



## Description

The NT20-3k Thermotest Chip is designed as a modular system to provide maximum flexibility for thermal characterization and qualification of materials, packages, and systems.

Each chip cell of  $2.5 \times 2.5 \text{ mm}^2$  size provides two uniform heaters and a centered thermistor, both connected to a large solder ball matrix for flip chip assembly via a robust redistribution layer (RDL). The solder ball matrix additionally provides solder balls explicitly dedicated to health monitoring and thermo-mechanical and reliability investigations.

The chip can be configured in any desired matrix. Temperature sensors, heaters and monitoring solder balls are individually addressable for maximum flexibility in sensing resolution and heat distribution.

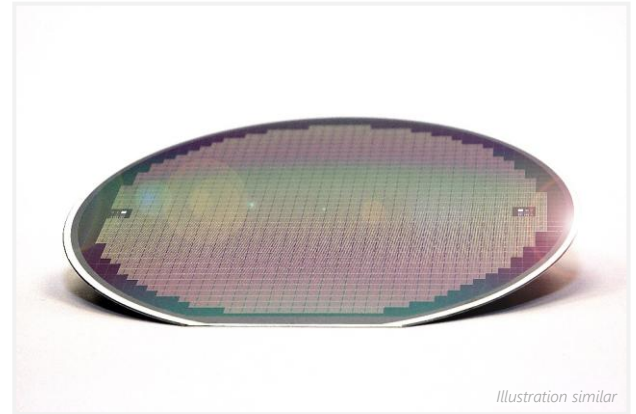


Illustration similar

## Technical Specification

### Technology and Methodology

Fabrication technology	Thin film
Assembly technology	Flip chip
Sensor	Resistance thermometer

### Wafer

Wafer material	Silicon, undoped	
Wafer size	200	mm
Wafer thickness	500	$\mu\text{m}$
Cell size	$2.4 \times 2.4$	$\text{mm}^2$
Scribe line between cells	100	$\mu\text{m}$
Topside passivation	7 $\mu\text{m}$ PI (polymer passivation)	
Backside metal	option A	NiV 300 nm   Pt 100 nm   Au 100 nm
	option B	Ti 100 nm   NiV 300 nm   Au 200 nm
	option C	none
Unit cell count	4400	

### Heater (Electrical Specification)

Heater type	Resistor	
Resistors per chip	2	
Resistance per resistor	$14 \pm 1$	$\Omega$
Max current per heater	1.5	A
Max power per cell	63	W
Max power density	10	$\text{W}/\text{mm}^2$
Active heater area	82% of cell area	

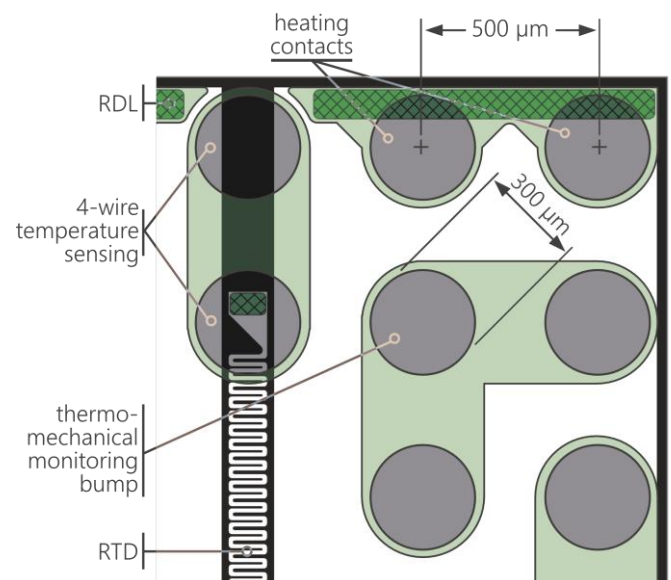
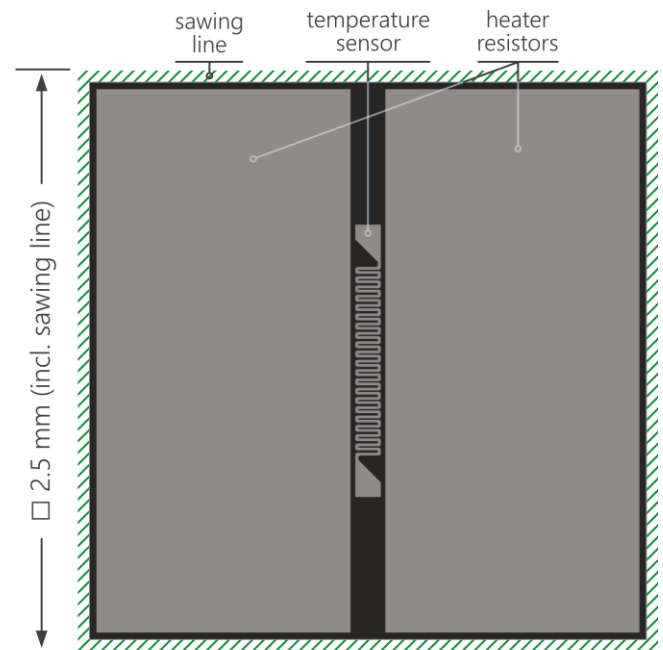
### Sensor (Electrical Specification)

Sensor type	meander-structured resistor	
Sensor position	cell center	
Sensor connection	4-wire termination	
Resistance value (25°C)	$3 \pm 0.2$	$\text{k}\Omega$
Sensitivity	10.0 *	$\Omega/\text{K}$
Dimensions ( $l \times w$ )	$820 \times 100$	$\mu\text{m}^2$

### Assembly

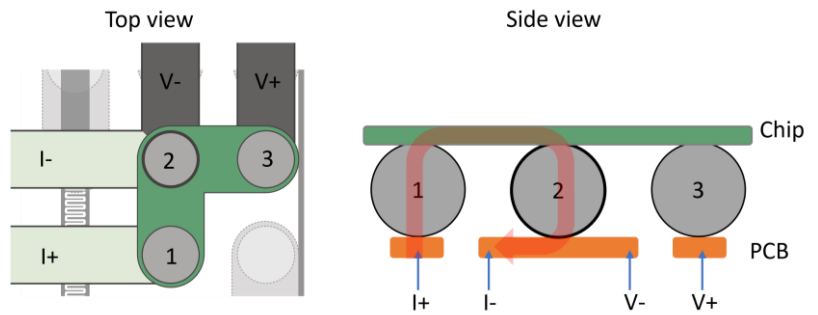
Assembly technology	Flip chip	
Solder type	SAC305	
Under bump metallization	NiAu (4 $\mu\text{m}$ )	
Solder bump diameter	300	$\mu\text{m}$
Pad raster	500	$\mu\text{m}$

\* Theoretical value based on the Ti temperature coefficient



## Thermo-mechanical monitoring

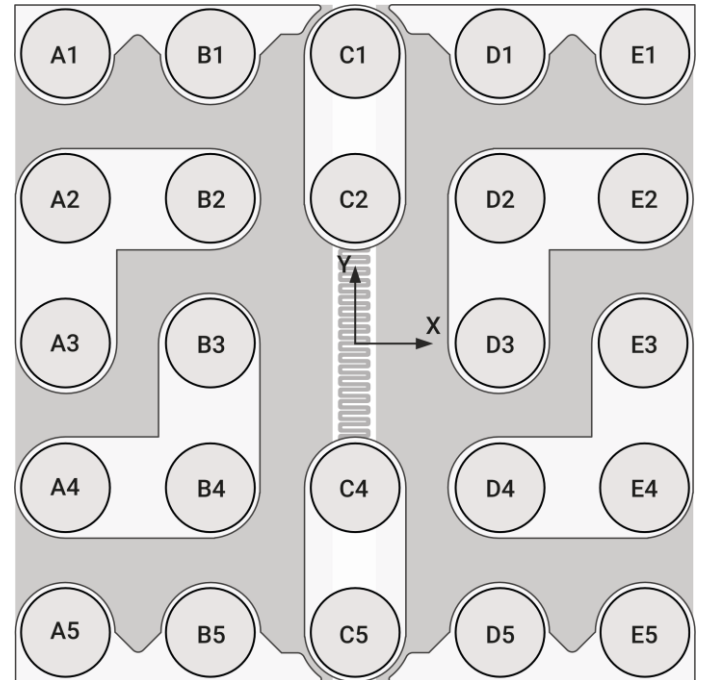
The center bump in each thermo-mechanical monitoring structure as depicted on the right (marked with a bold stroke), can be electrically monitored using 4-wire termination in a configuration as shown. The state of health correlates with the measured electrical resistance.



## Pin configuration

For absolute coordinates of each pin the point of origin (X=0, Y=0) is the cell center. Nomenclature is involving a prefixed letter which indicates the purpose of the specific pin. H0 and H1 pins connect to heating structures, SI to the sensor current input and SV sensor voltage sensing. TM0, TM1, TM2 and TM3 are connected to the thermo-mechanical monitoring structures.

	Connection	X [μm]	Y [μm]
A1	H0_0		1000
A2	TM0		500
A3	TM0	-1000	0
A4	TM1		-500
A5	H0_1		-1000
B1	H0_0		1000
B2	TM0		500
B3	TM1	-500	0
B4	TM1		-500
B5	H0_1		-1000
C1	SI_0		1000
C2	SV_0	0	500
C4	SV_1		-500
C5	SI_1		-1000
D1	H1_0		1000
D2	TM2		500
D3	TM2	500	0
D4	TM3		-500
D5	H1_1		-1000
E1	H1_0		1000
E2	TM2		500
E3	TM3	1000	0
E4	TM3		-500
E5	H1_1		-1000



Live Bug View

## Chip selection guide

The length of the chip edge can be calculated depending on the number of cells per row and column using the following equation.

$$\text{Edge length} = n \times \text{cell length} - \text{scribe line length}$$

$$\text{Edge length} = n \times 2.5 \text{ mm} - 0.1 \text{ mm}$$

Example: (4 x 4 matrix of cells)

$$\text{Edge length} = 4 \times 2.5 \text{ mm} - 0.1 \text{ mm}$$

$$\text{Chip size} = 9.9 \times 9.9 \text{ mm}^2$$

## Handling and storage

It is recommended to handle the wafers only with suitable tools and only when wearing gloves. The solderability of the contacts strongly depends on the storage conditions. To prevent oxidation/corrosion of the contacts and moisture-induced defects to the polymer passivation during processing, the wafer should be stored at room temperature in a dry and low-oxygen atmosphere. The use of a nitrogen storage cabinet is recommended.

## Application remarks

The offered products are supposed to be used for characterization purposes. The application of the data from the test die to a functional system lies in the responsibility of the user. Nanotest makes no warranty, express or implied including the implied warranties of merchantability and fitness for a particular purpose, that the user's system designed using that data will perform as intended.