GmbH" find the project named "BMF055_SHUTTLE_BOARD_[EXAMPLE] – atsamd20j18a"
- 8. Select it and press "OK" button
- 9. Read and accept the license agreement and press "Finish" button to create a new example project

5.2 Hardware

- 10. Establish the minimum necessary connections; including power, reset and programmer/debugger.
- 11. Establish a USART connection between the shuttle board and a host computer^{*}. Use bridges if necessary.
- 12. Install required drivers for your virtual COM port.
- 13. Go to "Start Menu -> Control Panel -> Device Manager"
- 14. Below "Ports (COM and LPT)" find the virtual COM port that you are going to use and note the COM Port Number
- 15. In Atmel Studio go to "Project -> Properties" and select the tab named "Tool"

^{*} It is assumed that the shuttle board would be interfaced to a terminal software running on a host computer.

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015

[©] Bosch Sensortec GmbH reserves all rights even in the event of industrial property rights. We reserve all rights of disposal such as copying and passing on to third parties. BOSCH and the symbol are registered trademarks of Robert Bosch GmbH, Germany.



16. Below "Selected debugger/programmer" select the "SAM-ICE" tool. And select "SWD" as the interface and save the changes.

5.3 Run the Project

17. In Atmel Studio to "Build -> Build Solution"

The build process should succeed with no errors or warnings. (Figure 5)

- 18. Go to "Debug -> Start Without Debugging" (Figure 6)
- 19. Wait for the process to be done.

(Notice the "Ready" message below, on the status bar)

20. Run and connect the required software (e.g. Terminal) on the host computer if required

5.4 Check the Use-case*

21. Check the application as explained in the example's application note.

RMF055_EMPTY_PROJECT - AtmelStudio					
<u>File Edit View VAssistX ASF Project Buil</u>	ld <u>D</u> ebug <u>T</u> ools <u>W</u> indow <u>H</u> elp				
🗄 • 🔁 🖼 • 📂 🚽 🗿 🔏 🛍 🛗	Build Solution	F7	👂 Part of BMF055 Data Stream Pro 🗸 🖓 😭 🛃 🍰 🖬 🗸 💷 🛫 🍦 🛱 🚝 🚆		
! 🗑 🗁 🎇 🍋 음 염 🗛 💑 🎬 🚽 🕅	Rebuild Solution	Ctrl+Alt+F7	🖕 i 🐼 🖂 📖 📮 i 🎬 🚟 🚵 🖕 i 📟 ATSAMD20J18 🍟		
	Clean Solution		Solution Explorer 🛛 👻 🕂 🗙		
	Build BMF055_EMPTY_PROJECT				
	Rebuild BMF055_EMPTY_PROJECT		Solution 'BMF055_EMPTY_PROJECT' (1 proje		
	Clean BMF055_EMPTY_PROJECT		a 📙 BMF055_EMPTY_PROJECT		
	Configuration Manager		 Image: Image: Ima		
	Compile	Ctrl+F7	▷ i i i i i i i i i i i i i i i i i i i		
			⊳ 🛅 src		
			< III >		
			🔍 ASF 🥌 VA Vi 📫 VA O 🏹 Solut		
Output			- - ↓ ×		
Show output from: Build	a a. (a -	x 🔹 🖃			
Done building target "CoreBuild" in p			*		
Target "PostBuildEvent" skipped, due	to false condition; ('\$(PostBui	ldEvent)' != '	'') was evaluated as ('' != ''). on.targets" from project "C:\Users\meo7rt.DE\Desktop\Ku_BSDK		
Done building target "Build" in proje	ect "BMF055_EMPTY_PROJECT.cproj"		Jn. Largets from project C: \users\meo/rt.DE\Uesktop\ku_bsbk		
Done building project "BME055 EMPTY P	PROJECT.cproj".				
Build succeeded.					
============= Rebuild All: 1 succeeded,	0 failed, 0 skipped =====		*		
<			Þ		
📸 Error List 📃 Output					
Ready			Ln 169 Col 52 Ch 52 INS!		

Figure 5 - Build Project

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015

^{*} For detailed information refer to **Error! Reference source not found.**

[©] Bosch Sensortec GmbH reserves all rights even in the event of industrial property rights. We reserve all rights of disposal such as copying and passing on to third parties. BOSCH and the symbol are registered trademarks of Robert Bosch GmbH, Germany. Note: Specifications within this document are subject to change without notice.



BMF055 EMPTY PROJECT - AtmelStudio				
File Edit View VAssistX ASF Project Build	Deb	ug Tools Window Help		
	DED	Windows	•	irt of BMF055 Data Stream Pro 📲 💀 🚰 🎫 🍰 💋 💌 🚦 🏥 🛱
: 🖸 🗁 🦝 🕾 음 음 아. 🔬 🗟 🕂 🚧 🗴	Þ 11	Start Debugging and Break	Alt+F5	💭 🔤 🗐 📮 🗄 📇 📥 📮 📜 🛲 ATSAMD20J18 🚆
	Ď	Attach to Target		Solution Explorer 🔷 🕂 🗙
		Stop Debugging	Ctrl+Shift+F5	
		Start Without Debugging	Ctrl+Alt+F5	Solution 'BMF055_EMPTY_PROJECT' (1 proje
		Disable debugWIRE and Close		BMF055_EMPTY_PROJECT (1 proje
		Continue	F5	Dependencies
	-	Execute Stimulifile		> 📴 Output Files
	÷	Set Stimulifile		 Libraries Src
		Restart		
	63	QuickWatch	Shift+F9	
	SI	Step Into	F11	
	Ç⊒	Step Over	F10	
	≥	Step Out	Shift+F11	
	*3	Run To Cursor	Ctrl+F10	< >
	Î	Reset	Shift+F5	🔍 ASF 🤎 VA Vi 😤 VA O 🙀 Solut
Output		Percepio Trace	•	• # ×
Show output from: Build		Toggle Breakpoint	F9	
Done building target "CoreBuild" in pro		New Breakpoint	•	A
Target "PostBuildEvent" skipped, due to Target "Build" in file "C:\Program File		Delete All Breakpoints	Ctrl+Shift+F9	<pre>was evaluated as ('' != ''). argets" from project "C:\Users\meo7rt.DE\Desktop\Ku_BSDK</pre>
Done building target "Build" in project		Clear All DataTips		
Done building project "BMF055_EMPTY_PRO		Export DataTips		
Build succeeded. ======== Rebuild All: 1 succeeded, 0		Import DataTips		
======== Rebuild All: 1 Succeeded, 0		Options and Settings		•
<	-			
📸 Error List 📃 Output				
Ready				Ln 169 Col 52 Ch 52 INS!

Figure 6 - Start without Debugging

BST -BMF055 -AN 001-00 | Revision 1.0 | October 2015



6 BMF055 Shuttle Board

Bosch Sensortec BMF055 shuttle board is a PCB with a BMF055 Orientation Sensor mounted on it. It has the required decoupling capacitors, an external 32 KHz crystal and its load capacitors and allows easy access to the sensors pins via a simple socket.

Pin No.	Pin Name	BMF055 Pin Connected	SAMD20 Pin Connected	Description
1	VDD	3		VDD
2	VDDIO	28	-	VDDIO
3	GND	2, 25	-	GND
4	MISO	-	-	DNC
5	MOSI	-	-	DNC
6	SCK	-	-	DNC
7	CS	-	-	DNC
8	IO5/INTA	6	PB00	GPIO
9	100	5	PB01	GPIO
10	COD_GND	-	-	DNC
11	COD_GND	-	-	DNC
12	COD_GND	-	-	DNC
13	COD_GND	-	-	DNC
14	IO1	4	PB02	GPIO
15	102	16	PA22	GPIO
16	103	15	PA23	GPIO
17	SDA	20	PB16	GPIO
18	SCL	19	PB17	GPIO
19	108	11	RESET	RESET
20	INTB/IO6	10	PA28	GPIO
21	INTC/IO7	14	PA24	GPIO
22	104	17	PA21	GPIO
23	COD_GND	-	-	DNC
24	COD_PULL	-	-	DNC
25	COD_GND	-	-	DNC
26	COD_GND	-	-	DNC
27	COD_PULL	-	-	DNC
28	COD_PULL	-	-	DNC
29	SWCLK	8	PA30	Debugging CLK
30	SWDIO	7	PA31	Debugging IO

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015

Bosch Sensortec

© Bosch Sensortec GmbH reserves all rights even in the event of industrial property rights. We reserve all rights of disposal such as copying and passing on to third parties. BOSCH and the symbol are registered trademarks of Robert Bosch GmbH, Germany.



The shuttle board can be plugged into Bosch Sensortec development tools, custom designed boards or breadboards.

6.1 Power

BMF055 has two distinct power supply pins:

- VDD is the main power supply for the internal sensors
- VDDIO is a separate power supply pin used for the supply of the MCU and the digital interfaces

The voltage supply range for VDD is 2.4V to 3.6V and for VDDIO is 1.7V to 3.6V.

For the switching sequence of power supply VDD and VDDIO it is mandatory that V_{DD} is powered on and driven to the specified level before or at the same time as V_{DDIO} is powered ON. Otherwise there are no limitations on the voltage levels of both pins relative to each other, as long as they are used within the specified operating range.

6.2 **Programming/ Debugging**

Programming and debugging of the chip is done Serial Wire Debug Interface available. Any debugger that supports the interface can be used. (e.g Atmel SAM-ICE)



7 References

Atmel-42129-SAM-D20_Datasheet

http://www.atmel.com/Images/atmel-42129-sam-d20_datasheet.pdf

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015



8 Legal disclaimer

8.1 Engineering samples

Engineering Samples are marked with an asterisk (*) or (e) or (E). Samples may vary from the valid technical specifications of the product series contained in this data sheet. They are therefore not intended or fit for resale to third parties or for use in end products. Their sole purpose is internal client testing. The testing of an engineering sample may in no way replace the testing of a product series. Bosch Sensortec assumes no liability for the use of engineering samples. The Purchaser shall indemnify Bosch Sensortec from all claims arising from the use of engineering samples.

8.2 **Product Use**

Bosch Sensortec products are developed for the consumer goods industry. They may only be used within the parameters of this product data sheet. They are not fit for use in life-sustaining or security sensitive systems. Security sensitive systems are those for which a malfunction is expected to lead to bodily harm or significant property damage. In addition, they are not fit for use in products which interact with motor vehicle systems.

The resale and/or use of products are at the purchaser's own risk and his own responsibility. The examination of fitness for the intended use is the sole responsibility of the Purchaser.

The purchaser shall indemnify Bosch Sensortec from all third party claims arising from any product use not covered by the parameters of this product data sheet or not approved by Bosch Sensortec and reimburse Bosch Sensortec for all costs in connection with such claims.

The purchaser must monitor the market for the purchased products, particularly with regard to product safety, and inform Bosch Sensortec without delay of all security relevant incidents.

8.3 Application Examples and Hints

With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Bosch Sensortec hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights or copyrights of any third party. The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. They are provided for illustrative purposes only and no evaluation regarding infringement of intellectual property rights or copyrights or regarding functionality, performance or error has been made.



9 Document History and Modifications

Rev. No.	Chapter	Description of Modification/ Changes	Date
1.0		Document Created	07.10.2015

Bosch Sensortec GmbH Gerhard-Kindler-Strasse 8 72770 Reutlingen/ Germany

contact@bosch-sensortec.com www.bosch-sensortec.com

Modifications reserved | Printed in Germany Specifications subject to change without notice

BST-BMF055-AN 001-00 | Revision 1.0 | October 2015

Bosch Sensortec

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Bosch:

0330.SB5-235 BMF055 Breakout Board BM055 SHUTTLE BOARD BMF055 SHUTTLE BOARD