



everyday genius

Pump Express Plus™

MediaTek Technology White Paper

April 2015

Introducing Pump Express Plus™

Pump Express Plus™ is a fast-charging technology that cuts battery charge times in half for mobile devices like smartphones and tablets. When built into a device's power management integrated circuit or charger IC, Pump Express Plus™ can recharge a battery twice as fast as a standard charger, giving a 75% charge in around 30 minutes. The high power Pump Express Plus protocol enables the phone or tablet to request voltages as high as 7V/9V/12V from the power adapter to provide safe and reliable power transfer at 24W or more. No special cables are needed and Pump Express Plus-enabled devices are compatible with existing USB mains chargers, but fast charging is only possible with a Pump Express Plus-enabled charger.



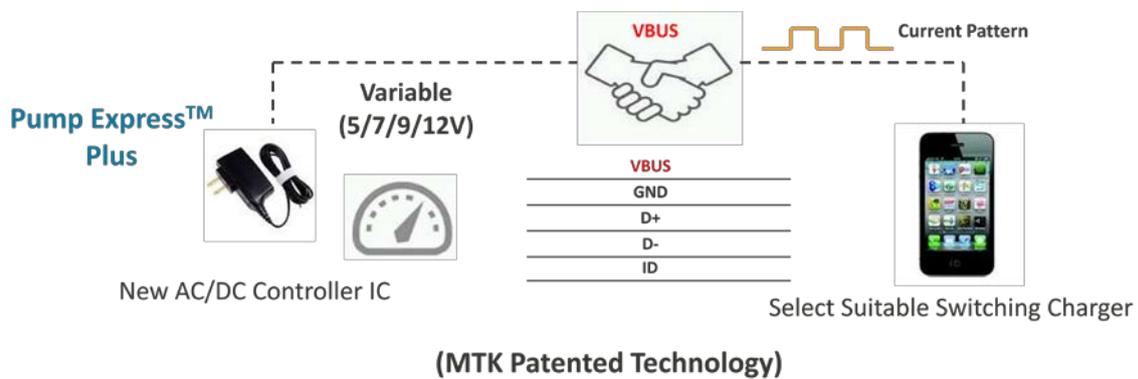
Functionality

The charger will work with 5, 7, 9, or 12 volt supplies and can provide more power. The range of higher voltages means that a single charger can work with a wide range of devices and also ensures high quality performance by reducing the impact of any voltage losses that appear over long cable distances or poor quality cables.

The commonplace USB 2.0 standards deliver just 0.5A of current, while USB 3.0 ports bump this up to 0.9A and also lay out a specification for dedicated charging ports which can provide 1.5A of current at 5 volts.

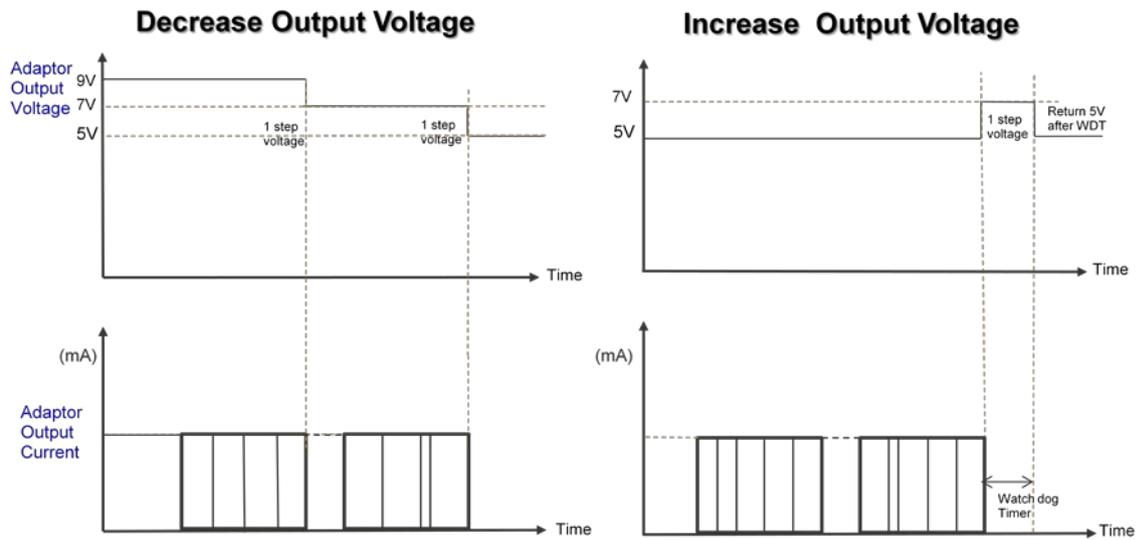
	USB 2.0	USB 3.0	USB 3.0	USB 3.1(PD2.0)	Pump Express Plus
Voltage	5V	5V	5V	5V / 12V / 20V	5V/7V/9V/12V
Max Current	0.5A	0.9A	1.5A	5V at 3A, 12V/ 20V at 5A	1.5~2A

Pump Express Plus controls supply current with custom current patterns that are recognized by AC/DC adaptor ICs, and adjust the output voltage accordingly. The custom current patterns include an “UP” control and a “DOWN” control for the AC/DC adaptor to step up or down the adaptor output voltage. As this method utilizes current control as the handshaking method between from the MTK device to the adaptor.



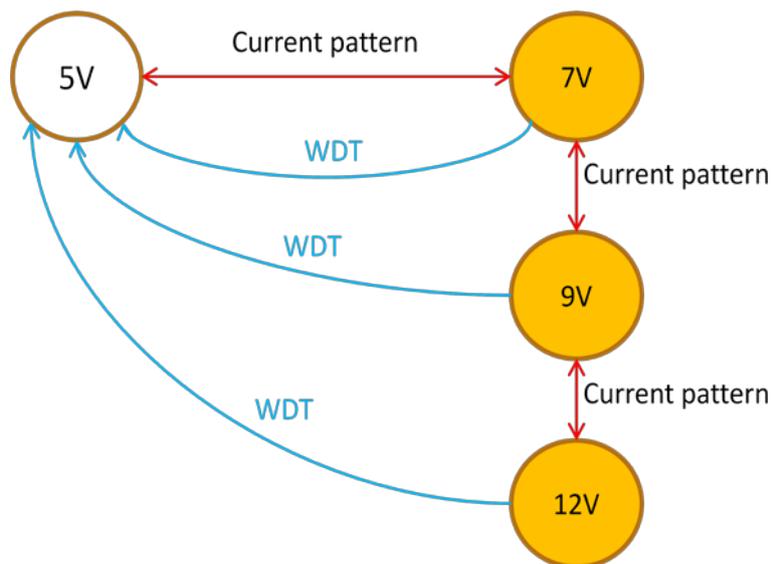
Operating Principles

Pump Express Plus modulates the output current of the AC/DC wall adapter. The phone generates a specific pattern of current corresponding to an “UP” or “DOWN” command to increase or decrease the wall adapter’s output voltage. Since load modulation is used for communication from the phone to the adapter, no secondary side IC is required in the wall adapter to encode the information received from the phone. Such approach minimizes the cost impact on the wall adapter.



Specific Pattern of Current

The portable device can apply the decrease commands, cycling through the voltages until reaching the final desired output voltage. The watchdog timer (WDT) monitors the output, and the output automatically resets to 5V if the output current goes below the minimum low current level for 240ms or longer. This serves two functions-- to act as a quick return to 5V and to determine if the adaptor is unplugged from the mobile device.



Voltage Control

Compatibility

The Pump Express Plus adaptor has a default output voltage of 5V, and there is no difference in the adaptor protection mechanism. Therefore, the Pump Express Plus adaptors is safe to use as a typical 5V adaptor for non-Pump Express Plus device charging. It is compatible with existing USB cable (1.5A) and backwards compatible with USB BC1.2, Type C , PD2.0 YDT1591 and traditional adaptors.

Safety

For the adaptor, there is no initialization or handshaking protocol. The output starts at a default 5V when initially powered, and stays at 5V until any command is received. When the fast charging mode is activated on Pump Express Plus adaptors, current and duration monitoring mechanisms are also enabled. When the Adaptor detects abnormal behaviors, it will enable protection mode by reducing the current to under a certain range, as well as restoring the output voltage to 5V.

Certification

The MediaTek Pump Express Plus certification program (certification unit : UL), in place since February 2015, offers two categories: Category A for devices that support Pump Express Plus, and Category B for devices that support Pump Express.

Conclusion

MediaTek provides excellent service to business partners and potential customers. Our reference design includes.

- Design guide
- Pump Express Plus Verify Guideline
- Adaptor and AC_DC controller certification list

Pump Express Plus technology offers safety, good compatibility, high quality and ease of mass production for customer. It provides consumers with more secure and efficient fast charging experience.