

# MC74VHC1GT66

## SPST (NO) Normally Open Analog Switch

The MC74VHC1GT66 is a Single Pole Single Throw (SPST) analog switch. It achieves high speed propagation delays and low ON resistances while maintaining low power dissipation. This bilateral switch controls analog and digital voltages that may vary across the full power-supply range (from  $V_{CC}$  to GND).

The MC74VHC1GT66 is compatible in function to a single gate of the High Speed CMOS MC74VHCT4066 and the metal-gate CMOS MC14066. The device has been designed so that the ON resistances ( $R_{ON}$ ) are much lower and more linear over input voltage than  $R_{ON}$  of the metal-gate CMOS or High Speed CMOS analog switches.

The ON/OFF Control input is compatible with TTL-type input thresholds allowing the device to be used as a logic-level translator from 3 V CMOS logic to 5 V CMOS logic or from 1.8 V CMOS logic to 3 V CMOS logic while operating at the high-voltage power supply. The input protection circuitry on this device allows overvoltage tolerance on the input, which provides protection when voltages of up to 7 V are applied, regardless of the supply voltage. This allows the MC74VHC1GT66 to be used to interface 5 V circuits to 3 V circuits.

### Features

- High Speed:  $t_{PD} = 20$  ns (Typ) at  $V_{CC} = 5$  V
- Low Power Dissipation:  $I_{CC} = 1.0$   $\mu$ A (Max) at  $T_A = 25^\circ\text{C}$
- Diode Protection Provided on Inputs and Outputs
- Improved Linearity and Lower ON Resistance over Input Voltage
- On/Off Control Input Has OVT
- Chip Complexity: FETs = 11; Equivalent Gates = 3
- Pb-Free Packages are Available



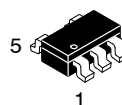
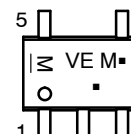
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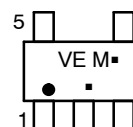
### MARKING DIAGRAMS



**SC-88A  
DF SUFFIX  
CASE 419A**



**TSOP-5  
DT SUFFIX  
CASE 483**



VE = Device Code  
M = Date Code\*  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

### PIN ASSIGNMENT

| PIN ASSIGNMENT |                |
|----------------|----------------|
| 1              | IN/OUT $X_A$   |
| 2              | OUT/IN $Y_A$   |
| 3              | GND            |
| 4              | ON/OFF CONTROL |
| 5              | $V_{CC}$       |

### FUNCTION TABLE

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

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

# MC74VHC1GT66

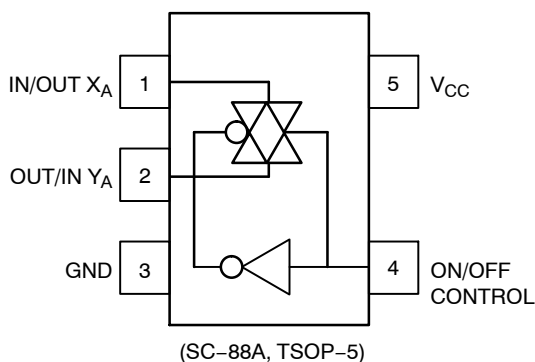


Figure 1. Pinout Diagram

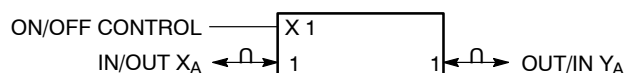


Figure 2. Logic Symbol

## MAXIMUM RATINGS

| Symbol               | Characteristics                                 | Value                                                                                                          | Unit |
|----------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------|
| V <sub>CC</sub>      | DC Supply Voltage                               | -0.5 to +7.0                                                                                                   | V    |
| V <sub>IN</sub>      | DC Input Voltage                                | -0.5 to +7.0                                                                                                   | V    |
| V <sub>IS</sub>      | Analog Output Voltage                           | -0.5 to 7.0                                                                                                    | V    |
| I <sub>IK</sub>      | Input Diode Current                             | -20                                                                                                            | mA   |
| I <sub>CC</sub>      | DC Supply Current, V <sub>CC</sub> and GND      | +25                                                                                                            | mA   |
| T <sub>STG</sub>     | Storage Temperature Range                       | -65 to +150                                                                                                    | °C   |
| T <sub>L</sub>       | Lead Temperature, 1 mm from Case for 10 Seconds | 260                                                                                                            | °C   |
| T <sub>J</sub>       | Junction Temperature Under Bias                 | +150                                                                                                           | °C   |
| θ <sub>JA</sub>      | Thermal Resistance                              | SC70-5 (Note 1)<br>SOT23-5<br>350<br>230                                                                       | °C/W |
| P <sub>D</sub>       | Power Dissipation in Still Air at 85°C          | SC70-5<br>SOT23-5<br>150<br>200                                                                                | mW   |
| MSL                  | Moisture Sensitivity                            | Level 1                                                                                                        |      |
| F <sub>R</sub>       | Flammability Rating                             | Oxygen Index: 28 to 34<br>UL 94 V-0 @ 0.125 in                                                                 |      |
| V <sub>ESD</sub>     | ESD Withstand Voltage                           | Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4)<br>> 2000<br>> 200<br>N/A | V    |
| I <sub>Latchup</sub> | Latchup Performance                             | Above V <sub>CC</sub> and Below GND at 125°C (Note 5)<br>± 500                                                 | mA   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.
5. Tested to EIA/JESD78.

# MC74VHC1GT66

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Characteristics                                                                                                      | Min    | Max       | Unit |
|------------|----------------------------------------------------------------------------------------------------------------------|--------|-----------|------|
| $V_{CC}$   | DC Supply Voltage                                                                                                    | 2.0    | 5.5       | V    |
| $V_{IN}$   | Digital Input Voltage                                                                                                | GND    | 5.5       | V    |
| $V_{IS}$   | Analog Input Voltage                                                                                                 | GND    | $V_{CC}$  | V    |
| $T_A$      | Operating Temperature Range                                                                                          | -55    | +125      | °C   |
| $t_r, t_f$ | Input Rise and Fall Time<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 |

## 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         |

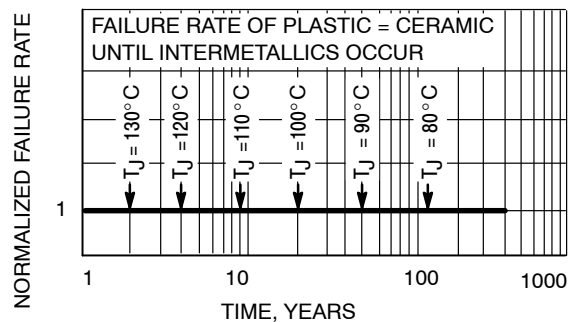


Figure 3. Failure Rate vs. Time Junction Temperature

# MC74VHC1GT66

## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                                                | Test Conditions                                                                                                        | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |                    | T <sub>A</sub> ≤ 85°C |                    | -55°C ≤ T <sub>A</sub> ≤ 125°C |                    | Unit |
|------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------|--------------------|-----------------------|--------------------|--------------------------------|--------------------|------|
|                  |                                                          |                                                                                                                        |                        | Min                   | Max                | Min                   | Max                | Min                            | Max                |      |
| V <sub>IH</sub>  | Minimum High-Level Input Voltage<br>ON/OFF Control Input | R <sub>ON</sub> = Per Spec                                                                                             | 3.0<br>4.5<br>5.5      | 1.2<br>2.0<br>2.0     |                    | 1.2<br>2.0<br>2.0     |                    | 1.2<br>2.0<br>2.0              |                    | V    |
| V <sub>IL</sub>  | Maximum Low-Level Input Voltage<br>ON/OFF Control Input  | R <sub>ON</sub> = Per Spec                                                                                             | 3.0<br>4.5<br>5.5      |                       | 0.53<br>0.8<br>0.8 |                       | 0.53<br>0.8<br>0.8 |                                | 0.53<br>0.8<br>0.8 | V    |
| I <sub>IN</sub>  | Maximum Input Leakage Current<br>ON/OFF Control Input    | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                               | 0 to 5.5               |                       | ±0.1               |                       | ±1.0               |                                | ±1.0               | μA   |
| I <sub>CC</sub>  | Maximum Quiescent Supply Current                         | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>V <sub>IO</sub> = 0 V                                                      | 5.5                    |                       | 1.0                |                       | 20                 |                                | 40                 | μA   |
| I <sub>CCT</sub> | Quiescent Supply Current                                 | ON/OFF Control at 3.4 V                                                                                                | 5.5                    |                       | 1.35               |                       | 1.5                |                                | 1.65               | mA   |
| R <sub>ON</sub>  | Maximum "ON" Resistance                                  | V <sub>IN</sub> = V <sub>IH</sub><br>V <sub>IS</sub> = V <sub>CC</sub> or GND<br> I <sub>IS</sub>   ≤ 10 mA (Figure 4) | 3.0<br>4.5<br>5.5      |                       | 60<br>45<br>40     |                       | 70<br>50<br>45     |                                | 100<br>60<br>55    | Ω    |
| I <sub>OFF</sub> | Maximum Off-Channel Leakage Current                      | V <sub>IN</sub> = V <sub>IL</sub><br>V <sub>IS</sub> = V <sub>CC</sub> or GND<br>Switch Off (Figure 5)                 | 5.5                    |                       | 0.1                |                       | 0.5                |                                | 1.0                | μA   |

## AC ELECTRICAL CHARACTERISTICS C<sub>load</sub> = 50 pF, Input t<sub>r</sub>/t<sub>f</sub> = 3.0 ns

| Symbol                                 | Parameter                                                  | Test Conditions                               | V <sub>CC</sub><br>(V)   | T <sub>A</sub> = 25°C |                        |                      | T <sub>A</sub> ≤ 85°C |                      | -55°C ≤ T <sub>A</sub> ≤ 125°C |                      | Unit |
|----------------------------------------|------------------------------------------------------------|-----------------------------------------------|--------------------------|-----------------------|------------------------|----------------------|-----------------------|----------------------|--------------------------------|----------------------|------|
|                                        |                                                            |                                               |                          | Min                   | Typ                    | Max                  | Min                   | Max                  | Min                            | Max                  |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Input X to Y                    | Y <sub>A</sub> = Open<br>(Figures 7, 14)      | 2.0<br>3.0<br>4.5<br>5.5 |                       | 1<br>0.6<br>0.6<br>0.6 | 5<br>2<br>1<br>1     |                       | 6<br>3<br>1<br>1     |                                | 7<br>4<br>2<br>1     | ns   |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, ON/OFF Control to Analog Output | R <sub>L</sub> = 1000 Ω<br>(Figures 8, 15)    | 2.0<br>3.0<br>4.5<br>5.5 |                       | 32<br>28<br>24<br>20   | 40<br>35<br>30<br>25 |                       | 45<br>40<br>35<br>30 |                                | 50<br>45<br>40<br>35 | ns   |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, ON/OFF Control to Analog Output | R <sub>L</sub> = 1000 Ω<br>(Figures 8, 15)    | 2.0<br>3.0<br>4.5<br>5.5 |                       | 32<br>28<br>24<br>20   | 40<br>35<br>30<br>25 |                       | 45<br>40<br>35<br>30 |                                | 50<br>45<br>40<br>35 | ns   |
| C <sub>IN</sub>                        | Maximum Input Capacitance                                  | ON/OFF Control Input                          | 0.0                      |                       | 3                      | 10                   |                       | 10                   |                                | 10                   | pF   |
|                                        |                                                            | Control Input = GND<br>Analog I/O Feedthrough | 5.0                      |                       | 4<br>4                 | 10<br>10             |                       | 10<br>10             |                                | 10<br>10             |      |

| C <sub>PD</sub> | Power Dissipation Capacitance (Note 6) | Typical @ 25°C, V <sub>CC</sub> = 5.0 V | pF |
|-----------------|----------------------------------------|-----------------------------------------|----|
|                 |                                        | 18                                      |    |

6. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# MC74VHC1GT66

## ADDITIONAL APPLICATION CHARACTERISTICS (Voltages Referenced to GND Unless Noted)

| Symbol                | Parameter                                                              | Test Conditions                                                                                                                                                                                                | V <sub>CC</sub>   | Limit 25°C        | Unit             |
|-----------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|------------------|
| BW                    | Maximum On-Channel Bandwidth or Minimum Frequency Response (Figure 10) | f <sub>in</sub> = 1 MHz Sine Wave<br>Adjust f <sub>in</sub> voltage to obtain 0 dBm at V <sub>OS</sub><br>Increase f <sub>in</sub> = frequency until dB meter reads -3 dB<br>R <sub>L</sub> = 50 Ω             | 3.0<br>4.5<br>5.5 | 150<br>175<br>180 | MHz              |
| ISO <sub>off</sub>    | Off-Channel Feedthrough Isolation (Figure 11)                          | f <sub>in</sub> = Sine Wave<br>Adjust f <sub>in</sub> voltage to obtain 0 dBm at V <sub>IS</sub><br>f <sub>in</sub> = 10 kHz, R <sub>L</sub> = 600 Ω                                                           | 3.0<br>4.5<br>5.5 | -80<br>-80<br>-80 | dB               |
| NOISE <sub>feed</sub> | Feedthrough Noise Control to Switch (Figure 12)                        | V <sub>in</sub> ≤ 1 MHz Square Wave (t <sub>r</sub> = t <sub>f</sub> = 2ns)<br>R <sub>L</sub> = 600 Ω                                                                                                          | 3.0<br>4.5<br>5.5 | 45<br>60<br>130   | mV <sub>PP</sub> |
| THD                   | Total Harmonic Distortion (Figure 13)                                  | f <sub>in</sub> = 1 kHz, R <sub>L</sub> = 10 kΩ<br>THD = THD <sub>Measured</sub> - THD <sub>Source</sub><br>V <sub>IS</sub> = 3.0 V <sub>PP</sub> sine wave<br>V <sub>IS</sub> = 5.0 V <sub>PP</sub> sine wave | 3.3<br>5.5        | 0.30<br>0.15      | %                |

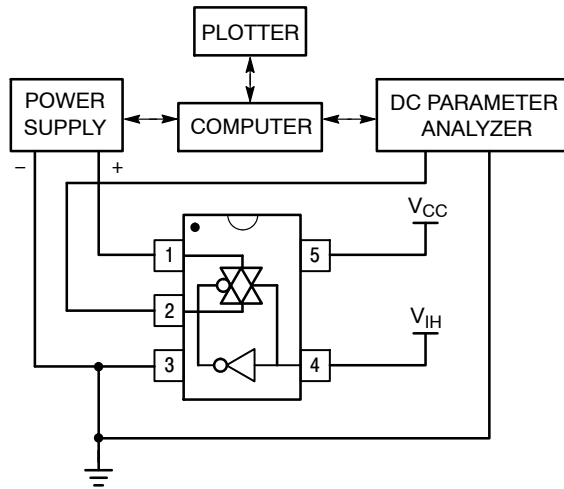


Figure 4. On Resistance Test Set-Up

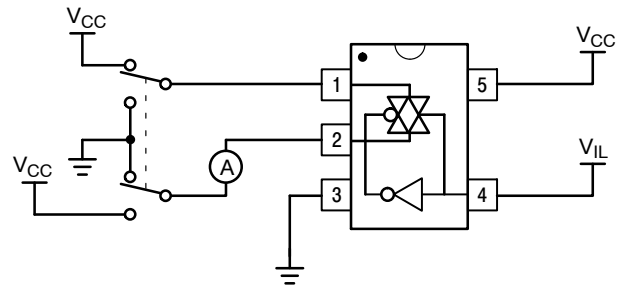


Figure 5. Maximum Off-Channel Leakage Current Test Set-Up

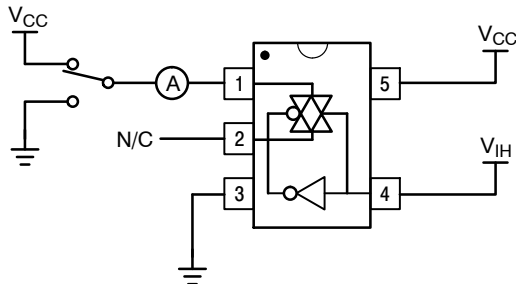


Figure 6. Maximum On-Channel Leakage Current Test Set-Up

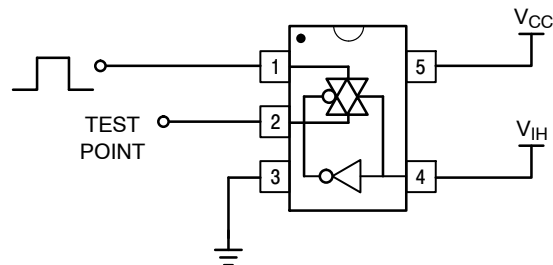
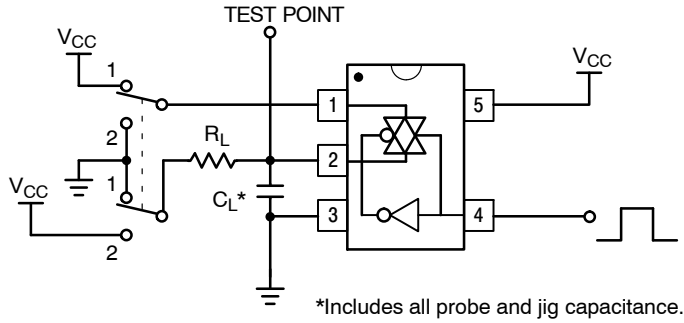


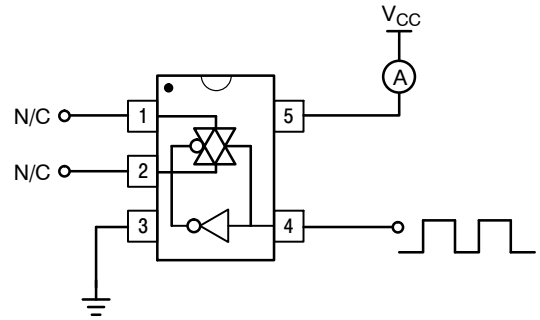
Figure 7. Propagation Delay Test Set-Up

# MC74VHC1GT66

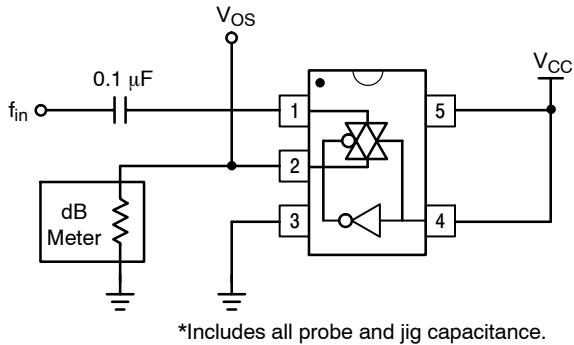
Switch to Position 2 when testing  $t_{PLZ}$  and  $t_{PZL}$   
Switch to Position 1 when testing  $t_{PHZ}$  and  $t_{PZH}$



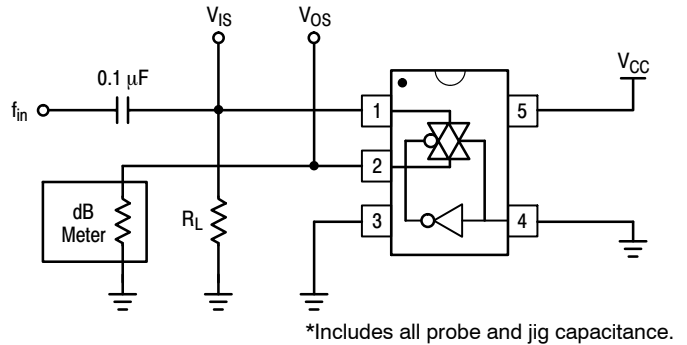
**Figure 8. Propagation Delay Output Enable/Disable Test Set-Up**



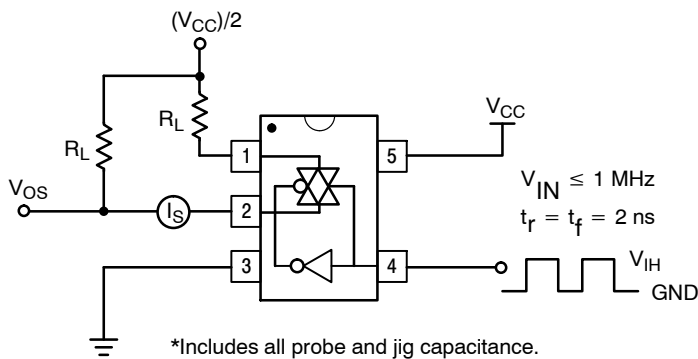
**Figure 9. Power Dissipation Capacitance Test Set-Up**



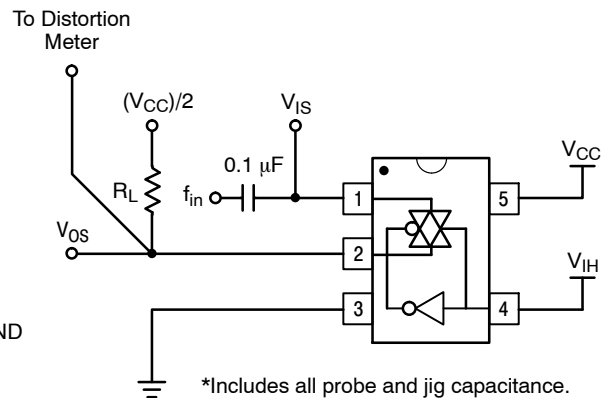
**Figure 10. Maximum On-Channel Bandwidth Test Set-Up**



**Figure 11. Off-Channel Feedthrough Isolation Test Set-Up**



**Figure 12. Feedthrough Noise, ON/OFF Control to Analog Out, Test Set-Up**



**Figure 13. Total Harmonic Distortion Test Set-Up**

## MC74VHC1GT66

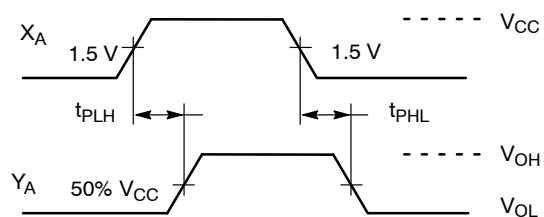


Figure 14. Propagation Delay, Analog In to Analog Out Waveforms

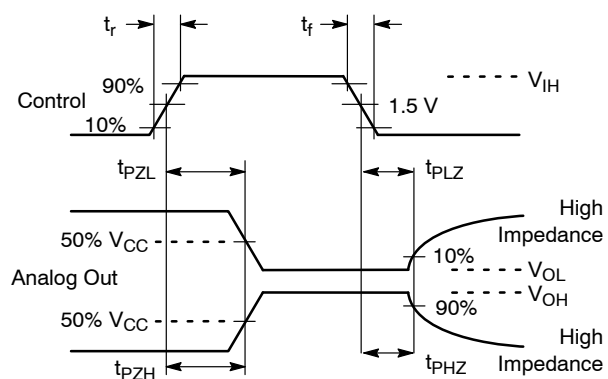


Figure 15. Propagation Delay, ON/OFF Control

### ORDERING INFORMATION

| Device           | Package             | Shipping <sup>†</sup> |
|------------------|---------------------|-----------------------|
| M74VHC1GT66DFT1G | SC-88A<br>(Pb-Free) | 3000 / Tape & Reel    |
| MC74VHC1GT66DFT2 | SC-88A              |                       |
| M74VHC1GT66DFT2G | SC-88A<br>(Pb-Free) |                       |
| MC74VHC1GT66DTT1 | TSOP-5              |                       |
| M74VHC1GT66DTT1G | TSOP-5<br>(Pb-Free) |                       |

<sup>†</sup>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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

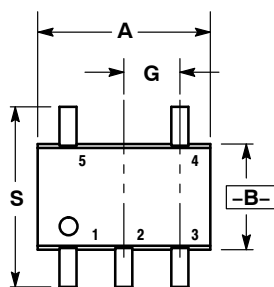
ON Semiconductor®



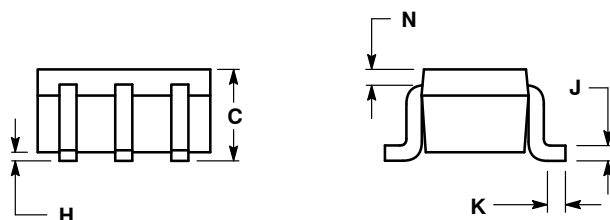
SCALE 2:1

SC-88A (SC-70-5/SOT-353)  
CASE 419A-02  
ISSUE L

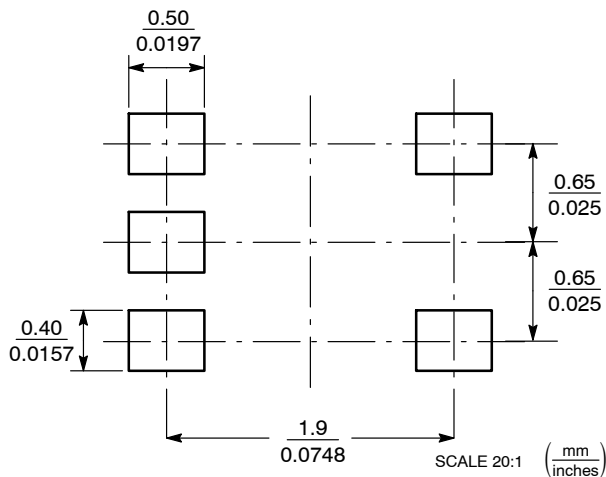
DATE 17 JAN 2013



D 5 PL  $\oplus$  0.2 (0.008) (M) B (M)



### SOLDER FOOTPRINT

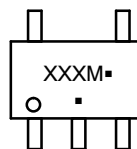


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.071     | 0.087 | 1.80        | 2.20 |
| B   | 0.045     | 0.053 | 1.15        | 1.35 |
| C   | 0.031     | 0.043 | 0.80        | 1.10 |
| D   | 0.004     | 0.012 | 0.10        | 0.30 |
| G   | 0.026 BSC |       | 0.65 BSC    |      |
| H   | ---       | 0.004 | ---         | 0.10 |
| J   | 0.004     | 0.010 | 0.10        | 0.25 |
| K   | 0.004     | 0.012 | 0.10        | 0.30 |
| N   | 0.008 REF |       | 0.20 REF    |      |
| S   | 0.079     | 0.087 | 2.00        | 2.20 |

### GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLE 1:  
PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

STYLE 2:  
PIN 1. ANODE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. CATHODE

STYLE 3:  
PIN 1. ANODE 1  
2. N/C  
3. ANODE 2  
4. CATHODE 2  
5. CATHODE 1

STYLE 4:  
PIN 1. SOURCE 1  
2. DRAIN 1/2  
3. SOURCE 1  
4. GATE 1  
5. GATE 2

STYLE 5:  
PIN 1. CATHODE  
2. COMMON ANODE  
3. CATHODE 2  
4. CATHODE 3  
5. CATHODE 4

STYLE 6:  
PIN 1. EMITTER 2  
2. BASE 2  
3. EMITTER 1  
4. COLLECTOR  
5. COLLECTOR 2/BASE 1

STYLE 7:  
PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

STYLE 8:  
PIN 1. CATHODE  
2. COLLECTOR  
3. N/C  
4. BASE  
5. EMITTER

STYLE 9:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. ANODE

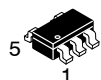
Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

|                  |                          |                                                                                                                                                                                     |
|------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98ASB42984B              | Electronic versions are uncontrolled except when accessed directly from the Document Repository.<br>Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | SC-88A (SC-70-5/SOT-353) | PAGE 1 OF 1                                                                                                                                                                         |

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

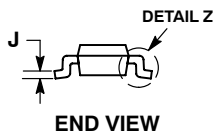
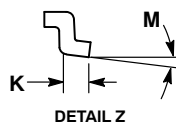
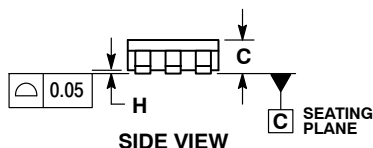
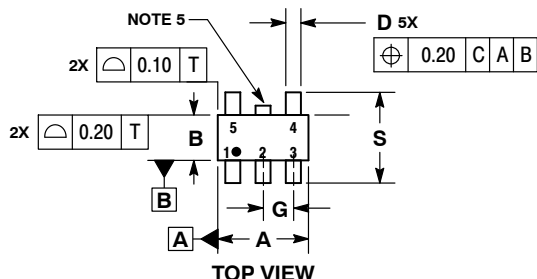
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SCALE 2:1

## TSOP-5 CASE 483 ISSUE N

DATE 12 AUG 2020

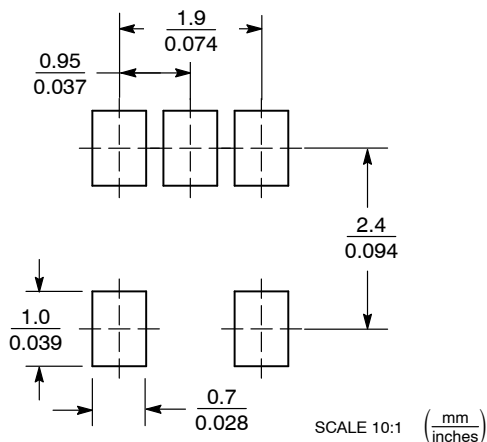


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION A.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

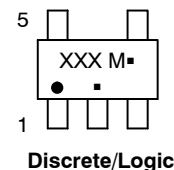
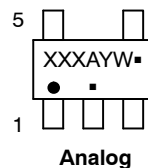
| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 2.85        | 3.15 |
| B   | 1.35        | 1.65 |
| C   | 0.90        | 1.10 |
| D   | 0.25        | 0.50 |
| G   | 0.95 BSC    |      |
| H   | 0.01        | 0.10 |
| J   | 0.10        | 0.26 |
| K   | 0.20        | 0.60 |
| M   | 0°          | 10°  |
| S   | 2.50        | 3.00 |

### 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.

### GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
■ = Pb-Free Package

XXX = Specific Device Code  
M = Date Code  
■ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present.

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DESCRIPTION: TSOP-5

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