

## Ultra-low Power Consumption 300 mA Buck DC/DC Converter with Battery Monitor Evaluation Board

No.EEV-505-K183C-191021

RP515K183C-EV is the evaluation board for RP515 which has the below features, benefits and specifications.

### OVERVIEW

The RP515K is a buck DC/DC converter with a Battery Monitor (BM) featuring ultra-low current and low-voltage resistance. The battery monitor divides the input voltage ( $V_{IN}$ ) into 1/3 or 1/4, and directly provides the MCU's built-in low voltage AD converter with buffered voltage without external circuits.

### KEY BENEFITS

- Ultra-low consumption current ( $I_Q$ :0.3  $\mu$ A) with the VFM control for DC/DC (switching frequency: 1 MHz max.)
- High efficiency under light load conditions
- Reducing components and space by combining DC/DC and BM into a single chip
- Suitable for coin batteries and USB ports due to its wide input voltage range from 1.8 V to 5.5 V

### KEY SPECIFICATIONS

#### DC/DC Section

- Supply Current: Typ. 0.3  $\mu$ A
- Output Current: 300 mA
- Input Voltage Range: 1.8 V to 5.5 V
- Output Voltage Range : 1.0 V to 4.0 V
- Output Voltage Accuracy:  $\pm$ 1.5%

#### Battery Monitor Section

- Output Voltage:  $V_{IN}/3$  (RP515xxx3x)  
 $V_{IN}/4$  (RP515xxx4x)
- Supply Current: Typ. 0.1  $\mu$ A

#### Others

- Package: DFN(PLP)2527-10
- For more details on RP515 IC, please refer to <https://www.e-devices.ricoh.co.jp/en/products/power/dcdc/rp515/rp515-ea.pdf>

### PART NUMBER INFORMATION

| Product Name | Package         |
|--------------|-----------------|
| RP515K183C   | DFN(PLP)2527-10 |

18: Specify the set output voltage for DC/DC ( $V_{SET}$ ): 1.8 V

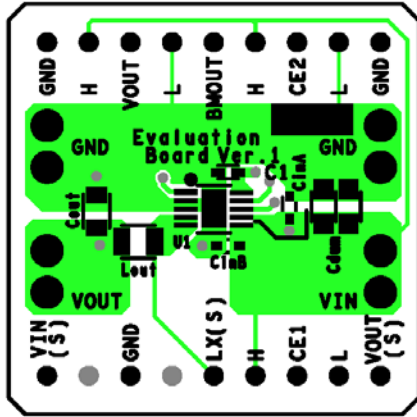
3: Division ratio of BM output voltage =  $V_{IN}/3$

C: DC/DC auto-discharge is not included

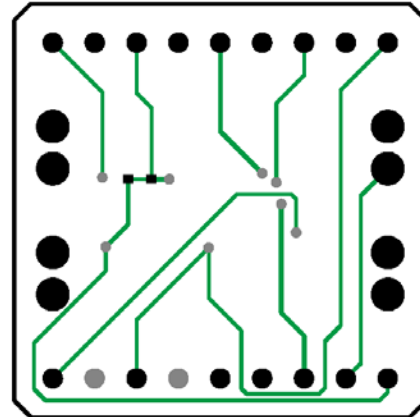
# PCB LAYOUT

RP515K (DFN(PLP)2527-10)

Top Layer



Bottom Layer



## ABSOLUTE MAXIMUM RATINGS

### Absolute Maximum Ratings

| Symbol           | Parameter                                           |                 | Rating                        | Unit |
|------------------|-----------------------------------------------------|-----------------|-------------------------------|------|
| V <sub>IN</sub>  | Input Voltage for AVIN and PVIN Pins                |                 | -0.3 to 6.5                   | V    |
| V <sub>CE1</sub> | CE1 Pin Voltage                                     |                 | -0.3 to 6.5                   | V    |
| V <sub>CE2</sub> | CE2 Pin Voltage                                     |                 | -0.3 to 6.5                   | V    |
| V <sub>OUT</sub> | Output Pin Voltage                                  |                 | -0.3 to V <sub>IN</sub> + 0.3 | V    |
| V <sub>BM</sub>  | BM Pin Voltage                                      |                 | -0.3 to V <sub>IN</sub> + 0.3 | V    |
| I <sub>LX</sub>  | LX Pin Output Current                               |                 | 650                           | mA   |
| P <sub>D</sub>   | Power Dissipation <sup>(1)</sup><br>(JEDEC STD. 51) | DFN(PLP)2527-10 | 2500                          | mW   |
| T <sub>j</sub>   | Junction Temperature Range                          |                 | -40 to 125                    | °C   |
| T <sub>stg</sub> | Storage Temperature Range                           |                 | -55 to 125                    | °C   |

### ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage and may degrade the life time and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

## RECOMMENDED OPERATING CONDITIONS

### Recommended Operating Conditions

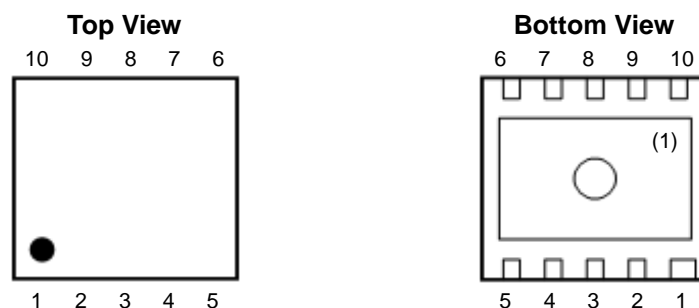
| Symbol          | Parameter             |            | Rating     | Unit |
|-----------------|-----------------------|------------|------------|------|
| V <sub>IN</sub> | Input Voltage         | RP515xxx3x | 1.8 to 5.5 | V    |
|                 |                       | RP515xxx4x | 2.4 to 5.5 |      |
| T <sub>a</sub>  | Operating Temperature |            | -40 to 85  | °C   |

### RECOMMENDED OPERATING CONDITIONS

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

<sup>(1)</sup> Refer to *POWEWR DISSIPATION* in the product data sheet.

## PIN DESCRIPTIONS



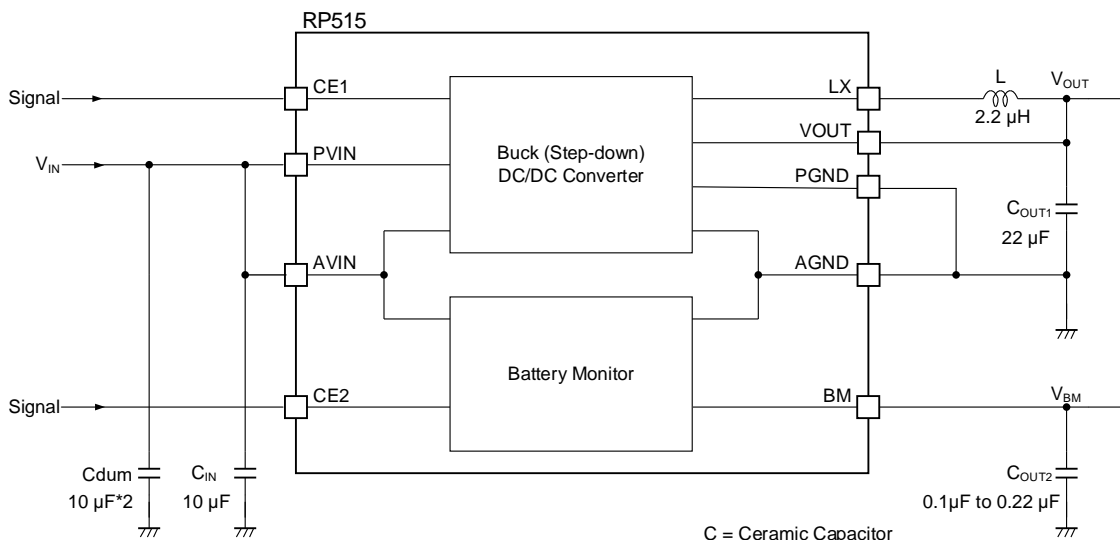
RP515K [DFN(PLP)2570-10] Pin Configuration

### RP515K Pin Description

| Pin No. | Symbol | Description                                                  |
|---------|--------|--------------------------------------------------------------|
| 1       | VOUT   | DC/DC Output Pin                                             |
| 2       | AGND   | Analog Ground Pin                                            |
| 3       | PGND   | Power Ground Pin                                             |
| 4       | LX     | Switching Pin                                                |
| 5       | LX     | Switching Pin                                                |
| 6       | PVIN   | Input Pin for Power Supply                                   |
| 7       | AVIN   | Input Pin for Analog Power Supply (also for Battery Monitor) |
| 8       | CE1    | DC/DC Enable Pin (Active-high)                               |
| 9       | CE2    | Battery Monitor Enable Pin (Active-high)                     |
| 10      | BM     | Battery Monitor Output Pin                                   |

<sup>(1)</sup> The tab on the bottom of the package is substrate level (GND). It is recommended that the tab be connected to the ground plane on the board, but it is possible to leave the tab floating.

**TYPICAL APPLICATION CIRCUIT**



**RP515 Typical Application Circuit**

※Testing with this EV board, an external attachment might be necessary for evaluation of the correct performance of the RP515 and already has been attached as C<sub>dum</sub>. For evaluation, wiring for power supply or GND will be used. Considering the voltage drop or noise by the wiring, C<sub>dum</sub> has been mounted on the EV board to obtain the right performance of the RP515. In the actual PCB layout or measurement unit's wire is very short, and C<sub>dum</sub> will be unnecessary.

Recommended External Components\*1

| Symbol            | Value     |
|-------------------|-----------|
| C <sub>IN</sub>   | 10 µF     |
| C <sub>OUT1</sub> | 22 µF     |
| C <sub>OUT2</sub> | 0.1 µF    |
| C <sub>dum</sub>  | 10 µF x 2 |
| L                 | 2.2 µH    |

\*1 The bill of materials will be attached on the shipment of each purchased evaluation board.

## TECHNICAL NOTES

The performance of a power source circuit using this device is highly dependent on the peripheral circuit. A peripheral component or the device mounted on PCB should not exceed a rated voltage, a rated current or a rated power. When designing a peripheral circuit, please be fully aware of the following points.

- When an intermediate voltage other than  $V_{IN}$  and GND is input to the CE1 pin or/and CE2 pin, a supply current may be increased with a through current of a logic circuit in the IC. The CE pin is neither pulled up nor pulled down, therefore the operation is not stable at open.



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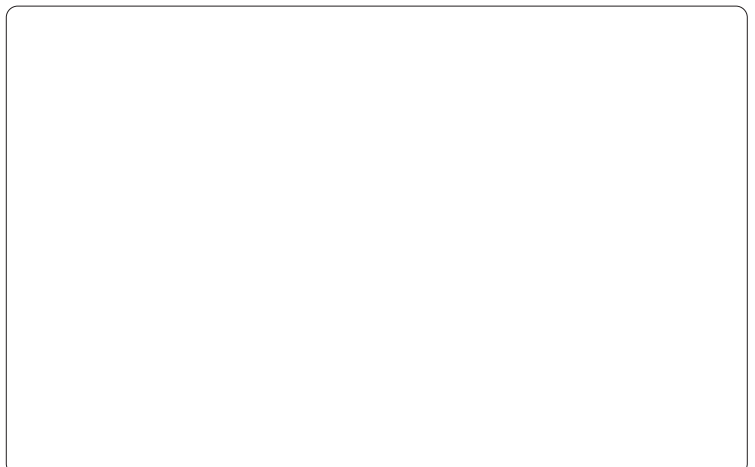
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