

# 74ALVC373

## Octal D-type transparent latch; 3-state

Rev. 02 — 18 October 2007

Product data sheet

### 1. General description

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The 74ALVC373 is an octal D-type transparent latch featuring separate D-type inputs for each latch and 3-state true outputs for bus-oriented applications. A latch enable (LE) input and an outputs enable ( $\overline{OE}$ ) input are common to all latches.

When pin LE is HIGH, data at the D-inputs (pins D0 to D7) enters the latches. In this condition, the latches are transparent, that is, a latch output will change each time its corresponding D-input changes. When pin LE is LOW, the latches store the information that was present at the D-inputs one set-up time preceding the HIGH-to-LOW transition of pin LE.

When pin  $\overline{OE}$  is LOW, the contents of the eight latches are available at the Q-outputs (pins Q0 to Q7). When pin  $\overline{OE}$  is HIGH, the outputs go to the high-impedance OFF-state. Operation of input pin  $\overline{OE}$  does not affect the state of the latches.

The 74ALVC373 is functionally identical to the 74ALVC573, but has a different pin arrangement.

### 2. Features

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- Wide supply voltage range from 1.65 V to 3.6 V
- 3.6 V tolerant inputs/outputs
- CMOS low power consumption
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Power-down mode
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standards:
  - ◆ JESD8-7 (1.65 V to 1.95 V)
  - ◆ JESD8-5 (2.3 V to 2.7 V)
  - ◆ JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A 115-A exceeds 200 V

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74ALVC373D	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74ALVC373PW	-40 °C to +85 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74ALVC373BQ	-40 °C to +85 °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

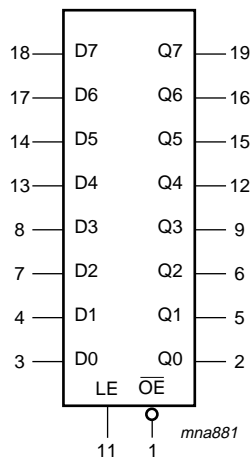


Fig 1. Logic symbol

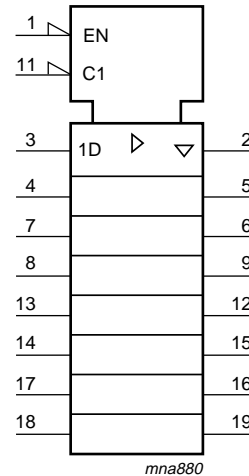


Fig 2. IEC logic symbol

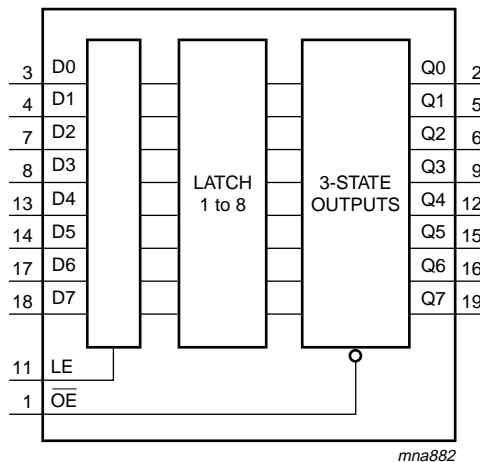


Fig 3. Functional diagram

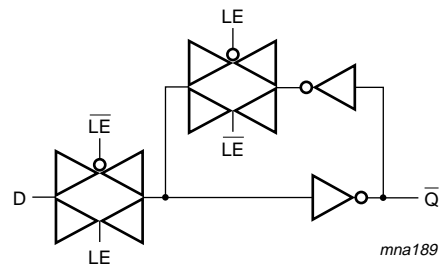


Fig 4. Logic diagram (one latch)

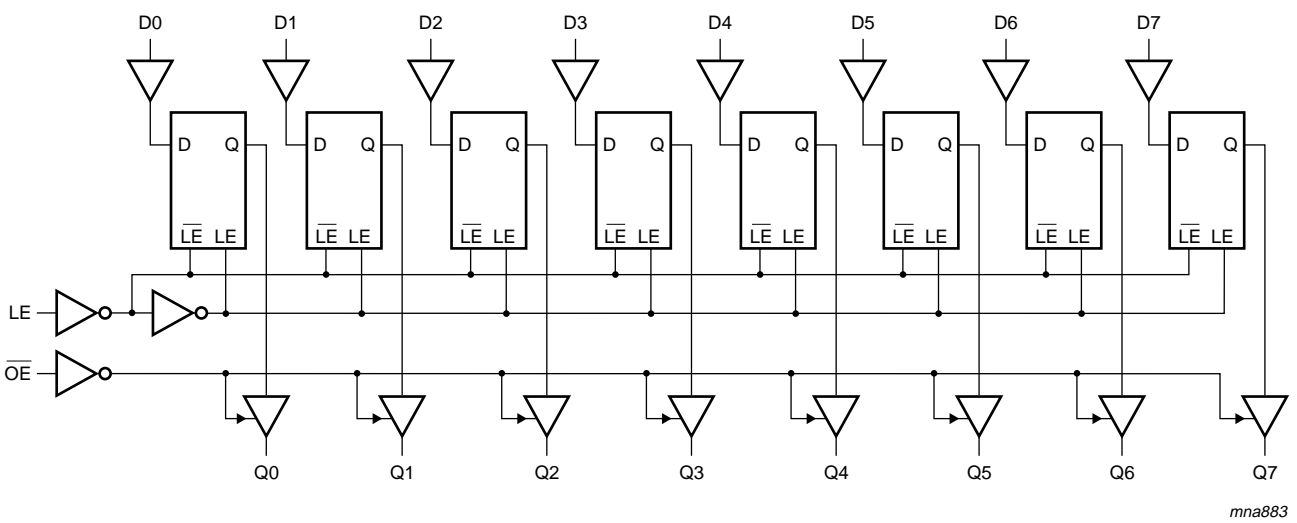
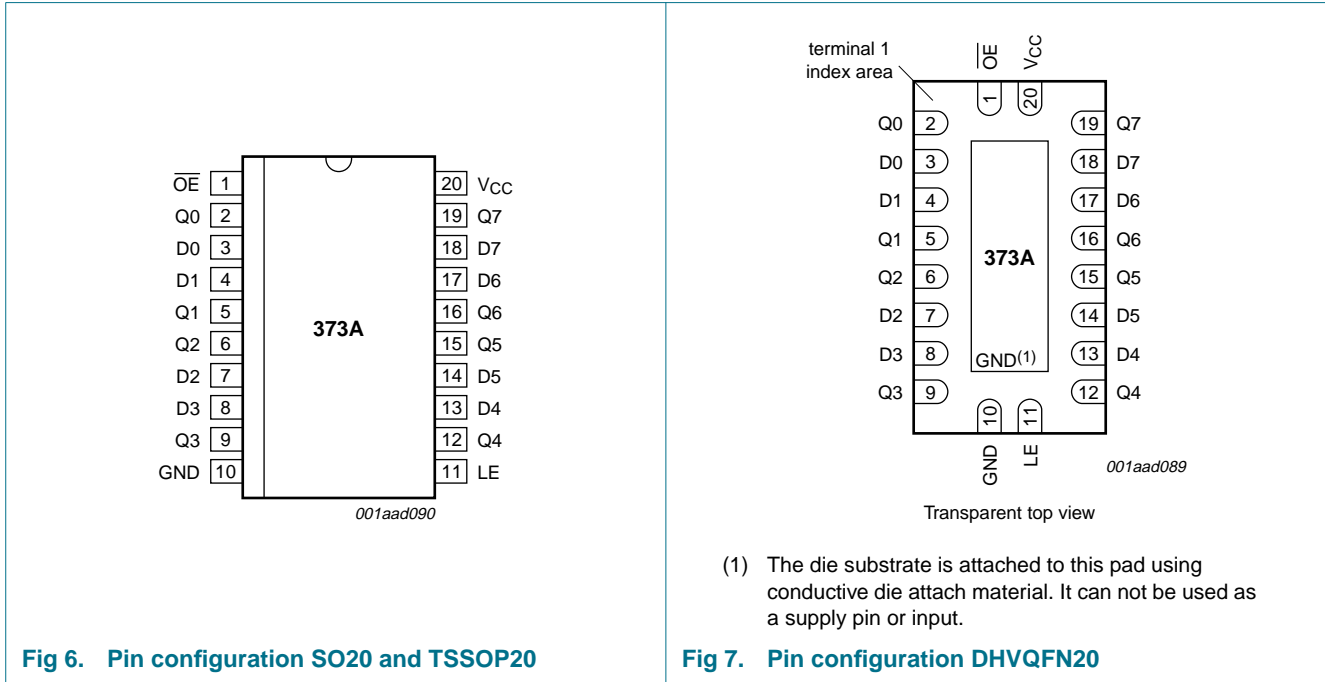


Fig 5. Logic diagram

## 5. Pinning information

### 5.1 Pinning



### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
D[0:7]	3, 4, 7, 8, 13, 14, 17, 18	data input
LE	11	latch enable input (active HIGH)
OE	1	output enable input (active LOW)
Q[0:7]	2, 5, 6, 9, 12, 15, 16, 19	3-state latch output
V <sub>CC</sub>	20	supply voltage
GND	10	ground (0 V)

## 6. Functional description

**Table 3. Functional table<sup>[1]</sup>**

Operating modes	Input			Internal latch	Output Qn
	$\overline{OE}$	LE	Dn		
Enable and read register (transparent mode)	L	H	L	L	L
	L	H	H	H	H
Latch and read register	L	L	l	L	L
	L	L	h	H	H
Latch register and disable outputs	H	X	X	X	Z
	H	L	h	H	Z

- [1] H = HIGH voltage level  
 h = HIGH voltage level one set-up time prior to the HIGH-to-LOW LE transition  
 L = LOW voltage level  
 l = LOW voltage level one set-up time prior to the HIGH-to-LOW LE transition  
 X = don't care  
 Z = High-impedance OFF-state

## 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	+4.6	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$V_I$	input voltage		-0.5	+4.6	V
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA
$V_O$	output voltage	output HIGH or LOW state	<sup>[1]</sup> <sup>[2]</sup> -0.5	$V_{CC} + 0.5$	V
		output 3-state	-0.5	+4.6	V
		power-down mode, $V_{CC} = 0$ V	<sup>[2]</sup> -0.5	+4.6	V
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}$	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +85 °C	<sup>[3]</sup> -	500	mW

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 [2] When  $V_{CC} = 0$  V (power-down mode), the output voltage can be 3.6 V in normal operation.  
 [3] For SO20 packages: above 70 °C derate linearly with 8 mW/K.  
 For TSSOP20 packages: above 60 °C derate linearly with 5.5 mW/K.  
 For DHVQFN20 packages: above 60 °C derate linearly with 4.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		1.65	3.6	V
$V_I$	input voltage		0	3.6	V
$V_O$	output voltage	output HIGH or LOW state	0	$V_{CC}$	V
		output 3-state	0	3.6	V
		power-down mode; $V_{CC} = 0$ V	0	3.6	V
$T_{amb}$	ambient temperature	in free air	-40	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	-	20	ns/V
		$V_{CC} = 2.7$ V to 3.6 V	-	10	ns/V

## 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			Unit
			Min	Typ <sup>[1]</sup>	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3$ V to 2.7 V	1.7	-	-	V
		$V_{CC} = 2.7$ V to 3.6 V	2.0	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3$ V to 2.7 V	-	-	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	-	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = -100$ $\mu$ A; $V_{CC} = 1.65$ V to 3.6 V	$V_{CC} - 0.2$	-	-	V
		$I_O = -6$ mA; $V_{CC} = 1.65$ V	1.25	1.51	-	V
		$I_O = -12$ mA; $V_{CC} = 2.3$ V	1.8	2.10	-	V
		$I_O = -18$ mA; $V_{CC} = 2.3$ V	1.7	2.01	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	2.53	-	V
		$I_O = -18$ mA; $V_{CC} = 3.0$ V	2.4	2.76	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.2	2.68	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 100$ $\mu$ A; $V_{CC} = 1.65$ V to 3.6 V	-	-	0.2	V
		$I_O = 6$ mA; $V_{CC} = 1.65$ V	-	0.11	0.3	V
		$I_O = 12$ mA; $V_{CC} = 2.3$ V	-	0.17	0.4	V
		$I_O = 18$ mA; $V_{CC} = 2.3$ V	-	0.25	0.6	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	0.16	0.4	V
		$I_O = 18$ mA; $V_{CC} = 3.0$ V	-	0.23	0.4	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	-	0.30	0.55	V
$I_I$	input leakage current	$V_{CC} = 3.6$ V; $V_I = 3.6$ V or GND	-	$\pm 0.1$	$\pm 5$	$\mu$ A

**Table 6. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ <sup>[1]</sup>	Max	
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 1.65 V to 3.6 V; V <sub>O</sub> = 3.6 V or GND;	-	±0.1	±10	µA
I <sub>OFF</sub>	power-off leakage supply	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V	-	±0.1	±10	µA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.2	10	µA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 3.0 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	5	750	µA
C <sub>I</sub>	input capacitance		-	3.5	-	pF

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 12](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit		
			Min	Typ <sup>[1]</sup>	Max			
t <sub>pd</sub>	propagation delay	Dn to Qn; see <a href="#">Figure 8</a> <sup>[2]</sup>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	2.5	5.4	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.0	3.5	ns		
		V <sub>CC</sub> = 2.7 V	1.0	2.3	3.6	ns		
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.2	3.3	ns		
		LE to Qn; see <a href="#">Figure 9</a>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	2.8	6.0	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.1	3.8	ns		
		V <sub>CC</sub> = 2.7 V	1.0	2.4	3.7	ns		
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.3	3.3	ns		
		t <sub>en</sub>	enable time	OE to Qn; see <a href="#">Figure 10</a> <sup>[2]</sup>				
				V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	3.0	6.4	ns
V <sub>CC</sub> = 2.3 V to 2.7 V	1.0			2.4	4.5	ns		
V <sub>CC</sub> = 2.7 V	1.5			3.0	4.6	ns		
V <sub>CC</sub> = 3.0 V to 3.6 V	1.0			2.3	4.0	ns		
t <sub>dis</sub>	disable time	OE to Qn; see <a href="#">Figure 10</a> <sup>[2]</sup>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	3.4	7.0	ns		
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.2	4.4	ns		
		V <sub>CC</sub> = 2.7 V	1.5	2.8	4.4	ns		
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.7	4.4	ns		

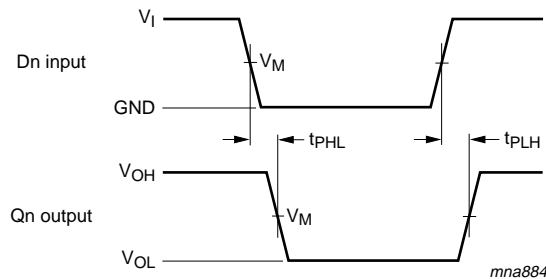
**Table 7. Dynamic characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 12](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ <sup>[1]</sup>	Max	
t <sub>W</sub>	pulse width	LE pulse width HIGH; see <a href="#">Figure 9</a>				
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.8	1.0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	3.3	0.8	-	ns
		V <sub>CC</sub> = 2.7 V	3.3	2.0	-	ns
t <sub>su</sub>	set-up time	Dn to LE; see <a href="#">Figure 11</a>				
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.8	0.1	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.8	0.1	-	ns
		V <sub>CC</sub> = 2.7 V	0.8	0.1	-	ns
t <sub>h</sub>	hold time	Dn to LE; see <a href="#">Figure 11</a>				
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.8	-0.1	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.8	-0.2	-	ns
		V <sub>CC</sub> = 2.7 V	0.8	-0.3	-	ns
C <sub>PD</sub>	power dissipation capacitance	per latch; V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 3.3 V <sup>[3]</sup>				
		outputs HIGH or LOW state	-	35	-	pF
		outputs 3-state	-	14	-	pF

- [1] Typical values are measured at T<sub>amb</sub> = 25 °C
- [2] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.  
 t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.  
 t<sub>dis</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.
- [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> 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<sub>i</sub> = input frequency in MHz; f<sub>o</sub> = output frequency in MHz  
 C<sub>L</sub> = output load capacitance in pF  
 V<sub>CC</sub> = supply voltage in Volts  
 N = number of inputs switching  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs



11. Waveforms



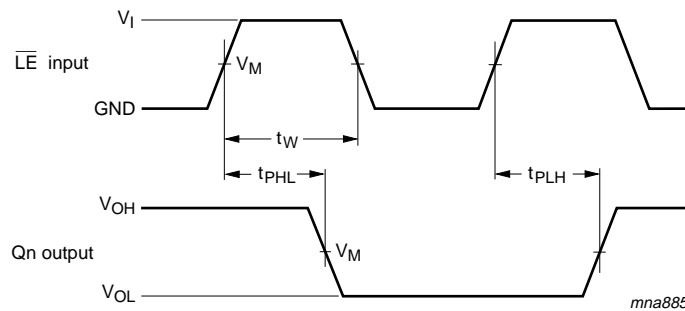
Measurement points are given in [Table 8](#).

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

**Fig 8. Input Dn to output Qn propagation delay times**

**Table 8. Measurement points**

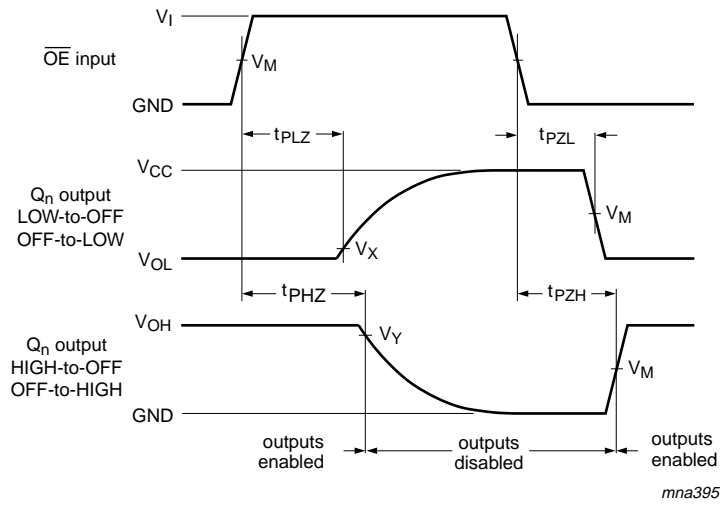
Supply voltage $V_{CC}$	$V_M$	Output	
		$V_x$	$V_y$
1.65 V to 1.95 V	$0.5V_{CC}$	$V_{OL} + 0.15 V$	$V_{OH} - 0.15 V$
2.3 V to 2.7 V	$0.5V_{CC}$	$V_{OL} + 0.15 V$	$V_{OH} - 0.15 V$
2.7 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$
3.0 V to 3.6 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



Measurement points are given in [Table 8](#).

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

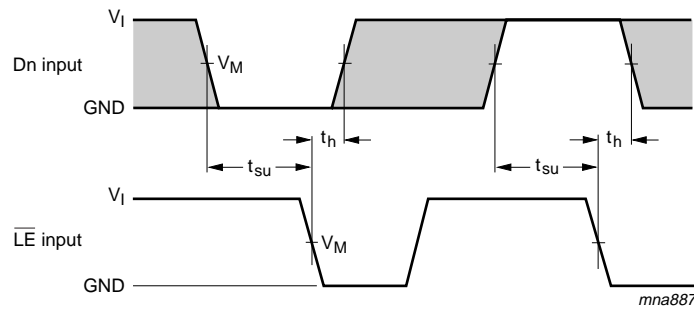
**Fig 9. Latch enable ( $\overline{LE}$ ) pulse width and latch enable input to output (Qn) propagation delays**



Measurement points are given in [Table 8](#).

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

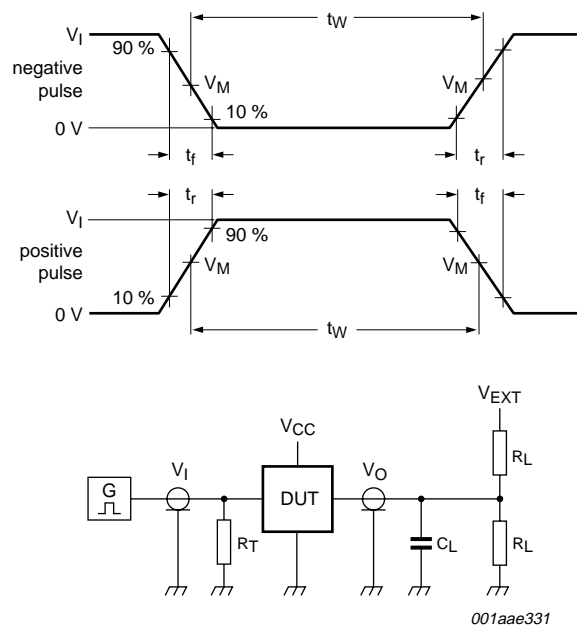
**Fig 10. Enable and disable times**



Measurement points are given in [Table 8](#).

The shaded areas indicate when the input is permitted to change for predicable output performance.

**Fig 11. The data set-up and hold times for Dn input to LE input**



Test data is given in [Table 9](#).

Definitions for test circuit:

$R_L$  = Load resistance.

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

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

$V_{EXT}$  = External voltage for measuring switching times.

**Fig 12. Test circuitry for switching times**

**Table 9. Test data**

Supply voltage	Input		Load		$V_{EXT}$		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
1.65 V to 1.95 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	6 V	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	6 V	GND

12. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

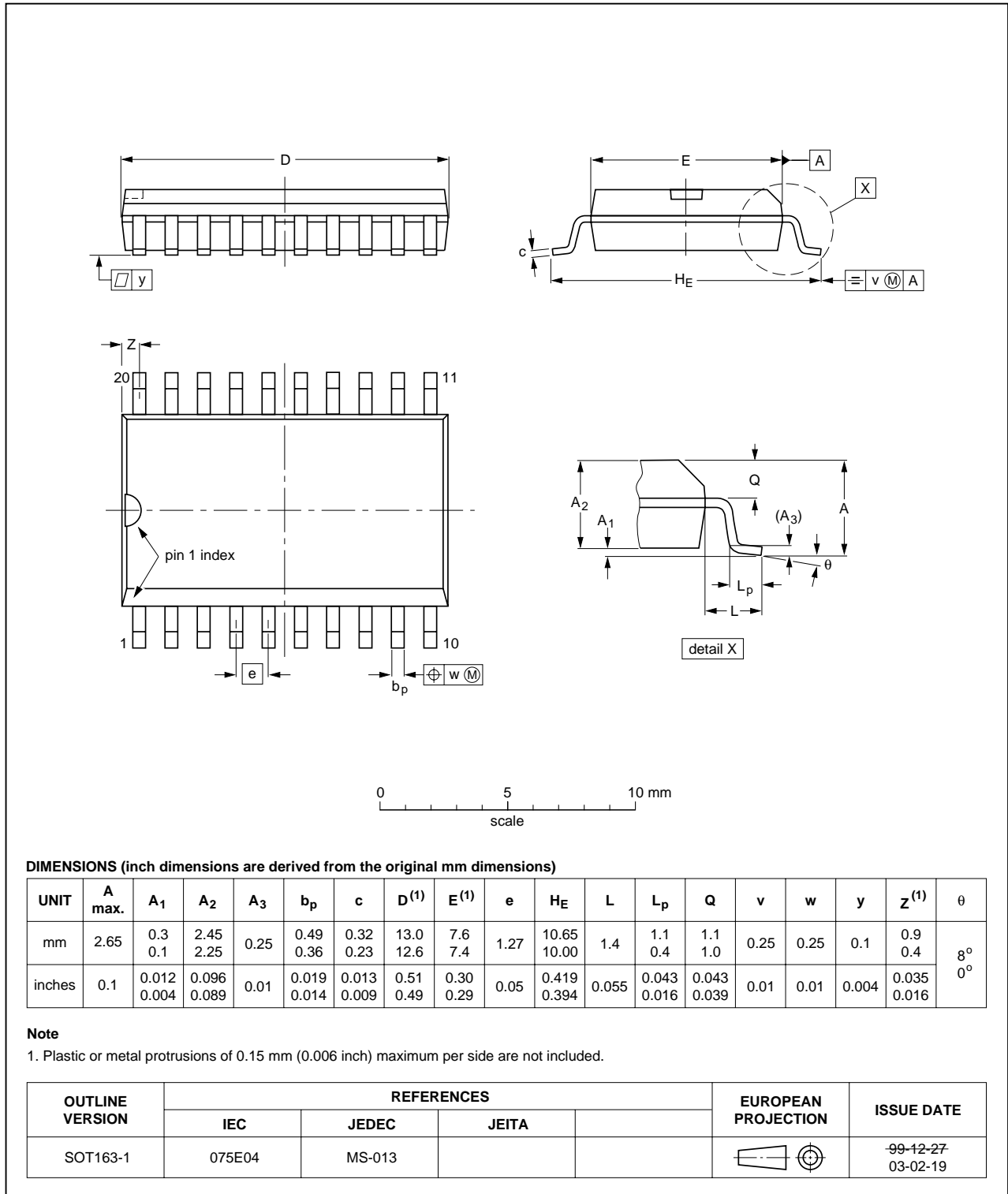


Fig 13. Package outline SOT163-1 (SO20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

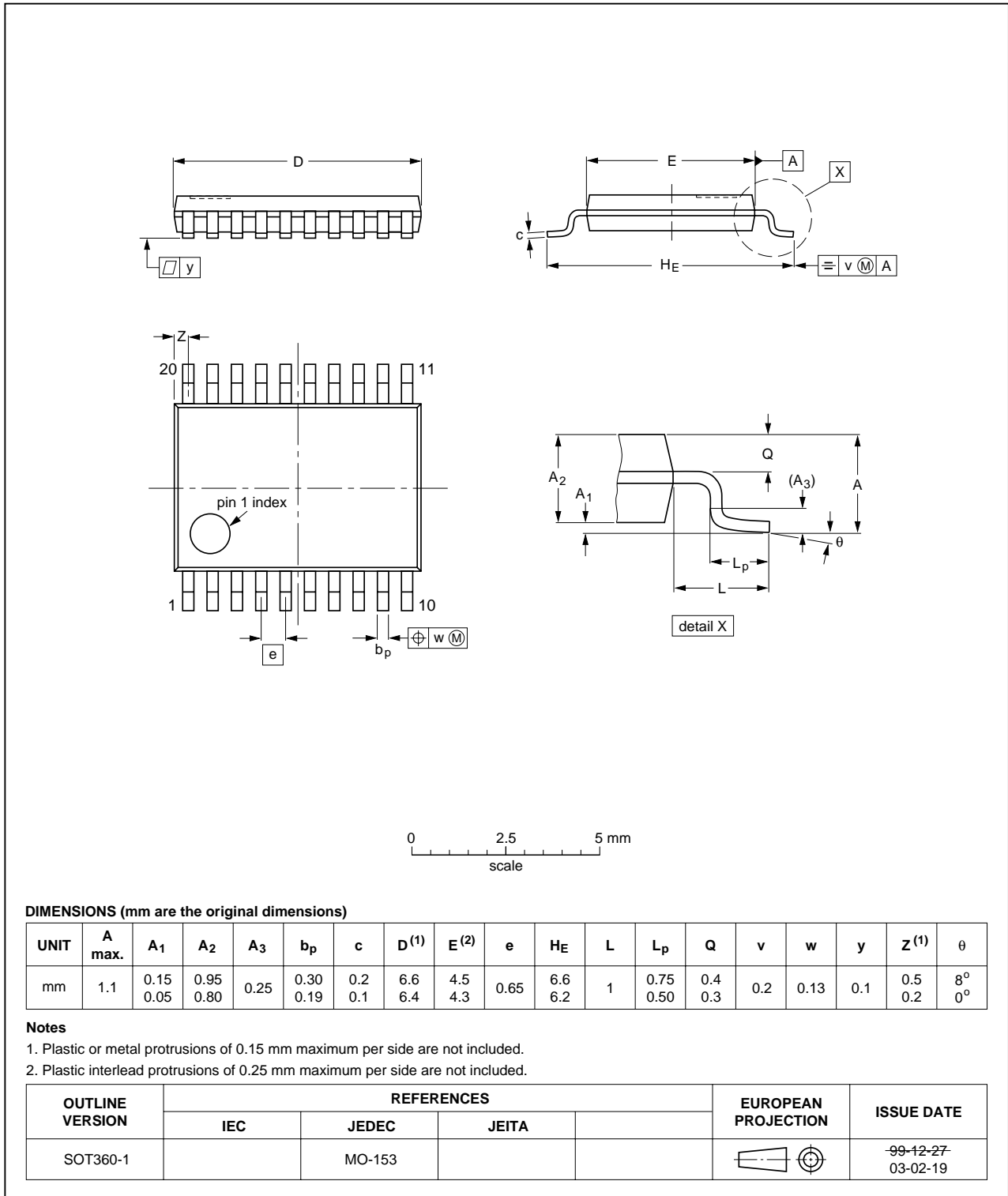


Fig 14. Package outline SOT360-1 (TSSOP20)

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

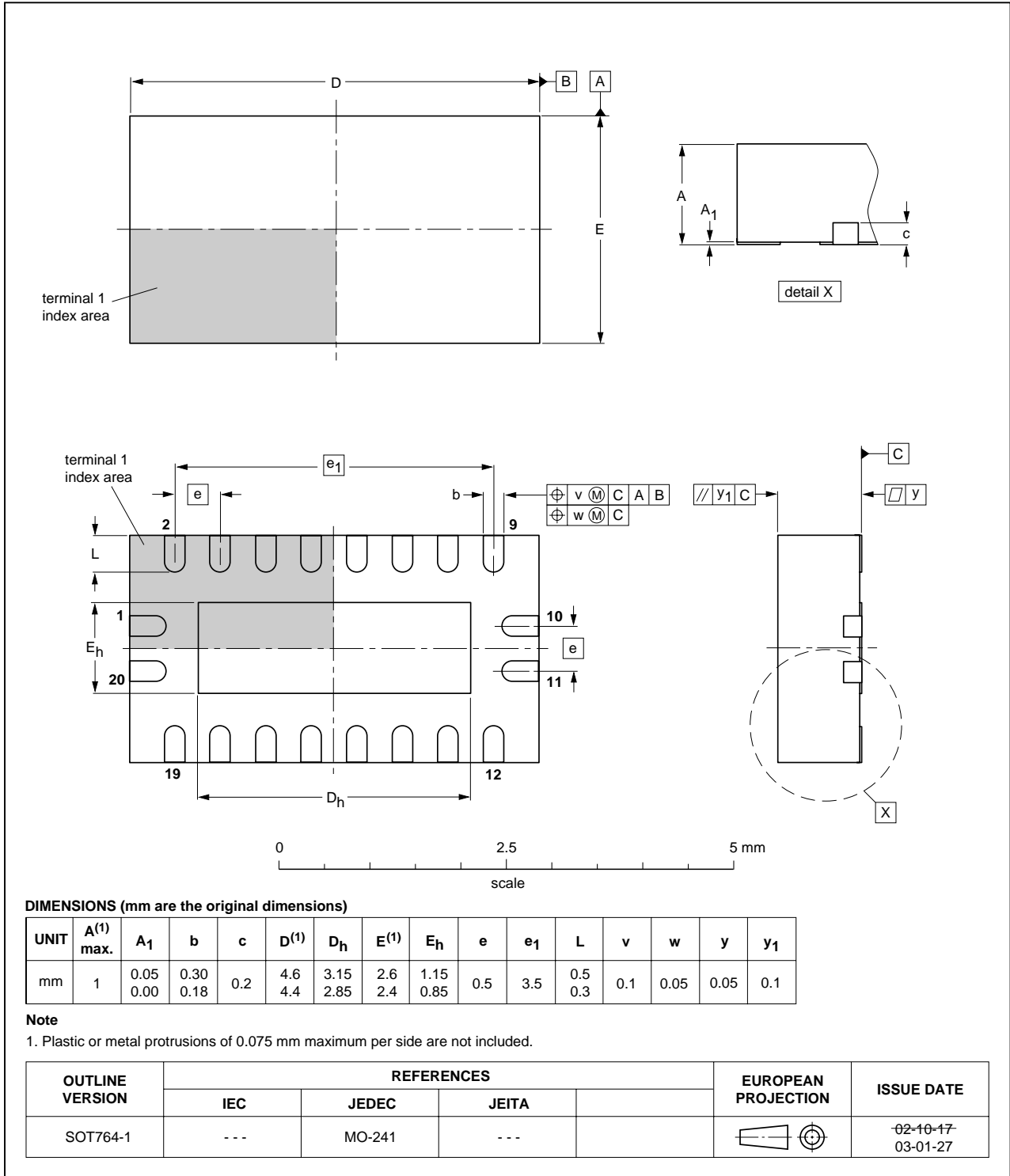


Fig 15. Package outline SOT764-1 (DHVQFN20)

## 13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVC373_2	20071018	Product data sheet	-	74ALVC373_1
Modifications:	<ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Section 3</a>: DHVQFN20 package added.</li> <li>• <a href="#">Section 7</a>: derating values added for DHVQFN20 package.</li> <li>• <a href="#">Section 12</a>: outline drawing added for DHVQFN20 package.</li> </ul>			
74ALVC373_1	20020226	Product specification	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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 URL <http://www.nxp.com>.

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