SONY

CXD2309Q

10-bit 50MSPS 3-Channel D/A Converter

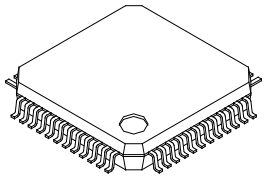
Description

The CXD2309Q is a 10-bit high-speed D/A converter for video band, featuring RGB 3-channel input/output. This is ideal for use in high-definition TVs and high-resolution displays.

Features

- Resolution 10-bit
- Maximum conversion speed 50MSPS
- RGB 3-channel input/output
- Differential linearity error ±0.5 LSB
- Low power consumption 200mW (200Ω load for 2Vp-p output)
- Single +5V power supply
- Low glitch
- 48-pin QFP package

48 pin QFP (Plastic)



Structure

Silicon gate CMOS IC

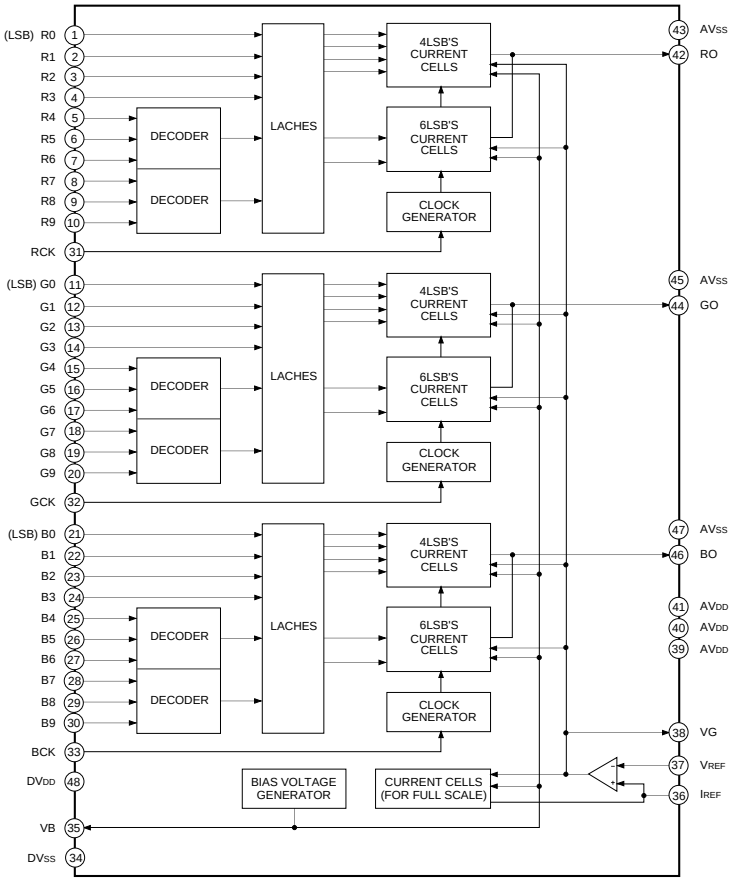
Recommended Operating Conditions

• Supply voltage	AV_{DD}, AV_{SS}	4.75 to 5.25	V
	DV_{DD}, DV_{SS}	4.75 to 5.25	V
• Reference input voltage	V_{REF}	0.5 to 2.0	V
• Clock pulse width	$T_{PW}1$	10 (Min.)	ns
	$T_{PW}0$	10 (Min.)	ns
• Operating temperature	Topr	–20 to +75	°C

Absolute Maximum Ratings

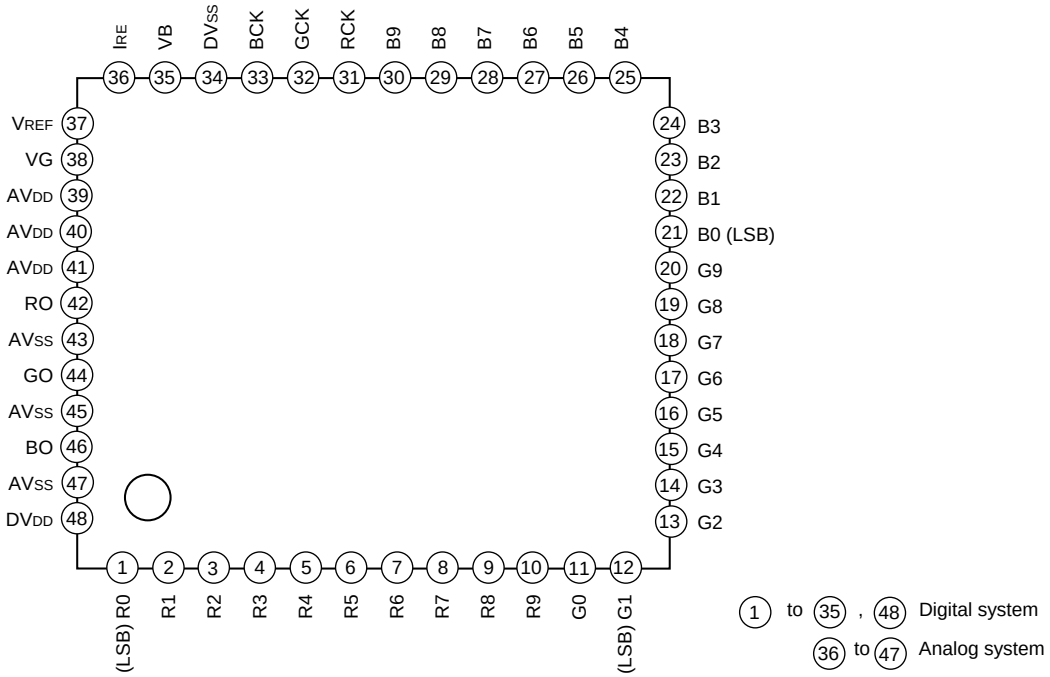
• Supply voltage	V_{DD}	7	V
• Input voltage	V_{IN}	V_{DD} to V_{SS}	V
• Output current	I_{OUT}	0 to 15	mA
• Storage temperature	Tstg	–55 to +150	°C

Block Diagram

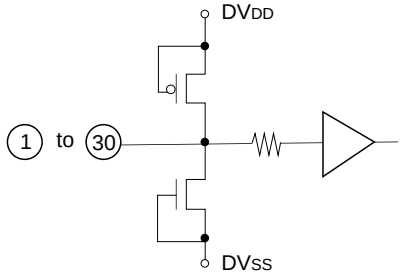
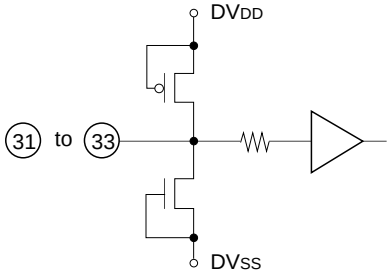
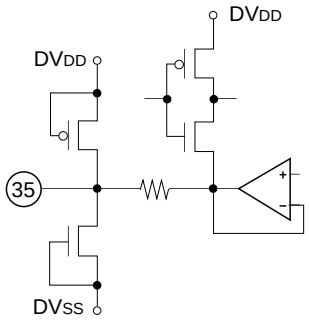


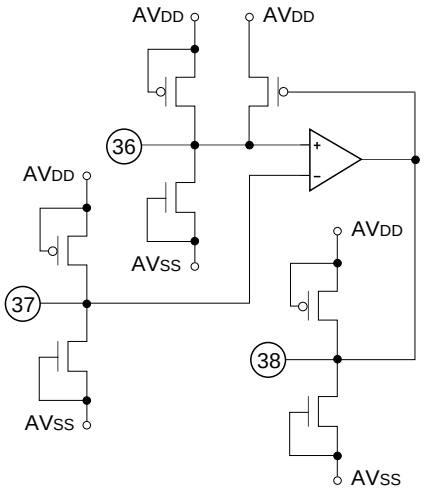
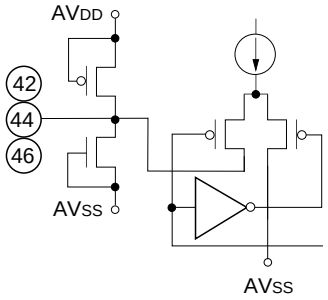
E94341-PK

Pin Configuration



Pin Description and Equivalent Circuit

Pin No.	Symbol	Equivalent circuit	Description
1 to 10	R0 to R9		Digital input.
11 to 20	G0 to G9		
21 to 30	B0 to B9		
31	RCLK		Clock pin.
32	GCLK		
33	BCLK		
34	DVSS		Digital GND.
35	VB		Connect an approximately 0.1µF capacitor.

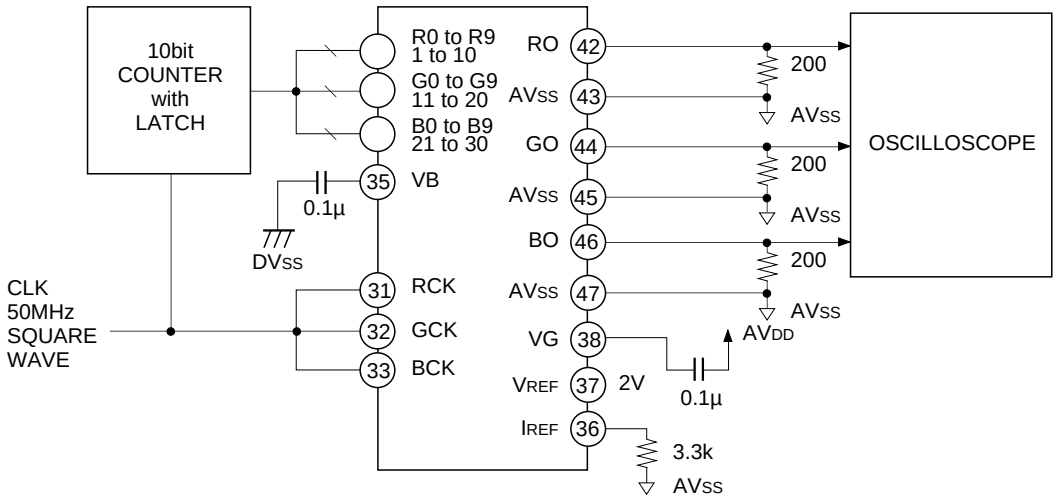
Pin No.	Symbol	Equivalent circuit	Description
36	I_{REF}		Connect a "16R" resistor which are 16 times the output resistance "R".
37	V_{REF}		Sets an output full-scale value.
38	VG		Connect an approximately 0.1µF capacitor.
39 to 41	AV_{DD}		Analog V_{DD}.
42	RO		Current output. Output can be obtained by connecting a resistor (200Ω typ.).
44	GO		
46	BO		
43, 45, 47	AV_{DD}		Analog GND.
47, 48	DV_{DD}		Digital V_{DD}.

Electrical Characteristics (f_{CLK} = 50MHz, V_{DD} = 5V, R = 200Ω, V_{REF} = 2.0V, Ta = 25°C)

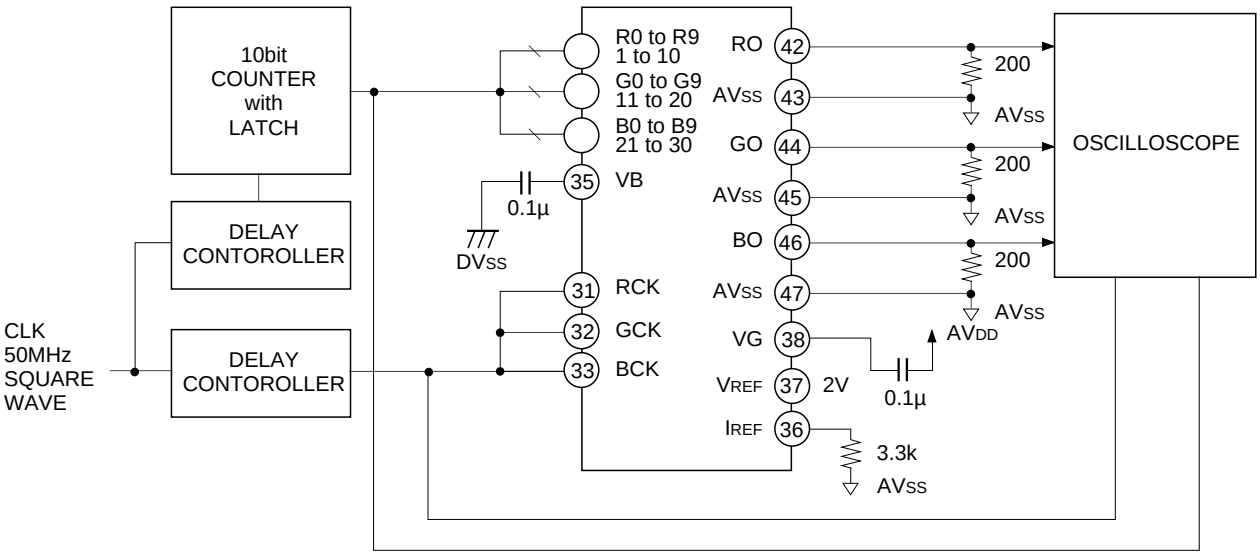
Item		Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Resolution		n			10		bit
Maximum conversion speed		f_{MAX}		50			MSPS
Linearity error		E_L		–2.0		2.0	LSB
Differential linearity error		E_D		–0.5		0.5	LSB
Output full-scale voltage		V_{FS}		1.8	1.92	2.0	V
Output full-scale current		I_{FS}		9.0	9.6	10	mA
Output offset voltage		V_{OS}				1	mV
Supply current		I_{DD}			40	50	mA
Digital input current	High level	I_{IH}				5	µA
	Low level	I_{IL}		–5			µA
Digital input voltage	High level	V_{IH}	(DV_{DD} = 4.75 to 5.25V)	2.15			V
	Low level	V_{IL}	(DV_{DD} = 4.75 to 5.25V)			0.85	V
Output full-scale ratio		F_{SR}		0		3	%
Precision guaranteed output voltage range		V_{OC}		1.8	1.92	2.0	V
Setup time		t_S		6			ns
Hold time		th		3			ns
Propagation delay time		t_{PD}			14		ns
Glitch energy		GE	For Rout = 100Ω, 1Vp-p output		50		pV-s
Cross talk		CT	For 10MHz sine wave output	40	42		dB
SNR		SNR	For 1MHz sine wave output	50	55		dB

$$\text{Output full-scale ratio} = \left| \frac{\text{Full-scale voltage for each channel}}{\text{Average of full-scale voltage for each channel}} - 1 \right| \times 100\ (\%)$$

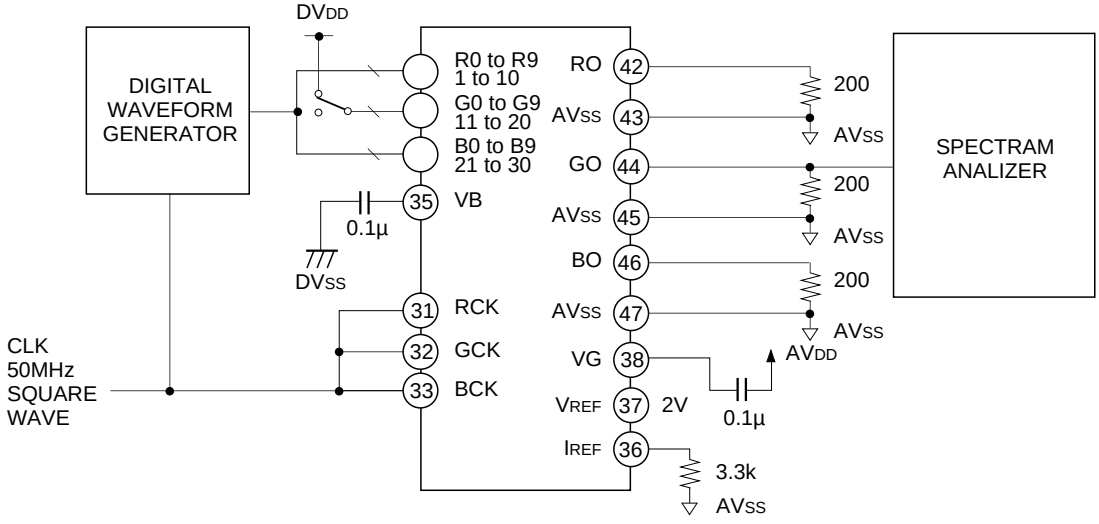
Maximum conversion rate measurement circuit



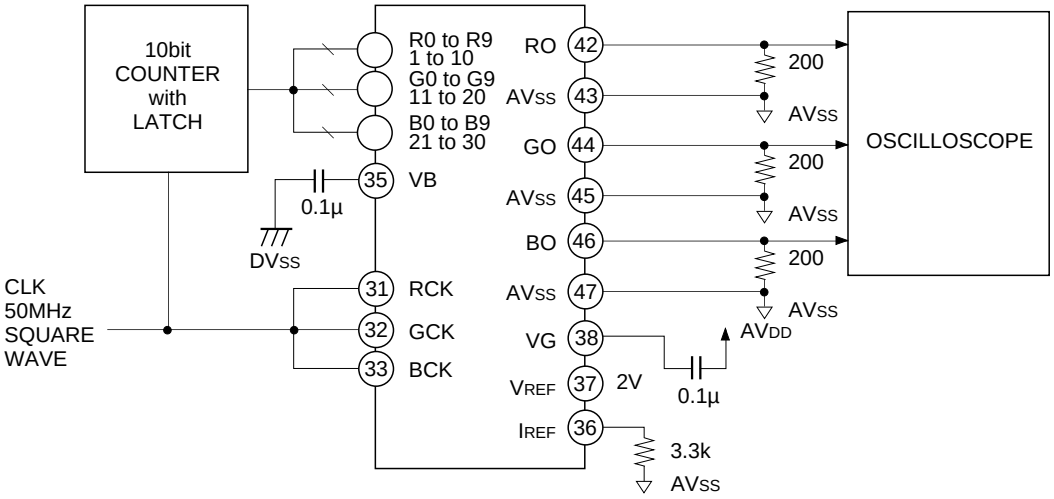
Setup hold time
Glitch energy **measurement circuit**



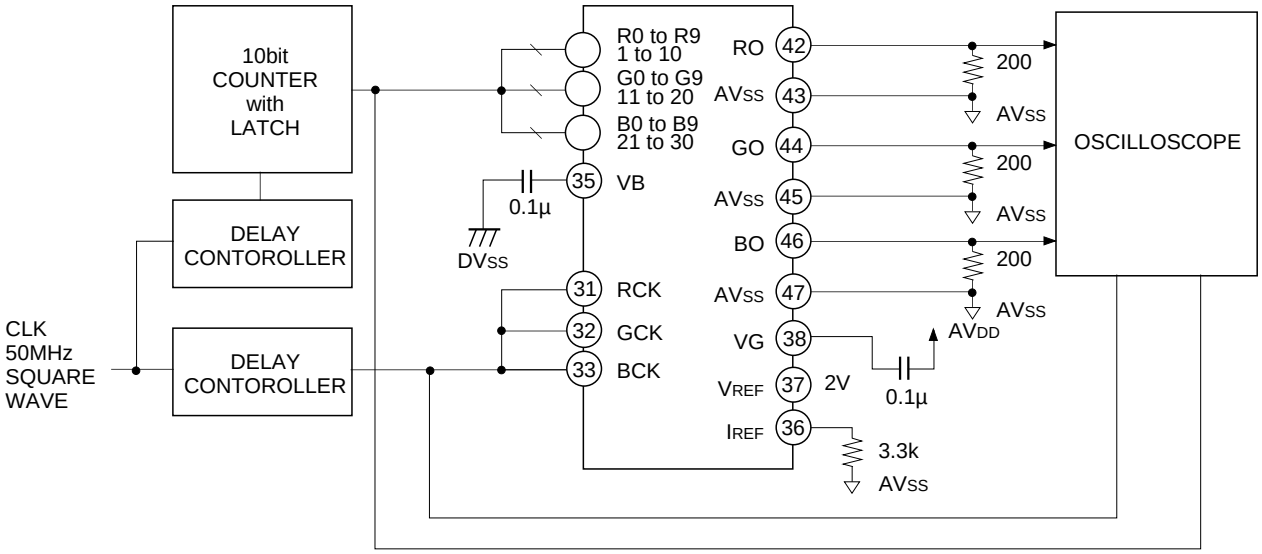
Cross talk measurement circuit



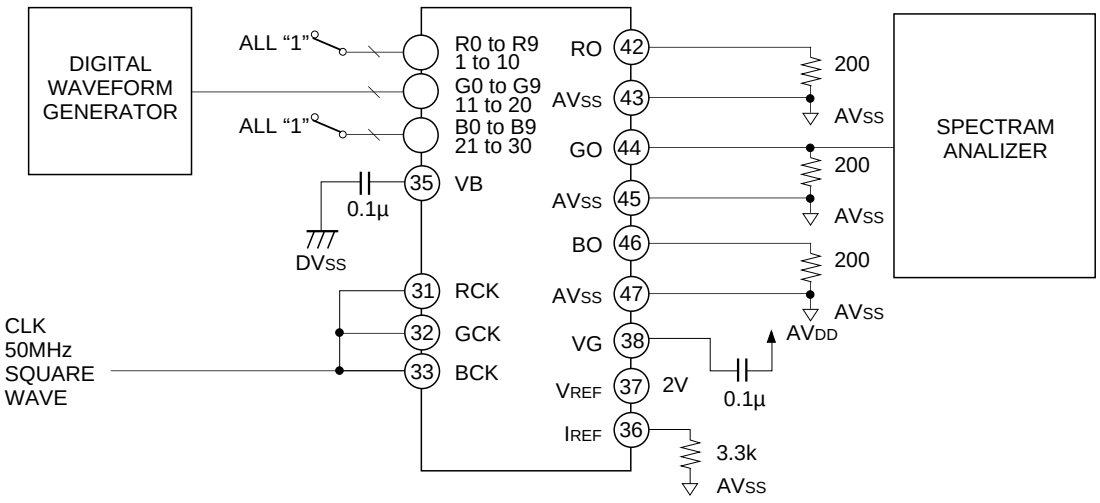
DC characteristics measurement circuit



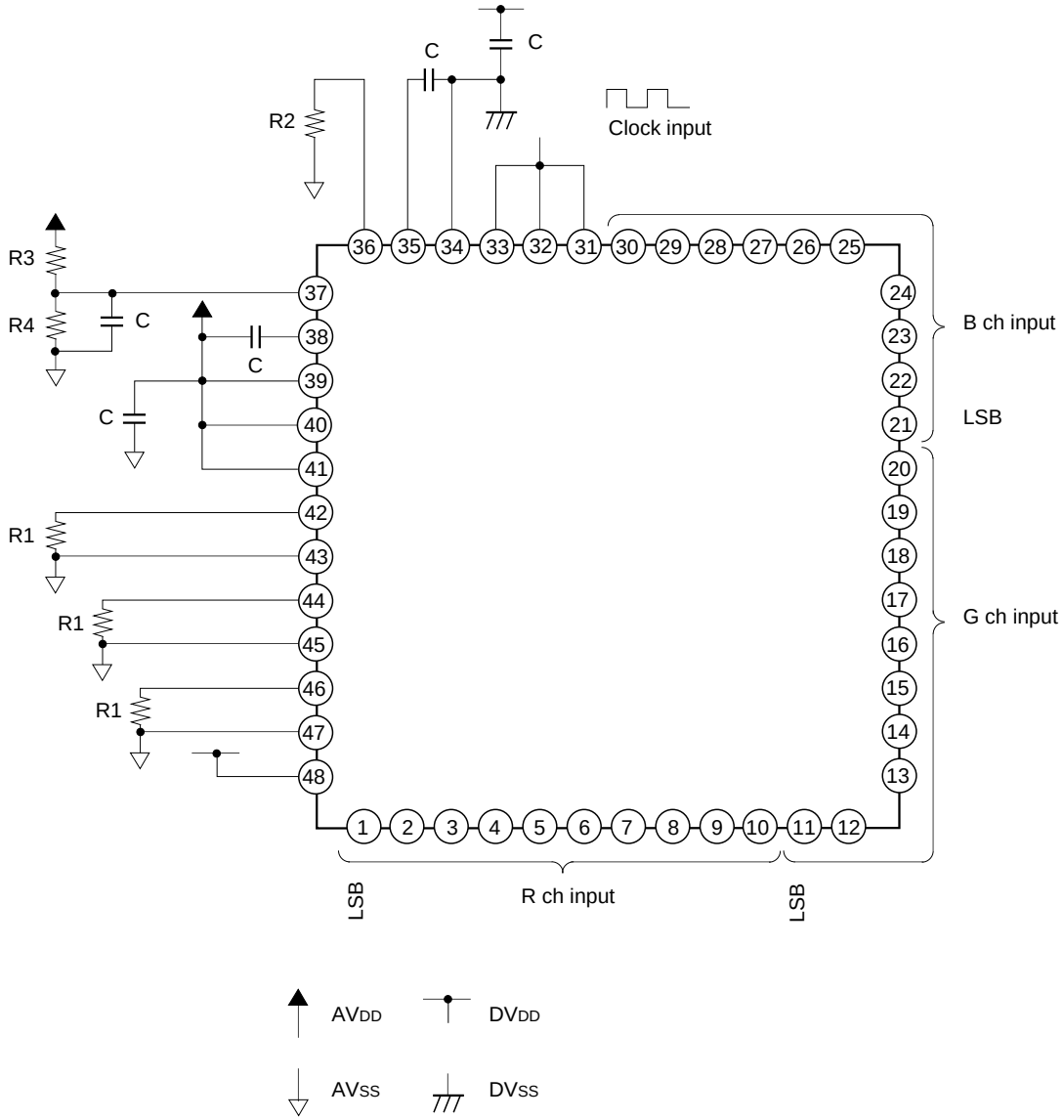
Propagation delay time measurement circuit



SNR measurement circuit



Application Circuit



- When the power supply (AV_{DD} and DV_{DD}) is 5.0V.
- R1 = 200Ω
- R2 = 3.3kΩ
- R3 = 3.0kΩ
- R4 = 2.0kΩ
- C = 0.1µF

Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

Example of Representative Characteristics

Fig. 1. Output full-scale voltage vs. Reference voltage

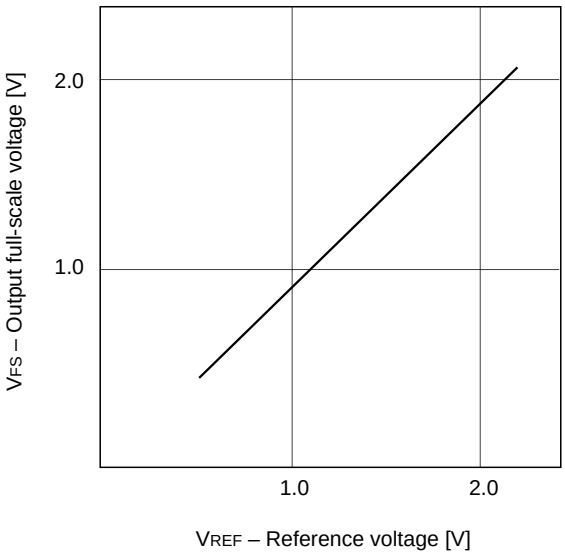


Fig. 2. Output resistance vs. Glitch energy

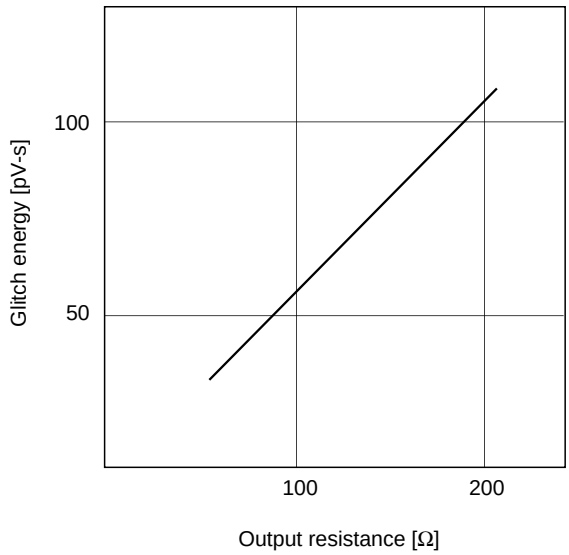


Fig. 3. Output full-scale voltage vs. Ambient temperature

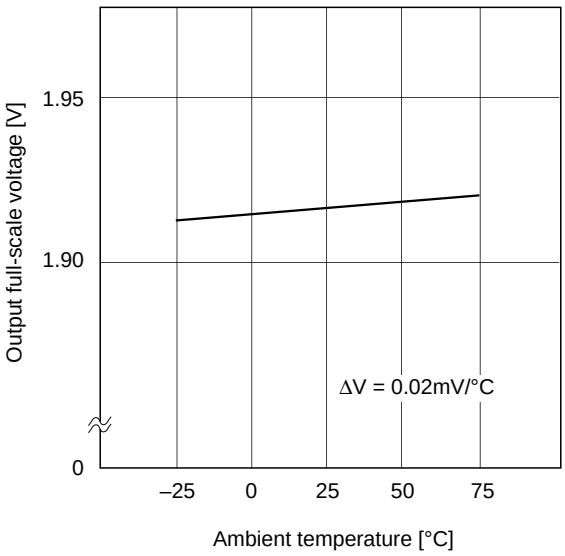
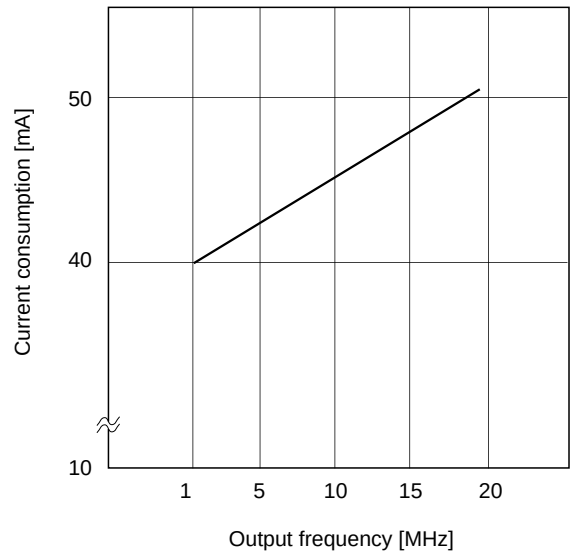


Fig. 4. Output frequency vs. Current consumption



Standard Measurement Conditions and description

- V_{DD} = 5.0V
- V_{REF} = 2.0V
- R = 200Ω
- 16R = 3.3kΩ
- Ta = 25°C
- V_{REF} in the Fig. 3. is fixed to 2Vdc without resistor dividing.
- Input data in Fig. 4. = all "0" and "1" of rectangular wave, clock frequency = 50MHz for a total value of three channels.

Notes on Operation

- Selecting the Output Resistance

  CXD2309Q is a current output type D/A converter. To create the output voltage, connect the resistor to the current output pin.

  Specifications: Output full-scale voltage V_{FS} max = 2.0 [V]
  Output full-scale current I_{FS} max = 10 [mA]

  Calculate the output resistance from $V_{FS} = I_{FS} \times R$. Connect a resistance sixteen times the output resistance to the reference current pin I_{REF}. In some cases, as this value may not exist, a similar value can be used instead.

  Note that the V_{FS} will be the following.

  $$V_{FS} = V_{REF} \times 16\ R/R'$$

  R is the resistor to be connected to the IO and R' is the resistor to be connected to the I_{REF}. Power consumption can be reduced by increasing the resistance, but this will on the contrary increase the glitch energy and data setting time. Set the best values according to the purpose of use.

- Correlation between Data and Clock

  For CXD2309Q to display the desired performance as a D/A converter, the data transmitted from outside and the clock must be synchronized properly. Adjust the setup time (ts) and hold time (th) as specified in "Electrical Characteristics".

- V_{DD}, V_{SS}

  Separate the analog and digital signals around the device to reduce noise effects. Bypass the V_{DD} pin to each GND with a 0.1µF ceramics capacitor as near as possible to the pin for both the digital and analog signals.

- Latch up

  The AV_{DD} and DV_{DD} pins must be able to share the same power supply of the board. This is to prevent latch up caused by potential difference between the two pins when the power is turned on.

- I_{REF} pin

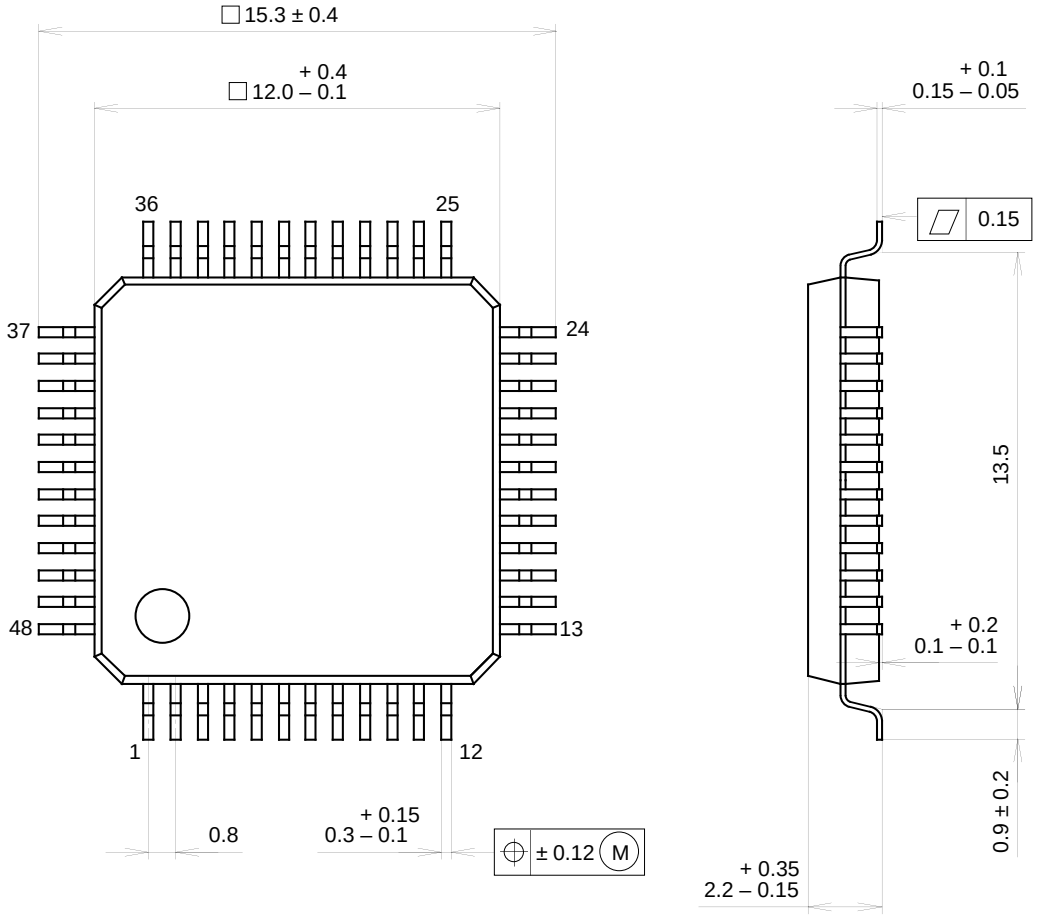
  The I_{REF} pin is very sensitive to improve the AC characteristics. Pay attention for capacitance component not to attach to this pin because its output may become unstable.

- VG pin

  It is recommended to use a 1µF capacitor to improve the AC characteristics though the typical capacitance value externally connected to the VG pin is 0.1µF.

Package Outline Unit : mm

48PIN QFP (PLASTIC)



PACKAGE STRUCTURE

SONY CODE	QFP-48P-L04
EIAJ CODE	∗QFP048-P-1212-B
JEDEC CODE	————

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER / PALLADIUM PLATING
LEAD MATERIAL	COPPER / 42 ALLOY
PACKAGE WEIGHT	0.7g