Power Semiconductor Solutions for Automotive Applications

IXYS Corporation
October 2017
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I. IXYS AUTOMOTIVE BACKGROUND

- 1983: Power semis since foundation in Silicon Valley
- 1980s: IXYS Germany powered VW EV in Germany (DCB)
- 1989: GM Delco picked IXYS tech to power GM Impact EV1
- 1992: IXYS powered solar EV; won the Australian Solar Race
- In 2006: IXYS provided HV IGBTs to Tesla Motors for the Roadster EV

SELECT IXYS AUTOMOTIVE APPLICATIONS

- Semis to the HEV, EV, E-bikes, E-scooters.
- Solutions for trains: Korea, UK, Italy, South Africa, Germany, Dubai, US, Russia.
- DCB & DAB based power semi in design for Cars, HEVs, EVs
- Power MOS/IGBT for windows, fans, seats, AC, power steering, DC/DC, audio amplifiers, window tinting, power ABS.
- Rectifiers for alternators and battery chargers.
- IC for collision avoidance, CO sensors.
- MOSFET/IGBT modules for direct valve control
II. IXYS POWER SEMICONDUCTOR PORTFOLIO

- DISCRETE MOSFETs
- MOSFET MODULES
- DISCRETE IGBTs
- IGBT MODULES
- FAST RECOVERY DIODES – DISCRETES & MODULES
- SCHOTTKY DIODES
- RECTIFIER DIODES AND BRIDGES
- DISCRETE THYRISTORS
- THYRISTOR MODULES
- HIGH VOLTAGE CURRENT REGULATORS
- PROTECTION DEVICES
- SILICON CARBIDE (SiC) PRODUCTS
- DCB & DAB SUBSTRATES
IXYS POWER MOSFETs: AUTOMOTIVE

36V-300V Trench

100V-500V Depletion Mode D2™

75V-600V LinearL2™ with Extended FBSOAs

650V Ultra-Junction X2-Class HiPerFET™

-50V to -200V P-Channel TrenchP™
# IXYS POWER MOSFETs: AUTOMOTIVE

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
</table>
| 36V-300V GigaMOS™ Trench/TrenchT2™/TrenchT4™ (12A-660A) | ▪ High current capability  
▪ Ultra-low on-resistance $R_{DS(on)}$  
▪ Avalanche capability  
▪ Fast intrinsic diodes  
▪ 175°C operating temperature | ▪ Motor drive  
▪ Power windows and mirrors  
▪ Fuel injection  
▪ Braking systems  
▪ Electric Power Steering (EPS) |
| For low-voltage, high-current power conversion systems | | |

| 100V-500V Depletion Mode D2™ (800mA-16A) | ▪ ‘Normally-On’ operation  
▪ Low $R_{DS(on)}$  
▪ Linear mode tolerant  
▪ Useable body diode  
▪ Fast switching | ▪ Fans and pumps  
▪ Current regulators  
▪ Power distribution |
| “Normally ON” Power MOSFETs | | |

| 75V-600V LinearL2™ with extended FBSOAs (15A-200A) | ▪ High power in linear mode operation  
▪ Guaranteed FBSOA at 75°C  
▪ Avalanche rated  
▪ Low static drain-to-source on resistance | ▪ Fans and pumps  
▪ Fuel injection  
▪ Power windows and mirrors |
| Designed for high-power linear-mode applications | | |
## IXYS POWER MOSFETs: AUTOMOTIVE

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>650V Ultra Junction X2-Class HiPerFET™ (8A-170A)</td>
<td>▪ Low $R_{DS(on)}$ and $Q_g$</td>
<td>▪ On-Board Battery chargers</td>
</tr>
<tr>
<td></td>
<td>▪ Fast body diode</td>
<td>▪ Fuel injection</td>
</tr>
<tr>
<td></td>
<td>▪ $dv/dt$ ruggedness</td>
<td>▪ Water pumps</td>
</tr>
<tr>
<td></td>
<td>▪ Avalanche rated</td>
<td>▪ Power windows and mirrors</td>
</tr>
<tr>
<td></td>
<td>▪ High power density</td>
<td>▪ Air conditioning</td>
</tr>
<tr>
<td></td>
<td>▪ On-Board Battery chargers</td>
<td>▪ Hybrid Electric Vehicles</td>
</tr>
<tr>
<td><strong>Optimized for soft switching power conversion applications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-50V to -200V P-Channel TrenchP™ (-10A to -210A)</td>
<td>▪ Low $Q_g$ and $R_{DS(on)}$</td>
<td>▪ High side switches</td>
</tr>
<tr>
<td></td>
<td>▪ Fast intrinsic diode</td>
<td>▪ Battery chargers</td>
</tr>
<tr>
<td></td>
<td>▪ Avalanche rated</td>
<td>▪ Power inverters</td>
</tr>
<tr>
<td></td>
<td>▪ High power density</td>
<td>▪ Power windows and mirrors</td>
</tr>
<tr>
<td></td>
<td>▪ Fast switching</td>
<td>▪ Air conditioning</td>
</tr>
<tr>
<td><strong>Cost effective. Rugged.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**30V-300V TrenchT2™ POWER MOSFETs**

(70A - 600A)

**IXTK550N055T2**

“T2” denotes 2\textsuperscript{nd} generation Trench
100V-500V Depletion Mode D2™ Power MOSFETs (0.8A – 16A)

High Voltage Protected Regulator

Current source protection circuit

IXTH16N20D2
“D2” denotes Depletion-Mode D2™ MOSFET

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Vdss max (V)</th>
<th>Id @ Tc=25°C (A)</th>
<th>Rds(on) @ Tj=25°C (Ω)</th>
<th>VGS (off) max (V)</th>
<th>Ciss typ (pF)</th>
<th>Crss typ (pF)</th>
<th>Qg typ (nC)</th>
<th>Pd (W)</th>
<th>Package Type</th>
</tr>
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<tbody>
<tr>
<td>IXTH16N10D2</td>
<td>100</td>
<td>16</td>
<td>0.064</td>
<td>-4</td>
<td>5700</td>
<td>940</td>
<td>225</td>
<td>695</td>
<td>TO-247</td>
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<tr>
<td>IXTH16N10D2</td>
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<td>16</td>
<td>0.064</td>
<td>-4</td>
<td>5700</td>
<td>940</td>
<td>225</td>
<td>695</td>
<td>TO-268</td>
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<tr>
<td>IXTH16N20D2</td>
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<td>0.073</td>
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<td>5500</td>
<td>607</td>
<td>208</td>
<td>695</td>
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<tr>
<td>IXTH16N20D2</td>
<td>200</td>
<td>16</td>
<td>0.073</td>
<td>-4</td>
<td>5500</td>
<td>607</td>
<td>208</td>
<td>695</td>
<td>TO-268</td>
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<tr>
<td>IXTA08N50D2</td>
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<td>4.6</td>
<td>-4</td>
<td>312</td>
<td>11</td>
<td>12.7</td>
<td>60</td>
<td>TO-263</td>
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<tr>
<td>IXTP08N50D2</td>
<td>500</td>
<td>0.8</td>
<td>4.6</td>
<td>-4</td>
<td>312</td>
<td>11</td>
<td>12.7</td>
<td>60</td>
<td>TO-220</td>
</tr>
</tbody>
</table>
75V-600V LinearL2™ Power MOSFETs with Extended FBSOAs (15A – 200A)

Linear Motor Control

Electronic Load (programmable resistive load)

IXTK200N10L2
“L2” denotes 2nd generation linear devices
650V Ultra-Junction X2-Class HiPerFET™ Power MOSFETs (8A – 170A)

IXFH60N65X2
“F” denotes HiPerFET™
“X2” denotes 2nd Generation Ultra Junction

<table>
<thead>
<tr>
<th>Part Number</th>
<th>V_{dss} (V)</th>
<th>I_{dss} (A)</th>
<th>R_{DSS} \text{max}</th>
<th>Q_{gs} \text{typ}</th>
<th>C_{gs} \text{typ}</th>
<th>t_{r} \text{typ}</th>
<th>R_{BSC} \text{max}</th>
<th>P_{d} \text{max}</th>
<th>Package Type</th>
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<tr>
<td>IXFA22N65X2</td>
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<td>22</td>
<td>0.145</td>
<td>37</td>
<td>2190</td>
<td>145</td>
<td>0.32</td>
<td>390</td>
<td>TO-263</td>
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<tr>
<td>IXFH22N65X2</td>
<td>650</td>
<td>22</td>
<td>0.145</td>
<td>37</td>
<td>2190</td>
<td>145</td>
<td>0.32</td>
<td>390</td>
<td>TO-247</td>
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<tr>
<td>IXFP22N65X2</td>
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<td>22</td>
<td>0.145</td>
<td>37</td>
<td>2190</td>
<td>145</td>
<td>0.32</td>
<td>390</td>
<td>TO-220</td>
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<tr>
<td>IXFH34N65X2</td>
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<td>34</td>
<td>0.1</td>
<td>56</td>
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<td>164</td>
<td>0.23</td>
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<tr>
<td>IXFH46N65X2</td>
<td>650</td>
<td>46</td>
<td>0.069</td>
<td>98</td>
<td>4570</td>
<td>180</td>
<td>0.19</td>
<td>660</td>
<td>TO-247</td>
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<tr>
<td>IXFH60N65X2</td>
<td>650</td>
<td>60</td>
<td>0.052</td>
<td>108</td>
<td>6300</td>
<td>180</td>
<td>0.16</td>
<td>780</td>
<td>TO-247</td>
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<tr>
<td>IXFH80N65X2</td>
<td>650</td>
<td>80</td>
<td>0.038</td>
<td>140</td>
<td>8300</td>
<td>200</td>
<td>0.14</td>
<td>890</td>
<td>TO-247</td>
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<tr>
<td>IXFK100N65X2</td>
<td>650</td>
<td>100</td>
<td>0.03</td>
<td>183</td>
<td>10800</td>
<td>200</td>
<td>0.12</td>
<td>1040</td>
<td>TO-264</td>
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</table>
-50V to -200V P-Channel TrenchP™ Power MOSFETs
(-10A to -210A)

IXTA36P05T
“P” denotes P-Channel MOSFET
“T” denotes “Trench-Gated”

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Vdss (max) V</th>
<th>Id @ Tc=25°C (A)</th>
<th>Rds(on) @ Tj=25°C (Ω)</th>
<th>Ciss (pF)</th>
<th>Qg (nC)</th>
<th>trr @ Tj= 25°C (ns)</th>
<th>R(th)JC (°C/W)</th>
<th>Pd (W)</th>
<th>Package Type</th>
</tr>
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<tbody>
<tr>
<td>IXTA36P15P</td>
<td>-150</td>
<td>-36.0</td>
<td>0.110</td>
<td>2950</td>
<td>55</td>
<td>228</td>
<td>0.50</td>
<td>300</td>
<td>TO-263</td>
</tr>
<tr>
<td>IXTP36P15P</td>
<td>-150</td>
<td>-36.0</td>
<td>0.110</td>
<td>2950</td>
<td>55</td>
<td>228</td>
<td>0.50</td>
<td>300</td>
<td>TO-220</td>
</tr>
</tbody>
</table>
IXYS IGBTs: Automotive

- 600V XPT™ Planar
- 650V XPT™ Planar
- 650V XPT™ Trench
- 900V XPT™ Planar
- 1200V XPT™ Planar
# IXYS IGBTs: Automotive

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
</table>
| **600V XPT™ Planar** (33A-550A) | - Low $V_{CE(sat)}$ & $E_{ts}$  
- Easy to parallel  
- Square RBSOA (rated up to 600V)  
- Extended FBSOA  
- Avalanche rated  
- Short circuit capability (10µs) | - Motor drive  
- Power windows and mirrors  
- Fuel injection  
- Braking systems  
- Car battery chargers |
| **650V XPT™ Planar** (15A-200A) | - Optimized for 20kHz-60kHz switching  
- Avalanche rated  
- Square RBSOA (rated up to 650V)  
- Positive thermal coefficient of $V_{CE(sat)}$  
- Avalanche rated  
- Short circuit capability (8µs-10µs)  
- International standard and proprietary high voltage packages | - Motor drive  
- Power windows and mirrors  
- Fuel injection  
- Braking systems  
- Electric Power Steering |
| **650V XPT™ Trench** (65A-480A) | - Optimized for low conduction & switching losses  
- Square RBOSA (rated up to 650V)  
- Positive thermal coefficient of $V_{CE(sat)}$  
- Avalanche rated  
- High power density | - Fans and pumps  
- Car battery chargers  
- Power distribution  
- Motor drive |

*IXYS IGBTs: Automotive*
### IXYS IGBTs: Automotive

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>900V XPT™ Planar</strong></td>
<td>- Optimized for 20kHz-50kHz switching</td>
<td>- Electric power steering</td>
</tr>
<tr>
<td>(20A-310A)</td>
<td>- High current handling capability</td>
<td>- Power inverters</td>
</tr>
<tr>
<td></td>
<td>- Maximum junction temperature $T_{JM} = 175^\circ C$</td>
<td>- Power windows and mirrors</td>
</tr>
<tr>
<td></td>
<td>- Positive thermal coefficient of $V_{CE(sat)}$</td>
<td>- Braking systems</td>
</tr>
<tr>
<td></td>
<td>- Square RBSOA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Ultra-fast anti-parallel diodes</td>
<td></td>
</tr>
<tr>
<td><strong>For energy-efficient high-speed, hard-switching power conversion applications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1200V XPT™ Planar</strong></td>
<td>- Optimized for low conduction &amp; switching losses</td>
<td>- Battery chargers</td>
</tr>
<tr>
<td>(21A-240A)</td>
<td>- Easy to parallel</td>
<td>- Power inverters</td>
</tr>
<tr>
<td></td>
<td>- Square RBSOA (rated up to 1200V)</td>
<td>- Power windows and mirrors</td>
</tr>
<tr>
<td></td>
<td>- Positive thermal coefficient of $V_{CE(sat)}$</td>
<td>- Motor drive</td>
</tr>
<tr>
<td></td>
<td>- Avalanche rated</td>
<td></td>
</tr>
<tr>
<td><strong>For high-speed, hard-switching applications (up to 50kHz)</strong></td>
<td></td>
<td></td>
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</tbody>
</table>
IXYS IGBT Technology

eXtreme-light Punch-Through (XPT™) Technology

IXYS IGBTs: Cross Sectional Views
XPT™ Technology Advantages

- Thin wafer technology
- Reduced thermal resistance
- Low energy losses
- Fast switching
- Low tail current
- High current density
- Positive temperature coefficient of \( V_{CE(sat)} \)

**Advantages**

**Total energy loss vs. frequency**

**Trade-off performance \( [E_{off} \text{ vs. } V_{CE(sat)}] \)**
**600V XPT™ Planar IGBTs**

**Rugged and Low Loss Extreme-Light Punch -Through IGBTs!**

![Image of Brushed DC Motor Drive Circuit](image)

**Part number example:**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>VCES (V)</th>
<th>IC25 TC=25°C IGBT (A)</th>
<th>IC110 TC=110°C IGBT (A)</th>
<th>VCE(sat) max TJ=25°C IGBT(V)</th>
<th>tfi typ TJ=25°C IGBT(ns)</th>
<th>Eoff typ TJ=150°C IGBT(mJ)</th>
<th>RthJC max IGBT(C/W)</th>
<th>Configuration</th>
<th>Package Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>IXXH30N60C3D1</td>
<td>600</td>
<td>60</td>
<td>30</td>
<td>2.2</td>
<td>32</td>
<td>0.4</td>
<td>0.55</td>
<td>Copack (FRD)</td>
<td>TO-247</td>
</tr>
<tr>
<td>IXXH30N60B3D1</td>
<td>600</td>
<td>60</td>
<td>30</td>
<td>1.85</td>
<td>125</td>
<td>0.7</td>
<td>0.55</td>
<td>Copack (FRD)</td>
<td>TO-247</td>
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<tr>
<td>IXXH50N60C3</td>
<td>600</td>
<td>100</td>
<td>50</td>
<td>2.3</td>
<td>42</td>
<td>0.48</td>
<td>0.25</td>
<td>Copack (FRD)</td>
<td>TO-247</td>
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<tr>
<td>IXXH50N60C3D1</td>
<td>600</td>
<td>100</td>
<td>50</td>
<td>2.3</td>
<td>42</td>
<td>0.48</td>
<td>0.25</td>
<td>Copack (FRD)</td>
<td>TO-247</td>
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</tbody>
</table>

Prefix “IXX” denotes X-series XPT™ IGBT
“B3” denotes B3-Class
“H1” denotes co-packed diode Sonic-FRD™
650V XPT™ Planar IGBTs
(15A-200A)

For demanding high-speed hard-switching power conversion systems

Part number example:
IXYH30N65C3H1
Prefix “IXY” denotes Y-series XPT™ IGBT
“C3” denotes C3-Class
“H1” denotes co-packed diode Sonic-FRD™

<table>
<thead>
<tr>
<th>Part Number</th>
<th>$V_{CES}$</th>
<th>$I_{C5}$</th>
<th>$I_{C110}$</th>
<th>$V_{CE(sat)}$ max</th>
<th>$t_{f}$ typ</th>
<th>$E_{off}$ typ</th>
<th>$R_{on}$ max</th>
<th>Configuration</th>
<th>Package Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>IXYP15N65C3D1M</td>
<td>650</td>
<td>16</td>
<td>8</td>
<td>2.5</td>
<td>42</td>
<td>0.24</td>
<td>3.1</td>
<td>Copacked (FRED)</td>
<td>TO-220 (overmolded)</td>
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<tr>
<td>IXYP20N65C3D1M</td>
<td>650</td>
<td>18</td>
<td>9</td>
<td>2.5</td>
<td>36</td>
<td>0.4</td>
<td>3</td>
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<td>TO-220 (overmolded)</td>
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<td>IXYP10N65C3</td>
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<td>10</td>
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<td>IXYP15N65C3</td>
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<td>15</td>
<td>2.5</td>
<td>42</td>
<td>0.24</td>
<td>0.75</td>
<td>Single</td>
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<td>50</td>
<td>20</td>
<td>2.5</td>
<td>36</td>
<td>0.4</td>
<td>0.65</td>
<td>Single</td>
<td>TO-220</td>
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<tr>
<td>IXYH30N65C3</td>
<td>650</td>
<td>60</td>
<td>30</td>
<td>2.7</td>
<td>30</td>
<td>0.41</td>
<td>0.55</td>
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<td>TO-220</td>
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<tr>
<td>IXYH30N65C3H1</td>
<td>650</td>
<td>60</td>
<td>30</td>
<td>2.7</td>
<td>30</td>
<td>0.41</td>
<td>0.55</td>
<td>Copacked (Sonic-FRD™)</td>
<td>TO-220</td>
</tr>
</tbody>
</table>
650V XPT™ Trench IGBTs
(65A-480A)

On-board Battery Charger

Superior trade-off (turn-off energy loss vs. on-state voltage)

Part number example:
IXXN110N65C4H1
Prefix “IXX” denotes X-series XPT™ IGBT
“C4” denotes C4-Class
“H1” denotes co-packed diode Sonic-FRD™
**900V XPT™ Planar IGBTs**

*(20A-310A)*

For energy-efficient high-speed, hard-switching power conversion applications

![Half-bridge resonant power supply diagram](image)

**Part number example:**

- **IXYA8N90C3D1**
- Prefix “IXY” denotes Y-series XPT™ IGBT
- “C3” denotes C3-Class
- “D1” denotes co-packed diode HiPerFRED™

<table>
<thead>
<tr>
<th>Part Number</th>
<th>$V_{GS}$ (V)</th>
<th>$I_{CS}$ (A)</th>
<th>$I_{C1S}$ (A)</th>
<th>$V_{C1S(sat)}$ max $T_A=25^\circ$C (V)</th>
<th>$t_s$ typ $T_A=125^\circ$C (ns)</th>
<th>$E_{off}$ typ $T_A=125^\circ$C (mJ)</th>
<th>$R_{ON}$ max IGBT $T_A=125^\circ$C ($^\circ$/W)</th>
<th>Configuration</th>
<th>Package Style</th>
</tr>
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<tbody>
<tr>
<td>IXYA8N90C3D1</td>
<td>900</td>
<td>20</td>
<td>8</td>
<td>2.5</td>
<td>163</td>
<td>0.22</td>
<td>1.2</td>
<td>Copacked (HiPerFRED™)</td>
<td>TO-263</td>
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<tr>
<td>IXYP8N90C3</td>
<td>900</td>
<td>20</td>
<td>8</td>
<td>2.5</td>
<td>163</td>
<td>0.22</td>
<td>1.2</td>
<td>Single</td>
<td>TO-220</td>
</tr>
<tr>
<td>IXYP8N90C3D1</td>
<td>900</td>
<td>20</td>
<td>8</td>
<td>2.5</td>
<td>163</td>
<td>0.22</td>
<td>1.2</td>
<td>Copacked (HiPerFRED™)</td>
<td>TO-220</td>
</tr>
<tr>
<td>IXYH8N90C3</td>
<td>900</td>
<td>20</td>
<td>8</td>
<td>2.5</td>
<td>163</td>
<td>0.22</td>
<td>1.2</td>
<td>Single</td>
<td>TO-252</td>
</tr>
<tr>
<td>IXYH24N90C3</td>
<td>900</td>
<td>44</td>
<td>24</td>
<td>2.7</td>
<td>130</td>
<td>0.55</td>
<td>0.62</td>
<td>Single</td>
<td>TO-247</td>
</tr>
<tr>
<td>IXYH24N90C3D1</td>
<td>900</td>
<td>44</td>
<td>24 ($T_A=90^\circ$C)</td>
<td>2.7</td>
<td>130</td>
<td>0.55</td>
<td>0.62</td>
<td>Copacked (HiPerFRED™)</td>
<td>TO-247</td>
</tr>
</tbody>
</table>
1200V XPT™ Planar IGBTs

(21A-240A) For high-speed, hard-switching applications (up to 50kHz)

Part number example:

**IXY**N82N120C3H1

Prefix “**IXY**” denotes Y-series XPT™ IGBT

“**C3**” denotes C3-Class

“**H1**” denotes co-packed diode Sonic-FRD™

<table>
<thead>
<tr>
<th>Part Number</th>
<th>$V_{CES}$ (V)</th>
<th>$I_{CES}$</th>
<th>$I_{C110}$</th>
<th>$V_{CE(sat)}$ max</th>
<th>$t_n$ typ</th>
<th>$E_{off}$ typ</th>
<th>$R_{VCE}$ max IGBT</th>
<th>Configuration</th>
<th>Package Style</th>
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<tr>
<td><strong>IXY</strong>J20N120C3D1</td>
<td>1200</td>
<td>16</td>
<td>7</td>
<td>4</td>
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<td>40</td>
<td>20</td>
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<td>Single</td>
<td>TO-247</td>
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<tr>
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<td>1200</td>
<td>66</td>
<td>30</td>
<td>4</td>
<td>88</td>
<td>0.9</td>
<td>0.3</td>
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<td>TO-247</td>
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<tr>
<td><strong>IXY</strong>N30N120C3D1</td>
<td>1200</td>
<td>66</td>
<td>30</td>
<td>4</td>
<td>88</td>
<td>0.9</td>
<td>0.3</td>
<td>Copacked (FRED)</td>
<td>TO-247</td>
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</tbody>
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IV. IXYS POWER MODULES

- H-Bridge MOSFET Modules
- Phase leg XPT™ IGBT Modules
- Converter-Brake-Inverter (CBI) IGBT Modules
<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H-Bridge MOSFET Modules</strong></td>
<td>▪ Low $R_{DS(on)}$</td>
<td>▪ HEV and EV applications</td>
</tr>
<tr>
<td></td>
<td>▪ Low gate charge</td>
<td>▪ Motor drive</td>
</tr>
<tr>
<td></td>
<td>▪ Unclamped inductive switching (UIS) capability</td>
<td>▪ Power supplies</td>
</tr>
<tr>
<td></td>
<td>▪ $dv/dt$ ruggedness</td>
<td>▪ Battery or fuel-cell powered applications</td>
</tr>
<tr>
<td></td>
<td>▪ Fast intrinsic reverse diode</td>
<td></td>
</tr>
<tr>
<td><strong>Phase leg XPT™ IGBT Modules</strong></td>
<td>▪ High level of integration</td>
<td>▪ Automotive pumps and fans</td>
</tr>
<tr>
<td></td>
<td>▪ Rugged XPT™ design</td>
<td>▪ Air-conditioning systems</td>
</tr>
<tr>
<td></td>
<td>▪ Short circuit rated for 10µs</td>
<td>▪ AC motor drives</td>
</tr>
<tr>
<td></td>
<td>▪ Square RBSOA</td>
<td>▪ Inverter and power supplies</td>
</tr>
<tr>
<td></td>
<td>▪ Very low gate charge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Fast and soft reverse recovery diode</td>
<td></td>
</tr>
<tr>
<td>**Converter-Brake-Inverter (CBI) IGBT</td>
<td>▪ NPT IGBT technology with low saturation voltage</td>
<td>▪ Electric braking system</td>
</tr>
<tr>
<td>Modules</td>
<td>▪ Low switching losses</td>
<td>▪ 3-phase synchronous or asynchronous motor drive</td>
</tr>
<tr>
<td></td>
<td>▪ Short circuit rated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Epitaxial free-wheeling diodes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Insulated copper base plate and soldering pins for PCB mounting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Temperature sense included</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</table>
IV. IXYS INTEGRATED CIRCUITS PORTFOLIO

- Solid State Relays/Semiconductor Relays
- Optocouplers
- MOSFET and IGBT Gate Drivers
- Diode Bridges
- AC Power Switches (SCR-Based)
- Solar Cells
IXYS ICs: AUTOMOTIVE

- Gate Drivers
- Optocouplers
- PLA171PH (SSR)
- Other SSRs
# IXYS ICs: AUTOMOTIVE

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
</table>
| 4-AMP and 9-AMP DUAL LOWSIDE ULTRAFAST MOSFET DRIVER | ▪ AEC Q100 Qualified  
▪ 4A Peak Source/Sink Drive Current  
▪ Wide Operating Voltage Range: 4.5V to 35V  
▪ AEC Q100 Grade 1: -40°C to +125°C Operating Temperature Range  
▪ Logic Input Withstands Negative Swing of up to 5V  
▪ Outputs May be Connected in Parallel for Higher Drive Current  
▪ Matched Rise and Fall Times  
▪ Low Propagation Delay Time  
▪ Low 10µA Supply Current  
▪ Low Output Impedance | ▪ battery for electronic vehicle  
▪ battery charger for hybrids  
▪ electronic control board in “S coupe” e-vehicle  
▪ for IGBT driver in electronic diesel tractors  
▪ automotive security systems  
▪ automotive heater |
| OPTOCOUPLEERS                       | ▪ Couples analog and digital signals  
▪ 3750 Vrms input/output isolation  
▪ Wide bandwidth (>200kHz)  
▪ High gain stability  
▪ Low input/output capacitance  
▪ Low power consumption  
▪ 0.01% servo linearity  
▪ THD 87dB typical | Automotive: Suited for driving power IGBTs and MOSFETs in automotive motor control inverter and DC-DC converter applications. Suitable for isolation needs in automotive, industrial inverters and power management |
# IXYS ICs: AUTOMOTIVE

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
</table>
| PLA171PH: HIGH RELIABILITY AUTOMOTIVE GRADE SSR | - 800V Output Blocking Voltage over –40°... +105°C operating temperature range  
- AEC-Q 101 automotive grade product  
- 8-pin Flatpack surface mount package with >7mm Load Output Creepage Distance meeting pollution class 2 requirements  
- 5000V$_{\text{rms}}$ Input/Output Isolation  
- 50 Ohms/100mA load output rating | - Battery Monitoring on HEV or EV  
- Isolation Monitor |
| POWER SOLID STATE RELAYS | - AC/DC switching  
- 2500V$_{\text{rms}}$ input-to-output isolation  
- 30V to 1000V load voltage  
- 180mA to 32Amp load current | - Automotive flasher applications  
- ABS or air-conditioning compressor clutch  
- Vacuum pump for brake booster support in hybrid vehicles |
AUTOMOTIVE GRADE GATE DRIVERS

- IXYS ICD IXD_600 Series Gate Driver ICs are well suited for harsh automotive applications.

  - Wide operating voltage range: 4.5V to 35V
  - AEC Q100 Grade 1 Operating Temperature Range: -40°C to +125°C
  - Very robust; virtually immune to transient spikes
  - Very high reliability
AUTOMOTIVE APPLICATIONS

- IXYS ICD IXD_600 Series Gate Driver ICs are used in automotive applications worldwide. High volume automotive applications include:
  
  - 2kW DC/DC for hybrid sedan
  - 6.6kW on board charger for hybrid sedan
  - Automotive induction motor drive
  - 3.3kW DC/DC for hybrid SUV
  - 3.3kW DC/DC for EV bus
AUTOMOTIVE GRADE GATE DRIVERS

IXD_604SI, IXD_604SIA, IXD_609SI

Features
- AEC Q100 Qualified
- 4A Peak Source/Sink Drive Current
- Wide Operating Voltage Range: 4.5V to 35V
- AEC Q100 Grade 1, -40°C to +125°C Operating Temperature Range
- Logic Input Withstands Negative Swing of up to 5V
- Outputs May Be Connected in Parallel for Higher Drive Current
- Matched Rise and Fall Times
- Low Propagation Delay Time
- Low, 10µA Supply Current
- Low Output Impedance

Features
- AEC Q100 Qualified
- 9A Peak Source/Sink Drive Current
- Wide Operating Voltage Range: 4.5V to 35V
- AEC Q100 Grade 1, -40°C to +125°C Operating Temperature Range
- Logic Input Withstands Negative Swing of up to 5V
- Matched Rise and Fall Times
- Low Propagation Delay Time
- Low, 10µA Supply Current
- Low Output Impedance

Applications
- Automotive DC/DC Regulators
- Electronic Power Steering
- Electric Vehicle Power Train Drives
- Brushless DC Motors

Applications
- Automotive DC/DC Regulators
- Electronic Power Steering
- Electric Vehicle Power Train Drives
- Brushless DC Motors

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Logic Configuration</th>
<th>Package Type</th>
<th>Packing Method</th>
<th>Quantity</th>
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<tr>
<td>IXD_604SI</td>
<td></td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tube</td>
<td>100</td>
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<tr>
<td>IXD_604SITR</td>
<td></td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tape &amp; Reel</td>
<td>2000</td>
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<tr>
<td>IXD_604SIA</td>
<td></td>
<td>8-Pin SOIC</td>
<td>Tube</td>
<td>100</td>
</tr>
<tr>
<td>IXD_604SIATR</td>
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<td>8-Pin SOIC</td>
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<td>100</td>
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<td>IXD_609SI</td>
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<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tube</td>
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<tr>
<td>IXD_609SITR</td>
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<td>8-Pin Power SOIC with Exposed Metal Back</td>
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<td>8-Pin SOIC</td>
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<td>IXD_609SIATR</td>
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<td>8-Pin SOIC</td>
<td>Tube</td>
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<td>8-Pin Power SOIC with Exposed Metal Back</td>
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<td>100</td>
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<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tape &amp; Reel</td>
<td>2000</td>
</tr>
<tr>
<td>IXN_604SIA</td>
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<td>8-Pin SOIC</td>
<td>Tube</td>
<td>100</td>
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<tr>
<td>IXN_604SIATR</td>
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<td>8-Pin SOIC</td>
<td>Tube</td>
<td>100</td>
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Ordering Information

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<th>Part Number</th>
<th>Logic Configuration</th>
<th>Package Type</th>
<th>Packing Method</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>IXD_609SI</td>
<td></td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tube</td>
<td>100</td>
</tr>
<tr>
<td>IXD_609SITR</td>
<td></td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tape &amp; Reel</td>
<td>2000</td>
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<tr>
<td>IXD_609SI</td>
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<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tube</td>
<td>100</td>
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<tr>
<td>IXD_609SITR</td>
<td></td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tape &amp; Reel</td>
<td>2000</td>
</tr>
<tr>
<td>IXN_609SI</td>
<td></td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tube</td>
<td>100</td>
</tr>
<tr>
<td>IXN_609SITR</td>
<td></td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tape &amp; Reel</td>
<td>2000</td>
</tr>
</tbody>
</table>
AUTOMOTIVE GRADE GATE DRIVERS

IXD_614SI

IXYS
INTEGRATED CIRCUITS DIVISION

Features
- AEC Q100 Qualified
- 14A Peak Source/Sink Drive Current
- Wide Operating Voltage Range: 4.5V to 35V
- AEC Q100 Grade -40°C to +125°C Operating Temperature Range
- Logic Input Withstands Negative Swing of up to 5V
- Matched Rise and Fall Times
- Low Propagation Delay Time
- Low, 10µA Supply Current
- Low Output Impedance

Applications
- Automotive DC/DC Regulators
- Electronic Power Steering
- Electric Vehicle Power Train Drives
- Brushless DC Motors

Description
The IXD_614SI is an automotive grade, high-speed gate driver that is qualified according to AEC Q100 standards. The IXD_614SI output can source and sink 14A of peak current, while producing rise and fall times of less than 35ns. Both the output and input are rated to 35V. The input is virtually immune to latch-up, and proprietary circuitry eliminates cross conduction and “shoot-through.” The IXD_614SI has a Grade 1, -40°C to +125°C ambient operating temperature range.

The IXD614Si is configured as a non-inverting driver with an enable, the IXDN614Si is configured as a non-inverting driver, and the IXDI614Si is configured as an inverting driver. The AEC Q100 qualified IXD_614SI is available in an 8-pin Power SOIC package with an exposed metal back.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Logic Configuration</th>
<th>Package Type</th>
<th>Packing Method</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>IXD614SI</td>
<td>IN ▶ OUT</td>
<td>8-Pin Power SOIC with Exposed Metal Back</td>
<td>Tube</td>
<td>100</td>
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<tr>
<td>IXD614SIGTR</td>
<td>EN ▶ OUT</td>
<td></td>
<td>Tape &amp; Reel</td>
<td>2000</td>
</tr>
<tr>
<td>IXDI614SI</td>
<td>IN ▶ OUT</td>
<td></td>
<td>Tube</td>
<td>100</td>
</tr>
<tr>
<td>IXDI614SIGTR</td>
<td>EN ▶ OUT</td>
<td></td>
<td>Tape &amp; Reel</td>
<td>2000</td>
</tr>
<tr>
<td>IXDN814SI</td>
<td>IN ▶ OUT</td>
<td></td>
<td>Tube</td>
<td>100</td>
</tr>
<tr>
<td>IXDN814SIGTR</td>
<td>EN ▶ OUT</td>
<td></td>
<td>Tape &amp; Reel</td>
<td>2000</td>
</tr>
</tbody>
</table>
IXYS ICs: OPTOCOUPLERS

LOC117
Linear Optocoupler

Features:
• Small 8-Pin Package
• Flatpack Package (PCMCIA Compatible)
• Couples Analog and Digital Signals
• Wide Bandwidth (>200kHz)
• High Gain Stability
• Low Input-to-Output Capacitance
• Low Power Consumption
• 0.01% Servo Linearity
• THD -87dB Typical
• Machine Insertable, Wave Solderable
• Surface Mount Tape and Reel Packaging Available
• VDE Compatible

Applications

• Linear Optocouplers and Isolation Amplifiers (analog couplers)
• Low Cost Single and Dual Optocouplers for signal switching
• Linear Error Amplifiers

Applications

 Automotive: Suited for driving power IGBTs and MOSFETs in automotive motor control inverter and DC-DC converter applications.
 Suitable for isolation needs in automotive, industrial inverters and power management

Figure 1: Isolation Amplifier (Photoconductive Operation)
IXYS ICs: OPTOCOUPLECTRS

Linear Optocoupler

Isolation Amplifier (Photoconductive Operation)

![Amplitude Response](image1.png)

![Phase Response](image2.png)

<table>
<thead>
<tr>
<th>Product Part Number</th>
<th>K1 Servo Gain</th>
<th>K2 Forward Gain</th>
<th>K3 Transfer Gain</th>
<th>Standard Package</th>
<th>Input Control Current</th>
<th>Isolation Voltage</th>
<th>Optional Packaging1</th>
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<tbody>
<tr>
<td>LOC110 R5</td>
<td>0.004/0.030</td>
<td>0.004/0.030</td>
<td>0.008/1.179</td>
<td>8 Pin DIP</td>
<td>2</td>
<td>3750</td>
<td>1</td>
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<tr>
<td>LOC111 R7</td>
<td>0.008/0.030</td>
<td>0.008/0.030</td>
<td>0.733/1.072</td>
<td>8 Pin DIP</td>
<td>2</td>
<td>3750</td>
<td>1</td>
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<td>LOC112 R5</td>
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<td>0.004/0.030</td>
<td>0.733/1.072</td>
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<td>3750</td>
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<td>LOC117 R3</td>
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<td>0.008/0.030</td>
<td>0.887/1.072</td>
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<td>3750</td>
<td>1</td>
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<tr>
<td>LOC210P R6</td>
<td>0.004/0.03</td>
<td>0.004/0.03</td>
<td>0.733/1.072</td>
<td>16 Pin SOIC</td>
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<td>3750</td>
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<tr>
<td>LOC211F R6</td>
<td>0.008/0.03</td>
<td>0.008/0.03</td>
<td>0.733/1.072</td>
<td>16 Pin SOIC</td>
<td>2</td>
<td>3750</td>
<td>1</td>
</tr>
</tbody>
</table>
IXYS ICs: PLA171PH: HIGH RELIABILITY AUTO GRADE SSR

Features
• 7mm Separation of Output Pins
• 800VP Blocking Voltage
• 5000Vrms Input/Output Isolation
• Low Drive Power Requirements (TTL/CMOS Compatible)
• Arc-Free With No Snubbing Circuits
• No EMI/RFI Generation
• Small Surface Mount Package
• Machine Insertable, Wave Solderable
• Flammability Rating UL 94 V-0

Applications
• Instrumentation
• Multiplexers
• Data Acquisition
• Electronic Switching
• I/O Subsystems
• Meters (Watt-Hour, Water, Gas)
• Medical Equipment—Patient/Equipment Isolation
• Automotive High-Voltage Circuitry
• Aerospace
• Industrial Controls
• Battery monitoring for the EV

Approvals
• UL Certified Component: File E76270
• EN/IEC 60950 Certified Component: TUV Certificate B 12 11 82667 001

8 Pin Flatpack Package

AC/DC Configuration

IXYS
IXYS ICs: PLA171PH: HIGH RELIABILITY AUTO GRADE SSR

Single-Pole Normally Open OptoMOS® Relay

Well-suited for automotive high-voltage circuitry

Switching characteristics

AC/DC Configuration

<table>
<thead>
<tr>
<th>NC</th>
<th>1</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Control</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>- Control</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

Typical LED Forward Voltage Drop
(N=50, \( I_F = 5\text{mA}, T_A = 25^\circ\text{C}\))

<table>
<thead>
<tr>
<th>Device Count (N)</th>
<th>LED Forward Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.230</td>
<td>35</td>
</tr>
<tr>
<td>1.235</td>
<td>25</td>
</tr>
<tr>
<td>1.240</td>
<td>20</td>
</tr>
<tr>
<td>1.245</td>
<td>15</td>
</tr>
<tr>
<td>1.250</td>
<td>10</td>
</tr>
<tr>
<td>1.255</td>
<td>5</td>
</tr>
</tbody>
</table>

Typical Turn-On Time
(N=50, \( I_F = 5\text{mA}, I_L = 100\text{mA}, T_A = 25^\circ\text{C}\))

<table>
<thead>
<tr>
<th>Device Count (N)</th>
<th>Turn-On Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.36</td>
<td>20</td>
</tr>
<tr>
<td>0.38</td>
<td>15</td>
</tr>
<tr>
<td>0.40</td>
<td>10</td>
</tr>
<tr>
<td>0.42</td>
<td>5</td>
</tr>
<tr>
<td>0.44</td>
<td>2</td>
</tr>
</tbody>
</table>

Typical Turn-Off Time
(N=50, \( I_F = 5\text{mA}, I_L = 100\text{mA}, T_A = 25^\circ\text{C}\))

<table>
<thead>
<tr>
<th>Device Count (N)</th>
<th>Turn-Off Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.135</td>
<td>20</td>
</tr>
<tr>
<td>0.140</td>
<td>15</td>
</tr>
<tr>
<td>0.145</td>
<td>10</td>
</tr>
<tr>
<td>0.150</td>
<td>5</td>
</tr>
<tr>
<td>0.155</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Voltage</td>
<td>800</td>
<td>( V_F )</td>
</tr>
<tr>
<td>Load Current</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum On-Resistance</td>
<td>50</td>
<td>( \Omega )</td>
</tr>
<tr>
<td>Input Control Current</td>
<td>2</td>
<td>mA</td>
</tr>
</tbody>
</table>
IXYS ICs: 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

APPLICATIONS

Automotive:

- Can be used for applications with a high number of switching processes e.g. Automotive flasher applications
- ABS or air-conditioning compressor clutch or vacuum pump for brake booster support in hybrid vehicles.
IXYS ICs: SOLID STATE RELAYS

Solid State Relays/Semiconductor Relays
- Form-A (Normally Open) Relays
- Form-B (Normally Closed) Relays
- Combination Form-A & Form-B Relays
- Power Relays (MOSFET-Based)
- Current-Limited SSRs with Thermal Management and Voltage Triggered Shutdown

**IXYS Solid State Relays**

![Graph showing current handling vs. blocking voltage for IXYS ICs.]

<table>
<thead>
<tr>
<th>Part</th>
<th>Package</th>
<th>Number of Poles</th>
<th>Area per Pole (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPC7581BA LCAS</td>
<td>16 SOIC</td>
<td>4</td>
<td>54</td>
</tr>
<tr>
<td>CPC7582BA LCAS</td>
<td></td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td>CPC7583BA LCAS</td>
<td>28 SOIC</td>
<td>10</td>
<td>32</td>
</tr>
<tr>
<td>CPC7581MA LCAS</td>
<td>16 MLP</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>CPC7582MA LCAS</td>
<td></td>
<td>6</td>
<td>10.5</td>
</tr>
<tr>
<td>CPC7583MA LCAS</td>
<td>28 MLP</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>LCA110 OptoMOS</td>
<td>6-pin SMT</td>
<td>1</td>
<td>53</td>
</tr>
<tr>
<td>LAA110 OptoMOS</td>
<td>8-pin SMT</td>
<td>2</td>
<td>30.5</td>
</tr>
<tr>
<td>CPC1035 OptoMOS</td>
<td>4-pin SOP</td>
<td>1</td>
<td>16</td>
</tr>
</tbody>
</table>
V. PROPRIETARY PACKAGING TECHNOLOGIES

- ISOPLUS™ Technology
- Surface Mount Power Device (SMPD) Packages
- High Voltage Packages
## IXYS PACKAGING: AUTOMOTIVE

<table>
<thead>
<tr>
<th>Package Technology</th>
<th>Features/Advantages</th>
<th>Automotive Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISOPLUS™ Technology</td>
<td>▪ Low thermal resistance</td>
<td>▪ Electric and hybrid vehicles and E-bikes</td>
</tr>
<tr>
<td></td>
<td>▪ Space savings</td>
<td>▪ DC-DC converters</td>
</tr>
<tr>
<td></td>
<td>▪ Increased power and temperature cycling</td>
<td>▪ Automotive battery chargers</td>
</tr>
<tr>
<td></td>
<td>▪ Reduced EMI</td>
<td>▪ Motor drive</td>
</tr>
<tr>
<td></td>
<td>▪ High reliability</td>
<td>▪ Switching and resonant power supplies</td>
</tr>
<tr>
<td></td>
<td>▪ 3, 4, or 5 lead configurations available</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 3500V electrical isolation</td>
<td></td>
</tr>
<tr>
<td>Surface Mount Power Device (SMPD) Packages</td>
<td>▪ Ultra-low and compact package profile (5.3mm height x 24.8mm length x 32.3mm width)</td>
<td>▪ Electric and hybrid vehicles and E-bikes</td>
</tr>
<tr>
<td></td>
<td>▪ Surface mountable via standard reflow process</td>
<td>▪ DC-DC converters</td>
</tr>
<tr>
<td></td>
<td>(Available in Tape &amp; Reel packaging)</td>
<td>▪ Automotive battery chargers</td>
</tr>
<tr>
<td></td>
<td>▪ Low package weight (8g)</td>
<td>▪ Motor drive</td>
</tr>
<tr>
<td></td>
<td>▪ Up to 4500V ceramic isolation (DCB)</td>
<td>▪ Switching and resonant power supplies</td>
</tr>
<tr>
<td></td>
<td>▪ Low package inductance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Excellent thermal performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ High power cycling capability</td>
<td></td>
</tr>
<tr>
<td>High Voltage Packages</td>
<td>▪ Increased distance between leads</td>
<td>▪ Electric and hybrid vehicles and E-bikes</td>
</tr>
<tr>
<td></td>
<td>▪ Arc-prevention in high voltage applications</td>
<td>▪ DC-DC converters</td>
</tr>
<tr>
<td></td>
<td>▪ Electrical isolated tab for heat sinking</td>
<td>▪ Automotive battery chargers</td>
</tr>
<tr>
<td></td>
<td>▪ Excellent thermal performance</td>
<td>▪ Motor drive</td>
</tr>
<tr>
<td></td>
<td>▪ Best-in-class power and temperature cycling capabilities</td>
<td>▪ Switching and resonant power supplies</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**IXYS**
ISOPLUS™ Technology

FEATURES

- Incorporates a DCB ceramic isolator
- Provides UL recognized 3500Vrms isolation
- Isolation continues above 4000V
- DCB substrate provides lower thermal resistance and higher load cycling capability
- JEDEC TO-247, PLUS220, & TO-264 compatibility
- Unbeatable low thermal resistance: up to 40% lower ($R_{thJS}$) than std. packages with same die and external isolation
- Reduced EMI/RFI emissions due to low coupling capacitance between die and heat sink
- Space and weight savings
- Transfer molded housing for low cost
- Allows new circuit configurations

IXYS ISOPLUS US Patents: 420,983, 6,534,343B2, 6,583,505B2, 6,710,463B2, 6,727,585B2, 6,731,002B2, 7,005,734B2, 6,404,065B1
ISOPLUS™ Packages: Automotive

Highest power density and reliability – well suited for automotive applications
- ISOPLUS i4-Pak™
- ISOPLUS i5-Pak™
- ISOPLUS DIL™

Features
- Low thermal resistance
- Increased power and temperature cycling
- High reliability
- Reduced EMI
- 3, 4, 5 lead configurations available

Applications
- Full diode bridges
- Phase leg configurations
- Buck converters
- Boost converters
- Electric and hybrid electric vehicles applications
Surface Mount Power Device (SMPD) Packages: Automotive

Ultra-low profile SMPD package

The above accentuates the compact and low profile nature of the device. Compared to a conventional high power package such as the SOT-227, the IXYS SMPD features ¼ the weight and 1/3 the volume and provides similar electrical and thermal characteristics.

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 (Available in Tape & Reel packaging)
- Low package weight (8g)
- Up to 4500V ceramic isolation (DCB)
- Low package inductance
- Excellent thermal performance
- High power cycling capability

CONFIGURATIONS
- Buck
- Boost
- Full-bridge
- Half-bridge
- Phase leg
- Single

APPLICATIONS
- DC-DC converters
- Battery chargers
- Switching and resonant power supplies
- DC choppers
- Temperature and lighting controls
- Motor drives
- E-bikes and electric and hybrid vehicles
- Solar inverters
- Induction heaters
The Mini-SMPD

Light and compact Mini SMPD package

The figure above illustrates a comparison of the Mini-SMPD with other industry standard packages. The volume of it (1.8cm³) is only at 60% of that of the SMPD (3cm³). But the Mini SMPD is able to maintain a high voltage isolation of 4.5kV and weighs just 5g.

Mini SMPD ADVANTAGES

- High-voltage electrical isolation (4500V)
- Lower thermal resistance compared to standard packages (TO-247, TO-264, SOT-227B)
- High component density/flexible configurations (H-bridge, half-bridge, boost, buck, phase-leg)
- High current carrying capability
- Low parasitic capacitances and inductances
- Low package weight (5g)
- Better protection against vibrations and g-forces

Applications: Electric and hybrid vehicles, E-bikes, battery chargers, DC-DC converters
High Voltage Packages: Automotive

Proprietary high-voltage versions of international standard size packages

- TO-263HV
- TO-268HV
- TO-247-3L-HV
- TO-247PLUS-3L-HV
- TO-247-4L
- i4-Pak (non-isolated)
High Voltage Packages: Automotive

**BENEFITS:**
- Elimination of multiple series-connected lower-voltage devices, simplifying and reducing gate drive circuitry
- Arc prevention
- Higher efficiency

**APPLICATIONS:**
- High voltage power supplies
- Defibrillators
- Industrial instrumentation
- CT and MRI scanners
- X-ray machines
- Ultrasound machines
- Capacitor discharge applications

**Example Part Numbers:**
- IXAA30N65C3HV (TO-263HV)
- IXYT30N65C3H1HV (TO-268HV)
- IXYA20N120C3HV (TO-268HV)
- IXYT20N120C3D1HV (TO-268HV)
- IXTH1N450HV (TO-247-3L-HV)

“HV” denotes high-voltage package
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