

**FFM3020  
Digital Camera Module**

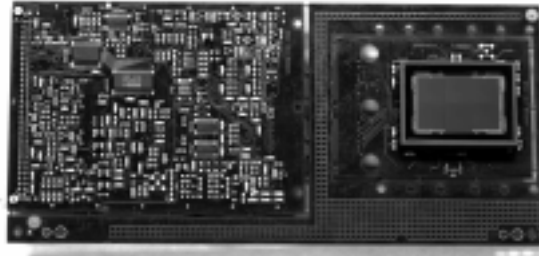
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**Applications**

The **FFM3020** digital camera module is designed for professional applications in:

- **Medical imaging**
- **Scientific imaging**
- **Machine vision**
- **General purpose digital imaging**
- **Digital photography**



**Description**

The **FFM3020** is a 3K x 2K digital camera module that is designed for OEM applications. The module consists of two boards: a sensor board that contains either a **3K x 2K** monochrome or **3K x 2K** color CCD image sensor and a processing board containing the circuitry required to drive the sensor. The boards are connected by two flat flex cables, allowing maximum configuration capability in the camera system.

**Features**

The **FFM3020** digital camera module offers:

- A **3K x 2K progressive scan CCD** in either **color** or **monochrome**
- **True 12 bit images**
- **1/2 sec. single register readout**
- **Compact mechanical design**

**Camera Target Performance Summary:**

<b>AD Conversion .....</b>	<b>12 bit</b>
<b>Total RMS Dark Noise .....</b>	<b>&lt; 2 DN</b>
<b>QMax .....</b>	<b>200 kel</b>
<b>Gain .....</b>	<b>50el / DN</b>
<b>Black Level Adjusted To .....</b>	<b>50 DN ± 5 DN</b>
<b>Black Level Stability .....</b>	<b>± 20 DN</b>
<b>Pixel Separation .....</b>	<b>&gt; 95%</b>
<b>Operating Temperature Range .....</b>	<b>10°...45°C</b>
<b>Power Requirements .....</b>	<b>±5V DC ±12V DC +15V DC</b>

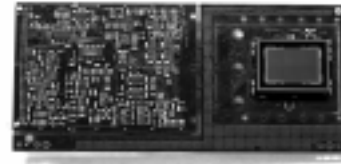
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FFM3020  
Digital Camera Module

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## Sensor

The CCD is a **full frame 3K x 2K progressive scan** image sensor designed for professional digital photographic applications and is available in either **color** or **monochrome** versions. With a very high full-well capacity and an extremely low dark current it produces a **linear dynamic range over 12 true bits** at room temperature. Using four low-noise output amplifiers the FTF3020 can offer **extensive high end visual light application possibilities**.

Figure 1. shows the structure of the sensor in the **FFM3020** module. Data is extracted from output W.

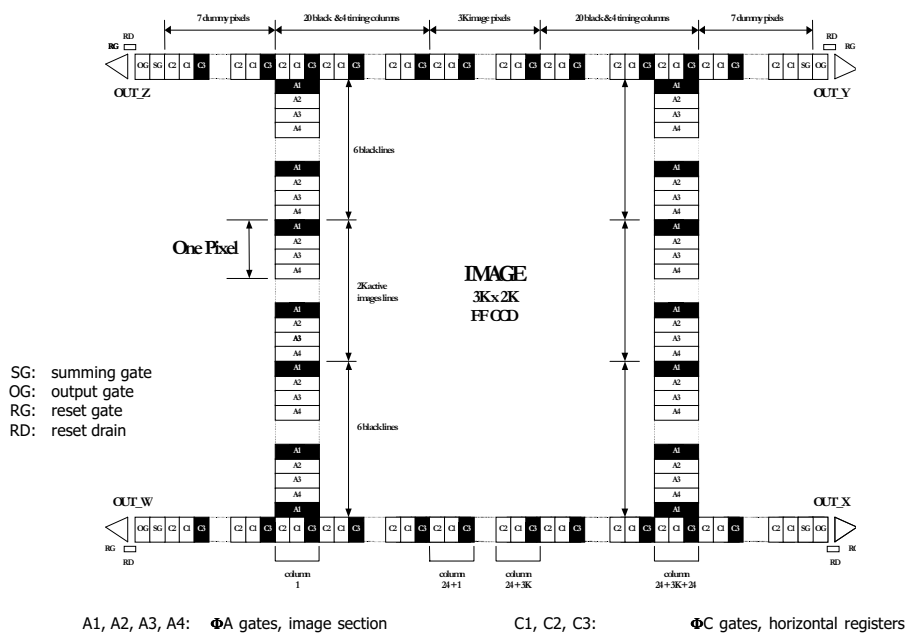


Figure 1. Detailed Internal Structure

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FFM3020  
Digital Camera Module

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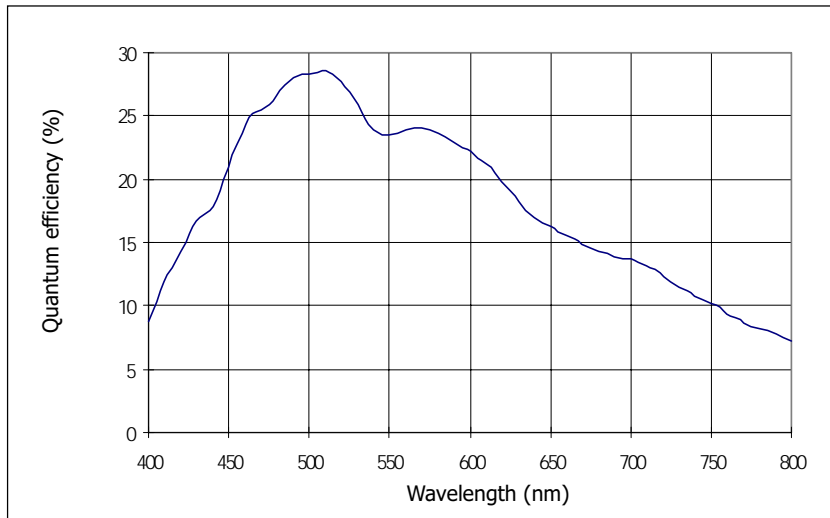
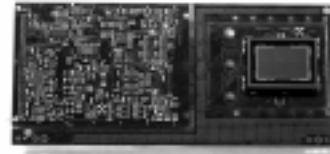


Figure 2. *Quantum Efficiency (Monochrome)*

**Table 1. Blemish specification (max. number of blemishes permitted) (Monochrome)**

	<i>Economy Grade</i>	<i>Industrial Grade</i>	<i>High Grade</i>
Columns	12	1	0
Clusters	12	6	3
Pixels	60	36	24

**Test conditions:**

Temperature        ——— 35°C  
Integration time   ——— 10 ms

**Definition of blemishes:**

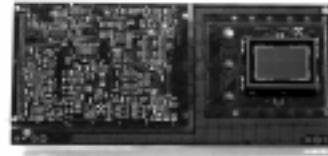
- Pixel defect:
  1. A pixel whose signal, at nominal light (illumination at 50% of the linear range), deviates more than  $\pm 30\%$  from its neighboring pixels
  2. A pixel whose signal, in dark, deviates more than 6mV from its neighboring pixels (about 1% of nominal light).
- Cluster defect:
 

The presence of at most 4 pixel defects around one pixel defect, within a subarea of 3 x 3 pixels
- Column or row defect:
  1. A column which has more than 12 pixel defects.
  2. Column defects must be horizontally separated by 3 pixels.
  3. Row defects are not allowed.

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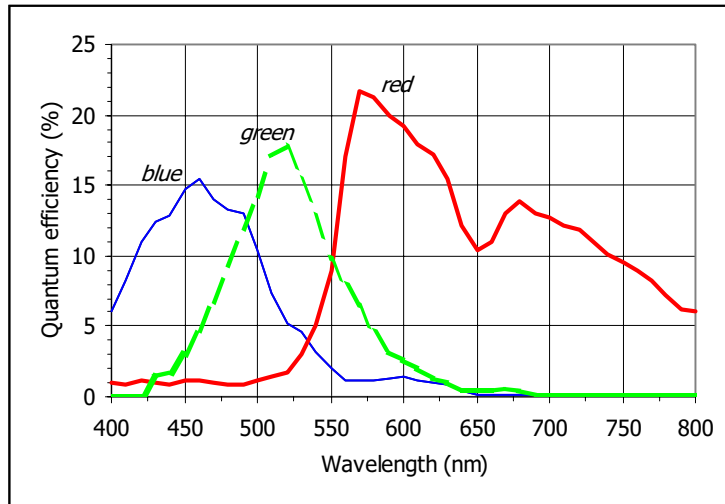
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R	G	R	G	R
G	B	G	B	G
R	G	R	G	R
G	B	G	B	G
R	G	R	G	R

**Figure 3. Bayer RGB Color Filter Pattern**  
The sensor can be provided with **Bayer RGB color filters**. In each grouping of 2 x 2 pixels a red pixel is positioned diagonally opposite a blue pixel with two green pixels in the remaining diagonal spaces as indicated in **Figure 3**. This 2 x 2 pattern is repeated over the whole image area of the sensor.



**Figure 4. Quantum Efficiency (Color)**

**Table 2. Blemish specification (max. number of blemishes permitted) (Color)**

	<i>Economy Grade</i>	<i>Industrial Grade</i>	<i>High Grade</i>
Columns	12	1	0
Clusters	200	50	20
Pixels	3000	1200	250

**Test conditions:**

Temperature      —    35°C  
Integration time   —    10 ms

**Definition of blemishes:**

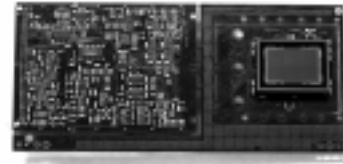
- Pixel defect:
  1. A pixel whose signal, at nominal light (illumination at 50% of the linear range), deviates more than  $\pm 30\%$  from its neighboring pixels
  2. A pixel whose signal, in dark, deviates more than 6mV from its neighboring pixels (about 1% of nominal light).
- Cluster defect:
 

A grouping of pixel defects within a subarea of 3 x 3 pixels where there are at most 5 present.
- Column or row defect:
  1. A column which has more than 12 pixel defects.
  2. Column defects must be horizontally separated by 3 pixels.
  3. Row defects are not allowed.

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**FFM3020**  
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## Connector Pin Out Definition

<u>Pin</u>	<u>Row A</u>	<u>Function</u>	<u>Row B</u>	<u>Function</u>
1.	+5V DC	+5V Power Supply	+5V DC	+5V Power Supply
2.	GND	Ground	GND	Ground
3.	PXLCLK	Pixel Clock	GND	Ground
4.	H-Drive	Horizontal Drive Out	GND	Ground
5.	V-Drive	Vertical Drive Out	GND	Ground
6.	GND	Ground	GND	Ground
7.	D2	Video Data Bit 2	GND	Ground
8.	D3	Video Data Bit 3	GND	Ground
9.	D4	Video Data Bit 4	GND	Ground
10.	D5	Video Data Bit 5	GND	Ground
11.	D6	Video Data Bit 6	GND	Ground
12.	D7	Video Data Bit 7	GND	Ground
13.	D8	Video Data Bit 8	GND	Ground
14.	D9	Video Data Bit 9	GND	Ground
15.	D10	Video Data Bit 10	GND	Ground
16.	D11	Video Data Bit 11 (MSB)	GND	Ground
17.	GND	Ground	GND	Ground
18.	+5V DC	+5V Power Supply	+5V DC	+5V Power Supply
19.	ITC	Integration Control	GND	Ground
20.	OE-NOT	Output Enable Clock Data	XTAL-EN	Enable Oscillator
21.	BINNING-NOT	Vertical Binning On/Off	FREE-RUN-NOT	Freerunning/IT control mode
22.	GND	Ground	GND	Ground
23.	D1	Video Data Bit 1	+15V DC	+15V Power Supply
24.	NC	Do Not Connect	NC	Do Not Connect
25.	NC	Do Not Connect	NC	Do Not Connect
26.	-12V DC	-12V Power Supply	-12V DC	-12V Power Supply
27.	D0	Video Data Bit 0 (LSB)	NC	Do Not Connect
28.	GND	Ground	GND	Ground
29.	+12V DC	+12V Power Supply	+12V DC	+12V Power Supply
30.	GND	Ground	GND	Ground
31.	-5V DC	-5V Power Supply	-5V DC	-5V Power Supply
32.	GND	Ground	GND	Ground

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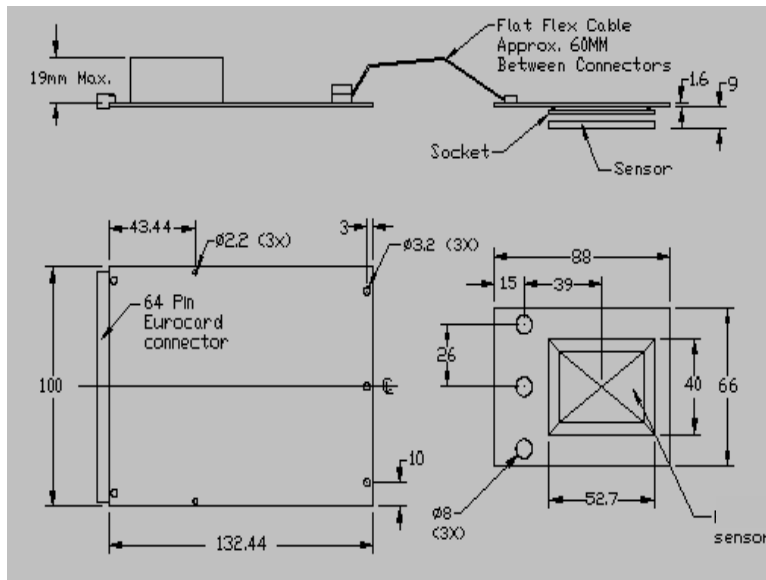


Figure 5. Mechanical Dimensions

Processing board	100 x 132.44 mm
Sensor board	66 x 88 mm



Bottom View FFM3020

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**Table 3. Ordering information**

Module	D/A	Frame Rate (FPS)	Sensor Grade*	Other
			High grade (HG)	<ul style="list-style-type: none"> <li>•Color (C)</li> <li>•Monochrome (M)</li> </ul>
FFM3020	digital (D)	2 frames/sec (14.3 MHz)	Industrial grade (IG) Economy grade (EG)	<ul style="list-style-type: none"> <li>•With removable coverglass (WC) -can be ordered w/ any configuration that includes a sensor</li> <li>•Without Sensor** (WoS)</li> </ul>

### Deliverables

1. **FFM3020** camera module
2. **FFM3020** user manual

**Table 4. Ordering information**  
**Module configurations**

Ordering code	Definition
1. FFM3020 D/2/HG/C	Digital 2 FPS High grade, Color
2. FFM3020 D/2/HG/CWC	Digital 2 FPS High grade, Color, With removable coverglass
3. FFM3020 D/2/HG/M	Digital 2 FPS High grade, Monochrome
4. FFM3020 D/2/HG/MWC	Digital 2 FPS High grade, Monochrome, With removable coverglass
5. FFM3020 D/2/IG/C	Digital 2 FPS Industrial grade, Color
6. FFM3020 D/2/IG/CWC	Digital 2 FPS Industrial grade, Color, With removable coverglass
7. FFM3020 D/2/IG/M	Digital 2 FPS Industrial grade, Monochrome
8. FFM3020 D/2/IG/MWC	Digital 2 FPS Industrial grade, Monochrome, With removable coverglass
9. FFM3020 D/2/EG/C	Digital 2 FPS Economy grade, Color
10. FFM3020 D/2/EG/CWC	Digital 2 FPS Economy grade, Color, With removable coverglass
11. FFM3020 D/2/EG/M	Digital 2 FPS Economy grade, Monochrome
12. FFM3020 D/2/EG/MWC	Digital 2 FPS Economy grade, Monochrome, With removable coverglass
13. FFM3020 D/2/WoS	Digital 2 FPS Without Sensor

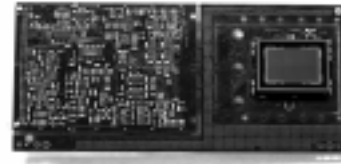
\* See Tables 1 & 2 for determination of Sensor Grades

\*\* If ordering *Without Sensor (WoS)*, disregard column headed "Sensor Grade"

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