SPEC No.	CT080802
ISSUE:	Aug. 2 1996

To ;

PRELIMINARY
SPECIFICATIONS

Product Type Timing IC (350K/380K/450K pixels CCD)

Model No. LR38516

※This specifications contains 29 pages including the cover and appendix.
If you have any objections, please contact us before issuing purchasing order.

CUSTOMERS ACCEPTANCE

DATE:

BY:

PRESENTED
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Engineering Dept. 3
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● When using the products covered herein, please observe the conditions written herein and the precautions outlined in the following paragraphs. In no event shall the company be liable for any damages resulting from failure to strictly adhere to these conditions and precautions.

(1) The products covered herein are designed and manufactured for the following application areas. When using the products covered herein for the equipment listed in Paragraph (2), even for the following application areas, be sure to observe the precautions given in Paragraph (2). Never use the products for the equipment listed in Paragraph (3).
- ·Office electronics
- ·Instrumentation and measuring equipment
- ·Machine tools
- ·Audiovisual equipment
- ·Home appliances
- ·Communication equipment other than for trunk lines

(2) Those contemplating using the products covered herein for the following equipment which demands high reliability, should first contact a sales representative of the company and then accept responsibility for incorporating into the design fail-safe operation, redundancy, and other appropriate measures for ensuring reliability and safety of the equipment and the overall system.
- ·Control and safety devices for airplanes, trains, automobiles, and other transportation equipment
- ·Mainframe computers
- ·Traffic control systems
- ·Gas leak detectors and automatic cutoff devices
- ·Rescue and security equipment
- ·Other safety devices and safety equipment, etc.

(3) Do not use the products covered herein for the following equipment which demands extremely high performance in terms of functionality, reliability, or accuracy.
- ·Aerospace equipment
- ·Communications equipment for trunk lines
- ·Control equipment for the nuclear power industry
- ·Medical equipment related to life support, etc.

(4) Please direct all queries and comments regarding the interpretation of the above three Paragraphs to a sales representative of the company.

● Please direct all queries regarding the products covered herein to a sales representative of the company.

CONTENTS

1. General

The LR38516 is a CMOS gate array LSI. It is designed for Video-camcoder, and it generates timing pulses for driving 1/3" 350K, 380K and 450K pixels progressive Scan CCD area sensor, and synchronous pulses for TV signals and processing pulses for video signals.

1-1. Features

* The package material is plastic.
* A p-type silicon circuit board is used.
* The package type is 48-pin QFP (0.5mm pin-pitch)
* The process (structure) is CMOS.
* The delay time per 1 gate is 0.4ns.
* Not designed or rated as radiation hardened.

1-2. Functions

* Designed for CCD area sensor with 350,000, 380,000 or 450,000 pixels on 1/3 Format size for OFD shutter.
* The Frame rate is 30 Frame/sec at 350,000 and 380,000 pixels CCD, and is 25 Frame/sec at 450,000 pixels CCD,
* +3V, +4.5V and 5V power supply.
* Shutter speed can be controlled in 1H period using a serial code.
* To select TV mode, power save mode and the phase select of DCLK can be also controlled using a serial code.

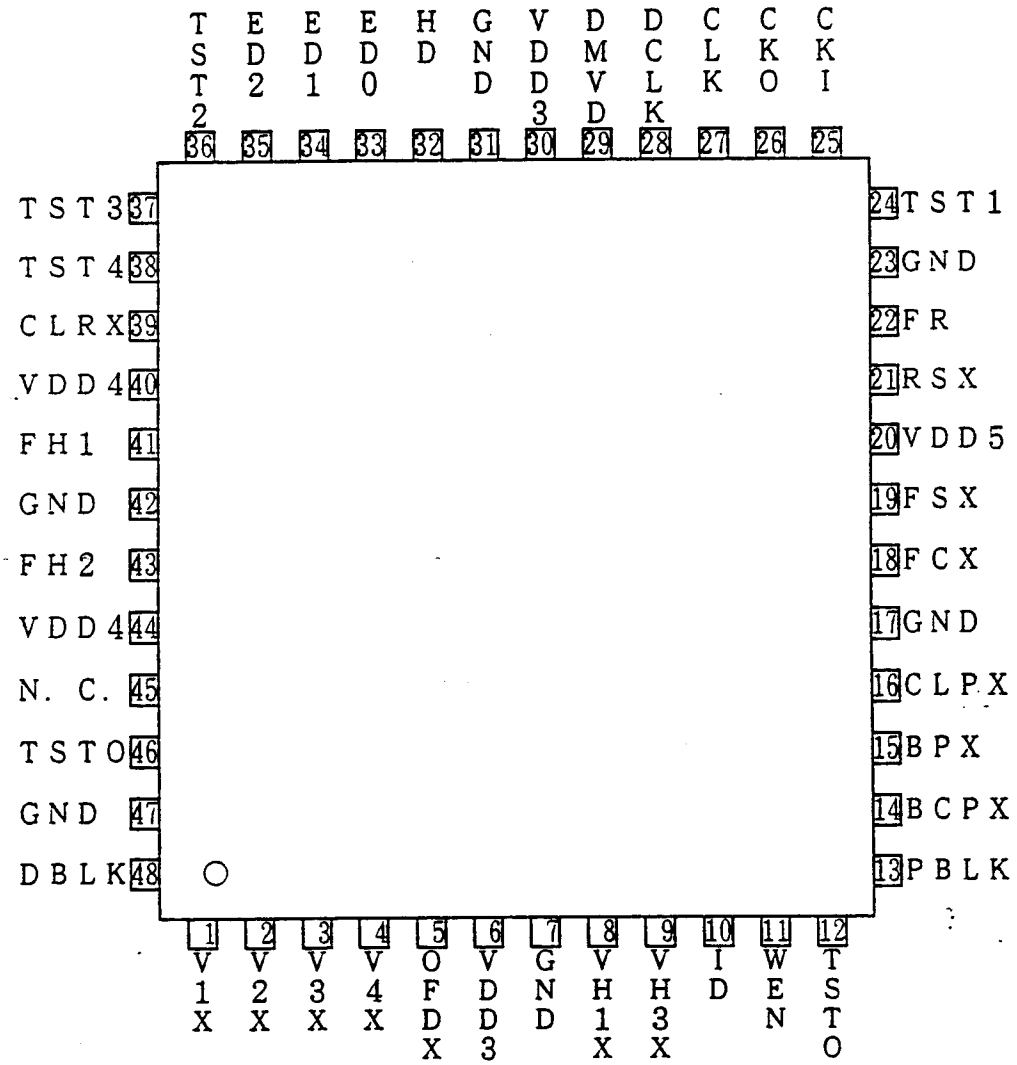
2. Pin Assignment

2-1. Table of pin assignment

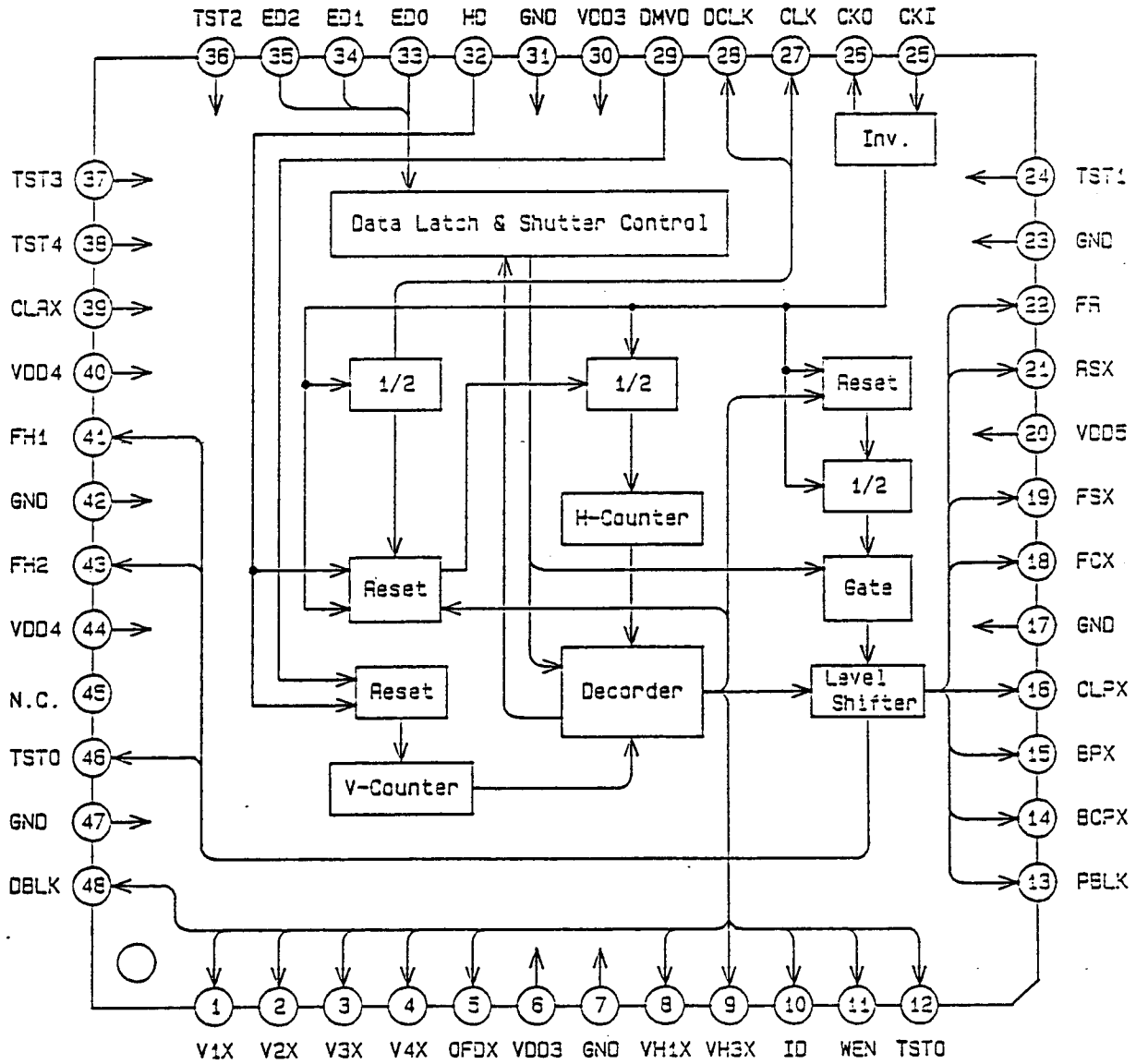
PIN NO.	I/O	SIGNAL	PIN NO.	I/O	SIGNAL
1	O3	V1X	25	OSCI3	CKI
2	O3	V2X	26	OSCO3	CKO
3	O3	V3X	27	O6MA3	CLK
4	O3	V4X	28	O6MA3	DCLK
5	O3	OFDX	29	IC3	DMVD
6	–	VDD3	30	–	VDD3
7	–	GND	31	–	GND
8	O3	VH1X	32	IC3	HD
9	O3	VH3X	33	ICD3	ED0
10	O3	ID	34	ICD3	ED1
11	O3	WEN	35	ICD3	ED2
12	O3	TSTO	36	ICD3	TST2
13	O5	PBLK	37	ICU4	TST3
14	O5	BCPX	38	ICU4	TST4
15	O5	BPX	39	ICU4	CLRX
16	O5	CLPX	40	–	VDD4
17	–	GND	41	O6MA44	FH1
18	O6MA5	FCX	42	–	GND
19	O6MA5	FSX	43	O6MA44	FH2
20	–	VDD5	44	–	VDD4
21	O6MA5	RSX	45	–	N.C.
22	O6MA52	FR	46	O6MA44	TSTO
23	–	GND	47	–	GND
24	ICD3	TST1	48	O3	DBLK

IC3	: Input (CMOS level)
ICU4	: Input (CMOS level with pull-up resister)
ICD3	: Input (CMOS level with pull-down resister)
O3	: Output
O6MA3	: Output
O6MA43	: Output
O5	: Output
O6MA5	: Output
O6MA52	: Output
OSCI3	: Input pin for oscillation
OSCO3	: Output pin for oscillation
VDD3	: +3V Power supply
VDD4	: +4.5V Power Supply
VDD5	: +5V Power supply

2-2. Figure of pin assignment



3. Block Diagram



4. Pin Description

4-1. Description

No.	Symbol	I/O	Pol.	Pin Name	Description
1	V1X	03	⊓	Ver. transfer pulse 1	A vertical transfer pulse for CCD. Connect to the 1AX pin of the vertical driver IC.
2	V2X	03	⊓	Ver. transfer pulse 1	A vertical transfer pulse for CCD. Connect to the 2AX pin of the vertical driver IC.
3	V3X	03	⊔	Ver. transfer pulse 3	A vertical transfer pulse for CCD. Connect to the 3AX pin of the vertical driver IC.
4	V4X	03	⊔	Ver. transfer pulse 4	A vertical transfer pulse for CCD. Connect to the 4AX pin of the vertical driver IC.
5	OFDX	03	⊔	OFD pulse output	A pulse that sweeps the charge of the photodiode for electrical shutter. Held at H level at normal mode.
6	VDD3	-	-	Power supply	Supply +3 V power.
7	GND	-	-	Ground	A grounding pin.
8	VH1X	03	⊔	Read out pulse 1	A pulse that transfers the charge of the photodiode to the vertical shift resister. Connect to the 1BX pin of the vertical driver IC.
9	VH3X	03	⊔	Read out pulse 2	A pulse that transfers the charge of the photodiode to the vertical shift resister. Connect to the 3BX pin of the vertical driver IC.
10	ID	03	⊓	Line index pulse	The pulse is used in color separator. The signal swiches H and L at every line. H: R color line L: B color line
11	WEN	03	⊔	Write enable output	Write enable output for low-speed shutter pulse.
12	TSTO	03	-	Test output pin	A test pin. Set open in the normal
13	PBLK	05	⊔	Pre-blanking pulse output	A pulse that corresponds to the cease period of horizontal transfer pulse.
14	BCPX	05	⊔	Optical black clamp pulse	A pulse to clamp the optical black signal. Output stays Low during the absence of effective pixels within Ver. blanking.
15	BPX	05	⊔	Clamp pulse	A pulse to clamp the signal. The phase is same as as BCPX (pin 14). This pulse is continuous at Hor. cycle.
16	CLPX	05	⊔	Clamp pulse	A pulse to clamp the dummy outputs of CCD.
17	GND	-	-	Ground	A grounding pin.
18	FCX	06 MA5	⊔	CDS pulse 1	A pulse to clamp the feed-through level from CCD.
19	FSX	06 MA5	⊔	CDS pulse 2	A pulse to sample-hold the signal from CCD.
20	VDD5	-	-	Power supply	Supply +5 V power.
21	RSX	06 MA5	⊔	S/h pulse	A pulse to sample-hold the signal after CDS circuit.

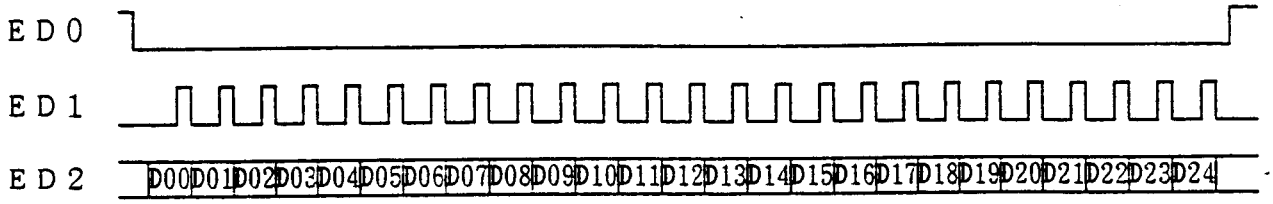
22	FR	06MA52	⎍	Reset pulse	A reset pulse for CCD. Connect to φR of CCD through the D.C. offset circuit.
23	GND	-	—	Ground	A grounding pin.
24	TST1	ICD3	—	Test pin 1	A test pin. Set open or to L level in the normal
25	CKI	OSCI3	⎍⎍	Clock input	An input pin for reference clock oscillation. The frequencies are as follows : at TST3=L in NTSC mode : 27.0MHz (1716fH) in PAL mode : 27.0MHz (1728fH) at TST3=H in NTSC mode : 24.54545MHz (1560fH) fH=Hor. frequency
26	CKO	OSCO3	—	Clock output	An output pin for reference clock oscillation. The output is the inverse CKI (pin 37).
27	CLK	06MA3	⎍⎍	1/2 dividing output 1	The frequency is 1/2 dividing pulse of a reference clock CKI (pin 25). Connect to clock input terminal of SSG IC. at TST3=L in NTSC mode : 13.5MHz (858fH) in PAL mode : 13.5MHz (864fH) at TST3=H in NTSC mode : 12.27273MHz (780fH) fH=Hor. frequency
28	DCLK	06MA3	⎍⎍	1/2 dividing output 2	The frequency is 1/2 dividing pulse of a reference clock CKI (pin 25) as same as CLK (pin 27).. The output phase is selected by the serial data step by 90°. *1 at TST3=L in NTSC mode : 13.5MHz (858fH) in PAL mode : 13.5MHz (864fH) at TST3=H in NTSC mode : 12.27273MHz (780fH) fH=Hor. frequency
29	VD	IC3	⎍	Ver. reference input	An input pin for the Vertical reference signal. Connect to VD pin of SSG IC.
30	VDD3	-	—	Power supply	Supply +3 V power.
31	GND	-	—	Ground	A grounding pin.
32	HD	IC3	⎍	Hor. reference input	An input pin for the Horizontal reference signal. Connect to HD pin of SSG IC.
33	ED0	ICD3	—	Shutter speed control input 0	An input pin to control the shutter speed. For details, see shutter control. *1
34	ED1	ICD3	—	Shutter speed control input 1	An input pin to control the shutter speed. For details, see shutter control. *1
35	ED2	ICD3	—	Shutter speed control input 2	An input pin to control the shutter speed. For details, see shutter control. *1

36	TST2	ICD3	–	Test pin 4	A test pin. Set open or to L level in the normal
37	TST3	ICU4	–	Select input for CCD	An input pin to select CCD type. at TST3=L 380K pixels CCD (at NTSC) 450K pixels CCD (at PAL) at TST3=H 350K pixels CCD (at NTSC)
38	TST4	ICU4	–	Test pin 4	A test pin. Set open or to H level in the normal
39	CLRX	ICU4	–	Data clear input	An input pin for resetting all serial data at power on. To connect Diode with VDD4, and Capacitor with GND.
40	VDD4	-	–	Power supply	Supply +4.5 V power.
41	FH1	O6MA 44	⊓⊔	Hor. transfer pulse 1	A horizontal transfer pulse for CCD. Connect to ϕH1 of CCD without inverting driver.
42	GND	–	–	Ground	A grounding pin.
43	FH2	O6MA 44	⊓⊔	hor. transfer pulse 2	A horizontal transfer pulse for CCD. Connect to ϕH2 of CCD without inverting driver.
44	VDD4	-	–	Power supply	Supply +4.5 V power.
45	N.C.	–	–	Non connection	A pin for no use.
46	TSTO	O6MA 44	–	Test output pin	A test pin. Set open in the normal
47	GND	–	–	Ground	A grounding pin.
48	DBLK	03	⊔	Dummy composit	Composit blanking pulse. In NTSC mode ; V:33H period In PAL mode ; V:45H period

(*1) ; For details, see page 9~11.

4-2. Serial data control

(1) Serial data inputs



The data on ED2 is latched in the register at the rising edge of of ED1. The data of D13 is effective. Other data is effective at next Hor. line (NTSC:12H, PAL:15H) of Readout hor. line while VH1X and VH3X are active.

ED0 has to be stayed L level in effective data input period

(2) Serial data

Data	Name	Function		Data=L	Data=H	at CLRX=L
D00 〜 D09	SD0 〜 SD9	Electronic shutter speed control		See shutter speed Table		All L
D10	SMD0	Electronic shutter mode control		See shutter speed Table		L
D11	SMD1					L
D12	TVMD	Select TV mode		NTSC	PAL	L
D13	PWSA	Power save control		Normal	Power save	−
D14	DUMMY1	Dummy	Input to Right side data	L	−	L
D15	DUMMY2			L		L
D16	DUMMY3			H		L
D17	DUMMY4			L		L
D18	DUMMY5			H		L
D19	DUMMY6			H		L
D20	DUMMY7			H		L
D21	DUMMY8			H		L
D22	ML1	DCLK phase control		See DCLK pahse control		L
D23	ML2					L
D24	DUMMY9	Dummy		−	−	−

(3) SD0〜SD9, SMD0, SMD1

(3-1) Shutter mode

D10 SMD0	D11 SMD1	Shutter mode	Function
L	L	Shutter off	・No shutter operation.
H	H	Flickerless	・Flickerless mode ・1/100(NTSC), 1/120(PAL)
H	L	High-speed shutter	・High-sped shutter:Shutter speed faster than 1/30(NTSC) 1/25(PAL)
L	H	Low-speedシャッター	・High-sped shutter:Shutter speed slower than 1/30(NTSC) 1/25(PAL)

(3-2) Shutter speed calculation formula

・High-speed shutter

NTSC : $T = 1/((n-498)\times 63.56 \div 30.8)$ [μs] $(499 \leqq n \leqq 1021)$

PAL : $T = 1/((n-398)\times 64.00 \div 30.8)$ [μs] $(399 \leqq n \leqq 1021)$

・Low-speed shutter

NTSC : $T = 1/((1023-n)\times 33.37)$ [ms] $(1015 \leqq n \leqq 1021)$

PAL : $T = 1/((1023-n)\times 40.00)$ [ms] $(1015 \leqq n \leqq 1021)$

D00	D01	D02	D03	D04	D05	D06	D07	D08	D09	D10	D11	D12	HEX	Shutter speed	Note
SD0	SD1	SD2	SD3	SD4	SD5	SD6	SD7	SD8	SD9	SMD0	SMD1	TVMD			
H	H	L	L	H	H	H	H	H	L	H	L	L	05F3	1/10.000	
H	L	H	L	H	H	H	H	H	L	H	L	L	05F5	1/ 4.000	
H	L	L	H	H	H	H	H	H	L	H	L	L	05F9	1/ 2.000	
H	L	L	L	L	L	L	L	L	H	H	L	L	0601	1/ 1.000	NTSC
H	L	L	L	H	L	L	L	L	H	H	L	L	0611	1/ 500	High
L	L	L	L	H	H	L	L	L	H	H	L	L	0630	1/ 250	speed
H	H	H	H	L	H	H	L	L	H	H	L	L	066F	1/ 125	shutter
H	H	H	H	L	L	L	H	L	H	H	L	L	068F	1/ 100	
L	L	L	H	H	H	H	H	L	H	H	L	L	06F8	1 / 60	
H	L	H	H	H	H	H	H	H	H	H	L	L	07FD	≒ 1/ 30	
H	H	H	H	L	L	L	H	H	L	H	L	H	158F	1/10.000	
H	L	L	L	H	L	L	H	H	L	H	L	H	1591	1/ 4.000	
H	L	H	L	H	L	L	H	H	L	H	L	H	1595	1/ 2.000	
H	L	H	H	H	L	L	H	H	L	H	L	H	159D	1/ 1.000	PAL
H	L	H	H	L	H	L	H	H	L	H	L	H	15AD	1/ 500	High
L	L	H	H	L	L	H	H	H	L	H	L	H	15CC	1/ 250	speed
L	H	L	H	L	L	L	L	L	H	H	L	H	160A	1/ 125	shutter
L	L	L	L	H	L	L	L	L	H	H	L	H	1610	1/ 120	
L	H	H	L	L	L	H	H	L	H	H	L	H	16C6	1/ 50	
H	L	H	H	H	H	H	H	H	H	H	L	H	17FD	≒ 1/ 25	
H	L	H	H	H	H	H	H	H	H	L	H	×	BFD	2 Frame	
L	L	H	H	H	H	H	H	H	H	L	H	×	BFC	3 Frame	
H	H	L	H	H	H	H	H	H	H	L	H	×	BFB	4 Frame	Lowe
L	H	L	H	H	H	H	H	H	H	L	H	×	BFA	5 Frame	speed
H	L	L	H	H	H	H	H	H	H	L	H	×	BF9	6 Frame	shutter
L	L	L	H	H	H	H	H	H	H	L	H	×	BF8	7 Frame	
H	H	H	L	H	H	H	H	H	H	L	H	×	BF7	8 Frame	
×	×	×	×	×	×	×	×	×	×	H	H	L	−	1/ 100	Flicker-
×	×	×	×	×	×	×	×	×	×	H	H	H	−	1/ 120	less
×	×	×	×	×	×	×	×	×	×	L	L	L	−	1/ 30	Shutter
×	×	×	×	×	×	×	×	×	×	L	L	H	−	1/ 25	OFF

(4) PWSA

H level input ; Power save ON.

No operatin input ; HD. DMVD

Operating output ; CKO. CLK. DCLK

No operating output ; Stay L level

L level input ; Normal operation

(5) ML1, ML2

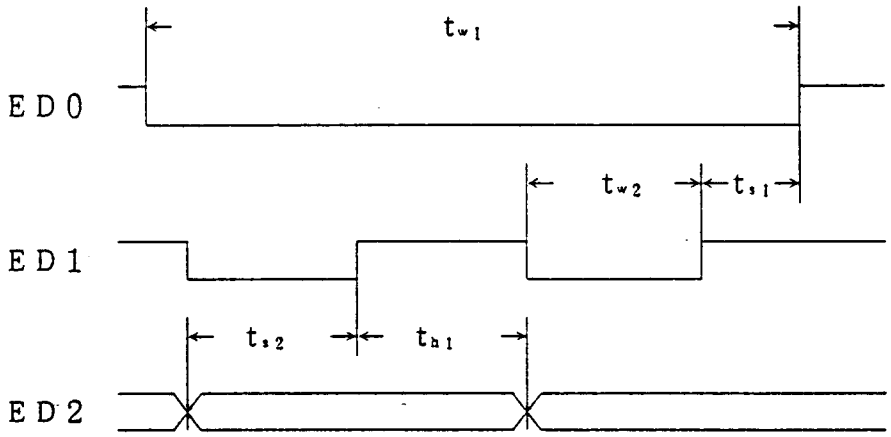
The phase difference of FH1

ML1 [D22]	L	H	L	H
ML2 [D23]	L	L	H	H
Phase diff.	0°	90°	180°	270°

(6) ダミー項目

Inputs of the data [D14], [D15], [D17] are L level, and
inputs of the data [D16], [D18], [D19], [D20], [D21] are H level。

(7) Input characteristic of serial data



記　号	適　　用	最小値	最大値
t_{w1}	ED0 pulse width	*	−
t_{w2}	ED1 pulse width	20ns	−
t_{s1}	ED1 rising setup time against the rising edge of ED0	20ns	−
t_{s2}	ED2 rising setup time against the rising edge of ED1	20ns	−
t_{h1}	ED2 hold time against the rising edge of ED1	20ns	−

* t_{w1} ; Input period of effective data of ED1, ED2.

5. Electorical Characteristics

5-1. Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit	
Supply voltage	V_{DD3}, V_{DD4}, V_{DD5}	−0.3 ~ 6.0	V	
Input voltage	V_{I3}	−0.3 ~ V_{DD3} +0.3	V	
	V_{I4}	−0.3 ~ V_{DD4} +0.3	V	
Output voltage	V_{O3}	−0.3 ~ V_{DD3} +0.3	V	
	V_{O4}	−0.3 ~ V_{DD4} +0.3	V	
	V_{O5}	−0.3 ~ V_{DD5} +0.3	V	
Operation temparature	T_{opr}	−20 ~ +70	℃	
Strage temparature	T_{stg}	−55 ~ +150	℃	

5-2. DC Characteristics

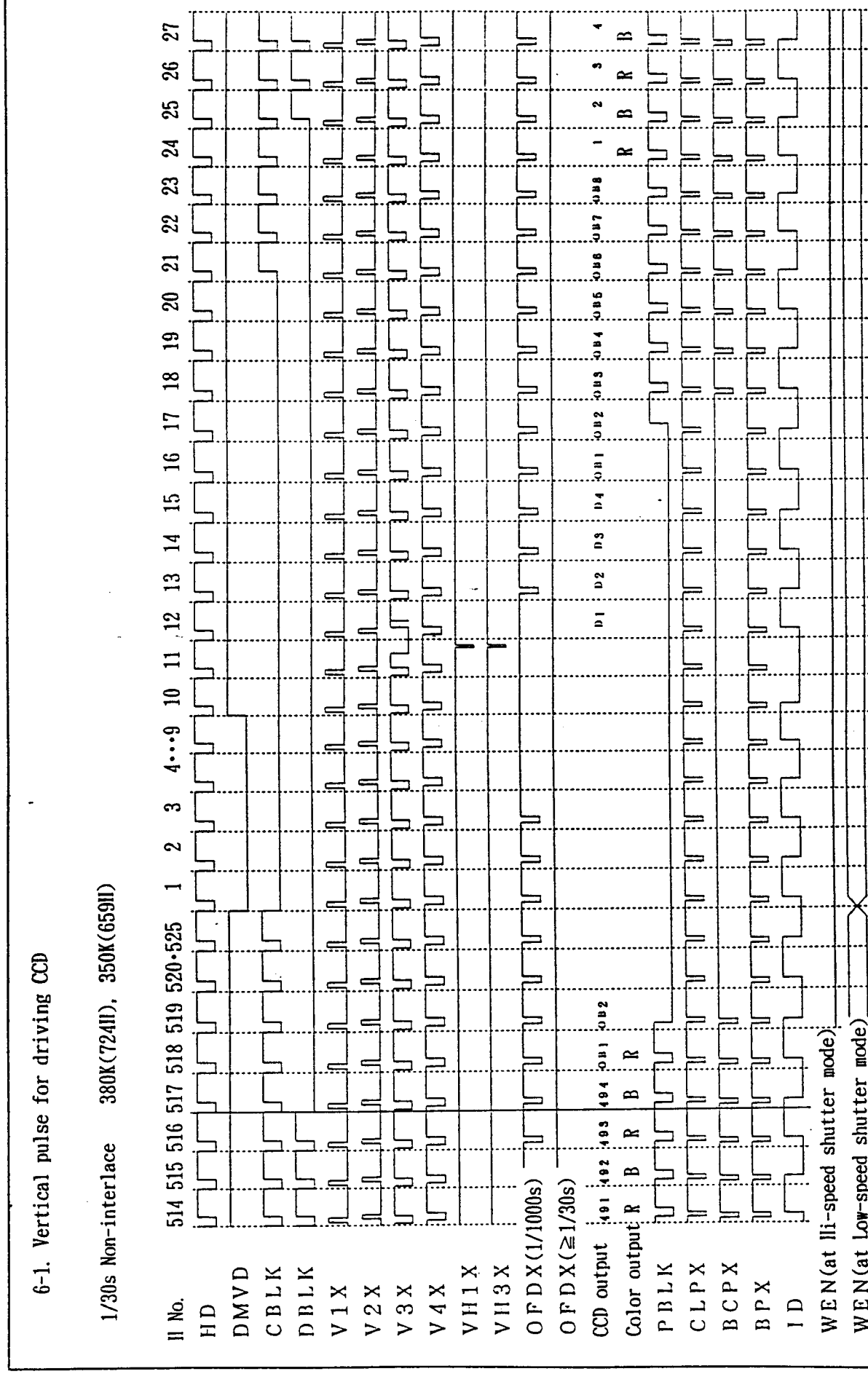
(V_{DD3}=3.0V±10%, V_{DD4}=4.5V±10%, V_{DD5}=5V±10%, T_{opr}=-20~+70℃)

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit	Note
Input "Low" voltage	V_{IL3}				0.2×V_{DD3}	V	1
Input "High" voltage	V_{IH3}		0.8×V_{DD3}			V	
Input "Low" voltage	V_{IL4}				0.2×V_{DD4}	V	2
Input "High" voltage	V_{IH4}		0.8×V_{DD4}			V	
Input "High" current	$\|I_{IH3-1}\|$	V_I = V_{DD3}			1.0	μA	1
Input "Low" current	$\|I_{IL3-1}\|$	V_I = 0 V			1.0	μA	
Input "High" current	$\|I_{IH3-2}\|$	V_I = V_{DD3}	2.0		30	μA	2
Input "Low" current	$\|I_{IL3-2}\|$	V_I = 0 V			1.0	μA	
Input "High" current	$\|I_{IH4-1}\|$	V_I = V_{DD4}			2.0	μA	3
Input "Low" current	$\|I_{IL4-1}\|$	V_I = 0 V	4.0		60	μA	
Output "High" voltage	V_{OH3-1}	I_{OH} = −2mA	V_{DD3}-0.5			V	4
Output "Low" voltage	V_{OL3-1}	I_{OL} = 2mA			0.4	V	
Output "High" voltage	V_{OH3-2}	I_{OH} = −1mA	V_{DD3}-0.5			V	5
Output "Low" voltage	V_{OL3-2}	I_{OL} = 2mA			0.4	V	
Output "High" voltage	V_{OH3-3}	I_{OH} = −3mA	V_{DD3}-0.5			V	6
Output "Low" voltage	V_{OL3-3}	I_{OL} = 3mA			0.4	V	
Output "High" voltage	V_{OH4}	I_{OH} = -12mA	V_{DD4}-0.5			V	7
Output "Low" voltage	V_{OL4}	I_{OL} = 12mA			0.4	V	
Output "High" voltage	V_{OH5-1}	I_{OH} = −2mA	V_{DD5}-0.5			V	8
Output "Low" voltage	V_{OL5-1}	I_{OL} = 4mA			0.4	V	
Output "High" voltage	V_{OH5-2}	I_{OH} = −6mA	V_{DD5}-0.5			V	9
Output "Low" voltage	V_{OL5-2}	I_{OL} = 6mA			0.4	V	
Output "High" voltage	V_{OH5-3}	I_{OH} = -12mA	V_{DD5}-0.5			V	10
Output "Low" voltage	V_{OL5-3}	I_{OL} = 12mA			0.4	V	

Note 1 : Applied to Inputs(IC3, OSCI3).
Note 2 : Applied to Input(ICD3).
Note 3 : Applied to Input(ICU4).
Note 4 : Applied to Output(OSCO3).
(Output(OSCO3) measures on conditions that input(OSCI3) level is 0V or V_{DD3}.)
Note 5 : Applied to Output(O3).
Note 6 : Applied to Output(O6MA3).
Note 7 : Applied to Output(O6MA55).
Note 8 : Applied to Output(O5).
Note 9 : Applied to Output(O6MA5).
Note 10 : Applied to Output(O6MA52).

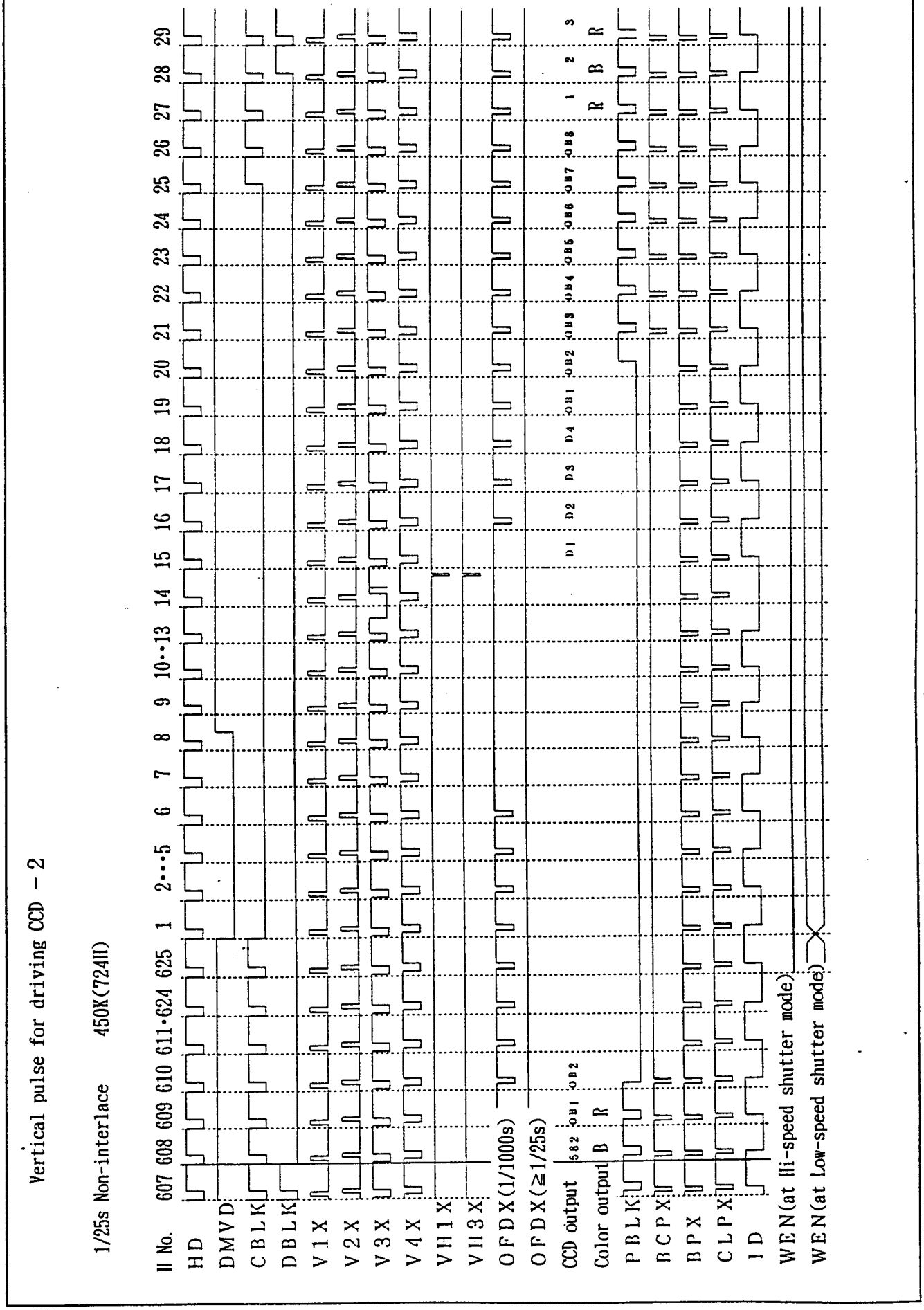
6-1. Vertical pulse for driving CCD

1/30s Non-interlace 380K(724H), 350K(659H)

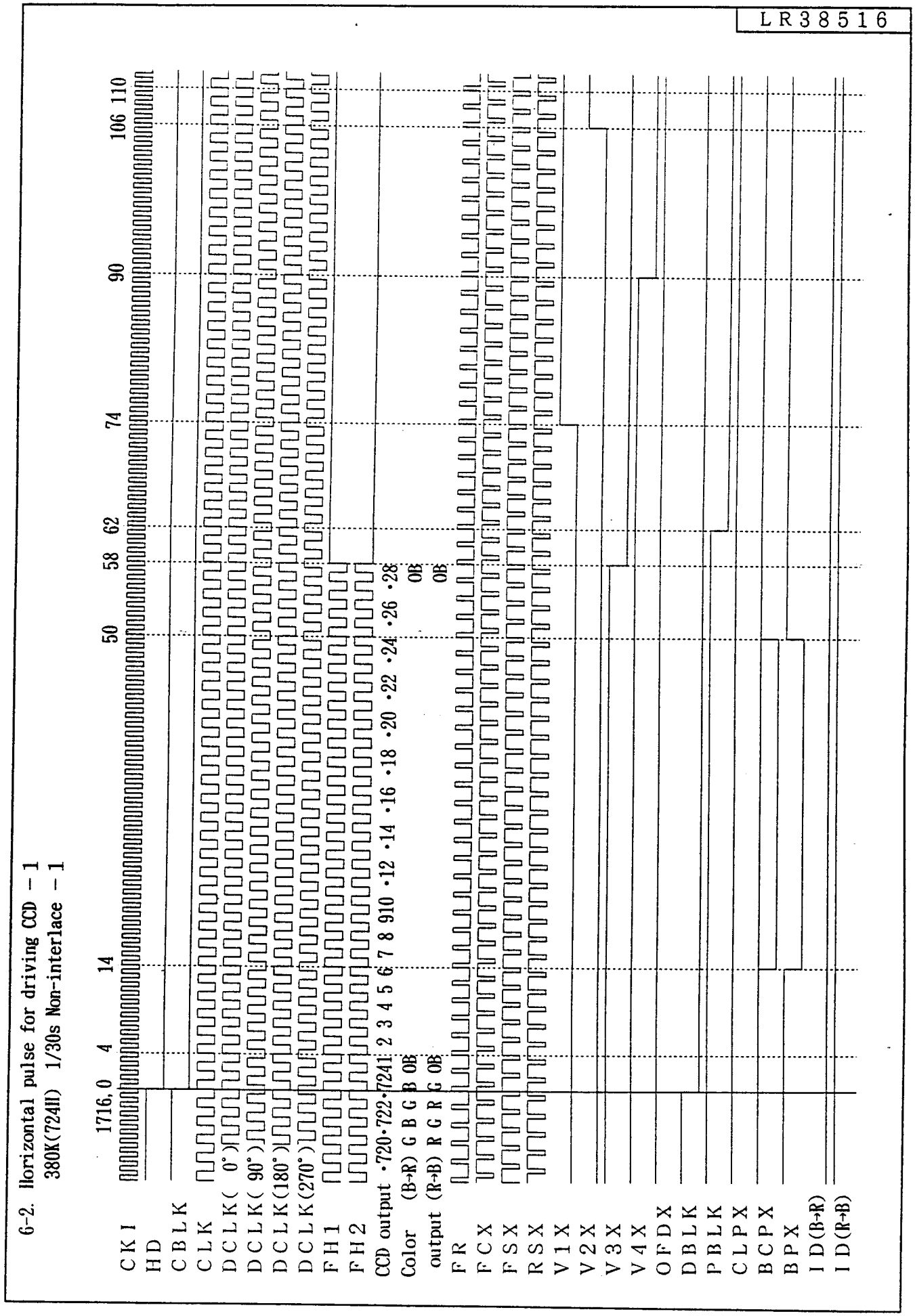


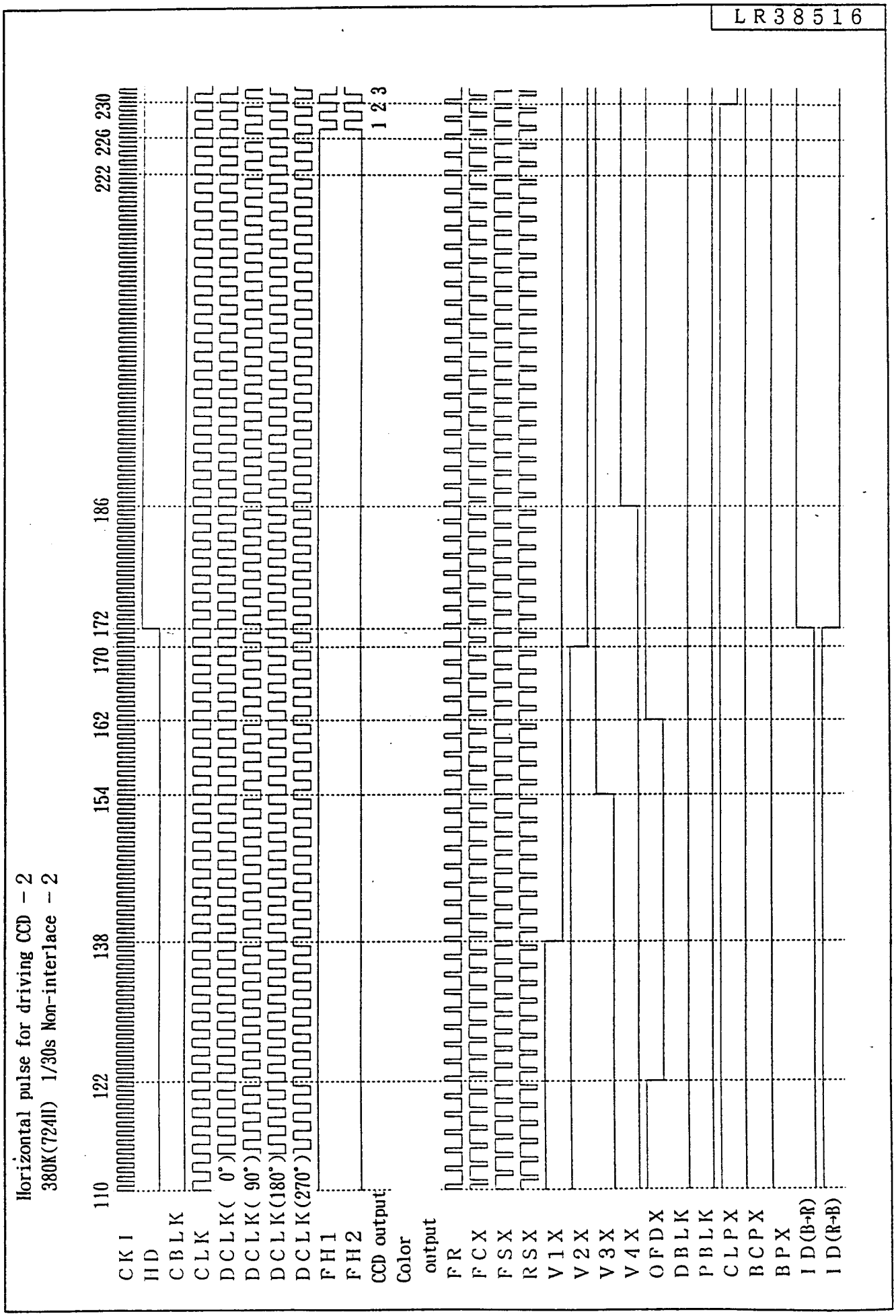
Vertical pulse for driving CCD – 2

1/25s Non-interlace 450K(724H)



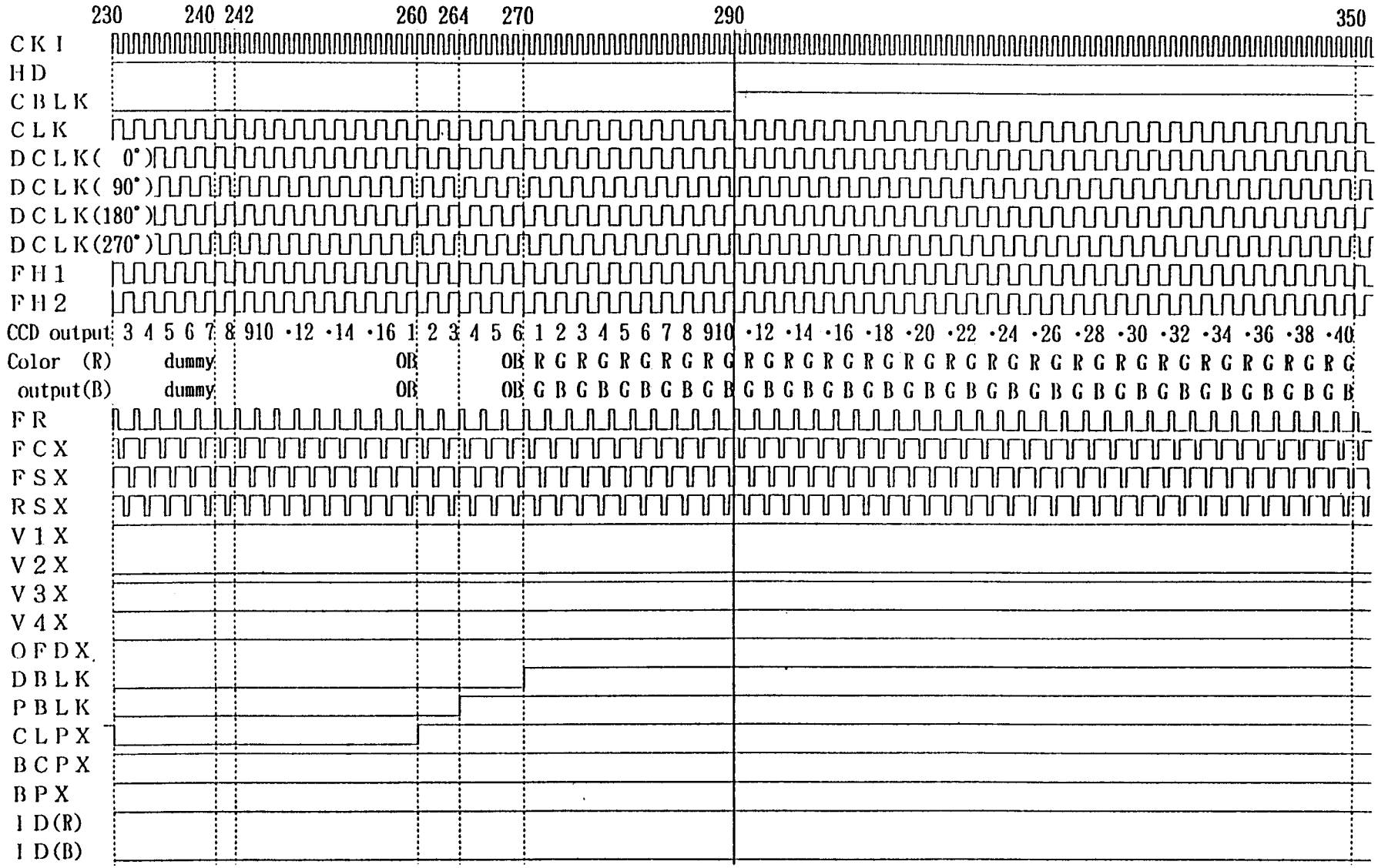
6-2. Horizontal pulse for driving CCD – 1
380K(724H) 1/30s Non-interlace – 1




LR38516
Horizontal pulse for driving CCD - 2
380K(724H) 1/30s Non-interlace - 2
110 122 138 154 162 170 172 186 222 226 230
CK1
HD
CBLK
CLK
DCLK(0°)
DCLK(90°)
DCLK(180°)
DCLK(270°)
FH1
FH2
CCD output
1 2 3
Color output
FR
FCX
FSX
RSX
V1X
V2X
V3X
V4X
OFDX
DBLK
PBLK
CLPX
BCPX
BPX
ID(B→R)
ID(R→B)

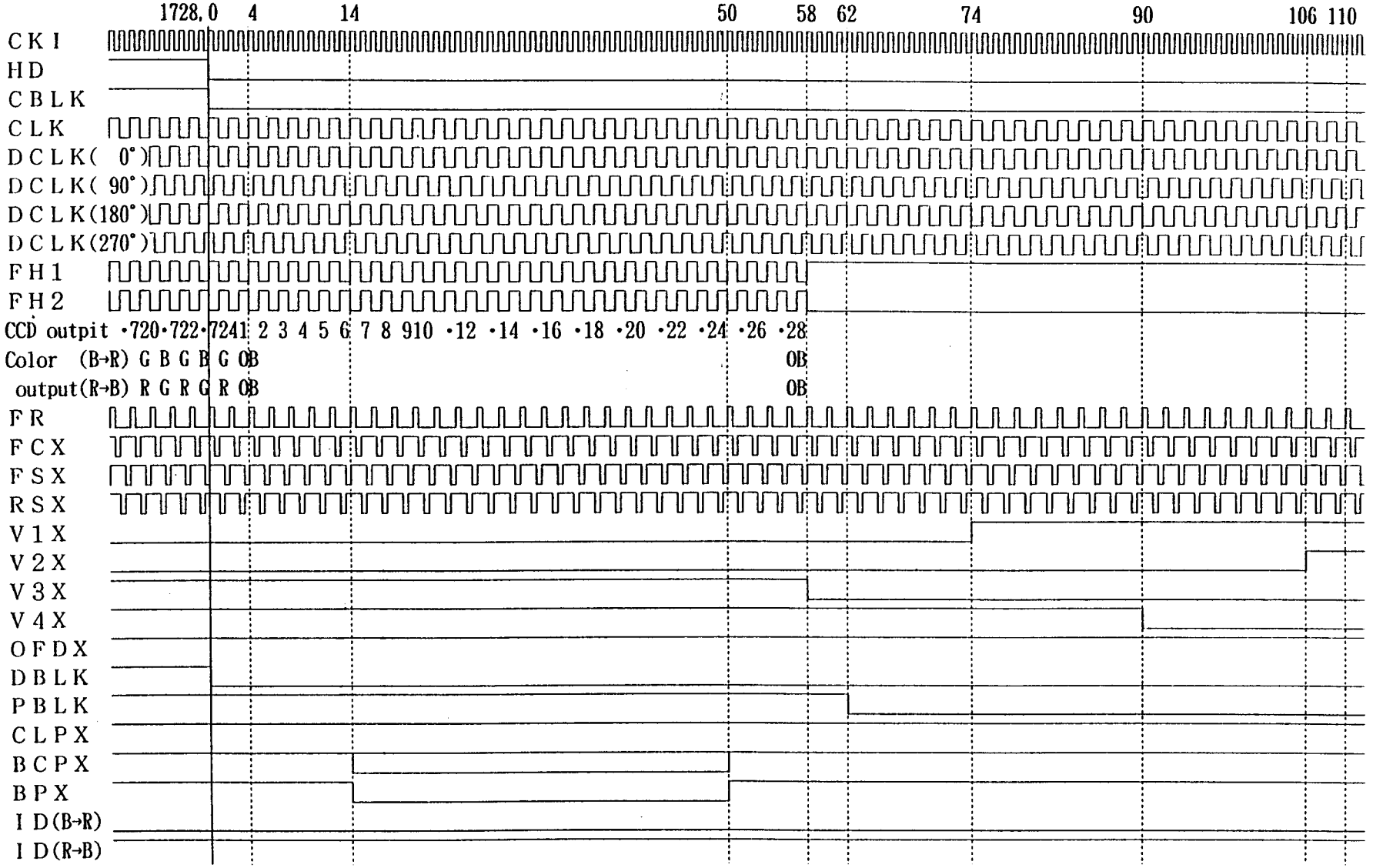
Horizontal pulse for driving CCD – 3

380K(724H) 1/30s Non-interlace – 3



Horizontal pulse for driving CCD – 4

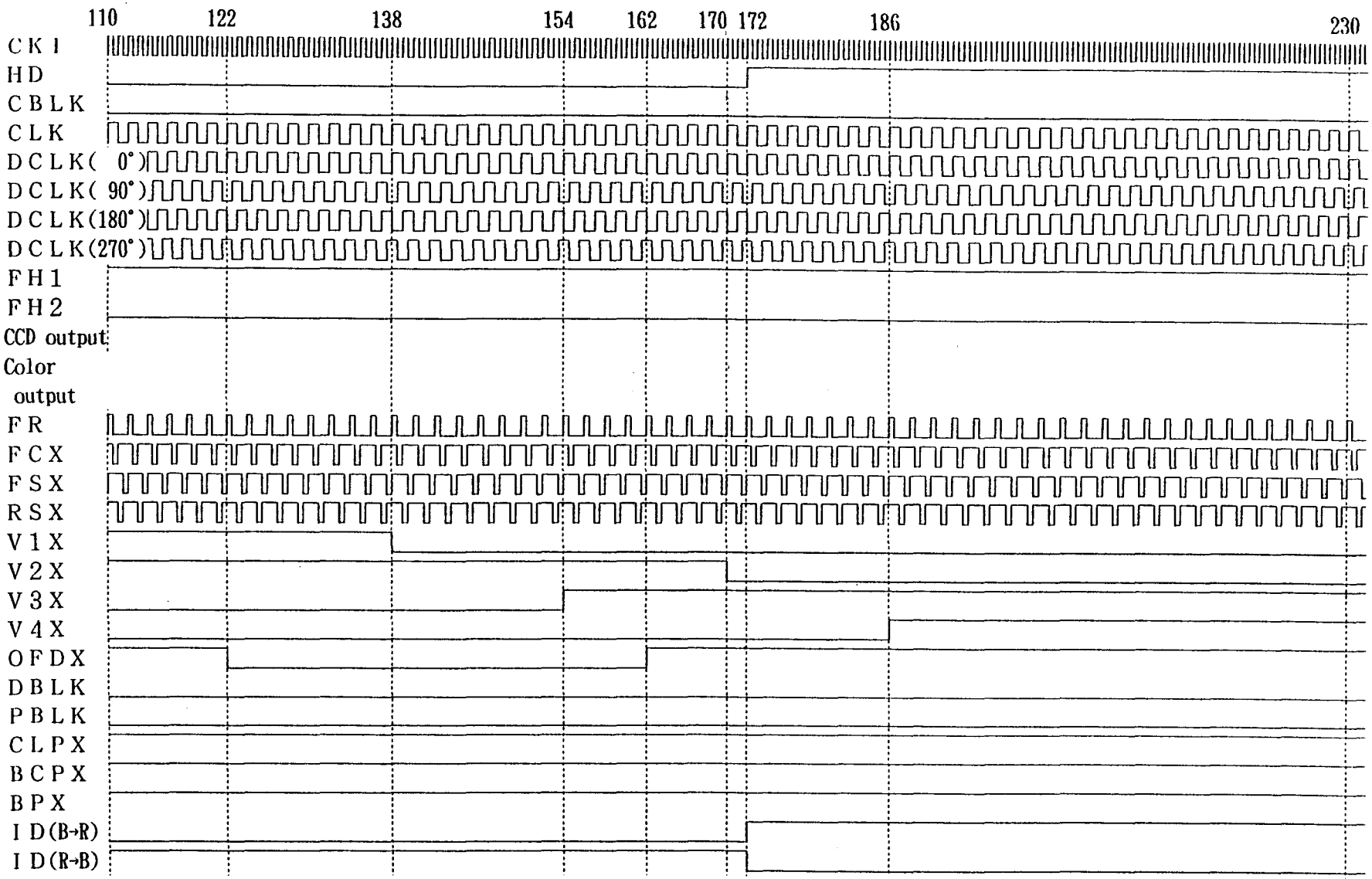
450K(724H) 1/25s Non-interlace – 1



LR38516

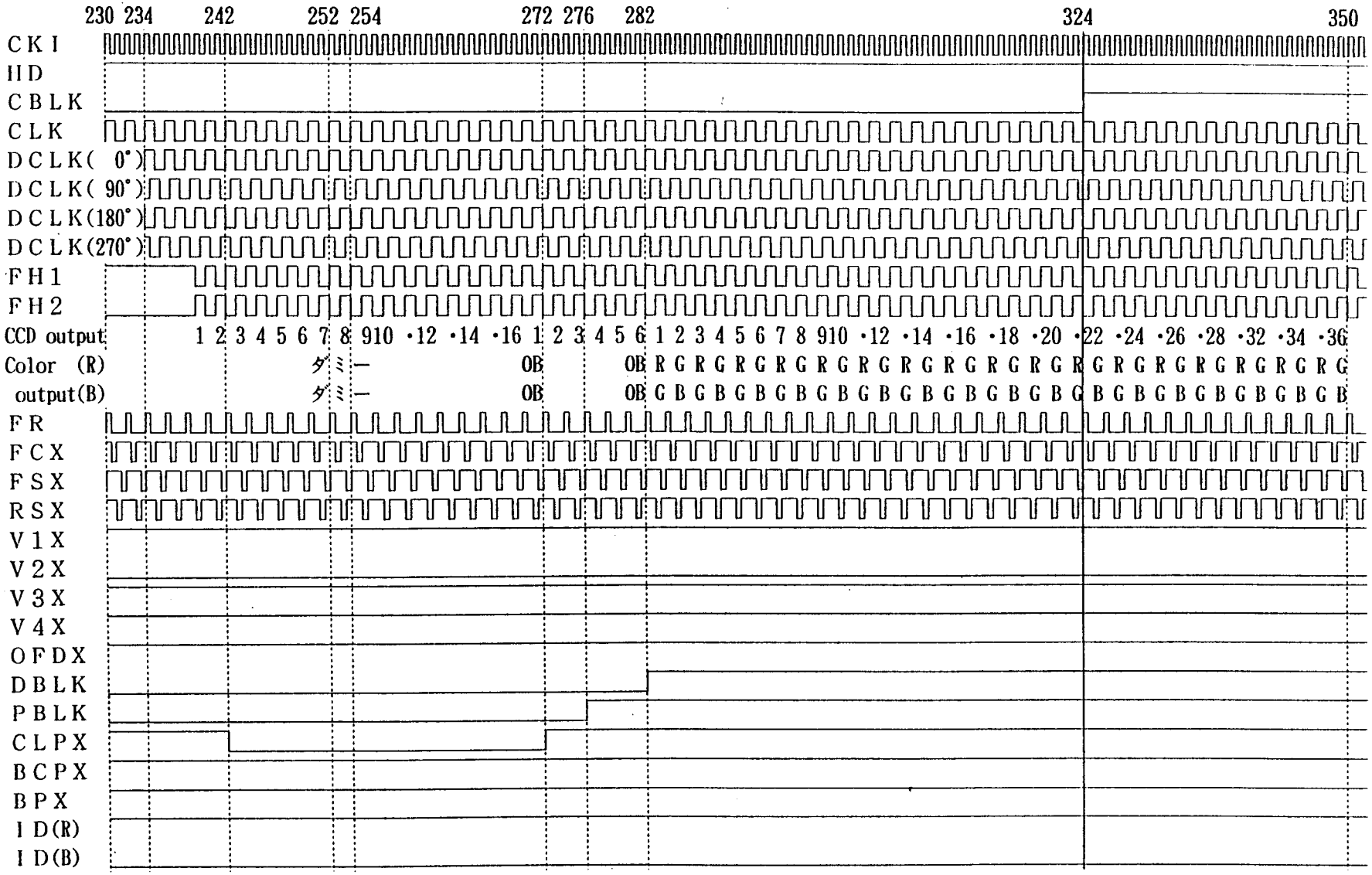
Horizontal pulse for driving CCD – 5

450K(724H) 1/25s Non-interlace – 2



LR38516

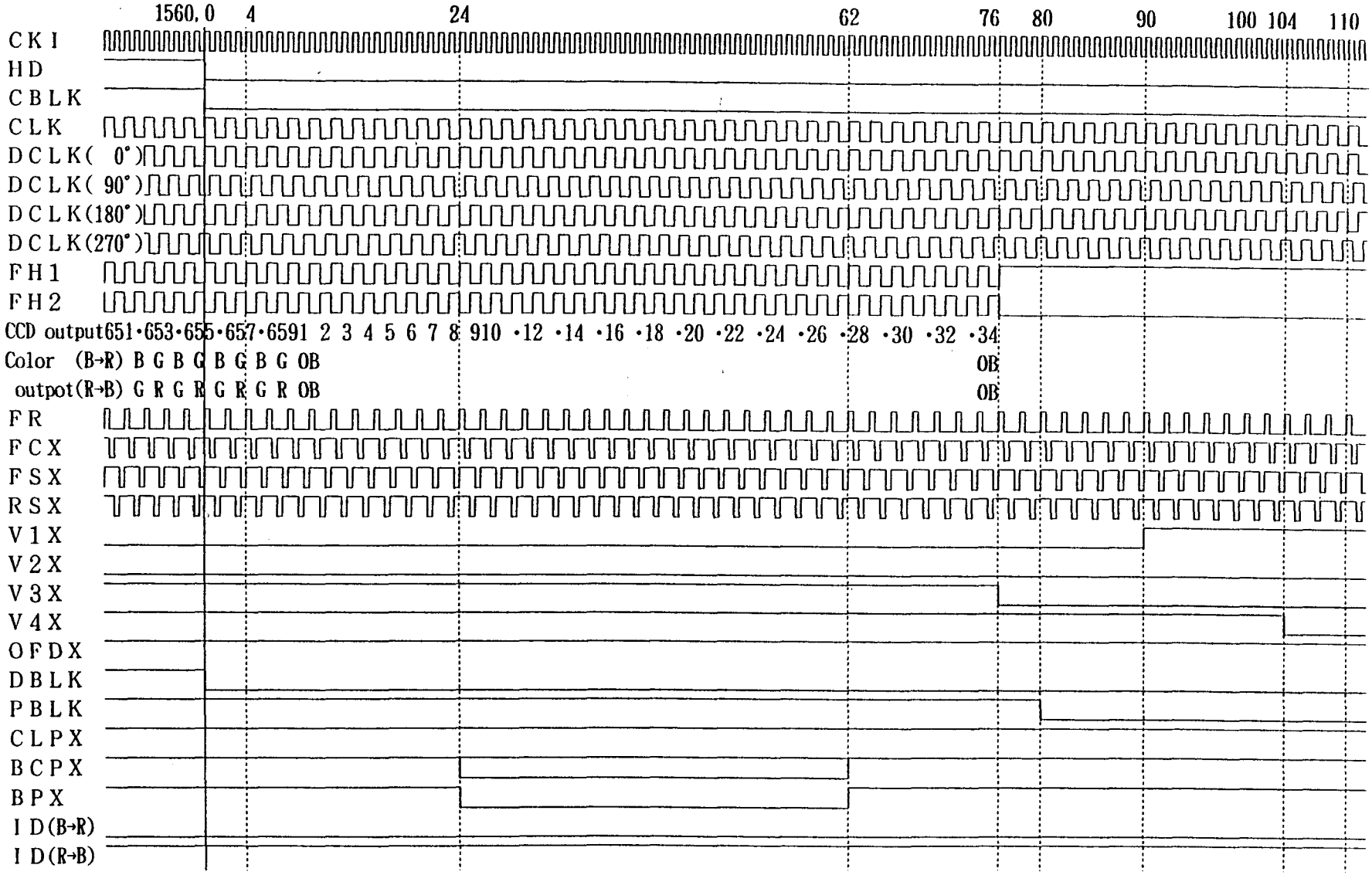
Horizontal pulse for driving CCD －6
450K(724H) 1/25s Non-interlace －3



LR38516

Horizontal pulse for driving CCD – 7

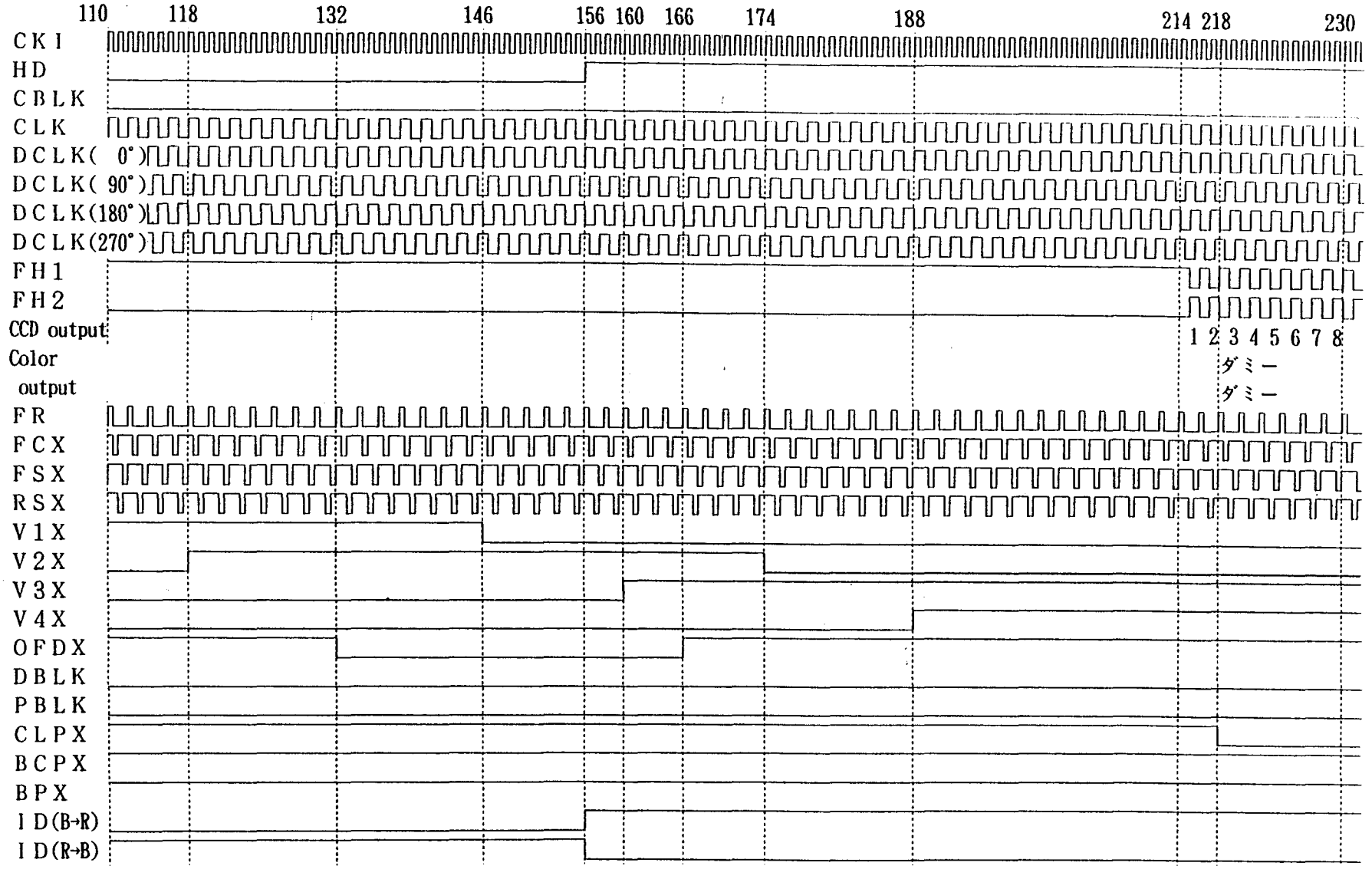
350K(659H) 1/30s Non-interlace – 1



LR38516

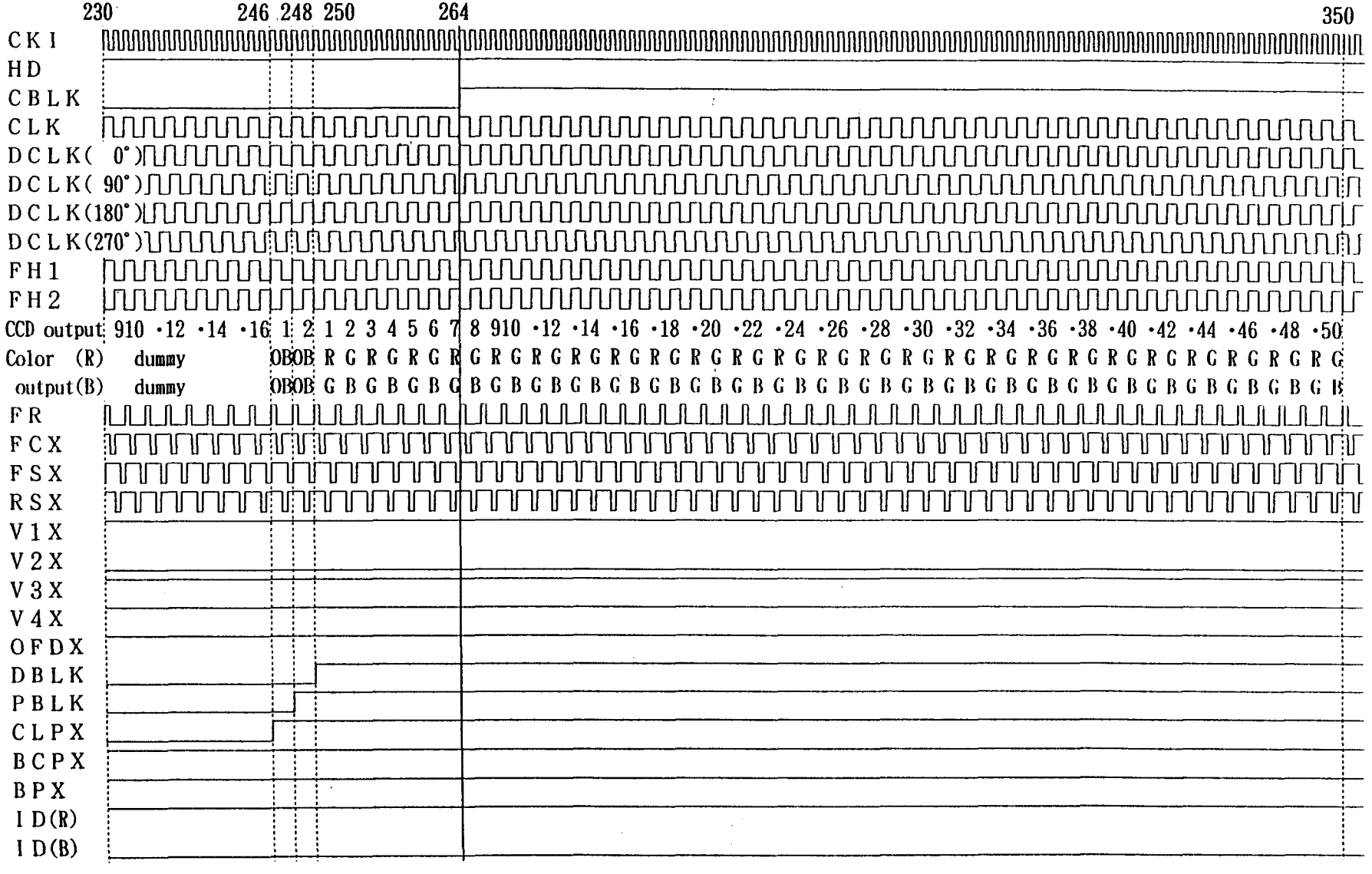
Horizontal pulse for driving CCD －8

350K(659H) 1/30s Non-interlace －2



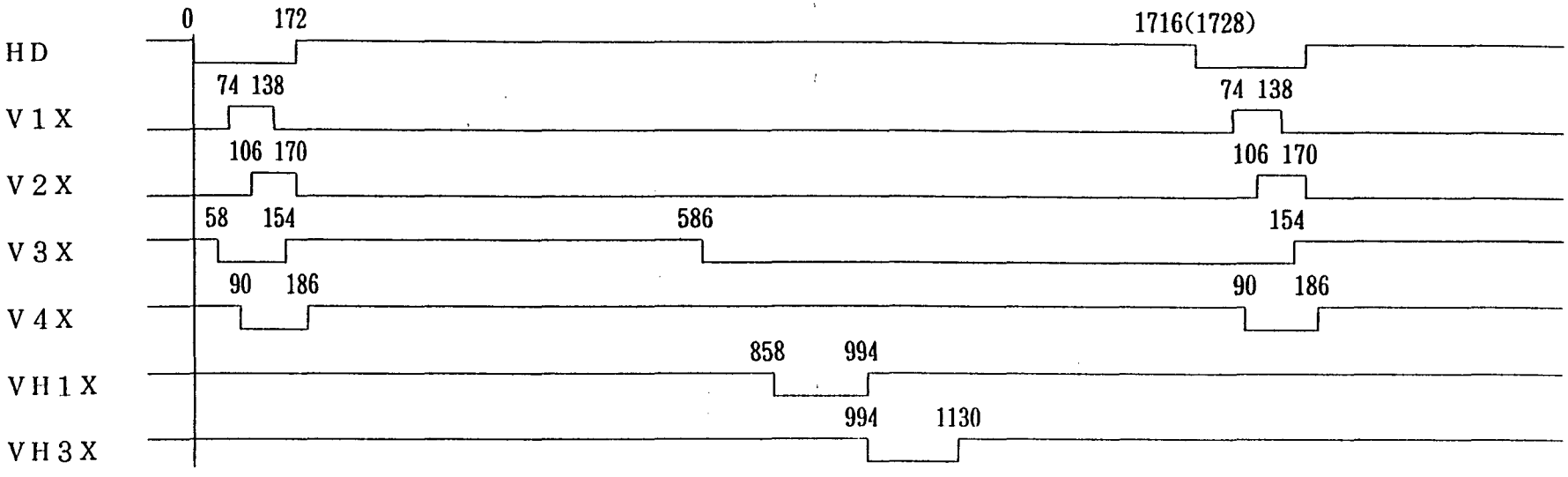
Horizontal pulse for driving CCD – 9

350K(659H) 1/30s Non-interlace – 3



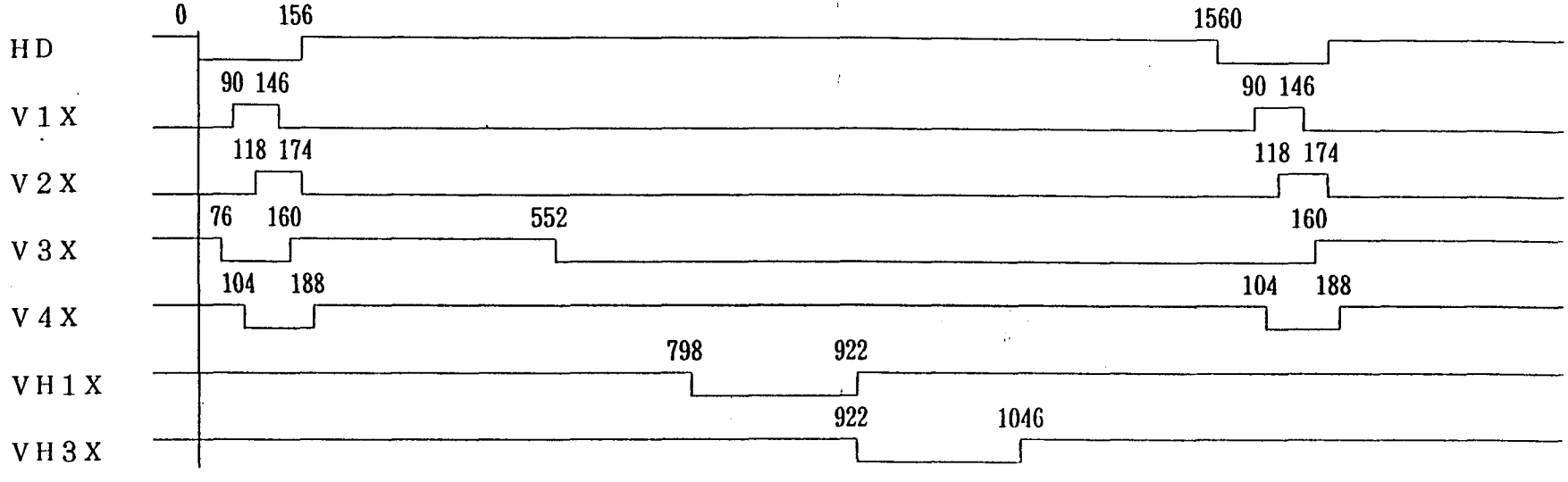
6-3. Read out pulse - 1

380K(724H) 1/30s Non-interlace, 450K(724H) 1/25s Non-interlace ( ) ; P A L

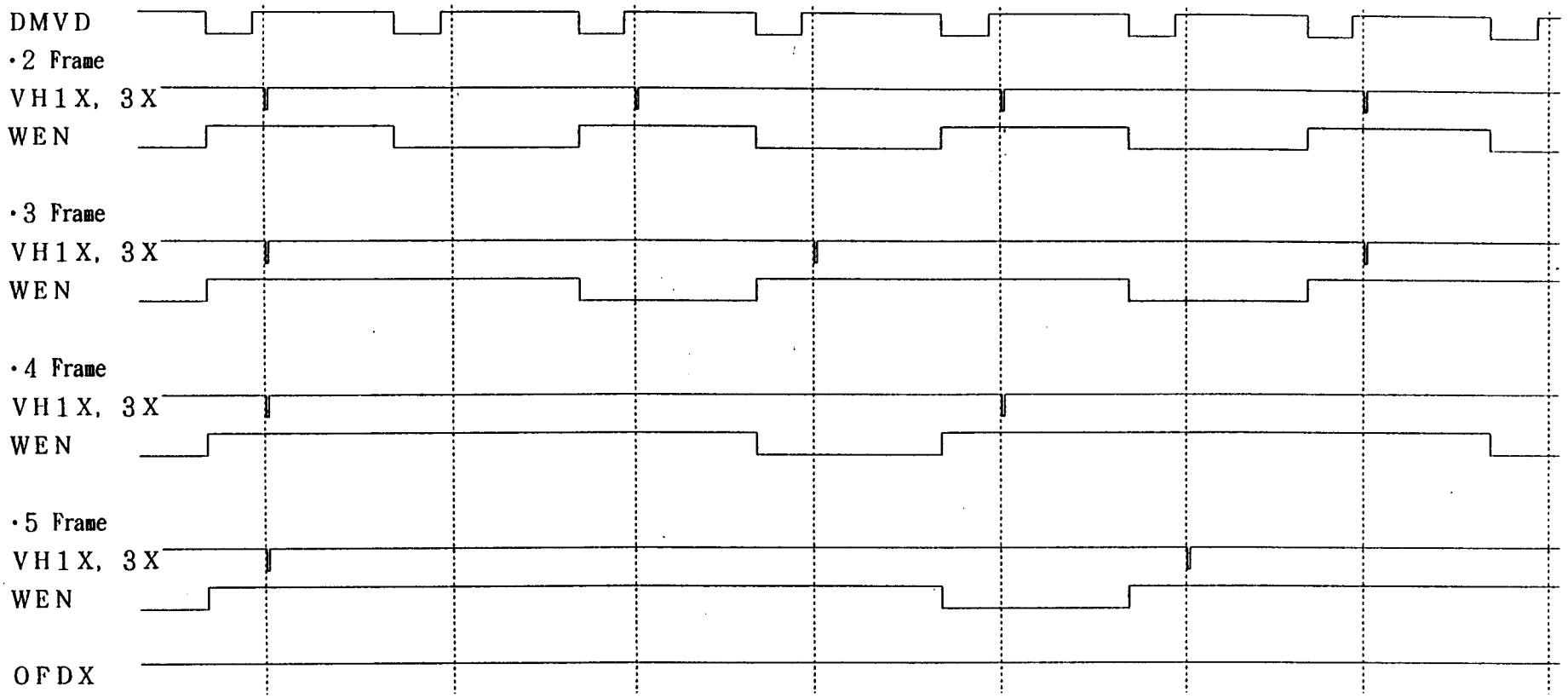


Read out pulse – 2

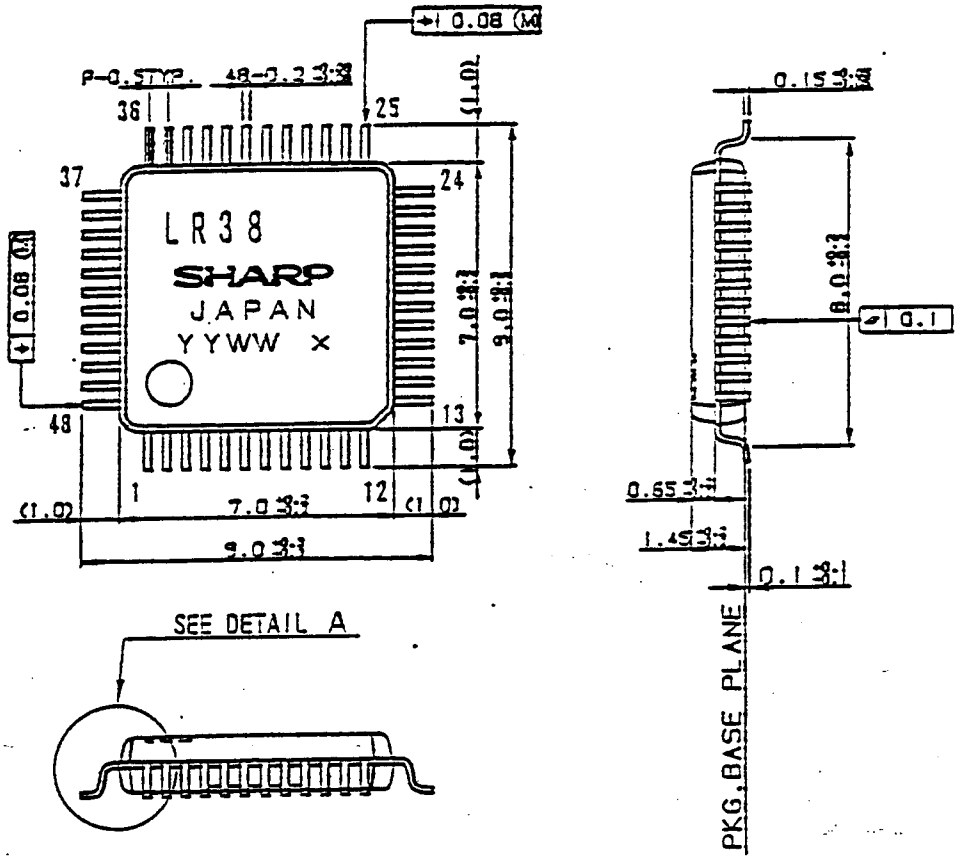
350K(659H) 1/30s Non-interlace

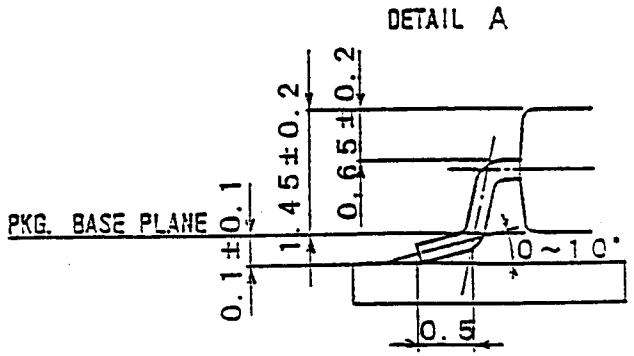


6-4. Low-speed shutter pulse



7. Package Outline





名称 NAME	QFP48-P-0707	リード仕上 LEAD FINISH	TIN-LEAD PLATING	備考 NOTE	プラスチックパッケージ外形寸法は、バリを含まないものとする。 Plastic body dimensions do not include burr of resin.
DRAWING NO.	AA1035	単位 UNIT	mm		

CCD sensor imaging area sensor pattern recognition timing generator vertical driver white balance