



CBTD3384-Q100

10-bit level shifting bus switch with 5-bit output enables

Rev. 1 — 20 October 2023

Product data sheet

1. General description

The CBTD3384-Q100 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. CBTD3384-Q100 is specifically designed for 5 V to 3.3 V level shifting applications. This device is fully specified for partial power down applications using I_{OFF} .

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 3) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 3)
 - Specified from -40 °C to +85 °C
- Designed to be used in 5 V to 3.3 V level shifting applications with internal diode
- 5 Ω switch connection between two ports
- Direct interface with TTL levels
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up protection exceeds 100 mA per JESD78
- ESD protection:
 - HBM JESD22-A114E exceeds 2000 V
 - CDM JESD22-C101C exceeds 1000 V

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
CBTD3384PW-Q100	-40 °C to +85 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1

4. Functional diagram

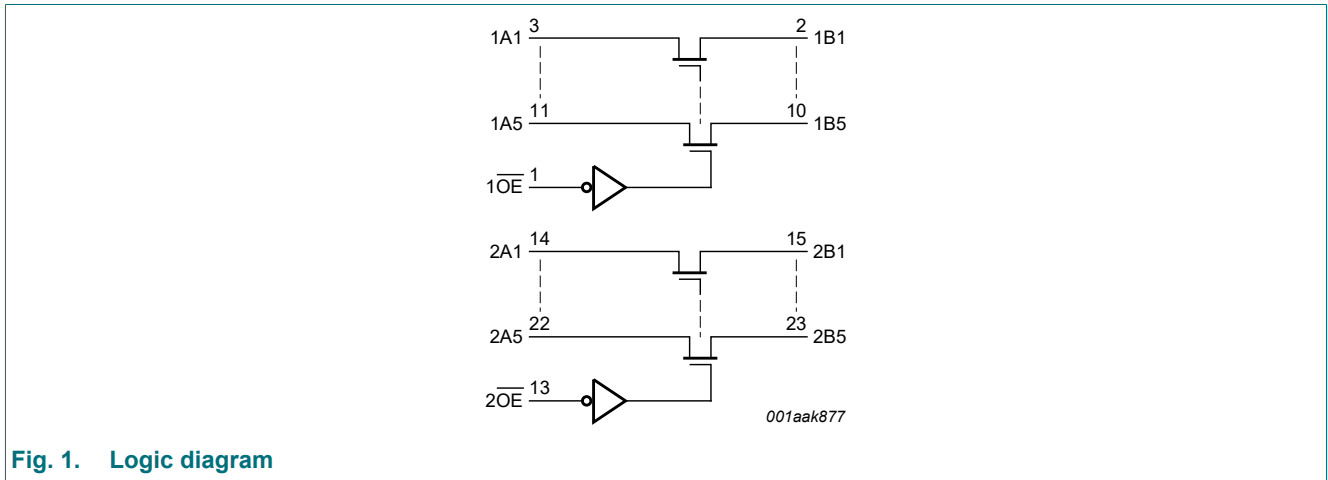
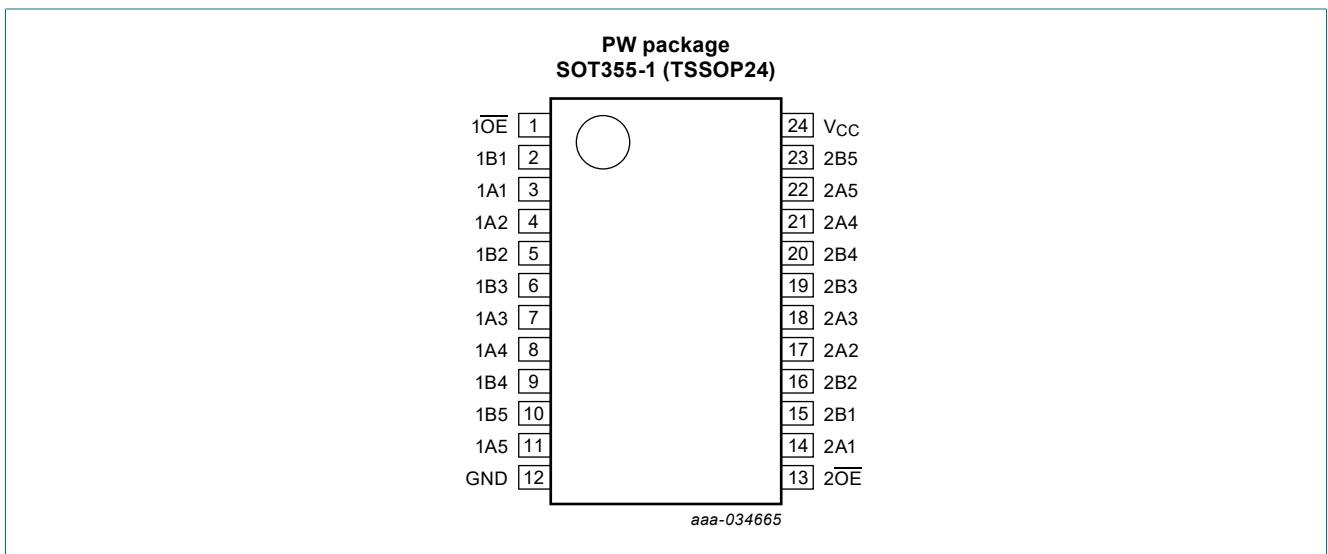


Fig. 1. Logic diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE, 2OE	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)
VCC	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	
1OE	2OE	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).

T_{amb} = -40 °C to +85 °C, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	+7.0	V
V _I	input voltage	[1]	-0.5	+7.0	V
I _O	output current	V _O < 0 V	-	±128	mA
I _{IK}	input clamping current	V _{I/O} = 0 V	-50	-	mA
T _{stg}	storage temperature		-65	+150	°C

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

8. Recommended operating conditions

Table 5. Operating conditions

All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CC}	supply voltage		4.5	-	5.5	V
V _{IH}	HIGH-level input voltage		2.0	-	-	V
V _{IL}	LOW-level input voltage		-	-	0.8	V
T _{amb}	ambient temperature	operating in free air	-40	-	+85	°C

9. Static characteristics

Table 6. Static characteristics

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ[1]	Max	
V _{IK}	input clamping voltage	V _{CC} = 4.5 V; I _I = -18 mA	-	-	-1.2	V
I _I	input leakage current	V _{CC} = 5.5 V; V _I = GND or 5.5 V	-	-	±1	µA
I _{CC}	supply current	V _{CC} = 5.5 V; I _O = 0 mA; V _I = V _{CC} or GND	-	-	1.5	mA
ΔI _{CC}	additional supply current	per input pin; V _{CC} = 5.5 V; one input at 3.4 V, other inputs at V _{CC} or GND [2]	-	-	2.5	mA
V _{pass}	pass voltage	see Fig. 2 to Fig. 6	-	-	-	V
C _I	input capacitance	control pins; V _I = 3 V or 0 V	-	3.2	-	pF
C _{io(off)}	off-state input/output capacitance	port off; V _I = 3 V or 0 V; n \overline{OE} = V _{CC}	-	6.0	-	pF
R _{ON}	ON resistance	V _{CC} = 4.5 V; V _I = 0 V; I _I = 64 mA [3]	-	5	7	Ω
		V _{CC} = 4.5 V; V _I = 0 V; I _I = 30 mA [3]	-	5	7	Ω
		V _{CC} = 4.5 V; V _I = 2.4 V; I _I = -15 mA [3]	-	17	50	Ω

[1] All typical values are at V_{CC} = 5 V, T_{amb} = 25 °C.

[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

[3] Measured by the voltage drop between the nAn and the nBn terminals at the indicated current through the switch. ON resistance is determined by the lowest voltage of the two (nAn or nBn) terminals.

9.1. Typical pass voltage graphs

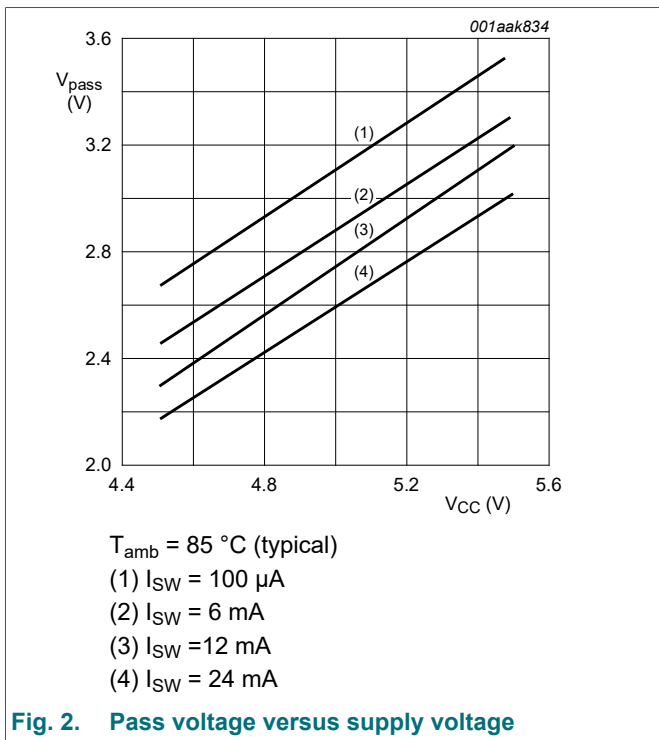


Fig. 2. Pass voltage versus supply voltage

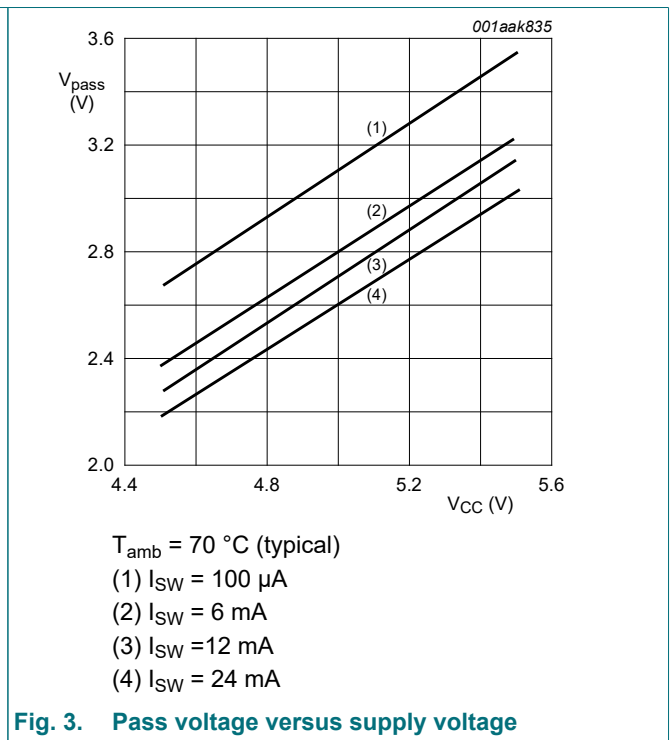


Fig. 3. Pass voltage versus supply voltage

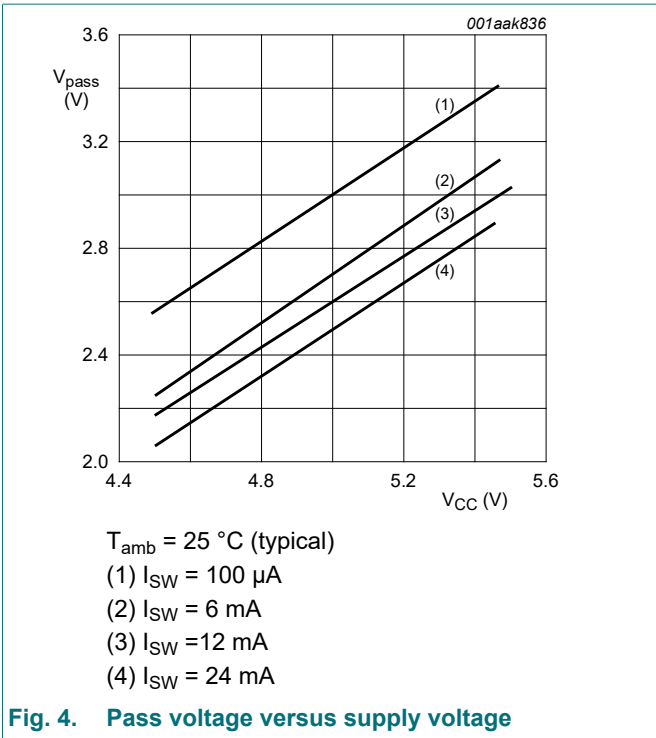


Fig. 4. Pass voltage versus supply voltage

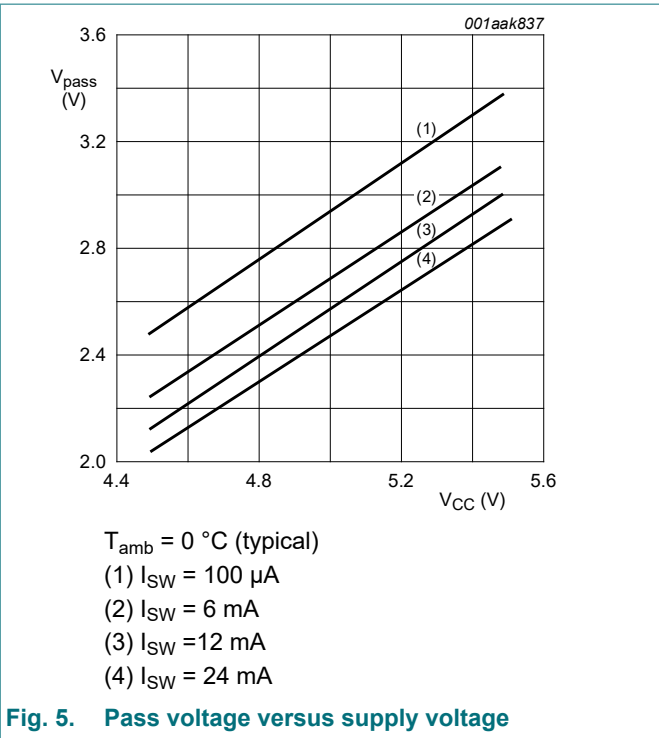


Fig. 5. Pass voltage versus supply voltage

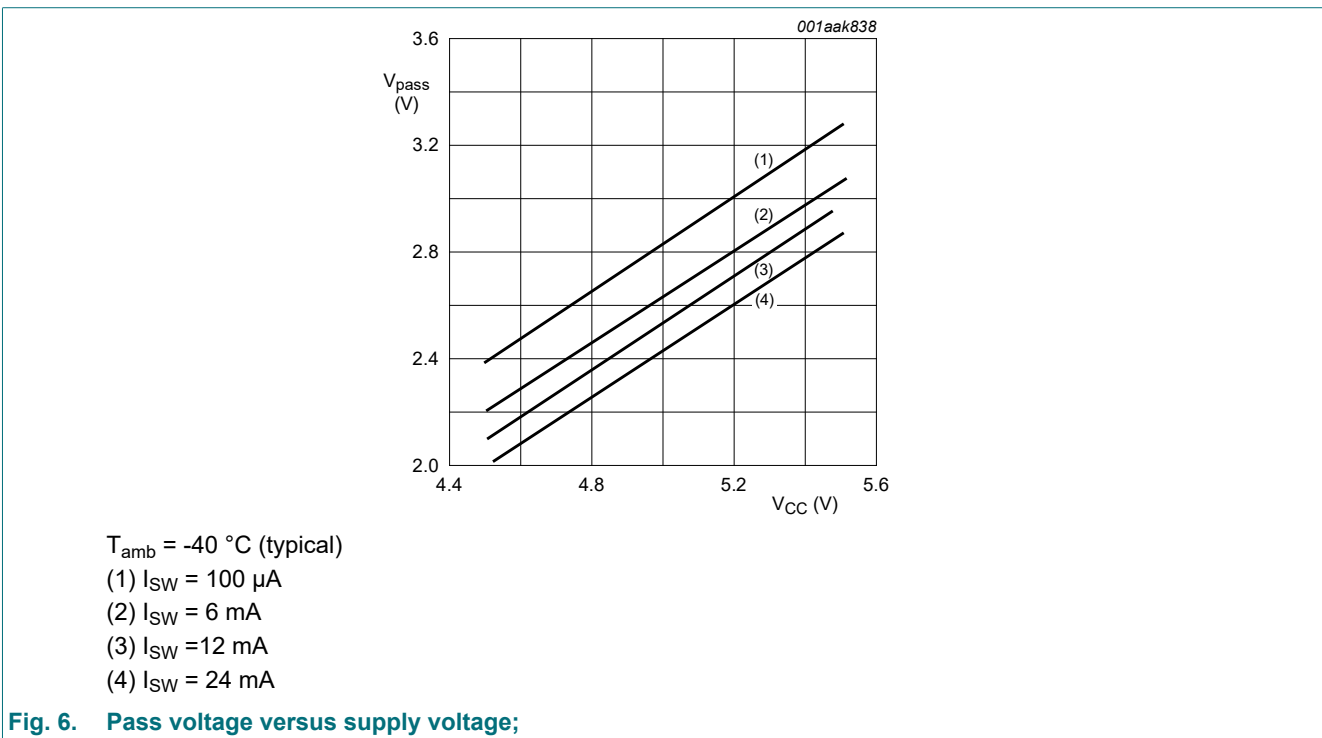


Fig. 6. Pass voltage versus supply voltage;

10. Dynamic characteristics

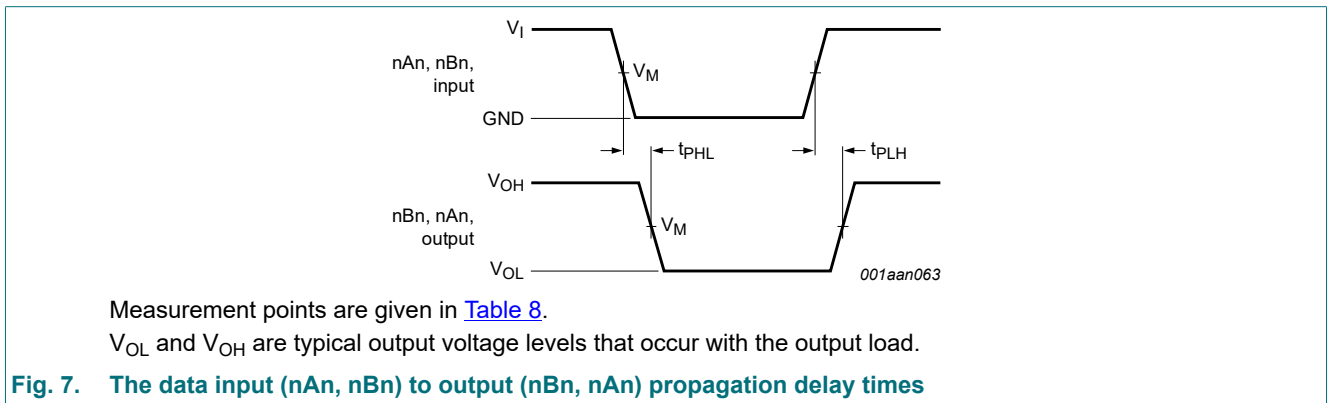
Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 9.

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ	Max	
t _{pd}	propagation delay	nAn, nBn to nBn, nAn; see Fig. 7 [1] [2]				
		V _{CC} = 5.0 V ± 0.5 V	-	-	0.25	ns
t _{en}	enable time	n $\overline{O}E$ to nAn or nBn; see Fig. 8 [2]				
		V _{CC} = 5.0 V ± 0.5 V	1.2	4.3	7.0	ns
t _{dis}	disable time	n $\overline{O}E$ to nAn or nBn; see Fig. 8 [2]				
		V _{CC} = 5.0 V ± 0.5 V	1.7	3.0	5.3	ns

- [1] The propagation delay is the calculated RC time constant of the typical ON resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).
- [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}.

10.1. Waveforms and test circuit



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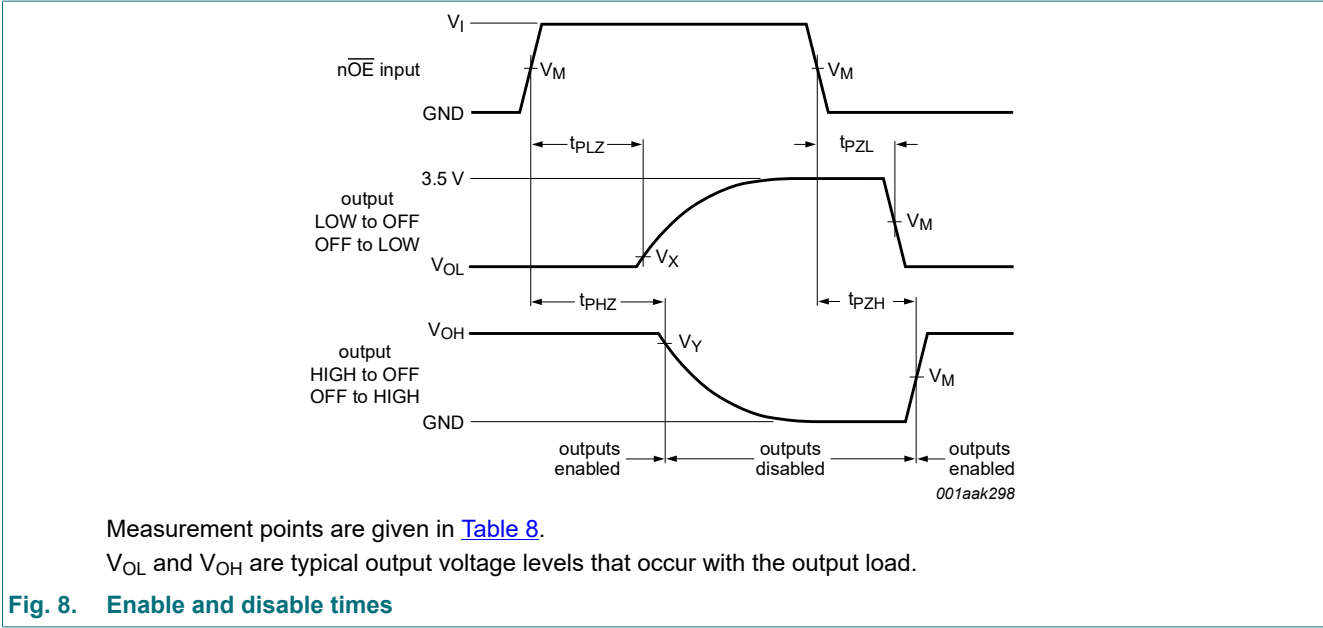
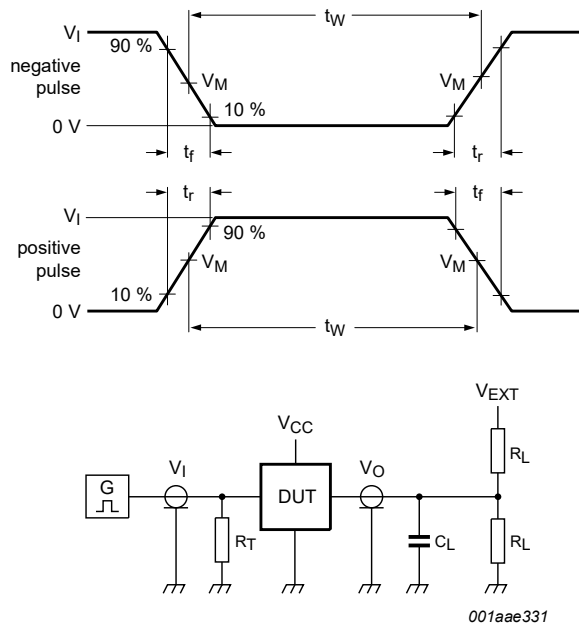


Table 8. Measurement points

Supply voltage	Input		Output		
V_{CC}	V_I	V_M	V_M	V_X	V_Y
$V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$	GND to 3.0 V	1.5 V	1.5 V	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$

10-bit level shifting bus switch with 5-bit output enables



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

All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz; Z_o = 50 Ω.

The outputs are measured one at a time with one transition per measurement.

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. 9. Test circuit for measuring 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}
V _{CC} = 5.0 V ± 0.5 V	GND to 3.0 V	≤ 2.5 ns	50 pF	500 Ω	open	7.0 V	open

11. Package outline

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

SOT355-1

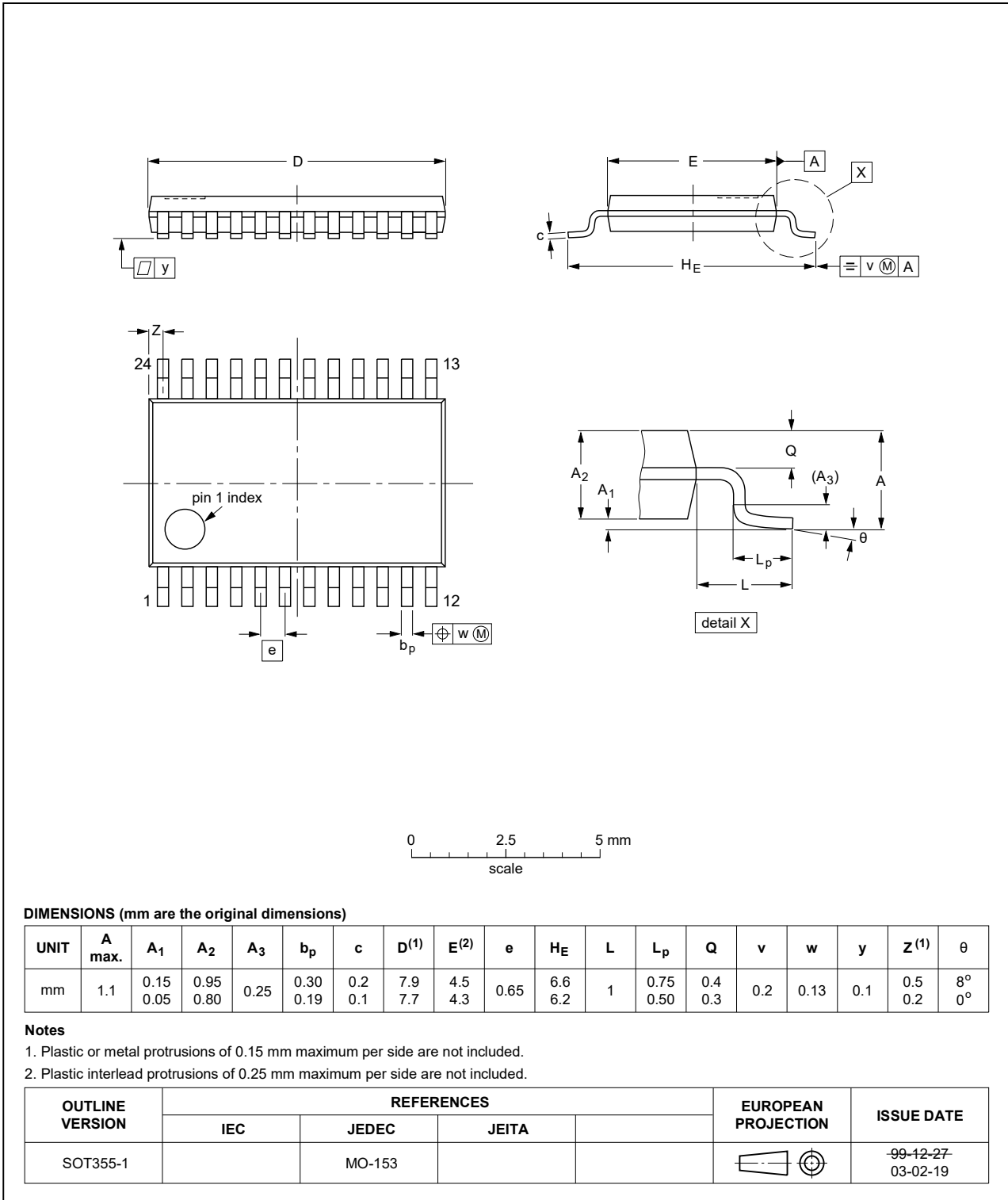


Fig. 10. Package outline SOT355-1 (TSSOP24)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
ESD	ElectroStatic Discharge
HBM	Human Body Model
PRR	Pulse Rate Repetition
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
CBTD3384_Q100 v.1	20231020	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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