

RT5716 Design Tips and System Application Examples

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Richtek has launched a high-frequency, miniaturized [RT5716](#) synchronous Buck converter, featuring an ultra-small wafer-level chip scale package (WLCSP) with dimensions of 1.04x0.69mm². It operates at a switching frequency of up to 4MHz, and the overall circuit design size is only 4.65mm², saving 38% of the PCB layout area compared to the previous generation of Richtek's Hysteresis COT (HCOT) products.

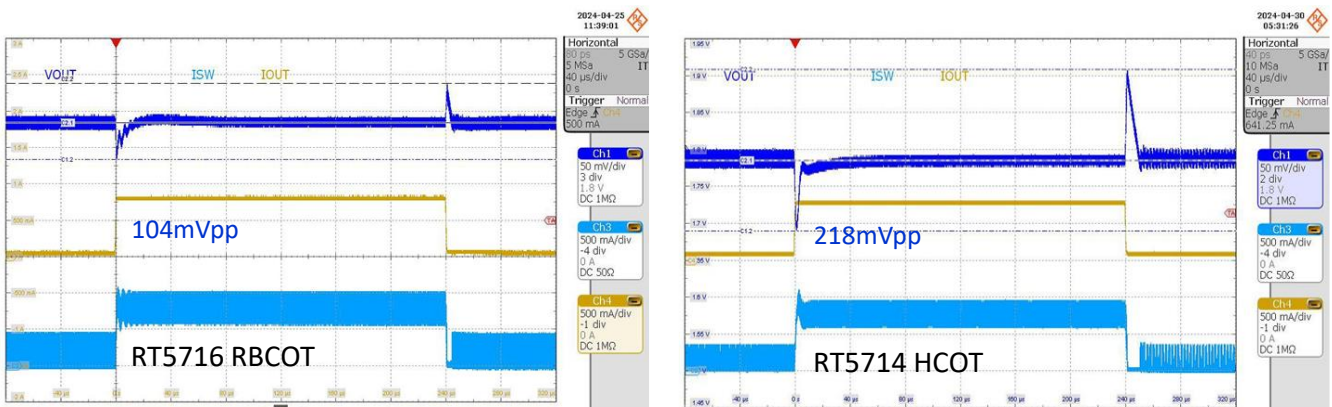
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1 RBCOT Topology

Based on the patented Hysteretic COT (HCOT) topology for enhanced load transient response, aiming for faster load transient response, we have introduced the latest Ripple-Based COT (RBCOT) topology. This control method injects the output voltage ripple variation into the control loop, allowing for more immediate detection of output voltage drops and adjustment of the on-time period. When the output voltage has not yet reached the rated value, the on-time can be adjusted according to the load current changes, achieving superior voltage compensation capability compared to the HCOT topology.

The [RT5716](#) synchronous Buck converter adopts the RBCOT topology and features a high switching frequency of 4MHz. This product has enhanced load transient response, achieving optimal performance across various load and output capacitance ranges. Its transient response (0.05A to 0.8A, slew rate time = 1 μ s) voltage variation is only Vpp = 104mV, which is just 41% of the previous generation products, significantly increasing transient response. This is crucial for certain circuit applications, especially digital power supply systems, where the load current has characteristics of instantaneous changes. If the output voltage exhibits significant fluctuations while the load current suddenly increases or decreases, it may cause control logic failure, leading to operational anomalies. For example, issues such as temporary communication interruptions or audio signal disruptions may occur, affecting the system's stability and performance.



Load transient test condition: $V_{IN} = 3.6V$, $V_{OUT} = 1.8V$, $I_{OUT} = 50mA$ to $800mA$, slew rate = $1\mu s$

2 Product Features

To provide high design flexibility, we offer two packaging options: TWL-CSP-6B 0.69mm x 1.04mm (BSC), suitable for wearable and miniature devices; and WDFN-6L 1.5mm x 1.5mm (FC) packaging, suitable for general products. The [RT5716](#) has an input voltage range of 1.8V to 5.5V and an output voltage range of 0.4V to 3.3V, with a maximum supply current of up to 1A. By connecting a resistor between the RSEL/MODE pin and GND, 16 selectable output voltage levels can be provided.

3 Reference Design Examples

As mobile and wearable devices, such as smartwatches and asset trackers, become increasingly thin and compact in design, the requirements for component size are becoming more stringent. In these applications, the [RT5716](#), with its high switching frequency of 4MHz, allows designers to use smaller peripheral components, such as low-inductance inductors, further reducing the overall circuit size. Moreover, the [RT5716](#) can provide a smaller output ripple, making it ideal for applications sensitive to noise ripple.

Additionally, with the advancement of semiconductor process technology, MCUs/SOCs require lower operating voltages. The [RT5716](#) fully meets this trend, with a minimum output voltage as low as 0.4V, significantly lower than Richtek's first-generation COT product [RT5707](#) ($V_{out\ min} = 0.7V$) and the second-generation HCOT product [RT5714](#) ($V_{out\ min} = 0.525V$). With its high switching frequency, low output voltage, and ultra-small packages, the [RT5716](#) is the ideal choice for applications requiring small form factors.

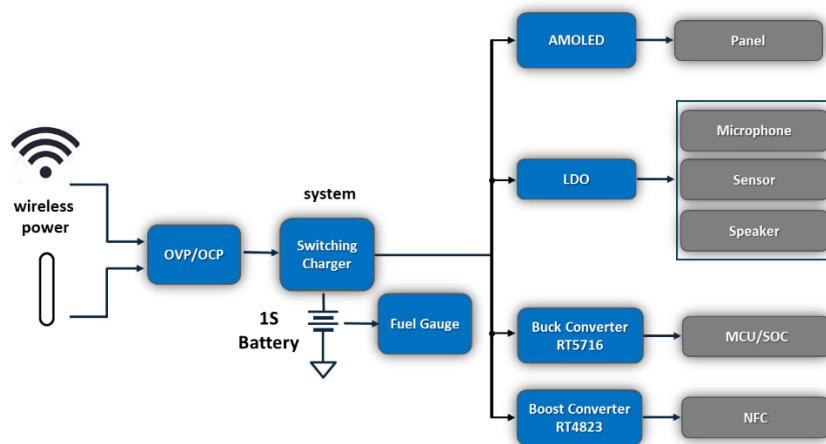


Figure 1. Application Examples for Mobile/Wearable Devices Supplying MCU/SOC

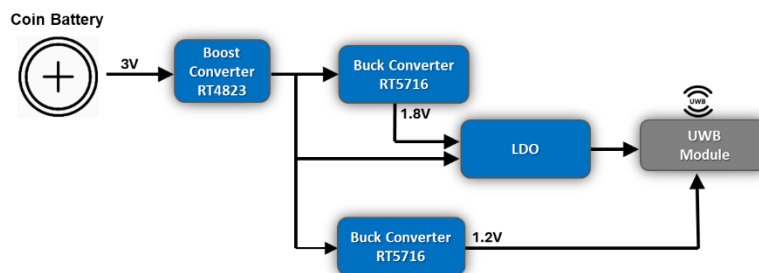


Figure 2. Application Examples for Asset Tracker

Note: The application system diagrams are for reference only. Products must be evaluated and adjusted based on your specific requirements. For assistance, please contact our regional offices near you.

4 Conclusion

Richtek's [RT5716](#) synchronous Buck converter delivers high performance, making it ideal for compact designs. With unique RBCOT topology and high switching frequency of 4MHz, it optimizes voltage stability in minimal PCB space. Flexible output voltage options also make the [RT5716](#) suitable for wearables, asset trackers, and other small devices. The above summary concludes the contents covered in this application note. To stay informed with more information about our products, please [subscribe to our newsletter](#).

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