

# ON Semiconductor

## Is Now

# onsemi™

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

---

**onsemi** and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



# 5 W, CCCV Cell Phone Battery Charger

ON Semiconductor

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1014	Cell Phone Charger	90 to 270 Vac	5 W	Flyback	Isolated

## Other Specifications

	Output 1	Output 2	Output 3	Output 4
<b>Output Voltage</b>	5.0 V	N/A	N/A	N/A
<b>Ripple</b>	200 mV p/p	N/A	N/A	N/A
<b>Nominal Current</b>	1.0 A	N/A	N/A	N/A
<b>Max Current</b>	1.1 A	N/A	N/A	N/A
<b>Min Current</b>	zero	N/A	N/A	N/A

<b>PFC (Yes/No)</b>	No
<b>Minimum Efficiency</b>	65%
<b>Operating Temp. Range</b>	0 to +60°C
<b>Cooling Method/Supply Orientation</b>	Convection

<b>Others</b>	CCCV (Constant Current – Constant Voltage) output load profile for typical battery charger.
---------------	---

## Circuit Description

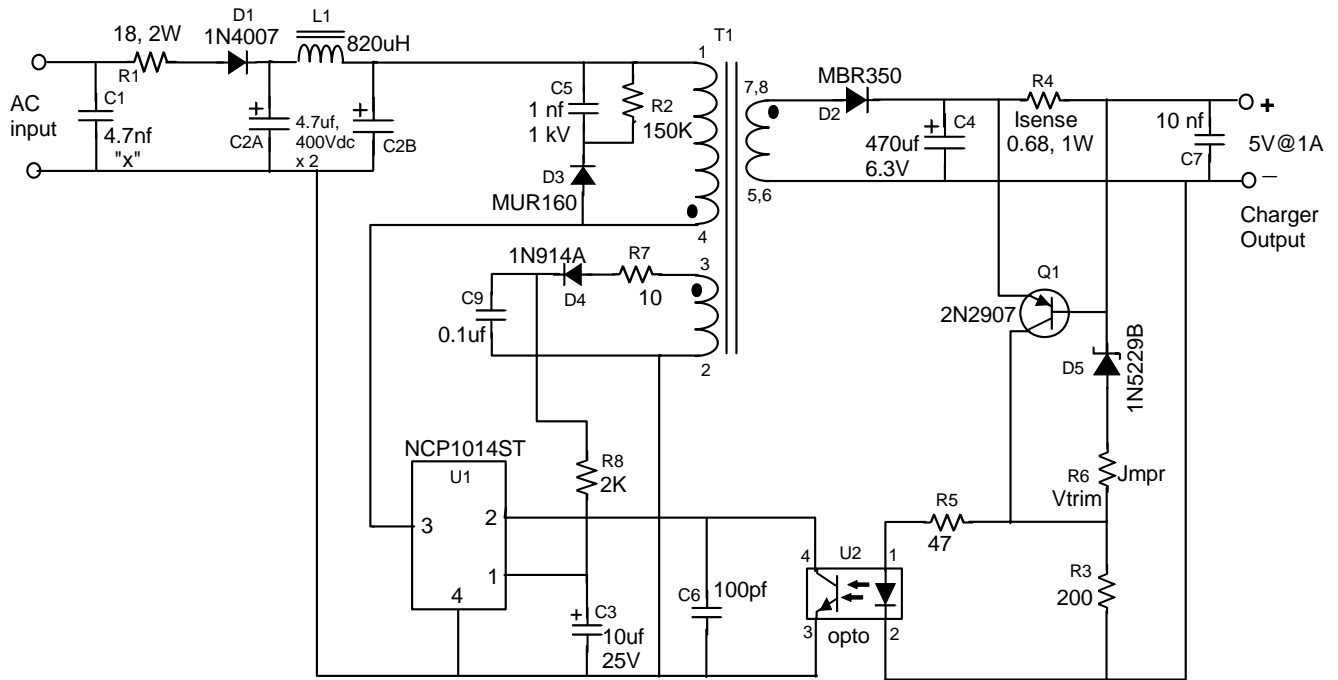
This circuit presents a very simple, low cost, yet highly effective 5 watt, off-line constant current – constant voltage battery charger for cell phones or similar applications. The circuit is designed around ON's NCP1014 integrated controller with internal mosfet in a discontinuous mode flyback topology. Current and voltage feedback are accomplished with a single optocoupler as well as providing ac mains isolation. The circuit provides a respectable output V/I load-line characteristic for battery charging over typical temperature variations. The use of an auxiliary V<sub>cc</sub> winding on T1, although not required because of the 1014's DSS circuitry, guarantees very low standby (no load) power consumption (< 300 mW). For maximum simplicity a half-wave input rectifier (D1) is utilized and a conducted EMI filter is provided by C1 and L1. If there are very low output line frequency ripple and/or low ac input constraints, a full bridge input rectifier is recommended. The T1 flyback transformer design is compliant enough for output voltage requirements from 4 to 6.5 volts.

## Key Features

- Extremely simple yet effective off-line battery charger circuit.
- Constant current – constant voltage output load line profile.
- Less than 300 mW standby (no load) input power if auxiliary winding is used.
- Conducted EMI input filter.
- Adjustable output voltage and current with resistors.
- Monolithic, integrated current mode controller with inherent over-current, over-temperature, and over-voltage protection.

# DN06009/D

## Schematic



### NOTES:

1. Zener D5 and resistor R6 sets the output voltage.  $V_{out} = V_z + 0.9$  volts approximately.  
Use R6 instead of a jumper to incrementally raise output voltage higher than  $V_z + 0.9$  value.
2. R4 sets current limit threshold.  $I_{limit} = 0.65/R4$
3. Schematic shows "generic" passive component types. Surface mount parts may have different ID prefixes.
4. L1 is Coilcraft RFB0807-821L or similar (820 uH, 300 mA).

**NCP1014 Cell Phone Charger**  
**5 Vout @ 1000 mA**  
**ON Semiconductor**

**MAGNETICS DESIGN DATA SHEET**

Project / Customer: ON Semiconductor - NCP1014 CC - CV battery charger

Part Description: 5 watt flyback transformer, 4 - 6 volts out

Schematic ID: T1

Core Type: EF16 (E16/8/5); 3C90 material or similar

Core Gap: Gap for 3.5 mH inductance

Inductance: 3.5 mH +/-5%

Bobbin Type: 8 pin horizontal mount for EF16

Windings (in order):

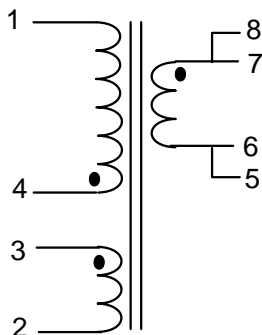
Winding # / type	Turns / Material / Gauge / Insulation Data
Vcc/Boost (2 - 3)	22 turns of #35HN spiral wound over 1 layer. Insulate with 1 layer of tape (500V insulation to next winding)
Primary (1 - 4)	150 turns of #35HN over 3 layers. Insulate for 3 kV to the next winding.
5V Secondary (5, 6 - 7, 8)	10 turns of #24HN spiral wound over one layer with 0.050" (1.3mm) end margins. Triple insulated #24 can be substituted without end margins.

Vacuum varnish assembly

NOTE: Existing vendor for this specific part is Mesa Power Systems, Escondido, CA. 1-800-515-8514

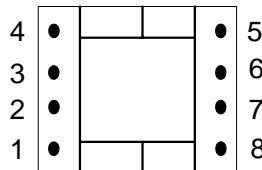
Hipot: 3 kV from boost/primary to secondary

Schematic



Lead Breakout / Pinout

(Bottom View - facing pins)



© 2006 ON Semiconductor.

**Disclaimer:** ON Semiconductor is providing this design note "AS IS" and does not assume any liability arising from its use; nor does ON Semiconductor convey any license to its or any third party's intellectual property rights. This document is provided only to assist customers in evaluation of the referenced circuit implementation and the recipient assumes all liability and risk associated with its use, including, but not limited to, compliance with all regulatory standards. ON Semiconductor may change any of its products at any time, without notice.

Design note created by Frank Cathell, e-mail: [f.cathell@onsemi.com](mailto:f.cathell@onsemi.com)