

## COSMAC Elf 2000 80x25 Video Timing Calculations

### Character Timing

Pixel Clock	12.00000 MHz
Pixel Time	83.33 ns
Pixels per Character	8 pixels
Character Clock	1.50 MHz
Character Time	666.7 ns

### Line Timing

Characters per line	80 characters
Retrace Time	16 characters
Horizontal Total	96 characters
Line Time	64.00 us
Horizontal Frequency	15.63 kHz
Error	0.79% from 15.75 kHz

### Frame Timing

Lines per Row	10 scan lines per character row
Rows per Frame	24 character rows
Retrace Time	2 character rows
Vertical Total	26 character rows
Vertical Total	260 scan lines
Frame Time	16.64 ms
Vertical Frequency	60.10 Hz
Error	0.16% from 60.00 Hz

### CDP1802 DMA Overhead

1802 Clock Frequency	3.00 MHz
1802 Clock Period	333 ns
1802 Machine Cycle	2.67 us
Machine Cycles per Frame	6240 machine cy
DMA Characters per Frame	1920 characters
DMA Overhead	30.8%

### CDP1802 End of Row Interrupt Overhead

End of Row ISR	33 machine cy
Scrolling Overhead	10 machine cy
Total Overhead per Frame	802 machine cy
End of Row Interrupt Overhead	12.9%

### CDP1802 End of Frame Interrupt Overhead

End of Frame ISR	105 machine cy
End of Frame Overhead	1.7%

### Total Video Overhead

Total Overhead per Frame	2827 machine c
Total Overhead per Frame	45.3%
Effective Clock Speed	1.64 MHz

1.79

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