



**THE DATASHEET OF
AZ4052P-G1**



DUAL 4-CHANNEL ANALOG MULTIPLEXER/DEMULTIPLEXER

Description

The AZ4052 is high-speed si-gate CMOS device. The AZ4052 is dual 4-channel analog multiplexers or demultiplexers with common select logic. Each multiplexer has four independent inputs/outputs (pins nY0 to nY3) and a common input/output (pin nZ). The common channel select logics include two digital select inputs (pins S0 and S1) and an active LOW enable input (pin \bar{E}). When pin \bar{E} = LOW, one of the four switches is selected (Low-impedance On-state) with pins S0 and S1. When pin \bar{E} = HIGH, all switches are in the high-impedance Off-state, independent of pins S0 and S1. V_{CC} and GND are the supply voltage pins for the digital control inputs (pins S0, S1 and \bar{E}). The V_{CC} to GND ranges are 3.0V to 10V. The analog inputs/outputs (pins nY0 to nY3 and nZ) can swing between V_{CC} as a positive limit and V_{EE} as a negative limit. V_{CC} - V_{EE} may not exceed 10V. For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to GND (Typically Ground).

The AZ4052 is available in standard packages of SOIC-16 and DIP-16.

Features

- Wide Operation Voltage: $\pm 5.0V$ or 10V
- Low On-resistance:
 - 55 Ω (Typ.) at V_{CC} - V_{EE} = 5V
 - 40 Ω (Typ.) at V_{CC} - V_{EE} = 10V
- Ultra Low THD+N: 0.003% @ 10V, 0.008% @ 5.0V
- Ultra Low Crosstalk: -120dB
- Ultra Low Noise: 6.0 μV_{RMS}
- Operating Temperature: -40°C to +85°C
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

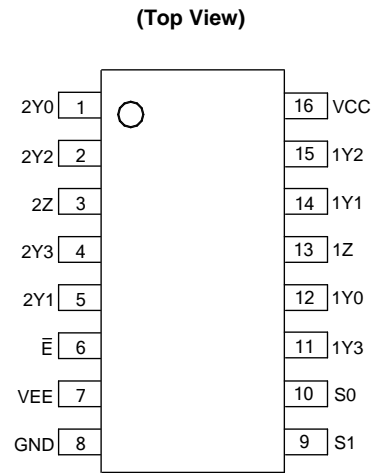
- LCD TV/PDP TV/CRT TV
- 4:1 Multi-channel Signal Selecting

Function Table

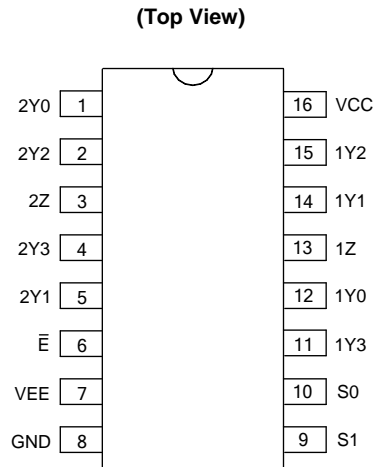
| Control Input | | | On Channel | |
|---------------|----|----|------------|----|
| \bar{E} | S1 | S0 | - | |
| L | L | L | nY0 | nZ |
| L | L | H | nY1 | nZ |
| L | H | L | nY2 | nZ |
| L | H | H | nY3 | nZ |
| H | X | X | None | |

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Assignments

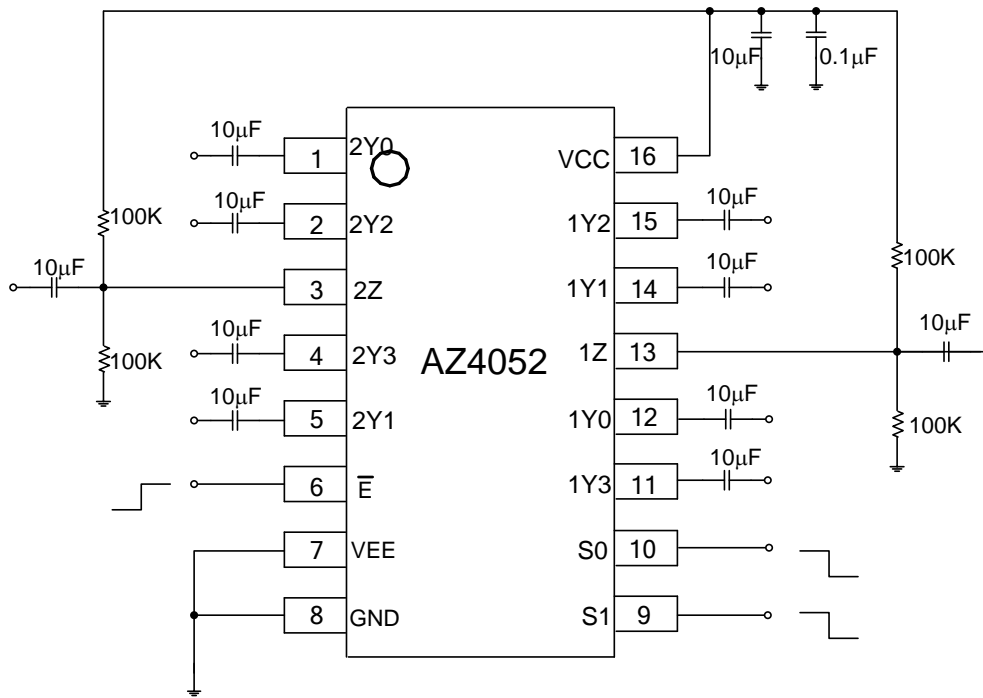


SOIC-16



DIP-16

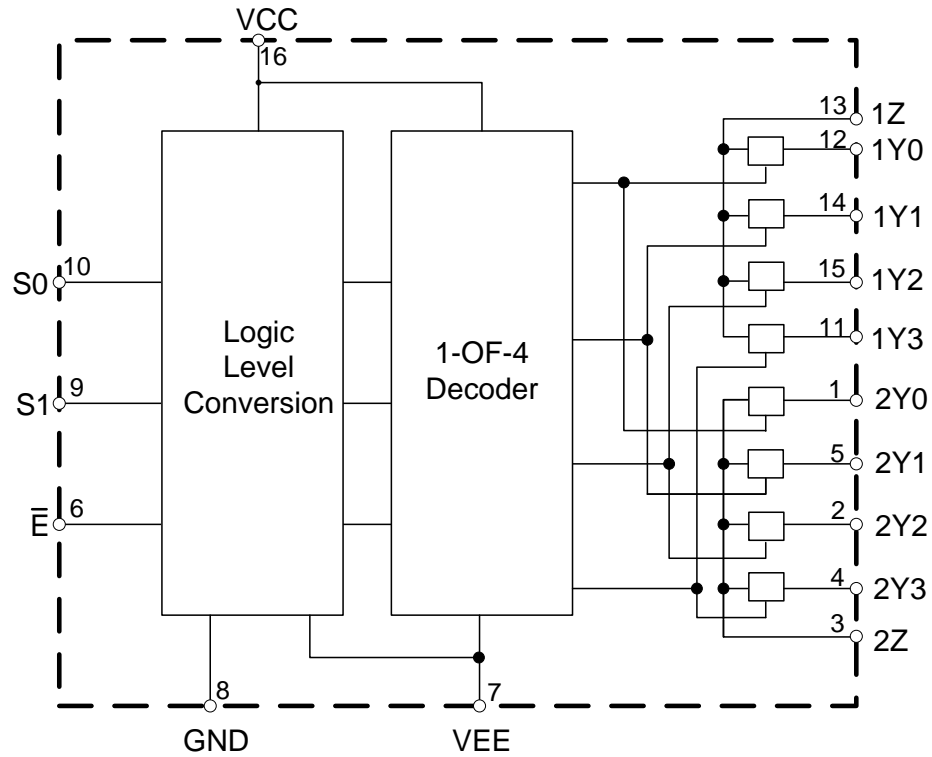
Typical Applications Circuit



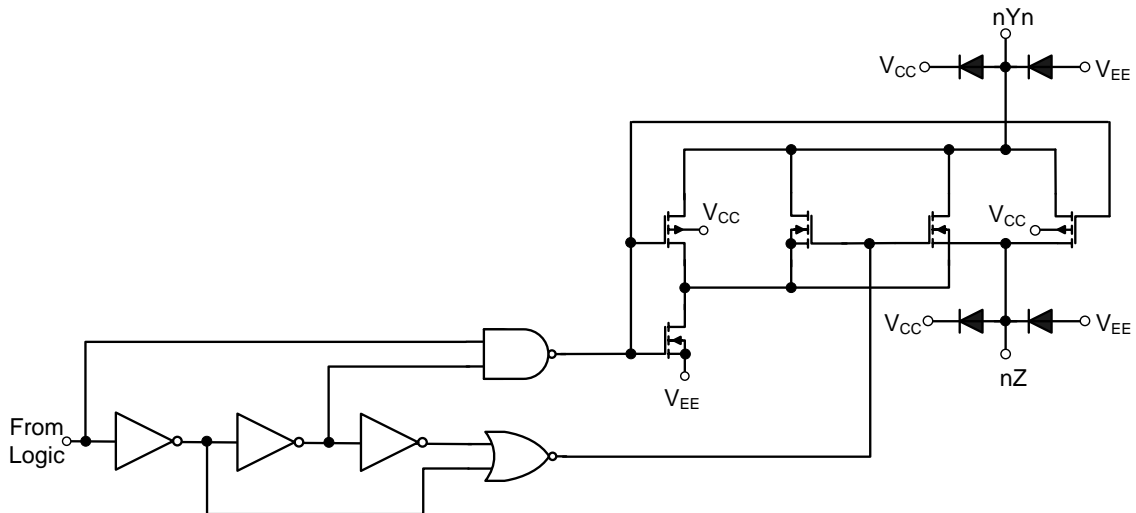
Pin Description

| Pin Number | Pin Name | Function |
|------------|-----------|--|
| 1 | 2Y0 | 2CH signal input or output terminal 0 |
| 2 | 2Y2 | 2CH signal input or output terminal 2 |
| 3 | 2Z | 2CH common signal input or output terminal |
| 4 | 2Y3 | 2CH signal input or output terminal 3 |
| 5 | 2Y1 | 2CH signal input or output terminal 1 |
| 6 | \bar{E} | Enable input (Active LOW) |
| 7 | VEE | Negative supply voltage |
| 8 | GND | Ground (0V) |
| 9 | S1 | Select logic input terminal 1 |
| 10 | S0 | Select logic input terminal 0 |
| 11 | 1Y3 | 1CH signal input or output terminal 3 |
| 12 | 1Y0 | 1CH signal input or output terminal 0 |
| 13 | 1Z | 1CH common signal input or output terminal |
| 14 | 1Y1 | 1CH signal input or output terminal 1 |
| 15 | 1Y2 | 1CH signal input or output terminal 2 |
| 16 | VCC | Positive supply voltage |

Functional Block Diagram



Schematic Diagram (One Switch)



Absolute Maximum Ratings (Notes 4 & 5)

| Symbol | Parameter | Condition | Rating | Unit |
|-----------------------|--------------------------------------|---|--------------|-------------|
| V_{CC} | Power Supply Voltage | – | -0.5 to 11.0 | V |
| I_{IK} | Input Diode Current | $V_I < -0.5V, V_I > V_{CC}+0.5V$ | 20 | mA |
| I_{SK} | Switch Diode Current | $V_S < -0.5V, V_S > V_{CC}+0.5V$ | 20 | mA |
| I_S | Switch Current | $-0.5V < V_S < V_{CC}+0.5V$ | 25 | mA |
| I_{EE} | V_{EE} Current | – | 20 | mA |
| I_{CC} I_{GND} | V_{CC} Current GND Current | – | 50 | mA |
| P_D | Power Dissipation | $T_A = -40^{\circ}C$ to $+85^{\circ}C$ (Note 6) | 500 | mW |
| T_{STG} | Storage Temperature Range | – | -65 to +150 | $^{\circ}C$ |
| T_J | Operating Junction Temperature Range | – | +150 | $^{\circ}C$ |
| P_S | Power Dissipation Per Switch | – | 100 | mW |
| – | ESD (Machine Model) | – | 100 | V |
| – | ESD (Human Body Model) | – | 1,000 | V |

- Notes:
- Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.
 - To avoid drawing V_{CC} current out of pins nZ, when switch current flows in pins nYn, the voltage drop across the bidirectional switch must not exceed 0.4V. If the switch current flows into pins nZ, no VCC current will flow out of pins nYn. In this case there is no limit for the voltage drop across the switch, but the voltages at pins nYn and nZ may not exceed V_{CC} or V_{EE} .
 - Above $+70^{\circ}C$ derate linearly with 12mW/K (DIP-16 package). Above $+70^{\circ}C$ derate linearly with 8mW/K (SOIC-16 package).

Recommended Operating Conditions

| Symbol | Parameter | Condition | Min | Type | Max | Unit |
|-----------------|-------------------------------------|---------------------|----------|------|----------|-------------|
| V_{IN} | Supply Voltage | V_{CC} -GND | 3.0 | – | 10 | V |
| | | V_{CC} - V_{EE} | 3.0 | – | 10 | |
| V_I | Logic Input Voltage | – | V_{EE} | – | V_{CC} | V |
| V_{IS}/V_{OS} | Switch Signal Input/Output Voltage | – | V_{EE} | – | V_{CC} | V |
| T_A | Operating Ambient Temperature Range | – | -40 | – | +85 | $^{\circ}C$ |
| t_r, t_f | Input Rise and Fall Time | $V_{CC} = 5.0V$ | – | 6.0 | 400 | ns |
| | | $V_{CC} = 10V$ | – | 6.0 | 250 | |

Electrical Characteristics

DC Characteristics

V_{IS} is the input voltage at pins nYn or nZ, whichever is assigned as an input; V_{OS} is the output voltage at pins nZ or nYn, whichever is assigned as an output, voltages are referenced to GND (Ground = 0V).

| Symbol | Parameter | Conditions | | | Min | Typ | Max | Unit |
|----------------------|---------------------------------|--|---------------------|---------------------|-----|-----|------|------|
| | | Other | V _{CC} (V) | V _{EE} (V) | | | | |
| V _{IH} | High-level Input Voltage | - | 5.0 | - | 2.8 | - | - | V |
| | | | 10 | - | 6.0 | - | - | |
| V _{IL} | Low-level Input Voltage | - | 5.0 | - | - | - | 1.5 | V |
| | | | 10 | - | - | - | 3.0 | |
| I _{LI} | Input Leakage Current | V _I = V _{CC} or GND | 5.0 | 0 | - | - | ±1.0 | μA |
| | | | 10 | 0 | - | - | ±1.0 | μA |
| I _S (Off) | Analog Switch Off-state Current | V _I = V _{IH} or V _{IL} , V _S = V _{CC} -V _{EE} (Figure 1) | 5.0 | - | - | - | ±1.0 | μA |
| | | | 10 | 0 | - | - | ±1.0 | μA |
| | | | 10 | 0 □ | - | - | ±2.0 | μA |
| I _S (On) | Analog Switch On-state Current | V _I = V _{IH} or V _{IL} , V _S = V _{CC} -V _{EE} (Figure 2) | 10 | 0 | - | - | ±2.0 | μA |
| I _{CC} | Quiescent Supply Current | V _I = V _{CC} or GND, V _{IS} = V _{EE} or V _{CC} , V _{OS} = V _{CC} or V _{EE} | 5.0 | 0 | - | 50 | 160 | μA |
| | | | 10 | 0 | - | 100 | 320 | μA |

Resistance R_{ON}

V_{IS} is the input voltage at pins nYn or nZ, which is assigned as an input ((Note 7) see figure 3)

| Symbol | Parameter | Conditions | | | | Min | Typ | Max | Unit |
|------------------------|---|---|---------------------|---------------------|---------------------|-----|-----|-----|------|
| | | Other | V _{CC} (V) | V _{EE} (V) | I _S (μA) | | | | |
| R _{ON} (Peak) | On-resistance (Peak) | V _{IS} = V _{CC} to V _{EE} , V _I = V _{IH} or V _{IL} | 5.0 | 0 | 1,000 | - | 73 | 180 | Ω |
| | | | 10 | 0 | 1,000 | - | 47 | 120 | Ω |
| R _{ON} (Rail) | On-resistance (Rail) | V _{IS} = V _{EE} , V _I = V _{IH} or V _{IL} | 5.0 | 0 | 1,000 | - | 55 | 130 | Ω |
| | | | 10 | 0 | 1,000 | - | 40 | 100 | Ω |
| | | V _{IS} = V _{CC} , V _I = V _{IH} or V _{IL} | 5.0 | 0 | 1,000 | - | 61 | 150 | Ω |
| | | | 10 | 0 | 1,000 | - | 45 | 110 | Ω |
| R _{ON} | Maximum On-resistance Difference Between Any Two Channels | V _{IS} = V _{CC} to V _{EE} , V _I = V _{IH} or V _{IL} | 5.0 | 0 | - | - | 5 | - | Ω |
| | | | 10 | 0 | - | - | 6 | - | Ω |

Note: 7. When supply voltages (V_{CC}-V_{EE}) near 2.0V the analog switch On-resistance becomes extremely non-linear. When using a supply of 2V, it is recommended to use these devices only for transmitting digital signals.

Electrical Characteristics (continued)

AC Characteristics

GND = 0V, $t_r = t_f = 6\text{ns}$, $C_L = 50\text{pF}$

| Symbol | Parameter | Conditions | | | Min | Typ | Max | Unit |
|------------------------------------|--|--|---------------------|---------------------|-----|-----|-----|------|
| | | Other | V _{CC} (V) | V _{EE} (V) | | | | |
| t _{PHL} /t _{PLH} | Propagation Delay V _{IS} to V _{OS} | R _L = ∞ (Figure 20) | 5.0 | 0 | - | 15 | 25 | ns |
| | | | 5.0 | -5.0 | - | 12 | 25 | ns |
| t _{PZH} /t _{PZL} | Turn-on Time \bar{E} , Sn to V _{OS} | R _L = 1kΩ (Figure 21 and 22) | 5.0 | 0 | - | 38 | 81 | ns |
| | | | 5.0 | -5.0 | - | 26 | 81 | ns |
| t _{PHZ} /t _{PLZ} | Turn-off Time \bar{E} , Sn to V _{OS} | R _L = 1kΩ (Figure 21 and 22) | 5.0 | 0 | - | 27 | 63 | ns |
| | | | 5.0 | -5.0 | - | 22 | 48 | ns |

Recommended conditions and typical values, GND = 0V, T_A = +25°C, C_L = 50pF. V_{IS} is the input voltage at pins nYn or nZ, whichever is assigned as an input. V_{OS} is the output voltage at pins nYn or nZ, whichever is assigned as an output.

| Symbol | Parameter | Conditions | | | | Min | Typ | Max | Unit |
|-----------------------------------|---|--|---------------------------|---------------------|---------------------|-----|-------|-----|-------------------|
| | | Other | V _{IS} (p-p) (V) | V _{CC} (V) | V _{EE} (V) | | | | |
| d _{SIN} | Sine-wave Distortion | f = 1kHz, R _L = 10kΩ (Figure 4) | 0.5 | 5.0 | 0 | - | 0.008 | - | % |
| | | | 1.5 | 10 | 0 | - | 0.003 | - | % |
| | | f = 10kHz, R _L = 10kΩ (Figure 4) | 0.5 | 5.0 | 0 | - | 0.008 | - | % |
| | | | 1.5 | 10 | 0 | - | 0.003 | - | % |
| α _{OFF} (Feedthrough) | Switch OFF Signal Feed-through | R _L = 10kΩ, f = 1MHz (Figure 5), V _{IS} = 1V _{RMS} | - | 5.0 | 0 | - | -50 | - | dB |
| | | | - | 5.0 | -5.0 | - | -50 | - | dB |
| α _{CT(S)} | Crosstalk Between Two Channels | R _L = 10kΩ, f = 1kHz (Figure 6), V _{IS} = 1V _{RMS} | - | 5.0 | 0 | - | -120 | - | dB |
| | | | - | 5.0 | -5.0 | - | -120 | - | dB |
| | Crosstalk Between Two Switches / Multiplexers | R _L = 10kΩ, f = 1kHz (Figure 6), V _{IS} = 1V _{RMS} | - | 5.0 | 0 | - | -60 | - | dB |
| | | | - | 5.0 | -5.0 | - | -60 | - | dB |
| V _{CT(P-P)} | Crosstalk Voltage Between Control and Any Switch (Peak-to-peak Value) | R _L = 10kΩ, f = 1MHz, \bar{E} or Sn, Square-wave Between V _{CC} and GND, $t_r = t_f = 6\text{ns}$ (Figure 7) | - | 5.0 | 0 | - | 110 | - | mV |
| f _{MAX} | Frequency Response (-3dB) | R _L = 10kΩ (Figure 4) | - | 5.0 | 0 | - | 70 | - | MHz |
| | | | - | 5.0 | -5.0 | - | 70 | - | MHz |
| V _{NOISE} | Output Noise Voltage | A-weighted | - | 5.0 | 0 | - | 6.0 | - | μV _{RMS} |

Typical Test Circuit

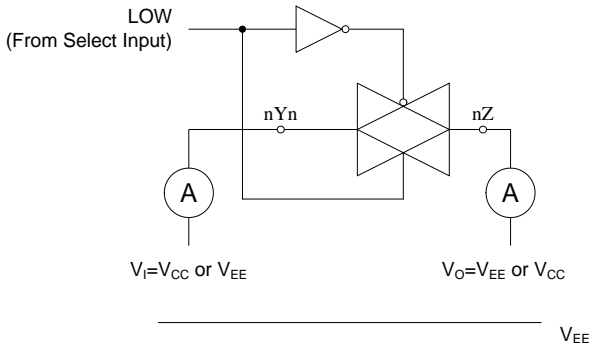


Figure 1. Test Circuit for Measuring OFF-state Current

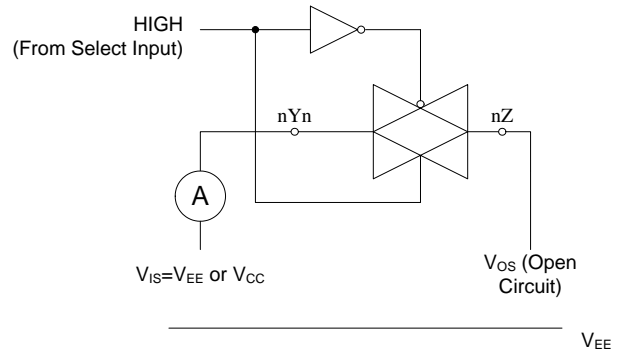


Figure 2. Test Circuit for Measuring ON-state Current

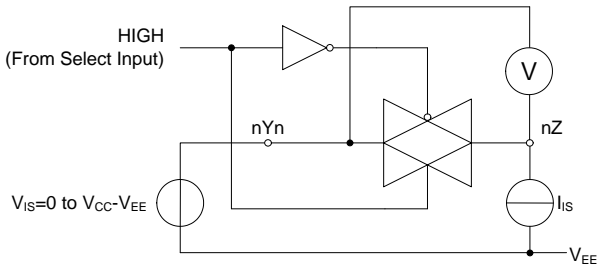


Figure 3. Test Circuit for Measuring Ron

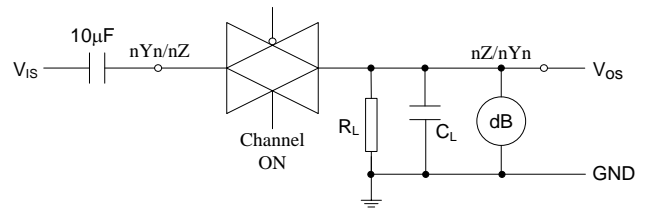


Figure 4. Test Circuit for Measuring Sine-wave Distortion and Minimum Frequency Response

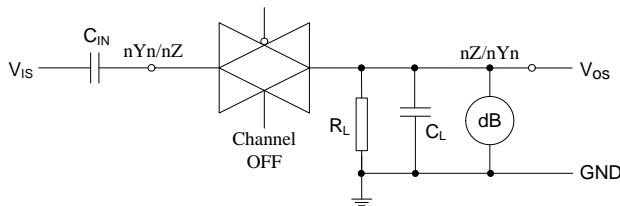
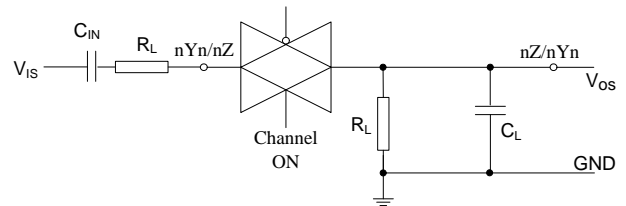
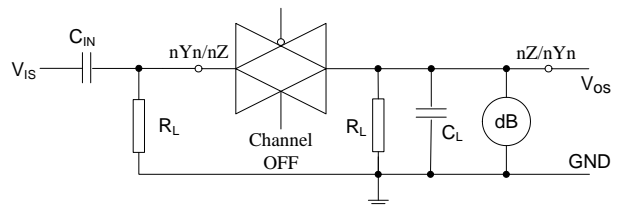


Figure 5. Test Circuit for Measuring Switch Off Signal Feed-through



(a) Channel ON Condition



(b) Channel OFF Condition

Figure 6. Test Circuits for Measuring Crosstalk between Any Two Switches/Multiplexers

Typical Test Circuit (continued)

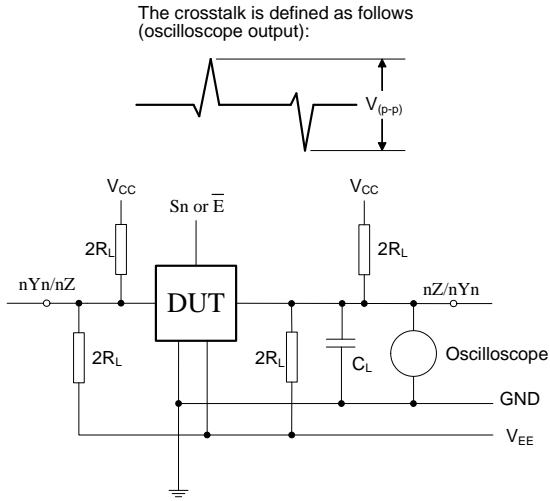


Figure 7. Test Circuit for Measuring Crosstalk Performance

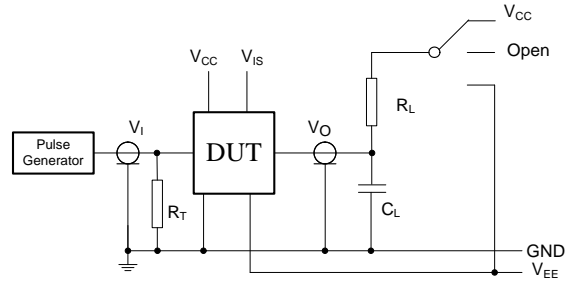


Figure 8. Test Circuit for Measuring AC between Control and Any Switch

Performance Characteristics

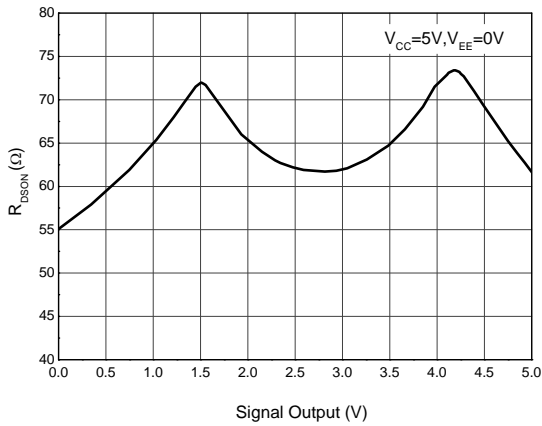


Figure 9. $R_{DS(on)}$ vs. Signal Output

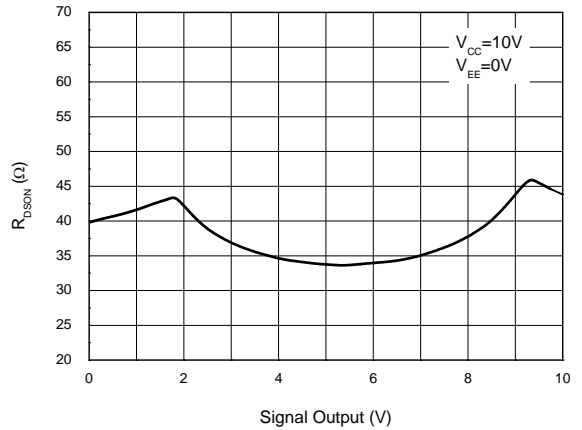


Figure 10. $R_{DS(on)}$ vs. Signal Output

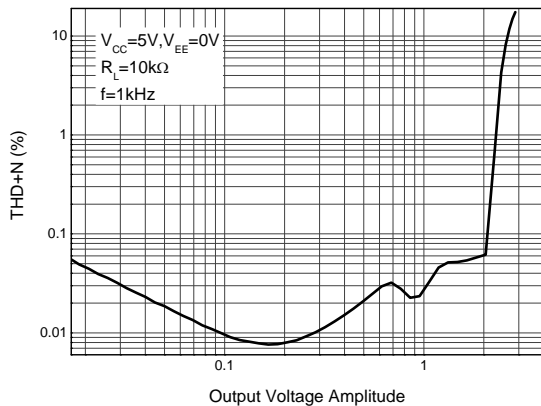


Figure 11. THD+N vs. Output Voltage Amplitude

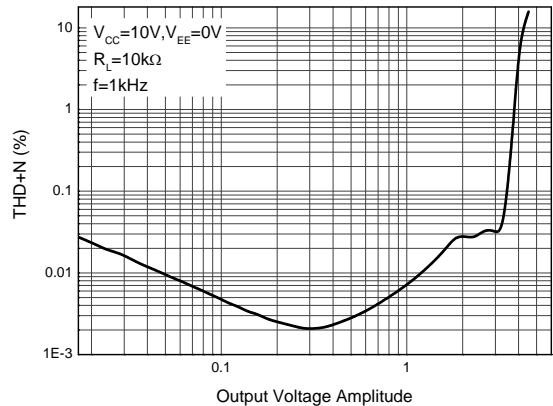


Figure 12. THD+N vs. Output Voltage Amplitude

Performance Characteristics (continued)

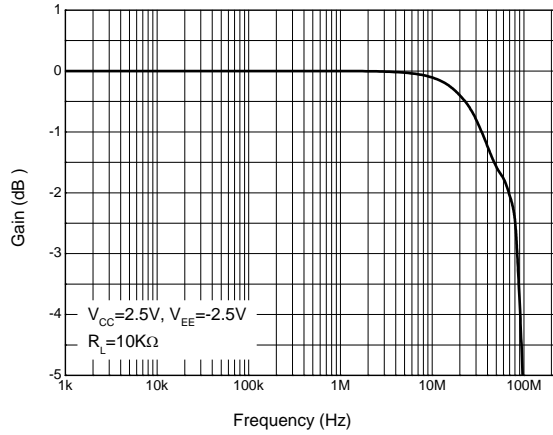


Figure 13. Frequency Response

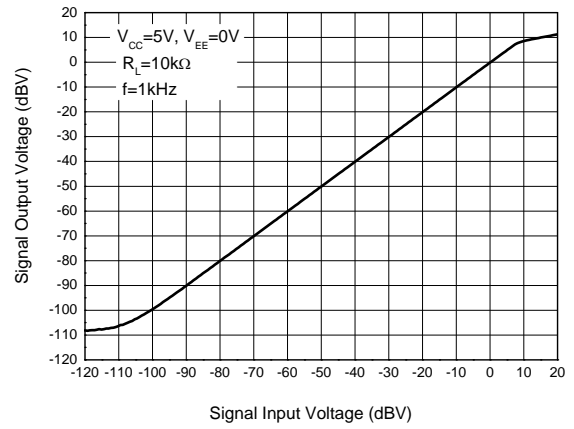


Figure 14. Linear Range

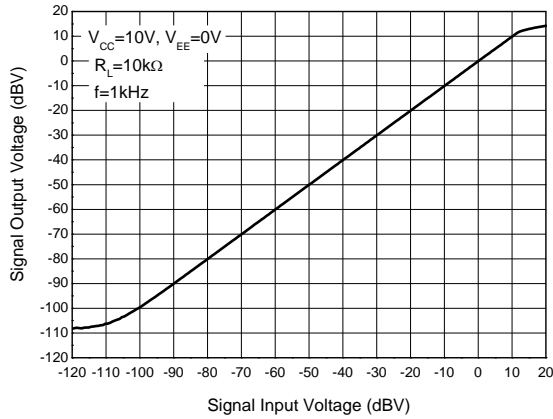


Figure 15. Linear Range

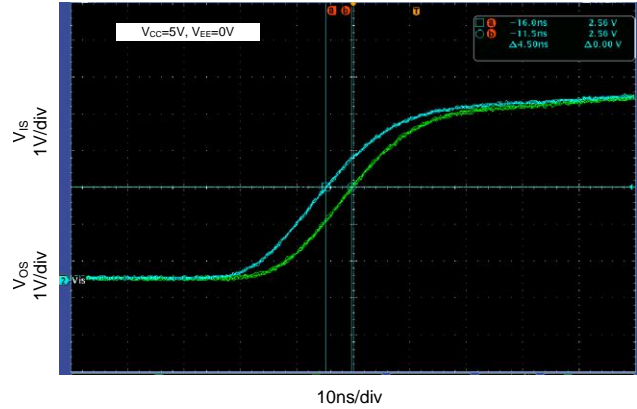


Figure 16. Propagation Delay

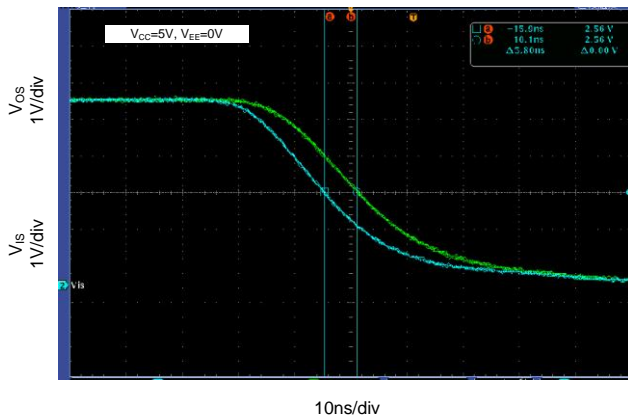


Figure 17. Propagation Delay

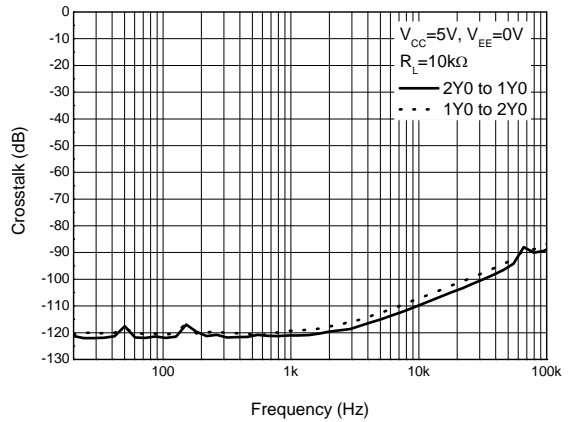


Figure 18. Crosstalk vs. Frequency

Performance Characteristics (cont.)

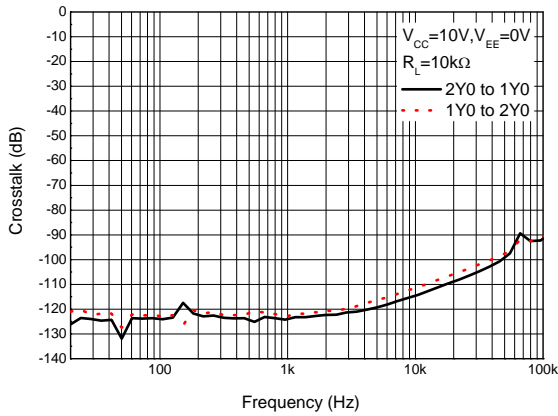


Figure 19. Crosstalk vs. Frequency

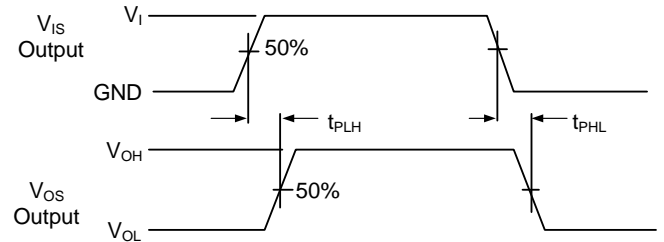


Figure 20. Waveforms Showing the Input (VIS) to Output (VOS) Propagation Delays

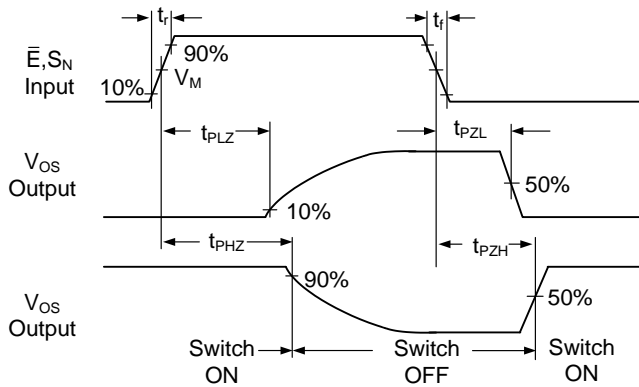


Figure 21. Waveforms Showing the Turn-on and Turn-off Times (VM = 50%, VI = GND to VCC)

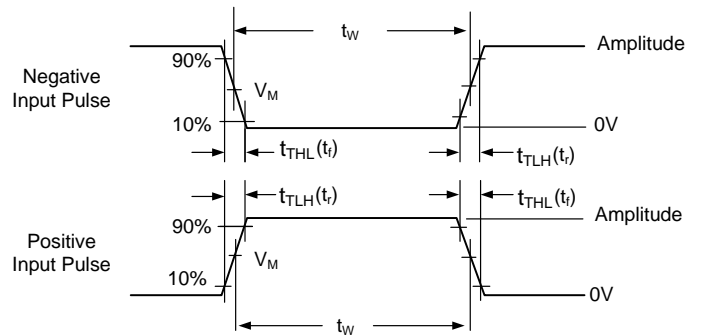
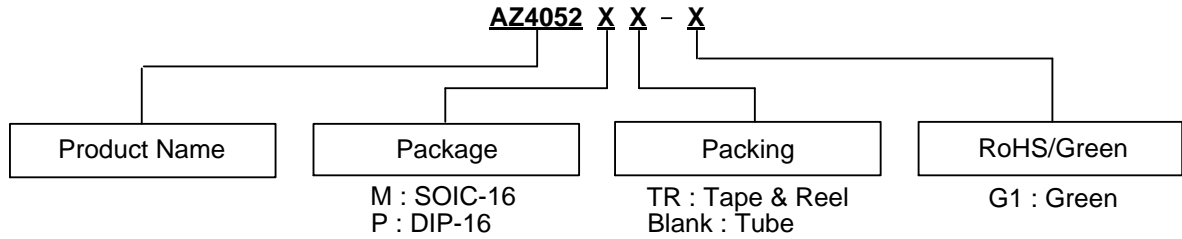


Figure 22. Input Pulse Definitions

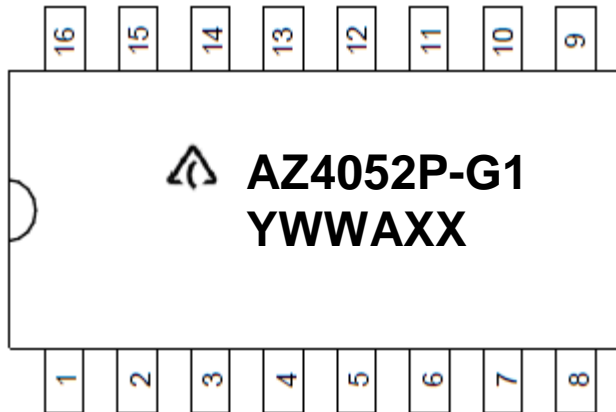
| Amplitude | VM | tr and tr | |
|-----------|-----|------------------|-------|
| | | Fmax Pulse Width | Other |
| VCC | 50% | <2ns | 6ns |

Ordering Information



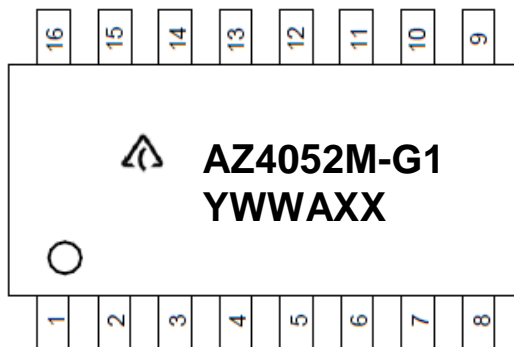
| Package | Temperature Range | Part Number | Marking ID | Packing |
|---------|-------------------|--------------|------------|---------------------------|
| SOIC-16 | -40 to +85°C | AZ4052M-G1 | AZ4052M-G1 | 25/Tube |
| | | AZ4052MTR-G1 | AZ4052M-G1 | 4,000/13"/ Tape & Reel |
| DIP-16 | -40 to +85°C | AZ4052P-G1 | AZ4052P-G1 | 25/Tube |

DIP16 Marking Information:



First line: Logo and Marking ID
 Second line: Date Code
 Y: year
 WW: work week of molding
 A: assembly house code
 XX: 7th and 8th digits of Batch Number

SOIC16 Marking Information:

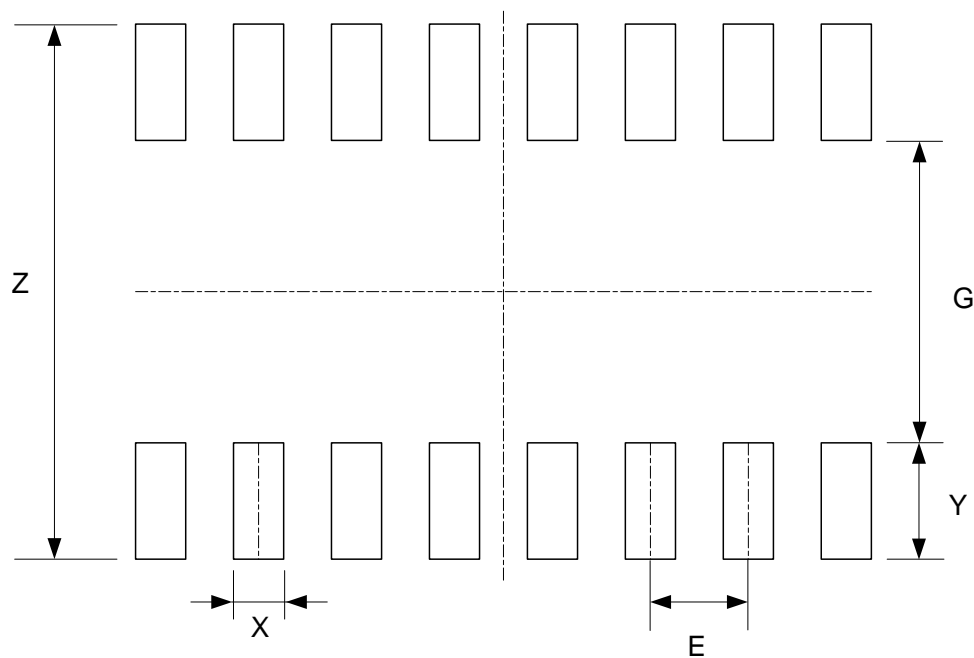


First line: Logo and Marking ID
 Second line: Date Code
 Y: year
 WW: work week of molding
 A: assembly house code
 XX: 7th and 8th digits of Batch Number

Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: SOIC-16



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|------------------|
| Value | 6.900/0.272 | 3.900/0.154 | 0.650/0.026 | 1.500/0.059 | 1.270/0.050 |

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