

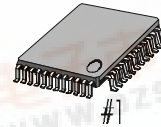
## TIMING & SYNC. GENERATOR FOR B/W CCD

S5C7214X01

### INTRODUCTION

The S5C7214X01 is a timing control IC for generating timing signals & pulses for B/W sync signals which are required for camera systems using monochrome CCD Image sensors.

48-QFP-0707



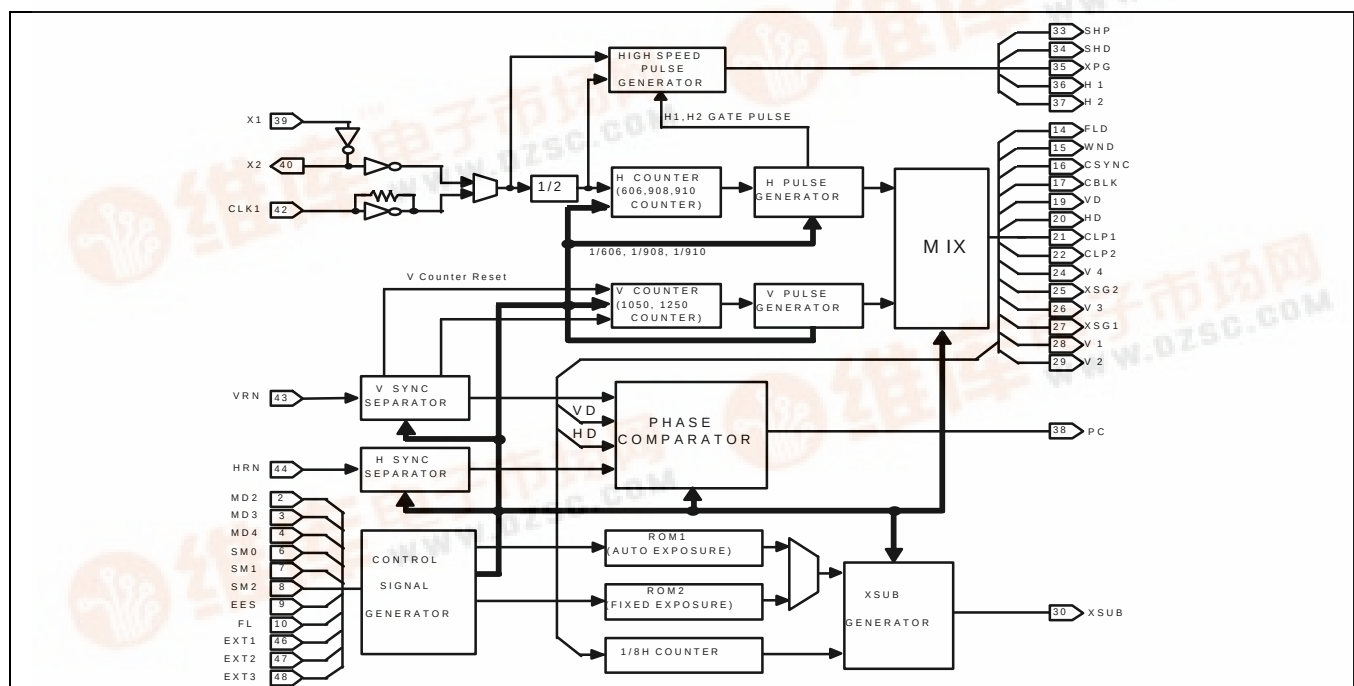
### FEATURES

- EIA / CCIR STANDARDS TIMING MODE
- HI-BAND / NORMAL TIMING MODE
- FRAME / FIELD ACCUMULATION MODE
- INTERLACE / NON - INTERLACE MODE
- EXTERNAL SYNCHRONIZATION MODE
- ELECTRONIC IRIS (ELECTRONIC SHUTTER)
- SYNC SIGNAL GENERATION
- OSCILLATION FREQUENCY :  
 EIA NORMAL MODE : 19.06992 MHz  
 CCIR NORMAL MODE : 18.93750 MHz  
 EIA HI-BAND MODE : 28.63636 MHz  
 CCIR HI-BAND MODE : 28.37500 MHz

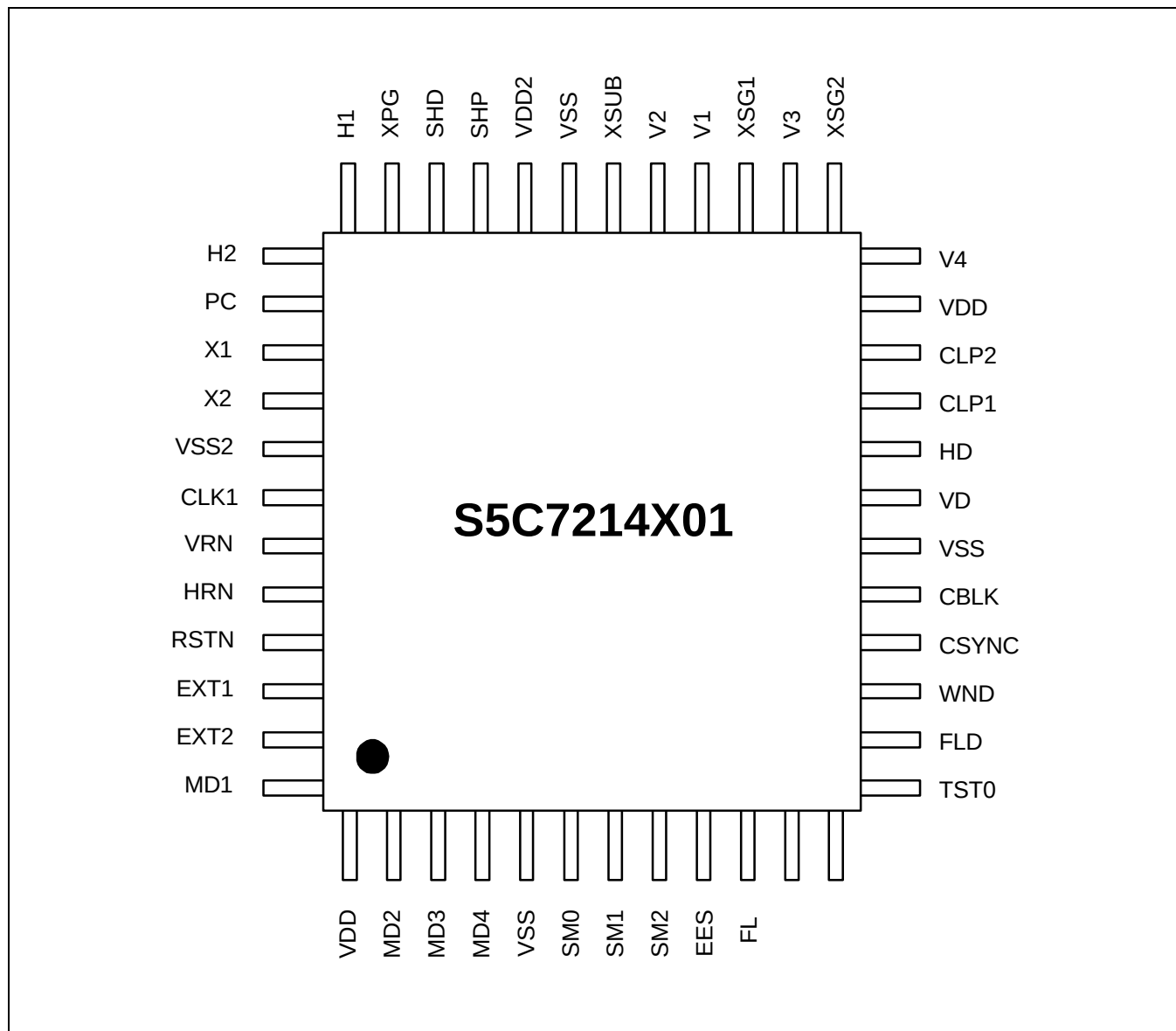
### ORDERING INFORMATION

| Device          | Package     | Operating      |
|-----------------|-------------|----------------|
| S5C7214X01-E0R0 | 48-QFP-0707 | -20 °C – 75 °C |

### BLOCK DIAGRAM



## PIN CONFIGURATION



**PIN DESCRIPTION**

| Pin No. | Pin Name | I/O | Pin Description                                                            |
|---------|----------|-----|----------------------------------------------------------------------------|
| 1       | VDD      | -   | Power Supply                                                               |
| 2       | MD2      | I   | Mode Switching; HI-Band: High, Normal: Low (with Pull-down)                |
| 3       | MD3      | I   | Mode Switching; Non - Interlace: High, Interlace: Low (with Pull-down)     |
| 4       | MD4      | I   | Mode Switching; Frame : High, Field: Low (with Pull-down)                  |
| 5       | VSS      | -   | Ground                                                                     |
| 6       | SM0      | I   | Shutter Speed Control (with Pull-down)                                     |
| 7       | SM1      | I   | Shutter Speed Control (with Pull-down)                                     |
| 8       | SM2      | I   | Shutter Speed Control (with Pull-down)                                     |
| 9       | EES      | I   | Electronic Shutter Mode; Auto Mode: High, Fixed Mode: Low (with Pull-down) |
| 10      | FL       | I   | Flickerless Shutter Mode; Flickerless Mode: High (with Pull-down)          |
| 11      | TST2     | I   | Test Mode Select 2 (with Pull-down)                                        |
| 12      | TST1     | I   | Test Mode Select 1 (with Pull-down)                                        |
| 13      | TST0     | I   | Test Mode Select 0 (with Pull-down)                                        |
| 14      | FLD      | O   | Field Separation Pulse                                                     |
| 15      | WND      | O   | Window Pulse                                                               |
| 16      | CSYNC    | O   | Composite Sync Pulse                                                       |
| 17      | CBLK     | O   | Composite Blank Pulse                                                      |
| 18      | VSS      | -   | Ground                                                                     |
| 19      | VD       | O   | Vertical Drive Pulse                                                       |
| 20      | HD       | O   | Horizontal Drive Pulse                                                     |
| 21      | CLP1     | O   | Clamp Pulse 1                                                              |
| 22      | CLP2     | O   | Clamp Pulse 2                                                              |
| 23      | VDD      | -   | Power Supply                                                               |
| 24      | V4       | O   | CCD Vertical Register Drive Pulse 4                                        |

**PIN DESCRIPTION (Continued)**

| Pin No. | Pin Name | I/O | Pin Description                                                   |
|---------|----------|-----|-------------------------------------------------------------------|
| 25      | XSG2     | O   | CCD Sensor Read Out Pulse 2                                       |
| 26      | V3       | O   | CCD Vertical Register Drive Pulse 3                               |
| 27      | XSG1     | O   | CCD Sensor Read Out Pulse 1                                       |
| 28      | V1       | O   | CCD Vertical Register Drive Pulse 1                               |
| 29      | V2       | O   | CCD Vertical Register Drive Pulse 2                               |
| 30      | XSUB     | O   | CCD Discharge Pulse                                               |
| 31      | VSS      | -   | Ground                                                            |
| 32      | VDD2     | -   | Power Supply 2                                                    |
| 33      | SHP      | O   | Precharge Sample & Hold Pulse                                     |
| 34      | SHD      | O   | Data Sample & Hold Pulse                                          |
| 35      | XPG      | O   | CCD Reset Gate Pulse                                              |
| 36      | H1       | O   | CCD Horizontal Register Drive Pulse                               |
| 37      | H2       | O   | CCD Horizontal Register Drive Pulse                               |
| 38      | PC       | O   | Phase Comparator Output                                           |
| 39      | X1       | I   | Oscillator Input                                                  |
| 40      | X2       | O   | Oscillator Output                                                 |
| 41      | VSS2     | -   | Ground 2                                                          |
| 42      | CLKI     | I   | Clock Input For EXT. Sync Mode                                    |
| 43      | VRN      | I   | Vertical PLL Reference For External Sync Mode (Schmitt Pull-up)   |
| 44      | HRN      | I   | Horizontal PLL Reference For External Sync Mode (Schmitt Pull-up) |
| 45      | RSTN     | I   | System Initialization Pulse (Schmitt Pull- up)                    |
| 46      | EXT1     | I   | External Sync Mode Select (with Pull-down)                        |
| 47      | EXT2     | I   | External Sync Mode Select (with Pull-down)                        |
| 48      | MD1      | I   | Mode Switching; CCIR: High, EIA: Low (with Pull-down)             |

**ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)**

| Parameter        | Symbol   | Condition                     | Unit |
|------------------|----------|-------------------------------|------|
| Supply Voltage   | $V_{DD}$ | $V_{SS} - 0.3 - + 7.0$        | V    |
| Input Voltage    | $V_I$    | $V_{SS} - 0.3 - V_{DD} + 0.3$ | V    |
| Output Voltage   | $V_O$    | $V_{SS} - 0.3 - V_{DD} + 0.3$ | V    |
| Operating Temp.  | Topr     | 0 – + 70                      | °C   |
| Storage Temp.    | Tstr     | - 40 – + 125                  | °C   |
| Latch-up Current | $I_{LU}$ | 100                           | mA   |

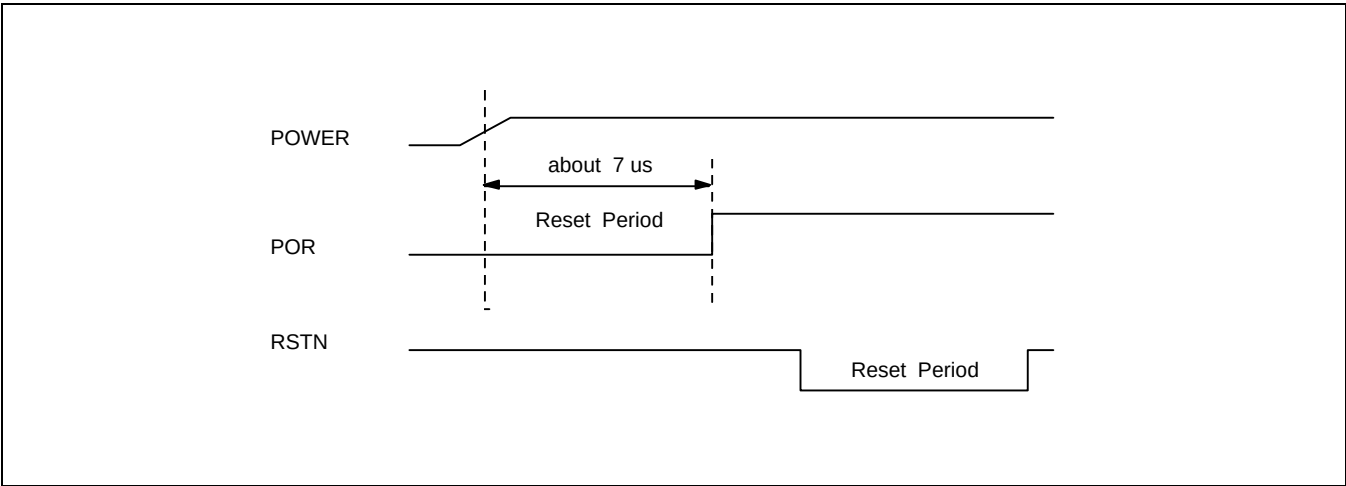
**DC CHARACTERISTICS (Ta = 25 °C)**

| Item                                                           | Symbol    | Condition                  | Min.        | Typ. | Max.        | Unit |
|----------------------------------------------------------------|-----------|----------------------------|-------------|------|-------------|------|
| Supply voltage                                                 | $V_{DD}$  | -                          | 4.75        | 5.00 | 5.25        | V    |
| Input voltage 1 (Normal input, except Pin 40, 43, 44, 45)      | $V_{IH1}$ | CMOS Level Interface       | $0.7V_{DD}$ | -    | -           | V    |
|                                                                | $V_{IL1}$ | CMOS Level Interface       | -           | -    | $0.3V_{DD}$ | V    |
| Input voltage 2 (Pin 43, 44, 45)                               | $V_{IH2}$ | CMOS Level Schmitt trigger | $0.8V_{DD}$ | -    | -           | V    |
|                                                                | $V_{IL2}$ | CMOS Level Schmitt trigger | -           | -    | $0.2V_{DD}$ | V    |
| Input Current 1(With pull-down)                                | $I_{IH1}$ | $V_I = V_{DD}$             | 50          | -    | 200         | uA   |
|                                                                | $I_{IL1}$ | $V_I = V_{SS}$             | -10         | -    | 10          | uA   |
| Input Current 2<br>(With pull-up: Pin 43, 44, 45)              | $I_{IH2}$ | $V_I = V_{DD}$             | -10         | -    | 10          | uA   |
|                                                                | $I_{IL2}$ | $V_I = V_{SS}$             | -200        | -    | -50         | uA   |
| Input Current 3<br>(Normal Input: Pin 42)                      | $I_{IH3}$ | $V_I = V_{DD}$             | -40         | -    | 40          | uA   |
|                                                                | $I_{IL3}$ | $V_I = V_{SS}$             | -40         | -    | 40          | uA   |
| Output voltage 1(Normal output, except 33, 34, 35, 36, 37, 40) | $V_{OH1}$ | $I_{OH} = -2mA$            | 2.4         | -    | -           | V    |
|                                                                | $V_{OL1}$ | $I_{OL} = 2mA$             | -           | -    | 0.4         | V    |
| Output voltage 2 (Pin 33, 34, 35)                              | $V_{OH2}$ | $I_{OH} = -4mA$            | 2.4         | -    | -           | V    |
|                                                                | $V_{OL2}$ | $I_{OL} = 4mA$             | -           | -    | 0.4         | V    |
| Output voltage 3 (Pin 36, 37)                                  | $V_{OH3}$ | $I_{OH} = -16mA$           | 2.4         | -    | -           | V    |
|                                                                | $V_{OL3}$ | $I_{OL} = 16mA$            | -           | -    | 0.4         | V    |
| Operating current                                              | $I_{DD}$  | $V_{DD} = 5.25 V$          | -           | 25   | 50          | mA   |
| Static current                                                 | $I_{ST}$  | $V_{DD} = 5.25 V$          | -           | 420  | -           | uA   |

OPERATION

INTERNAL RESET OPERATION

- Including power on reset. (Typ. 7us)
- RSTN low active reset at the internal mode



EXTERNAL SYNCHRONIZATION OPERATION

| EXT 1 | EXT 2 | MODE                          |
|-------|-------|-------------------------------|
| 0     | 0     | Internal Sync. Mode           |
| 0     | 1     | External Composite Sync. Mode |
| 1     | 0     | Line Lock Sync. Mode          |
| 1     | 1     | Separate Sync. Mode           |

HD PHASE SELECTION

| TST 2 | TST 1 | TST0 | MODE        |
|-------|-------|------|-------------|
| 0     | 0     | 0    | Normal HD   |
| 1     | 1     | 1    | Reversed HD |
| ELSE  |       |      | Reversed    |

## ELECTRONIC SHUTTER

There are two electronic shutter modes in S5C7214X01.

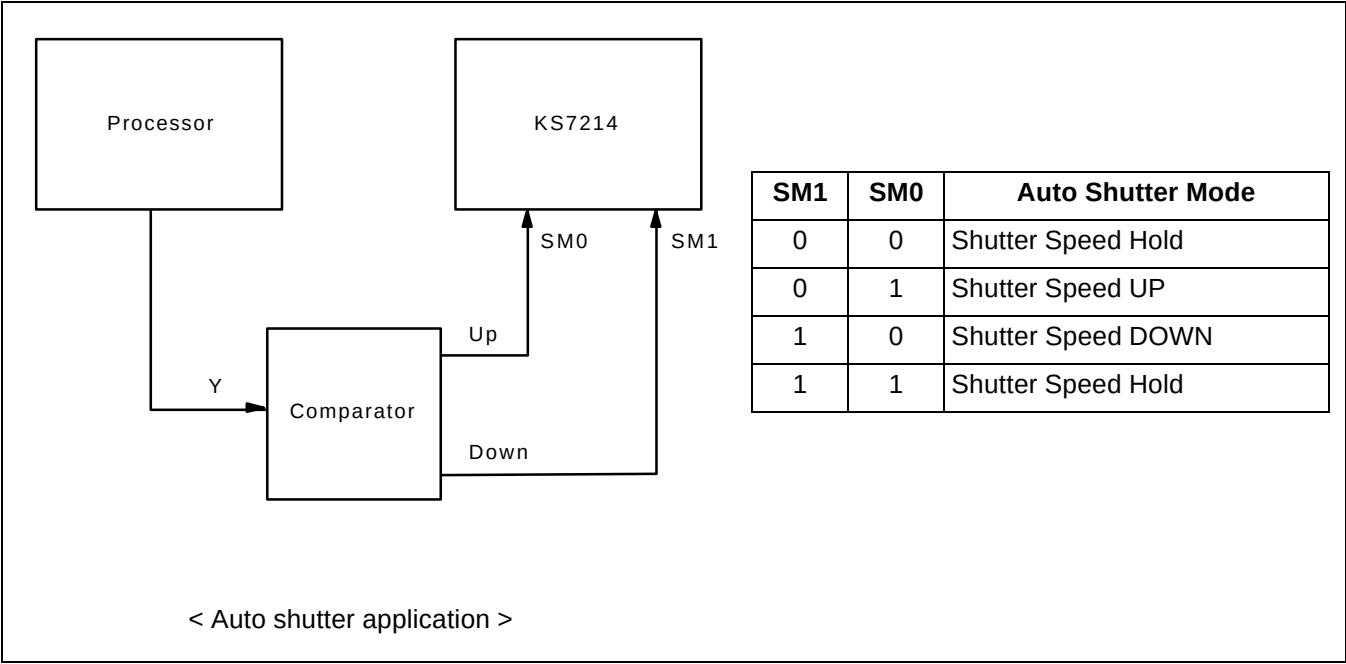
One is a Fixed Iris mode that controls shutter speed through parallel interface with the external pin. The other is an Auto Iris mode that controls the electronic Iris automatically by detecting the amount of light of current objects from the signal process IC.

### FIXED SHUTTER MODE

| MD1 | FL | SM2 | SM1 | SM0 | SHUTTER SPEED |         |
|-----|----|-----|-----|-----|---------------|---------|
|     |    |     |     |     | STEP          | REAL    |
| L   | L  | L   | L   | L   | 1/60          | 1/60    |
| L   | L  | L   | L   | H   | 1/250         | 1/251   |
| L   | L  | L   | H   | L   | 1/500         | 1/513   |
| L   | L  | L   | H   | H   | 1/1000        | 1/1006  |
| L   | L  | H   | L   | L   | 1/2000        | 1/1936  |
| L   | L  | H   | L   | H   | 1/5000        | 1/5034  |
| L   | L  | H   | H   | L   | 1/10000       | 1/10489 |
| L   | L  | H   | H   | H   | 1/30000       | 1/31469 |
| L   | H  | X   | X   | X   | 1/100 *       | 1/101   |
| H   | L  | L   | L   | L   | 1/50          | 1/50    |
| H   | L  | L   | L   | H   | 1/250         | 1/249   |
| H   | L  | L   | H   | L   | 1/500         | 1/510   |
| H   | L  | L   | H   | H   | 1/1000        | 1/999   |
| H   | L  | H   | L   | L   | 1/2000        | 1/1923  |
| H   | L  | H   | L   | H   | 1/5000        | 1/5000  |
| H   | L  | H   | H   | L   | 1/10000       | 1/10416 |
| H   | L  | H   | H   | H   | 1/30000       | 1/31249 |
| H   | H  | X   | X   | X   | 1/120 *       | 1/120   |

\* FLICKERLESS MODE

AUTO SHUTTER MODE

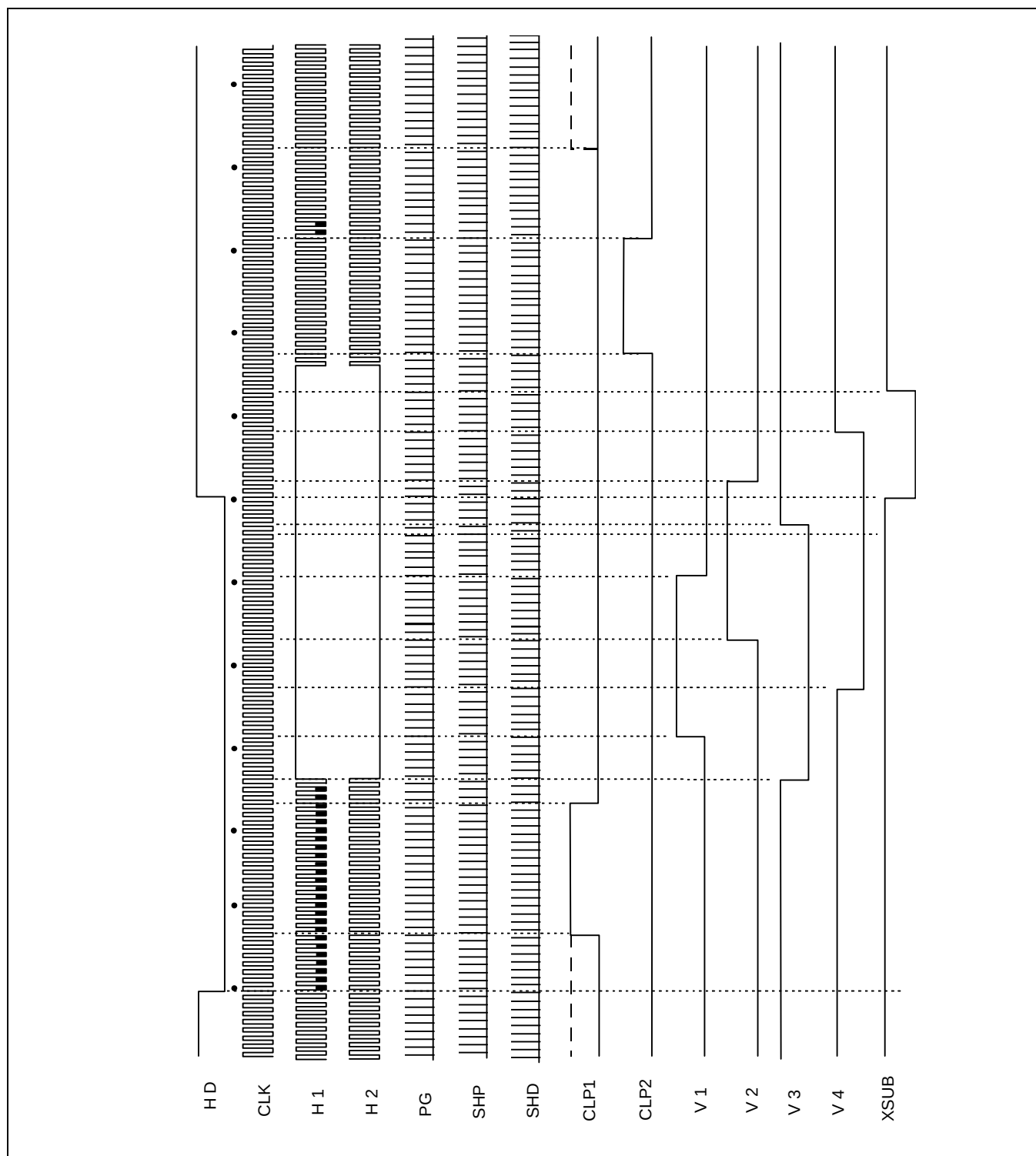


| NO | Step Period | EIA  |                   | CCIR |                   |
|----|-------------|------|-------------------|------|-------------------|
|    |             | Step | Shutter Speed     | Step | Shutter Speed     |
| 1  | 7H          | 8    | 1/60 — 1/76       | 8    | 1/50 — 1/75       |
| 2  | 5H          | 7    | 1/77 — 1/91       | 7    | 1/76 — 1/91       |
| 3  | 4H          | 9    | 1/92 — 1/116      | 9    | 1/92 — 1/115      |
| 4  | 3H          | 12   | 1/117 — 1/157     | 12   | 1/116 — 1/156     |
| 5  | 2H          | 18   | 1/158 — 1/247     | 18   | 1/157 — 1/245     |
| 6  | 1H          | 50   | 1/248 — 1/1154    | 50   | 1/246 — 1/1146    |
| 7  | 1 / 2H      | 18   | 1/1155 — 1/3402   | 18   | 1/1147 — 1/3378   |
| 8  | 1 / 4H      | 12   | 1/3403 — 1/9682   | 12   | 1/3379 — 1/9615   |
| 9  | 1 / 8H      | 11   | 1/9683 — 1/125875 | 11   | 1/9616 — 1/124999 |

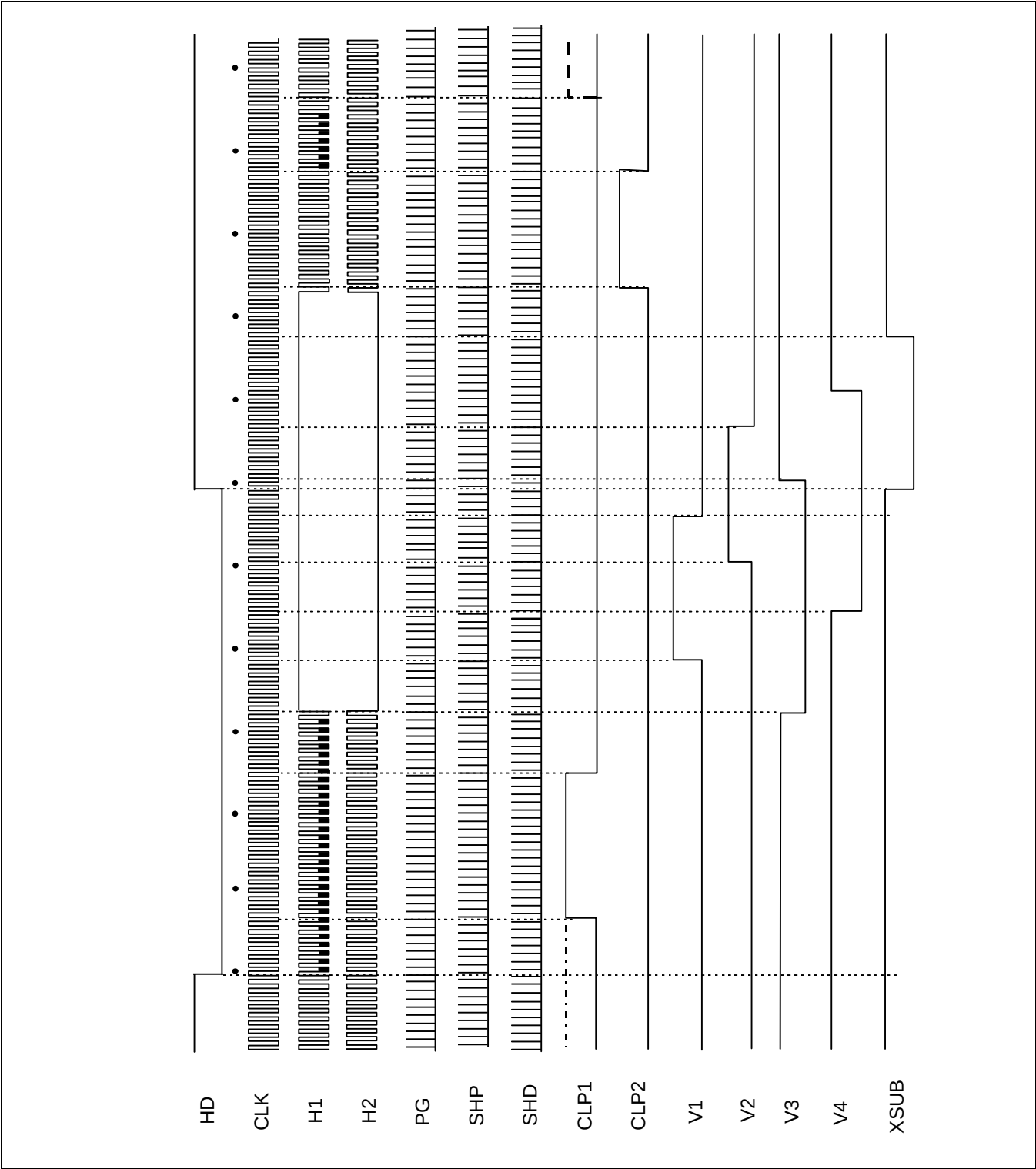
< Auto shutter speed table >



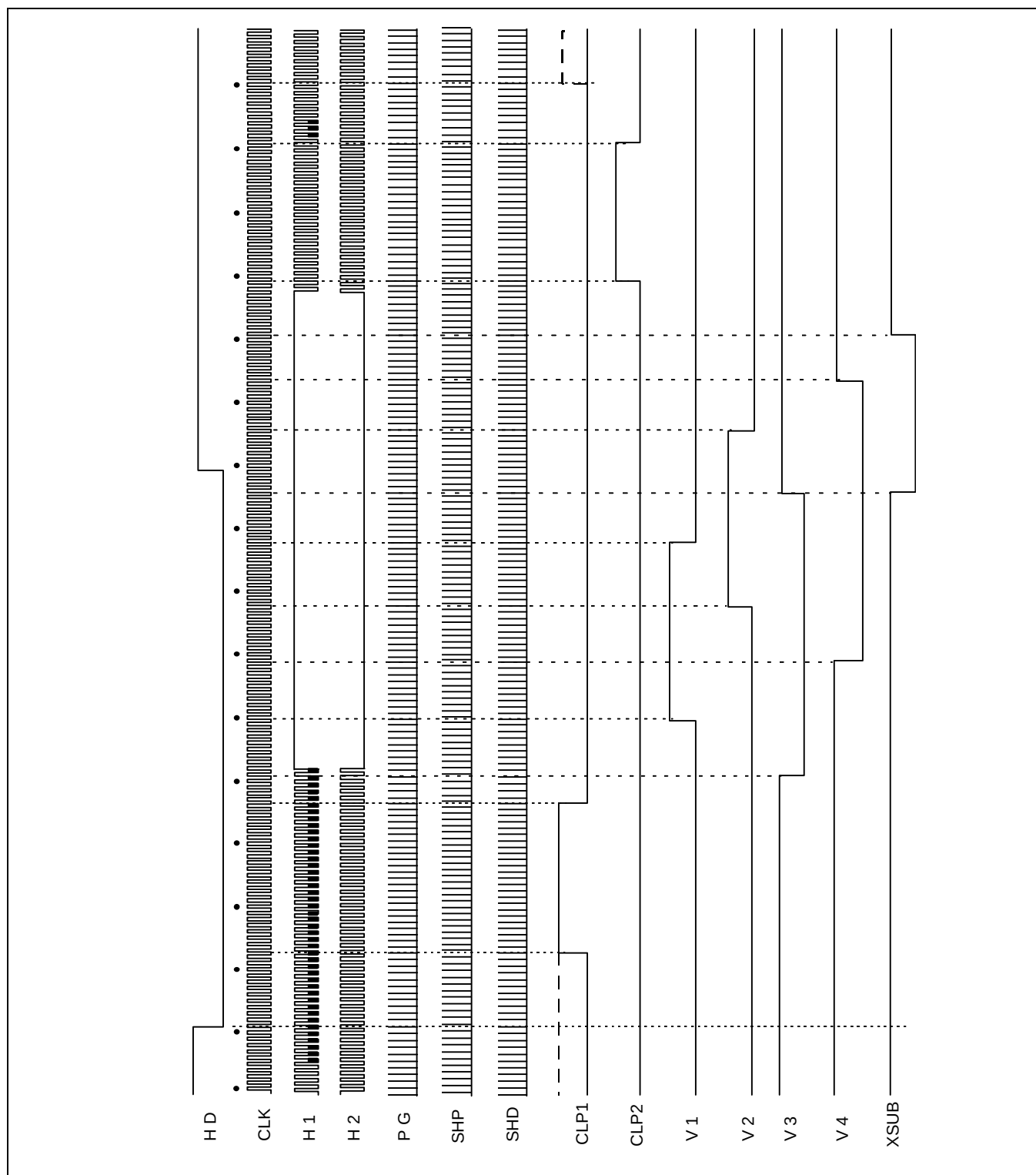
## HORIZONTAL TIMING CHART FOR EIA NORMAL



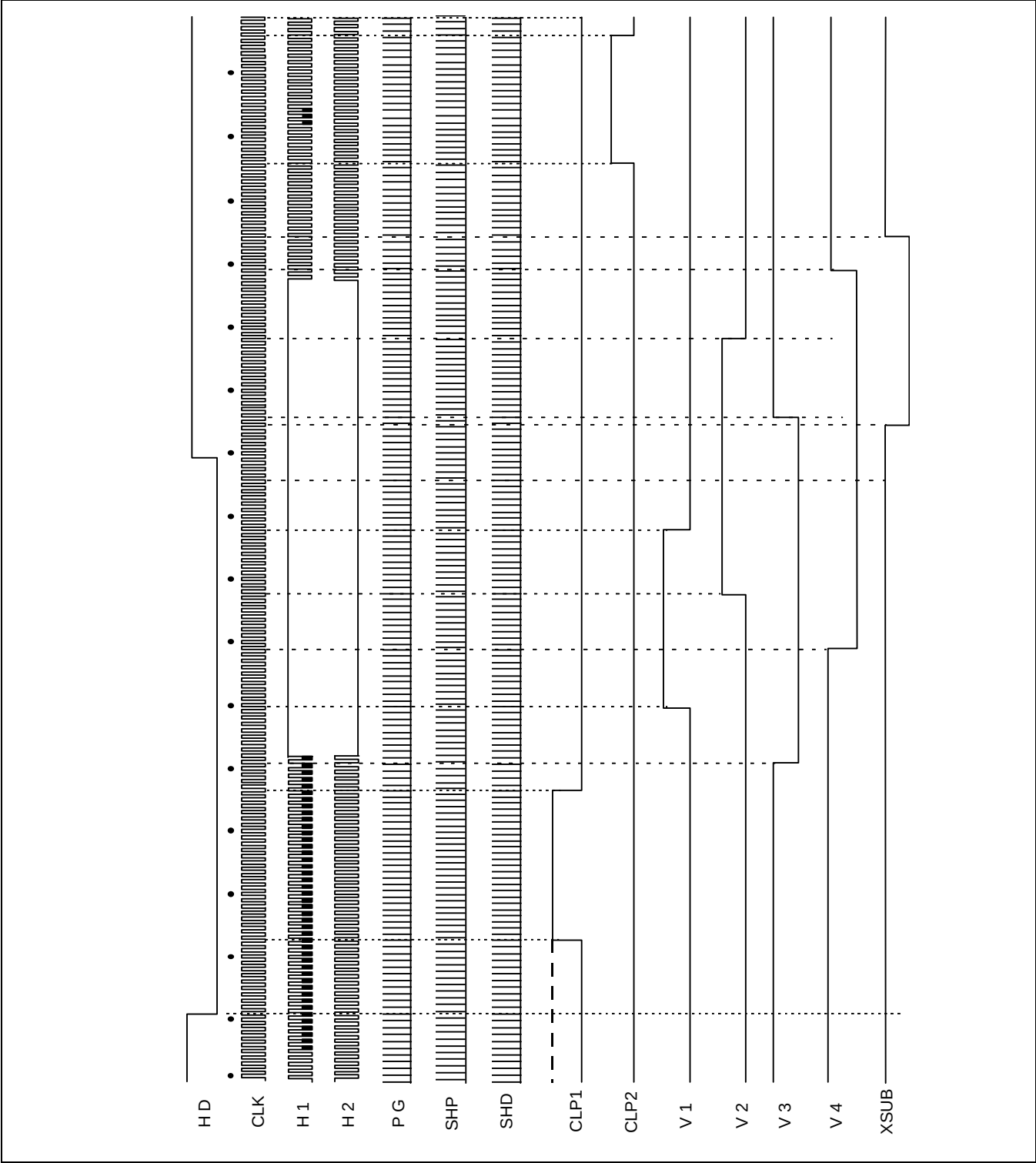
HORIZONTAL TIMING CHART FOR CCIR NORMAL



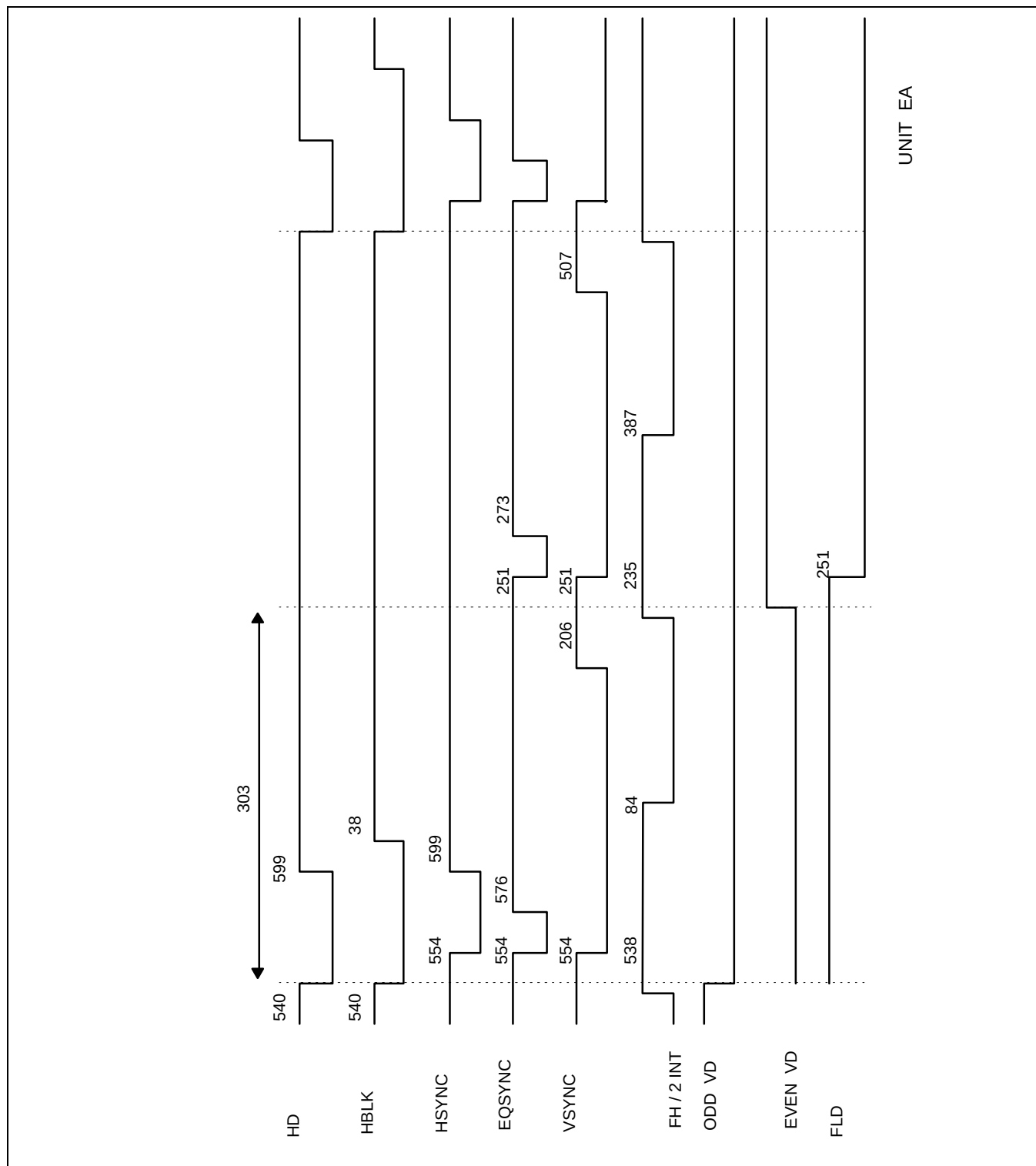
## HORIZONTAL TIMING CHART FOR EIA Hi- 8



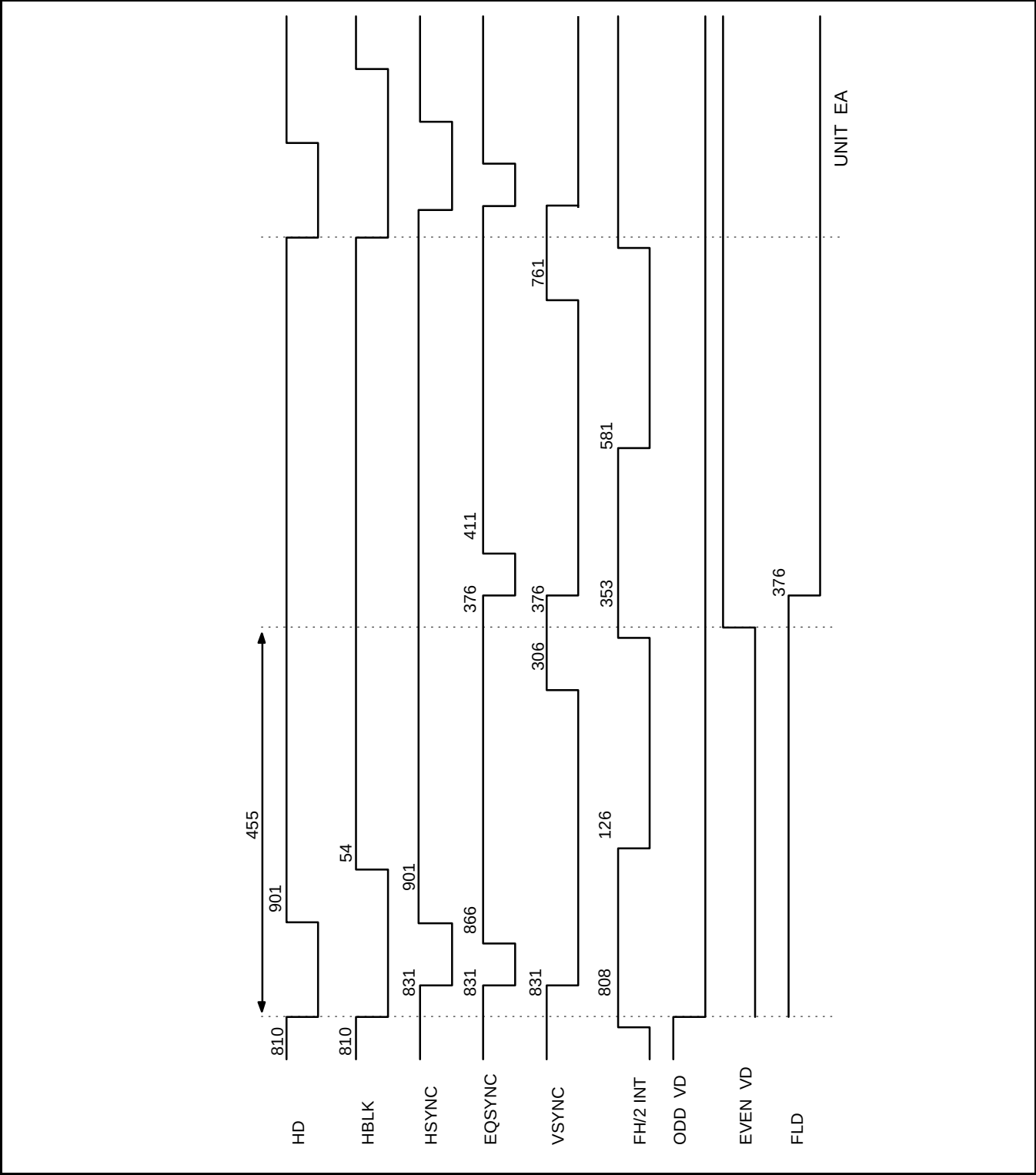
HORIZONTAL TIMING CHART FOR CCIR Hi- 8



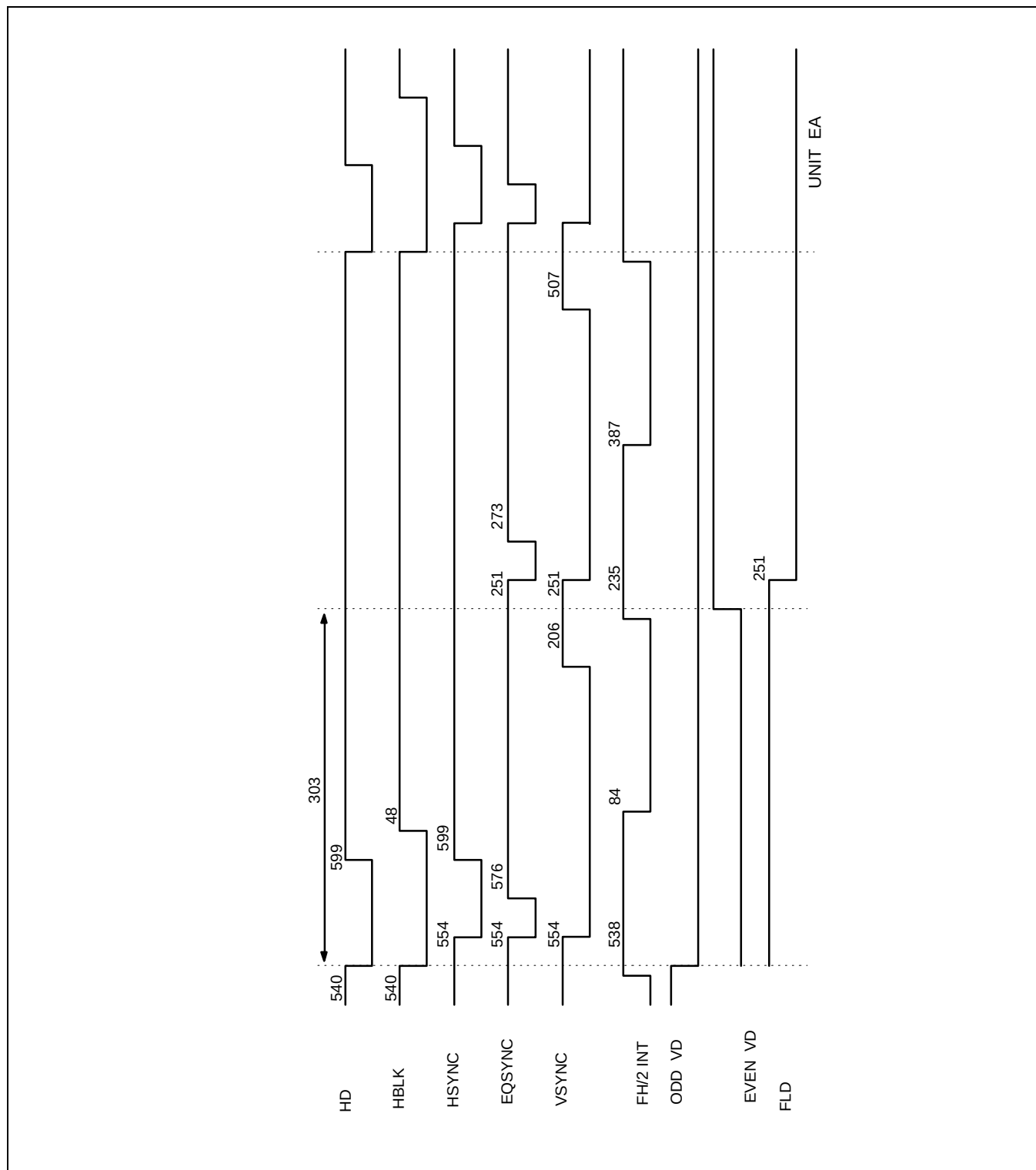
## HORIZONTAL TIMING CHART FOR EIA NORMAL



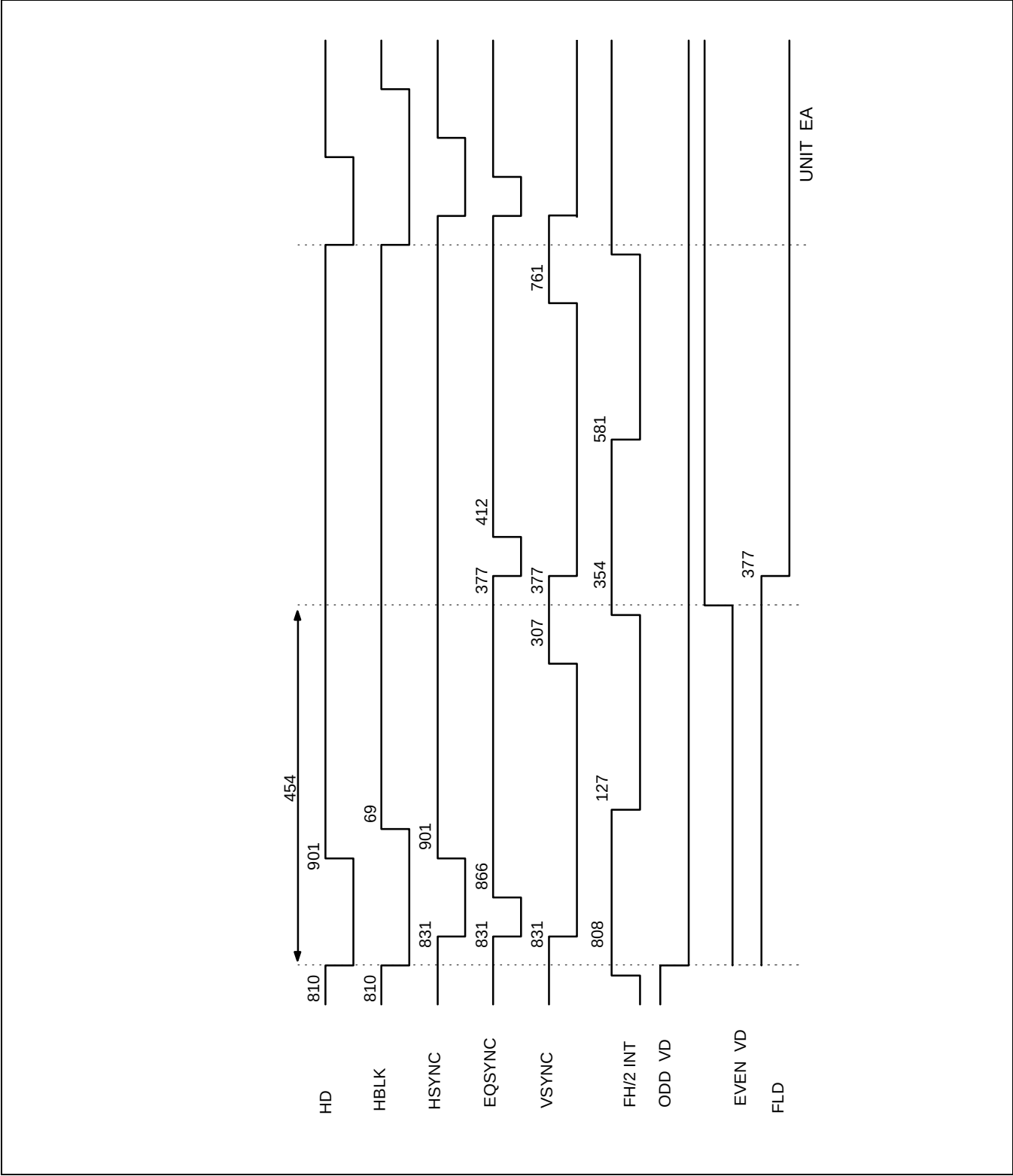
HORIZONTAL TIMING CHART FOR EIA Hi- 8



## HORIZONTAL TIMING CHART FOR CCIR NORMAL

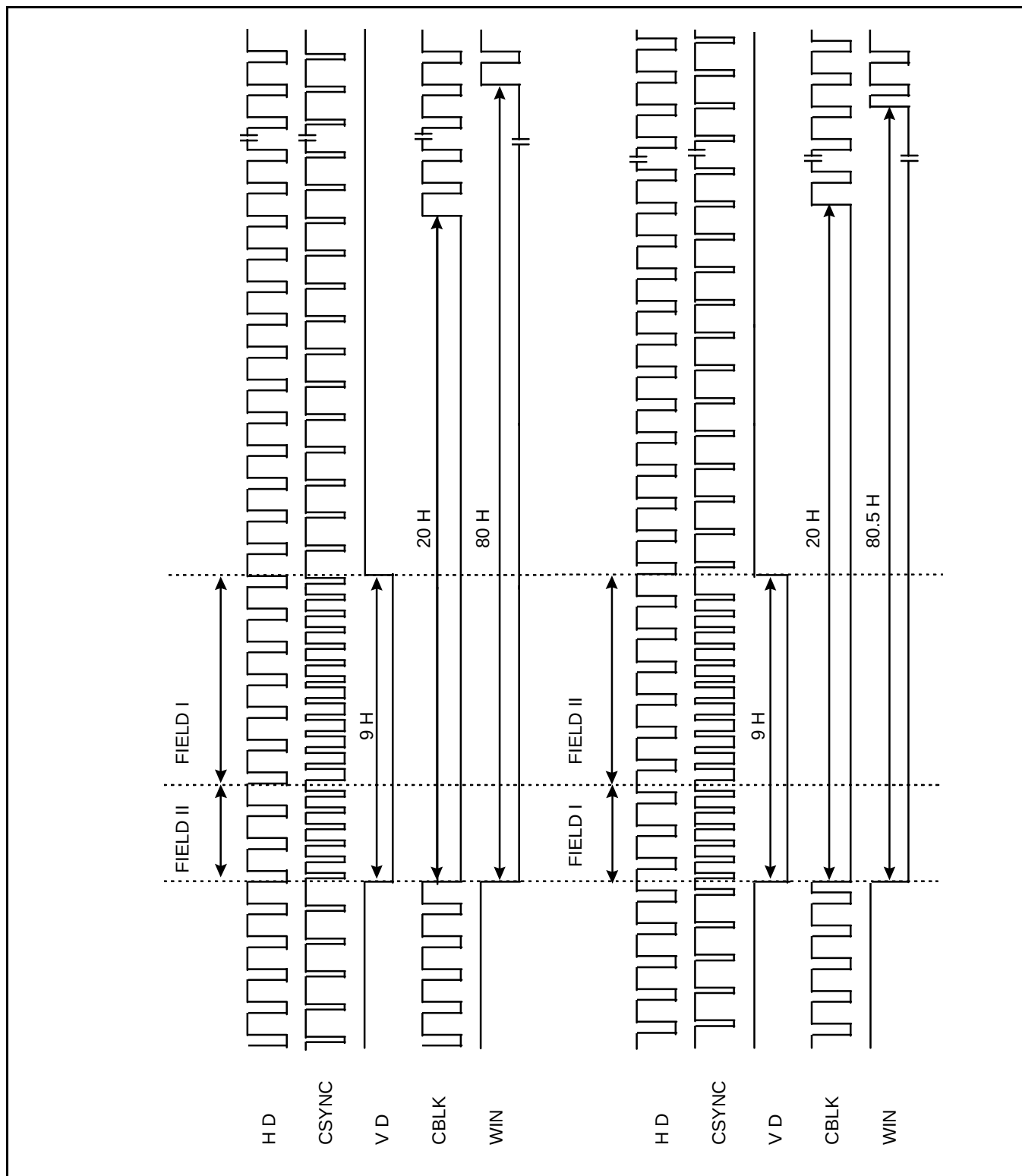


HORIZONTAL TIMING CHART FOR CCIR Hi- 8

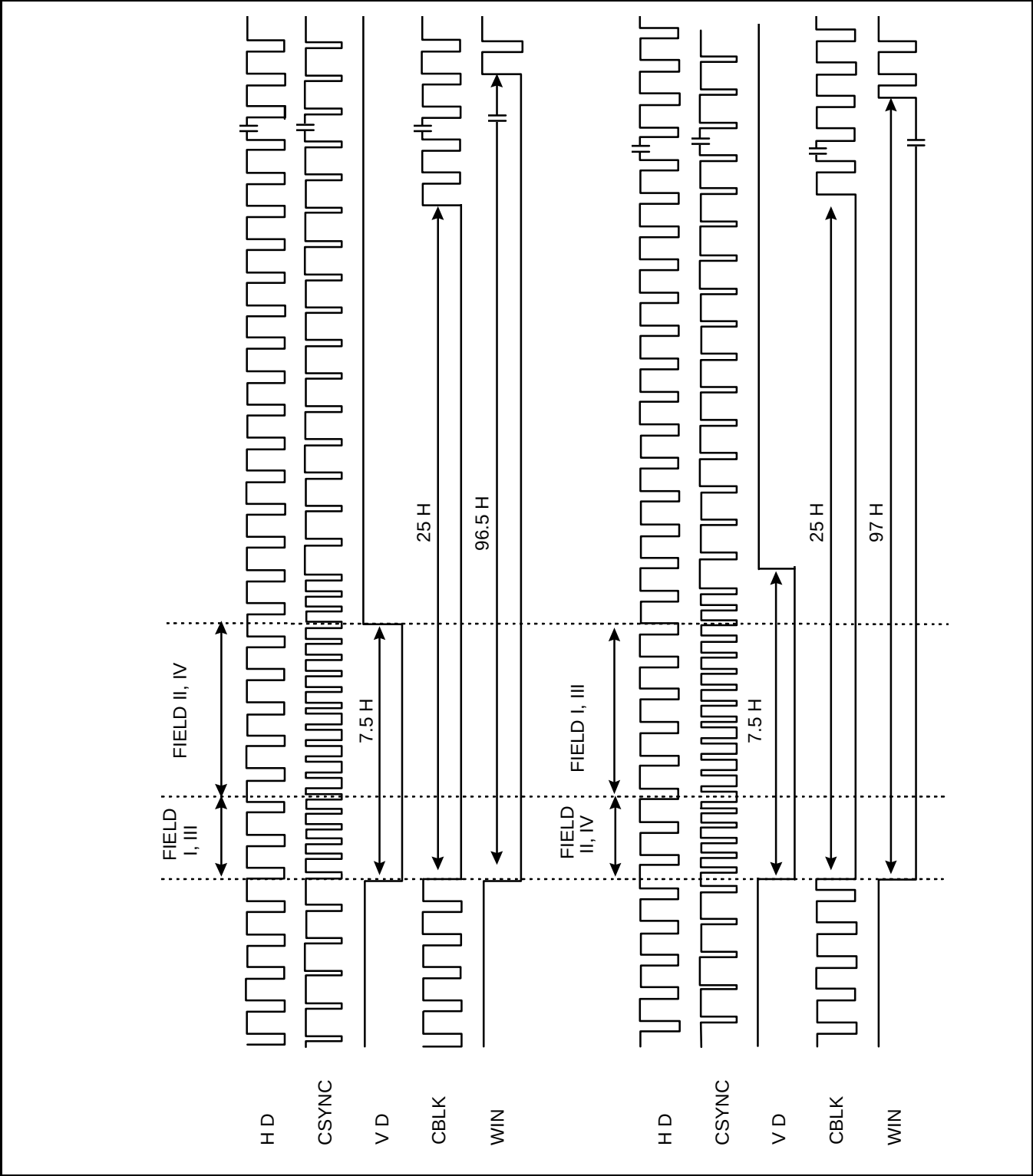




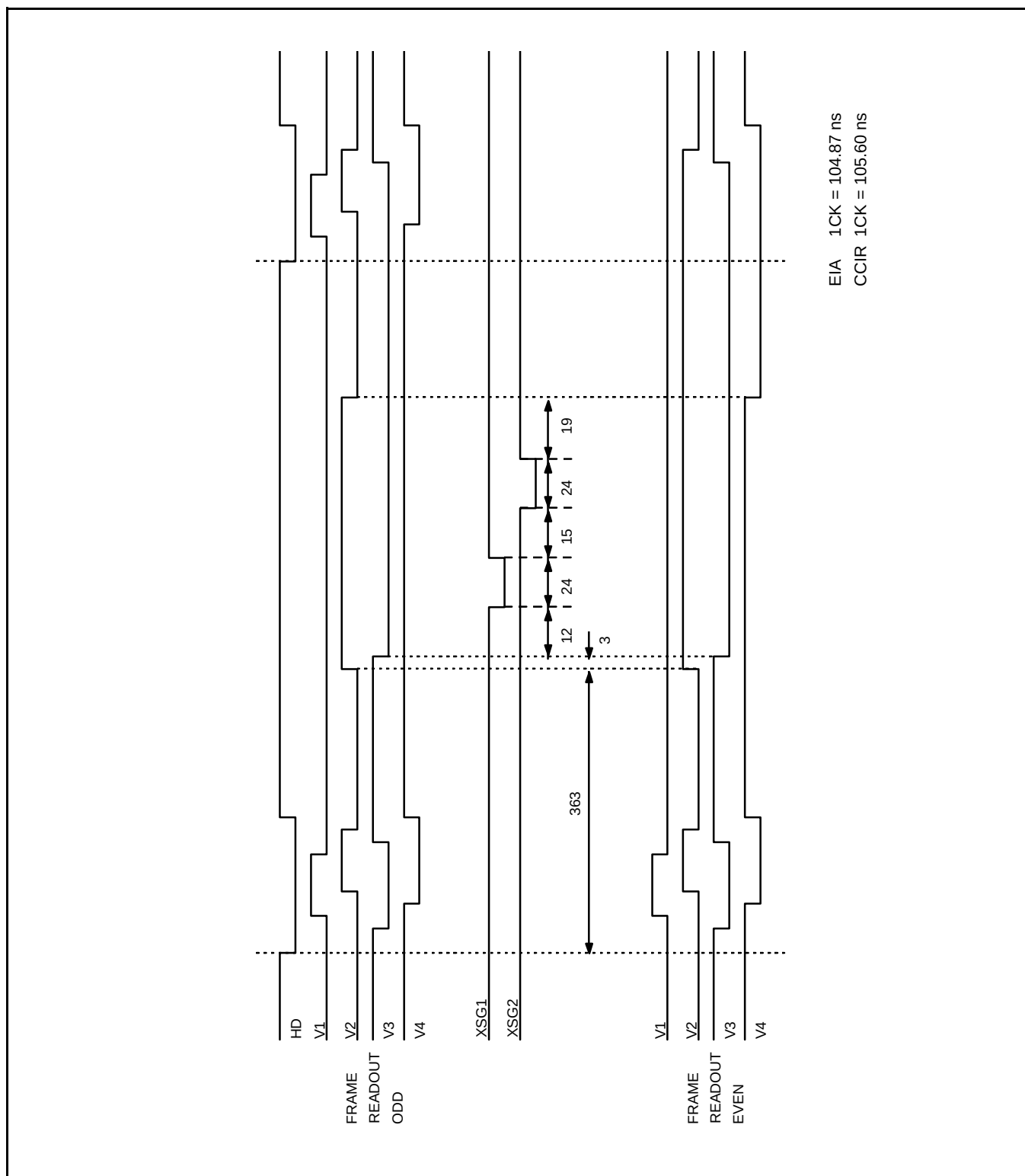
## VERTICAL TIMING CHART FOR EIA



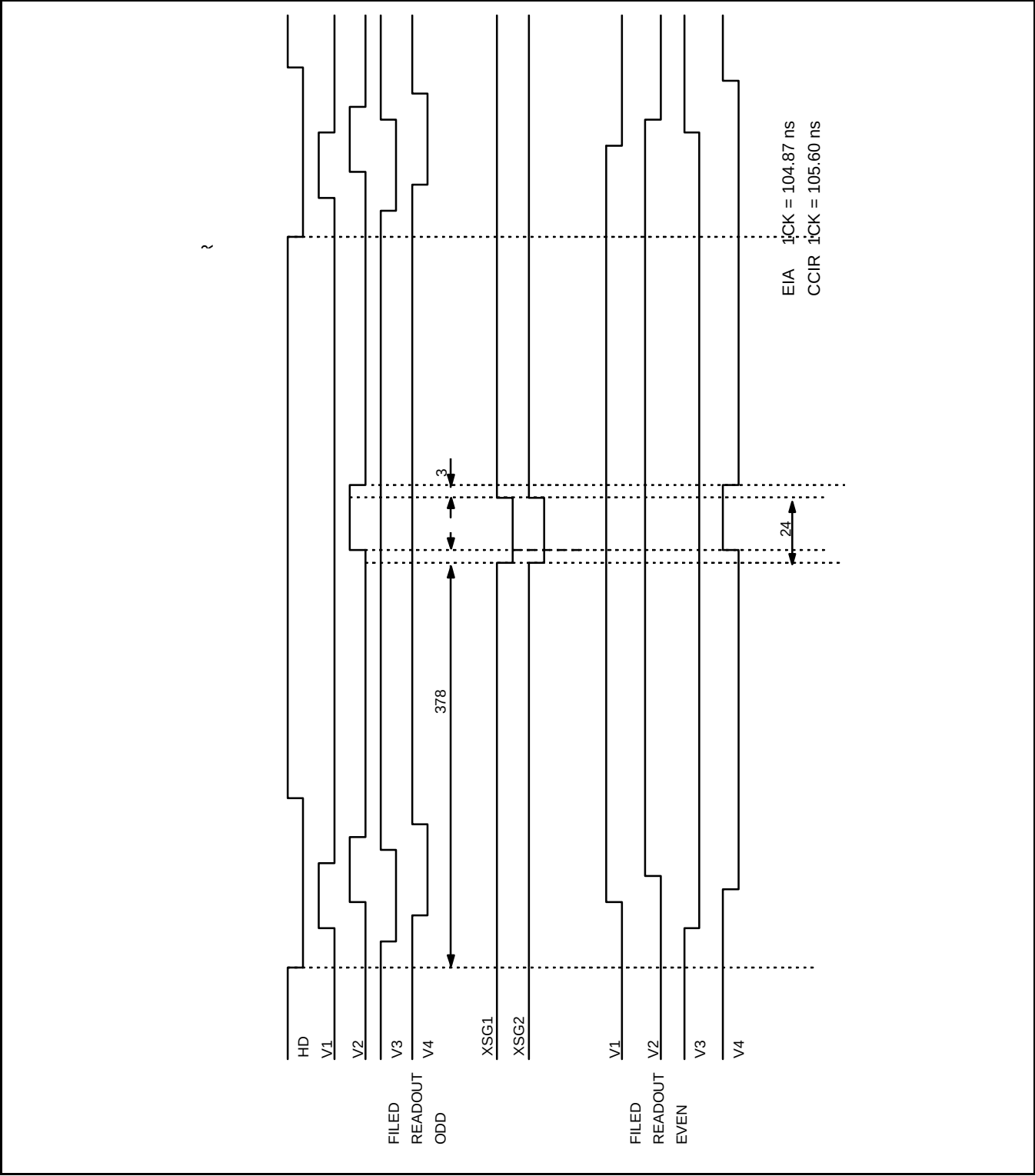
VERTICAL TIMING CHART FOR CCIR



## VERTICAL CCD REGISTER DRIVING PULSE TIMING CHART FOR NORMAL EIA AND CCIR

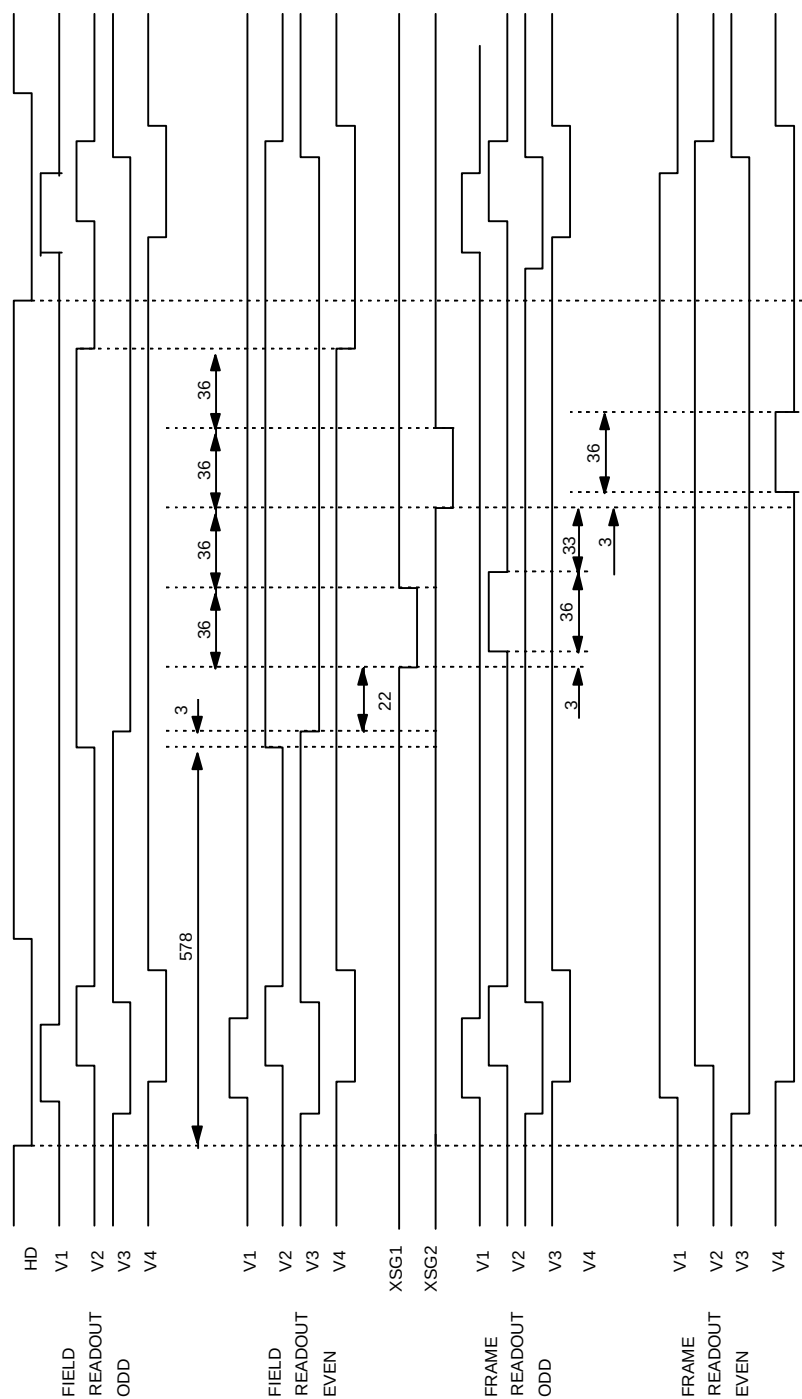


VERTICAL CCD REGISTER DRIVING PULSE TIMING CHART FOR NORMAL EIA AND CCIR



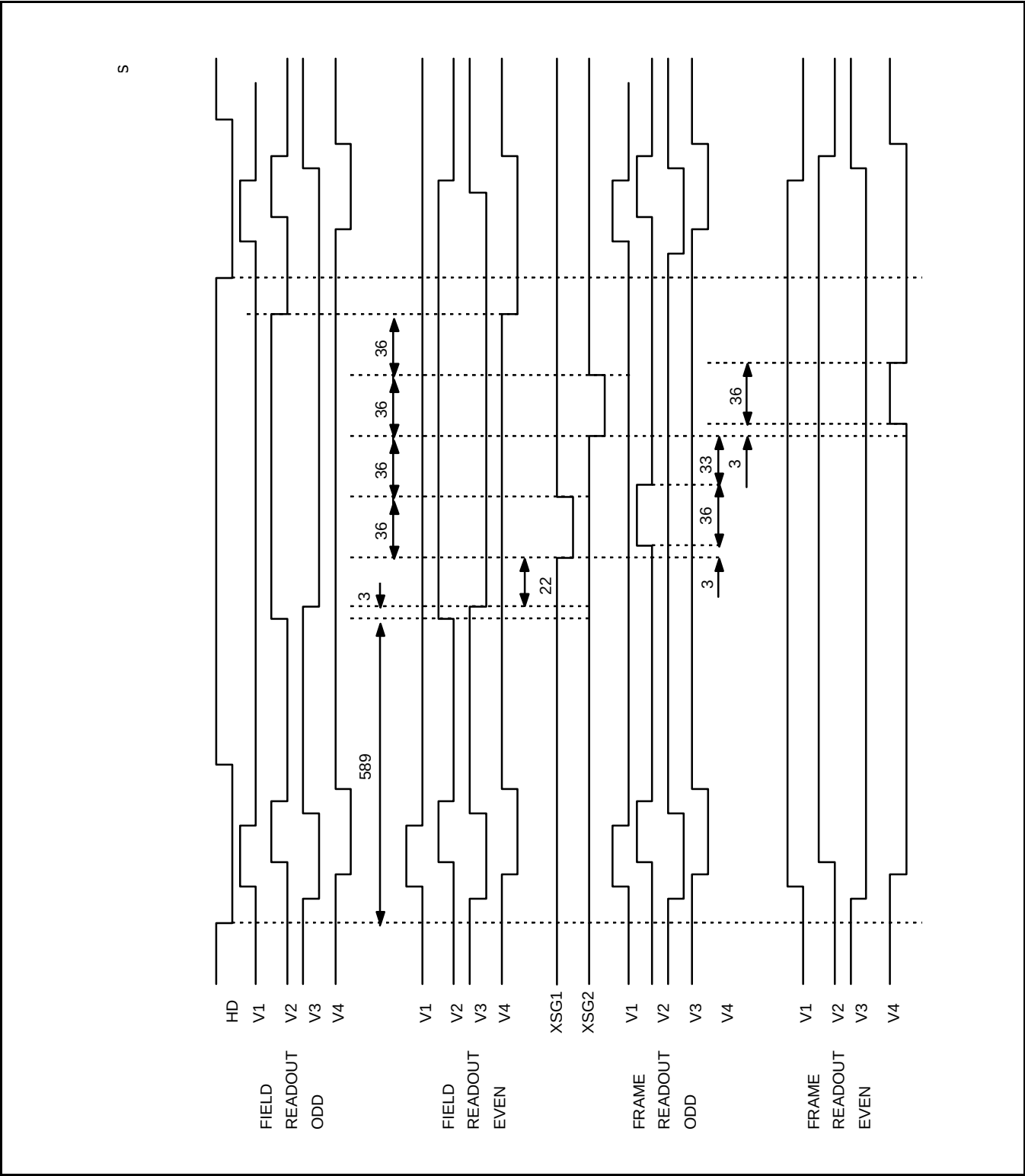
## VERTICAL CCD REGISTER DRIVING PULSE TIMING CHART FOR Hi- 8 EIA

UNIT : 1CK = 69.84ns

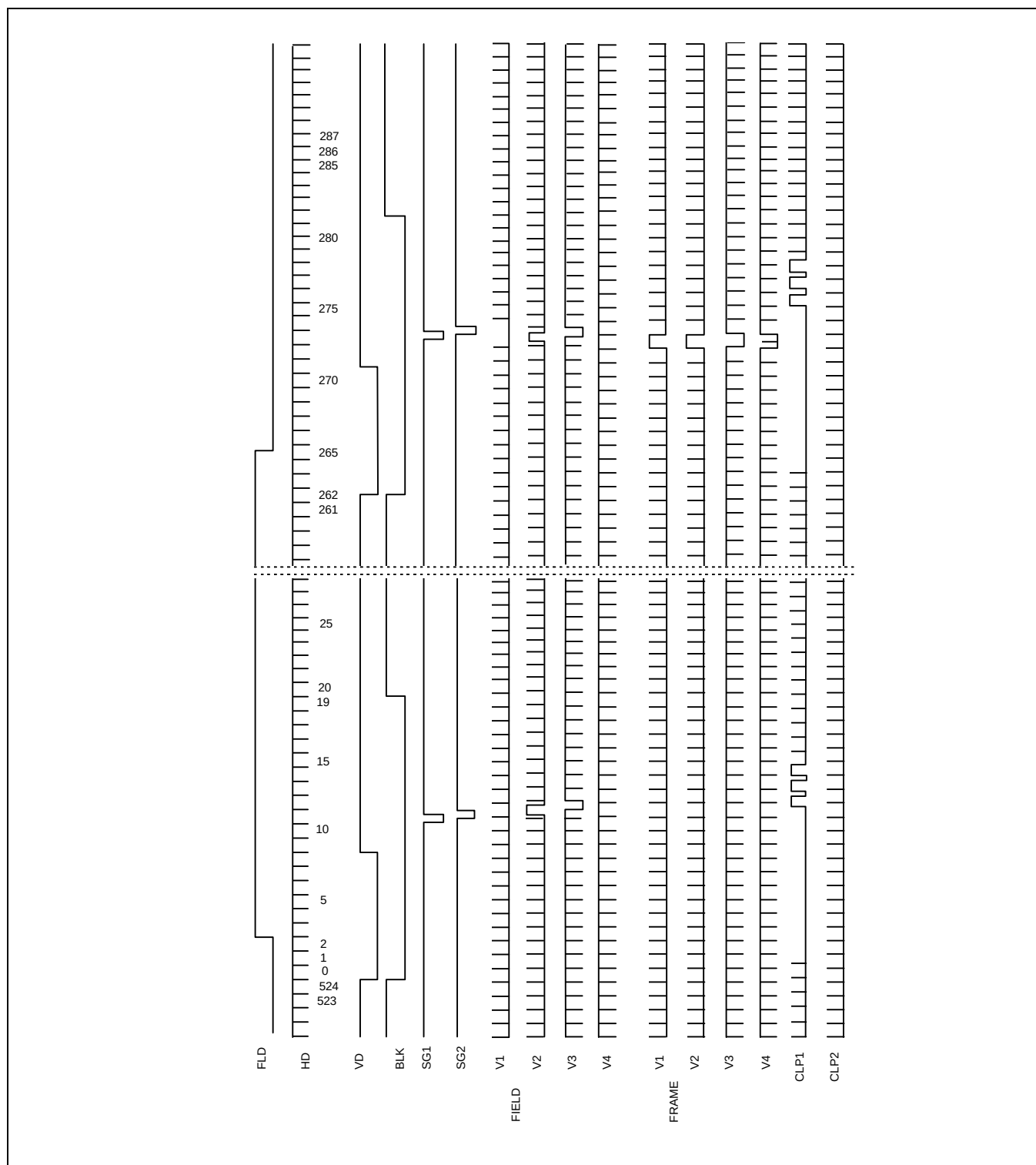


VERTICAL CCD REGISTER DRIVING PULSE TIMING CHART FOR Hi- 8 CCIR

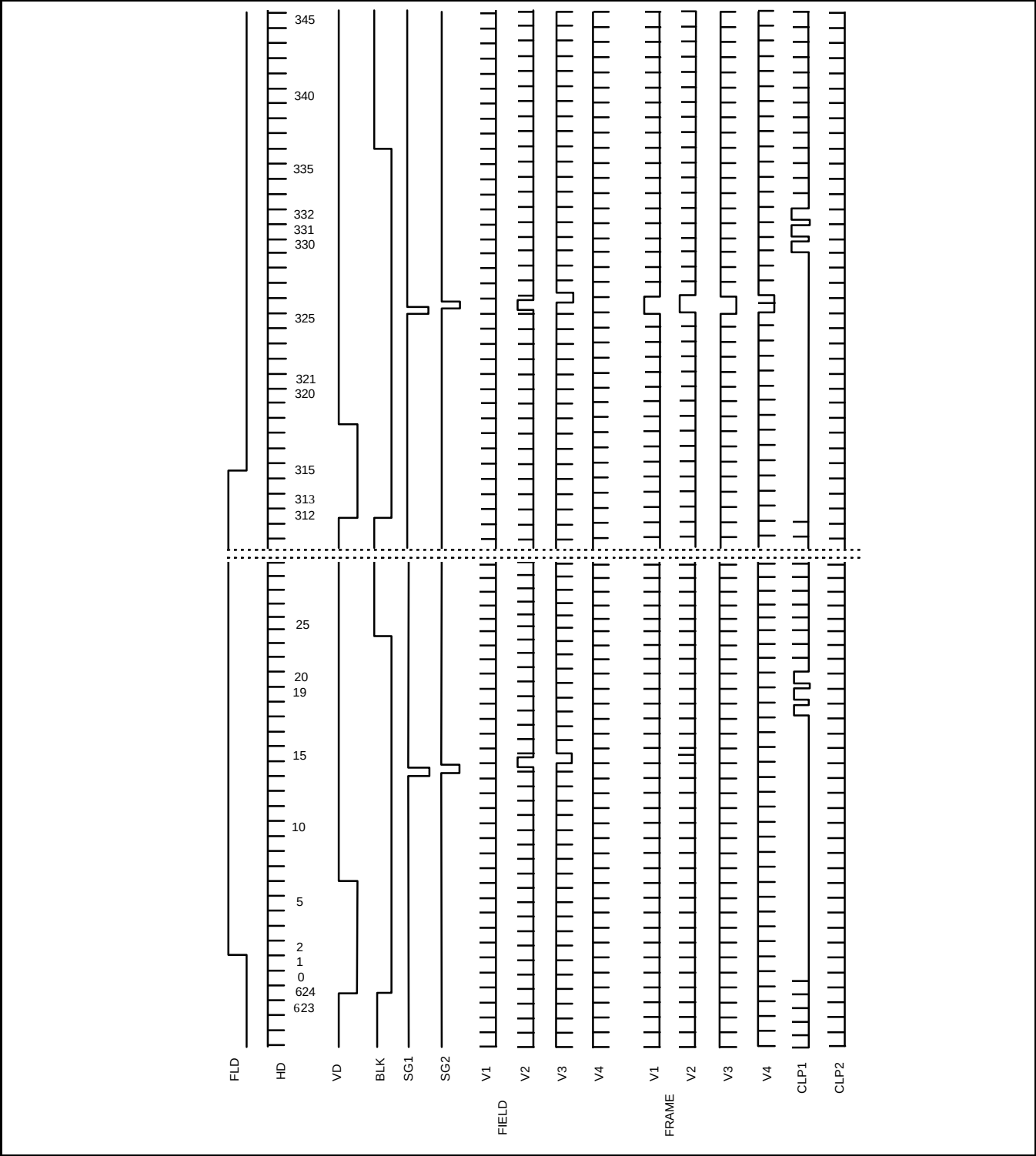
UNIT : 1CK = 70.48ns



## NORMAL EIA VERTICAL TIMING CHART AT INTERLACE

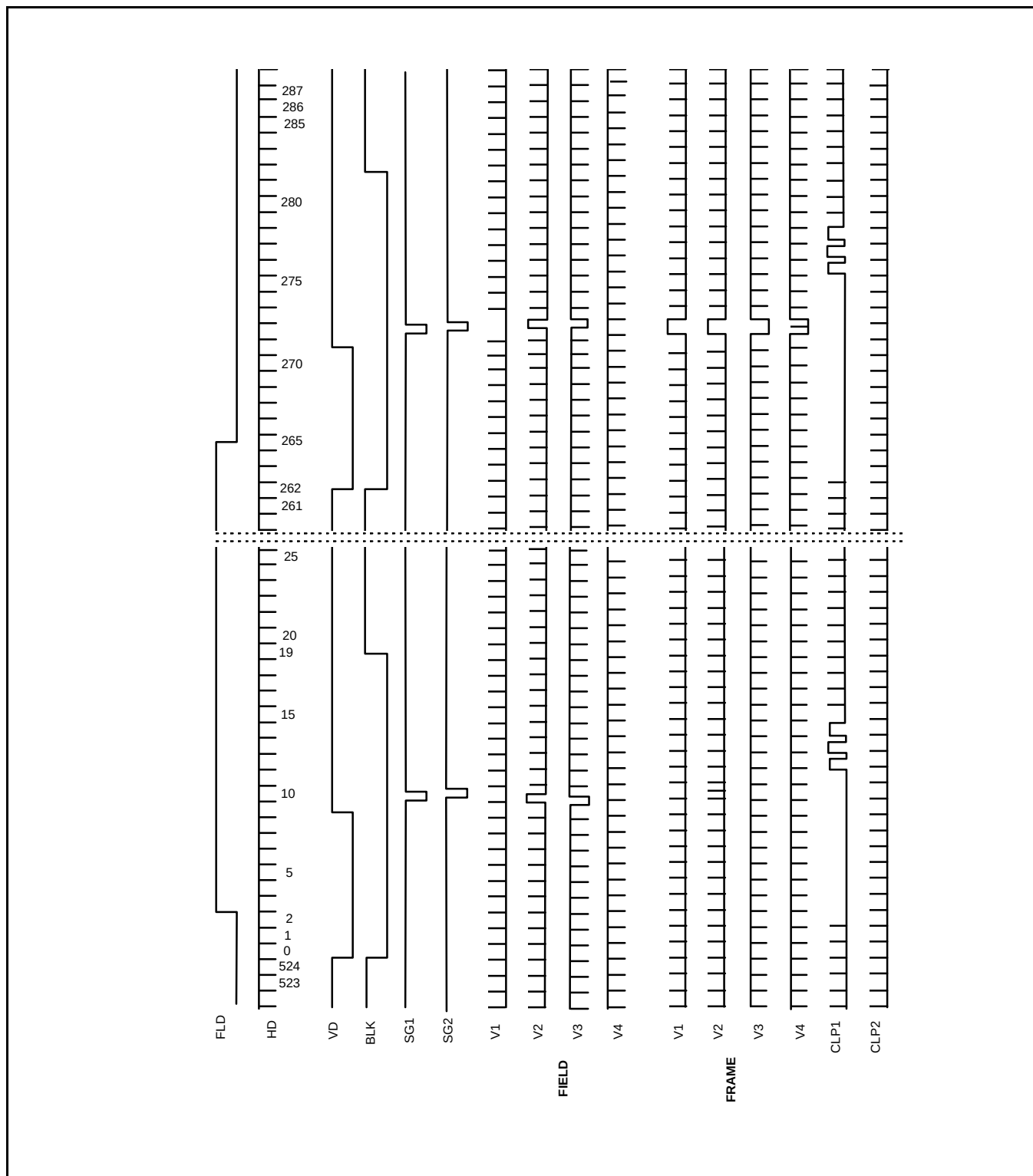


NORMAL CCIR VERTICAL TIMING CHART AT INTERLACE

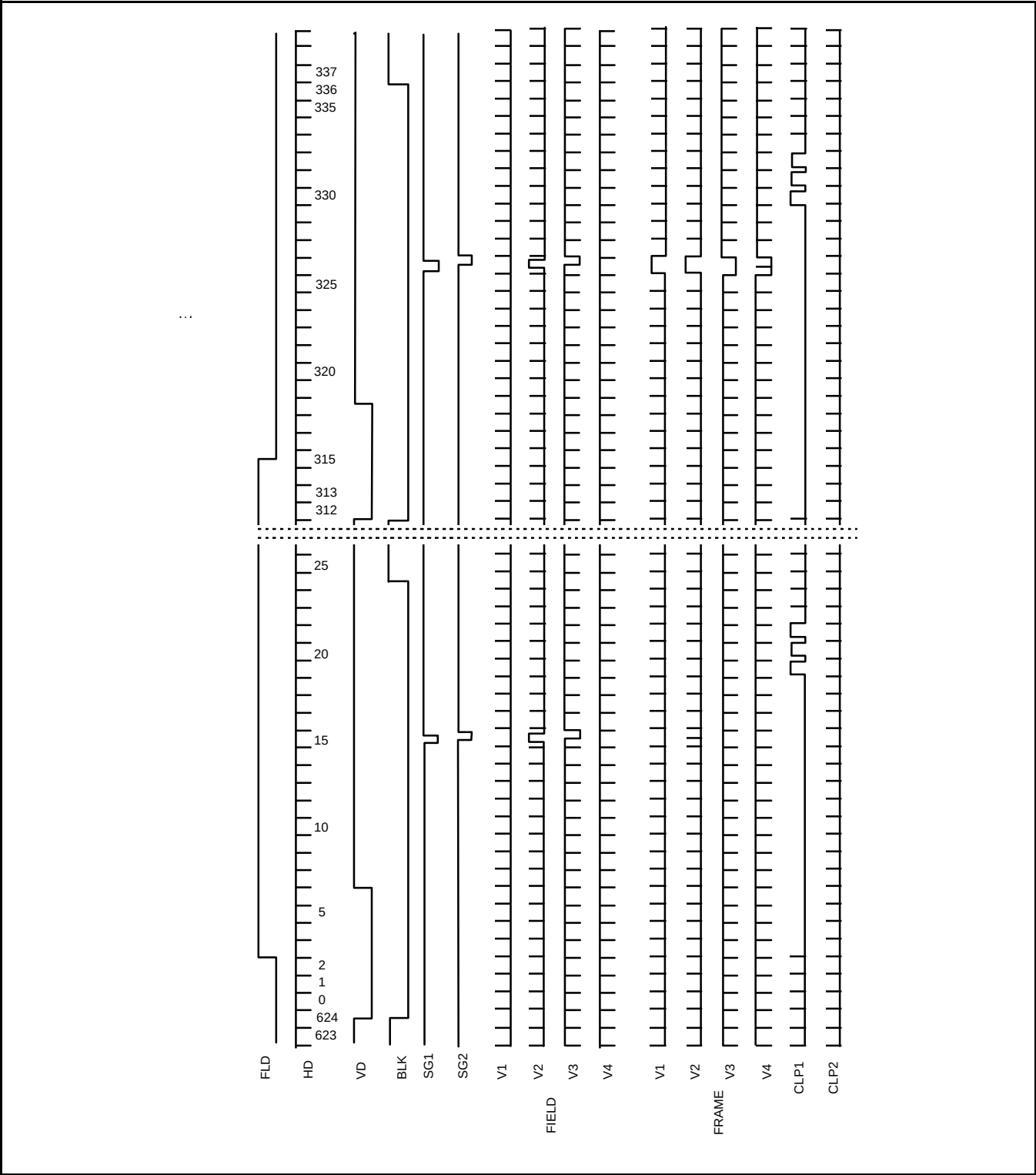




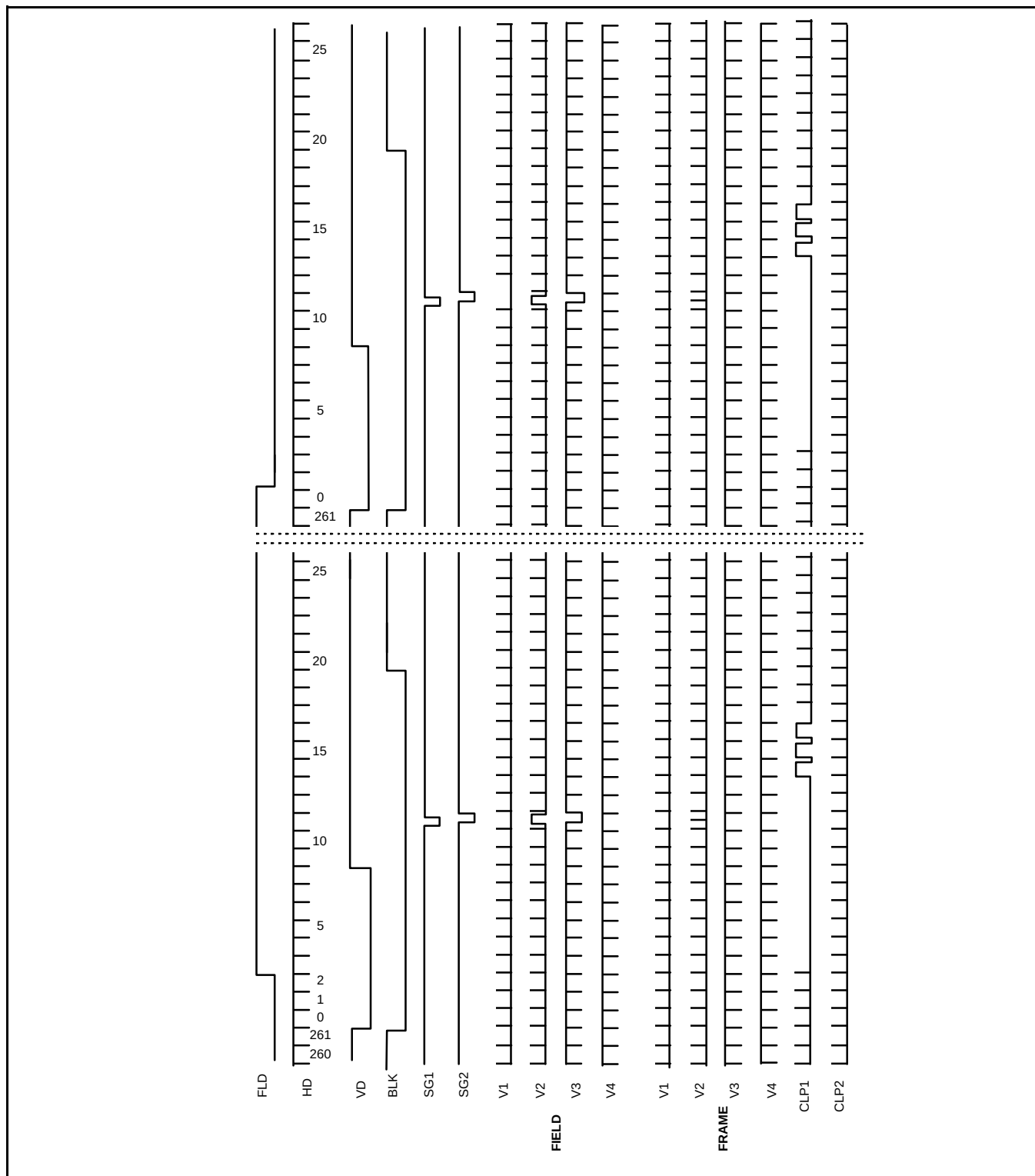
## Hi- 8 EIA VERTICAL TIMING CHART AT INTERLACE



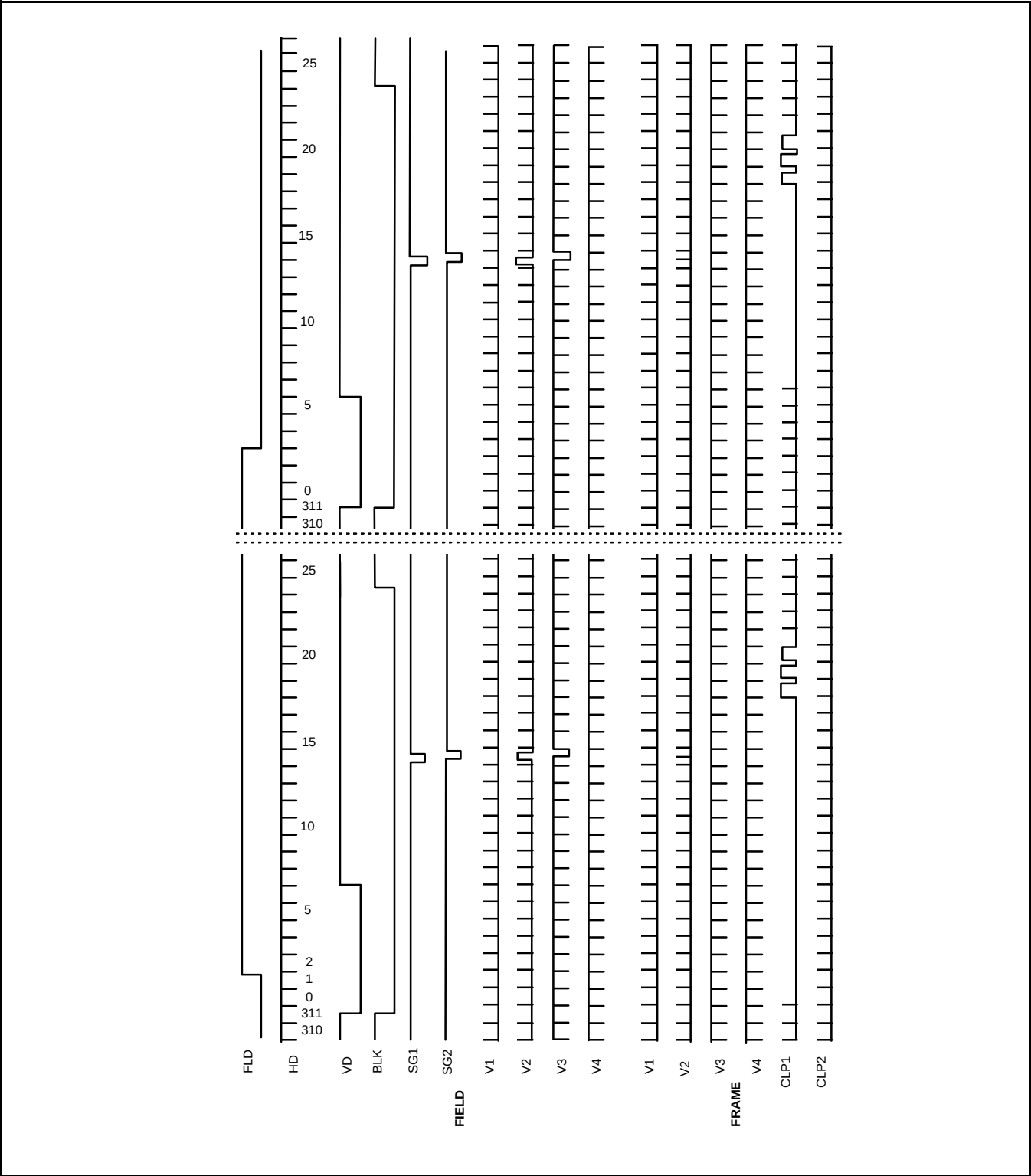
Hi- 8 CCIR VERTICAL TIMING CHART AT INTERLACE



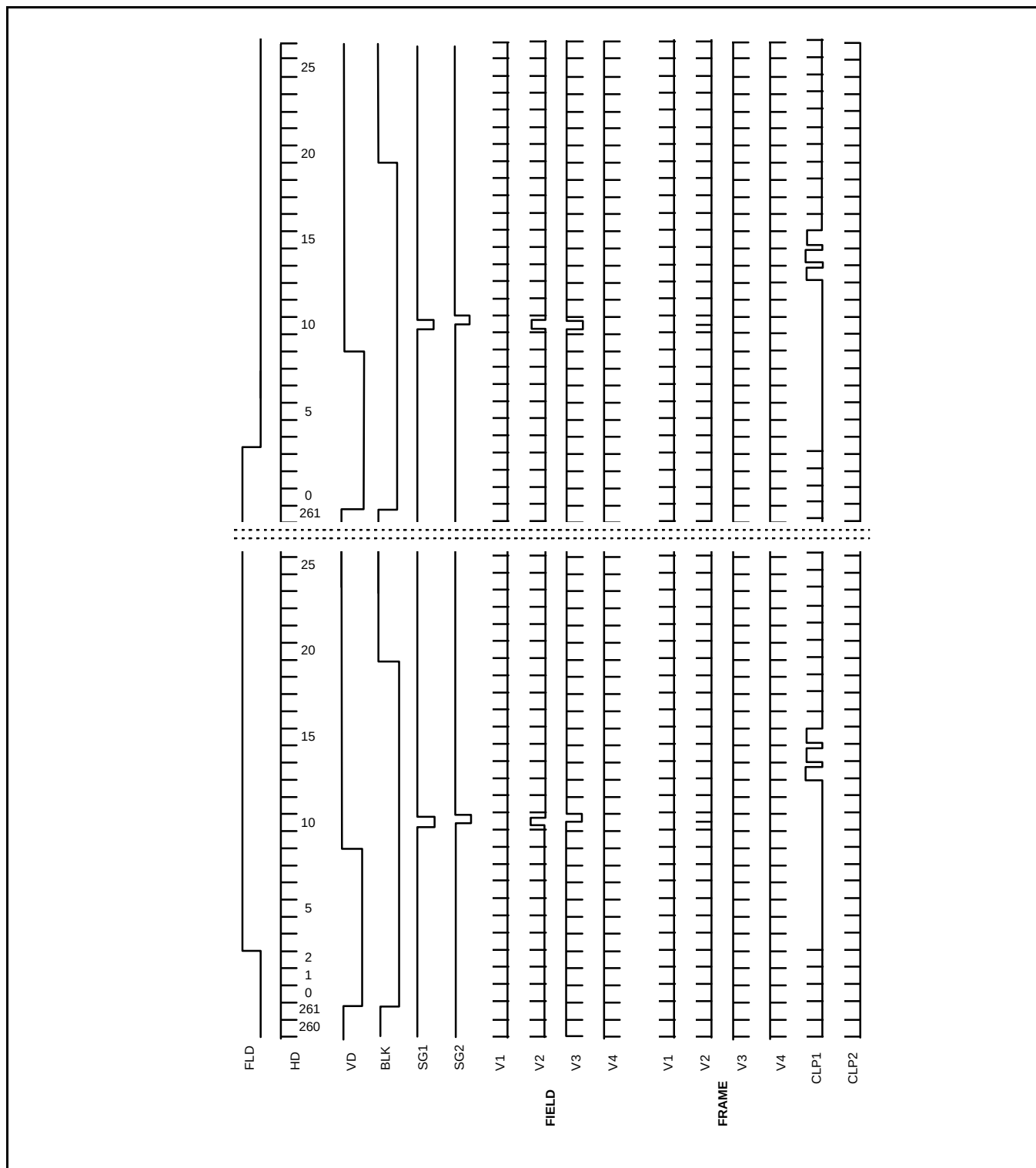
## NORMAL EIA VERTICAL TIMING CHART AT NON- INTERLACE



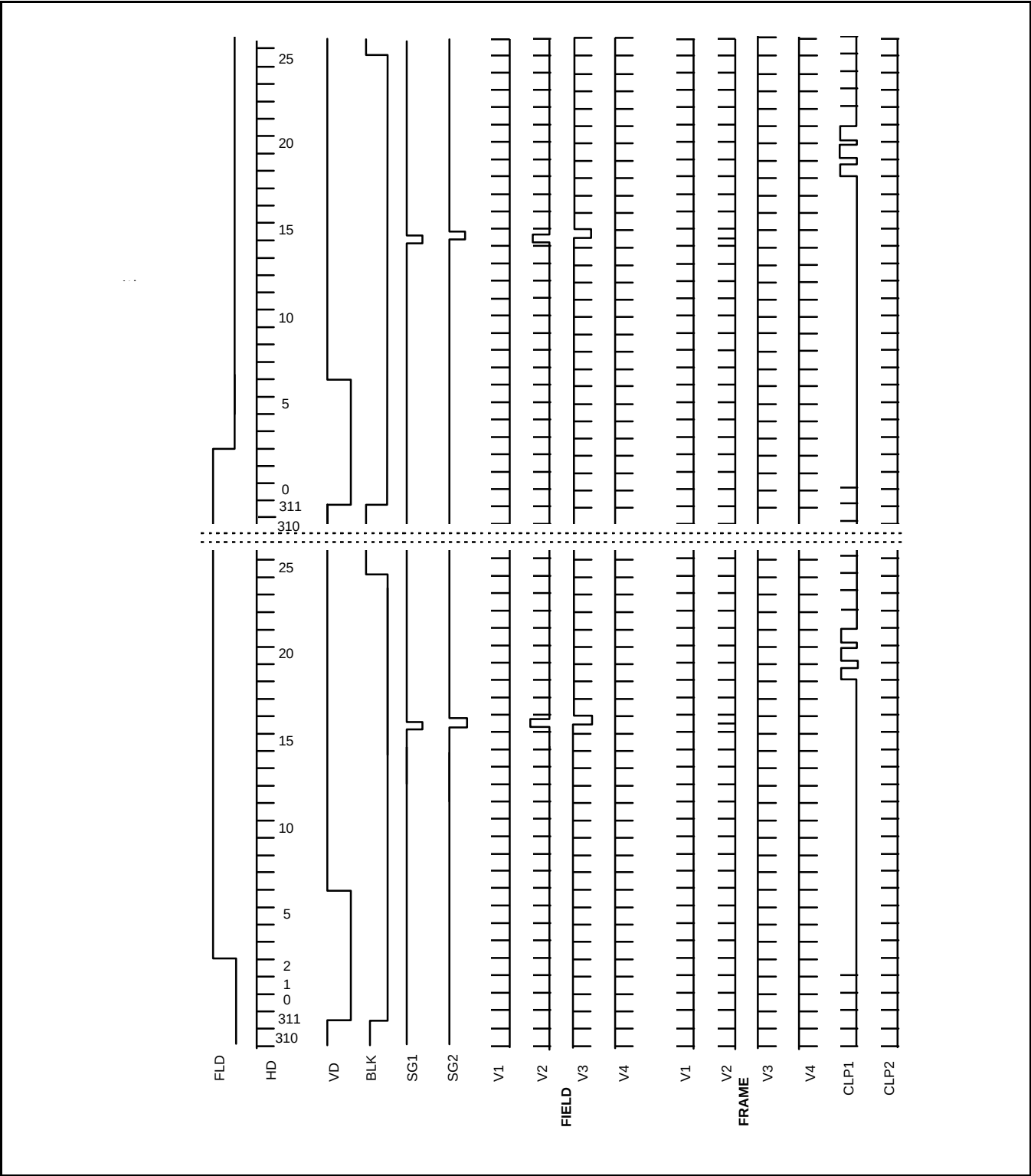
NORMAL CCIR VERTICAL TIMING CHART AT NON- INTERLACE



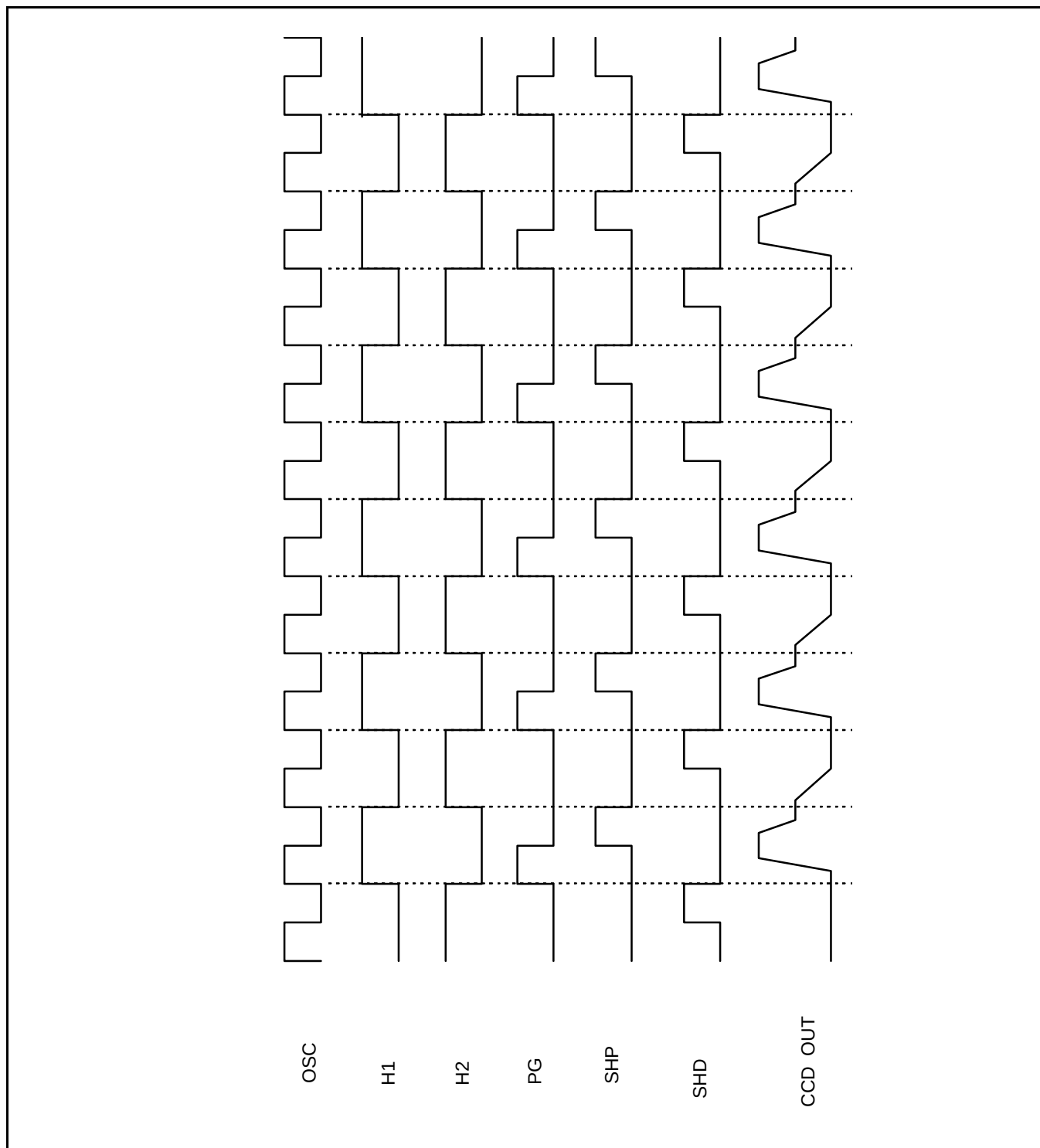
## Hi- 8 EIA VERTICAL TIMING CHART AT NON- INTERLACE



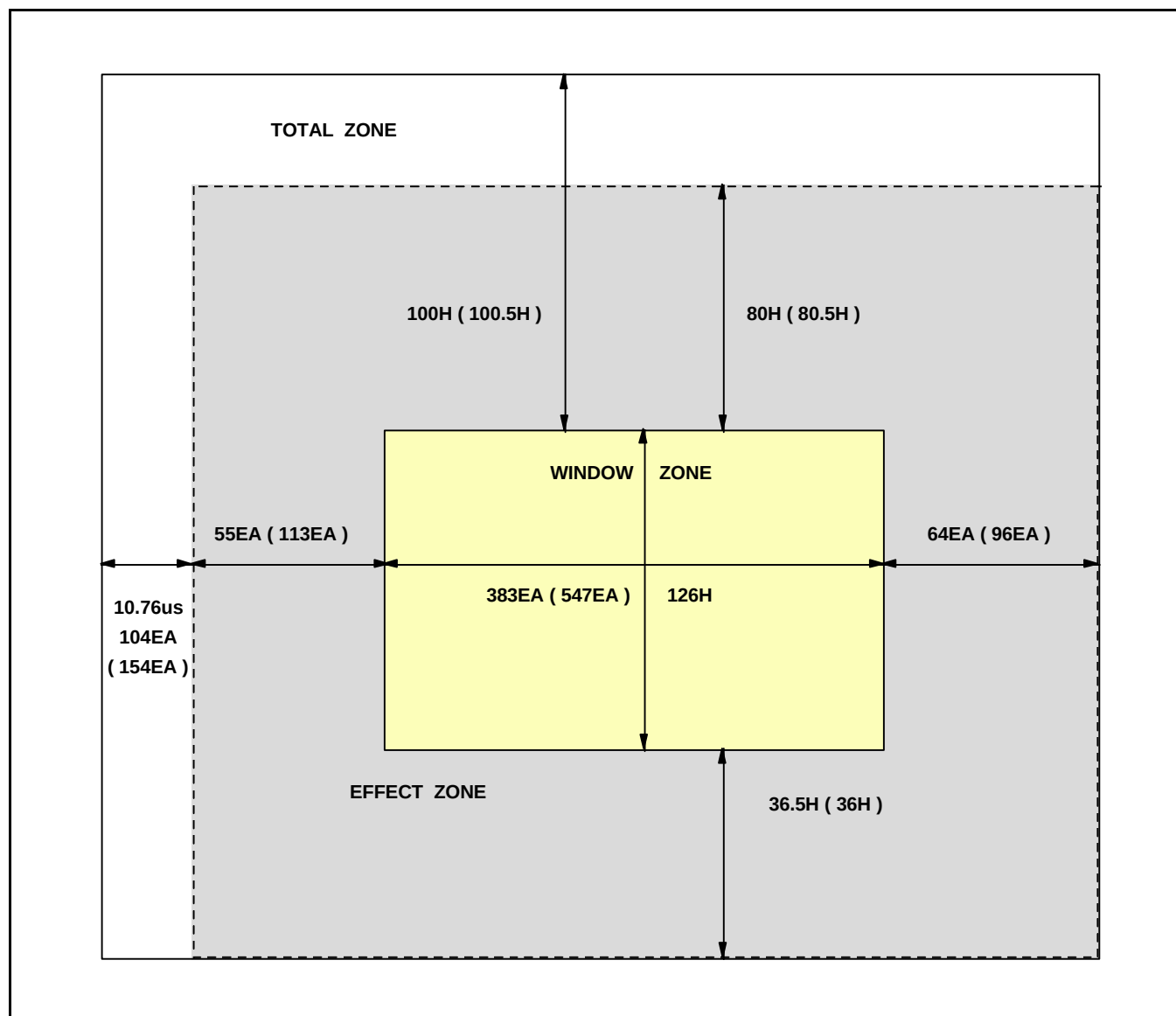
Hi- 8 CCIR VERTICAL TIMING CHART AT NON- INTERLACE



## HIGH SPEED PHASE TIMING CHART

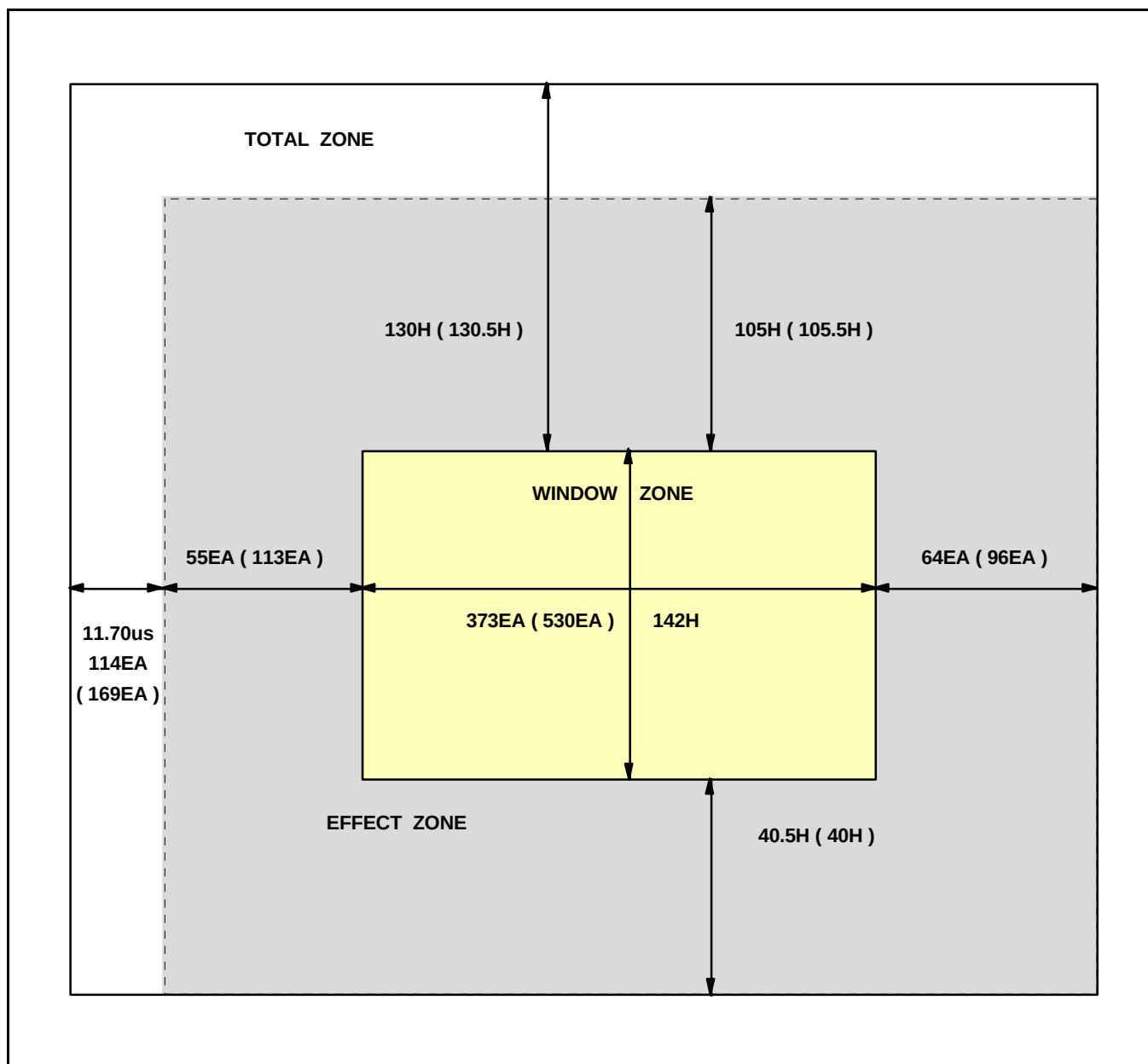


## EIA NORMAL / Hi- 8 WINDOWS AREA





## CCIR NORMAL / Hi- 8 WINDOWS AREA



## APPLICATION EXAMPLE

(EIA NORMAL AUTO IRIS MODE APPLICATION)

