

**CHIPS Newsletter Vol 12**

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# CHIPS newsletter

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## Official Newsletter of *Chuck Hellebuyck's* Electronic Products

<http://www.elproducts.com/>

### Topic

Temperature Sensor  
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Conclusion

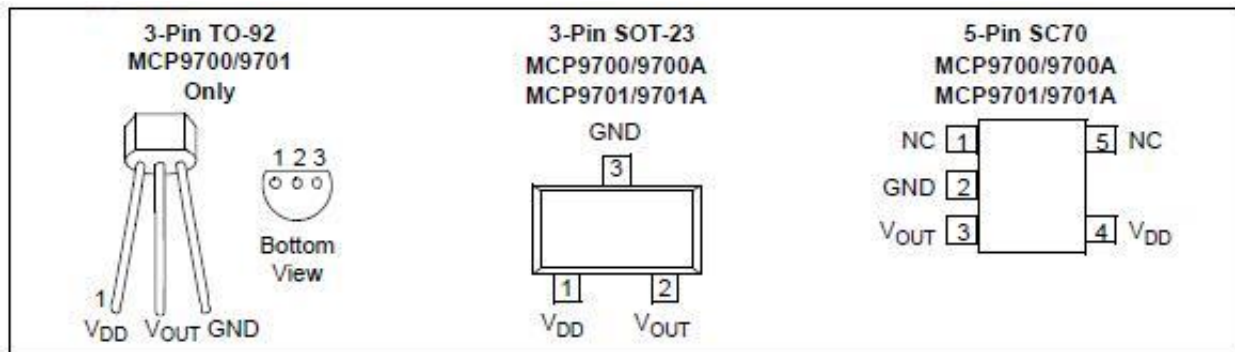
This month I cover a diverse set of topics. A temperature sensor that is easier to work with than a thermistor. I offer a book review on a book I didn't write! Then I offer a recommendation on a low cost oscilloscope for the home lab and finalize with an update on the latest version of the HI-TECH C compiler I use in my books. Let's get started.

### **Temperature Sensor**

I've often used a thermistor to measure temperature. They are cheap and easy to use with a simple pull-up resistor to form a voltage divider. That connection can then be fed into an analog to digital converter (ADC) pin of a microcontroller. The problem is they are not linear or in other words the response is a curve and not a straight line. This requires the software to use a look up table instead of a simple equation to convert the voltage to a temperature value. Well no more.

I've started using the MCP9700A from Microchip to measure

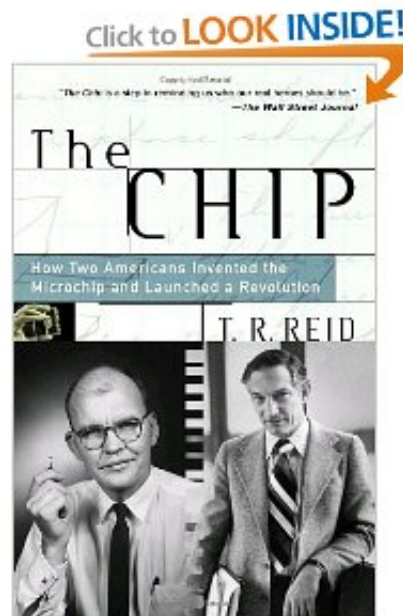
temperature. You can get them in various packages including a very small SOT-23 size. They output a constant 10 millivolt per degree C. Zero degrees outputs 500 millivolts or  $\frac{1}{2}$  volt so you can even go below zero. You supply voltage to one pin, ground to the other and then connect the Vout pin to the ADC pin. Not much different then hooking up a potentiometer. You can get them for around \$0.35 each in single quantity from MicrochipDirect.com, digikey.com, mouser.com. As I write this they all have them in stock.



**Figure 1: MCP9700A Temperature Sensor Packages**

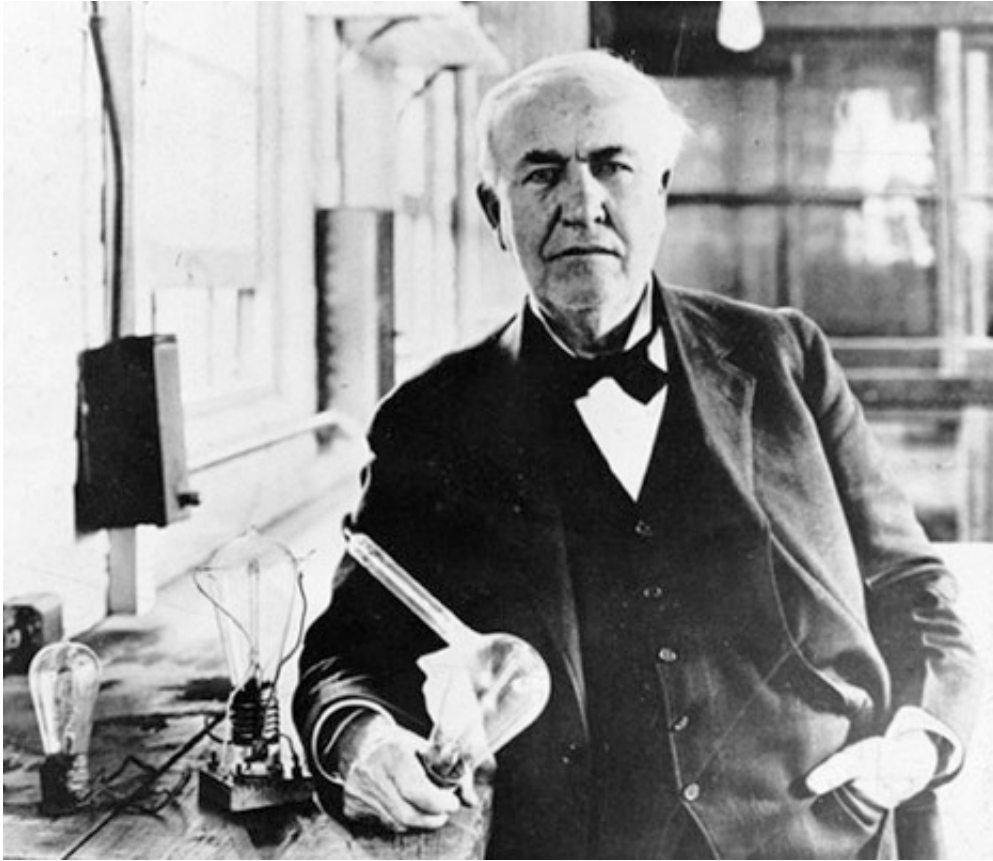
### Book Review "The CHIP"

Normally I spend a small section of this newsletter promoting my own books but on occasion I also read a few books so I thought I would recommend one I liked. The book is called "The CHIP" by T.R. Reid. It's been around a while so this isn't a new release. I actually found a used copy on EBAY for a couple bucks. What a gem it turned out to be. If you are deep into technical theory then you might find this book a bit irritating as it explains the history of the microcontroller in a very basic way. I found the book quite entertaining and well written. The author explains electrical theory in a way that people not familiar with electricity or electronics can still follow along.



**Figure 2: The book "The CHIP"**

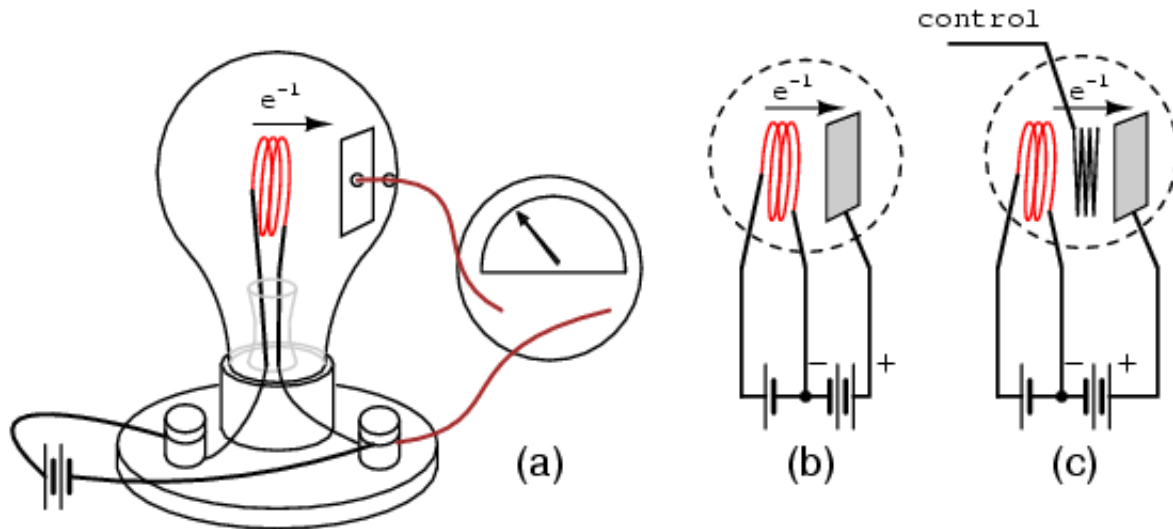
The book even covered a topic I've wondered about for years. I make at least one trip a year to the Edison Laboratory at Greenfield Village in Dearborn, Michigan. Thomas Edison's whole Menlo Park, New Jersey lab was moved to Greenfield Village by Henry Ford many years ago. As a kid growing up, I read everything I could about Thomas Edison and being able to go to his lab is a thrill to this day. Outside the lab is a small shed where an employee of Edison's would scrape off the soot from the ceiling and bring it into the lab. The shed had numerous oil lamps burning that created the soot on the ceiling of the shed. That soot was almost pure carbon which Edison used for many inventions including an early potentiometer design, a carbon based microphone for an improved telephone and when baked on top of a piece of thread; the filament for his most famous invention: the light bulb.



**Figure 3: Thomas Edison and his Long Tube Light Bulb**

In several pictures of Edison holding the light bulb, I noticed a long tube extending from the side. I never understood what that was until I read "The CHIP". The log tube had a conductor inside that Edison and team had discovered would create an electrical current when the light bulb was on.

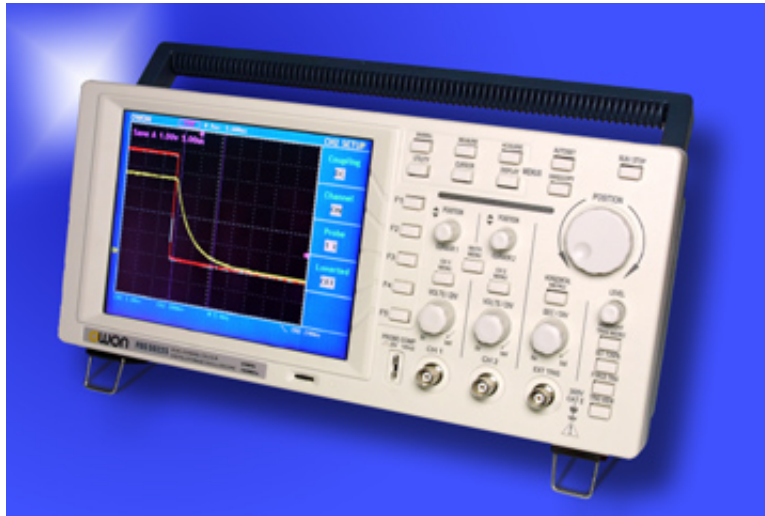
Electrons from the light bulb filament would escape and collect on the conductor. This became known as the Edison Effect. It also became the basis for the vacuum tube which led to the transistor and eventually the microcontroller. The book goes deep into the history of that path so I recommend this to anybody who likes to know the history of the microcontroller.



**Figure 4: Graphic of the Edison Effect**

### **PDS5022S Oscilloscope**

Every electronics hobbyist should have an oscilloscope though I know that is a very expensive tool to buy. I've watched the price of good scopes come down and there is the occasional great deal on EBAY for a used one. Then about two years ago I came across a low cost digital scope that claimed it could also capture waveforms on your computer. Since I needed a better method to capture signals for my books I bought one. It's the PDS5022S from OWON. I paid around \$280 for this 25Mhz dual channel scope and I've been very happy with it. It has a USB port so you can plug it into the USB port of your computer with a type A-B USB cable. The software runs on Windows but not MAC. The software is easy to use and does a great job capturing a waveform. If you need a low cost scope then I can recommend this one. You can get one from various sources on EBAY or online resellers. Just do a search on PDS5022S.



**Figure 5: PDS5022S Oscilloscope**

### **HI-TECH V9.80**

It's now known that the HI-TECH compiler for the PIC10F,12F and 16F needed an update and we've finally got a good one. A lot of bugs were fixed in this latest update. You can download version 9.80 from [www.htsoft.com](http://www.htsoft.com). You'll need to create a login and password if you don't already have one but the download is free. If you are using my books to learn C, then please download this latest version. It may fix some strange behavior in your code.

While you are at it, you might want to just download the latest MPLAB version 8.63. You can download it for free from [microchip.com/mplab](http://microchip.com/mplab). When you install the this latest version it will also offer to install the latest version 9.80 of the HI-TECH compiler. Let it happen.

### **Conclusion**

As usual, give me your feedback on this newsletter or any topic you'd like me to cover. I do get some requests that frankly are not easy to cover in a short newsletter. I also get some requests for topics I'm not qualified to write about. Don't let this stop you from asking. If you have any questions or comments regarding this newsletter send them to me at [chuck@elproducts.com](mailto:chuck@elproducts.com).

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