

600V GenX3™ IGBTs

NEXT GENERATION 600V IGBTs FOR POWER CONVERSION APPLICATIONS

JANUARY 2009

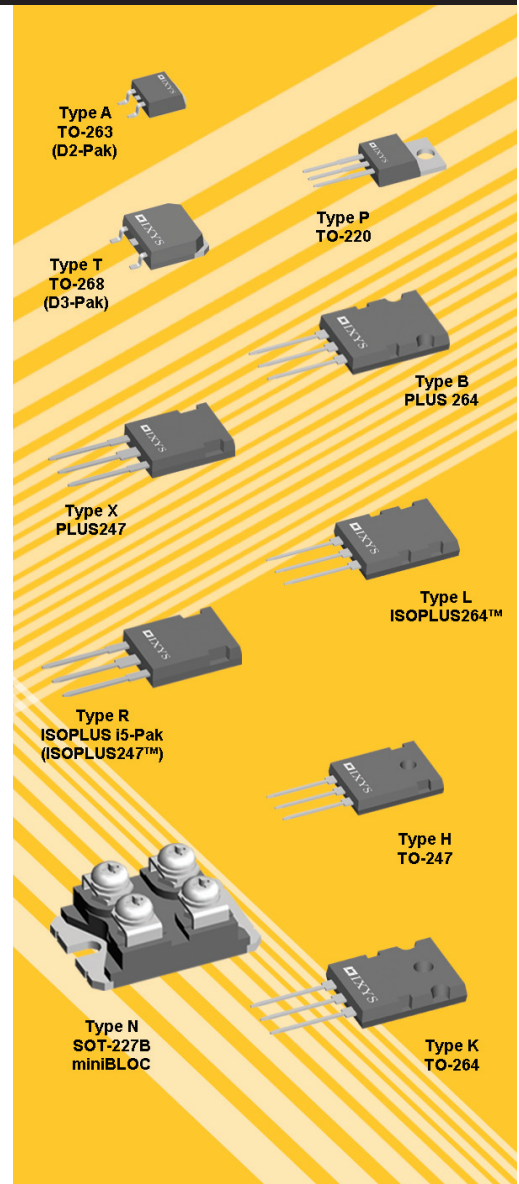
OVERVIEW

IXYS extends its GenX3™ insulated gate bipolar transistor (IGBT) product line to 600 volts. These new IGBTs are manufactured using IXYS' state-of-the-art GenX3™ IGBT process and utilize IXYS' advanced Punch-Through (PT) technology, tailored to provide higher surge current capabilities, lower saturation voltages, and lower switching losses.

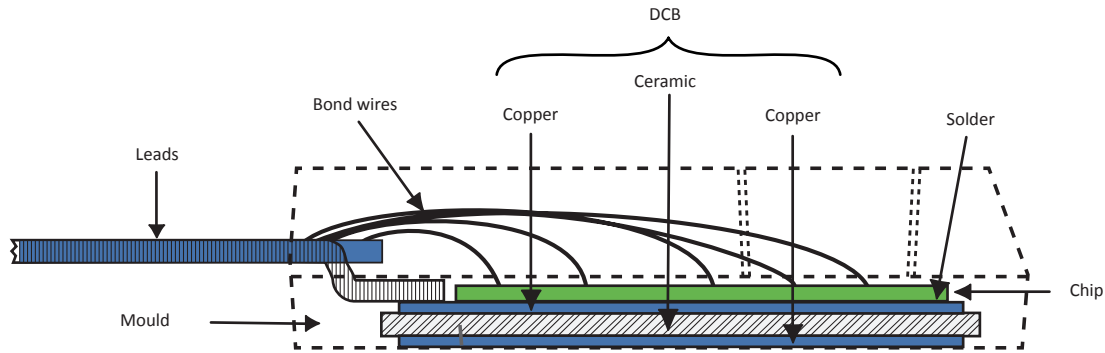
To accommodate optimum part selection, designers have a choice in selecting between three sub-classes denoted A3, B3, and C3. These classifications allow designers to "dial in" the best compromise between static (conduction) and dynamic (switching) losses, improving over-all system efficiency in a variety of power conversion applications by balancing critical requirements such as switching frequency, efficiency, and cost structure. The A3-Class are optimized for low saturation voltage V_{sat} and are well suited for applications requiring switching frequencies up to 5kHz. Similarly, the B3-Class offers low saturation voltages, but is optimized to accommodate applications that require "medium speed" switching operation from 5kHz to 40kHz. The C3-Class is optimized for "high speed" switching operation from 40kHz to 100kHz and resonant switching operation of up to 400kHz.

IXYS 600V GenX3™ IGBTs are offered in various standard packages, including the full gamut of surface mount and discrete packages with current ratings from 36 amperes to 210 amperes. Furthermore, some devices will be offered in PLUS and ISOPLUS isolated packages, featuring UL recognized 2500V isolation and superior thermal performance. Co-Packed variants of these new devices are available with IXYS' HiPerFRED™ ultra-fast recovery diodes providing exceptional fast recovery and soft switching characteristics.

These IGBTs are designed to achieve the optimal solution in applications such as power inverters, UPS, motor drives, SMPS, PFC, battery chargers, welding machines, lamp ballasts, inrush current protection circuits and DC choppers.



ISOPLUS™ Packages with Internal Alumina DCB Isolation*



- Provides 2500V, UL recognized isolation with superior thermal performance (E153432).
- Improves temperature and power cycling capability.
- Cost effective clip mounting.

* IXYS Patented Packages, Patent No. 6,404,065

* For information regarding IXYS ISOPLUS packages, visit <http://www.ixys.com/IXAN0022.pdf>

600V GenX3™ (A3) IGBTs Summary Table

A3-Class ■ Ultra low V(sat) IGBTs ■ Up to 5kHz

The switching and conduction losses for the A3-Class are optimized for sub-5kHz switching frequency applications.

Performance improvements for this classification include up to a 16% reduction in saturation voltage Vce(sat) compared to prior generation product.

| Part Number | Vces (V) | Ic @ Tc = 110°C (A) | Vce (sat) TJ = 25°C (V) | tfi typ (ns) | Eoff typ (mJ) | RthJC (°C/W) | Package |
|----------------|----------|---------------------|-------------------------|--------------|---------------|--------------|------------|
| IXGP36N60A3 | 600 | 36 | 1.4 | 325 | 3 | 0.56 | TO-220 |
| IXGH36N60A3 | 600 | 36 | 1.4 | 325 | 3 | 0.56 | TO-247 |
| IXGH36N60A3D4 | 600 | 36 | 1.4 | 325 | 3 | 0.56 | TO-247 |
| IXGA36N60A3 | 600 | 36 | 1.4 | 325 | 3 | 0.56 | TO-263 |
| IXGR64N60A3 | 600 | 47 | 1.35 | 222 | 3.28 | 0.62 | ISOPLUS247 |
| IXGP48N60A3 | 600 | 48 | 1.35 | 224 | 2.9 | 0.42 | TO-220 |
| IXGH48N60A3 | 600 | 48 | 1.35 | 224 | 2.9 | 0.42 | TO-247 |
| IXGH48N60A3D1 | 600 | 48 | 1.35 | 224 | 2.9 | 0.42 | TO-247 |
| IXGA48N60A3 | 600 | 48 | 1.35 | 224 | 2.9 | 0.42 | TO-263 |
| IXGR72N60A3 | 600 | 52 | 1.35 | 250 | 3.5 | 0.62 | ISOPLUS247 |
| IXGR72N60A3U1 | 600 | 52 | 1.35 | 250 | 3.5 | 0.62 | ISOPLUS247 |
| IXGH64N60A3 | 600 | 64 | 1.35 | 222 | 3.28 | 0.27 | TO-247 |
| IXGT64N60A3 | 600 | 64 | 1.35 | 222 | 3.28 | 0.27 | TO-268 |
| IXGH72N60A3 | 600 | 72 | 1.35 | 250 | 3.5 | 0.23 | TO-247 |
| IXGH72N60A3 | 600 | 72 | 1.35 | 250 | 3.5 | 0.23 | TO-247 |
| IXGT72N60A3 | 600 | 72 | 1.35 | 250 | 3.5 | 0.23 | TO-268 |
| IXGX120N60A3 | 600 | 120 | 1.35 | 260 | 6.6 | 0.16 | PLUS247 |
| IXGN120N60A3 | 600 | 120 | 1.35 | 260 | 6.6 | 0.21 | SOT-227B |
| IXGN120N60A3D1 | 600 | 120 | 1.35 | 260 | 6.6 | 0.21 | SOT-227B |
| IXGK120N60A3 | 600 | 120 | 1.35 | 260 | 6.6 | 0.16 | TO-264 |
| IXGN320N60A3 | 600 | 170 | 1.25 | 740 | na | 0.17 | SOT-227B |
| IXGN400N60A3 | 600 | 190 | 1.25 | 270 | na | 0.15 | SOT-227 |
| IXGX320N60A3 | 600 | 210 | 1.25 | 740 | na | 0.125 | PLUS247 |
| IXGK320N60A3 | 600 | 210 | 1.25 | 740 | na | 0.125 | TO-264 |

600V GenX3™ (B3) IGBTs Summary Table

B3-Class ■ Medium Speed IGBTs ■ Up to 40kHz

The switching and conduction losses for the B3-Class are optimized for up to 40kHz. Performance improvements were incorporated to yield up to 22% lower turn-off energy per pulse (Eoff) and 10% lower thermal resistance to improve power handling.

| Part Number | Vces (V) | Ic @ Tc = 110°C (A) | Vce (sat) TJ = 25°C (V) | tfi typ (ns) | Eoff typ (mJ) | RthJC (°C/W) | Package |
|---------------|----------|---------------------|-------------------------|--------------|---------------|--------------|------------|
| IXGR48N60B3 | 600 | 27 | 2.1 | 116 | 0.66 | 0.83 | ISOPLUS247 |
| IXGR48N60B3D1 | 600 | 27 | 2.1 | 116 | 0.66 | 0.83 | ISOPLUS247 |
| IXGH36N60B3D1 | 600 | 36 | 1.8 | 100 | 0.8 | 0.5 | TO-247 |
| IXGH36N60B3D4 | 600 | 36 | 1.8 | 100 | 0.8 | 0.5 | TO-247 |
| IXGP48N60B3 | 600 | 48 | 1.8 | 116 | 0.66 | 0.42 | TO-220 |
| IXGH48N60B3D1 | 600 | 48 | 1.8 | 116 | 0.66 | 0.42 | TO-247 |
| IXGH48N60B3 | 600 | 48 | 1.8 | 116 | 0.66 | 0.42 | TO-247 |
| IXGA48N60B3 | 600 | 48 | 1.8 | 116 | 0.66 | 0.42 | TO-263 |
| IXGH56N60B3D1 | 600 | 56 | 1.8 | 95 | 1.05 | 0.375 | TO-247 |
| IXGX64N60B3D1 | 600 | 64 | 1.8 | 88 | 1 | 0.27 | PLUS247 |
| IXGH64N60B3 | 600 | 64 | 1.8 | 88 | 1 | 0.27 | TO-247 |
| IXGK64N60B3D1 | 600 | 64 | 1.8 | 88 | 1 | 0.27 | TO-264 |
| IXGT64N60B3 | 600 | 64 | 1.8 | 88 | 1 | 0.27 | TO-268 |
| IXGX72N60B3H1 | 600 | 72 | 1.8 | 92 | 1 | 0.23 | PLUS247 |
| IXGH72N60B3 | 600 | 72 | 1.8 | 92 | 1 | 0.23 | TO-247 |
| IXGK72N60B3H1 | 600 | 72 | 1.8 | 92 | 1 | 0.23 | TO-264 |
| IXGT72N60B3 | 600 | 72 | 1.8 | 92 | 1 | 0.23 | TO-268 |
| IXGL200N60B3 | 600 | 90 | 1.5 | 183 | 2.9 | 0.31 | ISOPLUS264 |
| IXGH90N60B3 | 600 | 90 | 1.8 | 148 | 1.37 | 0.19 | TO-247 |
| IXGX120N60B3 | 600 | 120 | 1.8 | 145 | 3.5 | 0.16 | PLUS247 |
| IXGK120N60B3 | 600 | 120 | 1.8 | 145 | 3.5 | 0.16 | TO-264 AA |
| IXGB200N60B3 | 600 | 200 | 1.5 | 183 | 2.9 | 0.1 | PLUS264 |
| IXGN200N60B3 | 600 | 200 | 1.5 | 183 | 2.9 | 0.15 | SOT-227B |

600V GenX3™ (C3) IGBTs Summary Table

C3-Class ■ High Speed IGBTs ■ Up to 100kHz

The switching and conduction losses for the C3-Class are optimized for switching frequencies up to 100kHz. The C3-Class performance improvements include up to a 12% decrease in thermal resistance for improved power handling and also include up to 22% lower turn-off energy per pulse (Eoff) for significantly lower switching losses versus prior generation of high speed IGBTs.

| Part Number | Vces (V) | Ic @ Tc = 110°C (A) | Vce (sat) TJ = 25°C (V) | tfi typ (ns) | Eoff typ (mJ) | RthJC (°C/W) | Package |
|---------------|----------|---------------------|-------------------------|--------------|---------------|--------------|-------------|
| IXGR48N60C3D1 | 600 | 26 | 2.7 | 38 | 0.23 | 1 | ISOPLUS 247 |
| IXGP30N60C3 | 600 | 30 | 3 | 47 | 0.09 | 0.56 | TO-220 |
| IXGH30N60C3D1 | 600 | 30 | 3 | 47 | 0.09 | 0.56 | TO-247 |
| IXGA30N60C3 | 600 | 30 | 3 | 47 | 0.09 | 0.56 | TO-263 |
| IXGR72N60C3D1 | 600 | 35 | 2.7 | 55 | 0.48 | 0.62 | ISOPLUS 247 |
| IXGP48N60C3 | 600 | 48 | 2.5 | 38 | 0.23 | 0.42 | TO-220 |
| IXGH48N60C3 | 600 | 48 | 2.5 | 38 | 0.23 | 0.42 | TO-247 |
| IXGH48N60C3D1 | 600 | 48 | 2.5 | 38 | 0.23 | 0.42 | TO-247 |
| IXGA48N60C3 | 600 | 48 | 2.5 | 38 | 0.23 | 0.42 | TO-263 |
| IXGH60N60C3 | 600 | 60 | 2.5 | 55 | 0.42 | 0.33 | TO-247 |
| IXGH60N60C3D1 | 600 | 60 | 2.5 | 55 | 0.42 | 0.33 | TO-247 |
| IXGX72N60C3H1 | 600 | 72 | 2.5 | 55 | 0.48 | 0.23 | PLUS247 |
| IXGH72N60C3 | 600 | 72 | 2.5 | 55 | 0.48 | 0.23 | TO-247 |

APPLICATIONS

- Power inverters
- Uninterruptible power supplies
- Motor drives
- Switch mode power supplies
- Power factor correction circuits
- Welding machines
- Lamp ballasts

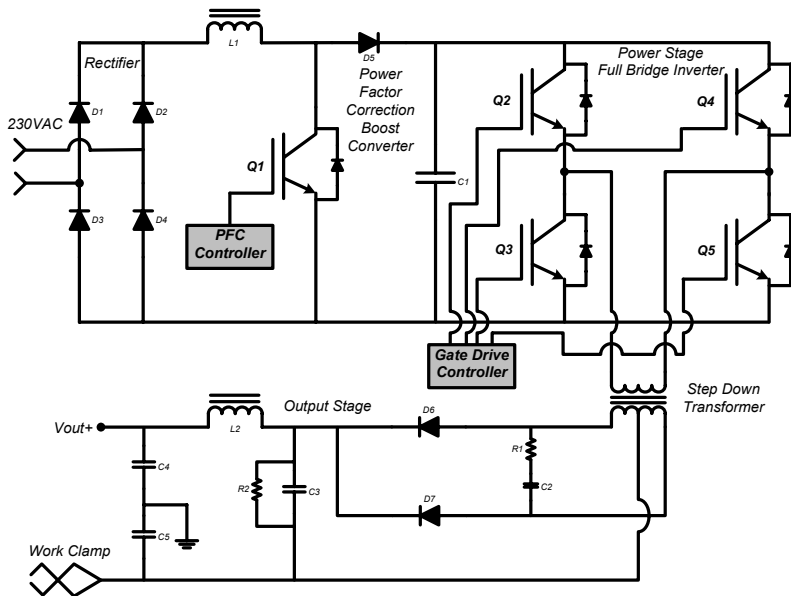
FEATURES

- Optimized for low switching & conduction losses
- Square RBSOA
- High current handling capability
- International standard packages

BENEFITS

- High power density
- Low gate drive requirement

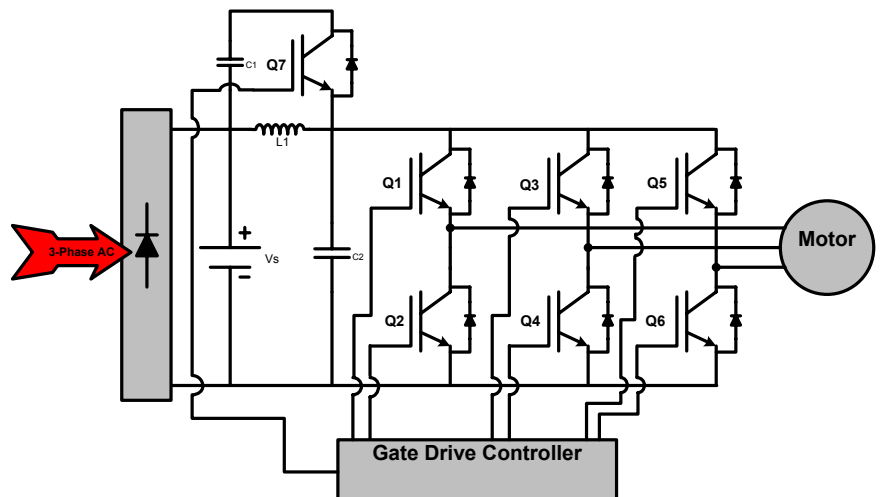
Multi-Process High Frequency Inverter Welder



The figure on the left illustrates a general circuit topology of an inverter welding power source. This circuit topology is composed of four stages: A) Rectifier stage, B) PFC & Boost stage, C) Power stage, and D) Output stage. Input power from a power grid enters the rectification stage to be rectified to a DC value and is processed via a power factor correction boost converter. From there it enters the power stage which employs a full bridge inverter to convert the voltage back to AC at high frequencies typically from 50Khz to 100Khz. The AC signal is then stepped down via T1 transformer which then gets rectified and smoothed out at the output stage.

AC Motor Drive (Resonant DC Link Inverter)

The figure on the right illustrates an AC motor drive that utilizes a resonant DC link inverter. A resonant link (L1, C2) is affixed to the DC bus line of a pulse width modulation inverter. The resonant link is then 'excited' and maintains resonance through the control of the IGBTs in a way that the resonating dc voltage bus frequently reaches zero volts. The IGBTs are turned on and off at zero voltage and are synchronized to match the zero voltage crossings to achieve the desired low switching loss. An active clamp circuit (Q7, C1) is added to clamp down unwanted overshoot when the DC inverter current decreases abruptly caused by the switching behavior of the IGBTs.



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