



**PROTECT
CONTROL
SENSE**



A Littelfuse Technology

LF/IXYS Power Devices And Industrial Applications

LF/IXYS Semiconductor Business Unit Segments



Protection Semiconductor

- TVS Diode
- Diode Arrays
- SIDACtor® Protection Thyristor



Power Semiconductor

- Bipolar
- IGBT
- MOSFET
- Silicon Carbide
- High Power
- Discrete & Module Solutions
- Bare Die
- Fully engineered subsystems



Integrated Circuits & Solid State Relays

- High Voltage ICs
- Solid State Relays
- Gate Drivers

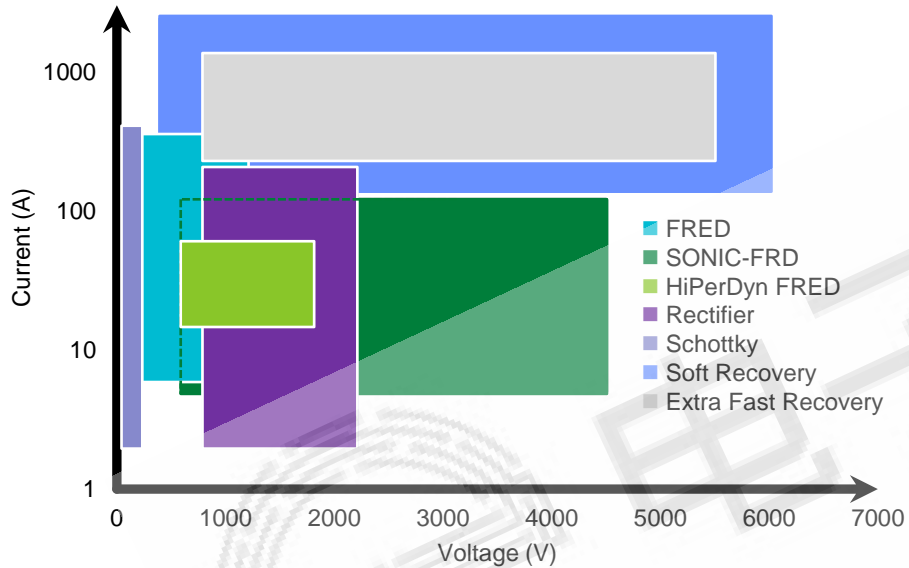


**PROTECT
CONTROL
SENSE**

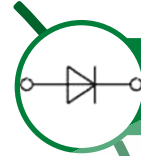


LF/IXYS Power Devices Overview

Diodes



- Broad portfolio and options for same ratings.
- Broadest portfolio and industry and dominant at >1200 V



RECTIFIER

- Single, Phase leg, 3-Phase
- Standard, Avalanche, Semifast



FRED

- Gold doped → good recovery w/ respect to V_f
- Soft recovery w/ fast switching
- Typical applications: PFC



HiPerFRED

- Platinum doped
- Typical Applications: Battery chargers; High freq. output rectifiers



SONIC-FRD

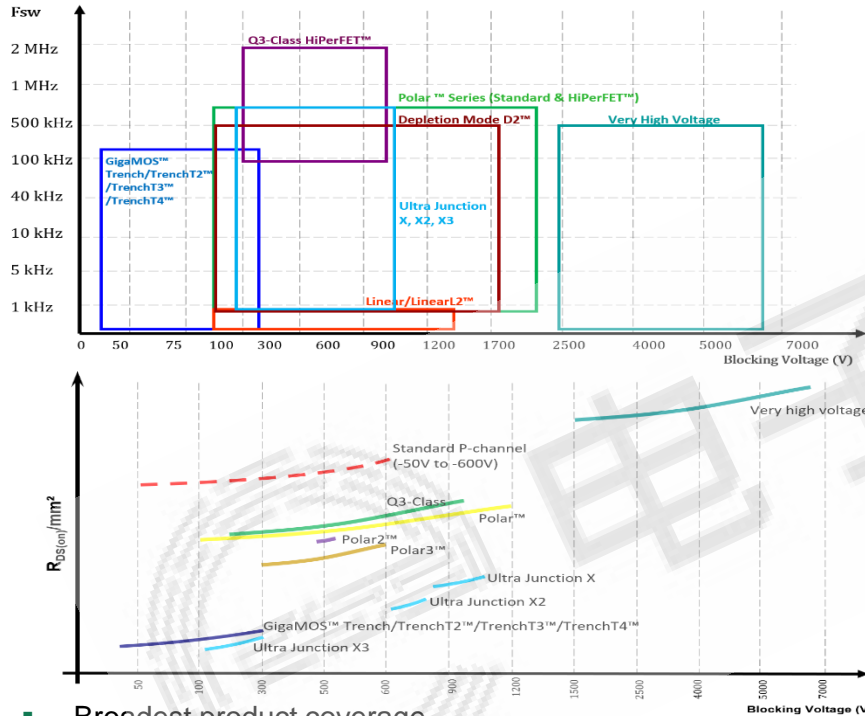
- Helium implanted
- Neutral temp. coefficient → good for paralleling, soft recovery, very fast switching
- Typical Applications: High freq. circuits










HiPerDyn

- Series die connected in package to achieve BV rating → reduces recovery charge
- Customized products → Can use all materials used in three above. Can be developed based on customer's requirements

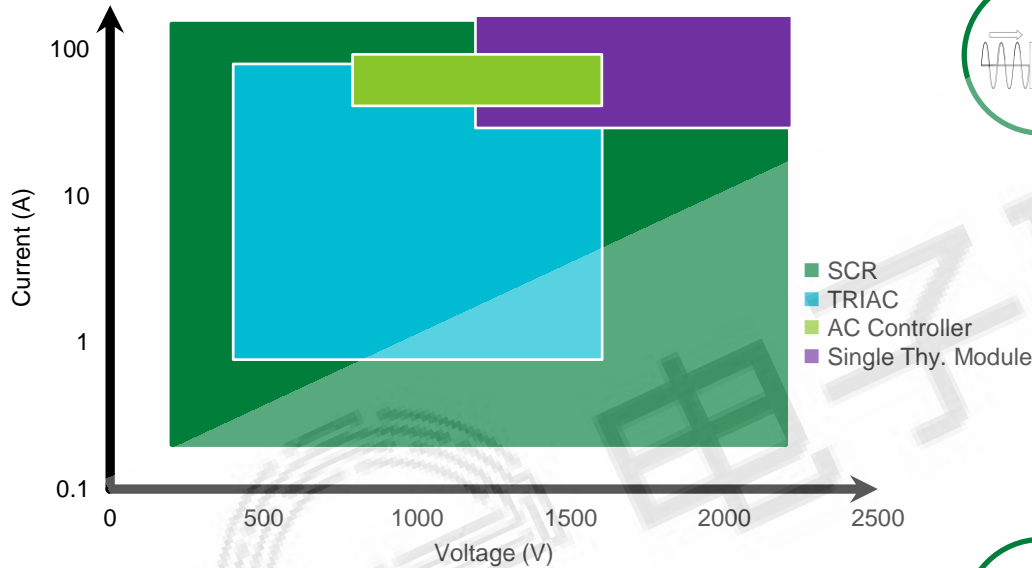
Discrete MOSFET



- Broadest product coverage
- Exclusive supplier for many specific products
- Competitive product performance with leading technical expertise
- Ruggedness and high reliability verified over a long history in various applications

- 
Very High Voltage
 - Only supplier for over 1700V MOSFET product
- 
Linear
 - Low frequency and high power with optimized FBSOA; Only supplier available
- 
Q3-Class HiPerFET
 - Up to 2 MHz – super high frequency solution
- 
Depletion
 - 'Normally-On' operation with fast switching and usable body diode
- 
Ultra Junction
 - Lowest $R_{DS(on)}$ and gate charge; Fast soft-recovery body diodes
- 
GigaMOS™
 - Strong avalanche capability and 175° C operating temperature
- 
Polar Series
 - Rugged product with low noise and high frequency

Low-Medium Power Thyristors



- Global leading supplier with most comprehensive Thyristor product line worldwide.
- Low-Medium Thyristor product across voltage 200V~2.2KV and current 0.25A~150A.
- Products are globally recognized for high quality, performance and delivery.

SCR

- Most broadest portfolio worldwide across low and medium voltage.
- One-Stop supplier for Thyristor design and applications.

TRIAC

- Expertise for Heating & Lighting app with design advantage.
- Extend the portfolio for Motor control application.

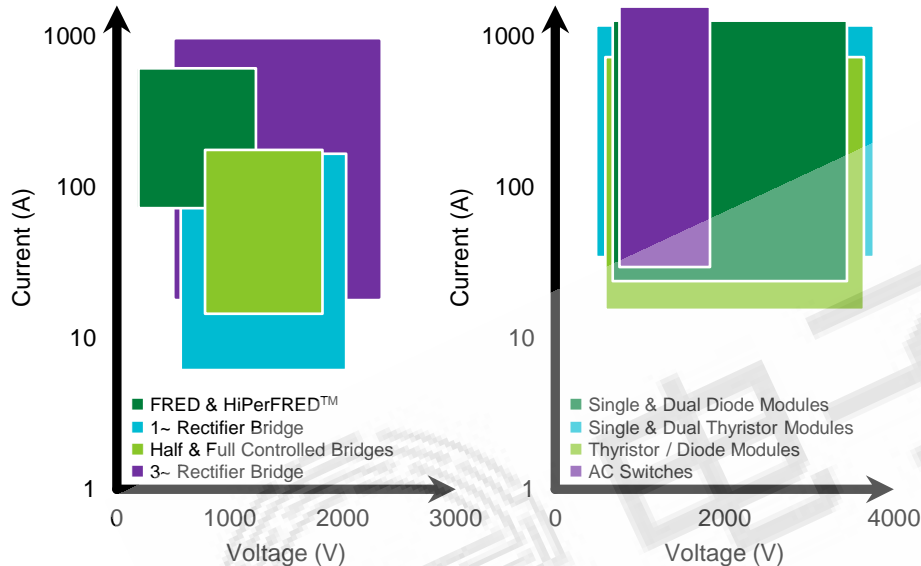
Chip Technology

- Advanced SCR/TRIAC process and design expertise across multiple FAB. Leading new Chip Technology development.

Packaging

- Extensive packaging capabilities with industry standard and differentiated packages. Unique product performance focused.

Bipolar Modules



Topologies:

- Single / Dual
- Common Cathode / Phase Leg
- 1~ Rect. Bridge / 3~ Rect. Bridge
- Half / Full Controlled Bridge
- Rectifier + IGBT-Diode Brake
- AC Switch

- One of the top worldwide leader for SCR/Diode modules.
- Wide standard product portfolio and great capabilities to offer modified standard configurations and ratings in various packages.

Std. Recovery diodes for AC line rectification and reverse protection

- Avalanche rated diodes, Semifast diodes, Rugged designs
- 3 different classes defined by material, reverse voltage & forward voltage drop
- 800 V to 3400 V, 14 A to 1400 A

Fast diodes for secondary rectification and free-wheeling

- FRED, HiPerFRED™, HiPerDynFRED™ and Sonic-FRD™ types
- High commutation robustness, High surge capability
- 200 V and 1800 V, 9 A to 600 A

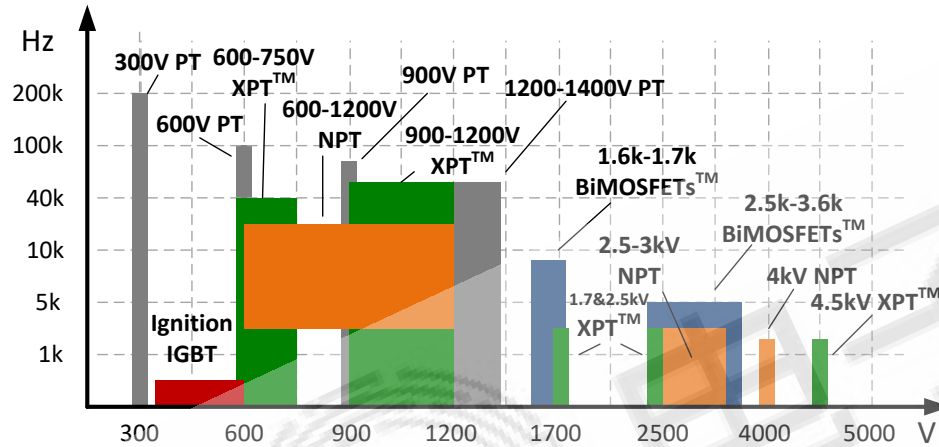
Thyristors for AC rectification, AC-controlling, Crowbar, etc.

- Standard or High efficiency or High voltage or Fast SCR's, Triac
- Complete range of Thyristor & Thyristor/Diode module in various packages
- 800 V to 2400 V, 18 A to 1400 A

Technology and Various options available for given packages

- Phase Change Material
- Press Fit
- Thick copper DBC
- Solder clip interconnect technology

Discrete IGBTs



- The widest Discrete IGBT portfolio in the market
- Very strong in customized devices for niche customer needs
 - Apps: defibrillator, laser, pulse power supply



XPT™ Planar & Trench

- Low conduction and switching losses
- Great efficiency at low, medium and high switching frequencies
- Positive temperature coefficient



Ignition IGBTs

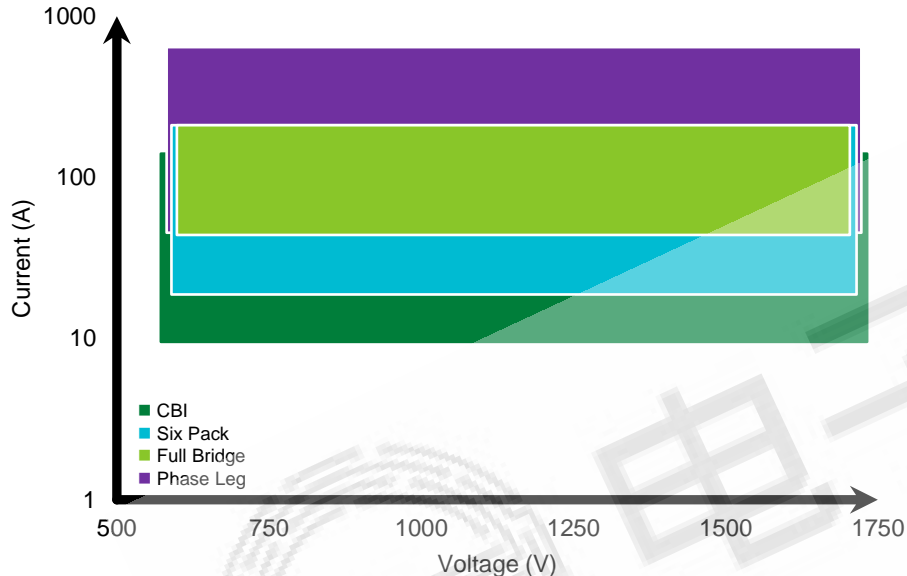
- Industry leading, covering all gasoline engine requirements
- Very low $V_{CE(sat)}$
- Automotive grade as per AEC-Q



BiMOSFETs

- Combines strengths of MOSFETs and IGBTs
- Features a monolithic intrinsic diode
- Ideal for parallel operation

IGBT Modules



Topologies:

- Six Pack
- Phase Leg
- CBI
- H-Bridge
- Boost / Brake
- Buck / Boost

Industry standard packages + innovative ones

- Econo2, Econo3, 34mm, 62mm, SimbusF, Minipack 1B & 2B
- SMPD surface mount package
- 10 A to 450 A per switch – 600 V to 1700 V

Proprietary IGBT, fast, Standard diode die + DBC

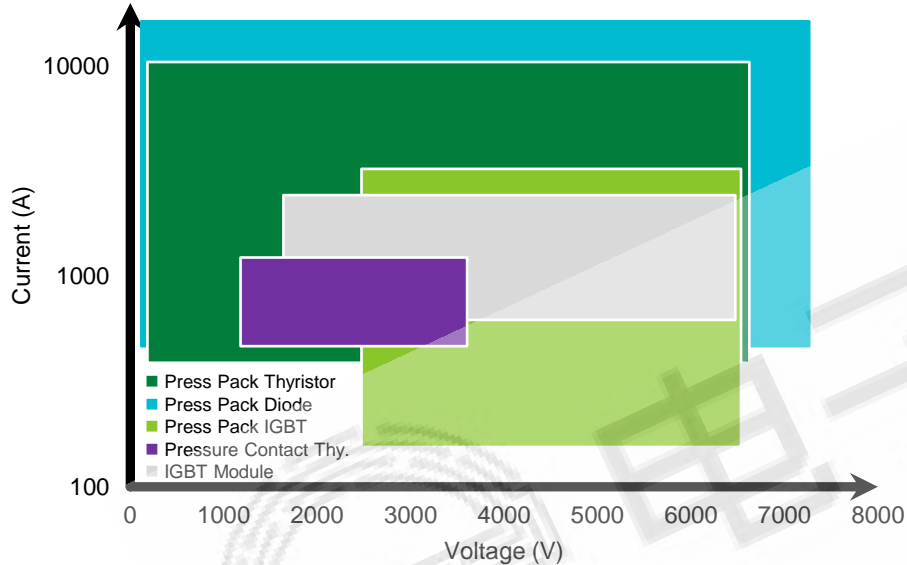
- XPT & X2PT IGBT 1200 V & 1700 V
- Trench IGBT 650 V, 1200 V & 1700 V (in development)
- Sonic Diode 650 V, 1200 V & 1700 V

Customization and Options possibilities


- Modified standard solutions capabilities
- Different substrate material (Al2O3, Si3N4), Shunt, NTC
- Phase Change Material, Press Fit

- Independent IGBT and diode die manufacturer.
- Our value proposition lies with our ability to provide a level of customization to customers.

High Power Modules




- One of the widest portfolios of high power semiconductors on the market with leading edge Press Pack IGBT technology.
- Suited for Industrial Controls, Transportation, Heavy Industry and Energy sectors, we offer standard products and bespoke stack solutions tailored to customer needs.



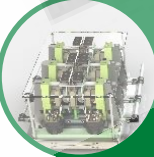
Bipolar

- Range of Thyristor and Diode technology available delivering products to suit a wide range of applications and needs.
- Product flexibility allowing customization to meet customer exact design needs
- Engineering support to assist in device selection, mechanical considerations and cooling requirements.



Press Pack IGBT

- Failure to short circuit allowing n+ redundancy.
- Simple mechanical design for medium and high voltage systems.
- Enhanced power cycling capability providing product robustness in the field.
- High package rupture tolerance.



Stacks

- 80 years of experience in stack design.
- Designed 100% to customer requirements.
- Dedicated global electrical, thermal and mechanical design team.
- 100s kW to 10s MW.



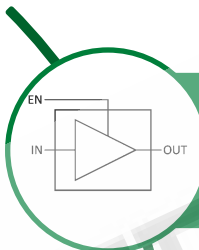
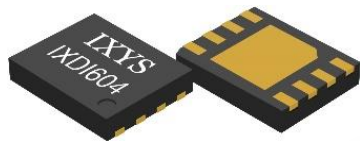
High Power Module First Product release: Q4 2020

- Pressure contact Bipolar portfolio offering field robustness and fail to short
- 3300V and 4500V IGBT modules in 2020 offering fully independent alternative supply channel to Infineon, ABB, Mitsubishi.

Gate Drivers

IXD_600 Series

Mosfet driver
Dual Output 2A~30A current
~35V operating voltage
AEC Q100

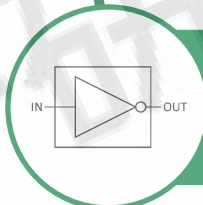
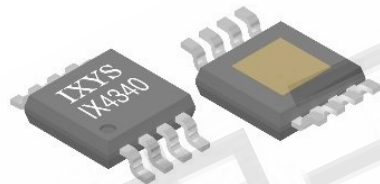


Low Side Gate Drivers 1.5A to 30A

- 4A, 5A, 9A, & 14A automotive grade AEC-Q101 qualified gate drivers
- Thermal enhanced power packages

IX4340 **New!**

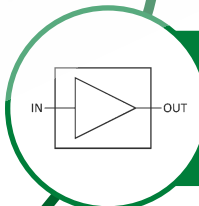
Mosfet Driver
Dual Output 5A current
~20V operating voltage
AEC Q100



600V High Side and Low Side Drivers

IX4351NE **New!**

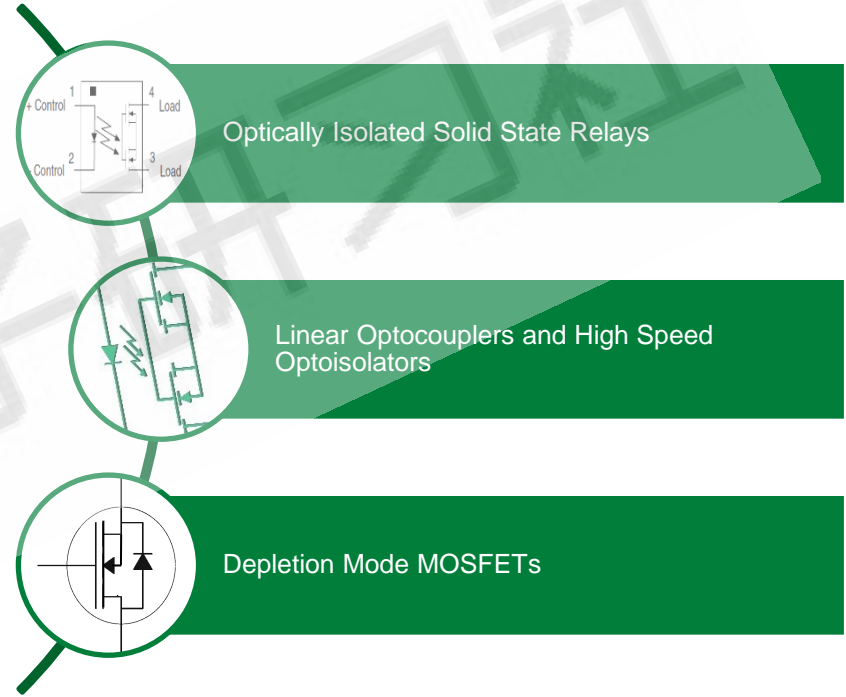
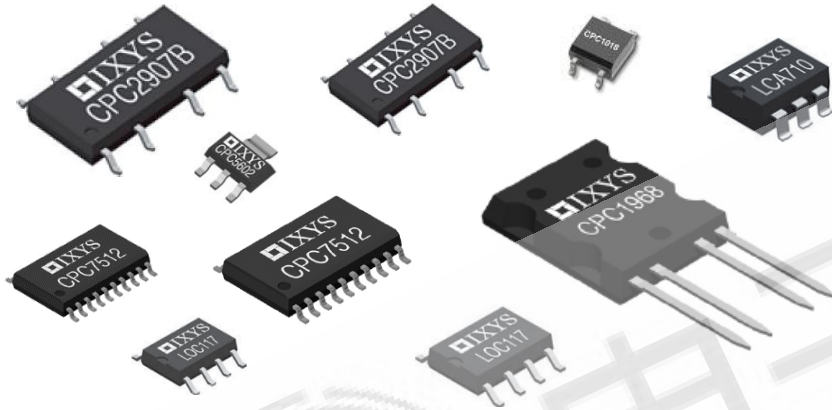
SiC MOSFET & IGBT Driver
Output 9A current
Output -10V~ +30V
DESAT & Fault Output
AEC Q100



Optically Isolated Gate Drivers

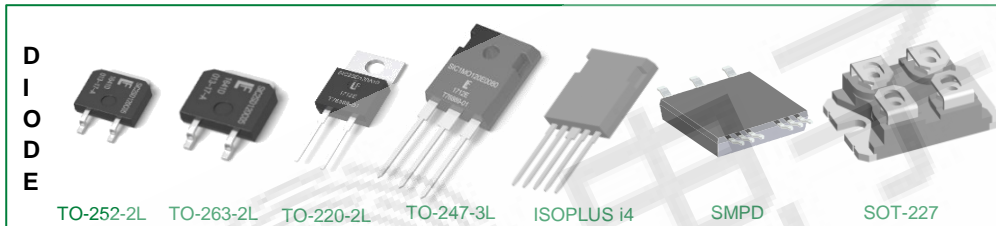
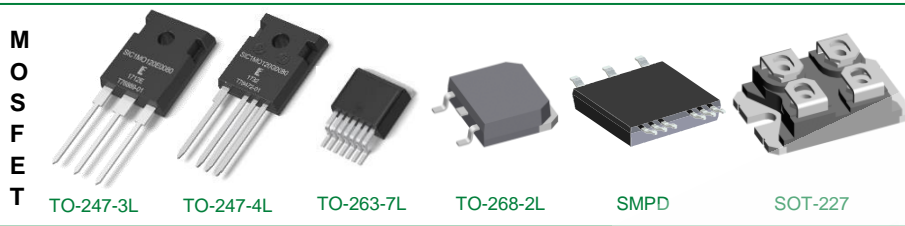
- 3750 V_{RMS} input to output isolation

Solid State Relays



- Full portfolio of Optically Isolated Solid State Relays, MOSFET and SCR based including unique Power Relays (22A with heat sink)
- Optical isolation for linear signals and high speed digital data
- Widest selection of Depletion Mode MOSFETs, low power, 60V to 800V

Silicon Carbide



- Industry leading performance with respect to operating characteristics.
- Robust planar design with exceptional gate oxide reliability.
- Internally owned device designs and process; secure manufacturing and supply chain ensures satisfactory delivery times.
- Circuit topology 'building blocks' enabled by SMPD packaging (full-bridge, phase leg, boost, etc.)

- 1200 V SiC MOSFET Family**
 - 25, 40, 80, 120, 160 mOhm
- 1700 V SiC MOSFET Family**
 - 1 Ohm
- 650 V SiC Schottky Diode Family (AEC-Q101 Qualified)**
 - 5 to 40 A
- 1200 V SiC Schottky Diode Family**
 - 5 to 120 A
- 1700 V SiC Schottky Diode Family**
 - 10 to 50 A

Packages

- MOSFET: TO-247-3L, TO-247-4L, TO-263-7L (D2PAK), TO-268-2L (D3PAK), SMPD
- Diode: TO-252-2L (DPAK), TO-263-2L (D2PAK), TO-220-2L, TO-247-3L, TO-247-2L, SOT-227, SMPD



Power Applications and Industrial Market Examples

VFD
Industrial & Electrical Power
Soft Starter
UPS
STATCOM
Welding Machine

Rectifier Application



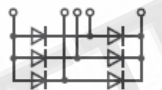
AC Rectifier



Switching F
50~60Hz

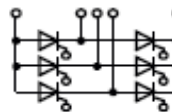
Rectifier Diode (800V~)

- *Discrete Rectifier Diode
DLA**, DSP**, DMA**, DSI**
- *1~3 phases Rectifier Modules:
GUO**, VUO**
- *Diode Phase-leg modules :
MDD**, MDMA**



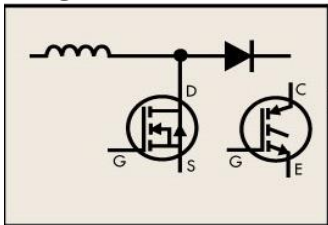
Thyristor (1200V~)

- *Discrete Thyristor:
CLA**, CMA**, CS**
- *Thyristor Phase-leg modules :
MCC**, MCMA**

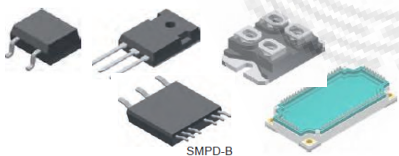
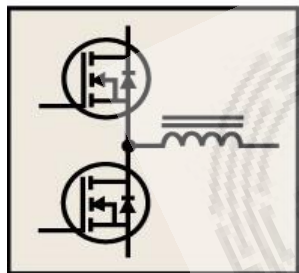


MOSFET & IGBT Application

PFC



Primary Switch



Si MOSFET (500V, 650V ~4500V)

*X-Class Mosfet (AECQ!)

IXF**X2, IXT**X2, IXF**X3

*Polar Mosfet:

IXF**P, IXT**P

*Trench Mosfet:

IXF**T, IXT**T2

(IXF-Fast diode IXT-Normal diode)

SiC MOSFET (1200V)

* LSIC1MO120**

IGBT (600V~4000V)

*XPT IGBT without diode :

IXX**B3, IXX**C3, IXY**B3

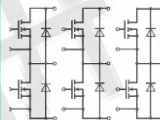
* XPT IGBT with diode :

IXX**B3D1, IXX**C3D1, IXY**B3D1

*PT IGBT :

IXG**A/B/C(D1)

(A-low speed, B-medium speed, C-Fast speed)



EV Charger
EV DC-DC



Telecom Power



Server Power



Bit-coin
Power



Solar Inverter



Drive



UPS



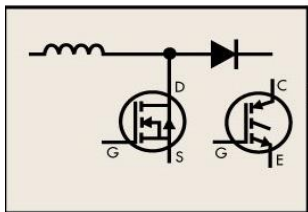
VF Air-con



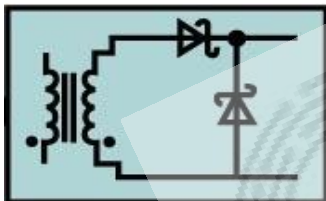
FR Diode & Sic Diode



PFC



Output Rectifier



Fast Recovery Diode (300 ~1800V)

*Normal FRD

DSEI** (gold doping)

*HiPer FRD :

DSEP** (Platinum doping)

*Sonic FRD :

DHG** (Helium)

* Schottky FRD : (< 250V)

DSA**, DSB**, DSSK**

Sic Diode (650V, 1200V)

LSIC2SB065**

LSIC2SD120**



EV Charger



Telecom Power



VF Air-con

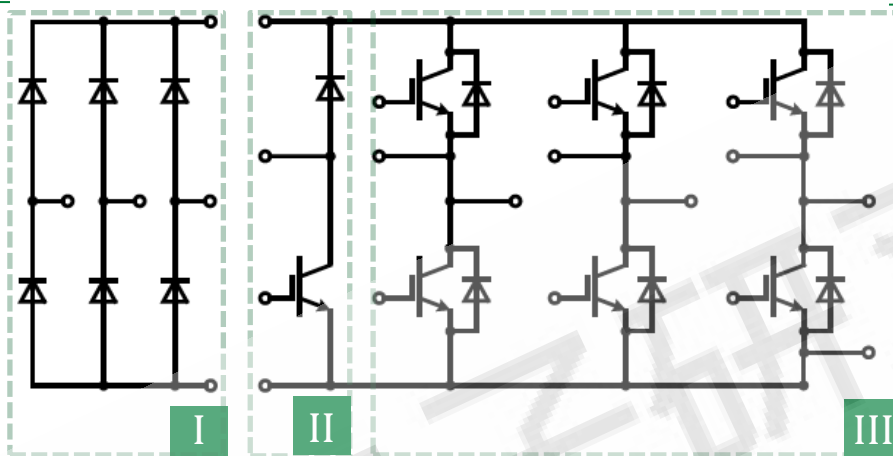


Solar Inverter



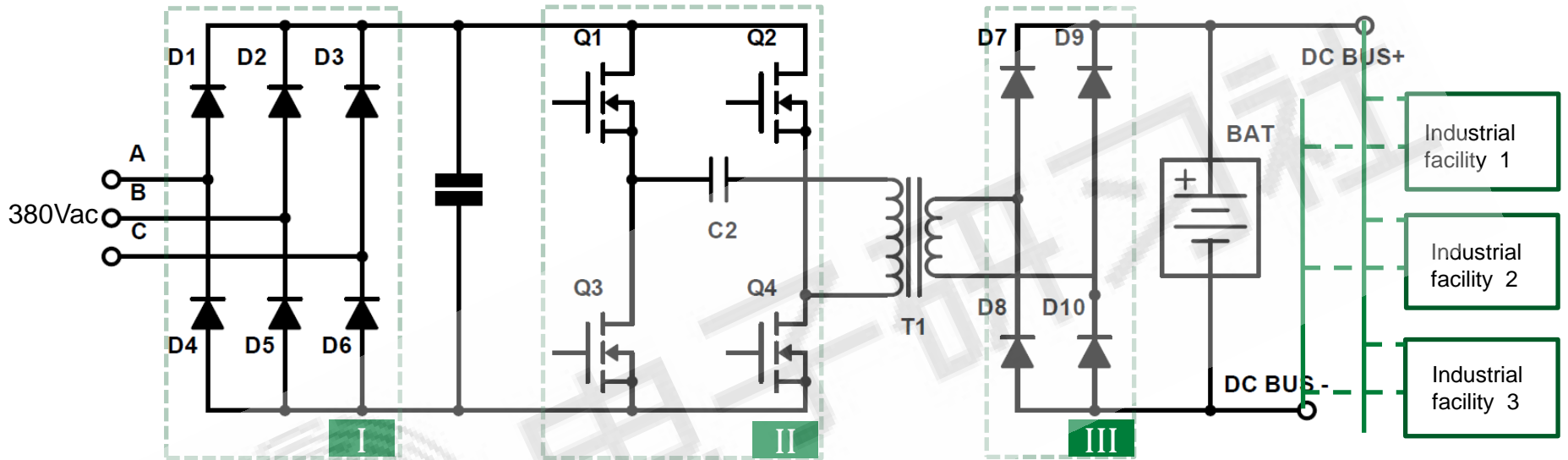
Other AC-DC/DC-DC Power Supply

VFD (variable frequency drive)



	Topology	LF/IXYS Product Series	Voltage
I	No Control , Diode module	MDMA** , MDD**	1200V,1600V, 2200V
	Half Control, Diode + Thyristor Module	MCMA** , MCD**	1200V,1600V , 2200V
	Full Control , Thyristor Module	MCMA** , MCC**	1200V,1600V, 2200V
II	Brake IGBT	IXXH** , IX** , IXA**	1200V
	Brake Diode	DSEI**	1200V
III	IGBT Six Pack Module	MIXA**W**	1200V
I+II	Rectifier + Brake	VUB** , MDMA**UB**	1200V (IGBT)
I+II+III	CBI Module	MIXA**WB**	1200V (IGBT)

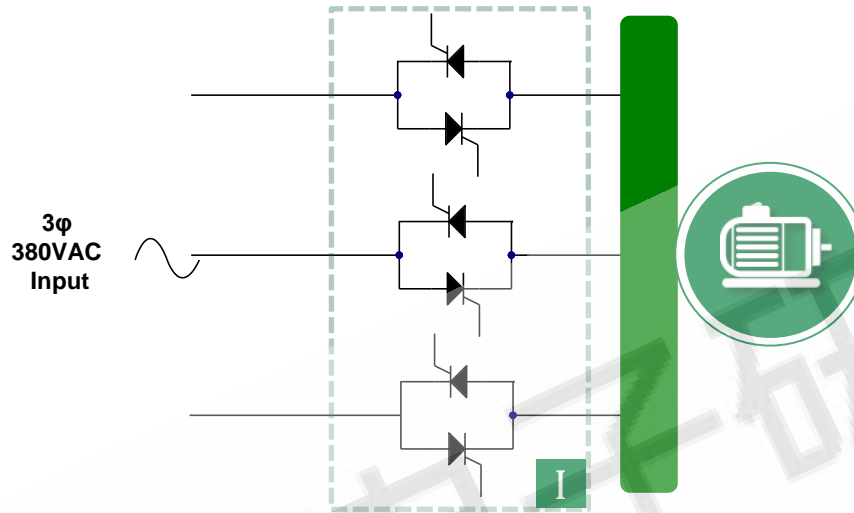
Industrial & Electrical Power



	Topology	LF/IXYS Product Series	Voltage
I	Rectifier , Diode discrete	DSP**, DSI**	1200V,1600V,2200V
	Rectifier , Diode module	VUO** , MDMA** , MDD**	1200V,1600V,2200V
II	Full-bridge , MOSFET	X-Class Mosfet Q3 Mosfet for high frequency	850V 800V , 1000V
	Full-bridge, IGBT	IXXH** , IXY** , IXA**	1200V
III	Output Rectifier , Fast Recovery Diode	DSEI** , DSEP** , DPG**	600V,1200V

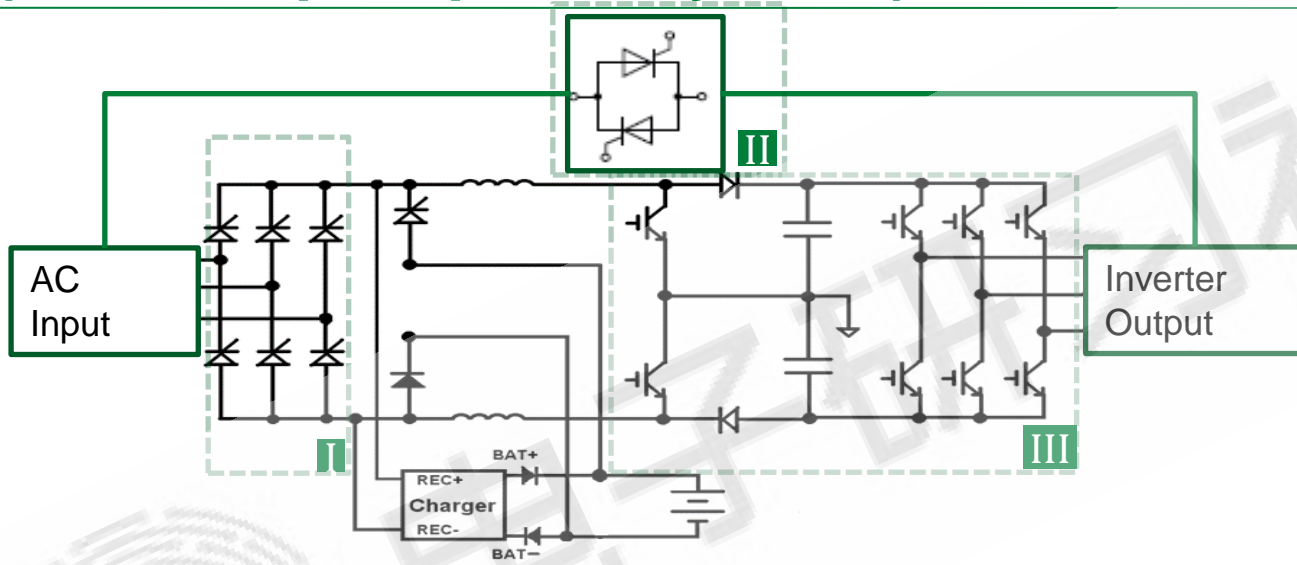
DC BUS
220VDC

Soft Starter



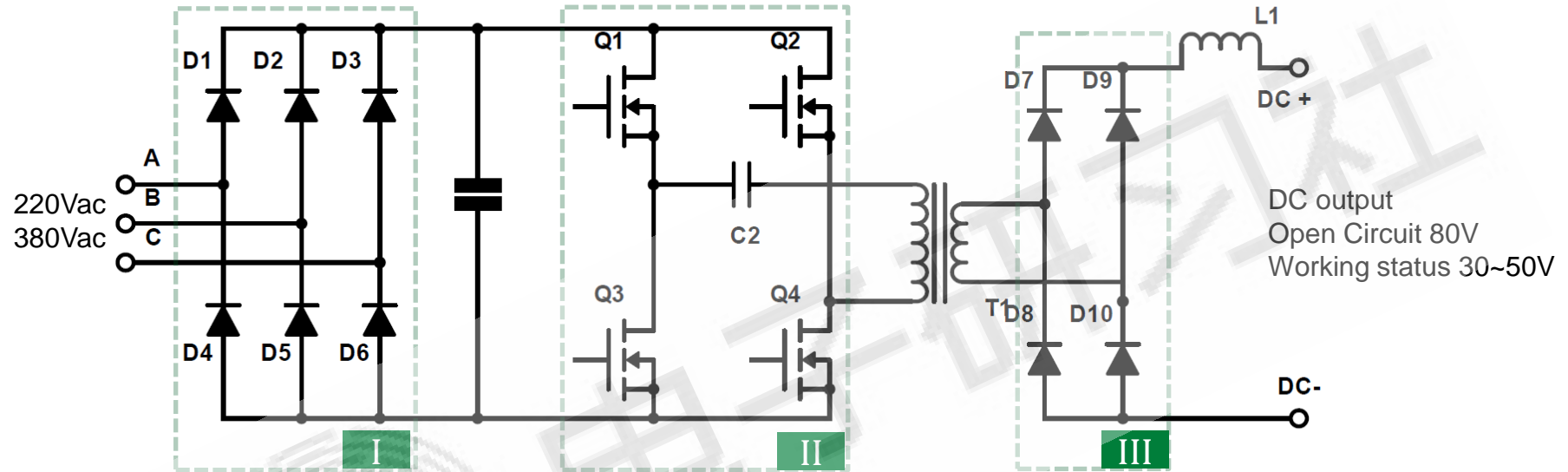
	Topology	LF/IXYS Product Series	Voltage
I	AC Switcher , Thyristor Discrete	CLA** , CMA**	1200V,1600V, 2200V
	AC Switcher , Thyristor Module	MCMA** , MCC**	1200V,1600V,2200V

UPS (uninterrupted power system)



	Topology	LF/IXYS Product Series	Voltage
I	Rectifier , 3 phase input , Thyristor	CLA**, CMA**	1200V,1600V,2200V
	Rectifier Module	MCMA**, MCC**	1200V,1600V,2200V
II	Bypass Module , Thyristor	MCMA**, MCC**	1200V,1600V,2200V
III	PFC and Inverter , IGBT	IXXH**, IXY**, IXA**	1200V , 650V for three level
	PFC , Fast Recovery Diode	DSEI** , DSEP**	1200V , 600V for three level

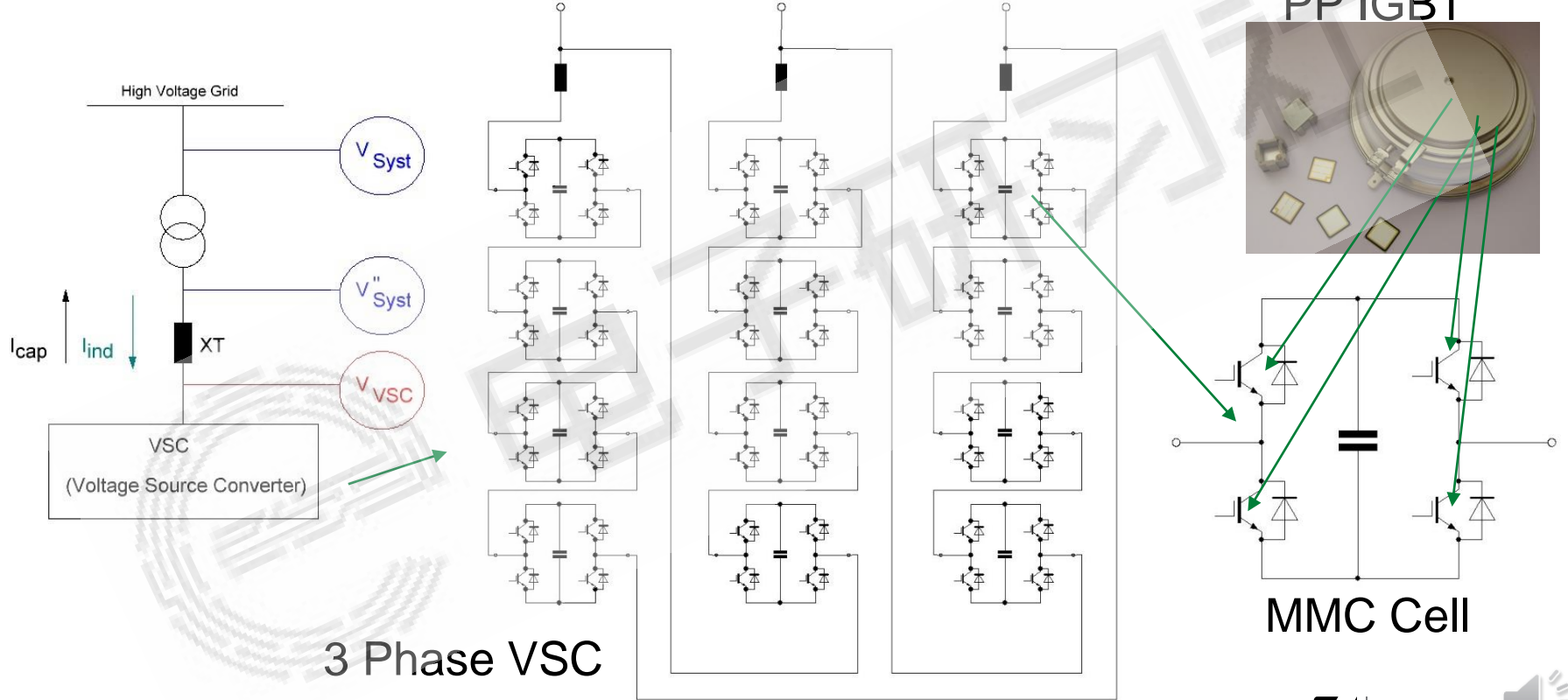
Welding Machine



	Topology	LF/IXYS Product Series	Voltage
I	Rectifier , Diode discrete	DSP**, DSI**	1200V,1600V,2200V
	Rectifier , Diode module	VUO** , MDMA** , MDD**	1200V,1600V,2200V
II	Full-bridge , MOSFET	X-Class Mosfet Q3 Mosfet for high frequency	650V, 850V 1200V
	Full-bridge, IGBT	IXXH** , IXY** , IXA**	650V, 1200V
III	Output Rectifier , Fast Recovery Diode	DSEI** , DSEP** , DPG**	300V, 600V

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STATCOM



Press-pack IGBT portfolio

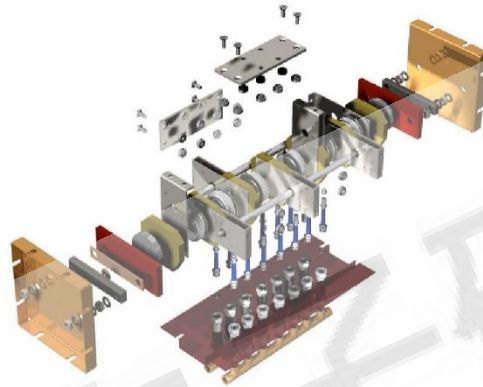
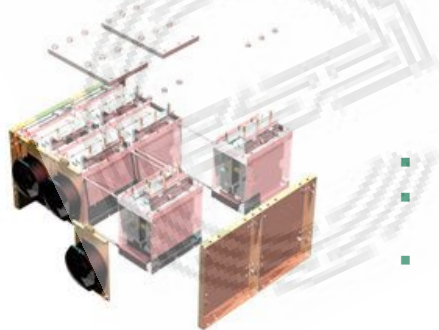


Voltage	Reverse conducting - with integral anti-parallel diode									
1.7kV		600A	960A		1680A		2520A			
2.5kV		360A	570A		1200A					
3.3kV	140A		425A		710A	1065A		2000A		
4.5kV	115A		340A		600A	900A		1600A	2000A	
6.5kV				258A			600A	900A	1290A	
Discrete IGBTs										
1.7kV		840A	1440A		2520A		3840A			
2.5kV		500A	850A		1500A		2250A			
3.3kV		285A	640A		1000A	1500A		3000A		
4.5kV		240A	510A		800A	1200A		2400A	3000A	
6.5kV				385A			900A	1375A	1890A	
Package	34mm	47mm	63mm	66mm	75mm	85mm	96mm	110mm	125mm	132mm
26mm	Q	N	V		T	E	A		G	B
30mm				H			A	D		B

Stack Capability

Product scope

- Engineered sub assemblies
- Devices +
 - Mounting clamps
 - Cooling
 - Air with or without fans
 - Liquid
- Protection
 - dv/dt networks
 - Fusing
 - Temperature
- Gate drives
- Component / kit of parts sales
- Design services
- Projects

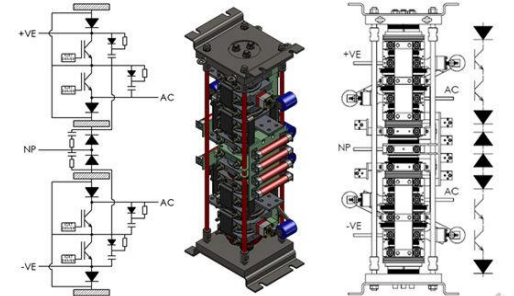


Custom solutions

- Wide experience over 80 years
 - Rectifiers, dc and ac drives, MVDs, Transportation drives, Traction substation, Wind power interties, Excitation, Transfer switches, VAR compensators, STATCOM, HVDC, Pulsed power
 - Systems up to 50kV / 140kA
- Designed 100% to customer needs
- Projects represent over 70% of the assemblies business
- Dedicated highly skilled electrical and mechanical design team
 - Based across UK, USA and Germany

Standard solutions

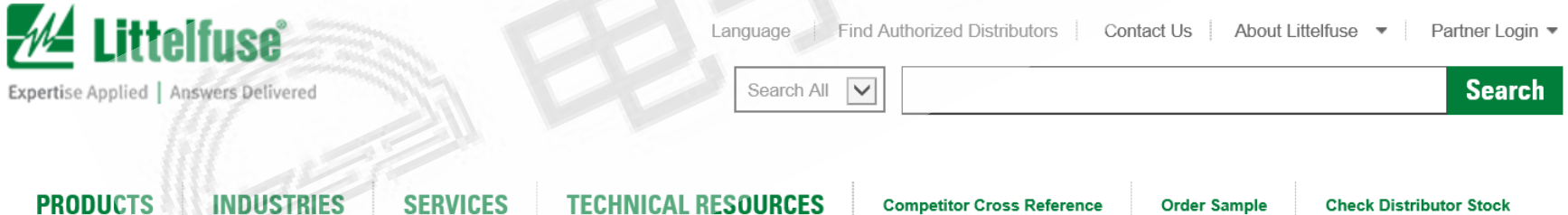
- Phase legs
 - L1U, L1H, L1C
- AC switch
 - W1H, W1C, W2H, W2C, W3H, W3C
- Centre tap connection
 - M2UA, M2UK, M2CA, M2CK
- Star connection
 - 3 to 12 phases
- Bridge connections
 - B2U, B2H, B2C, B6U, B6H, B6C, B6CI
- 110V to 690V applications
- Air cooled to 8kA, water cooled 15kA



How to find LF/IXYS PNs and Datasheet from Website ??

- LF/IXYS Power Semiconductor Selection guide download from below link , It is a very useful file for engineer to choose the parts in a easy way .
https://www.littelfuse.com/~media/electronics/product_catalogs/littelfuse_power_semi_conductors_product_catalog.pdf.pdf

Then, You can find the datasheet from www.littelfuse.com search bar directly :



The screenshot shows the top section of the Littelfuse website. On the left is the Littelfuse logo with the tagline "Expertise Applied | Answers Delivered". To the right of the logo are navigation links: "Language", "Find Authorized Distributors", "Contact Us", "About Littelfuse" (with a dropdown arrow), and "Partner Login" (with a dropdown arrow). Below these links is a search bar with a "Search All" dropdown menu and a "Search" button. At the bottom of the header is a horizontal navigation bar with the following items: "PRODUCTS", "INDUSTRIES", "SERVICES", "TECHNICAL RESOURCES", "Competitor Cross Reference", "Order Sample", and "Check Distributor Stock".

The End...

THANK YOU FOR YOUR ATTENTION



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