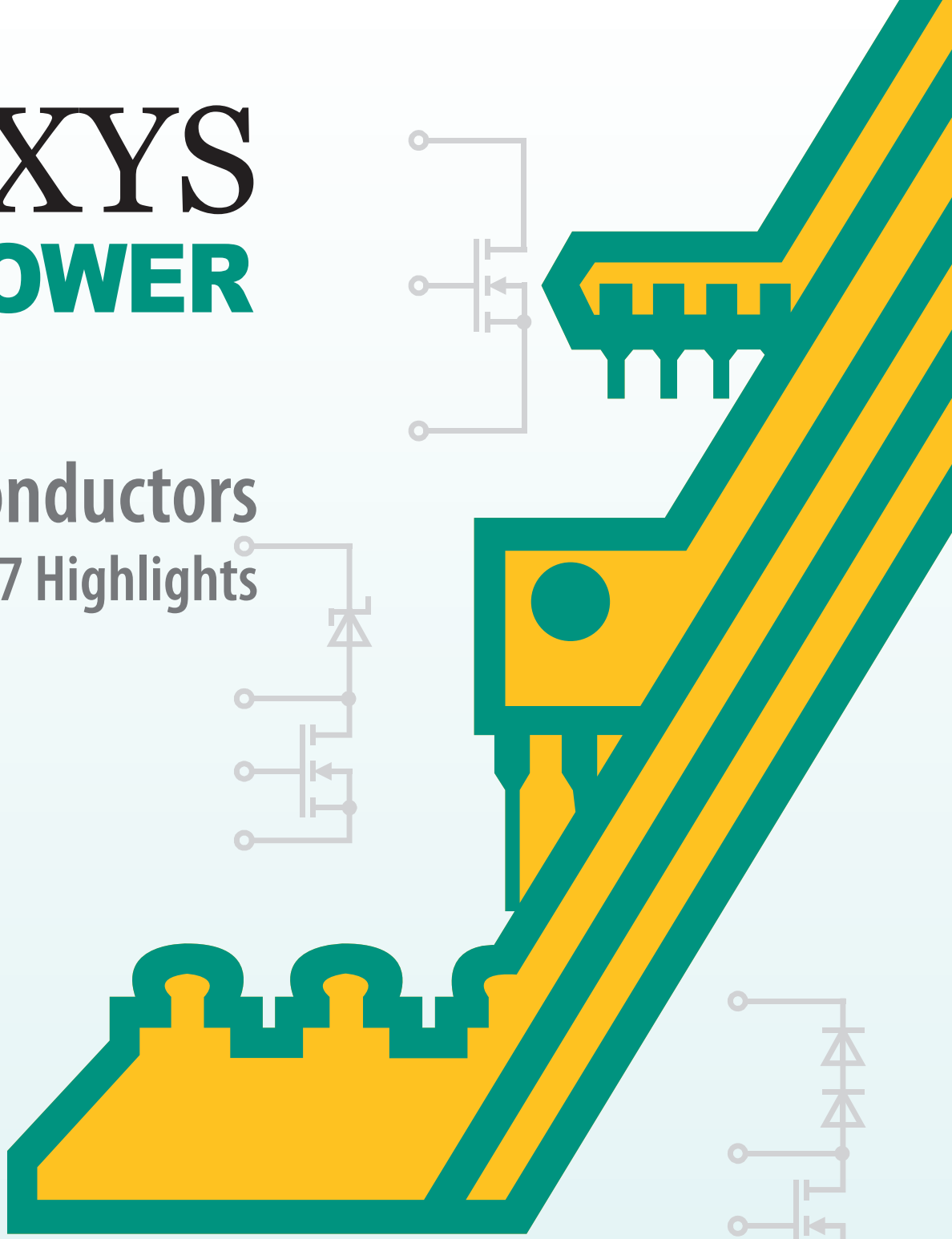




Semiconductors

PCIM 2017 Highlights



World of IXYS
World of Inspiration

World of IXYS

World of Inspiration

 *Embedded in Life*
An  IXYS Company

 **IXYSPOWER**
Efficiency Through Technology

 **IXYS**
UK WESTCODE

 **IXYS**
INTEGRATED CIRCUITS DIVISION

 **IXYS**
COLORADO

 **MWT**
MicroWave Technology
An  IXYS Company

 **IXYS**
INCIDE SAN SEBASTIAN

 **IXYS LongBeach**
Efficiency Through Technology

 **IXYS KOREA**
Efficiency By The Sun

 **IXYS**
RadioPulse KOREA

Corporate Overview

IXYS Corporation (Nasdaq: IXYS), was founded as a silicon valley power semiconductor company. IXYS pioneered the high voltage power MOSFET and IGBT technologies, with the highest power density most rugged high voltage products.

IXYS today is a leading Cleantech semiconductor company developing and manufacturing products to improve power conversion efficiency, generate clean energy, control motors, improve automation, improve medical equipment, electrify transportation from bikes to cars, and water treatment. IXYS and its divisions is a development pioneer of power semiconductors, solid state relays, GaAs base RF amplifiers, MCU's and IC's necessary for reducing the world's dependence on fossil fuels and improve our health.

IXYS is one of the few worldwide semiconductor companies that offer the full product portfolio for power management. We offer rectifiers, fast diodes, MOSFETs, IGBTs and thyristors, in discrete and as integrated power modules. We offer the necessary IC's to drive the power devices and the MCU's to add digital control.

With three major wafer FAB's and hundreds of patents, IXYS continues to invest in technologies through R&D in the USA, Europe and Asia, with focus on serving its customers. IXYS works with a customer base of over 2,500 telecommunications, transportation, industrial medical, environmental, aerospace and consumer electronics companies.

Product Portfolios- THE WORLD OF IXYS

IXYS has three power MOS product lines, which include power MOSFETs, IGBTs and BIMOSFETs. IXYS' MOS based power devices are used in power conversion systems and are focused on voltage applications from 60 to 7000 volts. IXYS offers bipolar products consisting of rectifiers, thyristors, press-pack IGBTs and GTO thyristors. IXYS offers a variety of standard and custom power modules that integrate the above products for its customers.

IXYS IC division (CLARE) designs and produces SOI base HVIC's flexible display drivers, driver IC's, optically isolated drivers, solid state relays (SSR), isolated AC switches, optocouplers, photovoltaic chips and ASIC's. With the IXYS San Sebastian Division (ISS), we provide advanced RFID IC's, solutions and Custom IC designs.

Through MWT and IXYS Colorado, we manufacture RF and microwave products.

With the Zilog's industry proven and rugged MCU's, we complement our POWER and IC products with matched digital power management and embedded control. We have introduced unique power management reference designs to control motors, LED lights, battery charging and motion sensing. The added S3 low cost MCU product lines serve consumer white goods, home automation and remote controls. With the Radio Pulse Division we offer SOC's that integrate RF Zigbee transceivers and MCU's for the consumer, security, industrial, home automation, energy management, LED lighting and IoT markets.

Today, IXYS provides sub-systems and power assembly products based on customers demand.

For further information visit: www.ixys.com

IGBT & MOSFET GATE DRIVERS

• LOW-SIDE GATE DRIVERS

Part Number	Output Type	I_{PEAK} $T_c=25^\circ\text{C}$ (A_p)	Output Resistance (Ω)	Available Logic Configurations	Enable Function	Under-voltage Lockout (V)	Package Type
IXD_630	SINGLE	30	0.4	I, N, D	•	$V_{CC} \leq 12.5$	57, 58
IXD_630M	SINGLE	30	0.4	I, N, D	•	$V_{CC} \leq 9$	57, 58
IXD_614	SINGLE	14	0.8	I, N, D	•	-	20, 53, 57, 58
IXD_609	SINGLE	9	1	I, N, D	•	-	20, 53, 54, 56, 57, 58
IXD_604	DUAL	4	2.5	F, I, N, D	•	-	20, 53, 54, 56
IX4423N	DUAL	3	4	I	-	-	54
IX4424N	DUAL	3	4	N	-	-	54
IX4424G	DUAL	3	4	N	-	-	20
IX4425N	DUAL	3	4	F	-	-	54
IXD_602	DUAL	2	4	F, I, N	-	-	20, 53, 54, 56
IX4426	DUAL	1.5	8	I	-	-	54, 56
IX4427	DUAL	1.5	8	N	-	-	54, 56
IX4428	DUAL	1.5	8	F	-	-	54, 56

* AEC-Q100 Qualified Low-Side Gate Drivers

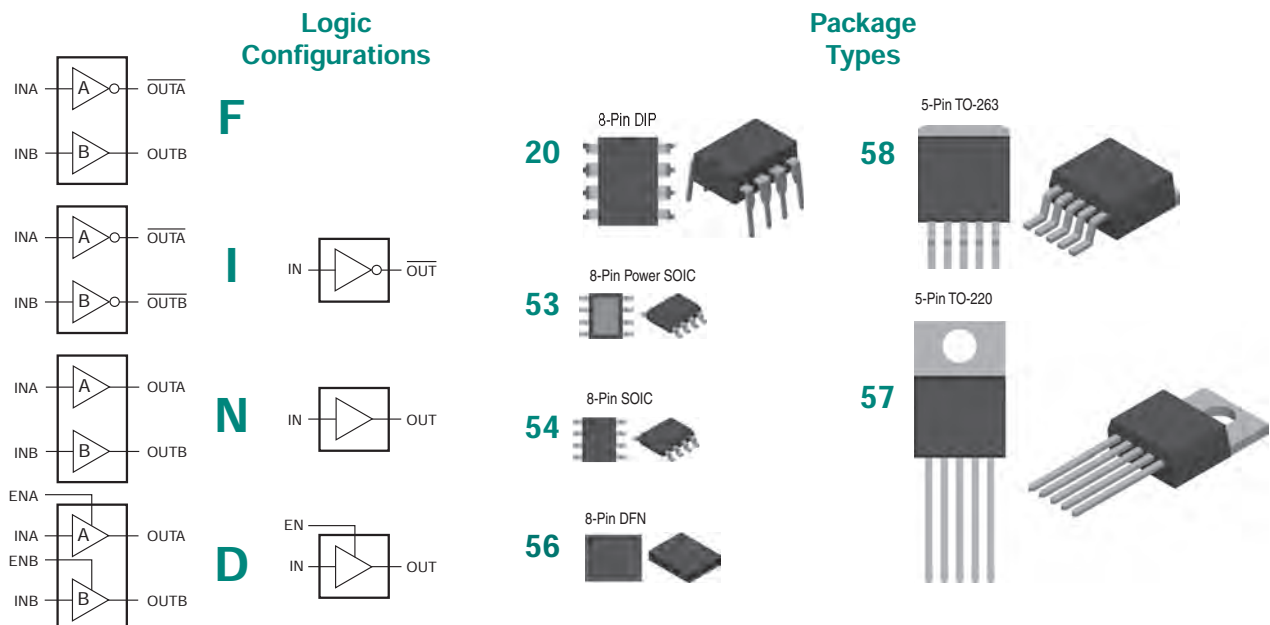
Part Number	Output Type	I_{PEAK} $T_c=25^\circ\text{C}$ (A_p)	Output Resistance (Ω)	Available Logic Configurations	Enable Function	Package Type
IXD_614SI	SINGLE	14	0.8	I, N, D	•	53
IXD_609SI	SINGLE	9	1	I, N, D	•	53
IXD_604SI	DUAL	4	2.5	F, I, N, D	•	53
IXD_604SIA	DUAL	4	2.5	F, I, N, D	•	54

Features:

- AEC-Q100 qualified parts *
- 1.5A to 30A peak source/sink drive current
- Wide operating voltage range: 4.5V to 35V
- -40°C to $+125^\circ\text{C}$ extended operating temperature range
- Logic input withstands negative swing of up to -5V
- Matched rise and fall times
- Low propagation delay time
- Low $10\mu\text{A}$ supply current
- Low output impedance

Applications:

- Efficient power MOSFET and IGBT switching
- Switch mode power supplies
- Motor controls
- DC to DC converters
- Class-D switching amplifiers
- Pulse transformer driver

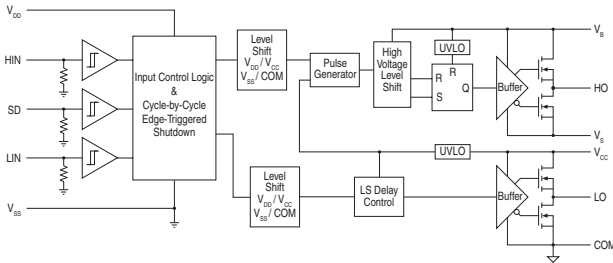


• HIGH VOLTAGE HALF-BRIDGE GATE DRIVERS

- Floating channel for bootstrap operation up to 600V with a 700V absolute maximum rating
- Gate drive supply range from 10V to 20V
- 3.3V logic compatible
- UVLO for both high-side and low-side outputs
- Matched propagation delays

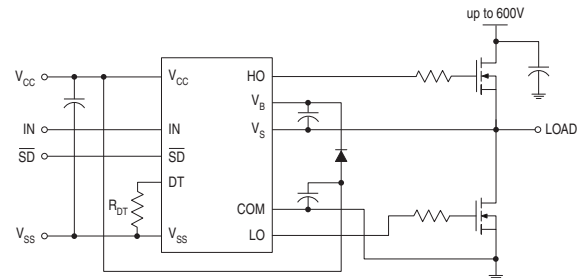
IX2113:

- Outputs capable of sourcing and sinking 2A



IX21844:

- Outputs capable of sourcing 1.4A and sinking 1.6A
- Programmable dead time



• OPTICALLY COUPLED GATE DRIVERS

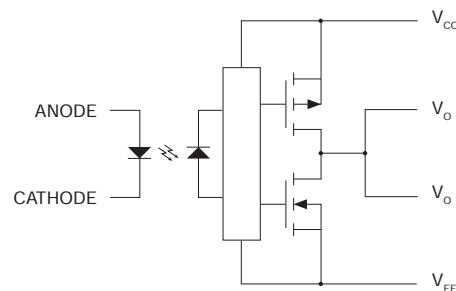
- 3750V_{rms} input to output isolation
- ±2.5A maximum peak current
- Wide temperature range -40°C to +100°C
- UVLO with hysteresis

IX3120:

- 15V to 30V operating range for driving IGBT gates

IX3180:

- 10V to 20V operating range for driving MOSFET gates



• DUAL LOW SIDE SiC MOSFET & IGBT GATE DRIVER: IX2204

- Provides a negative gate drive voltage to ensure the turn-off of SiC MOSFETs & high power IGBTs
- Outputs can be paralleled for IGBT gate drives that require higher gate drive current

Features:

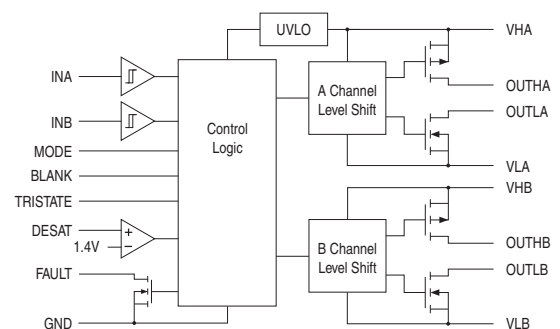
- High output current: 2A source/4A sink
- Wide operating voltage range: -10V to +26V
- Negative gate drive capability
- Desaturation detection circuit
- Separate source and sink outputs
- Programmable blanking and output tristate
- TTL compatible inputs
- -40°C to +125°C extended operating temperature range
- Under-voltage lockout circuitry
- Fault status output

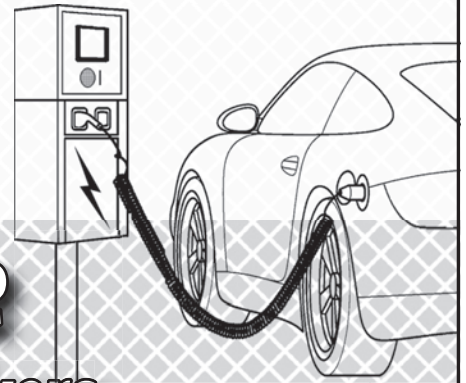
Applications:

- Ideal for driving SiC devices
- Efficient IGBT switching
- Motor controls
- Switch mode power supplies

The IX2204 has a programmable two-level turn-off feature that protects the device against excessive voltages when the IGBT is being turned off due to an over-current situation.

IX2204

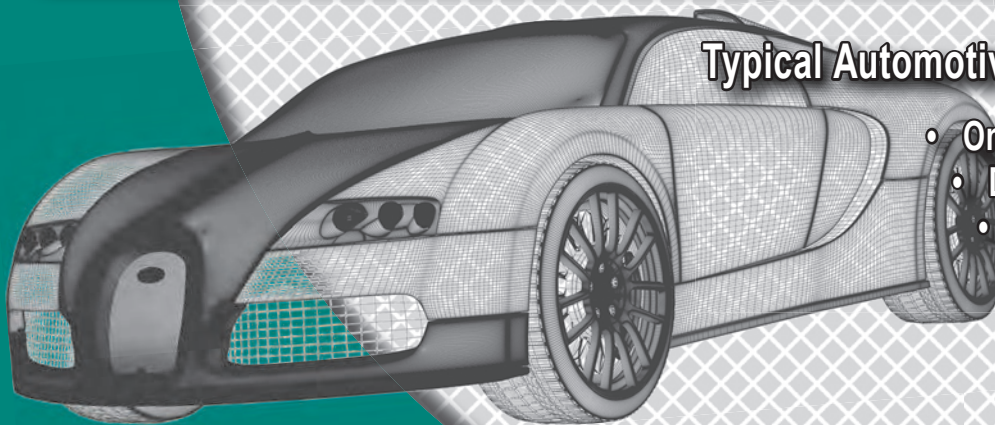




Automotive Grade MOSFET and IGBT Gate Drivers

World Class Performance, Robustness, and Reliability

IXYS Integrated Circuits Division (ICD) Automotive Grade Gate Drivers are used by customers worldwide. IXYS ICD offers AEC Q100 qualified dual 4A and single 9A and 14A drivers. For additional margin in harsh automotive applications, these automotive grade gate drivers have an absolute maximum voltage rating of 40V and are packaged in a thermally enhanced 8-pin SOIC package. All devices have a Grade 1 (-40°C to +125°C) operating temperature range.



Typical Automotive Applications:

- On-Board Chargers
- DC/DC Converters
- EV Motor Drives
- SiC Gate Driver

IXYS ICD Part Number	Number of Channels	Peak Output Current	Channel Input Logic
IXDD604SI	2	4A	Non-Inverting with Enable
IXDF604SI	2	4A	Inverting & Non-Inverting
IXDI604SI	2	4A	Inverting
IXDN604SI	2	4A	Non-Inverting
IXDD609SI	1	9A	Non-Inverting with Enable
IXDI609SI	1	9A	Inverting
IXDN609SI	1	9A	Non-Inverting
IXDD614SI	1	14A	Non-Inverting with Enable
IXDI614SI	1	14A	Inverting
IXDN614SI	1	14A	Non-Inverting

Visit IXYS IC Division's Automotive Grade MOSFET & IGBT Gate Driver Web Page:
www.ixysic.com/Products/Automotive.htm

Transformer Coupled Driver Logic Interface (IX6610)

Capable of sourcing and sinking a peak current of 10A, the IX6610 is a secondary side, intelligent, high-speed gate driver designed to drive both IGBTs and Power MOSFETs. It contains the necessary circuit blocks for pulse transformer isolated applications. High-frequency narrow pulses (as short as 500ns) can be used for transmitting bidirectional signals across the isolation barrier to avoid duty cycle restrictions and prevent transformer saturation. Other features include supply under and over voltage lockout, thermal shutdown, overcurrent and over voltage protection. The IX6610 is designed to operate over a temperature range of -40°C and +125°C and available in a 16-pin SOIC with an exposed thermal pad.

FEATURES

- TTL Logic level micro-controller Interface
- Pulse transformer bidirectional data interface
- Short input pulse suppression
- Interlock and dead time control
- Four 1A pulse transformer drivers
- Two 1A drivers for push-pull power converter for the secondary side power supply
- Non-overlap operation of high side and low side drivers
- Internal startup oscillator
- Primary side fault monitoring
- Secondary side fault monitoring
- Two fault status outputs
- 2mA quiescent current (non-switching)

APPLICATIONS

- Pulse transformer coupled IGBT/MOSFET gate driver interface

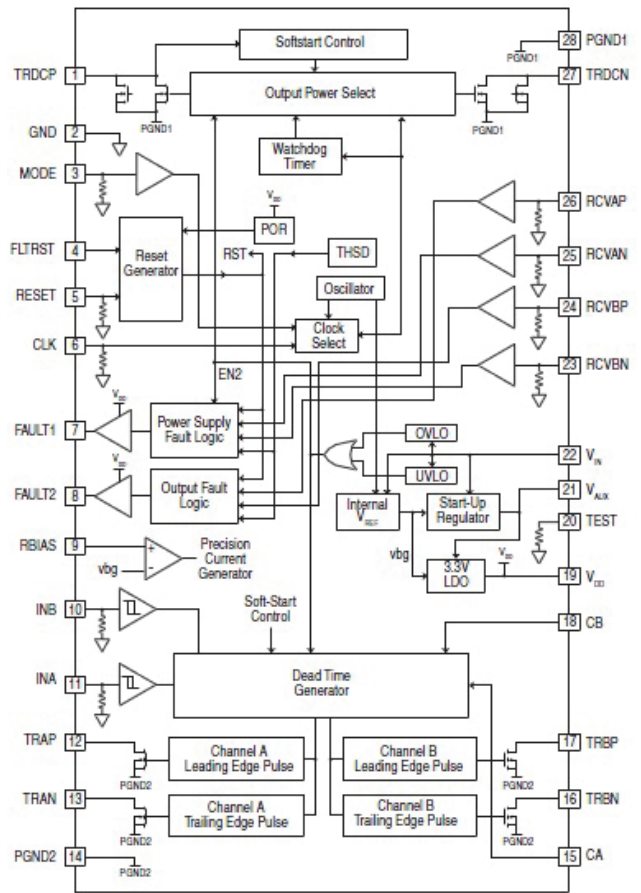
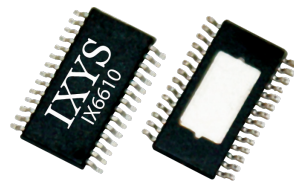


Figure 2: IX6610 Functional Block Diagram

High-Speed Gate Driver (IX6611)

Capable of sourcing and sinking a peak current of 10A, the IX6611 is a secondary side, intelligent, high-speed gate driver designed to drive both IGBTs and Power MOSFETs. It contains the necessary circuit blocks for pulse transformer isolated applications. High-frequency narrow pulses (as short as 500ns) can be used for transmitting bidirectional signals across the isolation barrier to avoid duty cycle restrictions and prevent transformer saturation. Other features include supply under and over voltage lockout, thermal shutdown, overcurrent and over voltage protection. The IX6611 is designed to operate over a temperature range of -40°C and +125°C and available in a 16-pin SOIC with an exposed thermal pad.

FEATURES

- Input compatible with pulse transformer
- 10A peak source and sink current gate drive
- Separate source and sink outputs
- Negative gate drive capability
- Over current protection with adjustable blanking time
- Advanced active clamping protection
- Under voltage lockout protection
- Over voltage lockout protection
- Two 1A pulse transformer drivers for fault communication

APPLICATIONS

- AC and DC motor drives
- UPS systems
- High voltage DC/DC converters

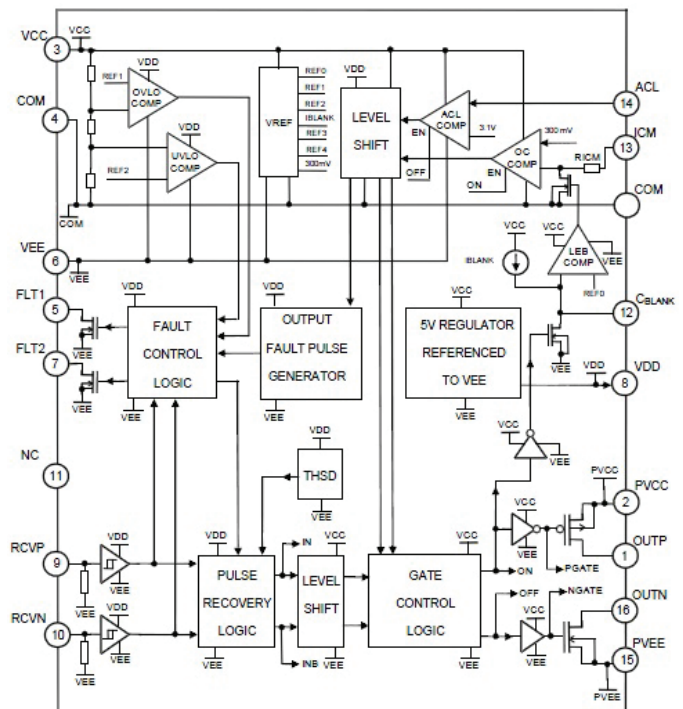
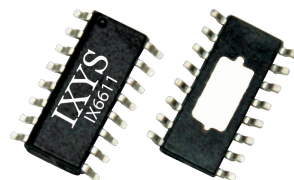


Figure 1: IX6611 Functional Block Diagram

4000V Isolated Gate Driver Module

IXIDM140103: 30A and IXIDM1401: 10A

The new IXIDM1403/IXIDM1401 driver module combines supreme compactness with the highest performance and reliability. It comprises a dual-channel driver core that targets medium power dual-channel IGBTs for up to 4kV and applications such as inverters, drives & automation, UPS, renewable energy, transportation and medical. Its parallel capability allows easy power system design. It supports switching up to 250 kHz, short-circuit protection, advanced active clamping and supply-voltage monitoring.



APPLICATIONS

- Various Appliances with Motors Operating by Microcontrollers
- Wind power and photovoltaic
- Industrial drives
- Electric/hybrid drive commercial vehicles
- Uninterruptible power supplies (UPS)
- Driving large parallel-connected IGBTs
- Medical (MrT, CT, X-ray)
- Tractions Applications

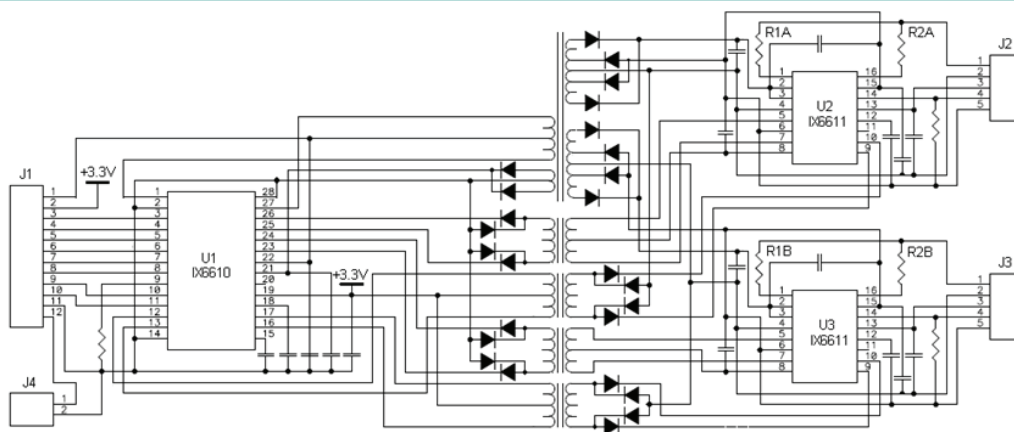
KEY FEATURES

- Dual Channel Driver for Half-Bridge Switching Modules
- Blocking voltages up to 4000 V
- Minimum Input Pulse Width 500 ns
- Input to Output Gate Driver Signal Propagation Delay <100 ns
- Gate Drive Pulse Width Distortion <20 ns
- Internal Power Supply for Isolated Drivers with up to 2 W Output Power per Channel
- +15 V/-5 V Isolated Gate Driver Output Voltage to Drive IGBTs with up to 10 A or 30A Pulse Current
- 3 V TTL Logic Level Microcontroller Interface
- Non-Overlap Operation of High Side and Low Side Drivers allows use Single Signal Source to drive Half-Bridge Modules
- Hardware-programmable Dead Time
- Single 15 V Power Supply Operations
- Gate current ±10A or ±30A
- Under- and over-voltage Lockout Protection
- Up to 50 mA 3.3 V Load Capability Output to Drive an External MCU
- Cycle-by-cycle IGBT Over-current Protection
- Advanced Active Clamping
- FAULT Signals Informing MCU about Over-Voltage, Under-Voltage, and Over-Current Conditions at Isolated Gate Drivers
- Latched FAULT Signals from Gate Drivers to Let MCU Read Fault Information Asynchronously
- Operating Ambient Temperature: -40C~+1050C
- Driver and Internal Power Supply Over- Temperature Protection with 1500C Threshold and 250C Hysteresis
- Footprint: 50 mm x 50 mm

KEY DATA OVERVIEW

Parameter	Min	Typical	Max	Unit
Nominal supply voltage	12	15	16	V
Supply current @ f _{IN} =0 Hz		25		mA
Supply Current at Full Load		160		mA
Output power per channel		2		W
Gate voltage swing	Positive	12	20	V
	Negative	-10	-5	V
Peak output current	-10		+10	A
Minimum Pulse Width		500		ns
Input Signal Propagation Delay Time		100		ns
Input Pulse Width Distortion	-20		+20	ns
Input Pulse Duty cycle	0		100	%
Dead Time Programmability Range	50		2000	ns (C (F))
Fault Signals Propagation Delay Time		100		ns
ACL Comparator Threshold (to VEE)		3.1		V
Over-current Comparator Threshold (to COM)		300		mV
MCU Supply Output Voltage		3.3		V
MCU Supply Short Circuit Current		100		mA
Operating temperature	-40		+105	0C
Dielectric test voltage	4000			VAC

BASIC SCHEMATIC OF THE IXIDM1401



The IXIDM1401 targets medium-power, half-bridge IGBT and MOSFET applications. The driver supports switching up to 250 kHz at best-in-class efficiency. The IXIDM1401 comprises a complete dual-channel IGBT driver core, fully equipped with an isolated DC/DC converter, short-circuit protection, advanced active clamping and supply-voltage monitoring. It is a driver core equipped with the IXYS Corporation IX6610/6611 chipset of application-specific integrated circuits that covers the main range of functions needed to design intelligent gate drivers.

Ultra Junction Power MOSFETs

Developed using the charge compensation principle and proprietary process technology, these new devices exhibit the lowest on-state resistances, along with low gate charges and superior dv/dt performance. Their avalanche capability also enhances the device ruggedness. In addition, thanks to the fast soft-recovery body diode, the Ultra-Junction MOSFETs help reduce switching losses and electromagnetic interference (EMI).

FEATURES

- Ultra low on-resistance $R_{DS(ON)}$ and gate charge Q_g
- Fast body diode
- dv/dt ruggedness
- Avalanche rated
- Low package inductance
- International standard packages

ADVANTAGES

- Higher efficiency
- High power density
- Easy to mount
- Space savings

APPLICATIONS

- Industrial switched-mode and resonant-mode power supplies
- Electric vehicle battery chargers
- AC and DC motor drives
- DC-DC converters
- Renewable-energy inverters
- Power Factor Correction (PFC) circuits
- Robotics and servo control

Part Number	V_{DSS} (V)	I_{D25} $T_c = 25^\circ\text{C}$ (A)	$R_{DS(on)}$ max $T_j = 25^\circ\text{C}$ (m Ω)	$Q_{g(on)}$ typ (nC)	C_{iss} typ (pF)	t_{tr} typ (ns)	$R_{th(jc)}$ max ($^\circ\text{C}/\text{W}$)	P_D max (W)	Package Type
250V X3-Class HiPerFET™ Power MOSFETs with Fast Body Diodes									
IXFJ80N25X3	250	44	0.02	5430	83	105	1.2	104	ISO TO-247
IXFA80N25X3	250	80	0.018	5430	83	105	0.4	310	TO-263
IXFH80N25X3	250	80	0.018	5430	83	105	0.4	310	TO-247
IXFP80N25X3	250	80	0.018	5430	83	105	0.4	310	TO-220
650V X2-Class HiPerFET™ Power MOSFETs with Fast Body Diodes									
IXFA8N65X2	650	8	0.45	790	11	105	0.83	150	TO-263
IXFH60N65X2	650	60	0.052	6300	108	180	0.16	780	TO-247-4L
IXFH60N65X2-4	650	60	0.052	6300	108	180	0.16	780	TO-247-4L
IXFT60N65X2HV	650	60	0.052	6300	108	180	0.16	780	TO-268HV
IXFH80N65X2	650	80	0.038	8300	140	200	0.14	890	TO-247
IXFH80N65X2-4	650	80	0.038	8300	140	200	0.14	890	TO-247-4L
IXFK120N65X2	650	120	0.024	14000	240	220	0.1	1250	TO-264
IXFN150N65X2	650	145	0.017	21000	355	260	0.12	1040	SOT-227
IXFB150N65X2	650	150	0.017	21000	355	260	0.08	1560	PLUS264
IXFN170N65X2	650	170	0.013	27000	434	270	0.107	1170	SOT-227
850V X-Class HiPerFET™ Power MOSFETs with Fast Body Diodes									
IXFA4N85X	850	3.5	2.5	247	7	170	0.83	150	TO-263
IXFT40N85XHV	850	40	0.145	3700	98	200	0.145	860	TO-268HV
IXFK66N85X	850	66	0.065	8900	230	250	0.1	1250	TO-264
IXFX66N85X	850	66	0.065	8900	230	250	0.1	1250	PLUS247
IXFB90N85X	850	90	0.041	13300	340	250	0.07	1785	PLUS264
IXFN90N85X	850	90	0.041	13300	340	250	0.104	1200	SOT-227
IXFN110N85X	850	110	0.033	17000	425	205	0.107	1170	SOT-227

XPT™ / X2PT™ Power IGBTs 1200V up to 4500V

Designed using the proprietary thin-wafer technology called Extreme-light Punch-Through (XPT™) and the state-of-the-art IGBT process, these devices exhibit such qualities as reduced thermal resistance, low tail current, and high-speed switching capability. Also, thanks to the positive temperature coefficient of their on-state voltage, these very high voltage IGBTs are ideally suited for parallel device operation, which provides cost-effective solutions compared to series-connected, lower-voltage device ones. This also results in reduction in the associated gate drive circuitry, further simplifying the design, saving PCB board space, and improving the reliability of the overall system.

FEATURES

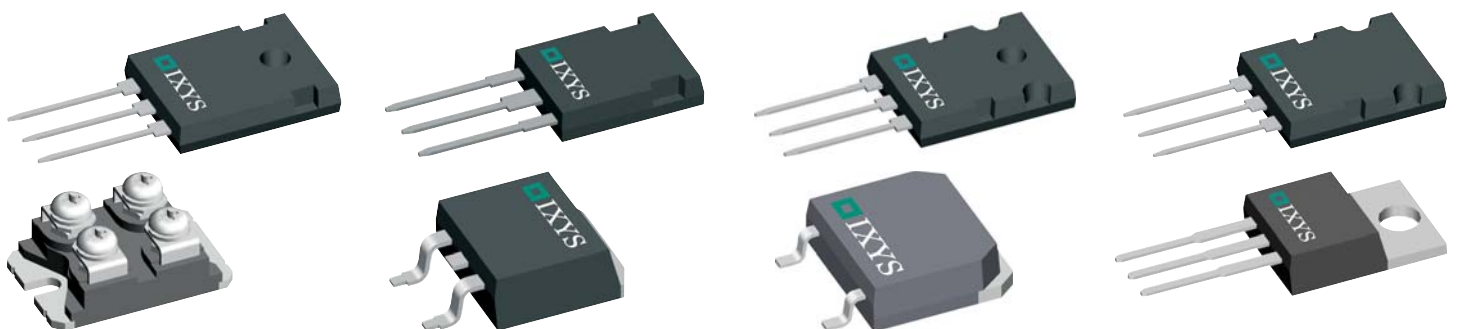
- High blocking voltages
- Low on-state voltage
- High power density
- Co-packed fast recovery diodes
- International standard size packages

APPLICATIONS

- Pulsar circuits
- Capacitor discharge circuits
- High-voltage power supplies
- Laser & X-ray generators
- AC switches

Part Number	V _{CE5} (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 =150°C (ns)	E _{off} typ T _J =150°C (mJ)	R _{thJC} max IGBT (°C/W)	Configuration	Package Style
1200V X2PT™ Planar IGBTs									
IXG70IF1200NA	1200	130	86 (100°C)	2.2	100	5.3 (50A)	0.3	Copacked	SOT-227
IXG100IF1200HF	1200	140	104 (100°C)	2.2	100	5.3 (50A)	0.2	Copacked	PLUS247™
IXG100IF1200KB	1200	140	104 (100°C)	2.2	100	5.3 (50A)	0.2	Copacked	TO-264
1700V XPT™ Planar IGBTs									
IXYH24N170C	1700	58	24	3.8	120	2.7	0.3	Single	TO-247
IXYN30N170CV1	1700	88	30	3.7	178	4.5	0.22	Copacked	SOT-227
IXYH30N170C	1700	108	30	3.7	178	4.5	0.16	Single	TO-247
IXYX30N170CV1	1700	108	30	3.7	178	4.5	0.16	Copacked	PLUS247™
2500V XPT™ Planar IGBTs									
IXYH25N250CHV	2500	95	25	4	350	10.5	0.16	Single	TO-247HV
IXYT25N250CHV	2500	95	25	4	350	10.5	0.16	Single	TO-268HV
IXYX25N250CV1	2500	95	25	4	350	10.5	0.16	Copacked	PLUS247
IXYX25N250CV1HV	2500	95	25	4	350	10.5	0.16	Copacked	TO-247PLUS-HV
High Voltage X2PT™ Planar IGBTs									
IXG65I3300KN	3300	85	48 (100°C)	2.8	400 (125°C)	60	0.34	Single	ISOPLUS264-HV™
IXG50I4500KN*)	4500	74	42 (100°C)	3.2	1350 (125°C)	73	0.34	Single	ISOPLUS264-HV™

*) recommended free wheeling diode: DHG45I4500KO in ISOPLUS264™ package



IXYS Silicon Carbide Package Power - Mosfets

Silicon Carbide is known as a semiconductor material offering very fast switching, very low on state and switching losses and increased power density. These features can be used achieving smaller and more efficient converters following the trend to higher bus voltages. Examples among others are high efficient DC-DC converters, solar inverters, UPS systems or supercharger solutions.

IXYS offers Silicon Carbide solutions based on IXYS own ISOPLUS packaging technology offering transfer molded packages like ISOPLUS i4 or SMPD with dies mounted on DCB (Direct Copper Bonded) substrates featuring insulation towards heat sink. Furthermore ISOPLUS SMPD is made for SMD placement facilitating efficient mounting for cost reduction. MiniBLOC (SOT-227) package is a solution based on unique thermal design of high thermal conductivity AlN ceramic substrates.

All these packages allow for dense layouts following markets demand for smaller inverter designs, higher power density and efficiency.

FEATURES / ADVANTAGES

- Very fast switching
- Highest efficiency
- Highest power density

ISOPLUS Packages

- 3kV isolation voltage towards heatsink
- Low stray inductance
- Low coupling capacity
- Low thermal impedance
- Excellent reliability

APPLICATIONS

- Solar inverters
- High voltage DC/DC converters
- Motor drives
- Switch mode power supplies
- PFC
- UPS
- Battery chargers
- Induction heating

SiC Mosfet Products	V _{DS} (V)	R _{DS(ON)} typ (mΩ)	Package	Circuit
IXFN 130N90SK *	900	10	SOT-227	Single Mosfet
IXFN 27N120SK *	1200	80	SOT-227	Single Mosfet
IXFN 50N120SiC	1200	40	SOT-227	Single Mosfet
IXFN 50N120SK *	1200	40	SOT-227	Single Mosfet
MCB 40I1200TZ	1200	40	TO-263	Single Mosfet
IXFN 70N120SK *	1200	25	SOT-227	Single Mosfet
MCB 60I1200TZ	1200	25	TO-263	Single Mosfet
IXFN 45N170SK *	1700	45	SOT-227	Single Mosfet
IXFN 90N170SK *	1700	23	SOT-227	Single Mosfet

*) Kelvin source gate connection

SiC Mosfet Products	V _{DS} (V)	R _{DS(ON)} typ (mΩ)	Package	Circuit
MCB 20P1200LB	1200	2 x 80	SMPD	Phase Leg
MCB 25P1200TLB	1200	2 x 80	SMPD	Phase Leg + NTC
MCB 30P1200LB	1200	2 x 40	SMPD	Phase Leg
MCB 40P1200LB	1200	2 x 25	SMPD	Phase Leg
MCB 60P1200TLB	1200	2 x 25	SMPD	Phase Leg + NTC
MMCB 20WO1200TMI	1200	6 x 80	MiniPack2B	6-Pack open Source



IXYS Silicon Carbide Package Power - Diodes

Silicon Carbide Schottky diodes feature an excellent and temperature independent switching behavior with no reverse recovery behavior like silicon based fast recovery diodes. This enables the designer to increase system switching frequency for smaller and more efficient converters. For higher power Silicon Carbide diodes can be paralleled because of the positive temperature coefficient of the forward voltage.

IXYS offers Silicon Carbide solutions based on IXYS own ISOPLUS packaging technology offering transfer molded packages like ISOPLUS i4 or SMPD with dies mounted on DCB (Direct Copper Bonded) substrates featuring insulation towards heat sink. Furthermore ISOPLUS SMPD is made for SMD placement facilitating efficient mounting for cost reduction. MiniBLOC (SOT-227) package is a solution based on unique thermal design of high thermal conductivity AlN ceramic substrates.

ISO247 is the latest development of the ISOPLUS family. It is compatible to TO-247, does have a screw mounting hole but offers a DCB isolated backside with outstanding low thermal impedance. First ISO247 SiC products are common cathode DCG20C1200HR and DCG35C1200HR. Unique in TO-247 footprint are the phase legs DCG10P1200HR and DCG17P1200HR.

FEATURES / ADVANTAGES

- Very fast switching
- Highest efficiency
- Highest power density

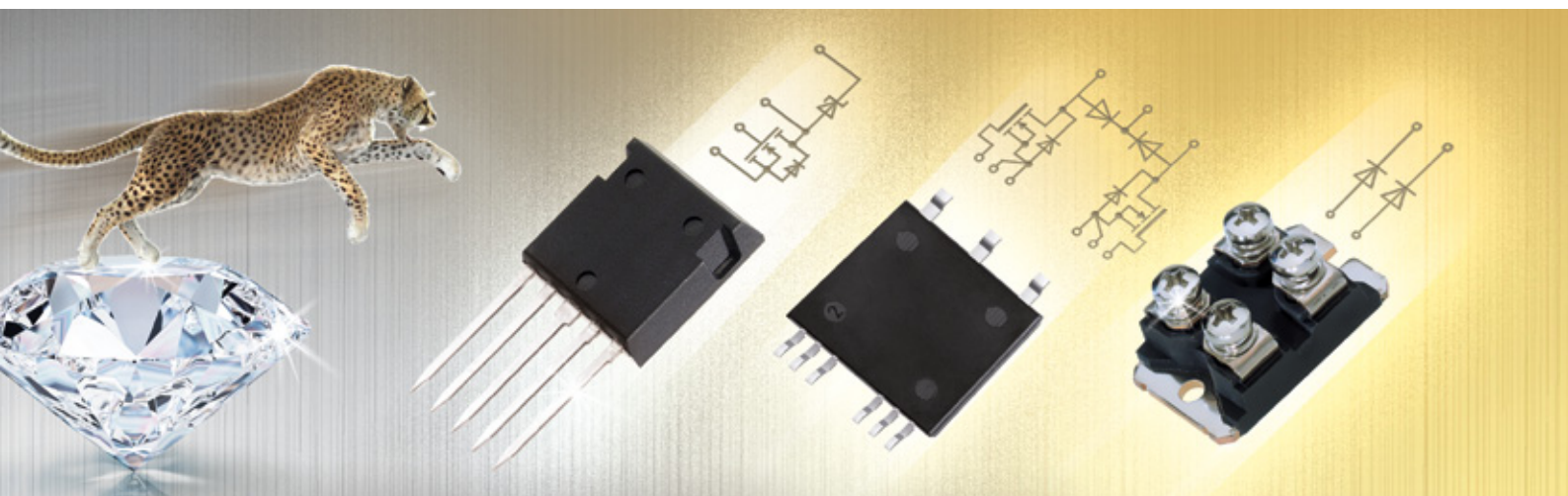
ISOPLUS Packages

- 3kV isolation voltage towards heatsink
- Low stray inductance
- Low coupling capacity
- Low thermal impedance
- Excellent reliability

APPLICATIONS

- Solar inverters
- High voltage DC/DC converters
- Motor drives
- Switch mode power supplies
- PFC
- UPS
- Battery chargers
- Induction heating

SiC Diode Products	V_{RRM} (V)	I_{DAV} & $d=0,5$ (A)	Package	Circuit
DCG 45X1200NA	900	2 x 22	SOT-227	Dual diode
DCG 85X1200NA	1200	2 x 43	SOT-227	Dual diode
DCG 100X1200NA	1200	2 x 49	SOT-227	Dual diode
DCG 130X1200NA	1200	2 x 64	SOT-227	Dual diode
DCG 20C1200HR	1200	2 x 10	ISO247	Common Cathode
DCG 35C1200HR	1200	2 x 17	ISO247	Common Cathode
DCG 10P1200HR	2 x 1200	10	ISO247	Phase leg
DCG 17P1200HR	2 x 1200	17	ISO247	Phase leg
DCG 20B650LB	650	21	SMPD	Full bridge
FBS 10-12SC	1200	4.5	ISOPLUS i4	Full bridge
DCG 20B1200LB	1200	9.2	SMPD	Full bridge
MKG 17RK600DCGLB	600	Mosfet: 2 x 110 mΩ Diode: 2 x 11A	SMPD	Double boost



SimBus F – Rectifier Phase-Legs with PressFit Pins

Today IXYS represents a new line of rectifier phase-legs in the standard industry package SimBus F. This is the first time IXYS offers the SimBus F package with PressFit Pins (PFP) for solder-free control contacts. The new range is available as diode-diode, thyristor-diode and thyristor-thyristor configuration.

To provide a high performance rectifier module IXYS has integrated several new features to the SimBus F. Internally the semiconductors are all contacted with the well-proven clip-solder-technology of IXYS known from several other standard packages as TO-240, Y4 (34 mm) or Y1 (50 mm). Additionally the main contacts are soldered on the DCB substrates (Direct Copper Bonded). The DCB has a new design called **DBthiC** that provides a thicker copper layer for the semiconductor. These three new integrated developments improve drastically the thermal management of the SimBus F module and give the rectifier phase-legs an outstanding performance. Last but not least the combination of rectifier phase-legs with the SimBus F and its standard industrial height of 17 mm allows easy bus bar connections between the rectifier and the inverter stages.

The portfolio of the different phase-leg types starts with three current ratings (250 – 600A) for two voltages classes (1600 – 2200 V). The DCB substrate allows an isolation voltage of 4300V between the terminals and the heat sink. On request IXYS provides a Phase Change Material (PCM) on the module backside for an optimized heat transfer and an easier handling in the assembly for the user.

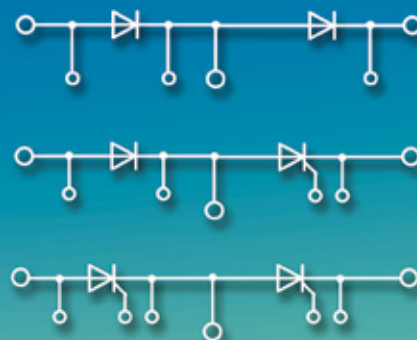
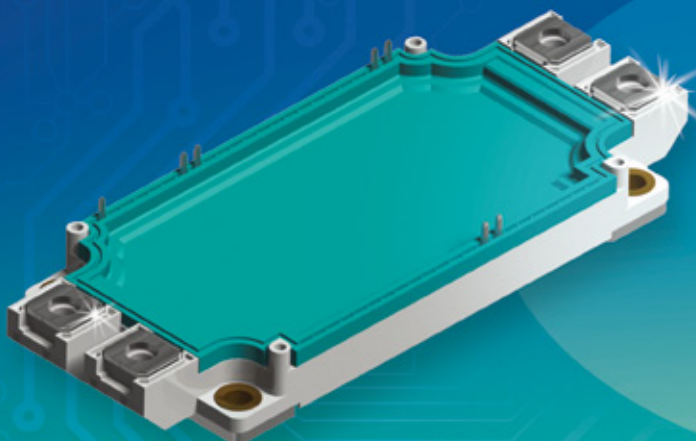
FEATURES / ADVANTAGES

- Package with **DBthiC** substrate
 - Clip-solder-contacts for semiconductors
 - Power terminals soldered on DCB
 - Improved temperature and power cycling
 - PressFit-Pins for PCB mounting
 - Industry standard outline
 - Height: 17 mm
 - Isolation Voltage: 4300 V~
 - Planar passivated chips
 - Very low forward voltage drop
 - Very low leakage current
- Option: Phase Change Material

APPLICATIONS

- Line rectifying 50/60 Hz
- For single and three phase bridge configurations
- Supplies for DC power equipment
- Input rectifiers for PWM inverter
- Battery DC power supplies
- Field supply for DC motors
- Softstart AC motor control
- AC power control
- Power converter
- Lighting and temperature control

Diode – Diode	I_{FAV} (A)	V_{RRM} (V)	Thyristor – Diode	I_{FAV} (A)	V_{RRM} (V)	Thyristor – Thyristor	I_{FAV} (A)	V_{RRM} (V)
MDMA300P1600PTSF	300	1600	MCMA280PD1600PTSF	280	1600	MCMA280P1600PTSF	280	1600
MDNA300P2200PTSF	300	2200	MCNA250PD2200PTSF	250	2200	MCNA250P2200PTSF	250	2200
MDMA425P1600PTSF	425	1600	MCMA400PD1600PTSF	400	1600	MCMA400P1600PTSF	400	1600
MDNA425P2200PTSF	425	2200	MCNA360PD2200PTSF	360	2200	MCNA360P2200PTSF	360	2200
MDMA600P1600PTSF	600	1600	MCMA550PD1600PTSF	550	1600	MCMA550P1600PTSF	550	1600
MDNA600P2200PTSF	600	2200	MCNA500PD2200PTSF	500	2200	MCNA500P2200PTSF	500	2200



More Power and PressFit-Pins for Rectifier Bridges with integrated Brake function

Today IXYS represents the extension of its product line of rectifier bridges with integrated brake units. The current portfolio offers several new modules including many new feature to provide the customers a wide range of high integrated and powerful rectifier solutions.

Biggest improvement is the implementation of the new IGBT generation X2PT of IXYS for the brake units. The X2PT-IGBT is characterized by an improved switching and thermal behavior resulting in a higher robustness and reliability.

An important feature is the new DCB (Direct Copper Bonded) technology called **DBthiC** providing a thicker copper layer for the semiconductor. A higher integration for the rectifier, a lower thermal resistance and a higher long-term stability are the benefit especially for the package type E2.

For a high performance, solder free mounting IXYS provides PressFit-Pin (PFP) versions for the E2 package. Optionally this module type is available with a Phase Change Material (PCM) printed on the backside to achieve an optimized thermal connection for a clean and cost effective mounting with reduced effort for the user.

IXYS offers a wide current range from 75 up to 450 Amps; the voltage ratings of the rectifiers are available from 1200 up to 2200V. The three phase input rectifier provides two circuits: one time with diodes and second a half-controlled circuit with thyristors.

Diode Rectifier	I_{DAV} (A)	V_{RRM} (V)	Package	PFP	DBthiC
VUB72-12NOXT	75	1200	V1		
VUB72-16NOXT	75	1600	V1		
VUI72-16NOXT	75	1600	V1		
VUB116-16NOXT	120	1600	E2		
VUB120-16NOX	180	1600	V2		
VUB120-16NOXT	180	1600	V2		
VUB135-22NO1	150	2200	E2		
VUB145-16NOXT	150	1600	E2		
VUB160-16NOX	180	1600	V2		
VUB160-16NOXT	180	1600	V2		
MDMA210UB1600PTED	210	1600	E2	x	x
MDNA210UB2200PTED	210	2200	E2	x	x
MDMA240UB1600ED	240	1600	E2		x
MDMA280UB1600PTED	280	1600	E2	x	x
MDNA280UB2200PTED	280	2200	E2	x	x
MDMA360UB1600PTED	360	1600	E2	x	x
MDNA360UB2200PTED	360	2200	E2	x	x
MDMA450UB1600PTED	450	1600	E2	x	x

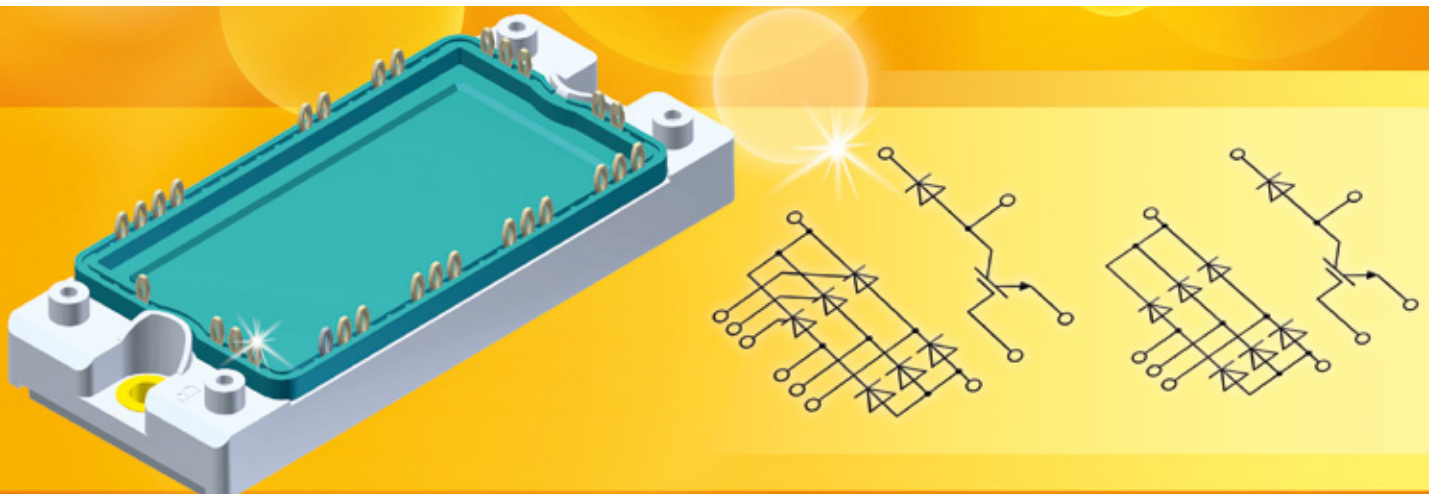
Thyristor Rectifier	I_{DAV} (A)	V_{RRM} (V)	Package	PFP	DBthiC
VVZB120-16ioX	180	1600	V2		
MCNA120UI2200TED	117	2200	E2		
VVZB135-16ioXT	150	1600	E2		
VVZB170-16ioXT	180	1600	E2		
MCMA240UI1600ED	240	1600	E2		x
MCMA240UI1600PED	240	1600	E2	x	x
MCMA245UI1600ED	240	1600	E2		x

FEATURES / ADVANTAGES

- Package with **DBthiC** substrate
- Improved temperature and power cycling
- PressFit-Pins (PFP) for PCB mounting
- Industry standard outline
- Height: 17 mm
- Option: Phase Change Material (PCM)
- Isolation voltage: 4300 V~
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current
- X2PT – 2nd generation Xtreme light Punch Through
- Thin wafer technology -> low VCE(sat); low Rth
- Rugged design

APPLICATIONS

- 50/60 Hz line rectifying
- 3~ Rectifier with Brake function for drive inverters



X2PT... the efficient solution for motor drives

X2PT™ IGBTs are the second generation of Xtreme Light Punch Through XPT IGBTs. With an improved vertical structure and an improved design the X2PT™ IGBT benefits are a superior short circuit capability, 175°C max junction temperature, a further reduced $V_{ce(sat)}$ and lower turn-off losses (E_{off}) resulting in a competitive performance to latest trench devices but at reduced R_{th} .

This extremely rugged IGBT platform is ideal for critical applications that require low conduction and low switching losses with a 10 μ s short circuit withstand capability.

A large portfolio of modules with X2PT™ IGBTs co-packaged with ultrafast soft recovery SONIC™ diodes are available in standard E2, E3 and SIMBUS F packages offering improved die cooling and reduced mounting resistance by the use of thick copper layer DCBs (Direct Copper Bonded).

For solder free mounting IXYS further more offers PressFit-Pin (PFP) versions and optionally modules with Phase Change Material (PCM) printed on the copper base plate for easy and silicone free mounting.

FEATURES / ADVANTAGES

- New cell design results in:
 - lower E_{off}
 - lower $V_{ce(sat)}$
 - T_{jmax} of 175°C
 - reduced R_{th}
 - very low gate charge
 - easy paralleling
 - square RBSOA @ $2 \times I_{nom}$
 - short circuit rated for 10 μ s
- Designs for 1200V and 1700V IGBTs

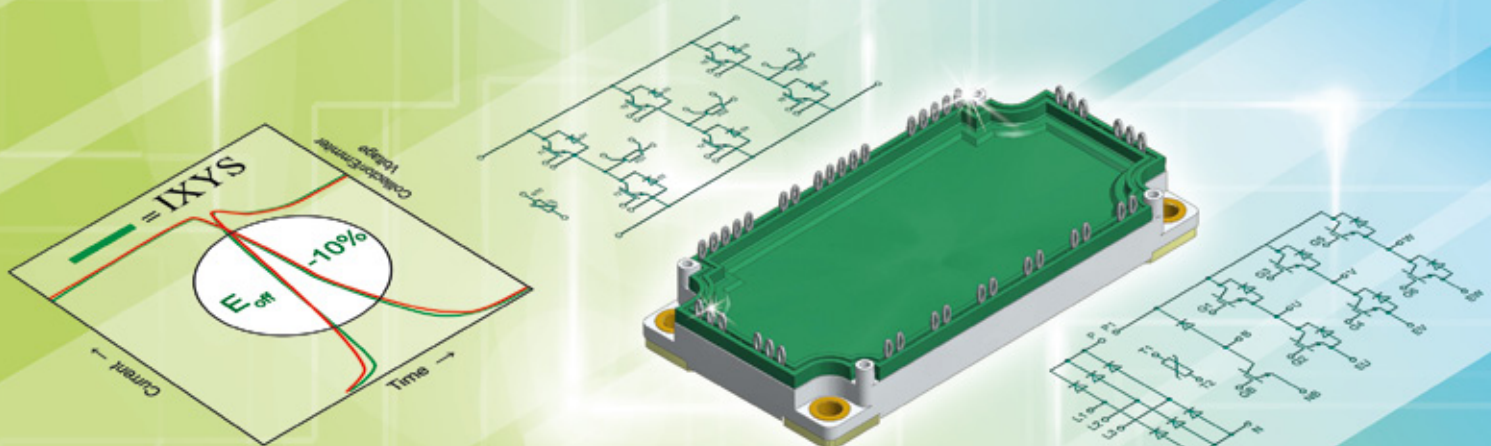
Options:

- Press fit pin
- Phase Change Material (PCM)

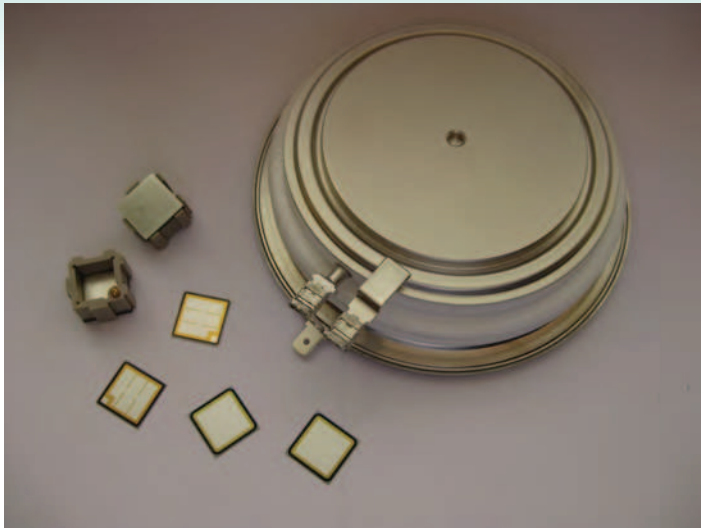
APPLICATIONS

- AC motor control
- Servo and robot drives
- Solar inverter
- UPS inverter
- Welding equipment
- Inductive heating
- Pumps, Fans

Products	V_{ce} (V)	I_{c80} (A)	Circuit	Package
MIXG 70W1200TED	1200	79	6-pack	E2
MIXG 90W1200TED	1200	102	6-pack	E2
MIXG 70WB1200TEH	1200	79	CBI	E3
MIXG 90WB1200TEH	1200	102	CBI	E3
MIXG 120W1200DPFTEH	1200	140	6-pack, HiPerFRED FWD	E3
MIXG 120W1200TEH	1200	140	6-pack	E3
MIXG 180W1200TEH	1200	195	6-pack	E3
MIXG 240W1200TEH	1200	240	6-pack	E3
MIXG 120W1200STEH	1200	140	6-pack with Shunt	E3
MIXG 180W1200STEH	1200	195	6-pack with Shunt	E3
MIXG 240W1200STEH	1200	240	6-pack with Shunt	E3
MIXG 330PF1200TSF	1200	395	Phase leg	SIMBUS F
MIXG 360PF1200TED	1200	420	Phase leg	E2
MIXG 490PF1200TSF	1200	580	Phase leg	SIMBUS F
MIXG 240RF1200TED	1200	250	Brake	E2
MIXG 360RF1200TED	1200	400	Brake	E2



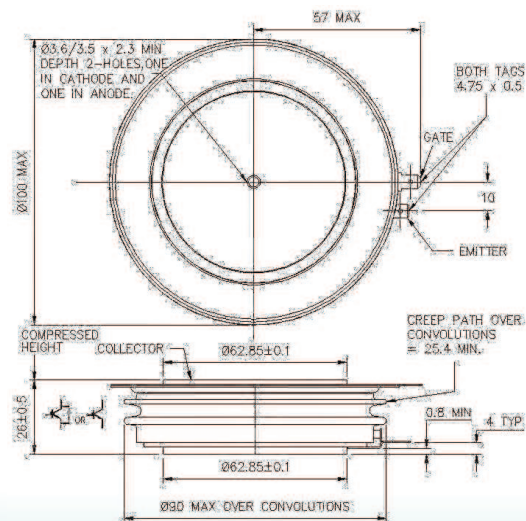
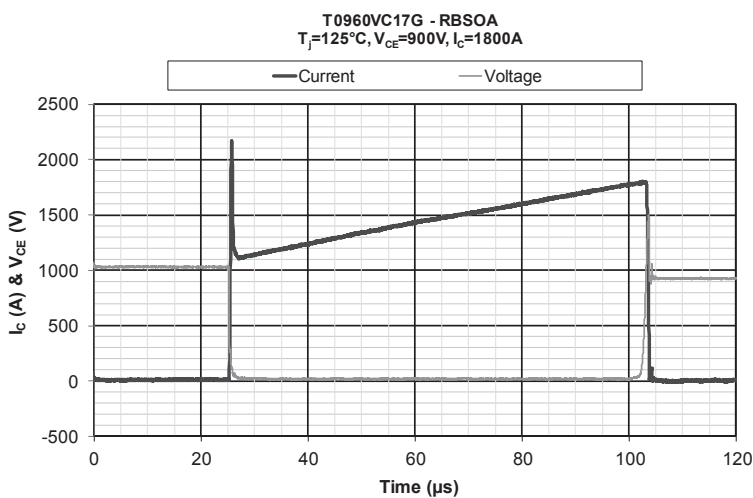
T0960VC17G: New 1.7kV press-pack IGBT



- First of a new range of 1.7kV press-pack IGBT's
- Reverse conducting with fully rated integral diode.
- 960A nominal current rating in a 63mm electrode, 100mm overall diameter industry standard package.
- Short circuit failure mode

Key parameters

- V_{CES} , 1.7kV / I_C , 900A
- V_{DC} link, 900V with 100 FIT
- I_{CRM} , 1920A
- $V_{CE(sat)}$, 3.3V @ 960A & 125°C
- E_{ON} , 0.47J / E_{OFF} , 0.8J, nominal
- R_{thJK} , 33.8K/kW, double side cooled
- Operating temperature -40 to +125°C
- I_{SC} , 10.9kA, 10 μ s



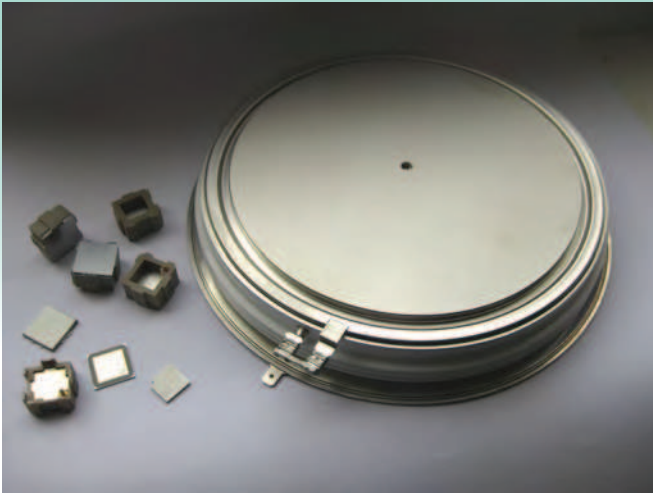
Prospective product matrix

Provisional part number	Electrode diameter (mm)	Integral diode
T0600NC17A	50	Yes
T0840NC17E	50	No
T0960VC17G	63	Yes
T1440VC17E	63	No
T1800TC17A	75	Yes
T2520TC17E	75	No
T2520TC17G	96	Yes

Applications

- Traction including light rail, trams, trolley-bus and other electric vehicles;
- AC drives for harsh environments such as mining, marine and off shore, gas and oil installations;
- Renewable energy for wind turbines, hydro generation, wave-generation and solar;
- Any application where high power density and reliability are key considerations.

T2960BB45EA: New 3kA, 4.5kV press-pack IGBT



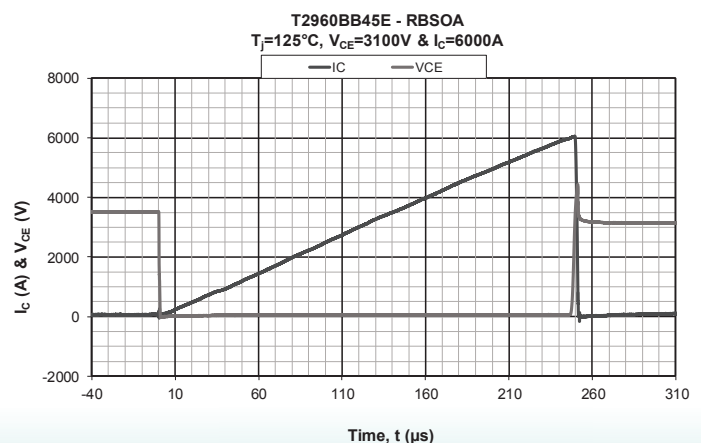
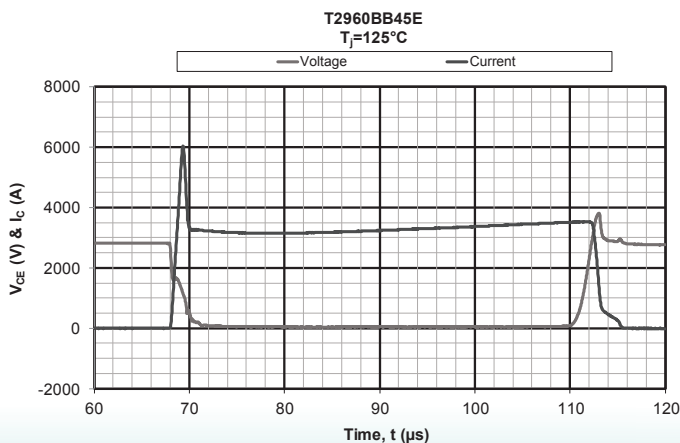
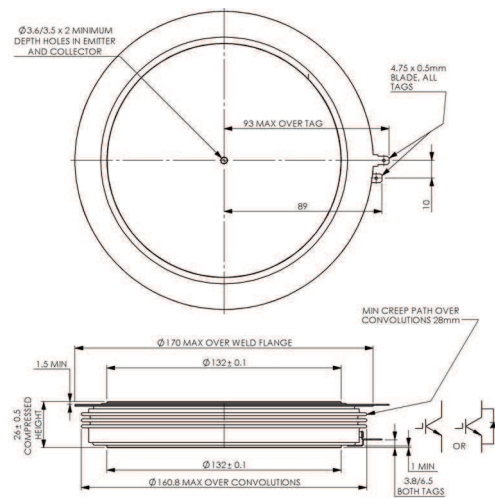
- 3kA nominal current rating in 132mm electrode 170mm overall diameter industry standard package
- Optimised HP Sonic FRD E3000EC45E also available
- Short circuit failure mode

Applications

- Utilities: Flexible AC transmission systems, HVDC transmission, statcoms, VSC, SVC, etc.
- Medium voltage drives: Marine, oil and gas pumps, industrial drives etc.

Key parameters

- V_{CES} , 4.5kV / I_C , 3kA
- V_{DC} link, 2.8kV with 100 FIT
- I_{CRM} , 6kA
- $V_{CE(sat)}$, 3.6V@3kA&125°C
- E_{ON} , 11.5J / E_{OFF} , 17.5J, nominal
- R_{thJK} , 4.2K/kW, double side cooled
- Operating temperature -40 to +125°C
- I_{SC} , 10.9kA, 10μs



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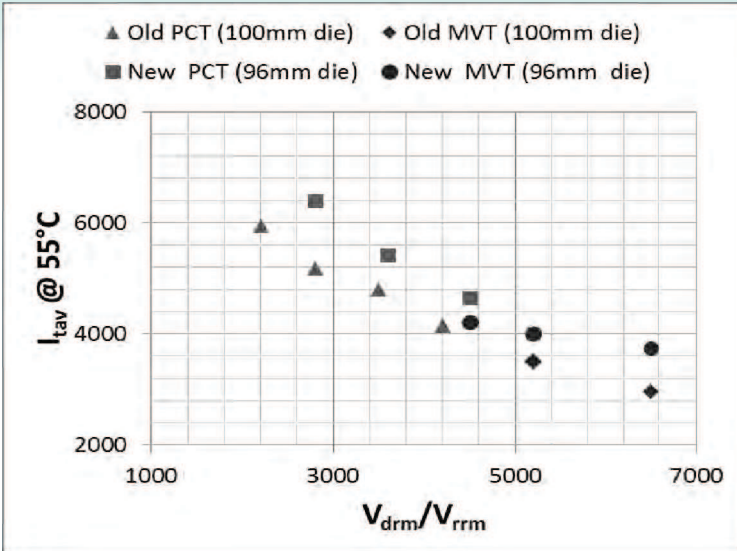
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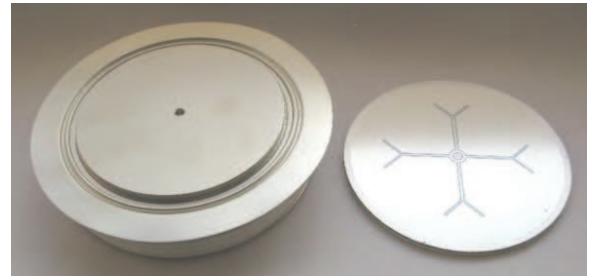
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New 96mm die phase control and medium voltage thyristors

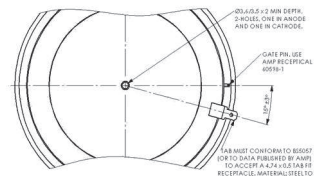
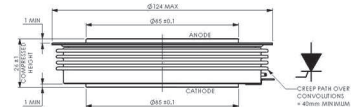


- Bonded die construction
- New smaller package design with 85mm electrode and 124mm overall diameter
- Higher average current rating than old 100mm die designs in large package
- Range includes medium voltage thyristors with optimised characteristics for series connection

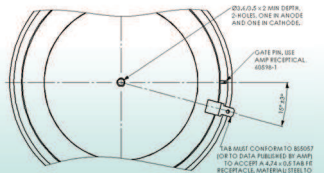
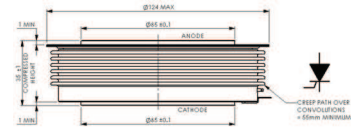


Phase control thyristors

Part No.	V _{DRM} V _{RRM}	I _{TAV} T _K =55°C	I _{TSM}	I ² t	V _{T0}	r _T	T _{JM}	R _{thJC}		Fig. No.
	V	A	A	A ² s	V	mΩ	°C	180° Sine K/W	120° Rect. K/W	
N4165EE400	4000	4165	56000	15.7 x 10 ⁶	0.977	0.177	125	0.006	0.00639	W108
N4165EE450	4500	4165	56000	15.7 x 10 ⁶	0.977	0.177	125	0.006	0.00639	W108
N4650EA400	4000	4650	56000	15.7 x 10 ⁶	0.977	0.177	125	0.005	0.00538	W107
N4650EA450	4500	4650	56000	15.7 x 10 ⁶	0.977	0.177	125	0.005	0.00538	W107
N4845EE320	3200	4845	65000	21.1 x 10 ⁶	0.913	0.125	125	0.006	0.00654	W108
N4845EE360	3600	4845	65000	21.1 x 10 ⁶	0.913	0.125	125	0.006	0.00654	W108
N5415EA320	3200	5415	65000	21.1 x 10 ⁶	0.913	0.125	125	0.005	0.00538	W107
N5415EA360	3600	5415	65000	21.1 x 10 ⁶	0.913	0.125	125	0.005	0.00538	W107
N5715EE240	2400	5715	80000	32.0 x 10 ⁶	0.840	0.085	125	0.006	0.00654	W108
N5715EE280	2800	5715	80000	32.0 x 10 ⁶	0.840	0.085	125	0.006	0.00654	W108
N6405EA240	2400	6405	80000	32.0 x 10 ⁶	0.840	0.085	125	0.005	0.00538	W107
N6405EA280	2800	6405	80000	32.0 x 10 ⁶	0.840	0.085	125	0.005	0.00538	W107



W107



W108

Medium voltage thyristors (will also be available in W108 outline)

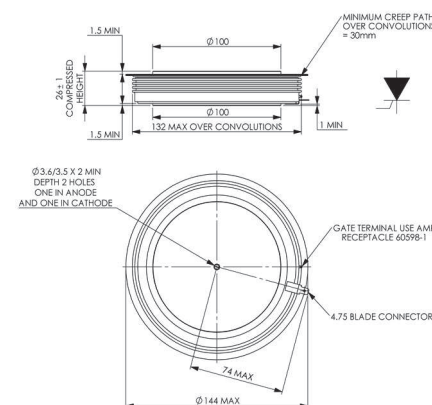
Part No.	V _{DRM} V _{RRM}	I _{TAV} T _K =55°C	I _{TSM}	I ² t	t _q	Typ. Reverse Recovery Charge			V _{T0}	r _T	T _{JM}	R _{thJC}		Fig. No.
	V	A	A	A ² s	@ 200V/μs μs	Q _{rr} μC	@I _{TM} A	@-di/dt A/μs	V	mΩ	°C	180° Sine K/W	120° Rect. K/W	
K3745EA600	6000	3745	35400	6.26 x 10 ⁶	1500-1800	14000	4000	10	1.481	0.244	125	0.005	0.00538	W107
K3745EA650	6500	3745	35400	6.26 x 10 ⁶	1500-1800	14000	4000	10	1.481	0.244	125	0.005	0.00538	W107
K4005EA480	4800	4005	43200	9.33 x 10 ⁶	1300-1600	8000	4000	10	1.359	0.216	125	0.005	0.00538	W107
K4005EA520	5200	4005	43200	9.33 x 10 ⁶	1300-1600	8000	4000	10	1.359	0.216	125	0.005	0.00538	W107
K4215EA420	4200	4215	47000	11.0 x 10 ⁶	1200-1500	4800	4000	10	1.224	0.201	125	0.005	0.00538	W107
K4215EA450	4500	4215	47000	11.0 x 10 ⁶	1200-1500	4800	4000	10	1.224	0.201	125	0.005	0.00538	W107

New 115mm die phase control thyristors

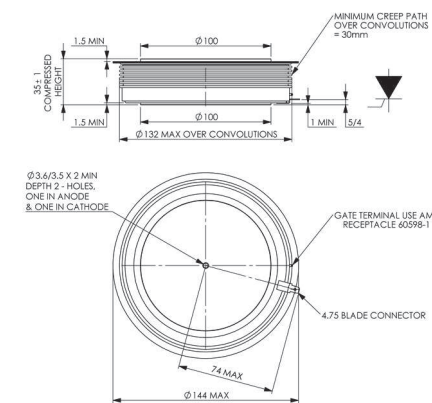
- New 115mm bonded die device in same outline as old 100mm die device
- More than 40% increase in average current rating
- Medium voltage parts planned for late 2017



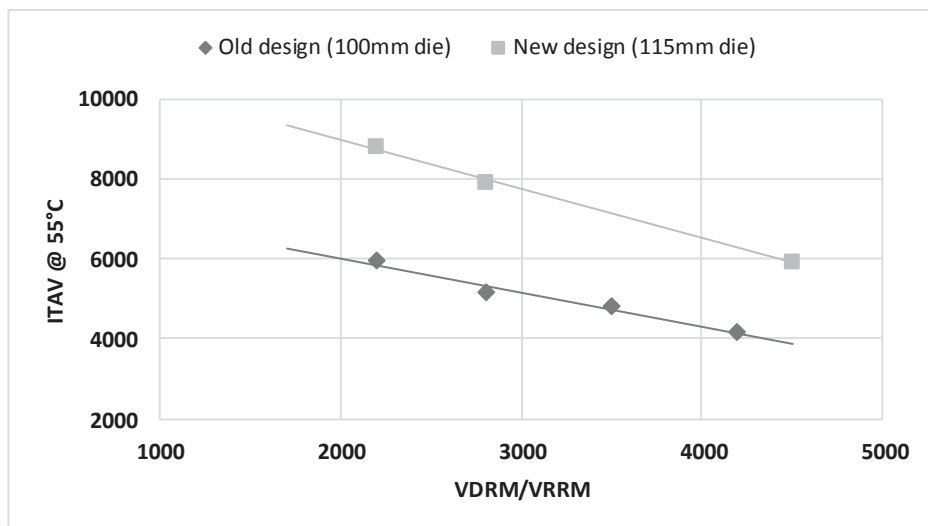
Part No.	V _{DRM} V _{R RM}	I _{TAV} T _K =55°C	I _{TSM} 10ms 1/2 sine V _R ≤ 60% V _{R RM}	I ² t A A ² s	V _{TO} @T _{JM}	r _T mΩ	T _{JM} °C	R _{thJC}		Fig. No.
	V	A	A	A ² s	V	mΩ	°C	180° Sine K/W	120° Rect. K/W	
N5320FE400	4000	5320	78000	30.42×10 ⁶	1.060	0.130	125	0.00475	0.00513	W119
N5320FE450	4500	5320	78000	30.42×10 ⁶	1.060	0.130	125	0.00475	0.00513	W119
N5910FA400	4000	5910	78000	30.42×10 ⁶	1.060	0.130	125	0.00400	0.00439	W118
N5910FA450	4500	5910	78000	30.42×10 ⁶	1.060	0.130	125	0.00400	0.00439	W118
N7585FE240	2400	7585	110000	60.50×10 ⁶	0.780	0.062	125	0.00475	0.00513	W119
N7585FE280	2800	7585	110000	60.50×10 ⁶	0.780	0.062	125	0.00475	0.00513	W119
N7905FE180	1800	7905	117000	68.44×10 ⁶	0.770	0.056	125	0.00475	0.00513	W118
N7905FE220	2200	7905	117000	68.44×10 ⁶	0.770	0.056	125	0.00475	0.00513	W118
N8440FA240	2400	8440	110000	60.50×10 ⁶	0.780	0.062	125	0.00400	0.00439	W119
N8440FA280	2800	8440	110000	60.50×10 ⁶	0.780	0.062	125	0.00400	0.00439	W119
N8800FA180	1800	8800	117000	68.44×10 ⁶	0.770	0.056	125	0.00400	0.00439	W118
N8800FA220	2200	8800	117000	68.44×10 ⁶	0.770	0.056	125	0.00400	0.00439	W118



W118



W119



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