



## INTRODUCTION

The MODEL # is an automotive power socket device designed to supply power to “Apple” portable devices that is marked with an output capability of 1000mA (1 amp). This device has a flat removable cord used to connect an Apple device to the charger. The retail package and the device are marked as accepting an input voltage of 12 to 24 volts DC.

## Golden sample findings

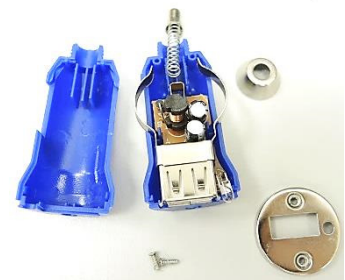
The cigar lighter plug body of the charger was about 2” long and 1” diameter cone-to-cylinder shape (50 x 24 x 24 mm). For the 12 volts systems, the “contact point” which is the center part of the plug when viewed end-on, carries the positive voltage, whereas the “can part”, which is the outer part of the connector, carries the negative voltage. The opposite end of the charger has a type A USB jack which can accept a USB cable with the proper mating connector. A flat cable with a mating USB connector at one end and a 30 position Apple dock connector at the other is included with the charger.



The base of the charger is marked with the model number and to indicate that the charger accept a 12 to 24 VDC input. The marking further states an output of 5 VDC at a maximum of 1 amp. Additional marks include a CE mark, a European Waste Electrical and Electronic Equipment (WEEE) mark, and a notification of “Not for use with tablets”.

## Construction

The plastic housing contains a printed wire board that makes connection with the power socket by means of spring loaded contacts; two on either side for the negative connection and one at the top center for the positive connection. The board is of a typical glass-reinforced epoxy laminate construction with a solder resist layer on the bottom and silkscreen on both the top and bottom. The board components consist of both through hole mounted to the top of the board and surface mount types mounted to the bottom.



The circuit on the printed wire board is of a power converting design. The power converting IC (MC34063) on the bottom side converts the 12-24 VDC input to a 5 VDC output. Several SMD components are also soldered to the same side as the power converting IC. Two electrolytic capacitors, one inductor, one diode, one LED and the USB connector are on the top side of the board.

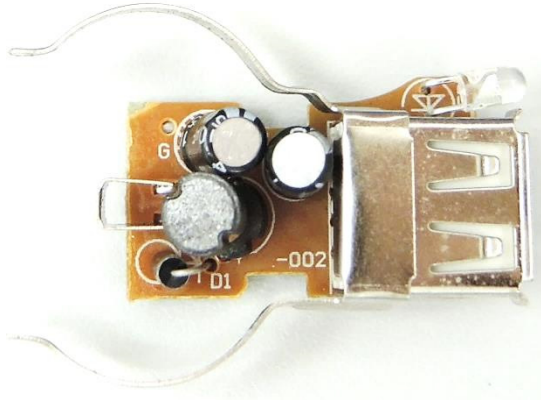


Figure 1: Top side of board

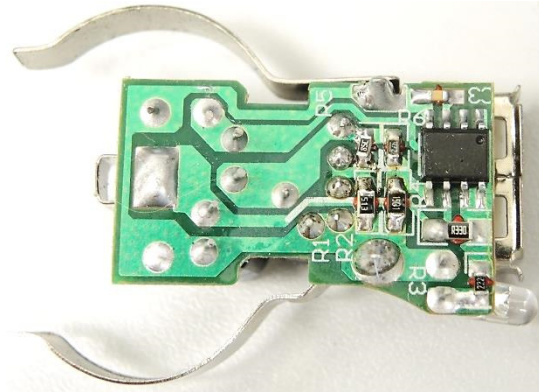


Figure 2: Bottom side of board

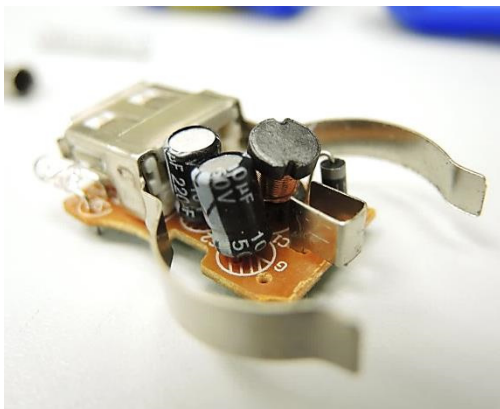


Figure 3: Left side of board

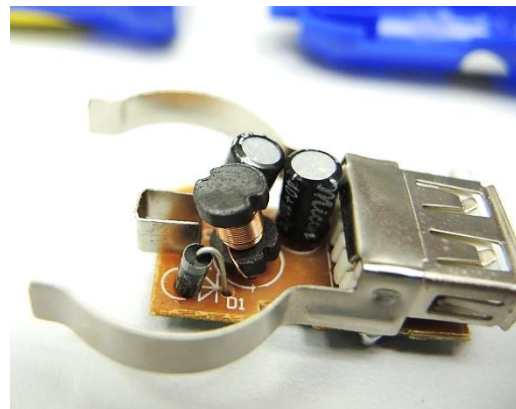


Figure 4: Right side of board

### Marking

The output end of the charger is marked with a model number, input/output specifications, a couple of graphic marks, the text “Made in China” and the text “NOT FOR USE WITH TABLETS”.

The input/output specifications do not specify a maximum input current; such must be specified. The specified output current is greater than the capability of the charger.

### Output Characteristics

Output voltage was characterized at four different voltages within the range marked as input voltage; 12 VDC, 13.8 VDC, 18 VDC and 24 VDC ( $\pm 0.1$  volts). For all four input voltages, the output voltage was measured at 100mA current output increments starting at 100mA.

Output voltage of the charger fell off rapidly after about 500mA of output current at all tested input voltages. At 700mA of output current the output voltage was approximately 2-1/2 volts and only 1/4 volt at 1000mA of output current.

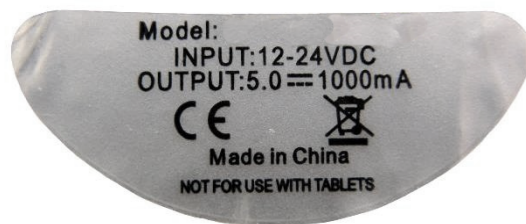


Figure 5: Charger label

## Output Voltage vs Current

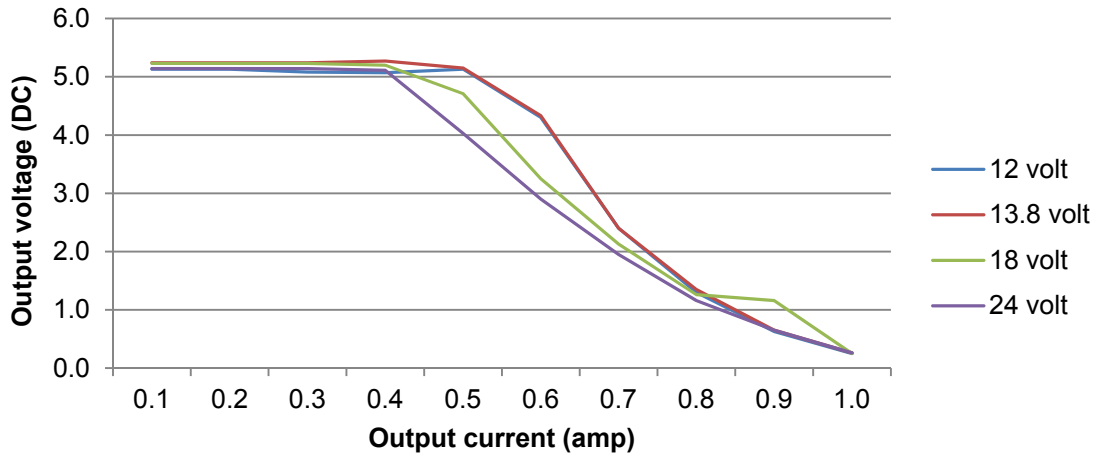


Figure 6: Output voltage at load current

### Thermal Characteristics

After one hour of operation at the highest stable current output (700mA) of the charger with a 13.8 VDC input; the hottest component on the charger was the transformer designated L1 near the center of the board at just under 70°C. The remainder of the charger was in the 50°-60° C range.

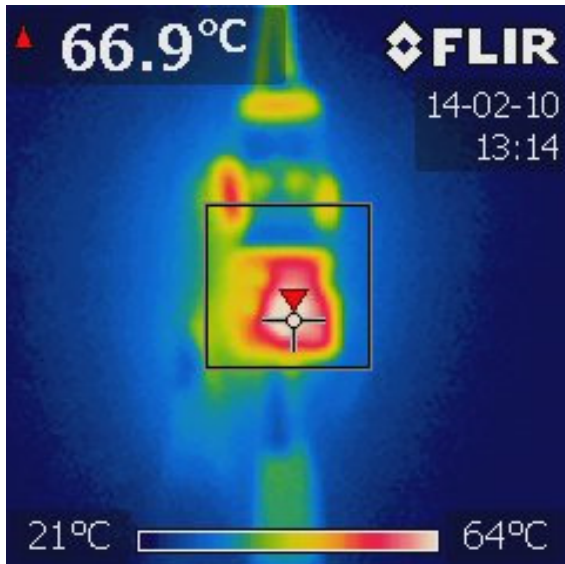


Figure 7: Top view

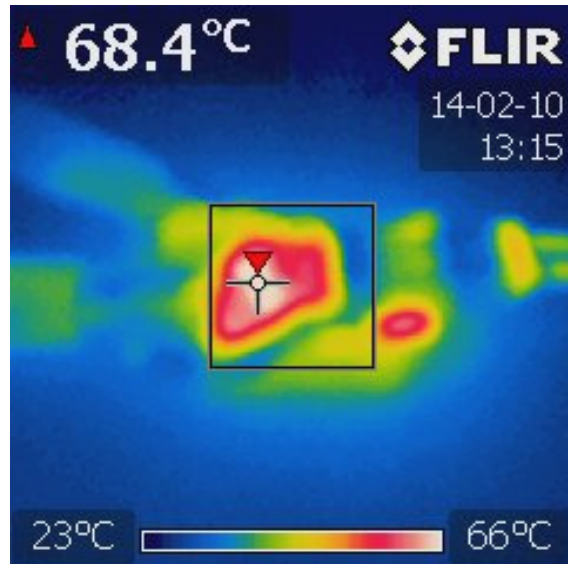


Figure 8: Side view

### Removable Cable

This charger is supplied with a removable cable; the contribution (e.g. voltage drop) of the cable is not included in this document.

## Corrective Actions

The design of this charger does not provide the output that it is marked as being capable of providing.

This charger must be redesigned to provide the 1000mA output it is marked as capable of providing.

The other marking issues below must also be addressed.

Label text:

1. "INPUT: 12-24VDC 0.5A MAX"
2. "OUTPUT: 5VDC 1000mA MAX"
3. "CE"
4. "Made In China"
5. "NOT FOR USE WITH TABLETS"
6. "..."



Figure 9: Label for ...

Steps must be taken to meet the BRAND Quality protocol. Issues found have included:

- Connector misalignment
- Excessive solder

	<p>USB plug of MODEL # golden sample was not aligned perfectly with its enclosure. The USB plug is tilted and the right side is horizontally lower than the left.</p>
	<p>(Bottom side) PC Board of MODEL # golden sample has <b>extra solder</b> on the board.</p>

## Revision History

xx.xx.14 Initial "Golden" sample

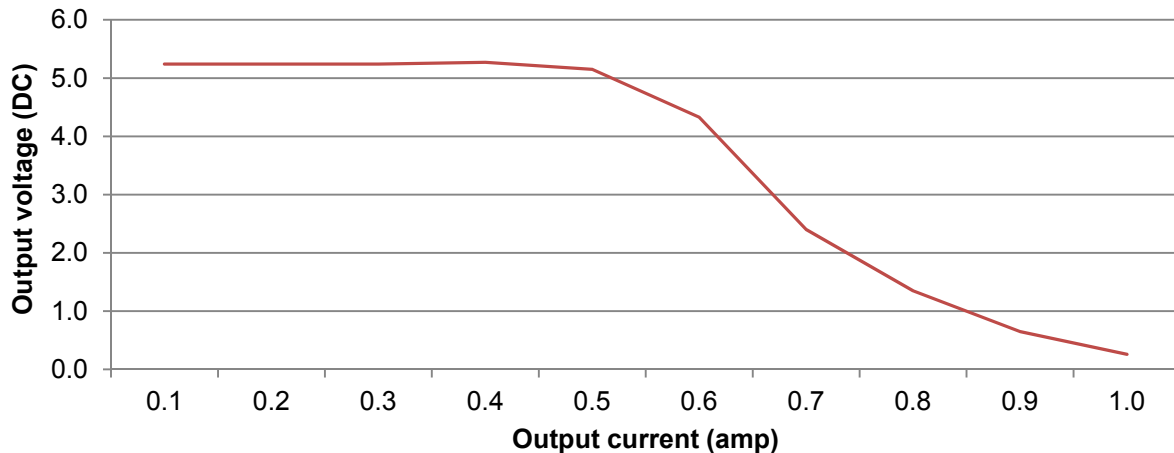
## Sample Inspection

**NOTE: This charger is not capable of supplying the output it is marked as capable of providing.**

### Output Voltage

The output voltage of the charger will be measured at output currents of 100mA increments up to the marked output current with an input voltage of 13.8 volts DC. The output voltage at each current output shall be 5 volts DC ( $\pm 0.25$  volts) or no greater than 5.25 volts DC and no more than 0.1 volt less than:

## Output Voltage vs Current



### Temperature

The sampled charger shall be operated at 13.8 volts DC and a 700mA load applied. The output voltage should be stable ( $\pm 0.05$  volts). After one hour of operation with the load the temperature profile should not significantly exceed that illustrated below.

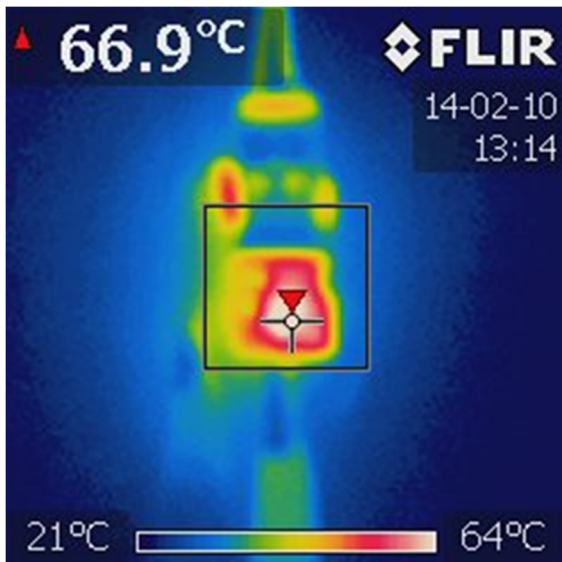


Figure 10: Temperature profile - Top view

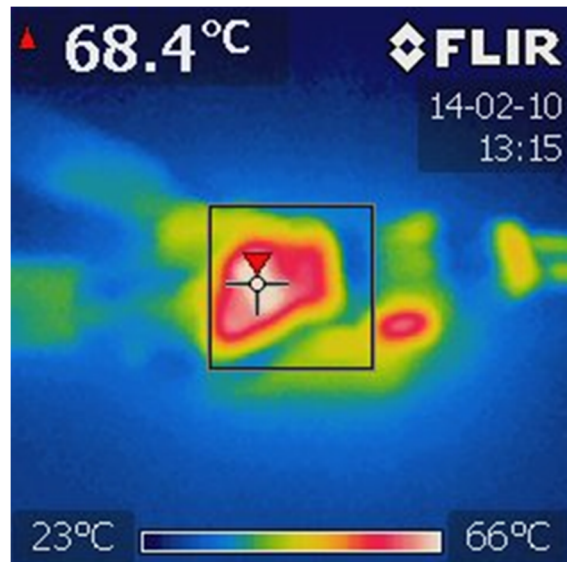


Figure 11: Temperature profile - Side view

**MODEL # Manufacturing Checklist V1.0 (xx/xx/2014)**

The following listed below are requirements for MODEL #. Tasks were based on golden sample test result and returned failure sample inspections.

Each charger **MUST** be checked before packing. Each charger should be checked by trained operators with appropriate instrumentation (i.e., annually calibrated DC power supply, and electronic load). Estimated testing time is 3~5 minutes total.

No.	Task	Pass	Fail
1	When 12VDC is connected to MODEL #, does the LED light of the charger turn "ON"?		
2	When supplied 12VDC to MODEL #, is the output current the rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the USB plug.)		
3	When 18VDC is connected to MODEL #, does the LED light of the charger turn "ON"?		
4	When supplied 18VDC to MODEL #, is the output current the rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the USB plug.)		
5	When 24VDC is connected to MODEL #, does the LED light of the charger turn "ON"?		
6	When supplied 24VDC to MODEL #, is the output current the rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the USB plug.)		
7	Supply 12VDC to MODEL # and connect with the provided cable. (The cable that will be included in the retail package.) Is the output current as rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the 30 position Apple dock connector.)		
8	Temperature measured from outside (at any angle) of MODEL # after testing the above tasks. The exterior temperature of MODEL # should <b>NOT</b> exceed 65°C when ambient temperature is between 20~30°C.		
9	Does charger labeling comply with the label specification for MODEL #?		
10	Does the USB plug on MODEL # align with its enclosure?		

**Reengineered MODEL # Manufacturing Checklist V1.0 (xx/xx/2014)**

The following checking list is for any failed MODEL # from **MODEL # Manufacturing Checklist V1.0**.

Reengineered products will **NOT** be accepted if the MODEL # did not pass all listed below tasks. Each charger should be checked by trained operators with appropriate instrumentation (i.e., annually calibrated DC power supply and electronic load). Estimated testing time is 4~5 hours total.

No.	Task	Pass	Fail
1	When 12VDC is connected to MODEL #, does the LED light of the charger turn "ON"?		
2	When supplied 12VDC to MODEL #, is the output current the rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the USB plug.) <b>Test for 1 hour</b>		
3	When 18VDC is connected to MODEL #, does the LED light of the charger turn "ON"?		
4	When supplied 18VDC to MODEL #, is the output current the rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the USB plug.) <b>Test for 1 hour</b>		
5	When 24VDC is connected to MODEL #, does the LED light of the charger turn "ON"?		
6	When supplied 24VDC to MODEL #, is the output current the rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the USB plug.) <b>Test for 1 hour</b>		
7	Supply 12VDC to MODEL # and connect with the provided cable. (The cable that will be included in the retail package.) Is the output current as rated 1000 mA (1A) <b>and</b> output voltage between 4.75 VDC ~ 5.25 VDC? (Measure from the 30 position Apple dock connector.) <b>Test for 1 hour</b>		
8	Temperature measured from outside (at any angle) of MODEL # after testing the above tasks. The exterior temperature of MODEL # should <b>NOT</b> exceed 65°C when ambient temperature is between 20~30°C.		
9	Does charger labeling comply with the label specification for MODEL #?		
10	Does the USB plug on MODEL # align with its enclosure?		