

Piezoelectric Crystals and Crystal Devices – Types, Materials, Applications, New Developments, Industry Structure and Global Markets

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Abstracts

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The markets for piezoelectric crystal products are characterized by price competition, rapid technological change, short product life cycles, and heightened global competition. Due to the increasing requirements for high-speed, high-frequency components as well as the entry of new competitors to the large market, there is intensified competition among existing crystal device suppliers.

The global piezoelectric crystal industry has gone through several boom-and-bust cycles. However, in the last five years, several applications have emerged for piezoelectric materials because of the new revolution in wireless and wire line communications. Markets have boomed in these areas especially for piezoelectric crystals. In addition, new developments in piezoelectric ceramics and ceramic/polymer composites have evolved new applications and markets. However, piezoelectric quartz crystals and crystal devices still hold a large market segment, and with the boom in the wireless industry, the average market growth rate reached double digits in the last five years.

STUDY GOAL AND OBJECTIVES

This study focuses on key piezoelectric crystal devices and provides data about the size and growth of the piezoelectric crystal devices markets, company profiles and industry trends. The goal of this report is to provide a detailed and comprehensive multi-client

study of the markets in North America, Europe, Japan, China, Korea and the rest of the world (ROW) for piezoelectric crystal devices, as well as potential business opportunities in the future. The report covers the global market, industry structure, competition, profiles of leading manufacturing companies, and a patent analysis.

The objectives include thorough coverage of underlying economic issues driving the piezoelectric crystal device business, as well as assessments of new, advanced piezoelectric crystal devices that are being developed. Another important objective is to provide realistic market data and forecasts for piezoelectric crystal devices. This study provides the most thorough and up-to-date assessment that can be found anywhere on the subject. The study also provides extensive quantification of the many important facets of worldwide market development in piezoelectric devices. This, in turn, contributes to a determination of the kinds of strategic responses companies may adopt in order to compete in these dynamic markets.

Users of piezoelectric crystal devices in developed markets must contend with twin pressures: to innovate and, at the same time, to reduce costs. New applications for piezoelectric crystal devices have been proposed in recent years. This study condenses all of these business related issues and opportunities.

This report has been prepared to:

provide an overview of the various piezoelectric quartz crystals and devices, and their production technologies and applications;

identify the technological and business issues related to the commercial applications of piezoelectric quartz crystals and crystal devices;

analyze the domestic and foreign competition among companies within each segment of the market for piezoelectric quartz crystals and devices;

determine the current size and future growth of the markets for piezoelectric quartz crystals and devices;

determine the current size and future growth of the markets for piezoelectric non-quartz single crystals;

ascertain which piezoelectric technologies and applications will be winners until

the year 2012;

identify and profile Japanese, European, North American, Chinese, Korean and “rest of world” producers and suppliers of piezoelectric crystals and crystal devices.

REASONS FOR DOING THE STUDY

The piezoelectric devices market is a diversified but attractive and still-growing multi-billion dollar market characterized by very high production volumes of a diversified range of piezoelectric devices that must be both extremely reliable and low in cost. Growth in the piezoelectric devices market continues to be driven by increasing demands in camera phones for autofocus mechanisms, piezo-transformers, energy harvesting devices, data storage, semiconductors, microelectronics production, precision mechanics, life science and medical technology, optics, photonics, nano-metrology, robots, toys, HVAC control systems, hand held consumer electronic devices, automotives sensors, ultrasonic transducers for medical imaging and non-destructive testing and vibration related applications, structure health monitoring, ultrasonic welding and cleaning, ceramic resonators for mobile phones and devices used for information and communication technologies.

The diversified piezoelectric crystal and crystal device business is complex and fast moving, with manufacturers increasingly adopting a truly global view of the market. Traditional piezoelectric devices have a broad customer base, and new applications have also emerging for these devices.

With this background of new emerging applications, iRAP felt a need to conduct a detailed study and update technology developments and markets. The report identifies and evaluates piezoelectric crystals and crystal devices and technologies which show potential growth.

CONTRIBUTIONS OF THE STUDY

Traditional piezoelectric crystal devices have a broad customer base, as frequency control devices and new applications such as sensors and optical devices are potential areas that have now entered the mainstream and are showing significant sales volumes. The diversified piezoelectric crystal device business is complex and fast moving, with manufacturers increasingly adopting a truly global view of the market. With

this background of new emerging technologies and applications, iRAP felt a need to conduct a detailed study and update technology developments and markets.

The study covers the markets, materials, synthesis and fabrication techniques, and new developments in piezoelectric crystals and crystal devices, current and emerging applications, and a market analysis. Current size and future growth of the markets are estimated for the period 2007 to 2012. The report analyzes the competitive environment within each of the market segments and applications. The report profiles all leading global suppliers of piezoelectric quartz and non-quartz crystals and crystal devices.

SCOPE AND FORMAT

Three market segments have been analyzed – frequency control devices (quartz crystals, crystal oscillators, crystal filters SAW devices); sensor devices (accelerometers, temperature sensors, pressure sensors, quartz crystal microbalances); and optical devices (optical low pass filters). In addition to these we have provided market numbers for cultured quartz crystals and lumbered bars.

The qualitative and quantitative judgments embodied in this report are a valuable contribution to the current knowledge of piezoelectric quartz crystals, crystal devices. Moreover, this study has been conducted at a vital stage of the quartz crystal device industry, as decisions are to be made by a number of companies on their future strategies of expansion and reorientation due to the shift from the military to the commercial market.

TO WHOM THE STUDY CATERS

The study will benefit the existing manufacturers of piezoelectric actuators, ultrasonic motors, sensors, transducers, transformers, resonators and micro- energy harvesting devices that seek to expand revenues and market opportunities by expanding and diversify in vast applications of devices.

This report is directed to various types of companies that are interested in the developments in this field, such as:

companies involved in the development, manufacturing and supplying of advanced materials;

companies involved in the development, manufacturing and supplying of electronic devices;

manufacturers of cultured quartz crystals and lumbered bars;

manufacturers and suppliers of piezoelectric elements and devices;

manufacturers of telecommunication equipment and cellular telephones;.

companies involved in smart materials, nanotechnology and MEMS devices;

manufacturers of advanced materials and electronic components interested in diversification;

venture capital companies, angel investors and financial institutions interested in new and attractive investments.

REPORT SUMMARY

The emergence of wireless communications and the increased need for data transmission using wireline communications has created a booming market for piezoelectric quartz crystals and crystal devices. Several new industrial and consumer applications have emerged, steering the industry from over-dependence on military demand to commercial applications.

In high bandwidth systems, data transfer needs to be synchronized, creating a high demand for timing products. Crystal devices provide the precise timing signals needed to ensure reliable data transfer at high speeds in applications ranging from notebook computers to network switches. As systems continue to grow in processing power and complexity, the demand for these products will accelerate. The demand for higher precision will also continue to increase as timing margins shrink in higher bandwidth systems. New high-end cell phone applications require low voltage, small packages and very low resistance to provide the highest fidelity sound. These mobile phones also offer functions beyond simple voice communication, including PDAs, digital still cameras and digital media players, with very low power consumption for extended battery life and increased need for coordination among functions.

The continuing increase in electronic sophistication, as well as the penetration and

proliferation of electronic products into new consumer and commercial applications, puts new demands on frequency control devices. This creates both technological challenges and new business opportunities for products offering faster speeds, higher stability relative to temperature, smaller surface-mountable packaging and lower unit cost.

In the 1980s, Japan was the world leader in mass-produced piezoelectric crystals and crystal devices. However, in the later part of the 1990s, the balance shifted, with China and Korea taking over the low-end products. Japan still supplies the expensive and high-end products. At present, Japan and Korea are supplying quartz devices for microprocessor products and extended temperature products. China is supplying large quantities of low end products for such application as toys and games.

Major findings of this report are:

The major findings of this report can be summarized as follows:

The global piezoelectric crystal industry is characterized by over 450 companies involved in the industry as manufacturers and suppliers.

The 2007 global market is expected to reach \$4.8 billion and will increase further to \$6.91 billion by the year 2012, with an annual average growth rate of 7.5%.

Among the seven market segments of piezoelectric crystal frequency control devices, telecommunication has the largest market share, as much as 30%, followed by consumer applications including video games, audio, visual and amusement (20%), computing (17%), military and government (10%), automotive (9%), industrial (8%), and medical (6%).

During 2007, crystal units (resonators) and filters shared 62% of the total market, followed by oscillators and real time clock modules (32%). Sensors and optical devices market shares are about 3% each.

Acoustic wave technologies account for 21.4% of the devices made from crystal wafers.

In 2007, Japan has the highest market share of 50%, followed by North America with 20%, Europe with 15%, China with 8%, and the rest of the world with 7%.

By 2012, China's share will be 11%, positioning it close to Europe with 13% share of the global market.

Contents

INTRODUCTION

Study Goals and Objectives
Contributions of the Study
Scope and Format
Methodology
Information Sources
Target Audience for the Study
Author's Credentials

EXECUTIVE SUMMARY

Summary Table Global Market Size and Share for Piezoelectric Crystal Devices by Product Type, 2007 and 2012
Summary Figure Global Market Size/percentage Share for Piezoelectric Crystal Devices by Product Type, 2007 and 2012

INDUSTRY OVERVIEW

Broad Category of Devices
Timing Devices
Sensing Devices
Optical Devices
Market Segments
Telecommunication
Military and Government
Automotive
Medical
Computing
Industrial
Consumer
Industry Structure
Table 1 Leading Manufacturers of Piezoelectric Crystals and Devices in North America
Table 1 Leading Manufacturers of Piezoelectric Crystals and Devices in North America (continued)
Table 2 Leading Manufacturers of Piezoelectric Crystals and Devices in Japan
Table 3 Leading Manufacturers of Piezoelectric Crystals and Devices in Europe

Table 4 Leading Manufacturers of Piezoelectric Crystals and Devices in the Rest of the World

TECHNOLOGY OVERVIEW

Piezoelectric Crystals

Table 5 Piezoelectric Crystal Materials and Their Properties

The Bravais-miller System

Figure 1 Illustration of Crystal Showing the B-M System

Orthogonal System

Figure 2 Cross-section of a Crystal Showing the Orthogonal System

Figure 3 Quartz Crystal Structure, I.e. Axes and Angles, and Principal Cuts

Crystal Types

Quartz

Factors Affecting Crystal Performance

CUT

Table 6 Recommended Element vs. Frequency Range

Figure 4 At-cut Quartz Crystal

Aging

Temperature Stability

Load Capacitance

Frequency Tolerance

Drive Level

Crystal Quality Factor (Q)

Fabrication Trends

Other Piezo-crystals

Table 7 Properties of Various Piezoelectric Crystals

Rochelle Salt

Tourmaline

Ammonium Dihydrogen Phosphate (ADP)

Lithium Niobate

Lithium Tantalate

Bismuth Germanium Oxide

Langasite

Berlinite

Zinc Oxide

Pmnt and Pznt

the Basic Process of Growing Cultured Quartz

Processing Into a Crystal Blank

Figure 5 Manufacturing Process of Crystal Blanks
Frequency Adjustment and Cleaning
Surface Acoustic Wave (saw) Technology
Surface Acoustic Wave (saw) Technology (continued)
Figure 6 Structural and Operational Principle of Surface Acoustic Wave Technology
Table 8 Explanation of Parameters Used in Surface Acoustic Wave (saw) Devices
Table 9 saw Materials
Surface Acoustic Wave (saw) Technology (continued)
Bulk Acoustic Wave (baw) Technology
Figure 7 Structural Principle of Bulk Acoustic Wave Technology
Piezoelectric Crystal Devices
Table 10 Commonly Used Crystal Frequencies
Table 10 Commonly Used Crystal Frequencies (continued)
Table 10 Commonly Used Crystal Frequencies (continued)
Definitions
Table 11 Explanation of Crystal Device Parameters
Table 11 Explanation of Crystal Device Parameters (continued)
Table 11 Explanation of Crystal Device Parameters (continued)
Table 11 Explanation of Crystal Device Parameters (continued)
Crystal Units (resonators)
Table 12 Comparison of Crystal Resonators
Figure 8 Electrical Equivalent Circuit of Piezoelectric Crystal
khz Tuning Forks
Table 13 Typical Frequency Standard of Crystals Units Used in Crystal Watches
(frequency-32.768 Khz)
MHZ Crystals – At
Figure 9 Manufacturing Process of Crystal Resonators
Types of Seals for Quartz Crystal Resonators
Three key Properties of Quartz Resonators
saw Resonators
Figure 10 Constructional Principle of saw Resonator
Applications
Oscillators
XO
TCXO
VCXO
OCXO
Rubidium Atomic Oscillators
Cesium Atomic Oscillators

Hydrogen Maser Atomic Oscillators

Figure 11 Constructional Principle of Atomic Frequency Oscillators

Table 14 Hierarchy of Oscillators

Real Time Clocks (RTCS)

Filters

Monolithic Crystal Filter (MCF)

Saw Filters

Figure 12 Construction Principle of saw Filters

Figure 13 Comparison of SAW Bandpass Filters With Dielectric Resonators and LC Multilayer Filters

Table 15 Comparison of SAW Band Pass Filter With Quartz and Other Technologies
SAW Filters (continued)

Figure 14 Band Pass Filter Specification Parameters

Table 16 Typical Space Requirements of Piezo Crystal Devices/SAW in Mobile Phones

Table 16 Typical Space Requirements of Piezo Crystal Devices/SAW in Mobile Phones (continued)

Piezo-crystal Sensors

Table 17 Explanation of Terminologies Related to Surface Acoustic Wave (SAW) Sensors

Table 18 Comparison of Acoustic Sensors

Figure 15 Piezocrystal Cuts for Sensor Applications

Accelerometers/gyros

Table 19 Explanation of Parameters Used in Piezo-crystal Accelerator

Table 19 Explanation of Parameters Used in Piezo-crystal Accelerator (continued)

Temperature Sensors

Pressure Sensors

Quartz Crystal Microbalances

Torque Sensors

Mass Sensors

DEW Point/humidity Sensors

Vapor Chemical Sensors

Surface Transverse Wave (STW) Sensors

Figure 16 Comparison of SAW and STW Technologies

Piezo-crystal Optical Devices

Optical low Pass Filters (olpf) and Other Devices

Table 20 Explanation of Technical Parameters Related to Piezo-crystal Optical Devices

Table 20 Explanation of Technical Parameters Related to Piezo-crystal Optical Devices (continued)

Table 20 Explanation of Technical Parameters Related to Piezo-crystal Optical Devices

(continued)

Figure 17 Acousto-optic Modulator

new Developments and Trends in Piezo-crystals

new Developments and Trends in Piezo-crystals (continued)

Ceramic Packaging

Chip-scale Packaging (CSP)

Composite Filter

Future Endeavors

MARKET ANALYSIS

Table 21 Global Market Size/percentage Share for Piezoelectric Crystal Devices by Product Segment, 2007 and 2012

Table 22 Market of Piezo-crystal Devices by Product Category

Figure 18 Market of Piezo-crystals Devices by Products

Figure 19 Global Market Size/percentage Share for Piezoelectric Crystal Devices by Product Type, 2007 and 2012

Market by Function

Timing Device Market

Sensor Market

Optical Device Market

Market by Product Type

Piezo-crystal Resonators Market

Table 23 Market for Piezo-crystal Resonators, 2007-2012

Piezo-crystal Oscillators Market

Table 24 Market for Piezo-crystal Oscillators, 2007-2012

Piezo-crystal Real Time Clock Market

Table 25 Market for Piezo-crystal Real Time Clock Modules, 2007-2012

Piezo-crystal Filters Market

Table 26 Market for Piezo-crystal Filters, 2007-2012

Piezo-crystal Accelerators and Sensors Market

Table 27 Market for Piezo-crystal Accelerators and Sensors, 2007-2012

Piezo-crystal Optical Devices Market

Table 28 Market for Piezo-crystal Optical Devices, 2007-2012

Market by Material Types and Technology

Table 29 Market for Piezo-crystal Devices Adopting Acoustic Wave Technology by Preference for Wafer Materials Used in 2007 and Forecast use Through 2012

Market by Material Types and Technology (continued)

Market by Material Types and Technology (continued)

Table 30 Market for Piezo-crystal Devices Using Conventional Technology by Preference of Materials Used in 2007 and Forecast for 2012

Table 31 Global Market of Piezo-crystal Devices by Material Used (SAW Process + Conventional Process), 2007 & Forecast for 2012

Figure 20 Global Market of Piezo-crystal Devices by Material Used (SAW Process and Conventional Process), 2007 & Forecast for 2012

Market Trends

Market Dynamics

Drivers for Crystal-based Devices

SAW Resonators

Oscillators

Crystal Oscillator-xo

Voltage Controlled Oscillator

Temperature Compensated Crystal Oscillator-tcxo

Oven Controlled Crystal Oscillator-ocxo

Small Atomic Frequency Standard-rb-oscillators

Real Time Clock Modules

Filters

Monolithic Crystal Filter (mcf)

Surface Acoustic Wave (SAW) Filters

Surface Acoustic Wave (SAW) Filters (continued)

Sensors

Accelerometers/gyros

Temperature Sensing

Pressure Sensing

Quartz Crystal Microbalance (qcm) Products

Other Sensors

Optical Devices

Market by Application

Table 32 Breakup of Piezoelectric Crystal Frequency Devices by Application, 2007 and 2012

Figure 21 Breakup of Piezoelectric Crystal Frequency Devices by Application, 2007 and 2012

Telecommunications Applications

Telecommunications Applications (continued)

Telecommunications Applications (continued)

Telecommunications Applications (continued)

Industrial Applications

Industrial Applications (continued)

Medical Applications

Automotive Applications

Computing Applications

Consumer Applications

Consumer Applications (continued)

Military and Government Applications

Military and Government Applications (continued)

Market by Region

Table 33 Global Market Size/percentage Share for Piezoelectric Crystal Devices by Region, 2007 and 2012

Figure 22 Global Market Size/percentage Share for Piezoelectric Crystal Devices by Region, 2007 and 2012

Market by Region (continued)

INDUSTRY STRUCTURE

Competition

Table 34 top Companies Sharing the Global Market for Piezo-crystal Based Devices Through 2007

Competition (continued)

Table 35 Piezo-crystal Material (wafers and Crystals) top Suppliers Product Line Reference

Table 35 Piezo-crystal Material (wafers and Crystals) top Suppliers Product Line Reference (continued)

Mergers and Acquisitions

Table 36 Acquisition Deals Among Manufacturers of Piezoelectric Devices From 2000 to 2007

Mergers and Acquisitions (continued)

Table 37 Piezo-crystal Devices Suppliers Product Line Reference

Table 37 Piezo-crystal Devices Suppliers Product Line Reference (continued)

Table 37 Piezo-crystal Devices Suppliers Product Line Reference (continued)

PATENTS AND PATENT ANALYSIS

Patent Analysis

Existing Patent Portfolios Covering Technologies Associated With Piezo-crystal Devices Focus Primarily on Materials Used, Design, Construction, Assembly, Testing and Performance Characteristics. the Timeframe for Evaluation Covers January 2003 Through November 2007. Table 38 Provides the Number of U.s. Patents Issued to Each

of 18 Companies Over the Five-year Period. These are Further Illustrated in Figures 23 and 24.

Table 38 Number of US Patents Granted to Eighteen Companies Manufacturing Piezo-crystal Devices, 2003 Through November 2007

Figure 23 First Nine Companies by Number of Patents Granted for Piezo-crystal Devices, Jan. 2003 to Nov. 2007

Figure 24 Remaining Companies by Number of Patents Granted for Piezoelectric Devices, Jan. 2003 to Nov. 2007

International Overview of U.S. Patent Activity in Piezo-crystal Devices

Table 39 US Patents Granted by Assigned Country/region for Piezo-crystal Devices From Jan. 2003 to Nov. 2007

International Overview of U.S. Patent Activity in Piezo-crystal Devices (continued)

COMPANY PROFILES

Abracon Corporation.

Advanced Crystal Technology

AEL Crystals,usa

Bliley Technologies, Inc.

Citizen Component Sales Division

Colorado Crystal Corporation

Connor-winfield Corporation

Cradley Crystal, Russia

Croven Crystals

Crystal Technology, Inc.

CTS Corporation

Daishinku Corp (KDS)

Ecliptek Corporation

ECS International

Epcos Ag

Epson Toyocom

Euroquartz Limited

Fomos-materials

fox Electronics (U.S.)

Fujitsu Media Devices Limited

Frequency Electronics, Inc.

H. C. Jauch, Germany (same as Jauch.de)

H.ELE., Taiwan

Hoffman Materials, Inc.

Ilsi America
International Crystal Manufacturing
Kristall-russia
kvg Quartz Crystal Technology GMBH
Kyocera Keinski
Magic Xtal Ltd
Matsushita Electronic Components Co., Ltd.
Mercury United Electronics, Inc
Micro Crystal
Morion Inc.
mmd Components
mmc Electronics America
Mti-milliren Technologies Inc.
Murata Manufacturing Co., Ltd.
Mtronpti
International Division
NDK
NEC Corporation
OKI Systems (UK) Ltd
Oscilloquartz SA
Pericom
Phonon Incorporated
Quartzdyne Inc.
Quartex
Roditi International Corporation Ltd.
Rakon LTD
Rami Technology Group
RF Monolithics, USA
River Electronics (Singapore) PTE.ltd.
Samsung Electro-mechanics
SAWyer Technical Materials, LLC
Shenzhen Jingyuan Precision Frequency Device Corp. LTD
Shin-ETSU Chemical Co., ltd
Shenzhen Crystal Technology Industrial Co.,LTD.
Siward International, Inc.
Tai-SAW Technology Co., Ltd.
Taitien Electronics Co., Ltd.
Temex SAS
TXC Taiwan

TEW

Valpey-fisher Corporation

Vectron International

Vishay Intertechnology, Inc.

Wenzel Associates, Inc.

Wilcoxon Research, Inc.

Xeco Inc.

APPENDIX I - SPECIFICS OF SELECTED KEY IEEE NETWORKS

Table 40 Summary of the Specifics of Selected key IEEE Wireless LAN (Local Area Network), MANs (Metropolitan Area Network), and PANS (Personal Area Network)

Table 40 Summary of the Specifics of Selected key IEEE Wireless LAN, MANs, and PANS (continued)

Table 40 Summary of the Specifics of Selected key IEEE Wireless LAN, MANs, and PANS (continued)

Table 40 Summary of the Specifics of Selected key IEEE Wireless LAN, MANs, and PANS (continued)

APPENDIX II – FREQUENCY SPECTRUM ALLOCATION IN PROTOCOLS

Table 41 Frequency Spectrum Allocation in Zigbee/Bluetooth/Wi-Fi Protocols

Table 41 Frequency Spectrum Allocation in Zigbee/Bluetooth/Wi-Fi Protocols (continued)

APPENDIX III – TERMS USED IN WIRELESS COMMUNICATION

Table 42 Explanation of Terms Used in Wireless Communication

Table 42 Explanation of Terms Used in Wireless Communication (continued)

Table 42 Explanation of Terms Used in Wireless Communication (continued)

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