IXYSPOWER
Efficiency Through Technology

Product Brief

900V XPT™ IGBTs

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

May 2014

OVERVIEW

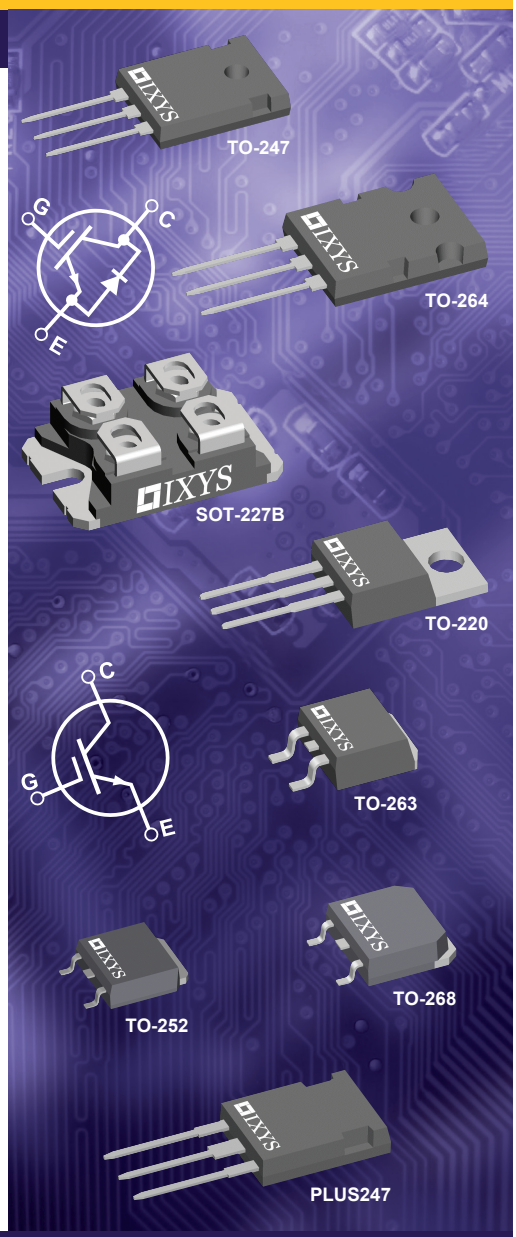
IXYS Corporation (NASDAQ: IXYS) launches a new IGBT product line: 900V XPT™ IGBTs. The current ratings range from 20A to 310A. Designed especially for hard-switching applications, these new devices are able to achieve an optimal balance between the turn-off energy loss and on-state voltage. Able to support switching frequencies up to 50 kHz, they allow designers to use smaller and lighter components in their systems. Devices co-packed with anti-parallel fast diodes are also available.

Manufactured using the proprietary thin-wafer technology called Extreme-light Punch-Through (XPT™) and the state-of-the-art 3rd generation (GenX3™) IGBT process, the devices exhibit such qualities as reduced thermal resistance, low tail current, low energy loss, and high-speed switching capability. In addition to being avalanche rated, they have square Reverse Bias Safe Operating Areas (RBSOA) up to the breakdown voltage of 900V – a necessary ruggedness in snubberless hard-switching applications.

The optional co-packed diodes in Sonic-FRD™ or HiPerFRED™ Technology are optimized to reduce turn-off losses and suppress ringing oscillations, thereby producing smooth switching waveforms and significantly lowering electromagnetic interference (EMI) in the system. Furthermore, due to the soft recovery characteristics of the diodes, the IGBTs can be switched on at very high rates of change in current (di/dt), even in low current and temperature conditions. Other advantages include low gate charge and a positive temperature coefficient of the on-state voltage, translating into lower gate drive requirements and multiple-device paralleling capability, respectively.

There are various high-voltage and high-speed applications that the new IGBTs are well-suited for. Among these are high-frequency power inverters, uninterruptible power supplies, motor drives, switched-mode power supplies, power factor correction circuits, battery chargers, welding machines, lamp ballasts, E-bikes, and hybrid electric vehicles.

The new 900V XPT™ IGBTs are available in the following international standard packages: TO-220, TO-247, PLUS247, TO-252, TO-263, TO-264, TO-268, and SOT-227. Some example part numbers include IXYA8N90C3D1, IXYH24N90C3, IXYN80N90C3H1, and IXYK140N90C3, with collector current ratings of 20A, 44A, 115A, and 310A, respectively.



FEATURES

- Optimized for 20kHz-50kHz switching
- High current handling capability
- Maximum junction temperature T_{JM}=175°C
- Square RBSOA
- Avalanche rated
- Positive thermal coefficient of $V_{CE(sat)}$
- Ultra-fast anti-parallel diodes
- International standard packages

ADVANTAGES

- Hard-switching capability
- High power density
- Low gate drive requirements

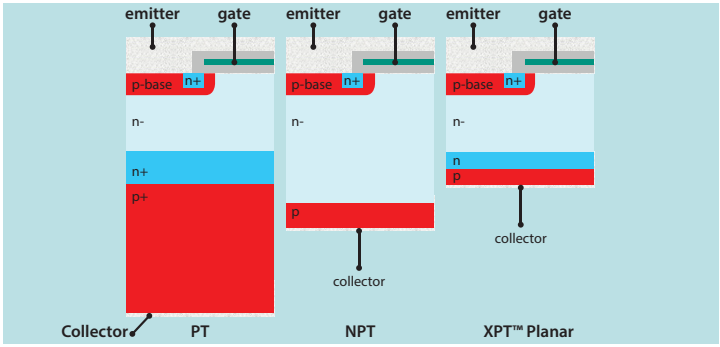
APPLICATIONS

- E-bikes and hybrid electric vehicles
- High frequency power inverters
- Lamp ballasts
- Power Factor Correction (PFC) circuits
- Switched-mode power supplies
- Uninterruptible Power Supplies (UPS)
- Welding machines

Available Parts

Part Number	V_{CES} (V)	I_{C25} T_C=25°C (A)	I_{C110} T_C=110°C (A)	$V_{CE(sat)}$ max T_J=25°C (V)	t_{fi} typ T_J=125°C (ns)	E_{off} typ T_J=125°C (mJ)	R_{thJC} max IGBT (°C/W)	Configuration	Package Style
IXYA8N90C3D1	900	20	8	2.5	163	0.22	1.2	Copacked (HiPerFRED™)	TO-263
IXYP8N90C3	900	20	8	2.5	163	0.22	1.2	Single	TO-220
IXYP8N90C3D1	900	20	8	2.5	163	0.22	1.2	Copacked (HiPerFRED™)	TO-220
IXYY8N90C3	900	20	8	2.5	163	0.22	1.2	Single	TO-252
IXYH24N90C3	900	44	24	2.7	130	0.55	0.62	Single	TO-247
IXYH24N90C3D1	900	44	24 (T_C=90°C)	2.7	130	0.55	0.62	Copacked (HiPerFRED™)	TO-247
IXYH40N90C3D1	900	90	40	2.5	150	1.2	0.25	Copacked (HiPerFRED™)	TO-247
IXYH40N90C3	900	105	40	2.5	150	1.2	0.25	Single	TO-247
IXYN80N90C3H1	900	115	70 (T_C=90°C)	2.7	98 (T_J=150°C)	2.5 (T_J=150°C)	0.25	Copacked (Sonic-FRD™)	SOT-227
IXYH60N90C3	900	140	60	2.7	165 (T_J=150°C)	2.15 (T_J=150°C)	0.2	Single	TO-247
IXYH80N90C3	900	165	80	2.7	98 (T_J=150°C)	2.5 (T_J=150°C)	0.18	Single	TO-247
IXYT80N90C3	900	165	80	2.7	98 (T_J=150°C)	2.5 (T_J=150°C)	0.18	Single	TO-268
IXYK140N90C3	900	310	140	2.7	125 (T_J=150°C)	5 (T_J=150°C)	0.092	Single	TO-264
IXYX140N90C3	900	310	140	2.7	125 (T_J=150°C)	5 (T_J=150°C)	0.092	Single	PLUS247

Extreme-Light Punch-Through (XPT™) Technology



These 900V Planar IGBTs are built with IXYS' proprietary thin-wafer technology: Extreme-Light Punch-Through (XPT™) Technology as illustrated in the figure on the left. Advantages of the XPT™ include, among others, reduced thermal resistance, low energy losses, fast switching, low tail current, high current density, and positive temperature coefficient of the on-state voltage.

Application Examples

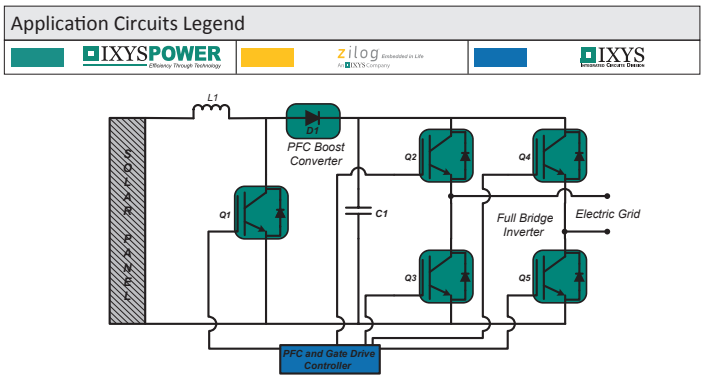


Figure 1: Solar Inverter

Figure 1 depicts a general solar inverter circuit comprised of a Power Factor Correction (PFC) boost converter and full-bridge power inverter stage. The input power from the solar panel enters the PFC converter and then the full-bridge inverter, before interfacing with the electrical grid. Five **IXYH24N90C3D1** XPT™ IGBTs (Q1, Q2, Q3, Q4, Q5 can be utilized to construct the inverter and PFC).

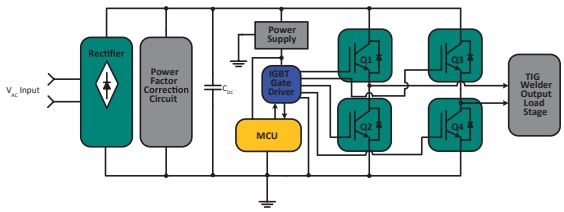


Figure 2: TIG Welding Inverter

Figure 2 shows a general circuit diagram of a high-current TIG welding inverter. This topology is comprised of a rectification stage, power factor correction (PFC) stage, control stage (Power supply, MCU, and IGBT Gate Driver), and power-inverter stage. An AC input (185VAC-265VAC) from the power grid is applied to the rectification stage to be converted into a DC value. This DC value then goes through the PFC circuit where its distorted current is reshaped into a waveform in phase with the input voltage. The DC output of the PFC circuit next enters the power-inverter stage, which is a full-bridge inverter and made up of four **IXYN80N90C3D1** XPT™ IGBTs (Q1, Q2, Q3, Q4), to be converted back to an AC voltage that has a higher frequency (typically ranging from 30kHz to 50kHz). This AC voltage signal is applied to the output stage of the TIG welder.

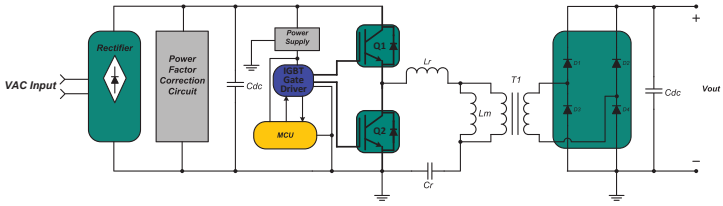


Figure 3: Half-bridge resonant power supply

Figure 3 illustrates a simplified SMPS circuit diagram that uses an LLC resonant converter as the primary power conversion element of the circuit. The indicated SMPS circuit consists of a primary rectifier, power factor correction circuit, control unit (power supply, MCU, and IGBT Driver), LLC half-bridge resonant converter, isolation transformer, and secondary rectifier stage. Two XPT™ IGBTs **IXYH40N90C3D1** are paired to form the LLC half-bridge resonant converter stage to ensure a fast, space-saving, and energy-efficient power switching operation.