

# One Solution for Step-Up DC-DC Converter Based Power Supply for Mobile Phone Detector

Marko Olujić, Miloš Slankamenac, Vladimir Rajs, Miloš Živanov<sup>1</sup>

**Abstract** Most digital systems are equipped with DC-DC converters to convert various levels of voltages from batteries to voltage appropriate for electronic components and devices. DC-DC converters maintain legal voltage ranges regardless of the load current variation as well as battery voltage drop. Instead of starting with a higher voltage and bringing it down by dissipating heat like the voltage regulators, step-up converters manage to convert a low voltage to a higher one. In this paper one solution of power supply for device for cellular phone activity detection - DC-DC converter, based on Analog Devices specialized chip, is represented.

**Keywords** - DC-DC voltage converter, Mobile phone detector.

## I. INTRODUCTION

### A. Step-Up DC-DC Converter

Switching regulators offer three main advantages compared to a linear regulators. First, switching efficiency can be much better than linear. Second, because less energy is lost in the transfer, smaller components and less thermal management are required. Third, the energy stored by an inductor in a switching regulator can be transformed to output voltages that can be greater than the input.

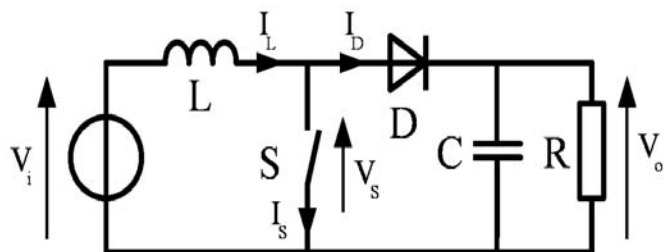


Fig. 1. Boost converter basic schematic

A boost converter (step-up converter), Fig. 1, is a power converter with an output DC voltage ( $V_o$ ) greater than its input DC voltage ( $V_i$ ). It is a class of switching-mode power supply containing at least two semiconductor switches (a diode and a transistor) and at least one energy storage element. In addition, DC-DC converters are used to provide noise isolation, power bus regulation, etc.

<sup>1</sup> Authors are from Department of Electronics, University of Novi Sad, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, 21000 Novi Sad, Republic of Serbia.

### B. Mobile Phone Detector

This device detects wide range of frequencies from 100MHz to 3500MHz [1, 2]. In this range, there are all three bands for mobile communication, so the device has possibility for locating active cellular phones [3, 4]. Sensitivity of the device regulate in wide range. The device is mobile, slight and very handle, see Fig. 2.



Fig. 2. Mobile phone detector

Because of its simple and handle characteristics and his reliability it has wide range of applications on faculties, primary and secondary schools for detection forbidden wireless communication (cheating on exams).

## II. POWER SUPPLY

Mobile phone detector power supply consists of three main blocks: current-limit switch block, dc-dc converter block and LED indicator block, Fig. 3.

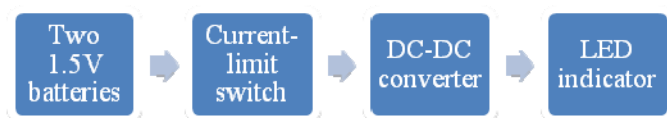


Fig. 3. Power supply block diagram

As a power source two 1.5V rechargeable batteries are used.

#### A. Current-Limit Switch Block

MAX4793 chip [5], which is used in this system, is a switch which features internal current limiting to prevent damage to host device due to faulty load conditions (Fig. 4). This analog switch has a low 0.2Ω on-resistance and operates from 2.3V to 5.5V input voltage range.

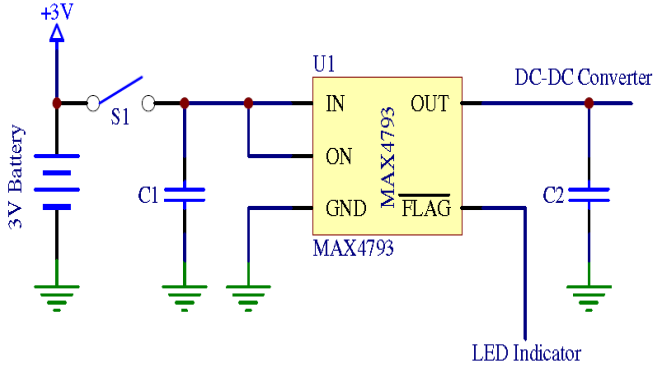


Fig. 4. Current-limit switch configuration

When the switch is on and a load is connected to the port, a guaranteed blanking time of 14ms ensures that the transient voltages settle down. If after this blanking time the load current is greater than the current limit, the MAX4793 enters a latch-off state where the switch is turned off and FLAG output is turned low. This output pin is connected to LED indicator block. The switch can be turned on again by cycling the power.

If input voltage, voltage from batteries, goes too low, below 2V, the undervoltage lockout circuit prevents erroneous switch operation and the switch enters switch-off state. It goes on only if input voltage exceeds the undervoltage lockout threshold and there is no fault. This prevents any battery damage that could occur due to exploiting nearly empty battery.

Output voltage pin is connected to DC-DC Converter block.

#### B. DC-DC Converter Block

For this project MAX856 step-up DC-DC converter is used, Fig. 5. It is a high-efficiency, CMOS switching regulator for small, low input voltage or battery-powered systems, like this system is. MAX856 accepts a positive input voltage between 0.8V and 5V and converts it to a higher, pin-selectable output voltage of 3.3V or 5V (5V for this device).

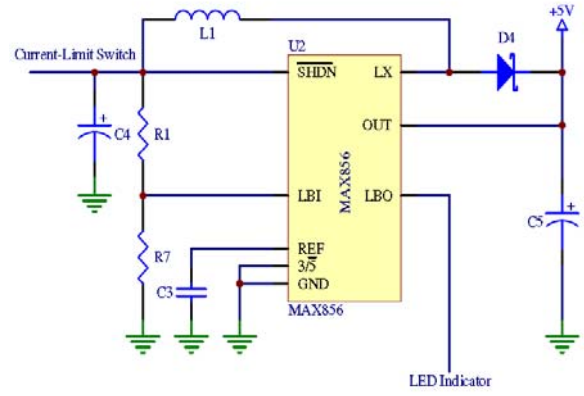


Fig. 5. DC-DC converter configuration

The MAX856 combines ultra-low quiescent supply current and high efficiency to give maximum battery life. An internal MOSFET power transistor permits high switching frequencies. This benefit, combined with internally set peak inductor current limits, permits the use of small, low-cost inductors.

The MAX856 series contains an on-chip comparator for low-battery detection. If the voltage at LBI falls below the regulator's internal reference voltage (1.25V), LBO (an open-drain output) sinks current to GND. The low-battery monitor's threshold is set by two resistors, R1 and R7. The threshold voltage is set using the Eq. (1):

$$R_1 = R_7 \left( \frac{V_{LBI}}{V_{REF}} - 1 \right), \quad (1)$$

Threshold voltage is 2.3V.

#### C. LED Indicator

For visual indication three LE diodes are used, as shown on Fig. 6.

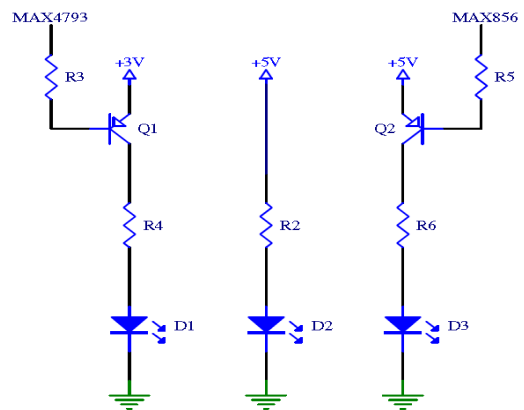


Fig. 6. LED indicator configuration

LE diode D1 is used for indication of a faulty load condition, in which higher current level is being used by device that could damage batteries and also the device itself.

When device is working properly green LE diode D2 emits light.

LE diode D3 flashes when a low battery voltage is present. In other words, it indicates when batteries need to be recharged.

### III. CONCLUSION

Although switching techniques are more difficult to implement, switching circuits have almost completely replaced linear power supplies in a wide range of portable and stationary designs. This is because switching circuits offer better efficiency, smaller components, and fewer thermal management issues.

MOSFET power switches are now integrated with controllers to form single-chip solutions, like the MAX856 circuit shown in Fig. 5.

As MOSFET power-switch technologies continue to improve, so will switch-mode performance, further reducing cost, size, and thermal management problems.

### ACKNOWLEDGEMENT

This paper is part of the project “Development of systems and instruments for investigation water, oil and gas”, NO 11006. Project has been carried out with the financial support of the Ministry of Science and Technological Development of the Republic of Serbia, to which authors are very grateful.

### REFERENCES

- [1] Vladimir Milosavljević, Vladimir Rajs, Miloš Slankamenac, Miloš Živanov: Hardware system MD-100 for cellular phones activity and other HF electromagnetic field sources, INFOTEH 2007, Vol. 6, Ref. B-13, p. 112-113, pp. 28-30, March 2007, ISBN 99938-624-2-8.
- [2] <http://www.ftn.ns.ac.yu/apel/detektor.html>
- [3] Vladimir Milosavljević. Vladimir Rajs, Miloš Slankamenac, Miloš Živanov: A system for detection a cellular phones activities and other hf electromagnetic field sources, Research people and actual tasks on multidisciplinary sciences, Loznec, Bulgaria: Vol 2, 6-8 Jun, 2007, pp. 291- 293, ISBN 978-954-91147-3-7.
- [4] Vladimir Rajs, Vladimir Milosavljević, Miloš Slankamenac, Miloš Živanov: Upgraded version of the detector for cellular phones activity, INFOTEH 2008, Jahorina: 26-28 Mart, 2008, pp. 195- 197, ISBN 99938-624-2-8.
- [5] MAXIM Integrated Products, <http://www.maxim-ic.com>.