User Manual

DPM over AT-CMD between the DA16200 and MCU

UM-WI-034

Abstract

This document describes how to run the DPM operation over AT-CMD on the DA16200 and MCU.

Contents

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1   Terms and Definitions

DPM   Dynamic Power Management
MCU   Micro Controller Unit

2   References

[1]   <DA16200>, AT Command User Manual, Dialog Semiconductor
[2]   <DA16200>, DPM APIs Programmer Guide, Dialog Semiconductor
[3]   <DA16200>, Hardware Design Guide, Dialog Semiconductor
[4]   <DA16200>, EVK User Manual, Dialog Semiconductor

3   Overview

In order to hardwire between the DA16200 and MCU, the DA16200 provides various hardwiring interfaces. For example, the DA16200 and MCU can be connected in hardware PIN as UART, SPI, and SDIO.

The DA16200 SDK provides AT-CMD as basic function to communicate between the DA16200 and MCU. And MCU can control the DPM operation of the DA16200 over AT-CMD.

This document describes how to implement DPM operation over AT-CMD when Customer/Developer writes an application on MCU.

NOTE
1. This document describes the operation based on the AT-CMD standard features of the DA16200 SDK.
2. To provide a low power mode for customer products, not only the DA16200 but also MCU is required as an additional hardware connection between the DA16200 and MCU.   Refer to the Hardware Design Guide and EVK User Manual.

4   MCU DPM Procedure to the DA16200

After initial settings are done for MCU and the DA16200, when MCU sets the DPM Enable of the DA16200 using AT-CMD (AT+DPM=1), the DA16200 drives the DPM module of the DA16200.

After the initial setting between MCU and the DA16200 is completed, when MCU sets the DPM Enable of the DA16200 using AT-CMD (AT+DPM=1), the DA16200 drives the DPM module.

If the DPM mode of DA16200 is enabled, the DA16200 is ready to enter DPM Sleep mode.

In this case, MCU of the customer's product have two conditions.

● MCU power : Always ON
● MCU power : Power OFF

NOTE
This document does not describe how to use AT-CMDs and DPM setting over AT-CMD.   Refer to the AT-CMD User Manual.

4.1   MCU Power - Always ON

In this case, the DPM operation of the DA16200 is simple. Since the power of MCU is always turned ON, MCU can operate in a pre-determined sequence to control the DPM operation of the DA16200. No additional separate operation is required.

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The DPM operation of the DA16200 is independent of the MCU working. So, if MCU has something to do before the DA16200 enters DPM Sleep state, MCU must control the DPM operation (CPU Power-OFF) of the DA16200.

There are two instances as follows:

● Operation / Data communication : MCU to DA16200
● Operation / Data communication : DA16200 to MCU

NOTE
In this case, a physical HW connection is required for MCU to drive the DA16200, which is in DPM Sleep mode. **It is necessary to hardwire a connection between MCU GPIO and the DA16200 External Wakeup PIN.** Refer to the Hardware Design Guide and EVK User Manual.

4.1.1 MCU to DA16200

The proper sequences are required for the DPM of the DA16200 to operate normally on a customer product, which consists of MCU and the DA16200.

After doing any operation, MCU has to determine the correct time for DA16200 to enter DPM Sleep mode (CPU Power-Off). If MCU does not send a defined AT-CMD for DPM operation of the DA16200, the DA16200 enters DPM Sleep mode without delay. So if MCU has something to do itself, MCU must notify to enter the DPM Sleep mode to the DA16200.

```
     …
Do operation for MCU itself
     …
```

Drive the DA16200 External Wakeup PIN   ← Wakeup the DA16200 from DPM Sleep

Detect the DA16200 wakeup event from DPM Sleep mode: **+INIT:WAKEUP,UC**

AT+CLRDPMSLPEXT ← Send AT-CMD to hold the DA16200 from entering DPM mode

```
     …
Operates or sends data from MCU to the DA16200
     …
```

AT+SETDPMSLPEXT ← Send AT-CMD to resume the DA16200 DPM module

```
     …
```

4.1.2 DA16200 to MCU

The DA16200 state is in DPM Sleep mode (CPU Power-Off), but the MCU power is always ON, and the DA16200 operates according to the DPM standard.

There are three instances as follows:

● In case of wakeup from receiving network data
● In case of wakeup from RTC timer event
● In case of wakeup from Wi-Fi disconnect

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4.1.2.1   In Case of Wakeup from Receiving Network Data

In this case, the received data is transferred to the MCU for data processing from the DA16200 over AT-CMD protocol.

When the MCU detects data reception from the DA16200, it must process as the following order to stably receive the data from the DA16200, and then let the DA16200 enter DPM Sleep again.

```
    …
Waiting any event from the DA16200
    …
Detect the DA16200 wakeup event from DPM Sleep mode : +INIT:WAKEUP,UC

AT+CLRDPMSLPEXT  ← Send AT-CMD to hold the DA16200 from entering DPM mode

    …
Receive the data from the DA16200 and run the operation MCU itself
    …

AT+SETDPMSLPEXT  ← Send AT-CMD to resume the DA16200 DPM module

    …
```

4.1.2.2   In Case of Wakeup from RTC Timer Event

In this case, the DA16200 automatically wakes up by the timer registered in DPM Sleep state and the DA16200 sends the wakeup event to MCU. If this timer event was registered by MCU, MCU has to process the event and then proceed to the DPM Sleep procedure again.

```
    …
Waiting any action from the DA16200
    …
Detect the DA16200 wakeup event from DPM Sleep mode : +INIT:WAKEUP,RTC

AT+CLRDPMSLPEXT  ← Send AT-CMD to hold the DA16200 from entering DPM mode

    …
Process any action for this Timer event
    …

AT+SETDPMSLPEXT  ← Send AT-CMD to resume the DA16200 DPM module

    …
```

4.1.2.3   In Case of Wakeup from Wi-Fi Disconnect Event

In this case, the DA16200 wakes up with the Wi-Fi disconnection event in the DPM Sleep state; the DA16200 sends the wakeup event to MCU. If any actions are needed in MCU about Wi-Fi disconnection, MCU does not need any DPM process, except this event action.

The DA16200 enters the DPM abnormal case handling procedure.

```
    …
Waiting any action from the DA16200
    …
Detect the DA16200 wakeup event from DPM Sleep mode : +INIT:WAKEUP,[NOBCN / DEAUTH]

AT+CLRDPMSLPEXT  ← Send AT-CMD to hold the DA16200 from entering DPM mode

    …
To do something which defined for this timer event
    …

AT+SETDPMSLPEXT  ← Send AT-CMD to resume the DA16200 DPM module

    …
```

4.2   MCU Power - Power OFF for Low-Power Mode

In this case, the DPM operation for the DA16200 is needed for additional operation to the MCU (see 4.1). Since MCU power also turned off in low-power mode, it is necessary to wakeup MCU before any action.

There are two instances as follows:

● Operation / Data communication : MCU → DA16200

● Operation / Data communication : DA16200 → MCU

NOTE
In this case, **MCU or the DA16200 is need to hardwire the connection to wakeup each one.** One is the DA16200 Wakeup PIN and the other is MCU wakeup PIN. Refer to the Hardware Design Guide and EVK User Manual.

4.2.1   MCU to DA16200

In the low-power standby state (In DPM Sleep of the DA16200 and MCU Power OFF), if MCU needs to perform any operation with the DA16200 after waking up first, MCU must drive the "External Wake up PIN" of the DA16200 and have to perform any operation after detecting the DA16200 wakeup message.

```
     …
MCU start/wakeup by any events
Drive the DA16200 External Wakeup PIN
     …
Detect the DA16200 wakeup event from DPM Sleep mode : +INIT:WAKEUP,EXT

AT+CLRDPMSLPEXT  ← Send AT-CMD to hold the DA16200 from entering DPM mode

     …
Process any action to the DA16200
     …

AT+SETDPMSLPEXT  ← Send AT-CMD to resume the DA16200 DPM module

     …
```

4.2.2   DA16200 to MCU

In the low-power standby state (In DPM Sleep of the DA16200 and MCU Power OFF), if MCU needs to do some operation with the DA16200 after waking up first, MCU must drive the "External Wake up PIN" of the DA16200, then has to run the next operation after detecting the DA16200 wakeup message.
For descriptions on data communication, timer, and Wi-Fi disconnect, see to 4.1.2.1 and 4.1.2.3.

```
     …
[DA16200] Wakeup from DPM Sleep by any events
[DA16200] Drives the "Wakeup PIN" of MCU
     …
MCU have to send the defined AT-CMD to notice "MCU Ready" : AT+MCUWUDONE

AT+CLRDPMSLPEXT  ← Send AT-CMD to hold the DA16200 from entering DPM mode

     …
Process any action for this Timer event
     …

AT+SETDPMSLPEXT  ← Send AT-CMD to resume the DA16200 DPM module

     …
```

Revision History

Revision	Date	Description
1.0	26-Nov-2020	First version.

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Status Definitions

Status	Definition
DRAFT	The content of this document is under review and subject to formal approval, which may result in modifications or additions.
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