PERICOM

Application Brief 20

PC Clock Offerings

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Introduction

This is the first document in a series of application briefs to be written on the PC clock solutions offered by Pericom Semiconductor. This application brief discusses an overview of the clock solutions offered by Pericom regarding the development of Intel processor-based PC systems. This brief should be used with the data sheets of each individual device. All devices discussed comply with Intel's CKDM-66 or CK97 specification. There are also Intel specs for the clock buffers known as CKBF and CKBF-M (M is for mobile computing applications). These devices generate all timing requirements for Pentium-I or Pentium II-based PC systems.

Pericom PC Clock Family

In a Pentium II-based PC system the PI6C100 and C180, 102/182, and 104/184 are companion clock management devices. The first device in the companion set is the clock generator, the second device is the clock driver.
In a PC system, the following clocks need to be generated:

- 2.5V CPU clock
- 3.3V reference clock
- I/O clock
- PCI clock
- 48 MHz clock (USB)
- 24 MHz Clock (Super I/O)

Summary of Pericom's Current PC Clock Offerings

Pericom Part #	Intel Spec.	# of 2.5V CPU Clock	#of 3.3V Ref. Clock	#of I/O Clock (APIC)	#of PCI CLOCK	#of 48MHz (USB Clock)	# of 24MHz (Super I/O)	Processor/ Chipset	Applications
PI6C100/ 180	CK100 CKBF	4	3	2	8	2		PentiumII/ BX440	Desktop PC or Servers. Supports dual processors. Spread spectrum implemented in the clock generator. Can support 66MHz or 100 MHz. The Clock driver supports 18 SDRAM clocks drivers. I2C interface to turn on/ off the clock drivers.
PI6C102/ 182	CK100-M CKBF-M	2	1	0	6	0		PentiumII/ BX-M	Suitable for mobile computer applications. Can support 66MHz or 100 MHz. Power down features. The buffers has 10 outputs to support SDRAM modules. I2C interface to turn on/off the clock drivers.
PI6C104/ 184	CK100 CKBF	2	1	0	7	1	1	PentiumII/ BX chipset	Desktop or single processor PC. Spread spectrum implemented in the clock generator. Can support 66MHz or 100 MHz.The Clock driver supports 18 SDRAM clocks drivers (4 DIMM applications). I2C interface to turn on/off the clock drivers.

The table below is the feature summary of Pericom's current PC clock offerings:

Pericom Part #	Intel spec.	# of 2.5V CPU Clock	#of 3.3V Ref. Clock	#of I/O clock (APIC)	#of PCI CLOCK	#of 48MHz (USB Clock)	#of 24MHz (Super I/O)	Processor/ Chipset	Applications
PI6C105/ 185	CK100-M CKBF-M	2	1		6	1	1	PentiumII/ BX-M	66/100 MHz operation. Power down mode. The buffers supports up to 4 SDRAM DIMMs. I2C interface to turn on/off the clock drivers.
PI6C671E /F	CKDM66 -M	4	3	1	7	1 or 2	1 or 2	Pentium/ PentiumII modules. TX-M	66/60 MHz operation. Spread Spectrum implemented. PDA/Portable applications. I2C interface to turn on/off the clock drivers.
PI6C9148 -02	CKD	4		1	7	1 or 2	1 or 2	Pentium TX-M	I2C interface to turn on/off the clock drivers. 6/8 SDRAM clocks.
PI6C651	CKDM66 -M	4	3	1	selectable	1	1	Pentium TX-M	

I^2C and Spread Spectrum

In a modern PC system there are many high-frequency clocks that are generated and driven. These high-speed clocks cause a significant EMI. To comply with the FCC and other governing body's requirements, several techniques are implemented to reduce this EMI. The circuit implementation of these techniques are called Spread Spectrum and I^2C.

Spread Spectrum

Conceptually, spread spectrum distributes the energy of the clock signals to wider harmonics of the fundamental frequency. This is accomplished by modulating the clock signal with a very low frequency signal and varying the output frequency within a prescribed range. (For example a 100 MHz peak frequency is down spread with a modulation rate 40 kHz). With a down spread of 0.5%, the output frequency of the clock will vary between 100 MHz and 99.5 MHz, within a period of 25µs. The output frequency will smoothly vary, within a period of 25 micro seconds, from 99.5 MHz to 100 MHz (and back down to 99.5 MHz). This reduces the peak energy level of the fundamental frequency. For PC systems, the modulating frequency is established between 30 kHz and 60 kHz. In PC motherboard applications, the CPU clocks and the PCI clocks of the clock generator are modulated but the fixed frequencies (the USB and SUPER I/O) are not. Generally the modulating frequency is selected by experimenting with the CPU and determining what what the CPU will tolerate.

There are two types of spread spectrum that are used to reduce EMI: center spread and down spread. In center spread, the center frequency is varied within a certain percentage. In down spreading, the energy is distributed over a band of center frequency and a lower side of the spectrum.

Note that spreading the spectrum of the clock does not affect the rise and fall time of the clock. Only the down spread is normally implemented since the design can meet the margin at lower frequency than at the higher frequency.

Also, there are two types of spreading techniques that are used: linear and non-linear. There are advantages for each type. In non-linear spread, the EMI is less than linear spread, but the frequency shift is unpredictable; where as for linear spread, the frequency shift is predictable. Pericom currently implements linear spread in its clock circuitry.

Figure 1 shows the variation of frequencies with time (modulation) for linear and nonlinear spread. Figures 2 and 3 show the actual waveform and energy distribution. Figure 4 shows the difference in peak energy with spread spectrum on and off.

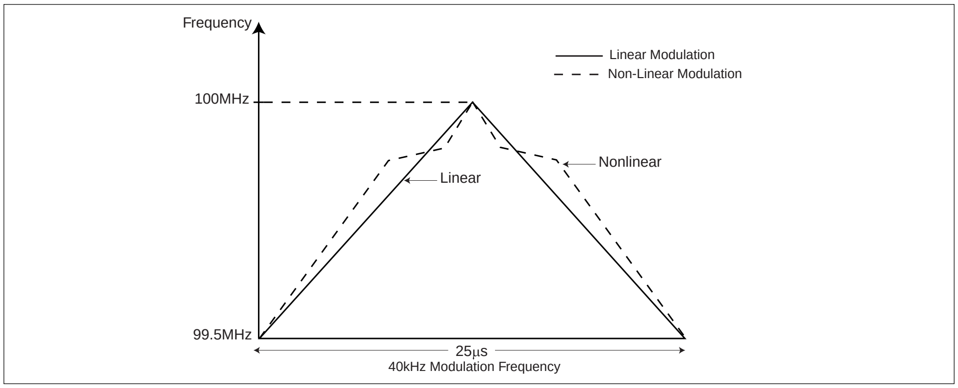

Figure 1. Variation of Frequencies.

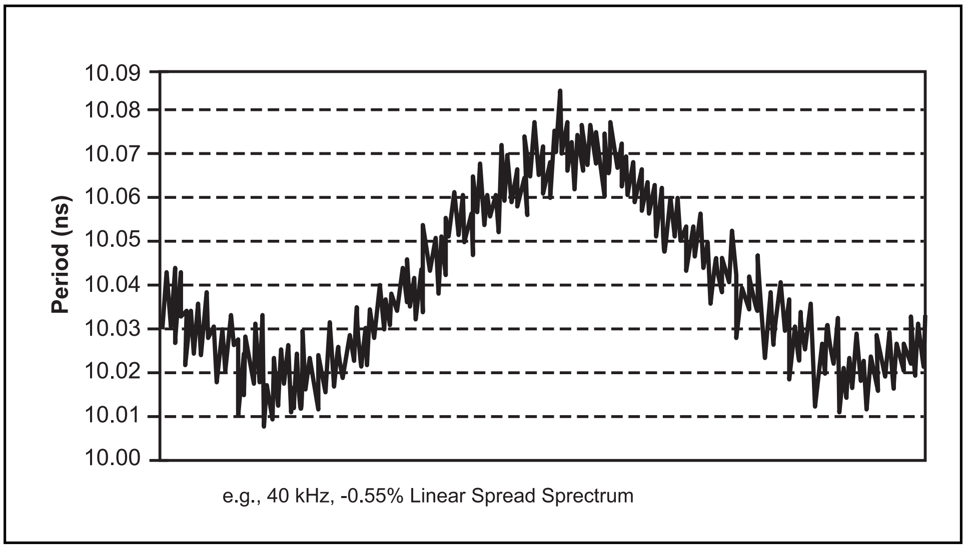

Figure 2. Actual Waveform

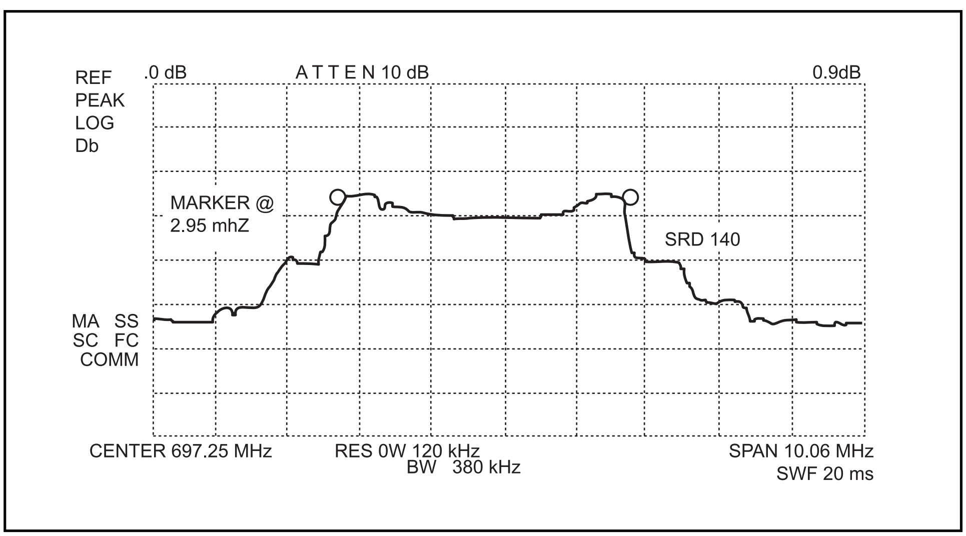

Figure 3. Energy Distribution

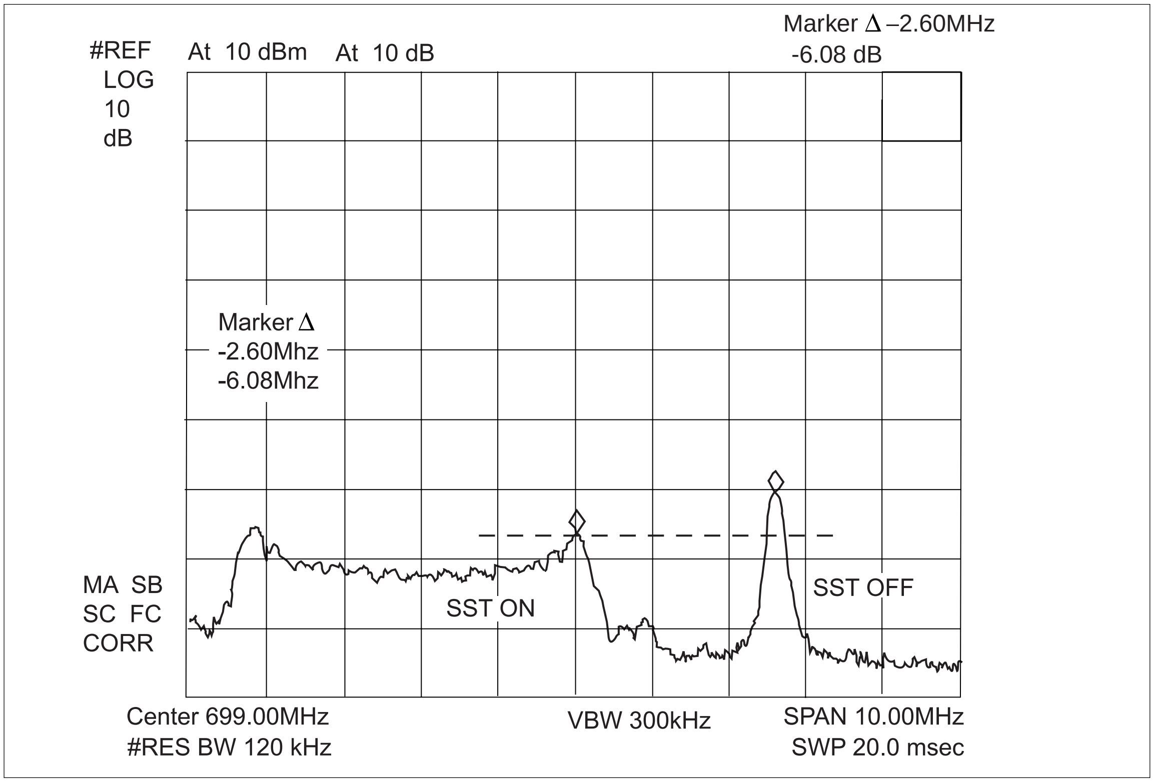

Figure 4. Difference in Peak Energy with Spread Spectrum On/Off

I^{2}C Interface

This is a patented interface licensed from Philips. I^{2}C is a serial interface where one byte of data when programmed in the device can be used to control outputs of the devices. In general this interface can be used to turn on /off outputs of clock drivers and clock generators. Turning off the unused outputs of clock drivers will reduce the EMI emissions. Sometimes I^{2}C is also used to enable/disable/select spread spectrum.

Pericom Semiconductor Corporation's clock drivers and generators implement spread spectrum and I^{2}C. Please refer to the data sheet to determine if this is implemented in a specific device.

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