

MAXIM

General Purpose CMOS Analog Switches

IH5040/41/42/43/44/45

General Description

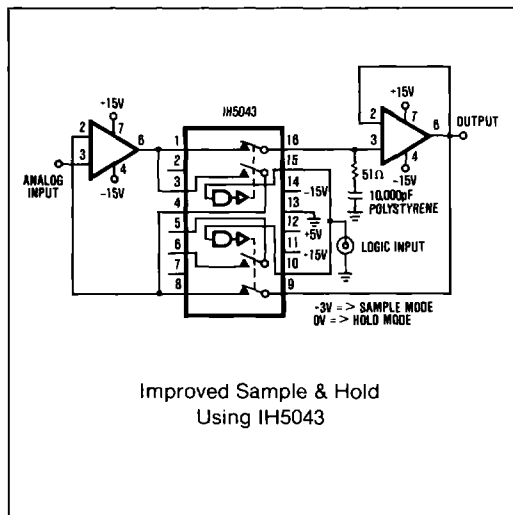
The IH5040 family consists of six CMOS analog switches that are intended for general purpose applications. These switches are latch-up proof, break-before-make single and dual versions of all the popular switch formats — SPST, SPDT, and DPST. Key features of the family include low leakage current of 1nA and quiescent current of less than 1 μ A.

Maxim IH5040 family has faster switching times than the original manufacturer's devices. All devices are bi-directional and maintain almost constant ON resistance throughout their operating range. These devices are guaranteed to operate from $\pm 4.5V$ to $\pm 18V$, and will switch input signals that include the supplies.

Applications

- PBX, PABX
- Disc Drives
- Guidance and Control Systems
- Test Equipment
- Sample and Holds
- Military Radios

Typical Operating Circuit



Features

- ◆ Improved 2nd Source! (See 3rd page for "Maxim Advantage™").
- ◆ Guaranteed $\pm 4.5V$ to $\pm 18V$ Operation
- ◆ Input Voltage Range Includes Supplies
- ◆ Latch-Up Proof Construction
- ◆ TTL, CMOS Logic Compatible
- ◆ Quiescent Current Less Than 1 μ A
- ◆ Monolithic Low Power CMOS Design

Ordering Information

PART	TEMP. RANGE	PACKAGE
SINGLE POLE SINGLE THROW (SPST)		
IH5040C/D	0°C to +70°C	DICE
IH5040CJE	0°C to +70°C	16 Lead CERDIP
IH5040CPE	0°C to +70°C	16 Lead Plastic DIP
IH5040CWE	0°C to +70°C	16 Lead Wide SO
IH5040M/D	-55°C to +125°C	DICE
IH5040MJE	-55°C to +125°C	16 Lead CERDIP
DUAL SINGLE POLE SINGLE THROW (DUAL SPST)		
IH5041C/D	0°C to +70°C	DICE
IH5041CJE	0°C to +70°C	16 Lead CERDIP
IH5041CPE	0°C to +70°C	16 Lead Plastic DIP
IH5041CTW	0°C to +70°C	10 Lead Metal Can
IH5041CWE	0°C to +70°C	16 Lead Wide SO
IH5041M/D	-55°C to +125°C	DICE
IH5041MJE	-55°C to +125°C	16 Lead CERDIP
IH5041MTW	-55°C to +125°C	10 Lead Metal Can
SINGLE POLE DOUBLE THROW (SPDT)		
IH5042C/D	0°C to +70°C	DICE
IH5042CJE	0°C to +70°C	16 Lead CERDIP
IH5042CPE	0°C to +70°C	16 Lead Plastic DIP
IH5042CWE	0°C to +70°C	16 Lead Wide SO
IH5042M/D	-55°C to +125°C	DICE
IH5042MJE	-55°C to +125°C	16 Lead CERDIP
DUAL SINGLE POLE DOUBLE THROW (DUAL SPDT)		
IH5043C/D	0°C to +70°C	DICE
IH5043CJE	0°C to +70°C	16 Lead CERDIP
IH5043CPE	0°C to +70°C	16 Lead Plastic DIP
IH5043CWE	0°C to +70°C	16 Lead Wide SO
IH5043M/D	-55°C to +125°C	DICE
IH5043MJE	-55°C to +125°C	16 Lead CERDIP

(Ordering information continued on fourth page.)

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The "Maxim Advantage™" signifies an upgraded quality level. At no additional cost we offer a second-source device that is subject to the following guaranteed performance over temperature along with tighter test specifications on many key parameters; and device enhancements when needed, that result in improved performance without changing the functionality.

IH5040/41/42/43/44/45

General Purpose CMOS Analog Switches

ABSOLUTE MAXIMUM RATINGS

Current (Any Terminal)	< 30mA
Storage Temperature	-65°C to +150°C
Operating Temperature	-55°C to +125°C
Power Dissipation	450mW
(All Leads Soldered to a P.C. Board)	
Derate 6mW/°C Above +70°C	
Lead Temperature (Soldering, 10 sec)	300°C
Voltages	
V ⁺ - V ⁻	< 38V
V ⁺ - V _D	< 30V

V _D - V ⁻	< 30V
V _D - V _S	< ±22V
V _L - V ⁻	< 33V
V _L - V _{IN}	< 30V
V _L - GND	< 20V
V _{IN} - GND	< 20V
Digital Inputs	(V ⁺ + 0.3V) to (V ⁺ - 38V)
V _S or V _D	-0.3V to (V ⁺ + 0.3V) (Note 1)

Note 1: Signals on S, D and digital inputs which exceed V⁻ or V⁺ will be clamped by internal diodes. Limit forward diode current to 30mA maximum.

Stresses above 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 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, V_L = +5V, T_A = +25°C unless otherwise indicated)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN./MAX. LIMITS						UNITS
			MILITARY			COMMERCIAL			
			-55°C	+25°C	+125°C	0°C	+25°C	+70°C	
Input Logic Current	I _{IN(ON)}	V _{IN} = 2.4V (Note 3)	±1	±1	10	±1	±1	10	μA
Input Logic Current	I _{IN(OFF)}	V _{IN} = 0.8V (Note 3)	±1	±1	10	±1	±1	10	μA
Drain-Source On Resistance	r _{DS(ON)}	I _S = 10mA V _{ANALOG} = -10V to +10V	75	75	150	80	80	130	Ω
Channel to Channel r _{DS(ON)} Match	Δr _{DS(ON)}		25 (typ)			30 (typ)			Ω
Minimum Analog Signal Handling Capability	V _{ANALOG}		±11 (typ)			±10 (typ)			V
Switch OFF Leakage Current	I _D /I _{S(OFF)}	V _{ANALOG} = -10V to +10V	±1 100			±5 100			nA
Switch ON Leakage Current	I _{D(ON)} + I _{S(ON)}	V _D = V _S = -10V to +10V	±2 200			±10 100			nA
Switch "ON" Time	t _{ON}	R _L = 1kΩ, V _{ANALOG} = -10V to +10V.	750			1000			ns
Switch "OFF" Time	t _{OFF}	R _L = 1kΩ, V _{ANALOG} = -10V to +10V.	350			500			ns
Charge Injection	Q _{I(NJ)}		15 (typ)			20 (typ)			mV
Minimum Off Isolation Rejection Ratio	OIRR	f = 1MHz, R _L = 100Ω, C _L ≤ 5pF	54 (typ)			50 (typ)			dB
V ⁺ Power Supply Quiescent Current	I ⁺ _O		1	1	10	10	10	100	μA
V ⁻ Power Supply Quiescent Current	I ⁻ _O	V ⁺ = +15V, V ⁻ = -15V, V _L = +5V	1	1	10	10	10	100	μA
+5V Supply Quiescent Current	I ⁻ _{LO}		1	1	10	10	10	100	μA
Ground Supply Quiescent Current	I _{GND}		1	1	10	10	10	100	μA
Minimum Channel to Channel Cross Coupling Rejection Ratio	CCRR	One Channel Off.	54 (typ)			50 (typ)			dB

The electrical characteristics above are a reproduction of a portion of Intersil's copyrighted 1986 Component Data Catalog. This information does not constitute any representation by Maxim that Intersil's products will perform in accordance with these specifications. The "Electrical Characteristics Table" along with descriptive excerpts from the original manufacturer's data sheet have been included in this data sheet solely for comparative purposes.

General Purpose CMOS Analog Switches

◆ Guaranteed ±4.5V to ±18V Operation

◆ Guaranteed To Switch Signals Up To Either Supply

◆ Faster Switching Speeds

ABSOLUTE MAXIMUM RATINGS: This device conforms to the Absolute Maximum Ratings on the adjacent page.

ELECTRICAL CHARACTERISTICS: Specifications below satisfy or exceed all "tested" parameters on adjacent page ($V^+ = +15V$, $V^- = -15V$, $V_L = +5V$, $T_A = +25^\circ C$ unless otherwise indicated)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN./MAX. LIMITS						UNITS
			MILITARY			COMMERCIAL			
			-55°C	+25°C	+125°C	0°C	+25°C	+70°C	
Input Logic Current	$I_{IN(ON)}$	$V_{IN} = 2.4V$	±1	±1	10	±1	±1	10	μA
Input Logic Current	$I_{IN(OFF)}$	$V_{IN} = 0.8V$	±1	±1	10	±1	±1	10	μA
Input Logic Low	V_{IL}		0.8	0.8	0.8	0.8	0.8	0.8	V
Input Logic High	V_{IH}		2.4	2.4	2.4	2.4	2.4	2.4	V
Drain-Source On Resistance	$r_{DS(ON)}$	$I_S = 10mA$, $V_{ANALOG} = -10V$ to $+10V$	75	75	150	80	80	130	Ω
Channel to Channel $r_{DS(ON)}$ Match	$\Delta r_{DS(ON)}$		3 (typ)			5 (typ)			Ω
Minimum Analog Signal Handling Capability	V_{ANALOG}		±15			±15			V
Switch OFF Leakage Current	$I_{D/OFF}$, $I_{S/OFF}$	$V_{ANALOG} = -10V$ to $+10V$	±1	100		±5	100		nA
Switch ON Leakage Current	$I_{D(ON)}$, $I_{S(ON)}$	$V_C = V_S = -10V$ to $+10V$	±2	200		+10	100		nA
Switch "ON" Time	t_{ON}	Fig. A	400			400			ns
Switch "OFF" Time	t_{OFF}	Fig. A	200			200			ns
Charge Injection	$Q_{I(NJ)}$	Fig. B (Note 2)	15			20			mV
Minimum Off Isolation Rejection Ratio	CI RR	Fig. C, $C_L < 5pF$	54 (typ)			50 (typ)			dB
V^+ Quiescent Current	I^+_O		1	1	10	10	10	100	μA
V^- Quiescent Current	I^-_O		-1	-1	-10	-10	-10	-100	μA
+5V Quiescent Current	I_{LO}		1	1	10	10	10	100	μA
Ground Quiescent Current	I_{GND}		1	1	10	10	10	100	μA
Min. Channel to Channel Cross Coupling Rej Ratio	CCRR	One Channel Off (Note 2)	54 (typ)			50 (typ)			dB
Power Supply Range For Continuous Operation	V_{OP}	Min. (Note 3) Max. (Note 3)	±4.5 ±18			±4.5 ±18			V

Note 2: Not tested in production.

Note 3: Electrical characteristics, such as ON Resistance, will change when power supplies other than ±15V are used.

Test Circuits

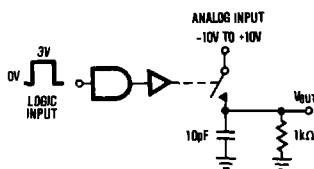


Figure A. Switching Time

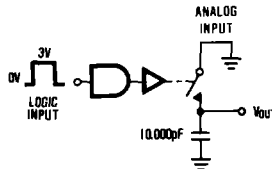


Figure B. Charge Injection

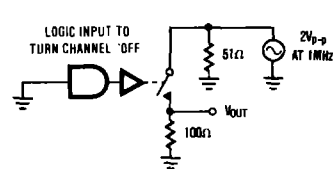


Figure C. Off Isolation Rejection Ratio

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Pin Configuration & Switching State Diagrams

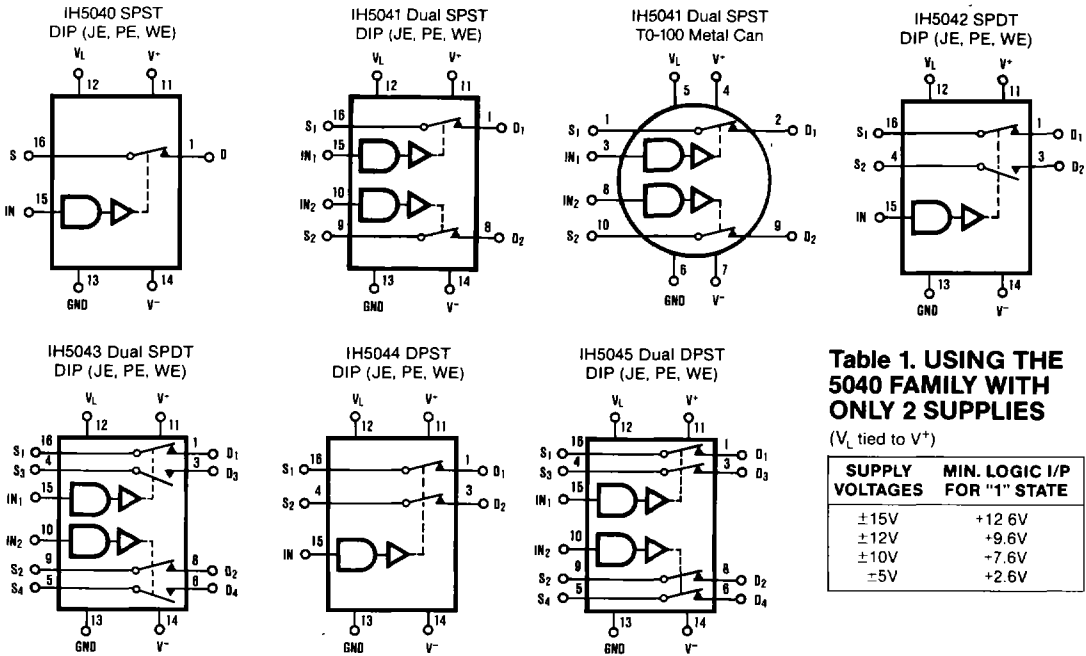


Table 1. USING THE 5040 FAMILY WITH ONLY 2 SUPPLIES
(V_L tied to V^+)

SUPPLY VOLTAGES	MIN. LOGIC I/P FOR "1" STATE
$\pm 15V$	+12.6V
$\pm 12V$	+9.6V
$\pm 10V$	+7.6V
$\pm 5V$	+2.6V

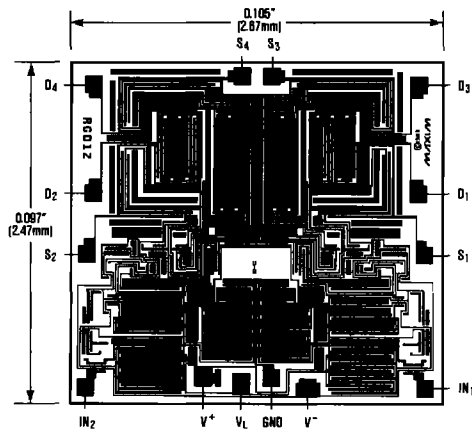
Note: Switch states are for logic "1" input.

Ordering Information (continued)

PART	TEMP. RANGE	PACKAGE
DOUBLE POLE SINGLE THROW (DPST)		
IH5044C/D	0°C to +70°C	DICE
IH5044CJE	0°C to +70°C	16 Lead CERDIP
IH5044CPE	0°C to +70°C	16 Lead Plastic DIP
IH5044CWE	0°C to +70°C	16 Lead Small Outline
IH5044M/D	-55°C to +125°C	DICE
IH5044MJE	-55°C to +125°C	16 Lead CERDIP
DUAL DOUBLE POLE SINGLE THROW (DUAL DPST)		
IH5045C/D	0°C to +70°C	DICE
IH5045CJE	0°C to +70°C	16 Lead CERDIP
IH5045CPE	0°C to +70°C	16 Lead Plastic DIP
IH5045CWE	0°C to +70°C	16 Lead Small Outline
IH5045M/D	-55°C to +125°C	DICE
IH5045MJE	-55°C to +125°C	16 Lead CERDIP

For the IH5042 and IH5044 in 10 Lead Metal Can Package Contact Factory. For all devices in Ceramic Flat Package Contact Factory.

Chip Topography



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