

# 74AUP1G74

Low-power D-type flip-flop with set and reset; positive-edge trigger

Rev. 04 — 3 June 2008

Product data sheet

## 1. General description

The 74AUP1G74 provides a low-power, low-voltage single positive-edge triggered D-type flip-flop with individual data (D), clock (CP), set ( $\overline{SD}$ ) and reset ( $\overline{RD}$ ) inputs and complementary Q and  $\overline{Q}$  outputs. The  $\overline{SD}$  and  $\overline{RD}$  are asynchronous active LOW inputs and operate independently of the clock input. Information on the data input is transferred to the Q output on the LOW-to-HIGH transition of the clock pulse. The D input must be stable one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

Schmitt trigger action at all inputs makes the circuit tolerant to slower input rise and fall times across the entire  $V_{CC}$  range from 0.8 V to 3.6 V.

This device ensures a very low static and dynamic power consumption across the entire  $V_{CC}$  range from 0.8 V to 3.6 V.

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

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
  - ◆ JESD8-12 (0.8 V to 1.3 V)
  - ◆ JESD8-11 (0.9 V to 1.65 V)
  - ◆ JESD8-7 (1.2 V to 1.95 V)
  - ◆ JESD8-5 (1.8 V to 2.7 V)
  - ◆ JESD8-B (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114E Class 3A exceeds 5000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101C exceeds 1000 V
- Low static power consumption;  $I_{CC} = 0.9 \mu\text{A}$  (maximum)
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- Low noise overshoot and undershoot < 10 % of  $V_{CC}$
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from  $-40 \text{ }^\circ\text{C}$  to  $+85 \text{ }^\circ\text{C}$  and  $-40 \text{ }^\circ\text{C}$  to  $+125 \text{ }^\circ\text{C}$

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74AUP1G74DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74AUP1G74GT	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1
74AUP1G74GD	-40 °C to +125 °C	XSON8U	plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body 3 × 2 × 0.5 mm	SOT996-2
74AUP1G74GM	-40 °C to +125 °C	XQFN8U	plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 × 1.6 × 0.5 mm	SOT902-1

### 4. Marking

Table 2. Marking codes

Type number	Marking code
74AUP1G74DC	p74
74AUP1G74GT	p74
74AUP1G74GD	p74
74AUP1G74GM	p74

### 5. Functional diagram

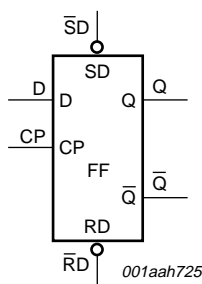


Fig 1. Logic symbol

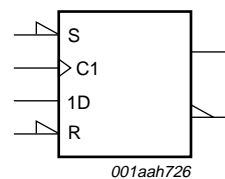
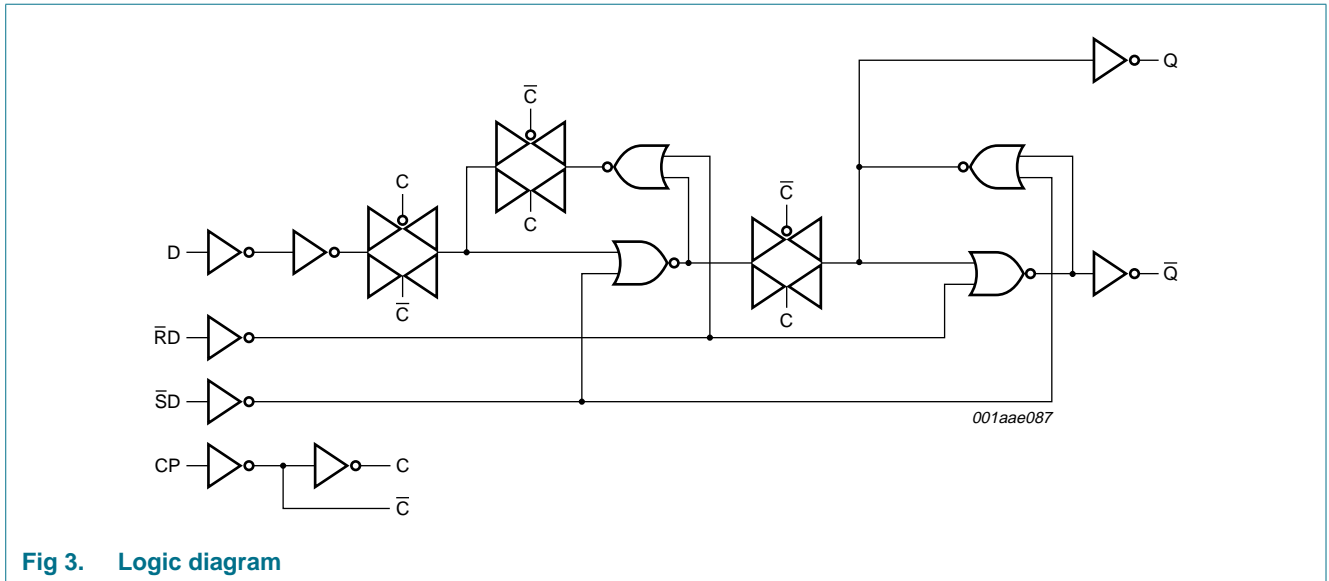
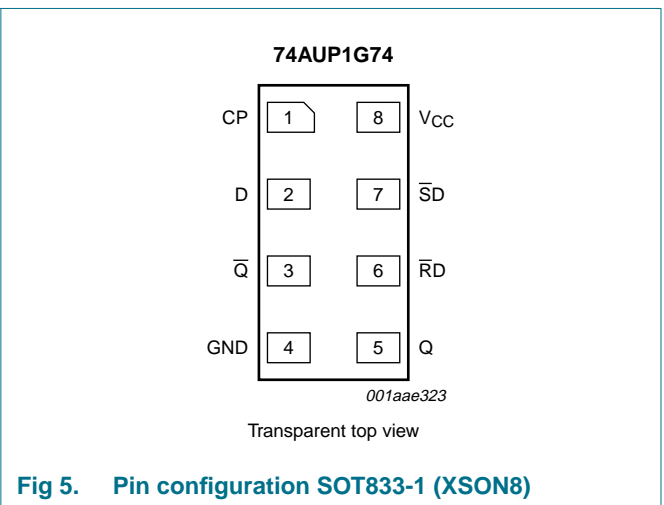
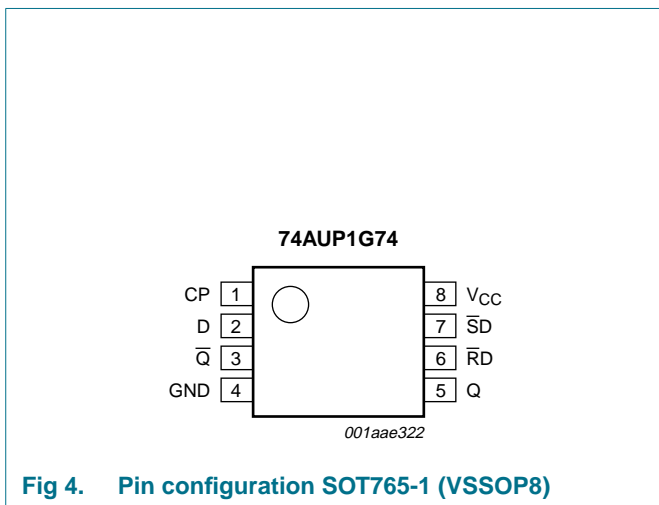


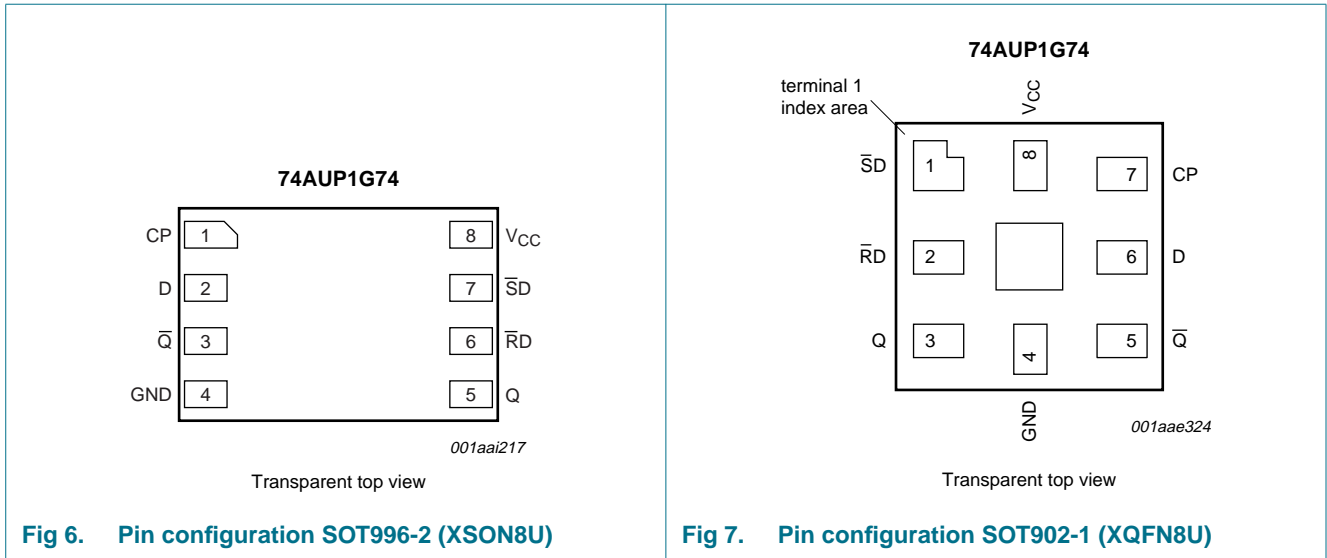
Fig 2. IEC logic symbol



## 6. Pinning information

### 6.1 Pinning





6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT765-1, SOT833-1 and SOT996-2	SOT902-1	
CP	1	7	clock input
D	2	6	data input
$\bar{Q}$	3	5	complement output
GND	4	4	ground (0 V)
Q	5	3	true output
$\bar{RD}$	6	2	asynchronous reset input (active LOW)
$\bar{SD}$	7	1	asynchronous set input (active LOW)
V <sub>CC</sub>	8	8	supply voltage

7. Functional description

Table 4. Function table for asynchronous operation<sup>[1]</sup>

Input				Output	
$\bar{SD}$	$\bar{RD}$	CP	D	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H

[1] H = HIGH voltage level;  
 L = LOW voltage level;  
 X = don't care.

**Table 5.** Function table for synchronous operation<sup>[1]</sup>

Input				Output	
SD	RD	CP	D	Q <sub>n+1</sub>	$\bar{Q}_{n+1}$
H	H	↑	L	L	H
H	H	↑	H	H	L

- [1] H = HIGH voltage level;
- L = LOW voltage level;
- X = don't care;
- ↑ = LOW-to-HIGH CP transition;
- Q<sub>n+1</sub> = state after the next LOW-to-HIGH CP transition.

## 8. Limiting values

**Table 6.** 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
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
V <sub>I</sub>	input voltage		[1] -0.5	+4.6	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
V <sub>O</sub>	output voltage	Active mode and Power-down mode	[1] -0.5	+4.6	V
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	-	±20	mA
I <sub>CC</sub>	supply current		-	+50	mA
I <sub>GND</sub>	ground current		-50	-	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] -	250	mW

- [1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- [2] For VSSOP8 packages: above 110 °C the value of P<sub>tot</sub> derates linearly with 8.0 mW/K.  
For XSON8, XSON8U and XQFN8U packages: above 45 °C the value of P<sub>tot</sub> derates linearly with 2.4 mW/K.

## 9. Recommended operating conditions

**Table 7.** Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		0.8	3.6	V
V <sub>I</sub>	input voltage		0	3.6	V
V <sub>O</sub>	output voltage	Active mode	0	V <sub>CC</sub>	V
		Power-down mode; V <sub>CC</sub> = 0 V	0	3.6	V
T <sub>amb</sub>	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 0.8 V to 3.6 V	-	200	ns/V

## 10. Static characteristics

**Table 8. Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = 25 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 0.8 V	0.70 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 0.9 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.6	-	-	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 0.8 V	-	-	0.30 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 0.9 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	0.9	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V	V <sub>CC</sub> - 0.1	-	-	V
		I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V	0.75 × V <sub>CC</sub>	-	-	V
		I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V	1.11	-	-	V
		I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V	1.32	-	-	V
		I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V	2.05	-	-	V
		I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V	1.9	-	-	V
		I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V	2.72	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V	-	-	0.1	V
		I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V	-	-	0.3 × V <sub>CC</sub>	V
		I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V	-	-	0.31	V
		I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V	-	-	0.31	V
		I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V	-	-	0.31	V
		I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V	-	-	0.44	V
		I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V	-	-	0.31	V
	I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.44	V	
I <sub>I</sub>	input leakage current	V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V	-	-	±0.1	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V	-	-	±0.2	μA
ΔI <sub>OFF</sub>	additional power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V	-	-	±0.2	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V	-	-	0.5	μA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V; per pin	<a href="#">[1]</a>	-	40	μA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>	-	0.6	-	pF
C <sub>O</sub>	output capacitance	V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V	-	1.3	-	pF

**Table 8. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 0.8 V	0.70 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 0.9 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.6	-	-	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 0.8 V	-	-	0.30 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 0.9 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	0.9	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V	V <sub>CC</sub> - 0.1	-	-	V
		I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V	0.7 × V <sub>CC</sub>	-	-	V
		I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V	1.03	-	-	V
		I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V	1.30	-	-	V
		I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V	1.97	-	-	V
		I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V	1.85	-	-	V
		I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V	2.67	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V	-	-	0.1	V
		I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V	-	-	0.3 × V <sub>CC</sub>	V
		I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V	-	-	0.37	V
		I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V	-	-	0.35	V
		I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V	-	-	0.33	V
		I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V	-	-	0.45	V
		I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V	-	-	0.33	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V	-	-	±0.5	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V	-	-	±0.5	μA
ΔI <sub>OFF</sub>	additional power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V	-	-	±0.6	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V	-	-	0.9	μA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V; per pin	[1]	-	50	μA

**Table 8. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 0.8 V	0.75 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 0.9 V to 1.95 V	0.70 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.6	-	-	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 0.8 V	-	-	0.25 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 0.9 V to 1.95 V	-	-	0.30 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	0.9	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V	V <sub>CC</sub> - 0.11	-	-	V
		I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V	0.6 × V <sub>CC</sub>	-	-	V
		I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V	0.93	-	-	V
		I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V	1.17	-	-	V
		I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V	1.77	-	-	V
		I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V	1.67	-	-	V
		I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V	2.40	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V	-	-	0.11	V
		I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V	-	-	0.33 × V <sub>CC</sub>	V
		I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V	-	-	0.41	V
		I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V	-	-	0.39	V
		I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V	-	-	0.36	V
		I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V	-	-	0.50	V
		I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V	-	-	±0.75	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V	-	-	±0.75	μA
ΔI <sub>OFF</sub>	additional power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V	-	-	±0.75	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V	-	-	1.4	μA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V; per pin	[1]	-	75	μA

[1] One input at V<sub>CC</sub> - 0.6 V, other input at V<sub>CC</sub> or GND.



## 11. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 10](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C				Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max (85 °C)	Min	Max (125 °C)	
<b>C<sub>L</sub> = 5 pF</b>										
t <sub>pd</sub>	propagation delay	CP to Q, $\bar{Q}$ ; see <a href="#">Figure 8</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	25.4	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.9	6.7	14.0	2.6	14.2	2.6	14.2	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	2.4	4.5	7.6	2.3	8.3	2.3	8.6	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.9	3.5	5.7	1.7	6.5	1.7	6.8	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	2.6	3.8	1.4	4.4	1.4	4.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	2.2	3.1	1.2	3.4	1.2	3.7	ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	19.6	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.7	5.6	11.0	2.5	11.4	2.5	11.5	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	2.4	4.0	6.3	2.2	6.9	2.2	7.3	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.0	3.3	4.9	1.7	5.6	1.7	5.9	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.9	2.7	3.7	1.7	4.0	1.7	4.2	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.8	2.5	3.2	1.5	3.6	1.5	3.8	ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	19.2	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.6	5.5	11.0	2.5	11.3	2.5	11.5	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	2.3	3.9	6.3	2.2	6.8	2.2	7.3	ns
V <sub>CC</sub> = 1.65 V to 1.95 V	1.9	3.2	5.0	1.8	5.6	1.8	5.9	ns		
V <sub>CC</sub> = 2.3 V to 2.7 V	1.9	2.6	3.6	1.7	4.1	1.7	4.3	ns		
V <sub>CC</sub> = 3.0 V to 3.6 V	1.8	2.4	3.3	1.5	3.6	1.5	3.8	ns		
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 0.8 V	-	53	-	-	-	-	MHz	
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	203	-	170	-	170	-	MHz
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	347	-	310	-	300	-	MHz
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	435	-	400	-	390	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	550	-	490	-	480	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	619	-	550	-	510	-	MHz

**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 10](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C				Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max (85 °C)	Min	Max (125 °C)	
<b>C<sub>L</sub> = 10 pF</b>										
t <sub>pd</sub>	propagation delay	CP to Q, $\bar{Q}$ ; see <a href="#">Figure 8</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	28.9	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	3.1	7.5	15.8	2.9	16.1	2.9	16.1	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	2.7	5.1	8.7	2.4	9.4	2.4	9.8	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.5	4.1	6.5	2.2	7.2	2.2	7.6	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.0	3.2	4.6	1.8	5.3	1.8	5.6	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.8	2.8	3.8	1.6	4.1	1.6	4.4	ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	23.2	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.9	6.5	12.9	2.8	13.3	2.8	13.5	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	2.7	4.6	7.5	2.3	7.9	2.3	8.3	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.6	3.9	5.6	2.3	6.3	2.3	6.6	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.3	3.2	4.4	2.0	4.8	2.0	5.2	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.2	3.0	3.9	1.9	4.2	1.9	4.4	ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	22.7	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.8	6.4	12.8	2.7	13.2	2.7	13.4	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	2.6	4.5	7.5	2.3	8.1	2.3	8.4	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.5	3.3	5.8	2.3	6.3	2.3	6.7	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.2	3.2	4.4	2.0	4.9	2.0	5.2	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.0	2.9	4.0	1.9	4.3	1.9	4.5	ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 0.8 V	-	52	-	-	-	-	MHz	
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	192	-	150	-	150	-	MHz
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	324	-	280	-	230	-	MHz
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	421	-	310	-	250	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	486	-	370	-	360	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	550	-	410	-	360	-	MHz

**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 10](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C				Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max (85 °C)	Min	Max (125 °C)	
<b>C<sub>L</sub> = 15 pF</b>										
t <sub>pd</sub>	propagation delay	CP to Q, $\bar{Q}$ ; see <a href="#">Figure 8</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	32.4	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	3.5	8.3	17.6	3.3	17.8	3.3	18.0	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	3.2	5.6	9.5	2.8	10.5	2.8	11.1	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.7	4.6	7.2	2.5	8.1	2.5	8.6	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.4	3.6	5.2	2.2	5.8	2.2	6.2	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.2	3.2	4.4	2.0	4.9	2.0	5.2	ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	26.7	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	3.3	7.3	14.7	3.1	15.2	3.1	15.4	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	3.2	5.2	8.3	2.9	9.0	2.9	9.5	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.8	4.3	6.4	2.5	7.1	2.5	7.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.8	3.7	5.1	2.2	5.5	2.2	5.8	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.5	3.5	4.6	2.4	5.0	2.4	5.2	ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	26.1	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	3.2	7.2	14.5	3.1	15.0	3.1	15.2	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	3.1	5.1	8.4	2.7	9.2	2.7	9.7	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.7	4.3	6.5	2.6	7.3	2.6	7.7	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.6	3.6	5.0	2.4	5.5	2.4	5.8	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.4	3.4	4.6	2.3	5.0	2.3	5.2	ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 0.8 V	-	50	-	-	-	-	MHz	
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	181	-	120	-	120	-	MHz
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	301	-	190	-	160	-	MHz
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	407	-	240	-	190	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	422	-	300	-	270	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	481	-	320	-	300	-	MHz

**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 10](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C				Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max (85 °C)	Min	Max (125 °C)	
<b>C<sub>L</sub> = 30 pF</b>										
t <sub>pd</sub>	propagation delay	CP to Q, $\bar{Q}$ ; see <a href="#">Figure 8</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	42.7	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	4.2	10.6	22.5	4.0	23.0	4.0	23.3	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	3.7	7.2	12.0	3.7	13.3	3.7	14.0	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.5	5.8	9.2	3.4	10.4	3.4	11.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	3.3	4.7	6.6	3.0	7.3	3.0	7.8	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.0	4.3	5.8	2.8	6.8	2.8	7.3	ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	37.0	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	4.0	9.5	19.8	3.8	20.8	3.8	21.1	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	3.8	6.7	10.9	3.7	12.0	3.7	12.7	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.7	5.6	8.4	3.5	9.3	3.5	9.9	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	3.7	4.8	6.6	3.2	7.2	3.2	7.6	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.4	4.6	6.0	3.1	6.8	3.1	7.1	ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 9</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	36.4	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	3.9	9.4	19.5	3.8	20.2	3.8	20.5	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	3.6	6.6	10.9	3.7	12.0	3.7	12.6	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.5	5.5	8.5	3.5	9.5	3.5	10.1	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	3.5	4.7	6.5	3.2	7.1	3.2	7.6	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.3	4.4	6.1	3.1	7.1	3.1	7.5	ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 0.8 V	-	28	-	-	-	-	MHz	
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	145	-	70	-	70	-	MHz
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	185	-	120	-	110	-	MHz
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	270	-	150	-	120	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	290	-	190	-	170	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	315	-	200	-	190	-	MHz

**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 10](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C				Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max (85 °C)	Min	Max (125 °C)	
<b>C<sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF</b>										
t <sub>su</sub>	set-up time	D to CP HIGH; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 0.8 V	-	3.4	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	0.6	-	1.2	-	1.2	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	0.3	-	0.6	-	0.6	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	0.4	-	0.5	-	0.5	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	0.2	-	0.4	-	0.4	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.3	-	0.4	-	0.4	-	ns
		D to CP LOW; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 0.8 V	-	3.0	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	0.5	-	1.2	-	1.2	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	0.3	-	0.7	-	0.7	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	0.4	-	0.7	-	0.7	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	0.5	-	0.7	-	0.7	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.6	-	0.8	-	0.8	-	ns
t <sub>h</sub>	hold time	D to CP; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 0.8 V	-	-1.9	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	-0.3	-	0.5	-	0.5	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	-0.2	-	0.2	-	0.2	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-0.2	-	0.1	-	0.1	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-0.2	-	0.1	-	0.1	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-0.2	-	0.1	-	0.1	-	ns
t <sub>rec</sub>	recovery time	$\overline{RD}$ ; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	-0.5	-	-0.9	-	-0.9	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	-0.2	-	-0.6	-	-0.6	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-0.2	-	-0.4	-	-0.4	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-0.1	-	-0.1	-	-0.1	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-0.1	-	-0.1	-	-0.1	-	ns
		$\overline{SD}$ ; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	-0.5	-	-0.3	-	-0.3	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	-0.4	-	-0.1	-	-0.1	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-0.3	-	0	-	0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-0.2	-	0.1	-	0.1	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-0.1	-	0.1	-	0.1	-	ns

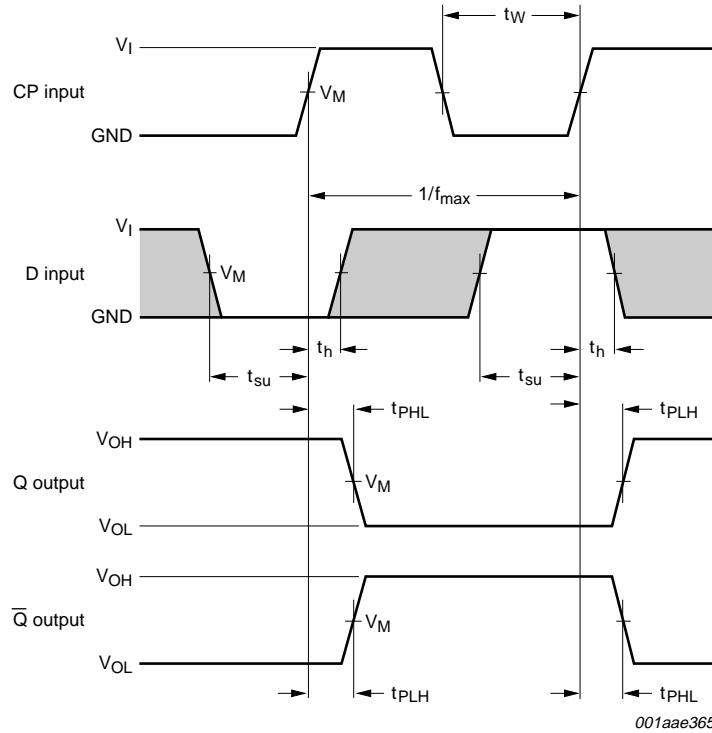
**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 10](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C				Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max (85 °C)	Min	Max (125 °C)	
t <sub>w</sub>	pulse width	CP HIGH or LOW; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	2.1	-	2.7	-	2.7	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	1.1	-	1.5	-	1.5	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	0.9	-	1.6	-	1.6	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	0.6	-	1.7	-	1.7	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.6	-	1.9	-	1.9	-	ns
		SD or RD LOW; see <a href="#">Figure 9</a>								
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	4.2	-	11.3	-	11.5	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	2.3	-	6.2	-	6.4	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	1.8	-	4.8	-	5.0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	1.2	-	3.3	-	3.5	-	ns
V <sub>CC</sub> = 3.0 V to 3.6 V	-	1.1	-	2.6	-	2.8	-	ns		
C <sub>PD</sub>	power dissipation capacitance	f <sub>i</sub> = 1 MHz; <sup>[3]</sup> V <sub>I</sub> = GND to V <sub>CC</sub>								
		V <sub>CC</sub> = 0.8 V	-	2.8	-	-	-	-	-	pF
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	2.9	-	-	-	-	-	pF
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	3.0	-	-	-	-	-	pF
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	3.0	-	-	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	3.5	-	-	-	-	-	pF
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	3.9	-	-	-	-	-	pF

- [1] All typical values are measured at nominal V<sub>CC</sub>.
- [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 C<sub>L</sub> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 N = number of inputs switching;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

12. Waveforms

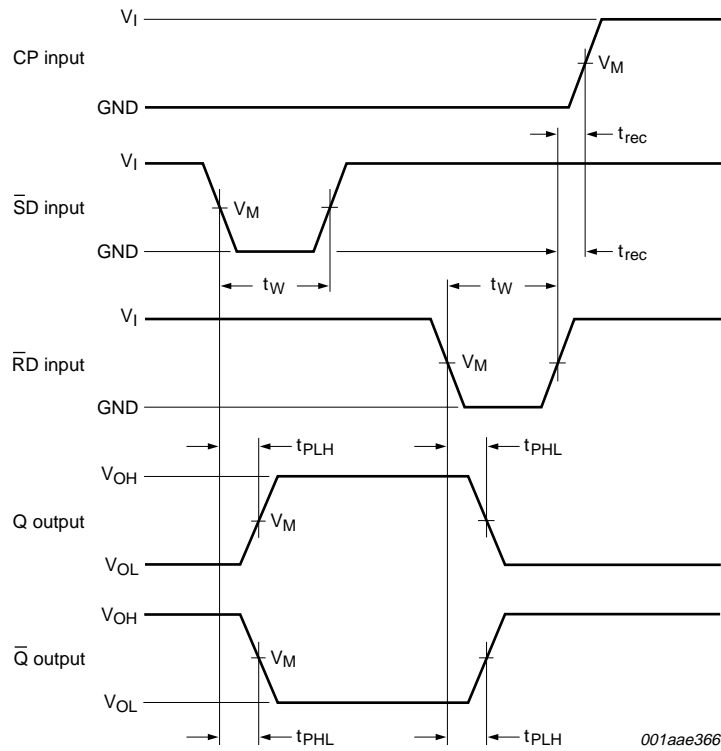


Measurement points are given in [Table 10](#).  
 The shaded areas indicate when the input is permitted to change for predictable output performance.  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 8.** The clock input (CP) to output (Q, Q̄) propagation delays, the data input (D) to clock input (CP) set-up and hold times and the clock input (CP) pulse width and maximum frequency

**Table 10.** Measurement points

Supply voltage	Output	Input		
$V_{CC}$	$V_M$	$V_M$	$V_I$	$t_r = t_f$
0.8 V to 3.6 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 3.0$ ns

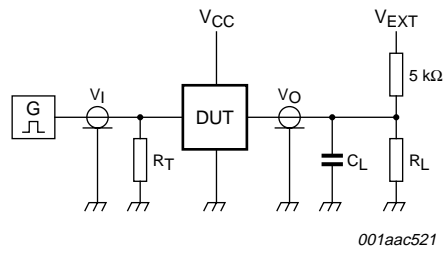


Measurement points are given in [Table 10](#).

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

**Fig 9.** The set input ( $\bar{S}D$ ) and reset input ( $\bar{R}D$ ) to output (Q,  $\bar{Q}$ ) propagation delays, the set input ( $\bar{S}D$ ) and reset input ( $\bar{R}D$ ) pulse widths and the reset input ( $\bar{R}D$ ) to clock input (CP) recovery time





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.

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

**Fig 10. Load circuitry for switching times**

**Table 11. Test data**

Supply voltage	Load		$V_{EXT}$		
$V_{CC}$	$C_L$	$R_L$ [1]	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
0.8 V to 3.6 V	5 pF, 10 pF, 15 pF and 30 pF	5 kΩ or 1 MΩ	open	GND	$2 \times V_{CC}$

[1] For measuring enable and disable times  $R_L = 5 \text{ k}\Omega$

For measuring propagation delays, setup and hold times and pulse width  $R_L = 1 \text{ M}\Omega$ .

13. Package outline

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1

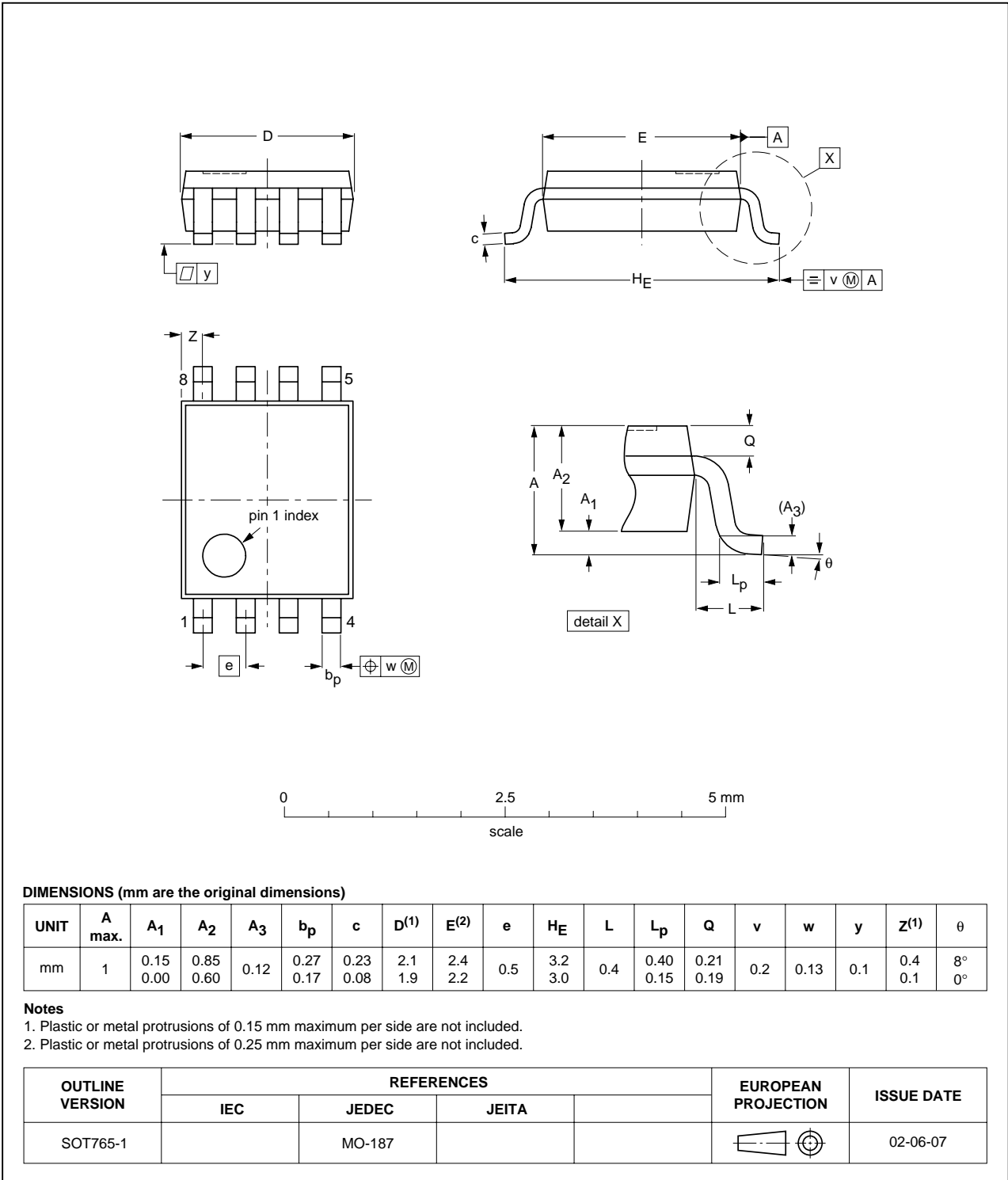


Fig 11. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

SOT833-1

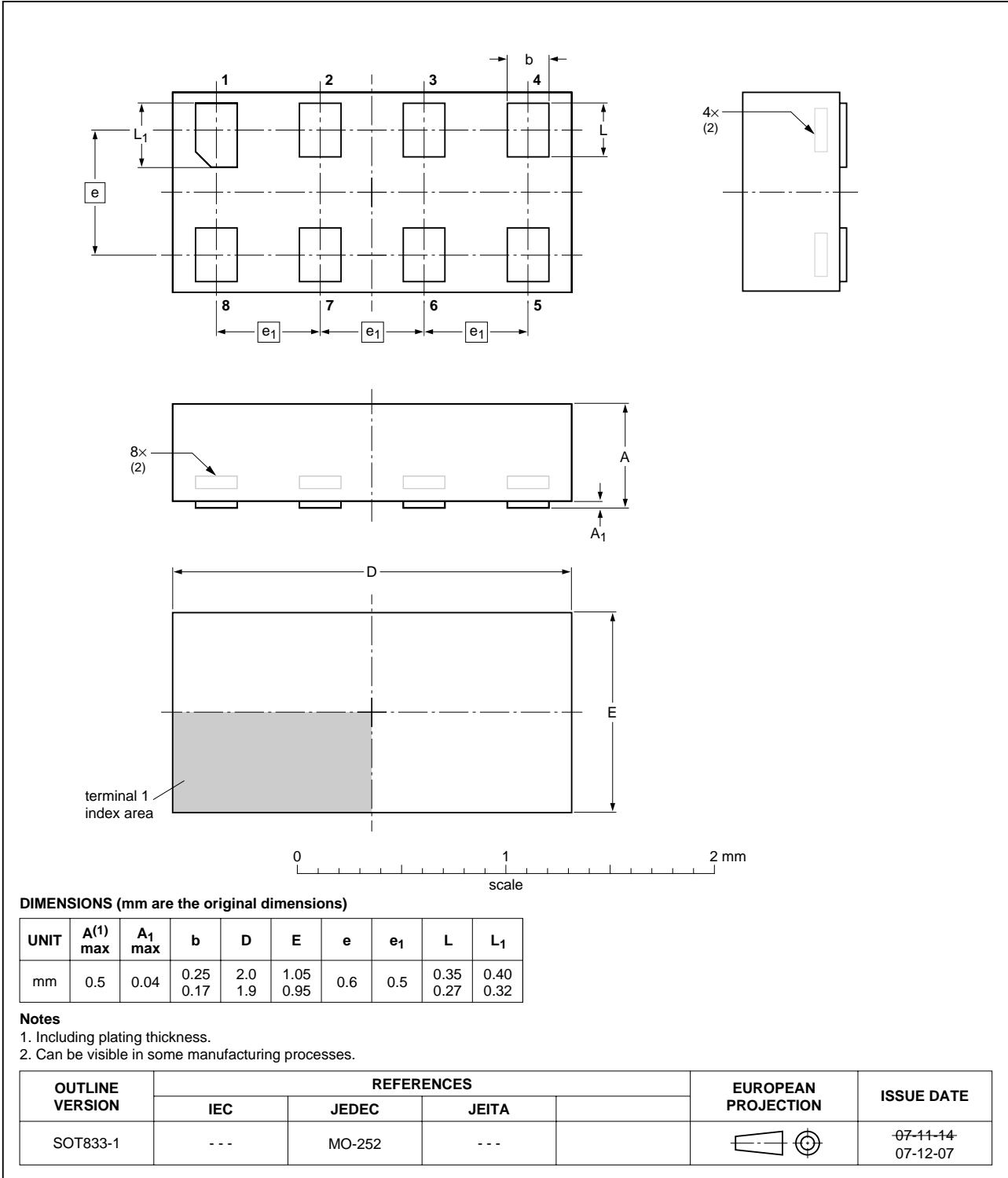


Fig 12. Package outline SOT833-1 (XSON8)

XSON8U: plastic extremely thin small outline package; no leads;  
8 terminals; UTLP based; body 3 x 2 x 0.5 mm

SOT996-2

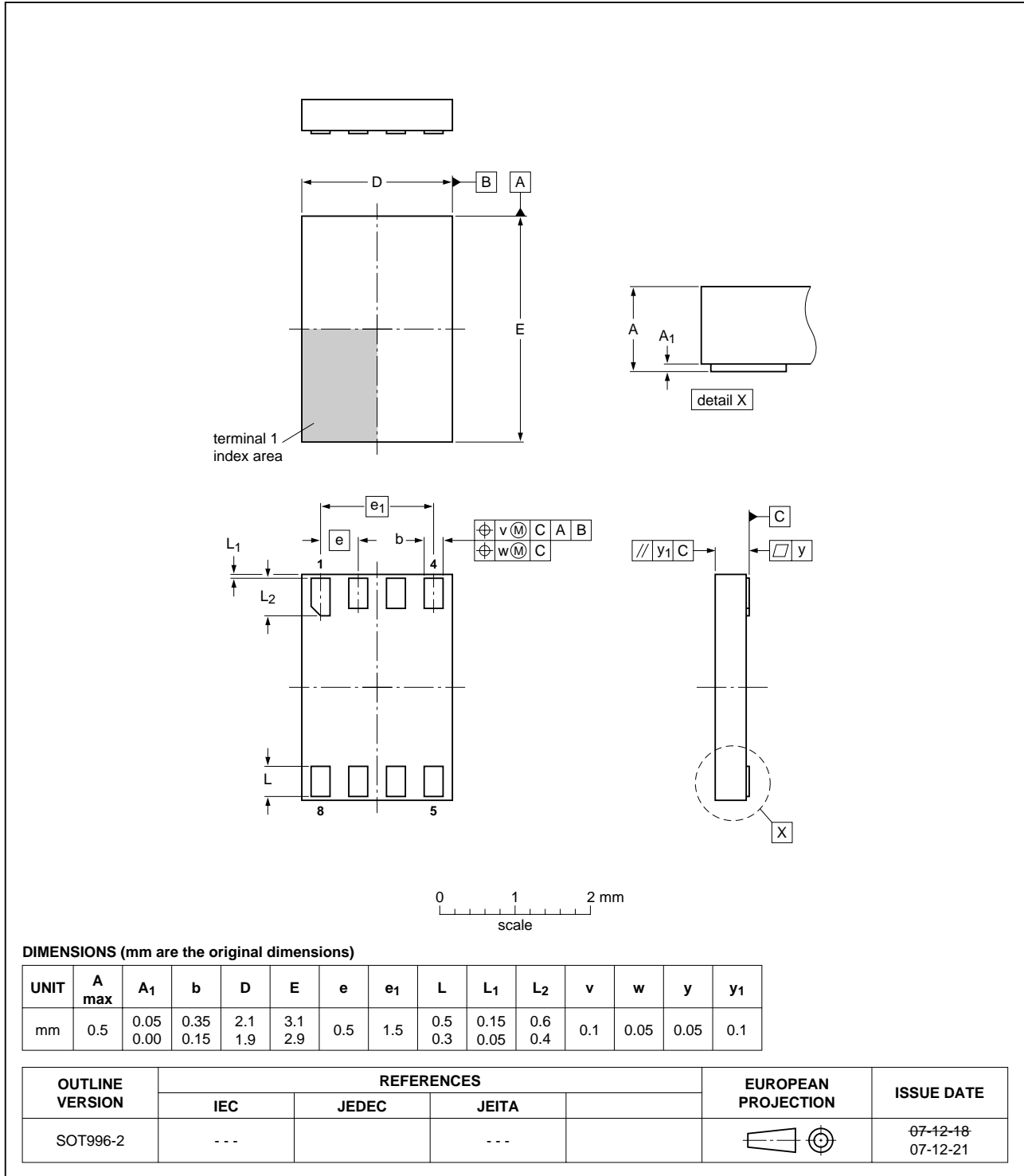


Fig 13. Package outline SOT996-2 (XSON8U)

XQFN8U: plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 x 1.6 x 0.5 mm

SOT902-1

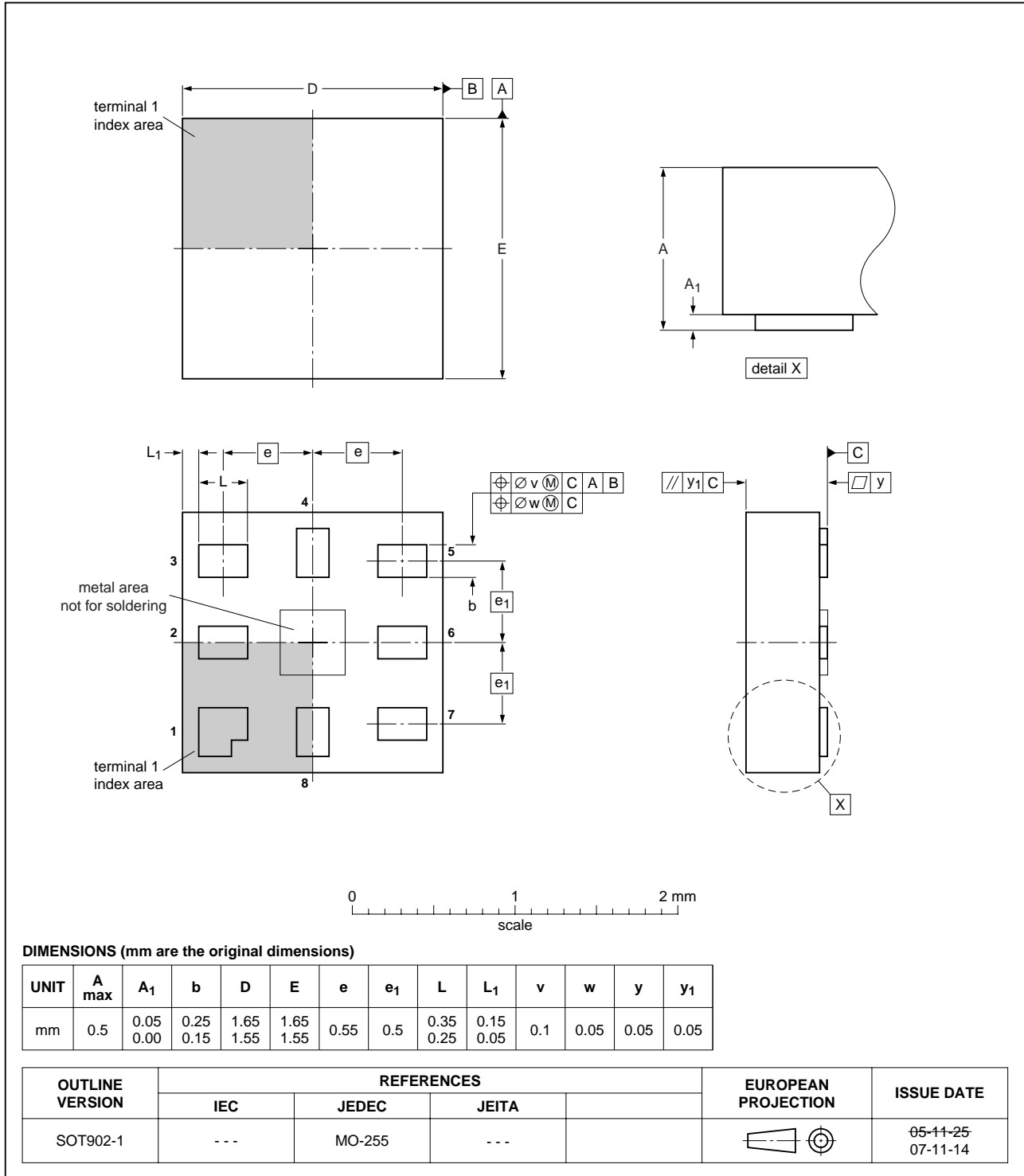


Fig 14. Package outline SOT902-1 (XQFN8U)

## 14. 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

## 15. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AUP1G74_4	20080603	Product data sheet	-	74AUP1G74_3
Modifications:	• Added type number 74AUP1G74GD (XSON8U package)			
74AUP1G74_3	20080207	Product data sheet	-	74AUP1G74_2
74AUP1G74_2	20070515	Product data sheet	-	74AUP1G74_1
74AUP1G74_1	20060825	Product data sheet	-	-

## 16. Legal information

### 16.1 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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