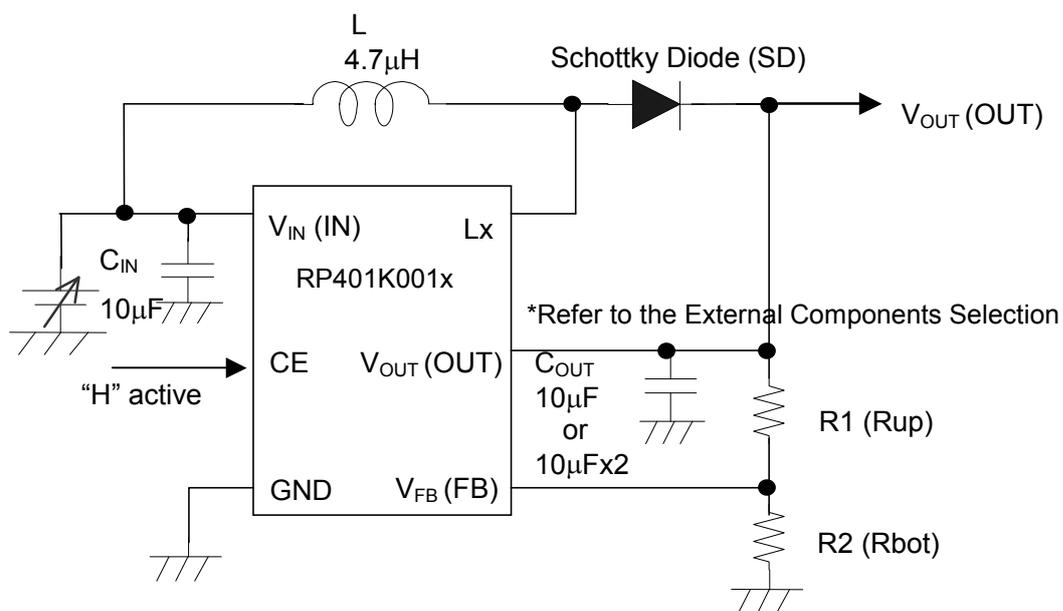


Design Guide

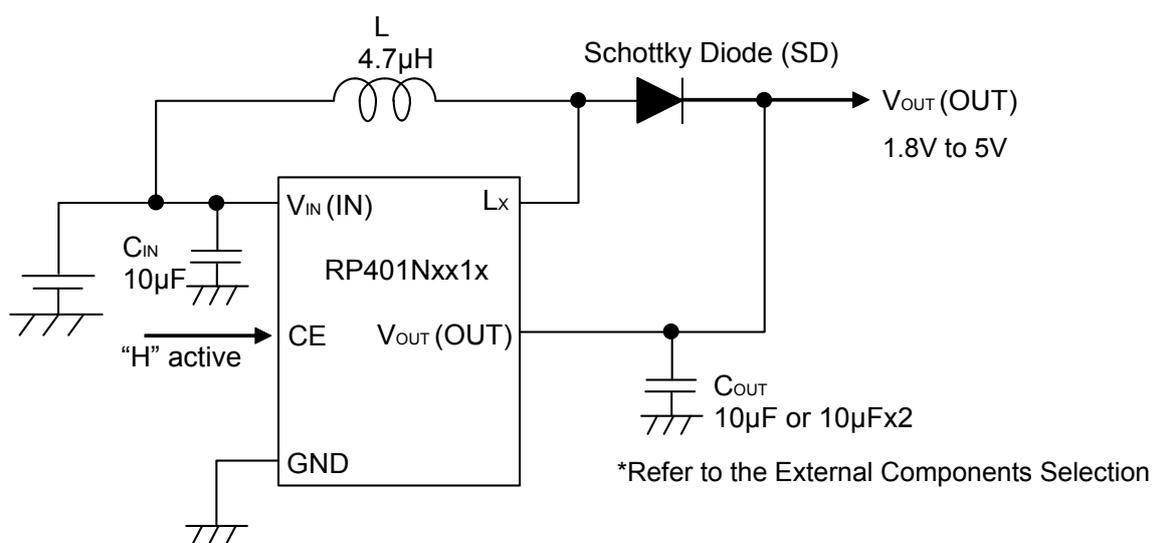
NO.ED-260-160812

■ TYPICAL APPLICATION

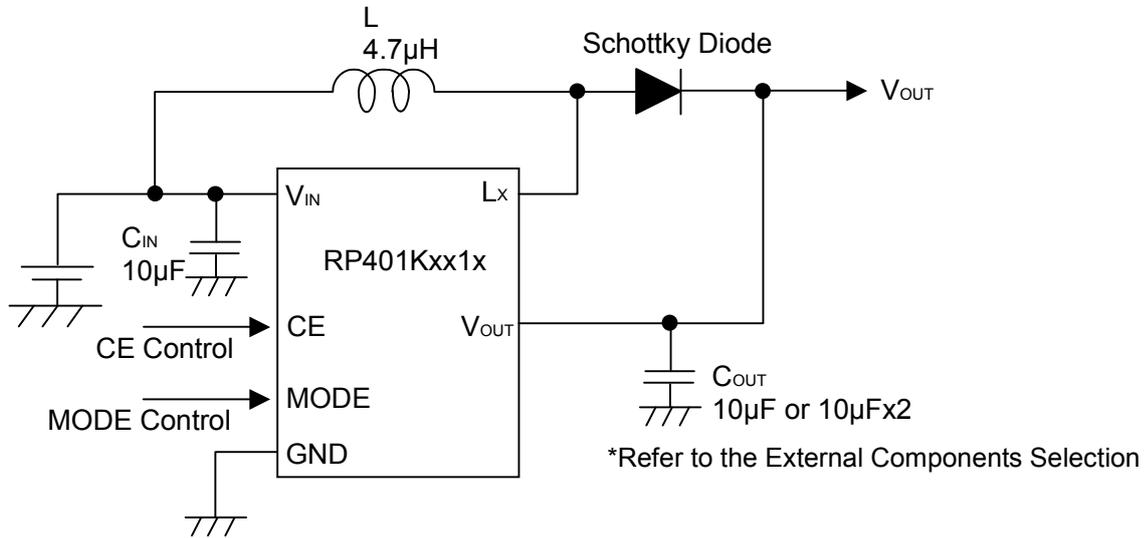
Adjustable Output Voltage Type: RP401K001C/D



Fixed Output Voltage Type: RP401Nxx1C/D



Fixed Output Voltage Type: RP401Kxx1A/B



■ EXTERNAL COMPONENTS SELECTION (Example)

Capacitor C_{IN} : C1608JB0J106M (10µF, TDK)

Capacitor C_{OUT} : Refer to the table below

V_{OUT} [V]	$I_{Lmax} < 700mA$	$I_{Lmax} \geq 700mA$
1.8 to 3.2	C1608JB0J106M×2 (10µF×2, TDK)	
3.3 to 5.5	C1608JB0J106M (10µF, TDK)	C1608JB0J106M×2 (10µF×2, TDK)

Diode: If $I_{Lmax} < 700mA$: CRS10I30A (TOSHIBA)

If $I_{Lmax} \geq 700mA$: CMS06 (TOSHIBA)

Inductor: SLF6028T-4R7M1R6-PF (4.7µH, TDK)

■ TYPICAL BOARD LAYOUT

●Current path on PCB

The current paths in an application circuit are shown in Fig.1 and Fig.2 (Boost).

The current paths when the internal driver MOSFET turns on are shown in Fig.1, and the current paths when the internal driver MOSFET turns off are shown in Fig.2.

In the pointed paths with red arrows in Fig.2, a current flows only during the internal driver MOSFET turning on, or off. Therefore, the parasitic impedance, inductance and the capacitance of these paths have a bad impact on the stability of the DC/DC converters and may cause the noise generation. To make minimize this effect, the board layout must be done to make these parasitic elements as small as possible. Further, the wiring of current paths shown in Fig.1 and Fig.2 must be as short and wide as possible.

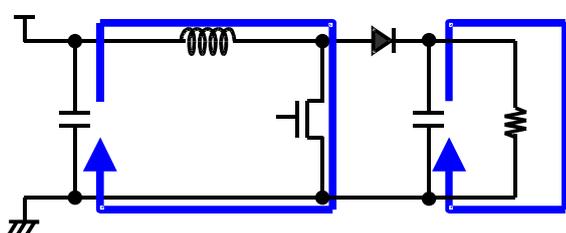


Fig.1 MOSFET-ON

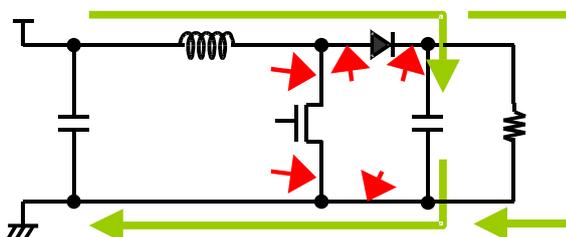


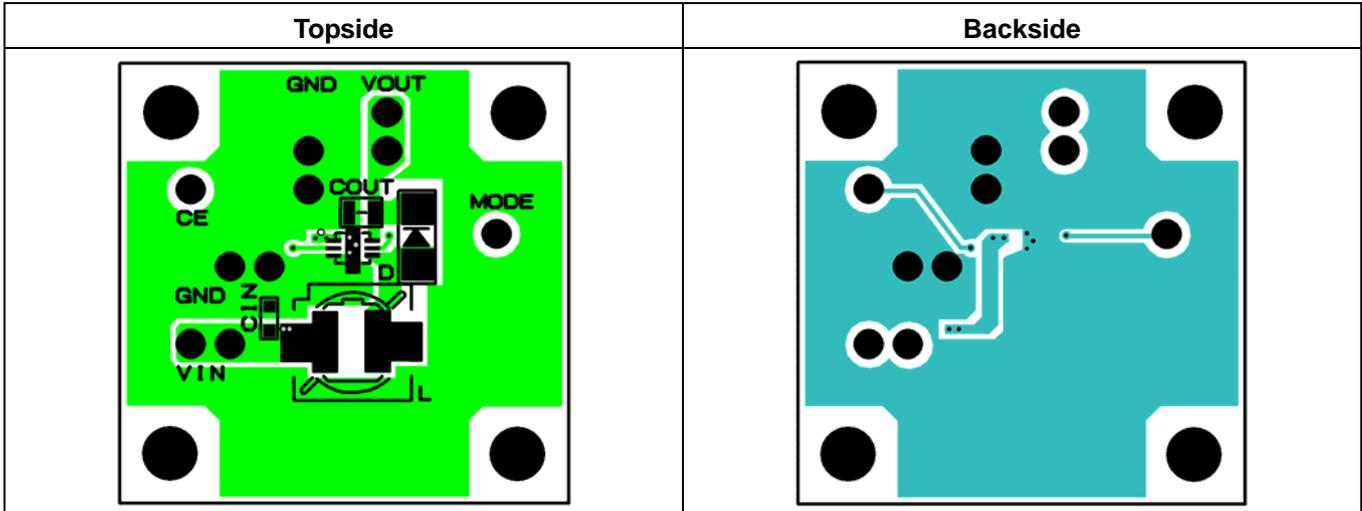
Fig.2 MOSFET-OFF

●Layout Guide for PCB

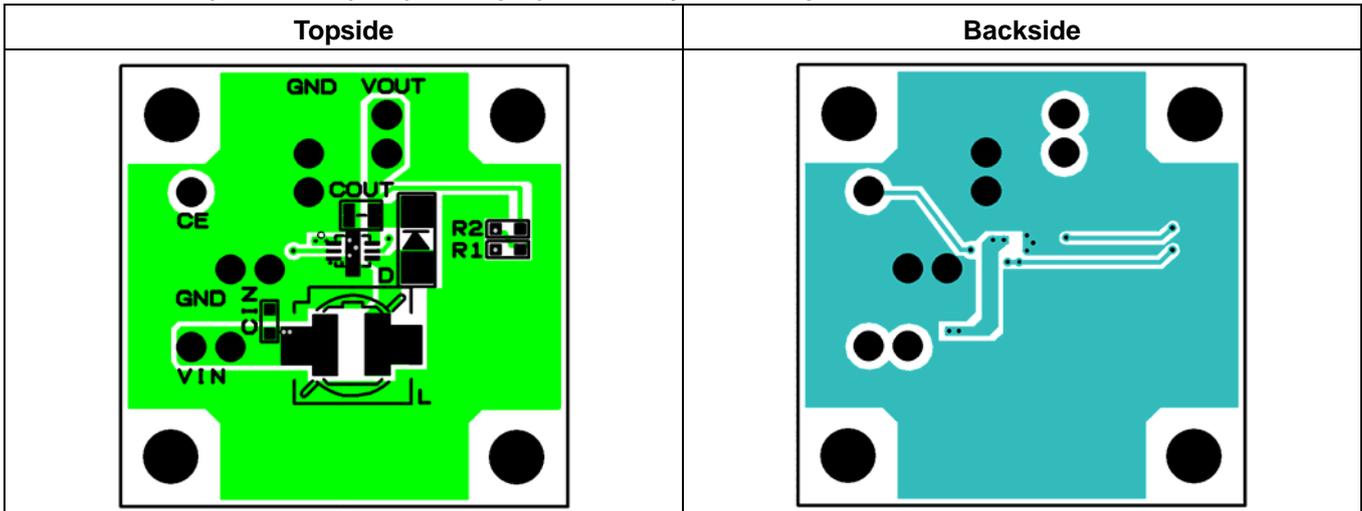
- Make V_{IN} and GND lines sufficient. A large switching current flows through V_{IN} and GND lines. If their impedance is too high, the internal voltage level may shift by the switching current and unstable operation may result. When the internal Lx switch turns off, by the effect of the inductor, spike voltage may be generated, therefore, the voltage rating of the C_{OUT} and the shottky diode is better to be selected at least as 1.5 times as much as the set output voltage.
- Diode selection: Low forward voltage (Vf) Schottky barrier diode, and low reverse current, and fast switching speed acceptable type is recommended.
- Capacitor selection: As the operation of the RP401, once the boost operation is secured, the output of the V_{OUT} is becomes the main voltage supplier for the IC, therefore, the capacitor between V_{OUT} and GND has a role of the bypass capacitor of the IC. Considering the bias characteristics, the capacitor between V_{OUT} and GND must be 10 μ F or more. Ceramic capacitor must be put as close as possible to the V_{OUT} pin and GND pin. We recommend mounting as much as 10 μ F input capacitor between V_{IN} and GND as C_{IN} .
- Inductor Selection: We recommend 4.7 μ H as the suitable inductance value. Small DC resistance and enough permissible current and hard to reach magnetic saturation are the desirable characteristics.
- If the spike noise of the Lx pin is large, mount a snub circuit (CR serial connection) in parallel with the diode to reduce the spike noise. The time constants of CR largely depends on the PCB and have some influence on the efficiency, therefore the evaluation on the exact PCB is necessary. Reference initial value is 10 Ω and 300pF.

* The performance of the power circuit using this IC largely depends on the external components. Choose the suitable external components and especially, do not exceed beyond the absolute maximum ratings (such as voltage, current and power) of the IC and external components.

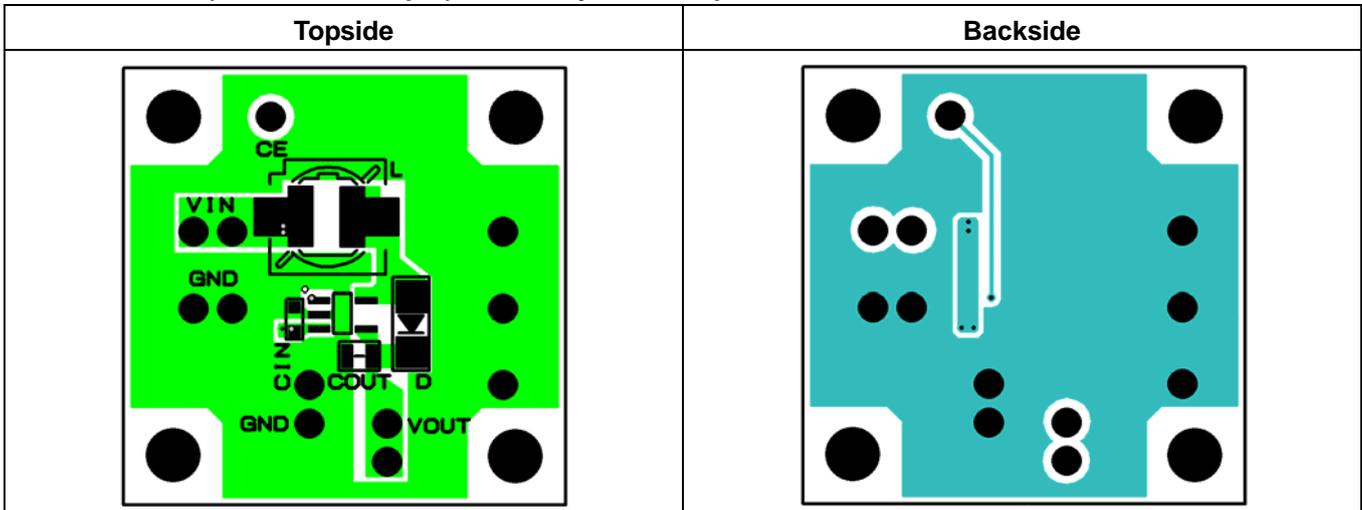
RP401Kxx1A/B (PKG: DFN(PLP)1820-6pin) Board Layout Example



RP401K001C/D (PKG: DFN(PLP)1820-6pin) Board Layout Example



RP401Nxx1C/D (PKG: SOT-23-5pin) Board Layout Example





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 Ricoh 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 Ricoh.
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 Ricoh'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. Please contact Ricoh sales representatives should you have any questions or comments concerning the products or the technical information.



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.

Ricoh has been providing RoHS compliant products since April 1, 2006 and Halogen-free products since April 1, 2012.

RICOH RICOH ELECTRONIC DEVICES CO., LTD.

<http://www.e-devices.ricoh.co.jp/en/>

Sales & Support Offices

RICOH ELECTRONIC DEVICES CO., LTD.

Higashi-Shinagawa Office (International Sales)
3-32-3, Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-8655, Japan
Phone: +81-3-5479-2857 Fax: +81-3-5479-0502

RICOH EUROPE (NETHERLANDS) B.V.

Semiconductor Support Centre
Prof. W.H. Keesomlaan 1, 1183 DJ Amstelveen, The Netherlands
Phone: +31-20-5474-309

RICOH INTERNATIONAL B.V. - German Branch

Semiconductor Sales and Support Centre
Oberrather Strasse 6, 40472 Düsseldorf, Germany
Phone: +49-211-6546-0

RICOH ELECTRONIC DEVICES KOREA CO., LTD.

3F, Haesung Bldg, 504, Teheran-ro, Gangnam-gu, Seoul, 135-725, Korea
Phone: +82-2-2135-5700 Fax: +82-2-2051-5713

RICOH ELECTRONIC DEVICES SHANGHAI CO., LTD.

Room 403, No.2 Building, No.690 Bibo Road, Pu Dong New District, Shanghai 201203, People's Republic of China
Phone: +86-21-5027-3200 Fax: +86-21-5027-3299

RICOH ELECTRONIC DEVICES CO., LTD.

Taipei office
Room 109, 10F-1, No.51, Hengyang Rd., Taipei City, Taiwan (R.O.C.)
Phone: +886-2-2313-1621/1622 Fax: +886-2-2313-1623