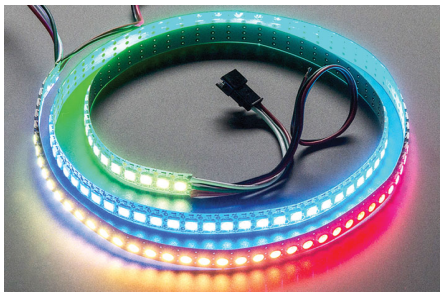
Like everyone interested in electronics, I'm hearing daily about the “Internet of Things” as well as “wearables” which I think is driven by an industry desperate to find the next “Great New Product” to sell us. I'm not sure how useful these new ideas will be.



However, I do feel that LEDs are products that will see an exponential growth in the future. There is no question that their efficiency and versatility make them the perfect choice for almost all general lighting needs. Although cost is an issue today, that will soon disappear because the cost of LEDs is on a steady downward trajectory.

You have likely seen large outdoor displays used for sporting events and concerts. These are very expensive, highly specialized displays, but a similar idea is now being found in smaller

commercial displays used for promotional and advertising purposes. Such displays are usually a square meter and upwards in size, and are made up of thousands of individually-driven LEDs. Although displays like this used for traffic notifications are generally only one color, most of the units used for any form of advertising use RGB LEDS and can reproduce the whole color spectrum.

While the cost of such a large number of RGB LEDs is not insignificant, what is more of an issue is the problem of driving them in such a way that they can be individually controlled. You have probably built projects using multiplexed 7-Segment LED displays, so you are familiar with that method of reducing the number of wires/drivers needed to handle multiple LEDs. Multiplexing of LEDs works because the human eye has a persistence of vision, which means it can't respond to changes in a light source at a frequency much beyond about 40 Hz. So, when we look at a 4-digit LED multiplexed display, our brain will mask out the fact that, at any given moment, only one of the 4 LED digits is actually lit. While you can certainly use multiplexing techniques for large panels of LEDs, as you increase the multiplexing ratio, the “perceived” brightness will decrease as this ratio increases. Since brightness is a key factor for outdoor displays, this is definitely a limitation.

Parameter	Minimalni čas	Maksimalni čas
T0H	0.20 us	0.50 us
T1H	0.55 us	0.85 us
T0L	0.65 us	0.95 us
T1L	0.45 us	0.75 us
RES	50 us	Anything > 50 us

To facilitate the design of large LED display panels (and other related display products), the concept of the NeoPixel LED was invented. Initially, the idea was to develop a small IC that could control 3 LEDs (Red,Green,Blue) utilizing 8-bit PWM drive for each LED. Theoretically this gives “24-bit” color resolution: in practice the LEDS don't really yield this high a color resolution, but it is nonetheless very good. To further simplify the wiring, these LED driver IC's used a single-wire control protocol, and each IC device contained both a Data in and a Data out pin, allowing many such devices to be strung together in a “daisy-chain” configuration.

In practice, it's possible to string up to about 100 RGB LED driver IC's in this fashion, using only three lines (Vcc, ground and data). This is a tremendous reduction in the amount of wiring and circuitry needed to drive 300 completely independent LEDs (100 X Red,Green and Blue). While

the original idea was to have this IC used with seperate Red,Green and Blue LEDs (or a single RGB LED unit), it soon made sense to manufacture RGB LEDs with this driver IC built-in. Such LED/driver modules units are called NeoPixel LEDs. These driver IC's were developed by World-Semi in ShenZhen, China, and, as far as I can tell, all of the NeoPixel modules come from the far-east. Let's look at some technical details of the most common NeoPixel IC driver chip, the WS2812.

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