

MAXIM

Low Power Fast CMOS Analog Switches

General Description

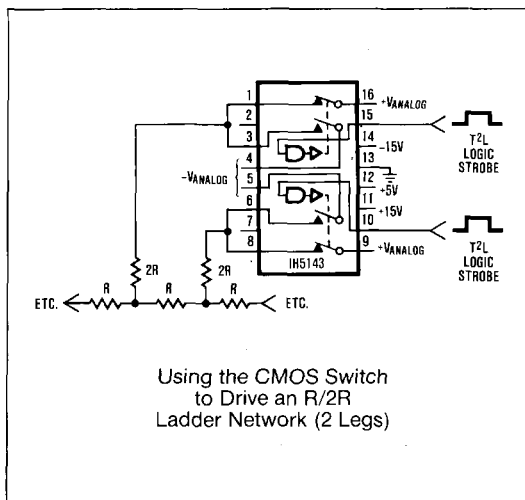
The IH5140 family consists of six CMOS analog switches that are intended for high speed general purpose applications. These switches are latch-up proof, break-before-make single and dual versions of all the popular switch formats — SPST, SPDT, and DPST. Key features of the family include toggle rates in excess of 1MHz, t_{ON} times of 80ns typical and t_{OFF} times of 50ns. OFF leakage current is less than 100pA maximum at +25°C and quiescent currents are 1 μ A maximum, making the switches ideal for portable equipment.

Maxim has significantly improved the design of these switches versus the original manufacturer. Maxim's switches are guaranteed to operate from $\pm 4.5V$ to $\pm 18V$, and will switch input signals that include the supplies.

Applications

High Speed Test Equipment
Sample and Hold Circuits
Guidance and Control Systems
Radar Systems
Aircraft Head-Up Displays
Military Radios

Typical Operating Circuit



Features

- ◆ Pin for Pin 2nd Source!
- ◆ Break-Before-Make Switching Action
- ◆ Fast t_{ON} (80ns typ.) and t_{OFF} (50ns)
- ◆ Input Signal Range Includes Supply Rails
- ◆ Guaranteed $\pm 4.5V$ to $\pm 18V$ Operation
- ◆ Low OFF Leakage Current — 100pA max.
- ◆ Greater than 1MHz Toggle Rate
- ◆ TTL and CMOS Compatible

Ordering Information

PART	TEMP. RANGE	PACKAGE
SINGLE POLE SINGLE THROW (SPST)		
IH5140C/D	0°C to +70°C	DICE
IH5140CJE	0°C to +70°C	16 Lead Cerdip
IH5140CPE	0°C to +70°C	16 Lead Plastic DIP
IH5140CWE	0°C to +70°C	16 Lead Wide SO
IH5140M/D	-55°C to +125°C	DICE
IH5140MJE	-55°C to +125°C	16 Lead Cerdip
DUAL SINGLE POLE SINGLE THROW (DUAL SPST)		
IH5141C/D	0°C to +70°C	DICE
IH5141CJE	0°C to +70°C	16 Lead Cerdip
IH5141CPE	0°C to +70°C	16 Lead Plastic DIP
IH5141CTW	0°C to +70°C	10 Lead Metal Can
IH5141CWE	0°C to +70°C	16 Lead Wide SO
IH5141M/D	-55°C to +125°C	DICE
IH5141MJE	-55°C to +125°C	16 Lead Cerdip
IH5141MTW	-55°C to +125°C	10 Lead Metal Can
SINGLE POLE DOUBLE THROW (SPDT)		
IH5142C/D	0°C to +70°C	DICE
IH5142CJE	0°C to +70°C	16 Lead Cerdip
IH5142CPE	0°C to +70°C	16 Lead Plastic DIP
IH5142CWE	0°C to +70°C	16 Lead Wide SO
IH5142M/D	-55°C to +125°C	DICE
IH5142MJE	-55°C to +125°C	16 Lead Cerdip
DUAL SINGLE POLE DOUBLE THROW (DUAL SPDT)		
IH5143C/D	0°C to +70°C	DICE
IH5143CJE	0°C to +70°C	16 Lead Cerdip
IH5143CPE	0°C to +70°C	16 Lead Plastic DIP
IH5143CWE	0°C to +70°C	16 Lead Wide SO
IH5143M/D	-55°C to +125°C	DICE
IH5143MJE	-55°C to +125°C	16 Lead Cerdip

(Ordering information continued on fourth page.)

IH5140/41/42/43/44/45

MAXIM

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Low Power Fast 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

(All Parameters with V⁺ = +15V, V⁻ = -15V, V_L = +5V, 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 _{INH}	V _{IN} = 2.4V (Note 2)	±1	±1	10	±1	±1	10	μA
Input Logic Current	I _{INL}	V _{IN} = 0.8V (Note 2)	+1	±1	10	±1	±1	10	μA
Drain-Source On Resistance	r _{DS(ON)}	I _S = -10mA V _{ANALOG} = -10V to +10V	50	50	75	75	75	100	Ω
Channel to Channel r _{DS(ON)} Match	Δr _{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 _D = +10V, V _S = -10V V _D = -10V, V _S = +10V	±0.5		100	±5		100	nA
Switch ON Leakage Current	I _{D(ON)} + I _{S(ON)}	V _D = V _S = -10V to +10V	±1		200	+2		200	nA
Switch "ON" Time Switch "OFF" Time	t _{ON} t _{OFF}		See switching time specifications and timing diagrams.						
Charge Injection	Q _(INJ.)	(Note 3)	10 (typ)			15 (typ)			pC
Minimum Off Isolation Rejection Ratio	OIRR	f = 1MHz, R _L = 100Ω, C _L ≤ 5pF (Note 3)	54 (typ)			50 (typ)			dB
+ Power Supply Quiescent Current	I ⁺	V ⁺ = +15V, V ⁻ = -15V, V _L = +5V	1.0	1.0	10.0	10	10	100	μA
- Power Supply Quiescent Current	I ⁻		-1.0	-1.0	-10.0	-10	-10	-100	μA
+5V Supply Quiescent Current	I _L		1.0	1.0	10.0	10	10	100	μA
Ground Supply Quiescent Current	I _{GND}		1.0	1.0	10.0	10	10	100	μA
Minimum Channel to Channel Cross Coupling Rejection Ratio	CCRR	One Channel Off (Note 3)	54 (typ)			50 (typ)			dB
Power Supply Range for Continuous Operation	V _{OP}	(Note 4)	±4.5 (min) ±18V (max)			+4.5 (min) ±18V (max)			V

Note: 2. Some channels are turned on by high (1) logic inputs and other channels are turned on by low (0) inputs; however, 0.8V to 2.4V describes the minimum range for switching properly. Refer to logic diagrams to find logical value of logic input required to produce ON or OFF state.

3. Typical values are for design aid only, not guaranteed and not subject to production testing.

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

Low Power Fast CMOS Analog Switches

IH5140/41/42/43/44/45

SWITCHING TIME SPECIFICATIONS

(t_{on} , t_{off} are maximum specifications and $t_{on}-t_{off}$ is minimum specifications)

PART NUMBER	CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MILITARY			COMMERCIAL			UNITS
				-55°C	+25°C	+125°C	0°C	+25°C	+70°C	
IH5140-5141	Switch "ON" time	t_{on}	Figure 1	100*	75*		150	125	5	ns
	Switch "OFF" time	t_{off}								
	Break-before-make	$t_{on}-t_{off}$		10* TYP						
IH5142-5143	Switch "ON" time	t_{on}	Figure 2	150	125		175	150	5	ns
	Switch "OFF" time	t_{off}								
	Break-before-make	$t_{on}-t_{off}$		10* TYP						
IH5142-5143	Switch "ON" time	t_{on}	Figure 2	200	125		300	150	5	ns
	Switch "OFF" time	t_{off}								
	Break-before-make	$t_{on}-t_{off}$		10* TYP						
IH5142-5143	Switch "ON" time	t_{on}	Figure 3	175*	125*		250	150	5	ns
	Switch "OFF" time	t_{off}								
	Break-before-make	$t_{on}-t_{off}$		10* TYP						
IH5142-5143	Switch "ON" time	t_{on}	Figure 4	200	125		300	150	5	ns
	Switch "OFF" time	t_{off}								
	Break-before-make	$t_{on}-t_{off}$		10* TYP						
IH5144-5145	Switch "ON" time	t_{on}	Figure 1	175*	125*		250	150	5	ns
	Switch "OFF" time	t_{off}								
	Break-before-make	$t_{on}-t_{off}$		10* TYP						
IH5144-5145	Switch "ON" time	t_{on}	Figure 2	200	125		300	150	5	ns
	Switch "OFF" time	t_{off}								
	Break-before-make	$t_{on}-t_{off}$		10* TYP						

Note: Switching times are measured at 90% points.

* Guaranteed but not subjected to production testing.

Switching Time Test Circuits

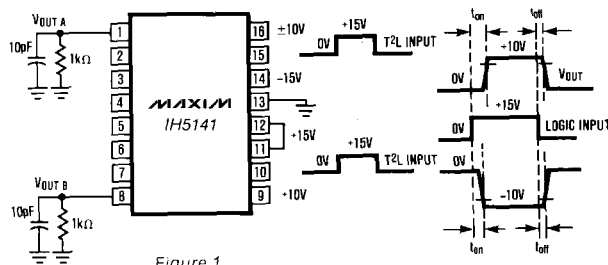


Figure 1

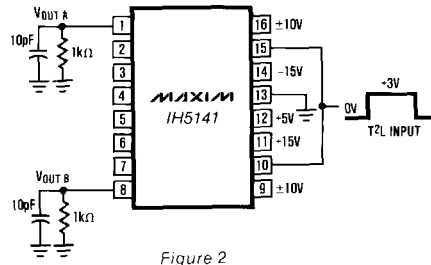


Figure 2

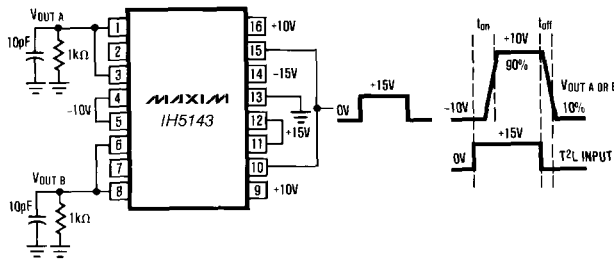


Figure 3

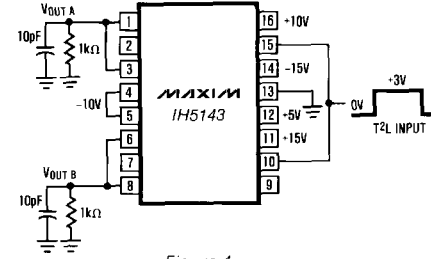


Figure 4

Low Power Fast CMOS Analog Switches

Pin Configuration and Switching State Diagrams

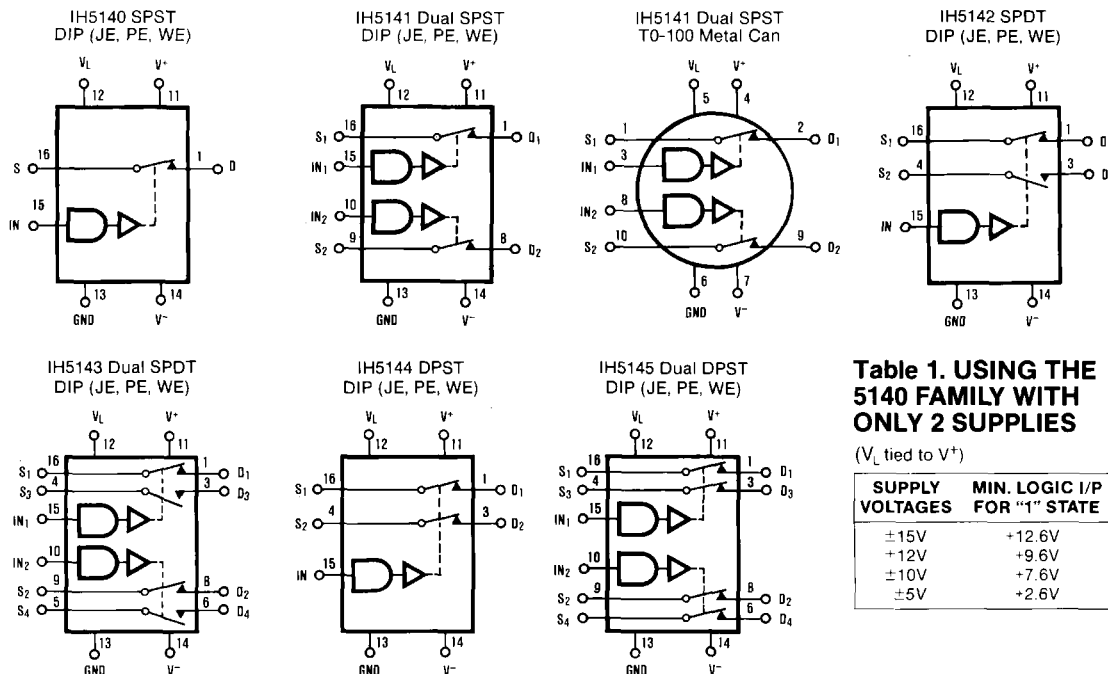


Table 1. USING THE 5140 FAMILY WITH ONLY 2 SUPPLIES

(V_L tied to V^+)

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

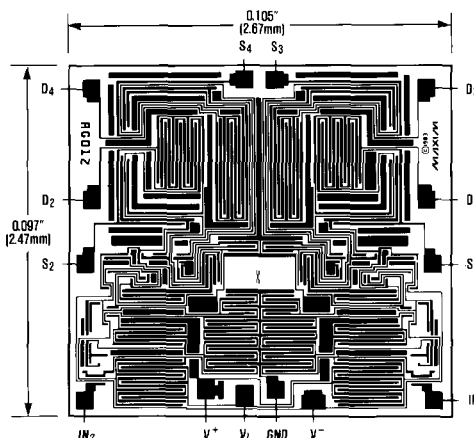
Note: Switch states are for logic "1" input.

Ordering Information (continued)

PART	TEMP. RANGE	PACKAGE
DOUBLE POLE SINGLE THROW (DPST)		
IH5144C/D	0°C to +70°C	DICE
IH5144CJE	0°C to +70°C	16 Lead Cerdip
IH5144CPE	0°C to +70°C	16 Lead Plastic DIP
IH5144CWE	0°C to +70°C	16 Lead Wide SO
IH5144M/D	-55°C to +125°C	DICE
IH5144MJE	-55°C to +125°C	16 Lead Cerdip
DUAL DOUBLE POLE SINGLE THROW (DUAL DPST)		
IH5145C/D	0°C to +70°C	DICE
IH5145CJE	0°C to +70°C	16 Lead Cerdip
IH5145CPE	0°C to +70°C	16 Lead Plastic DIP
IH5145CWE	0°C to +70°C	16 Lead Wide SO
IH5145M/D	-55°C to +125°C	DICE
IH5145MJE	-55°C to +125°C	16 Lead Cerdip

For the IH5142 and IH5144 in 10 Lead Metal Can package contact factory. For all devices in Ceramic Flat Package contact factory.

Chip Topography

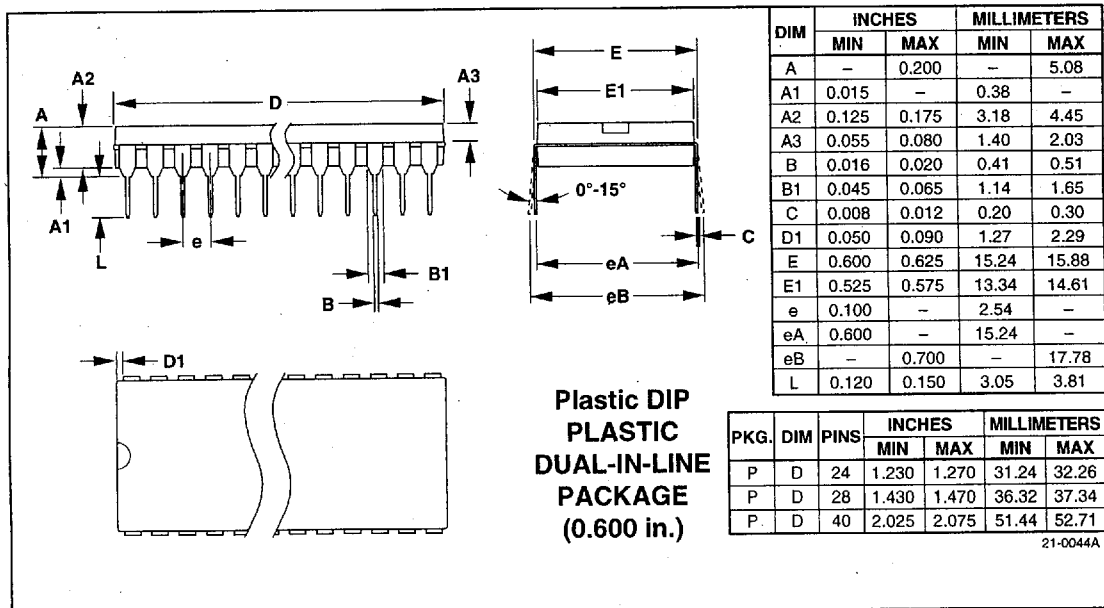
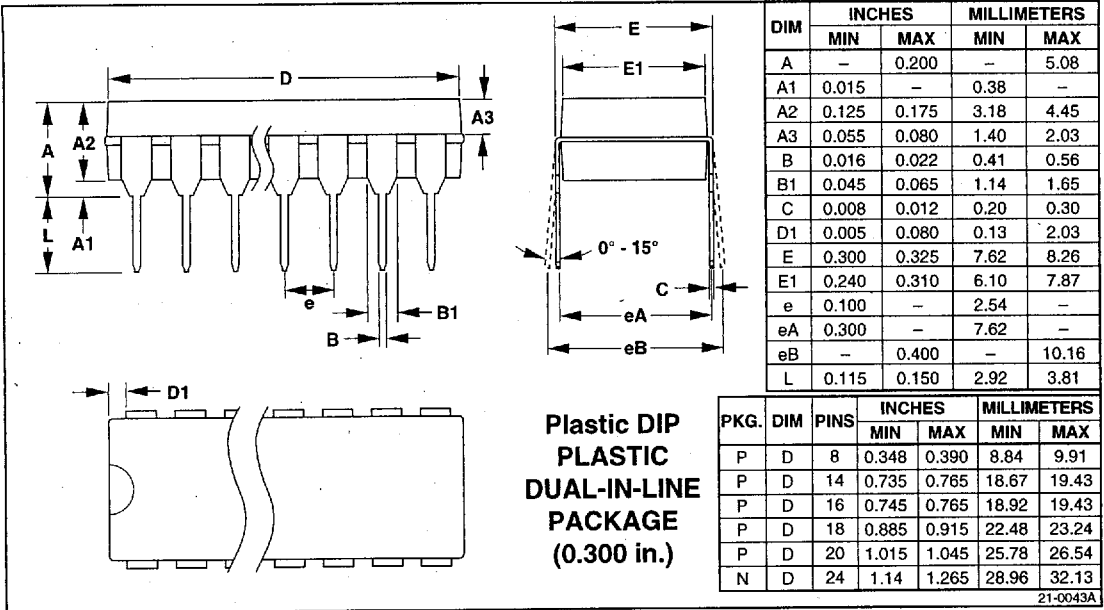


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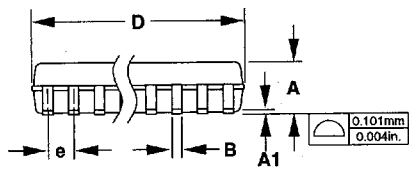
Package Information

This section contains physical dimensions for all packages currently supplied by Maxim.

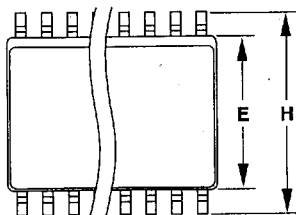


A

Package Information



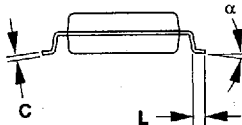
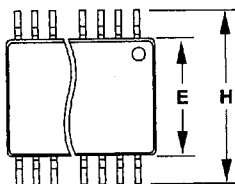
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
B	0.014	0.019	0.35	0.49
C	0.009	0.013	0.23	0.32
E	0.291	0.299	7.40	7.60
e	0.050		1.27	
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27



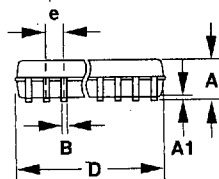
**Wide SO
SMALL-OUTLINE
PACKAGE
(0.300 in.)**

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	16	0.398	0.413	10.10	10.50
D	18	0.447	0.463	11.35	11.75
D	20	0.496	0.512	12.60	13.00
D	24	0.598	0.614	15.20	15.60
D	28	0.697	0.713	17.70	18.10

21-0042A



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.068	0.078	1.73	1.99
A1	0.002	0.008	0.05	0.21
B	0.010	0.015	0.25	0.38
C	0.004	0.008	0.09	0.20
D	SEE VARIATIONS			
E	0.205	0.209	5.20	5.38
e	0.0256 BSC		0.65 BSC	
H	0.301	0.311	7.65	7.90
L	0.025	0.037	0.63	0.95
alpha	0°	8°	0°	8°



**SSOP
SHRINK
SMALL-OUTLINE
PACKAGE**

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	14	0.239	0.249	6.07	6.33
D	16	0.239	0.249	6.07	6.33
D	20	0.278	0.289	7.07	7.33
D	24	0.317	0.328	8.07	8.33
D	28	0.397	0.407	10.07	10.33

21-0056A

