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 µA (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_{OFF} 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			
	Temperature range	Name	Description	Version
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

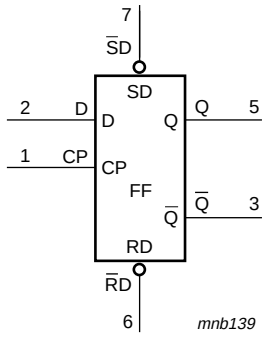


Fig 1. Logic symbol

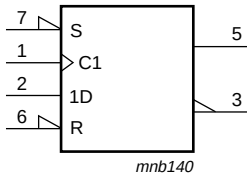


Fig 2. IEC logic symbol

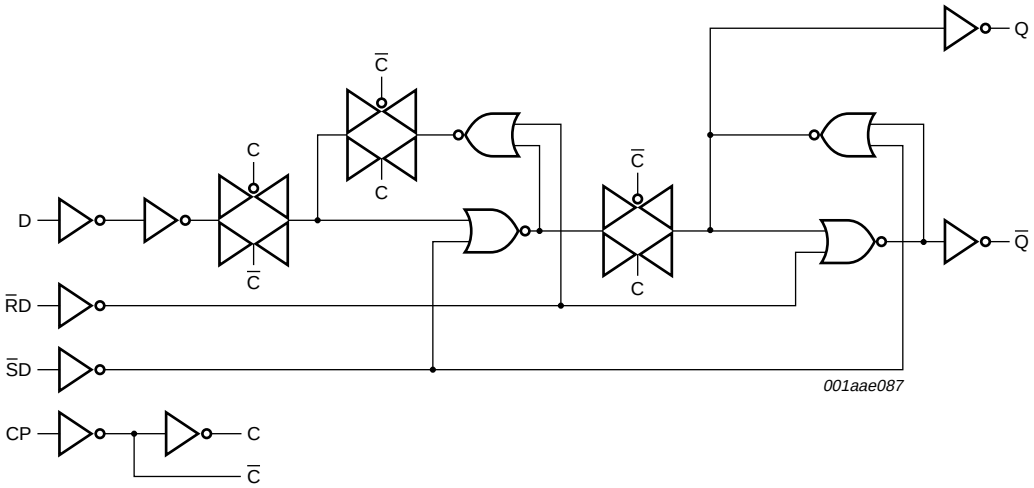


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

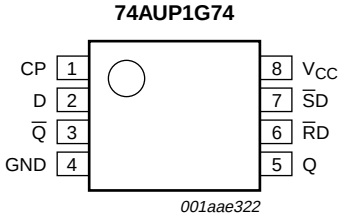
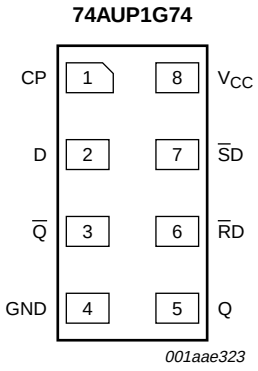
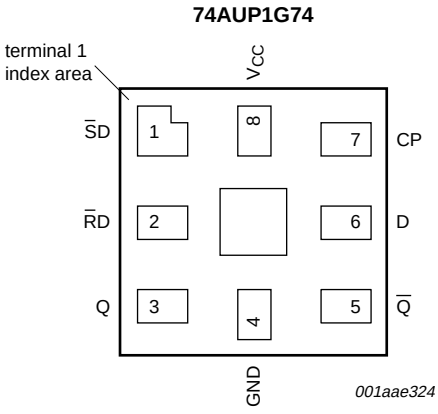


Fig 4. Pin configuration SOT765-1 (VSSOP8)



Transparent top view

Fig 5. Pin configuration SOT833-1 (XSON8)



Transparent top view

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
$\overline{Q}$	3	5	complement flip-flop output
GND	4	4	ground (0 V)
Q	5	3	true flip-flop output
$\overline{RD}$	6	2	asynchronous reset-direct (active LOW)
$\overline{SD}$	7	1	asynchronous set-direct (active LOW)
V_{CC}	8	8	supply voltage

7. Functional description

Table 4. Asynchronous operation[1]

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

Table 5. Synchronous operation[1]

Input				Output	
$\overline{SD}$	$\overline{RD}$	CP	D	Q_{n+1}	$\overline{Q}_{n+1}$
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_{GND}	ground current			-	–50	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation	T_{amb} = –40 °C to +125 °C	[2]	-	250	mW

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

[2] For VSSOP8 packages: above 110 °C the value of P_{tot} derates linearly with 8.0 mW/K.
For XSON8 and XQFN8 packages: above 45 °C the value of P_{tot} derates linearly with 2.4 mW/K.

9. Recommended operating conditions

Table 7. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		0.8	3.6	V
V_I	input voltage		0	3.6	V
V_O	output voltage	Active mode	0	V_{CC}	V
		Power-down mode; V_{CC} = 0 V	0	3.6	V
T_{amb}	ambient temperature		–40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 0.8 V to 3.6 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_{amb} = 25 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 0.8 V	0.70 × V_{CC}	-	-	V
		V_{CC} = 0.9 V to 1.95 V	0.65 × V_{CC}	-	-	V
		V_{CC} = 2.3 V to 2.7 V	1.6	-	-	V
		V_{CC} = 3.0 V to 3.6 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 0.8 V	-	-	0.30 × V_{CC}	V
		V_{CC} = 0.9 V to 1.95 V	-	-	0.35 × V_{CC}	V
		V_{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V_{CC} = 3.0 V to 3.6 V	-	-	0.9	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}				
		I_O = –20 µA; V_{CC} = 0.8 V to 3.6 V	V_{CC} – 0.1	-	-	V
		I_O = –1.1 mA; V_{CC} = 1.1 V	0.75 × V_{CC}	-	-	V
		I_O = –1.7 mA; V_{CC} = 1.4 V	1.11	-	-	V
		I_O = –1.9 mA; V_{CC} = 1.65 V	1.32	-	-	V
		I_O = –2.3 mA; V_{CC} = 2.3 V	2.05	-	-	V
		I_O = –3.1 mA; V_{CC} = 2.3 V	1.9	-	-	V
		I_O = –2.7 mA; V_{CC} = 3.0 V	2.72	-	-	V
		I_O = –4.0 mA; V_{CC} = 3.0 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_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 µA; V_{CC} = 0.8 V to 3.6 V		-	-	0.1	V
		I_O = 1.1 mA; V_{CC} = 1.1 V		-	-	$0.3 \times V_{CC}$	V
		I_O = 1.7 mA; V_{CC} = 1.4 V		-	-	0.31	V
		I_O = 1.9 mA; V_{CC} = 1.65 V		-	-	0.31	V
		I_O = 2.3 mA; V_{CC} = 2.3 V		-	-	0.31	V
		I_O = 3.1 mA; V_{CC} = 2.3 V		-	-	0.44	V
		I_O = 2.7 mA; V_{CC} = 3.0 V		-	-	0.31	V
		I_O = 4.0 mA; V_{CC} = 3.0 V		-	-	0.44	V
I_I	input leakage current	V_I = GND to 3.6 V; V_{CC} = 0 V to 3.6 V		-	-	±0.1	µA
I_{OFF}	power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V		-	-	±0.2	µA
ΔI_{OFF}	additional power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V to 0.2 V		-	-	±0.2	µA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 A; V_{CC} = 0.8 V to 3.6 V		-	-	0.5	µA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6$ V; I_O = 0 A; V_{CC} = 3.3 V; per pin	[1]	-	-	40	µA
C_I	input capacitance	V_{CC} = 0 V to 3.6 V; V_I = GND or V_{CC}		-	0.6	-	pF
C_O	output capacitance	V_O = GND; V_{CC} = 0 V		-	1.3	-	pF
T_{amb} = −40 °C to +85 °C							
V_{IH}	HIGH-level input voltage	V_{CC} = 0.8 V		$0.70 \times V_{CC}$	-	-	V
		V_{CC} = 0.9 V to 1.95 V		$0.65 \times V_{CC}$	-	-	V
		V_{CC} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CC} = 3.0 V to 3.6 V		2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 0.8 V		-	-	$0.30 \times V_{CC}$	V
		V_{CC} = 0.9 V to 1.95 V		-	-	$0.35 \times V_{CC}$	V
		V_{CC} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CC} = 3.0 V to 3.6 V		-	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = −20 µA; V_{CC} = 0.8 V to 3.6 V		$V_{CC} - 0.1$	-	-	V
		I_O = −1.1 mA; V_{CC} = 1.1 V		$0.7 \times V_{CC}$	-	-	V
		I_O = −1.7 mA; V_{CC} = 1.4 V		1.03	-	-	V
		I_O = −1.9 mA; V_{CC} = 1.65 V		1.30	-	-	V
		I_O = −2.3 mA; V_{CC} = 2.3 V		1.97	-	-	V
		I_O = −3.1 mA; V_{CC} = 2.3 V		1.85	-	-	V
		I_O = −2.7 mA; V_{CC} = 3.0 V		2.67	-	-	V
		I_O = −4.0 mA; V_{CC} = 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_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 μA; V_{CC} = 0.8 V to 3.6 V		-	-	0.1	V
		I_O = 1.1 mA; V_{CC} = 1.1 V		-	-	0.3 × V_{CC}	V
		I_O = 1.7 mA; V_{CC} = 1.4 V		-	-	0.37	V
		I_O = 1.9 mA; V_{CC} = 1.65 V		-	-	0.35	V
		I_O = 2.3 mA; V_{CC} = 2.3 V		-	-	0.33	V
		I_O = 3.1 mA; V_{CC} = 2.3 V		-	-	0.45	V
		I_O = 2.7 mA; V_{CC} = 3.0 V		-	-	0.33	V
		I_O = 4.0 mA; V_{CC} = 3.0 V		-	-	0.45	V
I_I	input leakage current	V_I = GND to 3.6 V; V_{CC} = 0 V to 3.6 V		-	-	±0.5	μA
I_{OFF}	power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V		-	-	±0.5	μA
ΔI_{OFF}	additional power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V to 0.2 V		-	-	±0.6	μA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 A; V_{CC} = 0.8 V to 3.6 V		-	-	0.9	μA
ΔI_{CC}	additional supply current	$V_I = V_{CC}$ − 0.6 V; I_O = 0 A; V_{CC} = 3.3 V; per pin	[1]	-	-	50	μA
T_{amb} = −40 °C to +125 °C							
V_{IH}	HIGH-level input voltage	V_{CC} = 0.8 V		0.75 × V_{CC}	-	-	V
		V_{CC} = 0.9 V to 1.95 V		0.70 × V_{CC}	-	-	V
		V_{CC} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CC} = 3.0 V to 3.6 V		2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 0.8 V		-	-	0.25 × V_{CC}	V
		V_{CC} = 0.9 V to 1.95 V		-	-	0.30 × V_{CC}	V
		V_{CC} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CC} = 3.0 V to 3.6 V		-	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = −20 μA; V_{CC} = 0.8 V to 3.6 V		V_{CC} − 0.11	-	-	V
		I_O = −1.1 mA; V_{CC} = 1.1 V		0.6 × V_{CC}	-	-	V
		I_O = −1.7 mA; V_{CC} = 1.4 V		0.93	-	-	V
		I_O = −1.9 mA; V_{CC} = 1.65 V		1.17	-	-	V
		I_O = −2.3 mA; V_{CC} = 2.3 V		1.77	-	-	V
		I_O = −3.1 mA; V_{CC} = 2.3 V		1.67	-	-	V
		I_O = −2.7 mA; V_{CC} = 3.0 V		2.40	-	-	V
		I_O = −4.0 mA; V_{CC} = 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_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 µA; V_{CC} = 0.8 V to 3.6 V		-	-	0.11	V
		I_O = 1.1 mA; V_{CC} = 1.1 V		-	-	0.33 × V_{CC}	V
		I_O = 1.7 mA; V_{CC} = 1.4 V		-	-	0.41	V
		I_O = 1.9 mA; V_{CC} = 1.65 V		-	-	0.39	V
		I_O = 2.3 mA; V_{CC} = 2.3 V		-	-	0.36	V
		I_O = 3.1 mA; V_{CC} = 2.3 V		-	-	0.50	V
		I_O = 2.7 mA; V_{CC} = 3.0 V		-	-	0.36	V
		I_O = 4.0 mA; V_{CC} = 3.0 V		-	-	0.50	V
I_I	input leakage current	V_I = GND to 3.6 V; V_{CC} = 0 V to 3.6 V		-	-	±0.75	µA
I_{OFF}	power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V		-	-	±0.75	µA
ΔI_{OFF}	additional power-off leakage current	V_I or V_O = 0 V to 3.6 V; V_{CC} = 0 V to 0.2 V		-	-	±0.75	µA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 A; V_{CC} = 0.8 V to 3.6 V		-	-	1.4	µA
ΔI_{CC}	additional supply current	$V_I = V_{CC}$ − 0.6 V; I_O = 0 A; V_{CC} = 3.3 V; per pin	[1]	-	-	75	µA

[1] One input at V_{CC} − 0.6 V, other input at V_{CC} 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[1]	Max	Min	Max (85 °C)	Min	Max (125 °C)	
C_L = 5 pF										
t_{pd}	propagation delay	CP to Q, $\overline{Q}$; see Figure 7 [2]								
		V_{CC} = 0.8 V	-	25.4	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	2.9	6.7	14.0	2.6	14.2	2.6	14.2	ns
		V_{CC} = 1.4 V to 1.6 V	2.4	4.5	7.6	2.3	8.3	2.3	8.6	ns
		V_{CC} = 1.65 V to 1.95 V	1.9	3.5	5.7	1.7	6.5	1.7	6.8	ns
		V_{CC} = 2.3 V to 2.7 V	1.7	2.6	3.7	1.4	4.3	1.4	4.6	ns
		V_{CC} = 3.0 V to 3.6 V	1.5	2.2	3.0	1.2	3.3	1.2	3.5	ns
		$\overline{SD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	19.6	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	2.7	5.6	11.0	2.5	11.4	2.5	11.5	ns
		V_{CC} = 1.4 V to 1.6 V	2.4	4.0	6.3	2.2	6.9	2.2	7.3	ns
		V_{CC} = 1.65 V to 1.95 V	2.0	3.3	4.9	1.7	5.6	1.7	5.9	ns
		V_{CC} = 2.3 V to 2.7 V	1.9	2.7	3.6	1.7	3.8	1.7	4.1	ns
		V_{CC} = 3.0 V to 3.6 V	1.8	2.5	3.1	1.5	3.5	1.5	3.7	ns
		$\overline{RD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	19.2	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	2.6	5.5	11.0	2.5	11.3	2.5	11.4	ns
		V_{CC} = 1.4 V to 1.6 V	2.3	3.9	6.3	2.2	6.8	2.2	7.2	ns
		V_{CC} = 1.65 V to 1.95 V	1.9	3.2	5.0	1.8	5.6	1.8	5.9	ns
		V_{CC} = 2.3 V to 2.7 V	1.9	2.6	3.6	1.7	4.0	1.7	4.3	ns
		V_{CC} = 3.0 V to 3.6 V	1.8	2.4	3.2	1.5	3.8	1.5	4.0	ns
f_{max}	maximum frequency	CP; see Figure 8								
		V_{CC} = 0.8 V	-	53	-	-	-	-	-	MHz
		V_{CC} = 1.1 V to 1.3 V	-	203	-	170	-	170	-	MHz
		V_{CC} = 1.4 V to 1.6 V	-	347	-	310	-	300	-	MHz
		V_{CC} = 1.65 V to 1.95 V	-	435	-	400	-	390	-	MHz
		V_{CC} = 2.3 V to 2.7 V	-	550	-	490	-	480	-	MHz
		V_{CC} = 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[1]	Max	Min	Max (85 °C)	Min	Max (125 °C)	
C_L = 10 pF										
t_{pd}	propagation delay	CP to Q, $\overline{Q}$; see Figure 7 [2]								
		V_{CC} = 0.8 V	-	28.9	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	3.1	7.5	15.8	2.9	16.1	2.9	16.1	ns
		V_{CC} = 1.4 V to 1.6 V	2.7	5.1	8.7	2.4	9.4	2.4	9.8	ns
		V_{CC} = 1.65 V to 1.95 V	2.5	4.1	6.5	2.2	7.2	2.2	7.6	ns
		V_{CC} = 2.3 V to 2.7 V	2.0	3.2	4.3	1.8	4.9	1.8	5.3	ns
		V_{CC} = 3.0 V to 3.6 V	1.8	2.8	3.7	1.6	4.0	1.6	4.3	ns
		$\overline{SD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	23.2	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	2.9	6.5	12.9	2.8	13.3	2.8	13.5	ns
		V_{CC} = 1.4 V to 1.6 V	2.7	4.6	7.5	2.3	7.9	2.3	8.3	ns
		V_{CC} = 1.65 V to 1.95 V	2.6	3.9	5.6	2.3	6.3	2.3	6.6	ns
		V_{CC} = 2.3 V to 2.7 V	2.3	3.2	4.2	2.0	4.6	2.0	4.9	ns
		V_{CC} = 3.0 V to 3.6 V	2.2	3.0	3.7	1.9	4.0	1.9	4.2	ns
		$\overline{RD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	22.7	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	2.8	6.4	12.8	2.7	13.2	2.7	13.4	ns
		V_{CC} = 1.4 V to 1.6 V	2.6	4.5	7.5	2.3	8.1	2.3	8.4	ns
		V_{CC} = 1.65 V to 1.95 V	2.5	3.3	5.8	2.3	6.3	2.3	6.7	ns
		V_{CC} = 2.3 V to 2.7 V	2.2	3.2	4.2	2.0	4.6	2.0	5.0	ns
		V_{CC} = 3.0 V to 3.6 V	2.0	2.9	3.9	1.9	4.6	1.9	4.8	ns
f_{max}	maximum frequency	CP; see Figure 8								
		V_{CC} = 0.8 V	-	52	-	-	-	-	-	MHz
		V_{CC} = 1.1 V to 1.3 V	-	192	-	150	-	150	-	MHz
		V_{CC} = 1.4 V to 1.6 V	-	324	-	280	-	230	-	MHz
		V_{CC} = 1.65 V to 1.95 V	-	421	-	310	-	250	-	MHz
		V_{CC} = 2.3 V to 2.7 V	-	486	-	370	-	360	-	MHz
		V_{CC} = 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[1]	Max	Min	Max (85 °C)	Min	Max (125 °C)	
C_L = 15 pF										
t_{pd}	propagation delay	CP to Q, $\overline{Q}$; see Figure 7 [2]								
		V_{CC} = 0.8 V	-	23.4	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	3.5	8.3	17.6	3.3	17.8	3.3	18.0	ns
		V_{CC} = 1.4 V to 1.6 V	3.2	5.6	9.5	2.8	10.5	2.8	11.1	ns
		V_{CC} = 1.65 V to 1.95 V	2.7	4.6	7.2	2.5	8.1	2.5	8.6	ns
		V_{CC} = 2.3 V to 2.7 V	2.4	3.6	5.0	2.2	5.6	2.2	6.0	ns
		V_{CC} = 3.0 V to 3.6 V	2.2	3.2	4.1	2.0	4.6	2.0	4.9	ns
		$\overline{SD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	26.7	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	3.3	7.3	14.7	3.1	15.2	3.1	15.4	ns
		V_{CC} = 1.4 V to 1.6 V	3.2	5.2	8.3	2.9	9.0	2.9	9.5	ns
		V_{CC} = 1.65 V to 1.95 V	2.8	4.3	6.4	2.5	7.1	2.5	7.5	ns
		V_{CC} = 2.3 V to 2.7 V	2.8	3.7	4.8	2.2	5.3	2.2	5.6	ns
		V_{CC} = 3.0 V to 3.6 V	2.5	3.5	4.3	2.4	4.7	2.4	4.9	ns
		$\overline{RD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	26.1	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	3.2	7.2	14.5	3.1	15.0	3.1	15.2	ns
		V_{CC} = 1.4 V to 1.6 V	3.1	5.1	8.4	2.7	9.2	2.7	9.7	ns
		V_{CC} = 1.65 V to 1.95 V	2.7	4.3	6.5	2.6	7.3	2.6	7.7	ns
		V_{CC} = 2.3 V to 2.7 V	2.6	3.6	4.9	2.4	5.4	2.4	5.8	ns
		V_{CC} = 3.0 V to 3.6 V	2.4	3.4	4.4	2.3	5.2	2.3	5.4	ns
f_{max}	maximum frequency	CP; see Figure 8								
		V_{CC} = 0.8 V	-	50	-	-	-	-	-	MHz
		V_{CC} = 1.1 V to 1.3 V	-	181	-	120	-	120	-	MHz
		V_{CC} = 1.4 V to 1.6 V	-	301	-	190	-	160	-	MHz
		V_{CC} = 1.65 V to 1.95 V	-	407	-	240	-	190	-	MHz
		V_{CC} = 2.3 V to 2.7 V	-	422	-	300	-	270	-	MHz
		V_{CC} = 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[1]	Max	Min	Max (85 °C)	Min	Max (125 °C)	
C_L = 30 pF										
t_{pd}	propagation delay	CP to Q, $\overline{Q}$; see Figure 7 [2]								
		V_{CC} = 0.8 V	-	42.7	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	4.2	10.6	22.5	4.0	23.0	4.0	23.3	ns
		V_{CC} = 1.4 V to 1.6 V	3.7	7.2	12.0	3.7	12.0	3.7	14.0	ns
		V_{CC} = 1.65 V to 1.95 V	3.5	5.8	9.2	3.4	9.2	3.4	11.0	ns
		V_{CC} = 2.3 V to 2.7 V	3.3	4.7	6.3	3.0	7.5	3.0	7.5	ns
		V_{CC} = 3.0 V to 3.6 V	3.0	4.3	5.3	2.8	5.3	2.8	6.7	ns
		$\overline{SD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	37.0	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	4.0	9.5	19.8	3.8	20.8	3.8	21.1	ns
		V_{CC} = 1.4 V to 1.6 V	3.8	6.7	10.9	3.7	12.0	3.7	12.7	ns
		V_{CC} = 1.65 V to 1.95 V	3.7	5.6	8.4	3.5	9.3	3.5	9.9	ns
		V_{CC} = 2.3 V to 2.7 V	3.7	4.8	6.1	3.2	6.7	3.2	7.1	ns
		V_{CC} = 3.0 V to 3.6 V	3.4	4.6	5.6	3.1	6.4	3.1	6.7	ns
		$\overline{RD}$ to Q, $\overline{Q}$; see Figure 8 [2]								
		V_{CC} = 0.8 V	-	36.4	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	3.9	9.4	19.5	3.8	20.2	3.8	20.5	ns
		V_{CC} = 1.4 V to 1.6 V	3.6	6.6	10.9	3.7	12.0	3.7	12.6	ns
		V_{CC} = 1.65 V to 1.95 V	3.5	5.5	8.5	3.5	9.5	3.5	10.1	ns
		V_{CC} = 2.3 V to 2.7 V	3.5	4.7	6.3	3.2	6.9	3.2	7.4	ns
		V_{CC} = 3.0 V to 3.6 V	3.3	4.4	5.7	3.1	6.7	3.1	7.0	ns
f_{max}	maximum frequency	CP; see Figure 8								
		V_{CC} = 0.8 V	-	28	-	-	-	-	-	MHz
		V_{CC} = 1.1 V to 1.3 V	-	128	-	70	-	70	-	MHz
		V_{CC} = 1.4 V to 1.6 V	-	206	-	120	-	110	-	MHz
		V_{CC} = 1.65 V to 1.95 V	-	262	-	150	-	120	-	MHz
		V_{CC} = 2.3 V to 2.7 V	-	269	-	190	-	170	-	MHz
		V_{CC} = 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[1]	Max	Min	Max (85 °C)	Min	Max (125 °C)	
C_L = 5 pF, 10 pF, 15 pF and 30 pF										
t_{su}	set-up time	D to CP HIGH; see Figure 7								
		V_{CC} = 0.8 V	-	3.4	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	-	0.6	-	1.1	-	1.1	-	ns
		V_{CC} = 1.4 V to 1.6 V	-	0.3	-	0.9	-	0.9	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	0.4	-	0.8	-	0.8	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	0.2	-	0.6	-	0.6	-	ns
		V_{CC} = 3.0 V to 3.6 V	-	0.3	-	0.5	-	0.5	-	ns
		D to CP LOW; see Figure 7								
		V_{CC} = 0.8 V	-	3.0	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	-	0.5	-	1.3	-	1.3	-	ns
		V_{CC} = 1.4 V to 1.6 V	-	0.3	-	1.1	-	1.1	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	0.4	-	1.0	-	1.0	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	0.5	-	0.9	-	0.9	-	ns
		V_{CC} = 3.0 V to 3.6 V	-	0.6	-	0.9	-	0.9	-	ns
t_h	hold time	D to CP; see Figure 7								
		V_{CC} = 0.8 V	-	–1.9	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	-	–0.3	-	0.2	-	0.2	-	ns
		V_{CC} = 1.4 V to 1.6 V	-	–0.2	-	0	-	0	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	–0.2	-	0	-	0	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	–0.2	-	0	-	0	-	ns
		V_{CC} = 3.0 V to 3.6 V	-	–0.2	-	0	-	0	-	ns
t_{rec}	recovery time	$\overline{R}D$; see Figure 8								
		V_{CC} = 1.1 V to 1.3 V	-	–0.5	-	–0.3	-	–0.3	-	ns
		V_{CC} = 1.4 V to 1.6 V	-	–0.2	-	–0.2	-	–0.2	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	–0.2	-	–0.1	-	–0.1	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	–0.1	-	0.1	-	0.1	-	ns
		V_{CC} = 3.0 V to 3.6 V	-	–0.1	-	0.1	-	0.1	-	ns
		$\overline{S}D$; see Figure 8								
		V_{CC} = 1.1 V to 1.3 V	-	–0.5	-	0	-	0	-	ns
		V_{CC} = 1.4 V to 1.6 V	-	–0.4	-	0	-	0	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	–0.3	-	0	-	0	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	–0.2	-	0.2	-	0.2	-	ns
		V_{CC} = 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.

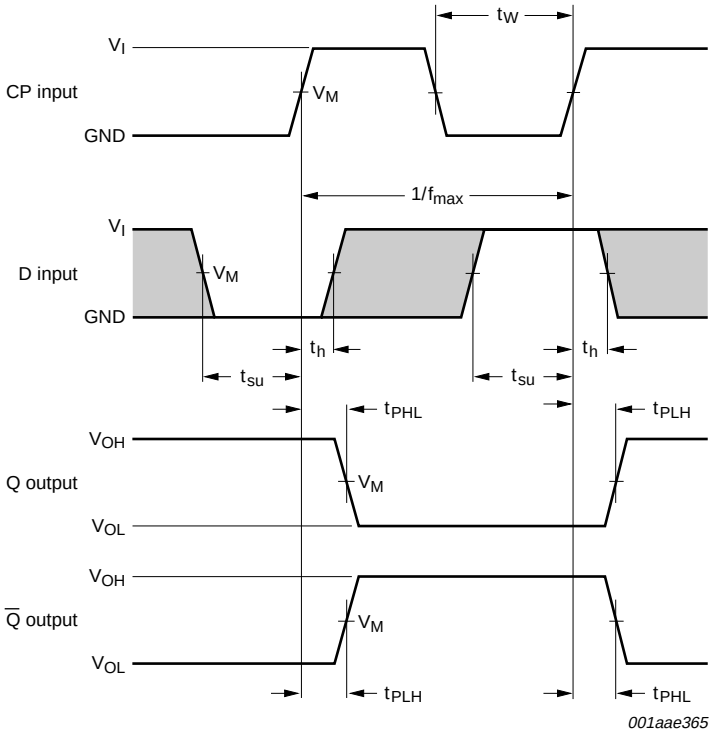
Symbol	Parameter	Conditions	25 °C			–40 °C to +125 °C				Unit
			Min	Typ[1]	Max	Min	Max (85 °C)	Min	Max (125 °C)	
t_W	pulse width	CP HIGH or LOW; see Figure 7								
		V_{CC} = 1.1 V to 1.3 V	-	1.7	-	2.6	-	2.6	-	ns
		V_{CC} = 1.4 V to 1.6 V	-	1.1	-	1.5	-	1.5	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	0.7	-	1.6	-	1.6	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	0.6	-	1.7	-	1.7	-	ns
		V_{CC} = 3.0 V to 3.6 V	-	0.5	-	1.9	-	1.9	-	ns
		$\overline{SD}$ or $\overline{RD}$ LOW; see Figure 8								
		V_{CC} = 1.1 V to 1.3 V	-	1.9	-	2.9	-	3.1	-	ns
		V_{CC} = 1.4 V to 1.6 V	-	1.1	-	1.5	-	1.7	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	0.8	-	1.1	-	1.3	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	0.5	-	0.7	-	0.9	-	ns
		V_{CC} = 3.0 V to 3.6 V	-	0.4	-	0.5	-	0.7	-	ns
C_{PD}	power dissipation capacitance	f = 1 MHz; V_I = GND to V_{CC} [3]								
		V_{CC} = 0.8 V	-	2.8	-	-	-	-	-	pF
		V_{CC} = 1.1 V to 1.3 V	-	2.9	-	-	-	-	-	pF
		V_{CC} = 1.4 V to 1.6 V	-	3.0	-	-	-	-	-	pF
		V_{CC} = 1.65 V to 1.95 V	-	3.0	-	-	-	-	-	pF
		V_{CC} = 2.3 V to 2.7 V	-	3.5	-	-	-	-	-	pF
		V_{CC} = 3.0 V to 3.6 V	-	3.9	-	-	-	-	-	pF

[1] All typical values are measured at nominal V_{CC}.

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = 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



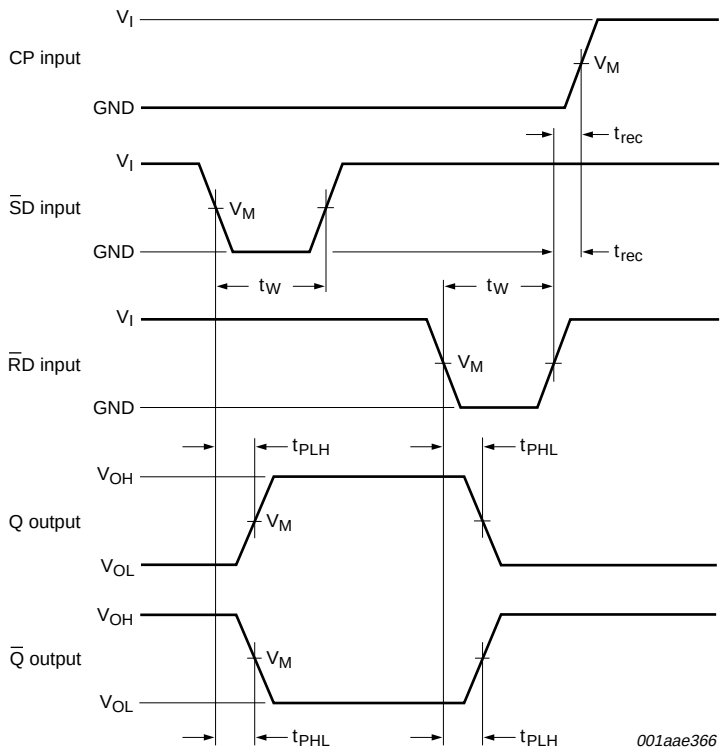
Measurement points are given in Table 10.

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, $\overline{Q}$) 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}	≤ 3.0 ns



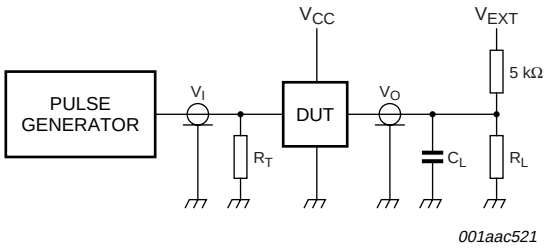
Measurement points are given in Table 11.

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

Fig 8. The set ($\overline{SD}$) and reset ($\overline{RD}$) input to output (Q, $\overline{Q}$) propagation delays, the set and reset pulse widths and the $\overline{RD}$ 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}	≤ 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

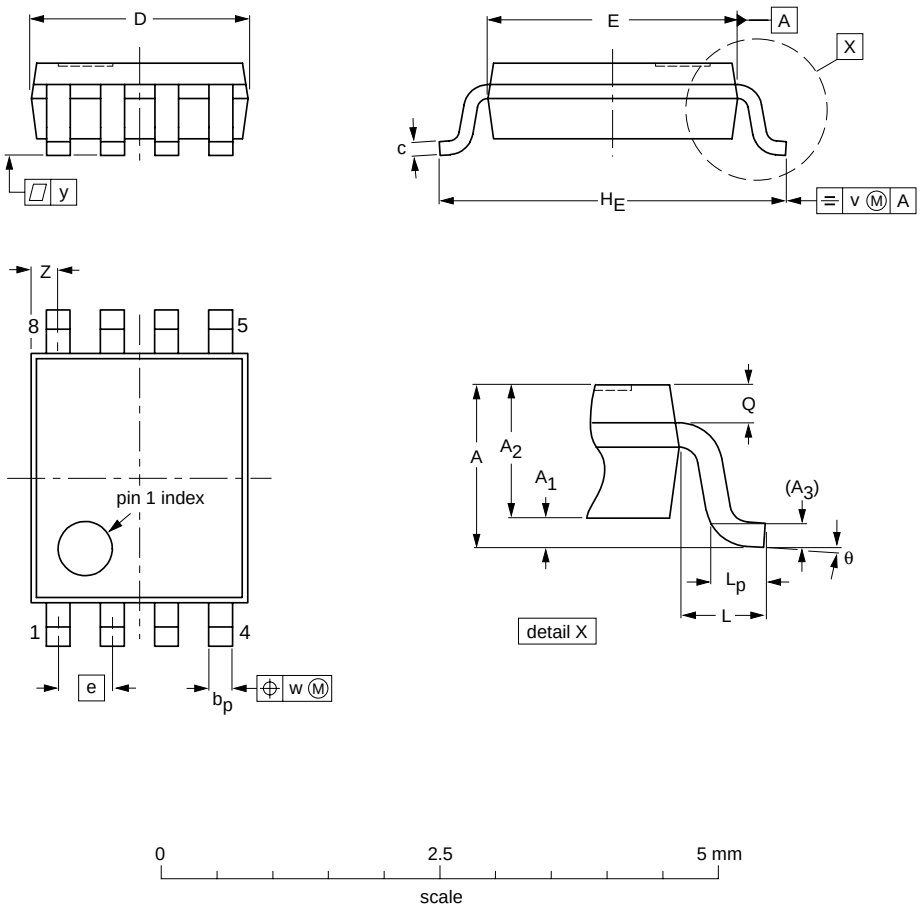
Table 12. Test data

Supply voltage	Load		V_{EXT}		
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 kΩ, for measuring propagation delays, setup and hold times and pulse width R_L = 1 MΩ .

13. Package outline

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm **SOT765-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1	0.15 0.00	0.85 0.60	0.12	0.27 0.17	0.23 0.08	2.1 1.9	2.4 2.2	0.5	3.2 3.0	0.4	0.40 0.15	0.21 0.19	0.2	0.13	0.1	0.4 0.1	8° 0°

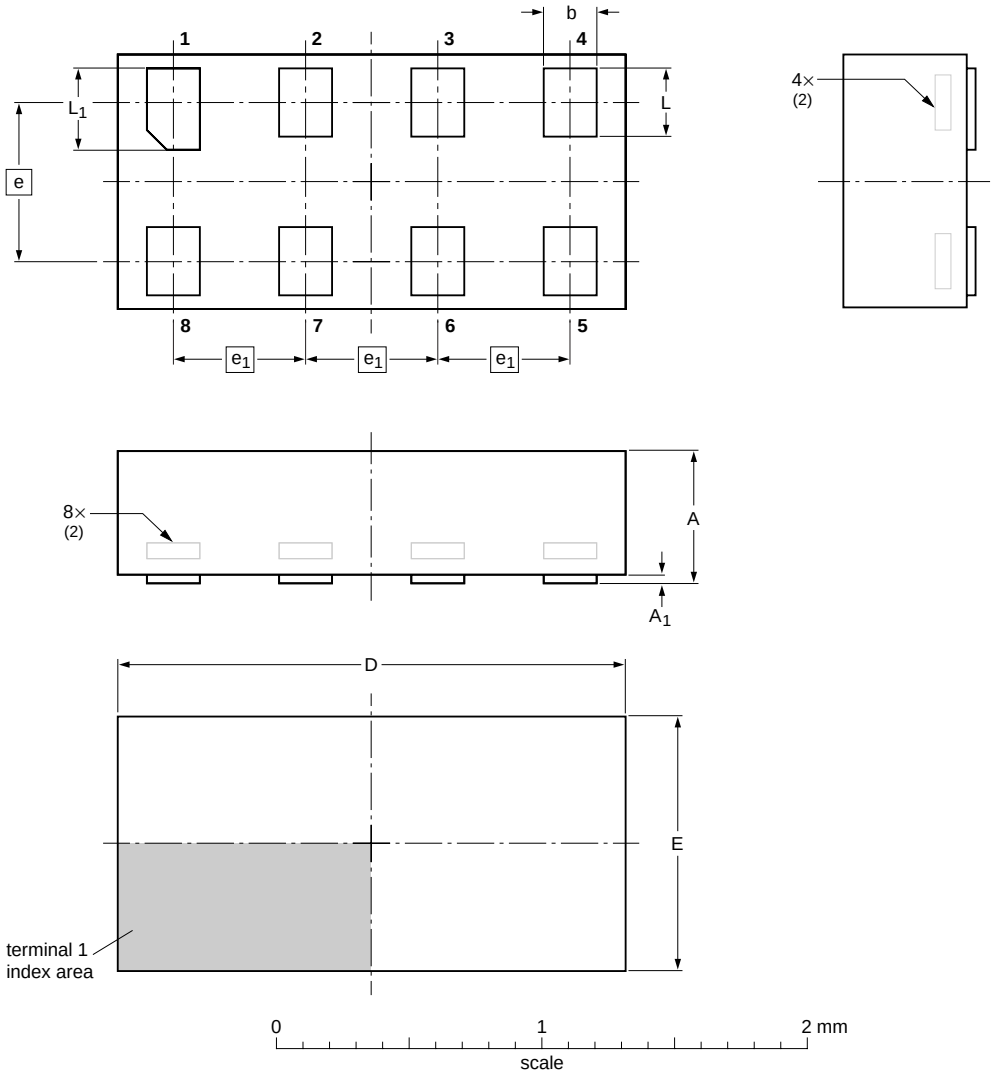
Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT765-1		MO-187				02-06-07

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**



DIMENSIONS (mm are the original dimensions)

UNIT	A(1) max	A1 max	b	D	E	e	e1	L	L1
mm	0.5	0.04	0.25 0.17	2.0 1.9	1.05 0.95	0.6	0.5	0.35 0.27	0.40 0.32

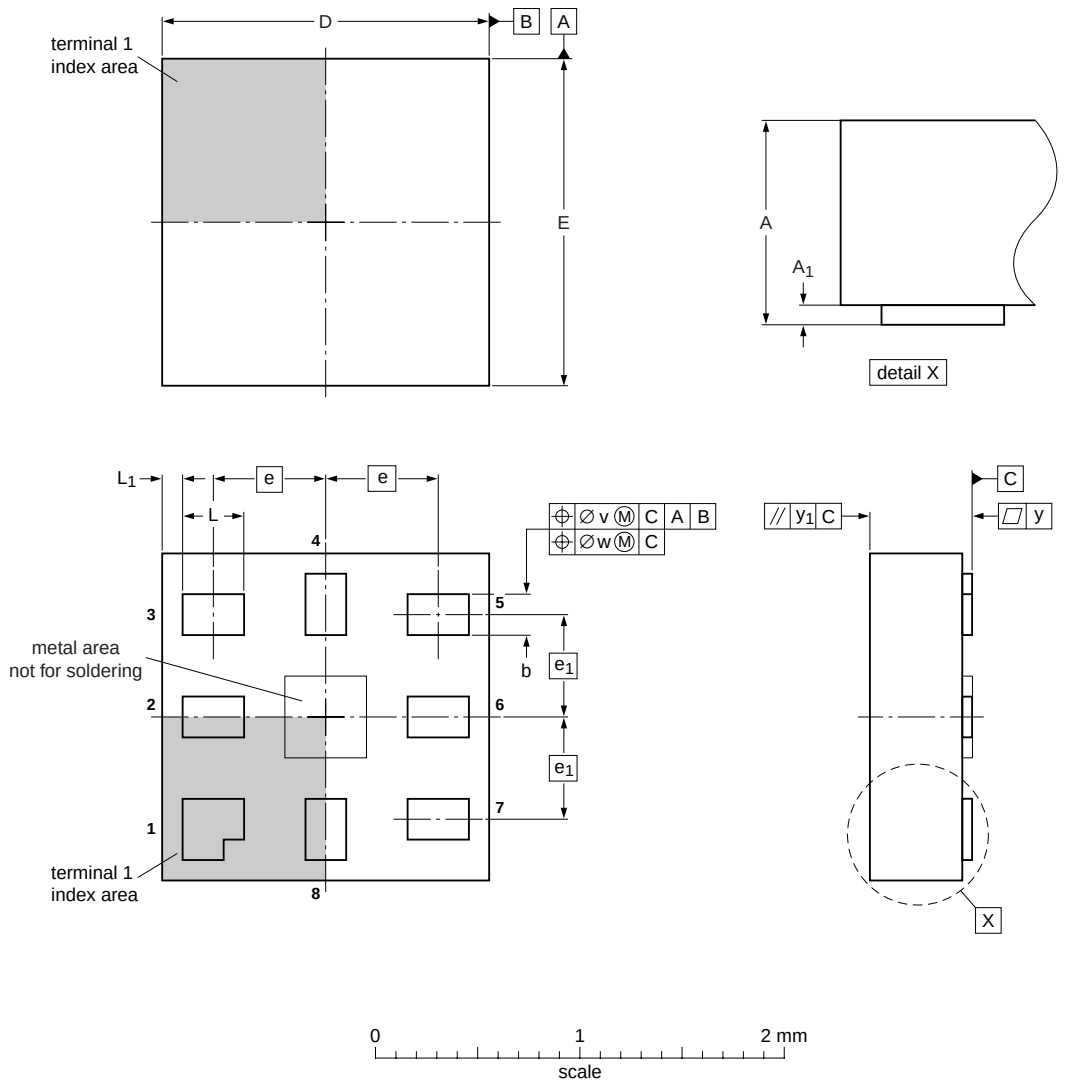
Notes

1. Including plating thickness.
2. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT833-1	- - -	MO-252	- - -			~~04-07-22~~ 04-11-09

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**



DIMENSIONS (mm are the original dimensions)

UNIT	A max	A_1	b	D	E	e	e_1	L	L_1	v	w	y	y_1
mm	0.5	0.05 0.00	0.25 0.15	1.65 1.55	1.65 1.55	0.55	0.5	0.35 0.25	0.15 0.05	0.1	0.05	0.05	0.05

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT902-1	- - -	MO-255	- - -			~~05-11-16~~ 05-11-25

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	-	-

16. Legal information

16.1 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.

[2] The term 'short data sheet' is explained in section "Definitions".

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