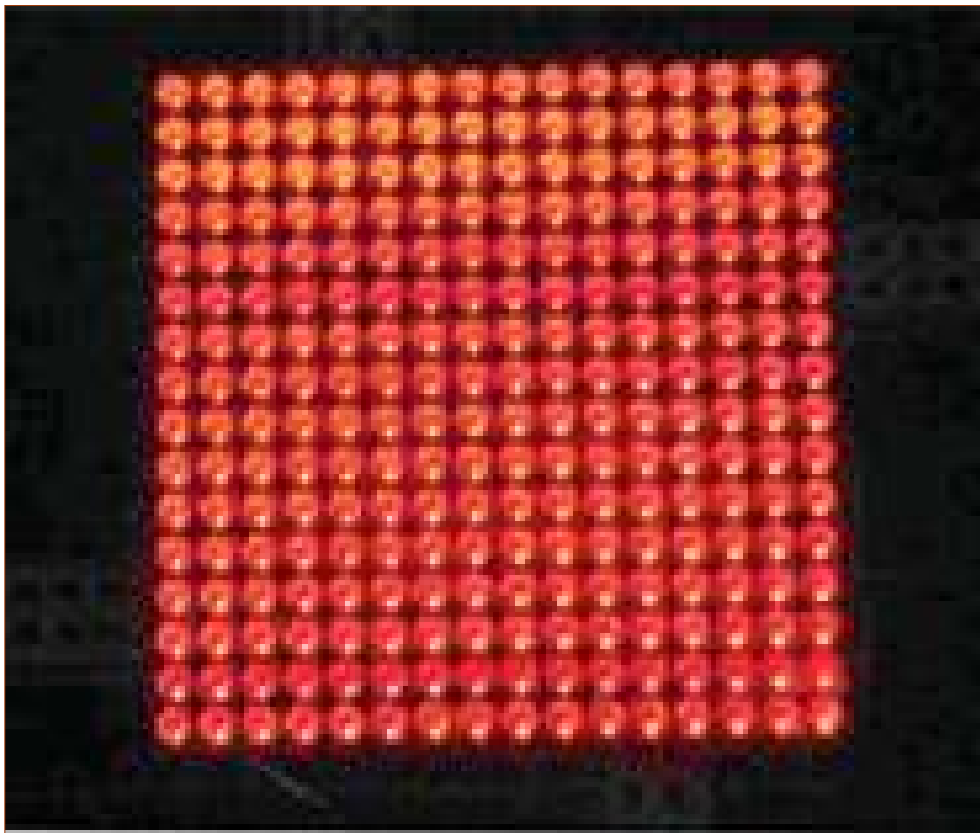


## Announcement from ElectroniCast Consultants

# LEDs Used in Test/Measurement, Medical & Other Science Devices

## Market Forecast and Analysis 2018-2028



Date: April 4, 2019





## LEDs Used in Test/Measurement, Medical & Other Science Devices Market Forecast and Analysis 2018-2028

Published: April 4, 2019  
Text Pages: 289 pages – PDF  
Also Included: Excel worksheets and PowerPoint slides Files  
Fee: \$4,240

### One-Fee Policy

All employees of the client company/organization may use this report, worldwide at the consultant service subscription fee shown above.

### **10-Year Market Forecast**

This market forecast report, which is available immediately, is part of a consultant service from ElectroniCast Consultants to our clients. This 2018-2028 market estimate and forecast is presented for our extensive study of the worldwide use of packaged Light Emitting Diodes (LEDs) in Test/ Measurement, Medical and other Science Devices.

The market data are segmented into the following geographic regions, plus a Global summary:

- North, Central and South America (America)
- Europe, plus Middle Eastern and African countries (EMEA)
- Asia Pacific (APAC)

The LED market is segmented into the following sub-application categories:

- Sensing/Detection and Analytical/Monitoring
- Photo-therapy/Sanitation/Cell Regeneration/Curing
- Instrumentation Light Source and Imaging

The market data for are also segmented by the following colors (type):

- Red
- Green
- Blue
- White
- Multiple Color/Multiple Chip
- UV and Other

**LED Level Quantified in the ElectroniCast Study** Below, are four levels (or “food chain”) of LEDs. For the purposes of this ElectroniCast study, we quantify and provide a market forecast for “Level 2”

Level 1 - The chip or die

**Level 2 - The Packaged LED Chip(s)**

Level 3 – LED module / LED Lamp

Level 4 - LED luminaire (light fixture/light fitting with LED module/lamp)

This report provides the market data by the following functions:

- Consumption Value (US\$, million)
- Quantity (number/units)
- Average Selling Prices (ASP \$, each)

The value is determined by multiplying the number of units by the average selling price (ASP). The ASPs are based on the price of the packaged LED at the initial factory level. The value is then based on the end-use application and the end-use region.

**Microsoft Excel- Data Base Structure** At each database level, the ElectroniCast estimates and forecast for packaged LEDs is built from the bottom up, segmented by color-type, arranged in a hierarchy, of the end-user types (applications) that use devices that the LEDs are used in, and arranged in a hierarchy and summed upward. The estimates and forecast for each LED color-type in each region is in terms of quantity (unit/each), value (US\$ Million) and average selling price.

**Excel File Facts –**

Number of Market Forecast Data Tables: 38

Number of Spreadsheets (Excel Worksheets) 4

*One for each region, plus the global summary*

**Number of Data Cells** 3,964

*924 data cells per worksheet x 4 worksheets*

Plus: 7- Bar Charts (Data Figures)

**Announcement – LEDs Used in Test/Measurement, Medical & Other Science Devices Market Forecast  
April 2019**  
**ElectroniCast Consultants**

**SAMPLE**  
Excel Worksheet (2018-2028)  
ElectroniCast Market Forecast

CATEGORY NAME	FUNCTION	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	AVERAGE ANNUAL GROWTH RATE, %		
													2018-23	2023-28	
TOTAL CONSUMPTION	Value, \$ Million Quantity, Million ASP, \$, Each														
Red	Value, \$ Million Quantity, Million ASP, \$, Each														
Green	Value, \$ Million Quantity, Million ASP, \$, Each														
Blue	Value, \$ Million Quantity, Million ASP, \$, Each														
White	Value, \$ Million Quantity, Million ASP, \$, Each														
Multi-Color/Chip	Value, \$ Million Quantity, Million ASP, \$, Each														
UV and Other	Value, \$ Million Quantity, Million ASP, \$, Each														

**SAMPLE**  
Excel Data Table (2018-2028)  
ElectroniCast Market Forecast

End-User Group (Application)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Average Annual Growth Rate, %		
												2018-23	2023-28	
Sensing/Detection & Analytical/Monitoring Phototherapy/Sanitation/Cell Regeneration Instrumentation Light Source and Imaging														
Total Consumption (\$ Million)														

NOTE: Totals may not be exact, due to rounding LED-Medical/Science ElectroniCast Consultants

## **Information Base for the Market Forecast**

**Primary Research** This study is based on analysis of information obtained continually over the past several years, but updated through the end of March 2019. During this period, ElectroniCast analysts performed interviews with authoritative and selected representative individuals in the following sectors relative to the use of LEDs: medical, science, bio-photonic, display industry, test/measurement, instrumentation, R&D, university, military defense/space and government. The interviews were conducted principally with:

- Engineers, marketing personnel and management at manufacturers of LED test/measurement & medical science equipment/devices and related equipment, as well as other technologies
- Design group leaders, engineers, marketing personnel and market planners at major users and potential users of LEDs and test/measurement & medical and other science equipment/devices
- Other industry experts, including those focused on standards activities, trade associations, and investments.

The interviews covered issues of technology, R&D support, pricing, contract size, reliability, documentation, installation/maintenance crafts, standards, supplier competition and other topics.

**Analysis** The analyst then considered customer expectations of near term growth in their application, plus forecasted economic payback of investment, technology trends and changes in government regulations in each geographical region, to derive estimated growth rates of quantity and price of each product subset in each application. These forecasted growth rates are combined with the estimated baseline data to obtain the long-range forecasts at the lowest detailed level of each product and application.

**Secondary Research** A full review of published information was also performed to supplement information obtained through our interviews. The following sources were reviewed:

- Professional technical journals, papers and conference proceedings
- Trade press articles
- Company profile and financial information; Product literature
- Additional information based on previous ElectroniCast market studies
- Personal knowledge of the research team

In analyzing and forecasting the complexities of geographical regional markets, it is essential that the market research team have a good and a deep understanding of the technology and of the industry. ElectroniCast members who participated in this report were qualified.

Bottom-up Methodology ElectroniCast forecasts, as illustrated in the forecast data structure, are developed initially at the lowest detail level, then summed to successively higher levels. The background market research focuses on the amount of each type of product used in each application in the base year (last year = 2017), and the prices paid at the first transaction from the manufacturer. This forms the base year data. ElectroniCast analysts then forecast the growth rates in component quantity use in each application, along with price trends, based on competitive, economic and technology forecast trends, and apply these to derive long term forecasts at the lowest application levels. The usage growth rate forecasts depend heavily on analysis of overall end user trends applicable products/applications and equipment usage and economic payback.

Cross-Correlation Increases Accuracy The quantities of packaged LEDs, LED Driver ICs, LED materials/wafer/die/chips, LED Lamps and LED fixtures (luminaries) and other LED-based components, manufacturing processes/quality control/yields, and end-use products used in a particular application are interrelated. Since ElectroniCast conducts annual analysis and forecast updates in each LED component field, accurate current quantity estimates are part of the corporate database. These quantities are cross-correlated as a "sanity check".

ElectroniCast, each year since 2002, has conducted extensive research and updated their forecasts of several LED lighting categories. As technology and applications have advanced, the number of component subsets covered by the forecasts has expanded impressively.

The calculation and analysis data spreadsheet technique is based upon input/output analysis, leveraging the quantitative consumption quantity, price and value of each item in each application at all levels to achieve reasonable quantitative conclusions; this interactive analysis concept, first applied on a major scale by Leonteff, of the US Department of Commerce, in the mid 1950s, was then adopted successfully by analyst/forecasting firms Quantum Science, Gnostic Concepts and (in 1981) by ElectroniCast

### About ElectroniCast

ElectroniCast, founded in 1981, specializes in forecasting technology and global market trends in fiber optics communication components and devices, as well providing market data on light emitting diodes used in lighting.

As an independent consultancy we offer multi-client and custom market research studies to the world's leading companies based on comprehensive, in- depth analysis of quantitative and qualitative factors. This includes technology forecasting, markets and applications forecasting, strategic planning, competitive analysis, customer-satisfaction surveys and marketing/sales consultation. ElectroniCast, founded as a technology-based independent consulting firm, meets the information needs of the investment community, industry planners and related suppliers.

### Proprietary Statement

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### One-Fee Policy

All employees of the client company/organization may use this report, worldwide at the consultant service subscription fee shown in the front pages of this announcement.

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Market Forecast and Analysis (2018-2028)  
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**Addendum –**

- Microsoft Excel - Data Base Spreadsheets (Global Market Forecast); Detailed Data:
  - Average Selling Price, per unit (\$, each)
  - Quantity (Million)
  - Value (\$, Million)



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## **Companies/Organizations Credited or Mentioned in this report:**

### Chapter 1.2

Nitride Semiconductors Company Limited  
Institute of Semiconductors, Chinese Academy of Sciences (China)  
Nichia Corporation  
Samsung / Samsung Electronics Co., Ltd  
Murata  
Tecco Group Ltd  
ProPhotonix  
Luminus Devices, Incorporated  
Electronics Maker (Magazine)  
Shine Technologies Ltd – Shine ®  
LED News  
Cree, Incorporated

### Chapter 1.3

OKSolar.com  
LEDtronics, Incorporated

### Chapter 1.4

DARPA (Defense Advanced Research Projects Agency)  
ANAB (ANSI National Accreditation Board)  
International Aerospace Quality Group (IAQG)  
Americas Aerospace Quality Group (AAQG)  
Defense Contract Audit Agency - (DCAA)  
DOD (Defense Department-United States)  
Department of State (United States)  
Department of Commerce (United States)  
Treasury Department (United States)  
Department of Justice (United States)  
Department of Commerce (United States)  
Department of Energy (United States)  
Department of Homeland Security (United States)  
Census Bureau (United States)

### Chapter 2.2

Royal Society of Chemistry  
Thermo Fisher Scientific  
Azure Biosystems, Inc.  
SCHOTT AG Lighting and Imaging  
US National Library of Medicine National Institutes of Health  
HercepTest™ (an Agilent Technologies Company)  
Food and Drug Administration (FDA) – United States  
American Society of Clinical Oncology (ASCO)  
Joint Commission of Healthcare Organizations  
CE label (Consumer electronics or Council of the European Union)  
Skyla (LITE-ON Technology Corporation)  
Polish Academy of Sciences, Institute of Low Temperatures and Structural Research

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### Chapter 2.2 - Continued

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Queensland Micro- and Nanotechnology Centre & School of Engineering, Griffith University  
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CSIRO Materials Science and Engineering  
Osram Opto Semiconductors  
Sensors and Actuators B: Chemical  
Laboratory for Gas Sensors, Department of Microsystems Engineering, University of Freiburg, Germany  
Fraunhofer Institute for Physical Measurement Techniques (IPM), Freiburg, Germany  
LeddarTech Inc. (Leddar™)  
Integrated Device Technology, Inc. (IDT)  
University of Central Florida  
Fuels, Engines and Emissions Research Center, Oak Ridge National Laboratory  
Faculty of Electrical Engineering, University of Montenegro  
School of Engineering and Built Environment, Glasgow Caledonian University  
Hikari Tec/Miura-ori Lab.  
Ritsumeikan University, Faculty of Engineering Science  
Ritsumeikan University, Global Innovation Research Organization  
Tokyo Metropolitan Industrial Technology Research Institute  
HexaTech  
One Hour Heating & Air Conditioning  
Dublin City University (DCU)  
Edgewood Chemical and Biological Center (ECBC)  
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Atom  
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GE Medical  
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Philips  
Spacelabs  
ZollSyngene (A Division of Synoptics Ltd)  
Masimo Corporation  
Department of Analytical Chemistry Faculty of Sciences, Campus Fuentenuev, University of Granada  
CLARITY: Centre for Sensor Web Technologies  
National Centre for Sensor Research, Dublin  
Department of Chemistry, Biotechnology, and Chemical Engineering - Kagoshima University  
China Agricultural University  
Department of Electro-Optical Engineering, National Taipei University of Technology  
Department of Chemistry, University of Warsaw  
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### Chapter 2.2 - Continued

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National Science Foundation (United States)  
SRU Biosystems  
University of Illinois - Center for Microanalysis of Materials  
US Department of Energy  
Marshall Space Flight Center, Alabama  
Greatbatch Ltd (Biophan) Technologies Inc  
Imperial College London  
Karlstad University  
College of Chemistry and College of Chemical Engineering, Sichuan University, PR China  
HyperQuan, Inc.  
Analog Devices Inc (ADI)  
Chrontel, Inc.  
Redmere Technology Ltd.  
University of Warsaw, Department of Chemistry  
Department of Chemistry, National University of Singapore  
Oak Ridge National Laboratory  
Dalian Institute of Chemical Physics, Chinese Academy of Sciences  
Department of Applied Chemistry, Graduate School of Engineering, Tokyo Metropolitan University  
Department of Physics, Harbin Institute of Technology, Science and Technology Park, Harbin, China  
Department of Chemistry, National Taiwan Normal University  
LED Medical Diagnostics Inc.  
McGill University in Montreal, Canada  
Oral Cancer Foundation  
LED Medical Diagnostics Inc.  
UCLA Henry Samueli School of Engineering and Applied Science  
U.S. Department of Veterans Affairs (National Center for PTSD)  
University of Texas at Arlington  
Ultradent Products Inc.  
Excelitas Technologies Corporation  
allnex group  
Nikkiso Giken Co., Ltd.  
AP Technologies Ltd  
Sensor Electronic Technology, inc. (SETi)  
LG Innotek  
Bavarian Ministry for Economic Affairs, Media, Energy and Technology  
Osram Opto Semiconductors  
aprotec GmbH  
SCHOTT AG in Landshut  
University of Minnesota's Lillehei Heart Institute  
University of Bristol (Aquatest Research Program); Bill & Melinda Gates Foundation  
World Health Organization  
Garrett Corporation, Air Research Division  
Carefree Clearwater, Ltd  
National Oceanic and Atmospheric Administration  
Plaza Hotel in Auckland  
Wallops Flight Facility  
Aquionics - Halma Holdings, Inc  
Asahi Kasei Group (Crystal IS)

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### Chapter 2.2 - Continued

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Department of Obstetrics and Gynecology - Tel-Aviv University  
Krupa Electro Device  
Microdermabrasion Machines  
Virtual Beauty Corporation  
United States Navy Sea, Air, and Land Teams (Navy SEALs)  
US National Library of Medicine  
National Institute of Mental Health  
Lighting Science (Rhode Island, USA)  
Infineon Technologies AG  
Mount Sinai Hospital  
National Center for Advancing Translational Sciences (NCATS) - (US) National Institutes of Health (NIH)  
Commission for Occupational Health and Safety and Standardization (KAN) – Germany  
Delos Living LLC  
International WELL Building Institute (IWBI)  
Green Business Certification Inc. (GBCI) - Energy and Environmental Design (LEED) program  
Lumenia – Slovenija  
SRAM Innovation  
Environmental Protection Agency (EPA) – USA  
OSRAM Innovation  
University of Twente VU - Amsterdam  
CBRE Group Inc.  
National Institute of General Medical Sciences (USA)  
Regiolux GmbH  
Lighting Research Center (LRC)  
Alphabet Lighting, Inc.  
Smile Brilliant Ventures, Inc.  
U.S. Food and Drug Administration (FDA)  
Medical College of Wisconsin  
Naval Special Warfare Command, Submarine Squadron ELEVEN - USS Salt Lake City  
Quantum Devices, Inc (QDI)  
Wisconsin Center for Space Automation and Robotics (WCSAR) - University of Wisconsin-Madison (NASA)  
Medical College of Wisconsin  
Roswell Park Cancer Institute in Buffalo, New York  
Rush-Presbyterian-St. Lukes Medical Center in Chicago  
Instituto de Oncologia Pediatrica in Sao Paulo, Brazil  
Instituto de Física de São Carlos, Universidade de São Paulo, São Carlos, SP, Brazil  
Mayo Clinic  
Light4Tech  
University of Minnesota - Lillehei Heart Institute  
Boston VA – (US) Army's Advanced Medical Technology Initiative  
LumiThera Inc.  
National Institute of Health (NIH) - National Eye Institute (NEI)  
U.S. Department of Veterans Affairs  
Army Research Institute of Environmental Medicine  
Boston University School of Medicine (BUSM)  
Photomedex  
Vielight  
MedX Health  
Ivoclar Vivadent AG

## **Companies/Organizations Credited or Mentioned in this report - Continued**

### Chapter 2.2 - Continued

Carl Zeiss MicroImaging Inc  
Radiant Vision Systems, LLC  
CoolLED (UK)  
Photon Systems Instruments  
Haag-Streit USA  
Qubit Systems Incorporated  
Titan Tool Supply Inc.  
Omicron  
Opticology, Inc.  
Stanford University  
Korea Advanced Institute of Science and Technology (KAIST)  
International Electrotechnical Commission (IEC)  
Surgiris  
STERIS plc.  
Striker  
S.I.M.E.O.N. Medical GmbH & Co. KG  
Medical Illumination International  
Burton Medical LLC (Philips Burton)  
Cool View (Hawkeye Distributing, LLC)  
Division of Electron Microscopic Research, Korea Basic Science Institute  
Firefly Institute, Culture and Tourism Division (Korea)  
Division of Physical Metrology, Korea Research Institute of Standards and Science (Korea)  
Department of Bio and Brain Engineering and KAIST Institute for Optical Science and Technology (Korea)  
Nagoya University (Japan)  
World Health Organization (WHO)