We drive efficiency in drives

Our expertise for your optimal drive systems

Nov, 2019

Agenda

1. Introduction
2. A closer look on inverter solutions
3. Product solutions overview
4. Efficient solutions with IGBT7 and Silicon Carbide MOSFETs
5. Key take-aways
6. Further information and links

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Specific drives applications in the industry

Drives

Standard and compact drives

- Packaging & Automation
- GP Applications

Servo drives

- Robotics
- Material handling

Premium drives

- PM-elevator drive with high position accuracy and energy recovery

High power drives

- Packaging & automation
- GP Applications

Heavy duty drives for mining, oil and gas industry

- Heavy Duty Drives for Mining, Oil & Gas Industry

Overview of two major areas in Industrial Drives

Standard and compact drives

370 W — 1250 kW

Requirements

- Performance and reliability
- Safety features
- Good price / performance ratio

Key applications

- Pumps and fans
- Process automation
- Cranes
- Marine drives

Infineon products

- iMOTION™
- CIPOS™ IPM
- EiceDRIVER™ gate driver
- EasyPIM™
- EconoPIM™
- EconoDUAL™
- PrimePACK™

Servo drives

370 W — 315 kW

Requirements

- High positioning accuracy
- Fast response with no overshoot
- High reliability

Key applications

- Robotics
- Material handling
- Machine tools

Infineon products

- CIPOS™ IPM
- Discretes
- EiceDRIVER™ gate driver
- EconoPACK™
- EasyPACK™
- EconoDUAL™

Drives segmented by end applications in the industry

Low voltage drives <1kVac

General purpose drives

60%

Standard & compact drives

Pumps & fans

Process automation etc.

Compressed air systems

Premium drives

Cranes
Marine drives etc.

Servo drives

31%

Servo

Robotics

Material handling

Machine tools etc.

Medium voltage drives >1kVac

High power drives

9%

Oil & gas industry

Rolling mills

Pumps & fans etc.

% of total drives market by revenue – “Industrial motor control sourcebook 2018”

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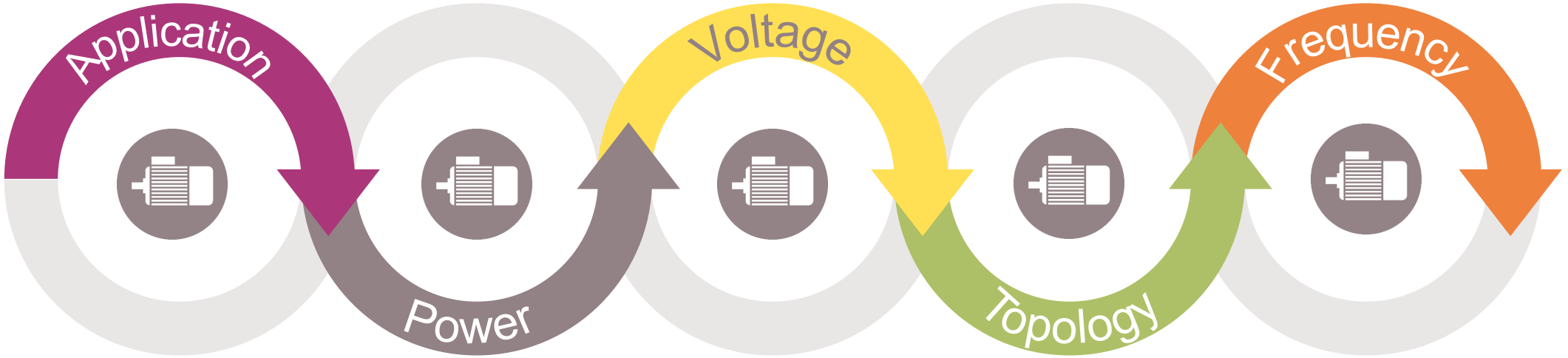
The five key questions

What is the RMS current/motor power?

What is the topology?

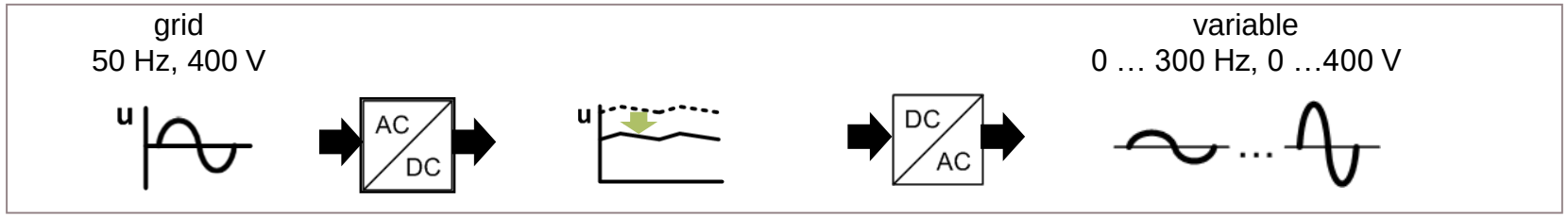


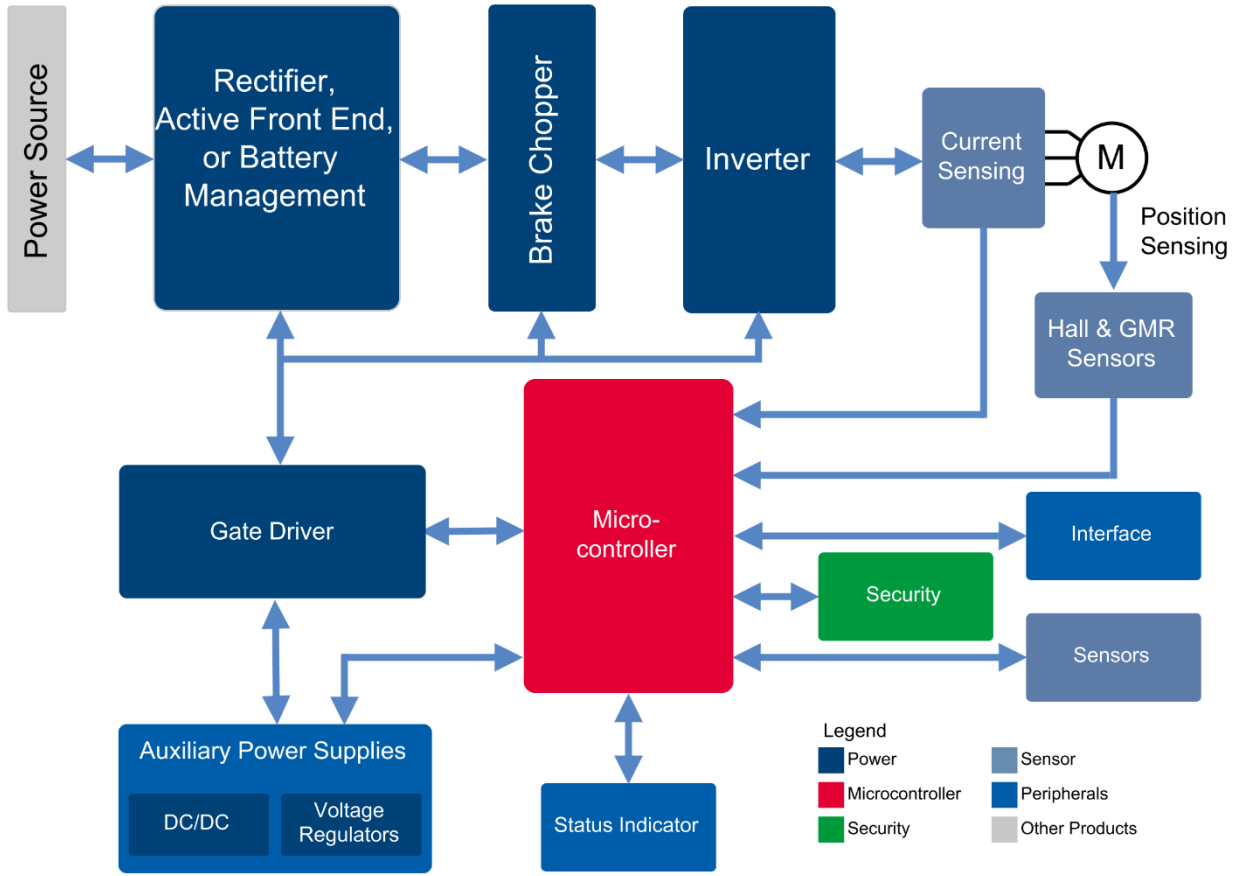
What is your specific application?

What is the voltage AC/DC?

What is the switching frequency?

A closer look to a typical converter system



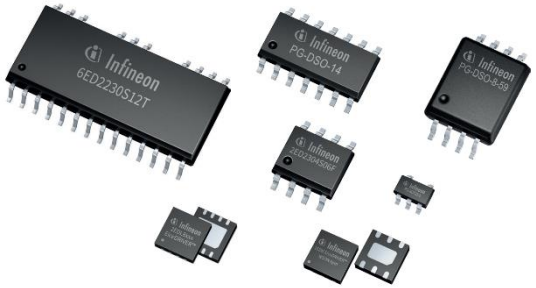


The levels of integration

Microcontrollers

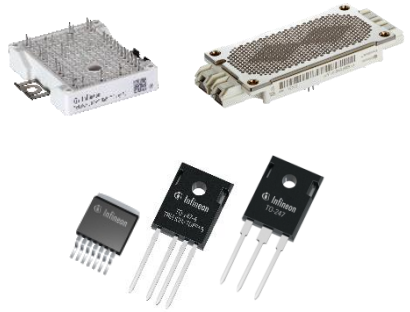
- XMC™ controller family based on ARM® Cortex®-M
- Countless possibilities for motor control

Gate Drivers



- Level shift driver
  - High side
  - Half bridge
  - High and low side
  - Three phase
- Isolated driver (1 & 2 channel)
- Low side driver (1 & 2 channel)

Power Electronics



- Discretes
- 3-phase PIM
- Sixpack
- Dual switch
- Single switch
- Thyristors & Diode Discs

Intelligent Power Modules

Digital Motor Controller iMOTION™

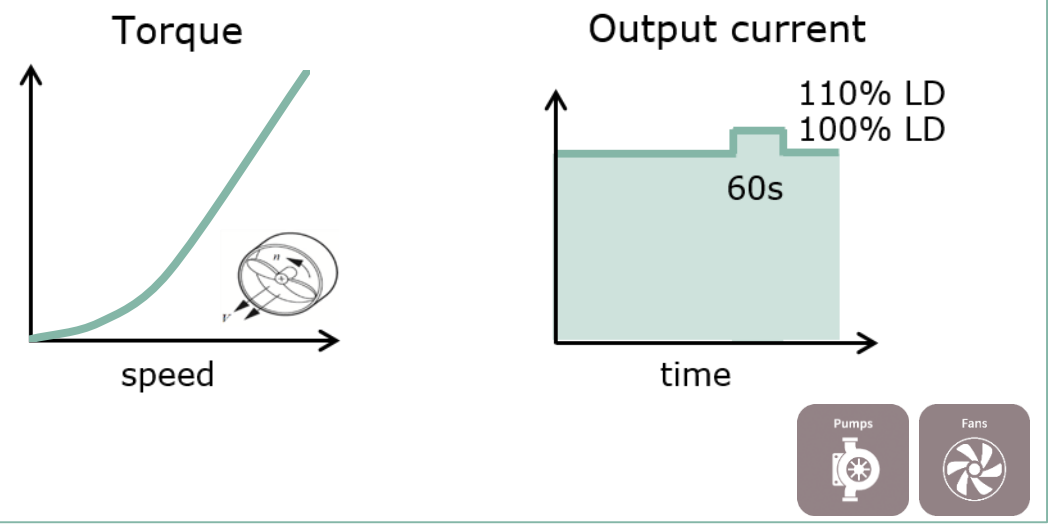
Application requirements for standard, compact and servo drives

	Standard and compact drives	Servo drives
Power	Broad portfolio (0.37… 1250 kW) 600 V, 1700 V and 1200 V switches (major)	Less broad portfolio (… ~315 kW or customized current classes) 600 V, 1200 V switches (major)
f_{sw}	4…8 kHz <100 kW 2…4 kHz >100 kW	4…8 kHz, 16 kHz w/ derating
dv/dt	≤ 5 kV/µs	
SC	Fast short circuit detection (e.g. 8 µs for IGBT)	
f_{out}	A) Light duty – 50/60 Hz B) Heavy duty 1Hz w/ derating	Low f_{out} common down to 0 Hz (locked rotor)
OL	A) Light duty e.g. 110% I_N 60 sec 100% I_N 240 sec B) Heavy duty e.g. 150% I_N 60 sec 100% I_N 240 sec	A) High overload e.g. 200% I_N 3 sec 0% I_N 7 sec B) Very high overload e.g. 300% I_N 0.25 sec 70% I_N 3.75 sec

Overload ratings

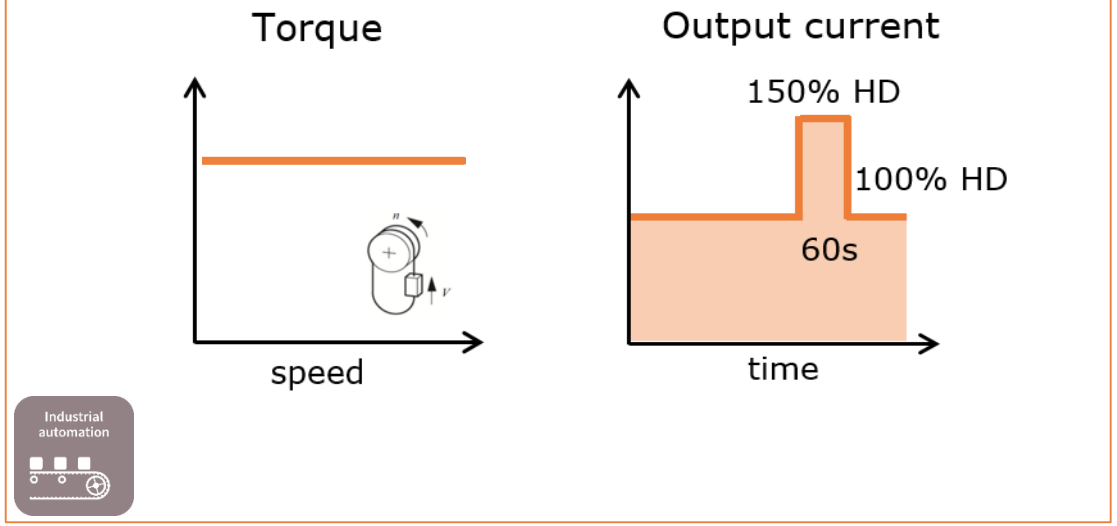
Overload capability is the property in which, during acceleration operations, the inverter temporarily delivers a higher current than the rated current. There are two sorts of ratings used in industrial drives:

Light/Normal Duty (LD/ND)



- Applied in fans and pumps, since they do not require high torque at low speed and have a 110% overload rating

Heavy Duty (HD)



- Applied in industrial automation and requires high torque at low speeds and a 150% overload rating
- The base load current is reduced when compared to normal duty

For Servo drives the overload capability can increase up to 300% of rated current.

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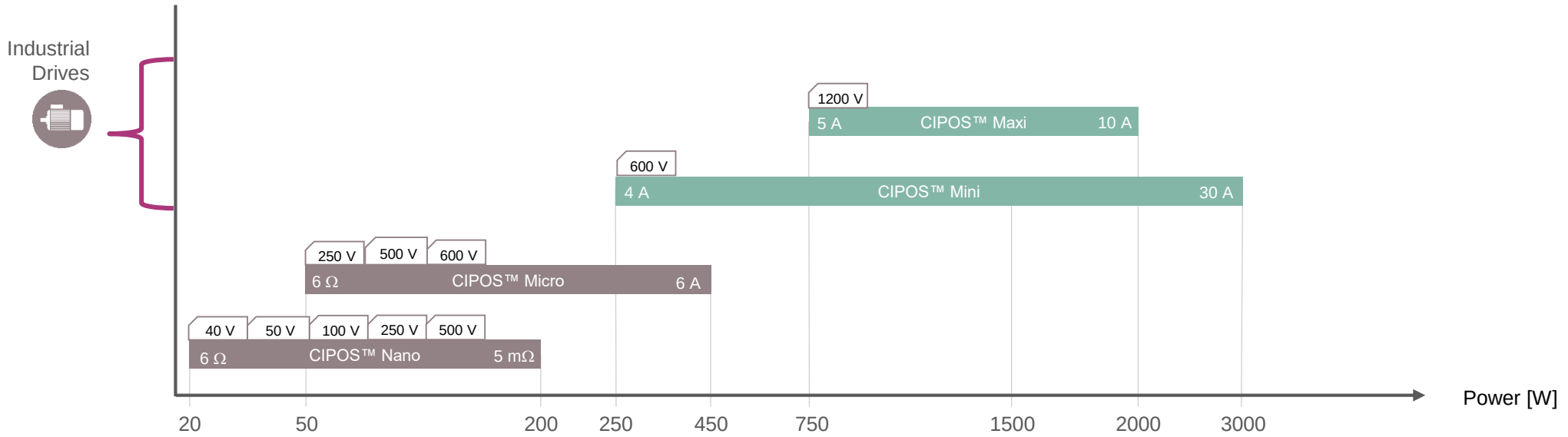
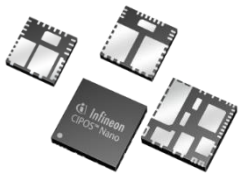
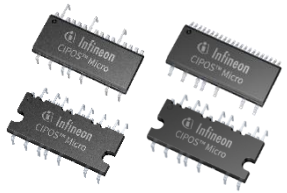
Broad IPM portfolio serving power ranges from 20 W to 3 kW



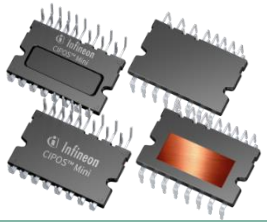
Intelligent Power Module Portfolio



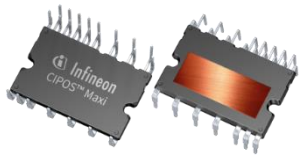
CIPOS™ Nano



CIPOS™ Micro

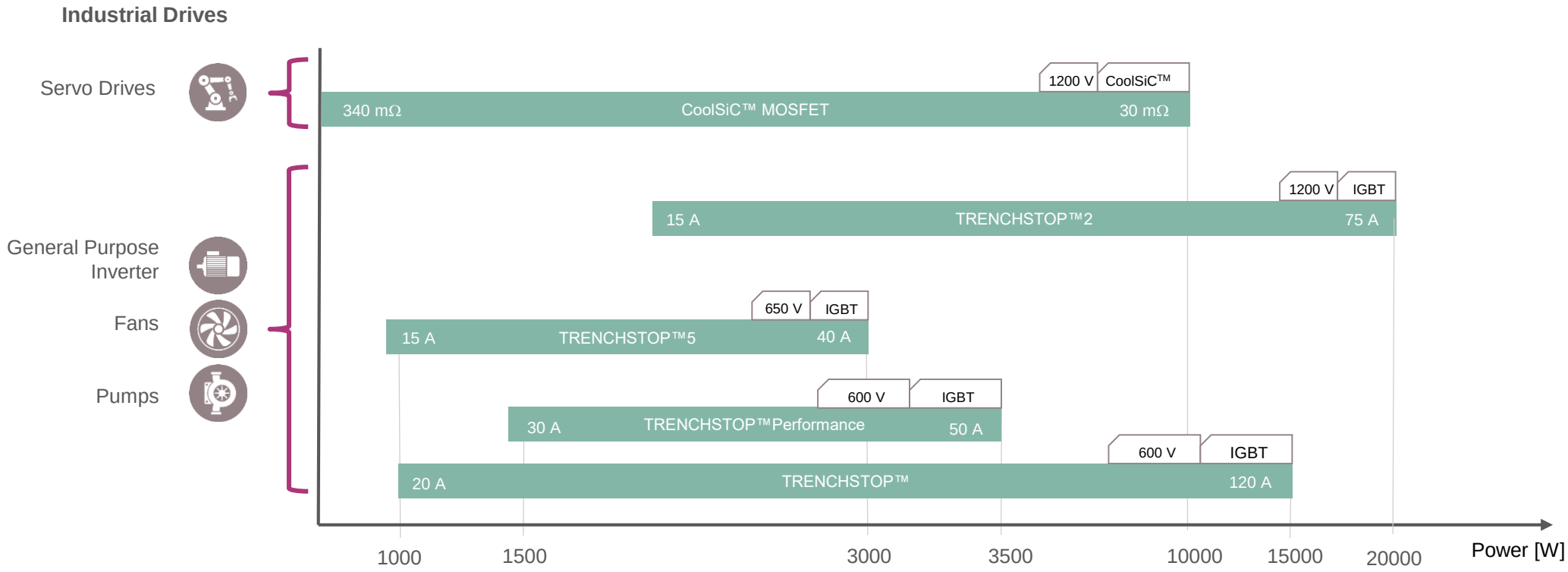


CIPOS™ Mini



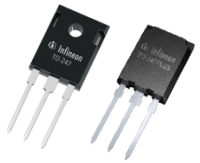
CIPOS™ Maxi

Broad discrete IGBT & SiC portfolio serving power ranges up to 20 kW



Discrete IGBT and CoolSiC™ MOSFET Portfolio

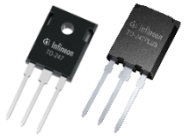
CoolSiC™ MOSFET



TRENCHSTOP™2

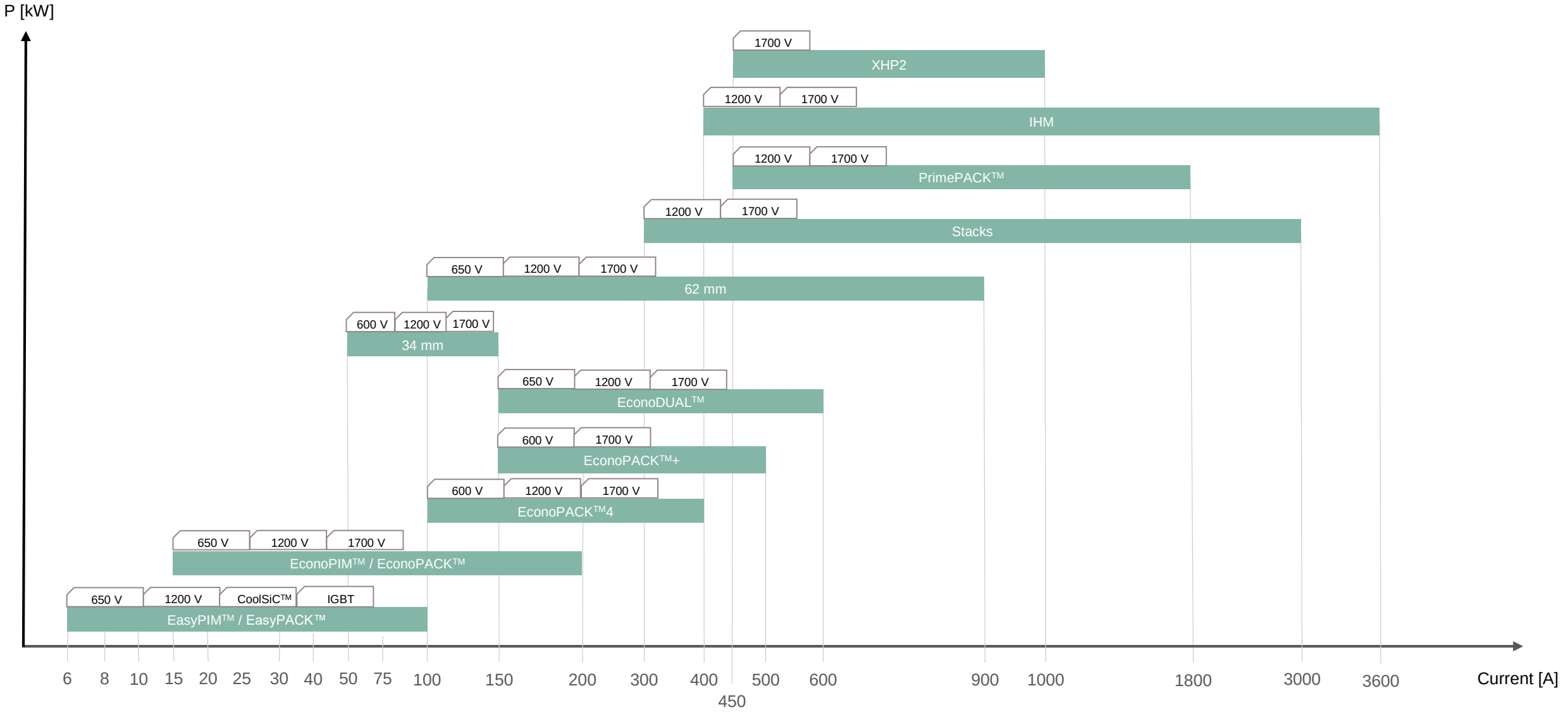
TRENCHSTOP™5

TRENCHSTOP™Performance



TRENCHSTOP™

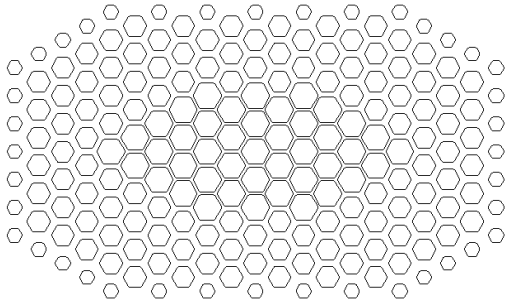
Broad IGBT package portfolio serving current ranges from 6 to 3600 A



Technical benefits with pre-applied thermal interface material

Features

- Best in class thermal resistance
- Pre-applied to Power Modules
- Dry to the touch
- Fully qualified



Printed pattern

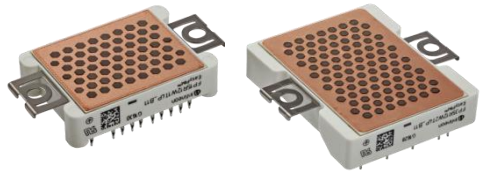
Benefits

- Reduced process time in manufacturing
- Simplified mounting
- Increased system reliability
- Increased system lifetime
- Optimized thermal management
- Improved handling in mounting and maintenance

Product examples

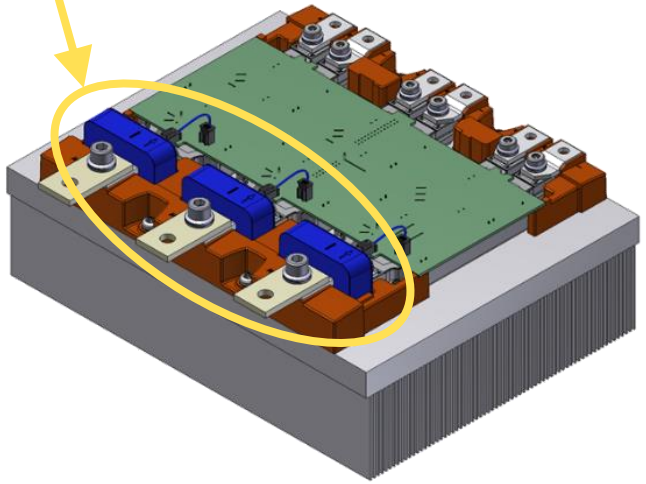
Econo

Easy



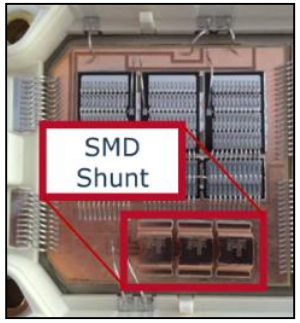
EconoDUAL™ 3 with integrated shunts – cost reduction by integration

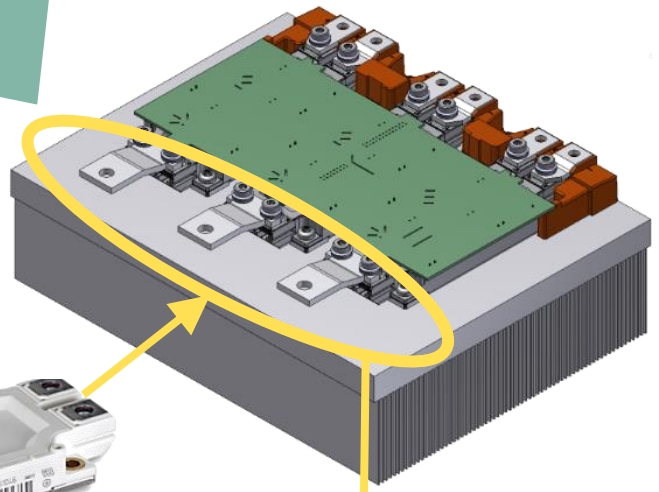
Hall effect current sensor



Three phase inverter 240 kW

replace external current sensors



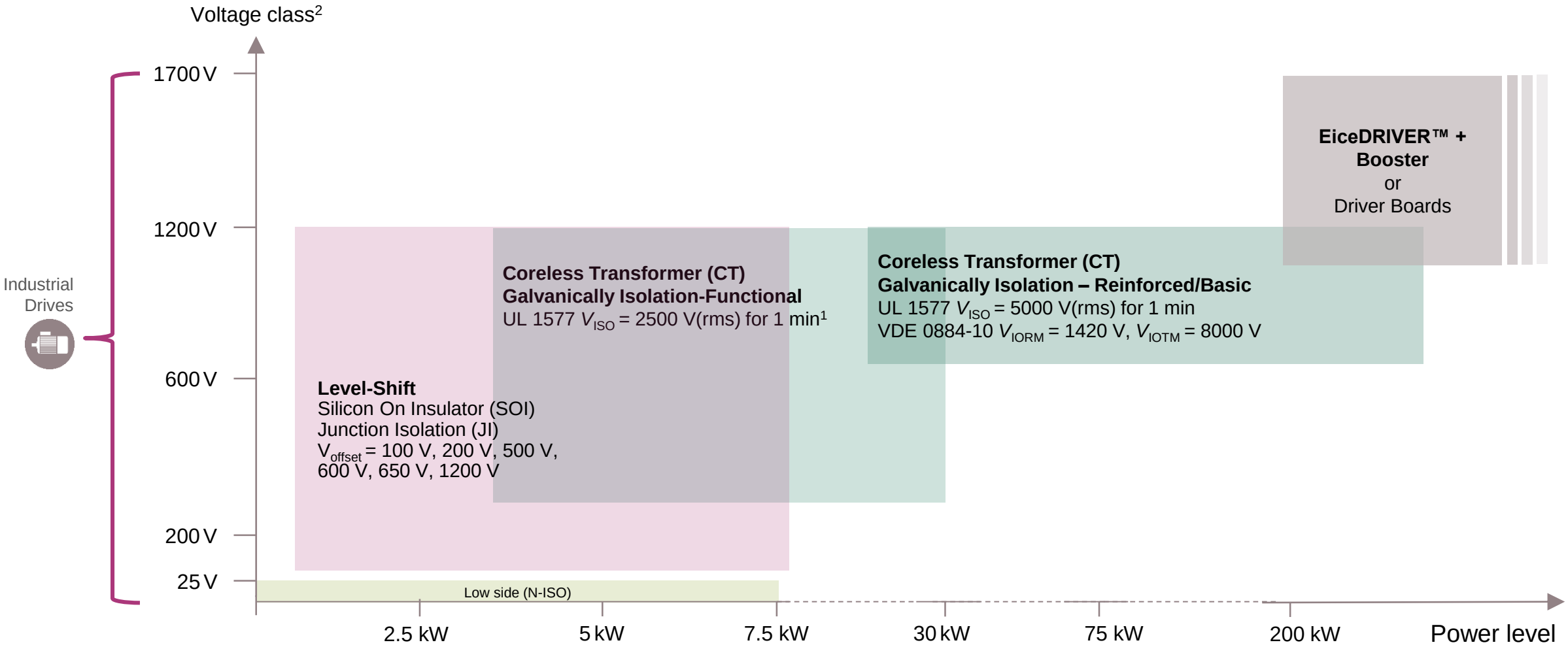


Module integrated current sensor

› cost savings due to including shunts

› cost reduction
› reduced space
› reduced cabling effort

Broad gate driver portfolio serving power ranges up to 200 kW and above

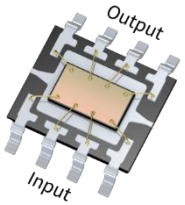


Note 1: 1EDC Compact only
Note 2: Voltage class is defined based on different driver configurations.
1. For single high-side, high- and low-side, half bridge and three phase gate drivers, voltage class is defined as switch break down voltage in applications.
2. 2. For low side drivers, voltage class is defined as maximum operating range supply voltage.
3. For special cases as 1EDNx550 (1EDN-TDI), common mode rejection (CMR) voltage range up to 80 V.

Key gate driver categories for drives

Non-Isolated GD

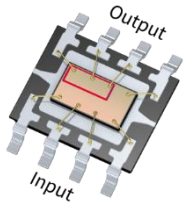
Low Voltage



- **Comprehensive Families** of single- and dual-low-side drivers with flexible options for output current, logic configurations, and UVLOs
- **Rugged technology** of the high-voltage gate drivers, and on the latest state-of-the-art 130-nm process
- **Industry-standard** DSO-8 and small form-factor SOT23 and WSON packages

Level-Shift GD

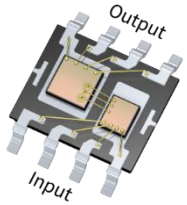
Junction Isolation (JI) & Silicon on Insulator (SOI)



- **Proven JI technology** trustfully used in all high-voltage gate drive applications for 20 years
- **Infineon SOI technology** with integrated boot-strap diode, lower level-shift losses, and industry **best-in-class robustness** against –VS transient spikes
- **Largest portfolio** of 200 V, 600 V, 700 V and 1200 V industry-standard gate drivers

Isolated GD

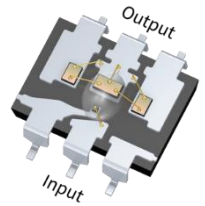
Coreless Transformer



- **Magnetically-coupled isolation technology** provides galvanic isolation for industrial applications
- **Strongest gate-drive output currents** (up to 10 A) reducing need for external booster circuits
- **Reliable and accurate protection** options of precise & tight desat protection, active Miller clamp, isolation rating in different packages

Solid-State Relay

Optical Safety Isolation



- **Optically isolated technology** provides galvanic isolation for safety applications
- **Established** and reliable products with over 20 years of history
- **Wide range of applications** from industrial automation to test and measurement equipment

Recommended gate drivers for Drives

Application	Voltage class	Configuration	Part number	Source/Sink current typ.	Packages	Description	Suitable power switches and modules
Inverter (<3.5 kW)	200 V	Half-Bridge	IRS2007S/M	0.29/0.6 A	DSO-8, VQFN-14	200-V half-bridge with V_{CC} & V_{BS} UVLO	StrongIRFET™ (IRF135B203, IRF135SA204) OptiMOSTM 3 (IPB072N15N3, IPB042N10N3 G, IPB107N20N3)
	650 V	High and Low Side	2ED2106S06F	0.29/0.7 A	DSO-8, DSO-14	Infineon SOI technology with integrated bootstrap diode	TRENCHSTOP™ IGBT+Diode (IKD10N60RF, IKA15N65ET6, IKW30N60DTP, IKB40N65ES5) EasyPIM™ 1B/2B module (FP10R06W1E3_B11,FP15R06W1E3_B11, FB20R06W1E3, FP20R06W1E3_B11, FB30R06W1E3) EasyPACK™ 1B module (FS20R06W1E3_B11)
		Half-Bridge	2ED2304S06F	0.36/0.7 A	DSO-8		
		Half-Bridge	2ED2184S06F	2.5/2.5 A	DSO-8, DSO-14		
	600 V	Half-Bridge	2EDL23I06PJ	2.3/2.8 A	DSO-14	Infineon SOI technology with integrated bootstrap diode, OCP, EN, FAULT-RPT, SD-ACT	
		Single High-Side	IRS2127S	0.29/0.6 A	DSO-8	FAULT-RPT, OCP	
		High and Low Side	IRS2186(4)S	4/4 A	DSO-14, DSO-8	600-V high and low side driver with high current	
		Three-Phase	6EDL04I06PT	0.165/0.375 A	DSO-28 300 mil	Infineon SOI technology with integrated bootstrap diode, OCP, EN, FAULT-RPT	
	1200 V	Half-Bridge	IR2214SS	2/3 A	SSOP-24	1200-V half-bridge driver with DESAT, Synchronization, SD-SOFT, FAULT-RPT	TRENCHSTOP™ IGBT+Diode (IKW25N120T2, IKW40N120T2, IKQ75N120CT2) EasyPIM™ 1B/2B module (FP15R12W1T4_B11, FP15R12W2T4) EasyPACK™ 1B/2B module (FS25R12W1T4_B11) Easy 1B/2B 3-Level module (F3L15R12W2H3_B27) EconoPIM™ 2 module (FP25R12KT4_B15)
		Three-Phase	6ED2230S12T	0.35/0.65 A	DSO-24	Infineon 1200-V SOI technology with integrated BSD, OCP (±5%), EN, FAULT-RPT	TRENCHSTOP™ IGBT+Diode (IKW08T120, IKW15N120T2) EasyPIM™ 1B/2B module (FP15R12W1T4, FP15R12W1T4_B11, FP15R12W2T4)
Inverter (<7.5 kW)	1200 V	Single High-Side	1EDC20I12AH	4/3.5 A	DSO-8 300 mil	Functional isolation, ≥ 100 kV/µs CMTI, short circuit clamping, V_{ISO} = 2500 V(rms) for 1 min (1EDC only), active Miller clamp (MH/MF only), separate sink/source output (AH only)	CoolSiC™ SiC MOSFET (IMZ120R045M1, IMZ120R080M1 - 4-pin) TRENCHSTOP™ IGBT+Diode (IKW40N120T2, IKQ50N120CT2, IKQ75N120CT2) EasyPIM™ 1B/2B module (FP25R12W2T4_B11, FP35R12W2T4_B11) EasyPACK™ 1B module (FS25R12W1T4_B11, FS50R12W2T4_B11) Easy 1B/2B 3-level (F3L15R12W2H3_B27) EconoPIM™ 2 module (FP25R12KT4_B15, FP50R12KT4G_B15) EconoPACK™ 2/3 module (FS50R12KT4_B15)
			1EDC30I12MH	5.9/6.2 A	DSO-8 300 mil		
			1EDI30I12MF	5.9/6.2 A	DSO-8		
		Three-Phase	6ED2230S12T	0.35/0.65 A	DSO-24	Infineon 1200-V SOI technology with integrated bootstrap diode, OCP (±5%), EN, FAULT-RPT	TRENCHSTOP™ IGBT+Diode (IKW40N120T2) EasyPIM™ 1B/2B module (FP15R12W1T4, FP15R12W1T4_B11, FP15R12W2T4)
		Half-Bridge	2ED020I12-FI	1.5/2.5 A	DSO-18	Functional Isolation on high side, comparator, OPAMP, SD	TRENCHSTOP™ IGBT+Diode (IKW40N120T2, IKQ50N120CT2, IKQ75N120CT2) EasyPIM™ 1B/2B module (FP15R12W1T4_B11, FP15R12W2T4, FP25R12W2T4_B11) EasyPACK™ 1B module (FS25R12W1T4_B11) Easy 1B/2B 3-level (F3L15R12W2H3_B27)

Recommended gate drivers for Drives

Application	Voltage class	Configuration	Part number	Source/Sink current typ.	Packages	Description	Suitable power switches and modules
Inverter (<30 kW)	1200 V	Single High-Side	1ED020I12-F2	2/2 A	DSO-16 300mil	Functional isolation, ≥ 100 kV/µs CMTI, active Miller clamp, DESAT, short circuit clamping, FAULT-RST	CoolSiC™ SiC MOSFET (IMZ120R045M1, IMZ120R080M1 – 4-pin) EasyPIM™ 1B/2B module (FP15R12W1T4_B11, FP25R12W2T4_B11) EasyPACK™ 1B module (FS25R12W1T4_B11, FS50R12W2T4_B11) EconoPIM™ 2 module (FP25R12KT4_B15, FP50R12KT4G_B15) EconoPACK™ 2/3 module (FS50R12KT4_B15)
		Dual High-Side	2ED020I12-F2	2/2 A	DSO-36		
		Single High-Side	1ED020I12-BT	2/2 A	DSO-16 300mil	Basic isolation, VDE 0884-10 certified, V_{IORM} = 1420 V, VIOTM = 6000 V; UL 1577 certified, VISO = 3750 V(rms) for 1 min, ≥ 100 kV/ µs CMTI, active Miller clamp, DESAT, short circuit clamping, two level turn off, FAULT-RST	
Inverter (<200 kW)	1200 V	Single High-Side	1EDI60I12AF	10/9.4 A	DSO-8	Functional isolation, ≥ 100 kV/µs CMTI, Separate sink/source output, short circuit clamping, 125-ns propagation delay	CoolSiC™ SiC MOSFET module (FF11MR12W1M1_B11; FF23MR12W1M1_B11) EconoPIM™ 2/3 module (FP150R12KT4(P)_B11) EconoPACK™ 2/3/4 module (FS150R12KT4(P)_B11) EconoDUAL™ 3 module (FF300R12ME4_B11) EconoPack™+ module (FS300R12OE4, FS450R12OE4) 34 mm module (FF15012RT4) 62 mm module (FF300R12KE4)
			1EDS20I12SV	SRC/2 A	DSO-36	Reinforced isolation, VDE 0884-10, VIORM = 1420 V, VIOTM = 8000 V; UL 1577; VISO = 5000 V(rms); soft shutdown, DESAT, FAULT-RPT, OCP, slew rate control, TLTO	CoolSiC™ SiC MOSFET module (FF11MR12W1M1_B11; FF23MR12W1M1_B11) EasyPACK™ 1B module (FS50R12W2T4_B11, FS75R12W2T4_B11) Easy 1B/2B 3-level (FS3L50R07W2H3F_B11, F3L75R12W1H3_B11, F3L100R12W2H3_B11) EconoPIM™ 2/3 module (FP75R12KT4_B15, FP100R12KT4(P)_B11) EconoPACK™ 2/3/4 module (FS75R12KT4_B15, FS100R12KT4G(P)_B11) 34 mm module (FF50R12RT4, FF100R12RT4)
			1ED020I12-B2	2/2 A	DSO-16 300mil	Basic isolation, VDE 0884-10 certified, VIORM = 1420 V, VIOTM = 6000 V; UL 1577 certified, VISO = 3750 V(rms) for 1 min, ≥ 100 kV/µs CMTI, active Miller clamp, DESAT, short circuit clamping, FAULT-RST, TLTO	
PFC	25 V	Single Low-Side	1ED44176N01F	0.8/1.75 A	DSO-8	Low-side gate driver with integrated overcurrent protection (±5%), fault reporting, and enable functionality	TRENCHSTOP™ IGBT+Diode (IKW30N65H5, IKW40N65WR5, IKFW40N60DH3E, IKFW50N60DH3E) Rapid Diode (IDW30E65D1, IDW60C65D1) CoolMOS™ MOSFET (IPx60R060P7, IPx60R080P7, IPx60R099P7, IPx60R120P7, IPx60R180P7, IPx60R280P7, IPx60R360P7) CIPOS™ Mini (IFCM15S60GD, IFCM10P60GD, IFCM10S60GD)
			IRS44273L	1.5/1.5 A	SOT23-5	Low-side gate driver in small, easy-to-use package	
		Dual Low-Side	IRS4427S	2.3/3.3 A	DSO-8	Industry proven dual-low-side gate driver	
SMPS (<3 kW)	650 V	Half-Bridge	2ED2184S06F	2.5/2.5 A	DSO-8, DSO-14	Infineon SOI technology with integrated bootstrap diode	TRENCHSTOP™ IGBT+Diode (IKW30N65F5, IKB40N65EF5) CoolMOS™ MOSFET (IPx60R060P7, IPx60R080P7, IPx60R099P7, IPx60R180P7, IPx60R280P7, IPx60R360P7, IP(W/Z)65R019C7, IP(W/Z)65R045C7, IP(W/Z)65R065C7, IP(W/Z)65R095C7, IPW65R190C7)
	600 V	High and Low Side	IRS2186(4)S	4/4 A	DSO-14, DSO-8	600-V high and low side driver with high current	
Brake Chopper (<3.5 kW)	25 V	Single Low-Side	IRS44273L	1.5/1.5 A	SOT23-5	Non-inverting single low-side driver with CMOS inputs	TRENCHSTOP™ IGBT+Diode (IKW40N120T2, IKQ50N120CT2, IKQ75N120CT2)
	1200 V	Single High-Side	1EDI05I12AF	1.3/0.9 A	DSO-8	Functional isolation, ≥ 100 kV/µs CMTI, short circuit clamping, separate sink/source output (AF only), active Miller clamp (MF only)	
			1EDI10I12MF	2.2/2.3 A	DSO-8		

Agenda

1. Introduction
2. A closer look on inverter solutions
3. Product solutions overview
4. Efficient solutions with IGBT7 and Silicon Carbide MOSFETs
5. Key take-aways
6. Further information and links

Easy with TRENCHSTOP™ IGBT7 brings multiple benefits

Tailored for Drives Application

› We focus on customer's application needs: From Product thinking to System understanding

Time to Market

› One change at one time: All improvements realized on chip level

Proven Quality

› We bring chip innovation in mature and known housing technology

Scalability for Platform Design

› Easy hits the 100: Easy 1B, 2B from 10 A up to 100 A

Lower System Cost

› Easy with IGBT7 portfolio is designed for system cost optimization

Easy with TRENCHSTOP™ IGBT7 portfolio

	Package	10 A	15 A	25 A	35 A	50 A	75 A	100 A
PIM	EasyPIM™ 1B 			★				
	EasyPIM™ 2B 					★		
6-pack	EasyPACK™ 1B 					★		
	EasyPACK™ 2B 							★

★ Frame size jump

★ Power extension

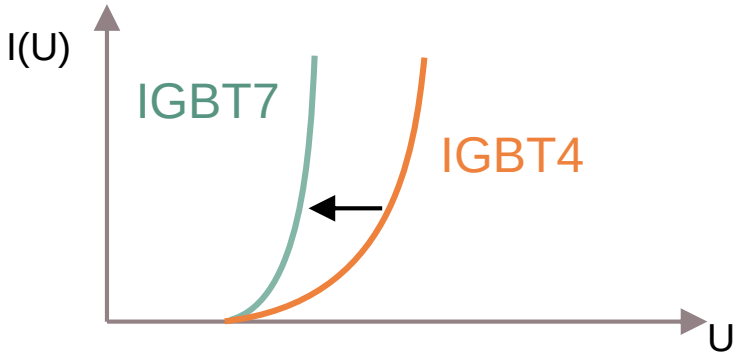
TIM All modules will be also available with TIM

Features of the TRENCHSTOP™ IGBT7 chip

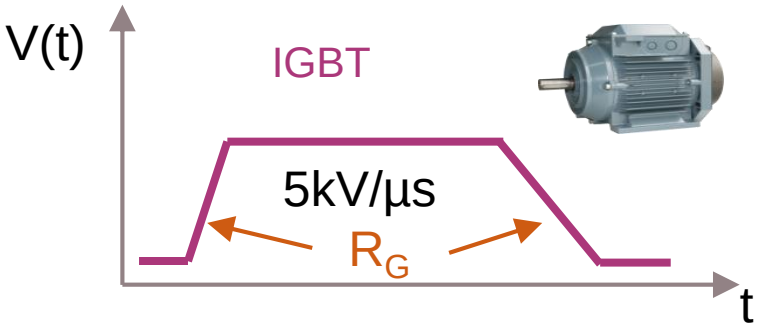
- Lower on state voltage $V_{CE(sat)}$ and V_f
- Optimized for simple driving
- Overload Capability at $T_{vj,op}$=175°C
- **TRENCHSTOP™ IGBT7**
- Higher power density and frame size jump
- Enhanced controllability of dv/dt
- Improved free wheeling diode softness

Technical benefits of TRENCHSTOP™ IGBT7

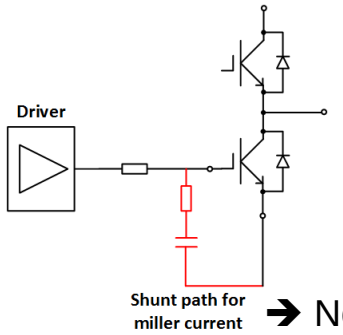
Best-in-class $V_{CE,sat}$



Enhanced controllability of dv/dt optimized for drive applications



IGBT7 is designed for zero voltage turn-off



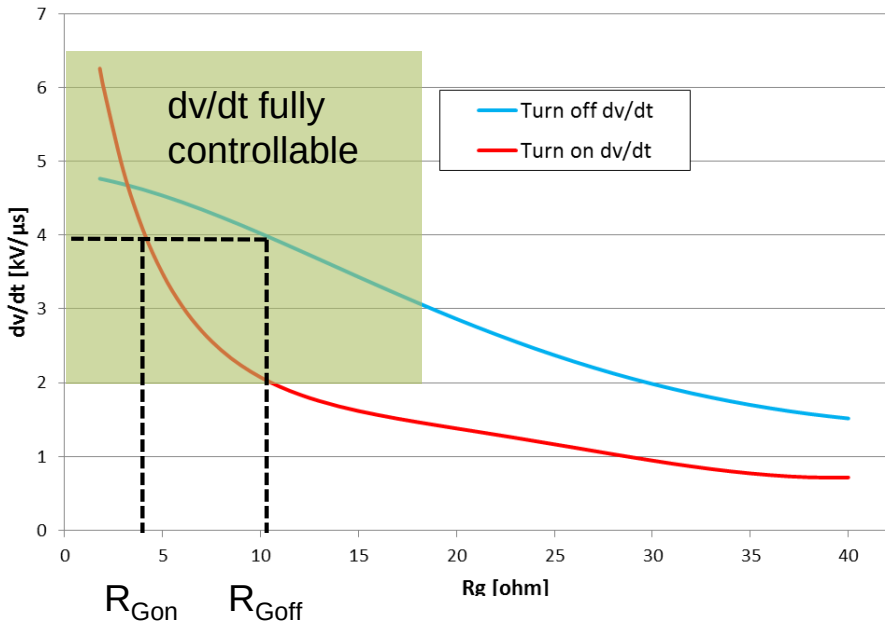
- The ratio of input capacitor is optimized to avoid parasitic turn-on
- **Gate driver circuit can thus be simplified**

➔ Not necessary for IGBT7

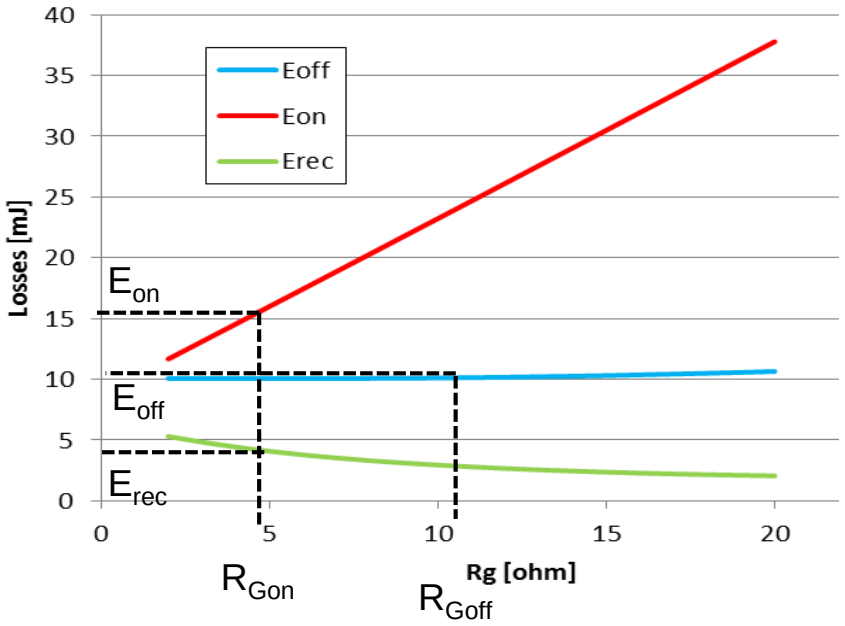
Higher power density with same power in 35% smaller package

Enhanced controllability of dv/dt

dv/dt vs. R_G



E_{sw} vs. R_G



Full control of turn on and turn off dv/dt in range of 2-8kV/µs.

Easy to choose the right gate resistor for specified dv/dt.

Benefits of IGBT7 solutions

Technology Benefits

- **Low losses**, new chip technology shows extremely lower losses with optimized **low V_{cesat}**
- **dv/dt** optimized for **2-8 kV/µs,** tailored for drive application
- **Short circuit** is tailored for better performance, **8 µs @150°C** is enough for drive application
- **Simpler gate drive,** is optimized for application condition, only a gate resistor is enough to control
- Increase of **T_{vjop}** up to **175°C** higher power density possible

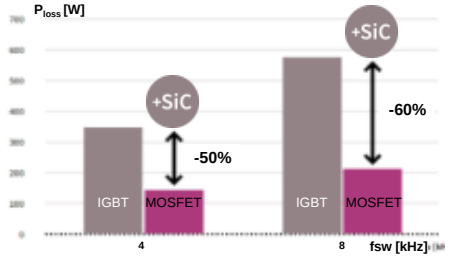
Customer Benefits

- **Plug and play**
  - Pin to pin compatibility with IGBT4 module
  - Lower losses
  - Higher robustness
- **Package Jump**
  - Cost saving on module side
  - Compact inverter design
  - Higher flexibility on inverter frame size
- **Reduction of heatsink**
  - System cost saving
  - Compact inverter design
- **Broad portfolio**
  - Will be available in a broad power range
  - High volume production

Benefits with SiC solutions

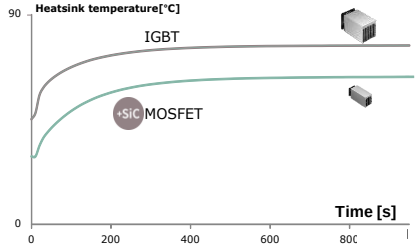
Increased performance

- Reduction of power losses lead to higher performance
- 60% reduction @ 8 kHz compared to IGBT-based



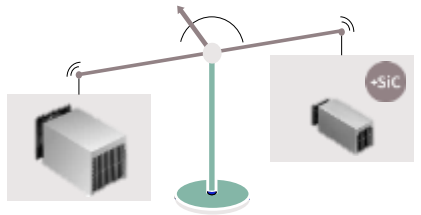
Higher robustness

- 10 K lower operating temperature of heatsink
- Cooling efforts significantly reduced



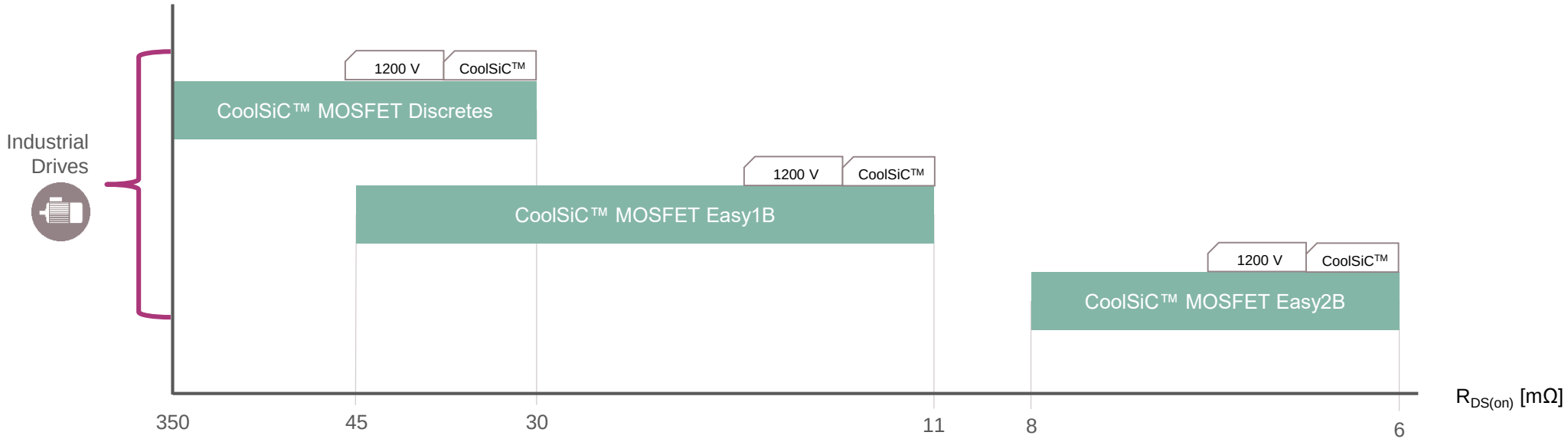
Higher power density & lower system cost

- Heatsink can be reduced by 2/3 compared to IGBT
- Leads to a much higher system power density

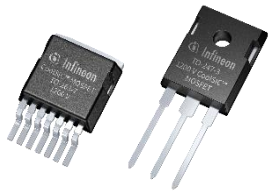


Note: Measurements based on drive demonstrator (22 kW; 50 Hz output freq.; dv/dt <5 kV/µs; IGBT system under same conditions)

1200 V SiC-MOSFET portfolio for Easy and discrete



Easy and discrete portfolio



Discretes

Easy1B

Easy 2B

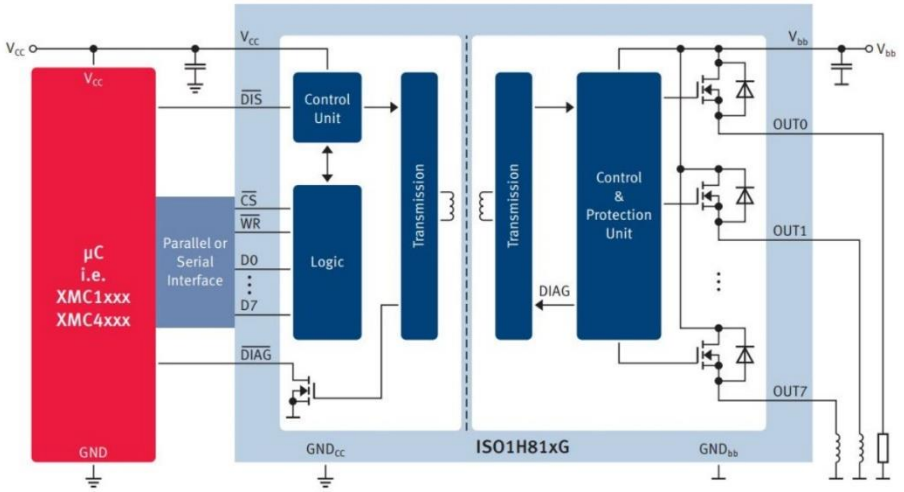
ISOFACE™ product family – Galvanic isolation & diagnostics integrated

2nd gen

- H823V 8x 0.6 A
  12 x 12 VQFN

8-channel switch IC

- 2.5 kV galvanic isolation
- 3.3 V µC interface (SPI, parallel)
- Diagnostics per channel:
  - Open load
  - Short to V_{bb}
  - Short to GND & overload
  - Over temperature
- 5-fold global diagnostics



1st gen

- H811G 8x 0.6 A Parallel
- H812G 8x 0.6 A SPI
- H815G 8x 1.2 A Parallel
- H816G 8x 1.2 A SPI

8-channel switch ICs

- Integrated galvanic isolation
- Direct interface to µC
  - 3.3 V/5 V
  - Serial or parallel
- Short-circuit protection
- Inductive load switching
- Up to 1.2 A load current
- Integrated diagnostics:
  - Overload & short circuit

8-ch. digital input ICs

- Integrated galvanic isolation
- Direct interface to µC
  - 3.3 V/5 V
  - Serial or parallel
- IEC-input types: 1/2/3

	Sampling speed	Filter settings	Diagnostics V_{bb}-monitor	Diagnostics Wire-break
I811T	125 kHz	4 / IC		
I813T	500 kHz	9 / channel	✓	✓

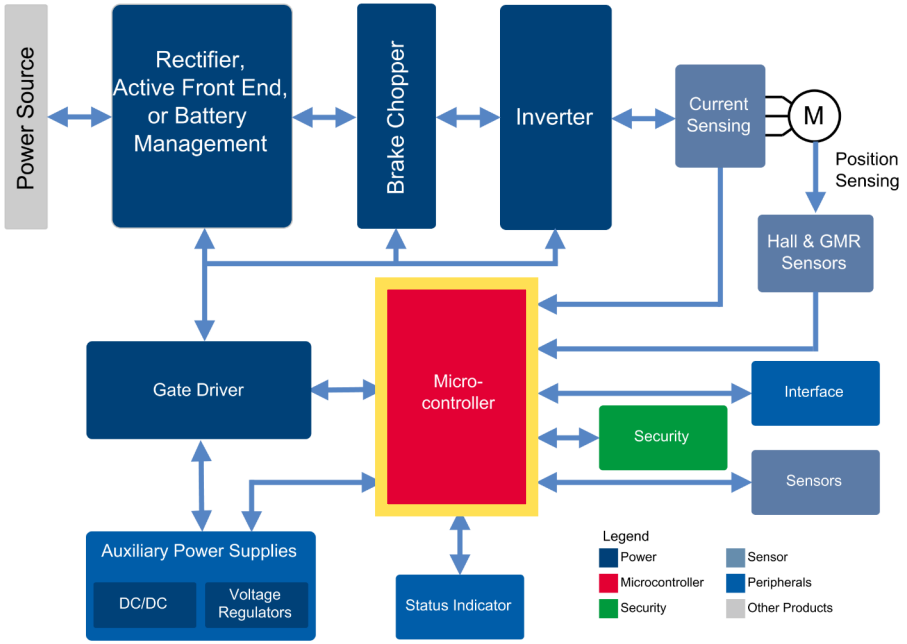
8-channel switch ICs

8-channel input ICs

XMC™ microcontroller: The converter's brain

Tasks of the controller

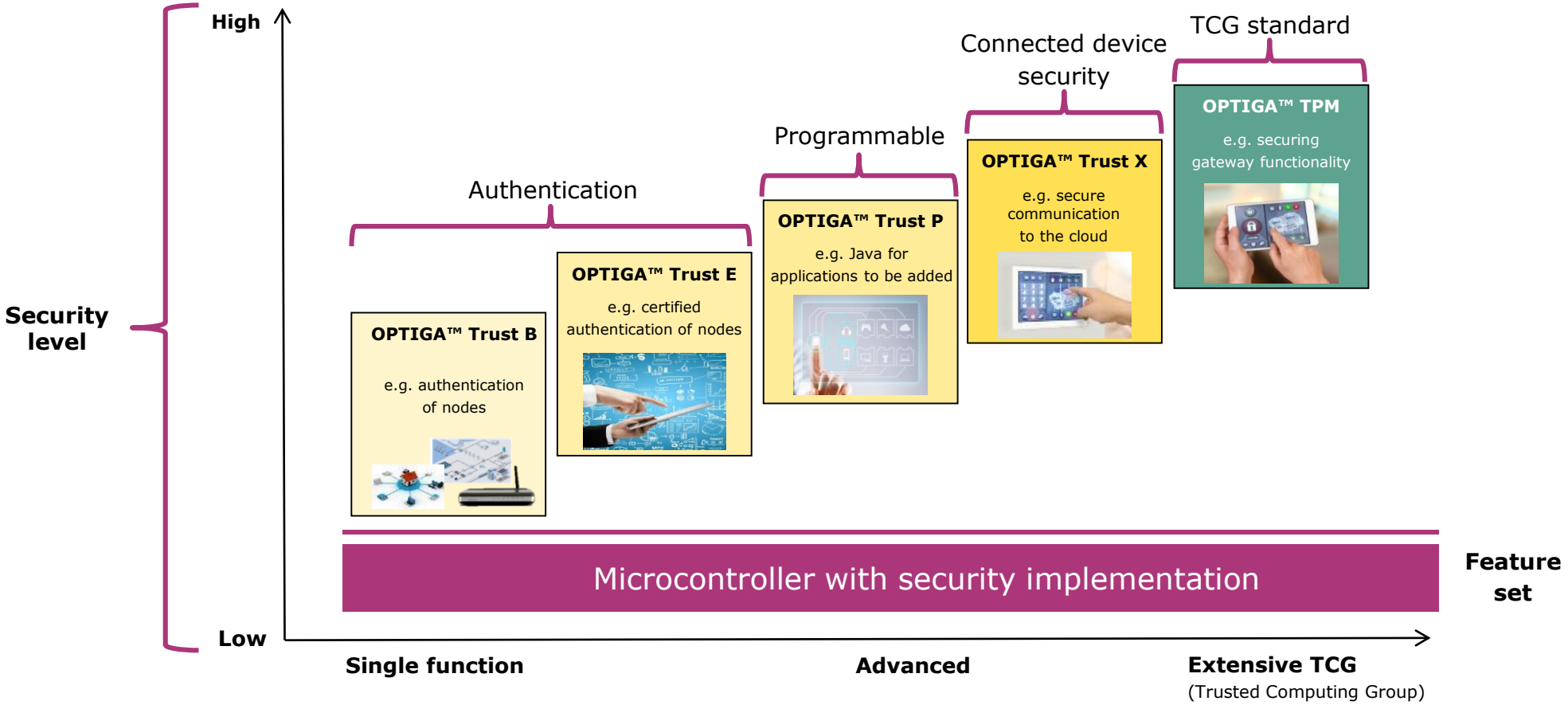
- IGBT control (PWM generation)
- Motor feedback sensing (current, position, speed)
- Speed, torque and position control
- Communication (industrial Ethernet, CAN…)



Solutions for industrial drives

- 32-bit ARM® Cortex™-M0 based XMC1000 family – low end
- 32-bit ARM® Cortex™-M4F based XMC4000 family – mid range
- 32-bit TriCore™ family – high end

Optimized OPTIGA™ product portfolio to meet security requirements



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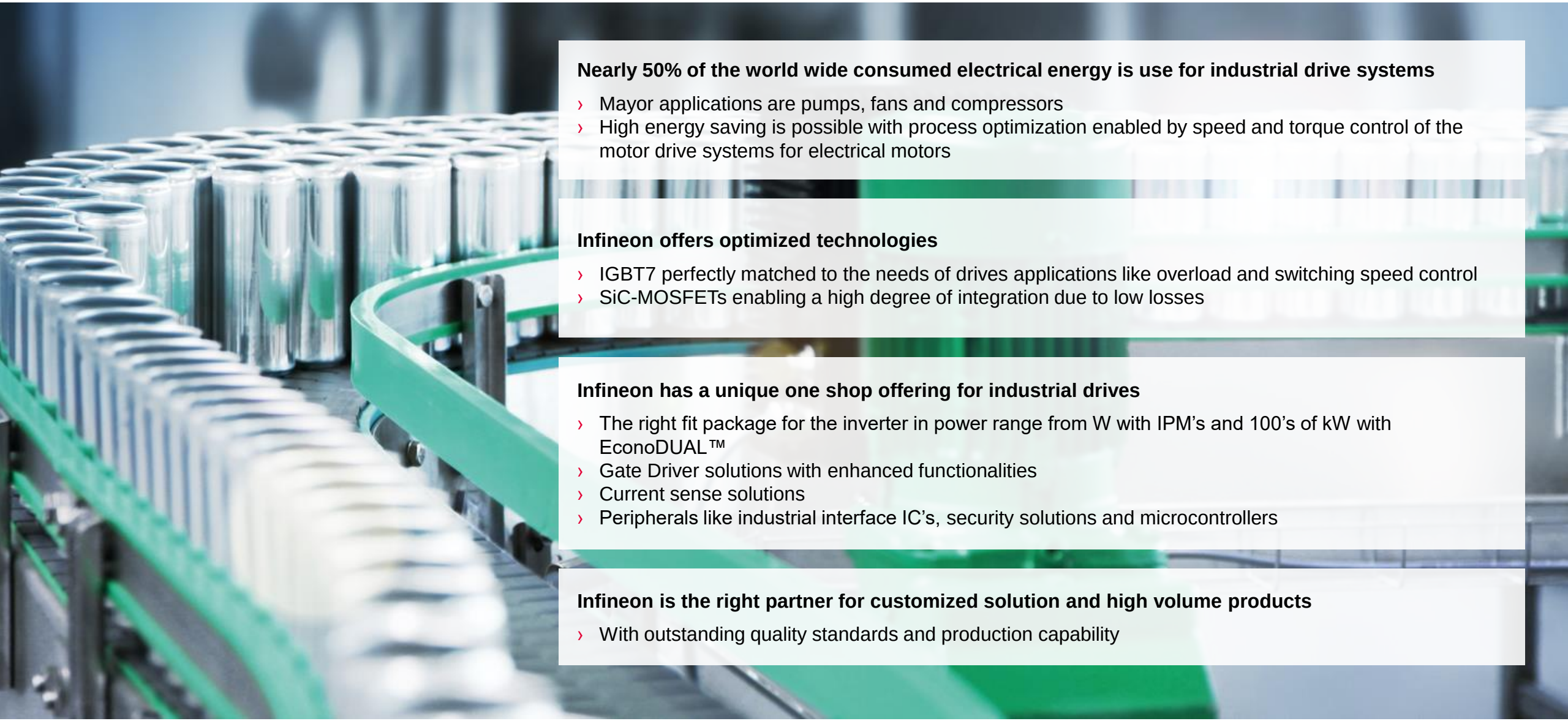
Key take-aways



Nearly 50% of the world wide consumed electrical energy is use for industrial drive systems

- Mayor applications are pumps, fans and compressors
- High energy saving is possible with process optimization enabled by speed and torque control of the motor drive systems for electrical motors

Infineon offers optimized technologies

- IGBT7 perfectly matched to the needs of drives applications like overload and switching speed control
- SiC-MOSFETs enabling a high degree of integration due to low losses

Infineon has a unique one shop offering for industrial drives

- The right fit package for the inverter in power range from W with IPM's and 100's of kW with EconoDUAL™
- Gate Driver solutions with enhanced functionalities
- Current sense solutions
- Peripherals like industrial interface IC's, security solutions and microcontrollers

Infineon is the right partner for customized solution and high volume products

- With outstanding quality standards and production capability

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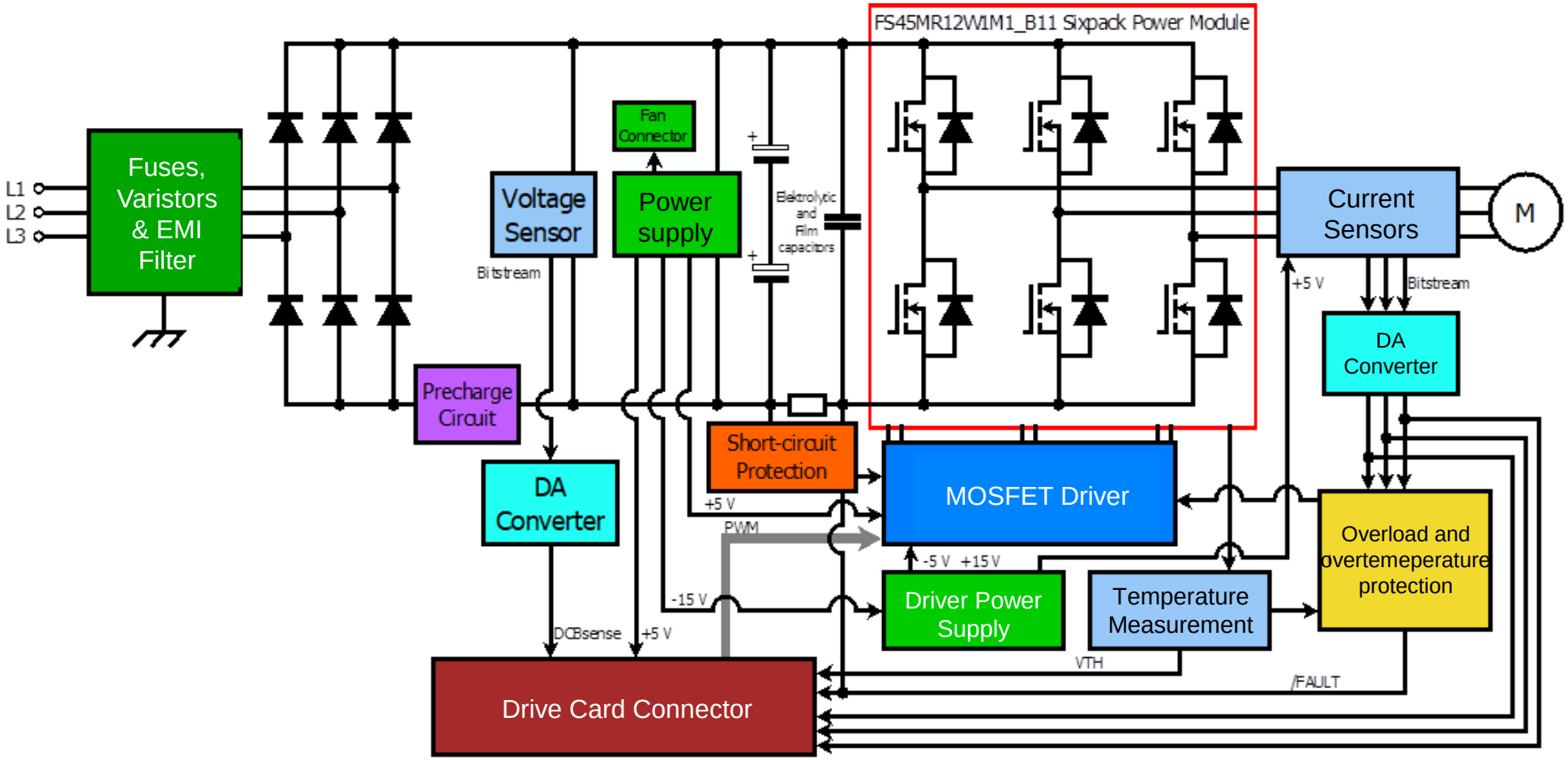
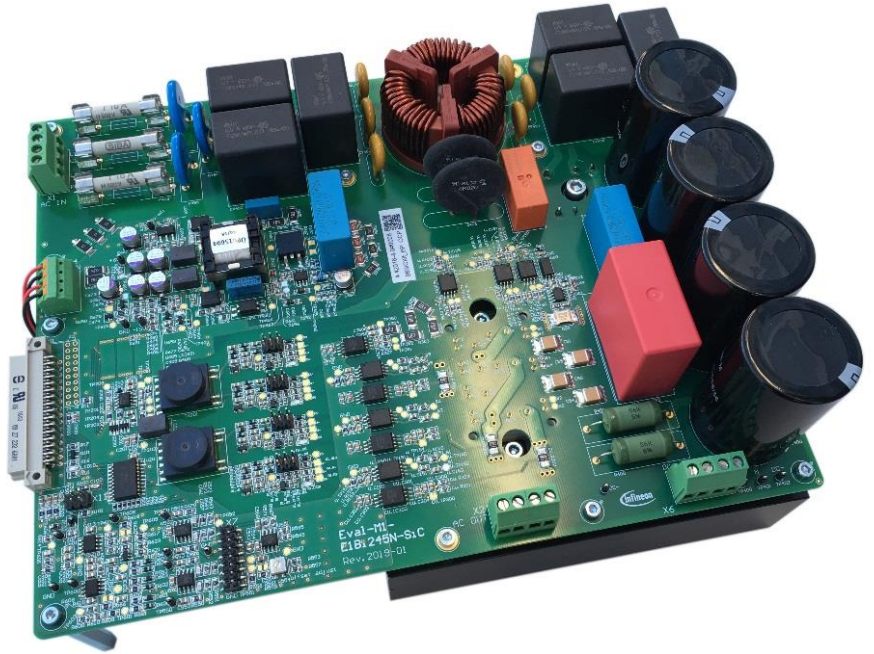
Modular Application Design Kit (MADK)
CoolSiC™ MOSFET evaluation board for industrial drives

- Compact and flexible 3-phase motor drive evaluation platform
  - CoolSiC™ MOSFET in EasyPACK™ 1B can easily tested



Modular Application Design Kit (MADK)
CoolSiC™ MOSFET evaluation board for industrial drives

Parameters	Values	Conditions / Comments
Including FS45MR12W1M1_B11 & 1EDI20H12AH		
Input		
Voltage	340 – 480 V_{rms}	
Current	16 A_{rms}	Input 400 V_{AC}, Ta = 25 °C
DC bus voltage	530 V – 670 V typ.	
Switching frequency	18 kHz nom 100 kHz max	
Output		
3ph P_{out} with mains line choke	11 kW max	Input 400 V_{AC}, f_{sw} = 18 kHz, T_a = 25 °C, T_h = 70 °C, forced convection cooling
3ph P_{out} without mains line choke	6 kW	Input 400 V_{AC}, f_{sw} = 18 kHz, T_a = 25 °C, T_h = 70 °C, forced convection cooling, limited by input current
Current per leg at f_{sw_nom}	16 A_{rms}	Input 400 V_{AC}, f_{sw} = 18 kHz, T_a = 25 °C, T_h = 70 °C, forced convection cooling
Current per leg at f_{sw_max}	8 A_{rms}	Input 400 V_{AC}, f_{sw} = 100 kHz, T_a = 25 °C, T_h = 70 °C, forced convection cooling



- 3ph AC-connector, EMI filter, bridge rectifier, inrush current limiter, 3ph voltage source inverter and a 3ph output for connecting the motor
- Isolated current, voltage sensing unit using ΔΣ-ADC (digital/analogue output)
- Temperature sensing circuitry
- Auxiliary power supply

Link to product page

Useful information material and tools

Product page links

- IGBT7
- SiC-MOSFET
- Gate Driver
- Magnetic Current Sensor

Application pages

- Overview
- Induction motor
- Permanent magnet synchronized motor
- Servo motor
- Motor control for industrial automation
- Robotics

Modular Application Design Kit (MADK)

Evaluation platform

IPOSIM

Infineon Online Power Simulation Tool

SiC Forum

Join the discussion About Silicon Carbide

Part of your life. Part of tomorrow.

Infineon