

THE NEW USB POWER DELIVERY CAR CHARGING SOLUTION

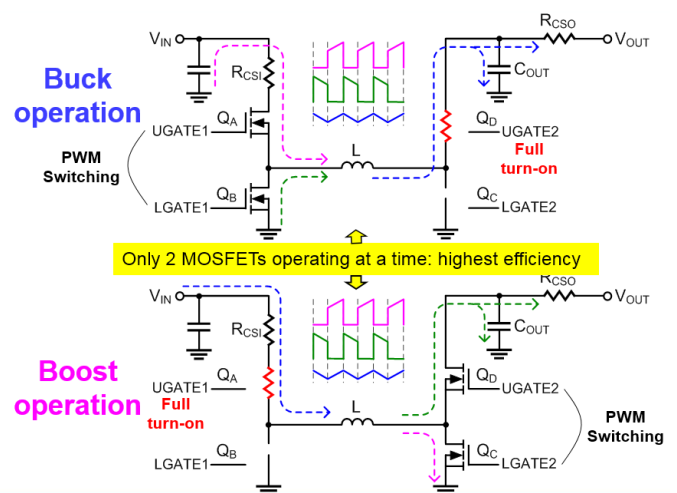
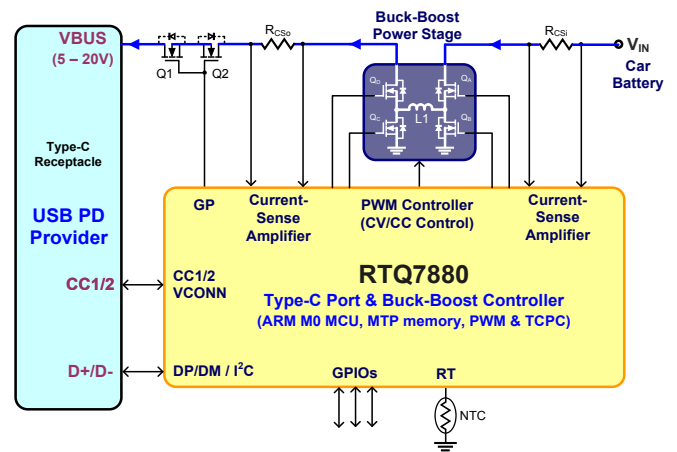
The RTQ7880 device is ready to fulfill the requirements of current and future car chargers

In the past, car chargers were designed for charging mobile phones. A simple Buck converter was sufficient to support a single-port output below 15 watts. However, with the growing demand for charging high power portable devices such as tablets and laptops through car chargers and the wide adoption of Type-C connectivity in the new generations of these devices, the adoption USB-C Power Delivery car charging systems is just a matter of time.

The RTQ7880 is the world's first integrated IC device that combines a USB Type-C power delivery (PD) and a Buck-Boost controller, making it a true one-chip solution for the new generation high power car chargers. Featuring high power, high efficiency, high power density, high flexibility and comprehensive protection functions, the RTQ7880 device is ready to fulfill the requirements of current and future car chargers.

Adding the power delivery function brings new challenges to existing car charger designs. The required output power and power density increase dramatically: Whereas previous charger ports only needed to provide 7.5W or 15W in step down mode only, the new Power Delivery port can deliver output powers up to 100W with a wide output voltage range. This requires high efficient step-down/step-up power conversion with well-designed thermal properties and protections. RTQ7880 uses a high efficient full-bridge buck-boost topology, with seamless buck to boost transition and programmable frequency to optimize efficiency. RTQ7880's thermal sensing capabilities provide programmable power reduction when exceeding temperature limits. RTQ7880's input voltage and input current sensing can be used for automatic power reduction in low car battery voltage conditions.

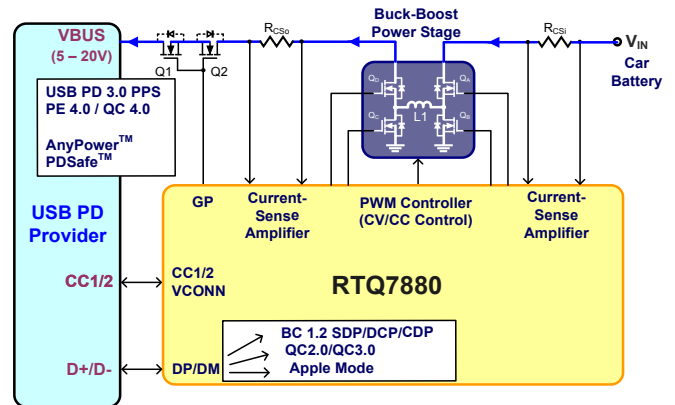
Several functions have been added to the USB-C PD standard seen since it was released in 2012. Starting with



5V/9V/15V/20V fixed voltage output range, the latest PD 3.0 standard now includes Programmable Power Supply (PPS), which requires a wider output voltage range: 3.3V-11V, 3.3V-16V and 3.3V - 21V, for 27W, 45W and 60W/100W output power respectively. The output voltage and current must be programmable in 20 mV and 50mA per step. USB PD PPS can be used for Direct Charge and Direct Charge with divide by 2 systems, and is now adopted by both MediaTek's PE4.0 and Qualcomm's QC4.0 charging standards. The RTQ7880 MTP memory firmware can be updated via the USB port. Below scenario connects a Richtek I²C bridge to the USB-C port. The MTP memory can then be updated via specific I²C commands over the D+/D- Lines. Another scenario in a USB-C with data system could be to have the Head Unit connect to the RTQ7880 slave I²C bus for firmware update. This online firmware update feature makes an RTQ7880 charger application future proof.

PPS	Fixed Nominal Voltage			
	5V Prog ≤15W	9V Prog ≤27W	15V Prog ≤45W	20V Prog 60/100W
Maximum Voltage	5.9V	11V	16V	21V
Minimum Voltage	3.3V	3.3V	3.3V	3.3V

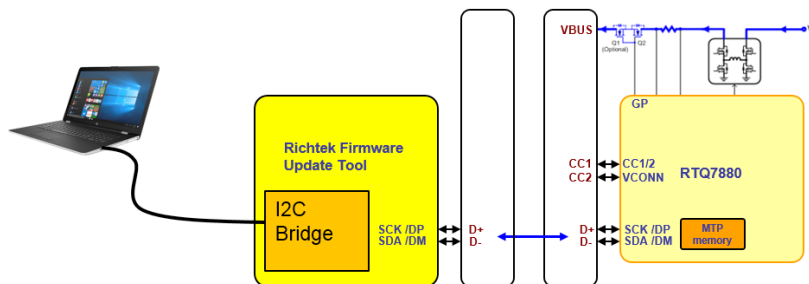
Example: A 27W PPS charger needs to support: 5V/3A, 9V/3A, 3.3V-5.9V/3A, and 3.3V~11V/3A



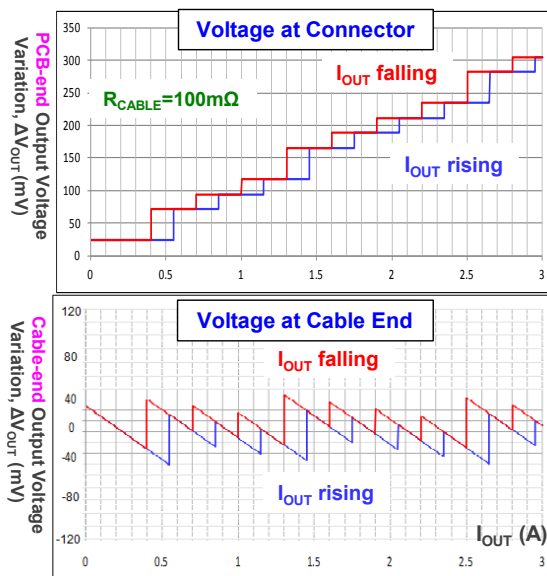
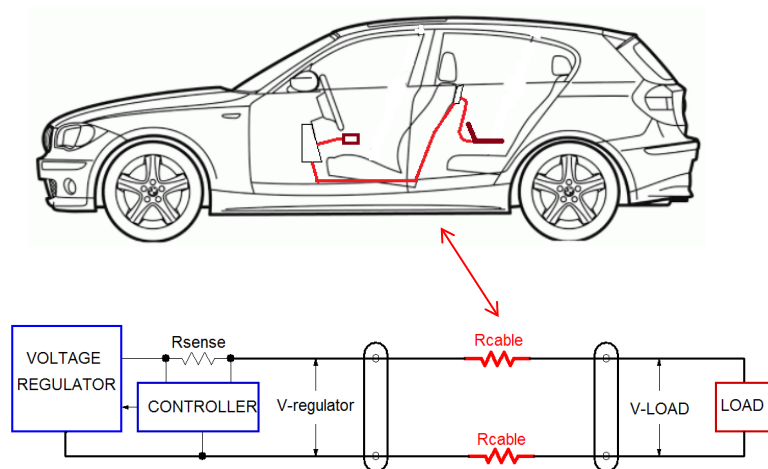
Richtek, being a member of USB Implementers Forum, has designed the RTQ7880 with high flexibility: The on-board ARM MCU and fully programmable PWM block enable a special AnyPower™ function, which meets the latest USB PD 3.0 with PPS requirements. Furthermore, RTQ7880 includes a wide range of protection functions which are all hardware controlled, making this system truly PDSafe™.

For charging systems that need to support non-USB-C legacy devices, RTQ7880 includes USB data-line sensing circuits, which can detect BC 1.2, QC2.0 and QC3.0 and Apple mode systems.

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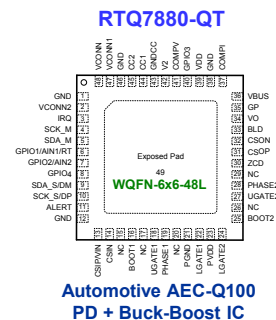
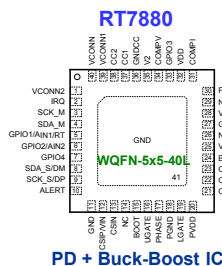
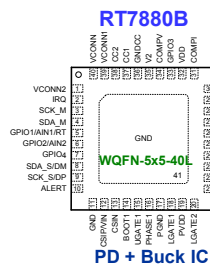


With higher power charging for tablets and notebooks, it is quite likely that rear-seat passengers may want to charge their devices as well. At higher charging currents, long cables can cause unwanted voltage drops. RTQ7880 includes a 9-step programmable cable drop compensation function, which adjusts the output voltage based on charging current. The voltage compensation value is adjustable for different cable lengths. The result is a charging voltage at the charging cable end that varies less than $\pm 50\text{mV}$ over charge current.



RTQ7880 has several GPIO pins that can be used for various functions: LED indication, firmware option settings or communication with other devices: For example in a dual charging port system, the GPIOs can be used to communicate between the two port controllers.

Richtek currently offers three TCPC USB-C PD + PWM controller devices for Car chargers: RT7880BGQW (consumer grade Buck only), RT7880GQW (consumer grade Buck-Boost) and RTQ7880GQW-QT Buck-boost (Automotive AEC-Q100 grade-2 with wettable flank QFN package).

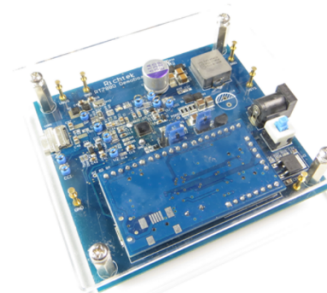
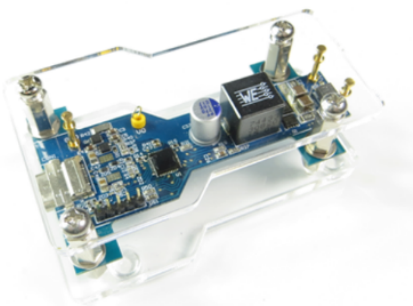
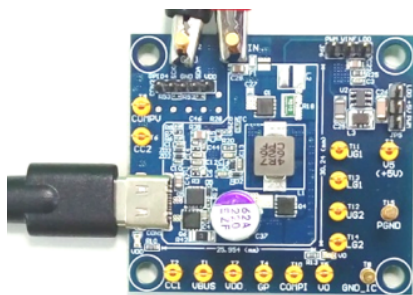


RT7880 Key Features

- Built-in 32bit ARM Cortex™ M0 MCU
- Support USB PD 3.0 PPS and various mainstream fast charging and direct charging communication protocols
- Integrated PWM Buck-Boost controller with programmable switching frequency (200kHz to 600kHz)
- Built-in constant voltage and constant current control circuit for high resolution (20mV/step; 50mA/step), and for highly accurate constant voltage (+/-5%) and constant current (+/-150mA) control
- 4V-36V wide input voltage range and 3V-21V output voltage range
- Built-in Charge Pump for driving cost-effective N-MOSFETs as the power channel control
- Support power up to 100 watts (20V/5A)
- Built-in VBUS fast discharge circuit
- Support CC1, CC2, D+,D- I²C(Master),and I²C(Slave) interfaces
- Support up to 10 GPIOs
- Comprehensive and programmable protection settings including over-voltage, over-current, over-temperature, under-voltage, and short-circuit protections which can be set to automatic recovery, latch-up, or hysteresis mode
- The embedded MTP memory allows the RT7880's firmware to be updated by an EC (Embedded Controller) or AP (Application Processor) through the I²C slave interface
- Available in WQFN-40L 5x5 Package and WQFN-48L 6x6 wettable flank package

TOOLS AND SUPPORT

We also provide RT(Q)7880 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

Offered in WQFN-40L 5x5 Package and WQFN-48L 6x6 wettable flank package, the RT(Q)7880 products are now available through the Richtek and authorized distributors. Please [contact us](#) for pricing.

Contact US

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RICHTEK

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](#).