

## Description

The 74AHC1G86Q is an automotive compliant single, two-input positive Exclusive OR gate with a standard push-pull output. The device is designed for operation with a power supply range of 2.0V to 5.5V. The gate performs the positive Boolean function:

$$Y = A \oplus B \text{ or } Y = \overline{A}B + A\overline{B}$$

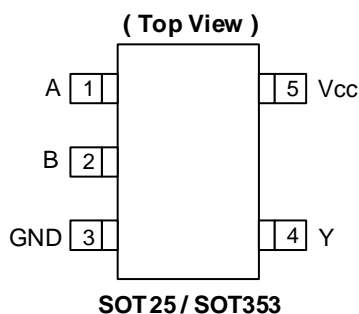
## Features

- Grade 1 Ambient Temperature Operation: -40°C to +125°C
- Supply Voltage Range from 2.0V to 5.5V
- ±8mA Output Drive at 5.0V
- CMOS Low-Power Consumption
- Schmitt Trigger Action at All Inputs Make the Circuit Tolerant for Slower Input Rise and Fall Time
- Inputs Not Limited by Vcc
- Balanced Propagation Delays
- Balanced Drive Capability
- ESD Protection Tested per AEC-Q100
- Exceeds 2000-V Human Body Model (AEC-Q100-002)
- Exceeds 1000-V Charged Device Model (AEC-Q100-011)
- Latch-Up Exceeds 100mA (AEC-Q100-004)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The 74AHC1G86Q is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Assignments



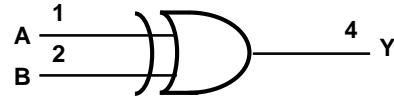
## Applications

- General Purpose Logic
- Wide Array of Products, such as:
  - Automotive Applications within Grade 1 Temperature Range
  - Industrial Computing/Controls/Automation
  - High Reliability Networking/Communications
  - Industrial/Agricultural Equipment

## Pin Descriptions

| Pin Name        | Description    |
|-----------------|----------------|
| A               | Data Input     |
| B               | Data Input     |
| GND             | Ground         |
| Y               | Data Output    |
| V <sub>CC</sub> | Supply Voltage |

## Logic Diagram



## Function Table

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| H      | H | L      |
| L      | H | H      |
| H      | L | H      |
| L      | L | L      |

## Absolute Maximum Ratings (Notes 4 & 5)

| Symbol           | Description  | Rating                        | Unit |
|------------------|--|-------------------------------|------|
| ESD HBM          | Human Body Model ESD Protection  | 2                             | kV   |
| ESD CDM          | Charged Device Model ESD Protection  | 1                             | kV   |
| V <sub>CC</sub>  | Supply Voltage Range   | -0.5 to 6.5                   | V    |
| V <sub>I</sub>   | Input Voltage Range  | -0.5 to 6.5                   | V    |
| V <sub>O</sub>   | Voltage Applied to Output in High or Low State                                 | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>  | Input Clamp Current V <sub>I</sub> < 0   | -20                           | mA   |
| I <sub>OK</sub>  | Output Clamp Current (V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> ) | ±20                           | mA   |
| I <sub>O</sub>   | Continuous Output Current (V <sub>O</sub> = 0 to V <sub>CC</sub> )             | ±25                           | mA   |
| I <sub>CC</sub>  | Continuous Current Through V <sub>CC</sub>                                     | 50                            | mA   |
| I <sub>GND</sub> | Continuous Current Through GND   | -50                           | mA   |
| T <sub>J</sub>   | Operating Junction Temperature   | -40 to +150                   | °C   |
| T <sub>STG</sub> | Storage Temperature  | -65 to +150                   | °C   |
| P <sub>D</sub>   | Total Power Dissipation (Note 6)   | 250                           | mW   |

- Notes:
- Stresses beyond the absolute maximum can result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.
  - Forcing the maximum allowed voltage could cause a condition exceeding the maximum current or conversely forcing the maximum current could cause a condition exceeding the maximum voltage. The ratings of both current and voltage must be maintained within the controlled range.
  - This will need to be derated at higher operating temperatures to prevent exceeding maximum T<sub>J</sub>. Refer to package thermal characteristics section.

**Recommended Operating Conditions** (Note 7)

| Symbol          | Parameter                          | Parameter                     | Min  | Max             | Unit |
|-----------------|------------------------------------|-------------------------------|------|-----------------|------|
| V <sub>CC</sub> | Operating Voltage                  | —                             | 2    | 5.5             | V    |
| V <sub>IH</sub> | High-Level Input Voltage           | V <sub>CC</sub> = 2V          | 1.5  | —               | V    |
|                 |                                    | V <sub>CC</sub> = 3V          | 2.1  | —               |      |
|                 |                                    | V <sub>CC</sub> = 5.5V        | 3.85 | —               |      |
| V <sub>IL</sub> | Low-Level Input Voltage            | V <sub>CC</sub> = 2V          | —    | 0.5             | V    |
|                 |                                    | V <sub>CC</sub> = 3V          | —    | 0.9             |      |
|                 |                                    | V <sub>CC</sub> = 5.5V        | —    | 1.65            |      |
| V <sub>I</sub>  | Input Voltage                      |                               | 0    | 5.5             | V    |
| V <sub>O</sub>  | Output Voltage                     |                               | 0    | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-Level Output Current          | V <sub>CC</sub> = 2V          | —    | -50             | μA   |
|                 |                                    | V <sub>CC</sub> = 3.3V ± 0.3V | —    | -4              | mA   |
|                 |                                    | V <sub>CC</sub> = 5V ± 0.5V   | —    | -8              |      |
| I <sub>OL</sub> | Low-Level Output Current           | V <sub>CC</sub> = 2V          | —    | 50              | μA   |
|                 |                                    | V <sub>CC</sub> = 5V ± 0.5V   | —    | 4               | mA   |
|                 |                                    | V <sub>CC</sub> = 3V          | —    | 8               |      |
| Δt/ΔV           | Input Transition Rise or Fall Rate | V <sub>CC</sub> = 3.3V ± 0.3V | —    | 100             | ns/V |
|                 |                                    | V <sub>CC</sub> = 5V ± 0.5V   | —    | 20              |      |

Note: 7. Unused inputs should be held at V<sub>CC</sub> or Ground.

**Electrical Characteristics** (All typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = +25°C.)

| Symbol          | Parameter                 | Test Conditions                                    | V <sub>CC</sub> | +25°C |     |      | -40°C to +85°C |      | -40°C to +125°C |      | Unit |
|-----------------|---------------------------|--|-----------------|-------|-----|------|----------------|------|-----------------|------|------|
|                 |                           |  |                 | Min   | Typ | Max  | Min            | Max  | Min             | Max  |      |
| V <sub>OH</sub> | High Level Output Voltage | I <sub>OH</sub> = -50μA                            | 2V              | 1.9   | 2   | —    | 1.9            | —    | 1.9             | —    | V    |
|                 |                           |  | 3V              | 2.9   | 3   | —    | 2.9            | —    | 2.9             | —    |      |
|                 |                           |  | 4.5V            | 4.4   | 4.5 | —    | 4.4            | —    | 4.4             | —    |      |
|                 |                           | I <sub>OH</sub> = -4mA                             | 3V              | 2.58  | —   | —    | 2.48           | —    | 2.40            | —    |      |
|                 |                           | I <sub>OH</sub> = -8mA                             | 4.5V            | 3.94  | —   | —    | 3.8            | —    | 3.70            | —    |      |
| V <sub>OL</sub> | Low Level Output Voltage  | I <sub>OL</sub> = 50μA                             | 2V              | —     | —   | 0.1  | —              | 0.1  | —               | 0.1  | V    |
|                 |                           |  | 3V              | —     | —   | 0.1  | —              | 0.1  | —               | 0.1  |      |
|                 |                           |  | 4.5V            | —     | —   | 0.1  | —              | 0.1  | —               | 0.1  |      |
|                 |                           | I <sub>OL</sub> = 4mA                              | 3V              | —     | —   | 0.36 | —              | 0.44 | —               | 0.55 |      |
|                 |                           | I <sub>OL</sub> = 8mA                              | 4.5V            | —     | —   | 0.36 | —              | 0.44 | —               | 0.55 |      |
| I <sub>I</sub>  | Input Current             | V <sub>I</sub> = 5.5V or GND                       | 0 to 5.5V       | —     | —   | ±0.1 | —              | ±1   | —               | ±2   | μA   |
| I <sub>CC</sub> | Supply Current            | V <sub>I</sub> = 5.5V or GND<br>I <sub>O</sub> = 0 | 5.5V            | —     | —   | 1    | —              | 10   | —               | 40   | μA   |
| C <sub>I</sub>  | Input Capacitance         | V <sub>I</sub> = V <sub>CC</sub> or GND            | 5.5V            | —     | 2.0 | 10   | —              | 10   | —               | 10   | pF   |

## Package Characteristics

| Symbol        | Parameter                                 | Package | Test Conditions | Min | Typ | Max | Unit |
|---------------|---|---------|-----------------|-----|-----|-----|------|
| $\theta_{JA}$ | Thermal Resistance<br>Junction-to-Ambient | SOT25   | Note 8          | —   | 184 | —   | °C/W |
|               |   | SOT353  |                 | —   | 385 | —   |      |
| $\theta_{JC}$ | Thermal Resistance<br>Junction-to-Case    | SOT25   | Note 8          | —   | 62  | —   | °C/W |
|               |   | SOT353  |                 | —   | 164 | —   |      |

Note: 8. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

## Switching Characteristics

$V_{CC} = 3.3V \pm 0.3V$  (See Figure 1)

| Parameter | From<br>(Input) | To<br>(Output) | Test<br>Conditions | +25°C |     |      | -40°C to +85°C |      | -40°C to +125°C |      | Unit |
|-----------|-----------------|----------------|--------------------|-------|-----|------|----------------|------|-----------------|------|------|
|           |                 |                |                    | Min   | Typ | Max  | Min            | Max  | Min             | Max  |      |
| $t_{PD}$  | A or B          | Y              | $C_L = 15pF$       | 0.6   | 4.0 | 11.0 | 0.6            | 13.0 | 0.6             | 14.0 | ns   |
|           |                 |                | $C_L = 50pF$       | 0.6   | 5.8 | 14.5 | 0.6            | 16.5 | 0.6             | 18.5 | ns   |

$V_{CC} = 5V \pm 0.5V$  (See Figure 1)

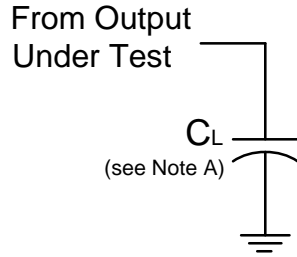
| Parameter | From<br>(Input) | To<br>(Output) | Test<br>Conditions | +25°C |     |     | -40°C to +85°C |      | -40°C to +125°C |      | Unit |
|-----------|-----------------|----------------|--------------------|-------|-----|-----|----------------|------|-----------------|------|------|
|           |                 |                |                    | Min   | Typ | Max | Min            | Max  | Min             | Max  |      |
| $t_{PD}$  | A or B          | Y              | $C_L = 15pF$       | 0.6   | 3.4 | 6.8 | 0.6            | 8.0  | 0.6             | 8.5  | ns   |
|           |                 |                | $C_L = 50pF$       | 0.6   | 4.9 | 8.8 | 0.6            | 10.0 | 0.6             | 11.5 | ns   |

## Operating Characteristics

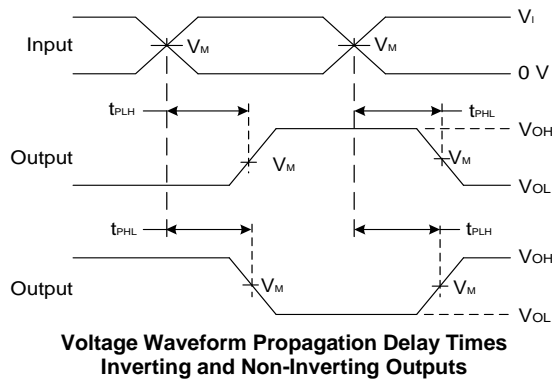
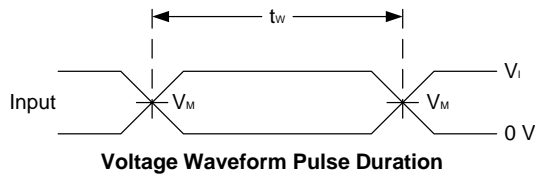
$T_A = +25^\circ C$

| Parameter | Test<br>Conditions  | $V_{CC} = 5V$ | Unit |
|-----------|---------------------|---------------|------|
|           |                     | Typ           |      |
| $C_{PD}$  | f = 1MHz<br>No Load | 10            | pF   |

**Measurement Information**



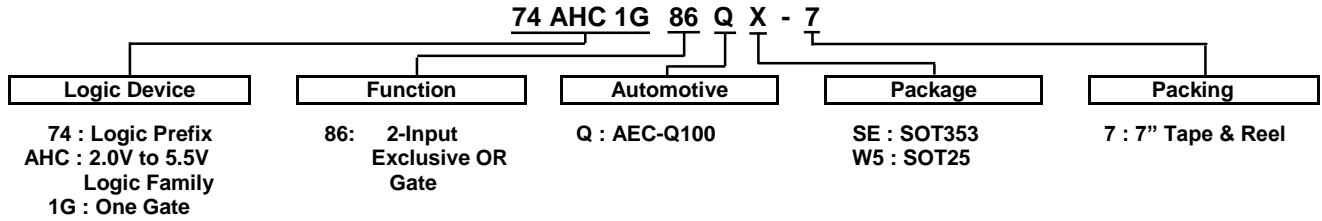
| Vcc       | Inputs |       | VM    | CL   |
|-----------|--------|-------|-------|------|
|           | VI     | tr/tf |       |      |
| 3.3V±0.3V | Vcc    | ≤3ns  | Vcc/2 | 15pF |
| 5V±0.5V   | Vcc    | ≤3ns  | Vcc/2 | 15pF |
| 3.3V±0.3V | Vcc    | ≤3ns  | Vcc/2 | 50pF |
| 5V±0.5V   | Vcc    | ≤3ns  | Vcc/2 | 50pF |



**Figure 1. Load Circuit and Voltage Waveforms**

- Notes:
- A. Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate ≤ 1MHz.
  - C. Inputs are measured separately one transition per measurement.
  - D. tPLH and tPHL are the same as tPD.

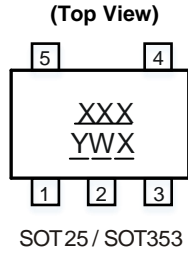
## Ordering Information (Note 9)



| Part Number    | Package Code | Package (Notes 10 & 11) | Package Size                                | 7" Tape and Reel |                    |
|----------------|--------------|-------------------------|---|------------------|--------------------|
|                |              |                         |   | Quantity         | Part Number Suffix |
| 74AHC1G86QSE-7 | SE           | SOT353                  | 2.15mm × 2.1mm × 1.1mm<br>0.65mm lead pitch | 3000/Tape & Reel | -7                 |
| 74AHC1G86QW5-7 | W5           | SOT25                   | 3.0mm × 2.8mm × 1.2mm<br>0.95mm lead pitch  | 3000/Tape & Reel | -7                 |

Notes: 9. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.  
 10. Pad layout as shown in Diodes Incorporated's package outline PDFs, which can be found on our website at <http://www.diodes.com/package-outlines.html>.  
 11. The taping orientation is located on our website at <https://www.diodes.com/assets/Packaging-Support-Docs/ap02007.pdf>.

## Marking Information



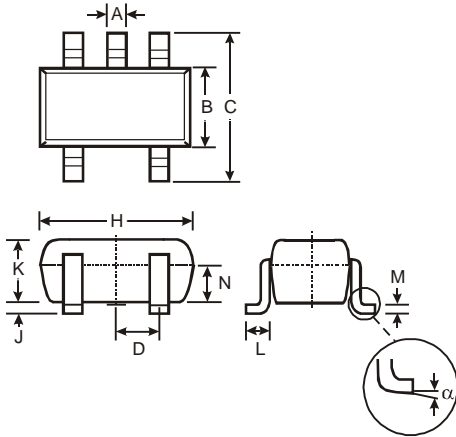
**XXX** : Identification Code  
**Y** : Year 0~9  
**W** : Week: A~Z 1~26 week  
           a~z 27~52 week  
           z represents week 52 and 53  
**X** : A~Z : Internal Code

| Part Number    | Package | Identification Code |
|----------------|---------|---------------------|
| 74AHC1G86QW5-7 | SOT25   | YXQ                 |
| 74AHC1G86QSE-7 | SOT353  | YXQ                 |

## Package Outline Dimensions

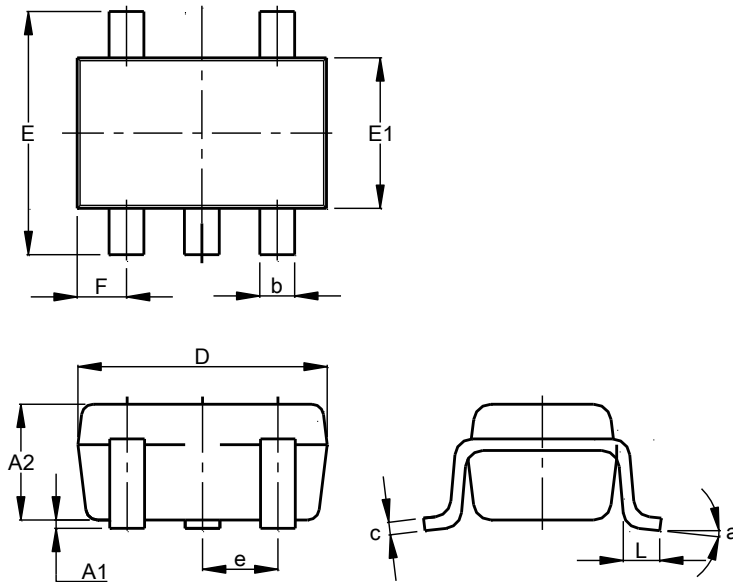
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (1) Package Type: SOT25



| SOT25                |       |      |      |
|----------------------|-------|------|------|
| Dim                  | Min   | Max  | Typ  |
| A                    | 0.35  | 0.50 | 0.38 |
| B                    | 1.50  | 1.70 | 1.60 |
| C                    | 2.70  | 3.00 | 2.80 |
| D                    | -     | -    | 0.95 |
| H                    | 2.90  | 3.10 | 3.00 |
| J                    | 0.013 | 0.10 | 0.05 |
| K                    | 1.00  | 1.30 | 1.10 |
| L                    | 0.35  | 0.55 | 0.40 |
| M                    | 0.10  | 0.20 | 0.15 |
| N                    | 0.70  | 0.80 | 0.75 |
| $\alpha$             | 0°    | 8°   | -    |
| All Dimensions in mm |       |      |      |

### (2) Package Type: SOT353

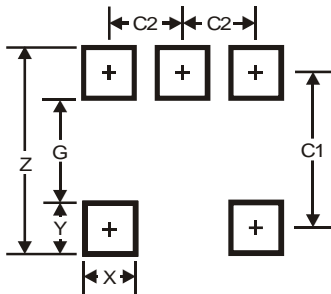


| SOT353               |           |      |       |
|----------------------|-----------|------|-------|
| Dim                  | Min       | Max  | Typ   |
| A1                   | 0.00      | 0.10 | 0.05  |
| A2                   | 0.90      | 1.00 | 0.95  |
| b                    | 0.10      | 0.30 | 0.25  |
| c                    | 0.10      | 0.22 | 0.11  |
| D                    | 1.80      | 2.20 | 2.15  |
| E                    | 2.00      | 2.20 | 2.10  |
| E1                   | 1.15      | 1.35 | 1.30  |
| e                    | 0.650 BSC |      |       |
| F                    | 0.40      | 0.45 | 0.425 |
| L                    | 0.25      | 0.40 | 0.30  |
| a                    | 0°        | 8°   | --    |
| All Dimensions in mm |           |      |       |

## Suggested Pad Layout

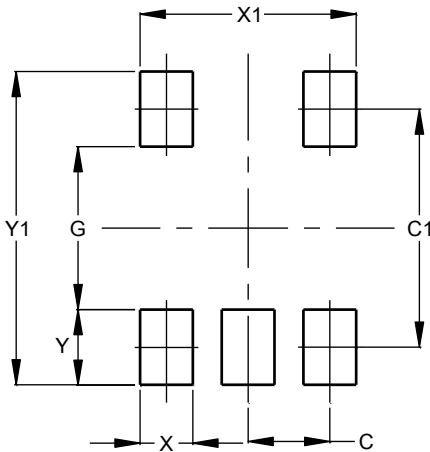
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (1) Package Type: SOT25



| Dimensions | Value |
|------------|-------|
| Z          | 3.20  |
| G          | 1.60  |
| X          | 0.55  |
| Y          | 0.80  |
| C1         | 2.40  |
| C2         | 0.95  |

### (2) Package Type: SOT353



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 0.650         |
| C1         | 1.900         |
| G          | 1.300         |
| X          | 0.420         |
| X1         | 1.720         |
| Y          | 0.600         |
| Y1         | 2.500         |

## Mechanical Data

### SOT25

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208@3
- Weight: 0.0158 grams (Approximate)

### SOT353

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208@3
- Weight: 0.0064 grams (Approximate)



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[NLV27WZ86USG](#) [NLU1G86CMUTCG](#) [NLU1G08CMUTCG](#) [NL17SZ32P5T5G](#) [NL17SZ00P5T5G](#) [NL17SH02P5T5G](#) [74AUP2G00RA3-7](#)  
[NLVVHC1GT00DFT2G](#) [NLV74HC02ADTR2G](#) [NLX1G332CMUTCG](#) [NL17SG86P5T5G](#)