M52338FP

INTERFACE IC FOR ACTIVE MATRIX LIQUID CRYSTAL PANEL

DESCRIPTION

The M52338FP is a semiconductor integrated circuit containing an interface circuit which is necessary to drive an active matrix liquid crystal panel.

FEATURES

- γ correction circuit is built in to correct non-linearity of luminance characteristics caused by applied voltage which is peculiar to a liquid crystal panel.
- By combining with Mitsubishi video/chroma signal processing ICs, M52042FP (NTSC) and M52045FP (PAL), low cost and optimal system configuration is possible.

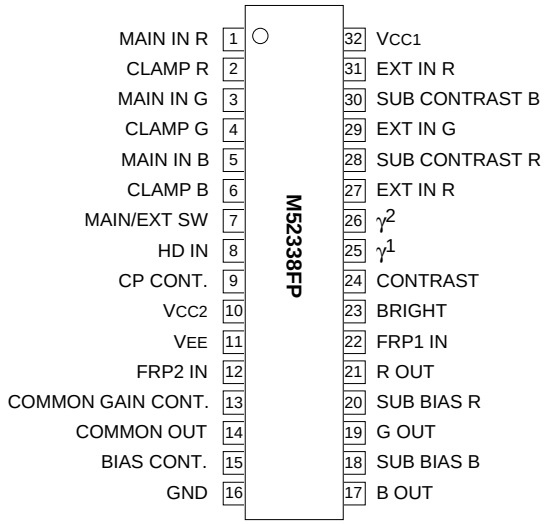
APPLICATION

Active matrix liquid crystal color television

RECOMMENDED OPERATING CONDITION

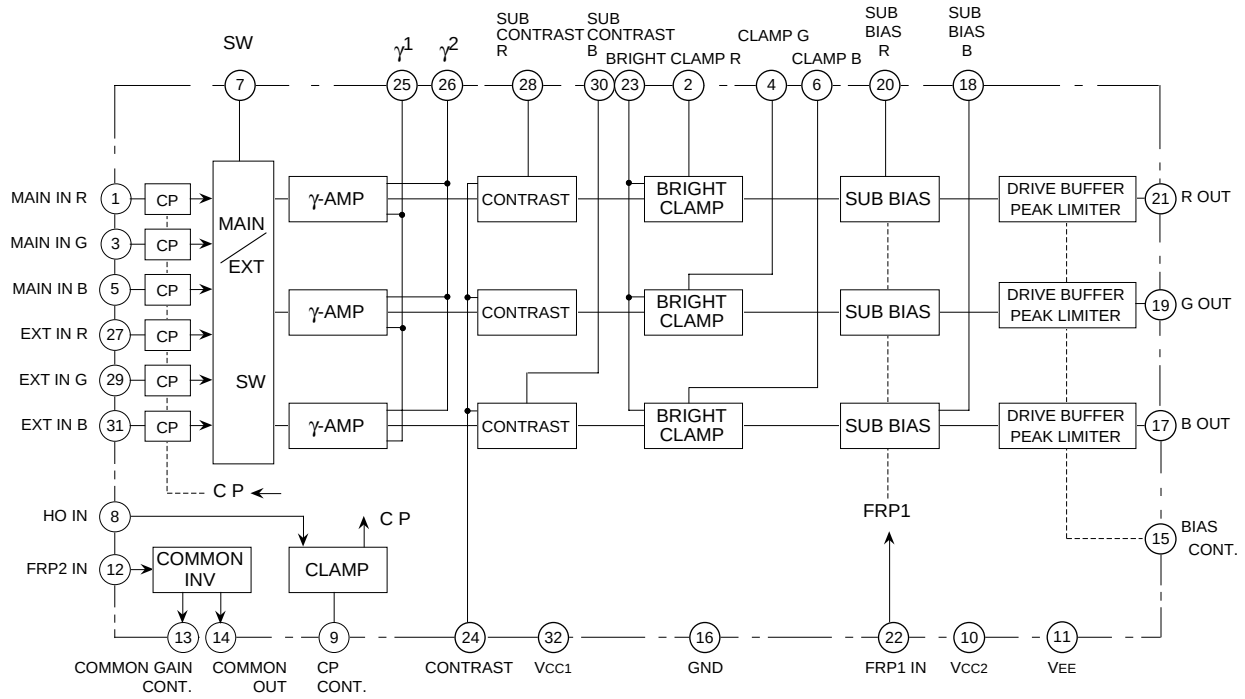
Supply voltage		Operating supply voltage	Recommended supply voltage
GND=0V, V_{CC1}=V_{CC2}	V_{CC1}	4.0 to 5.5V	4.5V
	V_{CC2}		
	V_{EE}	-7.0 to 8.5V	-7.5V

PIN CONFIGURATION (TOP VIEW)



Outline 32P2U-B

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta= 25˚C unless otherwise noted)

Symbol	Parameter	Ratings	Unit
V_{CC1}	Supply voltage 1	5.0	V
V_{CC2}	Supply voltage 2	5.5	V
V_{EE}	Supply voltage 3	-8.5	V
P_d	Power dissipation	580	mW
T_{opr}	Operating temperature	- 20 to +70	˚C
T_{stg}	Storage temperature	- 55 to +150	˚C
V_{max}	Electrostatic discharge	±200	V

ELECTRICAL CHARACTERISTICS

(V_{CC1} = V_{CC2} =4.5V, V_{EE} = 7.5V, Ta = 25˚C , HD pulse must be input, unless otherwise noted)

Symbol	Parameter	Test point	Input point	Input SG	Test conditions												Note (FRP1)	Limits			Unit
					P7	Pg	P13	P15	P18	P20	P23	P24	P25	P26	P28	P30		Min.	Typ.	Max.	
I_{CC1}	Circuit current 1	P32	—	—														—	36	45	mA
I_{CC2}	Circuit current 2	P10	—	—														—	26	30	mA
comin 1	Minimum common output 1	P14	P12	FRP2			4.5											1.0	1.2	2.0	V_{P-P}
cominT1	Minimum common center voltage level 1	P14	P12	FRP2			4.5											-1.65	-1.45	-1.25	V
comax1	Maximum common output 1	P14	P12	FRP2			GND											8.0	8.8	9.5	V_{P-P}
comaxT1	Maximum common center voltage level 1	P14	P12	FRP2			GND											-1.65	-1.45	-1.25	V
cothH1	Common through rate 1 (rising)	P14	P12	FRP2			GND											1.1	1.35	—	V/µsec
cothL1	Common through rate 1 (falling)	P14	P12	FRP2			GND											1.1	1.35	—	V/µsec
MA1	Maximum input level A1	P17 P19 P21	P1 P3 P5	Y								1.0V	4.5V	4.5V			4.5V	2.7	3.0	3.3	V_{P-P}
MOA1	Offset 1 among channels at maximum input level A																	—	0.0	200	mV
MB1	Maximum input level B1	P17 P19 P21	P1 P3 P5	Y								1.0V	4.5V	4.5V			GND	2.7	3.0	3.3	V_{P-P}
MOB1	Offset 1 among channels at maximum input level B																	—	0.0	200	mV
M1	Maximum input level difference 1																GND / 4.5V	—	0.0	300	mV_{P-P}
P11	Pedestal voltage level 11	P17 P19 P21	P1 P3 P5	Y								GND	4.5V	4.5V			4.5V	-4.90	-4.25	-3.90	V
PO11	Offset 1 among channels at pedestal voltage level 1																	—	0.0	300	mV
P21	Pedestal voltage level 21	P17 P19 P21	P1 P3 P5	Y								GND	4.5V	4.5V			GND	0.10	0.75	1.10	V
PO21	Offset 1 among channels at pedestal voltage level 2																	—	0.0	300	mV
S1	Center output voltage level 1																	-2.40	-1.75	-1.60	V
SO1	Offset 1 among channels at center output voltage level																	—	0.0	150	mV
A1	Output amplitude A1	P17 P19 P21	P1 P3 P5	Y								1.5V	4.5V	4.5V			4.5V	2.5	2.9	3.4	V_{P-P}
OA1	Offset 1 among channels at output amplitude A																	—	0.0	200	mV

ELECTRICAL CHARACTERISTICS (cont.)

Symbol	Parameter	Test point	Input point	Input SG	Test conditions												Note (FRP1)	Limits			Unit
					P7	Pg	P13	P15	P18	P20	P23	P24	P25	P26	P28	P30		Min.	Typ.	Max.	
B1	Output amplitude B1	P17 P19 P21	P1 P3 P5	Y								1.5V	4.5V	4.5V			GND	8.5	2.9	3.4	V_{P-P}
OB1	Offset 1 among channels at output amplitude B																	—	0.0	200	mV
L1	Linearity 1																GND / 4.5V	-100	0.0	100	V_{P-P}
W11	White balance 1	P17 P19 P21	P1 P3 P5	Y								4.5V	4.5V	4.5V			4.5V	0.3	0.5	0.7	mV
WO11	Offset 1 among channels at white balance 1																	—	0.0	100	V
W21	White balance 2	P17 P19 P21	P1 P3 P5	Y								4.5V	4.5V	4.5V			GND	-3.85	-3.65	-3.55	V
WO21	Offset 1 among channels at white balance 2																	—	0.0	100	mV
γ11	γ1 control 1	P17 P19 P21	P1 P3 P5	Y								1.5V	1.0V	4.5V			4.5V	7.5	9.0	10.5	dB
γ12	γ1 control 2	P17 P19 P21	P1 P3 P5	Y								1.5V	1.0V	4.5V			4.5V	5.0	6.5	7.5	dB
γ21	γ2 control 1	P17 P19 P21	P1 P3 P5	Y								1.5V	4.5V	1.0V			4.5V	2.0	3.0	4.0	dB
γ22	γ2 control 2	P17 P19 P21	P1 P3 P5	Y								1.5V	4.5V	1.0V			4.5V	3.0	4.0	5.0	dB
COmin1	Contrast control 1 (contrast=GND)	P17 P19 P21	P1 P3 P5	Y								GND	4.5V	4.5V			4.5V	—	0.0	30	mV_{P-P}
COopen1	Contrast control 1 (contrast=open)	P17 P19 P21	P1 P3 P5	Y									4.5V	4.5V			4.5V	1.00	1.30	1.60	V_{P-P}
COmax1	Contrast control 1 (contrast=4.5V)	P17 P19 P21	P1 P3 P5	Y								4.5V	4.5V	4.5V			4.5V	2.0	2.5	2.8	V_{P-P}
COmaxG1	Contrast control Max gain 1																4.5V	20	22	24	dB
COmina	Contrast control a (contrast=GND)	P17 P19 P21	P1 P3 P5	Y								GND	4.5V	4.5V			GND	—	0.0	30	mV_{P-P}
COopena	Contrast control a (contrast=open)	P17 P19 P21	P1 P3 P5	Y									4.5V	4.5V			GND	1.00	1.30	1.60	V_{P-P}
COmaxa	Contrast control a (contrast=4.5V)	P17 P19 P21	P1 P3 P5	Y								4.5V	4.5V	4.5V			GND	2.0	2.5	2.8	V_{P-P}
COmaxa	Contrast control Max gain a																GND	20	22	24	dB
COminO1	Non-inverted/inverted contrast control offset 1 (contrast=4.5V)																GND / 4.5V	-0.3	0.0	0.3	dB
COmaxO1	Non-inverted/inverted contrast control offset 1 (contrast=GND)																GND / 4.5V	-25	0.0	25	mV
COA1	Non-inverted contrast control offset 1 among channels (contrast=4.5V)																4.5V	-0.3	0.0	0.3	dB
COB1	Inverted contrast control offset 1 among channels (contrast=4.5V)																GND	-0.3	0.0	0.3	dB
SCmin 1	Sub contrast control 1 (sub contrast=GND)	P17 P21	P1 P5	Y								1.0V	4.5V	4.5V	GND	..... GND	4.5V	3.8	4.1	4.4	V_{P-P}

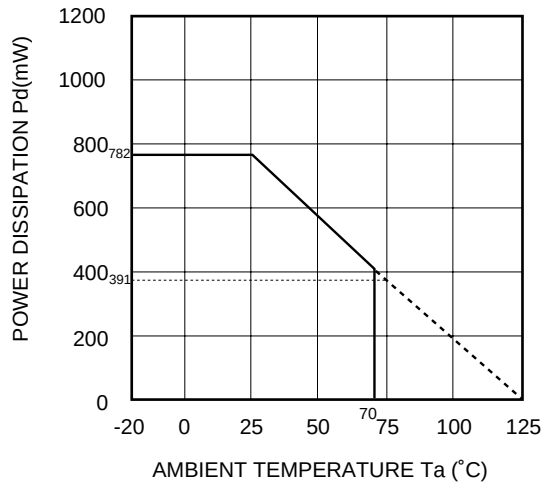
ELECTRICAL CHARACTERISTICS (cont.)

Symbol	Parameter	Test point	Input point	Input SG	Test conditions P7	Pg	P13	P15	P18	P20	P23	P24	P25	P26	P28	P30	Note (FRP1)	Limits Min.	Typ.	Max.	Unit
SCmax1	Sub contrast control 1 (sub contrast=4.5V)	P17 P21	P1 P5	Y								1.0V	4.5V	4.5V	4.5V 4.5V		4.5V	1.45	1.75	1.95	V_{P-P}
SC1	Sub contrast control variance 1																	2.10	2.45	2.80	V
BRmin1	Brightness control 1 (bright=GND)	P17 P19 P21	P1 P3 P5	Y							GND	GND	4.5V	4.5V			IN	-8.7	-8.1	-7.5	V_{P-P}
BRopen1	Brightness control 1 (bright=open)	P17 P19 P21	P1 P3 P5	Y								GND	4.5V	4.5V			IN	-5.5	-4.8	-4.2	V_{P-P}
BRmax1	Brightness control 1 (bright=4.5V)	P17 P19 P21	P1 P3 P5	Y							4.5V	GND	4.5V	4.5V			IN	3.3	3.6	3.9	V_{P-P}
BR1	Brightness control variance 1																	10.5	11.5	12.5	V
BRmin1	Brightness control offset 1 among channels (bright=GND)																	0.0	0.0	300	mV_{P-P}
BRmax1	Brightness control offset 1 among channels (bright=4.5V)																	0.0	0.0	300	mV_{P-P}
SBmiR1	Sub bias control 1 (sub bias=GND)	P17 P21	P1 P5	Y						GND ..... GND		GND	4.5V	4.5V			IN	-7.25	-7.00	-6.30	V_{P-P}
SBmax1	Sub bias control 1 (sub bias=4.5V)	P17 P21	P1 P5	Y						4.5V 4.5V		GND	4.5V	4.5V			IN	-3.05	-2.70	-2.15	V_{P-P}
SB1	Sub bias control variance 1																	3.6	4.3	4.8	V
F11	Main frequency characteristics 11	P17 P19 P21	P1 P3 P5	SYNC+ SWEEP								1.5V	4.5V	4.5V			GND	4.5	5.5	—	MHz
F21	Main frequency characteristics 21	P17 P19 P21	P1 P3 P5	SYNC+ SWEEP								1.5V	4.5V	4.5V			4.5V	4.0	5.0	—	MHz
CC1	Cross talk 1 among channels	P17 P19 P21	P1 P3 P5	Y								1.5V	4.5V	4.5V			IN	—	—	-45	dB
CS1	Main/EXT cross talk 1	P17 P19 P21	P1 P3 P5	Y								1.5V	4.5V	4.5V			IN	—	—	-45	dB

Note 1: Limits equivalent to the above are guaranteed when pin 7 is connected to GND and the mode is changed to EXT.

TYPICAL CHARACTERISTICS

THERMAL DERATING (MAXIMAM RATING)



ELECTRICAL CHARACTERISTICS TEST METHOD

ICC1,ICC2 Circuit current 1, 2

Measure quiescent current flowing into pins ① and ⑩.

COmin1,COmax1 Common output 1

Input FRP2 and measure the output amplitude when voltage at pin ⑬ is changed to GND, and 4.5V.

COminT1,COmaxT1 Common center voltage level 1

Input FRP2 and measure the center voltage level of output waveform when voltage at pin ⑬ is changed to GND, and 4.5V.

cothH1,cothL1 Common through rate 1

Input FRP2 and measure through rates at rising point and falling point of the output waveform when voltage at pin ⑬ is connect-ed to GND.

MA1 Maximum input level A

Connect pin ㉒ to 4.5V and measure the non-inverted output amplitude between pedestal level and white level at pins ⑰, ⑲, and ㉑ when signal Y (1.5V_{P-P}) is input. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

MOA1 Offset among channels at maximum input level A

Based on the results of maximum input level A, calculate the difference in amplitude level among channels.

MB1 Maximum input level B

Connect pin ㉒ to GND and measure the inverted output amplitude between pedestal level and white level at pins ⑰, ⑲, and ㉑ when signal Y (1.5V_{P-P}) is input. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

MOB1 Offset among channels at maximum input level B

Based on the results of the maximum input level B, calculate the difference in amplitude level among channels.

M1 Maximum input level difference

Calculate difference in output amplitude between maximum input level A and level B of each channel.

P11 Pedestal voltage level 1

In inputting signal Y, measure output voltage at pins ⑰, ⑲, and ㉑ when pin ㉒ is 4.5V and pin ㉔ is grounded. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

PO11 Offset among channels at pedestal voltage level 1

Based on the results of pedestal voltage level 1, calculate offset among channels.

PO21 Pedestal voltage level 2

In inputting signal Y, measure output voltage at pins ⑰, ⑲, and ㉑ when voltage at pins ㉒ and ㉔ are connected to GND. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

PO21 Offset among channels at pedestal voltage level 2

Based on the results of pedestal voltage level 2, calculate offset among channels.

S1 Center output voltage level

Measure the center voltage level based on pedestal voltage levels 1 and 2 of each channel.

M=(pedestal voltage level 1 - pedestal voltage level 2) /2

SO1 Offset among channels at center output voltage level

Based on the result of center output voltage level, measure offset among channels.

A1 Output amplitude A

In inputting signal Y, measure non-inverted output amplitude between pedestal level and white level at pins ⑰, ⑲, and ㉑ when pin ㉒ is 4.5V and voltage at pin ㉔ is 1.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

OA1 Offset among channels at output amplitude A

Based on the results of output amplitude A, calculate the difference in output amplitude among channels.

B1 Output amplitude B

In inputting signal Y, measure non-inverted output amplitude between pedestal level and white level at pins ⑰, ⑲, and ㉑ when voltage at pin ㉒ is grounded and voltage at pin ㉔ is 1.5V. Also, measure in the same way as above, when pin ⑦ is connected to GND and the mode is changed to EXT.

OB1 Offset among channels at output amplitude B

Based on the results of output amplitude B, calculate the difference in output amplitude among channels.

L1 Linearity

Measure the difference in inverted/inverted output amplitude of the output waveform found as the results of output amplitude A and B. Also, measure in the same way as above, when pin ⑦ is connected to GND and the mode is changed to EXT.

W11 White balance 1

In inputting signal Y, measure white peak level of each channel when voltage at pin ㉒ and ㉔ are 4.5V (in the state that peak limiter work). Also, measure in the same way as above when pin ⑦ is connected to 4.5V and the mode is changed to EXT.

WO11 Offset among channels at white balance 1

Based on the results of white balance 1, measure offset among channels.

W21 White balance 2

In inputting signal Y, measure white peak level of each channel when pin ㉒ is grounded and voltage at pin ㉔ is 4.5V (in the state peak limiter works). Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

WO21 Offset among channels at white balance 2

Based on the results of white balance 2, measure offset among channels.

γ11,γ21 γ1 control

In inputting signal Y, compare the voltage difference between pedestal level and the first or second gradation of output signal Y when voltage at pin ㉒ is 4.5V, voltage at pin ㉔ is 1.5V and voltage at pin ㉕ is 1.0V with the difference when voltage at pin ㉕ is 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

γ21,γ22 γ2 control

In inputting signal Y, compare the voltage difference between the 9th or 8th gradation and white level of output signal Y when voltage at pin ㉒ is 4.5V, voltage at pin ㉔ is 1.5V, and voltage at pin ㉖ 1.0V with the difference when voltage at pin ㉖ is 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

COmin1,COopen1,COmax1 Contrast control 1

In inputting signal Y (0.2V_{P-P}), measure the amplitude of output signal of each channel when voltage at pin ㉒ is 4.5V and voltage at pin ㉔ is changed to GND, open, and 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

COmaxG1 Contrast control MAX gain 1

In inputting signal Y (0.2V_{P-P}), calculate the ratio of input signal amplitude to output amplitude of each channel when voltage at pins ㉒ and ㉔ are 4.5V.

M=20log (output amplitude/input amplitude)

COmina,COopena,COmaxa Contrast control a

In inputting signal Y (0.2V_{P-P}), measure the amplitude of output signal of each channel when pin ㉒ is grounded and voltage at pin ㉔ is changed to GND, open, and 4.5V. Also, measure in the same way as above, when pin ⑦ is connected to GND and the mode is changed to EXT.

COmaxa Contrast control MAX gain a

In inputting signal Y (0.2V_{P-P}), calculate the ratio of input signal amplitude to output amplitude of each channel when pin ㉒ is grounded and voltage at pin ㉔ is 4.5V.

M=20log (output amplitude/input amplitude)

COminO1 Non-inverted/inverted contrast control offset 1 (contrast=4.5V)

Compare values of contrast 1 and a of each channel measured when voltage at pin ㉔ is 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

COmaxO1 Non-inverted/inverted contrast control offset 1 (contrast=GND)

Compare values of contrast 1 and a of each channel measured when pin ㉔ is connected to GND. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

COA1 Non-inverted contrast control offset 1 among channels (contrast=4.5V)

Calculate the difference in amplitude of contrast 1 measured when voltage at pins ㉒ and ㉔ are 4.5V among channels. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

COB1 Inverted contrast control offset 1 among channels (contrast=4.5V)

Calculate the difference in amplitude of contrast a measured when pins ㉒ is grounded and voltage at pin ㉔ is 4.5V among channels. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

SCmin1,SCmax1 Sub contrast control

In inputting signal Y (0.2V_{P-P}), measure the output amplitude of Rch and Bch when voltage at pin ㉒ is 4.5V, voltage at pin ㉔ is 1.0V and voltage at pin ㉘ or ㉚ is changed to GND and 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

SC1 Sub contrast control variance

Based on the results of sub contrast control, calculate the variance.

BRmin1,BRopen1,BRmax1 Brightness control

In inputting signal Y and FRP1, measure of the output amplitude of each channel when pin ㉔ is grounded and voltage at pin ㉓ is changed to GND, open and 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

BR1 Brightness control variance

Based on the results of brightness control, calculate the variance of each channel.

BRmin1 Brightness control offset among channels

Calculate the difference in output amplitude of brightness measured when pins ㉔.and ㉓ are grounded among channels. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

BRmax1 Brightness control offset among channels

Calculate the difference in output amplitude of brightness measured when pin ㉔ is grounded and voltage at pin ㉓ is 4.5V among channels. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

SBmiR1, SBmax1 Sub bias control

In inputting signal Y and FRP1, measure output amplitude of Rch and Bch when pin ㉔ is grounded and voltage at pin ⑳ or ⑱ is changed to GND and 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

SB1 Sub bias control variance

Based on the results of sub bias control, calculate the variance.

F11 Frequency characteristics 1

In inputting sync+sweep waveform (500mV$_{P-P}$), measure the cutoff frequency of each channel when pin⑫② is grounded. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

F21 Frequency characteristics 2

In inputting sync+sweep waveform (500mV$_{P-P}$), measure the cutoff frequency of each channel when voltage at pin ② is 4.5V. Also, measure in the same way as above when pin ⑦ is connected to GND and the mode is changed to EXT.

CC1 Crosstalk among channels

Input sync+1.0MHz (500mV$_{P-P}$) only to pin ① and measure the amplitude of output waveform, VR, VG, and VB, at pins ⑰, ⑲, and ㉑ respectively. Crosstalk is calculated as follows.

$$M=20 \log \frac{V_G \text{ or } V_B}{V_R} \text{ [dB]}$$

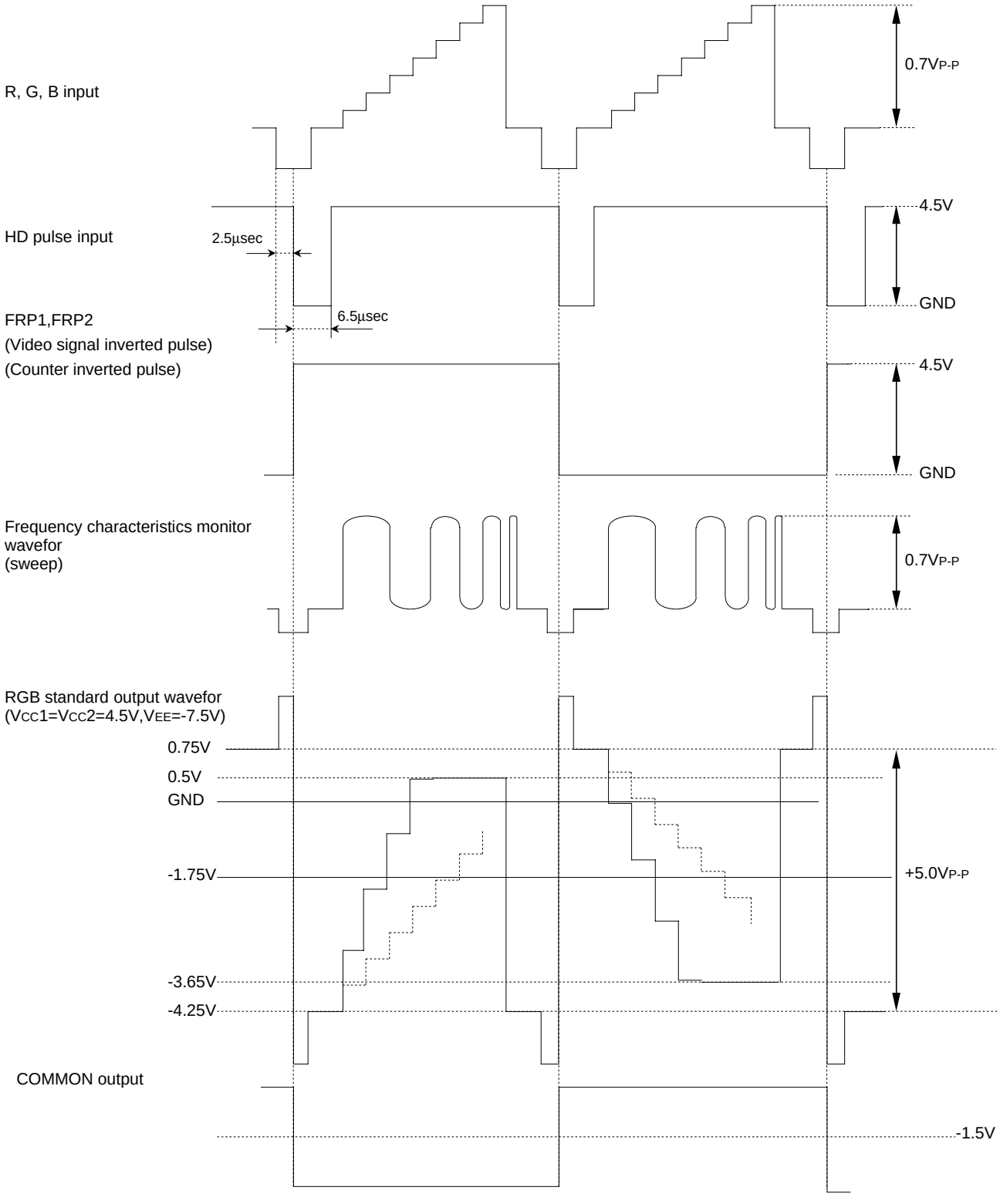
CS1 MAIN/EXT crosstalk

Input sync+1.0MHz (500mV$_{P-P}$) only to pin ⑦ and measure the amplitude of output waveform at pin ㉑ (VMR). Then, connect pin ⑦ to GND and measure the output amplitude when the same signal is input (VER). Crosstalk is calculated as follows.

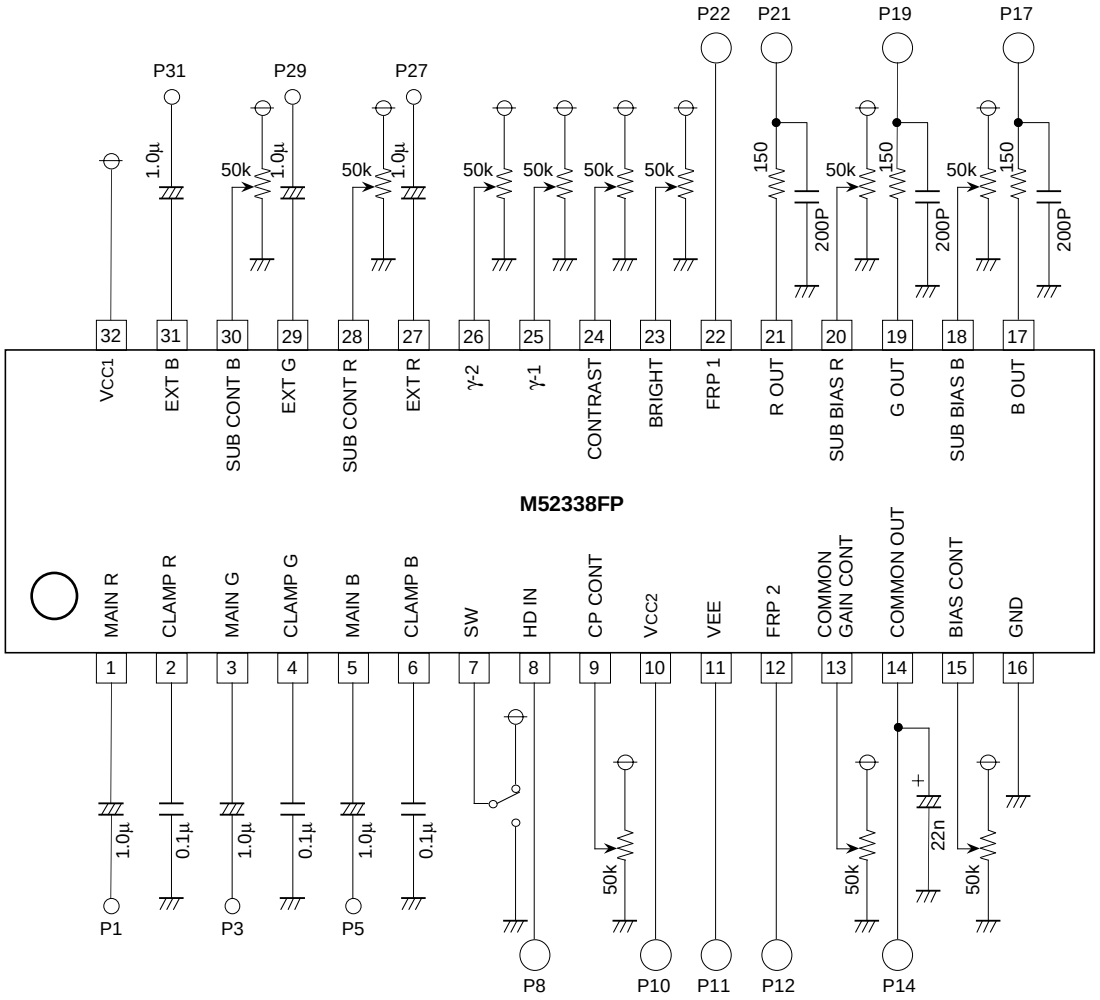
$$M=20 \log \frac{V_G \text{ or } V_B}{V_R} \text{ [dB]}$$

Note 4: When contrast and sub contrast parameters are measured, input signal is set to 0.2V$_{P-P}$ because a limiter may work when normal input signal is input.

INPUT/OUTPUT SIGNAL

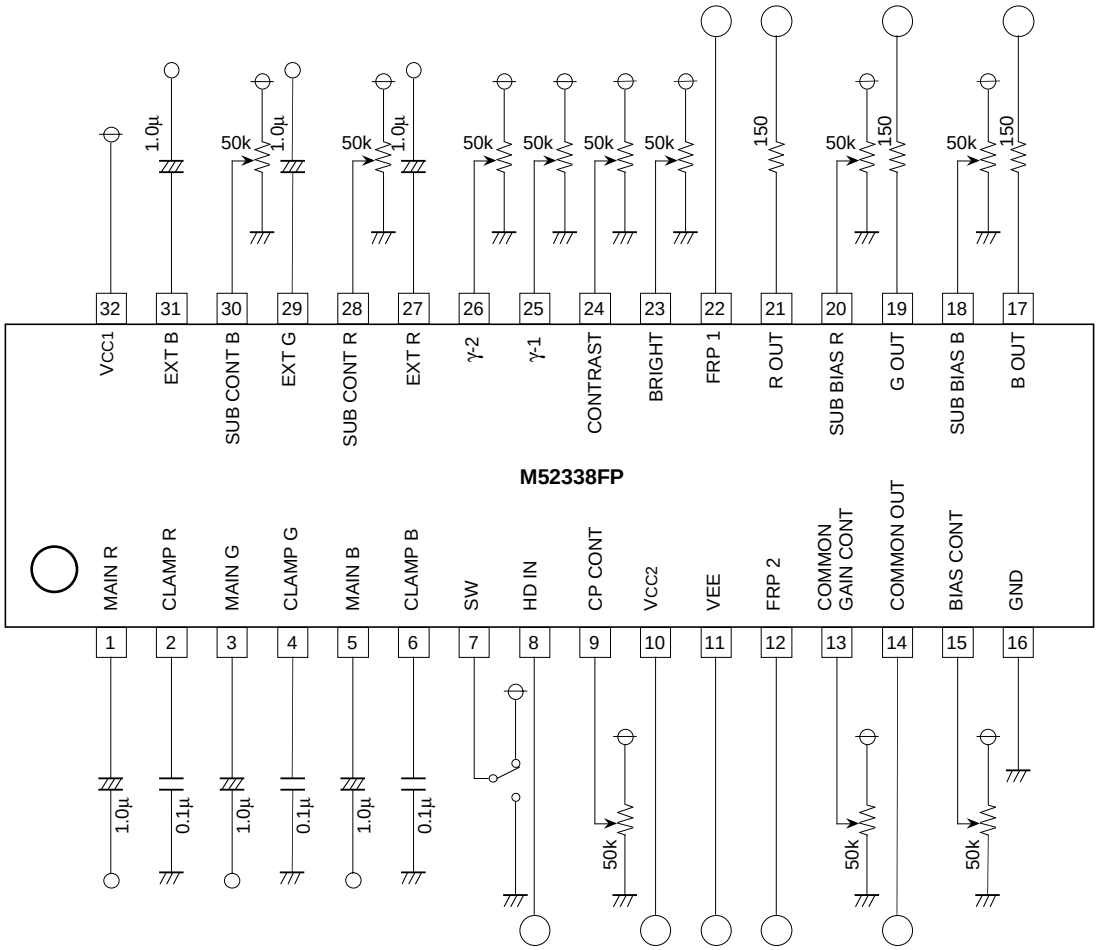


TEST CIRCUIT



Unit Resistance : Ω
Capacitance : F

APPLICATION EXAMPLE



Unit Resistance : Ω
Capacitance : F

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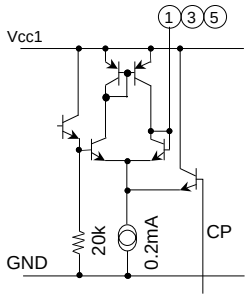
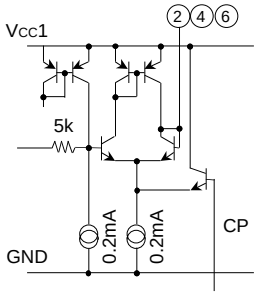
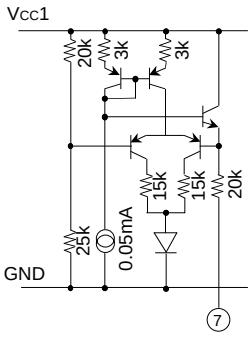
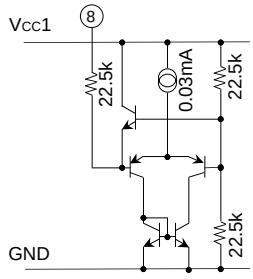
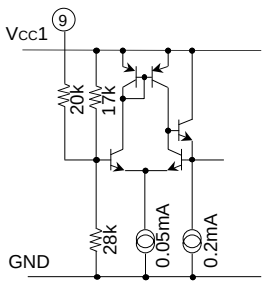
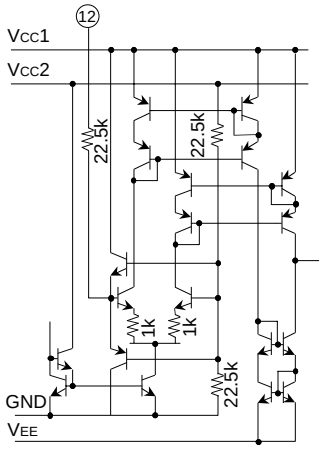
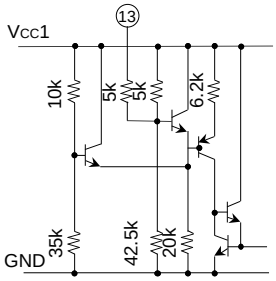
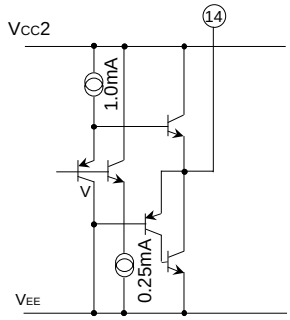
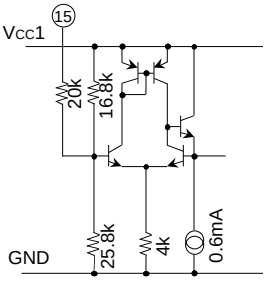
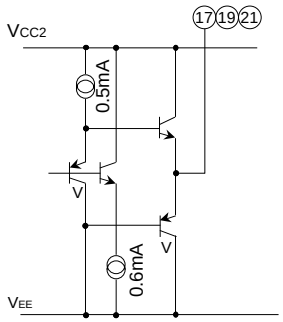
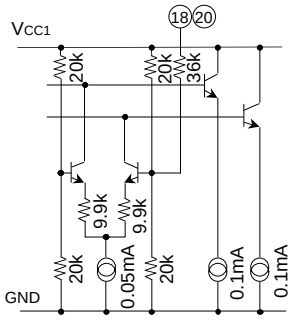
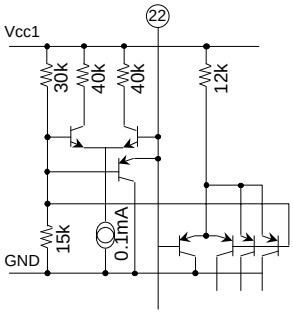
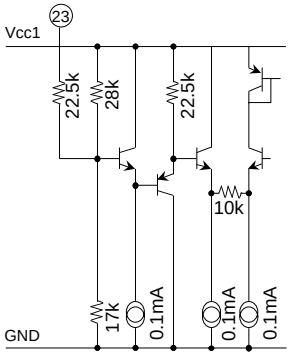
INTERFACE IC FOR ACTIVE MATRIX LIQUID CRYSTAL PANEL

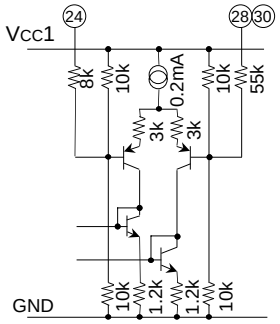
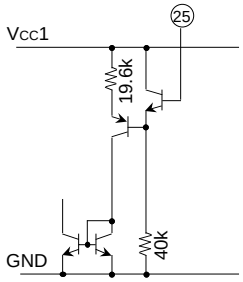
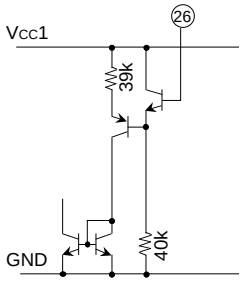
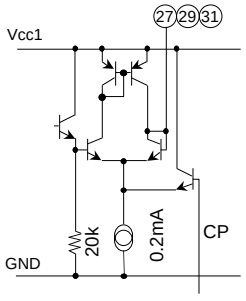
DESCRIPTION OF PIN

Pin No.	Name	Peripheral circuit pins
①	MAIN IN R (Main signal input Rch)	
③	MAIN IN G (Main signal input Gch)	
⑤	MAIN IN B (Main signal input Bch)	
②	CLAMP R (Clamped capacitance R)	
④	CLAMP G (Clamped capacitance G)	
⑥	CLAMP B (Clamped capacitance B)	
⑦	SW (MAIN/EXT SW)	
⑧	HD IN (HD pulse input)	
⑨	CP CONT. (Clamp pulse control)	

Pin No.	Name	Peripheral circuit pins
⑩	Vcc2 (Power supply)	
⑪	VEE (Grounded or - Power supply)	
⑫	FRP2 (FRP2 input)	
⑬	COMMON GAIN CONT. (Commom gain control)	
⑭	COMMON OUT (Commom output)	
⑮	BIAS CONT. (Bias control)	
⑯	GND (Grounding)	

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Peripheral circuit pins
⑰	R OUT (Rch output)	
⑲	G OUT (Gch output)	
㉑	B OUT (Bch output)	
⑱	SUB BIAS R (Sub bias control R)	
⑳	SUB BIAS B (Sub bias control B)	
㉒	FRP 1 (FRP 1 input)	
㉓	BRIGHT (Bright control)	

Pin No.	Name	Peripheral circuit pins
㉔	CONTRAST (Contrast control)	
㉘	SUB CONTRAST R (Sub contrast control R)	
㉚	SUB CONTRAST B (Sub contrast control B)	
㉕	γ1 CONT. (γ1control)	
㉖	γ2 CONT. (γ2control)	
㉗	EXT IN R (EXT signal input Rch)	
㉙	EXT IN G (EXT signal input Gch)	
㉛	EXT IN B (EXT signal input Bch)	
㉜	Vcc1 (Power supply)	