

# 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.

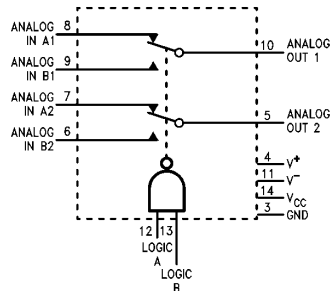
These switches are particularly suited for use in both military and industrial applications such as commutators in data acquisition systems, multiplexers, A/D and D/A converters, long time constant integrators, sample and hold circuits, modulators/demodulators, and other analog signal switching applications.

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

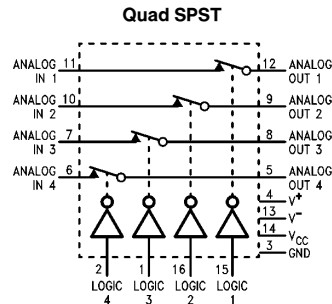
- Large analog voltage switching  $\pm 10\text{V}$
- Fast switching speed 500 ns
- Operation over wide range of power supplies
- Low ON resistance 200 $\Omega$
- High OFF resistance 10<sup>11</sup> $\Omega$
- Analog signals in excess of 25 MHz
- Fully compatible with DTL or TTL logic
- Includes gating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

## Block and Connection Diagrams



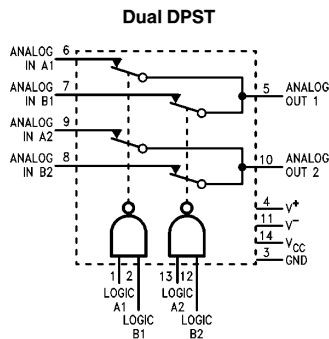
Note: All logic inputs shown at logic "1". TL/K/10125-1

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



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

Order Number AH0019D or AH0019CD  
See NS Package Number D14D

TL/K/10125-3

\*Previously called NH0014/NH0014C and NH0019/NH0019C

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

## Absolute Maximum Ratings

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

V <sub>CC</sub> Supply Voltage	7.0V
V <sup>-</sup> Supply Voltage	-30V
V <sup>+</sup> Supply Voltage	+30V

V <sup>+</sup> /V <sup>-</sup> 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 <sub>CC</sub> = 4.5V	2.0			V
Logical "0" Input Voltage	V <sub>CC</sub> = 4.5V			0.8	V
Logical "1" Input Current	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 2.4V			5	μA
Logical "1" Input Current	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 5.5V			1	μA
Logical "0" Input Current	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 0.4V		0.2	0.4	mA
Power Supply Current Logical "1" Input—Each Gate (Note 3)	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 4.5V		0.85	1.6	mA
Power Supply Current Logical "0" Input—Each Gate (Note 3)	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 0V				
AH0014, AH0014C			1.5	3.0	mA
AH0015, AH0015C			0.22	0.41	mA
AH0019, AH0019C			0.22	0.41	mA
Analogue Switch ON Resistance—Each Gate	V <sub>IN</sub> (Analog) = +10V V <sub>IN</sub> (Analog) = -10V		75 150	200 600	Ω
Analogue Switch OFF Resistance			10 <sup>11</sup>		Ω
Analogue Switch Input Leakage Current—Each Input (Note 4)	V <sub>IN</sub> = -10V				
AH0014, AH0015, AH0019	T <sub>A</sub> = 25°C		25	200	pA
	T <sub>A</sub> = 125°C		25	200	nA
AH0014C, AH0015C, AH0019C	T <sub>A</sub> = 25°C		0.1	10	nA
	T <sub>A</sub> = 70°C		30	100	nA
Analogue Switch Output Leakage Current—Each Output (Note 4)	V <sub>OUT</sub> = -10V				
AH0014, AH0015, AH0019	T <sub>A</sub> = 25°C		40	400	pA
	T <sub>A</sub> = 125°C		40	400	nA
AH0014C, AH0015C, AH0019C	T <sub>A</sub> = 25°C		0.05	10	nA
	T <sub>A</sub> = 70°C		4	50	nA
Analogue Input (Drain) Capacitance	1 MHz @ Zero Bias		8	10	pF
Output Source Capacitance	1 MHz @ Zero Bias		11	13	pF
Analogue Turn-OFF Time—t <sub>OFF</sub>	See Test Circuit; T <sub>A</sub> = 25°C		600	750	ns
Analogue Turn-ON Time—t <sub>ON</sub>	See Test Circuit; T <sub>A</sub> = 25°C				
AH0014, AH0014C			350	425	ns
AH0015, AH0015C			100	150	ns
AH0019, AH0019C			100	150	ns

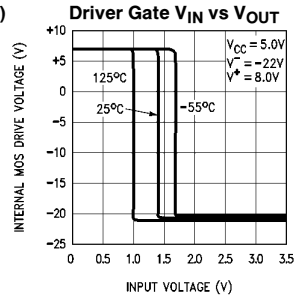
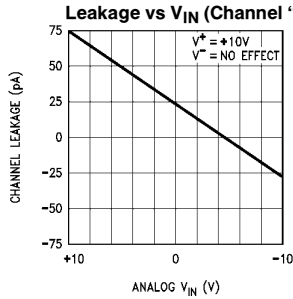
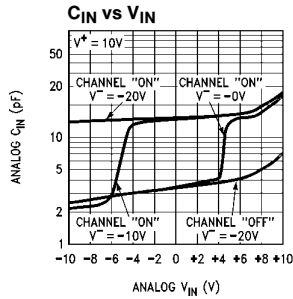
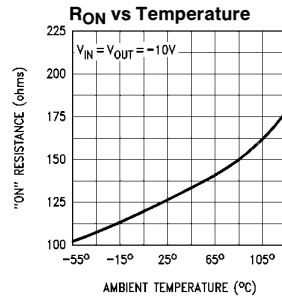
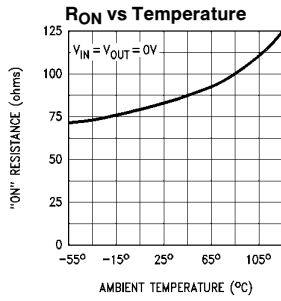
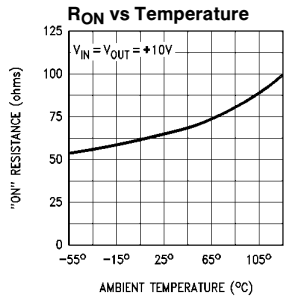
**Note 1:** Min/max limits apply across the guaranteed temperature range of -55°C to +125°C for AH0014, AH0015, AH0019 and -25°C to +85°C for AH0014C, AH0015C, AH0019C. V<sup>-</sup> = -20V. V<sup>+</sup> = +10V and an analogue test current of 1 mA unless otherwise specified.

**Note 2:** All typical values are measured at T<sub>A</sub> = 25°C with V<sub>CC</sub> = 5.0V. V<sup>+</sup> = +10V, V<sup>-</sup> = -22V.

**Note 3:** Current measured is drawn from V<sub>CC</sub> supply.

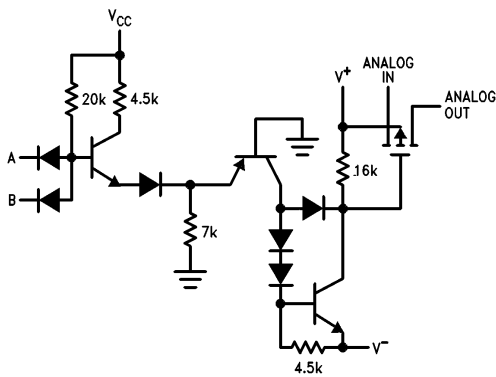
**Note 4:** All analogue switch pins except measurement pin are tied to V<sup>+</sup>.

## Analog Switch Characteristics (Note 2)



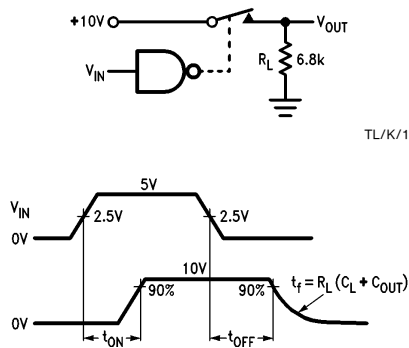
TL/K/10125-6

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



TL/K/10125-7

### Analog Switching Time Test Circuit

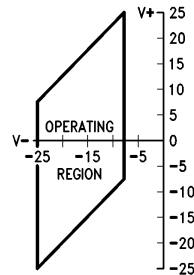


TL/K/10125-8

TL/K/10125-9

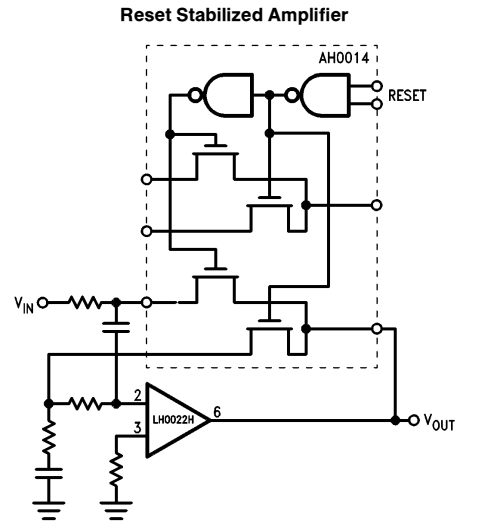
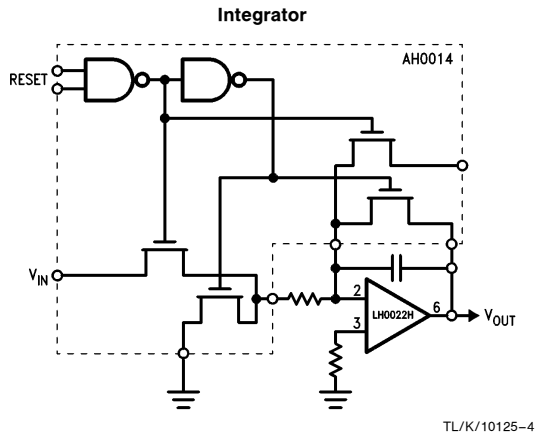
### Selecting Power Supply Voltage

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.

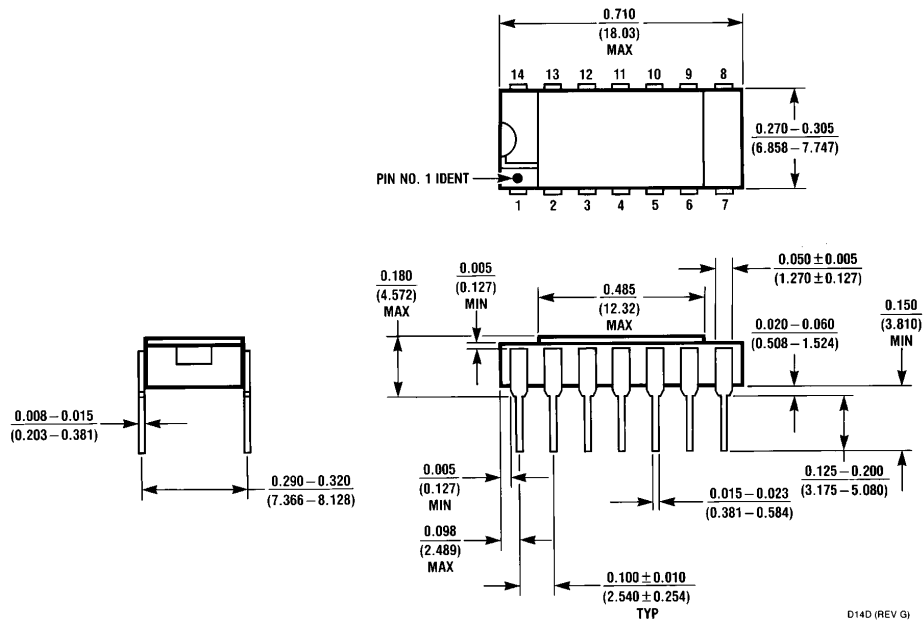


TL/K/10125-10

## Typical Applications



**Physical Dimensions** inches (millimeters)

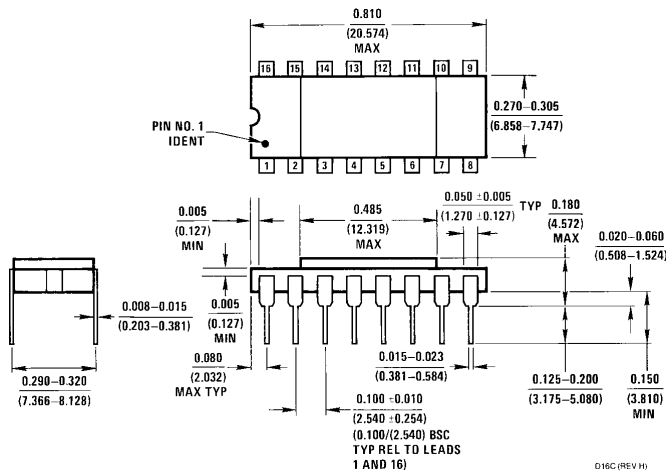


D14D (REV G)

**14 Lead Hermetic Dual-In-Line Package (D)**  
**Order Number AH0014D, AH0014CD, AH0019D or AH0019CD**  
**NS Package Number D14D**

**Physical Dimensions** inches (millimeters) (Continued)

Lit. # 101021



**16 Lead Hermetic Dual-In-Line Package (D)**  
**Order Number AH0015D or AH0015CD**  
**NS Package Number D16C**

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**National Semiconductor Corporation**  
 1111 West Bardin Road  
 Arlington, TX 76017  
 Tel: 1(800) 272-9959  
 Fax: 1(800) 737-7018

**National Semiconductor Europe**  
 Fax: (+49) 0-180-530 85 86  
 Email: onjwge@tevm2.nsc.com  
 Deutsch Tel: (+49) 0-180-530 85 85  
 English Tel: (+49) 0-180-532 78 32  
 Français Tel: (+49) 0-180-532 93 58  
 Italiano Tel: (+49) 0-180-534 16 80

**National Semiconductor Hong Kong Ltd.**  
 19th Floor, Straight Block,  
 Ocean Centre, 5 Canton Rd.  
 Tsimshatsui, Kowloon  
 Hong Kong  
 Tel: (852) 2737-1600  
 Fax: (852) 2736-9960

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 Tel: 81-043-299-2309  
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