

The PM829 6.8V Reference Circuit:

An Inexpensive Voltage Reference for Audio DIY Projects

Walt Jung, January 2019

The LM329 has been popular as a two-terminal IC reference since the 1970's, for good reason. But other voltage reference techniques were used back in the 1960s, namely the 1N821-829 series. These devices were actually a two-diode composite assembly, with a reference voltage of 6.2V @ 7.5mA of current.

The 1N821-829 were (are) *temperature compensated diodes*, composed of a reverse-biased zener in series with a forward biased diode. The voltage TCs of the two diodes are opposite in slope, and at a current of 7.5mA they are nominally equal, and thus will show a low net TC. The various device numbers within the series define different TCs, the best being the 1N829 with a TC of 0.0005%/°C. A background reference is MIL-PRF-19500/159. An interesting point is that the 1N821-829 series is still available!

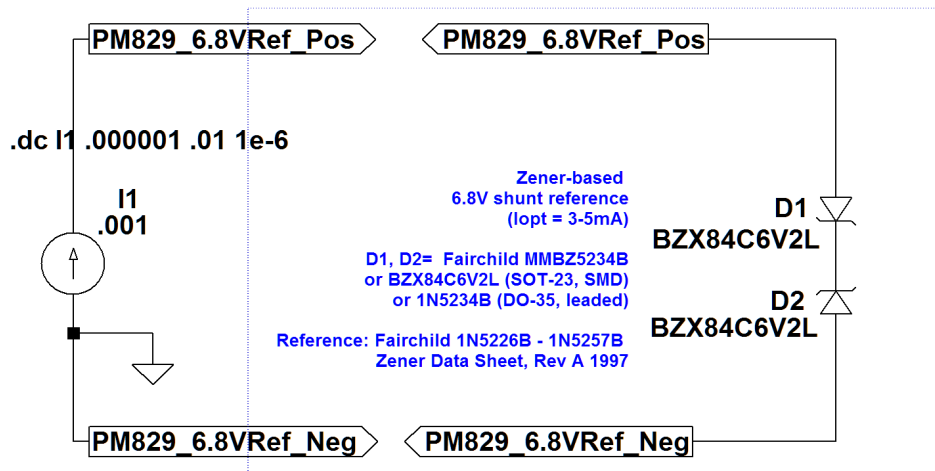


Figure B1: This PM829 reference circuit uses a pair of 6.2V zeners connected back-back, as noted in the right part of figure. Use the 1N5234B types mentioned for best results

The PM829 voltage reference is shown to the right within **Figure B1**, consisting simply of diodes D1 and D2. It applies the same principles as did the 1N821-829 series, but with ON Semiconductor (Fairchild) 1N5234B (or SMD equivalent) 6.2V zeners, operating at 3-5mA. A careful data sheet study of this series shows a positive TC for the zener, with a $\sim 2\text{mV}/^\circ\text{C}$ slope — opposite to that of a forward biased diode. To make this "complex" circuit, simply connect a pair of 6.2V zeners just as D1 and D2 are shown here.

The net result is that this PM829 can be used as a $\sim 6.8\text{V}$ zener with a low TC. The TC can be optimized by adjusting the forward current, with 4mA as a suggested starting point. This PM829 can be used as a drop-in replacement for an LM329, and will have a noise density in the range of 20nV/Hz (or perhaps less), which is many times lower than that of an LM329.

To apply the PM829 circuit, the external feed resistor should be adjusted so D1-D2 see $\sim 4\text{mA}$ of current. A caveat here — note that neither short nor long term DC stability will match a real LM329. A piece of soda straw filled with silicon compound can be used to minimize effects of air currents on the reference voltage.