

19-0484; Rev 1; 5/96

MAXIM

Dual Monolithic SPST CMOS Analog Switch

DG200A

General Description

The DG200A is a dual, normally closed, single-pole-single-throw (SPST) analog switch. This CMOS switch can be operated with power supplies ranging from $\pm 4.5V$ to $\pm 18V$. The DG200A has guaranteed break-before-make switching. Its maximum turn-off time is 500ns, and its maximum turn-on time is 100ns.

Maxim guarantees that the DG200A will not latch-up if the power supplies are turned off with input signals still connected as long as absolute maximum ratings are not violated.

Compared to the original manufacturer's product, Maxim's DG200A consumes significantly lower power, making it better suited for portable applications.

Applications

Winchester Disk Drives
Test Equipment
Communications Systems
PBX, PABX
Guidance and Control Systems
Head up Displays
Military Radios

Features

- ◆ Improved 2nd Source Power Supply Current $< 300\mu A$
- ◆ Wide Supply Range $\pm 4.5V$ to $\pm 18V$
- ◆ Single Supply Operation
- ◆ Non-Latching with Supplies Turned-off and Input Signals Present
- ◆ CMOS and TTL Logic Compatible
- ◆ Monolithic, Low Power CMOS Design

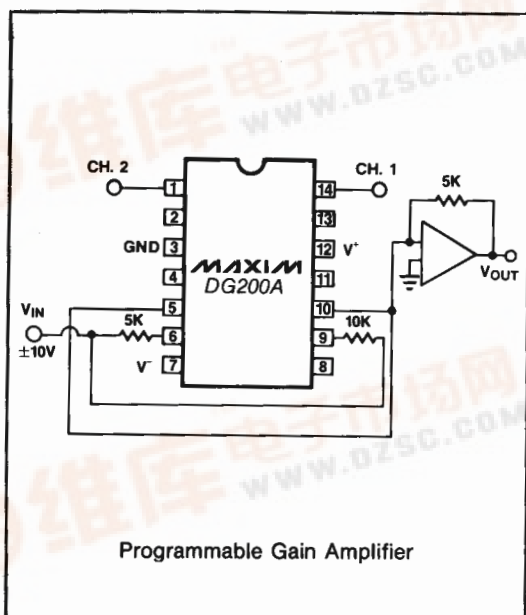
Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
DG200AAK	-55°C to +125°C	14 Lead CERDIP
DG200ABK	-25°C to +85°C	14 Lead CERDIP*
DG200ACK	0°C to +70°C	14 Lead CERDIP
DG200ACJ	0°C to +70°C	14 Lead Plastic DIP
DG200ADJ	-40°C to +85°C	14 Lead Plastic DIP
DG200ACY	0°C to +70°C	14 Lead SO
DG200ADY	-40°C to +85°C	14 Lead SO
DG200AC/D	0°C to +70°C	Dice
DG200AAA	-55°C to +125°C	10 Pin Metal Can*
DG200ABA	-25°C to +85°C	10 Pin Metal Can*
DG200ACA	0°C to +70°C	10 Pin Metal Can*

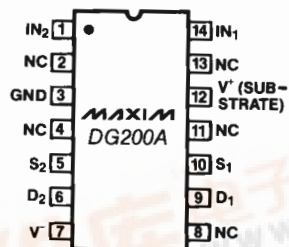
*Contact factory for availability.

Pin Configuration

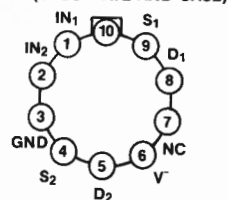
Typical Operating Circuit



Top View



V+ (SUBSTRATE AND CASE)



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ABSOLUTE MAXIMUM RATINGS

Voltages Referenced to V⁻

V ⁺	44V
GND	25V
Digital Inputs V _S , V _D (Note 1)	-2V to (V ⁺ + 2V) or 20mA, whichever occurs first.
Current, Any Terminal Except S or D	30mA
Continuous Current, S or D	20mA
(Pulsed at 1msec, 10% duty cycle max)	100mA
Storage Temperature (A & B Suffix)	-65 to 150°C
(C Suffix)	-65 to 125°C

Operating Temperature (A Suffix)	-55 to 125°C
(B Suffix)	-25 to 85°C
(C Suffix)	-25 to 85°C
(D Suffix)	-40 to 85°C

Power Dissipation (Package)*

Metal Can**	450mW
14 Pin Ceramic DIP***	825mW
14 Pin Plastic DIP****	470mW

* All leads soldered or welded to PC board.

** Derate 6mW/°C above 75°C.

*** Derate 11mW/°C above 75°C.

**** Derate 6.5mW/°C above 25°C.

Stresses listed under "Absolute Maximum Ratings" may be applied (one at a time) to devices without resulting in permanent damage. These are stress ratings only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS (V⁺ = +15V, V⁻ = -15V, GND = 0V, T_A = 25°C, unless otherwise indicated.)

PARAMETER	SYMBOL	TEST CONDITIONS	LIMITS						UNITS	
			DG200A			DG200 B/C/D				
			MIN (Note 2)	TYP (Note 3)	MAX	MIN (Note 2)	TYP (Note 3)	MAX		
SWITCH										
Analog Signal Range (Note 1)	V _{ANALOG}		-15		15	-15		15	V	
Drain-Source ON Resistance	r _{DS(on)}	V _D = ±10V, V _{in} = 0.8V, I _S = 1mA		45	70		45	80	Ω	
Source OFF Leakage Current	I _{S(off)}	V _{in} = 2.4V	V _S = 14V, V _D = -14V		0.01	2.0	0.01		5.0	nA
			V _S = -14V, V _D = 14V		-2.0	-0.02	-5.0		-0.02	
Drain OFF Leakage Current	I _{D(off)}		V _S = -14V, V _D = 14V		0.01	2.0	0.01		5.0	
		V _S = 14V, V _D = -14V		-2.0	-0.02	-5.0		-0.02		
Drain ON Leakage Current (Note 4)	I _{D(on)}	V _{in} = 0.8V	V _S = V _D = 14V		0.1	2.0	0.1		5.0	nA
			V _S = V _D = -14V		-2.0	-0.1	-5.0		-0.1	
INPUT										
Input Current with Input Voltage High	I _{NH}	V _{in} = 2.4V, V _{in} = 15V	-1.0	0.0009		-1.0	0.0009		μA	
				0.005	1.0		0.005	1.0		
Input Current with Input Voltage Low	I _{NL}	V _{in} = 0V	-1.0	-0.0015		-1.0	-0.0015		μA	
DYNAMIC										
Turn-ON Time	t _{on}	See Switching Time Test Circuit (Figure 1)	440	1000		440	1000		ns	
Turn-OFF Time	t _{off}		70	500		70	500			
Charge Injection	Q	C _L = 1000pF, V _{GEN} = 0V, R _{GEN} = 0Ω (Figure 2)	10			10			pC	
Source OFF Capacitance	C _{S(off)}	f = 140kHz V _{in} = 5V or V _S = 0V	V _S = 0V		9.0	9.0			pF	
Drain OFF Capacitance	C _{D(off)}		V _D = 0V		9.0	9.0				
Channel ON Capacitance	C _{D(on)} + C _{S(on)}		V _D = V _S = 0V		25	25				
OFF Isolation Figure 3 (Note 5)		V _{in} = 5V, Z _L = 75Ω V _S = 2.0V, f = 1MHz	75			75			dB	
Crosstalk Figure 4 (Channel to Channel)			90			90				

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DG200A

ELECTRICAL CHARACTERISTICS (continued)

($V^+ = +15V$, $V^- = -15V$, GND = 0V, $T_A = 25^\circ C$, unless otherwise indicated.)

PARAMETER	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			DG200A		DG200 B/C/D		
			MIN (Note 2)	TYP (Note 3)	MAX (Note 3)	MIN (Note 2)	
SUPPLY							
Positive Supply Current	I+	Both Channels ON or OFF V _{in} = 0 and 2.4V	180	300	200	500	μA
Negative Supply Current	I-		-10	-0.1	-100	-0.1	

ELECTRICAL CHARACTERISTICS (Over Temperature)

($V^+ = +15V$, $V^- = -15V$, GND = 0V, T_A = Over Temperature Range, unless otherwise indicated.)

PARAMETER	SYMBOL	TEST CONDITIONS	LIMITS						UNITS
			DG200A			DG200 B/C			
			MIN	TYP	MAX	MIN	TYP	MAX	
									(Note 2) (Note 3) (Note 2) (Note 3)
SWITCH									
Analog Signal Range (Note 1)	V _{ANALOG}			-15	15	-15	15	V	
Drain-Source ON Resistance	r _{DS(on)}	V _D = ±10V, V _{in} = 0.8V, I _S = 1mA		100		100		Ω	
Source OFF Leakage Current	I _{S(off)}	V _{in} = 2.4V	V _S = 14V, V _D = -14V	100		100		nA	
			V _S = -14V, V _D = 14V	-100		-100			
Drain OFF Leakage Current	I _{D(off)}		V _S = -14V, V _D = 14V	100		100			
			V _S = 14V, V _D = -14V	-100		-100			
Drain ON Leakage Current (Note 4)	I _{D(on)}	V _{in} = 0.8V	V _S = V _D = 14V	200		200			
			V _S = V _D = -14V	-200		-200			
INPUT									
Input Current/ Voltage High	I _{NH}	V _{in} = 2.4V, V _{in} = 15V		-10		-10		μA	
				10		10			
Input Current/ Voltage Low	I _{INL}	V _{in} = 0V		-10		-10			

Note 1: Signals on S_X , D_X , or IN_X , exceeding V^- or V^+ will be clamped by internal diodes. LIMIT FORWARD DIODE CURRENT to maximum current ratings.

Note 2: The algebraic convention whereby the most negative value is a minimum, and the most positive is a maximum, is used in this data sheet.

Note 3: Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Note 4: $I_{D(on)}$ is leakage from driver into "ON" switch.

Note 5: "OFF" isolation = $20 \log V_S/V_D$, V_S = input to OFF switch, V_D = output.

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Test Circuits

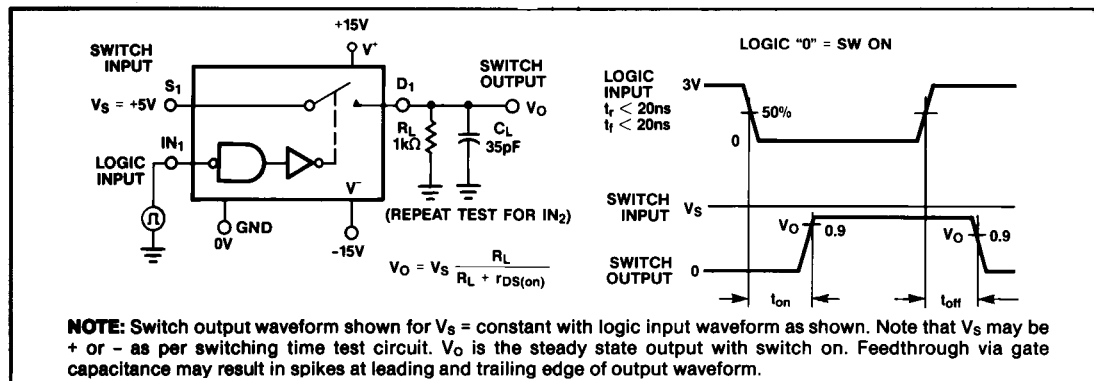


Figure 1. Switching Time Test Circuit

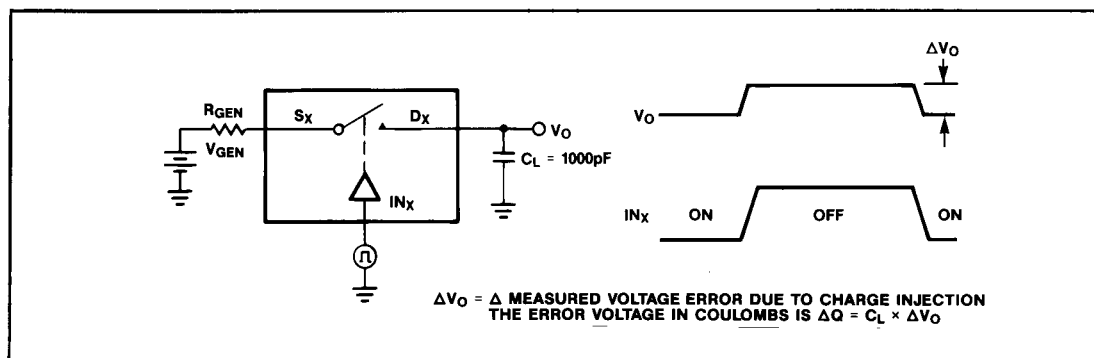


Figure 2. Charge Injection Test Circuit

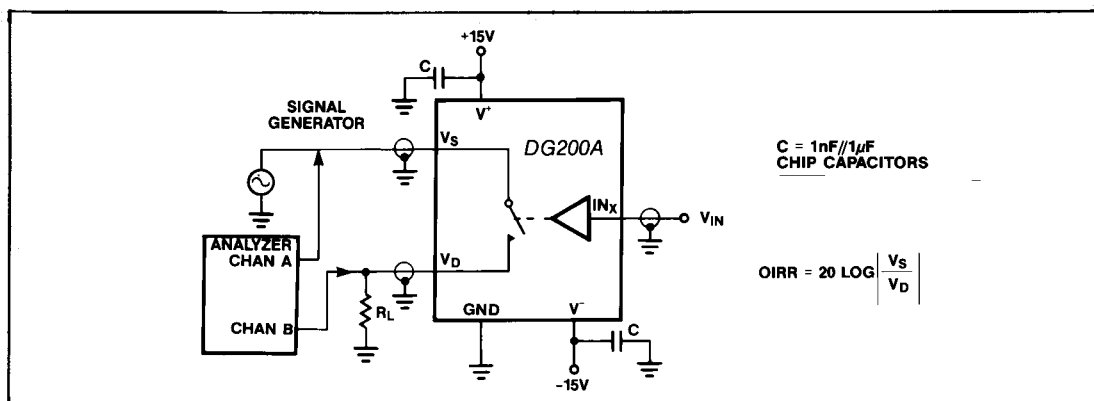


Figure 3. OFF Isolation Test Circuit

DG200A

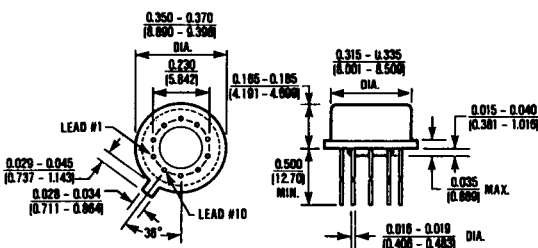
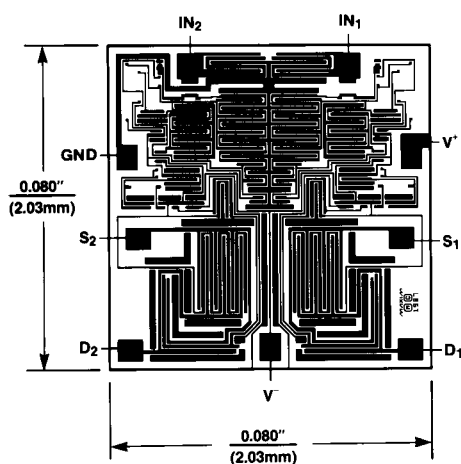
Diagram illustrating the CCR (Charge Transfer Ratio) measurement setup. The circuit includes a SIGNAL GENERATOR, ANALYZER CHAN A, CHAN B, and a dual op-amp circuit. The op-amp is powered by +15V and -15V supplies, with decoupling capacitors C. The output of the first stage (V_D) is connected to the IN₂ input of the second stage. The output of the second stage (V_L) is connected to a 50Ω load resistor. The circuit also includes an ANALYZER with CHAN A and CHAN B inputs, and a load resistor R_L. The output of the second stage is also connected to a 0V reference point. The circuit is labeled with various nodes: V_S, V_D, V_L, V₋, V₊, GND, and NC.

Capacitor values: $C = .001\mu F // 1\mu F$ CHIP CAPACITORS

Formula: $CCRR = 20 \log \left| \frac{V_{S1}}{V_{D2}} \right|$

Chip Topography

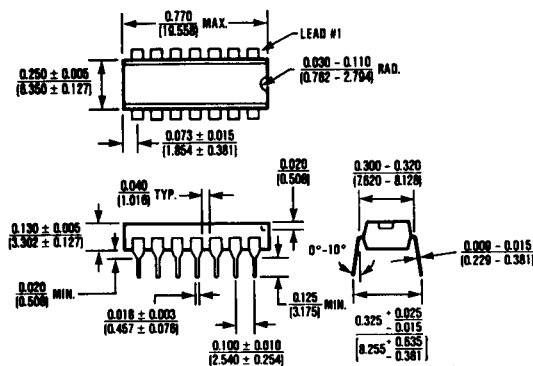
Package Information


$$\theta_{JA} = 150^{\circ}\text{C/W}$$

$$\theta_{JC} = 45^{\circ}\text{C/W}$$

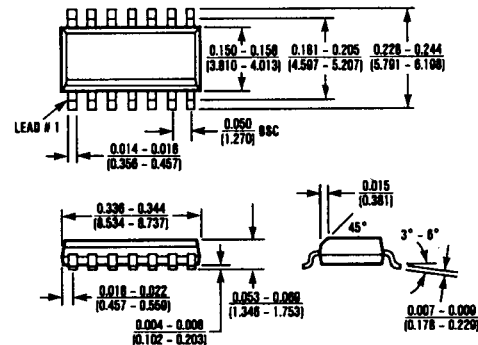
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Package Information



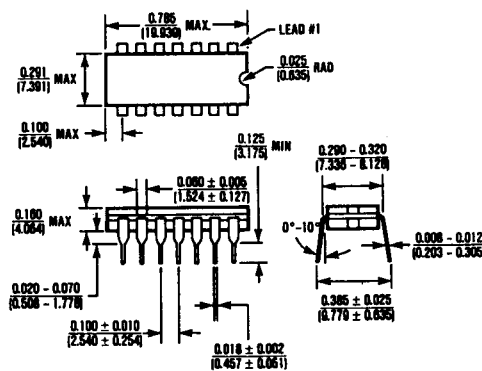
14 Lead Plastic DIP (PD)

$\theta_{JA} = 140^{\circ}\text{C/W}$
 $\theta_{JC} = 70^{\circ}\text{C/W}$



14 Lead Small Outline (SD)

$\theta_{JA} = 115^{\circ}\text{C/W}$
 $\theta_{JC} = 60^{\circ}\text{C/W}$



14 Lead Cerdip (JD)

$\theta_{JA} = 105^{\circ}\text{C/W}$
 $\theta_{JC} = 50^{\circ}\text{C/W}$

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