TB3066

MCP2200 HID Interface Command Description

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INTRODUCTION

This technical brief details the MCP2200 HID commands in order to help users understand the functions and operation when developing custom host applications.

MCP2200 is an USB composite device that provides two different interfaces to the host machine:

- Communication Device Class (CDC) compatible
- Human Interface Device (HID)

The CDC interface follows the USB 2.0 specifications. The information on this interface is not covered by this document.

The HID interface of the MCP2200 is used for the additional functionalities of the devices, such as GPIO, EEPROM or special features manipulation.

HID INTERFACE DETAILS

HID Interface Overview

For the user interested in building their own application using the HID interface of the MCP2200 device, here are the main features of this interface to remember during the design stage:

- 16 bytes long HID reports generated to read/write data from/to MCP2200
- Configuration, EEPROM and GPIO commands (see MCP2200 Commands section for details)
- All commands except READ_EE and READ_ALL use only one way communication, with respect to the host. The host needs to send only the 16 bytes HID report.
- For READ_EE and READ_ALL commands, the host sends a HID report of 16 bytes and then receives a 16 bytes HID report from the MCP2200.

The transmission order of HID reports is shown in Table 1:

TABLE 1: HID REPORTS ORDER

Index number		Description
0	=	First sent/received USB report byte
1	=	Second sent/received USB report byte
2		•
3		•
•		•
•		•
•		•
•		•
•		•
15	=	Last sent/received USB report byte

GPIO details on the bitmap values are presented throughout the document. Table 2 shows the details of an 8 bits long bitmap. All of the MCP2200 commands below that modify the GPIO port follow this bit mapping.

TABLE 2: GPIO BITMAP ASSIGNMENTS

bit 7 (MSB)							bit 0 (LSB)
GP7	GP6	GP5	GP4	GP3	GP2	GP1	GP0

MCP2200 Commands

A set of HID accessible commands includes:

- SET_CLEAR_OUTPUTS
- CONFIGURE
- READ_EE
- WRITE_EE
- READ_ALL

SET_CLEAR_OUTPUTS

The SET_CLEAR_OUTPUTS command is used for GPIO functionality to establish certain values to those GPIO pins that are not assigned to their alternative dedicated function. If one of these special functions is assigned (e.g., Tx/Rx LED enabling, SSPND pin or USBCFG pin), the corresponding GPIO pin will not be affected by this command.

TABLE 3: SET_CLEAR_OUTPUTS COMMAND DETAILS

Index number	Value	Description
0	0x08	SET_CLEAR_OUT command opcode
1		Don't care
2		Don't care
3		Don't care
4		Don't care
5		Don't care
6		Don't care
7		Don't care
8		Don't care
9		Don't care
10		Don't care
11	Set_bmap(1)	Bitmap for setting the corresponding GPIOs
12	Clear_bmap(2)	Bitmap for clearing the corresponding GPIOs
13		Don't care
14		Don't care
15		Don't care

Note 1: A bitmap value where the bits set to '1' sets the corresponding GPIO pins to logic '1'.

2: A bitmap value where the bits set to '1' clears the corresponding GPIO pins to logic '0'.

Note: Care must be taken when setting the values. If a bit is set in both Set_bmap and Clear_bmap fields, the assigned GPIO will end up with a value of '0'. When the SET_CLEAR_OUTPUTS command is executed, the first step is to set the GPIOs to '1' for the bits already set as '1' in the Set_bmap field. The second step is to clear to '0' the GPIOs for the corresponding bits that are set to '1' in Clear_bmap.

The mapping convention in Table 2 applies for both Set_bmap and Clear_bmap bytes.

CONFIGURE

This command is used to establish the configuration parameters that are stored in NVRAM, used by the MCP2200 after exiting the Reset mode.

TABLE 4: CONFIGURE COMMAND DETAILS

Index number	Value	Description
0	0x10	CONFIGURE command opcode
1		Don't care
2		Don't care
3		Don't care
4	IO_bmap	GPIO bitmap for pin assignment (input/output)
5	Config_Alt_Pins	Alternative configuration pin settings
6	IO_Default_Val_bmap	Default GPIO value bitmap
7	Config_Alt_Options	Alternative function options
8	Baud_H	High byte of the default baud rate setting
9	Baud_L	Low byte of the default baud rate setting
10		Don't care
11		Don't care
12		Don't care
13		Don't care
14		Don't care
15		Don't care

IO_bmap

The IO_bmap bits are defined as follows:

- 1 = input
- 0 = output

The mapping convention in Table 2 also applies for this IO_bmap byte.

Config_Alt_Pins

This is a bitmap value that sets certain GPIO pins to their alternative function (see Table 5).

TABLE 5: ALTERNATIVE PIN ASSIGNMENTS

bit 7 (MSB)							bit 0 (LSB)
SSPND	USBCFG	x	x	RxLED	TxLED	x	x

SSPND

- When this bit is set to '1', GP0 is designated to use its alternative function and signals the USB suspend events. When this bit is set to '1', all the GPIO related operations (setting/clearing the output value) will have no effect.
- When this bit is cleared to '0', GP0 behaves like a normal GPIO (input or output).

USBCFG

- When this bit is set to '1', GP1 is designated to use its alternative function and signals when the USB host successfully configures the MCP2200. An embedded system can use the value of this alternative function pin to determine when the host is able to load the appropriate drivers for MCP2200 and start the communication. When this bit is set to '1', all the GPIO related operations (setting/clearing the output value) will have no effect.
- When this bit is cleared to '0', GP1 behaves like a normal GPIO (input or output).

RxLED

- When this bit is set to '1', GP6 is designated to use its alternative function and signals when the MCP2200 UART received data is sent to the host. When this bit is set to '1', all the GPIO related operations (setting/clearing the output value) will have no effect.
- When this bit is cleared to '0', GP6 behaves like a normal GPIO (input or output).

TxLED

- When this bit is set to '1', GP7 is designated to use its alternative function and signals when the MCP2200 UART transmitted data is sent through the UART TX pin. When this bit is set to '1' all the GPIO related operations (setting/clearing the output value) will have no effect.
- When this bit is cleared to '0', GP7 behaves like a normal GPIO (input or output).

IO_Default_Val_bmap

This bitmap value sets the default output value (at Reset) for the pins configured as GPIO outputs. The IO_Default_Val_bmap bits are defined as follows:

- 1 = input
- 0 = output

The effect of this setting applies only to those GPIOs set as outputs that do not have their alternative function active.

Note:	This setting has no effect when the respective pin is configured as input, or its alternative function.

The mapping convention in Table 2 also applies for the IO_Default_Val_bmap byte.

Config_Alt_Options

This bitmap value sets/clears some of the special functionalities provided by the MCP2200 device.

TABLE 6: ALTERNATIVE PIN ASSIGNMENTS OPTIONS

bit 7 (MSB)							bit 0 (LSB)
RxTGL	TxTGL	LEDX	x	x	x	INVERT	HW_FLOW

RXTGL

- Modifies the behavior of the RxLED function (GP6). Refer to Table 7 for details.

TXTGL

- Modifies the behavior of the TxLED function (GP7). Refer to Table 7 for details.

LEDX

- This bit works together with the RXTGL and TXTGL bits in order to establish the behavior of the Rx and Tx LED

Table 7 details the configuration options for the Rx or Tx LEDs. In order for these settings to be applied to either Tx or Rx LEDs, GP7/GP6 must be configured for their alternative function in the `Config_Alt_Pins` bitmap value.

TABLE 7: LED CONFIGURATION OPTIONS

TXTGL or RXTGL	LEDX	Remarks
0	0	Blink fast (100 ms)
0	1	Blink slow (200 ms)
1	Don't care	Toggle LED

INVERT

- Setting this bit to '1' inverts the logic of the Tx, Rx, RTS and CTS pins. Normally, to be able to interface with the digital logic levels UART signals (e.g., direct connection to a microcontroller), this bit has to be '0'. The inversion of this bit can be very useful in order to simplify the direct connection with RS-232 signals (with a logical '1' signaled as a negative voltage and '0' as a positive voltage).

HW_FLOW

- This bit controls the activation/deactivation of the hardware flow control methods using the RTS and CTS pins. When this bit is set to '1', the MCP2200 uses hardware flow control, and the RTS and CTS pins are used as flow control pins. When this bit is cleared to '0', the MCP2200 device will not use any hardware flow control.

Baud_H and Baud_L

These two bytes are used to establish the default Reset baud rate that is set in the MCP2200 device. The baud rate value is calculated as follows:

EQUATION 1:

$$Baud\_rate\_divisor = \frac{12000000}{desired\_baud\_rate} - 1$$

The `Baud_rate_divisor` value represented on 16 bits is then split in 2 bytes.The user must load the `Baud_H` and `Baud_L` with the highest order byte, and the lower order byte respectively.

READ_EE

The READ_EE command is used to read a single EEPROM memory location (1 byte) out of a total of 256 bytes of the user's EEPROM. The MCP2200 device has 256 bytes integrated EEPROM to be used for user's own purposes. Tables 8 and 9 show the details for both commands and response.

TABLE 8: READ_EE COMMAND DETAILS

Index number	Value	Description
0	0x20	READ_EE command opcode
1	EEP_Addr	Address of the EEPROM location to be read
2		Don't care
3		Don't care
4		Don't care
5		Don't care
6		Don't care
7		Don't care
8		Don't care
9		Don't care
10		Don't care
11		Don't care
12		Don't care
13		Don't care
14		Don't care
15		Don't care

TABLE 9: READ_EE RESPONSE DETAILS

Index number	Value	Description
0	0x20	READ_EE command opcode
1	EEP_Addr	Address of the EEPROM location read
2		Don't care
3	EEP_Val	Value of the requested EEPROM location
4		Don't care
5		Don't care
6		Don't care
7		Don't care
8		Don't care
9		Don't care
10		Don't care
11		Don't care
12		Don't care
13		Don't care
14		Don't care
15		Don't care

EEP_Addr

This byte holds the EEPROM address to be read. When checking the Response HID Report (Table 9), this byte mirrors the EEPROM address from the preceding command report (Table 8).

EEP_Val

This is the value of the EEPROM location addressed by the EEP_Addr.

WRITE_EE

The WRITE_EE command is used to write a single EEPROM location (1 byte) out of a total of 256 bytes of user EEPROM, present in the MCP2200 device.

TABLE 10: WRITE_EE COMMAND DETAILS

Index No	Value	Description
0	0x40	WRITE_EE command opcode
1	EEP_Addr	Address of the EEPROM location to write to
2	EEP_Val	The data byte to be written at the specified EEPROM location
3		Don't care
4		Don't care
5		Don't care
6		Don't care
7		Don't care
8		Don't care
9		Don't care
10		Don't care
11		Don't care
12		Don't care
13		Don't care
14		Don't care
15		Don't care

EEP_Addr

This byte holds the EEPROM address to be written.

EEP_Val

This is the desired value to be written in the EEPROM memory location addressed by EEP_Addr.

This command does not offer a response HID report. In order to verify the correct behavior of this command, the user must issue a READ_EE command, check the latter HID report response and compare the read-back value against the one written in the first place by the WRITE_EE command.

READ_ALL

This command is used to retrieve the MCP2200's NVRAM parameters.

TABLE 11: COMMAND DETAILS FOR READ_ALL

Index No	Value	Description
0	0x80	READ_ALL command opcode
1		Don't care
2		Don't care
3		Don't care
4		Don't care
5		Don't care
6		Don't care
7		Don't care
8		Don't care
9		Don't care
10		Don't care
11		Don't care
12		Don't care
13		Don't care
14		Don't care
15		Don't care

TABLE 12: READ_ALL RESPONSE DETAILS

Index No	Value	Description
0	0x80	READ_ALL command opcode
1	EEP_Addr	Current EEPROM location
2		Don't care
3	EEP_Val	Current value of the EEPROM location specified by EEP_Addr
4	IO_bmap	GPIO bitmap for pin assign-ment (input/output)
5	Config_Alt_Pins	Alternative configuration pin settings
6	IO_Default_Val_bmap	Default GPIO value bitmap
7	Config_Alt_Options	Alternative function options
8	Baud_H	High byte of the default baud rate setting
9	Baud_L	Low byte of the default baud rate setting

TABLE 12: READ_ALL RESPONSE DETAILS (CONTINUED)

Index No	Value	Description
10	IO_Port_Val_bmap	Bitmap of the GPIO port values
11		Don't care
12		Don't care
13		Don't care
14		Don't care
15		Don't care

EEP_Addr

This is the current EEPROM address.

EEP_Val

This is the current value of the EEPROM address (EEP_Addr).

IO_bmap

This is the current GPIO input/output designation (see IO_bmap in the CONFIGURE section).

Config_Alt_Pins

This is the current GPIO alternative function designation ((see Config_Alt_Pins in the CONFIGURE section).

IO_Default_Val_bmap

This is the default (at Reset) GPIO value, that has effect only on the GPIO output designated pins (see IO_Default_Val_bmap in the CONFIGURE section).

Config_Alt_Options

This is the current alternative functions options (see Config_Alt_Options in the CONFIGURE section).

Baud_H and Baud_L

This is the default (at Reset) baud rate value. It is not required to change this default baud rate for communication changes. The host can change the communication baud rate through the CDC interface (e.g., from a terminal application at the time of communication parameters selection). This default baud rate may be useful when the MCP2200's USB side is connected to a feature-limited USB host that does not have the option to send the communication parameters through the CDC interface (see Baud_H and Baud_L in the CONFIGURE section).

IO_Port_Val_bmap

This is the current value of the entire GPIO port. The value of this byte also includes the values of the alternative function pins as well as the value of the GPIO pins at the moment the READ_ALL command is executed.

NOTES:

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