Application Report
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Configuring the bq78PL114 Cell Count

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ABSTRACT

Configuration of the bq78PL114 to a custom series and parallel cell arranged pack is accomplished outside parameter tabs in bqWizard™ or the .ppcsv parameter configuration file. It is easy to set by loading an appropriate .tmap file to the device. This application report describes loading the .tmap file, some considerations for the parallel cell count configuration, and how to simply edit the .tmap file to change the parallel cell configuration.

Introduction

The cell stack configuration information is loaded to the bq78PL114 through a configuration file with the .tmap extension. Tmap configuration file examples for supported series cell counts are found in the *C:\Program Files\Texas Instruments\bqWizardx.x\Configuration Files* directory of a typical bqWizard™ installation. These files describe a 1 or 2 parallel count configuration. The parallel cell count is an important value for the bq78PL114 to properly reflect the capacity of the pack and perform gauging. An appropriate file must be loaded to set the cell configuration for the device.

The .tmap file also controls other configuration of the bq78PL114 which is beyond the scope of this application report.

Parallel Cell Count Considerations

The minimum number of parallel cells is 1. The maximum number of parallel cells is limited by the system capacity which is a16-bit unsigned integer. The maximum capacity is typically 65,535 mAh, but the bq78PL114S12 firmware upgrade scales this to 655 Ah with the 1-mΩ setting. See the Technical Reference Manual (SLUU330) for more information.

The number of parallel cells is bounded by the 16-bit integer size, but more practically by the maximum capacity:

Maximum number of parallel cells = maximum capacity mAh/capacity per cell.

Examples with a maximum capacity of 65,535 mAh:

- For 5000-mAh cells: Maximum parallel count 13 cells
- For 1000-mAh cells: Maximum parallel count 65 cells

The system designer must provide some headroom in case the cells from the manufacturer have more capacity than advertised. This probably has to be verified by testing.

Another consideration is if the system has to properly report the design energy capacity in SBData. The response to the DesignCapacity command is limited to the value 65,535 maximum in 10-mWh or 100-mWh units. For the 10-mWh case, this is calculated by the formula:

(design capacity)10 mWh = ((cell capacity)mAh × (number parallel cells) × (cell nominal voltage)V × (number of series cells))/10

or

(maximum number of parallel cells) < (65,535 × 10)/((cell capacity in mAh) × (number series cells) x (cell nominal voltage))

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Examples with 8S configuration of 3.6-V nominal cells:

- For 5000-mAh cells: (65,535 × 10)/(5000 × 8 × 3.6) = 4.6; 4 maximum parallel cells
- For 1000-mAh cells: (65,535 × 10)/(1000 × 8 × 3.6) = 22.8; 22 maximum parallel cells

Changing the Cell Count Configuration

To change the number of cells in the configuration, follow these steps:

1. Locate the .tmap file for the number of series cells to be used. Files for the base device or bq78PL114S12 firmware version are located in separate subdirectories of the Configuration Files directory. Be sure to select the proper file because the files are not compatible between the versions.

   If the parallel cell count must be changed from the default of 2 for the base devise or 1 for the bq78PL114S12 firmware version:

   a. Open the .tmap file for the number of series cells intended with a text editor such as Microsoft™ Notepad.

   b. For the base device, change the tenth line from 2 to the number of parallel cells. Do not add new lines to the file or change other values in the file.

      Example: From the bq78PL114_8S.tmap:

      bqWizard
      2.0.51
      1
      11
      OCV_LUT
      2
      102
      0
      8
      2 ← **Change this number from 2 to 1 for 1 parallel cell configuration.**
      2
      ...

   c. For the bq78PL114S12 firmware version, the file has a comment on the line describing the parallel count. Example line from typical file:

      ```
      1    # 0x0001    [  6] Parallel Nodes
      ```

      Change the decimal and hexadecimal entries in the line to the new parallel count. Do not add new lines or change other values in the file.

2. Load the appropriate tmap to the device with the bqWizard menu item: *File* > *Pack Configuration* > *Load Configuration from File and Relearn.*
3. After loading a tmap file that changes the serial cell count, update the bqWizard™ display for the new cell count by using the bqWizard™ menu item: *Commands* > *Connect to Pack* or closing and re-starting the bqWizard™ software.

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