Abstract

This document describes the connections and usage of a test jig, which can be used for programming Flash and OTP of the DA14531 Smartbond Tiny module.
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Test Jig Tool for DA14531 SmartBond TINY™ Module

1 Terms and Definitions

- BLE: Bluetooth Low Energy
- IDE: Integrated Development Environment
- PLT: Production Line Tool
- SOC: System On Chip
- SWD: Serial Wire Debug interface
- UART: Universal Asynchronous Receiver Transmitter
- USB: Universal Serial Bus

2 References

[1] DA14531 Datasheet, Dialog Semiconductor
[6] Production Line Tool product page, Dialog Semiconductor
Test jig Tool for DA14531 Smartbond TINY™ Module

3 Introduction

The DA14531 SmartBond TINY™ Module [5], based on the world’s smallest and lowest power Bluetooth 5.1 System-on-Chip, brings the DA14531 SoC [4] advantages to an integrated module. It just requires a power supply and a printed circuit board to build a Bluetooth application.

This document explains the usage of a test fixture, also called the test jig for the DA14531 TINY Module. The test jig can be used for programming and testing small quantities of the module before mounting them on the PCB. With the test jig connected to an interface board the DA14531 Module can be loaded with firmware using the Dialog programming tools.

The document describes how to connect the test jig to dialog interface boards:

- Development Kit -Pro [2]
- DA14531 USB-Dongle [3]
- Production Line Tool (PLT) [6]

The jig can be used for loading firmware (FW) into SRAM, SPI flash-memory or OTP-memory. See Figure 1.

Figure 1: Photo of the DA14531 Test Jig
4 Setup of the hardware

The jig is equipped with 15 pogo-pins. These pogo-pins are connected to a 15-pins SUB D connector which is mounted on the backside of the jig. In Figure 2, the pins of this male connector are shown. Through a female connector the pins can be connected to an interface board.

![Figure 2: Connections from DA14531 Module to SUB D15](image)

<table>
<thead>
<tr>
<th>SUB D15</th>
<th>Module #</th>
<th>Function</th>
<th>SUB D15</th>
<th>Module #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 1</td>
<td>J2</td>
<td>GND</td>
<td>pin 9</td>
<td>J10</td>
<td>PD_2 / SWCLK</td>
</tr>
<tr>
<td>pin 2</td>
<td>J3</td>
<td>GND</td>
<td>pin 10</td>
<td>J11</td>
<td>GND</td>
</tr>
<tr>
<td>pin 3</td>
<td>J4</td>
<td>GND</td>
<td>pin 11</td>
<td>J12</td>
<td>PD_0 / RST</td>
</tr>
<tr>
<td>pin 4</td>
<td>J5</td>
<td>PO_6</td>
<td>pin 12</td>
<td>J13</td>
<td>PO_7</td>
</tr>
<tr>
<td>pin 5</td>
<td>J6</td>
<td>GND</td>
<td>pin 13</td>
<td>J14</td>
<td>PD_5 / 1-wire UART</td>
</tr>
<tr>
<td>pin 6</td>
<td>J7</td>
<td>VBAT</td>
<td>pin 14</td>
<td>J15</td>
<td>PO_9</td>
</tr>
<tr>
<td>pin 7</td>
<td>J8</td>
<td>PO_11</td>
<td>pin 15</td>
<td>J16</td>
<td>PO_8</td>
</tr>
<tr>
<td>pin 8</td>
<td>J9</td>
<td>PO_10 / SWDIO</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 3: DA14531 Module Connections and Top View of DA14531 Module](image)
5 Connecting the test jig to the DevKit -Pro

The connections between the test jig and the Dialog Devkit Pro are described in Figure 4. Using this set-up there are two different methods to download software to the DA14531 Module:

- **Serial Wire Debug (SWD):** This interface supports:
  - Downloading firmware to SRAM from Keil IDE
  - Programming Firmware into Flash from the FlashProgrammer tool
  - Programming/Downloading Firmware and settings into Flash, OTP, SRAM using SmartSnippets Toolbox.
- **Single-Wire UART:** This interface supports:
  - Programming/Downloading Firmware and settings into Flash, OTP, SRAM using SmartSnippets Toolbox.

<table>
<thead>
<tr>
<th>#</th>
<th>DevKit-Pro</th>
<th>Module J#</th>
<th>Module IO</th>
<th>JIG SUB D15 pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UART RxTx</td>
<td>J14</td>
<td>p05</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>RST</td>
<td>J12</td>
<td>p00</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>SWDIO</td>
<td>J9</td>
<td>p010</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>SWCLK</td>
<td>J10</td>
<td>p02</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>VBAT</td>
<td>J7</td>
<td>VBAT</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>J2</td>
<td>GND</td>
<td>2</td>
</tr>
</tbody>
</table>

![Figure 4: Connections between DevKit-Pro and SUB D15](image)

Connect the USB-cable between the DevKit-Pro and PC. Start one of the SW tools as indicated earlier. For usage of the tools refer to the available user manuals [7], [8].
6 Connecting the test jig to DA14531 USB Dongle

The DA14531 USB Dongle can be used for connecting the signals as described in Figure 6. Because this board has the DA14531 IC soldered on the PCB and connected directly the SWD and UART lines, it must be removed before using this method. Removing the product can be done by using hot air. Do not heat the rest of the components, they might get loose, resulting in general failure of the board. Configure the switches as indicated in Figure 5.

![Figure 5: Top View of the DA14531 USB Dongle with Switch-settings](image)

Using this set-up there are two different methods to download software to the DA14531 Module:

- **Serial Wire Debug (SWD),** this interface supports:
  - Downloading firmware to SRAM from Keil IDE
  - Programming Firmware into Flash from the FlashProgrammer tool
  - Programming/Downloading Firmware and settings into Flash, OTP, SRAM using SmartSnippets Toolbox.

- **Single-Wire UART,** this interface supports:
  - Programming/Downloading Firmware and settings into Flash, OTP, SRAM using SmartSnippets Toolbox.

Connect the USB-Devkit to a PC (an extension cable makes this easier) and start one of the SW tools as indicated earlier. For usage of the tools refer to the available user manuals [7], [8].

![Figure 6: Connections between DA14531 USB Dongle and SUB D15](image)

<table>
<thead>
<tr>
<th>#</th>
<th>531 Dongle</th>
<th>Module #</th>
<th>Module ID</th>
<th>JIG SUB D15 pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SW/DIO p010</td>
<td>J9</td>
<td>p010</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>VBAT</td>
<td>J7</td>
<td>VBAT</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>J2</td>
<td>GND</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>RST p00</td>
<td>J12</td>
<td>p00</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>SWCLK p02</td>
<td>J10</td>
<td>p02</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>UART p05</td>
<td>J14</td>
<td>p05</td>
<td>13</td>
</tr>
</tbody>
</table>
7 Connecting the test jig to the Production Line Tool (PLT)

The Dialog Production Line Tool hardware allows for programming and testing of up to 16 devices in parallel in a production environment. The method below describes how to connect the test jig with a single device to the PLT hardware. The connections as described in Figure 7 can be used for programming of Firmware and settings into OTP and Flash.

<table>
<thead>
<tr>
<th>#</th>
<th>PLT</th>
<th>Module J#</th>
<th>Module IO</th>
<th>JIG SUB D15 pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBAT headerpin1</td>
<td>J7</td>
<td>VBAT</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>GND headerpins</td>
<td>J2</td>
<td>GND</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>RST headerpin10</td>
<td>J12</td>
<td>p00</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>UART TxD headerpin7</td>
<td>J14</td>
<td>p05</td>
<td>13</td>
</tr>
</tbody>
</table>

The single-wire UART cable from the test jig is connected to both the UART-Rx and UART-Tx connection on the PLT. The Reset line (RST) is optional and the SWD is not used by the PLT.
8 How to operate the test jig

1. Create the connections as described in [5], [6] and [7].
2. Open the jig by moving the lever back-wards (Figure 8).
3. Take a used Module out of jig holder.
4. Put the new module in the jig holder.
5. Close the JIG. This connects the pogo pins to the module pads.
6. Run the software to program/download firmware.
7. Go to #2 to program the next device.

![Figure 8: Opened Jig - Empty Module Holder - Module in Holder - Closed Jig]

9 Ordering information

The test jig for the DA14531 Tiny module is available at the online store of Praxis-RF:
Appendix A Interconnections of Pogo-pins to Sub D15

Table 1: Interconnection Pogo-pins and SUB D15

<table>
<thead>
<tr>
<th>Module connections</th>
<th>SUB D15 connections</th>
<th>Module connections</th>
<th>SUB D15 connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>not connected</td>
<td>J9</td>
<td>pin 8</td>
</tr>
<tr>
<td>J2</td>
<td>pin 1</td>
<td>J10</td>
<td>pin 9</td>
</tr>
<tr>
<td>J3</td>
<td>pin 2</td>
<td>J11</td>
<td>pin 10</td>
</tr>
<tr>
<td>J4</td>
<td>pin 3</td>
<td>J12</td>
<td>pin 11</td>
</tr>
<tr>
<td>J5</td>
<td>pin 4</td>
<td>J13</td>
<td>pin 12</td>
</tr>
<tr>
<td>J6</td>
<td>pin 5</td>
<td>J14</td>
<td>pin 13</td>
</tr>
<tr>
<td>J7</td>
<td>pin 6</td>
<td>J15</td>
<td>pin 14</td>
</tr>
<tr>
<td>J8</td>
<td>pin 7</td>
<td>J16</td>
<td>pin 15</td>
</tr>
</tbody>
</table>

Figure 9: [Left] Connections of Module (Top View) - [Right] Module Holder With and Without Module

Figure 10: [Left and Middle] Backside of Pogo-pins - using Heat Shrink Tubing on all Pogo-pins  
[Right] Backside of SUB D15 - also Heat Shrink Tubing used
Test jig Tool for DA14531 Smartbond TINY™ Module

Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>07-May-2020</td>
<td>Initial version.</td>
</tr>
<tr>
<td>1.1</td>
<td>16-June-2020</td>
<td>Added new section with ordering information</td>
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</table>
Test jig Tool for DA14531 Smartbond TINY™ Module

Status Definitions

<table>
<thead>
<tr>
<th>Status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DRAFT</strong></td>
<td>The content of this document is under review and subject to formal approval, which may result in modifications or additions.</td>
</tr>
<tr>
<td><strong>APPROVED</strong> or unmarked</td>
<td>The content of this document has been approved for publication.</td>
</tr>
</tbody>
</table>

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