

Uninterruptible Power Systems

BRICs Series BR 450E/650E/850E

Service Manual

Date	Version	Remark
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Table of Contents

1 INTRODUCTION.....	5
1.1 Features	5
1.2 Applications.....	5
2 PRODUCT OUTLOOK	6
3 PRINCIPLES OF OPERATION.....	8
3.1 System Block Diagram.....	8
3.2 Normal Mode	8
3.3 Boost Mode	9
3.4 Battery Mode.....	9
4 REPAIR	10
4.1 Test Equipment.....	10
4.2 Repair Procedure	10
4.2.1 Equipment Preparation	10
4.2.2 Check MOSFET, Transistor, and Diode	12
4.2.3 Check Resister	12
4.2.4 Turn on the unit with DC Power Supply	13
4.2.5 Signal Measurement	13
4.2.6 Output Voltage Measurement.....	13
4.2.7 Connect UPS to Utility Power.....	14
4.2.8 Charging Voltage Measurement.....	14
4.2.9 Boost Test.....	14
5 SCHEMATIC	15
5.1 Charger Circuit	15
5.2 Transformer Flux Continue Circuit.....	16
5.3 Buzzer Circuit.....	16
5.4 Inverter Circuit	17
5.5 USB Sensing Circuit	17

5.6 Starting & System Power Circuit	18
5.7 Utility Power Sensing Circuit.....	19
5.8 USB Communication Circuit	19
5.9 Overload Protection Sensing Circuit	20
5.10 MCU Circuit.....	20
5.11 LCD Circuit.....	21
5.12 Output Voltage Sensing Circuit	21
5.13 AC Input / Output Main Circuit	22

Figures

Figure 1: Product Outlook	6
Figure 2: Product Outlook	7
Figure 3: System Block Diagram.....	8
Figure 4: Normal Mode.....	8
Figure 5: Boost Mode	9
Figure 6: Battery Mode	9
Figure 7: Square Wave.....	13
Figure 8: Sine Wave.....	14
Figure 9: Charger Circuit	15
Figure 10: Transformer Flux Continue Circuit	16
Figure 11: Buzzer Circuit.....	16
Figure 12: Inverter Circuit	17
Figure 13: USB Circuit	17
Figure 14: Starting & System Power Circuit	18
Figure 15: Utility Sensing Circuit.....	19
Figure 16: USB Communication Circuit	19
Figure 17: Overload Protection Sensing Circuit	20
Figure 18: MCU Circuit.....	20
Figure 19: MCU Circuit.....	21
Figure 20: Output Sensing Circuit	21
Figure 21: AC Input / Output Main Circuit	22

1 INTRODUCTION

The BRICs Series UPS can supply clean and stable power to protect your equipment. The included PowerPanel® Personal Edition management software showcases the feature rich abilities of this UPS such as input/output power voltage readings, self-diagnostics, scheduled shutdown, and approximate battery back-up time readings. These UPS units can be placed in either a horizontal or wall-mount position to mark the most of your space. With Energy-Saving Technology, BRICs Series UPS can save up to 75% of electricity and save your electricity bill.

1.1 Features:

- Energy-Saving UPS
- Microprocessor-based full digital control
- Automatic Voltage Regulator (AVR)
- EMI, RFI, surge and lighting spike protection
- Power Management software included
- Scheduled Shutdown
- Auto Restart / Auto Charge
- Horizontal / Wall-mount Use
- USB Connectivity Port
- Compact design with highest power output
- Green Power Technology
- Save up to 75% of electricity
- Cable collector included

1.2 Applications:

- Home and Home Office
- Small Office

This manual introduces basic functions and troubleshooting methods of the UPS unit.

2 PRODUCT OUTLOOK

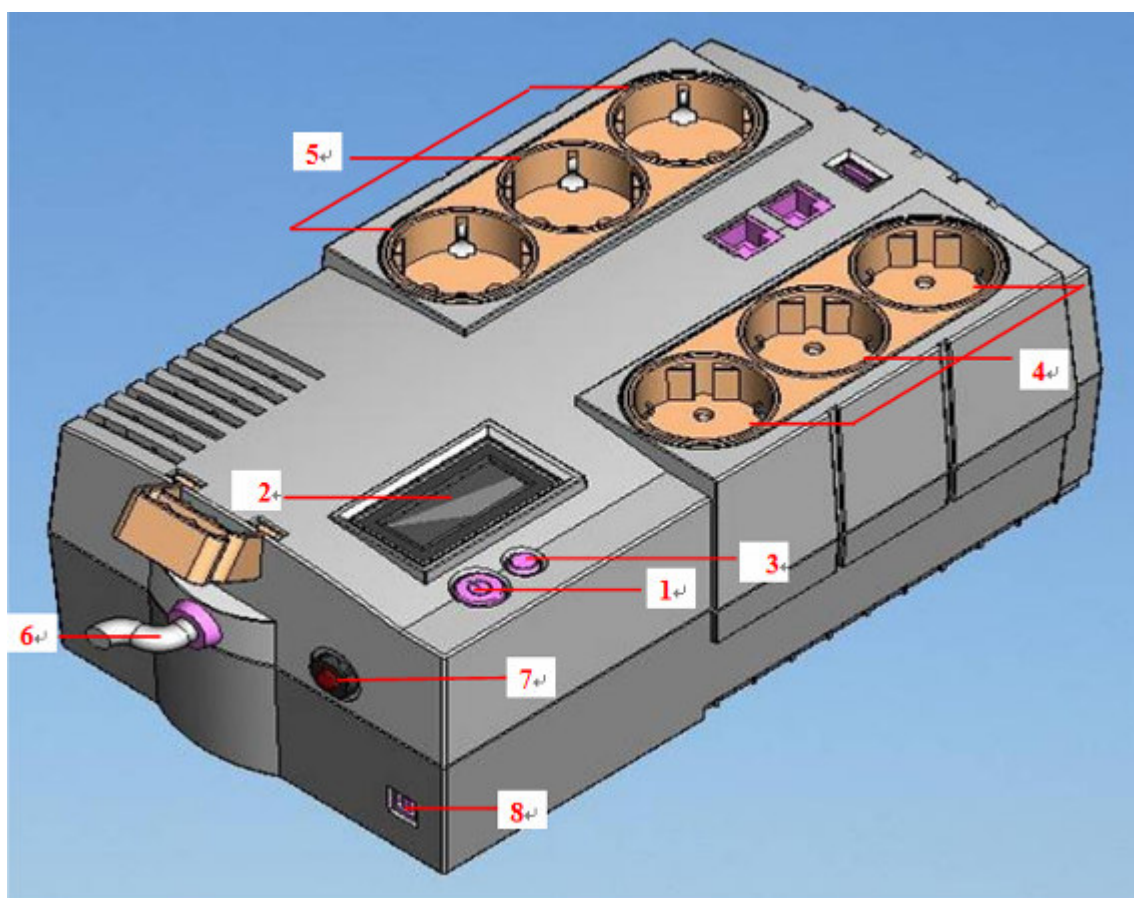


Figure 1: Product Outlook

No.	Function	Description
1	Power ON/OFF Switch	Press the power switch to turn the UPS ON or OFF.
2	LCD Display	The LCD will display the UPS status including input voltage, output voltage, runtime, percentage of load and battery, etc.
3	LCD Function Selection Switch	Press the LCD function selected switch to know the UPS status.
4	Surge Protection Outlets	Provides three surge protected outlets for connected equipment.
5	Battery Backup and Surge Protection Outlets	Provides three battery powered and surge protected outlets for connected equipment to insure temporary uninterrupted operation during a power failure.
6	Input Power Cord	Connect to utility.
7	Input Circuit Breaker	The Circuit Breaker provides optimal overload protection.
8	USB Port to PC	This port allows connection and communication from the USB port on the computer to the UPS unit.

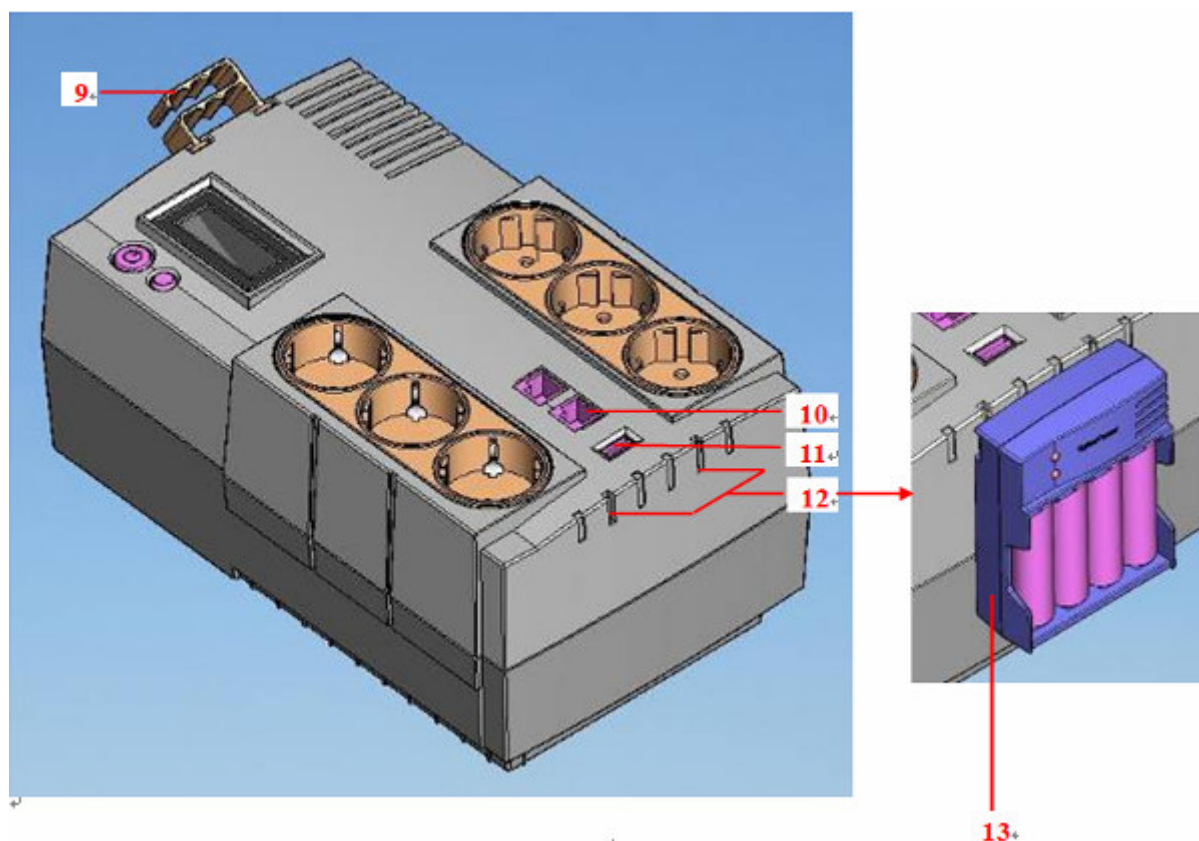


Figure 2: Product Outlook

No.	Function	Description
9	Cable Collector	Collect the cables connected from the AC outlets in the cable collector.
10	Communication Protection Ports (RJ45)	2 ports (one in, one out)
11	Battery Charger Port (USB 5V)	Charge external AA/AAA battery via battery charger port with the battery charger.
12	Battery Charger Fixture	For placing battery charger
13	Battery Charger	Put external AA/AAA batteries into the battery charger for charge. (AA/AAA Batteries NOT included)

3 PRINCIPLES OF OPERATION

3.1 System Block Diagram

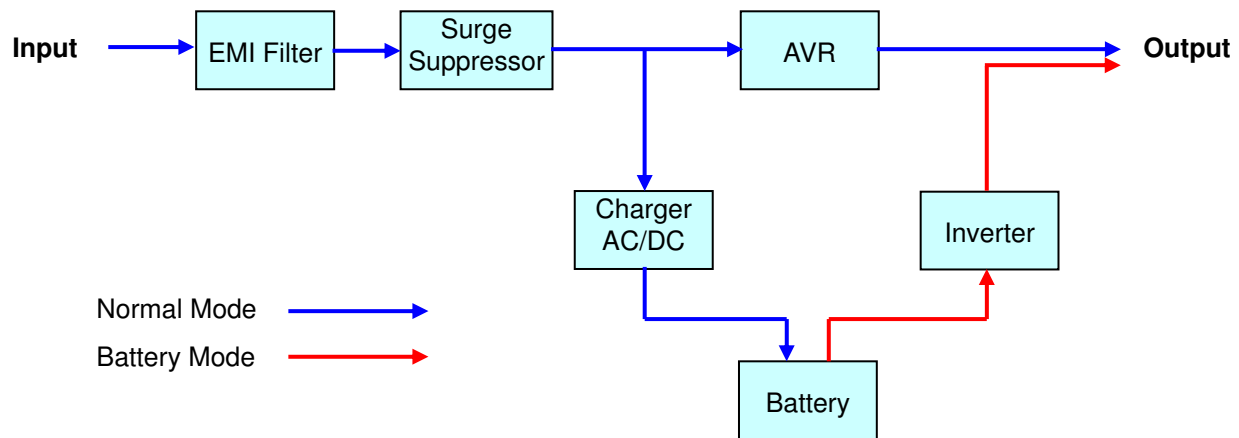


Figure 3: System Block Diagram

3.2 Normal Mode

When AC utility power is normal, it will go through the UPS to provide power (Bypass). At the same time, it will charge battery through AC/DC circuit (UPS Normal Mode).

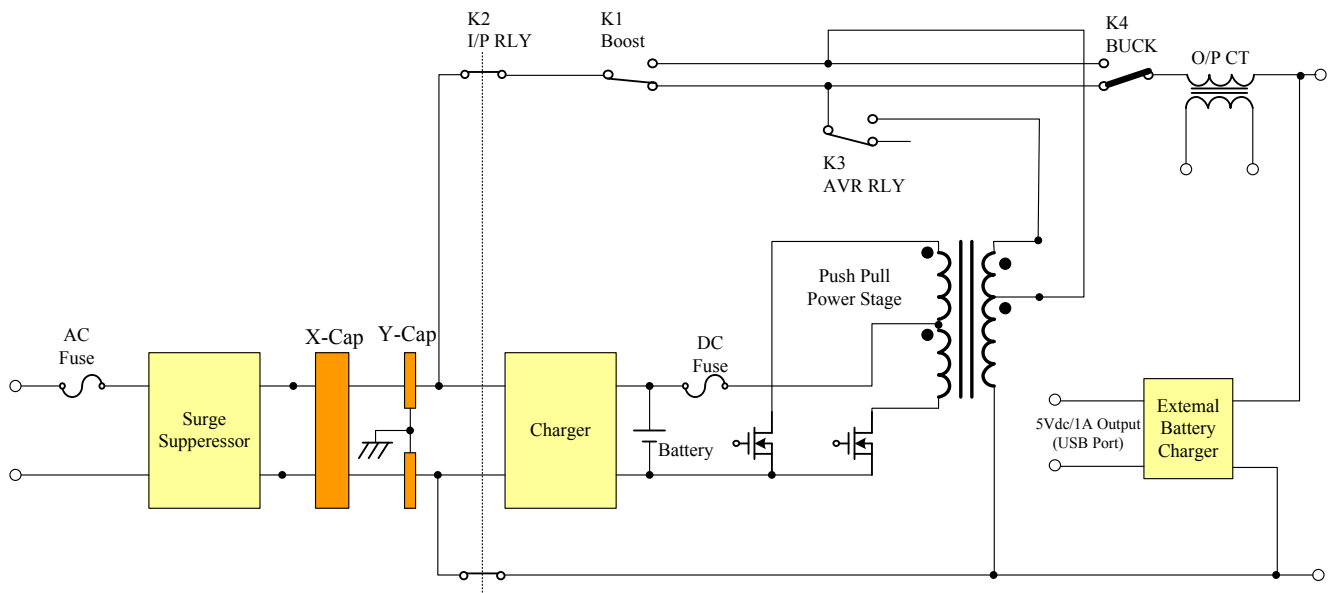


Figure 4: Normal Mode

3.3 Boost Mode

When AC utility power is low, it will go through boost circuit of the UPS to provide power, and correct it back to normal. At the same time, it will charge battery through AC/DC circuit (UPS Boost Mode).

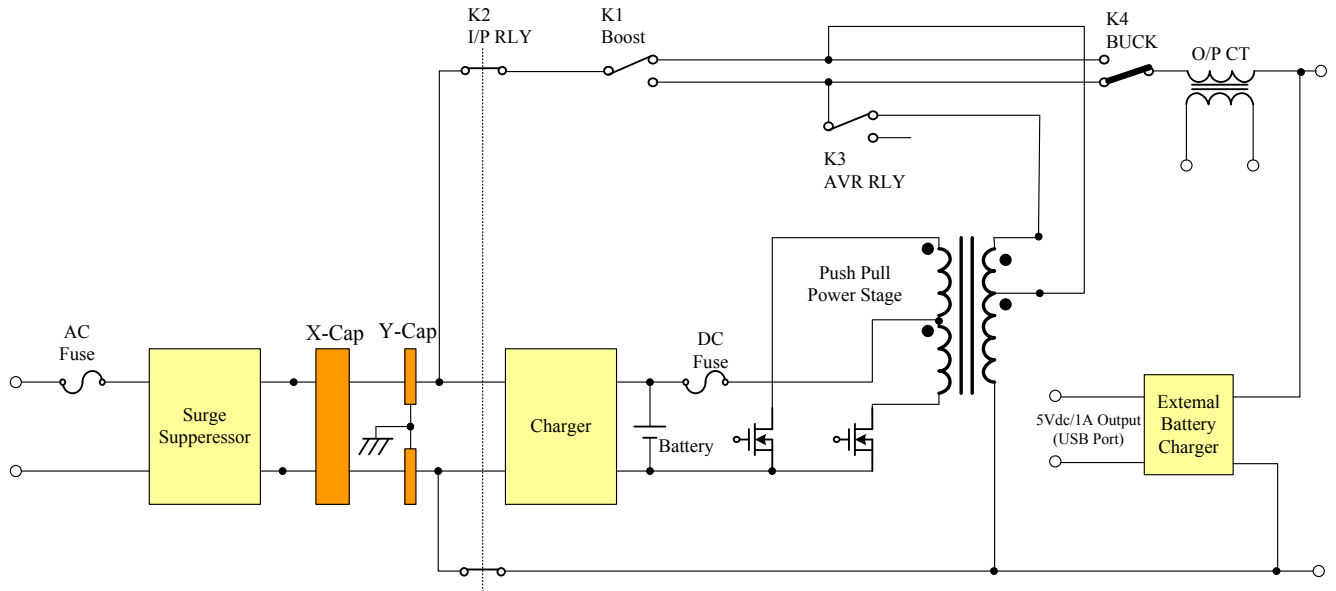


Figure 5: Boost Mode

3.4 Battery Mode

When AC utility power is abnormal, battery will provide power via DC/AC circuit (push-pull power stage) to output socket.

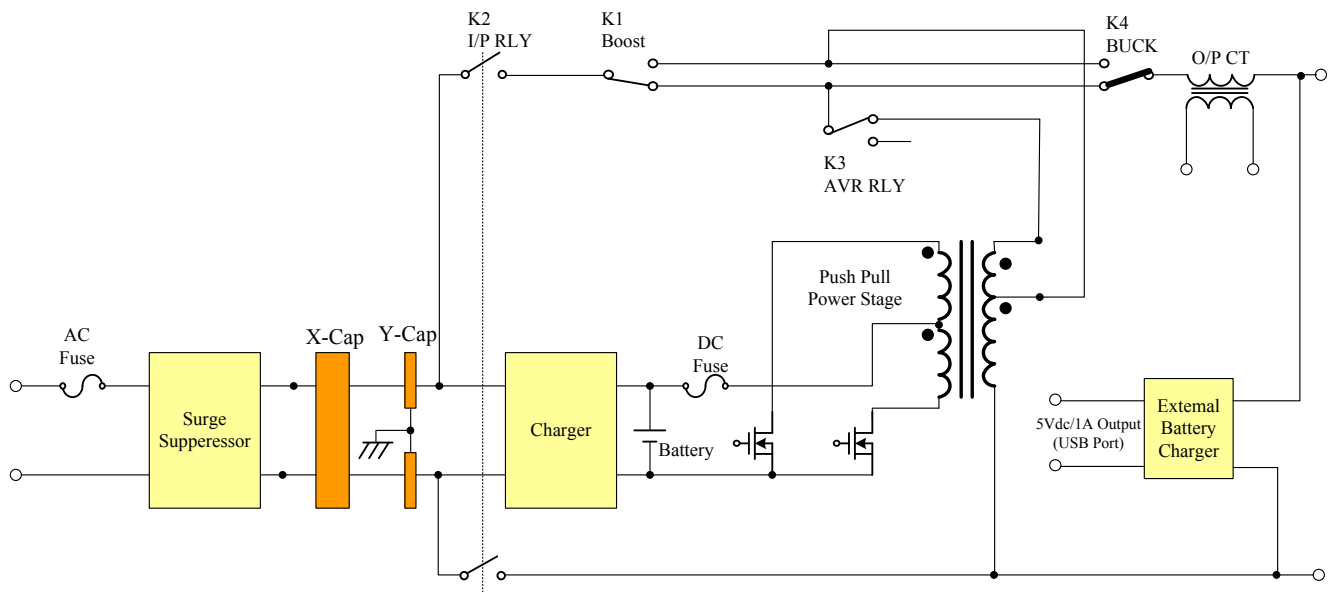


Figure 6: Battery Mode (INV)

4 REPAIR

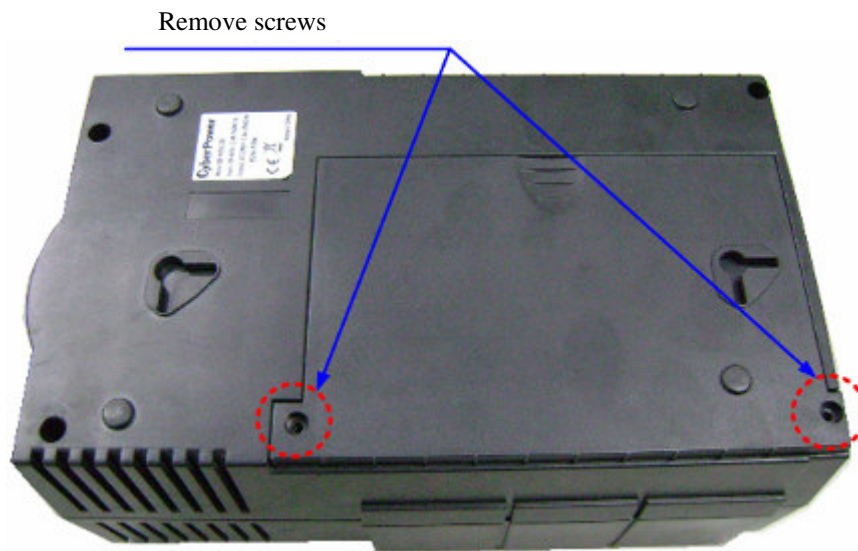
4.1 Test Equipment

- Digital Multi-Meter (DMM) with true RMS measurement
- DC power supply 15V 5A
- Digital Storage Oscilloscope (DSO)
- Load: 100~200W/230V milky light bulb.

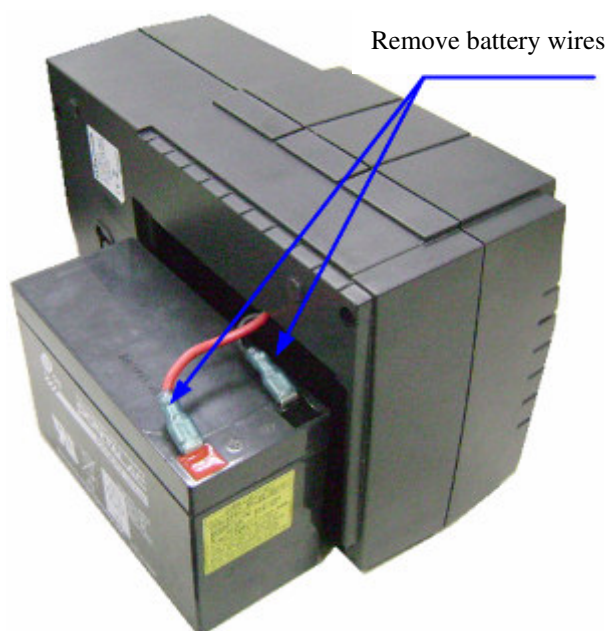
4.2 Repair Procedure

4.2.1 Equipment Preparation

- Remove the screws and open the cover

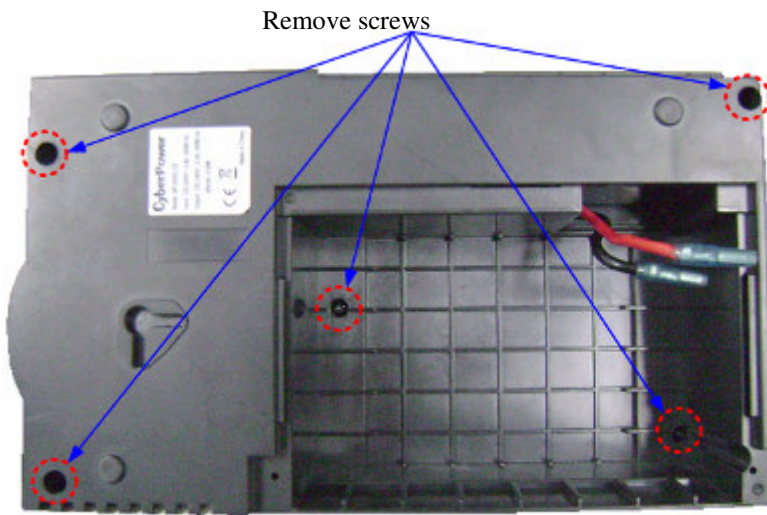


- Disconnect battery red and black wires. Turn the power on to discharge remaining electricity. Turn the power off.

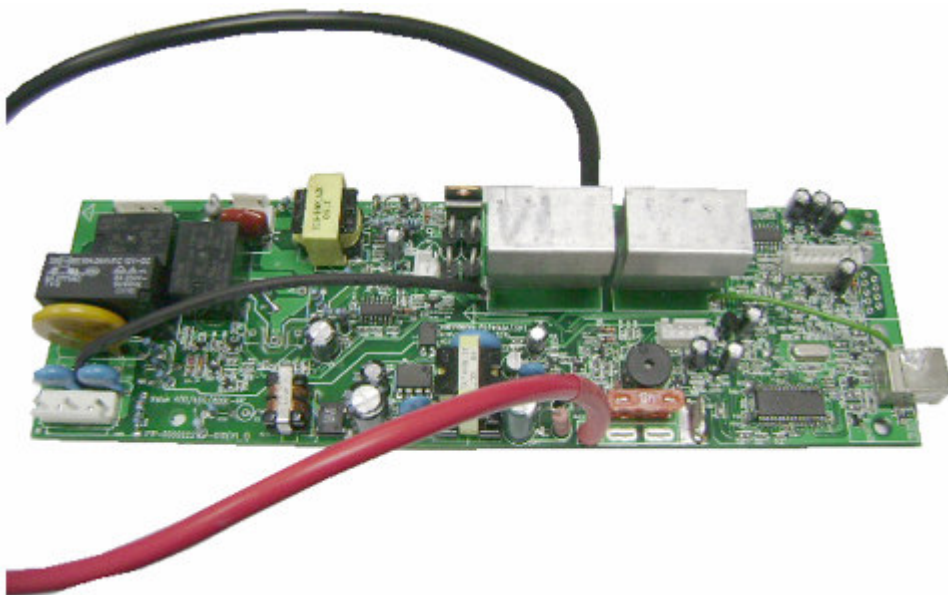


* Measure the battery voltage with DC power meter. Normal voltage should be within the range of 10.8V~13.8V.

- Remove the screws and bottom case to repair.

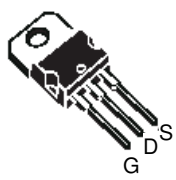
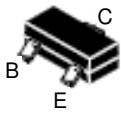


- PCB main board as shown below



4.2.2 Check MOSFET, Transistor, and Diode

- Remove the PCB from the cover
- Select the “” function on DMM then use DMM to check the voltage of the MOSFET and BJT as described below.
- Read the figure of voltage difference between S-G (“Source” and “Drain”) and the S-D (“Source” and “Gate”) of the MOSFET. The reading should be within the range of 1.3-2.5V / 0.45-0.65V.
- Read the figure of voltage difference between B-E (“Base” and “Emitter”) or B-C (“Base” and “Collector”) of the BJT. The reading should be within the range of 0.45-0.65V.
- Read the figure of voltage difference between A-K (“Anode” and “Cathode”) of the diode. The reading should be within the range of 0.45-0.65V

Part Reference	Measured Location	Expected Reading	Part Outline and Foot
Q1	S-G / S-D	1.3-1.5V / 0.45-0.65V	
Q2	S-G / S-D	1.5-2.5V / 0.45-0.65V	
Q3	S-G / S-D	1.5-2.5V / 0.45-0.65V	
Q4	S-G / S-D	1.5-2.5V / 0.45-0.65V	
Q5	S-G / S-D	1.5-2.5V / 0.45-0.65V	
Q20,Q10, Q7,Q9,Q15,Q 16,Q18,Q19,Q 21,Q22,Q23,Q 24, Q6,Q13,Q14	B-E / B-C	0.45-0.65V/ 0.45-0.65V	
D11-D14	P-N	0.45-0.65V	

4.2.3 Check Resister

- Set the DMM to “ Ω ” function and measure the resistance value of Inverter Circuit as the following table.

Part Reference	Measured Location	Expected Reading	Remark
R8,R9,R11,R14 R7,R10,R12,R13		2KOhm	R8,R9,R11,R14for BR 450E R8,R9,R11,R14, R7,R10,R12,R13 for BR 650E/850E

4.2.4 Turn on the unit with DC power supply

- Setup the instrument: adjust the output voltage of DC power supply to 13V with current limit set at 5~6Adc.
- Connect the positive output of the DC power supply to the BAT(+)(Red wire) of the transformer and the negative output to the BAT(-)(Black wire) of the PCB.
- Turn on the UPS.
- Check the reading of output current from the power supply; it should be between 0.6-0.9A.

4.2.5 Signal Measurement

Please follow the table below.

Item	Test Point	Test Procedure	Expected Result
+12V power	C18 TO GRND	1. Start UPS at battery mode. 2. Connect DVM (DC) to test points.	12V $\pm$ 0.5V
+5V power	C12 TO GRND	1. Start UPS at battery mode. 2. Connect DVM (DC) to test points.	5V $\pm$ 0.1V
CPU RESET signal	U7_PIN 8 TO GRND	1. Start UPS at battery mode. 2. Connect DVM (DC) to test points.	5V $\pm$ 0.1V
CPU oscillation wave	U7_PIN 2 3 TO GRND	1. Start UPS at battery mode. 2. Connect DSO to test points.	24M Hz

4.2.6 Output Voltage Measurement

- Check the output voltage of UPS. The reading should be within 225~240Vac.
- Check the waveform of UPS output. It should be square wave.

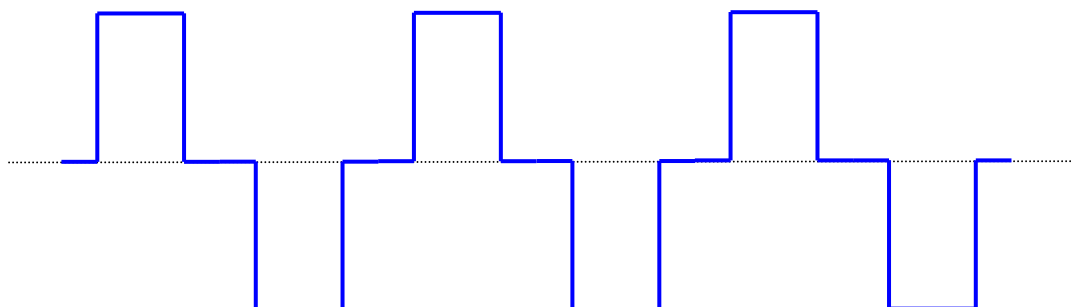


Figure 7: Square Wave

4.2.7 Connect UPS to Utility Power

- Connect UPS to utility power. The UPS should transfer to AC mode at this moment.
- If the transfer fails, check if input fuse is blown. When this occurs, replace the fuse.
- Check the output voltage of UPS. The reading should be within 220~240Vac, same as utility voltage.
- Check the waveform of UPS output. It should be sine wave.

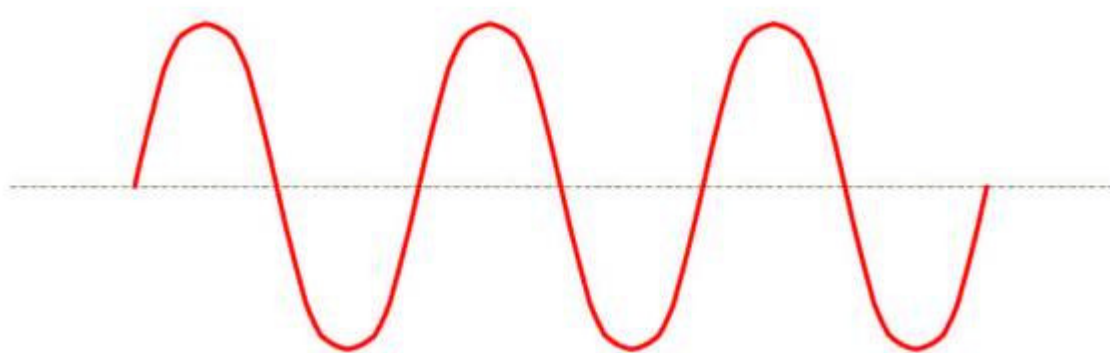


Figure 8: Sine Wave

4.2.8 Charging Voltage Measurement

- In utility mode, charging voltage is higher than original DC voltage output (13Vdc). The value is displayed on DC power supply. Check the value $13.8 \pm 0.2V$. You can also remove (+)(-) wires of DC power supply and measure the charging voltage of (+)(-) battery wires with DMM.
- Turn off the UPS unit and turn off utility power (or remove the UPS input power core from AC outlet). Remove (+)(-) wires of DC power supply, then connect the battery.

4.2.9 Boost Test

- Connect light bulb to UPS output outlet.
- Turn on the unit in battery mode. The UPS should supply power to light bulb normally. If UPS fails to supply power, it could be the problems of battery shortage or damage. Please charge the battery for hours or change a new battery before conducting the test again.
- Change the light bulb to computer and connect it to UPS output outlet. Connect the UPS power core to AC power and turn on the computer.
- Disconnect utility power. After UPS switch to battery mode, connect utility power back to utility mode. Check if the computer restarts due to the shift between battery and utility mode.
- Test completed. UPS can function normally.

5 SCHEMATIC

5.1 Charger Circuit

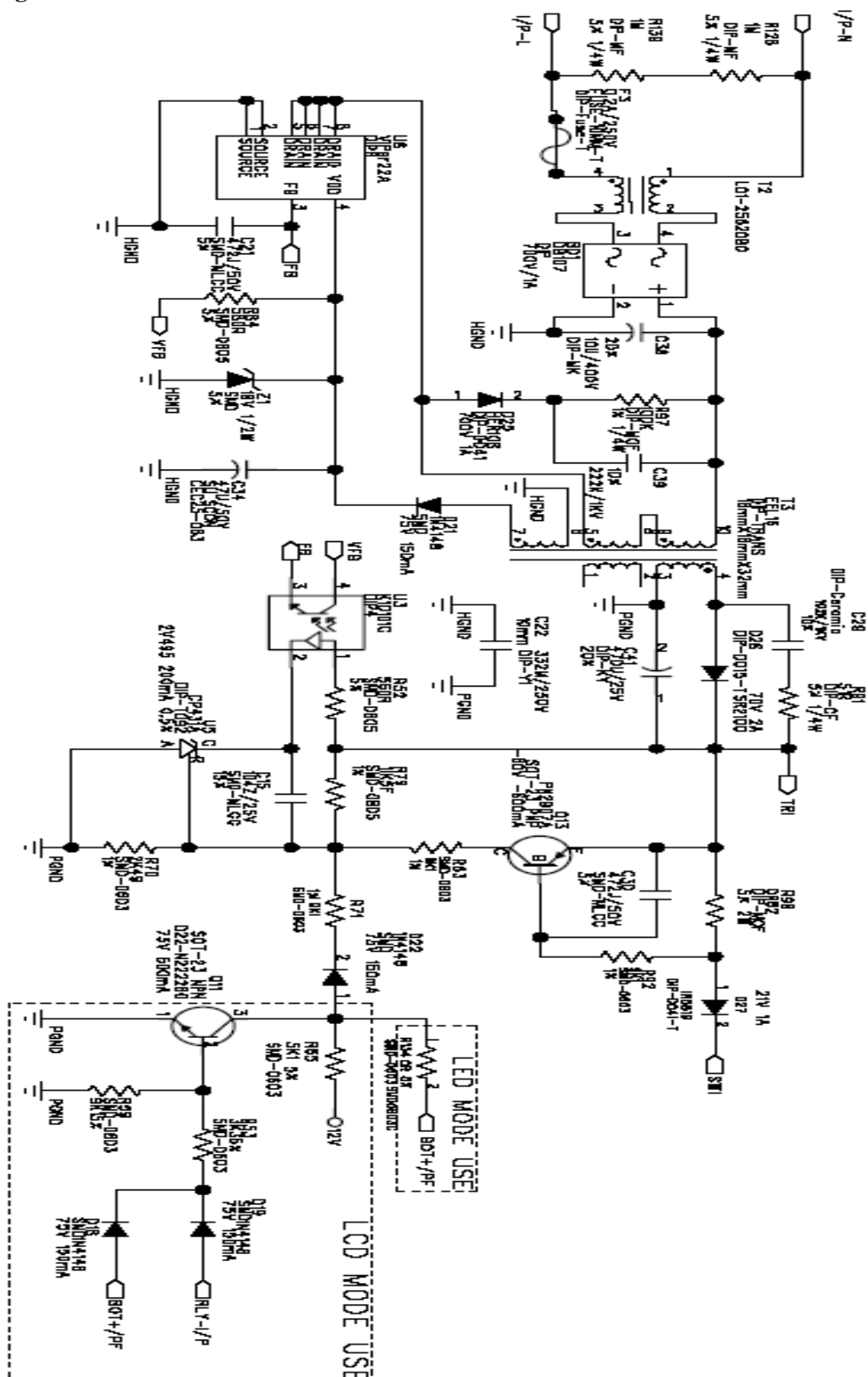


Figure 9: Charger Circuit

5.2 Transformer Flux Continue Circuit

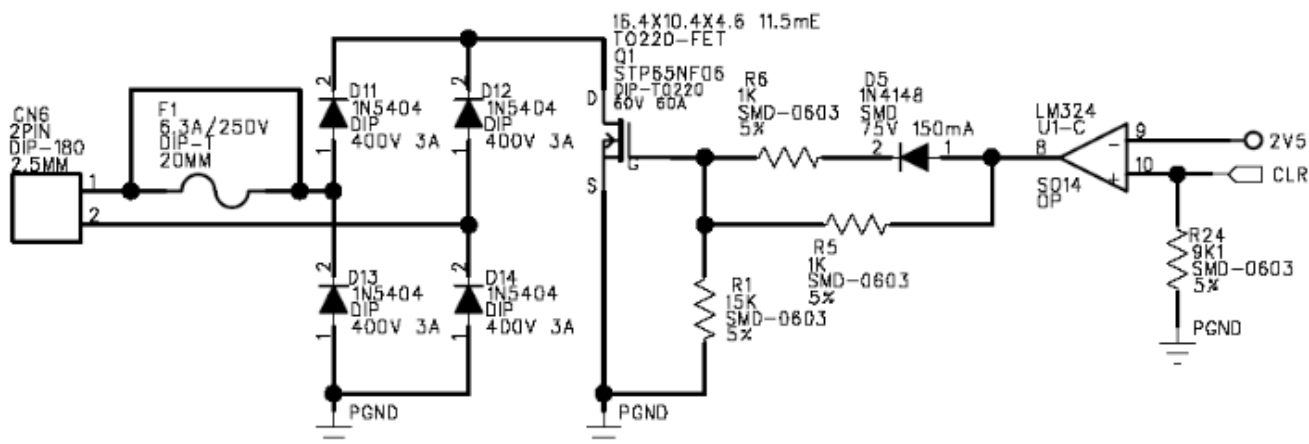


Figure 10: Transformer Flux Continue Circuit

5.3 Buzzer Circuit

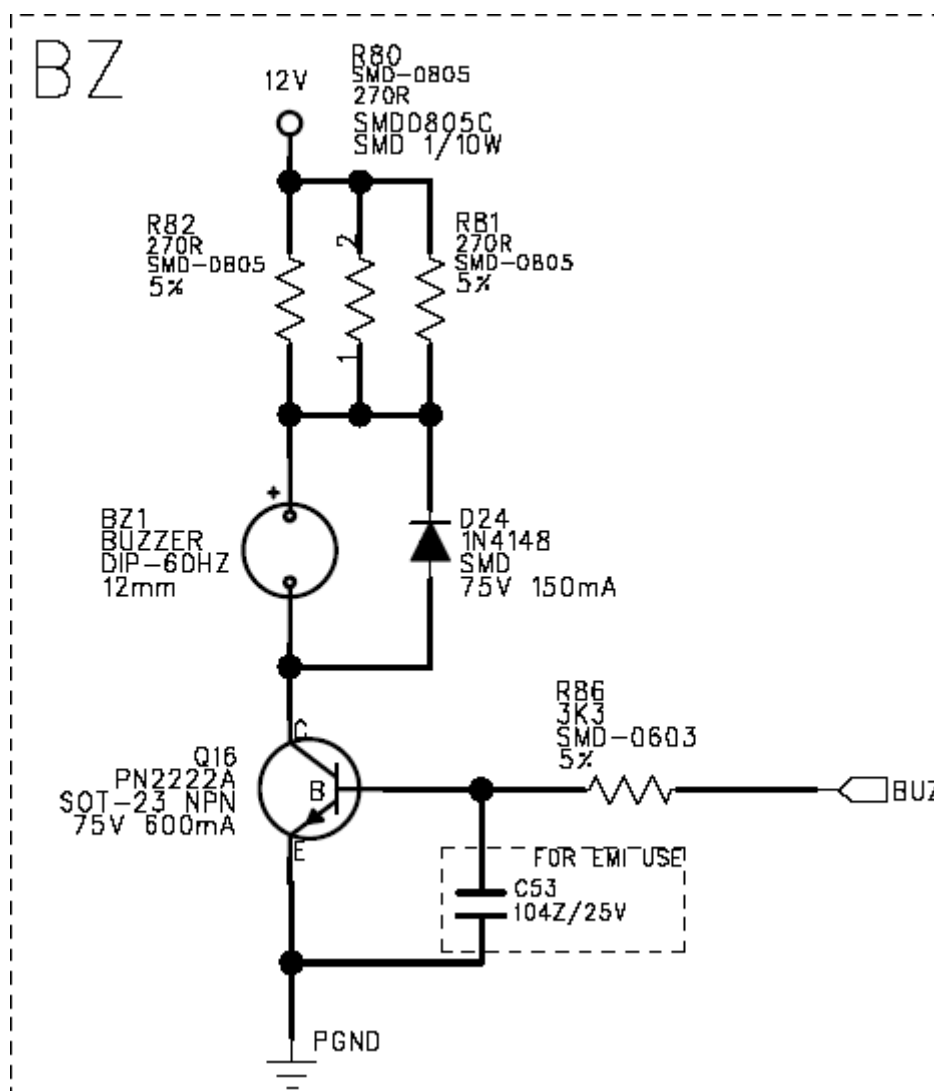


Figure 11: Buzzer Circuit

5.4 Inverter Circuit

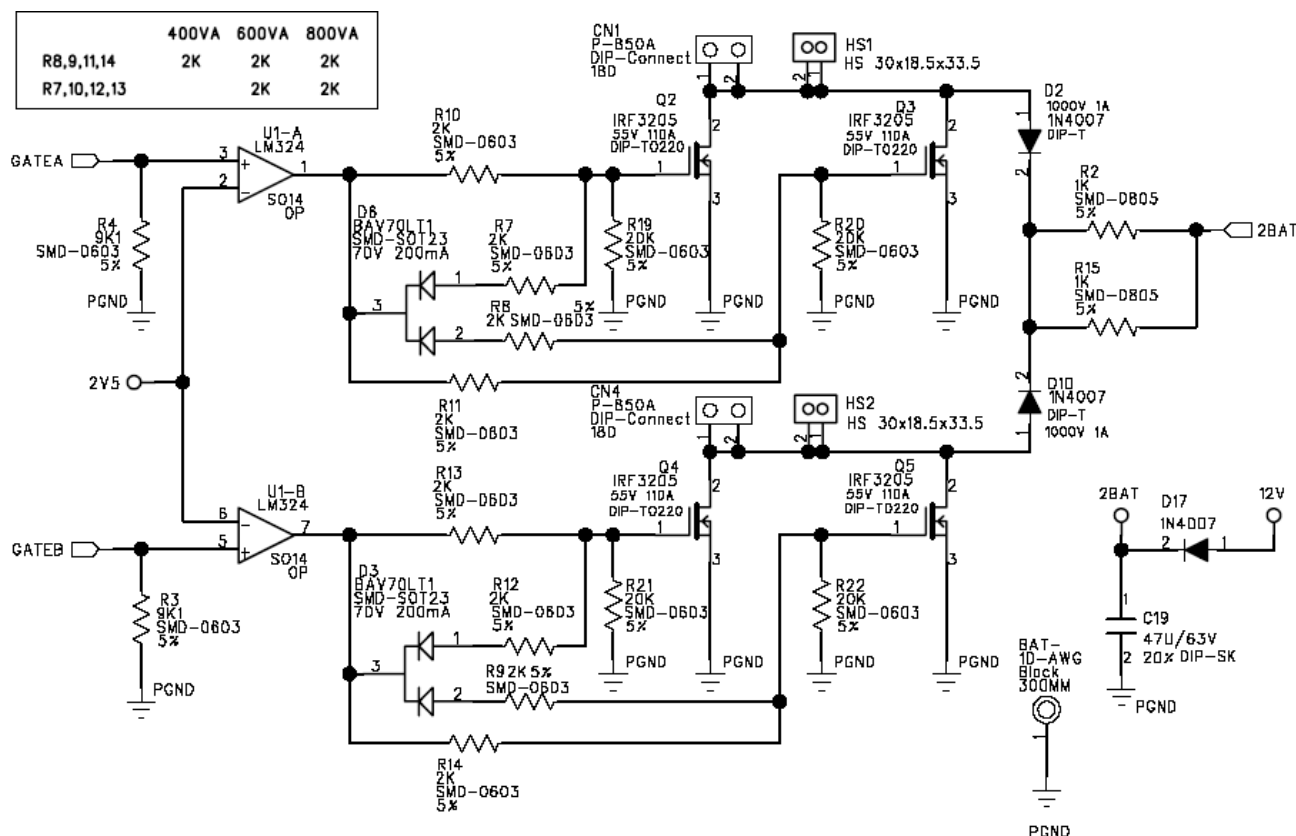


Figure 12: Inverter Circuit

5.5 USB Sensing Circuit

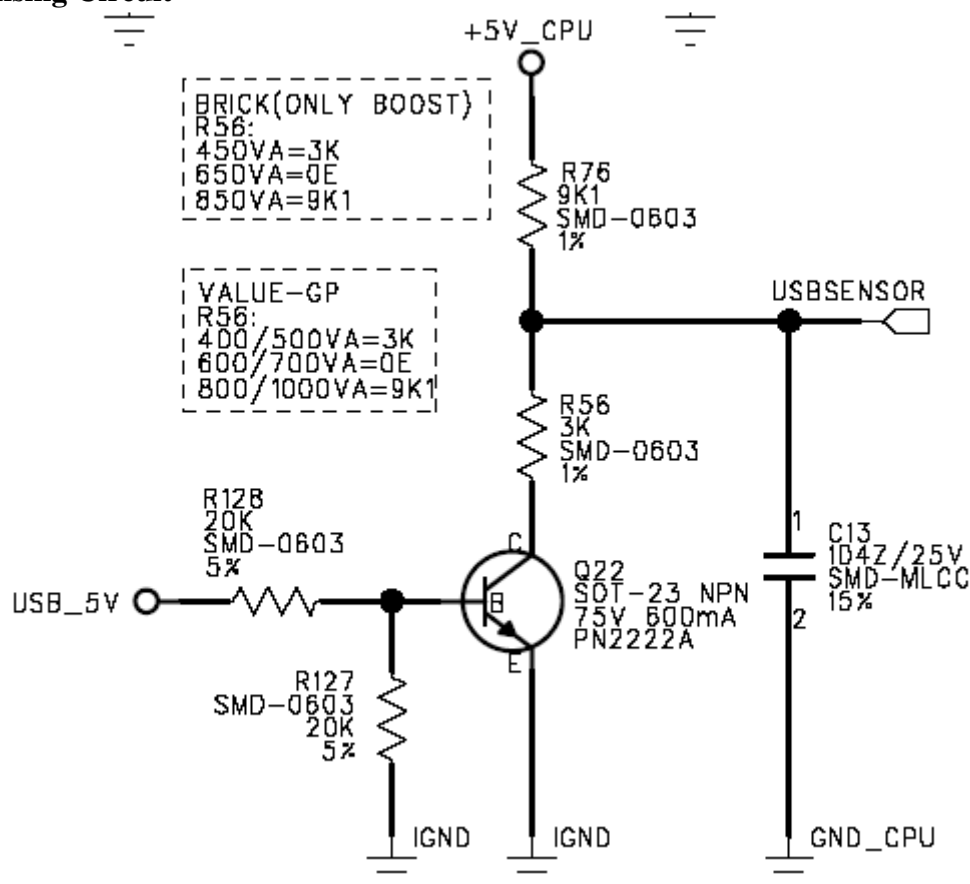


Figure 13: USB Sensing Circuit

5.6 Starting & System Power Circuit

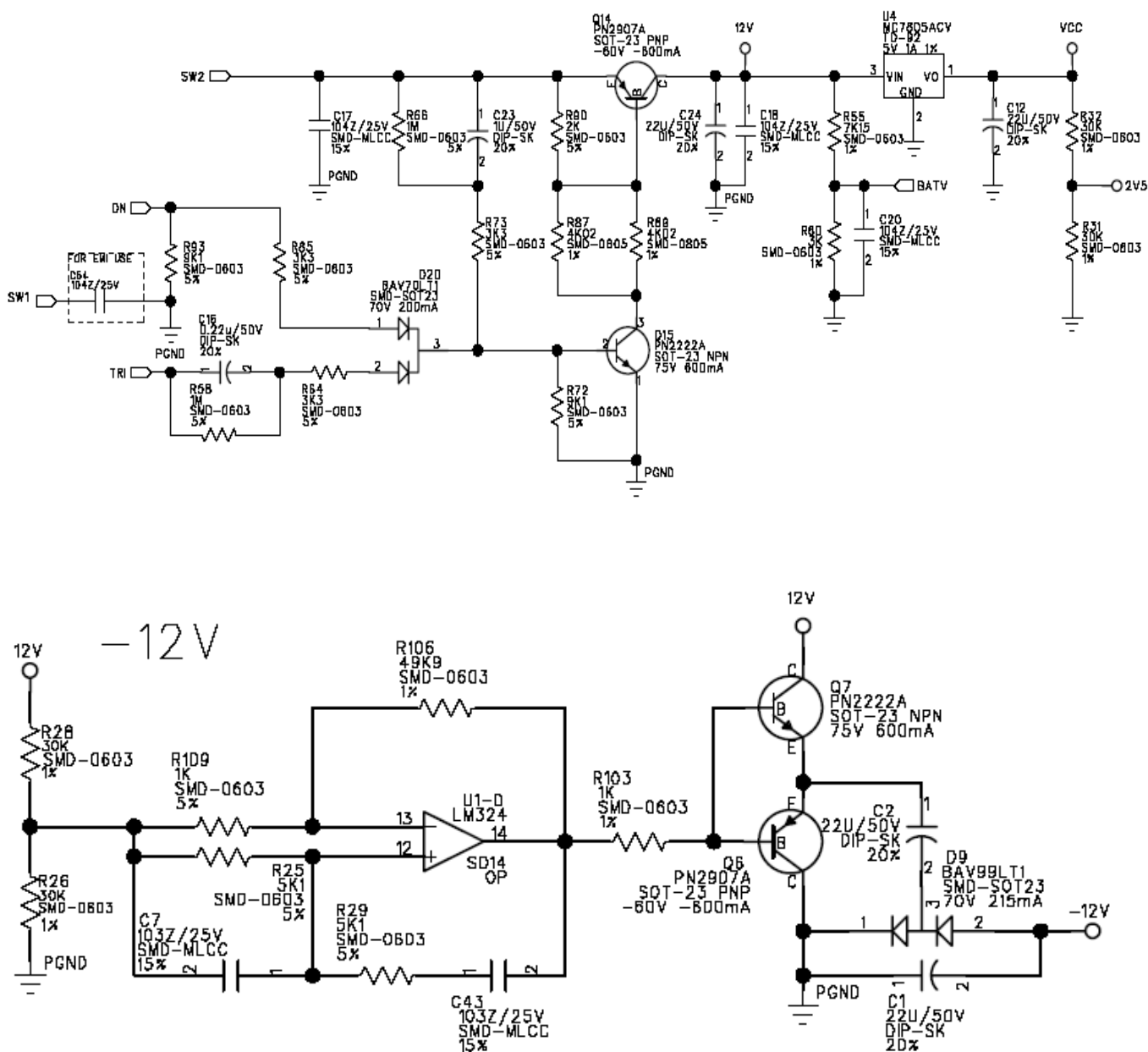
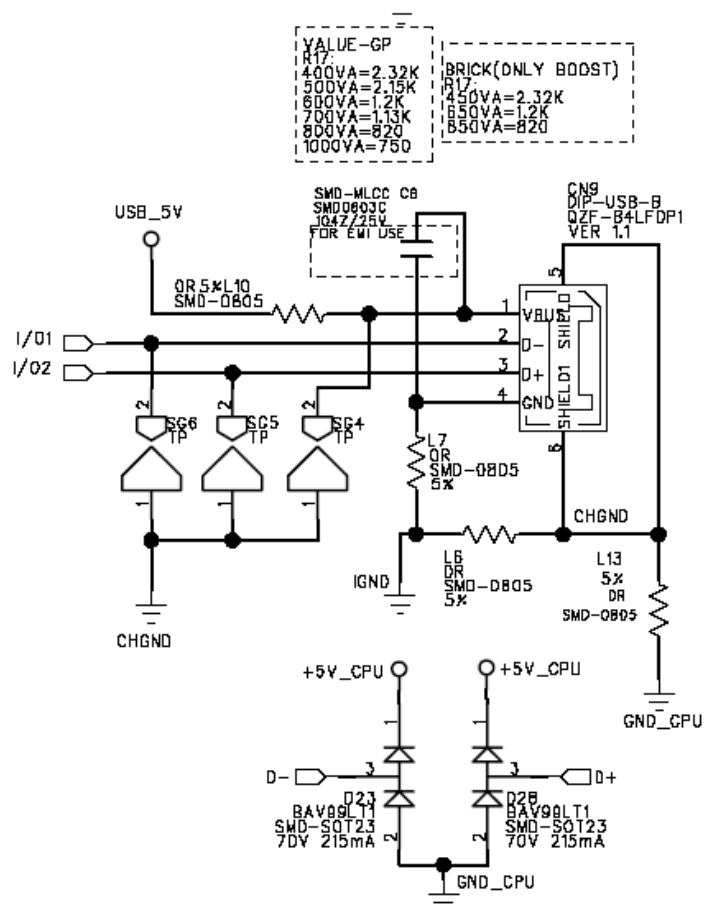
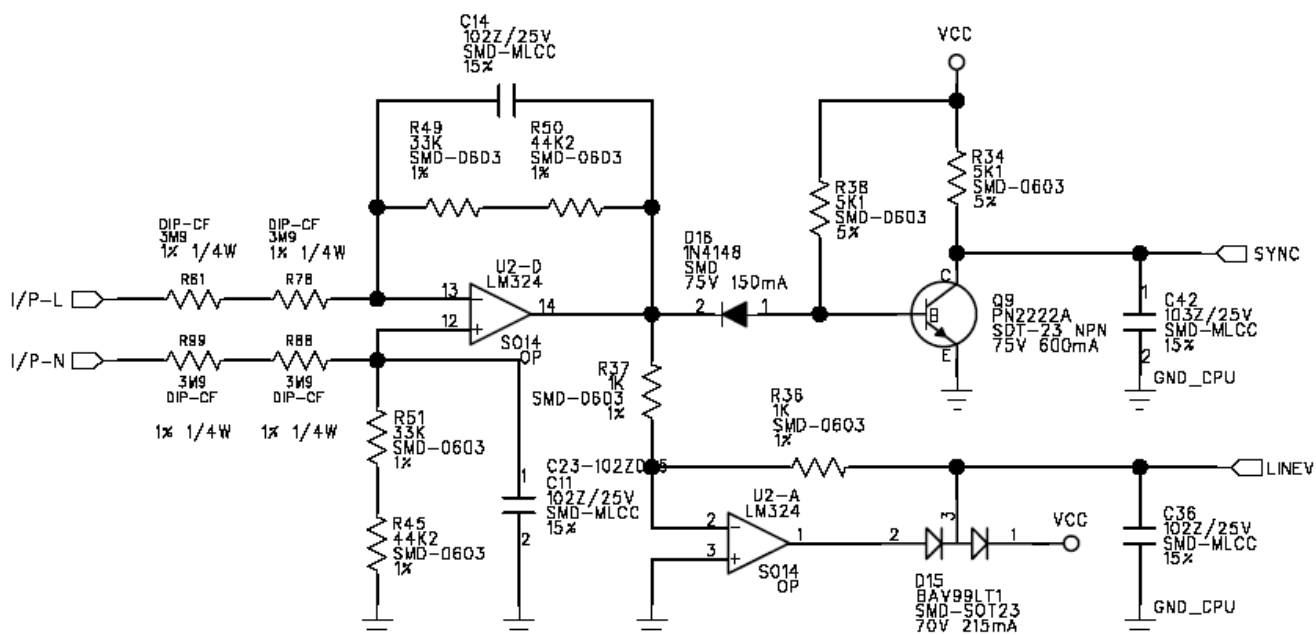
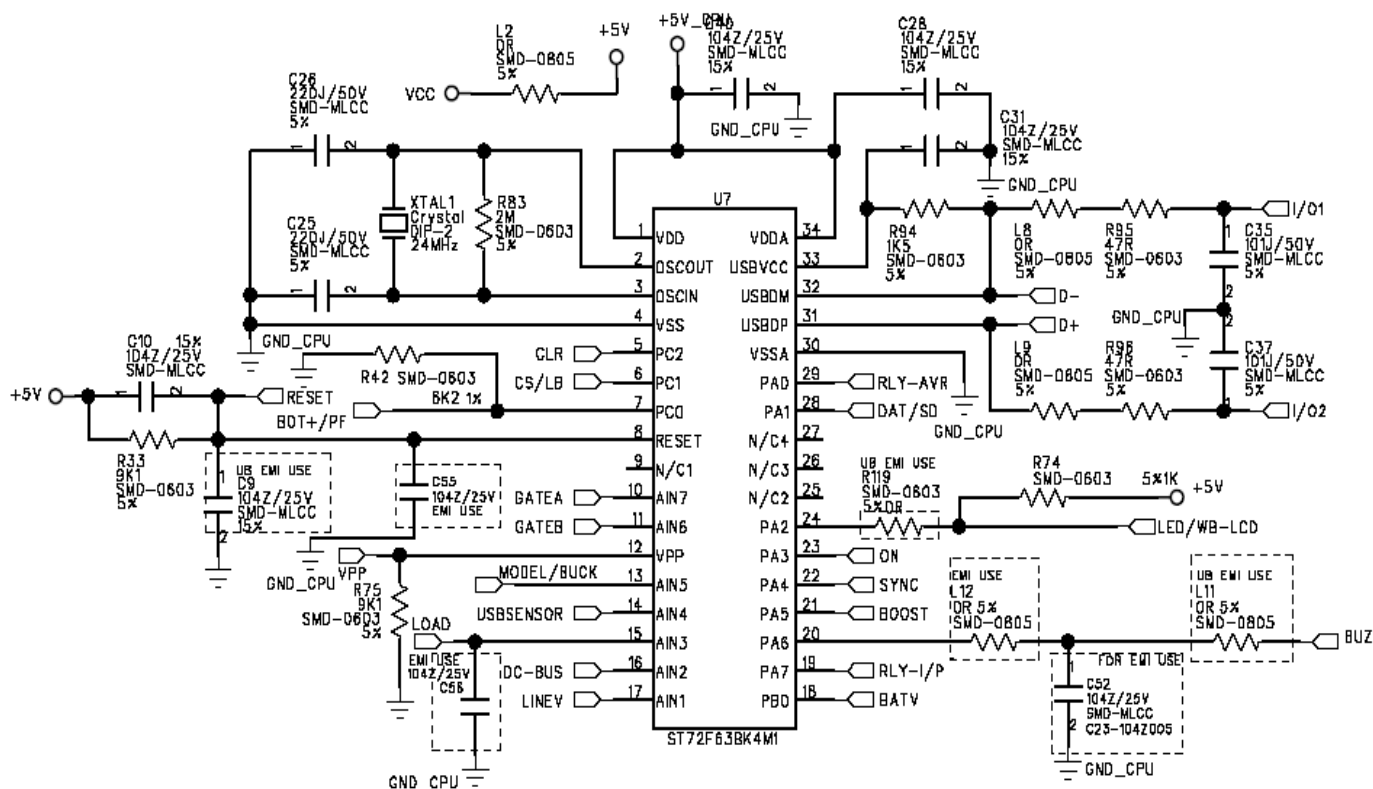
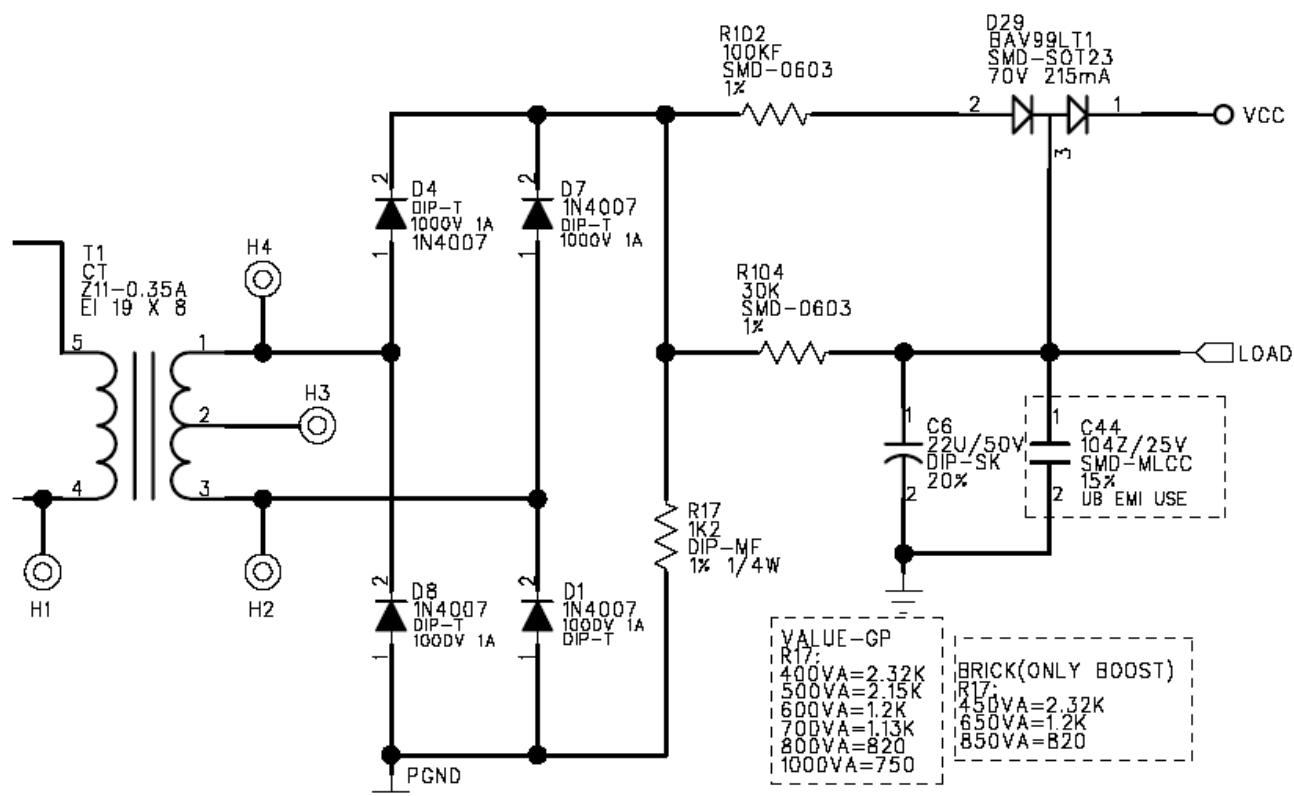


Figure 14: Starting & System Power Circuit





5.11 LCD Circuit

LCD MODEL ONLY

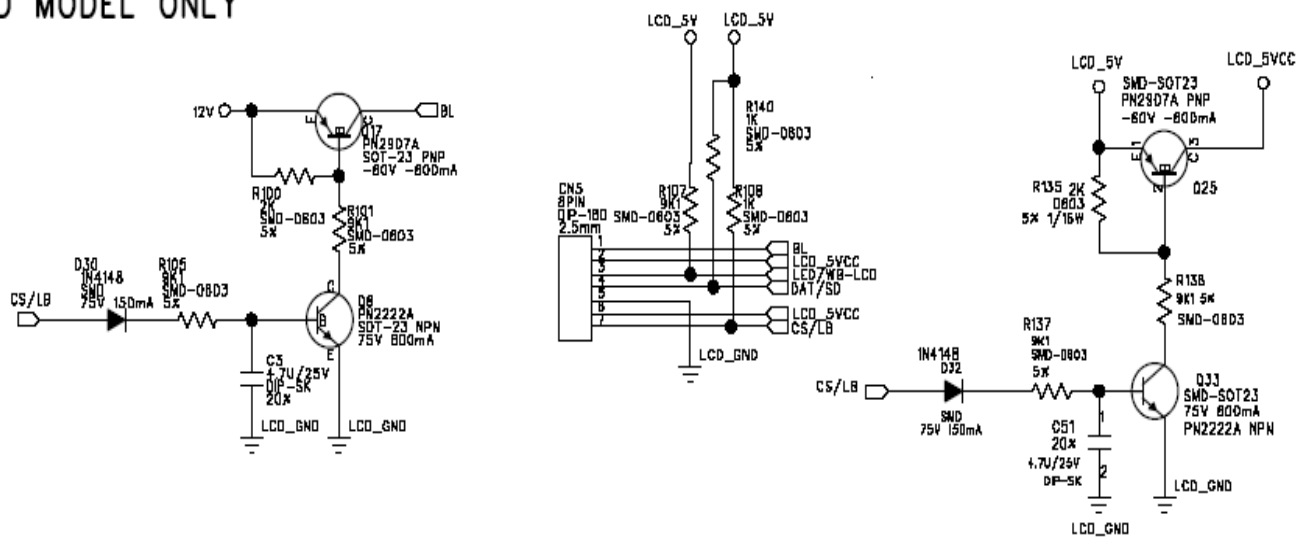


Figure 19: LCD Circuit

5.12 Output Voltage Sensing Circuit

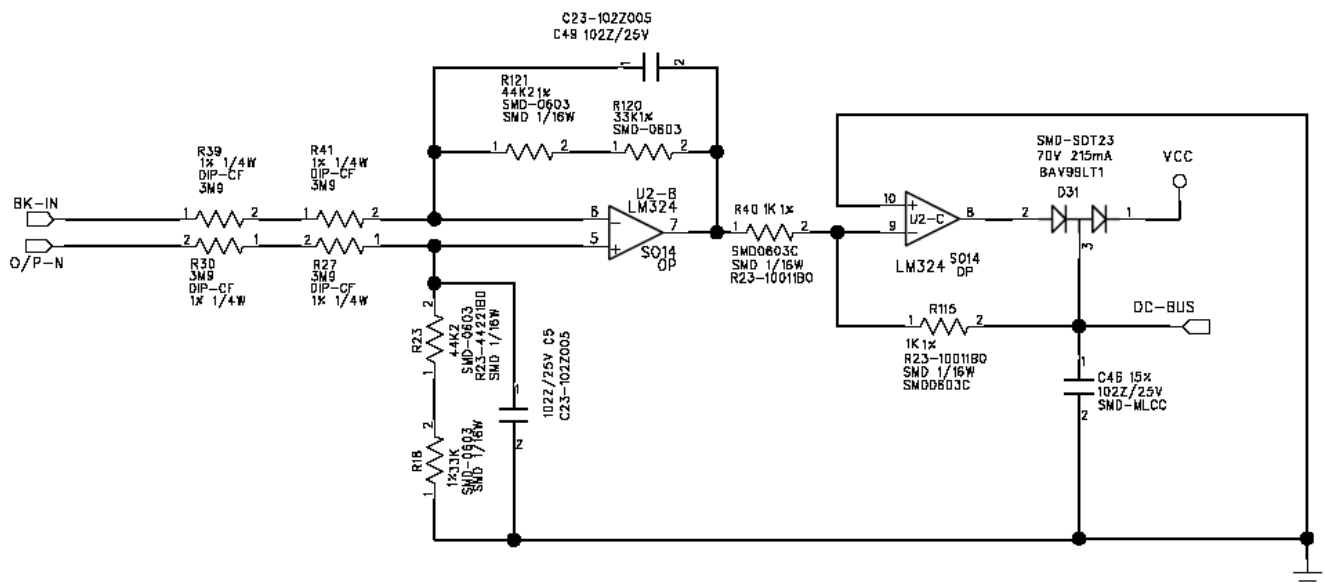


Figure 20: Output Voltage Sensing Circuit

5.13 AC Input/output Main Circuit

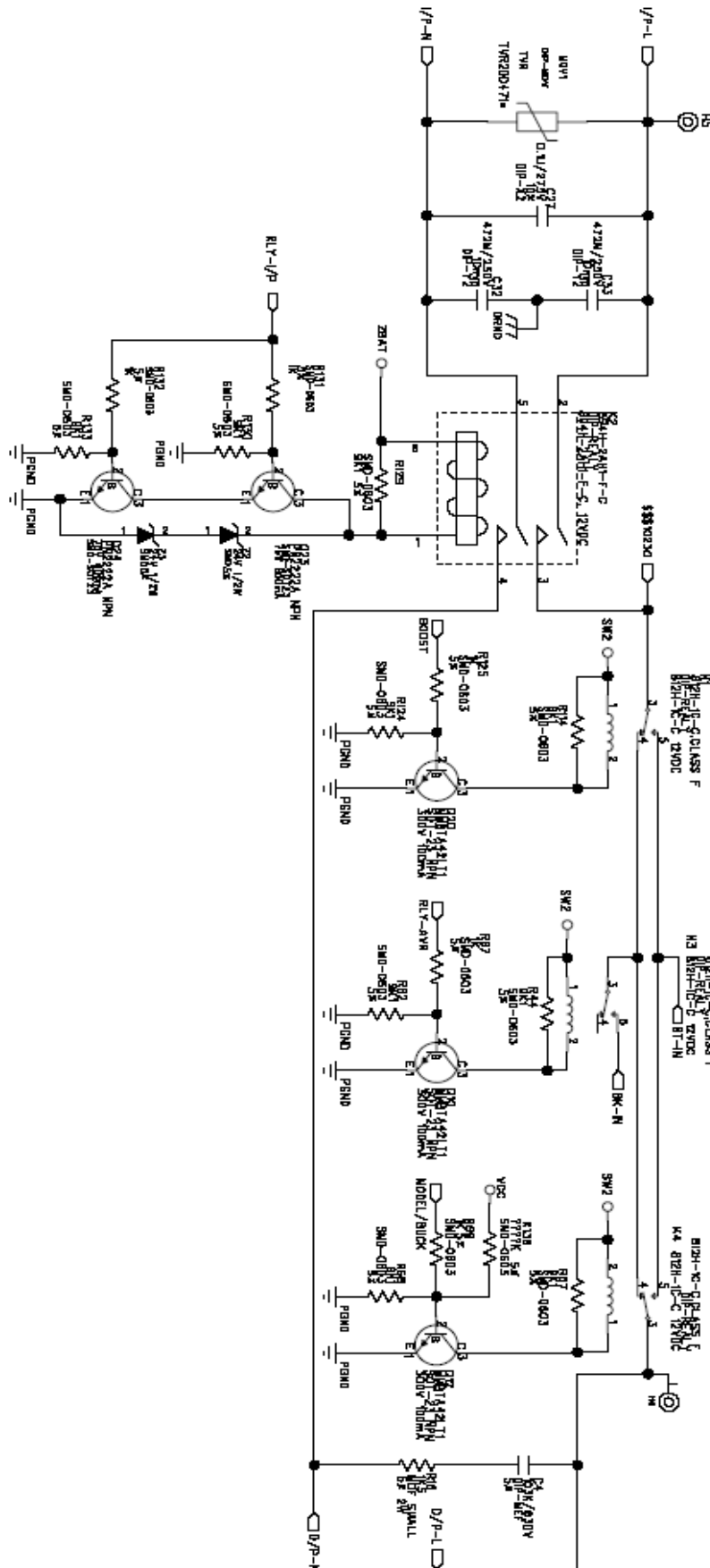


Figure 21: AC Input / Output Circuit