

NCP4330EVB

3V3 Post-Regulation Driven by the NCP4330

Evaluation Board Description

Prepared by Vitek Musil

ON Semiconductor



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Introduction

The NCP4330 IC is designed for forward, multiple output power supplies using synchronous rectification. Traditionally, a regulation arrangement regulates one of the outputs by modulating the forward converter duty-cycle. The other outputs are regulated by a dual MOSFET arrangement driven by the NCP4330. The high-side MOSFET turns on during one part of the forward converter on-time, while the low-side power switch is on for the rest of the period (free wheeling). The sequencing of the switching phases includes overlaps that result in only one hard switching (high-side turn on). The three other transitions are soft for an optimum efficiency. For detailed description see the NCP4330 datasheet.

The evaluation board is designed to speed up evaluation of NCP4330 based post regulator SMPS applications together with external traditionally regulated main forward supply.

Figure 2 shows how the NCP4330 evaluation board is to be connected to the secondary side of the main forward mode SMPS. The 9.0 VDC voltage for powering V_{CC} on the NCP4330 board is delivered from external DC supply for simplicity.

Short and thick wires are recommended for connecting the V_{in} and ground inputs on the board and the loop area should be kept as small as possible.

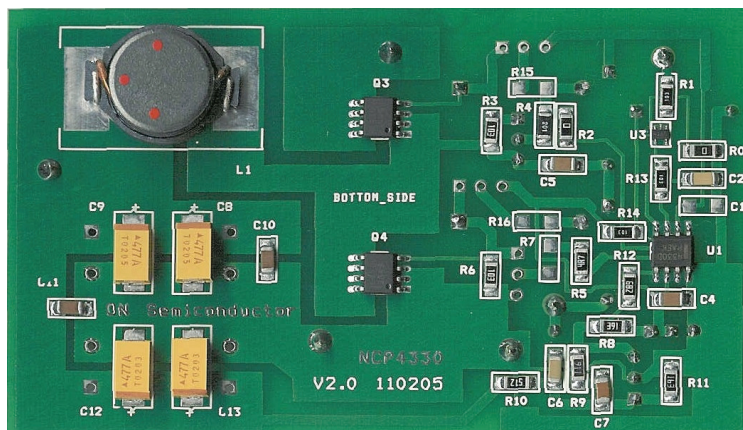


Figure 1. NCP4330 Evaluation Board

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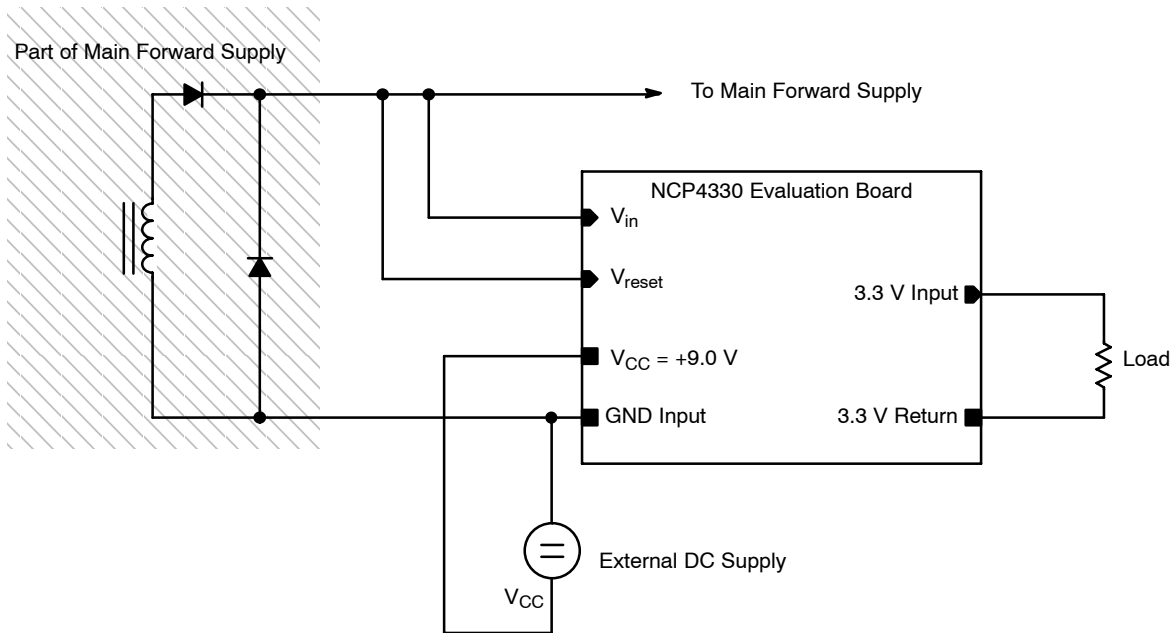


Figure 2. NCP4330 Evaluation Board Using Together with Main Forward Mode SMPS and External DC Supply

Evaluation Board

NCP4330 Evaluation board is built on one copper layer PCB using mixed (through hole and SMT) mounting technology. Large copper areas are used when needed for minimizing parasitic inductances and cooling the surface mounted power devices (NTMS4700N power FETs, NCP4330 IC and inductor).

Evaluation board schematics showing all the components mounted originally on the PCB can be seen in Figure 5.

In Figure 6 there are all possible components what can be mounted on the PCB optionally. Please find examples of additional driver booster with one or two transistors in Figure 3 and Figure 4. This can be useful for evaluation with huge external FETs. As shown in Figure 6, the free soldering pads for such components are available for both the low-side and high-side power FETs.

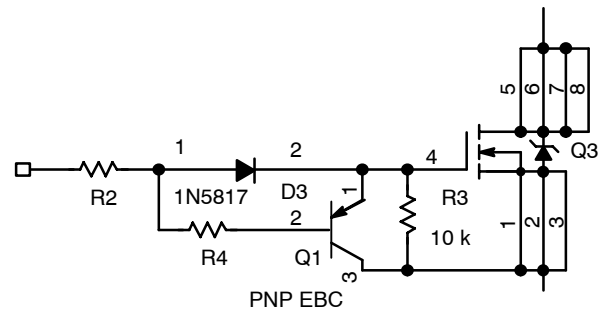


Figure 3. Example of Driver Booster with One Transistor

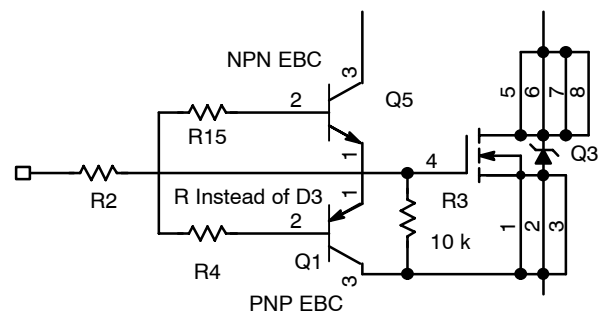


Figure 4. Example of Driver Booster with Two Transistors

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L1 inductor must be able to work under full output load current and magnetizing current ingredient without saturation in the whole range of operating temperatures.

The output capacitors right choice, very low ESR and high RMS current rating, is important for the post regulator output voltage quality. For those who want to test the application with an other type of capacitors C8,C9,C12,C13 instead than types specified in the BOM, silk screen on the PCB top side for through hole capacitors with the same reference designators, predrilled holes and soldering pads on the copper will be helpful.

Small diode D1 is to protect wrong polarity of external DC supply only and can be omitted in customer's applications using NCP4330. The D4 diode is mounted to allow using

optional C1 capacitor in some applications with very low V_{in} input voltages. In the majority of applications the C1 is not needed and diode D4 can be omitted. (In this paragraph omitted means replaced by wire.)

NCP4330 ramp signal in the NCP4330 evaluation board is designed for working with main forward SMPS operating on 200 kHz typically. For much different frequency the C2 capacitor and R12 resistor on C_{ramp} and I_{ramp} pins of the NCP4330 IC have to be tuned accordingly.

The U3 logic IC, Schmitt Trigger Inverter and Level shifter MC74VHC1GT14, is forming the input signal from main forward SMPS to get very exact information about behavior in the main supply to synchronize the NCP4330 post regulator with it.

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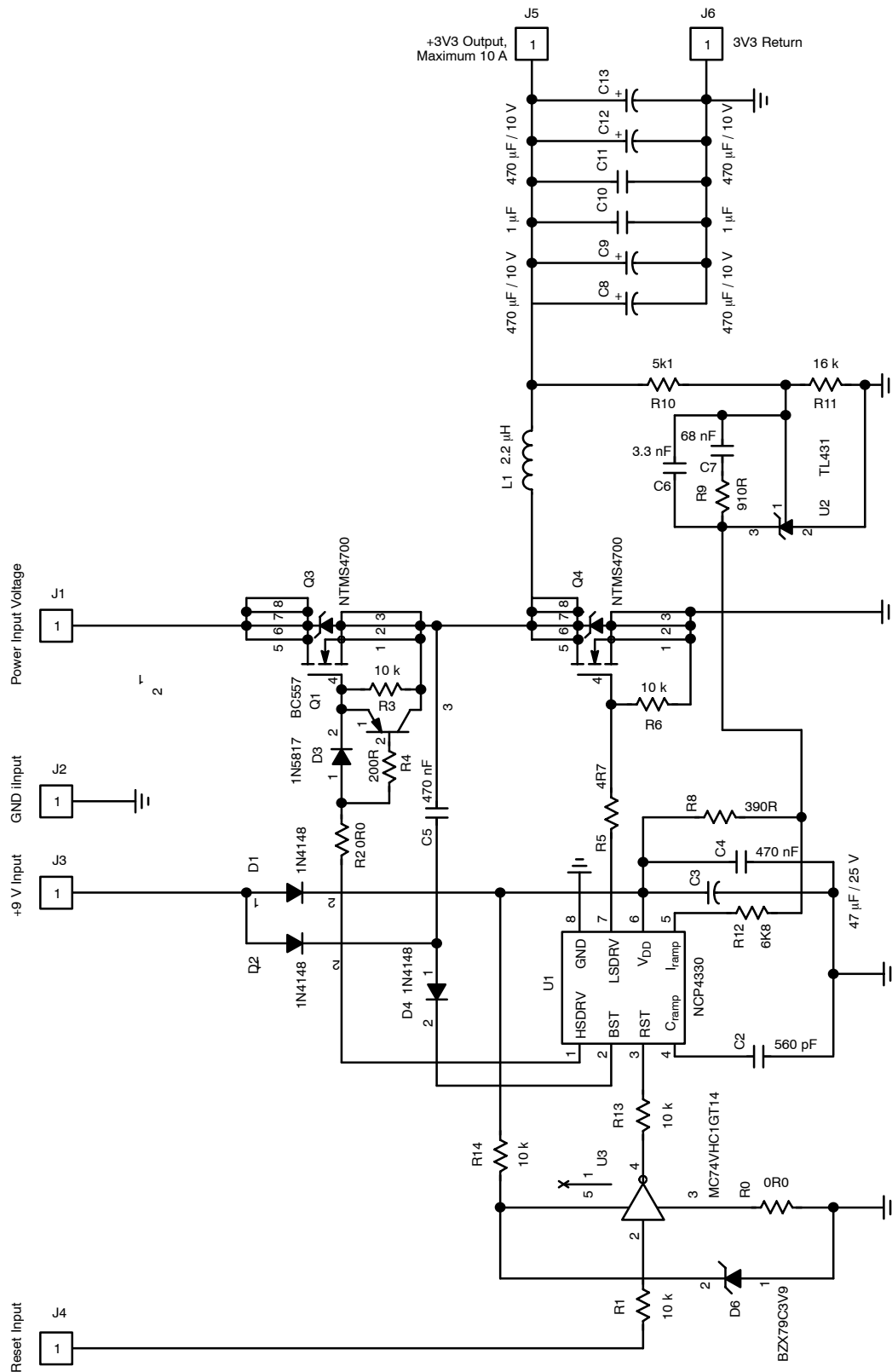


Figure 5. NCP4330 Evaluation Board Schematics – Components Mounted on the PCB

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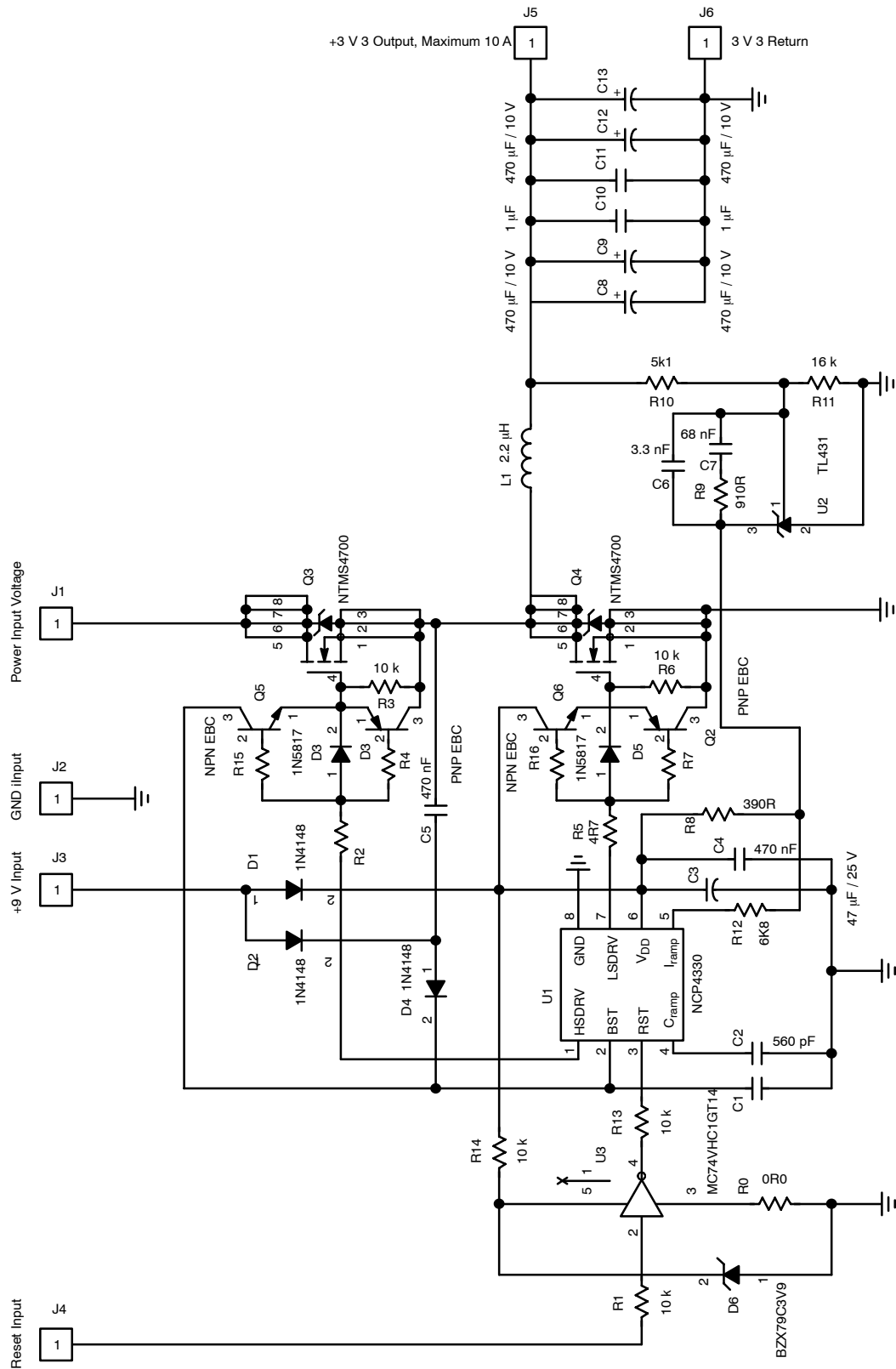


Figure 6. NCP4330 Evaluation Board – All Possible Components to be Mounted on the PCB Optionally

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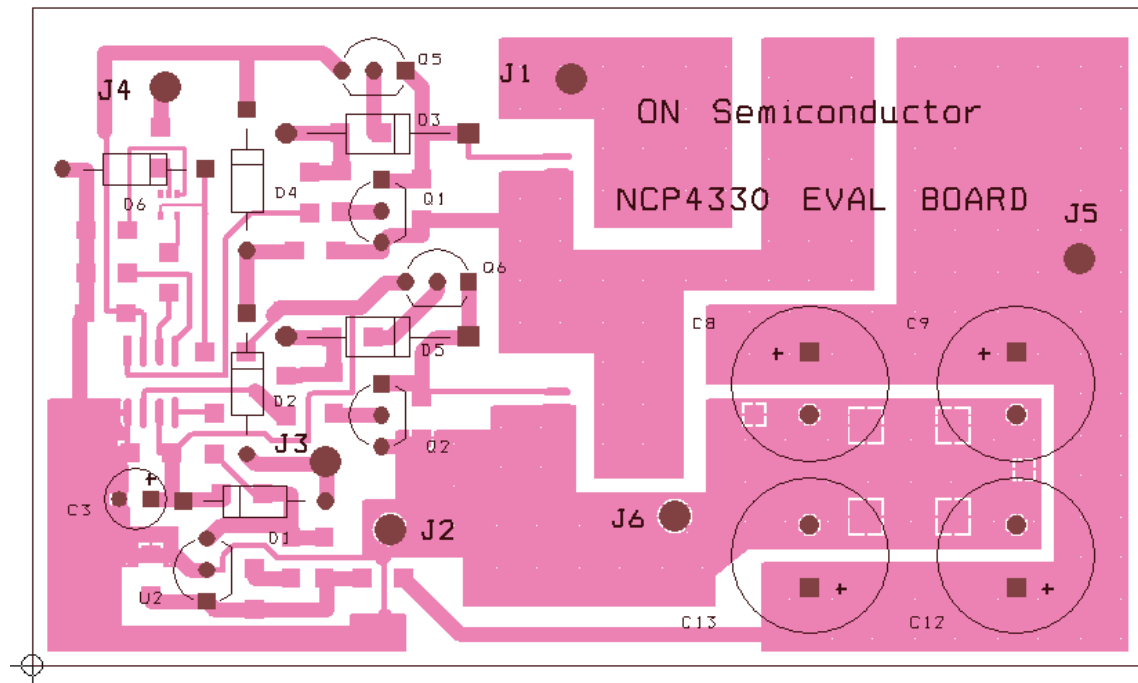


Figure 7. View through the PCB from Top Side

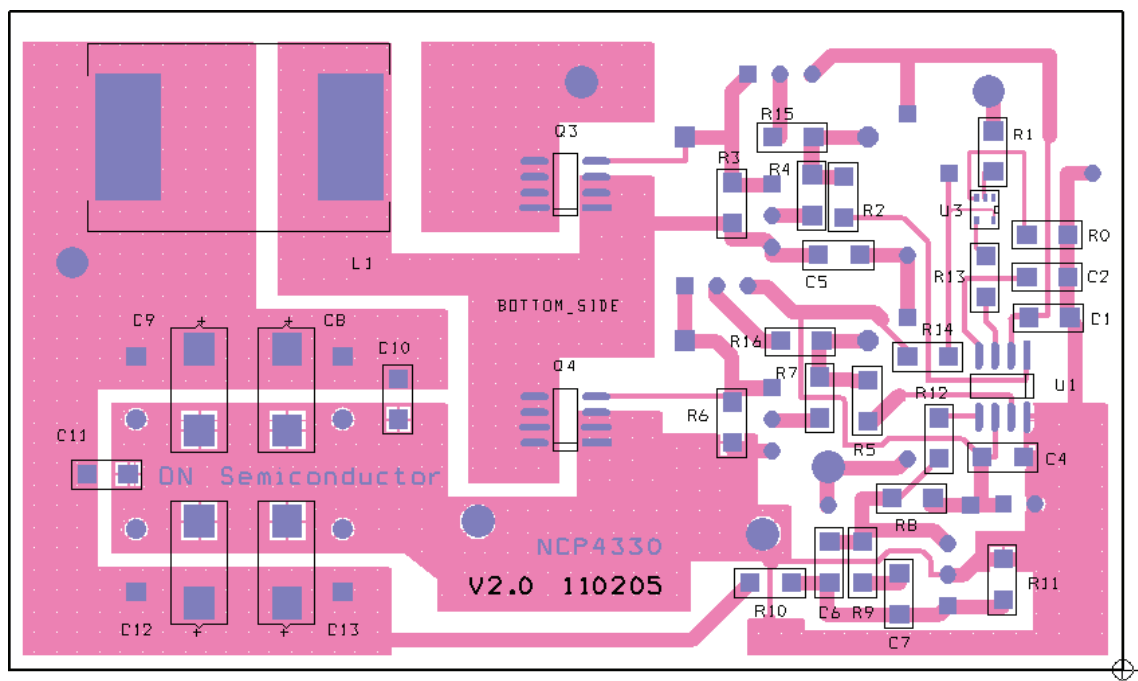


Figure 8. View from the PCB Bottom Side

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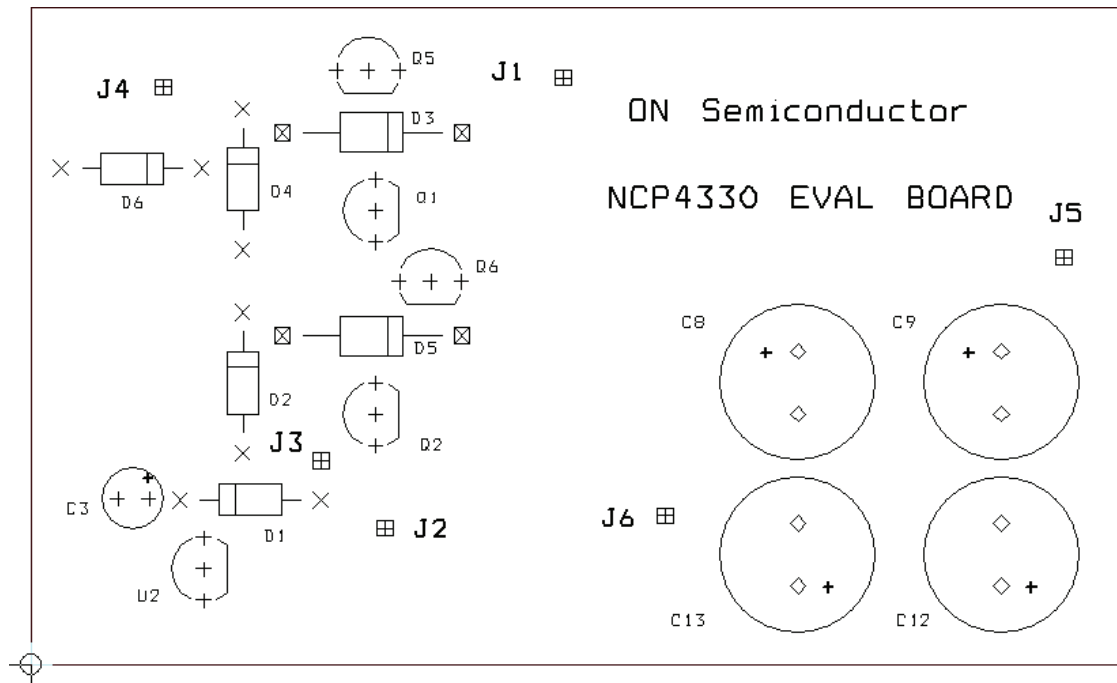


Figure 9. Components on the Top Side

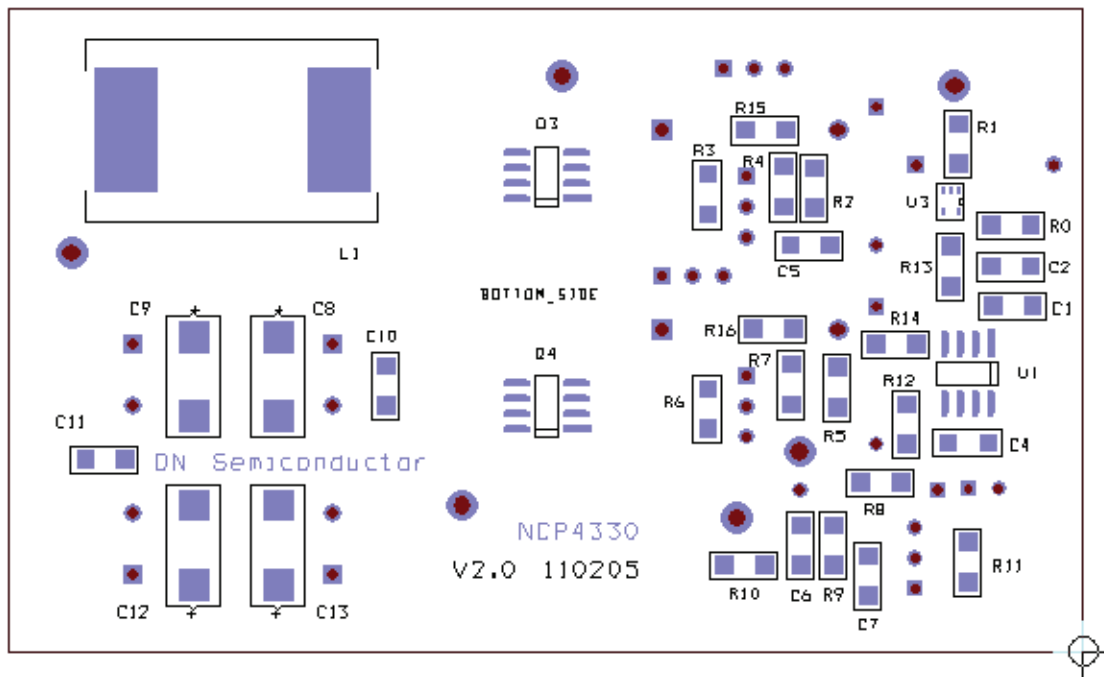


Figure 10. Components on the Bottom Side

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Table 1. BILL OF MATERIALS

Item	Qty	Reference Designator	Value	Part Description	P/N or Additional Information	Manufacturer
1	1	C2	560 pF/50 V	Ceramic Capacitor	SMD1206, NP0 Material	Various
2	1	C3	47 μ F/25 V	Al Ellyt capacitor		Various
3	2	C5, C4	470 nF/50 V	Ceramic Capacitor	SMD1206, X7R Material	Various
4	1	C6	3.3 nF/50 V	Ceramic Capacitor	SMD1206, X7R Material	Various
5	1	C7	68 nF/50 V	Ceramic Capacitor	SMD1206, X7R Material	Various
6	4	C8, C9, C12, C13	470 μ F/10 V	Tantalum Ultra Low ESR Capacitor	TPME477M010R0023	AVX
7	2	C11,C10	1 μ F/50 V	Ceramic Capacitor	SMD1206, Y5V Material	Various
8	3	D1, D2, D4	1N4148	Diode		Various
9	1	D3	1N5817	Schottky Diode	1N5817RL	ON Semiconductor
10	1	D6	BZX79C3V9	Zener Diode 3.9 V		Various
11	1	L1	2.2 μ H	Inductor	DO5010P-222HC	Coilcraft
12	1	Q1	BC557B	Transistor	BC557B	ON Semiconductor
13	2	Q3,Q4	NTMS4700N	Power MOSFET	NTMS4700NR2	ON Semiconductor
14	2	R0,R2	0R0	Resistor	SMD1206	Various
15	5	R1, R3, R6, R13, R14	10 k	Resistor	SMD1206	Various
16	1	R4	200R	Resistor	SMD1206	Various
17	1	R5	4R7	Resistor	SMD1206	Various
18	1	R8	390R	Resistor	SMD1206	Various
19	1	R9	910R	Resistor	SMD1206	Various
20	1	R10	5k1 $\pm$ 1%	Resistor	SMD1206	Various
21	1	R11	16k $\pm$ 1%	Resistor	SMD1206	Various
22	1	R12	6k8	Resistor	SMD1206	Various
23	1	U1	NCP4330	Post Regulator IC	NCP4330	ON Semiconductor
24	1	U2	TL431BILP	Prec. Reference IC	TL431BILP	ON Semiconductor
25	1	U3	MC74VHC1GT14	CMOS Logic IC	MC74VHC1GT1DFT1	ON Semiconductor

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