Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Studentsgroup:		Responsible for lab report:
Date:		Other participants
Lecturer:		

Task 2:

Diode

1. Forward characteristics of a silicon and germanium diode

Use an XY-plotter to plot the forward IV-characteristics $I_F = f(U_F)$ of a germanium diode AA138 and a silicon diode 1N4148 for forward currents in the range of I_F = 0..10mA.

Post processing:

a) Using the measured IV-characteristic plot, determine the differential (small-signal) resistance for both diodes at I_F = 2mA.

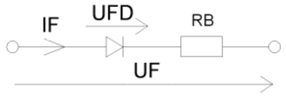
2. Forward characteristic of the Silicon diode

Measure the forward voltage of the silicon diode 1N4148 for forward currents in the range of 10µA…100mA. Measure 3 points per each current decade. For example 10µA, 20µA, 50µA, 100µA, 200µA, ….

Post processing:

a) Plot the IV characteristics graphically using MATLAB or MS Excel. The y-axis (I_F) should be plotted logarithmically.

b) Assume that the diode can be modelled by a series connection of Shockley diode $I_F = I_S \cdot e^{\frac{U_{FD}}{m \cdot U_T}}$ and a resistor R_B. Estimate the diode parameters I_S, m und R_B.

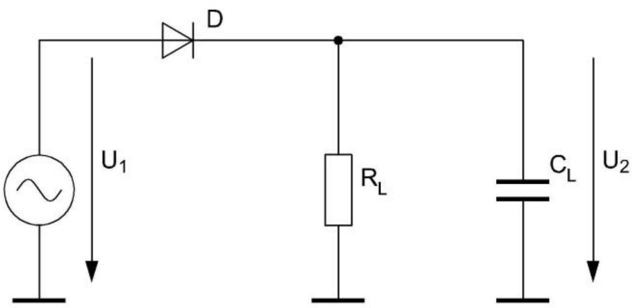


c) Plot the diode characteristic using the parameters obtained in b) and compare the IV-characteristics graph with the measurement plot in a).

d) Calculate the differential (small-signal) resistance of the diode using the Shockley equation at I_F = 2mA with the parameters obtained in 1a).

3. Half-wave rectifier/peak detector

Set up the half-wave rectifier as depicted in the following figure:



R_L = 10kΩ or ∞

C_L = 47nF or 470nF

U_1 = 10V (Amplitude)

f = 1kHz

D = 1N4148

3.1 Use an oscilloscope to plot the time varying input and output signals (U_1 and U_2) versus time for C_L = 470nF, and $R_L = \infty$. Export and save the plots as graphical data.

3.2 Use an oscilloscope to plot the time varying input and output signals (U_1 and U_2) versus time for both cases C_L= 47nF und 470nF simultaneously (R_L = 10kΩ). Determine the period of U_1 and U_2. Export and save the plots as graphical data.

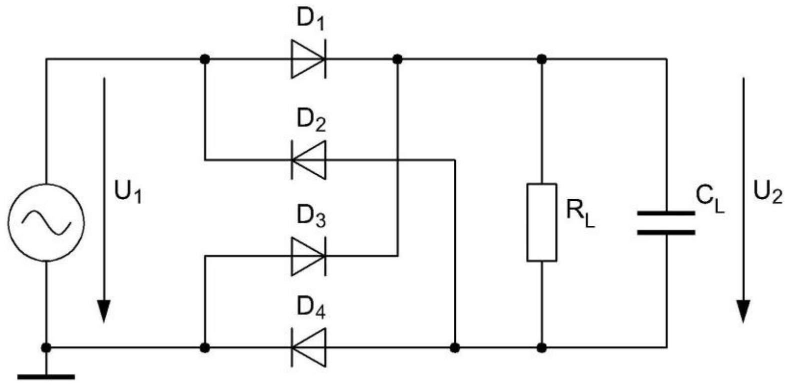
3.3 Use a METHRAHIT digital millimeter to measure the total effective value, the AC-effective value (the effective value of the ripple) and the average value of U_1 and U_2 for both cases C_L= 47nF und 470nF (R_L = 10kΩ).

Post processing:

a) Calculate the *ripple factor* which is defined as the ratio of the effective value of the ripple voltage to the average value of U_2.

4. Full-wave rectifier

Set up the half-wave rectifier as depicted in the following figure



R_L = 10kΩ

C_L = 47nF or 470nF

U_1 = 10V (Amplitude)

f = 1kHz

$D_{1...4}$ = 1N4148

4.1 Use an oscilloscope to plot the time varying input and output signals (U_1 and U_2) versus time for both cases C_L= 47nF und 470nF simultaneously. Export and save the plots as graphical data. Determine the period of U_1 and U_2.

Hint: A normal probe measures the potential difference between the probed signal with respect to ground node potential which is common to both probes 1 & 2 of the oscilloscope. Therefore, U_2 cannot be measured using a normal oscilloscope probe. For this measurement you should use the *differential probe* which is available in the lab and measures the difference between two arbitrary potentials.

4.2 Use a METHRAHIT digital millimeter to measure the total effective value, the AC-effective value (the effective value of the ripple) and the average value of U_1 and U_2 for both cases C_L= 47nF und 470nF.

Post processing:

a) Calculate the ripple factor which is defined as the ratio of the effective value of the ripple voltage to the average value for U_2. Compare the result with the results from 3a).