What is the minimum size allowed for R1 that will not damage the AT90USB1286 in the circuit in Fig 1?

Section 30.1 Absolute Maximum Ratings in the AT90USB1286 Datasheet includes the specification:

DC Current per I/O Pin ..... 40.0 mA

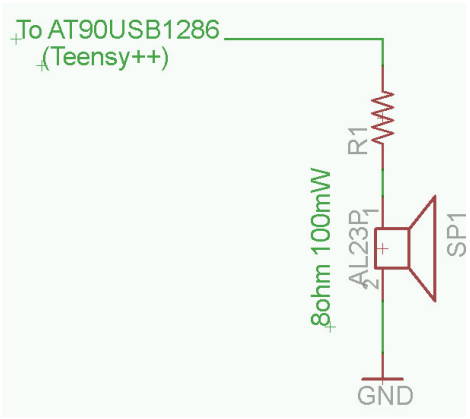

Fig. 1

Using the concept that the current flowing through a series circuit is the same everywhere and Ohm's law yields

Eq 1: $\text{Itotal} = \frac{\text{Vtotal}}{\text{Rtotal}}$

The AT90USB1286 specification requires that Itotal be less than or equal to 50mA thus Equation 1 becomes

Eq 1a: $40\text{mA} \Rightarrow \frac{\text{Vtotal}}{\text{Rtotal}}$

Because the circuit in Figure 1 is a series circuit Rtotal is the sum of all the resistances in the circuit or

Eq 2: $\text{Rtotal} = \text{R1} + 8\Omega$

Assuming the voltage being driven from the AT90USB1286 is 5V yields

Eq 3: $\text{Vtotal} = 5\text{V}$

Substituting Equations 2 and 3 into Equation 1a yields

Eq 4: $40\text{mA} \Rightarrow \frac{5\text{V}}{\text{R1} + 8\Omega}$ or

$$\text{R1} + 8\Omega \Rightarrow \frac{5\text{V}}{40\text{mA}} = 125\Omega \text{ or}$$

$$\text{R1} \Rightarrow 117\Omega$$

117Ω as the minimum resistance value for R1