TB073

Selecting an MCP21XX Device for IrDA® Applications

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INTRODUCTION

With a growing number of device options within the MCP21XX family, this Technical Brief serves as a guide in helping to select the device for your application.

All of the MCP21XX devices interface to the Host Controller with a UART. The MCP2120 and MCP2122 devices use only the TX and RX signals. The MCP215X and MCP2140 devices also use the TX and RX signals, as well as up to 6 other non-data signals. For additional information on this Host UART interface for the MCP215X (also valid for the MCP2140), please refer to Application Note 858, "Interfacing The MCP215X to a Host Controller", DS00858.

Table 1 compares some of the key features of the MCP2120 and the MCP2122, while Table 2 compares some of the key features of the MCP2140, MCP2150 and the MCP2155.

WORKING THROUGH THE DECISION TREE

Figure 1 and Figure 2 provide a decision tree to assist in selecting the MCP21XX device for your application. Figure 1 helps to determine if the device should have the IrCOMM application layer protocol handler with encoder/decoder implemented (MCP2140, MCP2150, and MCP2155) or if only the encoder/decoder device (MCP2120 and MCP2122) is needed. Figure 2 helps to determine which of the encoder/decoder devices to use. Other factors that could influence your device selection decision are also discussed.

TABLE 1: ENCODER/DECODER DEVICES

Device	Baud Rate	# Pins	Clock Source	IDD (Max)	IDD Low Power (Max)	Temp. Range	Comment
MCP2120	2,400 - 312,500	14	Crystal	7 mA (1)	8 µA	-40°C to +85°C	Use when the board does not have a 16x clock source
MCP2122	2,400 - 115,200	8	16XCLK	2 mA	4 µA	-40°C to +125°C	Pinout compatible with HSDL-7000

Note 1: IDD was measured at 3.0V and 10 MHz. IDD will increase for a higher voltage.

TABLE 2: IRCOMM PROTOCOL HANDLER DEVICES(1)

Device	Baud Rate		IDD (Max)	IDD Low Power (Max)	IR Wake-Up-on-Receive	Host UART Flow Control	Comment
	Host UART	IR					
MCP2140	9,600	9,600	2.2 mA	60 µA	Yes (3)	DCE	Easily interfaces to a modem's serial port
MCP2150	9,600 — 115,200 (2)	9,600 — 115,200 (2)	7 mA	9 µA	No	DTE	Easily interfaces to a PC's serial port
MCP2155	9,600 — 115,200 (2)	9,600 — 115,200 (2)	7 mA	9 µA	No	DCE	Easily interfaces to a modem's serial port

Note 1: Supports the 9-wire "cooked" service class of the IrCOMM Application Layer Protocol.

2: The Host UART baud rate and the IR baud rate operate independent of each other.

3: The MCP2140 will automatically enter Low-power mode once no IR activity has been detected for approximately 10 seconds. Once an IR pulse is detected, the MCP2140 will return to normal operation. Even though the MCP2140 low-power current is higher than the MCP215X low-power current, the MCP215X devices will typically spend a lot more of their time in the normal operating mode, which would mean that the average current would be higher.

IrCOMM Application Layer Protocol or Encoder/Decoder Determination

The first thing to determine is if the application should have one of the devices with the IrCOMM application layer protocol handler with encoder/decoder implemented or if only the encoder/decoder device is needed. Thus, the first question that needs to be asked is:

"Does your application require support for the IrDA® standard protocol?"

The application will use an IrDA standard protocol if the purpose is to communicate with commonly available IR devices, such as a notebook PC (with IR ports) or PDA (Palm® and PocketPC devices). The MCP215X and MCP2140 devices implement the IrCOMM protocol.

If the application does not require the IrDA standard protocol, it should be determined whether a simple UART to IR encoder/decoder (the MCP2120 or the MCP2122) would work for the application. When both ends of the application are owned by the hardware developer, a simple protocol could be implemented in each embedded systems firmware to address data integrity and the communication link.

If the application is expected to interface to a standard device (PCs or PDAs with IR ports), the following question is asked:

"Can the IrDA standard protocol be implemented in the Host Controller?"

Some embedded systems have a powerful Host Controller that has the performance and available throughput to implement both the desired functionality and the IrDA standard protocol stack. In this case, the embedded system only requires an encoder/decoder device (the MCP2120 or MCP2122).

If the Host Controller is already fully utilized, does not have the processing capabilities to implement the IrDA standard protocol in firmware or if there is no expertise to implement the firmware IrDA standard protocol, a dedicated device to perform that functionality is required, such as the MCP215X or MCP2140.

To determine which of these devices to choose, the following question is asked:

"Is the design new or existing?"

If the IrDA interface is added to a new design, any of the three devices may be appropriate. However, the data throughput requirement of the application needs to be evaluated. For applications where the communication rate may need to be greater than 9600 baud, the MCP215X devices should be used since the Host UART and IR interfaces can operate up to 115.2 Kbaud. The MCP2140 is fixed at 9.6 Kbaud for both the Host UART and IR interface.

When deciding between the MCP2150 and the MCP2155, the MCP2150 would typically be selected since it has a signal to indicate when the device has completed initialization. This status information is useful in the design debug stage.

If the IrDA interface is added to an existing design, the following question is asked:

"Does the existing design use the UART like a PC (DTE) or a modem (DCE)?"

With an existing application, the selection of the device will be determined by how the existing application uses its UART control signals. The MCP215X and MCP2140 devices require flow control, so the existing application must use the CTS signal to determine when data can be transmitted from the Host Controller to the MCP215X or MCP2140 device.

If the existing application uses its UART in the same configuration as a PC (DTE), the MCP2150 is the recommended choice.

If the existing application uses its UART in the same configuration as a modem (DCE), the MCP2155 or MCP2140 may be used, depending on the data throughput requirements of the application.

For DCE applications where communication rate may need to be greater than 9600 baud, the MCP2155 device should be used since the Host UART and IR interfaces can operate up to 115.2 Kbaud. The MCP2140 is fixed at 9.6 Kbaud for both the Host UART and IR interface.

"Does the IrCOMM protocol application require very low power consumption?"

In some IrCOMM protocol applications, such as battery-powered, low current consumption is one of the top requirements (even higher than the communication (baud) rate). In such applications, the MCP2140 should be the perferred device due to it's automatic entry into Low-power mode and it's wake-up on IR detect feature. This allows it to have the lowest average current consumption, typically.

While the MCP215X devices' Low-power mode has a lower current, the Host Controller must use an I/O pin to control the MCP215X operating mode (Normal or Low-power mode). In a typical application, the Host Controller needs to ensure that the MCP215X is in the normal operating mode at regular intervals to look for an IR Primary device.

The MCP2140 can remain in the low-power state until the Primary device polls for devices. The MCP2140 will automatically enter the Low-power mode approximately 10 seconds after IR activity has stopped. It will remain in the Low-power mode until either IR activity is detected or the device exits the reset state.

Determining which encoder/decoder device to use

Once it has been determined that the system will use one of the encoder/decoder devices, the decision tree in Figure 2 will aid in selecting the specific device. The first question that needs to be asked is:

"Does the baud rate need to be controlled by software or can it be fixed by hardware?"

Some systems like the ability to change the baud rate of the encoder/decoder by sending commands during operation. This type of system requires the MCP2120.

If the application is expected to have additional system clocks, the following question is asked:

"Does the design have an available 16x clock for the UART signals?"

Depending on the implementation of the application design, a 16x clock may be available in the system. The frequency of this clock is 16 times the frequency of the desired baud rate. The MCP2122 requires a 16x clock, while the MCP2120 requires that the clock (or crystal) have a frequency of at least 64 times the desired baud rate.

The Host Controller may have resources available to generate this 16x clock. The PICmicro® MCU's CPP and Timer2 modules can be used to create a PWM output of the desired frequency with a 50% duty cycle.

If there is not a 16x clock available, then the MCP2120 must be used. So the next question should be asked.

"What is the required baud rate for the system?"

The IrDA standard SIR specification has a maximum baud rate of 115.2 Kbaud. If both ends of the system are controlled by the developer, this specification can be ignored. The MCP2120 allows a maximum baud rate of 312.5 Kbaud (although some work may need to be done with the optical transceiver), while the MCP2122 has a maximum of 115.2 Kbaud.

Another question to ask is:

"Will this device be replacing the HSDL-7000?"

The MCP2122 is an 8-pin device that has the same pinout as the HSDL-7000. The MCP2122 8-pin SOIC package is smaller than the HSDL-7000 package and can be easily placed in an existing HSDL-7000 application circuit board to validate functional operation.

Table 3 shows a comparison of some key features between the MCP2122 and the HSDL-7000. The HSDL-7000 does not specify the supply current, but does specify power dissipation. The MCP2122's power dissipation has been calculated based upon the supply current specification.

TABLE 3: MCP2122 VS. HSDL-7000 COMPARISON

Feature	Device	
	MCP2122	HSDL-7000
Supply Current	2 mA (max)	—
	300 µA (typ)	—
Power Dissipation	11 mW (max) (1)	220 mW (max)
	540 µW - 1.65 mW (typ) (2)	4.9 mW (typ)
Low-power Mode Current	4 µA (maximum, in Reset) (3)	No
	7.2 µW - 22 µW (4)	—
Supply Voltage	1.8V to 5.5V	2.7V to 5.5V
Package Size	154 x 193 mils	220 x 260 mils
Temperature Range	-40°C to +125°C	-40°C to +85°C

Note 1: Calculated from maximum supply current times maximum voltage (2 mA * 5.5V)

2: Calculated from typical supply current times minimum and maximum voltage (300 µA * 1.8V to 300 µA * 5.5V)

3: Lowest power consumption mode when device RESET pin is forced low.

4: Calculated from Low-power mode current times minimum and maximum voltage (4 µA * 1.8V to 4 µA * 5.5V)

If this is a new design, another question to ask is:

"Is there a package size or supply current requirement?"

The MCP2122 is an 8-pin device that has a SOIC package, while the MCP2120 is a 14-pin device also available in a SOIC package. The MCP2122 also requires less power (refer to Table 1). If board space or supply current are at a premium, the MCP2122 may be the better choice.

SUMMARY

The MCP21XX family of IR devices allows a customer flexibility in partitioning a system to address application requirements including interface, data throughput and cost. This Technical Brief should assist you in selecting the MCP21XX device for your application.

FIGURE 1: MCP21XX SELECTION DECISION TREE

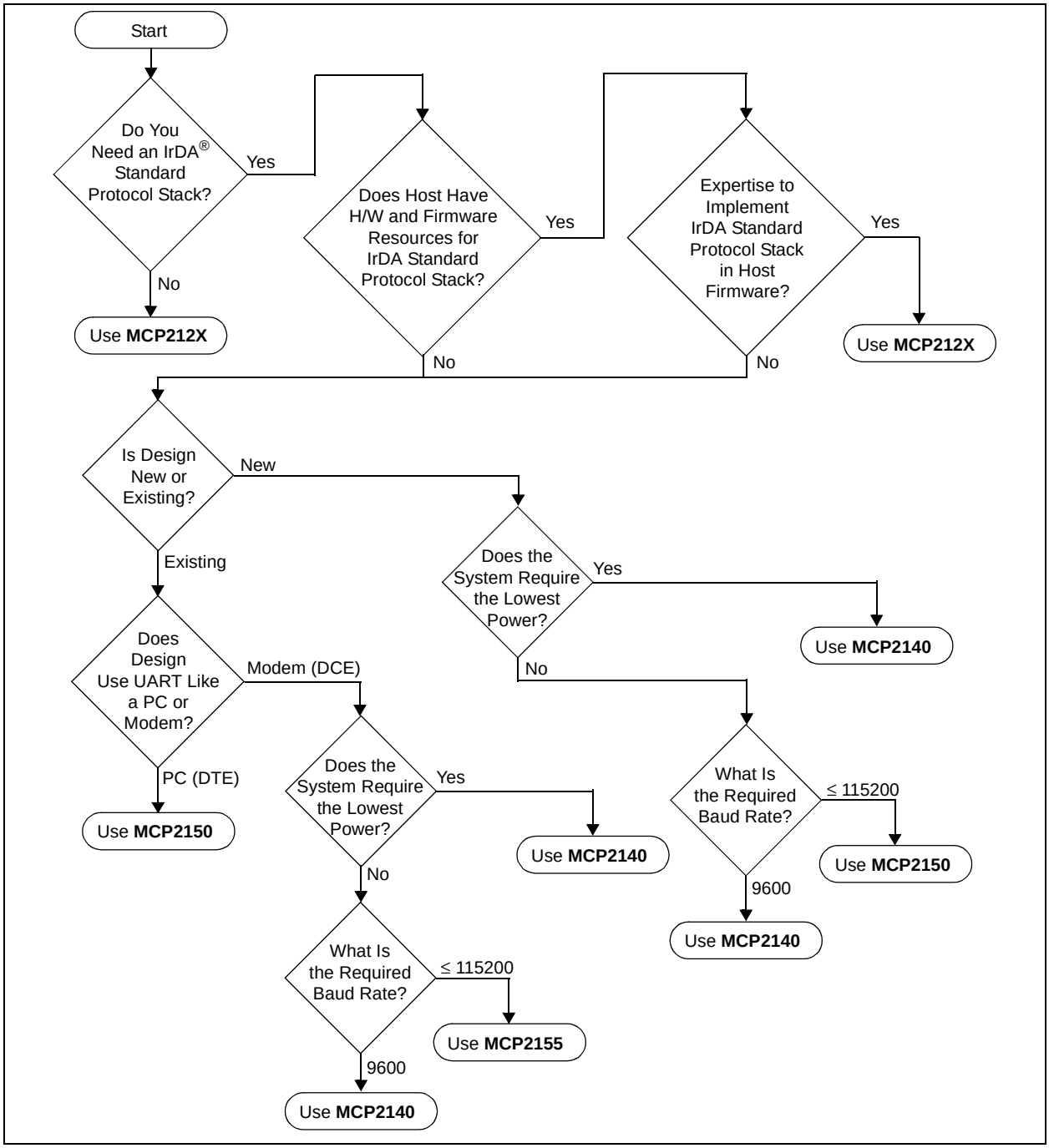
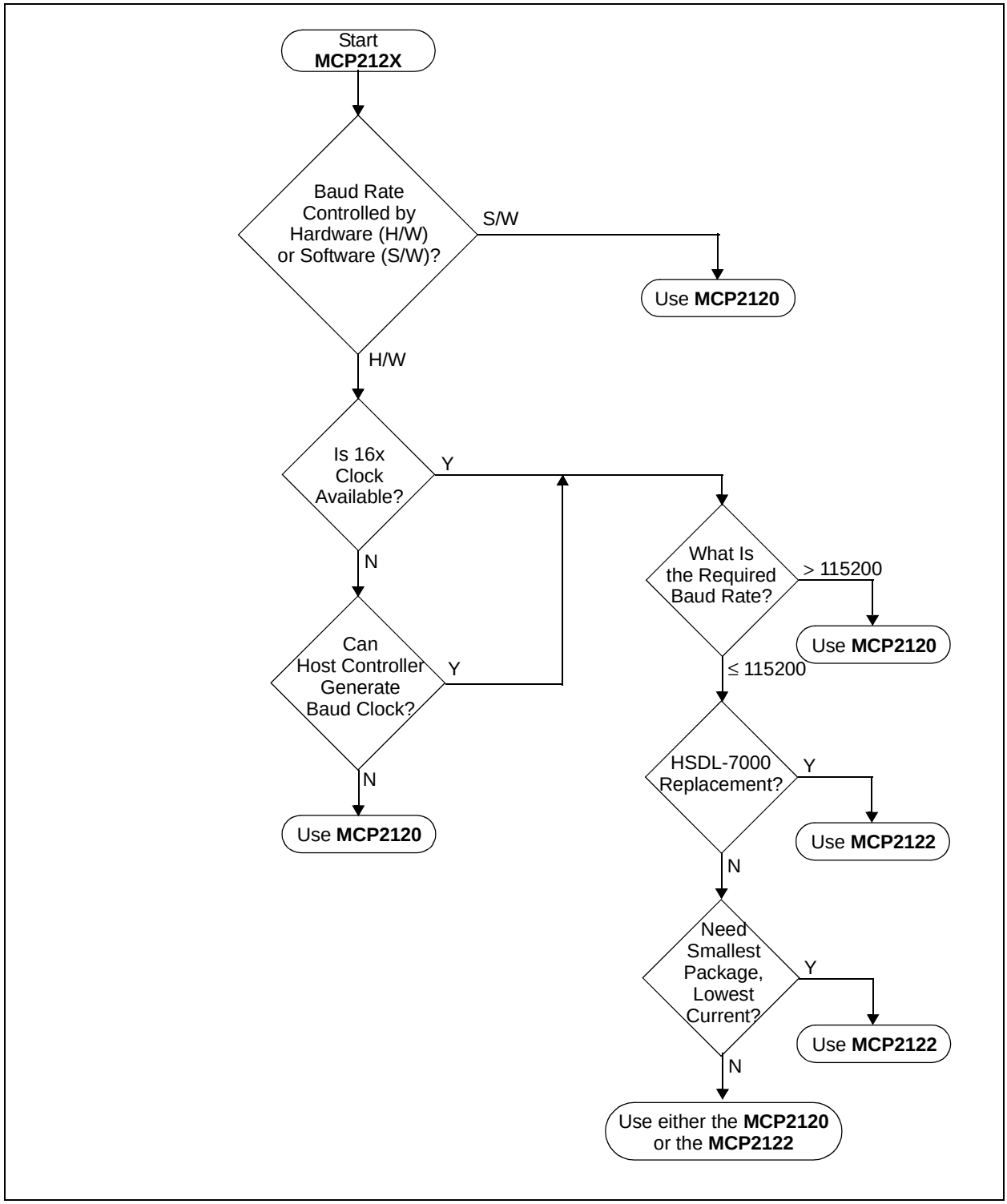


FIGURE 2: MCP212X SELECTION DECISION TREE



APPENDIX A: REVISION HISTORY

Revision B:

- Updated to include MCP2122 device
- Enhanced information for MCP2120, MCP2140, MCP2150 and MCP2155 devices.

Revision A:

Initial Release

Note the following details of the code protection feature on Microchip devices:

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