

Selecting a value for R_{Set}

The Arduino forum topics concerning the MAX72XX, often show that there is a fair bit of uncertainty when it comes to selecting a value for the resistor R_{Set}. It is the single component that limits the current for all the individual Leds. While some people seem to think of this resistor as a way to control the brightness of the Leds, its real purpose is to protect the MAX72XX and the Leds from excessive currents. Setting the brightness of the display can and should be done software-controlled.

To find out the correct value for R_{Set} you need the datasheet for the MAX72XX **and** the datasheet for the Led's, matrix, 7-segment display, whatever you are going to use.

From the datasheet of your Led's you will need only two values :

DC forward current

the maximum current that is allowed to go through the Led without damaging it in the long run.

Forward voltage

the voltage at which the Led operates.

While the *Forward voltage* is a fixed value which depends (mostly) on the color of the Led, you have to limit the current going through the Led with resistor R_{Set}. Since *DC forward current* is a maximum value, which is not be exceeded, you should settle for a slightly lower current. Standard Led's and 7-segment displays are often rated with a *DC forward current* of 25-30mA. Limiting to 20mA would make a good choice.

With the two value from the Led's datasheet we can now lookup the resulting value for resistor R_{Set} in the table below (which I have copied from the MAX72XX datasheet):

	Forward voltage				
I _{Seg}	1.5V	2.0V	2.5V	3.0V	3.5V
40mA	12.2kΩ	11.8kΩ	11.0kΩ	10.6kΩ	9.69kΩ
30mA	17.8kΩ	17.1kΩ	15.8kΩ	15.0kΩ	14.0kΩ
20mA	29.8kΩ	28.0kΩ	25.9kΩ	24.5kΩ	22.6kΩ
10mA	66.7kΩ	63.7kΩ	59.3kΩ	55.4kΩ	51.2kΩ

Here is an example: I have a 5x7 dots "bright red" Led matrix. The datasheet states a *Forward voltage* of 2.0V. The *DC forward current* is limited to 25mA. I'll settle for 20mA to stay a bit away from the absolute limits.

From the table above, the correct value for R_{Set} would be 28.0kΩ. You might have trouble finding that exact value in shops, but it is always safe to go for higher values. More common values would be 30kΩ or 33kΩ. The Leds will look a bit dimmer with these values, but since it affects all the Led's in the matrix in the same way, you will probably not even notice the difference. It also reduces the supply current that is needed which might be good news if your project runs on batteries.

Mixing Leds of different colors in a matrix is not really recommended with the MAX72XX. There is only one resistor R_{Set} that limits the current for all the Leds. After you have looked all the different resistors required by your Led colors you will have to settle for the highest value. The brightness of the Leds with different colors will not really match, so it's a *trial and error* thing finding the right Leds.