The SZA263

A little history: The SZA263 was developed by Motorola especially for Fluke's measurement technology, which is why none of the distributors had this part in their program. This means that you can't buy it anywhere. The only thing you can do is to get an old Fluke measuring device that you can buy cheaply somewhere and then desolder this reference element.

Now to the history of the SZA 263: It started with a reference element with the designation DH 80417B and was developed by Siemens and Halske. The part was later further developed by Motorola as the SZA263. Finally, the reference was updated again by Linear Technology as LTFLU and this was the last reference element from this series. This LTFLU is available from Alibaba. However, it has to be said that there are several reports on the net that have had problems with the parts sold there. So you should think twice about buying something like this from there.

Now let's turn our attention to the gearshift. You can already see that the SZA is wired from the outside using various resistor combinations. It contains a Z diode which has a voltage of exactly 6 volts. Above this is a transistor which is used to set the temperature compensation. The summed voltage is taken from the collector of this transistor and further amplified. The advantage of this reference is that it is completely wired from the outside and therefore the reference accuracy can also be influenced.

We have this voltage divider which is connected to the output voltage and regulates the base voltage of this transistor. The Z-diode is supplied with current via a resistor. The resistor picks up the voltage from the 10 volt output reference voltage. We also have the voltage divider for the operation amplifier, which specifies these 7 volts. The transistor is operated with an emitter-collector voltage of approximately one volt. The collector resistance must be adjusted accordingly to achieve a temperature coefficient of approximately 0. The collector current is between 20 and 100 microamperes.

The Z-diode is operated with 3 milliamperes. It is possible to deviate slightly from this, but the current also changes the Z-voltage and Fluke will of course have had something in mind. I have measured and entered the voltage.

It is important that the voltage divider resistors must be very good, with a low TC and good long-term stability. The age-related drift of these resistors must be very low. Wirewound resistors, which Fluke also uses in its standards, are of course best suited for this. And if you want to do it really well, then you would install the entire circuit in a thermostat again so that the temperature dependence is really reduced to a minimum.

The circuit does not have many other special features. As I said, the OPV amplifies this voltage of 7 volts and then brings it up to the 10 volts of the reference voltage. At the output we have another transistor for the current limitation and the second one makes the output low impedance, so that we can then draw about 5 milliamperes at the output without changing the reference output voltage.

These voltage dividers must be precisely calibrated in order to arrive at this 10 V reference voltage.

Finally, the exact output voltage is set with this potentiometer. A 4.7 Ohm resistor is connected in parallel to the potentiometer in order to set the control variable for the output voltage to a maximum of +/- 20 microvolts. Otherwise the output voltage will drift too much.

The output of the reference voltage is connected to the sense inputs at the front of the input terminals.

This Kelvin contact prevents a voltage drop across the supply lines.

That's the essentials of the circuit for now.

I would now like to demonstrate how to carry out temperature compensation with this SZA263. If you solder such a reference element, then it is the case that most devices work at different reference voltages. So you can see a small test circuit here, this is just a test circuit board that I have always experimented with. There is an adjustment regulator connected and it is in the collector circuit of the reference transistor. We use this to adjust the temperature coefficient. The current flowing through the collector is between 20 and 100 microamperes. To do this, we take this setting regulator and use it to adjust the temperature coefficient. We turn it a little here ... then you can see that the voltage changes and if we now take the SZA263 out of the oil here, the voltage also changes. I have connected the reference here to the circuit board via a lead. This is only for testing purposes, of course, as it also causes interference. We'll have to solder the part in properly later. But for our test, this is advantageous for now. We now immerse the SZA263 in this thermostat container - the transformer oil is warmed up to 30 degrees and we can already see how the voltage changes. It is now increasing. Of course, we use a liquid that must not be conductive (for example, transformer or silicone oil, or petroleum if necessary) around the entire reference element including the periphery, namely the contacts on which the reference is plugged in. Otherwise, thermal voltages are generated and therefore we have to immerse the entire part in the oil bath in order to achieve the same temperature for all peripheral parts. So we see that the voltage rises here when heated and when we cool the SZA263 down again, it falls again. This means that the temperature coefficient is now positive. To make it more negative, we have to reduce the current slightly. I had already tried this before. Now the whole thing has to calm down a bit again and you can see that the voltage really comes back quite close to its starting point. The oil in the thermostat is heated to 30 degrees and the temperature in the vat is just under 18 degrees. That is a relatively high temperature difference. But the TK is very well compensated.

The TC of the reference can therefore be adjusted in this way. Finally, of course, we have to adjust the voltage again to exactly 10 volts using the setting regulator. Finally, we measure the regulator with the resistor in series and this is the resistance we need to achieve the lowest possible TC. Here is the circuit as it should look later. This is the circuit board in its final form. I've just made it one-sided, here are a few more bridges on the top side. I'll also turn it over again to the conductor side. This capacitor here is very important. It's soldered to the conductor side. It bridges interference voltages at the base of the transistor to ground. I'll also show you the circuit board again, but you can download it all later from my homepage friedrich-messtechnik.de and there you'll find all the documents shown here. I then put the whole circuit in a tinplate housing and here you can also see the feedthrough capacitors. The connections are routed to the outside through these feed-through capacitors. This is what the whole thing looks like in the housing - of course this is only a preliminary device. I am now testing the long-term stability of this circuit. Here I have a temperature sensor inside, which is led to the terminals on the outside. This is what it looks like when soldered in. The small tinplate housing looks good, of course, because it is magnetically shielded.

Here is another list (not complete) of the devices that Fluke has equipped with its SZA263. These are mainly older devices, i.e. those that are 20-30 years old or older, and you might have the chance to get a module or a defective device. I haven't listed the newer devices here because nobody would think of dismantling a modern device.