

MC74LVXT4066

Quad Analog Switch/ Multiplexer/Demultiplexer

High-Performance Silicon-Gate CMOS

The MC74LVXT4066 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 LVXT4066 is identical in pinout to the metal-gate CMOS MC14066 and the high-speed CMOS HC4066A. Each device has four independent switches. The device has been designed so that the ON resistances (R_{ON}) are much more linear over input voltage than R_{ON} of metal-gate CMOS analog switches.

The ON/OFF control inputs are compatible with standard LSTTL outputs. The input protection circuitry on this device allows overvoltage tolerance on the ON/OFF control inputs, allowing the device to be used as a logic-level translator from 3.0 V CMOS logic to 5.0 V CMOS Logic or from 1.8 V CMOS logic to 3.0 V CMOS Logic while operating at the higher-voltage power supply.

The MC74LVXT4066 input structure provides protection when voltages up to 7.0 V are applied, regardless of the supply voltage. This allows the MC74LVXT4066 to be used to interface 5.0 V circuits to 3.0 V circuits.

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 ($V_{CC} - GND$) = 2.0 to 6.0 V
- Improved Linearity and Lower ON Resistance over Input Voltage than the MC14016 or MC14066
- Low Noise
- These Devices are Pb-Free and are RoHS Compliant



ON Semiconductor®

www.onsemi.com

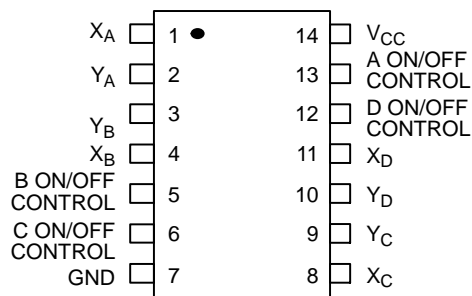


SOIC-14 NB
D SUFFIX
CASE 751A



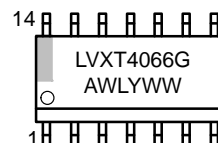
TSSOP-14
DT SUFFIX
CASE 948G

PIN ASSIGNMENT

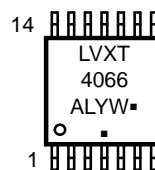


(Top View)

MARKING DIAGRAMS



SOIC-14 NB



TSSOP-14

LVXT4066 = Specific Device Code
A = Assembly Location
WL, L = Wafer Lot
Y = Year
WW, W = Work Week
G or ■ = Pb-Free Package

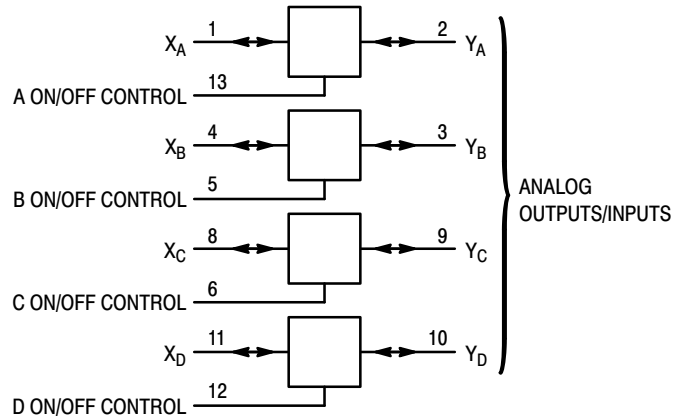
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 9 of this data sheet.

MC74LVXT4066

LOGIC DIAGRAM



ANALOG INPUTS/OUTPUTS = X_A , X_B , X_C , X_D

PIN 14 = V_{CC}

PIN 7 = GND

FUNCTION TABLE

On/Off Control Input	State of Analog Switch
L	Off
H	On

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Positive DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V_{IS}	Analog Input Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
V_{in}	Digital Input Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
I	DC Current Into or Out of Any Pin	-20	mA
P_D	Power Dissipation in Still Air, SOIC Package† TSSOP Package†	500 450	mW
T_{stg}	Storage Temperature	-65 to +150	°C
T_L		260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

†Derating: SOIC Package: -7 mW/°C from 65° to 125°C

TSSOP Package: -6.1 mW/°C from 65° to 125°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open. I/O pins must be connected to a properly terminated line or bus.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Positive DC Supply Voltage (Referenced to GND)	2.0	5.5	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	+85	°C
t_r, t_f	Input Rise and Fall Time, ON/OFF Control Inputs (Figure 10)	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$		ns/V
		0	100 20	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

*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.

MC74LVXT4066

DC ELECTRICAL CHARACTERISTIC – Digital Section (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				–55 to 25°C	≤ 85°C	≤ 125°C	
V _{IH}	Minimum High–Level Voltage ON/OFF Control Inputs (Note 1)	R _{on} = Per Spec	3.0	1.2	1.2	1.2	V
			4.5	2.0	2.0	2.0	
			5.5	2.0	2.0	2.0	
V _{IL}	Maximum Low–Level Voltage ON/OFF Control Inputs (Note 1)	R _{on} = Per Spec	3.0	0.53	0.53	0.53	V
			4.5	0.8	0.8	0.8	
			5.5	0.8	0.8	0.8	
I _{in}	Maximum Input Leakage Current ON/OFF Control Inputs	V _{in} = V _{CC} or GND	5.5	±0.1	±1.0	±1.0	μA
I _{CC}	Maximum Quiescent Supply Current (per Package)	V _{in} = V _{CC} or GND V _{IO} = 0 V	5.5	4.0	40	160	μA

1. Specifications are for design target only. Not final specification limits.

DC ELECTRICAL CHARACTERISTICS – Analog Section (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				–55 to 25°C	≤ 85°C	≤ 125°C	
R _{on}	Maximum “ON” Resistance	V _{in} = V _{IH} V _{IS} = V _{CC} to GND I _S ≤ 2.0 mA (Figures 1, 2)	2.0†	–	–	–	Ω
			3.0	40	45	50	
			4.5	25	28	35	
			5.5	20	25	30	
		V _{in} = V _{IH} V _{IS} = V _{CC} or GND (Endpoints) I _S ≤ 2.0 mA (Figures 1, 2)	2.0	–	–	–	
			3.0	30	35	40	
			4.5	25	28	35	
			5.5	20	25	30	
ΔR _{on}	Maximum Difference in “ON” Resistance Between Any Two Channels in the Same Package	V _{in} = V _{IH} V _{IS} = 1/2 (V _{CC} – GND) I _S ≤ 2.0 mA	3.0	15	20	25	Ω
			4.5	10	12	15	
			5.5	10	12	15	
I _{off}	Maximum Off–Channel Leakage Current, Any One Channel	V _{in} = V _{IL} V _{IO} = V _{CC} or GND Switch Off (Figure 3)	5.5	0.1	0.5	1.0	μA
I _{on}	Maximum On–Channel Leakage Current, Any One Channel	V _{in} = V _{IH} V _{IS} = V _{CC} or GND (Figure 4)	5.5	0.1	0.5	1.0	μA

†At supply voltage (V_{CC}) approaching 2 V the analog switch–on resistance becomes extremely non–linear. Therefore, for low–voltage operation, it is recommended that these devices only be used to control digital signals.

MC74LVXT4066

AC ELECTRICAL CHARACTERISTICS ($C_L = 50 \text{ pF}$, ON/OFF Control Inputs: $t_r = t_f = 6 \text{ ns}$)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			−55 to 25 °C	≤ 85 °C	≤ 125 °C	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, Analog Input to Analog Output (Figures 8 and 9)	2.0	4.0	6.0	8.0	ns
		3.0	3.0	5.0	6.0	
		4.5	1.0	2.0	2.0	
		5.5	1.0	2.0	2.0	
t _{PLZ} , t _{PHZ}	Maximum Propagation Delay, ON/OFF Control to Analog Output (Figures 10 and 11)	2.0	30	35	40	ns
		3.0	20	25	30	
		4.5	15	18	22	
		5.5	15	18	20	
t _{PZL} , t _{PZH}	Maximum Propagation Delay, ON/OFF Control to Analog Output (Figures 10 and 1 1)	2.0	20	25	30	ns
		3.0	12	14	15	
		4.5	8.0	10	12	
		5.5	8.0	10	12	
C	Maximum Capacitance ON/OFF Control Input Control Input = GND Analog I/O Feedthrough	–	10	10	10	pF
		–	35	35	35	
		–	1.0	1.0	1.0	
C _{PD}	Power Dissipation Capacitance (Per Switch) (Figure 13)*	Typical @ 25°C, V _{CC} = 5.0 V				pF
		15				

*Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

ADDITIONAL APPLICATION CHARACTERISTICS (Voltages Referenced to GND Unless Noted)

Symbol	Parameter	Test Conditions	V _{CC} V	Limit* 25°C	Unit
BW	Maximum On-Channel Bandwidth or Minimum Frequency Response (Figure 5)	f _{in} = 1 MHz Sine Wave Adjust f _{in} Voltage to Obtain 0 dBm at V _{OS} Increase f _{in} Frequency Until dB Meter Reads -3 dB R _L = 50 Ω, C _L = 10 pF	4.5 5.5	150 160	MHz
–	Off-Channel Feedthrough Isolation (Figure 6)	f _{in} ≡ Sine Wave Adjust f _{in} Voltage to Obtain 0 dBm at V _{IS} f _{in} = 10 kHz, R _L = 600 Ω, C _L = 50 pF f _{in} = 1.0 MHz, R _L = 50 Ω, C _L = 10 pF	4.5 5.5 4.5 5.5	-50 -50 -37 -37	dB
–	Feedthrough Noise, Control to Switch (Figure 7)	V _{in} ≤ 1 MHz Square Wave (t _r = t _f = 3 ns) Adjust R _L at Setup so that I _S = 0 A R _L = 600 Ω, C _L = 50 pF R _L = 10 kΩ, C _L = 10 pF	4.5 5.5 4.5 5.5	100 200 50 100	mV _{PP}
–	Crosstalk Between Any Two Switches (Figure 12)	f _{in} ≡ Sine Wave Adjust f _{in} Voltage to Obtain 0 dBm at V _{IS} f _{in} = 10 kHz, R _L = 600 Ω, C _L = 50 pF f _{in} = 1.0 MHz, R _L = 50 Ω, C _L = 10 pF	4.5 5.5 4.5 5.5	-70 -70 -80 -80	dB
THD	Total Harmonic Distortion (Figure 14)	f _{in} = 1 kHz, R _L = 10 kΩ, C _L = 50 pF THD = THD _{Measured} - THD _{Source} V _{IS} = 4.0 V _{PP} sine wave V _{IS} = 5.0 V _{PP} sine wave	4.5 5.5	0.10 0.06	%

*Guaranteed limits not tested. Determined by design and verified by qualification.

MC74LVXT4066

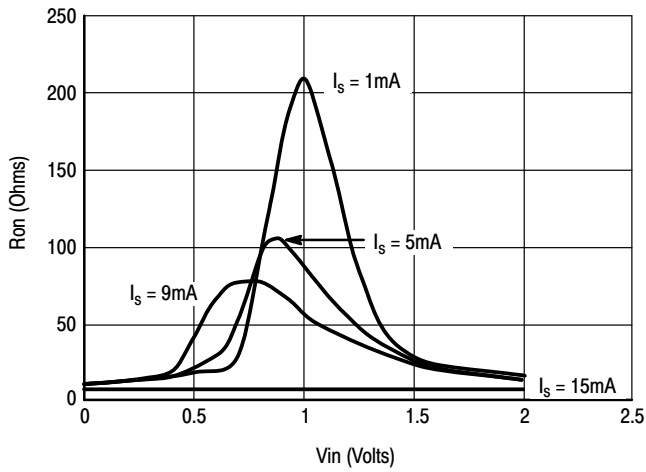


Figure 1a. Typical On Resistance, $V_{CC} = 2.0\text{ V}$, $T = 25^\circ\text{C}$

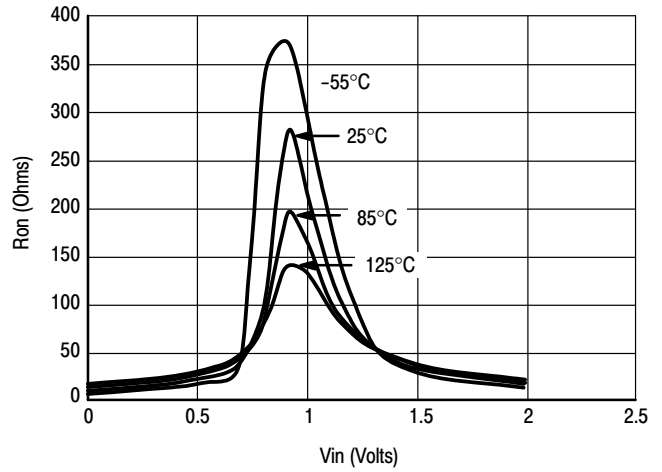


Figure 1b. Typical On Resistance, $V_{CC} = 2.0\text{ V}$

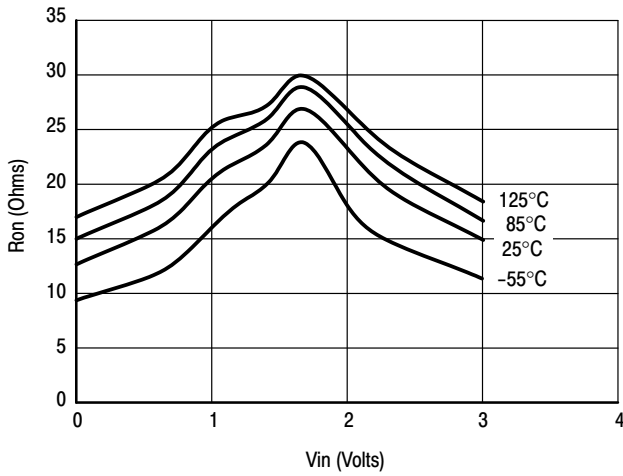


Figure 1c. Typical On Resistance, $V_{CC} = 3.0\text{ V}$

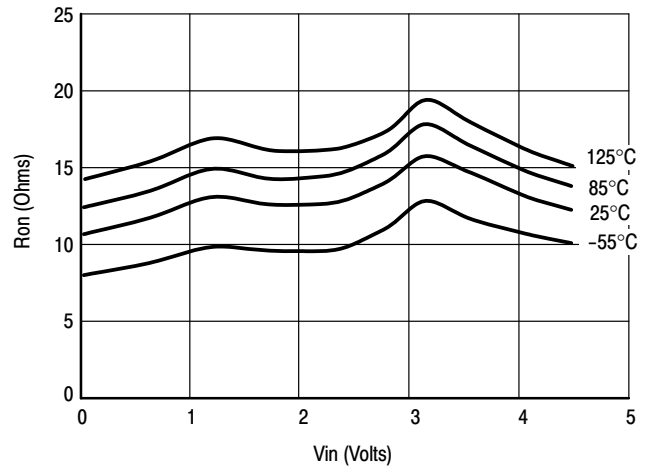


Figure 1d. Typical On Resistance, $V_{CC} = 4.5\text{ V}$

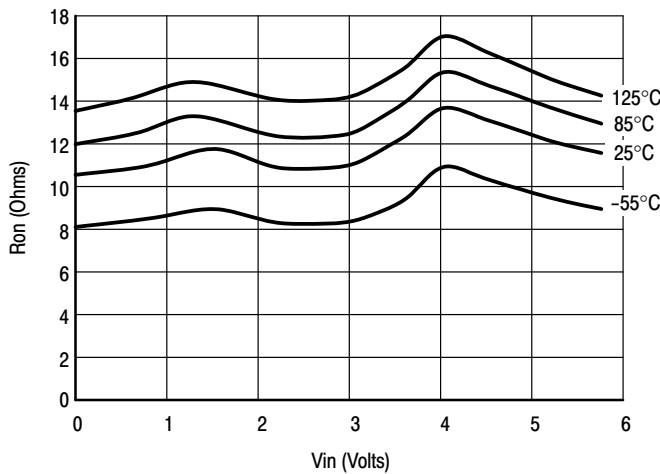


Figure 1e. Typical On Resistance, $V_{CC} = 5.5\text{ V}$

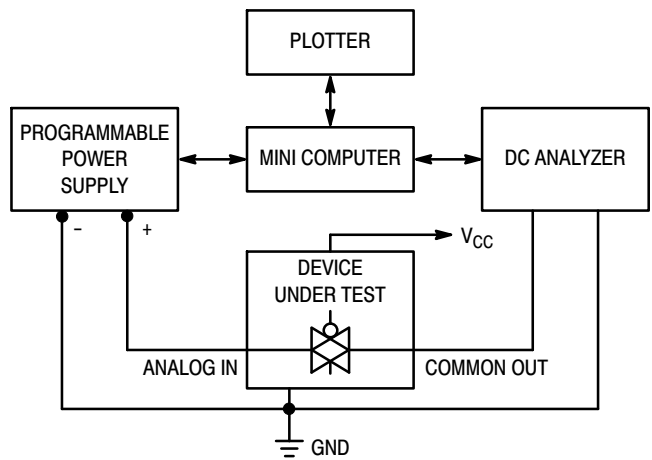


Figure 2. On Resistance Test Set-Up

MC74LVXT4066

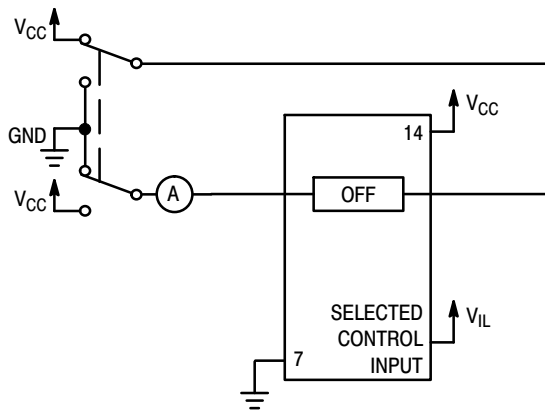


Figure 3. Maximum Off Channel Leakage Current, Any One Channel, Test Set-Up

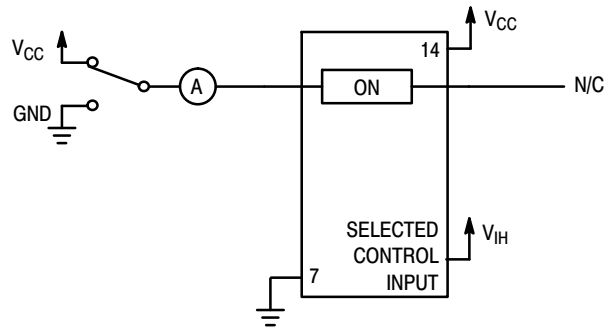
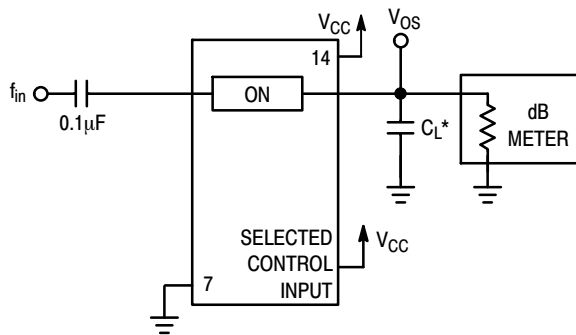
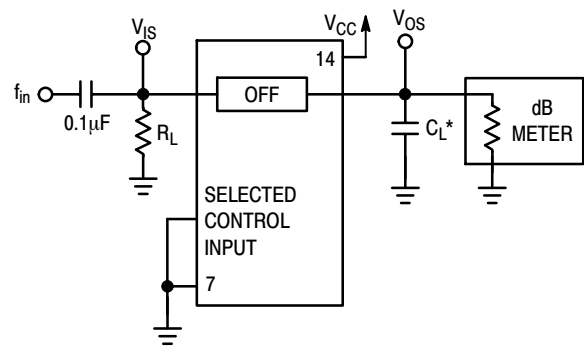


Figure 4. Maximum On Channel Leakage Current, Test Set-Up



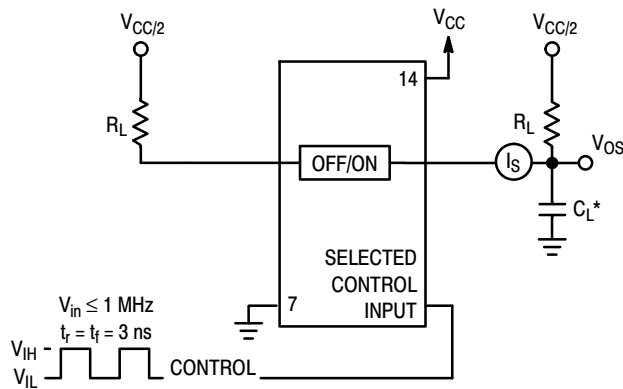
*Includes all probe and jig capacitance.

Figure 5. Maximum On-Channel Bandwidth Test Set-Up



*Includes all probe and jig capacitance.

Figure 6. Off-Channel Feedthrough Isolation, Test Set-Up



*Includes all probe and jig capacitance.

Figure 7. Feedthrough Noise, ON/OFF Control to Analog Out, Test Set-Up

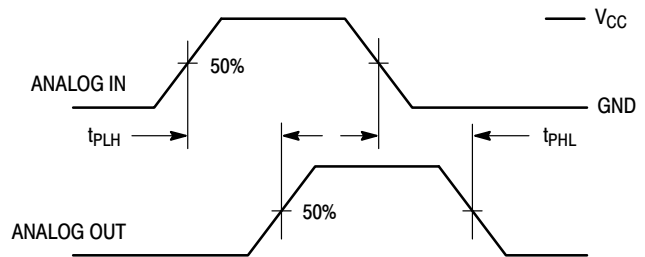
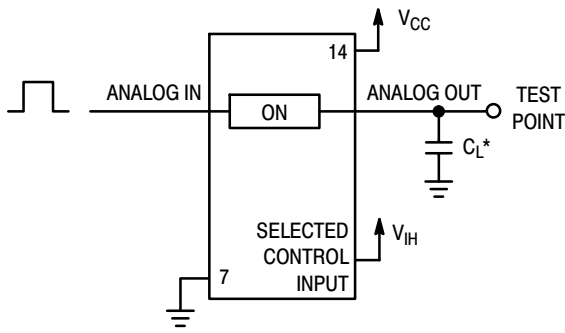


Figure 8. Propagation Delays, Analog In to Analog Out

MC74LVXT4066



*Includes all probe and jig capacitance.

Figure 9. Propagation Delay Test Set-Up

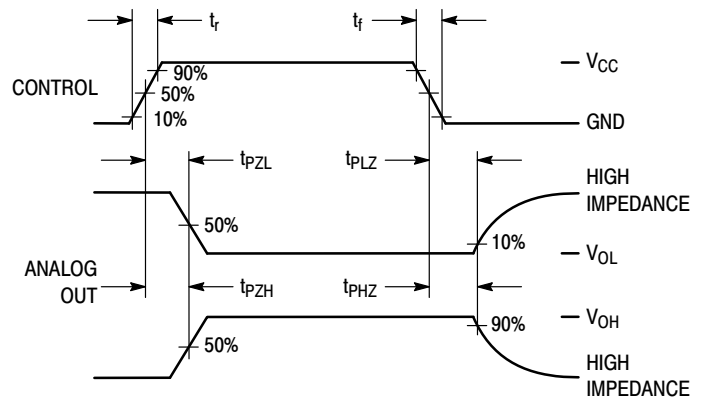
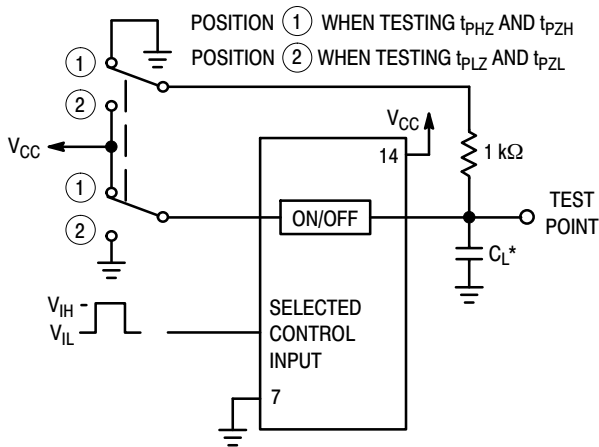
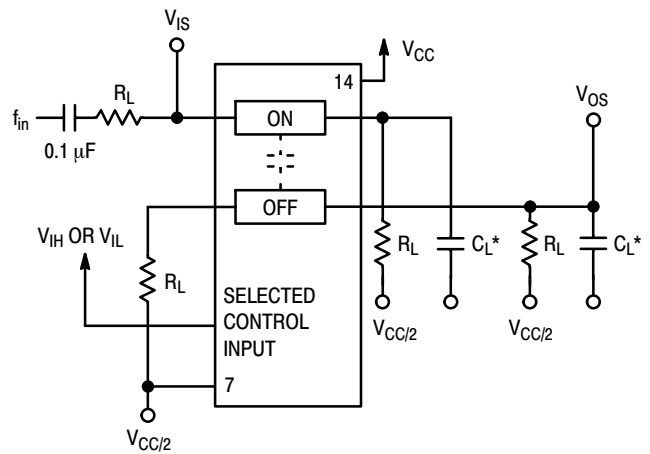


Figure 10. Propagation Delay, ON/OFF Control to Analog Out



*Includes all probe and jig capacitance.

Figure 11. Propagation Delay Test Set-Up



*Includes all probe and jig capacitance.

Figure 12. Crosstalk Between Any Two Switches, Test Set-Up

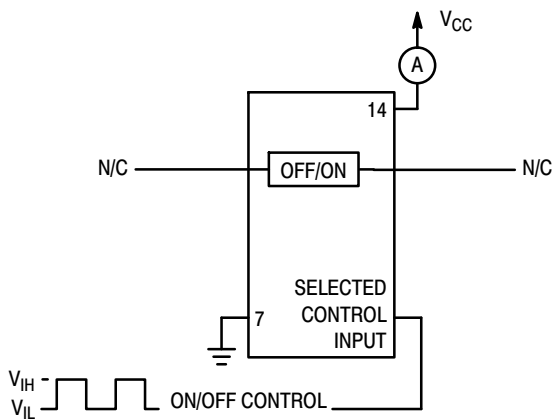
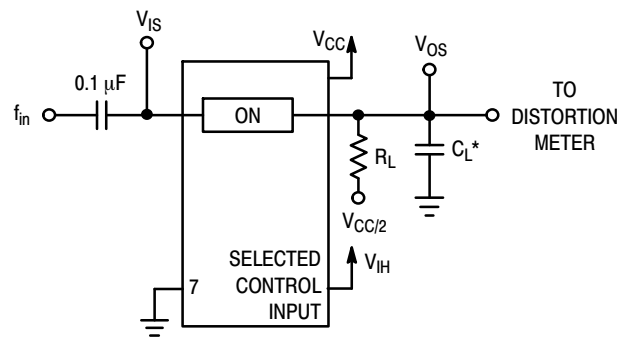


Figure 13. Power Dissipation Capacitance Test Set-Up



*Includes all probe and jig capacitance.

Figure 14. Total Harmonic Distortion, Test Set-Up

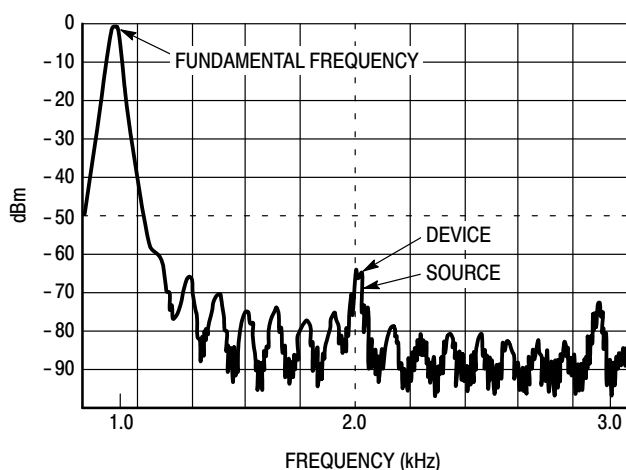


Figure 15. Plot, Harmonic Distortion

APPLICATION INFORMATION

The ON/OFF Control pins should be at V_{IH} or V_{IL} logic levels, V_{IH} being recognized as logic high and V_{IL} being recognized as a logic low. Unused analog inputs/outputs may be left floating (not connected). However, it is advisable to tie unused analog inputs and outputs to V_{CC} or GND through a low value resistor. This minimizes crosstalk and feedthrough noise that may be picked-up by the unused I/O pins.

The maximum analog voltage swings are determined by the supply voltages V_{CC} and GND. The positive peak analog voltage should not exceed V_{CC} . Similarly, the negative peak analog voltage should not go below GND. In the example below, the difference between V_{CC} and GND is six volts.

Therefore, using the configuration in Figure 16, a maximum analog signal of six volts peak-to-peak can be controlled.

When voltage transients above V_{CC} and/or below GND are anticipated on the analog channels, external diodes (D_x) are recommended as shown in Figure 17. These diodes should be small signal, fast turn-on types able to absorb the maximum anticipated current surges during clipping. An alternate method would be to replace the D_x diodes with Mosorbs (Mosorb™ is an acronym for high current surge protectors). Mosorbs are fast turn-on devices ideally suited for precise DC protection with no inherent wear out mechanism.

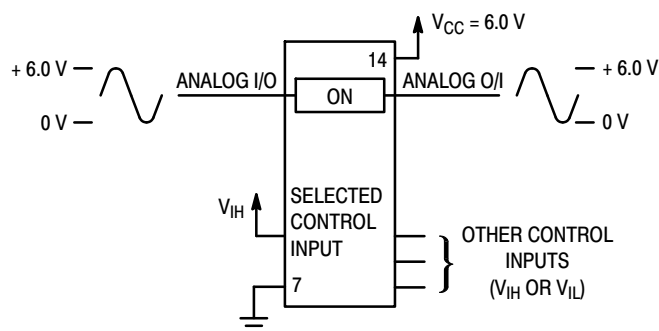


Figure 16. 6.0 V Application

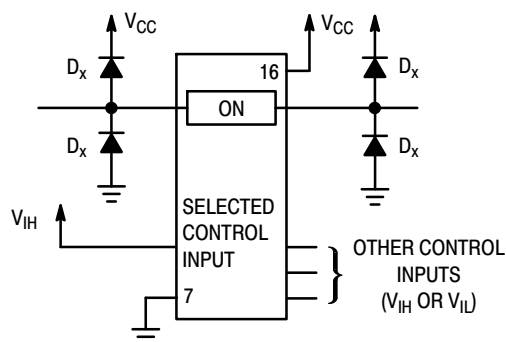


Figure 17. Transient Suppressor Application

MC74LVXT4066

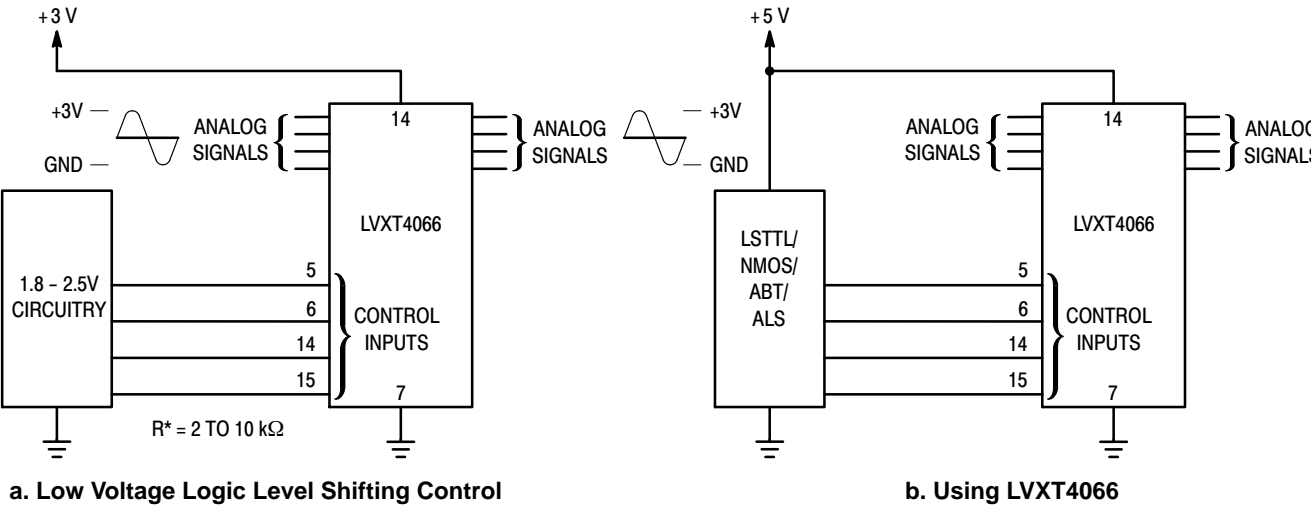


Figure 18. Low Voltage CMOS Interface

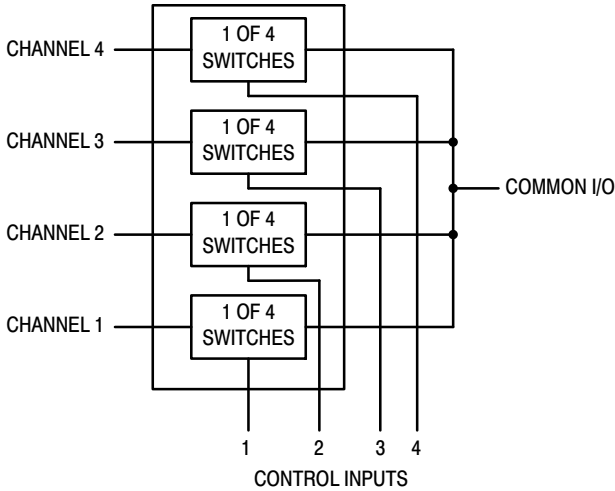


Figure 19. 4-Input Multiplexer

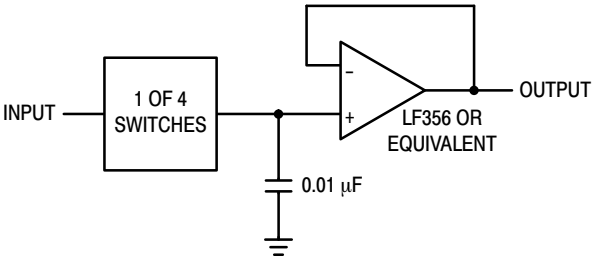


Figure 20. Sample/Hold Amplifier

ORDERING INFORMATION

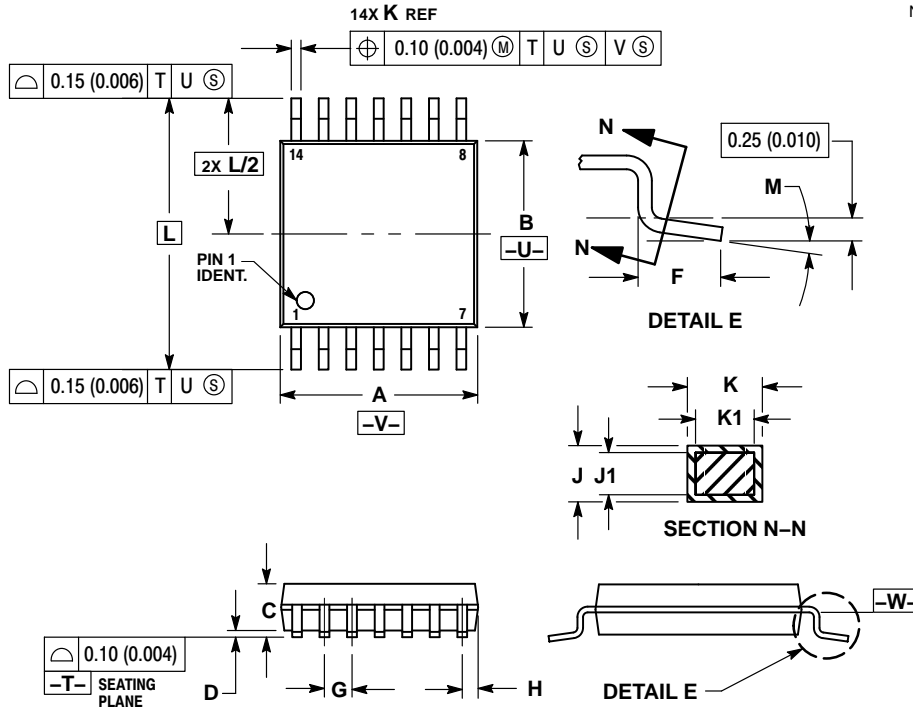
Device	Package	Shipping†
MC74LVXT4066DR2G	SOIC-14 NB (Pb-Free)	2500 Tape & Reel
MC74LVXT4066DTRG	TSSOP-14 (Pb-Free)	2500 Tape & Reel

†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.

MC74LVXT4066

PACKAGE DIMENSIONS

TSSOP-14
CASE 948G
ISSUE B

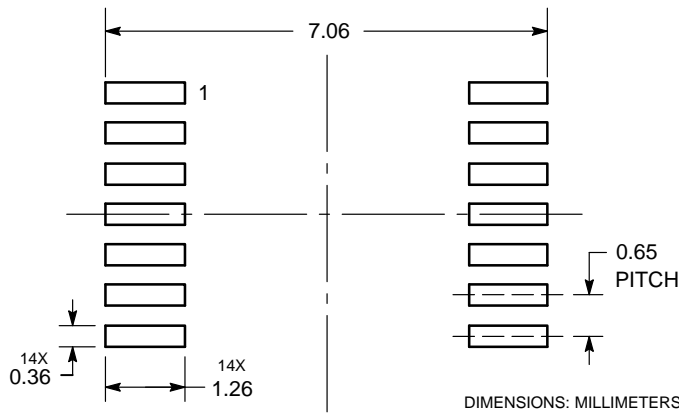


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

SOLDERING FOOTPRINT*

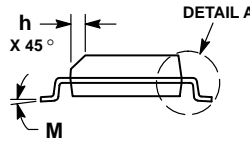
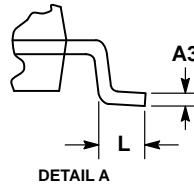
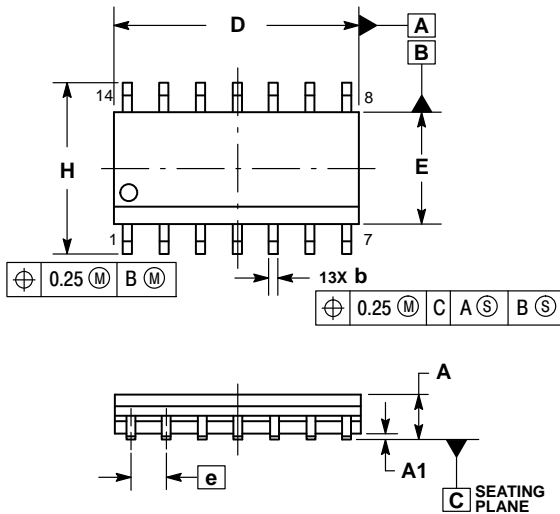


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MC74LVXT4066

PACKAGE DIMENSIONS

SOIC-14 NB CASE 751A-03 ISSUE K

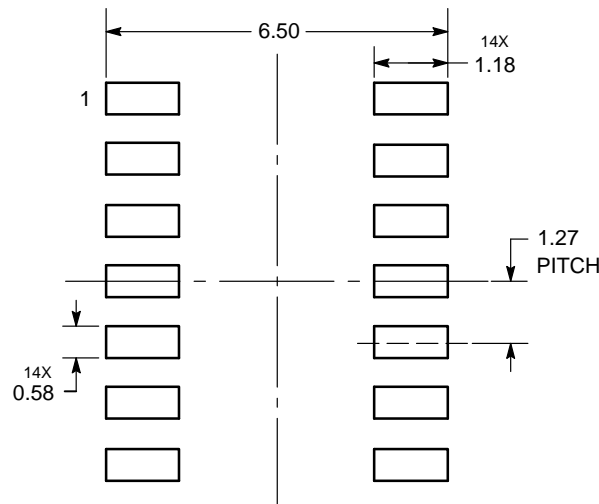


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
A3	0.19	0.25	0.008	0.010
b	0.35	0.49	0.014	0.019
D	8.55	8.75	0.337	0.344
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.019
L	0.40	1.25	0.016	0.049
M	0°	7°	0°	7°

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marketing.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative