1 Purpose

The application note purpose is to specify the connection of the "not connected" (NC) pins for the SBCLIN2.5G devices family which is composed of three devices:

- 33912G5: SBCLIN with DC Motor Pre Driver and Current Sense
- 33911G5: SBCLIN with DC Motor Pre Driver
- 33910G5: SBCLIN with High Side Driver

In this document, the developer can find for each three devices the voltage level connection for the pins labelled "nc" in the Data Sheet. A typical application schematic will be also described. The transgression of the "nc" pins connections especially for the 33911G5 and 33910G5 devices could generate a device failure.

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2 33912G5 Device

2.1 Pins Connections

The 33912G5 device is packaged in a LQFP-32 pins. Figure 1 illustrates the pin connections.

```
<table>
<thead>
<tr>
<th>Pin</th>
<th>Pin Name</th>
<th>Formal Name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RXD</td>
<td>Receiver Output</td>
<td>This pin is the receiver output of the LIN interface which reports the state of the bus voltage to the MCU interface.</td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>Transmitter Input</td>
<td>This pin is the transmitter input of the LIN interface which controls the state of the bus output.</td>
</tr>
<tr>
<td>3</td>
<td>MISO</td>
<td>SPI Output</td>
<td>SPI (Serial Peripheral Interface) data output. When CS is high, pin is in the high-impedance state.</td>
</tr>
<tr>
<td>4</td>
<td>MOSI</td>
<td>SPI Input</td>
<td>SPI (Serial Peripheral Interface) data input.</td>
</tr>
<tr>
<td>5</td>
<td>SCLK</td>
<td>SPI Clock</td>
<td>SPI (Serial Peripheral Interface) clock Input.</td>
</tr>
<tr>
<td>6</td>
<td>CS</td>
<td>SPI Chip Select</td>
<td>SPI (Serial Peripheral Interface) chip select input pin. CS is active low.</td>
</tr>
<tr>
<td>7</td>
<td>ADOUT0</td>
<td>Analog Output Pin 0</td>
<td>Analog Multiplexer Output.</td>
</tr>
<tr>
<td>8</td>
<td>PWMIN</td>
<td>PWM Input</td>
<td>High Side and Low Side Pulse Width Modulation Input.</td>
</tr>
<tr>
<td>9</td>
<td>RST</td>
<td>Internal Reset I/O</td>
<td>Bidirectional Reset I/O pin - driven low when any internal reset source is asserted. RST is active low.</td>
</tr>
<tr>
<td>10</td>
<td>IRQ</td>
<td>Internal Interrupt Output</td>
<td>Interrupt output pin, indicating wake-up events from Stop Mode or events from Normal and Normal request modes. IRQ is active low.</td>
</tr>
<tr>
<td>11</td>
<td>ADOUT1</td>
<td>Analog Output Pin 1</td>
<td>Current sense analog output.</td>
</tr>
<tr>
<td>12</td>
<td>WDCONF</td>
<td>Watchdog Configuration Pin</td>
<td>This input pin is for configuration of the watchdog period and allows the disabling of the watchdog.</td>
</tr>
<tr>
<td>13</td>
<td>LIN</td>
<td>LIN Bus</td>
<td>This pin represents the single-wire bus transmitter and receiver.</td>
</tr>
</tbody>
</table>
```

Figure 1. 33912G5 pin connections
### 2.2 Recommendation of NC Pin

This device presents one “NC” pin which is the pin number 28. This pin is not connected internally and can be left opening/floating or connected to any potential (ground, power supply).

---

### Table of Pins

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pin Name</th>
<th>Formal Name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>LGND</td>
<td>LIN Ground Pin</td>
<td>This pin is the device LIN ground connection. It is internally connected to the PGND pin.</td>
</tr>
<tr>
<td>15</td>
<td>ISENSEL</td>
<td>Current Sense Pins</td>
<td>Current Sense differential inputs.</td>
</tr>
<tr>
<td>16</td>
<td>ISENSEH</td>
<td>Current Sense Pins</td>
<td>Current Sense differential inputs.</td>
</tr>
<tr>
<td>17</td>
<td>LS2</td>
<td>Low Side Outputs</td>
<td>Relay drivers low side outputs.</td>
</tr>
<tr>
<td>18</td>
<td>LS1</td>
<td>Low Side Outputs</td>
<td>Relay drivers low side outputs.</td>
</tr>
<tr>
<td>19</td>
<td>PGND</td>
<td>Power Ground Pin</td>
<td>This pin is the device low side ground connection. It is internally connected to the LGND pin.</td>
</tr>
<tr>
<td>20</td>
<td>L4</td>
<td>Wake-up Inputs</td>
<td>These pins are the wake-up capable digital inputs.&lt;sup&gt;(1)&lt;/sup&gt; In addition, all Lx inputs can be sensed analog via the analog multiplexer.</td>
</tr>
<tr>
<td>21</td>
<td>L3</td>
<td>Wake-up Inputs</td>
<td>These pins are the wake-up capable digital inputs.&lt;sup&gt;(1)&lt;/sup&gt; In addition, all Lx inputs can be sensed analog via the analog multiplexer.</td>
</tr>
<tr>
<td>22</td>
<td>L2</td>
<td>Wake-up Inputs</td>
<td>These pins are the wake-up capable digital inputs.&lt;sup&gt;(1)&lt;/sup&gt; In addition, all Lx inputs can be sensed analog via the analog multiplexer.</td>
</tr>
<tr>
<td>23</td>
<td>L1</td>
<td>Wake-up Inputs</td>
<td>These pins are the wake-up capable digital inputs.&lt;sup&gt;(1)&lt;/sup&gt; In addition, all Lx inputs can be sensed analog via the analog multiplexer.</td>
</tr>
<tr>
<td>24</td>
<td>HS2</td>
<td>High Side Outputs</td>
<td>High side switch outputs.</td>
</tr>
<tr>
<td>25</td>
<td>HS1</td>
<td>High Side Outputs</td>
<td>High side switch outputs.</td>
</tr>
<tr>
<td>26</td>
<td>VS2</td>
<td>Power Supply Pin</td>
<td>These pins are device battery level power supply pins. VS2 is supplying the HSx drivers while VS1 supplies the remaining blocks.&lt;sup&gt;(2)&lt;/sup&gt;</td>
</tr>
<tr>
<td>27</td>
<td>VS1</td>
<td>Power Supply Pin</td>
<td>These pins are device battery level power supply pins. VS2 is supplying the HSx drivers while VS1 supplies the remaining blocks.&lt;sup&gt;(2)&lt;/sup&gt;</td>
</tr>
<tr>
<td>29</td>
<td>VSENSE</td>
<td>Voltage Sense Pin</td>
<td>Battery voltage sense input.&lt;sup&gt;(3)&lt;/sup&gt;</td>
</tr>
<tr>
<td>30</td>
<td>HVDD</td>
<td>Hall Sensor Supply Output</td>
<td>+5.0 V switchable supply output pin.&lt;sup&gt;(4)&lt;/sup&gt;</td>
</tr>
<tr>
<td>31</td>
<td>VDD</td>
<td>Voltage Regulator Output</td>
<td>+5.0 V main voltage regulator output pin.&lt;sup&gt;(5)&lt;/sup&gt;</td>
</tr>
<tr>
<td>32</td>
<td>AGND</td>
<td>Analog Ground Pin</td>
<td>This pin is the device analog ground connection.</td>
</tr>
</tbody>
</table>

**Notes**

1. When used as digital input, a series 33kΩ resistor must be used to protect against automotive transients.
2. Reverse battery protection series diodes must be used externally to protect the internal circuitry.
3. This pin can be connected directly to the battery line for voltage measurements. The pin is self protected against reverse battery connections. It is strongly recommended to connect a 10kΩ resistor in series with this pin for protection purposes.
4. External capacitor (1.0 µF < C < 10 µF; 0.1 Ω < ESR < 5.0 Ω) required.
5. External capacitor (2.0 µF < C < 100 µF; 0.1 Ω < ESR < 10 Ω) required.
2.3 Typical Application Schematic

The Figure 2, page 4 illustrates a typical application schematic.

Typical Component Values:
- C1 = 47 µF; C2 = C4 = 100 nF; C3 = 10 µF; C5 = 4.7 µF; C6 = 68pF or 0pF
- R1 = 10 kΩ; R2 = R3 = 10 kΩ; R4 = R5 = 33 kΩ; R6 = 20 Ω; R7 = 20 kΩ-200 kΩ; R8 = 1 kΩ

Recommended Configuration of the not Connected Pins (NC):
Pin 28 = this pin is not internally connected and may be used for PCB routing optimization.

Figure 2. 33912G5 Typical application schematic
3 33911G5 Device

3.1 Pins Connections

The 33911G5 device is packaged in a LQFP-32 pins. Figure 3 illustrates the pin connections.

![33911G5 pin connections diagram]

Figure 3. 33911G5 pin connections

3.2 Recommendation of NC Pins

The 33911G5 device has eight “nc” pins. The table below describes following each pins number the recommended connections. The user must respect them in order to not damage the device.

<table>
<thead>
<tr>
<th>Pins Numbers</th>
<th>Connections recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>not connected</td>
</tr>
<tr>
<td>15</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>16</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>20</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>21</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>24</td>
<td>not connected or connected to VS2</td>
</tr>
<tr>
<td>28</td>
<td>not connected</td>
</tr>
<tr>
<td>30</td>
<td>not connected</td>
</tr>
</tbody>
</table>
3.3 Typical Application Schematic

The Figure 4, page 6 illustrates a typical application schematic.

![Figure 4. 33911G5 Typical Application Schematic]

Typical Component Values:
- \( C_1 = 47 \, \mu \text{F}; \)  
- \( C_2 = C_4 = 100 \, \text{nF}; \)  
- \( C_3 = 10 \, \mu \text{F}; \)  
- \( C_6 = 68 \, \text{pF} \) or 0pF
- \( R_1 = 10 \, \text{k\Omega}; \)  
- \( R_2 = R_3 = 10 \, \text{k\Omega}; \)  
- \( R_7 = 20 \, \text{k\Omega} - 200 \, \text{k\Omega}; \)  
- \( R_8 = 1 \, \text{k\Omega}; \)  

Figure 4. 33911G5 Typical Application Schematic
4 33910G5 Device

4.1 Pins Connections
The 33910G5 device is packaged in a LQFP-32 pins. Figure 5 illustrates the pin connections.

![33910G5 pin connections diagram](image)

Figure 5. 33910G5 pin connections

4.2 Recommendation of NC Pins
The 33910G5 device has nine “nc” pins. The table below describes following each pins number the recommended connections. The user must respect them in order to not damage the device.

<table>
<thead>
<tr>
<th>Pins Numbers</th>
<th>Connections recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>not connected</td>
</tr>
<tr>
<td>15</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>16</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>17</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>19</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>20</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>21</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>22</td>
<td>not connected or connected to the Ground</td>
</tr>
<tr>
<td>28</td>
<td>not connected</td>
</tr>
</tbody>
</table>

Table 2. 33910G5 Not Connected Pins Connections
4.3 Typical Application Schematic

The Figure 6, page 8 illustrates a typical application schematic.

Figure 6. 33910G5 Typical Application Schematic

Typical Component Values:
C1 = 47 µF; C2 = C4 = 100 nF; C3 = 10 µF; C5 = 4.7 µF; C6 = 68pF or 0pF
R1 = 10 kΩ; R2 = 10 kΩ; R7 = 20 kΩ-200 kΩ; R8 = 1 kΩ