High Efficiency Precision LED Controller

**ABK36V1A1**

**FEATURES**
- High Efficiency: 90% typical
- No Heat Sink Required
- High Current without Heat Sink: 1A
- High Absolute Accuracy: <0.5%
- High Stability: ± 5mA@1A
- High Modulation Speed: 10 KHz
- Current Adjustable or Fixed Versions
- Compact Size
- Low Cost

**APPLICATIONS**
- General lighting
- Dynamo, pharos, electric torch
- Safety lamp, street lamp, signal lamp

**DESCRIPTION**
ABK36V1A1 is a high performance, high efficiency, and high intensity LED constant current controller. It is designed to maximize performance for lighting LED applications. The output current can be adjusted by using an internal resistor or external resistance circuit from 0A to 1A. Its precision can be up to 0.5%. The current fluctuation doesn’t exceed ±5mA. It has built-in 2A over-current protection circuit, thermal shutdown circuit, under-voltage lockout circuit, automatic temperature compensation circuit, and so on. The output current is stable by adjustment of automatic temperature compensation circuit within -25℃ to 85℃. The efficiency is up to 90%, which can greatly extend the battery life for lighting circuit by charged power. The controller operating input/output voltage range for multiple serial LEDs is widely, which can allow users the cost much lower. The LED controller has a micropower shutdown mode, which is very convenient for users. Shutdown is enabled by applying a logic high to the SDN pin.

**SPECIFICATIONS**
- Output current: 0 to 1A
- Input voltage: 4.5V to 36V
- Output voltage: 2.8V to Vps – 1V (Vps is the power supply voltage)
- Efficiency: 90% typical
- Operating temperature: -40℃ to 125℃

**PIN CONFIGURATION AND FUNCTION DESCRIPTIONS**
The ABK36V1A1 pin configuration is shown in figure 1. The pin function descriptions are shown in table 1.

![Figure 1. ABK36V1A1 Pin Configuration](image)

**Table 1 Pin Function Descriptions**

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Meaning</th>
<th>Type</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LDA</td>
<td>LED anode</td>
<td>Analog output</td>
<td>Connected to LED’s anode.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>LDC</td>
<td>LED cathode</td>
<td>Analog output</td>
<td>Connected to LED’s cathode.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground</td>
<td>Power Ground</td>
<td>Connect all control signal related ground to here.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>VPS</td>
<td>Power supply voltage</td>
<td>Power input</td>
<td>Connect them to the positive terminal of the power supply.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>VREF</td>
<td>Voltage reference</td>
<td>Analog output</td>
<td>Voltage reference of the DAC,3.3V±2%.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>LIS</td>
<td>Current limit set</td>
<td>Analog input</td>
<td>Sets the current limit.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>Ground</td>
<td>Ground</td>
<td>Connected internally to pin3.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Ground</td>
<td>Ground</td>
<td>Connected internally to pin3.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>SYNC</td>
<td>Synchronization</td>
<td>Digital input</td>
<td>This serves as synchronization input port.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SDN</td>
<td>Shut down</td>
<td>Digital input</td>
<td>Sets this pin high will shuts down the whole controller.</td>
<td></td>
</tr>
</tbody>
</table>
ABK36V1A1
High Efficiency Precision LED Controller

OPERATION PRINCIPLE
Figure 2 is the block diagram and external application circuit of the LED controller.

APPLICATION CIRCUITS
Figure 3 shows a typical stand-alone application schematic.
Figure 4 shows a typical micro-processor-based application.

ABK36V1A1 is a high performance, high efficiency, LED controller. The output current can be set by using an internal resistor, external resistance circuit (Figure 2) or external DAC (Figure 4). When the output current is set to 0.5A by using an internal resistor, it can also be adjusted from 0A to 1A, by setting input voltages of LIS from 3.3V to 0V.

If you use many an ABK36V1A1 in a system, all the SYNC (9-pin) can be connected together. In this system, each LED controller’s switching frequency is synchronal with the highest switching frequency. All the SYNC can be driven by external clock signal within 280 KHz to 500 KHz. The clock signal’s high level is from 2.5V to 3.3V, and low level is less than 0.74V. So the generated voltage fluctuation in the power and internal electronic components is the lowest.

The LED controller can be turned on and off by setting the SDN pin low and high respectively. As shown in figure 2. Turn on the LED controller by using the SDN pin connected to the GND pin, then turn on the S1 and pull the SDN pin down to logic low. Turn off the LED controller by using the SDN pin, then turn off the S1 and pull internally the SDN pin up to logic high. When the LED controller is in low-power consumption shutdown mode, the output current is 0A. The LED controller can also be controlled by setting externally digital signals to the enabled SDN pin. Turn on: the logic low voltage values are less than 0.8V, turn off: the logic low voltage values are more than 2.2V.

If the output current need be not set externally by the user, it can be used a very simple connection mode in figure 3. W1 is unconnected, the LIS pin is float. The output current can be adjusted by using an internal resistor in the LED controller.
The output current can be monitored in real time by measuring the voltage on the LDC pin. The formula is:

\[ I_{\text{output}} = \frac{V_{\text{LDC}}}{0.1V} \ (A) \]

For example, when seeing the LDC pin has a voltage of 0.1V, \( I_{\text{output}} = \frac{0.1V}{0.1V} = 1\) (A)

Figure 5 shows the measuring voltages of LDC schematic.

Use a high input impedance voltmeter or ADC to monitor the output current, such as >5K. Otherwise, some error will be introduced at the output current.

**TYPICAL PERFORMANCE CHARACTERISTICS**

![Efficiency vs. Vout, Iout = 350mA and Vin = Constant Values](image)

Figure 6. Efficiency vs. Vout, Iout = 350mA and Vin = Constant Values
Figure 7. Efficiency vs. Vout, Iout = 350mA and Vin = Constant Values

Figure 8. Efficiency vs. Vout, Iout = 700mA and Vin = Constant Values
Figure 9. Efficiency vs. Vout, Iout = 700mA and Vin = Constant Values

Figure 10. Efficiency vs. Vout, Iout = 1000mA and Vin = Constant Values
Figure 11. Efficiency vs. Vout, Iout = 1000mA and Vin = Constant Values

Figure 12. Iout vs. Vout, Iout = 350mA and Vin = Constant Values
Figure 13. I_{out} vs. V_{out}, I_{out} = 350mA and Vin = Constant Values

Figure 14. I_{out} vs. V_{out}, I_{out} = 700mA and Vin = Constant Values
Figure 15. $I_{out}$ vs. $V_{out}$, $I_{out} = 700\, mA$ and $V_{in} = $ Constant Values

Figure 16. $I_{out}$ vs. $V_{out}$, $I_{out} = 1000\, mA$ and $V_{in} = $ Constant Values
Figure 17. Iout vs. Vout, Iout = 1000mA and Vin = Constant Values

Figure 18. Efficiency vs. Vin, Iout = 350mA and Vout = Constant Values
Figure 19. Efficiency vs. Vin, Iout = 350mA and Vout = Constant Values

Figure 20. Efficiency vs. Vin, Iout = 700mA and Vout = Constant Values
Figure 21. Efficiency vs. Vin, Iout = 700mA and Vout = Constant Values

Figure 22. Efficiency vs. Vin, Iout = 1000mA and Vout = Constant Values
Figure 23. Efficiency vs. Vin, Iout = 1000mA and Vout = Constant Values

Figure 24. Iout vs. Vin, Iout = 350mA and Vout = Constant Values
Figure 25. Iout vs. Vin, Iout = 350mA and Vout = Constant Values

Figure 26. Iout vs. Vin, Iout = 700mA and Vout = Constant Values
Figure 27. Iout vs. Vin, Iout = 700mA and Vout = Constant Values

Figure 28. Iout vs. Vin, Iout = 1000mA and Vout = Constant Values
Figure 29. Iout vs. Vin, Iout = 1000mA and Vout = Constant Values

Figure 30. Controller Power Consumption vs. Vin, Iout = 350mA and Vout = Constant Values
Figure 31. Controller Power Consumption vs. Vin, Iout = 700mA and Vout = Constant Values

Figure 32. Controller Power Consumption vs. Vin, Iout = 1000mA and Vout = Constant Values
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ABK36V1A1

OUTLINE DIMENSIONS

Figure 33. TO-220 Type Package
ABK36V1A1 High Efficiency Precision LED Controller

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
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<tr>
<td>ABK36VFR35A1</td>
<td>Controller of fixed 0.35A output in TO-220 type package without wires</td>
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<tr>
<td>ABK36VFR35A1W</td>
<td>Controller of fixed 0.35A output in TO-220 type package with wires</td>
</tr>
<tr>
<td>ABK36VFR7A1</td>
<td>Controller of fixed 0.70A output in TO-220 type package without wires</td>
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<tr>
<td>ABK36VFR7A1W</td>
<td>Controller of fixed 0.70A output in TO-220 type package with wires</td>
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<tr>
<td>ABK36VF1A1</td>
<td>Controller of fixed 1A output in TO-220 type package without wires</td>
</tr>
<tr>
<td>ABK36VF1A1W</td>
<td>Controller of fixed 1A output in TO-220 type package with wires</td>
</tr>
<tr>
<td>ABK36V1A1</td>
<td>Controller of adjustable 1A output in TO-220 type package without wires</td>
</tr>
<tr>
<td>ABK36V1A1W</td>
<td>Controller of adjustable 1A output in TO-220 type package with wires</td>
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PRICES

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<th>200 – 499</th>
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<td>$13.3</td>
<td>$12.6</td>
<td>$11.9</td>
<td>$11.2</td>
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<tr>
<td>ABK36VF1A1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ABK36VFR35A1</td>
<td>$14.5</td>
<td>$13.8</td>
<td>$13.0</td>
<td>$12.3</td>
<td>$11.6</td>
</tr>
<tr>
<td>ABK36VFR7A1</td>
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</tr>
</tbody>
</table>
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