BMI

Boot Mode Index

XMC™ microcontrollers
September 2016

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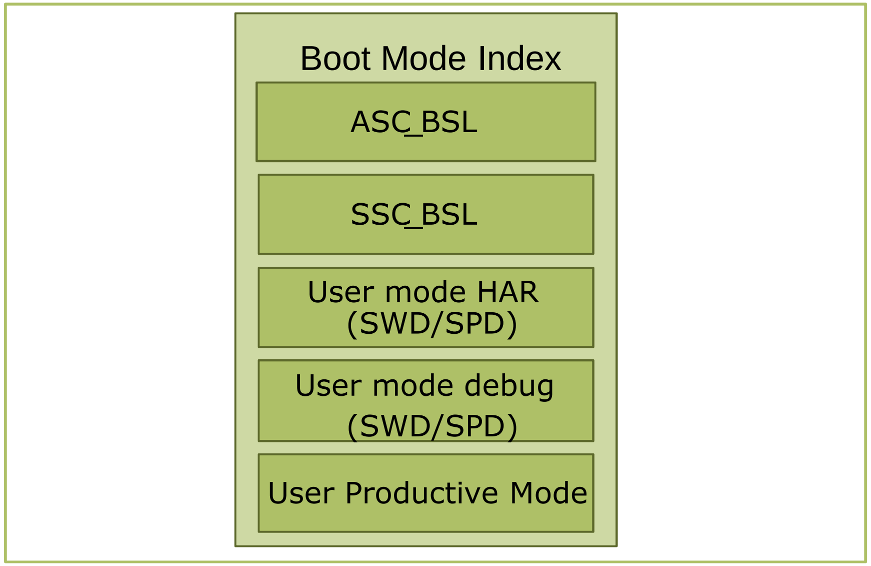

Boot Mode Index

ASC_BSL

SSC_BSL

User mode HAR (SWD/SPD)

User mode debug (SWD/SPD)

User Productive Mode

Highlights

The BMI value determines the start-up mode and debug configuration of the XMC1000. Bootstrap modes via UART or SPI as well as single pin debug or SWD are supported. Setting the BMI to "User Productive Mode" disables all interfaces to safeguard the XMC1000 against external accesses.

Key features

- Start-up mode selection requires no pins
- BMI change supported by ROM routine

Customer benefits

- More pins available for customer application usage
- Easy change of BMI through customer application code

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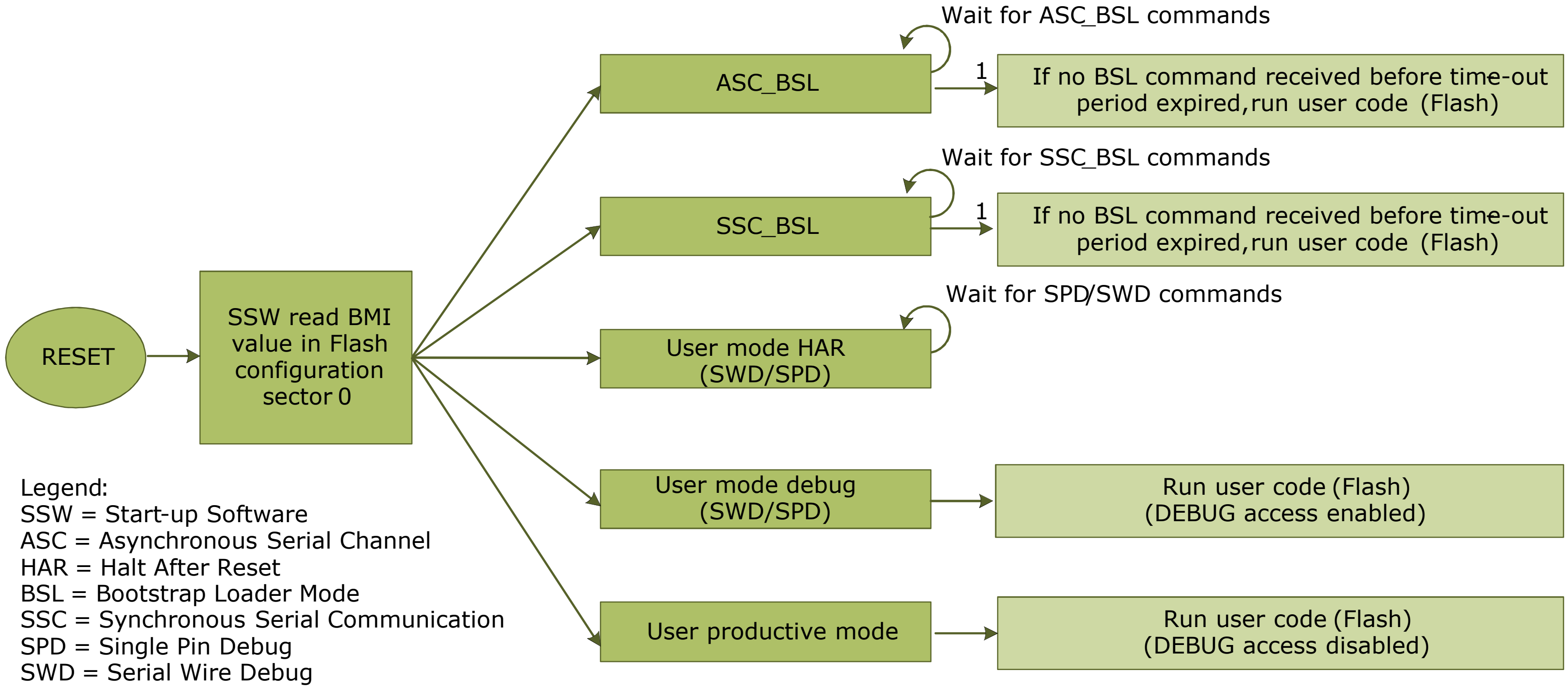
BMI
Start-up mode selection requires no pins

- The start-up mode depends on the value of the BMI value stored in the internal flash; no pin for selection is required
- Factory default start-up mode is the UART Bootstrap Loader (ASC_BSL)



RESET

SSW read BMI value in Flash configuration sector 0

ASC_BSL

Wait for ASC_BSL commands

1

If no BSL command received before time-out period expired, run user code (Flash)

SSC_BSL

Wait for SSC_BSL commands

1

If no BSL command received before time-out period expired, run user code (Flash)

User mode HAR (SWD/SPD)

Wait for SPD/SWD commands

User mode debug (SWD/SPD)

Run user code (Flash) (DEBUG access enabled)

User productive mode

Run user code (Flash) (DEBUG access disabled)

Legend:
SSW = Start-up Software
ASC = Asynchronous Serial Channel
HAR = Halt After Reset
BSL = Bootstrap Loader Mode
SSC = Synchronous Serial Communication
SPD = Single Pin Debug
SWD = Serial Wire Debug

Note: 1) for BSL with time-out mode

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BMI
BMI change supported by ROM routine

- BMI programing is supported by a ROM routine located at 0x00000108 and can be accessed in the following way:

```
#define _BmiInstallationReq (0x00000108)
#define XMC1000_BmiInstallationReq (*((unsigned long (**)
(unsigned short)) _BmiInstallationReq))
XMC1000_BmiInstallationReq(0xFFC0); // BMI = ASC_BSL
```

Start-up mode	Pins used	BMI value
ASC Bootstrap Load Mode (ASC_BSL)	P0.14/P0.15 or P1.3/P1.2	0xFFC0
User Mode (Productive)	-	0xF8C1
User Mode (Debug) SWD0	P0.14/P0.15	0xF8C3
User Mode (Debug) SWD1	P1.3/P1.2	0xFAC3
User Mode (Debug) SPD0	P0.14	0xF9C3
User Mode (Debug) SPD1	P1.3	0xFBC3
User Mode (HAR) SWD0	P0.14/P0.15	0xF8C7
User Mode (HAR) SWD1	P1.3/P1.2	0xFAC7
User Mode (HAR) SPD0	P0.14	0xF9C7
User Mode (HAR) SPD1	P1.3	0xFBC7

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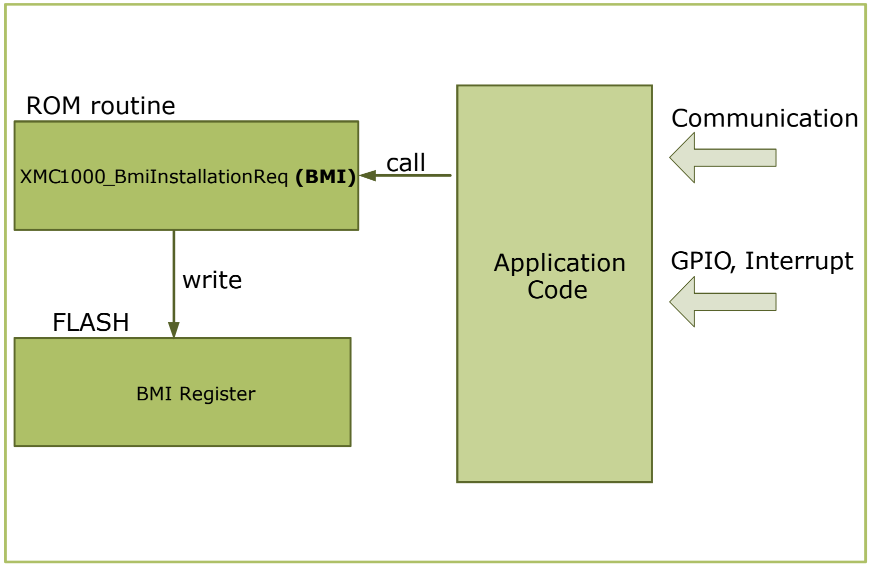

- Target applications
  - Motor control
  - Intelligent lighting
  - Power conversion
  - Human machine interface
  - Touch sense
  - Connectivity
  - General purpose

XMC1100	XMC1200	XMC1300
●	●	●

During mass production stage, the device will most probably programmed to “Productive mode” for flash protection of the application code.

For field update of the flash content the “Productive mode” can be changed back to another start-up mode by the application code at any time.

E.g. the application code could provide a feature for changing the BMI back to ASC_BSL mode when receiving a special command via UART or triggered by an external signal via a GPIO pin.

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Application examples
Use cases of the start-up modes

Start-up mode

- Bootstrap Loader mode (ASC_BSL, SSC_BSL)
- User mode with debug enabled (UMD)
- User mode with debug enabled and Halt After Reset (UMHAR)
- User Productive Mode (UPM)

Use case

- Allows easy and quick programming/erasing of the flash by code downloaded into the SRAM via UART or SPI
- The user code is executed after power-up. A debugger can connect to the device at any time via SWD or SPD
- **SWD** is a standard debug protocol for ARM® Cortex™ microcontrollers
- **SPD** is Infineon propriety debug protocol allowing Single Pin Debug
- User code execution in flash must be started by the debugger
- Flash protection scheme. Debugger cannot connect to device and access the Flash content

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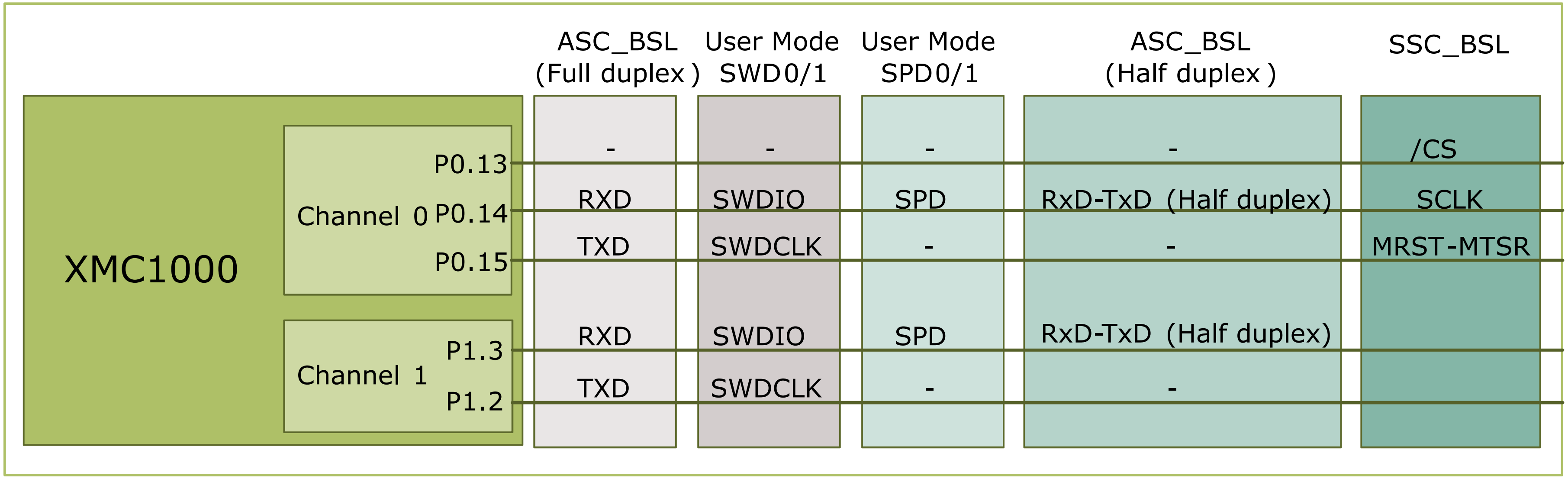
BMI
Programming and debugging pin

- Two sets of pins available for programming and debugging:
  - Channel 0 supports all start-up modes including SSC_SCL
  - Channel 1 supports full and half duplex ASC_BSL, SWD and SPD



			ASC_BSL (Full duplex)	User Mode SWD0/1	User Mode SPD0/1	ASC_BSL (Half duplex)	SSC_BSL
XMC1000	Channel 0	P0.13	-	-	-	-	/CS
		P0.14	RXD	SWDIO	SPD	RxD-TxD (Half duplex)	SCLK
		P0.15	TXD	SWDCLK	-	-	MRST-MTSR
	Channel 1	P1.3	RXD	SWDIO	SPD	RxD-TxD (Half duplex)	
		P1.2	TXD	SWDCLK	-	-	

BMI
User Productive Mode (1/2)

- BMI=0xF8C1
- This mode should only be used if the user has confirmed that the code is **FULLY TESTED** and **NO MORE MODIFICATION** of code is required
- After changing to “User Productive Mode” and a new power-up the user code will start to run at the address contained at the flash location 0x10001004
- “User Productive Mode” provides indirectly MEMORY PROTECTION by not allowing external tools, e.g. debugger and Flash Programming Tools to access (read/write) the device

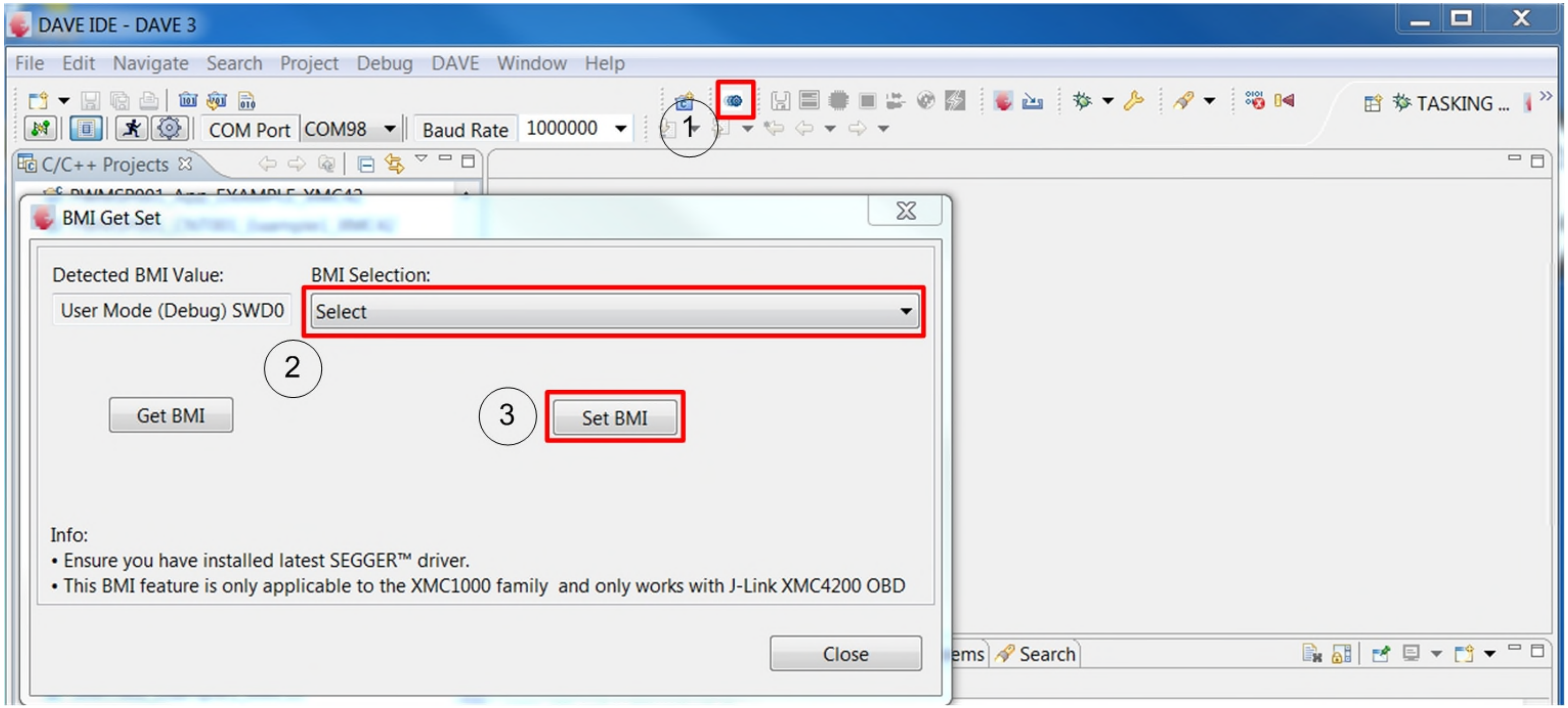
BMI
User Productive Mode (2/2)

- There is no external access to the device once it is programmed to “User Productive Mode”, unless there is a **specific routine** already ***embedded in user code***
- This **specific routine** has to be called under ***user-defined conditions***, e.g. via interrupt or GPIO pins latch values
- The **specific routine** calls the XMC1000_BmiInstallationReq(new BMI) routine to re-program a new BMI value
- For **code protection** purpose, changing from “User Productive Mode” and any other mode, the start-up software will erase the full flash of the device and re-install the default BMI -> ASC_BSL (UART-BSL). Hence, user needs to call the BMI re-programming routine again via the UART-BSL mode if that is not the desired start-up mode

BMI
Using DAVE™ to program BMI value

› From DAVE™ v3.1.8 onward, there is a BMI handling utility for user to read the BMI and set the BMI of XMC1000 device

› This BMI handling utility only works with XMC1000 Boot Kit



Detected BMI Value: User Mode (Debug) SWD0

BMI Selection: Select

Info:
- Ensure you have installed latest SEGGER™ driver.
- This BMI feature is only applicable to the XMC1000 family and only works with J-Link XMC4200 OBD

BMI
Additional note on programming the BMI value

- The default boot mode for XMC1000 device is UART-BSL mode
- A master reset will be executed after BMI value is updated
  Switching off the supply voltage before Master reset happen
  will cause the BMI value to change to default BMI -> ASC_BSL
- The VDDP should keep stable at operating voltage of XMC1000 during the programming of BMI value. The time taken from calling the XMC1000_BmiInstallationReq(new BMI) routine till the BMI value is changed after the master reset is about 10 msec @ MCLK 8 MHz

Support material

Collaterals and Brochures Document Info	› Product Briefs › Selection Guides › Application Brochures › Presentations › Press Releases, Ads	› www.infineon.com/XMC
Technical Material Tools Evaluation Board	› Application Notes › Technical Articles › Simulation Models › Datasheets, MCDS Files › PCB Design Data	› www.infineon.com/XMC › Kits and Boards › DAVE™ › Software and Tool Ecosystem
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