# 74AHCT86
# Quad 2-Input Exclusive-OR Gate

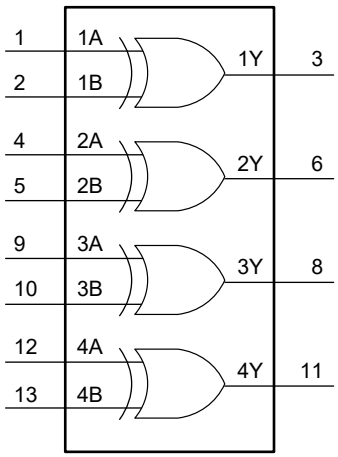
## GENERAL DESCRIPTION

The 74AHCT86 is a high-speed quad 2-input exclusive-OR gate fabricated with silicon-gate CMOS technology and is pin compatible with low-power Schottky TTL. This device performs the Boolean function $Y = \bar{A}B + A\bar{B}$ in positive logic.

## FEATURES

- **Balanced Propagation Delays**
- **All Inputs Have Schmitt Trigger Actions**
- **Inputs Accept Voltages Higher Than $V_{CC}$**
- **Operates with TTL Input Levels**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green SOIC-14 Package**

## LOGIC SYMBOL




## FUNCTION TABLE

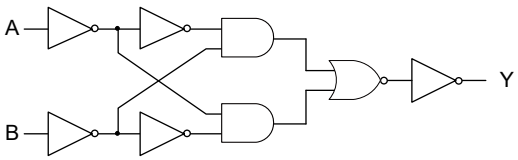
| INPUT | | OUTPUT |
|---|---|---|
| nA | nB | nY |
| L | L | L |
| L | H | H |
| H | L | H |
| H | H | L |

**$Y = \bar{A}B + A\bar{B}$**

H = High Voltage Level

L = Low Voltage Level

## LOGIC DIAGRAM

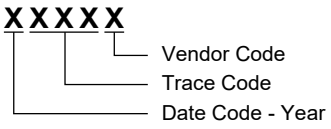


# PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| 74AHCT86 | SOIC-14 | -40℃ to +125℃ | 74AHCT86XS14G/TR | 74AHCT86XS14<br>XXXXX | Tape and Reel, 2500 |

## MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.




Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

## ABSOLUTE MAXIMUM RATINGS (1)

Supply Voltage Range, $V_{CC}$ ..... -0.5V to 7V
Input Voltage Range, $V_I$ (2) ..... -0.5V to 7V
Input Clamping Current, $I_{IK}$ (2) ($V_I$ < -0.5V).....-20mA
Output Clamping Current, $I_{OK}$ (2) ($V_O$ < -0.5V or $V_O$ > ($V_{CC}$ + 0.5V)) .....±20mA
Output Current, $I_O$ ($V_O$ = -0.5V to ($V_{CC}$ + 0.5V)) .....±25mA
Supply Current, $I_{CC}$ .....75mA
Ground Current, $I_{GND}$.....-75mA
Junction Temperature (3) .....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....+260℃
ESD Susceptibility
HBM.....6000V
CDM .....1000V

## RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, $V_{CC}$ .....4.5V to 5.5V
Input Voltage Range, $V_I$ .....0V to 5.5V
Output Voltage Range, $V_O$ ..... 0V to $V_{CC}$
Input Transition Rise and Fall Rate, Δt/ΔV
$V_{CC}$ = 5V ± 0.5V ..... 20ns/V (MAX)
Operating Temperature Range..... -40℃ to +125℃

## OVERSTRESS CAUTION

1. Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

2. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

3. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

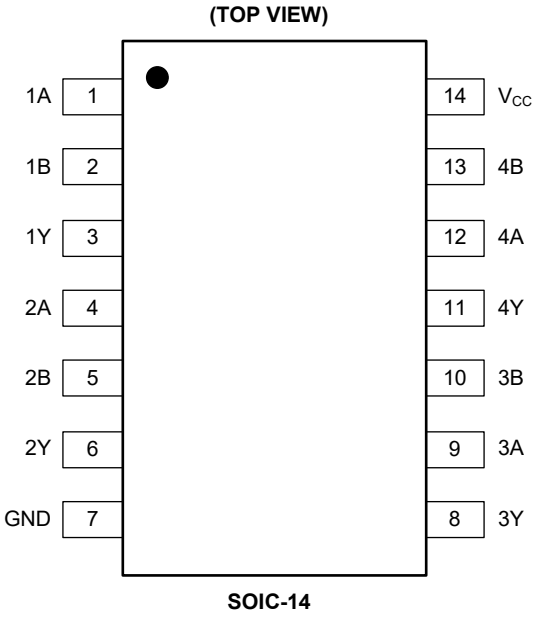
## ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

## DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

## PIN CONFIGURATION




## PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|---|---|---|
| 1, 4, 9, 12 | 1A, 2A, 3A, 4A | Data Inputs. |
| 2, 5, 10, 13 | 1B, 2B, 3B, 4B | Data Inputs. |
| 3, 6, 8, 11 | 1Y, 2Y, 3Y, 4Y | Data Outputs. |
| 7 | GND | Ground. |
| 14 | $V_{CC}$ | Supply Voltage. |

# ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃. All typical values are measured at $V_{CC}$ = 3.3V or $V_{CC}$ = 5V, $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | $V_{CC}$ = 4.5V to 5.5V | | Full | 2 | | | V |
| Low-Level Input Voltage | $V_{IL}$ | $V_{CC}$ = 4.5V to 5.5V | | Full | | | 0.8 | V |
| High-Level Output Voltage | $V_{OH}$ | $V_I$ = $V_{IH}$ or $V_{IL}$, $V_{CC}$ = 4.5V | $I_O$ = -50μA | Full | 4.45 | 4.495 | | V |
| | | | $I_O$ = -8.0mA | Full | 4 | 4.25 | | |
| Low-Level Output Voltage | $V_{OL}$ | $V_I$ = $V_{IH}$ or $V_{IL}$, $V_{CC}$ = 4.5V | $I_O$ = 50μA | Full | | 0.005 | 0.05 | V |
| | | | $I_O$ = 8.0mA | Full | | 0.25 | 0.5 | |
| Input Leakage Current | $I_I$ | $V_{CC}$ = 0V to 5.5V, $V_I$ = 5.5V or GND | | Full | | 0.02 | 2 | μA |
| Supply Current | $I_{CC}$ | $V_{CC}$ = 5.5V, $V_I$ = $V_{CC}$ or GND, $I_O$ = 0A | | Full | | 0.02 | 10 | μA |
| Additional Supply Current | $\Delta I_{CC}$ | Per input pin, $V_I$ = $V_{CC}$ - 2.1V, $I_O$ = 0A, other pins at $V_{CC}$ or GND, $V_{CC}$ = 4.5V to 5.5V | | Full | | 0.05 | 0.5 | mA |
| Input Capacitance | $C_I$ | | | +25℃ | | 5 | | pF |
| Output Capacitance | $C_O$ | | | +25℃ | | 5 | | pF |

# DYNAMIC CHARACTERISTICS

(For test circuit, see Figure 1. All typical values are measured at $T_A$ = +25℃ and $V_{CC}$ = 4.5V and 5.5V respectively, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| Propagation Delay (1) | $t_{PD}$ | nA, nB to nY, see Figure 2 | $V_{CC}$ = 4.5V to 5.5V, $C_L$ = 15pF | +25℃ | | 6 | | ns |
| | | | $V_{CC}$ = 4.5V to 5.5V, $C_L$ = 50pF | +25℃ | | 7 | | |
| Power Dissipation Capacitance (2) | $C_{PD}$ | $C_L$ = 50pF, $f_I$ = 1MHz, $V_I$ = GND to $V_{CC}$ | | +25℃ | | 10 | | pF |

NOTES:

1. $t_{PD}$ is the same as $t_{PLH}$ and $t_{PHL}$.
2. $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).

   $P_D = C_{PD} \times V_{CC}{}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}{}^2 \times f_o)$

   where:

   $f_i$ = Input frequency in MHz.

   $f_o$ = Output frequency in MHz.

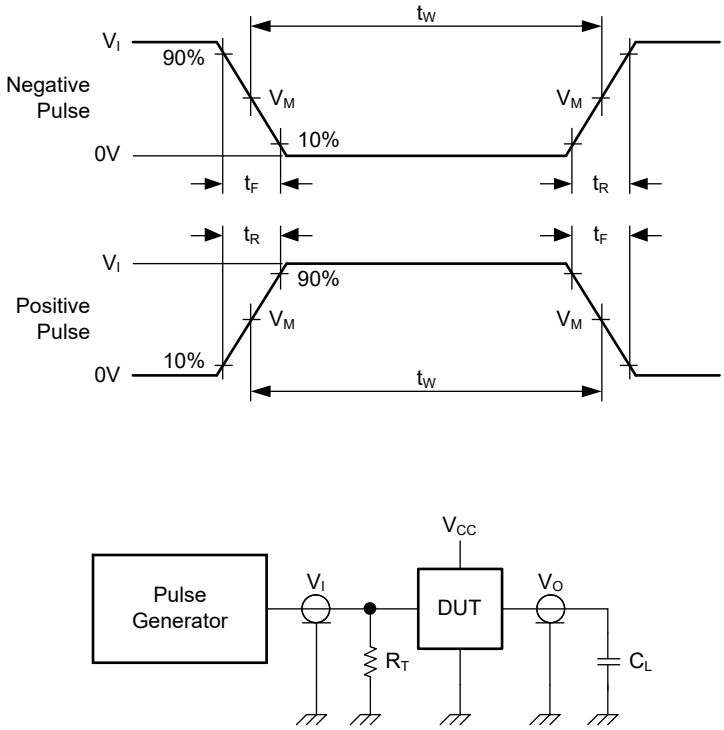
   $C_L$ = Output load capacitance in pF.

   $V_{CC}$ = Supply voltage in Volts.

   N = Number of inputs switching.

   $\Sigma(C_L \times V_{CC}{}^2 \times f_o)$ = Sum of the outputs.

# TEST CIRCUIT



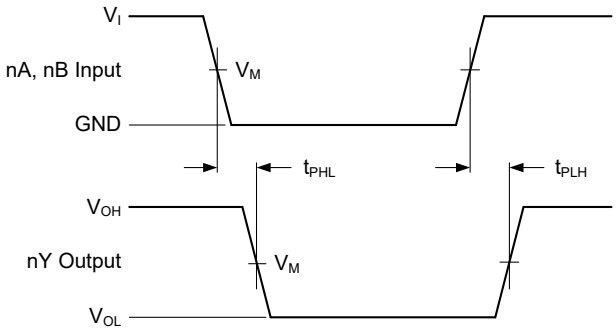

Test conditions are given in Table 1.
Definitions for test circuit:
$R_T$ = Termination resistance should be equal to the output impedance $Z_O$ of the pulse generator.
$C_L$ = Load capacitance including jig and probe capacitance.

**Figure 1. Test Circuit for Measuring Switching Times**

**Table 1. Test Conditions**

| INPUT | | LOAD | TEST |
|---|---|---|---|
| $V_I$ | $t_R$, $t_F$ | $C_L$ | |
| 3V | ≤ 3.0ns | 50pF, 15pF | $t_{PLH}$, $t_{PHL}$ |

# WAVEFORMS




Test conditions are given in Table 1.
Measurement points are given in Table 2.
Logic levels: $V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load.

**Figure 2. Input nA, nB to Output nY Propagation Delays**

**Table 2. Measurement Points**

| INPUT | OUTPUT |
|---|---|
| $V_M$ | $V_M$ |
| 1.5V | 0.5 × $V_{CC}$ |

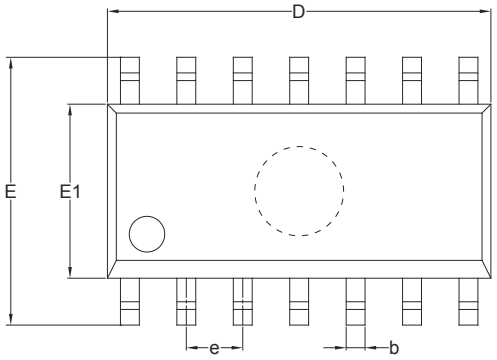
# REVISION HISTORY

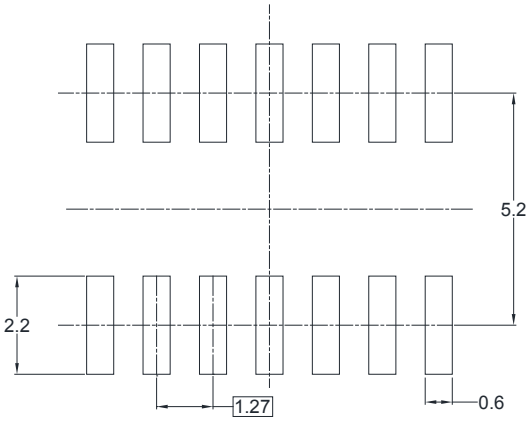
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Original (APRIL 2021) to REV.A | Page |
|---|---|
| Changed from product preview to production data | All |

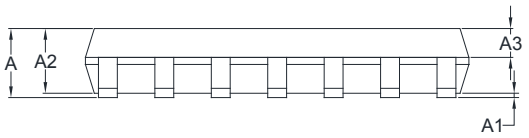
# PACKAGE OUTLINE DIMENSIONS

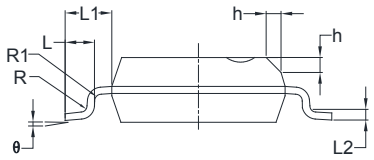
## SOIC-14




**RECOMMENDED LAND PATTERN** (Unit: mm)

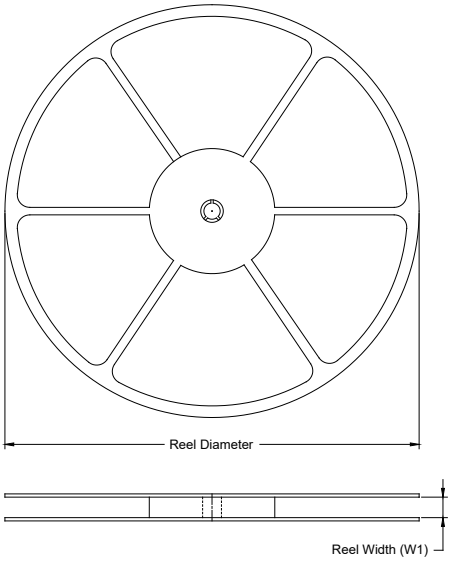


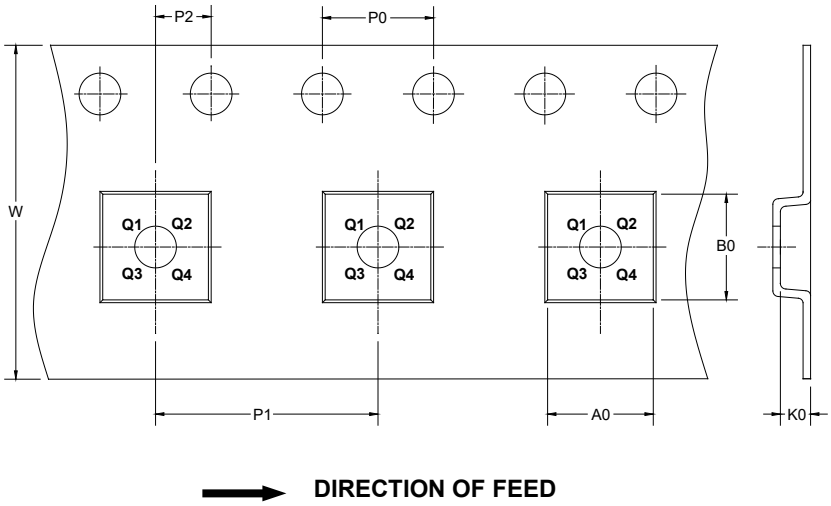

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A2 | 1.25 | 1.65 | 0.049 | 0.065 |
| A3 | 0.55 | 0.75 | 0.022 | 0.030 |
| b | 0.36 | 0.49 | 0.014 | 0.019 |
| D | 8.53 | 8.73 | 0.336 | 0.344 |
| E | 5.80 | 6.20 | 0.228 | 0.244 |
| E1 | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 0.45 | 0.80 | 0.018 | 0.032 |
| L1 | 1.04 REF | | 0.040 REF | |
| L2 | 0.25 BSC | | 0.01 BSC | |
| R | 0.07 | | 0.003 | |
| R1 | 0.07 | | 0.003 | |
| h | 0.30 | 0.50 | 0.012 | 0.020 |
| θ | 0° | 8° | 0° | 8° |

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



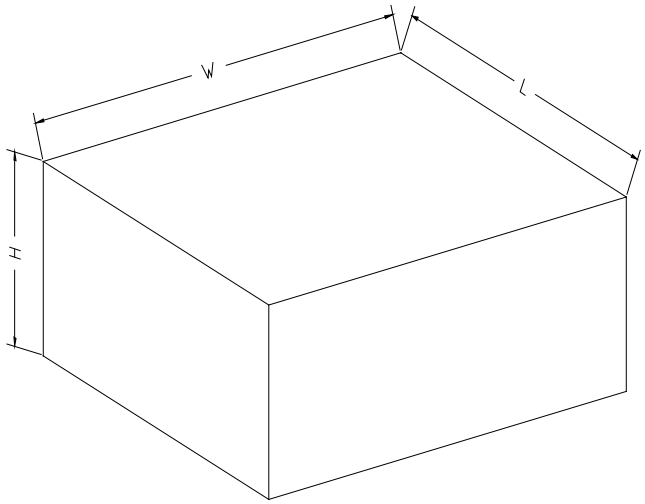

NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| SOIC-14 | 13″ | 16.4 | 6.60 | 9.30 | 2.10 | 4.0 | 8.0 | 2.0 | 16.0 | Q1 |

DD0001

## CARTON BOX DIMENSIONS




NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|---|---|---|---|---|
| 13″ | 386 | 280 | 370 | 5 |

DD0002