

Quad SPST CMOS Analog Switch

Features

- Analog Voltage Range $\pm 15V$
- Analog Current Range **80mA**
- Turn-On Time **185ns**
- Low R_{ON} **55 Ω**
- Low Power Dissipation **15mW**
- TTL/CMOS Compatible

Applications

- High Frequency Analog Switching
- Sample and Hold Circuits
- Digital Filters
- Operational Amplifier Gain Switching Networks

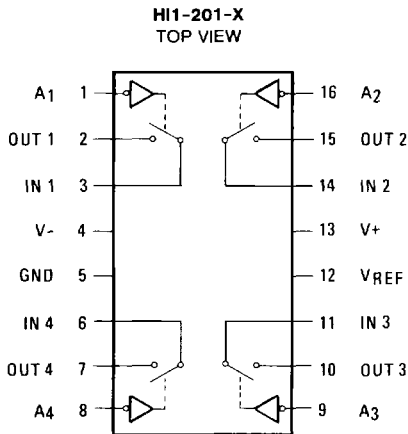
Description

HI-201 is a monolithic device comprising four independently selectable SPST switches which feature fast switching speeds (185ns) combined with low power dissipation (15mW at +25°C). Each switch provides low "ON" resistance operation for input signal voltages up to the supply rails and for signal currents up to 80mA. Employing Dielectric Isolation and CMOS processing, HI-201 operates without any applications problems induced by latch-up or SCR mode phenomena.

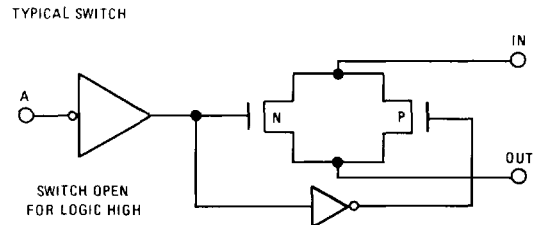
All devices provide break-before-make switching and are TTL and CMOS compatible for maximum application versatility. HI-201 is an ideal component for use in high frequency analog switching. Typical applications include signal path switching, sample and hold circuit, digital filters, and op amp gain switching networks.

HI-201 is available in a 16 lead Dual-In-Line package. HI-201-2 is specified from -55°C to +125°C while HI-201-5 operates from 0°C to +75°C. HI-201 is functionally and pin compatible with other available "200 series" switches.

Pinout



Functional Diagram



Specifications HI-201

Absolute Maximum Ratings

Supply Voltage Between Pins 4 and 13	44V (±22)
V _{REF} to Ground	+20V, -5V
Digital Input Voltage	+V _{SUPPLY} +4V -V _{SUPPLY} -4V
Analog Input Voltage (One Switch)	+V _{SUPPLY} +2.0V -V _{SUPPLY} -2.0V
Analog Current — Continuous, Peak	30mA, 80mA
Total Dissipation*	750mW

Operating Temperature Range

HI-201-2	-55°C to +125°C
HI-201-4	-25°C to +85°C
HI-201-5	0°C to +75°C
Storage Temperature	-65°C to +150°C

*Derate 8mW/°C Above T_A = +75°C

Electrical Specifications

Unless Otherwise Specified: Supplies = +15V, -15V; V_{REF} = Open; V_{AH} (Logic Level High) = 2.4V, V_{AL} (Logic Level Low) = +0.8V
For Test Conditions Consult Performance Characteristics

PARAMETER	TEMP	HI-201-2 -55°C to +125°C			HI-201-5** 0°C to +75°C			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
ANALOG SWITCH CHARACTERISTICS								
V _S , Analog Signal Range	Full	-15	-	+15	-15	-	+15	V
R _{ON} , On Resistance (Note 1)	+25°C	-	55	70	-	55	80	Ω
	Full	-	80	100	-	75	100	Ω
I _{S(OFF)} , Off Input Leakage Current (Note 6)	+25°C	-	2	5	-	2	50	nA
	Full	-	-	500	-	-	250	nA
I _{D(OFF)} , Off Output Leakage Current (Note 6)	+25°C	-	2	5	-	2	50	nA
	Full	-	35	500	-	35	250	nA
I _{D(ON)} , On Leakage Current (Note 6)	+25°C	-	2	5	-	2	50	nA
	Full	-	-	500	-	-	250	nA
DIGITAL INPUT CHARACTERISTICS								
V _{AL} , Input Low Threshold	Full	-	-	0.8	-	-	0.8	V
V _{AH} , Input High Threshold	Full	2.4	-	-	2.4	-	-	V
I _A , Input Leakage Current (High or Low) (Note 2)	Full	-	-	1.0	-	-	1.0	μA
SWITCHING CHARACTERISTICS								
t _{OPEN} , Break-Before Make Delay (Note 3)	+25°C	-	30	-	-	30	-	ns
t _{ON} , Switch On Time	+25°C	-	185	500	-	185	-	ns
	Full	-	1000	-	-	1000	-	ns
t _{OFF} , Switch Off Time	+25°C	-	220	500	-	220	-	ns
	Full	-	1000	-	-	1000	-	ns
"Off Isolation" (Note 4)	+25°C	-	80	-	-	80	-	dB
C _{S(OFF)} , Input Switch Capacitance	+25°C	-	5.5	-	-	5.5	-	pF
C _{D(OFF)} , } Output Switch Capacitance	+25°C	-	5.5	-	-	5.5	-	pF
C _{D(ON)} , }	+25°C	-	11	-	-	11	-	pF
C _A , Digital Input Capacitance	+25°C	-	5	-	-	5	-	pF
C _{DS(OFF)} , Drain-To-Source Capacitance	+25°C	-	0.5	-	-	0.5	-	pF
POWER REQUIREMENTS (Note 5)								
P _D , Power Dissipation	+25°C	-	15	-	-	15	-	mW
	Full	-	-	60	-	-	60	mW
I ⁺ , Current (Pin 13)	+25°C	-	0.5	-	-	0.5	-	mA
	Full	-	-	2.0	-	-	2.0	mA
I ⁻ , Current (Pin 4)	+25°C	-	0.5	-	-	0.5	-	mA
	Full	-	-	2.0	-	-	2.0	mA

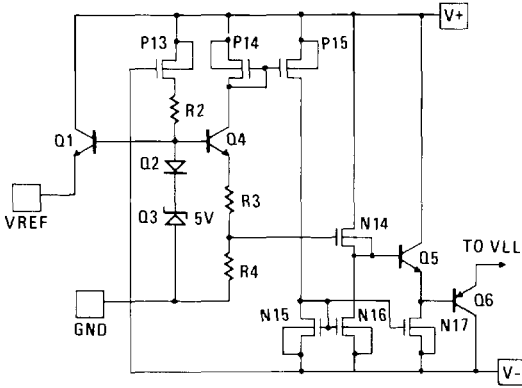
NOTES:

1. V_{OUT} = ±10V, I_{OUT} = 1mA
2. Digital Inputs are MOS gates — Typical Leakage is Less Than 1nA.
3. V_{AH} = 4.0V.
4. V_A = 5V, R_L = 1kΩ, C_L = 10pF, V_S = 3V_{RMS}, f = 100kHz.
5. V_A = +3V or V_A = 0V for All Switches.
6. Refer to Leakage Current Measurement Diagram on Page 3-8.

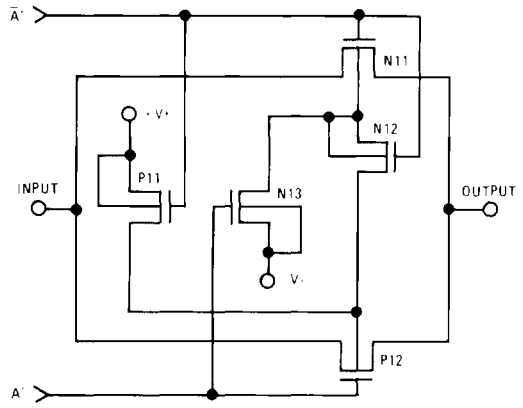
**NOTE: HI-201-4 Has Same Specifications as HI-201-5 Over the Temperature Range -25°C to +85°C.

Schematic Diagrams

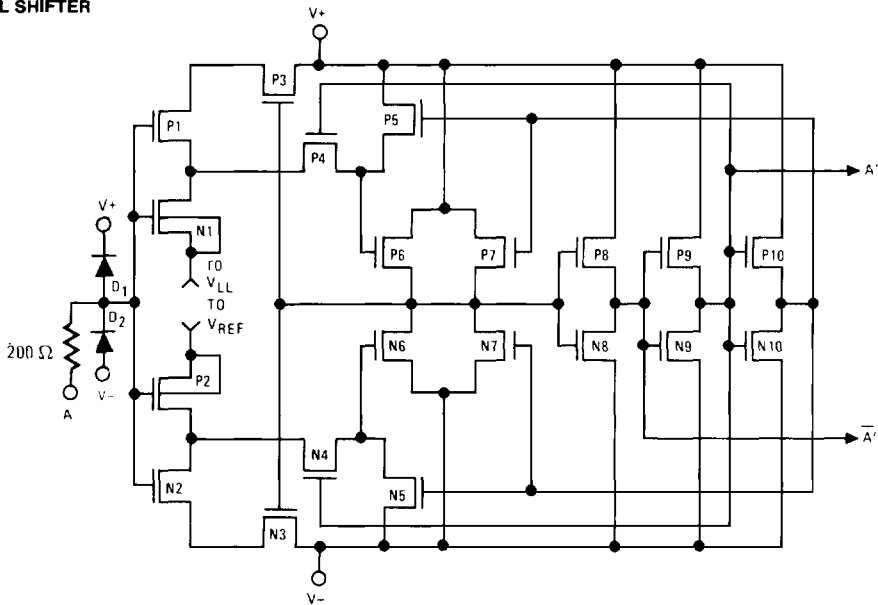
**TTL/CMOS REFERENCE CIRCUIT
V-REF CELL**



SWITCH CELL



**DIGITAL INPUT BUFFER
AND LEVEL SHIFTER**



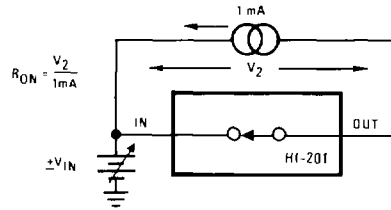
ALL N-CHANNEL BODIES TO V-
ALL P-CHANNEL BODIES TO V+
EXCEPT AS SHOWN.

HI-201

Performance Characteristics and Test Circuits

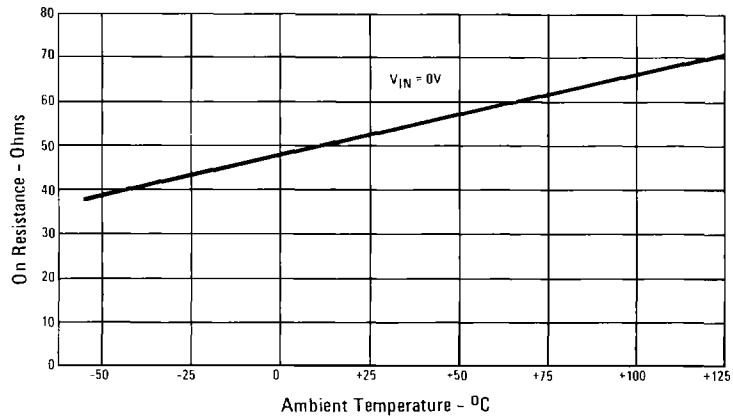
Unless Otherwise Specified: $T_A = +25^\circ\text{C}$, $V_{\text{SUPPLY}} = \pm 15\text{V}$, $V_{\text{AH}} = 2.4\text{V}$, $V_{\text{AL}} = 0.8\text{V}$ and $V_{\text{REF}} = \text{Open}$

ON RESISTANCE vs. ANALOG SIGNAL LEVEL, SUPPLY VOLTAGE AND TEMPERATURE

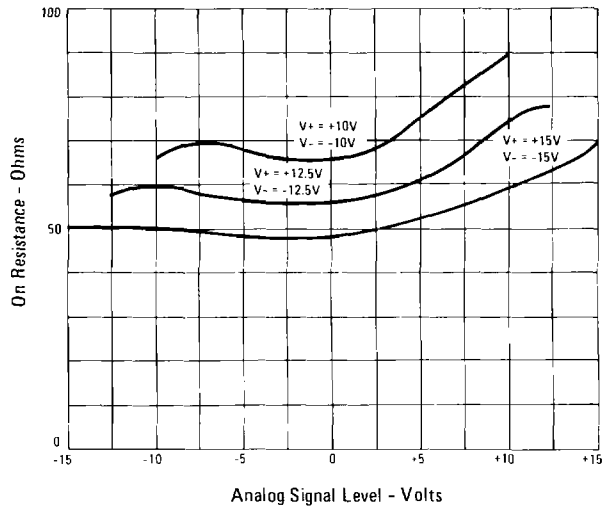


$$R_{\text{ON}} = \frac{V_2}{1\text{mA}}$$

ON RESISTANCE vs. TEMPERATURE

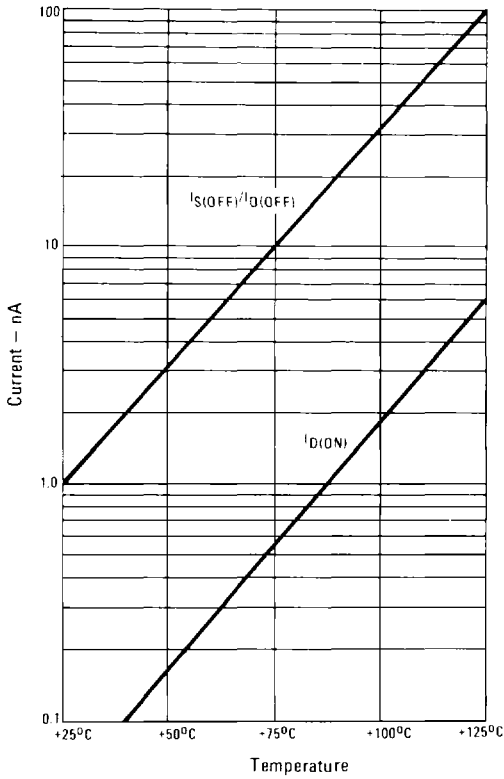


(HI-201) ON RESISTANCE vs. ANALOG SIGNAL LEVEL AND POWER SUPPLY VOLTAGE

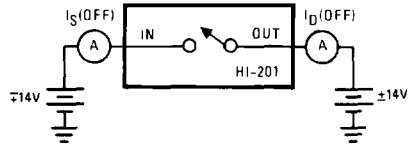


Performance Characteristics and Test Circuits (Continued)

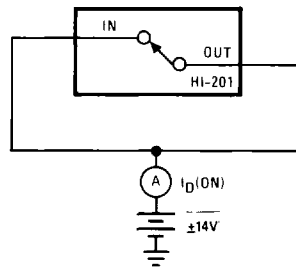
SWITCH LEAKAGE CURRENT vs. TEMPERATURE
(HI-201)



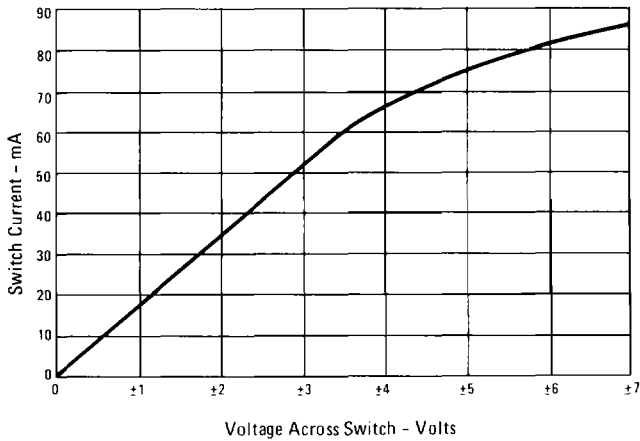
OFF LEAKAGE CURRENT vs. TEMPERATURE



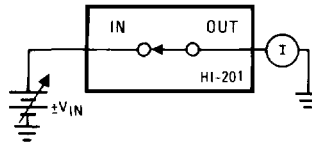
ON LEAKAGE CURRENT vs. TEMPERATURE



SWITCH CURRENT vs. VOLTAGE

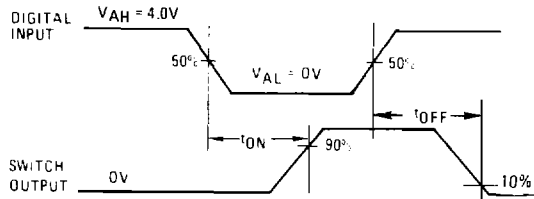


SWITCH CURRENT vs. VOLTAGE

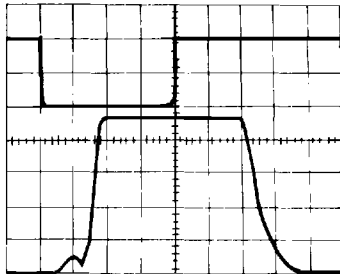


Switching Waveforms

LOGIC "0" = SWITCH ON

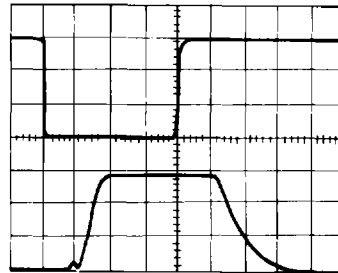


t_{ON} , t_{OFF} (TTL INPUT)
 $V_{IN} = +4.0V$



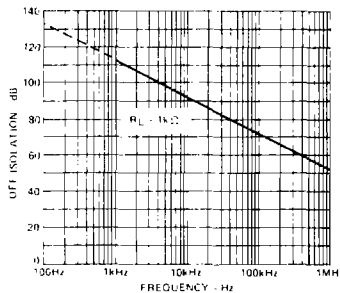
TOP: TTL Input VERTICAL: 2V/Div.
 BOTTOM: Output HORIZONTAL: 100ns/Div.

t_{ON} , t_{OFF} (CMOS INPUT)
 $V_{REF} = OPEN, V_{IN} = +15V$



TOP: CMOS Input VERTICAL: 5V/Div.
 BOTTOM: Output HORIZONTAL: 100ns/Div.

OFF ISOLATION vs. FREQUENCY



For More Information See Application Notes 520, 521, 531, 532 and 557 in Section 10 of Data Book.