

VESA^Ò

Proposed Standard

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Coordinated Video Timings (VESA-CVT) STANDARD PROPOSAL

Revision 1, Draft 6

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Purpose

The purpose of this standard is to establish a consistent and coordinate set of standard formats, display refresh rates, and timing specifications for computer display products, both those employing CRTs and those using other display technologies. As a convenience, earlier industry standards are also documented here for reference purposes.

Summary

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STANDARD TIMINGS – 4:3 Aspect Ratio

Resolution	Frame Rate	Horizontal Frequency	Pixel Frequency	Horizontal Total	Vertical Total
640 x 480 (0.3 M)	50 Hz	24.7 kHz	19.750 MHz	800 Pixels	495 Lines
	60 Hz	29.8 kHz	23.875 MHz	800 Pixels	497 Lines
	75 Hz	37.5 kHz	30.625 MHz	816 Pixels	502 Lines
	85 Hz	42.8 kHz	35.625 MHz	832 Pixels	505 Lines
800 x 600 (0.5 M)	50 Hz	30.9 kHz	31.125 MHz	1008 Pixels	618 Lines
	60 Hz	37.2 kHz	38.125 MHz	1024 Pixels	622 Lines
	75 Hz	47.0 kHz	48.875 MHz	1040 Pixels	627 Lines
	85 Hz	53.5 kHz	56.500 MHz	1056 Pixels	630 Lines
1024 x 768 (0.8 M)	50 Hz	39.4 kHz	51.750 MHz	1312 Pixels	791 Lines
	60 Hz	47.7 kHz	64.125 MHz	1344 Pixels	795 Lines
	75 Hz	60.1 kHz	81.750 MHz	1360 Pixels	802 Lines
	85 Hz	68.5 kHz	94.250 MHz	1376 Pixels	807 Lines
1280 x 960 (1.2 M)	50 Hz	49.4 kHz	83.000 MHz	1680 Pixels	988 Lines
	60 Hz	59.6 kHz	102.000 MHz	1712 Pixels	994 Lines
	75 Hz	75.2 kHz	129.875 MHz	1728 Pixels	1002 Lines
	85 Hz	85.7 kHz	149.375 MHz	1744 Pixels	1008 Lines
1400 x 1050 (1.6 M)	50 Hz	54.0 kHz	99.750 MHz	1848 Pixels	1081 Lines
	60 Hz	65.2 kHz	122.500 MHz	1880 Pixels	1087 Lines
	75 Hz	82.2 kHz	155.875 MHz	1896 Pixels	1096 Lines
	85 Hz	93.7 kHz	179.125 MHz	1912 Pixels	1103 Lines
1600 x 1200 (1.9 M)	50 Hz	61.7 kHz	132.375 MHz	2144 Pixels	1235 Lines
	60 Hz	74.5 kHz	160.875 MHz	2160 Pixels	1242 Lines
	75 Hz	94.0 kHz	205.875 MHz	2192 Pixels	1253 Lines
	85 Hz	107.0 kHz	234.625 MHz	2192 Pixels	1260 Lines
1800 x 1350 (2.4 M)	50 Hz	69.4 kHz	168.250 MHz	2424 Pixels	1389 Lines
	60 Hz	83.8 kHz	204.500 MHz	2440 Pixels	1397 Lines
	75 Hz	105.7 kHz	261.250 MHz	2472 Pixels	1409 Lines
	85 Hz	120.4 kHz	299.625 MHz	2488 Pixels	1417 Lines
2048 x 1536 (3.1 M)	50 Hz	79.0 kHz	218.625 MHz	2768 Pixels	1580 Lines
	60 Hz	95.4 kHz	267.000 MHz	2800 Pixels	1589 Lines
	75 Hz	120.2 kHz	340.500 MHz	2832 Pixels	1603 Lines
	85 Hz	137.1 kHz	388.125 MHz	2832 Pixels	1612 Lines
2560 x 1920 (4.9 M)	50 Hz	98.7 kHz	346.000 MHz	3504 Pixels	1975 Lines
	60 Hz	119.2 kHz	421.375 MHz	3536 Pixels	1987 Lines
	75 Hz	150.3 kHz	533.750 MHz	3552 Pixels	2004 Lines
	85 Hz	171.3 kHz	611.125 MHz	3568 Pixels	2015 Lines

STANDARD TIMINGS – 5:4 Aspect Ratio

Resolution	Frame Rate	Horizontal Frequency	Pixel Frequency	Horizontal Total	Vertical Total
1280 x 1024 (1.3 M)	50 Hz	52.7 kHz	89.375 MHz	1696 Pixels	1054 Lines
	60 Hz	63.6 kHz	108.875 MHz	1712 Pixels	1060 Lines

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Resolution	Frame Rate	Horizontal Frequency	Pixel Frequency	Horizontal Total	Vertical Total
	75 Hz	80.2 kHz	138.500 MHz	1728 Pixels	1069 Lines
	85 Hz	91.3 kHz	159.375 MHz	1744 Pixels	1075 Lines

STANDARD TIMINGS – 16:9 Aspect Ratio

Resolution	Frame Rate	Horizontal Frequency	Pixel Frequency	Horizontal Total	Vertical Total
640 x 360 (0.2 MW)	50 Hz	18.4 kHz	14.750 MHz	800 Pixels	371 Lines
	60 Hz	22.3 kHz	17.875 MHz	800 Pixels	373 Lines
	75 Hz	28.1 kHz	22.500 MHz	800 Pixels	377 Lines
	85 Hz	32.2 kHz	25.750 MHz	800 Pixels	379 Lines
848 x 480 (0.4 MW)	50 Hz	24.6 kHz	26.000 MHz	1056 Pixels	495 Lines
	60 Hz	29.8 kHz	31.500 MHz	1056 Pixels	497 Lines
	75 Hz	37.6 kHz	40.875 MHz	1088 Pixels	502 Lines
	85 Hz	42.8 kHz	47.250 MHz	1104 Pixels	505 Lines
1024 x 576 (0.6 MW)	50 Hz	29.6 kHz	37.875 MHz	1280 Pixels	593 Lines
	60 Hz	35.7 kHz	46.875 MHz	1312 Pixels	597 Lines
	75 Hz	45.1 kHz	60.625 MHz	1344 Pixels	602 Lines
	85 Hz	51.4 kHz	69.125 MHz	1344 Pixels	605 Lines
1280 x 720 (0.9 MW)	50 Hz	37.0 kHz	60.375 MHz	1632 Pixels	741 Lines
	60 Hz	44.7 kHz	74.375 MHz	1664 Pixels	746 Lines
	75 Hz	56.4 kHz	95.625 MHz	1696 Pixels	752 Lines
	85 Hz	64.3 kHz	110.000 MHz	1712 Pixels	756 Lines
1600 x 900 (1.3 MW)	50 Hz	46.3 kHz	97.000 MHz	2096 Pixels	926 Lines
	60 Hz	55.9 kHz	118.875 MHz	2128 Pixels	932 Lines
	75 Hz	70.4 kHz	152.125 MHz	2160 Pixels	940 Lines
	85 Hz	80.3 kHz	174.750 MHz	2176 Pixels	945 Lines
1920 x 1080 (2.1 MW)	50 Hz	55.6 kHz	141.375 MHz	2544 Pixels	1112 Lines
	60 Hz	67.0 kHz	172.750 MHz	2576 Pixels	1118 Lines
	75 Hz	84.5 kHz	220.500 MHz	2608 Pixels	1128 Lines
	85 Hz	96.4 kHz	252.875 MHz	2624 Pixels	1134 Lines
2048 x 1152 (2.4 MW)	50 Hz	59.3 kHz	162.125 MHz	2736 Pixels	1186 Lines
	60 Hz	71.5 kHz	198.000 MHz	2768 Pixels	1192 Lines
	75 Hz	75.0 kHz	252.500 MHz	2800 Pixels	1203 Lines
	85 Hz	102.8 kHz	289.500 MHz	2816 Pixels	1210 Lines
2560 x 1440 (3.7 MW)	50 Hz	74.1 kHz	256.000 MHz	3456 Pixels	1482 Lines
	60 Hz	89.4 kHz	311.750 MHz	3488 Pixels	1490 Lines
	75 Hz	112.7 kHz	396.750 MHz	3520 Pixels	1503 Lines
	85 Hz	128.5 kHz	454.250 MHz	3536 Pixels	1512 Lines

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STANDARD TIMINGS – 16:10 Aspect Ratio

Resolution	Frame Rate	Horizontal Frequency	Pixel Frequency	Horizontal Total	Vertical Total
640 x 400 (0.26 MW)	50 Hz	20.5 kHz	16.375 MHz	800 Pixels	412 Lines
	60 Hz	24.8 kHz	19.875 MHz	800 Pixels	415 Lines
	75 Hz	31.3 kHz	25.000 MHz	800 Pixels	418 Lines
	85 Hz	35.7 kHz	29.125 MHz	816 Pixels	421 Lines
768 x 480 (0.37 MW)	50 Hz	24.6 kHz	23.625 MHz	960 Pixels	495 Lines
	60 Hz	29.8 kHz	28.625 MHz	960 Pixels	497 Lines
	75 Hz	37.6 kHz	37.250 MHz	992 Pixels	502 Lines
	85 Hz	42.8 kHz	42.500 MHz	992 Pixels	505 Lines
1024 x 640 (0.7 MW)	50 Hz	32.9 kHz	42.625 MHz	1296 Pixels	659 Lines
	60 Hz	39.7 kHz	52.750 MHz	1328 Pixels	663 Lines
	75 Hz	50.1 kHz	67.375 MHz	1344 Pixels	669 Lines
	85 Hz	57.1 kHz	77.625 MHz	1360 Pixels	672 Lines
1280 x 800 (1.0 MW)	50 Hz	41.2 kHz	68.500 MHz	1664 Pixels	824 Lines
	60 Hz	49.6 kHz	83.375 MHz	1680 Pixels	828 Lines
	75 Hz	62.6 kHz	107.250 MHz	1712 Pixels	835 Lines
	85 Hz	71.4 kHz	123.375 MHz	1728 Pixels	840 Lines
1600 x 1000 (1.5 MW)	50 Hz	51.4 kHz	108.625 MHz	2112 Pixels	1029 Lines
	60 Hz	62.1 kHz	133.125 MHz	2144 Pixels	1035 Lines
	75 Hz	78.3 kHz	169.125 MHz	2160 Pixels	1044 Lines
	85 Hz	89.2 kHz	194.125 MHz	2176 Pixels	1050 Lines
1920 x 1200 (2.3 MW)	50 Hz	61.7 kHz	158.000 MHz	2560 Pixels	1235 Lines
	60 Hz	74.5 kHz	193.125 MHz	2592 Pixels	1242 Lines
	75 Hz	93.9 kHz	246.500 MHz	2624 Pixels	1253 Lines
	85 Hz	107.1 kHz	282.625 MHz	2640 Pixels	1260 Lines
2048 x 1280 (2.6 MW)	50 Hz	65.8 kHz	181.125 MHz	2752 Pixels	1317 Lines
	60 Hz	79.5 kHz	221.250 MHz	2784 Pixels	1325 Lines
	75 Hz	100.2 kHz	280.500 MHz	2800 Pixels	1336 Lines
	85 Hz	114.2 kHz	321.625 MHz	2816 Pixels	1344 Lines
2560 x 1600 (4.0 MW)	50 Hz	82.3 kHz	285.750 MHz	3472 Pixels	1646 Lines
	60 Hz	99.3 kHz	348.000 MHz	3504 Pixels	1656 Lines
	75 Hz	125.2 kHz	442.750 MHz	3536 Pixels	1670 Lines
	85 Hz	142.7 kHz	507.000 MHz	3552 Pixels	1680 Lines

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REDUCED BLANKING TIMINGS

Aspect Ratio	Resolution	Frame Rate	Horizontal Frequency	Pixel Frequency	Horizontal Total	Vertical Total
4:3	640 x 480 (0.3 M-R)	60 Hz	29.6 kHz	22.750 MHz	768 Pixels	494 Lines
	800 x 600 (0.5 M-R)	60 Hz	37.0 kHz	34.375 MHz	928 Pixels	618 Lines
	1024 x 768 (0.8 M-R)	60 Hz	47.3 kHz	54.500 MHz	1152 Pixels	790 Lines
	1280 x 960 (1.2 M-R)	60 Hz	59.2 kHz	83.375 MHz	1408 Pixels	988 Lines
	1400 x 1050 (1.5 M-R)	60 Hz	64.8 kHz	99.000 MHz	1528 Pixels	1080 Lines
	1600 x 1200 (1.9 M-R)	60 Hz	74.1 kHz	128.000 MHz	1728 Pixels	1235 Lines
	1800 x 1350 (2.4 M-R)	60 Hz	83.3 kHz	160.625 MHz	1928 Pixels	1389 Lines
	2048 x 1536 (3.1 M-R)	60 Hz	94.8 kHz	206.250 MHz	2176 Pixels	1580 Lines
	2560 x 1920 (4.9 M-R)	60 Hz	118.5 kHz	318.500 MHz	2688 Pixels	1975 Lines
5:4	1280 x 1024 (1.3 M-R)	60 Hz	63.2 kHz	89.000 MHz	1408 Pixels	1054 Lines
16:9	640 x 360 (0.2 MW-R)	60 Hz	22.1 kHz	17.000 MHz	768 Pixels	371 Lines
	848 x 480 (0.4 MW-R)	60 Hz	29.6 kHz	28.875 MHz	976 Pixels	494 Lines
	1024 x 576 (0.6 MW-R)	60 Hz	35.5 kHz	40.875 MHz	1152 Pixels	593 Lines
	1280 x 720 (0.9 MW-R)	60 Hz	44.4 kHz	62.500 MHz	1408 Pixels	741 Lines
	1600 x 900 (1.4 MW-R)	60 Hz	55.6 kHz	96.000 MHz	1728 Pixels	926 Lines
	1920 x 1080 (2.1 MW-R)	60 Hz	66.7 kHz	136.500 MHz	2048 Pixels	1111 Lines
	2048 x 1152 (2.4 MW-R)	60 Hz	71.1 kHz	154.625 MHz	2176 Pixels	1185 Lines
	2560 x 1440 (3.7 MW-R)	60 Hz	88.8 kHz	238.750 MHz	2688 Pixels	1481 Lines
16:10	640 x 400 (0.3 MW-R)	60 Hz	24.6 kHz	18.875 MHz	768 Pixels	412 Lines
	768 x 480 (0.37 MW-R)	60 Hz	29.6 kHz	26.500 MHz	896 Pixels	494 Lines
	1024 x 640 (0.7 MW-R)	60 Hz	39.5 kHz	45.500 MHz	1152 Pixels	659 Lines
	1280 x 800 (1.0 MW-R)	60 Hz	49.4 kHz	69.500 MHz	1408 Pixels	823 Lines
	1600 x 1000 (1.6 MW-R)	60 Hz	61.7 kHz	106.625 MHz	1728 Pixels	1029 Lines
	1920 x 1200 (2.3 MW-R)	60 Hz	74.1 kHz	151.750 MHz	2048 Pixels	1235 Lines

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Aspect Ratio	Resolution	Frame Rate	Horizontal Frequency	Pixel Frequency	Horizontal Total	Vertical Total
	2048 x 1280 (2.6 MW-R)	60 Hz	79.0 kHz	171.875 MHz	2176 Pixels	1317 Lines
	2560 x 1600 (4.1 MW-R)	60 Hz	98.7 kHz	265.375 MHz	2688 Pixels	1646 Lines

Preface

Intellectual Property

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Revision History

Draft 1 October 12, 2000 Bob Myers
Initial

Draft 2 January 14, 2001 Bob Myers
Intermediate working draft

Draft 3 April 9, 2001 Bob Myers
Expanded to include all standard formats/rates defined at this point by Timings WG. Timing specification format set.

Draft 4 January 3, 2002 Graham Loveridge
Modified timing generation rules to enable timing to be generated using a modified GTF.

Draft 5 January 31, 2002 Graham Loveridge
Added summary tables, timing information and formulas.

Draft 6 May 2, 2002 Graham Loveridge

Changed clock resolution step to 0.125MHz, making it more compatible with video related sources using a 2.25MHz base clock. Limited horizontal blanking so that it is always $\geq 20\%$ to stop calculated front porch timing from going negative.

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1. OVERVIEW

1.1 Summary

1.2 Background

1.3 Standard Objectives

1.4 Reference Documents

- VESA Enhanced Extended Display Identification Data Standard – E-EDID, Release A, September 2, 1999
- VESA Enhanced Display Data Channel Standard - E-DDC, Version 1, September 2, 1999
- VESA Generalized Timing Formula Standard - GTF, Version 1.0, December 18, 1996
- VESA and Industry Standards and Guidelines for Computer Display Monitor Timings, Version 1.0, Rev. 0.8, September 17, 1998.

2. History and Rationale for Format & Timing Selection

2.1 Situation and Needs

The computer industry has, primarily due to the high degree of flexibility provided by the modern multi-frequency CRT display, traditionally employed a very wide range of display formats and timings even within a given individual system. This permits the system to adapt the display "on the fly" to the requirements of various applications, and also permits the user to adapt the system to a wide range of display-device formats, sizes, and technologies. However, to date the development of timing standards for these various combinations of formats and rates has not been done in any sort of coordinated manner – and so we have a number of various standard formats which do not interoperate well, and timings which cannot all be precisely produced by any given graphics system.

VESA first attempted to address this problem through the release of the Generalized Timing Formula (GTF) Standard in 1996; GTF defined a process whereby a given display device and host system could algorithmically determine a timing which would permit both to work together, reducing the need for explicit timing specifications to cover all possible cases. The GTF method works well on paper since it relies on being able to create a pixel frequency of infinite resolution. This, however, is not practical for real world applications where clock generators have a finite resolution. It also does not cater for an increasing market segment, such as video in a window, which requires the video timing to be precisely locked to an external image source.

Also, due to the increasing number of non-CRT, fixed-format display types in the market, there is a need for timing standards that specifically address the requirements of these technologies. CRT-compatible timings require higher pixel rates than would be required by these other display technologies due to large amount of blanking which is required for retrace. This, in most cases, represents wasted bandwidth and results in higher-than-needed clock rates.

In addressing these needs, though, it is important to keep in mind the fact that the computer graphics systems, which must produce video outputs to these specifications, are not infinitely flexible. In general, they cannot produce any arbitrary number of pixels per line, synthesize any given pixel clock exactly, and so forth. In addition, the problem of scaling information between different formats and rates says that we should not simply generate timings and formats as independent entities. Some thought should be given to the interoperability and compatibility within the chosen set, as well as to the ability of the graphics hardware to produce the specified timing.

This standard represents an attempt to address these needs in a single, coordinated effort by developing a set of rules for generating timing. The goal being to create a method by which display manufacturers and graphic hardware vendors can develop new products with enhanced compatibility and interoperability.

A set of standard formats is presented, along with a limited set of standard rates, and then timing specifications for each combination is given for both CRT and non-CRT displays, regardless of interface type. The goal being that any graphics hardware, if designed with these simple guidelines in mind, should be able to exactly produce any specified timing within its range.

2.2 Format Selection

It is not the intention of this document to impose a fixed set of standard formats. This document lists a compilation of timings, which are considered to be "industry standard" formats that the PC and display industry may adopt. In choosing these formats, the following basic guidelines were considered:

1. Whether or not the format is already an established industry standard. It is not our intention to completely re-write the set of formats already in use within the industry, even if in many cases this set is not optimized for interoperability (scaling, etc.). However, alternatives that do offer certain advantages over their older counterparts may also be provided, where appropriate, in the VESA standard set.

2. Standard formats should conform to the standard aspect ratios being used by the industry in the design of new display devices. At present, display devices are almost without exception being produced with physical screen dimensions providing a 4:3, 16:9, or 16:10 aspect ratio (or the portrait-format version of these). Image formats should, therefore, be selected to match these. Exceptions will be made only in the case of a long-established industry standard (e.g., the 1280 x 1024 format, which is a 5:4 aspect ratio), or in the case of a clear need.
3. Standard formats should be produced assuming “square” pixel aspect ratios, i.e., the number of pixels per unit distance, as the image is to be displayed, is the same in both the vertical and horizontal directions. Exceptions again will be made only in the case of existing, established standards (e.g., the 720 x 480 format used in the DVD, which is displayed as either a 4:3 or 16:9 image), but even in these cases “square” alternatives may also be provided.
4. The number of pixels per line in any format should be chosen to fall on reasonable boundaries, as the majority of graphics hardware does not permit programmability down to the pixel level. In other words, arbitrary horizontal pixel counts are to be avoided, in favor of values that are multiples of an acceptable base “character” size. In the past, this has been assumed to mean that horizontal active counts should at a minimum be multiples of 8 pixels; for larger formats, it may even be desirable to use larger increments. Further, these counts should be chosen so as to permit good interoperability/scaling between the members of the standard set. For instance, the 640 x 480 and 1280 x 960 formats provide very good interoperability, due to the simple 2:1 relationship between their pixel and line counts.

These guidelines should be considered when developing new formats as a way to limit the number of infinite possibilities and increase compatibility and interoperability.

2.3 The Standard Frame Rate Set

With the release of the GTF standard, there is less reason to produce explicit timing specifications for any and all frame, or “refresh”, rates. The real driving force behind standard rates at this time is compatibility with other established image sources and displays – such as television – and to permit the precise synchronization of multiple systems and/or displays while still operating at an ergonomically-acceptable rate. For this reason, the set of standard rates for which timing specifications should be developed will be somewhat restricted. It should be understood that requirements outside of these specific rates could still be addressed by the timing generation rules outlined in this document.

For the first release of this standard, the following frame rates will be used to define the standard set of timings:

- 50.00 Hz – This is a long-established standard rate in European television production and other areas using the PAL or SECAM television systems.
- 60.00 Hz – This rate is a long-established standard; it is reasonably compatible with the standard television field rate used in North America and Japan, and is expected to be one of the standard field/frame rates used under the U.S. digital television broadcasting standard. It is also compatible with 24 FPS film-sourced material, via the “3:2 pulldown” technique.
- 75.00 Hz – This rate maintains good compatibility/interoperability with systems at both the 60 Hz and 50 Hz standard video rates, while providing more ergonomically acceptable performance in many display types. 75 Hz operation is also compatible with film-sourced material produced under the European 25 FPS standard.
- 85.00 Hz – While not a “video-friendly” rate, 85 Hz has become a de-facto standard for PC displays wishing to meet the strictest ergonomic requirements for a “flicker-free” image. At this rate, the typical CRT-based computer display, under standard viewing conditions, will appear “flicker-free” to greater than 95% of the population.

2.4 Rules for Timing Generation

In order to meet the goal of interoperability within the set of timing specifications established here, and with other established standards, the following rules, presented here in order of priority, have been used in the generation of the preferred VESA standard timings given in Section 5 of this standard. Section 4 details the computational steps involved to use these rules to generate timing for a given format.

1. **Pixel Clock Selection** – Due to the finite precision of modern clock synthesis circuitry, the pixel clocks used will all be members of a specified set, in this case integer multiples of 0.125 MHz. The only exception to this is when there is a need to lock the video timing to an external source, such as video in a window application. In these instances, the pixel clock rate shall be derived from the external source. See section 2.5 for more details.
2. **Frame Rate** – The Standard Frame Set is listed in section 2.3. Although other frame rates are not prohibited, it is strongly advised that one be chosen from the standard set. Due to pixel clock rounding, as described in item 1 above, the actual frame rate will be within +/-0.5Hz of the desired frame rate. For applications that are locked to an external video source, such as video in a window, the actual frame rate should be derived from the external source, see section 2.5 for more details. For Reduced Blanking timings, the preferred refresh rate is 60Hz. This frame rate is considered fast enough to eliminate motion artifacts without increasing the signal bandwidth (pixel clock) unnecessarily. In addition, a substantial amount of the non-CRT market has spent considerable effort optimizing display devices for 60Hz. Although 60Hz is preferred, it does not exclude other frame rates from existing
3. **Horizontal counts** – All definitions referring to the horizontal timing, including the horizontal active pixels, horizontal total pixels, sync pulse duration and “front porch” and “back porch” times, must be divisible by 8, and preferably by higher powers of 2.
4. **Blanking Times**
 - a) **"CRT" Timing** – For the case of "CRT" timing, the horizontal blanking shall be calculated using GTF. Default parameters of M = 600, C = 40, K = 128 and J = 20 shall be used and the vertical blanking shall exceed a minimum requirement of 500 microseconds. To ensure that the calculated value of the front porch does not go negative, the calculated blanking percentage shall be limited such that is always greater than or equal to 20%.
 - b) **Reduced Blanking** – For the case of Reduced Blanking timings, the blanking time is reduced to provide a significant pixel clock reduction over the corresponding “CRT” timing, while still providing sufficient time to meet the expected needs of non-CRT displays. Reduced Blanking timings will in all cases fix the horizontal blanking time to 132 clock cycles. The vertical blanking shall always exceed a minimum requirement of 460 microseconds.
5. **Horizontal Sync Pulse Duration and Position**
 - a) **"CRT" Timing** – The horizontal sync pulse duration will in all cases be set as closely as possible to 8% of the total horizontal time, with the position set so that the trailing edge of the horizontal sync pulse falls as closely as possible to the center of the horizontal blanking period.
 - b) **Reduced Blanking** – The horizontal sync pulse duration will in all cases be 32 pixel clocks in duration, with the position set so that the trailing edge of the horizontal sync pulse is located in the center of the horizontal blanking period. Since the horizontal blanking period is a fixed number of pixel clocks, the front porch and back porch are also a fixed number of pixel clock cycles.
6. **Vertical Sync Pulse Duration and Position** – The vertical sync pulse duration will in all cases be set to exactly three horizontal line times and follow the active video after a one line front porch.

2.5 Frame Rate Locking

Some specific applications may require an exact frame rate that is locked to an external video source, e.g. video in a window. For these instances it is necessary to derive the pixel clock from the external source by using a multiplication of either the external frame rate, line rate or pixel clock. Consequently, this process can not guarantee a pixel clock that is an exact multiple of 0.1 MHz as required by item 1, section 2.4. Also, the frame rate may deviate from the standard set list in section 2.3. Although the pixel clock and frame rate may vary from the published standard, all other timing parameters, such as horizontal and vertical starts, ends, totals, etc. should be as specified within this document. Doing this simplifies the display's task of image positioning and (for the case of digital displays being driven with an analog signal) clock recovery.

3. VESA Standard Display Formats

3.1 Overview

Using the rules and guidelines established in the previous section, VESA has selected standard display formats in several aspect ratios. Use of formats not included under this standard is strongly discouraged, due to the likelihood of incompatibility with standard compliant fixed-format displays.

3.2 VESA Format Naming Convention

In the past, the computer industry has used a de facto standard system of naming for various spatial formats, which traces its roots to the very early days of the personal computer. In the 1980s, IBM produced a series of graphics systems and associated display products, which were referred to as “graphics adapters”, such as the “Monochrome Graphics Adapter” (MGA), “Color Graphics Adapter” (CGA), “Enhanced Graphics Adapter” (EGA), and finally the “Video Graphics Adapter” (VGA), “Super-VGA” (SVGA), and “Extended Graphics Adapter” (XGA) systems.

These names were certainly useful distinctions in their day, but unfortunately the nomenclature survived long after the original hardware became obsolete – in the form of names informally applied to the spatial formats used by those systems. Thus, in current usage, “VGA” most often refers to the 640 x 480 format, “XGA” to 1024 x 768, and so forth. This system has become increasingly cumbersome, and the names do not provide much information about the specific format they are intended to represent. “QVGA”, for instance, is most often intended to mean “quarter-VGA”, or 320 x 240 pixels, while “QXGA” has been used to refer to “quad-XGA”, or 2048 x 1536 pixels!

It is our intention at this time to replace this outdated system with a simpler, more informative standard convention for referring to industry-standard display formats. Taking a cue from other electronic-imaging markets and systems, we are introducing with this standard the convention of naming image formats using the number of pixels contained in each. In this document, the standard naming for each format is the pixel count, rounded to the nearest 100,000 (or to the nearest 10,000 if needed to distinguish the lower pixel-count formats), and expressed in mega-pixels, or with the suffix “M”. As there remains the possibility of confusion between formats of similar pixel counts, but different aspect ratios, 16:9 or 16:10 formats will have the additional suffix “W” or “wide” associated with their names. As examples of the new naming systems:

- The 800 x 600 (formerly “SVGA”) format, at 480,000 pixels, is to be referred to as the “0.5 Mpixel” format or “0.5M”.
- The 1280 x 1024 (formerly “SXGA”) format, at 1,310,720 pixels, is to be referred to as the “1.3 Mpixel” format, or “1.3M”.
- The 1920 x 1080 format, at 2,073,600 pixels, is to be referred to as the “2.1 Mpixel – wide” format, or “2.1MW”.

To avoid confusion, a way of identifying Reduced Blanking timings from standard CRT timing is also required. This is achieved by adding an additional suffix “-R”. For example:

- 0.5M (800 x 600) Reduced Blanking timing is referred to as “0.5M-R”.
- 1.3M (1280 x 1024) Reduced Blanking timing is referred to as “1.3M-R”.
- 2.1MW (1920 x 1080) Reduced Blanking timing is referred to as “2.1MW-R”.

3.3 VESA Standard 4:3 Formats

The VESA standard formats at a 4:3 aspect ratio, and their names under the new convention, are as follows:

Format (Pixels x Lines)	Old Name (if applicable)	Pixel count (Exact)	VESA Standard Name	Comments
640 x 480	VGA	307200	0.3M	Est. standard; "square-pixel" U.S. TV
800 x 600	SVGA	480000	0.5M	Est. standard
1024 x 768	XGA	786432	0.8M	Est. standard
1280 x 960		1228800	1.2M	4:3 alternative to 1280 x 1024
1400 x 1050		1470000	1.5M	4:3 1080-line format
1600 x 1200	UXGA	1920000	1.9M	Est. standard; 4x 800 x 600
1800 x 1350		2430000	2.4M	
2048 x 1536		3145728	3.1M	4x 1024 x 768
2560 x 1920		4915200	4.9M	4x 1280 x 960

3.4 VESA Standard 5:4 Formats

There has been only one format with a 5:4 aspect ratio to achieve widespread use; this is the 1.3 Mpixel (formerly "SXGA") 1280 x 1024 format. As most display devices do not use this aspect ratio, further development of 5:4 formats is being discouraged by VESA, and 1280 x 1024 will remain the only established 5:4 standard.

Format (Pixels x Lines)	Old Name (if applicable)	Pixel count (Exact)	VESA Standard Name	Comments
1280 x 1024	SXGA	1310720	1.3M	Est. standard

3.5 VESA Standard 16:9 Formats

Format (Pixels x Lines)	Old Name (if applicable)	Pixel count (Exact)	VESA Standard Name	Comments
640 x 360		230400	0.2MW	
848 x 480		410880	0.4MW	16:9 480-line format; PDP standard Note: Approximated 16:9 standard
1024 x 576		589824	0.6MW	
1280 x 720		921600	0.9MW	DTV standard
1600 x 900		1440000	1.4MW	
1920 x 1080		2073600	2.1MW	DTV standard
2048 x 1152		2359296	2.4MW	
2560 x 1440		3686400	3.7MW	

3.6 VESA Standard 16:10 Formats

Format (Pixels x Lines)	Old Name (if applicable)	Pixel count (Exact)	VESA Standard Name	Comments
640 x 400		256000	0.3MW	
768 x 480		368640	0.37MW	
1024 x 640		655360	0.7MW	
1280 x 800		1024000	1.0MW	DTV standard w/extra lines
1600 x 1000		1600000	1.6MW	
1920 x 1200		2304000	2.3MW	DTV standard w/extra lines
2048 x 1280		2621440	2.6MW	
2560 x 1600		4096000	4.1MW	

4. Computation of Timing Parameters

4.1 Computation of Common Parameters

1. Find the frame rate required (Hz):
$$\mathbf{V_FIELD_RATE_RQD} = \text{IF}(\text{INT_RQD?}="y", \text{IP_FREQ_RQD} * 2, \text{IP_FREQ_RQD})$$
2. In order to give the correct results, the number of horizontal pixels requested is first processed to ensure that it is divisible by the character size, by rounding it to the nearest character cell boundary:
$$\mathbf{H_PIXELS_RND} = \text{ROUND}(\text{H_PIXELS} / \text{CELL_GRAN_RND}, 0) * \text{CELL_GRAN_RND}$$
3. Determine the width of the left and right borders:
$$\mathbf{LEFT_MARGIN} = \text{IF}(\text{MARGINS_RQD?}="Y", (\text{ROUND}(((\text{H_PIXELS_RND} * \text{MARGIN_PER} / 100) / \text{CELL_GRAN_RND}), 0)) * \text{CELL_GRAN_RND}, 0)$$

$$\mathbf{RIGHT_MARGIN} = \text{IF}(\text{MARGINS_RQD?}="Y", (\text{ROUND}(((\text{H_PIXELS_RND} * \text{MARGIN_PER} / 100) / \text{CELL_GRAN_RND}), 0)) * \text{CELL_GRAN_RND}, 0)$$
4. The total number of active pixels is equal to the rounded horizontal pixels and the margins:
$$\mathbf{TOTAL_ACTIVE_PIXELS} = \text{H_PIXELS_RND} + \text{LEFT_MARGIN} + \text{RIGHT_MARGIN}$$
5. If interlace is requested, the number of vertical lines assumed by the calculation must be halved, as the computation calculates the number of vertical lines per field. In either case, the number of lines is rounded to the nearest integer.
$$\mathbf{V_LINES_RND} = \text{IF}(\text{INT_RQD?}="y", \text{ROUND}(\text{V_LINES} / 2, 0), \text{ROUND}(\text{V_LINES}, 0))$$
6. Determine the top and bottom margins:
$$\mathbf{TOP_MARGIN} = \text{IF}(\text{MARGINS_RQD?}="Y", \text{ROUND}(((\text{MARGIN_PER} / 100) * \text{V_LINES_RND}), 0), 0)$$

$$\mathbf{BOT_MARGIN} = \text{IF}(\text{MARGINS_RQD?}="Y", \text{ROUND}(((\text{MARGIN_PER} / 100) * \text{V_LINES_RND}), 0), 0)$$
7. If interlaced is required, then set variable INTERLACE = 0.5:
$$\mathbf{INTERLACE} = \text{IF}(\text{INT_RQD?}="Y", 0.5, 0)$$

4.2 Computation of "CRT" Timing Parameters

[Common Parameter Calculations...]

8. Estimate the Horizontal Period (kHz):
$$\mathbf{H_PERIOD_EST} = ((1 / \text{V_FIELD_RATE_RQD}) - \text{MIN_VSYNC_BP} / 1000000) / (\text{V_LINES_RND} + (2 * \text{TOP_MARGIN}) + \text{MIN_V_PORCH_RND} + \text{INTERLACE}) * 1000000$$
9. Find the number of lines in V sync + back porch:
$$\mathbf{V_SYNC_BP} = \text{ROUND}((\text{MIN_VSYNC_BP} / \text{H_PERIOD_EST}), 0)$$
10. Find the number of lines in V back porch:
$$\mathbf{V_BACK_PORCH} = \text{V_SYNC_BP} - \text{V_SYNC_RND}$$
11. Find total number of lines in Vertical Field Period:
$$\mathbf{TOTAL_V_LINES} = \text{V_LINES_RND} + \text{TOP_MARGIN} + \text{BOT_MARGIN} + \text{V_SYNC_BP} + \text{INTERLACE} + \text{MIN_V_PORCH_RND}$$
12. Estimate Vertical Field Rate:
$$\mathbf{V_FIELD_RATE_EST} = 1000000 / (\text{H_PERIOD_EST} * \text{TOTAL_V_LINES})$$
13. Find the ideal blanking duty cycle from the blanking duty cycle equation (%):
$$\mathbf{IDEAL_DUTY_CYCLE} = \text{C_PRIME} - (\text{M_PRIME} * \text{H_PERIOD_EST} / 1000)$$
14. Find the number of pixels in the horizontal blanking time to the nearest double character cell (limit horizontal blanking so that it is $\geq 20\%$ of horizontal total):
$$\mathbf{IF}(\text{IDEAL_DUTY_CYCLE} < 20\%)$$

$$\mathbf{H_BLANK} = \text{ROUND}((\text{TOTAL_ACTIVE_PIXELS} * 20 / (100 - 20) / (2 * \text{CELL_GRAN_RND})), 0) * (2 * \text{CELL_GRAN_RND})$$

ELSE

$$\mathbf{H_BLANK} = \text{ROUND}((\text{TOTAL_ACTIVE_PIXELS} * \text{IDEAL_DUTY_CYCLE} / (100 - \text{DEAL_DUTY_CYCLE}) / (2 * \text{CELL_GRAN_RND})), 0) * (2 * \text{CELL_GRAN_RND})$$

15. Find the total number of pixels in a line:

$$\mathbf{TOTAL_PIXELS} = \text{TOTAL_ACTIVE_PIXELS} + \mathbf{H_BLANK}$$

16. Find Pixel Clock Frequency (MHz):

$$\mathbf{ACT_PIXEL_FREQ} = \text{FLOOR}(\text{TOTAL_PIXELS} / \text{H_PERIOD_EST}, 0.125)$$

17. Find actual Horizontal Frequency (kHz):

$$\mathbf{ACT_H_FREQ} = 1000 * \text{ACT_PIXEL_FREQ} / \text{TOTAL_PIXELS}$$

18. Find actual Field Rate (Hz):

$$\mathbf{ACT_FIELD_RATE} = 1000 * \text{ACT_H_FREQ} / \text{TOTAL_V_LINES}$$

19. Find actual Frame Rate (Hz):

$$\mathbf{ACT_FRAME_RATE} = \text{IF}(\text{INT_RQD?}="Y", \text{ACT_FIELD_RATE} / 2, \text{ACT_FIELD_RATE})$$

4.3 Computation of Reduced Blanking Timing Parameters

[Common Parameter Calculations...]

8. Estimate the Horizontal Period (kHz):

$$\mathbf{H_PERIOD_EST} = ((1000000 / \text{V_FIELD_RATE_RQD}) - \text{RB_MIN_V_BLANK}) / (\text{V_LINES_RND} + \text{TOP_MARGIN} + \text{BOT_MARGIN})$$

9. Determine the number of lines in the vertical blanking interval:

$$\mathbf{VBI_LINES} = \text{ROUNDUP}(\text{RB_MIN_V_BLANK} / \text{H_PERIOD_EST}, 0)$$

10. Find total number of vertical lines:

$$\mathbf{TOTAL_V_LINES} = \text{VBI_LINES} + \text{V_LINES_RND} + \text{TOP_MARGIN} + \text{BOT_MARGIN} + \text{INTERLACE}$$

11. Find total number of pixel clocks per line:

$$\mathbf{TOTAL_PIXELS} = \text{RB_H_BLANK} + \text{TOTAL_ACTIVE_PIXELS}$$

12. Calculate Pixel Clock Frequency to nearest 0.125 MHz:

$$\mathbf{ACT_PIXEL_FREQ} = \text{FLOOR}(\text{V_FIELD_RATE_RQD} * \text{TOTAL_V_LINES} * \text{TOTAL_PIXELS} / 1000000, 0.125)$$

13. Find actual Horizontal Frequency (kHz):

$$\mathbf{ACT_H_FREQ} = 1000 * \text{ACT_PIXEL_FREQ} / \text{TOTAL_PIXELS}$$

14. Find actual Vertical Frame Rate (Hz):

$$\mathbf{ACT_FRAME_RATE} = (1000000 * \text{ACT_PIXEL_FREQ} / (\text{TOTAL_V_LINES} * \text{TOTAL_PIXELS})) / \text{IF}(\text{INT_RQD?}="Y", 2, 1)$$

4.4 Definition of Variables

VARIABLE	DESCRIPTION	"CRT" TIMING	REDUCED BLANKING
ACT_FIELD_RATE	Actual field rate. Equals the frame rate if progressive scan timing is selected.	✓	✓
ACT_FRAME_RATE	Actual frame rate.	✓	✓
ACT_H_FREQ	Actual horizontal frequency.	✓	✓
ACT_PIXEL_FREQ	Actual pixel frequency, rounded down to the nearest 0.1 MHz.	✓	✓

VARIABLE	DESCRIPTION	"CRT" TIMING	REDUCED BLANKING
BOT_MARGIN	Number of lines in the bottom margin, rounded to the nearest line. If no margins are required, this value is set to zero.	✓	✓
C_PRIME	GTF Variable: $C_PRIME = ((C - J) * K / 256) + J$	✓	
CELL_GRAN	Input number of pixel clock cycles in each character cell. Typically set to 8.	✓	✓
CELL_GRAN_RND	Character cell width in pixel clock cycles, rounded to the nearest integer.	✓	✓
H_BLANK	Number of pixel clocks in the horizontal blanking period, rounded to the nearest character cell.	✓	✓
H_PERIOD_EST	Used as an intermediary variable to estimate the horizontal period so that critical parameters such as the required pixel clock frequency, vertical blanking interval, etc. can be determined.	✓	✓
H_PIXELS	Number of desired visible horizontal pixels per line.	✓	✓
H_PIXELS_RND	Number of desired visible horizontal pixels rounded to the nearest character cell.	✓	✓
H_SYNC_PER	CONSTANT: Percentage of the horizontal total period that defines horizontal sync width.	✓	
IDEAL_DUTY_CYCLE		✓	
INTERLACE	This variable is set to 0.5 when interlaced timing is desired. This enables the vertical lines per field to have the half line required to offset the odd and even field with respect to vertical sync.	✓	✓
LEFT_MARGIN	Number of pixels in the left hand margin, rounded to the nearest character cell. If no margins are required, this value is set to zero.	✓	✓
M_PRIME	GTF Variable: $M_PRIME = K / 256 * M$	✓	
MARGIN_PER	Margin width, expressed as a percentage of the horizontal number of pixels (H_PIXELS_RND).	✓	✓
MIN_VSYNC_BP	CONSTANT: Minimum time for vertical blanking period for "CRT" Timings.	✓	
RB_H_BLANK	CONSTANT: Specifies the fixed number of pixel clock cycles in the horizontal blanking period for Reduce Blanking timings. Measured as the number of pixels from the last active pixel of one line to the first active pixel of the next line.		✓
RB_H_SYNC	CONSTANT: Horizontal sync period for Reduced Blanking timings, expressed as the number of pixel clock cycles.		✓

VARIABLE	DESCRIPTION	"CRT" TIMING	REDUCED BLANKING
RB_MIN_V_BLANK	CONSTANT: Specifies the minimum vertical blanking period for Reduced Blanking timings. Measured as the number of lines from the last line of active video to the first line of active video.		✓
RIGHT_MARGIN	Number of pixels in the right hand margin, rounded to the nearest character cell. If no margins are required, this value is set to zero.	✓	✓
TOP_MARGIN	Number of lines in the top margin, rounded to the nearest line. If no margins are required, this value is set to zero.	✓	✓
TOTAL_ACTIVE_PIXELS	Total number of active pixels per line. This is determined as the number of horizontal pixels rounded to the nearest character cell (H_PIXELS_RND) plus the number of pixels in the left hand and right hand margins.	✓	✓
TOTAL_PIXELS	Total number of pixel clock cycles per horizontal line.	✓	✓
TOTAL_V_LINES	Total number of vertical lines per field. For interlaced timing this value has a half line added. For progressive scan timing, the value is always an integer.	✓	✓
V_BACK_PORCH	Number of lines in the vertical back porch period.	✓	✓
V_FIELD_RATE_EST	Used to estimate the vertical field frequency so that additional calculations can continue which finally determine the actual value.	✓	✓
V_FIELD_RATE_RQD	Specifies the desired vertical frame rate. The actual frame rate will be within +/- 0.5Hz of this value.	✓	✓
V_LINES	Number of desired visible vertical lines per frame.	✓	✓
V_LINES_RND	Number of desired visible vertical lines rounded to the nearest character cell.	✓	✓
V_SYNC_BP	Number of lines in the vertical sync period and the vertical back porch.	✓	✓

5. VESA Standard Display Timing Specifications (by format)

640 x 480

0.3 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	19.750 MHz		23.875 MHz		30.625 MHz		35.625 MHz		22.750 MHz	
Frame Rate	49.874 Hz		60.048 Hz		74.762 Hz		84.789 Hz		59.964 Hz	
Line Freq	24.688 kHz		29.844 kHz		37.531 kHz		42.819 kHz		29.622 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	800	40.506 us	800	33.508 us	816	26.645 us	832	23.354 us	768	33.758 us
Hor Addr	640	32.405 us	640	26.806 us	640	20.898 us	640	17.965 us	640	28.132 us
Hor Blanking	160	8.101 us	160	6.702 us	176	5.747 us	192	5.389 us	128	5.626 us
Hor Blank %	20.000%		20.000%		21.569%		23.077%		16.667%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	16	0.810 us	16	0.670 us	24	0.784 us	32	0.898 us	32	1.407 us
Sync Width	64	3.241 us	64	2.681 us	64	2.090 us	64	1.796 us	32	1.407 us
Back Porch	80	4.051 us	80	3.351 us	88	2.873 us	96	2.695 us	64	2.813 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	495	20.051 ms	497	16.653 ms	502	13.376 ms	505	11.794 ms	494	16.677 ms
Ver Addr	480	19.443 ms	480	16.084 ms	480	12.790 ms	480	11.210 ms	480	16.204 ms
Ver Blanking	15	0.608 ms	17	0.570 ms	22	0.586 ms	25	0.584 ms	14	0.473 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	40.506 us	1	33.508 us	1	26.645 us	1	23.354 us	1	33.758 us
Sync Width	3	121.519 us	3	100.524 us	3	79.935 us	3	70.063 us	3	101.275 us
Back Porch	11	445.570 us	13	435.602 us	18	479.608 us	21	490.442 us	10	337.582 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

800 x 600

0.5 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	31.125 MHz		38.125 MHz		48.875 MHz		56.500 MHz		34.375 MHz	
Frame Rate	49.964 Hz		59.858 Hz		74.952 Hz		84.927 Hz		59.939 Hz	
Line Freq	30.878 kHz		37.231 kHz		46.995 kHz		53.504 kHz		37.042 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1008	32.386 us	1024	26.859 us	1040	21.279 us	1056	18.690 us	928	26.996 us
Hor Addr	800	25.703 us	800	20.984 us	800	16.368 us	800	14.159 us	800	23.273 us
Hor Blanking	208	6.683 us	224	5.875 us	240	4.910 us	256	4.531 us	128	3.724 us
Hor Blank %	20.635%		21.875%		23.077%		24.242%		13.793%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	24	0.771 us	32	0.839 us	40	0.818 us	40	0.708 us	32	0.931 us
Sync Width	80	2.570 us	80	2.098 us	80	1.637 us	88	1.558 us	32	0.931 us
Back Porch	104	3.341 us	112	2.938 us	120	2.455 us	128	2.265 us	64	1.862 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	618	20.014 ms	622	16.706 ms	627	13.342 ms	630	11.775 ms	618	16.684 ms
Ver Addr	600	19.431 ms	600	16.115 ms	600	12.767 ms	600	11.214 ms	600	16.198 ms
Ver Blanking	18	0.583 ms	22	0.591 ms	27	0.575 ms	30	0.561 ms	18	0.486 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	32.386 us	1	26.859 us	1	21.279 us	1	18.690 us	1	26.996 us
Sync Width	3	97.157 us	3	80.577 us	3	63.836 us	3	56.071 us	3	80.989 us
Back Porch	14	453.398 us	18	483.462 us	23	489.412 us	26	485.947 us	14	377.949 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	51.750 MHz		64.125 MHz		81.750 MHz		94.250 MHz		54.500 MHz	
Frame Rate	49.865 Hz		60.015 Hz		74.950 Hz		84.877 Hz		59.885 Hz	
Line Freq	39.444 kHz		47.712 kHz		60.110 kHz		68.496 kHz		47.309 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1312	25.353 us	1344	20.959 us	1360	16.636 us	1376	14.599 us	1152	21.138 us
Hor Addr	1024	19.787 us	1024	15.969 us	1024	12.526 us	1024	10.865 us	1024	18.789 us
Hor Blanking	288	5.565 us	320	4.990 us	336	4.110 us	352	3.735 us	128	2.349 us
Hor Blank %	21.951%		23.810%		24.706%		25.581%		11.111%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	40	0.773 us	56	0.873 us	56	0.685 us	64	0.679 us	32	0.587 us
Sync Width	104	2.010 us	104	1.622 us	112	1.370 us	112	1.188 us	32	0.587 us
Back Porch	144	2.783 us	160	2.495 us	168	2.055 us	176	1.867 us	64	1.174 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	791	20.054 ms	795	16.662 ms	802	13.342 ms	807	11.782 ms	790	16.699 ms
Ver Addr	768	19.471 ms	768	16.097 ms	768	12.777 ms	768	11.212 ms	768	16.234 ms
Ver Blanking	23	0.583 ms	27	0.566 ms	34	0.566 ms	39	0.569 ms	22	0.465 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	25.353 us	1	20.959 us	1	16.636 us	1	14.599 us	1	21.138 us
Sync Width	3	76.058 us	3	62.877 us	3	49.908 us	3	43.798 us	3	63.413 us
Back Porch	19	481.700 us	23	482.058 us	30	499.083 us	35	510.981 us	18	380.477 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1280 x 960

1.2 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	83.000 MHz		102.000 MHz		129.875 MHz		149.375 MHz		83.375 MHz	
Frame Rate	50.005 Hz		59.939 Hz		75.009 Hz		84.971 Hz		59.934 Hz	
Line Freq	49.405 kHz		59.579 kHz		75.159 kHz		85.651 kHz		59.215 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1680	20.241 us	1712	16.784 us	1728	13.305 us	1744	11.675 us	1408	16.888 us
Hor Addr	1280	15.422 us	1280	12.549 us	1280	9.856 us	1280	8.569 us	1280	15.352 us
Hor Blanking	400	4.819 us	432	4.235 us	448	3.449 us	464	3.106 us	128	1.535 us
Hor Blank %	23.810%		25.234%		25.926%		26.606%		9.091%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	64	0.771 us	80	0.784 us	88	0.678 us	96	0.643 us	32	0.384 us
Sync Width	136	1.639 us	136	1.333 us	136	1.047 us	136	0.910 us	32	0.384 us
Back Porch	200	2.410 us	216	2.118 us	224	1.725 us	232	1.553 us	64	0.768 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	988	19.998 ms	994	16.684 ms	1002	13.332 ms	1008	11.769 ms	988	16.685 ms
Ver Addr	960	19.431 ms	960	16.113 ms	960	12.773 ms	960	11.208 ms	960	16.212 ms
Ver Blanking	28	0.567 ms	34	0.571 ms	42	0.559 ms	48	0.560 ms	28	0.473 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	20.241 us	1	16.784 us	1	13.305 us	1	11.675 us	1	16.888 us
Sync Width	3	60.723 us	3	50.353 us	3	39.915 us	3	35.026 us	3	50.663 us
Back Porch	24	485.783 us	30	503.529 us	38	505.594 us	44	513.714 us	24	405.301 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1400 x 1050

1.5 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	99.750 MHz		122.500 MHz		155.875 MHz		179.125 MHz		99.000 MHz	
Frame Rate	49.933 Hz		59.944 Hz		75.011 Hz		84.936 Hz		59.991 Hz	
Line Freq	53.977 kHz		65.160 kHz		82.213 kHz		93.685 kHz		64.791 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1848	18.526 us	1880	15.347 us	1896	12.164 us	1912	10.674 us	1528	15.434 us
Hor Addr	1400	14.035 us	1400	11.429 us	1400	8.982 us	1400	7.816 us	1400	14.141 us
Hor Blanking	448	4.491 us	480	3.918 us	496	3.182 us	512	2.858 us	128	1.293 us
Hor Blank %	24.242%		25.532%		26.160%		26.778%		8.377%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	80	0.802 us	88	0.718 us	96	0.616 us	104	0.581 us	32	0.323 us
Sync Width	144	1.444 us	152	1.241 us	152	0.975 us	152	0.849 us	32	0.323 us
Back Porch	224	2.246 us	240	1.959 us	248	1.591 us	256	1.429 us	64	0.646 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1081	20.027 ms	1087	16.682 ms	1096	13.331 ms	1103	11.774 ms	1080	16.669 ms
Ver Addr	1050	19.453 ms	1050	16.114 ms	1050	12.772 ms	1050	11.208 ms	1050	16.206 ms
Ver Blanking	31	0.574 ms	37	0.568 ms	46	0.560 ms	53	0.566 ms	30	0.463 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	18.526 us	1	15.347 us	1	12.164 us	1	10.674 us	1	15.434 us
Sync Width	3	55.579 us	3	46.041 us	3	36.491 us	3	32.022 us	3	46.303 us
Back Porch	27	500.211 us	33	506.449 us	42	510.871 us	49	523.031 us	26	401.293 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1600 x 1200

1.9 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	132.375 MHz		160.875 MHz		205.875 MHz		234.625 MHz		128.000 MHz	
Frame Rate	49.994 Hz		59.967 Hz		74.957 Hz		84.950 Hz		59.979 Hz	
Line Freq	61.742 kHz		74.479 kHz		93.921 kHz		107.037 kHz		74.074 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2144	16.196 us	2160	13.427 us	2192	10.647 us	2192	9.343 us	1728	13.500 us
Hor Addr	1600	12.087 us	1600	9.946 us	1600	7.772 us	1600	6.819 us	1600	12.500 us
Hor Blanking	544	4.110 us	560	3.481 us	592	2.876 us	592	2.523 us	128	1.000 us
Hor Blank %	25.373%		25.926%		27.007%		27.007%		7.407%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	104	0.786 us	104	0.646 us	120	0.583 us	120	0.511 us	32	0.250 us
Sync Width	168	1.269 us	176	1.094 us	176	0.855 us	176	0.750 us	32	0.250 us
Back Porch	272	2.055 us	280	1.740 us	296	1.438 us	296	1.262 us	64	0.500 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1235	20.003 ms	1242	16.676 ms	1253	13.341 ms	1260	11.772 ms	1235	16.673 ms
Ver Addr	1200	19.436 ms	1200	16.112 ms	1200	12.777 ms	1200	11.211 ms	1200	16.200 ms
Ver Blanking	35	0.567 ms	42	0.564 ms	53	0.564 ms	60	0.561 ms	35	0.473 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	16.196 us	1	13.427 us	1	10.647 us	1	9.343 us	1	13.500 us
Sync Width	3	48.589 us	3	40.280 us	3	31.942 us	3	28.028 us	3	40.500 us
Back Porch	31	502.089 us	38	510.210 us	49	521.715 us	56	523.184 us	31	418.500 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1800 x 1350

2.4 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	168.250 MHz		204.500 MHz		261.250 MHz		299.625 MHz		160.625 MHz	
Frame Rate	49.971 Hz		59.994 Hz		75.006 Hz		84.988 Hz		59.980 Hz	
Line Freq	69.410 kHz		83.811 kHz		105.684 kHz		120.428 kHz		83.312 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2424	14.407 us	2440	11.932 us	2472	9.462 us	2488	8.304 us	1928	12.003 us
Hor Addr	1800	10.698 us	1800	8.802 us	1800	6.890 us	1800	6.008 us	1800	11.206 us
Hor Blanking	624	3.709 us	640	3.130 us	672	2.572 us	688	2.296 us	128	0.797 us
Hor Blank %	25.743%		26.230%		27.184%		27.653%		6.639%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	120	0.713 us	128	0.626 us	136	0.521 us	144	0.481 us	32	0.199 us
Sync Width	192	1.141 us	192	0.939 us	200	0.766 us	200	0.668 us	32	0.199 us
Back Porch	312	1.854 us	320	1.565 us	336	1.286 us	344	1.148 us	64	0.398 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1389	20.012 ms	1397	16.668 ms	1409	13.332 ms	1417	11.766 ms	1389	16.672 ms
Ver Addr	1350	19.450 ms	1350	16.108 ms	1350	12.774 ms	1350	11.210 ms	1350	16.204 ms
Ver Blanking	39	0.562 ms	47	0.561 ms	59	0.558 ms	67	0.556 ms	39	0.468 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	14.407 us	1	11.932 us	1	9.462 us	1	8.304 us	1	12.003 us
Sync Width	3	43.221 us	3	35.795 us	3	28.387 us	3	24.911 us	3	36.009 us
Back Porch	35	504.250 us	43	513.056 us	55	520.421 us	63	523.134 us	35	420.109 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

2048 x 1536

3.1 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	218.625 MHz		267.000 MHz		340.500 MHz		388.125 MHz		206.250 MHz	
Frame Rate	49.989 Hz		60.011 Hz		75.005 Hz		85.018 Hz		59.990 Hz	
Line Freq	78.983 kHz		95.357 kHz		120.233 kHz		137.050 kHz		94.784 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2768	12.661 us	2800	10.487 us	2832	8.317 us	2832	7.297 us	2176	10.550 us
Hor Addr	2048	9.368 us	2048	7.670 us	2048	6.015 us	2048	5.277 us	2048	9.930 us
Hor Blanking	720	3.293 us	752	2.816 us	784	2.302 us	784	2.020 us	128	0.621 us
Hor Blank %	26.012%		26.857%		27.684%		27.684%		5.882%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	136	0.622 us	152	0.569 us	168	0.493 us	168	0.433 us	32	0.155 us
Sync Width	224	1.025 us	224	0.839 us	224	0.658 us	224	0.577 us	32	0.155 us
Back Porch	360	1.647 us	376	1.408 us	392	1.151 us	392	1.010 us	64	0.310 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1580	20.004 ms	1589	16.664 ms	1603	13.332 ms	1612	11.762 ms	1580	16.669 ms
Ver Addr	1536	19.447 ms	1536	16.108 ms	1536	12.775 ms	1536	11.208 ms	1536	16.205 ms
Ver Blanking	44	0.557 ms	53	0.556 ms	67	0.557 ms	76	0.555 ms	44	0.464 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	12.661 us	1	10.487 us	1	8.317 us	1	7.297 us	1	10.550 us
Sync Width	3	37.983 us	3	31.461 us	3	24.952 us	3	21.890 us	3	31.651 us
Back Porch	40	506.438 us	49	513.858 us	63	523.982 us	72	525.357 us	40	422.012 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

2560 x 1920

4.9 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	346.000 MHz		421.375 MHz		533.750 MHz		611.125 MHz		318.500 MHz	
Frame Rate	49.997 Hz		59.973 Hz		74.984 Hz		85.002 Hz		59.995 Hz	
Line Freq	98.744 kHz		119.167 kHz		150.267 kHz		171.279 kHz		118.490 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	3504	10.127 us	3536	8.392 us	3552	6.655 us	3568	5.838 us	2688	8.440 us
Hor Addr	2560	7.399 us	2560	6.075 us	2560	4.796 us	2560	4.189 us	2560	8.038 us
Hor Blanking	944	2.728 us	976	2.316 us	992	1.859 us	1008	1.649 us	128	0.402 us
Hor Blank %	26.941%		27.602%		27.928%		28.251%		4.762%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	192	0.555 us	208	0.494 us	208	0.390 us	216	0.353 us	32	0.100 us
Sync Width	280	0.809 us	280	0.664 us	288	0.540 us	288	0.471 us	32	0.100 us
Back Porch	472	1.364 us	488	1.158 us	496	0.929 us	504	0.825 us	64	0.201 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1975	20.001 ms	1987	16.674 ms	2004	13.336 ms	2015	11.764 ms	1975	16.668 ms
Ver Addr	1920	19.444 ms	1920	16.112 ms	1920	12.777 ms	1920	11.210 ms	1920	16.204 ms
Ver Blanking	55	0.557 ms	67	0.562 ms	84	0.559 ms	95	0.555 ms	55	0.464 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	10.127 us	1	8.392 us	1	6.655 us	1	5.838 us	1	8.440 us
Sync Width	3	30.382 us	3	25.175 us	3	19.964 us	3	17.515 us	3	25.319 us
Back Porch	51	516.486 us	63	528.669 us	80	532.384 us	91	531.296 us	51	430.418 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1280 x 1024

1.3 Mpixel

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	89.375 MHz		108.875 MHz		138.500 MHz		159.375 MHz		89.000 MHz	
Frame Rate	49.998 Hz		59.995 Hz		74.977 Hz		85.009 Hz		59.972 Hz	
Line Freq	52.698 kHz		63.595 kHz		80.150 kHz		91.385 kHz		63.210 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1696	18.976 us	1712	15.724 us	1728	12.477 us	1744	10.943 us	1408	15.820 us
Hor Addr	1280	14.322 us	1280	11.757 us	1280	9.242 us	1280	8.031 us	1280	14.382 us
Hor Blanking	416	4.655 us	432	3.968 us	448	3.235 us	464	2.911 us	128	1.438 us
Hor Blank %	24.528%		25.234%		25.926%		26.606%		9.091%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	72	0.806 us	80	0.735 us	88	0.635 us	96	0.602 us	32	0.360 us
Sync Width	136	1.522 us	136	1.249 us	136	0.982 us	136	0.853 us	32	0.360 us
Back Porch	208	2.327 us	216	1.984 us	224	1.617 us	232	1.456 us	64	0.719 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1054	20.001 ms	1060	16.668 ms	1069	13.337 ms	1075	11.763 ms	1054	16.675 ms
Ver Addr	1024	19.432 ms	1024	16.102 ms	1024	12.776 ms	1024	11.205 ms	1024	16.200 ms
Ver Blanking	30	0.569 ms	36	0.566 ms	45	0.561 ms	51	0.558 ms	30	0.475 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	18.976 us	1	15.724 us	1	12.477 us	1	10.943 us	1	15.820 us
Sync Width	3	56.929 us	3	47.173 us	3	37.430 us	3	32.828 us	3	47.461 us
Back Porch	26	493.382 us	32	503.183 us	41	511.538 us	47	514.309 us	26	411.326 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

640 x 360

0.2 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	14.750 MHz		17.875 MHz		22.500 MHz		25.750 MHz		17.000 MHz	
Frame Rate	49.697 Hz		59.903 Hz		74.602 Hz		84.927 Hz		59.664 Hz	
Line Freq	18.438 kHz		22.344 kHz		28.125 kHz		32.188 kHz		22.135 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	800	54.237 us	800	44.755 us	800	35.556 us	800	31.068 us	768	45.176 us
Hor Addr	640	43.390 us	640	35.804 us	640	28.444 us	640	24.854 us	640	37.647 us
Hor Blanking	160	10.847 us	160	8.951 us	160	7.111 us	160	6.214 us	128	7.529 us
Hor Blank %	20.000%		20.000%		20.000%		20.000%		16.667%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	16	1.085 us	16	0.895 us	16	0.711 us	16	0.621 us	32	1.882 us
Sync Width	64	4.339 us	64	3.580 us	64	2.844 us	64	2.485 us	32	1.882 us
Back Porch	80	5.424 us	80	4.476 us	80	3.556 us	80	3.107 us	64	3.765 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	371	20.122 ms	373	16.694 ms	377	13.404 ms	379	11.775 ms	371	16.760 ms
Ver Addr	360	19.525 ms	360	16.112 ms	360	12.800 ms	360	11.184 ms	360	16.264 ms
Ver Blanking	11	0.597 ms	13	0.582 ms	17	0.604 ms	19	0.590 ms	11	0.497 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	54.237 us	1	44.755 us	1	35.556 us	1	31.068 us	1	45.176 us
Sync Width	3	162.712 us	3	134.266 us	3	106.667 us	3	93.204 us	3	135.529 us
Back Porch	7	379.661 us	9	402.797 us	13	462.222 us	15	466.019 us	7	316.235 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

848 x 480

0.4 MW

	Standard Timings ("CRT")										Red. Blanking ("Non-CRT")
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz		
Pixel Clock	26.000 MHz		31.500 MHz		40.875 MHz		47.250 MHz		28.875 MHz		
Frame Rate	49.740 Hz		60.019 Hz		74.839 Hz		84.750 Hz		59.889 Hz		
Line Freq	24.621 kHz		29.830 kHz		37.569 kHz		42.799 kHz		29.585 kHz		
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	
Hor Total	1056	40.615 us	1056	33.524 us	1088	26.618 us	1104	23.365 us	976	33.801 us	
Hor Addr	848	32.615 us	848	26.921 us	848	20.746 us	848	17.947 us	848	29.368 us	
Hor Blanking	208	8.000 us	208	6.603 us	240	5.872 us	256	5.418 us	128	4.433 us	
Hor Blank %	19.697%		19.697%		22.059%		23.188%		13.115%		
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	
Front Porch	16	0.615 us	16	0.508 us	32	0.783 us	40	0.847 us	32	1.108 us	
Sync Width	88	3.385 us	88	2.794 us	88	2.153 us	88	1.862 us	32	1.108 us	
Back Porch	104	4.000 us	104	3.302 us	120	2.936 us	128	2.709 us	64	2.216 us	
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	
Ver Total	495	20.105 ms	497	16.661 ms	502	13.362 ms	505	11.799 ms	494	16.698 ms	
Ver Addr	480	19.495 ms	480	16.091 ms	480	12.777 ms	480	11.215 ms	480	16.224 ms	
Ver Blanking	15	0.609 ms	17	0.570 ms	22	0.586 ms	25	0.584 ms	14	0.473 ms	
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	
Front Porch	1	40.615 us	1	33.524 us	1	26.618 us	1	23.365 us	1	33.801 us	
Sync Width	3	121.846 us	3	100.571 us	3	79.853 us	3	70.095 us	3	101.403 us	
Back Porch	11	446.769 us	13	435.810 us	18	479.119 us	21	490.667 us	10	338.009 us	
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	
	H	V	H	V	H	V	H	V	H	V	
Sync Polarity											
VESA Standard 2-byte ID											
VESA Std. 8-byte Description											
Byte 0											
Byte 1											
Byte 2											
Byte 3											
Byte 4											
Byte 5											
Byte 6											
Byte 7											

NOTE: The exact 16:9, 480-line format is approximately 853.3 x 480 pixels. Popular display formats which approximate this are 848 x 480, 852 x 480, 854 x 480, and 856 x 480. It is expected that any of these formats will use the above timing, taking additional active pixels as needed from the horizontal blanking period through reducing the back porch time.

1024 x 576

0.6 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	37.875 MHz		46.875 MHz		60.625 MHz		69.125 MHz		40.875 MHz	
Frame Rate	49.899 Hz		59.846 Hz		74.930 Hz		85.012 Hz		59.834 Hz	
Line Freq	29.590 kHz		35.728 kHz		45.108 kHz		51.432 kHz		35.482 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1280	33.795 us	1312	27.989 us	1344	22.169 us	1344	19.443 us	1152	28.183 us
Hor Addr	1024	27.036 us	1024	21.845 us	1024	16.891 us	1024	14.814 us	1024	25.052 us
Hor Blanking	256	6.759 us	288	6.144 us	320	5.278 us	320	4.629 us	128	3.131 us
Hor Blank %	20.000%		21.951%		23.810%		23.810%		11.111%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	24	0.634 us	40	0.853 us	56	0.924 us	56	0.810 us	32	0.783 us
Sync Width	104	2.746 us	104	2.219 us	104	1.715 us	104	1.505 us	32	0.783 us
Back Porch	128	3.380 us	144	3.072 us	160	2.639 us	160	2.315 us	64	1.566 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	593	20.041 ms	597	16.710 ms	602	13.346 ms	605	11.763 ms	593	16.713 ms
Ver Addr	576	19.466 ms	576	16.122 ms	576	12.769 ms	576	11.199 ms	576	16.234 ms
Ver Blanking	17	0.575 ms	21	0.588 ms	26	0.576 ms	29	0.564 ms	17	0.479 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	33.795 us	1	27.989 us	1	22.169 us	1	19.443 us	1	28.183 us
Sync Width	3	101.386 us	3	83.968 us	3	66.507 us	3	58.329 us	3	84.550 us
Back Porch	13	439.340 us	17	475.819 us	22	487.720 us	25	486.076 us	13	366.385 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1280 x 720

0.9 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	60.375 MHz		74.375 MHz		95.625 MHz		110.000 MHz		62.500 MHz	
Frame Rate	49.925 Hz		59.915 Hz		74.977 Hz		84.990 Hz		59.904 Hz	
Line Freq	36.994 kHz		44.697 kHz		56.383 kHz		64.252 kHz		44.389 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1632	27.031 us	1664	22.373 us	1696	17.736 us	1712	15.564 us	1408	22.528 us
Hor Addr	1280	21.201 us	1280	17.210 us	1280	13.386 us	1280	11.636 us	1280	20.480 us
Hor Blanking	352	5.830 us	384	5.163 us	416	4.350 us	432	3.927 us	128	2.048 us
Hor Blank %	21.569%		23.077%		24.528%		25.234%		9.091%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	48	0.795 us	56	0.753 us	72	0.753 us	80	0.727 us	32	0.512 us
Sync Width	128	2.120 us	136	1.829 us	136	1.422 us	136	1.236 us	32	0.512 us
Back Porch	176	2.915 us	192	2.582 us	208	2.175 us	216	1.964 us	64	1.024 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	741	20.030 ms	746	16.690 ms	752	13.337 ms	756	11.766 ms	741	16.693 ms
Ver Addr	720	19.462 ms	720	16.109 ms	720	12.770 ms	720	11.206 ms	720	16.220 ms
Ver Blanking	21	0.568 ms	26	0.582 ms	32	0.568 ms	36	0.560 ms	21	0.473 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	27.031 us	1	22.373 us	1	17.736 us	1	15.564 us	1	22.528 us
Sync Width	3	81.093 us	3	67.119 us	3	53.208 us	3	46.691 us	3	67.584 us
Back Porch	17	459.528 us	22	492.208 us	28	496.607 us	32	498.036 us	17	382.976 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1600 x 900

1.3 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	97.000 MHz		118.875 MHz		152.125 MHz		174.750 MHz		96.000 MHz	
Frame Rate	49.977 Hz		59.938 Hz		74.924 Hz		84.982 Hz		59.995 Hz	
Line Freq	46.279 kHz		55.862 kHz		70.428 kHz		80.308 kHz		55.556 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2096	21.608 us	2128	17.901 us	2160	14.199 us	2176	12.452 us	1728	18.000 us
Hor Addr	1600	16.495 us	1600	13.460 us	1600	10.518 us	1600	9.156 us	1600	16.667 us
Hor Blanking	496	5.113 us	528	4.442 us	560	3.681 us	576	3.296 us	128	1.333 us
Hor Blank %	23.664%		24.812%		25.926%		26.471%		7.407%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	80	0.825 us	96	0.808 us	104	0.684 us	112	0.641 us	32	0.333 us
Sync Width	168	1.732 us	168	1.413 us	176	1.157 us	176	1.007 us	32	0.333 us
Back Porch	248	2.557 us	264	2.221 us	280	1.841 us	288	1.648 us	64	0.667 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	926	20.009 ms	932	16.684 ms	940	13.347 ms	945	11.767 ms	926	16.668 ms
Ver Addr	900	19.447 ms	900	16.111 ms	900	12.779 ms	900	11.207 ms	900	16.200 ms
Ver Blanking	26	0.562 ms	32	0.573 ms	40	0.568 ms	45	0.560 ms	26	0.468 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	21.608 us	1	17.901 us	1	14.199 us	1	12.452 us	1	18.000 us
Sync Width	3	64.825 us	3	53.703 us	3	42.597 us	3	37.356 us	3	54.000 us
Back Porch	22	475.381 us	28	501.232 us	36	511.159 us	41	510.535 us	22	396.000 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1920 x 1080

2.1 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	141.375 MHz		172.750 MHz		220.500 MHz		252.875 MHz		136.500 MHz	
Frame Rate	49.975 Hz		59.983 Hz		74.953 Hz		84.982 Hz		59.991 Hz	
Line Freq	55.572 kHz		67.061 kHz		84.548 kHz		96.370 kHz		66.650 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2544	17.995 us	2576	14.912 us	2608	11.828 us	2624	10.377 us	2048	15.004 us
Hor Addr	1920	13.581 us	1920	11.114 us	1920	8.707 us	1920	7.593 us	1920	14.066 us
Hor Blanking	624	4.414 us	656	3.797 us	688	3.120 us	704	2.784 us	128	0.938 us
Hor Blank %	24.528%		25.466%		26.380%		26.829%		6.250%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	112	0.792 us	120	0.695 us	136	0.617 us	144	0.569 us	32	0.234 us
Sync Width	200	1.415 us	208	1.204 us	208	0.943 us	208	0.823 us	32	0.234 us
Back Porch	312	2.207 us	328	1.899 us	344	1.560 us	352	1.392 us	64	0.469 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1112	20.010 ms	1118	16.671 ms	1128	13.342 ms	1134	11.767 ms	1111	16.669 ms
Ver Addr	1080	19.434 ms	1080	16.105 ms	1080	12.774 ms	1080	11.207 ms	1080	16.204 ms
Ver Blanking	32	0.576 ms	38	0.567 ms	48	0.568 ms	54	0.560 ms	31	0.465 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	17.995 us	1	14.912 us	1	11.828 us	1	10.377 us	1	15.004 us
Sync Width	3	53.984 us	3	44.735 us	3	35.483 us	3	31.130 us	3	45.011 us
Back Porch	28	503.851 us	34	506.999 us	44	520.417 us	50	518.833 us	27	405.099 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

2048 x 1152

2.4 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	162.125 MHz		198.000 MHz		252.500 MHz		289.500 MHz		154.625 MHz	
Frame Rate	49.963 Hz		60.010 Hz		74.961 Hz		84.963 Hz		59.966 Hz	
Line Freq	59.256 kHz		71.532 kHz		90.179 kHz		102.805 kHz		71.059 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2736	16.876 us	2768	13.980 us	2800	11.089 us	2816	9.727 us	2176	14.073 us
Hor Addr	2048	12.632 us	2048	10.343 us	2048	8.111 us	2048	7.074 us	2048	13.245 us
Hor Blanking	688	4.244 us	720	3.636 us	752	2.978 us	768	2.653 us	128	0.828 us
Hor Blank %	25.146%		26.012%		26.857%		27.273%		5.882%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	128	0.790 us	136	0.687 us	152	0.602 us	160	0.553 us	32	0.207 us
Sync Width	216	1.332 us	224	1.131 us	224	0.887 us	224	0.774 us	32	0.207 us
Back Porch	344	2.122 us	360	1.818 us	376	1.489 us	384	1.326 us	64	0.414 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1186	20.015 ms	1192	16.664 ms	1203	13.340 ms	1210	11.770 ms	1185	16.676 ms
Ver Addr	1152	19.441 ms	1152	16.105 ms	1152	12.775 ms	1152	11.206 ms	1152	16.212 ms
Ver Blanking	34	0.574 ms	40	0.559 ms	51	0.566 ms	58	0.564 ms	33	0.464 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	16.876 us	1	13.980 us	1	11.089 us	1	9.727 us	1	14.073 us
Sync Width	3	50.628 us	3	41.939 us	3	33.267 us	3	29.181 us	3	42.218 us
Back Porch	30	506.276 us	36	503.273 us	47	521.188 us	54	525.264 us	29	408.110 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

2560 x 1440

3.7 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	256.000 MHz		311.750 MHz		396.750 MHz		454.250 MHz		238.750 MHz	
Frame Rate	49.983 Hz		59.985 Hz		74.992 Hz		84.963 Hz		59.973 Hz	
Line Freq	74.074 kHz		89.378 kHz		112.713 kHz		128.464 kHz		88.821 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	3456	13.500 us	3488	11.188 us	3520	8.872 us	3536	7.784 us	2688	11.259 us
Hor Addr	2560	10.000 us	2560	8.212 us	2560	6.452 us	2560	5.636 us	2560	10.723 us
Hor Blanking	896	3.500 us	928	2.977 us	960	2.420 us	976	2.149 us	128	0.536 us
Hor Blank %	25.926%		26.606%		27.273%		27.602%		4.762%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	168	0.656 us	184	0.590 us	200	0.504 us	208	0.458 us	32	0.134 us
Sync Width	280	1.094 us	280	0.898 us	280	0.706 us	280	0.616 us	32	0.134 us
Back Porch	448	1.750 us	464	1.488 us	480	1.210 us	488	1.074 us	64	0.268 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1482	20.007 ms	1490	16.671 ms	1503	13.335 ms	1512	11.770 ms	1481	16.674 ms
Ver Addr	1440	19.440 ms	1440	16.111 ms	1440	12.776 ms	1440	11.209 ms	1440	16.212 ms
Ver Blanking	42	0.567 ms	50	0.559 ms	63	0.559 ms	72	0.560 ms	41	0.462 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	13.500 us	1	11.188 us	1	8.872 us	1	7.784 us	1	11.259 us
Sync Width	3	40.500 us	3	33.565 us	3	26.616 us	3	23.353 us	3	33.776 us
Back Porch	38	513.000 us	46	514.669 us	59	523.453 us	68	529.330 us	37	416.570 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

640 x 400

0.3 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	16.375 MHz		19.875 MHz		25.000 MHz		29.125 MHz		18.875 MHz	
Frame Rate	49.681 Hz		59.864 Hz		74.761 Hz		84.780 Hz		59.652 Hz	
Line Freq	20.469 kHz		24.844 kHz		31.250 kHz		35.692 kHz		24.577 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	800	48.855 us	800	40.252 us	800	32.000 us	816	28.017 us	768	40.689 us
Hor Addr	640	39.084 us	640	32.201 us	640	25.600 us	640	21.974 us	640	33.907 us
Hor Blanking	160	9.771 us	160	8.050 us	160	6.400 us	176	6.043 us	128	6.781 us
Hor Blank %	20.000%		20.000%		20.000%		21.569%		16.667%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	16	0.977 us	16	0.805 us	16	0.640 us	24	0.824 us	32	1.695 us
Sync Width	64	3.908 us	64	3.220 us	64	2.560 us	64	2.197 us	32	1.695 us
Back Porch	80	4.885 us	80	4.025 us	80	3.200 us	88	3.021 us	64	3.391 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	412	20.128 ms	415	16.704 ms	418	13.376 ms	421	11.795 ms	412	16.764 ms
Ver Addr	400	19.542 ms	400	16.101 ms	400	12.800 ms	400	11.207 ms	400	16.275 ms
Ver Blanking	12	0.586 ms	15	0.604 ms	18	0.576 ms	21	0.588 ms	12	0.488 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	48.855 us	1	40.252 us	1	32.000 us	1	28.017 us	1	40.689 us
Sync Width	3	146.565 us	3	120.755 us	3	96.000 us	3	84.052 us	3	122.066 us
Back Porch	8	390.840 us	11	442.767 us	14	448.000 us	17	476.292 us	8	325.510 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

768 x 480

0.37 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	23.625 MHz		28.625 MHz		37.250 MHz		42.500 MHz		26.500 MHz	
Frame Rate	49.716 Hz		59.995 Hz		74.802 Hz		84.837 Hz		59.870 Hz	
Line Freq	24.609 kHz		29.818 kHz		37.550 kHz		42.843 kHz		29.576 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	960	40.635 us	960	33.537 us	992	26.631 us	992	23.341 us	896	33.811 us
Hor Addr	768	32.508 us	768	26.830 us	768	20.617 us	768	18.071 us	768	28.981 us
Hor Blanking	192	8.127 us	192	6.707 us	224	6.013 us	224	5.271 us	128	4.830 us
Hor Blank %	20.000%		20.000%		22.581%		22.581%		14.286%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	16	0.677 us	16	0.559 us	32	0.859 us	32	0.753 us	32	1.208 us
Sync Width	80	3.386 us	80	2.795 us	80	2.148 us	80	1.882 us	32	1.208 us
Back Porch	96	4.063 us	96	3.354 us	112	3.007 us	112	2.635 us	64	2.415 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	495	20.114 ms	497	16.668 ms	502	13.369 ms	505	11.787 ms	494	16.703 ms
Ver Addr	480	19.505 ms	480	16.098 ms	480	12.783 ms	480	11.204 ms	480	16.229 ms
Ver Blanking	15	0.610 ms	17	0.570 ms	22	0.586 ms	25	0.584 ms	14	0.473 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	40.635 us	1	33.537 us	1	26.631 us	1	23.341 us	1	33.811 us
Sync Width	3	121.905 us	3	100.611 us	3	79.893 us	3	70.024 us	3	101.434 us
Back Porch	11	446.984 us	13	435.983 us	18	479.356 us	21	490.165 us	10	338.113 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1024 x 640

0.7 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	42.625 MHz		52.750 MHz		67.375 MHz		77.625 MHz		45.500 MHz	
Frame Rate	49.908 Hz		59.912 Hz		74.933 Hz		84.936 Hz		59.934 Hz	
Line Freq	32.890 kHz		39.721 kHz		50.130 kHz		57.077 kHz		39.497 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1296	30.405 us	1328	25.175 us	1344	19.948 us	1360	17.520 us	1152	25.319 us
Hor Addr	1024	24.023 us	1024	19.412 us	1024	15.199 us	1024	13.192 us	1024	22.505 us
Hor Blanking	272	6.381 us	304	5.763 us	320	4.750 us	336	4.329 us	128	2.813 us
Hor Blank %	20.988%		22.892%		23.810%		24.706%		11.111%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	32	0.751 us	48	0.910 us	56	0.831 us	56	0.721 us	32	0.703 us
Sync Width	104	2.440 us	104	1.972 us	104	1.544 us	112	1.443 us	32	0.703 us
Back Porch	136	3.191 us	152	2.882 us	160	2.375 us	168	2.164 us	64	1.407 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	659	20.037 ms	663	16.691 ms	669	13.345 ms	672	11.774 ms	659	16.685 ms
Ver Addr	640	19.459 ms	640	16.112 ms	640	12.767 ms	640	11.213 ms	640	16.204 ms
Ver Blanking	19	0.578 ms	23	0.579 ms	29	0.578 ms	32	0.561 ms	19	0.481 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	30.405 us	1	25.175 us	1	19.948 us	1	17.520 us	1	25.319 us
Sync Width	3	91.214 us	3	75.526 us	3	59.844 us	3	52.560 us	3	75.956 us
Back Porch	15	456.070 us	19	478.332 us	25	498.701 us	28	490.564 us	15	379.780 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1280 x 800

1.0 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	68.500 MHz		83.375 MHz		107.250 MHz		123.375 MHz		69.500 MHz	
Frame Rate	49.959 Hz		59.937 Hz		75.025 Hz		84.997 Hz		59.977 Hz	
Line Freq	41.166 kHz		49.628 kHz		62.646 kHz		71.398 kHz		49.361 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	1664	24.292 us	1680	20.150 us	1712	15.963 us	1728	14.006 us	1408	20.259 us
Hor Addr	1280	18.686 us	1280	15.352 us	1280	11.935 us	1280	10.375 us	1280	18.417 us
Hor Blanking	384	5.606 us	400	4.798 us	432	4.028 us	448	3.631 us	128	1.842 us
Hor Blank %	23.077%		23.810%		25.234%		25.926%		9.091%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	56	0.818 us	64	0.768 us	80	0.746 us	88	0.713 us	32	0.460 us
Sync Width	136	1.985 us	136	1.631 us	136	1.268 us	136	1.102 us	32	0.460 us
Back Porch	192	2.803 us	200	2.399 us	216	2.014 us	224	1.816 us	64	0.921 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	824	20.017 ms	828	16.684 ms	835	13.329 ms	840	11.765 ms	823	16.673 ms
Ver Addr	800	19.434 ms	800	16.120 ms	800	12.770 ms	800	11.205 ms	800	16.207 ms
Ver Blanking	24	0.583 ms	28	0.564 ms	35	0.559 ms	40	0.560 ms	23	0.466 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	24.292 us	1	20.150 us	1	15.963 us	1	14.006 us	1	20.259 us
Sync Width	3	72.876 us	3	60.450 us	3	47.888 us	3	42.018 us	3	60.777 us
Back Porch	20	485.839 us	24	483.598 us	31	494.844 us	36	504.219 us	19	384.921 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1600 x 1000

1.5 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	108.625 MHz		133.125 MHz		169.125 MHz		194.125 MHz		106.625 MHz	
Frame Rate	49.983 Hz		59.992 Hz		74.999 Hz		84.964 Hz		59.965 Hz	
Line Freq	51.432 kHz		62.092 kHz		78.299 kHz		89.212 kHz		61.704 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2112	19.443 us	2144	16.105 us	2160	12.772 us	2176	11.209 us	1728	16.206 us
Hor Addr	1600	14.730 us	1600	12.019 us	1600	9.460 us	1600	8.242 us	1600	15.006 us
Hor Blanking	512	4.713 us	544	4.086 us	560	3.311 us	576	2.967 us	128	1.200 us
Hor Blank %	24.242%		25.373%		25.926%		26.471%		7.407%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	88	0.810 us	104	0.781 us	104	0.615 us	112	0.577 us	32	0.300 us
Sync Width	168	1.547 us	168	1.262 us	176	1.041 us	176	0.907 us	32	0.300 us
Back Porch	256	2.357 us	272	2.043 us	280	1.656 us	288	1.484 us	64	0.600 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1029	20.007 ms	1035	16.669 ms	1044	13.334 ms	1050	11.770 ms	1029	16.676 ms
Ver Addr	1000	19.443 ms	1000	16.105 ms	1000	12.772 ms	1000	11.209 ms	1000	16.206 ms
Ver Blanking	29	0.564 ms	35	0.564 ms	44	0.562 ms	50	0.560 ms	29	0.470 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	19.443 us	1	16.105 us	1	12.772 us	1	11.209 us	1	16.206 us
Sync Width	3	58.329 us	3	48.315 us	3	38.315 us	3	33.628 us	3	48.619 us
Back Porch	25	486.076 us	31	499.260 us	40	510.865 us	46	515.627 us	25	405.158 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

1920 x 1200

2.3 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	158.000 MHz		193.125 MHz		246.500 MHz		282.625 MHz		151.750 MHz	
Frame Rate	49.975 Hz		59.990 Hz		74.973 Hz		84.964 Hz		59.997 Hz	
Line Freq	61.719 kHz		74.508 kHz		93.941 kHz		107.055 kHz		74.097 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2560	16.203 us	2592	13.421 us	2624	10.645 us	2640	9.341 us	2048	13.496 us
Hor Addr	1920	12.152 us	1920	9.942 us	1920	7.789 us	1920	6.793 us	1920	12.652 us
Hor Blanking	640	4.051 us	672	3.480 us	704	2.856 us	720	2.548 us	128	0.843 us
Hor Blank %	25.000%		25.926%		26.829%		27.273%		6.250%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	112	0.709 us	128	0.663 us	144	0.584 us	152	0.538 us	32	0.211 us
Sync Width	208	1.316 us	208	1.077 us	208	0.844 us	208	0.736 us	32	0.211 us
Back Porch	320	2.025 us	336	1.740 us	352	1.428 us	360	1.274 us	64	0.422 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1235	20.010 ms	1242	16.669 ms	1253	13.338 ms	1260	11.770 ms	1235	16.667 ms
Ver Addr	1200	19.443 ms	1200	16.106 ms	1200	12.774 ms	1200	11.209 ms	1200	16.195 ms
Ver Blanking	35	0.567 ms	42	0.564 ms	53	0.564 ms	60	0.560 ms	35	0.472 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	16.203 us	1	13.421 us	1	10.645 us	1	9.341 us	1	13.496 us
Sync Width	3	48.608 us	3	40.264 us	3	31.935 us	3	28.023 us	3	40.488 us
Back Porch	31	502.278 us	38	510.012 us	49	521.606 us	56	523.096 us	31	418.372 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

2048 x 1280

2.6 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	181.125 MHz		221.250 MHz		280.500 MHz		321.625 MHz		171.875 MHz	
Frame Rate	49.974 Hz		59.979 Hz		74.984 Hz		84.980 Hz		59.975 Hz	
Line Freq	65.816 kHz		79.472 kHz		100.179 kHz		114.213 kHz		78.987 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	2752	15.194 us	2784	12.583 us	2800	9.982 us	2816	8.756 us	2176	12.660 us
Hor Addr	2048	11.307 us	2048	9.256 us	2048	7.301 us	2048	6.368 us	2048	11.916 us
Hor Blanking	704	3.887 us	736	3.327 us	752	2.681 us	768	2.388 us	128	0.745 us
Hor Blank %	25.581%		26.437%		26.857%		27.273%		5.882%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	128	0.707 us	144	0.651 us	152	0.542 us	160	0.497 us	32	0.186 us
Sync Width	224	1.237 us	224	1.012 us	224	0.799 us	224	0.696 us	32	0.186 us
Back Porch	352	1.943 us	368	1.663 us	376	1.340 us	384	1.194 us	64	0.372 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1317	20.010 ms	1325	16.673 ms	1336	13.336 ms	1344	11.767 ms	1317	16.674 ms
Ver Addr	1280	19.448 ms	1280	16.106 ms	1280	12.777 ms	1280	11.207 ms	1280	16.205 ms
Ver Blanking	37	0.562 ms	45	0.566 ms	56	0.559 ms	64	0.560 ms	37	0.468 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	15.194 us	1	12.583 us	1	9.982 us	1	8.756 us	1	12.660 us
Sync Width	3	45.582 us	3	37.749 us	3	29.947 us	3	26.267 us	3	37.981 us
Back Porch	33	501.400 us	41	515.905 us	52	519.073 us	60	525.332 us	33	417.792 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										

2560 x 1600

4.0 MW

	Standard Timings ("CRT")								Red. Blanking ("Non-CRT")	
	50 Hz		60 Hz		75 Hz		85 Hz		60 Hz	
Pixel Clock	285.750 MHz		348.000 MHz		442.750 MHz		507.000 MHz		265.375 MHz	
Frame Rate	50.001 Hz		59.973 Hz		74.977 Hz		84.962 Hz		59.979 Hz	
Line Freq	82.301 kHz		99.315 kHz		125.212 kHz		142.736 kHz		98.726 kHz	
HORIZONTAL	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME	PIXELS	TIME
Hor Total	3472	12.150 us	3504	10.069 us	3536	7.986 us	3552	7.006 us	2688	10.129 us
Hor Addr	2560	8.959 us	2560	7.356 us	2560	5.782 us	2560	5.049 us	2560	9.647 us
Hor Blanking	912	3.192 us	944	2.713 us	976	2.204 us	992	1.957 us	128	0.482 us
Hor Blank %	26.267%		26.941%		27.602%		27.928%		4.762%	
Left Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	176	0.616 us	192	0.552 us	208	0.470 us	208	0.410 us	32	0.121 us
Sync Width	280	0.980 us	280	0.805 us	280	0.632 us	288	0.568 us	32	0.121 us
Back Porch	456	1.596 us	472	1.356 us	488	1.102 us	496	0.978 us	64	0.241 us
Right Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
VERTICAL	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME	LINES	TIME
Ver Total	1646	20.000 ms	1656	16.674 ms	1670	13.337 ms	1680	11.770 ms	1646	16.672 ms
Ver Addr	1600	19.441 ms	1600	16.110 ms	1600	12.778 ms	1600	11.209 ms	1600	16.207 ms
Ver Blanking	46	0.559 ms	56	0.564 ms	70	0.559 ms	80	0.560 ms	46	0.466 ms
Top Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
Front Porch	1	12.150 us	1	10.069 us	1	7.986 us	1	7.006 us	1	10.129 us
Sync Width	3	36.451 us	3	30.207 us	3	23.959 us	3	21.018 us	3	30.387 us
Back Porch	42	510.320 us	52	523.586 us	66	527.106 us	76	532.450 us	42	425.421 us
Bottom Margin	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us	0	0.000 us
	H	V	H	V	H	V	H	V	H	V
Sync Polarity										
VESA Standard 2-byte ID										
VESA Std. 8-byte Description										
Byte 0										
Byte 1										
Byte 2										
Byte 3										
Byte 4										
Byte 5										
Byte 6										
Byte 7										