74CBTLV1G125-Q100

Single bus switch

Rev. 1 — 26 January 2024 Product data sheet

1. General description

The 74CBTLV1G125-Q100 is a single high-speed line switch. The switch is disabled when the output enable ($\overline{OE}$) input is high.

To ensure the high-impedance OFF-state during power-up or power-down, tie $\overline{OE}$ to the V_{CC} through a pull-up resistor. The current-sinking capability of the driver determines the minimum value of the resistor.

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 potentially damaging backflow current through the device when it is powered down.

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
- Supply voltage range from 2.3 V to 3.6 V
- Overvoltage tolerant control inputs to 3.6 V
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8C (2.7 V to 3.6 V)
- 5 Ω switch connection between two ports
- Rail to rail switching on data I/O ports
- CMOS low power consumption
- Latch-up performance meets requirements of JESD78 Class I
- I_{OFF} circuitry provides partial Power-down mode operation
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101E exceeds 1000 V

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74CBTLV1G125GW-Q100	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74CBTLV1G125GV-Q100	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753

4. Marking

Table 2. Marking

Type number	Marking code [1]
74CBTLV1G125GW-Q100	bM
74CBTLV1G125GV-Q100	b25

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

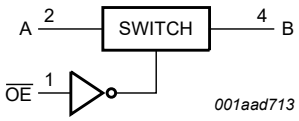


Fig. 1. Logic symbol

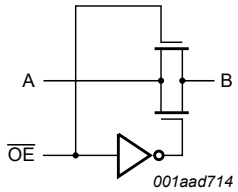
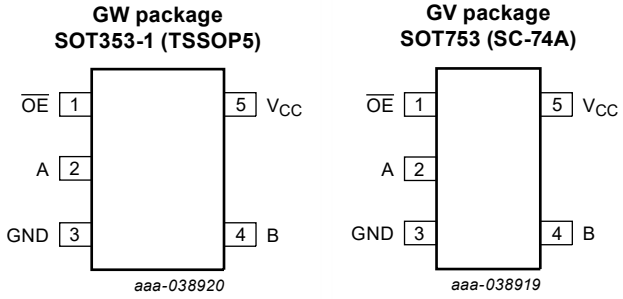


Fig. 2. Logic diagram

6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT353-1 and SOT753	SOT886, SOT1115 and SOT1202	
$\overline{OE}$	1	1	output enable input $\overline{OE}$ (active LOW)
A	2	2	data input or output A
GND	3	3	ground (0 V)
B	4	4	data input or output B
n.c.	-	5	not connected
V_{CC}	5	6	supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level.

Output enable input $\overline{OE}$	Function switch
L	ON-state
H	OFF-state

8. Limiting values

Table 5. 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	+4.6	V
V_I	input voltage	[1]	-0.5	+4.6	V
V_{SW}	switch voltage	enable and disable mode	-0.5	V_{CC} + 0.5	V
I_{IK}	input clamping current	$V_{I/O}$ < -0.5 V	-50	-	mA
I_{SK}	switch clamping current	V_I < -0.5 V or V_I > V_{CC} + 0.5 V	-	±50	mA
I_{SW}	switch current	V_{SW} = 0 V to V_{CC}	-	±128	mA
I_{CC}	supply current		-	+50	mA
I_{GND}	ground current		-50	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	T_{amb} = -40 °C to +125 °C [2]	-	250	mW

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	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 V to 3.6 V [1]	0	-	20	ns/V

[1] Applies to control signal levels.

10. Static characteristics

Table 7. 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 °C to +85 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 2.3 V to 2.7 V	1.7	-	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V_{CC} = 2.7 V to 3.6 V	-	-	0.8	V
I_I	input leakage current	V_I = GND to V_{CC}; V_{CC} = 3.6 V	-	-	±1.0	µA
$I_{S(OFF)}$	OFF-state leakage current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} - GND; V_{CC} = 3.6 V; see Fig. 3	-	±0.1	±5	µA
$I_{S(ON)}$	ON-state leakage current	V_I = V_{IH} or V_{IL}; V_{CC} = 3.6 V; see Fig. 4	-	±0.1	±5	µA
I_{OFF}	power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V	-	-	±10	µA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 A; V_{CC} = 3.6 V	-	-	10	µA
ΔI_{CC}	additional supply current	control input; V_I = V_{CC} - 0.6 V; V_{CC} = 3.6 V [2]	-	-	300	µA
C_I	input capacitance	control input; V_I = 0 V or 3 V	-	2.5	-	pF
C_{sw}	switch capacitance	OFF-state	-	7.0	-	pF
		ON-state	-	10.3	-	pF
T_{amb} = -40 °C to +125 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 2.3 V to 2.7 V	1.7	-	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V_{CC} = 2.7 V to 3.6 V	-	-	0.8	V
I_I	input leakage current	V_I = GND to V_{CC}; V_{CC} = 3.6 V	-	-	±100	µA
$I_{S(OFF)}$	OFF-state leakage current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} - GND; V_{CC} = 3.6 V; see Fig. 3	-	-	±200	µA
$I_{S(ON)}$	ON-state leakage current	V_I = V_{IH} or V_{IL}; V_{CC} = 3.6 V; see Fig. 4	-	-	±200	µA
I_{OFF}	power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V	-	-	±10	µA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 A; V_{CC} = 3.6 V	-	-	200	µA
ΔI_{CC}	additional supply current	control input; V_I = V_{CC} - 0.6 V; V_{CC} = 3.6 V [2]	-	-	5000	µA

[1] Typical values are measured at T_{amb} = 25 °C and at V_{CC} = 3.3 V.
[2] One input at 3 V, other inputs at V_{CC} or GND.

Table 8. Resistance R_{ON}

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see test circuit Fig. 5.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
R_{ON}	ON resistance	V_{CC} = 2.3 V; see Fig. 6 [2]						
		I_{SW} = 64 mA; V_I = 0 V	-	4.7	10	-	15.0	Ω
		I_{SW} = 24 mA; V_I = 0 V	-	4.5	10	-	15.0	Ω
		I_{SW} = 15 mA; V_I = 1.7 V	-	11	25	-	38.0	Ω
		V_{CC} = 3.0 V; see Fig. 7						
		I_{SW} = 64 mA; V_I = 0 V	-	4.2	7	-	11.0	Ω
		I_{SW} = 24 mA; V_I = 0 V	-	4.1	7	-	11.0	Ω
		I_{SW} = 15 mA; V_I = 2.4 V	-	7.3	15	-	25.5	Ω

[1] Typical values are measured at T_{amb} = 25 °C.
[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.

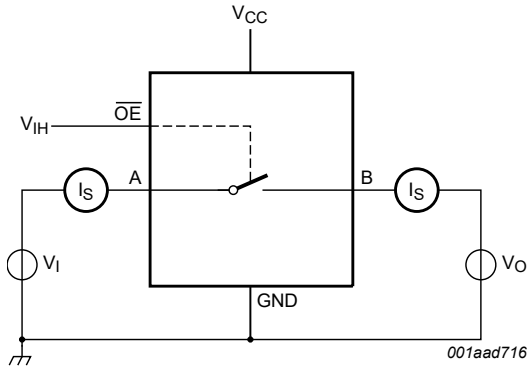


Fig. 3. Test circuit for measuring OFF-state leakage current

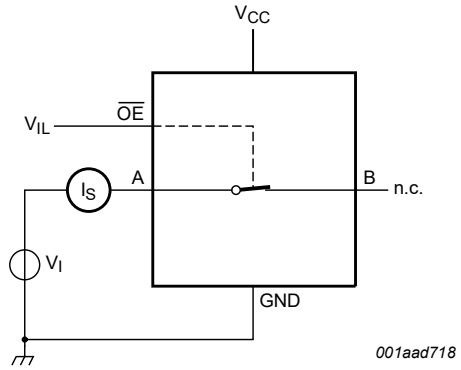
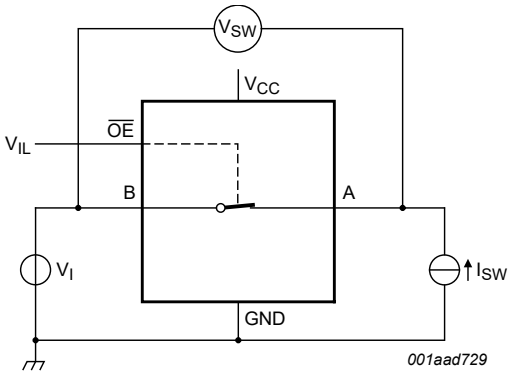
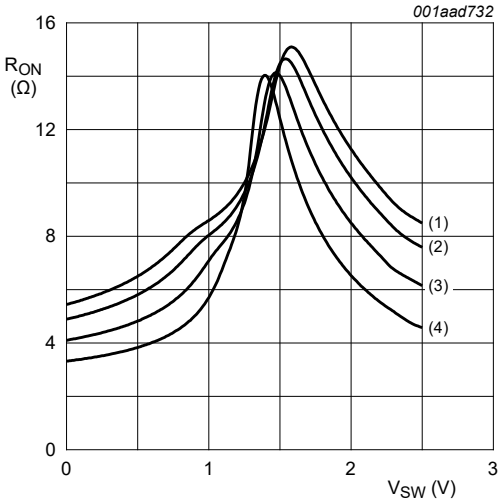


Fig. 4. Test circuit for measuring ON-state leakage current



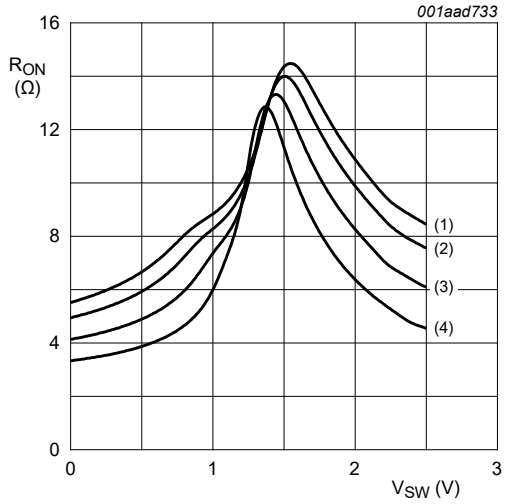
$R_{ON} = V_{SW} / I_{SW}$.

Fig. 5. Test circuit for measuring ON-resistance



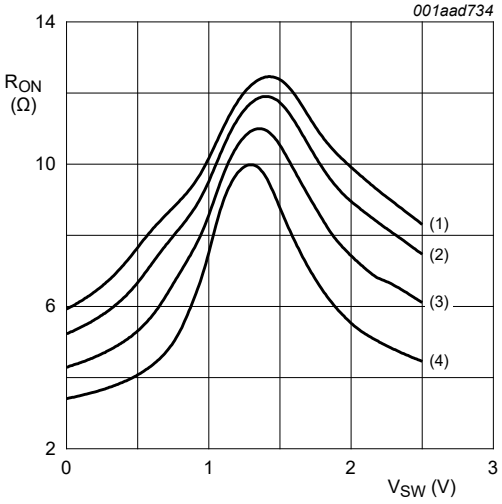
(1) T_{amb} = 125 °C
(2) T_{amb} = 85 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = -40 °C

a. V_{CC} = 2.5 V; I_{SW} = 15 mA; V_{SW} = 1.7 V



(1) T_{amb} = 125 °C
(2) T_{amb} = 85 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = -40 °C

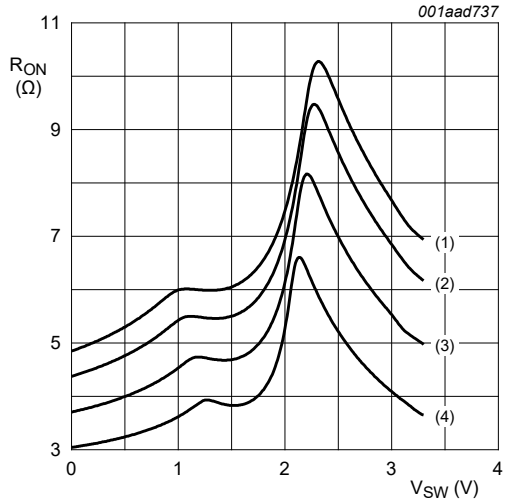
b. V_{CC} = 2.5 V; I_{SW} = 24 mA; V_{SW} = 0 V



(1) T_{amb} = 125 °C
(2) T_{amb} = 85 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = -40 °C

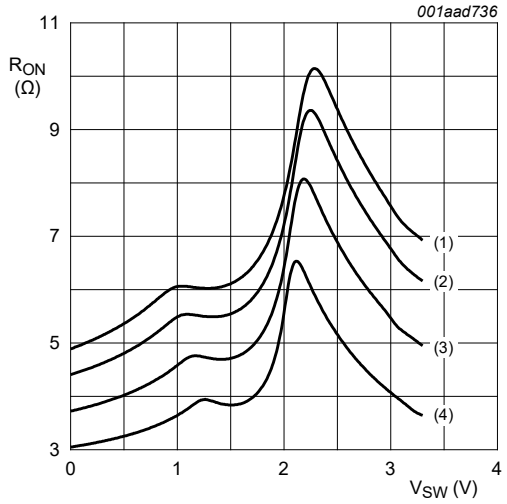
c. V_{CC} = 2.5 V; I_{SW} = 64 mA; V_{SW} = 0 V

Fig. 6. Switch ON-resistance as a function of input voltage at V_{CC} = 2.5 V



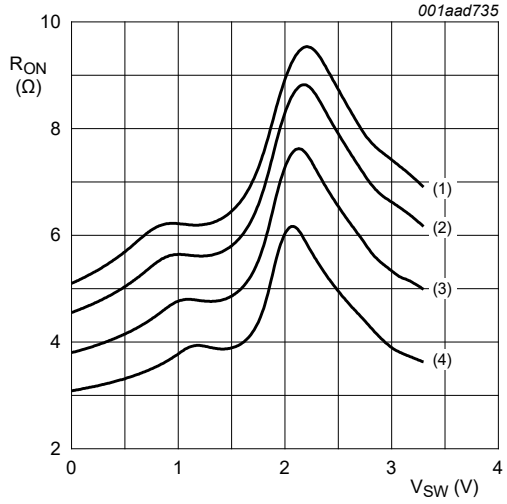
(1) T_{amb} = 125 °C
(2) T_{amb} = 85 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = -40 °C

a. V_{CC} = 3.3 V; I_{SW} = 15 mA; V_{SW} = 2.4 V



(1) T_{amb} = 125 °C
(2) T_{amb} = 85 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = -40 °C

b. V_{CC} = 3.3 V; I_{SW} = 24 mA; V_{SW} = 0 V



(1) T_{amb} = 125 °C
(2) T_{amb} = 85 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = -40 °C

c. V_{CC} = 3.3 V; I_{SW} = 64 mA; V_{SW} = 0 V

Fig. 7. Switch ON-resistance as a function of input voltage at V_{CC} = 3.3 V

11. Dynamic characteristics

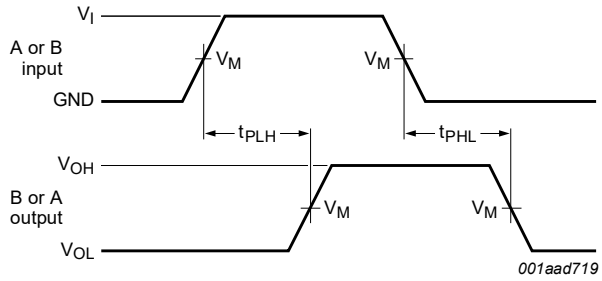
Table 9. Dynamic characteristics

GND = 0 V; see Fig. 10.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	A to B or B to A; see Fig. 8; R_L = ∞ Ω [2][3]						
		V_{CC} = 2.3 V to 2.7 V	-	-	0.21	-	0.32	ns
		V_{CC} = 3.0 V to 3.6 V	-	0.16	0.25	-	0.39	ns
t_{en}	enable time	$\overline{OE}$ to A or B; see Fig. 9; R_L = 500 Ω [4]						
		V_{CC} = 2.3 V to 2.7 V	1.0	2.50	4.00	1.0	5.00	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	2.05	4.00	1.0	5.00	ns
t_{dis}	disable time	$\overline{OE}$ to A or B; see Fig. 9; R_L = 500 Ω [5]						
		V_{CC} = 2.3 V to 2.7 V	1.0	2.80	5.00	1.0	6.30	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	3.40	4.10	1.0	5.40	ns

[1] All typical values are measured at T_{amb} = 25 °C and at nominal V_{CC}.
[2] The propagation delay is the calculated RC time constant of the maximum 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}.

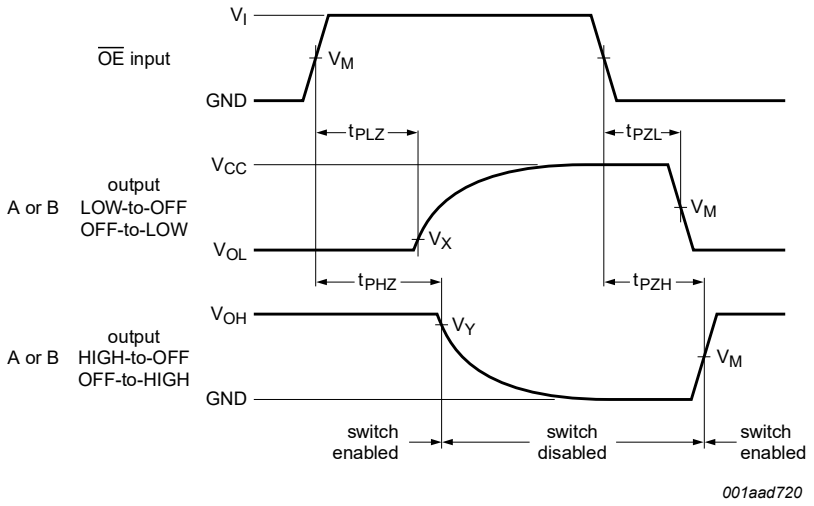
11.1. Waveforms and test circuit



Measurement points are given in Table 10.

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

Fig. 8. The data input (A or B) to output (B or A) propagation delays



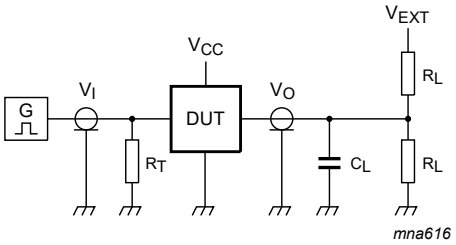
Measurement points are given in Table 10.

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

Fig. 9. Enable and disable times

Table 10. Measurement points

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



Test data is given in Table 11.

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} = Test voltage for switching times.

Fig. 10. Test circuit for measuring switching times

Table 11. Test data

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

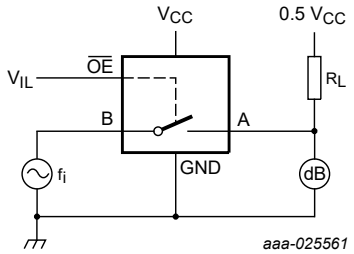
12. Additional dynamic characteristics

Table 12. Additional dynamic characteristics

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

Symbol	Parameter	Conditions	T_{amb} = 25 °C			Unit
			Min	Typ	Max	
$f_{(-3dB)}$	-3 dB frequency response	V_{CC} = 3.3 V; R_L = 50 Ω; see Fig. 11 [1]	-	263	-	MHz

[1] f_i is biased at 0.5 × V_{CC}.

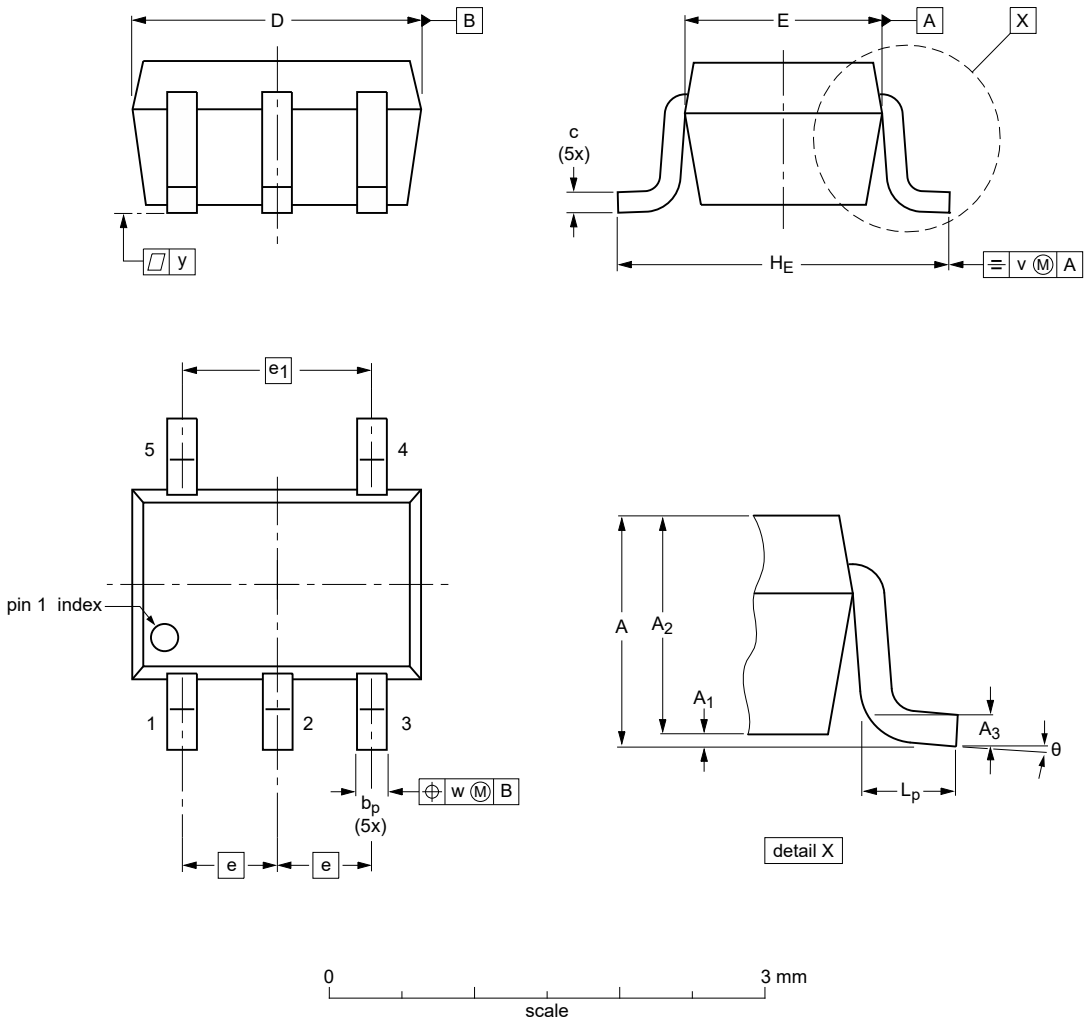


$\overline{OE}$ connected to GND; adjust f_i voltage to obtain 0 dBm level at output.
Increase f_i frequency until dB meter reads -3 dB.

Fig. 11. Test circuit for measuring the frequency response when channel is in ON-state

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm **SOT353-1**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L_p	v	w	y	θ
mm	max	1.1	0.1	1.0	0.15	0.30	0.25	2.2	1.35	0.65	1.3	2.4	0.46	0.3	0.1	0.1	8°
	min	0.8	0	0.8		0.15	0.08	1.8	1.15			1.8	0.26				0°

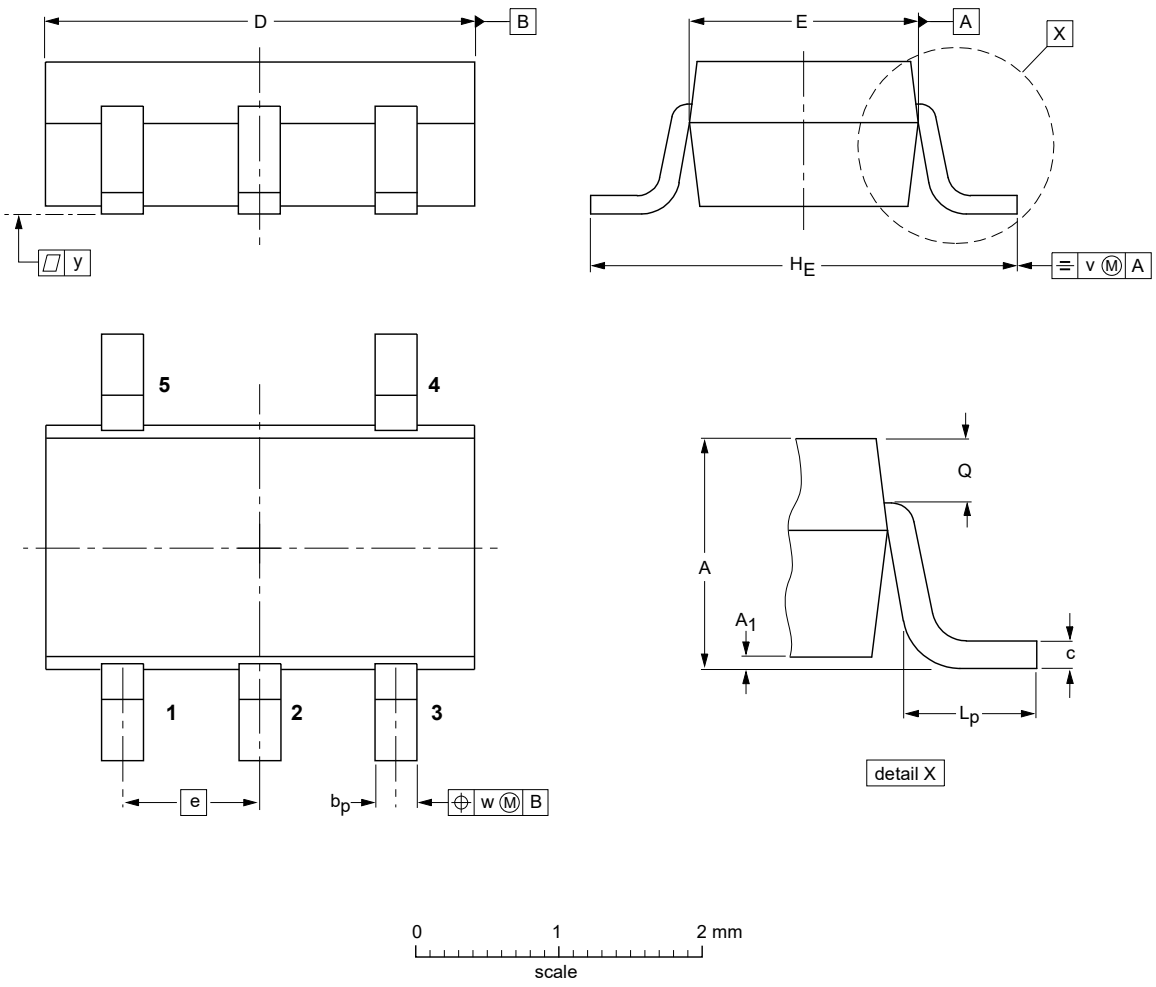
Note
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

sot353-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~21-12-15~~ 21-12-16

Fig. 12. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads **SOT753**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			~~02-04-16~~ 06-03-16

Fig. 13. Package outline SOT753 (SC-74A)

14. Abbreviations

Table 13. 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

15. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CBTLV1G125_Q100 v.1	20240126	Product data sheet	-	-

16. 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".
[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 https://www.nexperia.com.

Definitions

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