Department of Electronic Engineering

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FYP Project - Smart Charger

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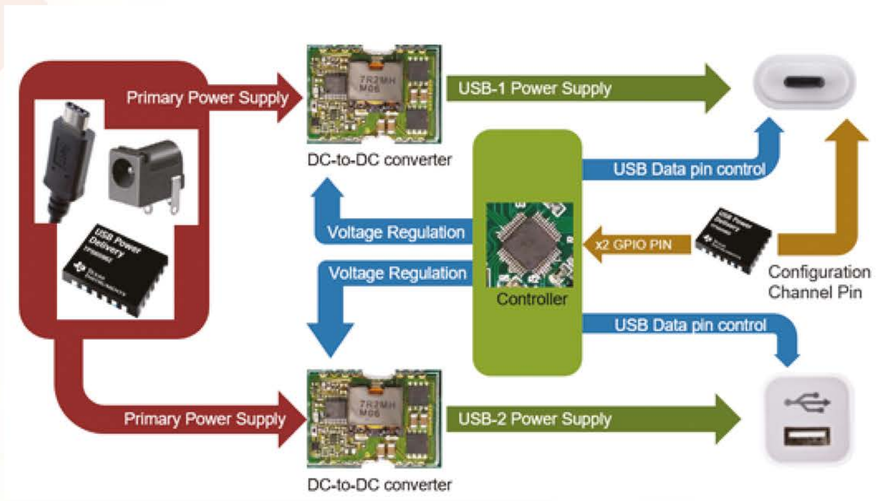
Abstract

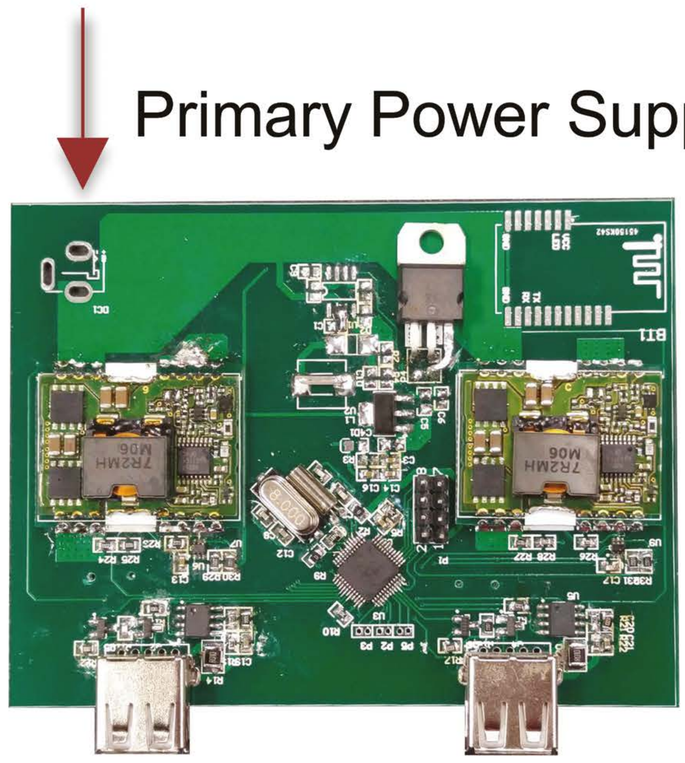
"USB power" has been widely used to charge electronic devices, such as mobile phones. To increase the power level for different applications and objectives, such as shortening the charging time of mobile charges, different charging standards, so-called "Fast Charge", have been proposed. They include Qualcomm Quick Charge (QC), MediaTek Pump Express Plus (PEP), USB Battery Charging (BC), and USB Type-C with USB Power Delivery (PD). As they are of different protocols and operating at different power and voltage levels, there exist compatibility problems. In other words, the mobile device must have the specific "fast charge" protocol before it can be powered or charged by the "special" USB port. The objective of this project is to develop a unified USB port, acting as an interface that can support abovementioned "fast charge" standards and a "smart USB" technology, which is developed by the City University of Hong Kong. The architecture of the USB port developed, named as "Smart Charger", is composed of an ARM-based embed system and a high-power DC-to-DC converter with adjustable output voltage. The maximum power output is 100W, which is sufficient for nowadays and upcoming devices. Such unique feature of allowing different "fast charge" protocols is believed to provide consumers and industry with a new perspective on the charging philosophy.

Design Objectives

The concept of Smart Charger provides an all-in-one solution for different kinds of mobile devices, such as mobile phones, battery banks, laptops, etc, using different charging standards.

Project Form Factor





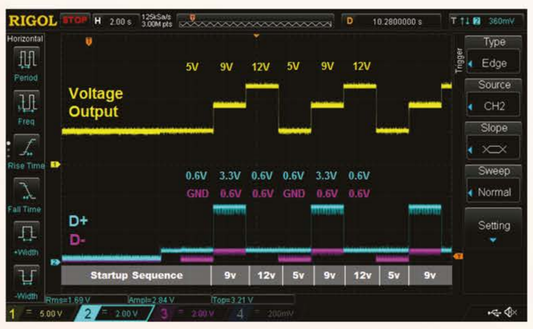
Feature of Project

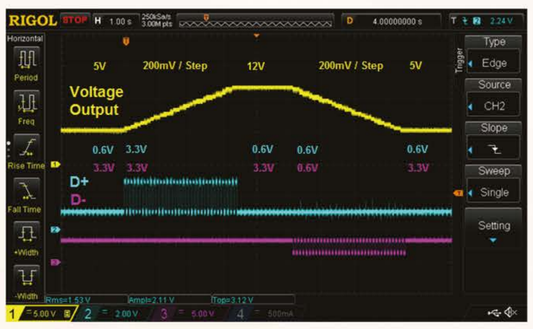
- Support multiple USB outputs
- Support multiple Fast Charge methods and protocols
- Allow firmware update
- Deliver maximum power output of 100W and maximum current of 5A
- Provide adaptive output voltage

Fast Charge Protocol Testing Result

Quick Charge Detection

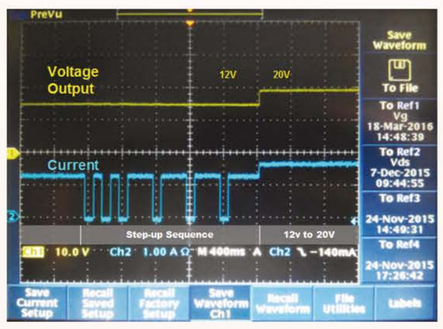
Qualcomm Quick Charge

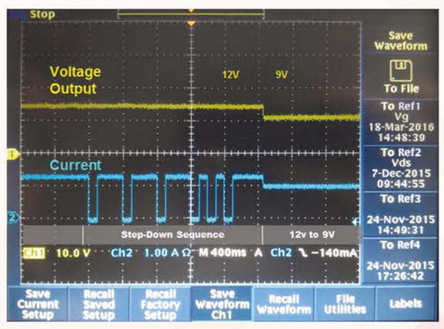




Pump Express Plus Detection

PumpExpress by MediaTek





Power Delivery Detection