

# Prototype Testing Report

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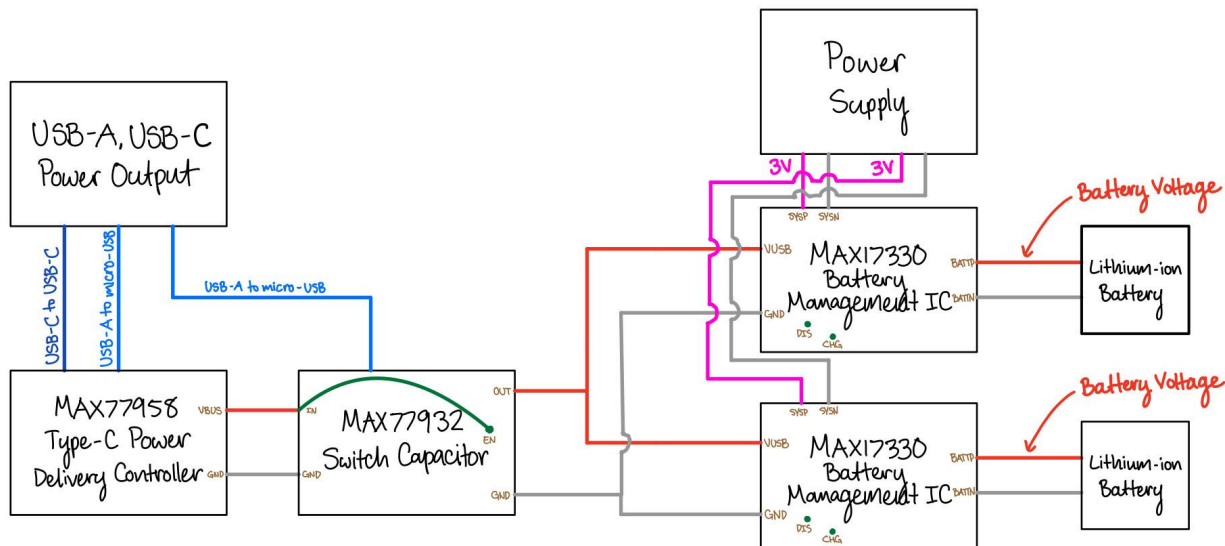
## 1.0 Equipment

- 1x 2-output power supply
- 2x USB-A power output
- 1x USB-C power output
- 2x PKCELL LP785060 3.7V 2500mAh lithium-ion battery
- 2x Battery Management IC, MAX17330
- 1x Type-C Power Delivery Controller, MAX77958
- 1x Switch Capacitor, MAX77932
- 1x TACKLife DM07 Handheld Smart Digital Multimeter
- Connection cables
  - 1x USB-C to USB-C connector
  - 2x USB-A to micro-USB connector
  - 7x Hook-to-hook jumper wires

## 2.0 Setup

1. First, before attaching any components to a power source, it is necessary to make the proper connections among the three Maxim evaluation boards in our prototype: the Type C power delivery controller, the battery management IC and the switch capacitor. For this the hook to hook cables will be needed.
2. On the MAX77958 evaluation board, connect a cable to the pin labeled “vbus” and connect the other end to the pin labeled “in” on the MAX77932.
3. Connect a cable from the “in” on the MAX77932 to the enable pin labeled “en” on the same board. This will provide the necessary operational voltage needed to trigger the functionality of the switch capacitor.
4. Continuing on the MAX77932, make a connection from the “out” pin to the “VUSB” pin on the MAX17330. Make the same connection between the MAX77932 and the second MAX17330 evaluation board in use.
5. Next, it is necessary to make the proper ground connections. Using another cable, connect the pin “GRN2” on the MAX77958 to “PGND” on the MAX77932.

6. Additionally, a connection between “PGND1” on the Max77932 and “DGND” on the MAX17330 will be necessary. Make the same connection between the MAX77932 and the second MAX17330 evaluation board in use.
7. It will also be helpful to solder male pins onto the “SYSP”, “SYSN”, “BATTP”, and “BATTN” points of both MAX17330 boards. This will make connections during testing easier.
8. On each MAX17330 board, connect a cable from the “BATTP” terminal to the positive end of the battery and the “BATTN” terminal to the negative end of the battery in use. For clarification, there should be a separate battery connected to each MAX17330 board.
9. Use a USB-C to USB-C cable to connect the input USB-C port of the MAX7758 to an external power source.
10. Using a micro USB-A to USB mini cable, connect the USB mini to the USB mini port on the IC’s and connect the USB-A to an external USB port.
11. Connect “SYSP” and “SYSN” of the MAX17330 board to the positive and ground outputs respectively of the voltage source. The charging voltage upper bound is 3.6-4.8V. Do this for both MAX17330 boards.



### 3.0 Testing Steps

1. Place multimeter leads to VBUS and GND pins of MAX77958 (type-C power delivery controller) and note the nonzero voltage reading.
2. Place multimeter leads to IN and GND pins of MAX77932 (switch capacitor) and verify it reads the same as the voltage measured in step 1.
3. Place multimeter leads to OUT and GND pins of MAX77932 and verify that it reads as half of the voltage measured in step 1.
4. Place multimeter leads to VUSB and GND pins of both MAX17330 (battery management IC) boards and verify that it reads as the same voltage measured in step 3.

5. Place multimeter leads to SYSP and SYSN pins of both MAX17330 boards and verify that the voltages are equivalent to the voltage provided by the power supply.
6. Place multimeter leads to BATTP and BATTN pins of both MAX17330 boards and verify that the voltages are nonzero. These voltages represent the voltages of the batteries.
7. Place multimeter leads to DIS and GND then CHG and GND pins of both MAX17330 boards and verify that the voltages are nonzero. This indicates that the discharging and charging FETs are ready for utilization and all connections are correct.

#### **4.0 Measurable Criteria**

- The VBUS-GND voltage of the MAX77958 should match the IN-GND voltage of the MAX77932.
- The OUT-GND voltage of the MAX77932 should be half of the IN-GND voltage of the MAX77932.
- The VUSB-GND voltages of both MAX17330 boards should match the OUT-GND voltage of the MAX77932.
- The SYSP-SYSN voltages of both MAX17330 boards should match the voltage provided by the power supply.
- The BATTP-BATTN voltages of both MAX17330 boards should be nonzero.
- The DIS-GND and CHG-GND voltages of both MAX17330 boards should be nonzero.

## 5.0 Results

Measurement	Correct? (Y/N)
VBUS-GND voltage of MAX77958 matches IN-GND voltage of MAX77932	Y
OUT-GND voltage of MAX77932 is half of IN-GND voltage of MAX77932	Y
VBUS-GND voltage of MAX17330 #1 matches OUT-GND voltage of MAX77932	Y
VBUS-GND voltage of MAX17330 #2 matches OUT-GND voltage of MAX77932	Y
SYSP-SYSN voltage of MAX17330 #1 matches voltage provided by power supply	Y
BATTP-BATTN voltage of MAX17330 #1 is nonzero	Y
BATTP-BATTN voltage of MAX17330 #2 is nonzero	Y
DIS-GND voltage of MAX17330 #1 is nonzero	Y
DIS-GND voltage of MAX17330 #2 is nonzero	Y
CHG-GND voltage of MAX17330 #1 is nonzero	Y
CHG-GND voltage of MAX17330 #2 is nonzero	Y

## 6.0 Conclusion

- The MAX77958, MAX77932, and the MAX17330 all work as intended individually
- The MAX77958, MAX77932 work as intended when connected in series
- The two MAX17330 connected in parallel to each other in series with the MAX77932 work as intended
- There are miniscule to zero voltage drops between the evaluation kit connections meaning connections are correct and barely any static power is lost between connections
- The MAX17330 does indeed charge the lithium ion batteries because of non zero CHG-GND voltage of MAX17330 on both boards

- The lithium ion batteries does indeed work and retain their rated voltage after charging because of non zero/correct BATTP-BATTN voltage and non zero/correct battery terminal voltage of both batteries