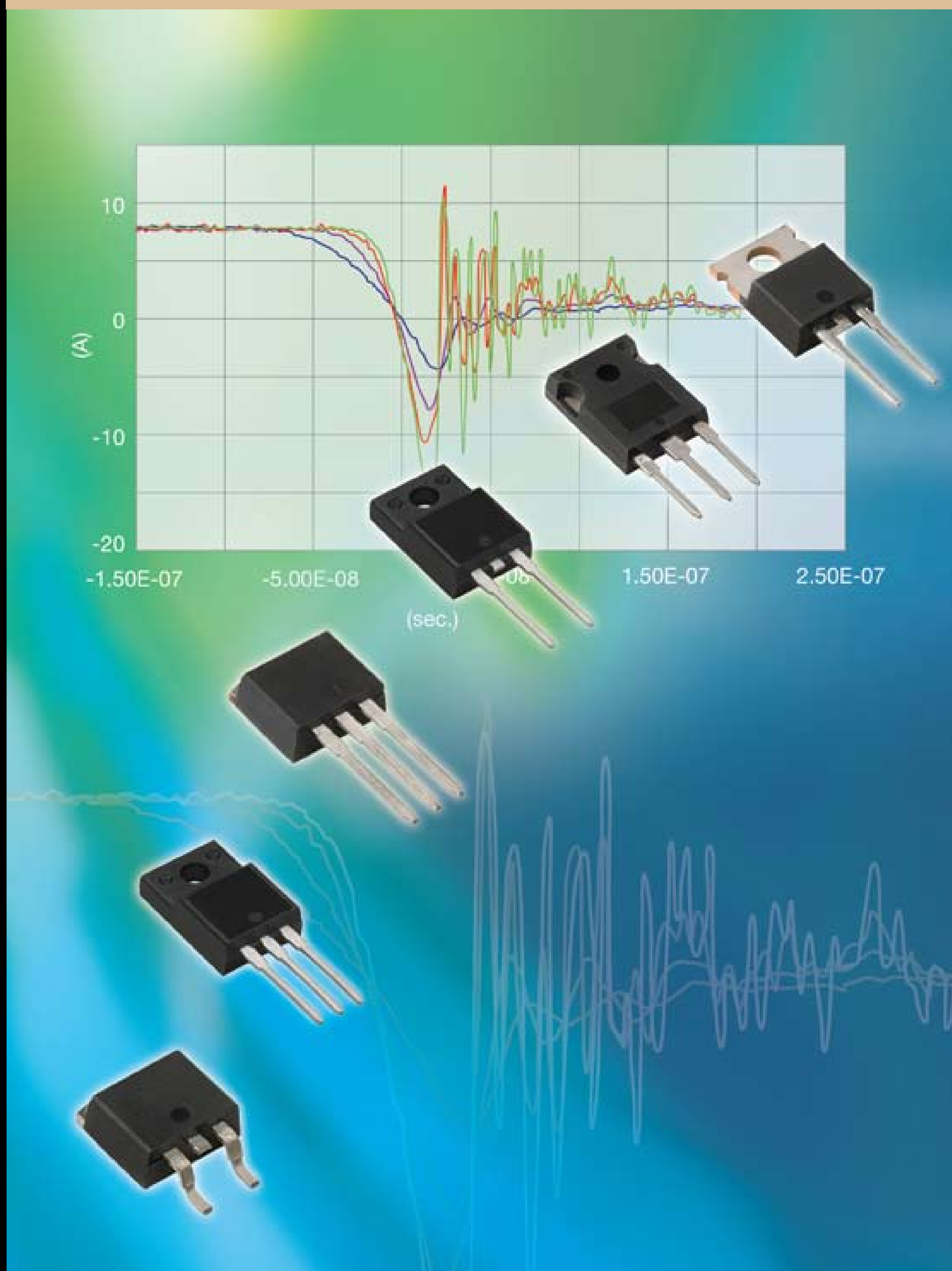
VISHAY INTERTECHNOLOGY, INC.

HIGH POWER PRODUCTS

FRED Pt™ DIODES FOR PFC

Ultrafast Diodes for DCM and CCM Power Factor Correction

CAPABILITIES



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PFC Capabilities

Introduction

Power factor correction (PFC) can be defined as the reduction of the harmonic content induced in the AC distribution net. An appropriate circuit is often required to reduce this kind of disturbance.
PFC can also be thought of as the aligning of the phase angle of incoming current with respect to the voltage waveform, thus maximizing the real power drawn from the AC line.

Regulatory Drivers

With widening applicability of the harmonic reduction standard, more power supply designs are incorporating PFC capabilities. Different PFC regulations and standards have recently arisen, resulting in the following regulations:

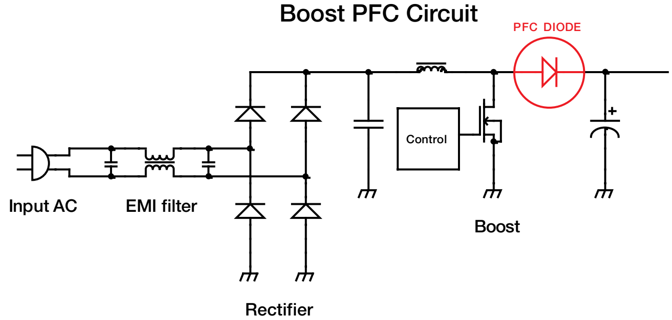
- Europe – EN61000-3-2
- UK – BSEN 61000-3-2
- Japan – JIC-C-61000-3-2
- China – CCC (China Compulsory Certificate)

Other standards apply in different ways to PFC circuits, especially in regards to efficiency, such as EPA Energy Star and 80 PLUS®.

Topology Choices

The active PFC option is a well-established solution, as it allows designers to meet regulatory requirements with minimal effort. Moreover, it gives other benefits such as simplifying the main power conversion stage and eliminating a number of bulky components.
A boost converter provides a natural means for achieving a high power factor, because of the inductor being present on the input side. This inductor allows the shaping of the input current to be in phase with the line voltage.

Boost PFC Circuit



DCM or CCM?

A boost converter can operate in two modes: continuous conduction mode (CCM) or discontinuous conduction mode (DCM). The mode is defined by the current flowing into the boost inductor:

- DCM – Suitable for low- to medium-power applications due to reduced switching losses (forward voltage is a critical parameter)
- CCM – Better suited for medium- to high-power applications. Peak currents are lower, which reduces switching losses and requires lower filtering (reverse recovery charge is a critical parameter)

V_{RRM}	I_F (av)	t_J (max)	V_F (max) @ I_F @ 25 °C	t_{rr} (typ) @ 25 °C *	t_{rr} (typ) @ 125 °C *	Q_{rr} (typ) @ 125 °C *
(V)	(A)	(°C)	(V)	(ns)	(ns)	(nC)
Ultrafast diodes (DCM or CRM)						
600	8	175	1.05	170	250	2600
600	15	175	1.05	220	320	4300
Hyperfast diodes (CCM)						
600	8	175	2.4	25	40	120
600	8	175	3.0	17	40	100
600	8	175	2.4	19	35	84
600	15	175	2.2	29	75	300
600	15	175	3.2	22	52	150
600	15	175	2.4	20	45	140
600	30	175	2.6	31 **	77 **	345 **

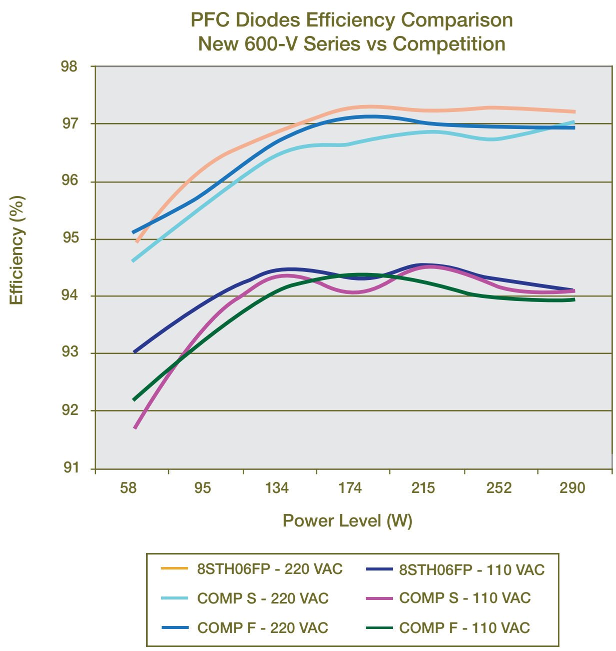
* $I_F = I_{F(AV)}$, dI_F/dt = 200 A/μs, V_R = 390 V
** $I_F = I_{F(AV)}$, dI_F/dt = 200 A/μs, V_R = 200 V

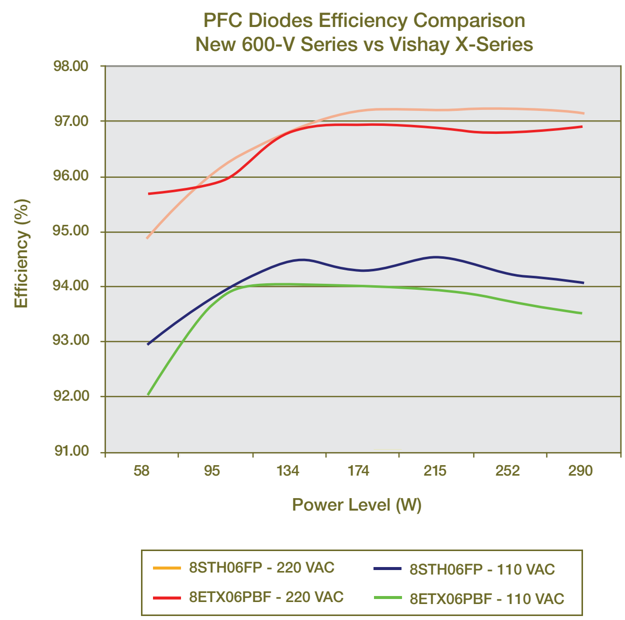
New Products
All parts also available with leaded terminations

PFC Diode Application Benchmarking

The following results were obtained comparing the efficiency of Vishay diodes with similar ones from competitors. The test bench conditions are reported below:

- AC line voltage range: 90 V_{AC} to 260 V_{AC}
- AC line frequency: 50 Hz
- Converter switching frequency: 100 kHz
- Output voltage: 386 V_{DC}
- Maximum output power: 300 W
- Operating ambient temperature: +25 °C
- PF (@ 115 V_{AC}/300 W): 0.99





For technical support, contact: diodes-tech@vishay.com

For further information: http://www.vishay.com/ref/fred_pt_for_pfc

Devices					
TO-220AC	TO-262	D^2-PAK	2-pin TO-220 FullPak	3-pin TO-220 FullPak	TO-247
8ETL06PBF	8ETL06-1PBF	8ETL06SPBF	8ETL06FPPBF		
15ETL06PBF	15ETL06-1PBF	15ETL06SPBF	15ETL06FPPBF		
8ETH06PBF	8ETH06-1PBF	8ETH06SPBF	8ETH06FPPBF		
8ETX06PBF	8ETX06-1PBF	8ETX06SPBF	8ETX06FPPBF		
			8S2TH06FP	8STH06FP	
15ETH06PBF	15ETH06-1PBF	15ETH06SPBF	15ETH06FPPBF		
15ETX06PBF	15ETX06-1PBF	15ETX06SPBF	15ETX06FPPBF		
			15S2TH06FP	15STH06FP	
30ETH06PBF	30ETH06-1PBF	30ETH06SPBF			30EPH06PBF

VISHAY®

SEMICONDUCTORS:
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