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

No. EEV-516-Z333B-201104

RP605Z333B-EV is the evaluation board for RP605 which has the below features, benefits and specification.

OVERVIEW

RP605Z333B is an ultra-low power DC/DC converter with a Battery Monitor (BM). The battery monitor divides the input voltage (V_{IN}) into 1/3 and directly provides the buffered voltage to a low-voltage AD converter in MCU, it monitors the remaining quantity of the battery.

KEY BENEFITS

- Long-time operation of battery powered equipment and downsizing of battery due to the ultra-low consumption current ($I_Q = 0.3 \mu A$).
- Reducing components and saving 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: 3.3 V
- Output Voltage Accuracy: $\pm 1.5\%$

Battery Monitor Section

- Output Voltage: $V_{IN}/3$ (RP605Z333B)
- Supply Current: Typ. $0.1 \mu A$

Other

- For more details on RP605 IC, please refer to <https://www.nisshinbo-microdevices.co.jp/en/pdf/datasheet/rp605-ea.pdf>.

SELECTION GUIDE

Product Name	Package
RP605Z333B	WLCSP-20-P3

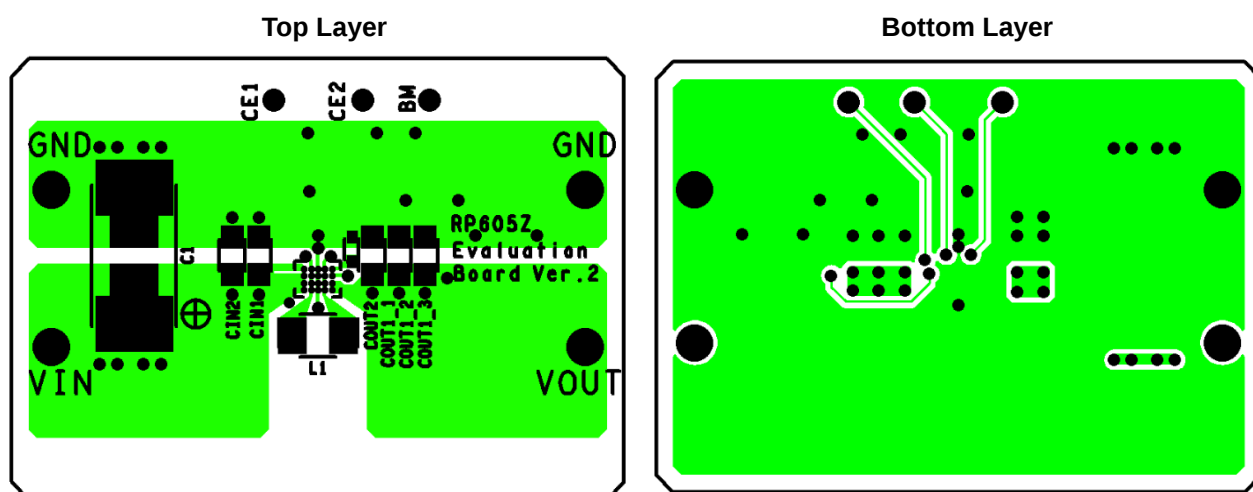
33: The DC/DC set output voltage (V_{SET}) = 3.3 V

3: The division ratio of BM output = $V_{IN}/3$

B: DC/DC auto-discharge is included.

PCB LAYOUT

RP605Z (Package: WLCSP-20-P3) PCB Layout



ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	-0.3 to 6.5	V
V_{BULX}	BULX Pin Voltage	-0.3 to $V_{IN} + 0.3$	V
V_{BOLX}	BOLX Pin Voltage	-0.3 to $V_{OUT} + 0.3$	V
V_{CE1}	CE1 Pin Voltage	-0.3 to 6.5	V
V_{CE2}	CE2 Pin Voltage	-0.3 to 6.5	V
V_{OUT}	VOUT Pin Voltage	-0.3 to 6.5	V
V_{FB}	VFB Pin Voltage	-0.3 to 6.5	V
V_{BM}	BM Pin Voltage	-0.3 to $V_{IN} + 0.3$	V
P_D	Power Dissipation	Refer to Appendix "POWER DISSIPATION"	
T_j	Junction Temperature Range	-40 to 125	°C
T_{stg}	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

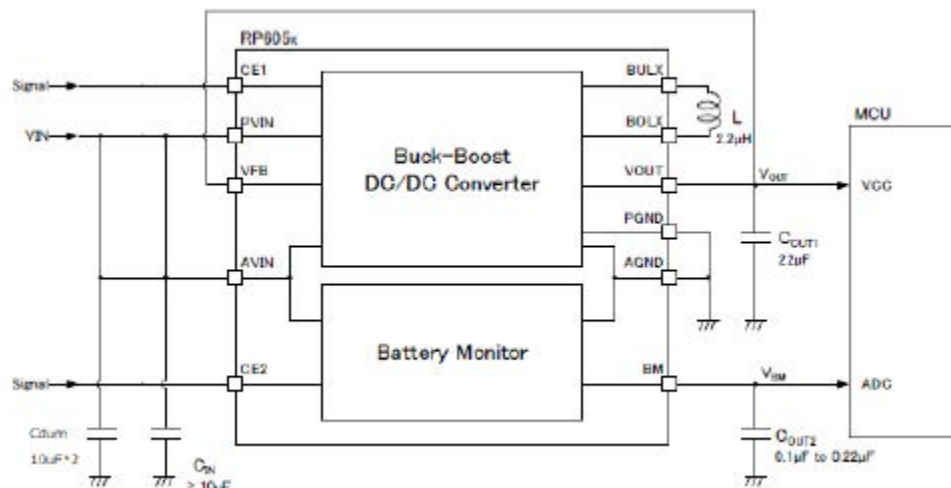
Recommended Operating Conditions

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage	RP605xxx3x	1.8 to 5.5	V
T_a	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.

APPLICATION INFORMATION



RP605x Typical Application Circuit

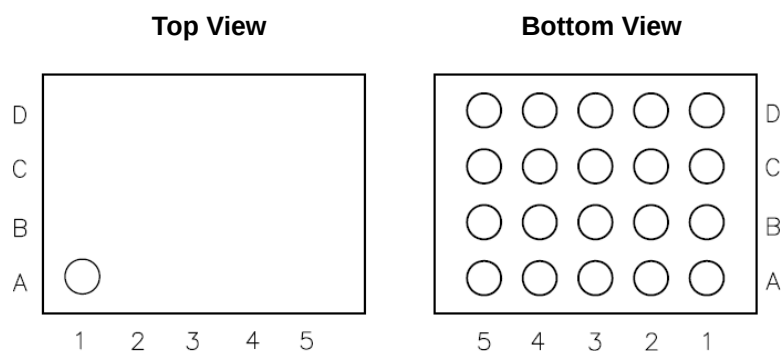
Recommended External Components^{*1}

Symbol	Value
L	2.2 μ H
CIN	10 μ F
COUT1	22 μ F
COUT2	0.1 μ F
Cdum ^{*2}	10 μ F x 2

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

^{*2} Testing with this EV board, an external attachment might be necessary for evaluation of the correct performance of the RP605 and already has been attached as Cdum. For evaluation, wiring for power supply or GND will be used. Considering the voltage drop or noise by the wiring, Cdum has been mounted on the EV board to obtain the right performance of the RP605. In the actual PCB layout or measurement unit's wire is very short, and Cdum will be unnecessary.

PIN DESCRIPTIONS



RP605Z (WLCSP-20-P3) Pin Configuration

RP605Z Pin Description

Pin No.	Symbol	Description
A5, B5	VOUT	DC/DC Output Pin
A4, B4, C4	BOLX	Boost Switching Output LX Pin
A3, B3, C3	PGND	Power Ground Pin
A2, B2, C2	BULX	Buck Switching Output LX Pin
A1, B1, C1	PVIN	Power Source Input Pin
C5	VFB	Feedback Pin
D1	AVIN	Analog Power Supply Pin
D2	CE1	DC/DC Enable Pin (Active-high)
D3	AGND	Analog Ground Pin
D4	CE2	Battery Monitor Enable Pin (Active-high)
D5	BM	Battery Monitor Output Pin

TECHNICAL NOTES

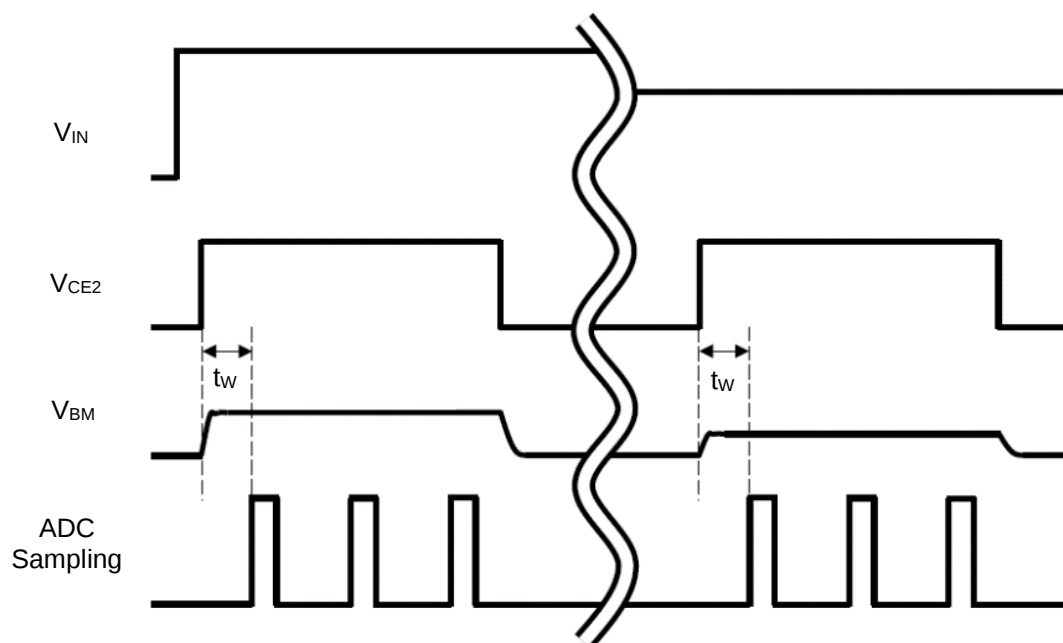
The performance of a power source circuit using this device is highly dependent on the peripheral circuit. A peripheral component or the device mounted on PCB should not exceed a rated voltage, a rated current or a rated power. When designing a peripheral circuit, please be fully aware of the following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

- Use carefully with the distance between the VFB pin and the wiring that causes noise.
- Noise reduction is possible by adding a filter component such as a resistor to the VFB pin
- Use ceramic capacitors with a low equivalent series resistance (ESR), considering the bias characteristics and input/output voltages.
- When the built-in switches are turned off, the inductor may generate a spike-shaped high voltage. Use the high-breakdown voltage capacitor (C_{OUT1}) which output voltage is 1.5 times or more than the set output voltage.
- Use an inductor that has a low DC resistance, has an enough tolerable current and is less likely to cause magnetic saturation.
- The CE1 and CE2 pins are neither pulled up nor pulled down, therefore an operation is not stable at open.
- The thermal shutdown function protects the IC from fuming and ignition but does not ensure the IC's reliability or keep the IC below the absolute maximum ratings. The thermal shutdown function only works on the heat generated by normal IC operation such as latch-up and overvoltage application.

The thermal shutdown function operates in a state over the absolute maximum ratings, therefore the thermal shutdown function should not be used for a system design.

BATTERY MONITOR SECTION

TIMING CHART OF TYPICAL APPLICATION CIRCUIT



RP605x Timing Chart of Typical Application Circuit

The RP605x can monitor the battery voltage by connecting BM pin with ADC input pin in MCU. The RP605x allows the CE2 pin to control the battery monitor's start and stop according to the sampling cycle from the ADC, reducing the power consumption of the entire system.

During the battery voltage monitoring, waiting time (t_w) is needed, recommended $t_w \geq 10\text{ms}$, for the CE2 pin to gain stable V_{BM} .



1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to our sales representatives for the latest information thereon.
2. The materials in this document may not be copied or otherwise reproduced in whole or in part without prior written consent of our company.
3. Please be sure to take any necessary formalities under relevant laws or regulations before exporting or otherwise taking out of your country the products or the technical information described herein.
4. The technical information described in this document shows typical characteristics of and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under our company's or any third party's intellectual property rights or any other rights.
5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death (aircraft, spacevehicle, nuclear reactor control system, traffic control system, automotive and transportation equipment, combustion equipment, safety devices, life support system etc.) should first contact us.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. Anti-radiation design is not implemented in the products described in this document.
8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
10. There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or our distributor before attempting to use AOI.
11. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.



Nisshinbo Micro Devices Inc.

Official website

<https://www.nisshinbo-microdevices.co.jp/en/>

Purchase information

<https://www.nisshinbo-microdevices.co.jp/en/buy/>