

S1R72U06
UART
Interface Manual

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Scope

This document applies to the S1R72U06 serial (UART/SPI) – USB Host/Device bridge LSI, which supports USB 2.0 FS/LS.

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1. Overview

This is the UART Interface Manual for the S1R72U06 serial (UART/SPI) – USB Host/Device bridge LSI (hereinafter referred to as the “LSI”), which supports USB 2.0 FS/LS.

This document explains the various commands and protocols supporting UART.

For details of hardware control and operating procedures for the LSI, refer to the *S1R72U06 Application Note*.

This document uses the terms defined in the section on “Terminology” in the *S1R72U06 Technical Manual*.

2. Command Specifications

2. Command Specifications

The LSI has two command systems, depending on the SIO (UART/SPI).

UART controls using EI requests (hereinafter referred to as “EIreq”).

For information on SPI, refer to the *S1R72U06 SPI Interface Manual*.

There are three EIreq types with differing functions, as follows.

- Control EI request:Common
- HID Class EI request:For USB (Host/Device) HID Class only
- MSC EI request:For USB Host MSC only

EIreq is a command consisting of three bytes for “Block size”, “Control code”, and “EIreq code”, and “Information data” (not included in some EIreq).

Data and notification information (status information, event information, error information) read from the LSI has the EIreq value (refer to the relevant EIreq for details) written by the Main CPU added at the start as an EI header (hereinafter referred to as “EIhead”). The Main CPU should check the EIhead to determine if the data is in response to an EIreq.

The XIRQ_STATUS and XIRQ_EVENT pins may change depending on the EIreq protocol.

The explanations in the following sections use the abbreviations shown in Table 2.1.

Table 2.1 Abbreviations

Abbreviation	Full description	Abbreviation	Full description
Tx	MOSI pin	size	Block size
Rx	MISO pin	code	Control code
xSTATUS	XIRQ_STATUS pin	cmd	EIreq code
xEVENT	XIRQ_EVENT pin	Info	Information data*
Stat	Status information	D	Data*
Event	Event information		
Error	Error information		

* Multiple Information data and multiple data are described as shown below in examples 1 and 2, respectively.

Example 1 When Information data exist from Block 3 to Block 5

Block 3: Info0, Block 4: Info1, Block 5: Info2

Example 2 When multiple data exist

D0 to Dn, D00 to D0n, D10 to D1n, Dm0 to Dmn

2.1 Terminology

The terminology used in this manual is defined as shown below.

EVENT notification	Notification of event information using the XIRQ_EVENT pin “enable” setting.
EVENT non-notification.....	Non-notification of event information using the XIRQ_EVENT pin “disable” setting.
THROUGH command	Generic term for the MSC “STORAGE COMMAND THROUGH (6) to (16)”.
Ended	“Command Through Ended event” that can be specified by the MSC THROUGH command.
Ended notification.....	Notification of Ended event information using the Ended “permitted” setting.
Ended non-notification.....	Non-notification of Ended event information using the Ended “prohibited” setting.

2.2 Usage conditions

- (1) “reserved” for each of the command settings should be set to “0”.
- (2) The Main CPU must process events occurring first. Unforeseen states (data errors or malfunction) may occur if other processes (e.g. writing Elreq unrelated to events) are performed after events have occurred.
- (3) Other Elreqs cannot be received while an Elreq is being processed. Therefore, if an error occurs during Elreq processing, the LSI transfers error information after the processing has ended.
- (4) The protocol may vary for some Elreqs depending on the XIRQ_EVENT pin settings. For details, refer to the relevant Elreq.
- (5) Unforeseen data may be transferred if the XIRQ_EVENT pin settings are changed (e.g. from “enable” to “disable”) while operating the LSI. The settings should be changed when “HID START” (10h) or “MSC START” (30h) is set to “Stop”.

2.3 Precautions

- (1) Errors or malfunction may occur if commands other than the Elreqs stipulated below are written in error. If an error occurs, check that the Elreq values have been set correctly and re-write. If the LSI malfunctions, it must be reset using a hardware reset.
- (2) The same event may occur in event management for the LSI depending on the baud rate and read timing from the Main CPU.

3. Sequences

3. Sequences

This section describes sequences of steps for various procedures between the Main CPU and the LSI.

3.1 EI header

An EI header is added at the start of data and notification information transferred from the LSI to the Main CPU. Figure 3.1 illustrates EI request and EI header examples (GET STATUS).

The EI header normally contains the same details as the EI request. For details of commands for which the EI request and EI header differ, refer to the relevant EIreq.

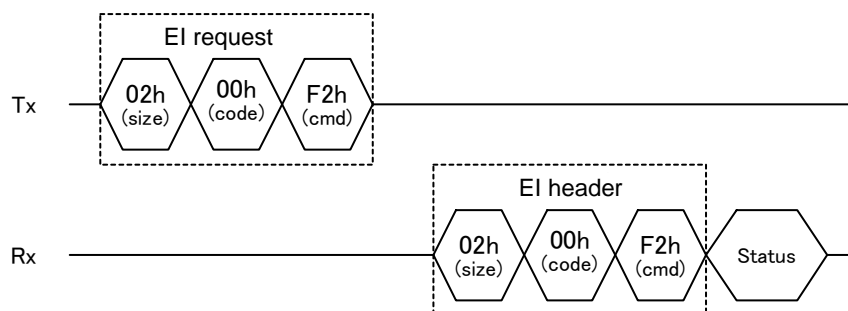


Figure 3.1 Elhead example

3.2 EI request transfer

Figure 3.2 illustrates an EI request transfer written from the Main CPU to the LSI.

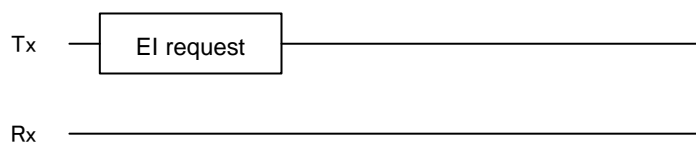


Figure 3.2 Elreq transfer

3.3 Data transfer

This section describes sequences of steps for various procedures for transferring data between the Main CPU and the LSI.

Figure 3.3 illustrates the sequence of steps for writing data after the EIreq.

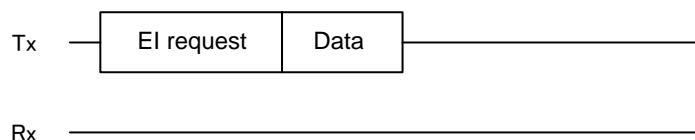


Figure 3.3 Data writing

Figure 3.4 illustrates the sequence of steps for reading data after transferring the EIreq.

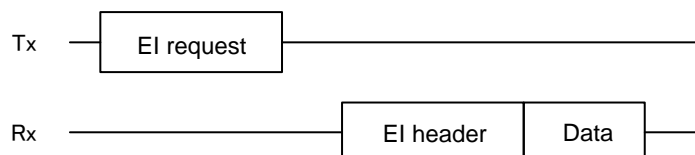


Figure 3.4 Data reading (1)

Figure 3.5 illustrates the sequence of steps for reading data after the EIhead.

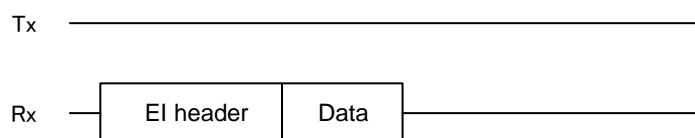


Figure 3.5 Data reading (2)

3. Sequences

Figure 3.6 illustrates the sequence for reading data with the “EVENT non-notification” setting. Event information is communicated from the LSI using **Sequence 1**. The Main CPU should read the data after the Elreq for reading has been transferred according to **Sequence 2**.

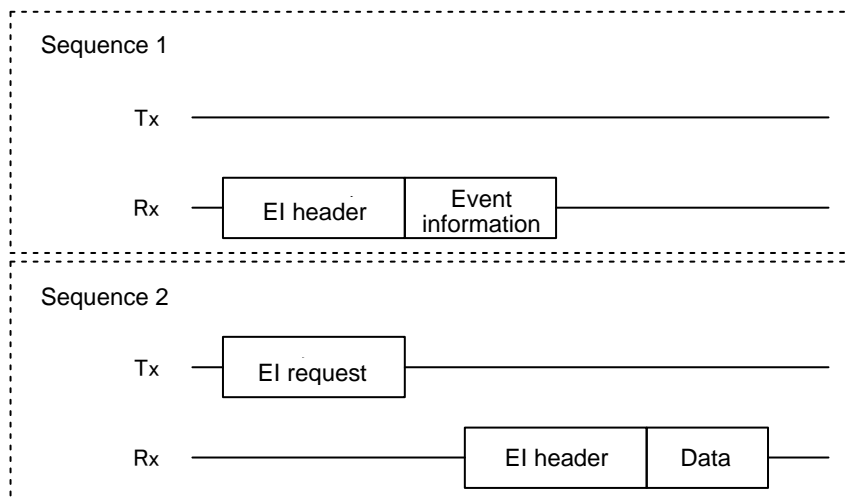


Figure 3.6 Data reading (3)

Figure 3.7 illustrates the sequence for reading data with the “EVENT notification” setting. Event information is communicated from the LSI using **Sequence 1**. The Main CPU should read the event information after the Elreq for acquiring event has been transferred according to **Sequence 2**. The data should be read after the Elreq for reading has been transferred according to **Sequence 3**.

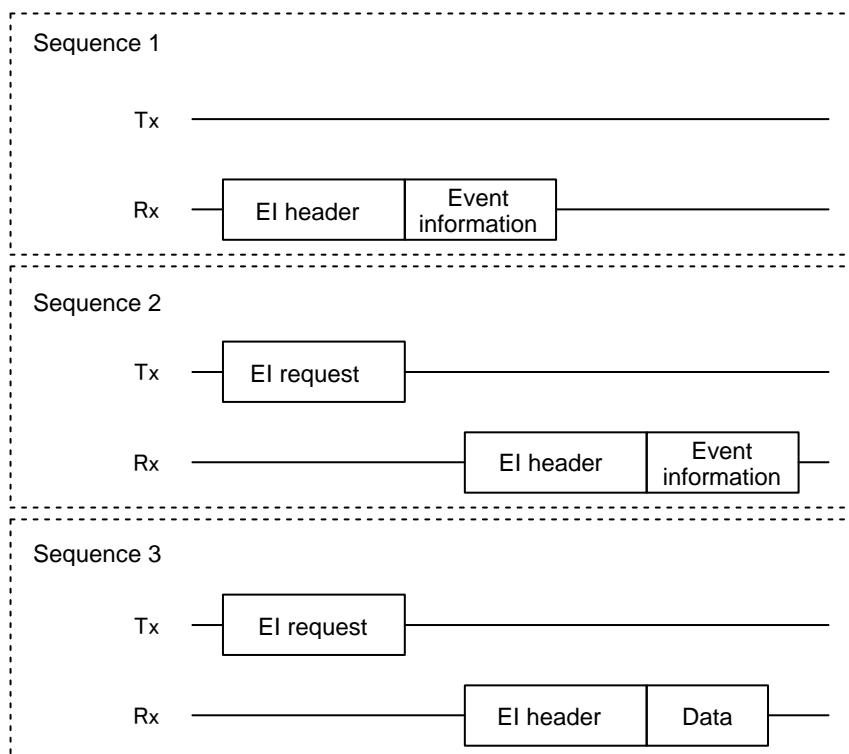


Figure 3.7 Data reading (4)

3.4 Notification transfer

This section describes the sequences of steps for transferring notifications between the Main CPU and the LSI. Notification information may refer to event information, status information, or error information.

Figure 3.8 illustrates the sequence of steps for transferring notification information after the EIhead.

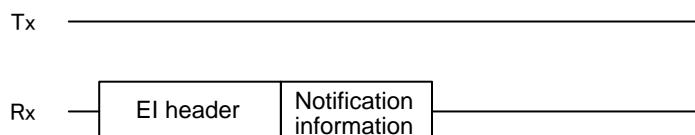


Figure 3.8 Notification transfer (1)

Figure 3.9 illustrates the sequence of steps for transferring notification information after transferring the EIreq.

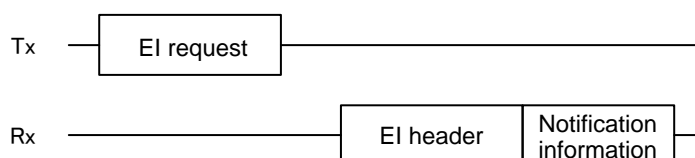


Figure 3.9 Notification transfer (2)

Figure 3.10 illustrates the sequences of steps for reacquiring notification information by the Main CPU after transferring notification from the LSI

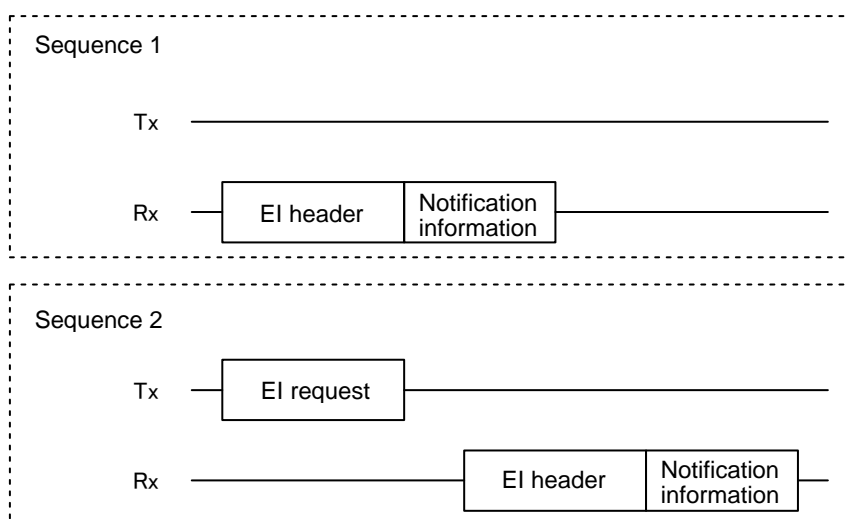


Figure 3.10 Notification transfer (3)

4. Control EI Requests

4. Control EI Requests

Table 4.1 lists the control EI requests. These EIreqs are used for both HID Class and MSC.

The following sections describe the command parameters and protocols.

Table 4.1 Control EI requests

Control code	EIreq code	EIreq name	Description
00h	01h	SLEEP	Sleep setting
	02h	DOWNLOAD	Download execution
	03h	LSI SETTING	LSI-specific setting
	F0h	GET EVENT	Event information acquisition
	F2h	GET STATUS	Status information acquisition
	F3h	GET ERROR	Error information acquisition
	F5h	GET DATA	Data read start request
	F8h	SERIAL PORT	Serial port setting
	FFh	EVENT INT CONTROL	Event interrupt setting

4.1 Usage conditions

- (1) If an error is detected, the LSI issues error notification by transferring “GET ERROR” (F3h) to the Main CPU.
- (2) The XIRQ_EVENT pin can be set to “enable” or “disable” (default) using “EVENT INT CONTROL” (FFh).

4.2 Precautions

- (1) “GET DATA” (F5h) is not used by the Main CPU when the XIRQ_EVENT pin is set to “disable”.

4.3 01h_SLEEP

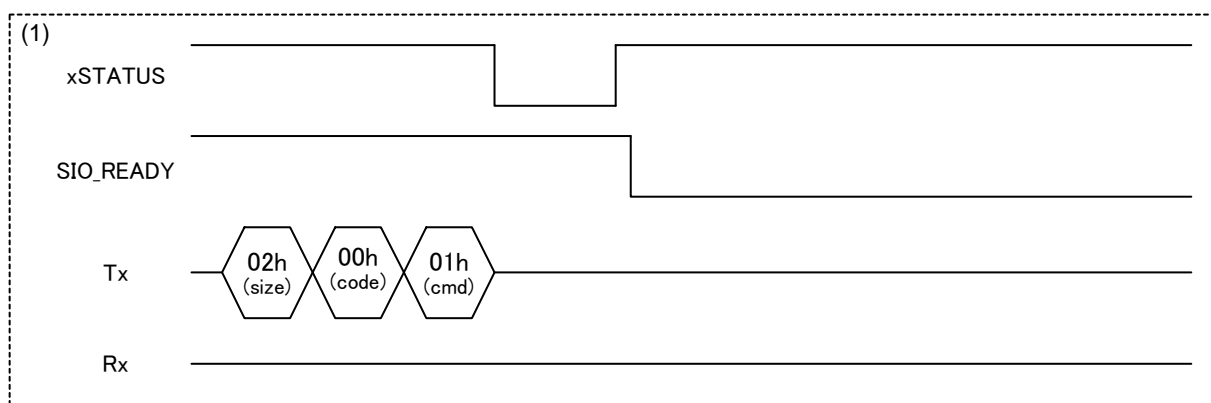
This switches the LSI to the Sleep state. For detailed information on how to reset from the Sleep state, refer to “Power management” in the *S1R72U06 Application Note*.

Table 4.2 SLEEP

	Content	Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	00h	Fixed value
	Elreq code	2	01h	Fixed value

Access using protocol procedure (1).

The SIO_READY pin is switched to “Low” when the LSI switches to the Sleep state.



4. Control EI Requests

4.4 02h_DOWNLOAD

This downloads TPL and descriptors to the LSI. The download data should be written after the Elreq. For information on how to create download data, refer to the *S1R72U06 Development Support Manual*. For detailed information on TPL and descriptors, refer to the *S1R72U06 Technical Manual*.

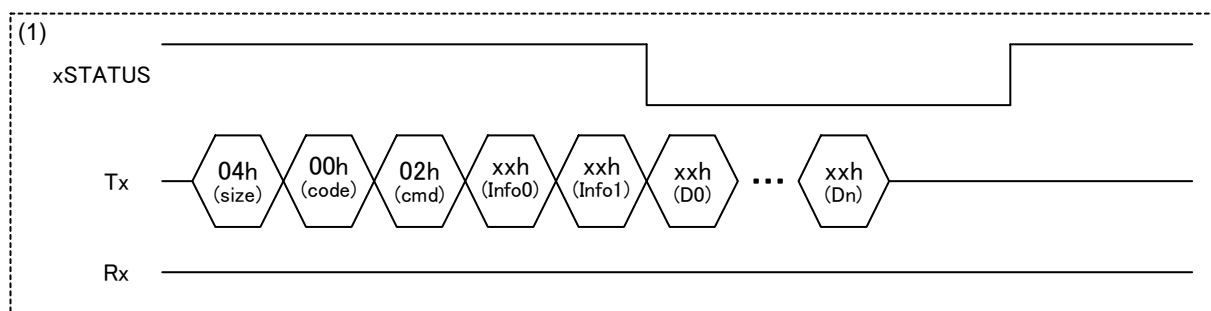
This Elreq can be executed when “HID START” (10h) or “MSC START” (30h) are set to “Stop”.

Table 4.3 DOWNLOAD

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	00h	Fixed value
	Elreq code	2	02h	Fixed value
	Information data	3	xxxxh	Download data size 0001h to FFFFh (Block4: MSB, Block3: LSB)
		4		
Data		-	xxh	Download data

Access using protocol procedure (1).

xSTATUS is asserted when the command is recognized by the LSI. xSTATUS is negated when data writing from the Main CPU is complete and internal processing has ended.



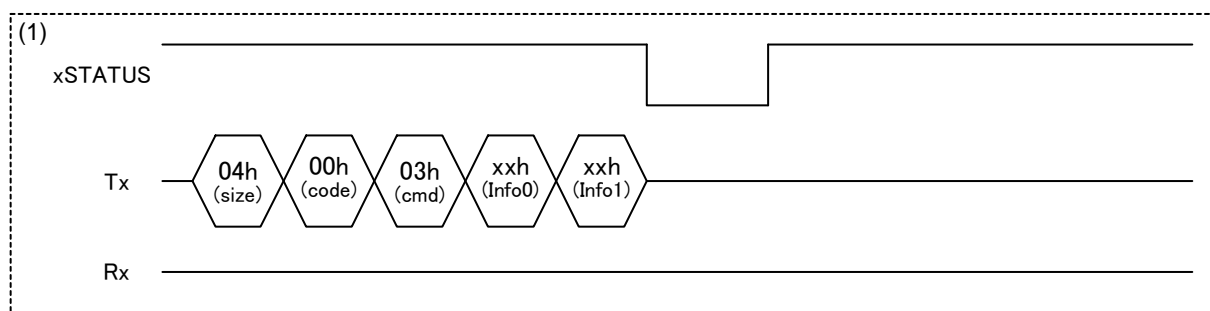
4.5 03h_LSI SETTING

This sets the LSI CLKOUT pin and VBUS detection for Host operation. Refer to the *S1R72U06 Data Sheet* for more information on the CLKOUT pin. For more information on VBUS detection, refer to the *S1R72U06 Technical Manual*.

Table 4.4 LSI SETTING

Content		Block	Value	Description		
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data		
	Control code	1	00h	Fixed value		
	Elreq code	2	03h	Fixed value		
	Information data	3	xxh	Clock output setting		
				Bit	Content	Setting value
				7	Output setting	0b: Output prohibited 1b: Output permitted (default)
				6-4	reserved	
				3-0	Frequency setting (valid when Bit 7 = 1b)	0000b: 48 MHz (default) 0001b: 24 MHz 0010b: 12 MHz 0100b: 6 MHz 1000b: 3 MHz
		4	xxh	VBUS setting		
				Bit	Content	Setting value
				7	Over Current detection setting	0b: Detection prohibited 1b: Detection permitted (default)
				6-0	reserved	

Access using protocol procedure (1).



4. Control EI Requests

4.6 F0h_GET EVENT

Event information includes protocols acquired when needed by the Main CPU and protocols issued by the LSI to notify the Main CPU of event occurrences. Event information is added to the EIhead transferred from the LSI.

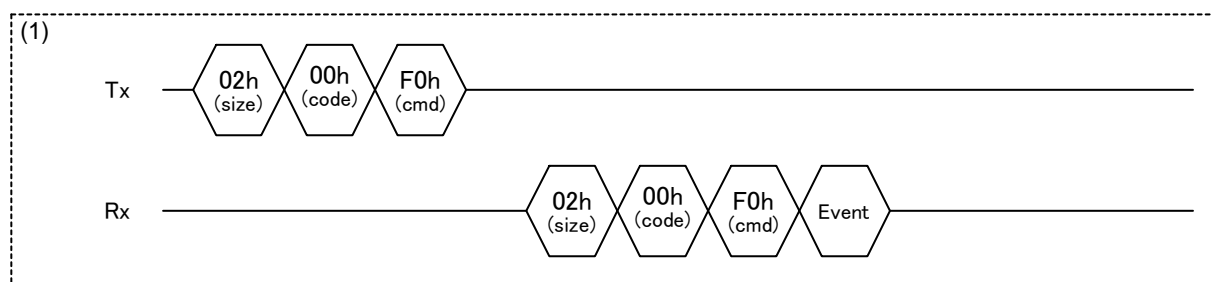
Table 4.5 GET EVENT

	Content	Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	00h	Fixed value
	Elreq code	2	F0h	Fixed value
Event information		-	xxh	Refer to the <i>S1R72U06 Technical Manual</i> for details.

4.6.1 Event information acquisition

Shown below is the protocol for acquiring event information when needed by the Main CPU.

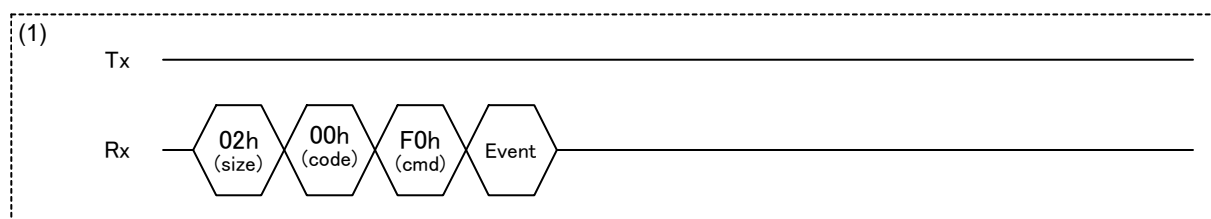
Access using protocol procedure (1).



4.6.2 Event notification

Shown below is the protocol for notifying the Main CPU of event occurrences.

Transfer to the Main CPU using protocol procedure (1). Note that this accompanies XIRQ_EVENT pin changes if “EVENT notification” is set. Refer to the respective commands for details.



4.7 F2h_GET STATUS

Status information includes protocols acquired when needed by the Main CPU and protocols issued by the LSI to notify the Main CPU of status changes. Status information is added to the EIhead transferred from the LSI.

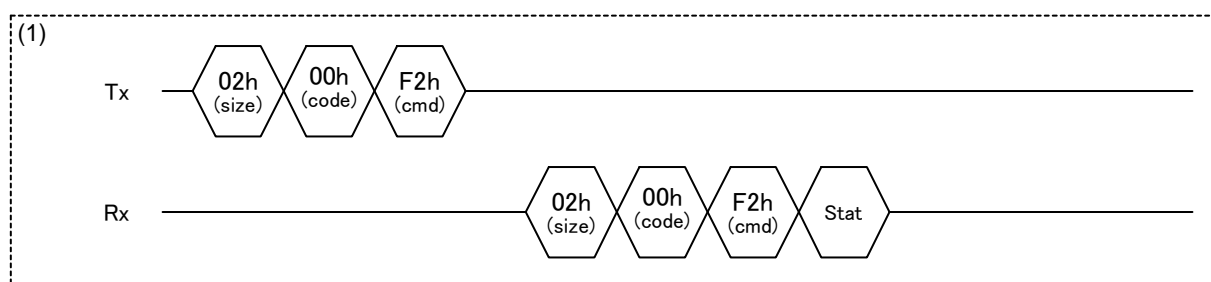
Table 4.6 GET STATUS

	Content	Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	00h	Fixed value
	Elreq code	2	F2h	Fixed value
Status information		-	xxh	Refer to the <i>S1R72U06 Technical Manual</i> for details.

4.7.1 Status information acquisition

Shown below is the protocol for acquiring status information when needed by the Main CPU.

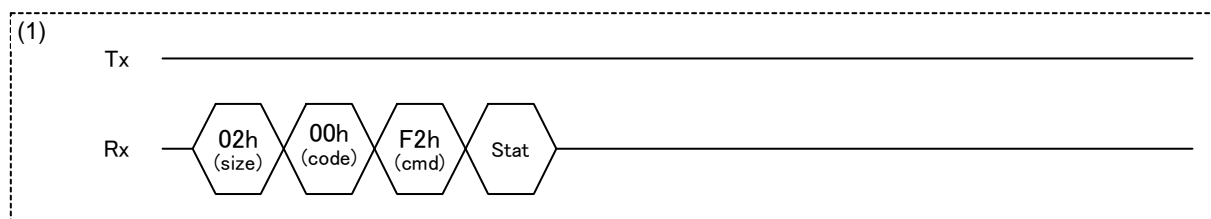
Access using protocol procedure (1).



4.7.2 Status notification

Shown below is the protocol for notifying the Main CPU of status changes.

Transfer to the Main CPU using protocol procedure (1).



4. Control EI Requests

4.8 F3h_GET ERROR

Error information includes protocols acquired when needed by the Main CPU and protocols issued by the LSI to notify the Main CPU of error occurrences. Error information is added to the EIhead transferred from the LSI.

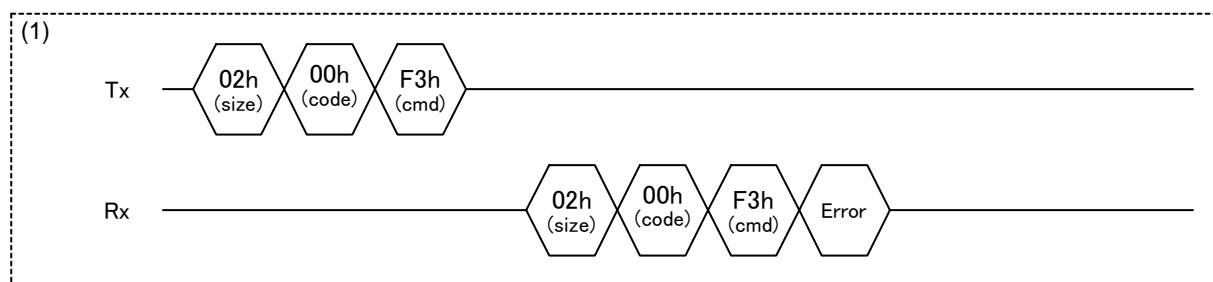
Table 4.7 GET ERROR

	Content	Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	00h	Fixed value
	Elreq code	2	F3h	Fixed value
Error information		-	xxh	Refer to the <i>S1R72U06 Technical Manual</i> for details.

4.8.1 Error information acquisition

Shown below is the protocol for acquiring error information when needed by the Main CPU.

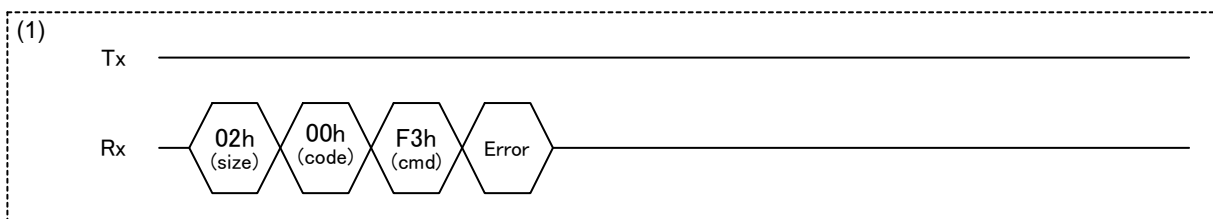
Access using protocol procedure (1).



4.8.2 Error notification

Shown below is the protocol for notifying the Main CPU of error occurrences.

Transfer to the Main CPU using protocol procedure (1).



4.9 F5h_GET DATA

This EI request is used when “EVENT notification” is set by an HID Class EI request.

Data is read from the LSI. This EI request can be used instead of “RECV FEATURE REPORT” (21h) or “RECV REPORT” (23h). For detailed information on protocol procedures, refer to “5.8 21h_RECV FEATURE REPORT” or “5.10 23h_RECV REPORT”.

Table 4.8 GET DATA

Content		Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	00h	Fixed value
	Elreq code	2	F5h	Fixed value

4. Control EI Requests

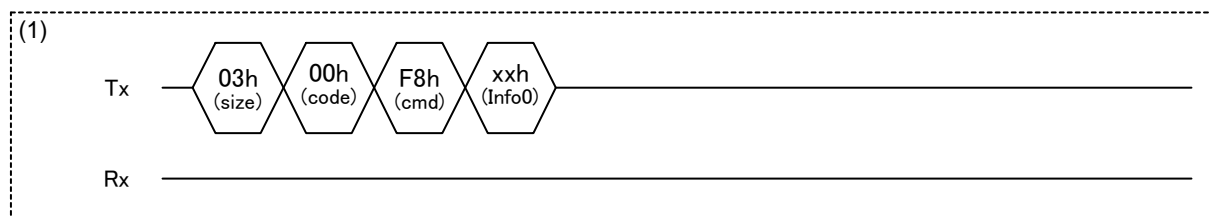
4.10 F8h_SERIAL PORT

This sets the LSI serial port. The SIO READY pin is set to “Low” (approx. 1 ms) when the command is recognized by the LSI. It is set to “High” when the setting is enabled.

Table 4.9 SERIAL PORT

Content		Block	Value	Description		
Elreq	Block size	0	03h	Total for Control code + Elreq code + Information data		
	Control code	1	00h	Fixed value		
	Elreq code	2	F8h	Fixed value		
	Information data	3	xxh	Serial port setting		
Bit				Content	Setting value	
7-6				Parity	00b: None 01b: Odd 10b: Even 11b: None	
5				Stop Bit	0b: 1 bit 1b: 2 bits	
4-0				Baud rate	00000b: 300 00001b: 600 00010b: 1,200 00011b: 2,400 00100b: 4,800 00101b: 9,600 00110b: 19,230.77 00111b: 38,461.54 01000b: 57,692.31 01001b: 115,384.62 01010b: 230,769.23 01011b: 300,000 01100b: 461,538.46 01101b: 600,000 01110b: 1,000,000 01111b: 1,200,000 10000b: 1,500,000 10001b: 2,000,000 10010b to 11111b: 3,000,000	

Access using protocol procedure (1).



4.11 FFh_EVENT INT CONTROL

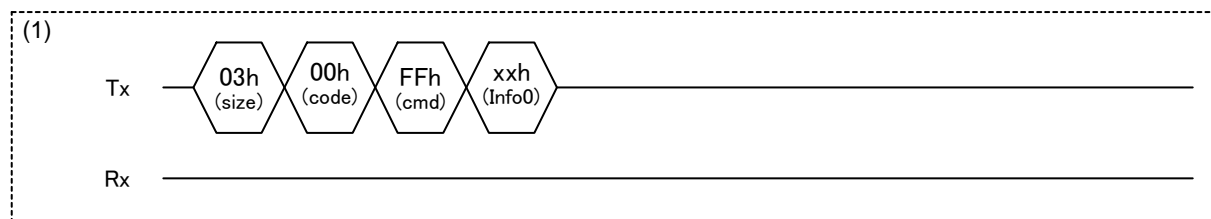
This enables and disables the LSI XIRQ_EVENT pin. The default setting for the LSI is “disable”. The event information control methods vary depending on the XIRQ_EVENT pin setting. For more information, refer to “UART event control” in the *S1R72U06 Technical Manual*.

The XIRQ_EVENT pin changes in the Sleep state regardless of this Elreq setting. For more information, refer to “Power management” in the *S1R72U06 Application Note*.

Table 4.10 EVENT INT CONTROL

	Content	Block	Value	Description
Elreq	Block size	0	03h	Total for Control code + Elreq code + Information data
	Control code	1	00h	Fixed value
	Elreq code	2	FFh	Fixed value
	Information data	3	xxh	XIRQ_EVENT pin setting 00h: disable (default) 01h: enable 02h to FFh: Must not be set

Access using protocol procedure (1).



5. HID Class EI Requests

5. HID Class EI Requests

Table 5.1 lists the HID Class EI requests. These EIreqs are used for HID Class only.

The command parameters and protocols are described in the following sections.

Table 5.1 HID Class EI requests

DEVICE		HOST		EIreq name	Description
Control code	EIreq code	Control code	EIreq code		
81h	10h	C1h	10h	HID START	HID Class control
	-		11h	REPORT ID REGISTRATION	Report ID registration information setting
	-		12h	DEVICE POWER MANAGEMENT	Power management
	-		13h	DEVICE RESET	USB BUS reset
	20h		20h	SEND FEATURE REPORT	Feature Report write
	21h		21h	RECV FEATURE REPORT	Feature Report read
	22h		22h	SEND REPORT	Report write
	23h		23h	RECV REPORT	Report read
	24h		-	INITIAL FEATURE REPORT	Feature Report initialization setting
	25h		-	GET PROTOCOL MODE	Protocol mode read
	-		24h	GET DESCRIPTOR	Descriptor read

5.1 Usage conditions

- (1) HID Class EI requests are assumed to be used after “HID START” (10h) has been set to “Start”. The only HID Class EI request that can be used with “HID START” (10h) set to “Stop” is “INITIAL FEATURE REPORT” (24h). For more details, refer to “HID Class Device initialization flow” in the *S1R72U06 Application Note*.
- (2) EIreqs cannot contain data with differing Report IDs.
- (3) It is not possible to divide into multiple EIreqs when writing Report data.
- (4) For details of Report settings, refer to the *S1R72U06 Technical Manual*.

5.2 Precautions

- (1) The corresponding code should be used, as the “Control code” will vary depending on the USB function (Host/Device).
- (2) The LSI will issue an error notification if the Main CPU issues a read command (such as “GET DATA” (F5h) or “RECV REPORT” (23h)) when there is no data to be transferred from the LSI.
- (3) “RECV FEATURE REPORT” (21h) and “RECV REPORT” (23h) are not used by the Main CPU when the LSI is in Device and the XIRQ_EVENT pin is set to “disable”, as they are transferred automatically from the LSI. Likewise, when the LSI is operated as a Host, “RECV REPORT” (23h) becomes an unused command.
- (4) The Host “HID START” (10h) should use “Report Protocol HID Class Start” if it is expected that a standard HID Class Device will be connected. “Boot Protocol HID Class Start” should be used when it is necessary to restrict to Boot Protocol dedicated Device.

5.3 10h_HID START

This sets HID Class control for the USB. Device settings are shown in Table 5.2; Host settings are shown in Table 5.3.

Table 5.2 Device HID START

	Content	Block	Value	Description
Elreq	Block size	0	03h	Total for Control code + Elreq code + Information data
	Control code	1	81h	Fixed value
	Elreq code	2	10h	Fixed value
	Information data	3	xxh	Mode setting 00h: HID Class Stop (default) 01h: Low Speed HID Class Start 02h: Full Speed HID Class Start 03h to FFh: reserved

Table 5.3 Host HID START

	Content	Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	10h	Fixed value
	Information data	3	xxh	Protocol mode setting 00h: HID Class Stop (default) 01h: Report Protocol HID Class Start 02h: Boot Protocol HID Class Start 03h to FFh: reserved
		4	xxh	Interrupt cycle setting 00h: Response only when change occurs 01h to FFh: Responds at specified frequency of between 4 and 1,020 ms

5. HID Class EI Requests

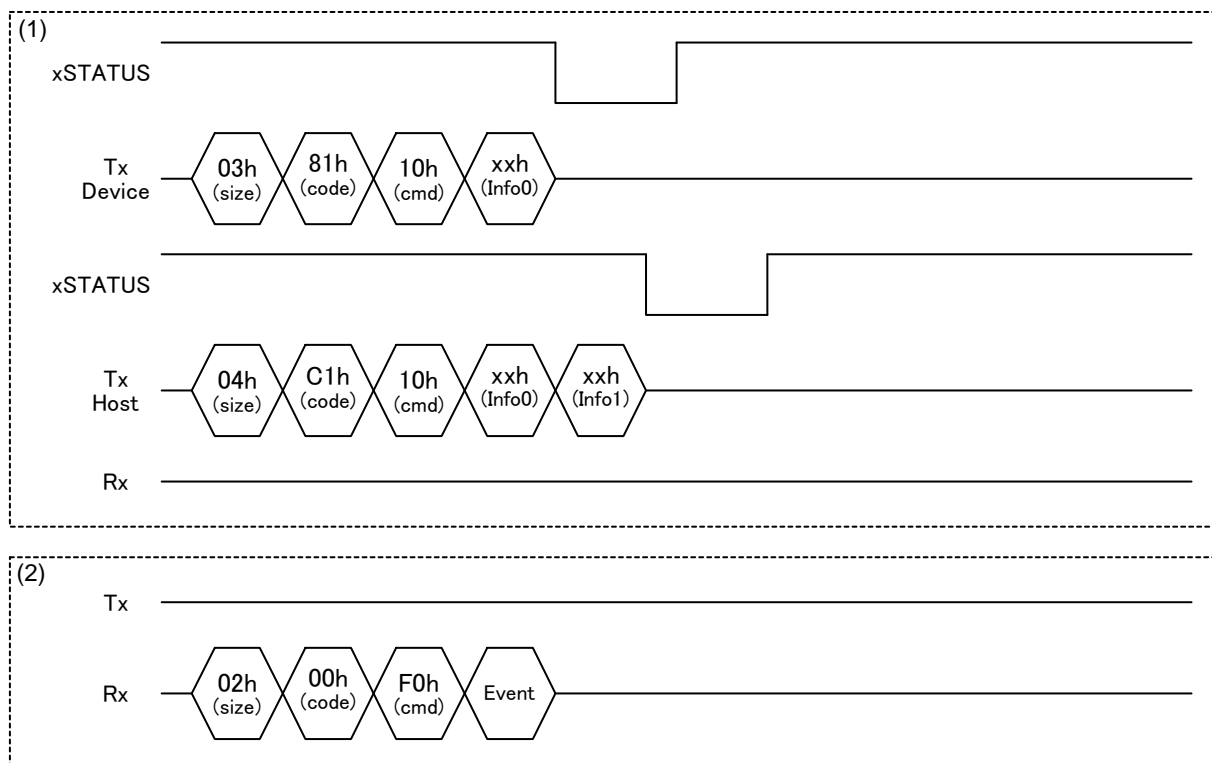
5.3.1 EVENT non-notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “disable”.

Access using protocol procedures (1) and (2).

xSTATUS in (1) changes when the command is recognized by the LSI.

The event information in (2) is communicated to the Main CPU when the LSI is connected to a Device or Host.



5.3.2 EVENT notification

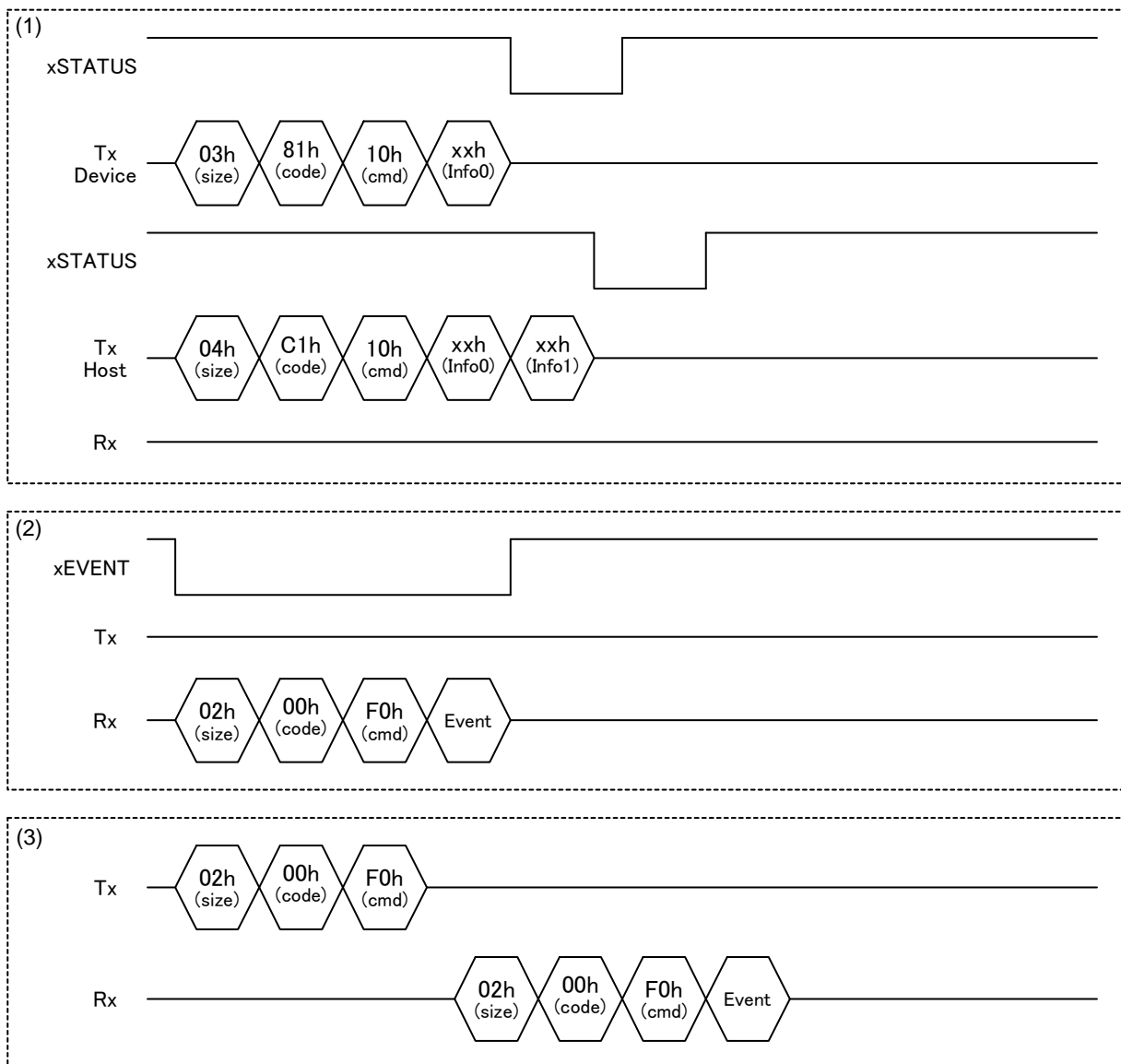
Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “enable”.

Access using protocol procedures (1) to (3).

xSTATUS in (1) changes when the command is recognized by the LSI.

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (2) when the LSI is connected to a Device or Host.

The event information is cleared by reading in (3).



5. HID Class EI Requests

5.4 11h_REPORT ID REGISTRATION

This sets the Report ID registration information acquired from the Device descriptor to the LSI. Report ID registration information data should be written after the Elreq.

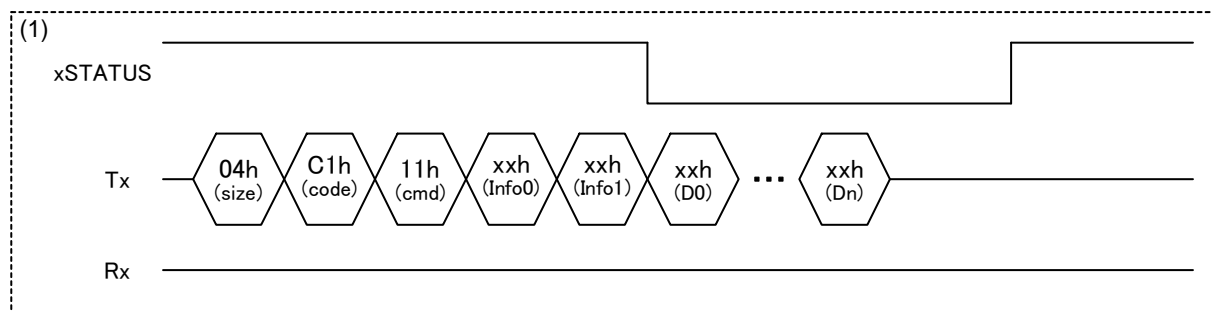
For more information on Report ID registration information, refer to the *S1R72U06 Technical Manual*.

Table 5.4 Host REPORT ID REGISTRATION

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	11h	Fixed value
	Information data	3	xxxxh	Report ID registration information data size 0008h to 0084h (Block4: MSB, Block3: LSB)
		4		
Data		-	xxh	Report ID registration information data

Access using protocol procedure (1).

xSTATUS is asserted when the command is recognized by the LSI. xSTATUS is negated when data writing from the Main CPU is complete and internal processing has ended.



5.5 12h_DEVICE POWER MANAGEMENT

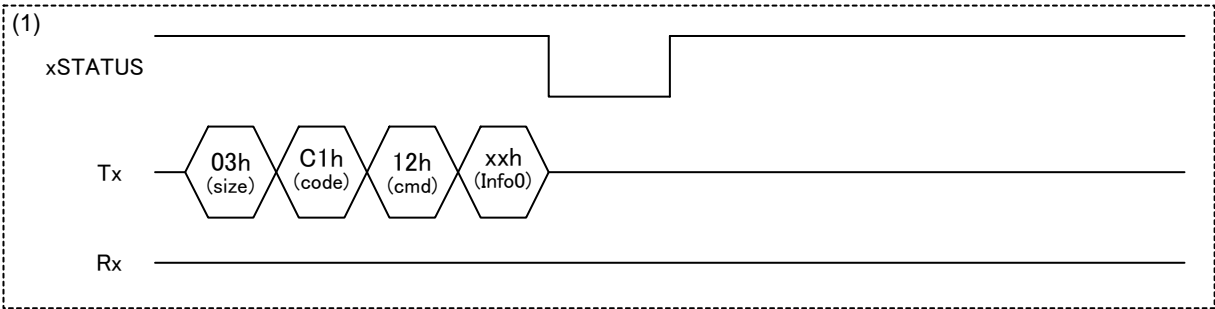
This controls Device Suspend and Resume operations. For more information on control methods, refer to “Power management” in the *S1R72U06 Application Note*.

Table 5.5 Host DEVICE POWER MANAGEMENT

Content		Block	Value	Description
Elreq	Block size	0	03h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	12h	Fixed value
	Information data	3	xxh	Operation setting 00h: Resume 01h: Suspend & Remote Wakeup prohibited 02h: Suspend & Remote Wakeup permitted 03h to FFh: reserved

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



5. HID Class El Requests

5.6 13h_DEVICE RESET

This performs a BUS reset for Devices in accordance with the USB standard.

Table 5.6 Host DEVICE RESET

	Content	Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	C1h	Fixed value
	Elreq code	2	13h	Fixed value

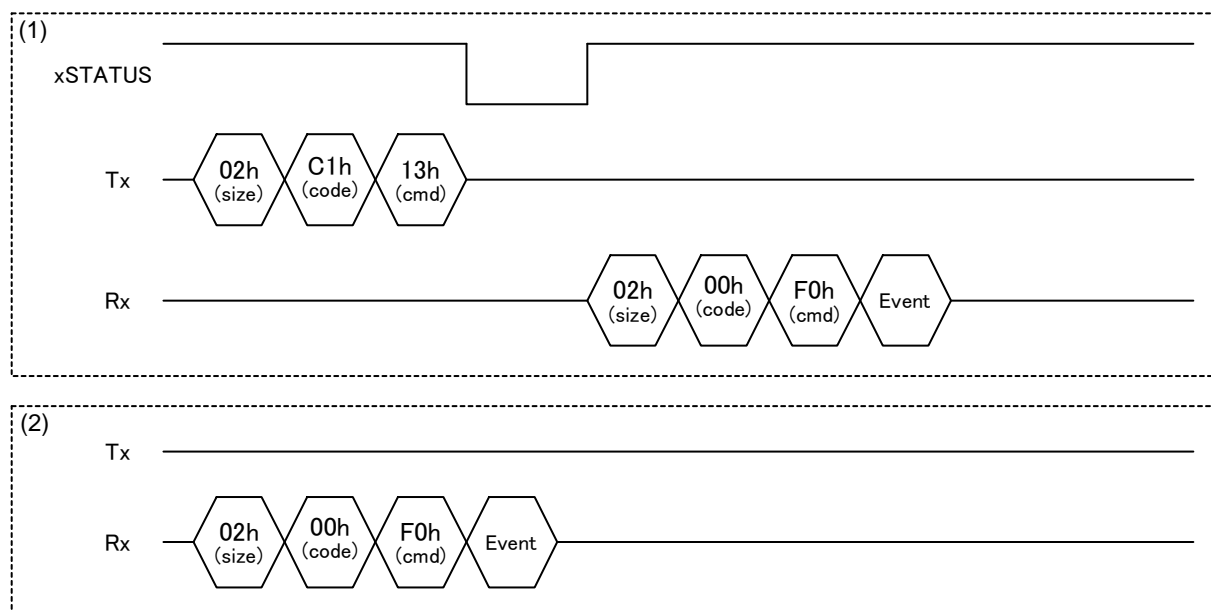
5.6.1 EVENT non-notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “disable”.

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted while the LSI is processing the command. The event information in (1) is communicated to the Main CPU when the Device is disconnected by a BUS reset.

The event information in (2) is communicated to the Main CPU when the Device is reconnected.



5.6.2 EVENT notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “enable”.

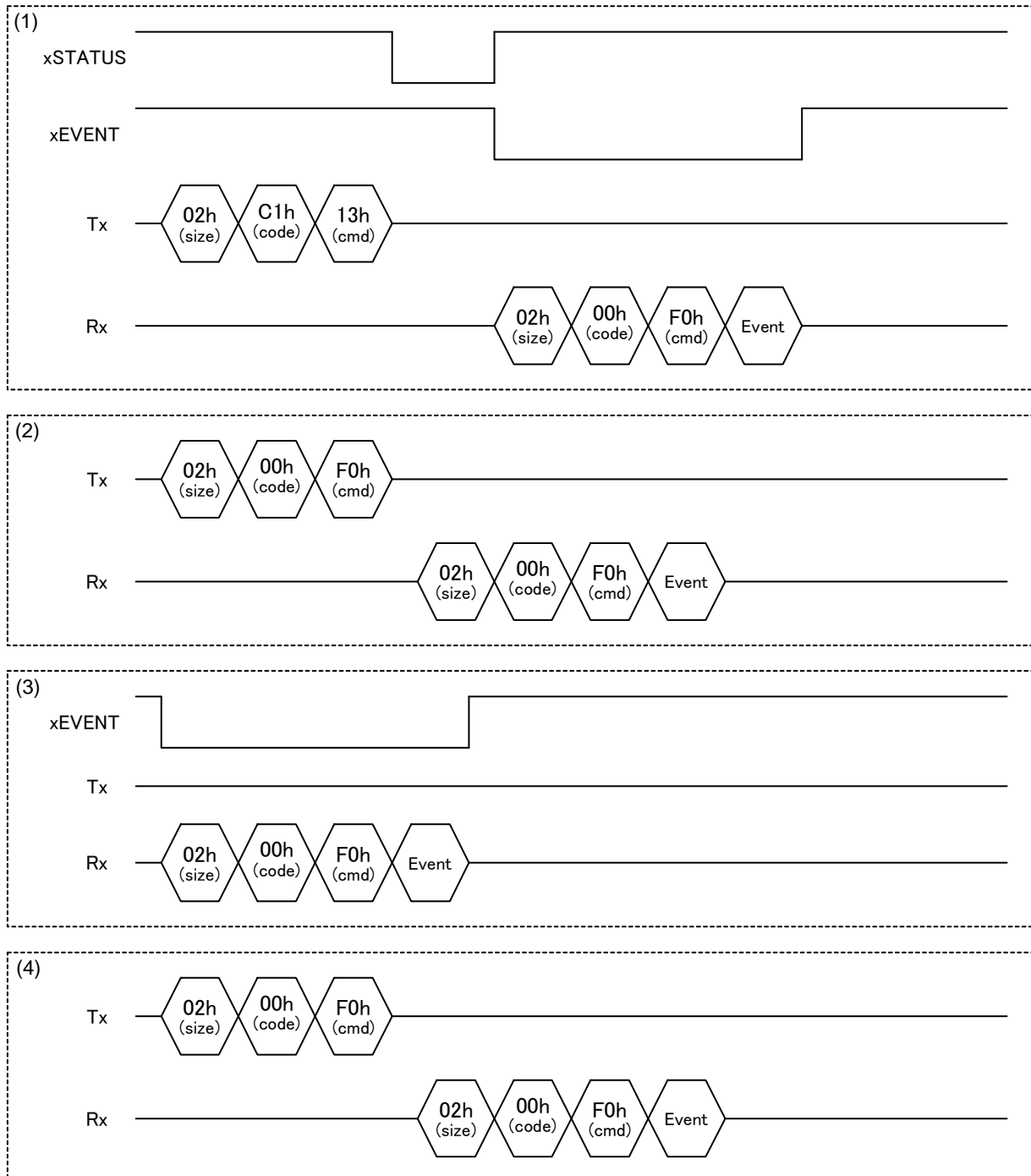
Access using protocol procedures (1) to (4).

xSTATUS in (1) is asserted while the LSI is processing a command. When the Device is disconnected by a BUS reset, the event information is passed on to the Main CPU concurrently with the xEVENT assert.

The event information is cleared by reading in (2).

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (3) when the Device is reconnected.

The event information is cleared by reading in (4).



5. HID Class EI Requests

5.7 20h_SEND FEATURE REPORT

This writes Feature Report data to the LSI. The Device settings are shown in Table 5.7; the Host settings are shown in Table 5.8. Feature Report data should be written after the Elreq.

“Write data size” should be set to the Feature Report data size. For more information on data size, refer to the *S1R72U06 Technical Manual*.

Table 5.7 Device SEND FEATURE REPORT

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	81h	Fixed value
	Elreq code	2	20h	Fixed value
	Information data	3	xxxxh	Write data size 0001h to 0101h (Block4: MSB, Block3: LSB)
		4		
Data		-	xxh	Feature Report data

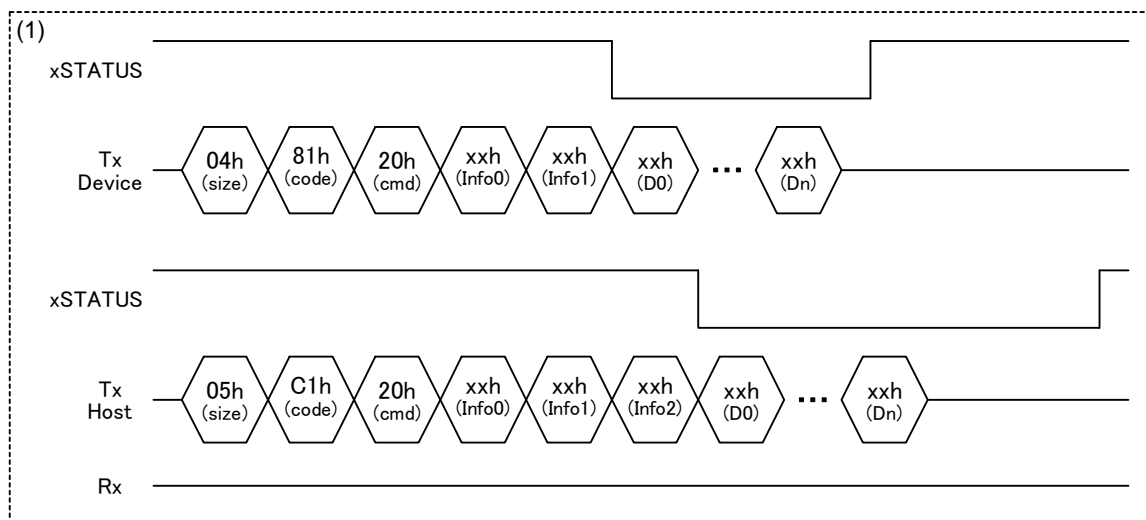
Table 5.8 Host SEND FEATURE REPORT

Content		Block	Value	Description
Elreq	Block size	0	05h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	20h	Fixed value
	Information data	3	00h	Fixed value
		4	xxxxh	Write data size
		5		0001h to 0101h (Block5: MSB, Block4: LSB)
Data		-	xxh	Feature Report data

Access using protocol procedure (1).

In the Device protocol, xSTATUS is asserted when the command is recognized by the LSI. xSTATUS is negated when data writing from the Main CPU is complete and internal processing has ended. The data is retained until a request is issued by the Host. The transmission timing depends on requests from the Host.

In the Host protocol, xSTATUS is asserted when the command is recognized by the LSI and negated when transmission to the Device is complete.



5.8 21h_RECV FEATURE REPORT

This reads Feature Report data from the LSI. The Device settings are shown in Table 5.9; the Host settings are shown in Table 5.10. Feature Report data is added after the EIhead when transferring from the LSI.

The LSI should set the EIhead “Information data” to the read data size. For more information on data size, refer to the *S1R72U06 Technical Manual*.

Table 5.9 Device RECV FEATURE REPORT

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	81h	Fixed value
	Elreq code	2	21h	Fixed value
	Information data	3	0000h	Fixed value (Block4: MSB, Block3: LSB) *Indicates read data size for EIhead.
		4		
Data		-	xxh	Feature Report data

Table 5.10 Host RECV FEATURE REPORT

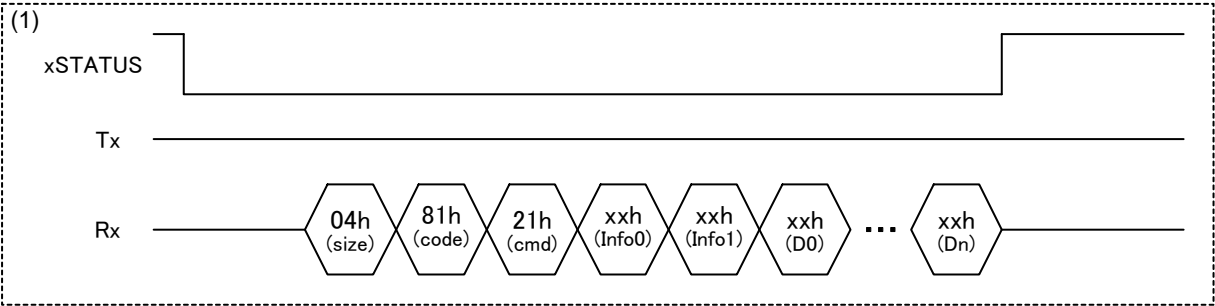
Content		Block	Value	Description
Elreq	Block size	0	05h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	21h	Fixed value
	Information data	3	xxh	Report ID [00h: ID not used]
		4	0000h	Fixed value (Block5: MSB, Block4: LSB) *Indicates read data size for Elhead.
		5		
Data		-	xxh	Feature Report data

5.8.1 Device EVENT non-notification

Shown below is the protocol that applies when the Device and XIRQ_EVENT pin are set to “disable”.

Access using protocol procedure (1).

xSTATUS in (1) is asserted when a Feature Report is received from the Host. Data transfer starts, and the data should be read. xSTATUS is negated when the data transfer is complete.



5. HID Class EI Requests

5.8.2 Device EVENT notification

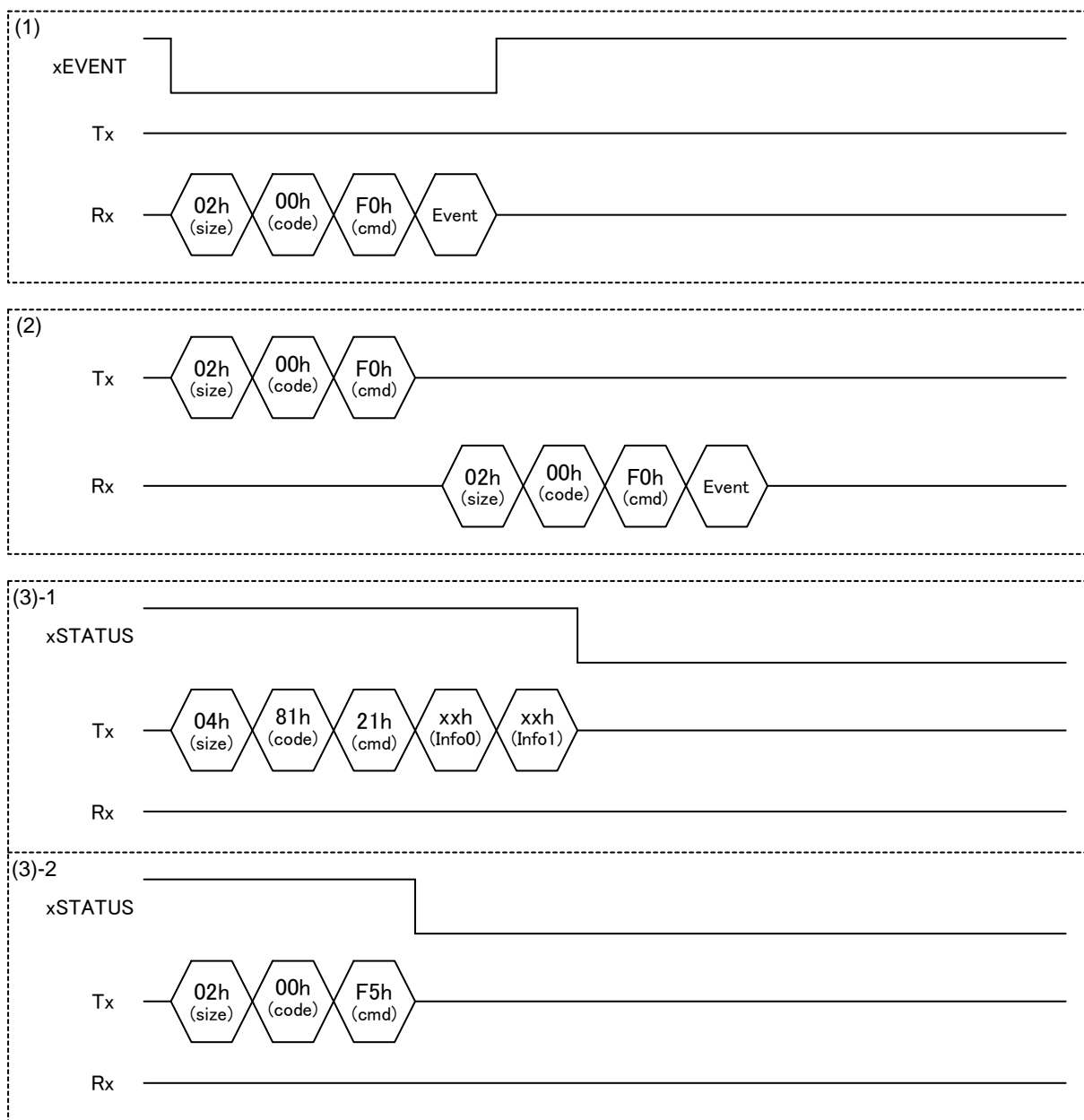
Shown below is the protocol that applies when the Device and XIRQ_EVENT pin are set to “enable”.

Access using protocol procedures (1) to (4).

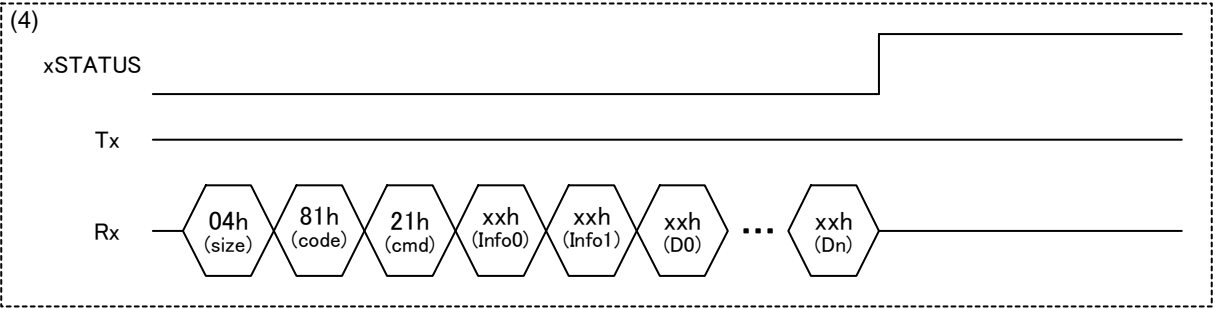
The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (1) when a Feature Report is received from the Host.

The event information is cleared by reading in (2).

The command in either (3)-1 or (3)-2 should be used with this protocol. xSTATUS is asserted when the command is recognized by the LSI.



Data transfer starts as in (4), and the data should be read. xSTATUS is negated when the data transfer is complete.

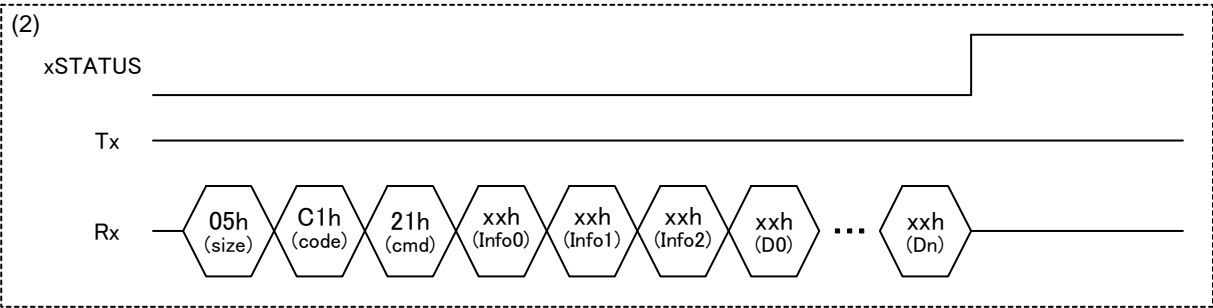
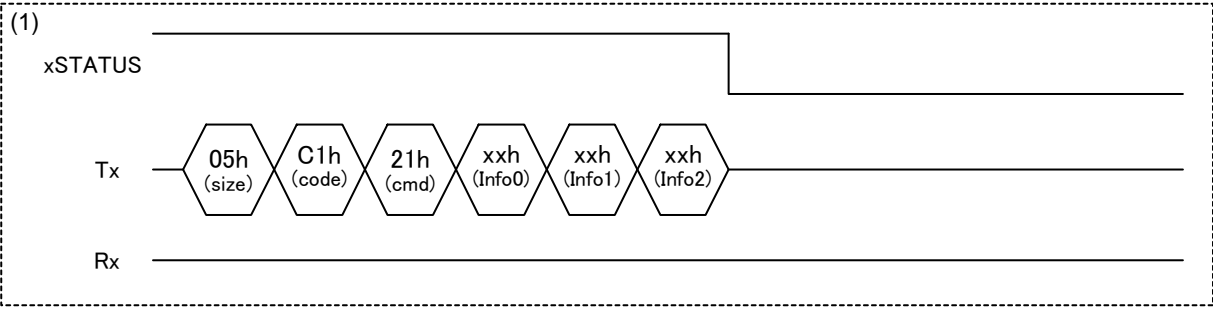


5.8.3 Host

The Host protocol is shown below. Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted when the command is recognized by the LSI.

Data transfer starts as in (2) when the data has been received from the Device, and the data should be read. xSTATUS is negated when the data transfer is complete.



5. HID Class EI Requests

5.9 22h_SEND REPORT

This writes Report data to the LSI. The Device settings are shown in Table 5.11; the Host settings are shown in Table 5.12. Report data should be written after the Elreq.

This command allows multiple Report data to be written together. When Report data is combined, “Write data size” should be set to an integer multiple of the Report data size. For more information on data size, refer to the *S1R72U06 Technical Manual*.

Table 5.11 Device SEND REPORT

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	81h	Fixed value
	Elreq code	2	22h	Fixed value
	Information data	3	xxxxh	Write data size 0001h to 0800h (Block4: MSB, Block3: LSB)
		4		
Data		-	xxh	Report data

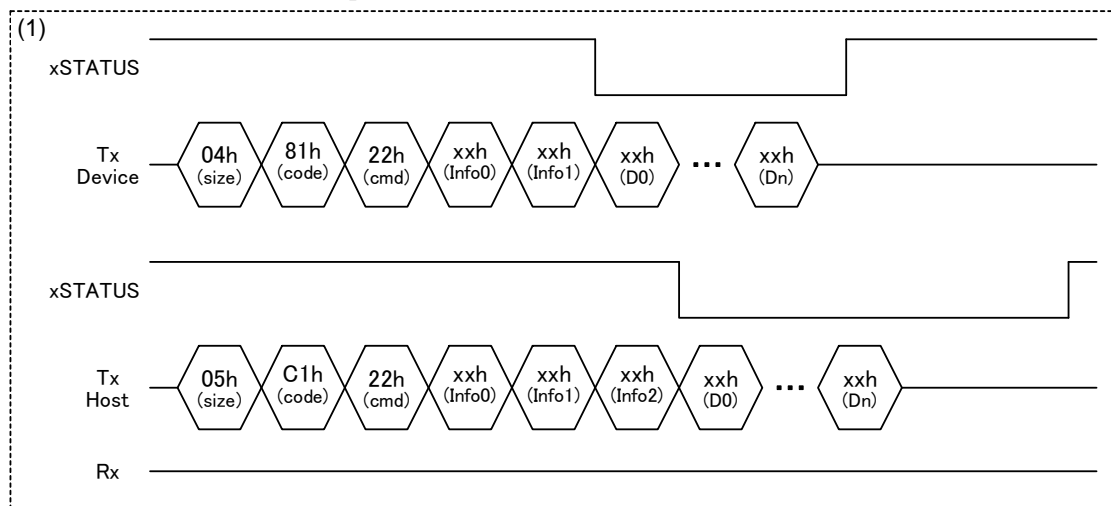
Table 5.12 Host SEND REPORT

Content		Block	Value	Description
Elreq	Block size	0	05h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	22h	Fixed value
	Information data	3	00h	Fixed value
		4	xxxxh	Write data size 0001h to 0800h (Block5: MSB, Block4: LSB)
		5		
Data		-	xxh	Report data

Access using protocol procedure (1).

In the Device protocol, xSTATUS is asserted when the command is recognized by the LSI. xSTATUS is negated when data writing from the Main CPU is complete and internal processing has ended. The data is retained until a request is issued by the Host. The transmission timing depends on requests from the Host.

In the Host protocol, xSTATUS is asserted when the command is recognized by the LSI and negated when transmission to the Device is complete.



5.10 23h_RECV REPORT

This reads Report data from the LSI. The Device settings are shown in Table 5.13; the Host settings are shown in Table 5.14. Report data is added to the Elhead transferred from the LSI.

The LSI sets the Elhead “Information data” to the read data size. For more information on data size, refer to the *S1R72U06 Technical Manual*.

Table 5.13 Device RECV REPORT

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	81h	Fixed value
	Elreq code	2	23h	Fixed value
	Information data	3	0000h	Fixed value (Block4: MSB, Block3: LSB) *Indicates read data size for Elhead.
		4		
Data		-	xxh	Report data

Table 5.14 Host RECV REPORT

Content		Block	Value	Description
Elreq	Block size	0	05h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	23h	Fixed value
	Information data	3	00h	Fixed value
		4	0000h	Fixed value (Block5: MSB, Block4: LSB) *Indicates read data size for Elhead.
		5		
Data		-	xxh	Report data

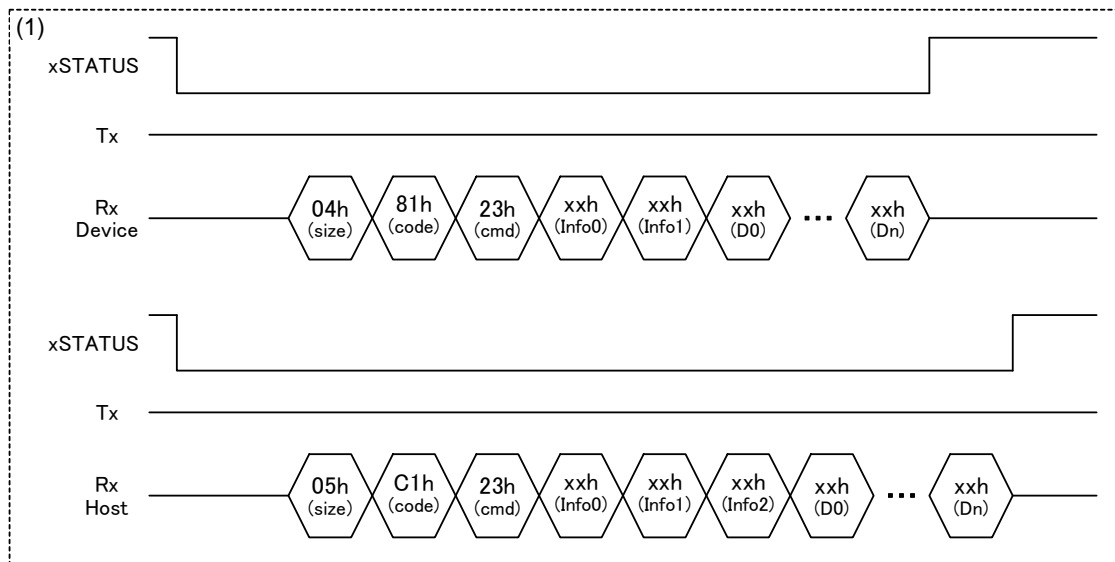
5. HID Class EI Requests

5.10.1 EVENT non-notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “disable”.

Access using protocol procedure (1).

xSTATUS in (1) is asserted when a Report is received. Data transfer starts, and the data should be read. xSTATUS is negated when the data transfer is complete.



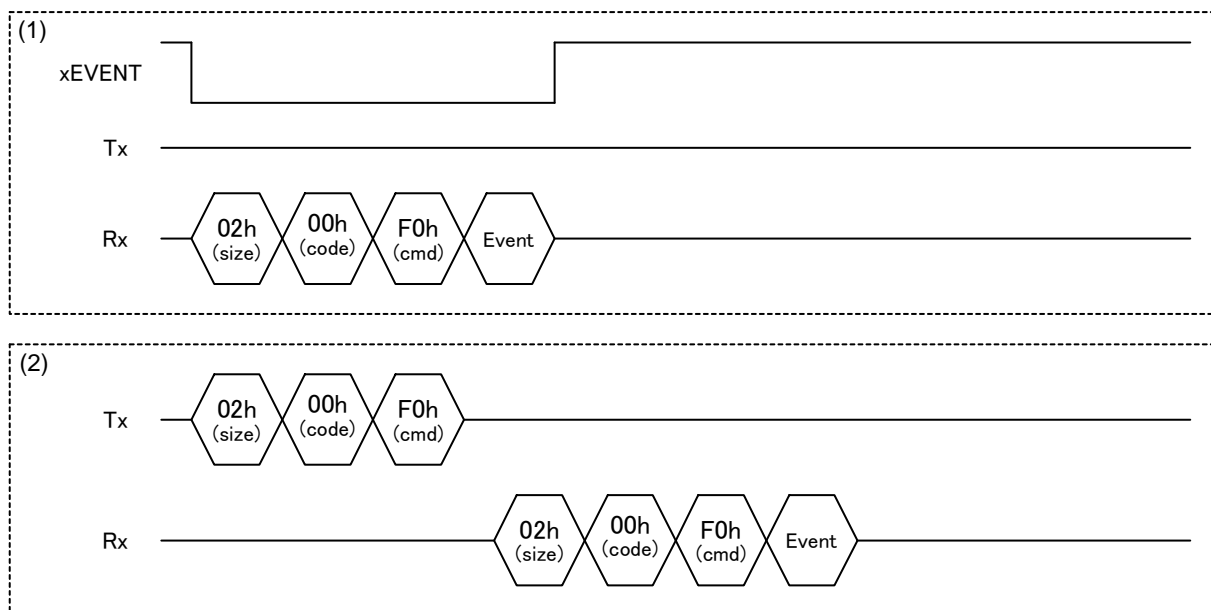
5.10.2 EVENT notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “enable”.

Access using protocol procedures (1) to (4).

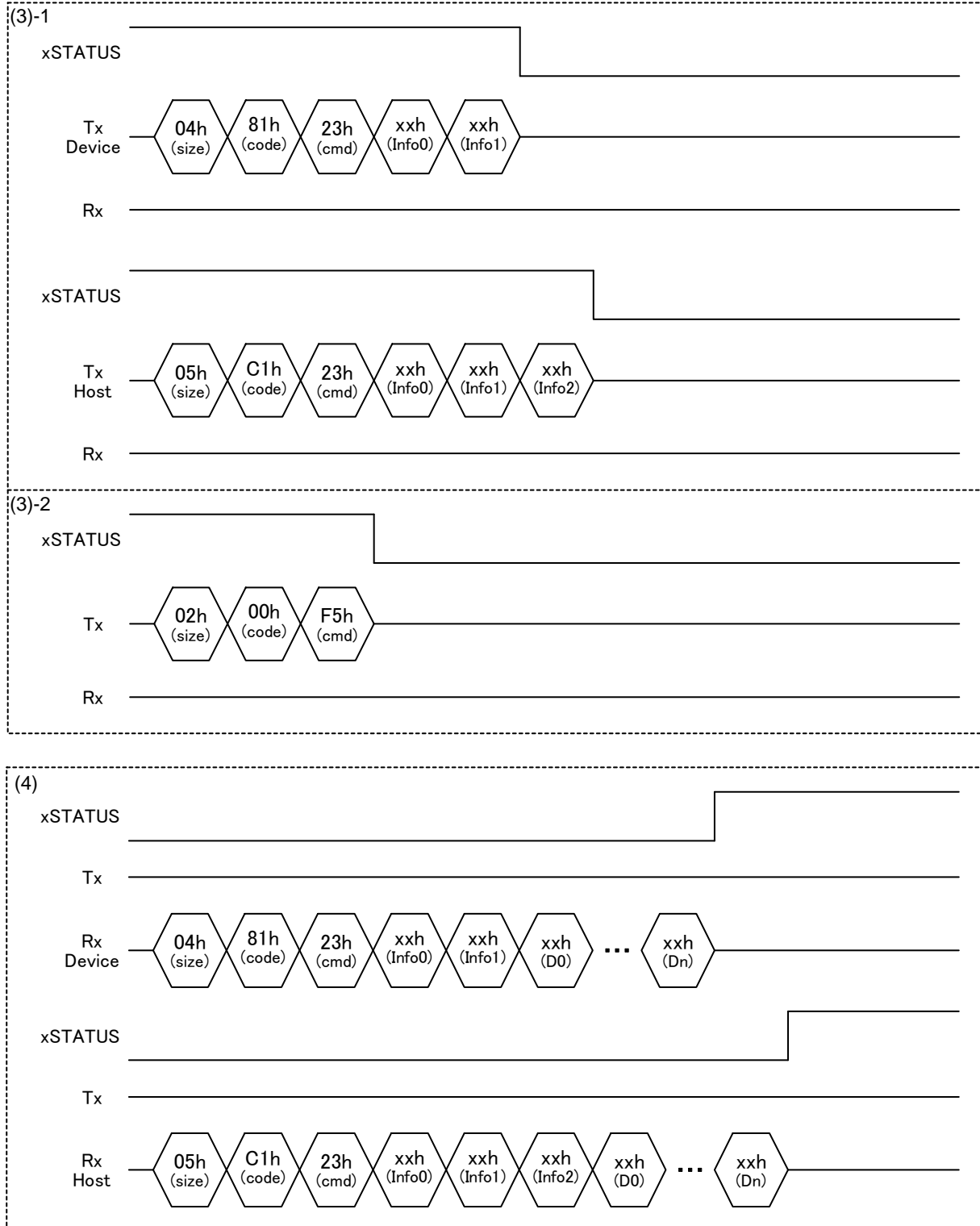
The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (1) when a Report is received.

The event information is cleared by reading in (2).



The command in either (3)-1 or (3)-2 should be used with this protocol. xSTATUS is asserted when the command is recognized by the LSI.

Data transfer starts as in (4) when data has been received from the USB, and the data should be read. xSTATUS is negated when the data transfer is complete.



5. HID Class El Requests

5.11 24h_INITIAL FEATURE REPORT

This writes Feature Report data initial values to the LSI. The Feature Report data initial values should be written after the Elreq.

“Write data size” should be set to the Feature Report data size. For more information on data size, refer to the *S1R72U06 Technical Manual*.

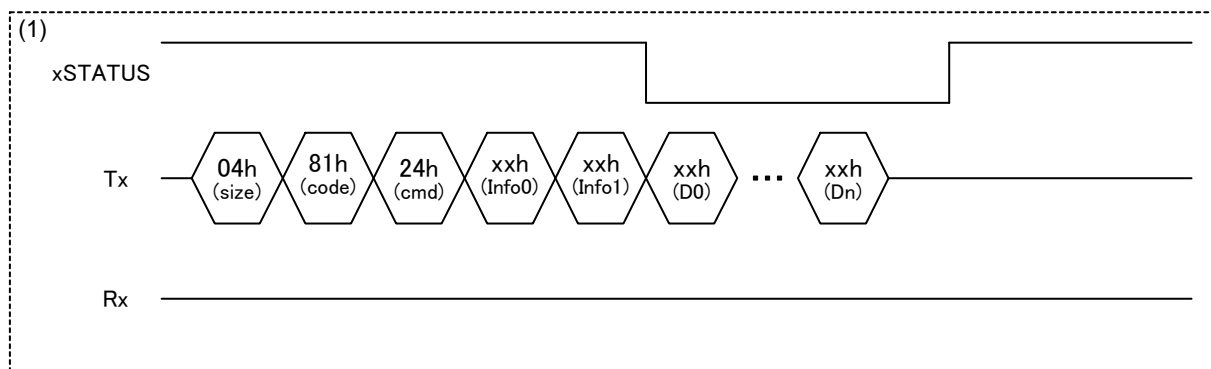
Table 5.15 Device INITIAL FEATURE REPORT

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	81h	Fixed value
	Elreq code	2	24h	Fixed value
	Information data	3	xxxxh	Write data size 0001h to 0101h (Block4: MSB, Block3: LSB)
		4		
Data		-	xxh	Feature Report data default values

Access using protocol procedure (1).

xSTATUS is asserted when the command is recognized by the LSI. xSTATUS is negated when data writing from the Main CPU is complete and internal processing has ended.

The data is retained until a request is issued by the Host. The transmission timing depends on requests from the Host.



5.12 25h_GET PROTOCOL MODE

This reads the protocol mode received from the Host from the LSI. “Data” is added to the Elhead transferred from the LSI.

Table 5.16 Device GET PROTOCOL MODE

	Content	Block	Value	Description
Elreq	Block size	0	03h	Total for Control code + Elreq code + Information data
	Control code	1	81h	Fixed value
	Elreq code	2	25h	Fixed value
	Information data	3	01h	Read data size (1 byte fixed)
Data		-	xxh	00h: Boot Protocol 01h: Report Protocol

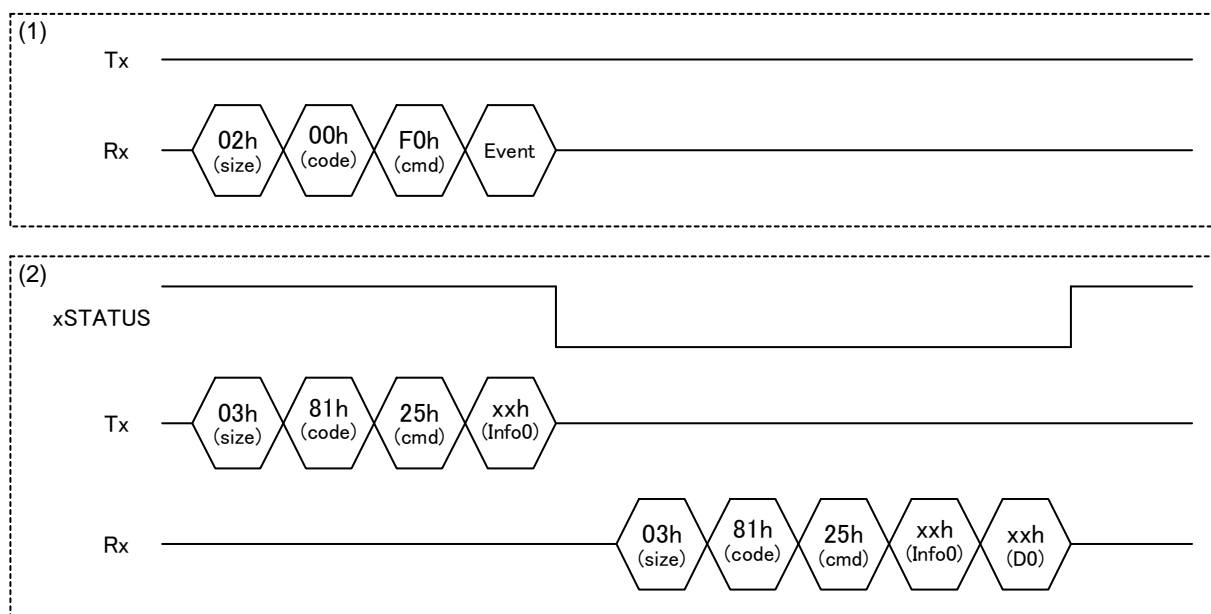
5.12.1 EVENT non-notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “disable”.

Access using protocol procedures (1) and (2).

Event information in (1) is communicated to the Main CPU when Protocol Mode is received from the Host.

xSTATUS in (2) is asserted when the command is recognized by the LSI. Data is transferred, and the data should be read. xSTATUS is negated when the data transfer is complete.



5. HID Class EI Requests

5.12.2 EVENT notification

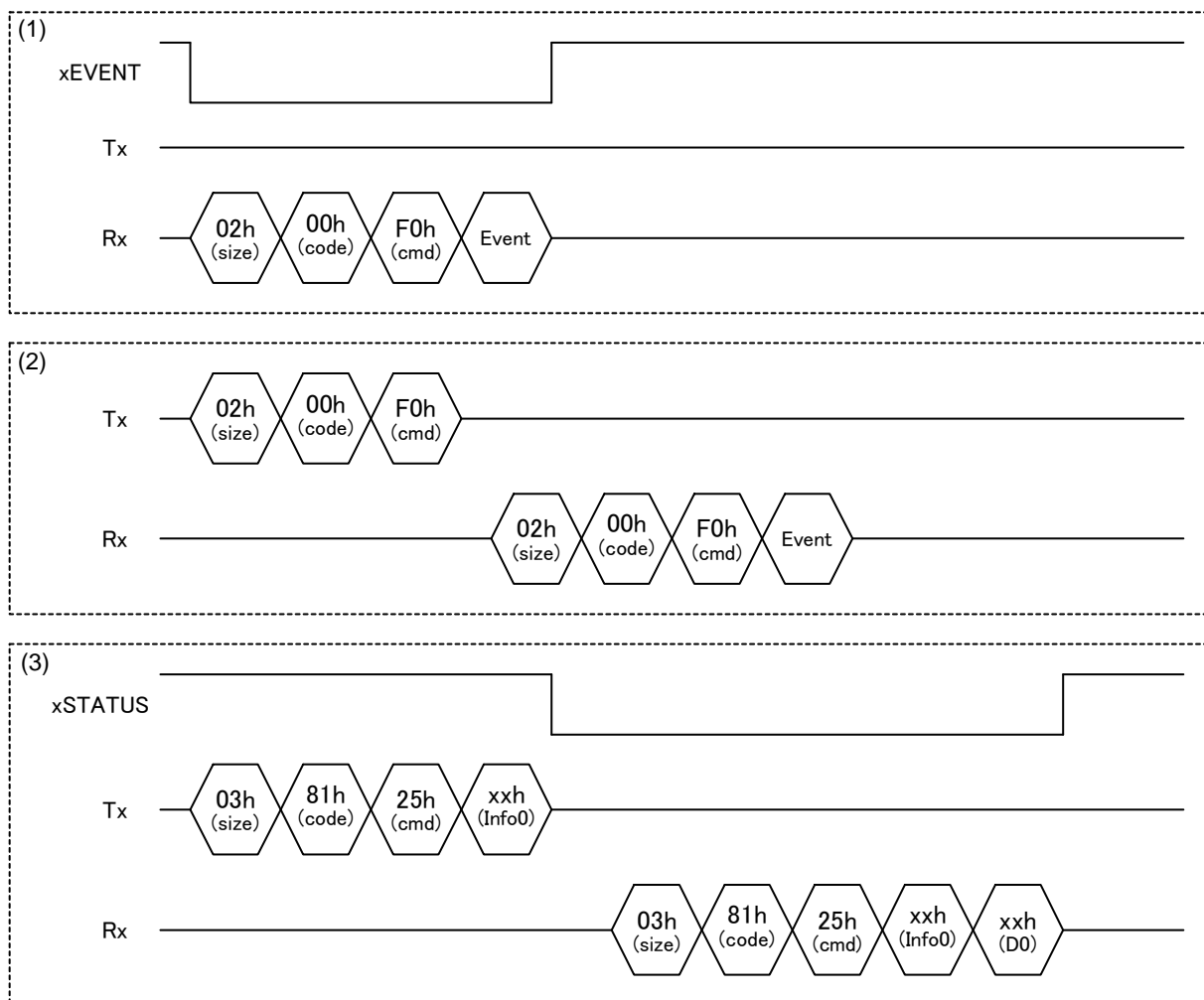
Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “enable”.

Access using protocol procedures (1) to (3).

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (1) when the Protocol Mode is received from the Host.

The event information is cleared by reading in (2).

xSTATUS in (3) is asserted when the command is recognized by the LSI. Data is transferred, and the data should be read. xSTATUS is negated when the data transfer is complete.



5.13 24h_GET_DESCRIPTOR

This reads the descriptor received from the Device from the LSI. “Data” is added to the EIhead transferred from the LSI. Configuration Descriptor includes the Interface Descriptor, HID Descriptor, and Endpoint Descriptor.

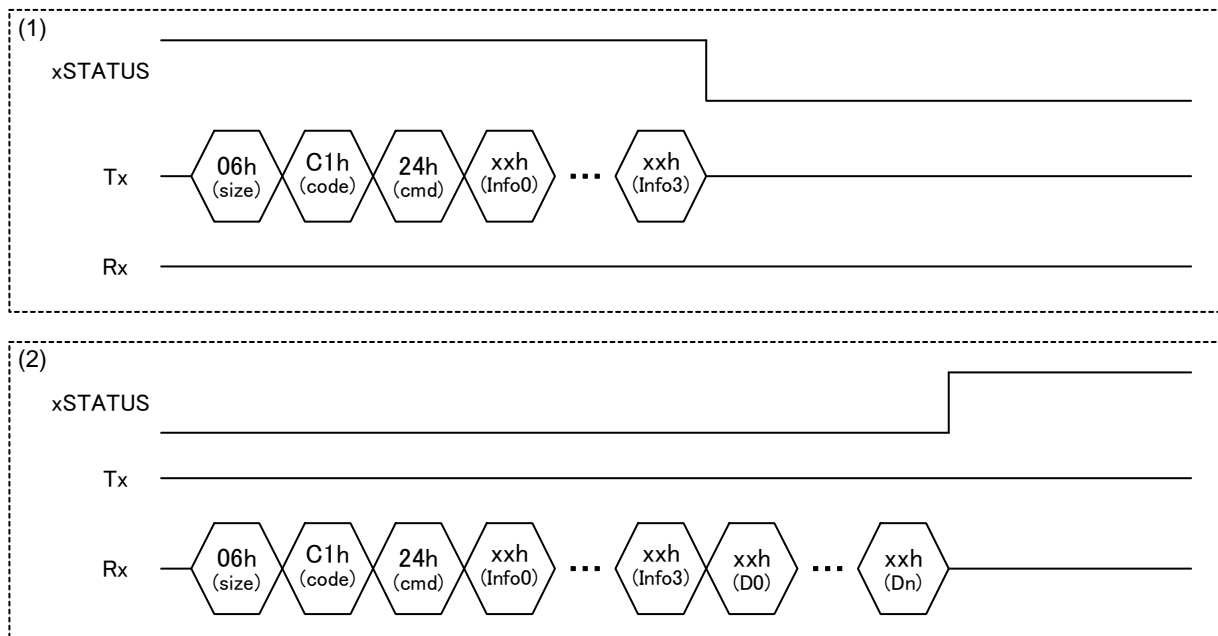
Table 5.17 Host GET_DESCRIPTOR

	Content	Block	Value	Description
Elreq	Block size	0	06h	Total for Control code + Elreq code + Information data
	Control code	1	C1h	Fixed value
	Elreq code	2	24h	Fixed value
	Information data	3	xxh	Descriptor type 00h: HID Descriptor 01h: Report Descriptor 02h: String Descriptor 03h: Device Descriptor 04h: Configuration Descriptor 05h to FFh: reserved
		4	xxh	String index number [00h: Not String]
		5	xxxxh	Read size [FFFFh: All Descriptor Read setting] 0001h to FFFFh (Block6: MSB, Block5: LSB)
		6		
Data		-	xxh	Refer to <i>S1R72U06 Technical Manual</i> for details.

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted when the command is recognized by the LSI.

Data transfer starts as in (2) when the data has been received from the Device, and the data should be read. xSTATUS is negated when the data transfer is complete.



6. MSC EI Requests

6. MSC EI Requests

Table 6.1 lists the MSC EI requests. These Elreqs are used for Host MSC only.

The command parameters and protocols are described in the following sections.

Table 6.1 MSC EI requests

Control code	Elreq code	Elreq name	Control	Description
C2h	30h	MSC START	Common	MSC control
	32h	DEVICE POWER MANAGEMENT	Common	Power management
	33h	DEVICE RESET	Common	USB BUS reset
	40h	GET STORAGE INFORMATION	Simple	Storage information read
	41h	START WRITING SECTORS	Simple	Sector write start
	42h	START READING SECTORS	Simple	Sector read start
	3Ah	BLK WRITE DATA	Common	Block transfer data write
	3Bh	BLK READ DATA	Common	Block transfer data read
	48h	STORAGE COMMAND THROUGH (6)	Full	SCSI/ATAPI command (6 bytes)
	49h	STORAGE COMMAND THROUGH (10)	Full	SCSI/ATAPI command (10 bytes)
	4Ah	STORAGE COMMAND THROUGH (12)	Full	SCSI/ATAPI command (12 bytes)
	4Bh	STORAGE COMMAND THROUGH (16)	Full	SCSI/ATAPI command (16 bytes)
	4Ch	STORAGE COMMAND RESULT	Full	SCSI/ATAPI command execution result acquisition

6.1 Usage conditions

- (1) MSC EI requests should be used after “MSC START” (30h) has been set to “Start”.
- (2) Block transfer completion requires processing dependent on the control method. For details, refer to the *S1R72U06 Application Note*.

6.1.1 Simple control

This control method enables USB MSC Devices to be controlled easily without the need for detailed knowledge of SCSI/ATAPI standards.

- (1) This control method limits the MSC Devices supported. For details, refer to the *S1R72U06 Application Note*.
- (2) This control method should be used with Elreqs indicated as “Common” or “Simple” in the Control column in Table 6.1.
- (3) For data size in block transfer, refer to “Appendix B MSC Access Size”.

6.1.2 Full control

This control method allows command control in compliance with the SCSI/ATAPI standards. For details of the standards, refer to “Compliance” in the *S1R72U06 Technical Manual*.

- (1) This control method should be used with EIreqs indicated as “Common” or “Full” in the Control column in Table 6.1.
- (2) After using the THROUGH command, check the execution results using “STORAGE COMMAND RESULT” (4Ch).
- (3) “STORAGE COMMAND RESULT” (4Ch) indicates the “Block Tran Executing” error information until the THROUGH command processing is complete.
- (4) The error information for the LSI protocol is separate from errors complying with the SCSI/ATAPI standards. SCSI/ATAPI error information should be acquired using “REQUEST SENSE” of the SCSI/ATAPI command.
- (5) If an error occurs in a protocol for the LSI when Ended notification is set to “permitted”, the Ended notification setting is canceled.
- (6) If Ended notification is set to “prohibited”, “STORAGE COMMAND RESULT” (4Ch) should be polled to check that processing is complete.
- (7) For SCSI/ATAPI command control details, refer to “Appendix C SCSI/ATAPI Command Control”.

6.2 Precautions

- (1) If the LSI internal data transfer ends when the Device is disconnected during read block transfer, error information accompanying disconnection is notified. The error information may be delayed, depending on the usage status.

6.2.1 Simple control

- (1) If an error occurs in the Device connected, the results for “GET STORAGE INFORMATION” (40h) may be all be “0”.

6.2.2 Full control

- (1) Error information for “Media Not Found” and “Media Changed” is disabled in this control method.
- (2) “STORAGE COMMAND RESULT” (4Ch) is retained until the next THROUGH command is written.
- (3) “STORAGE COMMAND RESULT” (4Ch) may not always be updated if an error occurs in a protocol for the LSI.

6. MSC EI Requests

6.3 30h_MSC START

This sets MSC control for the USB.

Table 6.2 MSC START

	Content	Block	Value	Description
Elreq	Block size	0	03h	Total for Control code + Elreq code + Information data
	Control code	1	C2h	Fixed value
	Elreq code	2	30h	Fixed value
	Information data	3	xxh	Operation setting 00h: MSC Stop (default) 01h: MSC Start 02h to FFh: reserved

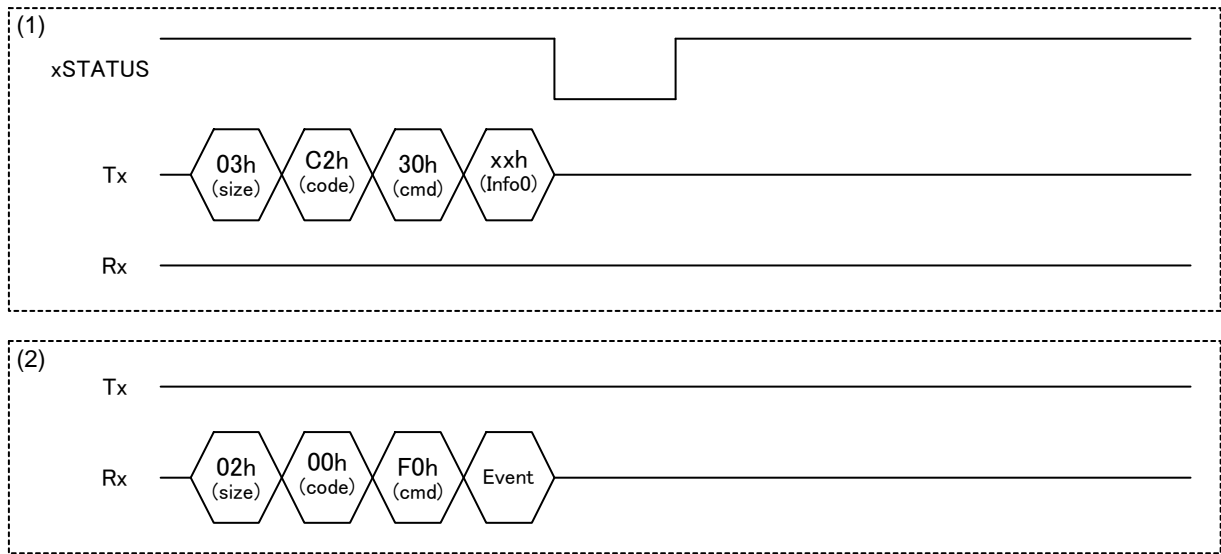
6.3.1 EVENT non-notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “disable”.

Access using protocol procedures (1) and (2).

xSTATUS in (1) changes when the command is recognized by the LSI.

The event information in (2) is communicated to the Main CPU when a Device is connected.



6.3.2 EVENT notification

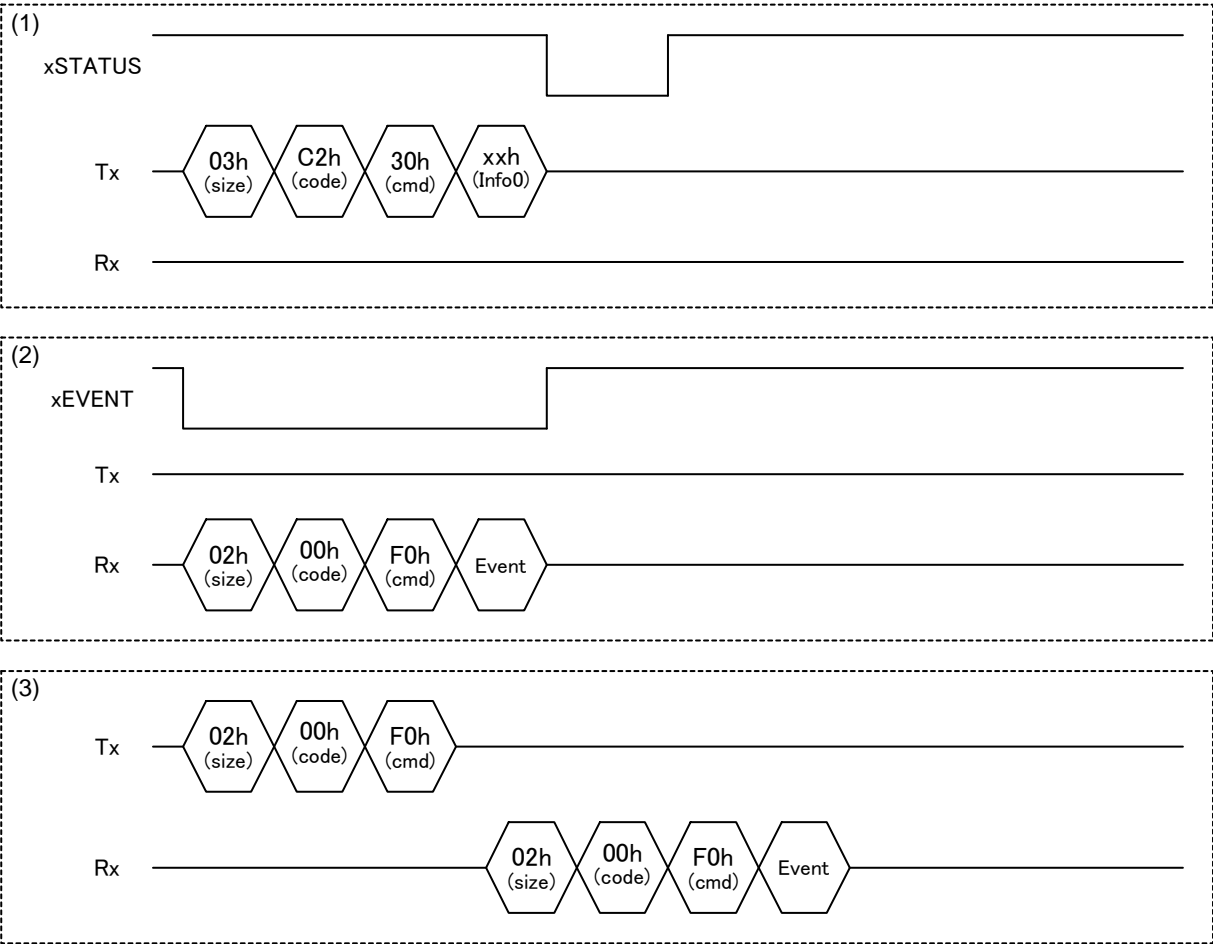
Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “enable”.

Access using protocol procedures (1) to (3).

xSTATUS in (1) changes when the command is recognized by the LSI.

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (2) when a Device is connected.

The event information is cleared by reading in (3).



6. MSC EI Requests

6.4 32h_DEVICE POWER MANAGEMENT

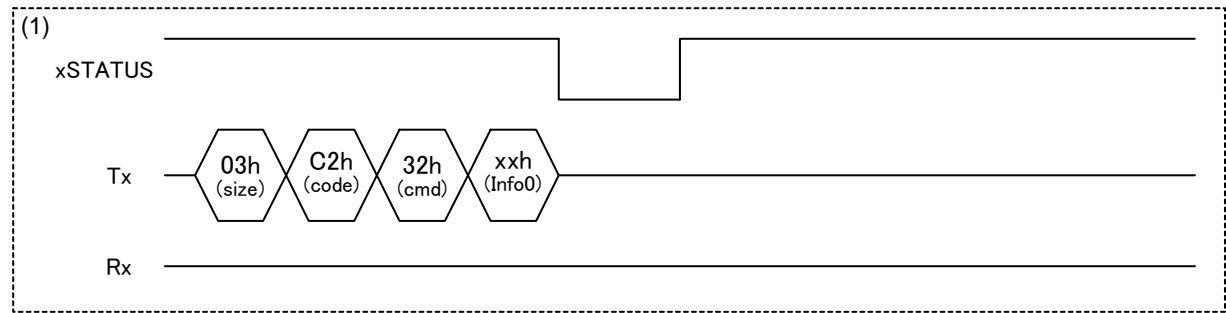
This controls the Device Suspend and Resume operations. For more information on control methods, refer to “Power management” in the *S1R72U06 Application Note*.

Table 6.3 DEVICE POWER MANAGEMENT

Content		Block	Value	Description
Elreq	Block size	0	03h	Total for Control code + Elreq code + Information data
	Control code	1	C2h	Fixed value
	Elreq code	2	32h	Fixed value
	Information data	3	xxh	Operation setting 00h: Resume 01h: Suspend & Remote Wakeup prohibited 02h: Suspend & Remote Wakeup permitted 03h to FFh: reserved

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



6.5 33h_DEVICE RESET

This performs a BUS reset for Devices in accordance with the USB standard.

Table 6.4 DEVICE RESET

	Content	Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	C2h	Fixed value
	Elreq code	2	33h	Fixed value

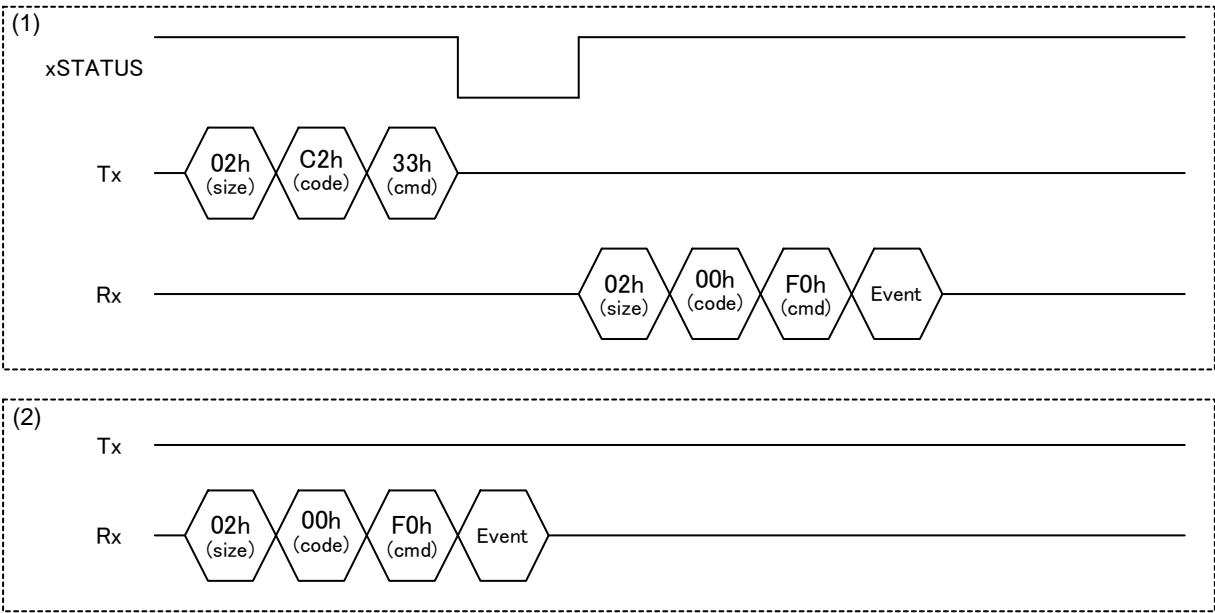
6.5.1 EVENT non-notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “disable”.

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted while the LSI is processing the command. The event information in (1) is communicated to the Main CPU when the Device is disconnected by a BUS reset.

The event information in (2) is communicated to the Main CPU when the Device is reconnected.



6. MSC EI Requests

6.5.2 EVENT notification

Shown below is the protocol that applies when the XIRQ_EVENT pin is set to “enable”.

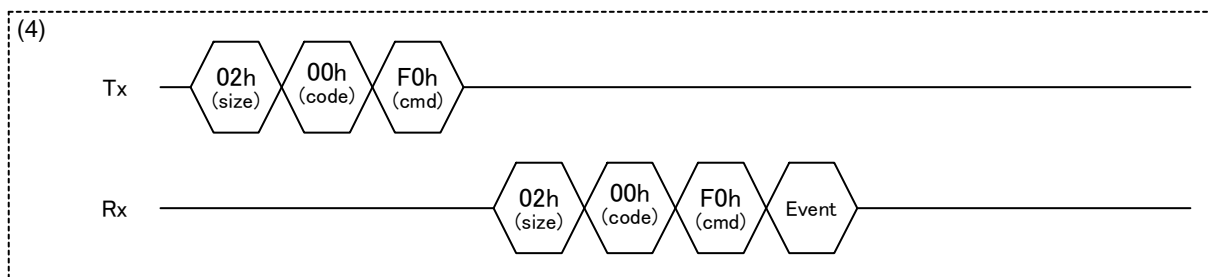
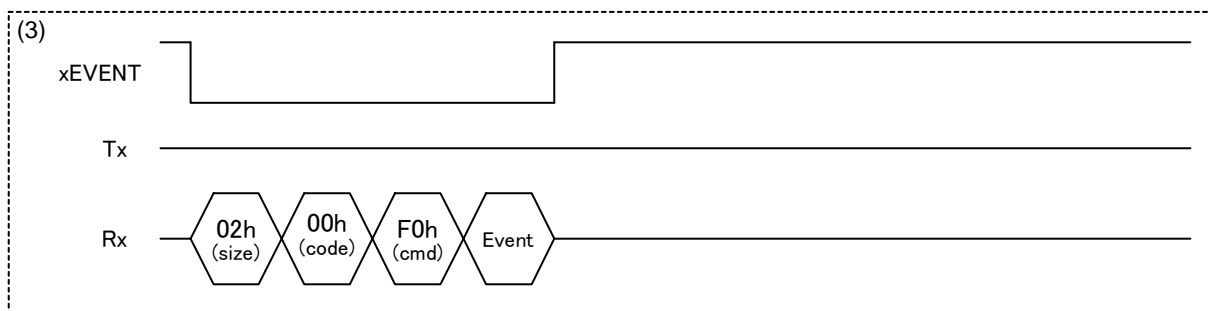
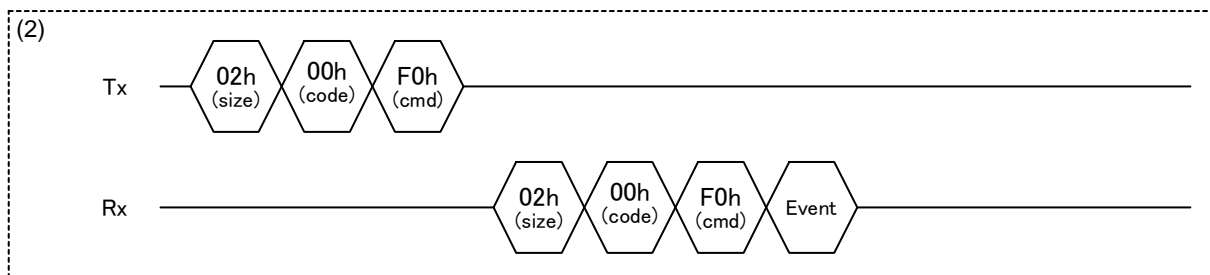
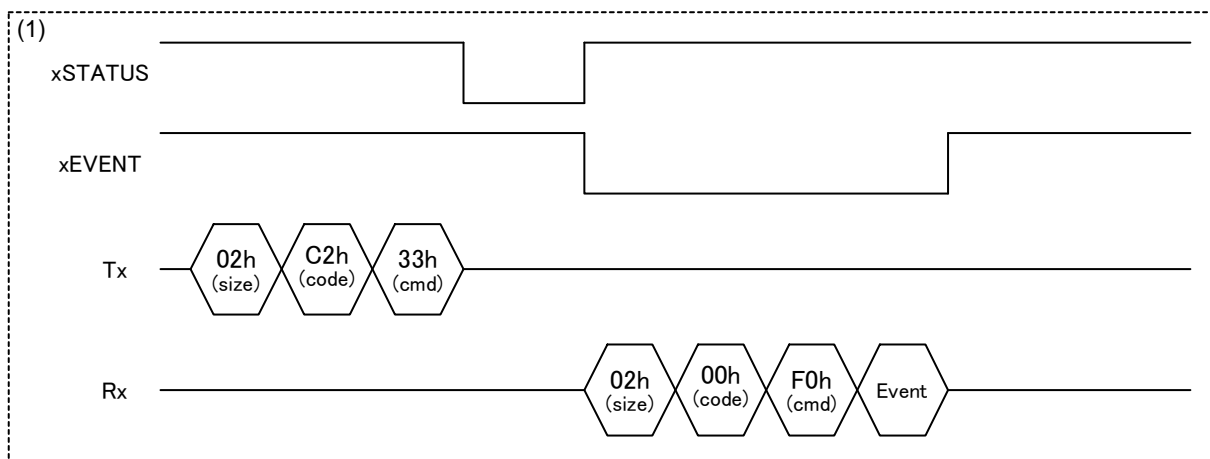
Access using protocol procedures (1) to (4).

xSTATUS in (1) is asserted while the LSI is processing a command. When the Device is disconnected by a BUS reset, the event information is passed on to the Main CPU concurrently with the xEVENT assert.

The event information is cleared by reading in (2).

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (3) when the Device is reconnected.

The event information is cleared by reading in (4).



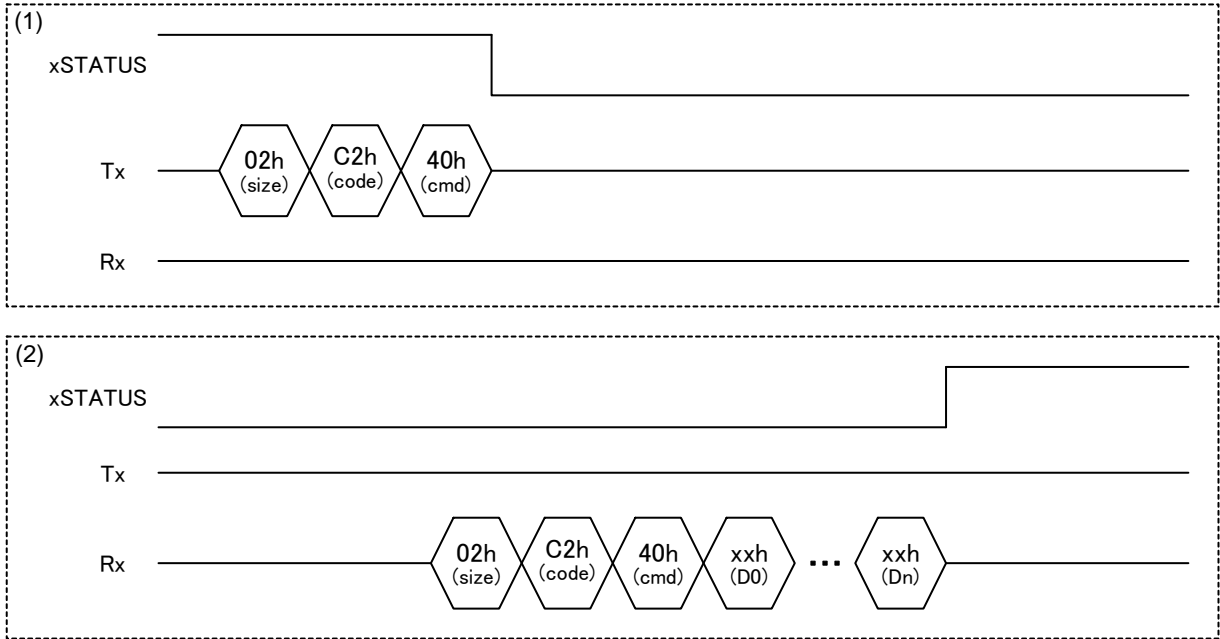
6.6 40h_GET STORAGE INFORMATION

This is an Elreq for simple control. This reads the storage information received from the connected Device from the LSI. “Data” is added to the Elhead transferred from the LSI.

Table 6.5 GET STORAGE INFORMATION

Content		Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	C2h	Fixed value
	Elreq code	2	40h	Fixed value
Data		-	xxh	Refer to “Appendix A” for details

Access using protocol procedures (1) and (2).
xSTATUS in (1) is asserted when the command is recognized by the LSI.
Data transfer starts as in (2) when the data has been received from the Device, and the data should be read.
xSTATUS is negated when the data transfer is complete.



6. MSC EI Requests

6.7 41h_START WRITING SECTORS

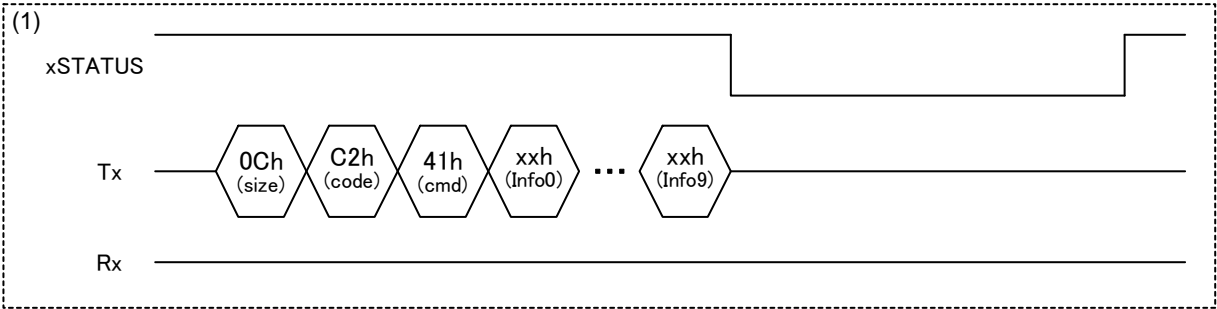
This is an Elreq for simple control. This writes to the LSI settings to start sector writing (block transfer). The payload data should be written after this Elreq using the procedure described in “6.9 3Ah_BLK WRITE DATA”. For Information data settings, refer to “Appendix B MSC Access Size”.

Table 6.6 START WRITING SECTORS

	Content	Block	Value	Description
Elreq	Block size	0	0Ch	Total for Control code + Elreq code + Information data
	Control code	1	C2h	Fixed value
	Elreq code	2	41h	Fixed value
	Information data	3	xxxxh	Sector count number 0001h to FFFFh (Block4: MSB, Block3: LSB)
		4		
		5	xxh	Access start LBA [7:0]
		6	xxh	Access start LBA [15:8]
		7	xxh	Access start LBA [23:16]
		8	xxh	Access start LBA [31:24]
		9	xxh	Access start LBA [39:32]
		10	xxh	Access start LBA [47:40]
		11	xxh	Access start LBA [55:48]
		12	xxh	Access start LBA [63:56]

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



6.8 42h_START READING SECTORS

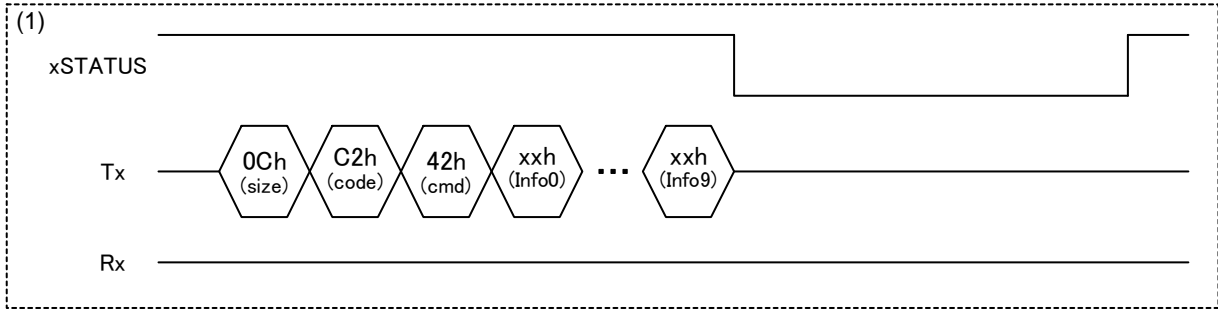
This is an Elreq for simple control. This writes to the LSI settings to start sector reading (block transfer). The payload data should be read after this Elreq using the procedure described in “6.10 3Bh_BLK READ DATA”. For Information data settings, refer to “Appendix B MSC Access Size”.

Table 6.7 START WRITING SECTORS

Content		Block	Value	Description
Elreq	Block size	0	0Ch	Total for Control code + Elreq code + Information data
	Control code	1	C2h	Fixed value
	Elreq code	2	42h	Fixed value
	Information data	3	xxxxh	Sector count number 0001h to FFFFh (Block4: MSB, Block3: LSB)
		4		
		5	xxh	Access start LBA [7:0]
		6	xxh	Access start LBA [15:8]
		7	xxh	Access start LBA [23:16]
		8	xxh	Access start LBA [31:24]
		9	xxh	Access start LBA [39:32]
		10	xxh	Access start LBA [47:40]
		11	xxh	Access start LBA [55:48]
		12	xxh	Access start LBA [63:56]

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



6. MSC EI Requests

6.9 3Ah_BLK WRITE DATA

This writes the payload data to the LSI (block transfer). Write the payload data after the Elreq.

Set start writing before this Elreq using the procedure described in “6.7 41h_START WRITING SECTORS” or the THROUGH command (refer to sections 6.11 to 6.14).

Repeat the protocol procedure if writing multiple payload data.

Table 6.8 BLK WRITE DATA

Content		Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	C2h	Fixed value
	Elreq code	2	3Ah	Fixed value
	Information data	3	xxxxh	Block transfer size 0001h to 0C00h (Block4: MSB, Block3: LSB)
		4		
Data		-	xxh	Payload data

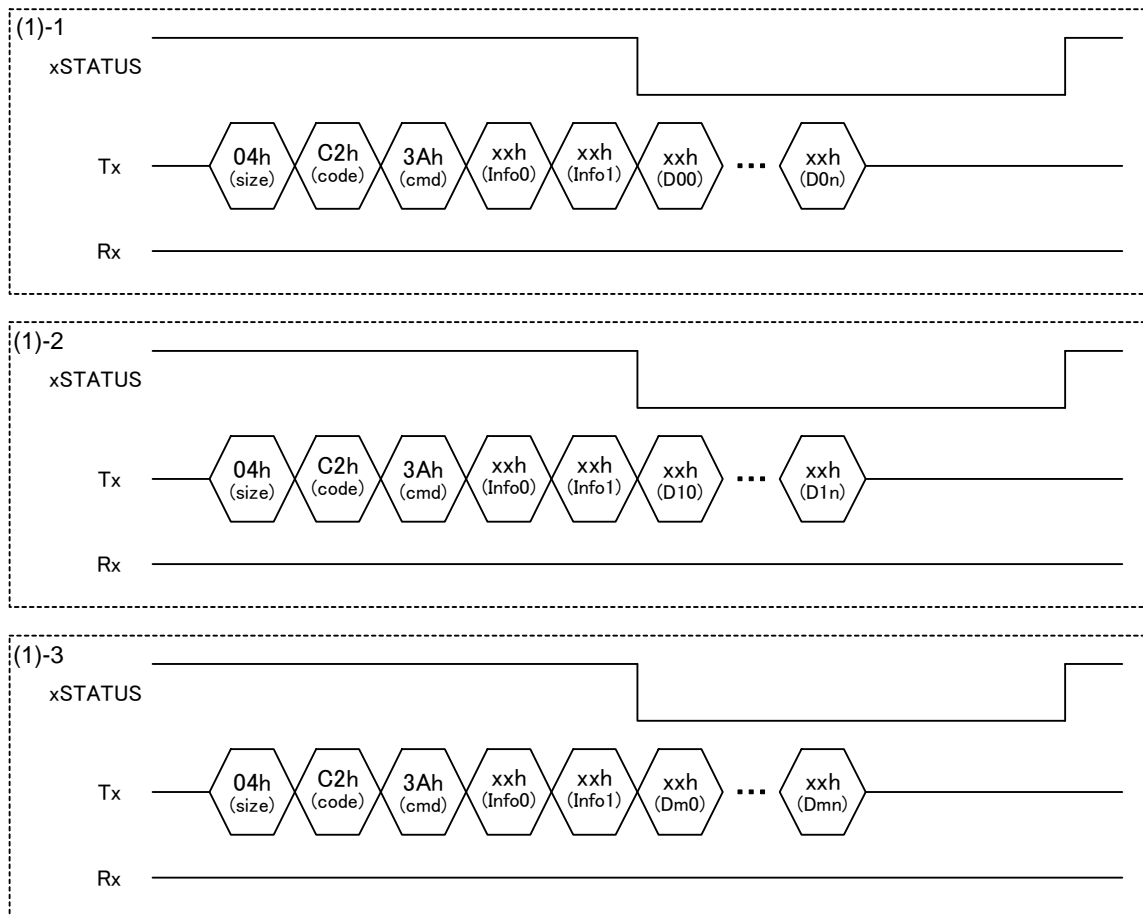
6.9.1 Ended non-notification

This protocol applies to Ended non-notification:

- When using the procedure described in “6.7 41h_START WRITING SECTORS”
- When THROUGH command Ended notification is set to “prohibited”

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command. (1)-2 and (1)-3 are protocols for writing multiple payload data using block transfers.



6. MSC EI Requests

6.9.2 Ended notification (EVENT non-notification)

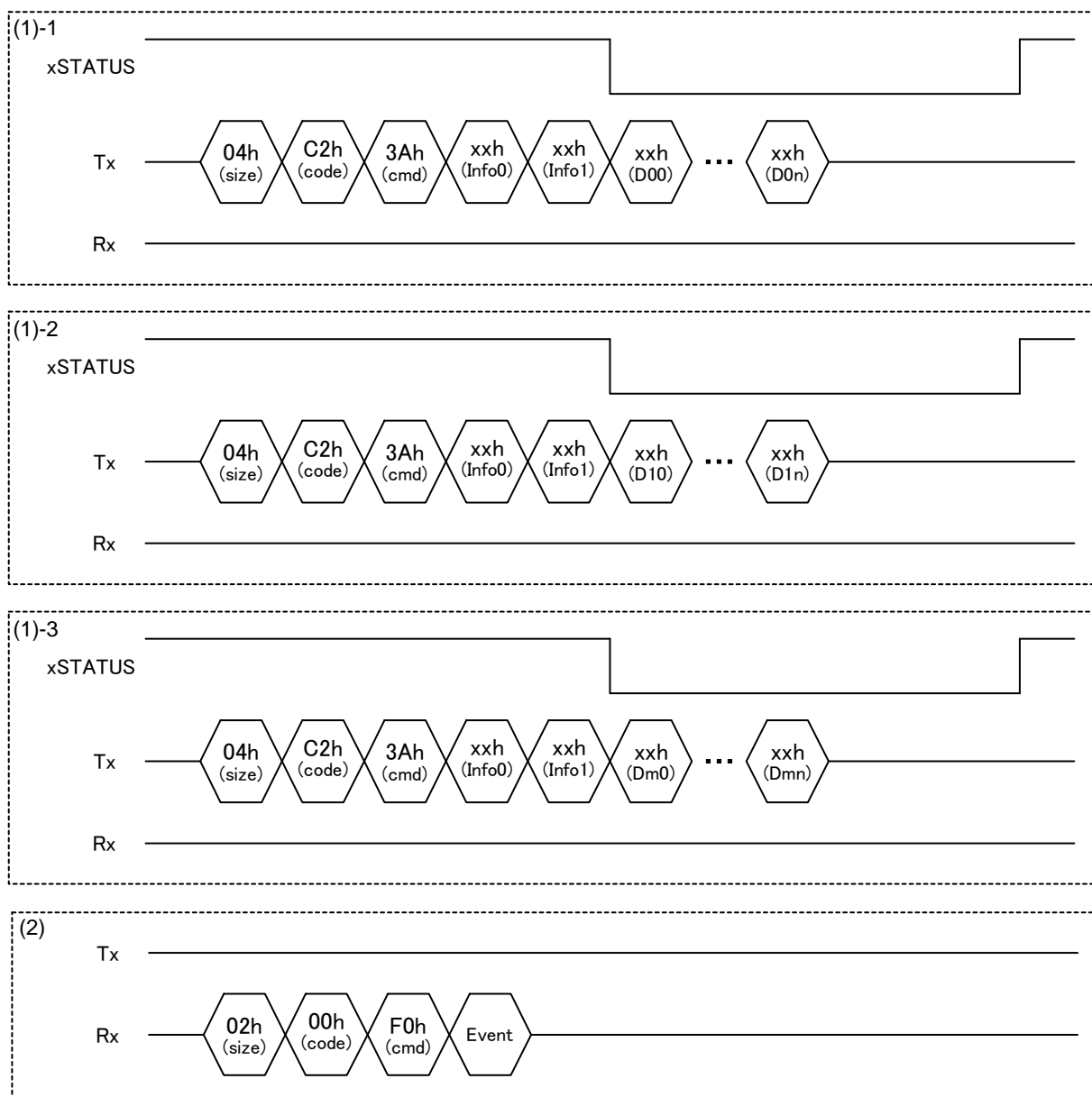
This protocol applies to Ended notification (EVENT non-notification):

- When THROUGH command Ended notification is set to “permitted” and the XIRQ_EVENT pin is set to “disable”

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted while the LSI is processing the command. (1)-2 and (1)-3 are protocols for writing multiple payload data using block transfers.

Event information in (2) is communicated to the Main CPU when writing of all the data set by the THROUGH command is complete.



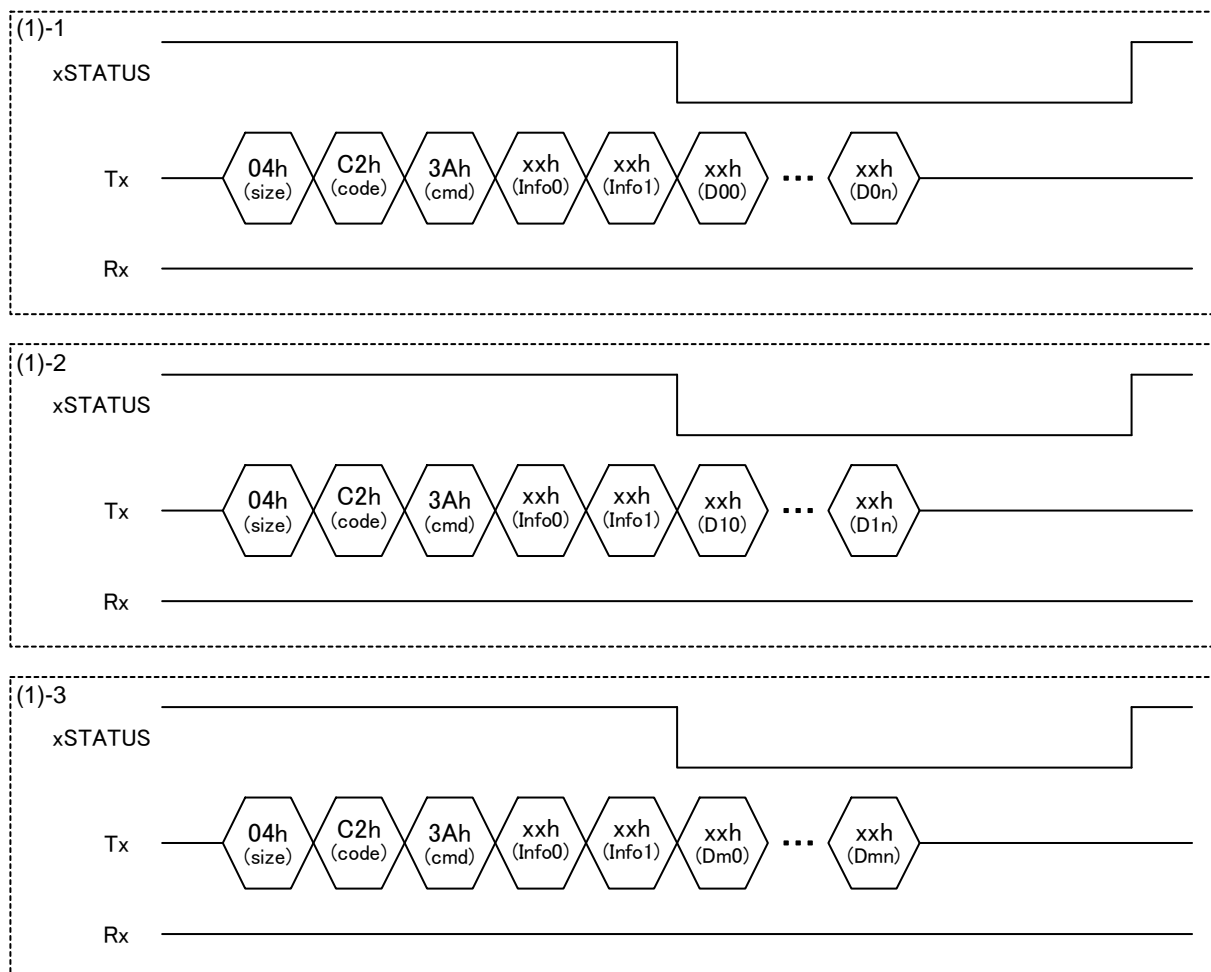
6.9.3 Ended notification (EVENT notification)

This protocol applies to Ended notification (EVENT notification):

- When THROUGH command Ended notification is set to “permitted” and the XIRQ_EVENT pin is set to “enable”

Access using protocol procedures (1) to (3).

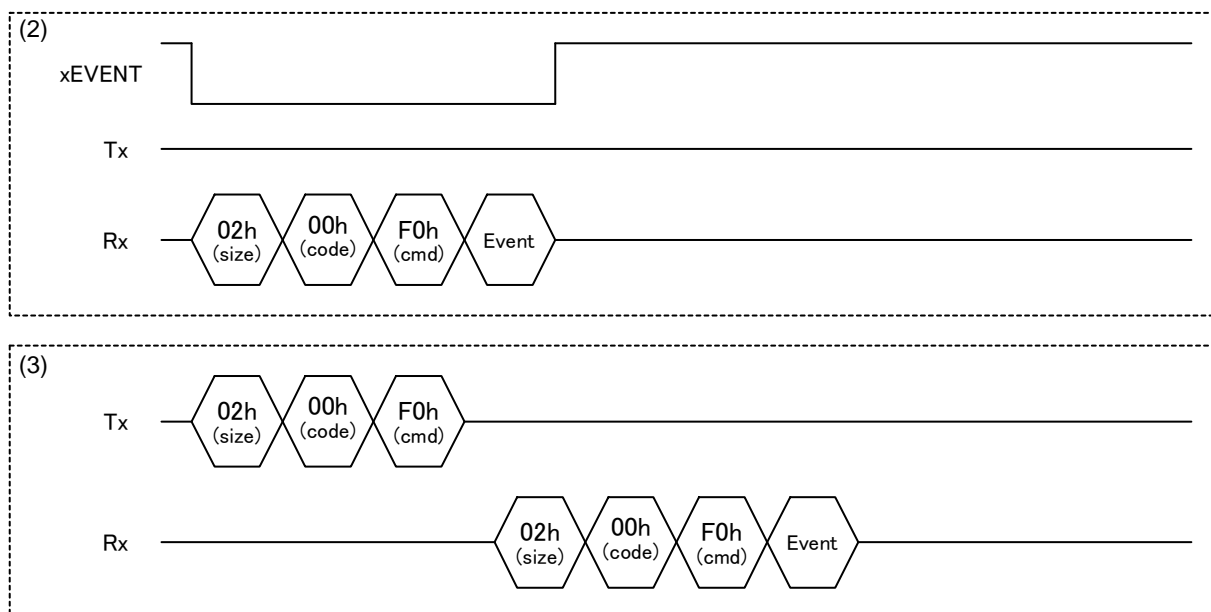
xSTATUS in (1) is asserted while the LSI is processing the command. (1)-2 and (1)-3 are protocols for writing multiple payload data using block transfers.



6. MSC EI Requests

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (2) when writing of all the data set by the THROUGH command is complete.

The event information is cleared by reading in (3).



6.10 3Bh_BLK READ DATA

This reads payload data from the LSI (block transfer). The payload data is added to the Elhead transferred from the LSI.

Set start reading before this Elreq using the procedure described in “6.8 42h_START READING SECTORS” or the THROUGH command (refer to sections 6.11 to 6.14).

Repeat the protocol procedure if reading multiple payload data.

Table 6.9 BLK READ DATA

	Content	Block	Value	Description
Elreq	Block size	0	04h	Total for Control code + Elreq code + Information data
	Control code	1	C2h	Fixed value
	Elreq code	2	3Bh	Fixed value
	Information data	3	xxxxh	Block transfer size 0001h to 0C00h (Block4: MSB, Block3: LSB)
		4		
Data		-	xxh	Payload data

6.10.1 Ended non-notification

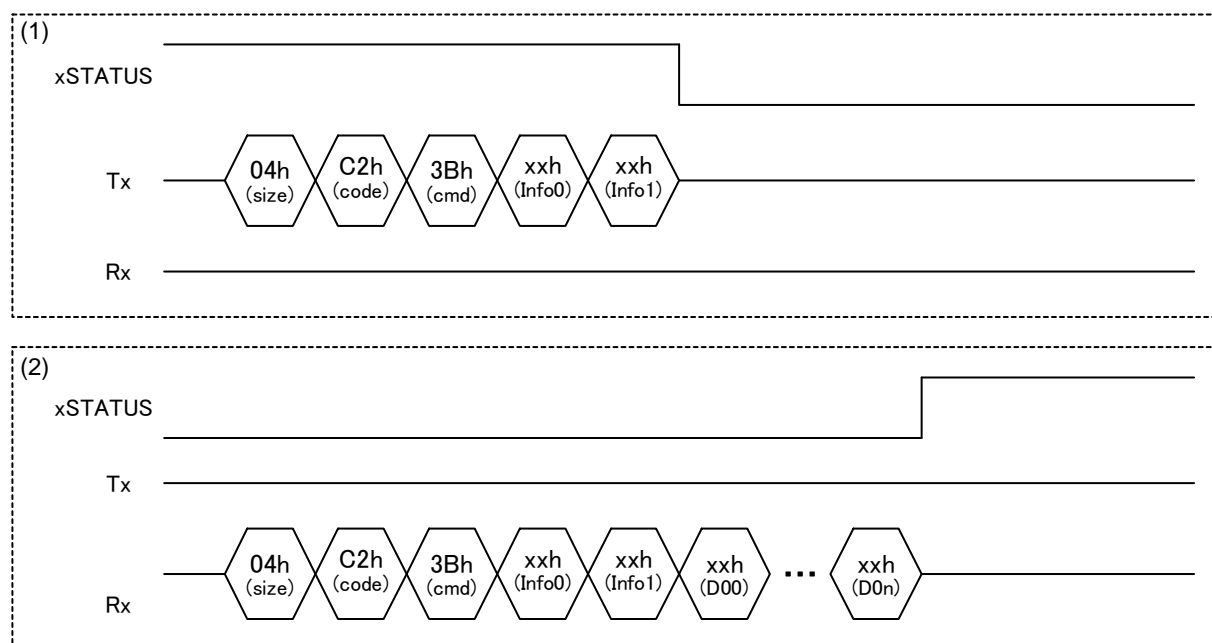
This protocol applies to Ended non-notification:

- When using the procedure described in “6.8 42h_START READING SECTORS”
- When THROUGH command Ended notification is set to “prohibited”

Access using protocol procedures (1) to (6).

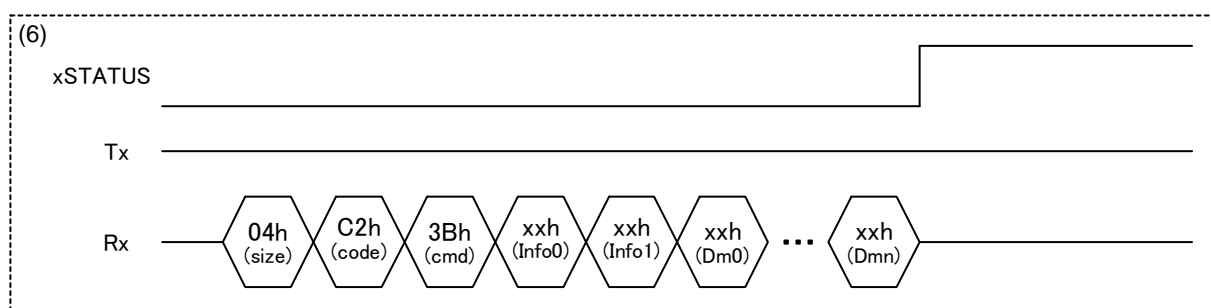
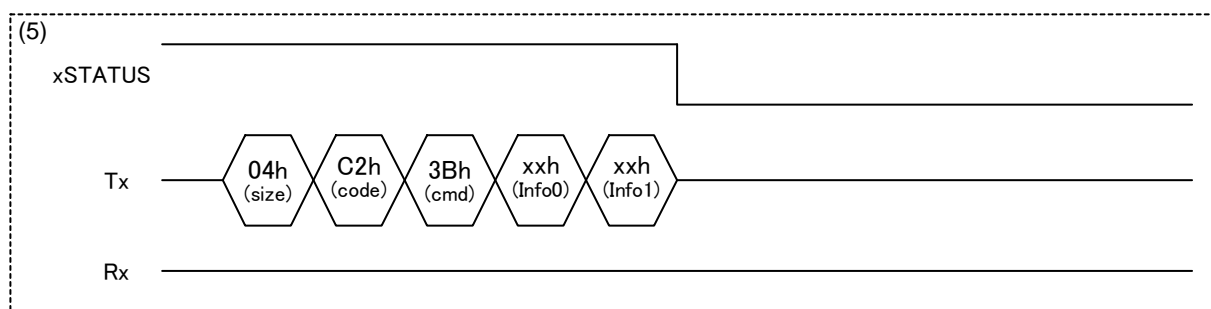
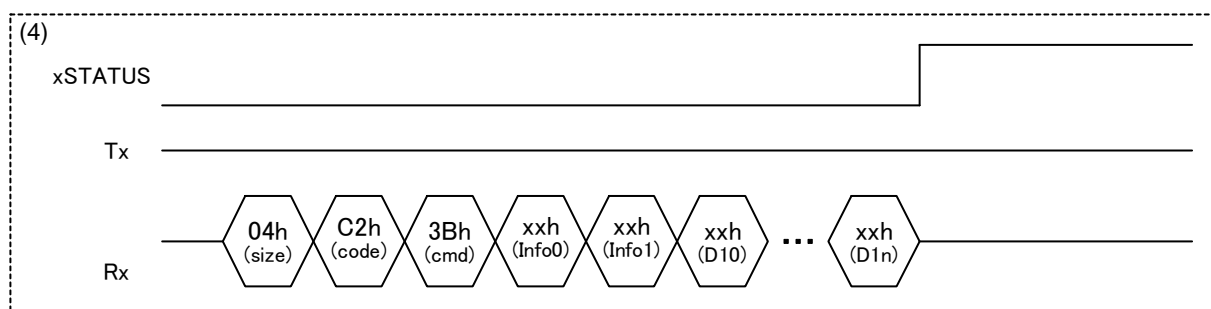
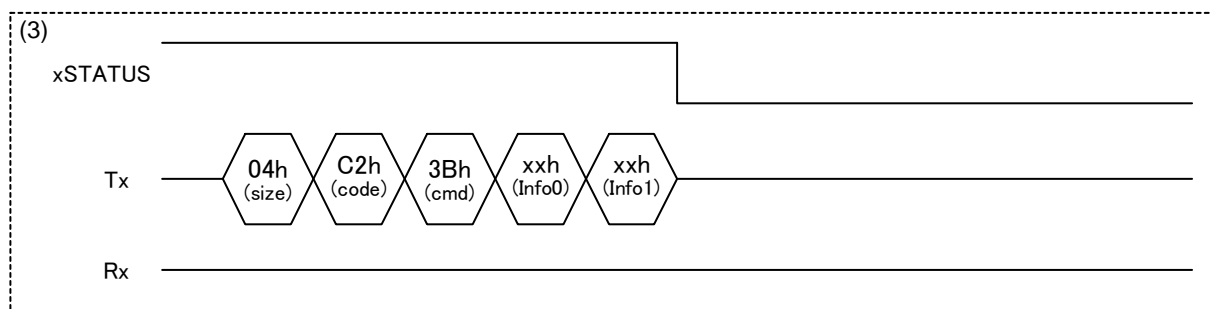
xSTATUS in (1) is asserted when the command is recognized by the LSI.

Data transfer starts as in (2), and the data should be read. xSTATUS is negated when the data transfer has ended.



6. MSC EI Requests

(3) to (6) are protocols for reading multiple payload data using block transfers.



6.10.2 Ended notification (EVENT non-notification)

This protocol applies to Ended notification (EVENT non-notification):

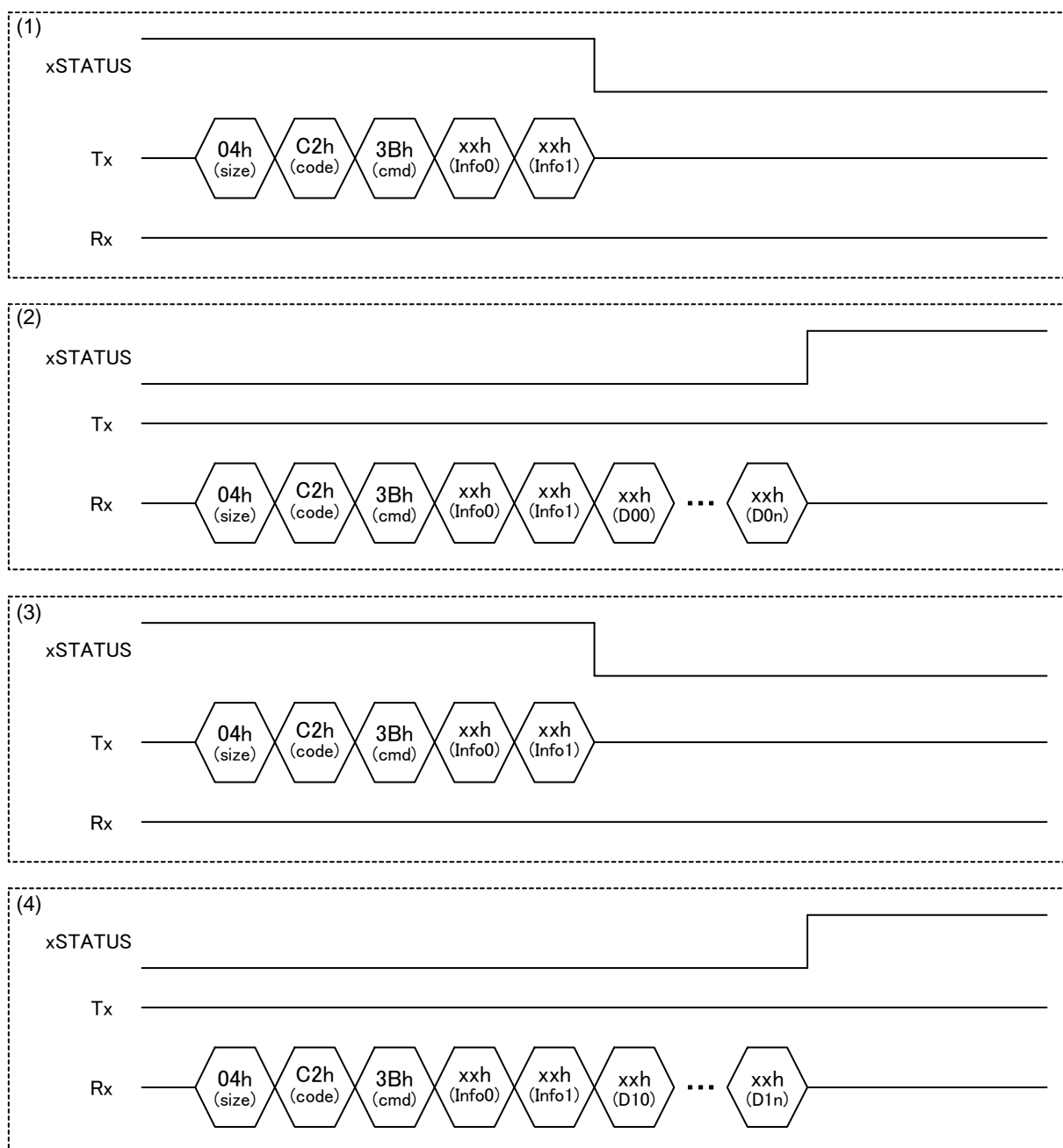
- When THROUGH command Ended notification is set to “permitted” and the XIRQ_EVENT pin is set to “disable”

Access using protocol procedures (1) to (7).

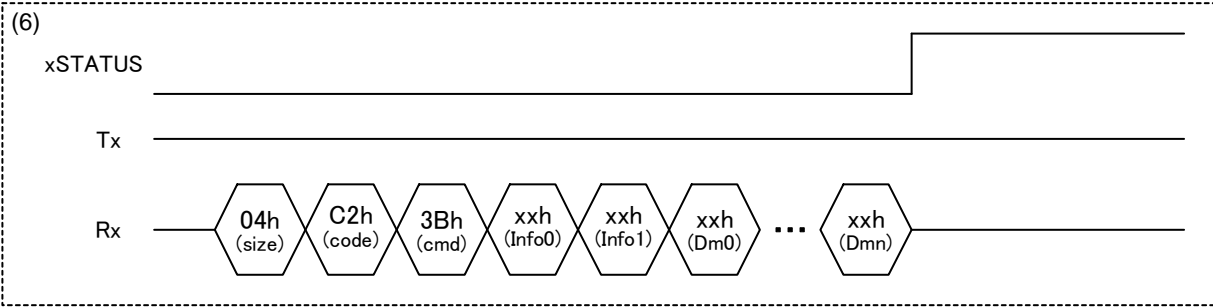
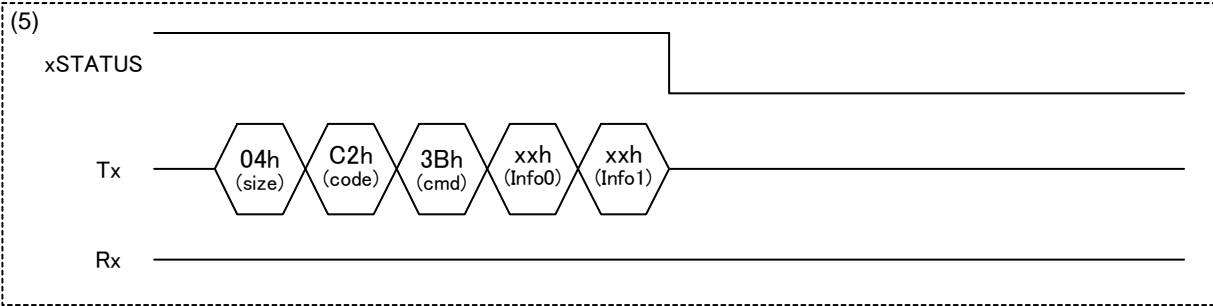
xSTATUS in (1) is asserted when the command is recognized by the LSI.

Data transfer starts as in (2), and the data should be read. xSTATUS is negated when the data transfer has ended.

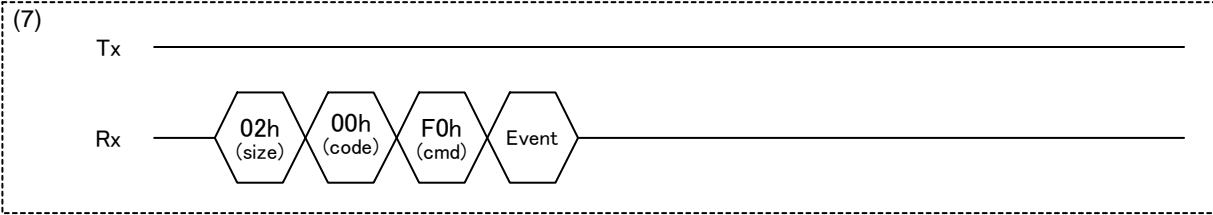
(3) to (6) are protocols for reading multiple payload data using block transfers.



6. MSC EI Requests



The event information in (7) is communicated to the Main CPU when writing of all the data set by the THROUGH command is complete.



6.10.3 Ended notification (EVENT notification)

This protocol applies to Ended notification (EVENT notification):

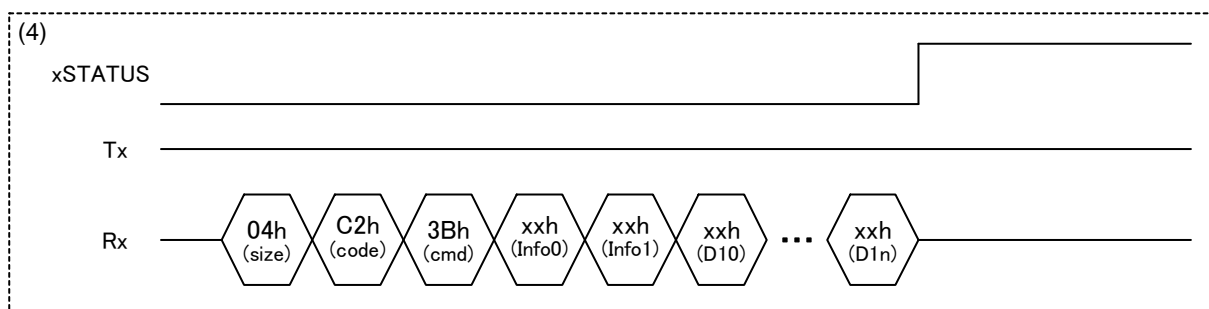
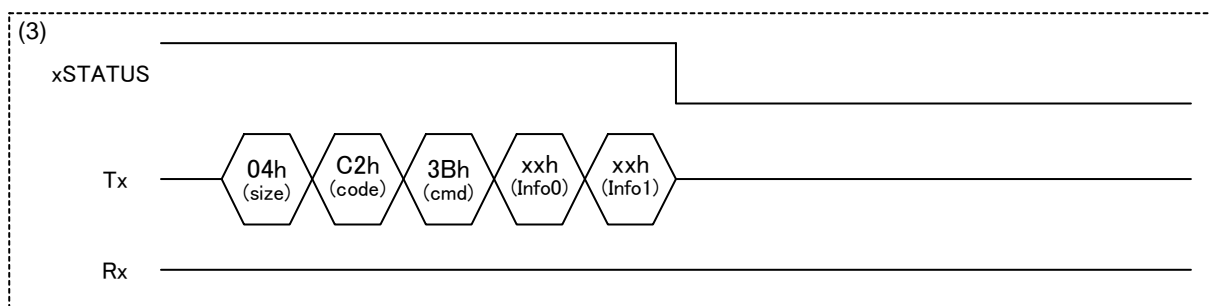
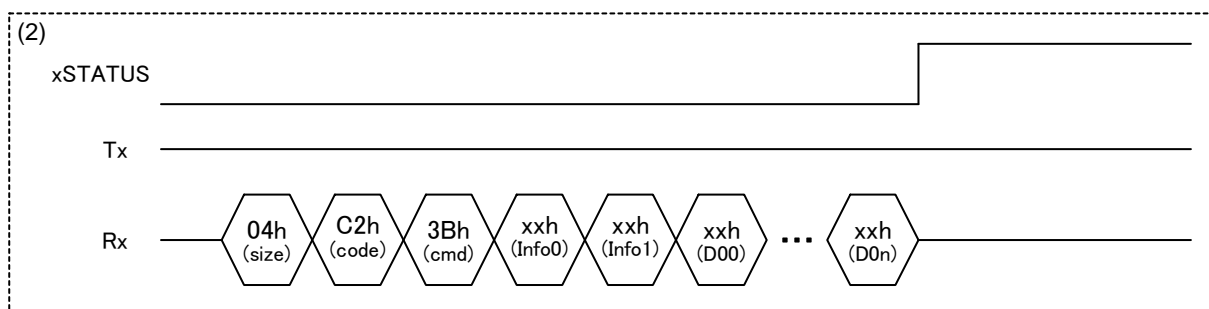
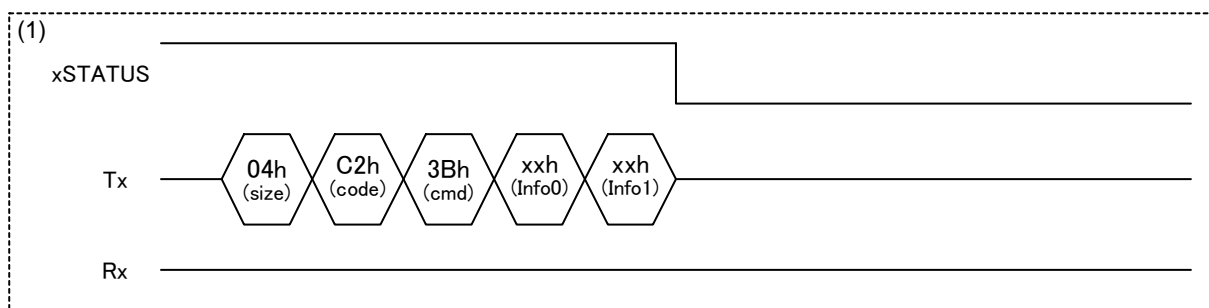
- When THROUGH command Ended notification is set to “permitted” and the XIRQ_EVENT pin is set to “enable”

Access using protocol procedures (1) to (8).

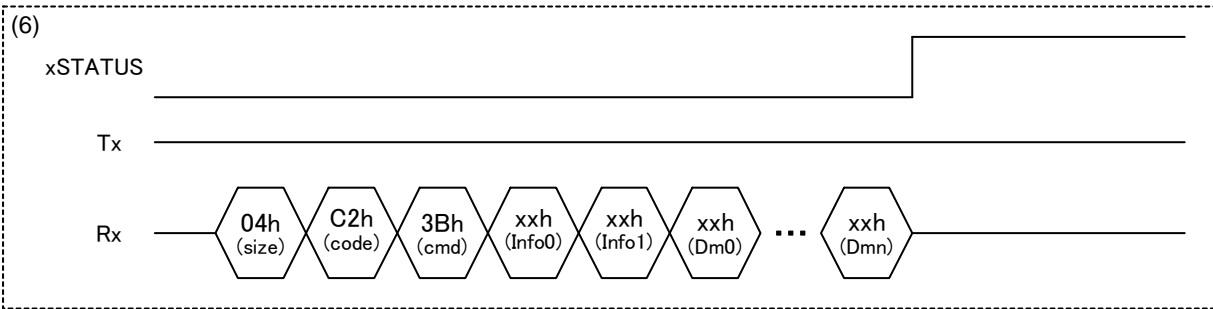
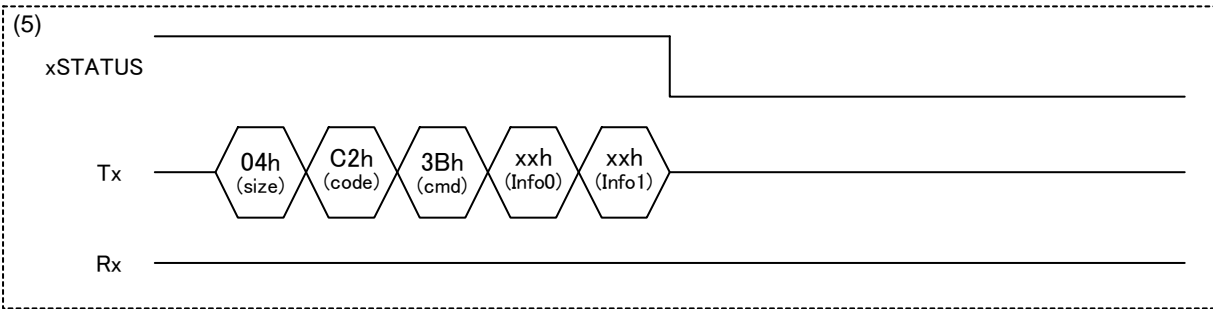
xSTATUS in (1) is asserted when the command is recognized by the LSI.

Data transfer starts as in (2), and the data should be read. xSTATUS is negated when the data transfer has ended.

(3) to (6) are protocols for reading multiple payload data using block transfers.

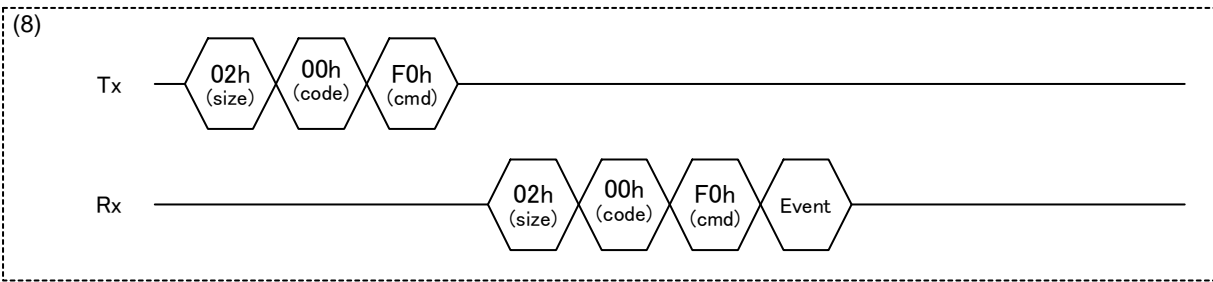
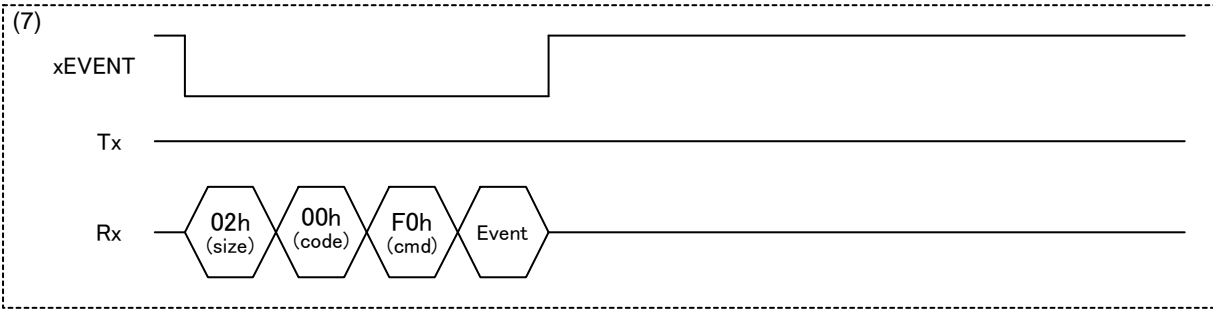


6. MSC EI Requests



The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (7) when writing of all the data set by the THROUGH command is complete.

The event information is cleared by reading in (8).



6.11 48h_STORAGE COMMAND THROUGH (6)

This is an Elreq for full control. This writes a 6-byte SCSI/ATAPI command to the LSI.

When this accompanies data reading or writing, the payload data should be processed after this Elreq using the procedure described in “6.9 3Ah_BLK WRITE DATA” or “6.10 3Bh_BLK READ DATA”.

In the case of “No data”, the total number of data transfer bytes should be set to “00h”.

Table 6.10 STORAGE COMMAND THROUGH (6)

Content		Block	Value	Description		
Elreq	Block size	0	0Dh	Total for Control code + Elreq code + Information data		
	Control code	1	C2h	Fixed value		
	Elreq code	2	48h	Fixed value		
	Information data	3	xxh	Command protocol		
				Bit	Content	Setting value
				7	Command Through Ended event notification setting	0b: prohibited 1b: permitted (default)
				6-2	reserved	
				1-0	Transfer specification	00b: No data 01b: Read 10b: Write 11b: reserved
	4	xxh	Total number of data transfer bytes [7:0]			
	5	xxh	Total number of data transfer bytes [15:8]			
	6	xxh	Total number of data transfer bytes [23:16]			
	7	xxh	Total number of data transfer bytes [31:24]			
	8	xxh	SCSI/ATAPI command packet [0]			
	9	xxh	SCSI/ATAPI command packet [1]			
	10	xxh	SCSI/ATAPI command packet [2]			
11	xxh	SCSI/ATAPI command packet [3]				
12	xxh	SCSI/ATAPI command packet [4]				
13	xxh	SCSI/ATAPI command packet [5]				

6. MSC EI Requests

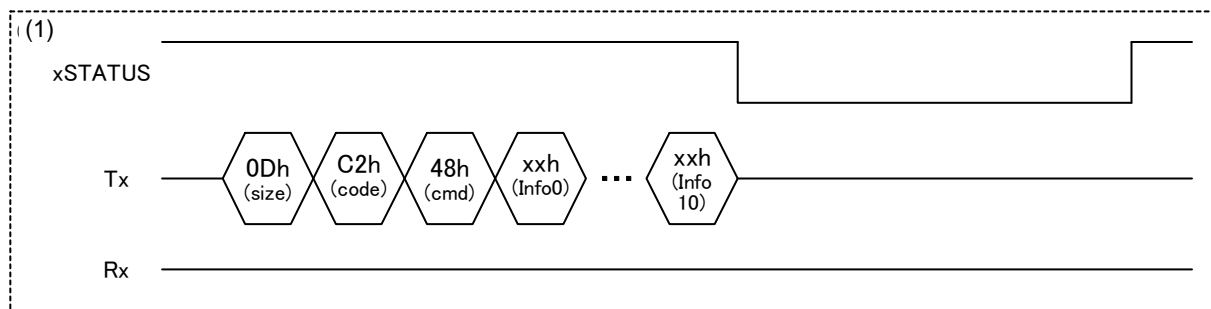
6.11.1 Ended non-notification

This protocol applies to Ended non-notification:

- When “Read” or “Write” is set
- When Ended notification is set to “prohibited” with “No data”

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



6.11.2 Ended notification (EVENT non-notification)

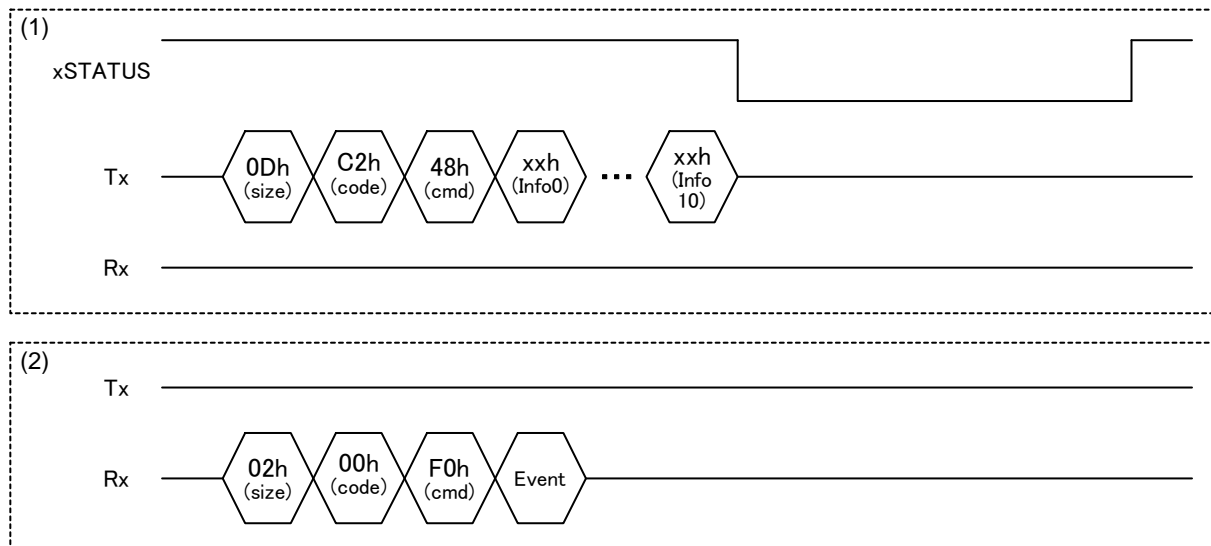
This protocol applies to Ended notification (EVENT non-notification):

- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “disable”

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted while the LSI is processing the command.

Event information in (2) is communicated to the Main CPU when command processing is complete.



6.11.3 Ended notification (EVENT notification)

This protocol applies to Ended notification (EVENT notification).

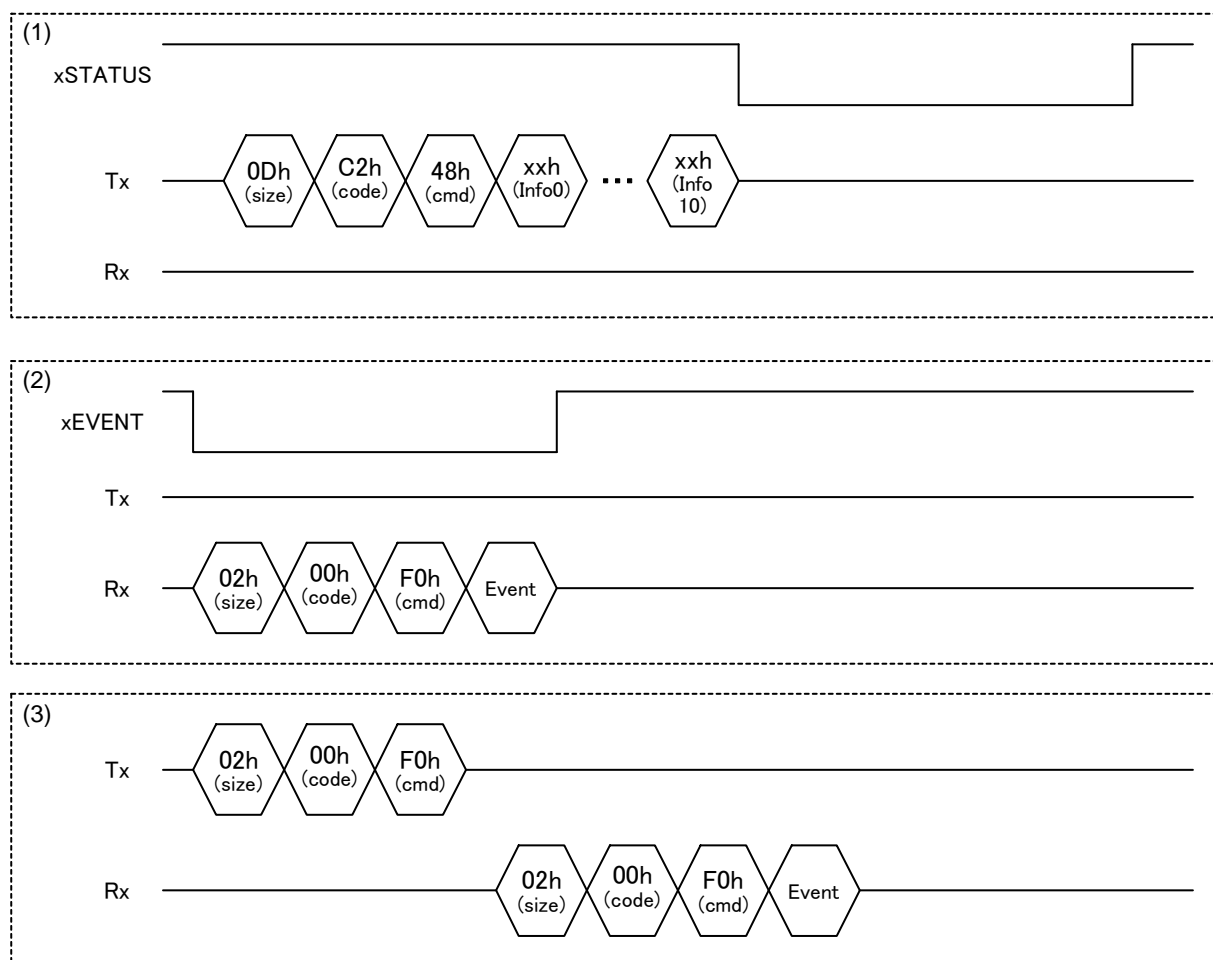
- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “enable”

Access using protocol procedures (1) to (3).

xSTATUS in (1) is asserted while the LSI is processing the command.

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (2) when command processing is complete.

The event information is cleared by reading in (3).



6. MSC EI Requests

6.12 49h_STORAGE COMMAND THROUGH (10)

This is an Elreq for full control. This writes a 10-byte SCSI/ATAPI command to the LSI.

When this accompanies data reading or writing, the payload data should be processed after this Elreq using the procedure described in “6.9 3Ah_BLK WRITE DATA” or “6.10 3Bh_BLK READ DATA”.

In the case of “No data”, the total number of data transfer bytes should be set to “00h”.

Table 6.11 STORAGE COMMAND THROUGH (10)

Content		Block	Value	Description		
Elreq	Block size	0	11h	Total for Control code + Elreq code + Information data		
	Control code	1	C2h	Fixed value		
	Elreq code	2	49h	Fixed value		
	Information data	3	xxh	Command protocol		
				Bit	Content	Setting value
				7	Command Through Ended event notification setting	0b: prohibited 1b: permitted (default)
				6-2	reserved	
				1-0	Transfer specification	00b: No data 01b: Read 10b: Write 11b: reserved
		4	xxh	Total number of data transfer bytes [7:0]		
		5	xxh	Total number of data transfer bytes [15:8]		
		6	xxh	Total number of data transfer bytes [23:16]		
		7	xxh	Total number of data transfer bytes [31:24]		
		8	xxh	SCSI/ATAPI command packet [0]		
		9	xxh	SCSI/ATAPI command packet [1]		
		10	xxh	SCSI/ATAPI command packet [2]		
		11	xxh	SCSI/ATAPI command packet [3]		
		12	xxh	SCSI/ATAPI command packet [4]		
		13	xxh	SCSI/ATAPI command packet [5]		
		14	xxh	SCSI/ATAPI command packet [6]		
		15	xxh	SCSI/ATAPI command packet [7]		
		16	xxh	SCSI/ATAPI command packet [8]		
		17	xxh	SCSI/ATAPI command packet [9]		

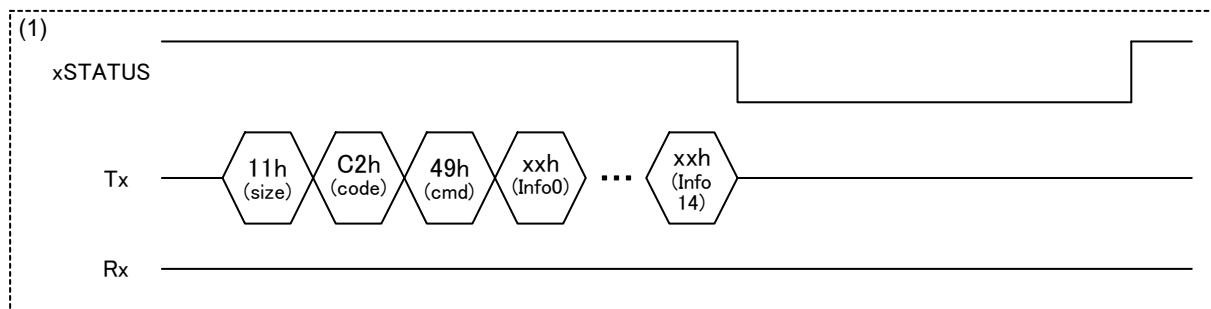
6.12.1 Ended non-notification

This protocol applies to Ended non-notification:

- When “Read” or “Write” is set
- When Ended notification is set to “prohibited” with “No data”

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



6.12.2 Ended notification (EVENT non-notification)

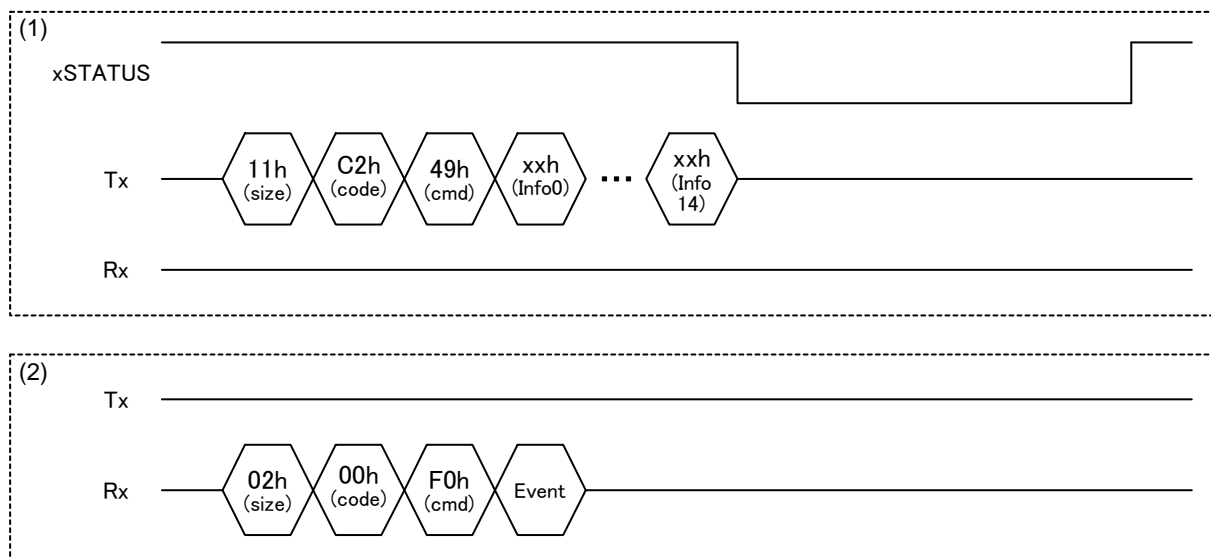
This protocol applies to Ended notification (EVENT non-notification):

- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “disable”

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted while the LSI is processing the command.

Event information in (2) is communicated to the Main CPU when command processing is complete.



6. MSC EI Requests

6.12.3 Ended notification (EVENT notification)

This protocol applies to Ended notification (EVENT notification):

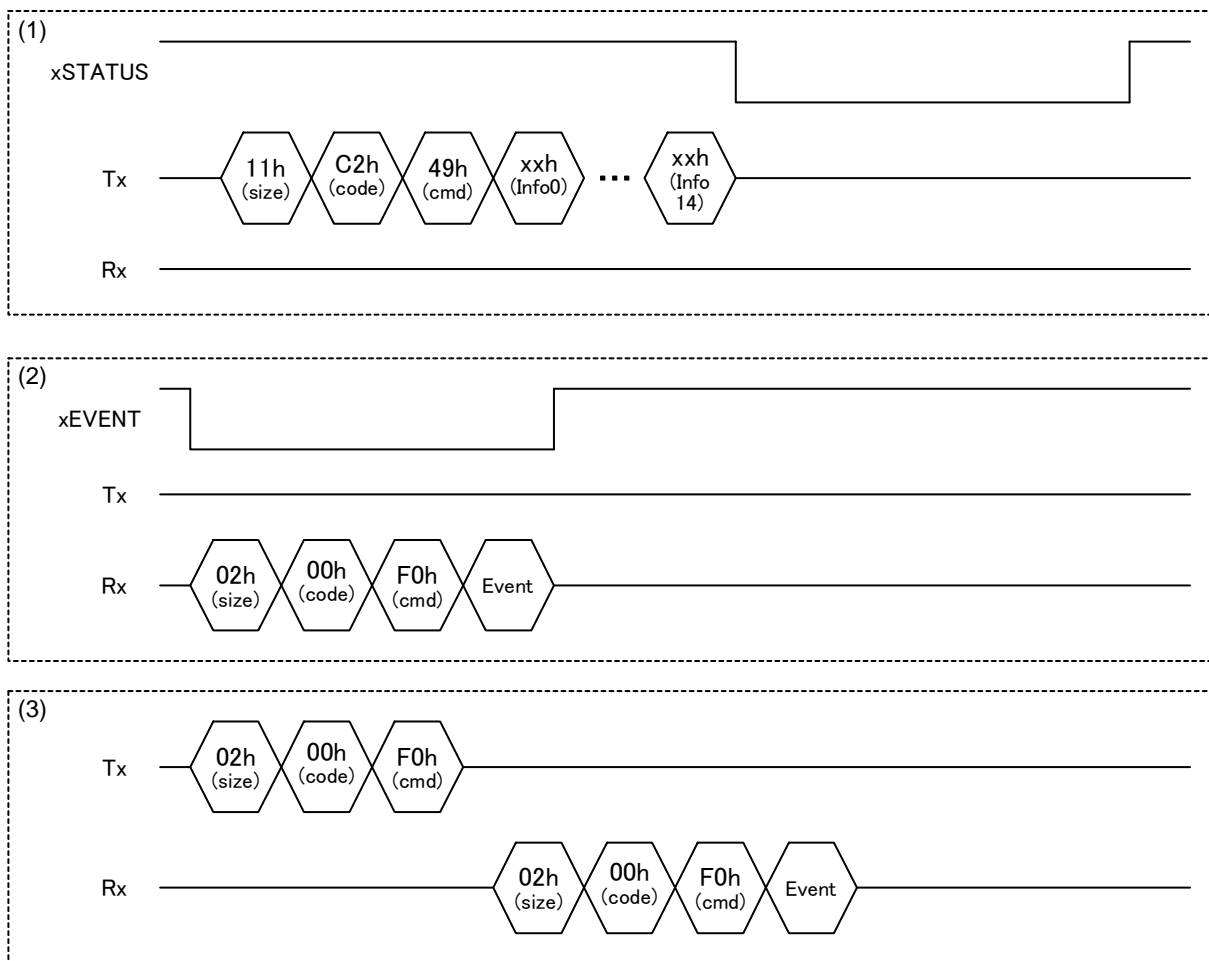
- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “enable”

Access using protocol procedures (1) to (3).

xSTATUS in (1) is asserted while the LSI is processing the command.

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (2) when command processing is complete.

The event information is cleared by reading in (3).



6.13 4Ah_STORAGE COMMAND THROUGH (12)

This is an Elreq for full control. This writes a 12-byte SCSI/ATAPI command to the LSI.

When this accompanies data reading or writing, the payload data should be processed after this Elreq using the procedure described in “6.9 3Ah_BLK WRITE DATA” or “6.10 3Bh_BLK READ DATA”.

In the case of “No data”, the total number of data transfer bytes should be set to “00h”.

Table 6.12 STORAGE COMMAND THROUGH (12)

	Content	Block	Value	Description		
Elreq	Block size	0	13h	Total for Control code + Elreq code + Information data		
	Control code	1	C2h	Fixed value		
	Elreq code	2	4Ah	Fixed value		
	Information data	3	xxh	Command protocol		
				Bit	Content	Setting value
				7	Command Through Ended event notification setting	0b: prohibited 1b: permitted (default)
				6-2	reserved	
				1-0	Transfer specification	00b: No data 01b: Read 10b: Write 11b: reserved
	4	xxh	Total number of data transfer bytes [7:0]			
	5	xxh	Total number of data transfer bytes [15:8]			
	6	xxh	Total number of data transfer bytes [23:16]			
	7	xxh	Total number of data transfer bytes [31:24]			
	8	xxh	SCSI/ATAPI command packet [0]			
	9	xxh	SCSI/ATAPI command packet [1]			
	10	xxh	SCSI/ATAPI command packet [2]			
	11	xxh	SCSI/ATAPI command packet [3]			
	12	xxh	SCSI/ATAPI command packet [4]			
	13	xxh	SCSI/ATAPI command packet [5]			
	14	xxh	SCSI/ATAPI command packet [6]			
	15	xxh	SCSI/ATAPI command packet [7]			
16	xxh	SCSI/ATAPI command packet [8]				
17	xxh	SCSI/ATAPI command packet [9]				
18	xxh	SCSI/ATAPI command packet [10]				
19	xxh	SCSI/ATAPI command packet [11]				

6. MSC EI Requests

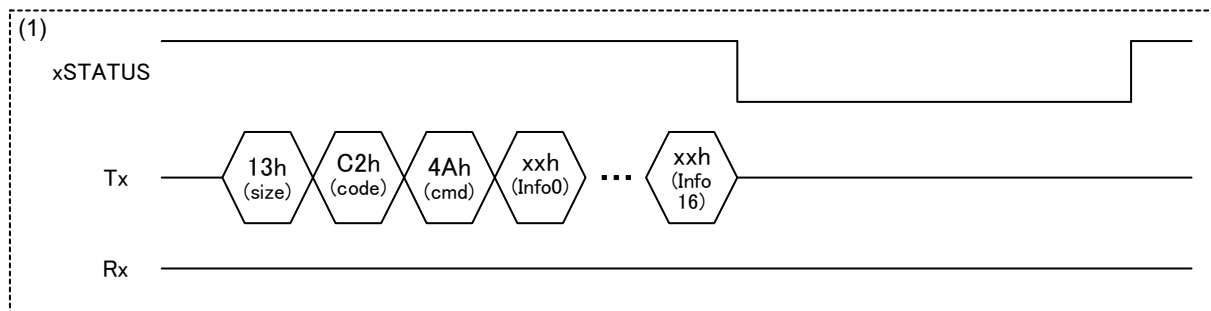
6.13.1 Ended non-notification

This protocol applies to Ended non-notification:

- When “Read” or “Write” is set
- When Ended notification is set to “prohibited” with “No data”

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



6.13.2 Ended notification (EVENT non-notification)

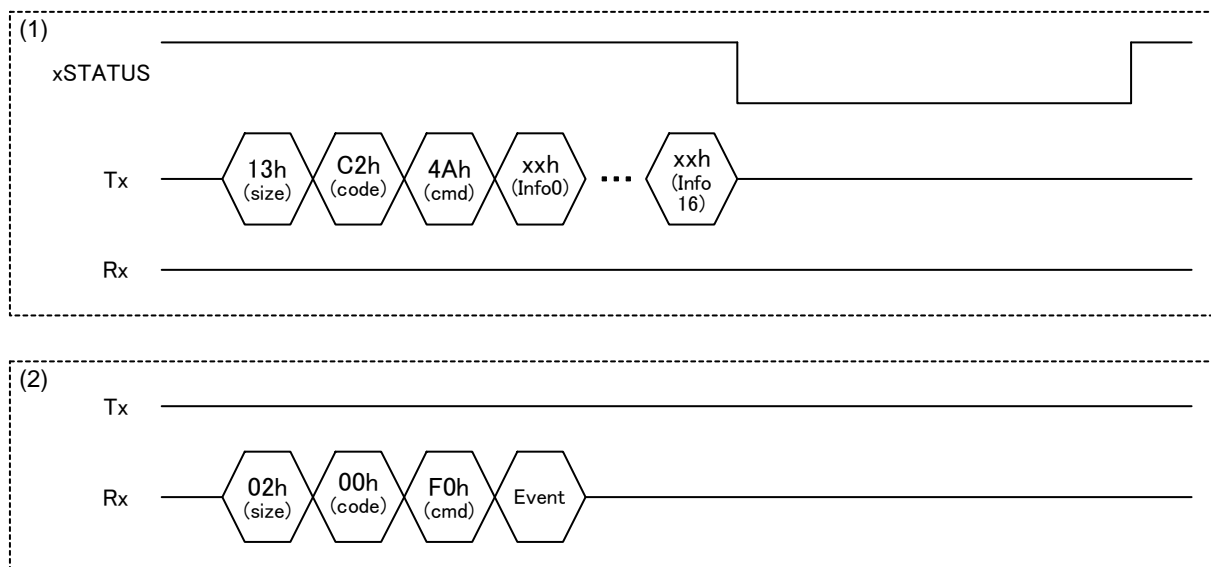
This protocol applies to Ended notification (EVENT non-notification):

- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “disable”

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted while the LSI is processing the command.

Event information in (2) is communicated to the Main CPU when command processing is complete.



6.13.3 Ended notification (EVENT notification)

This protocol applies to Ended notification (EVENT notification):

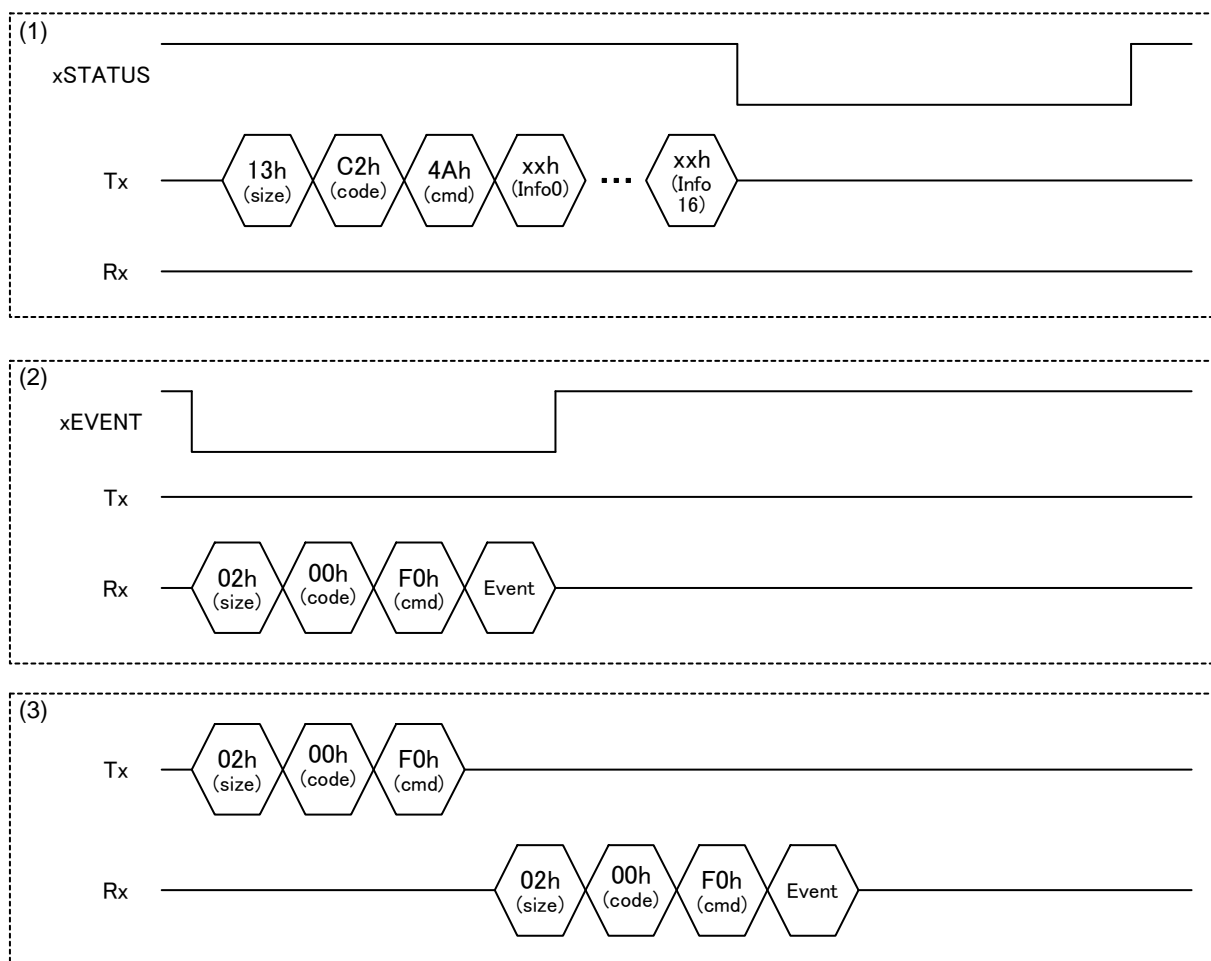
- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “enable”

Access using protocol procedures (1) to (3).

xSTATUS in (1) is asserted while the LSI is processing the command.

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (2) when command processing is complete.

The event information is cleared by reading in (3).



6. MSC EI Requests

6.14 4Bh_STORAGE COMMAND THROUGH (16)

This is an Elreq for full control. This writes a 16-byte SCSI/ATAPI command to the LSI.

When this accompanies data reading or writing, the payload data should be processed after this Elreq using the procedure described in “6.9 3Ah_BLK WRITE DATA” or “6.10 3Bh_BLK READ DATA”.

In the case of “No data”, the total number of data transfer bytes should be set to “00h”.

Table 6.13 STORAGE COMMAND THROUGH (16)

Content		Block	Value	Description		
Elreq	Block size	0	17h	Total for Control code + Elreq code + Information data		
	Control code	1	C2h	Fixed value		
	Elreq code	2	4Bh	Fixed value		
	Information data	3	xxh	Command protocol		
				Bit	Content	Setting value
				7	Command Through Ended event notification setting	0b: prohibited 1b: permitted (default)
				6-2	reserved	
				1-0	Transfer specification	00b: No data 01b: Read 10b: Write 11b: reserved
		4	xxh	Total number of data transfer bytes [7:0]		
		5	xxh	Total number of data transfer bytes [15:8]		
		6	xxh	Total number of data transfer bytes [23:16]		
		7	xxh	Total number of data transfer bytes [31:24]		
		8	xxh	SCSI/ATAPI command packet [0]		
		9	xxh	SCSI/ATAPI command packet [1]		
		10	xxh	SCSI/ATAPI command packet [2]		
		11	xxh	SCSI/ATAPI command packet [3]		
		12	xxh	SCSI/ATAPI command packet [4]		
		13	xxh	SCSI/ATAPI command packet [5]		
		14	xxh	SCSI/ATAPI command packet [6]		
		15	xxh	SCSI/ATAPI command packet [7]		
		16	xxh	SCSI/ATAPI command packet [8]		
		17	xxh	SCSI/ATAPI command packet [9]		
		18	xxh	SCSI/ATAPI command packet [10]		
		19	xxh	SCSI/ATAPI command packet [11]		
		20	xxh	SCSI/ATAPI command packet [12]		
		21	xxh	SCSI/ATAPI command packet [13]		
		22	xxh	SCSI/ATAPI command packet [14]		
		23	xxh	SCSI/ATAPI command packet [15]		

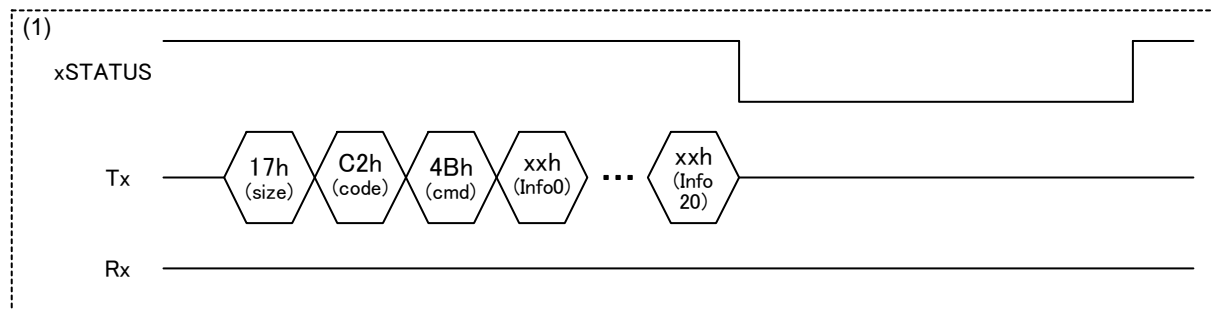
6.14.1 Ended non-notification

This protocol applies to Ended non-notification:

- When “Read” or “Write” is set
- When Ended notification is set to “prohibited” with “No data”

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.



6.14.2 Ended notification (EVENT non-notification)

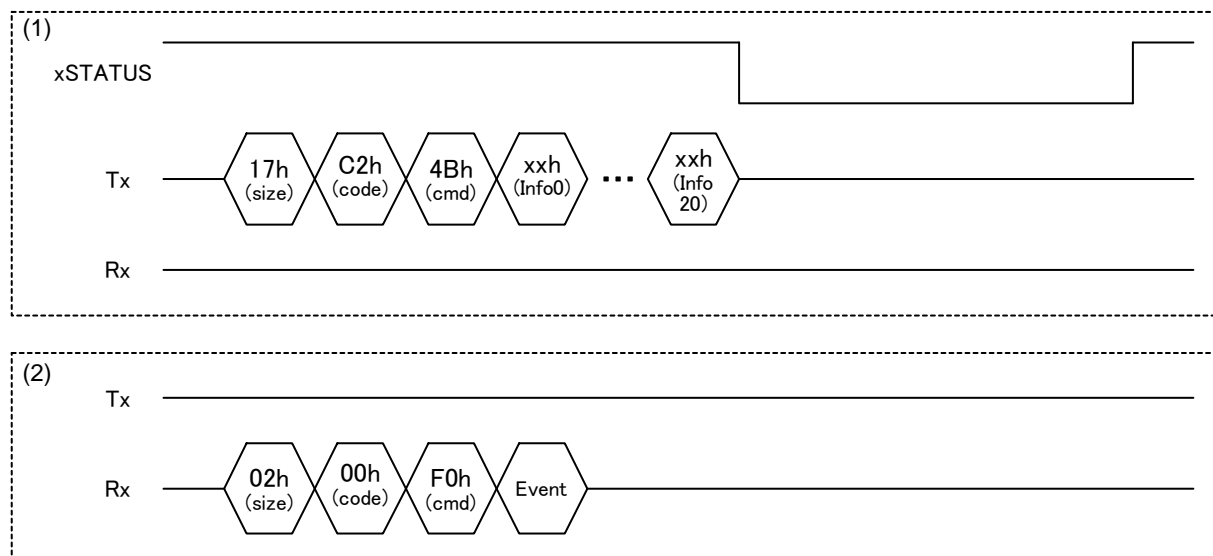
This protocol applies to Ended notification (EVENT non-notification):

- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “disable”

Access using protocol procedures (1) and (2).

xSTATUS in (1) is asserted while the LSI is processing the command.

Event information in (2) is communicated to the Main CPU when command processing is complete.



6. MSC EI Requests

6.14.3 Ended notification (EVENT notification)

This protocol applies to Ended notification (EVENT notification):

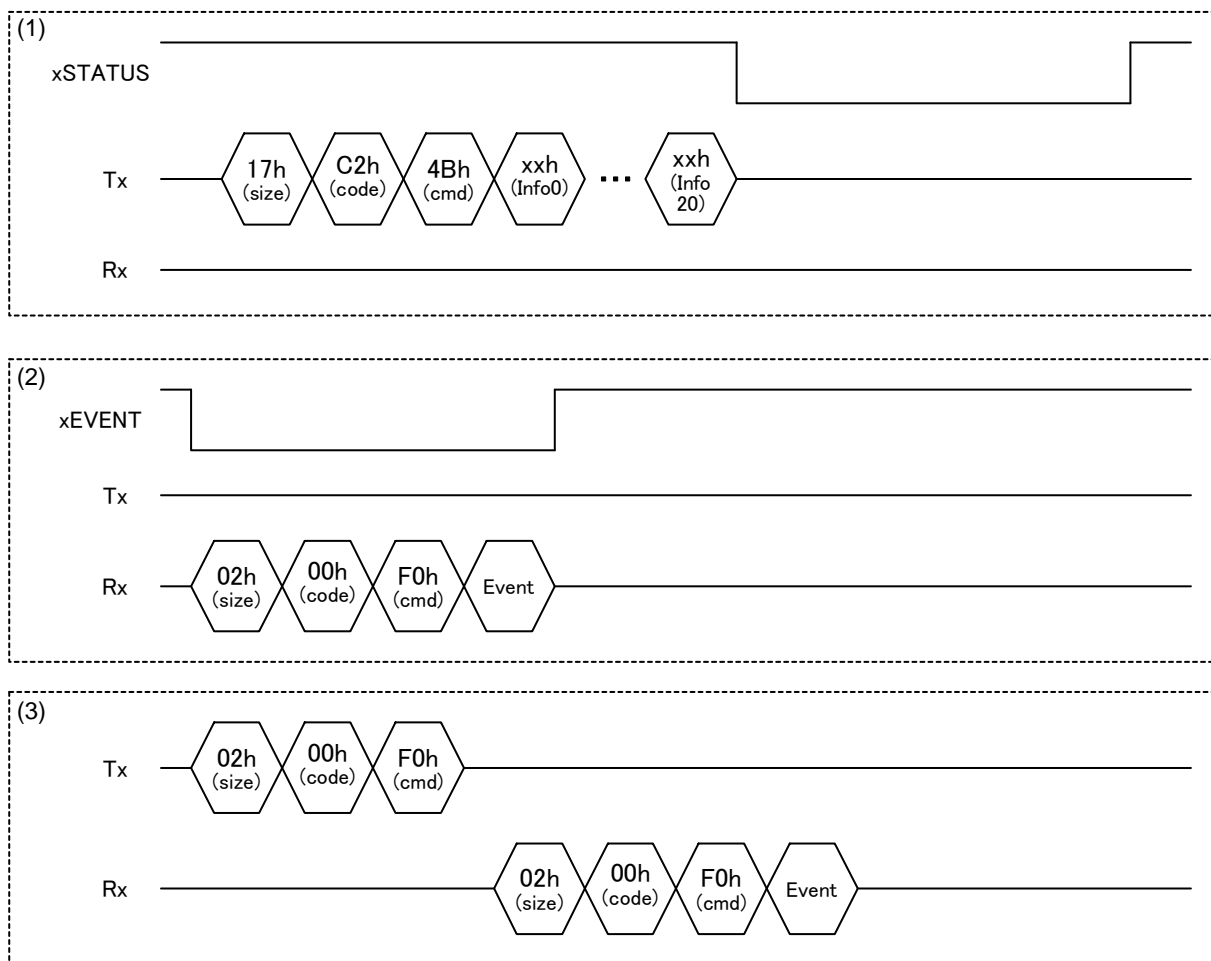
- When Ended notification is set to “permitted” with “No data” and the XIRQ_EVENT pin is set to “enable”

Access using protocol procedures (1) to (3).

xSTATUS in (1) is asserted while the LSI is processing the command.

The event information is communicated to the Main CPU concurrently with the xEVENT assert as in (2) when command processing is complete.

The event information is cleared by reading in (3).



6.15 4Ch_STORAGE COMMAND RESULT

This is an Elreq for full control. It checks the SCSI/ATAPI command results using the THROUGH command (refer to sections 6.11 to 6.14).

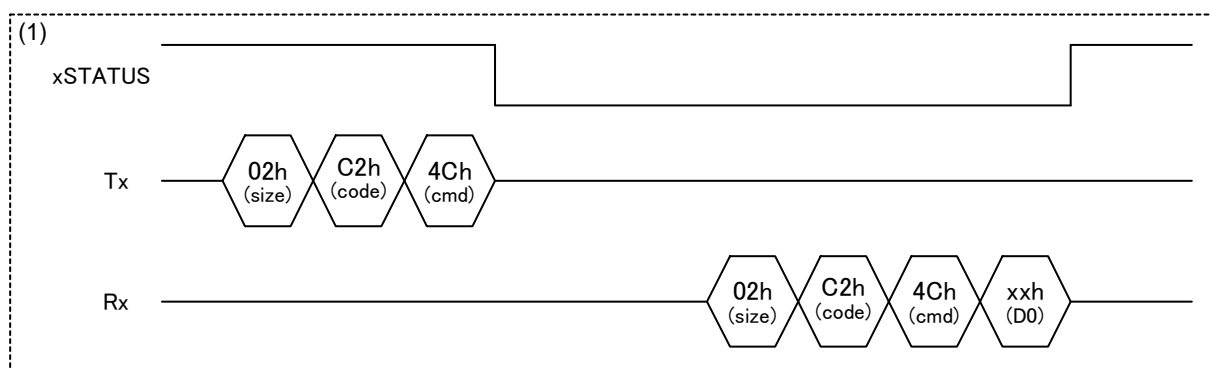
Table 6.14 STORAGE COMMAND RESULT

	Content	Block	Value	Description
Elreq	Block size	0	02h	Total for Control code + Elreq code
	Control code	1	C2h	Fixed value
	Elreq code	2	4Ch	Fixed value
Data		-	xxh	00h: Success 01h: Failure

Access using protocol procedure (1).

xSTATUS in (1) is asserted while the LSI is processing the command.

Data transfer starts, and the data should be read. xSTATUS is negated when the data transfer is complete.



Appendix A Storage Information

Table A.1 lists the Device storage information that can be obtained using “GET STORAGE INFORMATION” (40h). Storage information is set to a constant 39 bytes of data.

Appendix A-1 Storage Information

Content	Size (Byte)	Description
Device type	1	Device type 00h: direct access device (e.g HDD) 01h: sequential access device (e.g tape device) 02h: printer device 03h: processor device (e.g graphic display) 04h: write once device (May be included in optical memory device) 05h: CD-ROM device 06h: scanner device 07h: optical memory device (e.g MO) 08h: media changer device (e.g CD changer) 09h: communication device Device type Bit7 has the following meanings: 0b: fixed 1b: removable
vender id	8	Vendor ID (ASCII)
product id	16	Product ID (ASCII)
product revision	4	Product version (ASCII)
sector size	2	Sector size [7:0]
		Sector size [15:8]
Maximum logical block address	8	Max. LBA [7:0]
		Max. LBA [15:8]
		Max. LBA [23:16]
		Max. LBA [31:24]
		Max. LBA [39:32]
		Max. LBA [47:40]
		Max. LBA [55:48]
		Max. LBA [63:56]

Appendix B MSC Access Size

The MSC Device capacity and Access size are explained below.

The Main CPU should check the accessible size using “GET STORAGE INFORMATION” (40h). Figure B.1 illustrates the MSC Device capacity.

The MSC Device capacity accessible by the Main CPU is the total of the individual Sector sizes.



Figure B.1 MSC Device capacity

The example below describes setting the Access size shown in Figure B.2 to Elreq. Figure B.3 illustrates the setting configuration.

In this example, Elreq will be set as shown below. Note that this LSI retains the Sector size information, and so the Main CPU sets the sector count number.

In this setting example, an Access size of 2,048 bytes is set, and data is read in 256-byte block transfers from the 0000 0000 0000 010h LBA.

“START READING SECTORS” (42h)

- Sector count number = 0004h (4 x 512 = 2,048 bytes)
- Access start LBA = 0000 0000 0000 010h

“BLK READ DATA” (3Bh)

- Block transfer size = 0100h (set to an appropriate size as desired)

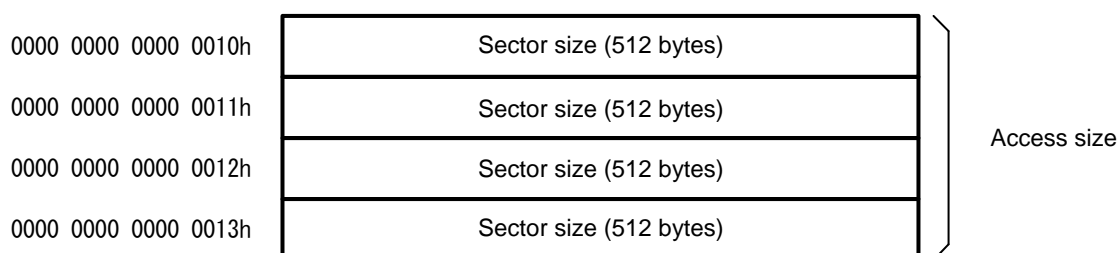


Figure B.2 Access size

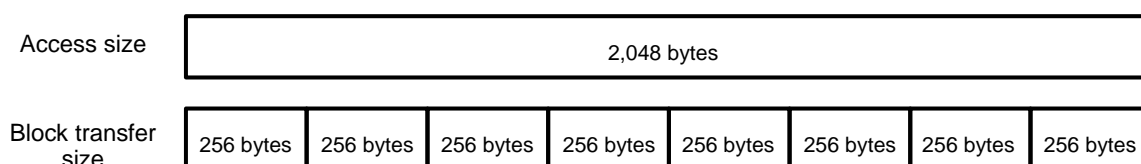


Figure B.3 Setting configuration

Appendix C SCSI/ATAPI Command Control

Table C.1 lists the SCSI/ATAPI command control details.

Table C.1 Control details

Elreq	SCSI/ATAPI command
GET STORAGE INFORMATION	INQUIRY *1
	READ CAPACITY(10) *1, *2
	READ CAPACITY(16) *1, *2
	REQUEST SENSE *3
START WRITING SECTORS	WRITE(10) *2
	WRITE(16) *2
	REQUEST SENSE *3
START READING SECTORS	READ(10) *2
	READ(16) *2
	REQUEST SENSE *3
BLK WRITE DATA	None
BLK READ DATA	None
STORAGE COMMAND THROUGH (6)	SCSI/ATAPI command packet *4
STORAGE COMMAND THROUGH (10)	SCSI/ATAPI command packet *4
STORAGE COMMAND THROUGH (12)	SCSI/ATAPI command packet *4
STORAGE COMMAND THROUGH (16)	SCSI/ATAPI command packet *4
STORAGE COMMAND RESULT	None

*1 Retries for “MEDIUM CHANGED” or “POWER ON RESET”.

*2 Transmits appropriate SCSI/ATAPI command to suit MSC Device.

*3 Transmitted if error occurs in SCSI/ATAPI command.

*4 Transmits SCSI/ATAPI command packet written from Main CPU to MSC Device.

[illegible]

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