Automatic Slave Node Position Detection (SNPD)

Anand Gopalan, Akeem Whitehead   *MSA - ASC*

ABSTRACT

This application note describes how to automatically detect the position of the slave nodes on the LIN bus and assign a unique ID to each device.

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Typically, one byte from the user EEPROM space is reserved for the device (slave node) ID, when the slaves are connected serially through the LIN pin. Each device on the LIN bus has a unique ID so that the LIN master can communicate with the device exclusively when required. The unique ID is not required if each slave device is connected back to the ECU or BCM with a unique connection (star connection).
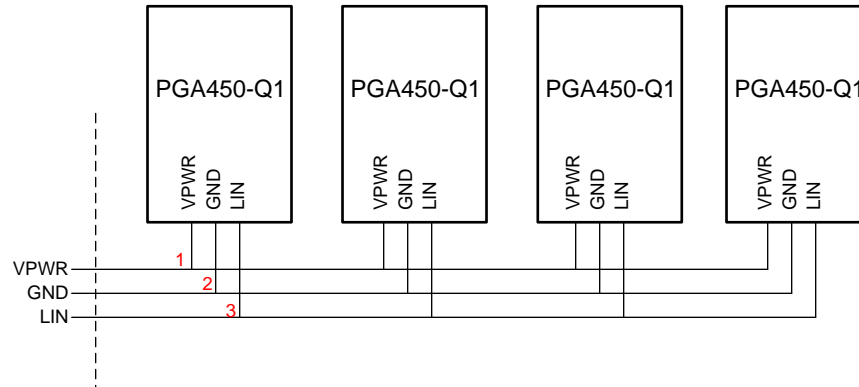

Figure 1. 3-Wire Connection

In a simple 3-wire connection (VPWR,GND,LIN) as shown in Figure 1, auto-addressing is not possible. Therefore the manufacturer must physically program each device to a unique ID depending on the position of the device.
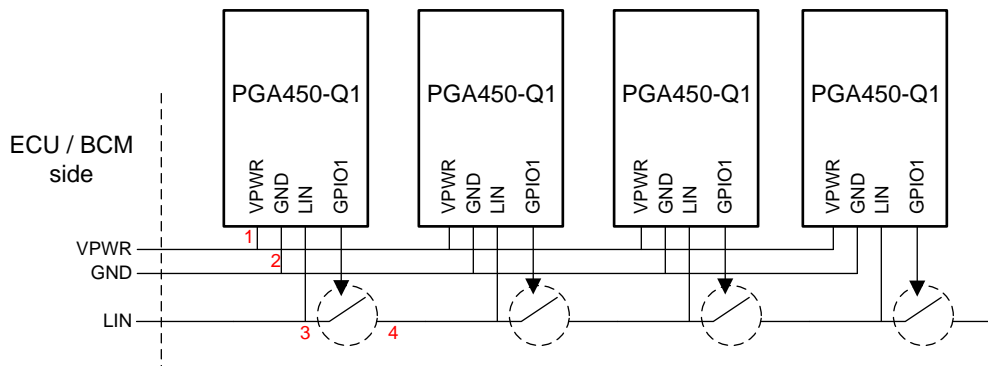

Figure 2. Daisy Chain Configuration

One way to achieve auto addressing is create a daisy chain on the LIN bus by an adding an external switch controlled to either GPIO1 or GPIO2 as shown in Figure 2. This method adds an additional wire, making it a 4-wire solution (VPWR, GND, LIN_IN, LIN_OUT). One drawback of this method is that it makes the LIN bus asymmetrical because of the additional series resistance of the switch (adding data interpretation challenges because of different timing depending on the slave position). Another major drawback of this method is that a fault in any of the slave devices or connections will render the rest of the devices on the daisy chain nonfunctional.

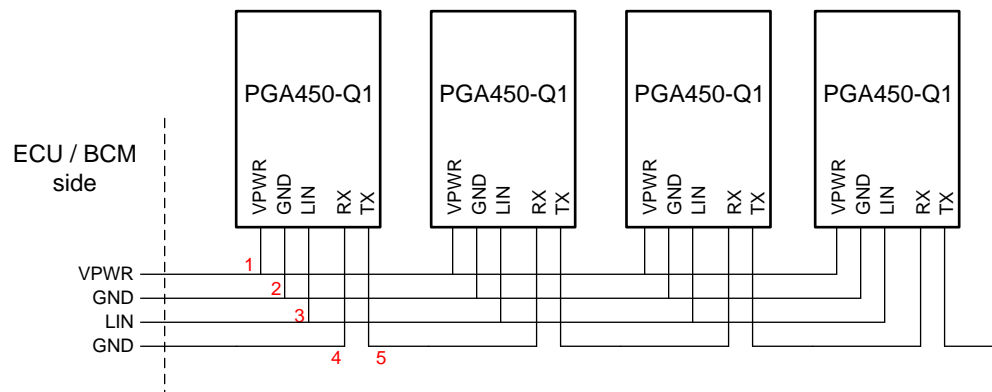## 1.1   TI Proposal (Additional Daisy Chain Wire)

Figure 3. Additional Daisy Chain Wire

In this approach, a daisy chain is added that is dedicated for auto addressing and can be connected to the RX and TX pins of PGA450-Q1 (or GPIO1 and GPIO2 pins). This connection essentially becomes a 5-wire interface (VPWR, GND, LIN, SNPD_IN, SNPD_OUT). The ECU side of SNPD_IN wire is grounded. All the communication occurs through the LIN line including the slave addresses that must be assigned during auto addressing. The SNPD_IN and SNPD_OUT lines do not switch and can be considered entirely as DC signals.

During auto addressing, the master sends a transmission on the LIN bus with the first slave device identification. The slave that senses that its RX pin is low accepts that ID and burns it into the EEPROM space that is reserved for ID. Then the slave device drives the TX pin to GND.

This is followed by a master LIN transmission on the LIN bus with second slave device identification. The second slave picks up this ID as it senses that its RX pin is low. This procedure is followed until all the slaves are identified by the master.

While this method adds an additional wire, it overcomes both the drawbacks of the LIN daisy chain method, namely the following:

1. The LIN bus is symmetrical, so all the slave nodes are exposed to the same timing.
2. A fault on any slave device does not affect the rest of the slave devices because the LIN bus is directly tied to each slave device.

> **NOTE:**   The user may need to add external components for ESD > 4-kV HBM on the SNPD_IN and SNPD_OUT pins (suggested values are as follows: 10-kΩ resistor with 10-µF capacitor with an optional 5-V Zener diode).

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