

# M52749FP

## BUS Controlled 3ch Video Pre-amp for CRT Display Monitor

REJ03F0194-0201

Rev.2.01

Mar 31, 2008

### Description

M52749FP is semiconductor integrated circuit for CRT display monitor.

It includes OSD blanking, OSD mixing, retrace blanking, wide band amplifier, brightness control, main/sub contrast and OSD adjust function.

### Features

- Frequency Band Width: RGB 180 MHz (3 V<sub>P,P</sub> at -3 dB)  
OSD 80 MHz
- Input: RGB 0.7 V<sub>P,P</sub> (typ.)  
OSD 3 V<sub>P,P</sub> min. (positive)  
BLK (for OSD) 3 V<sub>P,P</sub> min. (positive)  
Retrace BLK 3 V<sub>P,P</sub> min. (positive)
- Output: RGB 5.5 V<sub>P,P</sub> (max.)  
OSD 3.5 V<sub>P,P</sub> (max.)
- Main contrast, sub contrast, OSD adjust and 5ch D/A OUT can be controlled by I<sup>2</sup>C BUS.

### Application

CRT display monitor

### Recommended Operating Conditions

Supply voltage range: 11.5 V to 12.5 V (V3, V8, V12, V42)

4.5 V to 5.5 V (V19)

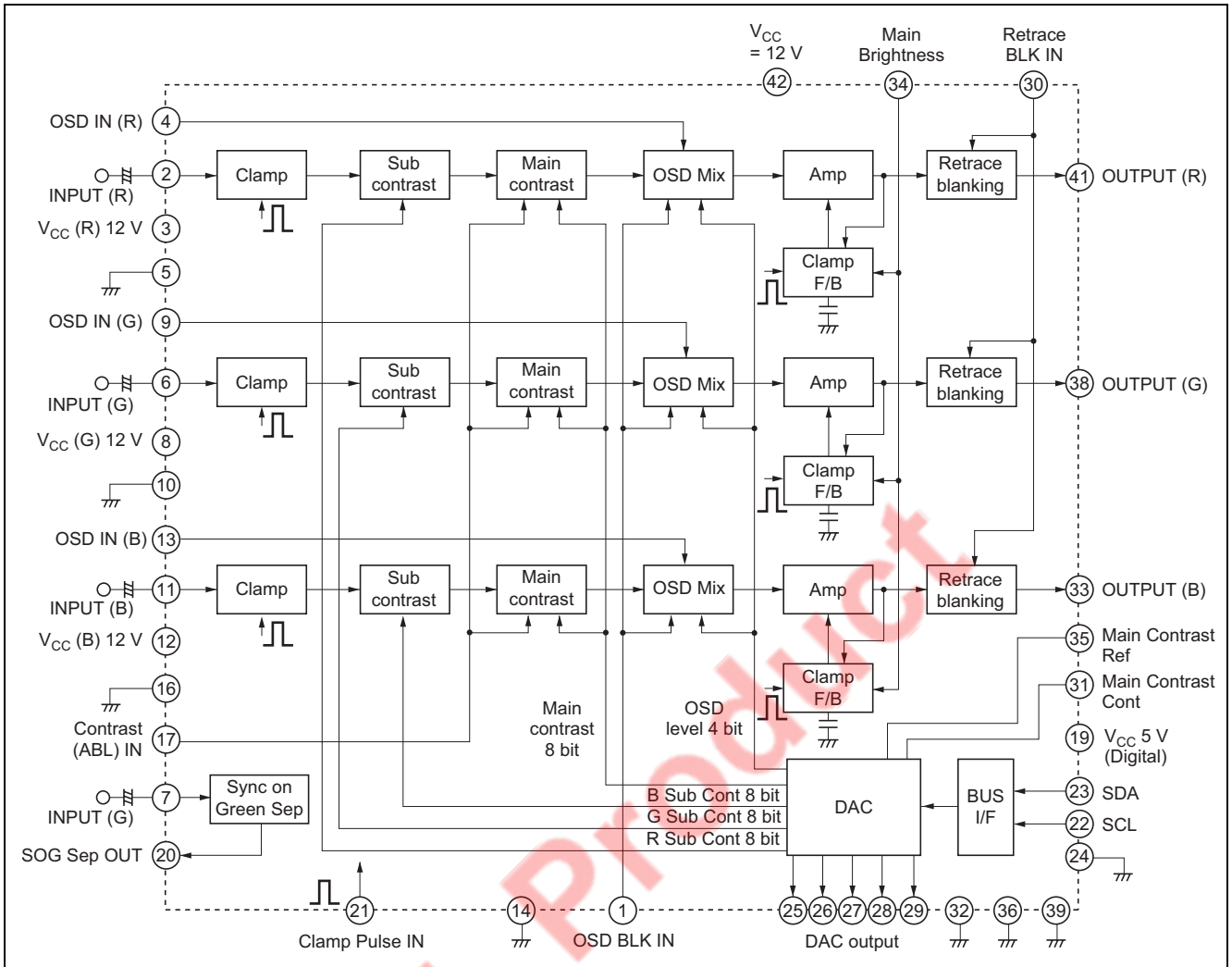
Rated supply voltage: 12.0 V (V3, V8, V12, V42)

5.0 V (V19)

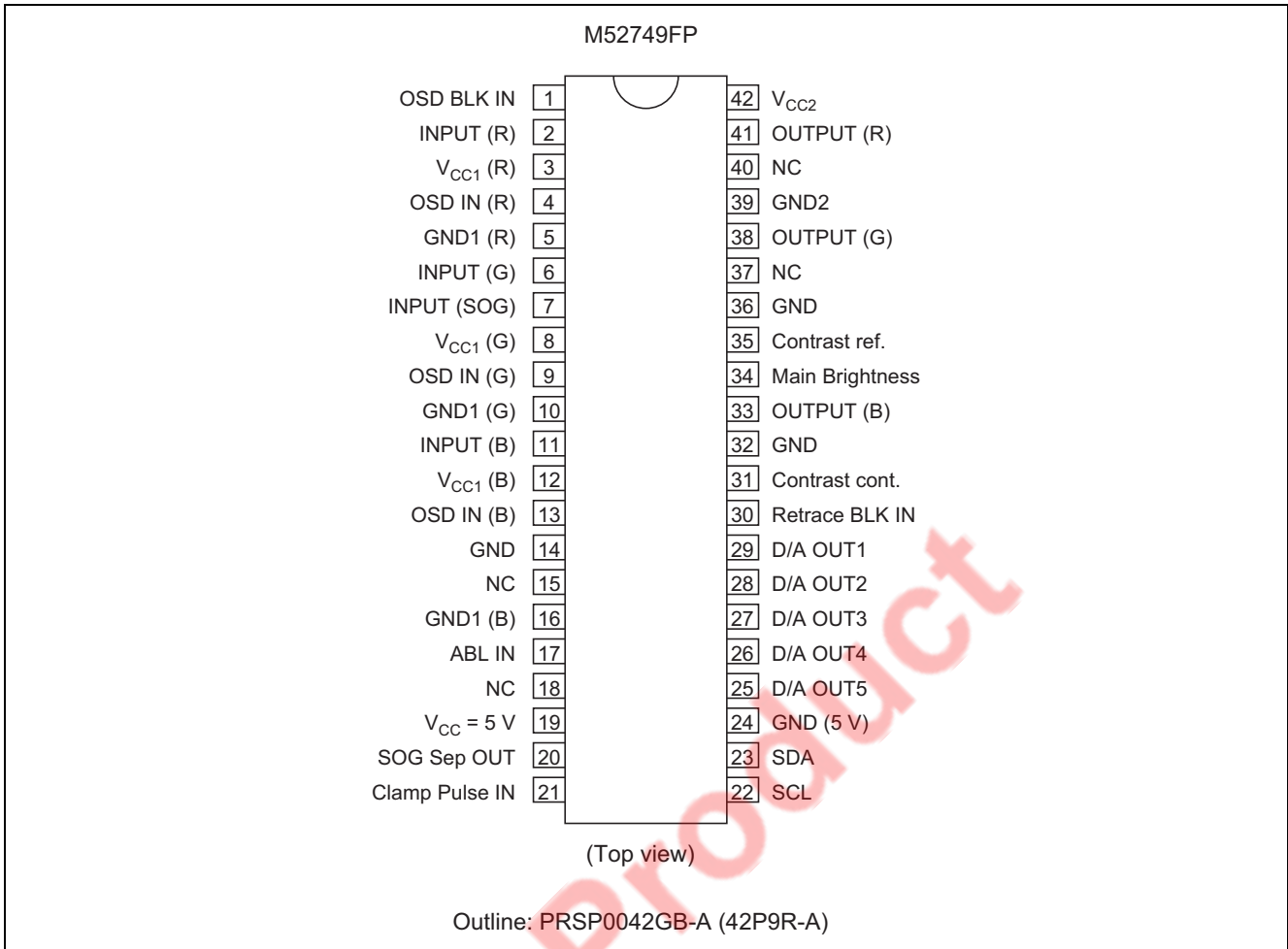
### Major Specification

BUS controlled 3ch video pre-amp with OSD mixing function and retrace blanking function

Block Diagram



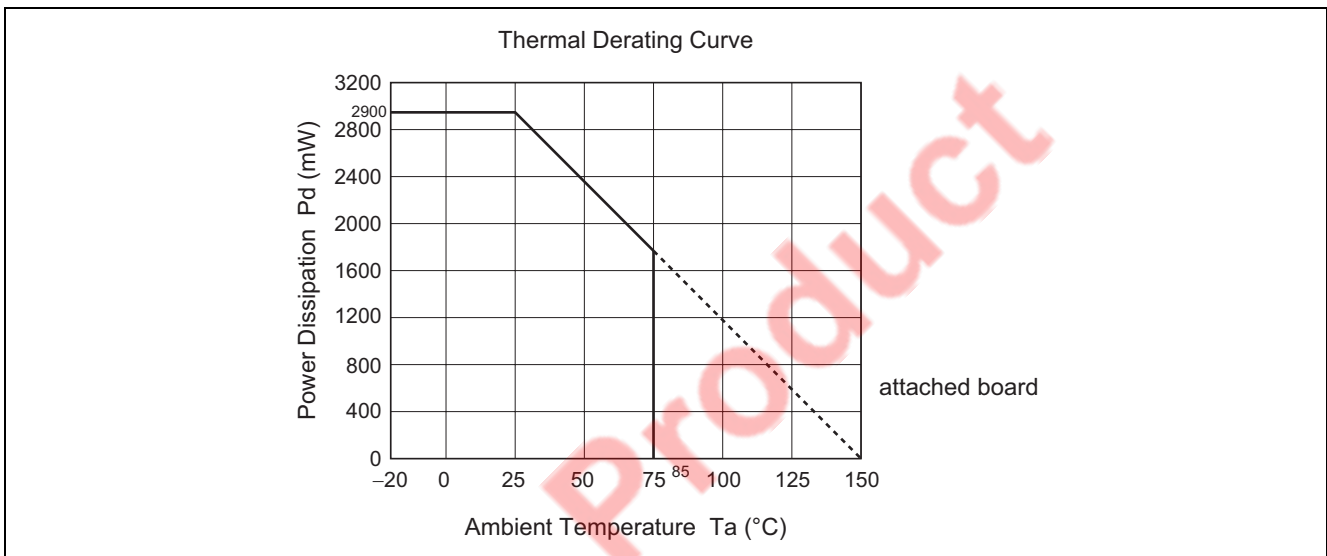
Pin Arrangement



**Absolute Maximum Ratings**

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Supply voltage (Pin 3, 8, 12, 42)	V <sub>CC12</sub>	13.0	V
Supply voltage (Pin 19)	V <sub>CC5</sub>	6.0	V
Power dissipation	P <sub>d</sub>	2900	mW
Ambient temperature	T <sub>opr</sub>	-20 to +75	°C
Storage temperature	T <sub>stg</sub>	-40 to +150	°C
Recommended supply12	V <sub>opr12</sub>	12.0	V
Recommended supply5	V <sub>opr5</sub>	5.0	V
Voltage range12	V <sub>opr'12</sub>	11.5 to 12.5 (Typ 12.0)	V
Voltage range5	V <sub>opr'5</sub>	4.5 to 5.5 (Typ 5.0)	V



## BUS Control Table

(1) Slave address:

D7	D6	D5	D4	D3	D2	D1	R/W	
1	0	0	0	1	0	0	0	= 88H

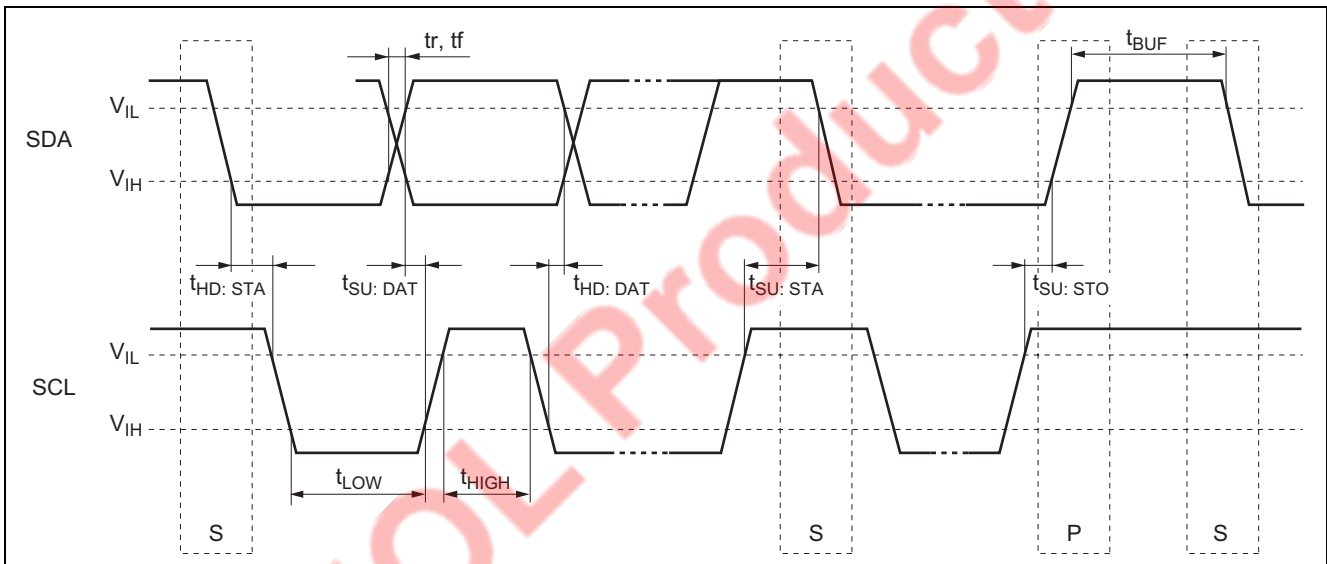
(2) Each function's sub address:

No.	Function	Bit	Sub Add.	Data Byte (Up: Bit, Information Down: Preset)							
				D7	D6	D5	D4	D3	D2	D1	D0
1	Main contrast	8	00H	A07	A06	A05	A04	A03	A02	A01	A00
				0	1	0	0	0	0	0	0
2	Sub contrast R	8	01H	A17	A16	A15	A14	A13	A12	A11	A10
				1	0	0	0	0	0	0	0
3	Sub contrast G	8	02H	A27	A26	A25	A24	A23	A22	A21	A20
				1	0	0	0	0	0	0	0
4	Sub contrast B	8	03H	A37	A36	A35	A34	A33	A32	A31	A30
				1	0	0	0	0	0	0	0
5	OSD level	4	04H	—	—	—	—	A43	A42	A41	A40
				0	0	0	0	1	0	0	0
6	D/A OUT1	8	06H	A67	A66	A65	A64	A63	A62	A61	A60
				1	0	0	0	0	0	0	0
7	D/A OUT2	8	07H	A77	A76	A75	A74	A73	A72	A71	A70
				1	0	0	0	0	0	0	0
8	D/A OUT3	8	08H	A87	A86	A85	A84	A83	A82	A81	A80
				1	0	0	0	0	0	0	0
9	D/A OUT4	8	09H	A97	A96	A95	A94	A93	A92	A91	A90
				1	0	0	0	0	0	0	0
10	D/A OUT5	8	0AH	AA7	AA6	AA5	AA4	AA3	AA2	AA1	AA0
				1	0	0	0	0	0	0	0

I<sup>2</sup>C BUS Control Section SDA, SCL Characteristics

Item	Symbol	Min.	Max.	Unit
Min. input LOW voltage	$V_{IL}$	-0.5	1.5	V
Max. input HIGH voltage	$V_{IH}$	3.0	5.5	V
SCL clock frequency	$f_{SCL}$	0	400	kHz
Time the bus must be free before a new transmission can start	$t_{BUF}$	1.3	—	$\mu$ S
Hold time start condition. After this period the first clock pulse is generated	$t_{HD:STA}$	0.6	—	$\mu$ S
The LOW period of the clock	$t_{LOW}$	1.3	—	$\mu$ S
The HIGH period of the clock	$t_{HIGH}$	0.6	—	$\mu$ S
Set up time for start condition (Only relevant for a repeated start condition)	$t_{SU:STA}$	0.6	—	$\mu$ S
Hold time DATA	$t_{HD:DAT}$	0.1	—	$\mu$ S
Set-up time DATA	$t_{SU:DAT}$	100	—	ns
Rise time of both SDA and SCL lines	$t_r$	—	300	ns
Fall time of both SDA and SCL lines	$t_f$	—	300	ns
Set-up time for stop condition	$t_{SU:STO}$	0.6	—	$\mu$ S

## Timing Chart



Electrical Characteristics

(V<sub>CC</sub> = 12 V, 5 V; Ta = 25°C unless otherwise specified)

Item	Symbol	Limits			Unit	Test Point (s)	Input							CTL Voltage		BUS CTL (H)													
		Min.	Typ.	Max.			2, 6, 11 RGB in	1 OSD BLK	4, 9, 13 OSD in	21 CP in	30 ReT BLK	7 SOG in	34 Bright	17 ABL	00H Main Cont	01H Sub Cont 1	02H Sub Cont 2	03H Sub Cont 3	04H OSD Adj	06H D/A OUT 1	07H D/A OUT 2	08H D/A OUT 3	09H D/A OUT 4	0AH D/A OUT 5					
Circuit current1	I <sub>CC1</sub>	—	110	130	mA	I <sub>A</sub>	a	a	a	b SG5	a	a	4.0	5.0	FFH 255	FFH 255	FFH 255	FFH 255	00H 0	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255	
Circuit current2	I <sub>CC2</sub>	—	18	22	mA	I <sub>B</sub>	a	a	a	b SG5	a	a	4.0	5.0															
Output dynamic range	V <sub>omax</sub>	6.0	8.0	—	V <sub>P-P</sub>	OUT	b SG2	a	a	b SG5	a	a	Variable	5.0															
Maximum input	V <sub>imax</sub>	1.6	—	—	V <sub>P-P</sub>	IN OUT	b SG2 Variable	a	a	b SG5	a	a	2.0	5.0	64H 100														
Maximum gain	G <sub>V</sub>	16.5	17.7	19.4	dB	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	FFH 255														
Relative maximum gain	ΔG <sub>V</sub>	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
Main contrast control characteristics1	V <sub>C1</sub>	15.5	17.0	18.5	dB	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	C8H 200														
Main contrast control relative characteristics1	ΔV <sub>C1</sub>	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
Main contrast control characteristics2	V <sub>C2</sub>	9.0	10.5	12.0	dB	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	64H 100														
Main contrast control relative characteristics2	ΔV <sub>C2</sub>	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
Main contrast control characteristics3	V <sub>C3</sub>	0.2	0.4	0.6	V <sub>P-P</sub>	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	14H 20														
Main contrast control relative characteristics3	ΔV <sub>C3</sub>	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
Sub contrast control characteristics1	V <sub>SC1</sub>	15.5	17.0	18.5	dB	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	FFH 255	C8H 200	C8H 200	C8H 200											
Sub contrast control relative characteristics1	ΔV <sub>SC1</sub>	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
Sub contrast control characteristics2	V <sub>SC2</sub>	10.5	12.0	13.5	dB	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	FFH 255	64H 100	64H 100	64H 100											
Sub contrast control relative characteristics2	ΔV <sub>SC2</sub>	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
Sub contrast control characteristics3	V <sub>SC3</sub>	0.7	1.2	1.5	V <sub>P-P</sub>	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	FFH 255	14H 20	14H 20	14H 20											
Sub contrast control relative characteristics3	ΔV <sub>SC3</sub>	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
Main/sub contrast control characteristics	VMSC	3.4	4.0	4.6	V <sub>P-P</sub>	OUT	b SG1	a	a	b SG5	a	a	2.0	5.0	C8H 200	C8H 200	C8H 200	C8H 200											
Main/sub contrast control relative characteristics	ΔVMSC	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
ABL control characteristics1	ABL1	4.6	5.4	6.2	V <sub>P-P</sub>	OUT	b SG1	a	a	b SG5	a	a	2.0	4.0	FFH 255	FFH 255	FFH 255	FFH 255											
ABL control relative characteristics1	ΔABL1	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														
ABL control characteristics2	ABL2	2.3	2.8	3.3	V <sub>P-P</sub>	OUT	b SG1	a	a	b SG5	a	a	2.0	2.0															
ABL control relative characteristics2	ΔABL2	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—														

Item	Symbol	Limits			Unit	Test Point (s)	Input							CTL Voltage		BUS CTL (H)									
		Min.	Typ.	Max.			2, 6, 11 RGB in	1 OSD BLK	4, 9, 13 OSD in	21 CP in	30 ReT BLK	7 SOG in	34 Bright	17 ABL	00H Main Cont	01H Sub Cont 1	02H Sub Cont 2	03H Sub Cont 3	04H OSD Adj	06H D/A OUT 1	07H D/A OUT 2	08H D/A OUT 3	09H D/A OUT 4	0AH D/A OUT 5	
Brightness control characteristics1	V <sub>B1</sub>	3.6	4.0	4.4	V	OUT	a	a	a	b SG5	a	a	4.0	5.0	FFH 255	FFH 255	FFH 255	FFH 255	00H 0	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255
Brightness control relative characteristics1	ΔV <sub>B1</sub>	-0.3	0	0.3	V	—	—	—	—	—	—	—	—	—	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Brightness control characteristics2	V <sub>B2</sub>	1.8	2.1	2.4	V	OUT	a	a	a	b SG5	a	a	2.0	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Brightness control relative characteristics2	ΔV <sub>B2</sub>	-0.3	0	0.3	V	—	—	—	—	—	—	—	—	—	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Brightness control characteristics3	V <sub>B3</sub>	0.9	1.1	1.3	V	OUT	a	a	a	b SG5	a	a	1.0	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Brightness control relative characteristics3	ΔV <sub>B3</sub>	-0.3	0	0.3	V	—	—	—	—	—	—	—	—	—	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Frequency characteristics1 (f = 50 MHz)	F <sub>C1</sub>	-2.0	0	2.5	dB	OUT	b SG3	a	a	a 5V	a	a	Variable	5.0	Variable	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Frequency relative characteristics1 (f = 50 MHz)	ΔF <sub>C1</sub>	-1.0	0	1.0	dB	—	—	—	—	—	—	—	—	—	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Frequency characteristics1 (f = 180 MHz)	F <sub>C1'</sub>	-3.0	0	3.0	dB	OUT	b SG3	a	a	a 5V	a	a	Variable	5.0	Variable	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Frequency relative characteristics1 (f = 180 MHz)	ΔF <sub>C1'</sub>	-1.0	0	1.0	dB	—	—	—	—	—	—	—	—	—	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Frequency characteristics2 (f = 180 MHz)	F <sub>C2</sub>	-3.0	3.0	5.0	dB	OUT	b SG3	a	a	a 5V	a	a	Variable	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Frequency relative characteristics2 (f = 180 MHz)	ΔF <sub>C2</sub>	-1.0	0	1.0	dB	—	—	—	—	—	—	—	—	—	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Crosstalk1 (f = 50 MHz)	C.T.1	—	-25	-20	dB	OUT (33) OUT (38)	2b SG3 6a 11a	a	a	a 5V	a	a	Variable	5.0	FFH 255	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Crosstalk1 (f = 180 MHz)	C.T.1'	—	-20	-15	dB	OUT (33) OUT (38)	2b SG3 6a 11a	a	a	a 5V	a	a	Variable	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Crosstalk2 (f = 50 MHz)	C.T.2	—	-25	-20	dB	OUT (33) OUT (41)	2a 6b SG3 11a	a	a	a 5V	a	a	Variable	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Crosstalk2 (f = 180 MHz)	C.T.2'	—	-20	-15	dB	OUT (33) OUT (41)	2a 6b SG3 11a	a	a	a 5V	a	a	Variable	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Crosstalk3 (f = 50 MHz)	C.T.3	—	-25	-20	dB	OUT (38) OUT (41)	2a 6a 11b SG3	a	a	a 5V	a	a	Variable	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Crosstalk3 (f = 180 MHz)	C.T.3'	—	-20	-15	dB	OUT (38) OUT (41)	2a 6a 11b SG3	a	a	a 5V	a	a	Variable	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Pulse characteristics1 (3 V <sub>P-P</sub> )	Tr	—	2.0	2.8	ns	OUT	b SG1	a	a	b SG5	a	a	Variable	5.0	Variable	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Pulse characteristics2 (3 V <sub>P-P</sub> )	Tf	—	2.0	2.8	ns	OUT	b SG1	a	a	b SG5	a	a	Variable	5.0	Variable	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Clamp pulse threshold voltage	V <sub>thCP</sub>	1.0	1.5	2.0	V	OUT	b SG1	a	a	b SG5 Variable	a	a	2.0	5.0	FFH 255	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Clamp pulse minimum width	WCP	0.2	—	—	μs	OUT	b SG1	a	a	b SG5 Variable	a	a	2.0	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
OSD pulse characteristics1	OT <sub>r</sub>	—	3.0	6.0	ns	OUT	a	a	b SG6	b SG5	a	a	2.0	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
OSD pulse characteristics2	OT <sub>f</sub>	—	3.0	6.0	ns	OUT	a	a	b SG6	b SG5	a	a	2.0	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓



Item	Symbol	Limits			Unit	Test Point (s)	Input						CTL Voltage		BUS CTL (H)									
		Min.	Typ.	Max.			2, 6, 11 RGB in	1 OSD BLK	4, 9, 13 OSD in	21 CP in	30 ReT BLK	7 SOG in	34 Bright	17 ABL	00H Main Cont	01H Sub Cont 1	02H Sub Cont 2	03H Sub Cont 3	04H OSD Adj	06H D/A OUT 1	07H D/A OUT 2	08H D/A OUT 3	09H D/A OUT 4	0AH D/A OUT 5
OSD adjust control characteristics1	Oaj1	2.8	3.5	4.2	V <sub>p,p</sub>	OUT	a	b SG6	b SG6	b SG5	a	a	2.0	5.0	FFH 255	FFH 255	FFH 255	FFH 255	0FH 15	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255
OSD adjust control relative characteristics1	ΔOaj1	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
OSD adjust control characteristics2	Oaj2	2.25	2.8	3.35	V <sub>p,p</sub>	OUT	a	b SG6	b SG6	b SG5	a	a	2.0	5.0	—	—	—	—	08H 8	—	—	—	—	—
OSD adjust control relative characteristics2	ΔOaj2	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
OSD adjust control characteristics3	Oaj3	1.2	1.5	1.8	V <sub>p,p</sub>	OUT	a	b SG6	b SG6	b SG5	a	a	2.0	5.0	—	—	—	—	00H 0	—	—	—	—	—
OSD adjust control relative characteristics3	ΔOaj3	0.8	1.0	1.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
OSD input threshold voltage	VthOSD	2.2	2.7	3.2	V	OUT	a	b SG6	b SG6 Variable	b SG5	a	a	2.0	5.0	—	—	—	—	08H 8	—	—	—	—	—
OSD BLK input threshold voltage	VthBLK	2.2	2.7	3.2	V	OUT	b SG1	b SG6 Variable	a	b SG5	a	a	2.0	5.0	—	—	—	—	00H 0	—	—	—	—	—
Retrace BLK characteristics1	HBLK1	—	0.3	0.6	V	OUT	a	a	a	b SG5	b SG7	a	2.0	5.0	—	—	—	—	—	—	—	—	—	—
Retrace BLK input threshold voltage	VthRET	1.0	1.5	2.0	V	OUT	a	a	a	b SG5	b SG7 Variable	a	2.0	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
SOG input maximum noise voltage	SS-NV	—	—	0.03	V <sub>p,p</sub>	SonG IN SyncOUT	a	a	a	a	a	b SG4 Variable	2.0	5.0	—	—	—	—	—	—	—	—	—	—
SOG minimum input voltage	SS-SV	0.2	—	—	V <sub>p,p</sub>	SonG IN SyncOUT	a	a	a	a	a	b SG4 Variable	2.0	5.0	—	—	—	—	—	—	—	—	—	—
Sync output high level	VSH	4.5	4.9	5.0	V	Sync OUT	a	a	a	a	a	b SG4	2.0	5.0	—	—	—	—	—	—	—	—	—	—
Sync output low level	VSL	0	0.3	0.6	V	Sync OUT	a	a	a	a	a	b SG4	2.0	5.0	—	—	—	—	—	—	—	—	—	—
Sync output delay time1	TDS-F	0	60	90	ns	Sync OUT	a	a	a	a	a	b SG4	2.0	5.0	—	—	—	—	—	—	—	—	—	—
Sync output delay time2	TDS-R	0	60	90	ns	Sync OUT	a	a	a	a	a	b SG4	2.0	5.0	—	—	—	—	—	—	—	—	—	—
D/A H output voltage	VOH	4.5	5.0	5.5	V <sub>DC</sub>	D/A OUT	a	a	a	a	a	a	2.0	5.0	FFH 255	FFH 255	FFH 255	FFH 255	00H 0	FFH 255	FFH 255	FFH 255	FFH 255	FFH 255
D/A L output voltage	VOL	0	0.5	1.0	V <sub>DC</sub>	D/A OUT	a	a	a	a	a	a	2.0	5.0	↓	↓	↓	↓	↓	00H 0	00H 0	00H 0	00H 0	00H 0
D/A OUT input current	IA-	0.18	—	—	mA	D/A OUT	a	a	a	a	a	a	2.0	5.0	00H 0	00H 0	00H 0	00H 0	00H 0	00H 0	00H 0	00H 0	00H 0	00H 0
D/A OUT output current	IA+	—	—	1.0	mA	D/A OUT	a	a	a	a	a	a	2.0	5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
D/A nonlinearity	DNL	-1.0	—	1.0	LSB	D/A OUT	a	a	a	a	a	a	2.0	5.0	FFH 255	FFH 255	FFH 255	FFH 255	00H 0	Vari able	Vari able	Vari able	Vari able	Vari able

## Electrical Characteristics Test Method

### I<sub>CC1</sub> Circuit Current1

Measuring conditions are as listed in supplementary Table.

Measured with a current meter at test point I<sub>A</sub>.

### I<sub>CC2</sub> Circuit Current2

Measuring conditions are as listed in supplementary Table.

Measured with a current meter at test point I<sub>B</sub>.

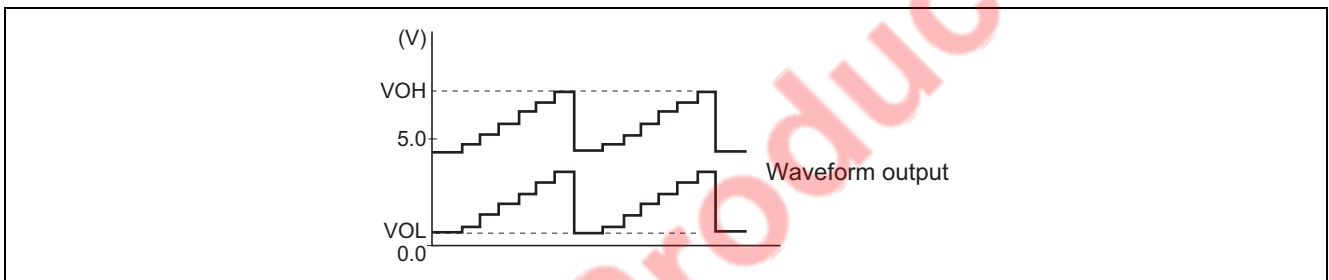
### V<sub>omax</sub> Output Dynamic Range

Decrease V34 gradually, and measure the voltage when the bottom of waveform output is distorted. The voltage is called VOL.

Next, increase V34 gradually, and measure the voltage when the top of waveform output is distorted. The voltage is called VOH.

Voltage V<sub>omax</sub> is calculated by the equation below:

$$V_{omax} = VOH - VOL$$



### V<sub>imax</sub> Maximum Input

Increase the input signal (SG2) amplitude gradually, starting from 700 mV<sub>p-p</sub>. Measure the amplitude of the input signal when the output signal starts becoming distorted.

### G<sub>v</sub> Maximum Gain

Input SG1, and read the amplitude output at OUT (33, 38, 41). The amplitude is called VOUT (33, 38, 41).

Maximum gain G<sub>v</sub> is calculated by the equation below:

$$G_v = 20 \log \frac{V_{OUT}}{0.7} \text{ (dB)}$$

### ΔG<sub>v</sub> Relative Maximum Gain

Relative maximum gain ΔG<sub>v</sub> is calculated by the equation below:

$$\begin{aligned} \Delta G_v &= V_{OUT} (33) / V_{OUT} (38), \\ &V_{OUT} (38) / V_{OUT} (41), \\ &V_{OUT} (41) / V_{OUT} (33) \end{aligned}$$

**V<sub>C1</sub> Main Contrast Control Characteristics1**

Measuring the amplitude output at OUT (33, 38, 41). The measured value is called VOUT (33, 38, 41). Main contrast control characteristics V<sub>C1</sub> is calculated by the equation below:

$$V_{C1} = 20 \log \frac{V_{OUT}}{0.7} \quad (\text{dB})$$

**ΔV<sub>C1</sub> Main Contrast Control Relative Characteristics1**

Relative characteristics ΔV<sub>C1</sub> is calculated by the equation below:

$$\begin{aligned} \Delta V_{C1} &= V_{OUT} (33) / V_{OUT} (38) , \\ &V_{OUT} (38) / V_{OUT} (41) , \\ &V_{OUT} (41) / V_{OUT} (33) \end{aligned}$$

**V<sub>C2</sub> Main Contrast Control Characteristics2**

Measuring condition and procedure are the same as described in V<sub>C1</sub>.

**ΔV<sub>C2</sub> Main Contrast Control Relative Characteristics2**

Measuring condition and procedure are the same as described in ΔV<sub>C1</sub>.

**V<sub>C3</sub> Main Contrast Control Characteristics3**

Measure the amplitude output at OUT (33, 38, 41). The measured value is called VOUT (33, 38, 41).

**ΔV<sub>C3</sub> Main Contrast Control Relative Characteristics3**

Measuring condition and procedure are the same as described in ΔV<sub>C1</sub>.

**V<sub>SC1</sub> Sub Contrast Control Characteristics1**

Measure the amplitude output at OUT (33, 38, 41). The measured value is called VOUT (33, 38, 41).

Sub contrast control characteristics V<sub>SC1</sub> is calculated by the equation below:

$$V_{SC1} = 20 \log \frac{V_{OUT}}{0.7} \quad (\text{dB})$$

**ΔV<sub>SC1</sub> Sub Contrast Control Relative Characteristics1**

Relative characteristics ΔV<sub>SC1</sub> is calculated by the equation below:

$$\begin{aligned} \Delta V_{SC1} &= V_{OUT} (33) / V_{OUT} (38), \\ &V_{OUT} (38) / V_{OUT} (41), \\ &V_{OUT} (41) / V_{OUT} (33). \end{aligned}$$

**V<sub>SC2</sub> Sub Contrast Control Characteristics2**

Measuring condition and procedure are the same as described in V<sub>SC1</sub>.

**ΔV<sub>SC2</sub> Sub Contrast Control Relative Characteristics2**

Measuring condition and procedure are the same as described in ΔV<sub>SC1</sub>.

**V<sub>SC3</sub> Sub Contrast Control Characteristics3**

Measure the amplitude output at OUT (33, 38, 41). The measured value is called VOUT (33, 38, 41).

**ΔV<sub>SC3</sub> Sub Contrast Control Relative Characteristics3**

Measuring condition and procedure are the same as described in ΔV<sub>SC1</sub>.

**VMSC Main/sub Contrast Control Characteristics**

Measure the amplitude output at OUT (33, 38, 41). The measured value is called VMSC.

 **$\Delta$ VMSC Main/sub Contrast Control Relative Characteristics**

Relative characteristics  $\Delta$ VMSC is calculated by the equation below:

$$\begin{aligned} \Delta\text{VMSC} = & \text{VOUT (33)} / \text{VOUT (38)}, \\ & \text{VOUT (38)} / \text{VOUT (41)}, \\ & \text{VOUT (41)} / \text{VOUT (33)}. \end{aligned}$$

**ABL1 ABL Control Characteristics1**

Measure the amplitude output at OUT (33, 38, 41). The measured value is called VOUT (33, 38, 41), and is treated as ABL1.

 **$\Delta$ ABL1 ABL Control Relative Characteristics1**

Relative characteristics  $\Delta$ ABL1 is calculated by the equation below:

$$\begin{aligned} \Delta\text{ABL1} = & \text{VOUT (33)} / \text{VOUT (38)}, \\ & \text{VOUT (38)} / \text{VOUT (41)}, \\ & \text{VOUT (41)} / \text{VOUT (33)}. \end{aligned}$$

**ABL2 ABL Control Characteristics2**

Measuring condition and procedure are the same as described in ABL1.

 **$\Delta$ ABL2 ABL Control Relative Characteristics2**

Measuring condition and procedure are the same as described in  $\Delta$ ABL1.

 **$V_{B1}$  Brightness Control Characteristics1**

Measure the DC voltage at OUT (33, 38, 41) with a voltmeter. The measured value is called VOUT (33, 38, 41), and is treated as  $V_{B1}$ .

 **$\Delta V_{B1}$  Brightness Control Relative Characteristics1**

Relative characteristics  $\Delta V_{B1}$  is calculated by the difference in the output between the channels.

$$\begin{aligned} \Delta V_{B1} = & \text{VOUT (33)} - \text{VOUT (38)}, \\ & \text{VOUT (38)} - \text{VOUT (41)}, \\ & \text{VOUT (41)} - \text{VOUT (33)}. \end{aligned}$$

 **$V_{B2}$  Brightness Control Characteristics2**

Measuring condition and procedure are the same as described in  $V_{B1}$ .

 **$\Delta V_{B2}$  Brightness Control Relative Characteristics2**

Measuring condition and procedure are the same as described in  $\Delta V_{B1}$ .

 **$V_{B3}$  Brightness Control Characteristics3**

Measuring condition and procedure are the same as described in  $V_{B1}$ .

 **$\Delta V_{B3}$  Brightness Control Relative Characteristics3**

Measuring condition and procedure are the same as described in  $\Delta V_{B1}$ .

**F<sub>C1</sub> Frequency Characteristics1 (f = 50 MHz)**

First, SG3 to 1 MHz is as input signal. Input a resistor that is about 2 kΩ to offer the voltage at input pins (2, 6, 11) in order that the bottom of input signal is 2.5 V.

Control the main contrast in order that the amplitude of sine wave output is 4.0 V<sub>P-P</sub>.

Control the brightness in order that the bottom of sine wave output is 2.0 V<sub>P-P</sub>.

By the same way, measure the output amplitude when SG3 to 50 MHz is as input signal.

The measured value is called VOUT (33, 38, 41). Frequency characteristics F<sub>C1</sub> (33, 38, 41) is calculated by the equation below:

$$F_{C1} = 20 \log \frac{V_{OUT} V_{P-P}}{\text{Output amplitude when inputted SG3 (1 MHz): } 4.0 V_{P-P}} \quad (\text{dB})$$

**ΔF<sub>C1</sub> Frequency Relative Characteristics1 (f = 50 MHz)**

Relative characteristics ΔF<sub>C1</sub> is calculated by the difference in the output between the channels.

**F<sub>C1'</sub> Frequency Characteristics1 (f = 180 MHz)**

Measuring condition and procedure are the same as described in F<sub>C1</sub>, expect SG3 to 180 MHz.

**ΔF<sub>C1'</sub> Frequency Relative Characteristics1 (f = 180 MHz)**

Relative characteristics ΔF<sub>C1'</sub> is calculated by the difference in the output between the channels.

**F<sub>C2</sub> Frequency Characteristics2 (f = 180 MHz)**

SG3 to 1 MHz is as input signal. Control the main contrast in order that the amplitude of sine wave output is 1.0 V<sub>P-P</sub>. By the same way, measure the output amplitude when SG3 to 150 MHz is as input signal.

The measured value is called VOUT (33, 38, 41).

Frequency characteristics F<sub>C2</sub> (33, 38, 41) is calculated by the equation below:

$$F_{C2} = 20 \log \frac{V_{OUT} V_{P-P}}{\text{Output amplitude when inputted SG3 (1 MHz): } 4.0 V_{P-P}} \quad (\text{dB})$$

**ΔF<sub>C2</sub> Frequency Relative Characteristics2 (f = 180 MHz)**

Relative characteristics ΔF<sub>C2</sub> is calculated by the difference in the output between the channels.

**C.T.1 Crosstalk1 (f = 50 MHz)**

Input SG3 (50 MHz) to pin 2 only, and then measure the waveform amplitude output at OUT (33, 38, 41). The measured value is called VOUT (33, 38, 41). Crosstalk C.T.1 is calculated by the equation below:

$$C.T.1 = 20 \log \frac{V_{OUT} (33, 38)}{V_{OUT} (41)} \quad (\text{dB})$$

**C.T.1' Crosstalk1 (f = 180 MHz)**

Measuring condition and procedure are the same as described in C.T.1, expect SG3 to 180 MHz.

**C.T.2 Crosstalk2 (f = 50 MHz)**

Input SG3 (50 MHz) to pin 6 only, and then measure the waveform amplitude output at OUT (33, 38, 41).

The measured value is called VOUT (33, 38, 41). Crosstalk C.T.2 is calculated by the equation below:

$$C.T.2 = 20 \log \frac{V_{OUT} (33, 41)}{V_{OUT} (38)} \quad (\text{dB})$$

**C.T.2' Crosstalk2 (f = 180 MHz)**

Measuring condition and procedure are the same as described in C.T.2, expect SG3 to 180 MHz.

**C.T.3 Crosstalk3 (f = 50 MHz)**

Input SG3 (50 MHz) to pin 11 only, and then measure the waveform amplitude output at OUT (33, 38, 41).

The measured value is called VOUT (33, 38, 41). Crosstalk C.T.3 is calculated by the equation below:

$$C.T.3 = 20 \log \frac{V_{OUT} (38, 41)}{V_{OUT} (33)} \quad (\text{dB})$$

**C.T.3' Crosstalk3 (f = 180 MHz)**

Measuring condition and procedure are the same as described in C.T.3, expect SG3 to 180 MHz.

**Tr Pulse Characteristics1 (3 V<sub>P-P</sub>)**

Control the main contrast (00H) in order that the amplitude of output signal is 3.0 V<sub>P-P</sub>.

Control the brightness (V34) in order that the Black level of output signal is 2.0 V.

Measure the time needed for the input pulse to rise from 10% to 90% (Tr1) and for the output pulse to rise from 10% to 90% (Tr2) with an active probe.

Pulse characteristics Tr is calculated by the equations below:

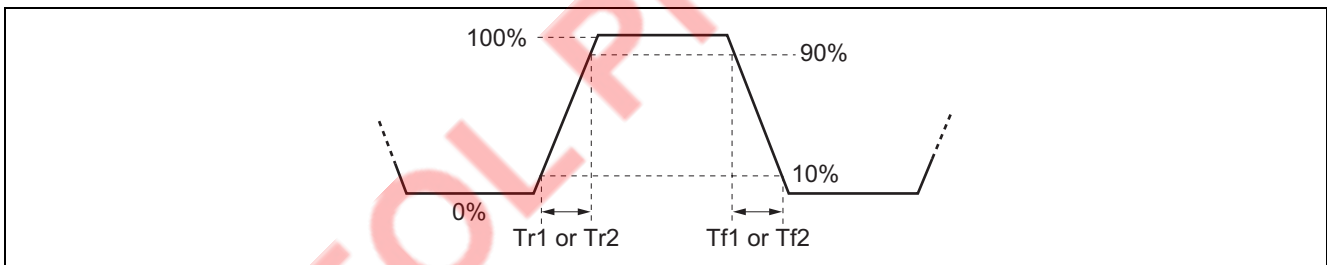
$$Tr = \sqrt{(Tr2)^2 - (Tr1)^2} \quad (\text{ns})$$

**Tf Pulse Characteristics2 (3 V<sub>P-P</sub>)**

Measure the time needed for the input pulse to fall from 90% to 10% (Tf1) and for the output pulse to fall from 90% to 10% (Tf2) with an active probe.

Pulse characteristics Tf is calculated by the equations below:

$$Tf = \sqrt{(Tf2)^2 - (Tf1)^2} \quad (\text{ns})$$

**VthCP Clamp Pulse Threshold Voltage**

Turn down the SG5 input level gradually from 5.0 V<sub>P-P</sub>, monitoring the waveform output.

Measure the top level of input pulse when the output pedestal voltage turn decrease with unstable.

**WCP Clamp Pulse Minimum Width**

Decrease the SG5 pulse width gradually from 0.5 μs, monitoring the output. Measure the SG5 pulse width (a point of 1.5 V) when the output pedestal voltage turn decrease with unstable.

**OTr OSD Pulse Characteristics1**

Measure the time needed for the output pulse to rise from 10% to 90% (OTr) with an active probe.

**OTf OSD Pulse Characteristics2**

Measure the time needed for the output pulse to fall from 90% to 10% (OTf) with an active probe.

**Oaj1 OSD Adjust Control Characteristics1**

Measure the amplitude output at OUT (33, 38, 41). The measured value is called VOUT (33, 38, 41), and is treated as Oaj1.

**ΔOaj1 OSD Adjust Control Relative Characteristics1**

Relative characteristics ΔOaj1 is calculated by the equation below:

$$\begin{aligned}\Delta Oaj1 &= VOUT (33) / VOUT (38), \\ &VOUT (38) / VOUT (41), \\ &VOUT (41) / VOUT (33).\end{aligned}$$

**Oaj2 OSD Adjust Control Characteristics2**

Measuring condition and procedure are the same as described in Oaj1.

**ΔOaj2 OSD Adjust Control Relative Characteristics2**

Measuring condition and procedure are the same as described in ΔOaj1.

**Oaj3 OSD Adjust Control Characteristics3**

Measuring condition and procedure are the same as described in Oaj1.

**ΔOaj3 OSD Adjust Control Relative Characteristics3**

Measuring condition and procedure are the same as described in ΔOaj1.

**VthOSD OSD Input Threshold Voltage**

Reduce the SG6 input level gradually, monitoring output. Measure the SG6 level when the output reaches 0 V.

The measured value is called VthOSD.

**VthBLK OSD BLK Input Threshold Voltage**

Confirm that output signal is being blanked by the SG6 at the time.

Monitoring to output signal, decreasing the level of SG6. Measure the top level of SG6 when the blanking period is disappeared. The measured value is called VthBLK.

**HBLK1 Retrace BLK Characteristics1**

Measure the amplitude output is blanked by the SG7 at OUT (33, 38, 41).

The measured value is called VOUT (33, 38, 41), and is treated as HBLK1.

**VthRET Retrace BLK Input Threshold Voltage**

Confirm that output signal is being blanked by the SG7 at the time.

Monitoring to output signal, decreasing the level of SG7. Measure the top level of SG7 when the blanking period is disappeared. The measured value is called VthRET.

**SS-NV SOG Input Maximum Noise Voltage**

The sync's amplitude of SG4 be changed all white into all black, increase from 0 V<sub>P-P</sub> to 0.02 V<sub>P-P</sub>. No pulse output permitted.

**SS-SV SOG Minimum Input Voltage**

The sync's amplitude of SG4 be changed all white or all black, decrease from 0.3 V<sub>P-P</sub> to 0.2 V<sub>P-P</sub>. Confirm no malfunction produced by noise.

**VSH Sync Output High level**

Measure the high voltage at SyncOUT. The measured value is treated as VSH.

**VSL Sync Output Low Level**

Measure the low voltage at SyncOUT. The measured value is treated as VSL.

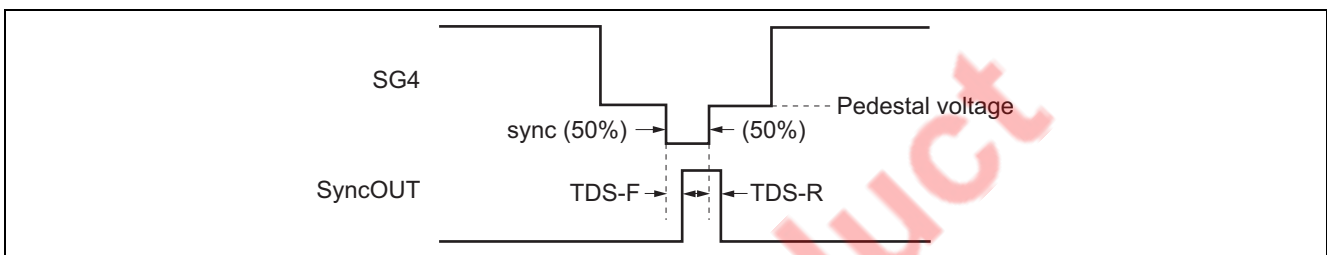
**TDS-F Sync Output Delay Time1**

SyncOUT becomes High with sync part of SG4.

Measure the time needed for the rear edge of SG4 sync to fall from 50% and for SyncOUT to rise from 50% with an active probe. The measured value is treated as TDS-F, less than 90 ns.

**TDS-R Sync Output Delay Time2**

Measure the time needed for the rear edge of SG4 sync to rise from 50% and for SyncOUT to fall from 50% with an active probe. The measured value is treated as TDS-R, less than 90 ns.

**VOH D/A H Output Voltage**

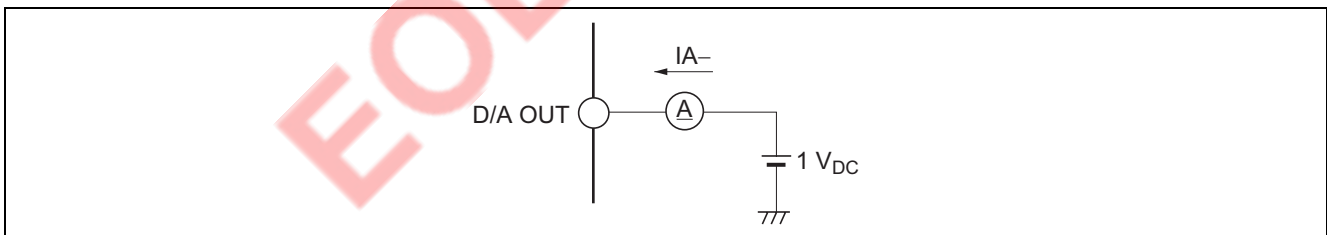
Measure the DC voltage at D/A OUT. The measured value is treated as VOH.

**VOL D/A L Output Voltage**

Measure the DC voltage at D/A OUT. The measured value is treated as VOL.

**IA- D/A OUT Input Current**

IA- is minimum input-current when input 1 V<sub>DC</sub> to D/A OUT

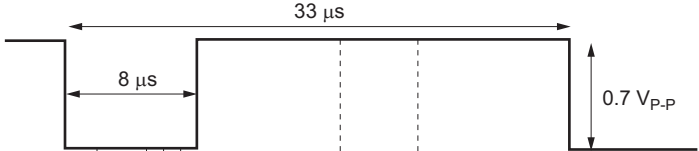
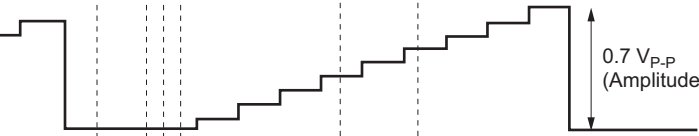
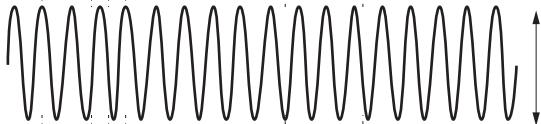
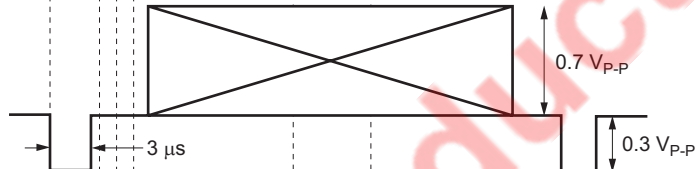
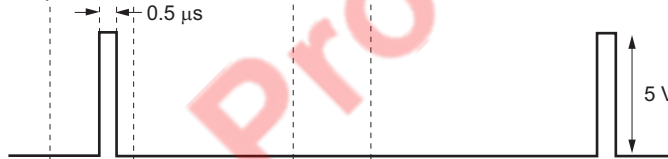
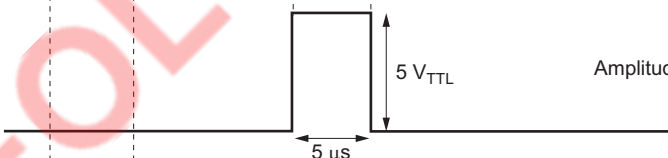

**IA+ D/A OUT Output Current**

IA+ is maximum output-current from D/A OUT

**DNL D/A Nonlinearity**

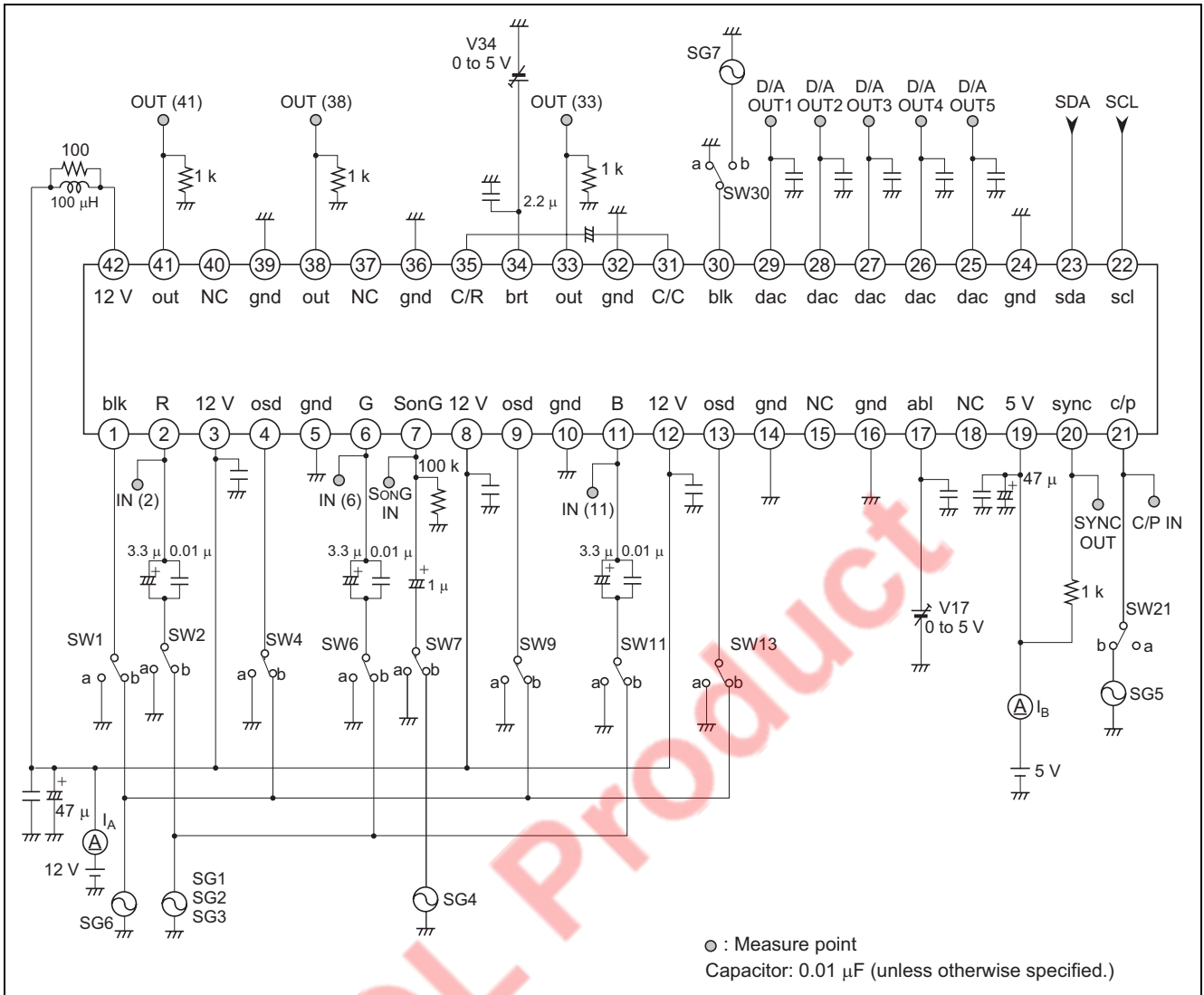
The difference of differential non-linearity of D/A OUT must be less than  $\pm 1.0$  LSB.



SG No.	Signals
<p>SG1 Video signal (all white)</p>	<p>Pulse with amplitude of <math>0.7 V_{P-P}</math> (<math>f = 30 \text{ kHz}</math>). Video width of <math>25 \mu\text{s}</math>. (75%)</p> 
<p>SG2 Video signal (step wave)</p>	
<p>SG3 Sine wave (for freq. char.)</p>	
<p>SG4 Video signal (all white, all black)</p>	<p>Video width of <math>25 \mu\text{s}</math>. (75%)</p>  <p>all white or all black variable. Sync's amplitude is variable.</p>
<p>SG5 Clamp pulse</p>	<p>Pulse width and amplitude are variable.</p> 
<p>SG6 OSD pulse</p>	 <p>Amplitude is variable.</p>
<p>SG7 BLK pulse</p>	 <p>Amplitude is variable.</p>

Note:  $f = 30 \text{ kHz}$

Test Circuit



Pin Description

Pin No.	Name	DC Voltage (V)	Peripheral Circuit	Function
1	OSD BLK IN	—		<p>Input pulses</p> <p>Connected to GND if not used.</p>
2 6 11	INPUT (R) INPUT (G) INPUT (B)	2.5		<p>Clamped to about 2.5 V due to clamp pulses from pin 21. Input at low impedance.</p>
3 8 12	V <sub>CC1</sub> (R) V <sub>CC1</sub> (G) V <sub>CC1</sub> (B)	12	—	<p>Apply equivalent voltage to 3 channels.</p>
4 9 13	OSD IN (R) OSD IN (G) OSD IN (B)	—		<p>Input pulses</p> <p>Connected to GND if not used.</p>
5 10 14 16 24 32 36 39	GND1 (R) GND1 (G) GND GND1 (B) GND (5 V) GND GND GND 2	GND	—	—

Pin Description (cont.)

Pin No.	Name	DC Voltage (V)	Peripheral Circuit	Function
7	INPUT (S on G)	When open 2.5 V		<p>SYNC ON VIDEO input pin. Sync is negative. Input signal at pin 7, compare with the reference voltage of internal circuit in order to separate sync signal from Sync on Green signal.</p>
17	ABL IN	When open 2.5 V		<p>ABL (Automatic Beam Limiter) input pin. Recommended voltage range is 0 to 5 V. When ABL function is not used, set to 5 V.</p>
15 18 37 40	NC	—	—	—
19	V <sub>CC</sub> (5 V)	5	—	—
20	SonG Sep OUT	—		<p>Sync signal output pin, being of open collector output type.</p>

EOL Product

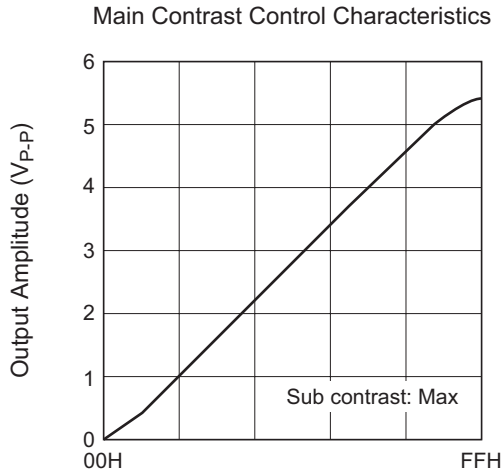
Pin Description (cont.)

Pin No.	Name	DC Voltage (V)	Peripheral Circuit	Function
21	Clamp Pulse IN	—		Input pulses  Input at low impedance
22	SCL	—		SCL of I <sup>2</sup> C BUS (Serial clock line) $V_{TH} = 2.3 V$
23	SDA	—		SDA of I <sup>2</sup> C BUS (Serial data line) $V_{TH} = 2.3 V$
25 26 27 28 29	D/A OUT	—		D/A output pin. Output voltage range is 0 to 5 V. Min input current is 0.18 mA when D/A output pin is 1 V. Max output current is 1.0 mA.

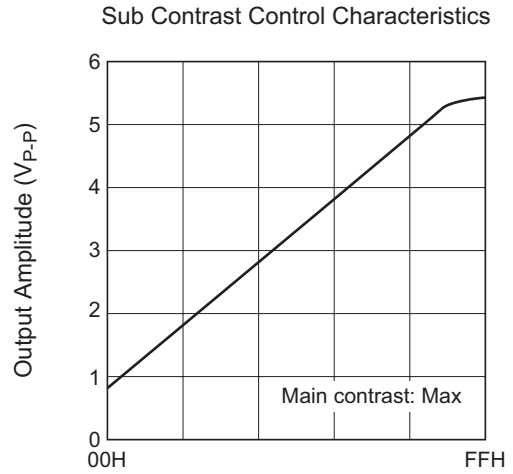
Pin Description (cont.)

Pin No.	Name	DC Voltage (V)	Peripheral Circuit of Pin	Description of Function
30	Retrace BLK IN	—		Input pulses  Connected to GND if not used.
31  35	Main Contrast Cont  Main Contrast Ref	3.5 to 5.5  4.5		Non-polar capacitance is required between pin 31 and pin 35.
33 38 41	OUTPUT (B) OUTPUT (G) OUTPUT (R)	Variable		A resistor is needed on the GND side. Set discretionaly to maximum 15 mA, depending on the required driving capacity.
42	V <sub>CC2</sub>	12		Used to supply power to output emitter follower only.
34	Main Brightness	—		It is recommended that the IC be used between pedestal voltage 2 V and 3 V.

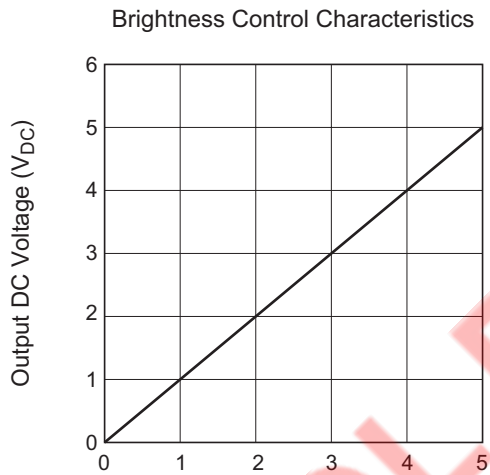
Typical Characteristics



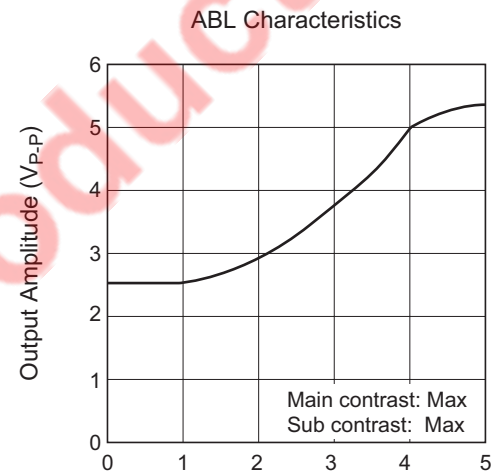
Main Contrast Control Data



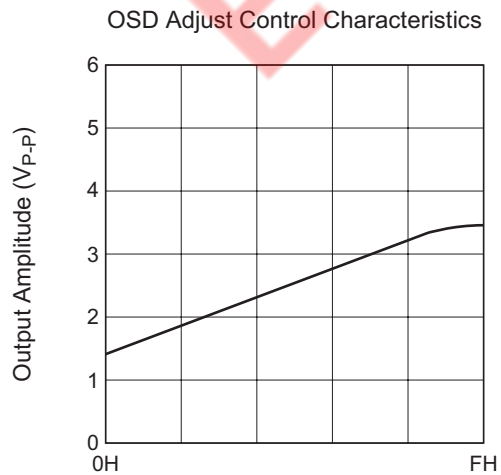
Sub Contrast Control Data



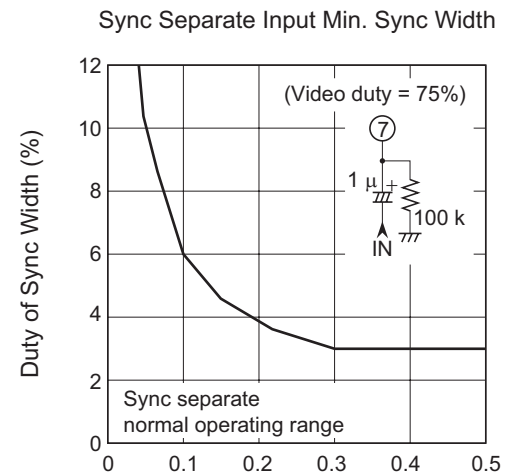
Brightness Control Voltage ( $V_{DC}$ )



ABL Control Voltage ( $V_{DC}$ )



OSD Adjust Control Data



Input Amplitude ( $V_{P-P}$ )

## Application Method for M52749FP

### Clamp Pulse Input

Clamp pulse width is recommended

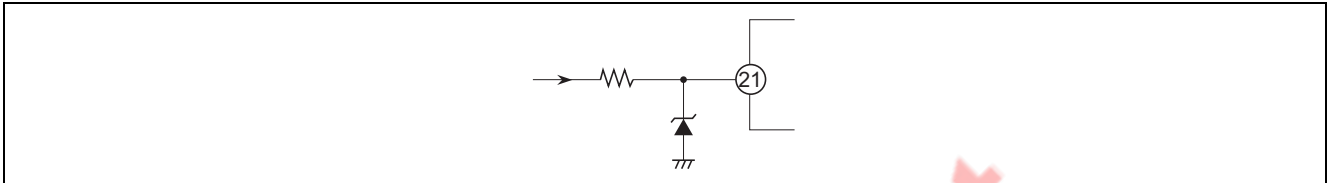
above 15 kHz, 1.0  $\mu$ s

above 30 kHz, 0.5  $\mu$ s

above 64 kHz, 0.3  $\mu$ s

The clamp pulse circuit in ordinary set is a long round about way, and beside high voltage, sometimes connected to external terminal, it is very easy affected by large surge.

Therefore, the figure shown below is recommended.



### Notice of Application

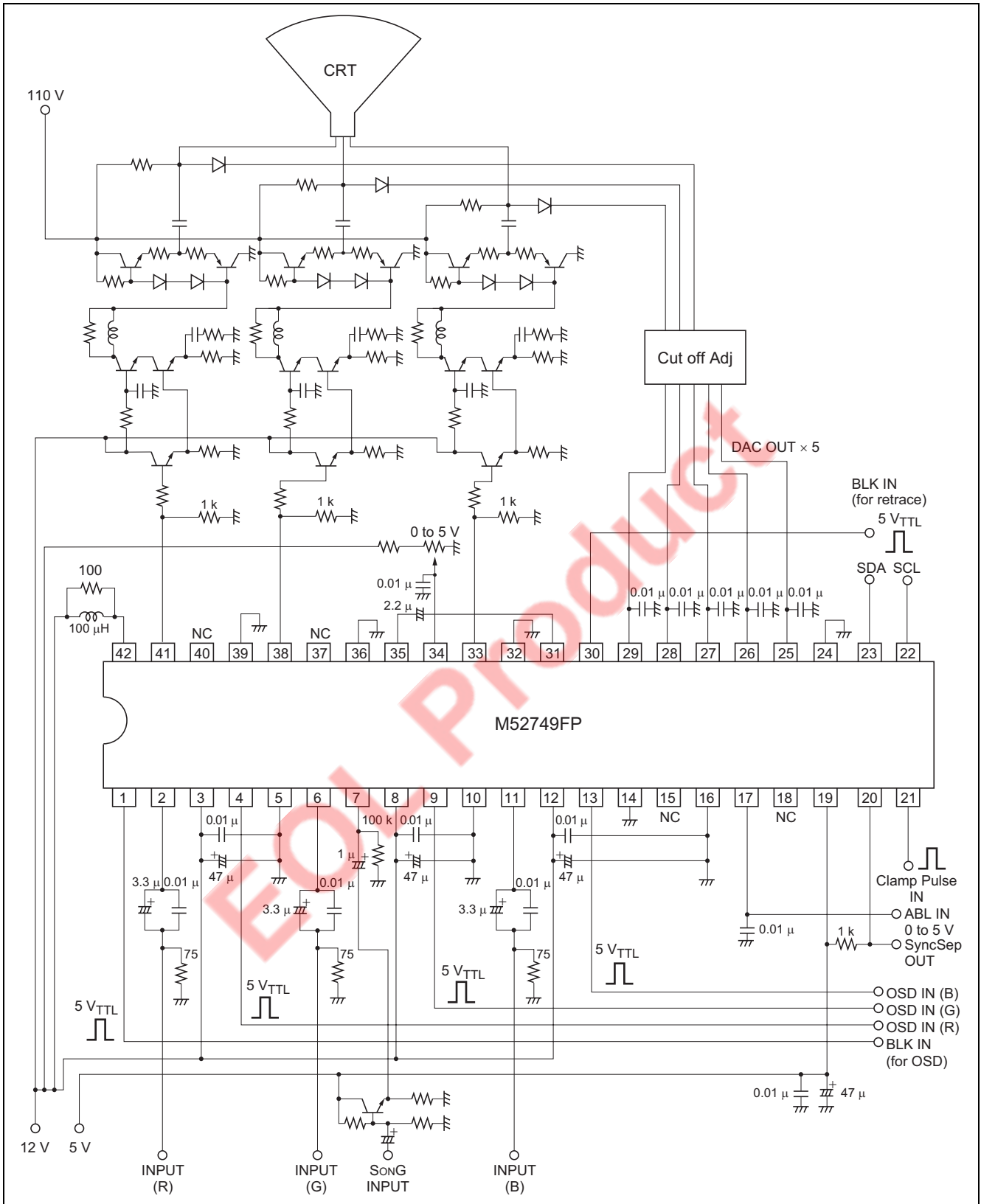
Make the nearest distance between output pin and pull down resistor.

Recommended pedestal voltage of IC output signal is 2 V.

EOL Product

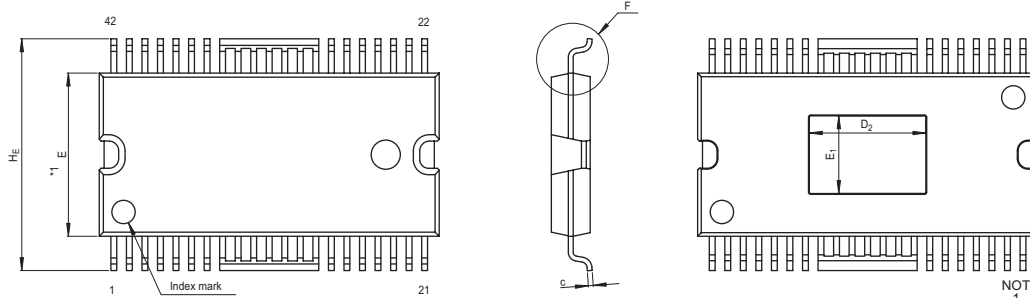


Application Example

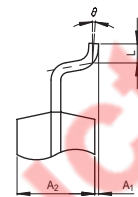
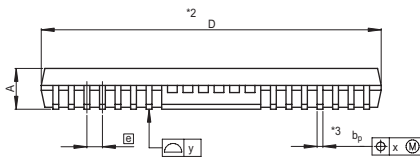


### Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-HSSOP42-8.4x17.5-0.80	PRSP0042GB-A	42P9R-A	0.7g



NOTE)  
 1. DIMENSIONS \*\*1\* AND \*\*2\* DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION \*\*3\* DOES NOT INCLUDE TRIM OFFSET.



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	17.3	17.5	17.7
E	8.2	8.4	8.6
A <sub>2</sub>	—	2.0	—
A	—	—	2.2
A <sub>1</sub>	0	0.1	0.2
b <sub>p</sub>	0.27	0.32	0.37
c	0.23	0.25	0.3
θ	0°	—	10°
H <sub>E</sub>	11.63	11.93	12.23
Ⓜ	—	0.8	—
x	—	—	0.12
y	—	—	0.10
L	0.3	0.5	0.7
D <sub>2</sub>	5.8	6.0	6.2
E <sub>1</sub>	3.8	4.0	4.2

EOL Product

Notes:

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