

# 74AUP1G74

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

Rev. 01 — 25 August 2006

Product data sheet

## 1. General description

The 74AUP1G74 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

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.

The 74AUP1G74 provides the single positive-edge triggered D-type flip-flop with individual data (D) input, clock (CP) input, set ( $\overline{SD}$ ) and reset ( $\overline{RD}$ ) inputs and complementary Q and  $\overline{Q}$  outputs. The set and reset 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.

## 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-A114-D Class 3A exceeds 5000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101-C 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  $V_{CC}$

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- I<sub>OFF</sub> circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °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
74AUP1G74GM	-40 °C to +125 °C	XQFN8	plastic extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm	SOT902-1

### 4. Marking

Table 2. Marking

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

### 5. Functional diagram

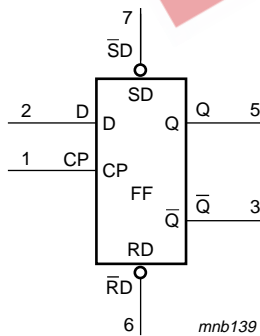


Fig 1. Logic symbol

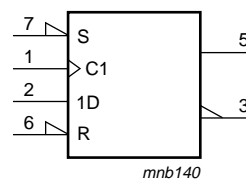


Fig 2. IEC logic symbol

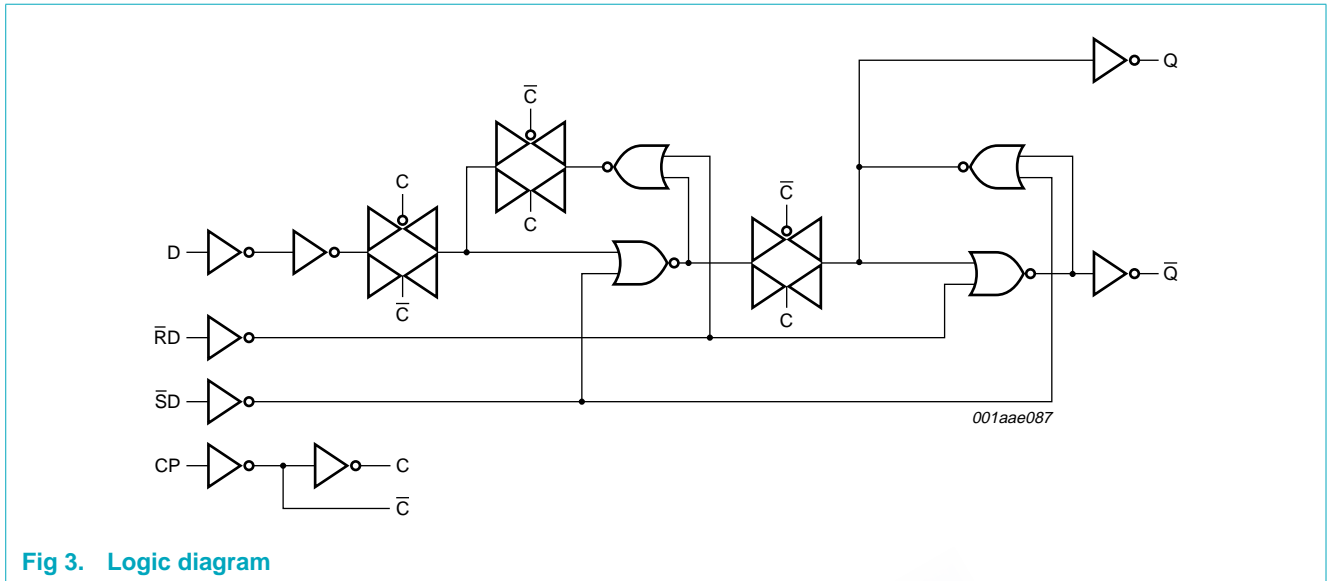


Fig 3. Logic diagram

## 6. Pinning information

### 6.1 Pinning

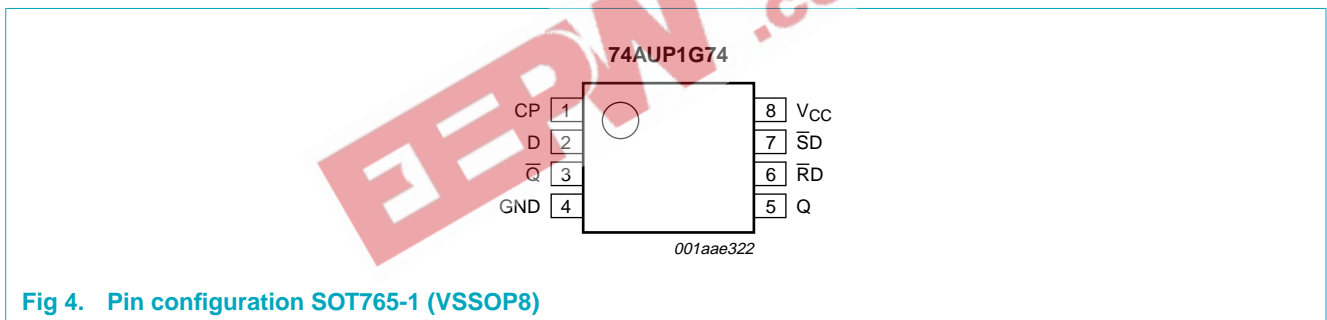


Fig 4. Pin configuration SOT765-1 (VSSOP8)

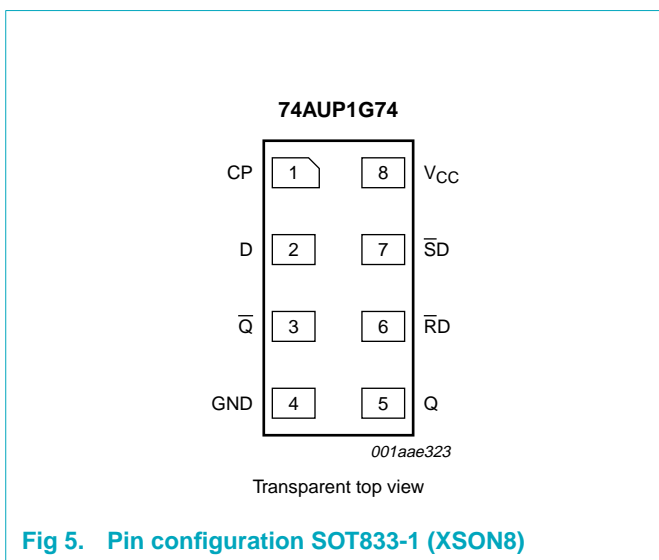


Fig 5. Pin configuration SOT833-1 (XSON8)

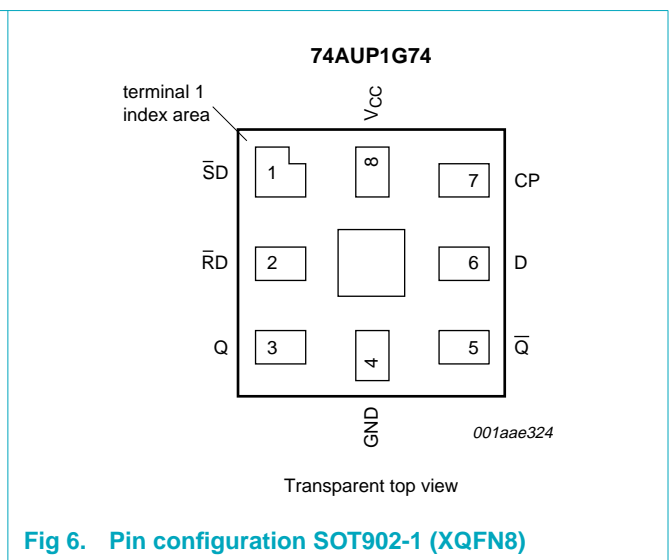


Fig 6. Pin configuration SOT902-1 (XQFN8)

## 6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT765-1 and SOT833-1	SOT902-1	
CP	1	7	clock input (LOW-to-HIGH, edge triggered)
D	2	6	data input
$\bar{Q}$	3	5	complement flip-flop output
GND	4	4	ground (0 V)
Q	5	3	true flip-flop output
$\bar{RD}$	6	2	asynchronous reset-direct (active LOW)
$\bar{SD}$	7	1	asynchronous set-direct (active LOW)
$V_{CC}$	8	8	supply voltage

## 7. Functional description

Table 4. 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

Table 5. Synchronous operation<sup>[1]</sup>

Input				Output	
$\bar{SD}$	$\bar{RD}$	CP	D	$Q_{n+1}$	$\bar{Q}_{n+1}$
H	H	↑	L	L	H
H	H	↑	H	H	L

- [1] H = HIGH voltage level;  
 L = LOW voltage level;  
 ↑ = LOW-to-HIGH CP transition;  
 X = don't care.

## 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
$V_{CC}$	supply voltage		-0.5	+4.6	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-	-50	mA
$V_I$	input voltage		[1] -0.5	+4.6	V
$I_{OK}$	output clamping current	$V_O < 0$ V	-	-50	mA
$V_O$	output voltage	Active mode and Power-down mode	[1] -0.5	+4.6	V
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	±20	mA
$I_{CC}$	supply current		-	+50	mA

**Table 6.** Limiting values ...continued

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{\text{GND}}$	ground current		-	-50	mA
$T_{\text{stg}}$	storage temperature		-65	+150	°C
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} = -40\text{ °C to }+125\text{ °C}$	[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  $P_{\text{tot}}$  derates linearly with 8.0 mW/K.  
For XSON8 and XQFN8 packages: above 45 °C the value of  $P_{\text{tot}}$  derates linearly with 2.4 mW/K.

## 9. Recommended operating conditions

**Table 7.** Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{\text{CC}}$	supply voltage		0.8	3.6	V
$V_{\text{I}}$	input voltage		0	3.6	V
$V_{\text{O}}$	output voltage	Active mode	0	$V_{\text{CC}}$	V
		Power-down mode; $V_{\text{CC}} = 0\text{ V}$	0	3.6	V
$T_{\text{amb}}$	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{\text{CC}} = 0.8\text{ V to }3.6\text{ V}$	0	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
$T_{\text{amb}} = 25\text{ °C}$						
$V_{\text{IH}}$	HIGH-level input voltage	$V_{\text{CC}} = 0.8\text{ V}$	$0.70 \times V_{\text{CC}}$	-	-	V
		$V_{\text{CC}} = 0.9\text{ V to }1.95\text{ V}$	$0.65 \times V_{\text{CC}}$	-	-	V
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	1.6	-	-	V
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	2.0	-	-	V
$V_{\text{IL}}$	LOW-level input voltage	$V_{\text{CC}} = 0.8\text{ V}$	-	-	$0.30 \times V_{\text{CC}}$	V
		$V_{\text{CC}} = 0.9\text{ V to }1.95\text{ V}$	-	-	$0.35 \times V_{\text{CC}}$	V
		$V_{\text{CC}} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.7	V
		$V_{\text{CC}} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.9	V
$V_{\text{OH}}$	HIGH-level output voltage	$V_{\text{I}} = V_{\text{IH}}$ or $V_{\text{IL}}$				
		$I_{\text{O}} = -20\text{ }\mu\text{A}; V_{\text{CC}} = 0.8\text{ V to }3.6\text{ V}$	$V_{\text{CC}} - 0.1$	-	-	V
		$I_{\text{O}} = -1.1\text{ mA}; V_{\text{CC}} = 1.1\text{ V}$	$0.75 \times V_{\text{CC}}$	-	-	V
		$I_{\text{O}} = -1.7\text{ mA}; V_{\text{CC}} = 1.4\text{ V}$	1.11	-	-	V
		$I_{\text{O}} = -1.9\text{ mA}; V_{\text{CC}} = 1.65\text{ V}$	1.32	-	-	V
		$I_{\text{O}} = -2.3\text{ mA}; V_{\text{CC}} = 2.3\text{ V}$	2.05	-	-	V
		$I_{\text{O}} = -3.1\text{ mA}; V_{\text{CC}} = 2.3\text{ V}$	1.9	-	-	V
		$I_{\text{O}} = -2.7\text{ mA}; V_{\text{CC}} = 3.0\text{ V}$	2.72	-	-	V
$I_{\text{O}} = -4.0\text{ mA}; V_{\text{CC}} = 3.0\text{ V}$	2.6	-	-	V		

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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	-	-	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
<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
I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.55	-	-	V		

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.45	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	-	-	50	μA
<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
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.30	-	-	V

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.50	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	-	-	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 9](#).

Symbol	Parameter	Conditions	25 °C			–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 7</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	3.7	1.4	4.3	1.4	4.6		ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	2.2	3.0	1.2	3.3	1.2	3.5		ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	3.6	1.7	3.8	1.7	4.1		ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.8	2.5	3.1	1.5	3.5	1.5	3.7		ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	11.4		ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	2.3	3.9	6.3	2.2	6.8	2.2	7.2		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	4.0	1.7	4.3		ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.8	2.4	3.2	1.5	3.8	1.5	4.0		ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 8</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 9](#).

Symbol	Parameter	Conditions	25 °C			-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 7</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	4.3	1.8	4.9	1.8	5.3	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.8	2.8	3.7	1.6	4.0	1.6	4.3	ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	4.2	2.0	4.6	2.0	4.9	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.2	3.0	3.7	1.9	4.0	1.9	4.2	ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	4.2	2.0	4.6	2.0	5.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.0	2.9	3.9	1.9	4.6	1.9	4.8	ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 8</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 9](#).

Symbol	Parameter	Conditions	25 °C			-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 7</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 0.8 V	-	23.4	-	-	-	-	-	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	5.0	2.2	5.6	2.2	6.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.2	3.2	4.1	2.0	4.6	2.0	4.9	ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	4.8	2.2	5.3	2.2	5.6	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.5	3.5	4.3	2.4	4.7	2.4	4.9	ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	4.9	2.4	5.4	2.4	5.8	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.4	3.4	4.4	2.3	5.2	2.3	5.4	ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 8</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 9](#).

Symbol	Parameter	Conditions	25 °C			-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 7</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	12.0	3.7	14.0	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.5	5.8	9.2	3.4	9.2	3.4	11.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	3.3	4.7	6.3	3.0	7.5	3.0	7.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.0	4.3	5.3	2.8	5.3	2.8	6.7	ns
		$\bar{S}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	6.1	3.2	6.7	3.2	7.1	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.4	4.6	5.6	3.1	6.4	3.1	6.7	ns
		$\bar{R}D$ to Q, $\bar{Q}$ ; see <a href="#">Figure 8</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	6.3	3.2	6.9	3.2	7.4	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.3	4.4	5.7	3.1	6.7	3.1	7.0	ns
f <sub>max</sub>	maximum frequency	CP; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 0.8 V	-	28	-	-	-	-	MHz	
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	128	-	70	-	70	-	MHz
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	206	-	120	-	110	-	MHz
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	262	-	150	-	120	-	MHz
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	269	-	190	-	170	-	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	309	-	200	-	190	-	MHz

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

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 9](#).

Symbol	Parameter	Conditions	25 °C			–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 7</a>								
		V <sub>CC</sub> = 0.8 V	-	3.4	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	0.6	-	1.1	-	1.1	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	0.3	-	0.9	-	0.9	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	0.4	-	0.8	-	0.8	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	0.2	-	0.6	-	0.6	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.3	-	0.5	-	0.5	-	ns
		D to CP LOW; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 0.8 V	-	3.0	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	0.5	-	1.3	-	1.3	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	0.3	-	1.1	-	1.1	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	0.4	-	1.0	-	1.0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	0.5	-	0.9	-	0.9	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.6	-	0.9	-	0.9	-	ns
t <sub>h</sub>	hold time	D to CP; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 0.8 V	-	-1.9	-	-	-	-	-	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	-0.3	-	0.2	-	0.2	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	-0.2	-	0	-	0	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-0.2	-	0	-	0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-0.2	-	0	-	0	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-0.2	-	0	-	0	-	ns
t <sub>rec</sub>	recovery time	$\overline{RD}$ ; see <a href="#">Figure 8</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	-	-0.2	-	-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	-	-0.1	-	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 8</a>								
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	-0.5	-	0	-	0	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	-0.4	-	0	-	0	-	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	-	0.2	-	0.2	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-0.1	-	0.2	-	0.2	-	ns

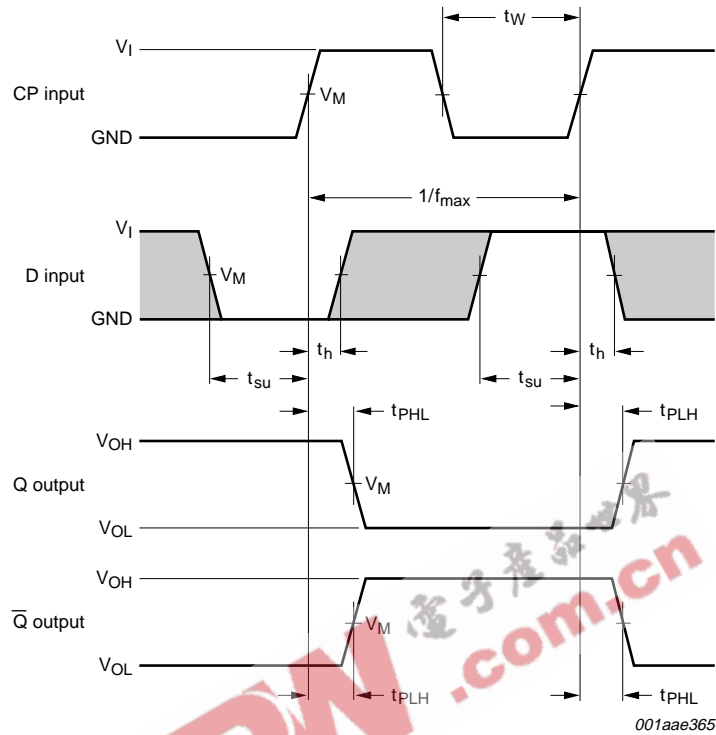
**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 9](#).

Symbol	Parameter	Conditions	25 °C			-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 7</a>								
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	1.7	-	2.6	-	2.6	-	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	-	0.7	-	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	-	0.5	-	1.9	-	1.9	-	ns
		SD or RD LOW; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	1.9	-	2.9	-	3.1	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	1.1	-	1.5	-	1.7	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	0.8	-	1.1	-	1.3	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	0.5	-	0.7	-	0.9	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.4	-	0.5	-	0.7	-	ns
C <sub>PD</sub>	power dissipation capacitance	f = 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 the outputs.

12. Waveforms



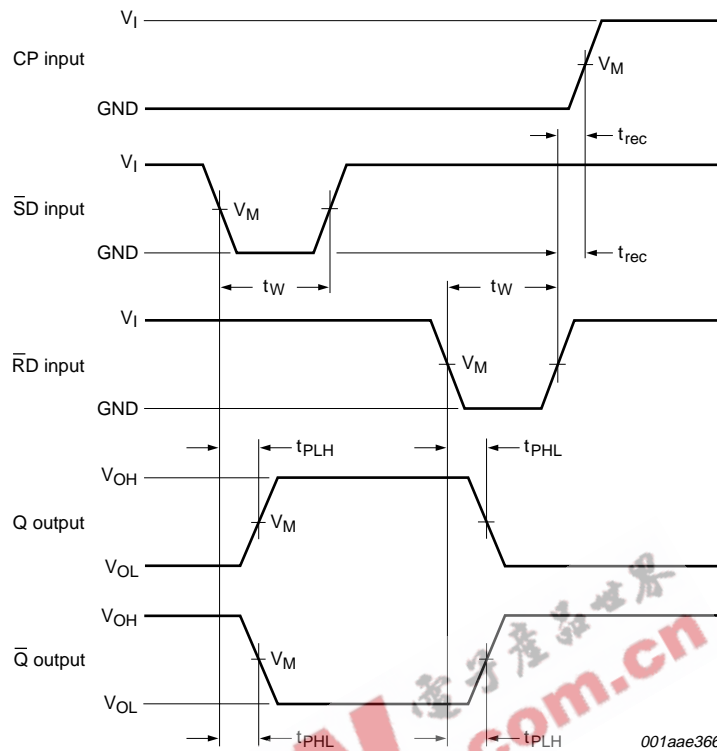
Measurement points are given in Table 10.

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

Fig 7. The clock input (CP) to output (Q,  $\bar{Q}$ ) propagation delays, the clock pulse width, The D to CP set-up and hold times and the maximum clock pulse 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 11](#).

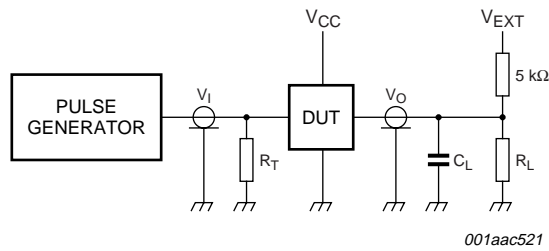
Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

**Fig 8. The set ( $\bar{S}D$ ) and reset ( $\bar{R}D$ ) input to output ( $Q$ ,  $\bar{Q}$ ) propagation delays, the set and reset pulse widths and the  $\bar{R}D$  to CP recovery time**

**Table 11. 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





Test data is given in [Table 12](#).

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 9. Load circuitry for switching times**

**Table 12. Test data**

Supply voltage	Load		$V_{EXT}$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
$V_{CC}$	$C_L$	$R_L$ [1]				
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

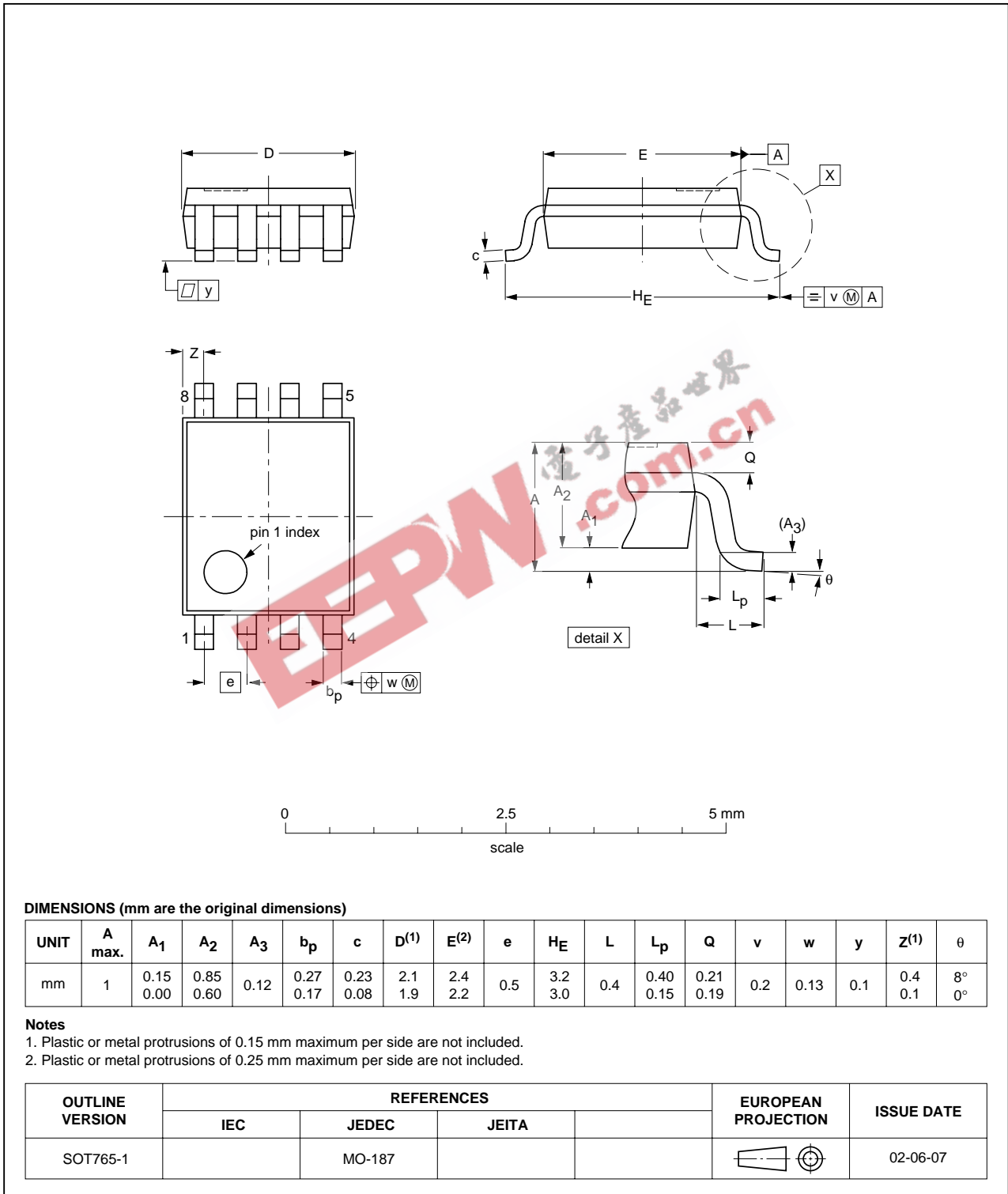


Fig 10. Package outline SOT765-1 (VSSOP8)

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

SOT833-1

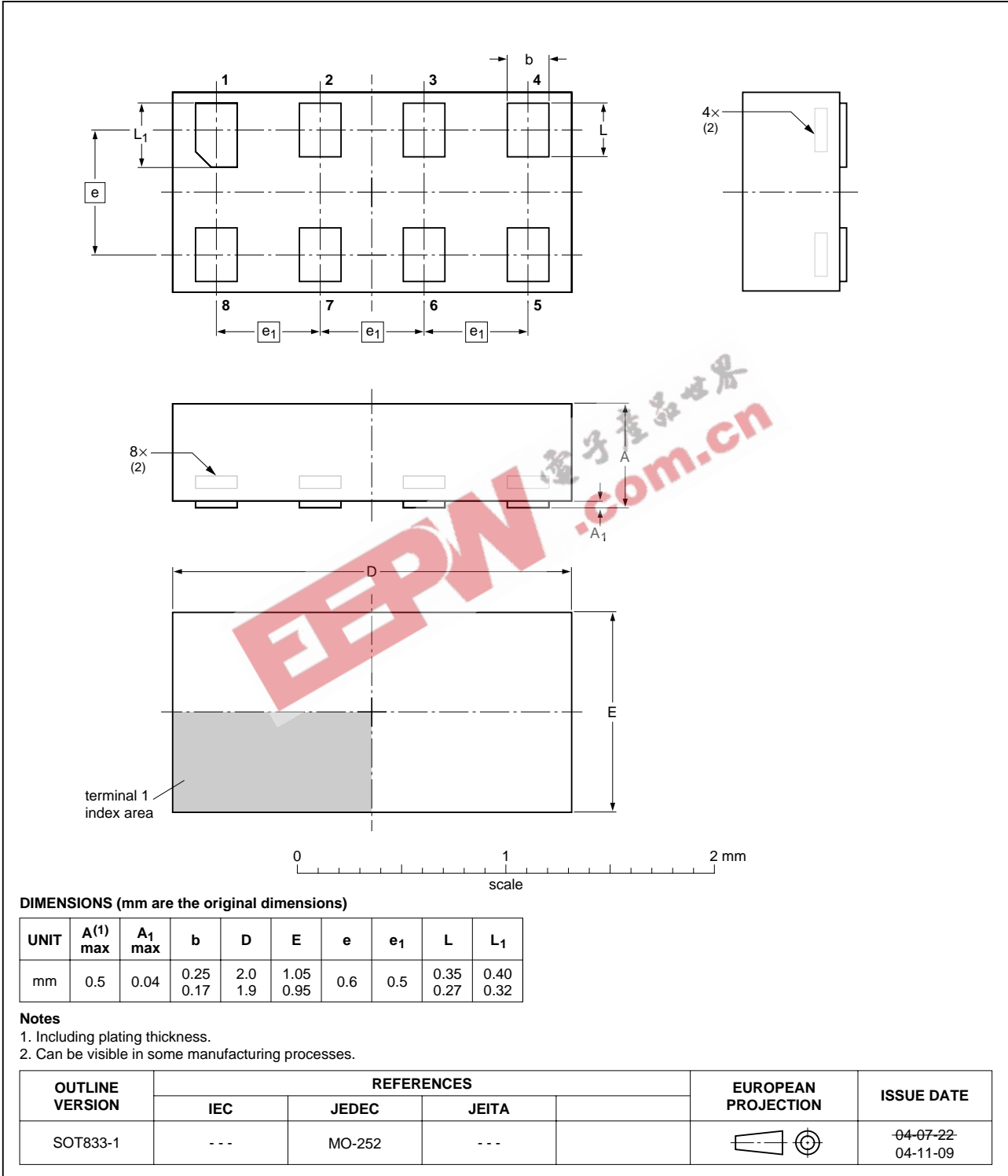


Fig 11. Package outline SOT833-1 (XSON8)

XQFN8: plastic extremely thin quad flat package; no leads; 8 terminals; body 1.6 x 1.6 x 0.5 mm

SOT902-1

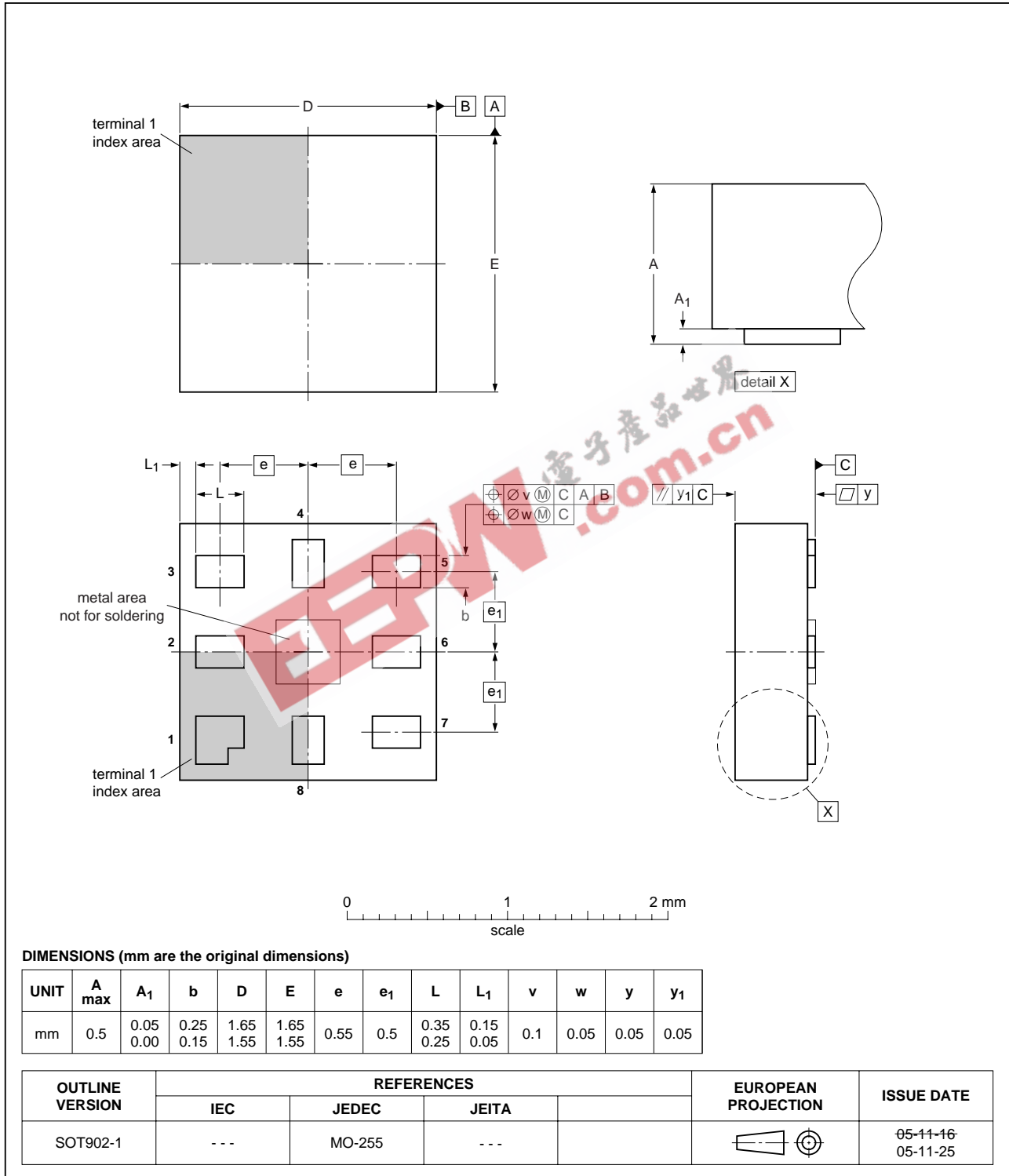


Fig 12. Package outline SOT902-1 (XQFN8)

## 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
TTL	Transistor-Transistor Logic

## 15. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AUP1G74_1	20060825	Product data sheet	-	-

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## 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".

[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 URL <http://www.semiconductors.philips.com>.

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