4-Channel Wideband and Video Multiplexer

The HI-524 is a 4-Channel CMOS analog multiplexer designed to process single-ended signals with bandwidths up to 10MHz. The chip includes a 1 of 4 decoder for channel selection and an enable input to inhibit all channels (chip select).

Three CMOS transmission gates are used in each channel, as compared to the single gate in more conventional CMOS multiplexers. This provides a double barrier to the unwanted coupling of signals from each input to the output. In addition, Dielectric Isolation (DI) processing helps to insure the Crosstalk is less than -60dB at 10MHz.

The HI-524 is designed to operate into a wideband buffer amplifier such as the Intersil HA-2541. The multiplexer chip includes two “ON” switches in series, for use as a feedback element with the amplifier. This feedback resistance matches and tracks the channel ON resistance, to minimize the amplifier V_{OS} and its variation with temperature.

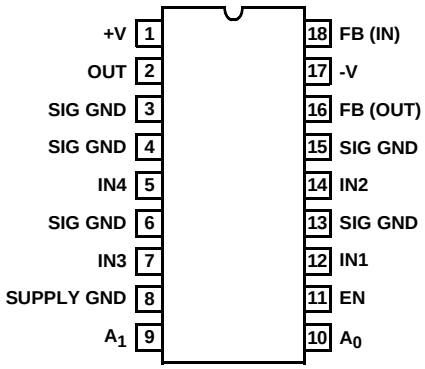
The HI-524 is well suited to the rapid switching of video and other wideband signals in telemetry, instrumentation, radar and video systems.

Ordering Information

PART NUMBER	TEMP. RANGE (^{o}C)	PACKAGE	PKG. NO.
HI1-0524-5	0 to 75	18 Ld CERDIP	F18.3

Pinout

HI-524 (CERDIP)
TOP VIEW



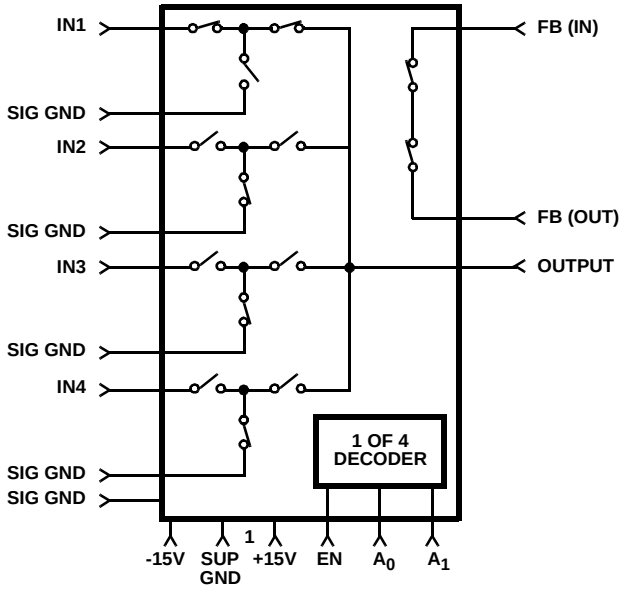
Features

- Crosstalk (10MHz) . . . . . .<-60dB
- Fast Access Time 150ns
- Fast Settling Time 200ns
- TTL Compatible

Applications

- Wideband Switching
- Radar
- TV Video
- ECM

Functional Diagram



TRUTH TABLE

A_1	A_0	EN	ON CHANNEL
X	X	L	None
L	L	H	1 (Note)
L	H	H	2
H	L	H	3
H	H	H	4

NOTE: Channel 1 is shown selected in the Functional Diagram.

Absolute Maximum Ratings

V+ to V- 33V
Digital Input Voltage (V_{EN}, V_A) . . . . . -6V to +6V
Analog Signal (V_{IN}, V_{OUT}) . . . . . (V-) -2V to (V+) +2V
Either Supply to Ground. 16.5V

Operating Conditions

Temperature Range
HI-524-5 . . . . . 0^oC to 75^oC

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} ($^oC/W$)	θ_{JC} ($^oC/W$)
CERDIP Package.	75	20

Maximum Junction Temperature
Ceramic Package. . . . . 175^oC
Maximum Storage Temperature . . . . . -65^oC to 150^oC
Maximum Lead Temperature (Soldering, 10s) . . . . . 300^oC

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.

NOTE:

1. θ_{JA} is measured with the component mounted on a low effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

Electrical Specifications

Supplies = +15V, -15V; V_{AH} (Logic Level High) = 2.4V, V_{AL} (Logic Level Low) = 0.5V; V_{EN} = 2.4V, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	TEMP (^oC)	-5			UNITS
			MIN	TYP	MAX	
DYNAMIC CHARACTERISTICS						
Access Time, t_A	Note 5	25	-	150	300	ns
Break-Before-Make Delay, t_{OPEN}	Note 5	25	-	20	-	ns
Enable Delay (ON), $t_{ON\ (EN)}$	R_L = 500Ω	25	-	180	-	ns
Enable Delay (OFF), $t_{OFF\ (EN)}$	R_L = 500Ω	25	-	180	-	ns
Settling Time (Note 5)	To 0.1%	25	-	200	-	ns
	To 0.01%	25	-	600	-	ns
Crosstalk	Note 6	25	-	-65	-	dB
Channel Input Capacitance, $C_{S(OFF)}$		25	-	4	-	pF
Channel Output Capacitance, $C_{D(OFF)}$		25	-	10	-	pF
Digital Input Capacitance, C_A		25	-	5	-	pF
DIGITAL INPUT SPECIFICATIONS						
Input Low Threshold (TTL), V_{AL}		Full	-	-	0.8	V
Input High Threshold (TTL), V_{AH}		Full	2.4	-	-	V
Input Leakage Current (High), I_{AH}		Full	-	0.05	1	µA
Input Leakage Current (Low), I_{AL}		Full	-	-	25	µA
ANALOG CHANNEL SPECIFICATIONS						
Analog Signal Range, V_{IN}		Full	-10	-	+10	V
On Resistance, r_{ON}	Note 2	25	-	700	-	Ω
		Full	-	-	1.5	kΩ
Off Input Leakage Current, $I_{S\ (OFF)}$	Note 3	25	-	0.2	-	nA
		Full	-	-	50	nA
Off Output Leakage Current, $I_{D\ (OFF)}$	Note 3	25	-	0.2	-	nA
		Full	-	-	50	nA
On Channel Leakage Current, $I_{D\ (ON)}$	Note 3	25	-	0.7	-	nA
		Full	-	-	50	nA
-3dB Bandwidth	Note 4	25	-	8	-	MHz

Electrical Specifications

Supplies = +15V, -15V; V_{AH} (Logic Level High) = 2.4V, V_{AL} (Logic Level Low) = 0.5V; V_{EN} = 2.4V, Unless Otherwise Specified **(Continued)**

PARAMETER	TEST CONDITIONS	TEMP (^{O}C)	-5			UNITS
			MIN	TYP	MAX	
POWER SUPPLY CHARACTERISTICS						
Power Dissipation, P_D		Full	-	-	750	mW
Current, I+	Note 7	Full	-	-	25	mA
Current, I-	Note 7	Full	-	-	25	mA

NOTES:

2. V_{IN} = 0V; I_{OUT} = 100µA (See Test Circuit section).
3. V_O = ±10V; V_{IN} = ±10V. (See Test Circuit section).
4. MUX output is buffered with HA-5033 amplifier.
5. 6V Step, ±3V to ∓3V, See Test Circuit section.
6. V_{IN} = 10MHz, $3V_{P-P}$ on one channel, with any other channel selected. (Worst case is channel 3 selected with input on channel 4.) MUX output is buffered with HA-2541 as shown in Applications section. Terminate all channels with 75Ω.
7. Supply currents vary less than 0.5mA for switching rates from DC to 2MHz.

Test Circuits and Waveforms

T_A = 25^{O}C, V_{SUPPLY} = ±15V, V_{AH} = 2.4V, V_{AL} = 0.8V, Unless Otherwise Specified

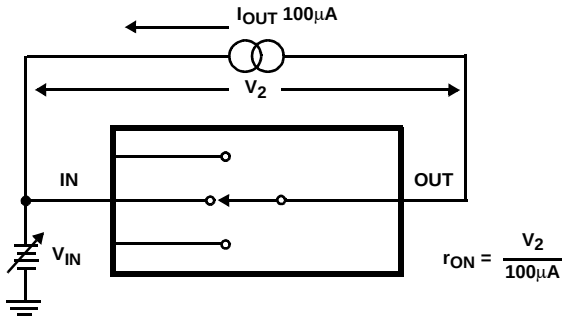


FIGURE 1A. TEST CIRCUIT

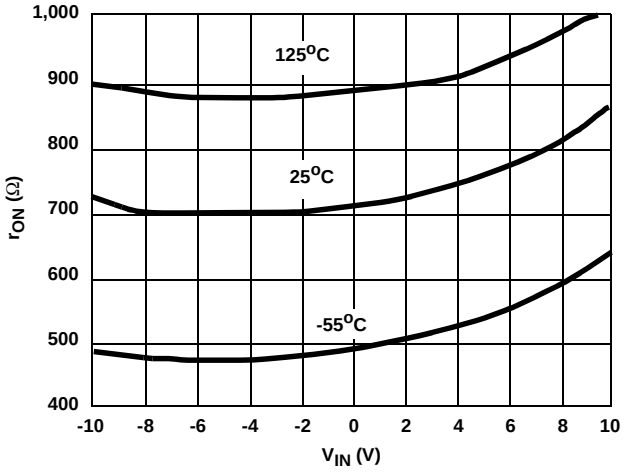


FIGURE 1B. ON RESISTANCE vs ANALOG INPUT VOLTAGE

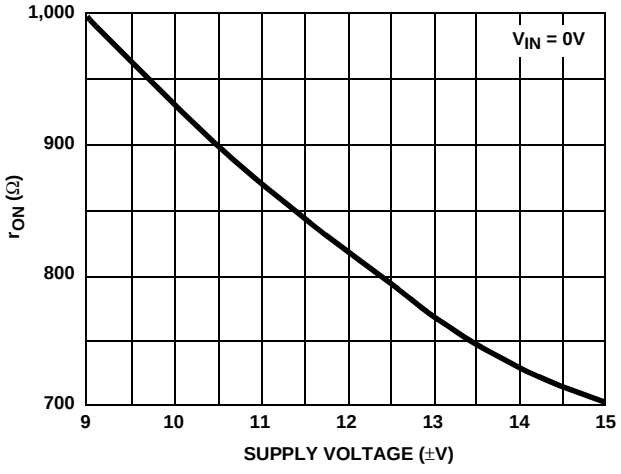


FIGURE 1C. ON RESISTANCE vs SUPPLY VOLTAGE

FIGURE 1. ON RESISTANCE

Test Circuits and Waveforms $T_A = 25^oC$, $V_{SUPPLY} = \pm15V$, $V_{AH} = 2.4V$, $V_{AL} = 0.8V$, Unless Otherwise Specified

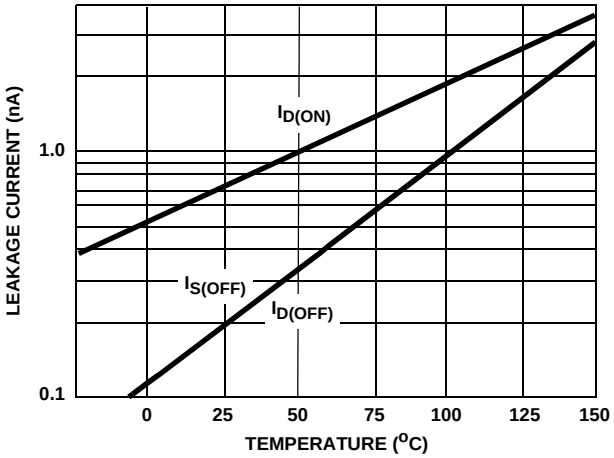


FIGURE 2A. LEAKAGE CURRENT vs TEMPERATURE

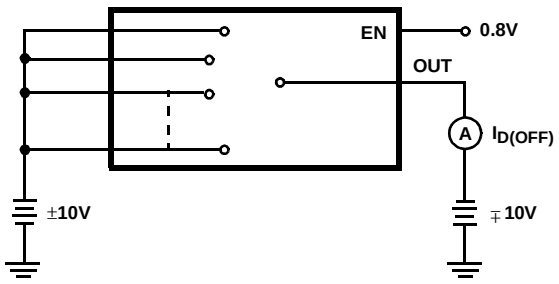


FIGURE 2B. $I_{D(OFF)}$ TEST CIRCUIT (NOTE 8)

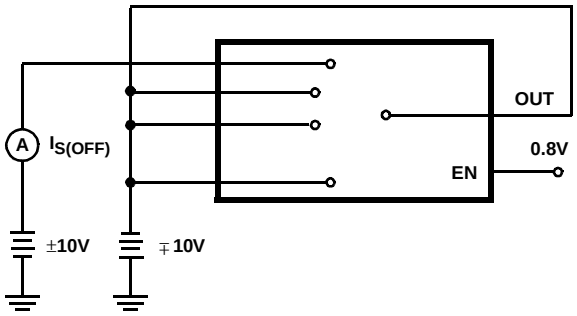


FIGURE 2C. $I_{S(OFF)}$ TEST CIRCUIT (NOTE 8)

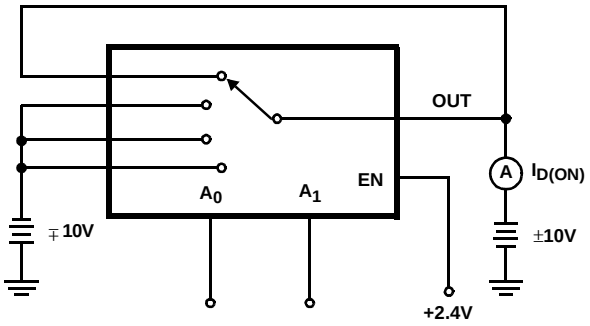


FIGURE 2D. $I_{D(ON)}$ TEST CIRCUIT (NOTE 8)

FIGURE 2. LEAKAGE CURRENTS

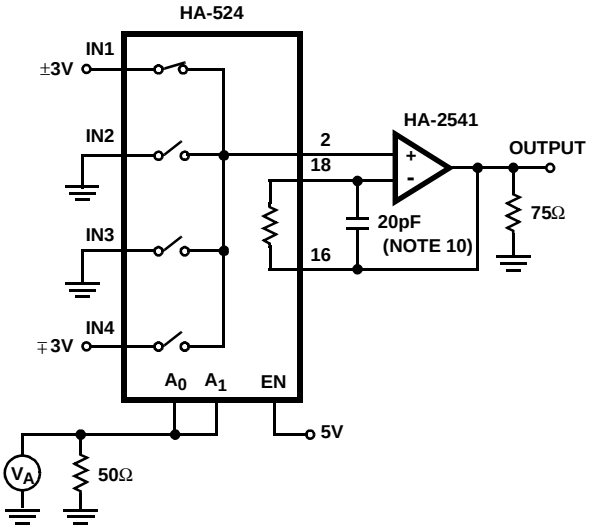


FIGURE 3A. TEST CIRCUIT

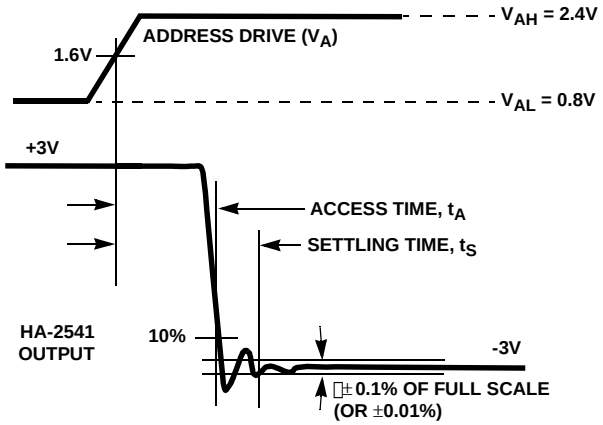


FIGURE 3B. MEASUREMENT POINTS

FIGURE 3. SETTLING TIME, ACCESS TIME, BREAK-BEFORE-MAKE DELAY (NOTE 9)

NOTES:

8. Two measurements per channel: ±10V and ∓10V. (Two measurements per device for $I_{D(OFF)}$ ±10V and ∓10V.)
9. The Break-Before-Make test requires inputs 1 and 4 at the same voltage.
10. Capacitor value may be selected to optimize AC performance.

Test Circuits and Waveforms $T_A = 25^oC$, $V_{SUPPLY} = \pm15V$, $V_{AH} = 2.4V$, $V_{AL} = 0.8V$, Unless Otherwise Specified

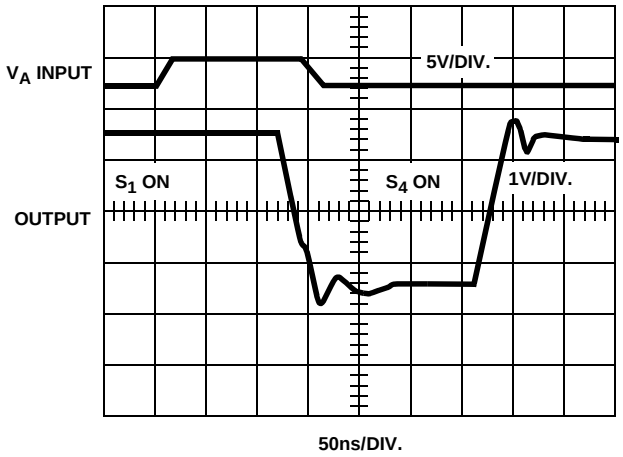
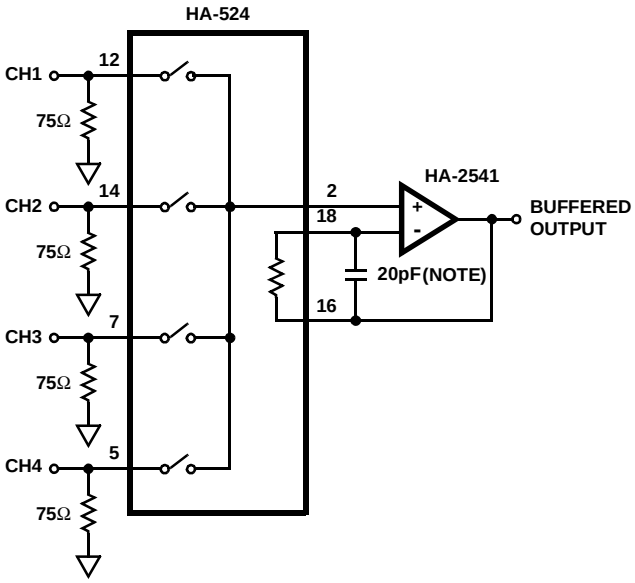


FIGURE 4. ACCESS TIME WAVEFORMS

Application Information

Often it is desirable to buffer the HI-524 output, to avoid loading errors due to the channel “ON” resistance:



NOTE: Capacitor value may be selected to optimize AC performance.

FIGURE 5.

The buffer amplifier should offer sufficient bandwidth and slew rate to avoid degradation of the anticipated signals. For video switching, the HA-5033 and HA-2542 offer good performance plus ±100mA output current for driving coaxial cables. For general wideband applications, the HA-2541 offers the convenience of unity gain stability plus 90ns settling (to ±0.1%) and ±10V output swing. Also, the HI-524 includes a feedback resistance for use with the HA-2541. This resistance matches and tracks the channel “ON” resistance, to minimize offset voltage due to the buffer's bias currents.

Note that the on-chip feedback element between pins 16 and 18 includes two switches in series, to simulate a channel resistance. These switches open for V_{EN} = Low. This allows two or more HI-524s to operate into one HA-2541, with their feedback elements connected in parallel. Thus, only the selected multiplexer provides feedback, and the amplifier remains stable.

All HI-524 pins labeled ‘SIG GND’ (pins 3, 4, 6, 13, 15) should be externally connected to signal ground for best crosstalk performance.

Bypass capacitors (0.1µF to 1µF) are recommended from each HI-524 supply pin to power ground (pins 1 and 17 to pin 8). Locate the buffer amplifier near the HI-524 so the two capacitors may bypass both devices.

If an analog input 1V or greater is present when supplies are off, a low resistance is seen from that input to a supply line. (For example, the resistance is approximately 160Ω for an input of -3V.) Current flow may be blocked by a diode in each supply line, or limited by a resistor in series with each channel. The best solution, of course, is to arrange that no digital or analog inputs are present when the power supplies are off.

Die Characteristics

DIE DIMENSIONS:

2250µm x 3720µm x 485µm

METALLIZATION:

Type: CuAl
Thickness: 16kÅ ±2kÅ

PASSIVATION:

Type: Nitride Over Silox
Nitride Thickness: 3.5kÅ ±1kÅ
Silox Thickness: 12kÅ ±2kÅ

WORST CASE CURRENT DENSITY:

1.58×10^5 A/cm^2

Metallization Mask Layout

HI-524