74HCT241-Q100

Octal buffer/line driver; 3-state

Rev. 2 — 5 August 2024 Product data sheet

1. General description

The 74HCT241-Q100 is an 8-bit buffer/line driver with 3-state outputs. The device can be used as two 4-bit buffers or one 8-bit buffer. The device features two output enables ($1\overline{OE}$ and 2OE), each controlling four of the 3-state outputs. A HIGH on $1\overline{OE}$ or LOW on 2OE causes the associated outputs to assume a high-impedance OFF-state. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

The 74HCT241-Q100 device features reduced input threshold levels to allow interfacing to TTL logic levels.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 4.5 V to 5.5 V
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Input levels at TTL level
- Octal bus interface
- Non-inverting 3-state outputs
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HCT241D-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HCT241PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1

4. Functional diagram

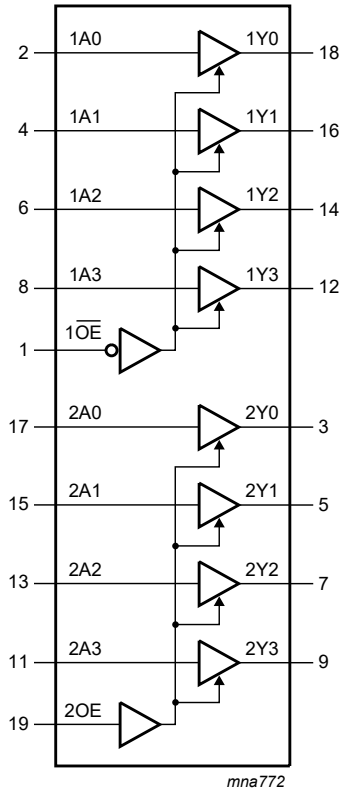


Fig. 1. Logic symbol

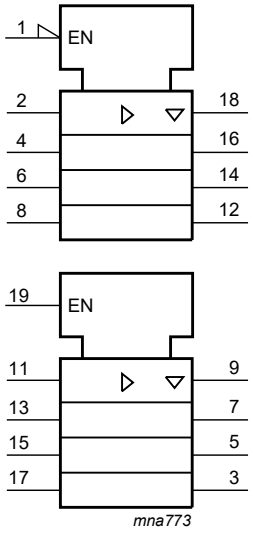
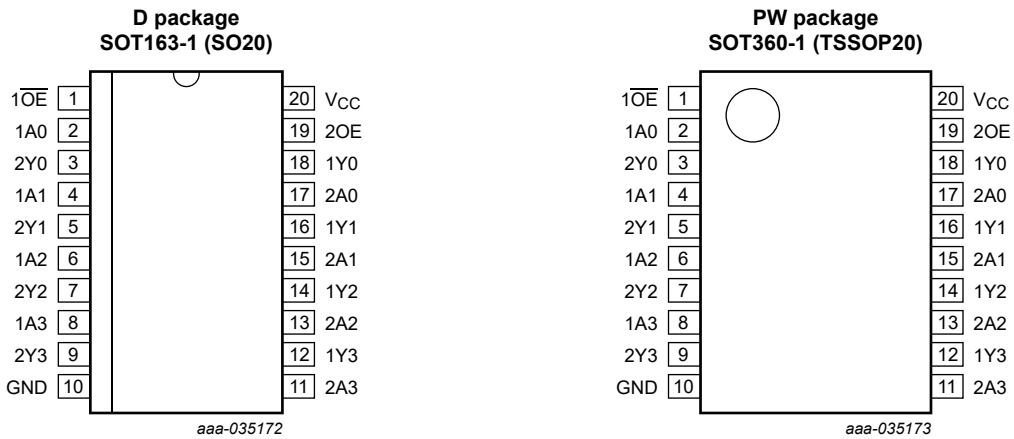


Fig. 2. IEC logic symbol

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$1\overline{OE}$	1	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
GND	10	ground (0 V)
1Y0, 1Y1, 1Y2, 1Y3	18, 16, 14, 12	data output
2Y0, 2Y1, 2Y2, 2Y3	3, 5, 7, 9	data output
2OE	19	output enable input (active HIGH)
V_{CC}	20	supply voltage

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = Don't care; Z = High impedance "OFF" state

Inputs		Outputs		Inputs		Outputs
$1\overline{OE}$	1An	1Yn		2OE	2An	2Yn
L	L	L		H	L	L
L	H	H		H	H	H
H	X	Z		L	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	V
I_{IK}	input clamping current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	±20	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	-	±20	mA
I_O	output current	-0.5 V $< V_O < V_{CC} + 0.5$ V	-	±35	mA
I_{CC}	supply current		-	70	mA
I_{GND}	ground current		-70	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	[1]	-	500	mW

[1] 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.

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	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 4.5 V	-	1.67	139	ns/V
T_{amb}	ambient temperature		-40	-	+125	°C

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	1.6	-	2.0	-	2.0	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	1.2	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 = -20 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = -6 mA	3.98	4.32	-	3.84	-	3.7	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}; V_{CC} = 4.5 V								
		I_O = 20 µA	-	0	0.1	-	0.1	-	0.1	V
		I_O = 6.0 mA	-	0.16	0.26	-	0.33	-	0.4	V
I_I	input leakage current	V_I = V_{CC} or GND; V_{CC} = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	µA
I_{OZ}	OFF-state output current	V_I = V_{IH} or V_{IL}; V_{CC} = 5.5 V; V_O = V_{CC} or GND	-	-	±0.5	-	±5.0	-	±10	µA
I_{CC}	supply current	V_I = V_{CC} or GND; V_{CC} = 5.5 V; I_O = 0 A	-	-	8.0	-	80	-	160	µA
ΔI_{CC}	additional supply current	per input pin; V_{CC} = 4.5 V to 5.5 V; V_I = V_{CC} - 2.1 V; other inputs at V_{CC} or GND; I_O = 0 A								
		nAn; $1\overline{OE}$	-	70	252	-	315	-	343	µA
		2OE	-	150	540	-	675	-	735	µA
C_I	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

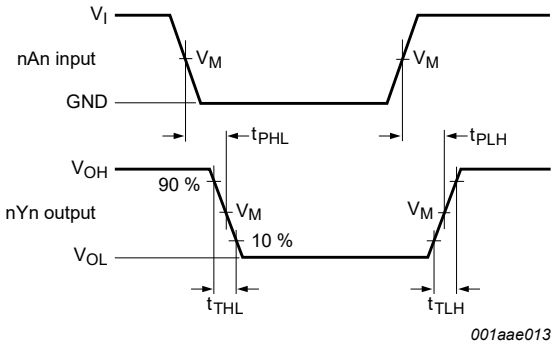
Table 7. Dynamic characteristics

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

Symbol	Parameter	Conditions	+25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{pd}	propagation delay	nAn to nYn; see Fig. 3 [1]								
		V_{CC} = 4.5 V	-	13	22	-	28	-	33	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	11	-	-	-	-	-	ns
t_{en}	enable time	$1\overline{OE}$ to 1Yn; see Fig. 4; [2] 2OE to 2Yn; see Fig. 5; V_{CC} = 4.5 V	-	15	30	-	38	-	45	ns
t_{dis}	disable time	$1\overline{OE}$ to 1Yn; see Fig. 4; [3] 2OE to 2Yn; see Fig. 5; V_{CC} = 4.5 V	-	18	30	-	38	-	45	ns
t_t	transition time	V_{CC} = 4.5 V; see Fig. 3 [4]	-	5	12	-	15	-	18	ns
C_{PD}	power dissipation capacitance	per buffer; [5] V_I = GND to V_{CC} - 1.5 V	-	30	-	-	-	-	-	pF

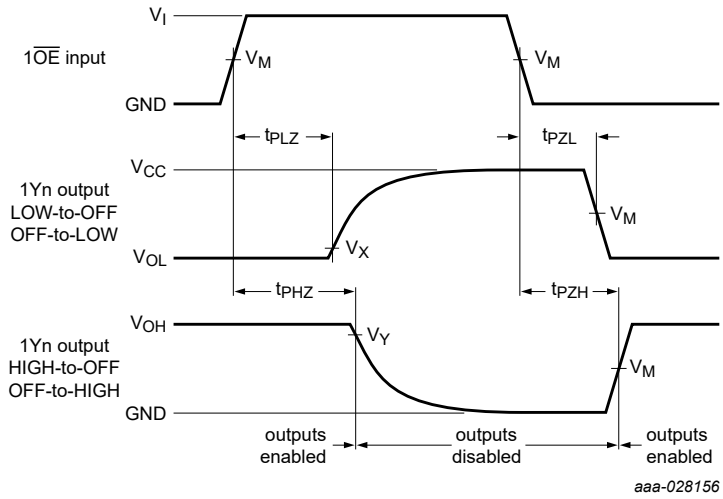
[1] t_{pd} is the same as t_{PHL} and t_{PLH}.
[2] t_{en} is the same as t_{PZH} and t_{PZL}.
[3] t_{dis} is the same as t_{PHZ} and t_{PLZ}.
[4] t_t is the same as t_{THL} and t_{TLH}.
[5] C_{PD} is used to determine the dynamic power dissipation (P_D in µW):
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$ 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;
$\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

10.1. Waveforms and test circuit



See Table 8 for measurement points.
V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

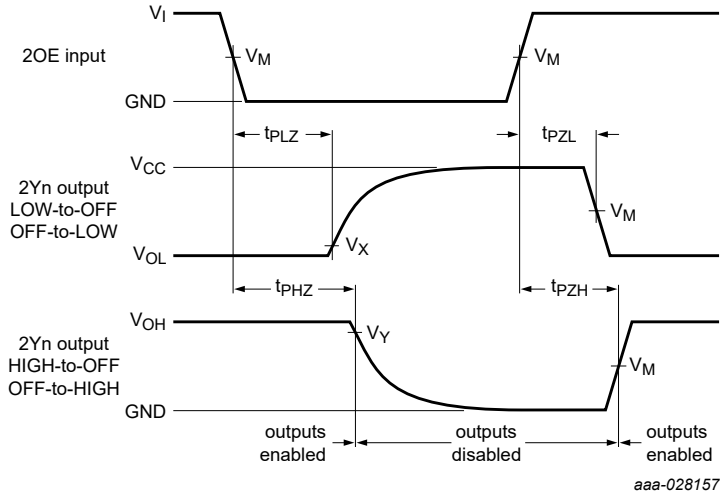
Fig. 3. Input (nAn) to output (nYn) propagation delays and output transition times



See Table 8 for measurement points.

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

Fig. 4. 3-state output ($1\overline{OE}$ to 1Yn) enable and disable times



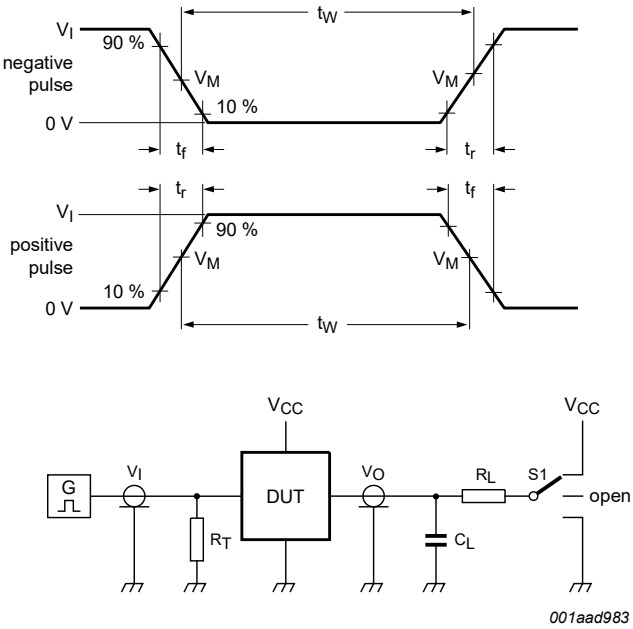
See Table 8 for measurement points.

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

Fig. 5. 3-state output (2OE to 2Yn) enable and disable times

Table 8. Measurement points

Type	Input		Output		
	V_I	V_M	V_M	V_X	V_Y
74HCT241-Q100	GND to 3 V	1.3 V	1.3 V	0.1 × V_{CC}	0.9 × V_{CC}



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.

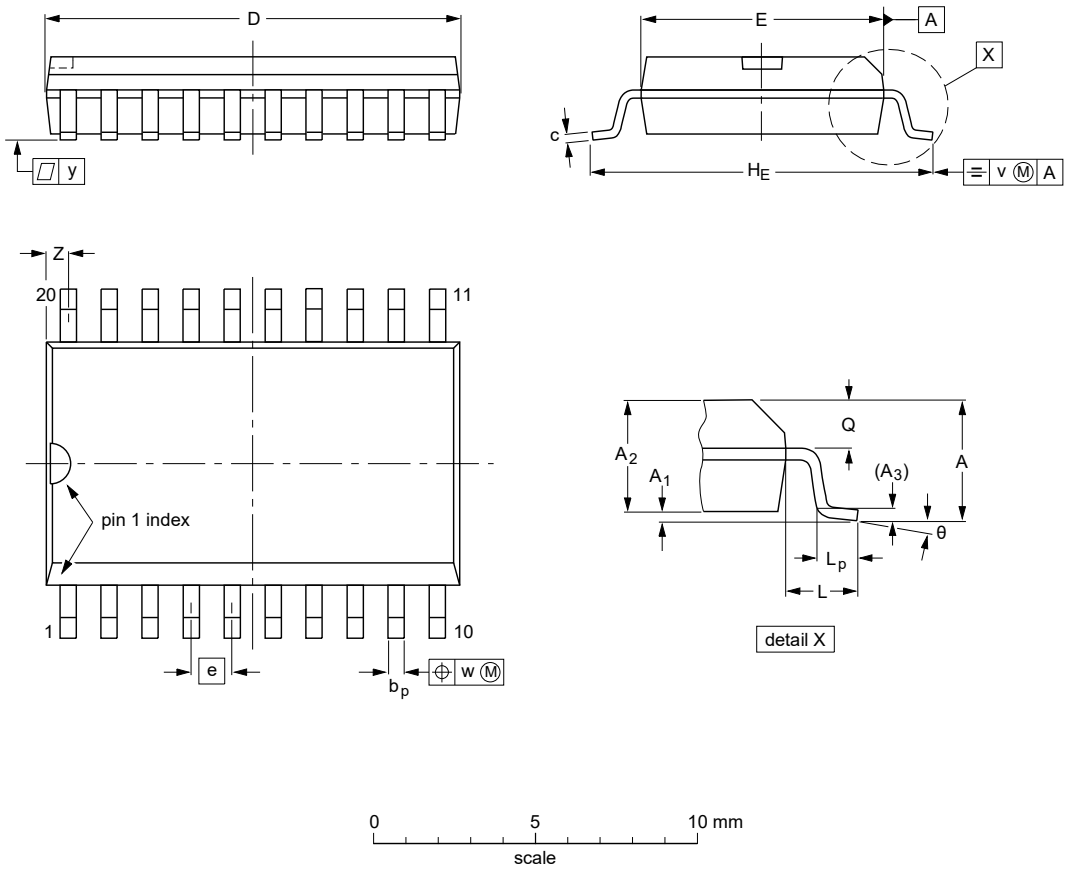
Fig. 6. Test circuit for measuring switching times

Table 9. Test data

Type	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}
74HCT241-Q100	GND to 3 V	6 ns	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 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

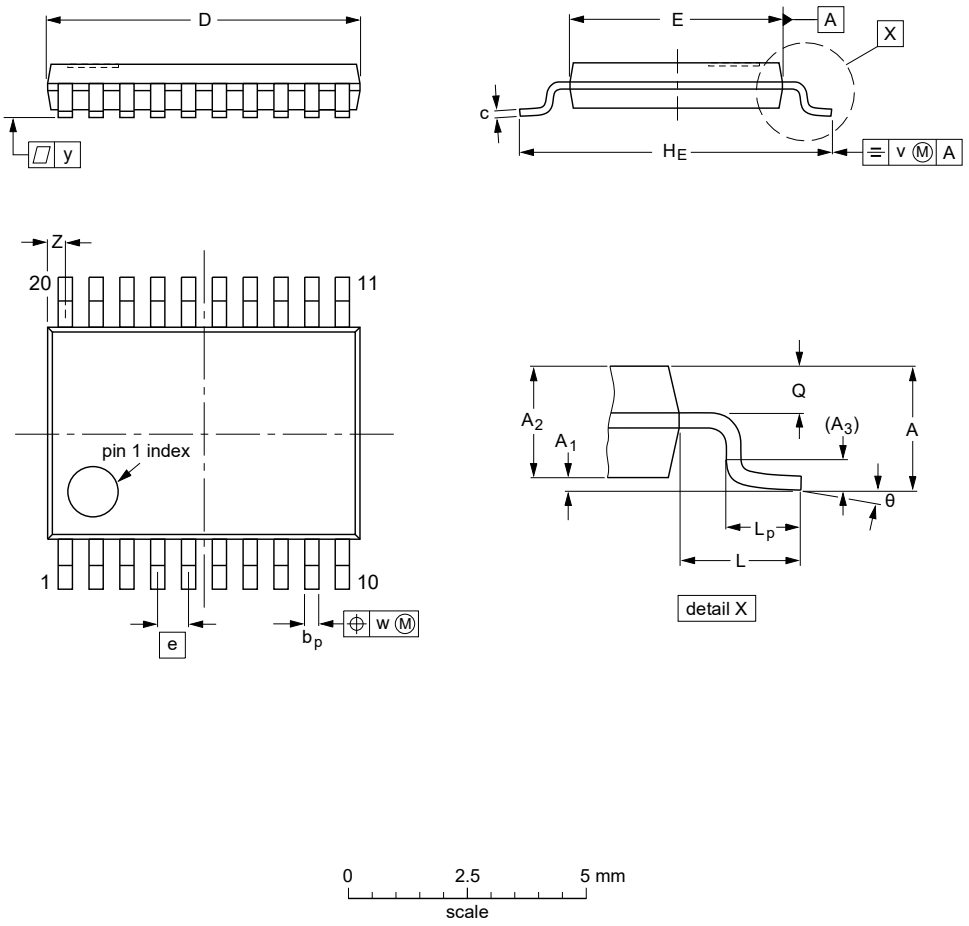
Note

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~~ 03-02-19

Fig. 7. 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 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 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~~ 03-02-19

Fig. 8. Package outline SOT360-1 (TSSOP20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HCT241_Q100 v.2	20240805	Product data sheet	-	74HCT241_Q100 v.1
Modifications:	• Section 2: ESD specification updated according to the latest JEDEC standard.			
74HCT241_Q100 v.1	20231025	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.

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[2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 5 August 2024

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