

9 System configuration controller (SYSCFG)

The system configuration controller is mainly used to remap the memory accessible in the code area, select the Ethernet PHY interface and manage the external interrupt line connection to the GPIOs.

This section applies to the whole STM32F4xx family, unless otherwise specified.

9.1 I/O compensation cell

By default the I/O compensation cell is not used. However when the I/O output buffer speed is configured in 50 MHz or 100 MHz mode, it is recommended to use the compensation cell for slew rate control on I/O $t_{r(I/O)out}/t_{r(I/O)out}$ commutation to reduce the I/O noise on power supply.

When the compensation cell is enabled, a READY flag is set to indicate that the compensation cell is ready and can be used. The I/O compensation cell can be used only when the supply voltage ranges from 2.4 to 3.6 V.

9.2 SYSCFG registers for STM32F405xx/07xx and STM32F415xx/17xx

9.2.1 SYSCFG memory remap register (SYSCFG_MEMRMP)

This register is used for specific configurations on memory remap:

- Two bits are used to configure the type of memory accessible at address 0x0000 0000. These bits are used to select the physical remap by software and so, bypass the BOOT pins.
- After reset these bits take the value selected by the BOOT pins. When booting from main Flash memory with BOOT pins set to 10 [(BOOT1,BOOT0) = (1,0)] this register takes the value 0x00.

When the FSMC is remapped at address 0x0000 0000, only the first two regions of Bank 1 memory controller (Bank1 NOR/PSRAM 1 and NOR/PSRAM 2) can be remapped. In remap mode, the CPU can access the external memory via ICode bus instead of System bus which boosts up the performance.

Address offset: 0x00

Reset value: 0x0000 000X (X is the memory mode selected by the BOOT pins)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved													MEM_MODE		
													rw	rw	

Bits 31:2 Reserved, must be kept at reset value.

Bits 1:0 **MEM_MODE**: Memory mapping selection

Set and cleared by software. This bit controls the memory internal mapping at address 0x0000 0000. After reset these bits take the value selected by the Boot pins (except for FSMC).

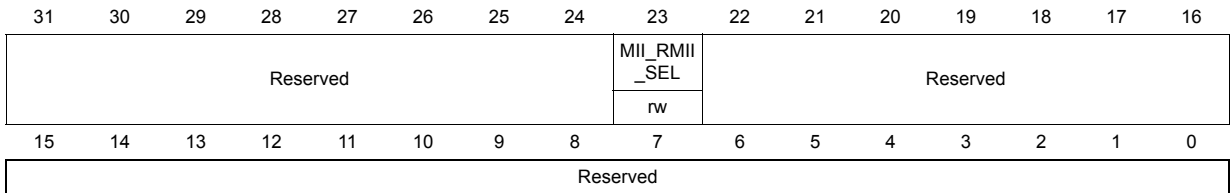
- 00: Main Flash memory mapped at 0x0000 0000
- 01: System Flash memory mapped at 0x0000 0000
- 10: FSMC Bank1 (NOR/PSRAM 1 and 2) mapped at 0x0000 0000
- 11: Embedded SRAM (SRAM1) mapped at 0x0000 0000

Note: Refer to [Section 2.3: Memory map](#) for details about the memory mapping at address 0x0000 0000.

9.2.2 SYSCFG peripheral mode configuration register (SYSCFG_PMC)

Address offset: 0x04

Reset value: 0x0000 0000



Bits 31:24 Reserved, must be kept at reset value.

Bit 23 **MII_RMII_SEL**: Ethernet PHY interface selection

Set and Cleared by software. These bits control the PHY interface for the Ethernet MAC.

- 0: MII interface is selected
- 1: RMII PHY interface is selected

Note: This configuration must be done while the MAC is under reset and before enabling the MAC clocks.

Bits 22:0 Reserved, must be kept at reset value.

9.2.3 SYSCFG external interrupt configuration register 1 (SYSCFG_EXTICR1)

Address offset: 0x08

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI3[3:0]				EXTI2[3:0]				EXTI1[3:0]				EXTI0[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 0 to 3)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

1000: PI[x] pin

9.2.4 SYSCFG external interrupt configuration register 2 (SYSCFG_EXTICR2)

Address offset: 0x0C

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI7[3:0]				EXTI6[3:0]				EXTI5[3:0]				EXTI4[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 4 to 7)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

1000: PI[x] pin

9.2.5 SYSCFG external interrupt configuration register 3 (SYSCFG_EXTICR3)

Address offset: 0x10

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI11[3:0]				EXTI10[3:0]				EXTI9[3:0]				EXTI8[3:0]			
rW	rW	rW	rW	rW	rW	rW	rW	rW	rW	rW	rW	rW	rW	rW	rW

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 8 to 11)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

1000: PI[x] pin

9.2.6 SYSCFG external interrupt configuration register 4 (SYSCFG_EXTICR4)

Address offset: 0x14

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI15[3:0]				EXTI14[3:0]				EXTI13[3:0]				EXTI12[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 12 to 15)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

Note: PI[15:12] are not used.

9.2.7 Compensation cell control register (SYSCFG_CMPCR)

Address offset: 0x20

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved							READY	Reserved					CMP_PD		
							r								

Bits 31:9 Reserved, must be kept at reset value.

Bit 8 **READY**: Compensation cell ready flag

0: I/O compensation cell not ready

1: O compensation cell ready

Bits 7:2 Reserved, must be kept at reset value.

Bit 0 **CMP_PD**: Compensation cell power-down

0: I/O compensation cell power-down mode

1: I/O compensation cell enabled

9.2.8 SYSCFG register maps for STM32F405xx/07xx and STM32F415xx/17xx

The following table gives the SYSCFG register map and the reset values.

**Table 41. SYSCFG register map and reset values
(STM32F405xx/07xx and STM32F415xx/17xx)**

Offset	Register	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				
0x00	SYSCFG_MEMRMP	Reserved																												MEM_MODE							
	Reset value																															x	x				
0x04	SYSCFG_PMC	Reserved								MIL_RMII_SEL		Reserved																									
Reset value	0																																				
0x08	SYSCFG_EXTICR1	Reserved																		EXTI3[3:0]				EXTI2[3:0]				EXTI1[3:0]				EXTI0[3:0]					
Reset value	0																			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x0C	SYSCFG_EXTICR2	Reserved																		EXTI7[3:0]				EXTI6[3:0]				EXTI5[3:0]				EXTI4[3:0]					
Reset value	0																			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x10	SYSCFG_EXTICR3	Reserved																		EXTI11[3:0]				EXTI10[3:0]				EXTI9[3:0]				EXTI8[3:0]					
Reset value	0																			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x14	SYSCFG_EXTICR4	Reserved																		EXTI15[3:0]				EXTI14[3:0]				EXTI13[3:0]				EXTI12[3:0]					
Reset value	0																			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x20	SYSCFG_CMPCR	Reserved																								READY		Reserved								CMP_PD	
Reset value	0																																				

Refer to [Section 2.3: Memory map](#) for the register boundary addresses.

9.3 SYSCFG registers for STM32F42xxx and STM32F43xxx

9.3.1 SYSCFG memory remap register (SYSCFG MEMRMP)

This register is used for specific configurations on memory remap:

- Three bits are used to configure the type of memory accessible at address 0x0000 0000. These bits are used to select the physical remap by software and so, bypass the BOOT pins.
- After reset these bits take the value selected by the BOOT pins. When booting from main Flash memory with BOOT pins set to 10 [(BOOT1,BOOT0) = (1,0)] this register takes the value 0x00.
- Other bits are used to swap FMC SDRAM Bank 1/2 with FMC Bank 3/4 and configure the Flash Bank 1/2 mapping

There are two possible FMC remap at address 0x0000 0000:

- FMC Bank 1 (NOR/PSRAM 1 and 2) remap:
Only the first two regions of Bank 1 memory controller (Bank1 NOR/PSRAM 1 and NOR/PSRAM 2) can be remapped.
- FMC SDRAM Bank 1 remap.

In remap mode at address 0x0000 0000, the CPU can access the external memory via ICode bus instead of System bus which boosts up the performance.

Address offset: 0x00

Reset value: 0x0000 000X (X is the memory mode selected by the BOOT pins)

Note: *Booting from NOR Flash memory or SDRAM is not allowed. The regions can only be mapped at 0x0000 0000 through software remap.*

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved				SWP_FMC		Res.	FB_MODE	Reserved					MEM_MODE[2:0]		
				rw	rw		rw						rw	rw	rw

Bits 31:12 Reserved, must be kept at reset value.

Bits 11:10 **SWP_FMC**: FMC memory mapping swap

Set and cleared by software. These bits are used to swap the FMC SDRAM Bank 1/2 and FMC Bank 3/4 (SDRAM Bank 1/2 and NAND Bank 2/PCCARD Bank) in order to enable the code execution from SDRAM Banks without a physical remapping at 0x0000 0000 address.

00: No FMC memory mapping swap

01: SDRAM banks and NAND Bank 2/PCCARD mapping are swapped. SDRAM Bank 1 and 2 are mapped at NAND Bank 2 (0x8000 0000) and PCCARD Bank (0x9000 0000) address, respectively. NAND Bank 2 and PCCARD Bank are mapped at 0xC000 0000 and 0xD000 0000, respectively.

10: Reserved

11: Reserved

Bit 9 Reserved, must be kept at reset value.

Bit 8 **FB_MODE**: Flash Bank mode selection

Set and cleared by software. This bit controls the Flash Bank 1/2 mapping.

0: Flash Bank 1 is mapped at 0x0800 0000 (and aliased at 0x0000 0000) and Flash Bank 2 is mapped at 0x0810 0000 (and aliased at 0x0010 0000)

1: Flash Bank 2 is mapped at 0x0800 0000 (and aliased at 0x0000 0000) and Flash Bank 1 is mapped at 0x0810 0000 (and aliased at 0x0010 0000)

Bits 7:3 Reserved, must be kept at reset value.

Bits 2:0 **MEM_MODE**: Memory mapping selection

Set and cleared by software. This bit controls the memory internal mapping at address 0x0000 0000. After reset these bits take the value selected by the Boot pins (except for FMC).

000: Main Flash memory mapped at 0x0000 0000

001: System Flash memory mapped at 0x0000 0000

010: FMC Bank1 (NOR/PSRAM 1 and 2) mapped at 0x0000 0000

011: Embedded SRAM (SRAM1) mapped at 0x0000 0000

100: FMC/SDRAM Bank 1 mapped at 0x0000 0000

Other configurations are reserved

Note: Refer to [Section 2.3: Memory map](#) for details about the memory mapping at address 0x0000 0000.

9.3.2 SYSCFG peripheral mode configuration register (SYSCFG_PMC)

Address offset: 0x04

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved								MII_RMII_SEL	Reserved				ADCxDC2		
								rw					rw	rw	rw
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved															

Bits 31:24 Reserved, must be kept at reset value.

Bit 23 **MII_RMII_SEL**: Ethernet PHY interface selection

Set and Cleared by software. These bits control the PHY interface for the Ethernet MAC.

0: MII interface is selected

1: RMII PHY interface is selected

Note: This configuration must be done while the MAC is under reset and before enabling the MAC clocks.

Bits 22:19 Reserved, must be kept at reset value.

Bits 18:16 **ADCxDC2**:

0: No effect.

1: Refer to AN4073 on how to use this bit.

Note: These bits can be set only if the following conditions are met:

- ADC clock higher or equal to 30 MHz.
- Only one ADCxDC2 bit must be selected if ADC conversions do not start at the same time and the sampling times differ.
- These bits must not be set when the ADCDC1 bit is set in PWR_CR register.

Bits 15:0 Reserved, must be kept at reset value.

9.3.3 SYSCFG external interrupt configuration register 1 (SYSCFG_EXTICR1)

Address offset: 0x08

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI3[3:0]				EXTI2[3:0]				EXTI1[3:0]				EXTI0[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 0 to 3)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

1000: PI[x] pin

1001: PJ[x] pin

1010: PK[x] pin

9.3.4 SYSCFG external interrupt configuration register 2 (SYSCFG_EXTICR2)

Address offset: 0x0C

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI7[3:0]				EXTI6[3:0]				EXTI5[3:0]				EXTI4[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 4 to 7)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

1000: PI[x] pin

1001: PJ[x] pin

1010: PK[x] pin

9.3.5 SYSCFG external interrupt configuration register 3 (SYSCFG_EXTICR3)

Address offset: 0x10

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI11[3:0]				EXTI10[3:0]				EXTI9[3:0]				EXTI8[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 8 to 11)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

1000: PI[x] pin

1001: PJ[x] pin

Note: PK[11:8] are not used.

9.3.6 SYSCFG external interrupt configuration register 4 (SYSCFG_EXTICR4)

Address offset: 0x14

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EXTI15[3:0]				EXTI14[3:0]				EXTI13[3:0]				EXTI12[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:16 Reserved, must be kept at reset value.

Bits 15:0 **EXTIx[3:0]**: EXTI x configuration (x = 12 to 15)

These bits are written by software to select the source input for the EXTIx external interrupt.

0000: PA[x] pin

0001: PB[x] pin

0010: PC[x] pin

0011: PD[x] pin

0100: PE[x] pin

0101: PF[x] pin

0110: PG[x] pin

0111: PH[x] pin

1000: PI[x] pin

1001: PJ[x] pin

Note: PK[15:12] are not used.

9.3.7 Compensation cell control register (SYSCFG_CMPCR)

Address offset: 0x20

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Reserved															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved							READY	Reserved					CMP_PD		
							r						rw		

Bits 31:9 Reserved, must be kept at reset value.

Bit 8 **READY**: Compensation cell ready flag
0: I/O compensation cell not ready
1: O compensation cell ready

Bits 7:2 Reserved, must be kept at reset value.

Bit 0 **CMP_PD**: Compensation cell power-down
0: I/O compensation cell power-down mode
1: I/O compensation cell enabled

9.3.8 SYSCFG register maps for STM32F42xxx and STM32F43xxx

The following table gives the SYSCFG register map and the reset values.

Table 42. SYSCFG register map and reset values (STM32F42xxx and STM32F43xxx)

Offset	Register	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0x00	SYSCFG_MEMRMP	Reserved																				SWP_FMC		Reserved	FB_MODE	Reserved				MEM_MODE			
	Reset value																																0
0x04	SYSCFG_PMC	Reserved								MIL_RMIL_SEL	Reserved			ADC3DC2	ADC2DC2	ADC1DC2	Reserved																
	Reset value																												0	0	0		
0x08	SYSCFG_EXTICR1 Reset value	Reserved												EXTI3[3:0]				EXTI2[3:0]				EXTI1[3:0]				EXTI0[3:0]							
0x0C	SYSCFG_EXTICR2 Reset value	Reserved												EXTI7[3:0]				EXTI6[3:0]				EXTI5[3:0]				EXTI4[3:0]							
0x10	SYSCFG_EXTICR3 Reset value	Reserved												EXTI11[3:0]				EXTI10[3:0]				EXTI9[3:0]				EXTI8[3:0]							
0x14	SYSCFG_EXTICR4 Reset value	Reserved												EXTI15[3:0]				EXTI14[3:0]				EXTI13[3:0]				EXTI12[3:0]							
0x20	SYSCFG_CMPCR	Reserved																						READY	Reserved				CMP_PD				
	Reset value																													0			

Refer to [Section 2.3: Memory map](#) for the register boundary addresses.