

APPLICATION NOTE 3898

## Calculator Simplifies Programming the Burst Dimming Stagger on the DS3994 Cold-Cathode Fluorescent Lamp (CCFL) Controller

*Abstract: The DS3994 is a 4-channel controller for cold-cathode fluorescent lamps (CCFL) that backlight liquid crystal displays (LCDs) in TV and PC monitor applications. The device uses burst dimming to control the brightness of the lamps. A unique feature allows the start of the burst dimming sequence for each of the four channels to be staggered independently. A set of four nonvolatile registers allows the user to program the stagger for each channel. A calculator is available to help users determine the proper value for programming these registers. This application note describes the advantages of staggering the burst dimming, and how to access and use the calculator.*

### Advantages of Staggering the Burst Dimming

The ability to stagger the start of the burst dimming for each channel is especially important in applications where a large number of CCFL lamps are being driven. It is not uncommon to have 16 to 24 lamps used in a single LCD-TV application. With each lamp consuming 5W to 6W, this means a 24V inverter may be required to deliver up to 7A of current.

Without the ability to stagger the burst dimming, the DC power supply must ramp the current from 0A to 7A and then back to 0A at the burst dimming cycle rate which is usually between 100Hz and 300Hz. This action causes a heavy strain on the DC power supply. See **Figure 1**, where the total number of lamps has been split into four groups. A single-channel CCFL controller cannot stagger the start of the burst dimming for the lamps and, hence, all of the lamps turn on and off simultaneously, creating a heavy strain on the DC power supply.

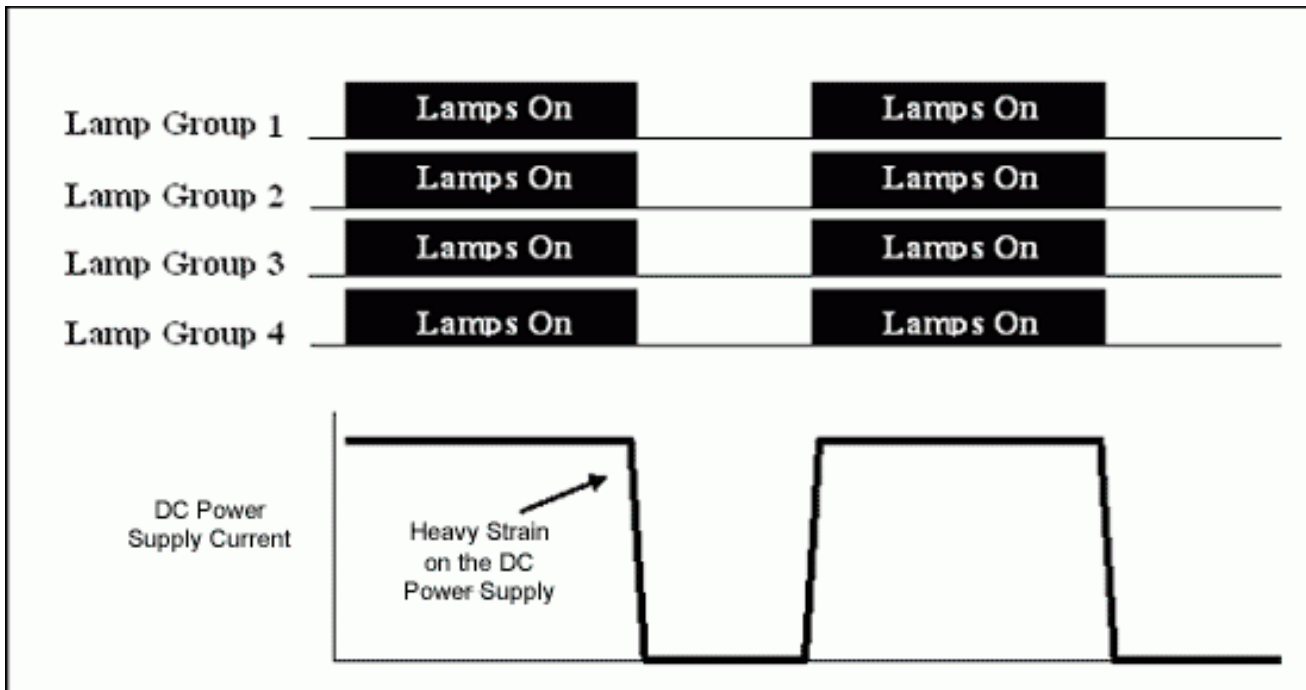


Figure 1. Application with no burst dimming stagger.

With the DS3994's four channels, the 16 to 24 lamps can be evenly divided into four groups. The start of the burst dimming sequence for each lamp group can thus be staggered to significantly reduce the strain on the DC power supply. See **Figure 2**.

Staggering the start of the burst dimming provides several advantages. It not only eases the strain on the DC power supply, but also allows the use of less bulk capacitance, thereby reducing system cost. It also reduces EMI and the possibility that the DC power supply could create audible noise.

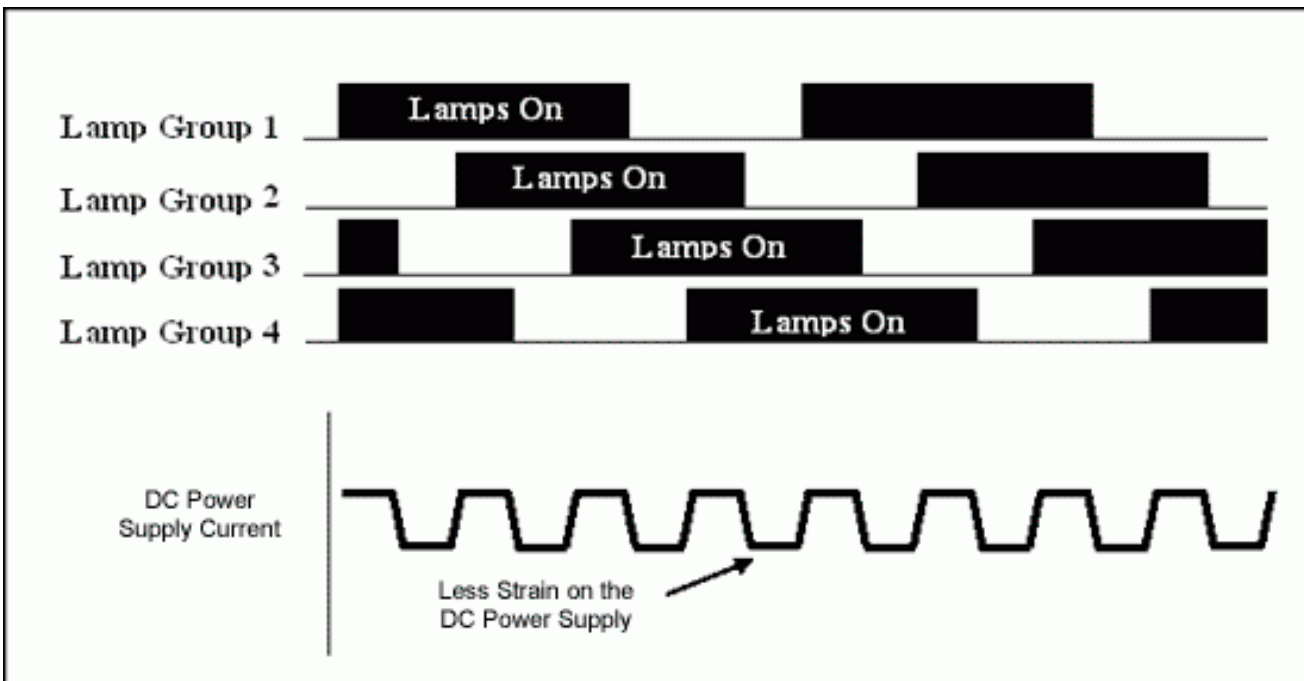


Figure 2. Application with burst dimming stagger.

## DS3994 Burst Dimming Stagger Calculator

At the ftp site listed below, there is a calculator available to help DS3994 users determine what values should be programmed into the Burst Dimming Stagger registers (BDS1 to BDS4). The calculator is an Excel spreadsheet in which the user inputs the lamp frequency, burst dimming frequency, and the desired burst dimming stagger. The calculator will output the values needed for programming. **Figure 3** shows the calculator.

[ftp://ftp.dalsemi.com/pub/system\\_extension/AppNotes/](ftp://ftp.dalsemi.com/pub/system_extension/AppNotes/)

The example shown in Figure 3 assumes that the lamp frequency is 60kHz, the burst dimming frequency is 120Hz, and the application requires an equal stagger on the four lamp groups. Once these values have been entered, the calculator will output the values (in hexadecimal) that should be programmed into the BDS1 to BDS4 registers. The BDS1 to BDS4 registers are nonvolatile in the DS3994, so the registers only need to be programmed once during the manufacturing process.

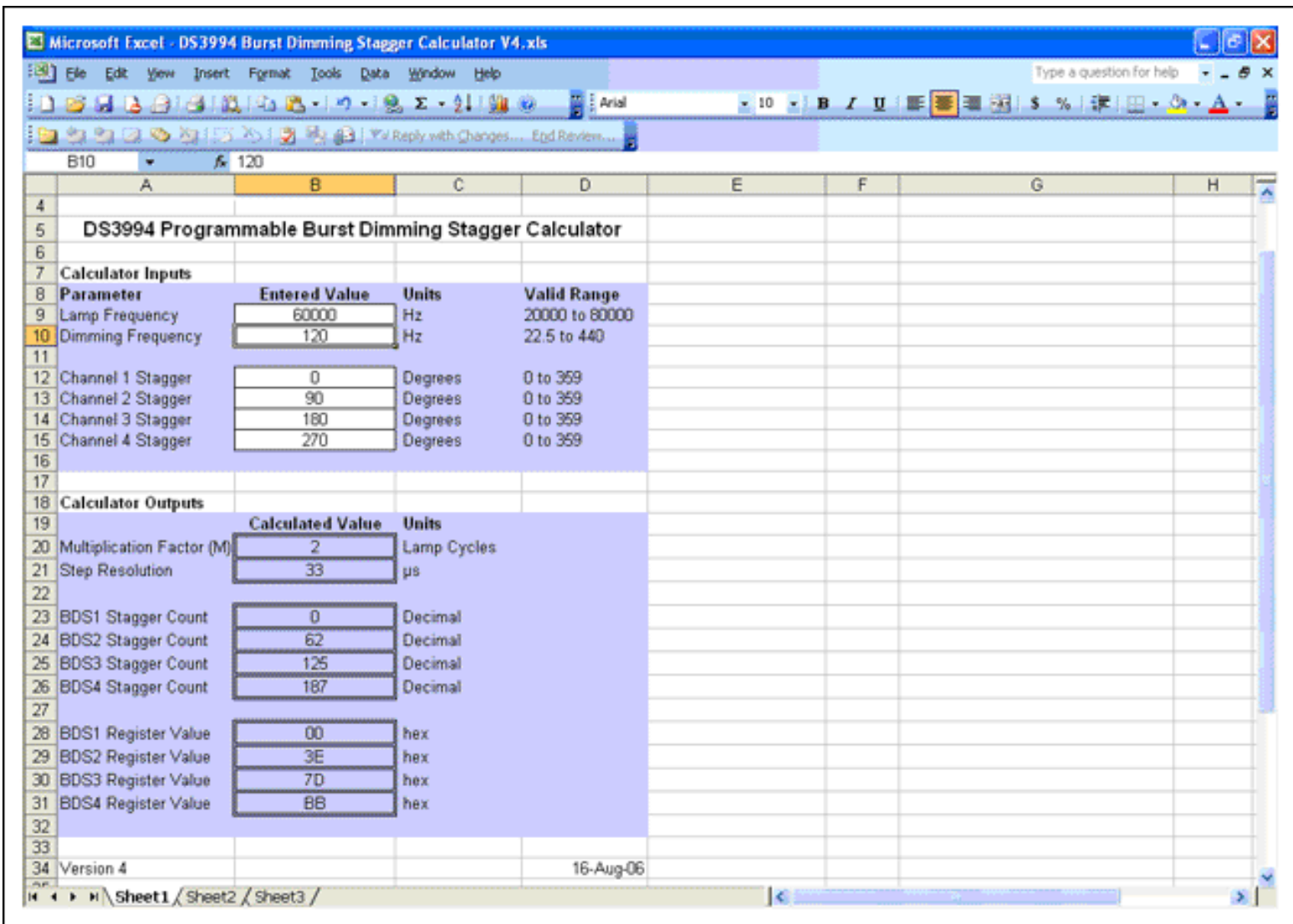


Figure 3. DS3994 burst dimming stagger calculator.

Application Note 3898: [www.maxim-ic.com/an3898](http://www.maxim-ic.com/an3898)

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