Dual 4-channel Analog Multiplexer/Demultiplexer AZ4052

General 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 $\overline{E}$). When pin $\overline{E}$=LOW, one of the four switches is selected (Low-impedance On-state) with pins S0 and S1. When pin $\overline{E}$=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 $\overline{E}$). 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: ±5.0V or 10V
- Low On-resistance:
  - 55Ω (Typ.) at V_{CC}-V_{EE}=5V
  - 40Ω (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: 6.0μV_{RMS}
- Operating Temperature: -40ºC to 85ºC

Applications

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

Function Table

Control Input			On Channel	
$\overline{E}$	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	

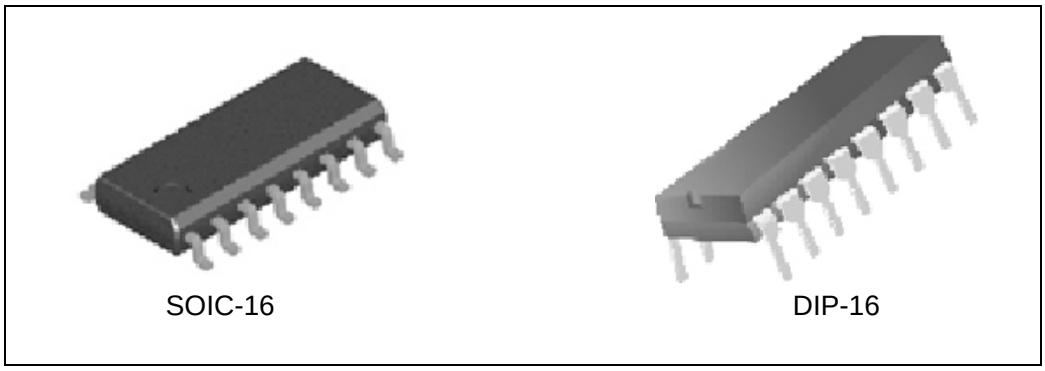


Figure 1. Package Types of AZ4052

Dual 4-channel Analog Multiplexer/Demultiplexer AZ4052

Pin Configuration

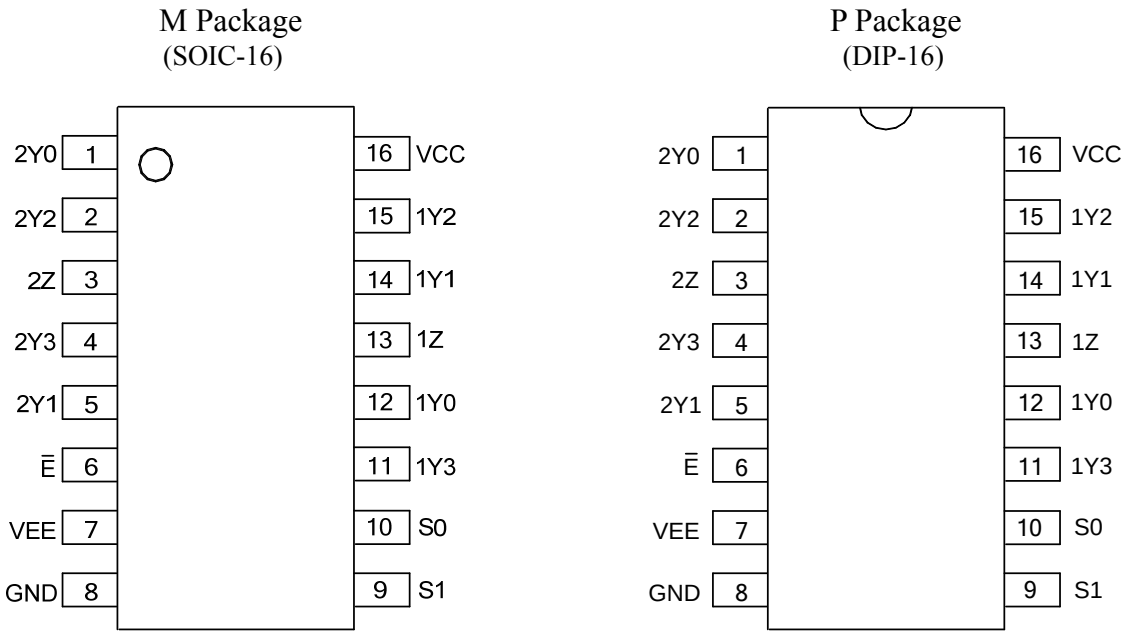


Figure 2. Pin Configuration of AZ4052 (Top View)

Pin Descriptions

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	$\overline{E}$	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

Dual 4-channel Analog Multiplexer/Demultiplexer AZ4052

Functional Block Diagram

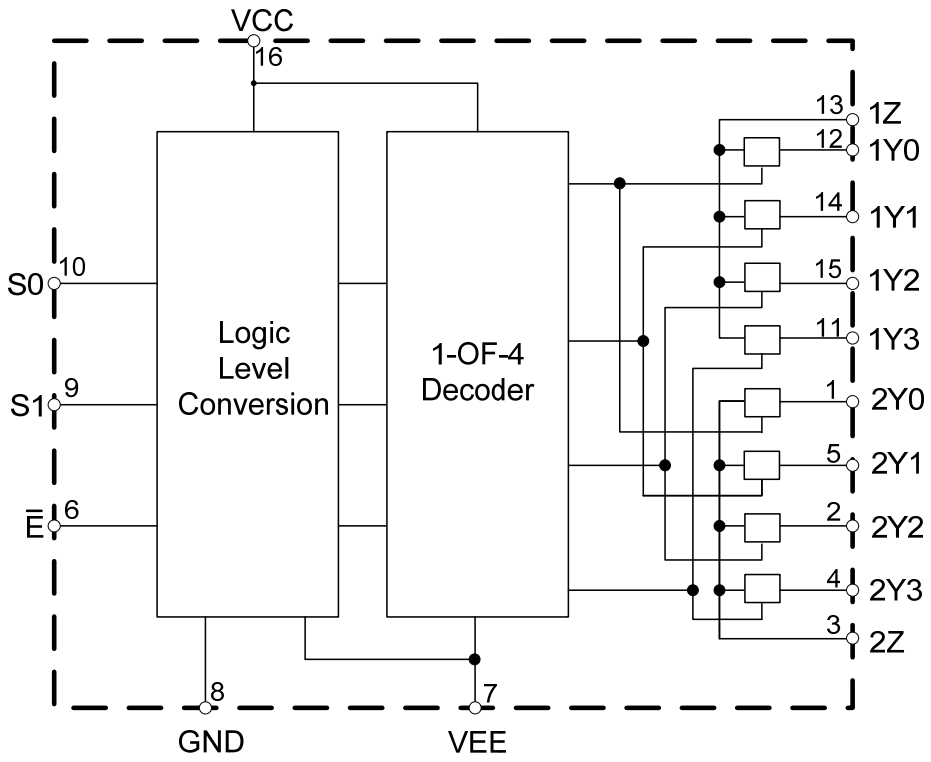


Figure 3. Functional Block Diagram of AZ4052

Schematic Diagram (One Switch)

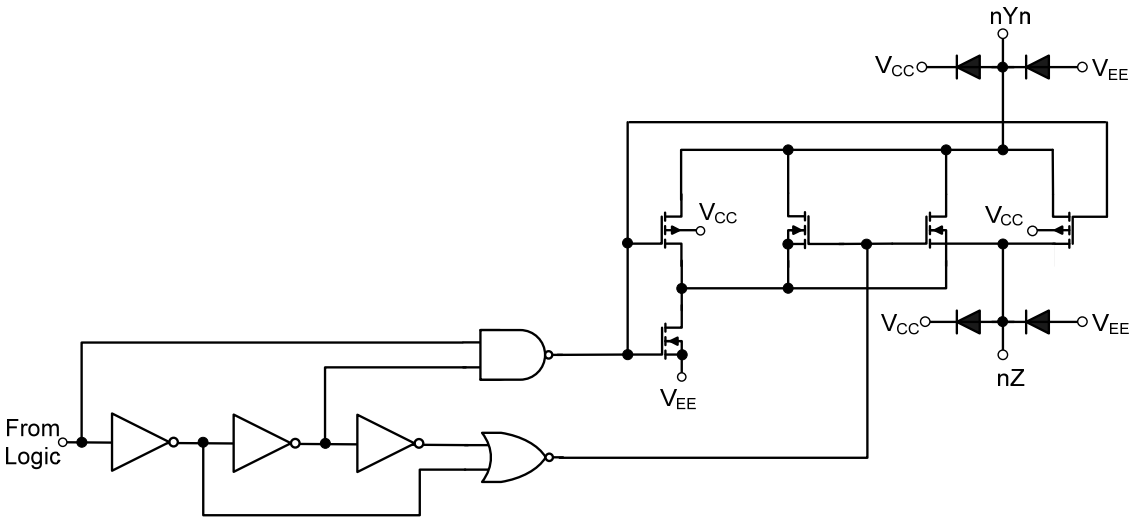
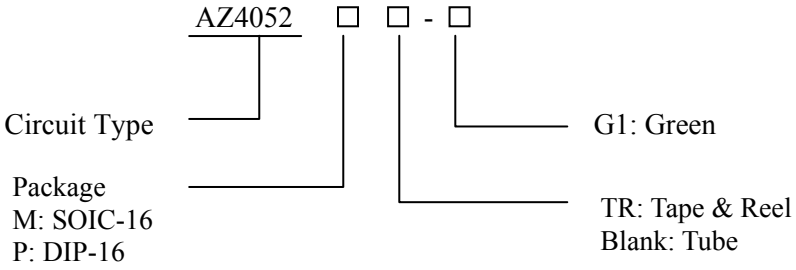


Figure 4. Schematic Diagram of AZ4052

Dual 4-channel Analog Multiplexer/Demultiplexer AZ4052

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOIC-16	-40 to 85°C	AZ4052M-G1	AZ4052M-G1	Tube
		AZ4052MTR-G1	AZ4052M-G1	Tape & Reel
DIP-16	-40 to 85°C	AZ4052P-G1	AZ4052P-G1	Tube

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.

Absolute Maximum Ratings (Note 1, 2)

Parameter	Symbol	Condition	Value	Unit
Power Supply Voltage	V_{CC}		-0.5 to 11.0	V
Input Diode Current	I_{IK}	$V_I < -0.5V$, $V_I > V_{CC}+0.5V$	20	mA
Switch Diode Current	I_{SK}	$V_S < -0.5V$, $V_S > V_{CC}+0.5V$	20	mA
Switch Current	I_S	$-0.5V < V_S < V_{CC}+0.5V$	25	mA
V_{EE} Current	I_{EE}		20	mA
V_{CC} Current GND Current	I_{CC} I_{GND}		50	mA
Power Dissipation	P_D	T_A=-40ºC to 85ºC (Note 3)	500	mW
Storage Temperature Range	T_{STG}		-65 to 150	ºC
Operating Junction Temperature Range	T_J		150	ºC
Power Dissipation Per Switch	P_S		100	mW
ESD (Machine Model)			200	V
ESD (Human Body Model)			2000	V

Note 1: 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.
Note 2: 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}.
Note 3: Above 70ºC derate linearly with 12mW/K (DIP-16 package).
Above 70ºC derate linearly with 8mW/K (SOIC-16 package)

Recommended Operating Conditions

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage	V_{IN}	V_{CC}-GND	3.0		10	V
		V_{CC}-V_{EE}	3.0		10	
Logic Input Voltage	V_I		V_{EE}		V_{CC}	V
Switch Signal Input/ Output Voltage	V_{IS}/V_{OS}		V_{EE}		V_{CC}	V
Operating Ambient Temperature Range	T_A		-40		85	℃
Input Rise and Fall Time	t_r, t_f	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).

Parameter	Symbol	Conditions			Min	Typ	Max	Unit
		Other	V_{CC}(V)	V_{EE}(V)				
High-level Input Voltage	V_{IH}		5.0		2.8			V
			10		6.0			
Low-level Input Voltage	V_{IL}		5.0				1.5	V
			10				3.0	
Input Leakage Current	I_{LI}	V_I=V_{CC} or GND	5.0	0			±1.0	μA
			10	0			±1.0	μA
Analog Switch Off-state Current	I_S (Off)	V_I=V_{IH} or V_{IL}, | V_S | =V_{CC}-V_{EE} (Figure 5)	5.0				±1.0	μA
		Per Channel	10	0			±1.0	μA
		All Channels	10	0			±2.0	μA
Analog Switch On-state Current	I_S (On)	V_I=V_{IH} or V_{IL}, | V_S | =V_{CC}-V_{EE} (Figure 6)	10	0			±2.0	μA
Quiescent Supply Current	I_{CC}	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

Electrical Characteristics (Continued)

Resistance R_{ON}

V_{IS} is the input voltage at pins nYn or nZ, which is assigned as an input ((note 4) see figure 7)

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
		Other	V_{CC} (V)	V_{EE} (V)	I_S (μA)				
On-resistance (Peak)	R_{ON} (Peak)	V_{IS}=V_{CC} to V_{EE}, V_I=V_{IH} or V_{IL}	5.0	0	1000		73	180	Ω
			10	0	1000		47	120	Ω
On-resistance (Rail)	R_{ON} (Rail)	V_{IS}=V_{EE}, V_I =V_{IH} or V_{IL}	5.0	0	1000		55	130	Ω
			10	0	1000		40	100	Ω
		V_{IS}=V_{CC}, V_I=V_{IH} or V_{IL}	5.0	0	1000		61	150	Ω
			10	0	1000		45	110	Ω
Maximum On-resistance Difference Between Any Two Channels	R_{ON}	V_{IS}=V_{CC} to V_{EE}, V_I=V_{IH} or V_{IL}	5.0	0			5		Ω
			10	0			6		Ω

Note 4: 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=6ns, C_L=50pF

Parameter	Symbol	Conditions			Min	Typ	Max	Unit
		Other	V_{CC} (V)	V_{EE} (V)				
Propagation Delay V_{IS} to V_{OS}	t_{PHL}/t_{PLH}	R_L=∞ (Figure 24)	5.0	0		15	25	ns
			5.0	-5.0		12	25	ns
Turn-on Time $\overline{E}$, Sn to V_{OS}	t_{PZH}/t_{PZL}	R_L=1kΩ (Figure 25 and 26)	5.0	0		38	81	ns
			5.0	-5.0		26	81	ns
Turn-off Time $\overline{E}$, Sn to V_{OS}	t_{PHZ}/t_{PLZ}	R_L=1kΩ (Figure 25 and 26)	5.0	0		27	63	ns
			5.0	-5.0		22	48	ns

Recommended conditions and typical values, GND=0V, T_A=25ºC, 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.

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
		Other	V_{IS}(p-p) (V)	V_{CC} (V)	V_{EE} (V)				
Sine-wave Distortion	d_{SIN}	f=1kHz, R_L=10kΩ (Figure 8)	0.5	5.0	0		0.008		%
			1.5	10	0		0.003		%
		f=10kHz, R_L=10kΩ (Figure 8)	0.5	5.0	0		0.008		%
			1.5	10	0		0.003		%
Switch OFF Signal Feed-through	α_{OFF} (Feedthrough)	R_L=10kΩ, f=1MHz (Figure 9), V_{IS}=1V_{RMS}		5.0	0		-50		dB
				5.0	-5.0		-50		dB
Crosstalk Between Two Channels	$\alpha_{CT(S)}$	R_L=10kΩ, f=1kHz (Figure 10), 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 10), V_{IS}=1V_{RMS}		5.0	0		-60		dB
				5.0	-5.0		-60		dB
Crosstalk Voltage Between Control and Any Switch (Peak-to-peak Value)	$V_{CT(P-P)}$	R_L=10kΩ, f=1MHz, $\overline{E}$ or Sn, Square-wave Between V_{CC} and GND, t_r= t_f=6ns (Figure 11)		5.0	0		110		mV
Frequency Response (-3dB)	f_{MAX}	R_L=10kΩ (Figure 8)		5.0	0		70		MHz
				5.0	-5.0		70		MHz
Output Noise Voltage	V_{NOISE}	A-weighted		5.0	0		6.0		μV_{RMS}

Typical Test Circuit

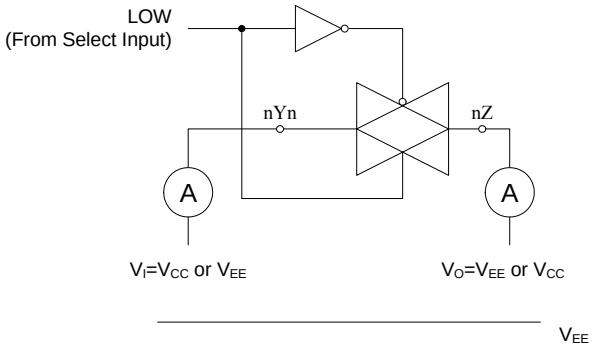


Figure 5. Test Circuit for Measuring OFF-state Current

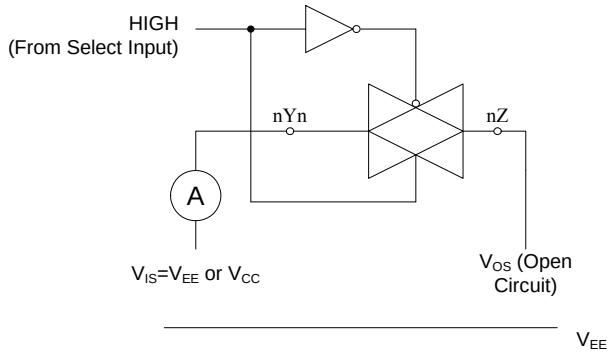


Figure 6. Test Circuit for Measuring ON-state Current

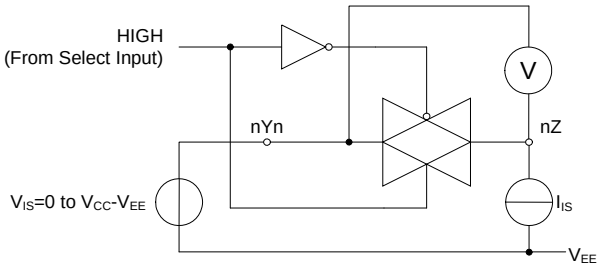


Figure 7. Test Circuit for Measuring R_{ON}

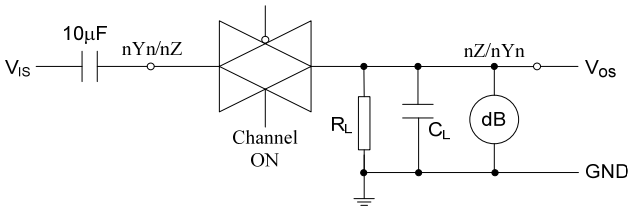


Figure 8. Test Circuit for Measuring Sine-wave Distortion and Minimum Frequency Response

Typical Test Circuit (Continued)

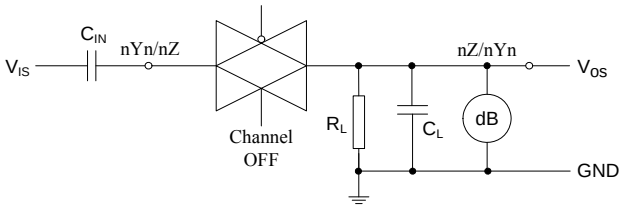


Figure 9. Test Circuit for Measuring Switch Off Signal Feed-through

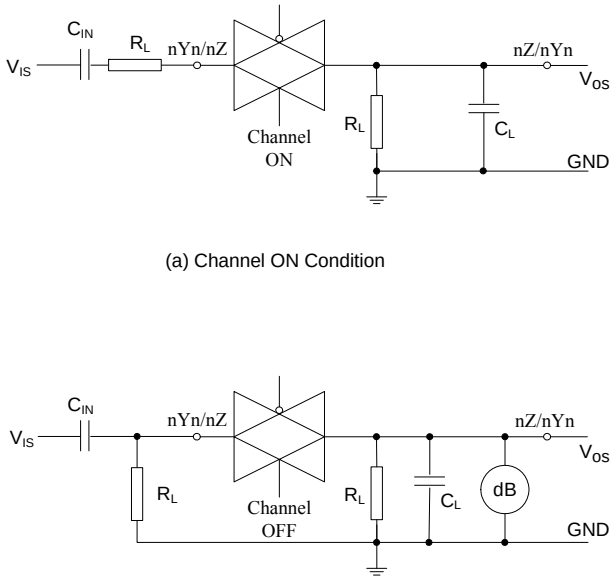


Figure 10. Test Circuits for Measuring Crosstalk Between Any Two Switches/Multiplexers

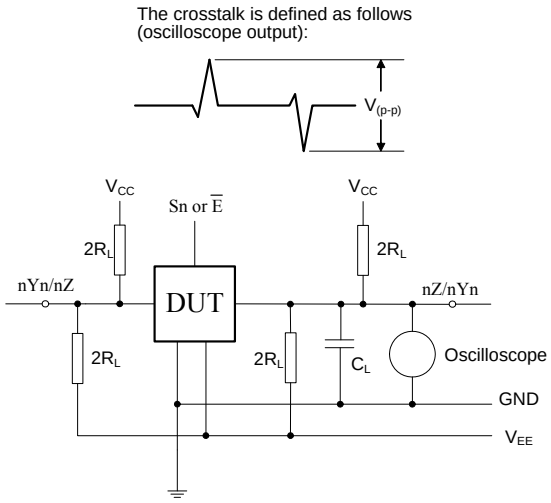


Figure 11. Test Circuit for Measuring Crosstalk Performance

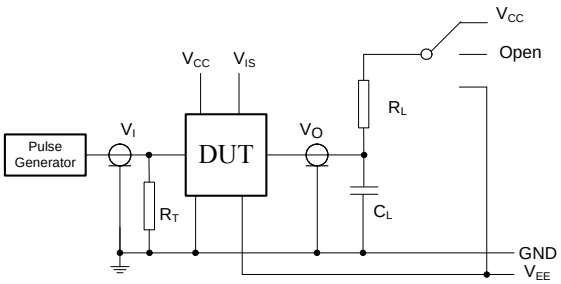


Figure 12. Test Circuit for Measuring AC Between Control and Any Switch

Typical Performance Characteristics

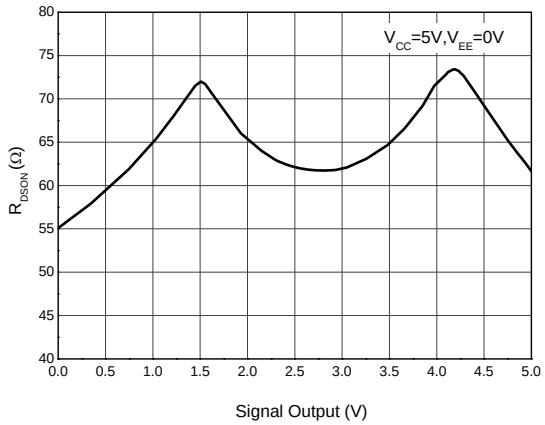


Figure 13. R_{DSON} vs. Signal Output

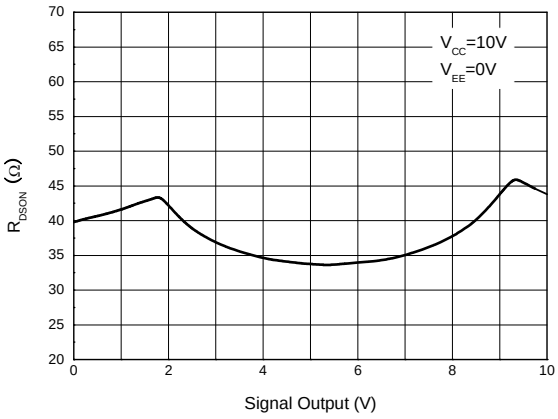


Figure 14. R_{DSON} vs. Signal Output

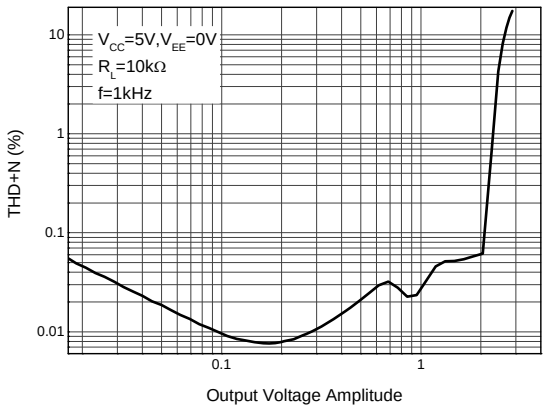


Figure 15. THD+N vs. Output Voltage Amplitude

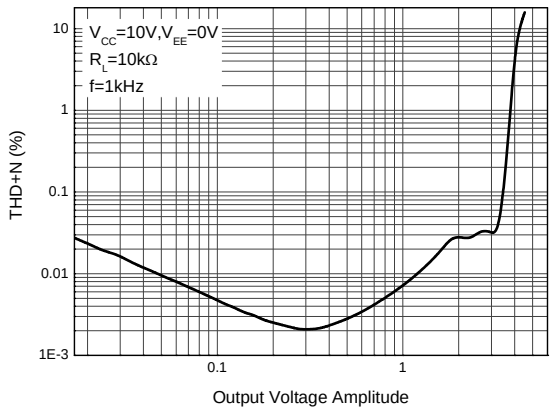


Figure 16. THD+N vs. Output Voltage Amplitude

Typical Performance Characteristics (Continued)

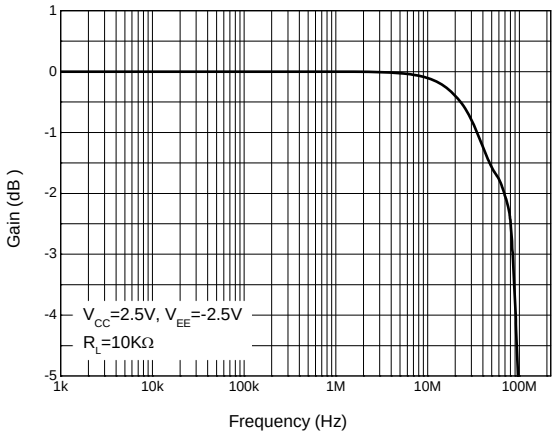


Figure 17. Frequency Response

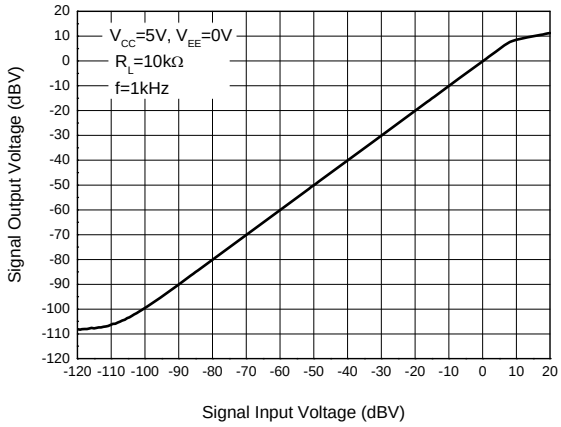


Figure 18. Linear Range

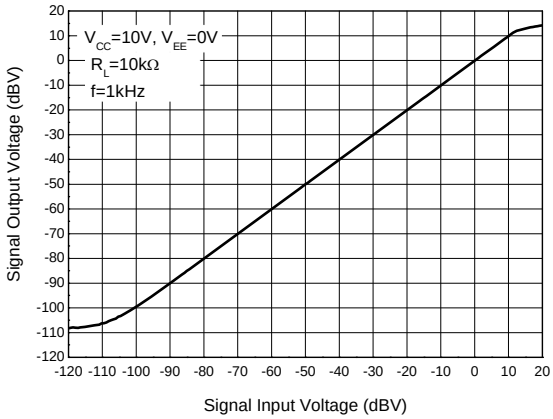


Figure 19. Linear Range

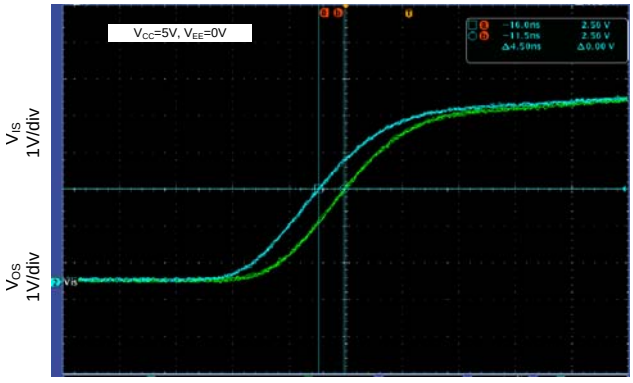


Figure 20. Propagation Delay

Typical Performance Characteristics (Continued)

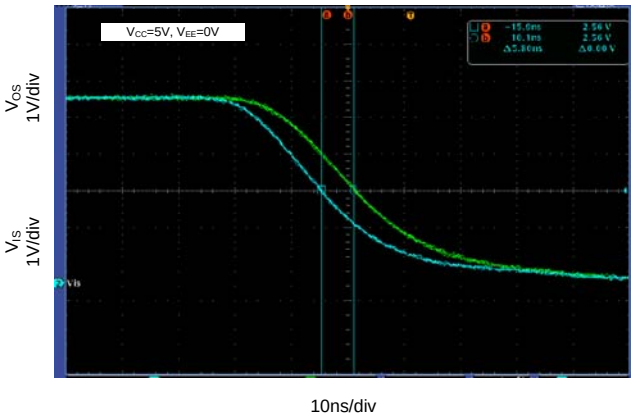


Figure 21. Propagation Delay

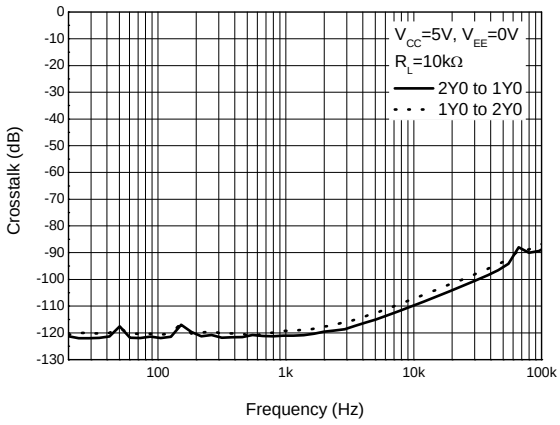


Figure 22. Crosstalk vs. Frequency

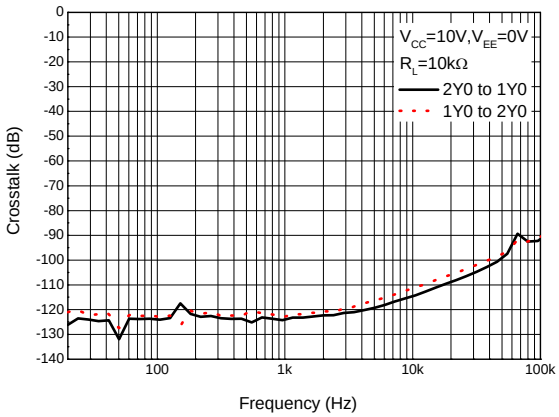


Figure 23. Crosstalk vs. Frequency

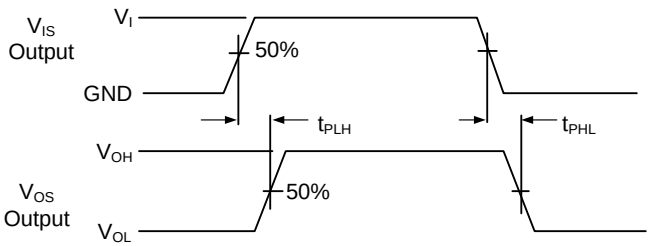


Figure 24. Waveforms Showing the Input (V_{IS}) to Output (V_{OS}) Propagation Delays

Typical Performance Characteristics (Continued)

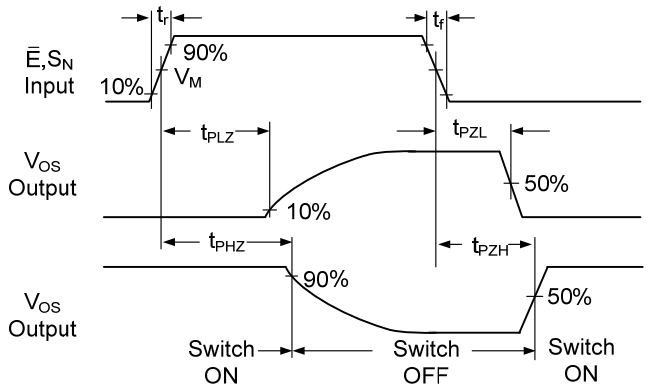


Figure 25. Waveforms Showing the Turn-on and Turn-off Times
(V_M = 50 %, V_I = GND to V_{CC})

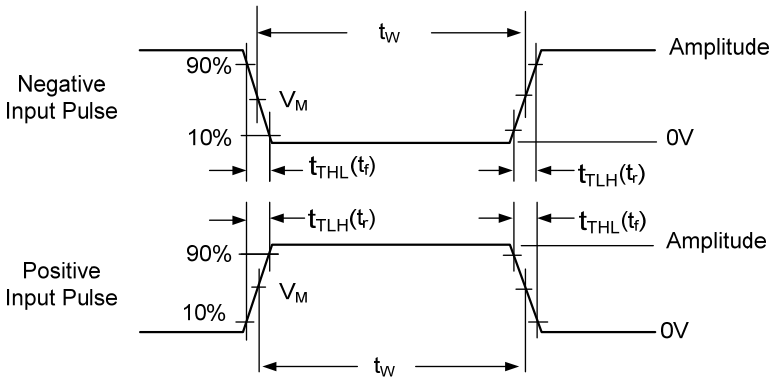


Figure 26. Input Pulse Definitions

Amplitude	V_M	t_r and t_f	
		F_{max} Pulse Width	Other
V_{CC}	50%	< 2ns	6ns

Typical Application

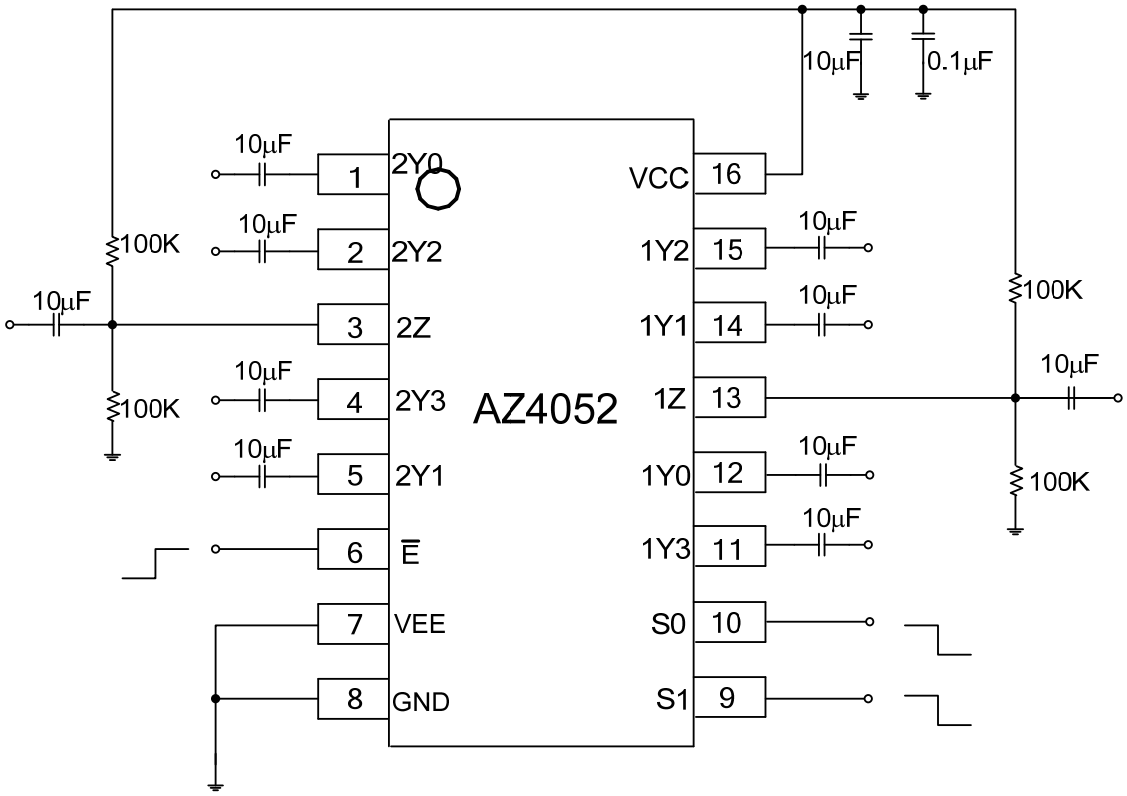
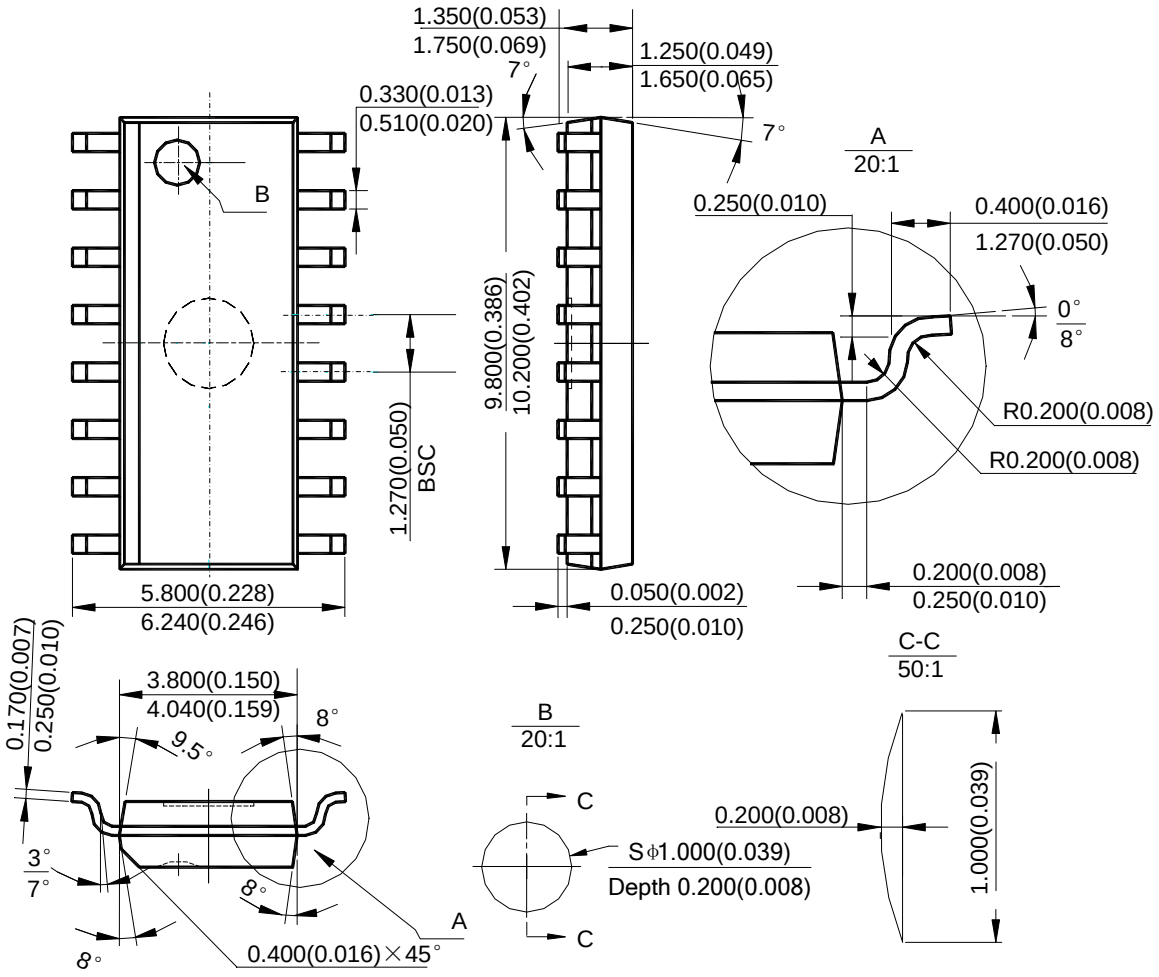


Figure 27. Typical Application of AZ4052

Mechanical Dimensions

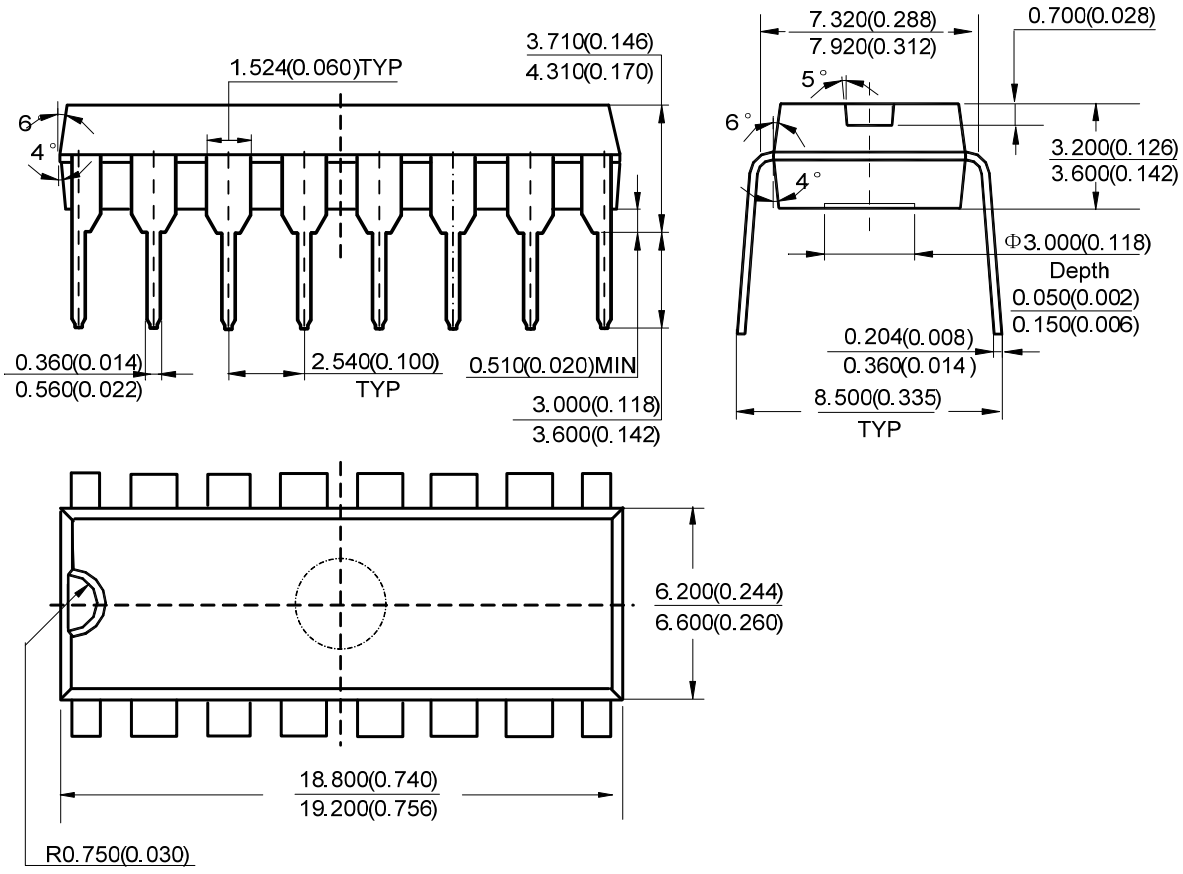
SOIC-16 **Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.

Mechanical Dimensions (Continued)

DIP-16 **Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional

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