The World of IXYS

PRODUCT OVERVIEW FOR MEDICAL APPLICATIONS

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www.IXYS.com
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Since its founding in Silicon Valley, IXYS Corporation has been developing technology-driven products to improve energy conversion efficiency, generate clean energy, improve automation, and provide advanced products for the transportation, medical and telecommunications industries. IXYS, with its subsidiaries, is a worldwide pioneer in the development of power semiconductors, solid state relays, high voltage integrated circuits (HVIC), and microcontrollers that are necessary in reducing energy costs and consumption by optimizing the energy efficiency of everyday products. With an end customer base of over 3,500 telecommunications, transportation, industrial, medical and consumer companies, IXYS is a worldwide recognized provider of advanced semiconductors.

- POWER SEMICONDUCTORS: Pioneer in high power MOSFET, IGBT and Bipolar Technologies
- ANALOG, MIXED SIGNAL SPECIALIZED ICs, HVICs, MCUs
- RF POWER & SYSTEMS
- “REAL CASH” profitability, lower operating costs and shareholder equity growth
- Multi-disciplined technology with more than 350 patents
- Founded in Silicon Valley (1983), with 10 divisions worldwide and over 1,000 employees
- More than 3,500 customers across sectors ranging from telecom, transportation, industrial, medical, consumer, aerospace and renewable energy companies
I. COMPANY BACKGROUND: ROADMAP

- 1983 IXYS Founded
- 1989 IXYS Acquired ABB’s German Semiconductor Division (IXYS Germany)
- 1998 IXYS Goes Public
- 2000 Acquisition of DEI (IXYS Colorado)
- 2002 Acquisition of Westcode Semiconductor Ltd. & Clare, Inc.
- 2003 Acquisition of Microwave Technology, Inc.
- 2009 IXYS CH GmbH Acquisition of Leadis business lines (LED/LCD)
- 2010 Acquisition of Zilog
- 2013 Acquisition of 4-/8-bit MCUs from Samsung
## I. COMPANY BACKGROUND: OUR TECHNOLOGY

<table>
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<tr>
<th>PRODUCT LINE</th>
<th>END MARKETS</th>
<th>IXYS DIVISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Semiconductors</td>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>(71.8% of total FY13 revenues)</td>
<td>MEDICAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telecom</td>
<td>IXYS POWER</td>
</tr>
<tr>
<td></td>
<td>Transportation</td>
<td>IXYS Long Beach</td>
</tr>
<tr>
<td></td>
<td>Renewable Energy</td>
<td>MEDICAL</td>
</tr>
<tr>
<td>Integrated Circuits/</td>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>Mixed Signals ICs/MCUs</td>
<td>MEDICAL</td>
<td></td>
</tr>
<tr>
<td>(20.7% of total FY13 revenues)</td>
<td>Telecom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Military/Aerospace</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transportation</td>
<td></td>
</tr>
<tr>
<td>RF Power &amp; Systems</td>
<td>MEDICAL</td>
<td></td>
</tr>
<tr>
<td>(7.5% of total FY13 revenues)</td>
<td>Military/Aerospace</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telecom</td>
<td></td>
</tr>
</tbody>
</table>
II. IXYS POWER SEMICONDUCTORS: PORTFOLIO

- Discrete MOSFETs
- MOSFET Modules
- Discrete IGBTs
- IGBT Modules
- Fast Recovery Diodes - Discretes & Modules
- Schottky Diodes
- Rectifier Diodes, Bridges, PFC
- Discrete Thyristors
- Thyristor Modules
- Direct Copper Bond (DCB) Substrates and Dies
- High-Voltage Current Regulators
- Protection Devices
- Silicon Carbide (SiC) Products
II. IXYS POWER MOSFETs: MEDICAL

- **200V-1kV Q3-Class HiPerFET™ (10A-100A)**
- **300V-600V Polar3™ HiPerFET™ (4A – 210A)**
- **1kV-1.5kV LinearL™ with Extended FBSOAs (7.5A–12A)**
- **1kV-1.7kV Depletion Mode D2™ (800mA – 10A)**
- **2kV – 4.5kV Very High Voltage (200mA – 5A)**
## II. IXYS POWER MOSFETs: MEDICAL

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Applications</th>
</tr>
</thead>
</table>
| **200V-1000V Q3-Class HiPerFET™ Power MOSFETs**  
(10A – 44A) |  
- Low $R_{DS(on)}$ and gate charge $Q_g$  
- Low intrinsic gate resistance  
- High avalanche energy rating  
- Excellent dv/dt performance  
- Fast intrinsic rectifier  
- High Power Density  
- Easy to mount  
- Space savings |  
- CT and MRI Scanners  
- X-Ray Machines  
- Ultrasound Machines  
- Ultrasonic  
- Medical Power  
- Medical Laser  
- High-voltage power supplies for diagnostic systems |
| **300V-600V Polar3™ HiPerFET™ Power MOSFETs**  
(4A – 2A) |  
- Dynamic dv/dt rating  
- Fast intrinsic rectifier  
- Avalanche rated  
- Low $R_{DS(on)}$ and $Q_g$  
- Low drain-to-tab capacitance  
- Low package inductance  
- Easy to mount  
- Space savings |  
- X-Ray Machines  
- Ultrasound Machines  
- Ultrasonic  
- High-voltage power supplies for diagnostic systems |
## II. IXYS POWER MOSFETs: MEDICAL

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1kV – 1.5kV LinearL™ Power MOSFETs with Extended FBSOAs</strong> (7.5A – 12A)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| With Extended Forward Bias Safe Operating Areas (FBSOA)! | ▪ Design to sustain high power in linear mode operation  
▪ Low static drain to source on-resistances  
▪ Avalanche rated  
▪ Guaranteed FBSOA at 60°C  
▪ Improved over-all system reliability  
▪ Improved energy efficiency and performance | ▪ CT and MRI Scanners  
▪ X-Ray Machines  
▪ Ultrasound Machines  
▪ High-voltage power supplies for diagnostic systems |
| **1kV – 1.7kV Depletion Mode D2™ Power MOSFETs** (800mA – 10A) | | |
| For zero-power “Normally-On” load-switch designs | ▪ ’Normally-On’ Operation  
▪ Low R$_{DS(on)}$  
▪ Fast Switching  
▪ Linear Mode Tolerant  
▪ Useable Body Diode  
▪ Simplified Control  
▪ Reduce Line Power Dissipation  
▪ Rugged in FBSOA | ▪ CT and MRI Scanners  
▪ X-Ray Machines  
▪ Ultrasound Machines  
▪ High-voltage power supplies for diagnostic systems |
| **2kV – 4.5kV Very High Voltage Power MOSFETs** (200mA – 5A) | | |
| Ideal for very high voltage power conversion applications | ▪ High blocking voltage  
▪ Proprietary high-voltage ISOPLUS™ packages  
▪ Up to 4500V electrical isolation (DCB)  
▪ UL 94 V-0 Flammability qualified (molding epoxies)  
▪ High power density  
▪ Space savings (eliminates multiple series-connected devices)  
▪ Easy mounting | ▪ CT and MRI Scanners  
▪ X-Ray Machines  
▪ Ultrasound Machines  
▪ High-voltage power supplies for diagnostic systems |
II. IXYS IGBTs: MEDICAL

650V XPT™ Planar

1200V XPT™ Planar

1200V-1400V Punch-Through

2.5kV – 4.5kV Non Punch-Through

1600V-3600V BiMOSFETs™
## II. IXYS IGBTs: MEDICAL

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>650V XPT™ Planar IGBTs (16A-200A)</strong>&lt;br/&gt;For demanding high-speed hard-switching power conversion systems</td>
<td>▪ Optimized for 20kHz-60kHz switching&lt;br/&gt;▪ Avalanche rated&lt;br/&gt;▪ Square RBSOA (rated up to 650V)&lt;br/&gt;▪ Positive thermal coefficient of $V_{CE(sat)}$&lt;br/&gt;▪ Avalanche rated&lt;br/&gt;▪ Short circuit capability (8µs-10µs)&lt;br/&gt;▪ International standard and proprietary high voltage packages</td>
<td>▪ Defibrillators&lt;br/&gt;▪ Dialysis Machines&lt;br/&gt;▪ Medical Test Equipment&lt;br/&gt;▪ Medical Power Supplies</td>
</tr>
<tr>
<td><strong>1200V XPT™ Planar IGBTs (21A-240A)</strong>&lt;br/&gt;For high-speed, hard-switching applications (up to 50kHz)</td>
<td>▪ Optimized for low conduction &amp; switching losses&lt;br/&gt;▪ Square RBSOA&lt;br/&gt;▪ Ultra-fast anti-parallel recovery diodes (Sonic-FRD™ or HiPerFRED™)&lt;br/&gt;▪ Positive thermal coefficient of $V_{CE(sat)}$&lt;br/&gt;▪ Avalanche rated&lt;br/&gt;▪ High power density&lt;br/&gt;▪ Low gate drive requirement&lt;br/&gt;▪ Easy to parallel</td>
<td>▪ Defibrillators&lt;br/&gt;▪ Dialysis Machines&lt;br/&gt;▪ CT and MRI Machines&lt;br/&gt;▪ X-Ray Machines&lt;br/&gt;▪ Medical Power Supplies</td>
</tr>
<tr>
<td><strong>1200V-1400V PT IGBTs (22A – 260A)</strong>&lt;br/&gt;Improved efficiency and reliability</td>
<td>▪ Optimized for low switching &amp; conduction losses&lt;br/&gt;▪ High avalanche capability&lt;br/&gt;▪ Anti-Parallel Ultra fast diode&lt;br/&gt;▪ International Standard Packages&lt;br/&gt;▪ High power density&lt;br/&gt;▪ Low gate drive requirements</td>
<td>▪ Medical Laser&lt;br/&gt;▪ Medical Imaging Systems&lt;br/&gt;▪ Ultrasound Machines&lt;br/&gt;▪ Defibrillators&lt;br/&gt;▪ High-Voltage Medical Power Supplies</td>
</tr>
</tbody>
</table>
## II. IXYS IGBTs: MEDICAL

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.5kV – 4.5kV NPT IGBTs</strong></td>
<td>▪ Silicon Chip on Direct Copper Bond (DCB) substrate</td>
<td>▪ PET, CT, and MRI Scanners</td>
</tr>
<tr>
<td><em>(5.5A – 170A)</em></td>
<td>▪ Isolated mounting surface</td>
<td>▪ Medical Laser</td>
</tr>
<tr>
<td></td>
<td>▪ 4000V electrical isolation</td>
<td>▪ Ultrasound Machines</td>
</tr>
<tr>
<td></td>
<td>▪ Proprietary High-Voltage ISOPLUS i4-Pak™ and i5-Pak™ packages</td>
<td>▪ Defibrillators</td>
</tr>
<tr>
<td></td>
<td>▪ Molding epoxies meet UL 94 V-0 Flammability classification</td>
<td>▪ Diagnostic and Computing Systems</td>
</tr>
<tr>
<td></td>
<td>▪ Easy to mount</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ High power density</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Space savings (eliminates multiple series-connected devices)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Few to no competing devices in the market.</td>
<td></td>
</tr>
<tr>
<td><strong>1600V-3600V BiMOSFETs</strong></td>
<td>▪ High blocking voltages</td>
<td>▪ PET, CT, and MRI Scanners</td>
</tr>
<tr>
<td><em>(5A – 200A)</em></td>
<td>▪ High current handling capability</td>
<td>▪ Defibrillators</td>
</tr>
<tr>
<td></td>
<td>▪ Low conduction losses</td>
<td>▪ X-Ray Machines</td>
</tr>
<tr>
<td></td>
<td>▪ International standard and proprietary ISOPLUS™ packages</td>
<td>▪ High-Voltage Medical Power Supplies</td>
</tr>
<tr>
<td></td>
<td>▪ High power density</td>
<td>▪ Medical Test Equipment</td>
</tr>
<tr>
<td></td>
<td>▪ Low gate drive requirements</td>
<td></td>
</tr>
</tbody>
</table>

*Combined Strength of MOSFETs and IGBTs!*
## II. IXYS DIODES: MEDICAL

<table>
<thead>
<tr>
<th>PRODUCT FAMILY</th>
<th>FEATURES/ADVANTAGES</th>
<th>APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectifier Bridges</td>
<td>▪ Direct Copper Bond (DCB) isolation</td>
<td>PET, CT, and MRI Scanners</td>
</tr>
<tr>
<td>(1-phase and 3-phase) (600V-2200V)</td>
<td>▪ Improved temperature and power cycling</td>
<td>Medical Laser</td>
</tr>
<tr>
<td>(1A-240A)</td>
<td>▪ Planar passivated chips</td>
<td>Ultrasound Machines</td>
</tr>
<tr>
<td></td>
<td>▪ Very low forward voltage drop</td>
<td>Defibrillators</td>
</tr>
<tr>
<td></td>
<td>▪ Very low leakage current</td>
<td>Diagnostic and Computing Systems</td>
</tr>
<tr>
<td>Silicon Schottky Diodes</td>
<td>▪ Very low $V_f$</td>
<td>PET, CT, and MRI Scanners</td>
</tr>
<tr>
<td>(8V-200V)</td>
<td>▪ Extremely low switching losses</td>
<td>Defibrillators</td>
</tr>
<tr>
<td>(2A-400A)</td>
<td>▪ Improved thermal behavior</td>
<td>Medical Power Supplies</td>
</tr>
<tr>
<td></td>
<td>▪ Low $I_{RM}$ values</td>
<td>Medical Test Equipment</td>
</tr>
<tr>
<td></td>
<td>▪ International standard packages</td>
<td>Pacemakers</td>
</tr>
<tr>
<td></td>
<td>▪ Epoxies meet UL 94V-0</td>
<td></td>
</tr>
<tr>
<td>HiPerFRED™ Diodes</td>
<td>▪ Planar passivated chips</td>
<td>PET, CT, and MRI Scanners</td>
</tr>
<tr>
<td>(300V-1200V)</td>
<td>▪ Very low leakage current</td>
<td>Defibrillators</td>
</tr>
<tr>
<td>(6A-240A)</td>
<td>▪ Very short recovery time</td>
<td>X-Ray Machines</td>
</tr>
<tr>
<td></td>
<td>▪ Very low $I_{RM}$ values</td>
<td>Ultrasound Machines</td>
</tr>
<tr>
<td></td>
<td>▪ Avalanche voltage rated</td>
<td>Medical Test Equipment</td>
</tr>
<tr>
<td></td>
<td>▪ Epoxies meet UL 94V-0</td>
<td></td>
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</table>
## II. IXYS DIODES & THYRISTORS: MEDICAL

<table>
<thead>
<tr>
<th>PRODUCT FAMILY</th>
<th>FEATURES/ADVANTAGES</th>
<th>APPLICATIONS</th>
</tr>
</thead>
</table>
| **FRED/HiPerFRED Diode Modules**    | ▪ Direct Copper Bond (DCB) isolation  
▪ Soft recovery behavior  
▪ Planar passivated chips  
▪ Low switching losses  
▪ International standard packages | PET, CT, and MRI Scanners  
Medical Laser  
Ultrasound Machines  
Defibrillators  
Medical Power Supplies |
| (200V-1200V) (75A-582A)             |                                                                                     |                                                  |
| **Fast Switching Thyristors**       | ▪ High power density  
▪ Very Rugged  
▪ Reduced thermal resistance                                                      | Transcranial Magnetic Stimulation  
PET, CT, and MRI Scanners  
X-Ray Machines  
Medical Pulsed Power applications |
| (400V – 1200V)                      |                                                                                     |                                                  |
| **Pulse Thyristors**                |                                                                                     |                                                  |
| 2500V                               |                                                                                     |                                                  |
III. IXYS INTEGRATED CIRCUITS: PORTFOLIO

- OPTICALLY ISOLATED SOLID STATE RELAYS
- OPTOCOUPLERS/AMPLIFIERS
- TELECOM ICs
- CONTROLLERS/REGS/SENSORS
- GATE DRIVERS
- MULTIFUNCTION PRODUCTS
- HIGH SPEED DIGITAL OPTICAL ISOLATORS
- POWER MANAGEMENT ICs
- GROUND FAULT INTERRUPT
III. IXYS INTEGRATED CIRCUITS: MEDICAL EXPERIENCE

- IXYS IC is a strategic IC supplier to several medical customers
  - IXYS IC has been supplying ICs to medical ultrasound customers for over 20 years.

- Ultrasound ICs Previously Developed
  - 1989 MX9xx Dual channel Time Gain Control (TGC) ASIC
  - 1990 MX9xx Dual channel apodizer ASIC
  - 1991 MX9xx Pulser ASIC
  - 1992 MX9xx Pulser ASIC
  - 1995 MX9xx Pulser ASIC
  - 1996 MX9xx Pulser ASIC
  - 1997 MX9xx TGC ASIC
  - 1998 MX9xx Pulser ASIC
  - 1999 MX9xx Quad channel TGC ASIC
  - 2004 MX8xx Pulser ASIC
  - 2004 MX8xx Pulser ASIC
  - 2007 MX10xx Improved Quad Channel TGC ASIC
  - 2007 MX10xx 8-Channel Pulser ASIC
  - 2007 CPC7220 8-Channel High Voltage Analog Switch
  - 2008 CPC7232 8-Channel High Voltage Analog Switch w/bleeder resistors
  - 2011 CPC7601 16-Channel High Voltage Analog Switch
  - 2011 CPC7701 16-Channel High Voltage Analog Switch w/bleeder resistors
# III. IXYS INTEGRATED CIRCUITS: MEDICAL

<table>
<thead>
<tr>
<th>PRODUCT FAMILY</th>
<th>FEATURES/ADVANTAGES</th>
<th>APPLICATIONS</th>
</tr>
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</table>
| **CPC7701** Low Charge Injection 16-Channel High Voltage Analog Switch with Bleed Resistors | - Processed with IXYS’s BCDMOS on SOI (Silicon on Insulator)  
- Integrated Output Bleed Resistors  
- Flexible High Voltage Supplies up to $V_{PP}-V_{NN}=200V$  
- DC to 10MHz Analog Signal Frequency  
- Low Quiescent Power Dissipation (< 1μA Typical)  
- Output Switch On-Resistance Typically 20Ω  
- TTL I/Os for 3.3V Interface  
- 20MHz Clock Frequency  
- Excellent Noise Immunity | Ultrasound imaging  
Medical instrumentation |
| **CPC7220** Low Charge Injection 8-Channel High Voltage Analog Switch | - Processed with IXYS IC’s BCDMOS on SOI (Silicon on Insulator)  
- Flexible High Voltage Supplies up to $V_{PP}-V_{NN}=200V$  
- DC to 10MHz Analog Signal Frequency  
- Low Quiescent Power Dissipation (< 1μA Typical)  
- Output Switch On-Resistance Typically 20Ω  
- TTL I/Os for 3.3V Interface  
- Excellent Noise Immunity  
- Available in PLCC & LQFP Surface Mount Packages  
- Direct Replacement to Supertex’s HV2201 & HV20220 and Maxim’s MAX4800A | Ultrasound imaging  
Medical instrumentation |
## III. IXYS INTEGRATED CIRCUITS: MEDICAL

<table>
<thead>
<tr>
<th>PRODUCT FAMILY</th>
<th>FEATURES/ADVANTAGES</th>
<th>APPLICATIONS</th>
</tr>
</thead>
</table>
| **CPC7232 Low Charge Injection** | ▪ Processed with IXYS IC’s BCDMOS on SOI (Silicon on Insulator)  
▪ Integrated Output Bleed Resistors  
▪ Flexible HV Supplies up to $V_{PP} - V_{NN} = 200V$  
▪ DC to 10MHz Analog Signal Frequency  
▪ Low Quiescent Power Dissipation (< 1μA Typical)  
▪ Output Switch On-Resistance Typically 20Ω  
▪ TTL I/Os for 3.3V Interface  
▪ Excellent Noise Immunity  
▪ Available in PLCC & LQFP Surface Mount Packages  
▪ Direct Replacement to Supertex’s HV2301 & HV232 and Maxim’s MAX4802A | Ultrasound imaging  
Medical Instrumentation                                                                 |
| **CPC7601 Low Charge Injection** | ▪ Processed with IXYS IC’s BCDMOS on SOI (Silicon on Insulator)  
▪ Flexible HV Supplies up to $V_{PP} - V_{NN} = 200V$  
▪ DC to 10MHz Analog Signal Frequency  
▪ Low Quiescent Power Dissipation (< 1μA Typical)  
▪ Output Switch On-Resistance Typically 20Ω  
▪ TTL I/Os for 3.3V Interface  
▪ 20MHz Clock Frequency  
▪ Excellent Noise Immunity  
▪ Available in 48-Lead LQFP Package  
▪ Direct Replacement to Supertex’s HV2601 and Maxim’s MAX14802 |
| **IXD_600 Series High Current**  | ▪ 2A IXD_602  
▪ 4A IXD_604  
▪ 9A IXD_609  
▪ 14A IXD_614  
▪ 30A IXD_630  
▪ Wide Operating Voltage Range: 4.5V to 35V  
▪ Very Robust Design  
▪ Very Fast Switching Speeds  
▪ Power Surface Mount & Through-Hole Packages | Gate Drivers for IXYS MOSFETs and IGBTs used in medical applications:  
- Defibrillators  
- Dialysis Machines  
- CT and MRI Machines  
- X-Ray Machines  
- Medical Power Supplies |

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**IXD_600 Series High Current Ultra-Fast Gate Drivers**
## III. IXYS INTEGRATED CIRCUITS: MEDICAL

<table>
<thead>
<tr>
<th>PRODUCT FAMILY</th>
<th>FEATURES/ADVANTAGES</th>
<th>APPLICATIONS</th>
</tr>
</thead>
</table>
| **Solid State Relays** | ▪ Optically isolated form A (normally-open), form B (normally-closed) and combination multiple relays in one package  
  ➢ AC & DC switching  
  ➢ 1500Vrms to 5000Vrms input-to-output isolation  
  ➢ 30V to 1000V load voltage  
  ➢ 50mA to 1Amp load current  

  ▪ **POWER Solid State Relays**  
  ➢ AC & DC switching  
  ➢ 2500Vrms input-to-output isolation  
  ➢ 30V to 1000V load voltage  
  ➢ 180mA to 32Amp load current | Instrumentation  
  Medical Power supplies  
  Thermal heat  
  Medical contaminate separator  
  Medical bed position  
  Electrical shock  
  Chemical dispenser |
| **Optocouplers**     | ▪ Linear Optocouplers and Isolation Amplifiers (analog couplers)                     | Electrocardiogram (ECG)  
  Medical Instrumentation |
|                      | ▪ Low Cost Single and Dual Optocouplers for signal switching                          |                                                  |
|                      | ▪ Linear Error Amplifiers                                                             |                                                  |
IV. IXYS MICROCONTROLLERS: PORTFOLIO FROM ZILOG/S3

**Z8 Encore!® Flash Microcontrollers**

**Z8F1680 Series**
- 8-bit eZ8 core
- 8K-24KB Flash
- 2KB SRAM
- 1KB PRAM
- 10bit ADC
- Op-Amp
- Comparator
- Timers/PWM
- UART/SPI/I2C
- Up to 37 GPIO
- Low Power
- Low Voltage

**Z8F642x Series**
- 8-bit eZ8 core
- 16K-64KB Flash
- 4KB SRAM
- Sigma/Delta ADC
- Timers/PWM
- DMA
- UART/SPI/I2C
- Up to 60 GPIO

**Z8F082A Series**
- 8-bit eZ8 core
- 1K-8KB Flash
- 1KB SRAM
- Sigma/Delta ADC
- Timers/PWM
- UART, Comparator
- Up to 25 GPIO

**S3F Series**
- 8-bit SAM8 core
- 4K-64KB Flash
- 10 bit ADC (2.8us)
- LCD
- Timers/PWM
- 16 pin to 128 pin

**Z8 Encore!® Motor Control Microcontrollers**

**Z8FMC Series**
- 8-bit eZ8 core
- 4K-16KB Flash
- 512B SRAM
- ADC/Op-Amp
- 6-ch PWM
- UART/SPI/I2C
- 17 GPIO

**Z8F083x Series**
- 8-bit eZ8 core
- 1K-12KB Flash
- 256B SRAM
- 10 bit ADC (2.8us)
- Comparator
- Timers/PWM
- Up to 25 GPIO

**Z8051 Series**
- 8-bit 8051 core
- 2 Clock/Cycle
- 4K-64KB Flash
- 3KB+ RAM
- 12bit ADC
- Op-Amp
- Comparator
- Timers/PWM
- UART/SPI/I2C
- LCD
- Up to 66 GPIO

**Z51F Series**
- 8-bit 8051 core
- 2 Clock/Cycle
- 4K-64KB Flash
- 3KB+ RAM
- 12bit ADC
- Op-Amp
- Comparator
- Timers/PWM
- UART/SPI/I2C
- LCD
- Up to 66 GPIO

**eZ80 Acclaim!® Flash Microcontrollers**

**Z16F/MC Series**
- 16-bit ZENO core
- 32K-128KB Flash
- 2K-4KB SRAM
- ADC/Op-Amp/Comp
- DMA
- 6-ch PWM
- UART/SPI/I2C
- Up to 76 GPIO

**eZ80F91 Series**
- 8-bit eZ80 core
- 64K-256KB Flash
- 4K-16KB SRAM
- External Bus
- 10/100 Ethernet MAC
- Timers/PWM
- UART/SPI/I2C
- Up to 32 GPIO
- TCP/IP Stack
- RTOS
### IV. IXYS MICROCONTROLLERS: MEDICAL

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Advantages</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ZMOTION</strong></td>
<td>Embedded software algorithms that provides a dramatic improvement in both sensitivity and stability over traditional security-related motion detection designs. These motion detection algorithms comprise the Passive Infrared (PIR) engine and run in the background of the MCU while control and status of the engine is accessed through a software Application Programming Interface (API). In effect, you can create your own application-specific software while taking advantage of PIR motion-detection technology.</td>
<td>Patient Monitoring, Medical Alert Signaling</td>
</tr>
<tr>
<td><strong>Flash-based</strong></td>
<td><strong>Z8F042A Z8 Encore! XP MCU</strong> 8-Bit MCU is optimized for low power applications and supports 1.8 V to 3.6 V of low-voltage operation with extremely low Active, Halt and Stop Mode currents, plus it offers a wide assortment of speed and low-power options.</td>
<td>Hand Sanitation, Portable Blood Glucose Monitor, Pulse Oximeter Monitor, Battery-Powered</td>
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<td></td>
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<td>Elevating Floor Lift, Perioperative Patient Warming System, Biological Monitoring system</td>
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<tr>
<td></td>
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<td>Enteral Feeding Pump</td>
</tr>
<tr>
<td><strong>Encore Z8F1680</strong></td>
<td>The 8-bit Z80180 MPU provides the benefits of reduced system costs and also provides full backward compatibility with existing ZILOG Z80 devices. Reduced system costs are obtained by incorporating several key system functions on-chip with the CPU. These key functions include I/O devices such as DMA, UART, and timer channels. Also included on-chip are wait-state generators, a clock oscillator, and an interrupt controller. The Z80180 MPU is housed in 80-pin QFP, 68-pin PLCC, and 64-pin DIP packages.</td>
<td>Infusion Pump, Medical Devices with LCD Display, Keypad Entry, Printer</td>
</tr>
<tr>
<td><strong>Z8S180</strong></td>
<td><strong>Acclaim eZ80F91-92</strong> eZ80Acclaim! Flash microcontrollers, is a high-speed 8 Bit microprocessor with a maximum clock speed of 50 MHz and single-cycle instruction fetch. It operates in Z80-compatible addressing mode (64 KB) or full 24-bit addressing mode (16 MB). The eZ80F91 is suitable for a variety of applications, including industrial control, embedded communication.</td>
<td>Bio Sensor</td>
</tr>
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<td>IV Pump</td>
</tr>
<tr>
<td><strong>Z8S51 Product Family</strong></td>
<td><strong>Z51F3221</strong> CMOS 8-bit microcontroller with 32KB of Flash memory. This powerful microcontroller provides a highly flexible and cost-effective solution to many embedded control applications, including digital clocks/watches, medical devices and power monitoring. With 256 bytes of IRAM, 1KB of XRAM, two clocks per machine cycle, general-purpose I/O, multiple timers (1x8-bit and 2x16-bit), plus PWM, watchdog and watch timers, UART, buzzer port, on-chip POR, 12-bit ADC</td>
<td>Medical Devices, Thermometer, Heart Pressure-Blood Pulse-Temperature Monitor, Dialysis Machine</td>
</tr>
<tr>
<td><strong>Z8F6421</strong></td>
<td><strong>Z8 Encore! XP F64XX Series</strong> support up to 64 KB of Flash program memory and 4 KB register RAM. The Z8 Encore! XP F64XX Series feature up to twelve channels of 10-bit A/D conversion for measuring analog signals. These devices include up to four enhanced 16-bit timer blocks featuring PWMs and Capture and Compare. Up to 24 vectored interrupts with programmable priorities provide increased application flexibility. 3-DMAs for faster data transfers. Flexibility in data communications with UARTs, I2C, and SPI.</td>
<td>Medical Imager, CO2 Nasal Monitor, Enteral Feeding Pump, Air Detector</td>
</tr>
<tr>
<td><strong>Serial Communication Controller</strong></td>
<td><strong>Serial Communications Controllers (Z85C30, Z85230/L)</strong> are pin and software-compatible members of the SCC family. The SCC is a dual-channel, full-duplex multiprotocol data communication peripheral, designed for use with both 8- and 16-bit microprocessors. The SCC handles asynchronous formats, byte oriented synchronous protocols such as MONOSYN and BISYN, plus bit-oriented synchronous protocols such as HDLC and SDLC. The device can generate and check CRC codes generate and check CRC codes in any synchronous mode.</td>
<td>Medical Device Communication, (Blood Glucose Monitor, Biological Monitor, Heart Pressure-Blood Pulse-Temperature Monitor, Perioperative Patient Warming System, Enteral Feeding Pump, CO2 Nasal Monitor, Pulse Oximeter Monitor)</td>
</tr>
</tbody>
</table>
V. IXYS RF POWER: PORTFOLIO

- RF AMPLIFIERS
- RF PRE-AMPLIFIERS
- RF MOSFETs
- HYBRID MODULES
- RF DRIVERS
- GUNN DIODES
- RFID DEVICES
## V. IXYS RF POWER: MEDICAL

<table>
<thead>
<tr>
<th>PRODUCT FAMILY</th>
<th>FEATURES/ADVANTAGES</th>
<th>APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH Series Pre-Amplifiers</td>
<td>▪ Low noise</td>
<td>MRI system preamps</td>
</tr>
<tr>
<td>43MHz-298MHz</td>
<td>▪ Very low magnetic</td>
<td></td>
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<tr>
<td></td>
<td>▪ 1.5 to 50 Ohm input impedance</td>
<td></td>
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<tr>
<td></td>
<td>▪ Very low power consumption</td>
<td></td>
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<tr>
<td></td>
<td>▪ High linearity</td>
<td></td>
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<tr>
<td></td>
<td>▪ Low package inductance</td>
<td></td>
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<tr>
<td></td>
<td>▪ High power density</td>
<td></td>
</tr>
<tr>
<td>MPM Series Pre-Amplifiers</td>
<td>▪ Low Noise Figure</td>
<td>MRI systems and coil applications</td>
</tr>
<tr>
<td>43MHz-127MHz</td>
<td>▪ High linearity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Low input impedance</td>
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<tr>
<td></td>
<td>▪ Very low magnetism</td>
<td></td>
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<tr>
<td></td>
<td>▪ Low power consumption</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Miniature size: 0.74”x0.60”x0.29”</td>
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</tr>
<tr>
<td>MSM Series Pre-Amplifiers</td>
<td>▪ Low Noise Figure</td>
<td>MRI systems and coil applications</td>
</tr>
<tr>
<td>(Customizable)</td>
<td>▪ Frequency range 30MHz to 300MHz</td>
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<tr>
<td></td>
<td>▪ Non-magnetic versions available</td>
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<tr>
<td></td>
<td>▪ 2Ohm and 50 Ohm impedance</td>
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<tr>
<td></td>
<td>▪ Low current (15mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Small size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Low cost</td>
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</tr>
</tbody>
</table>
## V. IXYS RF POWER: MEDICAL

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<th>PRODUCT FAMILY</th>
<th>FEATURES/ADVANTAGES</th>
<th>APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HiPerRF™ Power MOSFETs</strong></td>
<td>- RF capable MOSFETs</td>
<td>Medical Instrumentation</td>
</tr>
<tr>
<td>1000V / (6A-24A)</td>
<td>- Double metal process for low gate resistance</td>
<td>EKG/ECG Monitors</td>
</tr>
<tr>
<td>(F-Class: MegaHartz Switching)</td>
<td>- Unclamped Inductive Switching (UIS) rated</td>
<td>Ultrasound Machines</td>
</tr>
<tr>
<td></td>
<td>- Proprietary PLUS packages</td>
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<tr>
<td></td>
<td>- Fast intrinsic rectifier</td>
<td></td>
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<td></td>
<td>- Low package inductance</td>
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<tr>
<td></td>
<td>- High power density</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Space savings</td>
<td></td>
</tr>
<tr>
<td><strong>DE Series Power MOSFETs</strong></td>
<td>- Isolated Substrate (&gt;2500V)</td>
<td>Medical ISM applications</td>
</tr>
<tr>
<td>1000V / (2A-24A)</td>
<td>- Excellent thermal transfer</td>
<td>MRI Machines</td>
</tr>
<tr>
<td></td>
<td>- Increased temperature and power cycling</td>
<td>Ultrasound Machines</td>
</tr>
<tr>
<td></td>
<td>- IXYS advanced low $Q_g$ process</td>
<td></td>
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<tr>
<td></td>
<td>- Low $R_{DS(on)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Very low insertion inductance (&lt;2nH)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- High power density</td>
<td></td>
</tr>
<tr>
<td><strong>Z-MOS RF Power MOSFETs</strong></td>
<td>- IXYS advanced Z-MOS process</td>
<td>High frequency medical power supplies</td>
</tr>
<tr>
<td>1200V / 8A</td>
<td>- Low $R_{DS(on)}$</td>
<td>Medical ISM applications</td>
</tr>
<tr>
<td></td>
<td>- No beryllium oxide or other hazardous materials</td>
<td>MRI Machines</td>
</tr>
<tr>
<td></td>
<td>- Low gate charge and capacitances</td>
<td>Ultrasound Machines</td>
</tr>
<tr>
<td></td>
<td>- Easy to mount – no insulators needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Very low insertion inductance (&lt;2nH)</td>
<td></td>
</tr>
</tbody>
</table>
V. IXYS RF POWER: RFID DEVICES for MEDICAL
NCD1015_50RO: HDX Robust 50mm Transponder

Features
• Air Interface: Contact-Less, Sequential Power & Data Transmission (HDX)
• Radio Frequency Center Frequency : 134.2 kHz
• Tag => Reader Transmission: FSK Modulation, NRZ: “0” ~ 134.4kHz; “1” ~ 124.2kHz
• Tag => Reader Data Rate: RF/16 (~8kbits/sec)
• On-Chip 16-Bit CRC Generator: Reverse CRC-CCITT as used in ISO/IEC 11785
• Identification Data Page: 64 Bits Data + Associated 16 Bits CRC

Applications
• Item tracking in hospitals
• Monitoring patients
• Ensuring patients receive correct medications and medical devices
• Providing data for electronic medical record systems
V. IXYS RF POWER: RFID DEVICES for MEDICAL

NCD1025: HDX RFID IC with Integrated Temperature Sensor

Features
- Air Interface: Contact-Less, Sequential Power & Data Transmission (HDX)
- Radio Frequency Center Frequency: 134.2 kHz
- Tag => Reader Transmission: FSK Modulation, NRZ: “0” ~ 134.4kHz; “1” ~ 124.2kHz
- Tag => Reader Data Rate: RF/16 (~8kbits/sec)
- On-Chip 16-Bit CRC Generator: Reverse CRC-CCITT as used in ISO/IEC 11785
- Identification Data Page: 64 Bits Data + Associated 16 Bits CRC

Applications
- Item tracking in hospitals
- Ensuring patients receive correct medications and medical devices
- Providing data for electronic medical record systems
- Preventing distribution of counterfeit drugs and medical devices
- Out-of-bed detection and fall detection

Typical Configuration
V. IXYS RF POWER: RFID DEVICES for MEDICAL

NCD1110: 126 Bits RW LF Contactless Identification Device

Features
- High read sensitivity with dedicated antenna
- Non tune technology
- Industry leading read in proximity or through metal
- On chip rectifier and voltage limiter
- Reduce manufacturing variability via embedded trimming bits
- Fast tag presence confirmation using the ID_conf command
- Option to drive external LED when identified
- Re-programmable UID with irreversibly lock capability

Applications
- Ensuring patients receive correct medications and medical devices
- Providing data for electronic medical record systems
- Preventing distribution of counterfeit drugs and medical devices
- Out-of-bed detection and fall detection

Typical Configuration
WORLD OF IXYS

Industry Mind Share
Strong Product Promotion and Focus
Joint Strategic and Marketing Programs
Broad Technologies with Strong Power Solutions
Great Partner for Demand Creation

Creating New Products For Today and Tomorrow’s Needs

IXYS POWER, IC, and Microcontroller Solutions