

DG304A/305A/306A/307A

CMOS Analog Switches



T-51-11

FEATURES

- ± 15 V Input Range
- Fast Switching (< 250 ns)
- Low $r_{DS(ON)}$ ($< 50 \Omega$)
- Single Supply Operation
- CMOS Logic Levels

BENEFITS

- Full Rail-to-Rail Analog Signal Range
- Low Signal Error
- Wide Dynamic Range
- Low Power Dissipation

APPLICATIONS

- Low Level Switching Circuits
- Programmable Gain Amplifiers
- Portable Battery Operation

DESCRIPTION

The DG304A through DG307A series of monolithic CMOS switches were designed for applications in communications, instrumentation and process control. This series is well suited for applications requiring fast switching and nearly flat ON resistance over the entire analog range.

Designed on Siliconix PLUS-40 CMOS process to achieve low power consumption (a few milliwatts) and excellent ON/OFF switch performance, making these ideal for battery powered applications, without sacrificing switching speed. Break-before-make switching action is guaranteed, and an epitaxial layer prevents latchup. Single supply operation (for positive switch voltages) is afforded by connecting the V- rail to 0 V.

Each switch conducts equally well in both directions when ON, and blocks up to 30 volts peak-to-peak when OFF. These switches are CMOS input compatible.

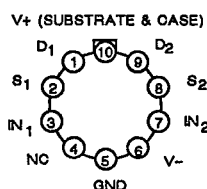
There are four devices in this series, which are differentiated by the type of switch action. Packaging for this series include the 14-pin CerDIP and plastic options. The 10-pin metal can option is also available for the DG304A/DG305A. Performance grades include the military, A suffix (-55 to 125°C), commercial, C suffix (0 to 70°C), and industrial, B suffix (-25 to 85°C) temperature ranges. Additionally, the DG307A is available in the LCC package.

PIN CONFIGURATION

FUNCTIONAL BLOCK DIAGRAM

Metal Can Package

Top View

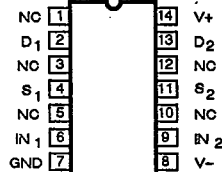


Order Numbers:

DG304AAA, DG304AAA/883
DG304ABA, DG304ACA

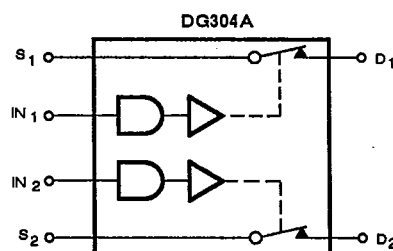
Dual-In-Line Package

Top View



Order Numbers:

CerDIP: DG304AAK, DG304AAK/883
DG304ABK, DG304ACK
Plastic: DG304ACJ



Two SPST Switches per Package*

LOGIC	SWITCH
0	OFF
1	ON

Logic "0" ≤ 3.5 V
Logic "1" ≥ 11 V

* Switches Shown for Logic "1" Input

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DG304A/305A/306A/307A**B** Siliconix
Incorporated**ABSOLUTE MAXIMUM RATINGS**

T-51-11

V_+ to V_- 44 V
 GND to V_- 25 V
 Digital Inputs, V_S , V_D^e (V_-) -2 V to (V_+) +2V or
 30 mA, whichever occurs first.
 Current, Any Terminal Except S or D 30 mA
 Continuous Current, S or D 30 mA
 (Pulsed at 1 ms, 10% duty cycle max) 100 mA
 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) 0 to 70°C

Power Dissipation*

14-Pin CerDIP (K)** 825 mW
 14-Pin Plastic DIP (J)*** 470 mW
 10-Pin Metal Can (A)**** 450 mW
 20-Pin LCC (Z)***** 750 mW

* Device mounted with all leads soldered or welded to PC board.

** Derate 11 mW/°C above 75°C.

*** Derate 6.5 mW/°C above 25°C.

**** Derate 6 mW/°C above 75°C.

***** Derate 10 mW/°C above 75°C.

ELECTRICAL CHARACTERISTICS^a

PARAMETER	SYMBOL	Test Conditions Unless otherwise specified: V ₊ = 15 V V ₋ = -15 V GND = 0 V		LIMITS						UNIT
				1=25°C 2=125,85,70°C 3=-55,-25,0°C		A SUFFIX -55 to 125°C		B, C SUFFIX		
				TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SWITCH										
Analog Signal Range °	V _{ANALOG}	I _S = 10 mA V _{IN} = 3.5 or 11 V ^f		1,2,3		-15	15	-15	15	V
Drain-Source ON Resistance	r _{DS(ON)}	V _{IN} = 3.5 V or V _{IN} = 11 V ^f	V _D = 10 V I _S = -10 mA	1,3 2	30		50 75		50 75	Ω
			V _D = -10 V I _S = 10 mA	1,3 2	30		50 75		50 75	
Source OFF Leakage Current	I _{S(OFF)}		V _S = 14 V V _D = -14 V	1 2	0.1		1 100		5 100	nA
			V _S = -14 V V _D = 14 V	1 2	-0.1	-1 -100		-5 -100		
Drain OFF Leakage Current	I _{D(OFF)}		V _S = -14 V V _D = 14 V	1 2	0.1		1 100		5 100	
			V _S = 14 V V _D = -14 V	1 2	-0.1	-1 -100		-5 -100		
Drain ON Leakage Current	I _{D(ON)}		V _D = V _S = 14 V	1 2	0.1		1 100		5 100	
		V _D = V _S = -14 V	1 2	-0.1	-2 -200		-5 -200			
INPUT										
Input Current with Input Voltage HIGH	I _{INH}	V _{IN} = 5 V	1 2,3	-0.001	-1 -1		-1		μA	
		V _{IN} = 15 V	1 2,3	0.001		1 1		1		
Input Current with Input Voltage LOW	I _{INL}	V _{IN} = 0 V	1 2,3	-0.001	-1 -1		-1			

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DG304A/305A/306A/307A

ELECTRICAL CHARACTERISTICS^a

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PARAMETER	SYMBOL	Test Conditions Unless otherwise specified: V ₊ = 15 V V ₋ = -15 V GND = 0 V	LIMITS						UNIT
			1=25°C 2=125,85,70 °C 3=-55,-25,0 °C		A SUFFIX -55 to 125°C		B, C SUFFIX		
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
DYNAMIC									
Turn-ON Time	t _{ON}	See Switching Time Test Circuit	1	110		250			ns
Turn-OFF Time	t _{OFF}		1	70		150			
Break-Before-Make Interval	t _{ON} - t _{OFF}	See Break-Before-Make Test Time Circuit DG305A/307A ONLY	1	50					
Charge Injection	Q	C _L = 0.01 μF, R _{gen} = 1 Ω V _{gen} = 0 V	1	30					pC
Source-OFF Capacitance	C _{S(OFF)}	V _{IN} = 3.5 V or V _{IN} = 11 V f ^f f = 1 MHz		V _S = 0 V	1	14			pF
Drain-OFF Capacitance	C _{D(OFF)}			V _D = 0 V	1	14			
Channel-ON Capacitance	C _{D(ON)} + C _{S(ON)}			V _S = V _D = 0 V	1	40			
Input Capacitance	C _{IN}	f = 1 MHz		V _{IN} = 0 V	1	6			
				V _{IN} = 15 V	1	7			
OFF Isolation ^g		V _{IN} = 0 V R _L = 1 kΩ V _S = 1 V _{rms} f = 500 kHz	1	62					dB
Crosstalk (Channel-to-Channel)			1	74					
SUPPLY									
Positive Supply Current	I ₊	V _{IN} = 15 V (All Inputs)	1,3 2	0.001		10 100		100	μA
Negative Supply Current	I ₋		1,3 2	-0.001	-10 -100		-100		
Positive Supply Current	I ₊	V _{IN} = 0 V (All Inputs)	1,3 2	0.001		10 100		100	
Negative Supply Current	I ₋		1,3 2	-0.001	-10 -100		-100		

NOTES:

- a. Refer to PROCESS OPTION FLOWCHART for additional information.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Guaranteed by design, not subject to production test.
d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
e. Signals on S_X, D_X, or I_{NX} exceeding V₊ or V₋ will be clamped by internal diodes. Limit diode forward current to maximum current ratings.
f. V_{IN} = Input voltage to perform proper function.
g. OFF Isolation = 20 log $\frac{V_S}{V_D}$. V_S = Input to OFF switch, V_D = Output.

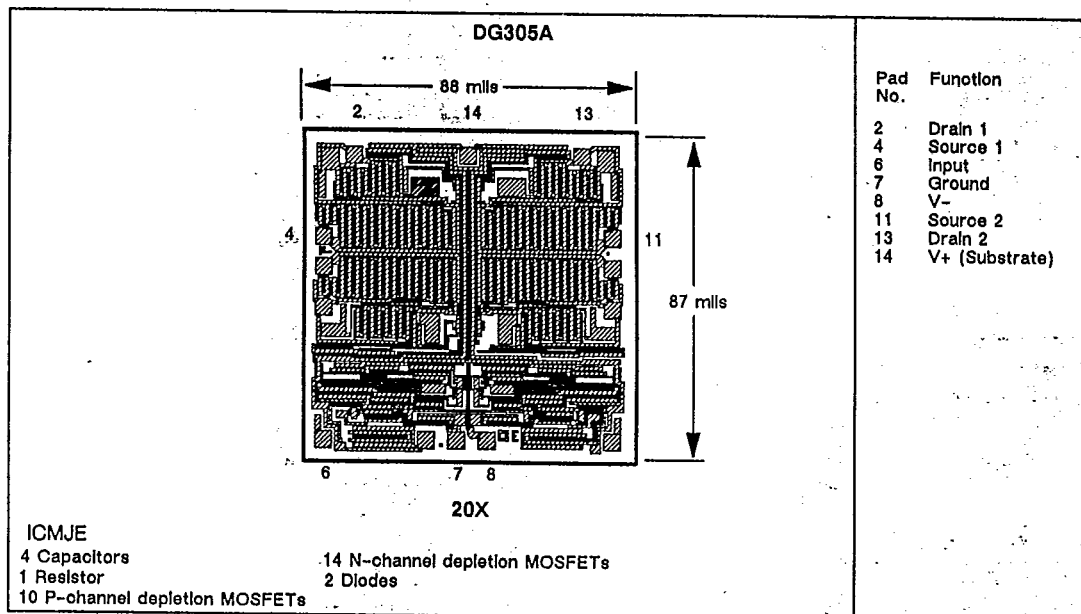
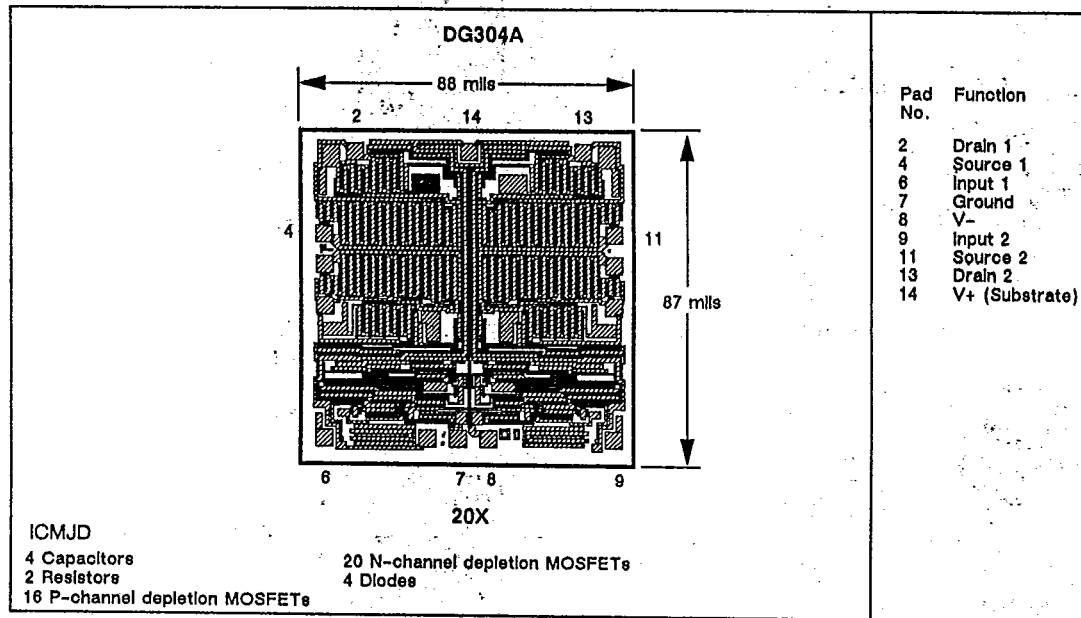
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DIE TOPOGRAPHY

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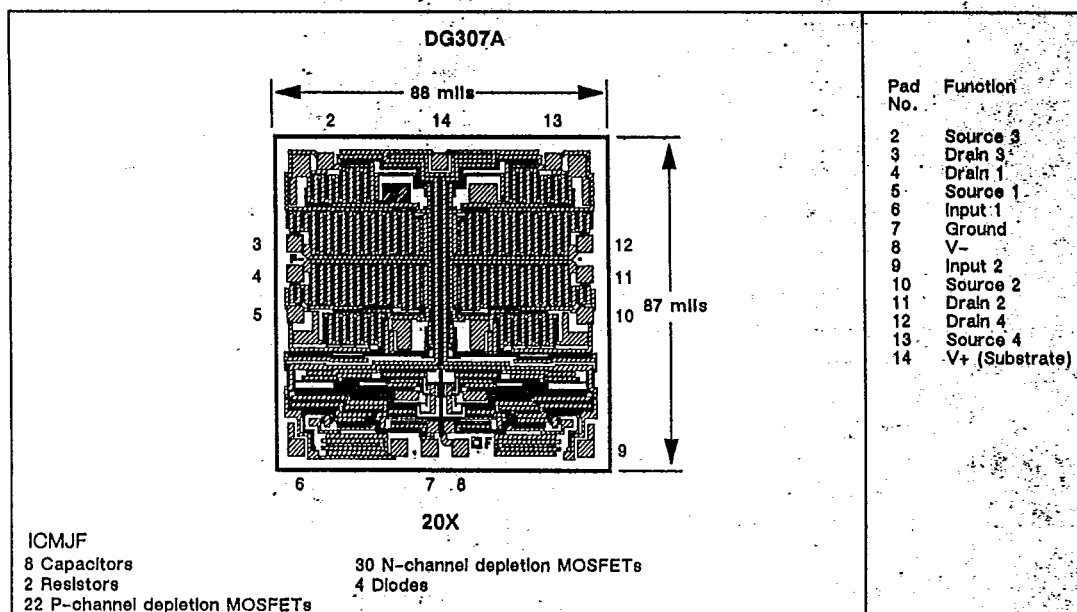
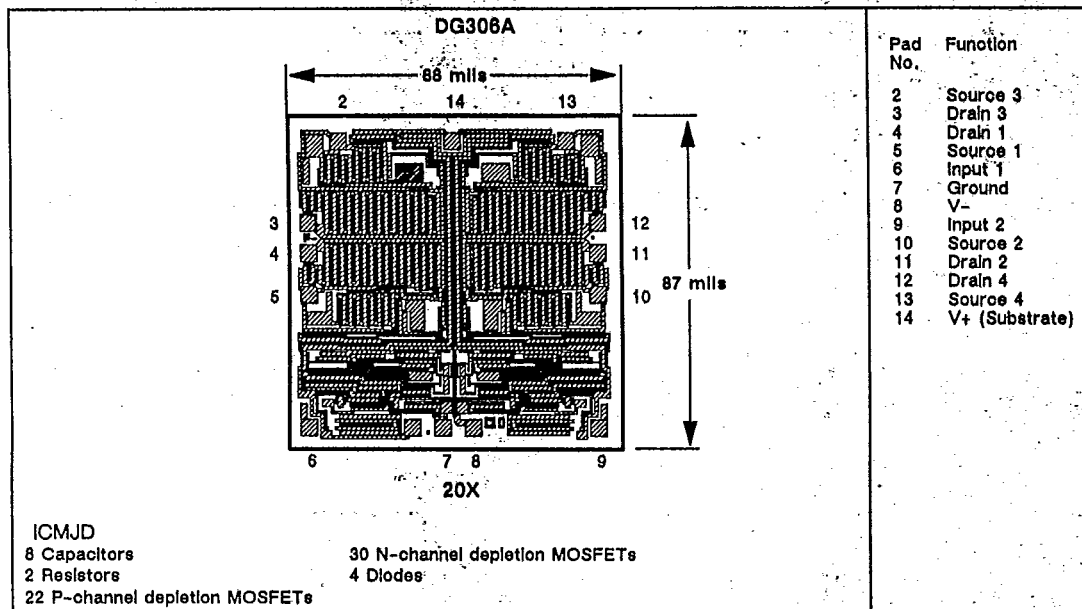
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**DG304A/305A/306A/307A**

DIE TOPOGRAPHY (Cont'd)

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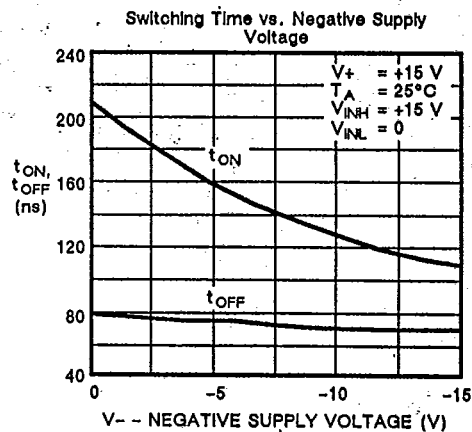
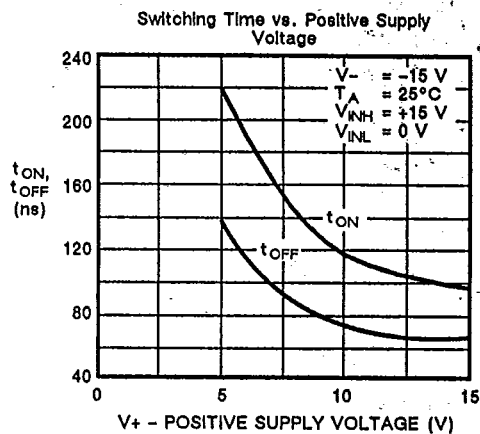
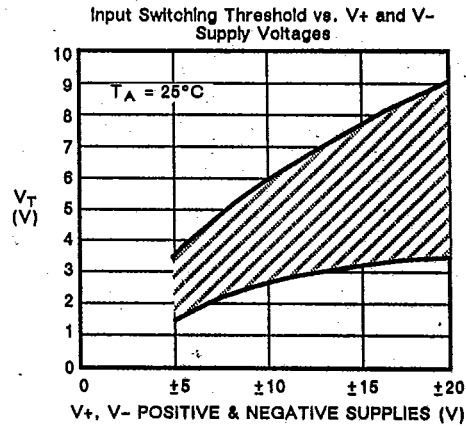
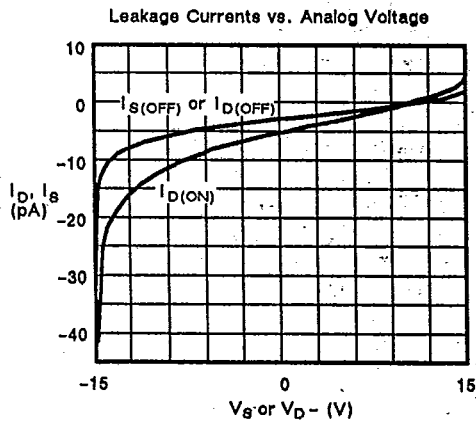
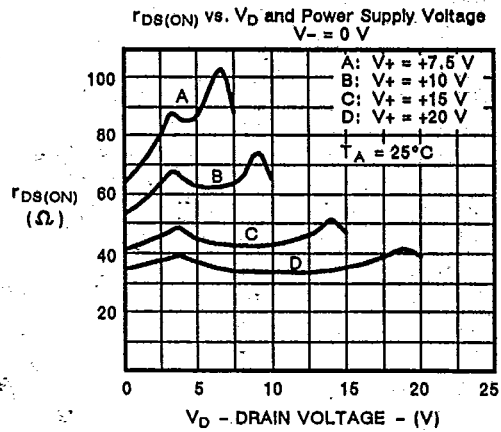
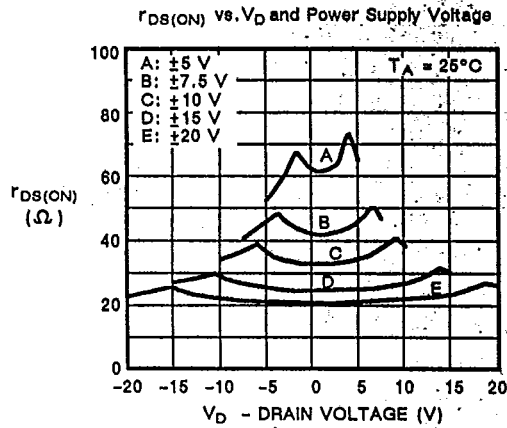
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TYPICAL CHARACTERISTICS

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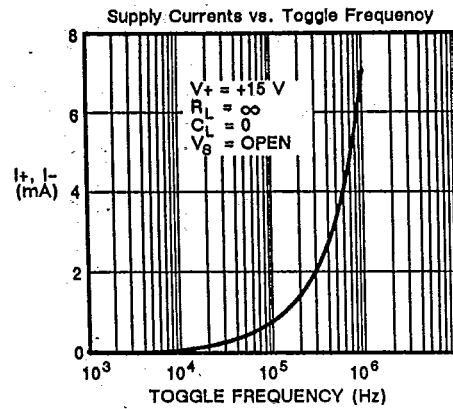
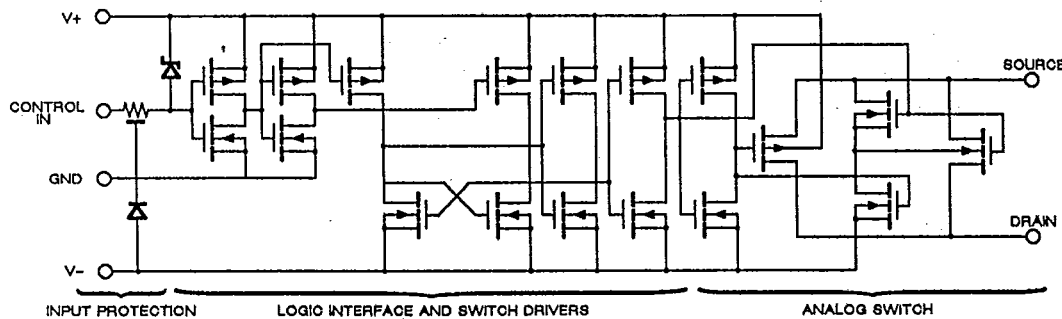
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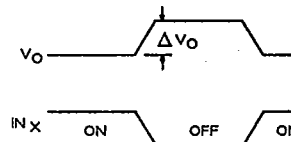
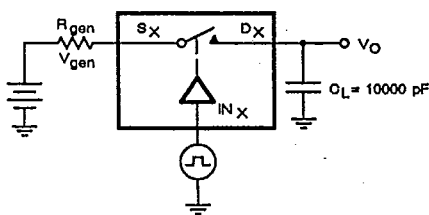
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TYPICAL CHARACTERISTICS (Cont'd)

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**SCHEMATIC DIAGRAM (Typical Channel)**

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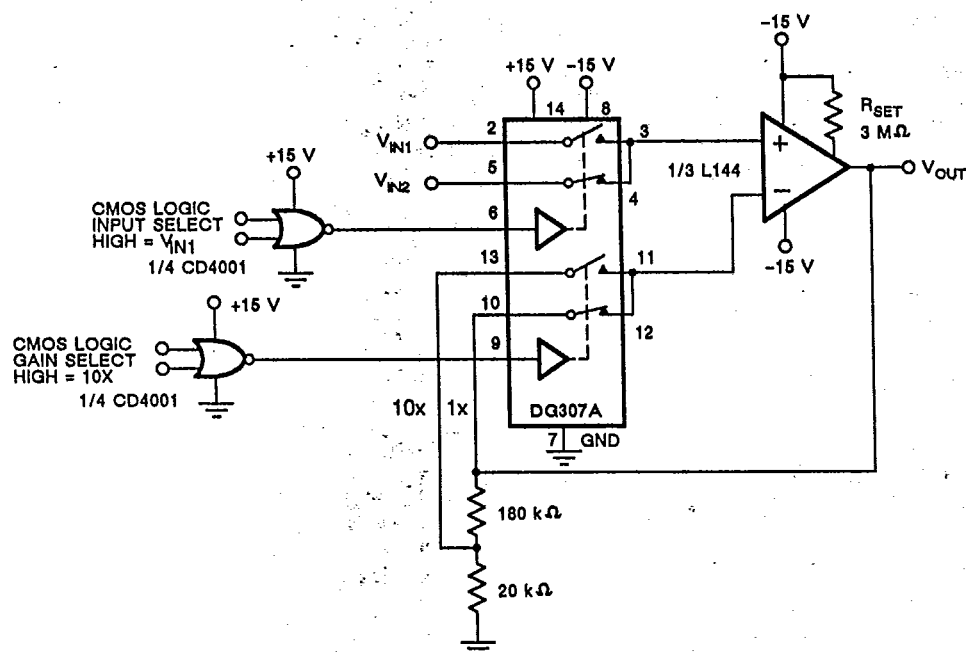
CHARGE INJECTION TEST CIRCUIT

ΔV_O IS THE MEASURED VOLTAGE ERROR DUE TO CHARGE INJECTION
 THE CHARGE INJECTION IN COULOMBS IS $\Delta Q = C_L \times \Delta V_O$

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APPLICATIONS (Cont'd)

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Low Power Non-Inverting Amplifier with
Digitally Selectable Inputs and Gain