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Design Note – DN06009/D

5 W, CCCV Cell Phone Battery Charger

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
Output Voltage	5.0 V	N/A	N/A	N/A
Ripple	200 mV p/p	N/A	N/A	N/A
Nominal Current	1.0 A	N/A	N/A	N/A
Max Current	1.1 A	N/A	N/A	N/A
Min Current	zero	N/A	N/A	N/A

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

Others	CCCV (Constant Current – Constant Voltage) output load profile for typical battery charger.

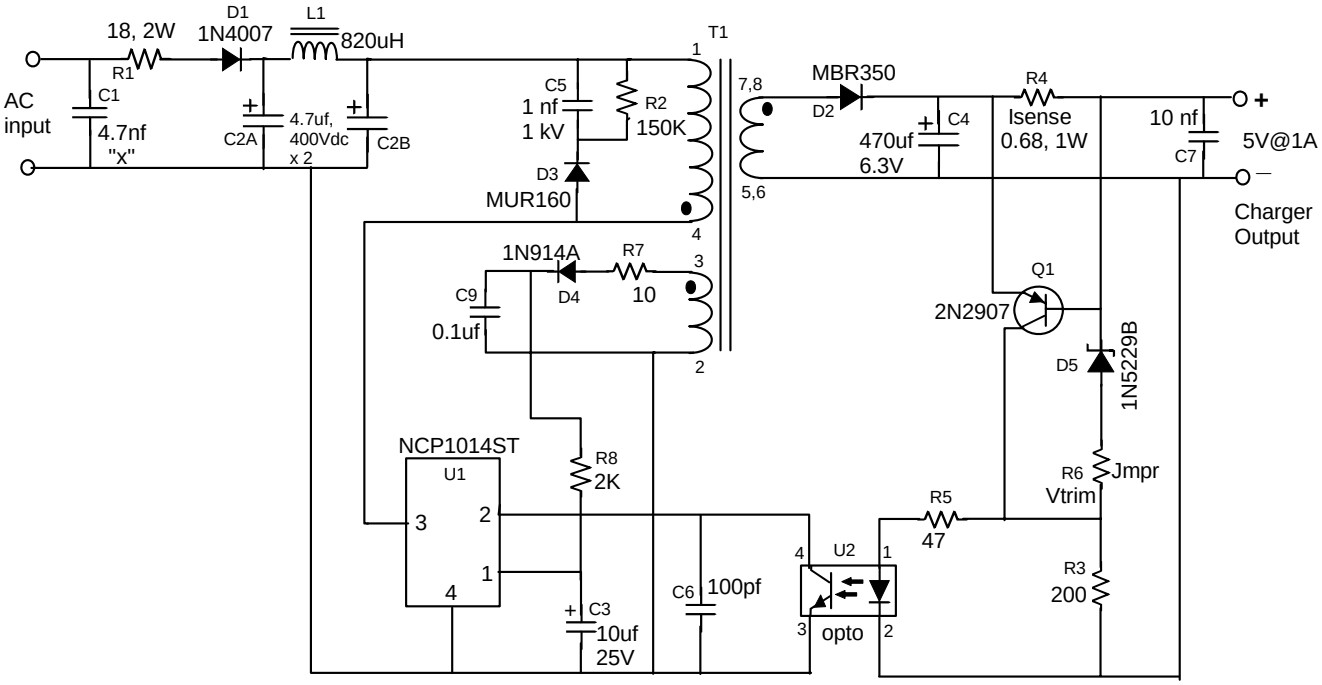
Circuit Description

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 Vcc 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.

Schematic



NOTES:

1. Zener D5 and resistor R6 sets the output voltage. Vout = Vz + 0.9 volts approximately.
   Use R6 instead of a jumper to incrementally raise output voltage higher than Vz + 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

DN06009/D

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):

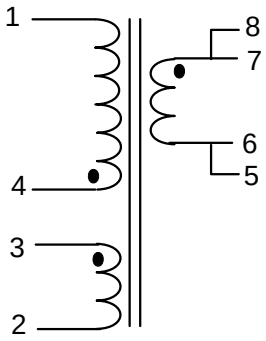
Winding # / type	Turns / Material / Gauge / Insulation Data
Vcc/Boost (2 - 3)	22 turns of #35HN spiral wound over 1 layer. Insulate with 1 layer of tape (500V insulation to next winding)
Primary (1 - 4)	150 turns of #35HN over 3 layers. Insulate for 3 kV to the next winding.
5V Secondary (5, 6 - 7, 8)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

Vacuum varnish assembly

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

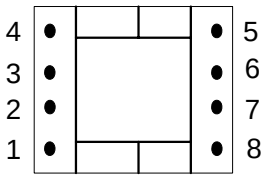
Hipot: 3 kV from boost/primary to secondary

Schematic



Lead Breakout / Pinout

(Bottom View - facing pins)



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