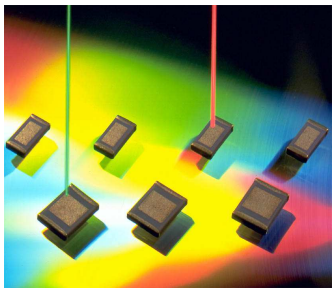
LaserTrim® Ceramic Chip Capacitor

RF & Microwave Capacitors, SMT, RoHS

DESCRIPTION

Laser adjustable monolithic ceramic
Rated voltage - 50V
Porcelain Capacitors
Excellent post-trim Q and ESR
No capacitance drift



APPLICATIONS

- Pagers, RF Modems
- Cellular Communications
- Remote Controls

CIRCUIT APPLICATIONS

- Oscillators
- Filters
- Antennas

I. ELECTRICAL SPECIFICATIONS

Parameter	*Value*
Capacitance	1 to 21 pF
Pre-trim Capacitance	-0% / +25%
Working Voltage (WVDC)	50V
Temperature Coefficient	0 +/-30ppm/℃, -55℃ to +12 5℃
Dielectric Withstanding	2.5 x WVDC (50 mA maximum)
Aging	none
Piezo Effects	none

II. MECHANICAL SPECIFICATIONS

Parameter	*Value*	*Comment*
Termination Materials All terminations are **lead-free**	G	gold over nickel barrier
Case Sizes	L14 L15 L18 L41	0603 0805 1206 1210

LaserTrim® Ceramic Chip Capacitor

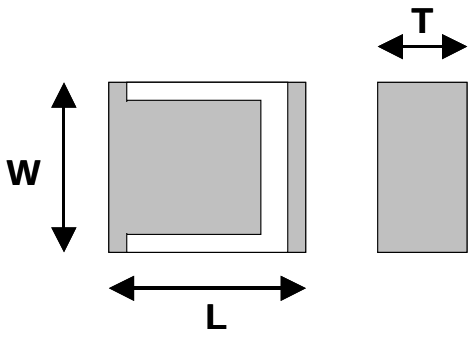
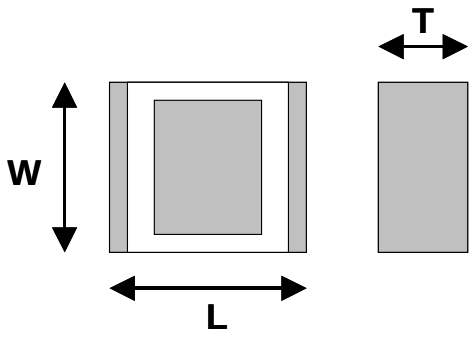
RF & Microwave Capacitors, SMT, RoHS

III. ENVIRONMENTAL SPECIFICATIONS

Parameter	Value
Life Test	1'000 hours, +125℃ at 1.5 x WVDC
Moisture Resistance Test	56 days, 93% relative humidity at +40℃ 0V, 5V, WVDC

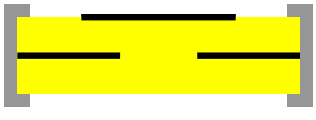
IV. OUTLINE DIMENSIONS

Parameter	L14 (0603)	L15 (0805)	L18 (1206)	L41 (1210)
Length (L)	1.60 ±0.30 mm	2.03 ±0.20 mm	3.09 ±0.20 mm	3.30 ±0.20 mm
Width (W)	0.80 ±0.20 mm	1.27 ±0.20 mm	1.52 ±0.20 mm	2.54 ±0.20 mm
Thickness (T)	0.76 mm (max.)	0.76 mm (max.)	0.76 mm (max.)	0.76 mm (max.)
Pad gap	0.10 mm (min)	0.10 mm (min)	0.10 mm (min)	0.10 mm (min)

L14 / L15	L18 / L41
	

V. ELECTRODE PATTERN

A "standard electrodes" design is used for the L14/L15 sizes and a "floating electrodes" design for the L18/L41 sizes. For the first pattern, the laser-trims are always taped using the same position.

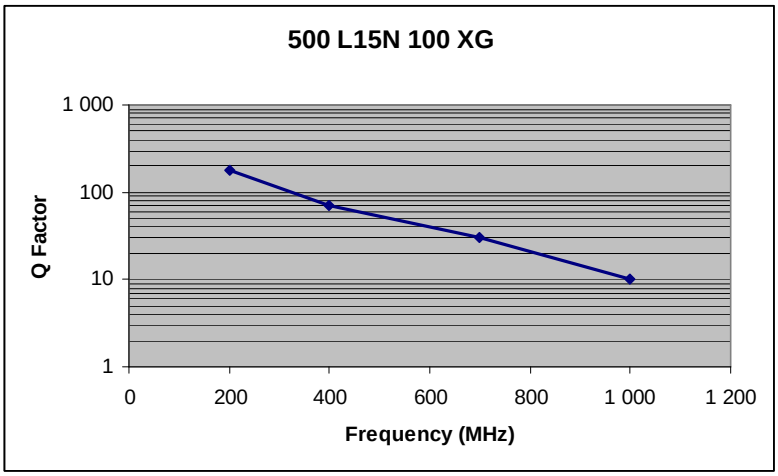
L14 / L15	L18 / L41
	
ceramic electrode gold over nickel	

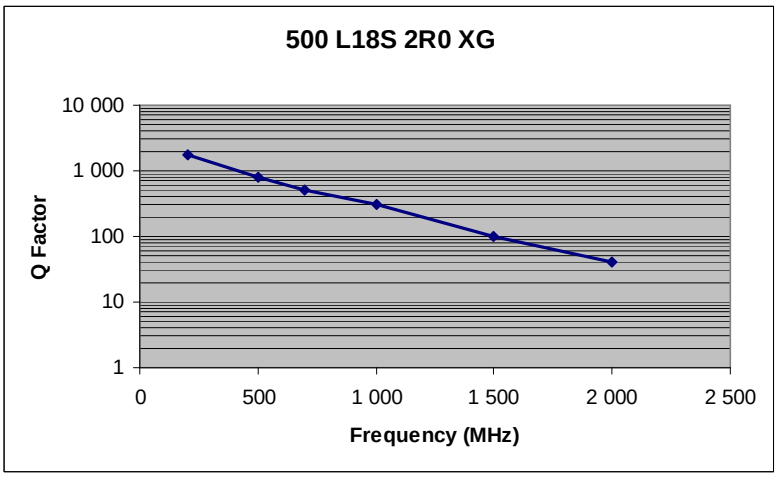
LaserTrim® Ceramic Chip Capacitor

RF & Microwave Capacitors, SMT, RoHS

VI. TYPICAL CHARACTERISTICS

VI.1. Typical Quality Factor

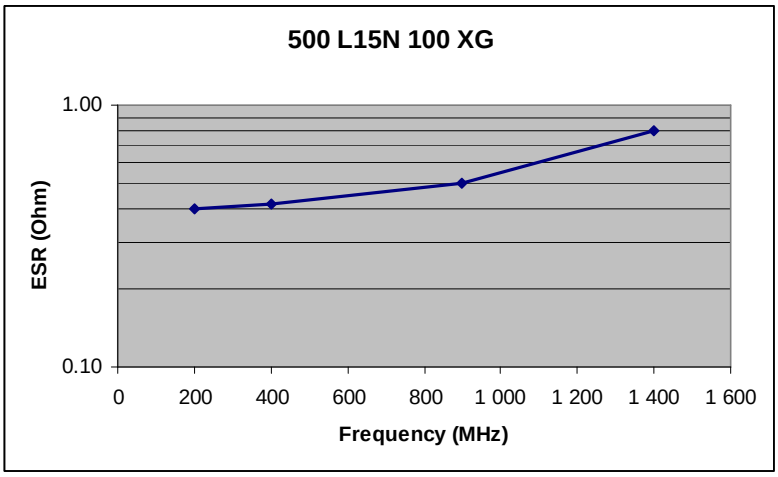


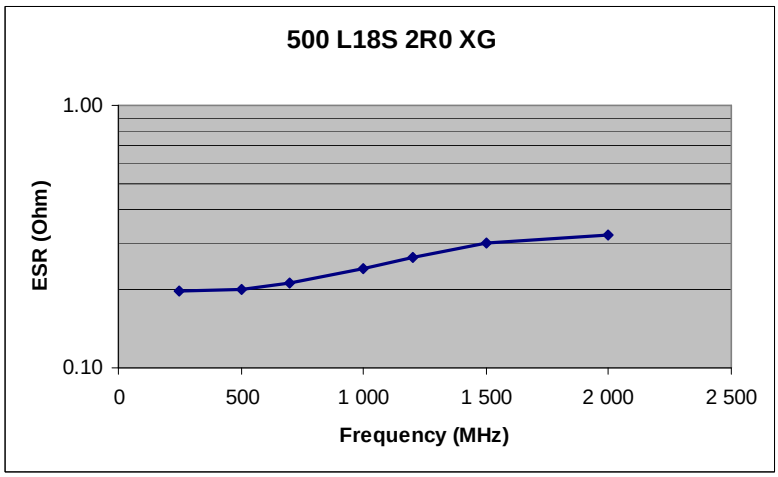


LaserTrim® Ceramic Chip Capacitor

RF & Microwave Capacitors, SMT, RoHS

VI.2. Typical Equivalent Series Resistance





LaserTrim® Ceramic Chip Capacitor

RF & Microwave Capacitors, SMT, RoHS

VII. MAJOR ADVANTAGES

⇒ Ease of functional tuning process automation

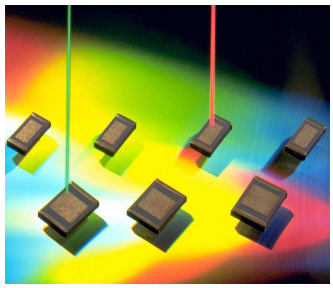
⇒ High resolution, high accuracy tuning capability

⇒ High stability and reliability after adjustment

⇒ No trim tool to affect the performances of RF circuits

⇒ Suitable for operating in vibrating environments

VIII. TECHNOLOGY ANALYSIS

Surface Mount Trimmer Capacitors	*LaserTrim®*
	
+ multiple "pole" settings	+ very low automatic tuning time
+ high voltage rating	+ reduced component placement
+ possibility to undo trimming	+ no capacitance drift (over time or with vibrations)
- potential drift in capacitance (mechanical, less than 1%)	- no possibility to undo trimming
- temperature coefficient ±300 ppm/℃	- single "pole" settings

LaserTrim® devices are especially well suited for mass-production applications and also for applications sensitive to vibrations where mechanical un-trimming is prohibited like missiles for instance. In order to perform the trimming operation, laser equipment is needed. However, the cost of this heavy equipment can be avoided by using a sub-contractor already having such a laser.

Therefore, as the sub-contractor has already paid for this laser equipment, the LaserTrim® capacitors entail a very low unit cost (lower than trimmer capacitors) even for small or medium quantities.

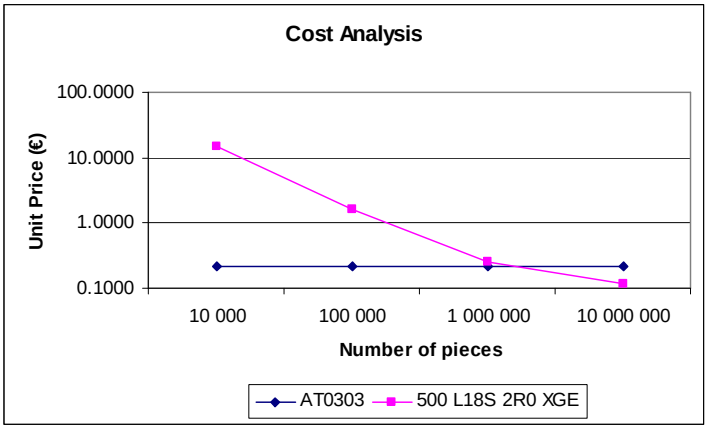
LaserTrim® Ceramic Chip Capacitor

RF & Microwave Capacitors, SMT, RoHS

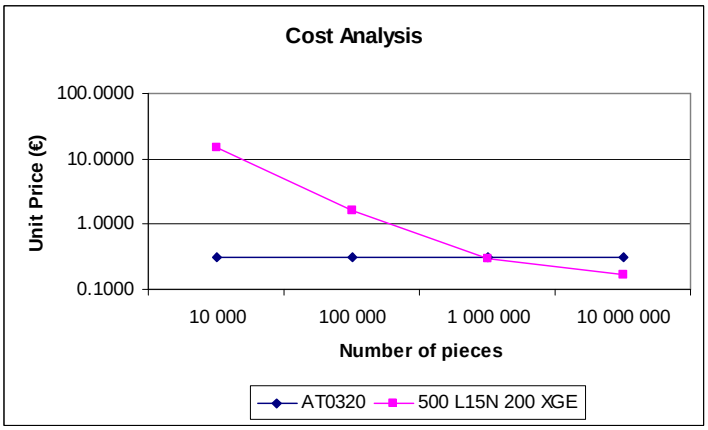
IX. COST ANALYSIS

Parameter	*Trimmer Capacitor*	*LaserTrim®*
Unit price	0.20 / 0.30€	0.10 / 0.15€
Tooling	N/A	Laser equipment @ 150K€
Tuning time	5 / 10s @ 5€/h	N/A

IX.1. Simulation for a 2pF capacitor



IX.2. Simulation for a 20pF capacitor

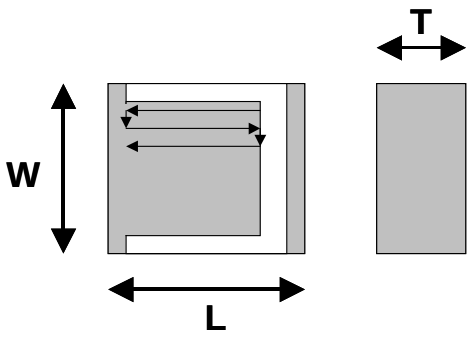


LaserTrim® Ceramic Chip Capacitor

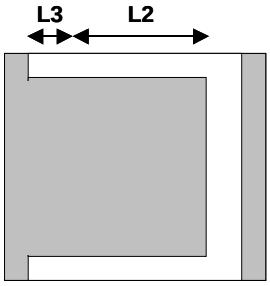
RF & Microwave Capacitors, SMT, RoHS

X. APPLICATION NOTES

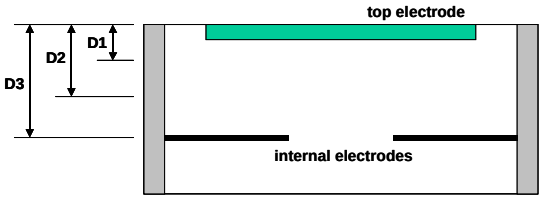
Trimming, which is done by removing part of the surface electrode by laser, has to be carefully carried out to avoid problems. To avoid destroying the electrical path through the surface electrode, and also to maintain balance throughout the operation, the laser must be operated along the axial line of the LaserTrim®.



Also, a safe margin between the termination and the laser-trimmed surface must be maintained. Therefore, the L3 distance - inactive length - must remain untrimmed and with a minimum length of 0.10mm.



The maximum thickness D_1 of the top electrode is 11µm. The trimmed depth is measured with reference to the surface of the external top electrode. We consider that an optimum depth for D_2 is 23µm. Therefore, the recommended trim depth would be 12µm. The first inner electrode is located at D_3 which equals 40µm. Therefore the distance between D_2 and D_3 represents the safety margin which is needed to protect the internal electrodes.



The recommended settings for an uncharacterized laser are: rep-rate 1kHz, beam speed 20mm/s, average power 1W and scan-in increment 12.5µm. Laser manufacturers are ESI, Hitachi, US Laser Corp, California Digital, Robotics, Sihan and Cheval Frères for instance.

LaserTrim® Ceramic Chip Capacitor

RF & Microwave Capacitors, SMT, RoHS

XI. PART NUMBERING

500	L15	N	200	X	G	E	ROHS
voltage	case size	dielectric	capacitance	initial tolerance	termination code	tape and reel	
500=50V	L14 L15 L41		please refer to Cap. Code given in Capacitance Range chart				the RoHS tag is not part of the reference tag added at the end of P/N for information

NB: the ROHS tag is for information only and does not belong to the reference itself. This tag is added on our stickers so that our customers can ensure that they use RoHS compliant parts on their process line.

500	L14	S	1R3	X	G	E	ROHS
voltage	case size	dielectric	capacitance	initial tolerance	termination code	tape and reel	
500=50V	L14 L18		please refer to Cap. Code given in Capacitance Range chart				the RoHS tag is not part of the reference tag added at the end of P/N for information

LaserTrim® Ceramic Chip Capacitor

RF & Microwave Capacitors, SMT, RoHS

XII. Capacitance Range

The following chart is giving the available nominal capacitances per size and dielectric. The nominal capacitance is the value mentioned in the part number, this is therefore the capacitance value exhibited by the LaserTrim® prior any trimming.

Initial Capacitance Range	L14	L15	L18	L41
S	1.0 / 1.5pF	N/A	1.0 / 3.0pF	N/A
N	3.0 / 10.0pF	7.0 / 20.0pF	N/A	12.0 / 21.0pF

NB: intermediate values are available within the indicated range but a prototyping phase might be conducted to finetune the internal design if the requested value has not been produced before. The S dielectric is a new RoHS compliant ceramic material. Please consult us.

XIII. Tuning Range

Initial Capacitance	1pF	2pF	5pF	10pF	20pF
Tuning range	1pF to 0.2pF	2pF to 0.5pF	5pF to 1pF	10pF to 2pF	20pF to 3pF

NB: the minimum value which can be reached without degradating too much the Q factor is around half the maximum value (initial capacitance), i.e. 2 or 3 laser runs maximum.

XIV. Tape and Reel

The following chart gives the number of components per reel.

Parts per Reel	L14	L15	L18	L41
MPQ	4'000	4'000	4'500	4'500