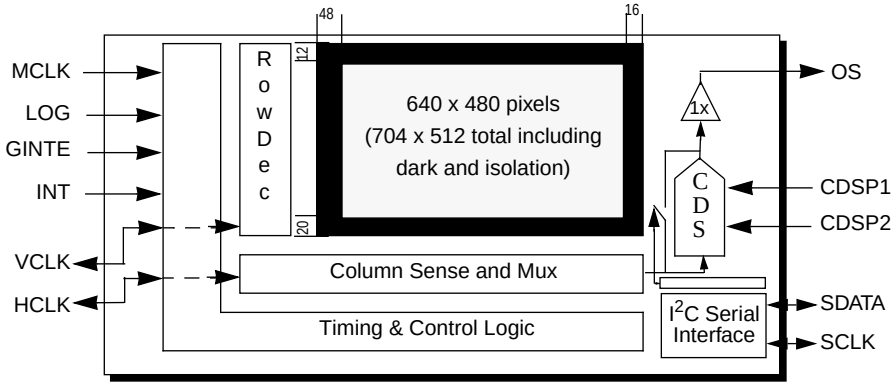
MCM20008

Product Overview

1/3” Color VGA Image Sensor
640x480 pixel progressive/interlace scan solid state image sensor

The MCM20008 is based on an active pixel design realized using sub-micron ImageMOS^{TM} technology developed especially for imaging applications. The proprietary ‘pinned’ photodiode process results in an excellent blue response. The quantum efficiency also exceeds that of comparable sensors in the red spectrum. Optional lenslet arrays can be added to improve the effective fill factor for higher sensitivity. Readout noise is minimized by using on-chip Correlated Double Sampling (CDS). This, along with the low dark current of 0.2nA/cm^2, optimizes the sensor dynamic range to 66 dB. The driver circuits for timing and control functions are integrated on-chip.

The sensor can be run by supplying a single Master Clock. The option for user supplied clocks is available. The sensor provides various user selectable options such as scan mode selection for full motion/still imaging, CDS on/off, and variable integration times. Either analog CDS or raw video signals are output via a 75Ω capable driver. Digitization can be done by Motorola’s MCM10005, among others. Given the excellent electro-optical performance, low power dissipation, and on-chip integration, Motorola’s image sensors and support devices are suitable for a variety of consumer applications including still/video imaging, scanners, security/ID systems, and automotive.



Feature	Value
Resolution	640x480 pixels
Pixel Size	7.8 μm x 7.8 μm
Image Size	5.0mm x 3.7mm
Readout Rate	13.5 MHz
Frame Rate	30 FPS
Vsat (w/CDS)	1.0 V
Conv. Gain	13 μV/e
Fill Factor (max)	65%
Sensitivity	1.8 V/lux-sec
Avg. Col. FPN	0.17%
Dark Current	0.2 nA/cm^2
Dynamic Range	66 dB
Power Diss.	50 mW
Power Supply	3.3 V+/-10%

Block Diagram and Sensor Specifications

This document contains information on a new product.
Specifications and information herein are subject to change without notice.

FEATURES

- Motorola's patented ImageMOS^{TM} process developed with Kodak.

- Patented pinned photodiode architecture
  > Provides enhanced quantum efficiency across the entire visual spectrum especially in blue.
  > Gives ultra low image lag and smear.

- Bayer RGB Color Filter Array (CFA)
  > Kodak CFA technology results in superior spectral and transmission characteristics of the CFAs.

- Microlenses available to improve pixel fill factor up to 65% for enhanced sensor sensitivity.

- Enhanced dynamic range: 66 dB (11 bits) operation
  > Available Correlated Double Sampling (CDS) aids in suppression of correlated pixel noise and pixel to pixel offset variations.
  > Low fixed pattern noise and dark current.
  > Antiblooming available for high light conditions.

- On-chip integration
  > Driver circuits for timing control and CDS are integrated on-chip.
  > The sensor can be run by supplying a single master clock. On chip generation of standard reference timing signals such as Row and Frame syncs is available.

- Multiple operating modes selectable via I^2C interface

- Shuttering mechanism
  > Available electronic shuttering allows a continuous variable speed exposure from 1 to 1/256 frame time.

- Frame capture
  > Continuous frame capture mode - allows high frame rates by integrating in parallel with readout - ideal for live video.
  > Single frame capture mode - user controlled integration, allows long integration times - ideal for still photography or low illumination conditions.

- CDS/Gain control
  > Allows user to disable on-chip CDS for applications utilizing external CDS circuits. CDS enable also provides a 2x gain on output video.

- Readout clock generation
  > The sensor generates vertical and horizontal readout clocks and provides sync pulses for peripherals. Internal clocks are disabled if user generated clocks are provided.

- Scan mode
  > Allows selection of either progressive or interlaced image scanning modes.

- Power down
  > Stand by - Power save mode selection during inactive periods reduces power dissipation by 10x.

- High speed readout
  > Readout rates of 13 MHz give frame rates in excess of 30 fps.

- Power Consumption
  > Single 3.3V power supply.
  > Power down mode results in substantial reduction in dynamic power dissipation.

BENEFITS

- On chip integration
- Reduced component count and footprint
- Lower system cost
- Low power consumption
- High frame rate
- Wide dynamic range
- Flexible application usage
- Improved system performance
- Architecture has the capability for future integration and cost reduction
- Image capture quality comprable to CCD technology
- Simplifies system design and architechture.

QUESTIONS AND ANSWERS

Q. How good is the image quality?

A. Motorola's image sensors incorporate a patented ImageMOS™ process which was jointly developed with Eastman Kodak. The sensor uses a patented pinned photodiode architecture which provides enhanced quantum efficiency and gives ultra low image lag and smear. The sensor has low fixed pattern noise, low dark current, and antiblooming for high light conditions giving it a high dynamic range (66 dB). Correlated double sampling aids in suppression of correlated or fixed pattern pixel noise and pixel to pixel offset variations.

Q. Do CMOS sensors have more noise than CCDs?

A. Many CMOS image sensors utilizing photodiodes and photogates have more noise and lower sensitivity than CCDs. Motorola's architecture utilizes 'pinned' photodiodes, the same photoelements used in CCDs. This along with on-chip CDS enables us to achieve the same low noise performance as CCDs.

Q. How does Motorola's VGA image sensor reduce the cost of my system?

A. Cost is reduced by simplifiing power supply requirements to a single 3.3 V power supply (vs. positive and negative high voltage (5-12 V) supplies for CCDs) and by eliminating the high power timing driver buffers. In addition, the integration of 3 chips into a single chip (digital control, analog signal processing and timing control) eliminates the cost of extra packages and simplifies board design and product manufacturing.

Q. How does Motorola's VGA image sensor reduce power consumption?

A. Motorola's sensors run off of a single 3.3 V power supply (compared to 5 V or higher power supplies required for many CMOS sensors and 12-15 V for CCD sensors). Our chip also has a power down mode that reduces power dissipation by 10x. Power dissipation at nominal speed of operation is only 50 mW.

Q. What are Motorola's future image sensor plans?

A. Motorola will offer a complete line of image sensors. We currently have CIF (352x288) and VGA (640x480) sensors. We are developing a megapixel sensor and will also offer digital output versions of all our sensors.

Q. How does the Motorola image sensor improve my system performance?

A. Motorola's sensors offer numerous features that improve system performance: on chip integration allows the sensor to be run off of a single master clock; standard reference timing signals (row and frame syncs); electronic shuttering; continuous frame capture mode and single frame capture mode; CDS / gain control; readout clock generation.

Q. How does the Motorola image sensor simplify my system architecture and design complexity?

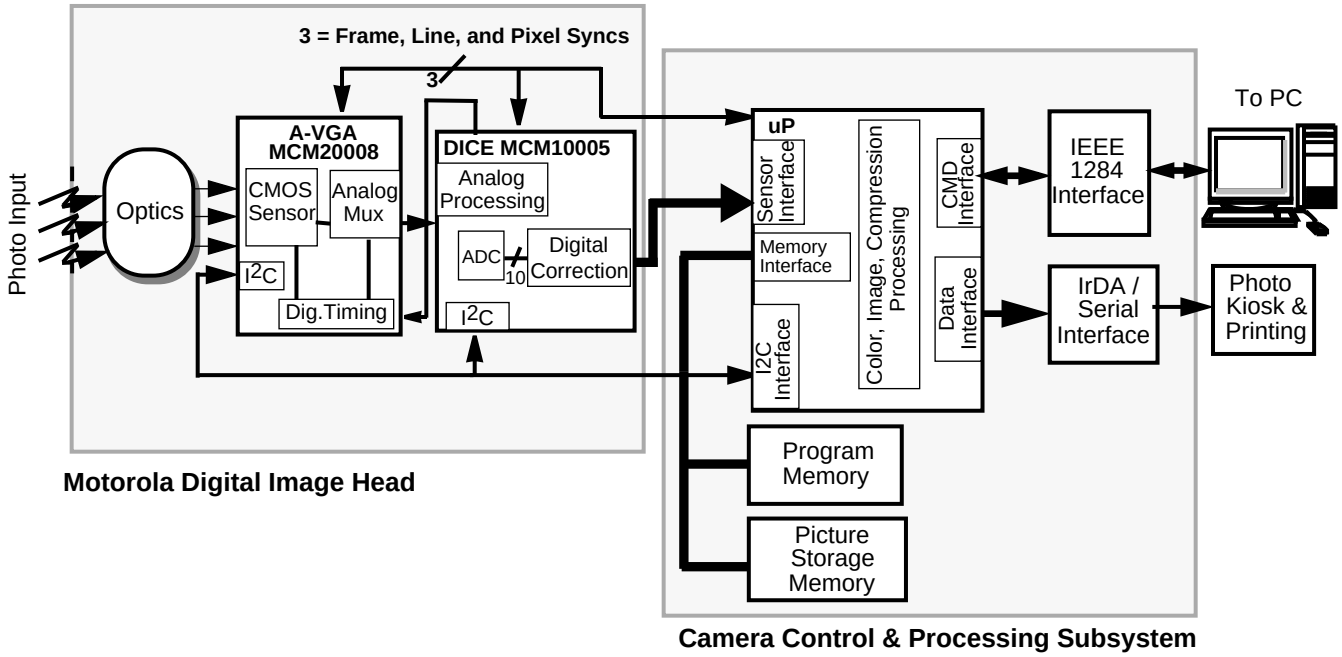
A. Through the I^2C serial bus the customer can select on the fly programming. There are several operational modes, i.e. single frame mode (ideal for still image capture) and video mode (ideal for video applications). Interleaved vs. progressive scan mode eliminates the need to design ASICs or other custom circuitry required to do the same operation on a CCD. Also, Motorola's family of CMOS sensors can be driven by a single system master clock rather than requiring special vertical and horizontal clocks - this eliminates the need for special timing chips and/or special ASICs.

TYPES OF APPLICATIONS

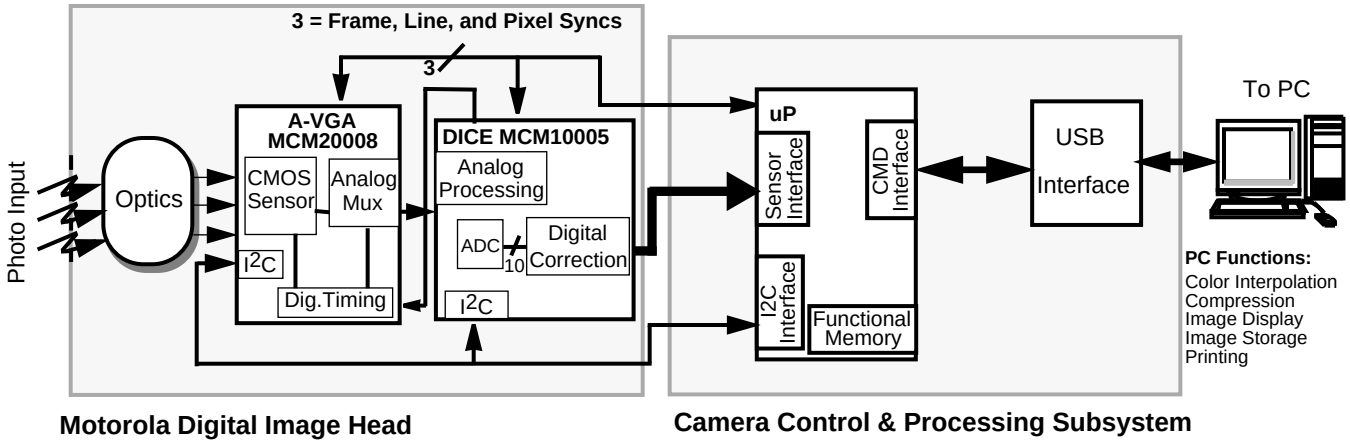
This device is an ideal solution for low cost monochrome and color consumer applications which are driven by cost and demand low power dissipation.

- PC peripheral cameras and video conferencing
- Still and full motion digital cameras
- Security and surveillance cameras
- Wireless video and portable applications
- Biometrics (fingerprint and face scanners)
- Automotive (security, smart airbags)

Digital Still Camera Concept Diagram



Tethered Camera Concept Diagram



LITERATURE
For further information or to see a full data sheet with specifications, characteristics, timing diagrams and pin descriptions, visit our web site: http://sps.motorola.com/consumer-solutions.

If you have questions, e-mail us at RVCB30@email.sps.mot.com or call us at 1-877-MOT-IMAG (1-877-668-4624).

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