Lead-free Green

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 $\overline{E}$). 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
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

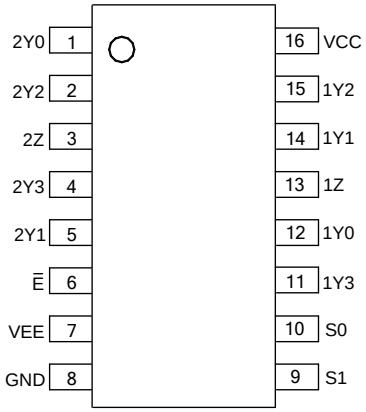
- LCD TV/PDP TV/CRT TV
- 4:1 Multi-channel Signal Selecting

Function Table

Control Input			On Channel	
$\overline{E}$	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	

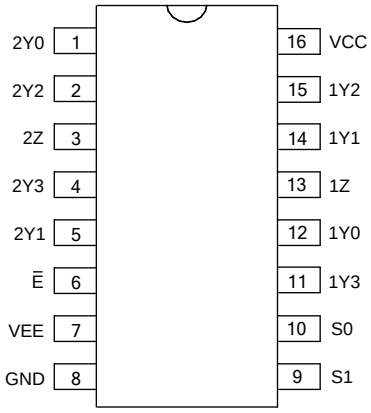
Pin Assignments

(Top View)



SOIC-16

(Top View)



DIP-16

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.

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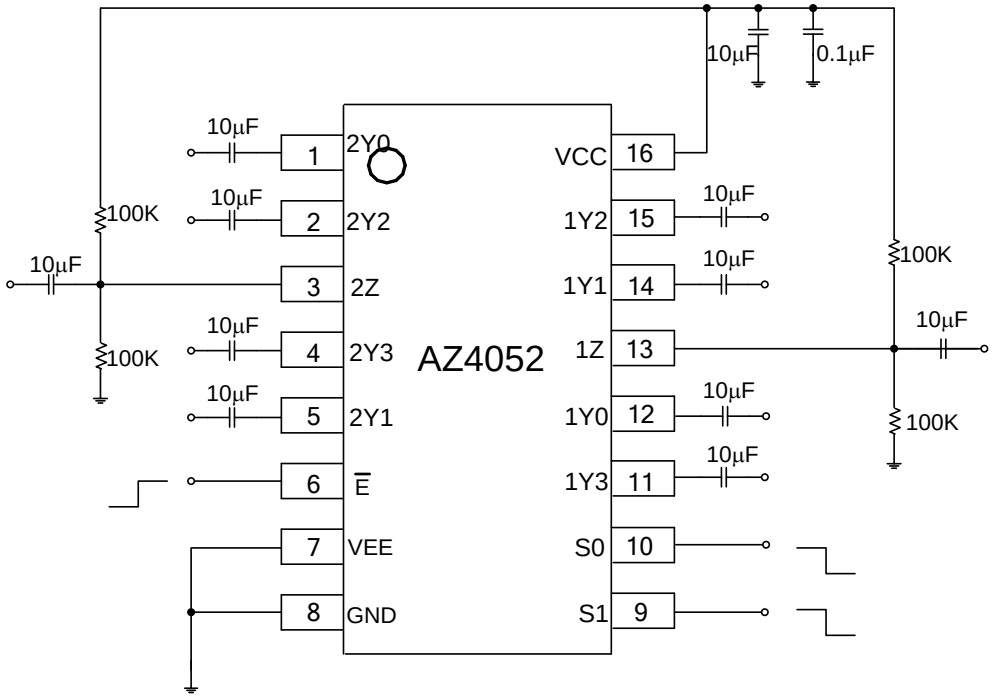
Typical Applications Circuit



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	$\overline{E}$	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

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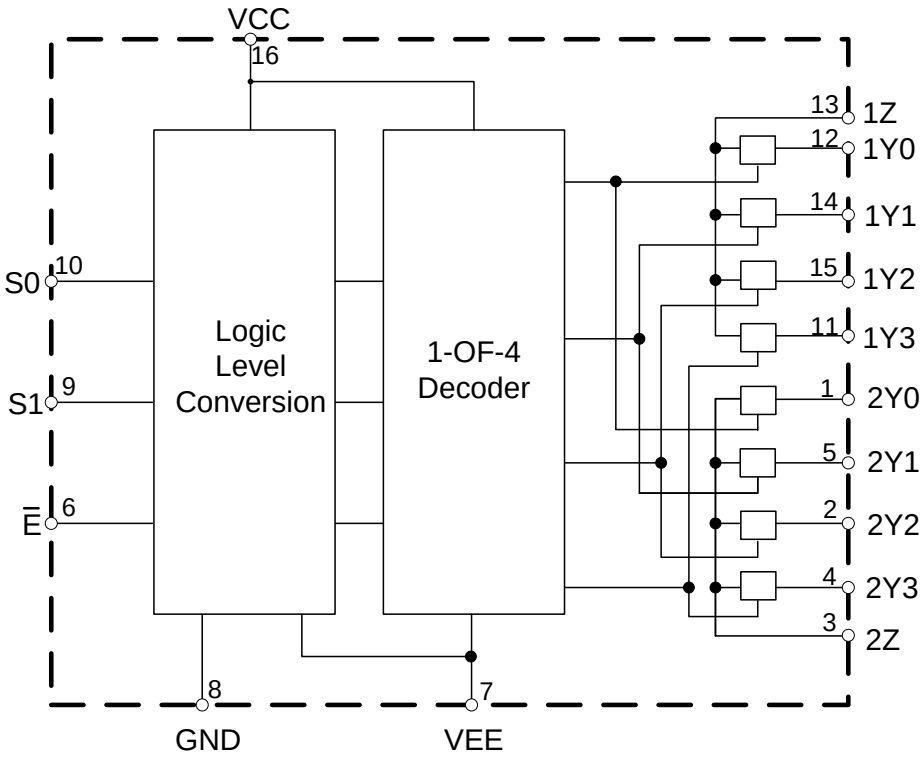
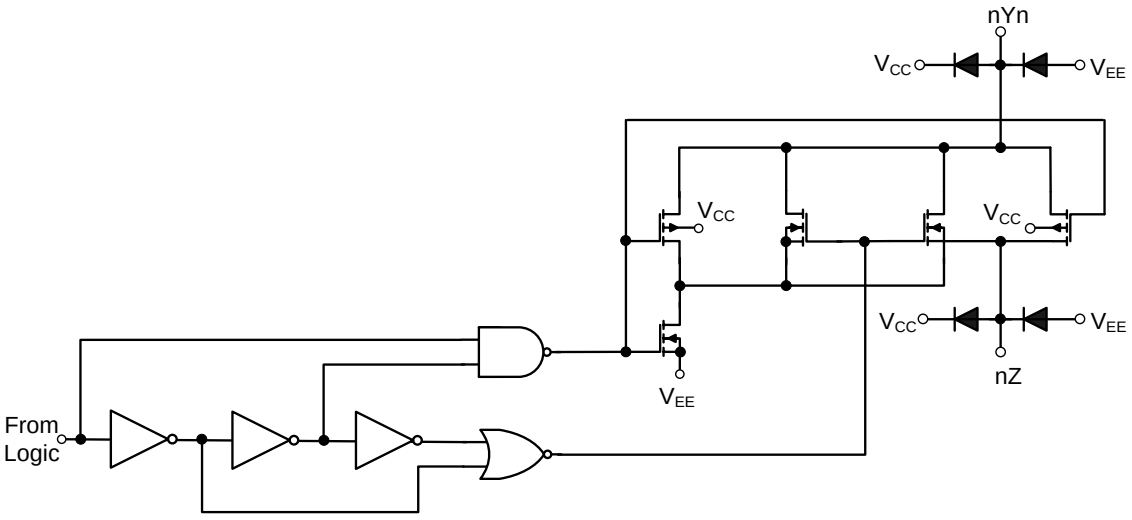
Functional Block Diagram



Schematic Diagram (One Switch)



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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°C to +85°C (Note 6)	500	mW
T_{STG}	Storage Temperature Range	–	-65 to +150	°C
T_J	Operating Junction Temperature Range	–	+150	°C
P_S	Power Dissipation Per Switch	–	100	mW
–	ESD (Machine Model)	–	100	V
–	ESD (Human Body Model)	–	1,000	V

Notes: 4. 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.

5. 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}.

6. Above +70ºC derate linearly with 12mW/K (DIP-16 package). Above +70ºC 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	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 5.0V	–	6.0	400	ns
		V_{CC} = 10V	–	6.0	250	

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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}, $\lvert V_S \rvert = V_{CC}-V_{EE}$ (Figure 1)	5.0	–	–	–	±1.0	μA
		Per Channel	10	0	–	–	±1.0	μA
		All Channels	10	0	–	–	±2.0	μA
I_S (On)	Analog Switch On-state Current	$V_I = V_{IH}$ or V_{IL}, $\lvert V_S \rvert = V_{CC}-V_{EE}$ (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.

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Electrical Characteristics (continued)

AC Characteristics

GND = 0V, $t_r = t_f = 6ns$, $C_L = 50pF$

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}	$R_L = \infty$ (Figure 20)	5.0	0	–	15	25	ns
			5.0	-5.0	–	12	25	ns
t_{PZH}/t_{PZL}	Turn-on Time $\overline{E}$, Sn to V_{OS}	$R_L = 1k\Omega$ (Figure 21 and 22)	5.0	0	–	38	81	ns
			5.0	-5.0	–	26	81	ns
t_{PHZ}/t_{PLZ}	Turn-off Time $\overline{E}$, Sn to V_{OS}	$R_L = 1k\Omega$ (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
$\alpha_{CT(S)}$	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, $\overline{E}$ or Sn, Square-wave Between V_{CC} and GND, $t_r = t_f$ = 6ns (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}

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Typical Test Circuit

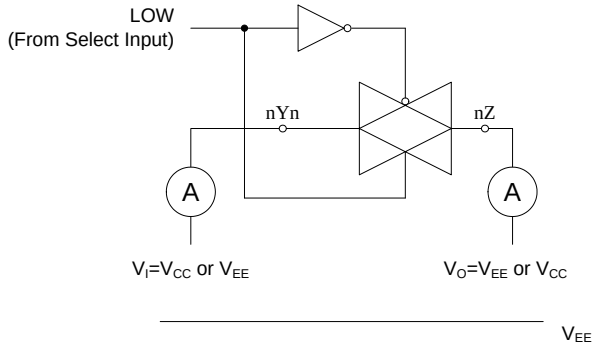


Figure 1. Test Circuit for Measuring OFF-state Current

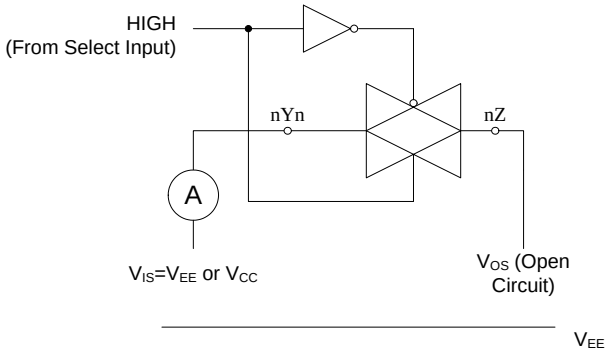


Figure 2. Test Circuit for Measuring ON-state Current

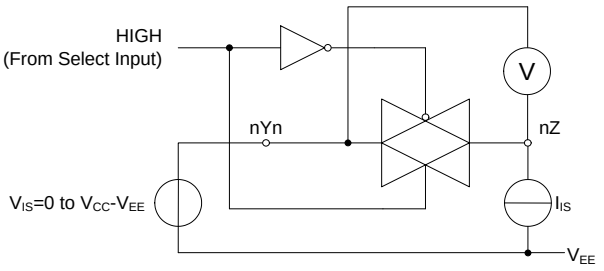


Figure 3. Test Circuit for Measuring R_{ON}

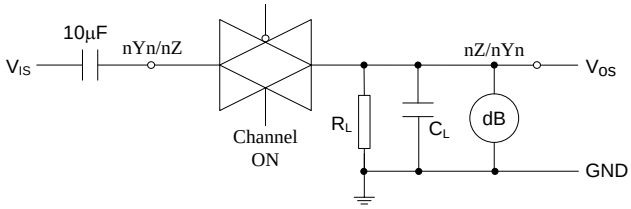
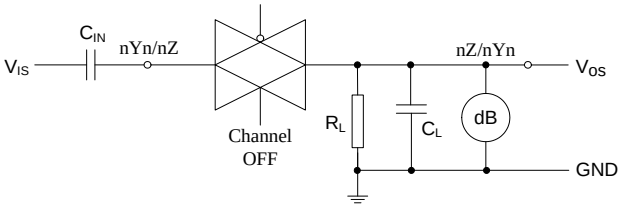
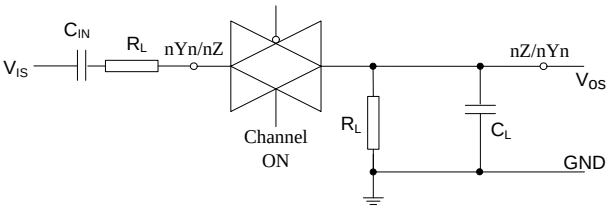
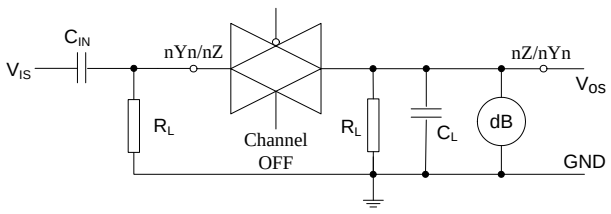


Figure 4. Test Circuit for Measuring Sine-wave Distortion and Minimum Frequency Response





(a) Channel ON Condition



(b) Channel OFF Condition

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

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

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Typical Test Circuit (continued)

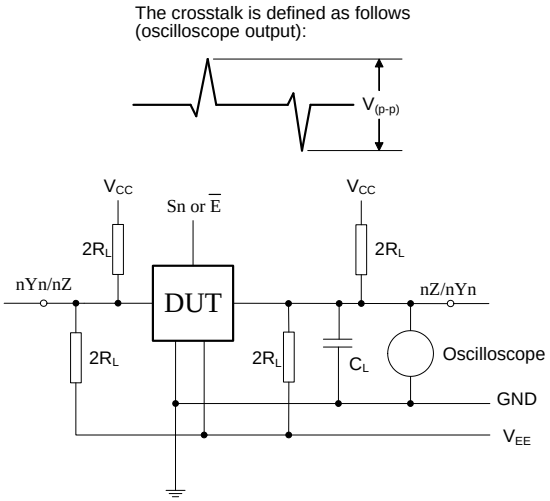

Figure 7. Test Circuit for Measuring Crosstalk Performance

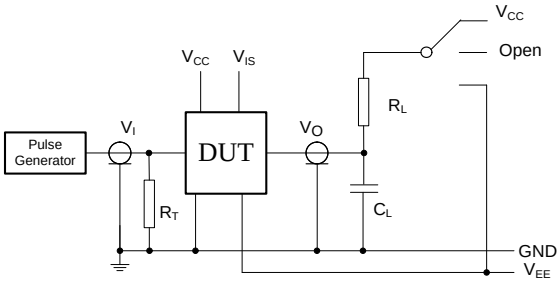

Figure 8. Test Circuit for Measuring AC between Control and Any Switch

Performance Characteristics

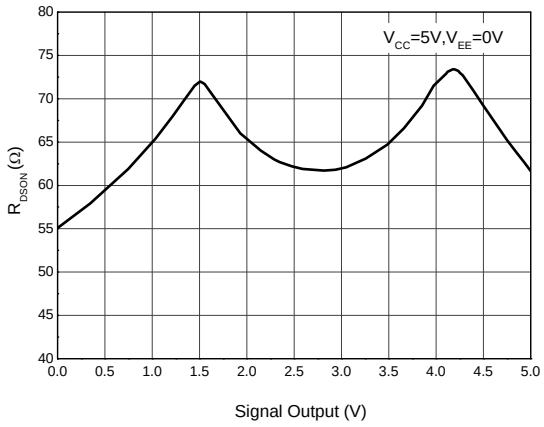

Figure 9. R_{DSON} vs. Signal Output

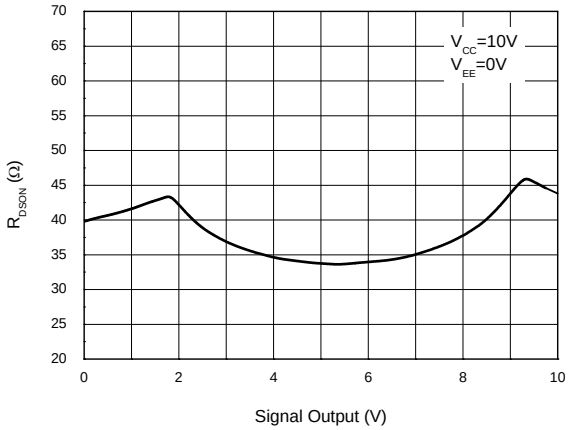

Figure 10. R_{DSON} vs. Signal Output

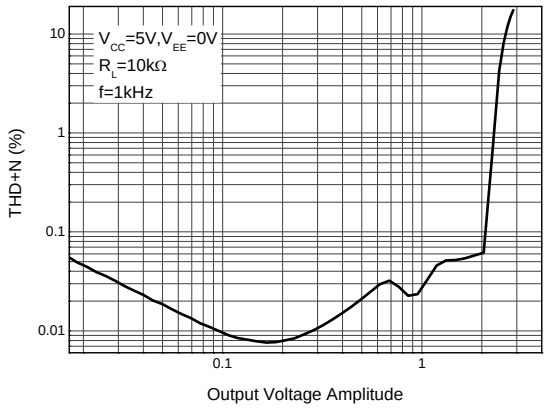

Figure 11. THD+N vs. Output Voltage Amplitude

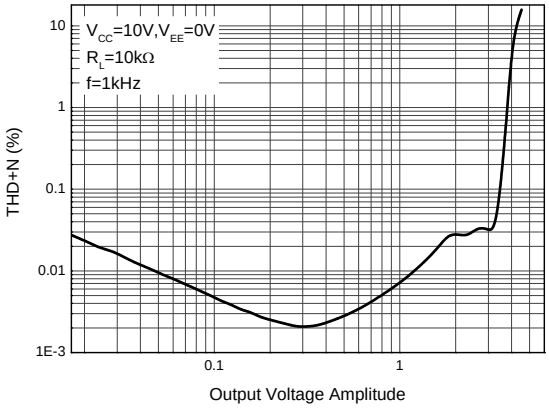

Figure 12. THD+N vs. Output Voltage Amplitude

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Performance Characteristics (continued)

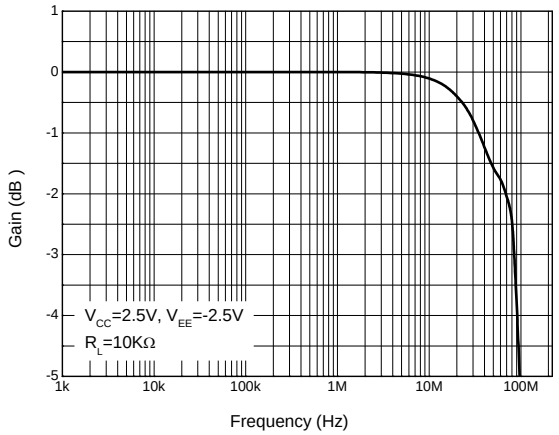

Figure 13. Frequency Response

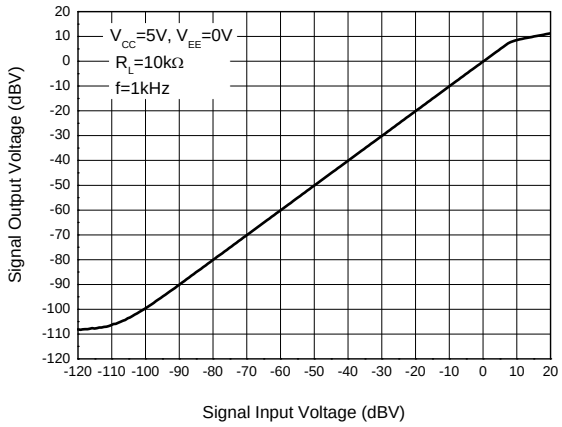

Figure 14. Linear Range

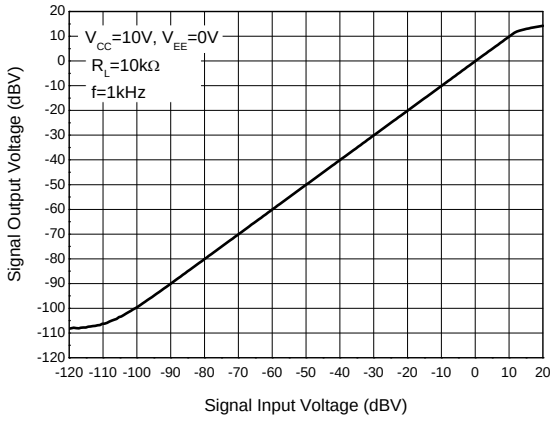

Figure 15. Linear Range

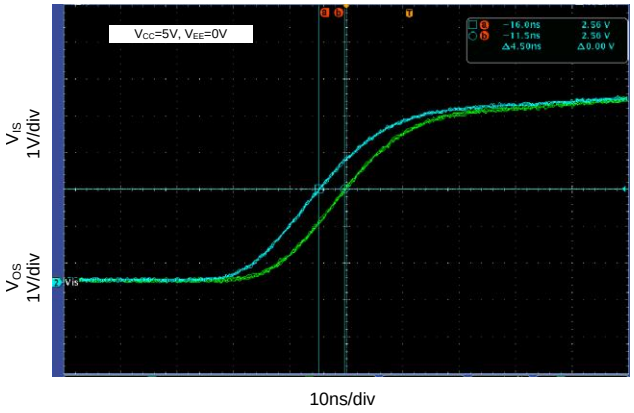

Figure 16. Propagation Delay

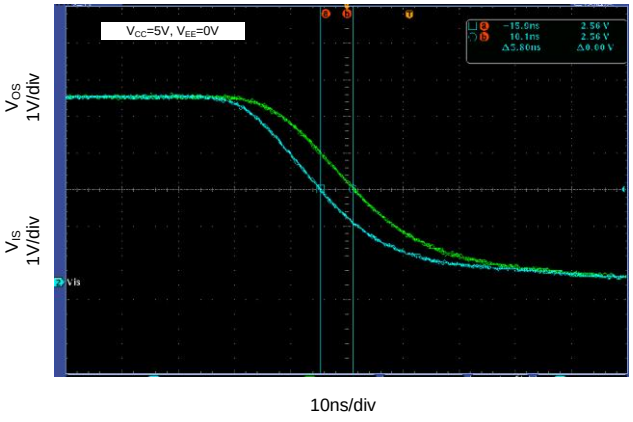

Figure 17. Propagation Delay

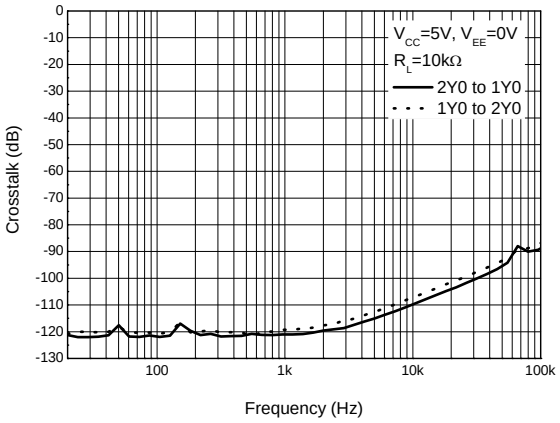

Figure 18. Crosstalk vs. Frequency

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Performance Characteristics (cont.)

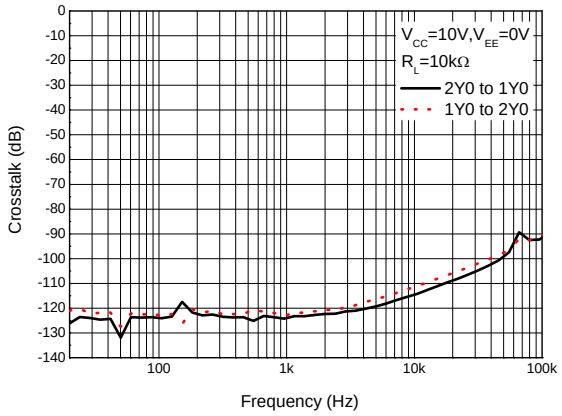

Figure 19. Crosstalk vs. Frequency

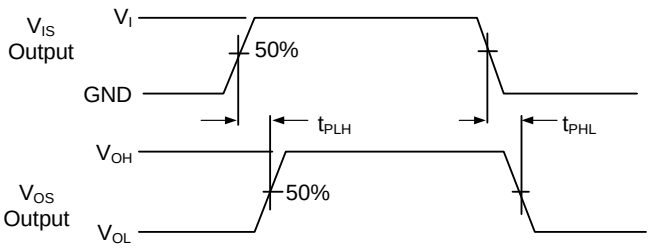

Figure 20. Waveforms Showing the Input (V_{IS}) to Output (V_{OS}) Propagation Delays

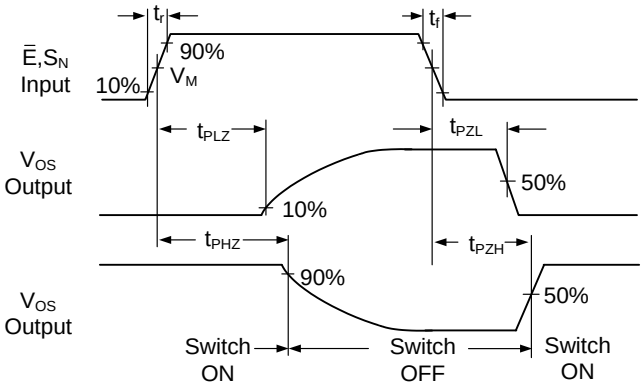

Figure 21. Waveforms Showing the Turn-on and Turn-off Times (V_M = 50%, V_I = GND to V_{CC})

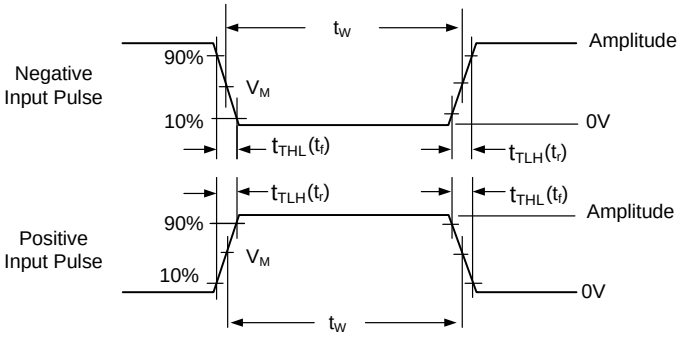

Figure 22. Input Pulse Definitions

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

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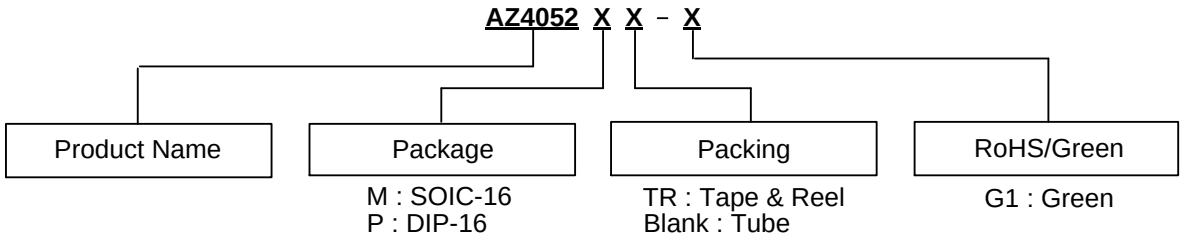
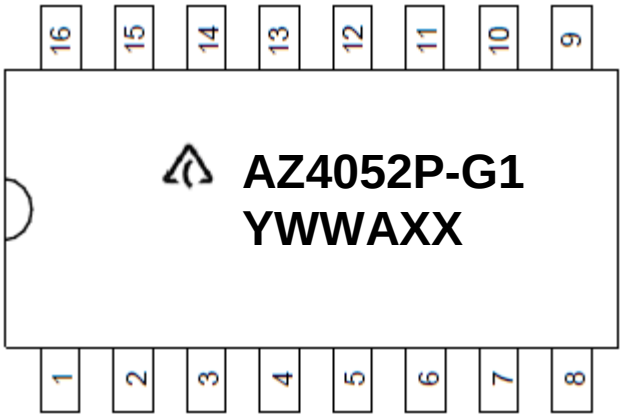
Ordering Information



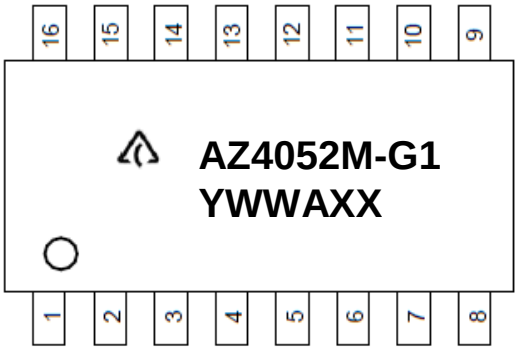
Package	Temperature Range	Part Number	Marking ID	Packing
SOIC-16	-40 to +85°C	AZ4052M-G1	AZ4052M-G1	25/Tube
		AZ4052MTR-G1	AZ4052M-G1	4,000/13"/ Tape & Reel
DIP-16	-40 to +85°C	AZ4052P-G1	AZ4052P-G1	25/Tube

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

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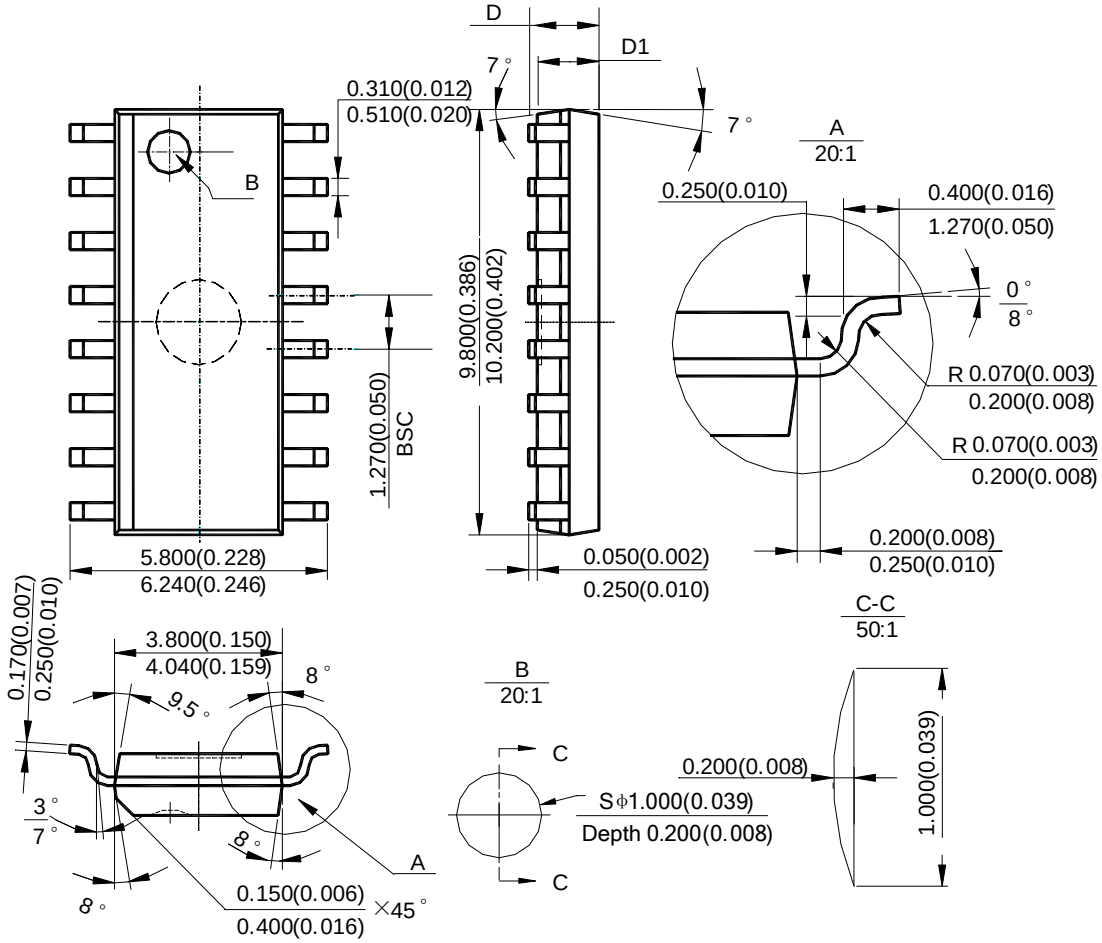
Package Outline Dimensions (All dimensions in mm(inch).)

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

(1) Package Type: SOIC-16



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

Symbol	D				D1			
	min(mm)	max(mm)	min(inch)	max(inch)	min(mm)	max(mm)	min(inch)	max(inch)
Option1	1.350	1.750	0.053	0.069	1.250	1.650	0.049	0.065
Option2	-	1.260	-	0.050	1.020	-	0.040	-

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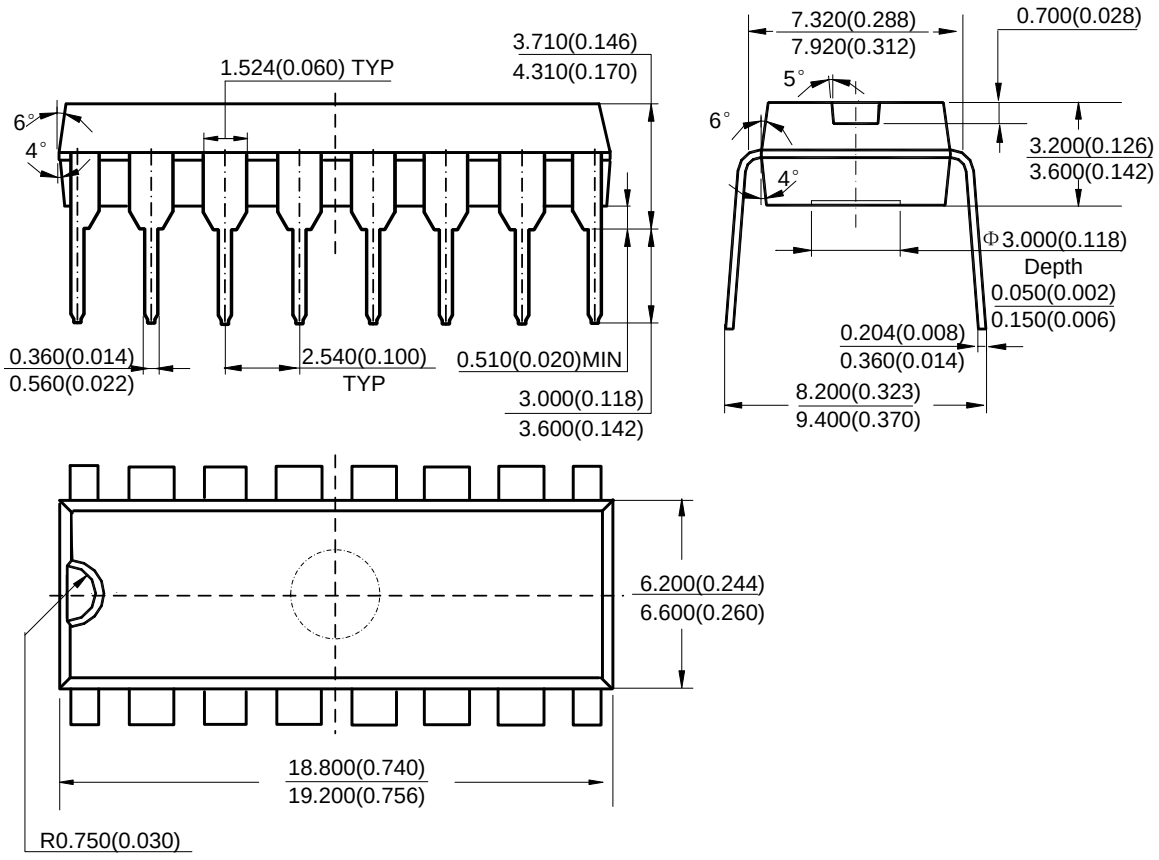
Package Outline Dimensions (continued… All dimensions in mm(inch).)

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

(2) Package Type: DIP-16



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

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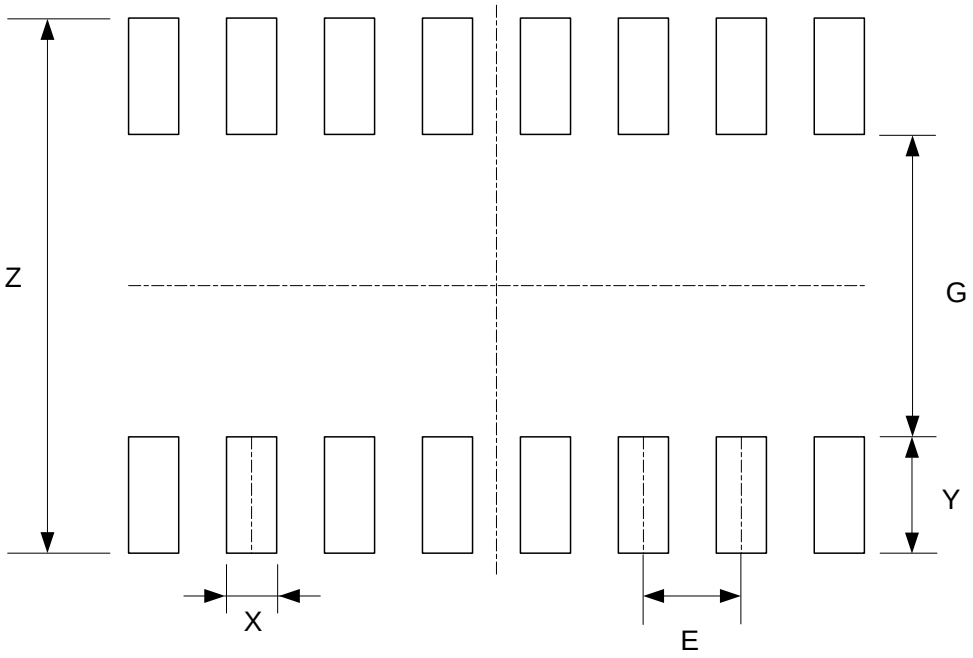
Suggested Pad Layout

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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