Test Report
For PMP9456
04/22/2014

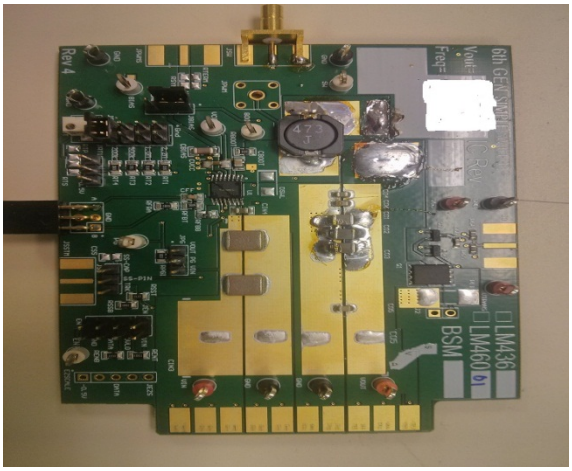
Overview

The reference design provides a Battery charging solution for 6V, 4.7AH Lead Acid battery with a simple charging algorithm implementation using DC/DC Buck converter LM46001. Such batteries are widely used in industrial and consumer applications such as Digital Weighing Scale. The design is done for 300mA of Constant current charging (and thereof Tapering of current) and the this can be changed by changing the Current sense Resistor (R2 and R3) .The feedback is modified using very low cost discrete devices to achieve charging algorithm .

Power Specification

Vin range:	10V-50V
Nominal Vin:	12V
Output:	4V-7.6V (Depends on State of 6V,4.7AH Lead Acid Battery)
Fsw:	500KHz

Board Photos



Power Board Front

Figure 1

Charging Algorithm implementation

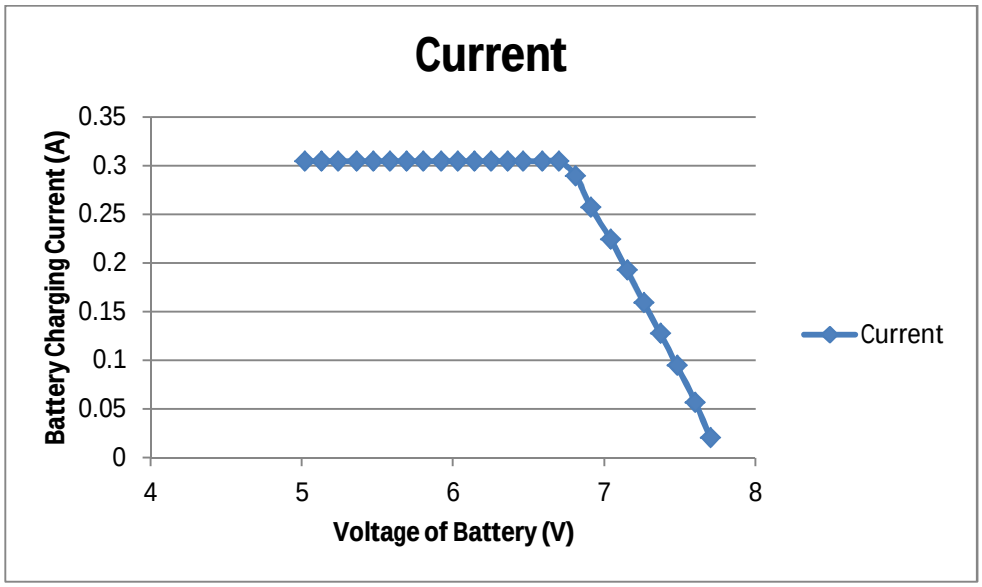


Figure 2

Below the Zener Voltage(D1), the Feedback is locked by the current flowing in the current Sense Resistor R2 and R3 and hence Constant current Charging is maintained. Once the Zener Voltage is reached at the output, the Charging current starts to taper off as needed in the Charging Algorithm of Lead Acid Battery. Zener D1 Voltage decides the Point of Current Taper off while Resistance R1 decides the Ramp of Current tapering and both can be chosen according to the Need of algorithm.

Efficiency

The efficiency is measured at Vin= 12V

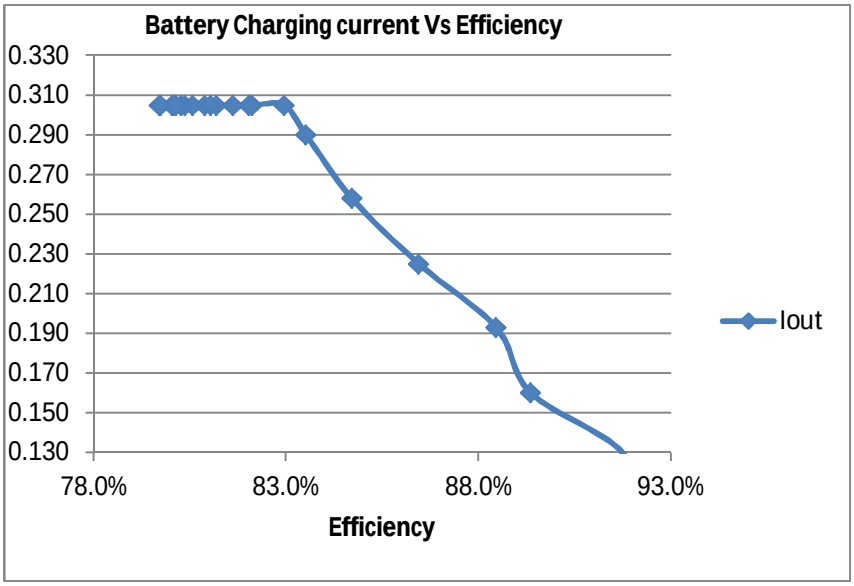


Figure 3

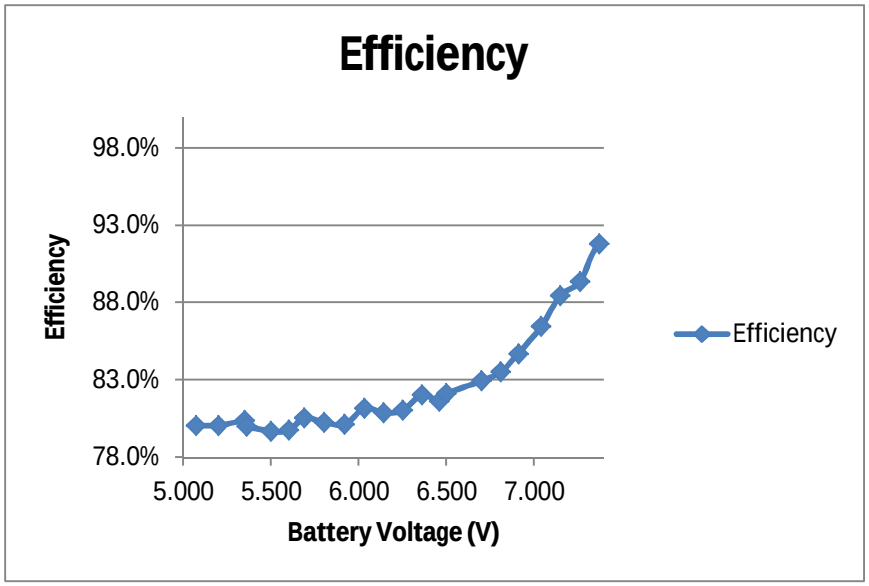
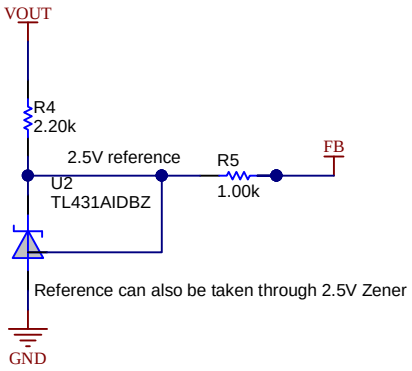


Figure 4

If the cost permits, the efficiency can further be improved to **88 to 90 percent** by adding external reference to feedback pin through TL431 shunt regulator or a Zener placed at the output. This will lower the losses on the Current Sense resistor R1 and R2.



This gives around 0.8V reference to FB (R1 and R5 potential divider) and for locking the feedback the rest 0.2V comes from the Drop across Current Sense resistor and hence can be changes accordingly.

Switch Node Waveform

Test condition: The input voltage was set at 12V, 24V and 48V, and the output is set at full load .The switching waveform is stable across the voltage range .

Ch2 – Vsw (switch node voltage).

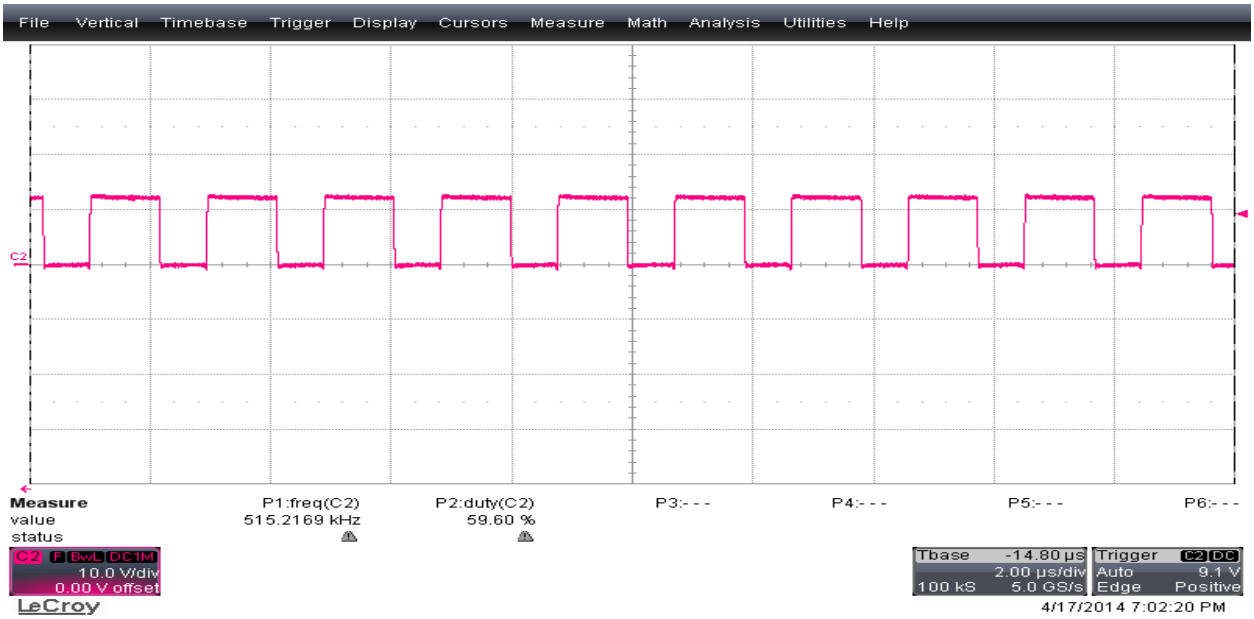


Figure 4 Vin=12V

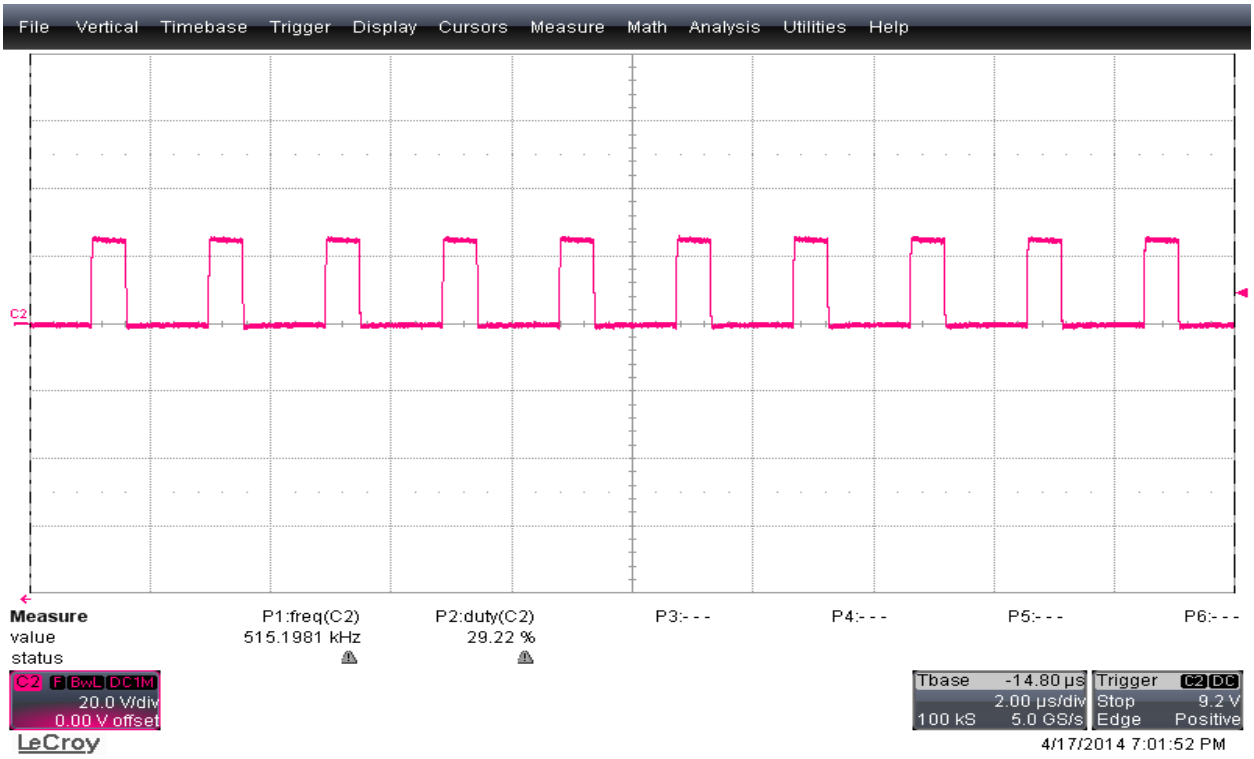


Figure 5 Vin=24V

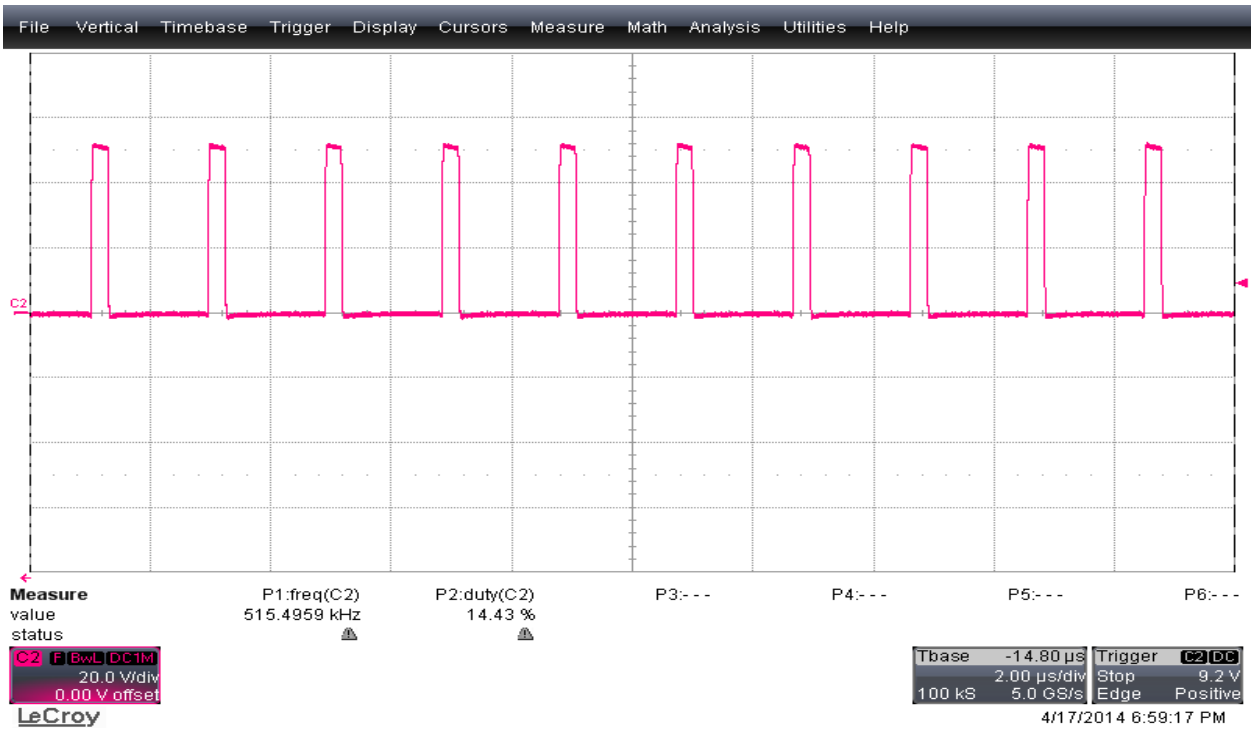
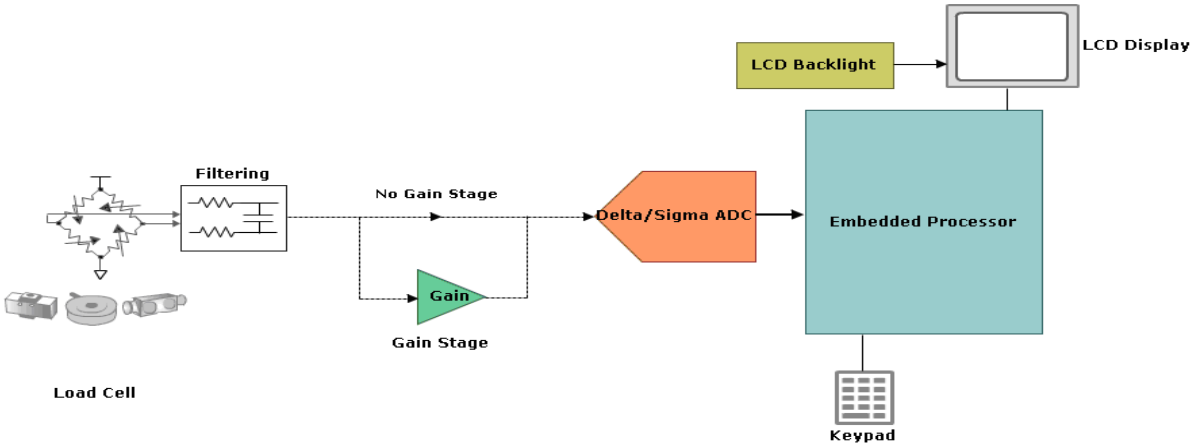
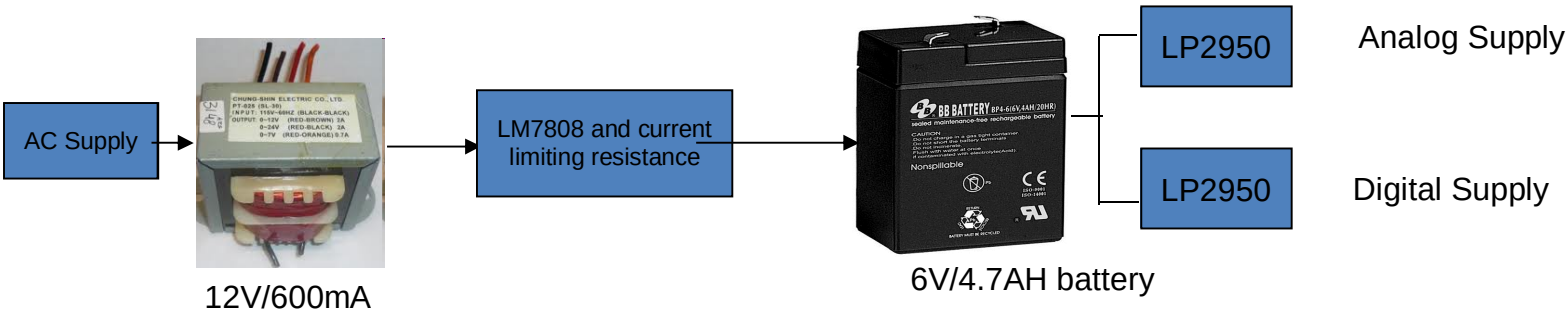


Figure 6 Vin=48V

A Typical Application: Weighing Scale





Issues with such Solution

1. Close to 2W drop across LM7808(4V drop * 500mA-Thermal issues) coupled with 0.5W drop across current limiting resistance.

2. In the remote areas ,15V transformer(12V Transformer@ 220V AC goes down to 8-9V at 130-140VAC and hence charging is stopped) is supplied to cater Low AC power issues. This further increased the power loss and results in greater thermal issues .

3. Lead Acid Battery is never charged fully to it’s capacity because of current limited charging. No. of Charge Discharge cycle is reduced.
4. Fast charge will result in further power losses and thermal issues.

All of this will be taken care through PMP9456 reference design.

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