

## 1. General Description

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The EM74AHC1G17 and EM74AHCT1G17 are single buffers with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

## 2. Features and Benefits

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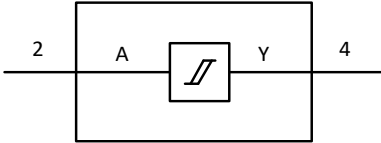
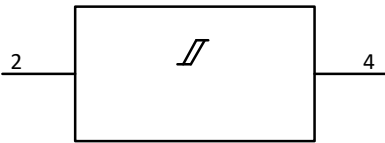
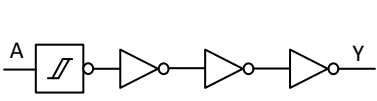
- Wide supply voltage range from 2.0 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- Latch-up performance exceeds 200 mA
- Symmetrical output impedance
- Balanced propagation delays
- Input levels:
  - For EM74AHC1G17: CMOS level
  - For EM74AHCT1G17: TTL level
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 Class 3A exceeds 7000 V
  - CDM ANSI/ESDA/JEDEC JS-002 Class C3 exceeds 2000 V
- Multiple package options

### 3. Ordering Information

**Table 1. Ordering information**

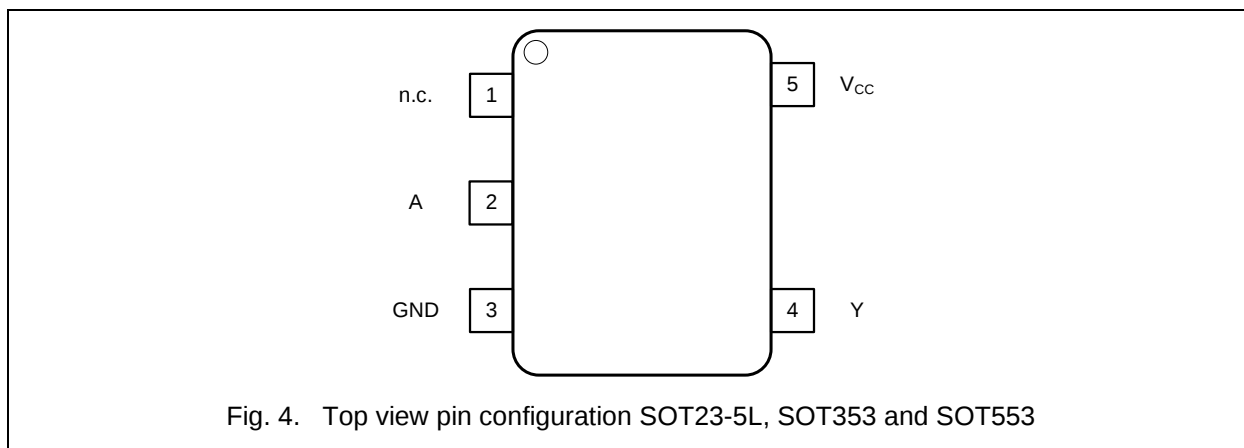
| Type number     | Topside marking | Package  |                                                              |          |
|-----------------|-----------------|----------|--------------------------------------------------------------|----------|
|                 |                 | Name     | Description                                                  | Quantity |
| EM74AHC1G17GV   | ACYW            | SOT23-5L | SOT23 package, 5 pins 2.92 mm × 1.6 mm; 1.25 mm (Max) height | 3000     |
| EM74AHCT1G17GV  | CCYW            |          |                                                              |          |
| EM74AHC1G17GW   | ACYW            | SOT353   | SOT353 package, 5 pins 2.1 mm × 1.25 mm; 1.1 mm (Max) height | 3000     |
| EM74AHCT1G17GW  | CCYW            |          |                                                              |          |
| EM74AHC1G17DRL  | ACYW            | SOT553   | SOT553 package, 5 pins 1.6 mm × 1.2 mm; 0.6 mm (Max) height  | 3000     |
| EM74AHCT1G17DRL | CCYW            |          |                                                              |          |

### 4. Function Diagram

|                                                                                                                 |                                                                                                                      |                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|  <p>Fig. 1. Logic symbol</p> |  <p>Fig. 2. IEC logic symbol</p> |  <p>Fig. 3. Logic diagram</p> |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|

## 5. Pinning Information

### 5.1. Pinning



### 5.2. Pin description

**Table 2. Pin description**

| Symbol          | Pin | Description    |
|-----------------|-----|----------------|
| n.c.            | 1   | Not connected  |
| A               | 2   | Data input     |
| GND             | 3   | Ground (0V)    |
| Y               | 4   | Data output    |
| V <sub>CC</sub> | 5   | Supply voltage |

## 6. Functional Description

**Table 3. Function table**

H = HIGH voltage level; L = LOW voltage level.

| Input    | Output   |
|----------|----------|
| <b>A</b> | <b>Y</b> |
| L        | L        |
| H        | H        |

## 7. Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

**Table 4. Absolute Maximum Ratings**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND.

| Symbol    | Parameter               | Conditions                                                 | Min  | Max      | Unit |
|-----------|-------------------------|------------------------------------------------------------|------|----------|------|
| $V_{CC}$  | supply voltage          |                                                            | -0.5 | 7.0      | V    |
| $V_I$     | input voltage           |                                                            | -0.5 | 7.0      | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5\text{ V}$                                      | -20  |          | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1] |      | $\pm 20$ | mA   |
| $I_O$     | output current          | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$              |      | $\pm 25$ | mA   |
| $I_{CC}$  | supply current          |                                                            |      | 75       | mA   |
| $I_{GND}$ | ground current          |                                                            | -75  |          | mA   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$              |      | 250      | mW   |
| $T_{stg}$ | storage temperature     |                                                            | -65  | 150      | °C   |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 8. Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. EnergyMath does not recommend exceeding them or designing to Absolute Maximum Ratings.

**Table 5. Recommended Operating Conditions**

| Symbol    | Parameter           | Conditions | EM74AHC1G17 |     |          | EM74AHCT1G17 |     |          | Unit |
|-----------|---------------------|------------|-------------|-----|----------|--------------|-----|----------|------|
|           |                     |            | Min         | Typ | Max      | Min          | Typ | Max      |      |
| $V_{CC}$  | supply voltage      |            | 2.0         | 5.0 | 5.5      | 4.5          | 5.0 | 5.5      | V    |
| $V_I$     | input voltage       |            | 0           |     | 5.5      | 0            |     | 5.5      | V    |
| $V_O$     | output voltage      |            | 0           |     | $V_{CC}$ | 0            |     | $V_{CC}$ | V    |
| $T_{amb}$ | ambient temperature |            | -40         | 25  | 125      | -40          | 25  | 125      | °C   |

## EM74AHC1G17; EM74AHCT1G17

Single Schmitt trigger buffer

# 9.Static Characteristics

**Table 6. Static characteristics**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                 | Conditions                                                                                  | -40 °C to +85 °C |        |      | -40 °C to +125 °C |      | Unit |
|-----------------|---------------------------|---------------------------------------------------------------------------------------------|------------------|--------|------|-------------------|------|------|
|                 |                           |                                                                                             | Min              | Typ[1] | Max  | Min               | Max  |      |
| EM74AHC1G17     |                           |                                                                                             |                  |        |      |                   |      |      |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>                                         |                  |        |      |                   |      |      |
|                 |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 2.0 V                                            | 1.9              | 2.0    |      | 1.9               |      | V    |
|                 |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V                                            | 2.9              | 3.0    |      | 2.9               |      | V    |
|                 |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V                                            | 4.4              | 4.5    |      | 4.4               |      | V    |
|                 |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V                                           | 2.48             | 2.93   |      | 2.40              |      | V    |
|                 |                           | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V                                           | 3.80             | 4.39   |      | 3.70              |      | V    |
| V <sub>OL</sub> | LOW-level output voltage  | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>                                         |                  |        |      |                   |      |      |
|                 |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 2.0 V                                             |                  | 0      | 0.1  |                   | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V                                             |                  | 0      | 0.1  |                   | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V                                             |                  | 0      | 0.1  |                   | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V                                            |                  | 0.05   | 0.44 |                   | 0.55 | V    |
|                 |                           | I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V                                            |                  | 0.07   | 0.44 |                   | 0.55 | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = 5.5 V or GND ;<br>V <sub>CC</sub> = 0 V to 5.5 V                           |                  | ±0.01  | ±1.0 |                   | ±2.0 | μA   |
| I <sub>CC</sub> | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND ; I <sub>O</sub> = 0 A ;<br>V <sub>CC</sub> = 5.5 V |                  | 0.01   | 10   |                   | 40   | μA   |
| C <sub>I</sub>  | input capacitance         |                                                                                             |                  | 3.5    |      |                   |      | pF   |

## EM74AHC1G17; EM74AHCT1G17

Single Schmitt trigger buffer

| Symbol           | Parameter                 | Conditions                                                                                                                          | -40 °C to +85 °C |        |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|------|-------------------|------|------|
|                  |                           |                                                                                                                                     | Min              | Typ[1] | Max  | Min               | Max  |      |
| EM74AHCT1G17     |                           |                                                                                                                                     |                  |        |      |                   |      |      |
| V <sub>OH</sub>  | HIGH-level output voltage | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V                                                       |                  |        |      |                   |      |      |
|                  |                           | I <sub>O</sub> = -50 μA;                                                                                                            | 4.4              | 4.5    |      | 4.4               |      | V    |
|                  |                           | I <sub>O</sub> = -8.0 mA;                                                                                                           | 3.80             | 4.39   |      | 3.70              |      | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V                                                       |                  |        |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 50 μA;                                                                                                             |                  | 0      | 0.1  |                   | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 8.0 mA;                                                                                                            |                  | 0.07   | 0.44 |                   | 0.55 | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = 5.5 V or GND ;<br>V <sub>CC</sub> = 0 V to 5.5 V                                                                   |                  | ±0.01  | ±1.0 |                   | ±2.0 | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND ; I <sub>O</sub> = 0 A ;<br>V <sub>CC</sub> = 5.5 V                                         |                  | 0.01   | 10   |                   | 40   | μA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin ; V <sub>I</sub> = 3.4 V;<br>other inputs at V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V |                  | 0.23   | 1.35 |                   | 1.35 | mA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                                     |                  | 3.5    |      |                   |      | pF   |

[1]All typical values are measured at  $T_{amb} = 25^\circ\text{C}$ .

## EM74AHC1G17; EM74AHCT1G17

Single Schmitt trigger buffer

# 10. Dynamic Characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6.

| Symbol          | Parameter                     | Conditions                                                                           | -40 °C to +85 °C |        |      | -40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|--------------------------------------------------------------------------------------|------------------|--------|------|-------------------|------|------|
|                 |                               |                                                                                      | Min              | Typ[1] | Max  | Min               | Max  |      |
| EM74AHC1G17     |                               |                                                                                      |                  |        |      |                   |      |      |
| t <sub>pd</sub> | propagation delay             | A to Y; see Fig. 5 [2]                                                               |                  |        |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 3.0 V to 3.6 V, C <sub>L</sub> = 15 pF                             | 1.5              | 6.1    | 12   | 1.5               | 13   | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 15 pF                             | 1.5              | 3.9    | 8.5  | 1.5               | 9.0  | ns   |
| C <sub>PD</sub> | power dissipation capacitance | C <sub>L</sub> = 15 pF ; f = 1MHz ;<br>V <sub>I</sub> = GND to V <sub>CC</sub> ; [3] |                  | 20     |      |                   |      | pF   |
| EM74AHCT1G17    |                               |                                                                                      |                  |        |      |                   |      |      |
| t <sub>pd</sub> | propagation delay             | A to Y; see Fig. 5 [2]                                                               |                  |        |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 15 pF                             | 1.5              | 5.0    | 10.0 | 1.5               | 10.5 | ns   |
| C <sub>PD</sub> | power dissipation capacitance | C <sub>L</sub> = 15 pF ; f = 1MHz ;<br>V <sub>I</sub> = GND to V <sub>CC</sub> ; [3] |                  | 21     |      |                   |      | pF   |

[1] Typical values are measured at  $T_{amb} = 25 \text{ °C}$  and  $V_{CC} = 3.3 \text{ V}$  and  $5.0 \text{ V}$  respectively.

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

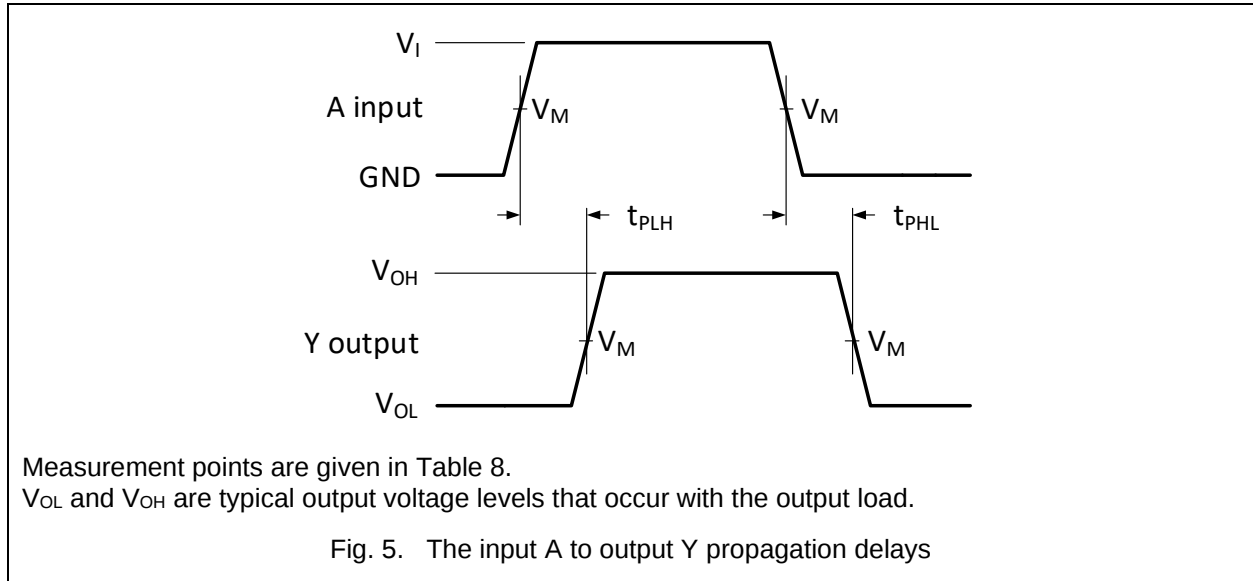
$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

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

## 10.1. Waveforms and test circuit

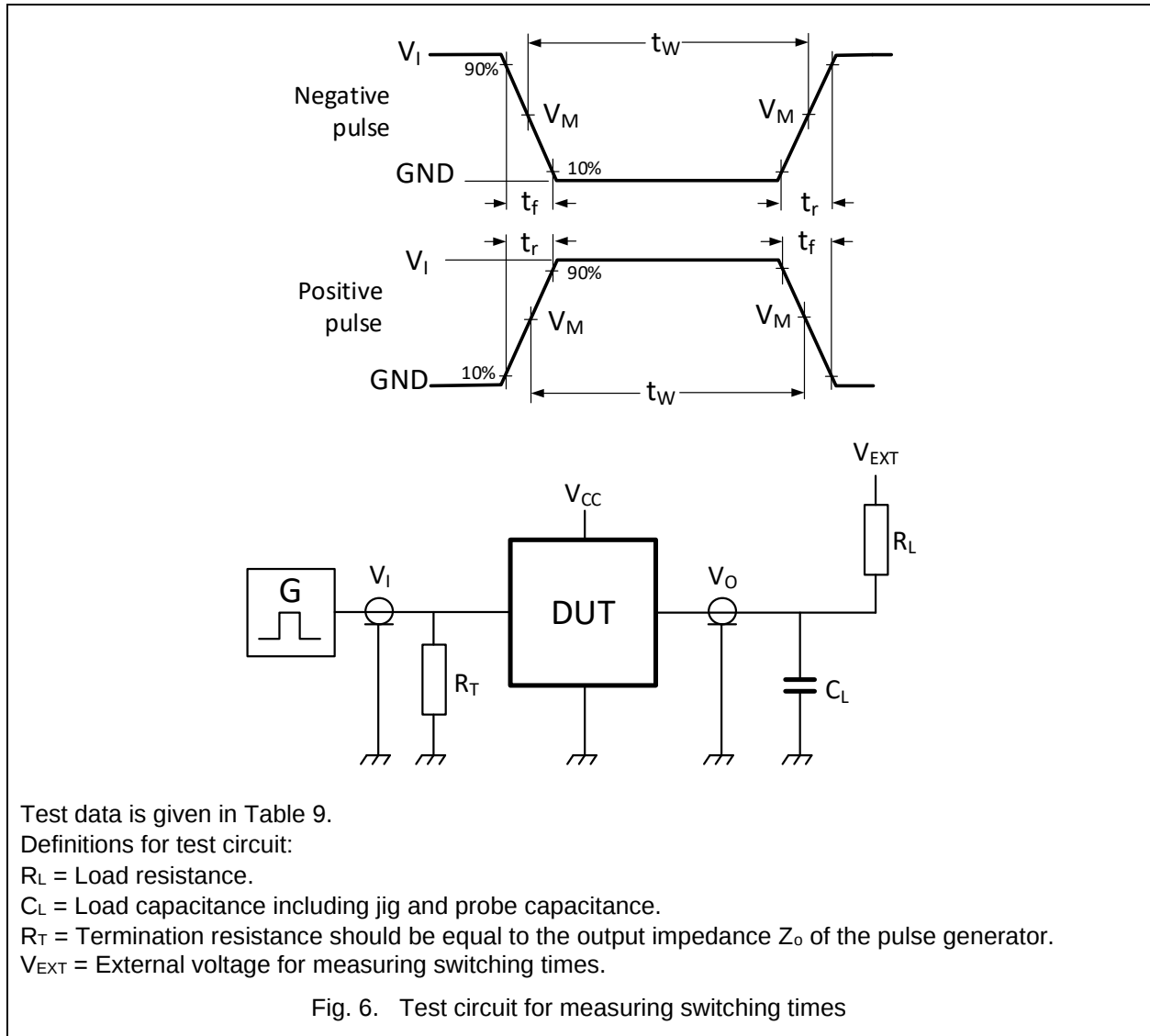


**Table 8. Measurement points**

| Type         | Input           |                     | Output              |
|--------------|-----------------|---------------------|---------------------|
|              | $V_I$           | $V_M$               | $V_M$               |
| EM74AHC1G17  | GND to $V_{CC}$ | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| EM74AHCT1G17 | GND to 3.0 V    | 1.5 V               | $0.5 \times V_{CC}$ |

## EM74AHC1G17; EM74AHCT1G17

### Single Schmitt trigger buffer



**Table 9. Test data**

| Type         | Input           |               | Load  |              | $V_{EXT}$ |
|--------------|-----------------|---------------|-------|--------------|-----------|
|              | $V_I$           | $t_r = t_f$   | $C_L$ | $R_L$        | $t_{PD}$  |
| EM74AHC1G17  | GND to $V_{CC}$ | $\leq 2.5$ ns | 15 pF | 500 $\Omega$ | open      |
| EM74AHCT1G17 | GND to 3.0 V    | $\leq 2.5$ ns | 15 pF | 500 $\Omega$ | open      |

# 11. Transfer Characteristics

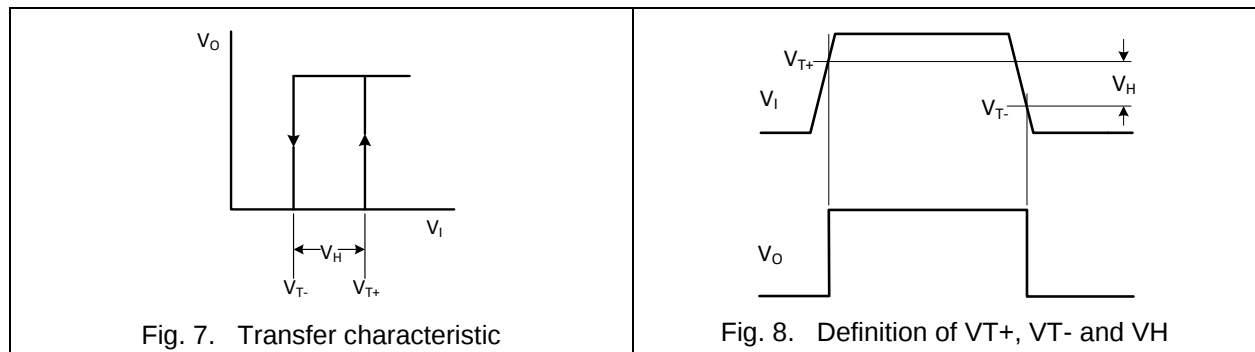
**Table 10. Transfer characteristics**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                        | Conditions              | -40 °C to +85 °C |        |      | -40 °C to +125 °C |      | Unit |
|-----------------|----------------------------------|-------------------------|------------------|--------|------|-------------------|------|------|
|                 |                                  |                         | Min              | Typ[1] | Max  | Min               | Max  |      |
| EM74AHC1G17     |                                  |                         |                  |        |      |                   |      |      |
| V <sub>T+</sub> | positive-going threshold voltage | V <sub>CC</sub> = 3.0 V |                  |        | 2.2  |                   | 2.2  | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V |                  |        | 3.15 |                   | 3.15 | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V |                  |        | 3.85 |                   | 3.85 | V    |
| V <sub>T-</sub> | negative-going threshold voltage | V <sub>CC</sub> = 3.0 V | 0.85             |        |      | 0.85              |      | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V | 1.35             |        |      | 1.35              |      | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V | 1.65             |        |      | 1.65              |      | V    |
| V <sub>H</sub>  | hysteresis voltage               | V <sub>CC</sub> = 3.0 V | 0.3              |        | 1.2  | 0.25              | 1.2  | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V | 0.4              |        | 1.4  | 0.35              | 1.4  | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V | 0.5              |        | 1.6  | 0.45              | 1.6  | V    |
| EM74AHCT1G17    |                                  |                         |                  |        |      |                   |      |      |
| V <sub>T+</sub> | positive-going threshold voltage | V <sub>CC</sub> = 4.5 V |                  |        | 2.0  |                   | 2.0  | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V |                  |        | 2.0  |                   | 2.0  | V    |
| V <sub>T-</sub> | negative-going threshold voltage | V <sub>CC</sub> = 4.5 V | 0.5              |        |      | 0.5               |      | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V | 0.6              |        |      | 0.6               |      | V    |
| V <sub>H</sub>  | hysteresis voltage               | V <sub>CC</sub> = 4.5 V | 0.4              |        | 1.4  | 0.35              | 1.4  | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V | 0.4              |        | 1.6  | 0.35              | 1.6  | V    |

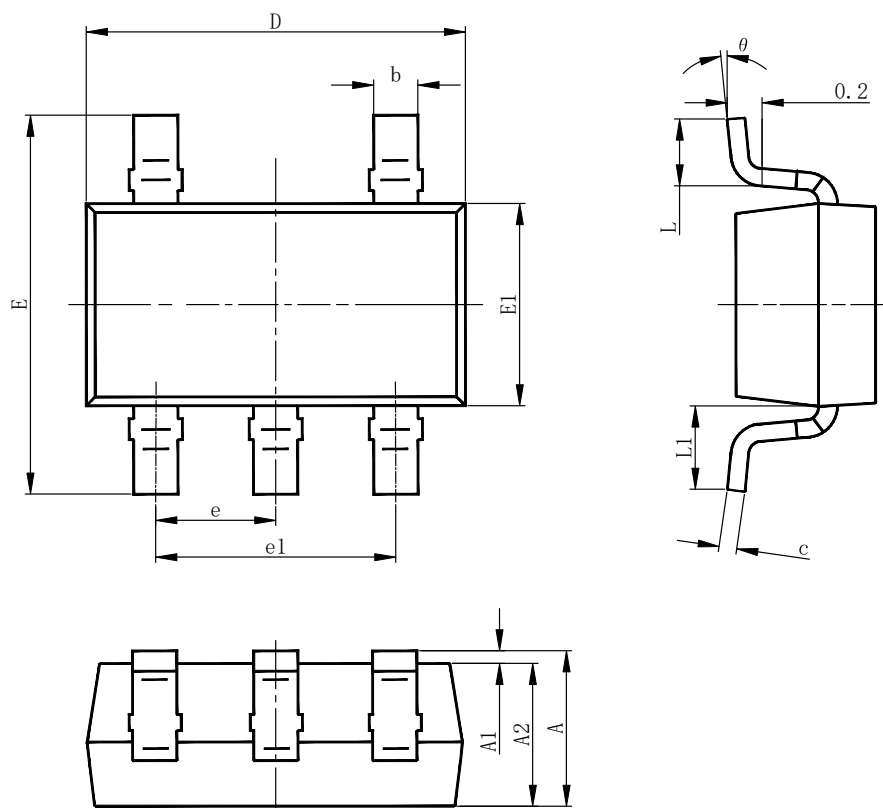
[1] Typical values are measured at  $T_{amb} = 25\text{ °C}$ .

## 11.1. Waveforms transfer characteristics



## 12. Package Outline

### SOT23-5L

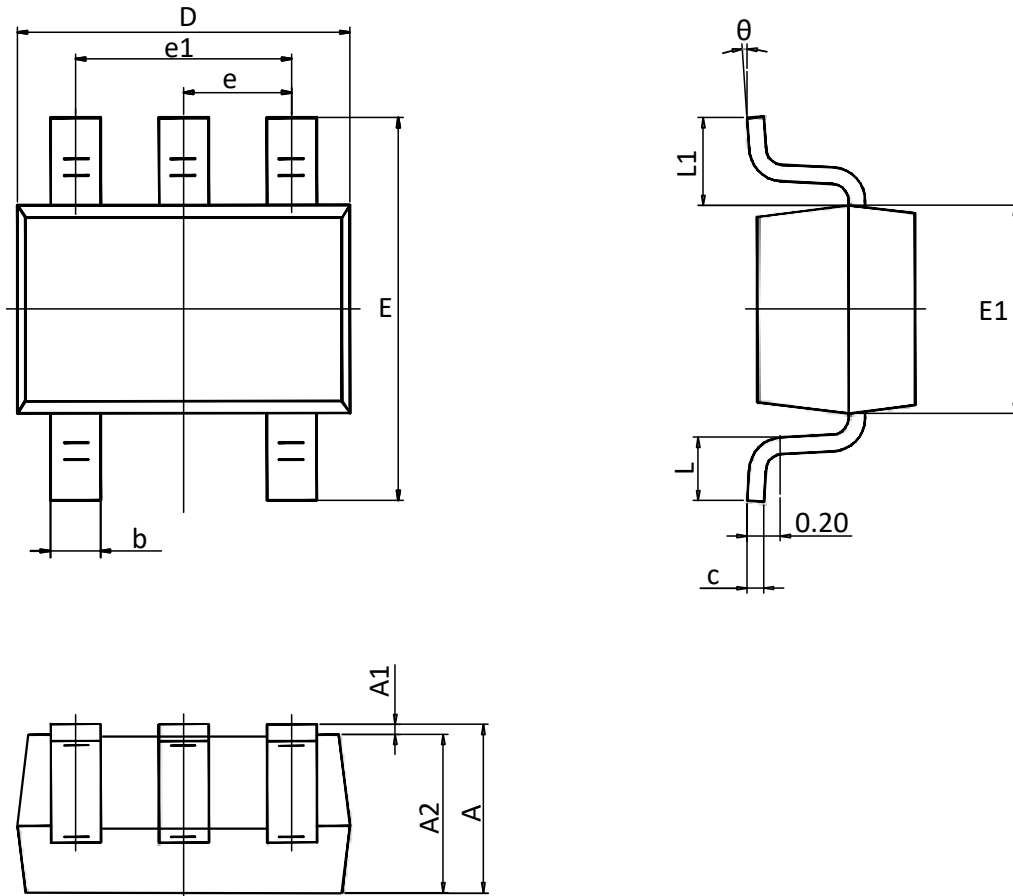


| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 1.050                     | 1.150 | 0.041                | 0.045 |
| b      | 0.300                     | 0.500 | 0.012                | 0.020 |
| c      | 0.100                     | 0.200 | 0.004                | 0.008 |
| D      | 2.820                     | 3.020 | 0.111                | 0.119 |
| E1     | 1.500                     | 1.700 | 0.059                | 0.067 |
| E      | 2.650                     | 2.950 | 0.104                | 0.116 |
| e      | 0.950(BSC)                |       | 0.037(BSC)           |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.300                     | 0.600 | 0.012                | 0.024 |
| L1     | 0.600REF.                 |       | 0.024REF.            |       |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

# EM74AHC1G17; EM74AHCT1G17

Single Schmitt trigger buffer

## SOT353

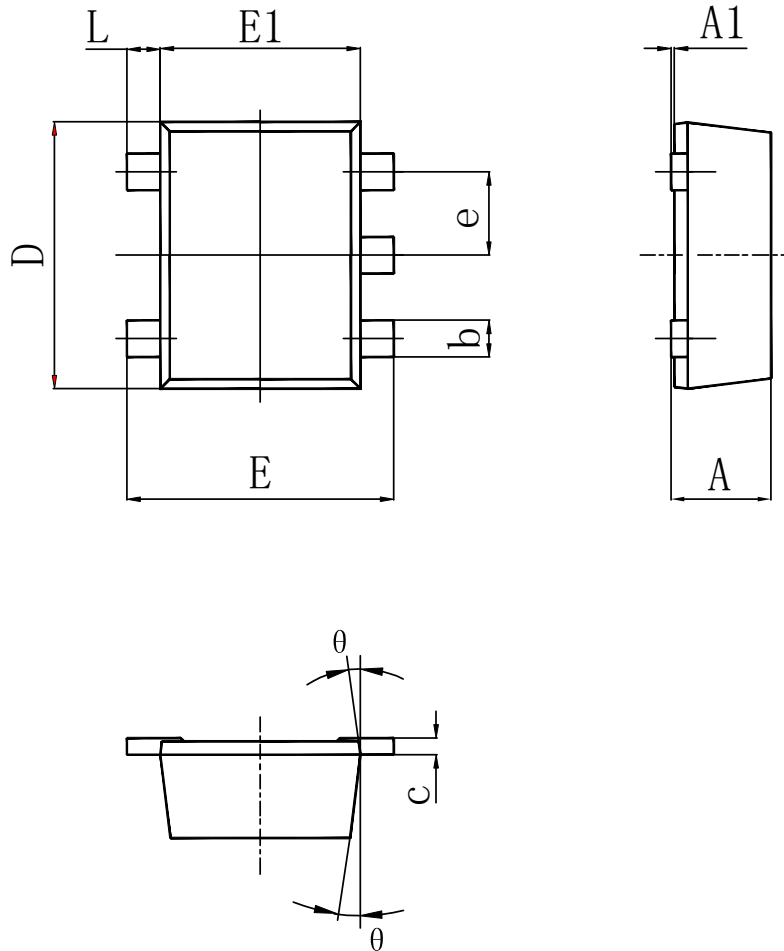


| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 0.900                     | 1.100 | 0.035                | 0.043 |
| A1       | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2       | 0.900                     | 1.000 | 0.035                | 0.039 |
| b        | 0.150                     | 0.350 | 0.006                | 0.014 |
| c        | 0.110                     | 0.175 | 0.004                | 0.007 |
| D        | 2.000                     | 2.200 | 0.079                | 0.087 |
| E        | 2.150                     | 2.450 | 0.085                | 0.096 |
| E1       | 1.150                     | 1.350 | 0.045                | 0.053 |
| e        | 0.650 TYP.                |       | 0.026 TYP.           |       |
| e1       | 1.200                     | 1.400 | 0.047                | 0.055 |
| L        | 0.260                     | 0.460 | 0.010                | 0.018 |
| L1       | 0.525 REF.                |       | 0.021 REF.           |       |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

# EM74AHC1G17; EM74AHCT1G17

Single Schmitt trigger buffer

SOT553



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 0.525                     | 0.600 | 0.021                | 0.024 |
| A1     | 0.000                     | 0.050 | 0.000                | 0.002 |
| e      | 0.450                     | 0.550 | 0.018                | 0.022 |
| c      | 0.090                     | 0.160 | 0.004                | 0.006 |
| D      | 1.500                     | 1.700 | 0.059                | 0.067 |
| b      | 0.170                     | 0.270 | 0.007                | 0.011 |
| E1     | 1.100                     | 1.300 | 0.043                | 0.051 |
| E      | 1.500                     | 1.700 | 0.059                | 0.067 |
| L      | 0.100                     | 0.300 | 0.004                | 0.012 |
| θ      | 7 °REF.                   |       | 7 °REF.              |       |

## 13. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description                             |
|---------|-----------------------------------------|
| CMOS    | Complementary Metal-Oxide Semiconductor |
| DUT     | Device Under Test                       |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| CDM     | Charged Device Model                    |
| TTL     | Transistor-Transistor Logic             |

## 14. Revision History

**Table 11. Revision history**

| Document ID                  | Release Date | Data sheet status | Change notice | Supersedes |
|------------------------------|--------------|-------------------|---------------|------------|
| EM74AHC_AHCT1G17<br>Rev. 1.0 | Apr 20, 2024 | Product datasheet |               |            |