



»» DATA SHEET

(DOC No. HX8218-C01-DS)

»» **HX8218-C01**
960CH TFT LCD Source Driver
with TCON
Version 04 October, 2006

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

Version 04

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1. General Description

HX8218-C01 is a 960 channel output source driver with TCON and DAC. The input interface can receive digital 8-bit serial/24-bit 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 groups of sample and hold circuits. While sampling video signals, the previously sampled data can be outputted synchronously through driver output channels. And simultaneous or sequential sampling can be chosen for matching the pixel array type.

The TCON provides horizontal and vertical control timing to source and gate drivers. With DAC and operational amplifiers, the gamma correction can be performed and digital data is converted to analog signal and then sent to source driver.

2. Features

TCON

- | 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.
- | Support Full and Side-Black 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 to 3.6V.

Source Driver

- | 5V analog power supply.
- | Dynamic output range: 0.1 to 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 to 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

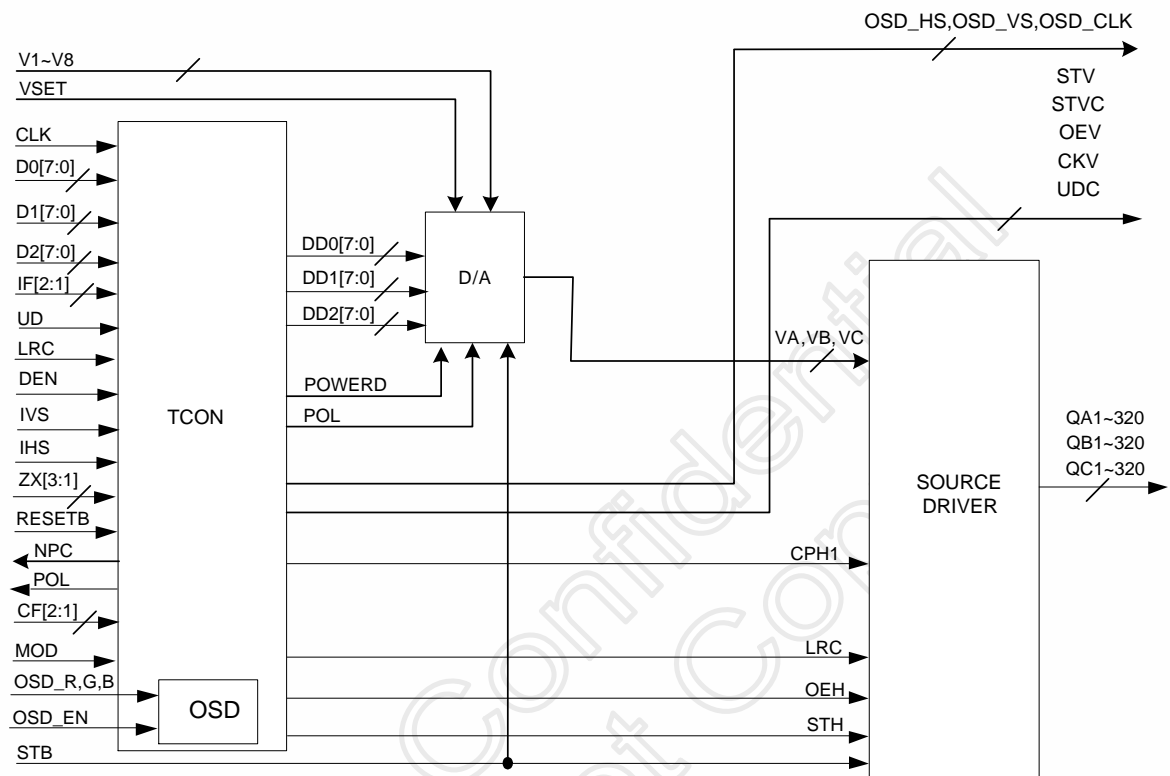


Figure 3. 1 Whole chip block diagram

3.2 Timing controller block diagram

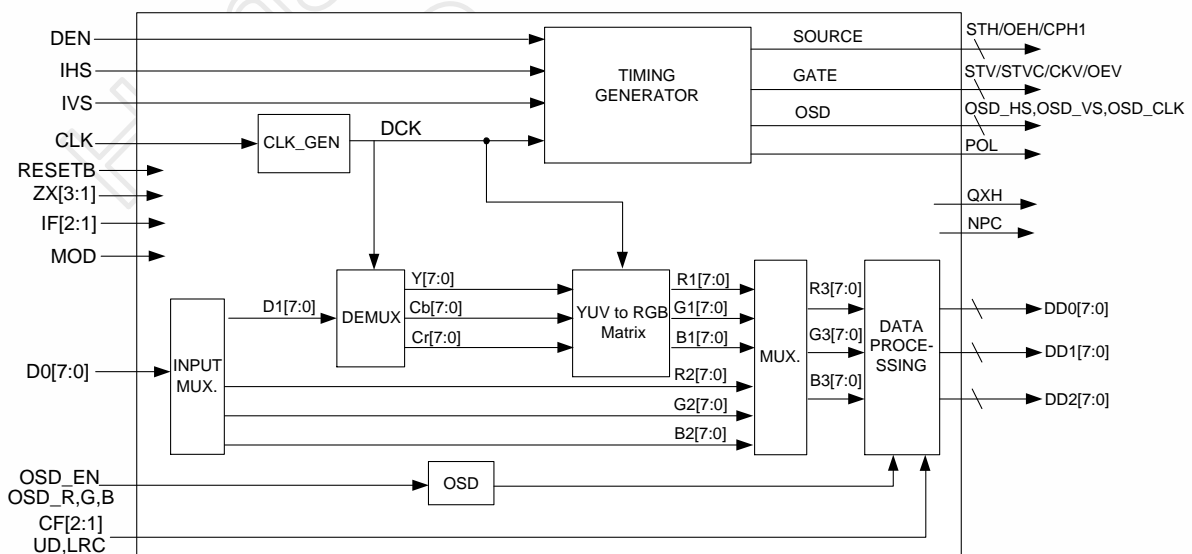


Figure 3. 2 Timing controller block diagram

3.3 Source driver block diagram

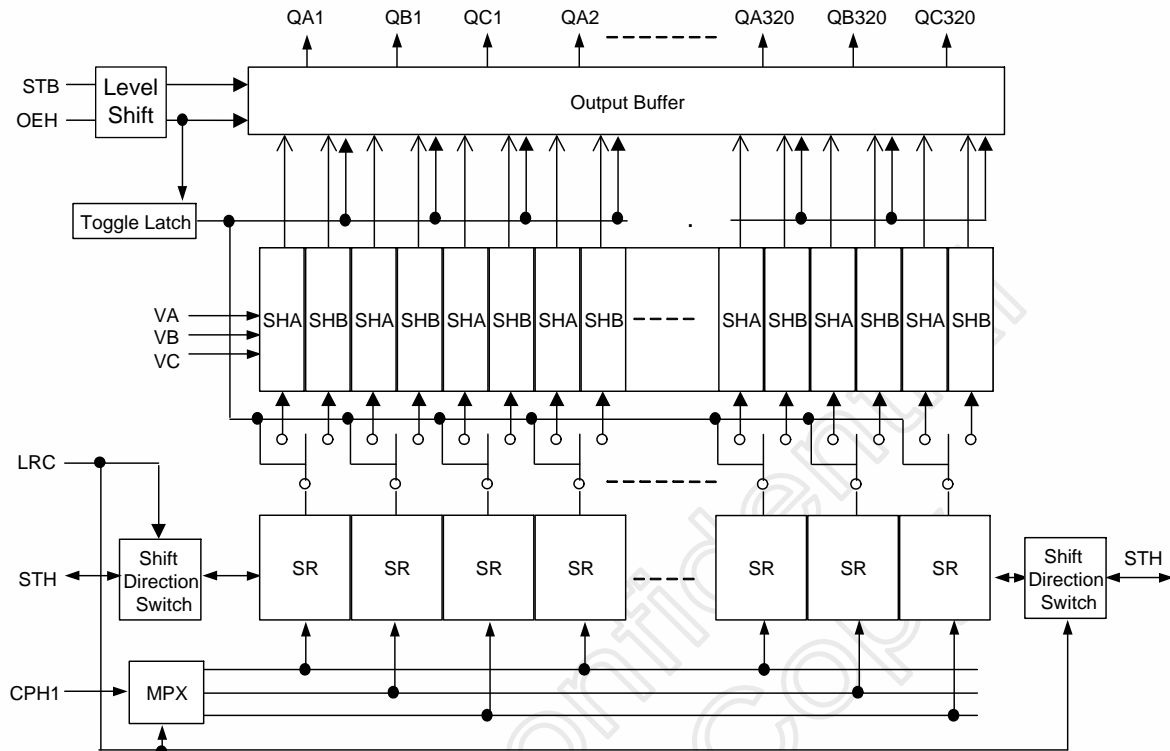


Figure 3. 3 Source driver block diagram

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→...→OUT960→STHO LRC=L: STH→OUT960→...→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. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>IF2, IF1</th> <th>Input data format</th> </tr> </thead> <tbody> <tr> <td>L, L (default)</td> <td>Serial RGB</td> </tr> <tr> <td>L, H</td> <td>Parallel RGB</td> </tr> <tr> <td>H, L</td> <td>CCIR601</td> </tr> <tr> <td>H, H</td> <td>CCIR656</td> </tr> </tbody> </table>	IF2, IF1	Input data format	L, L (default)	Serial RGB	L, H	Parallel RGB	H, L	CCIR601	H, H	CCIR656
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 in serial RGB in PAL mode.
CKV	O	Gate driver clock.
OEV	O	Enable output control of gate driver.
STV	O	Start pulse for gate driver. When UD=L, STV is output. When UD=H, STV is Hi-Z.
STVC	O	Start pulse for gate driver. 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 to 5.5V.
VSS	I	Analog ground.
VCC	I	Digital power. 3V to 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	-	Link together internally.
PASSR21 PASSR22	-	Link together internally.
PASSR31 PASSR32	-	Link together internally.
PASSR41 PASSR42	-	Link together internally.
PASSR51 PASSR52	-	Link together internally.
PASSL11 PASSL12	-	Link together internally.
PASSL21 PASSL22	-	Link together internally.
PASSL31 PASSL32	-	Link together internally.
PASSL41 PASSL42	-	Link together internally.
PASSL51 PASSL52	-	Link together internally.

5. Operation description

5.1 Relationship between input data and output channels

I Source Driver

LRC	first					→	last				
H	QA1	QB1	QC1	QA2	QA320	QB320	QC320	

LRC	last					←	first				
L	QA1	QB1	QC1	QA2	QA320	QB320	QC320	

Table 5. 1 Relationship between input data and output channels

5.2 Relationship between gamma correction and output voltage

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 based on VDD(5V) and VSS(0V). According to the different VDD and VSS, these 8 gamma correction reference voltages will be varied.

	V1	V2	V3	V4	V5	V6	V7	V8
Default voltage (V)	4.45	3.435	2.854	2.540	2.301	2.090	1.818	0.55

Table 5. 2 Relationship between gamma correction and output voltage

Gamma correction characteristic curve

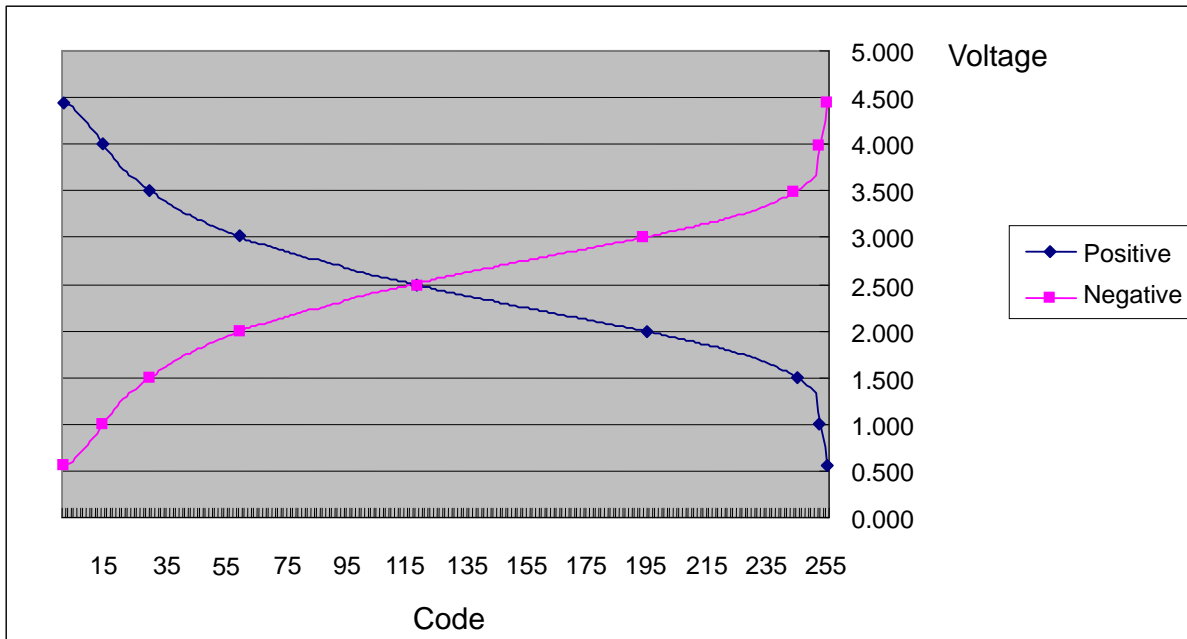


Figure 5. 1 Gamma correction characteristic curve

Relationship between input data and output voltage

Data	Positive polarity output voltage		Ω	Data	Negative polarity output voltage		Ω
00H	VP0	V1	71	00H	VN0	V8	71
01H	VP1	$V2 + (V1-V2) \times 3832/3903$	71	01H	VN1	$V8 + (V7-V8) \times 71/4875$	71
02H	VP2	$V2 + (V1-V2) \times 3761/3903$	71	02H	VN2	$V8 + (V7-V8) \times 142/4875$	71
03H	VP3	$V2 + (V1-V2) \times 3690/3903$	128	03H	VN3	$V8 + (V7-V8) \times 213/4875$	128
04H	VP4	$V2 + (V1-V2) \times 3562/3903$	128	04H	VN4	$V8 + (V7-V8) \times 341/4875$	128
05H	VP5	$V2 + (V1-V2) \times 3434/3903$	128	05H	VN5	$V8 + (V7-V8) \times 469/4875$	128
06H	VP6	$V2 + (V1-V2) \times 3306/3903$	128	06H	VN6	$V8 + (V7-V8) \times 597/4875$	128
07H	VP7	$V2 + (V1-V2) \times 3178/3903$	148	07H	VN7	$V8 + (V7-V8) \times 725/4875$	148
08H	VP8	$V2 + (V1-V2) \times 3030/3903$	148	08H	VN8	$V8 + (V7-V8) \times 873/4875$	148
09H	VP9	$V2 + (V1-V2) \times 2882/3903$	148	09H	VN9	$V8 + (V7-V8) \times 1021/4875$	148
0AH	VP10	$V2 + (V1-V2) \times 2734/3903$	148	0AH	VN10	$V8 + (V7-V8) \times 1169/4875$	148
0BH	VP11	$V2 + (V1-V2) \times 2586/3903$	183	0BH	VN11	$V8 + (V7-V8) \times 1317/4875$	183
0CH	VP12	$V2 + (V1-V2) \times 2403/3903$	183	0CH	VN12	$V8 + (V7-V8) \times 1500/4875$	183
0DH	VP13	$V2 + (V1-V2) \times 2220/3903$	183	0DH	VN13	$V8 + (V7-V8) \times 1683/4875$	183
0EH	VP14	$V2 + (V1-V2) \times 2037/3903$	183	0EH	VN14	$V8 + (V7-V8) \times 1866/4875$	183
0FH	VP15	$V2 + (V1-V2) \times 1854/3903$	148	0FH	VN15	$V8 + (V7-V8) \times 2049/4875$	148
10H	VP16	$V2 + (V1-V2) \times 1706/3903$	148	10H	VN16	$V8 + (V7-V8) \times 2197/4875$	148
11H	VP17	$V2 + (V1-V2) \times 1558/3903$	148	11H	VN17	$V8 + (V7-V8) \times 2345/4875$	148
12H	VP18	$V2 + (V1-V2) \times 1410/3903$	148	12H	VN18	$V8 + (V7-V8) \times 2493/4875$	148
13H	VP19	$V2 + (V1-V2) \times 1262/3903$	115	13H	VN19	$V8 + (V7-V8) \times 2641/4875$	115
14H	VP20	$V2 + (V1-V2) \times 1147/3903$	115	14H	VN20	$V8 + (V7-V8) \times 2756/4875$	115
15H	VP21	$V2 + (V1-V2) \times 1032/3903$	115	15H	VN21	$V8 + (V7-V8) \times 2871/4875$	115
16H	VP22	$V2 + (V1-V2) \times 917/3903$	115	16H	VN22	$V8 + (V7-V8) \times 2986/4875$	115
17H	VP23	$V2 + (V1-V2) \times 802/3903$	90	17H	VN23	$V8 + (V7-V8) \times 3101/4875$	90
18H	VP24	$V2 + (V1-V2) \times 712/3903$	90	18H	VN24	$V8 + (V7-V8) \times 3191/4875$	90
19H	VP25	$V2 + (V1-V2) \times 622/3903$	90	19H	VN25	$V8 + (V7-V8) \times 3281/4875$	90
1AH	VP26	$V2 + (V1-V2) \times 532/3903$	90	1AH	VN26	$V8 + (V7-V8) \times 3371/4875$	90
1BH	VP27	$V2 + (V1-V2) \times 442/3903$	87	1BH	VN27	$V8 + (V7-V8) \times 3461/4875$	87
1CH	VP28	$V2 + (V1-V2) \times 355/3903$	87	1CH	VN28	$V8 + (V7-V8) \times 3548/4875$	87
1DH	VP29	$V2 + (V1-V2) \times 268/3903$	87	1DH	VN29	$V8 + (V7-V8) \times 3635/4875$	87
1EH	VP30	$V2 + (V1-V2) \times 181/3903$	87	1EH	VN30	$V8 + (V7-V8) \times 3722/4875$	87
1FH	VP31	$V2 + (V1-V2) \times 94/3903$	94	1FH	VN31	$V8 + (V7-V8) \times 3809/4875$	94
20H	VP32	V2	94	20H	VN32	$V8 + (V7-V8) \times 3903/4875$	94
21H	VP33	$V3 + (V2-V3) \times 2142/2236$	94	21H	VN33	$V8 + (V7-V8) \times 3997/4875$	94
22H	VP34	$V3 + (V2-V3) \times 2048/2236$	94	22H	VN34	$V8 + (V7-V8) \times 4091/4875$	94
23H	VP35	$V3 + (V2-V3) \times 1954/2236$	75	23H	VN35	$V8 + (V7-V8) \times 4185/4875$	75
24H	VP36	$V3 + (V2-V3) \times 1879/2236$	75	24H	VN36	$V8 + (V7-V8) \times 4260/4875$	75
25H	VP37	$V3 + (V2-V3) \times 1804/2236$	75	25H	VN37	$V8 + (V7-V8) \times 4335/4875$	75
26H	VP38	$V3 + (V2-V3) \times 1729/2236$	75	26H	VN38	$V8 + (V7-V8) \times 4410/4875$	75
27H	VP39	$V3 + (V2-V3) \times 1654/2236$	57	27H	VN39	$V8 + (V7-V8) \times 4485/4875$	57
28H	VP40	$V3 + (V2-V3) \times 1597/2236$	57	28H	VN40	$V8 + (V7-V8) \times 4542/4875$	57
29H	VP41	$V3 + (V2-V3) \times 1540/2236$	57	29H	VN41	$V8 + (V7-V8) \times 4599/4875$	57
2AH	VP42	$V3 + (V2-V3) \times 1483/2236$	57	2AH	VN42	$V8 + (V7-V8) \times 4656/4875$	57
2BH	VP43	$V3 + (V2-V3) \times 1426/2236$	54	2BH	VN43	$V8 + (V7-V8) \times 4713/4875$	54
2CH	VP44	$V3 + (V2-V3) \times 1372/2236$	54	2CH	VN44	$V8 + (V7-V8) \times 4767/4875$	54
2DH	VP45	$V3 + (V2-V3) \times 1318/2236$	54	2DH	VN45	$V8 + (V7-V8) \times 4821/4875$	54
2EH	VP46	$V3 + (V2-V3) \times 1264/2236$	54	2EH	VN46	V7	54
2FH	VP47	$V3 + (V2-V3) \times 1210/2236$	62	2FH	VN47	$V7 + (V6-V7) \times 54/1045$	62
30H	VP48	$V3 + (V2-V3) \times 1148/2236$	62	30H	VN48	$V7 + (V6-V7) \times 116/1045$	62
31H	VP49	$V3 + (V2-V3) \times 1086/2236$	63	31H	VN49	$V7 + (V6-V7) \times 178/1045$	63
32H	VP50	$V3 + (V2-V3) \times 1023/2236$	62	32H	VN50	$V7 + (V6-V7) \times 241/1045$	62
33H	VP51	$V3 + (V2-V3) \times 961/2236$	48	33H	VN51	$V7 + (V6-V7) \times 303/1045$	48
34H	VP52	$V3 + (V2-V3) \times 913/2236$	48	34H	VN52	$V7 + (V6-V7) \times 351/1045$	48
35H	VP53	$V3 + (V2-V3) \times 865/2236$	48	35H	VN53	$V7 + (V6-V7) \times 399/1045$	48
36H	VP54	$V3 + (V2-V3) \times 817/2236$	48	36H	VN54	$V7 + (V6-V7) \times 447/1045$	48
37H	VP55	$V3 + (V2-V3) \times 769/2236$	48	37H	VN55	$V7 + (V6-V7) \times 495/1045$	48
38H	VP56	$V3 + (V2-V3) \times 721/2236$	48	38H	VN56	$V7 + (V6-V7) \times 543/1045$	48
39H	VP57	$V3 + (V2-V3) \times 673/2236$	48	39H	VN57	$V7 + (V6-V7) \times 591/1045$	48
3AH	VP58	$V3 + (V2-V3) \times 625/2236$	48	3AH	VN58	$V7 + (V6-V7) \times 639/1045$	48
3BH	VP59	$V3 + (V2-V3) \times 577/2236$	48	3BH	VN59	$V7 + (V6-V7) \times 687/1045$	48
3CH	VP60	$V3 + (V2-V3) \times 529/2236$	48	3CH	VN60	$V7 + (V6-V7) \times 735/1045$	48
3DH	VP61	$V3 + (V2-V3) \times 481/2236$	48	3DH	VN61	$V7 + (V6-V7) \times 783/1045$	48
3EH	VP62	$V3 + (V2-V3) \times 433/2236$	48	3EH	VN62	$V7 + (V6-V7) \times 831/1045$	48
3FH	VP63	$V3 + (V2-V3) \times 385/2236$	33	3FH	VN63	$V7 + (V6-V7) \times 879/1045$	33
40H	VP64	$V3 + (V2-V3) \times 352/2236$	33	40H	VN64	$V7 + (V6-V7) \times 912/1045$	33

Data	Positive polarity output voltage		Ω	Data	Negative polarity output voltage		Ω
41H	VP65	$V3 + (V2-V3) \times 319/2236$	33	41H	VN65	$V7 + (V6-V7) \times 945/1045$	33
42H	VP66	$V3 + (V2-V3) \times 286/2236$	33	42H	VN66	$V7 + (V6-V7) \times 978/1045$	33
43H	VP67	$V3 + (V2-V3) \times 253/2236$	34	43H	VN67	$V7 + (V6-V7) \times 1011/1045$	34
44H	VP68	$V3 + (V2-V3) \times 219/2236$	34	44H	VN68	V6	34
45H	VP69	$V3 + (V2-V3) \times 185/2236$	34	45H	VN69	$V6 + (V5-V6) \times 34/810$	34
46H	VP70	$V3 + (V2-V3) \times 151/2236$	34	46H	VN70	$V6 + (V5-V6) \times 68/810$	34
47H	VP71	$V3 + (V2-V3) \times 117/2236$	39	47H	VN71	$V6 + (V5-V6) \times 102/810$	39
48H	VP72	$V3 + (V2-V3) \times 78/2236$	39	48H	VN72	$V6 + (V5-V6) \times 141/810$	39
49H	VP73	$V3 + (V2-V3) \times 39/2236$	39	49H	VN73	$V6 + (V5-V6) \times 180/810$	39
4AH	VP74	V3	39	4AH	VN74	$V6 + (V5-V6) \times 219/810$	39
4BH	VP75	$V4 + (V3-V4) \times 1153/1192$	42	4BH	VN75	$V6 + (V5-V6) \times 258/810$	42
4CH	VP76	$V4 + (V3-V4) \times 1111/1192$	42	4CH	VN76	$V6 + (V5-V6) \times 300/810$	42
4DH	VP77	$V4 + (V3-V4) \times 1069/1192$	42	4DH	VN77	$V6 + (V5-V6) \times 342/810$	42
4EH	VP68	$V4 + (V3-V4) \times 1027/1192$	42	4EH	VN68	$V6 + (V5-V6) \times 384/810$	42
4FH	VP79	$V4 + (V3-V4) \times 985/1192$	26	4FH	VN79	$V6 + (V5-V6) \times 426/810$	26
50H	VP80	$V4 + (V3-V4) \times 959/1192$	26	50H	VN80	$V6 + (V5-V6) \times 452/810$	26
51H	VP81	$V4 + (V3-V4) \times 933/1192$	26	51H	VN81	$V6 + (V5-V6) \times 478/810$	26
52H	VP82	$V4 + (V3-V4) \times 907/1192$	26	52H	VN82	$V6 + (V5-V6) \times 504/810$	26
53H	VP83	$V4 + (V3-V4) \times 881/1192$	25	53H	VN83	$V6 + (V5-V6) \times 530/810$	25
54H	VP84	$V4 + (V3-V4) \times 856/1192$	25	54H	VN84	$V6 + (V5-V6) \times 555/810$	25
55H	VP85	$V4 + (V3-V4) \times 831/1192$	25	55H	VN85	$V6 + (V5-V6) \times 580/810$	25
56H	VP86	$V4 + (V3-V4) \times 806/1192$	25	56H	VN86	$V6 + (V5-V6) \times 605/810$	25
57H	VP87	$V4 + (V3-V4) \times 781/1192$	35	57H	VN87	$V6 + (V5-V6) \times 630/810$	35
58H	VP88	$V4 + (V3-V4) \times 746/1192$	35	58H	VN88	$V6 + (V5-V6) \times 665/810$	35
59H	VP89	$V4 + (V3-V4) \times 711/1192$	35	59H	VN89	$V6 + (V5-V6) \times 700/810$	35
5AH	VP90	$V4 + (V3-V4) \times 676/1192$	35	5AH	VN90	$V6 + (V5-V6) \times 735/810$	35
5BH	VP91	$V4 + (V3-V4) \times 641/1192$	40	5BH	VN91	$V6 + (V5-V6) \times 770/810$	40
5CH	VP92	$V4 + (V3-V4) \times 601/1192$	40	5CH	VN92	V5	40
5DH	VP93	$V4 + (V3-V4) \times 561/1192$	40	5DH	VN93	$V5 + (V4-V5) \times 40/919$	40
5EH	VP94	$V4 + (V3-V4) \times 521/1192$	40	5EH	VN94	$V5 + (V4-V5) \times 80/919$	40
5FH	VP95	$V4 + (V3-V4) \times 481/1192$	37	5FH	VN95	$V5 + (V4-V5) \times 120/919$	37
60H	VP96	$V4 + (V3-V4) \times 444/1192$	37	60H	VN96	$V5 + (V4-V5) \times 157/919$	37
61H	VP97	$V4 + (V3-V4) \times 407/1192$	37	61H	VN97	$V5 + (V4-V5) \times 194/919$	37
62H	VP98	$V4 + (V3-V4) \times 369/1192$	37	62H	VN98	$V5 + (V4-V5) \times 231/919$	37
63H	VP99	$V4 + (V3-V4) \times 332/1192$	32	63H	VN99	$V5 + (V4-V5) \times 268/919$	32
64H	VP100	$V4 + (V3-V4) \times 300/1192$	32	64H	VN100	$V5 + (V4-V5) \times 300/919$	32
65H	VP101	$V4 + (V3-V4) \times 268/1192$	32	65H	VN101	$V5 + (V4-V5) \times 332/919$	32
66H	VP102	$V4 + (V3-V4) \times 236/1192$	32	66H	VN102	$V5 + (V4-V5) \times 364/919$	32
67H	VP103	$V4 + (V3-V4) \times 204/1192$	24	67H	VN103	$V5 + (V4-V5) \times 396/919$	24
68H	VP104	$V4 + (V3-V4) \times 180/1192$	24	68H	VN104	$V5 + (V4-V5) \times 420/919$	24
69H	VP105	$V4 + (V3-V4) \times 156/1192$	24	69H	VN105	$V5 + (V4-V5) \times 444/919$	24
6AH	VP106	$V4 + (V3-V4) \times 132/1192$	24	6AH	VN106	$V5 + (V4-V5) \times 468/919$	24
6BH	VP107	$V4 + (V3-V4) \times 108/1192$	27	6BH	VN107	$V5 + (V4-V5) \times 492/919$	27
6CH	VP108	$V4 + (V3-V4) \times 81/1192$	27	6CH	VN108	$V5 + (V4-V5) \times 519/919$	27
6DH	VP109	$V4 + (V3-V4) \times 54/1192$	27	6DH	VN109	$V5 + (V4-V5) \times 546/919$	27
6EH	VP110	$V4 + (V3-V4) \times 27/1192$	27	6EH	VN110	$V5 + (V4-V5) \times 573/919$	27
6FH	VP111	V4	28	6FH	VN111	$V5 + (V4-V5) \times 600/919$	28
70H	VP112	$V5 + (V4-V5) \times 909/937$	28	70H	VN112	$V5 + (V4-V5) \times 628/919$	28
71H	VP113	$V5 + (V4-V5) \times 881/937$	28	71H	VN113	$V5 + (V4-V5) \times 656/919$	28
72H	VP114	$V5 + (V4-V5) \times 853/937$	28	72H	VN114	$V5 + (V4-V5) \times 684/919$	28
73H	VP115	$V5 + (V4-V5) \times 825/937$	30	73H	VN115	$V5 + (V4-V5) \times 712/919$	30
74H	VP116	$V5 + (V4-V5) \times 795/937$	30	74H	VN116	$V5 + (V4-V5) \times 742/919$	30
75H	VP117	$V5 + (V4-V5) \times 765/937$	30	75H	VN117	$V5 + (V4-V5) \times 772/919$	30
76H	VP118	$V5 + (V4-V5) \times 735/937$	30	76H	VN118	$V5 + (V4-V5) \times 802/919$	30
77H	VP119	$V5 + (V4-V5) \times 705/937$	29	77H	VN119	$V5 + (V4-V5) \times 832/919$	29
78H	VP120	$V5 + (V4-V5) \times 676/937$	29	78H	VN120	$V5 + (V4-V5) \times 861/919$	29
79H	VP121	$V5 + (V4-V5) \times 647/937$	29	79H	VN121	$V5 + (V4-V5) \times 890/919$	29
7AH	VP122	$V5 + (V4-V5) \times 618/937$	29	7AH	VN122	V4	29
7BH	VP123	$V5 + (V4-V5) \times 589/937$	26	7BH	VN123	$V4 + (V3-V4) \times 29/1209$	26
7CH	VP124	$V5 + (V4-V5) \times 563/937$	26	7CH	VN124	$V4 + (V3-V4) \times 55/1209$	26
7DH	VP125	$V5 + (V4-V5) \times 537/937$	26	7DH	VN125	$V4 + (V3-V4) \times 81/1209$	26
7EH	VP126	$V5 + (V4-V5) \times 511/937$	26	7EH	VN126	$V4 + (V3-V4) \times 107/1209$	26
7FH	VP127	$V5 + (V4-V5) \times 485/937$	27	7FH	VN127	$V4 + (V3-V4) \times 133/1209$	27
80H	VP128	$V5 + (V4-V5) \times 458/937$	27	80H	VN128	$V4 + (V3-V4) \times 160/1209$	27

Data	Positive polarity output voltage		Ω	Data	Negative polarity output voltage		Ω
81H	VP129	V5 + (V4-V5) x 431/937	27	81H	VN129	V4 + (V3-V4) x 187/1209	27
82H	VP130	V5 + (V4-V5) x 404/937	27	82H	VN130	V4 + (V3-V4) x 214/1209	27
83H	VP131	V5 + (V4-V5) x 377/937	30	83H	VN131	V4 + (V3-V4) x 241/1209	30
84H	VP132	V5 + (V4-V5) x 347/937	30	84H	VN132	V4 + (V3-V4) x 271/1209	30
85H	VP133	V5 + (V4-V5) x 317/937	30	85H	VN133	V4 + (V3-V4) x 301/1209	30
86H	VP134	V5 + (V4-V5) x 287/937	30	86H	VN134	V4 + (V3-V4) x 331/1209	30
87H	VP135	V5 + (V4-V5) x 257/937	23	87H	VN135	V4 + (V3-V4) x 361/1209	23
88H	VP136	V5 + (V4-V5) x 234/937	23	88H	VN136	V4 + (V3-V4) x 384/1209	23
89H	VP137	V5 + (V4-V5) x 211/937	23	89H	VN137	V4 + (V3-V4) x 407/1209	23
8AH	VP138	V5 + (V4-V5) x 188/937	23	8AH	VN138	V4 + (V3-V4) x 430/1209	23
8BH	VP139	V5 + (V4-V5) x 165/937	21	8BH	VN139	V4 + (V3-V4) x 453/1209	21
8CH	VP140	V5 + (V4-V5) x 144/937	21	8CH	VN140	V4 + (V3-V4) x 474/1209	21
8DH	VP141	V5 + (V4-V5) x 123/937	21	8DH	VN141	V4 + (V3-V4) x 495/1209	21
8EH	VP142	V5 + (V4-V5) x 102/937	21	8EH	VN142	V4 + (V3-V4) x 516/1209	21
8FH	VP143	V5 + (V4-V5) x 81/937	27	8FH	VN143	V4 + (V3-V4) x 537/1209	27
90H	VP144	V5 + (V4-V5) x 54/937	27	90H	VN144	V4 + (V3-V4) x 564/1209	27
91H	VP145	V5 + (V4-V5) x 27/937	27	91H	VN145	V4 + (V3-V4) x 591/1209	27
92H	VP146	V5	27	92H	VN146	V4 + (V3-V4) x 618/1209	27
93H	VP147	V6 + (V5-V6) x 776/803	25	93H	VN147	V4 + (V3-V4) x 645/1209	25
94H	VP148	V6 + (V5-V6) x 751/803	25	94H	VN148	V4 + (V3-V4) x 670/1209	25
95H	VP149	V6 + (V5-V6) x 726/803	25	95H	VN149	V4 + (V3-V4) x 695/1209	25
96H	VP150	V6 + (V5-V6) x 701/803	25	96H	VN150	V4 + (V3-V4) x 720/1209	25
97H	VP151	V6 + (V5-V6) x 676/803	24	97H	VN151	V4 + (V3-V4) x 745/1209	24
98H	VP152	V6 + (V5-V6) x 652/803	24	98H	VN152	V4 + (V3-V4) x 769/1209	24
99H	VP153	V6 + (V5-V6) x 628/803	24	99H	VN153	V4 + (V3-V4) x 793/1209	24
9AH	VP154	V6 + (V5-V6) x 604/803	24	9AH	VN154	V4 + (V3-V4) x 817/1209	24
9BH	VP155	V6 + (V5-V6) x 580/803	23	9BH	VN155	V4 + (V3-V4) x 841/1209	23
9CH	VP156	V6 + (V5-V6) x 557/803	23	9CH	VN156	V4 + (V3-V4) x 864/1209	23
9DH	VP157	V6 + (V5-V6) x 534/803	23	9DH	VN157	V4 + (V3-V4) x 887/1209	23
9EH	VP158	V6 + (V5-V6) x 511/803	23	9EH	VN158	V4 + (V3-V4) x 910/1209	23
9FH	VP159	V6 + (V5-V6) x 488/803	26	9FH	VN159	V4 + (V3-V4) x 933/1209	26
A0H	VP160	V6 + (V5-V6) x 462/803	26	A0H	VN160	V4 + (V3-V4) x 959/1209	26
A1H	VP161	V6 + (V5-V6) x 436/803	26	A1H	VN161	V4 + (V3-V4) x 985/1209	26
A2H	VP162	V6 + (V5-V6) x 410/803	26	A2H	VN162	V4 + (V3-V4) x 1011/1209	26
A3H	VP163	V6 + (V5-V6) x 384/803	24	A3H	VN163	V4 + (V3-V4) x 1037/1209	24
A4H	VP164	V6 + (V5-V6) x 360/803	24	A4H	VN164	V4 + (V3-V4) x 1061/1209	24
A5H	VP165	V6 + (V5-V6) x 336/803	24	A5H	VN165	V4 + (V3-V4) x 1085/1209	24
A6H	VP166	V6 + (V5-V6) x 312/803	24	A6H	VN166	V4 + (V3-V4) x 1109/1209	24
A7H	VP167	V6 + (V5-V6) x 288/803	19	A7H	VN167	V4 + (V3-V4) x 1133/1209	19
A8H	VP168	V6 + (V5-V6) x 269/803	19	A8H	VN168	V4 + (V3-V4) x 1152/1209	19
A9H	VP169	V6 + (V5-V6) x 250/803	19	A9H	VN169	V4 + (V3-V4) x 1171/1209	19
AAH	VP170	V6 + (V5-V6) x 231/803	19	AAH	VN170	V4 + (V3-V4) x 1190/1209	19
ABH	VP171	V6 + (V5-V6) x 212/803	28	ABH	VN171	V3	28
ACH	VP172	V6 + (V5-V6) x 184/803	28	ACH	VN172	V3 + (V2-V3) x 28/2197	28
ADH	VP173	V6 + (V5-V6) x 156/803	28	ADH	VN173	V3 + (V2-V3) x 56/2197	28
AEH	VP174	V6 + (V5-V6) x 128/803	28	AEH	VN174	V3 + (V2-V3) x 84/2197	28
AFH	VP175	V6 + (V5-V6) x 100/803	25	AFH	VN175	V3 + (V2-V3) x 112/2197	25
B0H	VP176	V6 + (V5-V6) x 75/803	25	B0H	VN176	V3 + (V2-V3) x 137/2197	25
B1H	VP177	V6 + (V5-V6) x 50/803	25	B1H	VN177	V3 + (V2-V3) x 162/2197	25
B2H	VP178	V6 + (V5-V6) x 25/803	25	B2H	VN178	V3 + (V2-V3) x 187/2197	25
B3H	VP179	V6	22	B3H	VN179	V3 + (V2-V3) x 212/2197	22
B4H	VP180	V7 + (V6-V7) x 998/1020	22	B4H	VN180	V3 + (V2-V3) x 234/2197	22
B5H	VP181	V7 + (V6-V7) x 976/1020	22	B5H	VN181	V3 + (V2-V3) x 256/2197	22
B6H	VP182	V7 + (V6-V7) x 954/1020	22	B6H	VN182	V3 + (V2-V3) x 278/2197	22
B7H	VP183	V7 + (V6-V7) x 932/1020	24	B7H	VN183	V3 + (V2-V3) x 300/2197	24
B8H	VP184	V7 + (V6-V7) x 908/1020	24	B8H	VN184	V3 + (V2-V3) x 324/2197	24
B9H	VP185	V7 + (V6-V7) x 884/1020	24	B9H	VN185	V3 + (V2-V3) x 348/2197	24
BAH	VP186	V7 + (V6-V7) x 860/1020	24	BAH	VN186	V3 + (V2-V3) x 372/2197	24
BBH	VP187	V7 + (V6-V7) x 836/1020	22	BBH	VN187	V3 + (V2-V3) x 396/2197	22
BCH	VP188	V7 + (V6-V7) x 814/1020	22	BCH	VN188	V3 + (V2-V3) x 418/2197	22
BDH	VP189	V7 + (V6-V7) x 792/1020	22	BDH	VN189	V3 + (V2-V3) x 440/2197	22
BEH	VP190	V7 + (V6-V7) x 770/1020	22	BEH	VN190	V3 + (V2-V3) x 462/2197	22
BFH	VP191	V7 + (V6-V7) x 748/1020	24	BFH	VN191	V3 + (V2-V3) x 484/2197	24

Data	Positive polarity output voltage		Ω	Data	Negative polarity output voltage		Ω
C0H	VP192	V7 + (V6-V7) x 724/1020	24	C0H	VN192	V3 + (V2-V3) x 508/2197	24
C1H	VP193	V7 + (V6-V7) x 700/1020	24	C1H	VN193	V3 + (V2-V3) x 532/2197	24
C2H	VP194	V7 + (V6-V7) x 676/1020	24	C2H	VN194	V3 + (V2-V3) x 556/2197	24
C3H	VP195	V7 + (V6-V7) x 652/1020	22	C3H	VN195	V3 + (V2-V3) x 580/2197	22
C4H	VP196	V7 + (V6-V7) x 630/1020	22	C4H	VN196	V3 + (V2-V3) x 602/2197	22
C5H	VP197	V7 + (V6-V7) x 608/1020	22	C5H	VN197	V3 + (V2-V3) x 624/2197	22
C6H	VP198	V7 + (V6-V7) x 586/1020	22	C6H	VN198	V3 + (V2-V3) x 646/2197	22
C7H	VP199	V7 + (V6-V7) x 564/1020	24	C7H	VN199	V3 + (V2-V3) x 668/2197	24
C8H	VP200	V7 + (V6-V7) x 540/1020	24	C8H	VN200	V3 + (V2-V3) x 692/2197	24
C9H	VP201	V7 + (V6-V7) x 516/1020	24	C9H	VN201	V3 + (V2-V3) x 716/2197	24
CAH	VP202	V7 + (V6-V7) x 492/1020	24	CAH	VN202	V3 + (V2-V3) x 740/2197	24
CBH	VP203	V7 + (V6-V7) x 468/1020	28	CBH	VN203	V3 + (V2-V3) x 764/2197	28
CCH	VP204	V7 + (V6-V7) x 440/1020	28	CCH	VN204	V3 + (V2-V3) x 792/2197	28
CDH	VP205	V7 + (V6-V7) x 412/1020	28	CDH	VN205	V3 + (V2-V3) x 820/2197	28
CEH	VP206	V7 + (V6-V7) x 384/1020	28	CEH	VN206	V3 + (V2-V3) x 848/2197	28
CFH	VP207	V7 + (V6-V7) x 356/1020	31	CFH	VN207	V3 + (V2-V3) x 876/2197	31
D0H	VP208	V7 + (V6-V7) x 325/1020	31	D0H	VN208	V3 + (V2-V3) x 907/2197	31
D1H	VP209	V7 + (V6-V7) x 294/1020	31	D1H	VN209	V3 + (V2-V3) x 938/2197	31
D2H	VP210	V7 + (V6-V7) x 263/1020	31	D2H	VN210	V3 + (V2-V3) x 969/2197	31
D3H	VP211	V7 + (V6-V7) x 232/1020	29	D3H	VN211	V3 + (V2-V3) x 1000/2197	29
D4H	VP212	V7 + (V6-V7) x 203/1020	29	D4H	VN212	V3 + (V2-V3) x 1029/2197	29
D5H	VP213	V7 + (V6-V7) x 174/1020	29	D5H	VN213	V3 + (V2-V3) x 1058/2197	29
D6H	VP214	V7 + (V6-V7) x 145/1020	29	D6H	VN214	V3 + (V2-V3) x 1087/2197	29
D7H	VP215	V7 + (V6-V7) x 116/1020	29	D7H	VN215	V3 + (V2-V3) x 1116/2197	29
D8H	VP216	V7 + (V6-V7) x 87/1020	29	D8H	VN216	V3 + (V2-V3) x 1145/2197	29
D9H	VP217	V7 + (V6-V7) x 58/1020	29	D9H	VN217	V3 + (V2-V3) x 1174/2197	29
DAH	VP218	V7 + (V6-V7) x 29/1020	29	DAH	VN218	V3 + (V2-V3) x 1203/2197	29
DBH	VP219	V7	36	DBH	VN219	V3 + (V2-V3) x 1232/2197	36
DCH	VP220	V8 + (V7-V8) x 4839/4875	36	DCH	VN220	V3 + (V2-V3) x 1268/2197	36
DDH	VP221	V8 + (V7-V8) x 4803/4875	36	DDH	VN221	V3 + (V2-V3) x 1304/2197	36
DEH	VP222	V8 + (V7-V8) x 4767/4875	36	DEH	VN222	V3 + (V2-V3) x 1340/2197	36
DFH	VP223	V8 + (V7-V8) x 4731/4875	32	DFH	VN223	V3 + (V2-V3) x 1376/2197	32
E0H	VP224	V8 + (V7-V8) x 4699/4875	32	E0H	VN224	V3 + (V2-V3) x 1408/2197	32
E1H	VP225	V8 + (V7-V8) x 4667/4875	32	E1H	VN225	V3 + (V2-V3) x 1440/2197	32
E2H	VP226	V8 + (V7-V8) x 4635/4875	32	E2H	VN226	V3 + (V2-V3) x 1472/2197	32
E3H	VP227	V8 + (V7-V8) x 4603/4875	40	E3H	VN227	V3 + (V2-V3) x 1504/2197	40
E4H	VP228	V8 + (V7-V8) x 4563/4875	40	E4H	VN228	V3 + (V2-V3) x 1544/2197	40
E5H	VP229	V8 + (V7-V8) x 4523/4875	40	E5H	VN229	V3 + (V2-V3) x 1584/2197	40
E6H	VP230	V8 + (V7-V8) x 4483/4875	40	E6H	VN230	V3 + (V2-V3) x 1624/2197	40
E7H	VP231	V8 + (V7-V8) x 4443/4875	50	E7H	VN231	V3 + (V2-V3) x 1664/2197	50
E8H	VP232	V8 + (V7-V8) x 4393/4875	50	E8H	VN232	V3 + (V2-V3) x 1714/2197	50
E9H	VP233	V8 + (V7-V8) x 4343/4875	50	E9H	VN233	V3 + (V2-V3) x 1764/2197	50
EAH	VP234	V8 + (V7-V8) x 4293/4875	50	EAH	VN234	V3 + (V2-V3) x 1814/2197	50
EBH	VP235	V8 + (V7-V8) x 4243/4875	52	EBH	VN235	V3 + (V2-V3) x 1864/2197	52
ECH	VP236	V8 + (V7-V8) x 4191/4875	52	ECH	VN236	V3 + (V2-V3) x 1916/2197	52
EDH	VP237	V8 + (V7-V8) x 4139/4875	52	EDH	VN237	V3 + (V2-V3) x 1968/2197	52
EEH	VP238	V8 + (V7-V8) x 4087/4875	52	EEH	VN238	V3 + (V2-V3) x 2020/2197	52
EFH	VP239	V8 + (V7-V8) x 4035/4875	63	EFH	VN239	V3 + (V2-V3) x 2072/2197	63
F0H	VP240	V8 + (V7-V8) x 3972/4875	62	F0H	VN240	V3 + (V2-V3) x 2135/2197	62
F1H	VP241	V8 + (V7-V8) x 3910/4875	63	F1H	VN241	V2	63
F2H	VP242	V8 + (V7-V8) x 3847/4875	63	F2H	VN242	V2 + (V1-V2) x 63/3910	63
F3H	VP243	V8 + (V7-V8) x 3784/4875	82	F3H	VN243	V2 + (V1-V2) x 126/3910	82
F4H	VP244	V8 + (V7-V8) x 3702/4875	82	F4H	VN244	V2 + (V1-V2) x 208/3910	82
F5H	VP245	V8 + (V7-V8) x 3620/4875	82	F5H	VN245	V2 + (V1-V2) x 290/3910	82
F6H	VP246	V8 + (V7-V8) x 3538/4875	82	F6H	VN246	V2 + (V1-V2) x 372/3910	82
F7H	VP247	V8 + (V7-V8) x 3456/4875	104	F7H	VN247	V2 + (V1-V2) x 454/3910	104
F8H	VP248	V8 + (V7-V8) x 3352/4875	104	F8H	VN248	V2 + (V1-V2) x 558/3910	104
F9H	VP249	V8 + (V7-V8) x 3248/4875	104	F9H	VN249	V2 + (V1-V2) x 662/3910	104
FAH	VP250	V8 + (V7-V8) x 3144/4875	104	FAH	VN250	V2 + (V1-V2) x 766/3910	104
FBH	VP251	V8 + (V7-V8) x 3040/4875	760	FBH	VN251	V2 + (V1-V2) x 870/3910	760
FCH	VP252	V8 + (V7-V8) x 2280/4875	760	FCH	VN252	V2 + (V1-V2) x 1630/3910	760
FDH	VP253	V8 + (V7-V8) x 1520/4875	760	FDH	VN253	V2 + (V1-V2) x 2390/3910	760
FEH	VP254	V8 + (V7-V8) x 760/4875	760	FEH	VN254	V2 + (V1-V2) x 3150/3910	760
FFH	VP255	V8	0	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

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

n 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

Table 5. 3 Input data sequence in serial digital RGB mode (CF=L)

n 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

Table 5. 4 Input data sequence in serial digital RGB mode (CF=H)

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.

n CF2=L, delta type 1

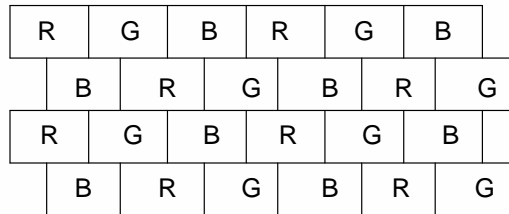


Figure 5. 2 Delta color filter type 1 (CF2=L)

n CF2=H, delta type 2

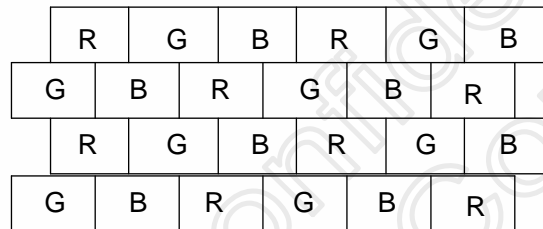


Figure 5. 3 Delta color filter type 2 (CF2=H)

5.6 Zoom in/out display mode setting

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

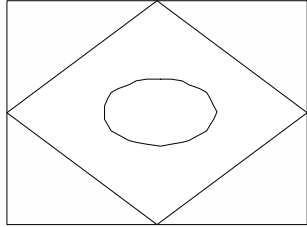
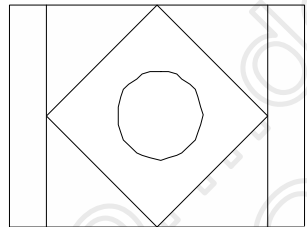
Display Mode	ZX1	ZX2	ZX3	Display characteristics (4:3 aspect-ratio input signal)	Note
Full	H	H	H		Input video signals are displayed on full screen.
Normal	L	L	H		Input video signals (4:3) are displayed on central 75% screen.

Figure 5. 4 Zoom in/out display mode setting

5.7 SPI Register Description

I 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

Table 5. 5 Register R0 setting

STHD [1:0]: adjust start pulse position by dot. (RGB mode only)

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

Table 5. 6 Adjust start pulse position by dot

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

Table 5. 7 Adjust start pulse position by pixel

I Register R1

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	STVP3	STVP2	STVP1	STVP0	STVNT1	STVNT0	STVPAL1	STVPAL0
Default	0	0	0	0	0	0	0	0

Table 5. 8 Register R1 setting

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

Table 5. 9 Adjust first line position by line

STVNT[1:0]: Adjust the relationship of first line of active video in Odd/Even Field in NTSC mode.

00: The first line of active video in Even Field = The first line of active video in Odd Field

01: The first line of active video in Even Field = The first line of active video in Odd Field + 1

10: No Use

11: The first line of active video in Even Field = The first line of active video in Odd Field - 1

STVPAL[1:0]: Adjust the relationship of first line of active video in Odd/Even Field in PAL mode.

00: The first line of active video in Even Field = The first line of active video in Odd Field

01: The first line of active video in Even Field = The first line of active video in Odd Field + 1

I Register R2

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	LPF	RGBVPOL	OEHCTL	OVER	VS_POL	HS_POL	NPC_IN	NPC_SET
Default	1	0	1	0	1	0	1	0

Table 5. 10 Register R2 setting

LPF: Low pass filter function enable/disable in CCIR656/CCIR601 mode

LPF="L", Low pass filter function disable

LPF="H", Low pass filter function enable

RGBVPOL: RGB mode VS polarity setting

RGBVPOL="L", negative polarity.

RGBVPOL="H", positive polarity

OEHCTL: OEH signal control in PAL mode

OVER: Sets display period in ITU-R BT. 656 or 601 modes.

0 => 50.3us of active data is displayed on the panel.

1 => 53.3 us of active data is displayed on the panel.

VS_POL: **CCIR601** VS polarity setting.

VS_POL=L, negative polarity.

VS_POL=H, positive polarity.

HS_POL: HS polarity setting.

HS_POL=L, negative polarity.

HS_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.

I Register R3

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	AUTO_DP	DISP_ON	A_TIME1	A_TIME0	reserved	POL_OUT	DE_POL	DE_SEL
Default	1	0	0	1	0	0	0	0

Table 5. 11 Register R3 setting

AUTO_DP: When power on, select black image display time decided by A_TIME (bit5, 4) or DISP_ON (bit6).

AUTO_DP = "L", Black image display time decided by DISP_ON (bit6).

AUTO_DP = "H", Black image display time decided by A_TIME(bit5, 4).

DISP_ON: When AUTO_DP (bit7) = "L", and DISP_ON = "H", black image display off, then display normal image.

A_TIME: When AUTO_DP(bit7) = "H", the black image display time is decided by A_TIME

00: black image display time is 0.166s (10 fields)

01: black image display time is 0.332s (20 fields)

10: black image display time is 0.664s (40 fields)

11: black image display time is 1.328s (80 fields)

POL_OUT: POL phase select

POL_OUT=L, POL and VCOM are in phase.

POL_OUT=H, POL and VCOM are reverse.

DE_POL: DE signal polarity setting.

When DE_SEL=L:

DE_POL =L, positive polarity.

DE_POL =H, negative polarity.

When DE_SEL=H:

DE_POL =L, negative polarity.

DE_POL =H, positive polarity.

DE_SEL: DE mode select.

DE_SEL=L, DE signal with HS and VS signal

DE_SEL=H, DE signal only

5.8 Power ON/OFF sequence

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

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

5.9 Power ON Control

HX8218-C01 has a power ON sequence control function. There are two kinds of the mode. One is Auto mode, and another is Manual Mode.

Auto Mode: When power is ON, black data is outputted for 20-frames (default value) first, from the falling edge of the following Vsync signal. It can be defined in Register R3 A_TIME1(bit5) and A_TIME0(bit4) when AUTO_DP(bit7) = "H"

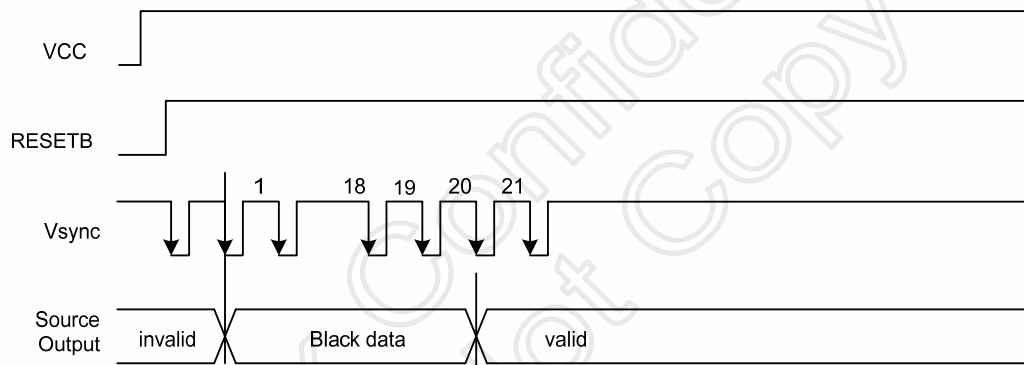


Figure 5. 5 Power on control for Auto Mode

Manual Mode: When power is ON, you should set the Register R3 AUTO_DP(bit7) = "L" to stay at the manual mode. Black data is outputted until the DISP_ON(bit 6) = H then display the normal image.

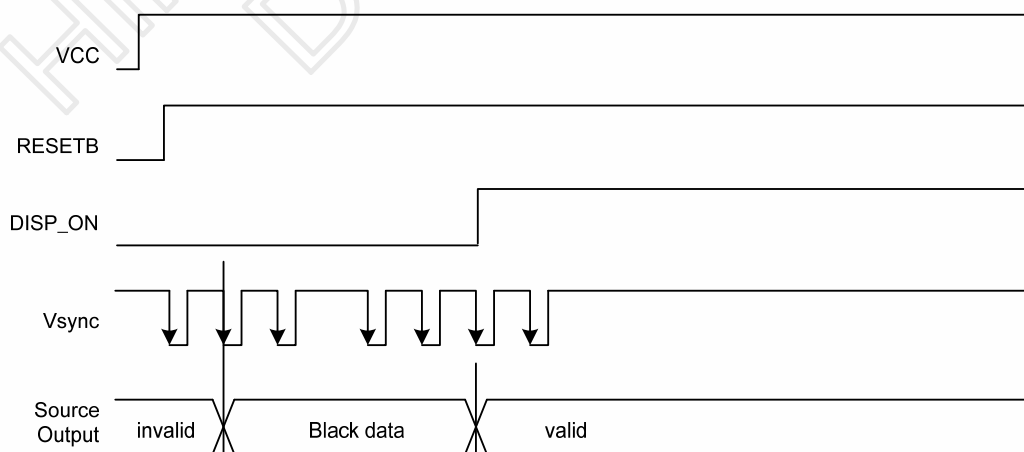


Figure 5. 6 Power on control for Manual Mode

5.10 Standby ON/OFF Control

HX8218-C01 has a power ON/OFF sequence control function. When STB pin is pulled L, blank data is outputted for 5-frames first, from the falling edge of the following VSYNC signal. The blank data would be gray level 255 for normally white LC.

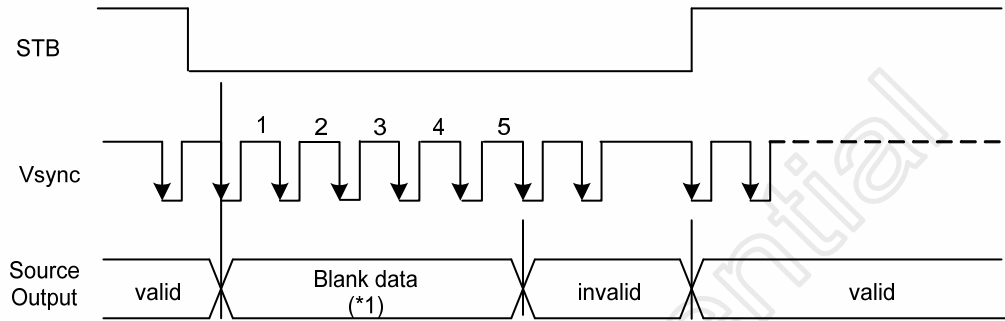


Figure 5. 7 Standby ON/OFF Control

6. DC Characteristics

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

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Power supply voltage 1	VCC	-0.3	-	+7.0	V
Power supply voltage 2	VDD	-0.3	-	+7.0	V
Logic Output Voltage	V _{OUT}	-0.3	-	+7.0	V
Input voltage	V _{in}	-0.3	-	VDD+0.3	V
Operation temperature	T _{OPR}	-40	-	+85	°C
Storage temperature	T _{STG}	-55	-	+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	Spec.			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	-	0.3VCC	V	-
High level input voltage	V _{IH}	0.7VCC	-	VCC	V	-
Output low voltage	V _{OL}	0	-	0.2VCC	V	I _{OL} =400μA
Output high voltage	V _{OH}	0.8VCC	-	VCC	V	I _{OH} =-400μA
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 vs. 4.0V, VDD=5V
Output current	I _{OL}	20	40	-	μA	QA/QB/QC1 ~ 320, V _O =0.1V vs. 1.0V, VDD=5V
Analog operating current	I _{DD}	-	-	6	mA	f _{CLK} =27MHz, f _{IHS} =15.7KHz, VDD=5V, CL=60pF
Digital operating current	I _{CC}	-	-	11	mA	f _{CLK} =27MHz, f _{IHS} =15.7KHz, VCC=3.3V
Analog standby current	I _{VDD}	-	-	2	mA	All LCD outputs are High-Z.
Digital standby current	I _{VCC}	-	16	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	Spec.			Unit
		Min.	Typ.	Max.	
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 setup time	T_{Cr}	12	-	-	ns
IHS hold time	T_{Cf}	12	-	-	ns
IVS pulse width	T_{VS}	1	3	5	T_H
IVS setup time	T_{Vr}	12	-	-	ns
IVS hold time	T_{Vf}	12	-	-	ns
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: 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	Spec.			Unit
		Min.	Typ.	Max.	
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 setup time	T_{Cr}	12	-	-	ns
IHS hold time	T_{Cf}	12	-	-	ns
IVS pulse width	T_{VS}	1	3	5	T_H
IVS setup time	T_{Vr}	12	-	-	ns
IVS hold time	T_{Vf}	12	-	-	ns
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: When SYNC mode is used, 1st data start from 68th CLK after IHS falling.

7.1.3 CCIR601/656 Interface

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

7.1.4 Hardware reset timing

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
RESETB low pulse width	T _{RSB}	10	-	-	μs
STB to Vsync Setup Time	T _{STB}	20	-	-	ns

7.2 Output signal characteristics for digital input signal

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
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
IHS-POL time	T ₄	-	4368	-	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 waveforms

I CCIR601 (HS_POL=L in Register R2)

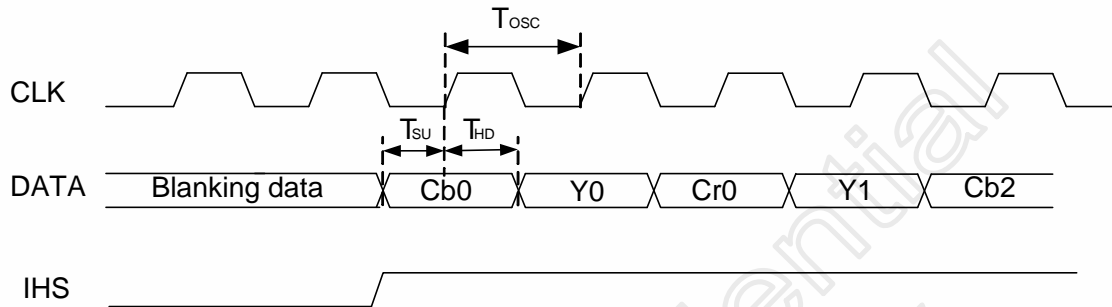


Figure 8. 1 CLK, DATA and IHS waveforms in CCIR601

I CCIR656

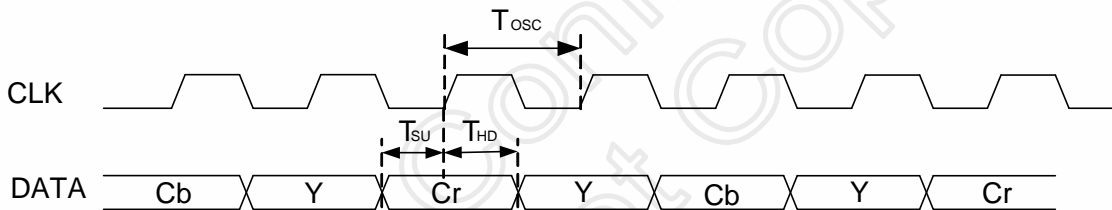


Figure 8. 2 CLK and DATA waveforms in CCIR656

I Digital Serial RGB

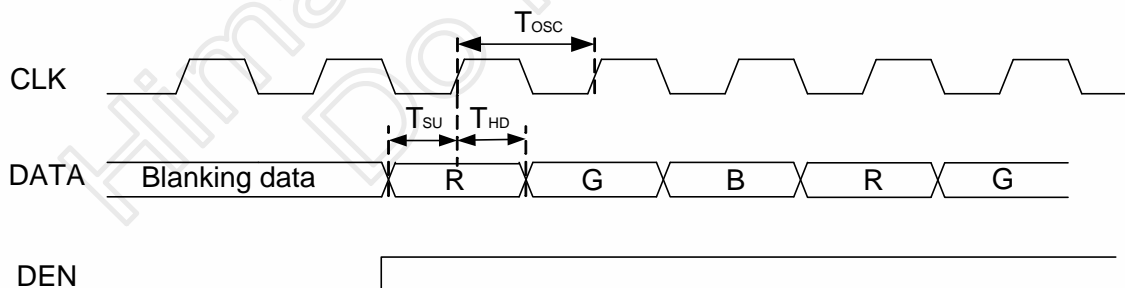


Figure 8. 3 CLK, DATA and DEN waveforms in Digital Serial RGB

I Digital Parallel RGB

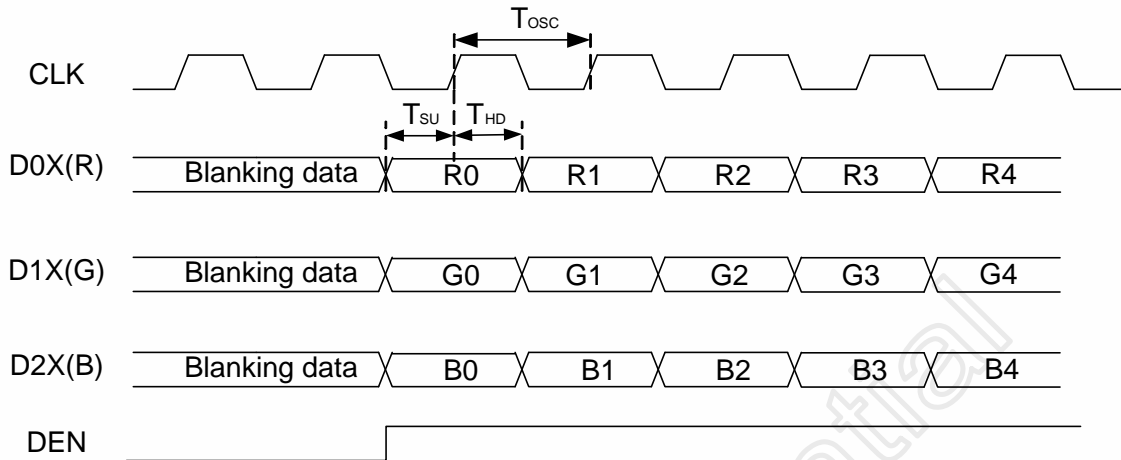


Figure 8. 4 CLK, DATA and DEN waveforms in Digital Parallel RGB

I Standby ON/OFF Control

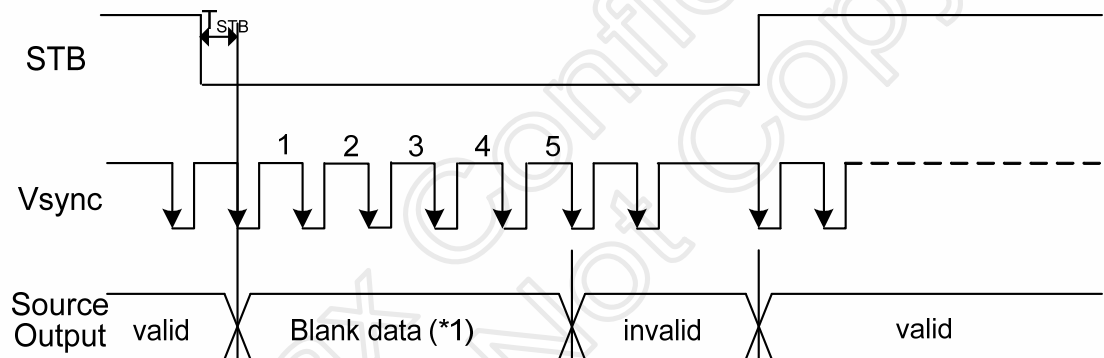


Figure 8. 5 STB, VSYNC and Source Output waveforms in Standby ON/OFF Control

8.1.2 Clock and Sync waveforms

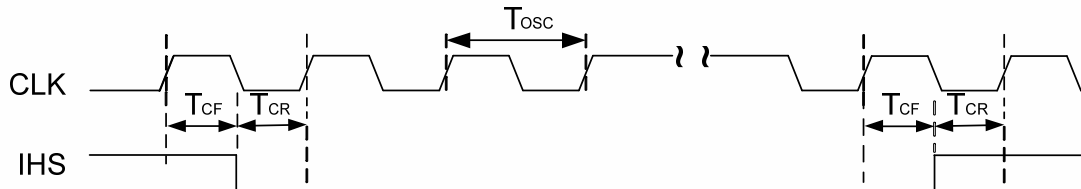


Figure 8. 6 CLK and IHS timing waveform

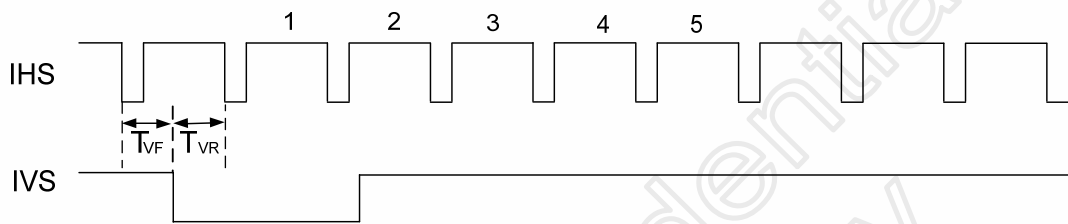


Figure 8. 7 IHS and IVS timing waveforms

8.1.3 Digital RGB timing waveform

8.1.3.1 DE Only Mode

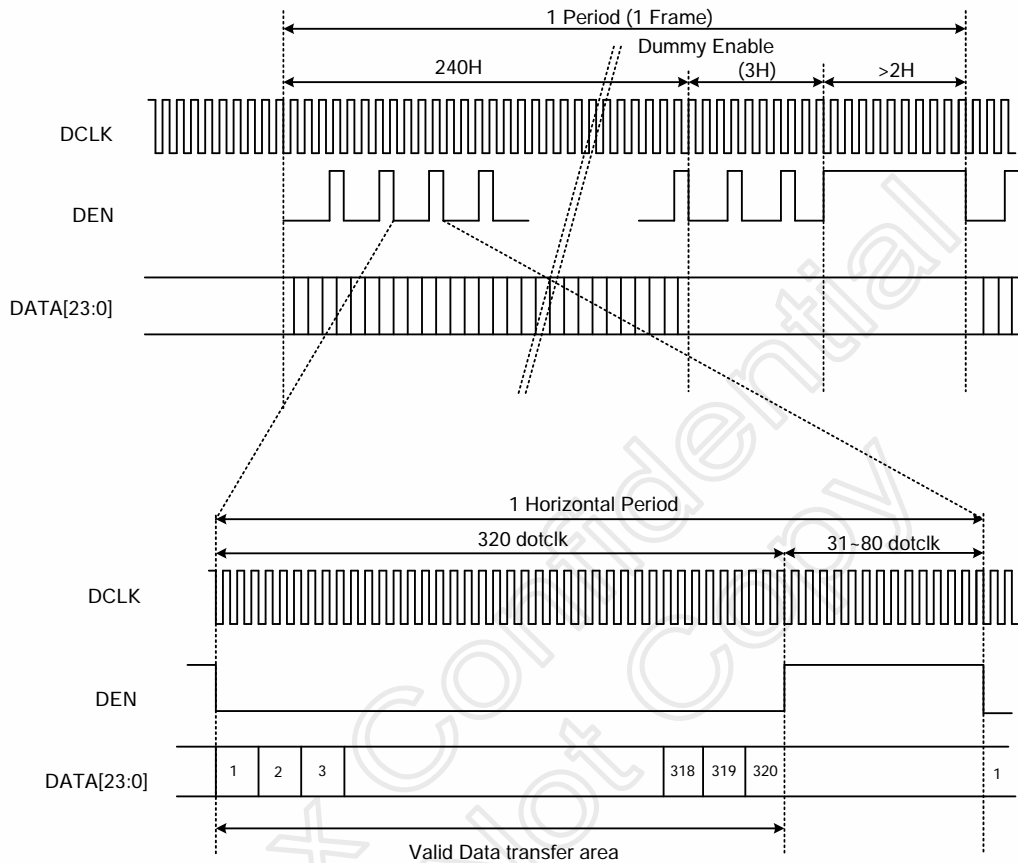


Figure 8. 8 CLK, ENABLE and DATA timing waveforms

8.1.3.2 IHS and horizontal control timing waveforms

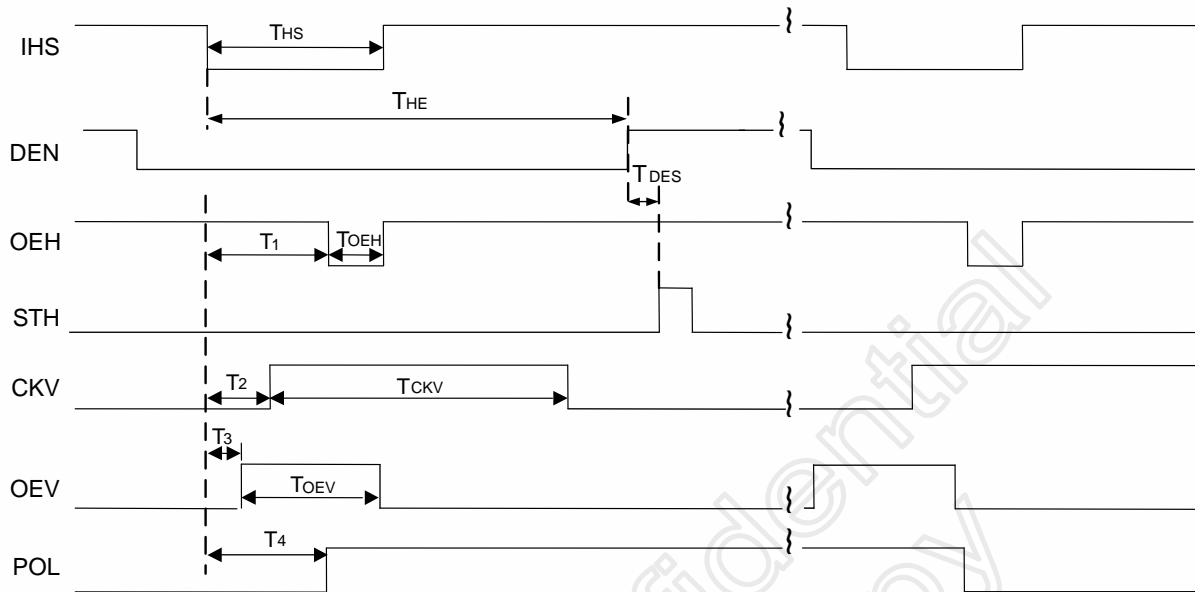


Figure 8. 9 IHS and horizontal control timing waveforms

8.1.3.3 IHS and vertical shift clock timing waveforms

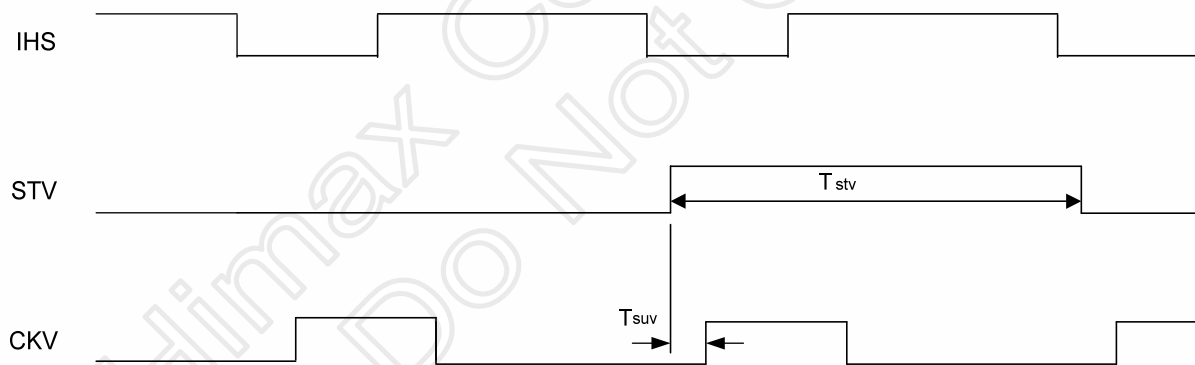


Figure 8. 10 IHS and vertical shift clock timing waveforms

8.1.3.4 IHS and vertical control timing waveforms

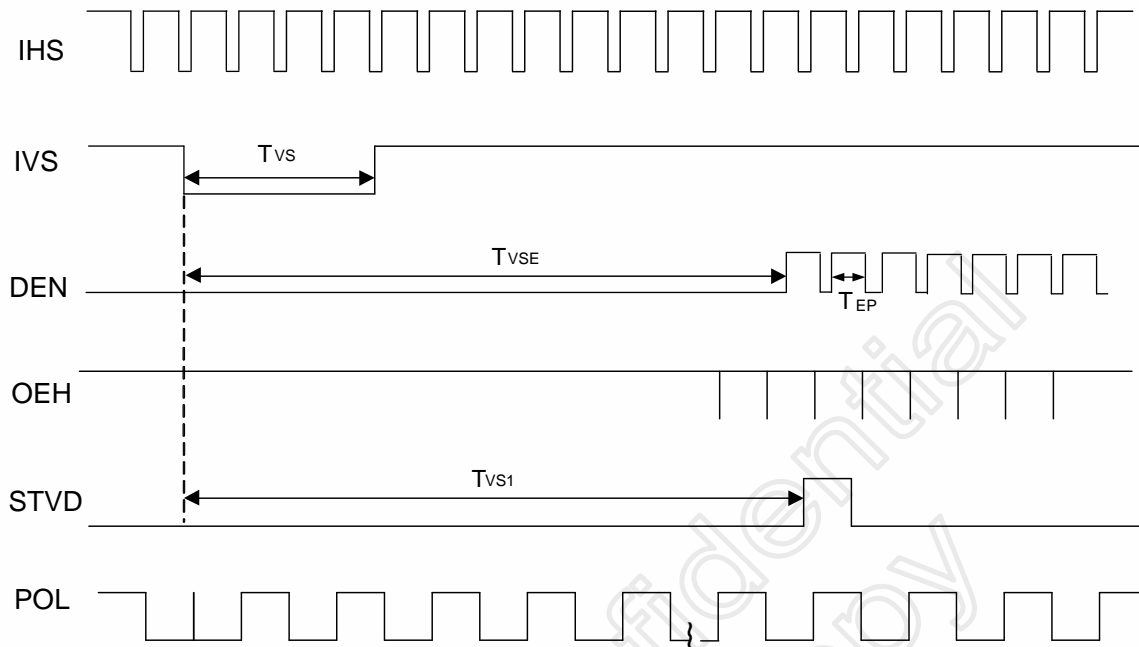


Figure 8. 11 IHS and vertical control timing waveforms

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

8.1.4.1 IHS and IVS timing

I Odd field

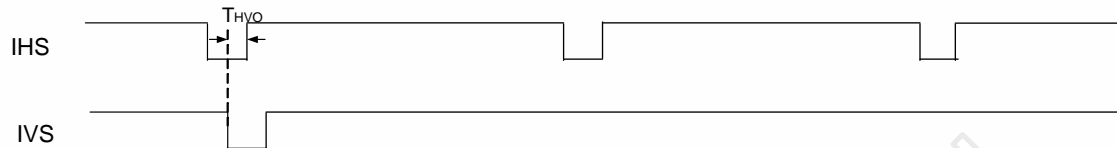


Figure 8. 12 IHS and IVS waveforms in odd field

I Even field

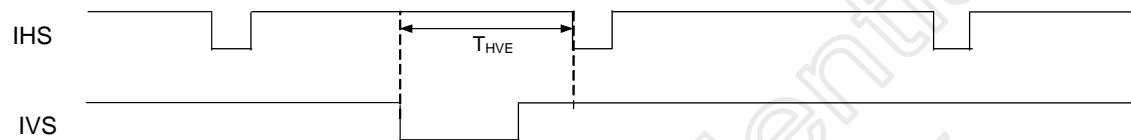


Figure 8. 13 IHS and IVS waveforms in even field

8.1.4.2 IHS and IVS timing

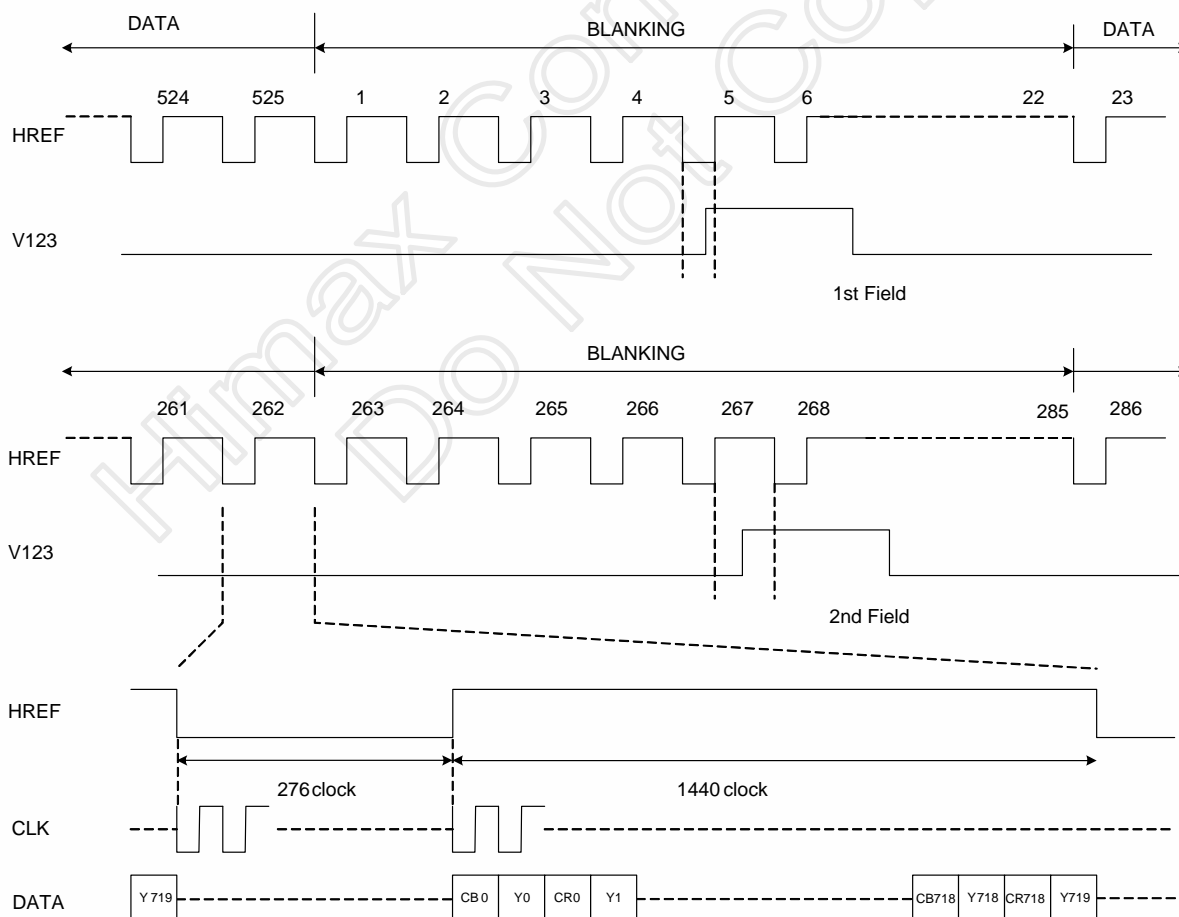


Figure 8. 14 ITU-R BT. 601 NTSC Input Timing

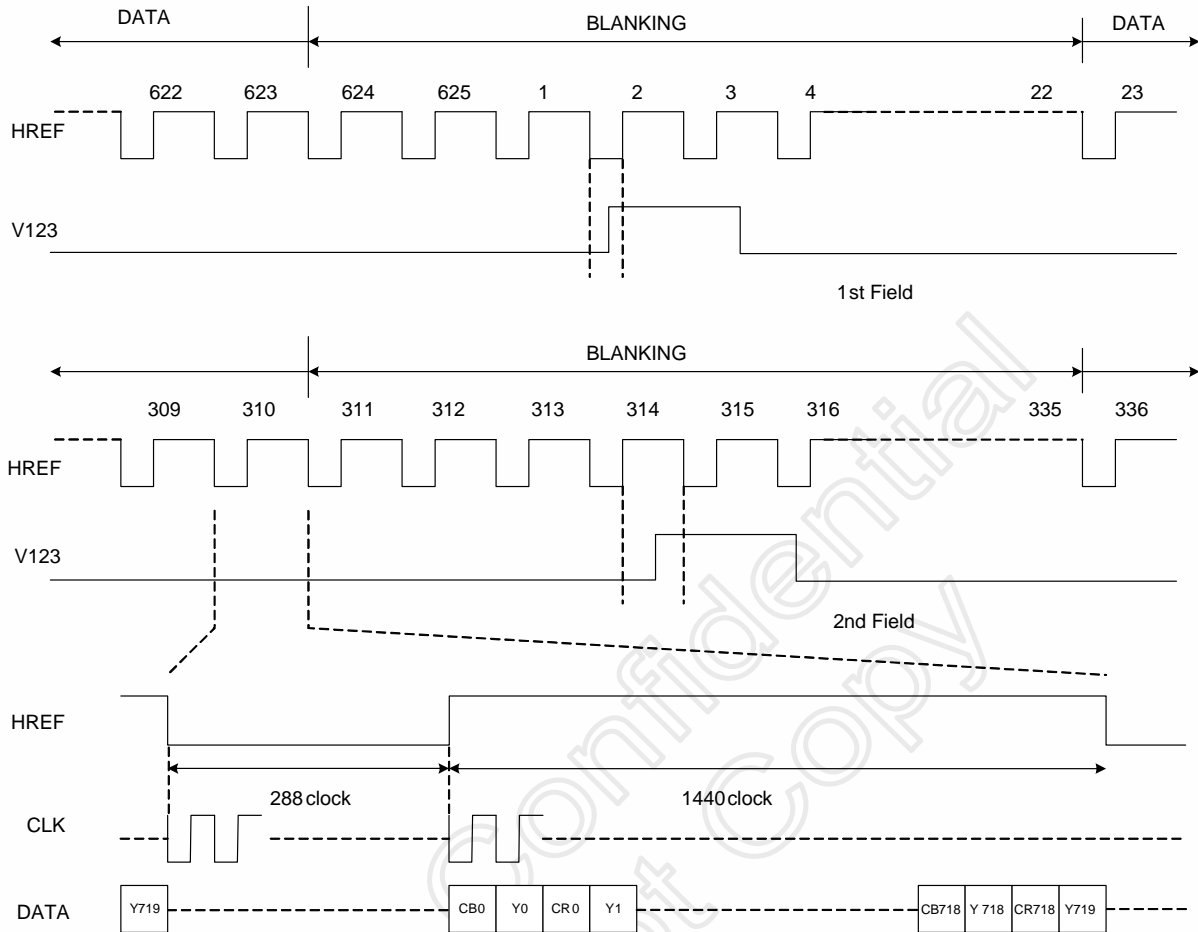


Figure 8. 15 ITU-R BT. 601 PAL Input Timing

8.2 Source Driver Timing Chart

8.2.1 Clock and Start Pulse timing waveforms

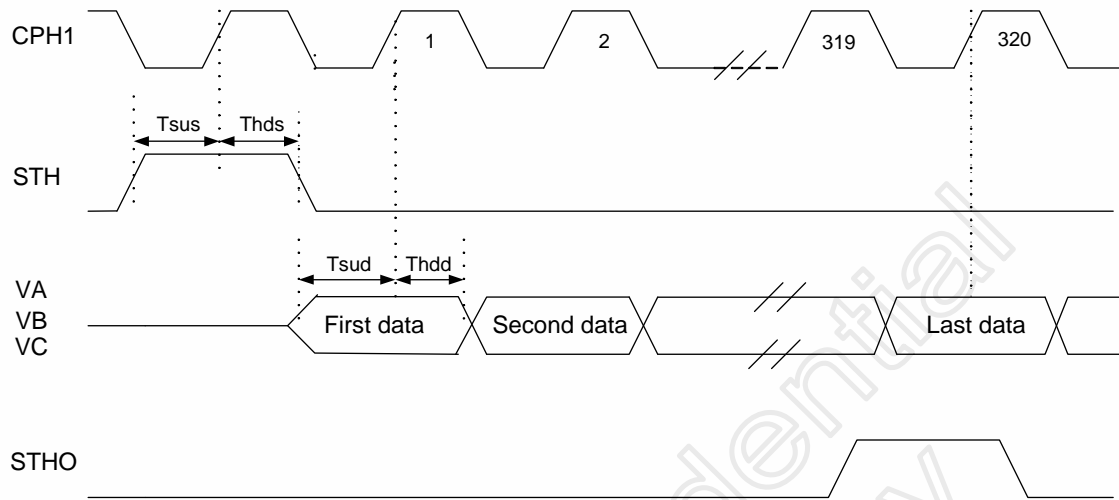


Figure 8. 16 Clock and Start Pulse timing waveforms

8.2.2 OEH and Data Output timing waveforms

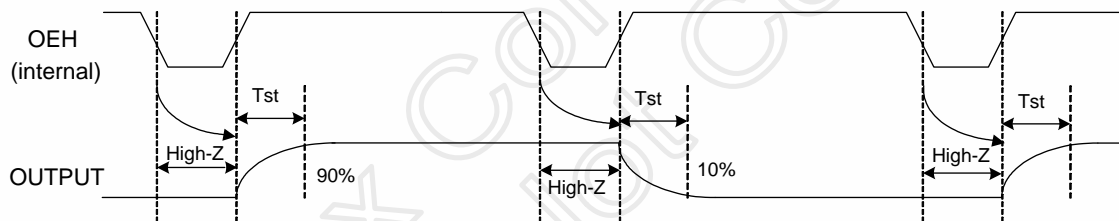


Figure 8. 17 OEH and Data Output timing waveforms

9. SPI timing characteristics

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
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}

I SPI read timing

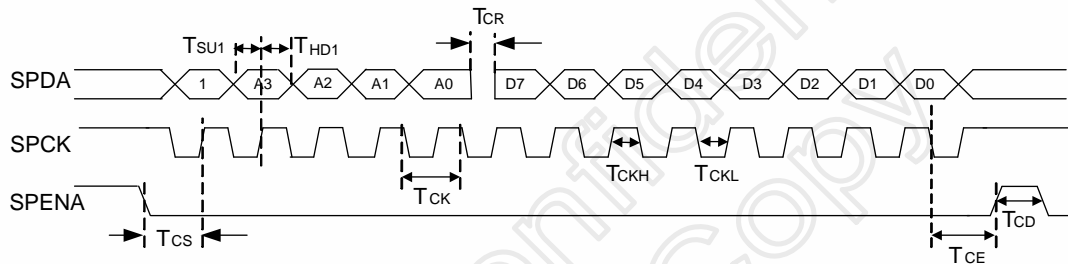


Figure 9. 1 SPI read timing

I SPI write timing

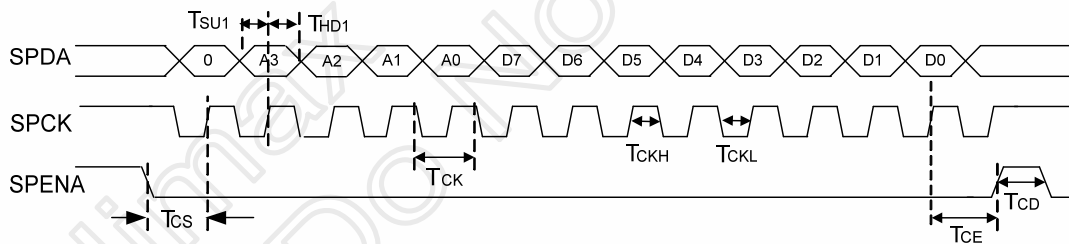
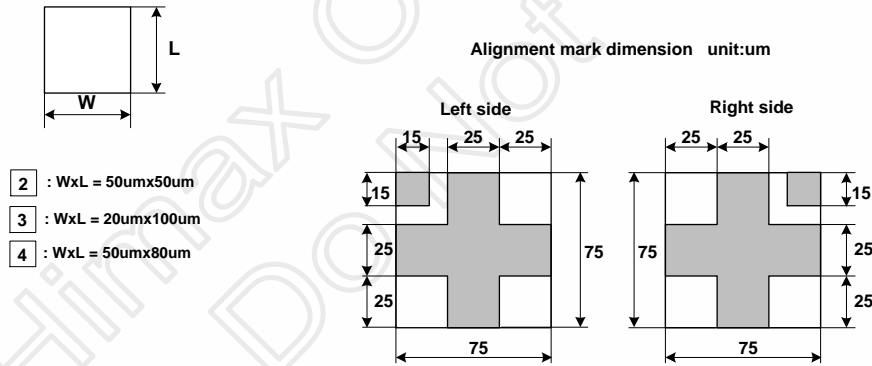
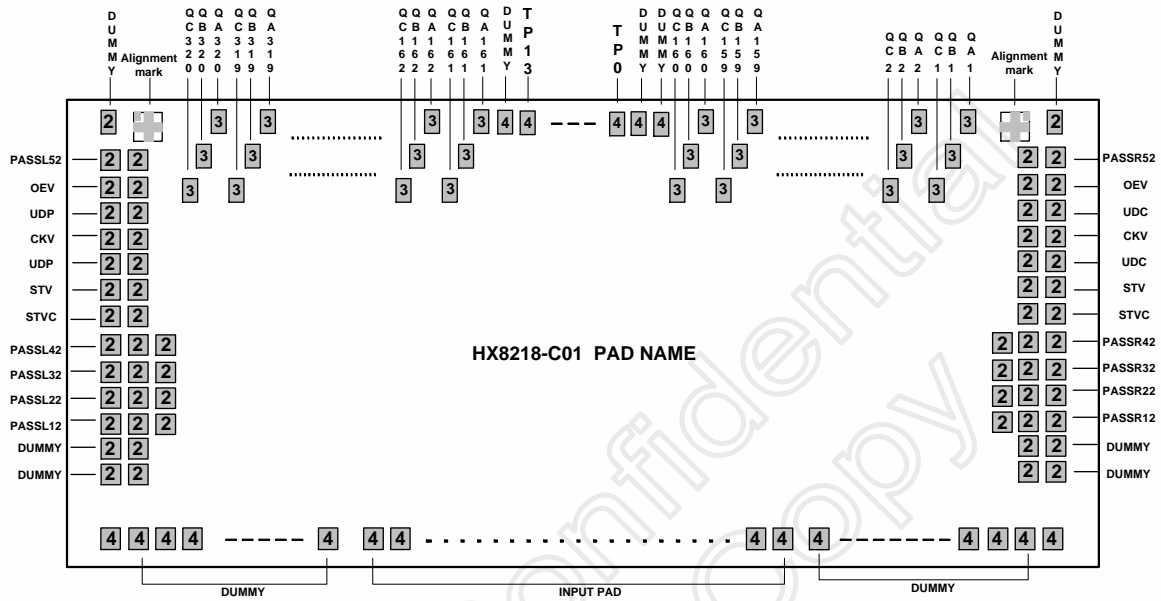


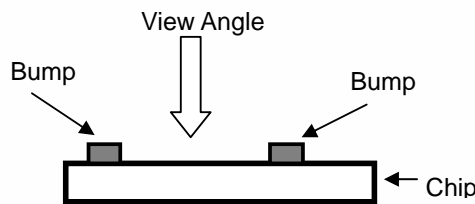
Figure 9. 2 SPI write timing

10. Bump Mask Information

- I Chip size: 23533 μm x 1396 μm
- I Bump height: 15 μm \pm 3 μm
- I Bump hardness: 60 H_V \pm 15 H_V



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



The figure of "View Angle"

Figure 10. 1 Pad name and size information

PAD Coordinate

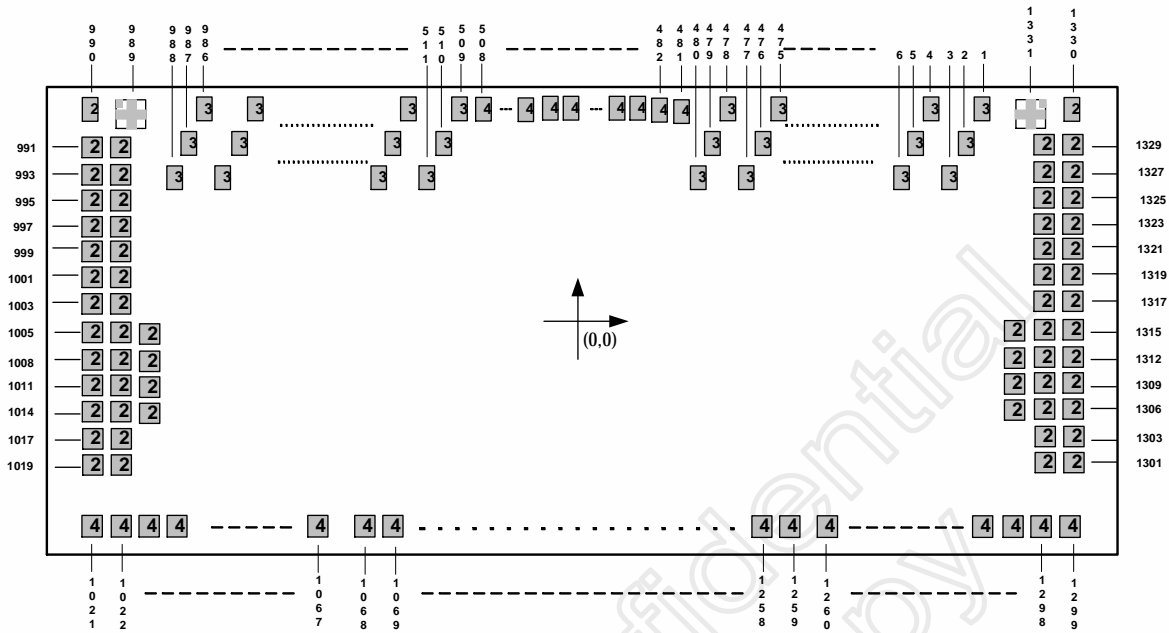
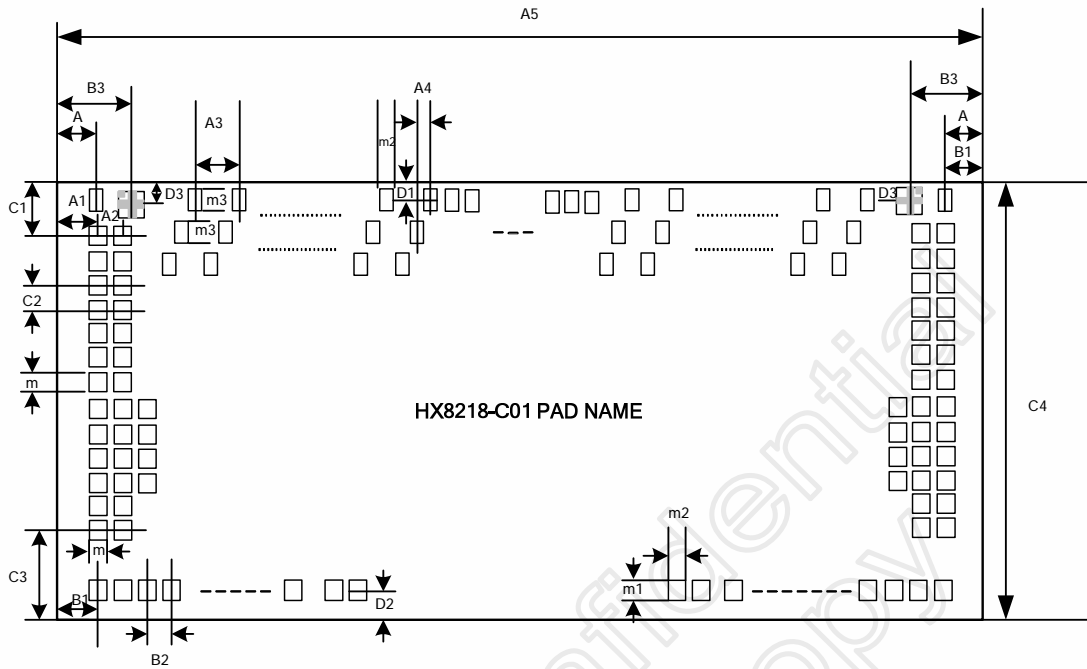


Figure 10.3 PAD coordinate

Bump Outline Dimensions



Symbol	Dimensions in um
A	90
A1	90
A2	70
A3	60
A4	20
A5	23533
B1	90
B2	86
B3	177.5
C1	182

Symbol	Dimensions in um
C2	80
C3	254
C4	1396
D1	115
D2	105
D3	107.5
m	50
m1	80
m2	50
m3	100

Figure 10. 4 Bump Outline Dimensions

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
234	QC78	6791.8	323	294	QC98	5591.8	323	354	QC118	4391.8	323
235	QA79	6771.8	583	295	QA99	5571.8	583	355	QA119	4371.8	583
236	QB79	6751.8	453	296	QB99	5551.8	453	356	QB119	4351.8	453
237	QC79	6731.8	323	297	QC99	5531.8	323	357	QC119	4331.8	323
238	QA80	6711.8	583	298	QA100	5511.8	583	358	QA120	4311.8	583
239	QB80	6691.8	453	299	QB100	5491.8	453	359	QB120	4291.8	453
240	QC80	6671.8	323	300	QC100	5471.8	323	360	QC120	4271.8	323

No.	Name	X	Y	No.	Name	X	Y	No.	Name	X	Y
361	QA121	4251.8	583	421	QA141	3051.8	583	481	DUMMY	1746.6	593
362	QB121	4231.8	453	422	QB141	3031.8	453	482	DUMMY	1660.6	593
363	QC121	4211.8	323	423	QC141	3011.8	323	483	TP0	1440.6	593
364	QA122	4191.8	583	424	QA142	2991.8	583	484	TP0	1370.6	593
365	QB122	4171.8	453	425	QB142	2971.8	453	485	TP1	1155.6	593
366	QC122	4151.8	323	426	QC142	2951.8	323	486	TP1	1085.6	593
367	QA123	4131.8	583	427	QA143	2931.8	583	487	TP2	870.6	593
368	QB123	4111.8	453	428	QB143	2911.8	453	488	TP2	800.6	593
369	QC123	4091.8	323	429	QC143	2891.8	323	489	TP3	585.6	593
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
374	QB125	3991.8	453	434	QB145	2791.8	453	494	TP5	-54.4	593
375	QC125	3971.8	323	435	QC145	2771.8	323	495	TP6	-269.4	593
376	QA126	3951.8	583	436	QA146	2751.8	583	496	TP6	-339.4	593
377	QB126	3931.8	453	437	QB146	2731.8	453	497	TP7	-554.4	593
378	QC126	3911.8	323	438	QC146	2711.8	323	498	TP7	-624.4	593
379	QA127	3891.8	583	439	QA147	2691.8	583	499	TP8	-839.4	593
380	QB127	3871.8	453	440	QB147	2671.8	453	500	TP8	-909.4	593
381	QC127	3851.8	323	441	QC147	2651.8	323	501	TP9	-1124.4	593
382	QA128	3831.8	583	442	QA148	2631.8	583	502	TP9	-1194.4	593
383	QB128	3811.8	453	443	QB148	2611.8	453	503	DUMMY	-1296.4	593
384	QC128	3791.8	323	444	QC148	2591.8	323	504	DUMMY	-1382.4	593
385	QA129	3771.8	583	445	QA149	2571.8	583	505	TP11	-1468.4	593
386	QB129	3751.8	453	446	QB149	2551.8	453	506	TP12	-1554.4	593
387	QC129	3731.8	323	447	QC149	2531.8	323	507	TP13	-1640.4	593
388	QA130	3711.8	583	448	QA150	2511.8	583	508	DUMMY	-1726.4	593
389	QB130	3691.8	453	449	QB150	2491.8	453	509	QA161	-1866.55	583
390	QC130	3671.8	323	450	QC150	2471.8	323	510	QB161	-1886.55	453
391	QA131	3651.8	583	451	QA151	2451.8	583	511	QC161	-1906.55	323
392	QB131	3631.8	453	452	QB151	2431.8	453	512	QA162	-1926.55	583
393	QC131	3611.8	323	453	QC151	2411.8	323	513	QB162	-1946.55	453
394	QA132	3591.8	583	454	QA152	2391.8	583	514	QC162	-1966.55	323
395	QB132	3571.8	453	455	QB152	2371.8	453	515	QA163	-1986.55	583
396	QC132	3551.8	323	456	QC152	2351.8	323	516	QB163	-2006.55	453
397	QA133	3531.8	583	457	QA153	2331.8	583	517	QC163	-2026.55	323
398	QB133	3511.8	453	458	QB153	2311.8	453	518	QA164	-2046.55	583
399	QC133	3491.8	323	459	QC153	2291.8	323	519	QB164	-2066.55	453
400	QA134	3471.8	583	460	QA154	2271.8	583	520	QC164	-2086.55	323
401	QB134	3451.8	453	461	QB154	2251.8	453	521	QA165	-2106.55	583
402	QC134	3431.8	323	462	QC154	2231.8	323	522	QB165	-2126.55	453
403	QA135	3411.8	583	463	QA155	2211.8	583	523	QC165	-2146.55	323
404	QB135	3391.8	453	464	QB155	2191.8	453	524	QA166	-2166.55	583
405	QC135	3371.8	323	465	QC155	2171.8	323	525	QB166	-2186.55	453
406	QA136	3351.8	583	466	QA156	2151.8	583	526	QC166	-2206.55	323
407	QB136	3331.8	453	467	QB156	2131.8	453	527	QA167	-2226.55	583
408	QC136	3311.8	323	468	QC156	2111.8	323	528	QB167	-2246.55	453
409	QA137	3291.8	583	469	QA157	2091.8	583	529	QC167	-2266.55	323
410	QB137	3271.8	453	470	QB157	2071.8	453	530	QA168	-2286.55	583
411	QC137	3251.8	323	471	QC157	2051.8	323	531	QB168	-2306.55	453
412	QA138	3231.8	583	472	QA158	2031.8	583	532	QC168	-2326.55	323
413	QB138	3211.8	453	473	QB158	2011.8	453	533	QA169	-2346.55	583
414	QC138	3191.8	323	474	QC158	1991.8	323	534	QB169	-2366.55	453
415	QA139	3171.8	583	475	QA159	1971.8	583	535	QC169	-2386.55	323
416	QB139	3151.8	453	476	QB159	1951.8	453	536	QA170	-2406.55	583
417	QC139	3131.8	323	477	QC159	1931.8	323	537	QB170	-2426.55	453
418	QA140	3111.8	583	478	QA160	1911.8	583	538	QC170	-2446.55	323
419	QB140	3091.8	453	479	QB160	1891.8	453	539	QA171	-2466.55	583
420	QC140	3071.8	323	480	QC160	1871.8	323	540	QB171	-2486.55	453

No.	Name	X	Y	No.	Name	X	Y	No.	Name	X	Y
541	QC171	-2506.55	323	601	QC191	-3706.55	323	661	QC211	-4906.55	323
542	QA172	-2526.55	583	602	QA192	-3726.55	583	662	QA212	-4926.55	583
543	QB172	-2546.55	453	603	QB192	-3746.55	453	663	QB212	-4946.55	453
544	QC172	-2566.55	323	604	QC192	-3766.55	323	664	QC212	-4966.55	323
545	QA173	-2586.55	583	605	QA193	-3786.55	583	665	QA213	-4986.55	583
546	QB173	-2606.55	453	606	QB193	-3806.55	453	666	QB213	-5006.55	453
547	QC173	-2626.55	323	607	QC193	-3826.55	323	667	QC213	-5026.55	323
548	QA174	-2646.55	583	608	QA194	-3846.55	583	668	QA214	-5046.55	583
549	QB174	-2666.55	453	609	QB194	-3866.55	453	669	QB214	-5066.55	453
550	QC174	-2686.55	323	610	QC194	-3886.55	323	670	QC214	-5086.55	323
551	QA175	-2706.55	583	611	QA195	-3906.55	583	671	QA215	-5106.55	583
552	QB175	-2726.55	453	612	QB195	-3926.55	453	672	QB215	-5126.55	453
553	QC175	-2746.55	323	613	QC195	-3946.55	323	673	QC215	-5146.55	323
554	QA176	-2766.55	583	614	QA196	-3966.55	583	674	QA216	-5166.55	583
555	QB176	-2786.55	453	615	QB196	-3986.55	453	675	QB216	-5186.55	453
556	QC176	-2806.55	323	616	QC196	-4006.55	323	676	QC216	-5206.55	323
557	QA177	-2826.55	583	617	QA197	-4026.55	583	677	QA217	-5226.55	583
558	QB177	-2846.55	453	618	QB197	-4046.55	453	678	QB217	-5246.55	453
559	QC177	-2866.55	323	619	QC197	-4066.55	323	679	QC217	-5266.55	323
560	QA178	-2886.55	583	620	QA198	-4086.55	583	680	QA218	-5286.55	583
561	QB178	-2906.55	453	621	QB198	-4106.55	453	681	QB218	-5306.55	453
562	QC178	-2926.55	323	622	QC198	-4126.55	323	682	QC218	-5326.55	323
563	QA179	-2946.55	583	623	QA199	-4146.55	583	683	QA219	-5346.55	583
564	QB179	-2966.55	453	624	QB199	-4166.55	453	684	QB219	-5366.55	453
565	QC179	-2986.55	323	625	QC199	-4186.55	323	685	QC219	-5386.55	323
566	QA180	-3006.55	583	626	QA200	-4206.55	583	686	QA220	-5406.55	583
567	QB180	-3026.55	453	627	QB200	-4226.55	453	687	QB220	-5426.55	453
568	QC180	-3046.55	323	628	QC200	-4246.55	323	688	QC220	-5446.55	323
569	QA181	-3066.55	583	629	QA201	-4266.55	583	689	QA221	-5466.55	583
570	QB181	-3086.55	453	630	QB201	-4286.55	453	690	QB221	-5486.55	453
571	QC181	-3106.55	323	631	QC201	-4306.55	323	691	QC221	-5506.55	323
572	QA182	-3126.55	583	632	QA202	-4326.55	583	692	QA222	-5526.55	583
573	QB182	-3146.55	453	633	QB202	-4346.55	453	693	QB222	-5546.55	453
574	QC182	-3166.55	323	634	QC202	-4366.55	323	694	QC222	-5566.55	323
575	QA183	-3186.55	583	635	QA203	-4386.55	583	695	QA223	-5586.55	583
576	QB183	-3206.55	453	636	QB203	-4406.55	453	696	QB223	-5606.55	453
577	QC183	-3226.55	323	637	QC203	-4426.55	323	697	QC223	-5626.55	323
578	QA184	-3246.55	583	638	QA204	-4446.55	583	698	QA224	-5646.55	583
579	QB184	-3266.55	453	639	QB204	-4466.55	453	699	QB224	-5666.55	453
580	QC184	-3286.55	323	640	QC204	-4486.55	323	700	QC224	-5686.55	323
581	QA185	-3306.55	583	641	QA205	-4506.55	583	701	QA225	-5706.55	583
582	QB185	-3326.55	453	642	QB205	-4526.55	453	702	QB225	-5726.55	453
583	QC185	-3346.55	323	643	QC205	-4546.55	323	703	QC225	-5746.55	323
584	QA186	-3366.55	583	644	QA206	-4566.55	583	704	QA226	-5766.55	583
585	QB186	-3386.55	453	645	QB206	-4586.55	453	705	QB226	-5786.55	453
586	QC186	-3406.55	323	646	QC206	-4606.55	323	706	QC226	-5806.55	323
587	QA187	-3426.55	583	647	QA207	-4626.55	583	707	QA227	-5826.55	583
588	QB187	-3446.55	453	648	QB207	-4646.55	453	708	QB227	-5846.55	453
589	QC187	-3466.55	323	649	QC207	-4666.55	323	709	QC227	-5866.55	323
590	QA188	-3486.55	583	650	QA208	-4686.55	583	710	QA228	-5886.55	583
591	QB188	-3506.55	453	651	QB208	-4706.55	453	711	QB228	-5906.55	453
592	QC188	-3526.55	323	652	QC208	-4726.55	323	712	QC228	-5926.55	323
593	QA189	-3546.55	583	653	QA209	-4746.55	583	713	QA229	-5946.55	583
594	QB189	-3566.55	453	654	QB209	-4766.55	453	714	QB229	-5966.55	453
595	QC189	-3586.55	323	655	QC209	-4786.55	323	715	QC229	-5986.55	323
596	QA190	-3606.55	583	656	QA210	-4806.55	583	716	QA230	-6006.55	583
597	QB190	-3626.55	453	657	QB210	-4826.55	453	717	QB230	-6026.55	453
598	QC190	-3646.55	323	658	QC210	-4846.55	323	718	QC230	-6046.55	323
599	QA191	-3666.55	583	659	QA211	-4866.55	583	719	QA231	-6066.55	583
600	QB191	-3686.55	453	660	QB211	-4886.55	453	720	QB231	-6086.55	453

No.	Name	X	Y	No.	Name	X	Y	No.	Name	X	Y
721	QC231	-6106.55	323	781	QC251	-7306.55	323	841	QC271	-8506.55	323
722	QA232	-6126.55	583	782	QA252	-7326.55	583	842	QA272	-8526.55	583
723	QB232	-6146.55	453	783	QB252	-7346.55	453	843	QB272	-8546.55	453
724	QC232	-6166.55	323	784	QC252	-7366.55	323	844	QC272	-8566.55	323
725	QA233	-6186.55	583	785	QA253	-7386.55	583	845	QA273	-8586.55	583
726	QB233	-6206.55	453	786	QB253	-7406.55	453	846	QB273	-8606.55	453
727	QC233	-6226.55	323	787	QC253	-7426.55	323	847	QC273	-8626.55	323
728	QA234	-6246.55	583	788	QA254	-7446.55	583	848	QA274	-8646.55	583
729	QB234	-6266.55	453	789	QB254	-7466.55	453	849	QB274	-8666.55	453
730	QC234	-6286.55	323	790	QC254	-7486.55	323	850	QC274	-8686.55	323
731	QA235	-6306.55	583	791	QA255	-7506.55	583	851	QA275	-8706.55	583
732	QB235	-6326.55	453	792	QB255	-7526.55	453	852	QB275	-8726.55	453
733	QC235	-6346.55	323	793	QC255	-7546.55	323	853	QC275	-8746.55	323
734	QA236	-6366.55	583	794	QA256	-7566.55	583	854	QA276	-8766.55	583
735	QB236	-6386.55	453	795	QB256	-7586.55	453	855	QB276	-8786.55	453
736	QC236	-6406.55	323	796	QC256	-7606.55	323	856	QC276	-8806.55	323
737	QA237	-6426.55	583	797	QA257	-7626.55	583	857	QA277	-8826.55	583
738	QB237	-6446.55	453	798	QB257	-7646.55	453	858	QB277	-8846.55	453
739	QC237	-6466.55	323	799	QC257	-7666.55	323	859	QC277	-8866.55	323
740	QA238	-6486.55	583	800	QA258	-7686.55	583	860	QA278	-8886.55	583
741	QB238	-6506.55	453	801	QB258	-7706.55	453	861	QB278	-8906.55	453
742	QC238	-6526.55	323	802	QC258	-7726.55	323	862	QC278	-8926.55	323
743	QA239	-6546.55	583	803	QA259	-7746.55	583	863	QA279	-8946.55	583
744	QB239	-6566.55	453	804	QB259	-7766.55	453	864	QB279	-8966.55	453
745	QC239	-6586.55	323	805	QC259	-7786.55	323	865	QC279	-8986.55	323
746	QA240	-6606.55	583	806	QA260	-7806.55	583	866	QA280	-9006.55	583
747	QB240	-6626.55	453	807	QB260	-7826.55	453	867	QB280	-9026.55	453
748	QC240	-6646.55	323	808	QC260	-7846.55	323	868	QC280	-9046.55	323
749	QA241	-6666.55	583	809	QA261	-7866.55	583	869	QA281	-9066.55	583
750	QB241	-6686.55	453	810	QB261	-7886.55	453	870	QB281	-9086.55	453
751	QC241	-6706.55	323	811	QC261	-7906.55	323	871	QC281	-9106.55	323
752	QA242	-6726.55	583	812	QA262	-7926.55	583	872	QA282	-9126.55	583
753	QB242	-6746.55	453	813	QB262	-7946.55	453	873	QB282	-9146.55	453
754	QC242	-6766.55	323	814	QC262	-7966.55	323	874	QC282	-9166.55	323
755	QA243	-6786.55	583	815	QA263	-7986.55	583	875	QA283	-9186.55	583
756	QB243	-6806.55	453	816	QB263	-8006.55	453	876	QB283	-9206.55	453
757	QC243	-6826.55	323	817	QC263	-8026.55	323	877	QC283	-9226.55	323
758	QA244	-6846.55	583	818	QA264	-8046.55	583	878	QA284	-9246.55	583
759	QB244	-6866.55	453	819	QB264	-8066.55	453	879	QB284	-9266.55	453
760	QC244	-6886.55	323	820	QC264	-8086.55	323	880	QC284	-9286.55	323
761	QA245	-6906.55	583	821	QA265	-8106.55	583	881	QA285	-9306.55	583
762	QB245	-6926.55	453	822	QB265	-8126.55	453	882	QB285	-9326.55	453
763	QC245	-6946.55	323	823	QC265	-8146.55	323	883	QC285	-9346.55	323
764	QA246	-6966.55	583	824	QA266	-8166.55	583	884	QA286	-9366.55	583
765	QB246	-6986.55	453	825	QB266	-8186.55	453	885	QB286	-9386.55	453
766	QC246	-7006.55	323	826	QC266	-8206.55	323	886	QC286	-9406.55	323
767	QA247	-7026.55	583	827	QA267	-8226.55	583	887	QA287	-9426.55	583
768	QB247	-7046.55	453	828	QB267	-8246.55	453	888	QB287	-9446.55	453
769	QC247	-7066.55	323	829	QC267	-8266.55	323	889	QC287	-9466.55	323
770	QA248	-7086.55	583	830	QA268	-8286.55	583	890	QA288	-9486.55	583
771	QB248	-7106.55	453	831	QB268	-8306.55	453	891	QB288	-9506.55	453
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
901	QC291	-9706.55	323	961	QC311	-10906.55	323	1021	DUMMY	-11676.5	-593
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
907	QC293	-9826.55	323	967	QC313	-11026.55	323	1027	DUMMY	-11160.45	-593
908	QA294	-9846.55	583	968	QA314	-11046.55	583	1028	DUMMY	-11074.45	-593
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
911	QA295	-9906.55	583	971	QA315	-11106.55	583	1031	DUMMY	-10816.45	-593
912	QB295	-9926.55	453	972	QB315	-11126.55	453	1032	DUMMY	-10730.45	-593
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
927	QB300	-10226.55	453	987	QB320	-11426.55	453	1047	DUMMY	-9440.45	-593
928	QC300	-10246.55	323	988	QC320	-11446.55	323	1048	DUMMY	-9354.45	-593
929	QA301	-10266.55	583	989	L alignment	-11589	590.5	1049	DUMMY	-9268.45	-593
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
933	QB302	-10346.55	453	993	OEV	-11676.5	436	1053	DUMMY	-8924.45	-593
934	QC302	-10366.55	323	994	OEV	-11606.5	436	1054	DUMMY	-8838.45	-593
935	QA303	-10386.55	583	995	UDP	-11676.5	356	1055	DUMMY	-8752.45	-593
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
938	QA304	-10446.55	583	998	CKV	-11606.5	276	1058	DUMMY	-8494.45	-593
939	QB304	-10466.55	453	999	UDP	-11676.5	196	1059	DUMMY	-8408.45	-593
940	QC304	-10486.55	323	1000	UDP	-11606.5	196	1060	DUMMY	-8322.45	-593
941	QA305	-10506.55	583	1001	STV	-11676.5	116	1061	DUMMY	-8236.45	-593
942	QB305	-10526.55	453	1002	STV	-11606.5	116	1062	DUMMY	-8150.45	-593
943	QC305	-10546.55	323	1003	STVC	-11676.5	36	1063	DUMMY	-8064.45	-593
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
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
1090	GND	-5998.45	-593	1150	D11	-666.45	-593	1210	CF2	4029.55	-593
1091	DUMMY	-5912.45	-593	1151	D10	-580.45	-593	1211	CF1	4115.55	-593
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
1103	IF2	-4887.45	-593	1163	V6	355.55	-593	1223	VCC	5051.55	-593
1104	IF1	-4801.45	-593	1164	V6	425.55	-593	1224	VCC	5121.55	-593
1105	IF1	-4731.45	-593	1165	V5	511.55	-593	1225	VCC	5191.55	-593
1106	DUMMY	-4645.45	-593	1166	V5	581.55	-593	1226	DUMMY	5277.55	-593
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
1110	SPCK	-4333.45	-593	1170	V3	893.55	-593	1230	OSD_B	5589.55	-593
1111	SPDA	-4247.45	-593	1171	V2	979.55	-593	1231	OSD_G	5675.55	-593
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

No.	Name	X	Y
1261	DUMMY	8354.55	-593
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
1267	DUMMY	8870.55	-593
1268	DUMMY	8956.55	-593
1269	DUMMY	9042.55	-593
1270	DUMMY	9128.55	-593
1271	DUMMY	9214.55	-593
1272	DUMMY	9300.55	-593
1273	DUMMY	9386.55	-593
1274	DUMMY	9472.55	-593
1275	DUMMY	9558.55	-593
1276	DUMMY	9644.55	-593
1277	DUMMY	9730.55	-593
1278	DUMMY	9816.55	-593
1279	DUMMY	9902.55	-593
1280	DUMMY	9988.55	-593
1281	DUMMY	10074.55	-593
1282	DUMMY	10160.55	-593
1283	DUMMY	10246.55	-593
1284	DUMMY	10332.55	-593
1285	DUMMY	10418.55	-593
1286	DUMMY	10504.55	-593
1287	DUMMY	10590.55	-593
1288	DUMMY	10676.55	-593
1289	DUMMY	10762.55	-593
1290	DUMMY	10848.55	-593
1291	DUMMY	10934.55	-593
1292	DUMMY	11020.55	-593
1293	DUMMY	11106.55	-593
1294	DUMMY	11192.55	-593
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
1300	DUMMY	11606.5	-444
1301	DUMMY	11676.5	-444
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

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11. Ordering Information

PART NO.	PACKAGE TYPE
HX8218-C010PDxxx	PD : mean COG xxx : mean chip thickness (μm) , (default 400μm)

12. Revision History

Version	EFF.DATE	DESCRIPTION OF CHANGES
01	2005/11/17	New setup
02	2006/02/06	Update the gamma table
	2006/04/10	Revised Operation temperature
03	2006/07/20	Update the resistor value of the gamma table
04	2006/10/09	All pages Remove 'preliminary' wording from the data sheet. Page 38 Add "Bump Outline Dimensions".



>> DATA SHEET

(DOC No. HX8615A-DS)

>> HX8615A

240 Channel TFT Gate Driver

Version 05 May, 2005

>> HX8615A

240 Channel TFT Gate Driver



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

Version 05

May, 2005

1. General Description

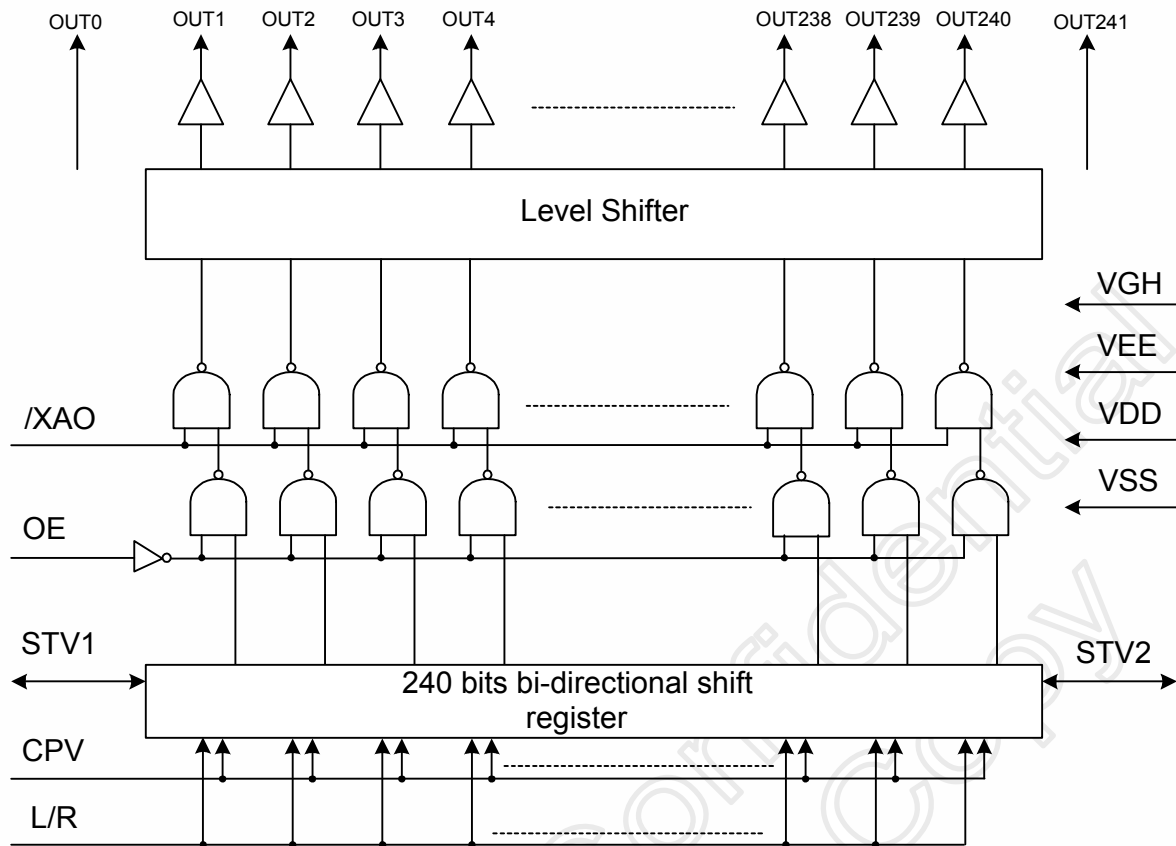
The HX8615A is a 240 channel outputs gate driver used for driving the gate electrode of TFT LCD panel. It is designed for 2-level output with maximum +40V output driving voltage. This device is applicable for a wide range of panel resolution including VGA and UXGA.

2. Features

- 2-level output gate driver for TFT LCD panel
- 240 channel outputs + 2 pins fixed to VEE
- Maximum +40V output driving voltage
- Bi-directional data shift capability
- 200KHz maximum operation frequency
- 2.7V to 5.5V power supply voltage range
- High voltage CMOS process technology
- COG package
- Possible applications:

Panel type	Resolution	Piece per panel
VGA	640 × 480	2
UXGA	1600 × 1200	5
	1920 × 1440	6

3. Block Diagram



4. Pin Description

Pin name	I/O	Function	Description									
CPV	In	Shift clock input	This is the clock input for chip internal shift register. Data is shifted at each rising edge of this clock.									
L/R	In	Shift direction control pin	This pin controls the output shifting direction as listed below. L/R = H, STV1 → OUT1 → OUT2 → ... → OUT240 → STV2 L/R = L, STV1 ← OUT1 ← OUT2 ← ... ← OUT240 ← STV2									
STV1 STV2	I/O	Start pulse input/output pin	These two pins are the device start pulse input or output pin. The function of these two pins depends on the status of L/R pin. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>STV1</th> <th>STV2</th> </tr> </thead> <tbody> <tr> <td>L/R=H</td> <td>input</td> <td>output</td> </tr> <tr> <td>L/R=L</td> <td>output</td> <td>input</td> </tr> </tbody> </table>		STV1	STV2	L/R=H	input	output	L/R=L	output	input
	STV1	STV2										
L/R=H	input	output										
L/R=L	output	input										
OE	In	Output enable control	This pin is used to control the channel output. When OE input is high, driver output is fixed to VEE level regardless CPV. However, the internal shift register is not cleared even if OE input is inactive.									
/XAO	In	Output all high	When /XAO input pin is low, all the output pins are forced to VGH level. Note that this pin has higher priority than OE. Also it has an internal pull high resistor, keep it to VDD is preferred when unused. The chip internal shift register is not cleared when /XAO input is active.									
OUT1 ~ OUT240	Out	Driver output pins for driving gate electrode of LCD	The output voltage is either VGH or VEE for driving the gate electrode of TFT LCD panel depending on the data stored in shift register and the state of OE.									
OUT0, OUT241	Out	Auxiliary pins	LCD panel auxiliary pins, these pins always output VEE level.									
VGH	In	Power supply	Power supply for LCM drive output High.									
VDD	In	Power supply	Digital power.									
VSS	In	Power supply	Digital ground.									
VEE	In	Power supply	LCD driver negative power supply.									
PATH	-	-	Linked together internal.									

5. Function Description

5.1 Device operation

In the condition of L/R=H, the STV1 start pulse input is sensed at the rising edge of CPV and stored in the first stage of shift register, which causes the first scan signal is outputted from the OUT1 output pin. While stored data is transferred to the next stage shift register at the rising edge of next CPV, new data of STV1 is sensed and stored simultaneously.

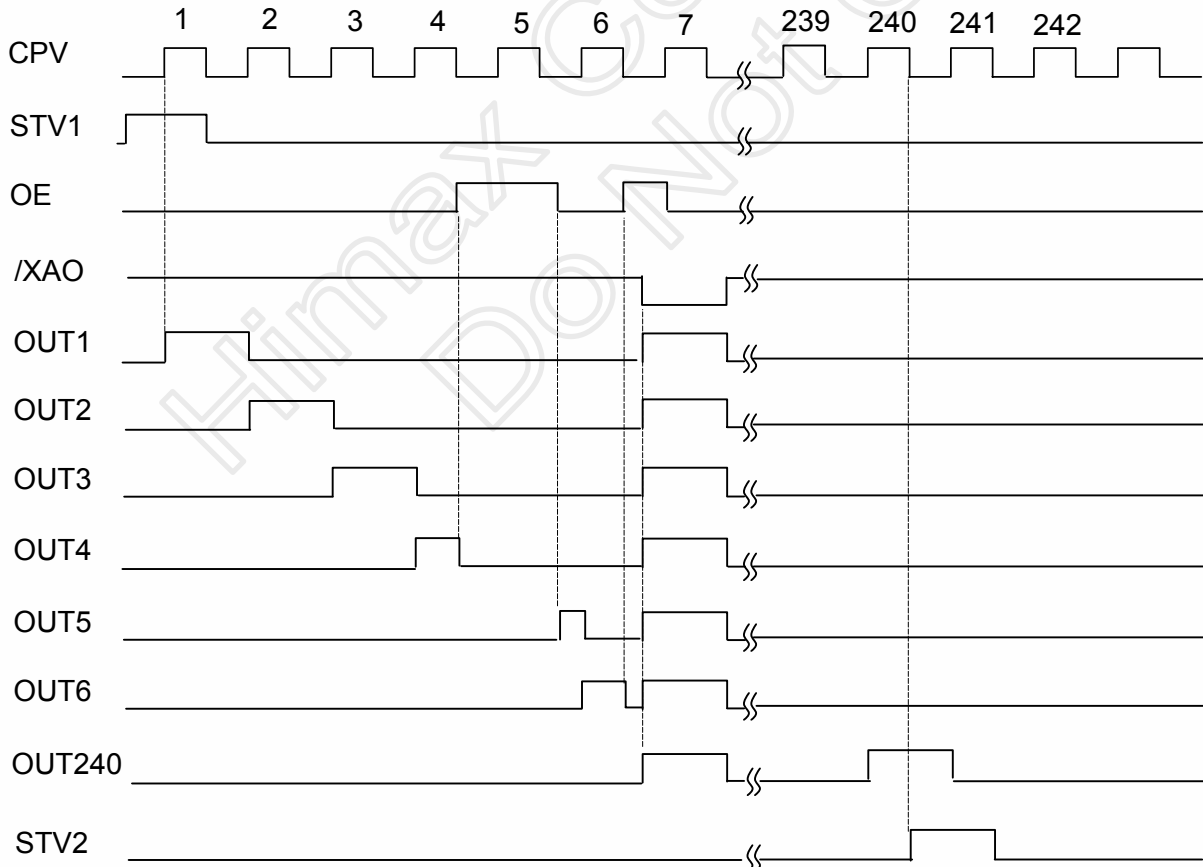
The output pin (OUT1 to OUT240) supplies VGH voltage or VEE voltage to the LCD panel depending on the data stored in the shift register. For normal operation, a VGH voltage is outputted one by one from OUT1 to OUT240 in sync with CPV pulse.

After 240 CPV rising edge are past, the STV2 goes up to high level at the 240th falling edge of CPV and goes down to low level at the 241th falling edge of CPV. This STV2 output signal becomes the STV1 start pulse input of next cascaded gate driver device.

During any H state of OE, the corresponding output channels are forced to VEE level regardless of CPV. The channel output returns to normal status as soon as OE go back to L.

During any L state of /XAO, all the output channels are forced to VGH regardless of CPV and OE. The channel output returns to normal status as soon as /XAO goes back to H.

Example of input/output timing (L/R=H)



5.2 Relationship among L/R, and STV1/STV2

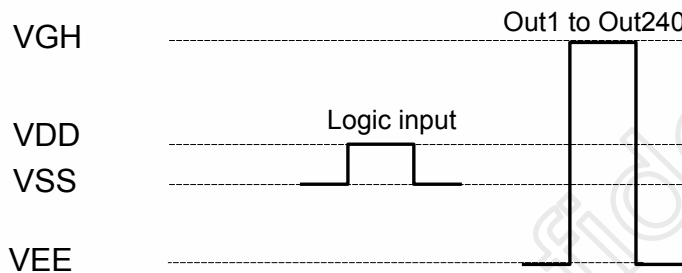
L/R	Start pulse		Data transfer direction
	Input	Output	
H	STV1	STV2	OUT1→OUT2→OUT3→ . . . →OUT240
L	STV2	STV1	OUT240→OUT239→OUT238→ . . . →OUT1

5.3 Device power supply

The HX8615A must be used by the following conditions.

- $V_{GH} - V_{EE} = 40V$ (max.)
- $V_{GH} - V_{SS} = 10 \sim 30V$

Example:

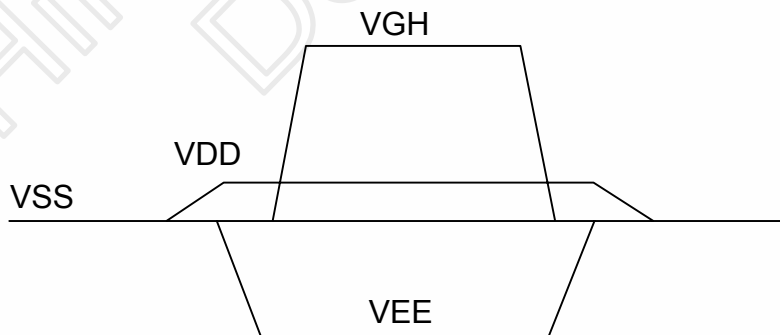


The input signal level of CPV, L/R, OE, STV1, /XAO and STV2 have to swing between VDD and VSS. The signal output level of start pulse (STV1 or STV2) to the next stage cascaded device is VDD for H and VSS for L.

5.4 Power ON/OFF sequence

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

- When power on: $V_{DD} \rightarrow V_{EE} \rightarrow V_{GH}$
- When power off: $V_{GH} \rightarrow V_{EE} \rightarrow V_{DD}$



6. DC Characteristics

6.1 Absolute Maximum Rating (VSS=0V)

Parameter	Symbol	Rating			Unit
		Min.	Typ.	Max.	
Power supply voltage (1)	VDD	-0.3	to	+7.0	V
Power supply voltage (2)	VGH	-0.3	to	+32.0	V
Power supply voltage (3)	VEE	-22.0	to	+0.3	V
Power supply voltage (4)	VGH-VEE	-0.3	to	+45.0	V
Input voltage	V _{in}	-0.3	to	VDD+0.3	V
Operation temperature	T _{OPR}	-40	to	+85	°C
Storage temperature	T _{STG}	-55	to	+125	°C

Note:

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

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

6.2 Recommended Operating Conditions (VSS=0V)

Parameter	Symbol	Rating			Unit
		Min.	Typ.	Max.	
Power supply voltage (1)	VDD	2.7	3.3	5.5	V
Power supply voltage (2)	VGH	7	-	VEE+40	V
Power supply voltage (3)	VEE	-20	-	-5	V
Power supply voltage (4)	VGH-VEE	12	-	40	V
Power supply voltage (5)	VDD-VEE	6	-	-	V
Operation frequency	F _{CPV}	-	-	200	KHz
Operation temperature	T _a	-40	-	+85	°C

6.3 DC Electrical Characteristics (VSS=0V)

Parameter	Symbol	Condition	Rating			Unit	Application pin
			Min.	Typ.	Max.		
Input H voltage	V_{IH}	-	0.7*VDD	-	VDD	V	All input
Input L voltage	V_{IL}	-	VSS	-	0.3*VDD		All input
Output H voltage	V_{OH}	$I_{OH}=200\mu A$	VDD-0.3	-	VDD		STV1,2
Output L voltage	V_{OL}	$I_{OL}=200\mu A$	VSS	-	VSS+0.3		STV1,2
Output H resistance	R_{OH}	$V_{OUT} = VGH-0.5V$	-	-	1000	Ω	OUT1 ~ OUT240
Output L resistance	R_{OL}	$V_{OUT} = VEE+0.5V$	-	-	1000	Ω	OUT1 ~ OUT240
Pull high resistance	R_{XAO}	-	30	-	200	k Ω	/XAO
Input current	I_{IN}	-	-1.0	-	+1.0	μA	Except /XAO pin
VGH Power consumption	I_{VGH}	Note ⁽¹⁾	-	-	100	μA	-
VEE Power consumption	I_{VEE}		-	-	-100		-
VDD Power consumption	I_{VDD}		-	-	50		-

Note:

(1)Power consumption with the following condition:
Output no load, VDD=3.3V, F_{CPV}=20KHZ, OE =V_{IL}.

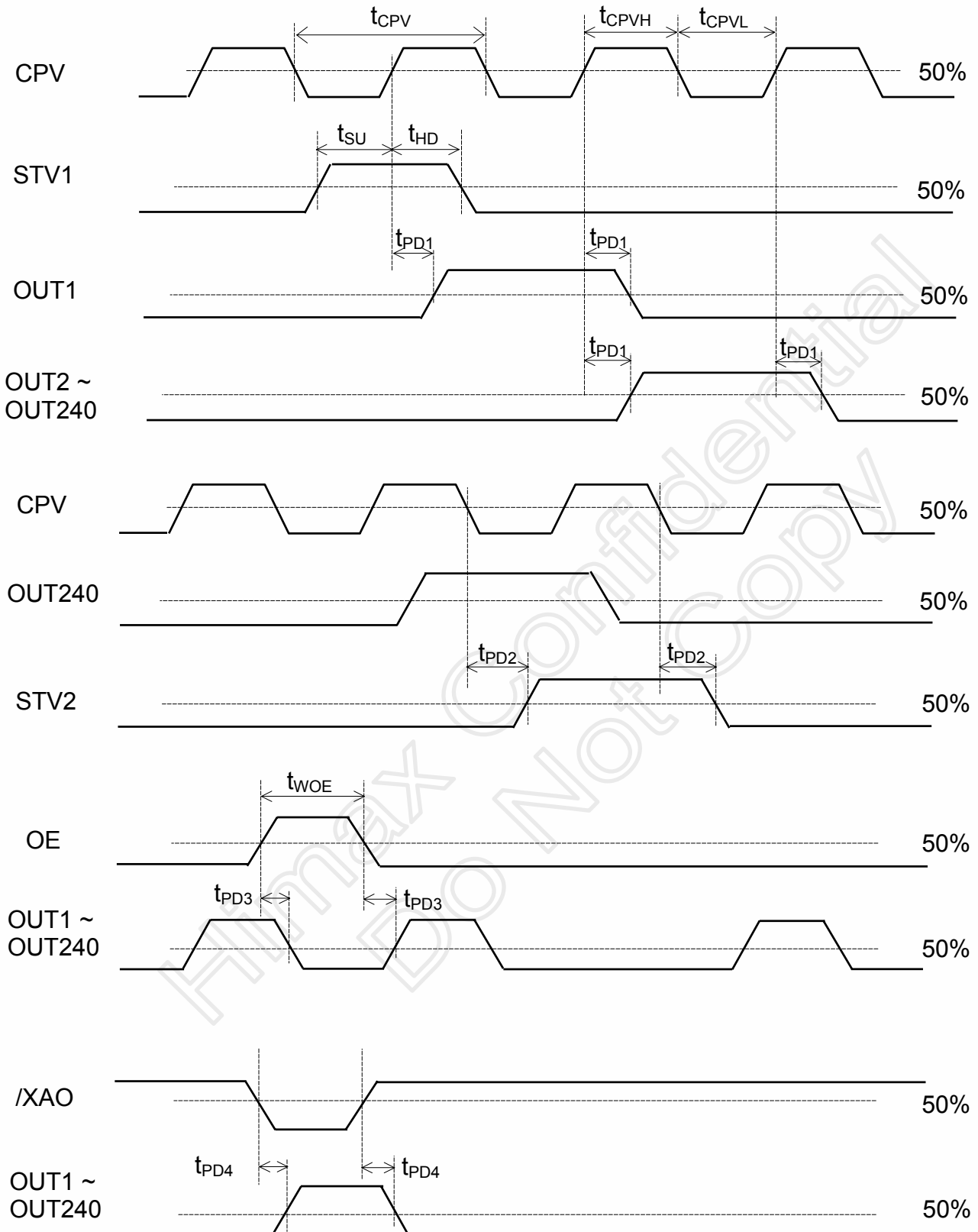
7. AC Characteristics

Parameter	Symbol	Condition	Spec			Unit
			Min.	Typ.	Max.	
CPV period	t_{CPV}	-	5	-	-	μs
CPV pulse width	t_{CPVH}, t_{CPVL}	50% duty cycle	2.5	-	-	
OE pulse width	t_{WOE}	-	1	-	-	
Data setup time	t_{SU}	-	0.2	-	-	
Data hold time	t_{HD}	-	0.3	-	-	
CPV to output delay time	t_{PD1}	CL=220pF	-	-	0.9	
Start pulse output delay time	t_{PD2}	CL=20pF	-	-	0.5	
OE to output delay time	t_{PD3}	CL=220pF	-	-	0.8	
/XAO to output delay time	t_{PD4}	CL=220pF	-	-	10	

Note:

(1)Test condition: TA=25°C, VGH=25V, VEE=-15V, VDD=3.3V

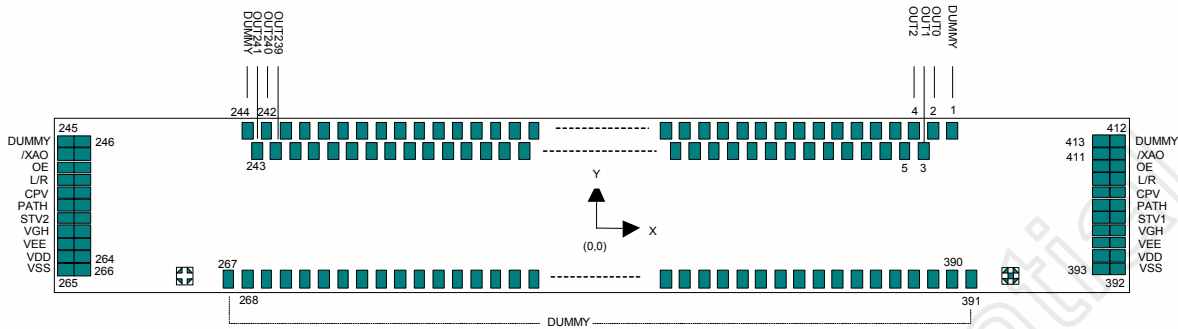
8. Waveform



9. Pad Coordinate

9.1 HX8615A 240 channels Gate Driver for COG

Bump Location



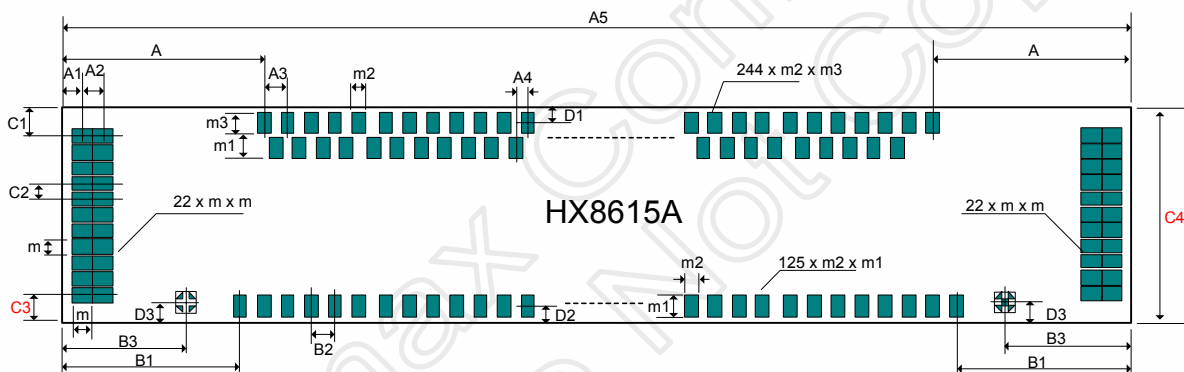
Chip size: 12090 μ m x 997.6 μ m (scribe line included)

Bump height: 15 μ m \pm 3 μ m

Bump hardness: 60Hv \pm 15Hv

Scribe line width: 100 μ m

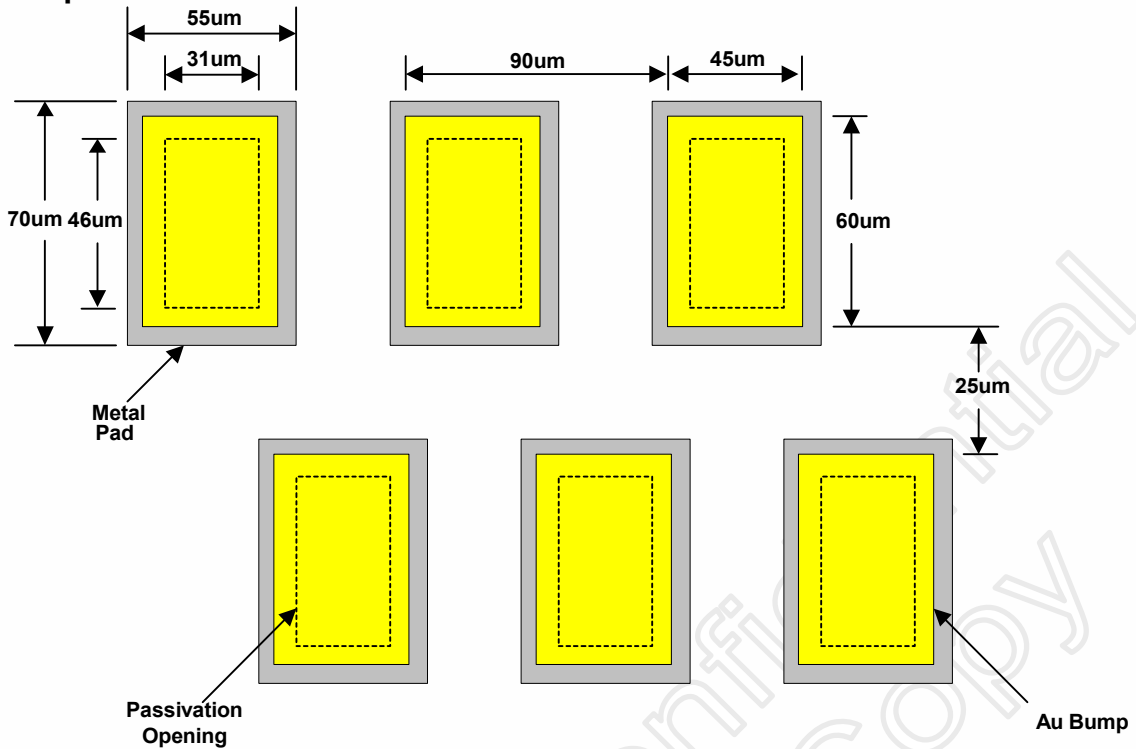
9.2 Bump Outline Dimensions



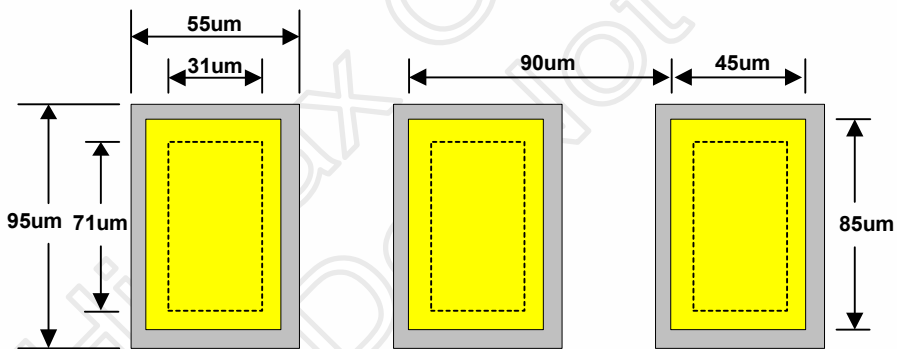
Symbol	Dimensions in μ m	Symbol	Dimensions in μ m
A	555	C2	75
A1	100	C3	142.6
A2	65	C4	997.6
A3	90	D1	105
A4	45	D2	117.6
A5	12090	D3	127.6
B1	465	m	50
B2	90	m1	85
B3	323	m2	45
C1	105	M3	60

9.3 BUMP SIZE

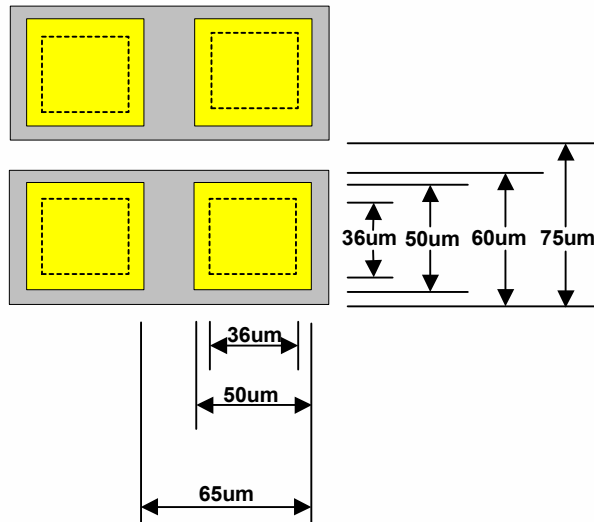
Top Bump



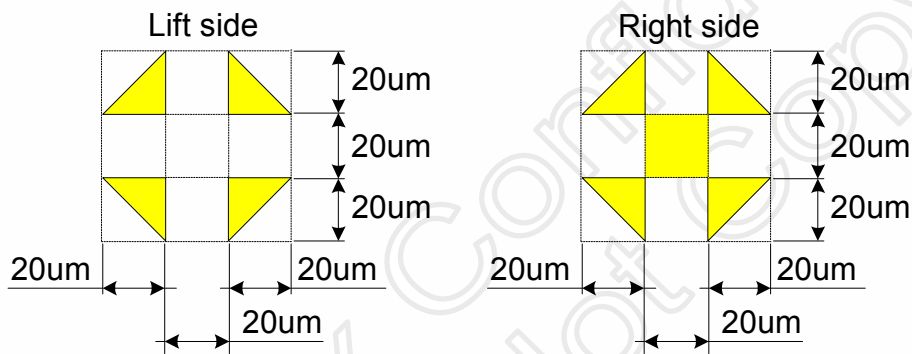
Bottom Bump



Side Bump



Alignment Mark



9.4 Bump center coordinate

(Unit: μm)

No.	Name	X	Y	Bump size
1	DUMMY	5490	375	45x60
2	OUT0	5400	375	45x60
3	OUT1	5355	290	45x60
4	OUT2	5310	375	45x60
5	OUT3	5265	290	45x60
6	OUT4	5220	375	45x60
7	OUT5	5175	290	45x60
8	OUT6	5130	375	45x60
9	OUT7	5085	290	45x60
10	OUT8	5040	375	45x60
11	OUT9	4995	290	45x60
12	OUT10	4950	375	45x60
13	OUT11	4905	290	45x60
14	OUT12	4860	375	45x60
15	OUT13	4815	290	45x60
16	OUT14	4770	375	45x60
17	OUT15	4725	290	45x60
18	OUT16	4680	375	45x60
19	OUT17	4635	290	45x60
20	OUT18	4590	375	45x60
21	OUT19	4545	290	45x60
22	OUT20	4500	375	45x60
23	OUT21	4455	290	45x60
24	OUT22	4410	375	45x60
25	OUT23	4365	290	45x60
26	OUT24	4320	375	45x60
27	OUT25	4275	290	45x60
28	OUT26	4230	375	45x60
29	OUT27	4185	290	45x60
30	OUT28	4140	375	45x60
31	OUT29	4095	290	45x60
32	OUT30	4050	375	45x60
33	OUT31	4005	290	45x60
34	OUT32	3960	375	45x60
35	OUT33	3915	290	45x60
36	OUT34	3870	375	45x60
37	OUT35	3825	290	45x60
38	OUT36	3780	375	45x60
39	OUT37	3735	290	45x60
40	OUT38	3690	375	45x60
41	OUT39	3645	290	45x60
42	OUT40	3600	375	45x60
43	OUT41	3555	290	45x60
44	OUT42	3510	375	45x60
45	OUT43	3465	290	45x60
46	OUT44	3420	375	45x60
47	OUT45	3375	290	45x60
48	OUT46	3330	375	45x60
49	OUT47	3285	290	45x60
50	OUT48	3240	375	45x60

No.	Name	X	Y	Bump size
51	OUT49	3195	290	45x60
52	OUT50	3150	375	45x60
53	OUT51	3105	290	45x60
54	OUT52	3060	375	45x60
55	OUT53	3015	290	45x60
56	OUT54	2970	375	45x60
57	OUT55	2925	290	45x60
58	OUT56	2880	375	45x60
59	OUT57	2835	290	45x60
60	OUT58	2790	375	45x60
61	OUT59	2745	290	45x60
62	OUT60	2700	375	45x60
63	OUT61	2655	290	45x60
64	OUT62	2610	375	45x60
65	OUT63	2565	290	45x60
66	OUT64	2520	375	45x60
67	OUT65	2475	290	45x60
68	OUT66	2430	375	45x60
69	OUT67	2385	290	45x60
70	OUT68	2340	375	45x60
71	OUT69	2295	290	45x60
72	OUT70	2250	375	45x60
73	OUT71	2205	290	45x60
74	OUT72	2160	375	45x60
75	OUT73	2115	290	45x60
76	OUT74	2070	375	45x60
77	OUT75	2025	290	45x60
78	OUT76	1980	375	45x60
79	OUT77	1935	290	45x60
80	OUT78	1890	375	45x60
81	OUT79	1845	290	45x60
82	OUT80	1800	375	45x60
83	OUT81	1755	290	45x60
84	OUT82	1710	375	45x60
85	OUT83	1665	290	45x60
86	OUT84	1620	375	45x60
87	OUT85	1575	290	45x60
88	OUT86	1530	375	45x60
89	OUT87	1485	290	45x60
90	OUT88	1440	375	45x60
91	OUT89	1395	290	45x60
92	OUT90	1350	375	45x60
93	OUT91	1305	290	45x60
94	OUT92	1260	375	45x60
95	OUT93	1215	290	45x60
96	OUT94	1170	375	45x60
97	OUT95	1125	290	45x60
98	OUT96	1080	375	45x60
99	OUT97	1035	290	45x60
100	OUT98	990	375	45x60

No.	Name	X	Y	Bump size
101	OUT99	945	290	45x60
102	OUT100	900	375	45x60
103	OUT101	855	290	45x60
104	OUT102	810	375	45x60
105	OUT103	765	290	45x60
106	OUT104	720	375	45x60
107	OUT105	675	290	45x60
108	OUT106	630	375	45x60
109	OUT107	585	290	45x60
110	OUT108	540	375	45x60
111	OUT109	495	290	45x60
112	OUT110	450	375	45x60
113	OUT111	405	290	45x60
114	OUT112	360	375	45x60
115	OUT113	315	290	45x60
116	OUT114	270	375	45x60
117	OUT115	225	290	45x60
118	OUT116	180	375	45x60
119	OUT117	135	290	45x60
120	OUT118	90	375	45x60
121	OUT119	45	290	45x60
122	OUT120	0	375	45x60
123	OUT121	-45	290	45x60
124	OUT122	-90	375	45x60
125	OUT123	-135	290	45x60
126	OUT124	-180	375	45x60
127	OUT125	-225	290	45x60
128	OUT126	-270	375	45x60
129	OUT127	-315	290	45x60
130	OUT128	-360	375	45x60
131	OUT129	-405	290	45x60
132	OUT130	-450	375	45x60
133	OUT131	-495	290	45x60
134	OUT132	-540	375	45x60
135	OUT133	-585	290	45x60
136	OUT134	-630	375	45x60
137	OUT135	-675	290	45x60
138	OUT136	-720	375	45x60
139	OUT137	-765	290	45x60
140	OUT138	-810	375	45x60
141	OUT139	-855	290	45x60
142	OUT140	-900	375	45x60
143	OUT141	-945	290	45x60
144	OUT142	-990	375	45x60
145	OUT143	-1035	290	45x60
146	OUT144	-1080	375	45x60
147	OUT145	-1125	290	45x60
148	OUT146	-1170	375	45x60
149	OUT147	-1215	290	45x60
150	OUT148	-1260	375	45x60

No.	Name	X	Y	Bump size
151	OUT149	-1305	290	45x60
152	OUT150	-1350	375	45x60
153	OUT151	-1395	290	45x60
154	OUT152	-1440	375	45x60
155	OUT153	-1485	290	45x60
156	OUT154	-1530	375	45x60
157	OUT155	-1575	290	45x60
158	OUT156	-1620	375	45x60
159	OUT157	-1665	290	45x60
160	OUT158	-1710	375	45x60
161	OUT159	-1755	290	45x60
162	OUT160	-1800	375	45x60
163	OUT161	-1845	290	45x60
164	OUT162	-1890	375	45x60
165	OUT163	-1935	290	45x60
166	OUT164	-1980	375	45x60
167	OUT165	-2025	290	45x60
168	OUT166	-2070	375	45x60
169	OUT167	-2115	290	45x60
170	OUT168	-2160	375	45x60
171	OUT169	-2205	290	45x60
172	OUT170	-2250	375	45x60
173	OUT171	-2295	290	45x60
174	OUT172	-2340	375	45x60
175	OUT173	-2385	290	45x60
176	OUT174	-2430	375	45x60
177	OUT175	-2475	290	45x60
178	OUT176	-2520	375	45x60
179	OUT177	-2565	290	45x60
180	OUT178	-2610	375	45x60
181	OUT179	-2655	290	45x60
182	OUT180	-2700	375	45x60
183	OUT181	-2745	290	45x60
184	OUT182	-2790	375	45x60
185	OUT183	-2835	290	45x60
186	OUT184	-2880	375	45x60
187	OUT185	-2925	290	45x60
188	OUT186	-2970	375	45x60
189	OUT187	-3015	290	45x60
190	OUT188	-3060	375	45x60
191	OUT189	-3105	290	45x60
192	OUT190	-3150	375	45x60
193	OUT191	-3195	290	45x60
194	OUT192	-3240	375	45x60
195	OUT193	-3285	290	45x60
196	OUT194	-3330	375	45x60
197	OUT195	-3375	290	45x60
198	OUT196	-3420	375	45x60
199	OUT197	-3465	290	45x60
200	OUT198	-3510	375	45x60

No.	Name	X	Y	Bump size
201	OUT199	-3555	290	45x60
202	OUT200	-3600	375	45x60
203	OUT201	-3645	290	45x60
204	OUT202	-3690	375	45x60
205	OUT203	-3735	290	45x60
206	OUT204	-3780	375	45x60
207	OUT205	-3825	290	45x60
208	OUT206	-3870	375	45x60
209	OUT207	-3915	290	45x60
210	OUT208	-3960	375	45x60
211	OUT209	-4005	290	45x60
212	OUT210	-4050	375	45x60
213	OUT211	-4095	290	45x60
214	OUT212	-4140	375	45x60
215	OUT213	-4185	290	45x60
216	OUT214	-4230	375	45x60
217	OUT215	-4275	290	45x60
218	OUT216	-4320	375	45x60
219	OUT217	-4365	290	45x60
220	OUT218	-4410	375	45x60
221	OUT219	-4455	290	45x60
222	OUT220	-4500	375	45x60
223	OUT221	-4545	290	45x60
224	OUT222	-4590	375	45x60
225	OUT223	-4635	290	45x60
226	OUT224	-4680	375	45x60
227	OUT225	-4725	290	45x60
228	OUT226	-4770	375	45x60
229	OUT227	-4815	290	45x60
230	OUT228	-4860	375	45x60
231	OUT229	-4905	290	45x60
232	OUT230	-4950	375	45x60
233	OUT231	-4995	290	45x60
234	OUT232	-5040	375	45x60
235	OUT233	-5085	290	45x60
236	OUT234	-5130	375	45x60
237	OUT235	-5175	290	45x60
238	OUT236	-5220	375	45x60
239	OUT237	-5265	290	45x60
240	OUT238	-5310	375	45x60
241	OUT239	-5355	290	45x60
242	OUT240	-5400	375	45x60
243	OUT241	-5445	290	45x60
244	DUMMY	-5490	375	45x60
245	DUMMY	-5945	375	50x50
246	DUMMY	-5880	375	50x50
247	/XAO	-5945	300	50x50
248	/XAO	-5880	300	50x50
249	OE	-5945	225	50x50
250	OE	-5880	225	50x50

No.	Name	X	Y	Bump size
251	L/R	-5945	150	50x50
252	L/R	-5880	150	50x50
253	CPV	-5945	75	50x50
254	CPV	-5880	75	50x50
255	PATH	-5945	0	50x50
256	PATH	-5880	0	50x50
257	STV2	-5945	-75	50x50
258	STV2	-5880	-75	50x50
259	VGH	-5945	-150	50x50
260	VGH	-5880	-150	50x50
261	VEE	-5945	-225	50x50
262	VEE	-5880	-225	50x50
263	VDD	-5945	-300	50x50
264	VDD	-5880	-300	50x50
265	VSS	-5945	-375	50x50
266	VSS	-5880	-375	50x50
267	DUMMY	-5580	-400	45x85
268	DUMMY	-5490	-400	45x85
269	DUMMY	-5400	-400	45x85
270	DUMMY	-5310	-400	45x85
271	DUMMY	-5220	-400	45x85
272	DUMMY	-5130	-400	45x85
273	DUMMY	-5040	-400	45x85
274	DUMMY	-4950	-400	45x85
275	DUMMY	-4860	-400	45x85
276	DUMMY	-4770	-400	45x85
277	DUMMY	-4680	-400	45x85
278	DUMMY	-4590	-400	45x85
279	DUMMY	-4500	-400	45x85
280	DUMMY	-4410	-400	45x85
281	DUMMY	-4320	-400	45x85
282	DUMMY	-4230	-400	45x85
283	DUMMY	-4140	-400	45x85
284	DUMMY	-4050	-400	45x85
285	DUMMY	-3960	-400	45x85
286	DUMMY	-3870	-400	45x85
287	DUMMY	-3780	-400	45x85
288	DUMMY	-3690	-400	45x85
289	DUMMY	-3600	-400	45x85
290	DUMMY	-3510	-400	45x85
291	DUMMY	-3420	-400	45x85
292	DUMMY	-3330	-400	45x85
293	DUMMY	-3240	-400	45x85
294	DUMMY	-3150	-400	45x85
295	DUMMY	-3060	-400	45x85
296	DUMMY	-2970	-400	45x85
297	DUMMY	-2880	-400	45x85
298	DUMMY	-2790	-400	45x85
299	DUMMY	-2700	-400	45x85
300	DUMMY	-2610	-400	45x85

No.	Name	X	Y	Bump size
301	DUMMY	-2520	-400	45x85
302	DUMMY	-2430	-400	45x85
303	DUMMY	-2340	-400	45x85
304	DUMMY	-2250	-400	45x85
305	DUMMY	-2160	-400	45x85
306	DUMMY	-2070	-400	45x85
307	DUMMY	-1980	-400	45x85
308	DUMMY	-1890	-400	45x85
309	DUMMY	-1800	-400	45x85
310	DUMMY	-1710	-400	45x85
311	DUMMY	-1620	-400	45x85
312	DUMMY	-1530	-400	45x85
313	DUMMY	-1440	-400	45x85
314	DUMMY	-1350	-400	45x85
315	DUMMY	-1260	-400	45x85
316	DUMMY	-1170	-400	45x85
317	DUMMY	-1080	-400	45x85
318	DUMMY	-990	-400	45x85
319	DUMMY	-900	-400	45x85
320	DUMMY	-810	-400	45x85
321	DUMMY	-720	-400	45x85
322	DUMMY	-630	-400	45x85
323	DUMMY	-540	-400	45x85
324	DUMMY	-450	-400	45x85
325	DUMMY	-360	-400	45x85
326	DUMMY	-270	-400	45x85
327	DUMMY	-180	-400	45x85
328	DUMMY	-90	-400	45x85
329	DUMMY	0	-400	45x85
330	DUMMY	90	-400	45x85
331	DUMMY	180	-400	45x85
332	DUMMY	270	-400	45x85
333	DUMMY	360	-400	45x85
334	DUMMY	450	-400	45x85
335	DUMMY	540	-400	45x85
336	DUMMY	630	-400	45x85
337	DUMMY	720	-400	45x85
338	DUMMY	810	-400	45x85
339	DUMMY	900	-400	45x85
340	DUMMY	990	-400	45x85
341	DUMMY	1080	-400	45x85
342	DUMMY	1170	-400	45x85
343	DUMMY	1260	-400	45x85
344	DUMMY	1350	-400	45x85
345	DUMMY	1440	-400	45x85
346	DUMMY	1530	-400	45x85
347	DUMMY	1620	-400	45x85
348	DUMMY	1710	-400	45x85
349	DUMMY	1800	-400	45x85
350	DUMMY	1890	-400	45x85

No.	Name	X	Y	Bump size
351	DUMMY	1980	-400	45x85
352	DUMMY	2070	-400	45x85
353	DUMMY	2160	-400	45x85
354	DUMMY	2250	-400	45x85
355	DUMMY	2340	-400	45x85
356	DUMMY	2430	-400	45x85
357	DUMMY	2520	-400	45x85
358	DUMMY	2610	-400	45x85
359	DUMMY	2700	-400	45x85
360	DUMMY	2790	-400	45x85
361	DUMMY	2880	-400	45x85
362	DUMMY	2970	-400	45x85
363	DUMMY	3060	-400	45x85
364	DUMMY	3150	-400	45x85
365	DUMMY	3240	-400	45x85
366	DUMMY	3330	-400	45x85
367	DUMMY	3420	-400	45x85
368	DUMMY	3510	-400	45x85
369	DUMMY	3600	-400	45x85
370	DUMMY	3690	-400	45x85
371	DUMMY	3780	-400	45x85
372	DUMMY	3870	-400	45x85
373	DUMMY	3960	-400	45x85
374	DUMMY	4050	-400	45x85
375	DUMMY	4140	-400	45x85
376	DUMMY	4230	-400	45x85
377	DUMMY	4320	-400	45x85
378	DUMMY	4410	-400	45x85
379	DUMMY	4500	-400	45x85
380	DUMMY	4590	-400	45x85
381	DUMMY	4680	-400	45x85
382	DUMMY	4770	-400	45x85
383	DUMMY	4860	-400	45x85
384	DUMMY	4950	-400	45x85
385	DUMMY	5040	-400	45x85
386	DUMMY	5130	-400	45x85
387	DUMMY	5220	-400	45x85
388	DUMMY	5310	-400	45x85
389	DUMMY	5400	-400	45x85
390	DUMMY	5490	-400	45x85
391	DUMMY	5580	-400	45x85
392	VSS	5945	-375	50x50
393	VSS	5880	-375	50x50
394	VDD	5945	-300	50x50
395	VDD	5880	-300	50x50
396	VEE	5945	-225	50x50
397	VEE	5880	-225	50x50
398	VGH	5945	-150	50x50
399	VGH	5880	-150	50x50
400	STV1	5945	-75	50x50

No.	Name	X	Y	Bump size
401	STV1	5880	-75	50x50
402	PATH	5945	0	50x50
403	PATH	5880	0	50x50
404	CPV	5945	75	50x50
405	CPV	5880	75	50x50
406	L/R	5945	150	50x50
407	L/R	5880	150	50x50
408	OE	5945	225	50x50
409	OE	5880	225	50x50
410	/XAO	5945	300	50x50
411	/XAO	5880	300	50x50
412	DUMMY	5945	375	50x50
413	DUMMY	5880	375	50x50

9.5 Alignment Mark center coordinate

Name	X	Y
L_AMK	-5722	-390
R_AMK	5722	-390

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10. Ordering Information

Part NO.	Package
HX8615APDxxx	PD : mean COG xxx : mean chip thickness (μm) , (default 400 μm)

11. Revision History

Version	EFF.DATE	DESCRIPTION OF CHANGES
0.1	2003/05/30	New setup
0.2	2003/06/07	Update pin description
01	2004/01/07	1. PATH pad description added, Page3. 2. Power on/off sequence updated, page 5. 3. Minimum VDD of recommended operating conditions updated, page6. 4. AC characteristics updated, page 7. 5. /XAO timing waveform added, page 8. 6. Bump information update, page9. 7."X=0, Y=0 is at chip center" description canceled, page 11.
02	2004/02/06	1. Minimum VDD of recommended operating conditions updated, page6.
03	2004/03/26	1. Modify VGH (Min) and VGH-VEE(Min) of recommended operating condition ,page6. 2. Modify I_{VGH} , I_{VEE} , I_{VDD} rating of DC Electrical Characteristics, page7. 3.Modify t_{SU} , t_{HD} , t_{PD1} , t_{PD2} spec , and test condition of AC Characteristics, page7 4.Modify XAO to /XAO (low active) 5.Modify VGH,VDD,VSS,VEE pin description, page3
04	2004/10/20	1. Modify STV1/2,OE,/XAO description,page3. 2. Add "Bump Outline Dimensions" item to substituted 9.2~9.4 section, page10.
05	2005/04/19	Update pad information, page 9~16.
	2005/05/09	Revise the pull high resistance spec, page7.