

Description

The TTV16 was conceived and engineered as a “*Thermal Twin*” of Intel’s server and workstation processor, **Sapphire Rapids**. Featuring a 40 × 40 mm² die, it serves as a highly versatile and precise thermal testing platform, tailored to meet the requirements of a wide range of temperature-related applications.

In its highest configuration, the TTV16 enables **independent control of up to 24 heater zones**, allowing users to simulate a broad spectrum of thermal scenarios. The intuitive device interface offers straightforward controls for configuring temperature profiles and setting up complex experiments with ease.

The package integrates **56 on-die temperature sensors** and is available either as a **monolithic design** or in a **2 × 2 chiplet configuration**, providing flexibility for diverse testing needs.

General Information

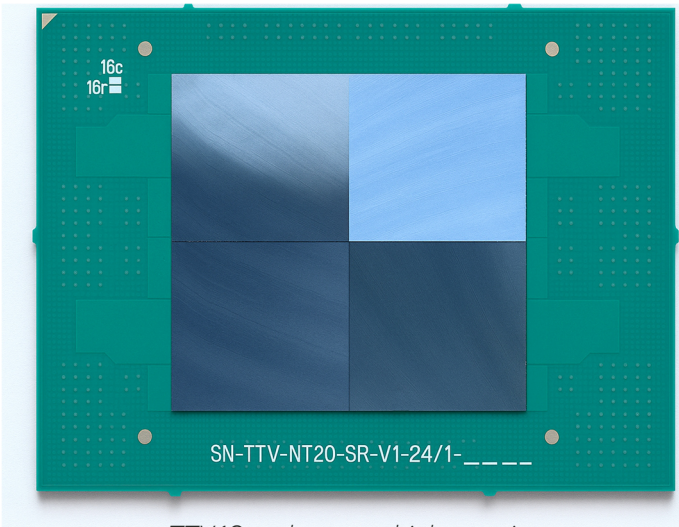
Chip type	NT20-3k-FC
Chip version	Monolithic / Chiplet
Chip configuration	16 x 16 matrix/ (4x) 8 x 8 matrix
Packaging technology	Flip chip
PCB substrate	MCL-E-795G
Chip substrate	Silicon, undoped
Chip surface	with or w/o backside metallization
Chip size	40 x 40 mm ³ / (4x) 20 x 20 mm ²

Heater (electrical specification)

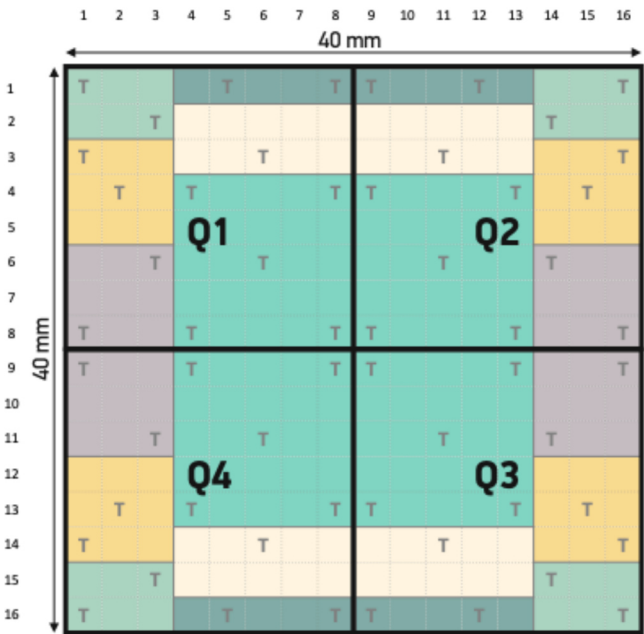
Heater type	Resistor
Heater material	Ti 100 nm
Number of heater zone	24
Electrical resistance per heater zone	7 / 10.5 / 17.5 / 35 Ω
Max voltage per heater zone	60 V
Max current per heater zone	≤ 8.5 A
Max package power	5000 W
Power density of heater zone	≤ 3.2 W/mm ²
Max operating temperature	125 °C

Sensor

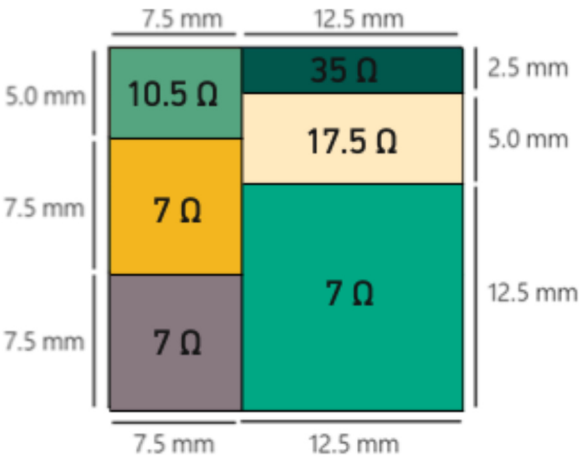
Sensor type	Meander-structured RTD
Sensor material	Ti 100 nm
Number of sensors	56
Resistance value at RT	(3.0 ± 0.2) kΩ
Sensitivity	10.0 Ω/K
Sensor connection	4-wire sensing
Dimensions (l × w)	820 × 100 μm ²



TTV16 package as chiplet version



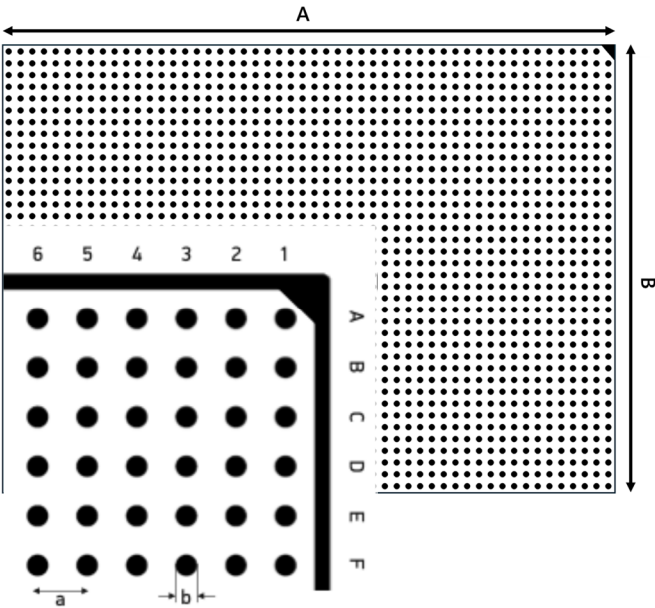
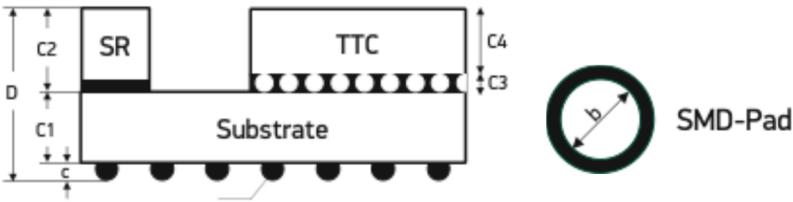
Heater zone and temperature sensor distribution map of complete die



Heater zone and resistances distribution map of quarter die

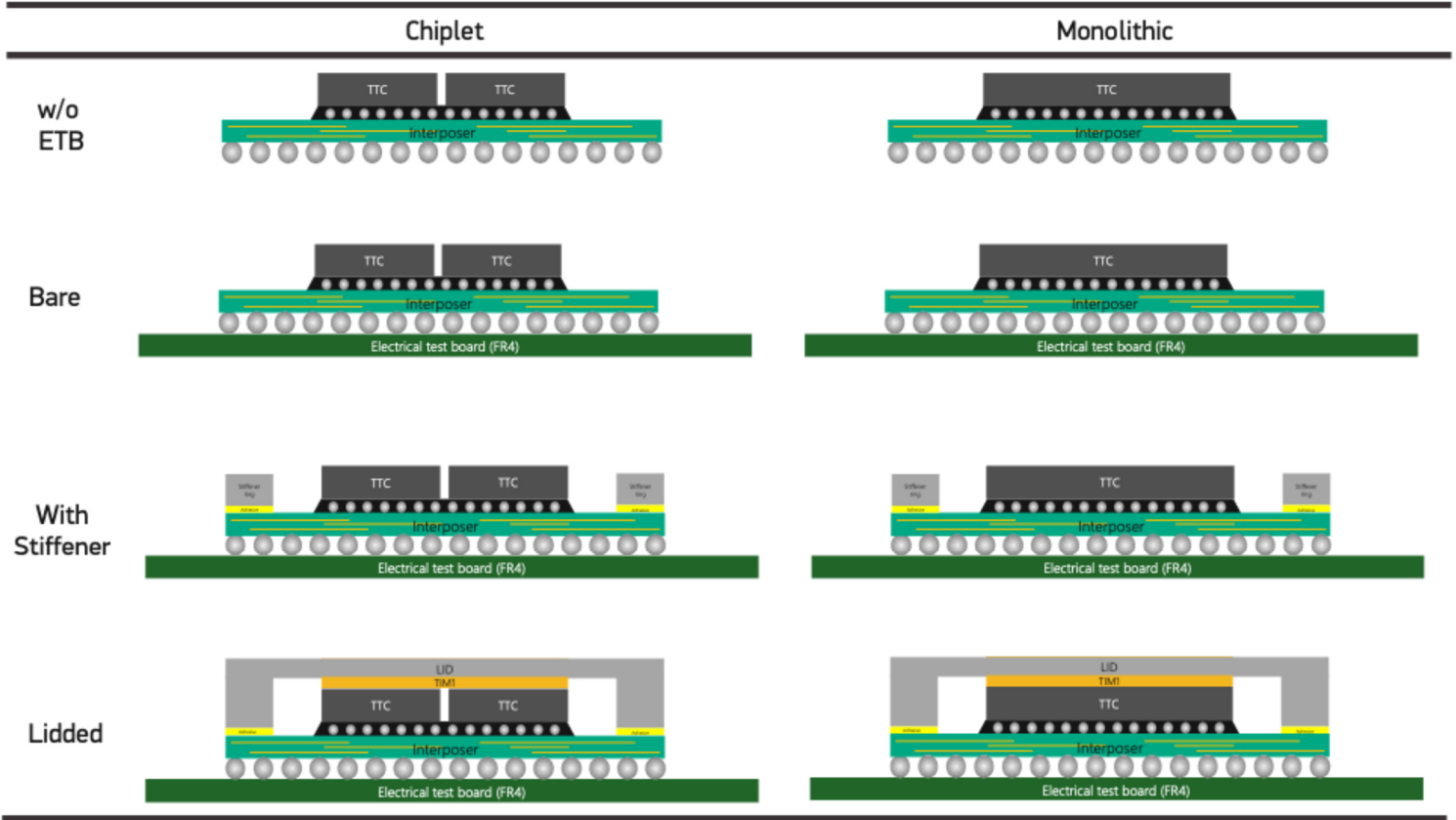
BGA-Package Specifications

A	Package width	78 mm (52 solder balls)
B	Package length	57 mm (38 solder balls)
C1	Substrate	2500 μ m
C2	Stiffener	900 μ m
C3	Bump height (soldered)	175 μ m
C4	Die	725 μ m
D	Package	3900 μ m
a	Pitch	1500 μ m
b	SMD-Pad	550
c	BGA height (soldered)	500
d	Ball diameter	670



Package Configurations

TTV16 is available in 8 different package configurations. Two die options are available with a monolithic and a chiplet version. These versions are available as bare die with or without ETB, supported by a stiffener ring or embedded in a lid.



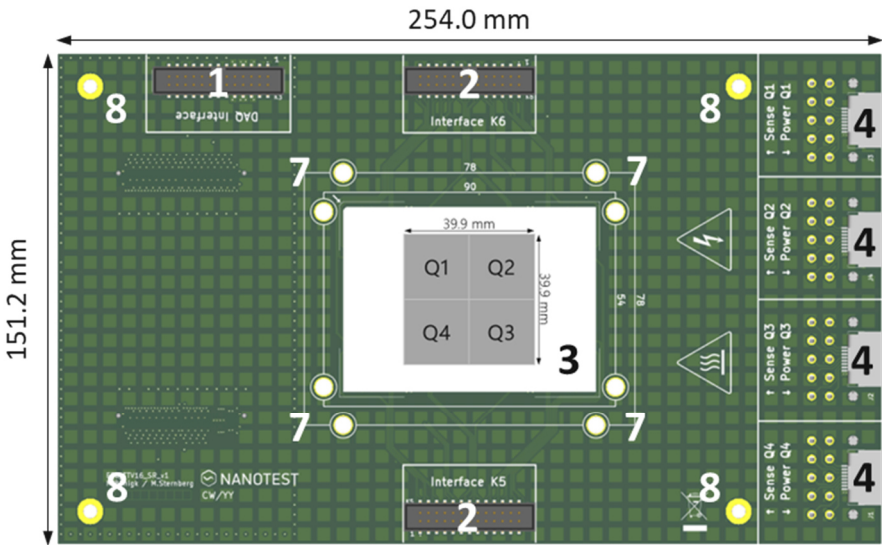
Electronic test board

The electronic test board (ETB) serves as an interface for connecting the TTV16 with the TTV control unit (TCU).

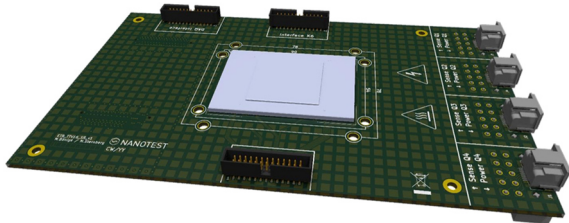
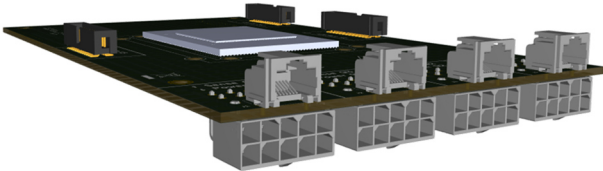
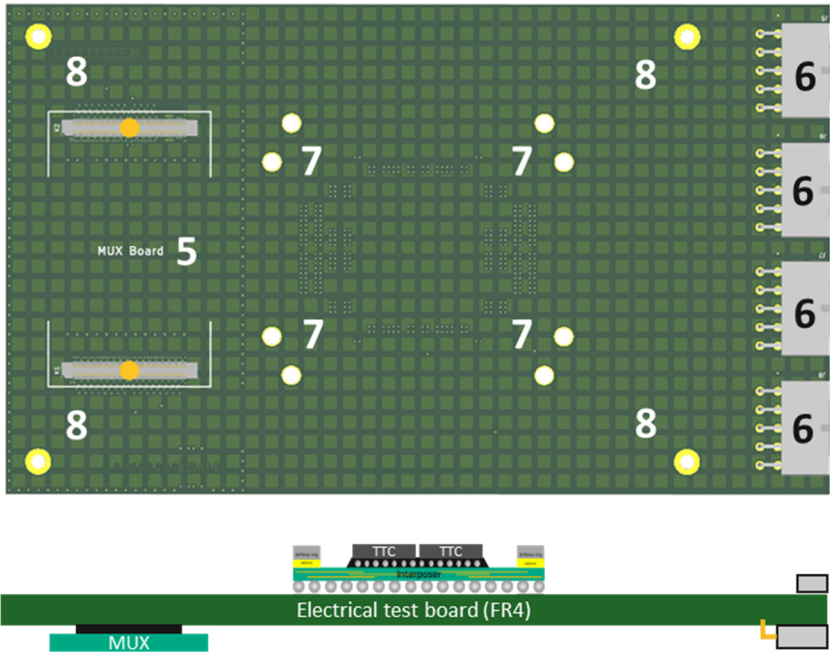
Four power connectors (Q1 PWR – Q4 PWR) provide easy access for supplying up to 24 independent heaters. Each heater zone can be monitored via 4-wire measurement, enabling accurate power sensing and minimizing the influence of lead resistance.

The ETB provides a plug-in slot for one multiplexing unit (MUX), allowing sequential connection to all 56 on-die temperature sensors without the need for extensive individual wiring. In addition, constant current sources are available to supply the sensor bias current.

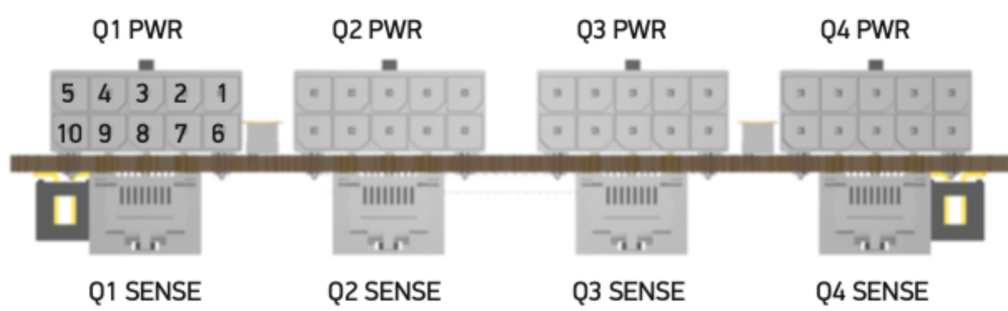
A new second-level daisy chain function is implemented to enable bump health monitoring, allowing early detection of interconnect degradation during thermal cycling and reliability testing.



1	Interface DAQ
2	Interface 2 nd level daisy chain
3	TTV package
4	Sense interface
5	Multiplexer (MUX) interface
6	Power interface
7	Cooler mounting holes
8	PCB mounting holes



Power and Sense Pinout

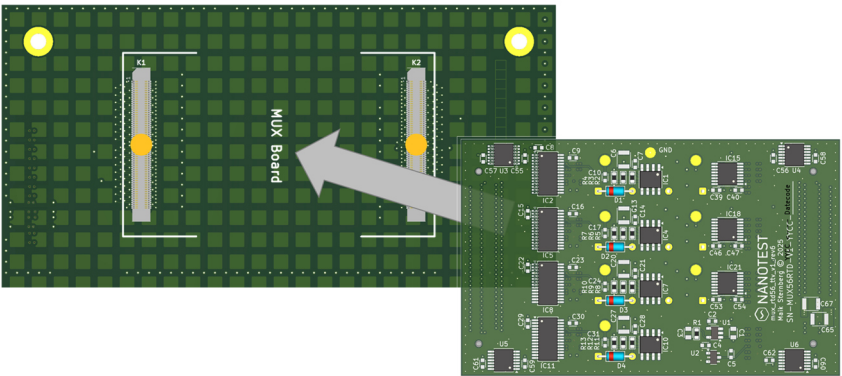


Q1		Q2		Q3		Q4	
Pin 1	S3_P1	Pin 1	S4_P1	Pin 1	S3_P1	Pin 1	S4_P1
Pin 2	PGND	Pin 2	PGND	Pin 2	PGND	Pin 2	PGND
Pin 3	PGND	Pin 3	PGND	Pin 3	PGND	Pin 3	PGND
Pin 4	PGND	Pin 4	PGND	Pin 4	PGND	Pin 4	PGND
Pin 5	PGND	Pin 5	PGND	Pin 5	PGND	Pin 5	PGND
Pin 6	S2_P1	Pin 6	S5_P1	Pin 6	S2_P1	Pin 6	S5_P1
Pin 7	S6_P1	Pin 7	S6_P1	Pin 7	S6_P1	Pin 7	S6_P1
Pin 8	S1_P1	Pin 8	S1_P1	Pin 8	S1_P1	Pin 8	S1_P1
Pin 9	S4_P1	Pin 9	S3_P1	Pin 9	S4_P1	Pin 9	S3_P1
Pin 10	S5_P1	Pin 10	S2_P1	Pin 10	S5_P1	Pin 10	S2_P1

MUX Board connection

Nanotest’s multiplexer unit board enables efficient signal routing for all 56 integrated sensors without the need for the hundreds of individual cables that would otherwise be required for powering and reading each sensor. By sequentially switching between sensor channels, the multiplexer drastically reduces wiring complexity, minimizes potential interference, and simplifies experimental setup.

The board connects directly to the backside of the TTV16 ETB, ensuring a compact, robust, and reliable interface between the thermal test vehicle and the measurement equipment. This design not only streamlines signal management but also improves measurement stability and maintainability during extended test campaigns.

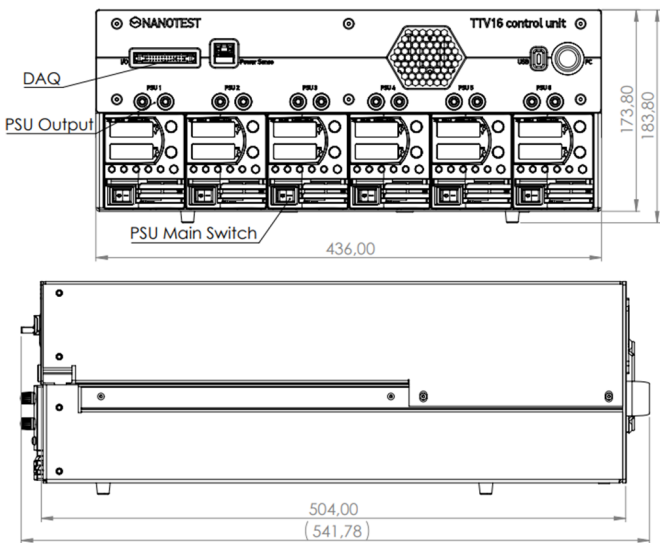


TTV16 Control Units

TTV16 Control Unit with 6 Power Supplies (TCU6)

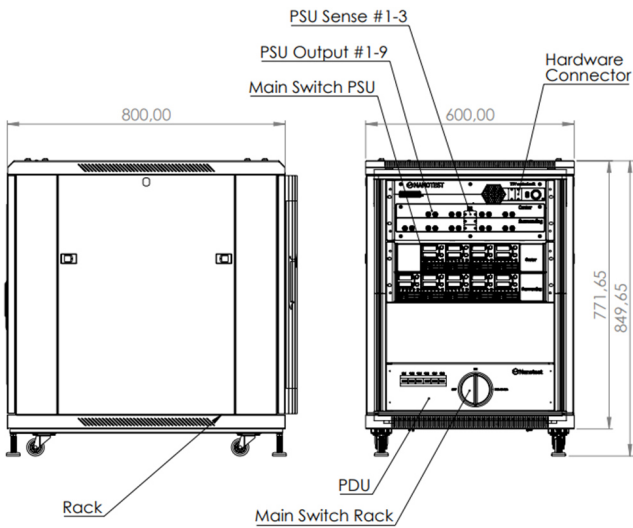
Number of power supplies/number of controllable heater zones	6
Max. heating power (not uniform)	2800 W*
Max. uniform heating power	960 W (0.6 W/mm ²)
Operating System	Windows 10
Rated voltage range	100 – 240 V (single-phase AC)
Rated input current	20 A
Rated line frequency	50 Hz/60 Hz
Weight	30 kg
Dimensions (w x h x d)	44 x 17.5 x 51 cm ³

*not guaranteed with voltage supply below 230 V



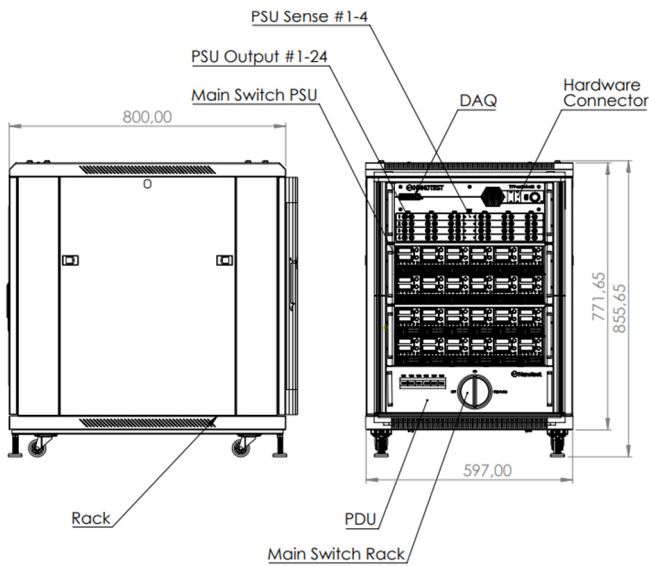
TTV16 Control Unit with 9 Power Supplies (TCU9)

Number of power supplies/number of controllable heater zones	9
Max. uniform heating power	4800 W (3 W/mm ²)
Operating System	Windows 10
Rated voltage range	380 - 400 V (3-phase AC)
Rated input current	32 A CEE plug
Rated line frequency	50 Hz/60 Hz
Power distribution unit	Yes, with emergency stop switch
Weight	90 kg
Dimensions (h x w x d)	86 x 60 x 80 cm ³



TTV16 Control Unit with 24 Power Supplies (TCU24)

Number of power supplies/number of controllable heater zones	24
Max. uniform heating power	5120 W (3.2 W/mm ²)
Operating System	Windows 10
Rated supply voltage range	380 - 400 V (3-phase AC)
Rated supply input current	32 A CEE plug
Rated supply line frequency	50 Hz/60 Hz
Power distribution unit	Yes, with emergency stop switch
Weight	120 kg
Dimensions (h x w x d)	86 x 60 x 80 cm ³



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.