



>> DATA SHEET

(DOC No. HX8218-A-DS)

>> HX8218-A

960CH TFT LCD Source Driver with
Built-in T-CON

Preliminary version 01 January, 2005

>> **HX8218-A**

960CH TFT LCD Source Driver with
Built-in T-CON



Himax Technologies, Inc.
<http://www.himax.com.tw>

Preliminary Version 01

January, 2005

1. General Description

HX8218-A is a 960-channel output Source Driver with built-in TCON and DAC. The interface follows digital 8-bits serial/24-bits parallel RGB, or CCIR601/656 input signals and digital control timing signals. The DAC supports transferring digital RGB data to analog RGB data for the internal Source Driver. The TCON generates the 960x240 resolution timing to Source driver and Gate Driver.

The Source Driver implements 2 lines of sample and hold circuits. While sampling video signals, the previously sampled data can be output synchronously through driver output channels. And simultaneous or sequential sampling can be chosen for matching the pixel array type.

The timing controller provides horizontal and vertical control timing to source and gate drivers. With built-in DAC and operational amplifiers, the gamma correction can be performed and digital data is converted to analog signal and sends to source driver.

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2. Features

T-CON

- Support display resolution 960x240.
- Support digital 8-bits serial/24-bits parallel RGB and CCIR601/656 input mode.
- Support two types of panel group.
- Operation frequency: 30 MHz max.
- Support NTSC/PAL TV system.
- Built-in zoom in/out function in CCIR601/656 input mode.
- OSD overlay supported in CCIR601/656 input mode.
- Line inversion driving scheme.
- Provide source and gate drivers control timing.
- Provide flip and mirror scan control.
- Operation Voltage Level 3V~3.6V.

Source Driver

- 5V analog power supply.
- Dynamic range: 0.1 ~ 4.9V.
- Voltage deviation of outputs: $\pm 20\text{mV}$.
- 960 channels output source driver for TFT LCD panel.
- Applicable to stripe and delta pattern color filter.
- Simultaneous or sequential sampling is selectable as matching pixel array type.
- Include 2 lines of sample and hold circuit.
- Right and left shift capability.
- LCD power: 3.8~5.5V.

DAC

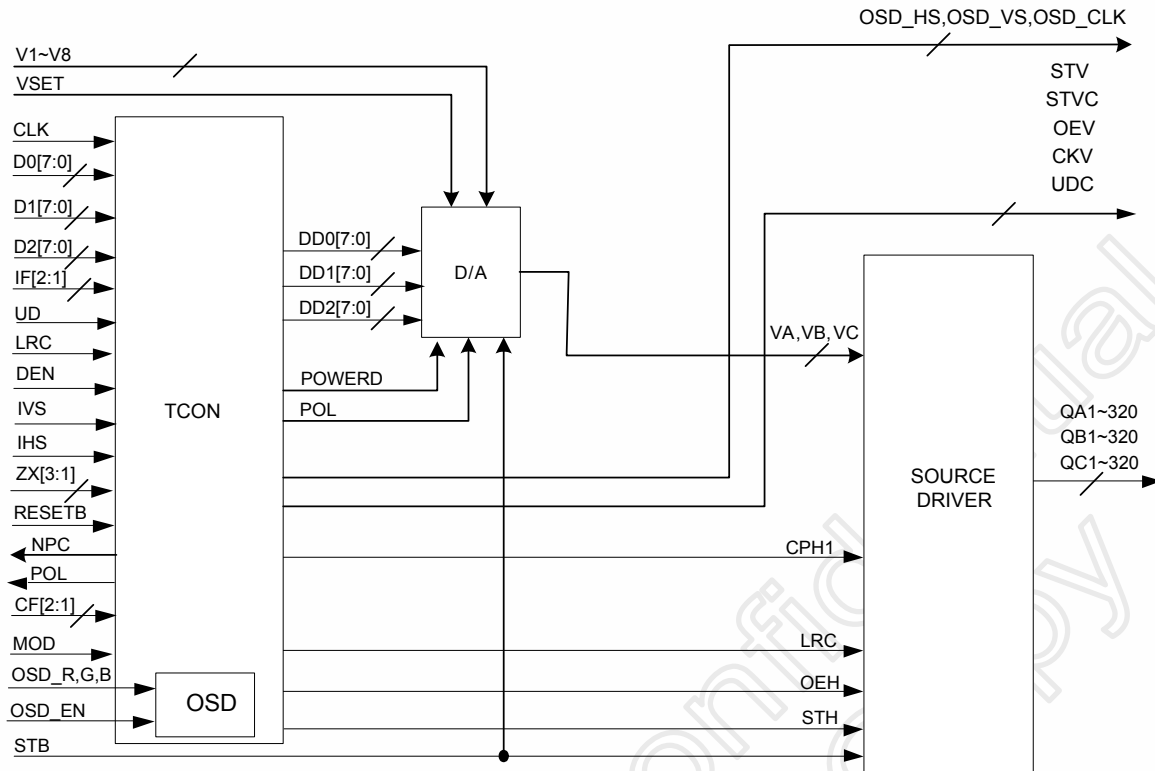
- Support 8 bits Digital Data Input (RGB), and output the analog RGB.
- 5V Operation voltage.

Package

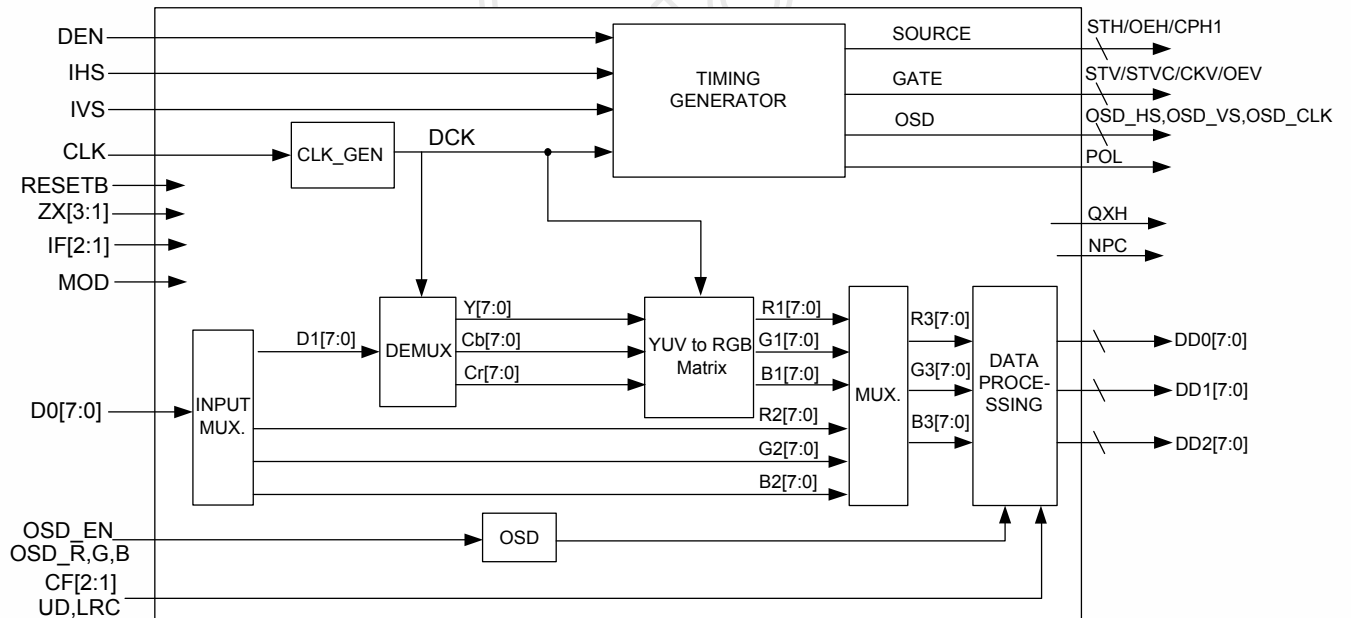
- Bare chip with gold bumper for COG solution.

3. Block Diagram

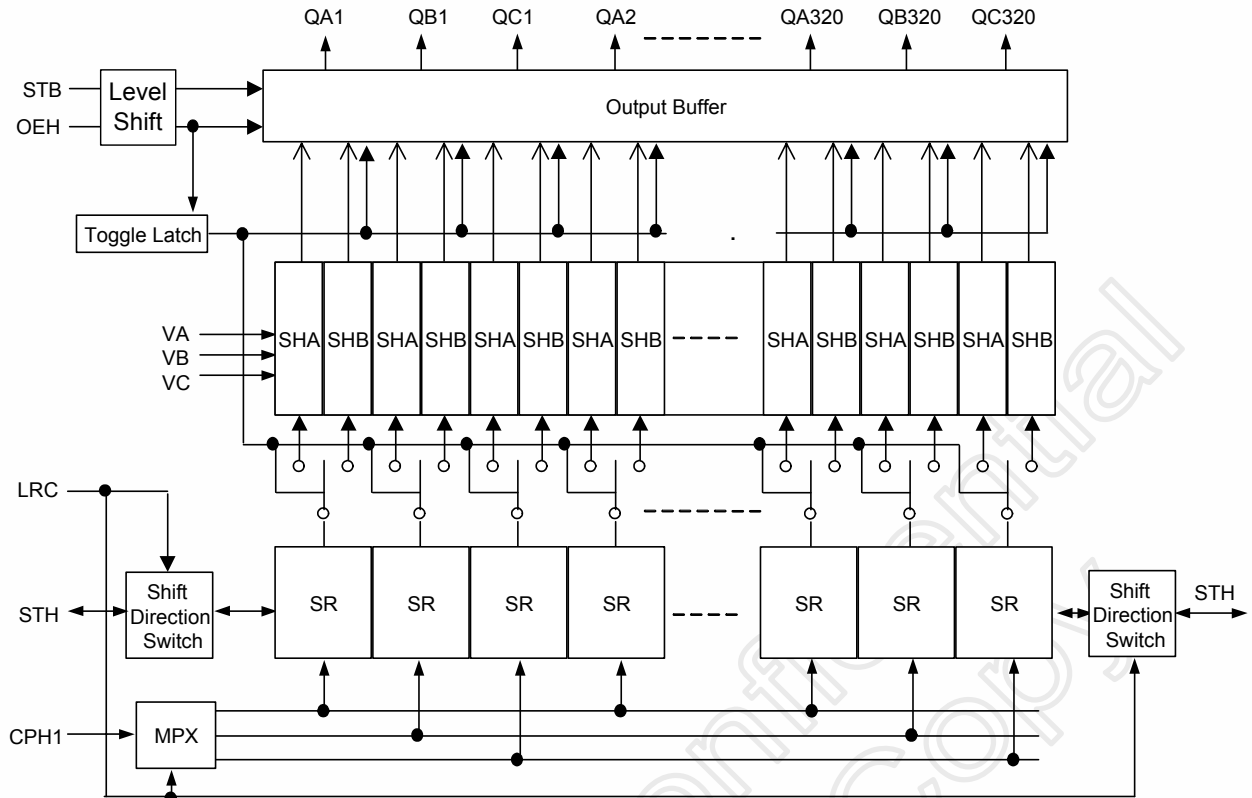
3.1 Whole chip block diagram



3.2 Timing controller block diagram



3.3 Source driver block diagram



4. Pin description

| Pin name | I/O | Description | |
|-------------------------------|---------|--|-------------------|
| CLK | I | Clock signal. Latching data at the rising edge. | |
| D07~D00 D17~D10 D27~D20 | I | Digital data input. DX0 is LSB and DX7 is MSB. 1. If parallel RGB input mode is used, D0X, D1X, and D2X indicate R, G, and B data in turn. 2. If serial RGB or CCIR601/656 input mode is selected, only D07~D00 are used, and others short to GND. | |
| IHS | I | Horizontal sync input in digital RGB mode. Or HREF input in CCIR601 mode. (Short to GND if not used) | |
| IVS | I | Vertical sync input in digital RGB mode. Or V123 input in CCIR601 mode. (Short to GND if not used) | |
| DEN | I | Input data enable control. Normally pull low. | |
| LRC | I | The shift direction of device internal shift register is controlled by this pin as shown below: LRC=H: STH→OUT1→...→OUT480→STHO LRC=L: STH→OUT480→...→OUT1→STHO | |
| POL | O | Polarity select for the line inversion control signal. When POL=L, output voltage is negative polarity. When POL=H, output voltage is positive polarity. | |
| STB | I | Standby mode control. Normally pull high. When STB="L", source driver and DAC are off. All outputs are shorted to VSS. When STB="H", source driver and DAC are on. | |
| RESETB | I | Hardware global reset. Low active. Normally pull high. | |
| NPC | O | NTSC or PAL mode auto detection result. When NPC="H", NTSC mode is selected. When NPC="L", PAL mode is selected. | |
| UD | I | Up/down scan setting. When UD="H", reverse scan. When UD="L", normal scan. | |
| V1~V8 | I | Gamma correction voltage for DAC. | |
| VSET | I | Gamma correction voltage is set internally or externally. Normally pull high. VSET="L", internally. VSET="H", externally. | |
| IF1, IF2 | I | Control the input data format. | |
| | | IF2, IF1 | Input data format |
| | | L, L (default) | Serial RGB |
| | | L, H | Parallel RGB |
| | | H, L | CCIR601 |
| H, H | CCIR656 | | |
| CF1 | I | Define the input data sequence in serial RGB mode. Please reference section5.5. Only effective when MOD="L". Normally pull low. | |
| CF2 | I | Define the used delta type color filter. Please reference section5.5. Only effective if MOD="L". Normally pull low. | |
| MOD | I | Define the color filter type. Normally pull low. When MOD="L", delta type. When MOD="H", stripe type. | |
| ZX1~3 | I | Zoom in/out modes setting pin. Zoom function is only active in CCIR601/656 input mode. Normally pull high. Reference 5.7. | |

| Pin name | I/O | Description |
|-------------------------------|-----|--|
| QXH | O | Reference signal for video decoder to arrange data sequence. |
| CKV | O | Gate driver clock. |
| OEV | O | Output enable control of gate driver. |
| STV | O | When UD="L", STV is output. When UD="H", STV is Hi-Z. |
| STVC | O | When UD="L", STVC is Hi-Z. When UD="H", STVC is output. |
| OSD_HS | O | OSD Hsync output. |
| OSD_VS | O | OSD Vsync output. |
| OSD_CLK | O | OSD clock output. |
| OSD_R | I | OSD red data input. Normally pull low. |
| OSD_G | I | OSD green data input. Normally pull low. |
| OSD_B | I | OSD blue data input. Normally pull low. |
| OSD_EN | I | OSD enable input. Normally pull low. |
| VDD | I | Analog power. 4.5V ~ 5.5V. |
| VSS | I | Analog ground. |
| VCC | I | Digital power. 3V ~ 3.6V. |
| GND | I | Digital ground. |
| QA1~320 QB1~320 QC1~320 | O | Output driver signal. |
| SPCK | I | Serial port Clock. Normally pull high. |
| SPDA | I/O | Serial port Data input/output. |
| SPENA | I | Serial port Data Enable Signal. Normally pull high. |
| UDC | O | Reverse of UD. |
| UDP | O | Internal link to UD. |
| TP[13:0] | I/O | Test pins. They must be OPEN. |
| PASSR11 PASSR12 | - | Internal link together. |
| PASSR21 PASSR22 | - | Internal link together. |
| PASSR31 PASSR32 | - | Internal link together. |
| PASSR41 PASSR42 | - | Internal link together. |
| PASSR51 PASSR52 | - | Internal link together. |
| PASSL11 PASSL12 | - | Internal link together. |
| PASSL21 PASSL22 | - | Internal link together. |
| PASSL31 PASSL32 | - | Internal link together. |
| PASSL41 PASSL42 | - | Internal link together. |
| PASSL51 PASSL52 | - | Internal link together. |

5. Operation description

5.1 Relationship between input data and output channels

- Source Driver:

| | | | | | | | | | | | |
|-----|-------|-----|-----|-----|-----|-----|------|-------|-------|-------|--|
| LRC | First | | | | | → | Last | | | | |
| H | QA1 | QB1 | QC1 | QA2 | ... | ... | ... | QA320 | QB320 | QC320 | |

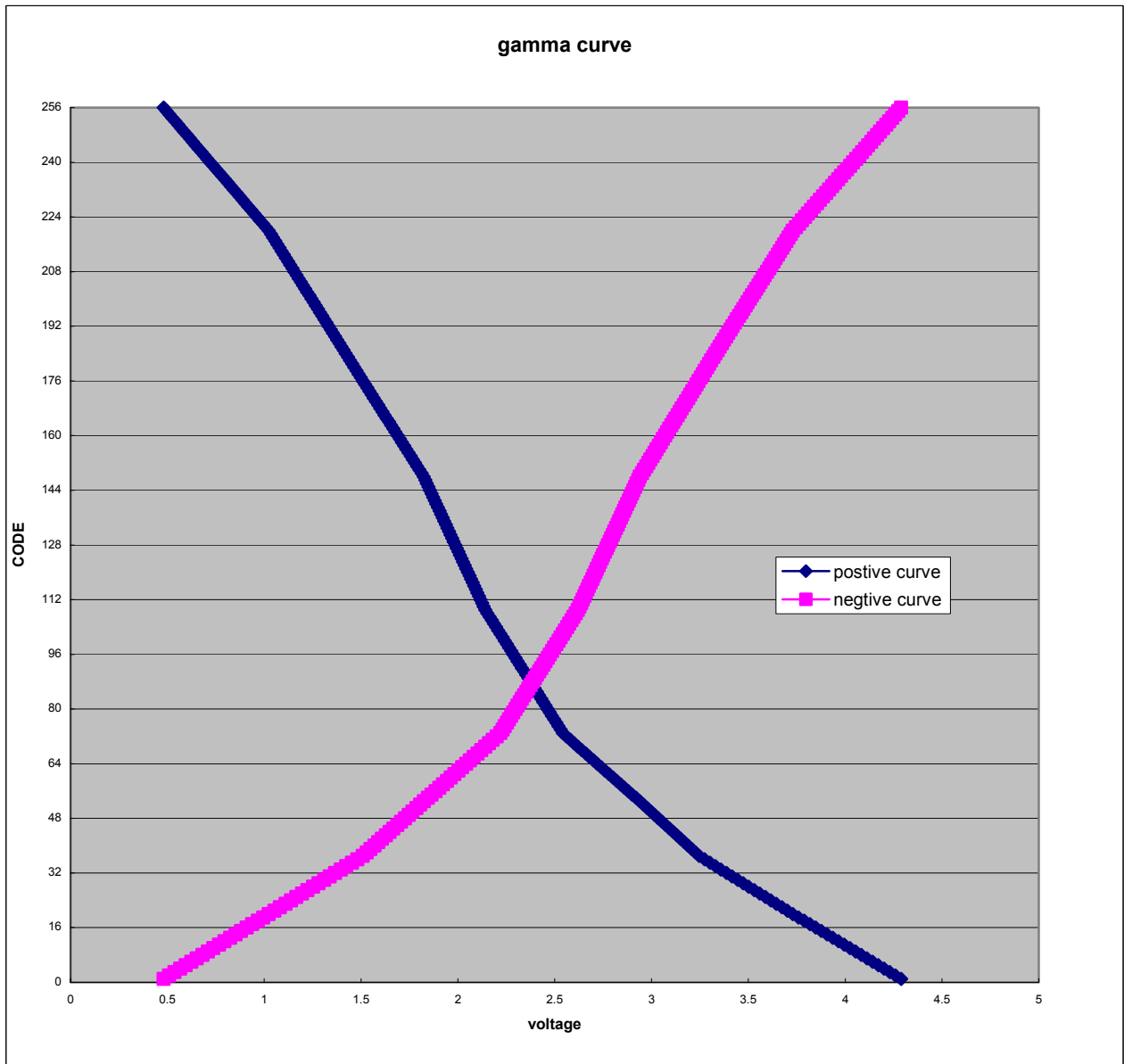
| | | | | | | | | | | | |
|-----|------|-----|-----|-----|-----|-----|-------|-------|-------|-------|--|
| LRC | Last | | | | | ← | First | | | | |
| L | QA1 | QB1 | QC1 | QA2 | ... | ... | ... | QA320 | QB320 | QC320 | |

5.2 Relationship between gamma correction and output voltage

The output voltage is determined by the digital input data if digital RGB or CCIR601 /656 input mode is selected. The 8 gamma correction reference voltages can be set externally or generated internally. If VSET="H", the gamma correction voltage is generated externally. If you want to set these voltages internally, set VSET="L" and the default voltage is as below table.

| | | | | | | | | |
|---------------------|------|------|------|------|------|------|------|------|
| | V1 | V2 | V3 | V4 | V5 | V6 | V7 | V8 |
| Default voltage (V) | 4.29 | 3.73 | 3.33 | 2.94 | 2.62 | 2.22 | 1.51 | 0.48 |

Gamma correction characteristic curve:



Relationship between input data and output voltage

| Data | Positive polarity output voltage | | Ω |
|------|----------------------------------|---------------------------------|----------|
| 00H | VP0 | V1 | 114 |
| 01H | VP1 | $V2 + (V1-V2) \times 2052/2166$ | 114 |
| 02H | VP2 | $V2 + (V1-V2) \times 1938/2166$ | 114 |
| 03H | VP3 | $V2 + (V1-V2) \times 1824/2166$ | 114 |
| 04H | VP4 | $V2 + (V1-V2) \times 1710/2166$ | 114 |
| 05H | VP5 | $V2 + (V1-V2) \times 1596/2166$ | 114 |
| 06H | VP6 | $V2 + (V1-V2) \times 1482/2166$ | 114 |
| 07H | VP7 | $V2 + (V1-V2) \times 1368/2166$ | 114 |
| 08H | VP8 | $V2 + (V1-V2) \times 1254/2166$ | 114 |
| 09H | VP9 | $V2 + (V1-V2) \times 1140/2166$ | 114 |
| 0AH | VP10 | $V2 + (V1-V2) \times 1026/2166$ | 114 |
| 0BH | VP11 | $V2 + (V1-V2) \times 912/2166$ | 114 |
| 0CH | VP12 | $V2 + (V1-V2) \times 798/2166$ | 114 |
| 0DH | VP13 | $V2 + (V1-V2) \times 684/2166$ | 114 |
| 0EH | VP14 | $V2 + (V1-V2) \times 570/2166$ | 114 |
| 0FH | VP15 | $V2 + (V1-V2) \times 456/2166$ | 114 |
| 10H | VP16 | $V2 + (V1-V2) \times 342/2166$ | 114 |
| 11H | VP17 | $V2 + (V1-V2) \times 228/2166$ | 114 |
| 12H | VP18 | $V2 + (V1-V2) \times 114/2166$ | 114 |
| 13H | VP19 | V2 | 114 |
| 14H | VP20 | $V3 + (V2-V3) \times 1482/1596$ | 114 |
| 15H | VP21 | $V3 + (V2-V3) \times 1368/1596$ | 114 |
| 16H | VP22 | $V3 + (V2-V3) \times 1254/1596$ | 114 |
| 17H | VP23 | $V3 + (V2-V3) \times 1140/1596$ | 114 |
| 18H | VP24 | $V3 + (V2-V3) \times 1026/1596$ | 114 |
| 19H | VP25 | $V3 + (V2-V3) \times 912/1596$ | 114 |
| 1AH | VP26 | $V3 + (V2-V3) \times 798/1596$ | 114 |
| 1BH | VP27 | $V3 + (V2-V3) \times 684/1596$ | 114 |
| 1CH | VP28 | $V3 + (V2-V3) \times 570/1596$ | 114 |
| 1DH | VP29 | $V3 + (V2-V3) \times 456/1596$ | 114 |
| 1EH | VP30 | $V3 + (V2-V3) \times 342/1596$ | 114 |
| 1FH | VP31 | $V3 + (V2-V3) \times 228/1596$ | 114 |
| 20H | VP32 | $V3 + (V2-V3) \times 114/1596$ | 114 |
| 21H | VP33 | V3 | 114 |
| 22H | VP34 | $V4 + (V3-V4) \times 1476/1590$ | 114 |
| 23H | VP35 | $V4 + (V3-V4) \times 1362/1590$ | 114 |
| 24H | VP36 | $V4 + (V3-V4) \times 1248/1590$ | 78 |
| 25H | VP37 | $V4 + (V3-V4) \times 1170/1590$ | 78 |
| 26H | VP38 | $V4 + (V3-V4) \times 1092/1590$ | 78 |
| 27H | VP39 | $V4 + (V3-V4) \times 1014/1590$ | 78 |
| 28H | VP40 | $V4 + (V3-V4) \times 936/1590$ | 78 |
| 29H | VP41 | $V4 + (V3-V4) \times 858/1590$ | 78 |
| 2AH | VP42 | $V4 + (V3-V4) \times 780/1590$ | 78 |
| 2BH | VP43 | $V4 + (V3-V4) \times 702/1590$ | 78 |
| 2CH | VP44 | $V4 + (V3-V4) \times 624/1590$ | 78 |
| 2DH | VP45 | $V4 + (V3-V4) \times 546/1590$ | 78 |
| 2EH | VP46 | $V4 + (V3-V4) \times 468/1590$ | 78 |
| 2FH | VP47 | $V4 + (V3-V4) \times 390/1590$ | 78 |
| 30H | VP48 | $V4 + (V3-V4) \times 312/1590$ | 78 |
| 31H | VP49 | $V4 + (V3-V4) \times 234/1590$ | 78 |
| 32H | VP50 | $V4 + (V3-V4) \times 156/1590$ | 78 |
| 33H | VP51 | $V4 + (V3-V4) \times 78/1590$ | 78 |
| 34H | VP52 | V4 | 78 |
| 35H | VP53 | $V5 + (V4-V5) \times 1170/1248$ | 78 |
| 36H | VP54 | $V5 + (V4-V5) \times 1092/1248$ | 78 |
| 37H | VP55 | $V5 + (V4-V5) \times 1014/1248$ | 78 |
| 38H | VP56 | $V5 + (V4-V5) \times 936/1248$ | 78 |
| 39H | VP57 | $V5 + (V4-V5) \times 858/1248$ | 78 |
| 3AH | VP58 | $V5 + (V4-V5) \times 780/1248$ | 78 |
| 3BH | VP59 | $V5 + (V4-V5) \times 702/1248$ | 78 |
| 3CH | VP60 | $V5 + (V4-V5) \times 624/1248$ | 78 |
| 3DH | VP61 | $V5 + (V4-V5) \times 546/1248$ | 78 |
| 3EH | VP62 | $V5 + (V4-V5) \times 468/1248$ | 78 |
| 3FH | VP63 | $V5 + (V4-V5) \times 390/1248$ | 78 |
| 40H | VP64 | $V5 + (V4-V5) \times 312/1248$ | 78 |

| Data | Negative polarity output voltage | | Ω |
|------|----------------------------------|---------------------------------|----------|
| 00H | VN0 | V8 | 114 |
| 01H | VN1 | $V8 + (V7-V8) \times 114/4104$ | 114 |
| 02H | VN2 | $V8 + (V7-V8) \times 228/4104$ | 114 |
| 03H | VN3 | $V8 + (V7-V8) \times 342/4104$ | 114 |
| 04H | VN4 | $V8 + (V7-V8) \times 456/4104$ | 114 |
| 05H | VN5 | $V8 + (V7-V8) \times 570/4104$ | 114 |
| 06H | VN6 | $V8 + (V7-V8) \times 684/4104$ | 114 |
| 07H | VN7 | $V8 + (V7-V8) \times 798/4104$ | 114 |
| 08H | VN8 | $V8 + (V7-V8) \times 912/4104$ | 114 |
| 09H | VN9 | $V8 + (V7-V8) \times 1026/4104$ | 114 |
| 0AH | VN10 | $V8 + (V7-V8) \times 1140/4104$ | 114 |
| 0BH | VN11 | $V8 + (V7-V8) \times 1254/4104$ | 114 |
| 0CH | VN12 | $V8 + (V7-V8) \times 1368/4104$ | 114 |
| 0DH | VN13 | $V8 + (V7-V8) \times 1482/4104$ | 114 |
| 0EH | VN14 | $V8 + (V7-V8) \times 1596/4104$ | 114 |
| 0FH | VN15 | $V8 + (V7-V8) \times 1710/4104$ | 114 |
| 10H | VN16 | $V8 + (V7-V8) \times 1824/4104$ | 114 |
| 11H | VN17 | $V8 + (V7-V8) \times 1938/4104$ | 114 |
| 12H | VN18 | $V8 + (V7-V8) \times 2052/4104$ | 114 |
| 13H | VN19 | $V8 + (V7-V8) \times 2166/4104$ | 114 |
| 14H | VN20 | $V8 + (V7-V8) \times 2280/4104$ | 114 |
| 15H | VN21 | $V8 + (V7-V8) \times 2394/4104$ | 114 |
| 16H | VN22 | $V8 + (V7-V8) \times 2508/4104$ | 114 |
| 17H | VN23 | $V8 + (V7-V8) \times 2622/4104$ | 114 |
| 18H | VN24 | $V8 + (V7-V8) \times 2736/4104$ | 114 |
| 19H | VN25 | $V8 + (V7-V8) \times 2850/4104$ | 114 |
| 1AH | VN26 | $V8 + (V7-V8) \times 2964/4104$ | 114 |
| 1BH | VN27 | $V8 + (V7-V8) \times 3078/4104$ | 114 |
| 1CH | VN28 | $V8 + (V7-V8) \times 3192/4104$ | 114 |
| 1DH | VN29 | $V8 + (V7-V8) \times 3306/4104$ | 114 |
| 1EH | VN30 | $V8 + (V7-V8) \times 3420/4104$ | 114 |
| 1FH | VN31 | $V8 + (V7-V8) \times 3534/4104$ | 114 |
| 20H | VN32 | $V8 + (V7-V8) \times 3648/4104$ | 114 |
| 21H | VN33 | $V8 + (V7-V8) \times 3762/4104$ | 114 |
| 22H | VN34 | $V8 + (V7-V8) \times 3876/4104$ | 114 |
| 23H | VN35 | $V8 + (V7-V8) \times 3990/4104$ | 114 |
| 24H | VN36 | V7 | 78 |
| 25H | VN37 | $V7 + (V6-V7) \times 78/2808$ | 78 |
| 26H | VN38 | $V7 + (V6-V7) \times 156/2808$ | 78 |
| 27H | VN39 | $V7 + (V6-V7) \times 234/2808$ | 78 |
| 28H | VN40 | $V7 + (V6-V7) \times 312/2808$ | 78 |
| 29H | VN41 | $V7 + (V6-V7) \times 390/2808$ | 78 |
| 2AH | VN42 | $V7 + (V6-V7) \times 468/2808$ | 78 |
| 2BH | VN43 | $V7 + (V6-V7) \times 546/2808$ | 78 |
| 2CH | VN44 | $V7 + (V6-V7) \times 624/2808$ | 78 |
| 2DH | VN45 | $V7 + (V6-V7) \times 702/2808$ | 78 |
| 2EH | VN46 | $V7 + (V6-V7) \times 780/2808$ | 78 |
| 2FH | VN47 | $V7 + (V6-V7) \times 858/2808$ | 78 |
| 30H | VN48 | $V7 + (V6-V7) \times 936/2808$ | 78 |
| 31H | VN49 | $V7 + (V6-V7) \times 1014/2808$ | 78 |
| 32H | VN50 | $V7 + (V6-V7) \times 1092/2808$ | 78 |
| 33H | VN51 | $V7 + (V6-V7) \times 1170/2808$ | 78 |
| 34H | VN52 | $V7 + (V6-V7) \times 1248/2808$ | 78 |
| 35H | VN53 | $V7 + (V6-V7) \times 1326/2808$ | 78 |
| 36H | VN54 | $V7 + (V6-V7) \times 1404/2808$ | 78 |
| 37H | VN55 | $V7 + (V6-V7) \times 1482/2808$ | 78 |
| 38H | VN56 | $V7 + (V6-V7) \times 1560/2808$ | 78 |
| 39H | VN57 | $V7 + (V6-V7) \times 1638/2808$ | 78 |
| 3AH | VN58 | $V7 + (V6-V7) \times 1716/2808$ | 78 |
| 3BH | VN59 | $V7 + (V6-V7) \times 1794/2808$ | 78 |
| 3CH | VN60 | $V7 + (V6-V7) \times 1872/2808$ | 78 |
| 3DH | VN61 | $V7 + (V6-V7) \times 1950/2808$ | 78 |
| 3EH | VN62 | $V7 + (V6-V7) \times 2028/2808$ | 78 |
| 3FH | VN63 | $V7 + (V6-V7) \times 2106/2808$ | 78 |
| 40H | VN64 | $V7 + (V6-V7) \times 2184/2808$ | 78 |

| Data | Positive polarity output voltage | | Ω |
|------|----------------------------------|--------------------------|----|
| 41H | VP65 | V5 + (V4-V5) x 234/1248 | 78 |
| 42H | VP66 | V5 + (V4-V5) x 156/1248 | 78 |
| 43H | VP67 | V5 + (V4-V5) x 78/1248 | 78 |
| 44H | VP68 | V5 | 78 |
| 45H | VP69 | V6 + (V5-V6) x 1510/1588 | 78 |
| 46H | VP70 | V6 + (V5-V6) x 1432/1588 | 78 |
| 47H | VP71 | V6 + (V5-V6) x 1354/1588 | 78 |
| 48H | VP72 | V6 + (V5-V6) x 1276/1588 | 44 |
| 49H | VP73 | V6 + (V5-V6) x 1232/1588 | 44 |
| 4AH | VP74 | V6 + (V5-V6) x 1188/1588 | 44 |
| 4BH | VP75 | V6 + (V5-V6) x 1144/1588 | 44 |
| 4CH | VP76 | V6 + (V5-V6) x 1100/1588 | 44 |
| 4DH | VP77 | V6 + (V5-V6) x 1056/1588 | 44 |
| 4EH | VP68 | V6 + (V5-V6) x 1012/1588 | 44 |
| 4FH | VP79 | V6 + (V5-V6) x 968/1588 | 44 |
| 50H | VP80 | V6 + (V5-V6) x 924/1588 | 44 |
| 51H | VP81 | V6 + (V5-V6) x 880/1588 | 44 |
| 52H | VP82 | V6 + (V5-V6) x 836/1588 | 44 |
| 53H | VP83 | V6 + (V5-V6) x 792/1588 | 44 |
| 54H | VP84 | V6 + (V5-V6) x 748/1588 | 44 |
| 55H | VP85 | V6 + (V5-V6) x 704/1588 | 44 |
| 56H | VP86 | V6 + (V5-V6) x 660/1588 | 44 |
| 57H | VP87 | V6 + (V5-V6) x 616/1588 | 44 |
| 58H | VP88 | V6 + (V5-V6) x 572/1588 | 44 |
| 59H | VP89 | V6 + (V5-V6) x 528/1588 | 44 |
| 5AH | VP90 | V6 + (V5-V6) x 484/1588 | 44 |
| 5BH | VP91 | V6 + (V5-V6) x 440/1588 | 44 |
| 5CH | VP92 | V6 + (V5-V6) x 396/1588 | 44 |
| 5DH | VP93 | V6 + (V5-V6) x 352/1588 | 44 |
| 5EH | VP94 | V6 + (V5-V6) x 308/1588 | 44 |
| 5FH | VP95 | V6 + (V5-V6) x 264/1588 | 44 |
| 60H | VP96 | V6 + (V5-V6) x 220/1588 | 44 |
| 61H | VP97 | V6 + (V5-V6) x 176/1588 | 44 |
| 62H | VP98 | V6 + (V5-V6) x 132/1588 | 44 |
| 63H | VP99 | V6 + (V5-V6) x 88/1588 | 44 |
| 64H | VP100 | V6 + (V5-V6) x 44/1588 | 44 |
| 65H | VP101 | V6 | 44 |
| 66H | VP102 | V7 + (V6-V7) x 2744/2788 | 44 |
| 67H | VP103 | V7 + (V6-V7) x 2700/2788 | 44 |
| 68H | VP104 | V7 + (V6-V7) x 2656/2788 | 44 |
| 69H | VP105 | V7 + (V6-V7) x 2612/2788 | 44 |
| 6AH | VP106 | V7 + (V6-V7) x 2568/2788 | 44 |
| 6BH | VP107 | V7 + (V6-V7) x 2524/2788 | 44 |
| 6CH | VP108 | V7 + (V6-V7) x 2480/2788 | 32 |
| 6DH | VP109 | V7 + (V6-V7) x 2448/2788 | 32 |
| 6EH | VP110 | V7 + (V6-V7) x 2416/2788 | 32 |
| 6FH | VP111 | V7 + (V6-V7) x 2384/2788 | 32 |
| 70H | VP112 | V7 + (V6-V7) x 2352/2788 | 32 |
| 71H | VP113 | V7 + (V6-V7) x 2320/2788 | 32 |
| 72H | VP114 | V7 + (V6-V7) x 2288/2788 | 32 |
| 73H | VP115 | V7 + (V6-V7) x 2256/2788 | 32 |
| 74H | VP116 | V7 + (V6-V7) x 2224/2788 | 32 |
| 75H | VP117 | V7 + (V6-V7) x 2192/2788 | 32 |
| 76H | VP118 | V7 + (V6-V7) x 2160/2788 | 32 |
| 77H | VP119 | V7 + (V6-V7) x 2128/2788 | 32 |
| 78H | VP120 | V7 + (V6-V7) x 2096/2788 | 32 |
| 79H | VP121 | V7 + (V6-V7) x 2064/2788 | 32 |
| 7AH | VP122 | V7 + (V6-V7) x 2032/2788 | 32 |
| 7BH | VP123 | V7 + (V6-V7) x 2000/2788 | 32 |
| 7CH | VP124 | V7 + (V6-V7) x 1968/2788 | 32 |
| 7DH | VP125 | V7 + (V6-V7) x 1936/2788 | 32 |
| 7EH | VP126 | V7 + (V6-V7) x 1904/2788 | 32 |
| 7FH | VP127 | V7 + (V6-V7) x 1872/2788 | 32 |
| 80H | VP128 | V7 + (V6-V7) x 1840/2788 | 32 |

| Data | Negative polarity output voltage | | Ω |
|------|----------------------------------|--------------------------|----|
| 41H | VN65 | V7 + (V6-V7) x 2262/2808 | 78 |
| 42H | VN66 | V7 + (V6-V7) x 2340/2808 | 78 |
| 43H | VN67 | V7 + (V6-V7) x 2418/2808 | 78 |
| 44H | VN68 | V7 + (V6-V7) x 2496/2808 | 78 |
| 45H | VN69 | V7 + (V6-V7) x 2574/2808 | 78 |
| 46H | VN70 | V7 + (V6-V7) x 2652/2808 | 78 |
| 47H | VN71 | V7 + (V6-V7) x 2730/2808 | 78 |
| 48H | VN72 | V6 | 44 |
| 49H | VN73 | V6 + (V5-V6) x 44/1584 | 44 |
| 4AH | VN74 | V6 + (V5-V6) x 88/1584 | 44 |
| 4BH | VN75 | V6 + (V5-V6) x 132/1584 | 44 |
| 4CH | VN76 | V6 + (V5-V6) x 176/1584 | 44 |
| 4DH | VN77 | V6 + (V5-V6) x 220/1584 | 44 |
| 4EH | VN68 | V6 + (V5-V6) x 264/1584 | 44 |
| 4FH | VN79 | V6 + (V5-V6) x 308/1584 | 44 |
| 50H | VN80 | V6 + (V5-V6) x 352/1584 | 44 |
| 51H | VN81 | V6 + (V5-V6) x 396/1584 | 44 |
| 52H | VN82 | V6 + (V5-V6) x 440/1584 | 44 |
| 53H | VN83 | V6 + (V5-V6) x 484/1584 | 44 |
| 54H | VN84 | V6 + (V5-V6) x 528/1584 | 44 |
| 55H | VN85 | V6 + (V5-V6) x 572/1584 | 44 |
| 56H | VN86 | V6 + (V5-V6) x 616/1584 | 44 |
| 57H | VN87 | V6 + (V5-V6) x 660/1584 | 44 |
| 58H | VN88 | V6 + (V5-V6) x 704/1584 | 44 |
| 59H | VN89 | V6 + (V5-V6) x 748/1584 | 44 |
| 5AH | VN90 | V6 + (V5-V6) x 792/1584 | 44 |
| 5BH | VN91 | V6 + (V5-V6) x 836/1584 | 44 |
| 5CH | VN92 | V6 + (V5-V6) x 880/1584 | 44 |
| 5DH | VN93 | V6 + (V5-V6) x 924/1584 | 44 |
| 5EH | VN94 | V6 + (V5-V6) x 968/1584 | 44 |
| 5FH | VN95 | V6 + (V5-V6) x 1012/1584 | 44 |
| 60H | VN96 | V6 + (V5-V6) x 1056/1584 | 44 |
| 61H | VN97 | V6 + (V5-V6) x 1100/1584 | 44 |
| 62H | VN98 | V6 + (V5-V6) x 1144/1584 | 44 |
| 63H | VN99 | V6 + (V5-V6) x 1188/1584 | 44 |
| 64H | VN100 | V6 + (V5-V6) x 1232/1584 | 44 |
| 65H | VN101 | V6 + (V5-V6) x 1276/1584 | 44 |
| 66H | VN102 | V6 + (V5-V6) x 1320/1584 | 44 |
| 67H | VN103 | V6 + (V5-V6) x 1364/1584 | 44 |
| 68H | VN104 | V6 + (V5-V6) x 1408/1584 | 44 |
| 69H | VN105 | V6 + (V5-V6) x 1452/1584 | 44 |
| 6AH | VN106 | V6 + (V5-V6) x 1496/1584 | 44 |
| 6BH | VN107 | V6 + (V5-V6) x 1540/1584 | 44 |
| 6CH | VN108 | V5 | 32 |
| 6DH | VN109 | V5 + (V4-V5) x 32/1248 | 32 |
| 6EH | VN110 | V5 + (V4-V5) x 64/1248 | 32 |
| 6FH | VN111 | V5 + (V4-V5) x 96/1248 | 32 |
| 70H | VN112 | V5 + (V4-V5) x 128/1248 | 32 |
| 71H | VN113 | V5 + (V4-V5) x 160/1248 | 32 |
| 72H | VN114 | V5 + (V4-V5) x 192/1248 | 32 |
| 73H | VN115 | V5 + (V4-V5) x 224/1248 | 32 |
| 74H | VN116 | V5 + (V4-V5) x 256/1248 | 32 |
| 75H | VN117 | V5 + (V4-V5) x 288/1248 | 32 |
| 76H | VN118 | V5 + (V4-V5) x 320/1248 | 32 |
| 77H | VN119 | V5 + (V4-V5) x 352/1248 | 32 |
| 78H | VN120 | V5 + (V4-V5) x 384/1248 | 32 |
| 79H | VN121 | V5 + (V4-V5) x 416/1248 | 32 |
| 7AH | VN122 | V5 + (V4-V5) x 448/1248 | 32 |
| 7BH | VN123 | V5 + (V4-V5) x 480/1248 | 32 |
| 7CH | VN124 | V5 + (V4-V5) x 512/1248 | 32 |
| 7DH | VN125 | V5 + (V4-V5) x 544/1248 | 32 |
| 7EH | VN126 | V5 + (V4-V5) x 576/1248 | 32 |
| 7FH | VN127 | V5 + (V4-V5) x 608/1248 | 32 |
| 80H | VN128 | V5 + (V4-V5) x 640/1248 | 32 |

| Data | Positive polarity output voltage | | Ω |
|------|----------------------------------|---------------------------------|----|
| 81H | VP129 | $V7 + (V6-V7) \times 1808/2788$ | 32 |
| 82H | VP130 | $V7 + (V6-V7) \times 1776/2788$ | 32 |
| 83H | VP131 | $V7 + (V6-V7) \times 1744/2788$ | 32 |
| 84H | VP132 | $V7 + (V6-V7) \times 1712/2788$ | 32 |
| 85H | VP133 | $V7 + (V6-V7) \times 1680/2788$ | 32 |
| 86H | VP134 | $V7 + (V6-V7) \times 1648/2788$ | 32 |
| 87H | VP135 | $V7 + (V6-V7) \times 1616/2788$ | 32 |
| 88H | VP136 | $V7 + (V6-V7) \times 1584/2788$ | 32 |
| 89H | VP137 | $V7 + (V6-V7) \times 1552/2788$ | 32 |
| 8AH | VP138 | $V7 + (V6-V7) \times 1520/2788$ | 32 |
| 8BH | VP139 | $V7 + (V6-V7) \times 1488/2788$ | 32 |
| 8CH | VP140 | $V7 + (V6-V7) \times 1456/2788$ | 32 |
| 8DH | VP141 | $V7 + (V6-V7) \times 1424/2788$ | 32 |
| 8EH | VP142 | $V7 + (V6-V7) \times 1392/2788$ | 32 |
| 8FH | VP143 | $V7 + (V6-V7) \times 1360/2788$ | 32 |
| 90H | VP144 | $V7 + (V6-V7) \times 1328/2788$ | 32 |
| 91H | VP145 | $V7 + (V6-V7) \times 1296/2788$ | 32 |
| 92H | VP146 | $V7 + (V6-V7) \times 1264/2788$ | 32 |
| 93H | VP147 | $V7 + (V6-V7) \times 1232/2788$ | 44 |
| 94H | VP148 | $V7 + (V6-V7) \times 1188/2788$ | 44 |
| 95H | VP149 | $V7 + (V6-V7) \times 1144/2788$ | 44 |
| 96H | VP150 | $V7 + (V6-V7) \times 1100/2788$ | 44 |
| 97H | VP151 | $V7 + (V6-V7) \times 1056/2788$ | 44 |
| 98H | VP152 | $V7 + (V6-V7) \times 1012/2788$ | 44 |
| 99H | VP153 | $V7 + (V6-V7) \times 968/2788$ | 44 |
| 9AH | VP154 | $V7 + (V6-V7) \times 924/2788$ | 44 |
| 9BH | VP155 | $V7 + (V6-V7) \times 880/2788$ | 44 |
| 9CH | VP156 | $V7 + (V6-V7) \times 836/2788$ | 44 |
| 9DH | VP157 | $V7 + (V6-V7) \times 792/2788$ | 44 |
| 9EH | VP158 | $V7 + (V6-V7) \times 748/2788$ | 44 |
| 9FH | VP159 | $V7 + (V6-V7) \times 704/2788$ | 44 |
| A0H | VP160 | $V7 + (V6-V7) \times 660/2788$ | 44 |
| A1H | VP161 | $V7 + (V6-V7) \times 616/2788$ | 44 |
| A2H | VP162 | $V7 + (V6-V7) \times 572/2788$ | 44 |
| A3H | VP163 | $V7 + (V6-V7) \times 528/2788$ | 44 |
| A4H | VP164 | $V7 + (V6-V7) \times 484/2788$ | 44 |
| A5H | VP165 | $V7 + (V6-V7) \times 440/2788$ | 44 |
| A6H | VP166 | $V7 + (V6-V7) \times 396/2788$ | 44 |
| A7H | VP167 | $V7 + (V6-V7) \times 352/2788$ | 44 |
| A8H | VP168 | $V7 + (V6-V7) \times 308/2788$ | 44 |
| A9H | VP169 | $V7 + (V6-V7) \times 264/2788$ | 44 |
| AAH | VP170 | $V7 + (V6-V7) \times 220/2788$ | 44 |
| ABH | VP171 | $V7 + (V6-V7) \times 176/2788$ | 44 |
| ACH | VP172 | $V7 + (V6-V7) \times 132/2788$ | 44 |
| ADH | VP173 | $V7 + (V6-V7) \times 88/2788$ | 44 |
| AEH | VP174 | $V7 + (V6-V7) \times 44/2788$ | 44 |
| AFH | VP175 | V7 | 44 |
| B0H | VP176 | $V8 + (V7-V8) \times 4052/4096$ | 44 |
| B1H | VP177 | $V8 + (V7-V8) \times 4008/4096$ | 44 |
| B2H | VP178 | $V8 + (V7-V8) \times 3964/4096$ | 44 |
| B3H | VP179 | $V8 + (V7-V8) \times 3920/4096$ | 44 |
| B4H | VP180 | $V8 + (V7-V8) \times 3876/4096$ | 44 |
| B5H | VP181 | $V8 + (V7-V8) \times 3832/4096$ | 44 |
| B6H | VP182 | $V8 + (V7-V8) \times 3788/4096$ | 44 |
| B7H | VP183 | $V8 + (V7-V8) \times 3744/4096$ | 44 |
| B8H | VP184 | $V8 + (V7-V8) \times 3700/4096$ | 44 |
| B9H | VP185 | $V8 + (V7-V8) \times 3656/4096$ | 44 |
| BAH | VP186 | $V8 + (V7-V8) \times 3612/4096$ | 44 |
| BBH | VP187 | $V8 + (V7-V8) \times 3568/4096$ | 44 |
| BCH | VP188 | $V8 + (V7-V8) \times 3524/4096$ | 44 |
| BDH | VP189 | $V8 + (V7-V8) \times 3480/4096$ | 44 |
| BEH | VP190 | $V8 + (V7-V8) \times 3436/4096$ | 44 |
| BFH | VP191 | $V8 + (V7-V8) \times 3392/4096$ | 44 |

| Data | Negative polarity output voltage | | Ω |
|------|----------------------------------|---------------------------------|----|
| 81H | VN129 | $V5 + (V4-V5) \times 672/1248$ | 32 |
| 82H | VN130 | $V5 + (V4-V5) \times 704/1248$ | 32 |
| 83H | VN131 | $V5 + (V4-V5) \times 736/1248$ | 32 |
| 84H | VN132 | $V5 + (V4-V5) \times 768/1248$ | 32 |
| 85H | VN133 | $V5 + (V4-V5) \times 800/1248$ | 32 |
| 86H | VN134 | $V5 + (V4-V5) \times 832/1248$ | 32 |
| 87H | VN135 | $V5 + (V4-V5) \times 864/1248$ | 32 |
| 88H | VN136 | $V5 + (V4-V5) \times 896/1248$ | 32 |
| 89H | VN137 | $V5 + (V4-V5) \times 928/1248$ | 32 |
| 8AH | VN138 | $V5 + (V4-V5) \times 960/1248$ | 32 |
| 8BH | VN139 | $V5 + (V4-V5) \times 992/1248$ | 32 |
| 8CH | VN140 | $V5 + (V4-V5) \times 1024/1248$ | 32 |
| 8DH | VN141 | $V5 + (V4-V5) \times 1056/1248$ | 32 |
| 8EH | VN142 | $V5 + (V4-V5) \times 1088/1248$ | 32 |
| 8FH | VN143 | $V5 + (V4-V5) \times 1120/1248$ | 32 |
| 90H | VN144 | $V5 + (V4-V5) \times 1152/1248$ | 32 |
| 91H | VN145 | $V5 + (V4-V5) \times 1184/1248$ | 32 |
| 92H | VN146 | $V5 + (V4-V5) \times 1216/1248$ | 32 |
| 93H | VN147 | V4 | 44 |
| 94H | VN148 | $V4 + (V3-V4) \times 44/1584$ | 44 |
| 95H | VN149 | $V4 + (V3-V4) \times 88/1584$ | 44 |
| 96H | VN150 | $V4 + (V3-V4) \times 132/1584$ | 44 |
| 97H | VN151 | $V4 + (V3-V4) \times 176/1584$ | 44 |
| 98H | VN152 | $V4 + (V3-V4) \times 220/1584$ | 44 |
| 99H | VN153 | $V4 + (V3-V4) \times 264/1584$ | 44 |
| 9AH | VN154 | $V4 + (V3-V4) \times 308/1584$ | 44 |
| 9BH | VN155 | $V4 + (V3-V4) \times 352/1584$ | 44 |
| 9CH | VN156 | $V4 + (V3-V4) \times 396/1584$ | 44 |
| 9DH | VN157 | $V4 + (V3-V4) \times 440/1584$ | 44 |
| 9EH | VN158 | $V4 + (V3-V4) \times 484/1584$ | 44 |
| 9FH | VN159 | $V4 + (V3-V4) \times 528/1584$ | 44 |
| A0H | VN160 | $V4 + (V3-V4) \times 572/1584$ | 44 |
| A1H | VN161 | $V4 + (V3-V4) \times 616/1584$ | 44 |
| A2H | VN162 | $V4 + (V3-V4) \times 660/1584$ | 44 |
| A3H | VN163 | $V4 + (V3-V4) \times 704/1584$ | 44 |
| A4H | VN164 | $V4 + (V3-V4) \times 748/1584$ | 44 |
| A5H | VN165 | $V4 + (V3-V4) \times 792/1584$ | 44 |
| A6H | VN166 | $V4 + (V3-V4) \times 836/1584$ | 44 |
| A7H | VN167 | $V4 + (V3-V4) \times 880/1584$ | 44 |
| A8H | VN168 | $V4 + (V3-V4) \times 924/1584$ | 44 |
| A9H | VN169 | $V4 + (V3-V4) \times 968/1584$ | 44 |
| AAH | VN170 | $V4 + (V3-V4) \times 1012/1584$ | 44 |
| ABH | VN171 | $V4 + (V3-V4) \times 1056/1584$ | 44 |
| ACH | VN172 | $V4 + (V3-V4) \times 1100/1584$ | 44 |
| ADH | VN173 | $V4 + (V3-V4) \times 1144/1584$ | 44 |
| AEH | VN174 | $V4 + (V3-V4) \times 1188/1584$ | 44 |
| AFH | VN175 | $V4 + (V3-V4) \times 1232/1584$ | 44 |
| B0H | VN176 | $V4 + (V3-V4) \times 1276/1584$ | 44 |
| B1H | VN177 | $V4 + (V3-V4) \times 1320/1584$ | 44 |
| B2H | VN178 | $V4 + (V3-V4) \times 1364/1584$ | 44 |
| B3H | VN179 | $V4 + (V3-V4) \times 1408/1584$ | 44 |
| B4H | VN180 | $V4 + (V3-V4) \times 1452/1584$ | 44 |
| B5H | VN181 | $V4 + (V3-V4) \times 1496/1584$ | 44 |
| B6H | VN182 | $V4 + (V3-V4) \times 1540/1584$ | 44 |
| B7H | VN183 | V3 | 44 |
| B8H | VN184 | $V3 + (V2-V3) \times 44/1584$ | 44 |
| B9H | VN185 | $V3 + (V2-V3) \times 88/1584$ | 44 |
| BAH | VN186 | $V3 + (V2-V3) \times 132/1584$ | 44 |
| BBH | VN187 | $V3 + (V2-V3) \times 176/1584$ | 44 |
| BCH | VN188 | $V3 + (V2-V3) \times 220/1584$ | 44 |
| BDH | VN189 | $V3 + (V2-V3) \times 264/1584$ | 44 |
| BEH | VN190 | $V3 + (V2-V3) \times 308/1584$ | 44 |
| BFH | VN191 | $V3 + (V2-V3) \times 352/1584$ | 44 |

| Data | Positive polarity output voltage | | Ω |
|------|----------------------------------|---------------------------------|----|
| C0H | VP192 | $V8 + (V7-V8) \times 3348/4096$ | 44 |
| C1H | VP193 | $V8 + (V7-V8) \times 3304/4096$ | 44 |
| C2H | VP194 | $V8 + (V7-V8) \times 3260/4096$ | 44 |
| C3H | VP195 | $V8 + (V7-V8) \times 3216/4096$ | 44 |
| C4H | VP196 | $V8 + (V7-V8) \times 3172/4096$ | 44 |
| C5H | VP197 | $V8 + (V7-V8) \times 3128/4096$ | 44 |
| C6H | VP198 | $V8 + (V7-V8) \times 3084/4096$ | 44 |
| C7H | VP199 | $V8 + (V7-V8) \times 3040/4096$ | 44 |
| C8H | VP200 | $V8 + (V7-V8) \times 2996/4096$ | 44 |
| C9H | VP201 | $V8 + (V7-V8) \times 2952/4096$ | 44 |
| CAH | VP202 | $V8 + (V7-V8) \times 2908/4096$ | 44 |
| CBH | VP203 | $V8 + (V7-V8) \times 2864/4096$ | 44 |
| CCH | VP204 | $V8 + (V7-V8) \times 2820/4096$ | 44 |
| CDH | VP205 | $V8 + (V7-V8) \times 2776/4096$ | 44 |
| CEH | VP206 | $V8 + (V7-V8) \times 2732/4096$ | 44 |
| CFH | VP207 | $V8 + (V7-V8) \times 2688/4096$ | 44 |
| D0H | VP208 | $V8 + (V7-V8) \times 2644/4096$ | 44 |
| D1H | VP209 | $V8 + (V7-V8) \times 2600/4096$ | 44 |
| D2H | VP210 | $V8 + (V7-V8) \times 2556/4096$ | 44 |
| D3H | VP211 | $V8 + (V7-V8) \times 2512/4096$ | 44 |
| D4H | VP212 | $V8 + (V7-V8) \times 2468/4096$ | 44 |
| D5H | VP213 | $V8 + (V7-V8) \times 2424/4096$ | 44 |
| D6H | VP214 | $V8 + (V7-V8) \times 2380/4096$ | 44 |
| D7H | VP215 | $V8 + (V7-V8) \times 2336/4096$ | 44 |
| D8H | VP216 | $V8 + (V7-V8) \times 2292/4096$ | 44 |
| D9H | VP217 | $V8 + (V7-V8) \times 2248/4096$ | 44 |
| DAH | VP218 | $V8 + (V7-V8) \times 2204/4096$ | 44 |
| DBH | VP219 | $V8 + (V7-V8) \times 2160/4096$ | 60 |
| DCH | VP220 | $V8 + (V7-V8) \times 2100/4096$ | 60 |
| DDH | VP221 | $V8 + (V7-V8) \times 2040/4096$ | 60 |
| DEH | VP222 | $V8 + (V7-V8) \times 1980/4096$ | 60 |
| DFH | VP223 | $V8 + (V7-V8) \times 1920/4096$ | 60 |
| E0H | VP224 | $V8 + (V7-V8) \times 1860/4096$ | 60 |
| E1H | VP225 | $V8 + (V7-V8) \times 1800/4096$ | 60 |
| E2H | VP226 | $V8 + (V7-V8) \times 1740/4096$ | 60 |
| E3H | VP227 | $V8 + (V7-V8) \times 1680/4096$ | 60 |
| E4H | VP228 | $V8 + (V7-V8) \times 1620/4096$ | 60 |
| E5H | VP229 | $V8 + (V7-V8) \times 1560/4096$ | 60 |
| E6H | VP230 | $V8 + (V7-V8) \times 1500/4096$ | 60 |
| E7H | VP231 | $V8 + (V7-V8) \times 1440/4096$ | 60 |
| E8H | VP232 | $V8 + (V7-V8) \times 1380/4096$ | 60 |
| E9H | VP233 | $V8 + (V7-V8) \times 1320/4096$ | 60 |
| EAH | VP234 | $V8 + (V7-V8) \times 1260/4096$ | 60 |
| EBH | VP235 | $V8 + (V7-V8) \times 1200/4096$ | 60 |
| ECH | VP236 | $V8 + (V7-V8) \times 1140/4096$ | 60 |
| EDH | VP237 | $V8 + (V7-V8) \times 1080/4096$ | 60 |
| EEH | VP238 | $V8 + (V7-V8) \times 1020/4096$ | 60 |
| EFH | VP239 | $V8 + (V7-V8) \times 960/4096$ | 60 |
| F0H | VP240 | $V8 + (V7-V8) \times 900/4096$ | 60 |
| F1H | VP241 | $V8 + (V7-V8) \times 840/4096$ | 60 |
| F2H | VP242 | $V8 + (V7-V8) \times 780/4096$ | 60 |
| F3H | VP243 | $V8 + (V7-V8) \times 720/4096$ | 60 |
| F4H | VP244 | $V8 + (V7-V8) \times 660/4096$ | 60 |
| F5H | VP245 | $V8 + (V7-V8) \times 600/4096$ | 60 |
| F6H | VP246 | $V8 + (V7-V8) \times 540/4096$ | 60 |
| F7H | VP247 | $V8 + (V7-V8) \times 480/4096$ | 60 |
| F8H | VP248 | $V8 + (V7-V8) \times 420/4096$ | 60 |
| F9H | VP249 | $V8 + (V7-V8) \times 360/4096$ | 60 |
| FAH | VP250 | $V8 + (V7-V8) \times 300/4096$ | 60 |
| FBH | VP251 | $V8 + (V7-V8) \times 240/4096$ | 60 |
| FCH | VP252 | $V8 + (V7-V8) \times 180/4096$ | 60 |
| FDH | VP253 | $V8 + (V7-V8) \times 120/4096$ | 60 |
| FEH | VP254 | $V8 + (V7-V8) \times 60/4096$ | 60 |
| FFH | VP255 | V8 | 0 |

| Data | Negative polarity output voltage | | Ω |
|------|----------------------------------|---------------------------------|----|
| C0H | VN192 | $V3 + (V2-V3) \times 396/1584$ | 44 |
| C1H | VN193 | $V3 + (V2-V3) \times 440/1584$ | 44 |
| C2H | VN194 | $V3 + (V2-V3) \times 484/1584$ | 44 |
| C3H | VN195 | $V3 + (V2-V3) \times 528/1584$ | 44 |
| C4H | VN196 | $V3 + (V2-V3) \times 572/1584$ | 44 |
| C5H | VN197 | $V3 + (V2-V3) \times 616/1584$ | 44 |
| C6H | VN198 | $V3 + (V2-V3) \times 660/1584$ | 44 |
| C7H | VN199 | $V3 + (V2-V3) \times 704/1584$ | 44 |
| C8H | VN200 | $V3 + (V2-V3) \times 748/1584$ | 44 |
| C9H | VN201 | $V3 + (V2-V3) \times 792/1584$ | 44 |
| CAH | VN202 | $V3 + (V2-V3) \times 836/1584$ | 44 |
| CBH | VN203 | $V3 + (V2-V3) \times 880/1584$ | 44 |
| CCH | VN204 | $V3 + (V2-V3) \times 924/1584$ | 44 |
| CDH | VN205 | $V3 + (V2-V3) \times 968/1584$ | 44 |
| CEH | VN206 | $V3 + (V2-V3) \times 1012/1584$ | 44 |
| CFH | VN207 | $V3 + (V2-V3) \times 1056/1584$ | 44 |
| D0H | VN208 | $V3 + (V2-V3) \times 1100/1584$ | 44 |
| D1H | VN209 | $V3 + (V2-V3) \times 1144/1584$ | 44 |
| D2H | VN210 | $V3 + (V2-V3) \times 1188/1584$ | 44 |
| D3H | VN211 | $V3 + (V2-V3) \times 1232/1584$ | 44 |
| D4H | VN212 | $V3 + (V2-V3) \times 1276/1584$ | 44 |
| D5H | VN213 | $V3 + (V2-V3) \times 1320/1584$ | 44 |
| D6H | VN214 | $V3 + (V2-V3) \times 1364/1584$ | 44 |
| D7H | VN215 | $V3 + (V2-V3) \times 1408/1584$ | 44 |
| D8H | VN216 | $V3 + (V2-V3) \times 1452/1584$ | 44 |
| D9H | VN217 | $V3 + (V2-V3) \times 1496/1584$ | 44 |
| DAH | VN218 | $V3 + (V2-V3) \times 1540/1584$ | 44 |
| DBH | VN219 | V2 | 60 |
| DCH | VN220 | $V2 + (V1-V2) \times 60/2160$ | 60 |
| DDH | VN221 | $V2 + (V1-V2) \times 120/2160$ | 60 |
| DEH | VN222 | $V2 + (V1-V2) \times 180/2160$ | 60 |
| DFH | VN223 | $V2 + (V1-V2) \times 240/2160$ | 60 |
| E0H | VN224 | $V2 + (V1-V2) \times 300/2160$ | 60 |
| E1H | VN225 | $V2 + (V1-V2) \times 360/2160$ | 60 |
| E2H | VN226 | $V2 + (V1-V2) \times 420/2160$ | 60 |
| E3H | VN227 | $V2 + (V1-V2) \times 480/2160$ | 60 |
| E4H | VN228 | $V2 + (V1-V2) \times 540/2160$ | 60 |
| E5H | VN229 | $V2 + (V1-V2) \times 600/2160$ | 60 |
| E6H | VN230 | $V2 + (V1-V2) \times 660/2160$ | 60 |
| E7H | VN231 | $V2 + (V1-V2) \times 720/2160$ | 60 |
| E8H | VN232 | $V2 + (V1-V2) \times 780/2160$ | 60 |
| E9H | VN233 | $V2 + (V1-V2) \times 840/2160$ | 60 |
| EAH | VN234 | $V2 + (V1-V2) \times 900/2160$ | 60 |
| EBH | VN235 | $V2 + (V1-V2) \times 960/2160$ | 60 |
| ECH | VN236 | $V2 + (V1-V2) \times 1020/2160$ | 60 |
| EDH | VN237 | $V2 + (V1-V2) \times 1080/2160$ | 60 |
| EEH | VN238 | $V2 + (V1-V2) \times 1140/2160$ | 60 |
| EFH | VN239 | $V2 + (V1-V2) \times 1200/2160$ | 60 |
| F0H | VN240 | $V2 + (V1-V2) \times 1260/2160$ | 60 |
| F1H | VN241 | $V2 + (V1-V2) \times 1320/2160$ | 60 |
| F2H | VN242 | $V2 + (V1-V2) \times 1380/2160$ | 60 |
| F3H | VN243 | $V2 + (V1-V2) \times 1440/2160$ | 60 |
| F4H | VN244 | $V2 + (V1-V2) \times 1500/2160$ | 60 |
| F5H | VN245 | $V2 + (V1-V2) \times 1560/2160$ | 60 |
| F6H | VN246 | $V2 + (V1-V2) \times 1620/2160$ | 60 |
| F7H | VN247 | $V2 + (V1-V2) \times 1680/2160$ | 60 |
| F8H | VN248 | $V2 + (V1-V2) \times 1740/2160$ | 60 |
| F9H | VN249 | $V2 + (V1-V2) \times 1800/2160$ | 60 |
| FAH | VN250 | $V2 + (V1-V2) \times 1860/2160$ | 60 |
| FBH | VN251 | $V2 + (V1-V2) \times 1920/2160$ | 60 |
| FCH | VN252 | $V2 + (V1-V2) \times 1980/2160$ | 60 |
| FDH | VN253 | $V2 + (V1-V2) \times 2040/2160$ | 60 |
| FEH | VN254 | $V2 + (V1-V2) \times 2100/2160$ | 60 |
| FFH | VN255 | V1 | 0 |

5.3 Digital RGB data input format

For digital RGB input data format, both SYNC mode and DE mode are supported. If DEN signal is fixed low, SYNC mode is used. Otherwise, DE mode is used. The zoom and OSD function is not supported in digital serial/parallel RGB mode.

5.4 NTSC/PAL mode auto detection

For NTSC/PAL mode setting, the auto-detection function is implemented. You don't have to define this setting and can use NPC pin to monitor detection result.

5.5 Input data sequence and color filter type

- CF1 defines the input data sequence in serial digital RGB mode as following tables.

1. CF1="L"

| | | | | | |
|-----------------|-----------|------|-----|------|------|
| Scan direction | UD | Low | Low | High | High |
| Shift direction | LRC | High | Low | High | Low |
| Data sequence | Odd line | RGB | BGR | BRG | GRB |
| | Even line | BRG | GRB | RGB | BGR |

2. CF1="H"

| | | | | | |
|-----------------|-----------|------|-----|------|------|
| Scan direction | UD | Low | Low | High | High |
| Shift direction | LRC | High | Low | High | Low |
| Data sequence | Odd line | RGB | BGR | GBR | RBG |
| | Even line | GBR | RBG | RGB | BGR |

- For the color filter type, set MOD="H" for stripe type and the CF1&CF2 definition will have no meaning. Set MOD="L" for delta color filter and CF2 defines which kind of delta type color filter is used.

-

1. CF2="L", delta type 1

| | | | | | | |
|---|---|---|---|---|---|---|
| R | G | B | R | G | B | |
| | B | R | G | B | R | G |
| R | G | B | R | G | B | |
| | B | R | G | B | R | G |

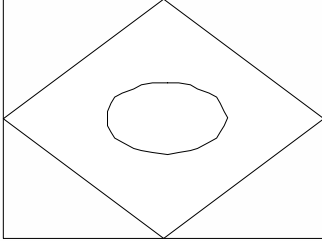
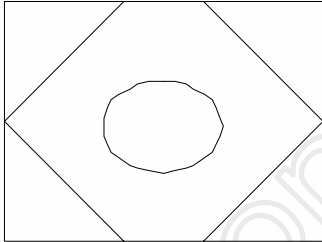
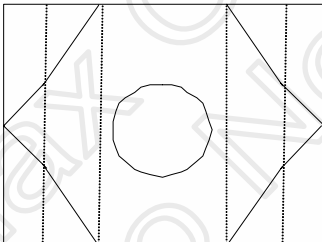
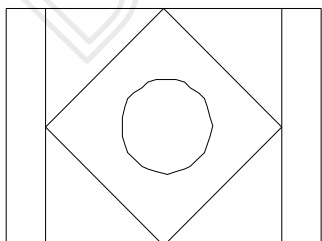
2. CF2="H", delta type 2:

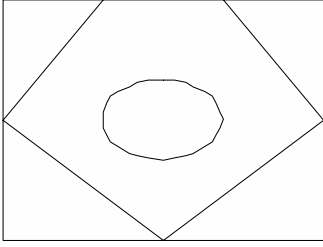
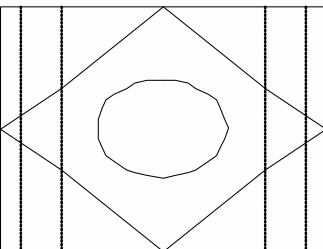
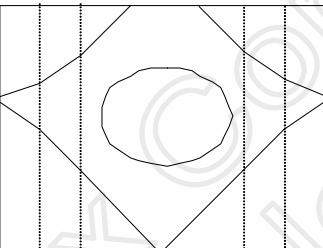
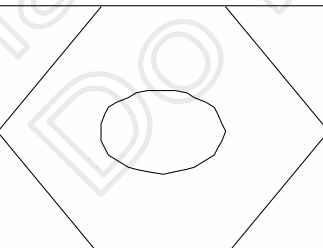
| | | | | | | |
|---|---|---|---|---|---|---|
| | R | G | B | R | G | B |
| G | B | R | G | B | R | |
| | R | G | B | R | G | B |
| G | B | R | G | B | R | |

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5.6 Zoom in/out display mode setting (stripe type color filter only)

The zoom in/out function is only supported in CCIR601/656 input mode. In serial or parallel RGB input mode, this function is disabled.

| Display Mode | ZX1 | ZX2 | ZX3 | Display characteristics (4:3 aspect-ratio input signal) | Note |
|--------------|-----|-----|-----|---|--|
| Full | H | H | H |  | Input video signals are displayed on full screen. |
| Zoom1 | L | H | H |  | Central 3/4 lines of input video signals are displayed on full screen (Vertically extension, zoom factor=4/3) |
| Zoom-Wide1 | H | L | H |  | Central 3/4 lines of input video signals are displayed on full screen (Vertically extension and different horizontal timing scaling) |
| Normal | L | L | H |  | Input video signals (4:3) are displayed on central 75% screen. |

| Display Mode | ZX1 | ZX2 | ZX3 | Display characteristics (4:3 aspect-ratio input signal) | Note |
|--------------|-----|-----|-----|---|---|
| Zoom2 | H | H | L |  | Lower 7/8 lines of input video signals are displayed on full screen. (Zoom factor=8/7, vertically offset extension) |
| Wide | L | H | L |  | Input video signals are displayed on full screen. (Different horizontal timing scaling) |
| Zoom-Wide2 | H | L | L |  | Lower 7/8 lines of input video signals are displayed in full screen. (Vertical extension and different horizontal timing scaling) |
| Zoom3 | L | L | L |  | Central 7/8 lines of input video signals are displayed on full screen. (Vertically extension, zoom factor=8/7) |

5.7 SPI Register Description

- **Register R0:**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---------|----------|-------|-------|-------|-------|-------|-------|-------|
| Name | reserved | STHD1 | STHD0 | STHP4 | STHP3 | STHP2 | STHP1 | STHP0 |
| Default | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

STHD [1:0]: adjust start pulse position by dot.

| STHD1 | STHD0 | STH position adjust by dot |
|-------|-------|----------------------------|
| 1 | 1 | -1 |
| 1 | 0 | -2 |
| 0 | 0 | 0 |
| 0 | 1 | +1 |

STHP [4:0]: adjust start pulse position by pixel

| STHP4 | STHP3 | STHP2 | STHP1 | STHP0 | STH position adjust by pixel |
|-------|-------|-------|-------|-------|------------------------------|
| 1 | 1 | 1 | 1 | 1 | -1 |
| 1 | 1 | 1 | 1 | 0 | -2 |
| 1 | 1 | 1 | 0 | 1 | -3 |
| 1 | 1 | 1 | 0 | 0 | -4 |
| 1 | 1 | 0 | 1 | 1 | -5 |
| 1 | 1 | 0 | 1 | 0 | -6 |
| 1 | 1 | 0 | 0 | 1 | -7 |
| 1 | 1 | 0 | 0 | 0 | -8 |
| 1 | 0 | 1 | 1 | 1 | -9 |
| 1 | 0 | 1 | 1 | 0 | -10 |
| 1 | 0 | 1 | 0 | 1 | -11 |
| 1 | 0 | 1 | 0 | 0 | -12 |
| 1 | 0 | 0 | 1 | 1 | -13 |
| 1 | 0 | 0 | 1 | 0 | -14 |
| 1 | 0 | 0 | 0 | 1 | -15 |
| 1 | 0 | 0 | 0 | 0 | -16 |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | +1 |
| 0 | 0 | 0 | 1 | 0 | +2 |
| 0 | 0 | 0 | 1 | 1 | +3 |
| 0 | 0 | 1 | 0 | 0 | +4 |
| 0 | 0 | 1 | 0 | 1 | +5 |
| 0 | 0 | 1 | 1 | 0 | +6 |
| 0 | 0 | 1 | 1 | 1 | +7 |
| 0 | 1 | 0 | 0 | 0 | +8 |
| 0 | 1 | 0 | 0 | 1 | +9 |
| 0 | 1 | 0 | 1 | 0 | +10 |
| 0 | 1 | 0 | 1 | 1 | +11 |
| 0 | 1 | 1 | 0 | 0 | +12 |
| 0 | 1 | 1 | 0 | 1 | +13 |
| 0 | 1 | 1 | 1 | 0 | +14 |
| 0 | 1 | 1 | 1 | 1 | +15 |

- **Register R1:**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---------|-------|-------|-------|-------|--------|--------|---------|----------|
| Name | STVP3 | STVP2 | STVP1 | STVP0 | STVNT1 | STVNT0 | STVPAL1 | STV_PAL0 |
| Default | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

STVP [3:0]: adjust first line position by line

| STVP3 | STVP2 | STVP1 | STVP0 | STV position adjust by line |
|-------|-------|-------|-------|-----------------------------|
| 1 | 1 | 1 | 1 | -1 |
| 1 | 1 | 1 | 0 | -2 |
| 1 | 1 | 0 | 1 | -3 |
| 1 | 1 | 0 | 0 | -4 |
| 1 | 0 | 1 | 1 | -5 |
| 1 | 0 | 1 | 0 | -6 |
| 1 | 0 | 0 | 1 | -7 |
| 1 | 0 | 0 | 0 | -8 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | +1 |
| 0 | 0 | 1 | 0 | +2 |
| 0 | 0 | 1 | 1 | +3 |
| 0 | 1 | 0 | 0 | +4 |
| 0 | 1 | 0 | 1 | +5 |
| 0 | 1 | 1 | 0 | +6 |
| 0 | 1 | 1 | 1 | +7 |

STVNT[1:0]: When NTSC Mode, the relationship of first line in Even Field and Odd Field

00 : First line in Even Field = First line in Odd Field

01 : First line in Even Field = First line in Odd Field + 1

10 : No Use

11 : First line in Even Field = First line in Odd Field - 1

STVPAL[1:0]: When PAL Mode, the relationship of first line in Even Field and Odd Field

00 : First line in Even Field = First line in Odd Field

01 : First line in Even Field = First line in Odd Field + 1

10 : No Use

11 : First line in Even Field = First line in Odd Field - 1

- **Register R2:**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---------|----------|----------|--------|--------|--------|--------|--------|---------|
| Name | reserved | reserved | OEHCTL | VZ_MOD | HS_POL | VS_POL | NPC_IN | NPC_SET |
| Default | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |

OEHCTL : PAL mode decimation line algorithm

VZ_MOD: zoom mode algorithm control.

HS_POL: HS polarity setting.

HS_POL="L", negative polarity.

HS_POL="H", positive polarity.

VS_POL: VS polarity setting.

VS_POL="L", negative polarity.

VS_POL="H", positive polarity.

NPC_IN: define the NTSC/PAL mode by SPI.

NPC_IN="L", PAL.

NPC_IN="H", NTSC.

NPC_SET: set the NTSC/PAL auto detection or define by NPC_IN.

NPC_SET="L", auto detection.

NPC_SET="H", define by NPC_IN.

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- **Register R3:**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---------|----------|------|---------|---------|--------|----------|-----------|-----------|
| Name | DAC_TEST | TPOE | BA_SET2 | BA_SET1 | PWD_EN | reserved | OSD_VSPOL | OSD_HSPOL |
| Default | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |

DAC_TEST: set test mode for DAC.
 DAC_TEST="L", disable.
 DAC_TEST="H", enable.

TPOE: set test pin, TP[9:0], output enable.
 TPOE="L", TP[9:0] is tri-state.
 TPOE="H", TP[9:0] output enable.

BA_SET[2:1]: set source driver high bias time.
 BA_SET[2:1]="L, L", 100% high bias.
 BA_SET[2:1]="L, H", 2/3 horizontal line period.
 BA_SET[2:1]="H, L", 1/2 horizontal line period.

BA_SET[2:1]="H, H", 1/3 horizontal line period.

PWD_EN: set DAC power saving function.
 PWD_EN="L", disable. The DAC is always power on.
 PWD_EN="H", enable.

OSD_VSPOL: Osd_vs polarity
 OSD_HSPOL: Osd_hs polarity

5.8 Power ON/OFF sequence

To prevent the device from damage due to latch-up, the power ON/OFF sequence shown below must be followed.

Power ON: VCC, GND → VDD, VSS → V1~V8
 Power OFF: V1~V8 → VDD, VSS → VCC, GND

6. DC Characteristics

6.1 Absolute Maximum Rating (GND=VSS=0V)

| Parameter | Symbol | Rating | | Unit |
|--------------------------|------------------|--------|------------|------|
| Power supply voltage (1) | VCC | -0.3 | to +7.0 | V |
| Power supply voltage (2) | VDD | -0.3 | to +7.0 | V |
| Logic Output Voltage | V _{OUT} | -0.3 | to +7.0 | V |
| Input voltage | V _{in} | -0.3 | to VDD+0.3 | V |
| Operation temperature | T _{OPR} | -30 | to +85 | °C |
| Storage temperature | T _{STG} | -55 | to +125 | °C |

Note:

(1)All of the voltages listed above are with respect to GND=VSS=0V.

(2)Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

6.2 DC Electrical Characteristics (GND=VSS=0V, TA=25°C)

| Parameter | Symbol | Rating | | | Unit | Condition |
|---------------------------|------------------|---------|------|---------|------|---|
| | | Min. | Typ. | Max. | | |
| Power supply voltage | VCC | 3 | 3.3 | 3.6 | V | - |
| Power supply voltage | VDD | 3.8 | 5 | 5.5 | V | - |
| Low level input voltage | V _{IL} | 0 | - | 0.3xVCC | V | - |
| High level input voltage | V _{IH} | 0.7xVCC | - | VCC | V | - |
| Output low voltage | V _{OL} | 0 | - | 0.2xVCC | V | I _{OL} =400uA |
| Output high voltage | V _{OH} | 0.8xVCC | - | VCC | V | I _{OH} =-400uA |
| Input leakage current | I _{IN} | -1 | - | +1 | μA | No pull up or pull down. |
| Output voltage deviation | V _{VD} | - | ±20 | - | mV | QA/QB/QC1 ~ 320, V _{IN} =0.1~4.9V, |
| DC offset | V _{OS} | - | - | ±20 | mV | QA/QB/QC1 ~ 320, V _{IN} =0.1~4.9V, |
| Output leakage current | I _O | -1 | - | ±1 | μA | QA/QB/QC1 ~ 320 at high impedance |
| Pull high resistance | R _H | 150 | 200 | 250 | KΩ | RESETB,STB,ZX1~3, VSET |
| Pull low resistance | R _L | 150 | 200 | 250 | KΩ | DEN,IF[2:1],MOD, CF[2:1],Dx[7:0], OSD_R,OSD_G, OSD_B,OSD_EN |
| Output current | I _{OH} | 20 | 40 | - | μA | QA/QB/QC1 ~ 320, V _O =4.9V v.s 4.0V, VDD=5V |
| Output current | I _{OL} | 20 | 40 | - | μA | QA/QB/QC1 ~ 320, V _O =0.1V v.s 1.0V, VDD=5V |
| Analog operating current | I _{DD} | - | - | TBD | mA | f _{CLK} =27MHz, f _{IHS} =15.7KHz, VDD=5V, CL=60pF |
| Digital operating current | I _{CC} | - | - | TBD | mA | f _{CLK} =27MHz, f _{IHS} =15.7KHz, VCC=3.3V |
| Analog standby current | I _{VDD} | - | - | TBD | μA | All LCD outputs are High-Z. |
| Digital standby current | I _{VCC} | - | 10 | 50 | μA | All inputs are stopped and outputs are High-Z. |

7. AC Characteristics

7.1 Input signal characteristics

7.1.1 Digital Serial RGB interface (960x240 resolution)

| PARAMETER | Symbol | Min. | Typ. | Max. | Unit | |
|--|-----------|-----------|------|-------|-----------|-------|
| CLK period | T_{OSC} | - | 52 | - | ns | |
| Data setup time | T_{SU} | 12 | - | - | ns | |
| Data hold time | T_{HD} | 12 | - | - | ns | |
| IHS period | T_H | - | 1224 | - | T_{OSC} | |
| IHS pulse width | T_{HS} | 5 | 90 | - | T_{OSC} | |
| IHS rising time | T_{Cr} | - | - | 700 | ns | |
| IHS falling time | T_{Cf} | - | - | 300 | ns | |
| IVS pulse width | T_{VS} | 1 | 3 | 5 | T_H | |
| IVS rising time | T_{Vr} | - | - | 700 | ns | |
| IVS falling time | T_{Vf} | - | - | 1.5 | μs | |
| IVS falling to IHS rising time for odd field | T_{HVO} | 3 | - | - | T_{OSC} | |
| IVS falling to IHS falling time for even field | T_{HVE} | 3 | - | - | T_{OSC} | |
| IVS-DEN time | NTSC | T_{VSE} | - | 18 | - | T_H |
| | PAL | T_{VSE} | - | 26 | - | T_H |
| IHS-DEN time | T_{HE} | 108 | 204 | 264 | T_{OSC} | |
| DEN pulse width | T_{EP} | - | 960 | - | T_{OSC} | |
| DEN-STH time | T_{DES} | - | 3 | - | T_{OSC} | |
| IVS period | NTSC | - | - | 262.5 | - | T_H |
| | PAL | - | - | 312.5 | - | T_H |

Note:

(1)When SYNC mode is used, 1st data start from 204th CLK after IHS falling

7.1.2 Digital Parallel RGB interface (960x240 resolution)

| PARAMETER | Symbol | Min. | Typ. | Max. | Unit | |
|--|------------------|------------------|-------|------|------------------|----------------|
| CLK period | T _{OSC} | - | 156 | - | ns | |
| Data setup time | T _{SU} | 12 | - | - | ns | |
| Data hold time | T _{HD} | 12 | - | - | ns | |
| IHS period | T _H | - | 408 | - | T _{OSC} | |
| IHS pulse width | T _{HS} | 5 | 30 | - | T _{OSC} | |
| IHS rising time | T _{Cr} | - | - | 700 | ns | |
| IHS falling time | T _{Cf} | - | - | 300 | ns | |
| IVS pulse width | T _{VS} | 1 | 3 | 5 | T _H | |
| IVS rising time | T _{Vr} | - | - | 700 | ns | |
| IVS falling time | T _{Vf} | - | - | 1.5 | μs | |
| IVS falling to IHS rising time for odd field | T _{HVO} | 1 | - | - | T _{OSC} | |
| IVS falling to IHS falling time for even field | T _{HVE} | 1 | - | - | T _{OSC} | |
| IVS-DEN time | NTSC | T _{VSE} | - | 18 | - | T _H |
| | PAL | T _{VSE} | - | 26 | - | T _H |
| IHS-DEN time | T _{HE} | 36 | 68 | 88 | T _{OSC} | |
| DEN pulse width | T _{EP} | - | 320 | - | T _{OSC} | |
| DEN-STH time | T _{DES} | - | 1 | - | T _{OSC} | |
| IVS period | NTSC | - | 262.5 | - | T _H | |
| | PAL | - | 312.5 | - | T _H | |

Note:

(1)When SYNC mode is used, 1st data start from 68th CLK after IHS falling.

7.1.3 CCIR601/656 Interface

| PARAMETER | Symbol | Min. | Typ. | Max. | Unit. |
|-----------------|------------------|------|------|------|-------|
| CLK period | T _{OSC} | - | 37 | - | ns |
| Data setup time | T _{SU} | 12 | - | - | ns |
| Data hold time | T _{HD} | 12 | - | - | ns |

7.1.4 Hardware reset timing

| PARAMETER | Symbol | Min. | Typ. | Max. | Unit. |
|------------------------|------------------|------|------|------|-------|
| RESETB low pulse width | T _{RSB} | 10 | - | - | μs |

7.2 Output signal characteristics for digital input signal

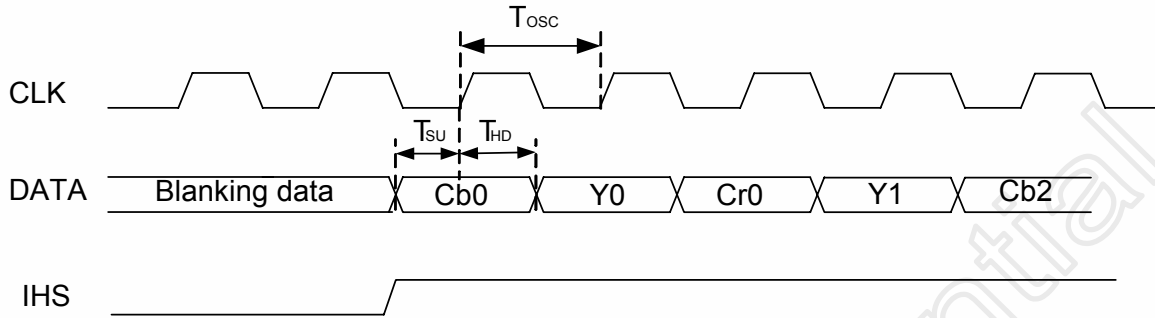
| PARAMETER | Symbol | Min. | Typ. | Max. | Unit. | |
|--------------------------|-----------|-----------|------|------|---------|-------|
| Rising time | T_r | - | - | 10 | ns | |
| Falling time | T_f | - | - | 10 | ns | |
| Internal STH setup time | T_{SUS} | 12 | - | - | ns | |
| Internal STH hold time | T_{HDS} | 12 | - | - | ns | |
| Internal data setup time | T_{SUD} | 60 | - | - | ns | |
| Internal data hold time | T_{HDD} | 40 | - | - | ns | |
| OEH pulse width | T_{OEH} | - | 1248 | - | ns | |
| OEV pulse width | T_{OEV} | - | 4992 | - | ns | |
| CKV pulse width | T_{CKV} | - | 3744 | - | ns | |
| IHS-OEH time | T_1 | - | 4368 | - | ns | |
| IHS-CKV time | T_2 | - | 2496 | - | ns | |
| IHS-OEV time | T_3 | - | 624 | - | ns | |
| STV setup time | T_{SUV} | - | 1872 | - | ns | |
| STV pulse width | T_{STV} | - | 1 | - | T_H | |
| IVS-STV time | NTSC | T_{VS1} | - | 19 | - | T_H |
| | PAL | T_{VS1} | - | 27 | - | T_H |
| OEH-STV time | T_{OES} | - | 2 | - | T_H | |
| Output settling time | T_{ST} | - | 12 | 20 | μs | |

8. Waveform

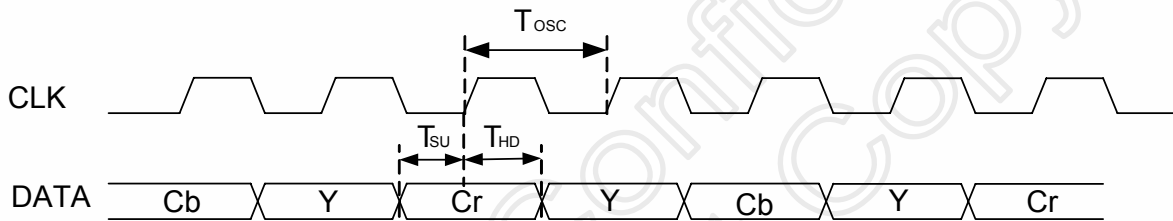
8.1 Timing Controller Timing Chart

8.1.1 Clock and Data waveform

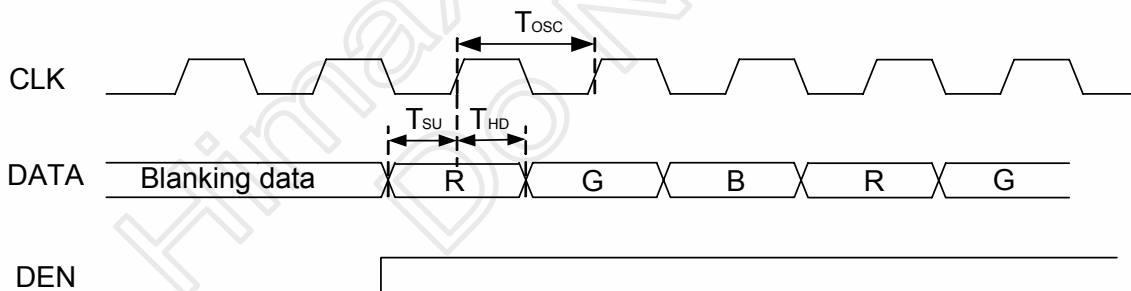
- CCIR601 (HS_POL="L" in Register R2)



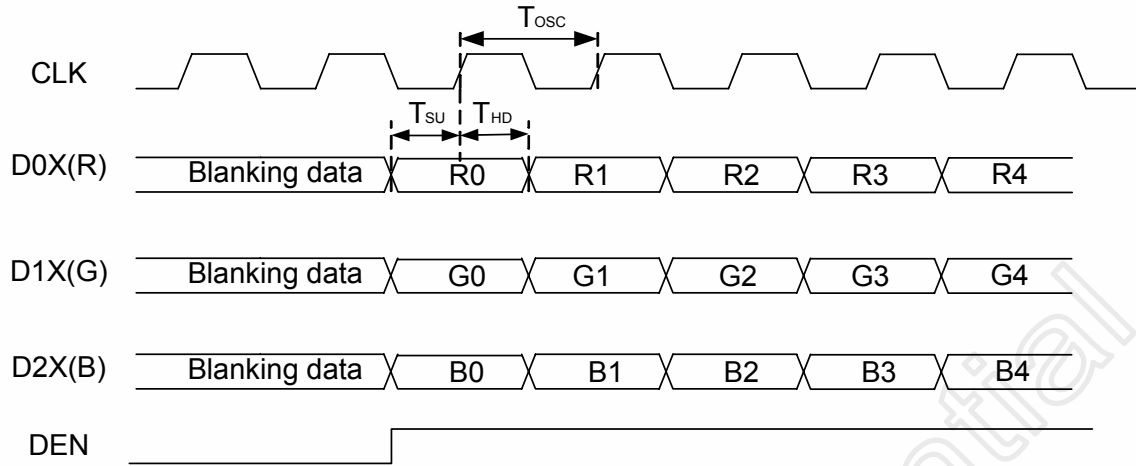
- CCIR656



- Digital Serial RGB



● **Digital Parallel RGB**

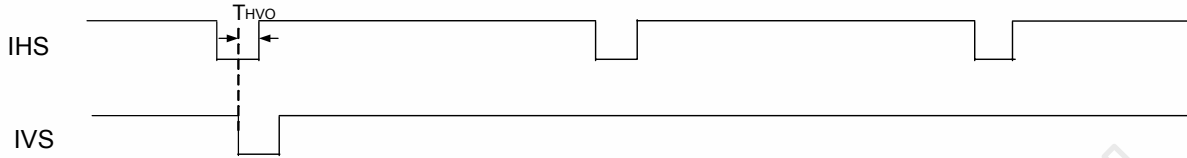


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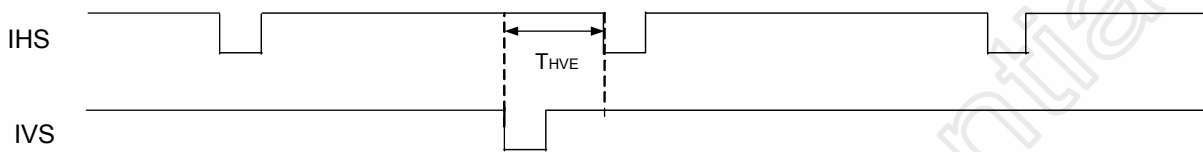
8.1.2 Digital/Analog RGB timing waveform

8.1.2.1 IHS and IVS timing

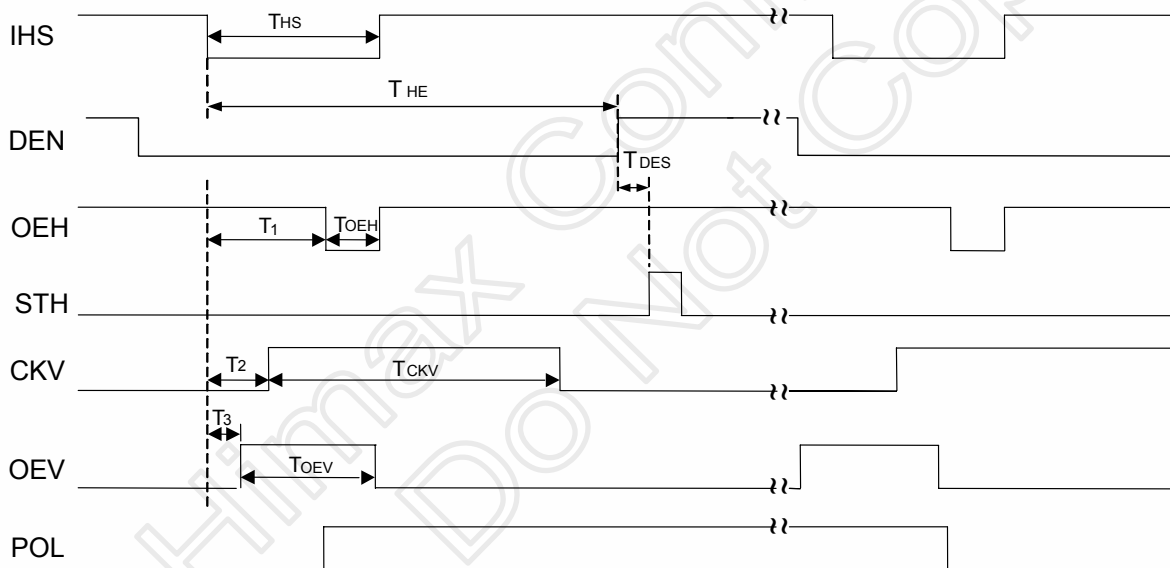
- Odd field



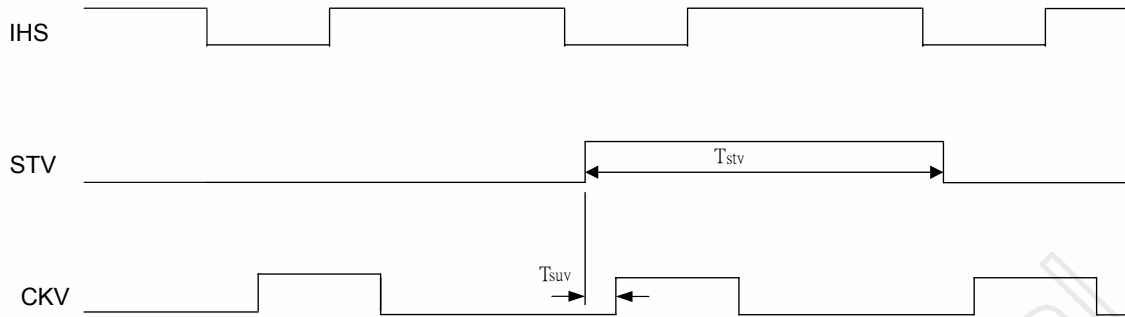
- Even field



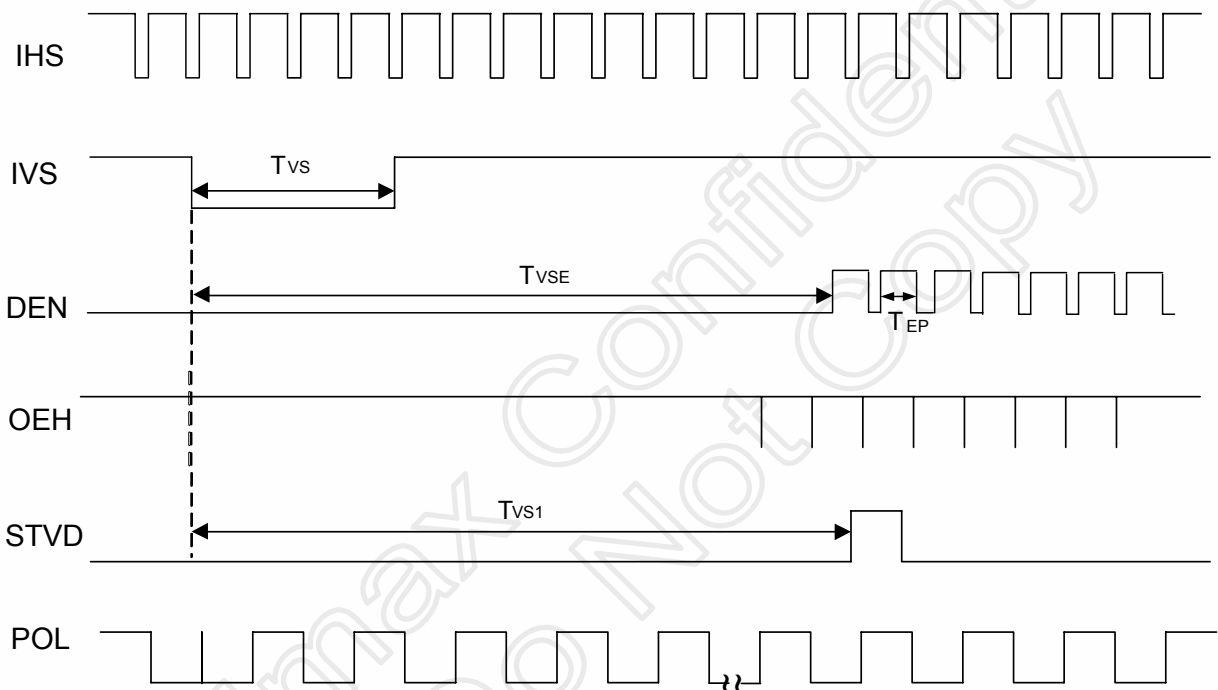
8.1.2.2 IHS and horizontal control timing waveform



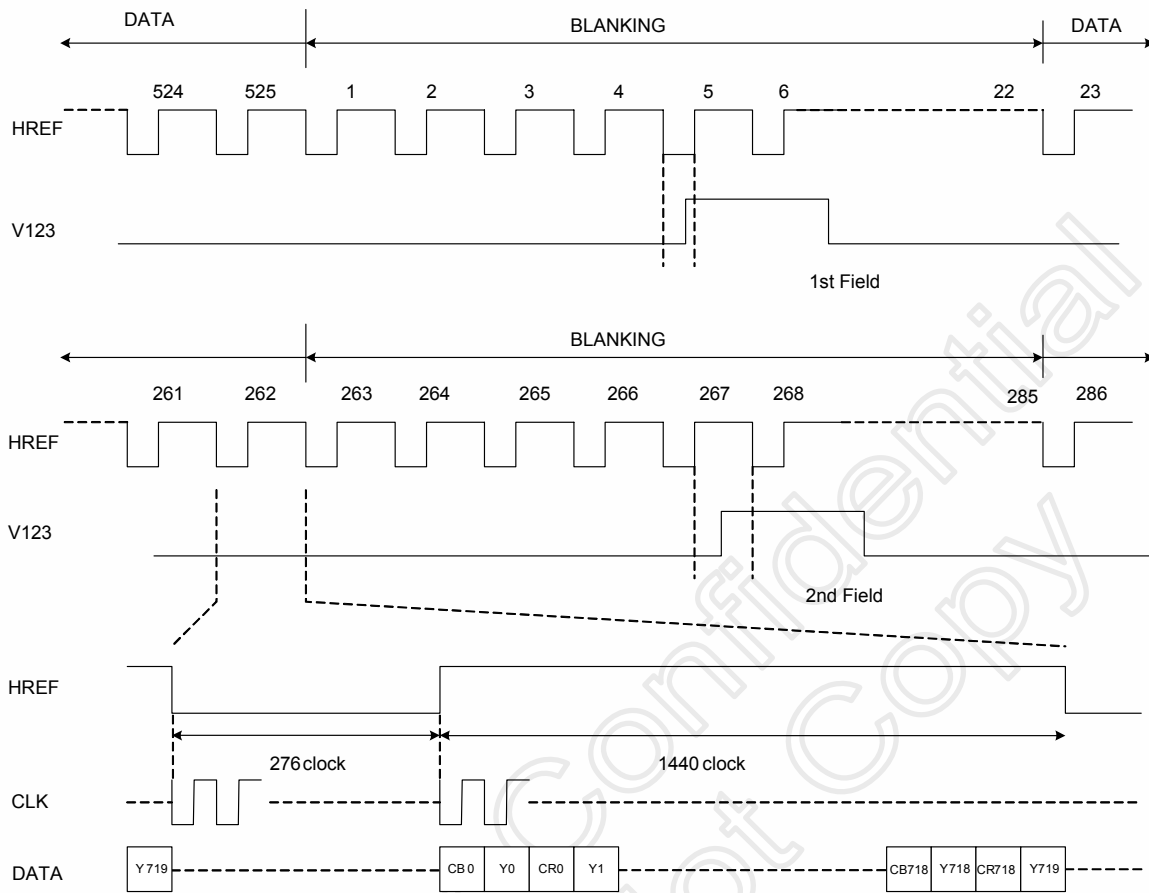
8.1.2.3 IHS and vertical shift clock timing waveform



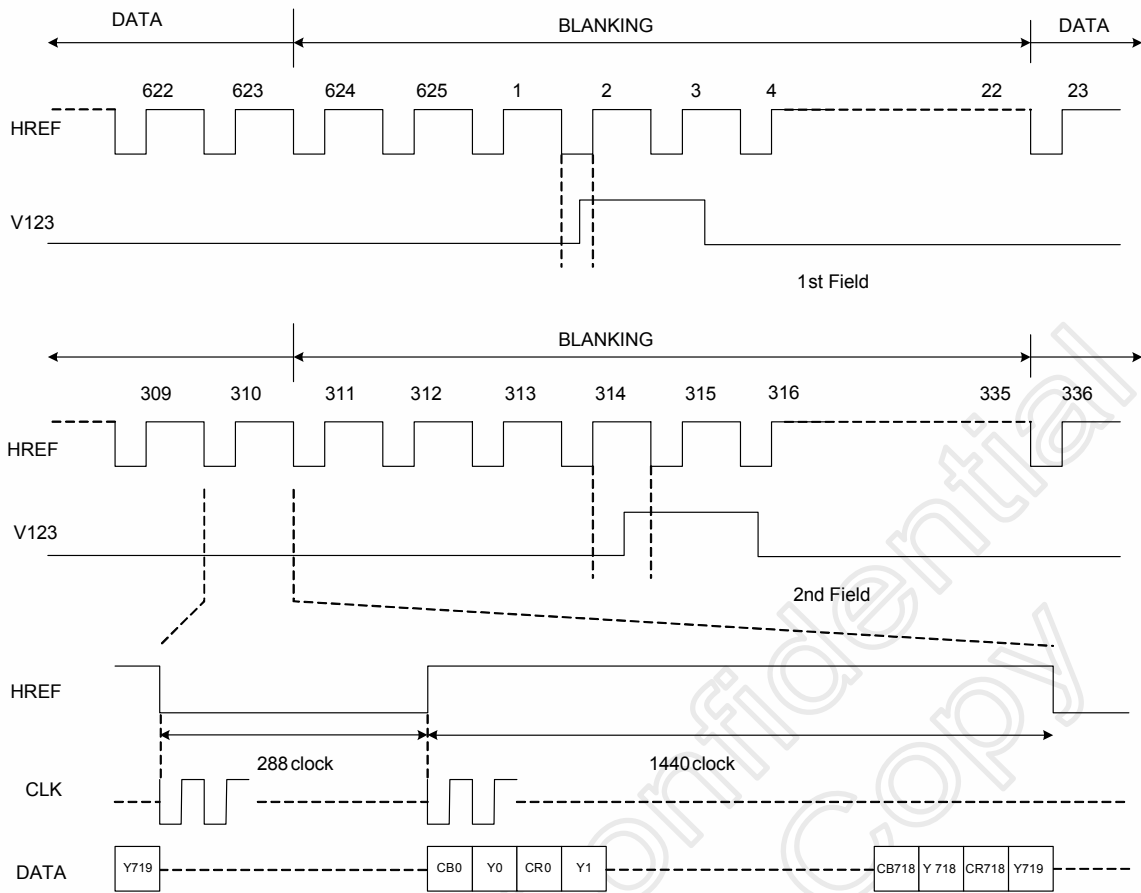
8.1.2.4 IHS and vertical control timing waveform



8.1.3 CCIR601 timing waveform VS_POL="H", HS_POL="L" in Register R2)



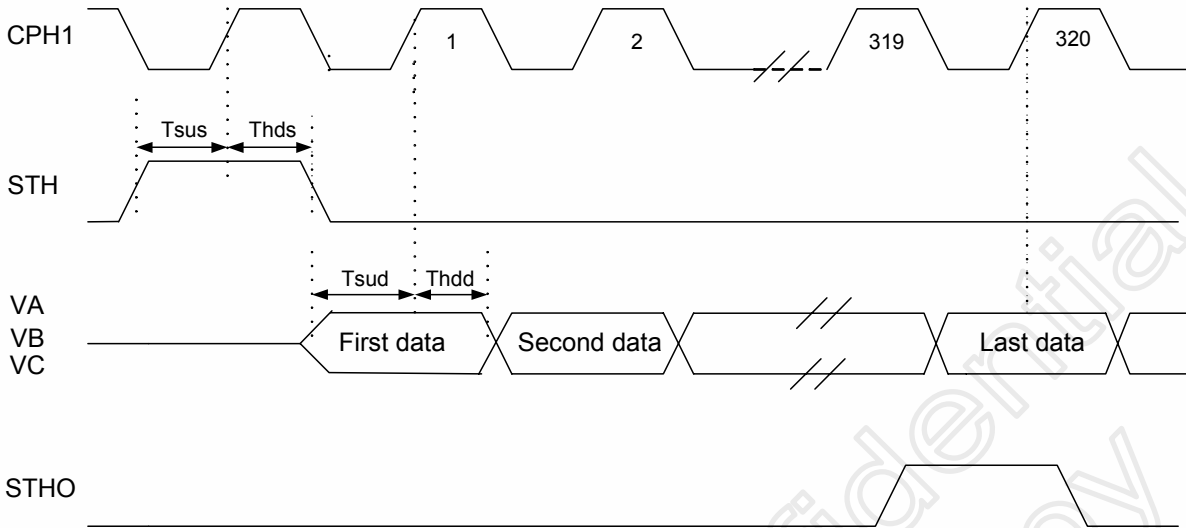
ITU-R BT. 601 NTSC Input Timing



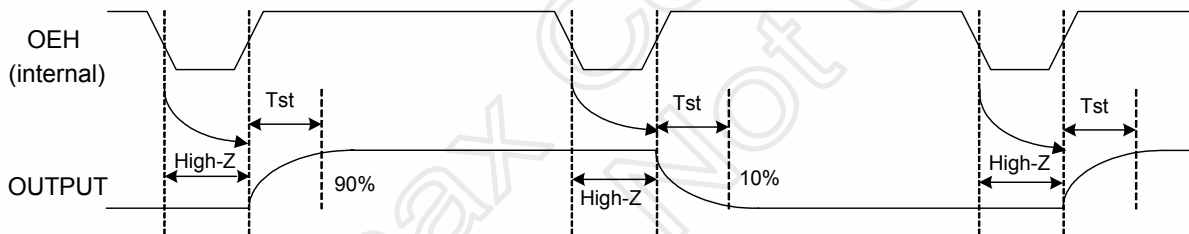
ITU-R BT. 601 PAL Input Timing

8.2 Source Driver Timing Chart

8.2.1 Clock and Start Pulse timing waveform

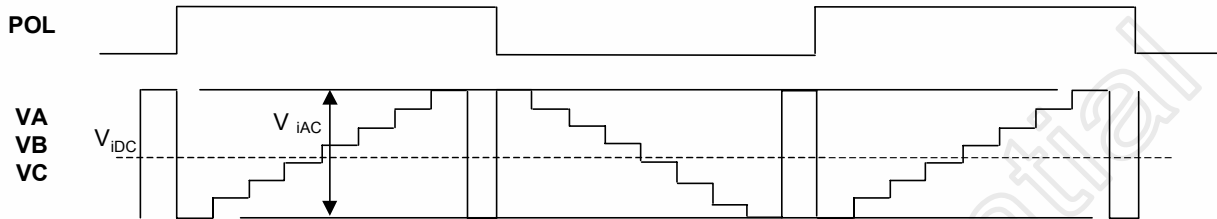


8.2.2 OEH and Data Output timing waveform



9. Analog video signal characteristics

| PARAMETER | Symbol | Min. | Typ. | Max. | Unit |
|--|-----------|------|-------|------|------|
| Video signal amplitude (VA, VB, VC) | V_{IAC} | - | 3.81 | - | V |
| | V_{IDC} | - | 2.385 | - | V |

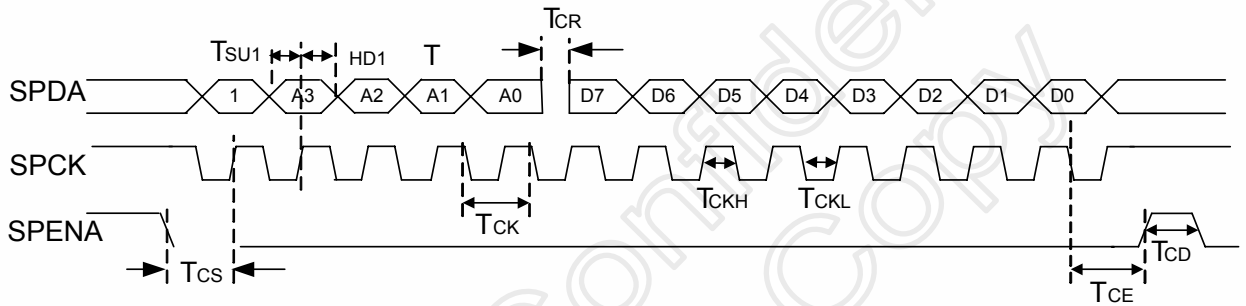


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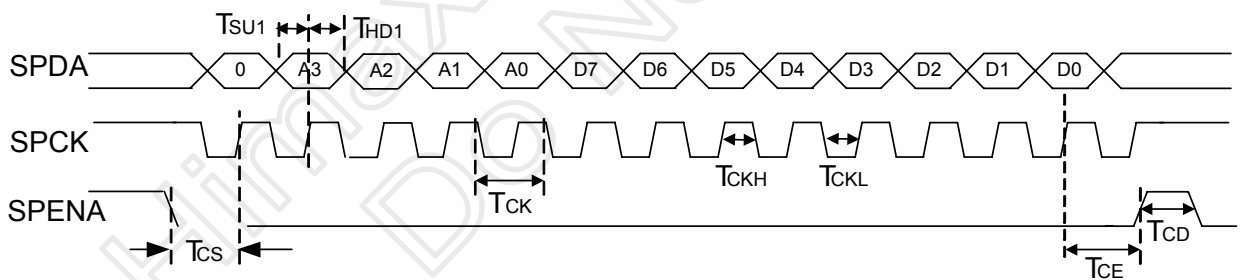
10. SPI timing characteristics

| PARAMETER | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------|-----------|------|------|------|----------|
| SPCK period | T_{CK} | 60 | - | - | ns |
| SPCK high width | T_{CKH} | 30 | - | - | ns |
| SPCK low width | T_{CKL} | 30 | - | - | ns |
| Data setup time | T_{SU1} | 12 | - | - | ns |
| Data hold time | T_{HD1} | 12 | - | - | ns |
| SPENA to SPCK setup time | T_{CS} | 20 | - | - | ns |
| SPENA to SPDA hold time | T_{CE} | 20 | - | - | ns |
| SPENA high pulse width | T_{CD} | 50 | - | - | ns |
| SPDA output latency | T_{CR} | - | 1/2 | - | T_{CK} |

● **SPI “read” timing**

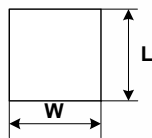
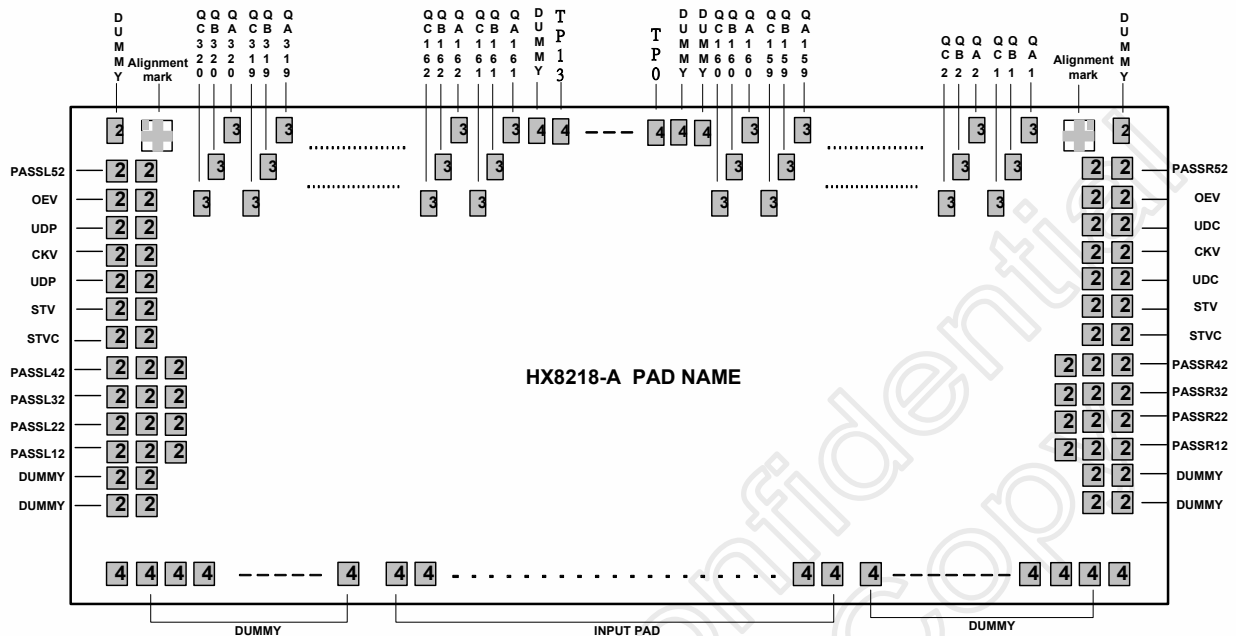


● **SPI “write” timing**



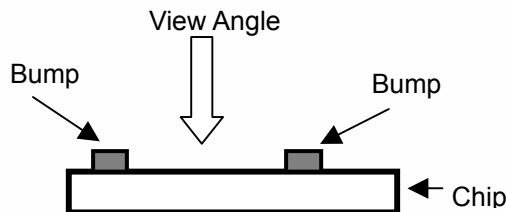
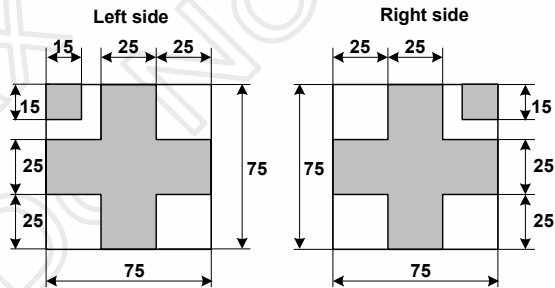
11. Bump Mask Information

- Chip size: 23573μm x 1436μm
- Bump height: 15 μm ± 3 μm
- Bump hardness: 60 H_V ± 15 H_V



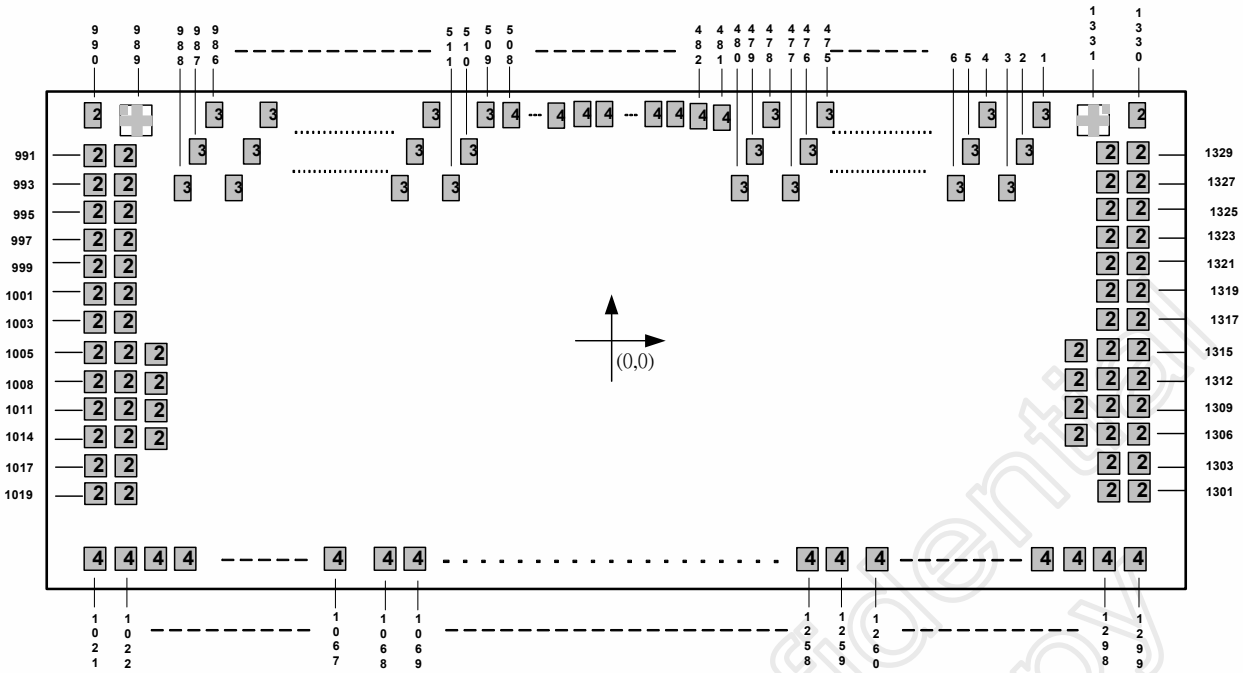
Alignment mark dimension unit:um

- 2 : WxL = 50umx50um
- 3 : WxL = 20umx100um
- 4 : WxL = 50umx80um



The figure of "View Angle"

● PAD Coordinate



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| No. | Name | X | Y | No. | Name | X | Y | No. | Name | X | Y |
|-----|------|---------|-----|-----|------|---------|-----|-----|------|--------|-----|
| 1 | QA1 | 11451.8 | 583 | 61 | QA21 | 10251.8 | 583 | 121 | QA41 | 9051.8 | 583 |
| 2 | QB1 | 11431.8 | 453 | 62 | QB21 | 10231.8 | 453 | 122 | QB41 | 9031.8 | 453 |
| 3 | QC1 | 11411.8 | 323 | 63 | QC21 | 10211.8 | 323 | 123 | QC41 | 9011.8 | 323 |
| 4 | QA2 | 11391.8 | 583 | 64 | QA22 | 10191.8 | 583 | 124 | QA42 | 8991.8 | 583 |
| 5 | QB2 | 11371.8 | 453 | 65 | QB22 | 10171.8 | 453 | 125 | QB42 | 8971.8 | 453 |
| 6 | QC2 | 11351.8 | 323 | 66 | QC22 | 10151.8 | 323 | 126 | QC42 | 8951.8 | 323 |
| 7 | QA3 | 11331.8 | 583 | 67 | QA23 | 10131.8 | 583 | 127 | QA43 | 8931.8 | 583 |
| 8 | QB3 | 11311.8 | 453 | 68 | QB23 | 10111.8 | 453 | 128 | QB43 | 8911.8 | 453 |
| 9 | QC3 | 11291.8 | 323 | 69 | QC23 | 10091.8 | 323 | 129 | QC43 | 8891.8 | 323 |
| 10 | QA4 | 11271.8 | 583 | 70 | QA24 | 10071.8 | 583 | 130 | QA44 | 8871.8 | 583 |
| 11 | QB4 | 11251.8 | 453 | 71 | QB24 | 10051.8 | 453 | 131 | QB44 | 8851.8 | 453 |
| 12 | QC4 | 11231.8 | 323 | 72 | QC24 | 10031.8 | 323 | 132 | QC44 | 8831.8 | 323 |
| 13 | QA5 | 11211.8 | 583 | 73 | QA25 | 10011.8 | 583 | 133 | QA45 | 8811.8 | 583 |
| 14 | QB5 | 11191.8 | 453 | 74 | QB25 | 9991.8 | 453 | 134 | QB45 | 8791.8 | 453 |
| 15 | QC5 | 11171.8 | 323 | 75 | QC25 | 9971.8 | 323 | 135 | QC45 | 8771.8 | 323 |
| 16 | QA6 | 11151.8 | 583 | 76 | QA26 | 9951.8 | 583 | 136 | QA46 | 8751.8 | 583 |
| 17 | QB6 | 11131.8 | 453 | 77 | QB26 | 9931.8 | 453 | 137 | QB46 | 8731.8 | 453 |
| 18 | QC6 | 11111.8 | 323 | 78 | QC26 | 9911.8 | 323 | 138 | QC46 | 8711.8 | 323 |
| 19 | QA7 | 11091.8 | 583 | 79 | QA27 | 9891.8 | 583 | 139 | QA47 | 8691.8 | 583 |
| 20 | QB7 | 11071.8 | 453 | 80 | QB27 | 9871.8 | 453 | 140 | QB47 | 8671.8 | 453 |
| 21 | QC7 | 11051.8 | 323 | 81 | QC27 | 9851.8 | 323 | 141 | QC47 | 8651.8 | 323 |
| 22 | QA8 | 11031.8 | 583 | 82 | QA28 | 9831.8 | 583 | 142 | QA48 | 8631.8 | 583 |
| 23 | QB8 | 11011.8 | 453 | 83 | QB28 | 9811.8 | 453 | 143 | QB48 | 8611.8 | 453 |
| 24 | QC8 | 10991.8 | 323 | 84 | QC28 | 9791.8 | 323 | 144 | QC48 | 8591.8 | 323 |
| 25 | QA9 | 10971.8 | 583 | 85 | QA29 | 9771.8 | 583 | 145 | QA49 | 8571.8 | 583 |
| 26 | QB9 | 10951.8 | 453 | 86 | QB29 | 9751.8 | 453 | 146 | QB49 | 8551.8 | 453 |
| 27 | QC9 | 10931.8 | 323 | 87 | QC29 | 9731.8 | 323 | 147 | QC49 | 8531.8 | 323 |
| 28 | QA10 | 10911.8 | 583 | 88 | QA30 | 9711.8 | 583 | 148 | QA50 | 8511.8 | 583 |
| 29 | QB10 | 10891.8 | 453 | 89 | QB30 | 9691.8 | 453 | 149 | QB50 | 8491.8 | 453 |
| 30 | QC10 | 10871.8 | 323 | 90 | QC30 | 9671.8 | 323 | 150 | QC50 | 8471.8 | 323 |
| 31 | QA11 | 10851.8 | 583 | 91 | QA31 | 9651.8 | 583 | 151 | QA51 | 8451.8 | 583 |
| 32 | QB11 | 10831.8 | 453 | 92 | QB31 | 9631.8 | 453 | 152 | QB51 | 8431.8 | 453 |
| 33 | QC11 | 10811.8 | 323 | 93 | QC31 | 9611.8 | 323 | 153 | QC51 | 8411.8 | 323 |
| 34 | QA12 | 10791.8 | 583 | 94 | QA32 | 9591.8 | 583 | 154 | QA52 | 8391.8 | 583 |
| 35 | QB12 | 10771.8 | 453 | 95 | QB32 | 9571.8 | 453 | 155 | QB52 | 8371.8 | 453 |
| 36 | QC12 | 10751.8 | 323 | 96 | QC32 | 9551.8 | 323 | 156 | QC52 | 8351.8 | 323 |
| 37 | QA13 | 10731.8 | 583 | 97 | QA33 | 9531.8 | 583 | 157 | QA53 | 8331.8 | 583 |
| 38 | QB13 | 10711.8 | 453 | 98 | QB33 | 9511.8 | 453 | 158 | QB53 | 8311.8 | 453 |
| 39 | QC13 | 10691.8 | 323 | 99 | QC33 | 9491.8 | 323 | 159 | QC53 | 8291.8 | 323 |
| 40 | QA14 | 10671.8 | 583 | 100 | QA34 | 9471.8 | 583 | 160 | QA54 | 8271.8 | 583 |
| 41 | QB14 | 10651.8 | 453 | 101 | QB34 | 9451.8 | 453 | 161 | QB54 | 8251.8 | 453 |
| 42 | QC14 | 10631.8 | 323 | 102 | QC34 | 9431.8 | 323 | 162 | QC54 | 8231.8 | 323 |
| 43 | QA15 | 10611.8 | 583 | 103 | QA35 | 9411.8 | 583 | 163 | QA55 | 8211.8 | 583 |
| 44 | QB15 | 10591.8 | 453 | 104 | QB35 | 9391.8 | 453 | 164 | QB55 | 8191.8 | 453 |
| 45 | QC15 | 10571.8 | 323 | 105 | QC35 | 9371.8 | 323 | 165 | QC55 | 8171.8 | 323 |
| 46 | QA16 | 10551.8 | 583 | 106 | QA36 | 9351.8 | 583 | 166 | QA56 | 8151.8 | 583 |
| 47 | QB16 | 10531.8 | 453 | 107 | QB36 | 9331.8 | 453 | 167 | QB56 | 8131.8 | 453 |
| 48 | QC16 | 10511.8 | 323 | 108 | QC36 | 9311.8 | 323 | 168 | QC56 | 8111.8 | 323 |
| 49 | QA17 | 10491.8 | 583 | 109 | QA37 | 9291.8 | 583 | 169 | QA57 | 8091.8 | 583 |
| 50 | QB17 | 10471.8 | 453 | 110 | QB37 | 9271.8 | 453 | 170 | QB57 | 8071.8 | 453 |
| 51 | QC17 | 10451.8 | 323 | 111 | QC37 | 9251.8 | 323 | 171 | QC57 | 8051.8 | 323 |
| 52 | QA18 | 10431.8 | 583 | 112 | QA38 | 9231.8 | 583 | 172 | QA58 | 8031.8 | 583 |
| 53 | QB18 | 10411.8 | 453 | 113 | QB38 | 9211.8 | 453 | 173 | QB58 | 8011.8 | 453 |
| 54 | QC18 | 10391.8 | 323 | 114 | QC38 | 9191.8 | 323 | 174 | QC58 | 7991.8 | 323 |
| 55 | QA19 | 10371.8 | 583 | 115 | QA39 | 9171.8 | 583 | 175 | QA59 | 7971.8 | 583 |
| 56 | QB19 | 10351.8 | 453 | 116 | QB39 | 9151.8 | 453 | 176 | QB59 | 7951.8 | 453 |
| 57 | QC19 | 10331.8 | 323 | 117 | QC39 | 9131.8 | 323 | 177 | QC59 | 7931.8 | 323 |
| 58 | QA20 | 10311.8 | 583 | 118 | QA40 | 9111.8 | 583 | 178 | QA60 | 7911.8 | 583 |
| 59 | QB20 | 10291.8 | 453 | 119 | QB40 | 9091.8 | 453 | 179 | QB60 | 7891.8 | 453 |
| 60 | QC20 | 10271.8 | 323 | 120 | QC40 | 9071.8 | 323 | 180 | QC60 | 7871.8 | 323 |

| No. | Name | X | Y | No. | Name | X | Y | No. | Name | X | Y |
|-----|------|--------|-----|-----|-------|--------|-----|-----|-------|--------|-----|
| 181 | QA61 | 7851.8 | 583 | 241 | QA81 | 6651.8 | 583 | 301 | QA101 | 5451.8 | 583 |
| 182 | QB61 | 7831.8 | 453 | 242 | QB81 | 6631.8 | 453 | 302 | QB101 | 5431.8 | 453 |
| 183 | QC61 | 7811.8 | 323 | 243 | QC81 | 6611.8 | 323 | 303 | QC101 | 5411.8 | 323 |
| 184 | QA62 | 7791.8 | 583 | 244 | QA82 | 6591.8 | 583 | 304 | QA102 | 5391.8 | 583 |
| 185 | QB62 | 7771.8 | 453 | 245 | QB82 | 6571.8 | 453 | 305 | QB102 | 5371.8 | 453 |
| 186 | QC62 | 7751.8 | 323 | 246 | QC82 | 6551.8 | 323 | 306 | QC102 | 5351.8 | 323 |
| 187 | QA63 | 7731.8 | 583 | 247 | QA83 | 6531.8 | 583 | 307 | QA103 | 5331.8 | 583 |
| 188 | QB63 | 7711.8 | 453 | 248 | QB83 | 6511.8 | 453 | 308 | QB103 | 5311.8 | 453 |
| 189 | QC63 | 7691.8 | 323 | 249 | QC83 | 6491.8 | 323 | 309 | QC103 | 5291.8 | 323 |
| 190 | QA64 | 7671.8 | 583 | 250 | QA84 | 6471.8 | 583 | 310 | QA104 | 5271.8 | 583 |
| 191 | QB64 | 7651.8 | 453 | 251 | QB84 | 6451.8 | 453 | 311 | QB104 | 5251.8 | 453 |
| 192 | QC64 | 7631.8 | 323 | 252 | QC84 | 6431.8 | 323 | 312 | QC104 | 5231.8 | 323 |
| 193 | QA65 | 7611.8 | 583 | 253 | QA85 | 6411.8 | 583 | 313 | QA105 | 5211.8 | 583 |
| 194 | QB65 | 7591.8 | 453 | 254 | QB85 | 6391.8 | 453 | 314 | QB105 | 5191.8 | 453 |
| 195 | QC65 | 7571.8 | 323 | 255 | QC85 | 6371.8 | 323 | 315 | QC105 | 5171.8 | 323 |
| 196 | QA66 | 7551.8 | 583 | 256 | QA86 | 6351.8 | 583 | 316 | QA106 | 5151.8 | 583 |
| 197 | QB66 | 7531.8 | 453 | 257 | QB86 | 6331.8 | 453 | 317 | QB106 | 5131.8 | 453 |
| 198 | QC66 | 7511.8 | 323 | 258 | QC86 | 6311.8 | 323 | 318 | QC106 | 5111.8 | 323 |
| 199 | QA67 | 7491.8 | 583 | 259 | QA87 | 6291.8 | 583 | 319 | QA107 | 5091.8 | 583 |
| 200 | QB67 | 7471.8 | 453 | 260 | QB87 | 6271.8 | 453 | 320 | QB107 | 5071.8 | 453 |
| 201 | QC67 | 7451.8 | 323 | 261 | QC87 | 6251.8 | 323 | 321 | QC107 | 5051.8 | 323 |
| 202 | QA68 | 7431.8 | 583 | 262 | QA88 | 6231.8 | 583 | 322 | QA108 | 5031.8 | 583 |
| 203 | QB68 | 7411.8 | 453 | 263 | QB88 | 6211.8 | 453 | 323 | QB108 | 5011.8 | 453 |
| 204 | QC68 | 7391.8 | 323 | 264 | QC88 | 6191.8 | 323 | 324 | QC108 | 4991.8 | 323 |
| 205 | QA69 | 7371.8 | 583 | 265 | QA89 | 6171.8 | 583 | 325 | QA109 | 4971.8 | 583 |
| 206 | QB69 | 7351.8 | 453 | 266 | QB89 | 6151.8 | 453 | 326 | QB109 | 4951.8 | 453 |
| 207 | QC69 | 7331.8 | 323 | 267 | QC89 | 6131.8 | 323 | 327 | QC109 | 4931.8 | 323 |
| 208 | QA70 | 7311.8 | 583 | 268 | QA90 | 6111.8 | 583 | 328 | QA110 | 4911.8 | 583 |
| 209 | QB70 | 7291.8 | 453 | 269 | QB90 | 6091.8 | 453 | 329 | QB110 | 4891.8 | 453 |
| 210 | QC70 | 7271.8 | 323 | 270 | QC90 | 6071.8 | 323 | 330 | QC110 | 4871.8 | 323 |
| 211 | QA71 | 7251.8 | 583 | 271 | QA91 | 6051.8 | 583 | 331 | QA111 | 4851.8 | 583 |
| 212 | QB71 | 7231.8 | 453 | 272 | QB91 | 6031.8 | 453 | 332 | QB111 | 4831.8 | 453 |
| 213 | QC71 | 7211.8 | 323 | 273 | QC91 | 6011.8 | 323 | 333 | QC111 | 4811.8 | 323 |
| 214 | QA72 | 7191.8 | 583 | 274 | QA92 | 5991.8 | 583 | 334 | QA112 | 4791.8 | 583 |
| 215 | QB72 | 7171.8 | 453 | 275 | QB92 | 5971.8 | 453 | 335 | QB112 | 4771.8 | 453 |
| 216 | QC72 | 7151.8 | 323 | 276 | QC92 | 5951.8 | 323 | 336 | QC112 | 4751.8 | 323 |
| 217 | QA73 | 7131.8 | 583 | 277 | QA93 | 5931.8 | 583 | 337 | QA113 | 4731.8 | 583 |
| 218 | QB73 | 7111.8 | 453 | 278 | QB93 | 5911.8 | 453 | 338 | QB113 | 4711.8 | 453 |
| 219 | QC73 | 7091.8 | 323 | 279 | QC93 | 5891.8 | 323 | 339 | QC113 | 4691.8 | 323 |
| 220 | QA74 | 7071.8 | 583 | 280 | QA94 | 5871.8 | 583 | 340 | QA114 | 4671.8 | 583 |
| 221 | QB74 | 7051.8 | 453 | 281 | QB94 | 5851.8 | 453 | 341 | QB114 | 4651.8 | 453 |
| 222 | QC74 | 7031.8 | 323 | 282 | QC94 | 5831.8 | 323 | 342 | QC114 | 4631.8 | 323 |
| 223 | QA75 | 7011.8 | 583 | 283 | QA95 | 5811.8 | 583 | 343 | QA115 | 4611.8 | 583 |
| 224 | QB75 | 6991.8 | 453 | 284 | QB95 | 5791.8 | 453 | 344 | QB115 | 4591.8 | 453 |
| 225 | QC75 | 6971.8 | 323 | 285 | QC95 | 5771.8 | 323 | 345 | QC115 | 4571.8 | 323 |
| 226 | QA76 | 6951.8 | 583 | 286 | QA96 | 5751.8 | 583 | 346 | QA116 | 4551.8 | 583 |
| 227 | QB76 | 6931.8 | 453 | 287 | QB96 | 5731.8 | 453 | 347 | QB116 | 4531.8 | 453 |
| 228 | QC76 | 6911.8 | 323 | 288 | QC96 | 5711.8 | 323 | 348 | QC116 | 4511.8 | 323 |
| 229 | QA77 | 6891.8 | 583 | 289 | QA97 | 5691.8 | 583 | 349 | QA117 | 4491.8 | 583 |
| 230 | QB77 | 6871.8 | 453 | 290 | QB97 | 5671.8 | 453 | 350 | QB117 | 4471.8 | 453 |
| 231 | QC77 | 6851.8 | 323 | 291 | QC97 | 5651.8 | 323 | 351 | QC117 | 4451.8 | 323 |
| 232 | QA78 | 6831.8 | 583 | 292 | QA98 | 5631.8 | 583 | 352 | QA118 | 4431.8 | 583 |
| 233 | QB78 | 6811.8 | 453 | 293 | QB98 | 5611.8 | 453 | 353 | QB118 | 4411.8 | 453 |
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| 237 | QC79 | 6731.8 | 323 | 297 | QC99 | 5531.8 | 323 | 357 | QC119 | 4331.8 | 323 |
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| 370 | QA124 | 4071.8 | 583 | 430 | QA144 | 2871.8 | 583 | 490 | TP3 | 515.6 | 593 |
| 371 | QB124 | 4051.8 | 453 | 431 | QB144 | 2851.8 | 453 | 491 | TP4 | 300.6 | 593 |
| 372 | QC124 | 4031.8 | 323 | 432 | QC144 | 2831.8 | 323 | 492 | TP4 | 230.6 | 593 |
| 373 | QA125 | 4011.8 | 583 | 433 | QA145 | 2811.8 | 583 | 493 | TP5 | 15.6 | 593 |
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| No. | Name | X | Y | No. | Name | X | Y | No. | Name | X | Y |
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| 772 | QC248 | -7126.55 | 323 | 832 | QC268 | -8326.55 | 323 | 892 | QC288 | -9526.55 | 323 |
| 773 | QA249 | -7146.55 | 583 | 833 | QA269 | -8346.55 | 583 | 893 | QA289 | -9546.55 | 583 |
| 774 | QB249 | -7166.55 | 453 | 834 | QB269 | -8366.55 | 453 | 894 | QB289 | -9566.55 | 453 |
| 775 | QC249 | -7186.55 | 323 | 835 | QC269 | -8386.55 | 323 | 895 | QC289 | -9586.55 | 323 |
| 776 | QA250 | -7206.55 | 583 | 836 | QA270 | -8406.55 | 583 | 896 | QA290 | -9606.55 | 583 |
| 777 | QB250 | -7226.55 | 453 | 837 | QB270 | -8426.55 | 453 | 897 | QB290 | -9626.55 | 453 |
| 778 | QC250 | -7246.55 | 323 | 838 | QC270 | -8446.55 | 323 | 898 | QC290 | -9646.55 | 323 |
| 779 | QA251 | -7266.55 | 583 | 839 | QA271 | -8466.55 | 583 | 899 | QA291 | -9666.55 | 583 |
| 780 | QB251 | -7286.55 | 453 | 840 | QB271 | -8486.55 | 453 | 900 | QB291 | -9686.55 | 453 |

| No. | Name | X | Y | No. | Name | X | Y | No. | Name | X | Y |
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| 902 | QA292 | -9726.55 | 583 | 962 | QA312 | -10926.55 | 583 | 1022 | DUMMY | -11590.45 | -593 |
| 903 | QB292 | -9746.55 | 453 | 963 | QB312 | -10946.55 | 453 | 1023 | DUMMY | -11504.45 | -593 |
| 904 | QC292 | -9766.55 | 323 | 964 | QC312 | -10966.55 | 323 | 1024 | DUMMY | -11418.45 | -593 |
| 905 | QA293 | -9786.55 | 583 | 965 | QA313 | -10986.55 | 583 | 1025 | DUMMY | -11332.45 | -593 |
| 906 | QB293 | -9806.55 | 453 | 966 | QB313 | -11006.55 | 453 | 1026 | DUMMY | -11246.45 | -593 |
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| 909 | QB294 | -9866.55 | 453 | 969 | QB314 | -11066.55 | 453 | 1029 | DUMMY | -10988.45 | -593 |
| 910 | QC294 | -9886.55 | 323 | 970 | QC314 | -11086.55 | 323 | 1030 | DUMMY | -10902.45 | -593 |
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| 913 | QC295 | -9946.55 | 323 | 973 | QC315 | -11146.55 | 323 | 1033 | DUMMY | -10644.45 | -593 |
| 914 | QA296 | -9966.55 | 583 | 974 | QA316 | -11166.55 | 583 | 1034 | DUMMY | -10558.45 | -593 |
| 915 | QB296 | -9986.55 | 453 | 975 | QB316 | -11186.55 | 453 | 1035 | DUMMY | -10472.45 | -593 |
| 916 | QC296 | -10006.55 | 323 | 976 | QC316 | -11206.55 | 323 | 1036 | DUMMY | -10386.45 | -593 |
| 917 | QA297 | -10026.55 | 583 | 977 | QA317 | -11226.55 | 583 | 1037 | DUMMY | -10300.45 | -593 |
| 918 | QB297 | -10046.55 | 453 | 978 | QB317 | -11246.55 | 453 | 1038 | DUMMY | -10214.45 | -593 |
| 919 | QC297 | -10066.55 | 323 | 979 | QC317 | -11266.55 | 323 | 1039 | DUMMY | -10128.45 | -593 |
| 920 | QA298 | -10086.55 | 583 | 980 | QA318 | -11286.55 | 583 | 1040 | DUMMY | -10042.45 | -593 |
| 921 | QB298 | -10106.55 | 453 | 981 | QB318 | -11306.55 | 453 | 1041 | DUMMY | -9956.45 | -593 |
| 922 | QC298 | -10126.55 | 323 | 982 | QC318 | -11326.55 | 323 | 1042 | DUMMY | -9870.45 | -593 |
| 923 | QA299 | -10146.55 | 583 | 983 | QA319 | -11346.55 | 583 | 1043 | DUMMY | -9784.45 | -593 |
| 924 | QB299 | -10166.55 | 453 | 984 | QB319 | -11366.55 | 453 | 1044 | DUMMY | -9698.45 | -593 |
| 925 | QC299 | -10186.55 | 323 | 985 | QC319 | -11386.55 | 323 | 1045 | DUMMY | -9612.45 | -593 |
| 926 | QA300 | -10206.55 | 583 | 986 | QA320 | -11406.55 | 583 | 1046 | DUMMY | -9526.45 | -593 |
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| 928 | QC300 | -10246.55 | 323 | 988 | QC320 | -11446.55 | 323 | 1048 | DUMMY | -9354.45 | -593 |
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| 930 | QB301 | -10286.55 | 453 | 990 | DUMMY | -11676.5 | 608 | 1050 | DUMMY | -9182.45 | -593 |
| 931 | QC301 | -10306.55 | 323 | 991 | PASSL52 | -11676.5 | 516 | 1051 | DUMMY | -9096.45 | -593 |
| 932 | QA302 | -10326.55 | 583 | 992 | PASSL52 | -11606.5 | 516 | 1052 | DUMMY | -9010.45 | -593 |
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| 936 | QB303 | -10406.55 | 453 | 996 | UDP | -11606.5 | 356 | 1056 | DUMMY | -8666.45 | -593 |
| 937 | QC303 | -10426.55 | 323 | 997 | CKV | -11676.5 | 276 | 1057 | DUMMY | -8580.45 | -593 |
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| 940 | QC304 | -10486.55 | 323 | 1000 | UDP | -11606.5 | 196 | 1060 | DUMMY | -8322.45 | -593 |
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| 944 | QA306 | -10566.55 | 583 | 1004 | STVC | -11606.5 | 36 | 1064 | DUMMY | -7978.45 | -593 |
| 945 | QB306 | -10586.55 | 453 | 1005 | PASSL42 | -11676.5 | -44 | 1065 | DUMMY | -7892.45 | -593 |
| 946 | QC306 | -10606.55 | 323 | 1006 | PASSL42 | -11606.5 | -44 | 1066 | DUMMY | -7806.45 | -593 |
| 947 | QA307 | -10626.55 | 583 | 1007 | PASSL42 | -11536.5 | -44 | 1067 | DUMMY | -7720.45 | -593 |
| 948 | QB307 | -10646.55 | 453 | 1008 | PASSL32 | -11676.5 | -124 | 1068 | PASSL11 | -7634.45 | -593 |
| 949 | QC307 | -10666.55 | 323 | 1009 | PASSL32 | -11606.5 | -124 | 1069 | PASSL11 | -7548.45 | -593 |
| 950 | QA308 | -10686.55 | 583 | 1010 | PASSL32 | -11536.5 | -124 | 1070 | PASSL11 | -7462.45 | -593 |
| 951 | QB308 | -10706.55 | 453 | 1011 | PASSL22 | -11676.5 | -204 | 1071 | PASSL11 | -7376.45 | -593 |
| 952 | QC308 | -10726.55 | 323 | 1012 | PASSL22 | -11606.5 | -204 | 1072 | PASSL21 | -7290.45 | -593 |
| 953 | QA309 | -10746.55 | 583 | 1013 | PASSL22 | -11536.5 | -204 | 1073 | PASSL21 | -7204.45 | -593 |
| 954 | QB309 | -10766.55 | 453 | 1014 | PASSL12 | -11676.5 | -284 | 1074 | PASSL21 | -7118.45 | -593 |
| 955 | QC309 | -10786.55 | 323 | 1015 | PASSL12 | -11606.5 | -284 | 1075 | PASSL21 | -7032.45 | -593 |
| 956 | QA310 | -10806.55 | 583 | 1016 | PASSL12 | -11536.5 | -284 | 1076 | PASSL31 | -6946.45 | -593 |
| 957 | QB310 | -10826.55 | 453 | 1017 | DUMMY | -11676.5 | -364 | 1077 | PASSL31 | -6860.45 | -593 |
| 958 | QC310 | -10846.55 | 323 | 1018 | DUMMY | -11606.5 | -364 | 1078 | PASSL31 | -6774.45 | -593 |
| 959 | QA311 | -10866.55 | 583 | 1019 | DUMMY | -11676.5 | -444 | 1079 | PASSL31 | -6688.45 | -593 |
| 960 | QB311 | -10886.55 | 453 | 1020 | DUMMY | -11606.5 | -444 | 1080 | PASSL41 | -6602.45 | -593 |

| No. | Name | X | Y | No. | Name | X | Y | No. | Name | X | Y |
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| 1081 | PASSL41 | -6676.45 | -593 | 1141 | D15 | -1360.45 | -593 | 1201 | IHS | 3319.55 | -593 |
| 1082 | PASSL41 | -6606.45 | -593 | 1142 | D15 | -1290.45 | -593 | 1202 | IVS | 3405.55 | -593 |
| 1083 | PASSL41 | -6536.45 | -593 | 1143 | D14 | -1204.45 | -593 | 1203 | IVS | 3475.55 | -593 |
| 1084 | PASSL51 | -6450.45 | -593 | 1144 | D14 | -1134.45 | -593 | 1204 | DEN | 3561.55 | -593 |
| 1085 | PASSL51 | -6380.45 | -593 | 1145 | D13 | -1048.45 | -593 | 1205 | DEN | 3631.55 | -593 |
| 1086 | DUMMY | -6294.45 | -593 | 1146 | D13 | -978.45 | -593 | 1206 | STB | 3717.55 | -593 |
| 1087 | GND | -6208.45 | -593 | 1147 | D12 | -892.45 | -593 | 1207 | STB | 3787.55 | -593 |
| 1088 | GND | -6138.45 | -593 | 1148 | D12 | -822.45 | -593 | 1208 | DUMMY | 3873.55 | -593 |
| 1089 | GND | -6068.45 | -593 | 1149 | D11 | -736.45 | -593 | 1209 | CF2 | 3959.55 | -593 |
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| 1092 | RESETB | -5826.45 | -593 | 1152 | D10 | -510.45 | -593 | 1212 | CF1 | 4185.55 | -593 |
| 1093 | RESETB | -5756.45 | -593 | 1153 | DUMMY | -424.45 | -593 | 1213 | MOD | 4271.55 | -593 |
| 1094 | VSET | -5670.45 | -593 | 1154 | VDD | -338.45 | -593 | 1214 | MOD | 4341.55 | -593 |
| 1095 | VSET | -5600.45 | -593 | 1155 | VDD | -268.45 | -593 | 1215 | ZX3 | 4427.55 | -593 |
| 1096 | TP10 | -5514.45 | -593 | 1156 | VDD | -198.45 | -593 | 1216 | ZX3 | 4497.55 | -593 |
| 1097 | TP10 | -5444.45 | -593 | 1157 | VDD | -128.45 | -593 | 1217 | ZX2 | 4583.55 | -593 |
| 1098 | UD | -5269.45 | -593 | 1158 | DUMMY | -42.45 | -593 | 1218 | ZX2 | 4653.55 | -593 |
| 1099 | UD | -5199.45 | -593 | 1159 | V8 | 43.55 | -593 | 1219 | ZX1 | 4739.55 | -593 |
| 1100 | LRC | -5113.45 | -593 | 1160 | V8 | 113.55 | -593 | 1220 | ZX1 | 4809.55 | -593 |
| 1101 | LRC | -5043.45 | -593 | 1161 | V7 | 199.55 | -593 | 1221 | DUMMY | 4895.55 | -593 |
| 1102 | IF2 | -4957.45 | -593 | 1162 | V7 | 269.55 | -593 | 1222 | VCC | 4981.55 | -593 |
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| 1107 | SPENA | -4559.45 | -593 | 1167 | V4 | 667.55 | -593 | 1227 | OSD_EN | 5363.55 | -593 |
| 1108 | SPENA | -4489.45 | -593 | 1168 | V4 | 737.55 | -593 | 1228 | OSD_EN | 5433.55 | -593 |
| 1109 | SPCK | -4403.45 | -593 | 1169 | V3 | 823.55 | -593 | 1229 | OSD_B | 5519.55 | -593 |
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| 1112 | SPDA | -4177.45 | -593 | 1172 | V2 | 1049.55 | -593 | 1232 | OSD_G | 5745.55 | -593 |
| 1113 | POL | -3947.45 | -593 | 1173 | V1 | 1135.55 | -593 | 1233 | OSD_R | 5831.55 | -593 |
| 1114 | POL | -3877.45 | -593 | 1174 | V1 | 1205.55 | -593 | 1234 | OSD_R | 5901.55 | -593 |
| 1115 | NPC | -3662.45 | -593 | 1175 | DUMMY | 1291.55 | -593 | 1235 | OSD_CLK | 5987.55 | -593 |
| 1116 | NPC | -3592.45 | -593 | 1176 | VSS | 1377.55 | -593 | 1236 | OSD_CLK | 6057.55 | -593 |
| 1117 | QXH | -3377.45 | -593 | 1177 | VSS | 1447.55 | -593 | 1237 | OSD_VS | 6272.55 | -593 |
| 1118 | QXH | -3307.45 | -593 | 1178 | VSS | 1517.55 | -593 | 1238 | OSD_VS | 6342.55 | -593 |
| 1119 | DUMMY | -3092.45 | -593 | 1179 | VSS | 1587.55 | -593 | 1239 | OSD_HS | 6557.55 | -593 |
| 1120 | D27 | -3006.45 | -593 | 1180 | DUMMY | 1673.55 | -593 | 1240 | OSD_HS | 6627.55 | -593 |
| 1121 | D27 | -2936.45 | -593 | 1181 | D07 | 1759.55 | -593 | 1241 | DUMMY | 6842.55 | -593 |
| 1122 | D26 | -2850.45 | -593 | 1182 | D07 | 1829.55 | -593 | 1242 | PASSR51 | 6928.55 | -593 |
| 1123 | D26 | -2780.45 | -593 | 1183 | D06 | 1915.55 | -593 | 1243 | PASSR51 | 6998.55 | -593 |
| 1124 | D25 | -2694.45 | -593 | 1184 | D06 | 1985.55 | -593 | 1244 | PASSR41 | 7084.55 | -593 |
| 1125 | D25 | -2624.45 | -593 | 1185 | D05 | 2071.55 | -593 | 1245 | PASSR41 | 7154.55 | -593 |
| 1126 | D24 | -2538.45 | -593 | 1186 | D05 | 2141.55 | -593 | 1246 | PASSR41 | 7224.55 | -593 |
| 1127 | D24 | -2468.45 | -593 | 1187 | D04 | 2227.55 | -593 | 1247 | PASSR41 | 7294.55 | -593 |
| 1128 | D23 | -2382.45 | -593 | 1188 | D04 | 2297.55 | -593 | 1248 | PASSR31 | 7380.55 | -593 |
| 1129 | D23 | -2312.45 | -593 | 1189 | D03 | 2383.55 | -593 | 1249 | PASSR31 | 7450.55 | -593 |
| 1130 | D22 | -2226.45 | -593 | 1190 | D03 | 2453.55 | -593 | 1250 | PASSR31 | 7520.55 | -593 |
| 1131 | D22 | -2156.45 | -593 | 1191 | D02 | 2539.55 | -593 | 1251 | PASSR31 | 7590.55 | -593 |
| 1132 | D21 | -2070.45 | -593 | 1192 | D02 | 2609.55 | -593 | 1252 | PASSR21 | 7676.55 | -593 |
| 1133 | D21 | -2000.45 | -593 | 1193 | D01 | 2695.55 | -593 | 1253 | PASSR21 | 7746.55 | -593 |
| 1134 | D20 | -1914.45 | -593 | 1194 | D01 | 2765.55 | -593 | 1254 | PASSR21 | 7816.55 | -593 |
| 1135 | D20 | -1844.45 | -593 | 1195 | D00 | 2851.55 | -593 | 1255 | PASSR21 | 7886.55 | -593 |
| 1136 | DUMMY | -1758.45 | -593 | 1196 | D00 | 2921.55 | -593 | 1256 | PASSR11 | 7972.55 | -593 |
| 1137 | D17 | -1672.45 | -593 | 1197 | DUMMY | 3007.55 | -593 | 1257 | PASSR11 | 8042.55 | -593 |
| 1138 | D17 | -1602.45 | -593 | 1198 | CLK | 3093.55 | -593 | 1258 | PASSR11 | 8112.55 | -593 |
| 1139 | D16 | -1516.45 | -593 | 1199 | CLK | 3163.55 | -593 | 1259 | PASSR11 | 8182.55 | -593 |
| 1140 | D16 | -1446.45 | -593 | 1200 | IHS | 3249.55 | -593 | 1260 | DUMMY | 8268.55 | -593 |

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| 1262 | DUMMY | 8440.55 | -593 |
| 1263 | DUMMY | 8526.55 | -593 |
| 1264 | DUMMY | 8612.55 | -593 |
| 1265 | DUMMY | 8698.55 | -593 |
| 1266 | DUMMY | 8784.55 | -593 |
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| 1268 | DUMMY | 8956.55 | -593 |
| 1269 | DUMMY | 9042.55 | -593 |
| 1270 | DUMMY | 9128.55 | -593 |
| 1271 | DUMMY | 9214.55 | -593 |
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| 1273 | DUMMY | 9386.55 | -593 |
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| 1277 | DUMMY | 9730.55 | -593 |
| 1278 | DUMMY | 9816.55 | -593 |
| 1279 | DUMMY | 9902.55 | -593 |
| 1280 | DUMMY | 9988.55 | -593 |
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| 1282 | DUMMY | 10160.55 | -593 |
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| 1284 | DUMMY | 10332.55 | -593 |
| 1285 | DUMMY | 10418.55 | -593 |
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| 1289 | DUMMY | 10762.55 | -593 |
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| 1292 | DUMMY | 11020.55 | -593 |
| 1293 | DUMMY | 11106.55 | -593 |
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| 1295 | DUMMY | 11278.55 | -593 |
| 1296 | DUMMY | 11364.55 | -593 |
| 1297 | DUMMY | 11450.55 | -593 |
| 1298 | DUMMY | 11536.55 | -593 |
| 1299 | DUMMY | 11676.5 | -593 |
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| 1302 | DUMMY | 11606.5 | -364 |
| 1303 | DUMMY | 11676.5 | -364 |
| 1304 | PASSR12 | 11536.5 | -284 |
| 1305 | PASSR12 | 11606.5 | -284 |
| 1306 | PASSR12 | 11676.5 | -284 |
| 1307 | PASSR22 | 11536.5 | -204 |
| 1308 | PASSR22 | 11606.5 | -204 |
| 1309 | PASSR22 | 11676.5 | -204 |
| 1310 | PASSR32 | 11536.5 | -124 |
| 1311 | PASSR32 | 11606.5 | -124 |
| 1312 | PASSR32 | 11676.5 | -124 |
| 1313 | PASSR42 | 11536.5 | -44 |
| 1314 | PASSR42 | 11606.5 | -44 |
| 1315 | PASSR42 | 11676.5 | -44 |
| 1316 | STVC | 11606.5 | 36 |
| 1317 | STVC | 11676.5 | 36 |
| 1318 | STV | 11606.5 | 116 |
| 1319 | STV | 11676.5 | 116 |
| 1320 | UDC | 11606.5 | 196 |

| No. | Name | X | Y |
|------|-------------|---------|-------|
| 1321 | UDC | 11676.5 | 196 |
| 1322 | CKV | 11606.5 | 276 |
| 1323 | CKV | 11676.5 | 276 |
| 1324 | UDC | 11606.5 | 356 |
| 1325 | UDC | 11676.5 | 356 |
| 1326 | OEV | 11606.5 | 436 |
| 1327 | OEV | 11676.5 | 436 |
| 1328 | PASSR52 | 11606.5 | 516 |
| 1329 | PASSR52 | 11676.5 | 516 |
| 1330 | DUMMY | 11676.5 | 608 |
| 1331 | R alignment | 11589 | 590.5 |

12. Revision History

| Version | EFF.DATE | DESCRIPTION OF CHANGES |
|---------|------------|------------------------|
| 01 | 2005/01/06 | New setup. |

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