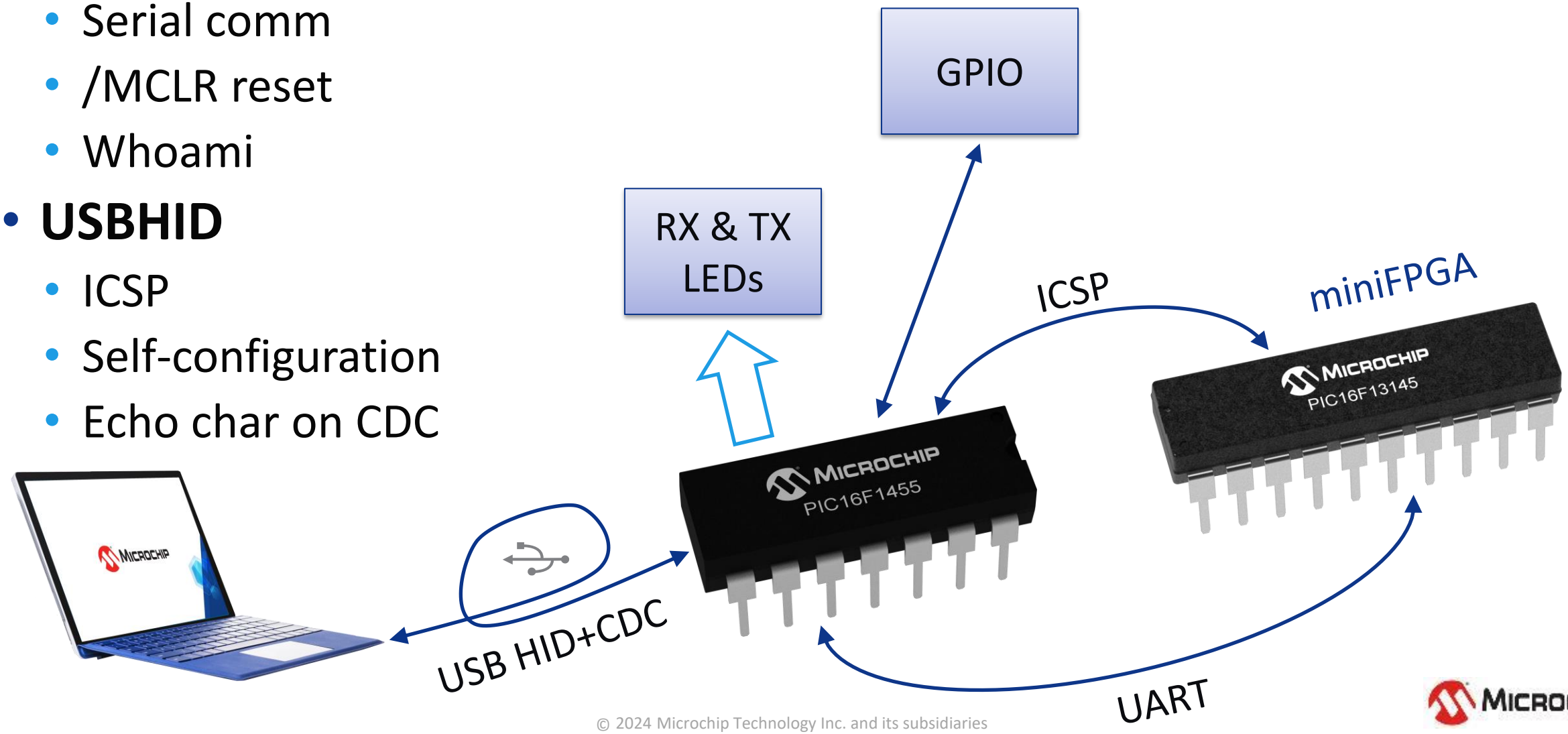
USB bridge

Developer’s guide

MICROCHIP

Main functions

- **USBCDC**
  - Serial comm
  - /MCLR reset
  - Whoami
- **USBHID**
  - ICSP
  - Self-configuration
  - Echo char on CDC



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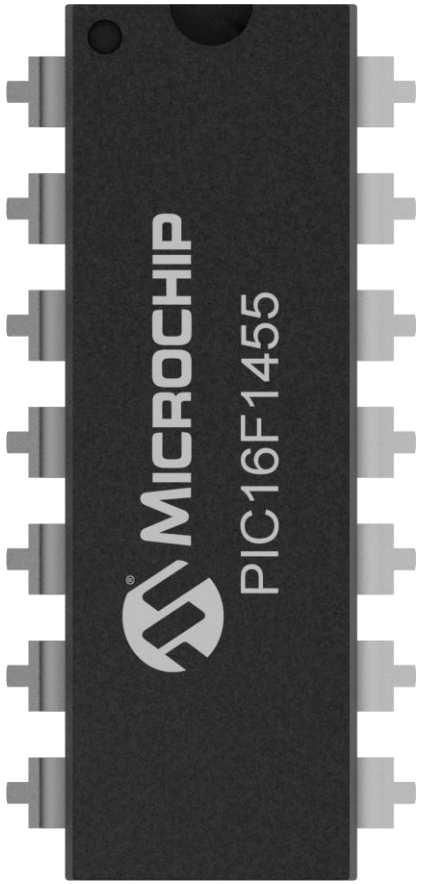
Pinout

Function	Name	Pin#
3.0 … 5.5V	V_{DD}	1
RX Activity	/RLED	2
TX Activity	/TLED	3
Pull to V_{DD} with 10kΩ	/RST	4
Data from target	RX	5
Output to target	TX	6
Target ICSP DT	IDAT	7



Pin#	Name	Function
14	V_{SS}	GND
13	USB D+	USB
12	USB D-	USB
11	V_{USB}	470nF to GND
10	GPIO	General purpose IO
9	/MCLR	Target ICSP /MCLR
8	ICLK	Target ICSP CK

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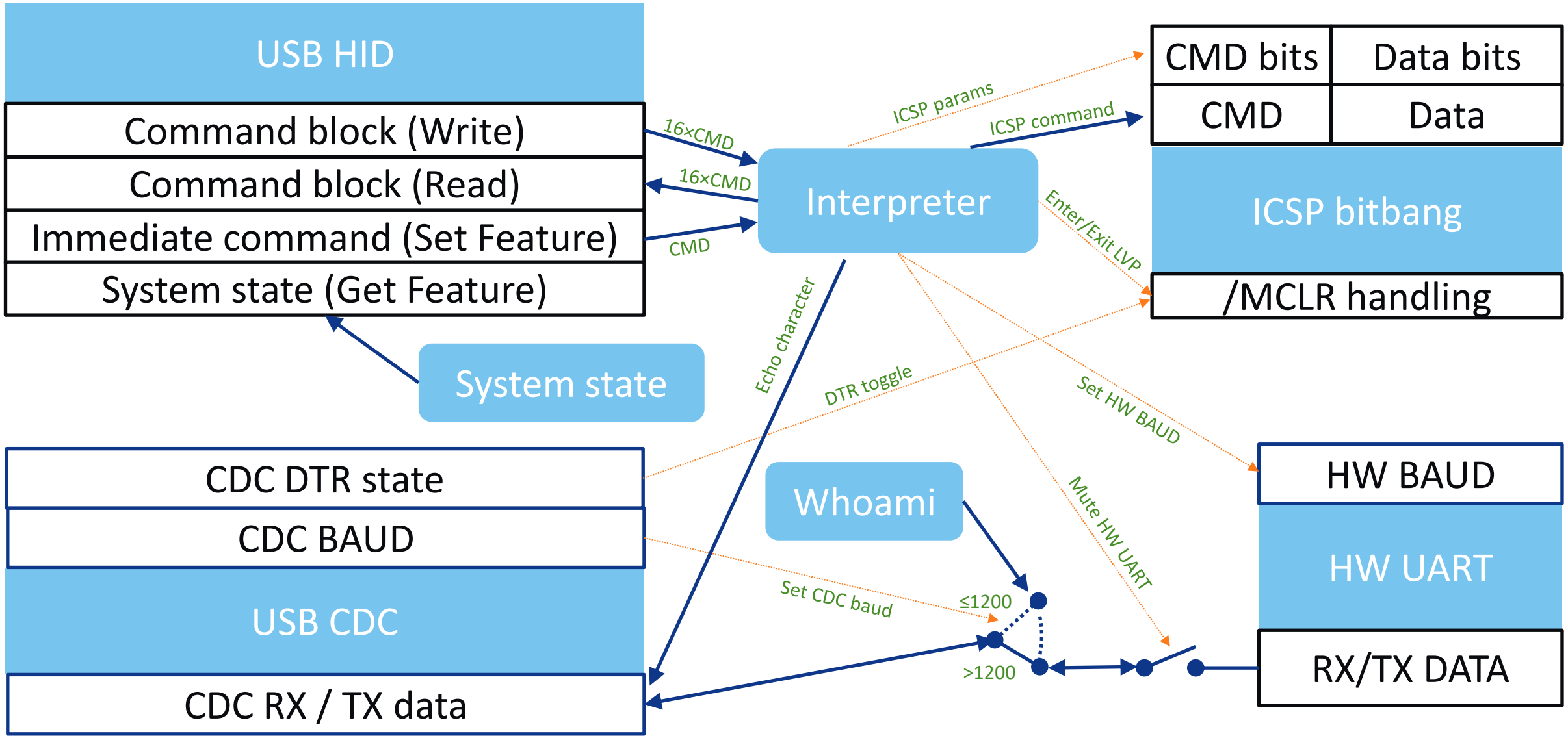
Logical structure



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USB CDC (virtual serial port) interface

- **Setting the DTR active will keep target in RESET**
- **Clearing the DTR will cycle target RESET pin and release RESET**
- **Setting baud rate ≤1200**
  - Mutes HW UART
  - Sends “Who am I?” JSON string
    - Example {"app":"miniFPGA board","USBFW":“0100","meta_cmd":255}
- **Setting baud rate >1200**
  - Connects HW UART to CDC UART
  - Unmutes HW UART
  - HW baud rate is not affected! (HWBAUD is set by HID commands!)

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USB HID reports

- **VID:PID = 0x04D8:0xE594**
- **Usage page: 0xFF00 (Vendor Page 1)**
- **Usage: 0x0001 (Vendor Usage 1)**
- **Report ID 0**
  - Read data (64bytes)
  - Write data (64bytes)
  - Get_feature (8bytes)
  - Set_feature (8bytes)

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HID get_feature – RPTID0

- **Returns 8 bytes with the following structure**

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
MCMD_ID	target_state	HWBaud_L	HWBaud_H	HWBaud_U	PORTA	PORTB	PORTC

MCMD_ID → Metacommand value

target_state → 0 – Running (MCLR_HIGH)

1 – Transitioning from STOP to RUN (MCLR_LOW)

2 – Stopped (MCLR_LOW)

HWBaud → HW UART baud rate = (HWBaud_U << 16) + (HWBaud_H << 8) + HWBaud_L

PORTA → PORTA value at the moment of executing get_feature

PORTB → PORTB value at the moment of executing get_feature

PORTC → PORTC value at the moment of executing get_feature

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HID set_feature – RPTID0

- **Executes a single metacommand**
- **Not all meta commands are available via set_feature**
- **8byte buffer is interpreted as:**
  - Command (1byte) + no parameters
  - Command (1byte) + unsigned byte parameter (1byte)
  - Command (1byte) + unsigned word parameter (2bytes)

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
MCMD_ID	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
MCMD_ID	**Parameter8**	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
MCMD_ID	**Parameter16 (L:H)**		*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

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HID set_feature – RPTID0

ICSP_MCMD_SET_HWUART_BAUD = 1

- Sets the HW UART new Baud rate
- The 100×Word parameter is set as new Baud rate for HW UART
- Word parameter range is 2…1152
- For 9600 baud the Word parameter = 96, for 115200 → 1152
- Example: 57600baud→57600/100→576→0x240→0x40;0x02

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x01	0x40	0x02	× Don't care	× Don't care	× Don't care	× Don't care	× Don't care

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x01	<new Baud rate / 100>		× Don't care	× Don't care	× Don't care	× Don't care	× Don't care

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HID set_feature – RPTID0

ICSP_MCMD_SET_METACMD = 2

- Sets the new metacommand value
- The byte parameter is set as new CMD_ID_MCMD

- Example: Set metacommand CMD_ID to 186 → 0xBA

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x02	**0xBA**	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x02	**<new CMD_ID_MCMD>**	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

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HID set_feature – RPTID0

ICSP_MCMD_HWUART_ENABLE = 10

- Enables / disables HW UART bridging to USB CDC
- Non-zero byte parameter enables bridging
- Example: Disable HWUART to CDC Bridging: Enable=0 → 0x00

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0A	**0x00**	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

- Example: Enable HWUART to CDC Bridging: Enable=1 → 0x01

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0A	**0x01**	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0A	**<Enable bridging>**	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*	*× Don't care*

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HID set_feature – RPTID0

ICSP_MCMD_USBCDC_SEND = 11

- Send ASCII character to USB CDC. HW UART is not affected
- Byte parameter is the ASCII value to send to CDC UART
- Used to check if serial port open is connected to this HID device
- Example: Send ‘U’ to USBCDC ‘U’→0x55

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0B	**0x55**	*× Don’t care*	*× Don’t care*	*× Don’t care*	*× Don’t care*	*× Don’t care*	*× Don’t care*

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x0B	**<ASCII Character>**	*× Don’t care*	*× Don’t care*	*× Don’t care*	*× Don’t care*	*× Don’t care*	*× Don’t care*

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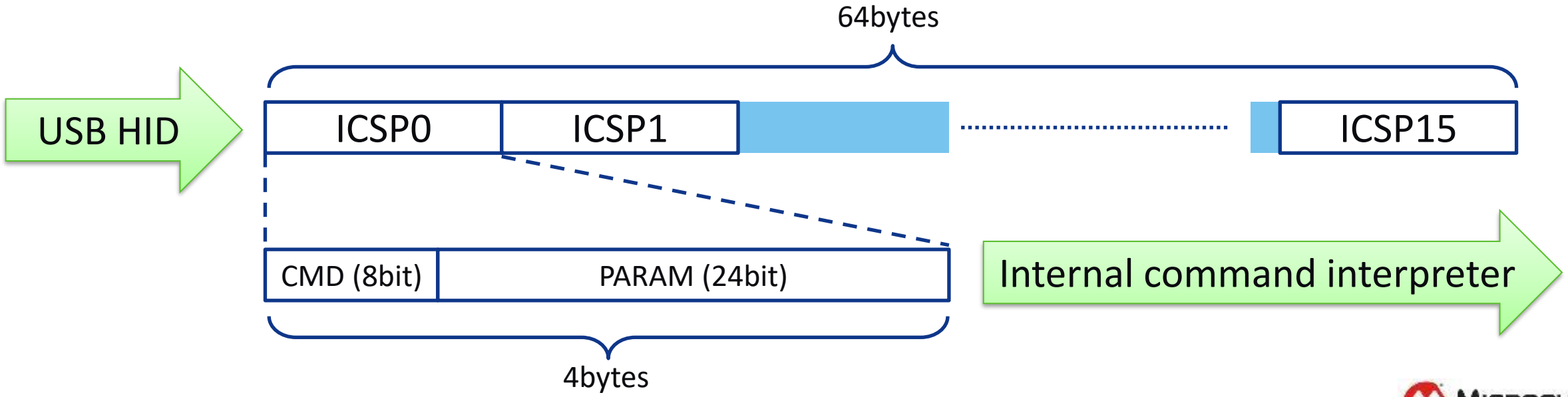
HID OUT (write) commands

- USB HID interface is used to send ICSP commands to target
- All commands are 4 bytes in length
- Each command is passed through an internal interpreter
- HID Write always sends 16 commands, 4bytes each
- If less than 16 commands are used, fill rest with “MCMD_NOP”



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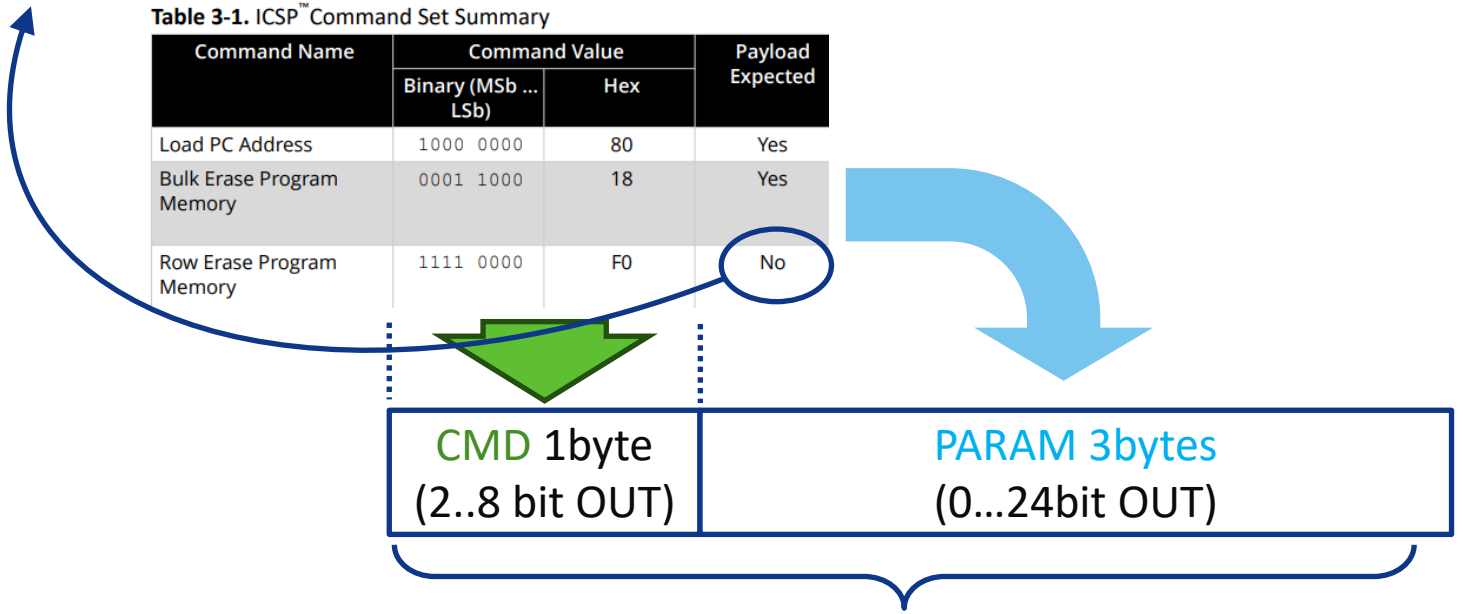
HID OUT (write) ICSP commands

- An ICSP command consist of a CMD and optionally a Payload
- The CMD & Payload values are in the PIC *Programming Specs DS*
- {#CMD bits} and {#Data bits} are adjustable (described later)
- The USB bridge will shift out total {#CMD bits} + {#Data bits} bits
- No Payload expected? Set {*#Data bits*} to 0!

Table 3-1. ICSP™ Command Set Summary

Command Name	Command Value		Payload Expected
	Binary (MSb ... LSb)	Hex	
Load PC Address	1000 0000	80	Yes
Bulk Erase Program Memory	0001 1000	18	Yes
Row Erase Program Memory	1111 0000	F0	No



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HID ICSP metacommands

- **Metacommands not part of the ICSP protocol**
- **Metacommand if CMD_ID == CMD_ID_MCMD** *(default 0xFF)*
- **Usually for setting parameters and control the interpreter**
- **Example metacommands:**
  - Enter / exit LVP mode / reset target
  - Change HW baud
  - Delay X microsec
  - Read data
  - Echo char from HID to CDC
  - Read data from target
  - etc.
- **Only transmitting data to the target if specifically noted in doc.**

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HID ICSP metacommand format

- **Only Interpreter decides if command is transmitted over ICSP or treated as metacommand**
- **All commands where CMD_ID ≠ CMD_ID_MCMD are transmitted to ICLK/IDAT pins**
- **Metacommand has 0 or 1 parameter (8/16bit)**

	Byte0	Byte1	Byte2	Byte3
ICSP CMD	CMD_ID (8bit)	PARAM (24bit)		
Metacmd	CMD_ID_MCMD	MCMD_ID	× Don't care	
Metacmd	CMD_ID_MCMD	MCMD_ID	**Parameter8**	× Don't care
Metacmd	CMD_ID_MCMD	MCMD_ID	**Parameter16 (L:H)**	

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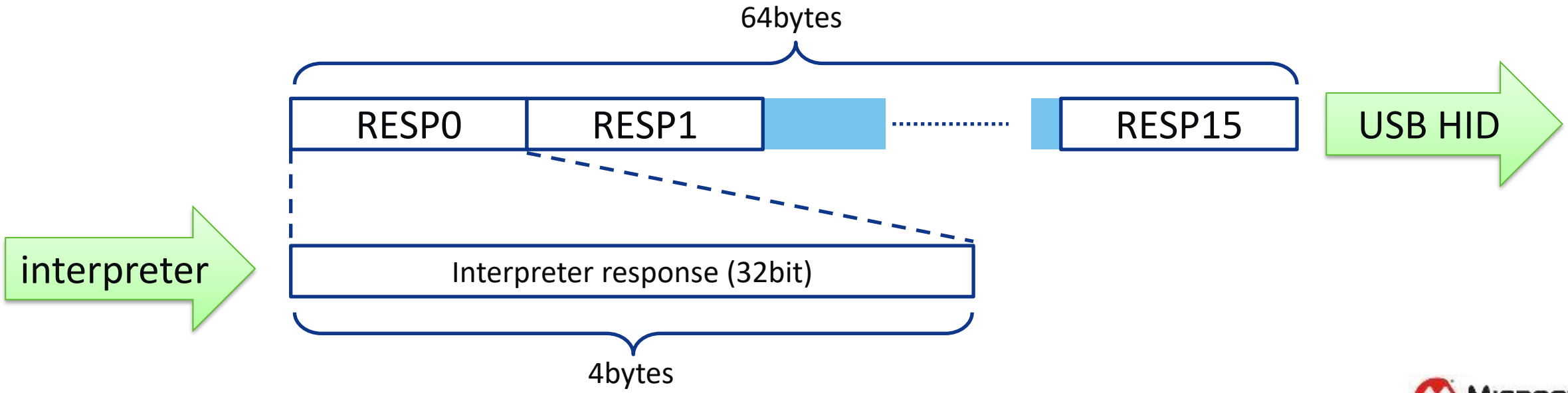
HID IN (read) commands

- After execution of a command block, a HID response is sent
- All command responses are 4 bytes in length
- HID Reply always sends 16 responses, 4bytes each
- Most of the responses are equal to the command byte sequence



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HID metacommand

ICSP_MCMD_NOP = 0

- **No operation. Used for filling the HID buffer**

- **Example: No operation (CMD_ID_MCMD = 0xFF)**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x00	0x00	0x00
Reply →	0xFF	0x00	0x00	0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x00	× Don't care	
Reply →	CMD_ID_MCMD	0x00	× Don't care < *same as CMD Byte2 and Byte3* >	

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HID metacommand

ICSP_MCMD_SET_HWUART_BAUD = 1

- Sets the HW UART new Baud rate
- The 100×Word parameter is set as new Baud rate for HW UART
- Word parameter range is 2…1152
- For 9600 baud the Word parameter = 96, for 115200 → 1152
- Exact baud baud rate set can be read with HID get_feature
- Example: 57600baud→57600/100→576→0x240→0x40;0x02

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x01	0x40	0x02
Reply →	0xFF	0x01	0x40	0x02

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x01	<new Baud rate / 100>	
Reply →	CMD_ID_MCMD	0x01	<Requested Baud rate / 100 >	

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HID metacommand

ICSP_MCMD_SET_METACMD = 2

- **Sets the new CMD_ID_MCMD**
- **CMD_ID_MCMD changes only if new CMD_ID_MCMD ≤255**
- **Example: Set new CMD_ID_MCMD to 100→0x0064→0x64;0x00**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x02	0x64	0x00
Reply →	0xFF	0x02	0x64	0x00

- **Example: Set new CMD_ID_MCMD to 999→0x03E7→0xE7;0x03**

	Byte0	Byte1	Byte2	Byte3
CMD →	0x64	0x02	0xE7	0x03
Reply →	0x64	0x02	0x64	0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x02	**<new CMD_ID_MCMD>**	
Reply →	Previous CMD_ID_MCMD	0x02	**<CMD_ID_MCMD in effect after this command completed>**	

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HID metacommand

ICSP_MCMD_SET_CMD_BITS = 3

- **Sets # of bits transmitted to target from the ICSP 8bit CMD_ID**
- **1 < {#CMD bits} ≤ 8 (Default: =8)**
- **Example: Set new {#CMD bits} to 6→0x0006→0x06;0x00**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x03	0x06	0x00
Reply →	0xFF	0x03	0x06	0x00

- **Example: Set new {#CMD bits} to 9999→0x270F→0x0F;0x27**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x03	0x0F	0x27
Reply →	0xFF	0x03	0x06	0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x03	<new {#CMD bits} >	
Reply →	CMD_ID_MCMD	0x03	<{#CMD bits} in effect after this command completed>	

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HID metacommand

ICSP_MCMD_SET_DATA_BITS = 4

- **Sets # of bits transmitted to target from the ICSP 24bit PARAM**
- **0 ≤ {#Data bits} ≤ 24 (Default: =24)**
- **Example: Set new {#Data bits} to 16→0x0010→0x10;0x00**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x04	0x10	0x00
Reply →	0xFF	0x04	0x10	0x00

- **Example: Set new {#Data bits} to 55→0x0037→0x37;0x00**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x04	0x37	0x00
Reply →	0xFF	0x04	0x10	0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x04	**<new** {#Data bits} **>**	
Reply →	CMD_ID_MCMD	0x04	**<**{#Data bits} **in effect after this command completed>**	

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HID metacommand with pin state changes

ICSP_MCMD_LVP_ENTER = 5

- Enter low voltage programming mode if possible (takes ≈25ms)
- LVP can be disabled in CONFIG bits (⚠)
- Factory shipped (blank) devices has LVP enabled
- It is not verified if the target is successfully in LVP
- The command will keep target $\overline{\text{MCLR}}$ pin low, ICLK→OutputL (⚠)
- Example: Enter LVP with default (MSB first) method

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x05	0x00	0x00
Reply →	0xFF	0x05	0x00	0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x05	× Don't care	
Reply →	CMD_ID_MCMD	0x05	× Don't care < *same as CMD Byte2 and Byte3* >	

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HID metacommand with pin state changes

V1.2

ICSP_MCMD_LVP_ENTER = 5

- In FW v1.2 alternative method for enter LVP is defined
- Method 1 = 0xFE01
- Valid for devices where LSb must be shifted in first to enter LVP
- Shift direction change affects only the enter LVP key sequence

- Example: Enter LVP with LSB first method→0xFE01→0x01;0xFE

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x05	0x01	0xFE
Reply →	0xFF	0x05	0x01	0xFE

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x05	Method ID	
Reply →	CMD_ID_MCMD	0x05	Method ID	

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HID metacommand with pin state changes

ICSP_MCMD_LVP_EXIT = 6

- **Set ICLK→Input, IDAT→INPUT, release target $\overline{\text{MCLR}}$**

- **Example: Release target MCLR → run the code**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x06	0x00	0x00
Reply →	0xFF	0x06	0x00	0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x06	× Don't care	
Reply →	CMD_ID_MCMD	0x06	× Don't care < *same as CMD Byte2 and Byte3* >	

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HID metacommand

ICSP_MCMD_DELAY_us = 7

- Immediate delay for <parameter16> µsec
- Delays in a loop⇒<parameter16>×(1µsec + loop instruction exec)
- Maximum delay ≈65.5msec

- Example: Delay ≈1ms→1000→0x03E8→0xE8;0x03

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x07	0xE8	0x03
Reply →	0xFF	0x07	0xE8	0x03

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x07	Delay length in µsec	
Reply →	CMD_ID_MCMD	0x07	Delay length in µsec	

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HID metacommand with pin state changes

ICSP_MCMD_READ_CMD = 8

- Sends RD_CMD_ID ICSP command and reads data response
- Parameter RD_CMD_ID sent according to {#CMD bits}
- Replies zero padded {#Data bits} from device
- Example: Read empty FLASH word from PIC16F13145

Read Data from NVM→ RD_CMD_ID=0xFC Empty FLASH=0x003FFF

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x08	0xFC	0x00
Reply →	0xFC	0xFF	0x3F	0x00

0x003FFF

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x08	ICSP Read RD_CMD_ID	× Don't care
Reply →	RD_CMD_ID	DATA_L	DATA_H	DATA_U

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HID metacommand

ICSP_MCMD_GET_HWUART_BAUD = 9

- **Get exact HW UART baud rate**

- **Example: HW UART baud?→Exact baud=115213→0x01C20D**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x09	0x00	0x00
Reply →	0xFF	0x0D	0xC2	0x01

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x00	× Don't care	
Reply →	CMD_ID_MCMD	Exact baud rate <24bits>		

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HID metacommand

ICSP_MCMD_HWUART_ENABLE = 10

- Enables or disables HWUART ↔ CDC bridging
- Useful for avoiding random characters during programming
- Example: Enable HWUART↔CDC bridging →0x0001→0x01;0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x0A	0x01	0x00
Reply →	0xFF	0x0A	0x01	0x00

- Example: Disable HWUART↔CDC bridging →0x0000→0x00;0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x0A	0x00	0x00
Reply →	0xFF	0x0A	0x00	0x00

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x0A	<Non-zero to enable HWUART to CDC bridging>	
Reply →	CMD_ID_MCMD	0x0A	0x0000→Bridging disabled 0x0001→Bridging enabled	

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HID metacommand

ICSP_MCMD_USBCDC_SEND = 11

- **Sends ASCII character to USB UART (USBCDC)**
- **HWUART not affected!**
- **Reply contains Success/Fail indication**
- **Used to match HID to USBCDC**
- **Example: Send ‘U’ to USBCDC → 0x55 → 0x0055 → 0x55;0x00**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x0B	0x55	0x00
Reply →	0xFF	0x0B	0x55	0x01

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x0B	ASCII character value to send via USBCDC	*× Don’t care*
Reply →	CMD_ID_MCMD	0x0B	ASCII character value	0x00→queue full 0x01→ASCII char queued

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HID metacommand with pin state changes

V1.2

ICSP_MCMD_GPIO = 12

- Controls IO pins (0=Out, 1=Input, 0=Low, 1=High)
- 1st set direction, 2nd write outputs, 3rd read inputs
- Reply contains digital value on the PIN (0=Low, 1=High)
- Used to blink RX/TX LEDs, add virtual buttons & LEDs
- ⚠ Setting Pin5 or Pin6 to output, disables HW UART!
- Example: TXLED=off, RXLED=on, other pins=input → 0xFC;0x02

IC Pin #	Bit
2-/RLED	0 (IO)
3-/TLED	1 (IO)
5-RX	2 (IO⚠)
6-TX	3 (IO⚠)
7-IDAT	4 (IO)
8-ICLK	5 (IO)
9-/MCLR	6 (IO)
10-GPIO	7 (IO)

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x0B	0xFC	0x02
Reply →	0xFF	0x0B	0xFE	0x02

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x0B	Pin I/O Direction values	Set OUTPUT pins H/L values
Reply →	CMD_ID_MCMD	0x0B	Pin logic levels bit values	OUTPUT pin bit values, × for input bits

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HID metacommand

V1.2

ICSP_MCMD_DELAY_ms = 13

- **Immediate delay for <parameter16> msec**
- **Maximum delay ≈1h5min**
- **Delay will be interrupted on reception of new HID Write packet**
- **On interrupt ,no reply, new packet will be processed from ICSP0**
- **Example: Delay ≈100ms→100→0x0064→0x64;0x00**

	Byte0	Byte1	Byte2	Byte3
CMD →	0xFF	0x0D	0x64	0x03
Reply →	0xFF	0x0D	0x64	0x03

	Byte0	Byte1	Byte2	Byte3
CMD →	CMD_ID_MCMD	0x0D	**Delay length in msec**	
Reply →	CMD_ID_MCMD	0x0D	**Delay length in msec**	

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ICSP REVID&DEVID read sequence example

PIC16F13145

Programming Specs: DS40002500B

JS: sendFeatureReport() Win: HidD_SetFeature() PY hidapi: send_feature_report()

byte0	byte1	Comment
0x02	0xFF	HID set_feature – RPTID0: ICSP_MCMD_SET_METACMD = 2 → No 0xFF ICSP cmd, set CMD_ID_MCMD to 0xFF (Pgspec P13, Table 3-1 . ICSP™ Command Set)

JS: write() Win: write() PY hidapi: write()

byte0	byte1	byte2	byte3	Comment
0xFF	0x06	0x00	0x00	ICSP_MCMD_LVP_EXIT = 6 → LVP Exit (Make sure, chip is able to go in LVP)
0xFF	0x03	0x08	0x00	ICSP_MCMD_SET_CMD_BITS = 3 → Set ICSP {#CMD bits} to 8 (Pgspec P12 - 3.2 Program/Verify Commands)
0xFF	0x04	0x18	0x00	ICSP_MCMD_SET_DATA_BITS = 4 → Set ICSP {#Data bits} to 24 (Pgspec P12 - 3.2 Program/Verify Commands)
0xFF	0x05	0x00	0x00	ICSP_MCMD_LVP_ENTER = 5 → LVP Enter with MSB first method (Pgspec P11 – 3.1.2 Low-Voltage Programming (LVP) Mode)
0x80	0x0A	0x00	0x01	HID OUT (write) ICSP commands → Set program counter to REVID location(0x8005<<1) (Pgspec P14 - 3.2.1 Load PC Address)
0xFF	0x08	0xFE	0x00	ICSP_MCMD_READ_CMD = 8 → Read location at PC with PC increment → REVID (Pgspec P16 - 3.2.5 Read Data from NVM)
0xFF	0x08	0xFC	0x00	ICSP_MCMD_READ_CMD = 8 → Read location at PC → DEVID (Pgspec P16 - 3.2.5 Read Data from NVM)
0xFF	0x06	0x00	0x00	ICSP_MCMD_LVP_EXIT = 6 → LVP Exit
0xFF	0x00	0x00	0x00	ICSP_MCMD_NOP = 0 → NOP
0xFF	0x00	0x00	0x00	ICSP_MCMD_NOP = 0 → NOP … … … … …
⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮
0xFF	0x00	0x00	0x00	Sixteenth instruction : ICSP_MCMD_NOP = 0 → NOP

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ICSP REVID&DEVID read sequence example

V1.2

PIC16F1455

Programming Specs: DS41620C

JS: sendFeatureReport() Win: HidD_SetFeature() PY hidapi: send_feature_report()

byte0	byte1	Comment
0x02	0xFF	HID set_feature – RPTID0: ICSP_MCMD_SET_METACMD = 2 → No 0xFF ICSP cmd, set CMD_ID_MCMD to 0xFF (Pgspec P13, Table 4-1 . Command Mapping)

JS: write() Win: write() PY hidapi: write()

byte0	byte1	byte2	byte3	Comment
0xFF	0x06	0x00	0x00	ICSP_MCMD_LVP_EXIT = 6 → LVP Exit (Make sure, chip is able to go in LVP)
0xFF	0x03	0x06	0x00	ICSP_MCMD_SET_CMD_BITS = 3 → Set ICSP {#CMD bits} to 6 (Pgspec P14 - 4.3 Program/Verify Commands)
0xFF	0x04	0x10	0x00	ICSP_MCMD_SET_DATA_BITS = 4 → Set ICSP {#Data bits} to 16 (Pgspec P14 – 4.3 Program/Verify Commands)
0xFF	0x05	0x01	0xFE	ICSP_MCMD_LVP_ENTER = 5 → LVP Enter with LSB first method (Pgspec: P13 – 4.2 Low-Voltage Programming (LVP) Mode)
0x00	0x00	0x00	0x00	HID OUT (write) ICSP commands → Set program counter to CONFIG location (0x8000) (Pgspec P14 - 4.3.1 Load Configuration)
0xFF	0x04	0x18	0x00	ICSP_MCMD_SET_DATA_BITS = 4 → Set ICSP {#Data bits} to 24 → CMD6+4*CMD6bit as parameter = 5×CMD6
0x06	0x18	0x86	0x61	HID OUT (write) ICSP commands → send 5×{6bit command} 0x06 → 5× Increment pointer → PC=0x8005
0xFF	0x04	0x10	0x00	ICSP_MCMD_SET_DATA_BITS = 4 → Set ICSP {#Data bits} to 16 (Pgspec P14 – 4.3 Program/Verify Commands)
0xFF	0x08	0x04	0x00	ICSP_MCMD_READ_CMD = 8 → Read location at PC → REVID (Pgspec P15 - 3.2.5 Read Data from NVM)
0xFF	0x04	0x00	0x00	ICSP_MCMD_SET_DATA_BITS = 4 → Set ICSP {#Data bits} to 0, Increment address command has no data (Pgspec P14 – 4.3 Program/Verify Commands)
0x06	0x00	0x00	0x00	HID OUT (write) ICSP commands → Increment PC Address → PC=0x8006 (Pgspec P15 – 4.3.4 Increment Address)
0xFF	0x04	0x10	0x00	ICSP_MCMD_SET_DATA_BITS = 4 → Set ICSP {#Data bits} to 16 (Pgspec P14 – 4.3 Program/Verify Commands)
0xFF	0x08	0x04	0x00	ICSP_MCMD_READ_CMD = 8 → Read location at PC → DEVID (Pgspec P15 - 3.2.5 Read Data from NVM)
0xFF	0x06	0x00	0x00	ICSP_MCMD_LVP_EXIT = 6 → LVP Exit (Make sure, chip is able to go in LVP)
0xFF	0x00	0x00	0x00	ICSP_MCMD_NOP = 0 → NOP
0xFF	0x00	0x00	0x00	ICSP_MCMD_NOP = 0 → NOP

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