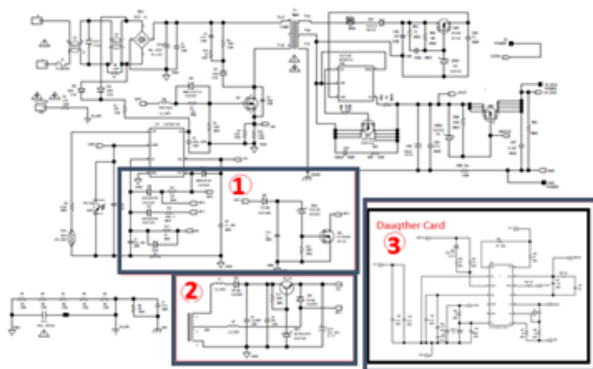


## FOR 45W ADAPTORS IN LOW-COMPONENT-COUNT, SINGLE-LAYER PCB DESIGNS

Richtek USB Power Delivery Type-C Adapter Solutions: RT7791 and RT7202K

The USB PD Type-C is the next-generation universal interface revolutionizing the way we charge our devices. It has increasingly been adopted as the standard for many devices. To make it more affordable and easy to integrate within your designs, Richtek has developed the low-component-count and cost-effective solution: RT7791 and RT7202K for 45W or 60W adaptor designs.

Conventional USB PD adaptor can cost more than double the price of the Richtek solution because they require components which require double layer design. The Figure 1 shows an example circuit of a conventional 45W adaptor where the extra circuit, marked as 1, 2 and 3 is needed for a USB PD design.



▲ Figure 1. The example of 45W conventional adaptor design

The first part in the Figure 1 is to solve the loop stability problem and to adjust the current sense resistor value in order to meet the safety requirement of Limited Power Source (LPS) requirement.

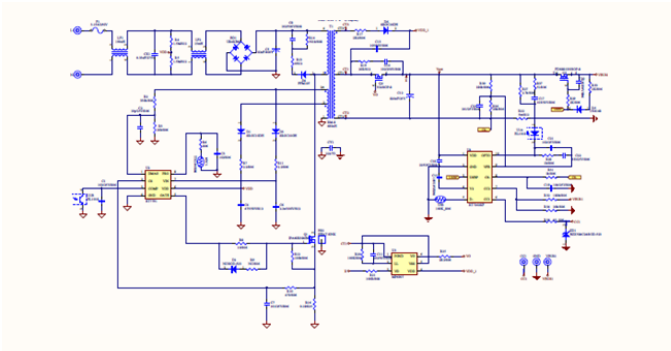
The second part is to reduce the power saving during standby mode (cable attached without load) in order to meet the 2013 ErP standby regulation, which should be

less than 0.5W at 0.25W load. Additionally, since the output voltage range varies from 5V to 20V, the maximum supply voltage (VDD) of a PWM controller could reach up to 60V, which will exceed the maximum VDD voltage rating. An external regulation circuit and two layers of auxiliary wiring is required to protect VDD and to meet the 2013 ErP power saving target.

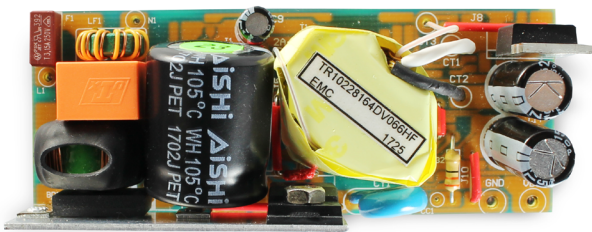
The third part is the USB PD IC and its peripheral components. This design example uses a two-layer PCB design with one daughter card for USB PD related circuitry, which allows sufficient circuit area while meeting the functionality. However, as a consequence of its design complexity it will have higher costs.

To simplify the design above and reduce the cost, Richtek has developed the 45W adaptor solution using RT7791 and RT7202K.

The RT7791 is a PWM controller with an integrated 70V LDO housed in a SOP-8 package. Without any external regulation circuit or extra auxiliary wiring, the RT7791 is designed to meet the 2013 ErP power saving regulation. It also has built-in loop stability compensation and adaptive OCP to meet LPS with extra components. Together with the RT7202K, which is a USB PD Type-C controller in a tiny SOP-10 package, Richtek's 45W adaptor design successfully reduces 23 external components and accomplishes in a single layer PCB without any extra daughter card. Please see the Figure 2 below for our solution. Please [contact us](#) if you would like to find more details on the reference design.



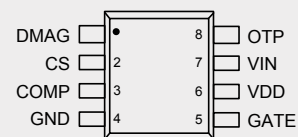
▲ Figure 2. Richtek's USB PD Type-C solution for 45W adaptor designs



▲ Figure 3. Single-Layer PCB design in Dimension: L80mm x W32mm x H21mm

## RT7791 Key Features

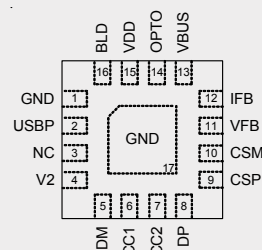
- Integrated 70V Low-Dropout Regulator (LDO)
- Optimized for Adaptive Output Power
  - Wide VDD Range : 10V to 41V
  - Adaptive Output Over-Voltage Protection
  - Adaptive Cycle by Cycle Over-Current Protection based on the output voltage to meet the Linear Power Source regulation
  - Adaptive Loop Gain Control for Loop Stability
- Green Mode Operation at Light Load or No Load < 50mW in 5V Standby Mode for Power Saving
- SmartJitter™ Technology to improve EMI
- Comprehensive Protection Features
  - Bulk-Capacitor Brown-In and Brown-Out Protection
  - OTP Pin for External Over-Temperature Protection
  - Secondary Rectifier Short-Circuit Protection
  - Output Over-Voltage and Under-Voltage Protection
  - Programmable Line Compensation
  - VDD Over-Voltage Protection
- SOP-8 package



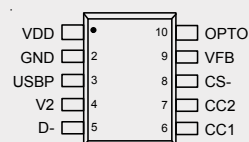
SOP-8

## RT7202K Key Features

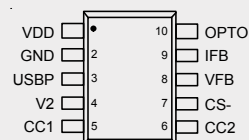
- Protocols Support USB PD 3.0 and PPS specifications (TID: 1080014)
- Built-in Shunt Regulator for Constant-Voltage and Constant-Current Control
- Programmable Cable Compensation
- BLD Pin for Quick Discharge of Output Capacitor (RT7202KD)
- VDD Pin for Quick Discharge of Output Capacitor (RT7202KE/KF)
- VBUS Pin for VBUS Voltage Detection and VBUS Capacitor Fast Voltage Discharge
- USBP Pin for Direct Drive of External Blocking N-MOSFET
- Comprehensive Protection
  - Adaptive Output Over-Voltage Protection
  - CC1/CC2/D+/D- Over-Voltage Protection
  - Firmware-Programmable Over-Current Protection
  - Adaptive Under-Voltage Protection
  - Firmware-Programmable Over-Temperature Protection
- SOP-10 Package or WQFN-16L 4x4 Package



WQFN-16L 4x4 (RT7202KD)



SOP-10 (RT7202KE)



SOP-10 (RT7202KF)

## TOOLS AND SUPPORT

We also provide product design tools and documents to accelerate your design process, and support any quality-related requirements. Please [contact us](#) for more information.

## AVAILABILITY, PACKAGING AND PRICING

The RT7791 and RT7202K products are now available through the Richtek regional offices and authorized distributors. Please [contact us](#) for pricing.

Contact US

E-Mail: [usbpd@richtek.com](mailto:usbpd@richtek.com)

Website: [www.richtek.com](http://www.richtek.com)

**RICHTEK**

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## FIND OUT MORE ABOUT RICHTEK USB PD SOLUTIONS

Richtek is continuously expanding the power management solutions for various [USB Type-C with Power Delivery applications](#), from Type-C power adapter, Car charger, Display, Power Bank, Cable ID to full function Dual Role Power applications such as Smart Phones.

For more information, please see the application note "[Introduction to Richtek USB Type-C Power Delivery Solutions](#)". You can also find other Richtek USB PD solution on the [application page](#) and the list of USB PD products on the [product page](#). If you would like to have more information on the USB Type-C PD samples and design kits, please contact your nearest [Richtek sales office](#).