



## High Speed Quad SPST Analog Switch

MAX334

### General Description

The MAX334 is a quad single-pole-single-throw, normally closed (SPST, NC) analog switch, pin compatible with the Harris HI-201HS and Siliconix DG271. The MAX334 has guaranteed break-before-make switching ( $t_{OFF} < t_{ON}$ ), while featuring fast switching speeds. Turn-on time is less than 100ns and turn-off time is less than 50ns; channel on resistance is 50 ohms maximum. CMOS inputs provide reduced input loading and very low leakage currents.

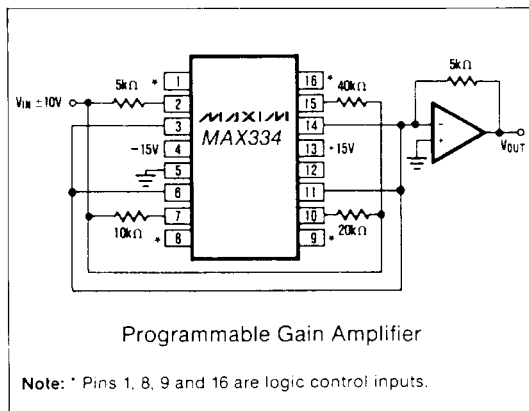
The MAX334 is also a direct replacement for the DG201 and DG211, featuring  $\frac{1}{4}$  the on resistance and five times the speed.

The MAX334 may be used with split supplies ( $\pm 5V$  to  $\pm 15V$ ) or single positive supplies (+5V to +30V) while retaining CMOS and TTL logic compatible inputs, and maintaining high switching speed.

### Applications

- Sample and Hold Circuits
- Winchester Disk Drives
- Test Equipment
- Communications Systems
- PBX, PABX
- Guidance and Control Systems
- Heads-up Displays
- Military Radios

### Typical Operating Circuit



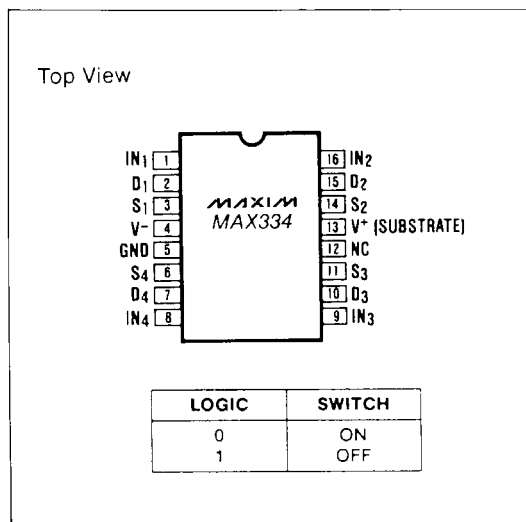
### Features

- ◆  $R_{ds(ON)}$  50Ω (max.)
- ◆ Guaranteed Break-Before-Make Switching
- ◆ Single or Bipolar Supply Operation
- ◆ CMOS and TTL Logic Compatible
- ◆ Faster, Lower  $R_{ON}$  Replacement for DG201 and DG211

### Ordering Information

PART	TEMP. RANGE	PACKAGE
MAX334CPE	0°C to +70°C	16 Lead Plastic DIP
MAX334CWE	0°C to +70°C	16 Lead Wide SO
MAX334C/D	0°C to +70°C	Dice
MAX334CJE	0°C to +70°C	16 Lead CERDIP
MAX334EPE	-40°C to +85°C	16 Lead Plastic DIP
MAX334EJE	-40°C to +85°C	16 Lead CERDIP
MAX334EWE	-40°C to +85°C	16 Lead Wide SO
MAX334MJE	-55°C to +125°C	16 Lead CERDIP

### Pin Configuration



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### ABSOLUTE MAXIMUM RATINGS

Supply Voltage (Between Pins 4 and 13)	36V	Maximum Junction Temperature	175°C
Digital Input Voltage (Pins 1, 8, 9, 16)	+V <sub>SUPPLY</sub> +4V -V <sub>SUPPLY</sub> -4V	Operating Temperature	
Analog Input Voltage (S to D)	+V <sub>SUPPLY</sub> +2.0V	MAX334M	-55°C to +125°C
Pins 2, 3, 6, 7, 10, 11, 14, 15	-V <sub>SUPPLY</sub> -2.0V	MAX334E	-40°C to +85°C
Peak Current, S or D	80mA	MAX334C	0°C to +70°C
Total Power Dissipation (Note 1)	750mW	Storage Temperature	-65°C to +150°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 Ratings conditions for extended periods may affect device reliability.

### ELECTRICAL CHARACTERISTICS

(V<sup>+</sup> = +15V, V<sup>-</sup> = -15V, V<sub>AH</sub> (Logic Level High) = 3.0V, V<sub>AL</sub> (Logic Level Low) = +0.8V, GND = 0V, unless otherwise specified.)

PARAMETER	TEMPERATURE	MAX334M/E			MAX334C			UNITS	
		MIN	TYP	MAX	MIN	TYP	MAX		
<b>ANALOG SWITCH CHARACTERISTICS</b>									
V <sub>S</sub> , Analog Signal Range	Full	-15		+15	-15		+15	V	
R <sub>ON</sub> , On Resistance (Note 2)	+25°C		30	50		30	50	Ω	
	Full			75			75		
R <sub>ON</sub> Match	+25°C		3			3		%	
I <sub>S(OFF)</sub> , Off Input Leakage Current	V <sub>S</sub> = 14V, V <sub>D</sub> = -14V	+25°C	-1	.3	1	-1	.3	1	nA
	V <sub>S</sub> = -14V, V <sub>D</sub> = 14V	Full	-100		100	-50		50	
I <sub>D(OFF)</sub> , Off Output Leakage Current	V <sub>D</sub> = 14V, V <sub>S</sub> = -14V	+25°C	-1	.3	1	-1	.3	1	nA
	V <sub>D</sub> = -14V, V <sub>S</sub> = 14V	Full	-100		100	-50		50	
I <sub>D(ON)</sub> , On Leakage Current	V <sub>D</sub> = V <sub>S</sub> = 14V	+25°C	-1	.1	1	-1	.1	1	nA
	V <sub>D</sub> = V <sub>S</sub> = -14V	Full	-100		100	-50		50	
<b>DIGITAL INPUT CHARACTERISTICS</b>									
V <sub>AL</sub> Input Low	+25°C							V	
	Full			0.8			0.8		
V <sub>AH</sub> Input High	+25°C							V	
	Full		3.0			3.0			
I <sub>AL</sub> , Input Leakage Current (Low)	+25°C	-1.0	0.1	1.0	-1.0	0.1	1.0	μA	
	Full	-10		10	-10		10		
I <sub>AH</sub> , Input Leakage Current (High)	+25°C	-1.0	0.1	1.0	-1.0	0.1	1.0	μA	
	Full	-10		10	-10		10		

**Note 1:** Derate 8mW/°C above T<sub>A</sub> = 75°C, θ<sub>JA</sub> = 100°C/W, θ<sub>JC</sub> = 60°C/W

**Note 2:** V<sub>OUT</sub> = ±10V, I<sub>OUT</sub> = 1mA

**Note 3:** R<sub>L</sub> = 1kΩ, C<sub>L</sub> = 35pF, V<sub>IN</sub> = +10V, V<sub>A</sub> = +3V (See Switching Waveforms)

**Note 4:** V<sub>A</sub> = 3V, R<sub>L</sub> = 1kΩ, C<sub>L</sub> = 10pF, V<sub>IN</sub> = 3Vrms, f = 100kHz

**Note 5:** V<sub>A</sub> = 3V, R<sub>L</sub> = 1kΩ, f = 100kHz, V<sub>IN</sub> = 3Vrms

**Note 6:** C<sub>L</sub> = 1000pF, V<sub>IN</sub> = 0V, R<sub>IN</sub> = 0Ω, ΔQ = C<sub>L</sub> × ΔV<sub>0</sub>

**Note 7:** V<sub>A</sub> = 3V or V<sub>A</sub> = 0 for all switches

**Note 8:** t<sub>BBM</sub> is fastest turn-on time (of the four switches) minus the slowest turn-off time.

# High Speed Quad SPST Analog Switch

**MAX334**

## ELECTRICAL CHARACTERISTICS (Continued)

(V<sup>+</sup> = +15V, V<sup>-</sup> = -15V, V<sub>AH</sub> (Logic Level High) = 3.0V, V<sub>AL</sub> (Logic Level Low) = +0.8V, GND = 0V, unless otherwise specified.)

PARAMETER	TEMPERATURE	MAX334M/E			MAX334C			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
<b>SWITCHING CHARACTERISTICS</b>								
t <sub>ON</sub> , Switch ON Time (Note 3)	+25°C		70	100		70	120	ns
t <sub>ON</sub> , Switch ON Time (Note 3)	Full		100			125		ns
t <sub>OFF1</sub> , Switch OFF Time (Note 3)	+25°C		40	50		40	75	ns
t <sub>OFF1</sub> , Switch OFF Time (Note 3)	Full		50			75		ns
t <sub>OFF2</sub> , Switch OFF Time (Note 3)	+25°C		150			150		ns
Output Settling Time 0.1%	+25°C		180			180		ns
t <sub>BBM</sub> , Break-Before-Make (Note 8)	+25°C		10	30		30		ns
"Off Isolation" (Note 4)	+25°C		72			72		dB
Crosstalk (Note 5)	+25°C		86			86		dB
Charge Injection (Note 6)	+25°C		10			10		pC
C <sub>S(OFF)</sub> , Input Switch Capacitance	+25°C		10			10		pF
Output Switch Capacitance	C <sub>D(OFF)</sub>	+25°C		10		10		pF
	C <sub>D(ON)</sub>	+25°C		30		30		
C <sub>A</sub> , Digital Input Capacitance	+25°C		18			18		pF
C <sub>DS(OFF)</sub> , Drain-to-Source Capacitance	+25°C		5			5		pF
<b>POWER REQUIREMENTS (Note 7)</b>								
P <sub>D</sub> , Power Dissipation	+25°C		120			120		mW
	Full							
I <sup>+</sup> , Current (Pin 13)	+25°C		4.5			4.5		mA
	Full			10.0		10.0		
I <sup>-</sup> , Current (Pin 4)	+25°C		3.5			3.5		mA
	Full			6		6		

### Typical Single Supply Operation (V<sup>-</sup> = GND, V<sub>S</sub> = +10V, R<sub>L</sub> = 1000 Ohms)

V <sup>+</sup>	R <sub>DS(ON)</sub> (Ohms)	T <sub>ON</sub> (ns)	T <sub>OFF</sub> (ns)	TTL Compatible?	I <sub>V+</sub> with TTL <sub>IN</sub> = 3V on all switches
+5*	200	360	25	Yes	6.0μA
+10	85	150	30	Yes	1.5mA
+12	75	140	25	Yes	2.0mA
+15	65	100	25	Yes	4.5mA
+20	55	70	25	Yes	7.0mA
+25	50	50	30	V <sub>AH</sub> = 4V	10.0mA
+30	45	45	40	V <sub>AH</sub> = 4V	14.0mA

\*V<sub>S</sub> = +5V, for this case.

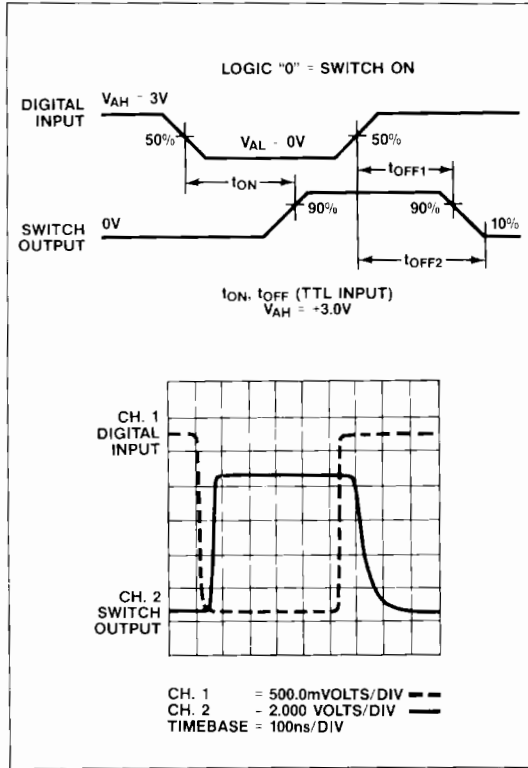
### Typical Single Supply

#### Charge Injection (C<sub>L</sub> = 1000pF)

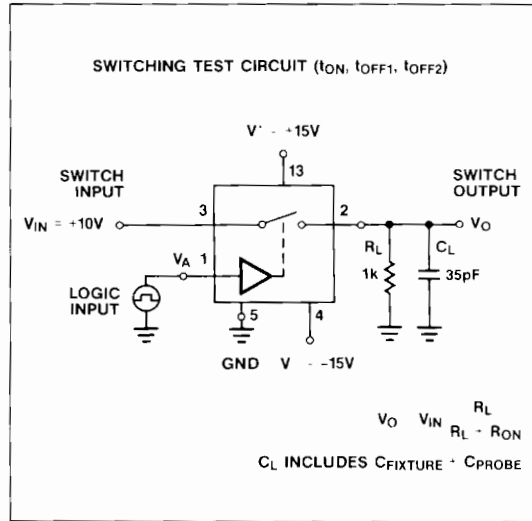
V <sub>ANALOG</sub>	V <sup>+</sup> SUPPLY VOLTAGE				
	+5V	+10V	+15V	+20V	+30V
0V	7pC	10pC	10pC	6pC	12pC
V <sup>+</sup>	4pC	6pC	6pC	6pC	14pC

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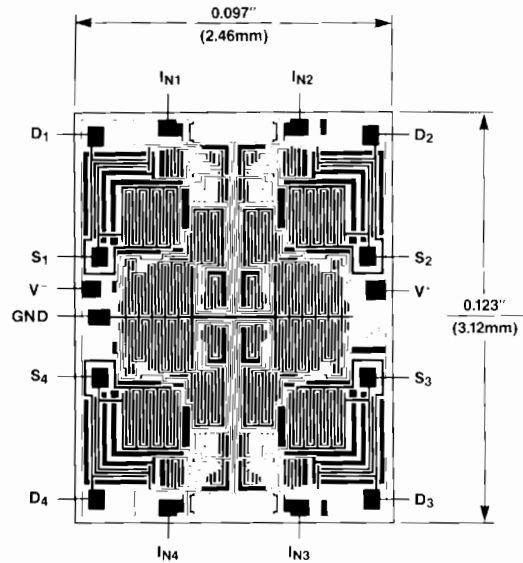
## Switching Waveforms



## Test Circuit



## Chip Topography



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