NANOTEST
Berliner Nanotest und Design GmbH

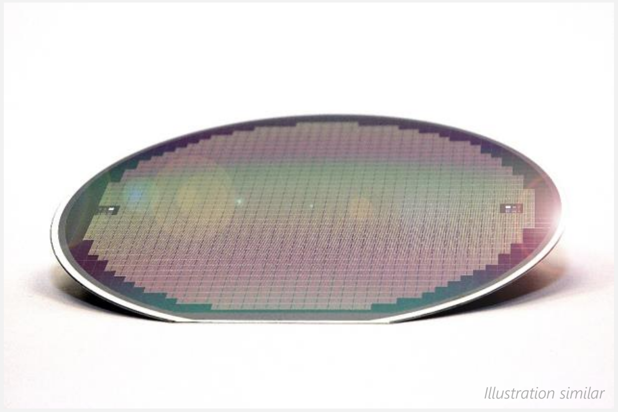
NT20-3k-FC

Description

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

Each chip cell of 2.5 × 2.5 mm² 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 investigation.

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



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	µm
Cell size	2.4 × 2.4	mm²
Scribe line between cells	100	µm
Topside passivation	7 µm Pi (polymer passivation)	
Backside metallization	NiV, Pt, Au (300 nm, 100 nm, 100 nm)	
Unit Cell count	4400	

Heater

Heater type	Resistor	
Resistors per chip	2	
Resistance per resistor	17 ± 1	Ω
Max current per heater	1.5	A
Max power per cell	70	W
Max power density	11.5	W/mm²
Active heater area	82% of cell area	

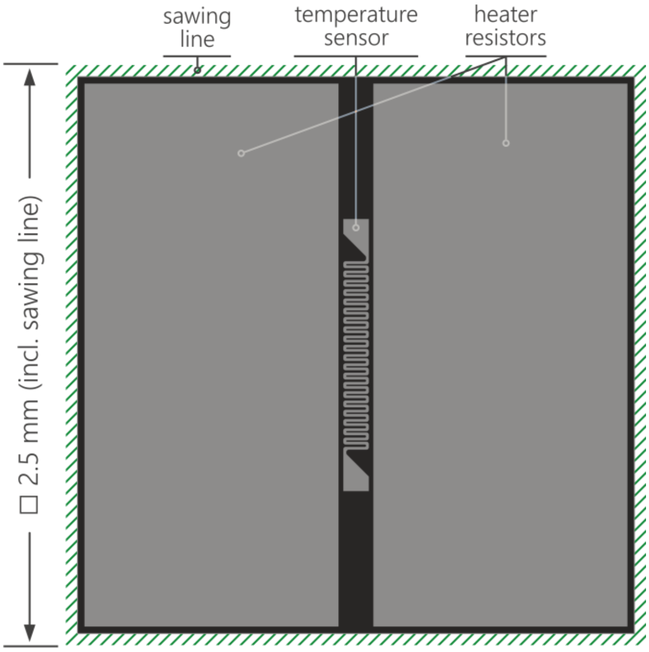
Sensor

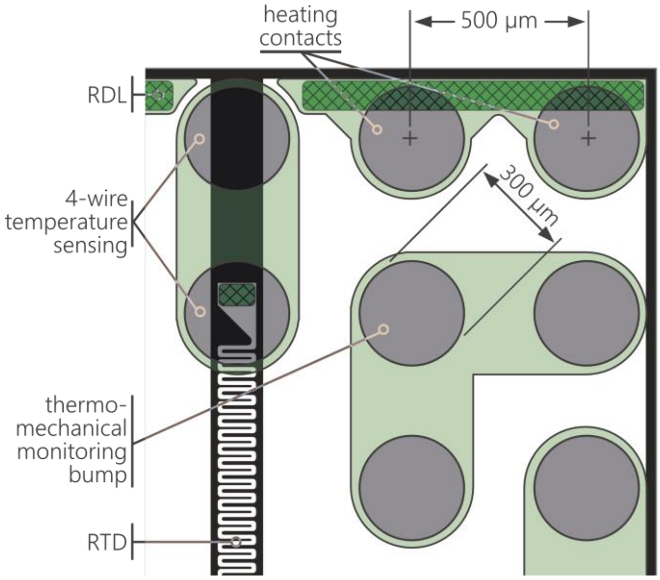
Sensor type	meander-structured resistor	
Sensor position	cell center	
Sensor connection	4-wire termination	
Resistance value (25°C)	3.2 ± 0.1	kΩ
Sensitivity	8.0 *	Ω/K
Dimensions (l × w)	820 × 100	µm²

Assembly

Assembly technology	Flip chip	
Solder type	SAC305	
Under bump metallization	NiAu (4 µm)	
Solder bump diameter	300	µm
Pad raster	500	µm

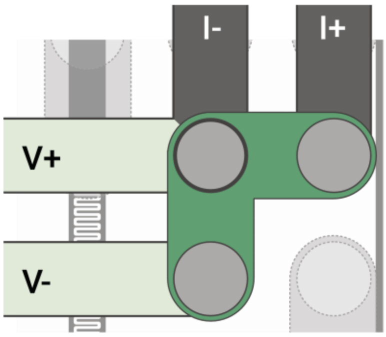
* theoretical value based on the Ti temperature coefficient





Thermo-mechanical monitoring

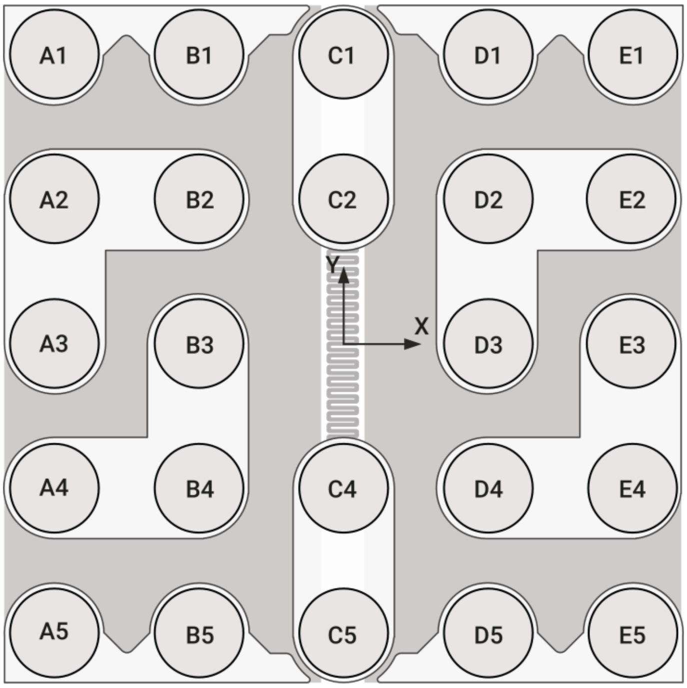
The center bump in each thermo-mechanical monitoring structure as depicted on the right (marked with a bold stroke), can be electrically monitored for using 4-wire termination in a configuration as shown. The state of health correlates with the measured thermal resistance.



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



Chip selection guide

You can calculate the length of the chip edge depending on the number of cells per row and column using the following equation.

edge length = n × cell length - scribe line length
edge length = n × 2.5 mm - 0.1 mm

Example: (4 x 4 matrix of cells)

edge length = 4 x 2.5 mm - 0.1 mm
chip size = 9.9 x 9.9 mm^2

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.