Discrete Power MOSFET Product Portfolio

IXYS Corporation
www.ixys.com
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IXYS Power MOSFET Technologies

- Vertical Diffused MOS (VDMOS) Technology
- Trench-Gated Technology
## Discrete Power MOSFETs

<table>
<thead>
<tr>
<th>Product Series</th>
<th>Voltage</th>
<th>Current</th>
<th>$R_{DS(on)}$ (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N-CHANNELS</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>GigaMOS™ Trench/TrenchT2™</td>
<td>40V - 300V</td>
<td>12A - 600A</td>
<td>1mΩ - 85mΩ</td>
</tr>
<tr>
<td>HiPerFET™ (Polar™, Q3-class)</td>
<td>70V - 1200V</td>
<td>0.7A - 340A</td>
<td>3mΩ - 4.5Ω</td>
</tr>
<tr>
<td>Linear with Extended FBSOA</td>
<td>100V - 1500V</td>
<td>8A - 200A</td>
<td>11mΩ - 3.6Ω</td>
</tr>
<tr>
<td>Depletion mode</td>
<td>100V - 1700V</td>
<td>0.2A - 20A</td>
<td>64mΩ - 80Ω</td>
</tr>
<tr>
<td>Standard (high voltage, very high voltage)</td>
<td>55V - 4500V</td>
<td>0.1A - 250A</td>
<td>5mΩ - 750Ω</td>
</tr>
<tr>
<td><strong>P-CHANNELS</strong></td>
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</tr>
<tr>
<td>TrenchP™</td>
<td>-50V to -200V</td>
<td>-10A to -210A</td>
<td>7.5mΩ - 0.35Ω</td>
</tr>
<tr>
<td>PolarP™</td>
<td>-100V to -600V</td>
<td>-10A to -170A</td>
<td>12mΩ - 1Ω</td>
</tr>
<tr>
<td>Standard</td>
<td>-85V to -600V</td>
<td>-8A to -50A</td>
<td>55mΩ - 1.2Ω</td>
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</tbody>
</table>
Competitive Landscape: discrete Power MOSFETs

- Very few to no competitors above 1700V!
- Closest competitor offers only up to 1700V
# Advantages and Applications

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Advantages</th>
<th>Applications</th>
</tr>
</thead>
</table>
| **GigaMOS™ Trench/TrenchT2™**  | High current capability  
Low $R_{DS(on)}$  
Avalanche capability  
Fast intrinsic diodes | Synchronous rectification, DC-DC converters, battery chargers, SMPS, UPS, motor drives, DC choppers |
| **Polar3™ HiPerFET™**          | Low $R_{DS(on)}$  
Low thermal resistance  
Dynamic dv/dt ratings  
Simple drive requirements  
High-speed switching | Solar inverters, lamp ballasts, laser drivers, robotic and servo control, industrial machinery, medical equipment |
| **Q3-Class HiPerFET™**         | Low gate charge  
Low $R_{DS(on)}$  
High avalanche energy rating  
Low intrinsic gate resistance  
High-speed switching | Switched-mode power supplies, PFC, induction heating, arc welding, pulse generation, motor controls, E-bikes |
# Advantages and Applications

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<tr>
<th>Product Family</th>
<th>Advantages</th>
<th>Applications</th>
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<tbody>
<tr>
<td>LinearL2™ with extended FBSOA</td>
<td>High power in linear mode operation</td>
<td>Current sources, circuit breakers, linear regulators, soft-start applications, programmable loads</td>
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<tr>
<td></td>
<td>Guaranteed FBSOA at 75°C</td>
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<tr>
<td></td>
<td>Avalanche rated</td>
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<tr>
<td></td>
<td>Low static drain-to-source on resistance</td>
<td></td>
</tr>
<tr>
<td>Depletion Mode D2™</td>
<td>‘Normally-On’ operation</td>
<td>Current regulation, solid-state relays, level shifting, active loads, start-up circuits</td>
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<tr>
<td></td>
<td>Low $R_{DS(on)}$</td>
<td></td>
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<tr>
<td></td>
<td>Linear mode tolerant</td>
<td></td>
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<tr>
<td></td>
<td>Useable body diode</td>
<td></td>
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<tr>
<td></td>
<td>Fast switching</td>
<td></td>
</tr>
<tr>
<td>High Voltage and Very High Voltage</td>
<td>High blocking voltage</td>
<td>Capacitor discharge circuits, high-voltage power supplies, pulse circuits, laser and X-ray generation systems, energy tapping applications from the power grid</td>
</tr>
<tr>
<td></td>
<td>Proprietary high-voltage ISOPLUS™ packages</td>
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<td></td>
<td>Up to 4500V electrical isolation (DCB)</td>
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<td>UL 94 V-0 Flammability qualified (molding epoxies)</td>
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</table>
Applications – Battery Charger

- **Key Components**
  - Power MOSFETs (*IXFH60N50P3*)
  - Gate Driver
  - MCU
Applications – Linear Operation

- Pass Transistor: Linear Power MOSFET with extended Forward Bias Safe Operating Area (FBSOA)
- LinearL2™ Power MOSFET (IXTK60N50L2)
- Low $R_{thJC}$ and guaranteed FBSOA at 75°C
- Other examples: Class-A amplifiers, Programmable Electronic Loads, Fan Controllers
Latest Power MOSFETs

- 500V-600V Polar3™ HiPerFETs™
- 200V-1000V Q3-Class HiPerFETs™
- 1000V/30A Q3-Class HiPerFET™ in SMPD package
- 4500V MOSFETs
TrenchT2™ Power MOSFETs
(40V - 120V / 70A - 600A)

For low-voltage, high-current power conversion systems

FEATURES
- Ultra low on-state resistance $R_{DS(on)}$
- Fast intrinsic rectifier
- Low package inductance
- 175°C operating temperature
- Avalanche rated

ADVANTAGES
- High power density
- Space saving
- Easy to mount
- Termination is Lead-free and ROHS compliant

APPLICATIONS
- Synchronous rectification, DC-DC converters, off-line UPS, battery powered electric motors, resonant-mode power Supplies, electronic ballasts, Class-D audio amplifiers, DC motor control

IXTA90N055T2
“T2” denotes 2nd generation Trench
GigaMOS™ TrenchT2™ HiPerFET™ MOSFETs (75V - 175V / 76A - 520A)

FEATURES
- High current capability
- Low $R_{DS(on)}$ and gate charge ($Q_g$)
- Incorporates IXYS HiPerFET™ technology for fast power switching
- Avalanche capabilities

ADVANTAGES
- Eliminates multiple paralleled lower current rated MOSFET devices
- Improves over-all system reliability
- Capability to control more power within a smaller footprint

APPLICATIONS
- High-current power switching applications, DC-DC converters, battery chargers, SMPS/RMPS, DC choppers, AC motor drives, uninterruptible power supplies

IXFH150N17T2
“F” denotes HiPerFET™ devices
“T2” denotes 2nd generation Trench
**Polar3™ HiPerFET™ Power MOSFETs**
*(300V – 600V / 4A – 210A)*

**FEATURES**
- Low $R_{DS(on)}$ and $Q_g$
- Low thermal resistance $R_{thJC}$
- High power dissipation
- Dynamic $dv/dt$ ratings
- Avalanche Rated

**ADVANTAGES**
- Simple drive requirements
- Enables high speed switching
- Reduced component count & circuit complexity
- Cooler device operation

**APPLICATIONS**
- SMPS/RMPS, UPS, PFC, DC-DC converters, laser drivers, battery chargers, motor drives, solar inverters, lamp ballasts, robotic and servo control

Energy efficient. Reliable.

IXFH60N50P3
“F” denotes HiPerFET™
“P3” denotes 3rd Generation Polar series
**900V Polar™ HiPerFET™ Power MOSFETs (10.5A – 56A)**

**FEATURES**
- International standard packages
- ISOPLUS™ high performance package options (2500V electrical isolation)
- Avalanche rated
- Fast intrinsic body diodes with low Qrr and trr
- Low package inductance
- Excellent ruggedness and dv/dt capability

**ADVANTAGES**
- High power density
- Easy to mount
- Space savings

**APPLICATIONS**
- Switch-mode and resonant power supplies, high-voltage lighting, industrial machinery, laser drivers, DC-DC converters, medical equipment

**Rugged and Fast!**

**IXFR18N90P**
- “F” denotes HiPerFET™
- “P” denotes Polar™ series
Q3-Class HiPerFET™ Power MOSFETs (200V – 1000V/10A – 100A)

IXYS’ latest generation of double metal power MOSFETs!
Extremely fast & rugged design!

**FEATURES**
- Low $R_{DS(on)}$ and gate charge $Q_g$
- Low intrinsic gate resistance
- High avalanche energy rating
- Excellent $dv/dt$ performance
- Fast intrinsic rectifier

**ADVANTAGES**
- High Power Density
- Easy to mount
- Space savings

**APPLICATIONS**
- SMPS, PFC, solar inverters, server and telecom power systems, arc welding, induction heating, motor controls

IXF32N100Q3
“F” denotes HiPerFET™
“Q3” denotes 3rd Generation Q-Class
LinearL2™ Power MOSFETs with Extended FBSOAs
(100V – 600V / 15A – 200A)

With Extended Forward Bias Safe Operating Areas (FBSOA)!

FEATURES

▪ Designed to sustain high power in linear mode operation
▪ Low static drain to source on-resistances
▪ Avalanche rated
▪ Guaranteed FBSOA at 75°C

ADVANTAGES

▪ Improved over-all system reliability
▪ Improved energy efficiency and performance

APPLICATIONS

▪ Current sources, circuit breaker, soft-start applications, power amplifiers, programmable loads, power regulators, motor control, power controllers

IXTH30N50L2
“L2” denotes 2nd generation linear devices
Depletion Mode D2™ Power MOSFETs
(100V – 1700V / 800mA – 16A)

FEATURES
- ‘Normally-On’ Operation
- Low $R_{ds(on)}$
- Fast Switching
- Linear Mode Tolerant
- Useable Body Diode
- Molding epoxies meet UL94 V-0 flammability classification

ADVANTAGES
- Simplified Control
- Enables Linear Control for High Voltage Applications (500V and 1000V)
- Reduce Line Power Dissipation for High Line Input
- Ideal for zero power normally-on load switch designs
- Rugged in FBSOA

APPLICATIONS
- Current Regulation, Solid-State Relays, Level Shifting, Load Switch, Active Loads, Start-up Circuits, Power Active Filters

IXTA3N50D2
“D2” denotes Depletion-Mode D2™ MOSFET
1500V Standard Power MOSFETs (2.5A – 20A)

FEATURES

- International standard or proprietary high-voltage packages
- Molding epoxies meet UL 94 V-0 Flammability Classification
- Fast intrinsic diode
- Low package inductance

ADVANTAGES

- Easy to mount
- Space savings
- High power density

APPLICATIONS

- High voltage power supplies, capacitor discharge applications, pulse circuits

Available in ISO TO-247, TO263, TO-263HV, TO-247, TO-268, TO-268HV, PLUS247, TO-264

IXTA4N150HV

“T” denotes standard devices
“HV” denotes proprietary high-voltage package
4500V Power MOSFETs (200mA – 2A)

FEATURES
- High blocking voltage
- Proprietary high-voltage ISOPLUS™ packages
- Up to 4500V electrical isolation (DCB)
- UL 94 V-0 Flammability qualified (molding epoxies)

ADVANTAGES
- High power density
- Space savings (eliminates multiple series-connected devices)
- Easy mounting

APPLICATIONS
- Capacitor discharge circuits
- High voltage power supplies
- Pulse circuits
- Laser and X-ray generation systems
- High voltage relay disconnect circuits
- Energy tapping applications from the power grid
P-Channel TrenchP™ Power MOSFETs
(-50V to -200V / -10A to -210A)

FEATURES
- International standard packages
- Fast intrinsic diode
- Avalanche Rated
- Low $Q_g$ and $R_{DS(on)}$
- Extended FBSOA

ADVANTAGES
- Low gate charge resulting in simple drive requirement
- High power density
- Fast switching

APPLICATIONS
- Load switches, high side switches, DC/DC converters, high efficiency
- Switching power supplies, inverters, battery chargers

IXTA32P05T
“P” denotes P-Channel MOSFET
“T” denotes “Trench-Gated”
FEATURES

- Fast intrinsic diode
- Dynamic $dv/dt$ rated
- Avalanche rated
- Rugged PolarP™ process
- Low gate charge and $R_{DS(on)}$

ADVANTAGES

- Low gate charge results in simple drive requirement
- High power density
- Fast switching
- Easy to parallel

APPLICATIONS

- High-side switching, push-pull amplifiers, DC/DC & DC/AC converters, current regulators, automatic test equipment, battery chargers

IXTN32P60P

“P” denotes P-Channel
“P” denotes Polar™
GigaMOS™ TrenchT2™ MOSFETs in SMPD Package (40V - 150V / 235A - 600A)

FEATURES
- Silicon chip on Direct Copper Bond (DCB) Substrate
- Excellent thermal transfer
- Increased temperature and power cycling capabilities
- 175°C operating Temperature
- Very high current handling capability
- Fast intrinsic diode
- Avalanche rated
- Very low $R_{DS(on)}$

SMPD Advantages:
- Ultra-low and compact package profile
- 5.3mm height x 24.8mm length x 32.3mm width
- Surface mountable via standard reflow process
- 4500V ceramic isolation (DCB)
- Very high power cycling capability
- Excellent thermal performance
- Low package weight (8g)

APPLICATIONS
- DC-DC converters, off-line UPS, primary-side switch, high speed power switching applications
Q3-Class HiPerFET™ Power MOSFET in SMPD Technology (1000V, 30A)

More Power, Less Package (ultra-low profile, energy efficient, and rugged)

**MMIX1F44N100Q3**

*Features:*
- Low $R_{DS(on)}$ and gate charge $Q_g$
- Low intrinsic gate resistance
- Fast intrinsic rectifier
- Excellent $dv/dt$ performance
- High avalanche energy rating
- High power density

*Applications:*
- DC-DC converters
- Battery chargers
- Switching and resonant power supplies
- DC choppers
- Temperature and lighting controls

*SMPD Advantages:*
- Ultra-low and compact package profile
- 5.3mm height x 24.8mm length x 32.3mm width
- Surface mountable via standard reflow process
- 4500V ceramic isolation (DCB)
- Very high power cycling capability
- Excellent thermal performance
- Low package weight (8g)
Polar™ HiPerFET™ Power MOSFET in SMPD (1100V, 24A)

Lighter weight, more power!
MMIX1F40N110P

Features:
- Low $R_{DS(on)}$ and $Q_g$
- Low thermal resistance $R_{thJC}$
- Dynamic $dv/dt$ ratings
- Avalanche rated
- Fast intrinsic rectifier
- Low package inductance

Applications:
- SMPS/RMPS
- Pulse power applications
- Discharge circuits in laser pulsers, spark igniters, RF generators
- DC-DC converters
- DC-AC inverters

SMPD Advantages:
- Ultra-low and compact package profile
- 5.3mm height x 24.8mm length x 32.3mm width
- Surface mountable via standard reflow process
- 4500V ceramic isolation (DCB)
- Very high power cycling capability
- Excellent thermal performance
- Low package weight (8g)
GigaMOS™ TrenchT2™ MOSFETs in DE475 Package
(55V – 75V / 465A – 550A)

TrenchT2™ MOSFETs in the ultra-low profile DE-Series package!

FEATURES
- Silicon chip on Direct-Copper Bond (DCB) Substrate
- Isolated substrate
  - excellent thermal transfer
  - increased temp and power cycling capabilities
  - high voltage isolation (2500V~)
- 175°C operating temperature
- Very high current handling capability
- Fast intrinsic diode
- Avalanche rated
- Very low $R_{DS(on)}$

ADVANTAGES
- Easy to mount, space savings, high power density

APPLICATIONS
- DC-DC converters,
- Off-line UPS,
- Primary-side switch,
- High speed power switching applications

IXTZ550N055T2
IXFZ520N075T2
“Z” denotes DE475 package
“F” denotes HiPerFET™ MOSFET
“T2” denotes TrenchT2™