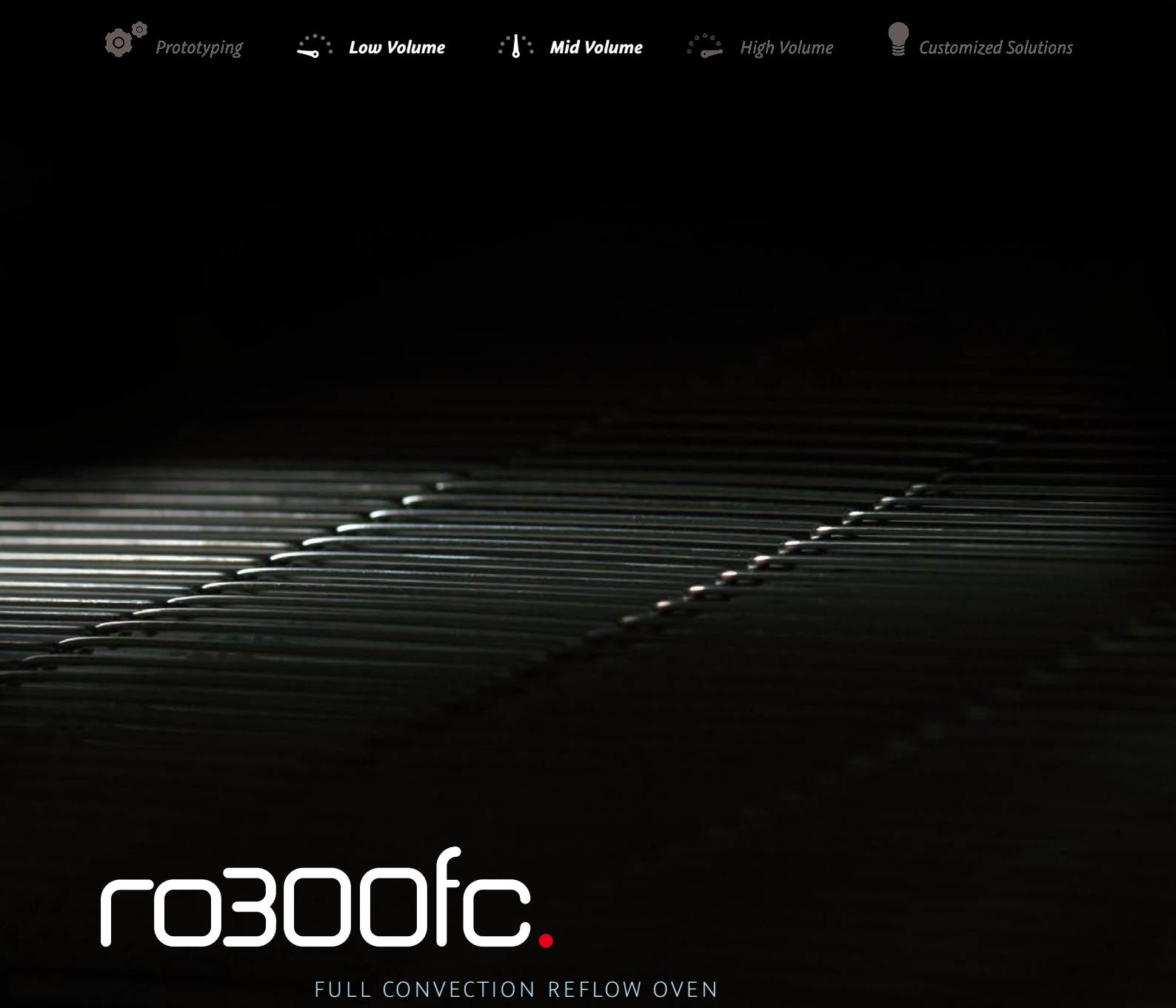
Prototyping | **Low Volume** | **Mid Volume** | High Volume | Customized Solutions



ro300fc.

FULL CONVECTION REFLOW OVEN

essemtec
swiss made

RO300FC N2

RO-CONTROL – PC software
for simulation, control, measurement and
documentation of perfect solder profiles

Full convection heating
ideal for lead free soldering

Small footprint 2m x 0,7m
at 300 mm ***process width***

Integrated microprocessor control with LCD

Equal heating rates
at ***minimal Delta T.*** As an option with N2

High troughput still at
very small dimensions

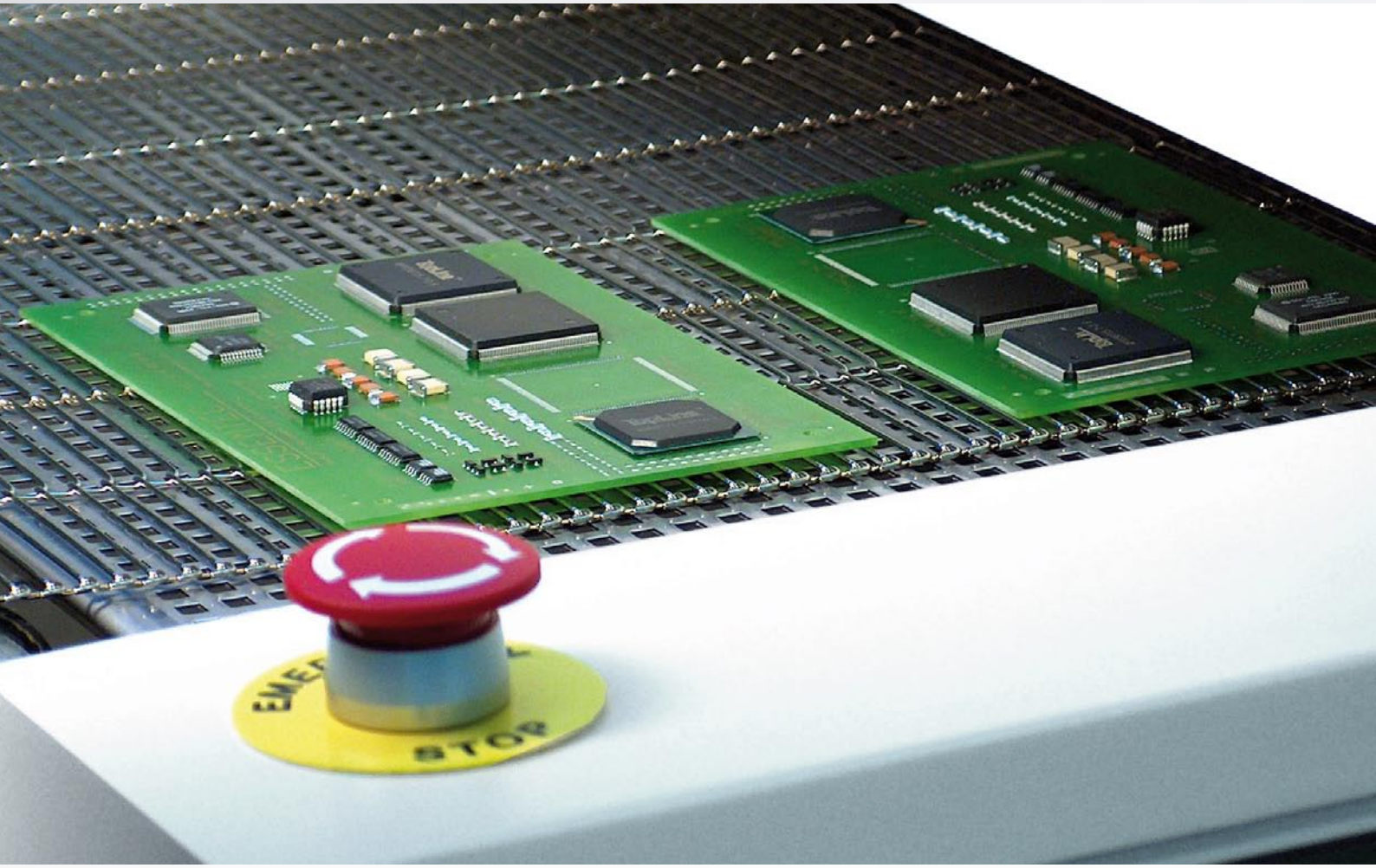
Apropriate for Prototyping and volume production

" Even low and small volumes of boards have to be soldered safe and reliable – with the same ongoing quality level. The RO300FC is setting the benchmark for small-batch production worldwide "

Soldering of complex SMD boards and new package technologies requires a well-controlled soldering process.

Lead free solders for SMT electronics have a higher melting temperature than solders with lead. The convection heating technology is the ideal solution for the reflow process. It guarantees the precise control of the higher process temperatures and the minimum thermal stress for the sensitive electronic components.

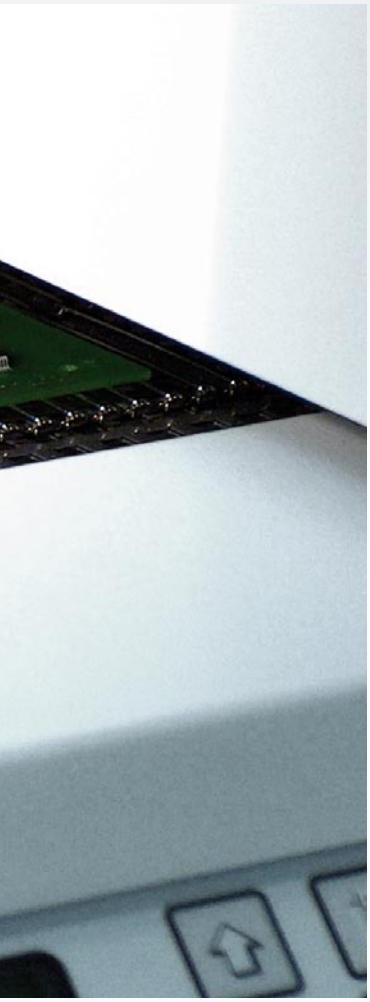
The integrated microprocessor control with LCD display provides an easy-to-use operator interface and storage capacity of up to 28 profiles. The memory provides program proposals and enough space for own profiles.



High tech engineering for a maximum in flexibility and quality

The RO300FC exclusively heats with hot air convection and can be used for the different tasks in SMT assembly, especially for the reflow soldering of lead free solder pastes or the curing of adhesives. It features easy operation, perfect reflow results and a robust construction. It is well suited for continuous production, small batch manufacturing and prototyping. Perfect zone separation allows the setup of profiles for all applications.

The vertical hot air stream evenly heats the complete PCB. The high air volume guarantees equal heating rates in all the components and the substrate. This technology eliminates the risk of hot spots or heat shadows.



Perfect soldering results

Uniform heating
The convection technology applies the same temperature everywhere on the board independent of component size or color, making programming as easy as possible.

RO-CONTROL
New soldering tasks can be simulated and it offers unlimited storage space for programs. Measured temperature profiles can be superimposed graphically.

With or without Nitrogen
The RO300FC-N2 can be operated with nitrogen or with air. The changeover takes less than five minutes.

Transport choices
Depending on the application a mesh belt or a chain conveyor system is used for substrate transport.

Easy integration
SMEMA connectors provide the ability to link the oven with any other compatible equipment.

Process control
With the optional flying thermocouples, temperatures can be recorded directly on the board and displayed on the machine's LCD display.

Easy to maintain
For the cleaning of flux residues all necessary parts of the oven can be removed easily and cleaned outside the oven.

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essemtec
swiss made

RO300FC Reflow Oven

Version 4 • June 28, 2013

Specifications

Configuration

		RO300FC	RO300FCN2	RO300FC-C	RO300FCN2-C
Machine base	Heating zones	3	3	3	3
	Cooling zones	1	1	1	1
	Nitrogen operation		●		●
	Air operation	●	●*	●	●*
	Base console	●	●	●	●
PCB Handling	Mesh belt conveyor	●	●		
	Pin (chain) conveyor			●	●
	SMEMA interface			○	○

● standard feature ○ optional feature *Changeover time Nitrogen<->air operation: less than 5 Minutes

Specifications

		RO300FC	RO300FCN2	RO300FC-C	RO300FCN2-C
Dimensions	Length x Width x Height	2'000x710x1'200 mm (78.8x28x47.2")			
	Weight	237 kg (523 lb)		237 kg (523 lb)	
Control	Type	Microprocessor			
	Languages	English, German, French			
	Temperatures selectable	°C, °F			
	Program capacity	49 (10 preset standard, 10 preset leadfree, 10 preset curing, 19 free)			
	Board counter	optional with sensor or standard with SMEMA option			
	Gas temperature adjustment	Adjustable from 20° to 300°C (68° to 572°F) for each zone			
Substrate dimensions	Max. reflow width	300 mm (11.8")			
	Substrate width	10-300 mm (0.39-15.8")		10-300 mm (0.39-11.8")	
Conveyor	Transport direction	left to right			
	Pin length	-		3 mm (0.12")	
	Conveyor speed range	100-800 mm/min (3.9"-31.5"/ min), see slow speed option for slower speed			
	Conveyor speed repeatability	+/-2 mm (0.079") / min			
	Conveyor motor type	24V DC with encoder			
	Rail parallelism	-		+/- 0.3mm (0.012") from 20 to 290°C	
	In feed length	170 mm (6.7")			
	Out feed length	165 mm (6.5")			
	Entrance height (max)	38 mm (1.5")	30 mm (1.2")	34 mm (1.34")	26 mm (1.2")
	Free space below substrate	0	0	32 mm (1.26")	32 mm (1.26")
Process dimensions	Heated length	1'160 mm (45.7")			
	Length of heating zone	380 mm (15.0")			
	Length of active cooling zone	140mm (5.5")			
	Overall length cooling zone	290mm (11.4")			
Process data	Total Air circulation heating zones	1'200 m^3/h (706 cfm)			
	Air circulation per heating zone	400 m^3/h (235 cfm)			
	Air circulation peak zone	400 m^3/h (235 cfm)			
	Air circulation cooling zone	300 m^3/h (177 cfm)			
	Atmosphere quality	air	<1'000 ppm O_2	air	<1'000 ppm O_2
Supplies	Electrical	EU: 3x400 VAC, 50Hz, 25 A US: 3x208 VAC, 60Hz, 25 A (without transformer)			
	Power consumption	6.1 kW continuous, 10 kW (during initial heat up,15 min)			
	Minimum exhaust volume	2x250 m3/h = 500 m3/h (2x150 cfm=300 cfm). Option RO300FC-VNT recommended.			
	Filter / Air Cleaning Systems	No / must be added in the exhausting system			
	Exhaust specifications	1 each at entry and exit, distance 1,34 m (52.76"), diameter 80 mm (3.15"), length 40 mm (1.57"), gas temperature at exhaust <55°C (<131F)			
	N2 consumption for <1'000 ppm		<19m^3/h		<19m^3/h
	Compressed air supply		3 sqm/hr*		3 sqm/hr*
Environment	Noise level	70 dB (A) maximum			
Features	Emergency stop buttons	1 (on left side of the machine)			
	Main power disconnect	1 with undervoltage circuit breaker			
	Overheat security	Overheat temperature control for each zone (electronic detection)			
	Safety standards	CE, EN 954-1 Class 3			
	Color	White (RAL9002) silky lustre, fine structure			

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*required only if N2-model is operated without nitrogen

Heating zone specifications

Temperature Profile	Preheat 1	Preheat 2	Reflow	Cooling
Type	Convection	Convection	Convection	Convection
Max. gas temperature setting	300°C (572°F)	300°C (572°F)	300°C (572°F)	--
Max. Heating power	3000 W	3000 W	3000+2500 W	--
Regulation (Reflow conditions)	+/- 3°K	+/- 3°K	+/- 3°K	--
Ramp times (FR4 inboard measurem.)	1.8-2°K/sec	1.8-2°K/s	2-3°K/sec	2.5-3°K
Temperature measurement	in airstream*	in airstream*	in airstream*	--
Heating up time from 20°C (68°F) to set temperature 160–160–160–235°C (320-320-320-455°F) (Typical used Profile)	6 min	4 min	8 min	--
ΔT within 300 mm conveyor width	<4°C (39.2°F)	<4°C (39.2°F)	<4°C (39.2°F)	--
Cold start warm up to 235°C (455°F)	14 min	8 min	8 min	--
Cold start warm up to 300°C (554°F)	35 min	13 min	14 min	--
Max temp difference between two adjacent zones	← 280°C** (536°F)	←90°C** (194°F)	← 90°C** (194°F)	← 270°C** (518°F)
Blower rpm	2 x 1850	2 x 1850	2 x 1850	2 x 2600

* Temperature measurement directly within air stream adjusted to PCB height.
** External exhausting with specified volume required.

Option specification

Option	Value	Specification
Signal tower	Colours	3
	Audio signal	optional
Slow speed option	Order number	RO300FC-15
	Conveyor speed range	10-200 mm / min (0.4"-7.9" / min)
Flying thermocouples	Order number	RO300FC-1
	Length	5 m (16.4 ft)
	Quantity	2
	Temperature display	Directly on the on the integrated LCD Panel or optional importable into RO-Soft
RO-Soft profiling software	Order number	RO300FC-SOFT-2
	Measure channels	5 (2 for thermocouples, 3 for zone temperature)
	Recording time	up to 180 hours
	Data export format	.pdf (pdf writer necessary on the PC), .csv (for excel import)
	Delivered with	RS232 connection cable, SUB-D Adapter 25pin-9pin
	Data Connection	RS232
	PC requirements	Pentium 3 or better
	System requirements	Option RO300FC-1 (Flying Thermocouples)
Exhaust incl. ventilator	Order number	RO300FC-VNT
	Scope of delivery	Covered exhaust fan with connection pipes to the two exhausting nozzles, Power cable connected to the oven
	Technical details	500m3/h (300cfm) air exhausting, 230V 50/60Hz
	Customers side installation	1 Pipe or tube to the outside or to air cleaning equipment Diameter 125 mm (4.92") (150mm (5.91") with adaptor), max length 5.0m (16.4 ft). Fire proof and temperature resistant up to 70°C (158°F)
Exhaust Tubes (without Ventilator)	Scope of delivery	Connection pipes to the two exhausting nozzles. Diameter 80mm (3.15") with T connection on top, Diameter 125 mm (4.92"), 150mm (5.91") with adaptor.
	Customer side installation	Exhausting system with 1 Pipe or tube Diameter 150mm (5.91"), max length 5.0m (16.4 ft). Fire proof and temperature resistant up to 70°C (158°F) Technical requirements for exhausting system see on chapter "Exhausting"
Slide out unit	Order number	Meshbelt: RO300FC-4, pin conveyor: RO300FC-4C
	Sliding angle	adjustable with screws
	Transport width	Meshbelt: 400 mm (15.8"),Pin conveyor:10-300 mm (0.4" - 15.8")

Option specification (cont.)

Option	Value	Specification
PCB Counter	Sensor type	Optical polarized
	Order numbers:	Mesh belt RO300FC-3B Chain conveyor) RO300FC-3
ling System for Chain conveyor	Order number	RO300FC-10
	Located	Directly on the two chain rails at the entrance side
	Type of used oil	High temperature oil up to 300°C (572°F)
	Oiling cycle	Daily to weekly (depending to operation time)
	Oil consumption	Depends from the oiling cycles
SMEMA Interface	Order number	RO300FC-13
	Sensor	one at entrance and one at exit side
	Sensor type	Optical polarized
	Functions by side	Board counter
	Scope of delivery	SMEMA connectors at entrance and exit side of the oven, one SMEMA cable, two sensors
3 color signal tower	Order number	
	Light colors	Red, yellow, green
	Standard with SMEMA interface	No, but recommended
PC monitor and keyboard support arm	Order no.	RO300FC-7
	Located	At the entrance side of the oven, easy to handle from the operators place and moveable to the backside if not needed.
Packing information	Box (LxWxH)	2170x1040x955 mm (7.12x3.41x3.13 ft)
	Shipping weight with meshbelt (Airfreight)	340 kg (750 lb)
	Shipping weight with pinchain conveyor (Airfreight)	340 kg (750 lb)

Application Note

Lead-free soldering with 3 heating zones only!

Version 2, June 6, 2007

Perfect reflow results using the RO300FC

Task
Lead free reflow soldering of a PCB with and without nitrogen and with different solder pastes.

PCB

- ESSEMTEC key tag
- Surface HAL lead-free
- Thickness: 0.8 mm
- Dimensions: 185x140 mm

Components

- All components have RoHS conformity
- Resistors, capacitors, diodes, IC

Stencil

- Laser stencil, thickness150 •m

Solder

- KOKI lead-free
  - Supplier: KOKI
  - Type: S3X58-M406
  - Alloy: Sn96.5Ag3Cu0.5
  - Grain size: 20-38µm
  - Metal content: ≥85%
- Heraeus lead-free
  - Supplier: W.C. Heraeus GmbH
  - Type: F 640 SA40C5-89 M 30
  - Alloy: Sn95.5Ag4Cu0.5
  - Grain size: 25-45µm
  - Metal content: 89% ± 1%

Equipment

The reflow oven RO300FC is a full convection reflow system with only 3 heating zones and one cooling zone. The length of the system is only 2 m (for full technical details refer to the product specifications). The reflow oven can solder with and without intert gas atmosphere (nitrogen).
This reflow oven features a special zone separation technique that allows a temperature difference between zones of up to 100°C. The Delta-T over the PCB is below 4°C. Due to these outstanding values, reflow profiles can be perfectly regulated and lead-free soldering is possible with "only" three zones!

* The Global Technology Awards program is sponsored by Global SMT & Packaging Magazine, and is an annual celebration of product excellence in semiconductor packaging and electronics assembly. Premier products based on the finest examples of creative advancement in technology in 19 key areas, including Soldering Equipment, are chosen by a distinguished panel of industry experts.

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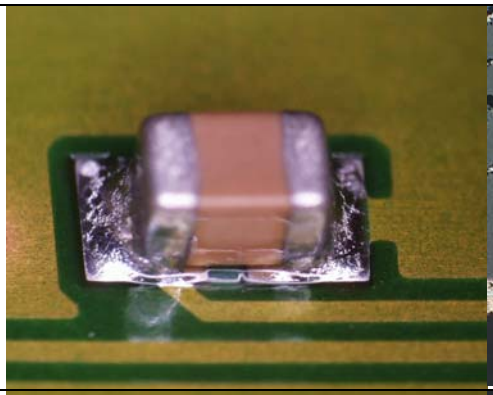
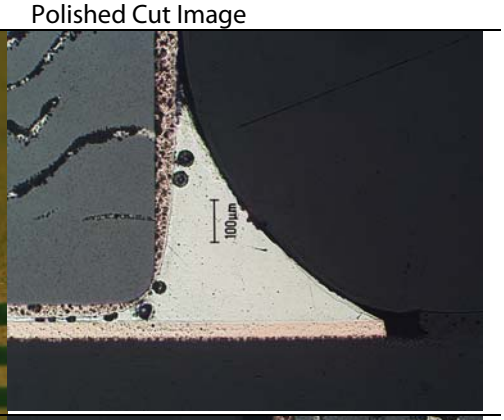
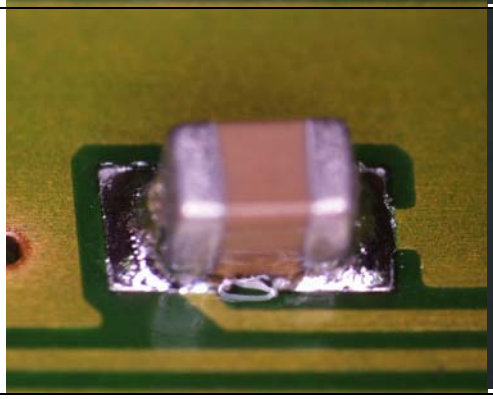
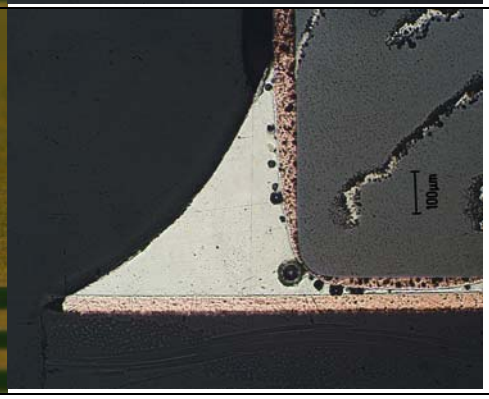
Results

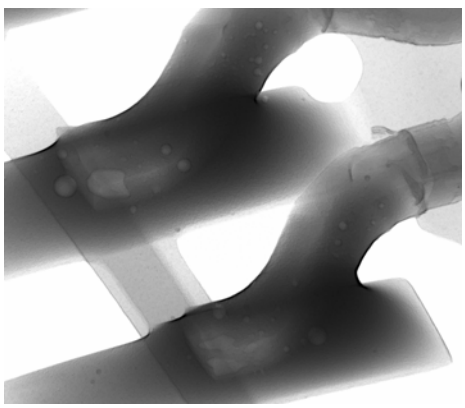
The soldered products were analyzed and judged by an independent organisation (Mettler Toledo, Nänikon, Switzerland)*:

Solder meniscus:	good
General impression:	good
Conspicuity:	none

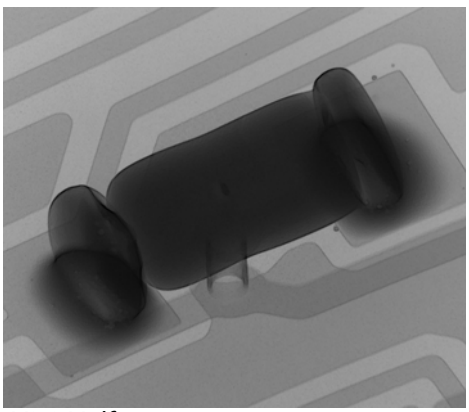
Process	Overview	Polished Cut Image
Process 1 **Component:** 220nF 0805C **Solder:** KOKI Pb-free **Reflowoven:** RO300FC with N2 **Temperature settings:** 190/200/255 **Transport speed:** 320mm/min.		
Process 2 **Component:** 220nF 0805C **Solder:** Heraeus Pb-free **Reflow oven:** RO300FC (no nitrogen) **Temperature settings:** 190/210/255 **Transport speed:** 360mm/min.		

* A complete report is available in German on request. Here only a very small assortment of pictures can be shown.

These X-ray pictures have been taken from samples soldered with process 1:



SO-14



Mini-Melf