

## 4.8 Practical Assignment

We are going to use the *uc3842* and the *uc3845* in various configurations and build the most common converter types, by simply using the internal BJT's, see Fig. 4.1 from the gatedriver as output. See Tab. 4.1 for the difference between the *uc3842* and *uc3845*, regarding supply voltage and maximum duty cycle.

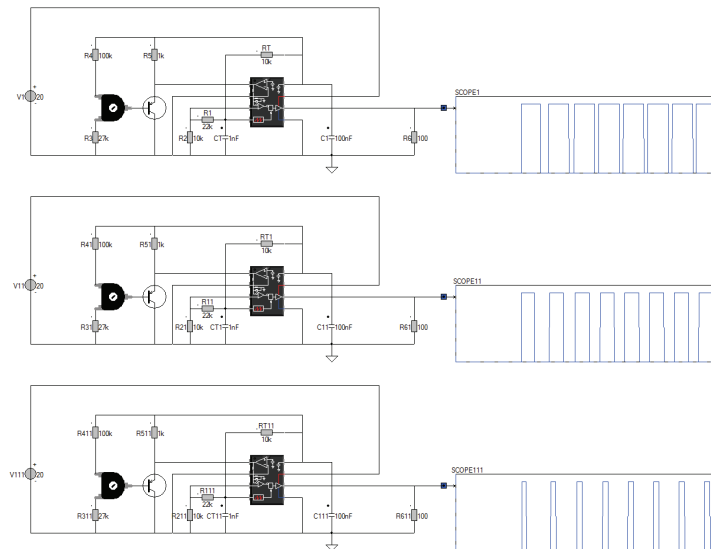


Figure 4.20: Variable duty cycle control directly creating a Buck Converter.

We start with building a new circuit, where the duty cycle is controlled using the output of the Opamp. The FB pin of the internal Opamp is connected to ground and therefore the output of the Opamp is going to its maximum output voltage. However, the Opamp can supply only a maximum of  $500\mu A$  (typical) to  $800\mu A$  (maximum), see Fig. 4.21.

PARAMETER	TEST CONDITIONS	UC184xA/UC284xA			UC384xA			UNITS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
<b>Error Amp Section</b>								
Input Voltage	$V_{PIN 1} = 2.5V$	2.45	2.50	2.55	2.42	2.50	2.58	V
Input Bias Current			-0.3	-1		-0.3	-2	$\mu A$
AVOL	$2 \leq V_o \leq 4V$	65	90		65	90		dB
Unity Gain Bandwidth	$T_J = 25^\circ C$ (Note 2)	0.7	1		0.7	1		MHz
PSRR	$12 \leq V_{CC} \leq 25V$	60	70		60	70		dB
Output Sink Current	$V_{PIN 2} = 2.7V, V_{PIN 1} = 1.1V$	2	6		2	6		mA
Output Source Current	$V_{PIN 2} = 2.3V, V_{PIN 1} = 5V$	-0.5	-0.8		-0.5	-0.8		mA
Vout High	$V_{PIN 2} = 2.3V, R_L = 15k$ to ground	5	6		5	6		V
Vout Low	$V_{PIN 2} = 2.7V, R_L = 15k$ to Pin 8		0.7	1.1		0.7	1.1	V

Figure 4.21: Typical and maximum current source of the internal Opamp.

By using some external circuitry, we can control this maximum output voltage. The output voltage from the Opamp is internally limited by the current source circuitry, as can be seen in Fig 4.22

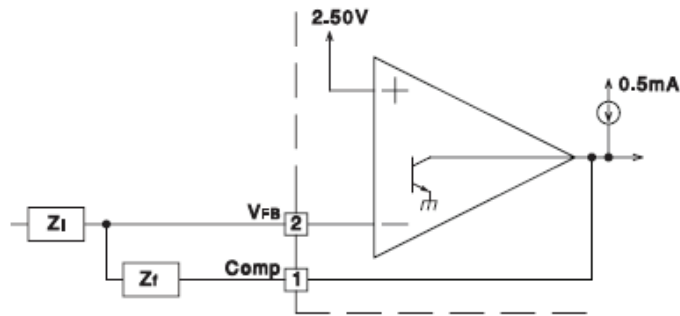


Figure 4.22: Internal current source capability of the *uc3842*.

The output from the Opamp is the negative input for the current sense comparator, and therefore we can use it to control the duty cycle. Internally the output from the Opamp is reduced by two series diodes and a resistive divider as

$$V_{PWM-Comparator-in} = (V_{COMP} - 0.6 - 0.6) \cdot \frac{R}{3R} \quad (4.3)$$

where  $V_{PWM-Comparator-in}$  is limited by the internal zener diode to a maximum of 1volt, see Fig. 4.23.

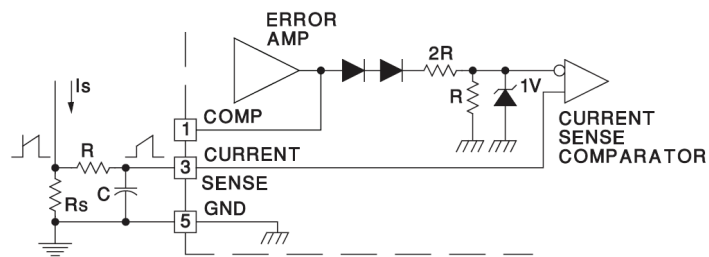


Figure 4.23: Internal current source capability of the *uc3842*.

By clamping the output voltage  $V_{COMP}$  of the Opamp to a fixed value and providing a way to sink the output current of the internal Opamp, we can control the voltage  $V_{PWM-Comparator-in}$  on the input of the internal current sense comparator, see fig. 4.24.

The pnp transistor is used to control the Opamp output voltage  $V_{COMP}$ . The transistor can sink any current, and the voltage at the Opamp output is

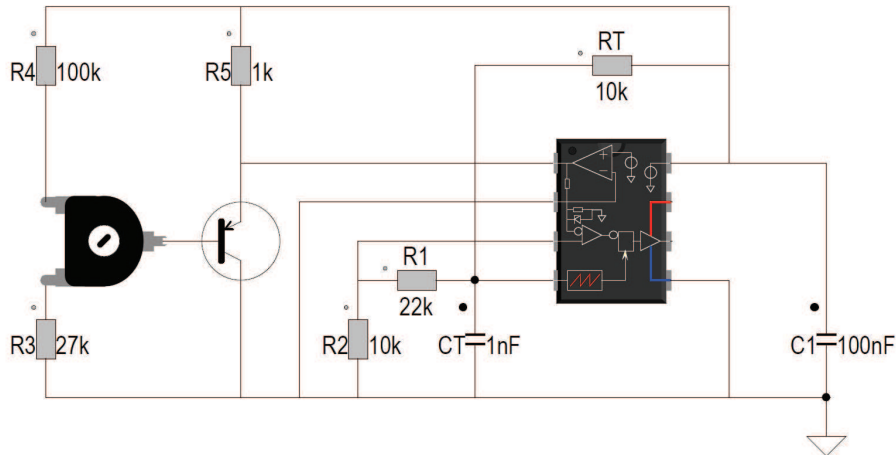


Figure 4.24: Clamp circuit to control the output voltage  $V_{COMP}$  of the internal Opamp.

equal to  $V_{ce}$ , where  $V_{ce} = V_b + 0.7$ . The voltage at the output of the Opamp is thus controlled by the voltage on the basis of the pnp transistor and this voltage we set using the potentiometer of  $100k\Omega$ .

The range of the controllable voltage is limited by the two resistors, as we need only a limited voltage range for  $V_{COMP}$ . The voltage on the *ISENSE* pin 3 is created from the oscillator voltage. However we now use a voltage division of  $\frac{1}{3}$  to keep the voltage on the pin *ISENSE* below 1 volt. See Fig. 4.7 and Fig. 4.8 for the maximum oscillator voltage.

#### 4.8.1 Assignments uc3842

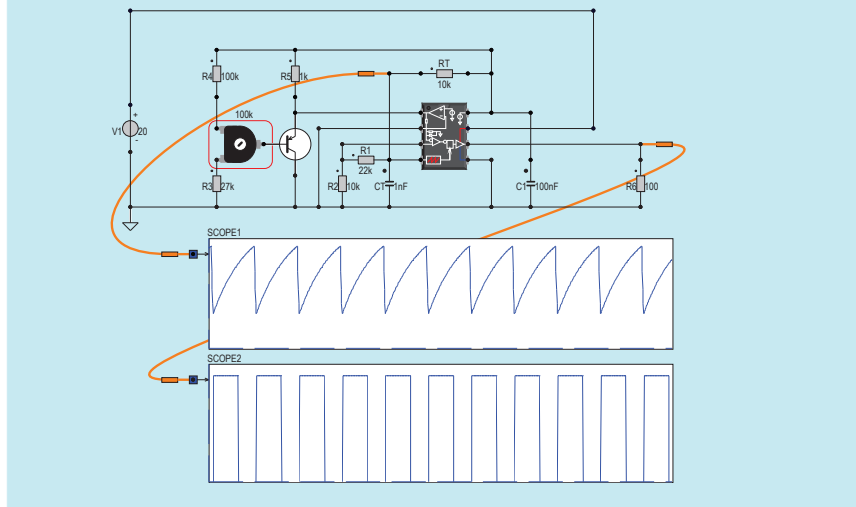
The assignments 1 to 9 show the use of the *uc3842/uc3845* for building simple converters. The purpose of these assignments is to understand the basics of these converters. They can be easily build on a breadboard, and by keeping the frequency and duty cycle variable, the operation of the converter can be studied.

### 4.8.2 Assignment 1: Variable duty cycle

**Question:**

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

**Answer:**

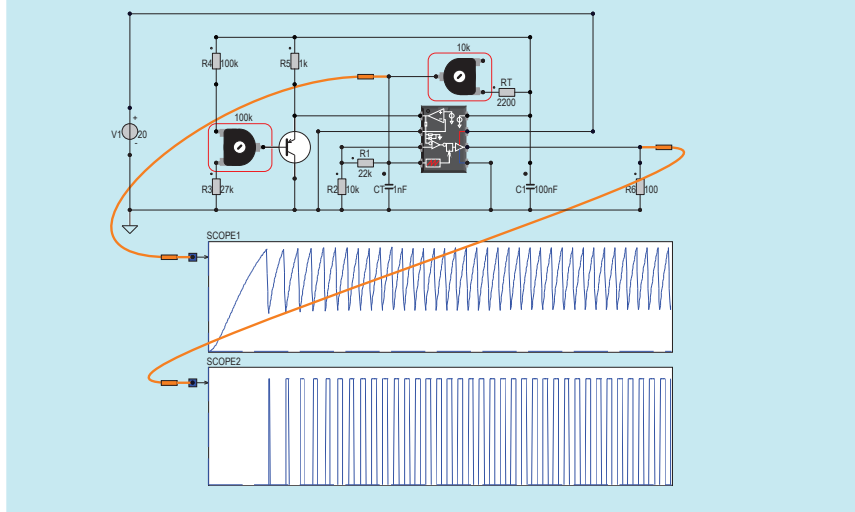


Open tutorial simulations/uc3842/Tut1-var-duty-cycle and run the simulation

### 4.8.3 Assignment 2: Variable frequency

**Question:**

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

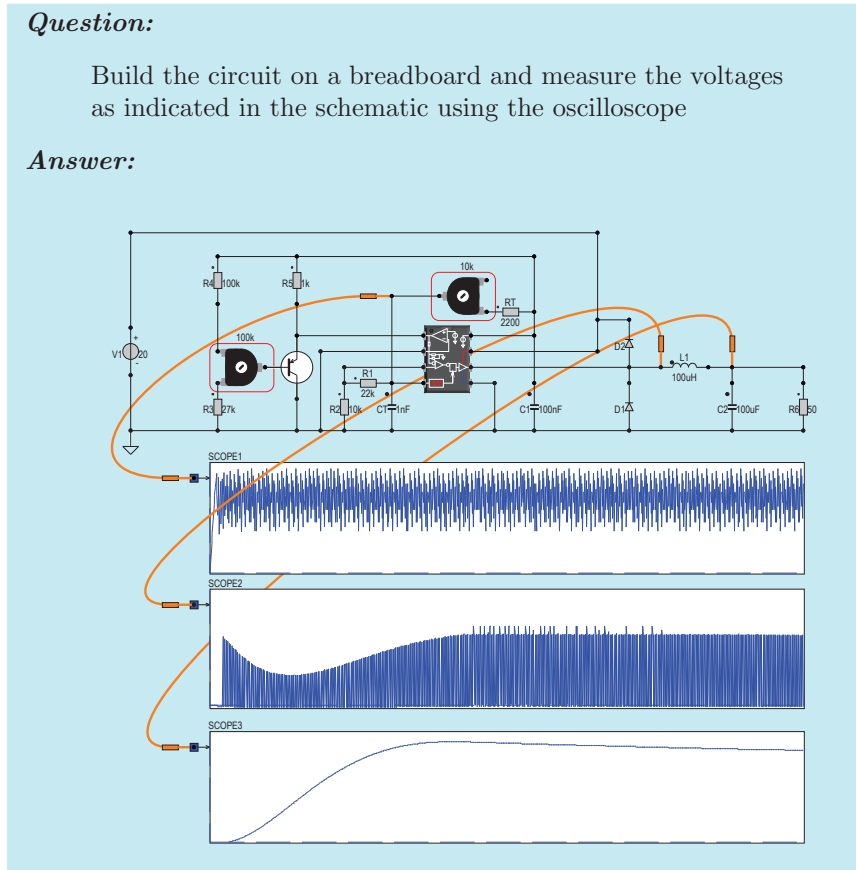
**Answer:**

Open tutorial simulations/uc3842/Tut2-varfreq and run the simulation

## 4.8.4 Assignment 3: Buck converter

**Question:**

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

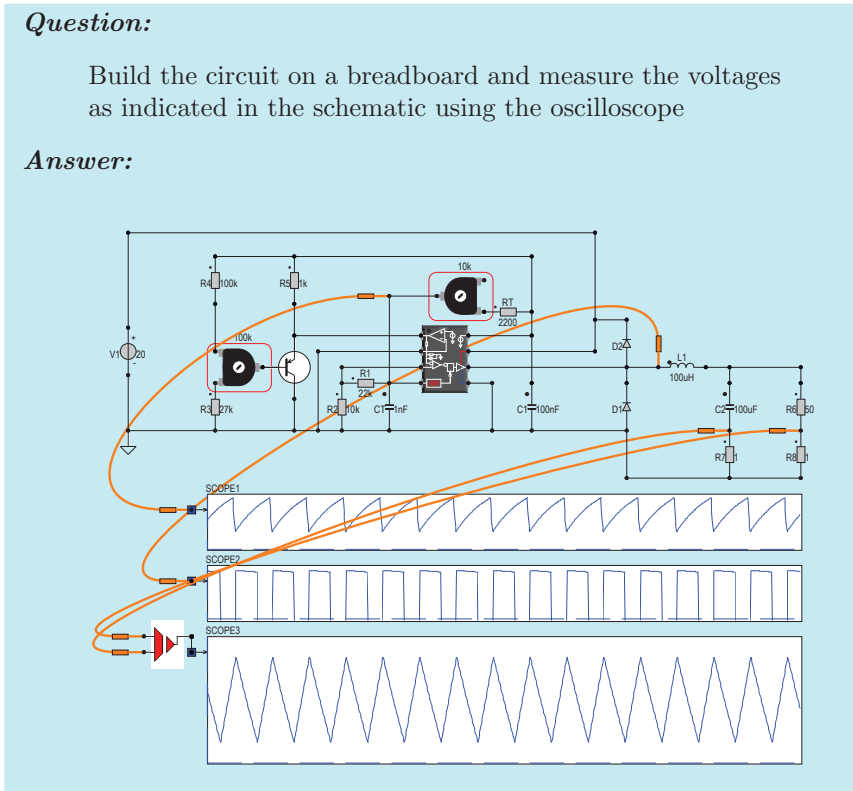
**Answer:**

Open tutorial simulations/uc3842/Tut3-buck and run the simulation

## 4.8.5 Assignment 4.1: Buck, current measurement 1

**Question:**

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

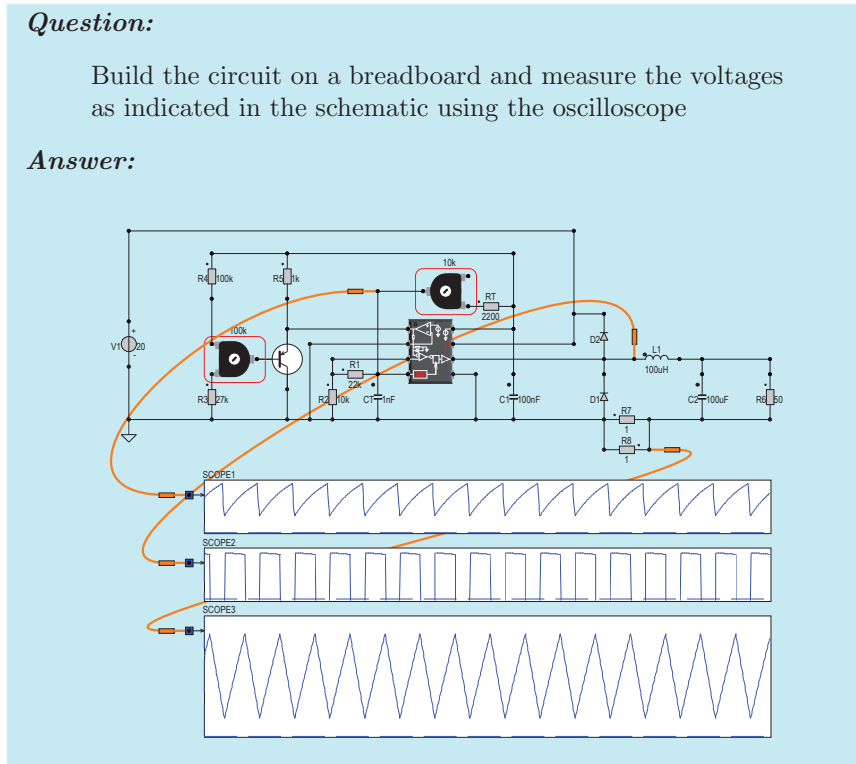
**Answer:**

Open tutorial simulations/[uc3842/Tut4-current1](#) and run the simulation

## 4.8.6 Assignment 4.2: Buck, current measurement 2

**Question:**

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

**Answer:**

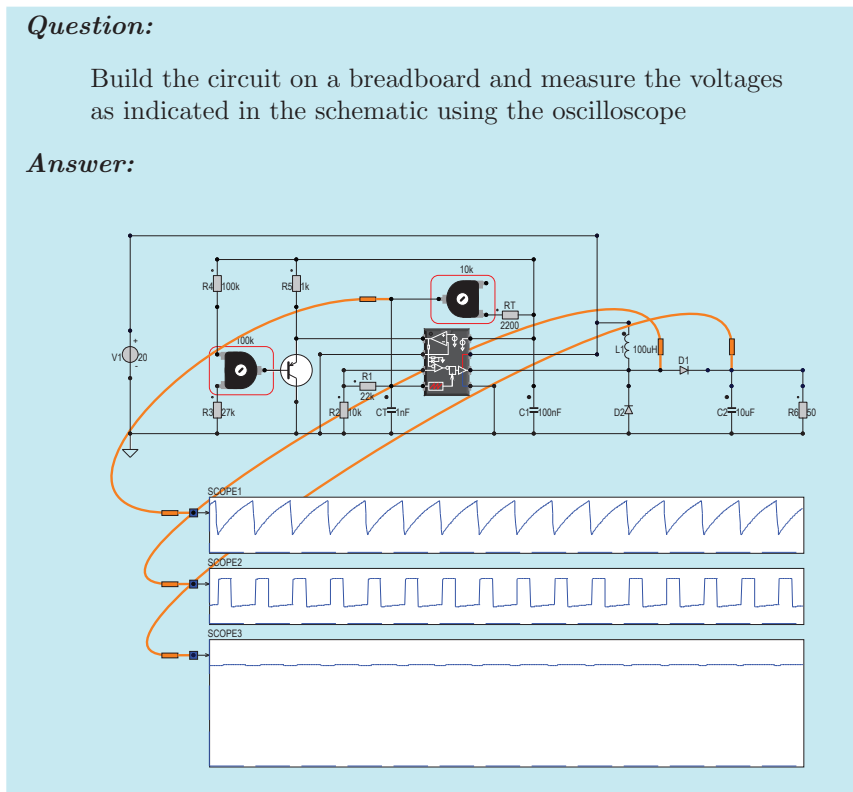
Open tutorial simulations/uc3842/Tut4-current2 and run the simulation



## 4.8.7 Assignment 5: Boost converter

**Question:**

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

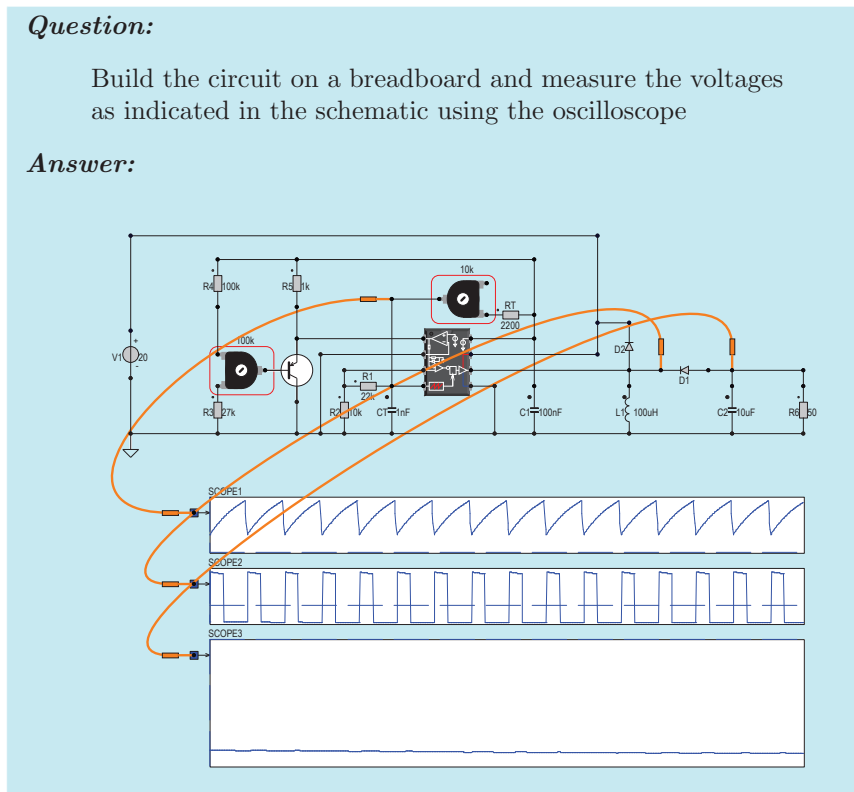
**Answer:**

Open tutorial simulations/[uc3842/Tut5-boost](#) and run the simulation

## 4.8.8 Assignment 6: Buckboost converter

**Question:**

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

**Answer:**

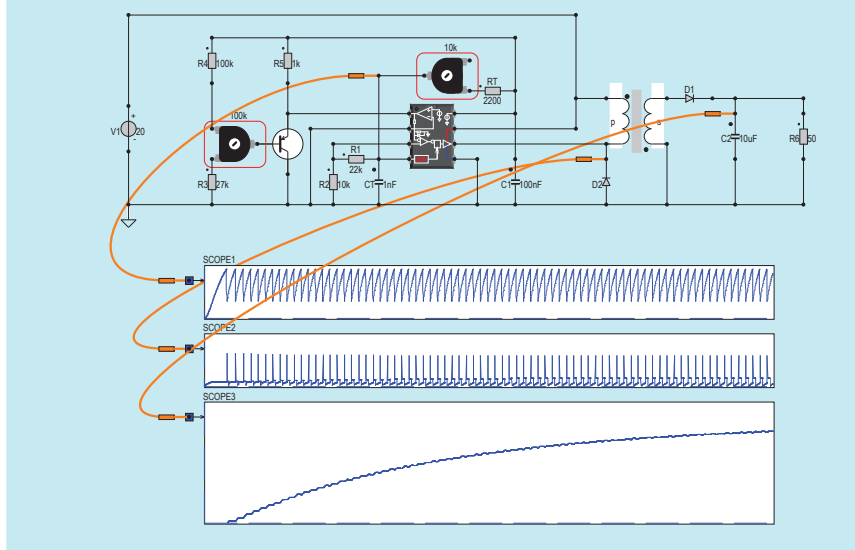
Open tutorial simulations/uc3842/Tut6-buckboost and run the simulation

## 4.9 Assignment 7: Flyback converter

### Question:

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

### Answer:



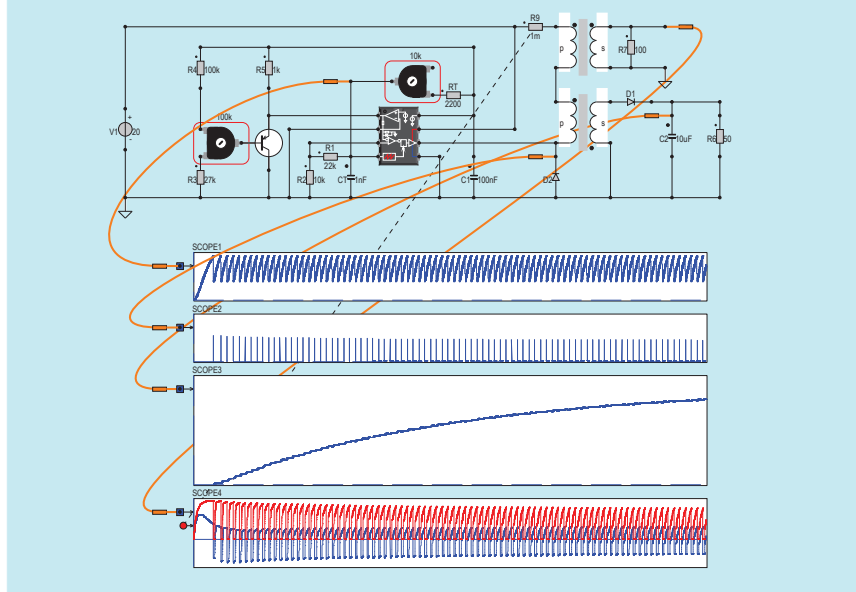
Open tutorial simulations/uc3842/Tut7-flyback and run the simulation

## 4.10 Assignment 8: Flyback current sensor

### Question:

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope

### Answer:



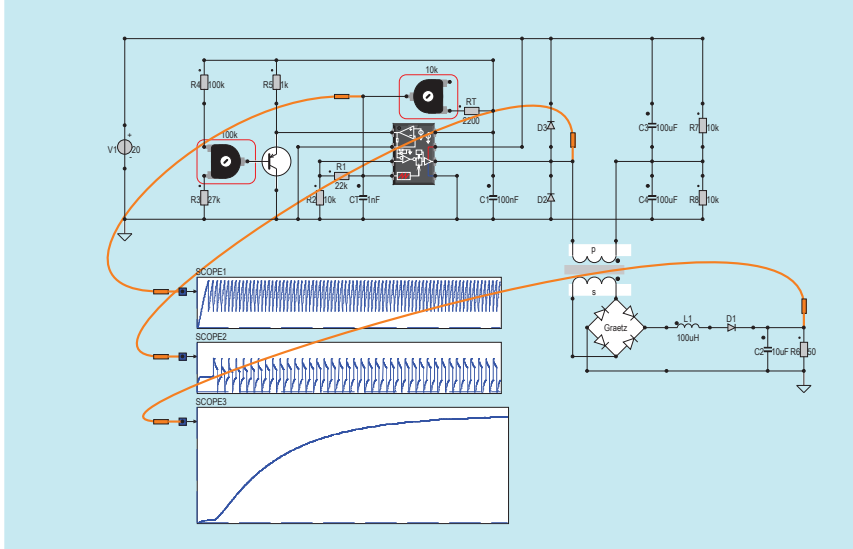
Open tutorial simulations/uc3842/Tut8-flyback-currentsensor and run the simulation

## 4.11 Assignment 9: Half-Bridge converter

### Question:

Build the circuit on a breadboard and measure the voltages as indicated in the schematic using the oscilloscope. Use the *uc3845* to limit the duty cycle to 50%.

### Answer:



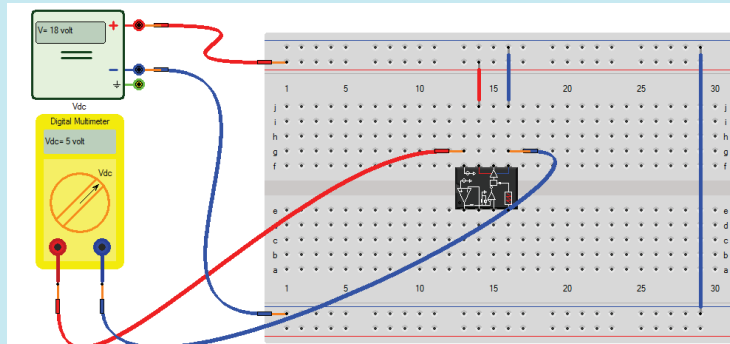
Open tutorial simulations/[uc3842/Tut9-halfbridge](#) and run the simulation

## 4.12 Tutorial Reference Voltage

**Question:**

Measure the reference voltage  $V_{ref}$  on pin [8]

**Answer:**

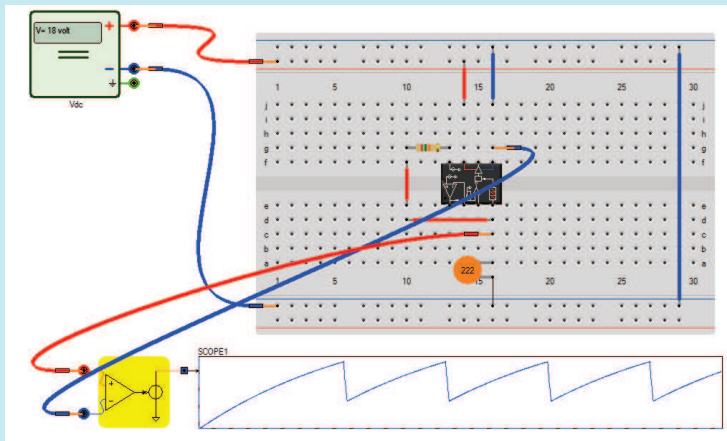


Open tutorial simulations/BasicsUC3842/1-Vref and run the simulation

## 4.13 Tutorial Oscillator

**Question:**

Measure the oscillator voltage  $V_{osc}$  on pin [4]

**Answer:**

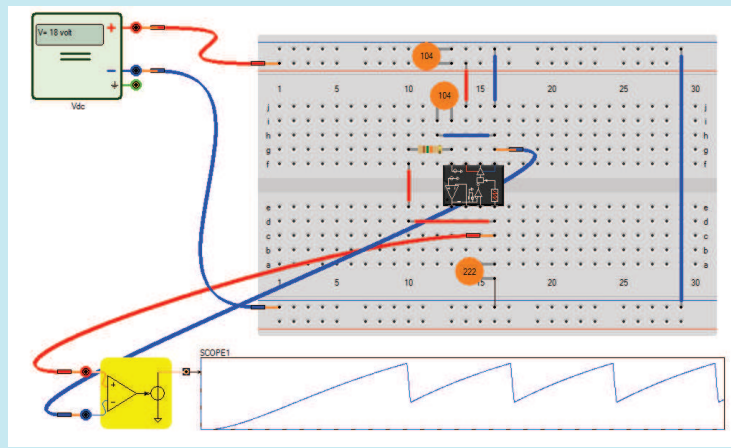
Open tutorial simulations/BasicsUC3842/2-Osc and run the simulation

## 4.14 Tutorial Bypass capacitors

**Question:**

Compare the reference voltage of 5volt with the previous tutorial

**Answer:**



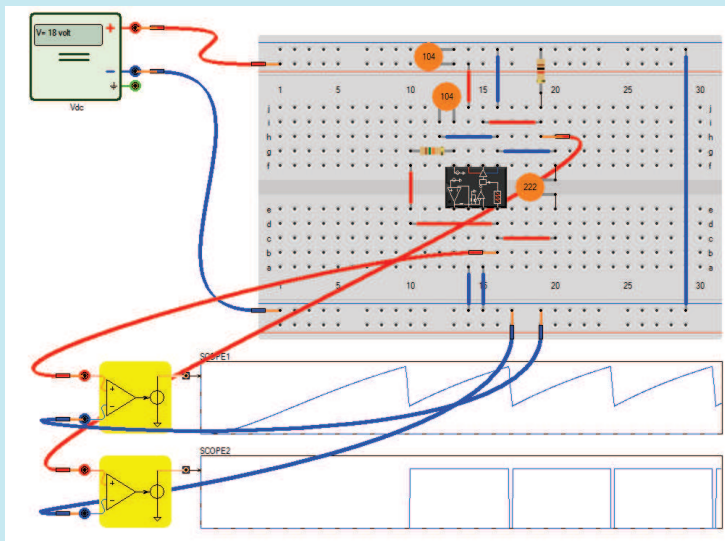
Open tutorial simulations/BasicsUC3842/3-Cap and run the simulation



## 4.15 Tutorial Output gate signal

*Question:*

*Answer:*

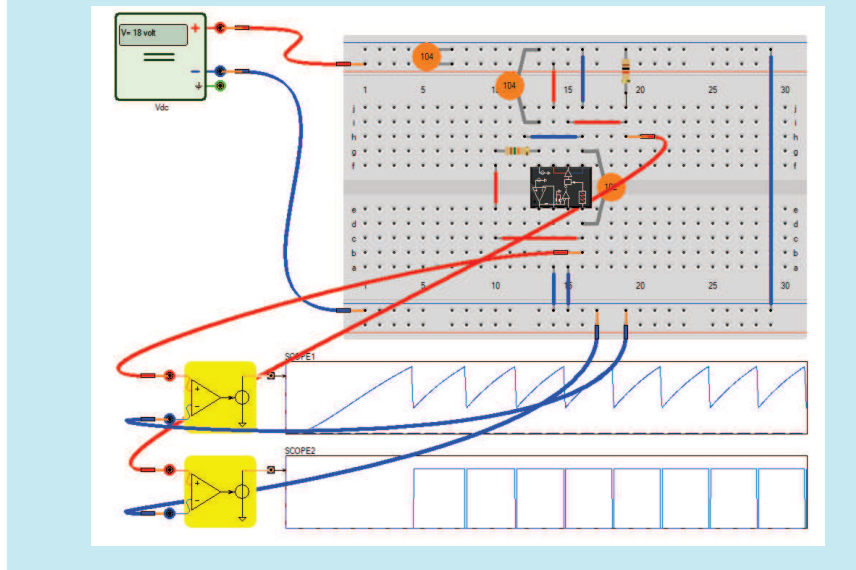


Open tutorial simulations/BasicsUC3842/4-out and run the simulation

## 4.16 Tutorial Output gate signal

*Question:*

*Answer:*



Open tutorial simulations/BasicsUC3842/4-out-Cbypass and run the simulation