

74LVC841A

10-bit transparent latch with 5 V tolerant inputs/outputs;
3-state

Rev. 4 — 2 April 2013

Product data sheet

1. General description

The 74LVC841A is a 10-bit transparent latch featuring separate D-type inputs for each latch and 3-state outputs for bus applications. A latch enable (pin $\overline{LE}$) input and an output enable (pin $\overline{OE}$) input are common to all internal latches. The device consists of ten transparent latches with 3-state true outputs. When pin $\overline{LE}$ is HIGH, data at the Dn inputs enters the latches. In this condition, the latches are transparent, that is, a latch output changes each time its corresponding D-input changes. When pin $\overline{LE}$ is LOW, the latches store the information that was present at the D-inputs a set-up time preceding the HIGH to LOW transition of pin $\overline{LE}$.

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

Inputs can be driven from either 3.3 V or 5 V devices. When disabled, up to 5.5 V can be applied to the outputs. These features allow the use of these devices as translators in mixed 3.3 V and 5 V applications.

2. Features and benefits

- 5 V tolerant inputs/outputs; for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- Flow-through pinout architecture
- Complies with JEDEC standard:
 - ◆ JESD8-7A (1.65 V to 1.95 V)
 - ◆ JESD8-5A (2.3 V to 2.7 V)
 - ◆ JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-B exceeds 200 V
 - ◆ CDM JESD22-C101E exceeds 1000 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$.



3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC841AD	−40 °C to +125 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVC841ADB	−40 °C to +125 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74LVC841APW	−40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1
74LVC841ABQ	−40 °C to +125 °C	DHVQFN24	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 24 terminals; body 3.5 x 5.5 x 0.85 mm	SOT815-1

4. Functional diagram

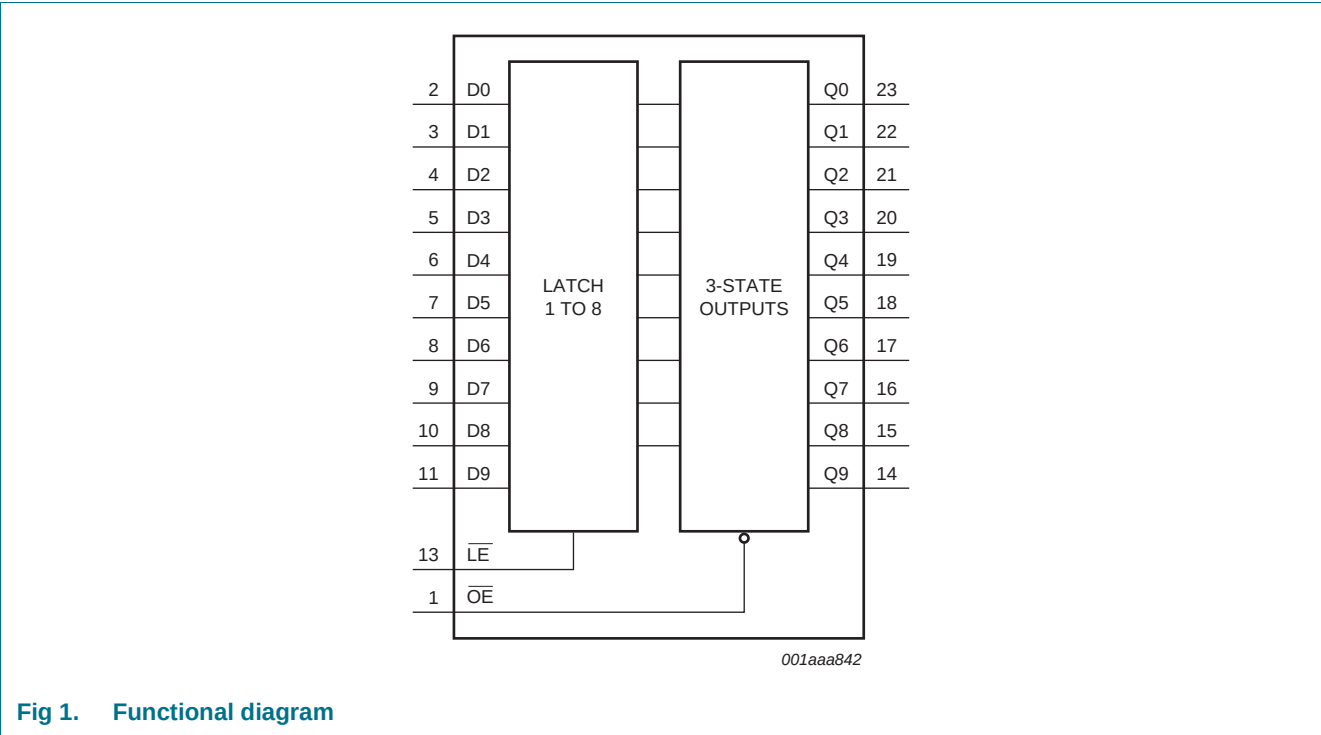


Fig 1. Functional diagram

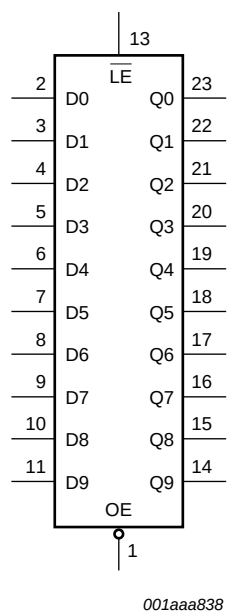


Fig 2. Logic symbol

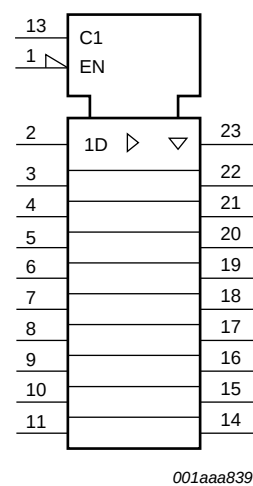


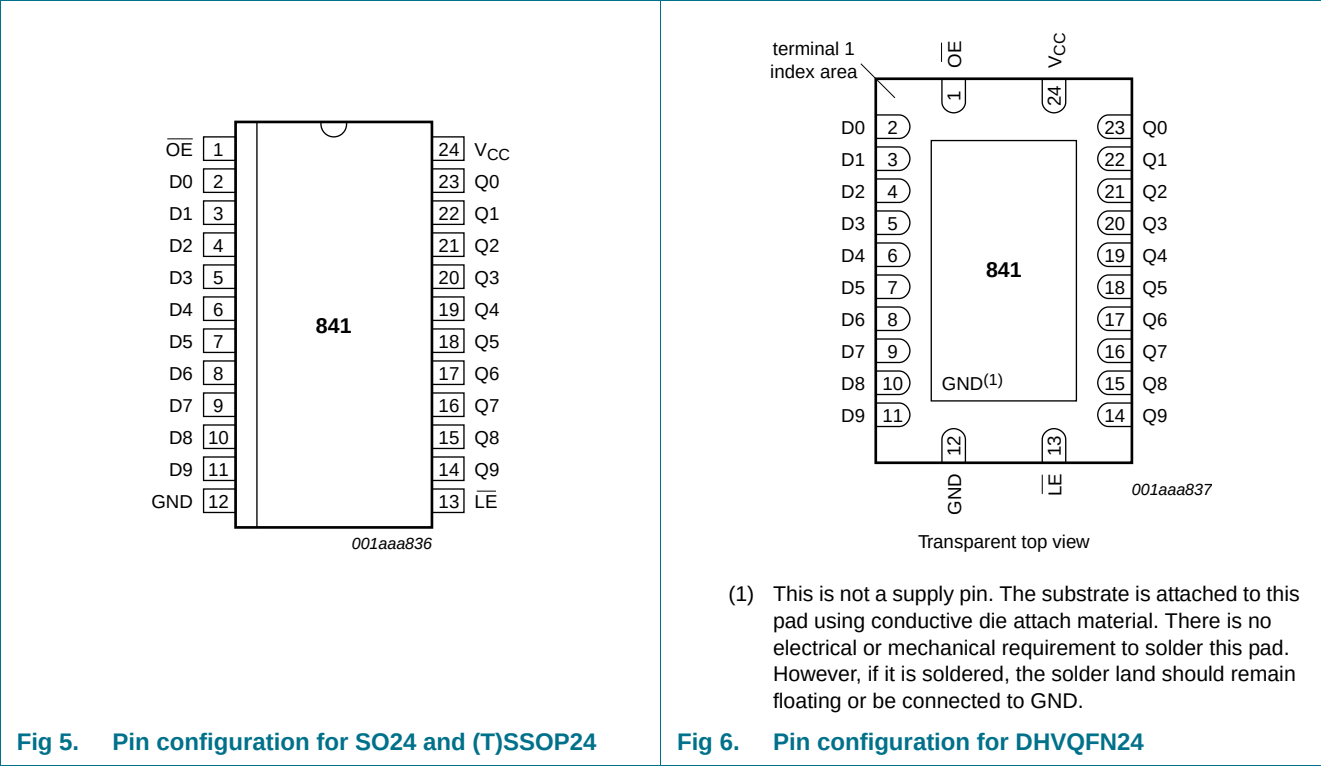
Fig 3. IEC logic symbol



Fig 4. Logic diagram

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Pin	Symbol	Description
1	$\overline{OE}$	output enable input (active LOW)
12	GND	ground (0 V)
13	$\overline{LE}$	latch enable input (active LOW)
D[0:9]	2, 3, 4, 5, 6, 7, 8, 9, 10, 11	data input
Q[0:9]	23, 22, 21, 20, 19, 18, 17, 16, 15, 14	3-state latch output
24	V _{CC}	supply voltage

6. Functional description

Table 3. Function table^[1]

Operating mode	Input			Internal latches	Output Qn
	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	L	l	L	Z
	H	L	h	H	Z
Hold	L	L	X	NC	NC

- [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
 Z = high-impedance OFF-state
 X = don't care
 NC = no change

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	+6.5	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
V _I	input voltage		^[1] -0.5	+6.5	V
I _{OK}	output clamping current	V _O > V _{CC} or V _O < 0 V	-	±50	mA
V _O	output voltage	HIGH or LOW state	^[2] -0.5	V _{CC} + 0.5	V
		3-state	^[2] -0.5	+6.5	V
I _O	output current	V _O = 0 V to V _{CC}	-	±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 +125 °C	^[3] -	500	mW

- [1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.
 [2] The output voltage ratings may be exceeded if the output current ratings are observed.
 [3] For SO24 packages: above 70 °C derate linearly with 8 mW/K.
 For (T)SSOP24 packages: above 60 °C derate linearly with 5.5 mW/K.
 For DHVQFN24 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
		functional	1.2	-	V
V _I	input voltage		0	5.5	V
V _O	output voltage	HIGH or LOW state	0	V _{CC}	V
		3-state	0	5.5	V
T _{amb}	ambient temperature	in free air	-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 1.65 V to 2.7 V	0	20	ns/V
		V _{CC} = 2.7 V to 3.6 V	0	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			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
V _{IH}	HIGH-level input voltage	V _{CC} = 1.2 V	1.08	-	-	1.08	-	V
		V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}	-	-	0.65 × V _{CC}	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.2 V	-	-	0.12	-	0.12	V
		V _{CC} = 1.65 V to 1.95 V	-	-	0.35 × V _{CC}	-	0.35 × V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = -100 μA; V _{CC} = 1.65 V to 3.6 V	V _{CC} - 0.2	-	-	V _{CC} - 0.3	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	-	-	1.05	-	V
		I _O = -8 mA; V _{CC} = 2.3 V	1.8	-	-	1.65	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	-	-	2.05	-	V
		I _O = -18 mA; V _{CC} = 3.0 V	2.4	-	-	2.25	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.2	-	-	2.0	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = 100 μA; V _{CC} = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	-	0.65	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.6	-	0.8	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.4	-	0.6	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	-	0.8	V
I _I	input leakage current	V _{CC} = 3.6 V; V _I = 5.5 V or GND	-	±0.1	±5	-	±20	μA

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			–40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _{CC} = 3.6 V; V _O = 5.5 V or GND;	-	0.1	±5	-	±20	μA
I _{OFF}	power-off leakage current	V _{CC} = 0 V; V _I or V _O = 5.5 V	-	0.1	±10	-	±20	μA
I _{CC}	supply current	V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A	-	0.1	10	-	40	μA
ΔI _{CC}	additional supply current	per input pin; V _{CC} = 2.7 V to 3.6 V; V _I = V _{CC} – 0.6 V; I _O = 0 A	-	5	500	-	5000	μA
C _I	input capacitance	V _{CC} = 0 V to 3.6 V; V _I = GND to V _{CC}	-	5.0	-	-	-	pF

[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristicsVoltages are referenced to GND (ground = 0 V). For test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	T _{amb} = –40 °C to +85 °C			–40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t _{pd}	propagation delay	Dn to Qn; see Figure 7 ^[2]						
		V _{CC} = 1.2 V	-	15	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.8	6.9	15.2	1.8	17.6	ns
		V _{CC} = 2.3 V to 2.7 V	1.5	3.6	8.0	1.5	9.3	ns
		V _{CC} = 2.7 V	1.5	3.6	7.5	1.5	9.5	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	3.1	6.7	1.5	8.5	ns
		LE to Qn; see Figure 8 ^[2]						
		V _{CC} = 1.2 V	-	17	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	2.3	7.9	17.7	2.3	20.4	ns
		V _{CC} = 2.3 V to 2.7 V	1.7	4.1	9.1	1.7	10.5	ns
		V _{CC} = 2.7 V	1.5	3.8	8.6	1.5	11.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	3.5	7.6	1.5	9.5	ns
t _{en}	enable time	OE to Qn; see Figure 10 ^[2]						
		V _{CC} = 1.2 V	-	19	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.8	7.6	16.5	1.8	19.0	ns
		V _{CC} = 2.3 V to 2.7 V	1.5	4.3	9.1	1.5	10.5	ns
		V _{CC} = 2.7 V	1.5	4.3	8.5	1.5	11.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	3.4	7.2	1.5	9.0	ns

Table 7. Dynamic characteristics ...continuedVoltages are referenced to GND (ground = 0 V). For test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	T _{amb} = –40 °C to +85 °C			–40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t _{dis}	disable time	OE to Qn; see Figure 10 ^[2]						
		V _{CC} = 1.2 V	-	8.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	2.6	4.4	9.8	2.6	11.3	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.5	5.5	1.0	6.4	ns
		V _{CC} = 2.7 V	1.5	3.3	6.6	1.5	8.5	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	3.1	5.9	1.5	7.5	ns
t _w	pulse width	LE HIGH; see Figure 8						
		V _{CC} = 1.65 V to 1.95 V	4.0	-	-	4.0	-	ns
		V _{CC} = 2.3 V to 2.7 V	3.0	-	-	3.0	-	ns
		V _{CC} = 2.7 V	2.0	-	-	2.0	-	ns
t _{su}	set-up time	Dn to LE; see Figure 9						
		V _{CC} = 1.65 V	3.5	-	-	3.5	-	ns
		V _{CC} = 2.3 V to 2.7 V	2.5	-	-	2.5	-	ns
		V _{CC} = 2.7 V	2.0	-	-	2.0	-	ns
t _h	hold time	Dn to LE; see Figure 9						
		V _{CC} = 1.65 V	3.0	-	-	3.0	-	ns
		V _{CC} = 2.3 V to 2.7 V	2.0	-	-	2.0	-	ns
		V _{CC} = 2.7 V	1.0	-	-	1.0	-	ns
t _{sk(o)}	output skew time	V _{CC} = 3.0 V to 3.6 V ^[3]	-	-	1.0	-	1.5	ns
C _{PD}	power dissipation capacitance	per input; V _I = GND to V _{CC} ^[4]						
		V _{CC} = 1.65 V to 1.95 V	-	5.8	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	9.3	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	12.4	-	-	-	pF

[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.8 V, 2.5 V, 2.7 V and 3.3 V respectively.

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

t_{en} is the same as t_{PZL} and t_{PZH}.

t_{dis} is the same as t_{PLZ} and t_{PHZ}.

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

P_D = C_{PD} × V_{CC}² × f_i × N + Σ(C_L × V_{CC}² × f_o) where:

f_i = input frequency in MHz; f_o = output frequency in MHz

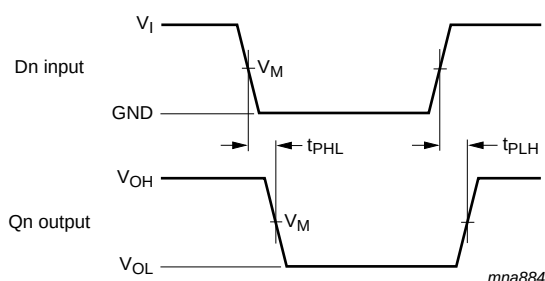
C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

N = number of inputs switching

Σ(C_L × V_{CC}² × f_o) = sum of the outputs

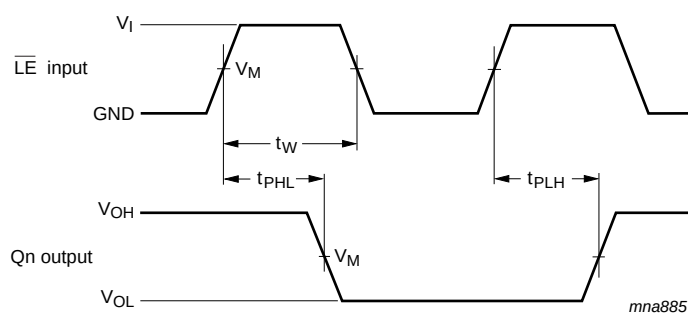
11. Waveforms



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

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

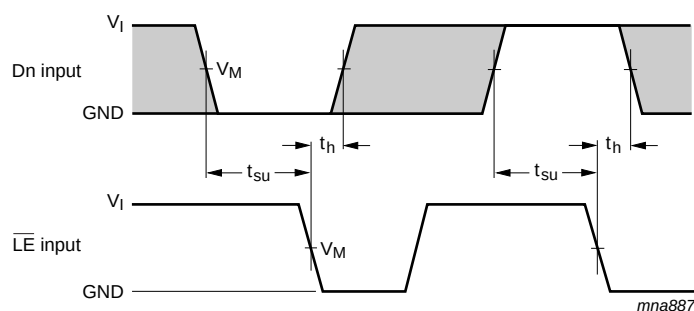
Fig 7. Input (Dn) to output (Qn) propagation delays



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 8. Latch enable input ($\overline{LE}$) pulse width, the latch enable input to output (Qn) propagation delays

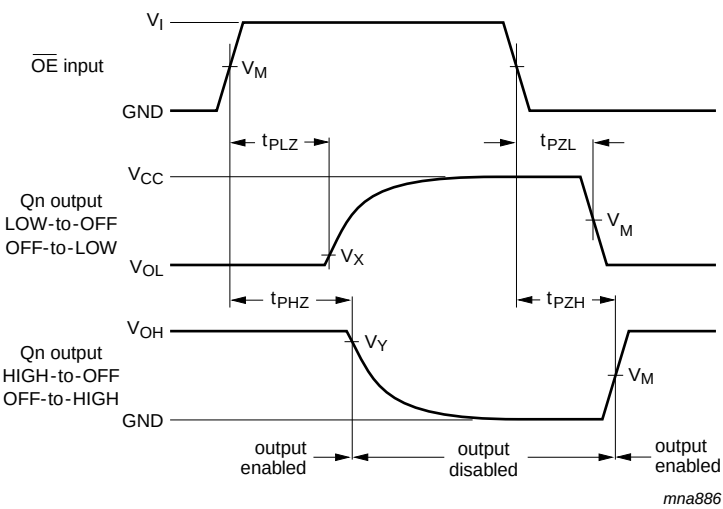


Measurement points are given in [Table 8](#).

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

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

Fig 9. Data set-up and hold times for the Dn input to the $\overline{LE}$ input

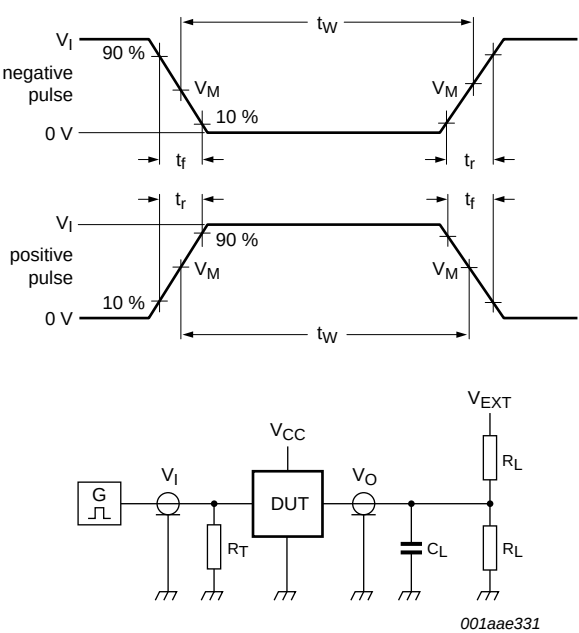


Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are the typical output voltage levels that occur with the output load.

Fig 10. 3-state enable and disable times

Table 8. Measurement points

Supply voltage	Input		Output		
V_{CC}	V_I	V_M	V_M	V_X	V_Y
1.2 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
1.65 V to 1.95 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$



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 11. Load 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}
1.2 V	V_{CC}	≤ 2 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	V_{CC}	≤ 2 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	V_{CC}	≤ 2 ns	30 pF	500 Ω	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND

12. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm SOT137-1

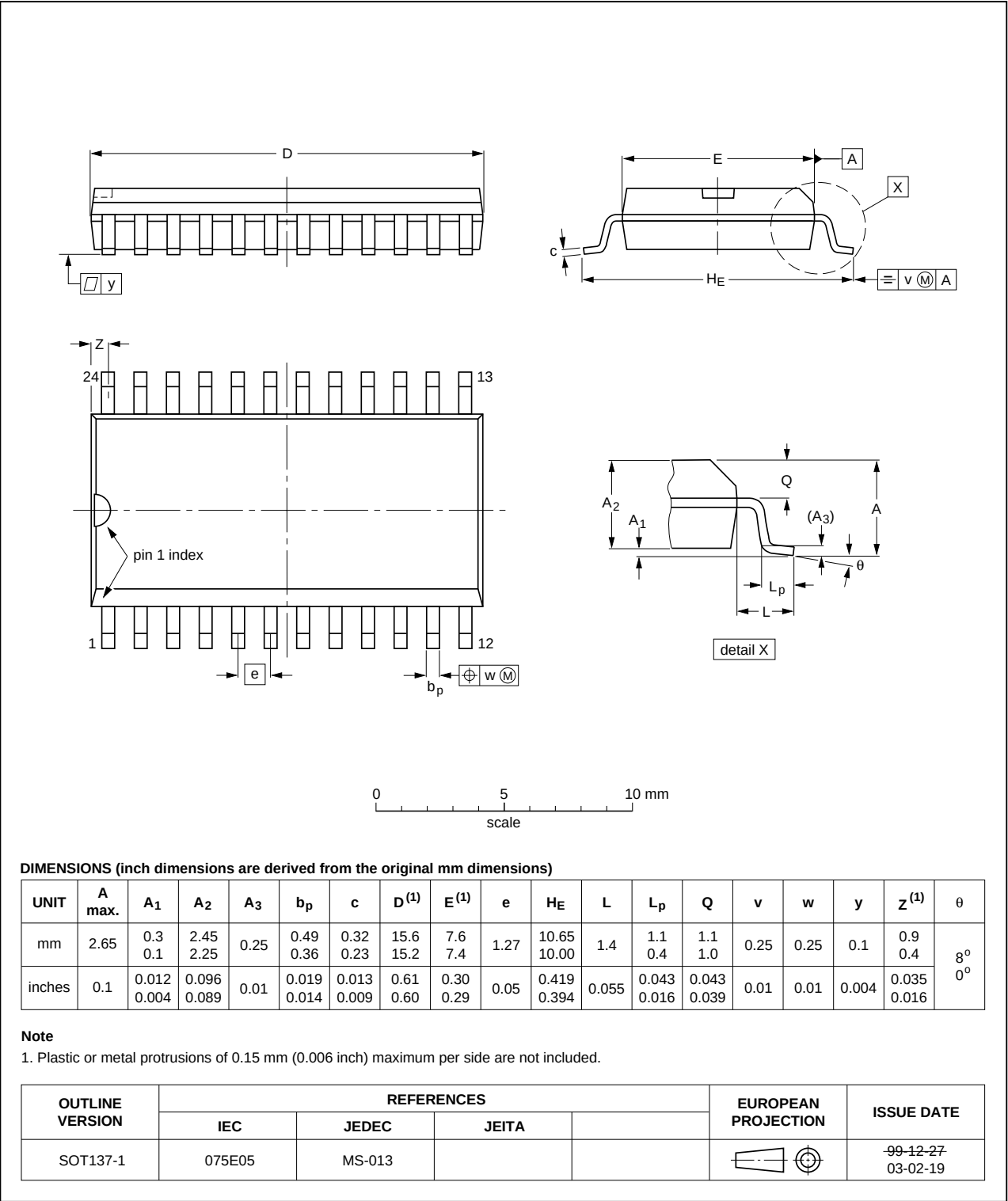


Fig 12. Package outline SOT137-1 (SO24)

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1

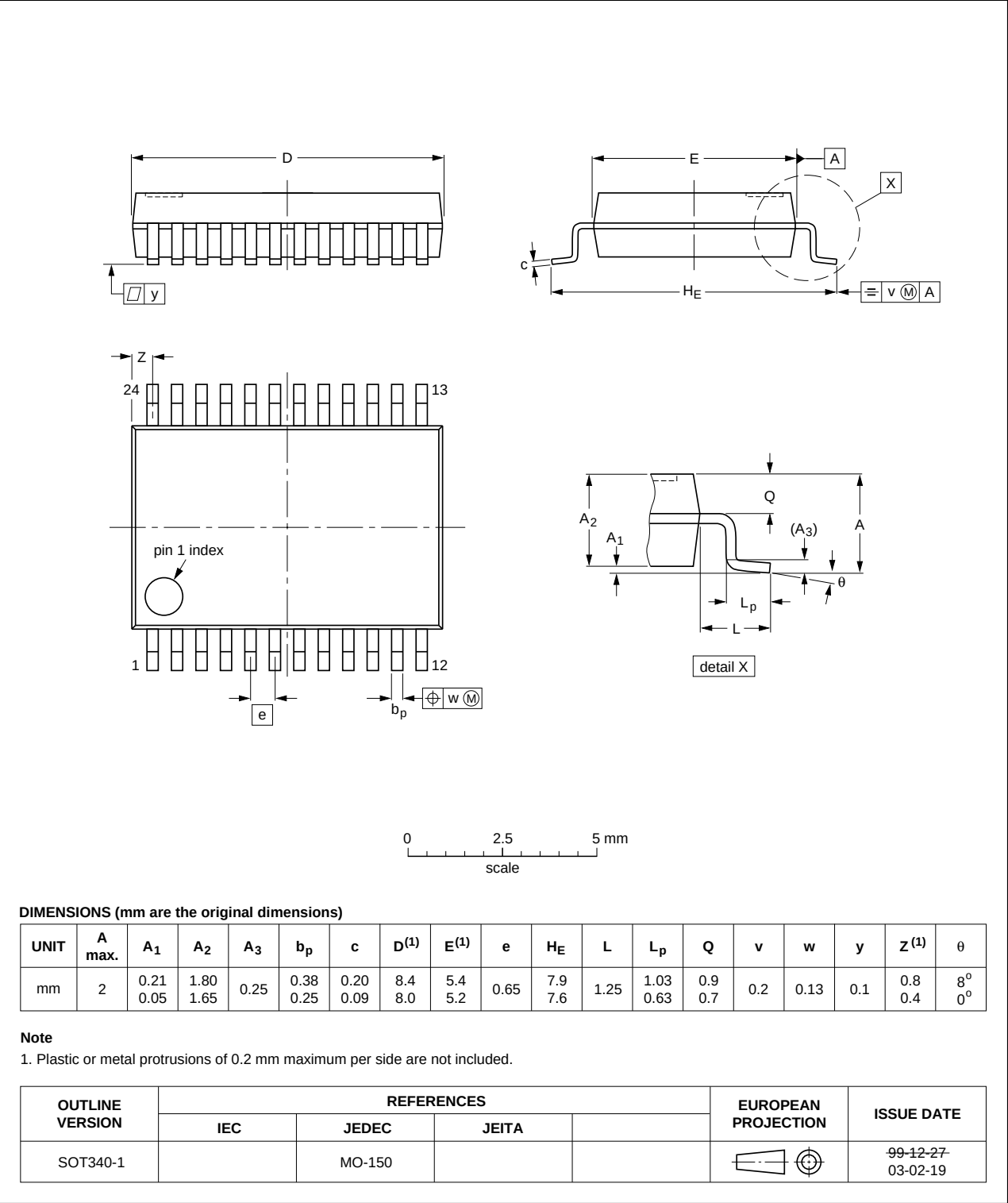


Fig 13. Package outline SOT340-1 (SSOP24)

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm

SOT355-1

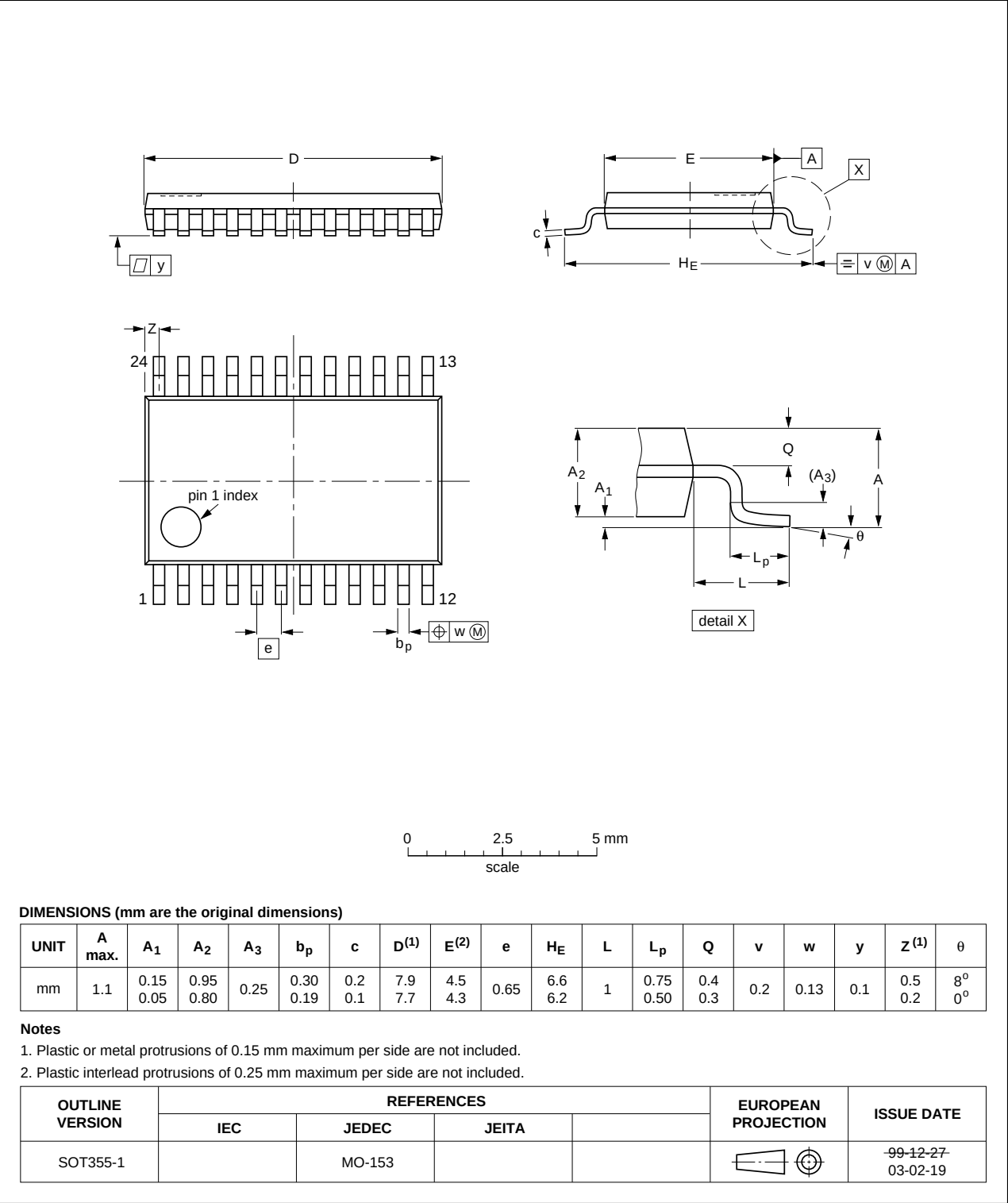


Fig 14. Package outline SOT355-1 (TSSOP24)

DHVQFN24: plastic dual in-line compatible thermal enhanced very thin quad flat package;
no leads; 24 terminals; body 3.5 x 5.5 x 0.85 mm

SOT815-1

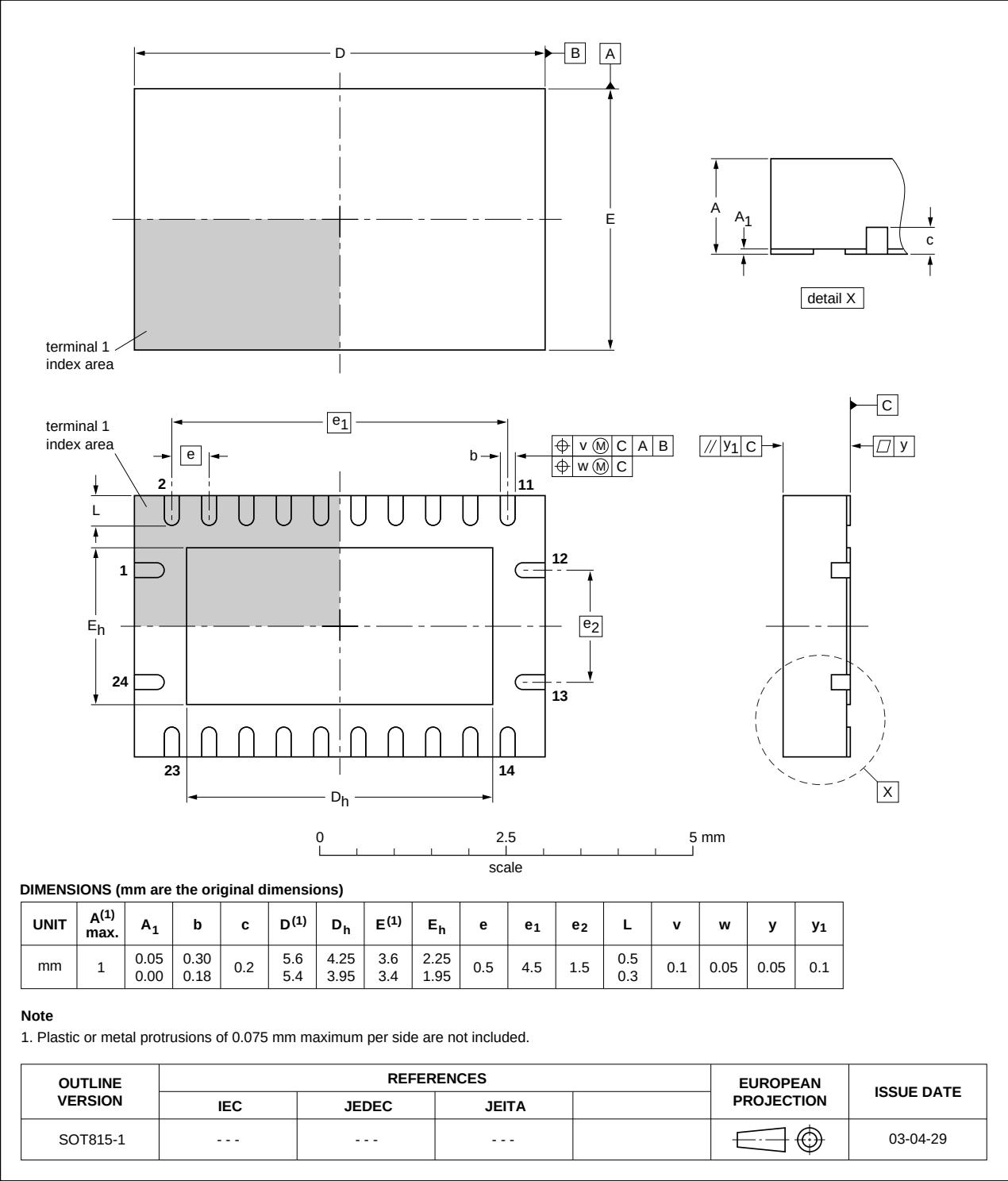


Fig 15. Package outline SOT815-1 (DHVQFN24)

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
74LVC841A v.4	20130402	Product data sheet	-	74LVC841A v.3
Modifications:	- The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. - Legal texts have been adapted to the new company name where appropriate. Table 4, Table 5, Table 6, Table 7, Table 8 and Table 9: values added for lower voltage ranges.			
74LVC841A v.3	20040524	Product specification	-	74LVC841A v.2
74LVC841A v.2	19980617	Product specification	-	74LVC841A v.1
74LVC841A v.1	19980617	Product specification	-	-

15. Legal information

15.1 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 URL <http://www.nxp.com>.

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