

## Product Overview



## Digital Photo Frames

## Overview

This Advance Product Information paper provides an introduction to Digital Photo Frames. Digital Photo Frames first appeared on the market in 1999. Due to high component memory and display prices (the primary components that make up photo frames), it took another 7 years for them to take hold in the market (after component prices declined). Frame sales started to ramp up in late 2006, and have been increasing ever since.

New product introductions within the past few months suggest we are in the midst of a transition to the next generation of photo frames. Frame sizes are moving in both directions with greater choices in the sub 5-inch market as well as the large wall mount units in sizes up to 42-inch and beyond.

The rest of this document details the current state of the DPF market. With the wide range of new products that have been announced, most of the available options are detailed, after which we have outlined the various products types and capabilities to match potential markets. Due to the vast number of products / product types available, the list presented below is not inclusive. Jade Connections works with buyers to obtain products / product types to match their specific needs.



## About Jade Connections

Jade Connections specializes in connecting the needs of Western buyers and Asian manufacturers. Jade Connections provides customized sourcing and provides customers with direct quality assurance, multiple sourcing options, and local factory representation. With its main office located in Hong Kong, five minutes from China's industrial center of Guangdong province, Jade Connections is centrally located for most suppliers. Additionally, the ports of Hong Kong and Guangdong are some of the world's largest, making worldwide shipping straightforward and efficient. By maintaining local telephone numbers in Los Angeles (USA), Shenzhen (China), Hong Kong, and soon New York and London, customers and suppliers alike can work with Jade Connections as they would any local company.

Whenever possible Jade Connections arranges for multiple suppliers ensuring that should problems arise with either products or production demands the automatic backup suppliers are already in place. This ensures a consistent and predictable flow of products. For most projects, Jade Connections staff physically visits all supplier factories to confirm production quality and capabilities. For this project, Jade Connections is working with a primary and two secondary suppliers, which we will visit to confirm capabilities prior to the first shipment.

Jade Connections also works with Chinese suppliers interested in expanding into Western markets. Jade Connections provides assistance with product development, documentation and sales material. Finally, Jade Connections matches the needs of the supplier and products to provide whatever after sales support is needed. Options include Internet based information and OEM call center service offerings.

## Introduction To Digital Photo Frames

The past several months have seen significant improvements in the Digital Photo Frame products being offered. A year ago most vendors were offering basic units with plain or basic looks. Today there are numerous choices in terms of aesthetics, functionality, network capabilities, and sizes ranging from key chains to 42 inch and larger wall mount units used for corporate advertising solutions.

Below are some of the things to consider when choosing a Digital Photo Frame.

### Aesthetic / Artistic Characteristics

The market for Digital Photo Frames is as concerned with style as it is with technology and functionality. The market for these devices has matured to the point where it is no longer satisfied with just basic functionality. As these devices continue to find more places in the home and office, they need to fit in with the target décor and enhance the environment they are a part of rather than act as a distraction.

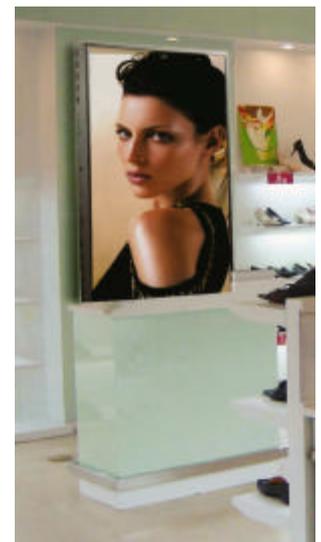
Some of the characteristics to consider include:

- ❖ **Style:** the look and presentation of frames vary widely. Photo Frames can now be had to match pretty much any look or style desired. Gone are the days where the only option was an oversized acrylic black border frame, with the displayed images being almost an afterthought. Frames are now available in many different styles and materials including acrylic, plastic, metal, leather, wood, and others. Some frames even allow the frame borders themselves to be changed.
- ❖ **Display / Mounting:** Most all frames in the 3.5-inch through 15-inch sizes are available for table display. Some also have mounting holes for wall mounting. When considering a frame for wall mounting, be sure to check the depth of the unit, as some of the units not specifically designed for wall mount tend to be quite thick, and might not have the desired look when wall mounted. When considering wall mounting, remember that these units still need power to operate, so you may end up with a somewhat unsightly wire to deal with.

Units sized 17-inch and above are almost all designed to be able to be wall mounted, with wall mounting being the only option for the largest units.

- ❖ **Orientation:** some frames can switch from portrait to/from landscape orientations. When the frame is rotated the photos should rotate to match.
- ❖ **Frame Lighting:** side lighting is available on a few of the acrylic frames.
- ❖ **Physical Controls:** most traditional photo frames have button controls on the side of the unit for controlling frame functions. Some of the newer frames have moved these controls to the front panel of the display. Depending on how this is done, it can represent a visual distraction even if it makes operation easier. Touch controls are being used more for this purpose, so as to avoid the bulky switches normally used on the side.

On some new high end devices, these controls take the form of touch controls that blend in well with the frame border, making them almost invisible. Other solutions which are likely to become more common over time is the incorporation of a touch screen, where all functions can be selected by simply touching menu items on the main screen of the frame itself.



## Screen Characteristics

In addition to how well a frame fits into its surroundings (aesthetics), its ability to deliver a clean and crisp image is critical. Characteristics that can affect how well a frame performs include screen size and resolution, color depth, display type, viewing angles, and how it handles different aspect ratios. These are discussed below:

- ❖ **Frame Size and Resolution:** The published frame size represents the diagonal distance between opposite corners of the screen. The larger this size, the more total area the frame has available to display images. The resolution of a frame represents the number of pixels, or dots, that the screen uses to render or display a picture. Pixel pitch, related to screen size and resolution is the distance between two adjacent pixels and represents the amount of definition you can expect from a given frame.

For example a frame with a resolution of 640 x 480 uses 640 pixels (dots) horizontally and 480 pixels vertically. A frame capable of a resolution of 1024 x 768 compared with one that can render 640 x 480 at the same frame size will be able to display much more detail in the images. Higher values for screen resolution, and lower values for pixel pitch are desirable.



- ❖ **Color Depth:** the number of colors that a display can render. The higher the number, the more natural pictures will look. Lower quality screens will be able to display fewer different colors (typically around 256,000) than higher quality ones.
- ❖ **Display Type:** the type of display has a huge effect on the quality of your images. Analog displays, an older technology (but cheaper to produce), are still found in some of the mid-sizes devices, and offer poorer brightness and contrast ratios as compared to the newer digital technologies.

The most common digital technology is currently active matrix Thin Film Transistor (TFT). It is anticipated that OLED (Organic Light-Emitting Diode) displays will likely to start appearing soon, initially in smaller devices as costs continue to drop. OLED display technology has a number of advantages over TFT, including much reduced power consumption, better brightness / contrast, and a wider field of view. The chief disadvantage at the time of this writing is a significant cost difference.

- ❖ **Brightness / Contrast:** Brightness is the perceived intensity of a display, and is measured in  $\text{cd}/\text{m}^2$  (sometimes also called nits). A representative value would be  $350 \text{ cd}/\text{m}^2$ , with larger values representing brighter displays.



The contrast ratio of a display measures the difference in brightness between pure white and black on the screen. A representative value is 350:1, with larger ratios being more desirable.

Most frames allow for the manual adjustment of brightness (up to the maximum the screen is capable of). Some of the newer, more advanced, frames can automatically adjust the brightness levels to provide the clearest viewing of images as background lighting changes.

- ❖ **Viewing Angles:** Most display technologies differ in the range of horizontal and vertical viewing angles that will produce satisfactory images. TFT displays in particular vary considerably from the cheaper units to the better quality ones. A poor quality TFT for instance will only display good images when viewed directly in front of the unit, or at just small angles off center. The better the unit, the wider (larger value) the viewing area is, allowing for better viewing.



- ❖ **Aspect Ratio:** The aspect ratio defines the ratio between the width and height of a display. Common ratios are 4:3 (traditional television, computer monitors), and 16:9 (HDTV). Most frames have a fixed aspect ratio, however some of the more advanced units allow for a software selection of the aspect ratio.

If the aspect ratio of the displayed image differs from that of the frame, some may crop (cut off part of the picture) for display in an attempt to maximize the size of the final image (displaying the central portion of the image). Some frames provide the ability to control the behavior of cropping in these situations, but not all. If you want full control over this process you can crop your images in a photo-editing program before sending them to the frame.

## Displaying / Playing Content

While the primary use of Digital Photo Frames is the display of images, many can do much more. For instance it is common for frames to be able to play music stored in MP3 format (and other formats). Video (movie) files saved in standard formats can also be played by many of them.



All frames support some type of slideshow capability, allowing for an automatic cycling of image files by the frame. Frames with multimedia capability (music) often let you associate music files with a slideshow.

A frame can display content as long as it is saved in a supported format. For example, PDF, Word, Power Point, Photoshop, and other file types can be displayed after saving them to an image format the frame can display. Presentations can be saved as separate images, and then displayed as a slideshow for example. With frames that support video, DVD and VCD content can be played once converted to a video format the frame understands.

Text file display is common among many photo frames. Some of the more advanced frames understand additional file formats such as PDF and can render these files directly. A few of the more sophisticated frames we have reviewed have a touch screen interface to the Windows CE operating system, and when connected to the Internet allow for direct web browsing from the frame.

Other display options include the following:

- ❖ **Image Playback:** Image display is the heart and soul of all photo frames. All photo frames can display JPEG images. In addition some frames can display in other formats such as GIF, BMP, TIFF, and PNG.
- ❖ **Audio Playback:** Many photo frames can play music files. Commonly supported formats include MP3, WAV, and WMA.
- ❖ **Video Playback:** Frames that support video or movie playback often vary in what video formats are recognized by the device. Some of the more common formats found are MPEG-1, MPEG-2 (VOB), MPEG-4 (DivX, Xvid, AVI), Motion JPEG, 3GP (cellular phone), WMV, and RMVB. As the controversy surrounding MP3 patents continues, especially in Europe, use of the RMVB (Real Media Variable Bitrate) format seems to be gaining in popularity (mp3 is the common audio codec used in many of the other formats such as DivX, Xvid, and AVI).
- ❖ **Single Image Viewing:** Normal browsing mode lets you scroll through images manually. Some frames provide thumbnail view, allowing for the display of many smaller images at the same time, so that individual photos can be identified and selected quickly.
- ❖ **Slideshows:** Allow for the display of a group of images in sequence. Some frames let you select the order of the display, while others sort based on filenames. Some allow for random shuffling of images, creating a less predictable experience. Most frames also let you choose the transition effects to apply between images. The choices in effects can vary from frame to frame. Transition timing can also usually be set.



- ❖ **Content Management:** lets you rotate, copy, crop, and delete images. Some frames let you add masks and borders and apply special effects or filter, for example, to show a photo in sepia or black and white.



Most frames allow for the automatic resizing of images to best fit the frame resolution. However automatic image resizing of large images can slow down some frames. In addition, not all frames will retain the images original aspect ratio when resizing, resulting in a distorted rendering. This can be overcome by manual resizing of the images prior to loading on the frame, but this is an extra step that many may not be willing to do, even considering the reduced size of the new image.

- ❖ **Album / Folder Support:** Some also let you organize photos into electronic albums or folders so you can select which set of images to display at any given time.
- ❖ **Multi-Show:** some of the newer frames offer an option where the screen area can be organized into several (4 or more) sub-frames, so that several images can be displayed at the same time.
- ❖ **Audio and video out:** An audio connector allows for the connection of external speakers for better sound. Photo frames with built in speakers vary in terms of sound quality. If music and/or movie playing is important, often attaching separate speakers can enhance the experience. Photo frames with video out connectors let you connect your photo frame to another system such as a television. Make sure that the video format matches the system in use in your market. Common formats include PAL, NTSC and others.



## Additional Features

Other more general features are becoming increasingly common on photo frames. Some of these include:

- ❖ **Remote Control:** Like your typical television or VCR remote control, a photo frame remote control lets you change settings and control a slide show in progress. Unlike the television or VCR remote however, Digital Photo Frame remote controls typically will only operate from at most a meter or two away from the device. Unless otherwise stated, using a remote across the room is usually not possible.
- ❖ **Clock Functions:** Many frames include a built-in digital clock. Options include calendar display, and alarm clock functionality. Some frames let you define times when the frame will automatically turn on and what time it will automatically shut down. On some of the more advanced units you can set different times for weekdays and weekends. At least one frame lets you specify a date, such as a birthday, when a specific photo will be displayed.
- ❖ **Rechargeable Battery:** most frames smaller than 3.5-inches have batteries integrated with the frame. The batteries are recharged when the frame is connected to a USB hub or charger. Models designed for desktop use (3.5-inch through 15-inch models) are starting to include options for an integrated Li-On battery as well. These frames can be easily moved and taken with you for display away from a power source.
- ❖ **Radio:** FM tuners are available as an option for some models.
- ❖ **Television:** A few of the more advanced models are starting to offer integrated television with the frame.
- ❖ **Language Selection:** sometimes referred to OSD (On Screen Display). It is critical to make sure that the language choices include those critical to the target market. All include support English and Chinese, and many also include support for Spanish and German. Other languages, such as Portuguese and others should be verified if important for your markets.



- ❖ **Software / Firmware Updates:** Some frames provide the user with the ability to directly update the embedded software. The updates are typically downloaded from the manufacturer site or can be obtained through other means (CD distribution, etc).

## Getting Content to Your Frame

For images to be displayed on a frame it must have access to them. There are many ways to send images to a frame, which are detailed below. Some of the newer frames, when used with online photo sharing services, allow for others to submit photos to the service and then have them displayed directly on the frame.

- ❖ **Memory Cards:** The most common way to provide images to a frame. Most frames can interpret memory cards used in digital cameras directly (although an adaptor may be needed if the size is different). Using a memory card reader on your computer, images or other content can be directly written to the card, and then moved to the frame. The number of photos you can display is usually only limited by the number of photos that will fit on the card.
- ❖ **Internal Memory:** provides permanent content storage internal to the device itself. Content stored in internal memory is available regardless if a memory card is inserted or removed. Software in the frame may reduce the size of stored images to the frame's optimal size so more will fit in memory. You can usually select which photos are moved into internal memory but some frames also store images there that have been fed to it by e-mail, RSS and other ways. With the recent price reductions in flash memory, more frames are becoming available with options for large internal memory.
- ❖ **USB Connections:** provides a connection for either USB memory devices (Flash / Thumbnail Drives) or a computer to the frame by cable. When connected to a computer, the frame usually appears as a hard drive so images can be copied directly to it. When a Flash Drive (otherwise known as a thumbnail drive) is connected, files can be directly read from the attached device and displayed.



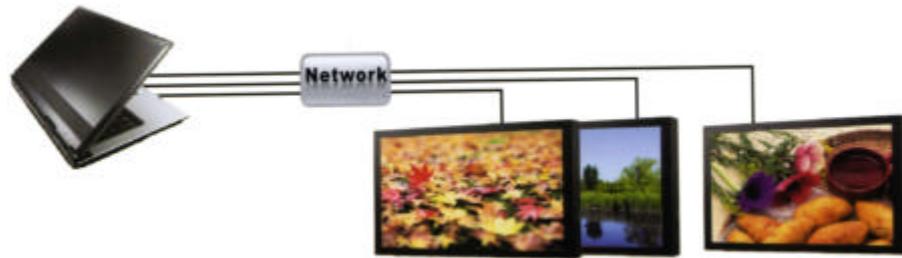
A few of the newer very high end frames allow for the computer to act as a master controller for the frame when connected via USB. These frames tend to be the largest sizes (over 20 inches) designed for wall display in an advertising environment.

When evaluating USB connections, the interface speed can be important. If all files are to be supplied on a SD memory card programmed on a host computer (not through USB), speed is not an issue. However, if the frame has a lot of memory that is changed on a regular basis, or if the SD memory is changed via the USB connection, speed is important. Many vendors advertise USB 2.0 interfaces, with the meaning that they can connect to USB 2.0 hubs (almost all USB 1.1 devices qualify under this very loose definition).

- ❖ **Networking Support:** allows the frame to be connected to a home or office network. Some frames physically connect directly into the local network while others support WiFi, allowing the frame wireless access to the network.

Most network enabled frames allow the frame to see volumes on a Microsoft compatible network, allowing the frame to view pictures, videos, etc from network based storage. Some frames may also allow for the frame to be visible to computers on the network, allowing for the download of images directly from networked computers to the frame.

- ❖ **Internet Enabled** frames can either retrieve and/or send images via the Internet in one or more ways. Photos that are stored in personal albums on popular web based photo sites picasa, webshots, flickr, and others, can be



automatically downloaded using a RSS (Really Simple Syndication) feed from the site. As RSS formats can differ, it is important to make sure that a given frame support the photo sharing site you intend to use.

Many popular photo sharing sites allow for the submission of photographs via email. A photo is simply sent via email from either a computer, or a device such as a cellphone to the service, and it is automatically added to your personal album. Frames that are configured to pull images from this web gallery will then automatically see the new photos. This capability is especially attractive to people wanting to give photo frames as gifts to and not have to train the recipient on how to load new photos. For instance, an elderly grandmother would be able to see pictures from her grandchildren, with the grandchildren supplying all the photos either directly or via email.

A few of the newer frames now also have the ability to send a photo directly from the frame via email – allowing for yet another way for photos to be shared.

- ❖ **Bluetooth** support lets you transfer photos to a frame from any other bluetooth device such as a camera phone.

## Sizes and Shapes

Digital Photo Frames are available in a large number of size, shape, and color combinations - everything from 1-inch frames to those that cover the better part of a wall. The greatest selection of shapes come with the smaller frames, 2-inches and smaller. These have been crafted to function as small displays (often with clock functionality) for a desk, as well as various size and shapes of key chains for truly portable use. And if you don't see precisely what you are looking for, let Jade Connections know and we can find a manufacturer that can build precisely the design you are looking for.



## The Photo Frame Market



The Digital Photo Frame market can be broken down by either size classifications or in terms of functionality. Very generally speaking, functionality increases with the size of the frame, but this is not always the case. The lower end of the market, the smallest devices (2-inch and below), are driven by price, whereas the upper end is more driven by quality and functionality concerns. Regardless of how the markets are broken down, the boundaries are not fixed. For example, items that are primarily sold into the promotion market can also be positioned at the low end of the retail market. Conversely, the newer 3.5-inch frames may be attractive to the upper end of the promotion market.

## Categorization of Photo Frames - Functionality

As is evident from the discussion of the large number of options now available in Digital Photo Frames, many combinations are possible. However it is possible to establish broad definitions for a few of the more important markets. The definitions below are not mutually exclusive – a given product may fit into more than one categorization. This breakdown establishes broad categories that match markets.

### Promotional

Promotional devices tend to be smaller (under 3.5-inch) and with minimal functionality. Price is the main driving force in this market. Since extra features can drive pricing up, they often are not present. Most devices have minimal internal memory, and many do not take SD type memory.

Common packaging includes small desktop displays, and an assortment of key chains in a wide variety of shapes and sizes.



### Basic

Basic units generally fall into the desktop size category. Frames in this category have minimal optional functionality. The market segment they fall into tends to be more price driven rather than feature / quality. Basic features generally include manual / slideshow image viewing, basic video, mp3 audio, and sometimes a remote control. Screen quality is adequate but not top of the line. Some may have minimal calendaring and clock functionality.

### Advanced

Advanced units include all the functionality of the basic category and more. Frames in this category fit into a market segment more focused on features and quality than simply price alone. Features seen on this category of frames not normally found on Basic units include changeable frame borders, image editing functions, large internal memory, better quality displays, adjustable orientation (software), and always the ability to accept either USB memory and/or SD type memory devices.



### Broadcast Enabled

Digital Photo Frames are starting to be seen with integrated Radio and/or Television tuners. Radio tuners, as they are cheaper and can be easier integrated are starting to be seen on the mid-range frames. Television tuners (both analog as well as the newer digital varieties) are also starting to be seen on top end units.

### Network Enabled

Network enabled frames currently occupy pretty much the high end of the market. From simple Bluetooth abilities to full wireless local network and Internet capabilities, these devices overlap with the high end of the advanced category. The simple network functions like Bluetooth are likely to be found on desktop frames. Full Internet and local network functionality can be found on the larger desktop frames as well as wall mount units. Generally speaking the larger the unit, the more important networking abilities become. For the larger wall mount units, targeting the corporate advertising market, wireless and remote administration of the frame becomes an important set of capabilities.



## Categorization of Photo Frames - Sizes

Breakdown by device size is reasonably simple. Below each category is defined by size ranges:

### Promotional / Portable

As the promotional market is extremely price driven, items in this category tend to be the smaller units, with less functionality. Sizes range from the smallest devices up to about 3.2-inch. Common sizes in this category (all measured in inches) are 1.5, 1.8, 2.0, 2.4, 2.8, and 3.2. It should be noted that the 1.8-inch to 3.2-inch devices often overlap devices categorized as mp4 players, as music capability is often integrated in with the device. For devices that have a better focus on music / video in the smaller form factors, but can still display images, please consult Jade Connections for suitable mp4 / portable media player offerings.

Common packaging includes small desktop displays, and an assortment of key chains in a wide variety of shapes and sizes.



## Desktop

Desktop units range in size from 3.5-inch through 15-inches. Common sizes in the desktop category (measured in inches) include 3.5, 5.6, 7, 8, 10.4, 12.1, and 15-inches.

Unlike the promotional category, desktop sized units are available in a complete range of functionalities and prices. Basic units in the 3.5-inch to 12.1-inch range tend to be targeted at the more price conscience lower end of the market. The more functionality however that is integrated tends to position the devices at the higher end of the market, which is more quality and functionality focused rather than simply price.



Most of the frames in this category of 10.4-inches and above have the ability to be wall mounted in one way or another. If wall mounting is desirable in this size range, be sure to check out the width of the device to make sure that it will look good. Many of the frames in this size range were not primarily designed with wall mounting in mind, so depth can be an issue.

## Wall Mount

Wall mounted units range in size from 17-inches to 42-inches and larger. Common sizes in the wall mount category (measured in inches) include 17, 19.7, 26, 32, 40, and 42-inches.

Features that can be important with wall mounted devices, especially in the larger sizes are networking and remote management. The larger units are targeted primarily at the corporate advertising space, and the ability to control or deliver content remotely via a network connection can be critical.

## Certifications and Licensing

Depending on the target geographic market, and the features found in the frame, one or more sets of certifications and/or licenses may be required. Any device that connects to a power source (this includes most all Digital Photo Frames) should be concerned about electrical safety. The CE certification (primarily Europe, Asia) covers this area. The American counterpart is UL (Underwriter Laboratories). Generally speaking CE and UL certifications are very similar, and as long as one is obtained, getting cross-certification is a relatively simple process.

RoHS certification addresses material safety, and is a UK driven certificate. Mainly important in European markets.

FCC (the American Federal Communications Commission) certification is important for any device that receives or transmits radio frequency. This includes frames with integrated radio and/or television tuners. It also covers frames with networking capabilities. Please check with your local regulators or Jade Connections to see if FCC certification is necessary for your market for a given Digital Photo Frame.



Sisvel as it relates to Digital Photo Frames is a license for mp3 related technologies. Any device that integrates mp3 player functionality may be required to have the proper Sisvel license. At the moment this relates primarily to Europe, as products with mp3 functionality but without a properly documented sisvel license have started to be confiscated by European customs officials. While there have been no reports of similar actions elsewhere, it the belief of Jade Connections that similar enforcement is likely to start occurring in the United States and elsewhere soon.

## For Additional Information

For more information regarding this proposal, please contact Jade Connections Sales at any of the phone numbers listed on the Jade Connections website, or via email to [sales@jadeconnections.com](mailto:sales@jadeconnections.com).