RICOH

RP605Z333B-EV

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 µA).
- 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 µA
- Output Current: 300 mA
- Input Voltage Range: 1.8 V to 5.5 V
- Output Voltage: 3.3 V
- Output Voltage Accuracy: ±1.5%

Battery Monitor Section

- Output Voltage: V_{IN}/3 (RP605Z333B)
- Supply Current: Typ. 0.1 µA

Other

- For more details on RP605 IC, please refer to https://www.n-redc.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

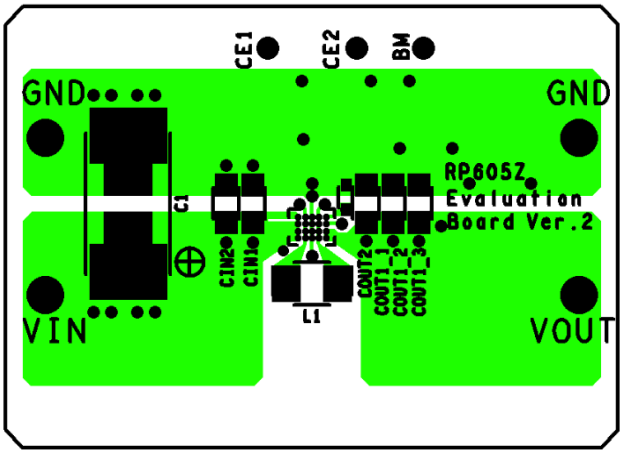
3: The division ratio of BM output = V_{IN}/3

B: DC/DC auto-discharge is included.

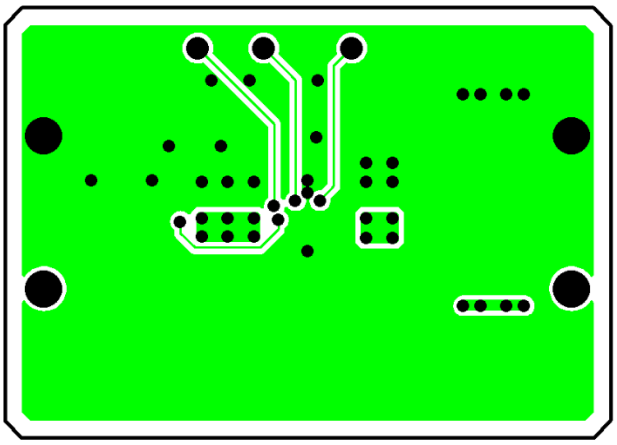
PCB LAYOUT

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

Top Layer



Bottom Layer



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"*	
Tj	Junction Temperature Range	−40 to 125	°C
Tstg	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

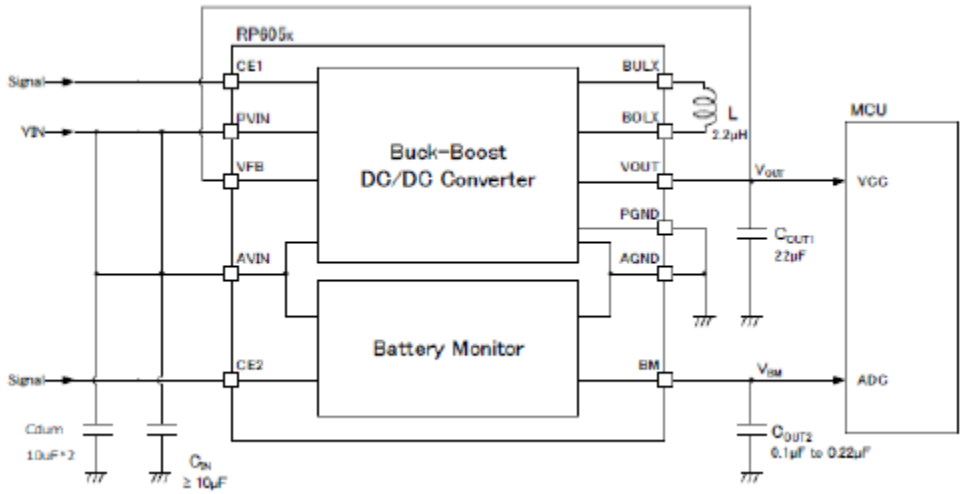
Recommended Operating Conditions

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

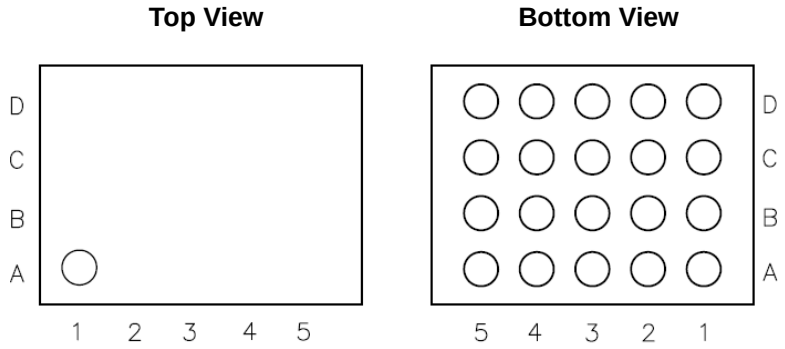
Recommended External Components[*1]

Symbol	Value
L	2.2 µH
C_{IN}	10 µF
C_{OUT1}	22 µF
C_{OUT2}	0.1 µF
Cdum[*2]	10 µF 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

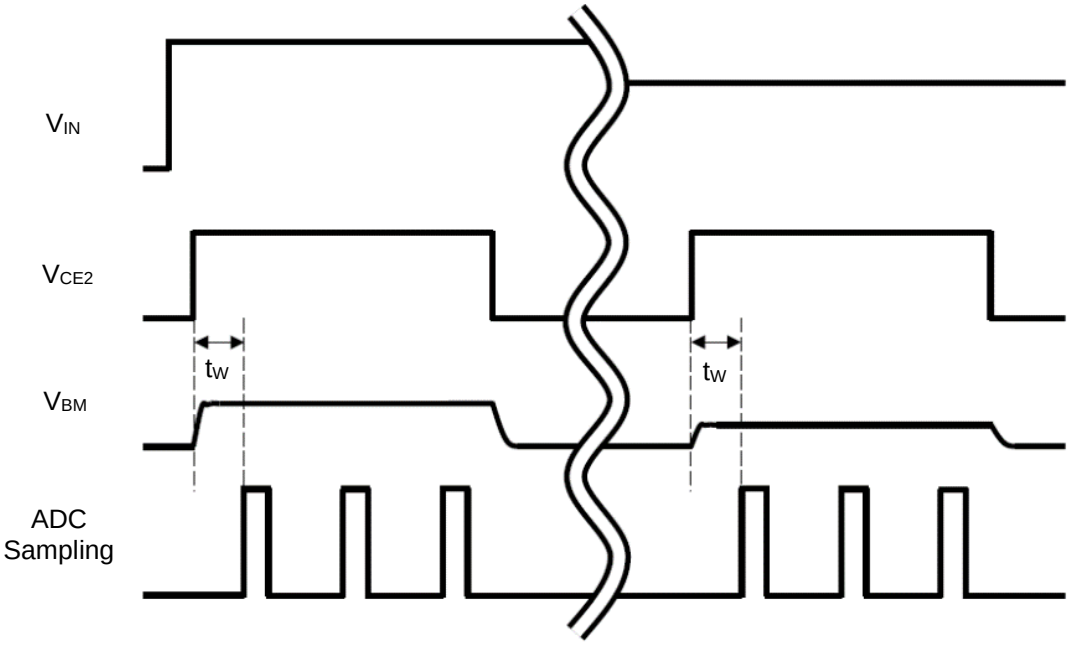
TECHNICAL NOTES

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 (tw) is needed, recommended tw ≥ 10ms, for the CE2 pin to gain stable V_{BM}.

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Halogen Free

Ricoh is committed to reducing the environmental loading materials in electrical devices with a view to contributing to the protection of human health and the environment.
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