05-Oct-2010

DIODESTAR™ Rectifiers

Introduction to DIODESTAR™ Rectifiers

Presentation focused on 600V Rectifiers for power supply PFC stages

DIODESTAR - A New Technology

- **DIODESTAR™ is a proprietary process platform that combines the expertise of the MOSFET and Bipolar process technology to manufacture next generation high voltage products > 400V**
- **Developed at Diodes' wafer fab in Oldham, UK**
- **Target to meet the needs of new energy efficency standards driven by legislation including high volume Power Factor Correction (PFC) solutions**
- **Initial product family is optimised for PFC applications in power supplies for consumer electronics**
  e.g. LCD-LED TV, notebooks and desktop PCs

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DIODESTAR - Diodes' 600V Rectifier Portfolio

Part No.	Description I_F & V_R Max.	Package	Forward V_F @ rated I_F Typ. (Note 1) (V)	Leakage I_R @ V_R=600V Typ. (Note 1) (μA)	T_{rr} Typ. (Note 2) (ns)	T_J Max. (°C)	Samples
DSR15V600	15 Amps / 600 Volts High Efficiency "V" DIODESTAR Rectifier	TO-220AC	2.6	0.25	23	175	Available Now!
DSR15U600	15 Amps / 600 Volts High Efficiency "U" DIODESTAR Rectifier	TO-220AC	2.0	0.15	28	175	Available Now!
DSR8V600	8 Amps / 600 Volts High Efficiency "V" DIODESTAR Rectifier	TO-220AC	2.4	0.50	18	175	Available Now!
DSR8U600	8 Amps / 600 Volts High Efficiency "U" DIODESTAR Rectifier	TO-220AC	1.9	0.50	23	175	Available Now!
DSR6V600D1	6 Amps / 600 Volts High Efficiency "V" DIODESTAR Rectifier	TO-252	2.6	0.60	19 (Note 3)	175	Available Now!
DSR6U600D1	6 Amps / 600 Volts High Efficiency "U" DIODESTAR Rectifier	TO-252	2.1	0.50	21 (Note 3)	175	Available Now!

Notes:
1. Measured at junction temperature T_J = 25°C
2. Reverse recovery time (T_{rr}) measured with di/dt = 100A/μS, I_F = 1A and V_R = 30V
3. T_{rr} measured under standard RG1 test condition of I_F = 0.5A, I_R = 1A, I_{RR} = 0.25A.

Package

- Industry standard TO-220AC, TO-252
- "Green" mold compound (TO-252)
- Moisture Sensitivity Level (MSL) = 1

Ordering Information

Standard packaging option in tube with 50pcs/tube (TO-220AC) and 80pcs/tube (TO-252)

"-13" = Tape & Reel option of 13" reel and 2,500/reel (TO-252)

DIODESTAR™ Rectifier offering to PFC application.

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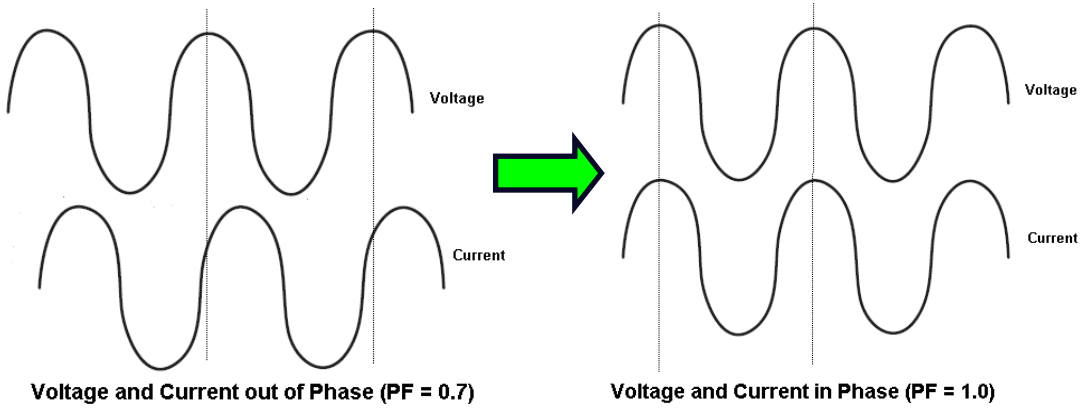
DIODESTAR - PFC Market Driving Forces

What is Power Factor Correction?

PFC reduces the loading effects on the AC electrical mains and overall increases AC-DC efficiency conversion and improves AC power quality



Regulation from Public-Sector

AC-DC power supplies need to be fully compliant with imposing restrictions on Power Factor (PF) and Total Harmonic Distortion (THD) for applications > 75W and for offline lighting > 25W

- **> CCC (or '3'C) in China**
- **> IEC1000-3-2/EN61000-3-2 in Europe**
- **> JISC61000-3-2 in Japan**
- **> 80PLUS in America (Energy Star)**

Regulation requires PFC in power supplies > 75W and offline lighting > 25W.

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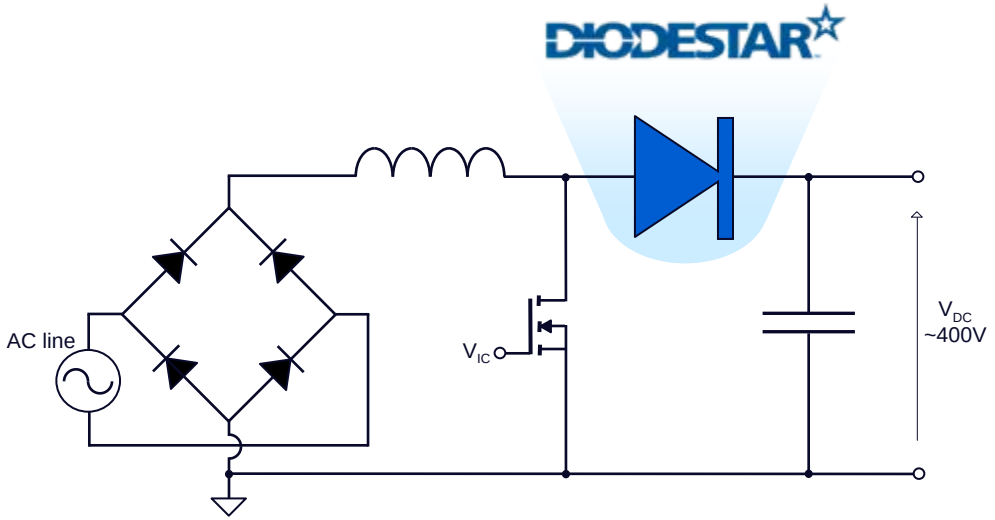
DIODESTAR - Target Application is PFC

600V Boost Diode in the Power Factor Correction (PFC) circuit of AC-DC power supplies.



Target Application: 600V ***Boost Diode*** in AC/DC Switch Mode Power Supply (SMPS). The requirement needed is a blocking voltage of at least 450V, with surge current ruggedness to handle large inrush and over currents in higher power applications. To minimize the power loss and increase the efficiency, the key parameters to this boost diode are ***ultra fast, soft switching T_{RR} (<30nS)*** combined with ***low forward voltage drop V_F***.

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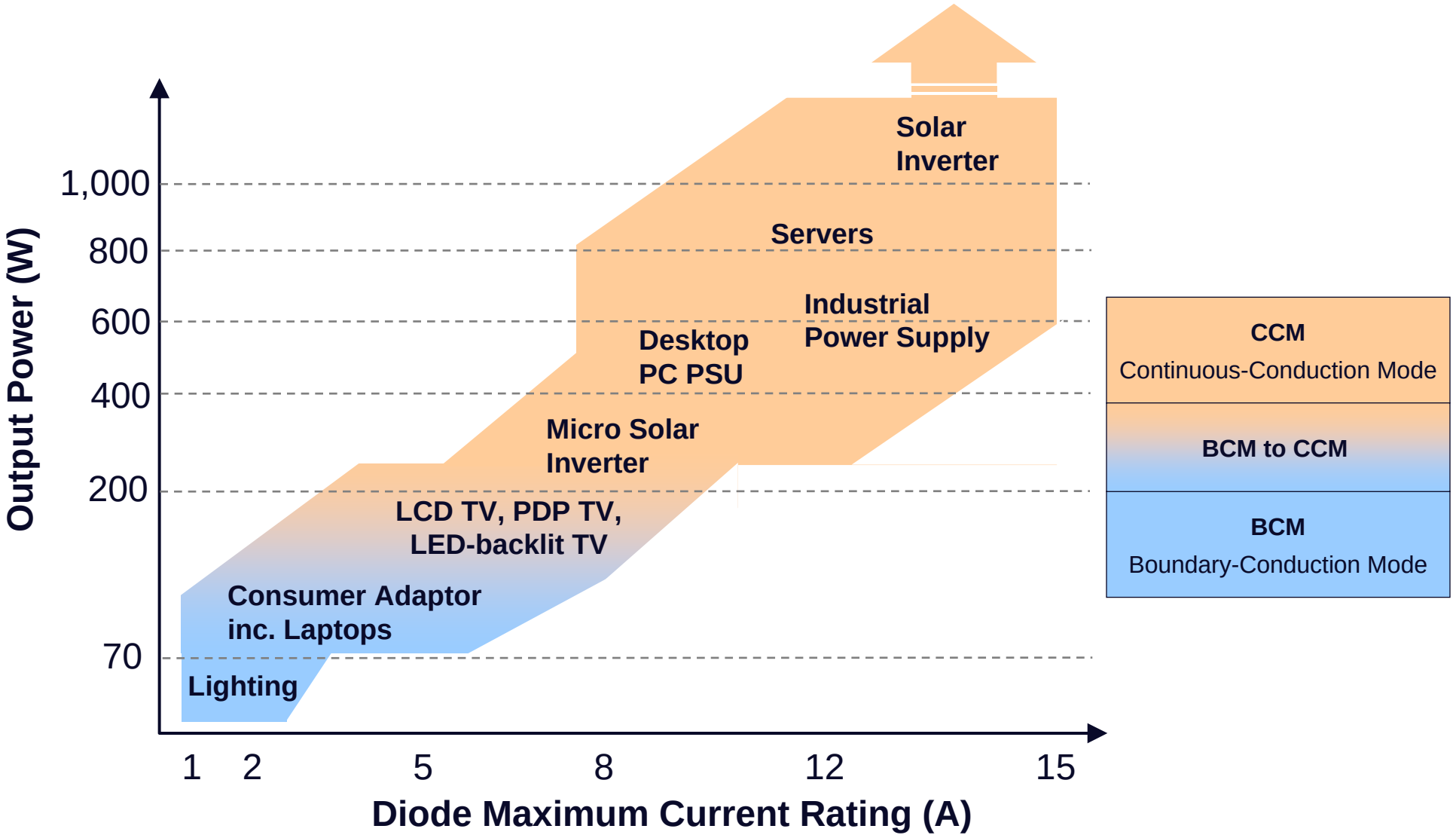
DIODESTAR - PFC Market landscape



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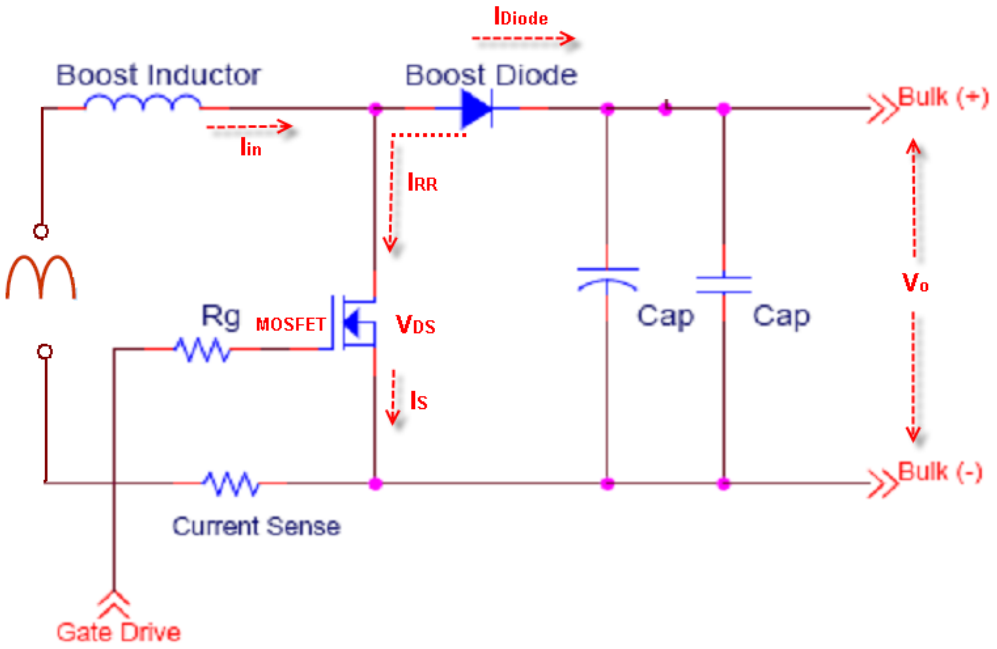
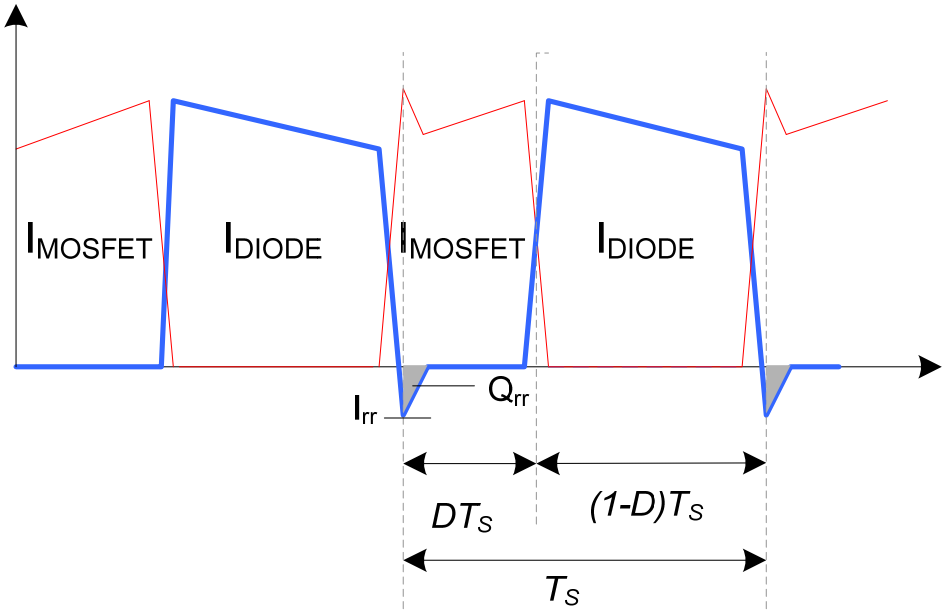
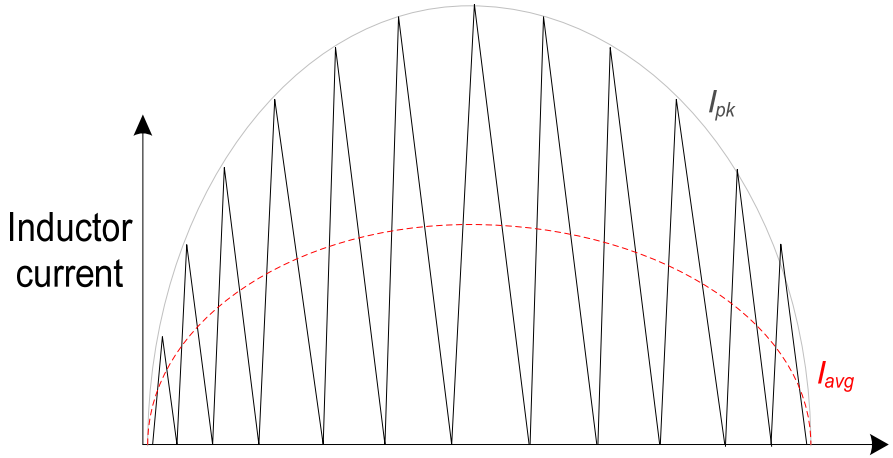
How does boost diode of CCM work?

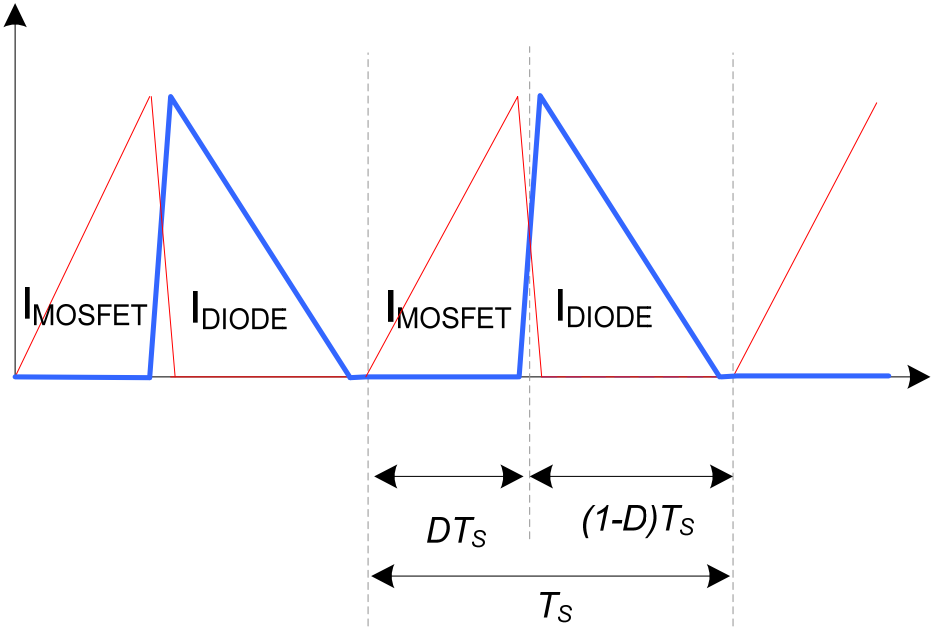




- CCM PFC boost diode will turn OFF when I_{DIODE} is not equal to zero
- The reverse recovery energy (Q_{RR}) from the PFC boost diode will flow into the MOSFET and the energy will be dissipated as a turn-on switching loss in the MOSFET
- Large Q_{RR} causes substantial power dissipation in the MOSFET resulting in increased loss and possible failure
- High I_{RRM} coupled with a snappy reverse-recovery increases EMI emission
- For CCM PFC diode, focus must be on low T_{RR} (<30ns) and low Q_{RR}

How does boost diode of BCM work?



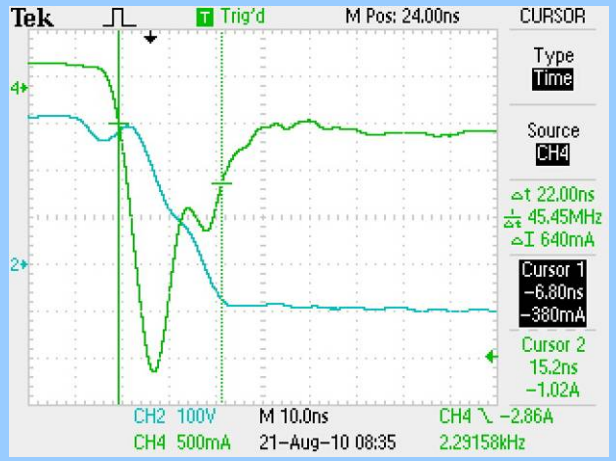


- PFC diode turns OFF at zero current with negligible reverse recovery energy (Q_{RR}) from the diode
- Soft switching reduces switching loss as MOSFET turns ON at zero current and minimum voltage
- Higher peak current leads to larger MOSFET and diode conduction loss
- BCM is for power supplies < 200W due to the large switching variation which will cause EMI to significantly increase at power levels above 250W
- For BCM PFC diode, ultra-fast reverse recovery (T_{RR}<30ns) must be combined with low V_F

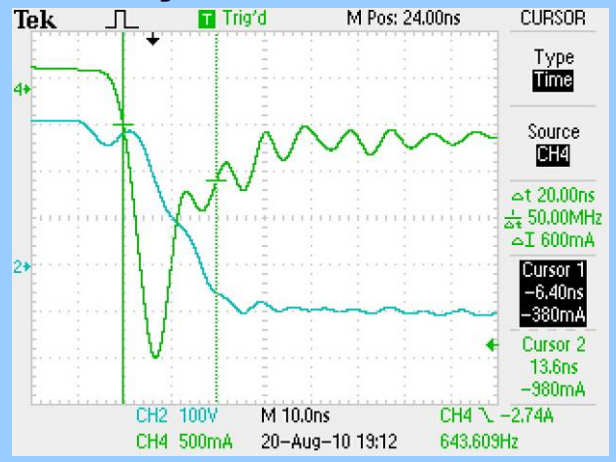
DIODESTAR - Diodes' Offering to PFC Market

- ☑ 600V rectifier optimised for PFC
- ☑ Ultra-Fast recovery speed with T_{rr} < 30ns
- ☑ Soft reverse recovery to reduce EMI
- ☑ High temperature stability
- ☑ Enables Energy Star 80+ compliance
- ☑ T_{rr}, Q_{rr} and I_{rr} comparable to industry
- ☑ Second-Source equivalent to industry standard 600V ultra-fast rectifiers

DIODESTAR™ DSR8V600



Industry standard ultra-fast



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DIODESTAR - More Information

Issue Number 001
September 2010

New Product Announcement

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DIODESTAR

DIODESTAR™ delivers the next generation 600V rectifier

DIODESTAR™ is a proprietary process platform from Diodes Incorporated for the manufacture of the next generation of high voltage rectifiers.

The DIODESTAR process generates rectifiers that are characterised by >400V voltage handling, soft recovery and ultra fast switching. The process will support the production of a range of high voltage rectifiers for a variety of end applications, including LCD-LED TV, notebook and desktop computers.

The first DIODESTAR products to be released are 600V rectifiers rated at 6, 8 and 15 Amps forward current. These are tailored for use as 600V diodes in the boost converter of Power Factor Correction (PFC) circuits. With the correct PFC design these rectifiers are appropriate for Boundary (BCM) and Continuous (CCM) Conduction Mode operation.

These high efficiency DIODESTAR rectifiers enable designers to comply with the stringent demands of the 80PLUS Energy Star requirements.

The DSR8V600 in particular is suitable for both single and dual PFC stages in Switched-Mode Power Supply (SMPS) up to 500W and 1,000W, respectively. The DSR8V600 is excellent as a PFC boost diode in the Line Independent Power Supply (LIPS) used in LCD LED-backlit TVs.

The Diodes' Advantage

The 600V DIODESTAR rectifiers have been tailored to the application of boost diode in the Power Factor Correction (PFC) stage of SMPS and LIPS.

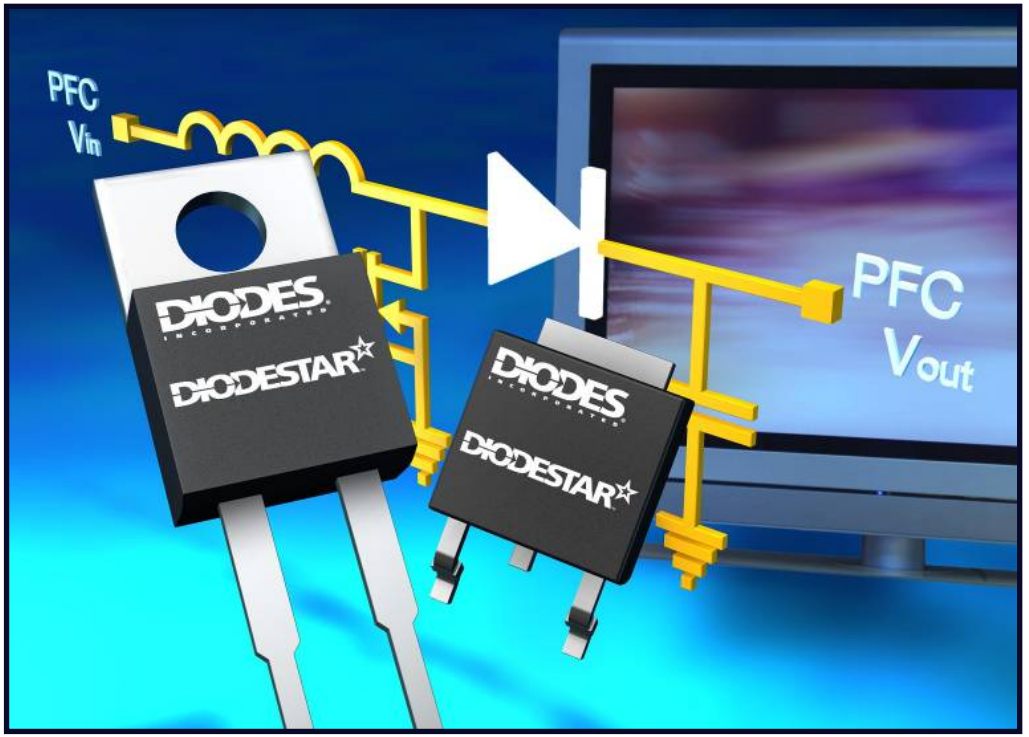
- **600V rectifier optimised for both BCM and CCM in PFC**
  The ultra-fast reverse recovery time (T_{rr} < 30ns) of the DIODESTAR gives optimised PFC performance in Boundary (BCM) and Continuous (CCM) Conduction Mode operation.
- **DIODESTAR enables compliance with energy efficiency legislation**
  For SMPS >70W or lighting >22W, then PFC must be integrated into the AC-DC conversion to conform with energy efficiency legislation. DIODESTAR enables compliance with Energy Star 80 PLUS and other efficiency standards.
- **Low EMI and high thermal stability**
  The best in class soft reverse recovery of the DIODESTAR rectifiers means reduced EMI noise from the PFC stage. Also, the DIODESTAR process gives high thermal stability.
- **Second source alternative**
  The 600V DIODESTAR rectifiers are a second source equivalent to industry standard ultra-fast 600V rectifiers.

Circuit Function

The PFC circuit is used in AC-DC SMPS to reduce the loading effects on the electrical mains by ensuring the AC voltage and current remain in phase.

- **Increased Efficiency**
  PFC stages improve the AC-DC efficiency conversion which means less energy is wasted and less heat is generated. Overall, this reduces the operational cost of running the equipment.
- **Increased Power Quality**
  Typical power supplies have low true power factor (0.5–0.6) that can cause the overheating of AC electrical main wires and transformers. With PFC stages inside power supplies, then these effects can be eliminated and more mains equipment can be operated from the same circuit without the need for costly infrastructure upgrades.

www.diodes.com



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