

# AH0014/AH0014C\* DPDT, AH0015/AH0015C Quad SPST, AH0019/AH0019C\* Dual DPST-TTL/DTL Compatible MOS Analog Switches

## General Description

This series of TTL/DTL compatible MOS analog switches feature high speed with internal level shifting and driving. The package contains two monolithic integrated circuit chips: the MOS analog chip is similar to the MM450 type which consists of four MOS analog switch transistors; the second chip is a bipolar I.C. gate and level shifter. The series is available in hermetic dual-in-line package.

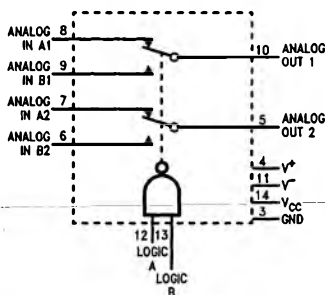
These switches are particularly suited for use in both military and industrial applications such as commutators in data acquisition systems, multiplexers, A/D and D/A converters, long time constant integrators, sample and hold circuits, modulators/demodulators, and other analog signal switching applications.

The AH0014, AH0015 and AH0019 are specified for operation over the  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  military temperature range. The AH0014C, AH0015C and AH0019C are specified for operation over the  $-25^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  temperature range.

## Features

- Large analog voltage switching  $\pm 10\text{V}$
- Fast switching speed 500 ns
- Operation over wide range of power supplies
- Low ON resistance 200  $\Omega$
- High OFF resistance  $10^{11} \Omega$
- Analog signals in excess of 25 MHz
- Fully compatible with DTL or TTL logic
- Includes gating and level shifting

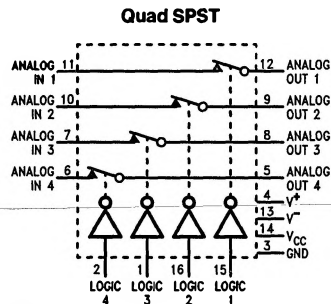
## Block and Connection Diagrams



Note: All logic inputs shown at logic "1".

TL/K/10125-1

Order Number AH0014D or AH0014CD  
See NS Package Number D14D

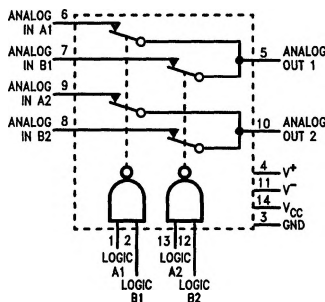


Note: All logic inputs shown at logic "1".

TL/K/10125-2

Order Number AH0015D or AH0015CD  
See NS Package Number D16C

## Dual DPST



Note: All logic inputs shown at logic "1".

TL/K/10125-3

Order Number AH0019D or AH0019CD  
See NS Package Number D14D

\*Previously called NH0014/NH0014C and NH0019/NH0019C

## Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|                         |      |
|-------------------------|------|
| $V_{CC}$ Supply Voltage | 7.0V |
| $V^-$ Supply Voltage    | -30V |
| $V^+$ Supply Voltage    | +30V |

|                                      |                 |
|--------------------------------------|-----------------|
| $V^+ / V^-$ Voltage Differential     | 40V             |
| Logic Input Voltage                  | 5.5V            |
| Storage Temperature Range            | -65°C to +150°C |
| Operating Temperature Range          |                 |
| AH0014, AH0015, AH0019               | -55°C to +125°C |
| AH0014C, AH0015C, AH0019C            | -25°C to +85°C  |
| Lead Temperature (Soldering, 10 sec) | 300°C           |

## Electrical Characteristics (Notes 1 and 2)

| Parameter                                                 | Conditions                                                           | Min | Typ       | Max        | Units    |
|-----------------------------------------------------------|----------------------------------------------------------------------|-----|-----------|------------|----------|
| Logical "1" Input Voltage                                 | $V_{CC} = 4.5V$                                                      | 2.0 |           |            | V        |
| Logical "0" Input Voltage                                 | $V_{CC} = 4.5V$                                                      |     |           | 0.8        | V        |
| Logical "1" Input Current                                 | $V_{CC} = 5.5V, V_{IN} = 2.4V$                                       |     |           | 5          | $\mu A$  |
| Logical "1" Input Current                                 | $V_{CC} = 5.5V, V_{IN} = 5.5V$                                       |     |           | 1          | $\mu A$  |
| Logical "0" Input Current                                 | $V_{CC} = 5.5V, V_{IN} = 0.4V$                                       |     | 0.2       | 0.4        | mA       |
| Power Supply Current Logical "1" Input—Each Gate (Note 3) | $V_{CC} = 5.5V, V_{IN} = 4.5V$                                       |     | 0.85      | 1.6        | mA       |
| Power Supply Current Logical "0" Input—Each Gate (Note 3) | $V_{CC} = 5.5V, V_{IN} = 0V$                                         |     |           |            |          |
| AH0014, AH0014C                                           |                                                                      |     | 1.5       | 3.0        | mA       |
| AH0015, AH0015C                                           |                                                                      |     | 0.22      | 0.41       | mA       |
| AH0019, AH0019C                                           |                                                                      |     | 0.22      | 0.41       | mA       |
| Analog Switch ON Resistance—Each Gate                     | $V_{IN} \text{ (Analog)} = +10V$<br>$V_{IN} \text{ (Analog)} = -10V$ |     | 75<br>150 | 200<br>600 | $\Omega$ |
| Analog Switch OFF Resistance                              |                                                                      |     | $10^{11}$ |            | $\Omega$ |
| Analog Switch Input Leakage Current—Each Input (Note 4)   | $V_{IN} = -10V$                                                      |     |           |            |          |
| AH0014, AH0015, AH0019                                    | $T_A = 25^\circ C$                                                   |     | 25        | 200        | pA       |
|                                                           | $T_A = 125^\circ C$                                                  |     | 25        | 200        | nA       |
| AH0014C, AH0015C, AH0019C                                 | $T_A = 25^\circ C$                                                   |     | 0.1       | 10         | nA       |
|                                                           | $T_A = 70^\circ C$                                                   |     | 30        | 100        | nA       |
| Analog Switch Output Leakage Current—Each Output (Note 4) | $V_{OUT} = -10V$                                                     |     |           |            |          |
| AH0014, AH0015, AH0019                                    | $T_A = 25^\circ C$                                                   |     | 40        | 400        | pA       |
|                                                           | $T_A = 125^\circ C$                                                  |     | 40        | 400        | nA       |
| AH0014C, AH0015C, AH0019C                                 | $T_A = 25^\circ C$                                                   |     | 0.05      | 10         | nA       |
|                                                           | $T_A = 70^\circ C$                                                   |     | 4         | 50         | nA       |
| Analog Input (Drain) Capacitance                          | 1 MHz @ Zero Bias                                                    |     | 8         | 10         | pF       |
| Output Source Capacitance                                 | 1 MHz @ Zero Bias                                                    |     | 11        | 13         | pF       |
| Analog Turn-OFF Time— $t_{OFF}$                           | See Test Circuit; $T_A = 25^\circ C$                                 |     | 600       | 750        | ns       |
| Analog Turn-ON Time— $t_{ON}$                             | See Test Circuit; $T_A = 25^\circ C$                                 |     |           |            |          |
| AH0014, AH0014C                                           |                                                                      |     | 350       | 425        | ns       |
| AH0015, AH0015C                                           |                                                                      |     | 100       | 150        | ns       |
| AH0019, AH0019C                                           |                                                                      |     | 100       | 150        | ns       |

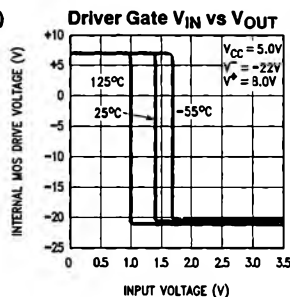
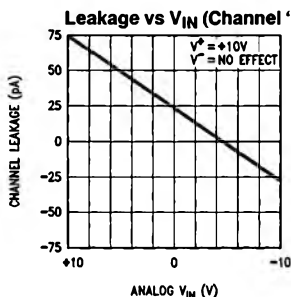
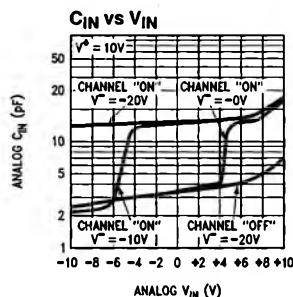
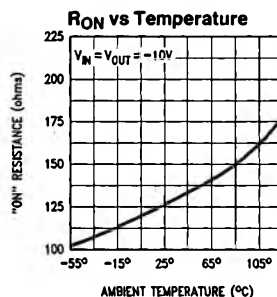
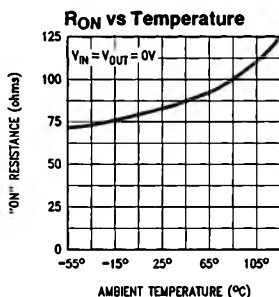
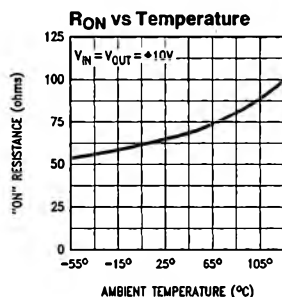
Note 1: Min/max limits apply across the guaranteed temperature range of -55°C to +125°C for AH0014, AH0015, AH0019 and -25°C to +85°C for AH0014C, AH0015C, AH0019C.  $V^- = -20V$ .  $V^+ = +10V$  and an analog test current of 1 mA unless otherwise specified.

Note 2: All typical values are measured at  $T_A = 25^\circ C$  with  $V_{CC} = 5.0V$ .  $V^+ = +10V$ ,  $V^- = -22V$ .

Note 3: Current measured is drawn from  $V_{CC}$  supply.

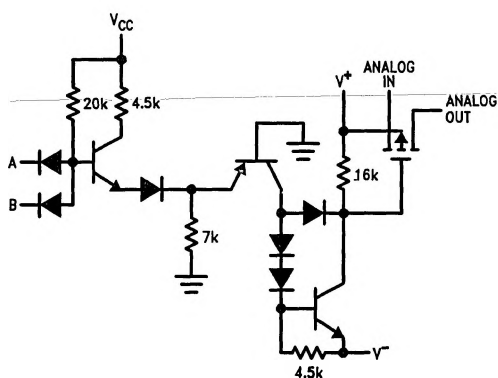
Note 4: All analog switch pins except measurement pin are tied to  $V^+$ .

# Analog Switch Characteristics (Note 2)



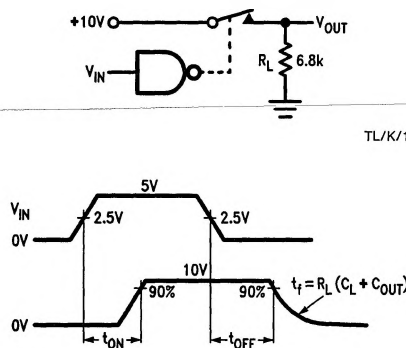
TL/K/10125-6

**Schematic (Single Driver Gate and MOS Switch Shown)**



TL/K/10125-7

**Analog Switching Time Test Circuit**

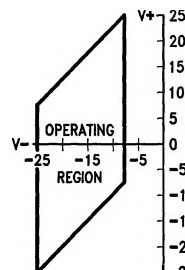


TL/K/10125-8

TL/K/10125-9

## Selecting Power Supply Voltage

The graph shows the boundary conditions which must be used for proper operation of the unit. The range of operation for power supply  $V^-$  is shown on the X axis. It must be between  $-25V$  and  $-8V$ . The allowable range for power supply  $V^+$  is governed by supply  $V^-$ . With a value chosen for  $V^-$ ,  $V^+$  may be selected as any value along a vertical line passing through the  $V^-$  value and terminated by the boundaries of the operating region. A voltage difference between power supplies of at least  $5V$  should be maintained for adequate signal swing.



TL/K/10125-10

## Typical Applications

