Tooling - Boot mode options XMC4000

XMC™ microcontrollers
July 2016

Agenda

1	Boot mode options overview
2	ACS and CAN bootstrap loader
3	8 boot modes
4	System integration
5	Boot mode options

Agenda

1 Boot mode options overview
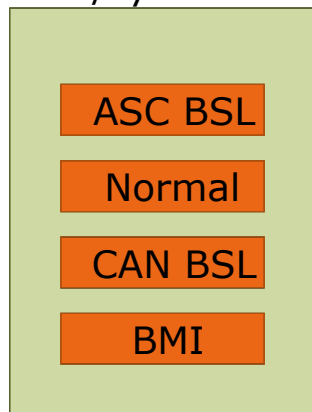
2 ACS and CAN bootstrap loader
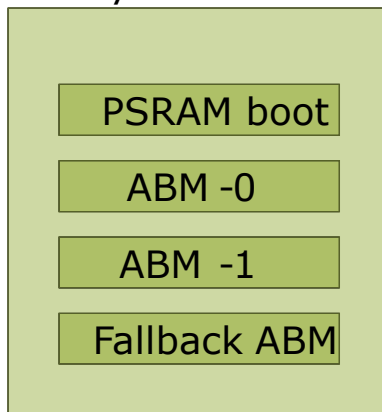
3 8 boot modes

4 System integration

5 Boot mode options

Boot mode options

Boot modes for PORST/system reset

- ASC BSL
- Normal
- CAN BSL
- BMI

Boot modes for system reset

- PSRAM boot
- ABM -0
- ABM -1
- Fallback ABM

Note: PORST means power-on reset

Highlights

XMC4000 device uses TCK and TMS to select the boot mode after RESET (PORST). For system reset, it supports ASC BSL, Normal booting, CAN BSL, Boot Mode Index (BMI), PSRAM boot, two Alternative boot modes and a Fallback ABM boot mode.

Key features

ASC and CAN Bootstrap Loader

8 Boot Modes

Customer benefits

› Allows to transfer user code into the internal RAM for e.g. flash programming via UART or CAN

› Allows user application code or boot code to run at user specified locations in Flash after system reset

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Boot mode options
ASC and CAN bootstrap loader

› XMC4000 has a built-in Bootstrap Loading (BSL) mechanism that can be used for Flash programming

› After power-on reset XMC4000 will enter boot mode based on the boot pins (TCK pin and TMS pin) voltage level which will be latch to HWCON[1:0] (TMS is inverted)

› User can write to STCON.SWCON register which determines the boot mode after a system reset

TCK	TMS	HWCON[1:0]	SWCON[3:0]	Boot mode
0	1	00	0000	Normal
0	0	01	0001	ASC BSL
1	1	10	0010	BMI
1	0	11	0011	CAN BSL
-	-	-	0100	PSRAM boot
-	-	-	1000	ABM-0
-	-	-	1100	ABM-1
-	-	-	1110	Fallback ABM

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Boot mode options
8 boot modes (1/2)

Start-up mode	Use case
› Bootstrap loader mode (ASC_BSL, CAN_BSL) › Normal boot mode › Alternative boot mode – Address0 (ABM-0) › Alternative boot mode – Address1 (ABM-1) › Fallback ABM	› Allows easy and quick programming/ erasing of the flash by code downloaded into the PSRAM via UART or CAN interface › Allows user application code located at the start of flash (0x0C000000) to run after power up and reset › Allows user application code located at 1st 64 KB flash (ABM-0) or 2nd 64 KB flash (ABM-1) to run after system reset. User could put their own defined starting location if default starting location at 0x0C000000 is not desired › Allows user to run a backup application code in ABM-1 if the original flash code in ABM-0 is corrupted

Boot mode options
8 boot modes (2/2)

Start-up mode

› PSRAM boot
› Boot Mode Index (BMI)

Use case

› Allows application code stored at user defined PSRAM address to run, after system reset
› Allows user to write to BMI Word register to copy MAC address, IP address, USB address to Page 1 of User Configuration Block-2 (UCB2-Page1), increase fsys to <120 MHz and execute the desired boot mode after power on reset
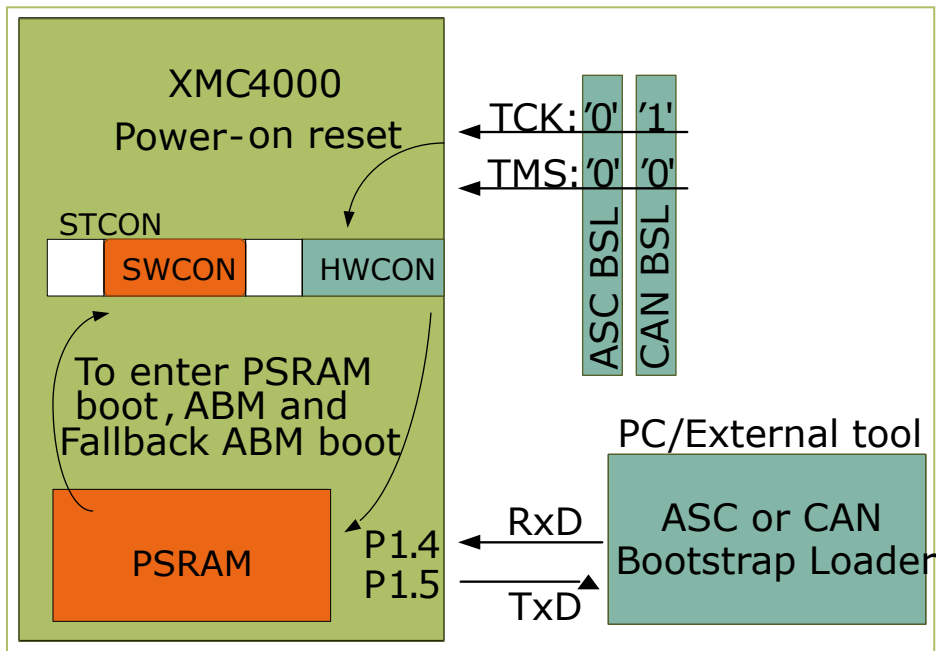
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System integration

System integration

The ASC and CAN BSL boot mode allow user to program or update code to the flash of the xmc4000 device.

User can select the execution of the code located in flash or PSRAM by writing the desired boot mode to SWCON first, followed by a system reset.

Target applications

› Motor control

› Intelligent lighting

› Power conversion

› General purpose

XMC4500	XMC4400	XMC4200
●	●	●

Agenda

Boot mode options
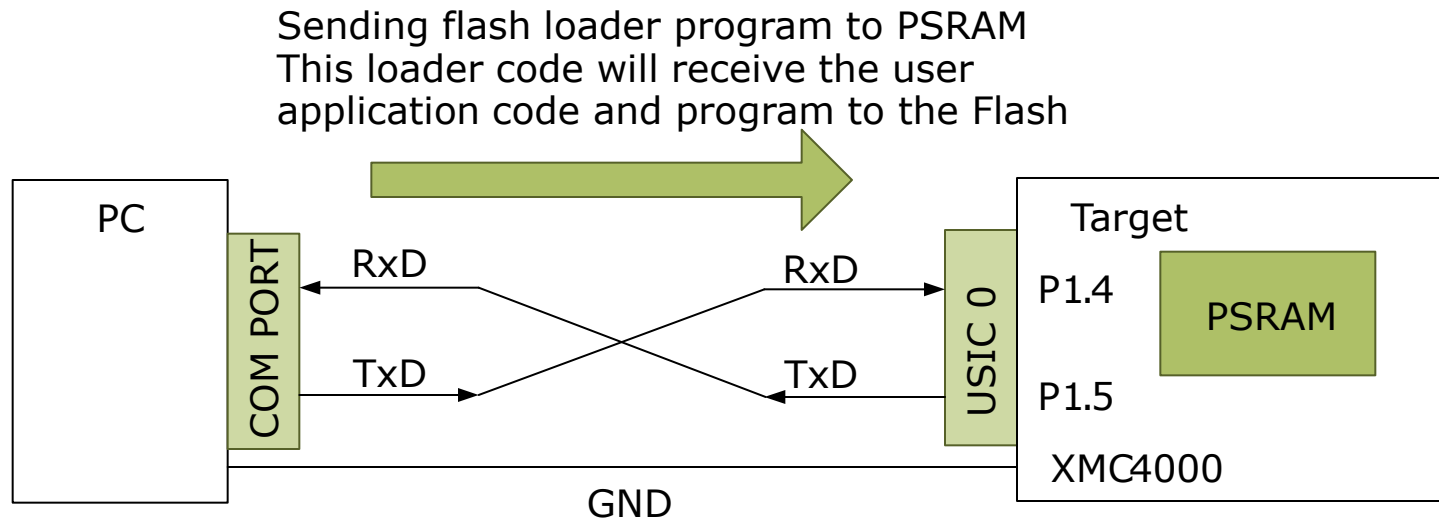# Normal boot mode

› User application at Flash location 0x0C000000 starts to run after startup software (SSW) execution completed from reset

› To enter normal boot mode:

  – Download application code to Flash

  – Set boot pins TMS=1 and TCK=0

  – Initiate a RESET (PORST)

  – Or

  – A currently running application in the device write to STCON.SWCON

  – Clear reset status

  – Issue a system reset

Boot mode options
ASC BSL boot mode

› Use for programming user application code to flash over UART interface

› To enter ASC BSL Boot mode:

1. Set TMS=0 and TCK=1

2. Initiate a PORST

3. PC start the ASC_BSL protocol

› Or a running application:

1. Write to STCON.SWCON

2. Clear reset status

3. Issue a system reset

Sending flash loader program to PSRAM
This loader code will receive the user
application code and program to the Flash

Boot mode options
Boot Mode Index (BMI) boot mode

› This mode enables storing of MAC Address, IP Address, USB serial number into DSRAM1, increases fsys and boot mode desired upon next reset. This is done by setting BMI Word @ 0x0C000900 or UCB2-Page1. After reset SSW set the V bit of BMI Word to '1' if checksum is correct.
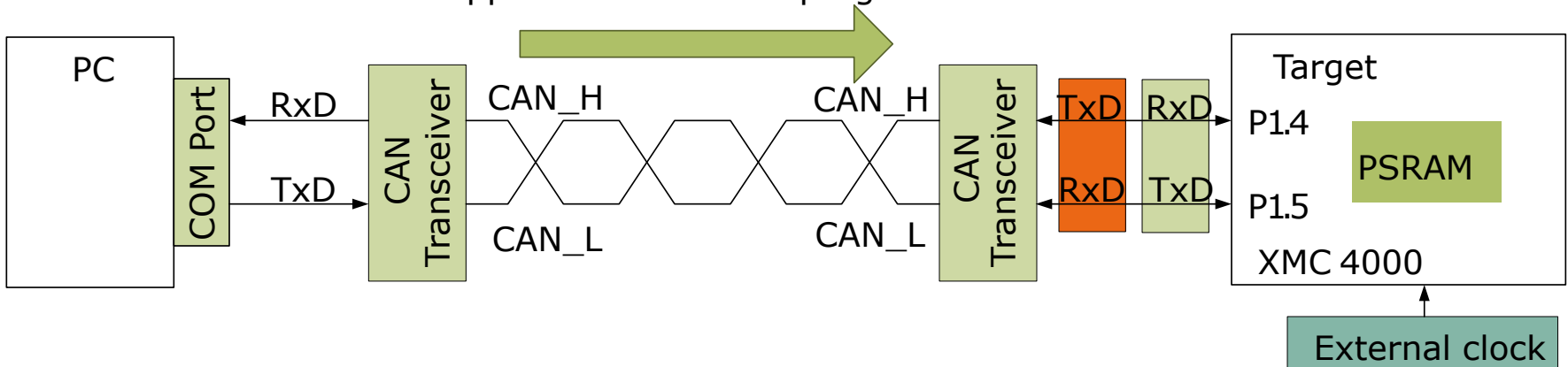
› To enter BMI boot mode:

1. User program the SWCON bit of BMI word to the desire boot mode

2. Set TMS=1 and TCK=1

3. Initiate a PORST

Or

1. A currently running application in the device write to STCON.SWCON

2. Clear reset status

3. Issue a system reset

Boot mode options
CAN BSL boot mode

› Use for programming user application code to flash over CAN interface. If SSW detect initialization frame on P1.5 first, it will configure P1.4 for TxD functionality and vice versa.

› To enter CAN BSL Boot mode:

  1. Set TMS=0 and TCK=0

  2. Initiate a PORST

  3. PC start the CAN BSL protocol

Or a running application:

  1. Write to STCON.SWCON
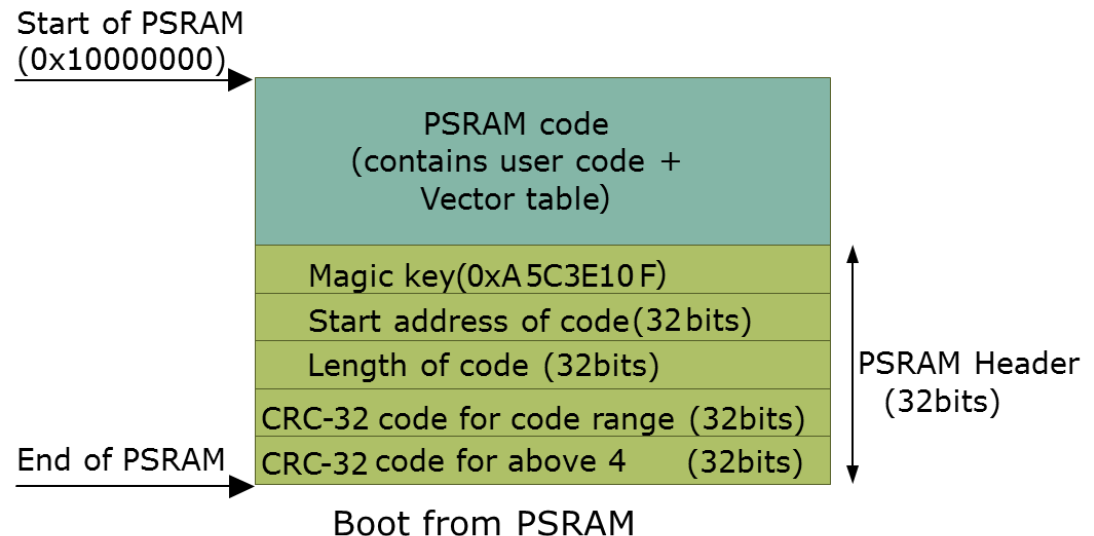
  2. Clear reset status

  3. Issue a system reset

Sending flash loader program to PSRAM
This loader code will receive the user application code and program to the Flash

Boot mode options
PSRAM boot mode

› Allow an application code reside in PSRAM to run after system reset

› To enter PSRAM Boot mode:

1. This mode requires user code to download to PSRAM first

2. Program the PSRAM header

3. Programmed SWCON[3:0] bit field to 0100_B

4. Clear reset status

5. Initiate system reset

Start of PSRAM
(0x10000000)

PSRAM code (contains user code + Vector table)
Magic key(0xA5C3E10F)
Start address of code (32 bits)
Length of code (32bits)
CRC-32 code for code range (32bits)
CRC-32 code for above 4   (32bits)

End of PSRAM

PSRAM Header (32bits)

Boot from PSRAM

Boot mode options
Alternative boot mode – address 0 (ABM-0)

› Allow a user application located at a user defined flash address (in 1st 64 KB flash sector) to run after system reset

› To enter ABM-0 Boot mode

  1. Program the user application to the desired flash location

  2. Program the ABM header

  3. Program SWCON[3:0] bit field to 1000_B

  4. Clear reset status

  5. Initiate system reset

Start of Flash
(0x0C000000 for XMC4500)

Vector table

A
A+4
A+8

First 64KB physical sector

| Stack pointer |
| Application Reset Vector |
| Application |

LEN

| Magic key (32 bits) |
| Start address of code (32 bits) = A |
| Application length (32 bits) = LEN |
| CRC-32 code for application length (32 bits) |
| CRC-32 code for above 4 (32 bits) |

ABM Header
(32 bytes)

(0x0C00FFFF for XMC4500)
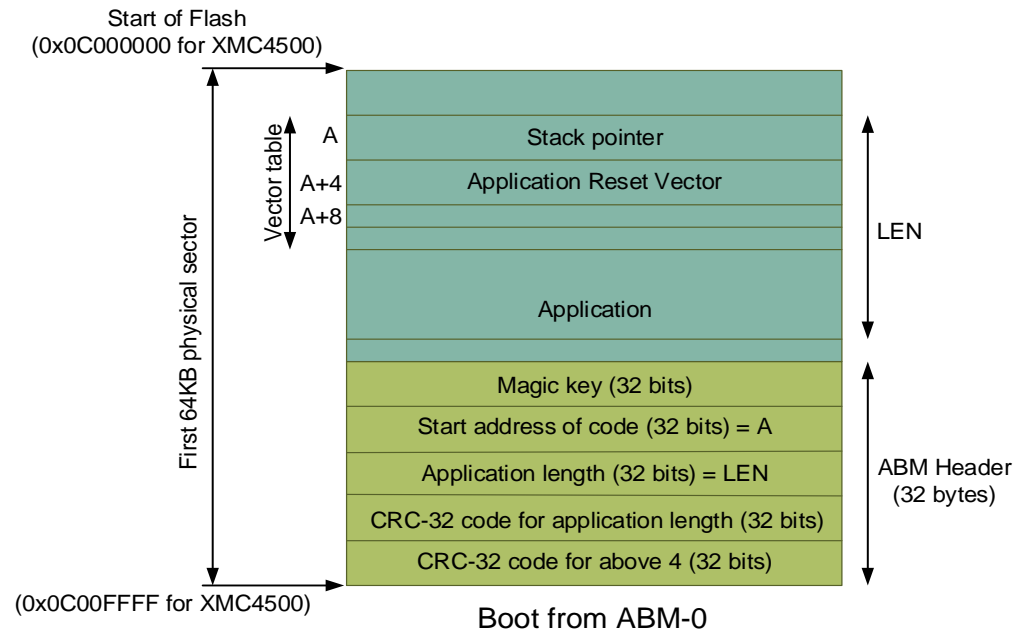
Boot from ABM-0

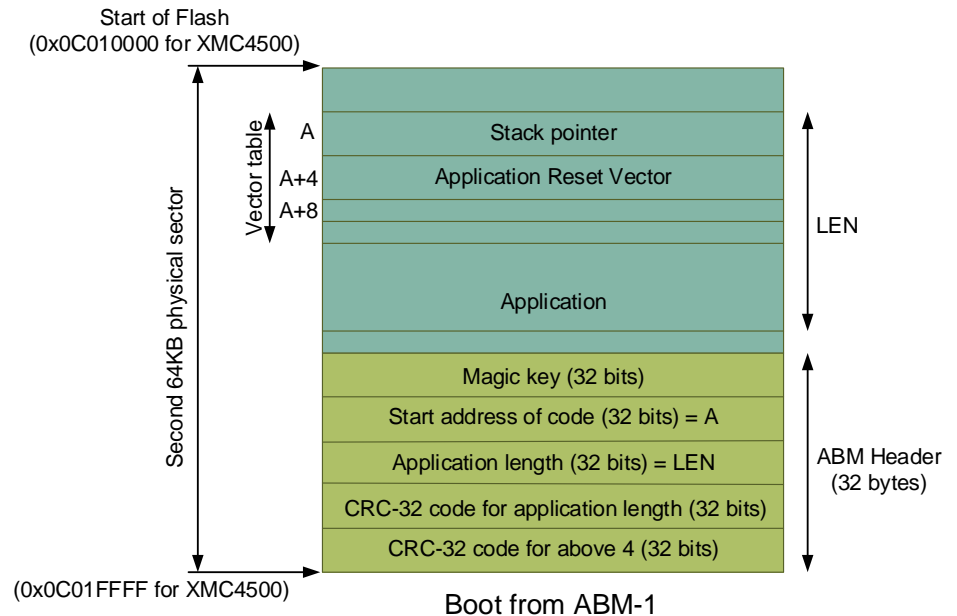# Boot mode options
Alternative boot mode – address 1 (ABM-1)

› Allow a user application located at a user defined flash address (in 2nd 64 KB flash sector) to run after system reset

› To enter ABM-1 Boot mode

1. Program the user application to the desired flash location

2. Program the ABM header

3. Program SWCON[3:0] bit field to 1100_B

4. Clear reset status

5. Initiate system reset

Start of Flash
(0x0C010000 for XMC4500)

| Stack pointer |
| Application Reset Vector |
| Application |

A
A+4
A+8

Vector table

LEN

Second 64KB physical sector

| Magic key (32 bits) |
| Start address of code (32 bits) = A |
| Application length (32 bits) = LEN |
| CRC-32 code for application length (32 bits) |
| CRC-32 code for above 4 (32 bits) |

ABM Header
(32 bytes)

(0x0C01FFFF for XMC4500)

Boot from ABM-1

Boot mode options
Fallback ABM boot mode

› Allow a backup application code to run if the first application code failed to run

› SSW will run user application pointed by ABM Address-0 header if passed the verification. If failed, then SSW will audit ABM Address-1 header. If passed, SSW will run user application pointer by ABM Address-1 header. If failed, execution is aborted and enter diagnostics monitor mode.

› To enter Fallback ABM Boot mode:

1. Program application code to 1st 64 KB sector

2. Program the ABM-0 header

3. Program a backup application code to 2nd 64 KB sector

4. Program the ABM-1 header

5. Program SWCON[3:0] bit field programmed to 1110_B

6. Clear reset status

7. Initiate system reset

Support material

Collaterals and Brochures	› Product Briefs › Selection Guides › Application Brochures › Presentations › Press Releases, Ads	› www.infineon.com/XMC
Technical Material	› 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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