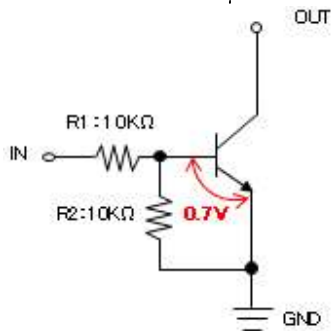


How do you calculate the Base current of a digital transistor?

Using ROHM's digital transistor DTC114EKA as an example:

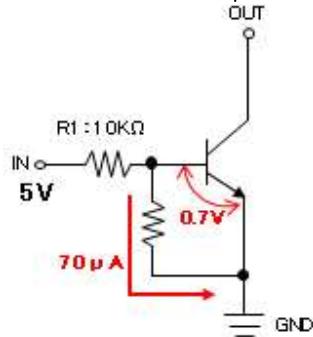
As forward current flows through E-B, approximately 0.7V exists (at 25°C) between E and B. Since the internal resistor R2 is connected in parallel, the voltage across is identical. Therefore, the current flowing through R2 is calculated as follows:

$$I_{R2} = 0.7V / 10k\Omega = 70\mu A$$

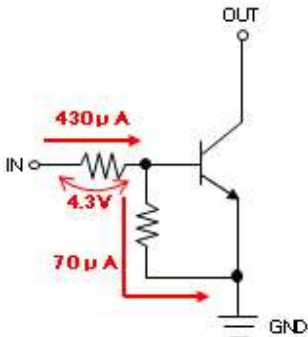


When 5V is supplied to the Base at IN a voltage of 4.3V (5V-0.7V) exists across R1, resulting in a current of:

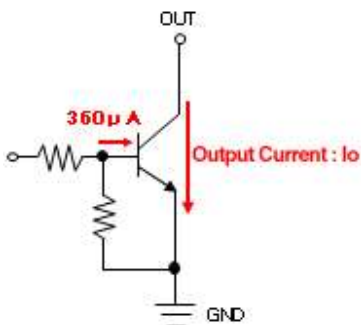
$$I_{R1} = 4.3V / 10k\Omega = 430\mu A$$



Therefore, $430\mu A - 70\mu A = 360\mu A$ flows through the Base of the transistor.



For stable operation the input voltage V_{in} must be adjusted in order to maintain an output current 10-20 times the Base current or lower. If sufficient output current cannot be obtained a digital transistor with lower R1 should be used.



At 25°C the forward voltage (VF) across E-B is approximately 0.7V. However, please note that VF will decrease by about 2.2mV for each degree 1°C above 25°C. For example, at an ambient temperature of +50°C the forward voltage is approximately: $0.7V - (50^{\circ}C - 25^{\circ}C) \times 2.2mV = 0.645V$. Therefore, it is imperative to consider the effects of ambient temperature on VF. Please note that there is a voltage tolerance of $\pm 0.1V$.

In the case of internal resistors R1 and R2 a tolerance of $\pm 30\%$ exists. Please calculate accordingly.