1/3.2-Inch 8Mp CMOS Digital Image Sensor Die

MT9E013 Die Data Sheet

For the latest data sheet, refer to Aptina's Web site: www.aptina.com

Features

- Low dark current
- Simple two-wire serial interface
- Auto black level calibration
- Support for external mechanical shutter
- Support for external LED or xenon flash
- High frame rate preview mode with arbitrary down-size scaling from maximum resolution
- Programmable controls: gain, horizontal and vertical blanking, auto black level offset correction, frame size/rate, exposure, left–right and top–bottom image reversal, window size, and panning
- Data interfaces: parallel or single/dual lanes serial mobile industry processor interface (MIPI)
- On-die phase-locked loop (PLL) oscillator
- Bayer pattern down-size scaler
- Superior low-light performance
- On-chip lens shading correction
- 6Kb one-time programmable (OTP) memory for storing shading correction coefficients of three light sources and module information
- Extended Flash duration that is up to start of frame readout
- On-chip VCM driver

General Physical Specifications

- Die thickness: 200µm ±12µm (Consult factory for other thickness)
- Backside wafer surface of bare silicon
- Bond pad metallization composition: 10000A Al over Cu
- Typical topside passivation: 2.2kÅ nitride over 6.0kÅ of undoped oxide
- Passivation openings (MIN): 75µm x 90µm

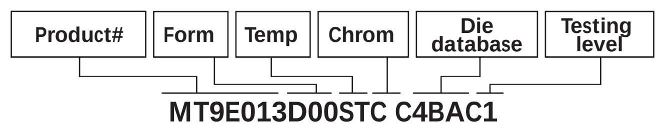
Order Information

MT9E013D00STCC4BAC1

Die Database

- Die outline, see Figure 3 on page 12
- Singulated die size
  - 6626 ± 25µm x 6244.4 ± 25µm
- Bond Pad Identification Tables, see pages 6–10

Options	Designator
• Form	
– Die	D
• Testing	
– Standard (level 1) probe	C1



Note: Consult die distributor or factory before ordering to verify long-term availability of these die products.

Key Performance Parameters

- Optical format: 1/3.2-inch (4:3)
- Active imager size: 4.57mm x 3.43mm: 5.71mm diagonal
- Active pixels: 3264H x 2448V
- Pixel size: 1.4µm x 1.4µm
- Color filter array: RGB Bayer pattern
- Shutter type
  - Electronic rolling shutter (ERS) with Global reset release (GRR)
- Maximum data rate/master clock
  - MIPI: 1000 Mbps/lane (2000 Mbps w/ 2 lanes)
  - Parallel: 100 MHz
- Frame rate
  - Full resolution at 15 fps using 2-lane MIPI
- ADC resolution: 10-bit, on-die
- Responsivity: 0.75V/lux-seconds
- Dynamic range: 65.5dB
- SNR MAX: 35.7dB

Key Performance Parameters (continued)

- Supply voltage
  - Digital I/O: 1.8V nominal
  - Digital Core: 1.2V nominal (1.5V for Rev1 sample)
  - Analog: 2.4–3.1V (2.8V nominal)
  - Digital PHY: 1.7–1.9V (1.8V nominal)
- Power consumption:
  - Full resolution (parallel): 290mW (estimate, not including I/O power) at 55°C (TYP)
  - Full resolution (MIPI): MIPI: 290mW (estimate, not including I/O power) at 55°C (TYP)
  - Hardware standby/shutdown: 15µA (estimate, not including I/O power) (by XSHUTDOWN pin). No state retention.
- Operating temperature: –30°C to +70°C (at junction)

General Description

The Aptina MT9E013 is a 1/3.2-inch CMOS active-pixel digital image sensor with a pixel array of 3264H x 2448V (3280H x 2464V including border pixels). It incorporates sophisticated on-chip camera functions such as windowing, mirroring, column and row skip modes, and snapshot mode. It is programmable through a simple two-wire serial interface and has very low power consumption.

The MT9E013 digital image sensor features Aptina's breakthrough low-noise CMOS imaging technology that achieves near-CCD image quality (based on signal-to-noise ratio and low-light sensitivity) while maintaining the inherent size, cost, and integration advantages of CMOS.

The MT9E013 sensor can generate full resolution image at up to 15 frames per second (fps). An on-chip analog-to-digital converter (ADC) generates a 10-bit value for each pixel.

Die Testing Procedures

Aptina imager die products are tested with a standard probe (C1) test level. Wafer probe is performed at an elevated temperature to ensure product functionality in Aptina's standard package. Because the package environment is not within Aptina's control, the user must determine the necessary heat sink requirements to ensure that the die junction temperature remains within specified limits.

Image quality is verified through various imaging tests. The probe functional test flow provides test coverage for the on-die ADC, logic, serial interface bus, and pixel array. Test conditions, margins, limits, and test sequence are determined by individual product yields and reliability data.

Aptina retains a wafer map of each wafer as part of the probe records, along with a lot summary of wafer yields for each lot probed. Aptina reserves the right to change the probe program at any time to improve the reliability, packaged device yield, or performance of the product.

Die users may experience differences in performance relative to Aptina's data sheets. This is due to differences in package capacitance, inductance, resistance, and trace length.

Functional Specifications

These specifications are provided for reference only. For target functional and parametric specifications, refer to the product data sheet found on Aptina's Web site.

Bonding Instructions

The MT9E013 imager die has 101 bond pads. Refer to Table 1 and Table 2 on pages 6–10 for a complete list of bond pads and coordinates.

The MT9E013 imager die does not require the user to determine bond option features.

The die also has several pads defined as "do not use." These pads are used for engineering purposes and should not be used. Bonding these pads could result in a nonfunctional die.

Figure 3 on page 12 shows the MT9E013 typical die connections. For low-noise operation, the MT9E013 die requires separate supplies for analog and digital power. Power supply rails should be decoupled to ground using capacitors. The use of inductance filters is not recommended.

All DGND pads must be tied together, as must all AGND pads, all VDD_IO pads, and all VDD pads. Doing so will minimize risk of damage to the sensor in an ESD event.

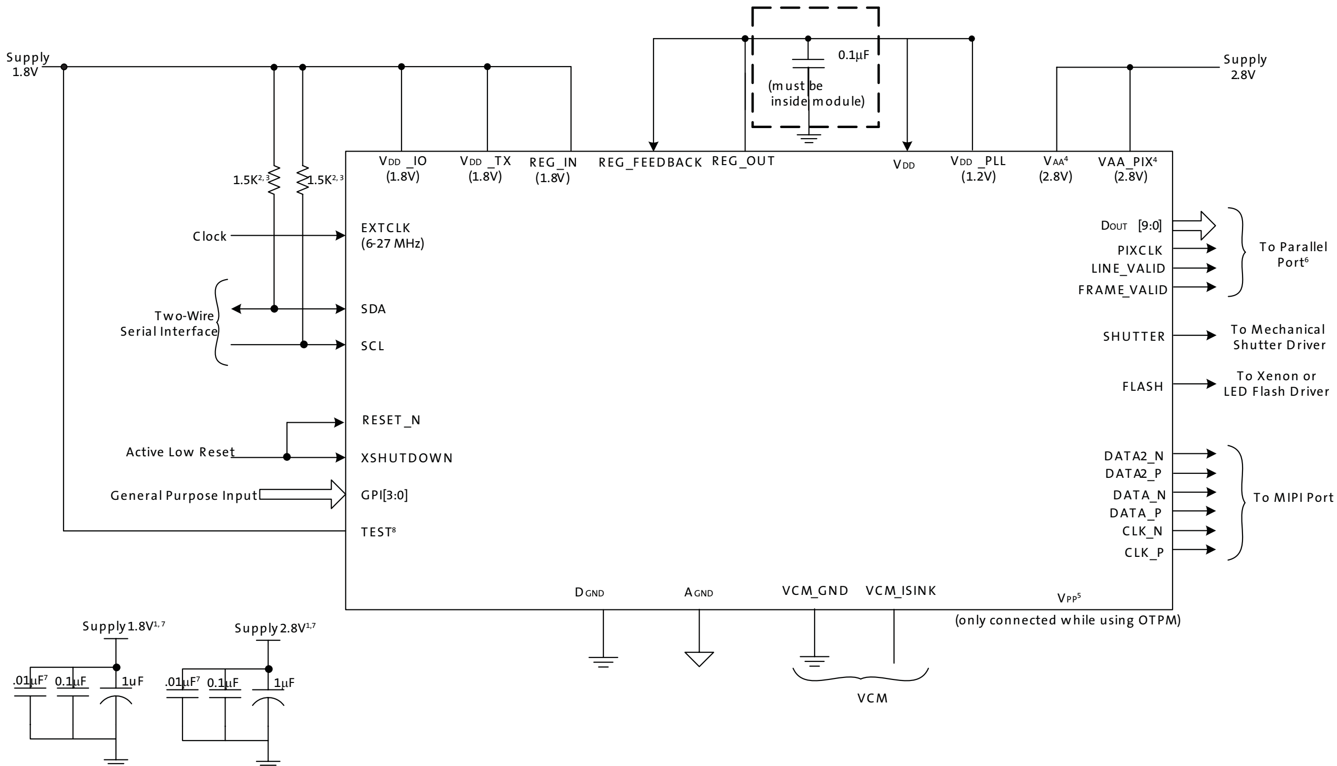
Storage Requirements

Aptina die products are packaged in a cleanroom environment for shipping. Upon receipt, the customer should transfer the die to a similar environment for storage. Aptina recommends the die be maintained in a filtered nitrogen atmosphere until removed for assembly. The moisture content of the storage facility should be maintained at 30 percent relative humidity ±10 percent. ESD damage precautions are necessary during handling. The die must be in an ESD-protected environment at all times for inspection and assembly.

Typical Connections

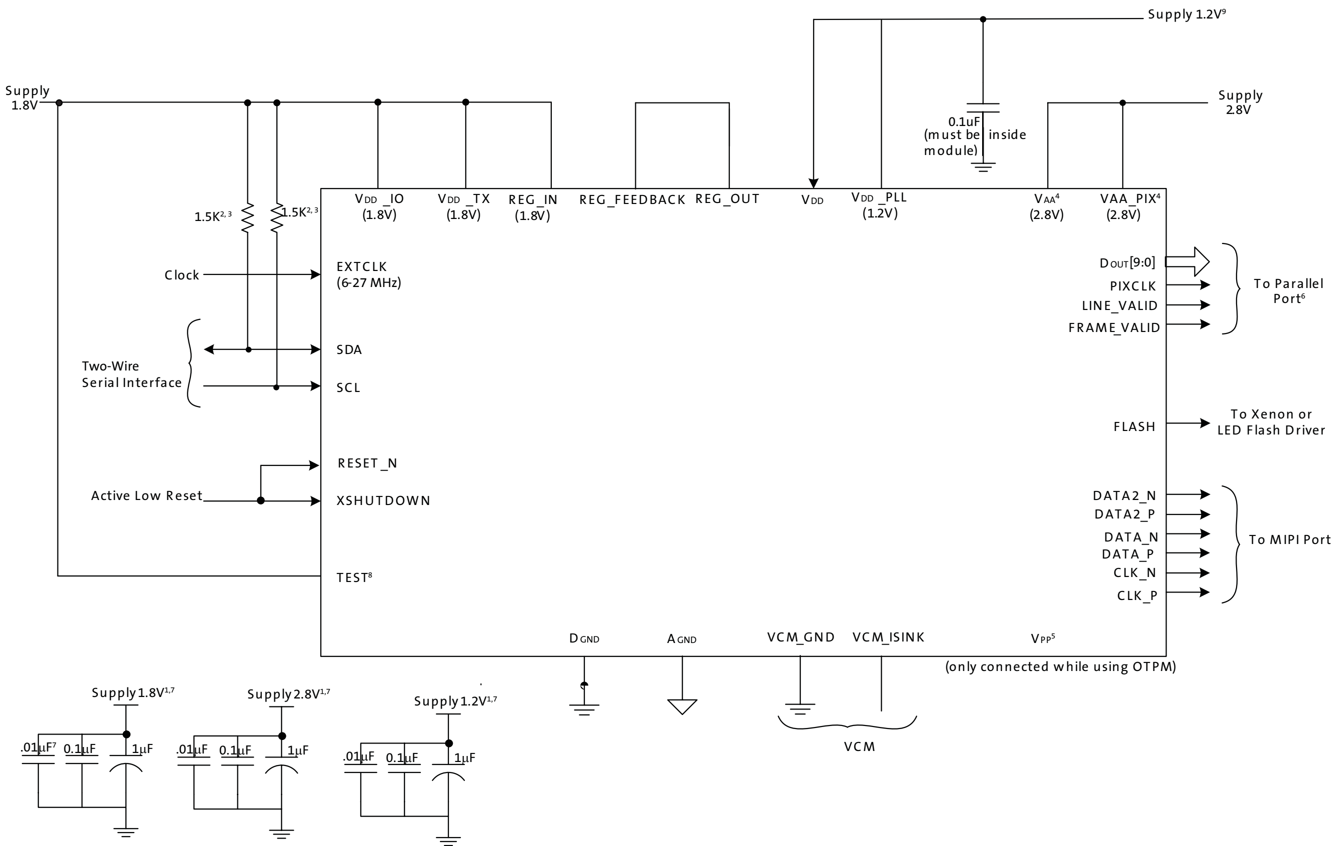
Figure 1 and Figure 2 show the typical MT9E013 connections.

Figure 1: Parallel/MIPI Typical Connections (Using Internal Regulator for VDD and Sensor-Connected PLL)



Note:
1. All power supplies must be adequately decoupled.
2. Aptina recommends using a resistor value of 1.5kΩ, but a greater value can be used for slower two-wire speed.
3. This pull-up resistor is not required if the controller drives a valid logic level on SCL at all times.
4. VAA and VAA_PIX must be tied together.
5. VPP, 6-7V, is used for programming OTPM. This pad is left unconnected during normal operation.
6. The parallel interface output pads can be left unconnected if the serial output interface is used.
7. Aptina recommends that 0.01µF, 0.1µF, and 1µF decoupling capacitors for each power supply are mounted as close as possible to the pad. Actual values and results may vary depending on layout and design considerations.
8. For MIPI configuration, TEST must be tied to VDD_IO. For CCP2, TEST must be tied to GND.
9. ATEST1_TOP, ATEST2_TOP, ATEST1_BTM, and ATEST2_BTM should be floating.

Figure 2: Parallel/MIPI Typical Connections (Not Using Internal Regulator)



Note:
1. All power supplies must be adequately decoupled.
2. Aptina recommends using a resistor value of 1.5kΩ, but a greater value can be used for slower two-wire speed.
3. This pull-up resistor is not required if the controller drives a valid logic level on SCLK at all times.
4. VAA and VAA_PIX must be tied together.
5. VPP, 6-7V, is used for programming OTPM. This pad is left unconnected during normal operation.
6. The parallel interface output pads can be left unconnected if the serial output interface is used.
7. Aptina recommends that 0.01µF, 0.1µF, and 1µF decoupling capacitors for each power supply are mounted as close as possible to the pad. Actual values and results may vary depending on layout and design considerations.
8. For MIPI configuration, TEST must be tied to VDD_IO. For CCP2, TEST must be tied to GND.
9. ATEST1_TOP, ATEST2_TOP, ATEST1_BTM, and ATEST2_BTM should be floating.

Bond Pad Identification Tables

Table 1: Bond Pad Location and Identification from Center of Pad 1

Pad	MT9E013	"X"1 Microns	"Y"1 Microns	"X"1 Inches	"Y"1 Inches
1	SHUTTER	0.0000	0.0000	0	0
2	GND5	150.7200	0.0000	0.005933846	0
3	VDD_IO2	300.8400	0.0000	0.011844071	0
4	EXTCLK	450.9600	0.0000	0.017754295	0
5	SDA	601.0800	0.0000	0.02366452	0
6	SCL	751.2000	0.0000	0.029574744	0
7	RESET_N	901.3200	0.0000	0.035484968	0
8	GPI0	1051.4400	0.0000	0.041395193	0
9	GPI1	1201.5600	0.0000	0.047305417	0
10	GPI2	1351.6800	0.0000	0.053215642	0
11	GPI3	1501.8000	0.0000	0.059125866	0
12	GND6	1651.9200	0.0000	0.06503609	0
13	VDD_IO3	1802.0400	0.0000	0.070946315	0
14	VDD4	1952.1600	0.0000	0.076856539	0
15	LINE_VALID	2098.4400	0.0000	0.082615583	0
16	FRAME_VALID	2281.0800	0.0000	0.08980612	0
17	PIXCLK	2454.8400	0.0000	0.096647051	0
18	GND7	2605.5600	0.0000	0.102580897	0
19	VDD_IO4	2755.6800	0.0000	0.108491122	0
20	DOUT9	2901.9600	0.0000	0.114250165	0
21	DOUT0	3084.6000	0.0000	0.121440702	0
22	GND8	3230.8800	0.0000	0.127199746	0
23	VDD_IO5	3381.0000	0.0000	0.13310997	0
24	DOUT1	3527.2800	0.0000	0.138869014	0
25	DOUT8	3709.9200	0.0000	0.14605955	0
26	VDD5	3856.2000	0.0000	0.151818594	0
27	GND9	4006.3200	0.0000	0.157728818	0
28	VDD_IO6	4156.4400	0.0000	0.163639043	0
29	DOUT2	4302.7200	0.0000	0.169398086	0
30	DOUT7	4485.3600	0.0000	0.176588623	0
31	GND10	4631.6400	0.0000	0.182347667	0
32	VDD_IO7	4781.7600	0.0000	0.188257891	0
33	DOUT3	4928.0400	0.0000	0.194016935	0
34	DOUT6	5110.6800	0.0000	0.201207472	0
35	GND11	5256.9600	0.0000	0.206966515	0
36	VDD_IO8	5407.0800	0.0000	0.21287674	0
37	DOUT4	5553.3600	0.0000	0.218635783	0
38	DOUT5	5736.0000	0.0000	0.22582632	0
39	VDD6	5882.2800	0.0000	0.231585364	0
40	GND12	6178.1600	–272.1200	0.243234159	–0.010713364
41	VDD_IO9	6178.1600	–422.2400	0.243234159	–0.016623589
42	AGND14	6178.1600	–616.2800	0.243234159	–0.024262944
43	VAA14	6178.1600	–766.4000	0.243234159	–0.030173168

Table 1: Bond Pad Location and Identification from Center of Pad 1 (continued)

Pad	MT9E013	"X"1 Microns	"Y"1 Microns	"X"1 Inches	"Y"1 Inches
44	VAA13	6178.1600	–916.5200	0.243234159	–0.036083392
45	ATEST1_TOP	6178.1600	–1026.6800	0.243234159	–0.040420392
46	AGND13	6178.1600	–1136.8400	0.243234159	–0.044757391
47	ATEST2_TOP	6178.1600	–1247.0000	0.243234159	–0.04909439
48	AGND12	6178.1600	–1357.1600	0.243234159	–0.053431389
49	VAA12	6178.1600	–1507.2800	0.243234159	–0.059341614
50	AGND11	6178.1600	–1657.4000	0.243234159	–0.065251838
51	VAA11	6178.1600	–1807.5200	0.243234159	–0.071162062
52	AGND10	6178.1600	–1957.6400	0.243234159	–0.077072287
53	VAA10	6178.1600	–2107.7600	0.243234159	–0.082982511
54	AGND9	6178.1600	–2257.8800	0.243234159	–0.088892736
55	VAA9	6178.1600	–2408.0000	0.243234159	–0.09480296
56	AGND8	6178.1600	–2558.1200	0.243234159	–0.100713184
57	VAA8	6178.1600	–2708.2400	0.243234159	–0.106623409
58	AGND7	6178.1600	–2858.3600	0.243234159	–0.112533633
59	VAA_PIX3	6178.1600	–3008.4800	0.243234159	–0.118443858
60	VAA_PIX2	6178.1600	–3158.6000	0.243234159	–0.124354082
61	VAA_PIX1	6178.1600	–3308.7200	0.243234159	–0.130264306
62	VAA7	6178.1600	–3458.8400	0.243234159	–0.136174531
63	AGND6	6178.1600	–3608.9600	0.243234159	–0.142084755
64	VAA6	6178.1600	–3759.0800	0.243234159	–0.14799498
65	AGND5	6178.1600	–3909.2000	0.243234159	–0.153905204
66	VAA5	6178.1600	–4059.3200	0.243234159	–0.159815428
67	AGND4	6178.1600	–4209.4400	0.243234159	–0.165725653
68	VAA4	6178.1600	–4359.5600	0.243234159	–0.171635877
69	AGND3	6178.1600	–4509.6800	0.243234159	–0.177546102
70	VAA3	6178.1600	–4659.8000	0.243234159	–0.183456326
71	AGND2	6178.1600	–4809.9200	0.243234159	–0.18936655
72	ATEST2_BTM	6178.1600	–4920.0800	0.243234159	–0.19370355
73	AGND1	6178.1600	–5030.2400	0.243234159	–0.198040549
74	ATEST1_BTM	6178.1600	–5146.8800	0.243234159	–0.202632666
75	VAA2	6178.1600	–5257.0400	0.243234159	–0.206969665
76	VAA1	6178.1600	–5407.1600	0.243234159	–0.212879889
77	VCM_ISINK	6178.1600	–5589.6600	0.243234159	–0.220064914
78	VCM_GND	6178.1600	–5943.6750	0.243234159	–0.234002485
79	VDD1	–261.4400	–5994.6800	–0.010292893	–0.236010552
80	VDD_IO1	–261.4400	–5858.9600	–0.010292893	–0.230667255
81	GND1	–261.4400	–5708.8400	–0.010292893	–0.224757031
82	VPP0	–261.4400	–5544.3200	–0.010292893	–0.218279878
83	XSHUTDOWN	–261.4400	–5328.6800	–0.010292893	–0.209790132
84	VDD_PLL	–261.4400	–5184.0300	–0.010292893	–0.204095261
85	REG_IN	–261.4400	–5034.0300	–0.010292893	–0.198189761
86	REG_OUT	–261.4400	–4823.1800	–0.010292893	–0.189888597
87	REG_FEEDBACK	–261.4400	–4673.1800	–0.010292893	–0.183983097
88	GND2	–261.4400	–4420.2850	–0.010292893	–0.17402662

Table 1: Bond Pad Location and Identification from Center of Pad 1 (continued)

Pad	MT9E013	"X"1 Microns	"Y"1 Microns	"X"1 Inches	"Y"1 Inches
89	GND3	–261.4400	–2960.9600	–0.010292893	–0.116572995
90	VDD2	–261.4400	–2812.1000	–0.010292893	–0.110712377
91	DATA2N	–261.4400	–2615.0000	–0.010292893	–0.10295255
92	DATA2P	–261.4400	–2295.6800	–0.010292893	–0.090380922
93	DATAN	–261.4400	–1932.8000	–0.010292893	–0.076094336
94	DATAP	–261.4400	–1613.4800	–0.010292893	–0.063522708
95	CLKN	–261.4400	–1364.3600	–0.010292893	–0.053714853
96	CLKP	–261.4400	–1045.0400	–0.010292893	–0.041143225
97	VDD_TX	–261.4400	–865.4000	–0.010292893	–0.034070798
98	VDD3	–261.4400	–715.4600	–0.010292893	–0.02816766
99	GND4	–261.4400	–566.6000	–0.010292893	–0.022307042
100	TEST	–261.4400	–407.8400	–0.010292893	–0.016056661
101	FLASH	–261.4400	–265.8800	–0.010292893	–0.010467696

Note:
1. Reference to center of each bond pad from center of bond pad 1.
2. DNU = do not use. See "Bonding Instructions" on page 3.
3. ATEST1_TOP, ATEST2_TOP, ATEST1_BTM, and ATEST2_BTM should be floating.

Table 2: Bond Pad Location and Identification from Center of Die

Pad	MT9E013	"X"[1] Microns	"Y"[1] Microns	"X"[1] Inches	"Y"[1] Inches
1	SHUTTER	–2958.3600	3029.0000	–0.116470633	0.11925173
2	GND5	–2807.6400	3029.0000	–0.110536787	0.11925173
3	VDD_IO2	–2657.5200	3029.0000	–0.104626562	0.11925173
4	EXTCLK	–2507.4000	3029.0000	–0.098716338	0.11925173
5	SDA	–2357.2800	3029.0000	–0.092806114	0.11925173
6	SCL	–2207.1600	3029.0000	–0.086895889	0.11925173
7	RESET_N	–2057.0400	3029.0000	–0.080985665	0.11925173
8	GPI0	–1906.9200	3029.0000	–0.07507544	0.11925173
9	GPI1	–1756.8000	3029.0000	–0.069165216	0.11925173
10	GPI2	–1606.6800	3029.0000	–0.063254992	0.11925173
11	GPI3	–1456.5600	3029.0000	–0.057344767	0.11925173
12	GND6	–1306.4400	3029.0000	–0.051434543	0.11925173
13	VDD_IO3	–1156.3200	3029.0000	–0.045524318	0.11925173
14	VDD4	–1006.2000	3029.0000	–0.039614094	0.11925173
15	LINE_VALID	–859.9200	3029.0000	–0.03385505	0.11925173
16	FRAME_VALID	–677.2800	3029.0000	–0.026664514	0.11925173
17	PIXCLK	–503.5200	3029.0000	–0.019823582	0.11925173
18	GND7	–352.8000	3029.0000	–0.013889736	0.11925173
19	VDD_IO4	–202.6800	3029.0000	–0.007979512	0.11925173
20	DOUT9	–56.4000	3029.0000	–0.002220468	0.11925173
21	DOUT0	126.2400	3029.0000	0.004970069	0.11925173
22	GND8	272.5200	3029.0000	0.010729112	0.11925173
23	VDD_IO5	422.6400	3029.0000	0.016639337	0.11925173
24	DOUT1	568.9200	3029.0000	0.02239838	0.11925173
25	DOUT8	751.5600	3029.0000	0.029588917	0.11925173
26	VDD5	897.8400	3029.0000	0.035347961	0.11925173
27	GND9	1047.9600	3029.0000	0.041258185	0.11925173
28	VDD_IO6	1198.0800	3029.0000	0.04716841	0.11925173
29	DOUT2	1344.3600	3029.0000	0.052927453	0.11925173
30	DOUT7	1527.0000	3029.0000	0.06011799	0.11925173
31	GND10	1673.2800	3029.0000	0.065877034	0.11925173
32	VDD_IO7	1823.4000	3029.0000	0.071787258	0.11925173
33	DOUT3	1969.6800	3029.0000	0.077546302	0.11925173
34	DOUT6	2152.3200	3029.0000	0.084736838	0.11925173
35	GND11	2298.6000	3029.0000	0.090495882	0.11925173
36	VDD_IO8	2448.7200	3029.0000	0.096406106	0.11925173
37	DOUT4	2595.0000	3029.0000	0.10216515	0.11925173
38	DOUT5	2777.6400	3029.0000	0.109355687	0.11925173
39	VDD6	2923.9200	3029.0000	0.11511473	0.11925173
40	GND12	3219.8000	2756.8800	0.126763526	0.108538366
41	VDD_IO9	3219.8000	2606.7600	0.126763526	0.102628141
42	AGND14	3219.8000	2412.7200	0.126763526	0.094988786
43	VAA14	3219.8000	2262.6000	0.126763526	0.089078562
44	VAA13	3219.8000	2112.4800	0.126763526	0.083168338
45	ATEST1_TOP	3219.8000	2002.3200	0.126763526	0.078831338

Table 2: Bond Pad Location and Identification from Center of Die (continued)

Pad	MT9E013	"X"[1] Microns	"Y"[1] Microns	"X"[1] Inches	"Y"[1] Inches
46	AGND13	3219.8000	1892.1600	0.126763526	0.074494339
47	ATEST2_TOP	3219.8000	1782.0000	0.126763526	0.07015734
48	AGND12	3219.8000	1671.8400	0.126763526	0.065820341
49	VAA12	3219.8000	1521.7200	0.126763526	0.059910116
50	AGND11	3219.8000	1371.6000	0.126763526	0.053999892
51	VAA11	3219.8000	1221.4800	0.126763526	0.048089668
52	AGND10	3219.8000	1071.3600	0.126763526	0.042179443
53	VAA10	3219.8000	921.2400	0.126763526	0.036269219
54	AGND9	3219.8000	771.1200	0.126763526	0.030358994
55	VAA9	3219.8000	621.0000	0.126763526	0.02444877
56	AGND8	3219.8000	470.8800	0.126763526	0.018538546
57	VAA8	3219.8000	320.7600	0.126763526	0.012628321
58	AGND7	3219.8000	170.6400	0.126763526	0.006718097
59	VAA_PIX3	3219.8000	20.5200	0.126763526	0.000807872
60	VAA_PIX2	3219.8000	–129.6000	0.126763526	-0.005102352
61	VAA_PIX1	3219.8000	–279.7200	0.126763526	-0.011012576
62	VAA7	3219.8000	–429.8400	0.126763526	-0.016922801
63	AGND6	3219.8000	–579.9600	0.126763526	-0.022833025
64	VAA6	3219.8000	–730.0800	0.126763526	-0.02874325
65	AGND5	3219.8000	–880.2000	0.126763526	-0.034653474
66	VAA5	3219.8000	–1030.3200	0.126763526	-0.040563698
67	AGND4	3219.8000	–1180.4400	0.126763526	-0.046473923
68	VAA4	3219.8000	–1330.5600	0.126763526	-0.052384147
69	AGND3	3219.8000	–1480.6800	0.126763526	-0.058294372
70	VAA3	3219.8000	–1630.8000	0.126763526	-0.064204596
71	AGND2	3219.8000	–1780.9200	0.126763526	-0.07011482
72	ATEST2_BTM	3219.8000	–1891.0800	0.126763526	-0.07445182
73	AGND1	3219.8000	–2001.2400	0.126763526	-0.078788819
74	ATEST1_BTM	3219.8000	–2117.8800	0.126763526	-0.083380936
75	VAA2	3219.8000	–2228.0400	0.126763526	-0.087717935
76	VAA1	3219.8000	–2378.1600	0.126763526	–0.093628159
77	VCM_ISINK	3219.8000	–2560.6600	0.126763526	-0.100813184
78	VCM_GND	3219.8000	–2914.6750	0.126763526	-0.114750755
79	VDD1	–3219.8000	–2965.6800	–0.126763526	-0.116758822
80	VDD_IO1	–3219.8000	–2829.9600	–0.126763526	-0.111415525
81	GND1	–3219.8000	–2679.8400	–0.126763526	-0.105505301
82	VPP0	–3219.8000	–2515.3200	–0.126763526	-0.099028148
83	XSHUTDOWN	–3219.8000	–2299.6800	–0.126763526	-0.090538402
84	VDD_PLL	–3219.8000	–2155.0300	–0.126763526	-0.084843531
85	REG_IN	–3219.8000	–2005.0300	–0.126763526	-0.078938031
86	REG_OUT	–3219.8000	–1794.1800	–0.126763526	-0.070636867
87	REG_FEEDBACK	–3219.8000	–1644.1800	–0.126763526	-0.064731367
88	GND2	–3219.8000	–1391.2850	–0.126763526	-0.05477489
89	GND3	–3219.8000	68.0400	–0.126763526	0.002678735
90	VDD2	–3219.8000	216.9000	–0.126763526	0.008539353

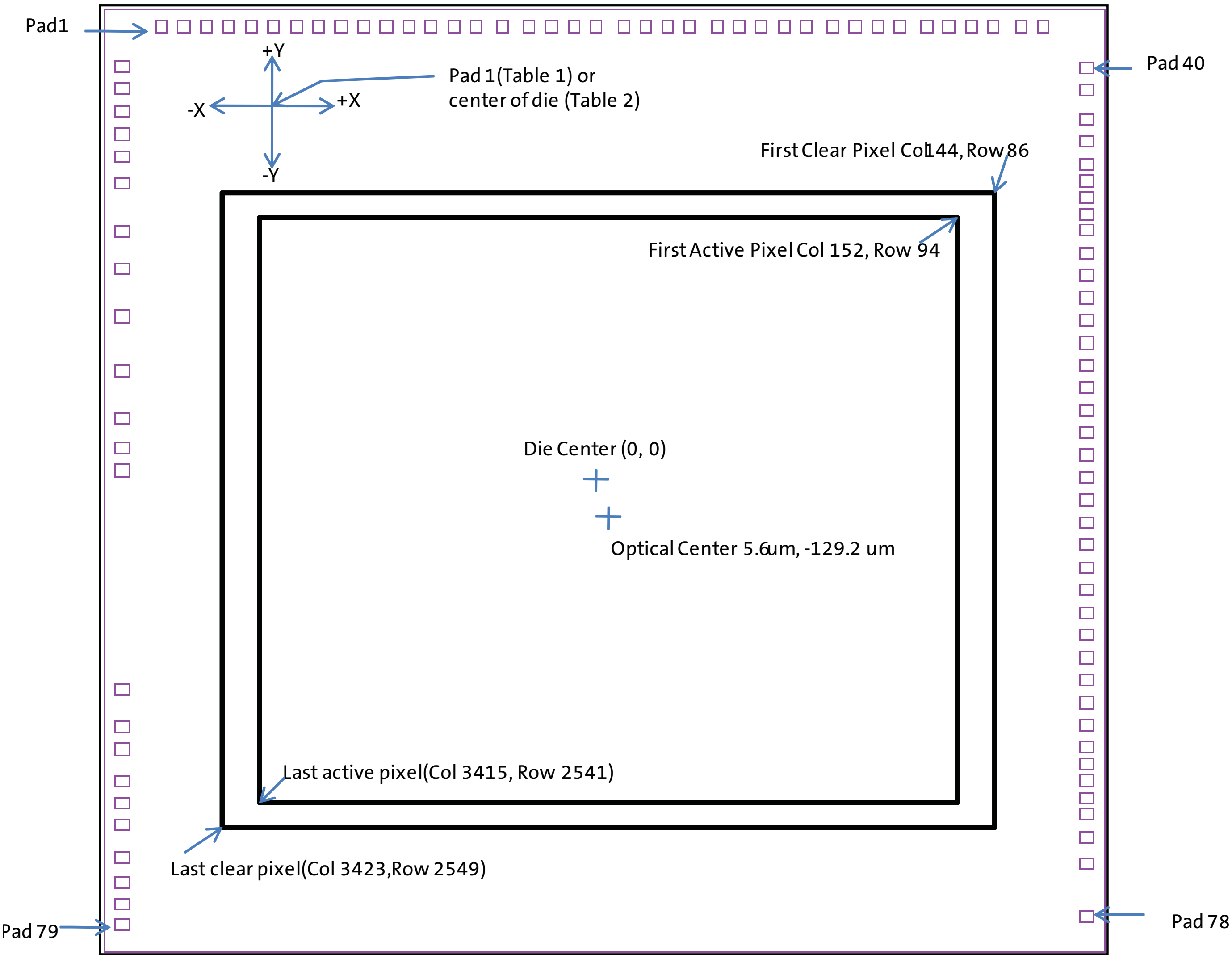
Table 2: Bond Pad Location and Identification from Center of Die (continued)

Pad	MT9E013	"X"[1] Microns	"Y"[1] Microns	"X"[1] Inches	"Y"[1] Inches
91	DATA2N	–3219.8000	414.0000	–0.126763526	0.01629918
92	DATA2P	–3219.8000	733.3200	–0.126763526	0.028870808
93	DATAN	–3219.8000	1096.2000	–0.126763526	0.043157394
94	DATAP	–3219.8000	1415.5200	–0.126763526	0.055729022
95	CLKN	–3219.8000	1664.6400	–0.126763526	0.065536877
96	CLKP	–3219.8000	1983.9600	–0.126763526	0.078108505
97	VDD_TX	–3219.8000	2163.6000	–0.126763526	0.085180932
98	VDD3	–3219.8000	2313.5400	–0.126763526	0.09108407
99	GND4	–3219.8000	2462.4000	–0.126763526	0.096944688
100	TEST	–3219.8000	2621.1600	–0.126763526	0.103195069
101	FLASH	–3219.8000	2763.1200	–0.126763526	0.108784034

Note:
1. Reference to center of each bond pad from center of die.
2. DNU = do not use. See "Bonding Instructions" on page 3.
3. ATEST1_TOP, ATEST2_TOP, ATEST1_BTM, and ATEST2_BTM should be floating.

Die Features

Figure 3: Die Outline (Top View)



Physical Specifications

Table 3: Physical Dimensions

Feature	Dimensions
Wafer diameter	200mm (8 inches)
Die thickness	200µm ± 12µm
Singulated die size (after wafer saw) Width (X dimension): Length (Y dimension):	 6626 ± 25µm 6244.4 ± 25µm
Bond pad size (MIN)	85µm x 100µm
Passivation openings (MIN)	75µm x 90µm
Minimum bond pad pitch	150µm
Optical array Optical center from die center: Optical center from center of pad 1:	 5.6µm, –129.2µm –2963.96µm, 3158.2µm
First clear pixel (col. 144, row 86) From die center: From center of pad 1:	 2301.02µm, 1596.25µm 5259.38µm, –1432.75µm
Last clear pixel (col. 3,423, row 2,549) From die center: From center of pad 1:	 –2289.83µm, –1851.78µm 668.53µm,–4880.78µm

Revision History

Rev. F **5/10/11**

- Updated trademarks
- Applied updated template

Rev. E, Production **6/14/10**

- Updated "Key Performance Parameters" on page 1
- Updated Figure 1: "Parallel/MIPI Typical Connections (Using Internal Regulator for VDD and Sensor-Connected PLL)," on page 4; added note 9
- Updated Figure 2: "Parallel/MIPI Typical Connections (Not Using Internal Regulator)," on page 5; updated note 9

Rev. D, Preliminary **1/4/10**

- Updated EXTCLK values in Figure 1 on page 4 and Figure 2 on page 5

Rev. C **2/13/09**

- Updated digital core, full resolution (parallel) power consumption, and full resolution (MIPI) power comsumption parameter values in "Key Performance Parameters (continued)" on page 2
- Updated Figure 1: "Parallel/MIPI Typical Connections (Using Internal Regulator for VDD and Sensor-Connected PLL)," on page 4
- Updated Figure 2: "Parallel/MIPI Typical Connections (Not Using Internal Regulator)," on page 5, deleted note 10

Rev. B, Advance **12/19/08**

- Updated to Advance designation.
- Added "On-chip VCM driver" to "Features" on page 1
- Added qualification to power consumption estimates (not including I/O power) in "Key Performance Parameters" on page 2
- Updated Figure 1 on page 4 and Figure 2 on page 5 and added notes to both.

Rev. A, Preview **10/23/08**

- Initial release.

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