Consultronix International
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MATRIX-256
TTC Diode Scanner System

Introduction

With the advent of Thermal Test Chips, which allow the integrated circuit thermal solution to be developed in parallel with the chip itself, the packaging and heat removal may be simulated and tested to be ready when the first articles come from the fab. The Thermal Test Chip is made up of an array of cells, each with 1 or 2 heating resistors and 1 or 4 temperature sensing diodes. The idea is straight forward: heat the chip by powering up the resistors in a manner closely approximating the expected power dissipation of the actual integrated circuit chip and read/display temperature(s) of specific cell(s) in real time as the chip heats up. There are many possible heating configurations put forth to heat the cell resistors, but the temperature sensor scanning scheme of the MATRIX-256 is adaptable to all heating schemes.

Description

The MATRIX-256 Scanner is designed to read all of the diodes in an array, up to 16 x 16 diodes. The user must specify the number of rows and columns in the chip array when addressing the MATRIX-256 scanner. Reading the array is done by addressing one row at a time and reading the diodes in that row. By proceeding this way through all of the rows, the entire array may be read.

The Matrix-256 consists of 16 precision 1 mA constant-current sources to bias the diodes, 16 row switches to select one row of diodes at a time and a high speed data acquisition system. When using a smaller array, for example a 10 x 10 array, only 10 diodes will be read per row for each of the 10 rows. Control commands are sent to the MATRIX-256 through a USB port.

The Matrix-256 system is packaged in a 1U rack-mounted chassis. Power input is universal (85 to 264 vac). Connection to the TTC Test Vehicle is with a ribbon cable from the front panel, maximum size is 32 lines.

Consultronix International has developed MATRIX, a software package which interfaces and controls the MATRIX-256 hardware and provides a user-friendly intuitive interface. To see the specification sheet for the software, download the file Matrixsoft.pdf.

Features

- Fixed precision current sources, no adjustments required
- High speed precision 16-bit data acquisition system
- All control issued through USB interface
- Easy hook up through 34 pin IDC front panel connector

Specifications

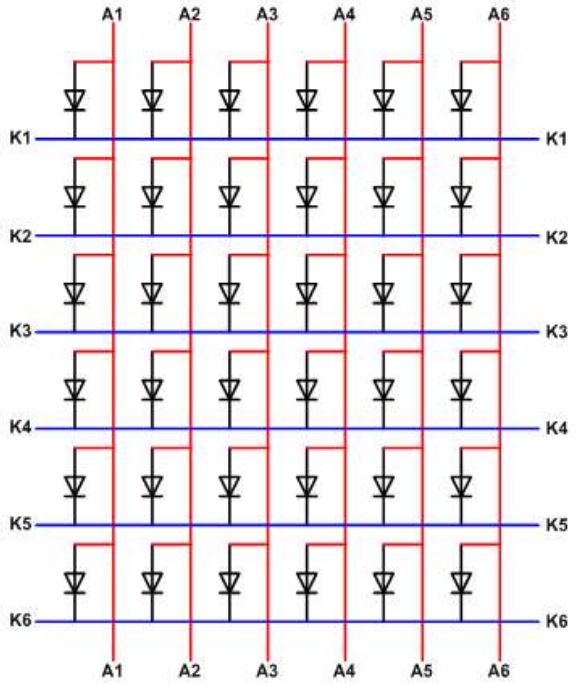
Diode Current Source	
Number of Channels	**16**
Measurement Current	**1.00mA**
Accuracy	**0.1%**
Voltage compliance	**1.999V**
Polarity	**+ to GND**
Connection	**Front Panel, IDC Ribbon Cable Connector**
Diode Voltage Measure	
Number of Channels	**16 (integrated with Current Source)**
Range	**1.999V**
Resolution	**1mV**
Accuracy	**0.01% of fs ±1 mV**
Power Indicator	
Type	**LED**
Color	**Blue**
Computer Connection	
Type	**USB 2.0 or higher**
Connector	**Rear Panel, USB Type B**
Relay Connection (optional)	
Configuration Type	**Single Pole, Double Throw (SPDT)**
Current Rating	**1A max**
Voltage Rating	**50V max**
Connector	**Rear Panel, (3-pin Molex Mini-Grid)**

Ordering Information

Model Number	Description
M-256-00	**Base Unit (256 channels)** • Includes USB Cable, Diode Cable & Connector • Operating Matrix Software and User Manual in electronic form on USB drive
M-256-01	**Base Unit (256 channels, without Operating Software)** Includes USB Cable, Diode Cable & Connector Application Manual in electronic form on USB drive

Addressing a diode row:

To demonstrate how to select a row of diodes to measure, use the diagram at the right. For example,
if the third row of diodes is desired to be read, set the row driver for row K3 low (0 volts). All the other rows must be set to high (+5 volts). All of the diode anodes are connected to the current sources but only row 3 conducts the current because the diodes in row 3 are *forward* biased. The rest of the diodes in the matrix are *reverse* biased and thus not consuming any of the source current. While row 3 is "selected", command a scan of the diodes. The resultant voltage readings will pertain to the diodes in row 3 only. Repeat the process for the other rows by selecting the desired row, one at a time.



Diode 6x6 Matrix

The display and presentation of the temperature data is up to the software developer. The Matrix software developed by Consultronix presents a color coded map of the entire TTC cell array, a temperature histogram for up to 8 reference cells and other user-friendly tasks such as TTC k-factor calibration and more. For a complete description of the Matrix software usage, see the Matrix User Manual.

If you desire to develop your own software to control the MATRIX-256, the following instructions may be used. You must install MCC's InstaCal program on your control computer and program the MATRIX-256 using the methods specified in the manual for Measurement Computing's USB2623 Data Acquisition System (DAS) board.

Operation

To operate the MATRIX-256, connect it to your computer with a USB cable. All commands are sent through the USB port. The USB2623 DAS should be initialized according to the methods stated in the MCC documentation and the schema of the control software. The following are the methods which should be used to read the temperature of each cell in the TTC array:

1. Before starting, allocate a windows buffer for the DAS to fill with its readings of the diode forward voltages. Example: MemHandle = cbWinBufAlloc(NumPoints)

2. There are 16 I/O bits which control which row of diodes are to be read. Select only one row at a time. There are two bytes of I/O in the DAS: Byte A is for rows 0 – 7 and byte B is for rows 8 – 15. Set only one bit to a 1. The rest are to be set to 0.

   Example: (select first row. Board number =0)

   m_Error = cbDOut(BoardNum, FirstPortA, 2^0) 'set bit 0 in byte A

3. Initialize a read of the diodes in the selected row, and then retrieve and process the data for that row. Do this for each row of the TTC.

   Example: Start foreground scan of the selected row's diodes
   m_Error = cbAInScan(BoardNum, LowChan, HighChan, Count, SampleRate, Gains(0), MemHandle, Options)

4. Retrieve DAS data into a Windows data array for processing.

   Example: m_Error = cbWinBufToArray(MemHandle, DataArray(0), FirstPoint, ArraySize)

Front Panel Connector