(1)

Assignment

My ID = 2023200000475

Now, Sum = 4+7+5

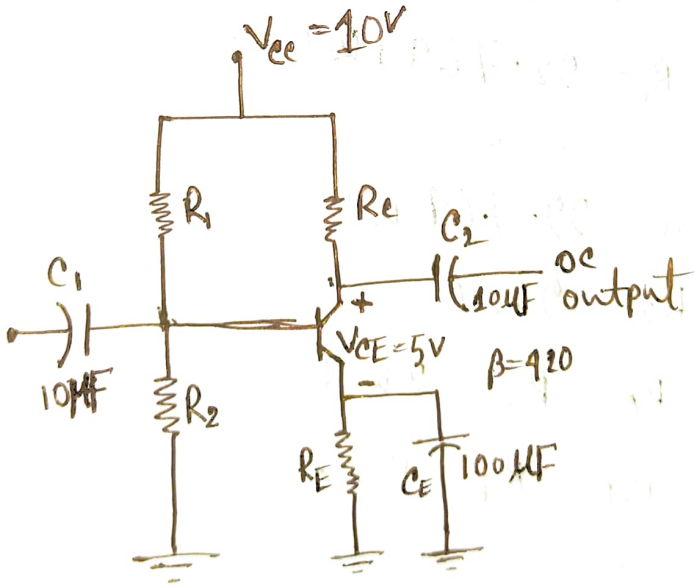
= 16 (even number)

So, my BJT is BC547C

This BJT's $I_c = 2mA$

$V_{CE} = 5V$ ∴ So, $V_{cc} = 10V$

$\beta = 420$ [data sheet]



$I_c = 2mA$

$V_{CE} = 5V$

$V_{cc} = 10V$

$\beta = 420$

$$V_E = \frac{1}{10} V_{cc} = \frac{1}{10}(10) = 1V$$

$$R_E = \frac{V_E}{I_e} \simeq \frac{V_E}{I_c} = \frac{1V}{2mA} = 0.5k\Omega = 500\Omega$$

$$R_c = \frac{V_{RC}}{I_c} = \frac{V_{cc} - V_{CE} - V_E}{I_c} = \frac{(10-5-1)V}{2mA} = 2k\Omega$$

$= 2000\Omega$

$$V_B = V_{BE} + V_E = 0.7 + 1 = 1.7\ V$$

then, $R_2 \leq \frac{1}{10} \beta R_E$

$\Rightarrow R_2 \leq \frac{1}{10} \times 420 \times (0.5)$

$\Rightarrow R_2 \leq 21\ k\Omega$

$\therefore R_2 = 19\ k\Omega$

$$V_B = \frac{R_2}{R_1 + R_2} \times V_{cc}$$

$\Rightarrow 1.7 = \frac{19}{R_1 + 19} (10V)$

$\Rightarrow 1.7R_1 + 32.3 = 190$

$\Rightarrow R_1 = 92.7647\ k\Omega$

— o —

$R_1 = 92.764\ k\Omega$

$R_2 = 19\ k\Omega$

$R_c = R_3 = 2k\Omega$

$R_E = R_4 = 0.5k\Omega$

now, $r_e = \frac{26mV}{I_E} \cong \frac{26mV}{I_c} = \frac{26mV}{2mA}$

$= 13\Omega$

$= 13 \times 10^{-3} k\Omega$

input impedence, $Z_{in} = R_1 \| R_2 \| \beta r_e$

$$= \left(\frac{1}{22.764} + \frac{1}{17} + \frac{1}{420 \times (13 \times 10^{-3})}\right)^{-1}$$

$$= 4.055 k\Omega$$

output impedence, $Z_{out} = R_e \| r_o$

$$= \left(\frac{1}{2} + \frac{1}{\infty}\right)^{-1}$$

$$= 2 k\Omega$$

Input AC $v = (4 + 4 + 5)/3$

$$= 5.33 mV$$

Grain $= \frac{V_o}{V_s}$

$$= \frac{680}{5.33}$$

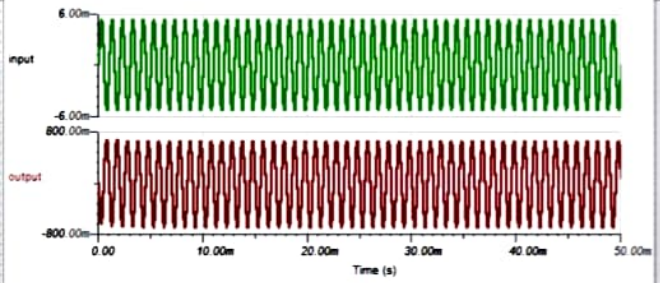
$$= 127.58 mV$$

Afser_475 - Schematic Editor

File Edit Insert View Analysis T&M Tools TI Utilities Help

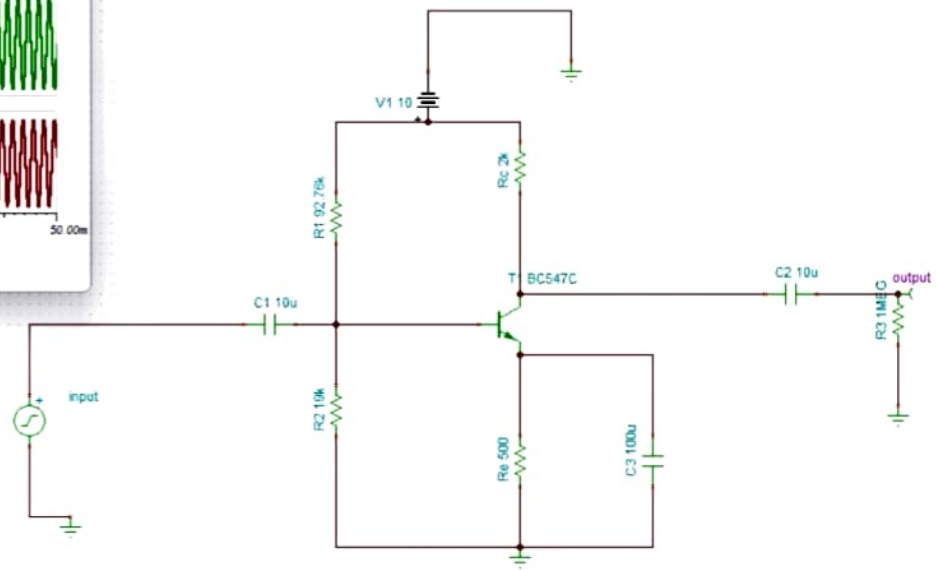
Noname - TR result1

File Edit View Process Help



TR result1

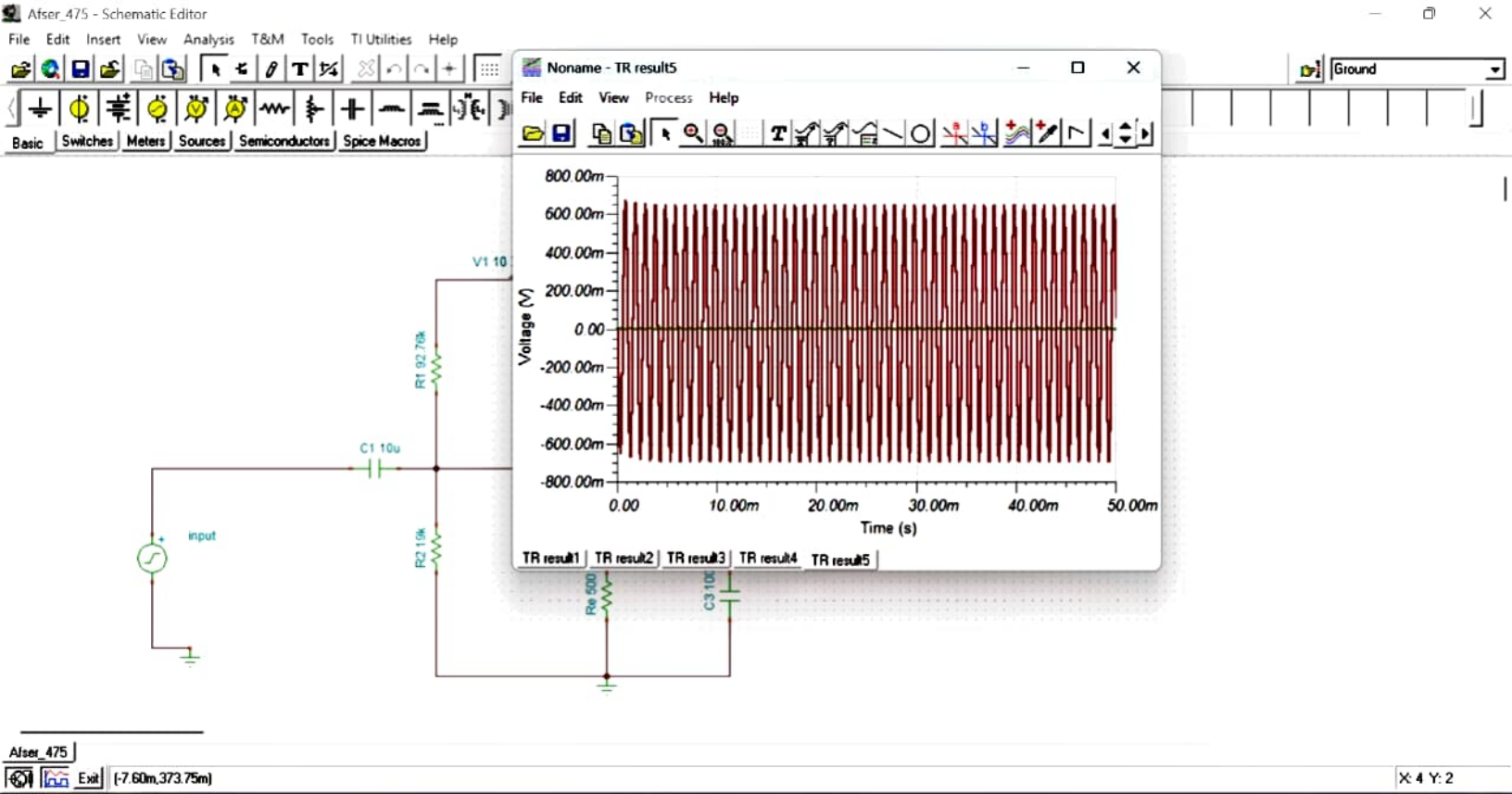
Ground



Afser_475

Exit (25.67m,-25.56m)

X: 929 Y: 477


Afser_475 - Schematic Editor
File Edit Insert View Analysis T&M Tools TI Utilities Help
Basic Switches Meters Sources Semiconductors Spice Macros
Ground
Noname - TR result5
File Edit View Process Help
800.00m
600.00m
400.00m
200.00m
0.00
-200.00m
-400.00m
-600.00m
-800.00m
Voltage (V)
0.00
10.00m
20.00m
30.00m
40.00m
50.00m
Time (s)
TR result1 TR result2 TR result3 TR result4 TR result5
V1 10
R1 92.76k
C1 10u
input
R2 19k
Re 500
C3 10
Afser_475
Exit
(-7.60m,373.75m)
X: 4 Y: 2

(2) My ID = 475

$\therefore$ Sum = 4+7+5 = 16 (even)

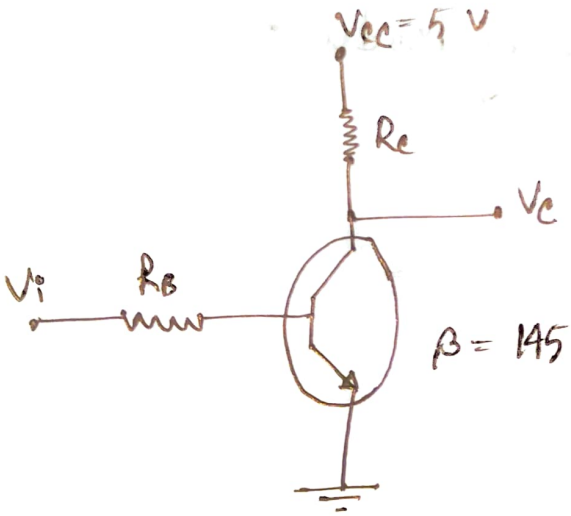
$\therefore$ Model No : SRD-09VDC-SL-C

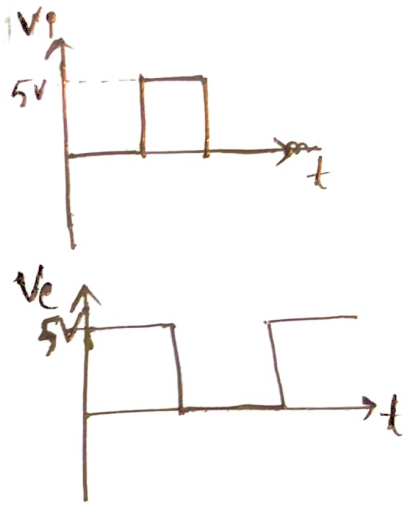
Here,

$\therefore$ $I_{C_{sat}}$ = 50 mA [data sheet]

using BC637 BJT,

for 50mA, β = 145 (120 to 160)





$$I_B > \frac{I_{C_{sat}}}{\beta}$$

$$I_B > 0.34 \text{ mA}$$

$$\therefore I_B = 0.68 \text{ mA}$$

$$\therefore R_B = \frac{V_i - 0.7}{I_B}$$

$$= \frac{5 - 0.7}{0.68}$$

$$= 6.32 \text{ k}\Omega$$

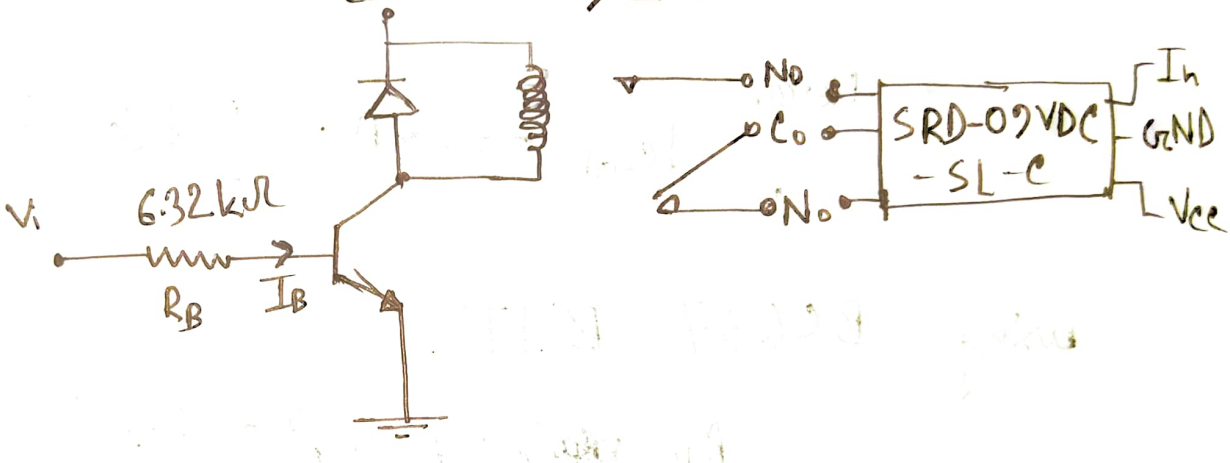


Diagram: Relay Module