# 74AHCT240

## Octal buffer/line driver; inverting; 3-state

Rev. 6 — 29 June 2020 Product data sheet

## 1. General description

The 74AHCT240 is an 8-bit inverting buffer/line driver with 3-state outputs. This device can be used as two 4-bit buffers or one 8-bit buffer. It features two output enables (1$\overline{OE}$ and 2$\overline{OE}$), each controlling four of the 3-state outputs. A HIGH on n$\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Inputs are over voltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

## 2. Features and benefits

- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accepts voltages higher than $V_{CC}$
- Operates with TTL input levels
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - CDM JESD22-C101D exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74AHCT240D | -40 °C to +125 °C | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74AHCT240PW | -40 °C to +125 °C | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74AHCT240BQ | -40 °C to +125 °C | DHVQFN20 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm | SOT764-1 |

# 4. Functional diagram

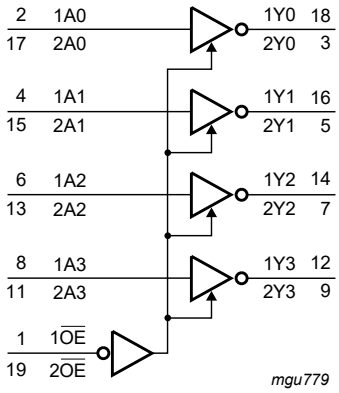



Fig. 1. Logic symbol

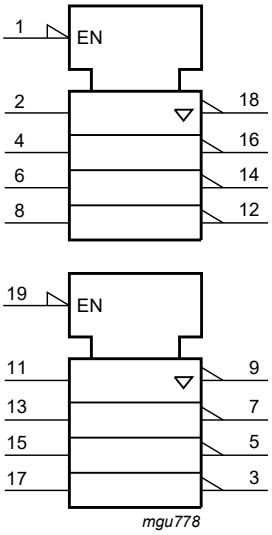



Fig. 2. IEC logic symbol

# 5. Pinning information

## 5.1. Pinning

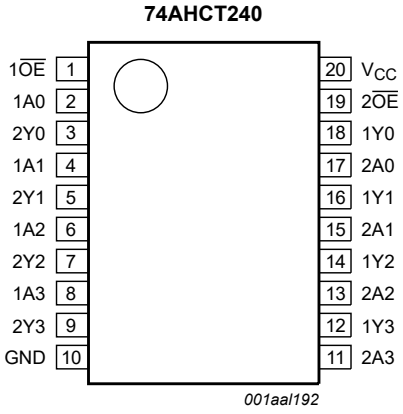
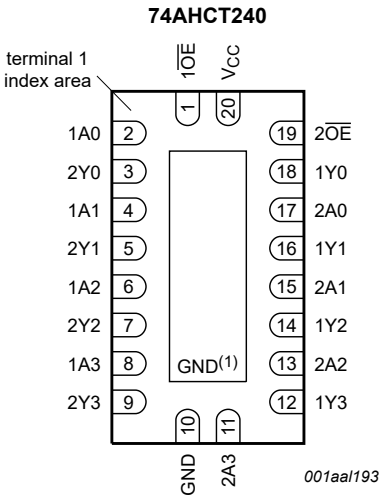



Fig. 3. Pin configuration SOT163-1 (SO20) and SOT360-1 (TSSOP20)




Transparent top view

(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

Fig. 4. Pin configuration SOT764-1 (DHVQFN20)

### 5.2. Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| $1\overline{OE}$, $2\overline{OE}$ | 1, 19 | output enable input (active LOW) |
| 1A0, 1A1, 1A2, 1A3 | 2, 4, 6, 8 | data input |
| 2A0, 2A1, 2A2, 2A3 | 17, 15, 13, 11 | data input |
| 1Y0, 1Y1, 1Y2, 1Y3 | 18, 16, 14, 12 | data output |
| 2Y0, 2Y1, 2Y2, 2Y3 | 3, 5, 7, 9 | data output |
| GND | 10 | ground (0 V) |
| $V_{CC}$ | 20 | power supply |

## 6. Functional description

**Table 3. Function table**

*H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.*

| Control | Input | Output |
|---|---|---|
| **$n\overline{OE}$** | **nAn** | **nYn** |
| L | L | H |
| L | H | L |
| H | X | Z |

## 7. Limiting values

**Table 4. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).*

| 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 V | [1] | -20 | - | mA |
| $I_{OK}$ | output clamping current | $V_O$ < -0.5 V or $V_O$ > $V_{CC}$ + 0.5 V | [1] | - | ±20 | mA |
| $I_O$ | output current | $V_O$ = -0.5 V to ($V_{CC}$ + 0.5 V) | | - | ±25 | mA |
| $I_{CC}$ | supply current | | | - | 75 | mA |
| $I_{GND}$ | ground current | | | -75 | - | mA |
| $T_{stg}$ | storage temperature | | | -65 | +150 | °C |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = -40 °C to +125 °C | [2] | - | 500 | mW |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For SOT163-1 (SO20) package: $P_{tot}$ derates linearly with 12.3 mW/K above 109 °C.
For SOT360-1 (TSSOP20) package: $P_{tot}$ derates linearly with 10.0 mW/K above 100 °C.
For SOT764-1 (DHVQFN20) package: $P_{tot}$ derates linearly with 12.9 mW/K above 111 °C.

# 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 4.5 | 5.0 | 5.5 | V |
| $V_I$ | input voltage | | 0 | - | 5.5 | V |
| $V_O$ | output voltage | | 0 | - | $V_{CC}$ | V |
| $T_{amb}$ | ambient temperature | | -40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC}$ = 5 V ± 0.5 V | - | - | 20 | ns/V |

# 9. Static characteristics

**Table 6. Static characteristics**

*At recommended operating conditions; voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | 2.0 | - | - | 2.0 | - | 2.0 | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | - | - | 0.8 | - | 0.8 | - | 0.8 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$; $V_{CC}$ = 4.5 V | | | | | | | | |
| | | $I_O$ = -50 µA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O$ = -8.0 mA | 3.94 | - | - | 3.80 | - | 3.70 | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$; $V_{CC}$ = 4.5 V | | | | | | | | |
| | | $I_O$ = 50 µA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O$ = 8.0 mA | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| $I_I$ | input leakage current | $V_I$ = 5.5 V or GND; $V_{CC}$ = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | µA |
| $I_{OZ}$ | OFF-state output current | $V_I$ = $V_{IH}$ or $V_{IL}$; $V_O$ = $V_{CC}$ or GND; $V_{CC}$ = 5.5 V | - | - | ±0.25 | - | ±2.5 | - | ±10.0 | µA |
| $I_{CC}$ | supply current | $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 A; $V_{CC}$ = 5.5 V | - | - | 4.0 | - | 40 | - | 80 | µA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_I$ = $V_{CC}$ - 2.1 V; other pins at $V_{CC}$ or GND; $I_O$ = 0 A; $V_{CC}$ = 4.5 V to 5.5 V | - | - | 1.35 | - | 1.5 | - | 1.5 | mA |
| $C_I$ | input capacitance | $V_I$ = $V_{CC}$ or GND | - | 3 | 10 | - | 10 | - | 10 | pF |
| $C_O$ | output capacitance | | - | 4 | - | - | - | - | - | pF |

# 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.*

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ [1] | Max | Min | Max | Min | Max | |
| $t_{pd}$ | propagation delay | nAn to nYn; see Fig. 5 [2] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V to 5.5 V; $C_L$ = 15 pF | - | 3.0 | 5.8 | 1.0 | 6.8 | 1.0 | 8.5 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V; $C_L$ = 50 pF | - | 4.4 | 8.4 | 1.0 | 9.5 | 1.0 | 11.9 | ns |
| $t_{en}$ | enable time | $n\overline{OE}$ to nYn; see Fig. 6 [2] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V to 5.5 V; $C_L$ = 15 pF | - | 3.4 | 7.5 | 1.0 | 9.0 | 1.0 | 14.4 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V; $C_L$ = 50 pF | - | 4.5 | 9.5 | 1.0 | 11.5 | 1.0 | 14.4 | ns |
| $t_{dis}$ | disable time | $n\overline{OE}$ to nYn; see Fig. 6 [2] | | | | | | | | |
| | | $V_{CC}$ = 4.5 V to 5.5 V; $C_L$ = 15 pF | - | 3.9 | 6.1 | 1.0 | 6.7 | 1.0 | 8.3 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V; $C_L$ = 50 pF | - | 6.2 | 8.7 | 1.0 | 9.2 | 1.0 | 11.5 | ns |
| $C_{PD}$ | power dissipation capacitance | $V_I$ = GND to $V_{CC}$; $C_L$ = 50 pF; $f_i$ = 1 MHz [3] | - | 9 | - | - | - | - | - | pF |

[1] Typical values are measured at nominal supply voltage ($V_{CC}$ = 5.0 V).

[2] $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$; $t_{en}$ is the same as $t_{PZH}$ and $t_{PZL}$; $t_{dis}$ is the same as $t_{PLZ}$ and $t_{PHZ}$.

[3] $C_{PD}$ 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;

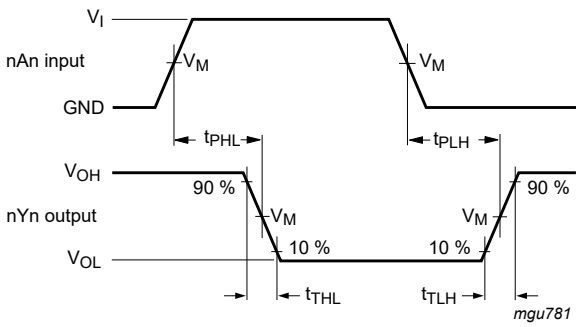
$C_L$ = output load capacitance in pF;

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

N = number of inputs switching;

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

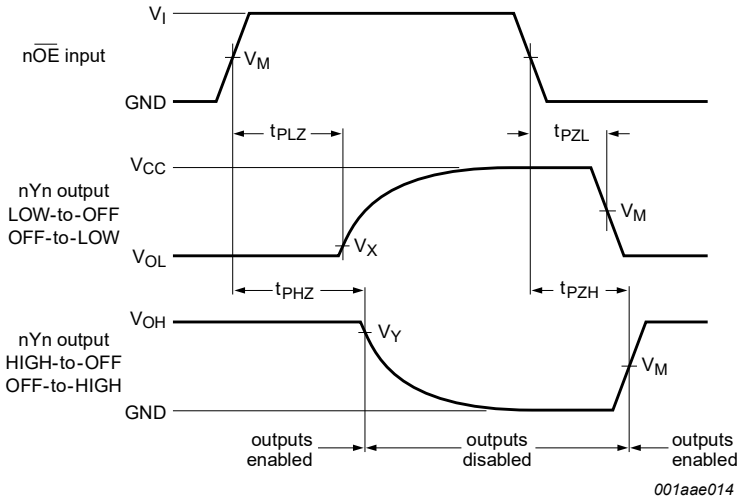
## 10.1. Waveforms and test circuit




Measurement points are given in Table 8.

$V_{OL}$ and $V_{OH}$ are typical voltage output drop that occur with the output load.

**Fig. 5. Propagation delay input (nAn) to output (nYn)**



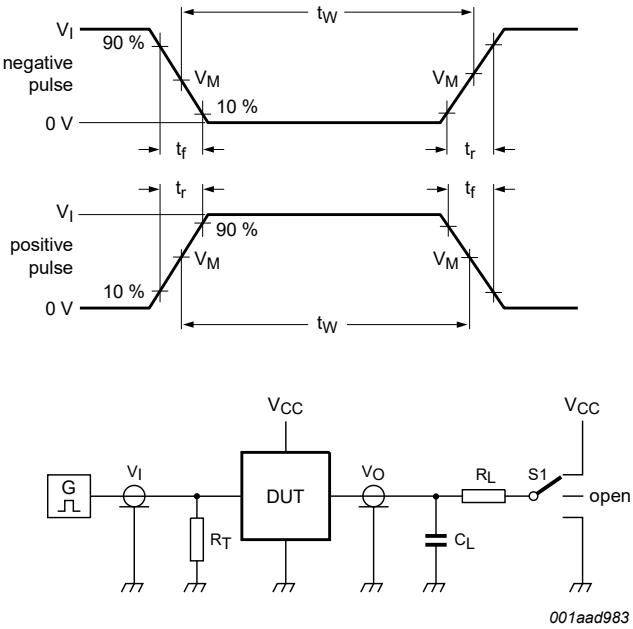

Measurement points are given in Table 8.

$V_{OL}$ and $V_{OH}$ are typical voltage output drop that occur with the output load.

**Fig. 6. Enable and disable times**

**Table 8. Measurement points**

| Input | Output | | |
|---|---|---|---|
| $V_M$ | $V_M$ | $V_X$ | $V_Y$ |
| 1.5 V | $0.5V_{CC}$ | $V_{OL}$ + 0.3 V | $V_{OH}$ - 0.3 V |




Test data is given in Table 9.

Definitions test circuit:

$R_T$ = Termination resistance should be equal to output impedance $Z_o$ of the pulse generator.

$C_L$ = Load capacitance including jig and probe capacitance.

$R_L$ = Load resistance.

S1 = Test selection switch.

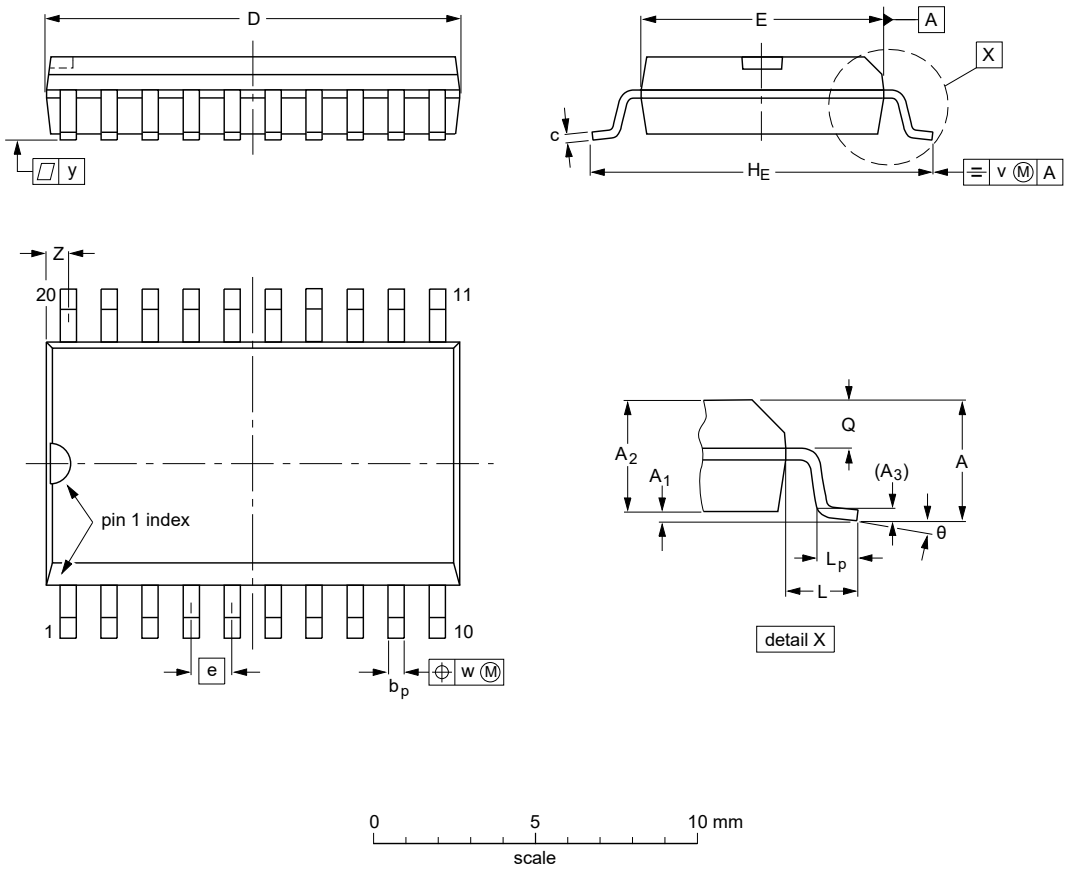
**Fig. 7. Test circuit for measuring switching times**

**Table 9. Test data**

| Input | | Load | | S1 position | | |
|---|---|---|---|---|---|---|
| $V_I$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PHL}$, $t_{PLH}$ | $t_{PZH}$, $t_{PHZ}$ | $t_{PZL}$, $t_{PLZ}$ |
| 3.0 V | 3.0 ns | 15 pF, 50 pF | 1 kΩ | open | GND | $V_{CC}$ |

# 11. Package outline

**SO20: plastic small outline package; 20 leads; body width 7.5 mm** **SOT163-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.65 | 0.3<br>0.1 | 2.45<br>2.25 | 0.25 | 0.49<br>0.36 | 0.32<br>0.23 | 13.0<br>12.6 | 7.6<br>7.4 | 1.27 | 10.65<br>10.00 | 1.4 | 1.1<br>0.4 | 1.1<br>1.0 | 0.25 | 0.25 | 0.1 | 0.9<br>0.4 | $8^o$<br>$0^o$ |
| inches | 0.1 | 0.012<br>0.004 | 0.096<br>0.089 | 0.01 | 0.019<br>0.014 | 0.013<br>0.009 | 0.51<br>0.49 | 0.30<br>0.29 | 0.05 | 0.419<br>0.394 | 0.055 | 0.043<br>0.016 | 0.043<br>0.039 | 0.01 | 0.01 | 0.004 | 0.035<br>0.016 | |

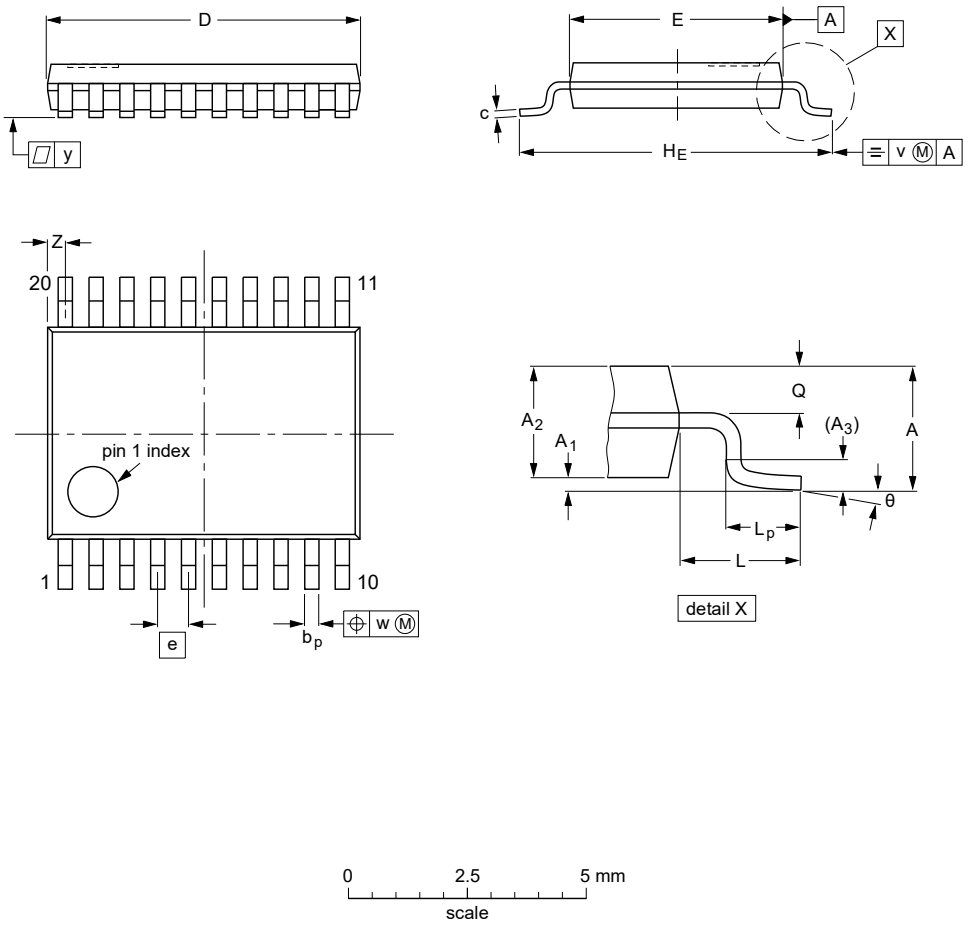
**Note**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT163-1 | 075E04 | MS-013 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig. 8. Package outline SOT163-1 (SO20)**

**TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm** **SOT360-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 6.6<br>6.4 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.5<br>0.2 | 8°<br>0° |

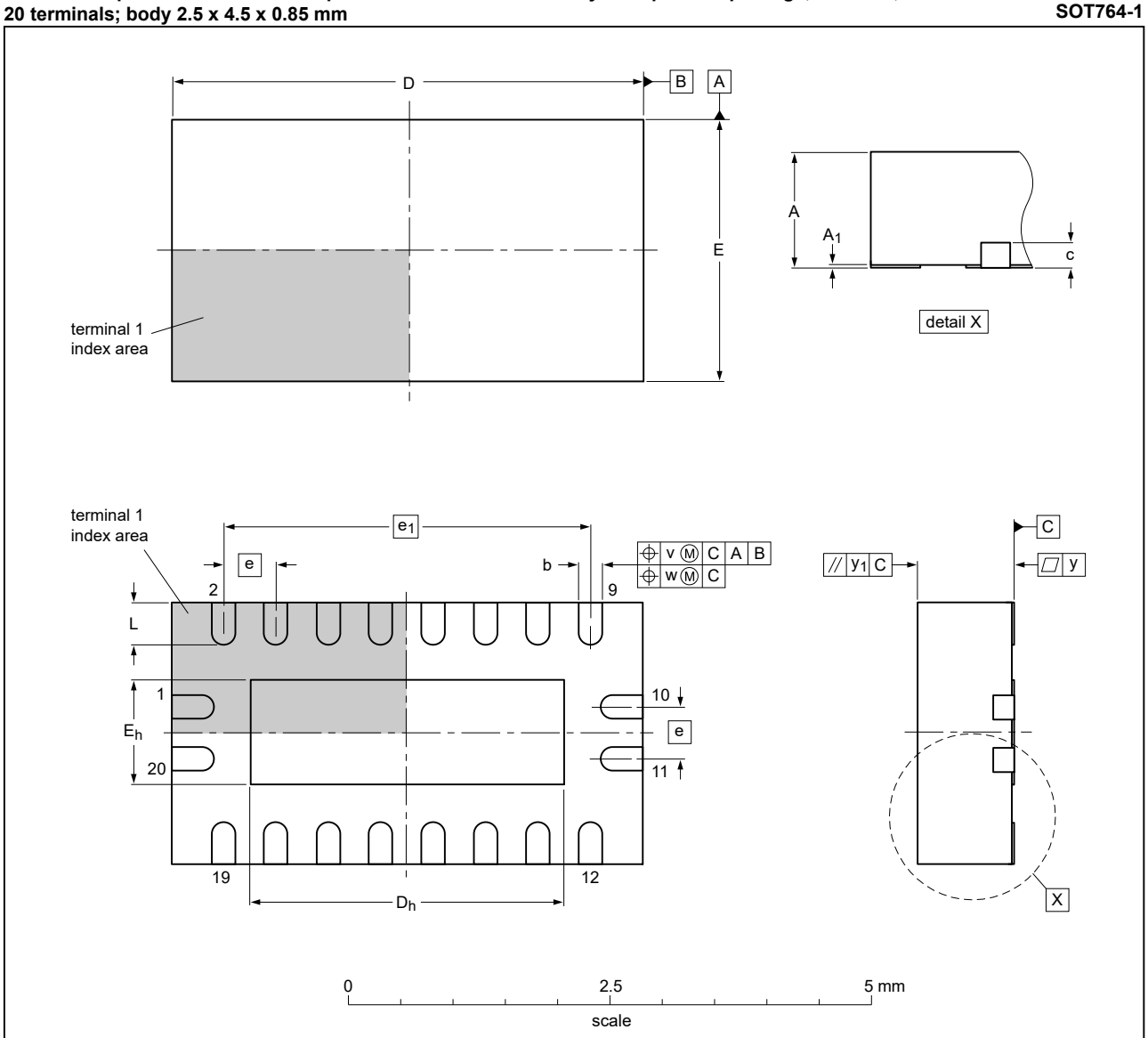
**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT360-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig. 9. Package outline SOT360-1 (TSSOP20)**

**DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm** **SOT764-1**




Dimensions (mm are the original dimensions)

| Unit | | $A^{(1)}$ | $A_1$ | b | c | $D^{(1)}$ | $D_h$ | $E^{(1)}$ | $E_h$ | e | $e_1$ | L | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | max | 1.00 | 0.05 | 0.30 | | 4.6 | 3.15 | 2.6 | 1.15 | | | 0.5 | | | | |
| mm | nom | 0.90 | 0.02 | 0.25 | 0.2 | 4.5 | 3.00 | 2.5 | 1.00 | 0.5 | 3.5 | 0.4 | 0.1 | 0.05 | 0.05 | 0.1 |
| | min | 0.80 | 0.00 | 0.18 | | 4.4 | 2.85 | 2.4 | 0.85 | | | 0.3 | | | | |

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

*sot764-1_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT764-1 | - - - | MO-241 | - - - | | | ~~03-01-27~~ 14-12-12 |

**Fig. 10. Package outline SOT764-1 (DHVQFN20)**

## 12. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description |
|---|---|
| CDM | Charge Device Model |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| TTL | Transistor-Transistor Logic |

## 13. Revision history

**Table 11. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74AHCT240 v.6 | 20200629 | Product data sheet | - | 74AHCT240 v.5 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Table 4: Derating values for $P_{tot}$ total power dissipation updated.<br>• Table 6: $I_{OZ}$ conditions corrected. (errata) | | | |
| 74AHCT240 v.5 | 20160229 | Product data sheet | - | 74AHC_AHCT240 v.4 |
| Modifications: | • Type numbers 74AHC240D, 74AHC240PW and 74AHC240BQ removed. | | | |
| 74AHC_AHCT240 v.4 | 20130925 | Product data sheet | - | 74AHC_AHCT240 v.3 |
| Modifications: | • Fig. 5 and Fig. 6 have been made visible (errata). | | | |
| 74AHC_AHCT240 v.3 | 20111108 | Product data sheet | - | 74AHC_AHCT240 v.2 |
| Modifications: | • Legal pages updated. | | | |
| 74AHC_AHCT240 v.2 | 20101126 | Product data sheet | - | 74AHC_AHCT240 v.1 |
| 74AHC_AHCT240 v.1 | 20100111 | Product data sheet | - | - |

# 14. Legal information

## Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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