

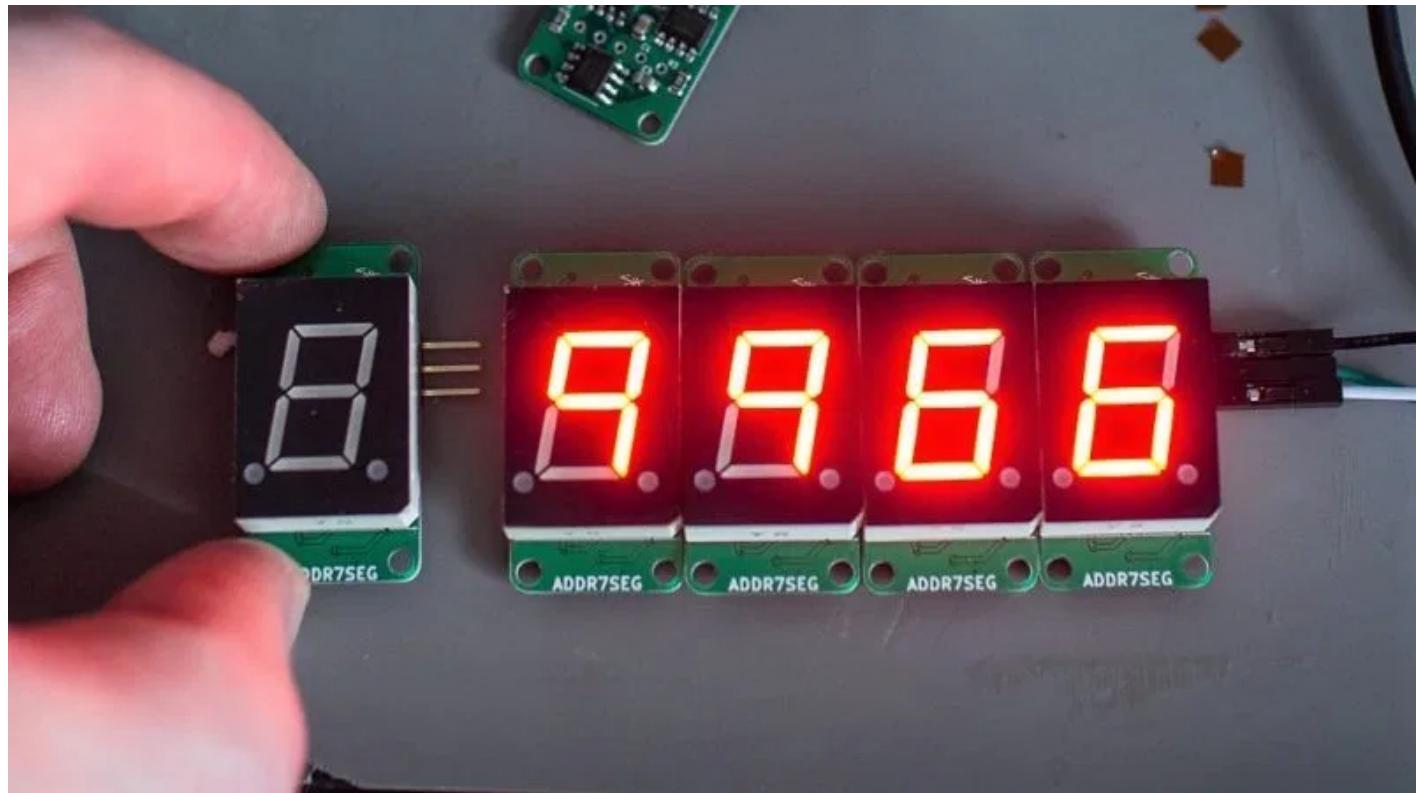


ADDRESSABLE 7-SEGMENT DISPLAYS MAY MAKE MULTIPLEXING A THING OF THE PAST

by: Dan Maloney

52 Comments

January 12, 2019



[Sean Hodgins] has a knack for coming up with simple solutions that can make a big difference, but this is one of those “Why didn’t I think of that?” things: [addressable seven-segment LED displays](#).

[Sean]’s design is basically a merging of everyone’s favorite Neopixel RGB LED driver with the ubiquitous seven-segment display. The WS2811 addressable RGB driver chip doesn’t necessarily have to drive three different color LEDs – it can drive three segments of the same display. With three of the chips on a single board, all seven segments plus the decimal point of a display can be controlled over a single data line. No more shift registers, no more multiplexing. And as a nice touch, individual displays can be ganged together with connectors on the back of each module. [Sean] has some code to support the display but is looking for someone to build a standalone library for it, so you might want to pitch in. Yes, he plans to sell the boards in his shop, but as with all his projects, this one is open source and everything you need to build your own is up on

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Like many of [Sean]'s designs, including this [Arduino rapid design board](#), this is a simple way to get a tedious job done, and it wrings a lot of functionality from a single IO pin.

Addressable 7-Segment Displays



Thanks to [0] for the tip.

Posted in [LED Hacks](#)

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52 THOUGHTS ON “ADDRESSABLE 7-SEGMENT DISPLAYS MAY MAKE MULTIPLEXING A THING OF THE PAST”

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Hopefully this will eventually become a cheaper alternative to RGBDigit's implementation:
<https://www.rgbdigit.com/rgbdigit/>

Reply

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stefan_z says:

January 12, 2019 at 4:28 pm

LOL \$8,- per single digit? WTF?
You can literally just use a color OLED for the same price.

Reply

Report comment

Connor Nishijima says:

January 12, 2019 at 5:38 pm

Do you have a source on that for \$8?

Reply

Report comment

Lew says:

January 12, 2019 at 6:40 pm

https://www.rgbdigit.com/shop/index.php?id_product=8&controller=product&id_lang=1
Priced at 7.95 Euro

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Connor Nishijima says:

January 13, 2019 at 3:00 am

I meant a full-color OLED display that size for \$8 that they mentioned, not the
RGB Digit, sorry!

Report comment

Mike R says:

January 12, 2019 at 6:46 pm

7,97 € each according to their shop.
https://www.rgbdigit.com/shop/index.php?id_product=8&controller=product&id_lang=1

Chinshu says:

January 12, 2019 at 7:11 pm

That's why I put down the word "eventually" in my initial comment as I tried making something similar about a year ago but gave up because I couldn't get the cost down enough to justify building one from scratch on my own (eg less than retail cost) when one include's the time commitment.

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Fredz says:

January 13, 2019 at 7:15 am

Search for 0.95" 96×64 OLED on Amazon (around \$7.50) or Aliexpress (around \$2).

[Reply](#)

[Report comment](#)

Rodney McKay says:

January 13, 2019 at 9:30 am

But any sort of screen-based approach wouldn't have the retro-cool look of a real led-segment display.

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Paul says:

January 12, 2019 at 2:40 pm

neat idea. one big advantage over the shift register approach is the built-in brightness control.

You *could* use a single chip (instead of 3 chips) per display by using daisy-chainable shift register, like the everyone's (lame) favorite 74HC595, but have to put up with a bunch of resistors, and get no brightness control.

Or (better), a dedicated LED driver like the one-dollar STP16CPC26, which can drive 16 segments (2 displays), and also is daisy-chainable, and also can drive high-voltage LEDs for large, bright displays.

Or (what I'm doing for a remoteable display) is 8 7-segment displays on a single I2C chip: the AS1115, with a single resistor for brightness control. \$1.50 single chip solution for up to eight 7-segment

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Jan says:

January 13, 2019 at 2:12 am

If you want brightness control using a 74HC595, just PWM the output enable line (OE). In many cases you don't need to control the brightness of a specific segment or digit. Most of the times you just want to dim it entirely to save power or reduce brightness in dark environments.

But the 74HC595 does require more wires so I can understand that this isn't always preferred when you want to slam in a display of a theoretical infinite size and have lots of money to spare. So This little project seems like a nice thought.

[Reply](#)[Report comment](#)**Laetitia** says:

January 16, 2019 at 4:22 am

The only remarkable advantage of [Sean Hodgins] solution is that you use only 3 wires (GND,VCC,SIGNAL) to drive as many as you want.

All the other suggested shift register solutions need at least 4 wires (GND,VCC, Clock, Signal). One wire "change la donne".

[Reply](#)[Report comment](#)**SebiR** says:

January 12, 2019 at 2:45 pm

Now let's hope that the Chinese like the Idea and they'll start producing 7-segment-displays with a special 8-channel WS2812 already inside it!

[Reply](#)[Report comment](#)**perry** says:

January 12, 2019 at 9:10 pm

Like they did with the Voltage displays.
Just don't reverse the power, They do a little pop. And that's the end of them.
Great job. But there must be an easier way of doing it.
Still a great job....

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if you were surprised by reversed voltage killing them, then I have some other tips: it seems that hitting them with a hammer also does some damage, and even high voltage of a few hundred volts (even with the correct polarity) seems to kill them too.

Submerging it for long periods of time with power applied doesn't seem to do them good either.

And I'm pretty sure that high intensity electric fields could interact with the communication too.

Jeezzz... this is electronics stuff is really difficult stuff!

It isn't like you can randomly connect everything make a wish and then it does something.

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Jii says:

[January 13, 2019 at 6:23 am](#)

Almost funny, but DMMs work both ways, reverse polarity protection isn't magic. It's not like it'd cost so much to not include it.

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light beams says:

[January 13, 2019 at 10:13 am](#)

It would cost another cent, which would add another 10c to the price, and someone else would undercut them. With these boards you make the absolute cheapest thing that isn't going to swamp you in returns.

[Report comment](#)

JCG says:

[January 14, 2019 at 3:53 am](#)

Modern super lean manufacturing: Ask prices quotes from a number of chinese manufacturers, send all project files so they can make an accurate quote. And then buy the finished product from alibabba 2 weeks later.

[Reply](#)

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[+1](#)[Reply](#)[Report comment](#)**Dave** says:

January 12, 2019 at 2:48 pm

Why. It just use a 7 segment SPI driver like MAX7221? Or have I missed something? Or this spark fun version <https://learn.sparkfun.com/tutorials/using-the-serial-7-segment-display/all>

[Reply](#)[Report comment](#)**Connor Nishijima** says:

January 12, 2019 at 5:41 pm

I don't believe the MAX7221 over SPI is neither controlled over a single wire, or has 8-bit brightness control. Am I wrong?

[Reply](#)[Report comment](#)**grandeurnature2018** says:

January 13, 2019 at 4:21 am

One MAX7221 chip can drive from 1 to 8 digits of 7+1 segments (or a 8x8 matrix), has 16 levels of brightness control, but needs 3 control wires.

But you cannot compare: the functionnality is not the same. What is proposed here in this hack is to have directly extensible displays of numerous digits without having to modify the hardware.

The MAX7221 approach is more "static"

Depending on your use case, you will use different solutions.

One is not better than another: it all depends what you want to achieve, and comparing different solutions can only be done in the frame of determining which solution better fits your needs

[Reply](#)[Report comment](#)**Soc Rat** says:

January 13, 2019 at 12:41 pm

The MAX72XX is much easier to use because it's not timing critical. People use libraries

microsecond pause. This pushes an Arduino to its limit, you can do very little besides control the WS2811 with a single Arduino. And even a more powerful CPU is burning timers, interrupts, and processing power that can be put to better uses.

If you're that short on IO, you're still better off with a MAX72XX and a port extender.

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profumple says:

January 12, 2019 at 3:09 pm

Thems chinese already got several different tube 7seg x 4 digits or more, and some with keyboard and encoder extra built in on the Amazon. 7219, SPI,I2C, and the such. Whole display intensity instead of individual . 2812 and RGB 7seg display is a cool idea too but not feeling need for either. Too cheap and ol school for the idea i guess.

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delmar says:

January 12, 2019 at 4:01 pm

How about this chip: it drives 8 leds and has IC2 control, \$0.69 in quantities of 2500.

<https://www.mouser.com/ProductDetail/Texas-Instruments/TPIC2810DRG4?qs=sGAEpiMZZMuXfccvO5DzakvfNN90H7gQ>

[Reply](#)

[Report comment](#)

Connor Nishijima says:

January 12, 2019 at 5:43 pm

If I need to build 625 VCR clocks I'll keep that one in mind.

[Reply](#)

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profumple says:

January 12, 2019 at 8:02 pm

But is it needed to have a controller or mcu to blink 12:00 continuously?

[Reply](#)

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profumple says:

January 12, 2019 at 8:01 pm

Did u check the price for maxim 7219 on mouser? Ya nothing funky going on there. Same on digikey. So anyway... for the price of 4 of them fancy TI chips could get 8 digit 7 segment with 7219 stuffed and ready or for the price of 7219 alone on mouser can get four stuffed boards. I do love TI but sheesh.

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morbos says:

January 12, 2019 at 6:31 pm

Or use the chip in dotstar LEDs APA102-xxxx. That is one extra wire for clock so its a bit easier to I/face since the timing is not critical.

[Reply](#)

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rnjacobs says:

January 12, 2019 at 7:18 pm

Kinda unfortunate you have to use three ICs per 7-segment display.

All that said, does someone have a photograph or video of using independent dimming on individual segments of a monochrome 7-segment display? Try as I might, I'm having a hard time figuring out where I'd want to use it.

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Chinshu says:

January 12, 2019 at 7:45 pm

I saw an application where before a digit itself changed (in a count-down timer), each individual segment dimmed down in sequence one right after the other. I guess it was kind of indicating fractions of a count without using another digit.

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Connor Nishijima says:

January 12, 2019 at 10:02 pm

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[Reply](#)[Report comment](#)**MRE** says:

January 12, 2019 at 10:21 pm

I dont get it. Why try to reinvent the wheel? WS2811 is 4.65 USD single quantity. You need 3 for a single digit. nearly 15 dollars, plus the additional parts (PCB and display, resistors, connectors etc). And you need to send 3 values per digit. Meanwhile MAX6958 is 9 dollars in single and drives 4 digits at a time. With one address /value per digit.

I get using what you are used to.. but 20 seconds of googling would turn up a variety of better options.

[Reply](#)[Report comment](#)**Feinfinger (private)** says:

January 12, 2019 at 11:36 pm

> 20 seconds of googling would turn up a variety of better options.

!!!

[Reply](#)[Report comment](#)**Rodney McKay** says:

January 13, 2019 at 10:09 am

Yeah, let me expand on that well-deserved snark: !!!!!!!!!!

[Reply](#)[Report comment](#)**Rodney McKay** says:

January 13, 2019 at 10:08 am

\$4.65?! Speaking of Googling...

<https://www.aliexpress.com/item/DC5V-WS2811-addressable-pixel-PCBA-without-LED-square-type/32466969629.html>

These are what I buy. Currently \$23.23 (delivered by DHL) for breakaway panels of 100 pieces, though I buy them by the hundreds (of 100-unit panels) so the total cost for each unit with shipping is far lower. Add the RGB LED of your choice (e.g., <https://www.aliexpress.com/item/8mm-diffused-round-hat-RGB-LED-3-2V-60ma-common-anode-4pin-dump-RGB/32270741270.html>), or use them

Yes, interconnecting a lot of these tiny PCBs can require some tedious wiring, and you ?????????????? buy them preassembled in strings (e.g.,

https://www.aliexpress.com/store/product/DC5V-WS2811-pixel-node-50node-a-string-non-waterproof-SIZE-13mm-13mm/312912_1624010105.html), but I like the versatility of being able to create any configuration I want (and use custom-length, less-visible wiring). Also, you can pass the LEDs' leads through a hole in something before soldering them to the PCBs, so you get an easy mounting solution (I use this a lot!).

And, before anyone feels compelled to point out that you can cheaply buy strips of SMD LEDs in many configurations, I want to add that I ????????????????????????? prefer the look of diffused "top hat" LEDs to SMD for any application where they will physically fit.

Actually, not to sound like a shill, but I recommend Shenzhen Rita Lighting for all sorts of LED-related stuff. Way too many of the sellers on AliExpress are scammers selling junk, but I have had excellent service from these folks for several years now. Yes, they only use expensive shipping methods like DHL, and are perhaps better for large-quantity orders like I make, but you get what you pay for. I generally receive my orders from them in under a week (to the U.S. east coast).

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Soc Rat says:

January 13, 2019 at 12:24 pm

There's a reason those Chinese chips are so cheap. They're either knock-offs not made to quality standards or factory seconds that don't work in some way.

Years ago, I built a 16×40 panel out of 10 60mm 8×8 LED matrices and 10 MAX7219's (about 50 cents each from ali-express). The chips don't initialize right every time, so when turning on my project I need to cycle power several times to get all 10 boards to light. The the MAX719's start crashing after 5-25 hours of use leaving an entire 8×8 section dark until I cycle power on the whole project. I've added capacitors everywhere, well beyond what the datasheet recommends and it doesn't improve things at all. I still use it as a nice clock, but I have to power-cycle it several times a week to fix the glitched display..

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Rodney McKay says:

January 13, 2019 at 3:33 pm

That's unfortunate. However, in the past few years I've used tens of thousands of cheap Chinese WS28xx thingies in my lighting projects, some of which have been fairly demanding, and while there have been some individual component failures (easily replaced) I haven't yet had any projects simply fail because of low-spec components. I'm just doing all this for the jollies, not to make money, and if I had to pay the price of "real" parts then I couldn't afford to do this at all.

Also, the very few AliExpress merchants that I'm willing to deal with (like Shenzhen Rita

As always, YMMV.

[Reply](#)

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RÖB says:

January 12, 2019 at 11:45 pm

I really love the modular idea but not the price.

Something like MAX7221 on a PCB with 8 or 10 7seg positions that are snap off so you only populate the ones you want would be better I think.

It would even be better if there were other module types like buttons, rotary encoders, slide pots, bar graphs etc.

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cv007 says:

January 13, 2019 at 1:31 am

Or you just use a 1 dollar pic16, 2 transistors, 2 caps, a 2 digit 14 segment display, and solder as many as you need together- up to 126 (each digit addressable, each digit brightness can be changed)

<https://goo.gl/photos/rTCwusquFnb8AfQE6>

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JDX says:

January 14, 2019 at 8:31 am

This is the solution my brain jumped to, nice to see it already reduced to practice—I already have too many projects.

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greenpossum says:

January 13, 2019 at 2:59 am

Inventor needs to shop more on eBay. I've been using Chinese made 4 digit LED "tubes" that use a 2

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so you only have to send it the data. Yes, it's one more signal wire than this, but \$1 vs \$15 is no contest. Search the Internet for TM1637 displays. And then there are the MAX products.

Reply

Report comment

Rodney McKay says:

January 13, 2019 at 9:37 am

And who could resist the opportunity to order from the "Sincere Company Store"?

<https://www.aliexpress.com/item/4-digital-display-with-adjustable-brightness-LED-module-clock-Point-Accessories-Blocks-for-arduino/1969258031.html>

Reply

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Rodney McKay says:

January 13, 2019 at 10:22 am

This ultra-cheap (under US\$2), daisy-chainable, 16-channel, I2C-connected board with 12-bit PWM outputs will directly drive an individual LED (like one segment of the display) on each channel. So, two seven-segment digits with (FWIW) much finer brightness control on each segment (WS2811 is 8-bit PWM) per board. Yeah, I2C requires one more data line than a WS2811 solution, but as always you get what you pay for: <https://www.aliexpress.com/item/16-Channel-12-bit-PWM-Servo-Driver-I2C-interface-PCA9685-for-arduino-or-Raspberry-pi-shield/32447354314.html>

And if you don't want to buy from AliExpress, and aren't a poor, starving student, you can always get the same thing from our dear friends at Adafruit: <https://www.adafruit.com/product/815>

Reply

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Rodney McKay says:

January 13, 2019 at 4:01 pm

BTW, over the past few years I've bought & used ?????????????????????????????????? of these little PCA9685 modules from a variety of AliExpress merchants (though I've recently settled on Advanced Tech as my favorite). They are my hands-down, all-time favorite gadget, because they can be used for so very, very many cool things that are difficult and/or painfully expensive to do in any other way (the connectors on the module are laid out on the assumption that they'll be used to drive servo motors, but my preferred use is as a driver for various sorts of lights). And so far (knock on wood) I haven't found a single one that didn't work for me, not that I'd really worry about it since replacement is so cheap & easy (but, why would anyone go to all the trouble to build a rather complex board around this cheap little chip without testing the chip first?). I now have a stock of close to a thousand, because I'm worried about what Agent Orange's trade war with China might do for future availability and, to be mildly hyperbolic, I'd rather die than have to live

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These modules used to be pretty expensive, and for a short while I was buying raw PCA9685 surface-mount chips and soldering them up myself. But now, at less than two bucks for an assembled module, that would be an insane thing to do. Get 'em while you can, folks.

[Reply](#)[Report comment](#)**chris cauwelier** says:

January 13, 2019 at 10:51 am

A+

[Reply](#)[Report comment](#)**Rodney McKay** says:

January 13, 2019 at 1:31 pm

With this (adafruit.com/product/815), connected via I2C and daisy-chainable, you could directly drive two full digits of seven-segment LED displays.

[Reply](#)[Report comment](#)**Rodney McKay** says:

January 13, 2019 at 1:33 pm

I'm learning to not put real links in my comments, to avoid falling into the moderation black hole.

[Reply](#)[Report comment](#)**Gallego** says:

January 13, 2019 at 11:55 pm

I've seen this kind of display before: <https://www.artekit.eu/products/accessories/ak-mr-wood-l/>

[Reply](#)[Report comment](#)**Thomas** says:

January 14, 2019 at 1:09 am

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[Reply](#)[Report comment](#)**Joshua** says:

January 14, 2019 at 1:37 pm

Or you could just buy one of these instead. Full RGB, two digits per module, larger. These have been out for well over a year now and you can buy them through CrowdSupply or Digikey. I've got a couple around the office and they're a blast to use.

<https://www.crowdsupply.com/maksmakes/neosegment>

[Reply](#)[Report comment](#)**Laetitia** says:

January 16, 2019 at 4:42 am

Good job.

I don't understand why yet no manufacturer yet thought about a WS2811 like chip with 8channels.

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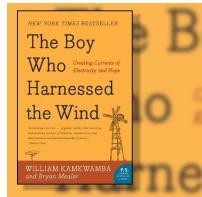
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