

BC547 Transistor Switching using Arduino

1. Objective:

Design a circuit to drive a blue LED by using transistor and switch the transistor using Arduino.

2. Requirement:

LED illuminates with a max current of 20mA. So, our transistor biased such that it should deliver minimum 20mA current.

3. Circuit Design/Calculations:

Consideration: According to the BC547 data sheet the transistors gain lies in between 110 to 800.

BC547 transistor Base to Emitter voltage drop is about **0.7V** (Refer Data sheet, **V_{BE}**).

BC547 transistor Collector to Emitter drop is about **0.1V** (Refer Data Sheet, **V_{CE}**).

Required Collector current to drive LED, **I_c=20mA**.

LED Forward drop voltage for Blue LED is about **3.0V** (Refer Data Sheet for more detail, **V_{D1}**).

Transistor gain, **β=110** (It is recommended to choose the minimum value if the exact value is not known to avoid under current)

Calculation:

1. To calculate required Base current

$$\beta = I_b \times I_c$$

We know I_c=20mA (Our requirement)

$$I_b = \beta / I_c$$

$$I_b = 110 / 20 \times 10^{-3} = 0.18\text{mA} \approx \mathbf{0.2\text{mA}}$$

2. To calculate R_c apply KVL to Collector – Emitter

$$V_{CC} - I_c \times R_c - V_{D1} - V_{CE} = 0 \text{ (VCC is Arduino 5V pin Voltage)}$$

$$5 - 20 \times 10^{-3} \times R_c - 3 - 0.1 = 0$$

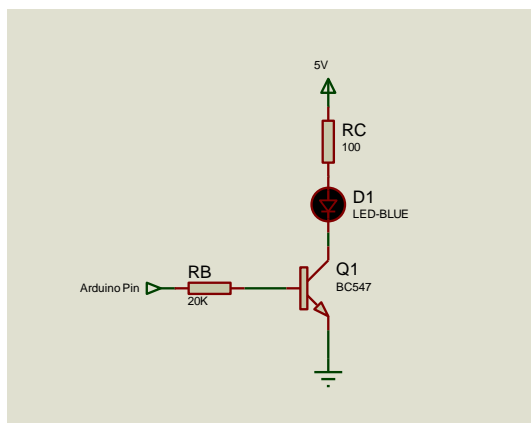
$$R_c = 95\Omega \approx \mathbf{100\Omega}$$

3. To calculate R_b apply KVL to Base – Emitter

$$V_B - I_b \times R_b - V_{BE} = 0 \text{ (V}_B \text{ is equal to Arduino OUTPUT pin on Voltage)}$$

$$5 - 0.2 \times 10^{-3} \times R_b - 0.7 = 0$$

$$R_b = 21.5\text{K}\Omega \approx \mathbf{20\text{K}\Omega} \text{ (Choose lesser value to increase little more collector current)}$$



**Connect the Arduino 5V to VCC / 100-ohm resistor,
Arduino GND to Emitter.**

**Connect any of the Arduino pin to Base 20K-ohm
resistor and declare it as OUTPUT (Refer Arduino code
“code.ino” file more details).**