

AD7501/AD7502/AD7503

FEATURES

- DTL/TTL/CMOS Direct Interface
- Power Dissipation: 30 μ W
- R_{ON} : 170 Ω
- Standard 16-Lead DIPs and 20-Terminal Surface Mount Packages

GENERAL DESCRIPTION

The AD7501 and AD7503 are monolithic CMOS, 8-channel analog multiplexers which switch one of eight inputs to a common output, depending on the state of three binary address lines and an “enable” input. The AD7503 is identical to the AD7501 except its “enable” logic is inverted. All digital inputs are TTL/DTL and CMOS logic compatible.

The AD7502 is a monolithic CMOS dual 4-channel analog multiplexer. Depending on the state of two binary address inputs and an “enable,” it switches two output buses to two of eight inputs.

Truth Tables

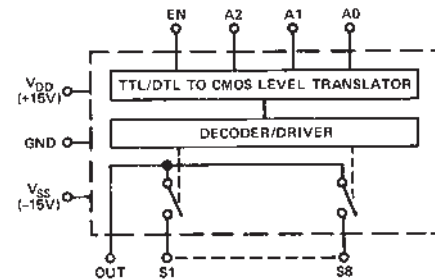
AD7501

| A_2 | A_1 | A_0 | EN | “ON” |
|-------|-------|-------|----|------|
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 2 |
| 0 | 1 | 0 | 1 | 3 |
| 0 | 1 | 1 | 1 | 4 |
| 1 | 0 | 0 | 1 | 5 |
| 1 | 0 | 1 | 1 | 6 |
| 1 | 1 | 0 | 1 | 7 |
| 1 | 1 | 1 | 1 | 8 |
| X | X | X | 0 | None |

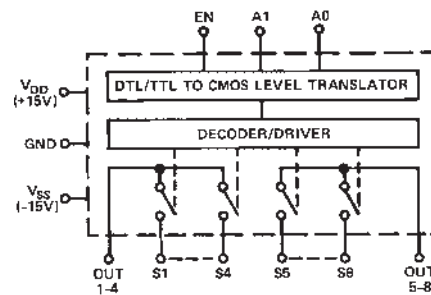
AD7503

| A_2 | A_1 | A_0 | EN | “ON” |
|-------|-------|-------|----|------|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 2 |
| 0 | 1 | 0 | 0 | 3 |
| 0 | 1 | 1 | 0 | 4 |
| 1 | 0 | 0 | 0 | 5 |
| 1 | 0 | 1 | 0 | 6 |
| 1 | 1 | 0 | 0 | 7 |
| 1 | 1 | 1 | 0 | 8 |
| X | X | X | 1 | None |

FUNCTIONAL BLOCK DIAGRAM
AD7501/AD7503



AD7502



AD7502

| A_1 | A_0 | EN | “ON” |
|-------|-------|----|-------|
| 0 | 0 | 1 | 1 & 5 |
| 0 | 1 | 1 | 2 & 6 |
| 1 | 0 | 1 | 3 & 7 |
| 1 | 1 | 1 | 4 & 8 |
| X | X | 0 | None |

REV. B

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AD7501/AD7502/AD7503—SPECIFICATIONS ($V_{DD} = +15\text{ V}$, $V_{SS} = -15\text{ V}$ unless otherwise noted.)

| Parameter | Version ¹ | Switch Condition | @ +25°C | | Over Specified Temperature Range | | Test Conditions |
|-------------------------------------------|------------------------|------------------|------------------------------------|------------------------------------|----------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | AD7501, AD7503 | AD7502 | AD7501, AD7503 | AD7502 | |
| ANALOG SWITCH | | | | | | | |
| R_{ON} | All | ON | 170 Ω typ, 300 Ω max | 170 Ω typ, 300 Ω max | | | $-10\text{ V} \leq V_S \leq +10\text{ V}$ $I_S = 1.0\text{ mA}$ $V_S = 0\text{ V}$, $I_S = 1.0\text{ mA}$ |
| R_{ON} vs. V_S | All | ON | 20% typ | 20% typ | | | |
| R_{ON} vs. Temperature | All | ON | 0.5%/°C typ | 0.5%/°C typ | | | |
| ΔR_{ON} Between Switches | All | ON | 4% typ | 4% typ | | | |
| R_{ON} vs. Temperature Between Switches | All | ON | $\pm 0.01\%/^{\circ}\text{C}$ | $\pm 0.01\%/^{\circ}\text{C}$ | | | $V_S = -10\text{ V}$, $V_{OUT} = +10\text{ V}$ and $V_S = +10\text{ V}$, $V_{OUT} = -10\text{ V}$ $V_S = -10\text{ V}$, $V_{OUT} = +10\text{ V}$ and $V_S = +10\text{ V}$, $V_{OUT} = -10\text{ V}$ AD7501/02: Enable LOW AD7503: Enable HIGH $V_S = 0$ |
| I_S | K | OFF | 0.2 nA typ, 2 nA max | 0.2 nA typ, 2 nA max | 50 nA max | 50 nA max | |
| I_{OUT} | S | OFF | 0.5 nA max | 0.5 nA max | 50 nA max | 50 nA max | |
| | K | OFF | 1 nA typ, 10 nA max | 0.6 nA typ, 5 nA max | 250 nA max | 125 nA max | |
| $ I_{OUT} - I_S $ | S | OFF | 5 nA max | 3 nA max | 250 nA max | 125 nA max | |
| | K | ON | 12 nA max | 7 nA max | 300 nA max | 175 nA max | |
| | S | ON | 5.5 nA max | 3.5 nA max | 300 nA max | 175 nA max | |
| | DIGITAL CONTROL | | | | | | |
| V_{INL} | All | | | | 0.8 V max | 0.8 V max | |
| V_{INH} | All | | | | 2.4 V min | 2.4 V min | |
| I_{INL} or I_{INH} | All | | 10 nA typ | 10 nA typ | | | |
| C_{IN} | All | | 3 pF typ | 3 pF typ | | | |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| t_{ON} | All | | 0.8 μs typ | 0.8 μs typ | | | $V_{IN} = 0$ to $+5.0\text{ V}$ (See Test Circuit 2) |
| t_{OFF} | All | | 0.8 μs typ | 0.8 μs typ | | | |
| C_S | All | OFF | 5 pF typ | 5 pF typ | | | |
| C_{OUT} | All | OFF | 30 pF typ | 15 pF typ | | | |
| C_{SOUT} | All | OFF | 0.5 pF typ | 0.5 pF typ | | | |
| C_{SS} Between Any Two Switches | All | OFF | 0.5 pF typ | 0.5 pF typ | | | |
| POWER SUPPLY | | | | | | | |
| I_{DD} | All | | 500 μA max | 500 μA max | 500 μA max | 500 μA max | All Digital Inputs Low |
| I_{SS} | All | | 500 μA max | 500 μA max | 500 μA max | 500 μA max | All Digital Inputs High |
| I_{DD} | All | | 800 μA max | 800 μA max | 800 μA max | 800 μA max | |
| I_{SS} | All | | 800 μA max | 800 μA max | 800 μA max | 800 μA max | |

NOTES

¹KN version specified for 0°C to +70°C, KQ version for -25°C to +85°C; and SQ, SE versions for -55°C to +125°C.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS

($T_A = +25^{\circ}\text{C}$ unless otherwise noted)

V_{DD} to GND +17 V

V_{SS} to GND -17 V

V Between Any Switch Terminals¹ 25 V

Digital Input Voltage Range V_{DD} to GND

Overvoltage at V_{OUT} (V_S) V_{SS} , V_{DD}

Switch Current (I_S , Continuous One Channel) 35 mA

Switch Current (I_S , Surge One Channel)

1 ms Duration, 10% Duty Cycle 50 mA

Power Dissipation (Any Package)

Up to +75°C 450 mW

Derates above +75°C by 6 mW/°C

Operating Temperature

Commercial (KN Version) 0°C to +70°C

Industrial (KQ Version) -25°C to +85°C

Extended (SQ, SE Versions) -55°C to +125°C

Storage Temperature -65°C to +150°C

Lead Temperature (Soldering, 10 sec) +300°C

CAUTION

¹Do not apply voltages higher than V_{DD} and V_{SS} to any other terminal, especially when $V_{SS} = V_{DD} = 0\text{ V}$ all other pins should be at 0 V.

²The digital control inputs are diode protected; however, permanent damage may occur on unconnected units under high energy electrostatic fields. Keep unused units in conductive foam at all times.

CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD7501, AD7502, and AD7503 feature proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



AD7501/AD7502/AD7503

ORDERING GUIDE

| Model ¹ | Temperature Range | Package Options ² |
|--------------------|-------------------|------------------------------|
| AD7501KN | 0°C to +70°C | N-16 |
| AD7501KQ | -25°C to +85°C | Q-16 |
| AD7501SQ | -55°C to +125°C | Q-16 |
| AD7501SE | -55°C to +125°C | E-20A |
| AD7502KN | 0°C to +70°C | N-16 |
| AD7502KQ | -25°C to +85°C | Q-16 |
| AD7502SQ | -55°C to +125°C | Q-16 |
| AD7502SE | -55°C to +125°C | E-20A |
| AD7503KN | 0°C to +70°C | N-16 |
| AD7503KQ | -25°C to +85°C | Q-16 |
| AD7503SQ | -55°C to +125°C | Q-16 |
| AD7503SE | -55°C to +125°C | E-20A |

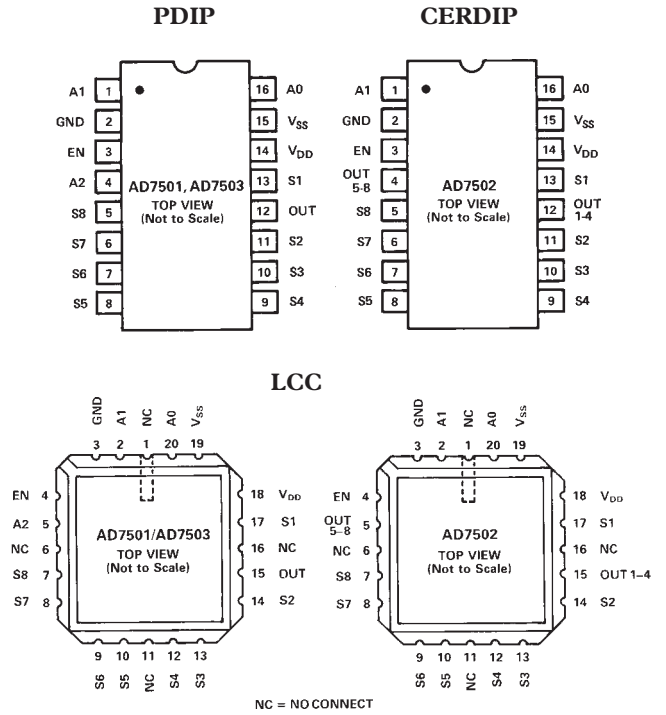
NOTES

¹To order MIL-STD-883, Class B processed parts, add/883B to part number.

See the Analog Devices' 1990 Military Databook for military data sheet.

²E = LCC; N = PDIP; Q = CERDIP.

PIN CONFIGURATIONS



Typical Performance Characteristics

1. R_{ON} Versus V_S

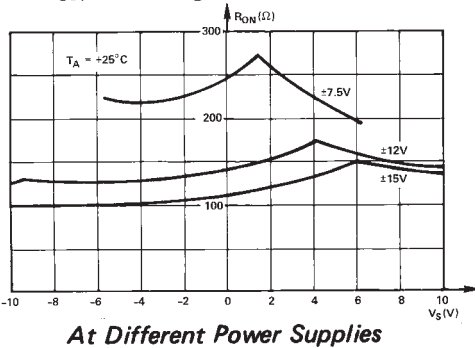


Figure 1a. R_{ON} vs. V_S At Different Power Supplies

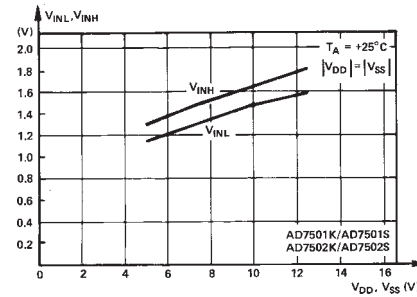


Figure 2a. Digital Threshold Voltage (V_{INH}, V_{INL}) vs. Power Supply

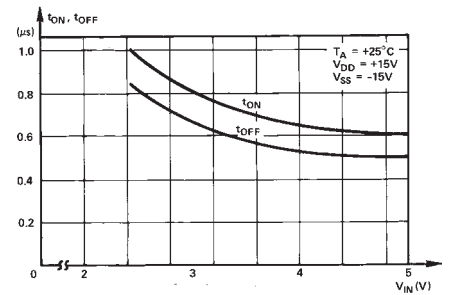


Figure 3. t_{ON}, t_{OFF} vs. Digital Input Voltage

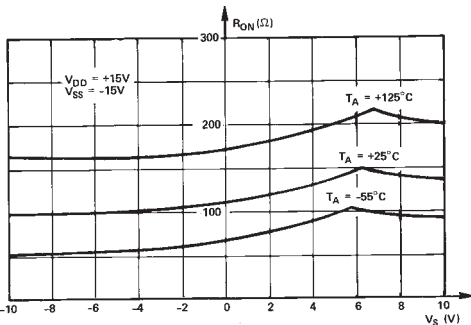


Figure 1b. R_{ON} vs. V_S At Different Temperatures

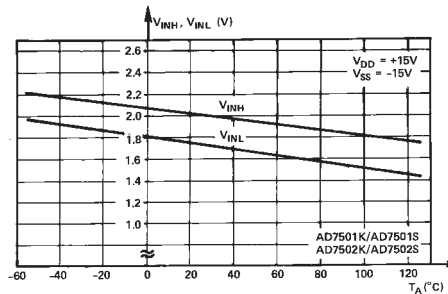


Figure 2b. Digital Threshold Voltage (V_{INH}, V_{INL}) vs. Temperature

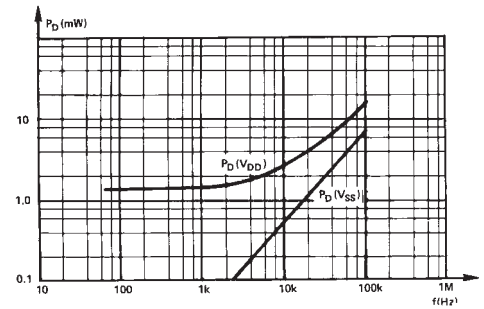
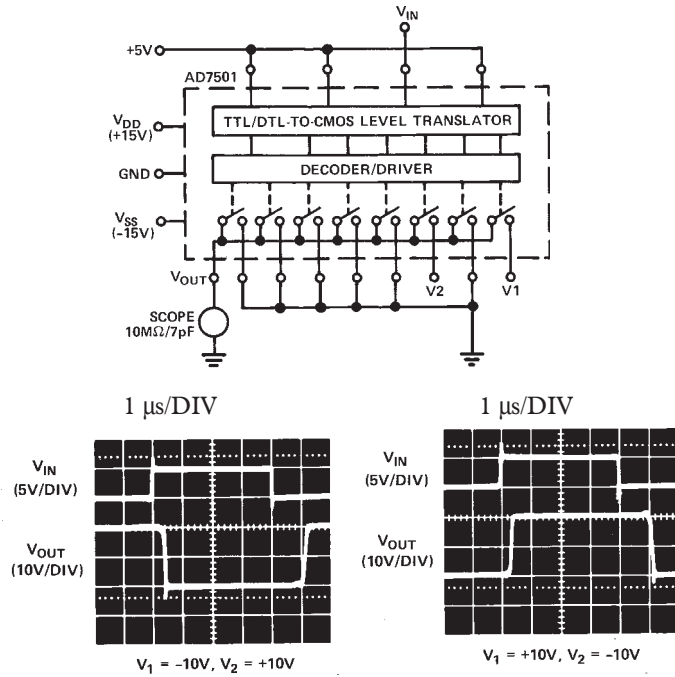


Figure 4. Power Dissipation vs. Logic Frequency (50% Duty Cycle)

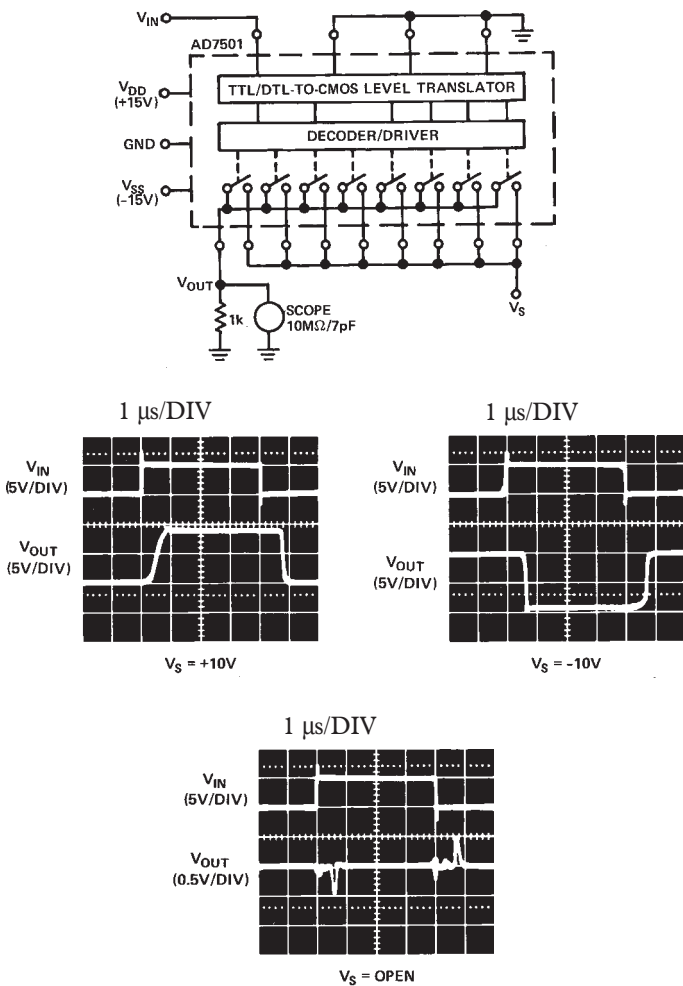
AD7501/AD7502/AD7503

TYPICAL SWITCHING CHARACTERISTICS

TEST CIRCUIT 1



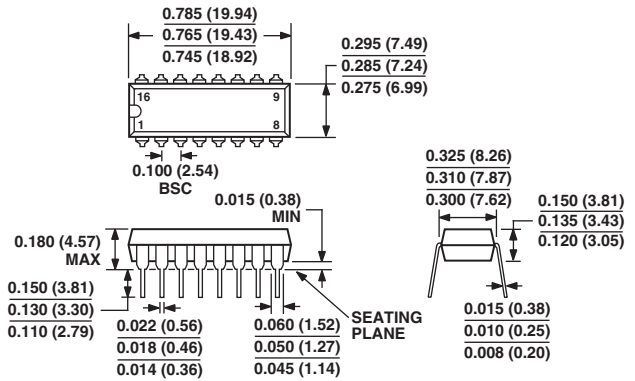
TEST CIRCUIT 2



OUTLINE DIMENSIONS

16-Lead Plastic Dual In-Line Package [PDIP] (N-16)

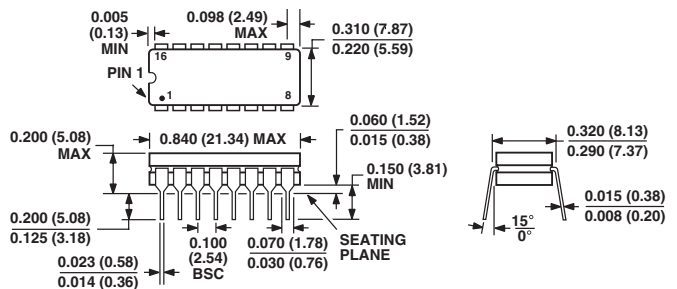
Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MO-095AC
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16-Lead Ceramic Dual In-Line Package [CERDIP] (Q-16)

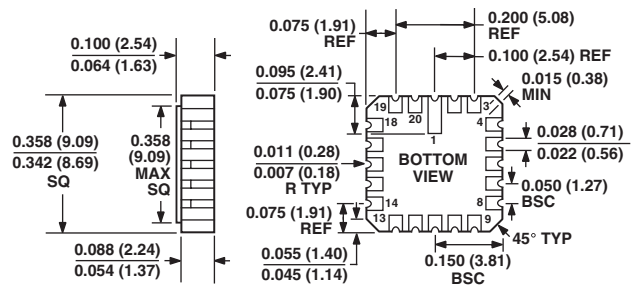
Dimensions shown in inches and (millimeters)



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20-Terminal Ceramic Leadless Chip Carrier [LCC] (E-20A)

Dimensions shown in inches and (millimeters)



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