

Digital Comb Filter (NTSC)

Description

The CXD2043Q is an adaptive comb filter compatible with NTSC system, and can provide high-precision Y/C separation with a single-chip.

Features

- Y/C separation by adaptive processing
- Horizontal aperture compensation circuit
- 8-bit A/D converter (1-channel)
- 8-bit D/A converter (2-channel)
- Two 1H delay lines
- 4-PLL

Absolute Maximum Ratings (Ta = 25°C, Vss = 0V)

- Supply voltage
 

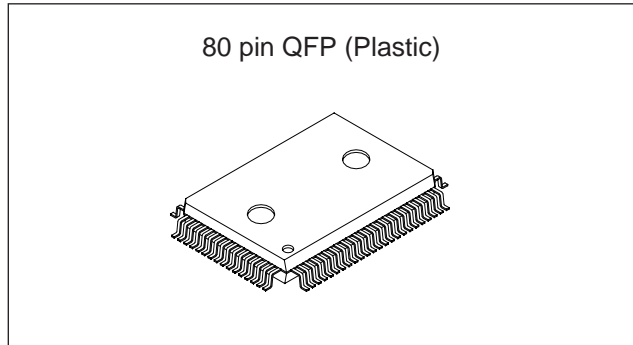
DVDD	Vss - 0.5 to +7.0	V
YVDD	Vss - 0.5 to +7.0	V
CVDD	Vss - 0.5 to +7.0	V
PVDD	Vss - 0.5 to +7.0	V
- Input voltage
 

Vi	Vss - 0.5 to VDD + 0.5	V
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- Output voltage
 

Vo	Vss - 0.5 to VDD + 0.5	V
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- Operating temperature
 

Topr	-20 to +75	°C
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- Storage temperature
 

Tstg	-55 to +150	°C
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Recommended Operating Conditions

- Supply voltage
 

DVDD	5.0 ± 0.25	V
YVDD	5.0 ± 0.25	V
CVDD	5.0 ± 0.25	V
PVDD	5.0 ± 0.25	V
- Operating temperature
 

Topr	-20 to +75	°C
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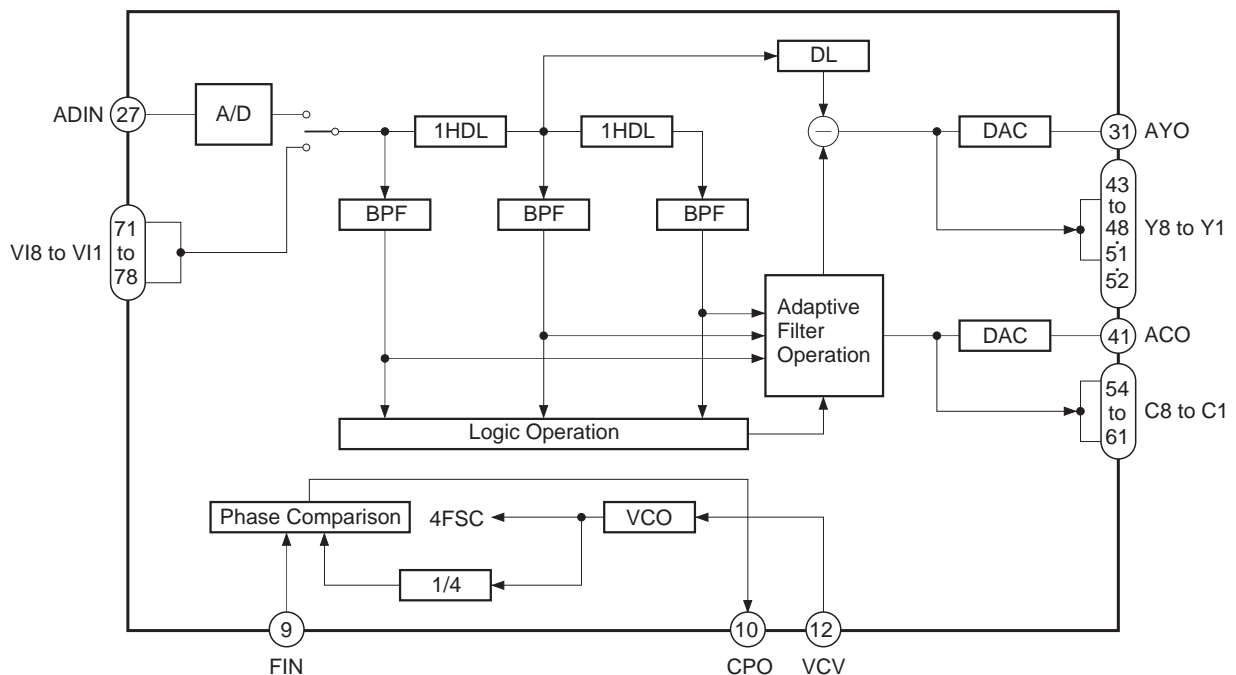
Structure

Silicon gate CMOS IC

Applications

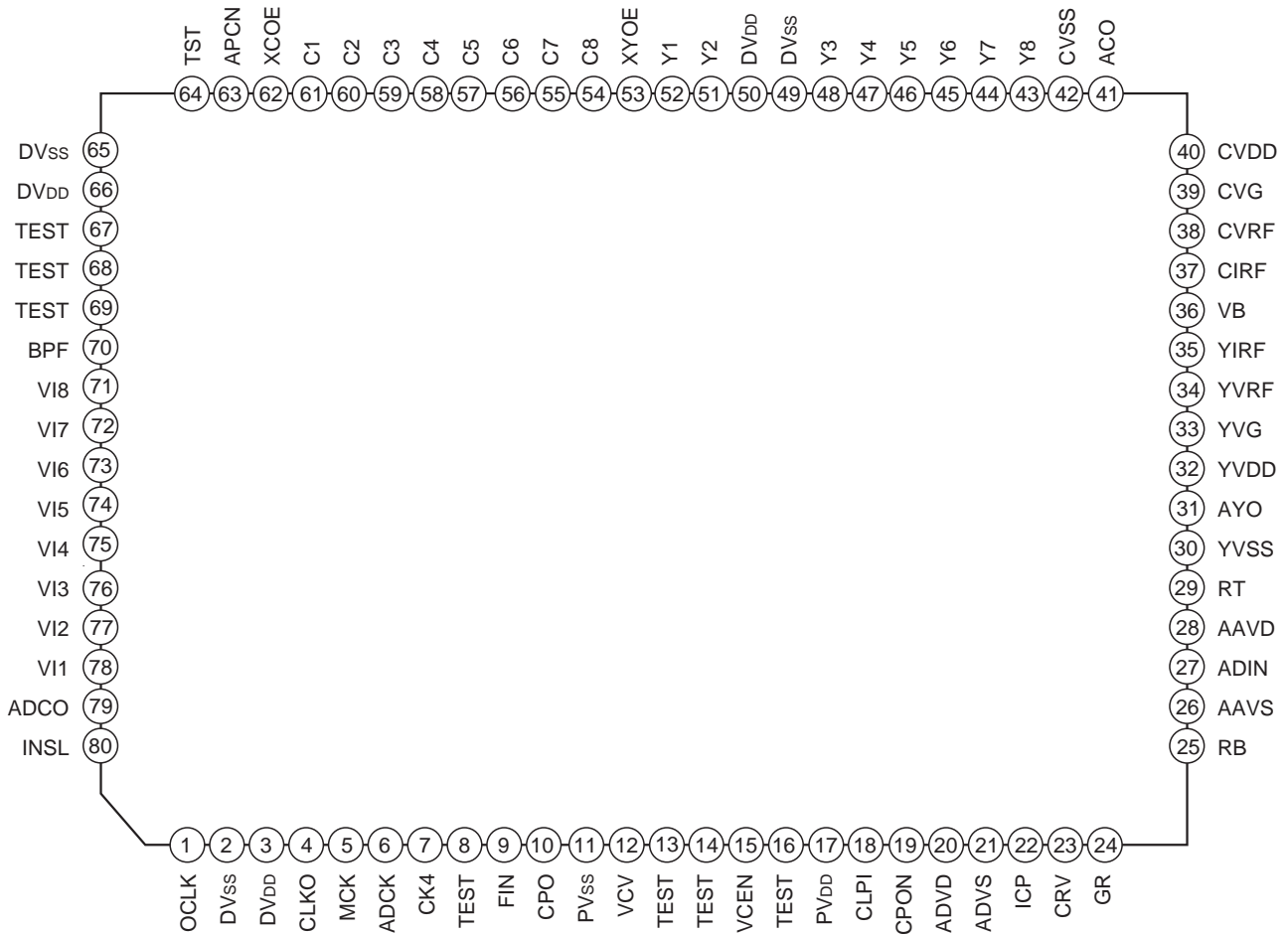
Y/C separation for color TVs and VCRs

Block Diagram



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Pin Configuration



Pin Description

Pin No.	Symbol	I/O	Description
1	OCLK	I	Clock amplifier input. Input at 0.8V <sub>p-p</sub> or more by eliminating DC components with a capacitor.
2	DV <sub>SS</sub>	—	Digital ground
3	DV <sub>DD</sub>	—	Digital power supply
4	CLKO	O	Clock amplifier output. Left open when the clock amplifier is not used.
5	MCK	I	Master clock input
6	ADCK	I	Clock input for A/D converter. Input the same clock signal as for Pin 5.
7	CK4	O	4FSC clock output. Generated from the built-in 4-PLL.
8	TEST	I	Test. Fix to Low.
9	FIN	I	FSC clock input. Input FSC which is burst-locked. Connect to DV <sub>SS</sub> when the PLL is not used.
10	CPO	O	Phase comparison output for the built-in PLL. Left open when the PLL is not used.
11	PV <sub>SS</sub>	—	PLL analog ground

Pin No.	Symbol	I/O	Description
12	VCV	I	Control voltage input for the built-in VCO oscillation. Connect to PVSS when the PLL is not used.
13	TEST	I	Test. Fix to Low.
14	TEST	I	Test. Fix to Low.
15	VCEN	I	Built-in VCO oscillation enable. Connect to PVDD when using the PLL. Connect to PVSS when the PLL is not used.
16	TEST	O	Test. Left open.
17	PVDD	—	PLL analog power supply
18	CLPI	I	Clamp pulse input for A/D converter (negative polarity). Connect to DVDD when the clamp is off.
19	CPON	I	High: Clamp function is set to off, and only the normal A/D converter function is enabled. Low: Clamp function is enabled.
20	ADVD	—	Digital power supply for A/D converter
21	ADVS	—	Digital ground for A/D converter
22	ICP	I	Clamp control voltage
23	CRV	I	Clamp reference voltage input
24	GR	—	Connect to analog ground.
25	RB	O	A/D converter reference voltage (bottom)
26	AAVS	—	Analog ground for A/D converter
27	ADIN	I	Comb filter analog input (A/D converter input)
28	AAVD	—	Analog power supply for A/D converter
29	RT	O	A/D converter reference voltage (top)
30	YVSS	—	Analog ground for Y-D/A converter
31	AYO	O	Analog luminance signal output
32	YVDD	—	Analog power supply for Y-D/A converter
33	YVG	O	Connect to YVDD via a capacitor of approximately 0.1 $\mu$ F.
34	YVRF	I	VRF for Y. Sets the output full-scale value for Y.
35	YIRF	I	Connect a resistor of 16 times (16R) that of the output resistor "R" of AYO pin.
36	VB	O	Connect to YVSS via a capacitor of approximately 0.1 $\mu$ F.
37	CIRF	O	Connect a resistor of 16 times (16R) that of the output resistor "R" of ACO pin.
38	CVRF	I	VRF for C. Sets the output full-scale value for C.
39	CVG	O	Connect to CVDD via a capacitor of approximately 0.1 $\mu$ F.
40	CVDD	—	Analog power supply for C-D/A converter
41	ACO	O	Analog chroma signal output
42	CVSS	—	Analog ground for C-D/A converter
43	Y8	O	Digital luminance signal output (MSB)
44	Y7	O	Digital luminance signal output
45	Y6	O	Digital luminance signal output

Pin No.	Symbol	I/O	Description
46	Y5	O	Digital luminance signal output
47	Y4	O	Digital luminance signal output
48	Y3	O	Digital luminance signal output
49	DV <sub>SS</sub>	—	Digital ground
50	DV <sub>DD</sub>	—	Digital power supply
51	Y2	O	Digital luminance signal output
52	Y1	O	Digital luminance signal output (LSB)
53	XYOE	I	Digital luminance signal output control High: High impedance Low: Standard output
54	C8	O	Digital chroma signal output (MSB)
55	C7	O	Digital chroma signal output
56	C6	O	Digital chroma signal output
57	C5	O	Digital chroma signal output
58	C4	O	Digital chroma signal output
59	C3	O	Digital chroma signal output
60	C2	O	Digital chroma signal output
61	C1	O	Digital chroma signal output (LSB)
62	XCOE	I	Digital chroma signal output control. High: High impedance Low: Standard output
63	APCN	I	Aperture compensation switching. High: Aperture compensation ON Low: Aperture compensation OFF
64	TST	I	Y output through mode. High: Outputs the input composite video signal from the Y output. At this time, there is 1H + 18 clock delay from the input. Low: Y/C separation mode
65	DV <sub>SS</sub>	—	Digital ground
66	DV <sub>DD</sub>	—	Digital power supply
67	TEST	I	Test. Fix to Low.
68	TEST	I	Test. Fix to Low.
69	TEST	I	Test. Fix to Low.
70	BPF	I	High: Fixed to BPF separation Low: Standard mode
71	V18	I	Digital composite video input (MSB)
72	V17	I	Digital composite video input
73	V16	I	Digital composite video input
74	V15	I	Digital composite video input
75	V14	I	Digital composite video input
76	V13	I	Digital composite video input

Pin No.	Symbol	I/O	Description
77	VI2	I	Digital composite video input
78	VI1	I	Digital composite video input (LSB)
79	ADCO	I	High: Video signals taken in form A/D converter are output from the Y output pins (Y8 to Y1) as 8-bit digital data with a 3.5 clock delay. Low: Normal mode
80	INSL	I	Input switching. High: Digital input Low: Analog input.

**Electrical Characteristics**

**DC Characteristics**

( $V_{DD} = 5 \pm 0.25V$ ,  $V_{SS} = 0V$ ,  $T_a = -20$  to  $+75^\circ C$ )

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	DV <sub>DD</sub>	—	4.75	5.0	5.25	V
	AAVD					
	ADVD					
	YVDD					
	CVDD					
Operating temperature	Topr	—	-20	—	+75	°C
Supply current	I <sub>DD</sub>	Clock 14MHz	—	—	80	mA
High level input voltage	V <sub>IH</sub>	CMOS level	$V_{DD} \times 0.7$	—	$V_{DD}$	V
Low level input voltage	V <sub>IL</sub>	CMOS level	$V_{SS}$	—	$V_{DD} \times 0.3$	V
High level output voltage	V <sub>OH</sub>	I <sub>OH</sub> = -2mA	$V_{DD} - 0.8$	—	$V_{DD}$	V
		I <sub>OH</sub> = -4mA (Pins 4, 7)				
Low level output voltage	V <sub>OL</sub>	I <sub>OL</sub> = 4mA	$V_{SS}$	—	0.4	
		I <sub>OL</sub> = 8mA (Pins 4, 7)				
Logical V <sub>th</sub>	LV <sub>th</sub>	OCLK (Pin 1)	—	$V_{DD}/2$	—	V
Input voltage	V <sub>IN</sub>		0.8	—	$V_{DD}$	V <sub>p-p</sub>
Feedback resistor	R <sub>FB</sub>		250k	1M	2.5M	Ω

**AC Characteristics**

( $V_{DD} = 5 \pm 0.25V$ ,  $V_{SS} = 0V$ ,  $T_a = -20$  to  $+75^\circ C$ ,  $C_L = 20pF$ )

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Data setup time	t <sub>dsu</sub>	MCK → VI [8 : 1]	15.0	—	—	ns
Data hold time	t <sub>dh</sub>	MCK → VI [8 : 1]	10.0	—	—	ns
Propagation delay time	t <sub>pd</sub>	MCK → Y [A : 1]	—	—	40	ns
		MCK → C [A : 1]				
Clock frequency	f	—	14	4f <sub>sc</sub>	15	MHz

**Pin Capacitance**

( $T_a = 25^\circ C$ ,  $f = 1MHz$ ,  $V_{IN} = V_{OUT} = 0V$ )

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input capacitance	C <sub>IN</sub>	—	—	—	9	pF
Output capacitance	C <sub>OUT</sub>	—	—	—	11	pF

**ADC Characteristics**(V<sub>DD</sub> = 5V, T<sub>a</sub> = 25°C, f = 10MHz)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Resolution	n		—	8	—	bit
Max. conversion speed	f <sub>max</sub>		14.3	—	—	MSPS
Analog input band width	BW	-3dB	—	18	—	MHz
Self bias	VRB		0.48	0.52	0.56	V
	VRT - VRB		1.96	2.08	2.22	V
Propagation delay time	t <sub>pd</sub>		—	—	45	ns
Differential linearity error	E <sub>D</sub>		-1.0	—	+1.0	LSB
Integral linearity error	E <sub>L</sub>		-3.0	—	+3.0	LSB
Clamp offset voltage	EOC	V <sub>REF</sub> = VRB	-20	0	+20	mV
		V <sub>REF</sub> = VRT	-30	-10	+10	mV

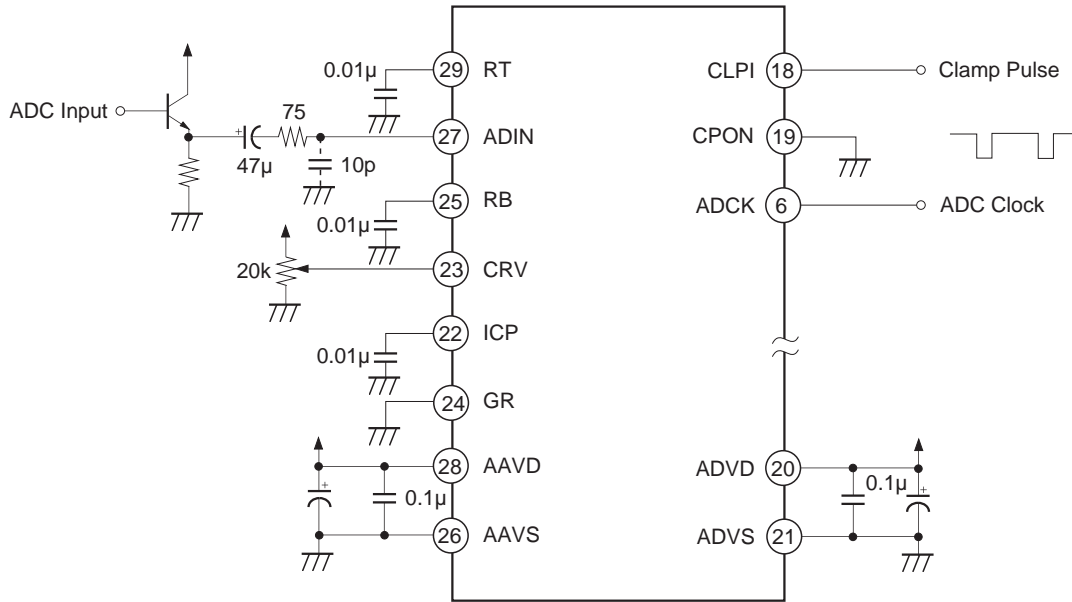
**DAC Characteristics**(V<sub>DD</sub> = 5V, V<sub>RF</sub> = 2V, I<sub>RF</sub> = 3.3kΩ, R = 200Ω, T<sub>a</sub> = 25°C, f = 10MHz)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Resolution	n	—	—	8	—	bit
Max. conversion speed	f <sub>max</sub>	—	14.3	—	—	MSPS
Differential linearity error	E <sub>D</sub>	—	-0.5	—	+0.5	LSB
Integral linearity error	E <sub>L</sub>	—	-1.5	—	+1.5	LSB
Output full-scale voltage	V <sub>FS</sub>	—	1.805	1.90	1.995	V
Output full-scale current	I <sub>FS</sub>	—	—	9.5	15	mA
Output offset voltage	V <sub>OS</sub>	—	—	—	1.0	mV
Precision guaranteed output voltage range	V <sub>OC</sub>	—	1.8	—	2.1	V
Glitch energy	GE	*1	—	30	—	pV-s

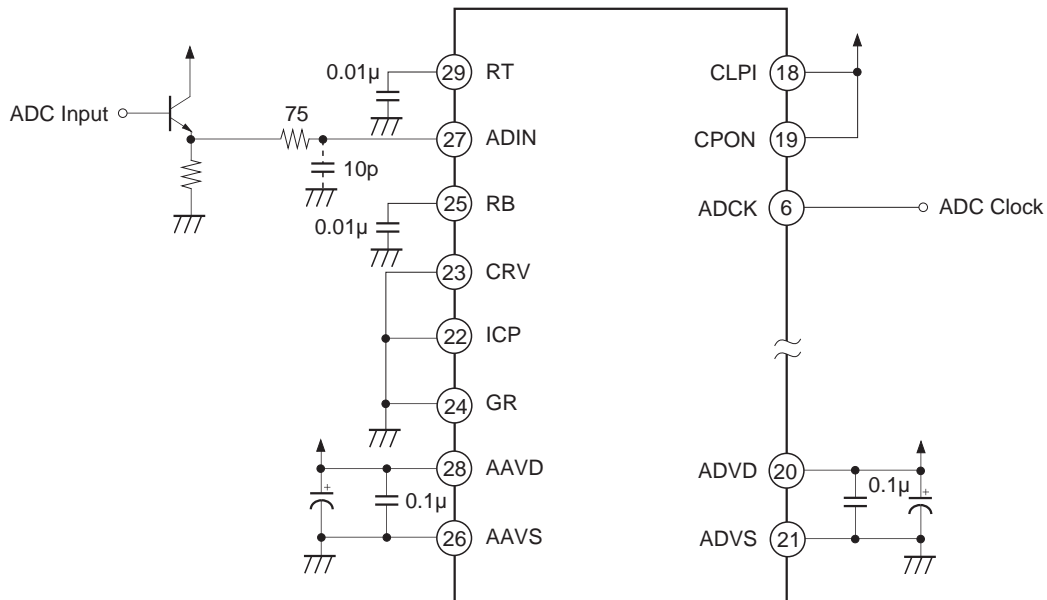
\*1 R = 75Ω, 1Vp-p output

Application Circuit for A/D Converter

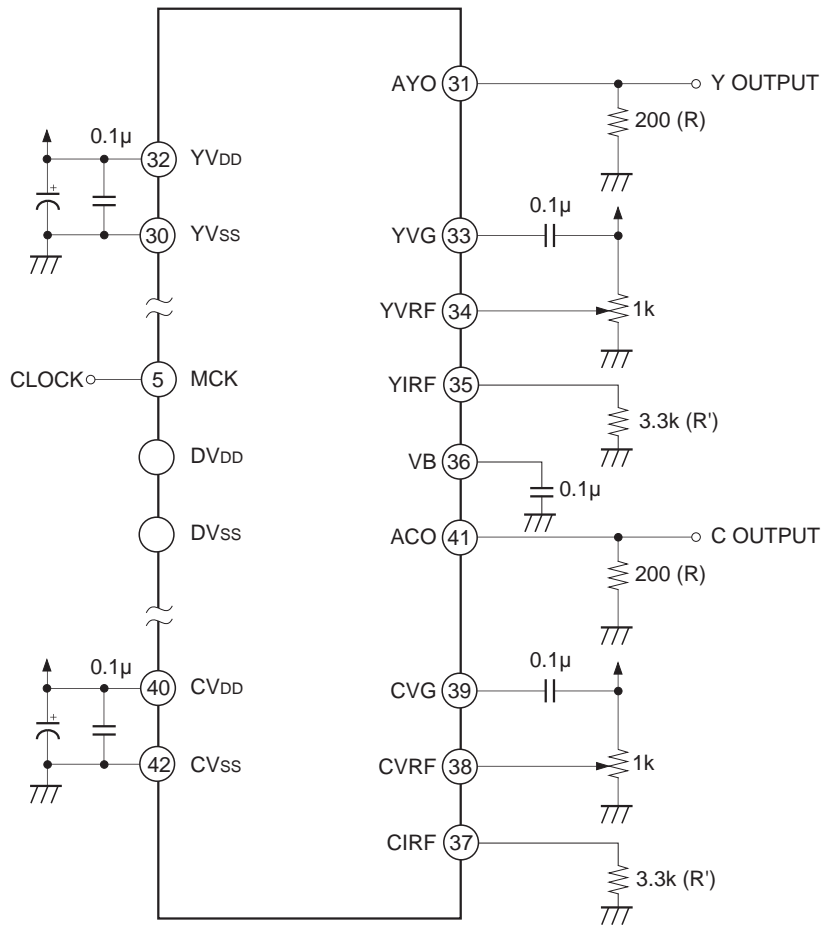
(1) In the case of input clamp pulse directly.



(2) In the case of not using the internal clamp circuit



Application Circuit for D/A Converter



• Method of Selecting Output Resistance

The CXD2043Q has a built-in current output-type D/A converter. To obtain the output voltages, connect resistances to AYO and ACO pins.

The voltage and current specifications are:

Output full-scale voltage:  $V_{FS} = 0.5$  to  $2.0V$

Output full-scale current:  $I_{FS} = 0$  to  $15mA$

Calculate the output resistance using the relationship  $V_{FS} = I_{FS} \times R$ . In addition, connect a resistance of 16 times the output resistance to the reference current pin (YIRF, CIRF). In the case where the value comes to be impractical, use a value of resistance as close to the value calculated as possible.

Note that, at this time,  $V_{FS} = V_{RF} \times 16R/R'$  ( $V_{RF}$ : Pin voltage of YVRF and CVRF).

R is the resistance connected to AYO/ACO, and R' is the resistance connected to YIRF/CIRF. Power consumption can be reduced by using higher resistance values, but then glitch energy and data settling time increase contrastingly. Select optimum resistance values according to the system applications.

•  $V_{DD}$ ,  $V_{SS}$

Separate the analog and digital systems around the device to reduce noise effect.  $YV_{DD}$  and  $CV_{DD}$  are respectively by-passed to  $YV_{SS}$  and  $CV_{SS}$  as close to each other as possible through ceramic capacitor of approximately  $0.1\mu F$ .





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