

74LVC4245A-Q100

Octal dual supply translating transceiver; 3-state

Rev. 3 — 12 April 2021

Product data sheet

1. General description

The 74LVC4245A-Q100 is an octal dual supply translating transceiver featuring 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 (OE) and a send/receive input (DIR) for direction control. A HIGH on OE causes the outputs to assume a high-impedance OFF-state, effectively isolating the buses. In suspend mode, when either supply is zero, there is no current path between supplies. $V_{CCA} \geq V_{CCB}$, except in suspend mode. Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

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
- 5 V tolerant inputs/outputs, for interfacing with 5 V logic
- Wide supply voltage range:
 - 3 V bus ($V_{CC(B)}$): 1.5 V to 3.6 V
 - 5 V bus ($V_{CC(A)}$): 1.5 V to 5.5 V
- CMOS low-power consumption
- TTL interface capability at 3.3 V
- Overvoltage tolerant control inputs to 5.5 V
- High-impedance when $V_{CC(A)} = 0$ V
- Complies with JEDEC standard no. JESD8B/JESD36
- Latch-up performance meets requirements of JESD78 Class 1
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114-A exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC4245AD-Q100	-40 °C to +125 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVC4245APW-Q100	-40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1
74LVC4245ABQ-Q100	-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

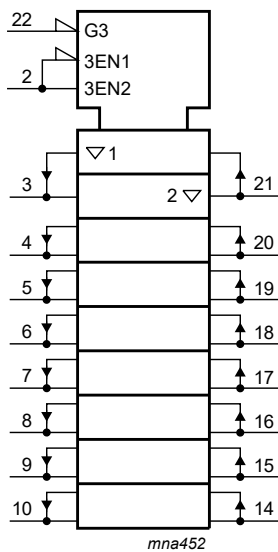


Fig. 1. IEC Logic symbol

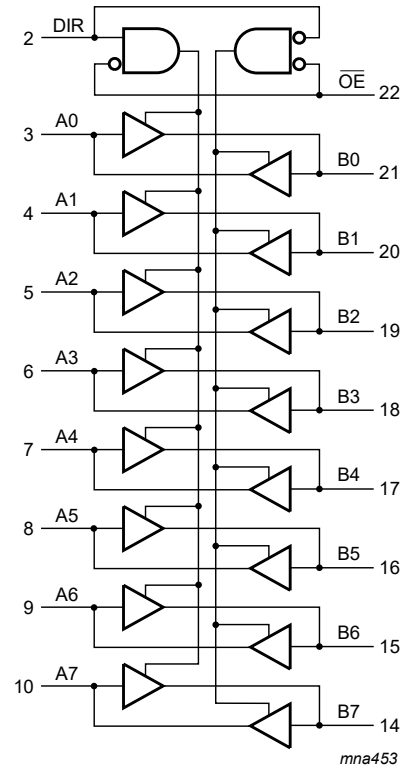
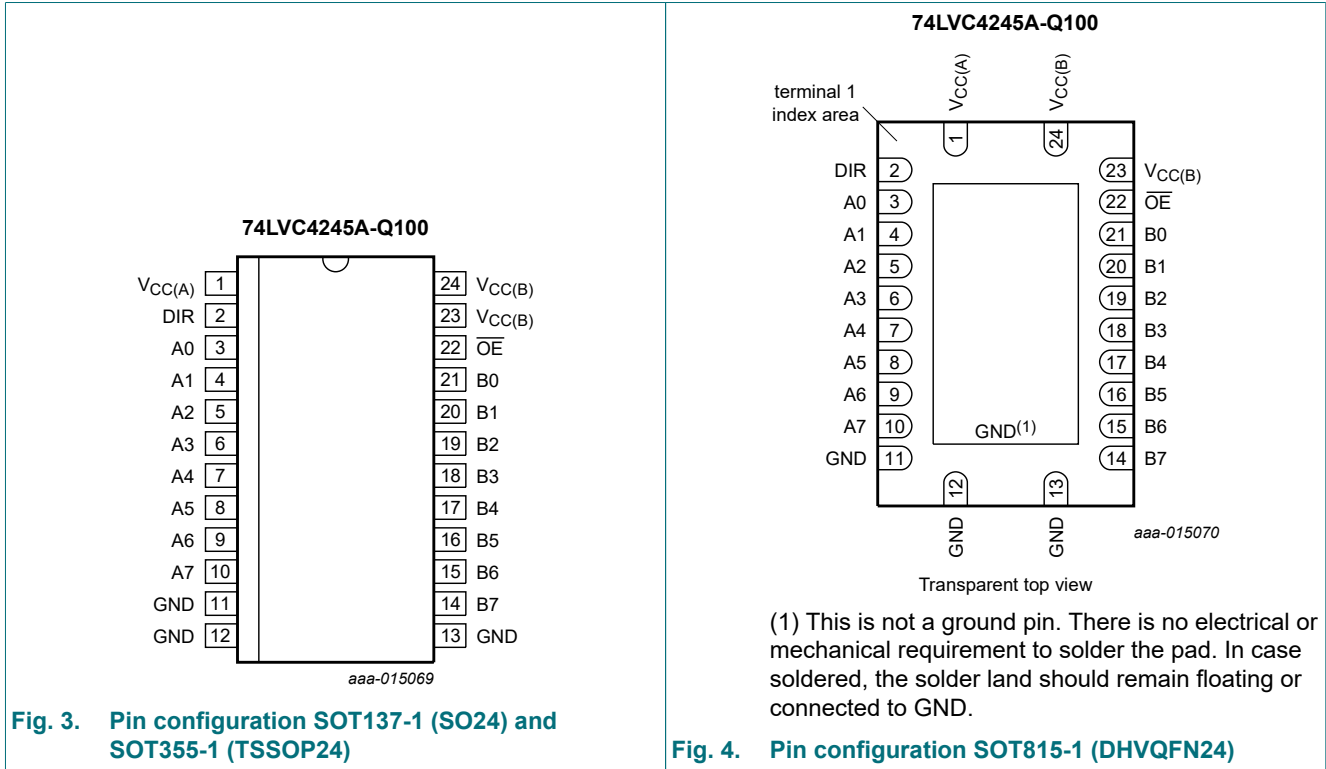


Fig. 2. Logic diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
V _{CC(A)}	1	supply voltage (5 V bus)
V _{CC(B)}	23, 24	supply voltage (3 V bus)
GND	11, 12, 13	ground (0 V)
DIR	2	direction control
A0, A1, A2, A3, A4, A5, A6, A7	3, 4, 5, 6, 7, 8, 9, 10	data input or output
B0, B1, B2, B3, B4, B5, B6, B7	21, 20, 19, 18, 17, 16, 15, 14	data input or output
OE	22	output enable input (active LOW)

6. Functional description

Table 3. Functional table

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

Input		Input/output	
OE	DIR	An	Bn
L	L	A = B	input
L	H	input	B = A
H	X	Z	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	
$V_{CC(A)}$	supply voltage A		-0.5	+6.5	V	
$V_{CC(B)}$	supply voltage B		-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	$V_O > V_{CCO}$ or $V_O < 0$ V	[2]	±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_{CCO}	[2]	±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 input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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

[3] For SOT137-1 (SO24) package: P_{tot} derates linearly with 16.2 mW/K above 119 °C.

For SOT355-1 (TSSOP24) package: P_{tot} derates linearly with 12.4 mW/K above 110 °C.

For SOT815-1 (DHVQFN24) package: P_{tot} derates linearly with 15.0 mW/K above 117 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC(A)}$	supply voltage A	$V_{CC(A)} \geq V_{CC(B)}$; see Fig. 5 for maximum speed performance	1.5	-	5.5	V
$V_{CC(B)}$	supply voltage B	$V_{CC(A)} \geq V_{CC(B)}$; see Fig. 5 for low-voltage applications	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
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC(B)} = 2.7\text{ V to }3.0\text{ V}$	-	-	20	ns/V
		$V_{CC(B)} = 3.0\text{ V to }3.6\text{ V}$	-	-	10	ns/V
		$V_{CC(A)} = 3.0\text{ V to }4.5\text{ V}$	-	-	20	ns/V
		$V_{CC(A)} = 4.5\text{ V to }5.5\text{ V}$	-	-	10	ns/V

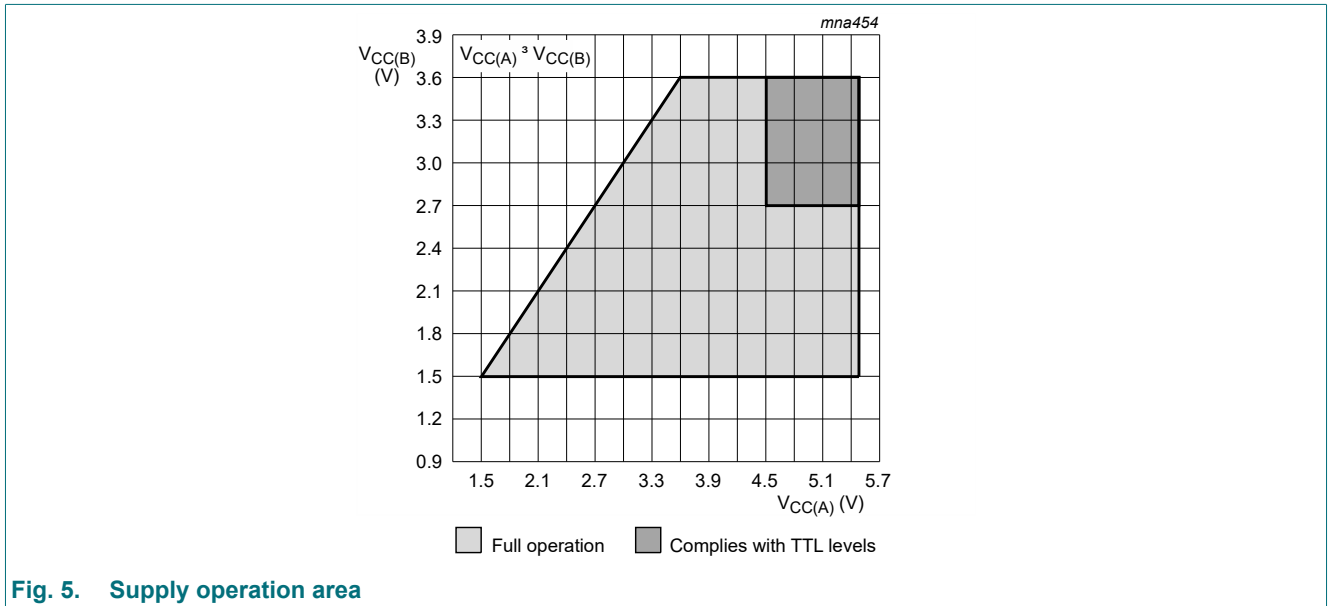


Fig. 5. Supply operation area

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
$T_{amb} = -40\text{ °C to }+85\text{ °C}$						
V_{IH}	HIGH-level input voltage	$V_{CC(B)} = 2.7\text{ V to }3.6\text{ V}$	2.0	-	-	V
		$V_{CC(A)} = 4.5\text{ V to }5.5\text{ V}$	2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC(B)} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.8	V
		$V_{CC(A)} = 4.5\text{ V to }5.5\text{ V}$	-	-	0.8	V

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		V _{CC(B)} = 2.7 V to 3.6 V; I _O = -100 μA	V _{CC(B)} - 0.2	V _{CC(B)}	-	V
		V _{CC(B)} = 2.7 V; I _O = -12 mA	V _{CC(B)} - 0.5	-	-	V
		V _{CC(B)} = 3.0 V; I _O = -24 mA	V _{CC(B)} - 0.8	-	-	V
		V _{CC(A)} = 4.5 V to 5.5 V; I _O = -100 μA	V _{CC(A)} - 0.2	V _{CC(A)}	-	V
		V _{CC(A)} = 4.5 V; I _O = -12 mA	V _{CC(A)} - 0.5	-	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		V _{CC(B)} = 2.7 V to 3.6 V; I _O = 100 μA	-	-	0.20	V
		V _{CC(B)} = 2.7 V; I _O = 12 mA	-	-	0.40	V
		V _{CC(B)} = 3.0 V; I _O = 24 mA	-	-	0.55	V
		V _{CC(A)} = 4.5 V to 5.5 V; I _O = 100 μA	-	-	0.20	V
		V _{CC(A)} = 4.5 V; I _O = 12 mA	-	-	0.40	V
I _I	input leakage current	V _I = 5.5 V or GND	-	±0.1	±5	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} [2]				
		V _{CC(B)} = 3.6 V; V _O = V _{CC(B)} or GND	-	±0.1	±5	μA
		V _{CC(A)} = 5.5 V; V _O = V _{CC(A)} or GND	-	±0.1	±5	μA
I _{CC}	supply current	I _O = 0 A				
		V _{CC(B)} = 3.6 V; other inputs at V _{CC(B)} or GND	-	0.1	10	μA
		V _{CC(A)} = 5.5 V; other inputs at V _{CC(A)} or GND	-	0.1	10	μA
ΔI _{CC}	additional supply current	per pin; I _O = 0 A				
		V _{CC(B)} = 2.7 V to 3.6 V; V _I = V _{CC(B)} - 0.6 V; other inputs at V _{CC(B)} or GND	-	5	500	μA
		V _{CC(A)} = 4.5 V to 5.5 V; V _I = V _{CC(A)} - 0.6 V; other inputs at V _{CC(A)} or GND	-	5	500	μA
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 _{CC(B)} = 2.7 V to 3.6 V	2.0	-	-	V
		V _{CC(A)} = 4.5 V to 5.5 V	2.0	-	-	V
V _{IL}	LOW-level input voltage	V _{CC(B)} = 2.7 V to 3.6 V	-	-	0.8	V
		V _{CC(A)} = 4.5 V to 5.5 V	-	-	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		V _{CC(B)} = 2.7 V to 3.6 V; I _O = -100 μA	V _{CC(B)} - 0.3	-	-	V
		V _{CC(B)} = 2.7 V; I _O = -12 mA	V _{CC(B)} - 0.65	-	-	V
		V _{CC(B)} = 3.0 V; I _O = -24 mA	V _{CC(B)} - 1.0	-	-	V
		V _{CC(A)} = 4.5 V to 5.5 V; I _O = -100 μA	V _{CC(A)} - 0.3	-	-	V
		V _{CC(A)} = 4.5 V; I _O = -12 mA	V _{CC(A)} - 0.65	-	-	V
		V _{CC(A)} = 4.5 V; I _O = -24 mA	V _{CC(A)} - 1.0	-	-	V

Octal dual supply translating transceiver; 3-state

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		V _{CC(B)} = 2.7 V to 3.6 V; I _O = 100 μA	-	-	0.30	V
		V _{CC(B)} = 2.7 V; I _O = 12 mA	-	-	0.60	V
		V _{CC(B)} = 3.0 V; I _O = 24 mA	-	-	0.80	V
		V _{CC(A)} = 4.5 V to 5.5 V; I _O = 100 μA	-	-	0.30	V
		V _{CC(A)} = 4.5 V; I _O = 12 mA	-	-	0.60	V
		V _{CC(A)} = 4.5 V; I _O = 24 mA	-	-	0.80	V
I _I	input leakage current	V _I = 5.5 V or GND	-	-	±20	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} [2]				
		V _{CC(B)} = 3.6 V; V _O = V _{CC(B)} or GND	-	-	±20	μA
		V _{CC(A)} = 5.5 V; V _O = V _{CC(A)} or GND	-	-	±20	μA
I _{CC}	supply current	I _O = 0 A				
		V _{CC(B)} = 3.6 V; other inputs at V _{CC(B)} or GND	-	-	40	μA
		V _{CC(A)} = 5.5 V; other inputs at V _{CC(A)} or GND	-	-	40	μA
ΔI _{CC}	additional supply current	per pin; I _O = 0 A				
		V _{CC(B)} = 2.7 V to 3.6 V; V _I = V _{CC(B)} - 0.6 V; other inputs at V _{CC(B)} or GND	-	-	5000	μA
		V _{CC(A)} = 4.5 V to 5.5 V; V _I = V _{CC(A)} - 0.6 V; other inputs at V _{CC(A)} or GND	-	-	5000	μA

[1] All typical values are measured at V_{CC(A)} = 5.0 V, V_{CC(B)} = 3.3 V and T_{amb} = 25 °C.

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). V_{CC(A)} = 4.5 V to 5.5 V; t_r = t_f ≤ 2.5 ns. For test circuit see Fig. 8.

Symbol	Parameter	Conditions	V _{CC(B)}	-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 Fig. 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 Fig. 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 Fig. 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 Fig. 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

Octal dual supply translating transceiver; 3-state

Symbol	Parameter	Conditions	V _{CC(B)}	-40 °C to +85 °C			-40 °C to +125 °C		Unit	
				Min	Typ [1]	Max	Min	Max		
t _{PZL}	OFF-state to LOW propagation delay	OE to An; see Fig. 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	
		OE to Bn; see Fig. 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	OE to An; see Fig. 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	
		OE to Bn; see Fig. 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	OE to An; see Fig. 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	
		OE to Bn; see Fig. 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	OE to An; see Fig. 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	
		OE to Bn; see Fig. 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	
t _{sk(o)}	output skew time		[2]	-	-	1.0	-	1.5	ns	
C _{PD}	power dissipation capacitance	5 V bus: Bn to An; V _I = GND to V _{CC(A)} ; V _{CC(A)} = 5.0 V	[3]							
			outputs enabled	-	-	17	-	-	-	pF
			outputs disabled	-	-	5	-	-	-	pF
		3 V bus: An to Bn; V _I = GND to V _{CC(B)} ; V _{CC(B)} = 3.3 V	[3]							
			outputs enabled	-	-	17	-	-	-	pF
			outputs disabled	-	-	5	-	-	-	pF

[1] Typical values are measured at T_{amb} = 25 °C, V_{CC(A)} = 5.0 V, and V_{CC(B)} = 2.7 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).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

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

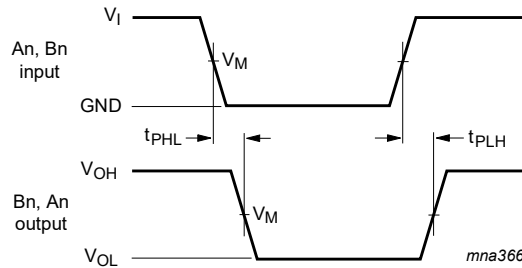
C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

N = number of inputs switching

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

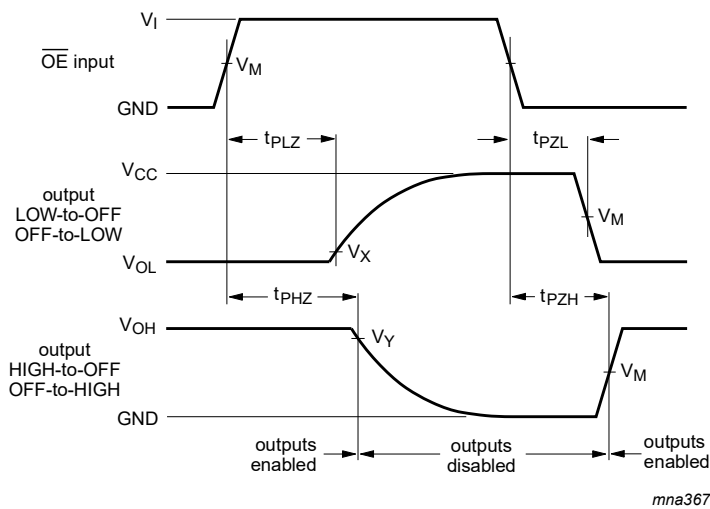
10.1. Waveforms and test circuit



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

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



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

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

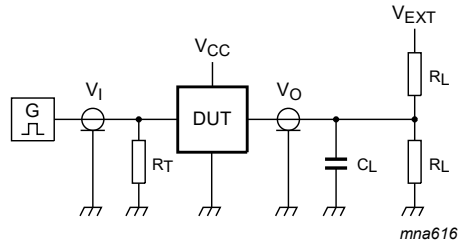
Fig. 7. 3-state enable and disable times

Table 8. Measurement points

Supply voltage		Input		Output		
$V_{CC(A)}$	$V_{CC(B)}$	V_M [1]	V_I [1]	V_M [2]	V_X	V_Y
$\leq 2.7\text{ V}$	$\leq 2.7\text{ V}$	$0.5 V_{CCI}$	V_{CCI}	$0.5 V_{CCO}$	-	-
-	$2.7\text{ V to } 3.6\text{ V}$	1.5 V	2.7 V	1.5 V	-	-
$\geq 4.5\text{ V}$	-	$0.5 V_{CCI}$	3.0 V	$0.5 V_{CCO}$	-	-
-	$\geq 2.7\text{ V}$	-	V_{CCI}	-	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$

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

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



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.

Fig. 8. Test circuit for measuring switching times

Table 9. Test data

Supply voltage		Input	Load		V_{EXT}		
$V_{CC(A)}$	$V_{CC(B)}$	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.

11. Package outline

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

SOT137-1

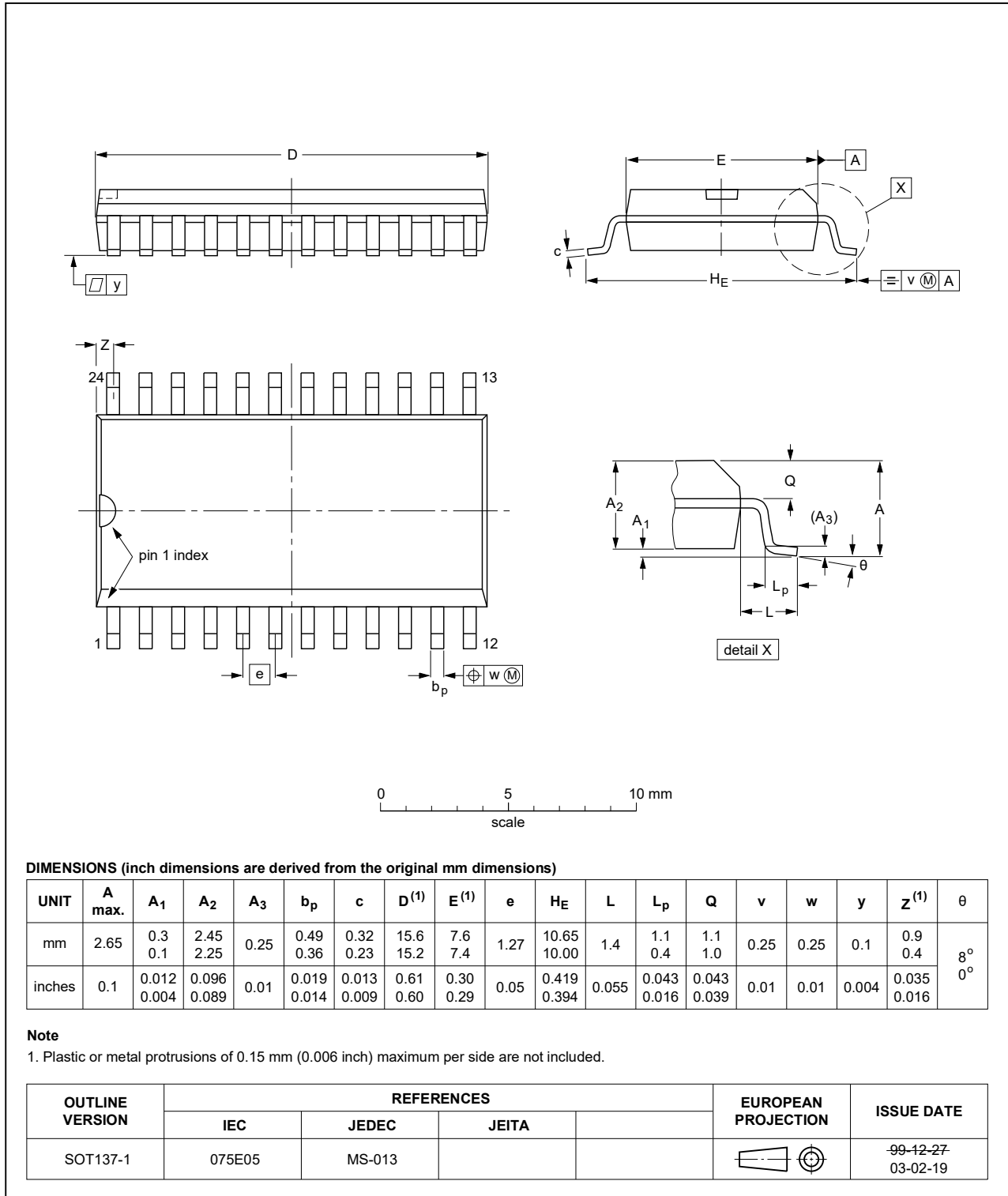


Fig. 9. Package outline SOT137-1 (SO24)

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

SOT355-1

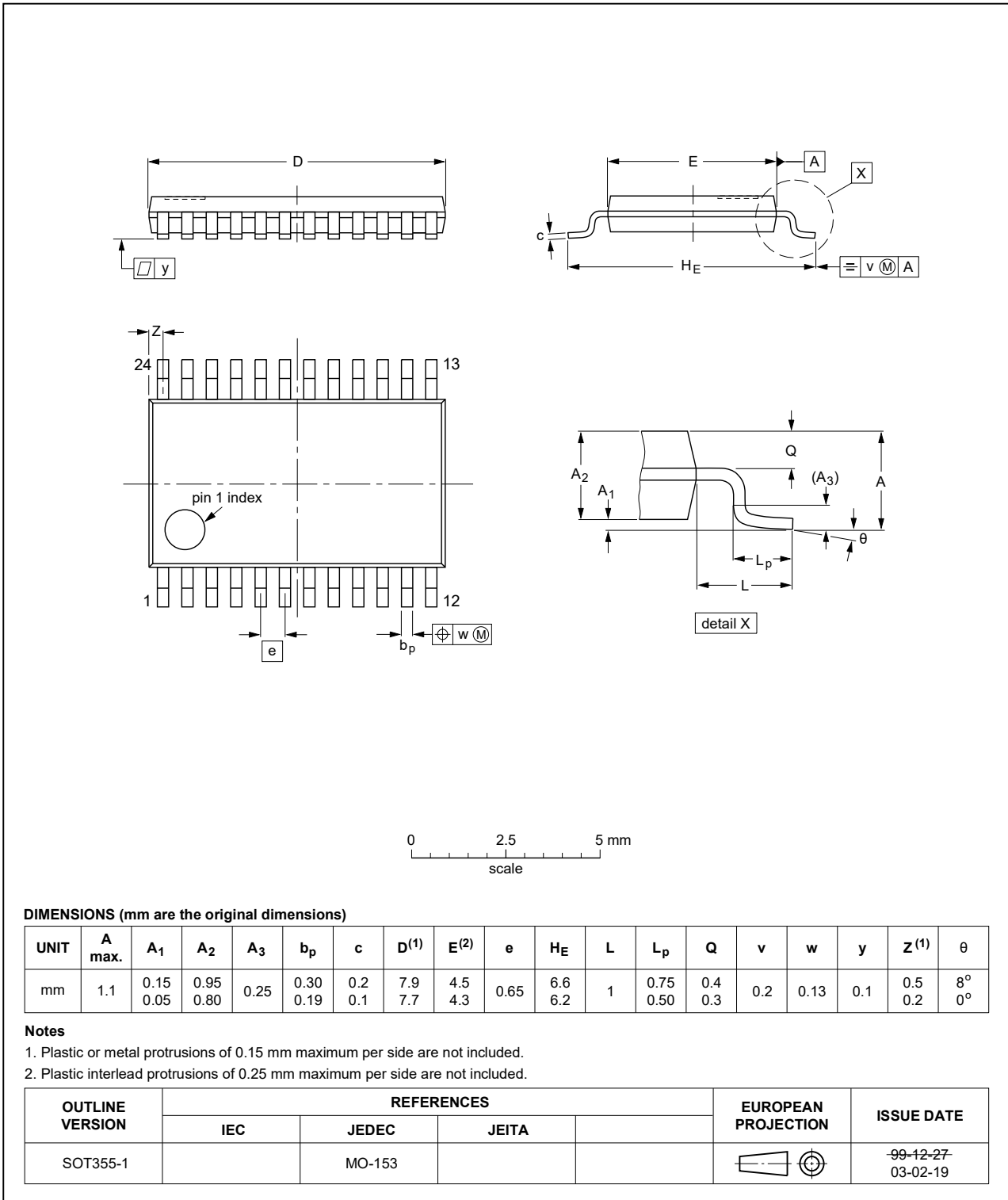


Fig. 10. Package outline SOT355-1 (TSSOP24)

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

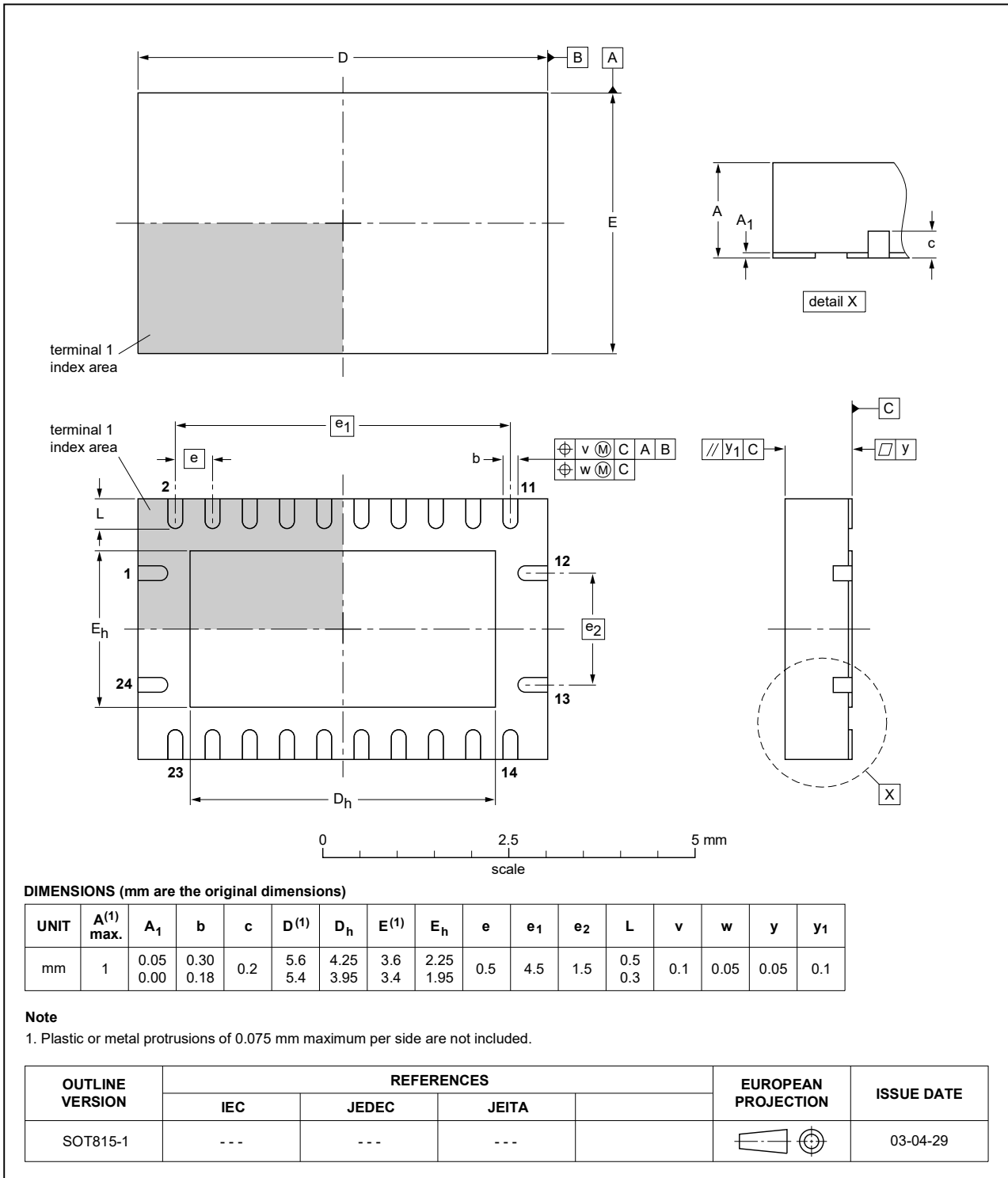


Fig. 11. Package outline SOT815-1 (DHVQFN24)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC4245A_Q100 v.3	20210412	Product data sheet	-	74LVC4245A_Q100 v.2
Modifications:	<ul style="list-style-type: none"> • Section 9: ΔI_{CC} conditions have changed. 			
74LVC4245A_Q100 v.2	20200922	Product data sheet	-	74LVC4245A_Q100 v.1
Modifications:	<ul style="list-style-type: none"> • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Section 1 and Section 2 updated. • Table 4: Derating values for P_{tot} total power dissipation updated. • Measurement points related to Fig. 6 and Fig. 7 are given in Table 8. 			
74LVC4245A_Q100 v.1	20141020	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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