

## 10 Direct memory access controller (DMA)

### 10.1 Introduction

The direct memory access (DMA) controller is a bus master and system peripheral.

The DMA is used to perform programmable data transfers between memory-mapped peripherals and/or memories, upon the control of an off-loaded CPU.

The DMA controller features a single AHB master architecture.

There is one instance of DMA with 5 channels.

Each channel is dedicated to managing memory access requests from one or more peripherals. The DMA includes an arbiter for handling the priority between DMA requests.

### 10.2 DMA main features

- Single AHB master
- Peripheral-to-memory, memory-to-peripheral, memory-to-memory and peripheral-to-peripheral data transfers
- Access, as source and destination, to on-chip memory-mapped devices such as flash memory, SRAM, and AHB and APB peripherals
- All DMA channels independently configurable:
  - Each channel is associated either with a DMA request signal coming from a peripheral, or with a software trigger in memory-to-memory transfers. This configuration is done by software.
  - Priority between the requests is programmable by software (4 levels per channel: very high, high, medium, low) and by hardware in case of equality (such as request to channel 1 has priority over request to channel 2).
  - Transfer size of source and destination are independent (byte, half-word, word), emulating packing and unpacking. Source and destination addresses must be aligned on the data size.
  - Support of transfers from/to peripherals to/from memory with circular buffer management
  - Programmable number of data to be transferred: 0 to  $2^{16} - 1$
- Generation of an interrupt request per channel. Each interrupt request is caused from any of the three DMA events: transfer complete, half transfer, or transfer error.

## 10.3 DMA implementation

### 10.3.1 DMA

DMA is implemented with the hardware configuration parameters shown in the table below.

**Table 25. DMA implementation**

Feature	DMA
Number of channels	5

### 10.3.2 DMA request mapping

#### DMA controller

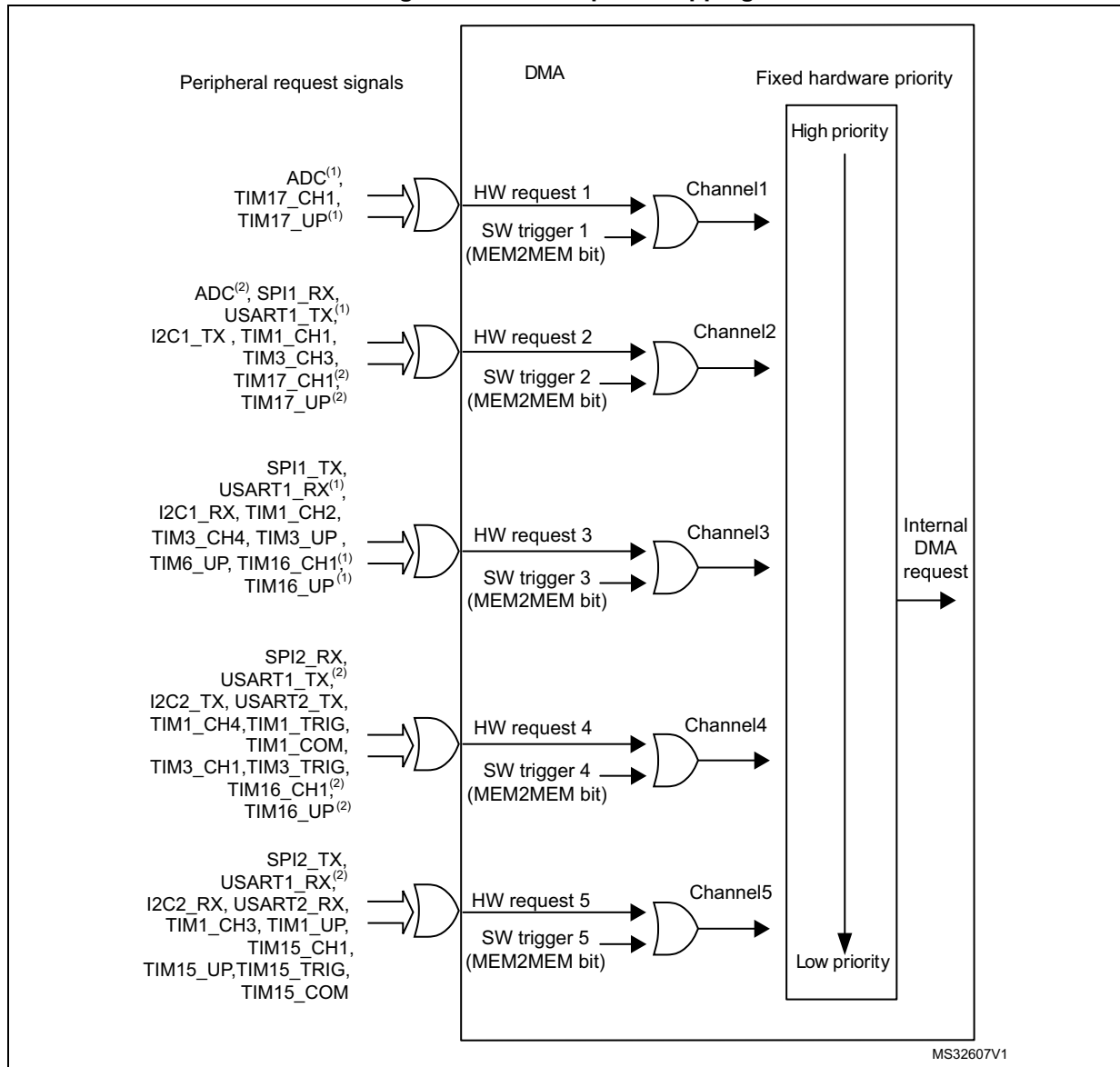
The hardware requests from the peripherals are simply logically ORed before entering the DMA. This means that on one channel, only one request must be enabled at a time (see [Figure 19](#)).

The peripheral DMA requests can be independently activated/de-activated by programming the DMA control bit in the registers of the corresponding peripheral.

**Caution:** A same peripheral request can be assigned to two different channels only if the application ensures that these channels are not requested to be served at the same time. In other words, if two different channels receive a same asserted peripheral request at the same time, an unpredictable DMA hardware behavior occurs.

[Table 26](#) and [Table 27](#) list the DMA requests for each channel and alternate position.

Figure 19. DMA request mapping



1. DMA request mapped on this DMA channel only if the corresponding remapping bit is cleared in *SYSCFG configuration register 1 (SYSCFG\_CFGR1)*.
2. DMA request mapped on this DMA channel only if the corresponding remapping bit is set in *SYSCFG configuration register 1 (SYSCFG\_CFGR1)*.

**Table 26. DMA requests for each channel**  
**on STM32F030x4/x6/x8 and STM32F070x6/xB devices**

Peripherals	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
<b>ADC</b>	ADC <sup>(1)</sup>	ADC <sup>(2)</sup>	-	-	-
<b>SPI</b>	-	SPI1_RX	SPI1_TX	SPI2_RX	SPI2_TX
<b>USART</b>	-	USART1_TX <sup>(1)</sup> USART3_TX <sup>(2)</sup>	USART1_RX <sup>(1)</sup> USART3_RX <sup>(2)</sup>	USART1_TX <sup>(2)</sup> USART2_TX	USART1_RX <sup>(2)</sup> USART2_RX
<b>I2C</b>	-	I2C1_TX	I2C1_RX	I2C2_TX	I2C2_RX

**Table 26. DMA requests for each channel  
on STM32F030x4/x6/x8 and STM32F070x6/xB devices (continued)**

Peripherals	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
<b>TIM1</b>	-	TIM1_CH1	TIM1_CH2	TIM1_CH4 TIM1_TRIG TIM1_COM	TIM1_CH3 TIM1_UP
<b>TIM3</b>	-	TIM3_CH3	TIM3_CH4 TIM3_UP	TIM3_CH1 TIM3_TRIG	-
<b>TIM6</b>	-	-	TIM6_UP	-	-
<b>TIM7</b>	-	-	-	TIM7_UP	-
<b>TIM15</b>	-	-	-	-	TIM15_CH1 TIM15_UP TIM15_TRIG TIM15_COM
<b>TIM16</b>	-	-	TIM16_CH1 <sup>(1)</sup> TIM16_UP <sup>(1)</sup>	TIM16_CH1 <sup>(2)</sup> TIM16_UP <sup>(2)</sup>	-
<b>TIM17</b>	TIM17_CH1 <sup>(1)</sup> TIM17_UP <sup>(1)</sup>	TIM17_CH1 <sup>(2)</sup> TIM17_UP <sup>(2)</sup>	-	-	-

1. DMA request mapped on this DMA channel only if the corresponding remapping bit is cleared in [SYSCFG configuration register 1 \(SYSCFG\\_CFGR1\)](#).
2. DMA request mapped on this DMA channel only if the corresponding remapping bit is set in [SYSCFG configuration register 1 \(SYSCFG\\_CFGR1\)](#).

**Table 27. DMA requests for each channel on STM32F030xC devices**

CxS[3:0]	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
0000	-	TIM3_CH3	TIM3_CH4 TIM3_UP	TIM1_CH4 TIM1_TRIG TIM1_COM	TIM1_UP
	-	-	-	-	TIM15_CH1 TIM15_UP TIM15_TRIG TIM15_COM
	ADC	-	TIM6_UP	TIM7_UP	-
	-	USART1_TX	USART1_RX	USART2_TX	USART2_RX
	-	-	-	-	-
	-	SPI1_RX	SPI1_TX	SPI2_RX	SPI2_TX
	-	I2C1_TX	I2C1_RX	I2C2_TX	I2C2_RX
	-	TIM1_CH1	TIM1_CH2	-	TIM1_CH3
	TIM17_CH1 TIM17_UP	-	TIM16_CH1 TIM16_UP	TIM3_CH1 TIM3_TRIG	-
<b>0001</b>	ADC	ADC	TIM6_UP	TIM7_UP	-
<b>0010</b>	-	I2C1_TX	I2C1_RX	I2C2_TX	I2C2_RX
<b>0011</b>	-	SPI1_RX	SPI1_TX	SPI2_RX	SPI2_TX
<b>0100</b>	-	TIM1_CH1	TIM1_CH2	-	TIM1_CH3

Table 27. DMA requests for each channel on STM32F030xC devices (continued)

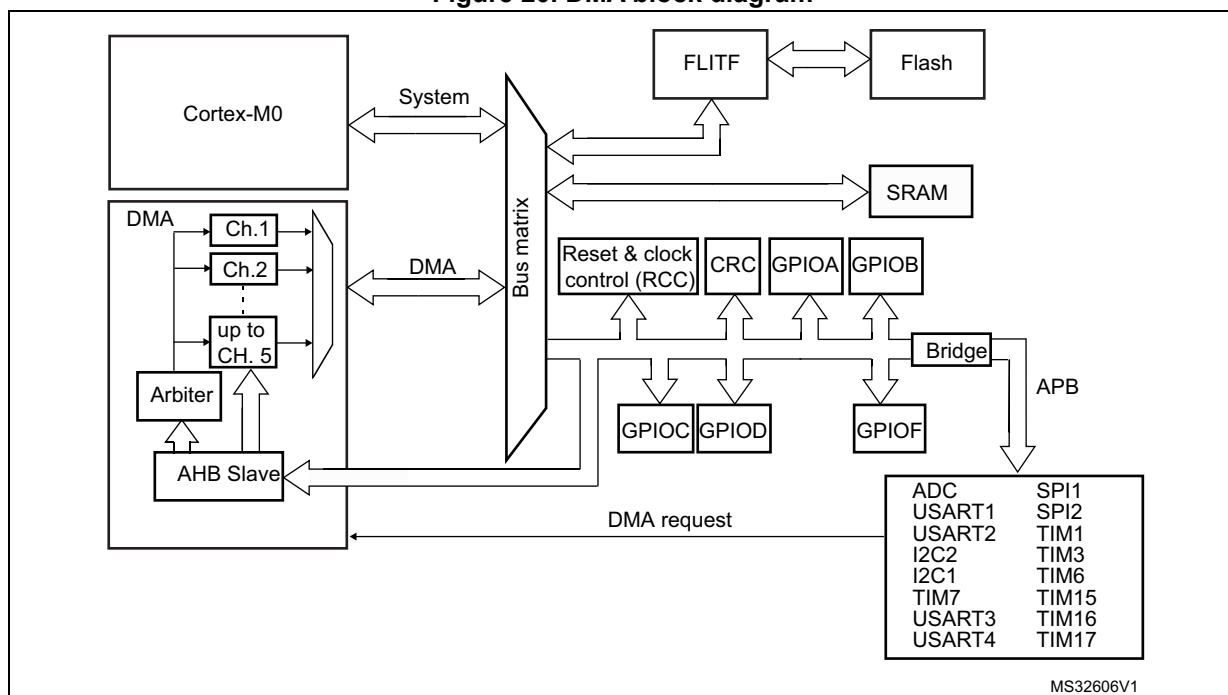
CxS[3:0]	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
0101	-	-	-	-	-
0110	-	-	-	TIM3_CH1 TIM3_TRIG	-
0111	TIM17_CH1 TIM17_UP	TIM17_CH1 TIM17_UP	TIM16_CH1 TIM16_UP	TIM16_CH1 TIM16_UP	-
1000	USART1_RX	USART1_TX	USART1_RX	USART1_TX	USART1_RX
1001	USART2_RX	USART2_TX	USART2_RX	USART2_TX	USART2_RX
1010	USART3_RX	USART3_TX	USART3_RX	USART3_TX	USART3_RX
1011	USART4_RX	USART4_TX	USART4_RX	USART4_TX	USART4_RX
1100	USART5_RX	USART5_TX	USART5_RX	USART5_TX	USART5_RX
1101	USART6_RX	USART6_TX	USART6_RX	USART6_TX	USART6_RX

## 10.4 DMA functional description

### 10.4.1 DMA block diagram

The DMA block diagram is shown in the figure below.

Figure 20. DMA block diagram



The DMA controller performs direct memory transfer by sharing the AHB system bus with other system masters. The bus matrix implements round-robin scheduling. DMA requests

may stop the CPU access to the system bus for a number of bus cycles, when CPU and DMA target the same destination (memory or peripheral).

According to its configuration through the AHB slave interface, the DMA controller arbitrates between the DMA channels and their associated received requests. The DMA controller also schedules the DMA data transfers over the single AHB port master.

The DMA controller generates an interrupt per channel to the interrupt controller.

#### 10.4.2 DMA transfers

The software configures the DMA controller at channel level, in order to perform a block transfer, composed of a sequence of AHB bus transfers.

A DMA block transfer may be requested from a peripheral, or triggered by the software in case of memory-to-memory transfer.

After an event, the following steps of a single DMA transfer occur:

1. The peripheral sends a single DMA request signal to the DMA controller.
2. The DMA controller serves the request, depending on the priority of the channel associated to this peripheral request.
3. As soon as the DMA controller grants the peripheral, an acknowledge is sent to the peripheral by the DMA controller.
4. The peripheral releases its request as soon as it gets the acknowledge from the DMA controller.
5. Once the request is de-asserted by the peripheral, the DMA controller releases the acknowledge.

The peripheral may order a further single request and initiate another single DMA transfer.

The request/acknowledge protocol is used when a peripheral is either the source or the destination of the transfer. For example, in case of memory-to-peripheral transfer, the peripheral initiates the transfer by driving its single request signal to the DMA controller. The DMA controller reads then a single data in the memory and writes this data to the peripheral.

For a given channel *x*, a DMA block transfer consists of a repeated sequence of:

- a single DMA transfer, encapsulating two AHB transfers of a single data, over the DMA AHB bus master:
  - a single data read (byte, half-word or word) from the peripheral data register or a location in the memory, addressed through an internal current peripheral/memory address register.  
The start address used for the first single transfer is the base address of the peripheral or memory, and is programmed in the DMA\_CPARx or DMA\_CMARx register.
  - a single data write (byte, half-word or word) to the peripheral data register or a location in the memory, addressed through an internal current peripheral/memory address register.  
The start address used for the first transfer is the base address of the peripheral or memory, and is programmed in the DMA\_CPARx or DMA\_CMARx register.
- post-decrementing of the programmed DMA\_CNDTRx register  
This register contains the remaining number of data items to transfer (number of AHB 'read followed by write' transfers).

This sequence is repeated until DMA\_CNDTRx is null.

*Note:* The AHB master bus source/destination address must be aligned with the programmed size of the transferred single data to the source/destination.

### 10.4.3 DMA arbitration

The DMA arbiter manages the priority between the different channels.

When an active channel x is granted by the arbiter (hardware requested or software triggered), a single DMA transfer is issued (such as a AHB 'read followed by write' transfer of a single data). Then, the arbiter considers again the set of active channels and selects the one with the highest priority.

The priorities are managed in two stages:

- software: priority of each channel is configured in the DMA\_CCRx register, to one of the four different levels:
  - very high
  - high
  - medium
  - low
- hardware: if two requests have the same software priority level, the channel with the lowest index gets priority. For example, channel 2 gets priority over channel 4.

When a channel x is programmed for a block transfer in memory-to-memory mode, re arbitration is considered between each single DMA transfer of this channel x. Whenever there is another concurrent active requested channel, the DMA arbiter automatically alternates and grants the other highest-priority requested channel, which may be of lower priority than the memory-to-memory channel.

### 10.4.4 DMA channels

Each channel may handle a DMA transfer between a peripheral register located at a fixed address, and a memory address. The amount of data items to transfer is programmable. The register that contains the amount of data items to transfer is decremented after each transfer.

A DMA channel is programmed at block transfer level.

#### Programmable data sizes

The transfer sizes of a single data (byte, half-word, or word) to the peripheral and memory are programmable through, respectively, the PSIZE[1:0] and MSIZE[1:0] fields of the DMA\_CCRx register.

#### Pointer incrementation

The peripheral and memory pointers may be automatically incremented after each transfer, depending on the PINC and MINC bits of the DMA\_CCRx register.

If the **incremented mode** is enabled (PINC or MINC set to 1), the address of the next transfer is the address of the previous one incremented by 1, 2 or 4, depending on the data size defined in PSIZE[1:0] or MSIZE[1:0]. The first transfer address is the one programmed in the DMA\_CPARx or DMA\_CMARx register. During transfers, these registers keep the initially programmed value. The current transfer addresses (in the current internal peripheral/memory address register) are not accessible by software.

If the channel x is configured in **non-circular mode**, no DMA request is served after the last data transfer (once the number of single data to transfer reaches zero). The DMA channel must be disabled in order to reload a new number of data items into the DMA\_CNDTRx register.

*Note:* If the channel x is disabled, the DMA registers are not reset. The DMA channel registers (DMA\_CCRx, DMA\_CPARx and DMA\_CMARx) retain the initial values programmed during the channel configuration phase.

In **circular mode**, after the last data transfer, the DMA\_CNDTRx register is automatically reloaded with the initially programmed value. The current internal address registers are reloaded with the base address values from the DMA\_CPARx and DMA\_CMARx registers.

### Channel configuration procedure

The following sequence is needed to configure a DMA channel x:

1. Set the peripheral register address in the DMA\_CPARx register.  
The data is moved from/to this address to/from the memory after the peripheral event, or after the channel is enabled in memory-to-memory mode.
2. Set the memory address in the DMA\_CMARx register.  
The data is written to/read from the memory after the peripheral event or after the channel is enabled in memory-to-memory mode.
3. Configure the total number of data to transfer in the DMA\_CNDTRx register.  
After each data transfer, this value is decremented.
4. Configure the parameters listed below in the DMA\_CCRx register:
  - the channel priority
  - the data transfer direction
  - the circular mode
  - the peripheral and memory incremented mode
  - the peripheral and memory data size
  - the interrupt enable at half and/or full transfer and/or transfer error
5. Activate the channel by setting the EN bit in the DMA\_CCRx register.

For code example refer to the Appendix [Section A.5.1: DMA channel configuration sequence](#).

A channel, as soon as enabled, may serve any DMA request from the peripheral connected to this channel, or may start a memory-to-memory block transfer.

*Note:* The two last steps of the channel configuration procedure may be merged into a single access to the DMA\_CCRx register, to configure and enable the channel.

### Channel state and disabling a channel

A channel x in active state is an enabled channel (read DMA\_CCRx.EN = 1). An active channel x is a channel that must have been enabled by the software (DMA\_CCRx.EN set to 1) and afterwards with no occurred transfer error (DMA\_ISR.TEIFx = 0). In case there is a transfer error, the channel is automatically disabled by hardware (DMA\_CCRx.EN = 0).



The three following use cases may happen:

- Suspend and resume a channel

This corresponds to the two following actions:

- An active channel is disabled by software (writing DMA\_CCRx.EN = 0 whereas DMA\_CCRx.EN = 1).
- The software enables the channel again (DMA\_CCRx.EN set to 1) without reconfiguring the other channel registers (such as DMA\_CNDTRx, DMA\_CPARx and DMA\_CMARx).

This case is not supported by the DMA hardware, that does not guarantee that the remaining data transfers are performed correctly.

- Stop and abort a channel

If the application does not need any more the channel, this active channel can be disabled by software. The channel is stopped and aborted but the DMA\_CNDTRx register content may not correctly reflect the remaining data transfers versus the aborted source and destination buffer/register.

- Abort and restart a channel

This corresponds to the software sequence: disable an active channel, then reconfigure the channel and enable it again.

This is supported by the hardware if the following conditions are met:

- The application guarantees that, when the software is disabling the channel, a DMA data transfer is not occurring at the same time over its master port. For example, the application can first disable the peripheral in DMA mode, in order to ensure that there is no pending hardware DMA request from this peripheral.
- The software must operate separated write accesses to the same DMA\_CCRx register: First disable the channel. Second reconfigure the channel for a next block transfer including the DMA\_CCRx if a configuration change is needed. There are read-only DMA\_CCRx register fields when DMA\_CCRx.EN=1. Finally enable again the channel.

When a channel transfer error occurs, the EN bit of the DMA\_CCRx register is cleared by hardware. This EN bit can not be set again by software to re-activate the channel x, until the TEIFx bit of the DMA\_ISR register is set.

### Circular mode (in memory-to-peripheral/peripheral-to-memory transfers)

The circular mode is available to handle circular buffers and continuous data flows (such as ADC scan mode). This feature is enabled using the CIRC bit in the DMA\_CCRx register.

*Note: The circular mode must not be used in memory-to-memory mode. Before enabling a channel in circular mode (CIRC = 1), the software must clear the MEM2MEM bit of the DMA\_CCRx register. When the circular mode is activated, the amount of data to transfer is automatically reloaded with the initial value programmed during the channel configuration phase, and the DMA requests continue to be served.*

*In order to stop a circular transfer, the software needs to stop the peripheral from generating DMA requests (such as quit the ADC scan mode), before disabling the DMA channel. The software must explicitly program the DMA\_CNDTRx value before starting/enabling a transfer, and after having stopped a circular transfer.*

### Memory-to-memory mode

The DMA channels may operate without being triggered by a request from a peripheral. This mode is called memory-to-memory mode, and is initiated by software.

If the MEM2MEM bit in the DMA\_CCRx register is set, the channel, if enabled, initiates transfers. The transfer stops once the DMA\_CNDTRx register reaches zero.

*Note: The memory-to-memory mode must not be used in circular mode. Before enabling a channel in memory-to-memory mode (MEM2MEM = 1), the software must clear the CIRC bit of the DMA\_CCRx register.*

### Peripheral-to-peripheral mode

Any DMA channel can operate in peripheral-to-peripheral mode:

- when the hardware request from a peripheral is selected to trigger the DMA channel  
This peripheral is the DMA initiator and paces the data transfer from/to this peripheral to/from a register belonging to another memory-mapped peripheral (this one being not configured in DMA mode).
- when no peripheral request is selected and connected to the DMA channel  
The software configures a register-to-register transfer by setting the MEM2MEM bit of the DMA\_CCRx register.

### Programming transfer direction, assigning source/destination

The value of the DIR bit of the DMA\_CCRx register sets the direction of the transfer, and consequently, it identifies the source and the destination, regardless the source/destination type (peripheral or memory):

- **DIR = 1** defines typically a memory-to-peripheral transfer. More generally, if DIR = 1:
  - The **source** attributes are defined by the DMA\_MARx register, the MSIZE[1:0] field and MINC bit of the DMA\_CCRx register.  
Regardless of their usual naming, these 'memory' register, field and bit are used to define the source peripheral in peripheral-to-peripheral mode.
  - The **destination** attributes are defined by the DMA\_PARx register, the PSIZE[1:0] field and PINC bit of the DMA\_CCRx register.  
Regardless of their usual naming, these 'peripheral' register, field and bit are used to define the destination memory in memory-to-memory mode.
- **DIR = 0** defines typically a peripheral-to-memory transfer. More generally, if DIR = 0:
  - The **source** attributes are defined by the DMA\_PARx register, the PSIZE[1:0] field and PINC bit of the DMA\_CCRx register.  
Regardless of their usual naming, these 'peripheral' register, field and bit are used to define the source memory in memory-to-memory mode
  - The **destination** attributes are defined by the DMA\_MARx register, the MSIZE[1:0] field and MINC bit of the DMA\_CCRx register.  
Regardless of their usual naming, these 'memory' register, field and bit are used to define the destination peripheral in peripheral-to-peripheral mode.

### 10.4.5 DMA data width, alignment and endianness

When PSIZE[1:0] and MSIZE[1:0] are not equal, the DMA controller performs some data alignments as described in the table below.

**Table 28. Programmable data width and endian behavior (when PINC = MINC = 1)**

Source port width (MSIZE if DIR = 1, else PSIZE)	Destination port width (PSIZE if DIR = 1, else MSIZE)	Number of data items to transfer (NDT)	Source content: address / data (DMA_CMARx if DIR = 1, else DMA_CPARx)	DMA transfers	Destination content: address / data (DMA_CPARx if DIR = 1, else DMA_CMARx)
8	8	4	@0x0 / B0 @0x1 / B1 @0x2 / B2 @0x3 / B3	1: read B0[7:0] @0x0 then write B0[7:0] @0x0 2: read B1[7:0] @0x1 then write B1[7:0] @0x1 3: read B2[7:0] @0x2 then write B2[7:0] @0x2 4: read B3[7:0] @0x3 then write B3[7:0] @0x3	@0x0 / B0 @0x1 / B1 @0x2 / B2 @0x3 / B3
8	16	4	@0x0 / B0 @0x1 / B1 @0x2 / B2 @0x3 / B3	1: read B0[7:0] @0x0 then write 00B0[15:0] @0x0 2: read B1[7:0] @0x1 then write 00B1[15:0] @0x2 3: read B2[7:0] @0x2 then write 00B2[15:0] @0x4 4: read B3[7:0] @0x3 then write 00B3[15:0] @0x6	@0x0 / 00B0 @0x2 / 00B1 @0x4 / 00B2 @0x6 / 00B3
8	32	4	@0x0 / B0 @0x1 / B1 @0x2 / B2 @0x3 / B3	1: read B0[7:0] @0x0 then write 000000B0[31:0] @0x0 2: read B1[7:0] @0x1 then write 000000B1[31:0] @0x4 3: read B2[7:0] @0x2 then write 000000B2[31:0] @0x8 4: read B3[7:0] @0x3 then write 000000B3[31:0] @0xC	@0x0 / 000000B0 @0x4 / 000000B1 @0x8 / 000000B2 @0xC / 000000B3
16	8	4	@0x0 / B1B0 @0x2 / B3B2 @0x4 / B5B4 @0x6 / B7B6	1: read B1B0[15:0] @0x0 then write B0[7:0] @0x0 2: read B3B2[15:0] @0x2 then write B2[7:0] @0x1 3: read B5B4[15:0] @0x4 then write B4[7:0] @0x2 4: read B7B6[15:0] @0x6 then write B6[7:0] @0x3	@0x0 / B0 @0x1 / B2 @0x2 / B4 @0x3 / B6
16	16	4	@0x0 / B1B0 @0x2 / B3B2 @0x4 / B5B4 @0x6 / B7B6	1: read B1B0[15:0] @0x0 then write B1B0[15:0] @0x0 2: read B3B2[15:0] @0x2 then write B3B2[15:0] @0x2 3: read B5B4[15:0] @0x4 then write B5B4[15:0] @0x4 4: read B7B6[15:0] @0x6 then write B7B6[15:0] @0x6	@0x0 / B1B0 @0x2 / B3B2 @0x4 / B5B4 @0x6 / B7B6
16	32	4	@0x0 / B1B0 @0x2 / B3B2 @0x4 / B5B4 @0x6 / B7B6	1: read B1B0[15:0] @0x0 then write 0000B1B0[31:0] @0x0 2: read B3B2[15:0] @0x2 then write 0000B3B2[31:0] @0x4 3: read B5B4[15:0] @0x4 then write 0000B5B4[31:0] @0x8 4: read B7B6[15:0] @0x6 then write 0000B7B6[31:0] @0xC	@0x0 / 0000B1B0 @0x4 / 0000B3B2 @0x8 / 0000B5B4 @0xC / 0000B7B6
32	8	4	@0x0 / B3B2B1B0 @0x4 / B7B6B5B4 @0x8 / BBBAB9B8 @0xC / BFBEBDBC	1: read B3B2B1B0[31:0] @0x0 then write B0[7:0] @0x0 2: read B7B6B5B4[31:0] @0x4 then write B4[7:0] @0x1 3: read BBBAB9B8[31:0] @0x8 then write B8[7:0] @0x2 4: read BFBEBDBC[31:0] @0xC then write BC[7:0] @0x3	@0x0 / B0 @0x1 / B4 @0x2 / B8 @0x3 / BC
32	16	4	@0x0 / B3B2B1B0 @0x4 / B7B6B5B4 @0x8 / BBBAB9B8 @0xC / BFBEBDBC	1: read B3B2B1B0[31:0] @0x0 then write B1B0[15:0] @0x0 2: read B7B6B5B4[31:0] @0x4 then write B5B4[15:0] @0x2 3: read BBBAB9B8[31:0] @0x8 then write B9B8[15:0] @0x4 4: read BFBEBDBC[31:0] @0xC then write BDBC[15:0] @0x6	@0x0 / B1B0 @0x2 / B5B4 @0x4 / B9B8 @0x6 / BDBC
32	32	4	@0x0 / B3B2B1B0 @0x4 / B7B6B5B4 @0x8 / BBBAB9B8 @0xC / BFBEBDBC	1: read B3B2B1B0[31:0] @0x0 then write B3B2B1B0[31:0] @0x0 2: read B7B6B5B4[31:0] @0x4 then write B7B6B5B4[31:0] @0x4 3: read BBBAB9B8[31:0] @0x8 then write BBBAB9B8[31:0] @0x8 4: read BFBEBDBC[31:0] @0xC then write BFBEBDBC[31:0] @0xC	@0x0 / B3B2B1B0 @0x4 / B7B6B5B4 @0x8 / BBBAB9B8 @0xC / BFBEBDBC

### Addressing AHB peripherals not supporting byte/half-word write transfers

When the DMA controller initiates an AHB byte or half-word write transfer, the data are duplicated on the unused lanes of the AHB master 32-bit data bus (HWDATA[31:0]).

When the AHB slave peripheral does not support byte or half-word write transfers and does not generate any error, the DMA controller writes the 32 HWDATA bits as shown in the two examples below:

- To write the half-word 0xABCD, the DMA controller sets the HWDATA bus to 0xABCDABCD with a half-word data size (HSIZE = HalfWord in AHB master bus).
- To write the byte 0xAB, the DMA controller sets the HWDATA bus to 0xABABABAB with a byte data size (HSIZE = Byte in the AHB master bus).

Assuming the AHB/APB bridge is an AHB 32-bit slave peripheral that does not take into account the HSIZE data, any AHB byte or half-word transfer is changed into a 32-bit APB transfer as described below:

- An AHB byte write transfer of 0xB0 to one of the 0x0, 0x1, 0x2 or 0x3 addresses, is converted to an APB word write transfer of 0xB0B0B0B0 to the 0x0 address.
- An AHB half-word write transfer of 0xB1B0 to the 0x0 or 0x2 addresses, is converted to an APB word write transfer of 0xB1B0B1B0 to the 0x0 address.

### 10.4.6 DMA error management

A DMA transfer error is generated when reading from or writing to a reserved address space. When a DMA transfer error occurs during a DMA read or write access, the faulty channel x is automatically disabled through a hardware clear of its EN bit in the corresponding DMA\_CCRx register.

The TEIFx bit of the DMA\_ISR register is set. An interrupt is then generated if the TEIE bit of the DMA\_CCRx register is set.

The EN bit of the DMA\_CCRx register can not be set again by software (channel x re-activated) until the TEIFx bit of the DMA\_ISR register is cleared (by setting the CTEIFx bit of the DMA\_IFCR register).

When the software is notified with a transfer error over a channel which involves a peripheral, the software has first to stop this peripheral in DMA mode, in order to disable any pending or future DMA request. Then software may normally reconfigure both DMA and the peripheral in DMA mode for a new transfer.

## 10.5 DMA interrupts

An interrupt can be generated on a half transfer, transfer complete or transfer error for each DMA channel x. Separate interrupt enable bits are available for flexibility.

**Table 29. DMA interrupt requests**

Interrupt request	Interrupt event	Event flag	Interrupt enable bit
Channel x interrupt	Half transfer on channel x	HTIFx	HTIEx
	Transfer complete on channel x	TCIFx	TCIEx
	Transfer error on channel x	TEIFx	TEIEx
	Half transfer or transfer complete or transfer error on channel x	GIFx	-

## 10.6 DMA registers

Refer to [Section 1.2](#) for a list of abbreviations used in register descriptions.

The DMA registers have to be accessed by words (32-bit).

### 10.6.1 DMA interrupt status register (DMA\_ISR)

Address offset: 0x00

Reset value: 0x0000 0000

Every status bit is cleared by hardware when the software sets the corresponding clear bit or the corresponding global clear bit CGIFx, in the DMA\_IFCR register.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	TEIF5	HTIF5	TCIF5	GIF5
												r	r	r	r
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
TEIF4	HTIF4	TCIF4	GIF4	TEIF3	HTIF3	TCIF3	GIF3	TEIF2	HTIF2	TCIF2	GIF2	TEIF1	HTIF1	TCIF1	GIF1
r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

Bits 31:20 Reserved, must be kept at reset value.

Bit 19 **TEIF5**: Transfer error (TE) flag for channel 5

0: No TE event  
1: A TE event occurred.

Bit 18 **HTIF5**: Half transfer (HT) flag for channel 5

0: No HT event  
1: An HT event occurred.

Bit 17 **TCIF5**: Transfer complete (TC) flag for channel 5

0: No TC event  
1: A TC event occurred.

Bit 16 **GIF5**: global interrupt flag for channel 5

0: No TE, HT, or TC event  
1: A TE, HT, or TC event occurred.

- Bit 15 **TEIF4**: Transfer error (TE) flag for channel 4  
0: No TE event  
1: A TE event occurred.
- Bit 14 **HTIF4**: Half transfer (HT) flag for channel 4  
0: No HT event  
1: An HT event occurred.
- Bit 13 **TCIF4**: Transfer complete (TC) flag for channel 4  
0: No TC event  
1: A TC event occurred.
- Bit 12 **GIF4**: global interrupt flag for channel 4  
0: No TE, HT, or TC event  
1: A TE, HT, or TC event occurred.
- Bit 11 **TEIF3**: Transfer error (TE) flag for channel 3  
0: No TE event  
1: A TE event occurred.
- Bit 10 **HTIF3**: Half transfer (HT) flag for channel 3  
0: No HT event  
1: An HT event occurred.
- Bit 9 **TCIF3**: Transfer complete (TC) flag for channel 3  
0: No TC event  
1: A TC event occurred.
- Bit 8 **GIF3**: Global interrupt flag for channel 3  
0: No TE, HT, or TC event  
1: A TE, HT, or TC event occurred.
- Bit 7 **TEIF2**: Transfer error (TE) flag for channel 2  
0: No TE event  
1: A TE event occurred.
- Bit 6 **HTIF2**: Half transfer (HT) flag for channel 2  
0: No HT event  
1: An HT event occurred.
- Bit 5 **TCIF2**: Transfer complete (TC) flag for channel 2  
0: No TC event  
1: A TC event occurred.
- Bit 4 **GIF2**: Global interrupt flag for channel 2  
0: No TE, HT, or TC event  
1: A TE, HT, or TC event occurred.
- Bit 3 **TEIF1**: Transfer error (TE) flag for channel 1  
0: No TE event  
1: A TE event occurred.
- Bit 2 **HTIF1**: Half transfer (HT) flag for channel 1  
0: No HT event  
1: An HT event occurred.
- Bit 1 **TCIF1**: Transfer complete (TC) flag for channel 1  
0: No TC event  
1: A TC event occurred.

- Bit 0 **GIF1**: Global interrupt flag for channel 1  
 0: No TE, HT, or TC event  
 1: A TE, HT, or TC event occurred.

## 10.6.2 DMA interrupt flag clear register (DMA\_IFCR)

Address offset: 0x04

Reset value: 0x0000 0000

Setting the global clear bit CGIFx of the channel x in this DMA\_IFCR register, causes the DMA hardware to clear the corresponding GIFx bit and any individual flag among TEIFx, HTIFx, TCIFx, in the DMA\_ISR register.

Setting any individual clear bit among CTEIFx, CHTIFx, CTCIFx in this DMA\_IFCR register, causes the DMA hardware to clear the corresponding individual flag and the global flag GIFx in the DMA\_ISR register, provided that none of the two other individual flags is set.

Writing 0 into any flag clear bit has no effect.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	CTEIF5	CHTIF5	CTCIF5	CGIF5
												w	w	w	w
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CTEIF4	CHTIF4	CTCIF4	CGIF4	CTEIF3	CHTIF3	CTCIF3	CGIF3	CTEIF2	CHTIF2	CTCIF2	CGIF2	CTEIF1	CHTIF1	CTCIF1	CGIF1
w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

Bits 31:20 Reserved, must be kept at reset value.

- Bit 19 **CTEIF5**: Transfer error flag clear for channel 5  
 Bit 18 **CHTIF5**: Half transfer flag clear for channel 5  
 Bit 17 **CTCIF5**: Transfer complete flag clear for channel 5  
 Bit 16 **CGIF5**: Global interrupt flag clear for channel 5  
 Bit 15 **CTEIF4**: Transfer error flag clear for channel 4  
 Bit 14 **CHTIF4**: Half transfer flag clear for channel 4  
 Bit 13 **CTCIF4**: Transfer complete flag clear for channel 4  
 Bit 12 **CGIF4**: Global interrupt flag clear for channel 4  
 Bit 11 **CTEIF3**: Transfer error flag clear for channel 3  
 Bit 10 **CHTIF3**: Half transfer flag clear for channel 3  
 Bit 9 **CTCIF3**: Transfer complete flag clear for channel 3  
 Bit 8 **CGIF3**: Global interrupt flag clear for channel 3  
 Bit 7 **CTEIF2**: Transfer error flag clear for channel 2  
 Bit 6 **CHTIF2**: Half transfer flag clear for channel 2  
 Bit 5 **CTCIF2**: Transfer complete flag clear for channel 2  
 Bit 4 **CGIF2**: Global interrupt flag clear for channel 2  
 Bit 3 **CTEIF1**: Transfer error flag clear for channel 1

Bit 2 **CHTIF1**: Half transfer flag clear for channel 1

Bit 1 **CTCIF1**: Transfer complete flag clear for channel 1

Bit 0 **CGIF1**: Global interrupt flag clear for channel 1

### 10.6.3 DMA channel x configuration register (DMA\_CCRx)

Address offset:  $0x08 + 0x14 * (x - 1)$ , ( $x = 1$  to 5)

Reset value: 0x0000 0000

The register fields/bits MEM2MEM, PL[1:0], MSIZE[1:0], PSIZE[1:0], MINC, PINC, and DIR are read-only when EN = 1.

The states of MEM2MEM and CIRC bits must not be both high at the same time.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Res.	MEM2 MEM	PL[1:0]		MSIZE[1:0]		PSIZE[1:0]		MINC	PINC	CIRC	DIR	TEIE	HTIE	TCIE	EN
	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:15 Reserved, must be kept at reset value.

Bit 14 **MEM2MEM**: Memory-to-memory mode

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*

Bits 13:12 **PL[1:0]**: Priority level

00: Low

01: Medium

10: High

11: Very high

*Note: This bitfield is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*

Bits 11:10 **MSIZE[1:0]**: Memory size

Defines the data size of each DMA transfer to the identified memory.

In memory-to-memory mode, this bitfield identifies the memory source if DIR = 1 and the memory destination if DIR = 0.

In peripheral-to-peripheral mode, this bitfield identifies the peripheral source if DIR = 1 and the peripheral destination if DIR = 0.

00: 8 bits

01: 16 bits

10: 32 bits

11: Reserved

*Note: This bitfield is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*



Bits 9:8 **PSIZE[1:0]**: Peripheral size

Defines the data size of each DMA transfer to the identified peripheral.

In memory-to-memory mode, this bitfield identifies the memory destination if DIR = 1 and the memory source if DIR = 0.

In peripheral-to-peripheral mode, this bitfield identifies the peripheral destination if DIR = 1 and the peripheral source if DIR = 0.

00: 8 bits

01: 16 bits

10: 32 bits

11: Reserved

*Note: This bitfield is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*

Bit 7 **MINC**: Memory increment mode

Defines the increment mode for each DMA transfer to the identified memory.

In memory-to-memory mode, this bit identifies the memory source if DIR = 1 and the memory destination if DIR = 0.

In peripheral-to-peripheral mode, this bit identifies the peripheral source if DIR = 1 and the peripheral destination if DIR = 0.

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*

Bit 6 **PINC**: Peripheral increment mode

Defines the increment mode for each DMA transfer to the identified peripheral.

In memory-to-memory mode, this bit identifies the memory destination if DIR = 1 and the memory source if DIR = 0.

In peripheral-to-peripheral mode, this bit identifies the peripheral destination if DIR = 1 and the peripheral source if DIR = 0.

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*

Bit 5 **CIRC**: Circular mode

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is not read-only when the channel is enabled (EN = 1).*

Bit 4 **DIR**: Data transfer direction

This bit must be set only in memory-to-peripheral and peripheral-to-memory modes.

0: Read from peripheral

- Source attributes are defined by PSIZE and PINC, plus the DMA\_CPARx register. This is still valid in a memory-to-memory mode.
- Destination attributes are defined by MSIZE and MINC, plus the DMA\_CMARx register. This is still valid in a peripheral-to-peripheral mode.

1: Read from memory

- Destination attributes are defined by PSIZE and PINC, plus the DMA\_CPARx register. This is still valid in a memory-to-memory mode.
- Source attributes are defined by MSIZE and MINC, plus the DMA\_CMARx register. This is still valid in a peripheral-to-peripheral mode.

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*

Bit 3 **TEIE**: Transfer error interrupt enable

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is not read-only when the channel is enabled (EN = 1).*

Bit 2 **HTIE**: Half transfer interrupt enable

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is not read-only when the channel is enabled (EN = 1).*

Bit 1 **TCIE**: Transfer complete interrupt enable

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is not read-only when the channel is enabled (EN = 1).*

Bit 0 **EN**: Channel enable

When a channel transfer error occurs, this bit is cleared by hardware. It can not be set again by software (channel x re-activated) until the TEIFx bit of the DMA\_ISR register is cleared (by setting the CTEIFx bit of the DMA\_IFCR register).

0: Disabled

1: Enabled

*Note: This bit is set and cleared by software.*

#### 10.6.4 DMA channel x number of data to transfer register (DMA\_CNDTRx)

Address offset:  $0x0C + 0x14 * (x - 1)$ , ( $x = 1$  to 5)

Reset value: 0x0000 0000

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
NDT[15:0]															
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 **NDT[15:0]**: Number of data to transfer (0 to  $2^{16} - 1$ )

This bitfield is updated by hardware when the channel is enabled:

- It is decremented after each single DMA 'read followed by write' transfer, indicating the remaining amount of data items to transfer.
- It is kept at zero when the programmed amount of data to transfer is reached, if the channel is not in circular mode (CIRC = 0 in the DMA\_CCRx register).
- It is reloaded automatically by the previously programmed value, when the transfer is complete, if the channel is in circular mode (CIRC = 1).

If this bitfield is zero, no transfer can be served whatever the channel status (enabled or not).

*Note: This bitfield is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is read-only when the channel is enabled (EN = 1).*

### 10.6.5 DMA channel x peripheral address register (DMA\_CPARx)

Address offset:  $0x10 + 0x14 * (x - 1)$ , (x = 1 to 5)

Reset value: 0x0000 0000

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

Bits 31:0 **PA[31:0]**: Peripheral address

It contains the base address of the peripheral data register from/to which the data is read/written.

When PSIZE[1:0] = 01 (16 bits), bit 0 of PA[31:0] is ignored. Access is automatically aligned to a half-word address.

When PSIZE[1:0] = 10 (32 bits), bits 1 and 0 of PA[31:0] are ignored. Access is automatically aligned to a word address.

In memory-to-memory mode, this bitfield identifies the memory destination address if DIR = 1 and the memory source address if DIR = 0.

In peripheral-to-peripheral mode, this bitfield identifies the peripheral destination address if DIR = 1 and the peripheral source address if DIR = 0.

*Note: This bitfield is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is not read-only when the channel is enabled (EN = 1).*

## 10.6.6 DMA channel x memory address register (DMA\_CMARx)

Address offset:  $0x14 + 0x14 * (x - 1)$ , ( $x = 1$  to  $5$ )

Reset value: 0x0000 0000

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

Bits 31:0 **MA[31:0]**: Peripheral address

It contains the base address of the memory from/to which the data is read/written.

When MSIZE[1:0] = 01 (16 bits), bit 0 of MA[31:0] is ignored. Access is automatically aligned to a half-word address.

When MSIZE[1:0] = 10 (32 bits), bits 1 and 0 of MA[31:0] are ignored. Access is automatically aligned to a word address.

In memory-to-memory mode, this bitfield identifies the memory source address if DIR = 1 and the memory destination address if DIR = 0.

In peripheral-to-peripheral mode, this bitfield identifies the peripheral source address if DIR = 1 and the peripheral destination address if DIR = 0.

*Note: This bitfield is set and cleared by software. It must not be written when the channel is enabled (EN = 1). It is not read-only when the channel is enabled (EN = 1).*

## 10.6.7 DMA channel selection register (DMA\_CSELR)

Address offset: 0xA8

Reset value: 0x0000 0000

This register is present only on STM32F030xC devices.

This register is used to manage the mapping of DMA channels as detailed in [Section 10.3.2: DMA request mapping](#).

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	C5S[3:0]			
												rw	rw	rw	rw
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
C4S[3:0]				C3S[3:0]				C2S[3:0]				C1S[3:0]			
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 31:20 Reserved, must be kept at reset value.

Bits 19:16 **C5S[3:0]**: DMA channel 5 selection

Details available in [Section 10.3.2: DMA request mapping](#)

Bits 15:12 **C4S[3:0]**: DMA channel 4 selection

Details available in [Section 10.3.2: DMA request mapping](#)

Bits 11:8 **C3S[3:0]**: DMA channel 3 selection

Details available in [Section 10.3.2: DMA request mapping](#)

Bits 7:4 **C2S[3:0]**: DMA channel 2 selection

Details available in [Section 10.3.2: DMA request mapping](#)

Bits 3:0 **C1S[3:0]**: DMA channel 1 selection

Details available in [Section 10.3.2: DMA request mapping](#)

## 10.6.8 DMA register map

Table 30. DMA register map and reset values

Offset	Register name	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
0x000	DMA_ISR	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	TEIF5	HTIF5	TCIF5	GIF5	TEIF4	HTIF4	TCIF4	GIF4	TEIF3	HTIF3	TCIF3	GIF3	TEIF2	HTIF2	TCIF2	GIF2	TEIF1	HTIF1	TCIF1	GIF1
	Reset value													0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x004	DMA_IFCR	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	CTEIF5	CHTIF5	CTCIF5	CGIF5	CTEIF4	CHTIF4	CTCIF4	CGIF4	CTEIF3	CHTIF3	CTCIF3	CGIF3	CTEIF2	CHTIF2	CTCIF2	CGIF2	CTEIF1	CHTIF1	CTCIF1	CGIF1
	Reset value													0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x008	DMA_CCR1	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	MEM2MEM	PL[1:0]	MSIZE[1:0]	PSIZE[1:0]	MINC	PINC	CIRC	DIR	TEIE	HTIE	TCIE	EN				
	Reset value																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x00C	DMA_CNDTR1	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	NDTR[15:0]																
	Reset value																0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x010	DMA_CPAR1	PA[31:0]																															
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x014	DMA_CMAR1	MA[31:0]																															
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x018	Reserved	Reserved																															
0x01C	DMA_CCR2	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	MEM2MEM	PL[1:0]	MSIZE[1:0]	PSIZE[1:0]	MINC	PINC	CIRC	DIR	TEIE	HTIE	TCIE	EN				
	Reset value																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x020	DMA_CNDTR2	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	NDTR[15:0]															
	Reset value																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x024	DMA_CPAR2	PA[31:0]																															
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x028	DMA_CMAR2	MA[31:0]																															
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x02C	Reserved	Reserved																															
0x030	DMA_CCR3	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	MEM2MEM	PL[1:0]	MSIZE[1:0]	PSIZE[1:0]	MINC	PINC	CIRC	DIR	TEIE	HTIE	TCIE	EN				
	Reset value																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x034	DMA_CNDTR3	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	Res	NDTR[15:0]															
	Reset value																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x038	DMA_CPAR3	PA[31:0]																															
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x03C	DMA_CMAR3	MA[31:0]																															
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x040	Reserved	Reserved																															

Table 30. DMA register map and reset values (continued)

Offset	Register name	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	
0x044	DMA_CCR4	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	MEM2MEM	PL[1:0]	MSIZE[1:0]	PSIZE[1:0]	MINC	PINC	CIRC	DIR	TEIE	HTIE	TCIE	EN				
	Reset value																		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0x048	DMA_CNDTR4	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.		NDTR[15:0]															
	Reset value																		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x04C	DMA_CPAR4	PA[31:0]																																
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x050	DMA_CMAR4	MA[31:0]																																
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x054	Reserved	Reserved.																																
0x058	DMA_CCR5	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	MEM2MEM	PL[1:0]	MSIZE[1:0]	PSIZE[1:0]	MINC	PINC	CIRC	DIR	TEIE	HTIE	TCIE	EN				
	Reset value																		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x05C	DMA_CNDTR5	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.		NDTR[15:0]															
	Reset value																		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x060	DMA_CPAR5	PA[31:0]																																
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x064	DMA_CMAR5	MA[31:0]																																
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x068-0x0A4	Reserved	Reserved.																																
0x0A8	DMA_CSELR	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.		C5S[3:0]			C4S[3:0]			C3S[3:0]			C2S[3:0]			C1S[3:0]							
	Reset value													0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Refer to [Section 2.2](#) for the register boundary addresses.