Microcontrollers for Fluorescent and High Intensity Discharge Lamp Ballasts

SMARTER, MORE FLEXIBLE LIGHTING SOLUTIONS

Developed together with the industries leading lamp ballast manufacturers, Atmel® microcontrollers are optimized for Linear and Dimmable Fluorescent tubes, as well as High Intensity Discharge (HID) ballasts. Their dedicated features allow for truly intelligent lighting networks, resulting in energy savings.
Regulation passed by the U.S. Department of Energy and the ballast directives adopted by the European Community have urged the lighting industry to shift towards the use of more efficient, energy-saving products, such as the electronic ballast.

The electronic ballast is an efficient electrical device that supplies a controlled current to start and run fluorescent and high intensity discharge (HID) lamps. As electronic ballasts are steadily becoming smaller, smarter and more flexible, they are poised to control the market.

Both fluorescent and HID lamp ballast applications will show improved performance, flexibility and cost advantages when using Atmel microcontrollers over currently available solutions.

**MARKET LAMP BALLAST**

**Atmel Lamp Ballast MCU Offering**

**For Non-dimmable Applications**
Developed in partnership with a leading fluorescent tube manufacturer, the AT83EB5114 is a highly integrated and optimized microcontroller designed to drive fluorescent lamp ballasts.

**AT90PWM**

**AT83EB5114**

**ATAVRFBKIT Ballast Demo Kit**

The AT89RFD-10 Ballast Demo Kit using AT89EB5114 to operate both PFC and lamp inverter control. Complete C code can be updated to implement advanced control and protection algorithm in the micro memory.

**Main features:**
- Universal Input Voltage: 90-256VAC
- Two lamps, type T8, 18W

**PFC Operation:**
- High power factor >0.95
- Low harmonic distortion <10%

**For Dimmable and HID Applications**

The AT90PWM AVR®-based microcontroller has been specially developed to handle High Intensity Discharge (HID) ballasts and ballasts for dimmable fluorescent lamps.

**ATAVRFBKIT Ballast Demo Kit**

The ATAVRFBKIT is a Dimmable Fluorescent Ballast kit which demonstrate the ability of the AT90PWM2 to control all the main functions of a DALI Fluorescent Ballast. C code is provided to speed-up development time.

**Main features:**
- Universal Input Voltage: 90-256VAC
- Two lamps, type T8, 18W

**PFC Operation:**
- High power factor >0.95
- Low harmonic distortion < 10%
- Low standby power <600mW

**Dimming controls:**
- DALI
- 0-10V analogue
- One Touch "Swiss" control
The AT83EB5114 and AT90PWM ICs offer in a single package all the features needed in a linear or dimmable fluorescent tube ballast, as well as in a HID ballast. They enable lighting products with increased performance and efficiency, resulting in cost benefits and efficient housing.

**Embedded EEPROM**
- Stores the tube wattages and parameters
- Allows for tube wattage detection and tube parameter adjustment
- Same ballast can be used for many types of lamp

**Optimized Analog Blocks**
- 10-bit ADC
- Analog comparator
- Amplifier/Rectifier
- DAC
- 64 MHz PLL for PWM generation

**Integrated Power stage Controllers (PSC)**
- Manages Power Factor Correction, ballast control and voltage control.
- Offers a higher resolution mode to the dimmable fluorescent lamp ballast

**Reduction of Ballast Component Count**
- Factory calibrated RC oscillator, avoiding the use of expensive crystals
- Integrated amplifiers

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**Supports DALI Protocol**
- High energy savings
- Extraordinary flexibility
- User control
- Maintenance benefits
<table>
<thead>
<tr>
<th>Memory</th>
<th>CS1</th>
<th>AT8xEB5114</th>
<th>AT90PWM1</th>
<th>AT90PWM2</th>
<th>AT90PWM3</th>
<th>AT90PWM216</th>
<th>AT90PWM316</th>
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</thead>
<tbody>
<tr>
<td>Flash (KB)</td>
<td>4</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>16</td>
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<td>ROM (KB)</td>
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<tr>
<td>EEPROM (bytes)</td>
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<td>512</td>
<td>512</td>
<td>1024</td>
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<tr>
<td>RAM (bytes)</td>
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<td>1024</td>
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### In-system Programming Capability

<table>
<thead>
<tr>
<th>On-chip Peripherals</th>
<th>CS1</th>
<th>AT8xEB5114</th>
<th>AT90PWM1</th>
<th>AT90PWM2</th>
<th>AT90PWM3</th>
<th>AT90PWM216</th>
<th>AT90PWM316</th>
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</thead>
<tbody>
<tr>
<td>PWM Channels</td>
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<tr>
<td>10-bit ADC</td>
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<td>11-channel</td>
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<td>11-channel</td>
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<td>Analog Comparator</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Amplifier</td>
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<td>Yes</td>
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<tr>
<td>10-bit DAC</td>
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<td>–</td>
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<tr>
<td>Temperature Sensor</td>
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<td>–</td>
<td>–</td>
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<tr>
<td>DALI/UART</td>
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<td>Yes</td>
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<td>RC Oscillators</td>
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### Available Versions

<table>
<thead>
<tr>
<th>Power Supply (V)</th>
<th>CS1</th>
<th>AT8xEB5114</th>
<th>AT90PWM1</th>
<th>AT90PWM2</th>
<th>AT90PWM3</th>
<th>AT90PWM216</th>
<th>AT90PWM316</th>
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</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>3.0 - 3.6</td>
<td>2.7 - 5.5</td>
<td>2.7 - 5.5</td>
<td>2.7 - 5.5</td>
<td>2.7 - 5.5</td>
<td>2.7 - 5.5</td>
<td>2.7 - 5.5</td>
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</table>

### Applications

- Fluorescent Tube
- Low-end HID lamp
- Dim. Fluor. Lamp
- HID Lamp
- DALI Control box
- High-end HID Lamp
- DALI Control box
- High-end Dim. Fluor. Lamp
- HID Lamp

### Development Tools

A complete development package is available to help designers develop their new applications. It includes evaluation and debug tools.

- **AT90PWMx**
  - STK®500 Starter Kit, STK520 Expansion Module, JTAGICE mkII Emulator,
  - DALI Controlled Dimmable Fluorescent demo-kit (ATAVRFBKIT)

- **AT8xEB5114**
  - Non Dimmable Fluorescent demo-kit (AT89RFD-10)
  - Third party Emulators, Compilers and Programmers.

Support: [avr@atmel.com](mailto:avr@atmel.com)