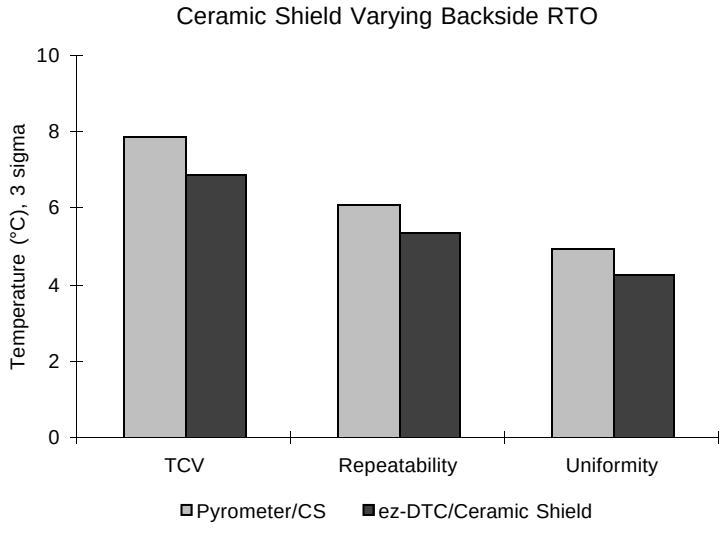
Enhanced Z-axis Direct Thermocouple Control (*ez*-DTC)

For Heatpulse® 8800 and 8108 Systems

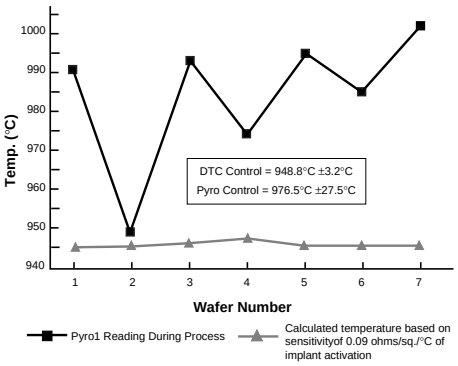
The Enhanced Z-axis Direct Thermocouple Control (*ez*-DTC) is a repeatable, closed-loop, thermocouple-based temperature control system which provides temperature control at the wafer edge in a contact or non-contact mode at the wafer backside (125mm-200mm wafers). The *ez*-DTC combined with the Ceramic Shield offers emissivity independence and the best across-the-wafer uniformity available on Heatpulse systems. As a standalone system, the *ez*-DTC offers repeatability superior to pyrometry and is a recommended option or retrofit for Heatpulse 8800 and 8108.

The *ez*-DTC has a vertically positioned, micrometer-set axis, is nitrogen purged and double-contained, and is guaranteed against contamination. The *ez*-DTC is also easy to operate and maintain and has field-replaceable components. The warranty on the thermocouple is 150,000 cycles. Upgrades are available to DTC customers with a trade-in of the process chamber rear flange.

When combined with the Ceramic Shield, the *ez*-DTC provides 0.25µ technology processing capabilities on Heatpulse 8800 or enhanced 0.35µ technology processing capabilities on Heatpulse 8108. Improved performance results from an *ez*-DTC-equipped Heatpulse 8800 with the Ceramic Shield. (See Figure 1.) The *ez*-DTC provides direct wafer temperature sensing when using the Ceramic Shield. The pyrometer acts as a backup temperature monitor in this configuration. Comparison of the temperature signals between the *ez*-DTC and the pyrometer is provided by the software. An interlock terminates processing upon out-of-range temperature deviation.

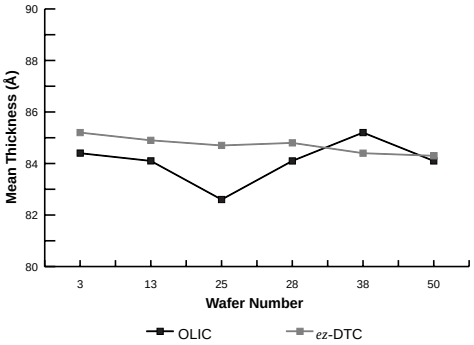


Temperature results using Heatpulse 8800 with Ceramic Shield com-paring ez-DTC vs. pyrometer control with varying backsides (emissivity range 0.4-0.9). Total Components of Variation (TCV) is all points, all wafers, ±3σ . Repeatability of means and average across-wafer uniformity are also ±3σ .



Wafer	Nitride	PSG	TEOS
1	8.0KÅ	2.5KÅ	3.0KÅ
2	7.0KÅ	2.0KÅ	2.5KÅ
3	9.0KÅ	2.0KÅ	2.5KÅ
4	7.0KÅ	3.0KÅ	2.5KÅ
5	9.0KÅ	3.0KÅ	2.5KÅ
6	7.0KÅ	2.0KÅ	3.5KÅ
7	9.0KÅ	3.0KÅ	2.5KÅ

emperature repeatability using DTC vs. pyrometer control with varying backsides.



Temperature repeatability using ez-DTC is 2½ times superior to OLIC.

Superior backside insensitivity and improved repeatability result when using the *ez*-DTC in place of pyrometry without the Ceramic Shield. (See Figure 2.) Heatpulse 8800 with the *ez*-DTC offers the highest throughput available, up to 50 wafers per hour, and is significantly less sensitive than pyrometry to emissivity variations caused by varying thicknesses or different layers on the wafer backside. It is also 2½ times better than Open-Loop Intensity Control (OLIC) for repeatability. (See Figure 3.) The performance specification is ±3°C for production wafer processing with typical production backside variations, and can eliminate the need for a backside wafer strip in production.

Features and Benefits

- Integrated design for performance and compatibility with the Ceramic Shield provides direct wafer temperature sensing.
- Secondary monitor and interlock capability between *ez*-DTC and pyrometer.
- Consistent temperature repeatability (compared to pyrometer control) over a range of wafer-to-wafer emissivities offers 2½ times better repeatability than OLIC.
- Enhanced Z-axis vertical movement and micrometer control simplify positioning.
- Safe, nitrogen-purged, double containment exhaust gas collection.
- Separable silicon carbide probes and R-type thermocouples are user replaceable and cost effective.
- Thermocouple lifetime is 150,000 cycles or 15 months, whichever comes first.
- Easy to handle single piece quartz tray.
- Simple and quick maintenance and installation.

Upgrade Kit (for current DTC users) Includes:

- *ez*-DTC probe assembly (1)
- Silicon carbide probe (1)
- Process chamber rear flange (with exchange of customer's DTC flange)
- Single piece tray (1)
- Thermocouple assembly (5)
- Slip-free ring (1)
- Nitrogen purge system (separate nitrogen line required)
- EEPROM for ATP 3.03 or later (3)

- GUI software version 4.601 or later
- Technical manual and installation procedures
- Chamber scope (with first order)

Retrofit Kit Includes:

- *ez*-DTC probe assembly (1)
- Silicon carbide probe (2)
- Process chamber rear flange (1)
- Single piece tray (2)
- Thermocouple assembly (5)
- Slip-free rings (4)
- Nitrogen purge system (separate nitrogen line required)
- ATP cards (2, 3 with DCP)
- GUI software version 4.601 or later
- Technical manual and installation procedures
- Chamber scope (with first order)

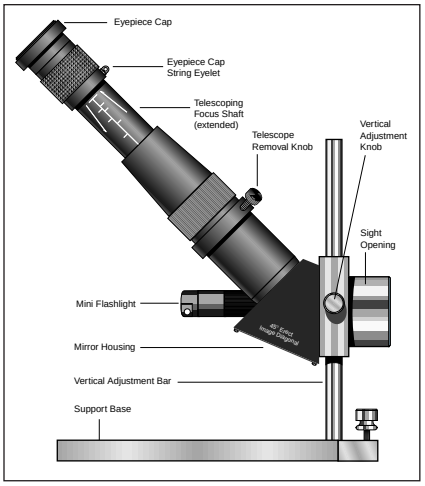
Note: Required information at time of order includes wafer size of 125, 150, or 200mm, wafer type of notch, semi (flat), or jeida, and type of pyrometer system (ERP/SWP or DCP).

For current DTC owners:
ez-DTC Upgrade Kit — Order No. DTC-UPG

For Heatpulse 8800 / 8108:
ez-DTC Retrofit Kit — Order No. DTC-RTRO

Related Spare Parts:

200mm single piece tray	Order No. 7100-5727-01
200mm 5-pack thermocouples	Order No. 0641-0767-03
200mm silicon carbide probe	Order No. 7310-2904-03
150mm single piece tray	Order No. 7100-5730-01
150mm 5-pack thermocouples	Order No. 0641-0767-02
150mm silicon carbide probe	Order No. 7310-2904-02
Chamber inspection scope	Order No. 7100-5779-01



The chamber scope is an accessory which aids in the setup of the ez-DTC probe. This handy telescope provides a clear view of the probe contacting the wafer backside. It can also be useful to inspect the Heatpulse process chamber.

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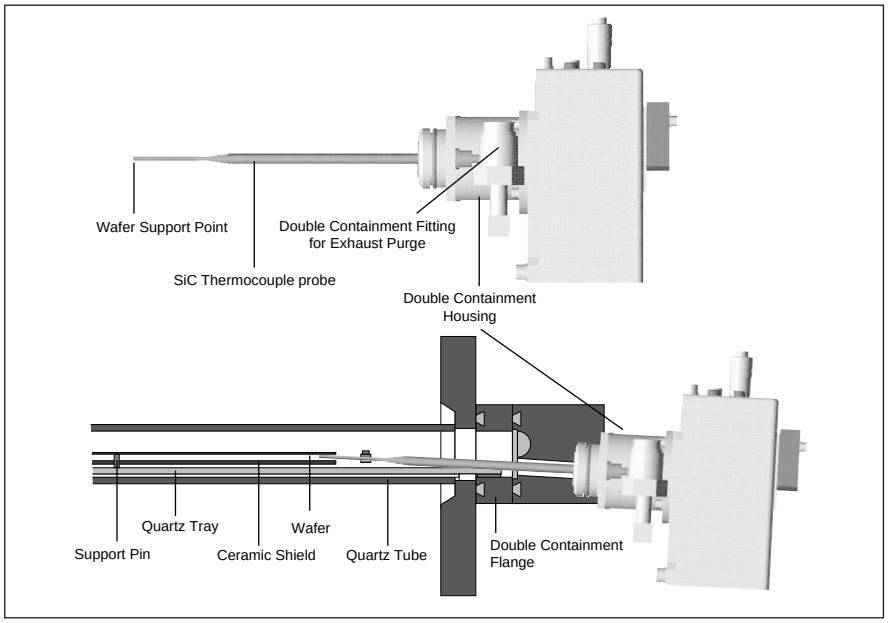
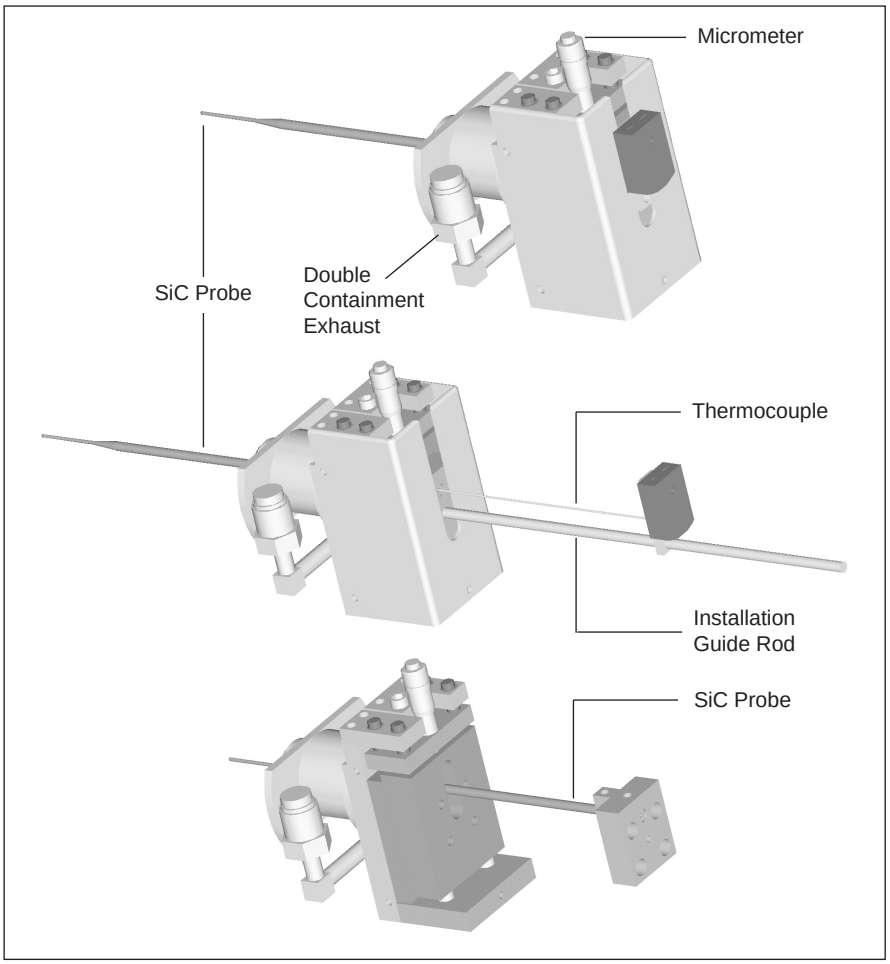


The ez-DTC installed in a Heatpulse process chamber.



The ez-DTC's design results in easier component removal for cleaning and repair.