



Instruction Manual

GSK-2 Temperature Meter

The Intersil chip 7106 is an amazing chip. We are so used to a constant stream of new and improved IC's that it is a surprise to find a chip which was launched in 1977, has remained unchanged during that time and yet sales of the chip today are actually increasing. What is the reason for this popularity?

The 7106 was the first IC to contain all the active circuitry for a 3 1/2 digit panel meter (DPM) in a single chip. It was designed to interface directly to a liquid crystal display (LCD). (The 7107 IC is intended for LED - light emitting diode - displays.) So the chip contains BCD to seven segment decoders, display drivers, clock and a reference voltage as well as the necessary analog to digital (AD) circuitry to convert the input voltage to a digital form. The AD system also indicates the polarity of the input voltage.

Voltage is the most frequently measured electrical quantity. In temperature meters, current meters, wind speed meters and resistance meters what is actually being measured is voltage, or more correctly, the potential difference between two points. After calibrating the meter for its particular purpose then the potential difference measured will give an accurate (digital) reading of the (variable analog) quantity being measured.

With less than 10 external passive components the 7106 chip may be made into an easy to use meter for any of these purposes especially multiple range digital volt meters. See the Kit 127 documentation enclosed with this kit for more details.

Digital displays have many advantages over analog meters which use a pointer and moving coil. Firstly they are easier to read especially by unskilled labor. In the majority of applications it is better that the value displayed is exactly the value being measured, for example, 13.6V. To use an analog display with its many graduated scales (some going up and others going down) and switches requires considerable practice. But a simple LCD which reads '13.6' can be understood by everyone.

Second, the DPM built using the 7106 is physically stronger and more robust than analog meters because it has no moving parts. Thirdly, for the manufacturer the assembly of the complete DPM unit can be done by relatively unskilled labor. Fourthly, the 7106 by its very nature can be adapted to so many uses at such a low cost that it has actually created markets for itself. All of these factors add up to a better, cheaper product which everyone can afford.

In this kit we have supplied the 7106, the LCD and the components necessary to build it into a temperature meter. A printed circuit board (PCB) is supplied with the kit. It has a printed overlay on it so that the position of all the components is clearly indicated and construction only takes a few minutes.

The PCB has a large breadboard area so that once you have become familiar with the module and used it as a temperature meter you can easily advance to build other metering devices such as a digital voltmeter, resistance meter, current meter and even an AC voltmeter. Used with a photodiode a light meter can be built. Applications are limited only by the availability of transducers and changing the circuit slightly to convert the external signals to a 0 to 199.9 mV DC signal. Copies of some of the circuits to do this are provided.

The kit is constructed on a single-sided printed circuit board (PCB). A computer aided design (CAD) program is used to design the board.

CIRCUIT DESCRIPTION

The potential difference (PD) across a silicon diode is dependent on its temperature and current through it. Its temperature coefficient is negative, that is, the voltage falls with increasing temperature. This fall is approximately linear and is typically $-2.2\text{mV}/\text{oC}$. That is, there is the same drop in voltage when the diode cools from 88 oC to 87 oC as there is when it cools from 23 oC to 22 oC. Better sensors have better linear characteristics.

In this Kit we have used a transistor as a diode (base and collector shorted together) which has a more linear temperature response over a bigger range than a diode does.

The temperature meter measures the PD across the diode after an offset voltage which is available from pins 1 and 32 of the 7106 has been added. The two 100K 10-turn trimpots are used to calibrate the sensor at two known temperatures. The calibration is easily done using water with ice in it to calibrate zero degrees Centigrade and putting the sensor in a jet of steam from a boiling water kettle to calibrate for 100 oC. The decimal point has been hard-wired on. (The enclosed literature shows you circuits of how to obtain a variable decimal point.)

ASSEMBLY INSTRUCTIONS

There are several important points to watch.

1. The LCD (liquid crystal display) is mounted on **two** 40 pin IC sockets which you must cut apart using your side cutters. This allows the LCD to sit above the 7106 chip and save space. Make sure you get the LCD and the 7106 chip around the correct way. Look for the notch at one end of the LCD and match it to the notch shown on the PCB overlay (it goes to the lefthand side of the PCB.) Similarly, match the notch on the 7106 (opposite to the LCD notch - it goes to the right.) These two components

