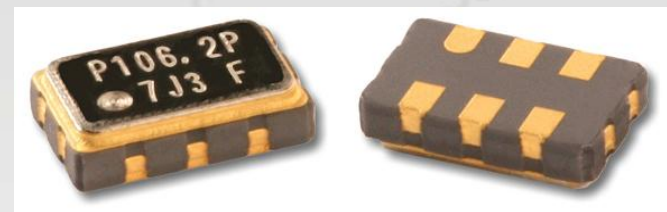


Pletronics, Inc.

Manufacturer of High Quality
Crystals and Oscillators

Company Introduction



Pletronics Inc.

Pletronics History

- 1979** **Founded** Pletronics Inc. in Washington USA
- 1981 Established a wholly Pletronics owned **factory in Korea**
- 1997 Achieved **ISO 9001**:1994 by BSI
- 2000 Sold the Korean factory. Moved to **contract manufacturing** (foundries)
- 2001 **Manufacturing** of PECL and LVDS oscillators **in Washington**, using discrete components on FR4 PCB
- 2002 Achieved ISO 9001:2000 by BSI
Developed high frequency **fundamental crystals**
- 2003 **Joint Ventures** in South Korea and China
- 2004 **Introduced Lower Cost** high frequency PECL and LVDS **oscillators** in 5x7 ceramic
- 2005 **First synthesized** PECL and LVDS oscillator 106.25MHz and 212.5MHz
- 2006 **Introduced** our line of synthesized PECL and LVDS (99 series)
- 2007 Joint ventures of the synthesized oscillators established
- 2008 Released Significant **new products for emerging technologies** such as femtocell
- 2009** **Developing processes** and initial pilot production of precision TCXOs
- 2010 Developing **OCXO replacement technology**
- 2011 Developing **LC oscillator technology** oscillators

Business Model

We offer a **complete solution for our customer's frequency control needs**.
Our goal is to be creative, flexible, and responsive to our customers' needs.

We are headquartered in Lynnwood, WA – where we **focus on design and product marketing**.
We outsource the manufacturing of our developed products to our contracted foundries, while maintaining supervision of the production processes.

What we do here:

Conduct research and development

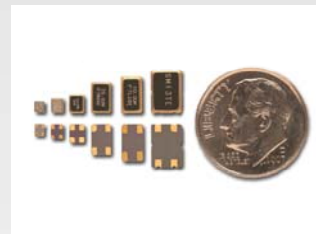
Monitor process control at the foundries

Perform final testing

Provide value-added services such as buffer stock, quick-turn samples, and programming

Customer Service and Sales

Example: Pletronics R&D center located in Lynnwood, designs Microcell/Femtocell/Picocell frequency control products. We have recently expanded our TCXO line and introduced OeXO's.



Pletronics Inc.

Diversification of Supply Chain Partners Ensures Timely Delivery

Pletronics uses multiple contracted or joint venture foundries for each product series. This allows Pletronics to maintain flexibility to react to supply chain issues.

Pletronics has multiple approved suppliers of the highest quality raw materials used in the production of our crystals and oscillators. This allows us to control the costs and quality of the raw materials used.

Pletronics is a Dynamic Supplier controlling every aspect from R&D to full production.

Allied Foundries

Locations

- Japan – 3 facilities
- Korea – 3 facilities
- China – 4 facilities
- Europe – 1 facility

Combined Capacity

- Total Oscillators
5.7M per month
- Total Crystals
20.0M per month



Pletronics Process Control

Diversification of Supply Chain

PLE has **maintained business relationships** with each contracting foundry in Japan, Korea, and China for 10-15 years; with joint venture agreements in place for specified projects.

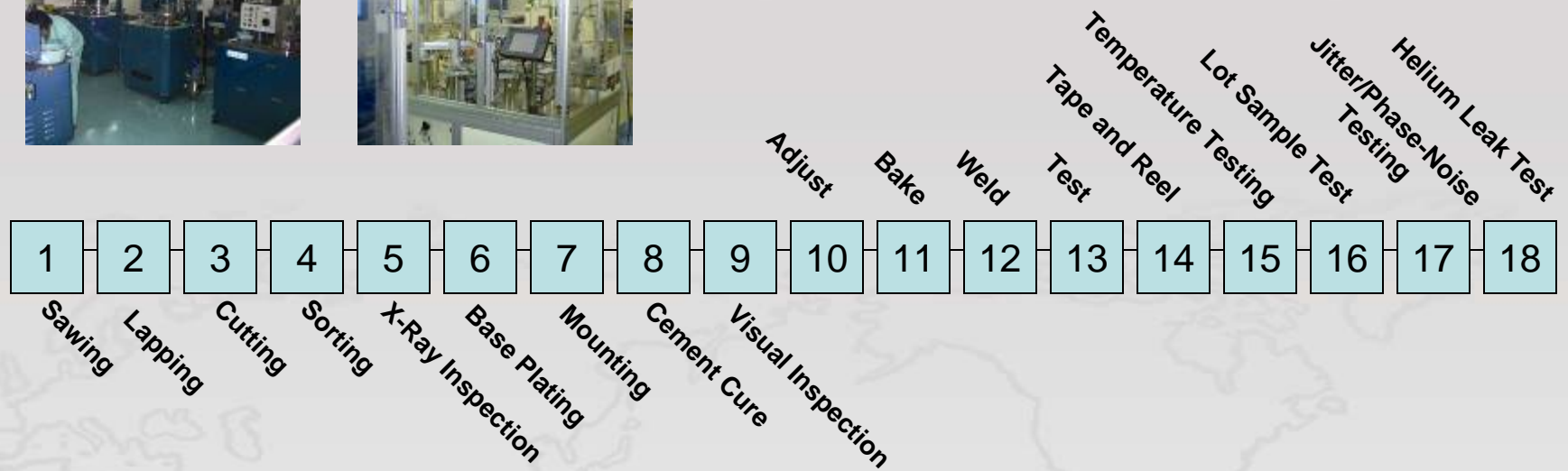
PLE engineering and purchasing staff are familiar with each foundry's history, business culture, capability, capacity, strength, & weakness.

PLE engineering and QA staff visit each foundry for audit and consultation at least two times per year.

Each lot received at PLE goes thru AQL test or 100% test in the incoming inspection.

The Pletronics Process

We control the process from design to finish product with ISO 9001 control documentation



Market Streams

Direct Customers (70%)

OEM – Original Equipment Manufacturer

CM – Contract Manufacturer

Distributors (30%)

Global

Regional

Pletronics Inc.

Product Portfolio

Watch Crystals

Microprocessor Crystals

Industrial Grade Crystals (extended temp)

Communication Grade Crystals (tight tolerance)

Clock Oscillators

VCXOs – Voltage Controlled Crystal Oscillators

TCXOs – Temperature Compensated Crystal Oscillators

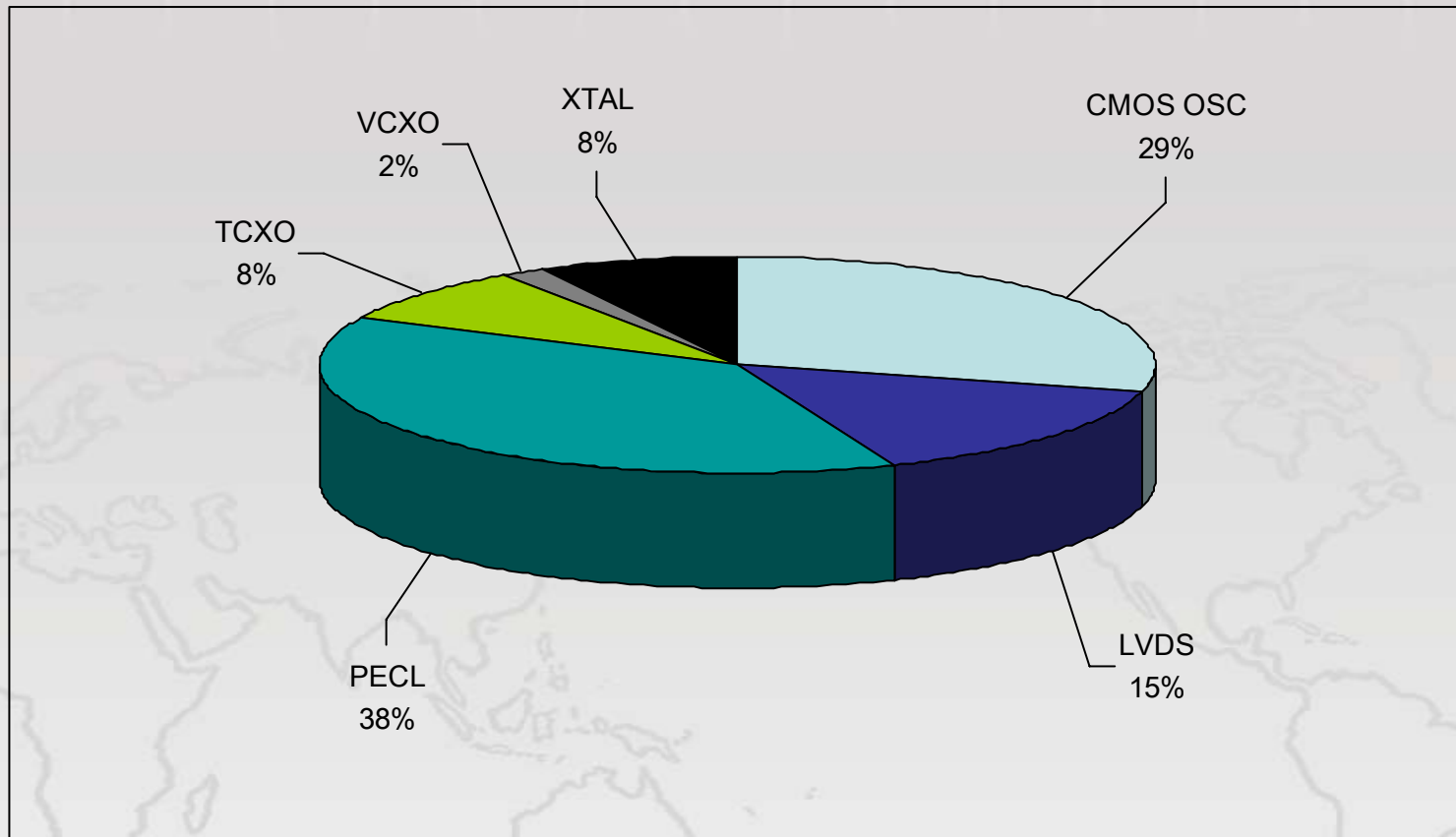
TCVCXOs – Temperature Compensated & Voltage Controlled Crystal Osc.

OCXOs – Oven Stabilized Crystal Oscillators

OeXO – OCXO Equivalent Crystal Oscillator

Pletronics Inc.

Sales by Product Type



Year 2010

Pletronics Inc.

RoHS Compliance

Additional reporting from Chinese Authorized Laboratory

**All ceramic packaged crystals and oscillators are
6.6 RoHS compliant from the inception.**

Revised datasheets show compliance statement, the interconnect codes and the moisture sensitivity level code.

Full reporting of all chemical constituents of the products is available on the Pletronics web site under **RoHS/WEEE.**

Compliance also includes **260°C for 10S reflow** processing for surface mount devices.

Pletronics Inc.

Markets

Consumer

- Cellular Phones
- Radio & Hi-fi Equipment
- Femtocell – wireless base station
- Set Top box and HD TV
- Digital Picture frames
- Video Camera
- Watches & Clocks
- Toys & Games
- Medical Equipment (limited)

Automotive

- Engine Controls (limited)
- Stereo, Clock
- Trip Computer, GPS

Networking

- Raid Storage
- SAN Storage
- Ethernet

Military

- Communications
- Navigation
- Radar
- Sensors

Industrial

- Communications
- Mobile/cellular/portable
- Radio, Telephone & Pager
- Aviation
- Marine
- Navigation
- Computers
- Digital Systems
- CRT Displays
- Disk Drives
- Modems
- Tagging/identification
- Utilities
- Smart Grid Metering
- Sensors

Research and Metrology

- Atomic Clocks
- Instruments
- Astronomy & Geodesy
- Space Tracking
- Celestial Navigation

Technology Road Map

TCXOs <0.28ppm over -40 to +85°C (5 x 7mm)	Available
TCXOs <0.5ppm over -30 to +85°C (3.2 x 5mm)	Available
TCXOs <0.5ppm over -30 to +85°C (2.5 x 3.2mm)	Available
TCXOs <0.5ppm extended temperature (2.0 x 2.5mm)	Available
OeXO (OCXO) Replacement Technology with TCXO (3.2 x 5mm) (5 x 7mm) (DIP/DIL package)	Available
TCXOs for Stratum 3 in 5 x 7mm package	Q2 2011
LC Technology to offer low end solution for standard CMOS logic product	Q3 2011

New Product Development

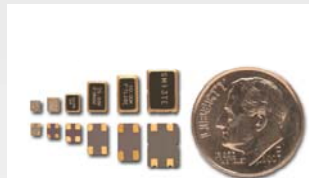
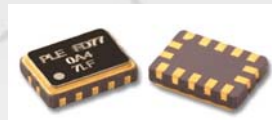
We strategize with our customers to anticipate industry needs.

We research competing technologies and provide customers with studies to show how our products are the better choice.

High precision OCXOs
High Precision TCXOs
Synthesized Oscillator with higher performance characteristics
Multi-output Oscillators
Smaller and smaller package sizes
Lower voltages to save power

Emerging and growing markets

Femtocell
Wireless Communication
Handsets
Broadband access
GPS
Test Equipment
Data Storage
High speed networking
Fiber Optics
Servers



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TCXO Features and Benefits

Tight stability

- Provides the frequency signal to operate DSPs, ADCs, and DACs.
- Good for Radio Frequency communications and GPS (Global Positioning System)

Meets miniaturization, lower profile demands

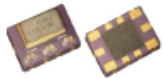



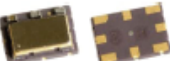
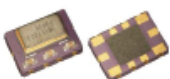
RoHS

Miniature CLCC version are ideal for pick and place and are reflow compatible.




Lowest power consumption for a precision frequency or timing signal.

The small sizes and low prices are not something that was available to customers 5 years ago...even just 1 year ago.

Pletronics TCXO series

Series	Features	Stability	Package Size
 THA4	8.0 MHz–52 MHz ♦ <u>CMOS</u> ♦ 2.7V–5.25V ♦ High Accuracy ♦ Optional VCXO function	± 0.3 ppm over -40° to $+85^{\circ}\text{C}$ ± 0.25 ppm over 0 to $+70^{\circ}\text{C}$ ± 0.1 ppm over $+20^{\circ}$ to $+60^{\circ}\text{C}$	5 x 7 mm
 TCF4	10 MHz–40 MHz ♦ <u>Clipped Sine</u> ♦ 2.5V–3.5V ♦ Smallest footprint ♦ Optional VCXO function	± 1.0 ppm over -30° to $+85^{\circ}\text{C}$	2.0 x 2.5 mm
 TCE4	10 MHz–40 MHz ♦ <u>Clipped Sine</u> ♦ 2.5V–3.5V ♦ Optional VCXO function	± 1.0 ppm over -30° to $+85^{\circ}\text{C}$	2.5 x 3.2 mm
 TCD4 *TCD4012 for Femtocell	10 MHz–26 MHz ♦ <u>Clipped Sine</u> ♦ 2.7V–3.5V ♦ Optional VCXO function	± 0.5 ppm over -30° to $+85^{\circ}\text{C}$	3.2 x 5 mm
 TCA4	10 MHz–26 MHz ♦ <u>Clipped Sine</u> ♦ 2.7V–5.25V ♦ Optional VCXO function	± 1.0 ppm over -40° to $+85^{\circ}\text{C}$	5 x 7 mm
 TBA4	8.0 MHz–52 MHz ♦ <u>Clipped Sine</u> ♦ 2.7V–5.25V ♦ High Accuracy ♦ Optional VCXO function	± 0.3 ppm over -40° to $+85^{\circ}\text{C}$ ± 0.25 ppm over 0 to $+70^{\circ}\text{C}$ ± 0.1 ppm over $+20^{\circ}$ to $+60^{\circ}\text{C}$	5 x 7 mm
Stratum III GR-1224-CORE Contact factory	♦ <u>CMOS</u> ♦ 3.3V	± 0.28 ppm over -40 to $+85^{\circ}\text{C}$ ± 4.6 ppm Overall	9 x 14 mm

OeXO Product Options

Series	Package Information	
OeM4	Full Size DIP/DIL Direct replacement for DIP/DIL OCXOs	
OeA4	5.0 x 7.0 mm	
OeD4	3.2 x 5.0 mm	

High Precision TCVCXO

Available Now!

5x7 Industry Compatible Footprint



Stability

Freq. stability: over temp -20 to 70°C +/- 0.5 ppm

Freq. stability: over temp -40 to 85°C +/- 1.0 ppm

Output Logic

Clipped Sinewave and CMOS

Current Draw

Clipped sign: 2.0ma typical @ 26 MHz 10K//10pf

CMOS: 3.5ma typical @ 26 MHz 15pf

Aging

1 ppm first year; 5 ppm per year thereafter

Pletronics Inc.

Pletronics Microcell/Femtocell/Picocell TCVCXO Oscillator

3.2x5mm LCC Ceramic package



Developed frequencies:

16.384MHz, 16.80MHz, 19.2MHz and 26.0MHz

Optional Control Voltage function

Clipped Sine Wave logic

Available at +/- .1ppm over 0 to +70°C

Performance similar to the simpler OCXOs

Contact factory for additional requirements

Methods of Realizing Higher Frequency Clock Signals

Pletronics

Crystal Oscillators (BAW) 3rd Overtone
Frequency synthesis methods

Others

Inverted Mesa quartz crystal oscillators
SAW oscillators
Crystal Oscillators with Multipliers

Low Cost Clock Oscillator

For applications needing wider tolerance (± 50 ppm or ± 100 ppm) clock oscillators with higher jitter, an LC based oscillator can be a low cost solution.

Standard CMOS semiconductor process

Standard IC assembly, can be assembled in an all plastic package

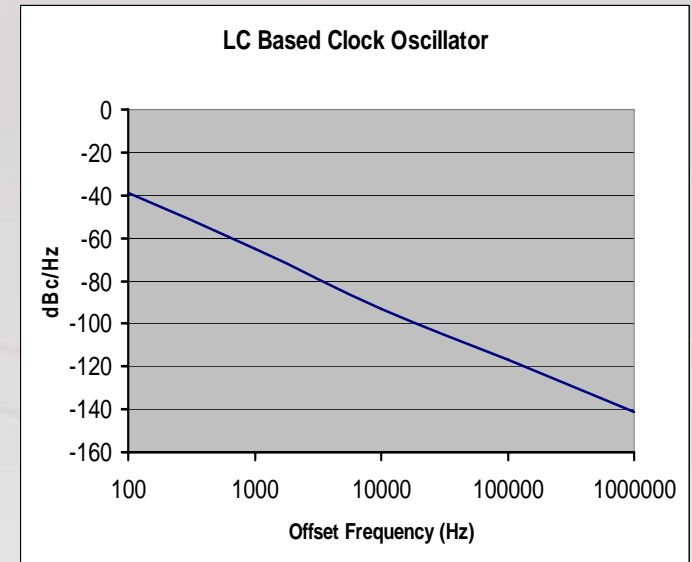
Can be made package compatible with quartz crystal based oscillators

Compensation of TC required

No frequency jumps or perturbation issues of quartz crystals

Phase noise better than a “programmable M/N” crystal clock above 10KHz offset

Can be spread spectrum enabled



Fundamental mode crystal based clock oscillator would be below -100dBc/Hz at 100Hz offset

Technology Summary

Device **sizes will continue to decrease**

The **frequencies will be increasing** to meet the demands of the digital semiconductors

More semiconductor content will occur to provide additional capabilities and functions

Supply voltages will continue to decrease, but 3.3V will be available in most applications to support analog circuits. 5V product is in decline. 2.5V and 1.8V are increasing used in new design.

The dominant frequency control devices will continue to be BAW and SAW quartz based devices. Ceramic resonators will have a place in low cost, lower frequency applications

The ceramic package will be most common, RoHS compliant, small size, rugged, low cost, etc.

More use of LVDS and PECL will occur, better for the distribution of precision clock signals

Pletronics Strengths

- Leader in cutting-edge oscillator technology
- Extensive product line
- All of our products are produced to and intended to promote the “Green” initiative
- Superb engineering and sales support
- User friendly website with over 3,000 hits per month
- Short lead times and competitive prices
- Global REP organization
- Comprehensive QA procedures

Pletronics Support Team

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