Ordering number : EN8928A

SANYO Semiconductors

DATA SHEET

LV4147W — Bi-CMOS LSI For LCD Panel Drive Single Chip IC

Overview

The LV4147W is single chip IC for LCD panel drive.

Functions

- Analog block RGB Decoder/Driver
- Digital block Timing Generator

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}1$ max	Analog LOW type	6	V
	$V_{CC}2$ max	Analog HIGH type	12	V
	V_{DD} max	Digital type	4.5	V
Allowable power dissipation	Pd max	Ta ≤ 75°C * Mounted on a board.	350	mW
Operating temperature	Topr		-15 to +75	°C
Storage temperature	Tstg		-40 to +125	°C
Input pin voltage	V_{IN}A	Analog input pin	-0.3 to $V_{CC}1$	V
	V_{IN}D	Digital input pin (Except pin 10, 11 and 12)	-0.3 to V_{DD}+0.3	V
	V_{IN}D	Digital input pin (10, 11, 12pin)	-0.3 to +4.5	V

* : Mounted on a board : 30×30×1.6mm^3, glass epoxy board

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Operating Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}1$	Analog LOW type	3.0	V
	$V_{CC}2$	Analog HIGH type	7.0	V
	V_{DD}	Digital type	3.0	V
Operating voltage range	$V_{CC}1op$	Analog LOW type	2.7 to 3.6	V
	$V_{CC}2op$	Analog HIGH type	6 to 9.5	V
	$V_{DD}op$	Digital type	2.7 to 3.6	V

Input Signal Voltage

Parameter		Symbol	Conditions	Ratings	Unit
Recommended input signal voltage	Y input signal	Yin	Sync chip - white	0.5	Vp-p
	Color Difference input signal	B-Yin	75% Color bar signal	0.3	Vp-p
		R-Yin	75% Color bar signal	0.24	Vp-p

Electrical DC Characteristics

Unless otherwise specified, settings 1 and 2 must be made.

Unless otherwise specified, $V_{CC}1$ = 3.0V, $V_{CC}2$ = $V_{CC}COM$ = 7.0V, GND1 = GND2 = GNDCOM = 0,
$V_{DD}1$ = $V_{DD}2$ = 3.0V, $V_{SS}1$ = $V_{SS}2$ = 0, Ta = 25°C

[Current Characteristics]

Parameter	Symbol	Conditions		Ratings min	Ratings typ	Ratings max	Unit
Current dissipation $V_{CC}1$, analog LOW	$I_{CC}1$	Enter SIG3 to (A), (D) and (E). Measure the current value of $I_{CC}1$.	TRAP OFF	18	26	33	mA
			TRAP ON	20	28	35	mA
Current dissipation $V_{CC}2$, analog HIGH	$I_{CC}2$	Enter SIG3 to (A) Measure the current value of $I_{CC}2$.		2	4	6	mA
Current dissipation V_{DD}, logic	$I_{DD}1$	Enter SIG3 to (A) Measure the current value of $I_{DD}11$ and $I_{DD}21$. $I_{DD}1$, $I_{DD}2$, $I_{DD}3$ = $I_{DD}11$+$I_{DD}21$	110,000 and 130,000 modes	7	10	13	mA
	$I_{DD}2$		180,000 mode	8.5	12	15.5	mA

[Digital block input/output characteristics]

Parameter	Symbol	Conditions	Ratings min	Ratings typ	Ratings max	Unit
L-level input voltage	V_{IL}	Digital block input pin (Note 1)			$0.3V_{DD}$	V
H-level input voltage	V_{IH}	Digital block input pin (Note 1)	$0.7V_{DD}$			V
H-level output voltage	$V_{OH}1$	I_{OH} = -1.2mA (Note 2)	V_{DD} -0.2			V
L-level output voltage	$V_{OL}1$	I_{OL} = 1.2mA (Note 2)			0.3	V
Output transition time	t_{TLH}	Load 50pF (see Fig. 3)			30	ns
	t_{THL}				30	ns
Cross point time difference	ΔT	Load 50pF CKH1/CKH2 and CKV1/CKV2 and CKH3/CKH4 (See Fig. 4)			10	ns
CHK duty	DTYHC	Load 50pF Measure the duty of CKH1, CKH2, CKH3 and CKH4.	47	50	53	%

(Note 1) Digital block input pins : LOAD, DATA, SCLK

(Note 2) Digital block output pins : Pins 15 to 31, 33, 34

Electrical AC Characteristics (1)

Unless otherwise specified, the setting 1 and 2 must be made.

Unless otherwise specified, $V_{CC}1 = 3.0V$, $V_{CC}2 = V_{CC}COM = 7.0V$, GND1 = GND2 = GNDCOM = 0,
$V_{DD}1 = V_{DD}2 = 3.0V$, $V_{SS}1 = V_{SS}2 = 0$, Ta = 25°C

Unless otherwise specified, measure the non-inverted output of TP40, TP43, and TP45.

[Y signal system]

Parameter	Symbol	Conditions			min	typ	max	unit
Contrast characteristics, TYP	GCNTTP	Enter SIG3 to (A) and measure the ratio between the output amplitude (white to black) and input amplitude of TP43.			14	16	18	dB
Contrast characteristics, MIN	GCNTMN	Enter SIG3 to (A) and measure the ratio between the output amplitude (white to black) and input amplitude of TP43.			-2	1	4.5	dB
Max. video gain	GV	Enter SIG3 to (A) and measure the ratio between the output amplitude (white to black) and input amplitude of TP43.			19	21	23	dB
Y signal frequency characteristics	FTRPN0	Assume that the output amplitude of TP43 when SIG1 (0dB, 100kHz) is entered to (A) is 0dB. Change the input signal frequency to change and determine the frequency at which the output amplitude becomes -3dB.	TRAP OFF		6.0			MHz
	FTRPNT		TRAP ON	NTSC	3.0			
	FTRPPL			PAL	3.5			
Picture quality adjustment variable amount 1 (TRAP OFF) 180,000 mode	GSHP1X	Assume that the output amplitude of TP43 when SIG6 (100kHz) is entered in (A) is 0dB. Determine the output amplitude ratio of the input SIG6 (2.5MHz).		MAX	11	14		dB
	GSHP1N			MIN		-3	0	
Picture quality adjustment variable amount 2 (TRAP OFF) 110,000 and 130,000 modes	GSHP2X	Assume that the output amplitude of TP43 when SIG6 (100kHz) is entered in (A) is 0dB. Determine the output amplitude ratio of the input SIG6 (1.8MHz).		MAX	11	14		dB
	GSHP2N			MIN		-1	2	
Picture quality adjustment variable amount 3 (TRAP ON) 110,000 and 130,000 modes	GSHP3X	Assume that the output amplitude of TP43 when SIG6 (100kHz) is entered in (A) is 0dB. Determine the output amplitude ratio of the input SIG6 (1.8MHz).		MAX	8	11		dB
	GSHP3N			MIN		-5	-2	
Picture quality adjustment variable amount 4 (TRAP ON) 180,000 mode	GSHP4X	Assume that the output amplitude of TP43 when SIG6 (100kHz) is entered in (A) is 0dB. Determine the output amplitude ratio of the input SIG6 (2.0MHz).		MAX	6	9		dB
	GSHP4N			MIN		-6	-3	
Y signal input/output delay rate	TDYTRN	Enter SIG8 to (A). Measure the delay time from the input signal 2T pulse peak to the peak of TP43 non-inverted output.	TRAP ON		200	300	400	ns
	TDYTRP		TRAP OFF		250	350	450	ns

[Color difference signal system]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Color difference input color adjustment	GEXCMX	Input SIG4 (V_L = 0mV) to (A) and SIG1 (0dB, 100kHz) to (D) and assume that the output amplitude (100kHz) of TP40 when COL = 128 is VCOCOL = 0 is VC2. Assume also that the output amplitude of TP40 when SIG1 is -10dB and COL = 255 is VC1. Calculate as follows : GEXCMX = 20log (VC1 / VCO) +10 GEXCMN = 20log (VC2 / VC0)	+3	+5		dB
	GEXCMN			-20	-15	dB
Color difference balance	VEXCBL	Input SIG4 (V_L = 0mV) to (A) and SIG1 (0dB, 100kHz) to (D) and (E). Assume that the output amplitude (100kHz) of TP40 is VB and that (100kHz) of TP45 is VR. Calculate as follows : VEXCBL = VR / VB	0.8	1.0	1.2	

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Parameter	Symbol	Conditions		Ratings min	Ratings typ	Ratings max	Unit
Color difference input balance adjustment R	GEXRMX	Input SIG4 (V_L = 0mV) to (A) and SIG1 (-6dB, 100kHz) to (D) and (E). Assume that the output amplitude (100kHz) of TP45 and that (100kHz) of TP40 when TINT = 128 are VRO and VB0 respectively. The output amplitude of TP45 and that of TP40 when TINT=255 are VR1 and VB1 respectively. Assume also that the output amplitude of TP45 and that of TP40 when TINT = 0 are VR2 and VB2 respectively. Then, calculate as follows : GEXRMX = 20log (VR1 / VR0) GEXRMN = 20log (VR2 / VR0) GEXBMX = 20log (VB1 / VB0) GEXBMN = 20log (VB2 / VB0)			-5	-2	dB
	GEXRMN			+2	+3		dB
Color difference input balance adjustment B	GEXBMX			+2	+3		dB
	GEXBMN				-5	-2	dB
G-γ matrix characteristics	VEXGBN	Input SIG4 (V_L = 0mV) to (A) and SIG1 (0dB, 100kHz) to (D). Assume that the output amplitude (100kHz) of TP40 is VEXB and that of TP43 is VEXBG. Calculate as follows ; VEXGB = VEXBG / VEXB	NTSC	0.23	0.26	0.29	
	VEXGBP		PAL	0.17	0.20	0.23	
	VEXGR	Input SIG4 (V_L = 0mV) to (A) and SIG1 (0dB, 100kHz) to (E). Assume that the output amplitude (100kHz) of TP45 is VEXR and that of TP43 is VEXRG. Calculate as follows ; VEXGR = VEXRG / VEXR		0.46	0.51	0.56	

[RGB signal system]

Parameter	Symbol	Conditions	Ratings min	Ratings typ	Ratings max	Unit
RGB signal and PCD output DC voltage	VOUT	Enter SIG4 (V_L = 0mV) to (A) and adjust BRIGHT of serial bus to set TP43 output to 3Vp-p. Then, measure the DC voltage of TP38, TP40, and TP43.	3.3	3.5	3.7	V
RGB signal and PCD output DC voltage difference	ΔVOUT	Determine the maximum value of difference of measured values of TP40, TP43, and TP45 of VOUT as described in the above item.		0	120	mV
User brightness change rate	UBRTMX	Measure the change rate of the black level of TP40, TP43, and TP45 outputs when SIG2 is entered to (A) and U-BRT is changed from 128 to 255.	2.0	3.0		V
	UBRTMN	Measure the change rate of the white level of TP40, TP43, and TP45 outputs when SIG2 is entered to (A) and U-BRT is changed from 128 to 0.		-3	-2.0	V
Brightness change rate	BRTMX	Measure the change rate of the black level of TP40, TP43, and TP45 outputs when SIG2 is entered to (A) and BRT is changed from 128 to 255.	2.0	2.5		V
	BRTMN	Measure the change rate of the white level of TP40, TP43, and TP45 outputs when SIG2 is entered to (A) and BRT is changed from 128 to 0.		-2.5	-2.0	V
Antipole output change rate	COMMX	Enter SIG2 to (A), and measure the TP38 output amplitude when COM = 255.	4.6			Vp-p
	COMMN	Enter SIG2 to (A), and measure the TP38 output amplitude when COM = 0.			1.5	Vp-p
Sub-brightness R change rates	SBBRTR	Enter SIG4 (V_L = 0mV) to (A) and measure the difference between the black level of TP45 output when R-BRT = 128 and the black level of output when R-BRT = 0 and R-BRT = 255.	±1.3	±1.7		V

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Sub-brightness B change rates	SBBRTB	Enter SIG4 (V_L = 0mV) to (A) and measure the difference between the black level of TP40 output when B-BRT = 128 and the black level of output when B-BRT = 0 and 255.	±1.3	±1.7		V
Gain difference between RGB signals	ΔGRGB	Determine the level difference of non-inverted output amplitude (white to black) of TP40, TP43, and TP45 when SIG3 is entered to (A).	-0.6	0	0.6	dB
Sub-contrast R change rate	SBCNTR	Measure the non-inverted output (white to black) of TP45 for the non-inverted output (white to black) of TP43 when SIG3 is entered to (A) and when R-CNT = 0 and R-CNT = 255.	±2.0			dB
Sub-contrast B change rate	SBCNTB	Input SIG3 to (A) and measure the difference of the level for B-CNT = 0 and 255 from the TP40 non-inverted output (white-black) when B-CNT = 128.	±2.0			dB
RGB inverted/non-inverted gain difference	ΔGINV	Determine the difference of inverted output amplitude for the non-inverted output amplitude (white to black) of TP40, TP43, and TP45 when SIG3 is entered to (A).	-0.5	0	0.5	dB
Black level potential difference between RGB signals	ΔVBL	Determine the difference between highest and lowest black levels for inverted and non-inverted outputs of TP40, TP43, and TP45 when SIG3 is entered to (A).			300	mV
Gamma gain	GγL	Enter SIG7 to (A) and set the amplitude (black to white) of non-inverted output of TP43 to 3.5Vp-p with CONT and set the level to 1.5V through BRIGHT adjustment.Measure VG1, VG2, and VG3 and calculated as follows : GγL = 20log (VG1/0.0357) GγM = 20log (VG2/0.0357) GγH = 20log (VG3/0.0357) (See Fig. 5)	23.0	26.0	29.0	dB
	GγM		12.0	15.0	18.0	dB
	GγH		18.0	22.0	26.0	dB
γ1 adjustment variable range	Vγ1MN	Enter SIG7 to (A) and set the TP43 output (black to black) to 3Vp-p through BRIGHT adjustment. Read the γ gain change point at γ1 = 0, γ1 = 255 by referring to the IRE level of input signal : Vγ1MN for γ1 = 0 Vγ1MX for γ1 = 255			0	IRE
	Vγ1MX		100			IRE
γ2 adjustment variable range	Vγ2MN	Enter SIG7 to (A) and set the TP43 output (black to black) to 3Vp-p through BRIGHT adjustment. Read the γ gain change point at γ2 = 0, γ2 = 255 by referring to the IRE level of input signal : Vγ1MN for γ2 = 0 Vγ1MX for γ2 = 255	100			IRE
	Vγ2MX				0	IRE
PCD transition time	tCOMH	Enter SIG3 to (A) and set the output amplitude of TP38 to 3Vp-p. Measure tCOMH for rise and tCOML for fall. Load : 20000pF		1.5	3	μs
	tCOML			1.5	3	μs
RGB output whitelimiter level	VWLIMN	Enter SIG2 to (A) and measure the amplitude of the white side limiter level of inverted / non-inverted TP38, 40, 43, and 45 output. VWLIMX when WLIM = 15 and VWLIMN when WLIM = 0.	4			Vp-p
	VWLIMX				2.2	Vp-p
RGB output black limiter variable range	VBLIMX	Enter SIG2 to (A) and measure the amplitude of the black side limiter level of inverted/non-inverted TP43 output. VBLIMX for BLIM = 255 and VBLIMN for BLIM = 0	4.5			Vp-p
	VBLIMN				2	Vp-p
White limiter DC voltage	VWLIM	Enter SIG4 (V_L = 0mV) to (A) and measure the DC voltage of TP40, TP43, and TP45.	3.3	3.5	3.7	V
Black limiter DC voltage	VBLIM	Input SIG4 (V_L = 350mV) to (A) and adjust BLIM to set the output of TP43 and TP40 to 3Vp-p. Measure the DC voltage of TP 40, TP43, and TP45.	3.3	3.5	3.7	V

[Filter characteristics]

Parameter	Symbol	Conditions		Ratings min	Ratings typ	Ratings max	Unit
TRAP attenuation amount	ATRAPN	Input SIG1 (0dB, 3.58MHz and 4.43MHz) in (A) and measure the TP43 output with a spectrum analyzer. Assuming that the TP43 amplitude in the TRAP ON mode is 0dB, determine the attenuation in the COMP input mode.	NTSC		-15	-20	dB
	ATRAPP		PAL		-15	-20	dB
R-Y, B-Y LPF characteristics	DEMLPF	Input SIG4 (V_L = 150mV) in (A) and SIG1 (100kHz) in (B). In this case, assume that the amplitude of 100kHz component of TP40, TP45 output is 0dB. Change the SIG1 frequency at which the output amplitude of TP40, TP45 becomes -3dB.		1.2	1.6	1.9	MHz

[Sync separation, TG system]

Parameter	Symbol	Conditions		Ratings min	Ratings typ	Ratings max	Unit
Input sync signal width sensitivity	WSSEP	Enter SIG4 (V_L = 0mV, VS = 143mV, WS variable) to (A) and confirm synchronization with the TP24 HD output. Narrow WS of SIG5 from 4.7µs and determine WS at which synchronization between the input and TP24HD output is lost.		2.0			µs
Sync separation input sensitivity	VSSEP	Enter SIG4 (V_L = 0mV, WS = 4.7µs, VS variable) to (A) and confirm synchronization with the TP24 HD output. Reduce VS of SIG4 from 143mV and determine VS at which synchronization between the input and TP24HD output is lost.			40	60	mV
Sync separation output delay rate	TDSYL	Enter SIG4 (V_L = 0mV, WS = 4.7µs, and VS = 143mV) to (A) and measure the delay rate from TP6RPD output. Assume that TDSYL is for a period from fall of input HSYNC to fall of RPD output and that TDSYH is for the period up to rise of RPD output.		300	500	700	ns
	TDSYH			4.7	5.0	5.3	µs
Horizontal pull-in range	HPLLN	Enter SIG4 (V_L = 0 mV, WS = 4.7µs, and VS = 143mV, horizontal frequency variable) to (A) and confirm synchronization with TP24 HD output. Change the horizontal frequency of SIG5 and determine the frequency f_H at which synchronization is established from the condition in which input / output synchronization is lost. Calculate as follows : HPLLN = f_H-15734 HPLLP = f_H-15625	NTSC	±500			Hz
	HPLLP		PAL	±500			Hz

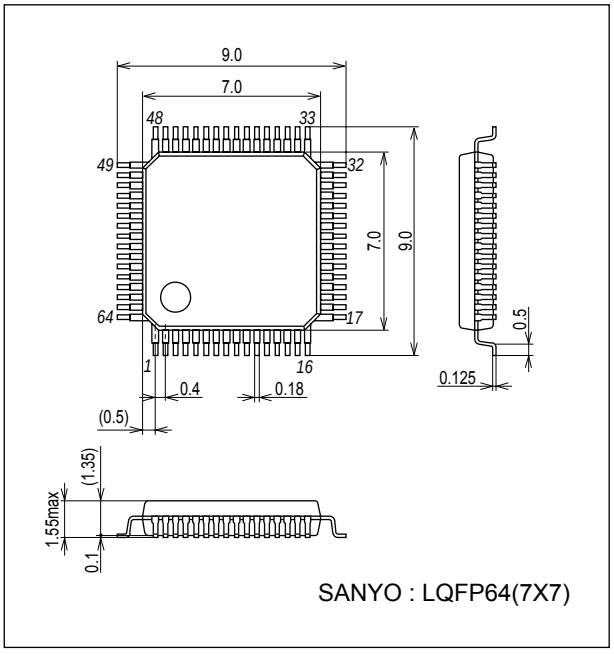
[External input output characteristics]

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
External RGB input threshold value	VTEXTB	Enter SIG4 (V_L = 0mV) to (A) and SIG5 (V_L variable) to (C), increase the amplitude (V_L) from 0V. Assume that the voltage at which TP40, TP43, and TP45 outputs become the black level is VTEXTB. Further increase the amplitude and assume the voltage at which they become the white level.	0.55	0.7	0.85	V
	VTEXTW		1.62	1.8	1.95	V
Propagation delay time between external RGB outputs	TD1EXT	Enter SIG4 (V_L = 0mV) to (A) and SIG5 (V_L = 3V) to (C) and measure the rise delay TD1EXT and fall delay TD2EXT of TP40, TP43, and TP45 outputs. (See Fig. 2)	50	90	130	ns
	TD2EXT		70	100	150	ns
External RGB output blanking level	EXTBK	Enter SIG4 (V_L = 0mV) to (A) and SIG5 (V_L = 1.0V) to (C) and measure the difference of TP40, TP43, and TP45 from the black level.			0	V
External RGB output white level	EXTWT	Enter SIG4 (V_L = 0mV) to (A) and SIG5 (V_L = 2.7V) to (C). Measure the difference of TP40, Tp43, and TP45 from the black level.	3.0			V
External RGB input minimum pulse width	TEXMIN	Enter SIG4 (V_L = 0mV) to (A) and SIG5 (V_L = 2.7V) to (C) and measure the minimum pulse width at which TP40, TP43, and TP45 outputs reach the white side limiter.			150	ns

Package Dimensions

unit : mm (typ)

3281



Conditions of setting to measure the electric characteristics

Following settings must be made before measurement of electric characteristics.

Setting 1. System reset
Turn ON SW58 and start V58 from GND in order to perform system reset for MOS block.
(See fig. 1-1.)
The default value is set for the serial bus.

Setting 2. Horizontal AFC adjustment
Enter SIG5 (V_L = 0mV) to (A) and adjust VCOADJ so that the width of WL and WH becomes equal in the TP6 output waveform. (See fig. 1-2.)

(Note) In order to measure the 2MHz or more band for measurement items, such as the Y-system frequency characteristics or sharpness characteristics, it is necessary to pass through the sample hold circuit via serial bus.

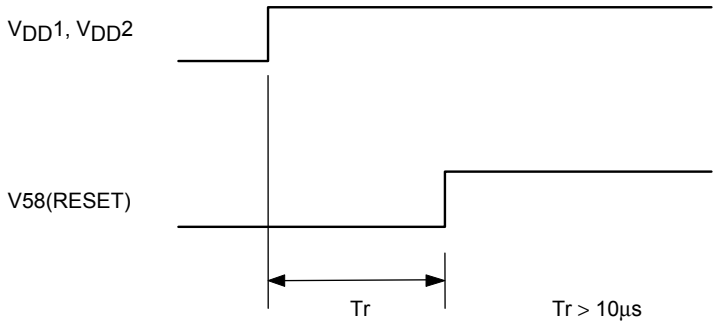


Fig.1-1 System reset

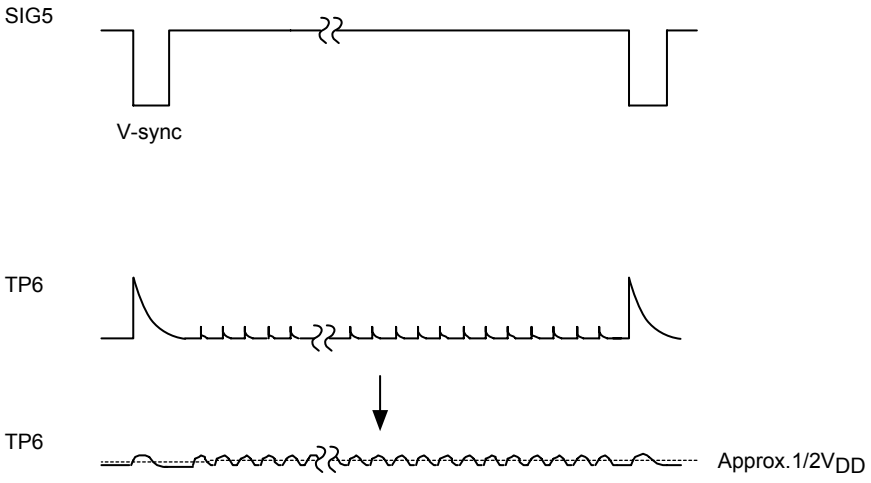


Fig.1-2 Horizontal AFC adjustment

Electric characteristics measurement method

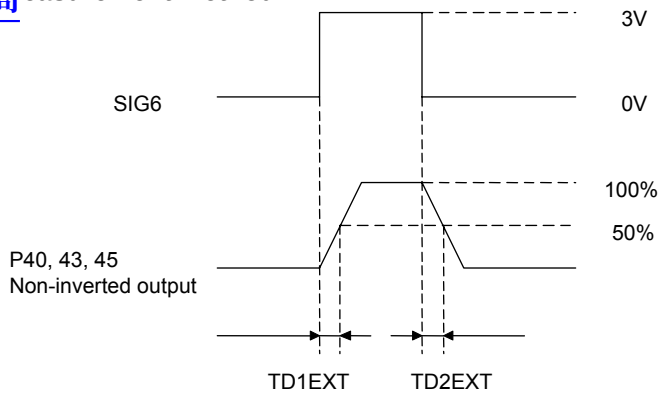


Fig.2 Delay between external RGB input/output

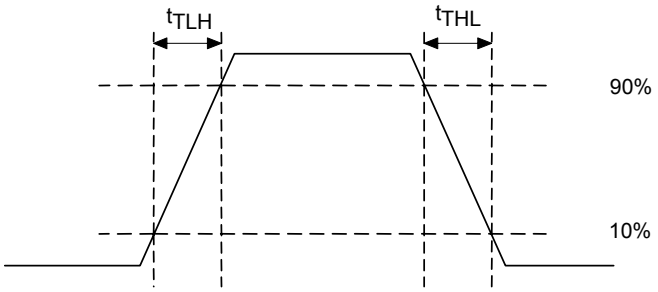


Fig.3 Output transition time measurement contitions

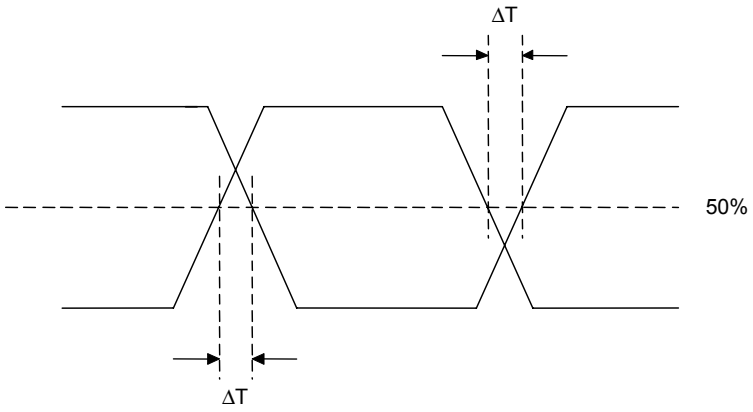


Fig.4 Cross point time difference measurement conditions

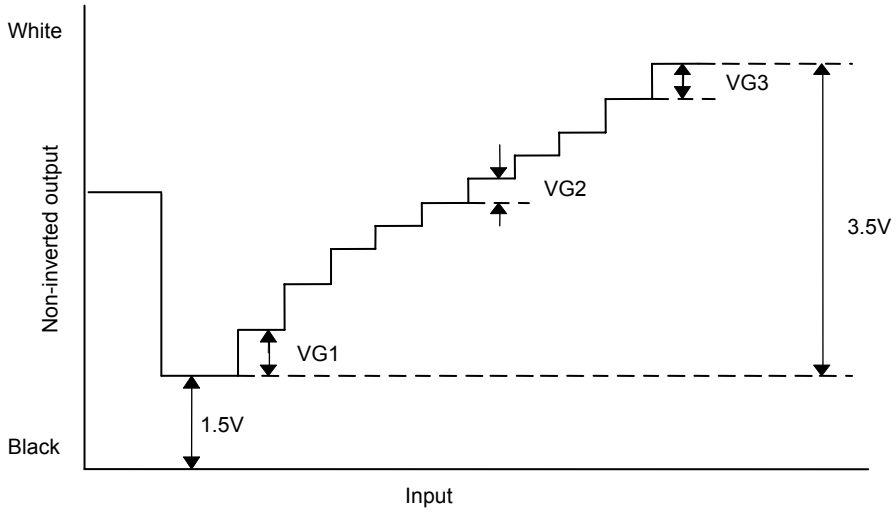
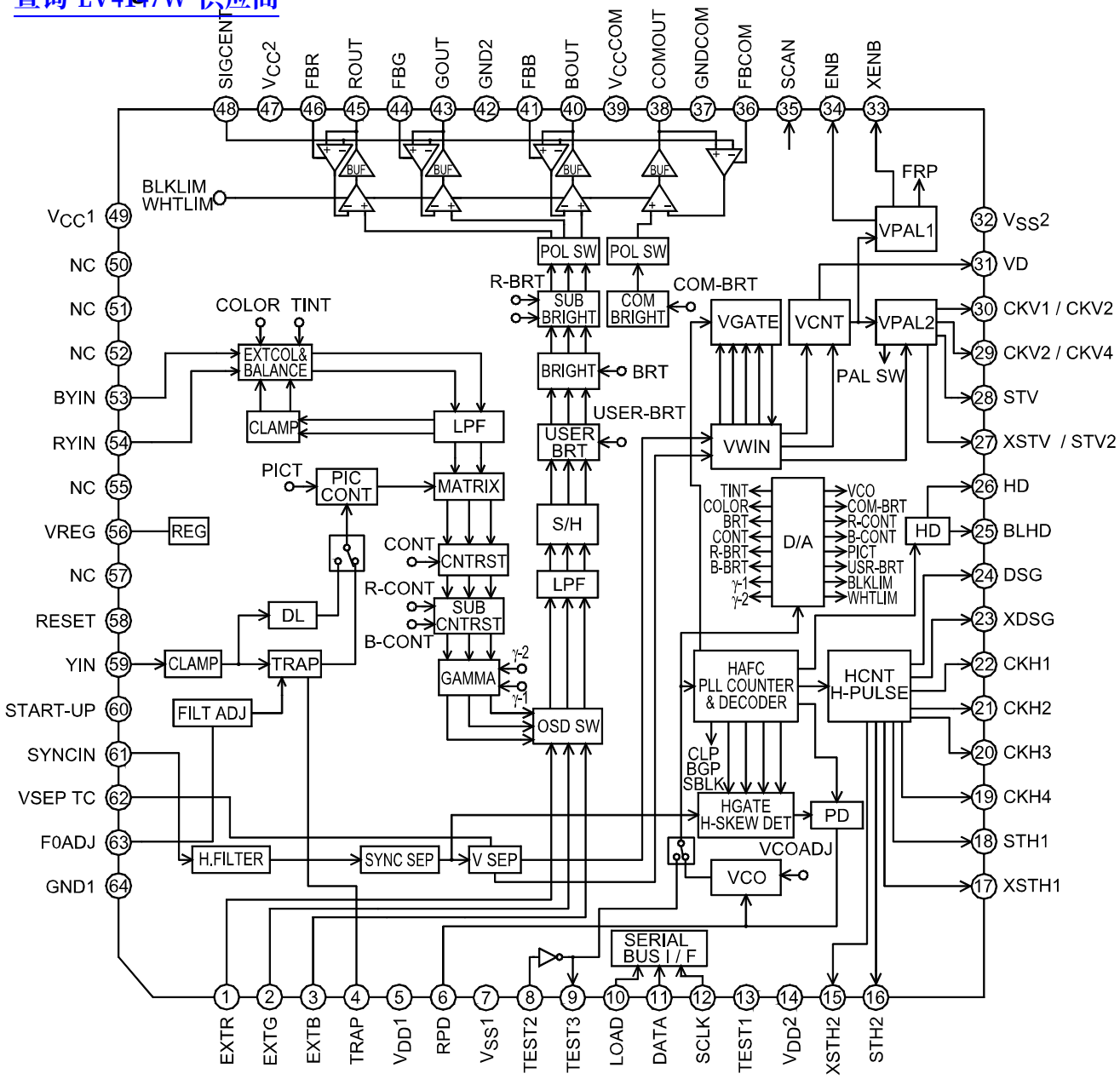


Fig.5 γ characteristics measurement conditions

Block Diagram



Pin Description

Pin No.	Pin Name	I/O	Pin Description	Common	For MONI only	For EVF only
1	EXTR	I	External digital R input (used also for the test)	○		
2	EXTG	I	External digital G input (used also for the test)	○		
3	EXTB	I	External digital B input (used also for the test)	○		
4	TRAP	O	External trap connection pin	○		
5	$V_{DD}1$		Oscillator cell input (3V)	○		
6	RPD	O	Phase comparison output	○		
7	$V_{SS}1$		Oscillator cell GND	○		
8	TEST2	I	Test pin 2	○		
9	TEST3	O	Test pin 3	○		
10	LOAD	I	Load input for serial bus	○		
11	DATA	I	Data input for serial bus	○		
12	SCLK	I	Clock input for serial bus	○		
13	TEST1	I	Test pin 1	○		
14	$V_{DD}2$		Digital 1 system power supply (3V)	○		

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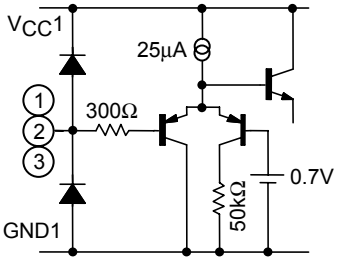
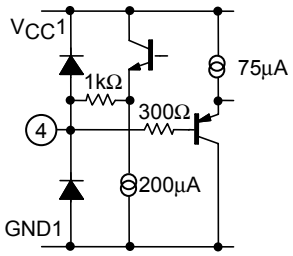
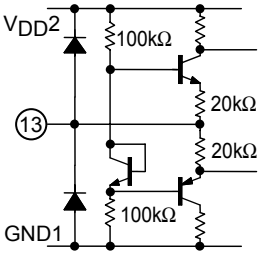
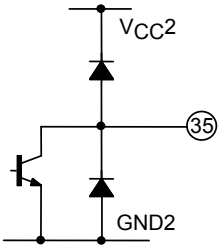
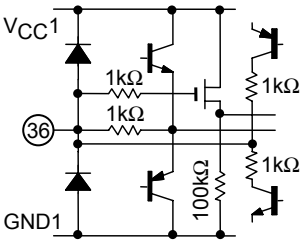
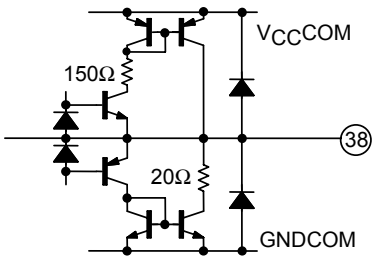
Pin No.	Pin Name	I/O	Pin Description	Common	For MONI only	For EVF only
15	XSTH2	O	EVF H-start reverse phase output			○
16	STH2	O	EVF H-start output			○
17	XSTH1	O	Monitor H-start reverse phase output		○	
18	STH1	O	Monitor H-start output		○	
19	CKH4	O	EVF H-clock 2 output			○
20	CKH3	O	EVF H-clock 1 output			○
21	CKH2	O	Monitor H-clock 2 output		○	
22	CKH1	O	Monitor H-clock 1 output		○	
23	XDSG	O	Drain hold timing pulse reverse-phase output	○		
24	DSG	O	Drain hold timing pulse output	○		
25	BLHD	O	Backlight HD output	○		
26	HD	O	H drive output	○		
27	XSTV/STV2	O	V-start reverse phase output/EVF V start output	○		(○)
28	STV	O	V start output	○	(○)	
29	CKV2/CKV4	O	V clock 2 output/EVF CKV2	○		(○)
30	CKV1/CKV2	O	V clock 1 output/Monitor CKV2	○	(○)	
31	VD	O	V drive output	○		
32	$V_{SS}2$		Digital 1 system GND	○		
33	XENB	O	Enable reverse-phase output	○		
34	ENB	O	Enable output	○		
35	SCAN	O	For scan selection (for monitor)		○	
36	FBCOM	I	Time constant pin for antipole output DC return	○		
37	GNDCOM		Antipole output gland	○		
38	COMOUT	O	Antipole output	○		
39	V_{CC}COM		Antipole output power supply (7V)	○		
40	BOUT	O	B output	○		
41	FBB	I	Time constant pin for B-output DC return	○		
42	GND2		Output system ground	○		
43	GOUT	O	G output	○		
44	FBG	I	Time constant pin for G-output DC return	○		
45	ROUT	O	R output	○		
46	FBR	I	Time constant pin for R-output DC return	○		
47	$V_{CC}2$		Output system power supply	○		
48	SIGCENT	I	Output DC level setting pin	○		
49	$V_{CC}1$		Analog 3V power supply	○		
50	NC	-				
51	NC	-				
52	NC	-				
53	BYIN	I	B-Y input	○		
54	RYIN	I	R-Y input	○		
55	NC	-				
56	VREG	O	Reference voltage	○		
57	NC					
58	RESET	I	System reset	○		
59	YIN	I	Brightness signal input	○		
60	START-UP	I	Power-ON blanking time constant pin	○		
61	SYNCIN	I	Sync input	○		
62	VSEPTC		Time constant and external VD input for vertical sync separation	○		
63	F0ADJ	O	Filter F0 adjustment	○		
64	GND1		3V ground	○		

Analog pin function description

Pin No.	Pin Name	Pin Voltage	Pin Description	Equivqlent Circuit
1 2 3	EXTR EXTG EXTB	-	The external digital signal is entered. All of RGB outputs become the black level when the threshold value is about 0.7V for Vth1 and about 1.8V for Vth2 and any one of RGB exceeds Vth1 and become the white level only for the output in which the input exceeds Vth2. Connect to the ground when not using.	
4	TRAP	1.0V	External trap pin. Trap can be inserted into Y-signal by connecting L and C in series to GND when TRAP ON is set.	
13	TEST1	-	Test pin. Connect this pin normally to GND for use.	
35	SCAN	-	Scan select control output pin. Output from the open collector	
36	FBCOM	1.5V	Feedback circuit smoothing capacitor pin for precharge output DC level control. Because of high impedance, a capacitor with small leakage is used.	
37	GNDCOM	0V	Gland of antipole output	
38	COMOUT	$V_{CC}2/2$	Antipole output	
39	V_{CC}COM	7V	Power supply for antipole output	

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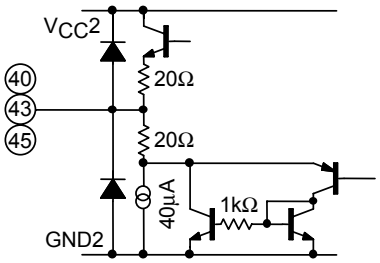
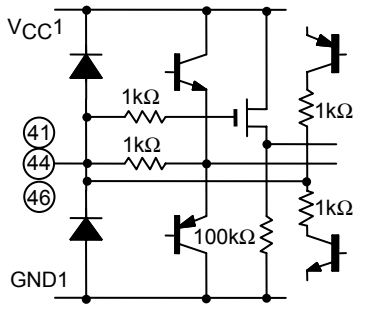
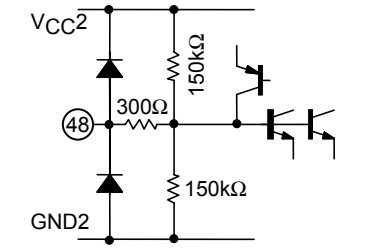
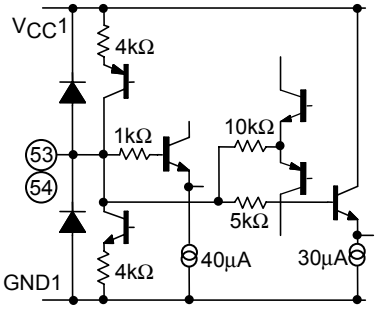
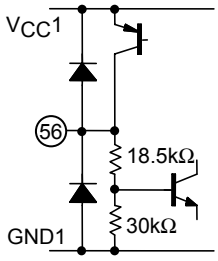
Pin No.	Pin Name	Pin Voltage	Pin Description	Equivqlent Circuit
40 43 45	BOUT GOUT ROUT	$V_{CC}2/2$	RGB primary color signal output.	
41 44 46	FBB FBG FBR	1.5V	Feedback circuit smoothing capacitor pin for RGB output DC level control.Because of high impedance, a capacitor with small leakage is used.	
42	GND2	0V	$V_{CC}2$ ground.	
47	$V_{CC}2$	7V	Power supply of output system	
48	SIGCENT	$V_{CC}2/2$	Apply external voltage when the signal output DC voltage is to be used for those other than 1/2 VCC2.	
49	$V_{CC}1$	3.0V	Analog 3V power supply.	
53 54	BYIN RYIN	1.7V	Enter the color difference of R-Y/B-Y. The clamp level in this case is about 1.7V.	
56	VREG	2.0V	Regulator output pin. Connect an external capacitor of 1μF or more.	

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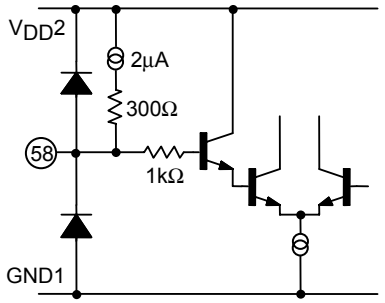
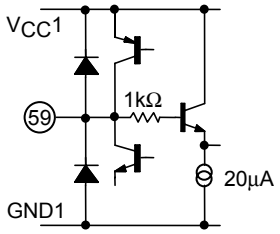
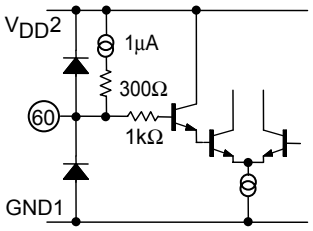
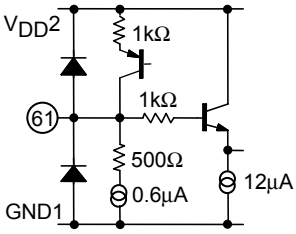
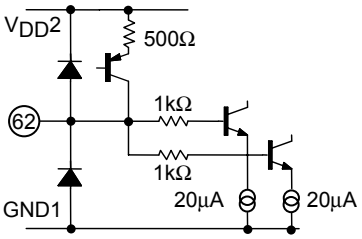
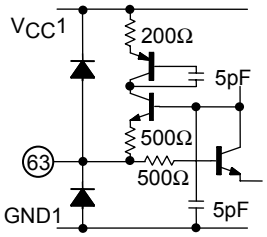
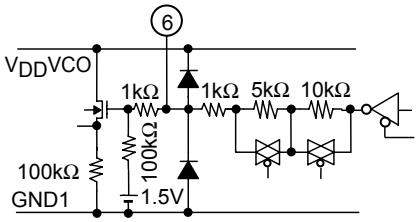
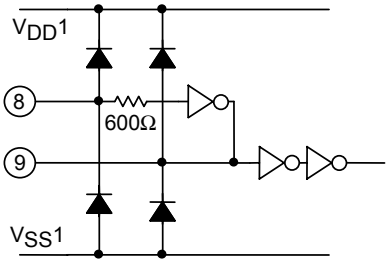
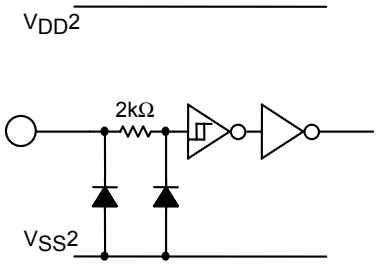
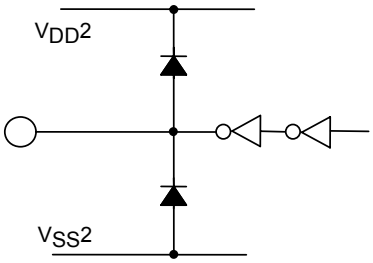
Pin No.	Pin Name	Pin Voltage	Pin Description	Equivqlent Circuit
58	RESET	-	C-MOS circuit reset pin. Normally, connect a capacitor between this pin and GND during use. (Threshold value = 2.0V)	
59	YIN	1.6V	Y signal input pin. The standard input signal level is 0.5Vp-p (from sync chip to 100% white).	
60	START-UP	-	Time constant connection pin to set the RGB output to the black level at power ON. Connect the pin to $V_{DD}2$ when not using. (Threshold value = 2.0V)	
61	SYNCIN	1.6V	Input pin for sync separation.	
62	VSEPTC	1.7V	Time constant connection pin for vertical sync separation. (The pin is used also for external VD input.)	
63	f0ADJ	1.5V	Reference current generation pin for filter. 15kΩ is connected between this pin and GND to generate the reference current. (Keep the pin open for trap OFF mode.)	
64	GND1	0V	3V ground.	

Digital pin function description

Pin No.	Pin Name	Pin Voltage	Equivalent Circuit	Pin Description
5	$V_{DD}1$	-	Power supply dedicated for VCO.	
6	RPD	-	Phase comparator output.	
7	$V_{SS}1$	0	Digital ground for VCO.	
8 9	TEST2 TEST3	-	Test pin.Normally, connect the input side (TEST2) to GND during use.	
10 11 12	LOAD DATA SCLK	-	Serial bus input pin.	
14	$V_{DD}2$	-	Digital output pin.	
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 33 34	XSTH2 STH2 XSTH1 STH1 CKH4 CKH3 CKH2 CKH1 XDSG DSG BLHD HD XSTV/STV2 STV CKV2/CKV4 CKV1/CKV2 VD XENB ENB	-	Digital output pin.	
32	$V_{SS}2$	O	Digital ground.	

No.	Parameter	Symbol	Input signal, condition, etc.	SW set							Mode set				DAC set															
				1	2	3	48	53	54	58	System	Panel	TRAP	S/H	TINT	COL	BRT	CNT	R-B	B-B	γ1	γ2	PLL	PIC	BLM1	UBRT	RCNT	BCNT	COM	WLIM
0	(Setting 2, horizontal AFC adjustment)		(A) = SIG4 (V_L = 0mV)	A	A	A	OFF	B	B	ON	NT	-	ON	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
1	Current dissipation $V_{CC}1$	$I_{CC}1$	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	ON	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
2	Current dissipation $V_{CC}2$	$I_{CC}2$	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	ON	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
3	Current dissipation V_{DD}(110,000 and 130,000)	$I_{DD}1$	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	110,000	ON	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
	Current dissipation V_{DD}(180,000)	$I_{DD}2$	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	180,000	ON	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
4	L-level input voltage	V_{IL}	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
5	H-level input voltage	V_{IH}	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
6	H-level output voltage	$V_{OH}1$	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
7	L-level output voltage	$V_{OL}1$	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
8	Output transition time	t_{TLH}	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		t_{THL}	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
9	Cross point time difference	ΔT	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
10	CKH duty	DTYHC	(A) = SIG3	A	A	A	OFF	B	B	ON	NT	-	-	1	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
11	Contrast characteristics, TYP	GCNTTP	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	ON	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
12	Contrast characteristics, MIN	GCNTMN	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	ON	ALL	128	128	128	0	128	128	0	0	ADJ	128	0	128	128	128	64	0
13	Video max. gain	GV	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	ON	ALL	128	128	128	255	128	128	0	0	ADJ	128	0	128	128	128	64	0
14	Y signal frequency	FTRPNO	(A) = SIG1	A	A	A	OFF	B	B	ON	-	180,000	OFF	ALL	128	128	128	128	128	128	0	0	ADJ	180	0	128	128	128	64	0
		FTRPNT	(A) = SIG1	A	A	A	OFF	B	B	ON	NT	180,000	ON	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		FTRPPL	(A) = SIG1	A	A	A	OFF	B	B	ON	PAL	180,000	ON	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
15	Picture quality variable amount 1 (TRAP OFF) 180,000 mode	GSHP1X	(A) = SIG6	A	A	A	OFF	B	B	ON	-	180,000	OFF	ALL	128	128	128	128	128	128	0	0	ADJ	255	0	128	128	128	64	0
		GSHP1N	(A) = SIG6	A	A	A	OFF	B	B	ON	-	180,000	OFF	ALL	128	128	128	128	128	128	0	0	ADJ	0	0	128	128	128	64	0
16	Picture quality adjustment variable amount 2 (TRAP OFF) 110,000 and 130,000 modes	GSHP2X	(A) = SIG6	A	A	A	OFF	B	B	ON	-	110,000	OFF	ALL	128	128	128	128	128	128	0	0	ADJ	255	0	128	128	128	64	0
		GSHP2N	(A) = SIG6	A	A	A	OFF	A	A	ON	-	110,000	OFF	ALL	128	128	128	128	128	128	0	0	ADJ	0	0	128	128	128	64	0
17	Picture quality adjustment variable amount 3 (TRAP ON) 110,000 and 130,000 modes	GSHP3X	(A) = SIG6	A	A	A	OFF	B	B	ON	NT	110,000	ON	ALL	128	128	128	128	128	128	0	0	ADJ	255	0	128	128	128	64	0
		GSHP3N	(A) = SIG6	A	A	A	OFF	B	B	ON	NT	110,000	ON	ALL	128	128	128	128	128	128	0	0	ADJ	0	0	128	128	128	64	0
18	Picture quality adjustment variable amount 4 (TRAP ON) 180,000 mode	GSHP4X	(A) = SIG6	A	A	A	OFF	B	B	ON	NT	180,000	ON	ALL	128	128	128	128	128	128	0	0	ADJ	255	0	128	128	128	64	0
		GSHP4N	(A) = SIG6	A	A	A	OFF	B	B	ON	NT	180,000	ON	ALL	128	128	128	128	128	128	0	0	ADJ	0	0	128	128	128	64	0

Note: PLL must be reset when the panel mode is changed.

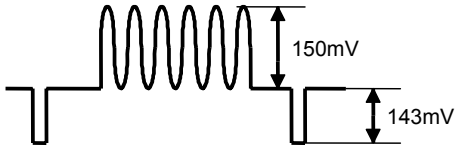
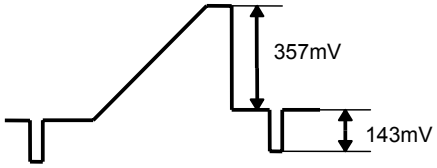
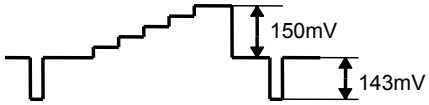
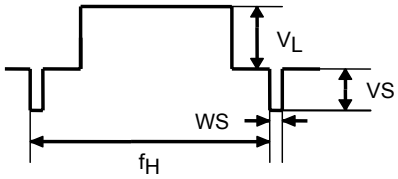
No.	Parameter	Symbol	Input signal, condition, etc.	SW set							Mode set				DAC set														
				1	2	3	48	53	54	58	System	Panel	TRAP	S/H	TINT	COL	BRT	CNT	R-B	B-B	γ1	γ2	PLL	PIC	BLM1	UBRT	RCNT	BCNT	COM	WLIM
19	Y signal input/output delay rate	TDYTRN	(A) = SIG8	A	A	A	OFF	B	B	ON	NT	-	OFF	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		TDYTRP	(A) = SIG8	A	A	A	OFF	B	B	ON	-	-	ON	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
20	Color difference input color adjustment	GEXCMX	(A) = SIG4, (D) = SIG1	A	A	A	OFF	A	B	ON	-	-	-	ALL	128	255	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		GEXCMN	(A) = SIG4, (D) = SIG1	A	A	A	OFF	A	B	ON	-	-	-	ALL	128	0	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
21	Color difference balance	VEXCBL	(A) = SIG4, (D) = (E) = SIG1	A	A	A	OFF	A	A	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
22	Color difference input balance adjustment R	GEXRMX	(A) = SIG4, (D) = (E) = SIG1	A	A	A	OFF	B	A	ON	-	-	-	ALL	255	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		GEXRMN	(A) = SIG4, (D) = (E) = SIG1	A	A	A	OFF	B	A	ON	-	-	-	ALL	0	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
23	Color difference input balance adjustment B	GEXBMX	(A) = SIG4, (D) = (E) = SIG1	A	A	A	OFF	A	B	ON	-	-	-	ALL	255	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		GEXBMN	(A) = SIG4, (D) = (E) = SIG1	A	A	A	OFF	A	B	ON	-	-	-	ALL	0	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
24	G-Y matrix characteristics	VEXGBN	(A) = SIG4, (D) = SIG1	A	A	A	OFF	A	B	ON	NT	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		VEXGBP	(A) = SIG4, (D) = SIG1	A	A	A	OFF	A	B	ON	PAL	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		VEXGR	(A) = SIG4, (D) = SIG1	A	A	A	OFF	B	A	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
25	RGB output DC voltage	VOUT	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
26	RGB output DC voltage difference	ΔVOUT	(Calculation)	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
27	User brightness change rate	UBRTMX	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	255	128	128	0	0	ADJ	128	0	255	128	128	64	0
		UBRTMN	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	255	128	128	0	0	ADJ	128	0	0	128	128	64	0
28	User brightness change rate	BRTMX	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	255	255	128	128	0	0	ADJ	128	0	128	128	128	64	0
		BRTMN	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	0	255	128	128	0	0	ADJ	128	0	128	128	128	64	0
29	Antipole output change rate	COMMX	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	255	0
		COMMN	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	0	0
30	Sub-brightness R change rate	SBBRTR	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	160	128	SET	128	0	0	ADJ	128	0	128	128	128	64	0
31	Sub-brightness B change rate	SBBRTB	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	160	128	128	SET	0	0	ADJ	128	0	128	128	128	64	0
32	Gain difference between RGB signals	ΔGRGB	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
33	Sub-contrast R change rate	SBCNTR	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	70	128	128	0	0	ADJ	128	0	128	SET	128	64	0
34	Sub-contrast B change rate	SBCNTB	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	70	128	128	0	0	ADJ	128	0	128	128	SET	64	0
35	RGB inverted/non-inverted gain difference	ΔGINV	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
36	Black level potential difference between RG signals	ΔVBL	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0

Note: PLL must be reset when the panel mode is changed.

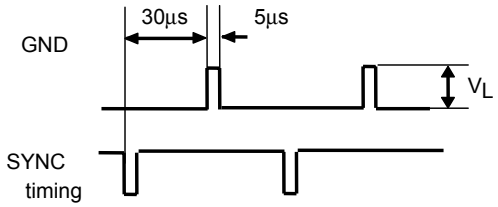
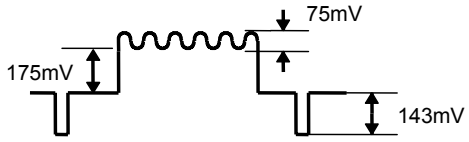
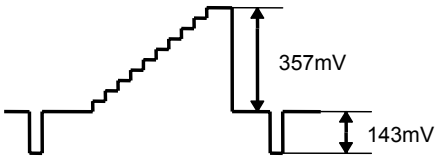
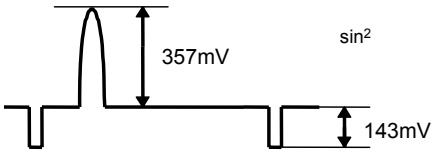
No.	Parameter	Symbol	Input signal, condition, etc.	SW set							Mode set				DAC set															
				1	2	3	48	53	54	58	System	Panel	TRAP	S/H	TINT	COL	BRT	CNT	R-B	B-B	γ1	γ2	PLL	PIC	BLM1	UBRT	RCNT	BCNT	COM	WLIM
37	Gamma gain	GγL	(A) = SIG7	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	ADJ	128	128	120	210	ADJ	128	0	128	128	128	64	0
		GγM	(A) = SIG7	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	ADJ	128	128	120	210	ADJ	128	0	128	128	128	64	0
		GγH	(A) = SIG7	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	ADJ	128	128	120	210	ADJ	128	0	128	128	128	64	0
38	γ1 adjustment variable range	Vγ1MN	(A) = SIG7	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	60	128	128	0	0	ADJ	128	0	128	128	128	64	0
		Vγ1MX	(A) = SIG7	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	60	128	128	255	0	ADJ	128	0	128	128	128	64	0
39	γ2 adjustment variable range	Vγ2MN	(A) = SIG7	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	60	128	128	0	0	ADJ	128	0	128	128	128	64	0
		Vγ2MX	(A) = SIG7	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	ADJ	60	128	128	0	255	ADJ	128	0	128	128	128	64	0
40	Antipole output transition time	tCOM	(A) = SIG3	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	ADJ	0
41	RGB output white limiter Operating voltage	VWLIMN	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	255	128	128	128	0	0	ADJ	128	64	0	128	128	64	0
		VWLIMX	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	255	128	128	128	0	0	ADJ	128	64	0	128	128	64	15
42	RGB output black limiter variable range	VBLIMN	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	0	128	128	128	0	0	ADJ	128	0	0	128	128	64	0
		VBLIMX	(A) = SIG2	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	0	128	128	128	0	0	ADJ	128	255	0	128	128	64	0
43	White limiter DC voltage	VWLIM	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	255	128	128	128	0	0	ADJ	128	64	128	128	128	64	8
44	Black limiter DC voltage	VBLIM	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	0	128	128	128	0	0	ADJ	128	ADJ	128	128	128	64	0
45	TRAP attenuation amount	ATRAPN	(A) = SIG1	A	A	A	OFF	B	B	ON	NT	-	ON	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		ATRAPP	(A) = SIG1	A	A	A	OFF	B	B	ON	PAL	-	ON	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
46	R-Y, B-Y LPF characteristics	DEMLPF	(A) = SIG4, (D) = (E) = SIG1	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
47	Input sync signal amplitude sensitivity	WSSEP	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
48	Sync separation input sensitivity	VSSEP	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
49	Sync separation output delay rate	TDSYL	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		TDSYH	(A) = SIG4	A	A	A	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
50	Horizontal pull-in range	HPLLN	(A) = SIG4	A	A	A	OFF	B	B	ON	NT	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		HPLLP	(A) = SIG4	A	A	A	OFF	B	B	ON	PAL	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
51	External RGB input threshold voltage	VTEXTB	(A) = SIG4, (C) = SIG5	B	B	B	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		VTEXTW	(A) = SIG4, (C) = SIG5	B	B	B	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
52	Propagation delay time between external RGB outputs	TD1EXT	(A) = SIG4, (C) = SIG5	B	B	B	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
		TD2EXT	(A) = SIG4, (C) = SIG5	B	B	B	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
53	External RGB output blanking level	EXTBK	(A) = SIG4, (C) = SIG5	B	B	B	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
54	External RGB output white level	EXTWT	(A) = SIG4, (C) = SIG5	B	B	B	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0
55	External RGB input minimum pulse width	TEXMIN	(A) = SIG4, (C) = SIG5	B	B	B	OFF	B	B	ON	-	-	-	ALL	128	128	128	128	128	128	0	0	ADJ	128	0	128	128	128	64	0

Note: PLL must be reset when the panel mode is changed.

Input sine wave (1)

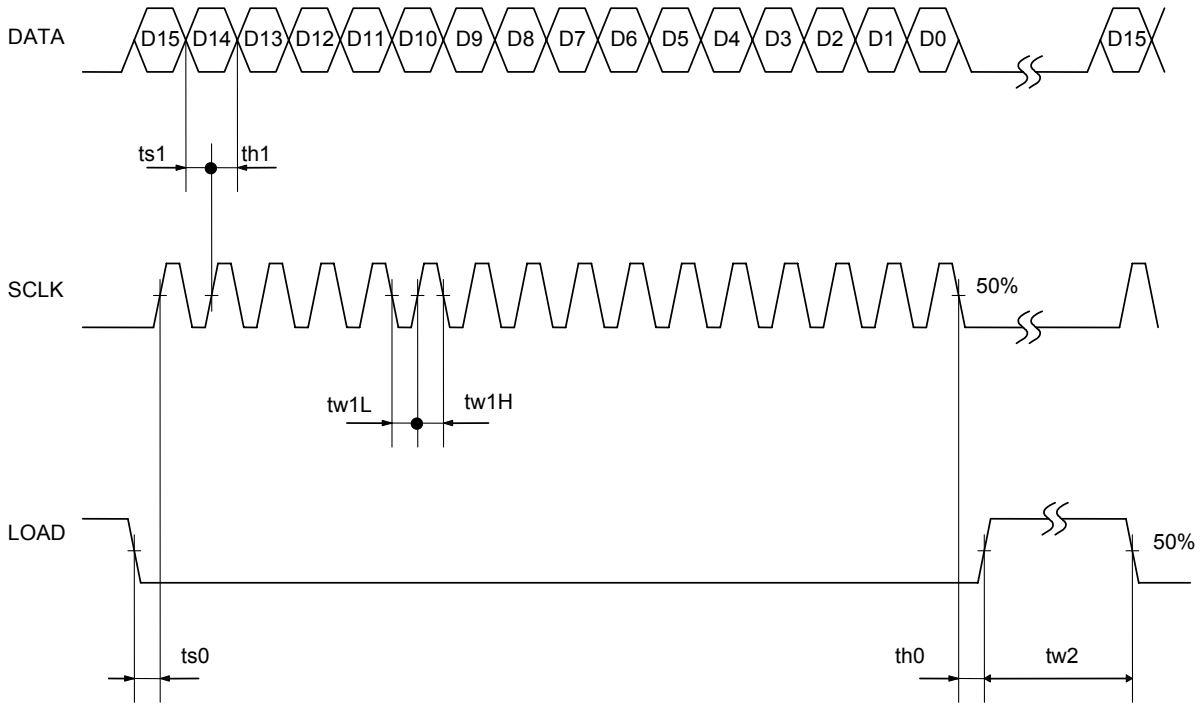
SG No.	Sine wave	
SIG1		With/without sine wave video signal (Amplitude, Frequency variable) ← Value shown in the left 0dB
SIG2		
SIG3		5-step staircase wave
SIG4		V_L amplitude variable VS variable : 143mV, unless otherwise specified. WS variable : 4.7µs, unless otherwise specified. f_H variable : NTSC 15.734kHz PAL 15.625kHz, unless otherwise specified.

Input sine wave (2)

SG No.	Sine wave	
SIG5		V_L amplitude variable
SIG6		Frequency variable
SIG7		10-step staircase wave
SIG8		2T pulse

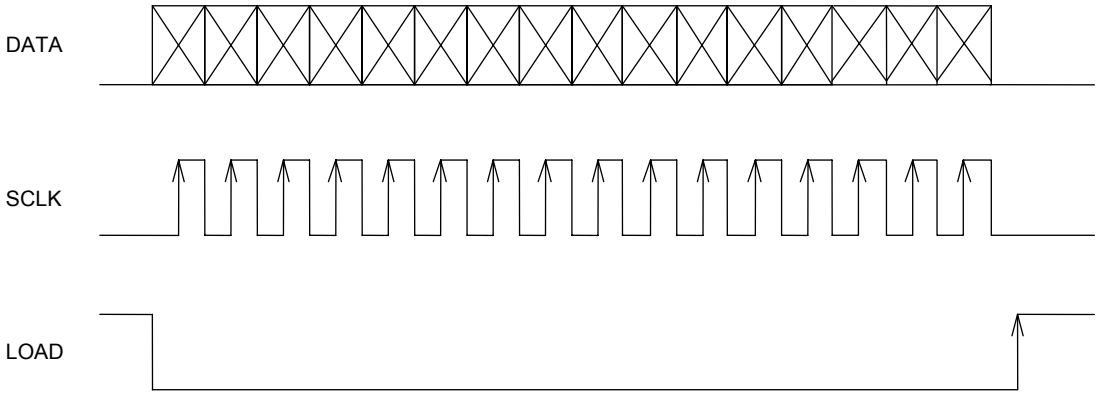
Serial bus communication specifications

(1) Conditions for serial transfer



Parameter	Symbol	Conditions	min	typ	max	unit
Serial transfer						
Data setup time	ts0	LOAD setup time to start SCLK.	150			ns
	ts1	DATA setup time to start SCLK.	150			ns
Data holdup time	th0	LOAD hold time to start SCLK	150			ns
	th1	Data hold time to start SCLK.	150			ns
Pulse width	tw1L	SCLK pulse width.	160			ns
	tw1H	SCLK pulse width.	160			ns
	tw2	LOAD pulse width.	1.0			μs

(2) 3-wave serial format



Data length : 16bit
Clock frequency : 3MHz or less

Only when SCLK is input in 16-bit clock while LOAD is in the L period, DATA is accepted at rise of LOAD.
Note : When SCLK is in 15-bit or 17-bit clock while LOAD is in the L period, DATA is not accepted.

(3) Data output timing

1. Various mode settings
   DATA accepted at rise of LOAD is set at fall of the vertical sync signal.
   When the data is transmitted several times for the same item, the data immediately before the vertical sync signal becomes valid.

2. Setting of the electric volume
   Concurrently with acceptance of DATA at rise of LOAD, the D/A output data is changed.

(4) Data specifications 1

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Description	Default
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Not used	○
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Not used	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	TRAP ON	○
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	TRAP OFF	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Not used	○
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	Not used	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	System changeover NTSC	○
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	System changeover PAL	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	External VSYNC input OFF	○
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	External VSYNC input ON	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Y/color difference clamp position, pedestal	○
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	Y/color difference clamp position, SYNC	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sample hold phase SHS1 (Note 1)	○
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	Sample hold phase SHS2 (Note 1)	
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Sample hold phase SHS3 (Note 1)	
0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	Sample hold phase ALL through (Note 1)	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	HD output polarity, positive	○
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	HD output polarity, negative	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	VD output polarity, positive	○
0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	VD output polarity, negative	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Panel selection 521 × 218 : 110,000 mode	○
0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	Panel selection 557 × 234 : 130,000 mode	
0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	Panel selection 800 × 225: 180,000 mode	
0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	For test. Do not set this bit to "1".	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Field overlap method, odd number on even number	○
0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	Field overlap method, even number on odd number	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Normal mode (Note 6)	○
0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	521×218 (EVF) + 557×234 (monitor) driving (Note 6-3)	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	BLHD output ON	○
0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	BLHD output Stop	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Sync generator function, OFF	○
0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	Sync generator functionON (output other than HD, VD, BLHD, and SPCLK is turned OFF).	
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	Normal mode	○
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	Skipping OFF mode for PAL (Indication of no skipping)	
0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	Not used	
0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	Not used	
0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	Not used	
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	Normal mode	○
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	Not used	
0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	For test. Do not set this bit to "1".	×
0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	For test. Do not set this bit to "1".	×

(4) Data specifications 2

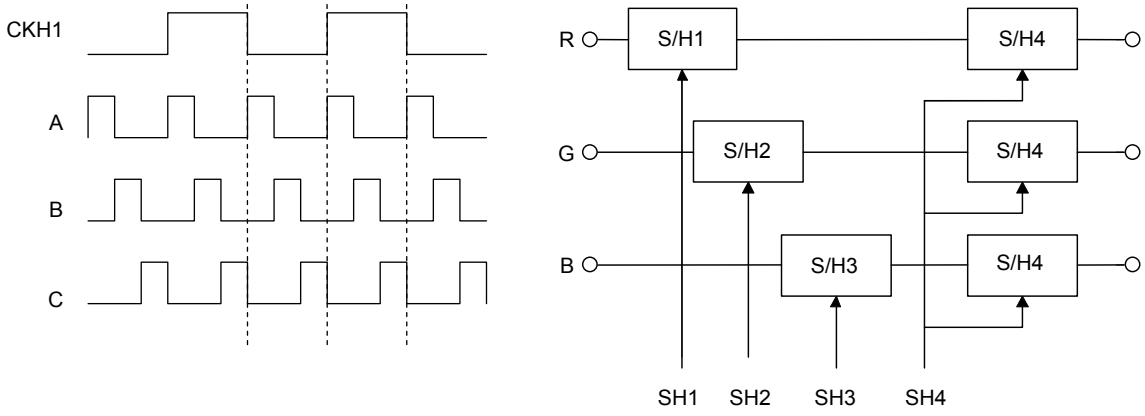
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Description	Default
0	0	0	0	0	1	0	0	×	×	×	HC5	HC4	HC3	HC2	HC1	H-position setting, 2/fh x 31 steps (Note 2)	10000
0	0	0	0	0	1	0	1	×	×	×	×	×	VP2	VP1	VP0	V-position setting, 1H x 4 steps (Note 3)	010
0	0	0	0	0	1	1	0	×	×	×	HD6	HD5	HD4	HD3	HD2	HD phase setting, 4/fh x 31 steps (Note 4)	00000
0	0	0	0	0	1	1	1	×	×	×	HW5	HW4	HW3	HW2	HW1	BLHD pulse setting, 2/fh x 31 steps (Note 5)	10000
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	Monitor horizontal inversion, normal scan mode	○
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	Monitor horizontal inversion, reverse scan mode	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	Monitor vertical inversion, normal scan mode	○
0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	Monitor vertical inversion, reverse scan mode	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	EVF horizontal inversion, normal scan mode	○
0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	EVF horizontal inversion, reverse scan mode	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	EVF vertical inversion, normal scan mode	○
0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	EVF vertical inversion, reverse scan mode	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	Scan changeover pin, normalSCAN pin : OPEN	○
0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	Scan changeover pin, reverse scanSCAN pin : OPEN	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	Not used	○
0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	Not used	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	VCO sensitivity changeover 1	
0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	VCO sensitivity changeover 2	○
0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	VCO sensitivity changeover 3	
0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	VCO sensitivity changeover 4	
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	Monitor scan stop mode (Note 6-4)	
0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	Monitor display mode	○
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	EVF scan stop mode (Note 6-4)	
0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	EVF display mode	○
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	blanking period CHK/STH stop OFF (NORMAL)	○
0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	blanking period CKH/STH stop ON (power save mode)	
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	H blanking period CKH stop OFF (NORMAL)	○
0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	H blanking period CKH stop ON (power save mode)	
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	Panel connection form MODE 1 (Note 6-1)	○
0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	Panel connection form MODE 2 (Note 6-2)	
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	Normal mode	○
0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	For test. Do not set this bit to “1”.	×

(4) Data specifications 3 (DAC set)

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Description	Default
1	0	0	0	0	0	0	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	TINT adjustment	10000000
1	0	0	0	0	0	0	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	COLOR adjustment	10000000
1	0	0	0	0	0	1	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	BRIGHT adjustment	10010101
1	0	0	0	0	0	1	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	CONTRAST adjustment	10001100
1	0	0	0	0	1	0	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	R-BRIGHT adjustment	10000000
1	0	0	0	0	1	0	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	B-BRIGHT adjustment	10000000
1	0	0	0	0	1	1	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	γ-1 adjustment	01100100
1	0	0	0	0	1	1	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	γ-2 adjustment	00000000
1	0	0	0	1	0	0	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	Antipole output amplitude adjustment	01010000
1	0	0	0	1	0	0	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	R-CONT adjustment	10000000
1	0	0	0	1	0	1	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	B-CONT adjustment	10000000
1	0	0	0	1	0	1	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	BLKLIMT adjustment	10101100
1	0	0	0	1	1	0	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	Not used	00000000
1	0	0	0	1	1	0	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	PICTURE adjustment	10000000
1	0	0	0	1	1	1	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	USER-BRIGHT adjustment	10000000
1	0	0	0	1	1	1	1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	VCO adjustment	10000000
1	0	0	1	0	0	0	0	×	×	×	×	DA3	DA2	DA1	DA0	WHTLIMT adjustment	0000
1	1	1	0	0	0	0	0	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0	Test mode. Do not set this address.	

(Note 1) Sample hold phase

S/H pulse timing



Horizontal inversion Normal scan

	SHS1	SHS2	SHS3
SH1	B	A	C
SH2	through	through	through
SH3	A	C	B
SH4	C	B	A

Horizontal inversion Reverse scan

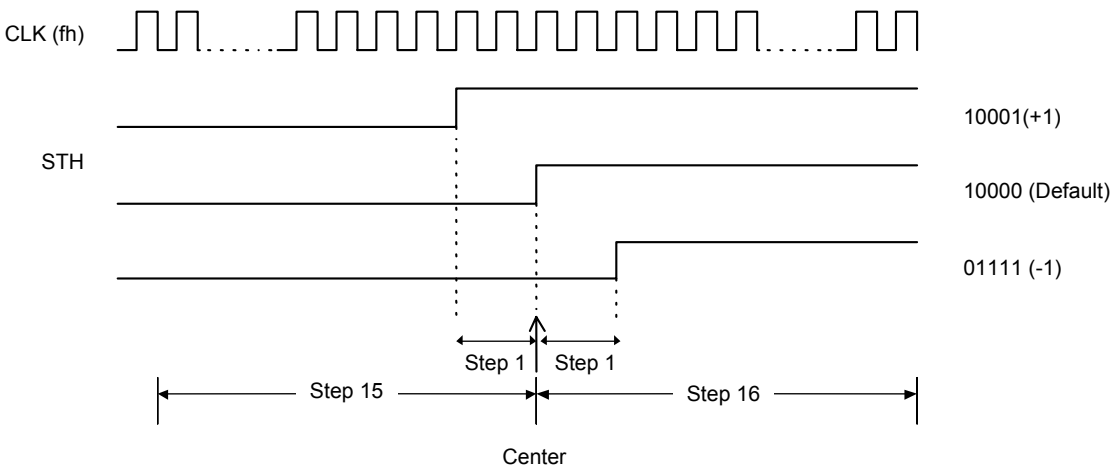
	SHS1	SHS2	SHS3
SH1	B	A	C
SH2	A	C	B
SH3	through	through	Through
SH4	C	B	A

SH1 : SH pulse for R signal SH2 : SH pulse for G signal
SH3 : SH pulse for B signal SH4 : Common SH pulse for RGB signal

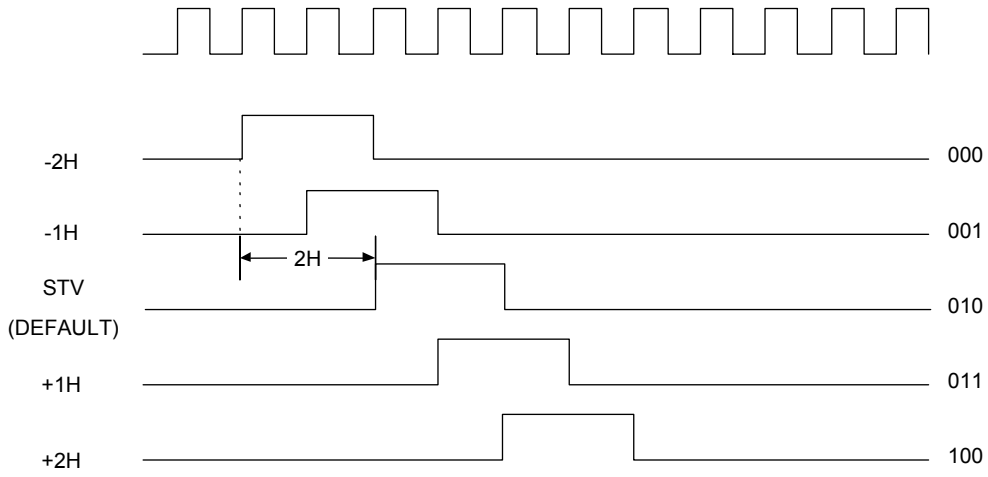
(Note 2) H-Position set

(step 1 = 2×1/fvco) : 1/fvco ≈ 90ns <521×218, 557×234 mode>

: 1/fvco ≈ 60ns <881×228 mode>

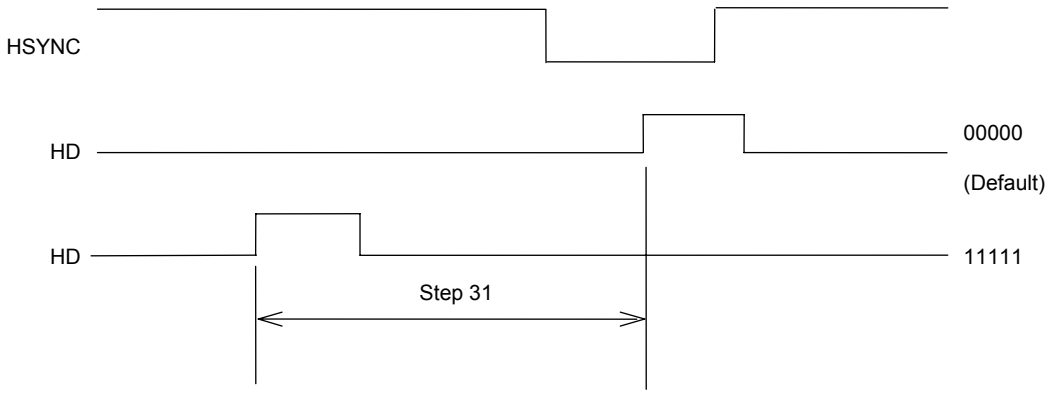


(Note 3) V-Position set



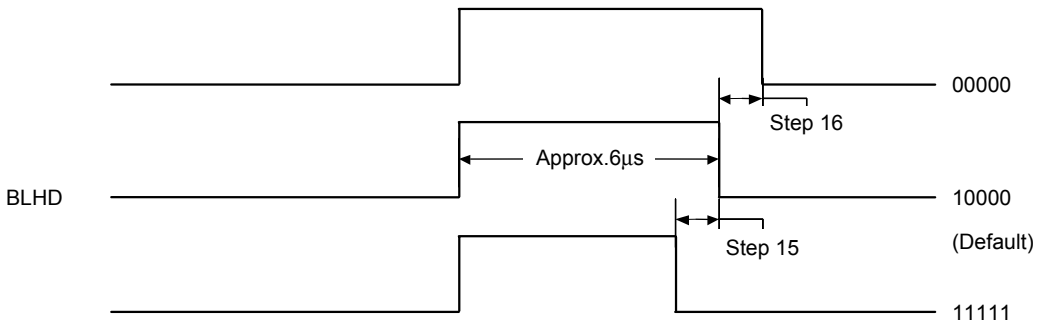
(Note 4) HD phase set

(step 1 = 4×1/fvco)



(Note 5) BLHD phase set

(step 1 = 2×1/fvco)



ON/OFF (output L fixed) possible with the serial bus

(Note 6) Output signal by mode

Pin No.	Pin symbol	MODE1 (Note 6-1)			MODE2 (Note 6-2)						Scan OFF	
		Normal			Normal			(521×218)+ (557×234)		(Note 6-3)	(Note 6-4)	
		Common	For EVF	For monitor	Common	For EVF	For monitor	Common	For EVF	For monitor	Motor OFF	EVF OFF
18	STH1			○			○			○	"L"	←
17	XSTH1			○			○			○	"H"	←
22	CKH1			○			○			○	"L"	←
21	CKH2			○			○			○	"H"	←
28	STV	○			○				*	○	←	←
27	XSTV/STV2	○			○				○ (STV2)	*	←	←
30	CKV1/CKV2	○				*	○ (CKV2)		*	○ (CKV2)	←	←
29	CKV2/CKV4	○				○ (CKV4)	*		○ (CKV4)	*	←	←
34	ENB	○			○			○			←	←
33	XENB	○			○			○			←	←
24	PCG	○			○			○			←	←
23	XPCG	○			○			○			←	←
16	STH2		○			○			○		←	"L"
15	XSTH2		○			○			○		←	"H"
20	CKH3		○			○			○		←	"L"
19	CKH4		○			○			○		←	"H"

* : Generated with an external inverte