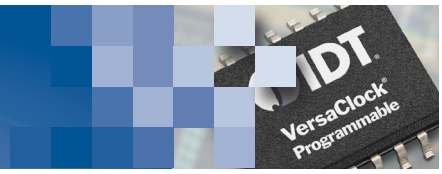

Design Tip: Spread Spectrum Clocking on IDT VersaClock® III

Description

The IDT® VersaClock® III is a programmable clock generator intended for high performance data-communications, telecommunications, consumer, and networking applications. There are four internal PLLs, each individually programmable, allowing for four unique non-integer-related frequencies. PLL0 and PLL3 support spread spectrum generation capability for electromagnetic interference (EMI) reduction. This design tip explains how to configure the spread spectrum on the VersaClock III.

Spread Spectrum Generation on PLL0

On the VersaClock III, PLL0 supports spread spectrum generation capability, which users have the option of turning on or off. The spread spectrum modulation frequency and spread amplitude are fully programmable. The programmable spread spectrum generation parameters are TSSC[3:0], NSSC[2:0], SS_OFFSET[5:0], SD[3:0] and X2 bits. The spread spectrum generation on PLL0 can be enabled/disabled using the TSSC[3:0] bits. To enable spread spectrum, set TSSC > '0' and set NSSC[2:0], SS_OFFSET[5:0], SD[3:0], and the A[3:0] (in the total M value) accordingly. To disable spread spectrum generation, set TSSC[3:0] = '0'.

Spread Spectrum Modulation Frequency

The modulation frequency (Fmod) can be calculated using equations Eq.1, Eq.2 and Eq.3 with the TSSC bits and NSSC bits. TSSC[3:0] is used to determine the number of phase/frequency detector cycles per spread spectrum cycle (ssc) steps. NSSC[2:0] is used to determine the number of delta-encoded samples used for a single quadrant of the spread spectrum waveform. All four quadrants of the spread spectrum waveform are mirror images of each other.

$$T_{ssc} = TSSC\,[3:0] + 2 \qquad (Eq.\ 1)$$

$$N_{ssc} = NSSC\,[2:0] \times 2 \qquad (Eq.\ 2)$$

$$F_{mod} = \frac{F_{pfd}}{4 \times T_{ssc} \times N_{ssc}} \qquad (Eq.\ 3)$$

Note 1: Valid TSSC integer values for the modulation frequency range from 5 to 14. Values of 0 - 4 and 15 should not be used.

Note 2: Valid NSSC integer values range from 1 to 6. Values of 0 and 7 should not be used.

Spread Spectrum Amplitude

Spread Spectrum Amplitude can be calculated using equation Eq.4 and Eq.6 with the SD0 bits, SD1 bits and NSSC bits.

SD0[3:0] and SD1[3:0] are used to determine the amplitude of the spread spectrum. These are delta-encoded samples of the waveform. The NSSC bits determine how many of these samples are used for the waveform. The sum of these delta-encoded samples (sigma delta-encoded samples) determines the amount of spread and should not exceed (63 - SS_OFFSET). The maximum spread is inversely proportional to the nominal M integer value.

X2 bit is used to double the total value of sigma-delta encoded samples which will increase the amplitude of the spread spectrum waveform by a factor of two. When X2 is '0', the amplitude remains nominal, but if set to '1', the amplitude is increased by x2.

$$\Delta\Sigma = NSSC\ [2:0] \times (SD_0 + SD_1) \times (X2 + 1) \qquad (Eq.\ 4)$$

$$SD_0 \geq SD_1\ [2:0] \times 2 \qquad (Eq.\ 5)$$

$$\pm Spread\ \% = \frac{100 \times \Delta\Sigma}{64 \times M} \qquad (Eq.\ 6)$$

Note: ±Spread% is amount of center spread.