

Migrating Designs from MCP202X to MCP202XA

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DEVICE MIGRATIONS

The MCP202X LIN (Local Interconnect Network) transceiver was designed to comply with LIN 1.3 and 2.1 physical layer specifications. The MCP202XA is designed to be pin- and functionally-compatible with the earlier MCP202X, and to meet the latest LIN 2.X, SAE J2602-2 and major OEM requirements. In addition, there are numerous enhancements in the MCP202XA, that allow it to meet the most current automotive requirements for ESD and EMC, with ESD levels exceeding (+/-15 kV). The MCP202XA also has an enhanced voltage regulator with 70 mA output capability and extremely low current consumption (refer to the “MCP2021A/2A - LIN Transceiver with Voltage Regulator” data sheet, DS22298).

For most applications, the MCP202XA can be used as a replacement for existing MCP202X designs, without printed circuit board modifications.

When evaluating an upgrade to the MCP202XA, there are several considerations to take into account.

HARDWARE DIFFERENCES

The only differences exist on two pins.

LBUS

The MCP202XA has two different features from the MCP202X:

- Pull-up resistor: On the MCP202X, the pull-up resistor is always connected. On the MCP202XA, the pull-up resistor is connected only in Operation mode; in all other modes, the pull-up resistor is disconnected and the LBUS will float.
- Permanent dominant detection: An internal timer in the MCP202XA deactivates the LBUS transmitter if a dominant status (Low) on the LIN bus or TXD pin lasts longer than 20 ms (approximately). The MCP202X device will only fault if a bus short results in an overtemperature condition.

RESET

MCP2022 has an open drain $\overline{\text{RESET}}$ output pin. An external pull-up resistor is needed to get a voltage signal output. The RESET pin on the MCP2022X has an internal pull-up resistor, so the external pull-up resistor is not necessary, but leaving the external pull-up resistor on the circuit board will not affect $\overline{\text{RESET}}$ pin function.

STATES AND STATE TRANSITION DIFFERENCES

The state transitions of the MCP202X and MCP202XA are compared in [Table 1](#) (refer to the MCP2021/2 Data Sheet, “LIN Transceiver with Voltage Regulator”, DS22018 and the MCP2021A/2A Data Sheet, “LIN Transceiver with Voltage Regulator”, DS22298).

TABLE 1: STATE TRANSITION COMPARISON

State Transition	Transition Conditions	
	MCP202X	MCP202XA
POR to Ready	VREG established and CS/LWAKE = 0, stays in Ready. If CS/LWAKE = 1, proceed to Operation	VREG established if CS/LWAKE = 0, stays in Ready. If CS/LWAKE = 1, proceed to Operation or TX-OFF
Ready to Operation	CS/LWAKE = 1 and $\overline{\text{FAULT}}/\text{TXE} = 1$	CS/LWAKE = 1 and $\overline{\text{FAULT}}/\text{TXE} = 1$ and TXD = 1
Ready to Transmitter Off	This transition does not exist	CS/LWAKE = 1 and $\overline{\text{FAULT}}/\text{TXE} = 0$
Operation to Transmitter Off	CS/LWAKE = 1 and $\overline{\text{FAULT}}/\text{TXE} = 0$	CS/LWAKE = 1 and $\overline{\text{FAULT}}/\text{TXE} = 0$
Transmitter Off to Operation	CS/LWAKE = 1 and $\overline{\text{FAULT}}/\text{TXE} = 1$	CS/LWAKE = 1 and $\overline{\text{FAULT}}/\text{TXE} = 1$ and TXD = 1
Operation to Power-down	CS/WAKE = 0	CS/LWAKE = 0
Power-down to Ready	Bus activity: Dominant level on LBUS or CS/LWAKE = 1	Bus activity: Rising edge on LBUS or CS/LWAKE = 1

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For the MCP202XA, TXD affects the state transitions. To change the state to Operation mode from either Ready or Transmitter Off mode, TXD must be set to '1' (or floating, the internal pull-up resistor will set TXD to '1'). For the MCP202X, TXD will not affect state transitions at all.

Remote Wake-up

LIN bus activities can wake up both the MCP202X and MCP202XA.

For the MCP202X, during Power-down mode, the LIN bus is pulled up to recessive (High). A dominant level on the LIN bus will cause the mode transition from Power-down mode to Ready mode.

For the MCP202XA, the pull up resistor on the LIN bus is connected only in Operation mode. This new functionality helps to minimize overall system power consumption and results in the bus voltage to drift down to a low level when the external pull up resistor in the master node is also disconnected. A rising edge from a valid dominant voltage level on the LIN bus will cause the mode transition from Power-down mode to Ready mode.

FIRMWARE DIFFERENCES

- In the MCP202XA, TXD status affects state transitions but in the MCP202X, it does not. To make a state transition from either Ready or TXOFF to Operation mode, the firmware should set TXD = 1 (or floating) if MCP202XA is used.
- Remote Wake-up: as described previously, a dominant level wakes up the MCP202X, while a rising edge from a valid dominant voltage level on the LIN bus wakes up the MCP202XA. Firmware designers should be aware of this difference.
- For the MCP202XA, if the firmware keeps TXD Low longer than 20 ms, the device will enter into Transmitter Off mode because of the permanent dominant in TXD and LBUS.

Voltage Regulator

For the MCP202X, VREG turns on when V_{BB} is between 5.5V and 6V, and shuts down when V_{BB} is below 4.5V.

For the MCP202XA, VREG turns on when V_{BB} is between 5.25V and 6V, and shuts down when V_{BB} is below 4.5V.

REFERENCES

MCP2021/2 Data Sheet, "*LIN Transceiver with Voltage Regulator*", DS22018.

MCP2021A/2A Data Sheet, "*LIN Transceiver with Voltage Regulator*", DS22298.

Chuck Simmers: Application note, "*Migrating Designs from MCP201 to MCP2021-500*", DS01075.

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