

74LVC4245A

Octal dual supply translating transceiver; 3-state

Rev. 06 — 18 January 2008

Product data sheet

1. General description

The 74LVC4245A is an octal dual supply translating transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. It is designed to interface between a 3 V and 5 V bus in a mixed 3 V and 5 V supply environment.

The device features an output enable input (pin $\overline{\text{OE}}$) for easy cascading and a send/receive input (pin DIR) for direction control. Pin $\overline{\text{OE}}$ controls the outputs so that the buses are effectively isolated.

In suspend mode, when V_{CCA} is zero, there will be no current flow from one supply to the other supply. The A-outputs must be set 3-state and the voltage on the A-bus must be smaller than V_{diode} (typical 0.7 V).

$V_{\text{CCA}} \geq V_{\text{CCB}}$, except in suspend mode.

2. Features

- 5 V tolerant inputs/outputs, for interfacing with 5 V logic
- Wide supply voltage range:
 - ◆ 3 V port (V_{CCB}): 1.5 V to 3.6 V
 - ◆ 5 V port (V_{CCA}): 1.5 V to 5.5 V
- CMOS low-power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5.5 V
- High-impedance when $V_{\text{CC}} = 0$ V
- Complies with JEDEC standard no. JESD8B/JESD36
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C

3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC4245AD	-40 °C to +125 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVC4245ADB	-40 °C to +125 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74LVC4245APW	-40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1
74LVC4245ABQ	-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 × 5.5 × 0.85 mm	SOT815-1

4. Functional diagram

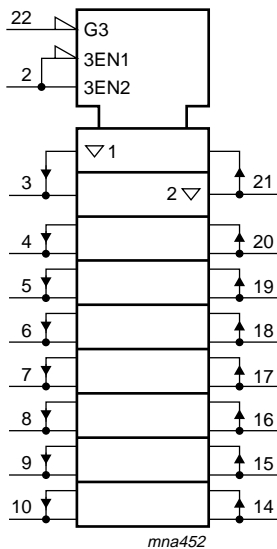


Fig 1. IEC Logic symbol

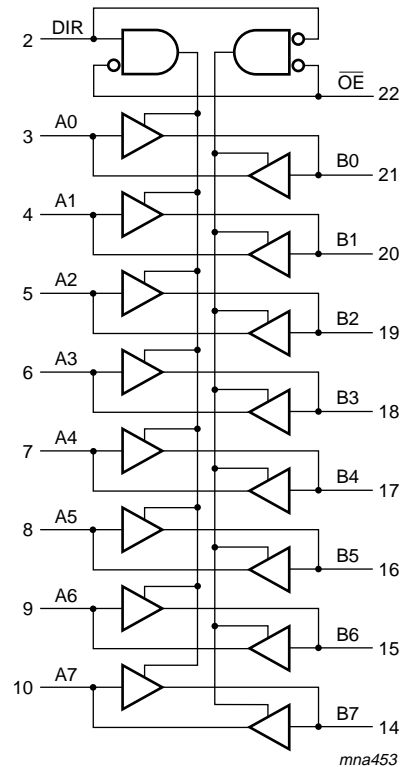
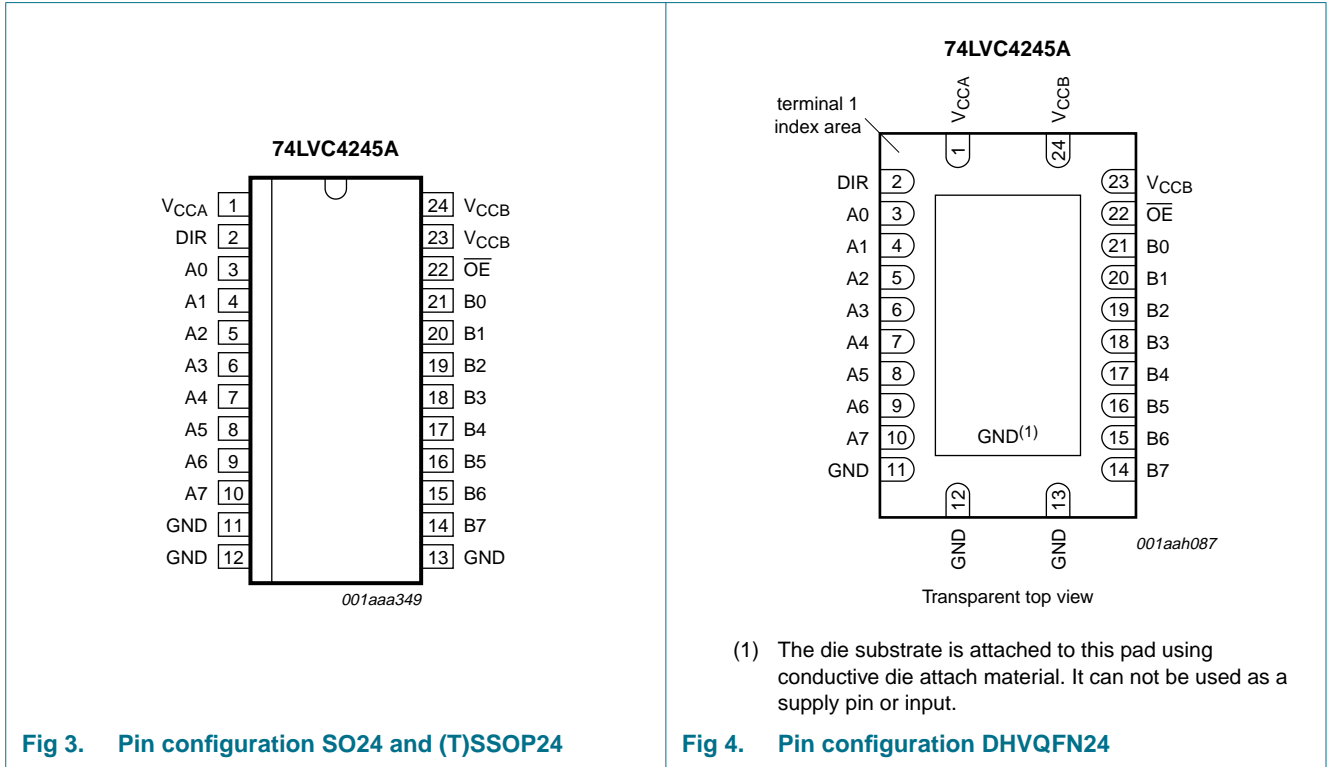


Fig 2. Logic diagram

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
V _{CCA}	1	supply voltage (5 V bus)
V _{CCB}	23, 24	supply voltage (3 V bus)
GND	11, 12, 13	ground (0 V)
DIR	2	direction control
A[0:7]	3, 4, 5, 6, 7, 8, 9, 10	data input or output
B[0:7]	21, 20, 19, 18, 17, 16, 15, 14	data input or output
\overline{OE}	22	output enable input (active LOW)

6. Functional description

Table 3. Functional table^[1]

Input		Input/output		
\overline{OE}	DIR	An	Bn	
L	L	A = B	input	
L	H	input	B = A	
H	X	Z	Z	

[1] H = HIGH voltage level; L = LOW voltage level; 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_{CCA}	supply voltage 5 V port		-0.5	+6.5	V
V_{CCB}	supply voltage 3 V port		-0.5	+4.6	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	output HIGH or LOW state	[1] -0.5	$V_{CC} + 0.5$	V
		output 3-state	[1] -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}	power dissipation	$T_{amb} = -40$ °C to +125 °C	[2] -	500	mW

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

[2] For SO24 packages: above 70 °C the value of P_{tot} derates linearly with 8 mW/K.
 For (T)SSOP24 packages: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
 For DHVQFN24 packages: above 60 °C the value of P_{tot} derates linearly with 4.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CCA}	supply voltage 5 V port (for maximum speed performance)	$V_{CCA} \geq V_{CCB}$; see Figure 5	1.5	-	5.5	V
V_{CCB}	supply voltage 3 V port (for low-voltage applications)	$V_{CCA} \geq V_{CCB}$; see Figure 5	1.5	-	3.6	V
V_I	input voltage	for control inputs	0	-	5.5	V
V_O	output voltage	output HIGH or LOW state	0	-	V_{CC}	V
		output 3-state	0	-	5.5	V
T_{amb}	ambient temperature		-40	-	+125	°C

Table 5. Recommended operating conditions ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CCB} = 2.7 \text{ V to } 3.0 \text{ V}$	-	-	20	ns/V
		$V_{CCB} = 3.0 \text{ V to } 3.6 \text{ V}$	-	-	10	ns/V
		$V_{CCA} = 3.0 \text{ V to } 4.5 \text{ V}$	-	-	20	ns/V
		$V_{CCA} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	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	Min	Typ ^[1]	Max	Unit
$T_{amb} = -40 \text{ }^{\circ}\text{C to } +85 \text{ }^{\circ}\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CCB} = 2.7 \text{ V to } 3.6 \text{ V}$	2.0	-	-	V
		$V_{CCA} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CCB} = 2.7 \text{ V to } 3.6 \text{ V}$	-	-	0.8	V
		$V_{CCA} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$				
		$V_{CCB} = 2.7 \text{ V to } 3.6 \text{ V}; I_O = -100 \text{ } \mu\text{A}$	$V_{CCB} - 0.2$	V_{CCB}	-	V
		$V_{CCB} = 2.7 \text{ V}; I_O = -12 \text{ mA}$	$V_{CCB} - 0.5$	-	-	V
		$V_{CCB} = 3.0 \text{ V}; I_O = -24 \text{ mA}$	$V_{CCB} - 0.8$	-	-	V
		$V_{CCA} = 4.5 \text{ V to } 5.5 \text{ V}; I_O = -100 \text{ } \mu\text{A}$	$V_{CCA} - 0.2$	V_{CCA}	-	V
		$V_{CCA} = 4.5 \text{ V}; I_O = -12 \text{ mA}$	$V_{CCA} - 0.5$	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$				
		$V_{CCB} = 2.7 \text{ V to } 3.6 \text{ V}; I_O = 100 \text{ } \mu\text{A}$	-	-	0.20	V
		$V_{CCB} = 2.7 \text{ V}; I_O = 12 \text{ mA}$	-	-	0.40	V
		$V_{CCB} = 3.0 \text{ V}; I_O = 24 \text{ mA}$	-	-	0.55	V
		$V_{CCA} = 4.5 \text{ V to } 5.5 \text{ V}; I_O = 100 \text{ } \mu\text{A}$	-	-	0.20	V
		$V_{CCA} = 4.5 \text{ V}; I_O = 12 \text{ mA}$	-	-	0.40	V
I_I	input leakage current	$V_I = 5.5 \text{ V or GND}$	-	± 0.1	± 5	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH} \text{ or } V_{IL}$	^[2]			
		$V_{CCB} = 3.6 \text{ V}; V_O = V_{CCB} \text{ or GND}$	-	± 0.1	± 5	μA
		$V_{CCA} = 5.5 \text{ V}; V_O = V_{CCA} \text{ or GND}$	-	± 0.1	± 5	μA
I_{CC}	supply current	$I_O = 0 \text{ A}$				
		$V_{CCB} = 3.6 \text{ V};$ other inputs at V_{CCB} or GND	-	0.1	10	μA
		$V_{CCA} = 5.5 \text{ V};$ other inputs at V_{CCA} or GND	-	0.1	10	μA

Table 6. Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
ΔI_{CC}	additional supply current	per control pin; $I_O = 0$ A	[3]			
		$V_{CCB} = 2.7$ V to 3.6 V; $V_I = V_{CCB} - 0.6$ V; other inputs at V_{CCB} or GND	-	5	500	μ A
		$V_{CCA} = 4.5$ V to 5.5 V; $V_I = V_{CCA} - 0.6$ V; other inputs at V_{CCA} or GND	-	5	500	μ A
C_I	input capacitance		-	4.0	-	pF
$C_{I/O}$	input/output capacitance	An and Bn	-	5.0	-	pF
$T_{amb} = -40$ °C to $+125$ °C						
V_{IH}	HIGH-level input voltage	$V_{CCB} = 2.7$ V to 3.6 V	2.0	-	-	V
		$V_{CCA} = 4.5$ V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CCB} = 2.7$ V to 3.6 V	-	-	0.8	V
		$V_{CCA} = 4.5$ V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$V_{CCB} = 2.7$ V to 3.6 V; $I_O = -100$ μ A	$V_{CCB} - 0.3$	-	-	V
		$V_{CCB} = 2.7$ V; $I_O = -12$ mA	$V_{CCB} - 0.65$	-	-	V
		$V_{CCB} = 3.0$ V; $I_O = -24$ mA	$V_{CCB} - 1.0$	-	-	V
		$V_{CCA} = 4.5$ V to 5.5 V; $I_O = -100$ μ A	$V_{CCA} - 0.3$	-	-	V
		$V_{CCA} = 4.5$ V; $I_O = -12$ mA	$V_{CCA} - 0.65$	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$V_{CCB} = 2.7$ V to 3.6 V; $I_O = 100$ μ A	-	-	0.30	V
		$V_{CCB} = 2.7$ V; $I_O = 12$ mA	-	-	0.60	V
		$V_{CCB} = 3.0$ V; $I_O = 24$ mA	-	-	0.80	V
		$V_{CCA} = 4.5$ V to 5.5 V; $I_O = 100$ μ A	-	-	0.30	V
		$V_{CCA} = 4.5$ V; $I_O = 12$ mA	-	-	0.60	V
		$V_{CCA} = 4.5$ V; $I_O = 24$ mA	-	-	0.80	V
I_I	input leakage current	$V_I = 5.5$ V or GND	-	-	± 20	μ A
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}	[2]			
		$V_{CCB} = 3.6$ V; $V_O = V_{CCB}$ or GND	-	-	± 20	μ A
		$V_{CCA} = 5.5$ V; $V_O = V_{CCA}$ or GND	-	-	± 20	μ A
I_{CC}	supply current	$I_O = 0$ A				
		$V_{CCB} = 3.6$ V; other inputs at V_{CCB} or GND	-	-	40	μ A
		$V_{CCA} = 5.5$ V; other inputs at V_{CCA} or GND	-	-	40	μ A

Table 6. Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
ΔI_{CC}	additional supply current	per control pin; $I_O = 0$ A	[3]			
		$V_{CCB} = 2.7$ V to 3.6 V; $V_I = V_{CCB} - 0.6$ V; other inputs at V_{CCB} or GND	-	-	5000	μ A
		$V_{CCA} = 4.5$ V to 5.5 V; $V_I = V_{CCA} - 0.6$ V; other inputs at V_{CCA} or GND	-	-	5000	μ A

[1] All typical values are measured at $V_{CCA} = 5.0$ V, $V_{CCB} = 3.3$ V and $T_{amb} = 25$ °C.

[2] For transceivers, the parameter I_{OZ} includes the input leakage current.

[3] $V_{CCB} = 2.7$ V to 3.6 V: other inputs at V_{CCB} or GND.
 $V_{CCA} = 4.5$ V to 5.5 V: other inputs at V_{CCA} or GND.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). $V_{CCA} = 4.5$ V to 5.5 V; $t_r = t_f \leq 2.5$ ns. For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	V_{CCB}	-40 °C to +85 °C			-40 °C to +125 °C		Unit
				Min	Typ ^[1]	Max	Min	Max	
t_{PHL}	HIGH to LOW propagation delay	An to Bn; see Figure 6	2.7 V	1.0	3.6	6.3	1.0	8.0	ns
			3.0 V to 3.6 V	1.0	3.3	6.3	1.0	8.0	ns
		Bn to An; see Figure 6	2.7 V	1.0	3.4	6.1	1.0	8.0	ns
			3.0 V to 3.6 V	1.0	3.4	6.1	1.0	8.0	ns
t_{PLH}	LOW to HIGH propagation delay	An to Bn; see Figure 6	2.7 V	1.0	3.3	6.7	1.0	8.5	ns
			3.0 V to 3.6 V	1.0	2.8	6.5	1.0	8.5	ns
		Bn to An; see Figure 6	2.7 V	1.0	3.0	5.0	1.0	6.5	ns
			3.0 V to 3.6 V	1.0	3.0	5.0	1.0	6.5	ns
t_{PZL}	OFF-state to LOW propagation delay	\overline{OE} to An; see Figure 7	2.7 V	1.0	4.5	9.0	1.0	11.5	ns
			3.0 V to 3.6 V	1.0	4.5	9.0	1.0	11.5	ns
		\overline{OE} to Bn; see Figure 7	2.7 V	1.0	4.4	8.7	1.0	11.0	ns
			3.0 V to 3.6 V	1.0	3.8	8.1	1.0	10.5	ns
t_{PZH}	OFF-state to HIGH propagation delay	\overline{OE} to An; see Figure 7	2.7 V	1.0	4.5	8.1	1.0	10.5	ns
			3.0 V to 3.6 V	1.0	4.5	8.1	1.0	10.5	ns
		\overline{OE} to Bn; see Figure 7	2.7 V	1.0	4.3	8.7	1.0	11.0	ns
			3.0 V to 3.6 V	1.0	3.2	8.1	1.0	10.5	ns
t_{PLZ}	LOW to OFF-state propagation delay	\overline{OE} to An; see Figure 7	2.7 V	1.0	2.9	7.0	1.0	9.0	ns
			3.0 V to 3.6 V	1.0	2.9	7.0	1.0	9.0	ns
		\overline{OE} to Bn; see Figure 7	2.7 V	1.0	3.9	7.7	1.0	10.0	ns
			3.0 V to 3.6 V	1.0	3.5	7.7	1.0	10.0	ns
t_{PHZ}	HIGH to OFF-state propagation delay	\overline{OE} to An; see Figure 7	2.7 V	1.0	2.8	5.8	1.0	7.5	ns
			3.0 V to 3.6 V	1.0	2.8	5.8	1.0	7.5	ns
		\overline{OE} to Bn; see Figure 7	2.7 V	1.0	3.3	7.8	1.0	10.0	ns
			3.0 V to 3.6 V	1.0	2.9	7.8	1.0	10.0	ns

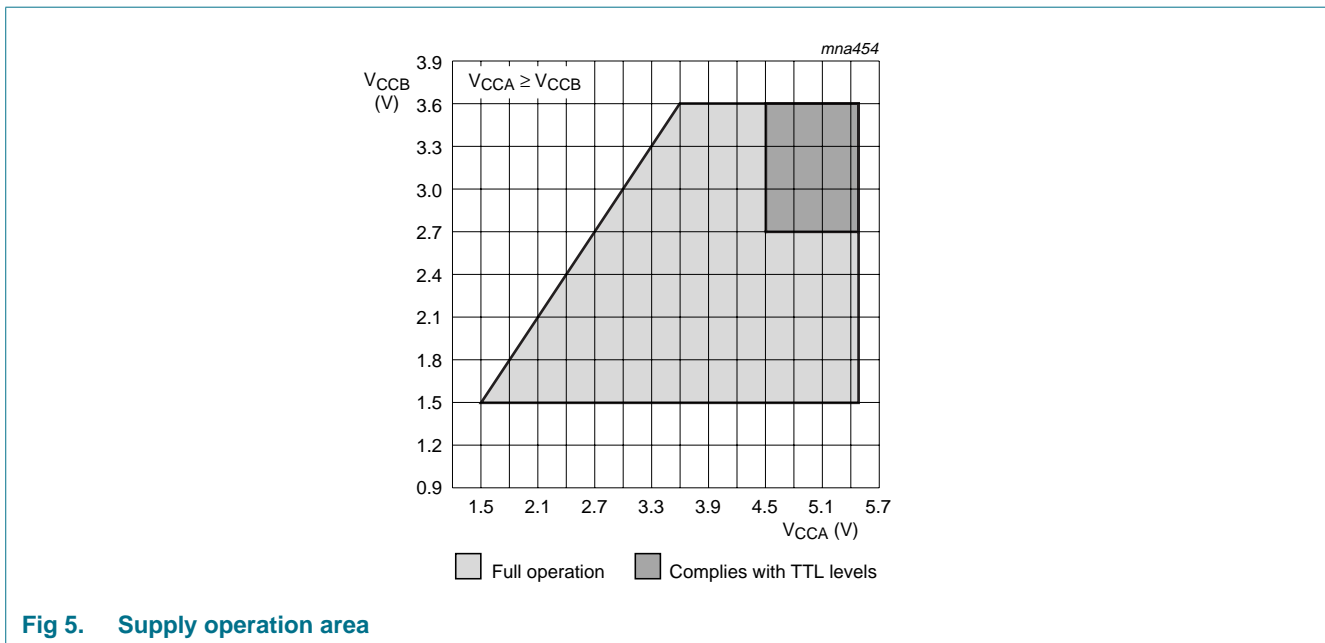
Table 7. Dynamic characteristics ...continued

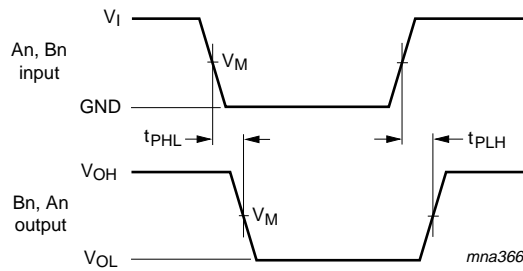
Voltages are referenced to GND (ground = 0 V). $V_{CCA} = 4.5\text{ V to }5.5\text{ V}$; $t_r = t_f \leq 2.5\text{ ns}$. For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	V_{CCB}	-40 °C to +85 °C			-40 °C to +125 °C		Unit		
				Min	Typ ^[1]	Max	Min	Max			
$t_{sk(o)}$	output skew time			[2]	-	-	1.0	-	1.5	ns	
C_{PD}	power dissipation capacitance	5 V port: Bn to An; $V_I = \text{GND to } V_{CCA}$; $V_{CCA} = 5.0\text{ V}$		[3]	outputs enabled	-	17	-	-	-	pF
					outputs disabled	-	5	-	-	-	pF
		3 V port: An to Bn; $V_I = \text{GND to } V_{CCB}$; $V_{CCB} = 3.3\text{ V}$	[3]	outputs enabled	-	17	-	-	-	pF	
				outputs disabled	-	5	-	-	-	pF	

- [1] Typical values are measured at $T_{amb} = 25\text{ °C}$, $V_{CCA} = 5.0\text{ V}$, and $V_{CCB} = 2.7\text{ V}$ and 3.3 V respectively.
- [2] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
- [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 Volts
 N = number of inputs switching
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs

11. AC waveforms



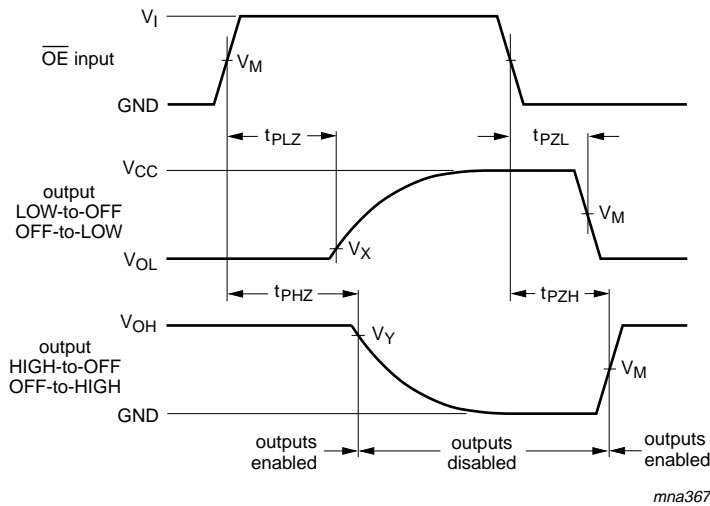


$V_M = 1.5 \text{ V}$ at $2.7 \text{ V} \leq V_{CCB} \leq 3.6 \text{ V}$;

$V_M = 0.5V_{CCA}$ at $V_{CCA} \geq 4.5 \text{ V}$.

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

Fig 6. Input (An, Bn) to output (Bn, An) propagation delays



$V_M = 1.5 \text{ V}$ at $2.7 \text{ V} \leq V_{CCB} \leq 3.6 \text{ V}$;

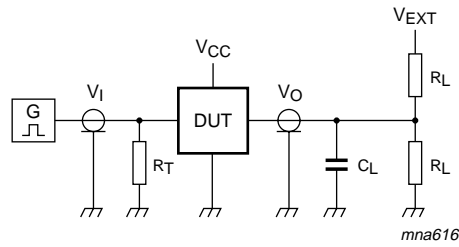
$V_M = 0.5V_{CCA}$ at $V_{CCA} \geq 4.5 \text{ V}$.

$V_X = V_{OL} + 0.3 \text{ V}$ at $V_{CCB} \geq 2.7 \text{ V}$;

$V_Y = V_{OH} - 0.3 \text{ V}$ at $V_{CCB} \geq 2.7 \text{ V}$.

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

Fig 7. 3-state enable and disable times



Test data is given in [Table 8](#). 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.

Fig 8. Load circuitry for switching times

Table 8. Test data

Supply voltage		Input	Load		V_{EXT}		
V_{CCA}	V_{CCB}	V_I [1]	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ} [2]
< 2.7 V	< 2.7 V	V_{CCI}	50 pF	500 Ω	open	GND	$2 \times V_{CCO}$
-	2.7 V to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	$2 \times V_{CCO}$
4.5 V to 5.5 V	-	3.0 V	50 pF	500 Ω	open	GND	$2 \times V_{CCO}$

[1] V_{CCI} is the supply voltage associated with the data input port.

[2] V_{CCO} is the supply voltage associated with the output port.

12. Package outline

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

SOT137-1

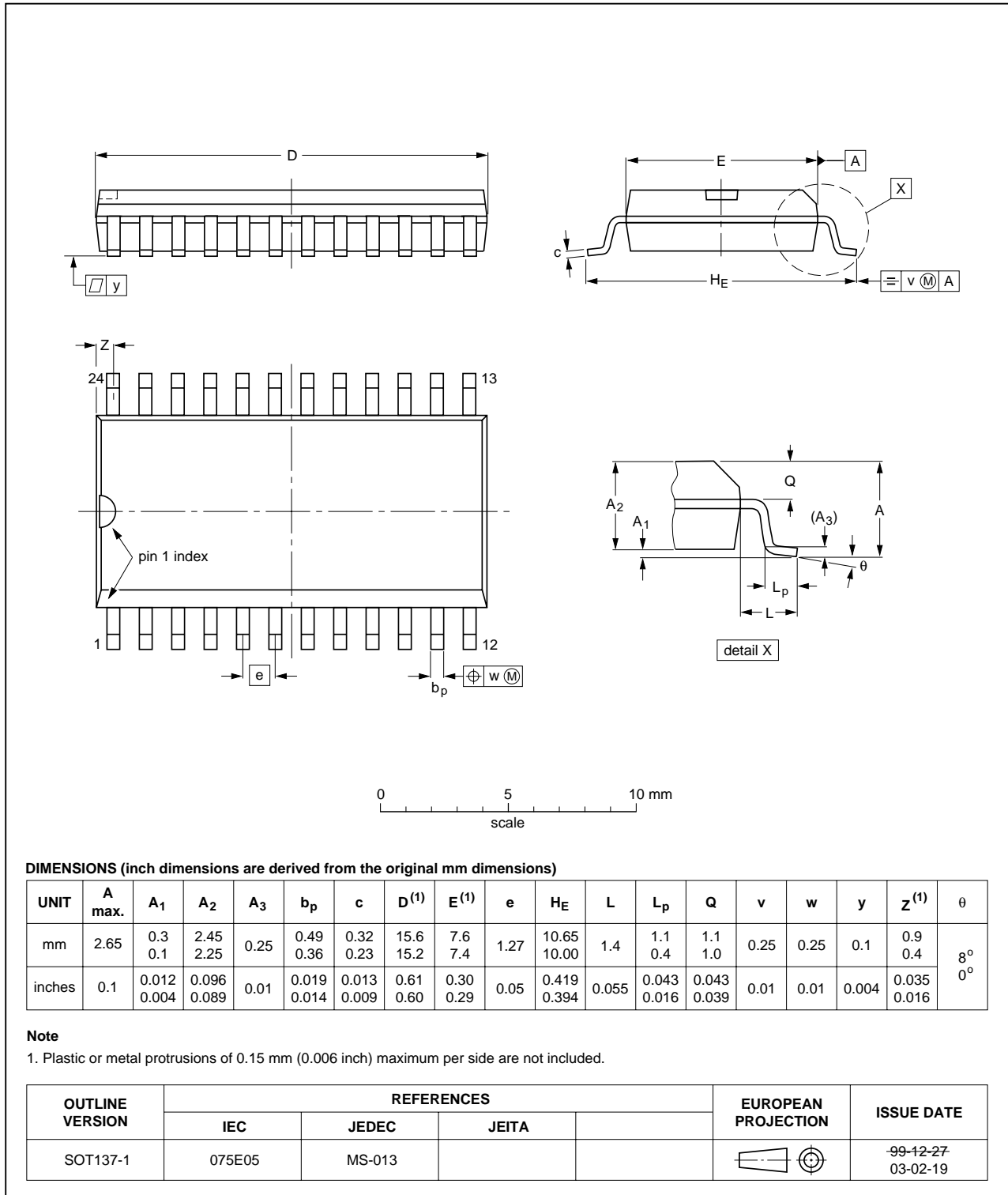


Fig 9. Package outline SOT137-1 (SO24)

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

SOT340-1

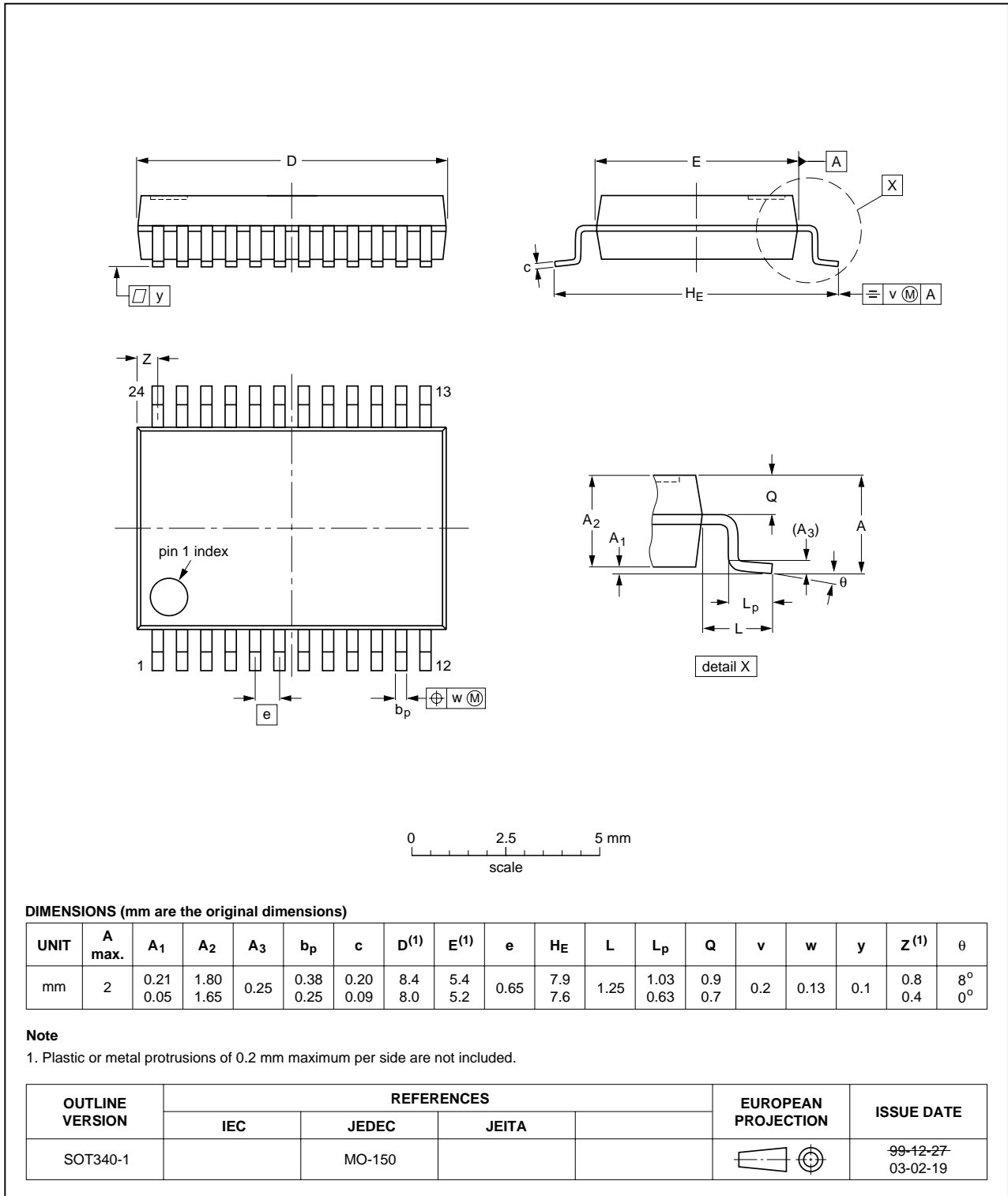


Fig 10. Package outline SOT340-1 (SSOP24)

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

SOT355-1

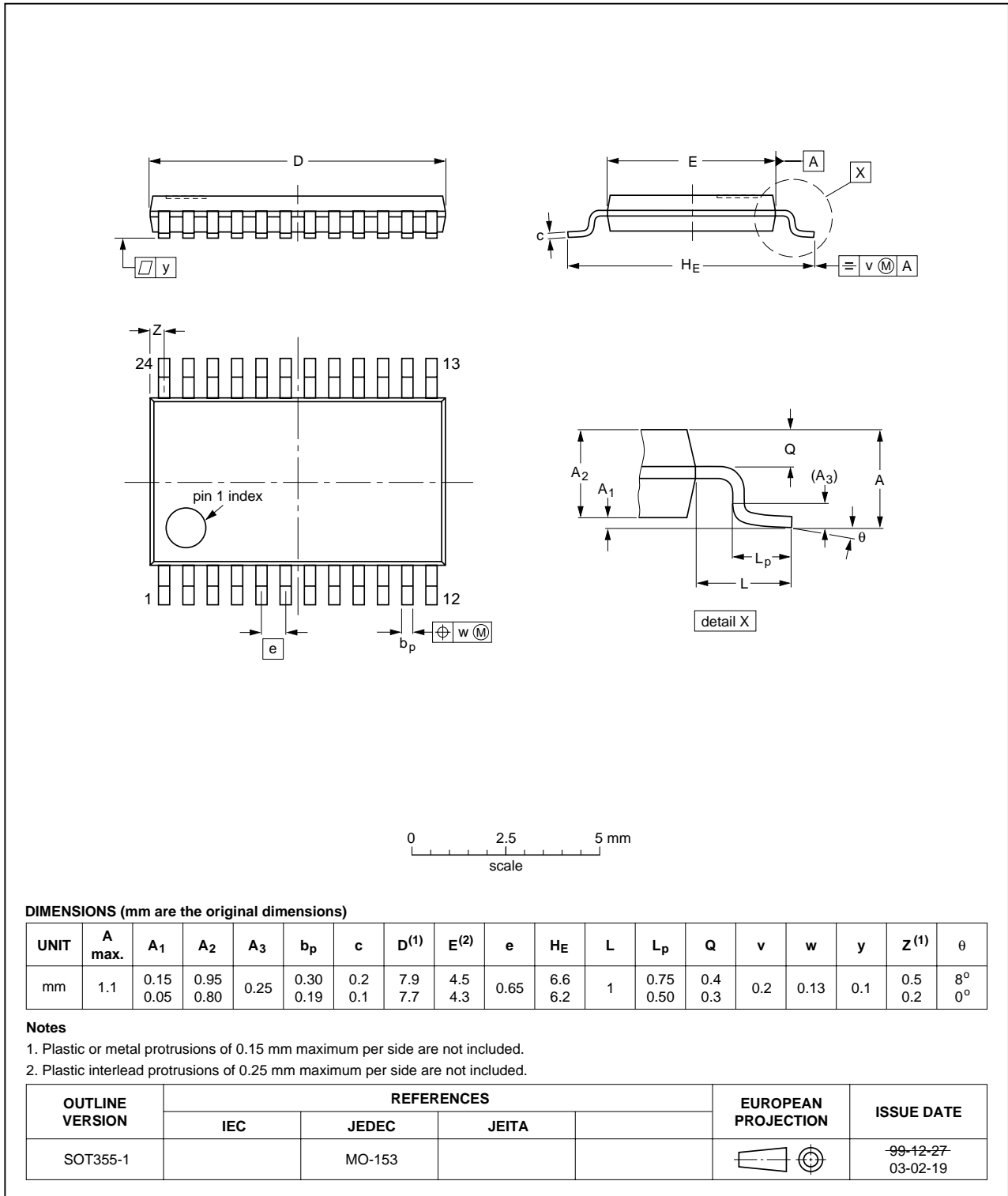


Fig 11. Package outline SOT355-1 (TSSOP24)

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

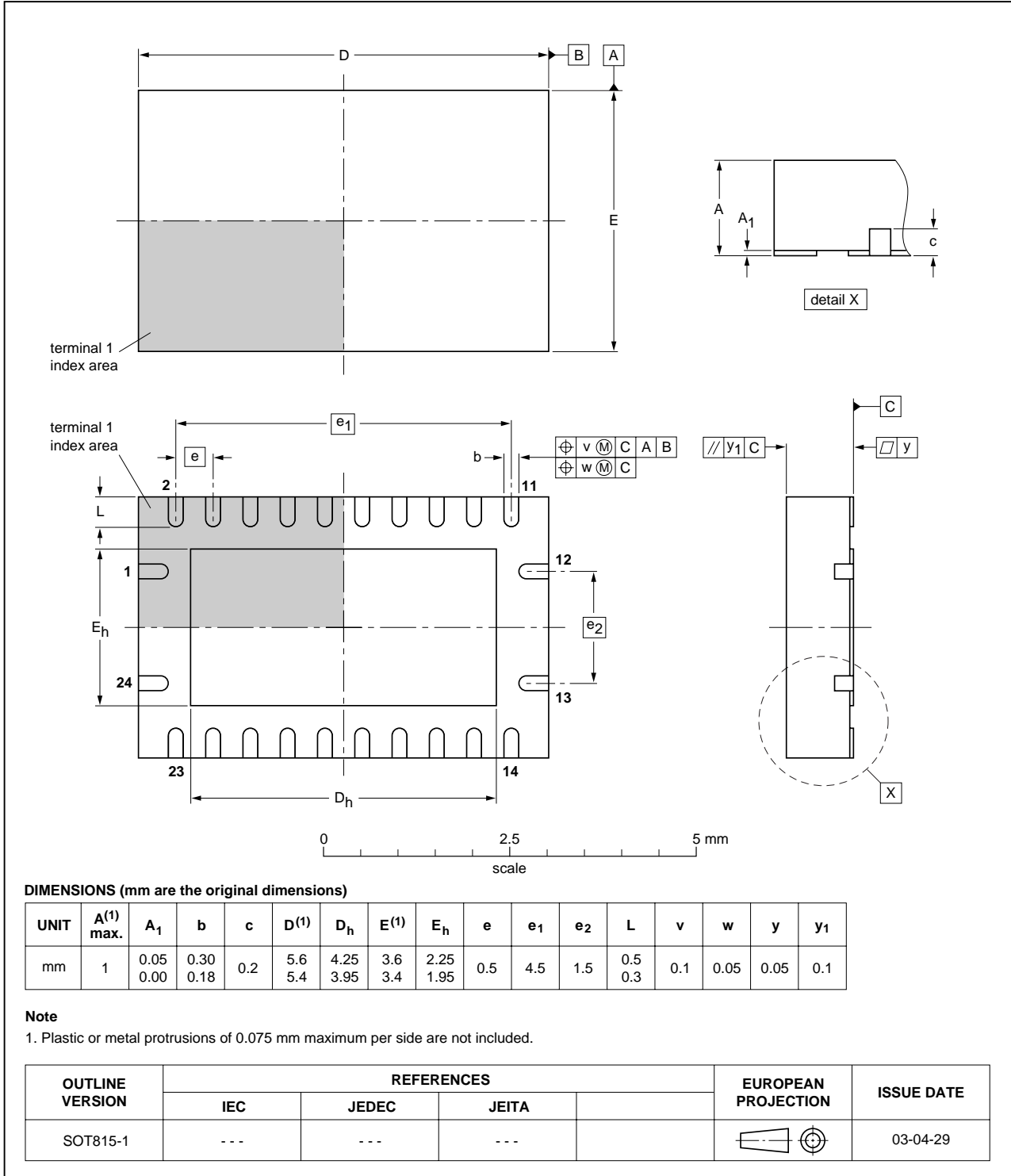


Fig 12. Package outline SOT815-1 (DHVQFN24)

13. Abbreviations

Table 9. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC4245A_6	20080118	Product data sheet	-	74LVC4245A_5
Modifications:	<ul style="list-style-type: none"> • 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. • Section 3: DHVQFN24 package added. • Section 7: derating values added for DHVQFN24 package. • Section 12: outline drawing added for DHVQFN24 package. 			
74LVC4245A_5	20040330	Product specification	-	74LVC4245A_4
74LVC4245A_4	20040211	Product specification	-	74LVC4245A_3
74LVC4245A_3	19990615	Product specification	-	74LVC4245A_2
74LVC4245A_2	19980729	Product specification	-	74LVC4245A_1
74LVC4245A_1	19980729	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".

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