

MC74HC4851A, MC74HC4852A

Analog Multiplexers/ Demultiplexers with Injection Current Effect Control

Automotive Customized

These devices are pin compatible to standard HC405x and MC1405xB analog mux/demux devices, but feature injection current effect control. This makes them especially suited for usage in automotive applications where voltages in excess of normal logic voltage are common.

The injection current effect control allows signals at disabled analog input channels to exceed the supply voltage range without affecting the signal of the enabled analog channel. This eliminates the need for external diode/ resistor networks typically used to keep the analog channel signals within the supply voltage range.

The devices utilize low power silicon gate CMOS technology. The Channel Select and Enable inputs are compatible with standard CMOS outputs.

Features

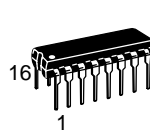
- Injection Current Cross-Coupling Less than 1mV/mA (See Figure 9)
- Pin Compatible to HC405X and MC1405XB Devices
- Power Supply Range ($V_{CC} - GND$) = 2.0 to 6.0 V
- In Compliance With the Requirements of JEDEC Standard No. 7A
- Chip Complexity: 154 FETs or 36 Equivalent Gates
- Pb-Free Packages are Available*



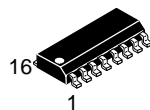
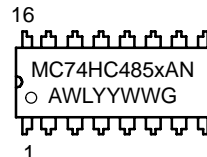
ON Semiconductor®

<http://onsemi.com>

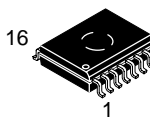
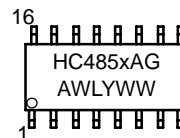
MARKING DIAGRAMS



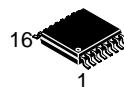
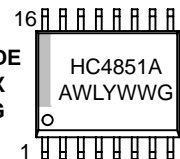
PDIP-16
N SUFFIX
CASE 648



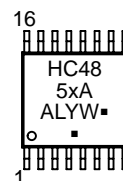
SOIC-16
D SUFFIX
CASE 751B



SOIC-16 WIDE
DW SUFFIX
CASE 751G



TSSOP-16
DT SUFFIX
CASE 948F



x = 1 or 2
A = Assembly Location
L, WL = Wafer Lot
Y, YY = Year
W, WW = Work Week
G = Pb-Free Package
▪ = 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 11 of this data sheet.

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

MC74HC4851A, MC74HC4852A

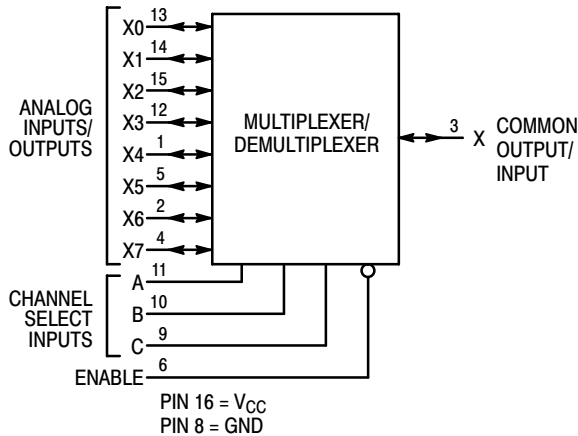


Figure 1. MC74HC4851A Logic Diagram Single-Pole, 8-Position Plus Common Off

FUNCTION TABLE – MC74HC4851A

| 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 |

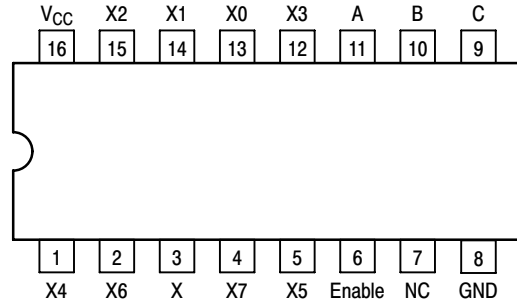


Figure 2. MC74HC4851A 16-Lead Pinout (Top View)

FUNCTION TABLE – MC74HC4852A

| Control Inputs | | | ON Channels | |
|----------------|--------|---|-------------|----|
| Enable | Select | | | |
| | B | A | | |
| L | L | L | Y0 | X0 |
| L | L | H | Y1 | X1 |
| L | H | L | Y2 | X2 |
| L | H | H | Y3 | X3 |
| H | X | X | NONE | |

X = Don't Care

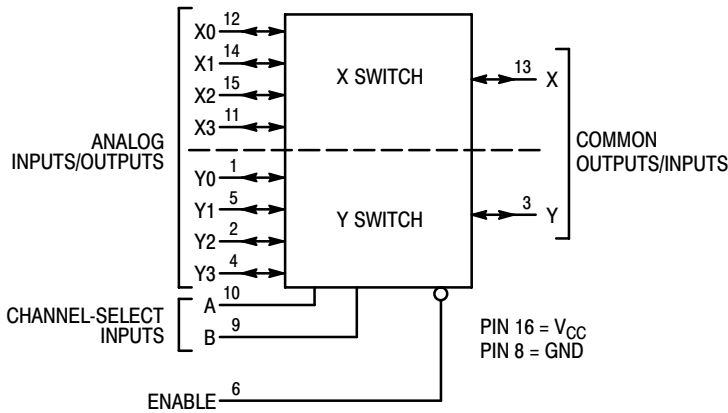


Figure 3. MC74HC4852A Logic Diagram Double-Pole, 4-Position Plus Common Off

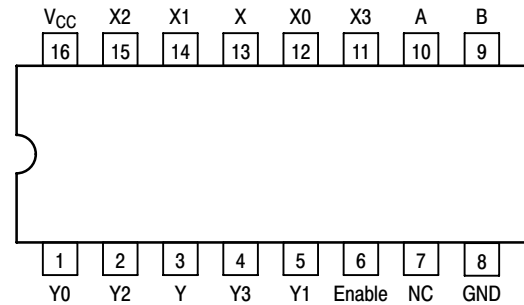


Figure 4. MC74HC4852A 16-Lead Pinout (Top View)

MC74HC4851A, MC74HC4852A

MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------|---|------------------------|------|
| V_{CC} | Positive DC Supply Voltage (Referenced to GND) | -0.5 to + 7.0 | V |
| V_{in} | DC Input Voltage (Any Pin) (Referenced to GND) | -0.5 to $V_{CC} + 0.5$ | V |
| I | DC Current, Into or Out of Any Pin | ± 25 | mA |
| P_D | Power Dissipation in Still Air, Plastic DIP† SOIC Package† TSSOP Package† | 750 500 450 | mW |
| T_{stg} | Storage Temperature Range | -65 to + 150 | °C |
| T_L | Lead Temperature, 1 mm from Case for 10 Seconds Plastic DIP, SOIC or TSSOP Package | 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.

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.

†Derating — Plastic DIP: - 10 mW/°C from 65° to 125°C
SOIC Package: - 7 mW/°C from 65° to 125°C
TSSOP Package: - 6.1 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit | |
|------------|---|--|-------------|--------------------|----|
| V_{CC} | Positive DC Supply Voltage (Referenced to GND) | 2.0 | 6.0 | V | |
| V_{in} | DC Input Voltage (Any Pin) (Referenced to GND) | GND | V_{CC} | V | |
| V_{IO}^* | Static or Dynamic Voltage Across Switch | 0.0 | 1.2 | V | |
| T_A | Operating Temperature Range, All Package Types | - 55 | + 125 | °C | |
| t_r, t_f | Input Rise/Fall Time (Channel Select or Enable Inputs) | $V_{CC} = 2.0 \text{ V}$ $V_{CC} = 4.5 \text{ V}$ $V_{CC} = 6.0 \text{ V}$ | 0 0 0 | 1000 500 400 | ns |

*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.

DC CHARACTERISTICS — Digital Section (Voltages Referenced to GND) $V_{EE} = GND$, Except Where Noted

| Symbol | Parameter | Condition | V_{CC} V | Guaranteed Limit | | | Unit |
|----------|--|--|---------------|------------------|-----------|-----------|---------|
| | | | | -55 to 25°C | ≤85°C | ≤125°C | |
| V_{IH} | Minimum High-Level Input Voltage, Channel-Select or Enable Inputs | $R_{on} = \text{Per Spec}$ | 2.0 | 1.50 | 1.50 | 1.50 | V |
| | | | 3.0 | 2.10 | 2.10 | 2.10 | |
| | | | 4.5 | 3.15 | 3.15 | 3.15 | |
| | | | 6.0 | 4.20 | 4.20 | 4.20 | |
| V_{IL} | Maximum Low-Level Input Voltage, Channel-Select or Enable Inputs | $R_{on} = \text{Per Spec}$ | 2.0 | 0.50 | 0.50 | 0.50 | V |
| | | | 3.0 | 0.90 | 0.90 | 0.90 | |
| | | | 4.5 | 1.35 | 1.35 | 1.35 | |
| | | | 6.0 | 1.80 | 1.80 | 1.80 | |
| I_{in} | Maximum Input Leakage Current on Digital Pins (Enable/A/B/C) | $V_{in} = V_{CC} \text{ or } GND$ | 6.0 | ± 0.1 | ± 1.0 | ± 1.0 | μA |
| I_{CC} | Maximum Quiescent Supply Current (per Package) | $V_{in(digital)} = V_{CC} \text{ or } GND$ $V_{in(analog)} = GND$ | 6.0 | 2 | 20 | 40 | μA |

NOTE: Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

MC74HC4851A, MC74HC4852A

DC CHARACTERISTICS — Analog Section

| Symbol | Parameter | Condition | V _{CC} | Guaranteed Limit | | | Unit |
|------------------|---|--|-----------------|------------------|-------|--------|------|
| | | | | -55 to 25°C | ≤85°C | ≤125°C | |
| R _{on} | Maximum "ON" Resistance | V _{in} = V _{IL} or V _{IH} ; V _{IS} = V _{CC} to GND; I _S ≤ 2.0 mA | 2.0 | 1700 | 1750 | 1800 | Ω |
| | | | 3.0 | 1100 | 1200 | 1300 | |
| | | | 4.5 | 550 | 650 | 750 | |
| | | | 6.0 | 400 | 500 | 600 | |
| ΔR _{on} | Delta "ON" Resistance | V _{in} = V _{IL} or V _{IH} ; V _{IS} = V _{CC} /2 I _S ≤ 2.0 mA | 2.0 | 300 | 400 | 500 | Ω |
| | | | 3.0 | 160 | 200 | 240 | |
| | | | 4.5 | 80 | 100 | 120 | |
| | | | 6.0 | 60 | 80 | 100 | |
| I _{off} | Maximum Off-Channel Leakage Current, Any One Channel Common Channel | V _{in} = V _{CC} or GND | 6.0 | ±0.1 | ±0.1 | ±0.1 | μA |
| | | | | ±0.1 | ±0.1 | ±0.1 | |
| I _{on} | Maximum On-Channel Leakage Channel-to-Channel | V _{in} = V _{CC} or GND | 6.0 | ±0.1 | ±0.1 | ±0.1 | μA |

AC CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

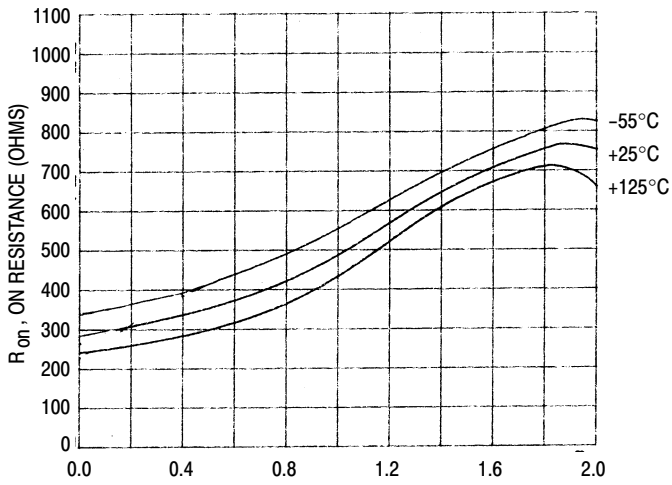
| Symbol | Parameter | V _{CC} | -55 to 25°C | ≤85°C | ≤125°C | Unit |
|--|---|-----------------|-------------|-------|--------|------|
| t _{PHL} , t _{PLH} | Maximum Propagation Delay, Analog Input to Analog Output | 2.0 | 160 | 180 | 200 | ns |
| | | 3.0 | 80 | 90 | 100 | |
| | | 4.5 | 40 | 45 | 50 | |
| | | 6.0 | 30 | 35 | 40 | |
| t _{PHL} , t _{PHZ,PZH} , t _{PLH} , t _{PLZ,PZL} | Maximum Propagation Delay, Enable or Channel-Select to Analog Output | 2.0 | 260 | 280 | 300 | ns |
| | | 3.0 | 160 | 180 | 200 | |
| | | 4.5 | 80 | 90 | 100 | |
| | | 6.0 | 60 | 70 | 80 | |
| C _{in} | Maximum Input Capacitance (All Switches Off) Any Single Analog Pin (All Switches Off) Common Analog Pin | | 10 | 10 | 10 | pF |
| | | | 35 | 35 | 35 | |
| | | | 130 | 130 | 130 | |
| C _{PD} | Power Dissipation Capacitance | Typical | 5.0 | 20 | | pF |

INJECTION CURRENT COUPLING SPECIFICATIONS (V_{CC} = 5V, T_A = -55°C to +125°C)

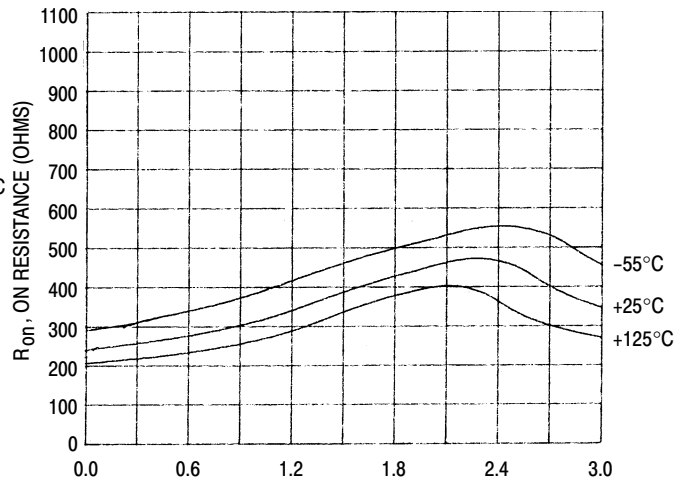
| Symbol | Parameter | Condition | Typ | Max | Unit |
|-------------------|---|--|-----|-----|------|
| VΔ _{out} | Maximum Shift of Output Voltage of Enabled Analog Channel | I _{in} * ≤ 1 mA, R _S ≤ 3,9 kΩ | 0.1 | 1.0 | mV |
| | | I _{in} * ≤ 10 mA, R _S ≤ 3,9 kΩ | 1.0 | 5.0 | |
| | | I _{in} * ≤ 1 mA, R _S ≤ 20 kΩ | 0.5 | 2.0 | |
| | | I _{in} * ≤ 10 mA, R _S ≤ 20 kΩ | 5.0 | 20 | |

* I_{in} = Total current injected into all disabled channels.

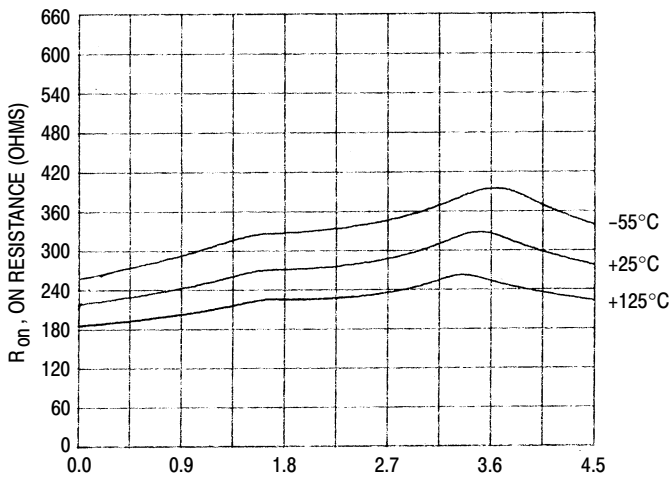
MC74HC4851A, MC74HC4852A



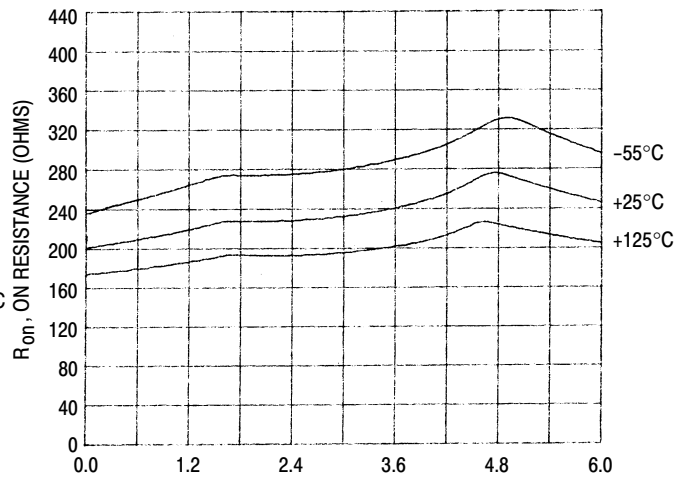
V_{in} , INPUT VOLTAGE (VOLTS), REFERENCED TO GND
Figure 5. Typical On Resistance $V_{CC} = 2V$



V_{in} , INPUT VOLTAGE (VOLTS), REFERENCED TO GND
Figure 6. Typical On Resistance $V_{CC} = 3V$



V_{in} , INPUT VOLTAGE (VOLTS), REFERENCED TO GND
Figure 7. Typical On Resistance $V_{CC} = 4.5V$



V_{in} , INPUT VOLTAGE (VOLTS), REFERENCED TO GND
Figure 8. Typical On Resistance $V_{CC} = 6V$

MC74HC4851A, MC74HC4852A

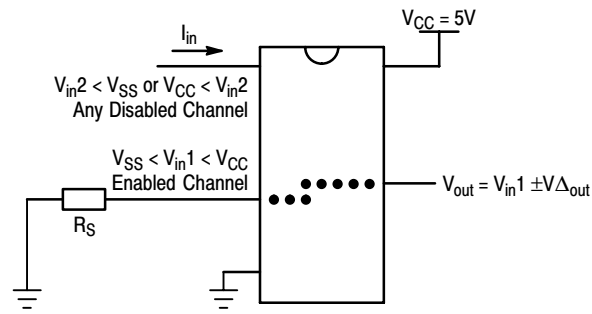


Figure 9. Injection Current Coupling Specification

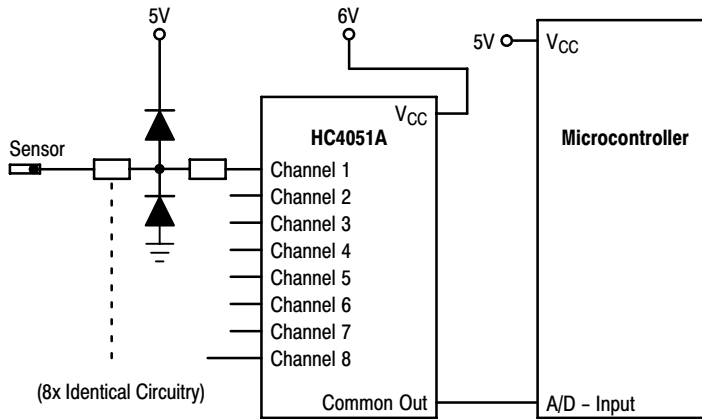


Figure 10. Actual Technology

Requires 32 passive components and one extra 6V regulator to suppress injection current into a standard HC4051 multiplexer

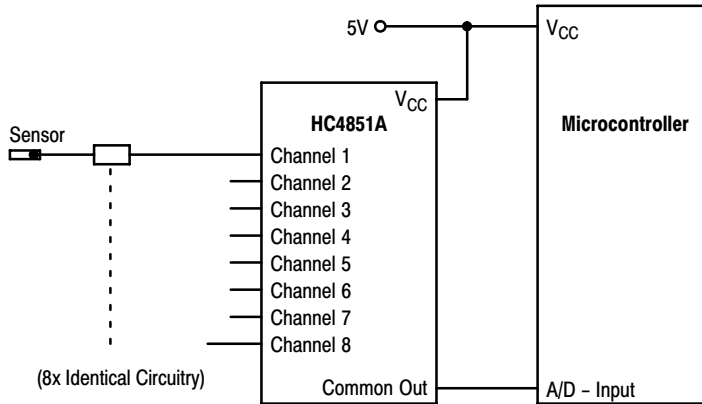


Figure 11. MC74HC4851A Solution

Solution by applying the HC4851A multiplexer

MC74HC4851A, MC74HC4852A

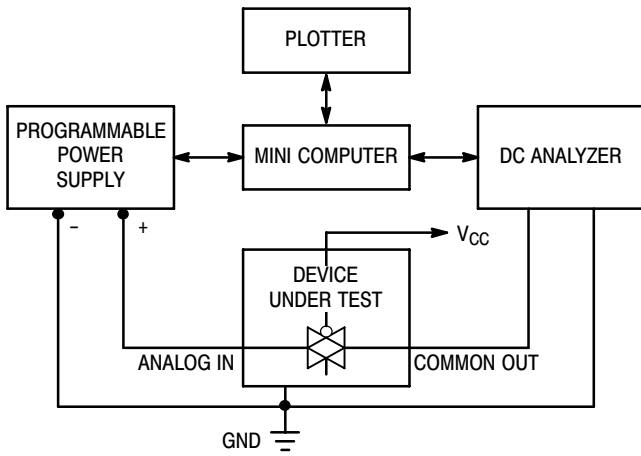


Figure 12. On Resistance Test Set-Up

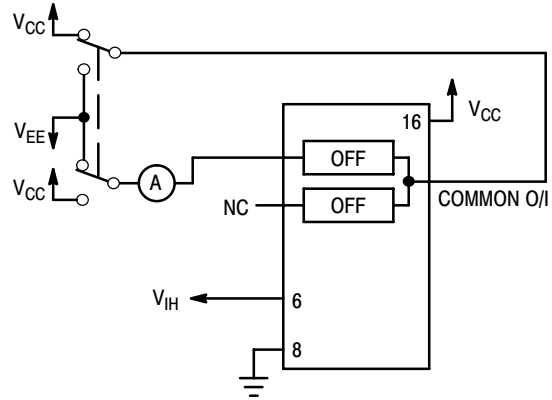


Figure 13. Maximum Off Channel Leakage Current, Any One Channel, Test Set-Up

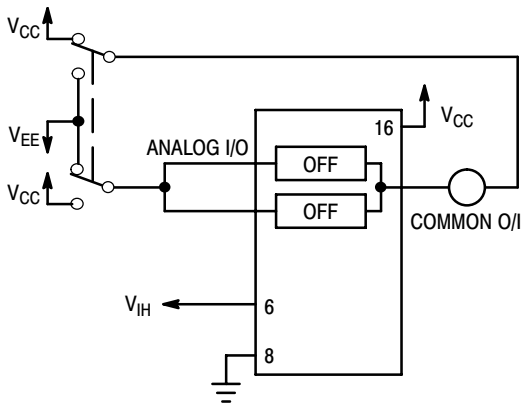


Figure 14. Maximum Off Channel Leakage Current, Common Channel, Test Set-Up

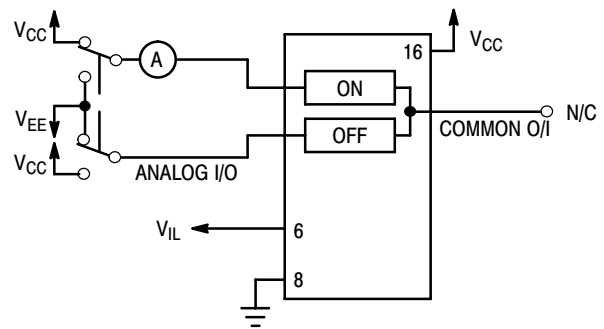


Figure 15. Maximum On Channel Leakage Current, Channel to Channel, Test Set-Up

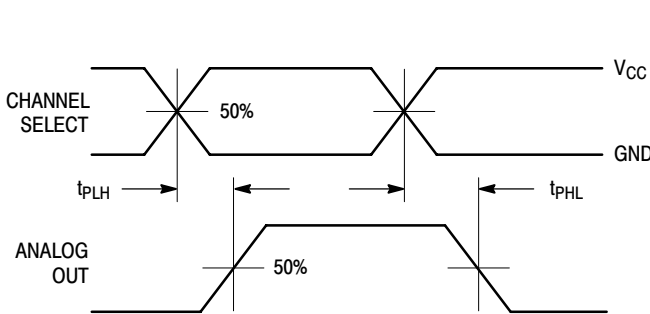
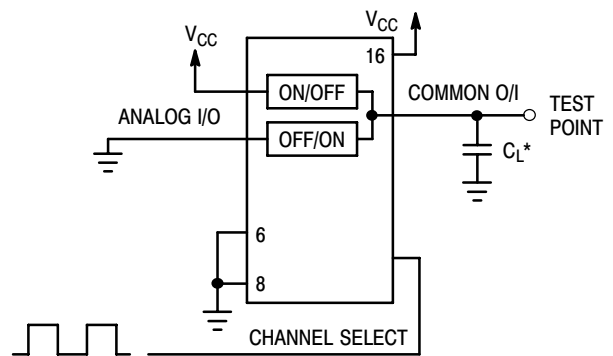


Figure 16. Propagation Delays, Channel Select to Analog Out



*Includes all probe and jig capacitance

Figure 17. Propagation Delay, Test Set-Up Channel Select to Analog Out

MC74HC4851A, MC74HC4852A

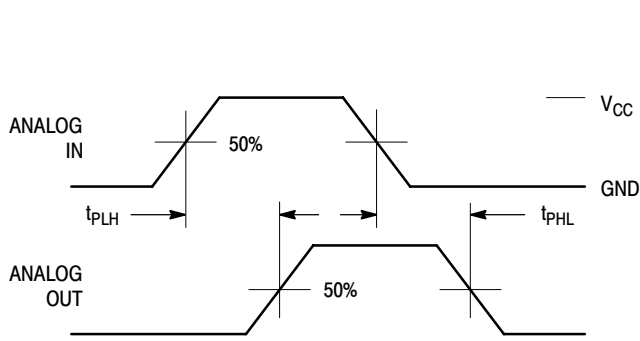
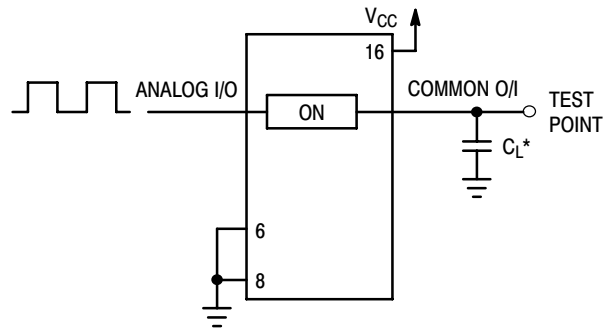


Figure 18. Propagation Delays, Analog In to Analog Out



*Includes all probe and jig capacitance

Figure 19. Propagation Delay, Test Set-Up Analog In to Analog Out

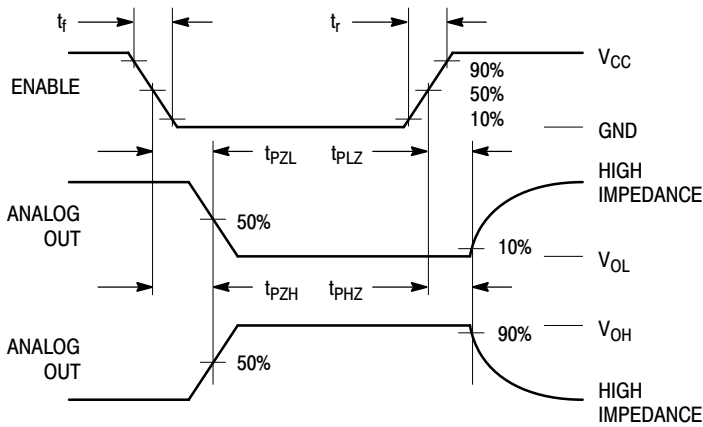


Figure 20. Propagation Delays, Enable to Analog Out

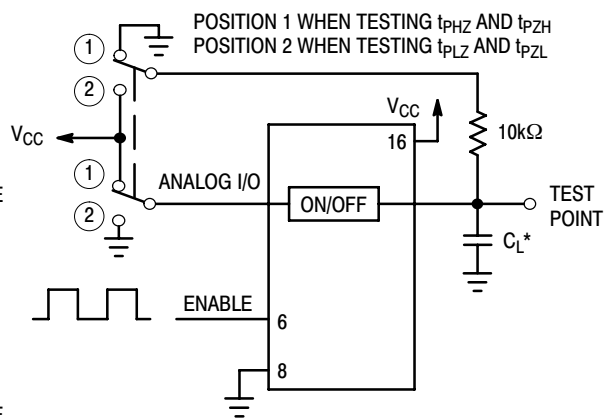


Figure 21. Propagation Delay, Test Set-Up Enable to Analog Out

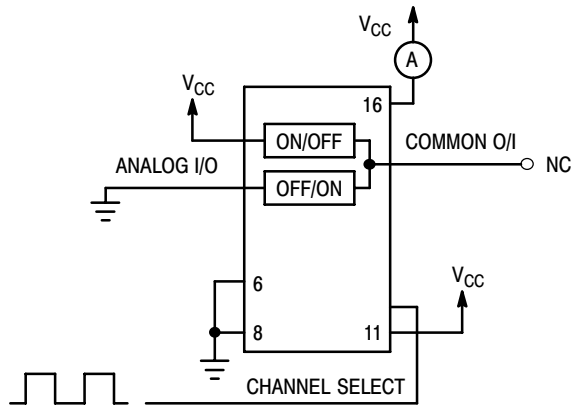


Figure 22. Power Dissipation Capacitance, Test Set-Up

MC74HC4851A, MC74HC4852A

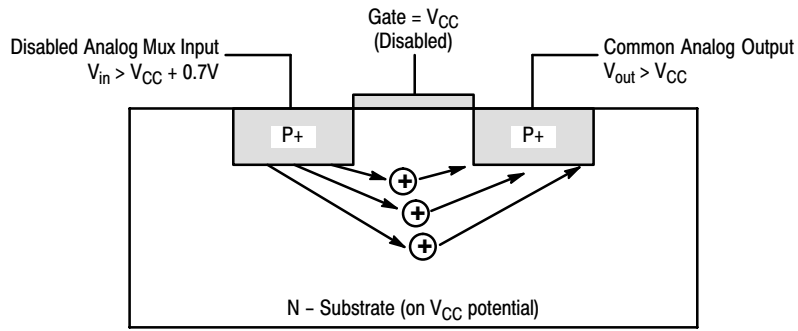


Figure 23. Diagram of Bipolar Coupling Mechanism
 Appears if V_{in} exceeds V_{CC}, driving injection current into the substrate

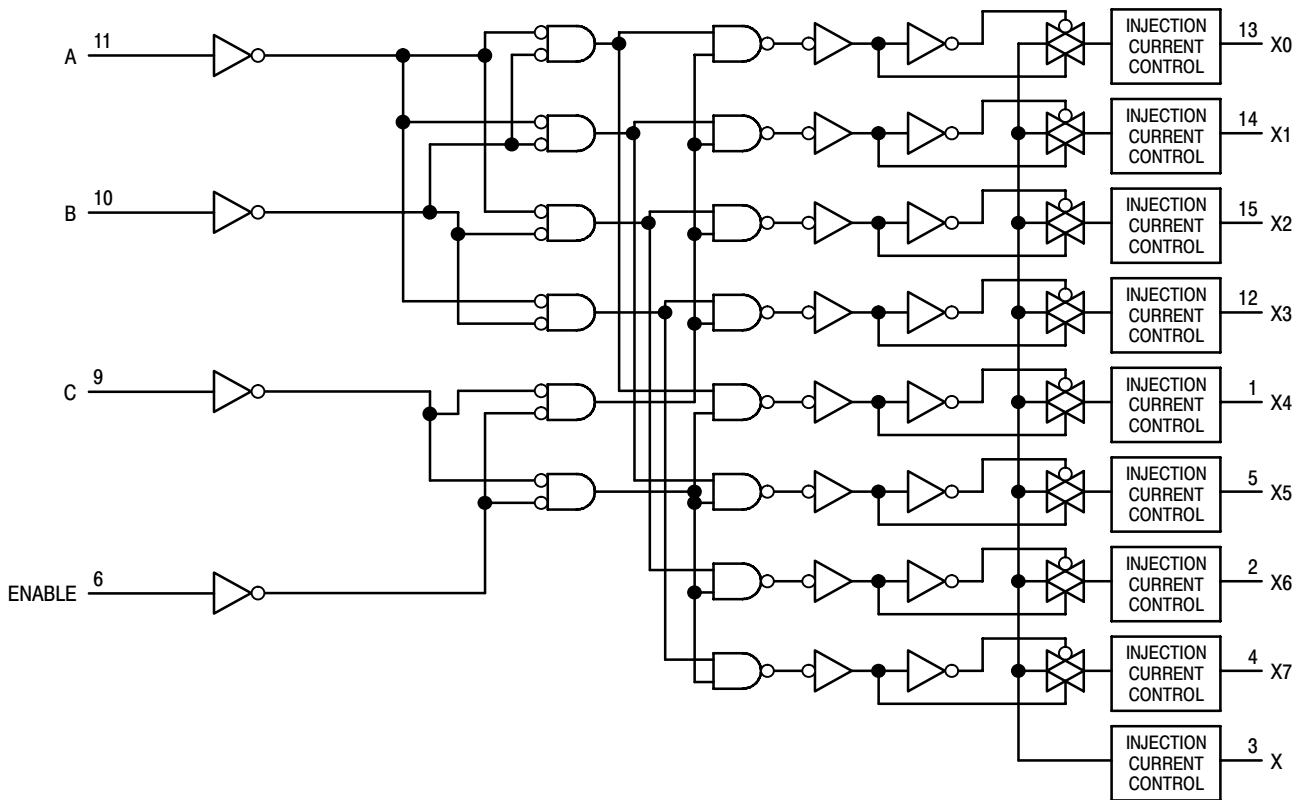


Figure 24. Function Diagram, HC4851A

MC74HC4851A, MC74HC4852A

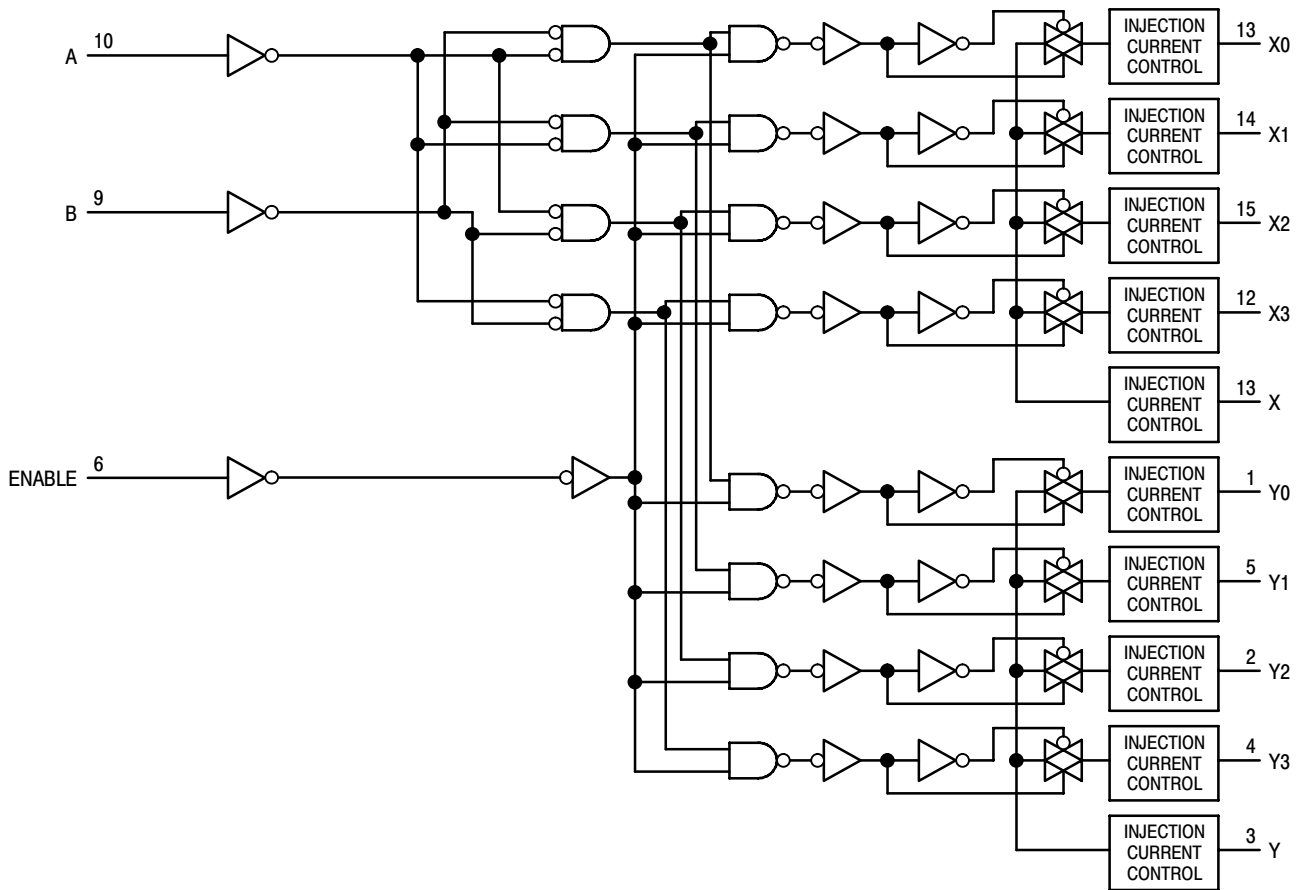


Figure 25. Function Diagram, HC4852A

MC74HC4851A, MC74HC4852A

ORDERING INFORMATION

| Device | Package | Shipping† |
|------------------|---------------------------|--------------------------|
| MC74HC4851AN | PDIP-16 | 500 Units / Box |
| MC74HC4851ANG | PDIP-16 (Pb-Free) | 500 Units / Box |
| MC74HC4851AD | SOIC-16 | 48 Units / Rail |
| MC74HC4851ADG | SOIC-16 (Pb-Free) | 48 Units / Rail |
| MC74HC4851ADR2 | SOIC-16 | 2500 Units / Tape & Reel |
| MC74HC4851ADR2G | SOIC-16 (Pb-Free) | 2500 Units / Tape & Reel |
| MC74HC4851ADTR2 | TSSOP-16* | 2500 Units / Tape & Reel |
| MC74HC4851ADTR2G | TSSOP-16* | 2500 Units / Tape & Reel |
| MC74HC4851ADW | SOIC-16 WIDE | 48 Units / Rail |
| MC74HC4851ADWG | SOIC-16 WIDE (Pb-Free) | 48 Units / Rail |
| MC74HC4851ADWR2 | SOIC-16 WIDE | 1000 Units / Tape & Reel |
| MC74HC4851ADWR2G | SOIC-16 WIDE (Pb-Free) | 1000 Units / Tape & Reel |
| MC74HC4852AN | PDIP-16 | 500 Units / Box |
| MC74HC4852ANG | PDIP-16 (Pb-Free) | 500 Units / Box |
| MC74HC4852AD | SOIC-16 | 48 Units / Rail |
| MC74HC4852ADG | SOIC-16 (Pb-Free) | 48 Units / Rail |
| MC74HC4852ADR2 | SOIC-16 | 2500 Units / Tape & Reel |
| MC74HC4852ADR2G | SOIC-16 (Pb-Free) | 2500 Units / Tape & Reel |
| MC74HC4852ADTR2 | TSSOP-16* | 2500 Units / Tape & Reel |
| MC74HC4852ADTR2G | TSSOP-16* | 2500 Units / Tape & Reel |

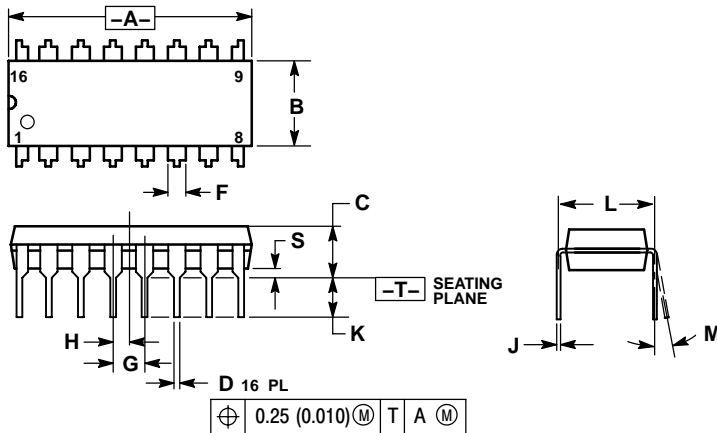
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*This package is inherently Pb-Free.

MC74HC4851A, MC74HC4852A

PACKAGE DIMENSIONS

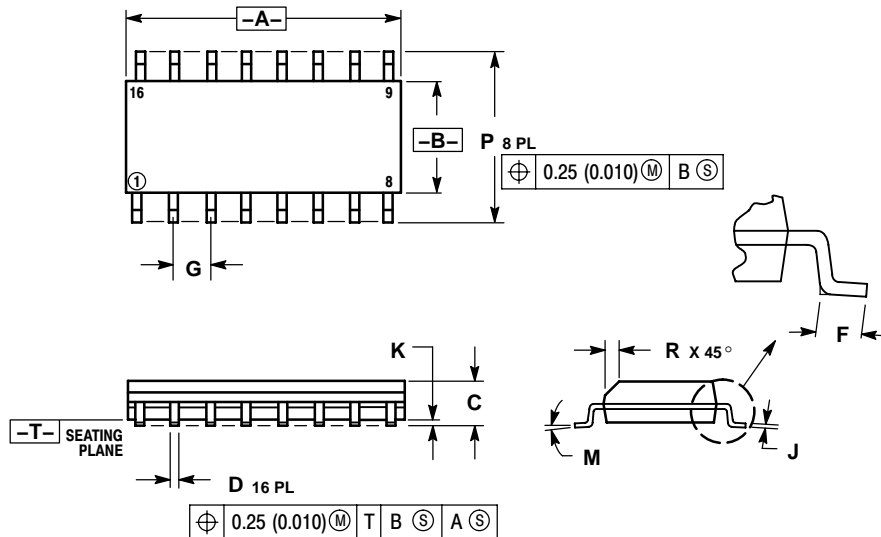
PDIP-16
N SUFFIX
CASE 648-08
ISSUE T



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
 4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
 5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.740 | 0.770 | 18.80 | 19.55 |
| B | 0.250 | 0.270 | 6.35 | 6.85 |
| C | 0.145 | 0.175 | 3.69 | 4.44 |
| D | 0.015 | 0.021 | 0.39 | 0.53 |
| F | 0.040 | 0.70 | 1.02 | 1.77 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.050 BSC | | 1.27 BSC | |
| J | 0.008 | 0.015 | 0.21 | 0.38 |
| K | 0.110 | 0.130 | 2.80 | 3.30 |
| L | 0.295 | 0.305 | 7.50 | 7.74 |
| M | 0° | | 10° | |
| S | 0.020 | 0.040 | 0.51 | 1.01 |

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

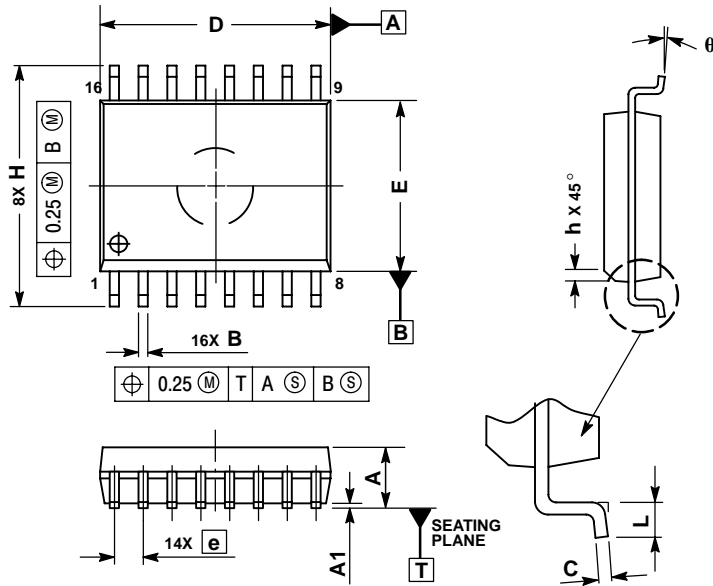


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (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° | |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

MC74HC4851A, MC74HC4852A

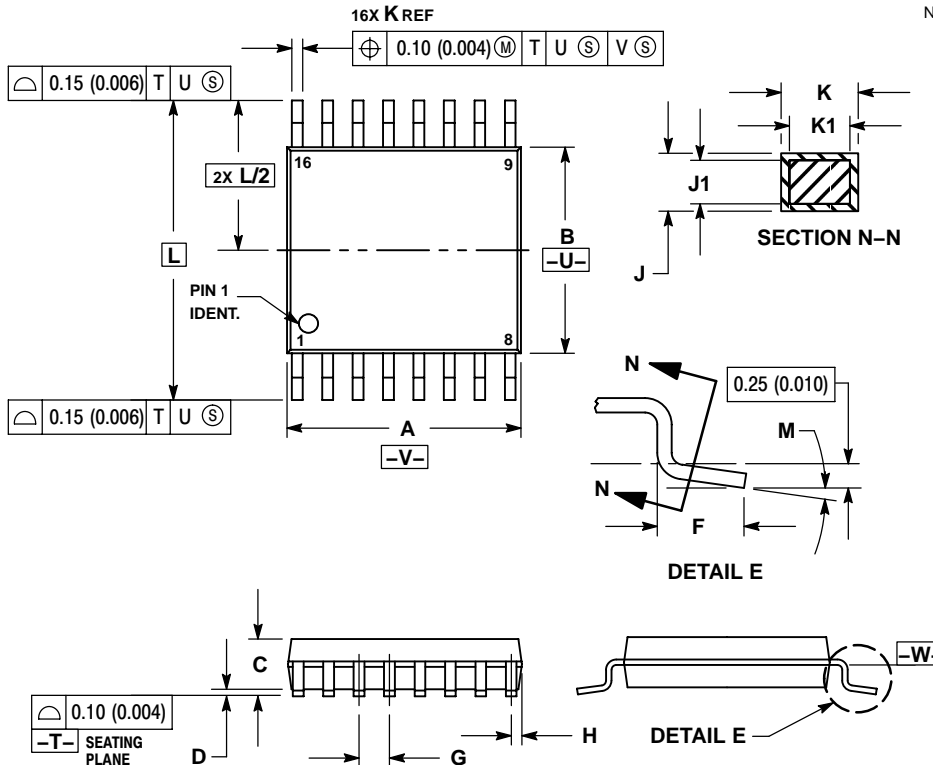
SOIC-16 WIDE
DW SUFFIX
CASE 751G-03
ISSUE C



NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

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



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-.

MC74HC4851A, MC74HC4852A

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