Quad Analog Switch/ Multiplexer/Demultiplexer

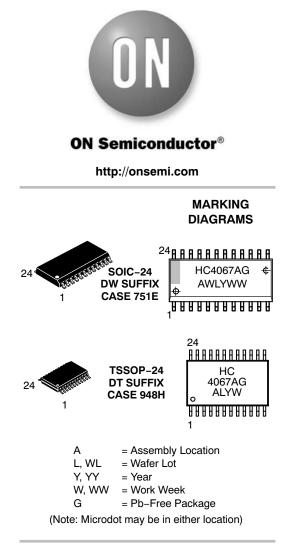
High-Performance Silicon-Gate CMOS

The MC74HC4067A utilizes silicon-gate CMOS technology to achieve fast propagation delays, low ON resistances, and low OFF-channel leakage current. This bilateral switch/ multiplexer/demultiplexer controls analog and digital voltages that may vary across the full power-supply range (from V_{CC} to GND).

The ON/OFF control inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs. For analog switches with voltage–level translators, see the HC4316A.

Features

- Fast Switching and Propagation Speeds
- High ON/OFF Output Voltage Ratio
- Low Crosstalk Between Switches
- Diode Protection on All Inputs/Outputs
- Wide Power–Supply Voltage Range (V_{CC} GND) = 2.0 to 6.0 V
- Analog Input Voltage Range (V_{CC} GND) = 0 to 6.0 V
- Improved Linearity and Lower ON Resistance over Input Voltage
- Low Noise
- These are Pb-Free Devices



ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

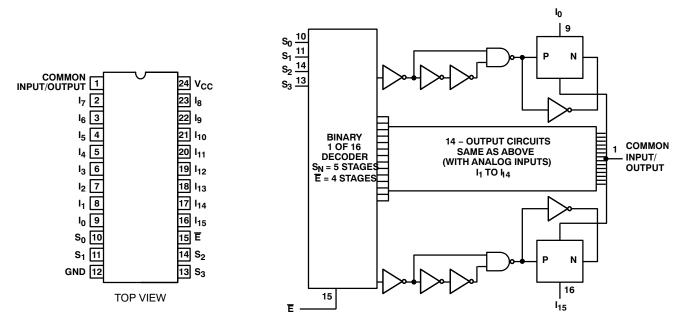


Figure 1. Pin Assignment

Figure 2. Function Diagram

S0	S1	S2	S3	Ē	SELECTED CHANNEL		
Х	Х	Х	Х	1	None		
0	0	0	0	0	0		
1	0	0	0	0	1		
0	1	0	0	0	2		
1	1	0	0	0	3		
0	0	1	0	0	4		
1	0	1	0	0	5		
0	1	1	0	0	6		
1	1	1	0	0	7		
0	0	0	1	0	8		
1	0	0	1	0	9		
0	1	0	1	0	10		
1	1	0	1	0	11		
0	0	1	1	0	12		
1	0	1	1	0	13		
0	1	1	1	0	14		
1	1	1	1	0	15		
1 1 1 1 1 0 15 H= High Level							

TRUTH TABLE

H= High Level

L= Low Level

X= Don't Care

MAXIMUM RATINGS

Symbol	P	Value	Unit	
V _{CC}	DC Supply Voltage		-0.5 to +7.0	V
VIS	Analog Input Voltage		–0.5 to V _{CC +} 0.5	V
V _{IN}	Digital Input Voltage		–0.5 to V _{CC +} 0.5	V
I _{IK}	Input Clamping Current	V_{IN} < -0.5 V or V_{IN} > V_{CC} + 0.5 V	±20	mA
I _{SK}	Switch Input Clamping Current	V_{IS} < –0.5 V or V_{IS} > V_{CC} $_{+}$ 0.5 V	±20	mA
I _{IS}	DC Switch Current		±25	mA
Ι _Ο	DC Output Source / Sink Current		±25	mA
I _{CC}	DC Supply Current per Supply Pin		±100	mA
I _{GND}	DC Ground Current per Ground Pin		±100	mA
T _{STG}	Storage Temperature Range		-65 to +150	°C
ΤL	Lead Temperature, 1 mm from Case for	or 10 Seconds	260	°C
TJ	Junction Temperature under Bias		+150	°C
θ_{JA}	Thermal Resistance	SOIC TSSOP	97 148	°C/W
PD	Power Dissipation in Still Air at 85°C	SOIC TSSOP	500 450	mW
MSL	Moisture Sensitivity		Level 1	
F _R	Flammability Rating	Oxygen Index: 30% – 35%	UL-94-VO (0.125 in)	
V _{ESD}	ESD Withstand Voltage	hstand Voltage Human Body Model (Note 1) Machine Model (Note 2)		
I _{Latchup}	Latchup Performance	Above V _{CC} and Below GND at 85°C (Note 3)	±100	mA

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability. 1. Tested to EIA/JESD22-A114-A.

2. Tested to EIA/JESD22-A115-A.

3. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Мах	Unit
V _{CC}	Positive DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V _{IS}	Analog Input Voltage (Referenced to GND)		GND	V _{CC}	V
V _{in}	Digital Input Voltage (Referenced to GND)	GND	V _{CC}	V	
V _{IO} *	Static or Dynamic Voltage Across Switch	-	1.2	V	
T _A	Operating Temperature, All Package Types	-55	+125	°C	
t _r , t _f	V _C V _C	_C = 2.0 V _C = 3.0 V _C = 4.5 V _C = 6.0 V	0 0 0 0	1000 600 500 400	ns

*For voltage drops across the switch greater than 1.2 V (switch on), excessive V_{CC} current may be drawn; i.e., the current out of the switch may contain both V_{CC} and switch input components. The reliability of the device will be unaffected unless the Maximum Ratings are exceeded.

		Conditions		Guaranteed Limit							
				25°C			-40 to 85°C		–55 to 125°C		1
Symbol	Parameter		V _{CC} (V)	Min	Тур	Max	Min	Max	Min	Max	Unit
V _{IH}	Minimum High-Level Input Voltage, Channel-Select or Enable Inputs		2.0 3.0 4.5 6.0	1.5 2.1 3.15 4.2			1.5 2.1 3.15 4.2			1.5 2.1 3.15 4.2	V
V _{IL}	Maximum Low-Level Input Voltage, Channel-Select or Enable Inputs		2.0 3.0 4.5 6.0			0.5 0.9 1.35 1.8		0.5 0.9 1.35 1.8		0.5 0.9 1.35 1.8	V
I _{IN}	Input Leakage Current, Control Inputs	V _{IN} = V _{CC} or GND	6.0			±0.1		±1.0		±1.0	μΑ
I _{CC}	Maximum Supply Current per Package		6.0			4.0		40		80	μA
R _{ON}	ON Resistance	$ I_O = 1 \text{ mA} $ $ V_{IN} = V_{CC} \text{ or GND}, $ $ V_{IS} = V_{CC} \text{ or GND} $	4.5 6.0		70 60	160 140		200 175		240 210	Ω
R _{ON(peak)}	ON Resistance (peak)	$I_{O} = 1 \text{ mA}$ $V_{IN} = V_{CC} \text{ to GND},$ $V_{IS} = V_{CC} \text{ to GND}$	4.5 6.0		90 80	180 160		225 200		270 240	Ω
ΔR_{on}	ON Resistance Mismatch Between Any 2 Switches		4.5 6.0		10 8.5						Ω
I _{OFF}	OFF-State Leakage Current, All Channels	SW OFF, V _{IS} = V _{CC} or GND	6.0			±0.8		±8		±8	μΑ
I _{ON}	ON-State Leakage Current	SW OFF, V _{IS} = V _{CC} or GND	6.0			±0.8		±8		±8	μΑ

AC CHARACTERISTICS (INPUT t_r , $t_f = 6 \text{ ns}$)

	Parameter					Guara	anteed I	imits			
		Conditions	Ver	25°C		–40 to 85°C		–55 to 125°C		1	
Symbol			V _{CC} (V)	Min	Тур	Max	Min	Max	Min	Max	Unit
t _{PLH} , t _{PHL}	Propagation Delay Switch In to Out	C _L = 50 pF	2.0 4.5 6.0			75 15 13		95 19 16		110 22 19	ns
		C _L = 15 pF	5.0		6.0						
t _{ON}	Switch Turn-ON Time										ns
	E to Out	C _L = 50 pF	2.0 4.5 6.0			275 55 47		345 69 59		415 83 71	
		C _L = 15 pF	5.0		23						
	SN to Out	C _L = 50 pF	2.0 4.5 6.0			300 60 51		375 75 64		450 90 76	
		C _L = 15 pF	5.0		25						
t _{OFF}	Switch Turn-OFF Time										ns
	E to Out	C _L = 50 pF	2.0 4.5 6.0			275 55 47		345 69 59		415 83 71	
		C _L = 15 pF	5.0		23						
	SN to Out	C _L = 50 pF	2.0 4.5 6.0			290 58 49		365 73 62		435 87 74	
		C _L = 15 pF	5.0		21						1
C _{in}	Input Capacitance, Control Pins				3.5	10		10		10	pF
C _{PD}	Power Dissipation Capacitance (Note 4)	C _L = 15 pF	5.0			29					pF

4. C_{PD} is used to determine the dynamic power consumption, per multivibrator.

ANALOG SWITCH CHANNEL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	Limit* 25°C	Unit
BW	Maximum On-Channel Bandwidth or Minimum Frequency Response	$ \begin{array}{l} f_{in} = 1 \mbox{ MHz Sine Wave} \\ \mbox{Adjust } f_{in} \mbox{ Voltage to Obtain 0 dBm at } V_{OS} \\ \mbox{Increase } f_{in} \mbox{ Frequency Until dB Meter Reads} - 3 \mbox{ dB} \\ R_L = 50 \Omega, C_L = 10 \mbox{ pF} \end{array} $	4.5	90	MHz
_	Off-Channel Feedthrough Isolation	$ \begin{array}{l} f_{in} \equiv \text{Sine Wave} \\ \text{Adjust } f_{in} \text{ Voltage to Obtain 0 dBm at } V_{IS} \\ f_{in} = 10 \text{ kHz}, \text{ R}_L = 600 \ \Omega, \text{ C}_L = 50 \text{ pF} \\ f_{in} = 1.0 \text{ MHz}, \text{ R}_L = 50 \ \Omega, \text{ C}_L = 10 \text{ pF} \end{array} $	4.5 4.5	-65 -75	dB
-	Feedthrough Noise Ē, Sn to Switch	$ \begin{array}{l} V_{in} \leq 1 \text{ MHz Square Wave } (t_r = t_f = 6 \text{ ns}) \\ \text{Adjust } R_L \text{ at Setup so that } I_S = 0 \text{ A} \\ R_L = 600 \ \Omega, \ C_L = 50 \ \text{pF} \\ R_L = 10 \ \text{k}\Omega, \ C_L = 10 \ \text{pF} \end{array} $	4.5 4.5	60 30	mV _{PP}
-	Crosstalk Between Any Two Switches	$ \begin{array}{l} f_{in} \equiv \text{Sine Wave} \\ \text{Adjust } f_{in} \text{ Voltage to Obtain 0 dBm at } V_{IS} \\ f_{in} = 10 \text{ kHz}, \text{ R}_L = 600 \ \Omega, \text{ C}_L = 50 \text{ pF} \\ f_{in} = 1.0 \text{ MHz}, \text{ R}_L = 50 \ \Omega, \text{ C}_L = 10 \text{ pF} \end{array} $	4.5 4.5	70 80	dB
THD	Total Harmonic Distortion	$ \begin{array}{l} f_{in} = 1 \text{ kHz}, \text{R}_{L} = 10 \text{k}\Omega, \text{C}_{L} = 50 \text{pF} \\ \text{THD} = \text{THD}_{Measured} - \text{THD}_{Source} \\ \text{V}_{IS} = 4.0 \text{V}_{PP} \text{ sine wave} \end{array} $	4.5	0.04	%
CS	Switch Input Capacitance			5	pF
C _{COM}	Switch Common Capacitance			45	pF

*Limits not tested. Determined by design and verified by qualification.

TYPICAL CHARACTERISTICS

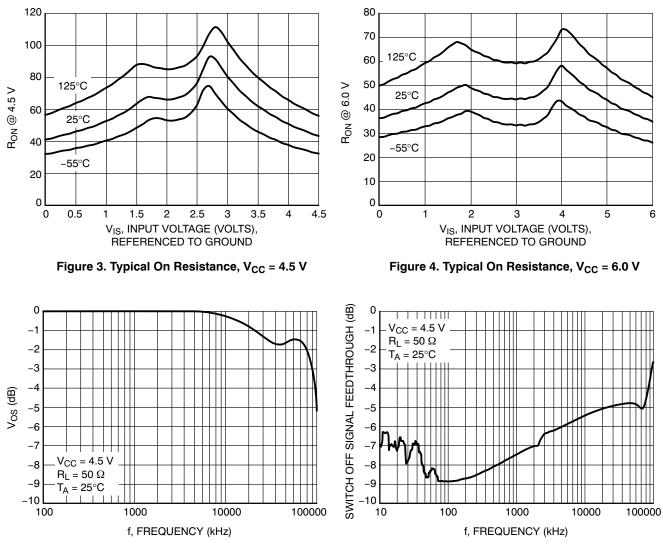
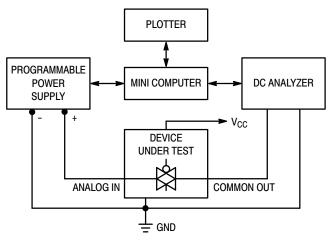


Figure 5. Typical Switch Frequency Response

Figure 6. Typical Switch OFF Signal Feedthrough vs Frequency





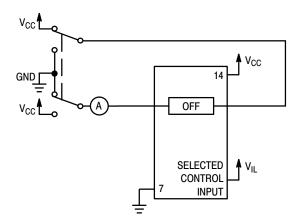
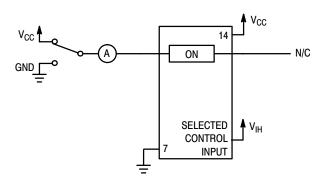
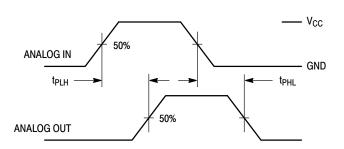


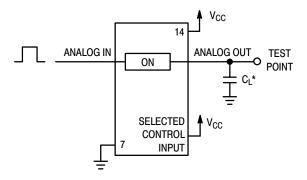
Figure 8. OFF Channel Leakage Current Test Setup, Any One Channel











*Includes all probe and jig capacitance.



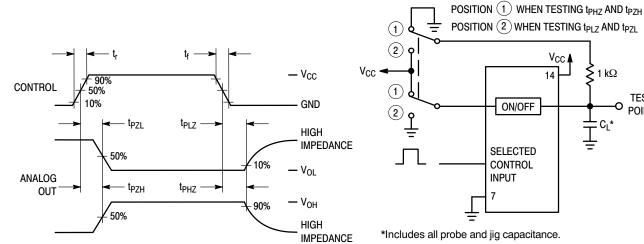


Figure 12. Turn-ON / Turn-OFF Times





TEST

0 POINT

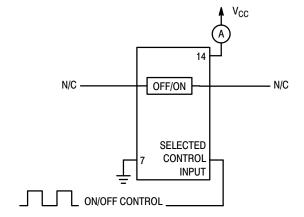
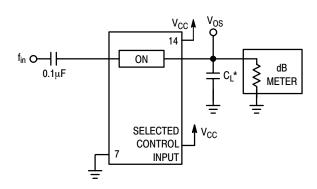
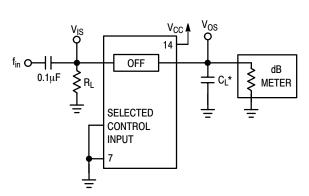


Figure 14. Power Dissipation Capacitance **Test Setup**



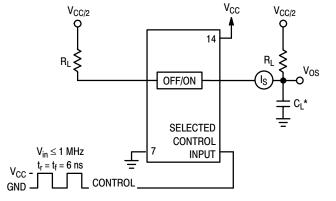
*Includes all probe and jig capacitance.

Figure 15. ON Channel Bandwidth Test Setup



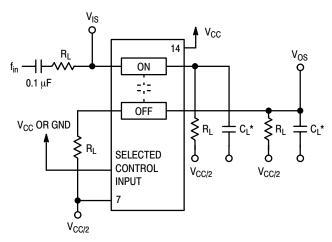
*Includes all probe and jig capacitance.

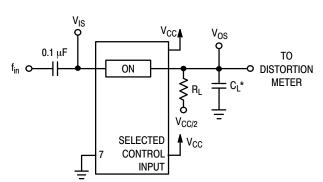




*Includes all probe and jig capacitance.

Figure 17. Feedthrough Noise Test Setup





*Includes all probe and jig capacitance.

Figure 18. Crosstalk Between Any Two Switches Test Setup *Includes all probe and jig capacitance.

Figure 19. Total Harmonic Distortion Test Setup

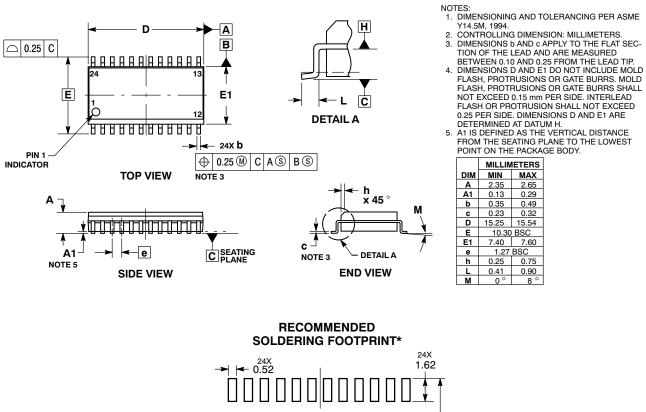
ORDERING INFORMATION

Device	Package	Shipping [†]
MC74HC4067ADWG	SOIC-24 (Pb-Free)	30 Units / Tube
MC74HC4067ADWR2G	SOIC-24 (Pb-Free)	1000 / Tape & Reel
MC74HC4067ADTG	TSSOP-24 (Pb-Free)	62 Units / Tube
MC74HC4067ADTR2G	TSSOP-24 (Pb-Free)	2500 / Tape & Reel

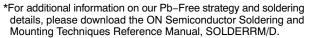
+For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

SOIC-24 WB CASE 751E-04 ISSUE F

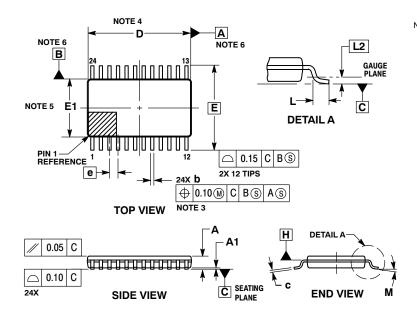


1 .27 PITCH DIMENSIONS: MILLIMETERS



PACKAGE DIMENSIONS

TSSOP24 7.8x4.4, 0.65P CASE 948H ISSUE B



NOTES

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1. . 1994.
- 2. CONTROLLING DIMENSION: MILLIMETERS. 3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL BE 0.08 MAX AT MMC. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.
- 4. DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION D IS DETERMINED AT DATUM PLANE H. 5. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR 5 PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE, DIMENSION E1 IS DETERMINED AT DATUM PLANE H.
- DATUMS A AND B ARE DETERMINED AT DATUM PLANE H. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE 6. ANE TO THE LOWEST POINT ON THE PACKAGE

BODY	MILLIMETERS				
DIM	MIN	MAX			
Α		1.20			
A1	0.05	0.15			
b	0.19	0.30			
C	0.09	0.20			
D	7.70	7.90			
E	6.40	BSC			
E1	4.30	4.50			
е	0.65	BSC			
L	0.50	0.75			
L2	0.25	BSC			
M	0°	8°			

RECOMMENDED SOLDERING FOOTPRINT 24X 0.42-> < 24X 1.15 6.70 DIMENSIONS: MILLIMETERS

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