VISHAY

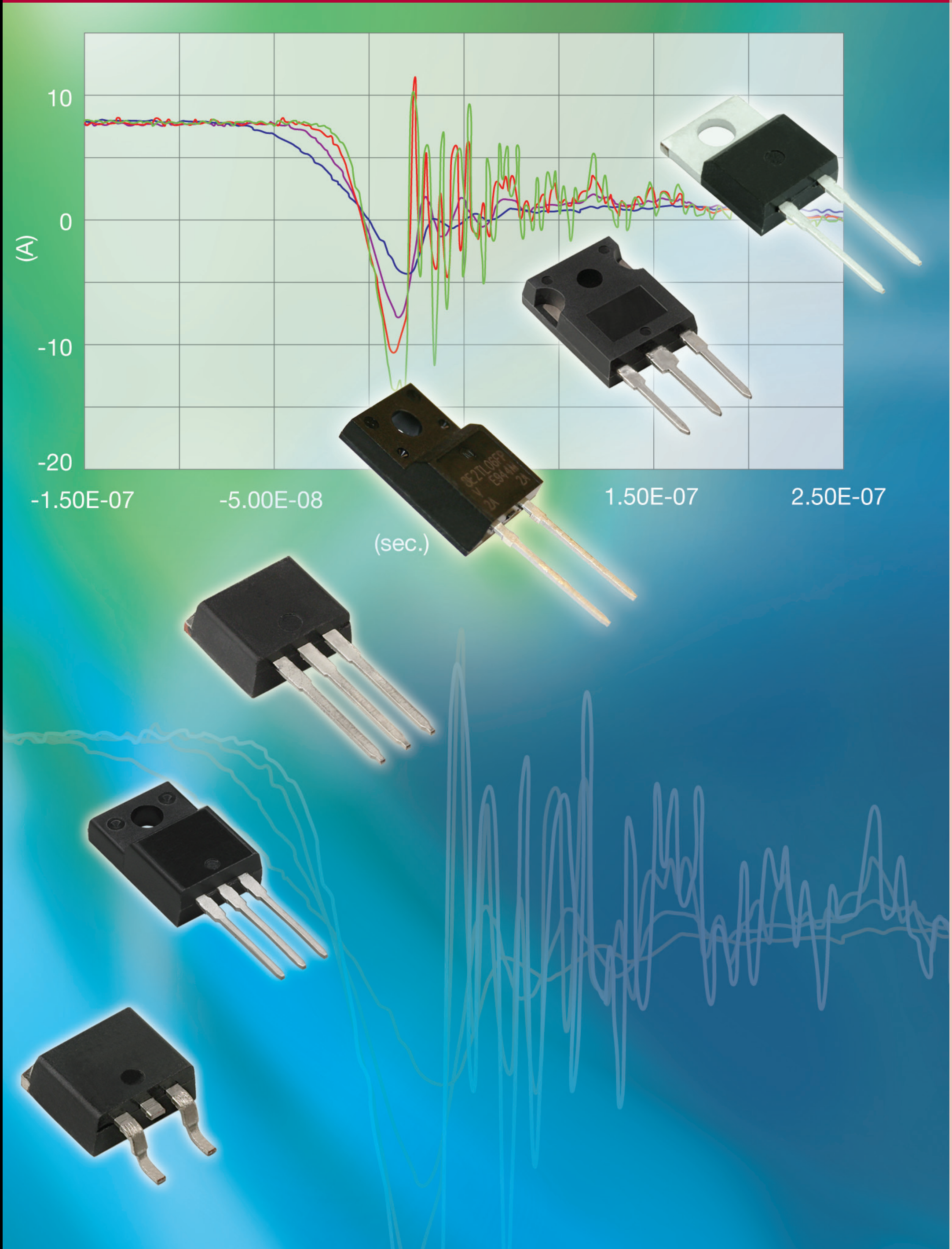
VISHAY INTERTECHNOLOGY, INC.

FRED Pt® DIODES FOR PFC

Ultrafast Diodes for DCM, CRM and CCM Power Factor Correction

DIODES

CAPABILITIES



www.vishay.com

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

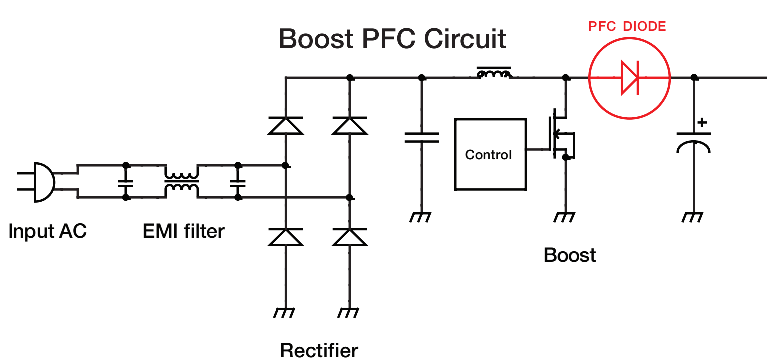
The active PFC option is a well-established solution, as it allows designers to meet regulatory requirements with minimal effort. Moreover, it gives other benefits such as simplifying the main power conversion stage and eliminating a number of bulky components.

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.

DCM, CRM, 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:

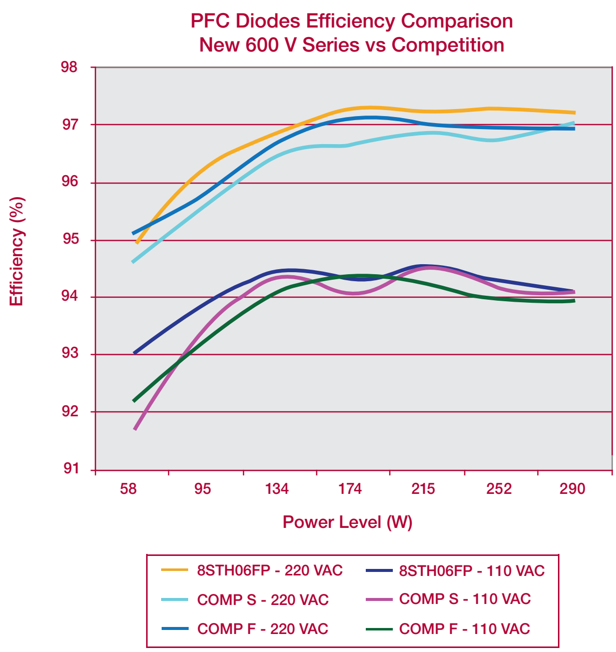
- DCM – Suitable for low- to medium-power applications due to reduced switching losses (forward voltage is a critical parameter)
- CRM – Border mode operation combine high efficiency maximizing the usage of inductive elements
- CCM – Better suited for medium- to high-power applications. Peak currents are lower, which reduces switching losses and requires lower filtering (reverse recovery charge is a critical parameter)

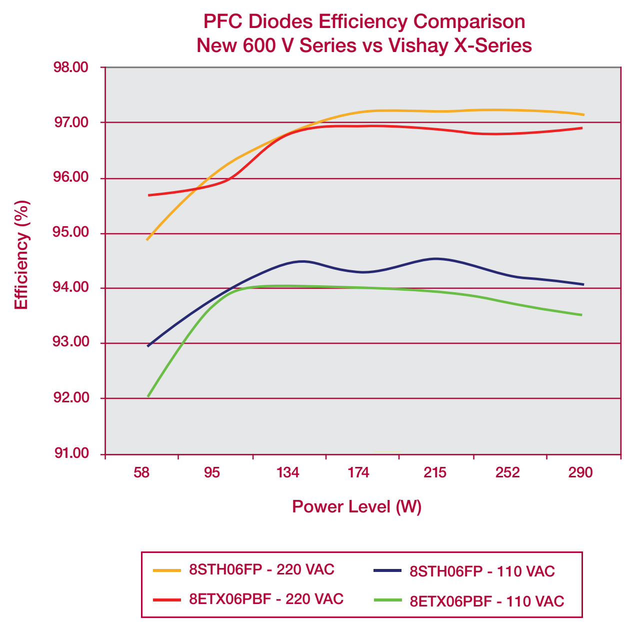


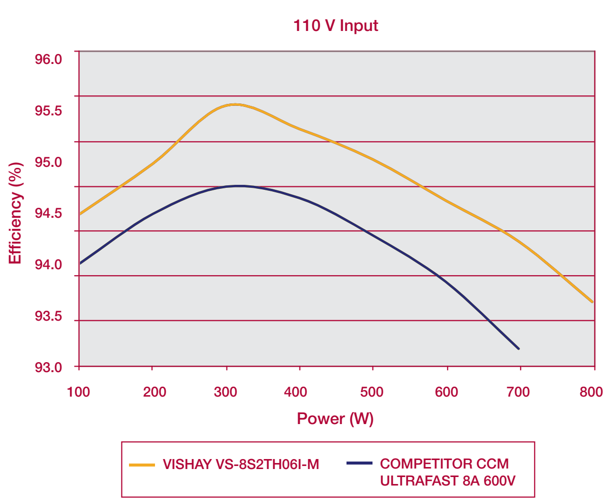
PFC Diode Application Benchmarking

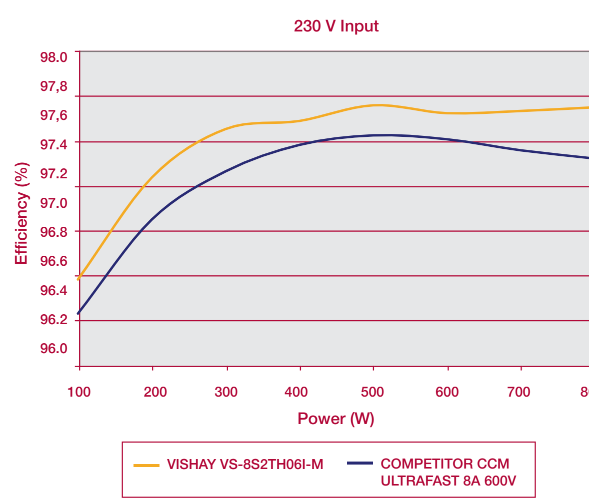
The following results were obtained comparing the efficiency of Vishay diodes with similar ones from competitors. The test bench conditions are reported below:

- 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









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For further information: http://www.vishay.com/ref/fred pt_for_pfc

DEVICE						
DPAK (TO-252)	TO-220AC	isol. TO-220AC	D^2PAK (TO-262)	TO-220 FPAC	TO-220 FPAB	TO247
Ultrafast Diodes (DCM)						
VS-5EWL06FNx-E3						
VS-6EWL06FNx-E3						
VS-8EWL06FNx-E3						
	8ETL06PBF		8ETL06xPBF			
				8ETL06FPPBF		
	VS-8E2TL06-E[1]					
				VS-8E2TL06FP-E		
VS-15AWL06FNx-E3/ VS-15EWL06FNx-E3						
	15ETL06PBF		15ETL06xPBF			
				15ETL06FPPBF		
Hyperfast Diodes (CRM / CCM)						
VS-5EWH06FNx-E3						
VS-5EWX06FNx-E3						
VS-6EWH06FNx-E3						
VS-6EWX06FNx-E3						
VS-8EWH06FNx-E3						
VS-8EWX06FNx-E3						
	8ETH06PBF		8ETH06xPBF			
				8ETH06FPPBF		
	8ETX06PBF		8ETX06xPBF			
				8ETX06FPPBF		
	VS-8E2TH06-E[1]					
				VS-8E2TH06FP-E		
	VS-8E2TX06-E[1]					
				VS-8E2TX06FP-E		
		VS-8S2TH06I-M				
				VS-8S2TH06FP	VS-8STH06FP	
VS-12EWH06FNx-E3						
VS-15EWH06FNx-E3						
VS-15EWX06FNx-E3						
	15ETH06PBF		15ETH06xPBF			
				15ETH06FPPBF		
	15ETX06PBF		15ETX06xPBF			
				15ETX06FPPBF		
				VS-15S2TH06FP	VS-15STH06FP	
	30ETH06PBF		30ETH06xPBF			
						30EPH06PBF

New Products

(1) Also available Halogen Free

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

(3) $I_F = I_{F(AV)}$, $dI_{F/dt}$ = 200 A/µs, V_R = 200 V

V_{RRM}	$I_{F(AV)}$ max	T_J (max)	T_C at I_F	V_F (max) @ I_F @ 25 °C	t_{rr} (typ) @ 25 °C[2]	t_{rr} (typ) @ 125 °C[2]	Irr (typ) @ 125 °C[2]	Q_{rr} (typ) @ 125 °C[2]	I_{FSM} (max)
(V)	(A)	(°C)	(°C)	(V)	(ns)	(ns)	(A)	(nC)	(A)
Ultrafast Diodes (DCM)									
600	5	175	159	1.2	154	203	12.8	1304	80
600	6	175	156	1.25	173	215	13.5	1452	80
600	8	175	158	1.05	170	250	20	2600	140
600	8	175	160	1.05	170	250	20	2600	175
600	8	175	142	1.05	170	250	20	2600	175
600	8	175	156	1.07	200	255	20	2400	125
600	8	175	131	1.07	200	255	20	2400	125
600	15	175	148	1.05	250	320	24	4000	180
600	15	175	154	1.05	220	320	26	4300	250
600	15	175	120	1.05	220	320	26	4300	250
Hyperfast Diodes (CRM / CCM)									
600	5	175	150	1.85	21	30	4.1	66	70
600	5	175	144	2.9	16	24	3.4	42	50
600	6	175	144	2.1	21	30	4.1	66	70
600	6	175	136	3.1	16	25	3.4	44	50
600	8	175	143	2.4	25	40	4.8	120	90
600	8	175	140	3.4	17	40	4.5	100	90
600	8	175	144	2.4	25	40	4.8	120	90
600	8	175	108	2.4	25	40	4.8	120	100
600	8	175	143	3.0	17	40	4.5	100	110
600	8	175	106	3.0	17	40	4.5	100	110
600	8	175	133	2.5	22	43	5.2	120	70
600	8	175	78	2.5	22	43	5.2	120	70
600	8	175	129	3.2	16	35	3.8	62	77
600	8	175	71	3.2	16	35	3.8	62	77
600	8	175	120	3.1	11	23	2.8	35	140
600	8	175	93	2.4	19	35	4.6	84	100
600	12	175	132	2.5	26	47	5.4	137	110
600	15	175	130	2.1	31	70	6	210	120
600	15	175	117	3.2	22	36	4.3	85	120
600	15	175	140	2.2	29	75	7	300	120
600	15	175	80	2.2	29	75	7	300	180
600	15	175	133	3.2	22	52	5.1	150	170
600	15	175	62	3.2	22	52	5.1	150	170
600	15	175	73	2.4	20	45	5.6	140	115
600	30	175	103	2.6	31[3]	77[3]	7.7[3]	345[3]	200
600	30	175	116	2.6	31[3]	77[3]	7.7[3]	345[3]	300

New Products

[1] Also available Halogen Free

[2] $I_F = I_{F(AV)}$, $dI_F/d_t = 200$ A/µs, $V_R = 390$ V

[3] $I_F = I_{F(AV)}$, $dI_{F/dt} = 200$ A/µs, $V_R = 200$ V

SEMICONDUCTORS:
Rectifiers • High-Power Diodes and Thyristors • Small-Signal Diodes • Zener and Suppressor Diodes • FETs • Optoelectronics • ICs • Modules

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VISHAY

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