1/4 INCH 330k PIXEL CMOS IMAGE SENSOR WITH A/D CONVERTOR

TECHNICAL DATA SHEET (TENTATIVE)

TCM5033T

May 17th, 2000

TOSHIBA CORPORATION
Semiconductor company

FEATURE

CHARACTERISTIC	RATING
Optical size	1/4 inch
Total pixel numbers	698(H) x 500(V)
Signal pixel numbers	660(H) x 492(V)
Pixel pitch	5.6um(H) x 5.6um(V) (square pixel)
Image size	3.696mm(H) x 2.766mm(V)
Aspect ratio	4(H) : 3(V)
Power supply current	20mA(Typ)
Frequency	24.54545 MHz
Signal output	Progressive scanning
Color Filter	Bayer arrangement (G check , R/B line in sequence)
Output format	10bit digital parallel output
Frame frequency	30fps(12.27272MHz data rate)
Package	32pinLCC
Additional functions	1 Variable electronic shutter parameter setting mode 2H to 525H / 1H step, input from 5pin 1H to 10V / 1H step 2 Variable RGB gain control (2 pixels independent control in 1 horizontal line) 3 Built-in Feed back clamp (optical-black is fixed to 64 :10bit) 4 Built-in synchronous circuits (generating HD,VD,ESR pulse) 5 parameter mode available 6 2.5V/3.3V digital input/output available

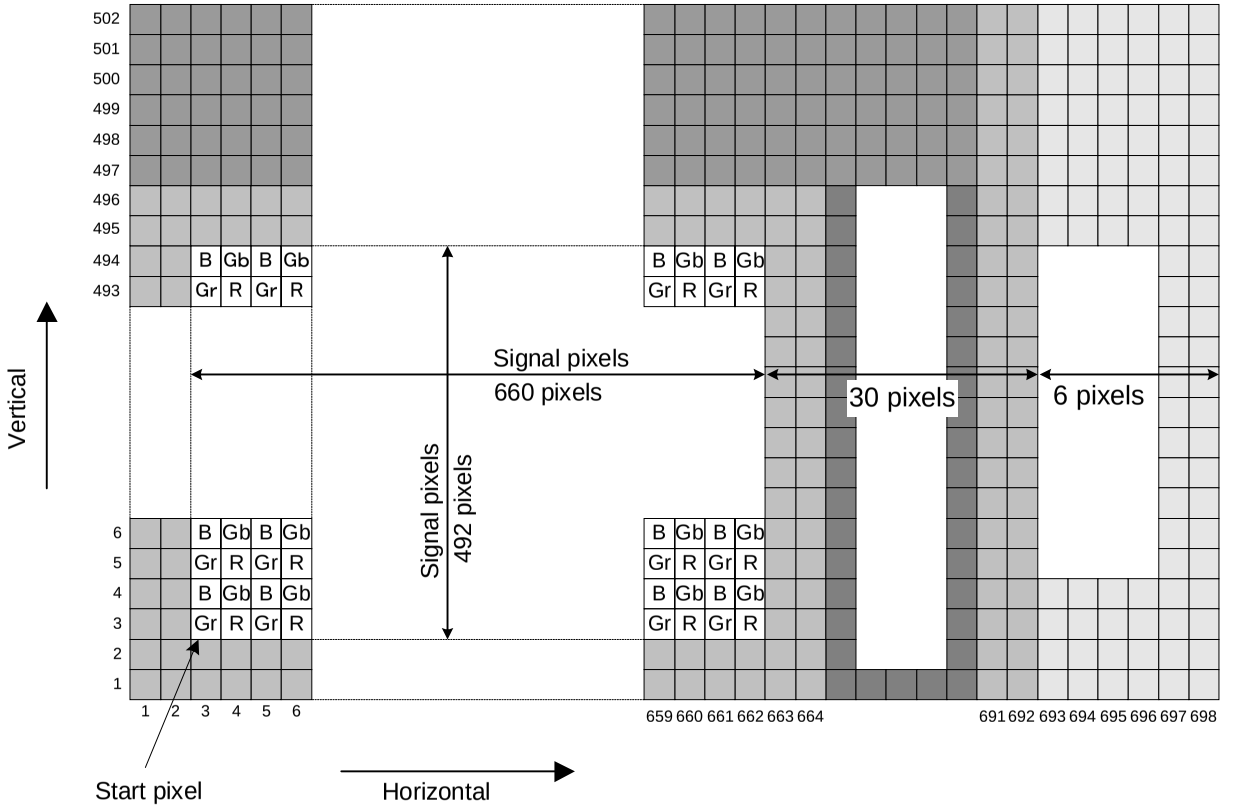
MAXIMUM RATINGS (Vss=0V)

CHARACTERISTICS	SYMBOL	RATING	UNIT
Power Supply Voltage	Vdd	-0.5 to 4.2	V
Input Voltage	Vin	-0.5 to Vdd+0.5	
Input Protection	Iin	+/- 20	mA
Storage Temperature	Tstg	-30 to 85	Centigrade

RECOMMENDED OPERATING CONDITIONS (Vss=0V)

CHARACTERISTICS	SYMBOL	RATING			UNIT
		MIN	TYP	MAX	
Power Supply Voltage	Vavdd	2.6	2.8	3.0	V
	Vdvdd	2.6	2.8	3.0	
	Vdvddio	2.3	2.8	3.6	
Input Voltage	Vin	0 to Vdvddio			
Operating Temperature	Topr	-20 to 60			Centigrade

Pixel arrangement



Definition of pixels R : Red pixels Gr/Gb : Green pixels B : Blue pixels

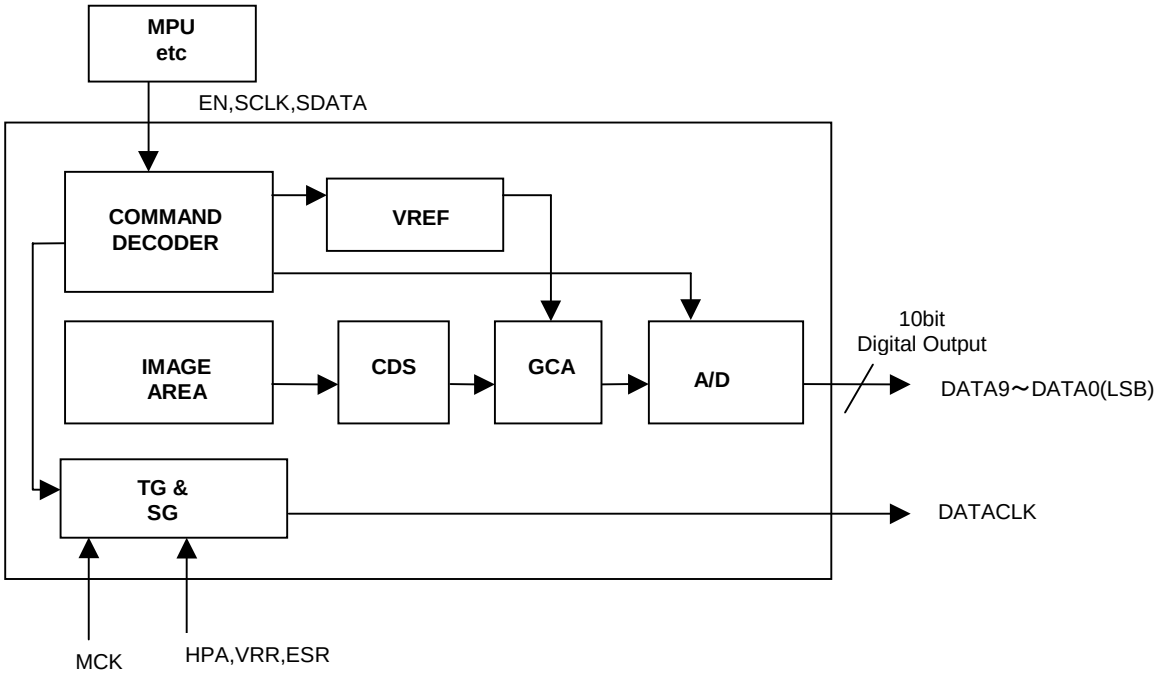
(*)Light shielded dummy pixels Light sheilded pixels (*)Test dummy pixels Dummy pixels

(*)No guaranteed in optical black level

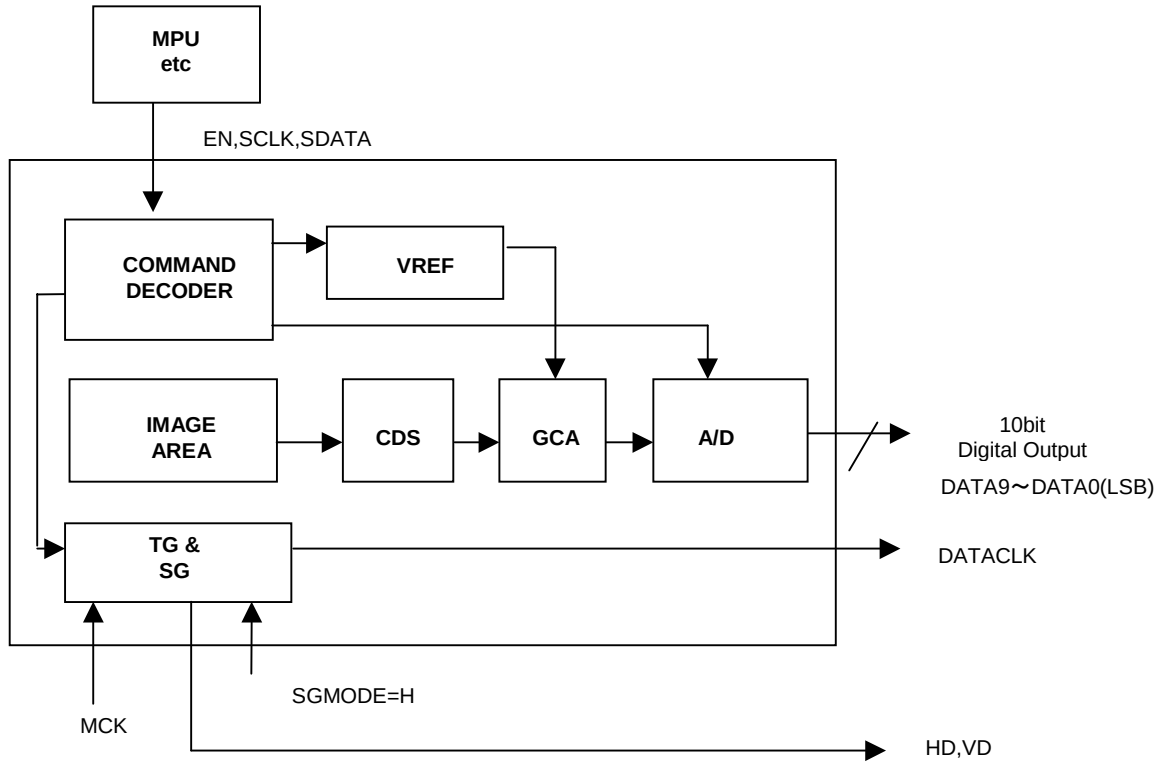
Block Diagram

The synchronization type is selectable between external sync and internal sync by controlling SGMODE pin. If using external sync,no necessary to arrange SGMODE pin. And HPA and VRR and ESR pulse must input. If using internal sync, must be connected to VDD. And HD and VD pulse output, ESR pulse is controlled by setting command mode

(1) External synchronization mode



(2) Internal synchronization mode

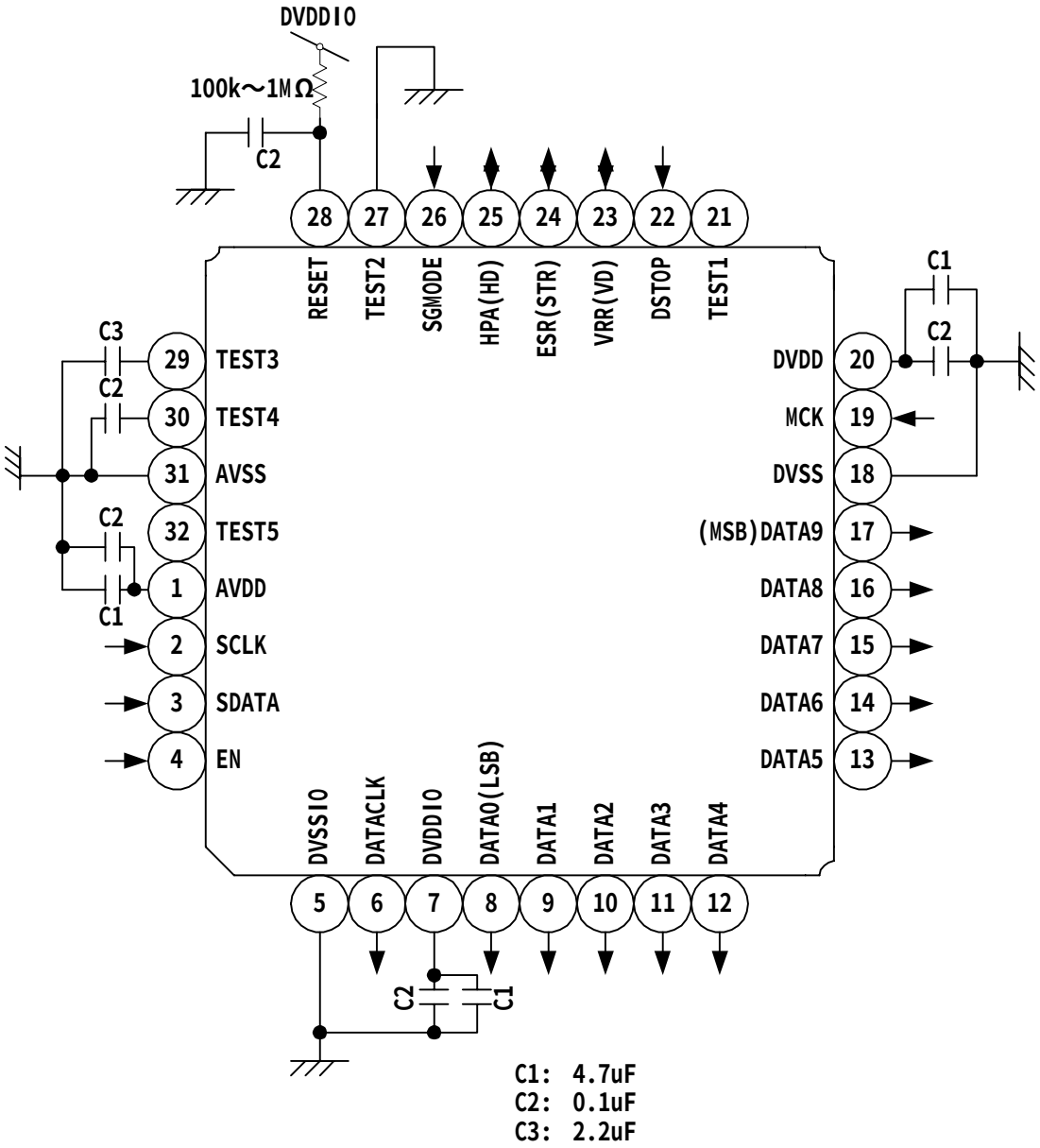


PIN CONFIGURATION

PIN No	SYMBOL	FUNCTION	PIN MANAGEMENT
1	AVDD	Analog power supply	2.6V to 3.0V
2	SCLK	Serial clock input	
3	SDATA	Serial data input	
4	EN	Data enable input	
5	DVSSIO	Digital I/O VSS	0V
6	DATACLK	Data clock output (harf of master clock)	
7	DVDDIO	Digital I/O power supply	2.3 to 2.7V / 2.6 to 3.0V / 3.0 to 3.6V
8	DATA0	AD output (LSB)	
9	DATA1	AD output	
10	DATA2	AD output	
11	DATA3	AD output	
12	DATA4	AD output	
13	DATA5	AD output	
14	DATA6	AD output	
15	DATA7	AD output	
16	DATA8	AD output	
17	DATA9	AD output (MSB)	
18	DVSS	Digital VSS	0V
19	MCK	Master clock input	24.54545 MHz
20	DVDD	Digital power supply	2.6 to 3.0V
21	TEST1	TEST terminal1	Pull up to dvddio
22	DSTOP	Read stop control input	1:active / 0: read stop
23	VRR(VD)	Vertical timing start pulse input / VD pulse Output	
24	ESR	Electrical shutter start pulse input	
25	HPA(HD)	Horizontal timing start pulse input / HD pulse output	
26	SGMODE	Internal / external sync select pin	Pull down to 0V, 0:HPA,VRR,ESR Input / 1:HD,VD output
27	TEST2	TEST terminal2	Must be connected to GND
28	RESET	Parameter mode reset input	
29	TEST3	TEST terminal3	*1
30	TEST4	TEST terminal4	*1
31	AVSS	Analog VSS	0V
32	TEST5	TEST terminal5	

*1 Must be decoupled with 4.7 uF to 10 uF capacitor to analog ground.Tantalum condenser is desirable

PIN ARRANGEMENT



Recommended output impedance of DVDD power supply ; under 0.5ohm at 10kHz

OPTICAL CHARACTERISTICS (VDD=2.6 to 3.0V , -20 to 60 centigrade)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Sensitivity(G)	R(G)	Standard conditions(*2)	300	400	-	
Saturation Voltage	VSAT	Saturation light conditions, G output	960		-	
Blooming Margin	BLM	500 times as standard conditions	No blooming			
S/N(dark)	S/N	G output	-	57	-	dB
Decay Lag	LAG	G output 20mV	-	-	2	

*GCA are 0 dB

Definition of Sensitivity, Saturation Voltage, Decay Lag are decimal expression and these value subtract optical black level (64=decimal expression).

(*1)Standard conditions(T_C=60 centigrade)as follows

Light conditions : Color temperature 3200K halogen light box.

Surface brightness : 100nt of equal white light

IR cut filter is applicable

Optical lens : f25mm lens manufactured by Fujinon Lens Co.,Ltd. Set to the F2.8.

Frame frequency : 30Hz continual operations, electronic shutter off(storage time=1/30s).

(*2)Standard conditions for measuring Sensitivity

F2.8,100nt,

Color temperature :3200K,

IR cut filter ; half value 650nm

If this sensor connected D/A converter(output :500mV peak to peak) ,characteristics as follows. Conditions are same

OPTICAL CHARACTERISTICS (VDD=2.6 to 3.0V , -20 to 60 centigrade)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Sensitivity(G)	R(G)	Standard conditions(*2)	150	200	-	mV
Saturation Voltage	VSAT	Saturation light conditions, G output	500		-	mV
Blooming Margin	BLM	500 times as standard conditions	No blooming			
S/N(dark)	S/N	G output	-	57	-	dB
Decay Lag	LAG	G output 20mV	-	-	1	mV

ELECTRICAL CHARACTERISTICS

DC Characteristics (Ta=25 centigrade,Vdd=2.6 to 3.0V)

CHARACTERISTIC	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	PIN
High level input voltage	VIH		2.0	-	-	V	1
Low level input voltage	VIL		-	-	0.8	V	1
High level input current	IIH	VIN=VDD	-1	-	1	uA	1
High level input current	IIL	VIN=VSS	-1	-	1	uA	1
High level output voltage	VOH	IOH=-4mA	2.4	-	-	V	2
Low level output voltage	VOL	IOL= 4mA	-	-	0.4	V	2
Power Supply Current	IDD	V_{DD}=2.8V	-	20	-	mA	

PIN

1 DSTOP,VRR,ESR,HPA,SGMODE,RESET,SCLK,SDATA,EN,MCK

2 VD,STR,HD,DATACLK,DATA0 to DATA9

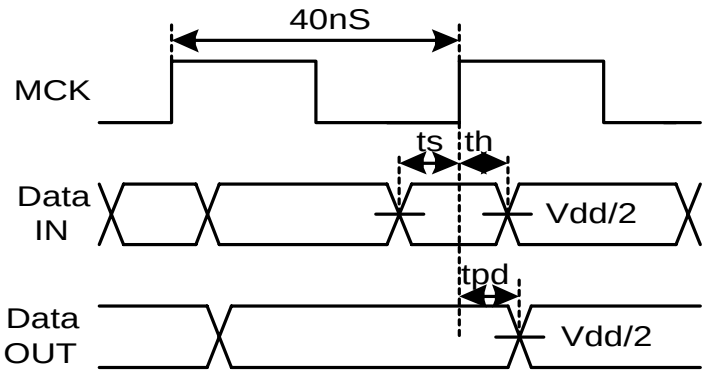
AC Characteristics (Ta=-20 to 60 centigrade,Vdd=2.6 to 3.0V)

CHARACTERISTC	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	PIN
Setup time	Ts				10	nS	1
Hold time	Th				10	nS	1
Output delay time	Tpd	C=15pF			20	nS	2

PIN

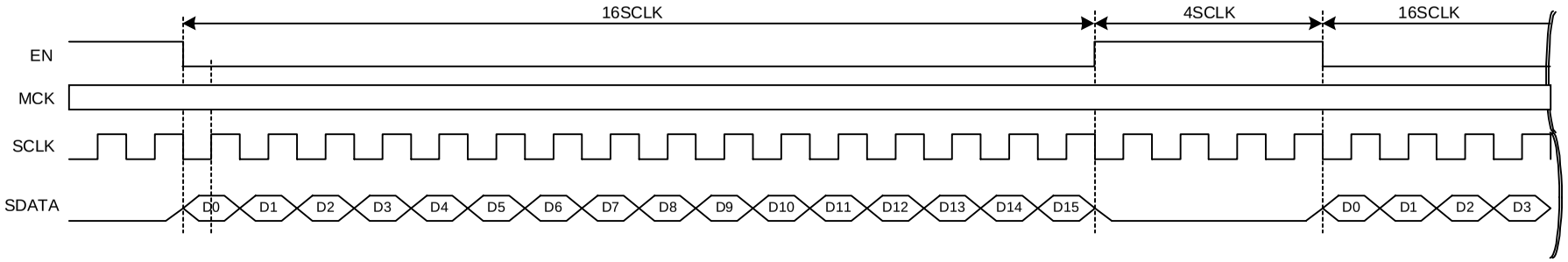
1 DSTOP,VRR,ESR,HPA,

2 DATACLK、DATA0 to DATA9



Command timing

(1)Timing



(2)Set table

CHARACTERISTIC	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Comment
Gr pixel gain control	0	0	0	0	MSB ← Data area (10bit) → LSB										X	X	
R pixel gain control	0	0	0	1	MSB ← Data area (10bit) → LSB										X	X	
B pixel gain control	0	0	1	0	MSB ← Data area (10bit) → LSB										X	X	
Gb pixel gain control	0	0	1	1	MSB ← Data area (10bit) → LSB										X	X	
Electoric shutter	1	0	1	0	MSB ← Data area (10bit) → LSB										X	X	In case of Interal sync mode
Monitoring mode	1	1	1	1	0	0/1	0	0	0	0	0	0	0	0	0	0	0:OFF(30fps) / 1:ON(60fps)

(3)Explanation of command CHARACTERISTIC

Gain control

Independent pixel(Gr/R/B/Gb) gain control available. Principal value as follows

setting data(BIN)	setting data(HEX)	gain value
1 1 0 0 0 0 0 0 0 0	C 0 0	0 (default)
0 1 1 0 0 0 0 0 0 1	6 0 1	6
0 0 1 1 0 0 0 0 0 1	3 0 1	12
0 0 0 1 1 0 0 0 0 1	1 8 1	18

Electronic shutter

In case of internal sync mode,setting command data controls electronic shutter speed

setting data(BIN)	electroric shutter value
0 0 0 0 0 0 0 0 0 0	2H
0 0 0 0 0 0 0 0 0 1	3H
0 0 0 0 0 0 0 0 1 0	4H
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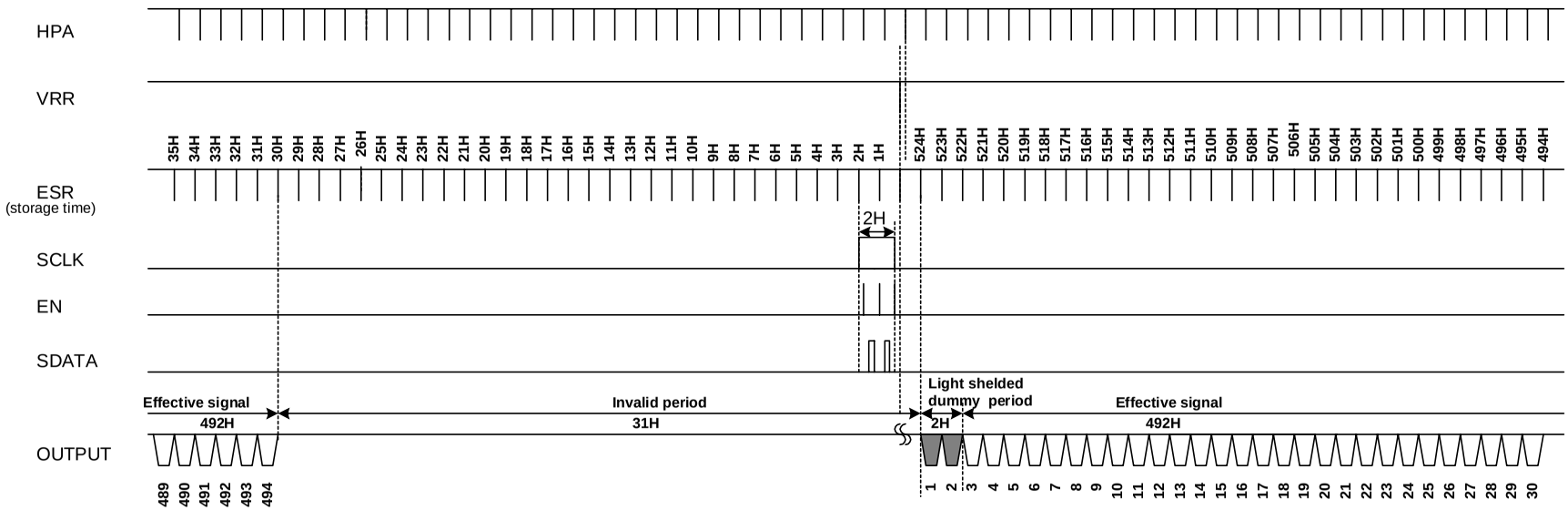
1 0 0 0 0 0 1 0 0 1	523H
1 0 0 0 0 0 1 0 1 0	524H

Monitering mode

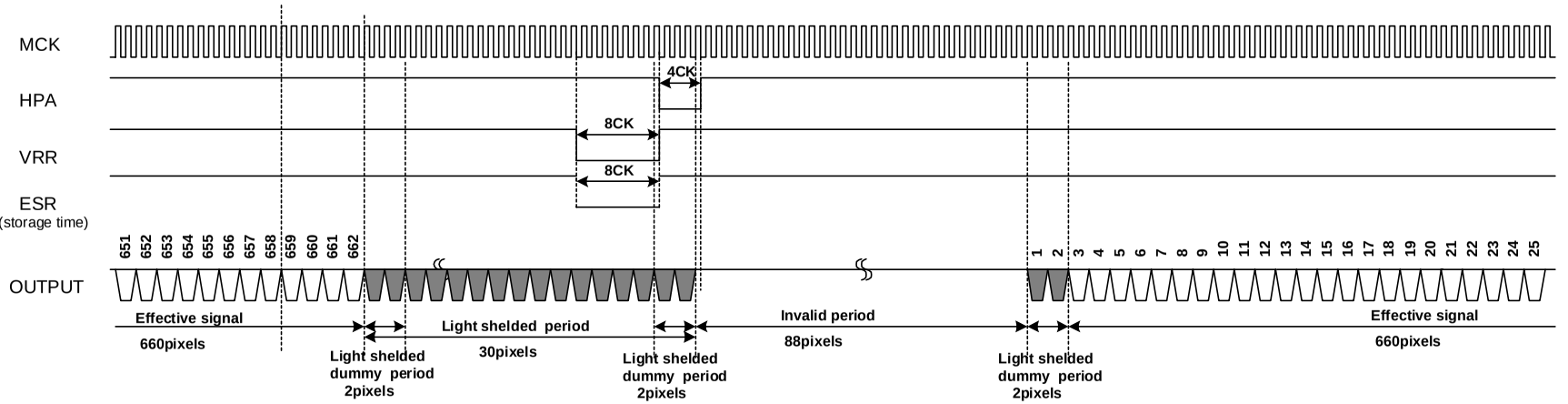
0:Progressive scan(30fps) / 1: Scannig each 2 lines(60fps)

Signal output format (external sync in normal mode)

Vertical period

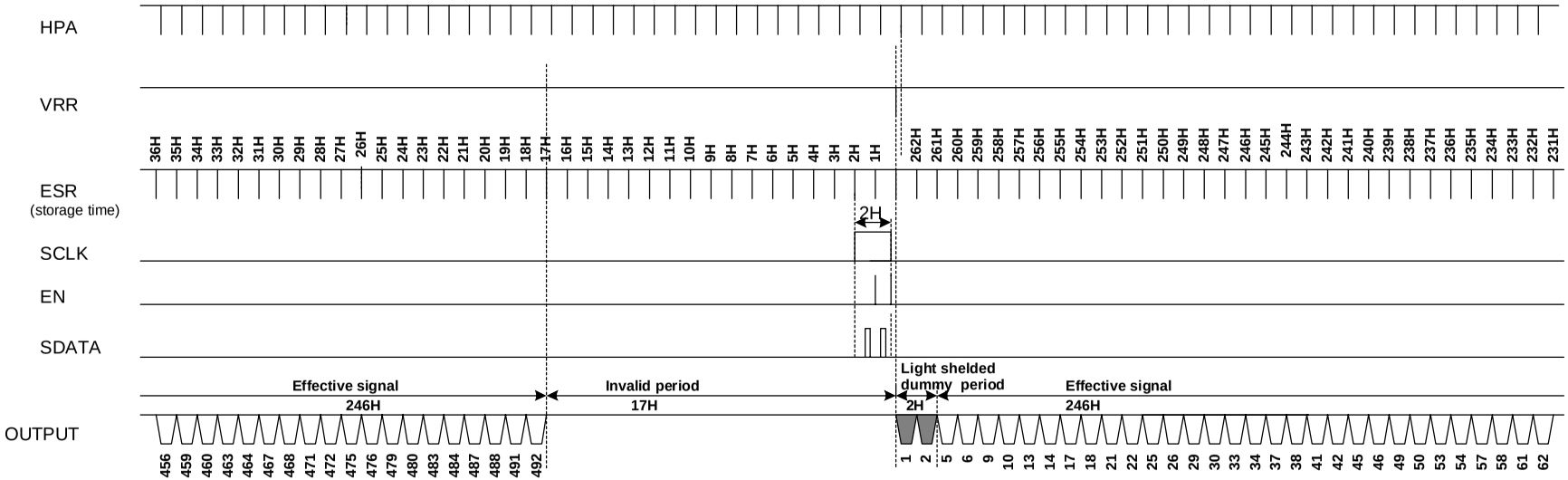


Horizontal period

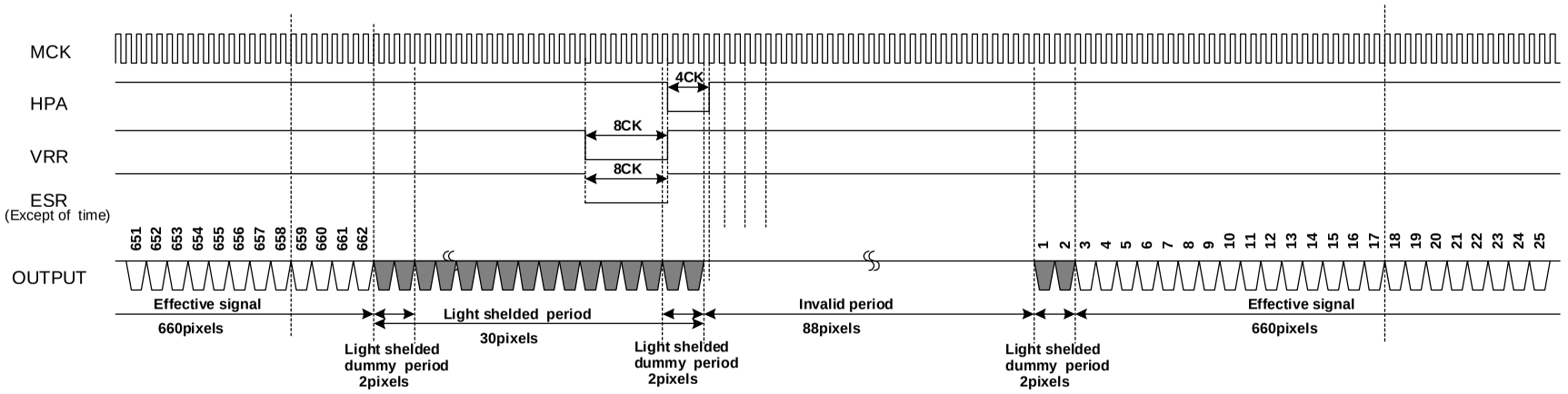


Signal output format(external sync in monitoring mode)

Vertical period

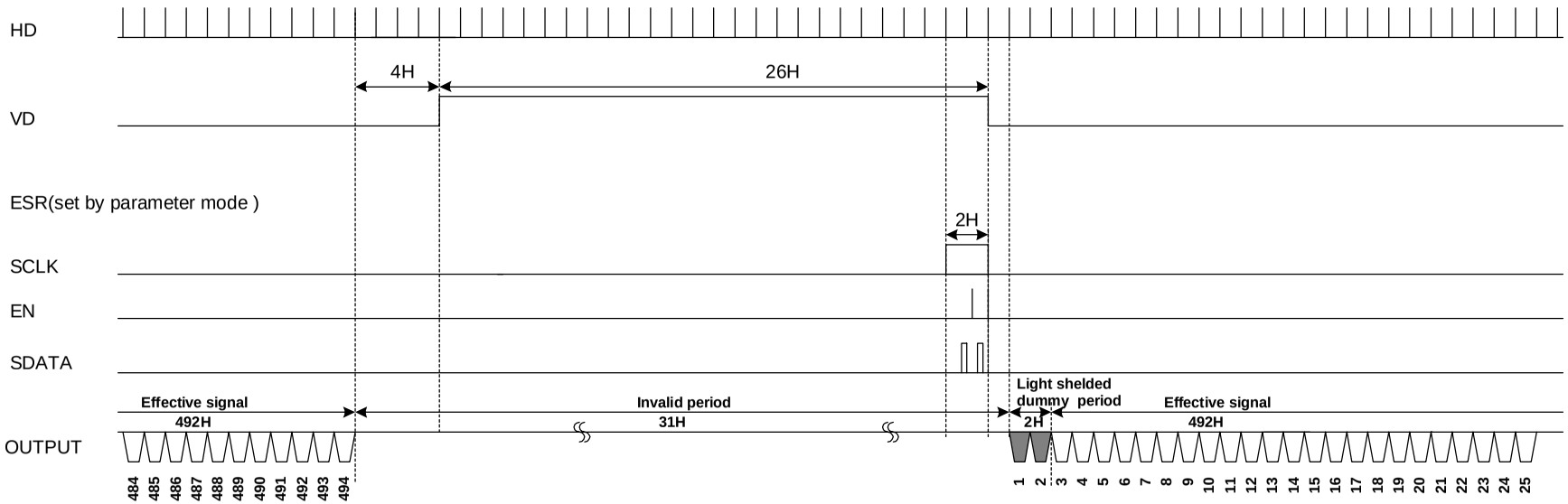


Horizontal period

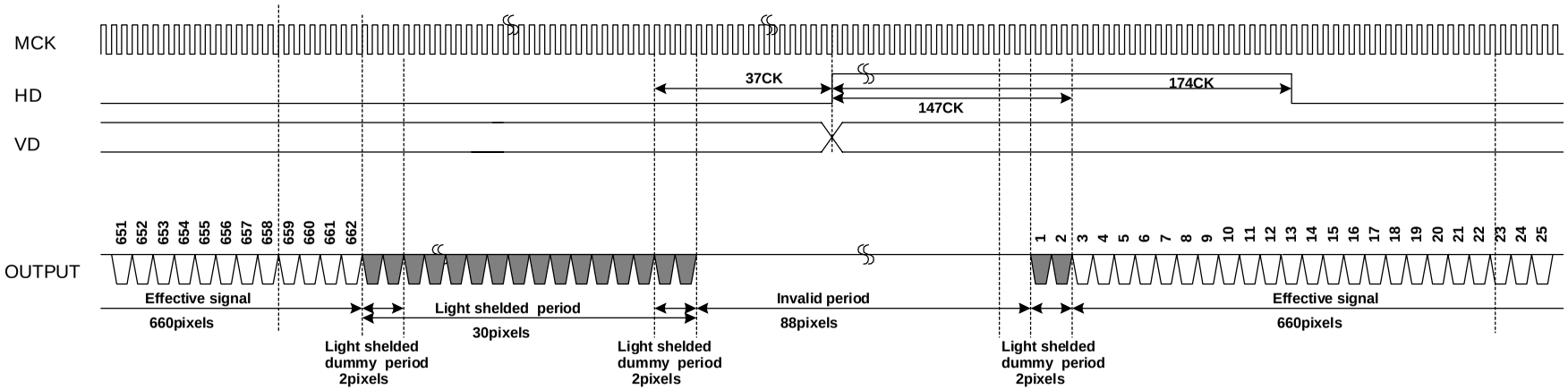


Signal output format(internal sync in normal mode)

Vertical period

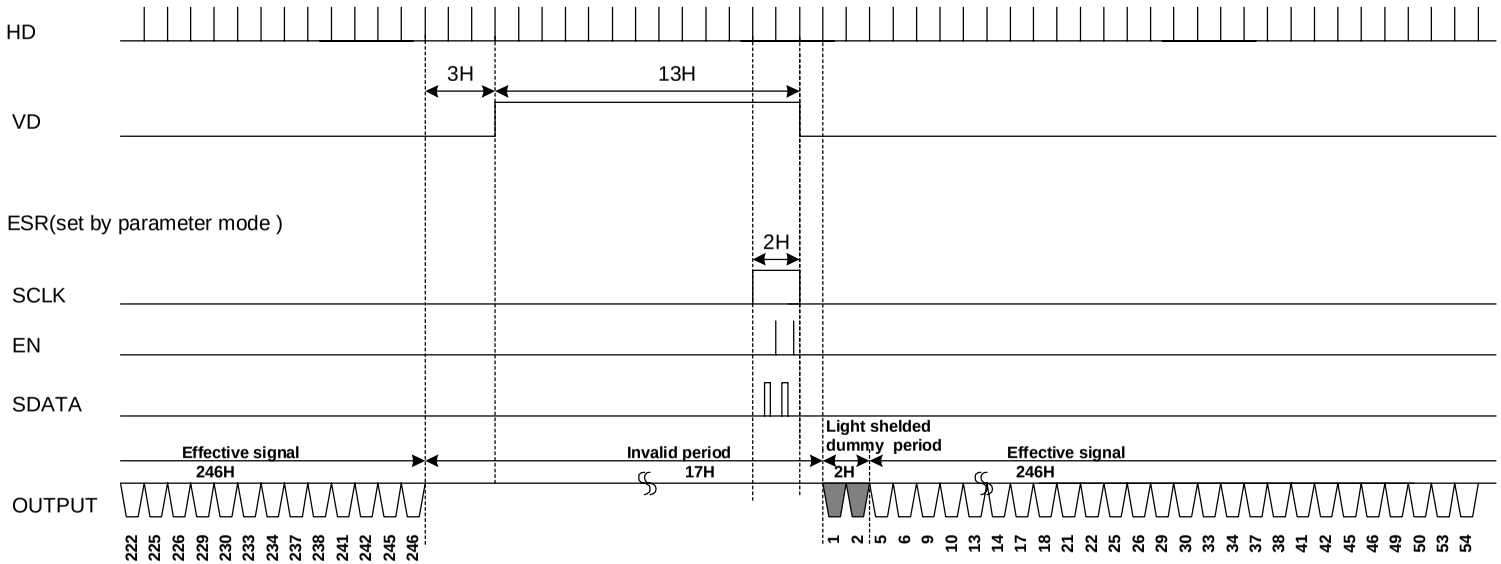


Horizontal period

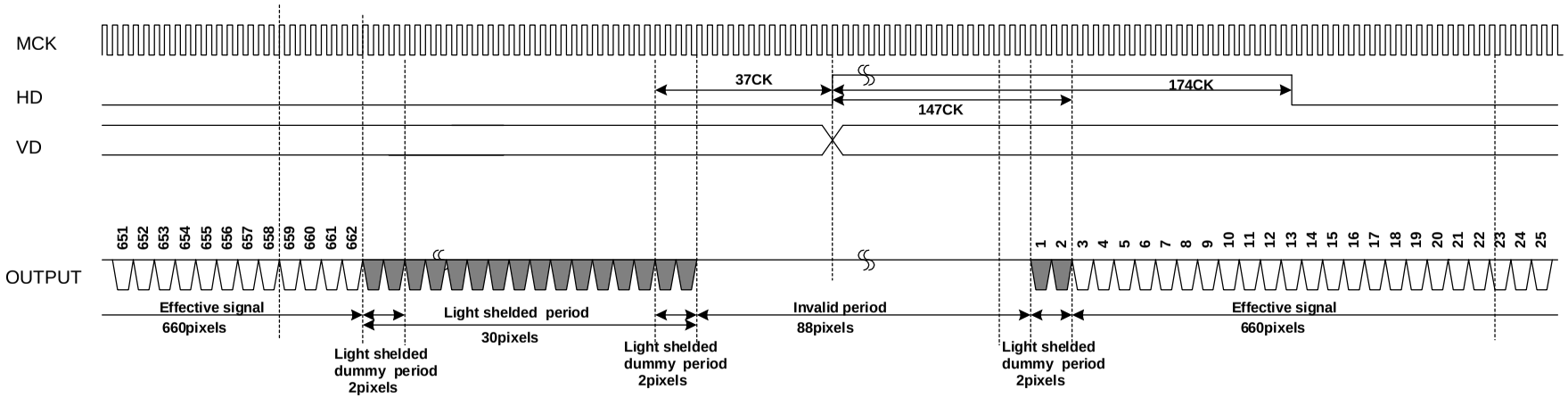


Signal output format(internal sync monitoring mode)

Vertical period



Horizontal period



Package Outline(Tentative)