

# 74ABT823

## 9-bit D-type flip-flop with reset and enable; 3-state

Rev. 4 — 7 November 2011

Product data sheet

### 1. General description

The 74ABT823 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT823 is a 9-bit wide buffered register with clock enable input ( $\overline{\text{CE}}$ ) and master reset input ( $\overline{\text{MR}}$ ) which are ideal for parity bus interfacing in systems using many microprocessors.

The 74ABT823 is designed to eliminate the extra packages required to buffer existing registers and provide extra data width for wider data and address paths of buses carrying parity.

The register is fully edge-triggered. The state of each D input, one set-up time before the LOW-to-HIGH clock transition, is transferred to the corresponding output Q of the flip-flop.

### 2. Features and benefits

- High-speed parallel registers with positive edge-triggered D-type flip-flops
- Ideal where high speed, light loading, or increased fan-in are required with MOS microprocessors
- Output capability: +64 mA and –32 mA
- Power-on 3-state
- Power-on reset
- Latch-up protection exceeds 500 mA per JESD78B class II level A
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V

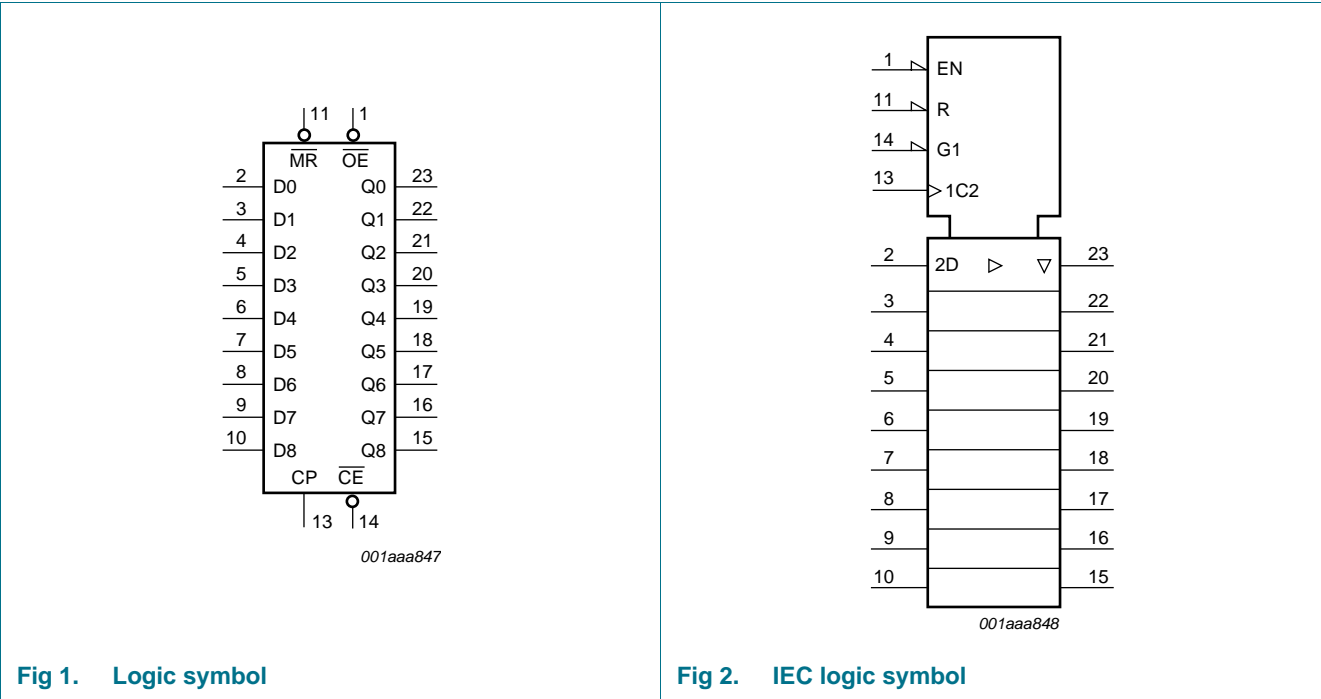
### 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74ABT823D	–40 °C to +85 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74ABT823DB	–40 °C to +85 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74ABT823PW	–40 °C to +85 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1



4. Functional diagram



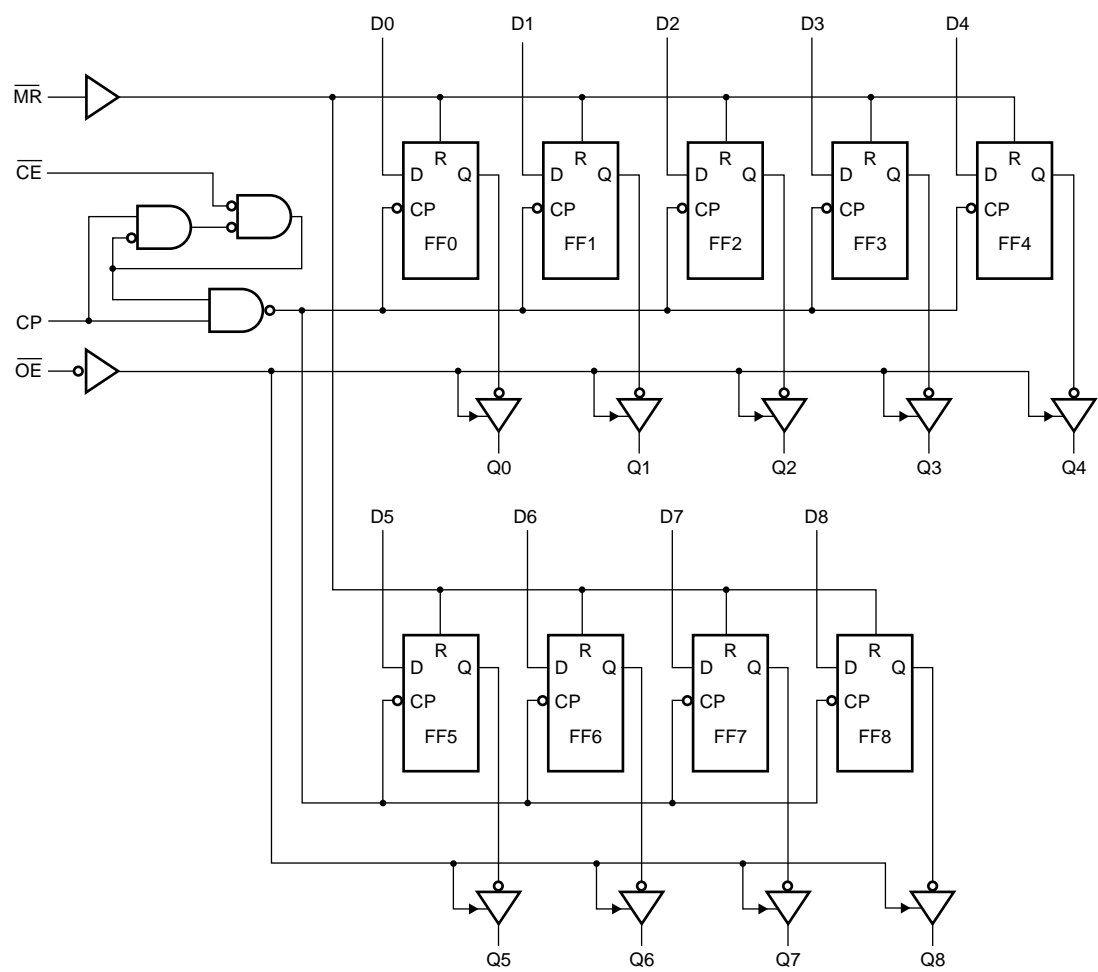


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

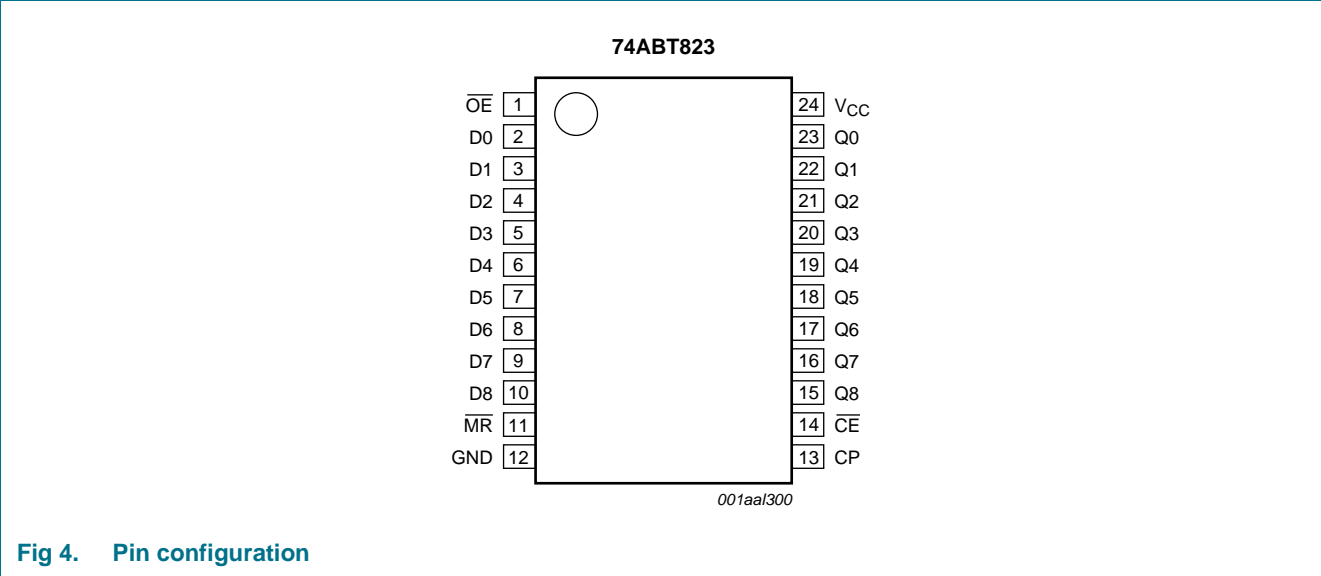


Fig 4. Pin configuration

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{OE}$	1	output enable input (active LOW)
D0, D1, D2, D3, D4, D5, D6, D7, D8	2, 3, 4, 5, 6, 7, 8, 9, 10	data input
MR	11	master reset input (active LOW)
GND	12	ground (0 V)
CP	13	clock pulse input (active rising edge)
$\overline{CE}$	14	clock enable input (active LOW)
Q8, Q7, Q6, Q5, Q4, Q3, Q2, Q1, Q0	15, 16, 17, 18, 19, 20, 21, 22, 23	data output
$V_{CC}$	24	positive supply voltage

## 6. Functional description

### 6.1 Function table

Table 3. Function table<sup>[1]</sup>

Input					Output	Operating mode
OE	MR	CE	CP	Dn	Qn	
L	L	X	X	X	L	clear
L	H	L	↑	h	H	load and read data
L	H	L	↑	l	L	
L	H	H	NC	X	NC	hold
H	X	X	X	X	Z	high-impedance

- [1] H = HIGH voltage level;  
 L = LOW voltage level;  
 h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
 l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
 ↑ = LOW-to-HIGH clock transition;  
 NC = no change;  
 X = don't care;  
 Z = high-impedance OFF-state.

## 7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7.0	V
V <sub>I</sub>	input voltage		<sup>[1]</sup> -1.2	+7.0	V
V <sub>O</sub>	output voltage	output in OFF-state or HIGH-state	<sup>[1]</sup> -0.5	+5.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-18	-	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
I <sub>O</sub>	output current	output in LOW-state	-	128	mA
T <sub>j</sub>	junction temperature		<sup>[2]</sup> -	150	°C
T <sub>stg</sub>	storage temperature		-65	+150	°C

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

## 8. Recommended operating conditions

**Table 5. Operating conditions**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		4.5	-	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_{IH}$	HIGH-level input voltage		2.0	-	-	V
$V_{IL}$	LOW-level Input voltage		-	-	0.8	V
$I_{OH}$	HIGH-level output current		-32	-	-	mA
$I_{OL}$	LOW-level output current		-	-	64	mA
$\Delta t/\Delta V$	input transition rise and fall rate		0	-	5	ns/V
$T_{amb}$	ambient temperature	in free air	-40	-	+85	°C

## 9. Static characteristics

**Table 6. Static characteristics**

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		Unit	
			Min	Typ	Max	Min	Max		
V <sub>IK</sub>	input clamping voltage	V <sub>CC</sub> = 4.5 V; I <sub>IK</sub> = −18 mA	−1.2	−0.9	-	−1.2	-	V	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>							
		V <sub>CC</sub> = 4.5 V; I <sub>OH</sub> = −3 mA	2.5	2.9	-	2.5	-	V	
		V <sub>CC</sub> = 5.0 V; I <sub>OH</sub> = −3 mA	3.0	3.4	-	3.0	-	V	
		V <sub>CC</sub> = 4.5 V; I <sub>OH</sub> = −32 mA	2.0	2.4	-	2.0	-	V	
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 4.5 V; I <sub>OL</sub> = 64 mA; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>	-	0.42	0.55	-	0.55	V	
V <sub>OL(pu)</sub>	power-up LOW-level output voltage	V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 1 mA; V <sub>I</sub> = GND or V <sub>CC</sub>	<a href="#">[1]</a>	-	0.13	0.55	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	±0.01	±1.0	-	±1.0	μA	
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> ≤ 4.5 V	-	±5.0	±100	-	±100	μA	
I <sub>O(pu/pd)</sub>	power-up/power-down output current	V <sub>CC</sub> = 2.0 V; V <sub>O</sub> = 0.5 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; $\overline{\text{OE}}$ HIGH	<a href="#">[2]</a>	-	±5.0	±50	-	±50	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>							
		V <sub>O</sub> = 2.7 V	-	5.0	50	-	50	μA	
		V <sub>O</sub> = 0.5 V	-	−5.0	−50	-	−50	μA	
I <sub>LO</sub>	output leakage current	HIGH-state; V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or V <sub>CC</sub>	-	5.0	50	-	50	μA	
I <sub>O</sub>	output current	V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = 2.5 V	<a href="#">[3]</a>	−180	−50	−50	−180	−50	mA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or V <sub>CC</sub>							
		outputs HIGH-state	-	0.5	250	-	250	μA	
		outputs LOW-state	-	27	34	-	34	mA	
		outputs disabled	-	0.5	250	-	250	μA	

Table 6. Static characteristics ...continued

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		Unit	
			Min	Typ	Max	Min	Max		
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 5.5$ V; one input at 3.4 V; other inputs at $V_{CC}$ or GND	[4]	-	0.5	1.5	-	1.5	mA
$C_I$	input capacitance	$V_I = 0$ V or $V_{CC}$	-	4	-	-	-	-	pF
$C_O$	output capacitance	outputs disabled; $V_O = 0$ V or $V_{CC}$	-	7	-	-	-	-	pF

[1] For valid test results, data must not be loaded into the flip-flops (or latches) after applying the power.

[2] This parameter is valid for any  $V_{CC}$  between 0 V and 2.1 V, with a transition time of up to 10 ms. From  $V_{CC} = 2.1$  V to  $V_{CC} = 5$  V  $\pm 10$  % a transition time of up to 100  $\mu$ s is permitted.

[3] Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

[4] This is the increase in supply current for each input at 3.4 V.

## 10. Dynamic characteristics

Table 7. Dynamic characteristics

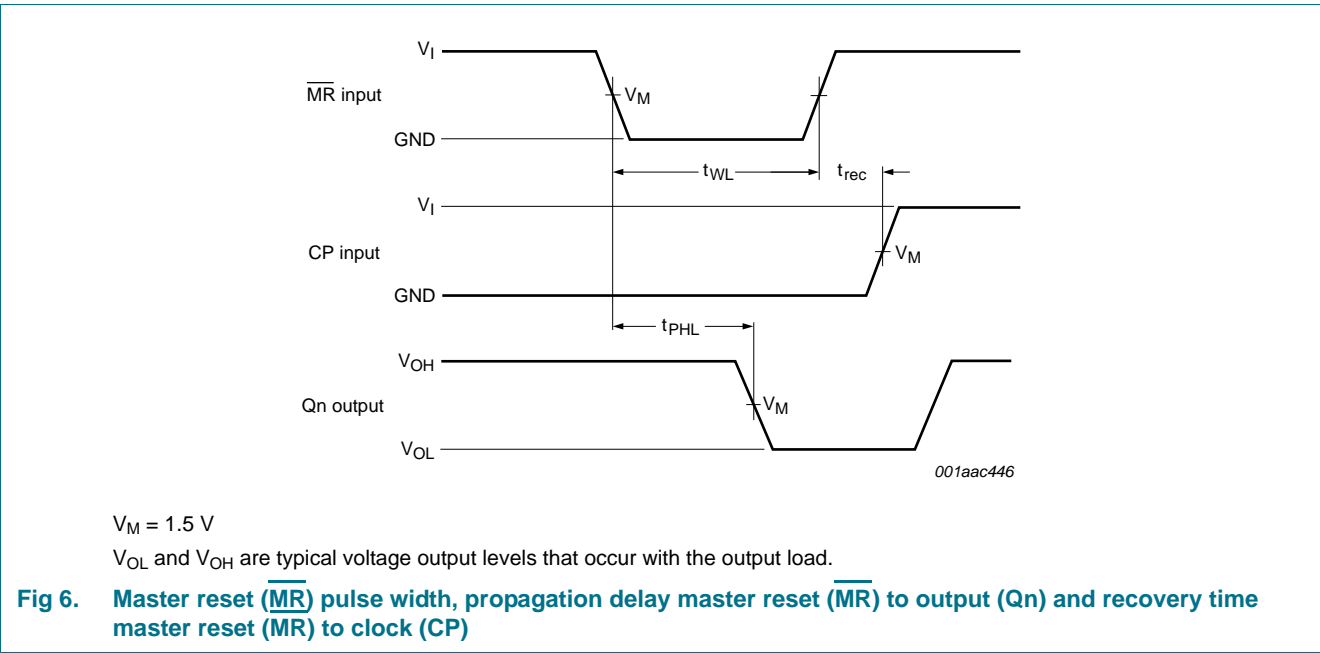
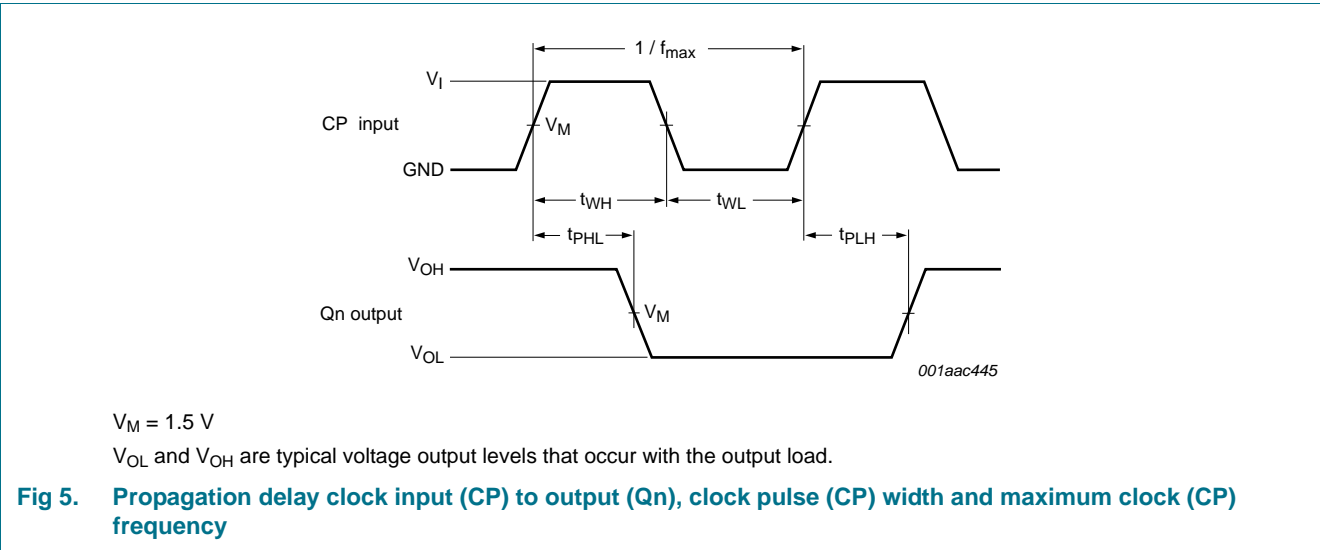
$GND = 0$  V; for test circuit, see [Figure 9](#).

Symbol	Parameter	Conditions	25 °C; $V_{CC} = 5.0$ V			–40 °C to +85 °C; $V_{CC} = 5.0$ V $\pm 0.5$ V		Unit
			Min	Typ	Max	Min	Max	
$f_{max}$	maximum frequency	see <a href="#">Figure 5</a>	125	200	-	125	-	MHz
$t_{PLH}$	LOW to HIGH propagation delay	CP to Qn, see <a href="#">Figure 5</a>	2.1	4.3	5.9	2.1	6.8	ns
$t_{PHL}$	HIGH to LOW propagation delay	CP to Qn, see <a href="#">Figure 5</a>	2.2	4.4	6.1	2.2	6.7	ns
		$\overline{MR}$ to Qn, see <a href="#">Figure 6</a>	2.0	4.1	6.3	2.0	7.1	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	$\overline{OE}$ to Qn; see <a href="#">Figure 8</a>	1.0	3.0	4.5	1.0	5.3	ns
$t_{PZL}$	OFF-state to LOW propagation delay	$\overline{OE}$ to Qn; see <a href="#">Figure 8</a>	2.2	4.1	5.6	2.2	6.3	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	$\overline{OE}$ to Qn; see <a href="#">Figure 8</a>	2.7	4.8	6.2	2.7	6.9	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	$\overline{OE}$ to Qn; see <a href="#">Figure 8</a>	2.5	5.0	6.4	2.5	6.9	ns
$t_{su(H)}$	set-up time HIGH	Dn to CP; see <a href="#">Figure 7</a>	2.1	0.5	-	2.1	-	ns
		$\overline{CE}$ to CP; see <a href="#">Figure 7</a>	+2.0	–0.5	-	+2.0	-	ns
$t_{su(L)}$	set-up time LOW	Dn to CP; see <a href="#">Figure 7</a>	2.1	0.2	-	2.1	-	ns
		$\overline{CE}$ to CP; see <a href="#">Figure 7</a>	3.3	1.5	-	3.3	-	ns
$t_{h(H)}$	hold time HIGH	CP to Dn; see <a href="#">Figure 7</a>	1.3	0.0	-	1.3	-	ns
		CP to $\overline{CE}$ ; see <a href="#">Figure 7</a>	+1.0	–1.4	-	+1.0	-	ns
$t_{h(L)}$	hold time LOW	CP to Dn; see <a href="#">Figure 7</a>	+1.3	–0.3	-	+1.3	-	ns
		CP to $\overline{CE}$ ; see <a href="#">Figure 7</a>	2.0	0.7	-	2.0	-	ns
$t_{WH}$	pulse width HIGH	CP; see <a href="#">Figure 5</a>	2.9	1.9	-	2.9	-	ns

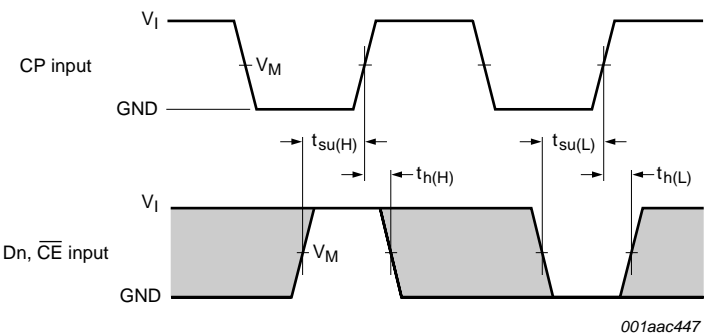
Table 7. Dynamic characteristics ...continued  
GND = 0 V; for test circuit, see Figure 9.

Symbol	Parameter	Conditions	25 °C; V <sub>CC</sub> = 5.0 V			−40 °C to +85 °C; V <sub>CC</sub> = 5.0 V ± 0.5 V		Unit
			Min	Typ	Max	Min	Max	
t <sub>WL</sub>	pulse width LOW	CP; see Figure 5	3.8	2.8	-	3.8	-	ns
		$\overline{\text{MR}}$ ; see Figure 6	5.5	4.0	-	5.5	-	ns
t <sub>rec</sub>	recovery time	$\overline{\text{MR}}$ to CP; see Figure 6	2.5	0.6	-	2.5	-	ns

11. Waveforms

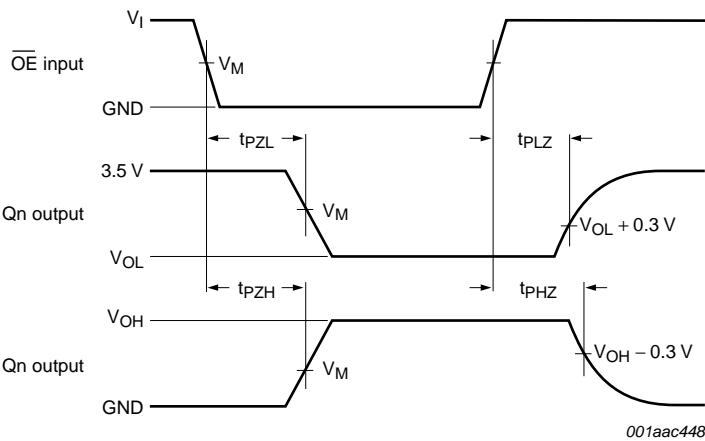






$V_M = 1.5\text{ V}$   
The shaded areas indicate when the input is permitted to change for predictable output performance.

**Fig 7. Set-up and hold times data output (Dn) to clock (CP) and clock enable input ( $\overline{CE}$ ) to clock (CP)**



$V_M = 1.5\text{ V}$   
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load

**Fig 8. 3-state output (Qn) enable and disable times**

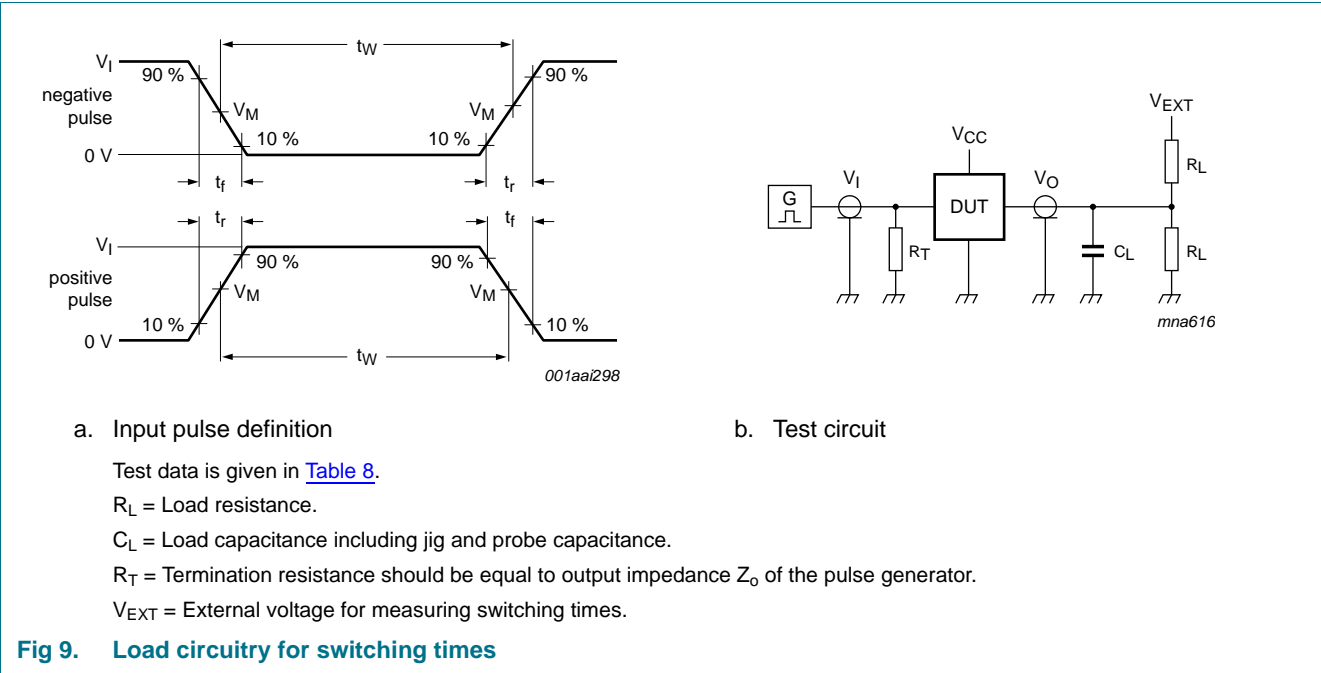


Fig 9. Load circuitry for switching times

Table 8. Test data

Input				Load		$V_{EXT}$		
$V_I$	$f_I$	$t_W$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
3.0 V	1 MHz	500 ns	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	open	7.0 V

12. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm SOT137-1

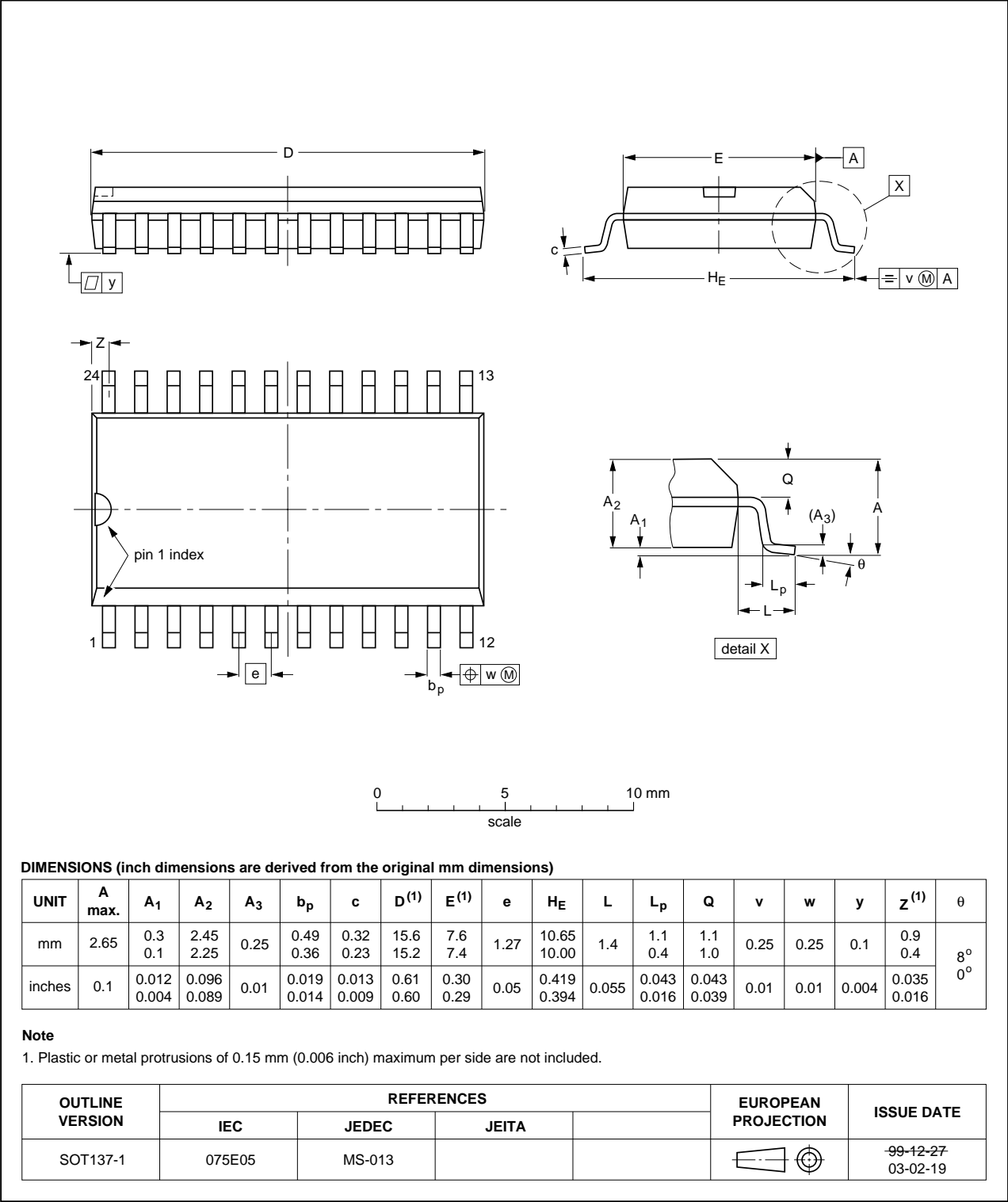


Fig 10. Package outline SOT137-1 (SO24)

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1

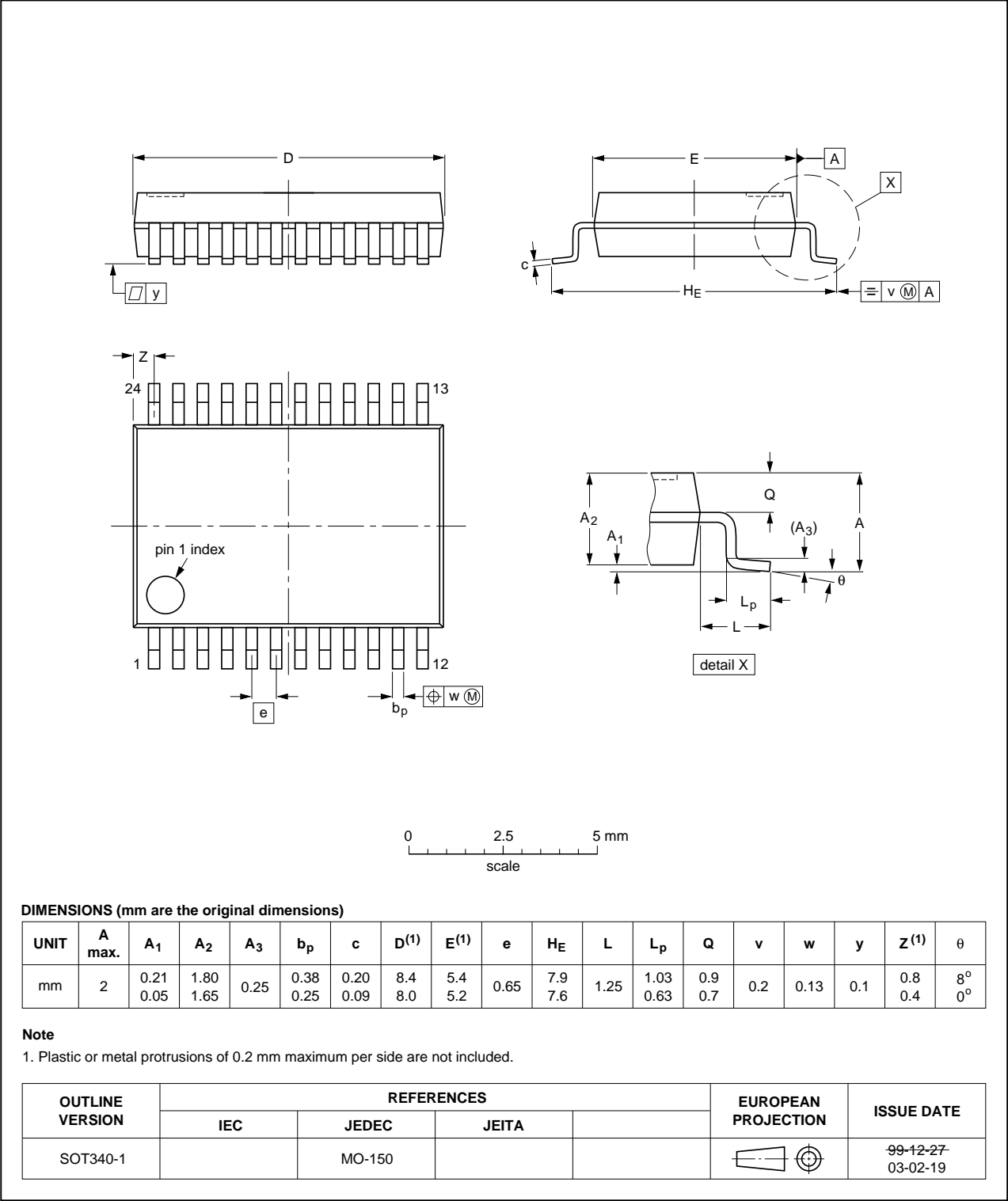


Fig 11. Package outline SOT340-1 (SSOP24)

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

SOT355-1

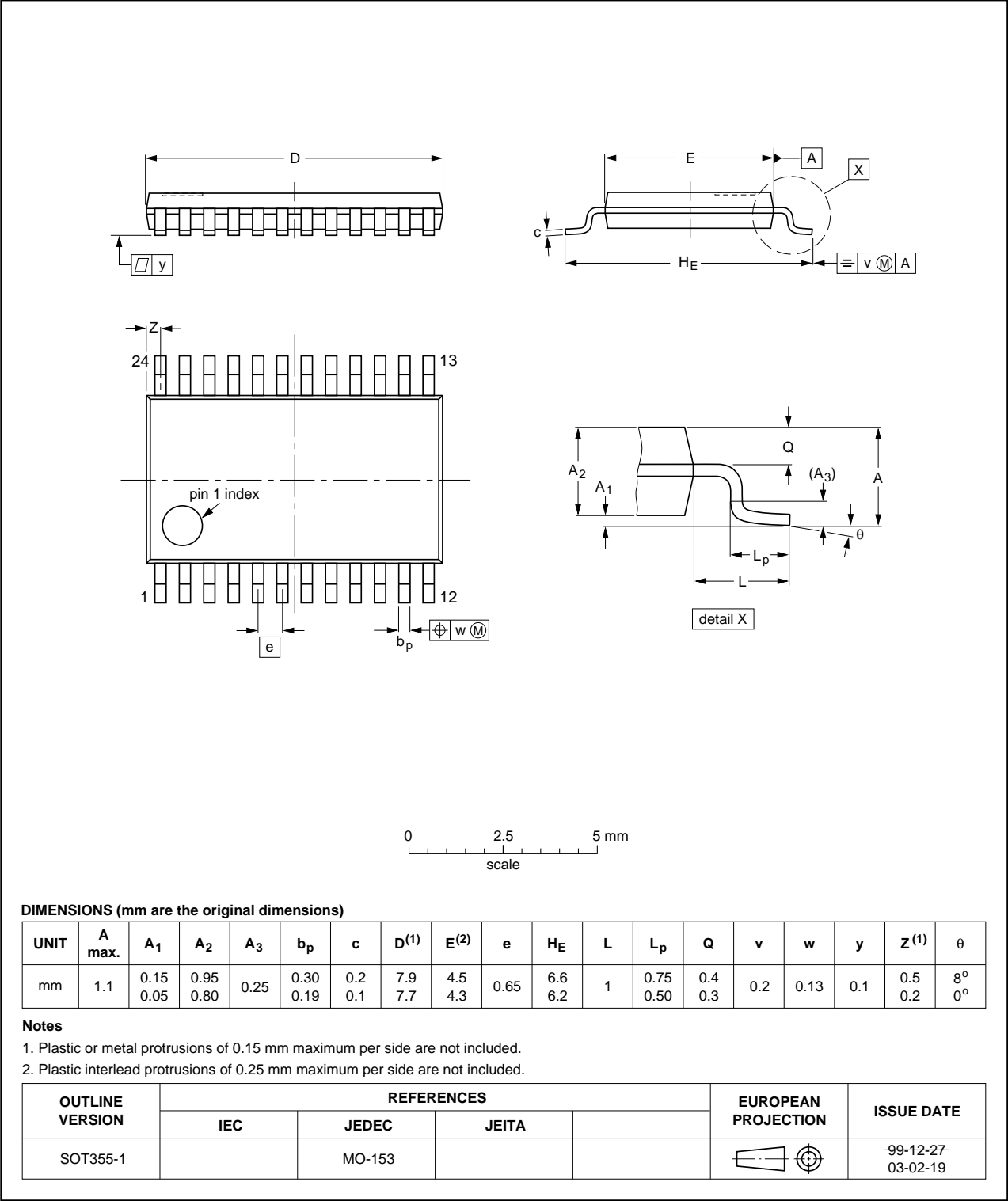


Fig 12. Package outline SOT355-1 (TSSOP24)

## 13. Abbreviations

Table 9. Abbreviations

Acronym	Description
BiCMOS	Bipolar Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

## 14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ABT823 v.4	20111107	Product data sheet	-	74ABT823 v.3
Modifications:	• Legal pages updated.			
74ABT823 v.3	20100323	Product data sheet	-	74ABT823 v.2
74ABT823 v.2	20050207	Product specification	-	74ABT823 v.1
74ABT823 v.1	19960314	Product specification	-	

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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