

Need to build compliant systems which are more cost-efficient?

Highlights

- > Fully integrated and easy-to-use:
Single unit 3-wire in, 3-wire out
- > Network distortion issues all under control
- > Ultra-low harmonics, < 3% THDi
- > Low supra harmonics levels
- > Generates no additional common-mode voltage
- > Power factor of 1.0
- > High efficiency, low losses
- > Unmatched compactness, less weight, and easy integration
- > Compliance-ready for the standards of tomorrow

The intelligent iC7 series includes a fully integrated solution for next-generation harmonic mitigation. The iC7-Aqua ultra low-harmonic drive is free of the shortcomings of traditional ultra low-harmonics solutions. With total harmonic signature of less than 3% THDi, the iC7-Aqua ULH frequency converter brings near-zero distortion to the electrical network, even at partial motor loads.

Zero compromise

Network distortion comes in many forms. With an advanced, next-generation rectifier, iC7-Aqua ULH has a lower common-mode noise signature, a lower high-frequency noise signature (also known as supra harmonics), and greater efficiency (lower losses) than conventional ULH drives. With its power factor of 1.0, there's also no additional reactive power to your network. This combination ensures *ultra-low overall distortion to the supply network – for zero compromise.*



Partial load? Keep performing

The iC7-Aqua ULH performs better than conventional ULH drives at partial loads. It delivers full THDi performance down to ~50% load and maintains excellent THDi performance at even lower loads.

Reduce system cost

Using iC7-Aqua ULH, expensive network components such as supply transformers and backup generators can be specified 10-25% smaller, since oversizing to handle high harmonic distortion is unnecessary. This can bring huge capital investment savings to large infrastructure projects.

No extras are required since *everything is integrated*: ULH rectifier with associated components and EMC filters in a 3-wire-in, 3-wire-out package. There's no need for power factor correction banks, either.

Next-gen technology for ultra compactness

While electric vehicles already use SiC solid-state electronic switches as standard, most drive manufacturers have been slow to adopt SiC MOSFETs to replace conventional Si IGBTs, due to higher component cost.

Now, by embracing a combination of multi-level rectifiers and SiC solid-state electronic switches, iC7-Aqua ULH achieves a huge increase in switching frequency. In turn, the dimensioning of the drive's LCL input filter is significantly reduced. As a result, the iC7-Aqua ULH delivers superior performance at almost the same cost as conventional ultra low-harmonic drives.

The iC7-Aqua ULH is fully contained within a single wall- or cabinet-mountable frame.

Fewer losses

Losses are significantly lower both at full load and partial load, for iC7-Aqua ULH. Besides reduction of the LCL size, the use of SiC MOSFETs also reduces conduction losses in the switches. Usually traditional ultra low-harmonic drives have twice the losses of standard drives, whereas the next generation iC7-Aqua ULH cuts these losses in half. As a result, the main issue of efficiency degradation when using ultra low-harmonic drives is diminished.

Energy efficient: Ideal for retrofits

It is well known that retrofitting variable speed drives to DOL (or across the line) systems can bring 20-60% energy savings. But adding drives can also overload existing electrical infrastructure to the extent that energy upgrade projects are not feasible.

This is where iC7-Aqua ULH comes into its own. Since the iC7-Aqua ULH brings ultra-low overall distortion, you can retrofit it to existing electrical systems without creating this overload situation, and the energy savings will soon pay back the investment.

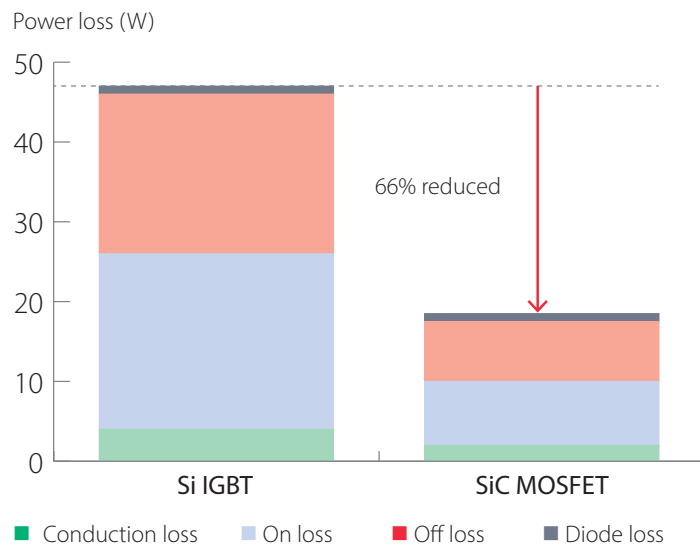


Figure 1

The IGBT and MOSFET transistors are made of silicon (Si) and silicon carbide (SiC), respectively. The choice of transistor material significantly affects conduction losses. The SiC MOSFET has a lower switching loss, enabling operation at a higher switching frequency. This higher switching frequency reduces the LCL dimensioning, making the drive more compact. SiC transistors are used in the power range 22-55 kW.

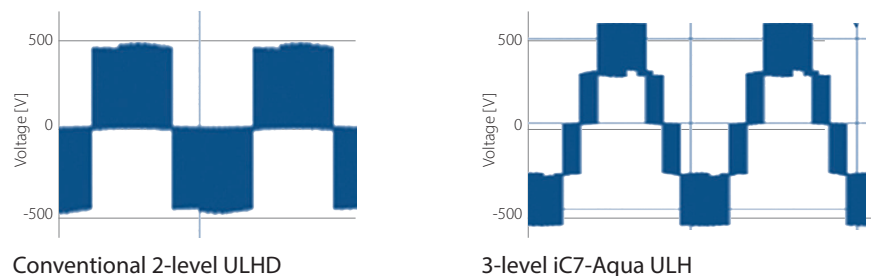


Figure 2

The iC7-Aqua ULH is designed with an innovative multi-stage input topology. The result is a more sinusoidal voltage waveform that requires less filtration by the built-in LCL components. As a result, LCL size can be further reduced.

Surpasses standards for supra harmonics

Conventional ultra-low-harmonic drives are clean up to the 50th harmonic but can generate high frequency disturbances (supra harmonics) in the 2-9 kHz frequency range.

iC7-Aqua ULH uses higher switching frequencies and therefore limits noise generation in this 2-9 kHz region. Additionally, its THDi performance is improved at the 50th-100th harmonic range, making it well-prepared for future standards.

MyDrive® tools

MyDrive® Harmonics

Determine the impact of harmonics on your system, using this professional harmonic simulation tool.

 [Try MyDrive® Harmonics](#)

MyDrive® Energy

Calculate efficiency class and part load efficiency for iC7 series according to IEC 61800-9, using the Efficiency Calculator. It's available in the MyDrive® Energy tool.

 [Try MyDrive® Energy](#)

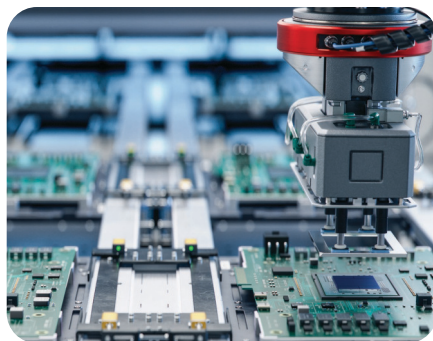


Better system reliability

The active rectifier of the iC7-Aqua ULH ensures stable operation despite unstable network power supply. Power dips and brown outs are easily handled whilst keeping the driven load fully operational and uninterrupted.

No common-mode noise

Leakage currents are undesirable because at high levels they risk causing serious damage to sensitive equipment, especially electric motor bearings. iC7-Aqua ULH eliminates common-mode noise using a simple but effective clamping technique, that leads leakage currents back to source – for optimal system integrity and long component lifetime.



Edge computing for more security

The drive can perform condition-based monitoring (CBM) functions onboard, to protect your valuable motor driven assets. The drive uses machine learning to baseline the application and detect and warn against changes and variations in load, motor winding integrity, and other programmable functions.


Using edge computing, these functions are performed within the drive, with no need to take the information to the cloud for analysis. This protects the drive better from unauthorized access.

Secure-by-design

Cyber security is especially important to the water industry. Water management comprises critical infrastructure and has to be protected. Cyber attacks can interrupt drinking water supplies or affect the treatment of waste water, which can in turn lead to fines and poor customer satisfaction.

As the frequency of cyber attacks increases, legislation is changing. The iC7 series is ready for these changes.

Your drive is equipped with market-leading hardware-based protection against unauthorized access. A built-in crypto chip on the control unit enables encrypted network connectivity, tamper-proof hardware, trusted firmware operation, and public key certificates – for stronger authentication.

 [Learn more about security](#)

Key specifications

Input	
Supply voltage	380-480 V AC, -15%/+10%
Supply frequency	45-65 Hz
Output	
Power range	22-160 kW (30-250 hp)
Output current	43-302 A
Overload ratings	110% (fans, pumps and compressors), 150%
Output frequency	0-590 Hz
Environmental conditions	
Protection ratings	
- Frames Fx07	IP21 (UL Type 1), IP55 (UL Type 12)
- Frames Fx10b	IP20 (UL Open Type), IP21 (UL Type 1), IP54 (UL Type 12)
Cooling versions	back-channel cooling (75 kW (100 hp) and above)
Ambient operating temperature ¹⁾	-30 to 40 °C (-22 to 104 °F) Up to 50 °C (122 °F) with derating
Maximum altitude	4400 m (14400 feet)
Relative humidity	3K22, maximum 95% non-condensing
Chemically active substances (IEC 60721-3-3:2019)	- C3 (P1) - Medium corrosivity - Non coated - C4 (P2) - High corrosivity - Coated
Shock & vibration (IEC 60721-3-3:2019)	3M12
Harmonic mitigation and THDi	
iC7-Aqua ULH	Active front-end integrated, THDi <3 % (full load), THDi <5 % (50-90% load)

EMC protection (EN/IEC 61800-3 compliance class)	Cable length ²⁾
C2 (~commercial)	Up to 150 m
Compliance	
Efficiency class (IEC61800-9-2)	IE2
Approvals	UL, CE, others available soon
Functional safety I/O	
STO	SIL3, PLe
Control I/O - standard	
Analog inputs (AI)	2
- Voltage mode	0-10 V, scalable
- Current mode	0/4-20 mA
- Temperature sensor support	Pt1000, Ni1000, KTY81, KTY82, KTY84
Analog outputs (AO)	1 (0/4-20 mA)
Digital inputs (DI)	4+2 (0/24V, selectable PNP or NPN)
Digital outputs (DO)	2 (0/24 V) Digital outputs are reconfigured from digital inputs
Relay outputs (RO)	2(NO/NC), 2 A/250 V AC
Auxiliary voltages	10 V output (10 mA), 24 V output (150 mA), 24 V external supply input (2 A)
Fieldbus options (embedded)	
Ethernet	Modbus TCP, EtherNet/IP, PROFINET RT, PROFINET RT/S2 ³⁾ , EtherCAT
Serial	Modbus RTU
Other protocols	OPCUA ³⁾

¹⁾ Rated operating temperature varies between products

²⁾ Cable length varies with product size

³⁾ Available soon

Dimensions and weight

Protection rating	IP20 [UL Open Type]	IP21 [UL Type 1] IP54/IP 55 [UL Type 12]	
		75-160 kW FA10b	22-55 kW FK07/FB07
Power range at 3 x 400 V Frame			
[mm/in]			
Width	352/13.9	239/9.4	422/16.6
Height	1186/46.7	770/30.3	1239/48.8
Depth	505/19.9	327/12.9	535/160
[kg/lbs]			
Maximum weight	158/348	38/83	160/352.7

