Neopixels Characterisation

Test setup:

- Using a stripe of 40LEDs
- Type:
  - WS2812B
  - 144LED/m
- Using only PWM setting corresponding to full brightness (255)
- Supplying the stripe with a bench power supply
- Measuring the voltage directly at te stripe to avoid IR loss

Goal

Goal of the characterisation was to obtain following parameters:

- Current consumption as a function of supply voltage
- Voltage at which a particular color starts to loose from its maximum brigtness

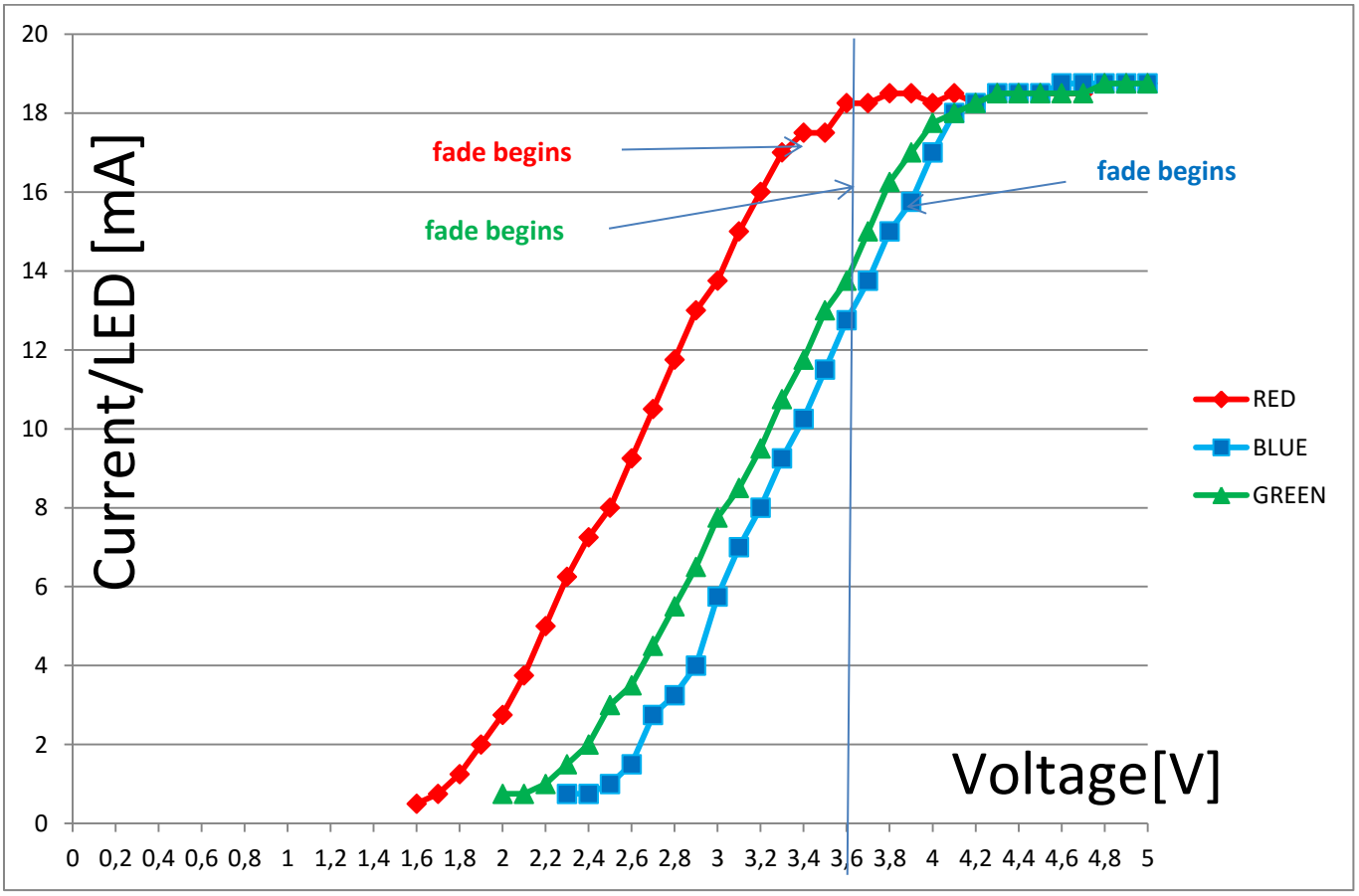
The first parameter is measurable, the 2nd parameter is based on subjective perception and can be taken as a rough guideline.

IR-drop

At max current an IR drop from supply to LEDs of ~0.5V was measured, which corresponds to ~660mOhms. While certainly a well soldered setup has less IR drop than a bread board setup with wire plugs, a certain contact loss is to be expected. Therefore if you want to get the full brigtness out of the stripe, dimension the supply accordingly.
Example: you select a 3.7V Li-Ion battery to power your stripe. You want to use a mosfet to be able to kill power to the stripe, with an Rdson of 100mOhms. Your contact resistance over the soldering and kill key etc. Adds another 200mOhms. If you use 100LEDs and drive 1 color at max power, you end up with 14mA*100=1.4A. The voltage drop via the 0.3Ohm is ~450mV. Of course the current also decreases quasi-linearly with the voltage, therefore the IR drop will decrease, and equilibrium will be reached at Vled=Vsupply-IR. Taking the chart below and assuming the LED currnet is a linear function of the voltage, using blue or green LEDs only you will end up at a supply voltage of 3.48V (a drop of 220mV) . The current consumption would be 660mA.

On the other hand side, using a higher rated voltage supply will see the LEDs in their saturation range (constant current but no brightness increase). This saturation range for blue and green starts from ~4V, for red much earlier at ~3.6V. In saturation the current of the LEDs never goes above 20mA if the voltage stays below the specified 5V nominal voltage. 100Led*20mA*0.3Ohm=660mV, i.e. to reach 4V an ideal supply of 4.66V would have to be used.

Characterisation Chart



Detailed measurement results

First row in red indicated the LED voltage at which a subjective fade has been perceived. 2nd row in red indicated the voltage at which that particular LED type switces completely off (no or negligible brightness). I.e. the red LEDs starts to fade below 3.3V and shuts off at 1.6V.

color	voltage[V]	current[mA]	current/LED
RED	5,00	750	18,75
	4,90	750	18,75
	4,80	750	18,75
	4,70	740	18,5
	4,60	740	18,5
	4,50	740	18,5
	4,40	740	18,5
	4,30	740	18,5
	4,20	730	18,25
	4,10	740	18,5
	4,00	730	18,25
	3,90	740	18,5
	3,80	740	18,5
	3,70	730	18,25
	3,60	730	18,25
	3,50	700	17,5

	3,40	700	17,5
	3,30	680	17
	3,20	640	16
	3,10	600	15
	3,00	550	13,75
	2,90	520	13
	2,80	470	11,75
	2,70	420	10,5
	2,60	370	9,25
	2,50	320	8
	2,40	290	7,25
	2,30	250	6,25
	2,20	200	5
	2,10	150	3,75
	2,00	110	2,75
	1,90	80	2
	1,80	50	1,25
	1,70	30	0,75
	1,60	20	0,5

color2	voltage[V]3	current[mA]4	current/LED5
BLUE	5,00	750	18,75
	4,90	750	18,75
	4,80	750	18,75
	4,70	750	18,75
	4,60	750	18,75
	4,50	740	18,5
	4,40	740	18,5
	4,30	740	18,5
	4,20	730	18,25
	4,10	720	18
	4,00	680	17
	3,90	630	15,75
	3,80	600	15
	3,70	550	13,75
	3,60	510	12,75
	3,50	460	11,5

	3,40	410	10,25
	3,30	370	9,25
	3,20	320	8
	3,10	280	7
	3,00	230	5,75
	2,90	160	4
	2,80	130	3,25
	2,70	110	2,75
	2,60	60	1,5
	2,50	40	1
	2,40	30	0,75
	2,30	30	0,75

color6	voltage[V]7	current[mA]8	current/LED9
GREEN	5,00	750	18,75
	4,90	750	18,75
	4,80	750	18,75
	4,70	740	18,5
	4,60	740	18,5
	4,50	740	18,5
	4,40	740	18,5
	4,30	740	18,5
	4,20	730	18,25
	4,10	720	18
	4,00	710	17,75
	3,90	680	17
	3,80	650	16,25
	3,70	600	15
	3,60	550	13,75
	3,50	520	13
	3,40	470	11,75
	3,30	430	10,75
	3,20	380	9,5
	3,10	340	8,5
	3,00	310	7,75
	2,90	260	6,5
	2,80	220	5,5
	2,70	180	4,5
	2,60	140	3,5
	2,50	120	3

	2,40	80	2
	2,30	60	1,5
	2,20	40	1
	2,10	30	0,75
	2,00	30	0,75