

# MC74LVX4051

## Product Preview

# Analog Multiplexer / Demultiplexer

## High-Performance Silicon-Gate CMOS

The MC74LVX4051 utilizes silicon-gate CMOS technology to achieve fast propagation delays, low ON resistances, and low OFF leakage currents. This analog multiplexer/demultiplexer controls analog voltages that may vary across the complete power supply range (from  $V_{CC}$  to  $V_{EE}$ ).

The LVX4051 is similar in pinout to the LVX8051, HC4051A and the metal-gate MC14051B. The Channel-Select inputs determine which one of the Analog Inputs/Outputs is to be connected, by means of an analog switch, to the Common Output/Input. When the Enable pin is HIGH, all analog switches are turned off.

The Channel-Select and Enable inputs are compatible with standard CMOS outputs; with pull-up resistors they are compatible with LSTTL outputs.

This device has been designed so that the ON resistance ( $R_{on}$ ) is more linear over input voltage than  $R_{on}$  of metal-gate CMOS analog switches, and High-Speed CMOS analog switches.

- Fast Switching and Propagation Speeds
- Low Crosstalk Between Switches
- Analog Power Supply Range ( $V_{CC} - GND$ ) = 2.0 to 6.0 V
- Digital (Control) Power Supply Range ( $V_{CC} - GND$ ) = 2.0 to 6.0 V
- Improved Linearity and Lower ON Resistance Than Metal-Gate, HSL, or VHC Counterparts
- Low Noise
- Designed to Operate on a Single Supply with  $V_{EE} = GND$ , or Using Split Supplies up to  $\pm 3.3$  V



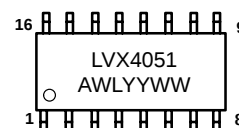
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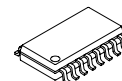
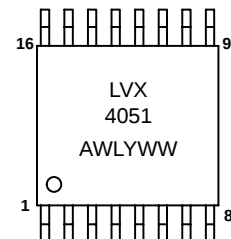
### MARKING DIAGRAMS



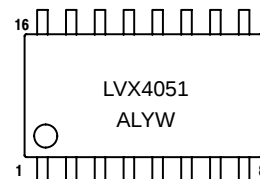
SOIC-16  
D SUFFIX  
CASE 751B



TSSOP-16  
DT SUFFIX  
CASE 948F



SOIC EIAJ-16  
M SUFFIX  
CASE 966



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week

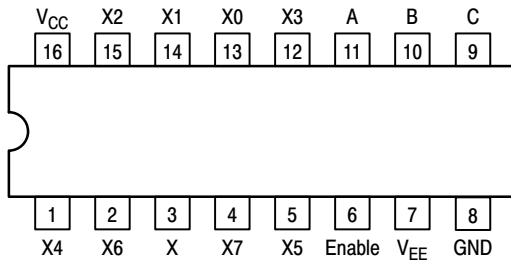
### ORDERING INFORMATION

| Device          | Package      | Shipping        |
|-----------------|--------------|-----------------|
| MC74LVX4051D    | SOIC-16      | 48 Units/Rail   |
| MC74LVX4051DR2  | SOIC-16      | 2500 Units/Reel |
| MC74LVX4051DT   | TSSOP-16     | 96 Units/Rail   |
| MC74LVX4051DTR2 | TSSOP-16     | 2500 Units/Reel |
| MC74LVX4051M    | SOIC EIAJ-16 | 48 Units/Rail   |
| MC74LVX4051MEL  | SOIC EIAJ-16 | 2000 Units/Reel |

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# MC74LVX4051

**PIN CONNECTION AND  
MARKING DIAGRAM (Top View)**

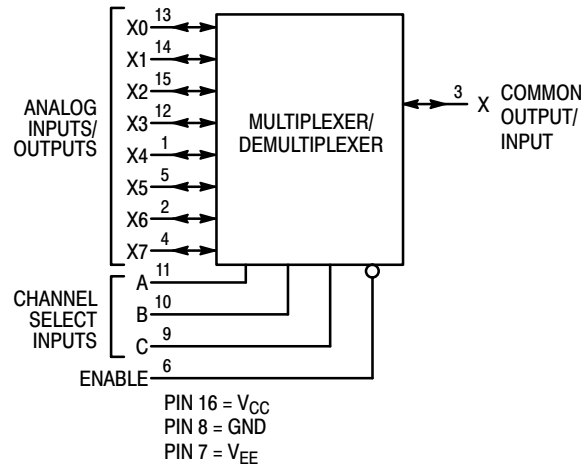


**FUNCTION TABLE**

| Control Inputs |        |   |   | ON Channels |
|----------------|--------|---|---|-------------|
| Enable         | Select |   |   |             |
|                | C      | B | A |             |
| L              | L      | L | L | X0          |
| L              | L      | L | H | X1          |
| L              | L      | H | L | X2          |
| L              | L      | H | H | X3          |
| L              | H      | L | L | X4          |
| L              | H      | L | H | X5          |
| L              | H      | H | L | X6          |
| L              | H      | H | H | X7          |
| H              | X      | X | X | NONE        |

X = Don't Care

**LOGIC DIAGRAM  
MC74LVX4051  
Single-Pole, 8-Position Plus Common Off**



# MC74LVX4051

## MAXIMUM RATINGS\*

| Symbol    | Parameter                                                                   | Value                            | Unit |
|-----------|-----------------------------------------------------------------------------|----------------------------------|------|
| $V_{EE}$  | Negative DC Supply Voltage (Referenced to GND)                              | – 7.0 to + 5.0                   | V    |
| $V_{CC}$  | Positive DC Supply Voltage (Referenced to GND)<br>(Referenced to $V_{EE}$ ) | – 0.5 to + 7.0<br>– 0.5 to + 7.0 | V    |
| $V_{IS}$  | Analog Input Voltage                                                        | – 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                                          | $\pm 20$                         | mA   |
| $P_D$     | Power Dissipation in Still Air, SOIC Package†<br>TSSOP Package†             | 500<br>450                       | mW   |
| $T_{stg}$ | Storage Temperature Range                                                   | – 65 to + 150                    | °C   |
| $T_L$     | Lead Temperature, 1 mm from Case for 10 Seconds                             | 260                              | °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.

\*Maximum Ratings are those values beyond which damage to the device may occur.

Functional operation should be restricted to the Recommended Operating Conditions.

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

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

## RECOMMENDED OPERATING CONDITIONS

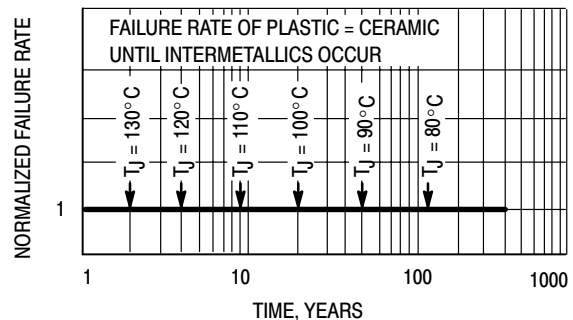
| Symbol     | Parameter                                                                                                                                              | Min        | Max        | Unit |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------|
| $V_{EE}$   | Negative DC Supply Voltage (Referenced to GND)                                                                                                         | –6.0       | GND        | V    |
| $V_{CC}$   | Positive DC Supply Voltage (Referenced to GND)<br>(Referenced to $V_{EE}$ )                                                                            | 2.0<br>2.0 | 6.0<br>6.6 | V    |
| $V_{IS}$   | Analog Input Voltage                                                                                                                                   | $V_{EE}$   | $V_{CC}$   | V    |
| $V_{in}$   | Digital Input Voltage (Referenced to GND)                                                                                                              | 0          | $V_{CC}$   | V    |
| $V_{IO}^*$ | Static or Dynamic Voltage Across Switch                                                                                                                |            | 1.2        | V    |
| $T_A$      | Operating Temperature Range, All Package Types                                                                                                         | – 55       | + 85       | °C   |
| $t_r, t_f$ | Input Rise/Fall Time (Channel Select or Enable Inputs)<br><br>$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$<br>$V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | 0<br>0     | 100<br>20  | ns/V |

\*For voltage drops across 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.

The  $\theta_{JA}$  of the package is equal to 1/Derating. Higher junction temperatures may affect the expected lifetime of the device per the table and figure below.

## DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

| Junction Temperature °C | Time, Hours | Time, Years |
|-------------------------|-------------|-------------|
| 80                      | 1,032,200   | 117.8       |
| 90                      | 419,300     | 47.9        |
| 100                     | 178,700     | 20.4        |
| 110                     | 79,600      | 9.4         |
| 120                     | 37,000      | 4.2         |
| 130                     | 17,800      | 2.0         |
| 140                     | 8,900       | 1.0         |



Failure Rate vs. Time Junction Temperature

# MC74LVX4051

## DC CHARACTERISTICS — Digital Section (Voltages Referenced to GND)

| Symbol          | Parameter                                                         | Condition                                                                                     | V <sub>CC</sub><br>V     | Guaranteed Limit             |                              |                              | Unit |
|-----------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------|------------------------------|------------------------------|------------------------------|------|
|                 |                                                                   |                                                                                               |                          | –55 to 25°C                  | ≤85°C                        | ≤125°C                       |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage, Channel-Select or Enable Inputs | R <sub>on</sub> = Per Spec                                                                    | 2.0<br>3.0<br>4.5<br>5.5 | 1.50<br>2.10<br>3.15<br>3.85 | 1.50<br>2.10<br>3.15<br>3.85 | 1.50<br>2.10<br>3.15<br>3.85 | V    |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage, Channel-Select or Enable Inputs  | R <sub>on</sub> = Per Spec                                                                    | 2.0<br>3.0<br>4.5<br>5.5 | 0.5<br>0.9<br>1.35<br>1.65   | 0.5<br>0.9<br>1.35<br>1.65   | 0.5<br>0.9<br>1.35<br>1.65   | V    |
| I <sub>in</sub> | Maximum Input Leakage Current, Channel-Select or Enable Inputs    | V <sub>in</sub> = V <sub>CC</sub> or GND                                                      | 5.5                      | ± 0.1                        | ± 1.0                        | ± 1.0                        | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per Package)                    | Channel Select, Enable and V <sub>IS</sub> = V <sub>CC</sub> or GND;<br>V <sub>in</sub> = 0 V | 5.5                      | 4.0                          | 40                           | 80                           | μA   |

## DC ELECTRICAL CHARACTERISTICS Analog Section

| Symbol           | Parameter                                                                          | Test Conditions                                                                                                                                                        | V <sub>CC</sub><br>V | V <sub>EE</sub><br>V | Guaranteed Limit |        |         | Unit |
|------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|------------------|--------|---------|------|
|                  |                                                                                    |                                                                                                                                                                        |                      |                      | – 55 to 25°C     | ≤ 85°C | ≤ 125°C |      |
| R <sub>on</sub>  | Maximum “ON” Resistance                                                            | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>IS</sub> = V <sub>CC</sub> to V <sub>EE</sub><br> I <sub>S</sub>   ≤ 10.0 mA (Figures 1, 2)             | 3.0                  | 0                    | 20               | 25     | 30      | Ω    |
|                  |                                                                                    |                                                                                                                                                                        | 4.5                  | 0                    | 10               | 15     | 20      |      |
|                  |                                                                                    |                                                                                                                                                                        | 5.5                  | 0                    | 7.0              | 10     | 15      |      |
|                  |                                                                                    |                                                                                                                                                                        | 3.3                  | –3.3                 | 4.0              | 10     | 15      |      |
|                  |                                                                                    | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>IS</sub> = V <sub>CC</sub> or V <sub>EE</sub> (Endpoints)<br> I <sub>S</sub>   ≤ 10.0 mA (Figures 1, 2) | 3.0                  | 0                    | 20               | 25     | 30      |      |
|                  |                                                                                    |                                                                                                                                                                        | 4.5                  | 0                    | 10               | 15     | 20      |      |
|                  |                                                                                    |                                                                                                                                                                        | 5.5                  | 0                    | 7.0              | 10     | 15      |      |
|                  |                                                                                    |                                                                                                                                                                        | 3.3                  | –3.3                 | 4.0              | 10     | 15      |      |
| ΔR <sub>on</sub> | Maximum Difference in “ON” Resistance Between Any Two Channels in the Same Package | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>IS</sub> = 1/2 (V <sub>CC</sub> – V <sub>EE</sub> )<br> I <sub>S</sub>   ≤ 10.0 mA                      | 3.0                  | 0                    | 5                | 5      | 5       | Ω    |
|                  |                                                                                    |                                                                                                                                                                        | 4.5                  | 0                    | 1                | 1.2    | 1.5     |      |
|                  |                                                                                    |                                                                                                                                                                        | 5.5                  | 0                    | 1                | 1.2    | 1.5     |      |
|                  |                                                                                    |                                                                                                                                                                        | 3.3                  | –3.3                 | 1                | 1.2    | 1.5     |      |
| I <sub>off</sub> | Maximum Off-Channel Leakage Current, Any One Channel                               | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> ;<br>V <sub>IO</sub> = V <sub>CC</sub> or GND;<br>Switch Off (Figure 3)                                           | 5.5                  | 0                    | 1                | 10     | 1000    | nA   |
|                  |                                                                                    |                                                                                                                                                                        | 3.3                  | –3.3                 | 1                | 10     | 1000    |      |
|                  | Maximum Off-Channel Leakage Current, Common Channel                                | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> ;<br>V <sub>IO</sub> = V <sub>CC</sub> or GND;<br>Switch Off (Figure 4)                                           | 5.5                  | 0                    | 1                | 10     | 1000    |      |
|                  |                                                                                    |                                                                                                                                                                        | 3.3                  | –3.3                 | 1                | 10     | 1000    |      |
| I <sub>on</sub>  | Maximum On-Channel Leakage Current, Channel-to-Channel                             | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> ;<br>Switch-to-Switch = V <sub>CC</sub> or GND; (Figure 5)                                                        | 5.5                  | 0                    | 1                | 10     | 1000    | nA   |
|                  |                                                                                    |                                                                                                                                                                        | 3.3                  | –3.3                 | 1                | 10     | 1000    |      |
| t <sub>BBM</sub> | Minimum Break-Before-Make Time <sup>§</sup> (Figure 12)                            | V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>IS</sub> = 1/2 (V <sub>CC</sub> – V <sub>EE</sub> )<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF   | 3.0                  | 0.0                  | 1                | TBD    | TBD     | ns   |
|                  |                                                                                    |                                                                                                                                                                        | 4.5                  | 0.0                  | 0.2              | TBD    | TBD     |      |
|                  |                                                                                    |                                                                                                                                                                        | 5.5                  | 0.0                  | 0.2              | TBD    | TBD     |      |
|                  |                                                                                    |                                                                                                                                                                        | 3.3                  | –3.3                 | 0.2              | TBD    | TBD     |      |

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

# MC74LVX4051

## AC CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input $t_r = t_f = 3 \text{ ns}$ )

| Symbol                                 | Parameter                                                             | V <sub>CC</sub><br>V                                          | V <sub>EE</sub><br>V | Guaranteed Limit |       |        | Unit |
|----------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------|----------------------|------------------|-------|--------|------|
|                                        |                                                                       |                                                               |                      | −55 to 25°C      | ≤85°C | ≤125°C |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Channel–Select to Analog Output (Figure 9) | 2.0                                                           | 0                    | 30               | 35    | 40     | ns   |
|                                        |                                                                       | 3.0                                                           | 0                    | 20               | 25    | 30     |      |
|                                        |                                                                       | 4.5                                                           | 0                    | 15               | 18    | 22     |      |
|                                        |                                                                       | 5.5                                                           | 0                    | 15               | 18    | 20     |      |
|                                        |                                                                       | 3.3                                                           | −3.3                 | 10               | 12    | 15     |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Analog Input to Analog Output (Figure 10)  | 2.0                                                           | 0                    | 1.0              | 1.0   | 2.0    | ns   |
|                                        |                                                                       | 3.0                                                           | 0                    | 1.0              | 1.0   | 2.0    |      |
|                                        |                                                                       | 4.5                                                           | 0                    | 1.0              | 1.0   | 1.0    |      |
|                                        |                                                                       | 5.5                                                           | 0                    | 1.0              | 1.0   | 1.0    |      |
|                                        |                                                                       | 3.3                                                           | −3.3                 | 1.0              | 1.0   | 1.0    |      |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Enable to Analog Output (Figure 11)        | 2.0                                                           | 0                    | 30               | 35    | 40     | ns   |
|                                        |                                                                       | 3.0                                                           | 0                    | 20               | 25    | 30     |      |
|                                        |                                                                       | 4.5                                                           | 0                    | 15               | 18    | 22     |      |
|                                        |                                                                       | 5.5                                                           | 0                    | 15               | 18    | 20     |      |
|                                        |                                                                       | 3.3                                                           | −3.3                 | 10               | 12    | 15     |      |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Enable to Analog Output (Figure 11)        | 2.0                                                           | 0                    | 20               | 25    | 30     | ns   |
|                                        |                                                                       | 3.0                                                           | 0                    | 12               | 14    | 15     |      |
|                                        |                                                                       | 4.5                                                           | 0                    | 8.0              | 10    | 12     |      |
|                                        |                                                                       | 5.5                                                           | 0                    | 8.0              | 10    | 12     |      |
|                                        |                                                                       | 3.3                                                           | −3.3                 | 5.0              | 8.0   | 10     |      |
| C <sub>in</sub>                        | Maximum Input Capacitance, Channel–Select or Enable Inputs            |                                                               |                      | 10               | 10    | 10     | pF   |
| C <sub>I/O</sub>                       | Maximum Capacitance<br><br>(All Switches Off)                         | Analog I/O                                                    |                      | 35               | 35    | 35     | pF   |
|                                        |                                                                       | Common O/I                                                    |                      | 130              | 130   | 130    |      |
|                                        |                                                                       | Feedthrough                                                   |                      | 1.0              | 1.0   | 1.0    |      |
| C <sub>PD</sub>                        | Power Dissipation Capacitance (Figure 17)*                            | Typical @ 25°C, V <sub>CC</sub> = 5.0 V, V <sub>EE</sub> = 0V |                      |                  |       |        | pF   |
|                                        |                                                                       | 45                                                            |                      |                  |       |        |      |

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

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## ADDITIONAL APPLICATION CHARACTERISTICS (GND = 0 V)

| Symbol            | Parameter                                                                                                           | Condition                                                                                                                                           | V <sub>CC</sub><br>V | V <sub>EE</sub><br>V | Limit* | Unit             |
|-------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|--------|------------------|
|                   |                                                                                                                     |                                                                                                                                                     |                      |                      | 25°C   |                  |
| BW                | Maximum On-Channel Bandwidth or Minimum Frequency Response (Figure 6)                                               | $V_{IS} = \frac{1}{2} (V_{CC} - V_{EE})$ ,<br>Ref & Test Attn = 10 dB<br>Source Amplitude = 0 dB                                                    | 3.0                  | 0.0                  | 80     | MHz              |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | 80     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | 80     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | 80     |                  |
| V <sub>ISO</sub>  | Off-Channel Feedthrough Isolation (Figure 7)                                                                        | $V_{IS} = \frac{1}{2} (V_{CC} - V_{EE})$ ,<br>Adjust Network Analyzer output to 10 dBm on each output from the power splitter                       | 3.0                  | 0.0                  | -93    | dB               |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | -93    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | -93    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | -93    |                  |
| V <sub>ISOC</sub> | Common-Channel Feedthrough Isolation (Figure 8)                                                                     | $V_{IS} = \frac{1}{2} (V_{CC} - V_{EE})$ ,<br>Adjust Network Analyzer output to 10 dBm on each output from the power splitter                       | 3.0                  | 0.0                  | -93    | dB               |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | -93    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | -93    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | -93    |                  |
| V <sub>ONL</sub>  | Maximum Feedthrough On Loss (Figure 11)                                                                             | $V_{IS} = \frac{1}{2} (V_{CC} - V_{EE})$ ,<br>Adjust Network Analyzer output to 10 dBm on each output from the power splitter                       | 3.0                  | 0.0                  | -2     | dB               |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | -2     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | -2     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | -2     |                  |
| Q                 | Feedthrough Noise.<br>Channel-Select Input to Common I/O (Figure 9)                                                 | $V_{IN} = V_{CC}$ to $V_{EE}$ , $f_{IS} = 1$ MHz,<br>$t_r = t_f = 3$ ns<br>$R_{IS} = 600 \Omega$ , $C_L = 50$ pF                                    | 3.0                  | 0.0                  | 25     | mV <sub>PP</sub> |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | 40     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | 50     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | 60     |                  |
|                   | Feedthrough Noise.<br>Channel-Select Input to Common I/O (Figure 9)                                                 | $V_{IN} = V_{CC}$ to $V_{EE}$ , $f_{IS} = 1$ MHz,<br>$t_r = t_f = 3$ ns<br>$R_{IS} = 10 \Omega$ , $C_L = 10$ pF                                     | 3.0                  | 0.0                  | 35     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | 40     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | 50     |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | 60     |                  |
| Q                 | Feedthrough Noise.†<br>Enable Input to Common I/O (Figure 10)                                                       | $V_{IN} = V_{CC}$ to $V_{EE}$ , $f_{IS} = 1$ MHz,<br>$t_r = t_f = 3$ ns<br>$R_{IS} = 0 \Omega$ , $C_L = 1000$ pF,<br>$Q = C_L \cdot \Delta V_{OUT}$ | 3.0                  | 0.0                  | TBD    | pC               |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | 3.0    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | 3.0    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | TBD    |                  |
|                   | Feedthrough Noise.<br>Channel-Select Input to Common I/O (Figure 9)                                                 | $V_{IN} = V_{CC}$ to $V_{EE}$ , $f_{IS} = 1$ MHz,<br>$t_r = t_f = 3$ ns<br>$R_{IS} = 0 \Omega$ , $C_L = 1000$ pF,<br>$Q = C_L \cdot \Delta V_{OUT}$ | 3.0                  | 0.0                  | TBD    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 4.5                  | 0.0                  | TBD    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 5.5                  | 0.0                  | TBD    |                  |
|                   |                                                                                                                     |                                                                                                                                                     | 3.3                  | -3.3                 | TBD    |                  |
| V <sub>ΔOUT</sub> | Maximum Shift in Output Voltage of Enabled Analog Channel due to injected Current on a Disabled Channel (Figure 16) | $I_{IN} \ddagger \leq 1$ mA, $R_S \leq 3.9$ KΩ                                                                                                      | 5.0                  | 0.0                  | TBD    | mV               |
|                   |                                                                                                                     | $I_{IN} \ddagger \leq 10$ mA, $R_S \leq 3.9$ KΩ                                                                                                     | 5.0                  | 0.0                  | TBD    |                  |
|                   |                                                                                                                     | $I_{IN} \ddagger \leq 1$ mA, $R_S \leq 20$ KΩ                                                                                                       | 5.0                  | 0.0                  | TBD    |                  |
|                   |                                                                                                                     | $I_{IN} \ddagger \leq 10$ mA, $R_S \leq 20$ KΩ                                                                                                      | 5.0                  | 0.0                  | TBD    |                  |
| THD               | Total Harmonic Distortion<br><br>THD = THD <sub>MEASURED</sub> - THD <sub>SOURCE</sub><br><br>(Figure 18)           | $f_{IS} = 1$ MHz, $R_L = 10$ KΩ, $C_L = 50$ pF,                                                                                                     |                      |                      |        | %                |
|                   |                                                                                                                     | $V_{IS} = 2.5$ V <sub>PP</sub> sine wave                                                                                                            | 3.0                  | 0.0                  | 0.10   |                  |
|                   |                                                                                                                     | $V_{IS} = 4.0$ V <sub>PP</sub> sine wave                                                                                                            | 4.5                  | 0.0                  | 0.08   |                  |
|                   |                                                                                                                     | $V_{IS} = 5.0$ V <sub>PP</sub> sine wave                                                                                                            | 5.5                  | 0.0                  | 0.05   |                  |
|                   |                                                                                                                     | $V_{IS} = 6.0$ V <sub>PP</sub> sine wave                                                                                                            | 3.3                  | -3.3                 | 0.05   |                  |

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

†Note: Some manufacturers may refer to this specification as Charge Injection.

‡Note:  $I_{IN}$  = Total current injected into all disabled channels.

# MC74LVX4051

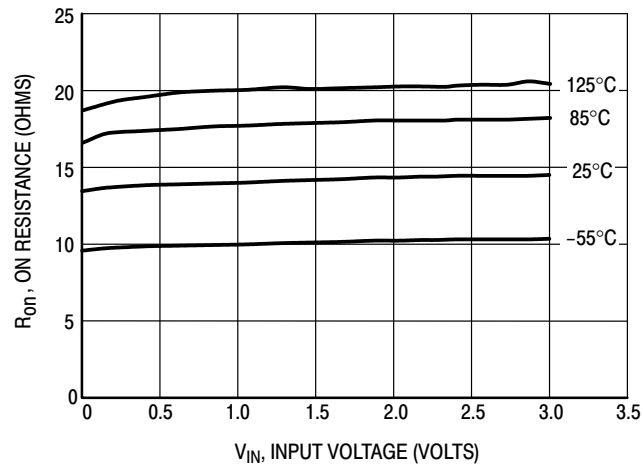


Figure 1a. Typical On Resistance,  $V_{CC} = 3.0\text{ V}$ ,  $V_{EE} = 0\text{ V}$

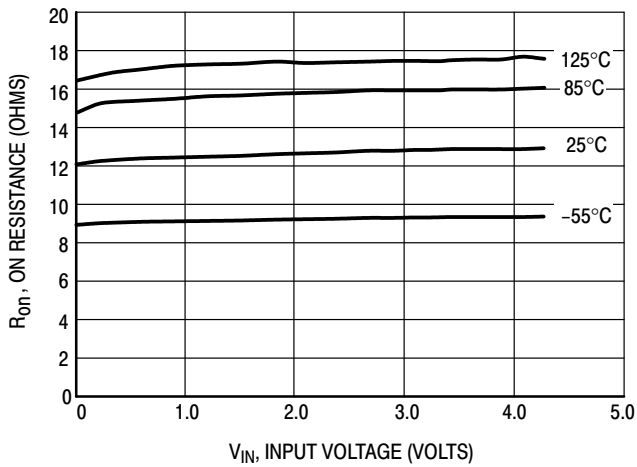


Figure 1b. Typical On Resistance,  $V_{CC} = 4.5\text{ V}$ ,  $V_{EE} = 0\text{ V}$

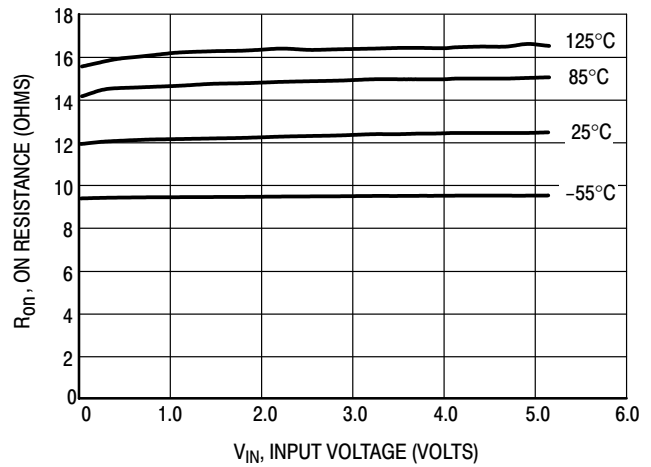


Figure 1c. Typical On Resistance,  $V_{CC} = 5.5\text{ V}$ ,  $V_{EE} = 0\text{ V}$

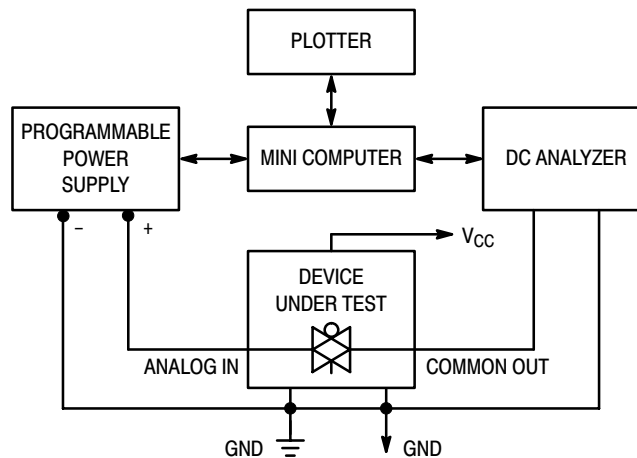
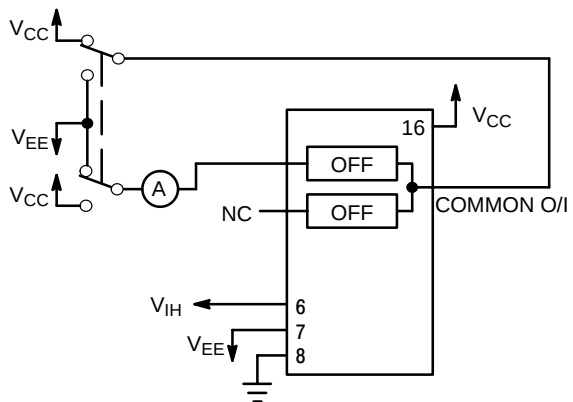
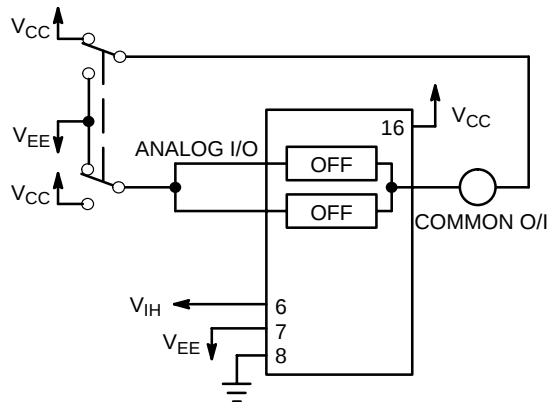


Figure 2. On Resistance Test Set-Up

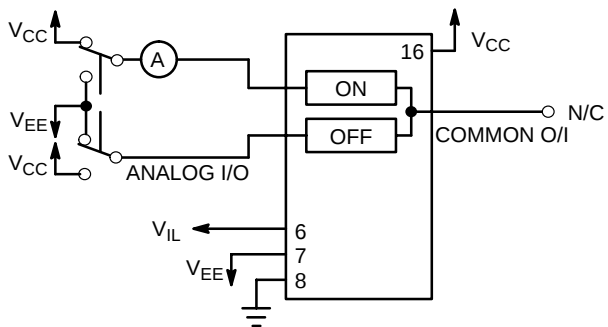
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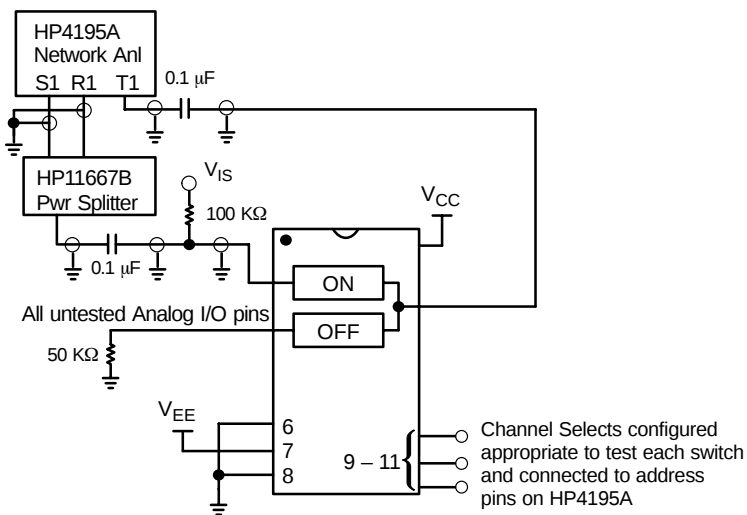
**Figure 3. Maximum Off Channel Leakage Current, Any One Channel, Test Set-Up**



**Figure 4. Maximum Off Channel Leakage Current, Common Channel, Test Set-Up**

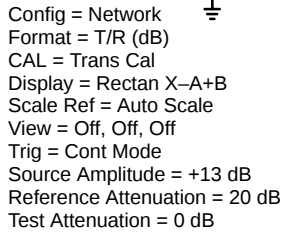


**Figure 5. Maximum On Channel Leakage Current, Channel to Channel, Test Set-Up**

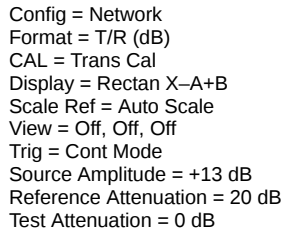


**Figure 6. Maximum On Channel Bandwidth, Test Set-Up**

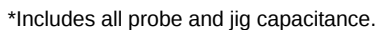
# MC74LVX4051



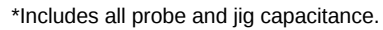
**Figure 7. Maximum Off Channel Feedthrough Isolation, Test Set-Up**



**Figure 8. Maximum Common-Channel Feedthrough Isolation Test Set-Up**



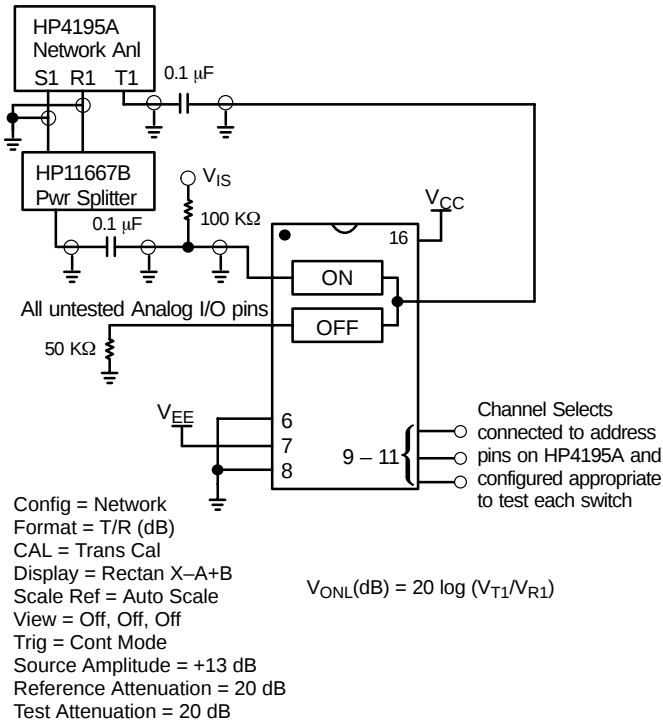
**Figure 9. Feedthrough Noise, Channel Select to Common Out, Test Set-Up**



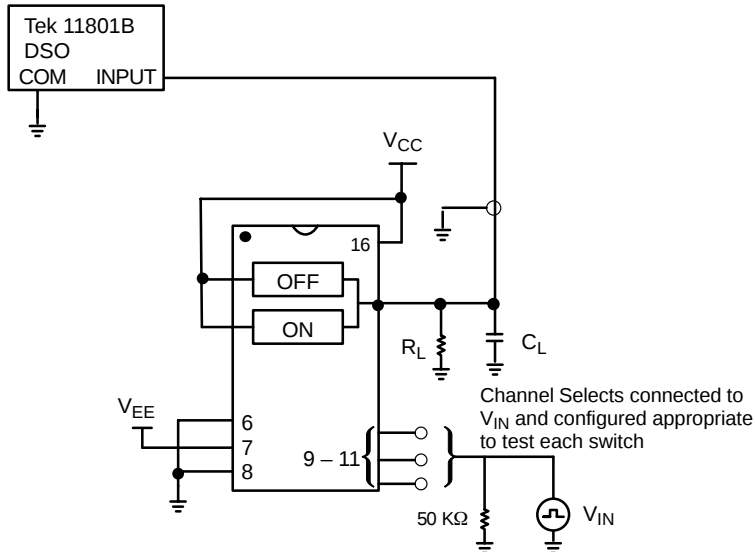
$$Q = C_L * \Delta V_{OUT}$$

**Figure 10. Feedthrough Noise, Enable to Common Out, Test Set-Up**

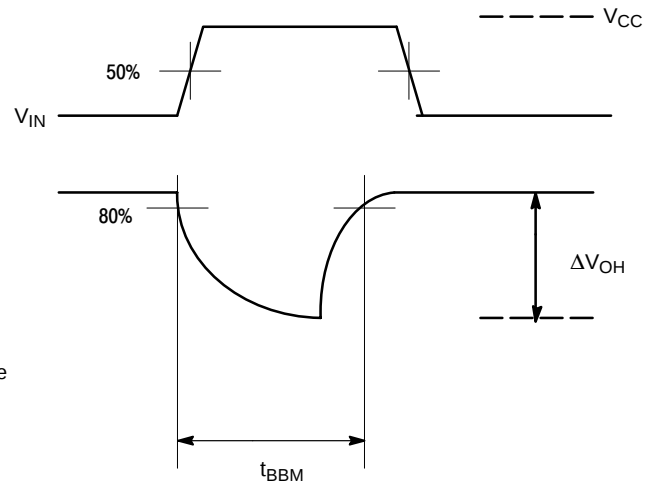
# MC74LVX4051



**Figure 11. Maximum On Channel Feedthrough On Loss Test Set-Up**



**Figure 12a. Break-Before-Make Test Set-Up**



**Figure 12b. Break-Before-Make Time**

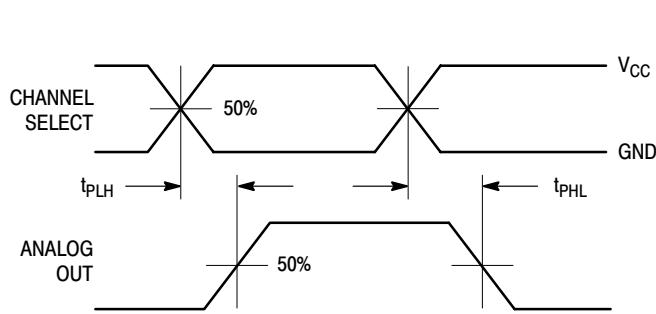
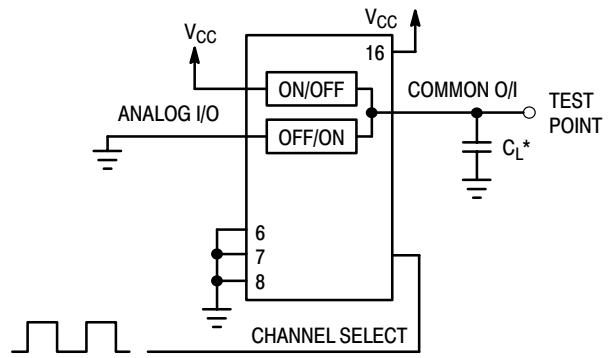


Figure 13a. Propagation Delays, Channel Select to Analog Out



\*Includes all probe and jig capacitance

Figure 13b. Propagation Delay, Test Set-Up Channel Select to Analog Out

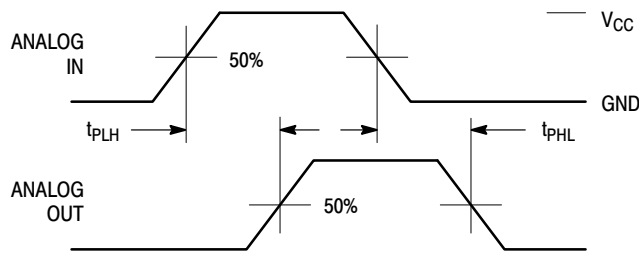
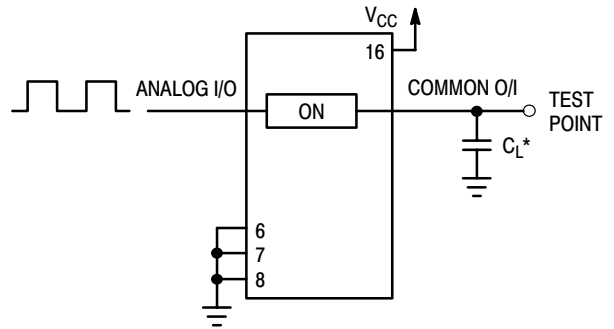


Figure 14a. Propagation Delays, Analog In to Analog Out



\*Includes all probe and jig capacitance

Figure 14b. Propagation Delay, Test Set-Up Analog In to Analog Out

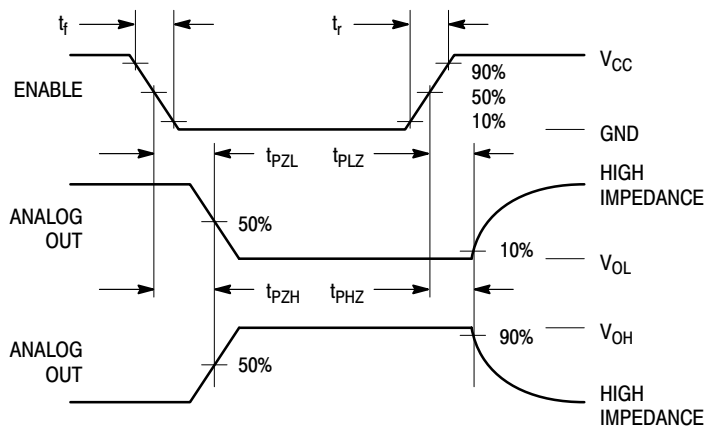


Figure 15a. Propagation Delays, Enable to Analog Out

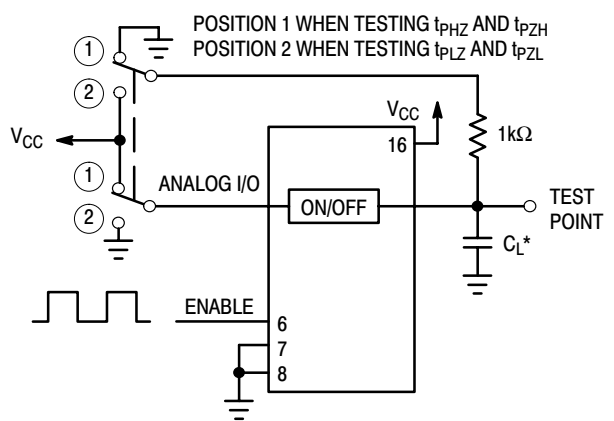


Figure 15b. Propagation Delay, Test Set-Up Enable to Analog Out

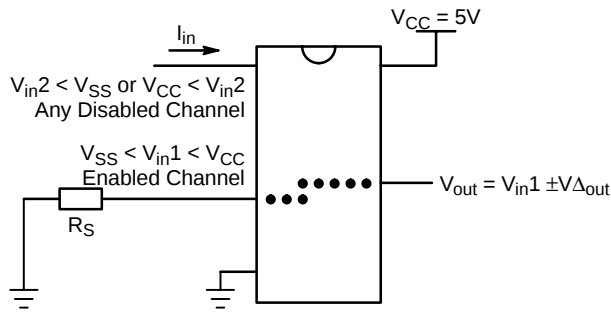


Figure 16. Maximum Shift in Output Voltage of Enabled Analog Channel due to Injected Current on a Disabled Channel Test Set-Up

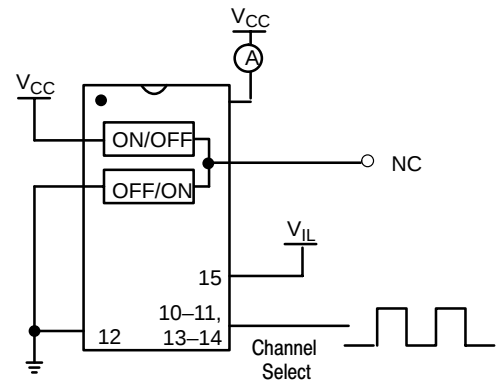


Figure 17. Power Dissipation Capacitance, Test Set-Up

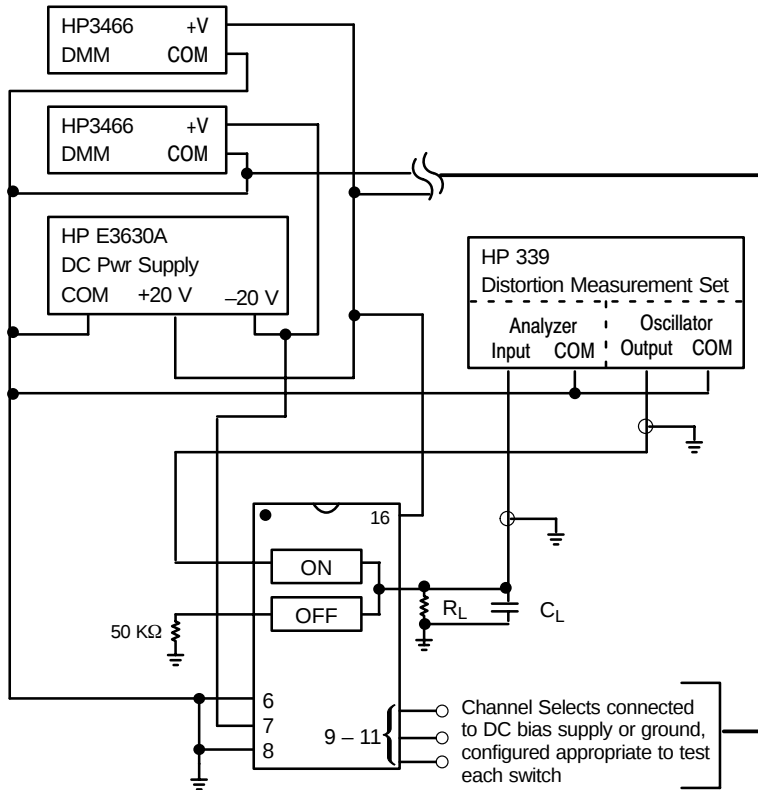


Figure 18a. Total Harmonic Distortion Test Set-Up

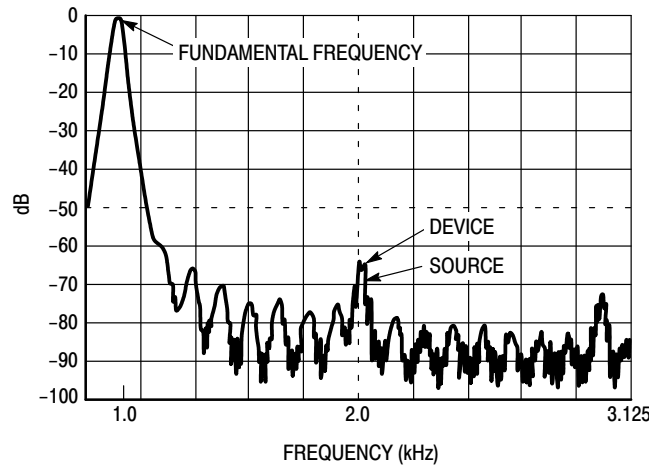


Figure 18b. Plot, Harmonic Distortion

## APPLICATIONS INFORMATION

The Channel Select and Enable control pins should be at  $V_{CC}$  or GND logic levels.  $V_{CC}$  being recognized as a logic high and GND being recognized as a logic low. In this example:

$$\begin{aligned} V_{CC} &= +5V = \text{logic high} \\ \text{GND} &= 0V = \text{logic low} \end{aligned}$$

The maximum analog voltage swing is determined by the supply voltages  $V_{CC}$  and  $V_{EE}$ . The positive peak analog voltage should not exceed  $V_{CC}$ . Similarly, the negative peak analog voltage should not go below  $V_{EE}$ . In this example, the difference between  $V_{CC}$  and  $V_{EE}$  is five volts. Therefore, using the configuration of Figure 15, a maximum analog signal of five volts peak-to-peak can be controlled. Unused analog inputs/outputs may be left floating (i.e., not connected). However, tying unused analog inputs and outputs to  $V_{CC}$  or

GND through a low value resistor helps minimize crosstalk and feedthrough noise that may be picked up by an unused switch.

Although used here, balanced supplies are not a requirement. The only constraints on the power supplies are that:

$$\begin{aligned} V_{EE} - \text{GND} &= 0 \text{ to } -6 \text{ volts} \\ V_{CC} - \text{GND} &= 2 \text{ to } 6 \text{ volts} \\ V_{CC} - V_{EE} &= 2 \text{ to } 6 \text{ volts} \\ &\text{and } V_{EE} \leq \text{GND} \end{aligned}$$

When voltage transients above  $V_{CC}$  and/or below  $V_{EE}$  are anticipated on the analog channels, external Germanium or Schottky diodes ( $D_x$ ) are recommended as shown in Figure 16. These diodes should be able to absorb the maximum anticipated current surges during clipping.

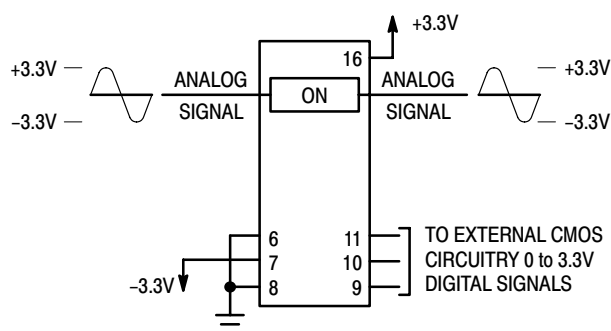


Figure 19a. Application Example

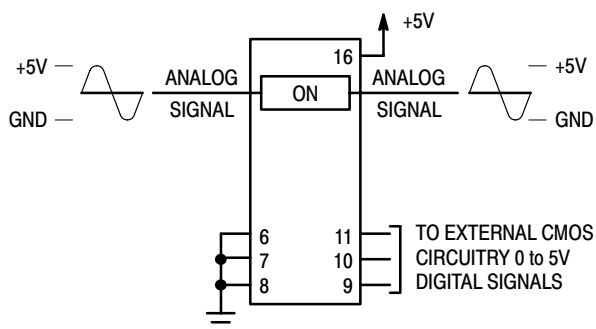


Figure 19b. Application Example

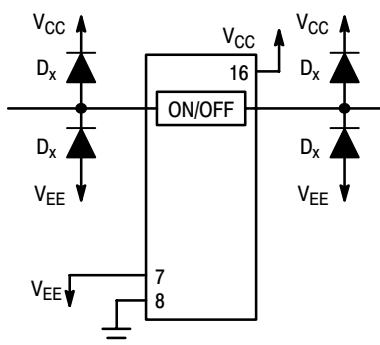


Figure 20. External Germanium or Schottky Clipping Diodes

# MC74LVX4051

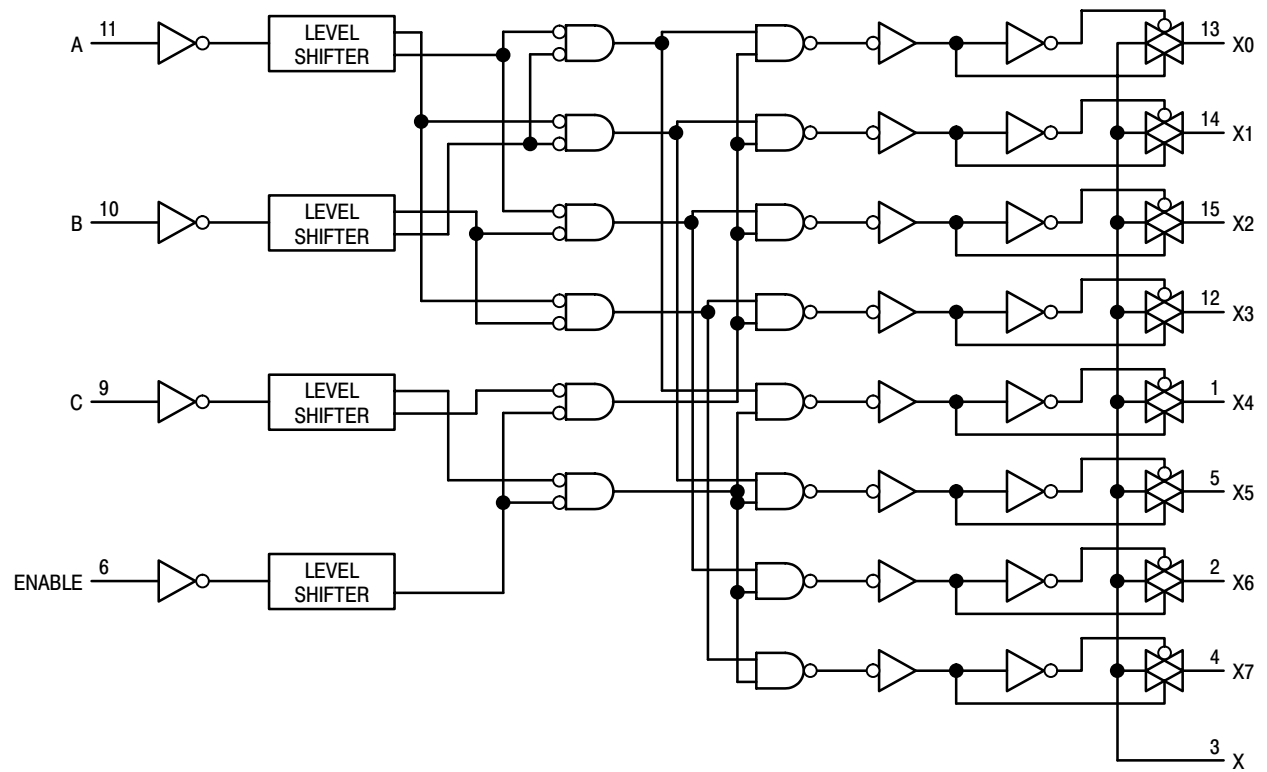
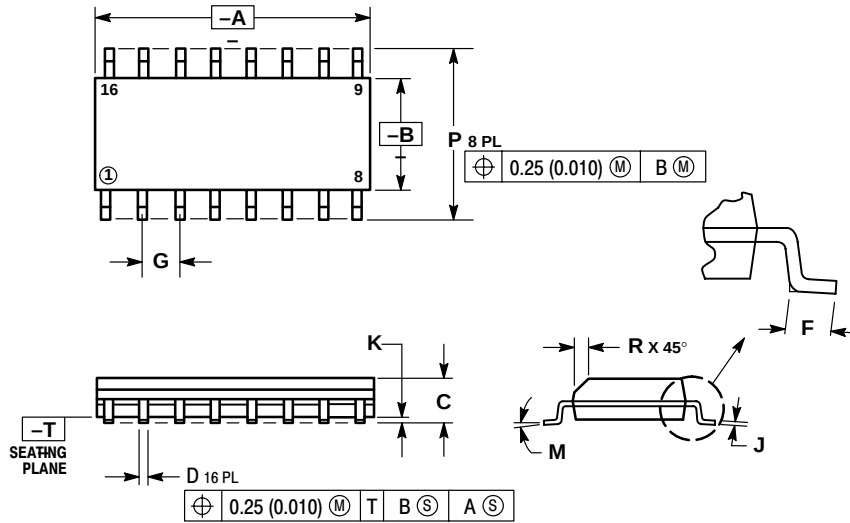


Figure 21. Function Diagram, LVX4051

# MC74LVX4051

## PACKAGE DIMENSIONS

SOIC-16  
D SUFFIX  
CASE 751B-05  
ISSUE J

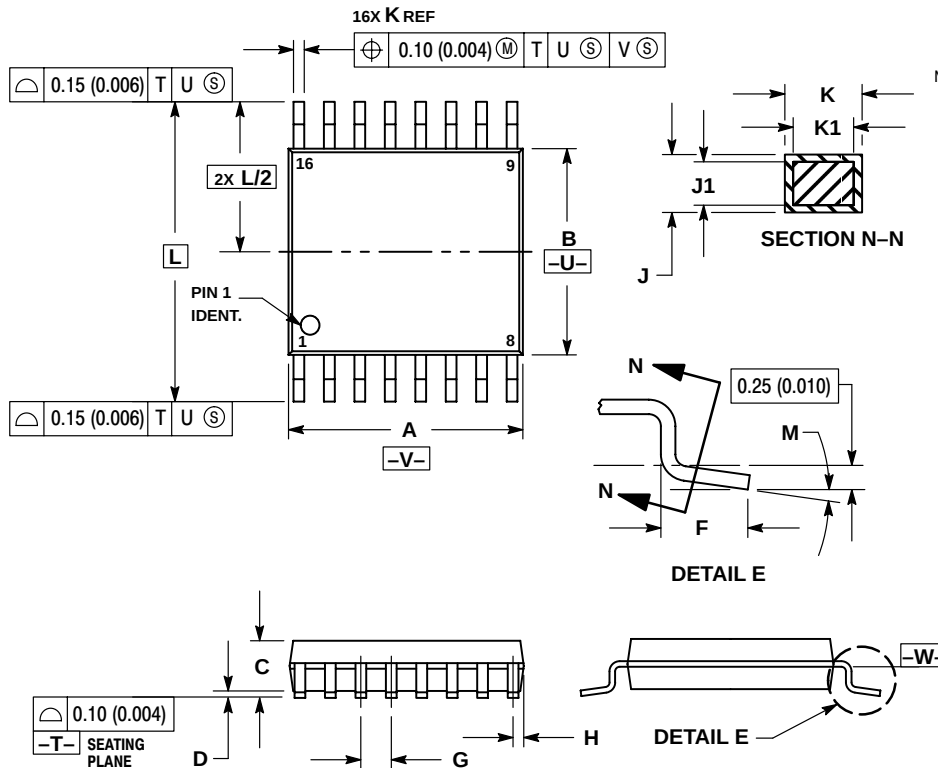


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 9.80        | 10.00 | 0.386     | 0.393 |
| B   | 3.80        | 4.00  | 0.150     | 0.157 |
| C   | 1.35        | 1.75  | 0.054     | 0.068 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.40        | 1.25  | 0.016     | 0.049 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.19        | 0.25  | 0.008     | 0.009 |
| K   | 0.10        | 0.25  | 0.004     | 0.009 |
| M   | 0°          | 7°    | 0°        | 7°    |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

TSSOP-16  
DT SUFFIX  
CASE 948F-01  
ISSUE O



### NOTES:

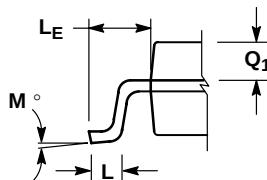
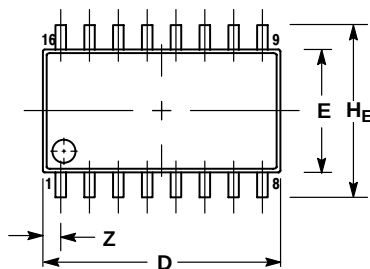
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2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH 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   | 0.18        | 0.28 | 0.007     | 0.011 |
| 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°    |

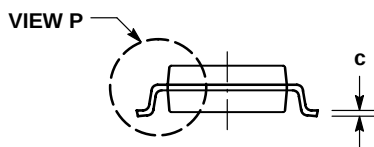
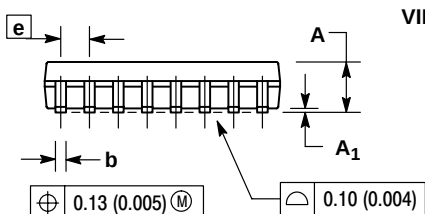
# MC74LVX4051

## PACKAGE DIMENSIONS

SOIC EIAJ-16  
M SUFFIX  
CASE 966-01  
ISSUE O



DETAIL P



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.18        | 0.27  | 0.007     | 0.011 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| L <sub>E</sub> | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0°          | 10°   | 0°        | 10°   |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 0.78  | ---       | 0.031 |

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