



Measurement of 3D Thermal expansion and Thermal strain of electronic Components.

True Full-Field Measurement of Thermal Expansion on Electronic Components

3D Measuring System Q-400 TCT

The Digital Image Correlation System Q-400 TCT is designed for complete three dimensional and highly sensitive thermal expansion measurement and strain analysis of materials and components in the heating and cooling phase.

Quantitative full-field and 3D-Analysis

Q-400 TCT has successfully been used in development and testing of complex (anisotropic) materials, components and structures in electronic applications. It is ideal for the experimental verification of analytical and numerical calculations.

The 3D information enables fast determination of the thermal expansion coefficient of materials as well of

the thermal stress of components such as printed circuits, BGA, Flip Chips, etc.

The measurement is performed non-contact, on the whole measuring area and on nearly any material. The field of view can be adjusted down to square millimetres.

The Q-400 TCT system is fully equipped with a heating device, control electronic and an Image Correlation System on an adjustable support.

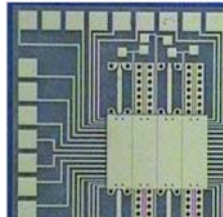
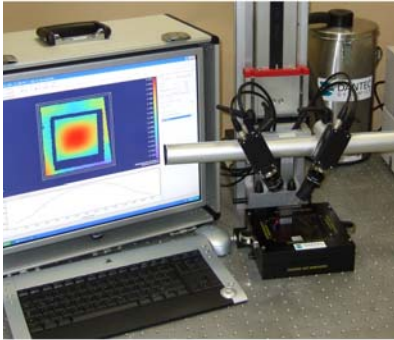
Complete package for thermal investigations

Different lenses are available to adjust the field of view. Areas from 50 mm x 70 mm down to 2 mm x 3 mm can be investigated. The measurement can be done from room temperature up to 300°C and down to minus 40°C.

Due to the 3D information provided by the Image Correlation technique the Q-400 TCT can not only be applied to flat surfaces, but also to curved surfaces, the measurement of warpage is possible.

The sensor is driven by a robust electronic control system with the complete software package ISTRA 4D. The temperature is acquired at each measuring step. It offers automatic or manual measurements, and quantitative data analysis of 3D displacement and thermal strain fields. Sub-micrometer accuracy is achieved depending on the geometrical set-up.

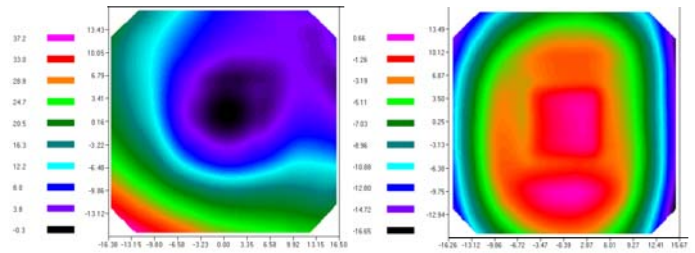
The measuring sensor is attached to a vertical support and enables fast adjustment to the field of view.



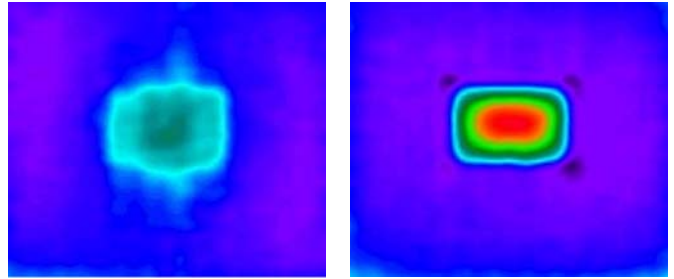
Flip Chip Assembly (1 cm x 1 cm)

Q-400 TCT System Set-up

The specifications in this document are subject to change without notice.



Thermal bending of Ball Grid Array (BGA) Assembly with thermal stress of $\Delta T=110\text{ }^{\circ}\text{C}$. Left: normal bending behaviour; Right: BGA with detected de-bonding.



Thermal expansion of a Flipchip with perfect bonding (left) and defect bonding (right); $\Delta T=100\text{ }^{\circ}\text{C}$

Technical Specifications	Q-400 TCT
Displacement resolution	Up to 1/100.000 of the Field of View depending on measuring conditions
CCD-resolution	up to 5 Mpx
Measuring range	From a few microns up to several millimetres
Measuring area	50 mm x 70 mm down to 3 mm x 4 mm (depending on objective lenses)
Working distance	Variable
Operation modes	Automatic, manual, 2D- and 3D-operation
Data interface	HDF5
Data acquisition speed	depending on shutter time and frame-rate of camera
Data analysis	Automatic serial analysis mode or manual at any measurement step
Dimension of heating/cooling device	200 mm x 200 mm x 50 mm
Illumination	Cold light LED array
Control and evaluation unit	Portable-PC or laptop, stand alone heating control computer controlled
Operation system	Windows 2000, XP, Vista
Heating Specification	Temperature range: -40°C to 300°C , heating rate: 50°C per minute, cooling rate 20°C per. Minute, Heating power: 200 W, cooling with LiN2

Options	Different lenses for variable field of views
	Optical table