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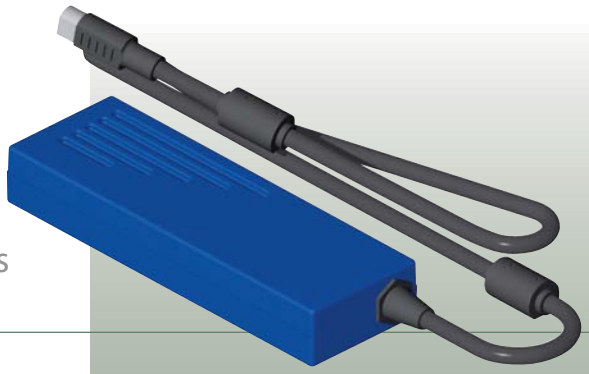
IPS102 Critical Conduction Mode, Power Factor Correction Controller

Self-Oscillating PFC Controller for Criticial Conduction Mode, Operation to 300kHz, >95% Power Factor and Efficiency With Voltage Control and Protection Features



Description

The IPS102 is a new Controller targeted for creation of Power Factor Corrected supplies in applications up to 200W. The IPS102 is designed for 'critical conduction' operation, as typically found in lower power systems. Such systems are implemented with smaller, lower power magnetic components, in turn reducing costs and increasing transient response capability in these supplies. Such ICs are being driven by the requirements that equipment sold into the European Market of 75W in power consumption and higher must comply with line harmonic, or power factor, requirements, (IEC Standard 71000-3-2). Such standards apply in Europe, as well as Japan and China.

Features include an asymmetric output drive stage allowing for faster turn off than turn on, with 20 Ohms pull down drive buffer resistance versus a pull-up resistance of 30 Ohms. The topology of this Critical Conduction Mode PFC is implemented using an internal multiplier circuit that controls the gating of the principal switching MOSFET, setting a peak allowable monitored switch current for the maximum on time in any switching event and a turn-off set to correspond to zero-inductor current. The levels of peak and minimum inductor current are set through current analog inputs to an internal circuit multiplier that sets the peak level in proportion to the line voltage, in combination with the monitoring of the output supply bus voltage.

Provision is made for connection of components for voltage mode compensation, as well as an internally generated 2.06V reference voltage. The reference is derived from the internal 10V shunt regulator, in turn connected to the control voltage input for start-up and input of an external control voltage. The IPS102 starts operation at about the 10V level, and will shut-off the IC with an under-voltage protection feature. Start-up power can be provided through an external resistor to the input line voltage or a current regulator, with steady state operating power best derived from an auxiliary inductor winding of the supply magnetic element for normal operation. Note that start-up and operating current, excluding drive current, of the IPS102 is very low, typically 100µA for start-up and 650µA for operation respectively. Additional protection features are included with the IPS102. Cycle-by-cycle current limiting is integrated by virtue of the cycle-by-cycle programmed limits on operating current from the power factor multiplier circuit. Thermal shutdown is included, shutting off when the junction temperature exceeds 150°C, resuming operation when the temperature drops to approximately 120°C.

Ordering Information for IPS102

Ordering PN(1)	Subgroup	Description	Temp. Range	Package	Packing Type	Packing Qty
IPS102 C-D-G-LF	Controller	PFC, Critical Conduction Mode	Commercial	8-Pin DIP	Tube	50
IPS102 I-D-G-LF	Controller	PFC, Critical Conduction Mode	Industrial	8-Pin DIP	Tube	50
IPS102 C-SO-G-LF	Controller	PFC, Critical Conduction Mode	Commercial	8-Pin SOIC	Tube	98
IPS102 I-SO-G-LF	Controller	PFC, Critical Conduction Mode	Industrial	8-Pin SOIC	Tube	98
IPS102 C-SO-G-LF-TR	Controller	PFC, Critical Conduction Mode	Commercial	8-Pin SOIC	13" T&R (2)	2500
IPS102 I-SO-G-LF-TR	Controller	PFC, Critical Conduction Mode	Industrial	8-Pin SOIC	13" T&R (2)	2500

(1) Only RoHS/Lead-Free Packaging is normally offered.
(2) T&R - Tape and Reel

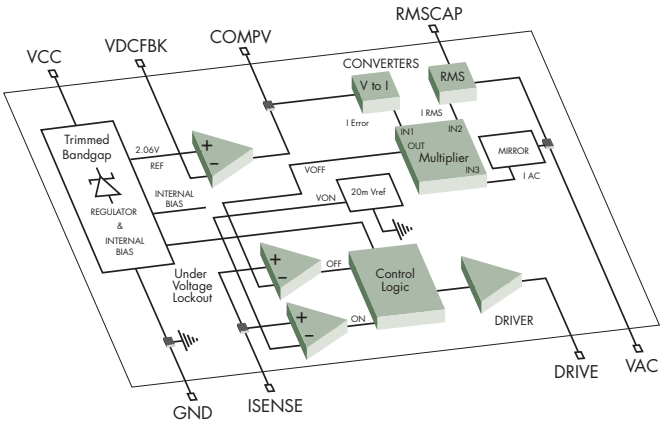
Features

- Three Input Multiplier for Critical Conduction Mode PFC Control (Line, Current and E/A Inputs)
- Reduced Switching Losses and EMI, Near ZVS MOSFET Switching
- Asymmetric Output Drive Stage for Self-Oscillating Drive Topology to 300kHz (30Ω Source, 20Ω Sink)
- Voltage E/A With Compensation Connection Pin
- Low Start-Up Current (100µA), Powered From 10V Internal Shunt-Regulator
- Under-voltage Provisions (10V Turn on, 1.4V to 2.1V Turn-off Hysterisis)
- Control Scheme Based on Cycle-by-Cycle Current Limit
- Thermal Shutdown (150°C Turn-off, 30°C Turn-on Hysterisis)
- Low Operating Current (650µA, Plus Drive Current)
- Design Kit Available for Qualified Designers (IPS-DK102)

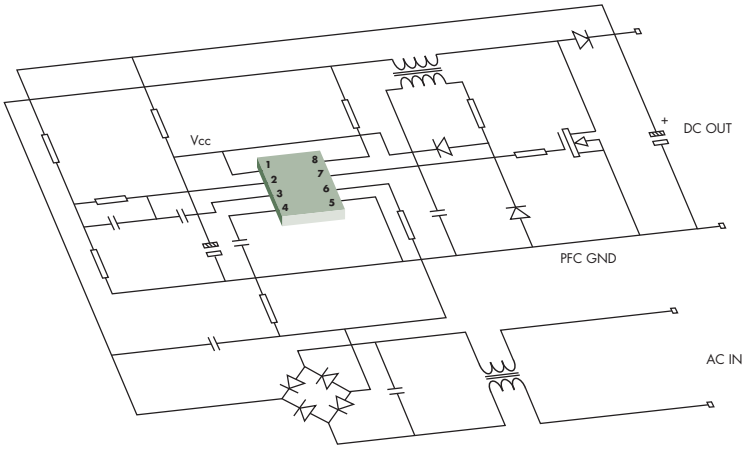
Application Examples

- Personal Computers
- Industrial Supplies
- Lighting
- Motor Controls
- Televisions, Video Displays

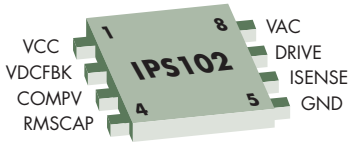
Block Diagram



Typical Application Circuit for IPS102



Pin Description



Signal	Description
VCC	IC supply pin. The circuit contains a shunt regulator that behaves like a 10V zener. During start-up the IC draws very little current. Operations start when the "zener" value is reached and stop when the VCC voltage becomes less than approximately 8V.
VDCFBK	Voltage feedback input pin. Negative input of the voltage error amplifier, while the positive input is internally connected to a 2.06V trimmed reference. It is used to regulate the voltage across the output capacitor to a value slightly above the maximum line peak voltage.
VCOMP	Voltage loop compensation pin. This is the output of the voltage error amplifier and is used for loop feedback compensation purposes. Also used as an optional feedback loop to regulate the output of a DC/DC converter fed by the PFC controller (see Application Note, AN102.pdf).
RMSCAP	RMS capacitor pin. The capacitor connected between this pin & GND generates a current proportional to the RMS value of the AC line voltage which feeds the multiplier circuit to maintain the loop gain constant at different line voltages thus preventing loop instabilities which could occur with other arrangements.
GND	Ground pin. This pin must be connected to the PFC module ground.
ISENSE	Inductor current sensing pin. This pin is used to measure the current flowing through the inductor which is forced by the PFC controller to be proportional to the instantaneous AC line voltage. The power MOSFET is automatically driven in a self-oscillating mode to restart a new cycle when the current in the inductor has dropped to near zero.
DRIVE	MOSFET gate drive pin. The internal buffer connected to this pin can drive a broad variety of power MOSFETs and IGBTs. A series resistor is sometimes added to improve the EMI signature.
VAC	AC voltage pin. This pin is used to sense the instantaneous AC line voltage through a series resistor that performs a voltage to current conversion. The resulting current feeds the internal multiplier.

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