

IH5143

High-Level CMOS Analog Switches

The IH5140 Family of CMOS switches utilizes Harris' latchfree Junction isolated processing to build the fastest switches currently available. These switches can be toggled at a rate of greater than 1MHz with fast t_{ON} times (80ns typical) and faster t_{OFF} times (50ns typical), guaranteeing break before make switching. This family of switches combines the speed of the hybrid FET DG180 family with the reliability and low power consumption of a monolithic CMOS construction.

Very low quiescent power is dissipated in either the ON or the OFF state of the switch. Maximum power supply current is 10 μ A (at 25°C) from any supply and typical quiescent currents are in the 10nA which makes these devices ideal for portable equipment and military applications.

The IH5140 Family is completely compatible with TTL (5V) logic, TTL open collector logic and CMOS logic. It is pin compatible with Harris' IH5040 family and part of the DG180/DG 190 family as shown in the switching state diagrams.

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer (OCM).

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-35835
 - Class Q Military
 - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
 - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

FOR REFERENCE ONLY

NOT RECOMMENDED FOR NEW DESIGNS

High-Level CMOS Analog Switches

September 1997

Features

- Super Fast Break-Before-Make Switching
- SPST Switches (Typ)
 - t_{ON} 80ns
 - t_{OFF} 50ns
- Power Supply Currents $<1\mu A$
- OFF Leakages at 25°C (Typ)..... $<100\mu A$
- Non-Latching with Supply Turn-Off
- Single Monolithic CMOS Chip
- Plug-In Replacements for IH5040 Family and Part of the DG180 Family to Upgrade Speed and Leakage
- Toggle Rate..... $>1\text{MHz}$
- Switches Signals with $\pm 15\text{V}$ Supplies..... $>20\text{V}_{P-P}$
- TTL, CMOS Direct Compatibility
- Internal Diode in Series with $V+$ for Fault Protection

Description

The IH5140 Family of CMOS switches utilizes Harris' latch-free junction isolated processing to build the fastest switches currently available. These switches can be toggled at a rate of greater than 1MHz with fast t_{ON} times (80ns typical) and faster t_{OFF} times (50ns typical), guaranteeing break before make switching. This family of switches combines the speed of the hybrid FET DG180 family with the reliability and low power consumption of a monolithic CMOS construction.

Very low quiescent power is dissipated in either the ON or the OFF state of the switch. Maximum power supply current is $10\mu A$ (at 25°C) from any supply and typical quiescent currents are in the 10nA which makes these devices ideal for portable equipment and military applications.

The IH5140 Family is completely compatible with TTL (5V) logic, TTL open collector logic and CMOS logic. It is pin compatible with Harris' IH5040 family and part of the DG180/DG190 family as shown in the switching state diagrams.

Ordering Information

PART NUMBER	FUNCTION	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
IH5140MJE	SPST	-55 to 125	16 Ld CerDIP	
IH5140CJE	SPST	0 to 70	16 Ld CERDIP	
IH5140CPE	SPST	0 to 70	16 Ld PDIP	
IH5141MJE	Dual SPST	-55 to 125	16 Ld CerDIP	
IH5141CJE	Dual SPST	0 to 70	16 Ld CERDIP	
IH5141CPE	Dual SPST	0 to 70	16 Ld PDIP	
IH5142MJE	SPDT	-55 to 125	16 Ld CerDIP	
IH5142CJE	SPDT	0 to 70	16 Ld CERDIP	
IH5142CPE	SPDT	0 to 70	16 Ld PDIP	
IH5143MJE	Dual SPDT	-55 to 125	16 Ld CERDIP	
IH5143CJE	Dual SPDT	0 to 70	16 Ld CerDIP	
IH5143CPE	Dual SPDT	0 to 70	16 Ld PDIP	
IH5144MJE	DPST	-55 to 125	16 Ld CERDIP	
IH5144CJE	DPST	0 to 70	16 Ld CERDIP	
IH5144CPE	DPST	0 to 70	16 Ld PDIP	
IH5145MJE	Dual DPST	-55 to 125	16 Ld CerDIP	
IH5145CJE	Dual DPST	0 to 70	16 Ld CerDIP	
IH5145CPE	Dual DPST	0 to 70	16 Ld PDIP	
IH5140MJE/883B	SPST	-55 to 125	16 Ld CERDIP	
IH5141MJE/883B	Dual SPST	-55 to 125	16 Ld CERDIP	
IH5142MJE/883B	SPDT	-55 to 125	16 Ld CERDIP	
IH5143MJE/883B	Dual SPDT	-55 to 125	16 Ld CERDIP	
IH5144MJE/883B	DPST	-55 to 125	16 Ld CERDIP	
IH5145MJE/883B	Dual DPST	-55 to 125	16 Ld CERDIP	

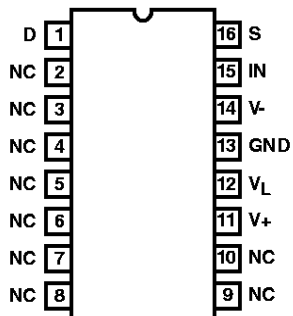
NOTE:

1. For MIL-STD-883 compliant parts, request the /883 datasheet on the above products.

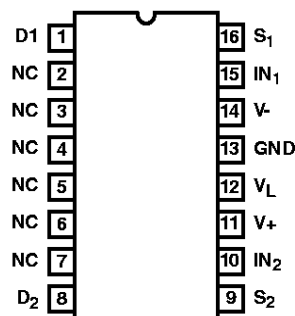
IH5140 thru IH5145

Pinouts

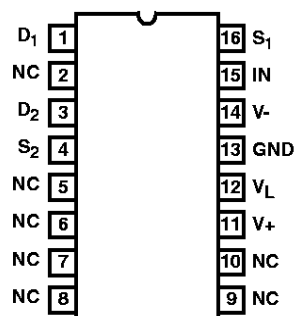
IH5140
(PDIP, CERDIP)
TOP VIEW



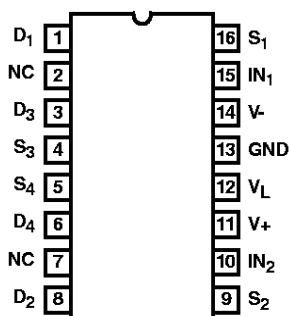
IH5141
(PDIP, CERDIP)
TOP VIEW



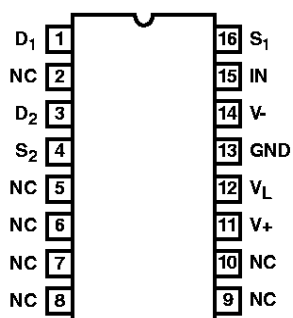
IH5142
(PDIP, CERDIP)
TOP VIEW



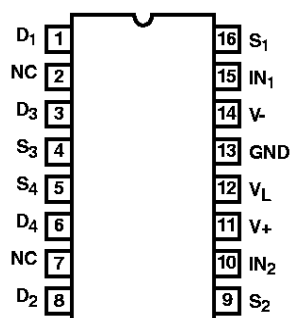
IH5143
(PDIP, CERDIP)
TOP VIEW



IH5144
(PDIP, CERDIP)
TOP VIEW



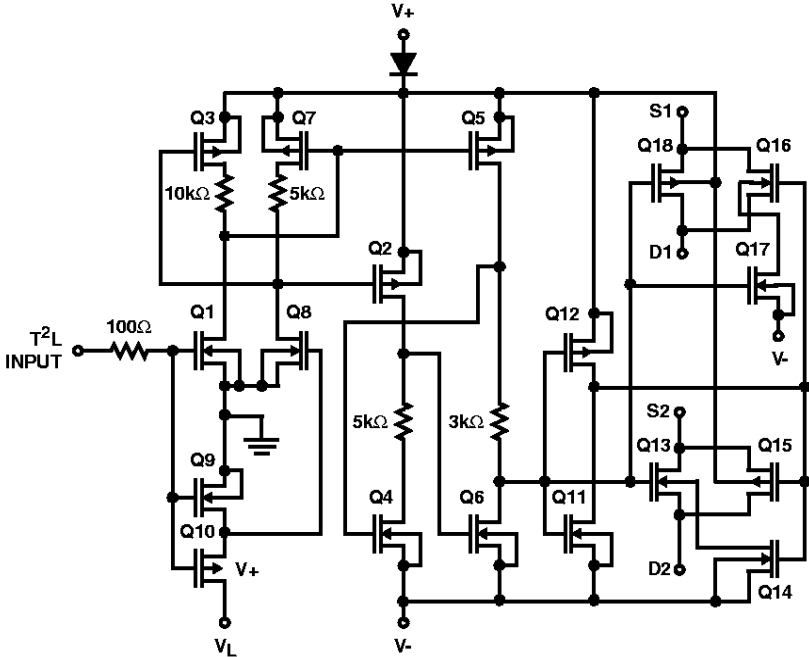
IH5145
(PDIP, CERDIP)
TOP VIEW



IH5140 thru IH5145

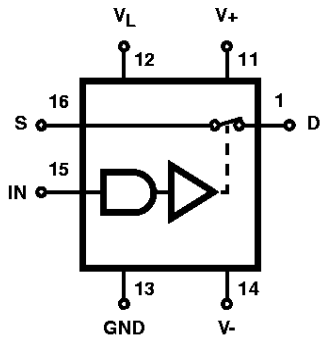
Functional Block Diagram

TYPICAL DRIVER/GATE - IH5142

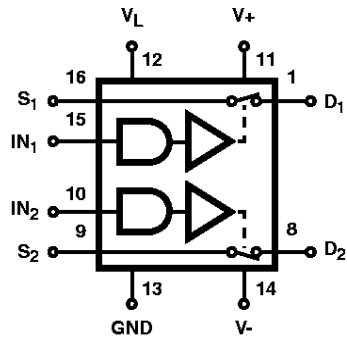


Switching State Diagrams

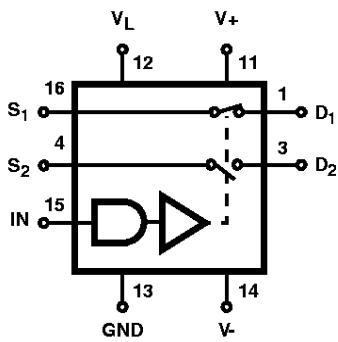
DIP (JE, PE)
SPST IH5140



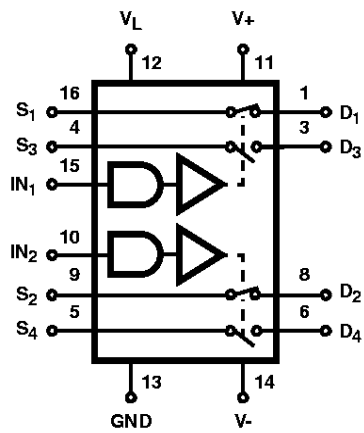
DIP (JE, PE)
DUAL SPST IH5141



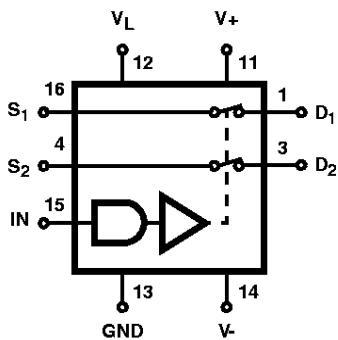
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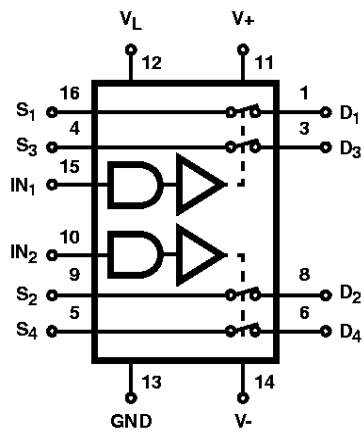
DIP (JE, PE)
DUAL SPDT IH5143



DIP (JE, PE)
DPST IH5144



DIP (JE, PE)
DUAL DPST IH5145



IH5140 thru IH5145

Absolute Maximum Ratings

V+ to V-	<36V
V+ to V _D	<30V
V _D to V-	<30V
V _D to V _S	<±22V
V _L to V-	<33V
V _L to V _{IN}	<30V
V _L to GND	<20V
V _{IN} to GND	<20V
Current (Any Terminal)	30mA

Thermal Information

Thermal Resistance (Typical)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
CERDIP Package	80	24
PDIP Package	100	N/A
Maximum Junction Temperature		
CERDIP Package	175°C	
PDIP Package	150°C	
Maximum Storage Temperature Range	-65°C to 150°C	
Maximum Lead Temperature (Soldering 10s)	300°C	

Operating Conditions

Temperature Ranges

Military	-55°C to 125°C
Commercial	0°C to 70°C

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Electrical Specifications 25°C, V+ = +15V, V- = -15V, V_L = +5V

PER CHANNEL PARAMETER	TEST CONDITIONS	MILITARY			COMMERCIAL			UNITS
		-55°C	25°C	125°C	0°C	25°C	70°C	
LOGIC INPUT								
Input Logic Current, I _{INH}	V _{IN} = 2.4V, Note 1	±1	±1	10	-	±10	10	µA
Input Logic Current, I _{INL}	V _{IN} = 0.8V, Note 1	±1	±1	10	-	±10	10	µA
SWITCH								
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)}		-	25 (Typ)	-	-	30 (Typ)	-	Ω
Minimum Analog Signal Handling Capability, V _{ANALOG}		-	±11 (Typ)	-	-	±10 (Typ)	-	V
Switch OFF Leakage Current, I _{D(OFF)} +I _{S(OFF)}	V _D = +10V, V _S = -10V	-	±0.5	100	-	±5	100	nA
	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
Minimum Channel to Channel Cross Coupling Rejection Ratio, CCRR	One Channel Off; Any Other Channel Switches, See Performance Characteristics	-	54 (Typ)	-	-	50 (Typ)	-	dB
Switch "ON" Time, t _{ON}	See Switching Time Specifications and Timing Diagrams							
Switch "OFF" Time, t _{OFF}	See Switching Time Specifications and Timing Diagrams							
Charge Injection, Q _(INJ)	See Performance Characteristics	-	10 (Typ)	-	-	15 (Typ)	-	pC
Minimum Off Isolation Rejection Ratio, OIRR	f = 1MHz, R _L = 100Ω, C _L ≤ 5pF, See Performance Characteristics	-	54 (Typ)	-	-	50 (Typ)	-	dB
SUPPLY								
+ Power Supply Quiescent Current, I ₊	V+ = +15V, V- = -15V, V _L = +5V, See Performance Characteristics	1.0	1.0	10	10	10	100	µA
- Power Supply Quiescent Current, I ₋		1.0	1.0	10	10	10	100	µA
+5V Supply Quiescent Current, I _L		1.0	1.0	10	10	10	100	µA
Ground Supply Quiescent Current, I _{GND}		1.0	1.0	10	10	10	100	µA

NOTES:

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

IH5140 thru IH5145

Switching Time Specifications t_{ON} , t_{OFF} are Maximum Specifications and $t_{ON} - t_{OFF}$ is Minimum Specification

PART NUMBER	SPECIFICATIONS	TEST CONDITIONS	MILITARY			COMMERCIAL			UNITS
			-55°C	25°C	125°C	0°C	25°C	70°C	
IH5140, IH5141	Switch "ON" Time, t_{ON}	Figure 8, Note 2	-	100	-	-	150	-	ns
	Switch "OFF" Time, t_{OFF}		-	75	-	-	125	-	ns
	Break-Before-Make, $t_{ON} - t_{OFF}$		-	10	-	-	5	-	ns
	Switch "ON" Time, t_{ON}	Figure 7	-	150	-	-	175	-	ns
	Switch "OFF" Time, t_{OFF}		-	125	-	-	150	-	ns
IH5142, IH5143	Switch "ON" Time, t_{ON}	Figure 8, Note 2	-	175	-	-	250	-	ns
	Switch "OFF" Time, t_{OFF}		-	125	-	-	150	-	ns
	Break-Before-Make, $t_{ON} - t_{OFF}$		-	10	-	-	5	-	ns
	Switch "ON" Time, t_{ON}	Figure 7	-	200	-	-	300	-	ns
	Switch "OFF" Time, t_{OFF}		-	125	-	-	150	-	ns
	Switch "ON" Time, t_{ON}	Figure 2, Note 2	-	175	-	-	250	-	ns
	Switch "OFF" Time, t_{OFF}		-	125	-	-	150	-	ns
	Break-Before-Make, $t_{ON} - t_{OFF}$		-	10	-	-	5	-	ns
	Switch "ON" Time, t_{ON}	Figure 3, Note 2	-	200	-	-	300	-	ns
	Switch "OFF" Time, t_{OFF}		-	125	-	-	150	-	ns
Break-Before-Make, $t_{ON} - t_{OFF}$	-		10	-	-	5	-	ns	
IH5144, IH5145	Switch "ON" Time, t_{ON}	Figure 8, Note 2	-	175	-	-	250	-	ns
	Switch "OFF" Time, t_{OFF}		-	125	-	-	150	-	ns
	Break-Before-Make, $t_{ON} - t_{OFF}$		-	10	-	-	5	-	ns
	Switch "ON" Time, t_{ON}	Figure 7	-	200	-	-	300	-	ns
	Switch "OFF" Time, t_{OFF}		-	125	-	-	150	-	ns

NOTES:

1. Switching times are measured at 90% points.
2. Typical values are for design aid only, not guaranteed and not subject to production testing.