

## CMOS Analog Switches

### General Description

Maxim's IH5048-IH5051 analog switches are designed for applications requiring low leakage. They feature extremely low on resistance ( $30\Omega$  typical) as well as quiescent power-supply current below  $1\mu\text{A}$ . Switch control inputs are fully compatible with both CMOS and TTL logic.

These switches are plug-in upgrades for the original manufacturer's devices, with improved specifications for analog-signal range and switch on and off times. They are also pin-compatible with the IH5040 family of analog switches. The IH5048 series is supplied in 16-pin DIP and SO packages.

### Applications

Precision Sample-and-Hold Circuits  
Transducer and Sensor Switching  
Low-Level Signal Conditioning  
Battery-Powered Instrumentation  
Programmable-Gain Amplifiers

### Features

- ◆ Low Charge Injection (10pC Typ)
- ◆ Quiescent Current Below 1mA
- ◆ TTL and CMOS Compatible
- ◆ Low On Resistance ( $25\Omega$  Max for IH5048A)
- ◆ Latchup-Proof Construction

### Ordering Information

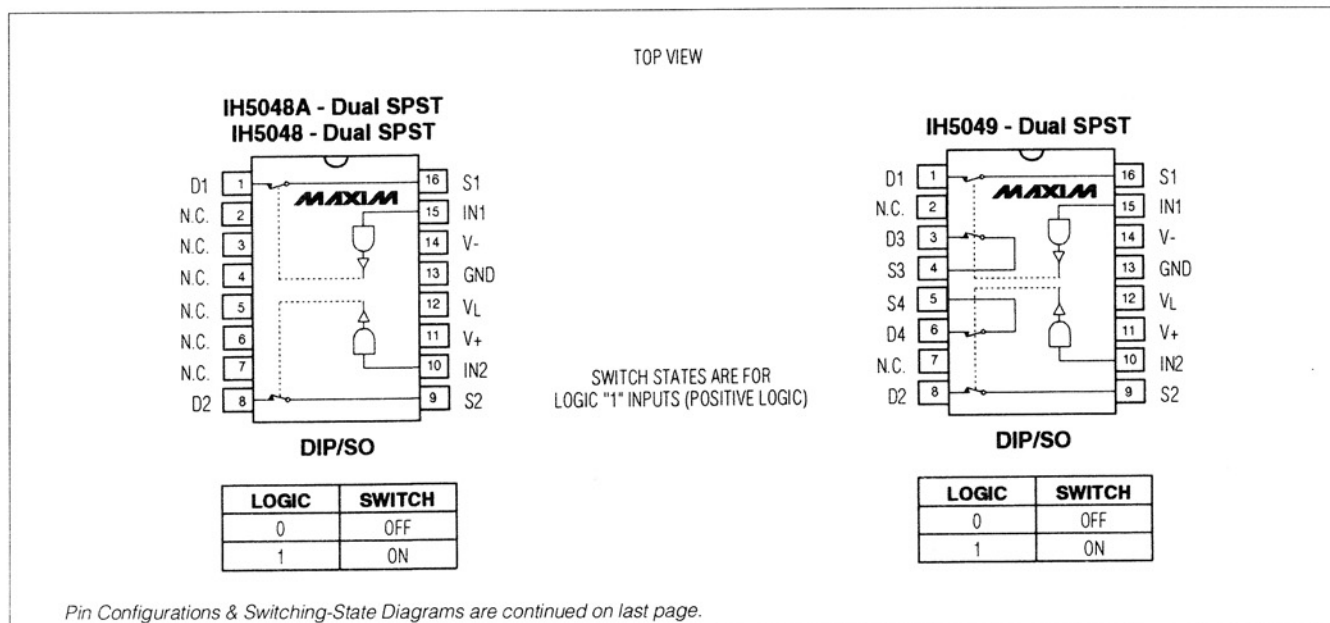
PART	TEMP. RANGE	PIN-PACKAGE
IH5048CPE	0°C to +70°C	16 Plastic DIP
IH5048CWE	0°C to +70°C	16 Wide SO
IH5048CJE	0°C to +70°C	16 CERDIP
IH5048C/D	0°C to +70°C	Dice*
IH5048MJE	-55°C to +125°C	16 CERDIP**
<b>IH5048ACPE</b>	0°C to +70°C	16 Plastic DIP
IH5048ACWE	0°C to +70°C	16 Wide SO
IH5048ACJE	0°C to +70°C	16 CERDIP
IH5048AC/D	0°C to +70°C	Dice*
IH5048AMJE	-55°C to +125°C	16 CERDIP**

Ordering Information continued on last page.

\* Contact factory for dice specifications.

\*\* Contact factory for availability and processing to MIL-STD-883.

### Pin Configurations & Switching-State Diagrams



# CMOS Analog Switches

## ABSOLUTE MAXIMUM RATINGS

V <sub>+</sub> to V <sub>-</sub>	36V
V <sub>+</sub> to V <sub>D</sub>	30V
V <sub>D</sub> to V <sub>-</sub>	30V
V <sub>D</sub> to V <sub>S</sub>	±28V
V <sub>L</sub> to V <sub>-</sub>	33V
V <sub>L</sub> to V <sub>IN</sub>	30V
V <sub>L</sub> to GND	20V
V <sub>IN</sub> to GND	20V
Current (any terminal)	30mA
Digital Inputs	(V <sub>+</sub> + 0.3V) to (V <sub>+</sub> - 38V)
V <sub>S</sub> or V <sub>D</sub> (Note 1)	-0.3V to (V <sub>+</sub> + 0.3V)

Continuous Power Dissipation (T<sub>A</sub> = +70°C)  
 Plastic DIP (derate 10.53mW/°C above +70°C) . . . . . 842mW  
 Wide SO (derate 20.00mW/°C above +70°C) . . . . . 1600mW  
 CERDIP (derate 10.00mW/°C above +70°C) . . . . . 800mW  
 Operating Temperature Ranges:  
 IH50\_C\_/IH50\_AC\_ . . . . . 0°C to +70°C  
 IH50\_M\_/IH50\_AM\_ . . . . . -55°C to +125°C  
 Storage Temperature Range . . . . . -65°C to +150°C  
 Lead Temperature (soldering, 10sec) . . . . . +300°C

**Note 1:** Signals on S, D, and digital inputs that exceed V<sub>-</sub> or V<sub>+</sub> will be clamped by internal diodes. Limit forward diode current to 30mA maximum.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond 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<sub>+</sub> = 15V, V<sub>-</sub> = -15V, V<sub>L</sub> = 5V, T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		IH50_M IH50_AM			IH50_C IH50_AC			UNITS
				-55°C	+25°C	+125°C	0°C	+25C	+70C	
Input Logic Current	I <sub>IN(ON)</sub>	V <sub>IN</sub> = 2.4V		±1	±1	±10	±1	±1	±10	μA
	I <sub>IN(OFF)</sub>	V <sub>IN</sub> = 0.8V		±1	±1	±10	±1	±1	±10	
Input Logic Low	V <sub>IL</sub>			0.8	0.8	0.8	0.8	0.8	0.8	V
Input Logic High	V <sub>IH</sub>			2.4	2.4	2.4	2.4	2.4	2.4	V
Drain-Source On Resistance	r <sub>DS(ON)</sub>	I <sub>S</sub> = 10mA, V <sub>D</sub> = ±10V	IH5048A only	25	25	35	30	30	45	Ω
			All others	40	40	60	45	45	75	
Channel-to-Channel r <sub>DS(ON)</sub> Match	Δr <sub>DS(ON)</sub>			8 (typ)			8 (typ)			Ω
Minimum Analog Signal Handling Capability	V <sub>ANALOG</sub>			±14	±14	±14	±14	±14	±14	V
Switch-Off Leakage Current	I <sub>D</sub> /I <sub>S(OFF)</sub>	V <sub>ANALOG</sub> = -10V to 10V		±1    ±100			±5    ±100			nA
Switch-On Leakage Current	I <sub>D(ON)</sub> + I <sub>S(ON)</sub>	V <sub>D</sub> = V <sub>S</sub> = -10V to 10V		±2    ±200			±10    ±200			nA
Switch-On Time	t <sub>ON</sub>	Figure 1		400			600			ns
Switch-Off Time	t <sub>OFF</sub>	Figure 1		200			300			ns
Charge Injection	Q <sub>INJ</sub>	Figure 2 (Note 2)		10 (typ)			10 (typ)			pC
Minimum Off-Isolation Rejection Ratio	O <sub>IRR</sub>	Figure 3, C <sub>L</sub> < 5pF		54 (typ)			50 (typ)			dB

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## ELECTRICAL CHARACTERISTICS (continued)

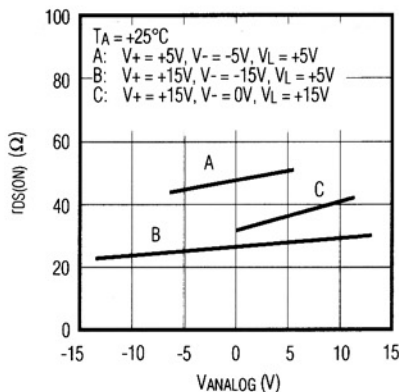
( $V_+ = 15V$ ,  $V_- = -15V$ ,  $V_L = 5V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	IH50_M IH50_AM			IH50_C IH50_AC			UNITS
			-55°C	+25°C	+125°C	0°C	+25°C	+70°C	
V+ Quiescent Current	I+Q	$V_{IN} = 0V$ or $5V$	1	1	10	10	10	100	$\mu A$
V- Quiescent Current	I-Q	$V_{IN} = 0V$ or $5V$	-1	-1	-10	-10	-10	-100	$\mu A$
+5V Quiescent Current	I <sub>LQ</sub>	$V_{IN} = 0V$ or $5V$	1	1	10	10	10	100	$\mu A$
Ground Quiescent Current	I <sub>GND</sub>	$V_{IN} = 0V$ or $5V$	1	1	10	10	10	100	$\mu A$
Minimum Channel-to-Channel Cross-Coupling Rejection Ratio	CCRR	One channel off (Note 2)	54 (typ)			50 (typ)			dB

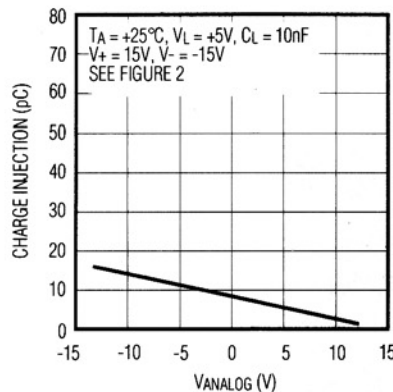
**Note 2:** Not production tested.

## Typical Operating Characteristics

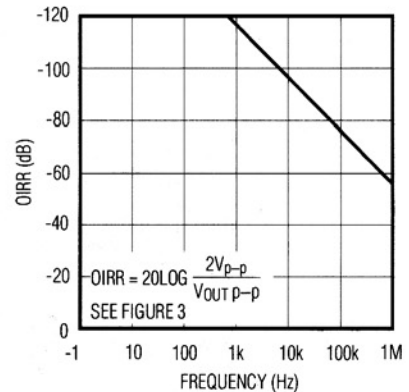
**DRAIN-SOURCE ON RESISTANCE vs. ANALOG SIGNAL**



**CHARGE INJECTION vs. ANALOG SIGNAL**



**OFF-ISOLATION REJECTION RATIO (OIRR)**



## Test Circuits

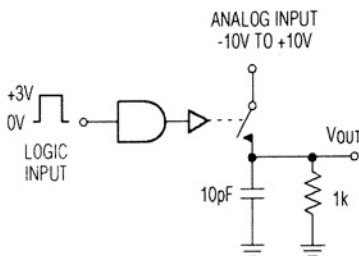


Figure 1. Switching Time

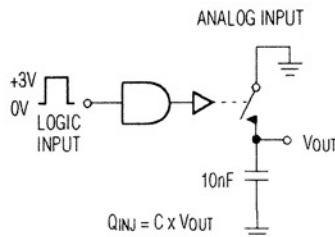


Figure 2. Charge Injection

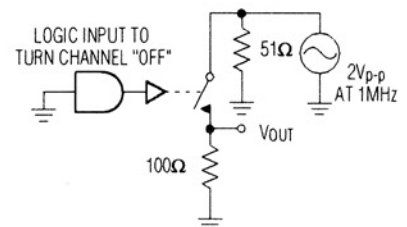
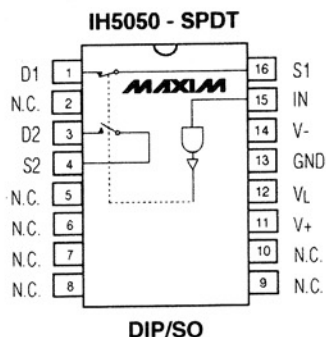


Figure 3. Off-Isolation Rejection Ratio

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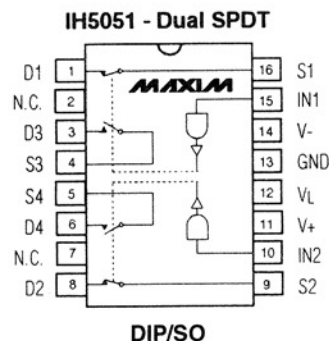
## Pin Configurations & Switching-State Diagrams (continued)

TOP VIEW



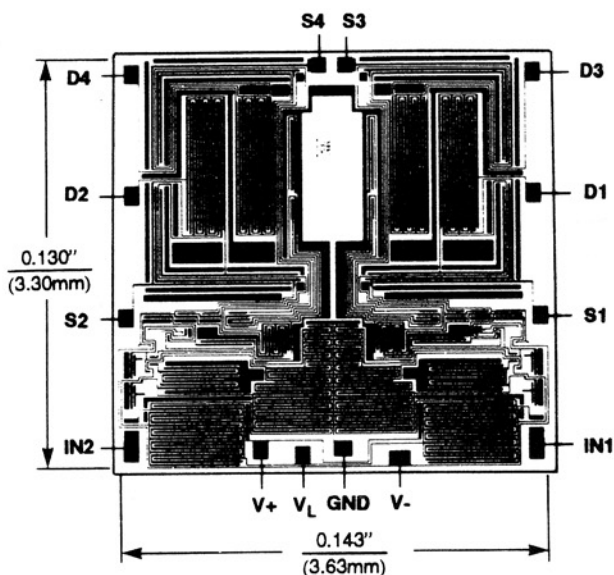
SWITCH STATES ARE FOR LOGIC "1" INPUTS (POSITIVE LOGIC)

LOGIC	SWITCH 1	SWITCH 2
0	OFF	ON
1	ON	OFF



LOGIC	SWITCH 1, SWITCH 2	SWITCH 3, SWITCH 4
0	OFF	ON
1	ON	OFF

## Chip Topography



## Ordering Information (continued)

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IH5049C/D	0°C to +70°C	Dice*
IH5049MJE	-55°C to +125°C	16 CERDIP**
<b>IH5050CPE</b>	0°C to +70°C	16 Plastic DIP
IH5050CWE	0°C to +70°C	16 Wide SO
IH5050CJE	0°C to +70°C	16 CERDIP
IH5050C/D	0°C to +70°C	Dice*
IH5050MJE	-55°C to +125°C	16 CERDIP**
<b>IH5051CPE</b>	0°C to +70°C	16 Plastic DIP
IH5051CWE	0°C to +70°C	16 Wide SO
IH5051ACJE	0°C to +70°C	16 CERDIP
IH5051AC/D	0°C to +70°C	Dice*
IH5051MJE	-55°C to +125°C	16 CERDIP**

\* Contact factory for dice specifications.

\*\* Contact factory for availability and processing to MIL-STD-883.

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