

# AN5395FBP

## Contour correction IC for HDTV

### ■ Overview

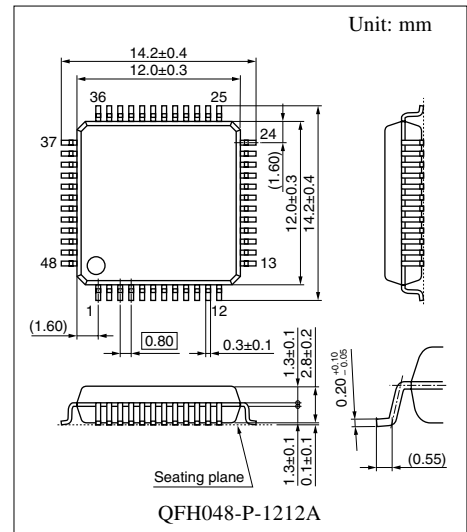
The AN5395FBP is a contour correction IC which enables correction band changeover for base band HDTV, MUSE, progressive NTSC TV.

### ■ Features

- Contour correction for HDTV
- Contour correction for progressive TV

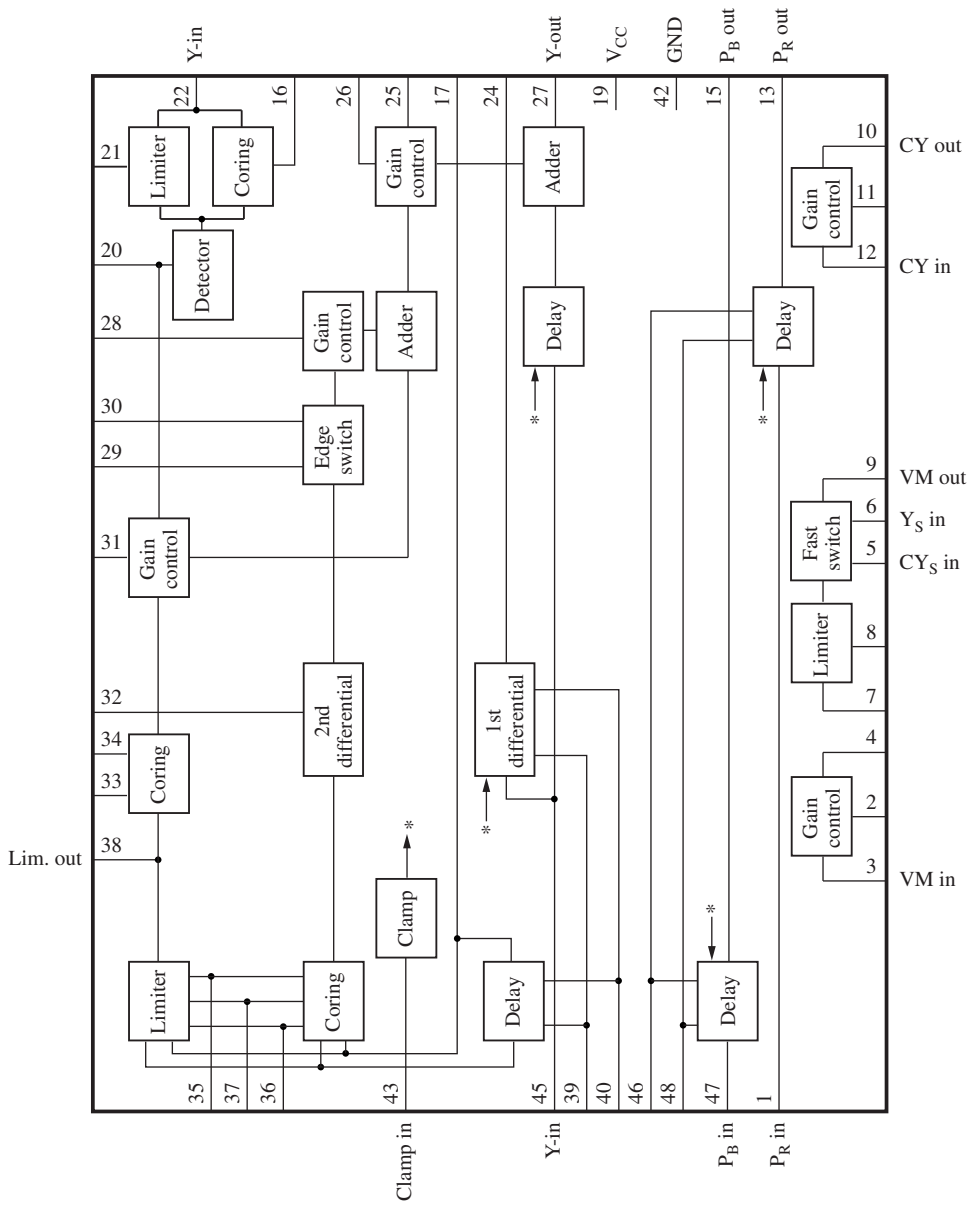
### ■ Applications

- HDTV



Note) The package of this product will be changed to lead-free type (QFH048-P-1212C). See the new package dimensions section later of this datasheet.

■ Block Diagram



## ■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	$P_R$ input	25	Sharpness mute control
2	VM pre-amp. gain control	26	Sharpness control
3	VM pre-amp. input	27	Y output
4	VM pre-amp. output	28	Contour block gain control
5	Child picture $Y_S$ input	29	Contour block bias
6	$Y_S$ input	30	Secondary differentiating input
7	VM limiter amp. input	31	Detail gain control
8	VM limiter amp. gain control	32	Primary differentiating output after correction
9	VM limiter amp. output	33	Detail coring control
10	Child picture amp. output	34	Detail coring bias
11	Child picture amp. gain control	35	Differentiating signal bias 1
12	Child picture amp. input	36	Contour block and detail separation level control
13	$P_R$ output		
14	N.C.	37	Differentiating signal bias 2
15	$P_B$ output	38	Detail limiter output
16	DSC large signal gain control	39	Y delay line changeover switch 1
17	Primary differentiating input before correction	40	Y delay line changeover switch 2
18	N.C.	41	N.C.
19	$V_{CC}$	42	GND
20	DSC detection output	43	Clamp pulse input
21	DSC small signal gain control	44	N.C.
22	DSC input	45	Y input
23	DSC bias	46	C delay line changeover switch 1
24	Primary differentiating output before correction	47	$P_B$ input
		48	C delay line changeover switch 2

## ■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	10.0	V
Supply current	$I_{CC}$	100	mA
Power dissipation *2	$P_D$	650	mW
Operating ambient temperature *1	$T_{opr}$	-20 to +70	°C
Storage temperature *1	$T_{stg}$	-55 to +150	°C

Note) \*1: Except for the operating ambient temperature and storage temperature, all ratings are for  $T_a = 25^\circ\text{C}$ .

\*2: The power dissipation shown is the value for  $T_a = 70^\circ\text{C}$ .

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	$V_{CC}$	8.1 to 9.9	V

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Circuit current	$I_{CC}$		50	70	90	mA
Circuit voltage	$V_1$		4.50	5.63	6.76	V
Circuit voltage	$V_2$		4.40	5.86	7.33	V
Circuit voltage	$V_3$		2.04	2.55	3.06	V
Circuit voltage	$V_4$		4.64	5.80	6.96	V
Circuit voltage	$V_7$		2.04	2.55	3.06	V
Circuit voltage	$V_9$		4.60	5.75	6.90	V
Circuit voltage	$V_{10}$		4.64	5.80	6.96	V
Circuit voltage	$V_{11}$		4.40	5.86	7.33	V
Circuit voltage	$V_{12}$		2.04	2.55	3.06	V
Circuit voltage	$V_{13}$		3.74	4.67	5.60	V
Circuit voltage	$V_{15}$		3.74	4.67	5.60	V
Circuit voltage	$V_{16}$		3.80	4.75	5.70	V
Circuit voltage	$V_{17}$		4.50	5.63	6.76	V
Circuit voltage	$V_{21}$		3.40	4.25	5.10	V
Circuit voltage	$V_{22}$		2.12	2.65	3.18	V
Circuit voltage	$V_{24}$		3.70	4.62	5.54	V
Circuit voltage	$V_{27}$		3.44	4.30	5.16	V
Circuit voltage	$V_{29}$		2.93	3.66	4.39	V
Circuit voltage	$V_{30}$		1.96	2.45	2.94	V
Circuit voltage	$V_{31}$		2.71	3.61	4.51	V
Circuit voltage	$V_{32}$		2.12	2.65	3.18	V
Circuit voltage	$V_{33}$		4.27	5.34	6.41	V
Circuit voltage	$V_{34}$		4.55	5.69	6.83	V
Circuit voltage	$V_{35}$		2.65	3.31	3.97	V
Circuit voltage	$V_{36}$		2.40	3.00	3.60	V
Circuit voltage	$V_{37}$		2.65	3.31	3.97	V
Circuit voltage	$V_{38}$		6.25	7.81	9.37	V
Circuit voltage	$V_{39}$		1.80	2.90	4.00	V
Circuit voltage	$V_{40}$		1.80	2.90	4.00	V
Circuit voltage	$V_{45}$		4.50	5.63	6.76	V

**■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$  (continued)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Circuit voltage	$V_{46}$		1.80	2.90	4.00	V
Circuit voltage	$V_{47}$		4.50	5.63	6.76	V
Circuit voltage	$V_{48}$		1.80	2.90	4.00	V
Circuit current	$I_{23}$		-1.50	0.00	1.50	$\mu\text{A}$
Circuit current	$I_{43}$		-1.50	0.00	1.50	$\mu\text{A}$
<b>C-D.L block</b>						
$P_B$ output dynamic range	$V_{DR15}$	$V_{IN47} = 5.18 \text{ V to } 6.08 \text{ V}$	0.9	1.2	1.5	V[p-p]
$P_R$ output dynamic range	$V_{DR13}$	$V_{IN1} = 5.18 \text{ V to } 6.08 \text{ V}$	0.9	1.2	1.5	V[p-p]
Delay time changeover switch C1 threshold level	$V_{TH46}$		0.9	1.5	2.1	V
Delay time changeover switch C2 threshold level	$V_{TH48}$		0.9	1.5	2.1	V
$P_B$ signal output gain (HD)	$G_{A(PB,1)}$	$V_{A(PB,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_B$ signal output gain (MUSE)	$G_{B(PB,1)}$	$V_{B(PB,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_B$ signal output gain (NTSC1)	$G_{C(PB,1)}$	$V_{C(PB,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_B$ signal output gain (NTSC2)	$G_{D(PB,1)}$	$V_{D(PB,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_B$ signal output gain difference (MUSE/HD)	$G_{B/A(PB)}$	$V_{B(PB,1)} / V_{A(PB,1)}$	-1	0	1	dB
$P_B$ signal output gain difference (NTSC1/HD)	$G_{C/A(PB)}$	$V_{C(PB,1)} / V_{A(PB,1)}$	-1	0	1	dB
$P_B$ signal output gain difference (NTSC2/HD)	$G_{D/A(PB)}$	$V_{D(PB,1)} / V_{A(PB,1)}$	-1	0	1	dB
$P_R$ signal output gain (HD)	$G_{A(PR,1)}$	$V_{A(PR,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_R$ signal output gain (MUSE)	$G_{B(PR,1)}$	$V_{B(PR,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_R$ signal output gain (NTSC1)	$G_{C(PR,1)}$	$V_{C(PR,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_R$ signal output gain (NTSC2)	$G_{D(PR,1)}$	$V_{D(PR,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
$P_R$ signal output gain difference (MUSE/HD)	$G_{B/A(PR)}$	$V_{B(PR,1)} / V_{A(PR,1)}$	-1	0	1	dB
$P_R$ signal output gain difference (NTSC1/HD)	$G_{C/A(PR)}$	$V_{C(PR,1)} / V_{A(PR,1)}$	-1	0	1	dB
$P_R$ signal output gain difference (NTSC2/HD)	$G_{D/A(PR)}$	$V_{D(PR,1)} / V_{A(PR,1)}$	-1	0	1	dB
$P_B, P_R$ signal output gain difference (HD)	$\Delta G_{A(C)}$	$V_{A(PB,1)} / V_{A(PR,1)}$	-1	0	1	dB
$P_B, P_R$ signal output gain difference (MUSE)	$\Delta G_{B(C)}$	$V_{B(PB,1)} / V_{B(PR,1)}$	-1	0	1	dB
$P_B, P_R$ signal output gain difference (NTSC1)	$\Delta G_{C(C)}$	$V_{C(PB,1)} / V_{C(PR,1)}$	-1	0	1	dB
$P_B, P_R$ signal output gain difference (NTSC2)	$\Delta G_{D(C)}$	$V_{D(PB,1)} / V_{D(PR,1)}$	-1	0	1	dB
$P_B$ signal frequency characteristics (HD)	$G_{A(PB,F)}$	$V_{A(PB,20)} / V_{A(PB,1)}$	-6	-3	0	dB
$P_B$ signal frequency characteristics (MUSE)	$G_{B(PB,F)}$	$V_{B(PB,20)} / V_{B(PB,1)}$	-6	-3	0	dB
$P_B$ signal frequency characteristics (NTSC1)	$G_{C(PB,F)}$	$V_{C(PB,16)} / V_{C(PB,1)}$	-6	-3	0	dB

**■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$  (continued)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>C-D.L block (continued)</b>						
$P_B$ signal frequency characteristics (NTSC2)	$G_{D(PB,F)}$	$V_{D(PB,16)}/V_{D(PB,1)}$	-6	-3	0	dB
$P_R$ signal frequency characteristics (HD)	$G_{A(PR,F)}$	$V_{A(PR,20)}/V_{A(PR,1)}$	-6	-3	0	dB
$P_R$ signal frequency characteristics (MUSE)	$G_{B(PR,F)}$	$V_{B(PR,20)}/V_{B(PR,1)}$	-6	-3	0	dB
$P_R$ signal frequency characteristics (NTSC1)	$G_{C(PR,F)}$	$V_{C(PR,16)}/V_{C(PR,1)}$	-6	-3	0	dB
$P_R$ signal frequency characteristics (NTSC2)	$G_{D(PR,F)}$	$V_{D(PR,16)}/V_{D(PR,1)}$	-6	-3	0	dB
<b>Y-D.L block</b>						
Y output dynamic range	$V_{DR27}$	$V_{IN45} = 5.23 \text{ V to } 6.43 \text{ V}$	1.2	1.6	2.0	V[p-p]
Clamp pulse input threshold level	$V_{TH43}$		0.9	1.5	2.1	V
Delay time changeover switch Y1 threshold level	$V_{TH39}$		0.9	1.5	2.1	V
Delay time changeover switch Y2 threshold level	$V_{TH40}$		0.9	1.5	2.1	V
Y signal output gain (HD)	$G_{A(Y,1)}$	$V_{A(Y,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
Y signal output gain (MUSE)	$G_{B(Y,1)}$	$V_{B(Y,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
Y signal output gain (NTSC1)	$G_{C(Y,1)}$	$V_{C(Y,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
Y signal output gain (NTSC2)	$G_{D(Y,1)}$	$V_{D(Y,1)} / 0.1 \text{ V[p-p]}$	1.81	2.92	3.91	dB
Y signal output gain difference (MUSE/HD)	$G_{B/A(Y)}$	$V_{B(Y,1)}/V_{A(Y,1)}$	-1	0	1	dB
Y signal output gain difference (NTSC1/HD)	$G_{C/A(Y)}$	$V_{C(Y,1)}/V_{A(Y,1)}$	-1	0	1	dB
Y signal output gain difference (NTSC2/HD)	$G_{D/A(Y)}$	$V_{D(Y,1)}/V_{A(Y,1)}$	-1	0	1	dB
$Y_1$ signal output gain (HD)	$G_{A(Y1,1)}$	$V_{A(Y1,1)} / 0.1 \text{ V[p-p]}$	12	15	18	dB
$Y_1$ signal output gain (MUSE)	$G_{B(Y1,1)}$	$V_{B(Y1,1)} / 0.1 \text{ V[p-p]}$	12	15	18	dB
$Y_1$ signal output gain(NTSC1)	$G_{C(Y1,1)}$	$V_{C(Y1,1)} / 0.1 \text{ V[p-p]}$	12	15	18	dB
$Y_1$ signal output gain (NTSC2)	$G_{D(Y1,1)}$	$V_{D(Y1,1)} / 0.1 \text{ V[p-p]}$	12	15	18	dB
$Y_1$ signal output gain difference (MUSE/HD)	$G_{B/A(Y1)}$	$V_{B(Y1,1)}/V_{A(Y1,1)}$	-1	0	1	dB
$Y_1$ signal output gain difference (NTSC1/HD)	$G_{C/A(Y1)}$	$V_{C(Y1,1)}/V_{A(Y1,1)}$	-1	0	1	dB
$Y_1$ signal output gain difference (NTSC2/HD)	$G_{D/A(Y1)}$	$V_{D(Y1,1)}/V_{A(Y1,1)}$	-1	0	1	dB
Y signal frequency characteristics (HD)	$G_{A(Y,F)}$	$V_{A(Y,30)}/V_{A(Y,1)}$	-4	-1	2	dB
Y signal frequency characteristics (MUSE)	$G_{B(Y,F)}$	$V_{B(Y,20)}/V_{B(Y,1)}$	-4	-1	2	dB
Y signal frequency characteristics (NTSC1)	$G_{C(Y,F)}$	$V_{C(Y,16)}/V_{C(Y,1)}$	-4	-1	2	dB
Y signal frequency characteristics (NTSC2)	$G_{D(Y,F)}$	$V_{D(Y,16)}/V_{D(Y,1)}$	-4	-1	2	dB

**■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$  (continued)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Sharpness block</b>						
Sharpness mute switch threshold level	$V_{TH25}$		1.10	2.65	4.20	V
Contour part max. gain	$V_{Rmax}$		1.40	1.75	2.10	V[p-p]
Contour part sharpness typ. gain	$V_{R.SHtyp}$		640	800	960	mV[p-p]
Contour part sharpness min. gain	$V_{R.SHmin}$		0	15	30	mV[p-p]
Contour part sharpness gain ratio	$G_{R.SHtyp/max}$	$V_{R.SHtyp}/V_{Rmax}$	-8	-6	-4	dB
Detail part max. gain	$V_{Smax}$		390	520	650	mV[p-p]
Detail part sharpness typ. gain	$V_{S.SHtyp}$		195	260	325	mV[p-p]
Detail part sharpness min. gain	$V_{S.SHmin}$		0	5	10	mV[p-p]
Detail part sharpness gain ratio	$G_{S.SHtyp/max}$	$V_{S.SHtyp}/V_{Smax}$	-9	-6	-3	dB
Detail part sharpness mute max. gain (on)	$V_{S.SH(M.ON)}$		0	5	10	mV[p-p]
Detail part sharpness mute gain ratio (on/off)	$G_{S.SH(M.ON/OFF)}$	$V_{S.SH(M.ON)}/V_{Smax}$	-60	-50	-40	dB
<b>Contour part</b>						
Coring characteristics (on)	$V_{R.CO(ON)}$		210	280	350	mV[p-p]
Coring characteristics (off)	$V_{R.CO(OFF)}$		0	30	60	mV[p-p]
Correction primary differentiating signal gain (8 MHz)	$V_{R.CO(8M)}$		0.64	0.8	0.96	V[p-p]
Correction primary differentiating signal gain (4 MHz)	$V_{R.CO(4M)}$		1.16	1.45	1.74	V[p-p]
Correction primary differentiating signal gain ratio	$G_{R.CO(8M/4M)}$	$V_{R.CO(8M)}/V_{R.CO(4M)}$	-7	-5	-3	dB
Contour gain switch (LO)	$V_{R.SW(LO)}$		0.88	1.1	1.32	V[p-p]
Contour gain switch gain ratio	$G_{R.SW(L/H)}$	$V_{R.SW(LO)}/V_{Rmax}$	-5	-3	-1	dB
<b>Detail part</b>						
Typ. gain 1	$V_{SG1typ}$		210	280	350	mV[p-p]
Typ. gain 2	$V_{SG2typ}$		210	280	350	mV[p-p]
Gain ratio 1	$G_{SG1typ/max}$	$V_{SG1typ}/V_{Smax}$	-7	-5	-3	dB
Gain ratio 2	$G_{SG2typ/max}$	$V_{SG2typ}/V_{Smax}$	-7	-5	-3	dB
Detail part coring typ. gain	$V_{S.COtyp}$		225	315	445	mV[p-p]
Detail part coring min. gain	$V_{S.COmin}$		0	75	150	mV[p-p]
Detail part coring gain ratio	$G_{S.COtyp/max}$	$V_{S.COtyp}/V_{Smax}$	-8	-5	-2	dB
Detail part limiter max. gain	$V_{S.Lmax}$		460	580	700	mV[p-p]
Detail part limiter typ. gain	$V_{S.Ltyp}$		320	400	480	mV[p-p]
Detail part limiter gain ratio	$G_{S.Ltyp/max}$	$V_{S.Ltyp}/V_{S.Lmax}$	-5.5	-3.5	-1.5	dB

**■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$  (continued)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>DSC block</b>						
DSC detection characteristics (−35 dB)	$V_{\text{DSC}(-35)}$		2.7	3.4	4.1	V
DSC detection characteristics (−20 dB)	$V_{\text{DSC}(-20)}$		7	8.7	9	V
DSC detection characteristics (−15 dB)	$V_{\text{DSC}(-15)}$		6.9	8.6	9	V
DSC detection characteristics (−5 dB)	$V_{\text{DSC}(-5)}$		0.26	0.33	0.40	V
DSC coring characteristics	$V_{\text{D.CO}(-5)}$		6.9	8.6	9	V
DSC limiter characteristics	$V_{\text{D.LIM}(-20)}$		2.7	3.4	4.1	V
<b>Child picture amp. block</b>						
Child picture amp. max. gain	$G_{\text{CAmax}}$		10	12	14	dB
Child picture amp. typ. gain	$G_{\text{CAtyp}}$		3.5	5.5	7.5	dB
Child picture amp. gain ratio	$G_{\text{CAtyp}/\text{max}}$	$V_{\text{CAtyp}}/V_{\text{CAmax}}$	−8.5	−6.5	−4.5	dB
Child picture amp. frequency characteristics 1	$G_{\text{CA}(20\text{M})}$	$V_{\text{CA}(20\text{M})}/0.1\text{ V[p-p]}$	9.5	11.5	13.5	dB
Child picture amp. frequency characteristics 2	$G_{\text{CA}(1\text{M})}$	$V_{\text{CA}(1\text{M})}/0.1\text{ V[p-p]}$	9.5	11.5	13.5	dB
Child picture amp. frequency characteristics 3	$G_{\text{CA}(F)}$	$V_{\text{CA}(20\text{M})}/V_{\text{CA}(1\text{M})}$	−1	0	1	dB
<b>VM pre-amp. block</b>						
VM pre-amp. max. gain	$G_{\text{VMPmax}}$		10	12	14	dB
VM pre-amp. typ. gain	$G_{\text{VMPtyp}}$		3.5	5.5	7.5	dB
VM pre-amp. gain ratio	$G_{\text{VMPtyp}/\text{max}}$	$V_{\text{VMPtyp}}/V_{\text{VMPmax}}$	−8.5	−6.5	−4.5	dB
VM pre-amp. frequency characteristics 1	$G_{\text{VMP}(20\text{M})}$	$V_{\text{VMP}(20\text{M})}/0.1\text{ V[p-p]}$	9.5	11.5	13.5	dB
VM pre-amp. frequency characteristics 2	$G_{\text{VMP}(1\text{M})}$	$V_{\text{VMP}(1\text{M})}/0.1\text{ V[p-p]}$	9.5	11.5	13.5	dB
VM pre-amp. frequency characteristics 3	$G_{\text{VMP}(F)}$	$V_{\text{VMP}(20\text{M})}/V_{\text{VMP}(1\text{M})}$	−1	0	1	dB
<b>VM limiter amp. block</b>						
$\text{CY}_S$ switch threshold level	$V_{\text{TH5}}$		0.45	0.75	1.05	V
$\text{Y}_S$ switch threshold level	$V_{\text{TH6}}$		0.45	0.75	1.05	V
Output DC step ( $\text{CY}_S$ )	$\Delta V_{\text{VML}(\text{CYS})}$		−50	0	50	mV
Output DC step ( $\text{Y}_S$ )	$\Delta V_{\text{VML}(\text{YS})}$		−50	0	50	mV
VM limiter amp. max. gain	$G_{\text{VMLmax}}$	$V_{\text{VMLmax}}/0.1\text{ V[p-p]}$	13.5	15.5	17.5	dB
VM limiter amp. typ. gain	$G_{\text{VMLtyp}}$	$V_{\text{VMLtyp}}/0.1\text{ V[p-p]}$	10.5	12.5	14.5	dB
VM limiter amp. gain ratio	$G_{\text{VMLtyp}/\text{max}}$	$V_{\text{VMLtyp}}/V_{\text{VMLmax}}$	−4.5	−2.5	−0.5	dB
VM limiter amp. frequency characteristics 1	$G_{\text{VML}(20\text{M})}$	$V_{\text{VML}(20\text{M})}/0.1\text{ V[p-p]}$	12.5	14.5	16.5	dB
VM limiter amp. frequency characteristics 2	$G_{\text{VML}(1\text{M})}$	$V_{\text{VML}(1\text{M})}/0.1\text{ V[p-p]}$	14.5	16.5	18.5	dB



### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
VM limiter amp. block (continued)						
VM limiter amp. frequency characteristics 3	$G_{V_{ML}(F)}$	$V_{V_{ML}(20M)} / V_{V_{ML}(1M)}$	-4	-2	0	dB
VM limiter amp. limiter characteristics 1	$G_{V_{ML}(LIMmax)}$	$V_{V_{ML}(LIM.max)} / 0.2 \text{ V[p-p]}$	14	16	18	dB
VM limiter amp. limiter characteristics 2	$G_{V_{ML}(LIMtyp)}$	$V_{V_{ML}(LIM.typ)} / 0.2 \text{ V[p-p]}$	6	8	10	dB
VM limiter amp. limiter characteristics 3	$G_{V_{ML}(LIM)}$	$V_{V_{ML}(LIM.typ)} / V_{V_{ML}(LIM.max)}$	-10	-8	-6	dB
$Y_S$ operation characteristics	$G_{V_{ML}(YS)}$	$V_{V_{ML}(YS)} / V_{V_{ML}(max)}$	-36	-30	-24	dB
$CY_S$ operation characteristics	$G_{V_{ML}(CYS)}$	$V_{V_{ML}(CYS)} / V_{V_{ML}(max)}$	-36	-30	-24	dB

### • Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
C-D.L block						
$P_B$ signal delay time (HD)	$t_{A(PB)}$	At DL = HD	40	50	60	ns
$P_B$ signal delay time (MUSE)	$t_{B(PB)}$	At DL = MUSE	52	65	78	ns
$P_B$ signal delay time (NTSC1)	$t_{C(PB)}$	At DL = NTSC1	60	75	90	ns
$P_B$ signal delay time (NTSC2)	$t_{D(PB)}$	At DL = NTSC2	72	90	108	ns
$P_B$ signal delay time variation amount (MUSE to HD)	$t_{1(PB)}$	$t_{B(PB)} - t_{A(PB)}$	12	16	20	ns
$P_B$ signal delay time variation amount (NTSC1 to HD)	$t_{2(PB)}$	$t_{C(PB)} - t_{A(PB)}$	20	26	32	ns
$P_R$ signal delay time (HD)	$t_{A(PR)}$	At DL = HD	40	50	60	ns
$P_R$ signal delay time (MUSE)	$t_{B(PR)}$	At DL = MUSE	52	65	78	ns
$P_R$ signal delay time (NTSC1)	$t_{C(PR)}$	At DL = NTSC1	60	75	90	ns
$P_R$ signal delay time (NTSC2)	$t_{D(PR)}$	At DL = NTSC2	72	90	108	ns
$P_R$ signal delay time variation amount (MUSE to HD)	$t_{1(PR)}$	$t_{B(PR)} - t_{A(PR)}$	12	16	20	ns
$P_R$ signal delay time variation amount (NTSC1 to HD)	$t_{2(PR)}$	$t_{C(PR)} - t_{A(PR)}$	20	26	32	ns
$P_B, P_R$ delay time difference (HD)	$\Delta t_{A(C)}$	$t_{A(PB)} - t_{A(PR)}$	-6	0	6	ns
$P_B, P_R$ delay time difference (MUSE)	$\Delta t_{B(C)}$	$t_{B(PB)} - t_{B(PR)}$	-6	0	6	ns
$P_B, P_R$ delay time difference (NTSC1)	$\Delta t_{C(C)}$	$t_{C(PB)} - t_{C(PR)}$	-6	0	6	ns
$P_B, P_R$ delay time difference (NTSC2)	$\Delta t_{D(C)}$	$t_{D(PB)} - t_{D(PR)}$	-6	0	6	ns

■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$  (continued)

• Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and not guaranteed.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Y-D.L block						
Y signal delay time (HD)	$t_{A(Y)}$	At DL = HD	40	50	60	ns
Y signal delay time (MUSE)	$t_{B(Y)}$	At DL = MUSE	52	65	78	ns
Y signal delay time (NTSC1)	$t_{C(Y)}$	At DL = NTSC1	60	75	90	ns
Y signal delay time (NTSC2)	$t_{D(Y)}$	At DL = NTSC2	72	90	108	ns
Y signal delay time variation amount (MUSE to HD)	$t_{1(Y)}$	$t_{B(Y)} - t_{A(Y)}$	12	16	20	ns
Y signal delay time variation amount (NTSC1 to HD)	$t_{2(Y)}$	$t_{C(Y)} - t_{A(Y)}$	20	26	32	ns
$Y_1$ signal delay time (HD)	$t_{A(Y1)}$	At DL = HD	32	40	48	ns
$Y_1$ signal delay time (MUSE)	$t_{B(Y1)}$	At DL = MUSE	40	50	60	ns
$Y_1$ signal delay time (NTSC1)	$t_{C(Y1)}$	At DL = NTSC1	44	55	66	ns
$Y_1$ signal delay time (NTSC2)	$t_{D(Y1)}$	At DL = NTSC2	48	60	72	ns
$Y_1$ signal delay time variation amount (MUSE to HD)	$t_{1(Y1)}$	$t_{B(Y1)} - t_{A(Y1)}$	4	8	12	ns
$Y_1$ signal delay time variation amount (NTSC1 to HD)	$t_{2(Y1)}$	$t_{C(Y1)} - t_{A(Y1)}$	10	14	18	ns

■ Terminal Equivalent Circuits

Pin No.	Equivalent circuit	Description
1		<p>Pin 1: <math>P_R</math> input signal pin: Pin 47: <math>P_B</math> input signal pin:</p> <ul style="list-style-type: none"> <li>Clamps input signal with clamp pulse of pin 43</li> <li>Drive with low impedance.</li> <li>Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>
2		<p>VM pre-amp. input pin:</p> <ul style="list-style-type: none"> <li>Control voltage: typ. 3V</li> </ul> <ul style="list-style-type: none"> <li>Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
3		<p>VM pre-amp. input pin:</p> <ul style="list-style-type: none"> <li>• Drive with low impedance.</li> <li>• Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>
4		<p>VM pre-amp. output pin:</p> <ul style="list-style-type: none"> <li>• Recommended application range: -3.2 mA to +3.2 mA</li> </ul>
5 6		<p>Pin5: Child picture <math>Y_S</math> input pin: Pin6: <math>Y_S</math> input pin:</p> <ul style="list-style-type: none"> <li>• Control pin for on/off of VM limiter amp. High: Off Low: On (<math>V_{TH} = 0.75 V</math>)</li> <li>• Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>
7		<p>VM limiter amp. input pin:</p> <ul style="list-style-type: none"> <li>• Drive with low impedance.</li> <li>• Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>

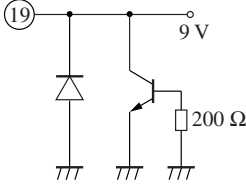
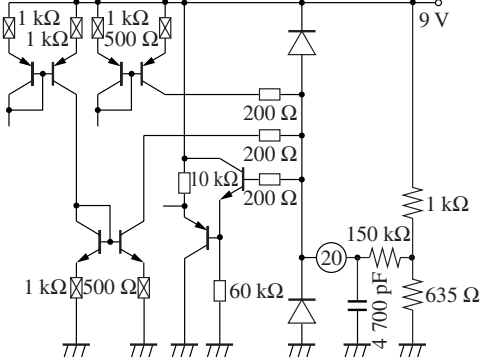
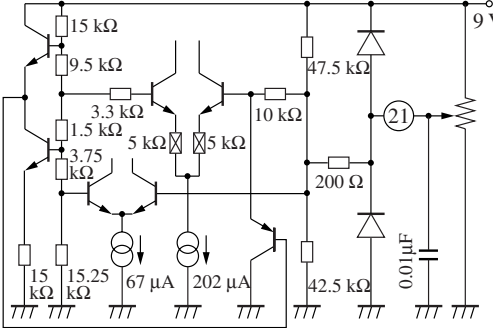
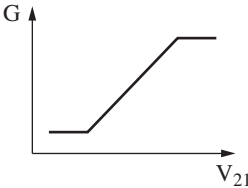
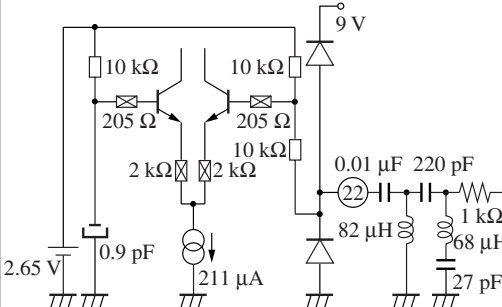
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
8		<p>VM limiter amp. gain control pin:</p> <ul style="list-style-type: none"> <li>Control voltage: typ. 2.5 V</li> </ul> <ul style="list-style-type: none"> <li>Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>
9		<p>VM limiter amp. output pin:</p> <ul style="list-style-type: none"> <li>Recommended application range: -3.2 mA to +3.2 mA</li> </ul>
10		<p>Child picture amp. output pin:</p> <ul style="list-style-type: none"> <li>Recommended application range: -3.2 mA to +3.2 mA</li> </ul>
11		<p>Child picture amp. gain control pin:</p> <ul style="list-style-type: none"> <li>Control voltage: typ. 3 V</li> </ul> <ul style="list-style-type: none"> <li>Recommended use range: 0 V to <math>V_{CC}</math></li> </ul>

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
12		<p>Child picture amp. input pin:</p> <ul style="list-style-type: none"> <li>• Drive with low impedance.</li> <li>• Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>
13		<p>Pin 13: P<sub>R</sub> output signal pin: Pin 15: P<sub>B</sub> output signal pin:</p> <ul style="list-style-type: none"> <li>• Recommended application range: -1.6 mA to +1.6 mA</li> </ul>
14	<p style="text-align: center;">—</p>	<p>N.C. pin:</p> <ul style="list-style-type: none"> <li>• Keep grounded</li> </ul>
15	<p style="text-align: center;">Refer to pin 13</p>	<p style="text-align: center;">Refer to pin 13</p>
16		<p>DSC large signal gain control pin:</p> <ul style="list-style-type: none"> <li>• Controls gain of large signal coring amp. on DSC detection.</li> <li>• Control voltage: typ. 3 V</li> </ul> <ul style="list-style-type: none"> <li>• Recommended application range: 0 V to V<sub>CC</sub></li> </ul>
17		<p>Primary differentiating input pin before correction:</p> <ul style="list-style-type: none"> <li>• Y1 primary differentiating signal outputted from pin 24 is inputted with capacitor coupling.</li> <li>• Drive with low impedance.</li> <li>• Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
18	—	N.C. pin: <ul style="list-style-type: none"> <li>• Keep grounded</li> </ul>
19		Power supply pin: <ul style="list-style-type: none"> <li>• Apply 9 V when use</li> </ul>
20		DSC detection output pin: <ul style="list-style-type: none"> <li>• Controls voltage of DSC.</li> <li>• Left diagram shows recommended external circuit.</li> <li>• Recommended application range: -1.6 mA to +1.6 mA</li> </ul>
21		DSC small signal gain control pin: <ul style="list-style-type: none"> <li>• Controls gain of small signal limiter amp. on DSC detection.</li> <li>• Control voltage: typ. 3 V</li> </ul>  <ul style="list-style-type: none"> <li>• Recommended application range: 0 V to V<sub>CC</sub></li> </ul>
22		DSC input pin: <ul style="list-style-type: none"> <li>• Y signal is inputted for DSC detection.</li> <li>• Left diagram shows recommended external circuit.</li> <li>• Recommended application method: Not apply DC voltage directly to pin.</li> </ul>

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
23		<p>DSC bias pin:</p> <ul style="list-style-type: none"> <li>• No use. Keep it connected to <math>V_{CC}</math></li> <li>• Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>
24		<p>Primary differentiating input pin before correction:</p> <ul style="list-style-type: none"> <li>• Output Y1 primary differentiating signal which is made by Y signal inputted from pin 45.</li> <li>• Recommended application range: -1.6 mA to +1.6 mA</li> </ul>
25 26		<p>Pin 25: Sharpness mute control pin: Pin 26: Sharpness gain control pin:</p> <ul style="list-style-type: none"> <li>• Controls contour correction amount of pin 27 Y output signal by pin 26 voltage. <math>V_{26typ} = 3\text{ V}</math></li> </ul> <div style="text-align: center;"> </div> <ul style="list-style-type: none"> <li>• On/off pin of contour correction signal by high/low of pin 25.</li> <li>• High: Off Low: On (<math>V_{TH} = 2.65\text{ V}</math>)</li> <li>• Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>
27		<p>Y output pin:</p> <ul style="list-style-type: none"> <li>• Outputs Y signal in which contour correction signal has been added on Y signal inputted from pin 45.</li> <li>• Recommended application range: -3.2 mA to +3.2 mA</li> </ul>

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
<p>28 29</p>		<p>Pin 28: Contour part gain control pin: Pin 29: Contour part bias pin:</p> <ul style="list-style-type: none"> <li>• Contour part amp. gain can be switched in 2 steps by high/low of pin 28 voltage.</li> <li>• High: Contour part gain high Low: Contour part gain low (<math>V_{TH} = 1.5\text{ V}</math>)</li> <li>• Smooths pin 29 signal by an external capacitor.</li> <li>• Recommended application range (pin 28): 0 V to <math>V_{CC}</math></li> <li>• Recommended application method (pin 29): Don't apply DC voltage directly to pin.</li> </ul>
<p>30</p>		<p>Secondary differentiating input pin:</p> <ul style="list-style-type: none"> <li>• With an external circuit, differentiate the primary differential signal that has been done contour correction and which is outputted from pin 32, then input it to pin 30.</li> <li>• Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>
<p>31</p>		<p>Detail part gain control pin:</p> <ul style="list-style-type: none"> <li>• Controls gain of small signal detail part amp. by pin 31 voltage. <math>V_{31typ} = 3\text{ V}</math></li> </ul> <div style="text-align: center;"> <p>Detail part gain</p> <p><math>V_{31}</math></p> </div> <ul style="list-style-type: none"> <li>• Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>
<p>32</p>		<p>Primary differentiating output after correction pin:</p> <ul style="list-style-type: none"> <li>• Outputs a primary differentiated signal as a signal for contour part edge switching.</li> <li>• Recommended application range: -1.6 mA to +1.6 mA</li> </ul>



■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
<p>33 34</p>		<p>Pin 33: Detail part coring control pin: Pin 34: Detail part coring bias pin:</p> <ul style="list-style-type: none"> <li>Controls gain of detail part coring amp. by pin 33 voltage. <math>V_{33typ} = 3\text{ V}</math></li> </ul> <ul style="list-style-type: none"> <li>Smooths pin 34 signal with an external capacitor.</li> <li>Recommended application range (pin 33): 0 V to <math>V_{CC}</math></li> <li>Recommended application method (pin 34): Don't apply DC voltage directly to pin.</li> </ul>
<p>35</p>		<p>Differentiating signal bias 1 pin:</p> <ul style="list-style-type: none"> <li>Makes a necessary bias by smoothing with an external capacitor to run a contour correction for the primary differentiating signal inputted from pin 17.</li> <li>Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>
<p>36</p>		<p>Contour part and detail part separation level control pin:</p> <ul style="list-style-type: none"> <li>Controls separation level of contour part (large signal) and detail part (small signal) by pin 36 voltage <math>V_{36typ} = 3\text{ V}</math></li> </ul> <ul style="list-style-type: none"> <li>Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>

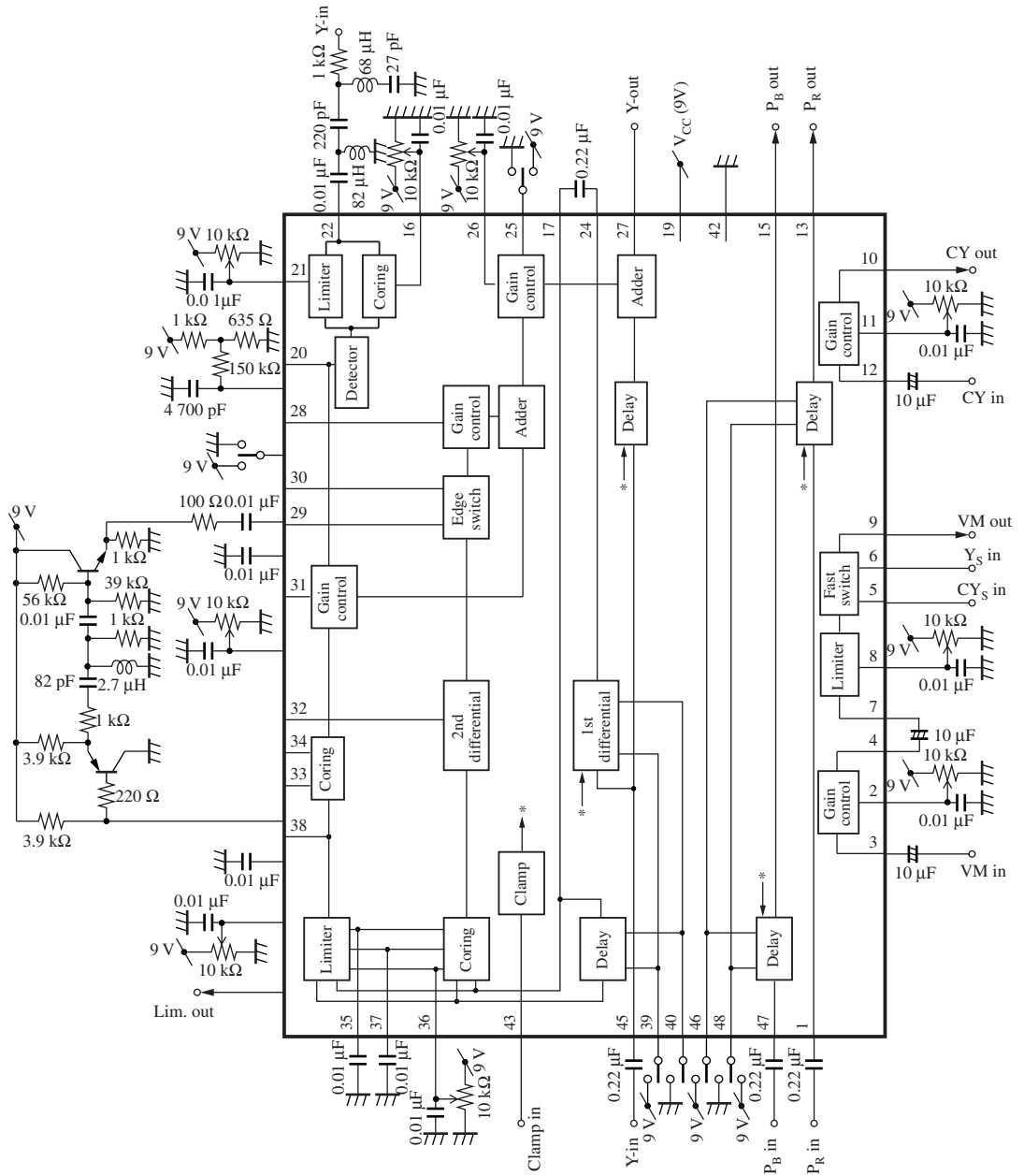
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description
37		<p>Differentiating signal bias 2 pin:</p> <ul style="list-style-type: none"> <li>• Necessary bias is made by an smoothing external capacitor in order to correct contour of primary differentiating signal inputted from Pin17</li> <li>• Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>
38		<p>Detail part limiter output pin:</p> <ul style="list-style-type: none"> <li>• Outputs detail part limiter signal</li> <li>• Recommended application range: -1.6 mA to +1.6 mA</li> </ul>
39 40		<p>Pin 39: Y delay line changeover switch-1 pin:          Pin 40: Y delay line changeover switch-2 pin:          Pin 46: C delay line changeover switch-1 pin:          Pin 48: C delay line changeover switch-2 pin:</p> <ul style="list-style-type: none"> <li>• Correction amount of Y, C delay line are switched by high/low of each pin voltage. (<math>V_{TH} = 1.5 V</math>)</li> <li>• Pin 39, pin 46 High: Off, low: +10 ns</li> <li>• Pin 40, pin 48 High: Off, low: +20 ns</li> <li>• Recommended application range: 0 V to <math>V_{CC}</math></li> </ul>
41	—	<p>N.C. pin:</p> <ul style="list-style-type: none"> <li>• Keep grounded</li> </ul>
42	—	<p>GND pin:</p>

Terminal Equivalent Circuits (continued)

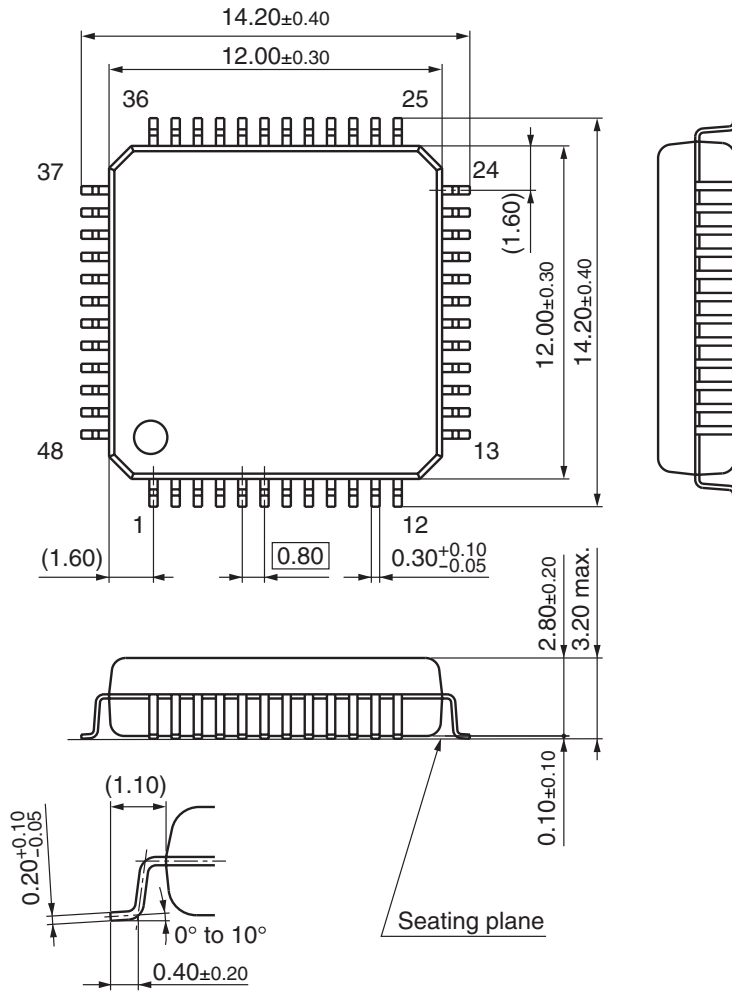
Pin No.	Equivalent circuit	Description
43		<p>Clamp pulse input pin:</p> <ul style="list-style-type: none"> <li>• Clamps inputted signal from each pin of pin 45, pin 47, pin 1 (<math>V_{TH} = 1.5\text{ V}</math>)</li> <li>• High: Clamp on</li> <li>• Low: Clamp off</li> <li>• Recommended pulse width (clamp on period) NTSC: <math>2.5\ \mu\text{s}</math> HD: <math>1.0\ \mu\text{s}</math></li> <li>• Recommended application range: <math>0\text{ V}</math> to <math>V_{CC}</math></li> </ul>
44	—	<p>N.C. pin:</p> <ul style="list-style-type: none"> <li>• Keep grounded</li> </ul>
45		<p>Y input signal pin:</p> <ul style="list-style-type: none"> <li>• Clamps input signal with Pin43 clamp pulse</li> <li>• Drive with low impedance</li> <li>• Recommended application method: Don't apply DC voltage directly to pin.</li> </ul>
46	Refer to pin 39	Refer to pin 39
47	Refer to pin 1	Refer to pin 1
48	Refer to pin 39	Refer to pin 39

■ Application Circuit Example (Basic Circuit)



■ New Package Dimensions (Unit: mm)

- QFH048-P-1212C (Lead-free package)



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