Ironwood Electronics

0.5mm pitch MLF socket

DC Measurement Results

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Table of Contents

Objective

The objective of these measurements is to determine the DC performance of a Ironwood Electronnics 0.5mm MLF socket. Measurements are to determine parameters relevant to test applications. Among those are current carrying ability, contact resistance, temperature rise during operation, leakage as a function of voltage and voltage withstanding capability. Mechanical repeatability is gauged by cycling the device through a number of actuations.

Methodology

A four terminal (Kelvin) measurement setup is used that includes a computer controlled voltage source as well as a current source capable of delivering 10 A. The voltage developed across the contact is recorded in a Kelvin (four terminal) measurement at separate terminals.

Leakage testing relies on acquisition of a large number of data points with subsequent averaging to reduce noise as much as possible. In this manner, pA leakage currents can be detected.

Breakdown voltage is measured in a setup with adjustable dc voltages up to 5.5 kV. The current drawn by the pin to adjacent pin arrangement is recorded as a function of voltage until breakdown occurs.

Test procedures

During testing drive current is increased in steps of 10 mA to a maximum value of 5 A. For **V/I** curves, the dwell time for each current step is 1.5 seconds.

For temperature as a function of resistance dwell time is set to 3 minutes per data point to allow temperatures to equalize.

Setup

For current handling tests, all contacts are isolated except for one.

The MLF socket test components are placed between two metal plates. Au over Ni plating was applied to the surfaces of the brass plates. A four terminal (Kelvin) measurement setup is used that included a computer controlled current source capable of delivering 10 A. The voltage developed across the contact is recorded at separate terminals with an HP3456A digital voltmeter.

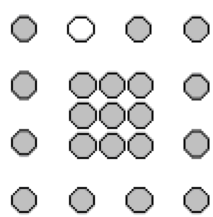

Fig. 1 MLF socket test arrangement

Once the data are available, they are processed to reveal the resistance and power dissipation as a function of drive current.

For temperature as a function of drive current the same setup is used. In addition, a second digital meter records the temperature of a small thermocouple located near the driven pin. To achieve a representative temperature reading, the thermocouple's access location is about 1mm away from the driven pin in a hole drilled into one of the metal plates. Dwell times are set to 3 min per data point to allow thermal equilibrium to be approached.

For leakage and breakdown measurements a different fixture is used that allows for connecting probes to two adjacent pins.

The MLF socket is held in a fixture consisting of insulating material similar to the one shown in Fig. 2:

Fig. 2 MLF socket mounting plate example

Leakage testing is performed via computer controlled voltage source and DMM. Voltage is increased in small steps and the associated current is recorded. From these values, resistance is computed.

Measurements

Current carrying capability

For the current handling test, all contacts were isolated except for one.

The socket components (contact set and silmat) were placed between two metal plates. Au over Ni plating was applied to the surface of the brass plates. A four terminal (Kelvin) measurement setup was used that included a computer controlled current source capable of delivering 10 A. The voltage developed across the contact was measured at separate terminals with an HP3456A digital voltmeter.

During the test the drive current was increased in steps of 10 mA to a maximum value of 5 A. The dwell time for each current step was 500 ms.

The resulting current – voltage relationship shows a linear slope up to a current level of approximately 4 A:

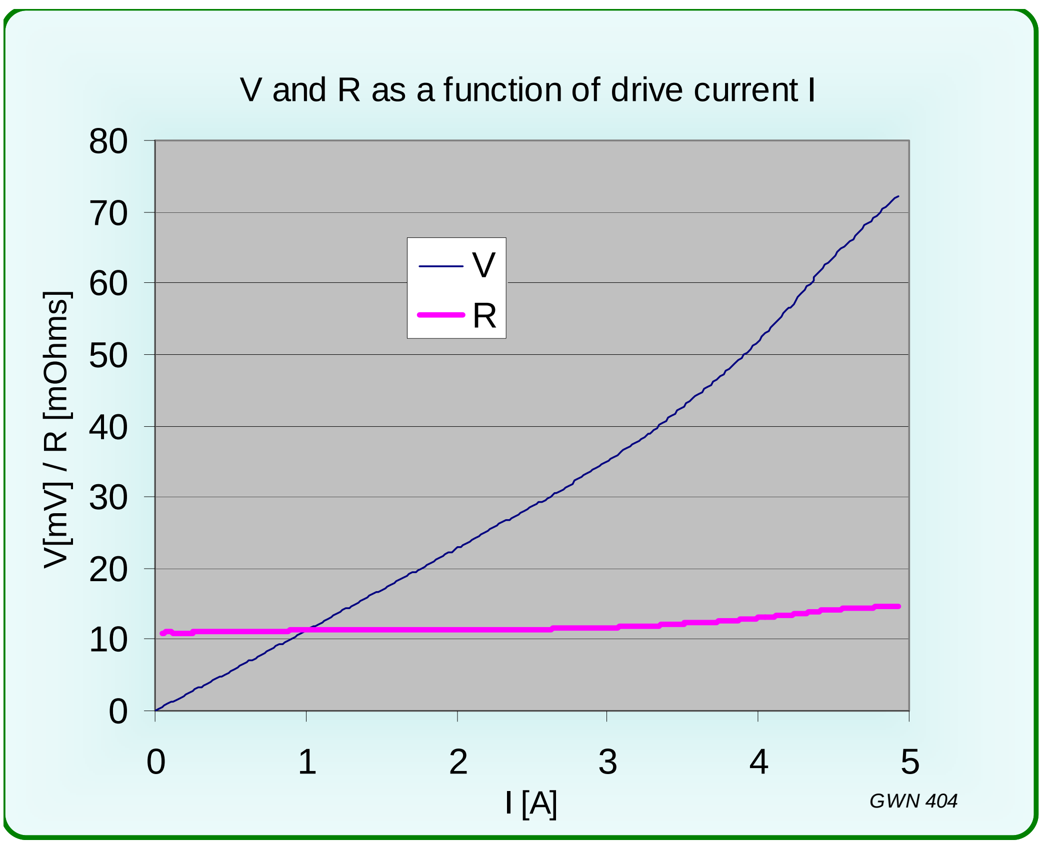

Fig. 3 Voltage and resistance as a function of drive current

The accompanying power dissipation in the pin exceeds 100mW at about 3A:

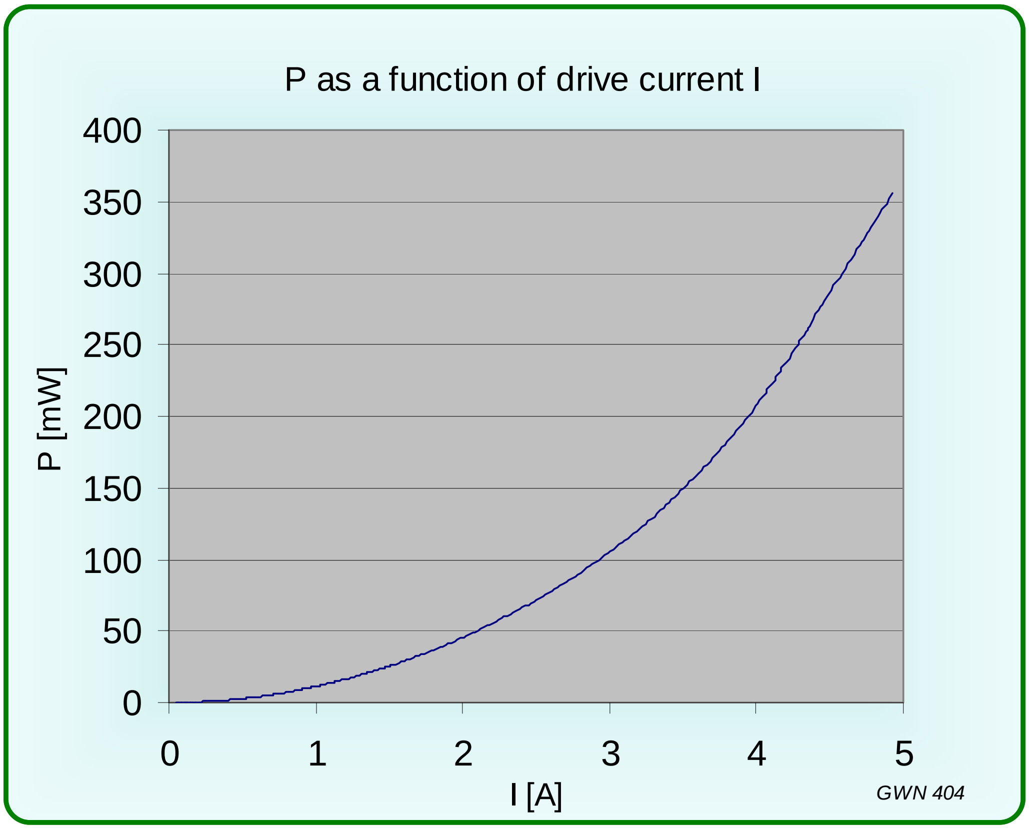

Fig. 4 Power dissipation as a function of drive current

Even though the resistance increases slightly above 3A, there were no noticeable effects from this test when inspecting the specimen and the test plates at drive levels below 4A.

The temperature rise curve for this case looks as follows:

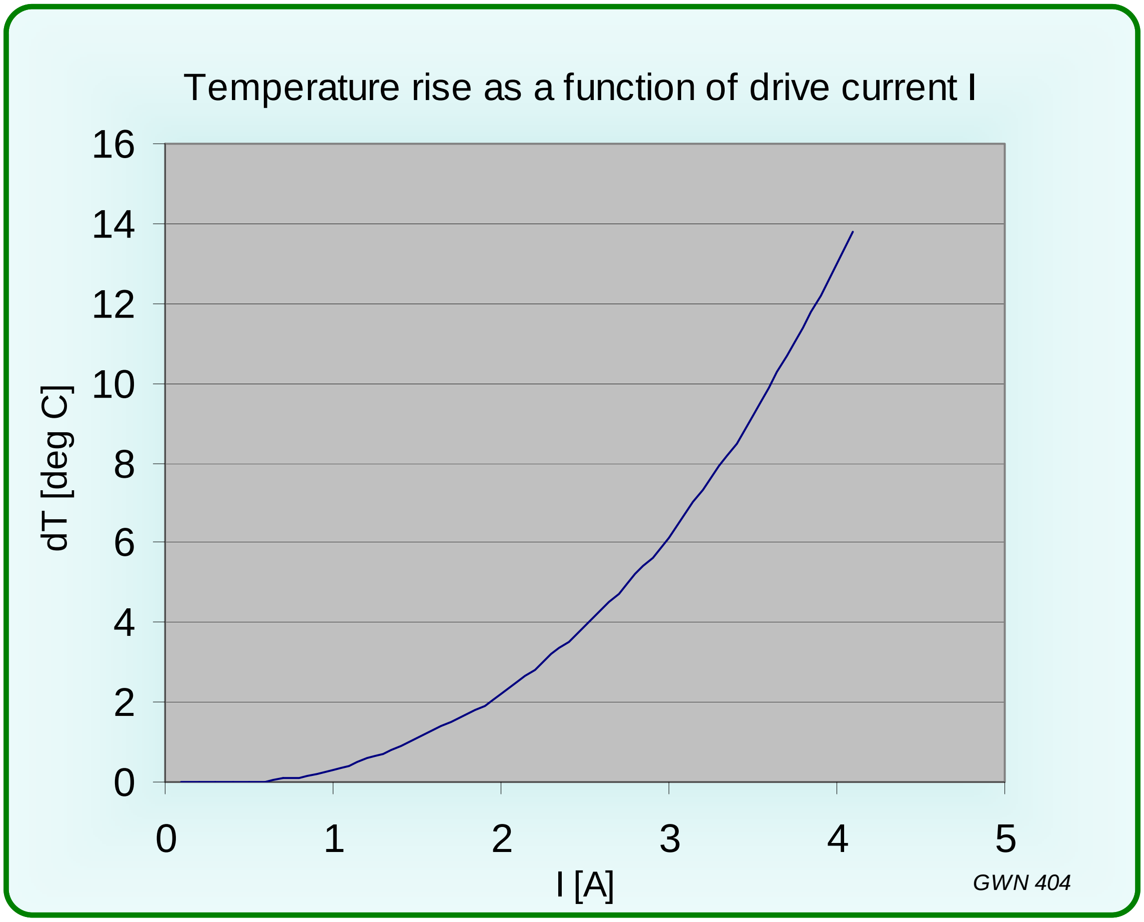

Fig. 5 Temperature rise as a function of drive current

Dwell times during this test were set to 3 minutes per data point to afford the temperature increase to level off before acquiring the data point. Nevertheless it should be kept in mind that the metal plates afford excellent heat removal from the contact area. In an environment with lower thermal conductivity the temperature rise during testing and the subsequent resistance increase as well as the current handling may be adversely affected.

Leakage current

Any conductive path between pins can and will cause difficulties for accurate testing of devices with high input impedances. Thus, leakage current was measured as a function of excitation voltage between two adjacent contacts:

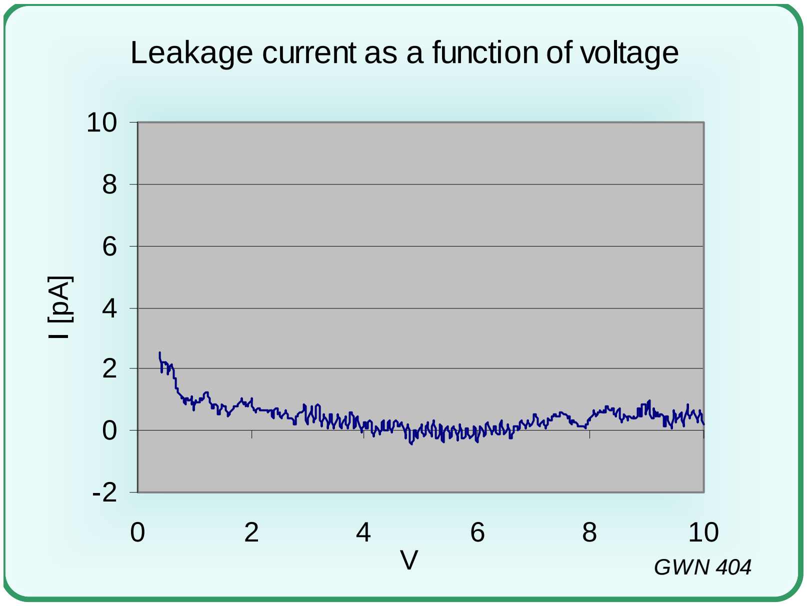

Fig. 6 Leakage current as a function of drive voltage

Leakage is very low and is at the system limits.

When computing the corresponding resistance very large values result:

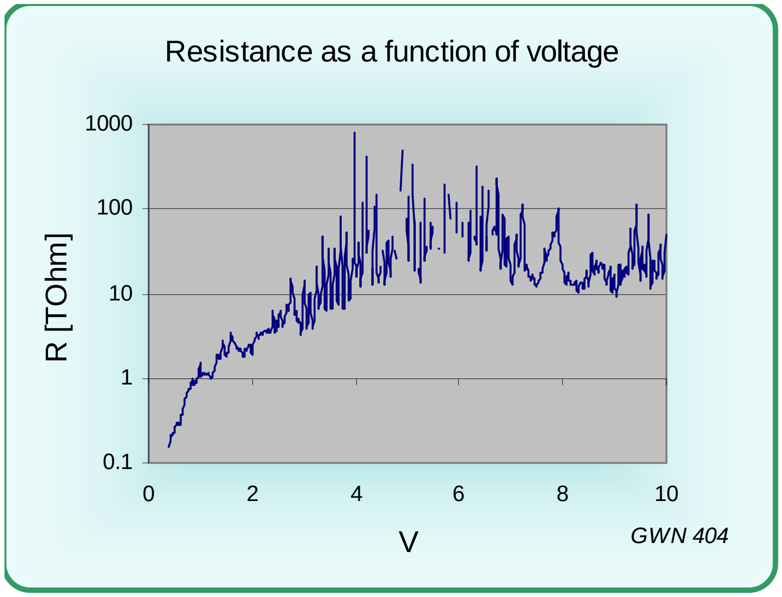

Fig. 7 Leakage resistance as a function of drive voltage

The large values are caused by the measured leakage oscillating around zero for a number of data points.

When examining leakage, temperature must also be taken into account. Thus, a steady state excitation of 10V DC was established and leakage current recorded and resistance as a function of temperature.

At elevated temperatures a small increase in leakage is noticeable. It has, however little impact for typical applications where nA levels are specified:

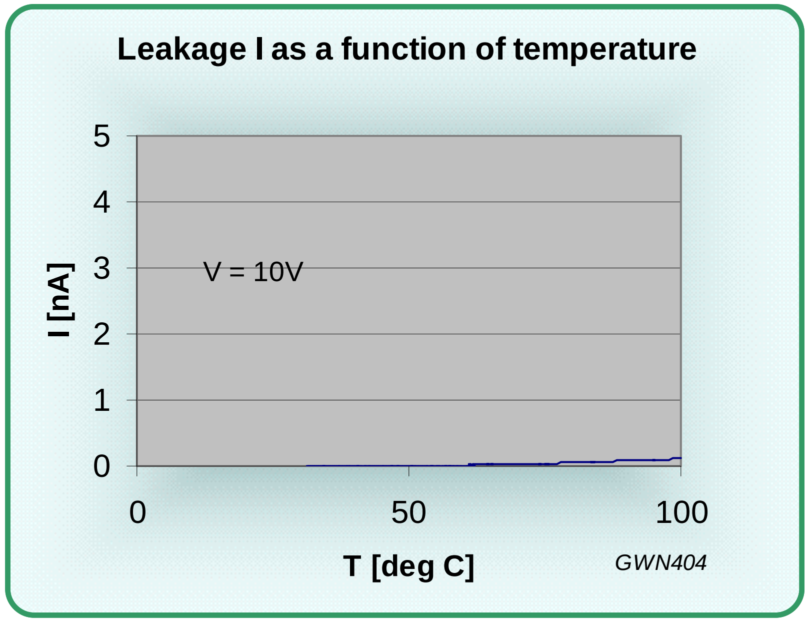

Fig. 8 Leakage current as a function of temperature

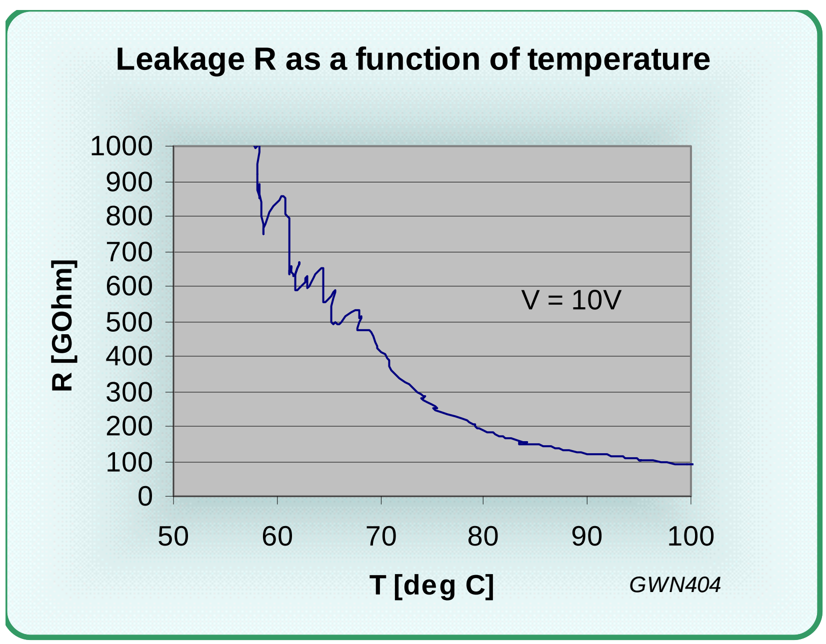

Fig. 9 Leakage resistance as a function of temperature

Breakdown voltage

The maximum withstanding voltage is determined by examining the current drawn by a pin-to-pin arrangement between adjacent pins (T=20 deg C):

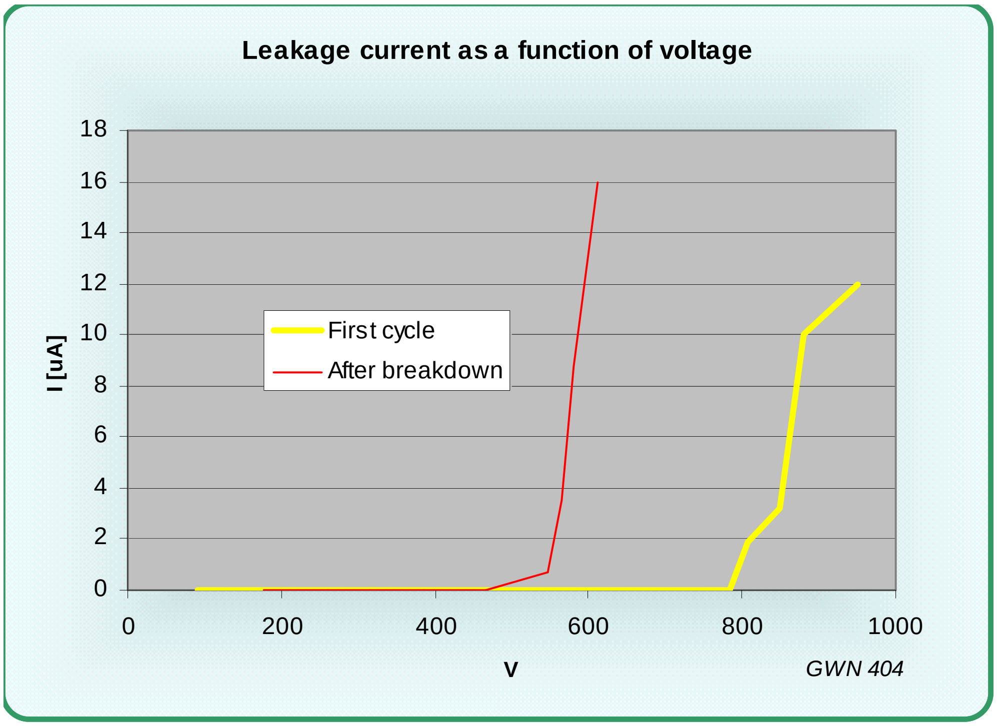

Fig. 9 Leakage current as a function of voltage

Breakdown occurs just shy of 800V. Even after breakdown, the silmat is still able to withstand 540V before again drawing currents greater than 0.1 uA (system sensitivity for HV tests).