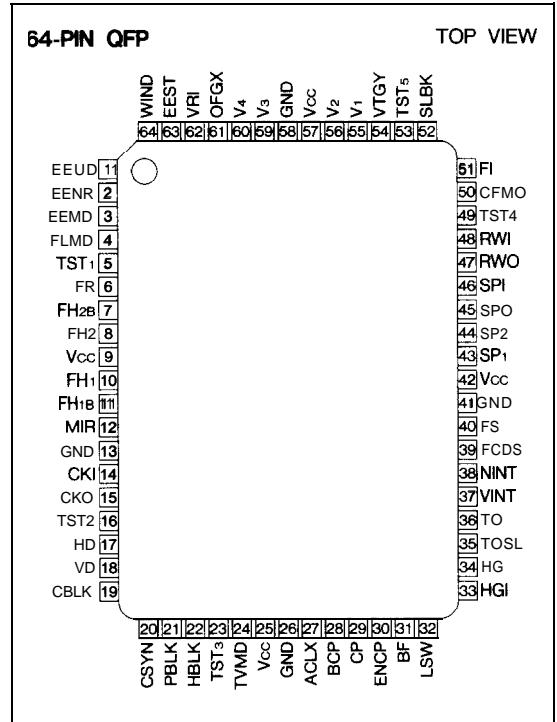# LZ95G53

Single-chip Driver LSI for CCD

DESCRIPTION

The LZ95G53 is a CMOS single chip driver LSI which provides timing pulses used to drive a CCD area sensor, and generates synchronous pulses for TV signals and processing pulses for video signals.
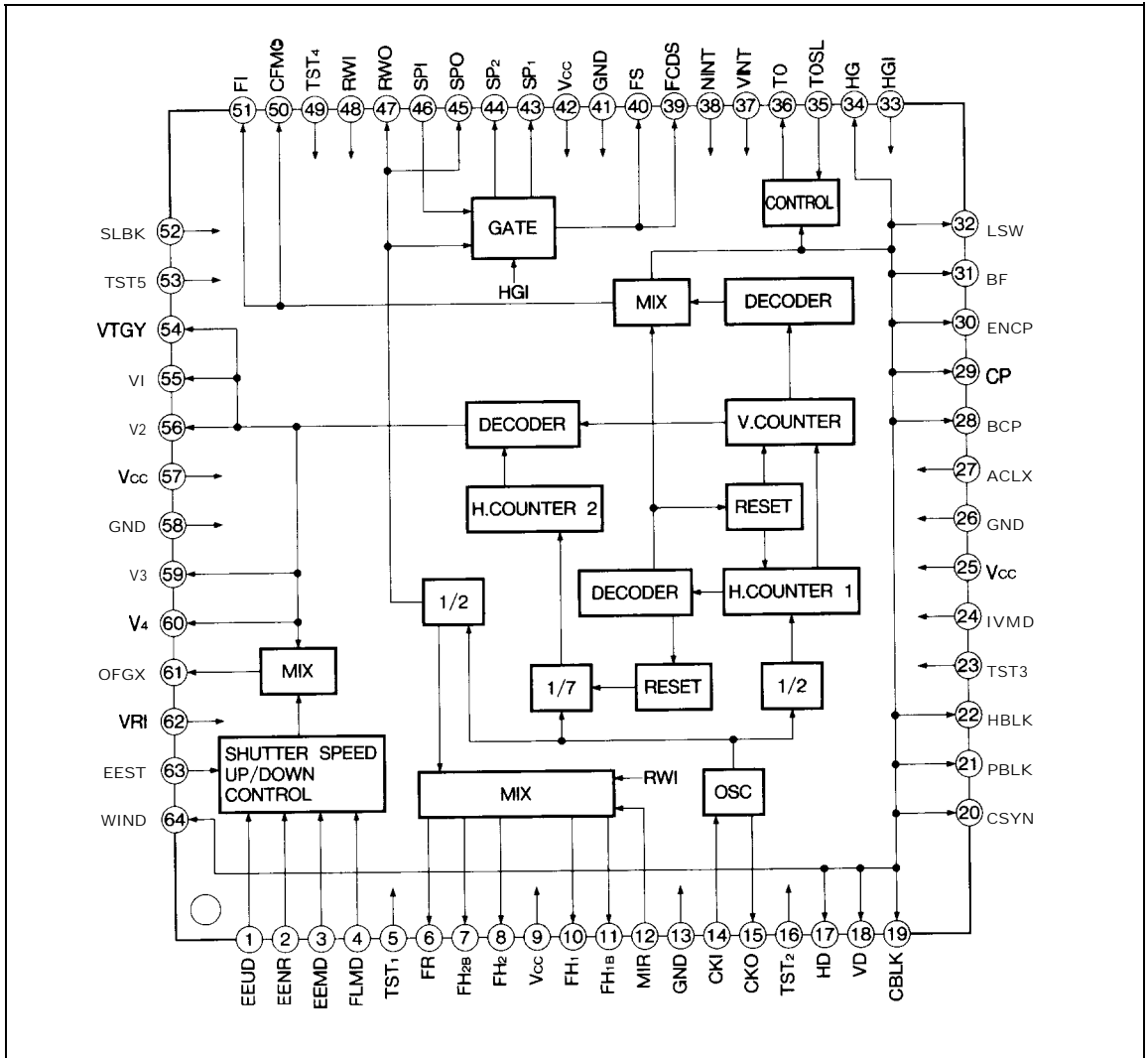
FEATURES

- Switchable **between 190000 pixels CCD and 220000 pixels CCD**
- Switchable **between NTSC (EIA) and PAL (CCIR) systems**
- **Built-in EE (Electronic Exposure) control (1/60 to 1/100000 s for NTSC; 1/50 to 1/100000 s for PAL)**
- **Flicker-less function**
- **Switchable between normal and mirror image**
- **No-interlace mode is possible**
- **External synchronization is possible**
- **Single +5 V power supply**
- **Package : 64-pin QFP(QFP064-P-1420)**

PIN CONNECTIONS

64-PIN QFP   TOP VIEW

Top pins (left to right): WIND 64, EEST 63, VRI 62, OFGX 61, V4 60, V3 59, GND 58, Vcc 57, V2 56, V1 55, VTGY 54, TST5 53, SLBK 52

Left side (top to bottom):
- EEUD 1
- EENR 2
- EEMD 3
- FLMD 4
- TST1 5
- FR 6
- FH2B 7
- FH2 8
- Vcc 9
- FH1 10
- FH1B 11
- MIR 12
- GND 13
- CKI 14
- CKO 15
- TST2 16
- HD 17
- VD 18
- CBLK 19

Right side (top to bottom):
- 51 FI
- 50 CFMO
- 49 TST4
- 48 RWI
- 47 RWO
- 46 SPI
- 45 SPO
- 44 SP2
- 43 SP1
- 42 Vcc
- 41 GND
- 40 FS
- 39 FCDS
- 38 NINT
- 37 VINT
- 36 TO
- 35 TOSL
- 34 HG
- 33 HGI

Bottom pins (left to right): CSYN 20, PBLK 21, HBLK 22, TST3 23, TVMD 24, Vcc 25, GND 26, ACLX 27, BCP 28, CP 29, ENCP 30, BF 31, LSW 32

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply voltage	Vcc	−0.3 to +7.0	v
Input voltage	VI	−0.3 to Vcc + 0.3	v
Output voltage	Vo	-0.3 to Vcc + 0.3	v
Operating temperature	Topr	−20 to +70	℃
Storage temperature	Tsta	−55 to +150	℃

DC CHARACTERISTICS $(Vcc = +5 V \pm 10\%, Ta = -20 \ to \ +70℃)$

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Input Low voltage	V_{IL}				1.5	v	1
Input High voltage	V_{IH}		3.5			v	
Input High threshold voltage	V_{T+}		2.2		3.8	v	
Input Low threshold voltage	VT-		1,0		2.4	v	2
Hysteresis voltage	V_{T+} −VT-		0.4			v	
Input Low current	$|I_{IL1}|$	$V_I = 0 \ V$			1.0	μA	3
	$|I_{IL2}|$	$V_I = 0 \ V$	8.0		60	μA	4
Input High current	$|I_{IH1}|$	$V_I = V_{CC}$			1.0	μA	5
	$|I_{IH2}|$	$V_I = V_{CC}$	6.0		60	μA	6
Output High voltage	$V_{OH}1$	$I_{OH} = -2 \ mA$	4.0			v	7
Output Low voltage	V_{OL1}	$I_{OL} = 4 \ mA$			0.4	v	
Output High voltage	V_{OH2}	$I_{OH} = -3 \ mA$	4.0			v	8
Output Low voltage	V_{OL2}	$I_{OL} = 4 \ mA$			0.4	v	
Output High voltage	V_{OH3}	$I_{OH} = -6 \ mA$	4.0			v	9
Output Low voltage	V_{OL3}	$I_{OL} = 8 \ mA$			0.4	v	
Output High voltage	V_{OH4}	$I_{OH} = -9 \ mA$	4.0			v	10
Output Low voltage	V_{OL4}	$I_{OL} = 12 \ mA$			0.4	v	

NOTES :
 1. Applied to inputs (IC, ICD, ICU, IBF0).
 2. Applied to input (ICSU).
 3. Applied to inputs (IC, ICD, IBF0).
 4. Applied to inputs (ICU, ICSU).
 5. Applied to inputs (IC, ICU, ICSU, IBF0).
 6. Applied to input (ICD).
 7. Applied to outputs (ORI, OSC).
    (Output (OSC) measures on conditions that input (IBF0) level is O V or Vcc.)
 8. Applied to output (O6R1).
 9. Applied to output (O6R12).
10. Applied to output (O6R13).

PIN FUNCTION

PIN NO.	SYMBOL	I/O	POLARITY	PIN NAME	FUNCTION
1	EEUD	IC	–	Electronic Exposure control 1	An input pin to control Electronic Exposure, with using EENR (pin 2).
2	EENR	IC	–	Electronic Exposure control 2	An input pin to control Electronic Exposure, with using EEUD (pin 1).
3	EEMD	ICD	–	Electronic Exposure select	An input pin to select Electronic Exposure mode, with using FLMD (pin 4).
4	FLMD	ICD	–	Flicker-less select	An input pin to select Flicker-lees Shutter mode, with using EEMD (pin 3).
5	TSTI	ICD	–	Test terminal 1	A teet pin. Set open or to L level in the Normal mode.
6	FR	06R13	⎍	Reset pulse	A reset pulse for CCD. Connect to ϕR of CCD through the DC offset circuit.
7	FH2B	O6R13	⎍	Horizontal transfer pulse 2B	A horizontal transfer pulse for CCD. Connect to ϕH2B of CCD.
8	FH2	O6R13	⎍	Horizontal transfer pulse 2	A horizontal transfer pulse for CCD. Connect to ϕH2 of CCD.
9	Vcc	–	–	Power supply	Supply +5 V power.
10	FH1	O6R13	⎍	Horizontal transfer pulse 1	A horizontal transfer pulse for CCD. Connect to ϕH1 of CCD.
11	FH1B	06R13	⎍	Horizontal transfer pulse 1 B	A horizontal transfer pulse for CCD. Connect to ϕH1B of CCD.
12	MIR	Icu	–	Mirror mode select	An input pin to select Mirror mode or Normal mode. 　L level : Normal Drive mode 　H level or open : Mirror Drive mode
13	GND	–	–	Ground	A grounding pin.
14	CKI	IBF0	⎍	Clock input	An input pin for reference clink oscillation. The frequencies are as follows : 　At NTSC mode : 13.500 MHz (858 fH) 　At PAL mode　: 13.500 MHz (864 fH) 　　　　　(fH = Horizontal frequency)
15	CKO	OSC	⎍	Clock output	An output pin for reference clock oscillation. The output is the inverse CKI (pin 14).
16	TST2	ICD	–	Test terminal 2	A test pin, Set open or to L level in the Normal mode.
17	HD	ORI	⎍	Horizontal drive pulse	The pulse occurs at the start of lines.

Pin 4 FLMD FUNCTION table:

EEMD (pin 3)	FLMD (pin 4)	Shutter speed (s)	
		NTSC	PAL
L	L	1 /60	1 /50
L	H	1/100	1/120
H	L	1/31320 max.	1/30690 max.
H	H	1/109890 max.	1/109 890 max.

PIN NO.	SYMBOL	I/O	POLARITY	PIN NAME	FUNCTION
18	VD	OR1	⊓	Vertical drive pulse	The pulse occurs at the start of every field.

19	CBLK	OR1	⎍	Composite blanking pulse	Composite blanking pulse.
					When SLBK (pin 52) is Low level,
					    at NTSC mode : H; 10.52 ns, V 20 H period,
					    at PAL mode : H; 11,26 ns, V; 25 H period.
					When SLBK (pin 52) is High level,
					    at NTSC mode : H; 10.81 ns, V 20 H period,
					    at PAL mode : H; 12.15 ns, V; 25 H period.

20	CSYN	OR1	⎍	Composite synchronizing pulse	Composite synchronous signal output pin.
21	PBLK	OR1	⊓	Pre-blanking pulse	**Equivalent to CBLK (pin 19) pulse except for shorter pulse width with cut-off trailing edge.**
22	HBLK	ORI	u	Horizontal blanking pulse	**A pulse that corresponded to the cease period of the horizontal transfer pulse.**
23	TST3	ICD	–	Test terminal 3	A test pin. Set open or to L level in the Normal mode.

24	TVMD	ICU	–	TV mode select	**An input pin to select TV standards.**
					    L level : NTSC mode
					    H level or open : PAL mode

25	Vcc	–	–	Power supply	**Supply +5 V power.**
26	GND	–	–	Ground	**A grounding pin.**
27	ACLX	Icu	–	All clear input	**An input pin for resetting all infernal circuit at power on. For details, see "NOTE 1".**
28	BCP	ORI	⎍	Optical black clamp pulse	**A pulse to clamp the optical black signal.** **This pulse stays Low during the absence of effective pixels within the vertical blanking.**
29	CP	ORI	⎍	Clamp pulse	**CP is the same aa BCP (pin 28) except that CP is delayad by 700 ns from BCP.**
30	ENCP	OR1	⎍	Encoder DC clamp pulse	**A clamp pulse that is used for recovering DC level. The repetition is horizontal frequency.**
31	BF	OR1	⎍	Burst flag	**A pulse to define burst period.**
32	LSW	OR1	⎍	Line switch	**The signal switches between H and L at every line in PAL mode, It is set at Low level at the 1st line of the 1st field.**
33	HGI	ICD	–	Color sampling pulse control input	**An input pin to control SP1, SP2 pulses correspond to color separator in signal processor.**

For pin 33 (HGI), the function cell additionally contains:

HGI input	Output to sample hold at color separator.
L level or open	SP1 : Output contain Ye signal. SP2 : Output contain Cy signal,
HG pulse	SP1 : Output contain Mg signal. SP2 : Output contain G signal.

| PIN NO.	SYMBOL	I/O	POLARITY	PIN NAME	FUNCTION
34	HG	OR1	n -	Line index pulse	The pulse is used in color separator. The signal switches between H and L at every line.
35	TOSL	ICD	–	TO control input	An input pin to control TO output (pin 36).
36	TO	OR1	1-r	TO output	A pin to output calling pulse.
37	VINT	ICU	–	Initialize input	An input pin for initializing circuit. It can be used field-reset input, and the circuit is initialized with the 1/2 dividing pulse of VINT. The frequency of VINT is 60 Hz in NTSC or 50 Hz in PAL. It may be occurced jitter because of catching VINT pulse with the 1/2 dividing pulse of CKI (pin 14). The point of resetting is following, the falling edge of VINT is advanced; At NTSC mode : 0 to 146 ns from the start of ODD field At PAL mode : 0 to 146 ns from the start of 1st field Set open or to H level when Internal Synchronization mode or no initializing.
38	NINT	ICU	–	Non-interlace select	An input pin to select Non-interlace mode. L level : Interlace mode H level or open : Non-interlace mode At Non-interlace mode, the field is ODD field and 262 H period at NTSC mode, and Ist field and 312 H period at PAL mode.
39	FCDS	O6R12	⎍	CDS pulse 1	A pulse to clamp the feed-through level from CCD.
40	FS	O6R12	⎍	CDS pulse 2	A pulse to sample-hold the signal from CCD.
41	GND	–	–	Ground	A grounding pin.
42	Vcc	–	–	Power supply	Supply +5 V power.
43	SP1	O6R12	⎍	Color sampling pulse 1	Pins to output the sampling pulse for color demodulation based on the output signal of CCD.
44	SP2	O6R12	⎍	Color sampling pulse 2	Pins to output the sampling pulse for color demodulation based on the output signal of CCD.
45	SPO	06R1	⎍	Timing of SP1, SP2 control output	A pulse to control pulse timing of SPI, SP2. Connect to SPI (pin 46) through the CR delay circuit.
46	SPI	IC	–	Timing of SPI, SP2 control input	An input pin to control pulse timing of SP1, SP2.
47	RWO	O6R1	⎍	Width of FR control output	A pulse to control pulse width of FR (pin 6). Connect to RWI (pin 48) pin through CR delay circuit.
46	RWI	IC	–	Width of FR control input	An input pin to control pulse width of FR. Falling edge of FR is defined by rising edge of input pulse.
49	TST4	ICD	–	Test terminal 4	Ateetpin. Setopen orto Llevel in the Normal mode.

3 CCD PERIPHERALs

PIN NO.	SYMBOL	I/O	POLARITY	PIN NAME	FUNCTION

50	CFMO	OR1	⎍	Color frame pulse	A pulse to control color frame.
					    Occurs at every 4 fields in NTSC mode,
					    occurs at every 8 fields in PAL mode.

51	FI	OR1	⎍	Field index	The pulse is used for detecting field,
					    At NTSC or EIA mode : ODD field; LOW
					                              EVEN field; HIGH
					    At PAL or CCIR mode : Test signal output

52	SLBK	Icu	–	CBLK width select	An input pin to select the Horizontal period of CBLK.
					    L level : At NTSC mode : H; 10.52 ns,
					                          V; 20 H period
					        At PAL mode : H; 11.26 ns,
					                          V; 25 H period
					    H level : At NTSC mode : H; 10.81 ns,
					                          V; 20 H period
					                          or open
					        At PAL mode : H; 12.15 ns,
					                          V; 25 H period

53	TST5	ICD	–	Test terminal 5	A test pin. Set open or to L level in the Normal mode.
54	VTGX	ORI	⎍	Read out pulse	A pulse that transfers the charge of the photodiode to the vertical shift register. Connect to VTG pin of CCD through the invert and level shift circuit.
55	V_1	06R12	⎍	Vertical transfer pulse 1	A vertical transfer pulse for CCD. Connect to ϕ v1 pin of CCD.
56	V2	O6R12	⎍	Vertical transfer pulse 2	A vertical transfer pulse for CCD. Connect to ϕ v2 pin of CCD.
57	Vcc	–	–	Power supply	Supply +5 V power.
58	GND	–	–	Ground	A grounding pin.
59	V3	O6R12	⎍	Vertical transfer pulse 3	A vertical transfer pulse for CCD. Connect to ϕ v3 pin of CCD.
60	V4	O6R12	⎍	Vertical transfer pulse 4	A vertical transfer pulse for CCD. Connect to ϕ v4 pin of CCD.
61	OFGX	ORI	⎍	OFG pulse Output	A pulse that sweeps the charge of the photodiode for electrical shutter. Connect to OFG of CCD through the invert, level shift and DC offset circuit. It is held at H level in Normal mode.

62	VRI	ICU	–	Vertical reset input	An input pin for resetting internal Vertical counter. The input pulse is necessary 1/2 horizontal max. delay from vertical synchronous start point, because VRI is counted 2 times horizontal frequency.
					The point of resetting is following :
					    At NTSC mode : 3.5 H from the start of VD.
					    At PAL mode : 3 H from the start of VD.
					Set open or to H level when internal synchronization or using VINT (pin 37).

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PIN NO.	SYMBOL	I/O	POLARITY	PIN NAME	FUNCTION
63	EEST	ICU	–	Electronic Exposure control 3	An input pin to control Electronic Exposure, with using EEUD (pin 1) and EENR (pin 2). " L level : Electronic Exposure is stopped. H level or open : Electronic Exposure is operated
64	WIND	OR1	⎍	Wind pulse	A pulse for wind pulse. When connected to EEST (Pin 63), the operation of Electronic Exposure can be stopped at the upper side of monitor.

IC   : **Input pin (CMOS level).**
ICU   : **Input pin (CMOS level with pull-up resistor).**
ICD   : **Input pin (CMOS level with pull-down resistor).**
ICSU : Schmit-trigger input pin
        (CMOS level with pull-up resistor).
OR1   : **Output pin.**
06RI   : **Output pin.**
06R12 : **Output pin.**
06R13 : **Output pin.**
IBF0 : **Input pin for oscillation.**
OSC : **Output pin for oscillation.**

NOTES :
1. How to use ACLX (Pin 27)
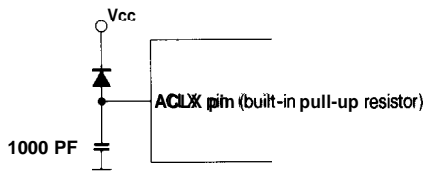
2. Shutter speed changes at Electronic Exposure Control mode

NTSC		PAL	
EXPOSURE TIME (μs)	SHUTTER SPEED (s)	EXPOSURE TIME (μs)	SHUTTER SPEED (s)
9.1	1/1 09890	9.1	1/1 09890
17.4	1/57 470	17.4	1 /57 470
31.9	1/31 320	32.4	1/W 890
48.0	1/20 830	48.4	1 /20 640
64.1	1/15 600	64.5	1/15500
81.0	1/12350	81.4	1/12260
95.5	1/10 470	96.4	1/10360
111.6	1/8960	112.4	1/8690
127.6	1/7630	128.5	1/7 780
144.5	1/6 920	1 45.4	1/6 880
159.0	1/6 290	160.4	1/6 240
175.1	1/5710	176.4	1/5 670
191.2	1/5 230	192.5	1/5 190
206.1	1/4 800	209.4	1/4 780
271.6	1/3 660	273.4	1/3 660
(every 63.64s)		(every 64.0 μs)	
1 2SS.5	1 /776	1425.4	1 /702
(every 254.2 μs)		(every 256.0 μs)	
4339.2	1 /230	4625.4	1/216
(every 572.06S μs)		(every 576.0 μs)	
16351.2	1/61.1	19473.4	1/51.4

3   **CCD PERIPHERALs**

TIMING DIAGRAM

VERTICAL PULSE < NTSC >

(ODD FIELD)
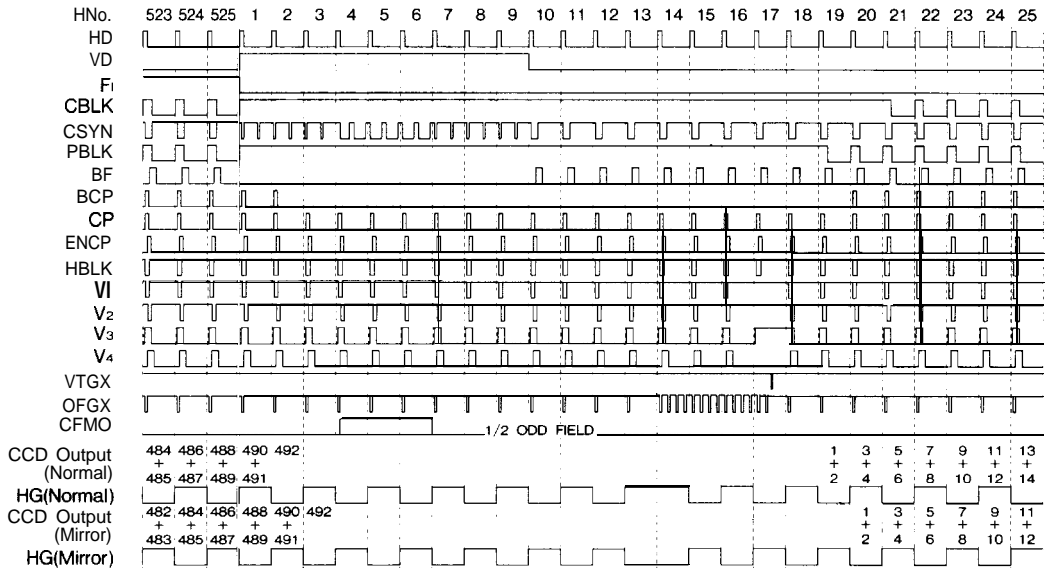
(EVEN FIELD)
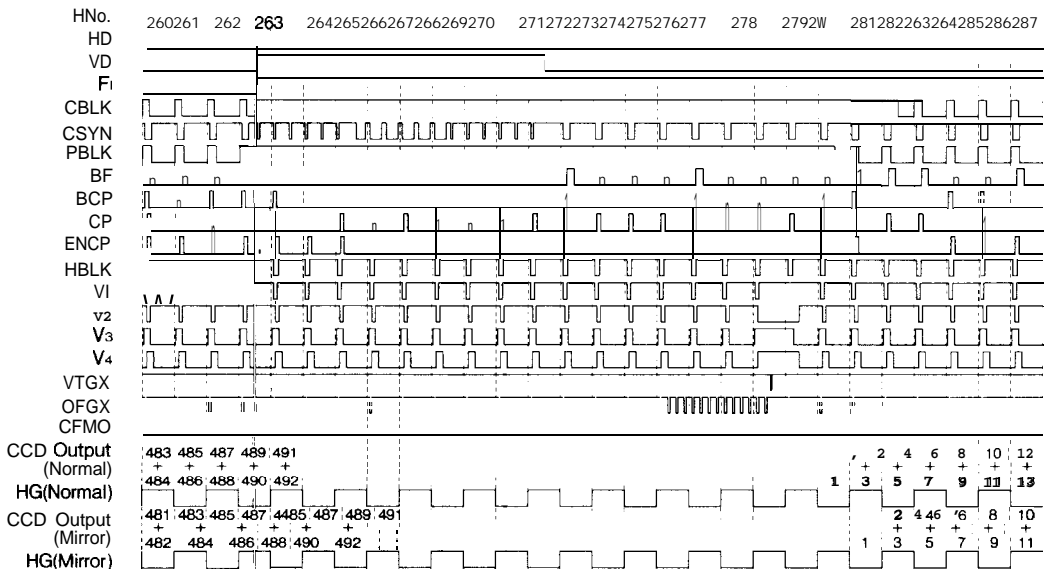
(1st, 3rd FIELD)   **VERTICAL PULSE < PAL >**

HNo. 621 622 623 624 625 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 192021 222324

HD
VD
CBLK
CSYN
PBLK
BF(I)
BF(3)
BCP
CP
ENCP
HBLK
V1
V2
V3
V4
VTGX
OFGX
LSW(1)
LSW(3)
CFMO   1/2 1st FIELD

CCD Output   576 578 580 582   1 3 5 7
(Normal)   + + + +
             577 579 581   2 4 6 8
HG(Normal)

CCD   Output 574 576 578 580 582   1 3 5
                                                                           + + +
             575 577 579 581   2 4 6
HG(Mirror)

(2nd, 4th FIELD)

HNo. 309310311312313314315 316317318319320321322 323324325 326 327328329330331232333 334335336337

HD
VD
CBLK
CSYN
PBLK
BF(2)
BF(4)
BCP
CP
ENCP
HBLK
V1
V2
V3
V4
VTGX
OFGX
LSW(2)
LSW(4)
CFMO

CCD Output   577 579 581   2 4 6 8
(Normal)   + + + +
             578 580 582   1   3 5 7 9
HG(Normal)

CCD Output   575 577 579 581   2 4 6
(Mirror)   + + + +   + + +
             576 578 580 582   1   3 5 7
HG(Mirror)

3 CCD PERIPHERALs

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HORIZONTAL PULSE ＜ NTSC ＞   Unit : μs

The inside of ( ) is a number of CKI clock.

HD   0(0,858)   6.37(86)

CSYN(H)   1.48(20)   6,37 86)

(EQ)   1.48(20)   3.93(53)

(SAW)   -3.41 −48)   1.48(20)

CBLK(SLBK＝L)   0)   10.52(1 42)

CBLK(SLBK＝H)   0)   10.81(148)

PBLK   0)   9.4.6(12S)

BF   6.96(94)   9.48(128)

ENCP   3.26(44)   5.93(80)

HG   0(0)

(NORMAL MODE)

BCP   0.59(8) 1.78(24)

CP   ;1.33(18 2.52(34)

HBLK   2.37(32)   8.44(1 14)

(MIRROR MODE)

BCP   7.56(102 6.74(1 16)

CP   8.30(112) 9.48(128)

HBLK   0.5S(8)   5.7 8)
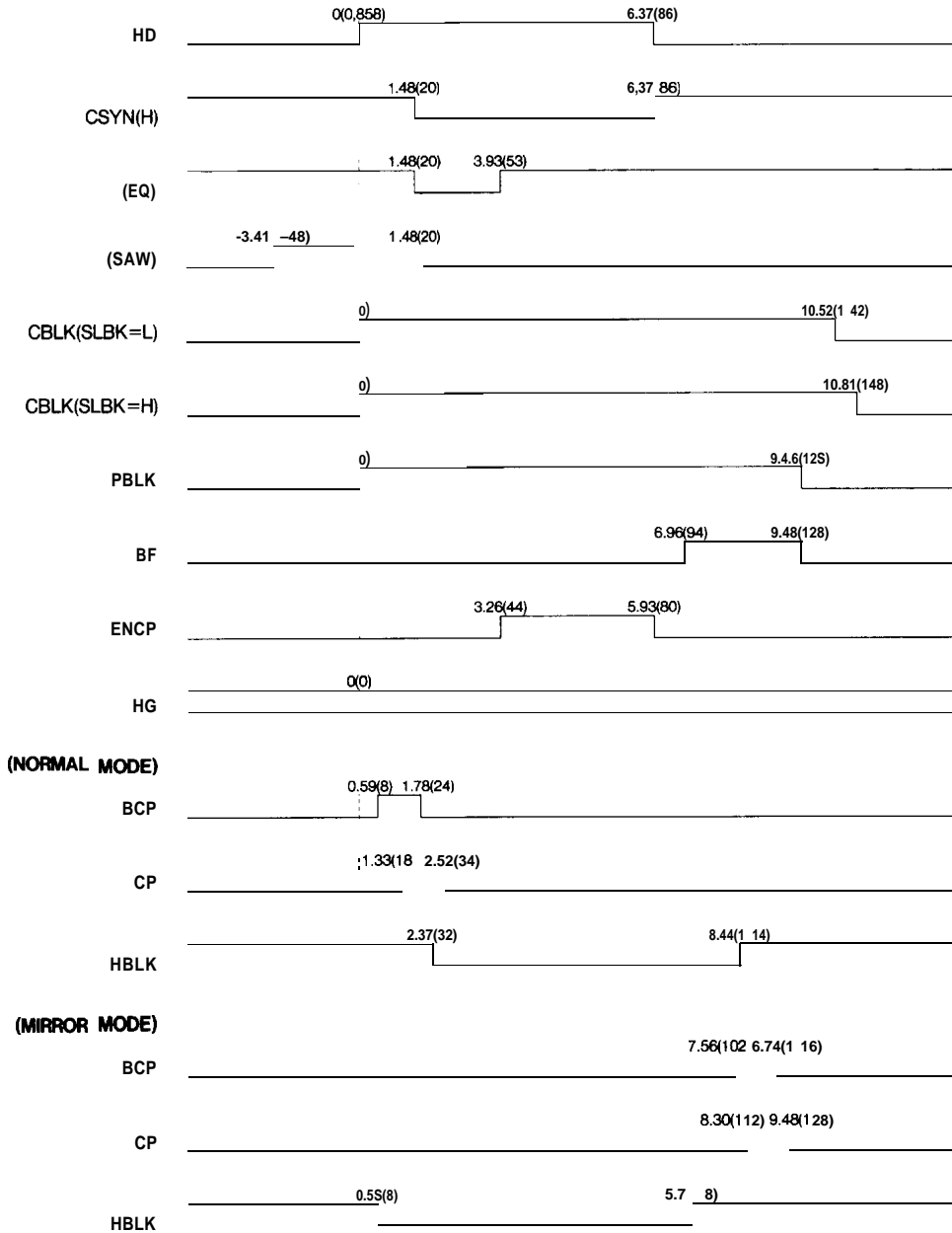
HORIZONTAL PULSE ＜ PAL ＞

Unit : μs

The inside of ( ) is a number of CKI clock.

HD   0(0,864)   6.37(86)

CSYN(H)   1.48(20)   6.37 86

(EQ)   1.48(20)   3.93(53)

(SAW)   −3.41 −46)   1.48(20)

CBLK(SLBK=L)   0(0)   11.26(152)

CBLK(SLBK=H)   0)   12.15(164)

PBLK   0(0)   9.93(134)

BF   7.11(96)   9.33(126)

ENCP   3.26(44)   5.93(80)

HG   0(0)

L$_{SW}$ 1.48(20)

(NORMAL MODE)

BCP   0.59(8)   1.78(24)

CP   1.33(16)   2.52(34)

HBLK   2.37(32)   6.8 120)

(MIRROR MODE)

BCP   8.00(108)   9.19(124)

CP   8.74(118)   9.93(134)

HBLK   0.59(8)   6.22(84)
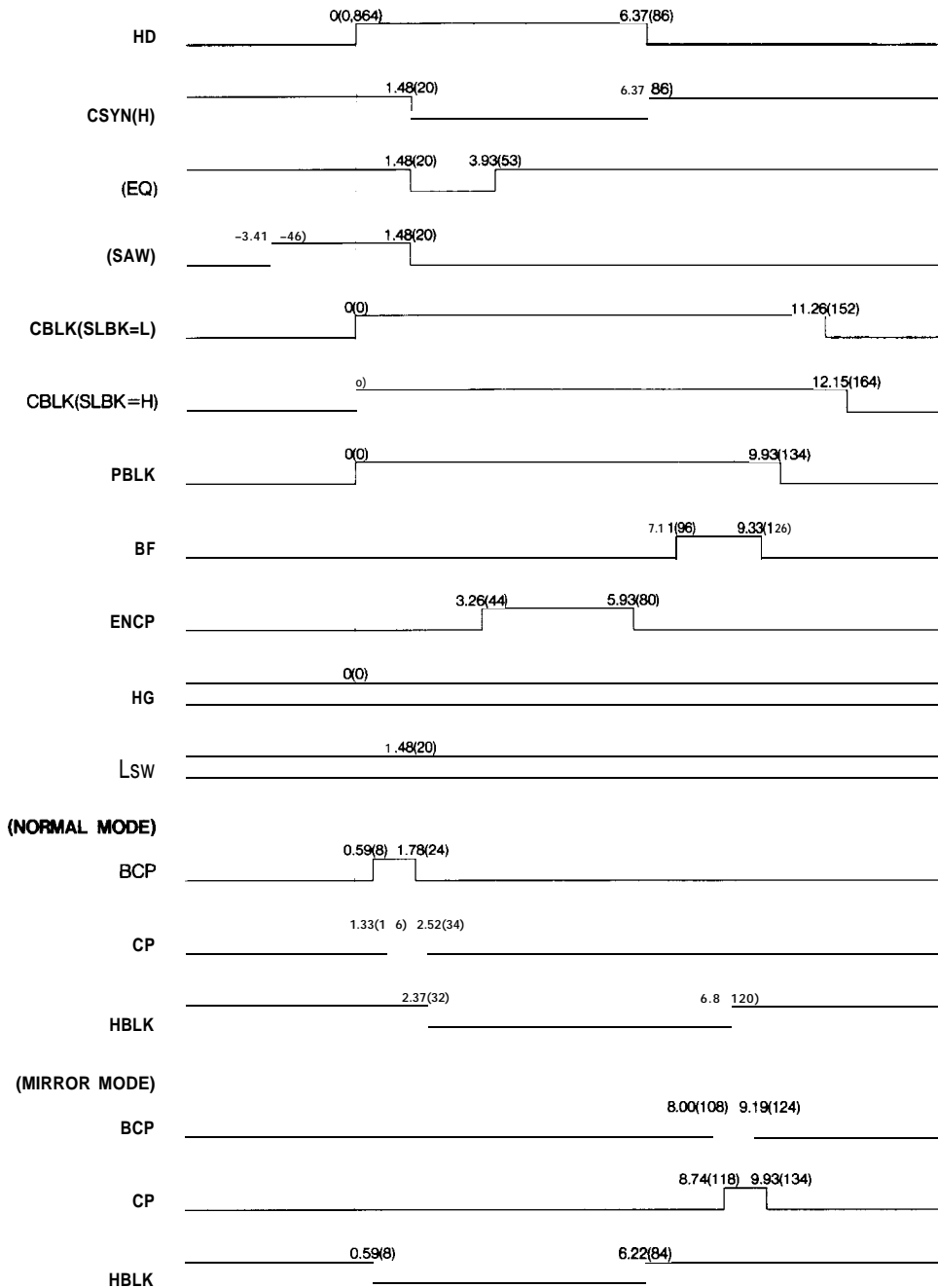
HORIZONTAL TIMING < NTSC, NORMAL MODE >
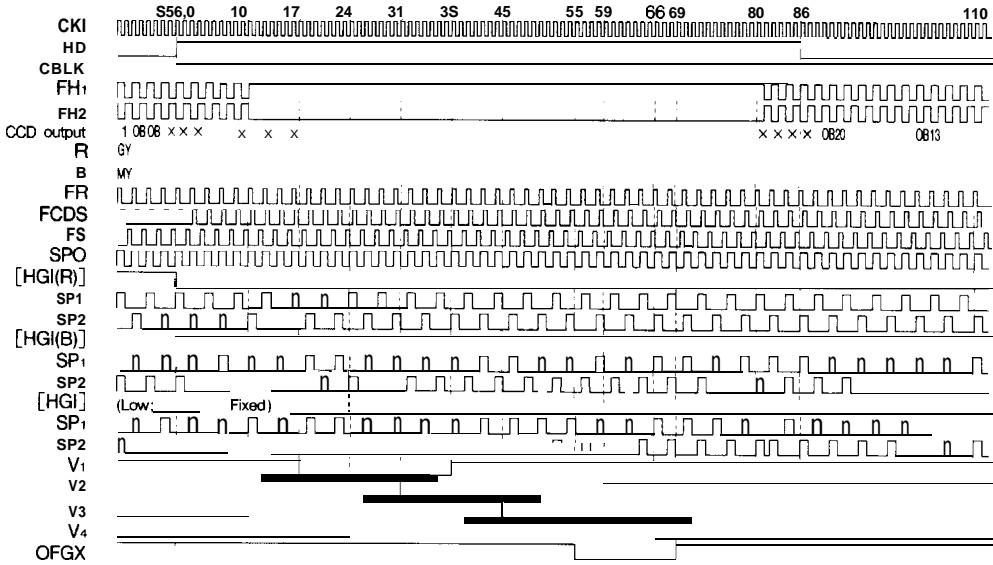
1 clock = 74.07 ns
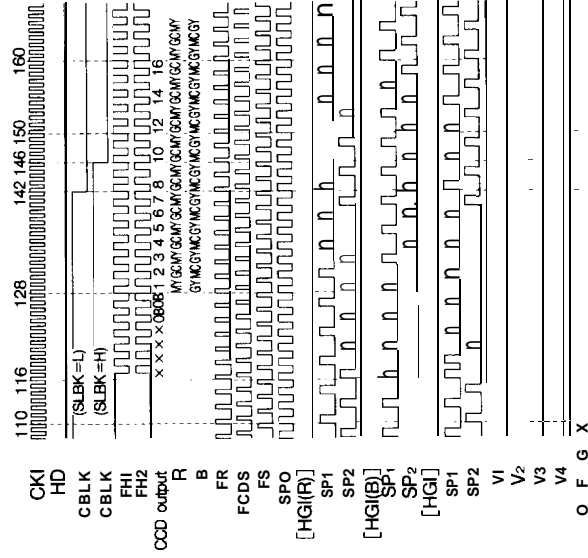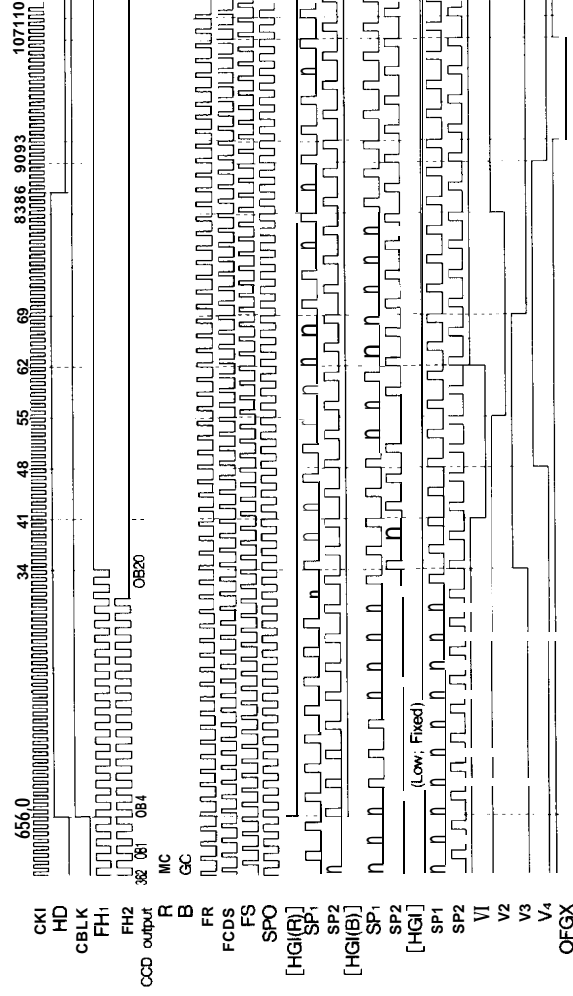
CCD output MY=Mg+Ye, GC=G+Cy
1GY=G+Ye, MC=Mg+Cy

HORIZONTAL TIMING < NTSC, MIRROR MODE >
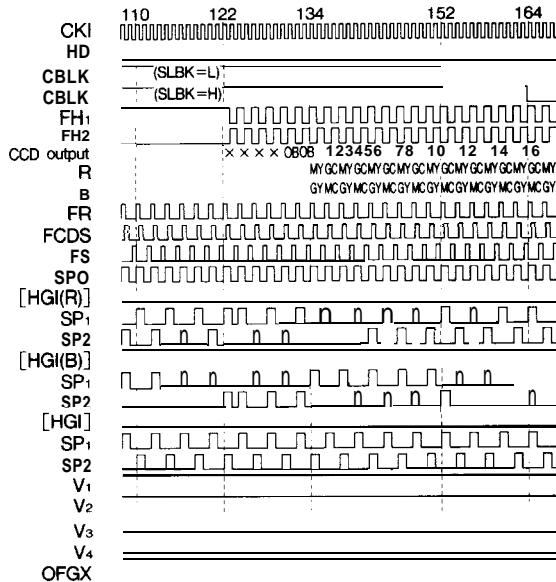
1 clock=74.07 ns

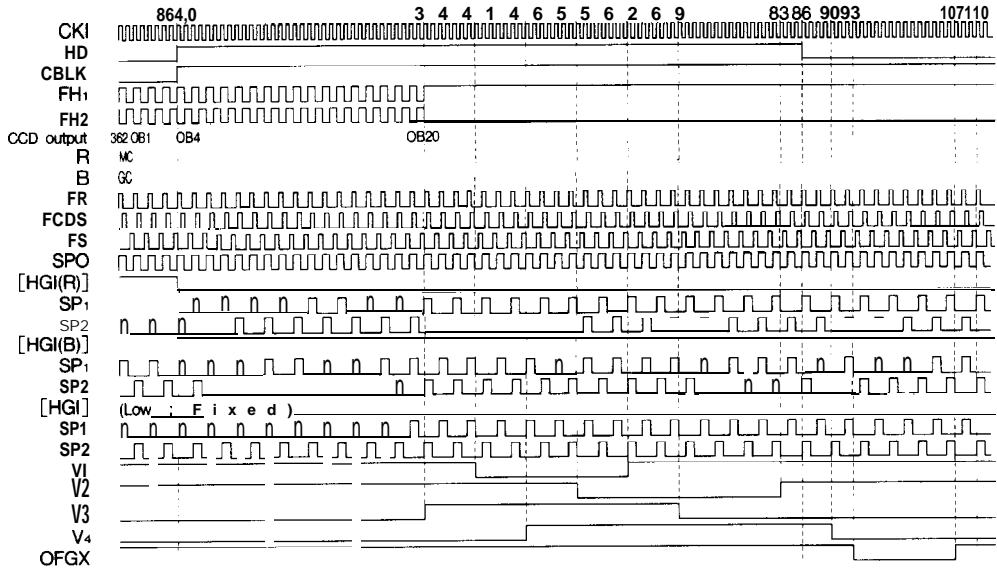**CCD** output GC=G+Cy,MY=Mg+Ye
MC=Mg+Cy, GY=G+Ye

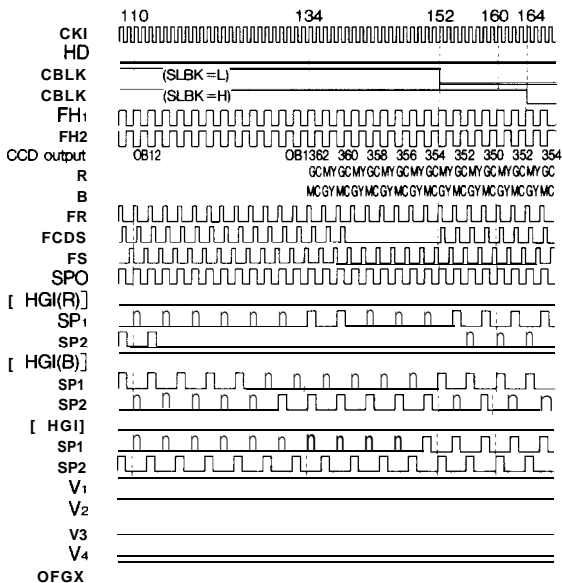## HORIZONTAL TIMING < PAL, NORMAL MODE >
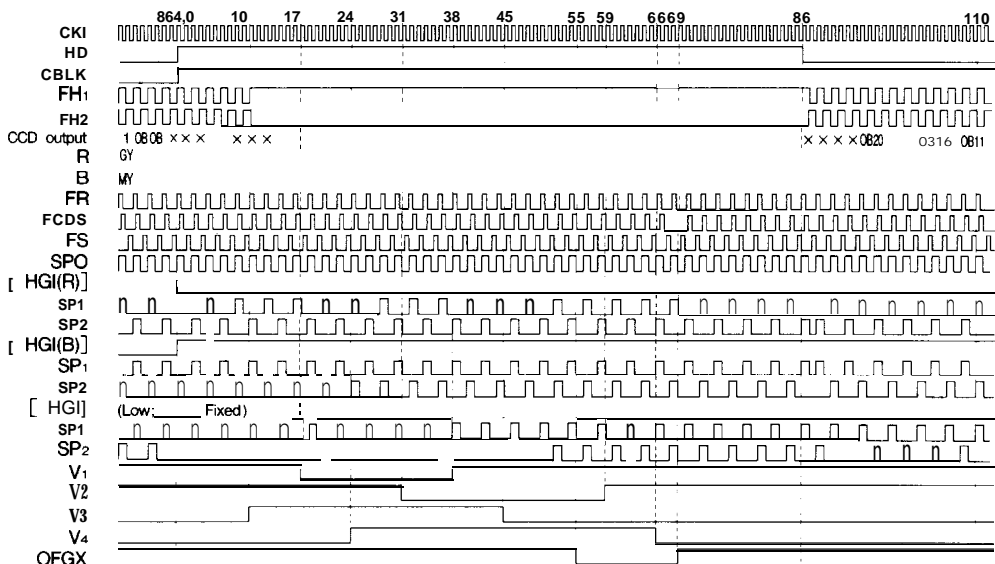
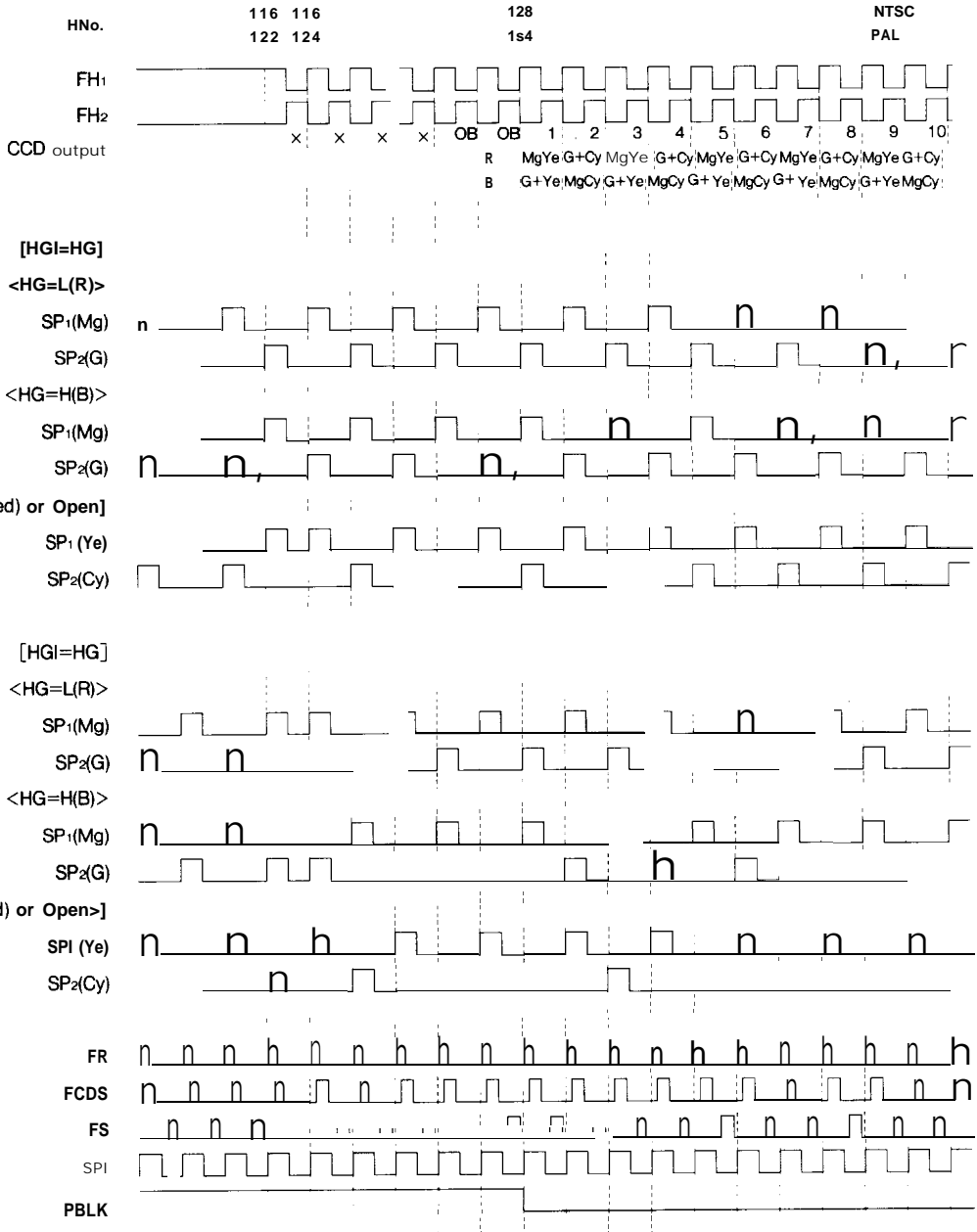1 clock=74.07 ns

CCD output MY=Mg+Ye, GC=G+Cy
GY=G+Ye, MC=Mg+Cy

HORIZONTAL TIMING < PAL, MIRROR MODE >

1clock= 74.07 ns

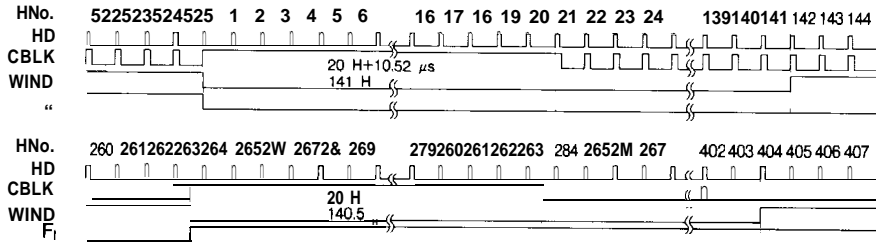CCD output GC=G+Cy, MY=Mg+Ye
MC=Mg+Cy, GY=G+Ye

COLOR SEPARATE PULSE < NORMAL MODE >

HNo.　116 116　　128　　　　　　　　　　NTSC
　　　122 124　　1s4　　　　　　　　　　PAL

FH₁

FH₂

CCD output　× × × ×　OB OB 1 2 3 4 5 6 7 8 9 10

R　MgYe G+Cy MgYe G+Cy MgYe G+Cy MgYe G+Cy MgYe G+Cy

B　G+Ye MgCy G+Ye MgCy G+Ye MgCy G+Ye MgCy G+Ye MgCy

(NTSC)

[HGI=HG]

<HG=L(R)>

SP₁(Mg)

SP₂(G)

<HG=H(B)>

SP₁(Mg)

SP₂(G)

[HGI=L(Fixed) or Open]

SP₁ (Ye)

SP₂(Cy)

(PAL)

[HGI=HG]

<HG=L(R)>

SP₁(Mg)

SP₂(G)

<HG=H(B)>

SP₁(Mg)

SP₂(G)

[< HGI=L(Fixed) or Open>]

SPI (Ye)

SP₂(Cy)

FR

FCDS

FS

SPI

PBLK

COLOR SEPARATE PULSE < MIRROR MODE >
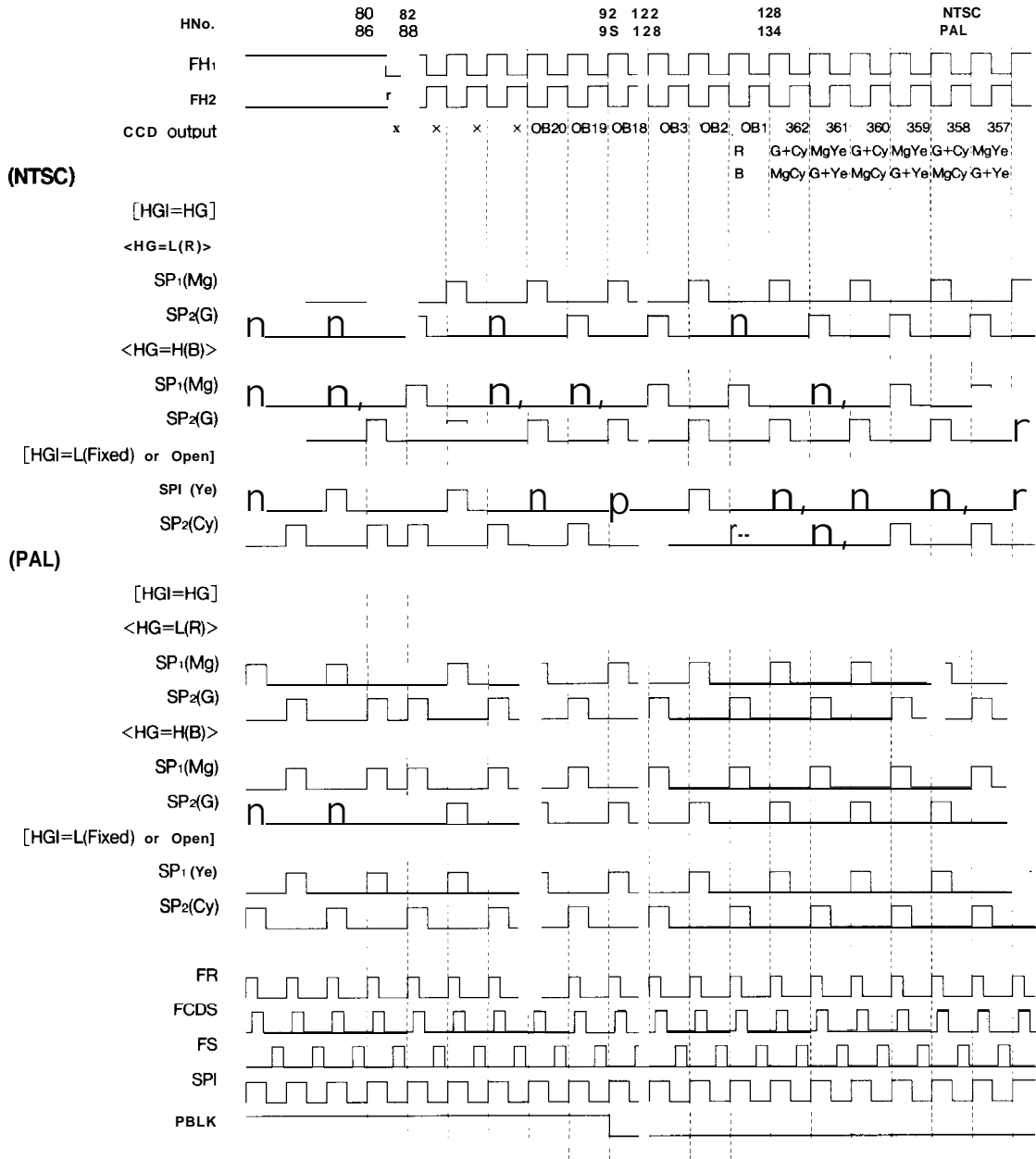
"WIND" PULSE

(NTSC)

(PAL)
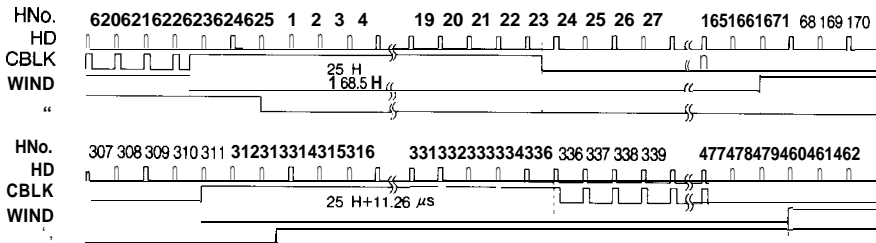
"TO" PULSE < INTERLACE MODE >
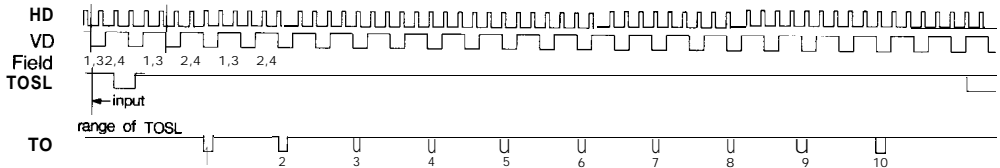
(NTSC)
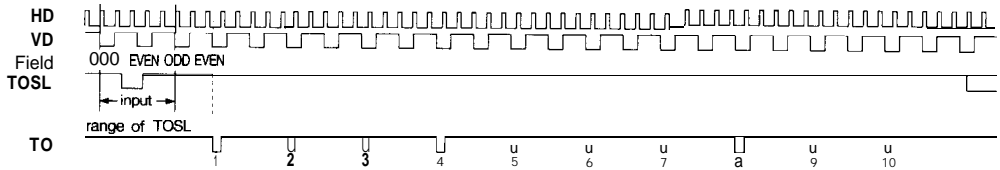
(PAL)

READ OUT PULSE < NORMAL MODE >

The number : clock pulse, ( ) : PAL

(ODD (1st, 3rd) FIELD)

HD	0 86	858(864) 66
v,		41 62
V₂		55 63
V₃	34	69
V₄		48 90
VTGX	342 462	
OFGX	93 107 205 219	·Max shutter speed 93 107

(EVEN (2nd, 4th) FIELD)

HD	0 86	858(864) 86
VI	41 62	
V₂	55	83
V₃	34	69
V₄	46	90
VTGX	342 482	
OFGX	93 107 205 219	"M" shutter speed 93 107
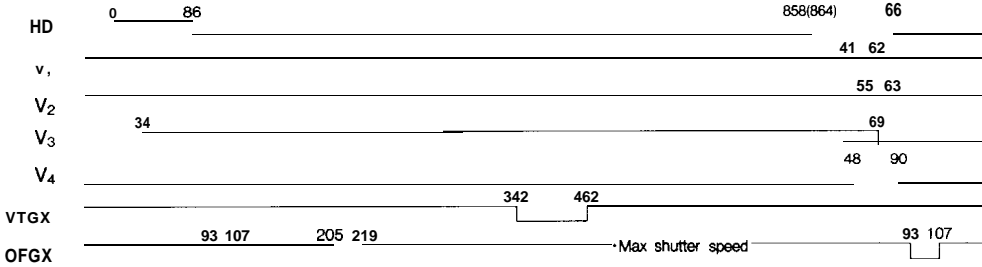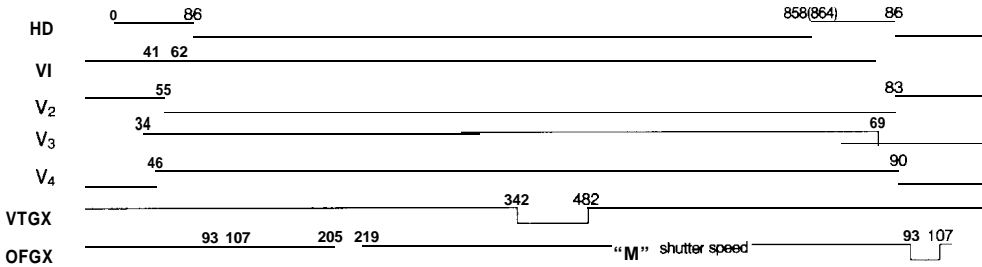
READ OUT PULSE < MIRROR MODE >

The number : clock pulse, ( ) : PAL

(ODD (lst, 3rd) FIELD)

H D	0 86	858(864) 86
VI		17 38
V*		31 59
V₃	10	52
V₄		24 66
VTGX	304 444	
OFGX	55 69 167 181	·Max shutter speed 55 69

(EVEN (2nd, 4th) FIELD)

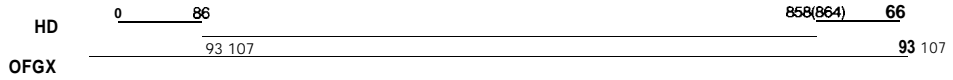|		
HD	0 86	858(864) 86
V,	17 36	
V₂	317	59
V3	10	52
V₄	24	66
VTGX	304 444	
OFGX	55 69 167 181	·Max shutter speed 55 69

3 **CCD PERIPHERALs**

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"OFGX" PULSE

The number : clock pulse, ( ) : PAL

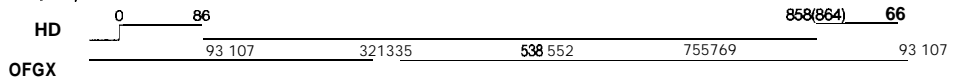·While shutter speed changes every 9 H or 4 H and 1 H.

(NORMAL MODE)

HD   0   86   858(864)   66

OFGX   93 107   93 107

(MIRROR MODE)

HD   0   86   858(864)   66

OFGX   55 69   55 69
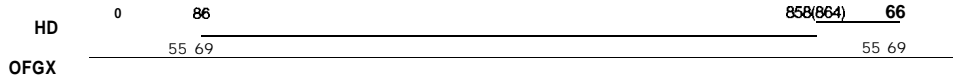
·While shutter is high speed (1/4800 or less).

(NORMAL MODE)

HD   0   86   858(864)   66

OFGX   93 107   321335   538 552   755769   93 107

(MIRROR MODE)

HD   0   66   858(864)   86

OFGX   55 69   263297   500 514   717731   55 m