MN673274

Signal-Processing IC for Multipurpose Cameras

■ Overview

The MN673274 is designed for surveillance and PC input cameras. In addition to the basic functions of luminance signal and chrominance signal processing, it also integrates microcontroller functions (ALC, AWB, and AGC) and SSG, CG, and I²C-bus circuits on a single chip.

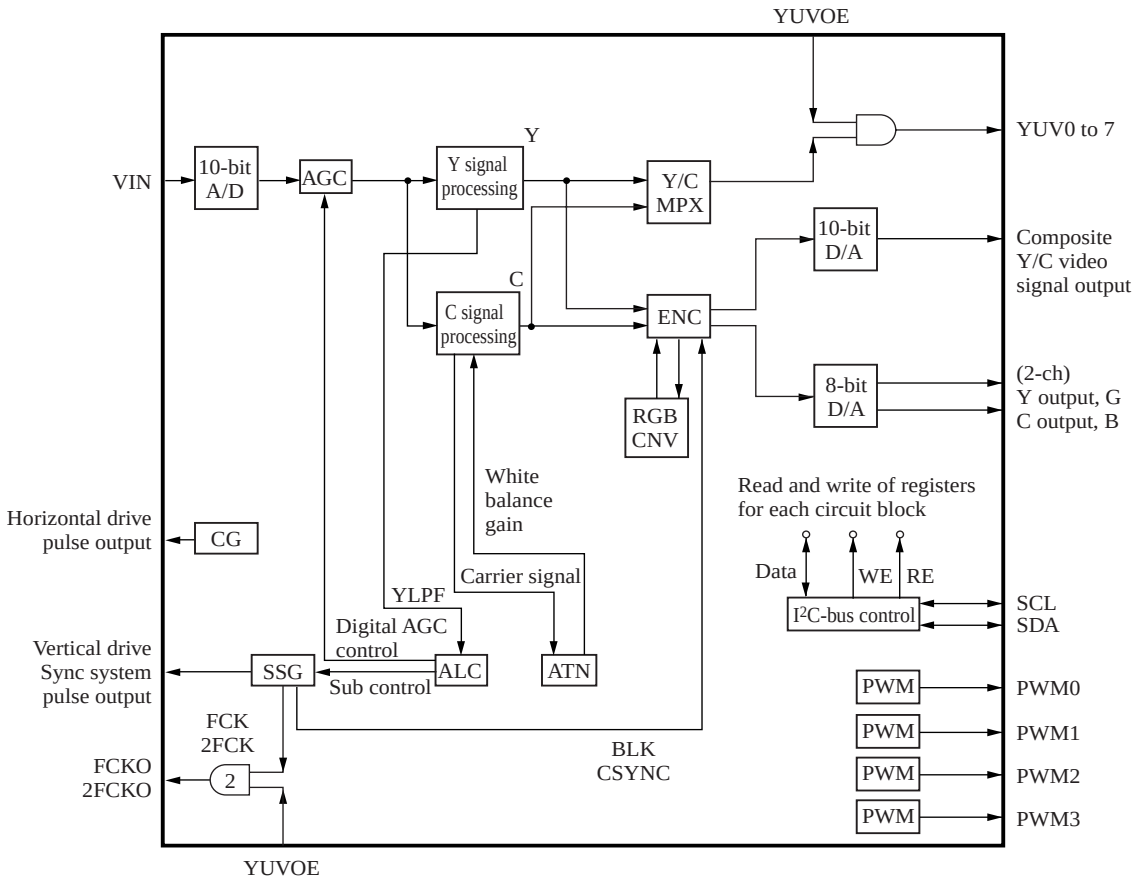
■ Features

- Input: Analog signal (A/D converter input)
- Output: Digital output
  - YUV signal: 8 bits
  - Analog outputs
    - Y signal
    - C signal
    - Composite video output
    - RGB outputs
- Operating supply voltage: 3.3 V ± 0.3 V
- Operating frequency: 9.5 MHz to 28.7 MHz
- Main functions
  - 10-bit A/D converter
  - 10-bit D/A converter
  - 2-channel 8-bit D/A converter
  - Support for analog AGC (NN2038, NN2039)
  - CG and SSG functions
  - 510H and 768H (Supports NTSC and PAL)
  - Supports progressive scan readout CCDs with complementary color filters for VGA
  - Supports black-and-white CCD signal processing
  - CCD white defect/black defect correction circuit
  - Maximum digital AGC gain: 24 dB
  - Left/right reversing function
  - Variable gamma correction ($\gamma = 0.3$ to 1)
  - ZV port conforming mode, BT656 conforming mode
  - External synchronization support: HD/VD, VD2, Sync., LL mode
  - On-chip I²C-bus circuit
  - ELC/AGC (Also supports external AGC)
  - Two-mode white balance (manual/ATW) with ATW lock function
  - Automatic OB correction function

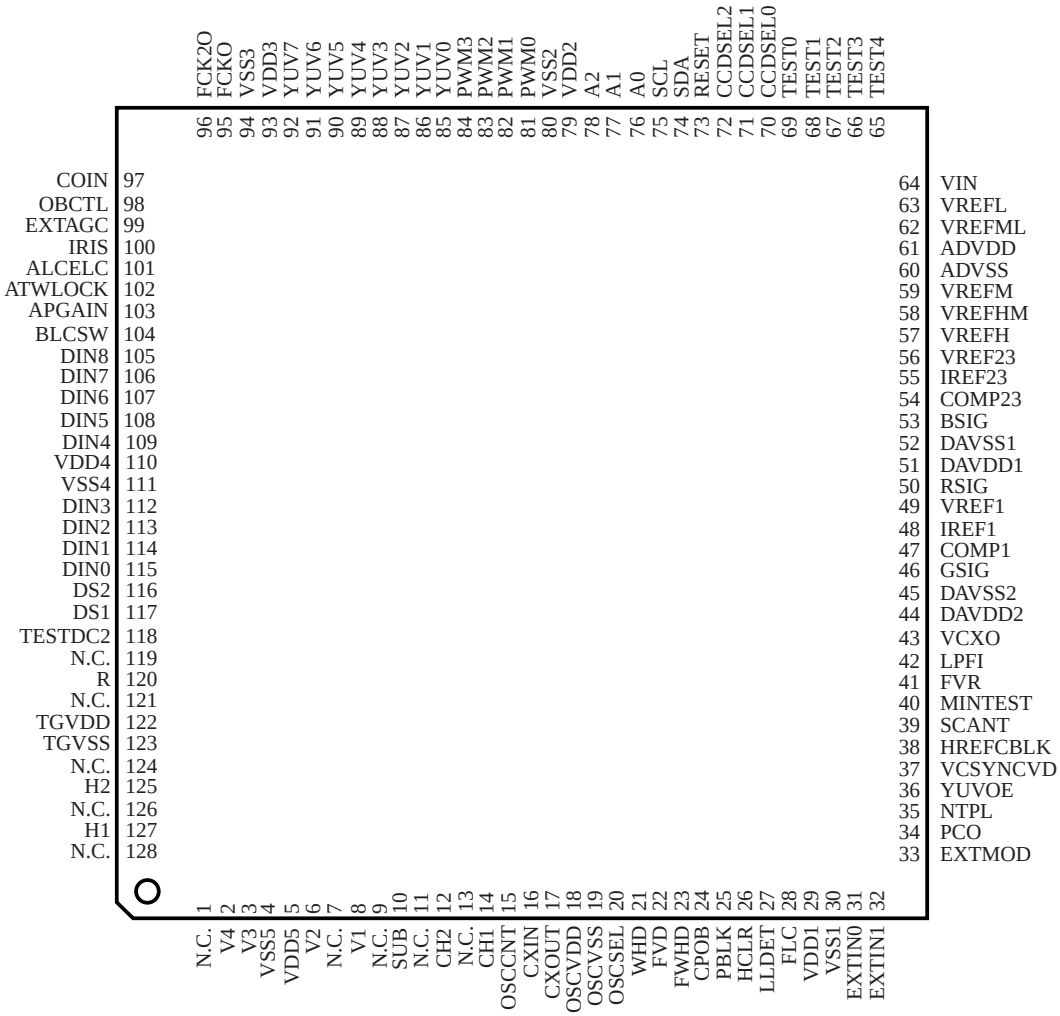
■ Applications

- Surveillance cameras, PC cameras

■ Block Diagram



■ Pin Arrangement



(TOP VIEW)

■ Pin Descriptions

Pin No.	Pin Name	I/O	Description
1	N.C.	—	—
2	V4	O	ϕ V4 charge pulse
3	V3	O	ϕ V3 charge pulse
4	VSS5	VSS	Digital system ground
5	VDD5	VDD	Digital system power supply (3.3 V)
6	V2	O	ϕ V2 charge pulse
7	N.C.	—	—
8	V1	O	ϕ V1 charge pulse
9	N.C.	—	—
10	SUB	O	Vertical exclusion pulse
11	N.C.	—	—
12	CH2	O	V3 charge pulse
13	N.C.	—	—
14	CH1	O	V1 charge pulse
15	OSCCNT	O	Oscillator control test
16	CXIN	I	Synchronization oscillator connection (crystal oscillator)
17	CXOUT	O	Synchronization oscillator connection (crystal oscillator)
18	OSCVDD	VDD	Oscillator cell power supply
19	OSCVSS	VSS	Oscillator cell ground
20	OSCSEL	I	Source oscillator 2FCK/4FCK switching
21	WHD	O	WHD signal with a normal phase to Sync
22	FVD	O	VD signal with a normal phase to Sync
23	FWHD	O	WHD for CG drive
24	CPOB	O	A/D converter input signal clamping pulse/ D/A converter output clamping pulse
25	PBLK	O	Pre-blanking pulse
26	HCLR	O	Horizontal reference signal
27	LLDET	I	Power supply synchronization switching Low: internal synchronization, high: LL synchronization
28	FLC	I	Flicker correction (pulled-up input) High: flicker correction on
29	VDD1	VDD	Digital system power supply (3.3 V)
30	VSS1	VSS	Digital system ground
31	EXTIN0	I	External synchronization input 1
32	EXTIN1	I	External synchronization input 2
33	EXTMOD	I	Surveillance/automotive mode switching (pulled-up input) High: automotive mode (HDVD/Sync synchronization mode)
34	PCO	O	Phase comparator output
35	NTPL	I	NTSC/PAL switching Low: NTSC, high: PAL (pulled-down input)

■ Pin Descriptions (continued)

Pin No.	Pin Name	I/O	Description
36	YUVOE	I	Digital output system output enable
37	VCSYNCVD	O	VCSYNC output/VD output (VGA mode: CSYNC, IT mode: register switching)
38	HREFCBLK	O	HREF output/CBLK output (VGA mode: HREF, IT mode: register switching)
39	SCANT	I	Test input (Normally connect low)
40	MINTEST	I	Test input (Normally connect low)
41	FVR	I	DC level input used for frequency control
42	LPFI	I	Low-pass filter analog switch input
43	VCXO	O	Analog switch output - LC oscillator
44	DAVDD2	VDD	D/A converter power supply
45	DAVSS2	VSS	D/A converter ground
46	GSIG	O	Video output (composite/G signal) Connect the resistor R_L between GSIG and DAVSS2
47	COMP1	I	Phase compensation Connect a 1 µF capacitor between COMP1 and DAVDD2
48	IREF1	I	Bias current resistor connection Connect the resistor R_{IREF} between IREGF1 and DAVSS2
49	VREF1	I	Reference voltage input
50	RSIG	O	Video output (luminance/R signal) Connect the resistor R_L between RSIG and DAVSS1
51	DAVDD1	VDD	D/A converter power supply
52	DAVSS1	VSS	D/A converter ground
53	BSIG	O	Video output (chrominance/B signal) Connect the resistor R_L between BSIG and DAVSS1
54	COMP23	I	Phase compensation Connect a 1 µF capacitor between this pin and DAVDD1
55	IREF23	I	Bias current resistor connection Connect the resistor R_{IREF} between this pin and DAVSS1
56	VREF23	I	Reference voltage input
57	VREFH	I	High-level reference voltage input
58	VREFHM	I	Intermediate reference potential Connect a capacitor between this pin and ADVSS
59	VREFM	I	Intermediate reference potential Connect a capacitor between this pin and ADVSS
60	ADVSS	VSS	A/D converter power supply
61	ADVDD	VDD	A/D converter ground
62	VREFML	I	Intermediate reference potential Connect a capacitor between this pin and ADVSS
63	VREFL	I	Low-level reference voltage input
64	VIN	I	Analog signal input
65	TEST4	I	Test input (Normally connect low)
66	TEST3	I	Test input (Normally connect low)
67	TEST2	I	Test input (Normally connect low)
68	TEST1	I	Test input (Normally connect low)
69	TEST0	I	Test input (Normally connect low)
70	CCDSEL0	I	CCD switching
71	CCDSEL1	I	CCD switching
72	CCDSEL2	I	CCD switching

■ Pin Descriptions (continued)

Pin No.	Pin Name	I/O	Description
73	RESET	I	Logic system initialization
74	SDA	I/O	I^2C-bus (data)
75	SCL	I/O	I^2C-bus (clock)
76	A0	I	EEPROM address (pulled-down input)
77	A1	I	EEPROM address (pulled-down input)
78	A2	I	EEPROM address (pulled-down input)
79	VDD2	VDD	Digital system power supply (3.3 V)
80	VSS2	VSS	Digital system ground
81	PWM0	O	PWM signal output
82	PWM1	O	PWM signal output
83	PWM2	O	PWM signal output
84	PWM3	O	PWM signal output
85	YUV0	O	Digital Y/U/V output (LSB)
86	YUV1	O	Digital Y/U/V output
87	YUV2	O	Digital Y/U/V output
88	YUV3	O	Digital Y/U/V output
89	YUV4	O	Digital Y/U/V output
90	YUV5	O	Digital Y/U/V output
91	YUV6	O	Digital Y/U/V output
92	YUV7	O	Digital Y/U/V output (MSB)
93	VDD3	VDD	Digital system power supply (3.3 V)
94	VSS3	VSS	Digital system ground
95	FCKO	O	FCK output
96	FCK2O	O	2FCK output
97	COIN	I	Synchronization oscillator cell (LC oscillator)
98	OBCTL	O	Automatic OB correction output
99	EXTAGC	O	External AGC control
100	IRIS	O	Mechanical iris locking (PWM output)
101	ALCELC	I	Locked/ELC switching Low: ELC, high: locked
102	ATWLOCK	I	ATW stop. Low: normal, high: ATWLOCK
103	APGAIN	I	Aperture gain switching Low: register value, high: register value divided by 2
104	BLCSW	I	Backlighting correction Low: normal, high: ATWLOCK
105	DIN8	I	Digital signal input (MSB)
106	DIN7	I	Digital signal input
107	DIN6	I	Digital signal input
108	DIN5	I	Digital signal input
109	DIN4	I	Digital signal input

■ Pin Descriptions (continued)

Pin No.	Pin Name	I/O	Description
110	VDD4	VDD	Digital system power supply (3.3 V)
111	VSS4	VSS	Digital system ground
112	DIN3	I	Digital signal input
113	DIN2	I	Digital signal input
114	DIN1	I	Digital signal input
115	DIN0	I	Digital signal input (LSB)
116	DS2	O	CDS pulse 2
117	DS1	O	CDS pulse 1
118	TESTDC2	I	Test input (Normally connect low)
119	N.C.	—	—
120	R	O	ϕR pulse
121	N.C.	—	—
122	TGVDD	VDD	CG power supply
123	TGVSS	VSS	CG ground
124	N.C.	—	—
125	H2	O	ϕH1 transfer pulse
126	N.C.	—	—
127	H1	O	ϕH2 transfer pulse
128	N.C.	—	—

■ Electrical Characteristics

1. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage (digital system)	V_{DD}	– 0.3 to +4.6	V
Supply voltage (analog system)	AV_{DD}	– 0.3 to +4.6	V
Input voltage	V_I	– 0.3 to V_{DD}+ 0.3	V
Output voltage	V_O	– 0.3 to V_{DD}+ 0.3	V
Output current	I_O	±48	mA
Power dissipation	P_D	750	mW
Operating temperature	T_{opr}	–20 to +70	°C
Storage temperature	T_{stg}	–55 to +150	°C

Notes: 1. The absolute maximum ratings are the limiting values for which chip destruction will not occur if that level is applied. Operation is not guaranteed at these levels.

2. The VDD1, VDD2, VDD3, VDD4, VDD5, VDDTG, ADVDD, and DAVDD pins must always be held at the same potential. The VSS1, VSS2, VSS3, VSS4, VSS5, VSSTG, ADVSS, and DAVSS pins must always be held at the same potential.

■ Electrical Characteristics (continued)

2. Recommended Operating Conditions

$V_{SS} = TGV_{SS} = OSCV_{SS} = ADV_{SS} = DAV_{SS} = 0$ V

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage (digital)	V_{DD}	Digital system power supply	3.0	3.3	3.6	V
Supply voltage (digital)	$OSCV_{DD}$	Oscillator pin power supply	3.0	3.3	3.6	V
Supply voltage (analog)	ADV_{DD}	A/D converter power supply	—	3.3	—	V
Supply voltage (analog)	DAV_{DD}	D/A converter power supply	—	3.3	—	V
Operating frequency	F_{OSC}	Duty 50%	9.5	—	28.7	MHz

3. DC Characteristics

$V_{DD} = TGV_{DD} = OSCV_{DD} = 3.0$ V to 3.6 V, $ADV_{DD} = DAV_{DD} = 3.0$ V to 3.6 V,
$V_{SS} = TGV_{SS} = OSCV_{SS} = ADV_{SS} = DAV_{SS} = 0$ V, $T_a = -20°C$ to $+70°C$

Item		Symbol	Condition	Min	Typ	Max	Unit
Operating supply current		I_{DD}	$V_{DD} = TGV_{DD} = TGV_{DD} = 3.6$ V	—	80	120	mA
		DAI_{DD}	$ADV_{DD} = DAV_{DD} = 3.6$ V	—	23	33	
		ADI_{DD}	$F_{CLK} = 28.7$ MHz, $T_a = 25°C$	—	20	40	
Input pins 1-1 Standard input pins EXTIN0, EXTIN1, YUVOE, CCDSEL0 to CCDSEL2, RESET, COIN, ALCELC, ATWLOCK, APGAIN, BLCSW, DIN0 to DIN8, H12BSTP, VDDSW, LLDET							
Input voltage	High level	V_{IH}		$V_{DD} \times 0.8$	—	V_{DD}	V
	Low level	V_{IL}		0	—	$V_{DD} \times 0.2$	
Input leakage current		I_{LIPD}	$V_I = V_{DD}$ or V_{SS}	–5	—	5	µA
Input pins 1-2 Pulled-up input pins FLC, EXTMOD							
Input voltage	High level	V_{IH}		$V_{DD} \times 0.8$	—	V_{DD}	V
	Low level	V_{IL}		0	—	$V_{DD} \times 0.2$	
Input leakage current		I_{LIPD}	$V_I = V_{DD}$	–10	—	10	µA
Pull-up resistance		R_{PU1}	$V_{DD} = 3.3$ V, $V_I = V_{SS}$	10	30	90	kΩ
Input pins 1-3 Pulled-down input pins OSCSEL, NTPL, SCANT, A0 to A2, TEST4 to TEST0, MINTEST							
Input voltage	High level	V_{IH}		$V_{DD} \times 0.8$	—	V_{DD}	V
	Low level	V_{IL}		0	—	$V_{DD} \times 0.2$	
Input leakage current		I_{LIPD}	$V_I = V_{SS}$	–10	—	10	µA
Pull-down resistance		P_{PD1}	$V_I = V_{DD}$	10	30	90	kΩ
Output pins 1-1 V4 to V1, SUB, CH2, CH1, OSCCNT, PCO, WHD, CPOB, PBLK, HCLR, PWM0 to PWM3, OBCTL, EXTAGC, IRIS							
Output voltage	High level	V_{OH}	$I_O = -1$ mA	$V_{DD} - 0.6$	—	—	V
	Low level	V_{OL}	$I_O = 1$ mA	—	—	0.4	

■ Electrical Characteristics (continued)

3. DC Characteristics (continued)

V_{DD} = TGV_{DD} = $OSCV_{DD}$ = 3.0 V to 3.6 V, ADV_{DD} = DAV_{DD} = 3.0 V to 3.6 V,
V_{SS} = TGV_{SS} = $OSCV_{SS}$ = ADV_{SS} = DAV_{SS} = 0 V, T_a = –20°C to +70°C

Item		Symbol	Condition	Min	Typ	Max	Unit
Output pins 1-2 YUV7 to YUV0							
Output voltage	High level	V_{OH}	I_O = – 2 mA	V_{DD} – 0.6	—	—	V
	Low level	V_{OL}	I_O = 2 mA	—	—	0.4	
Output pins 1-3 VCSYNCVD, HREFCBLK							
Output voltage	High level	V_{OH}	I_O = – 4 mA	V_{DD} – 0.6	—	—	V
	Low level	V_{OL}	I_O = 4 mA	—	—	0.4	
Output pins 1-4 FVD, EWHD, FCKO, FCK2O							
Output voltage	High level	V_{OH}	I_O = – 8 mA	V_{DD} – 0.6	—	—	V
	Low level	V_{OL}	I_O = 8 mA	—	—	0.4	
Output pins 1-5 DS1, DS2, R, H2, H1							
Output voltage	High level	V_{OH}	I_O = – 16 mA	V_{DD} – 0.6	—	—	V
	Low level	V_{OL}	I_O = 16 mA	—	—	0.4	
I/O pins 1 SDA, SCL							
TTL Schmitt trigger input voltage	Input Threshold voltage	V_{T+}	V_{DD} = 3.0 V to 3.6 V	—	1.6	2.2	V
		V_{T-}	V_{REF5} = 4.75 V to 5.25 V (V_{REF5} is an external reference voltage.)	0.6	1.2	—	
Output voltage	Low level	V_{OL}	I_O = 4 mA	—	—	0.4	V
Output leakage current		I_{LO}	V_O = V_{DD} or V_{SS}	– 10	—	10	µA
Oscillator pins 1 CXIN, CXOUT							
Standard oscillator frequency		F_{OSC}	V_{DD} = 3.3 V Using an external crystal	15	—	30	MHz
Internal feedback resistor		R_{FB}	V_{DD} = 3.3 V V_I (X_I) = V_{DD} or V_{SS}	0.73	2.2	6.6	kΩ
Output voltage	High level	I_{OH}	V_{DD} = 3.3 V V_I = V_{SS}, V_O = V_{SS}	– 9.2	– 23	– 57.5	mA
	Low level	I_{OL}	V_{DD} = 3.3 V V_I = V_{DD}, V_O = V_{DD}	9.6	24	60	

■ Electrical Characteristics (continued)

4. AC Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit
Input pins 2-1 CXIN							
Clock waveform	Period	tcyc	See figure 1	34.8	—	105.3	ns
	Clock duty	dclk	See figure 1 dclk = thi/tcyc	—	50	—	%
Output pins 1	OSCCNT, PCO, PWM0 to PWM3, YUV0 to YUV7, WHD, CPOB, PBLK, HCLR, VCSYNCVD, HREFCBLK, FVD, EWHD, OBCTL, EXTAGC, IRIS, FCKO, FCK2O, V1 to V4, SUB, CH1, CH2, DS1, DS2, R, H2, H1						

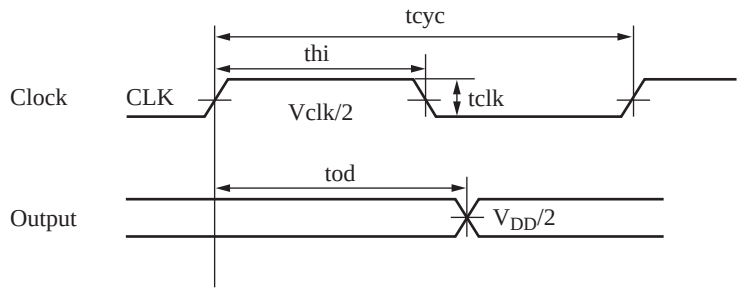


Figure 1. I/O Timing

5. A/D Converter

$V_{DD} = TGV_{DD} = OSCV_{DD} = 3.3$ V, $ADV_{DD} = DAV_{DD} = 3.3$ V, $V_{SS} = TGV_{SS} = OSCV_{SS} = ADV_{SS} = DAV_{SS} = 0$ V, $T_a = 25°C$

Pins: VIN, VREFH, VREFL, VREFM, VREFML, and VREFHM

Item	Symbol	Condition	Min	Typ	Max	Unit
A/D Converter Recommended Operating Conditions						
Analog input voltage	V_{AIN}	VIN	VREFL	—	VREFH	V
Analog input pin capacitance	C_{AI}	VIN	—	330	—	pF
Reference voltage high level	V_{REFH}	VREFH	—	2.5	—	V
Reference voltage low level	V_{REFL}	VREFL	—	0.5	—	V
Reference resistor (VREFL–VREFH)	R_{REF}		—	440	—	Ω
A/D converter characteristics						
Resolution	R_{ES}		—	—	10	bit
Nonlinearity error	NLE	$F_{ADCK} = 20$ MHz	—	± 5.0	± 7.5	LSB
Differential nonlinearity error	DNLE	$V_{REFH} = 2.5$ V $V_{REFL} = 0.5$ V	—	± 2.0	± 6.5	LSB
Analog input dynamic range	V_{AIN}		—	—	$V_{REFH} - V_{REFL}$	V[p-p]

6. D/A Converter

$V_{DD} = TGV_{DD} = OSCV_{DD} = 3.3$ V, $ADV_{DD} = DAV_{DD} = 3.3$ V, $V_{SS} = TGV_{SS} = OSCV_{SS} = ADV_{SS} = DAV_{SS} = 0$ V, $T_a = 25°C$

1) Pins: VREF23, IREF23, COMP23, BSIG, and RSIG

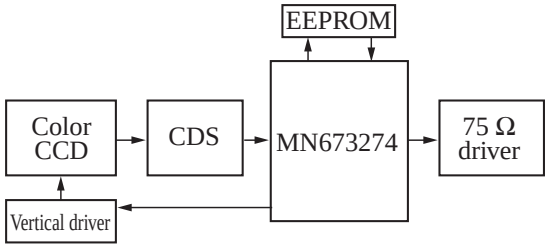
Item	Symbol	Condition	Min	Typ	Max	Unit
D/A Converter Recommended Operating Conditions						
Reference voltage	V_{REF}	$R_L = 75\ \Omega$ $R_{IREF23} = 820\ \Omega$	—	1.37	—	V
External phase assurance capacitor	C_{COMP}	Connect between the COMP23 pin and AV_{DD}.	—	1.0	—	µF
External output resistors	R_L	Connect these between the BSIG and RSIG pins respectively, and AV_{SS}.	—	75	—	Ω
External bias current setting resistor	R_{IREF}	Connect between the IREF23 pin and AV_{SS}.	—	820	—	Ω
D/A converter characteristics						
Resolution	R_{ES}		—	—	8	bit
Nonlinearity error	INLE	$R_L = 75\ \Omega$ VREF23 = 1.37 V $R_{IREF23} = 820\ \Omega$	—	—	± 2.5	LSB
Differential nonlinearity error	DNLE		—	—	± 2.5	LSB
Full-scale voltage	V_{OFS}		—	1.0	—	V
Zero-scale voltage	V_{OZS}		—	0	—	V

2) Pins: VREF1, IREF1, COMP1, and GSIG

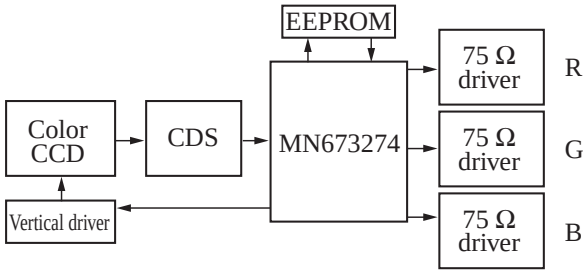
Item	Symbol	Condition	Min	Typ	Max	Unit
D/A Converter Recommended Operating Conditions						
Reference voltage	V_{REF}	$R_L = 75\ \Omega$ $R_{IREF1} = 1.13\ k\Omega$	—	1.5	—	V
External phase assurance capacitor	C_{COMP}	Connect between the COMP1 pin and AV_{DD}.	—	1.0	—	µF
External output resistors	R_L	Connect between the GSIG pin and AV_{SS}.	—	75	—	Ω
External bias current setting resistor	R_{IREF}	Connect between the IREF1 pin and AV_{SS}.	—	1.13	—	kΩ
D/A converter characteristics						
Resolution	R_{ES}		—	—	10	bit
Nonlinearity error	INLE	$R_L = 75\ \Omega$ VREF1 = 1.5 V $R_{IREF1} = 1.13\ k\Omega$	—	—	± 2.5	LSB
Differential nonlinearity error	DNLE		—	—	± 2.5	LSB
Full-scale voltage	V_{OFS}		—	1.0	—	V
Zero-scale voltage	V_{OZS}		—	0	—	V

■ Application System Examples

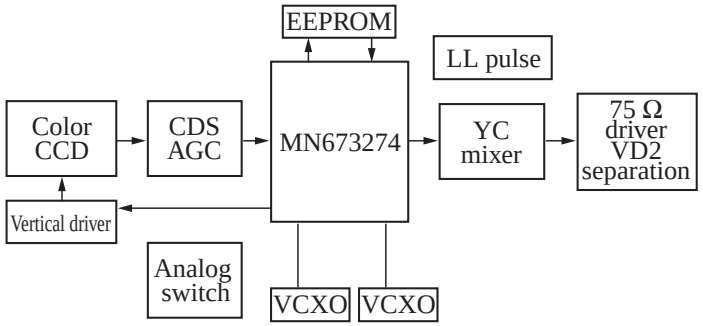
1. Example A (Minimum configuration)
   - Internal synchronization
   - Composite video output



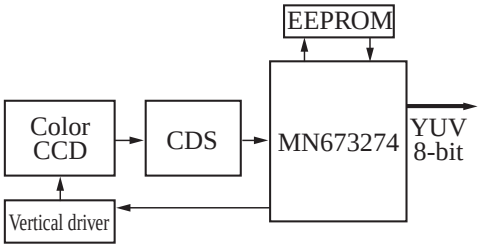
2. Example C
   - Internal synchronization
   - RGB output



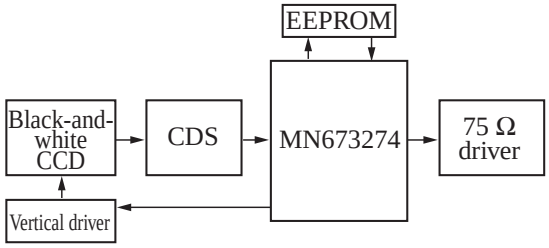
3. Example D (Surveillance camera)
   - External synchronization
   - YC output



4. Example E (PC camera)
   - Internal synchronization
   - Digital output

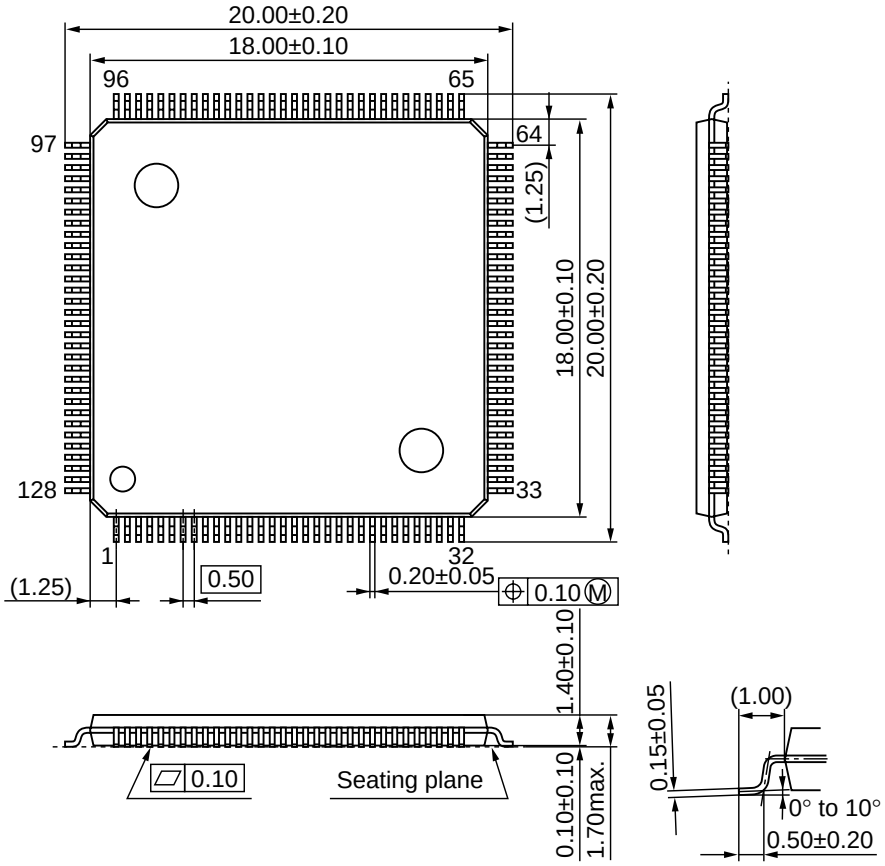


5. Example F
   - Internal synchronization
   - Y output



■ Package Dimensions (units: mm)

• LQFP128-P-1818C



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