Control IC Simplifies HID Ballast Design

International Rectifier’s IRS2573DS controller IC simplifies the design of electronic ballasts for high-intensity discharge (HID) lamps, replacing existing solutions requiring four or more chips with two-chip designs. The 600-V electronic ballast control IC combines a high-side, dual-mode buck controller with a full-bridge driver as well as the control and protection circuitry required to drive the lamp (Fig 1).

The chip was developed in response to customer requests for a simpler HID ballast design solution, which would make it easier for those who currently design fluorescent lamp ballasts to begin designing the more-complex HID ballasts. Tom Ribarich, IR’s director, Lighting Systems and Applications, Energy Saving Products Business Unit, says the company’s experience in supporting existing HID ballast designs gave IR the knowledge of application requirements needed to develop an integrated solution.

IR’s chips are among those currently used to implement four-chip HID ballast designs based on a three-stage topology (Fig 2). With the introduction of the IRS2573DS, the same three-stage topology can be implemented with just two chips (Fig. 3).

The IRS2573DS integrates a buck controller and full-bridge driver along with the functions typically performed by an MCU. These functions include the multiplier, ignition control, and fault detection. The IRS2573DS’s novel buck circuitry enables continuous-conduction mode control during lamp warm-up and critical-conduction mode control during steady state operation of the lamp. The full-bridge driver includes all high- and low-side gate driver outputs as well as integrated bootstrap MOSFETs for the high-side supply voltages.

Scalable for different lamp power levels and different HID lamp types, the IRS2573DS is designed for use in low-, medium- and high-power general-purpose industrial HID applications. These include retail store spotlights, general outdoor lighting applications and outdoor street lighting.

“Controlling HID lamp power within an accurate window has traditionally presented a complex design challenge. By offering complete HID electronic ballast system know-how in a chip, the highly integrated, feature-rich IRS2573DS allows companies that already have a market presence in lighting to enter the HID market very rapidly with minimal know-how,” says Ribarich. “Furthermore, by integrating a large portion of the HID ballast system circuitry into a single device, overall system cost can be greatly reduced.”

The IRS2573DS offers a high degree of flexibility and programmability. The device incorporates a state machine for controlling the lamp during various operating modes including ignition, warm-up, running and fault mode, and features a multiplier circuit to accurately measure and control lamp power. On-chip fault protection detects numerous lamp faults including open circuit, short circuit, failure to ignite, failure to warm-up, and lamp end-of-life fault conditions.

The chip also provides a lamp ignition enabler and timer. Additional specifications are shown in the table. The IRS2573DS is offered in a 28-pin SO28-WB package. Support materials include a datasheet, an application note (both are available at www.irf.com) and reference design kits. Pricing for the IRS2573DS begins at $2.50 each in quantities of 10,000-units and the reference design costs $250 per kit.
Fig. 1. An electronic ballast control IC, the IRS2573DS integrates a 600-V buck controller, 600-V full bridge, and all the lamp control circuitry (minus the PFC) required for driving HID lamps in low-, medium- and high-power applications.

Fig. 2 Existing HID Ballasts based on a three-stage topology require a minimum of four chips: a PFC controller, a buck controller, a microcontroller, and a full-bridge driver. In this approach, the MCU performs the multiplier, fault detection, and ignition control functions. Note that in some applications, customers have chosen to use two-half bridge driver ICs instead of a full-bridge driver, resulting in a 5-chip ballast design.
Fig. 3. The IRS2573D replaces three of the four chips employed in existing, 3-stage HID ballast designs (as shown in Fig. 2), resulting in a 2-chip solution. Note that PFC control was not integrated because it is physically located away from the other functions and depending on the power level, different PFC circuits can be used.

Table. Key specifications for the IRS2573DS.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Offset Voltage (V)</th>
<th>Output Voltage (V) Max.</th>
<th>Output Source Current (mA)</th>
<th>Output Sink Current (mA)</th>
<th>Deadtime (µsec)</th>
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<tbody>
<tr>
<td>IRS2573DS</td>
<td>SO28-WB</td>
<td>600</td>
<td>15.6</td>
<td>180</td>
<td>260</td>
<td>1.0</td>
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</tbody>
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