

# 74CBTLV3384

10-bit bus switch with 5-bit output enables

Rev. 4 — 11 February 2021

Product data sheet

## 1. General description

The 74CBTLV3384 is a dual 5-pole, single-throw bus switch. The device features two output enable inputs ( $n\overline{OE}$ ) that each control five switch channels. The switches are disabled when the associated  $n\overline{OE}$  input is HIGH. Schmitt-trigger action at control inputs makes the circuit tolerant of slower input rise and fall times. This device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

## 2. Features and benefits

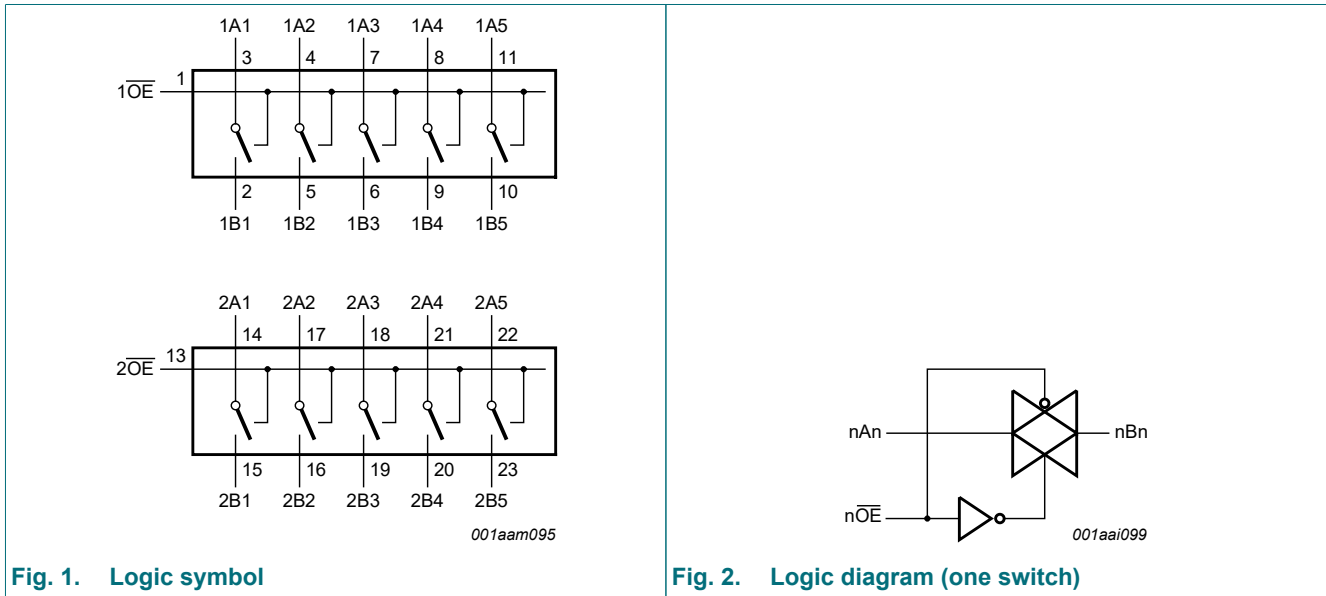
- Supply voltage range from 2.3 V to 3.6 V
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM AEC-Q100-011 revision B exceeds 1000 V
- 5  $\Omega$  switch connection between two ports
- Rail to rail switching on data I/O ports
- CMOS low power consumption
- Latch-up performance exceeds 250 mA per JESD78B Class I level A
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

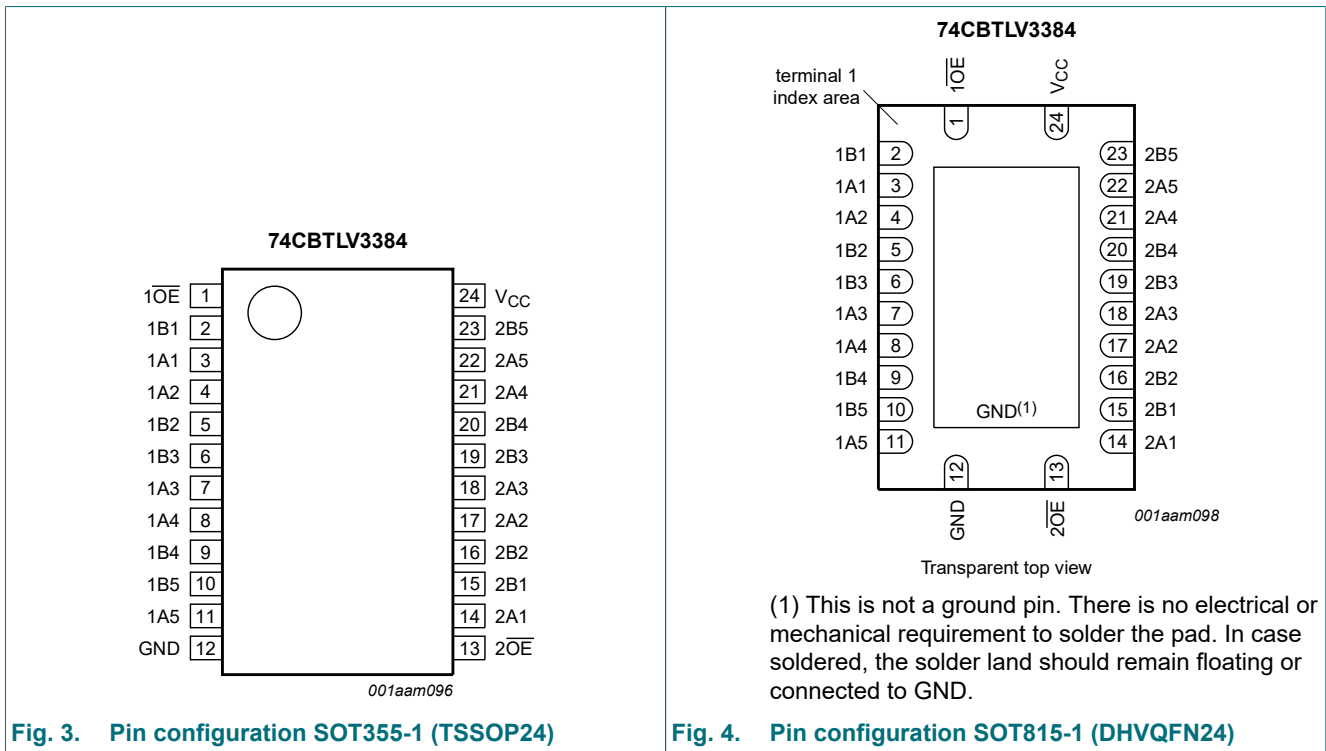
Type number	Package			
	Temperature range	Name	Description	Version
74CBTLV3384PW	-40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1
74CBTLV3384BQ	-40 °C to +125 °C	DHVQFN24	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 24 terminals; body 3.5 × 5.5 × 0.85 mm	SOT815-1

### 4. Functional diagram



### 5. Pinning information

#### 5.1. Pinning



## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$1\overline{OE}$ , $2\overline{OE}$	1, 13	output enable input (active LOW)
1A1, 1A2, 1A3, 1A4, 1A5	3, 4, 7, 8, 11	data input/output (A port)
2A1, 2A2, 2A3, 2A4, 2A5	14, 17, 18, 21, 22	data input/output (A port)
1B1, 1B2, 1B3, 1B4, 1B5	2, 5, 6, 9, 10	data input/output (B port)
2B1, 2B2, 2B3, 2B4, 2B5	15, 16, 19, 20, 23	data input/output (B port)
GND	12	ground (0 V)
V <sub>CC</sub>	24	positive supply voltage

## 6. Functional description

Table 3. Function selection

H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

Input		Input/output	
$1\overline{OE}$	$2\overline{OE}$	1An, 1Bn	2An, 2Bn
L	L	1An = 1Bn	2An = 2Bn
L	H	1An = 1Bn	Z
H	L	Z	2An = 2Bn
H	H	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 <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage		[1] -0.5	+4.6	V
V <sub>SW</sub>	switch voltage	enable and disable mode	[1] -0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V	-50	-	mA
I <sub>SK</sub>	switch clamping current	V <sub>I</sub> < -0.5 V	-50	-	mA
I <sub>SW</sub>	switch current	V <sub>SW</sub> = 0 V to V <sub>CC</sub>	-	±128	mA
I <sub>CC</sub>	supply current		-	+100	mA
I <sub>GND</sub>	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	[2] -	500	mW

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

[2] For SOT355-1 (TSSOP24) package: P<sub>tot</sub> derates linearly with 12.4 mW/K above 110 °C.  
For SOT815-1 (DHVQFN24) package: P<sub>tot</sub> derates linearly with 15.0 mW/K above 117 °C.

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		2.3	3.6	V
$V_I$	input voltage		0	3.6	V
$V_{SW}$	switch voltage	enable and disable mode	0	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.3 \text{ V to } 3.6 \text{ V}$ [1]	-	200	ns/V

[1] Applies to control signal levels.

## 9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	$T_{amb} = -40 \text{ °C to } +85 \text{ °C}$			$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$		Unit
			Min	Typ [1]	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7	-	-	1.7	-	V
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	2.0	-	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	-	-	0.7	-	0.7	V
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	-	-	0.9	-	0.9	V
$I_I$	input leakage current	pin $\overline{OE}$ ; $V_I = \text{GND to } V_{CC}$ ; $V_{CC} = 3.6 \text{ V}$	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$
$I_{S(OFF)}$	OFF-state leakage current	$V_{CC} = 3.6 \text{ V}$ ; see Fig. 5	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$
$I_{S(ON)}$	ON-state leakage current	$V_{CC} = 3.6 \text{ V}$ ; see Fig. 6	-	-	$\pm 1$	-	$\pm 20$	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_I$ or $V_O = 0 \text{ V to } 3.6 \text{ V}$ ; $V_{CC} = 0 \text{ V}$	-	-	$\pm 10$	-	$\pm 50$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = \text{GND or } V_{CC}$ ; $I_O = 0 \text{ A}$ ; $V_{SW} = \text{GND or } V_{CC}$ ; $V_{CC} = 3.6 \text{ V}$	-	-	10	-	50	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	pin $\overline{OE}$ ; $V_I = V_{CC} - 0.6 \text{ V}$ ; $V_{SW} = \text{GND or } V_{CC}$ ; $V_{CC} = 3.6 \text{ V}$ ; one input at 3 V, other inputs at $V_{CC}$ or GND.	-	-	300	-	2000	$\mu\text{A}$
$C_I$	input capacitance	pin $\overline{OE}$ ; $V_{CC} = 3.3 \text{ V}$ ; $V_I = 0 \text{ V to } 3.3 \text{ V}$	-	0.9	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance	$V_{CC} = 3.3 \text{ V}$ ; $V_I = 0 \text{ V to } 3.3 \text{ V}$	-	5.2	-	-	-	pF
$C_{S(ON)}$	ON-state capacitance	$V_{CC} = 3.3 \text{ V}$ ; $V_I = 0 \text{ V to } 3.3 \text{ V}$	-	14.3	-	-	-	pF

[1] All typical values are measured at  $T_{amb} = 25 \text{ °C}$ .

9.1. Test circuits

$V_I = V_{CC}$  or GND and  $V_O =$  GND or  $V_{CC}$ .

**Fig. 5. Test circuit for measuring OFF-state leakage current (one switch)**

$V_I = V_{CC}$  or GND and  $V_O =$  open circuit.

**Fig. 6. Test circuit for measuring ON-state leakage current (one switch)**

10. ON resistance

Table 7. Resistance  $R_{ON}$

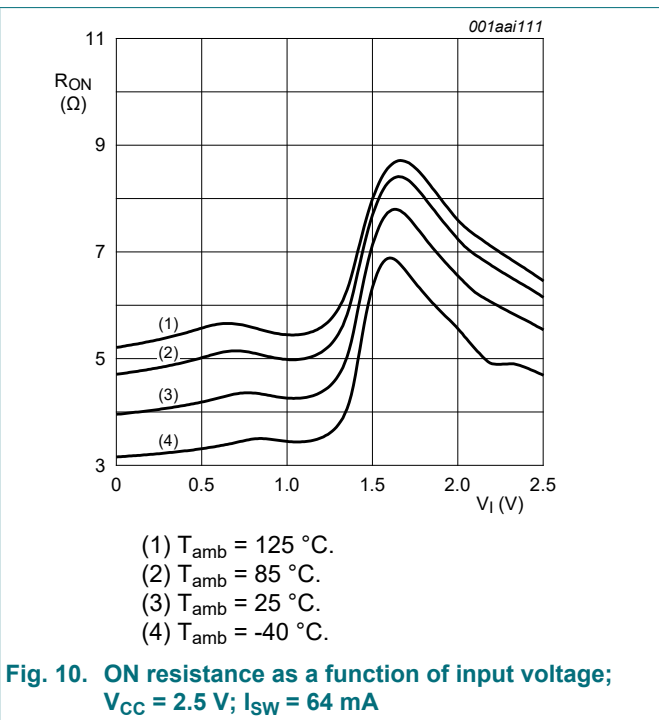
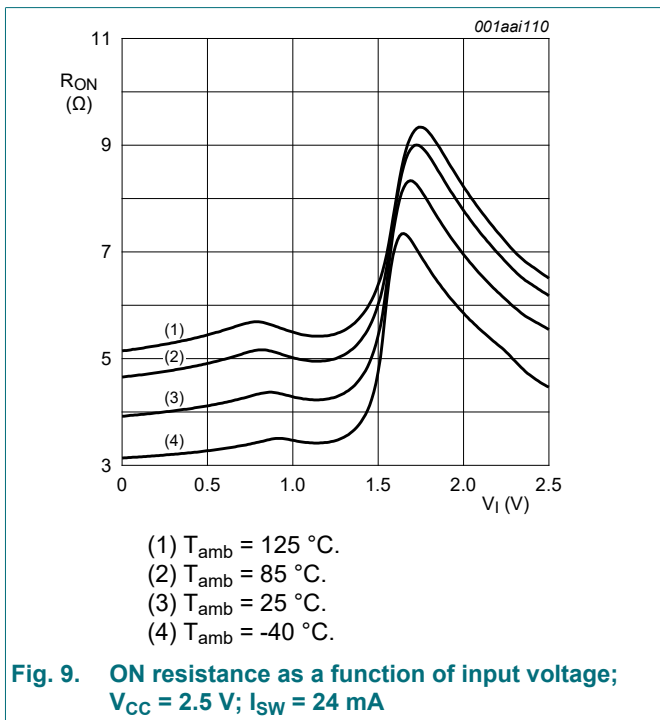
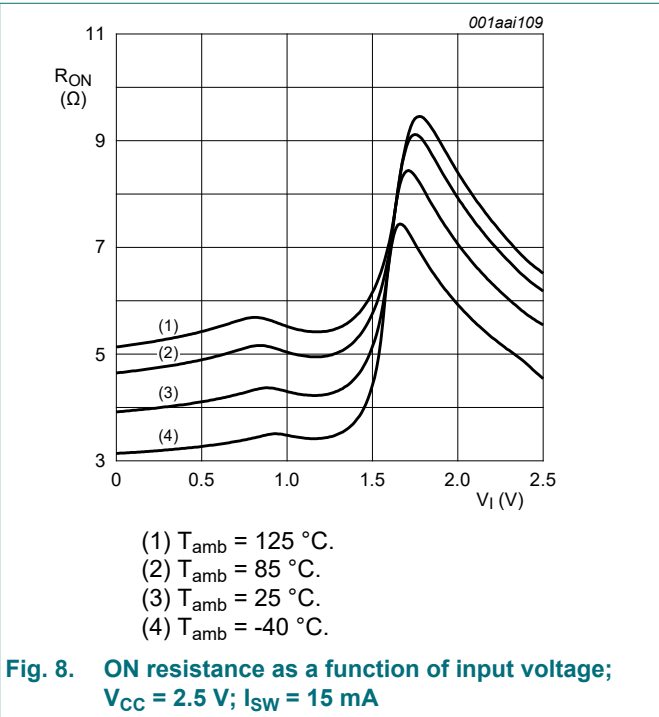
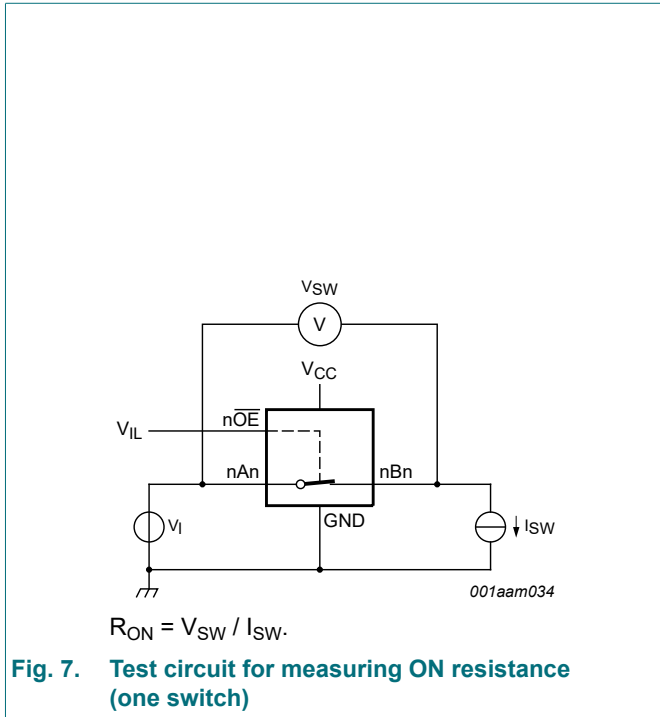
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

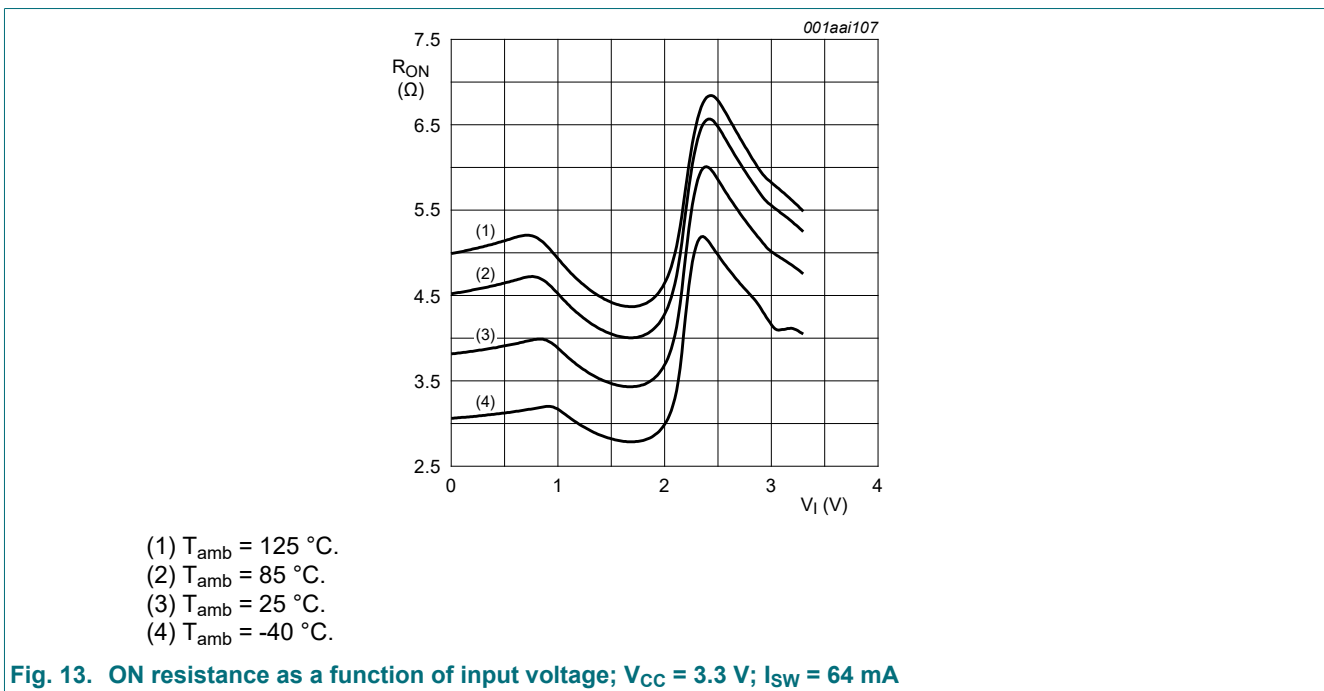
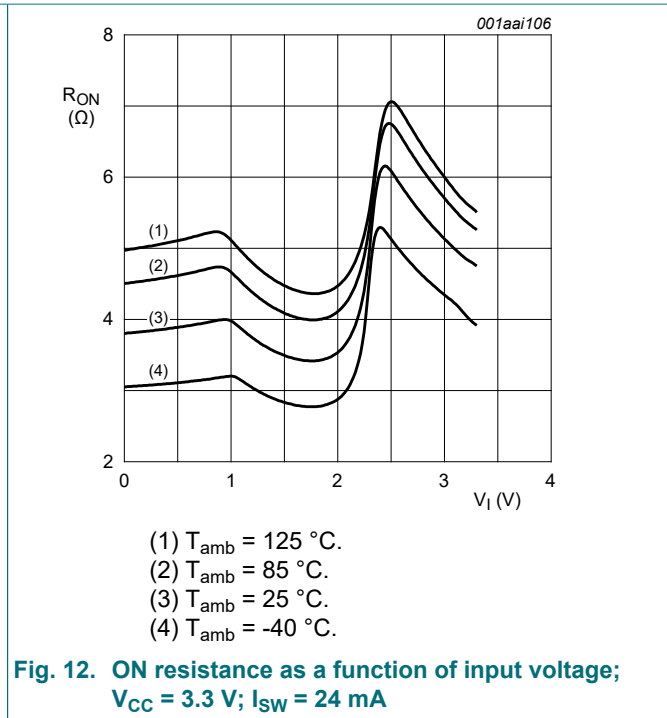
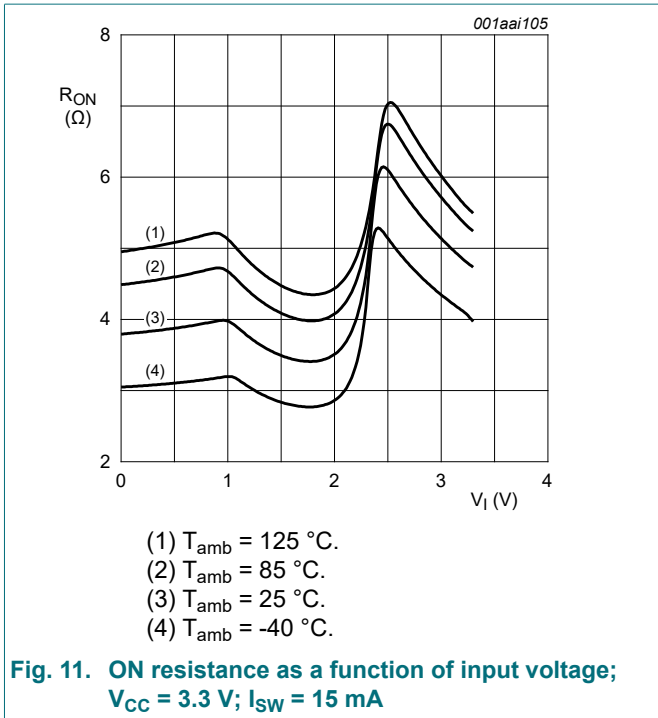
Symbol	Parameter	Conditions	$T_{amb} = -40\text{ °C to }+85\text{ °C}$			$T_{amb} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ [1]	Max	Min	Max	
$R_{ON}$	ON resistance	$V_{CC} = 2.3\text{ V to }2.7\text{ V};$ see Fig. 8 to Fig. 10 [2]						
		$I_{SW} = 64\text{ mA}; V_I = 0\text{ V}$	-	4.2	8.0	-	15.0	$\Omega$
		$I_{SW} = 24\text{ mA}; V_I = 0\text{ V}$	-	4.2	8.0	-	15.0	$\Omega$
		$I_{SW} = 15\text{ mA}; V_I = 1.7\text{ V}$	-	8.4	40	-	60.0	$\Omega$
		$V_{CC} = 3.0\text{ V to }3.6\text{ V};$ see Fig. 11 to Fig. 13						
		$I_{SW} = 64\text{ mA}; V_I = 0\text{ V}$	-	4.0	7.0	-	11.0	$\Omega$
		$I_{SW} = 24\text{ mA}; V_I = 0\text{ V}$	-	4.0	7.0	-	11.0	$\Omega$
$I_{SW} = 15\text{ mA}; V_I = 2.4\text{ V}$	-	6.2	15	-	25.5	$\Omega$		

[1] Typical values are measured at  $T_{amb} = 25\text{ °C}$  and nominal  $V_{CC}$ .

[2] Measured by the voltage drop between the A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

10.1. ON resistance test circuit and graphs





## 11. Dynamic characteristics

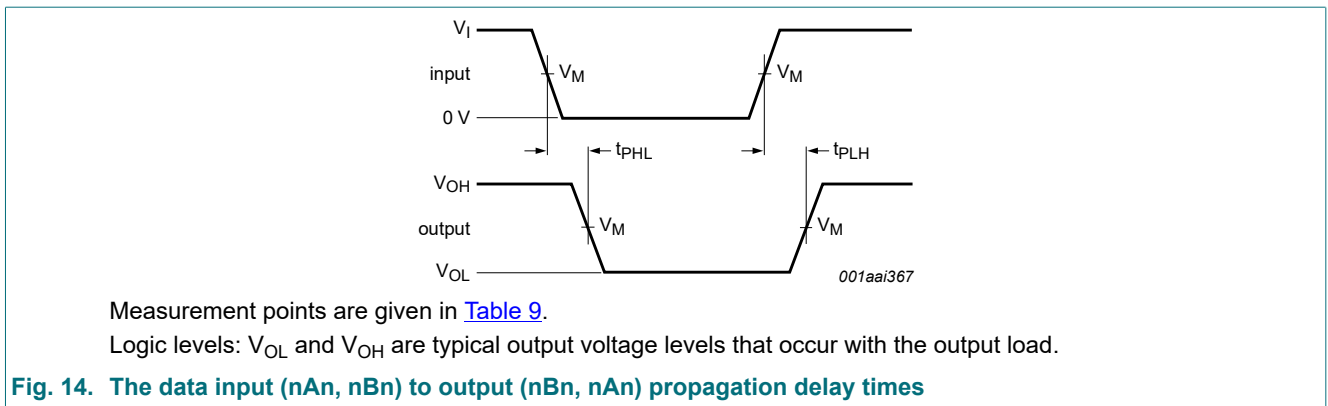
**Table 8. Dynamic characteristics**

$GND = 0\text{ V}$ ; for test circuit see [Fig. 16](#)

Symbol	Parameter	Conditions	$T_{amb} = -40\text{ °C to }+85\text{ °C}$			$T_{amb} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ [1]	Max	Min	Max	
$t_{pd}$	propagation delay	nAn to nBn or nBn to nAn; see <a href="#">Fig. 14</a> [2] [3]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.13	-	0.20	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.20	-	0.31	ns
$t_{en}$	enable time	$n\overline{OE}$ to nAn or nBn; see <a href="#">Fig. 15</a> [4]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.0	5.0	1.0	7.0	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	2.6	4.3	1.0	6.0	ns
$t_{dis}$	disable time	$n\overline{OE}$ to nAn or nBn; see <a href="#">Fig. 15</a> [5]						
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.6	5.5	1.0	7.5	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.2	5.5	1.0	7.5	ns

- [1] All typical values are measured at  $T_{amb} = 25\text{ °C}$  and at nominal  $V_{CC}$ .
- [2] The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).
- [3]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
- [4]  $t_{en}$  is the same as  $t_{PZH}$  and  $t_{PZL}$ .
- [5]  $t_{dis}$  is the same as  $t_{PHZ}$  and  $t_{PLZ}$ .

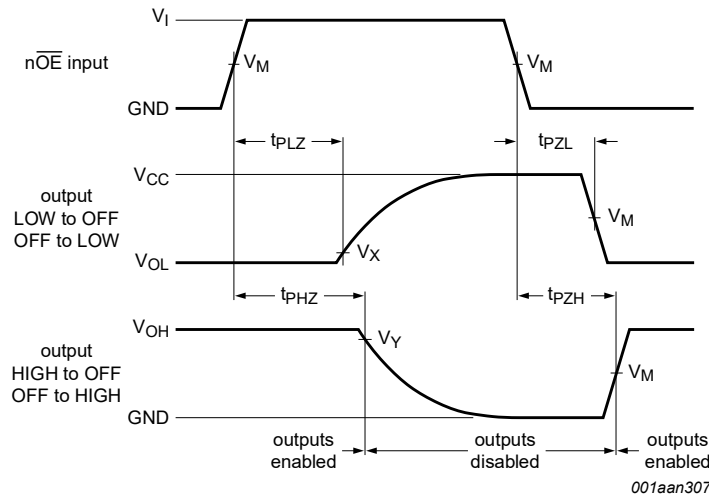
### 11.1. Waveforms and test circuit



**Table 9. Measurement points**

Supply voltage	Input			Output		
$V_{CC}$	$V_M$	$V_I$	$t_r = t_f$	$V_M$	$V_X$	$V_Y$
2.3 V to 2.7 V	$0.5V_{CC}$	$V_{CC}$	$\leq 2.0\text{ ns}$	$0.5V_{CC}$	$V_{OL} + 0.15\text{ V}$	$V_{OH} - 0.15\text{ V}$
3.0 V to 3.6 V	$0.5V_{CC}$	$V_{CC}$	$\leq 2.0\text{ ns}$	$0.5V_{CC}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$

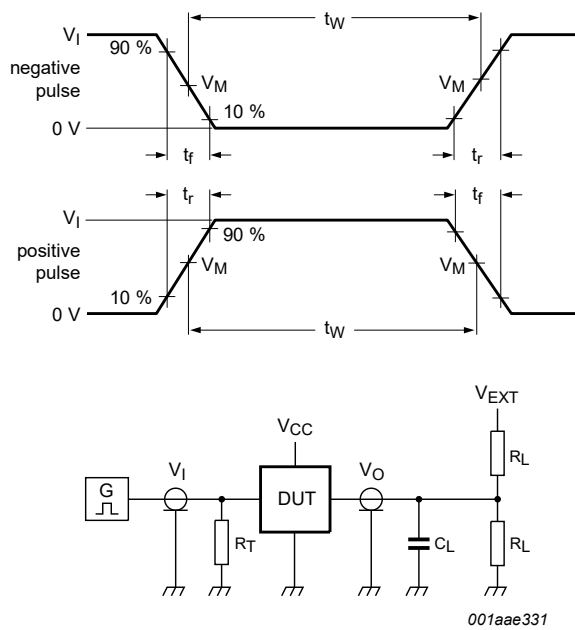




Measurement points are given in [Table 9](#).

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

**Fig. 15. Enable and disable times**



Test data is given in [Table 10](#).

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 the output impedance  $Z_o$  of the pulse generator.

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

**Fig. 16. Test circuit for measuring switching times**

**Table 10. Test data**

Supply voltage	Load		$V_{EXT}$		
$V_{CC}$	$C_L$	$R_L$	$t_{PLH}$ , $t_{PHL}$	$t_{PZH}$ , $t_{PHZ}$	$t_{PZL}$ , $t_{PLZ}$
2.3 V to 2.7 V	30 pF	500 $\Omega$	open	GND	$2V_{CC}$
3.0 V to 3.6 V	50 pF	500 $\Omega$	open	GND	$2V_{CC}$

11.2. Additional dynamic characteristics

Table 11. Additional dynamic characteristics

At recommended operating conditions; Voltages are referenced to GND (ground = 0 V);  $V_I = \text{GND or } V_{CC}$  (unless otherwise specified);  $t_r = t_f \leq 2.5 \text{ ns}$ .

Symbol	Parameter	Conditions	$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$			Unit
			Min	Typ	Max	
$f_{(-3\text{dB})}$	-3 dB frequency response	$V_{CC} = 3.3 \text{ V}$ ; $R_L = 50 \text{ } \Omega$ ; see Fig. 17 [1]	-	406	-	MHz

[1]  $f_i$  is biased at  $0.5V_{CC}$ .

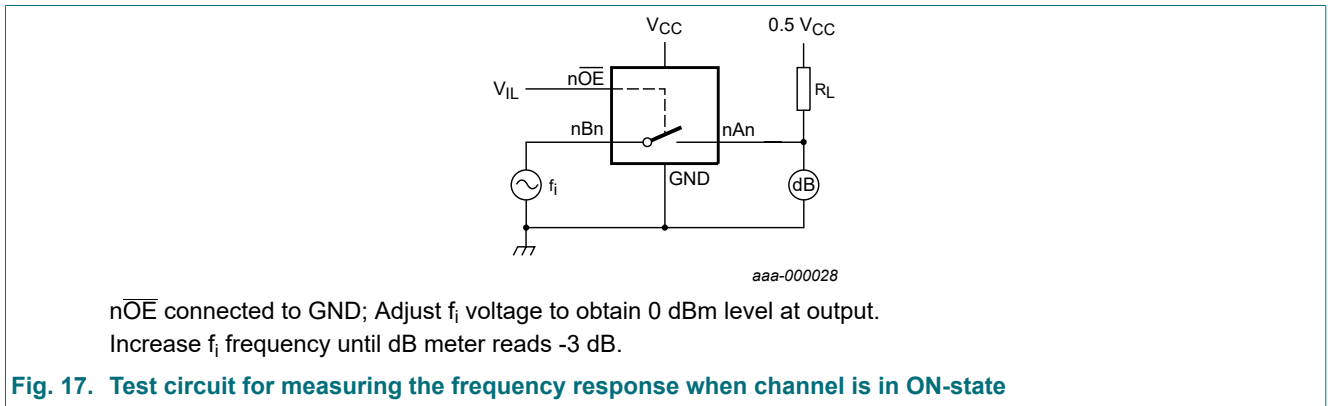


Fig. 17. Test circuit for measuring the frequency response when channel is in ON-state

## 12. Package outline

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

SOT355-1

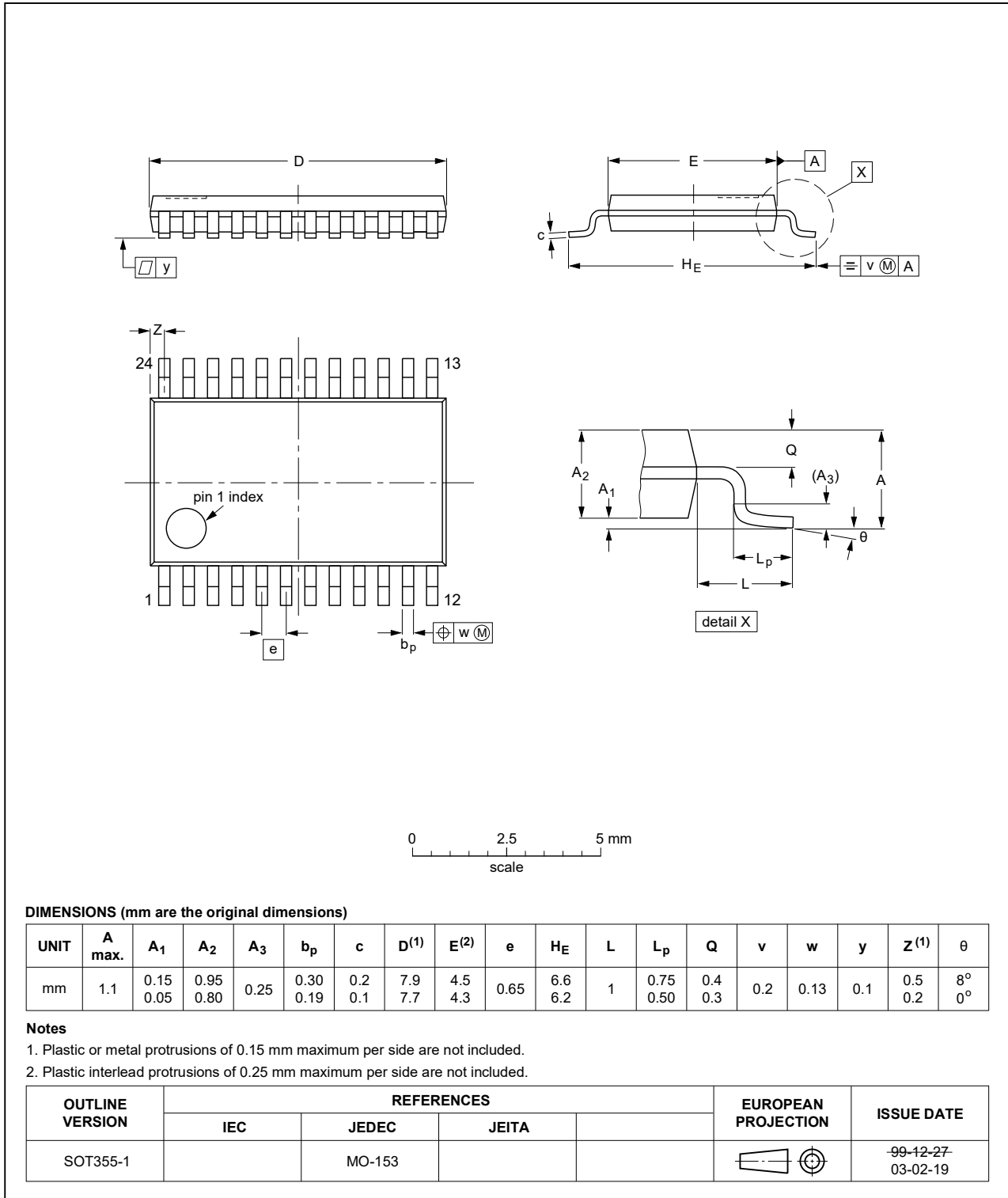


Fig. 18. Package outline SOT355-1 (TSSOP24)

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

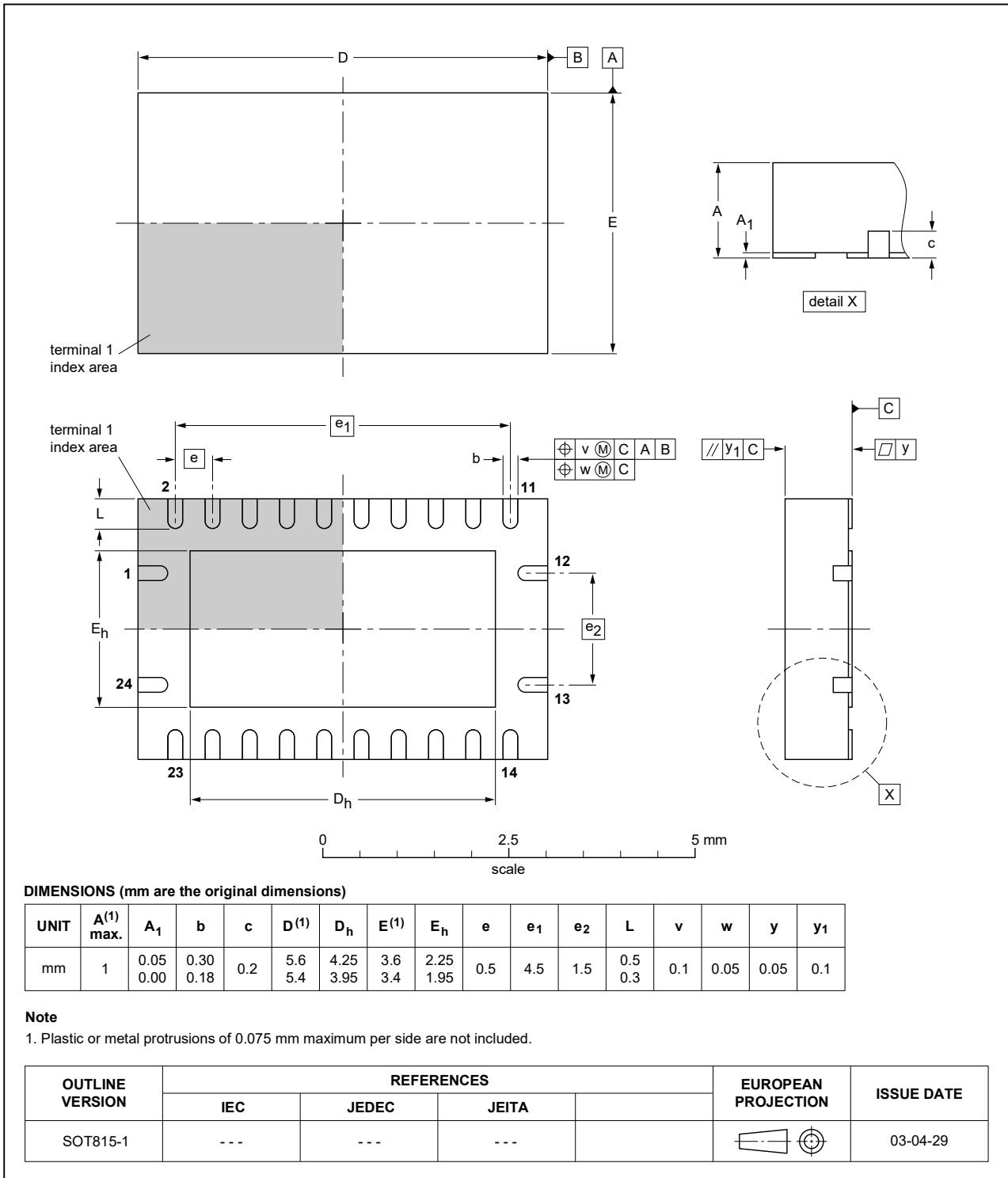


Fig. 19. Package outline SOT815-1 (DHVQFN24)

## 13. Abbreviations

Table 12. Abbreviations

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

## 14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLV3384 v.4	20210211	Product data sheet	-	74CBTLV3384 v.3
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type number 74CBTLV3384DK (SOT556-1 / SSOP24) removed.</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74CBTLV3384 v.3	20161111	Product data sheet	-	74CBTLV3384 v.2
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Section 11.2</a> added.</li> </ul>			
74CBTLV3384 v.2	20111216	Product data sheet	-	74CBTLV3384 v.1
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
74CBTLV3384 v.1	20101230	Product data sheet	-	-

## 15. 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.

- [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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