

74LVT2952-Q100

3.3 V Octal registered transceiver; 3-State

Rev. 1 — 23 September 2013

Product data sheet

1. General description

The 74LVT2952-Q100 is a high-performance BiCMOS product designed for V_{CC} operation at 3.3 V.

This device combines low static and dynamic power dissipation with high speed and high output drive.

The 74LVT2952-Q100 device is an 8-bit registered transceiver. Two 8-bit back-to-back registers store data flowing in both directions between two bidirectional buses.

If the clock enable ($\overline{CE_{xx}}$) is LOW, data applied to the inputs is entered and stored on the rising edge of the clock (CP_{xx}). The data is then present at the 3-state output buffers, but is only accessible when the output enable ($\overline{OE_{xx}}$) is LOW. Data flow from A_n inputs to B_n outputs is the same as for B_n inputs to A_n outputs.

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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
- 8-bit registered transceiver
- Independent registers for A and B buses
- Input and output interface capability to systems at 5 V supply
- TTL input and output switching levels
- Output capability: $+64\text{ mA}/-32\text{ mA}$
- Latch-up protection exceeds 500 mA per JESD78 class II level A
- ESD protection:
 - ◆ MIL-STD-883, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)
- Bus-hold data inputs eliminate the need for external pull-up resistors for unused inputs
- Live insertion/extraction permitted
- Power-up reset
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus



3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVT2952D-Q100	−40 °C to +85 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVT2952PW-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

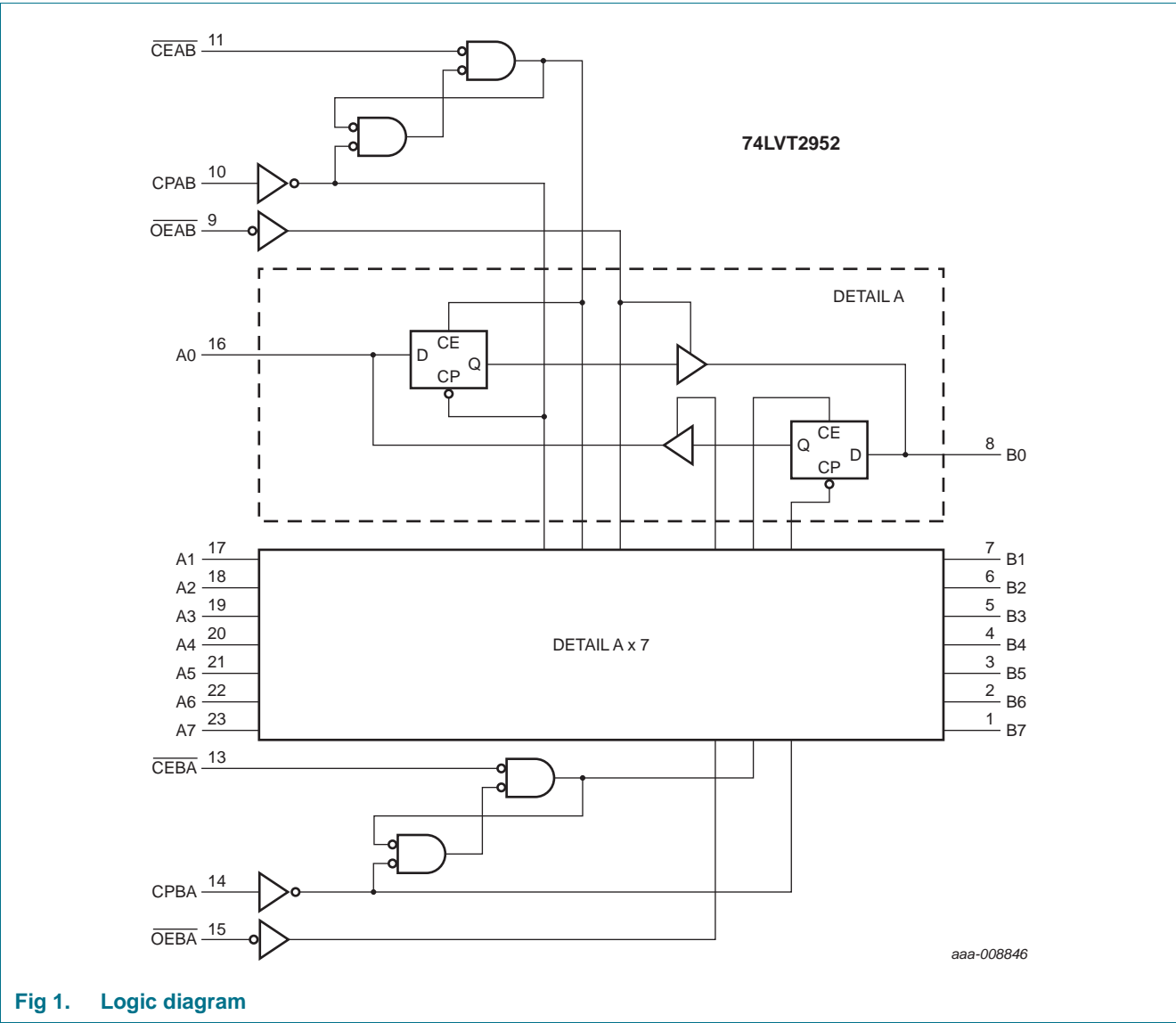
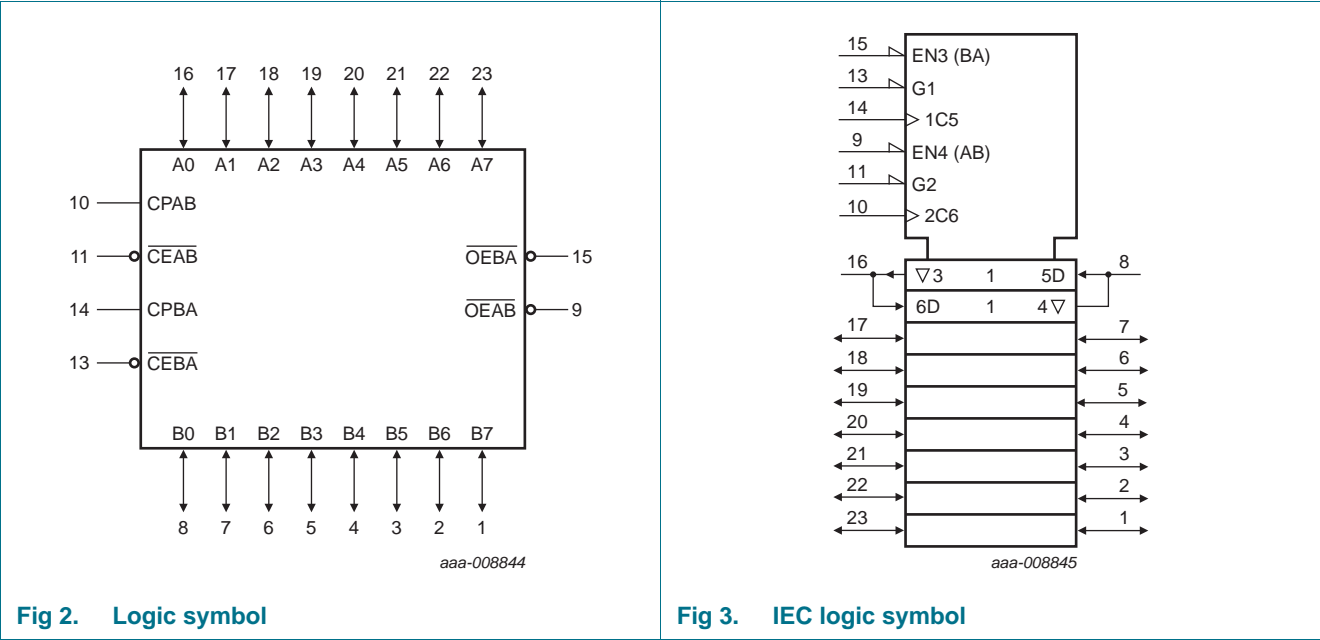
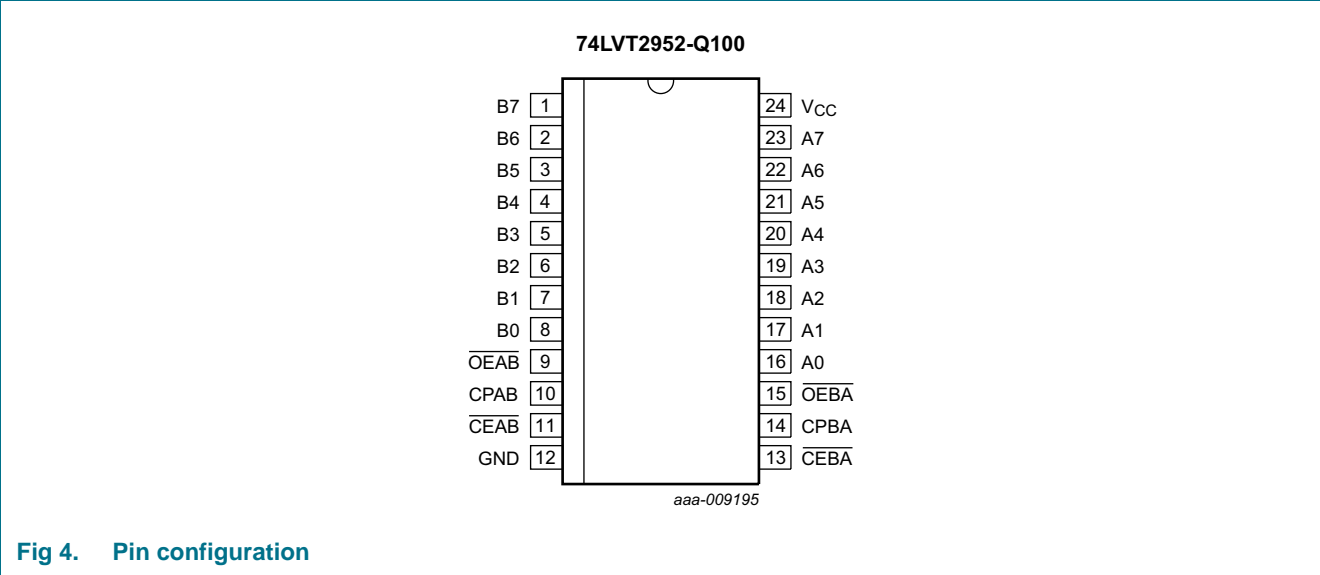


Fig 1. Logic diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
B7 to B0	1, 2, 3, 4, 5, 6, 7, 8	data input/output (B side)
OEAB, OEBA	9, 15	output enable input (active LOW)
CPAB, CPBA	10, 14	clock input
CEAB, CEBA	11, 13	clock enable input
GND	12	ground (0 V)
A0 to A7	16, 17, 18, 19, 20, 21, 22, 23	data input/output (A side)
V _{CC}	24	supply voltage

6. Functional description

Table 3. Function selection^[1]

Inputs			Internal	Operating mode
An, Bn	CPxx ^[2]	CExx ^[2]		
X	X	H	nc	hold data
L	↑	L	L	load data
H	↑	L	H	load data

- [1] H = HIGH voltage level;
 L = LOW voltage level;
 X = don't care;
 ↑ = LOW-to-HIGH clock transition;
 nc = no change.

- [2] xx = AB or BA.

Table 4. Function selection^[1]

Inputs	Internal Q	An, Bn outputs	Operating mode
OExx ^[2]			
H	X	Z	outputs disabled
L	L	L	outputs enabled
L	H	H	outputs enabled

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

- [2] xx = AB or BA.

7. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).^{[1][2]}

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	+4.6	V
V _I	input voltage		^[3] -0.5	7.0	V
V _O	output voltage	output in OFF or HIGH state	^[3] -0.5	+7	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
I _{OK}	output clamping current	V _O < 0 V	-50	-	mA
I _O	output current	output in LOW state	-	128	mA
		output in HIGH state	-64	-	mA
T _{stg}	storage temperature		-65	+150	°C
T _j	junction temperature		-	+150	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +85 °C	^[4] -	500	mW

- [1] Exceeding the values listed may permanently damage the device. The values are stress ratings only and functional operation of the device at or beyond the values indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- [2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment, can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
- [3] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
- [4] For SO20 package: above 70 °C derate linearly with 8 mW/K.
For TSSOP20 package: above 60 °C derate linearly with 5.5 mW/K.

8. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		2.7	3.6	V
V _I	input voltage		0	5.5	V
I _{OH}	HIGH-level output current		-	-32	mA
I _{OL}	LOW-level output current		-	32	mA
		current duty cycle ≤ 50 %; f _i ≥ 1 kHz	-	64	mA
T _{amb}	ambient temperature	in free air	-40	+85	°C
Δt/ΔV	input transition rise and fall rate	output enabled	-	10	ns/V

9. Static characteristics

Table 7. Static characteristics

At recommended operating conditions. 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} = 2.7 V; I _{IK} = -18 mA	-1.2	-0.9	-	V
V _{IH}	HIGH-level input voltage		2.0	-	-	V
V _{IL}	LOW-level input voltage		-	-	0.8	V
V _{OH}	HIGH-level output voltage	V _{CC} = 2.7 V to 3.6 V; I _{OH} = -100 µA	V _{CC} - 0.2	V _{CC} - 0.1	-	V
		V _{CC} = 2.7 V; I _{OH} = -8 mA	2.4	2.5	-	V
		V _{CC} = 3.0 V; I _{OH} = -32 mA	2.0	2.2	-	V
V _{OL}	LOW-level output voltage	V _{CC} = 2.7 V; I _{OL} = 100 µA	-	0.1	0.2	V
		V _{CC} = 2.7 V; I _{OL} = 24 mA	-	0.3	0.5	V
		V _{CC} = 3.0 V; I _{OL} = 16 mA	-	0.25	0.4	V
		V _{CC} = 3.0 V; I _{OL} = 32 mA	-	0.3	0.5	V
		V _{CC} = 3.0 V; I _{OL} = 64 mA	-	0.4	0.55	V
V _{OL(pu)}	power-up LOW-level output voltage	V _{CC} = 3.6 V; I _O = 1 mA; V _I = GND or V _{CC} ^[2]	-	0.13	0.55	V
I _I	input leakage current	control pins				
		V _{CC} = 0 V or 3.6 V; V _I = 5.5 V	-	1	10	µA
		V _{CC} = 3.6 V; V _I = V _{CC} or GND	-	±0.1	±1	µA
	I/O data pins ^[3]					
		V _{CC} = 3.6 V; V _I = 5.5 V	-	1	20	µA
		V _{CC} = 3.6 V; V _I = V _{CC}	-	0.1	1	µA
		V _{CC} = 3.6 V; V _I = 0 V	-5	-1	-	µA
I _{OFF}	power-off leakage current	V _{CC} = 0 V; V _I or V _O = 0 V to 4.5 V	-	1	±100	µA
I _{LO}	output leakage current	V _O = 5.5 V; V _{CC} = 3.6 V; output HIGH	-	60	125	µA
I _{O(pu/pd)}	power-up/power-down output current	V _{CC} ≤ 1.2 V V _O = 0.5 V to V _{CC} ; V _I = GND or V _{CC} ; $\overline{\text{OE}}_{\text{xx}}$ = don't care ^[4]	-	1	±100	µA
I _{BHL}	bus hold LOW current	V _{CC} = 3.0 V; V _I = 0.8 V	75	150	-	µA
I _{BHH}	bus hold HIGH current	V _{CC} = 3.0 V; V _I = 2.0 V	-	-150	-75	µA
I _{BHLO}	bus hold LOW overdrive current	V _{CC} = 0 V to 3.0 V; V _I = 3.6 V ^[5]	500	-	-	µA
I _{BHHO}	bus hold HIGH overdrive current	V _{CC} = 0 V to 3.0 V; V _I = 3.6 V ^[5]	-	-	-500	µA
I _{CC}	supply current	V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A				
		outputs HIGH	-	0.13	0.19	mA
		outputs LOW	-	3	12	mA
		outputs disabled	-	0.13	0.19	mA
ΔI _{CC}	additional supply current	per input pin; V _{CC} = 3.0 V to 3.6 V; one input = V _{CC} - 0.6 V; other inputs at V _{CC} or GND ^[6]	-	0.1	0.2	mA
C _I	input capacitance	control inputs; outputs disabled; V _I = 0 V or 3.0 V	-	4	-	pF

Table 7. Static characteristics ...continued

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

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
C _{I/O}	input/output capacitance	at I/O data pins, outputs disabled; V _{I/O} = 0 V or 3.0 V	-	8	-	pF

- [1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.
- [2] For valid test results, data must not be loaded into the flip-flops (or latches) after applying power.
- [3] Unused pins at V_{CC} or GND.
- [4] This parameter is valid for any V_{CC} between 0 V and 1.2 V with a transition time of up to 10 ms. From V_{CC} = 1.2 V to V_{CC} = 3.3 V ± 0.3 V a transition time of 100 ms is permitted. This parameter is valid for T_{amb} = +25 °C only.
- [5] This parameter is the bus hold overdrive current required to force the input to the opposite logic state.
- [6] This parameter is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

10. Dynamic characteristics

Table 8. Dynamic characteristicsVoltages are referenced to GND (ground = 0 V). For test circuit, see [Figure 8](#).

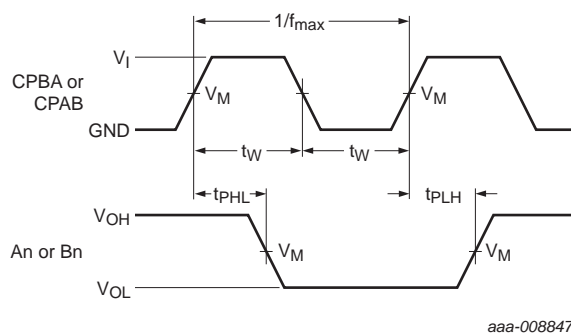
Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
t _{PLH}	LOW to HIGH propagation delay	CPBA to An or CPAB to Bn; see Figure 5				
		V _{CC} = 2.7 V	-	-	7.1	ns
		V _{CC} = 3.3 V ± 0.3 V	1.3	3.1	6.1	ns
t _{PHL}	HIGH to LOW propagation delay	CPBA to An or CPAB to Bn; see Figure 5				
		V _{CC} = 2.7 V	-	-	6.9	ns
		V _{CC} = 3.3 V ± 0.3 V	1.8	3.8	6.0	ns
t _{PZH}	OFF-state to HIGH propagation delay	OEBA to An; OEAB to Bn; see Figure 7				
		V _{CC} = 2.7 V	-	-	6.7	ns
		V _{CC} = 3.3 V ± 0.3 V	1.0	3.4	5.6	ns
t _{PZL}	OFF-state to LOW propagation delay	OEBA to An; OEAB to Bn; see Figure 7				
		V _{CC} = 2.7 V	-	-	8.0	ns
		V _{CC} = 3.3 V ± 0.3 V	1.2	3.6	6.5	ns
t _{PHZ}	HIGH to OFF-state propagation delay	OEBA to An; OEAB to Bn; see Figure 7				
		V _{CC} = 2.7 V	-	-	6.9	ns
		V _{CC} = 3.3 V ± 0.3 V	1.0	3.7	6.3	ns
t _{PLZ}	LOW to OFF-state propagation delay	OEBA to An; OEAB to Bn; see Figure 7				
		V _{CC} = 2.7 V	-	-	5.3	ns
		V _{CC} = 3.3 V ± 0.3 V	1.6	3.4	5.1	ns
t _{su(H)}	set-up time HIGH	An to CPAB or Bn to CPBA; see Figure 7				
		V _{CC} = 2.7 V	2.8	-	-	ns
		V _{CC} = 3.3 V ± 0.3 V	2.5	1.0	-	ns
		CEAB to CPAB or CEBA to CPBA; see Figure 7				
		V _{CC} = 2.7 V	0.8	-	-	ns
		V _{CC} = 3.3 V ± 0.3 V	0.9	0.3	-	ns

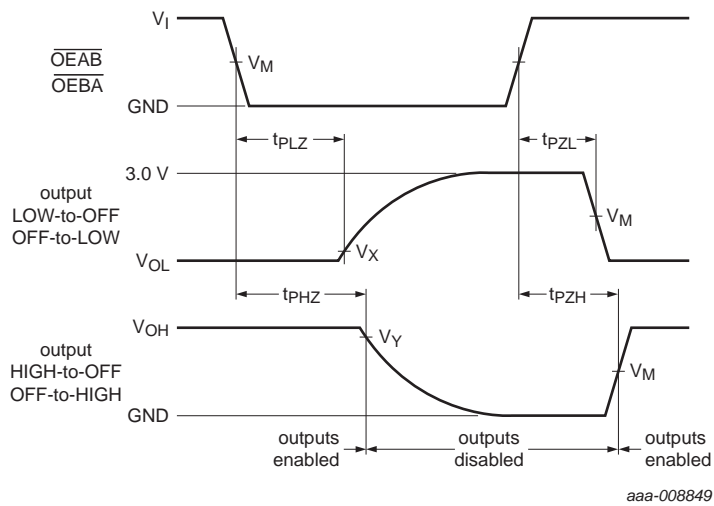
Table 8. Dynamic characteristics ...continuedVoltages are referenced to GND (ground = 0 V). For test circuit, see [Figure 8](#).

Symbol	Parameter	Conditions	$T_{\text{amb}} = -40\text{ }^{\circ}\text{C to } +85\text{ }^{\circ}\text{C}$			Unit
			Min	Typ ^[1]	Max	
$t_{\text{su(L)}}$	set-up time LOW	An to CPAB or Bn to CPBA; see Figure 7				
		$V_{\text{CC}} = 2.7\text{ V}$	3.0	-	-	ns
		$V_{\text{CC}} = 3.3\text{ V} \pm 0.3\text{ V}$	2.5	1.0	-	ns
		$\overline{\text{CEAB}}$ to CPAB or $\overline{\text{CEBA}}$ to CPBA; see Figure 7				
		$V_{\text{CC}} = 2.7\text{ V}$	2.7	-	-	ns
$t_{\text{h(H)}}$	hold time HIGH	An to CPAB or Bn to CPBA; see Figure 7				
		$V_{\text{CC}} = 2.7\text{ V}$	0.7	-	-	ns
		$V_{\text{CC}} = 3.3\text{ V} \pm 0.3\text{ V}$	+1.5	-0.5	-	ns
		$\overline{\text{CEAB}}$ to CPAB or $\overline{\text{CEBA}}$ to CPBA; see Figure 7				
		$V_{\text{CC}} = 2.7\text{ V}$	0.7	-	-	ns
$t_{\text{h(L)}}$	hold time LOW	An to CPAB or Bn to CPBA; see Figure 7				
		$V_{\text{CC}} = 2.7\text{ V}$	2.6	-	-	ns
		$V_{\text{CC}} = 3.3\text{ V} \pm 0.3\text{ V}$	+1.5	-0.5	-	ns
		$\overline{\text{CEAB}}$ to CPAB or $\overline{\text{CEBA}}$ to CPBA; see Figure 7				
		$V_{\text{CC}} = 2.7\text{ V}$	2.6	-	-	ns
t_{w}	pulse width	CPAB or CPBA; HIGH or LOW; see Figure 5				
		$V_{\text{CC}} = 2.7\text{ V}$	3.3	-	-	ns
		$V_{\text{CC}} = 3.3\text{ V} \pm 0.3\text{ V}$	3.3	1.0	-	ns
		f_{max}	150	200	-	MHz
		f_{max}				

[1] Typical values are measured at $T_{\text{amb}} = 25\text{ }^{\circ}\text{C}$ and $V_{\text{CC}} = 3.3\text{ V}$.

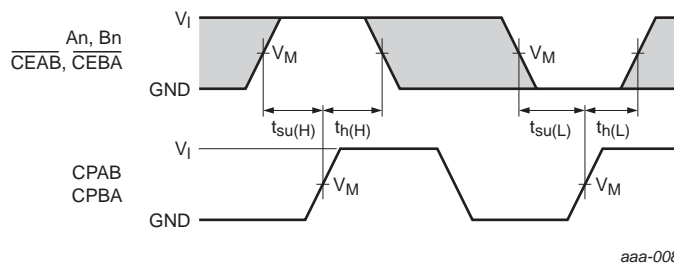
11. Waveforms

See [Table 9](#) for measurement points**Fig 5.** Clock input to output propagation delay, clock pulse width and maximum frequency



See Table 9 for measurement points

Fig 6. 3-state output enable and disable times



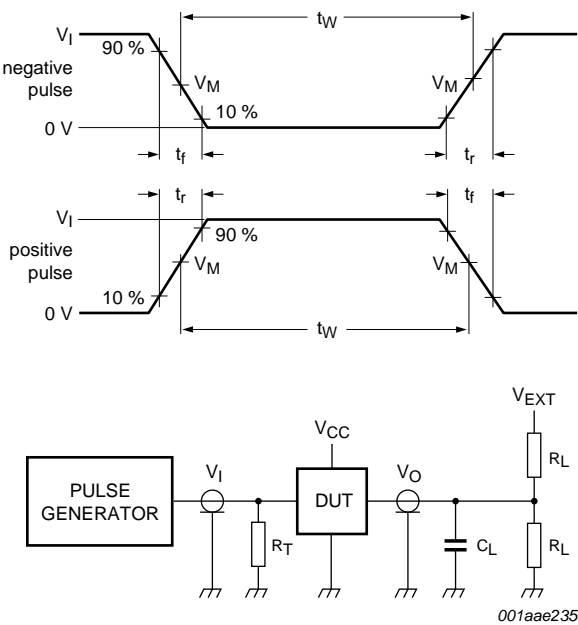
See Table 9 for measurement points

The shaded areas indicate when the input is permitted to change for predictable output performance

Fig 7. Data setup and hold times

Table 9. Measurement points

V _{CC}	Input		Output		
	V _I	V _M	V _M	V _X	V _Y
2.7 V to 3.6 V	GND to 2.7 V	1.5 V	1.5 V	V _{OL} + 0.3 V	V _{OH} - 0.3 V



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

Definitions 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 8. Test circuit for switching times

Table 10. Test data

Input				Load		V_{EXT}		
V_I	f_i	t_W	t_r, t_f	R_L	C_L	t_{PHZ}, t_{PZH}	t_{PLZ}, t_{PZL}	t_{PLH}, t_{PHL}
2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	500 Ω	50 pF	GND	6 V	open

12. Package outline

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

SOT137-1

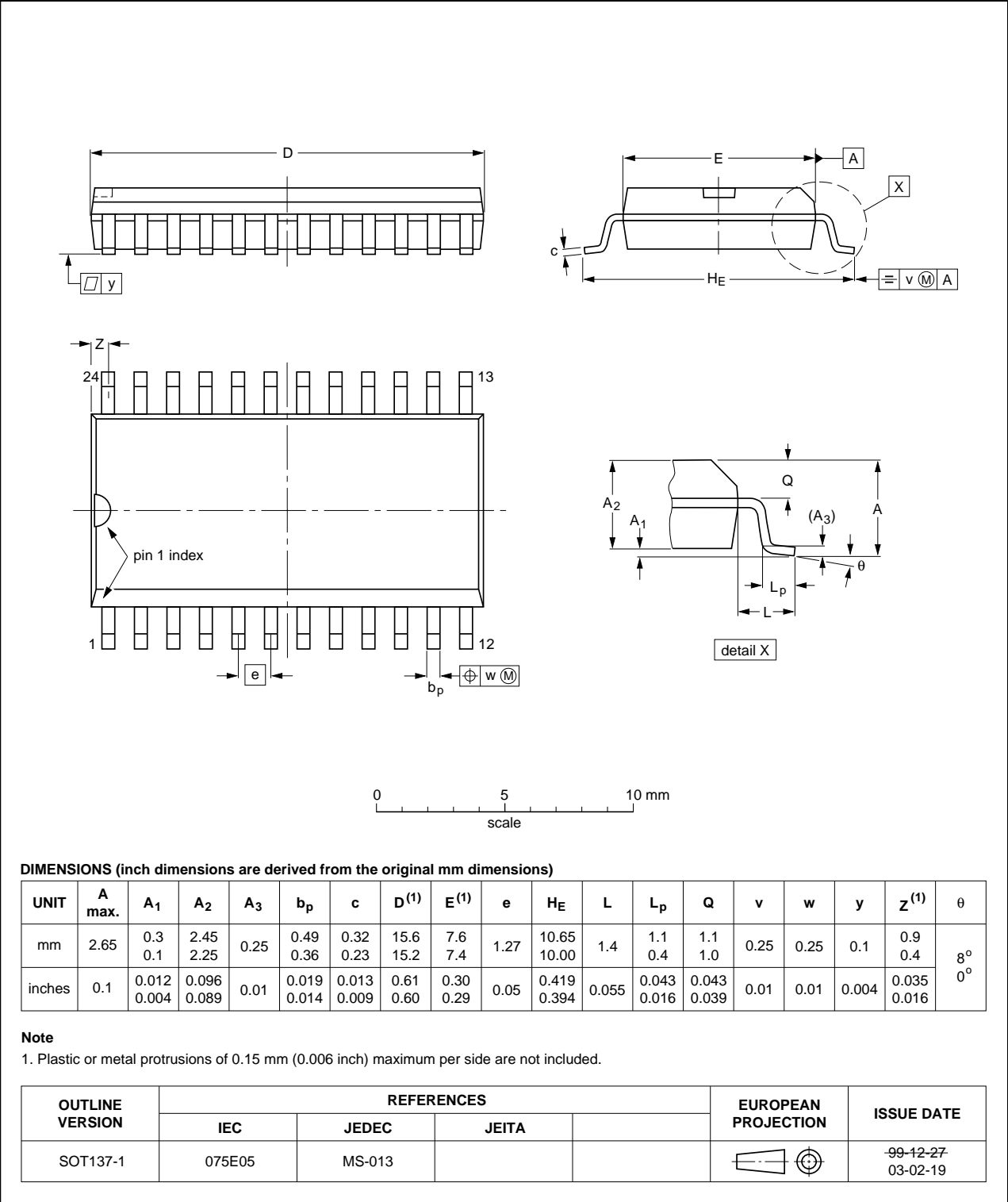


Fig 9. Package outline SOT137-1 (SO24)

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

SOT355-1

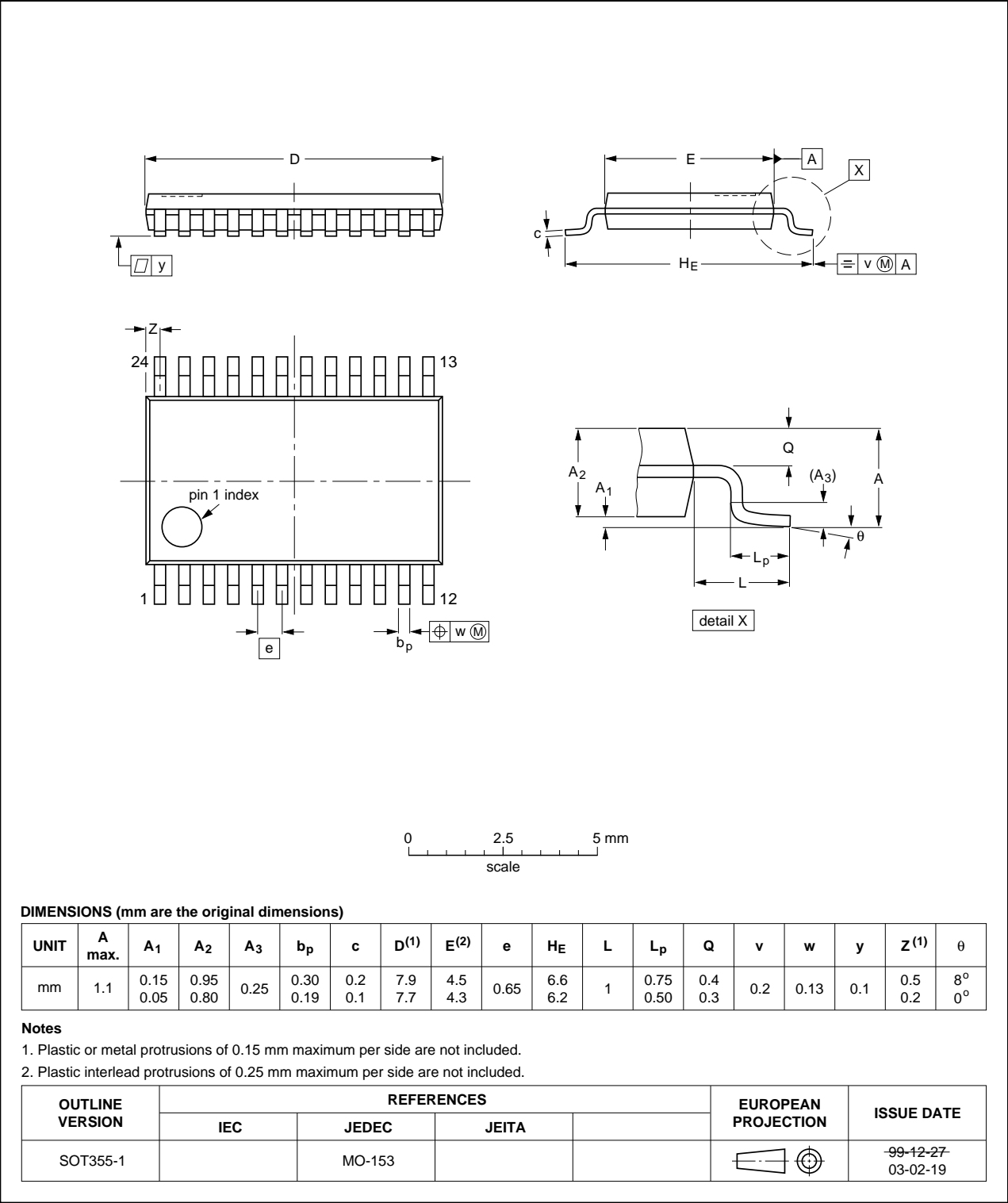


Fig 10. Package outline SOT355-1 (TSSOP24)

13. Abbreviations

Table 11. Abbreviations

Acronym	Description
BiCMOS	Bipolar 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 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT2952_Q100 v.1	20130923	Product data sheet	-	-

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.

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17. Contents

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