*TI Designs: TIDA-00160*

# *USB Automotive Infotainment Charge Port Controller with Linear Cable Compensation - Controller Driven*

TEXAS INSTRUMENTS

**System Description**

This TI Designs provides detailed data for evaluating and verifying a USB Charger, which uses a USB charge controller, a buck controller and a shunt amplifier. It simulates an Automotive USB Charging device that offers Short-to-Battery protection. With the help of the shunt amplifier, the design aims to compensate the effects on Vdroop when the smartphone/tablet is connected to the USB charger using a cable that is roughly 2-3 meters long. The internal FET in the USB charge controller reduces the part count and solution size.

**Featured Applications**

- Automotive Infotainment, USB charging, hubs
- Cell Phone / Smart Phone / Tablet Chargers

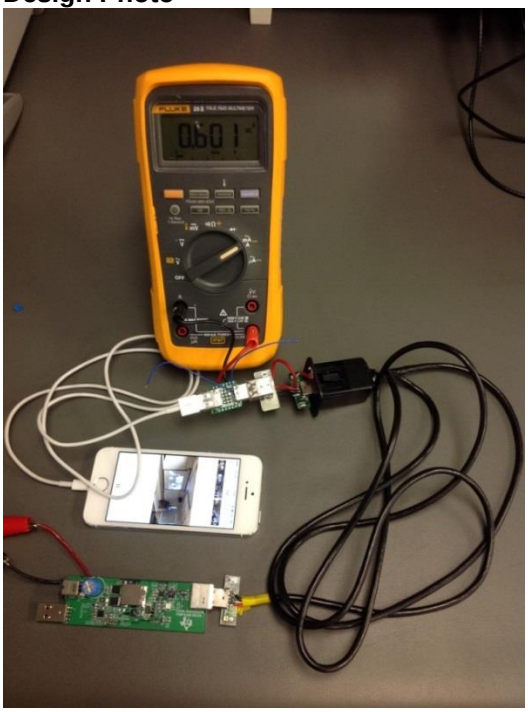
**Design Resources**

- Block Diagram and Schematic
- Test Data
- Gerber Files
- Design Files
- Bill of Materials

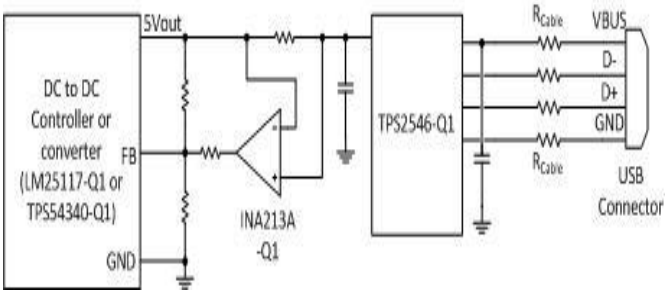
**Design Features**

- Compliance with almost all major smartphone/tablet manufacturers is supported due to :
    - Programmable current limit up to 3A
    - BC 1.2 compliant devices being supported
    - D+/D- divider modes of 2.7V/2.7V and 1.2V
- Drop in and BOM Compatible with TPS2543-Q1
- The TI devices in this design are AEC-Q100 qualified
- Supports CDP/SDP Auto switch for small industry standard footprint based devices

**Design Photo**



**Block Diagram**




**Jump start system design and speed time to market**

Comprehensive designs include schematics or block diagrams, BOMs, design files and test reports by experts with deep system and product knowledge. Designs span TI's portfolio of analog, embedded processor and connectivity products and supports a board range of applications including industrial, automotive, medical, consumer, and more. To explore the designs, go to http://www.ti.com/tidesigns

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TEXAS INSTRUMENTS

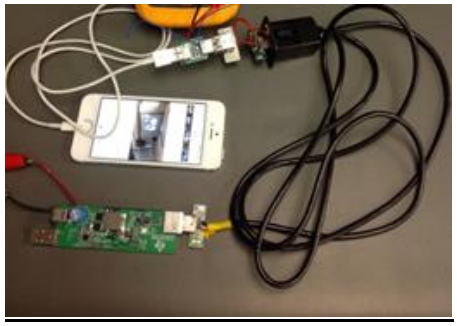
**Associated Part Numbers**

| Part Number | Part Description | EVM Link |
|---|---|---|
| TPS2546-Q1 | USB Charging Port Power Switch & Controller with Load Detect Feature. | Click Here |
| INA213A-Q1 | Voltage Output, High or Low Side Measurement Bi-Directional Zero-Drift Series Current Shunt Monitor | Click Here |
| LM25117-Q1 | Wide Input Range Synchronous Buck Controller with Analog Current Monitor | Click Here |
| TPD2E001-Q1 | Low-Capacitance 2-Channel ±15-kV ESD-Protection Array | Click Here |

**Design Considerations and Test Data:**

## 1. Design Considerations

1. An attempt to build a charger module in the passenger seat of a car throws up quite a few challenges, the foremost of which being the linear droop caused in the Output voltage when a long cable is used (black cable in the picture below for example).
2. This TI design successfully solves the issue with the help of a current shunt monitor and a buck controller.
3. This design continously provides a linear increase in Output current viz.-a-viz the Output voltage.
4. The use of a Buck controller adds further stability to the design.



## 2. Quick Start Guide

1. Connect 12Vdc (nominal) power to connector J6. Verify that LED indicator D3 is illuminated.
2. In order to measure performance:
3. Connect the desired USB load to J3.
    a.) without cable compensation, place a shunt jumper on J2.
    b.) with cable compensation, make sure there is no shunt jumper on J2.
4. The circuit will provide regulated 5Vdc power to the load connected to J3. Measurement of the voltage at the load will show the feature that the cable resistive losses are compensated.

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