

## Product Brief

Zoran Corporation  
1390 Kifer Road  
Sunnyvale, CA 94086-5305

www.zoran.com



The PM-2060i Precision Digital Modulator delivers the highest quality resolution enhancement available today. The PM-2060i is a single-chip solution that addresses all image enhancement functionality for virtually any resolution laser printer, multifunction peripheral (MFP), laser fax, or digital laser copier.

### Benefits

- Complete, single-chip laser resolution enhancement solutions reduces overall cost and time-to-market
- Best edge enhancement available
- High-resolution rendering
- Multi-bit color and grayscale rendering for photo-realistic output
- Full support for monochrome and four-color printing

### Description

#### High Integration

The PM-2060i is a completely integrated resolution enhancement solution for color and monochrome laser printing devices. It combines all the circuitry required to implement text and line-art edge enhancement, high-resolution rendering, and multi-bit color and grayscale rendering. The PM-2060i has serial and parallel data interfaces, internal line store memory, internal precision digital modulator, internal LUT memory, and clock scaling circuitry. It requires no external memory, delay lines, or phase-locked loops (PLLs).

#### Superior Enhancement

Based on Zoran's proprietary image enhancement technology, the PM-2060i offers a range of advanced image enhancement modes: High-resolution Rendering, Edge Enhancement, Multi-bit Color and Grayscale Rendering, and Contone Auto Position.

#### High-Resolution Rendering

This mode accepts 2x source data, rendering 1200 dpi text, line-art and images on 600 dpi engines. The PM-2060i prints the 1200 dpi input data using precision digital modulation, doubling both the horizontal and vertical resolution of a 600 dpi engine.

The PM-2060i supports engine speeds up to 60 pages per minute at 600 dpi independent of page description language, CPU, compression scheme, or host application. The result is a complete enhancement solution that maximizes performance, while minimizing development time, cost and complexity.

### Key Features

- Text and line-art edge enhancement
- 2x high-resolution rendering (vertical and horizontal)
- Multi-bit (contone) input mode
- Contone Auto Position mode
- Economy mode reduces toner used while preserving print quality
- Full support for four-color printing
- Two source data input modes (serial video, parallel video)
- On-chip precision digital modulator (66 MHz max/3 MHz min video rate)
- Multiple print engine resolution support - 300 to 800 dpi
- Internal beam detection synchronization
- Internal line store memory
- Internal print engine calibration table
- Supports 13.65" maximum scan line length at 600 dpi

#### Edge Enhancement

This eliminates "jaggies" to improve the appearance of text and lineart. The PM-2060i uses the industry's largest analysis window to generate the dot size and position information for the internal modulator, which has sub-nanosecond precision. The result is an effective doubling of the resolution of text and line-art. For MFP and low-end applications, the edge enhancement feature can also scale source data at 1/3 and 1/2 resolution of the print engine, while enhancing output.

#### Multi-bit Color and Grayscale Rendering

The multi-bit modes accept up to 8-bit-per-pixel input data (600x600x8, 600x600x4, etc.) to produce 256 shades per color plane for true photo-realistic output. The PM-2060i screens image data or accepts pre-screened image data and outputs to the print engine using the internal digital precision modulator. The multi-bit modes are ideal for printing scanned images or for printing from contone-capable PDLs.

## Precision Digital Modulator

### Product Brief

#### Descriptions (continued)

##### Contone Auto Position

This mode enhances 600x8 and 600x4 data by detecting solid black and white areas, and automatically positioning gray dots, or varying width pulses, adjacent to solid blacks to improve anti-aliased text, line art and halftone dots.

##### Versatile Implementation

Beyond the elimination of external components, the PM-2060i has been designed for easy implementation on any controller design. It offers significant advantages over competing designs:

- While other solutions require a 4x or 8x video clock, the PM-2060i only requires a 1x video clock from the print engine. This eliminates problems associated with transmitting very high frequency 4x or 8x clocks around on the controller board.
- Unlike solutions requiring external circuitry to synchronize with the beam detect (BD) signal, the PM-2060i has internal, automatic BD synchronization to within 1/256nd of a dot clock.
- The PM-2060i has sub-nanosecond positioning accuracy (resolution) for total control of laser pulse width and position within a video clock period.
- Unlike analog modulators that require linearization and inherently possess dead zones, the PM-2060i has an all-digital modulator. It is inherently linear, has no dead zones, and delivers a significant increase in subpixel placement accuracy, for exceptionally fine detail.

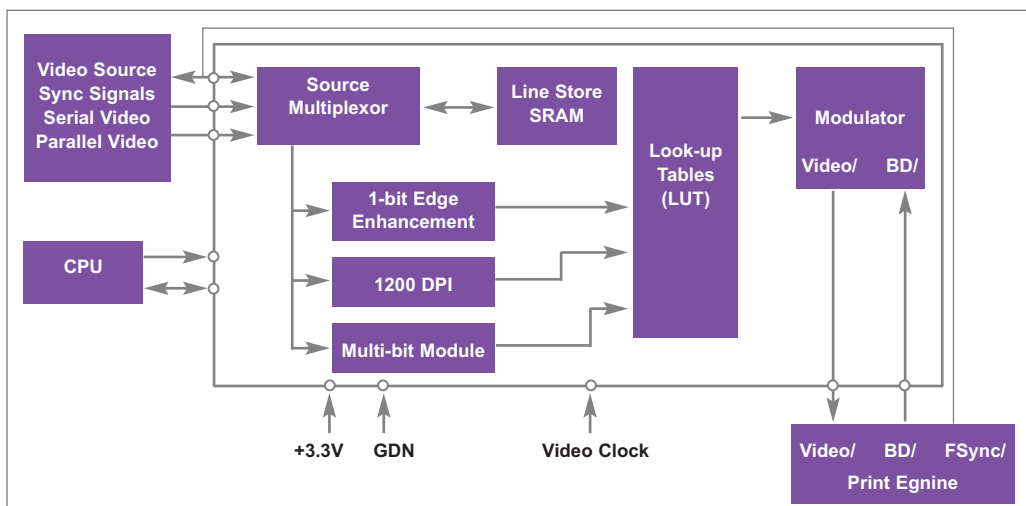
- Internal LUTs are used to store the print engine calibration tables that provide the correction necessary to compensate for print engine, toner, paper, and environmental variables in the printing process. The LUT is addressed and downloaded directly by the CPU at power up or between pages. Different LUTs may be loaded between color planes for maximum flexibility.
- The PM-2060i is designed for maximum flexibility to preserve your investment, offering full programmability of all functions. This enables adding new features as products grow and mature. Designs based on the PM-2060i can easily adapt to changes in CPUs, speeds, resolution, page description languages, and host applications.

#### Range of Configurations

The PM-2060i is available in a range of configurations to meet a variety of design, performance and cost requirements. The PM-2060i family includes the following:

	PM-2060i	PM-2040i	PM-2020i	PM-2010i
Max Pages Per Minute (ppm)	60	40	20	10
Max Video Rate (MHz)	66	50	30	15
Max Line Length (inches)	13.65	11.7	8.25	8.25
Multi-bit Rendering	●	●		
Contone Auto Position	●	●		
3 MHz Min Video Rate	●	●	●	●
3.3 Volt Supply Voltage	●	●	●	●
Available in 52-pin Metric Plastic Quad Flatpack	●	●	●	●

#### PM-2060i Block Diagram



© Copyright 1999-2006 Zoran Corporation. All rights reserved. Zoran, the Zoran logo are trademarks of Zoran Corporation. All other names used are owned by their respective owners. Zoran Corporation makes no guarantee concerning the accuracy of the information contained herein and further does not guarantee that the use of such information will not infringe the rights of any third party. Zoran will not be responsible for any loss or damage of whatever nature resulting from the use of, or reliance upon, the information. Zoran reserves the right to make changes in the product and/or specifications presented herein at any time without notice.