



[Maxim](#) > [Design Support](#) > [Technical Documents](#) > [Application Notes](#) > [Oscillators/Delay Lines/Timers/Counters](#) > APP 3692

[Maxim](#) > [Design Support](#) > [Technical Documents](#) > [Application Notes](#) > [Power-Supply Circuits](#) > APP 3692

[Maxim](#) > [Design Support](#) > [Technical Documents](#) > [Application Notes](#) > [Prototyping and PC-Board Layout](#) > APP 3692

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## APPLICATION NOTE 3692

# Frequency Calculator for the DS1090

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*Abstract: This application note presents an easy-to-use frequency calculator for determining the proper ordering option, discrete bias resistor selection, and input settings for the DS1090 low-frequency, resistor-programmable, spread-spectrum EconOscillator™. The DS1090 is capable of generating a spread-spectrum, square wave output between 125kHz and 8MHz. This spread-spectrum system function is important when EMI is a concern for the end application, such as a switched-mode power supply.*

## Need for the Calculator

The data sheet for the DS1090 shows: 1) how to select the proper ordering part number, 2) how to manually calculate the external bias resistor value necessary to achieve the desired output frequency, and 3) how to set the external pin connections to achieve the desired output modulation. The Frequency Calculator, however, is an intuitive, fast method for the user to experiment and reach an optimal solution with minimum effort.

## The Calculator

The DS1090 Frequency Calculator was developed using Excel® 97 and should function on any platform with Excel 97 (or any newer version). A screen shot of the calculator is shown in **Figure 1**.

**FREQUENCY CALCULATOR FOR THE DS1090**

**CENTER FREQUENCY**

1. Enter Desired Output Center Frequency (in kHz)  $f_{OUT}$    
*Note: Valid Frequencies are between 125kHz and 8000kHz*

**CALCULATIONS**

Ordering Part Number ("U" =  $\mu$ SOP package) 

Solution	
	DS1090U- 1

Master Oscillator Frequency (in kHz)  $f_{MOSC}$    
*Note: Range 4000kHz to 8000kHz*

Bias Resistor (in kohms)  $R_{SET}$

**SPREAD SPECTRUM**

2. Select Desired Dither Amount   
*Note: 0 = 0%, 2 = 2%, 4 = 4%, 8 = 8%*

3. Select Desired Dither Frequency   
*Note: 0 =  $f_{MOSC}/512$ , 1 =  $f_{MOSC}/1024$ , 2 =  $f_{MOSC}/2048$ , 3 =  $f_{MOSC}/4096$*

**INPUT PIN SETTINGS**

Dither Amount (J0 is LSB)  $J0$    
Dither Amount (J1 is MSB)  $J1$    
Dither Frequency (JC0 is LSB)  $JC0$    
Dither Frequency (JC1 is MSB)  $JC1$

Dither Frequency (in kHz)  $f_{MOD}$

Figure 1.

## User Inputs

The user must input, at the very minimum, the Item 1 value.

1. The first input is the Desired Output Frequency ( $f_{OUT}$ ), which is entered in kHz. Allowable frequencies range from 125.0kHz to 8000.0kHz. An error message will appear if an incorrect value is entered.

The Frequency Calculator will then present the DS1090 ordering information (specifying the correct divisor), Master Oscillator Frequency in kHz, and bias resistor ( $R_{SET}$ ) value necessary to achieve the desired output center frequency. The Master Oscillator Frequency ( $f_{MOSC}$ ) is displayed solely to assist the user in calculating the dithering frequency (Item 3), and is not part of the ordering information. Bias resistors will range in value from approximately 45k $\Omega$  to 91k $\Omega$ .

2. The second input is the Desired Dither Amount. If output dithering is not required, the default value of '0' corresponds to 0% (no dither). Note that the Dithering Frequency ( $f_{MOD}$ ) value shows "Disabled". Otherwise, the user should enter '2', '4', or '8' in the Item 2 box, representing the 2%,

4%, or 8% output frequency dithering range available. Resulting circuit connections for pins J0 and J1 are displayed in the INPUT PIN SETTINGS section of the calculator.

If the Desired Dither Amount is '0', skip Item 3 and connect pins J0, J1, JC0, and JC1 to ground as indicated. Do not float any of the four dither control input pins.

3. A valid nonzero entry in Dither Amount will also result in a display of the Dither Frequency in kHz. The last input is the Dither Frequency selection, and represents one of the four possible settings for the  $f_{MOD}$  calculation. The default is '0', corresponding to a dither frequency of  $f_{MOSC}/512$ . If a lower dithering frequency is desired, the user enters '1', '2', or '3', which correspond to the different frequencies shown in the calculator. Resulting circuit connections for pins JC0 and JC1 are displayed in the INPUT PIN SETTINGS section of the calculator.

## Interpreting the Results

Once the inputs are correctly entered, the Frequency Calculator presents the related frequency answers in kHz, the  $R_{SET}$  resistor value in  $k\Omega$ , and the pin connections as Logic 0 or 1 states.

## Conclusion

The Frequency Calculator allows the user to easily obtain correct values for ordering and pin connections to achieve the correct output frequency and dithering required from the DS1090.

Questions, comments, and suggestions concerning this application note can be sent to: [MixedSignal.Apps@dalsemi.com](mailto:MixedSignal.Apps@dalsemi.com).

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### Related Parts

[DS1090](#)

Low-Frequency, Spread-Spectrum EconOscillator

[Free Samples](#)

### More Information

For Technical Support: <http://www.maximintegrated.com/support>

For Samples: <http://www.maximintegrated.com/samples>

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