

## QUAD MONOLITHIC SPST CMOS/D-MOS ANALOG SWITCHES

### ORDERING INFORMATION

Quad SPST Break-before-make	SO-16 Surface Mount Package		16-Pin Plastic DIP		16-Pin Ceramic DIP		20-Pin Plastic DIP	
Commercial Temp. Range	—	—	CDG308CJ	CDG309CJ	—	—	—	—
Industrial Temp. Range	—	—	CDG308BJ	CDG309BJ	CDG308BK	CDG309BK	CDG4308BJ	CDG4309BJ
Ext. Industrial Temp. Range	CDG308DY	CDG309DY	—	—	—	—	—	—
Military Temp. Range	—	—	—	—	CDG308AK	CDG309AK	—	—
Logic '0' < 10V Logic '1' > 4.5V	Logic '1' ON	Logic '1' OFF	Logic '1' ON	Logic '1' OFF	Logic '1' ON	Logic '1' OFF	Logic '1' ON	Logic '1' OFF

### FEATURES

- High Off Isolation, 68dB @ 10MHz
- Low Insertion Loss, 0.9 x DC @ 100MHz
- Low Channel-to-Channel Cross Talk, -80dB @ 10MHz
- CMOS Compatible Inputs
- Low 'OFF' Leakage
- Industry Standard Pin-Out, CDG308/309

### DESCRIPTION

Topaz Semiconductor CMOS/DMOS Analog Switches feature high-speed, low-power CMOS input logic and level translation circuitry and high-speed, low capacitance Lateral D-MOS switches. CMOS and Lateral D-MOS circuitry are fabricated together on a single silicon chip. The CDG4308 and CDG4309 use the same die as CDG308 and CDG309; the extra isolating pin between switch input and output increases isolation by 6dB.

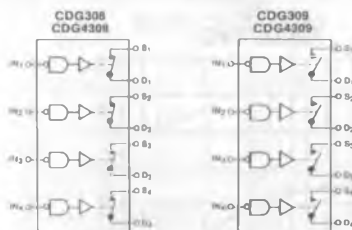
### APPLICATIONS

- Glitch-Free Analog Switches
- RF & Video Switches
- Track and Hold Switches
- Sample and Hold Switches

### NOTE

All devices contain diodes to protect inputs against damage due to high static voltages or electric fields; however, it is advised that precautions be taken not to exceed the maximum recommended input voltages. All unused inputs must be connected to an appropriate logic voltage level (either  $V_{DD}$  or GND).

### FUNCTIONAL BLOCK DIAGRAMS

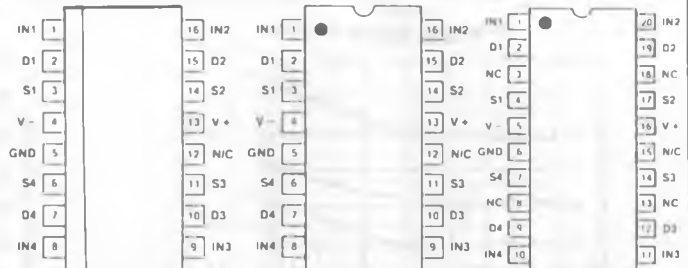


Four SPST Switches per Package  
Switches Shown in Logic "1" Input Position

### LOGIC TABLE

Logic	CDG308 CDG4308	CDG309 CDG4309
0	OFF	ON
1	ON	OFF

### PIN CONFIGURATIONS



TOP VIEW  
CDG308DY  
CDG309DY  
(See Package 21)

TOP VIEW  
CDG308-309AK  
CDG308-309BK  
(See Package 15)

TOP VIEW  
CDG4308BJ  
CDG4309BJ  
(See Package 12)

CDG308-309BJ  
CDG308-309CJ  
(See Package 10)

**ABSOLUTE MAXIMUM RATINGS**

V<sub>-</sub> Negative Supply Voltage ..... -20V  
 V<sub>+</sub> Positive Supply Voltage ..... +20V  
 V<sub>IN</sub> Control Input Voltage Range ..... V<sub>+</sub> +0.3V,  
 V<sub>-</sub> -0.3V  
 I<sub>L</sub> Continuous Current, any Pin  
 Except S or D ..... 20 mA  
 I<sub>S</sub> Continuous Current, S or D ..... 30 mA  
 I<sub>S</sub> Peak Pulsed Current, S or D,  
 80μsec, 1%, Duty Cycle ..... 180 mA  
 T<sub>J</sub> Junction Temperature Range ..... -55 to +125°C  
 T<sub>S</sub> Storage Temperature Range ..... -55 to +125°C  
 P<sub>D</sub> Power Dissipation ..... 500 mW

**RECOMMENDED OPERATING CONDITIONS**

V<sub>-</sub> Negative Supply Voltage ..... -8.0 to -15V  
 V<sub>+</sub> Positive Supply Voltage ..... +8.0 to +15V  
 V<sub>IN</sub> Control Input Voltage Range ..... 0 to +5V  
 V<sub>S</sub> Analog Switch Voltage Range ..... -10 to +10V  
 T<sub>OP</sub> Operating Temperature  
 (A Suffix) ..... -55 to +125°C  
 (B Suffix) ..... -25 to +85°C  
 (C Suffix) ..... 0 to +70°C  
 (D Suffix) ..... -40 to +85°C

**ELECTRICAL CHARACTERISTICS** (V<sub>-</sub> = -15V, V<sub>+</sub> = +15V per channel unless otherwise noted, T<sub>A</sub> = +25°C)

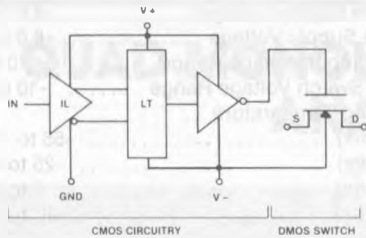
#	SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
1	V <sub>ANALOG</sub>	Analog Signal Range	-10		+10	V	
2	r <sub>DS(on)</sub>	Switch ON Resistance		40	80	ohms	V <sub>S</sub> = -10V
3				45	80		V <sub>S</sub> = +2.0V
4				100	160		V <sub>S</sub> = +10V
5	V <sub>IH</sub>	High Level Input Voltage	4.5	3.4		V	
6	V <sub>IL</sub>	Low Level Input Voltage			1.0		
7	I <sub>IN</sub>	Logic Input Leakage Current		0.01	0.1	μA	V <sub>IN</sub> = +5.0V
8				0.02	0.1		V <sub>IN</sub> = +15V
9	I <sub>DIOFF</sub>	Switch OFF Leakage Current		0.2	5.0	nA	V <sub>D</sub> = +10V, V <sub>S</sub> = -10V
10	I <sub>SIOFF</sub>			0.4	5.0		V <sub>S</sub> = +10V, V <sub>D</sub> = -10V
11	I <sub>-</sub>	Neg. Supply Quiescent Current		-0.1	-0.5	μA	CDG309/4309 V <sub>IN</sub> = 5.0V
12	I <sub>+</sub>	Pos. Supply Quiescent Current		0.1	0.5		
13	t <sub>ON</sub>	Switch Turn-On Time		140	250	nSec	V <sub>IN</sub> = 1.0V CDG308, CDG4308
14	t <sub>OH</sub>	Switch Turn-Off Time		80	220		V <sub>IN</sub> = 5.0V CDG309, CDG4309
15	O <sub>IRR</sub>	Off Isolation	CDG308/309	60	62	dB	f = 10MHz R <sub>L</sub> = 50Ω
16		Rejection Ratio	CDG4308/4309	66	68		
17	C <sub>CRR</sub>	Cross-Coupling Rejection Ratio		80		dB	f = 10MHz, R <sub>L</sub> = 50Ω
18	C <sub>d</sub>	Drain-Node Capacitance		0.3		pF	V <sub>IN</sub> = 1.0V CDG308, CDG4308
19	C <sub>s</sub>	Source-Node Capacitance		3.0			V <sub>IN</sub> = 5.0V, CDG309, CDG4309 V <sub>D</sub> = V <sub>S</sub> = 0, f = 1MHz

**ELECTRICAL CHARACTERISTICS** (V<sub>-</sub> = -15V, V<sub>+</sub> = +15V, per channel)

LIMITS AT TEMPERATURE EXTREMES

#	SYMBOL	PARAMETER	MAXIMUM @ T <sub>A</sub> =					UNITS	TEST CONDITIONS	
			-55°C	-25°C	+70°C	+85°C	+125°C			
1	V <sub>ANALOG</sub>	Analog Signal Range	±10	±10	±10	±10	±10	V		
2	r <sub>DS(on)</sub>	Switch On Resistance		80	80	120	120	150	ohms	V <sub>S</sub> = -10V
3				80	80	120	120	150		V <sub>S</sub> = +2.0V
4				160	160	240	240	300		V <sub>S</sub> = 10V
5	I <sub>IN</sub>	Logic Input Leakage Current		0.1	0.1	1.0	1.0	10	μA	V <sub>IN</sub> = +5.0V
6					0.1	0.1	2.0	2.0		20
7	I <sub>DIOFF</sub>	Switch OFF Leakage Current		5.0	5.0	100	100	1000	nA	V <sub>D</sub> = +10V, V <sub>S</sub> = -10V
8	I <sub>SIOFF</sub>	Leakage Current		5.0	5.0	100	100	1000		V <sub>S</sub> = +10V, V <sub>D</sub> = -10V
9	I <sub>-</sub>	Supply Quiescent Currents		-0.5	-0.5	-20	-20	-100	μA	
10	I <sub>+</sub>			0.5	0.5	20	20	100		

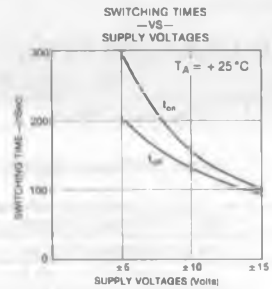
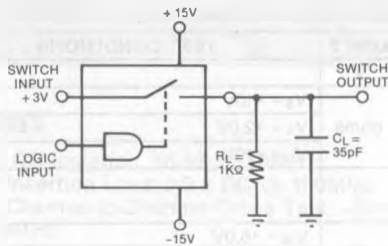
**FUNCTIONAL DIAGRAM** (1 of 4 channels)



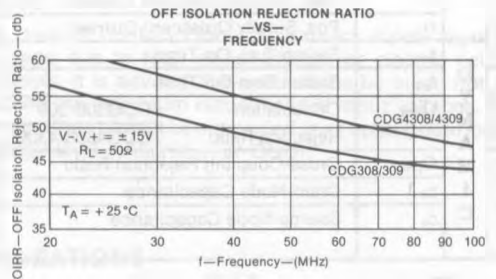
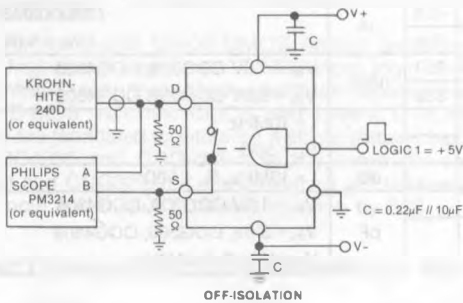
**Switch Contacts:**

Switches are bi-directional (Analog Input can be to Source or Drain). However, for optimum performance In Video Applications, connect Input to Source and Output to Drain.

**SWITCHING TIMES TEST CIRCUIT**

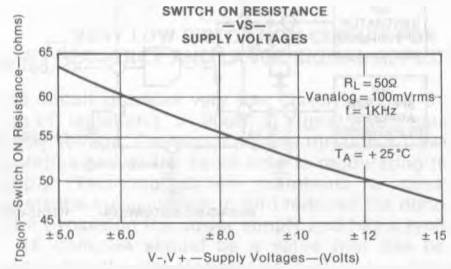
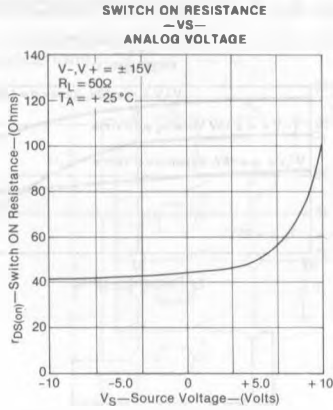


**OFF ISOLATION TEST CIRCUIT**

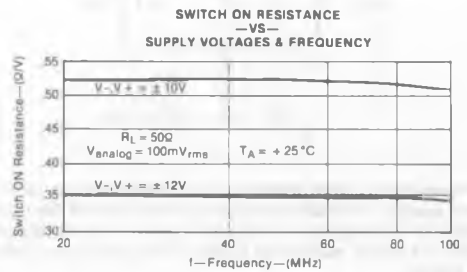
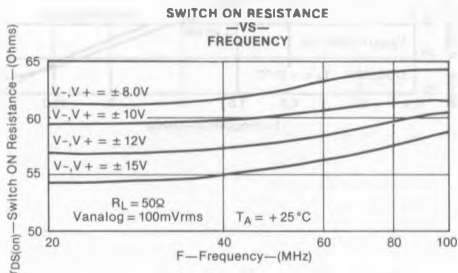
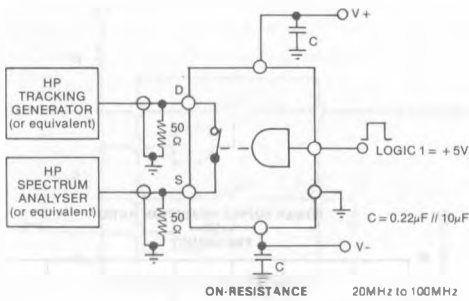


**CHANNEL-TO-CHANNEL CROSSTALK TEST CIRCUIT**

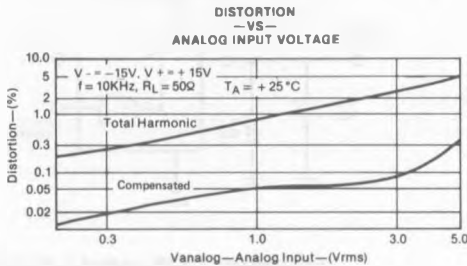
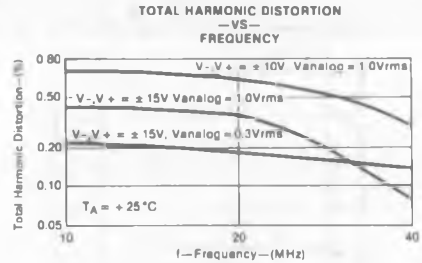
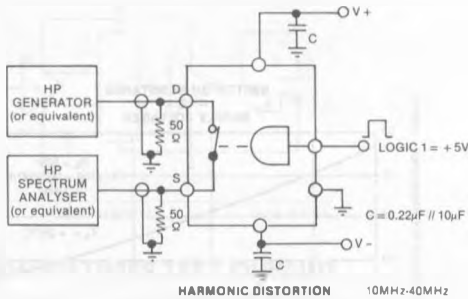
**SWITCH ON RESISTANCE**



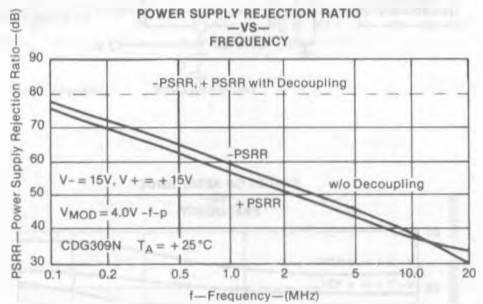
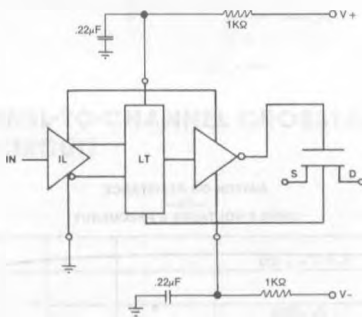
**SWITCH ON RESISTANCE —VS— FREQUENCY  
TEST CIRCUIT**



**DISTORTION —VS— FREQUENCY**



**POWER SUPPLY REJECTION RATIO  
POWER SUPPLY DECOUPLING CIRCUIT**

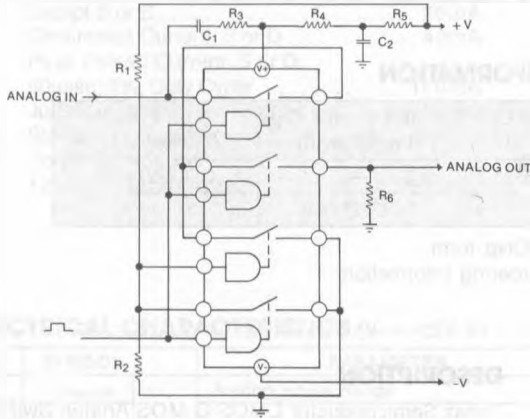


By inserting 1K ohm resistors in series with V+ and V- power supply lines and decoupling both pins at the device socket, it is possible to improve power supply rejection ratios of a video switch by 50dB at frequencies of 20MHz and higher.

**APPLICATIONS**

**LOW DISTORTION, RAIL-TO-RAIL ANALOG SWITCH**

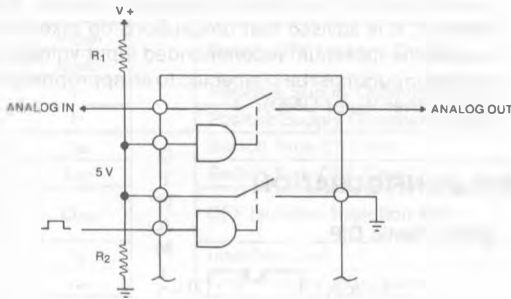
Features very low distortion for low frequency and large signal applications.



**VERY LOW DISTORTION CIRCUIT FOR LOW FREQUENCY AND LARGE SIGNAL APPLICATIONS**

This circuit provides very low distortion ( $< 0.1\%$ ) and high off isolation ( $> 90\text{dB}$ ) at signal levels equal to the supply voltage. The signal passes through a T switch configuration and at the same time is modulating the power supply. This modulation maintains a constant on resistance  $r_{DS(on)}$  which in turn reduces the distortion. R5 is for bypassing the power supply and has a typical value of 1K ohm, R4 should be a value that can be accommodated by the signal source as load, R3 is only necessary at loads lower than 100 ohms and should be selected during the initial design of the circuit, C1 has to be large enough for the lowest signal to pass and C2 will have to bypass all signals. R1 and R2 set up the one logic level for the control input and should be set to 5 volts.

**LOGIC INVERTER**



This circuit provides logic inversion with two resistors and one switch. It does not require additional logic parts. The resistors divide the supply voltage down to a 5 volt level when high and are switched to a low level via the switch. This configuration allows a single pole, single throw switch to be changed into a single pole, double throw switch.