

74AUP1G74

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

Rev. 11 — 3 July 2017

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 ($\bar{S}D$) and reset ($\bar{R}D$) inputs and complementary Q and \bar{Q} outputs. The $\bar{S}D$ and $\bar{R}D$ 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 and benefits

- 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-A114F Class 3A exceeds 5000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101E exceeds 1000 V
- Low static power consumption; $I_{CC} = 0.9 \mu A$ (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 °C to +85 °C and -40 °C to +125 °C

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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
74AUP1G74GF	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm		SOT1089
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		SOT902-2
74AUP1G74GN	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm		SOT1116
74AUP1G74GS	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm		SOT1203
74AUP1G74GX	-40 °C to +125 °C	X2SON8	plastic thermal enhanced extremely thin small outline package; no leads; 8 terminals; body 1.35 × 0.8 × 0.35 mm		SOT1233

4 Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74AUP1G74DC	p74
74AUP1G74GT	p74
74AUP1G74GF	54
74AUP1G74GM	p74
74AUP1G74GN	54
74AUP1G74GS	54
74AUP1G74GX	54

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5 Functional diagram

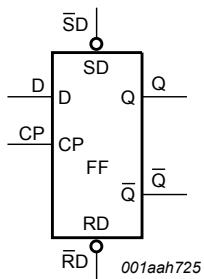


Figure 1. Logic symbol

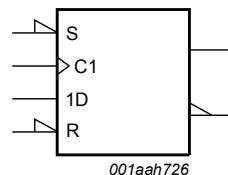


Figure 2. IEC logic symbol

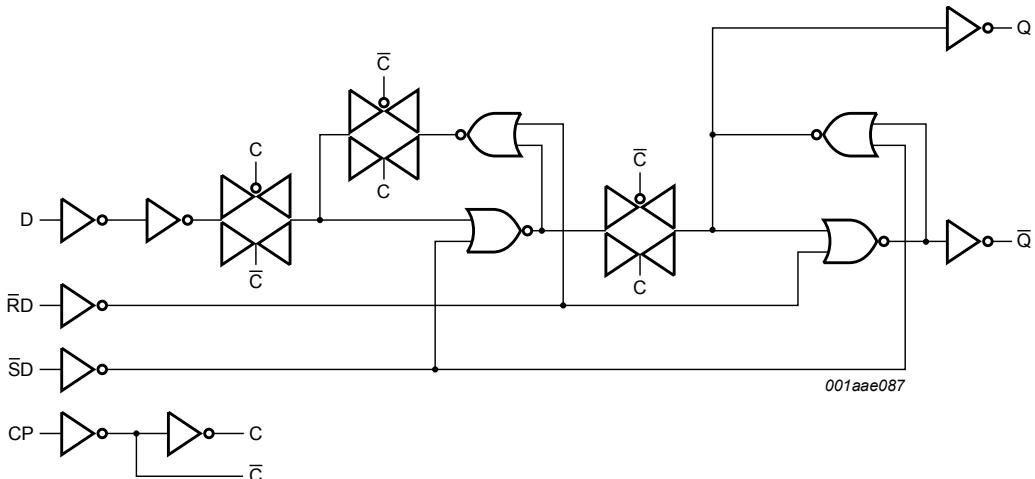


Figure 3. Logic diagram

6 Pinning information

6.1 Pinning

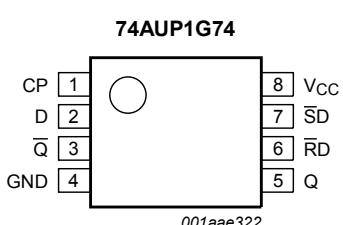


Figure 4. Pin configuration SOT765-1

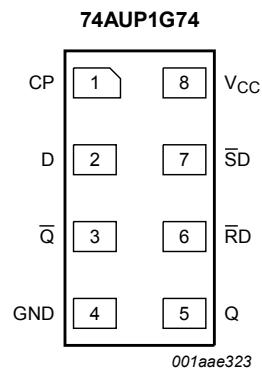


Figure 5. Pin configuration SOT833-1, SOT1089, SOT1116 and SOT1203

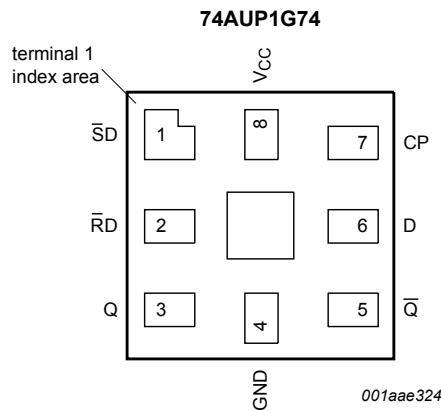


Figure 6. Pin configuration SOT902-2

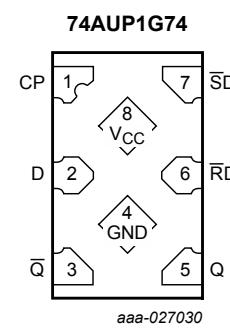


Figure 7. Pin configuration SOT1233

6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description	
		SOT765-1, SOT833-1, SOT1089, SOT1116, SOT1203 and SOT1233	SOT902-2
CP	1		7
D	2		6
\bar{Q}	3		5
GND	4		4
Q	5		3
$\bar{R}D$	6		2
$\bar{S}D$	7		1
V _{CC}	8		8

7 Functional description

Table 4. Function table for asynchronous operation ^[1]

Input				Output	
$\bar{S}D$	$\bar{R}D$	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 ^[1]

Input				Output	
$\bar{S}D$	$\bar{R}D$	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;
X = don't care;
↑ = LOW-to-HIGH CP transition;
 Q_{n+1} = 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_{CC}	supply voltage		-0.5	+4.6	V
V_I	input voltage		[1] -0.5	+4.6	V
V_O	output voltage	Active mode and Power-down mode	[1] -0.5	+4.6	V
I_{IK}	input clamping current	$V_I < 0$ V	-50	-	mA
I_{OK}	output clamping current	$V_O < 0$ V	-50	-	mA
I_o	output current	$V_O = 0$ V to V_{CC}	-	± 20	mA
I_{CC}	supply current		-	+50	mA
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 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

For X2SON8 package: above 118 °C the value of P_{tot} derates linearly with 7.7 mW/K.

9 Recommended operating conditions

Table 7. 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	-	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
$T_{\text{amb}} = 25^\circ\text{C}$						
V_{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_{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_{OH}	HIGH-level output voltage	$V_{\text{I}} = V_{\text{IH}}$ or V_{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
V_{OL}	LOW-level output voltage	$V_{\text{I}} = V_{\text{IH}}$ or V_{IL}				
		$I_{\text{O}} = 20\text{ }\mu\text{A}; V_{\text{CC}} = 0.8\text{ V to }3.6\text{ V}$	-	-	0.1	V
		$I_{\text{O}} = 1.1\text{ mA}; V_{\text{CC}} = 1.1\text{ V}$	-	-	$0.3 \times V_{\text{CC}}$	V
		$I_{\text{O}} = 1.7\text{ mA}; V_{\text{CC}} = 1.4\text{ V}$	-	-	0.31	V
		$I_{\text{O}} = 1.9\text{ mA}; V_{\text{CC}} = 1.65\text{ V}$	-	-	0.31	V
		$I_{\text{O}} = 2.3\text{ mA}; V_{\text{CC}} = 2.3\text{ V}$	-	-	0.31	V
		$I_{\text{O}} = 3.1\text{ mA}; V_{\text{CC}} = 2.3\text{ V}$	-	-	0.44	V
		$I_{\text{O}} = 2.7\text{ mA}; V_{\text{CC}} = 3.0\text{ V}$	-	-	0.31	V
		$I_{\text{O}} = 4.0\text{ mA}; V_{\text{CC}} = 3.0\text{ V}$	-	-	0.44	V
I_{I}	input leakage current	$V_{\text{I}} = \text{GND to }3.6\text{ V}; V_{\text{CC}} = 0\text{ V to }3.6\text{ V}$	-	-	± 0.1	μA
I_{OFF}	power-off leakage current	$V_{\text{I}} \text{ or } V_{\text{O}} = 0\text{ V to }3.6\text{ V}; V_{\text{CC}} = 0\text{ V}$	-	-	± 0.2	μA
ΔI_{OFF}	additional power-off leakage current	$V_{\text{I}} \text{ or } V_{\text{O}} = 0\text{ V to }3.6\text{ V}; V_{\text{CC}} = 0\text{ V to }0.2\text{ V}$	-	-	± 0.2	μA
I_{CC}	supply current	$V_{\text{I}} = \text{GND or }V_{\text{CC}}; I_{\text{O}} = 0\text{ A}; V_{\text{CC}} = 0.8\text{ V to }3.6\text{ V}$	-	-	0.5	μA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A}; V_{CC} = 3.3 \text{ V}$; per pin	[1]	-	-	40 μA
C_I	input capacitance	$V_{CC} = 0 \text{ V}$ to 3.6 V ; $V_I = \text{GND}$ or V_{CC}	-	0.6	-	pF
C_O	output capacitance	$V_O = \text{GND}$; $V_{CC} = 0 \text{ V}$	-	1.3	-	pF
$T_{\text{amb}} = -40 \text{ }^{\circ}\text{C}$ to $+85 \text{ }^{\circ}\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 0.8 \text{ V}$	$0.70 \times V_{CC}$	-	-	V
		$V_{CC} = 0.9 \text{ V}$ to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3 \text{ V}$ to 2.7 V	1.6	-	-	V
		$V_{CC} = 3.0 \text{ V}$ to 3.6 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 0.8 \text{ V}$	-	-	$0.30 \times V_{CC}$	V
		$V_{CC} = 0.9 \text{ V}$ to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3 \text{ V}$ to 2.7 V	-	-	0.7	V
		$V_{CC} = 3.0 \text{ V}$ to 3.6 V	-	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -20 \mu\text{A}; V_{CC} = 0.8 \text{ V}$ to 3.6 V	$V_{CC} - 0.1$	-	-	V
		$I_O = -1.1 \text{ mA}; V_{CC} = 1.1 \text{ V}$	$0.7 \times V_{CC}$	-	-	V
		$I_O = -1.7 \text{ mA}; V_{CC} = 1.4 \text{ V}$	1.03	-	-	V
		$I_O = -1.9 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.30	-	-	V
		$I_O = -2.3 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.97	-	-	V
		$I_O = -3.1 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.85	-	-	V
		$I_O = -2.7 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.67	-	-	V
		$I_O = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.55	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 20 \mu\text{A}; V_{CC} = 0.8 \text{ V}$ to 3.6 V	-	-	0.1	V
		$I_O = 1.1 \text{ mA}; V_{CC} = 1.1 \text{ V}$	-	-	$0.3 \times V_{CC}$	V
		$I_O = 1.7 \text{ mA}; V_{CC} = 1.4 \text{ V}$	-	-	0.37	V
		$I_O = 1.9 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.35	V
		$I_O = 2.3 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.33	V
		$I_O = 3.1 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.45	V
		$I_O = 2.7 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.33	V
		$I_O = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.45	V
I_I	input leakage current	$V_I = \text{GND}$ to $3.6 \text{ V}; V_{CC} = 0 \text{ V}$ to 3.6 V	-	-	± 0.5	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 0 \text{ V}$ to $3.6 \text{ V}; V_{CC} = 0 \text{ V}$	-	-	± 0.5	μA
ΔI_{OFF}	additional power-off leakage current	V_I or $V_O = 0 \text{ V}$ to $3.6 \text{ V}; V_{CC} = 0 \text{ V}$ to 0.2 V	-	-	± 0.6	μA
I_{CC}	supply current	$V_I = \text{GND}$ or V_{CC} ; $I_O = 0 \text{ A}; V_{CC} = 0.8 \text{ V}$ to 3.6 V	-	-	0.9	μA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 3.3 \text{ V}$; per pin	[1]	-	-	50 μA
$T_{amb} = -40 \text{ }^{\circ}\text{C}$ to $+125 \text{ }^{\circ}\text{C}$						
V_{IH}	HIGH-level input voltage	$V_{CC} = 0.8 \text{ V}$	$0.75 \times V_{CC}$	-	-	V
		$V_{CC} = 0.9 \text{ V}$ to 1.95 V	$0.70 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3 \text{ V}$ to 2.7 V	1.6	-	-	V
		$V_{CC} = 3.0 \text{ V}$ to 3.6 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 0.8 \text{ V}$	-	-	$0.25 \times V_{CC}$	V
		$V_{CC} = 0.9 \text{ V}$ to 1.95 V	-	-	$0.30 \times V_{CC}$	V
		$V_{CC} = 2.3 \text{ V}$ to 2.7 V	-	-	0.7	V
		$V_{CC} = 3.0 \text{ V}$ to 3.6 V	-	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -20 \mu\text{A}$; $V_{CC} = 0.8 \text{ V}$ to 3.6 V	$V_{CC} - 0.11$	-	-	V
		$I_O = -1.1 \text{ mA}$; $V_{CC} = 1.1 \text{ V}$	$0.6 \times V_{CC}$	-	-	V
		$I_O = -1.7 \text{ mA}$; $V_{CC} = 1.4 \text{ V}$	0.93	-	-	V
		$I_O = -1.9 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$	1.17	-	-	V
		$I_O = -2.3 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$	1.77	-	-	V
		$I_O = -3.1 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$	1.67	-	-	V
		$I_O = -2.7 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	2.40	-	-	V
		$I_O = -4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	2.30	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 20 \mu\text{A}$; $V_{CC} = 0.8 \text{ V}$ to 3.6 V	-	-	0.11	V
		$I_O = 1.1 \text{ mA}$; $V_{CC} = 1.1 \text{ V}$	-	-	$0.33 \times V_{CC}$	V
		$I_O = 1.7 \text{ mA}$; $V_{CC} = 1.4 \text{ V}$	-	-	0.41	V
		$I_O = 1.9 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$	-	-	0.39	V
		$I_O = 2.3 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$	-	-	0.36	V
		$I_O = 3.1 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$	-	-	0.50	V
		$I_O = 2.7 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	-	-	0.36	V
		$I_O = 4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	-	-	0.50	V
I_I	input leakage current	$V_I = \text{GND}$ to 3.6 V ; $V_{CC} = 0 \text{ V}$ to 3.6 V	-	-	± 0.75	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 0 \text{ V}$ to 3.6 V ; $V_{CC} = 0 \text{ V}$	-	-	± 0.75	μA
ΔI_{OFF}	additional power-off leakage current	V_I or $V_O = 0 \text{ V}$ to 3.6 V ; $V_{CC} = 0 \text{ V}$ to 0.2 V	-	-	± 0.75	μA
I_{CC}	supply current	$V_I = \text{GND}$ or V_{CC} ; $I_O = 0 \text{ A}$; $V_{CC} = 0.8 \text{ V}$ to 3.6 V	-	-	1.4	μA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 3.3 \text{ V}$; per pin	[1]	-	-	75 μA

[1] One input at $V_{CC} - 0.6 \text{ V}$, 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 10](#).

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Min	
<i>C_L</i> = 5 pF									
t _{pd}	propagation delay	CP to Q, \overline{Q} ; see Figure 8 . ^[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
		V _{CC} = 1.4 V to 1.6 V	2.4	4.5	7.6	2.3	8.3	2.3	8.6
		V _{CC} = 1.65 V to 1.95 V	1.9	3.5	5.7	1.7	6.5	1.7	6.8
		V _{CC} = 2.3 V to 2.7 V	1.7	2.6	3.8	1.4	4.4	1.4	4.7
		V _{CC} = 3.0 V to 3.6 V	1.5	2.2	3.1	1.2	3.4	1.2	3.7
		\overline{SD} to Q, \overline{Q} ; see Figure 9 . ^[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
		V _{CC} = 1.4 V to 1.6 V	2.4	4.0	6.3	2.2	6.9	2.2	7.3
		V _{CC} = 1.65 V to 1.95 V	2.0	3.3	4.9	1.7	5.6	1.7	5.9
		V _{CC} = 2.3 V to 2.7 V	1.9	2.7	3.7	1.7	4.0	1.7	4.2
		V _{CC} = 3.0 V to 3.6 V	1.8	2.5	3.2	1.5	3.6	1.5	3.8
		\overline{RD} to Q, \overline{Q} ; see Figure 9 . ^[2]							
		V _{CC} = 0.8 V	-	19.2	-	-	-	-	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	-
		V _{CC} = 1.4 V to 1.6 V	-	347	-	310	-	300	-
		V _{CC} = 1.65 V to 1.95 V	-	435	-	400	-	390	-
		V _{CC} = 2.3 V to 2.7 V	-	550	-	490	-	480	-
		V _{CC} = 3.0 V to 3.6 V	-	619	-	550	-	510	-

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Min	
<i>C_L = 10 pF</i>									
t _{pd}	propagation delay	CP to Q, \bar{Q} ; see Figure 8. [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
		V _{CC} = 1.4 V to 1.6 V	2.7	5.1	8.7	2.4	9.4	2.4	9.8
		V _{CC} = 1.65 V to 1.95 V	2.5	4.1	6.5	2.2	7.2	2.2	7.6
		V _{CC} = 2.3 V to 2.7 V	2.0	3.2	4.6	1.8	5.3	1.8	5.6
		V _{CC} = 3.0 V to 3.6 V	1.8	2.8	3.8	1.6	4.1	1.6	4.4
		$\bar{S}D$ to Q, \bar{Q} ; see Figure 9. [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
		V _{CC} = 1.4 V to 1.6 V	2.7	4.6	7.5	2.3	7.9	2.3	8.3
		V _{CC} = 1.65 V to 1.95 V	2.6	3.9	5.6	2.3	6.3	2.3	6.6
		V _{CC} = 2.3 V to 2.7 V	2.3	3.2	4.4	2.0	4.8	2.0	5.2
		V _{CC} = 3.0 V to 3.6 V	2.2	3.0	3.9	1.9	4.2	1.9	4.4
		RD to Q, \bar{Q} ; see Figure 9. [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
		V _{CC} = 1.4 V to 1.6 V	2.6	4.5	7.5	2.3	8.1	2.3	8.4
		V _{CC} = 1.65 V to 1.95 V	2.5	3.3	5.8	2.3	6.3	2.3	6.7
		V _{CC} = 2.3 V to 2.7 V	2.2	3.2	4.4	2.0	4.9	2.0	5.2
		V _{CC} = 3.0 V to 3.6 V	2.0	2.9	4.0	1.9	4.3	1.9	4.5
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	-
		V _{CC} = 1.4 V to 1.6 V	-	324	-	280	-	230	-
		V _{CC} = 1.65 V to 1.95 V	-	421	-	310	-	250	-
		V _{CC} = 2.3 V to 2.7 V	-	486	-	370	-	360	-
		V _{CC} = 3.0 V to 3.6 V	-	550	-	410	-	360	-

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Min	
<i>C_L = 15 pF</i>									
t _{pd}	propagation delay	CP to Q, \bar{Q} ; see Figure 8. [2]							
		V _{CC} = 0.8 V	-	32.4	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	3.5	8.3	17.6	3.3	17.8	3.3	18.0
		V _{CC} = 1.4 V to 1.6 V	3.2	5.6	9.5	2.8	10.5	2.8	11.1
		V _{CC} = 1.65 V to 1.95 V	2.7	4.6	7.2	2.5	8.1	2.5	8.6
		V _{CC} = 2.3 V to 2.7 V	2.4	3.6	5.2	2.2	5.8	2.2	6.2
		V _{CC} = 3.0 V to 3.6 V	2.2	3.2	4.4	2.0	4.9	2.0	5.2
		SD to Q, \bar{Q} ; see Figure 9. [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
		V _{CC} = 1.4 V to 1.6 V	3.2	5.2	8.3	2.9	9.0	2.9	9.5
		V _{CC} = 1.65 V to 1.95 V	2.8	4.3	6.4	2.5	7.1	2.5	7.5
		V _{CC} = 2.3 V to 2.7 V	2.8	3.7	5.1	2.2	5.5	2.2	5.8
		V _{CC} = 3.0 V to 3.6 V	2.5	3.5	4.6	2.4	5.0	2.4	5.2
		RD to Q, \bar{Q} ; see Figure 9. [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
		V _{CC} = 1.4 V to 1.6 V	3.1	5.1	8.4	2.7	9.2	2.7	9.7
		V _{CC} = 1.65 V to 1.95 V	2.7	4.3	6.5	2.6	7.3	2.6	7.7
		V _{CC} = 2.3 V to 2.7 V	2.6	3.6	5.0	2.4	5.5	2.4	5.8
		V _{CC} = 3.0 V to 3.6 V	2.4	3.4	4.6	2.3	5.0	2.3	5.2
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	-
		V _{CC} = 1.4 V to 1.6 V	-	301	-	190	-	160	-
		V _{CC} = 1.65 V to 1.95 V	-	407	-	240	-	190	-
		V _{CC} = 2.3 V to 2.7 V	-	422	-	300	-	270	-
		V _{CC} = 3.0 V to 3.6 V	-	481	-	320	-	300	-

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Min	
<i>C_L = 30 pF</i>									
t _{pd}	propagation delay	CP to Q, \bar{Q} ; see Figure 8. [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
		V _{CC} = 1.4 V to 1.6 V	3.7	7.2	12.0	3.7	13.3	3.7	14.0
		V _{CC} = 1.65 V to 1.95 V	3.5	5.8	9.2	3.4	10.4	3.4	11.0
		V _{CC} = 2.3 V to 2.7 V	3.3	4.7	6.6	3.0	7.3	3.0	7.8
		V _{CC} = 3.0 V to 3.6 V	3.0	4.3	5.8	2.8	6.8	2.8	7.3
		$\bar{S}D$ to Q, \bar{Q} ; see Figure 9. [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
		V _{CC} = 1.4 V to 1.6 V	3.8	6.7	10.9	3.7	12.0	3.7	12.7
		V _{CC} = 1.65 V to 1.95 V	3.7	5.6	8.4	3.5	9.3	3.5	9.9
		V _{CC} = 2.3 V to 2.7 V	3.7	4.8	6.6	3.2	7.2	3.2	7.6
		V _{CC} = 3.0 V to 3.6 V	3.4	4.6	6.0	3.1	6.8	3.1	7.1
		RD to Q, \bar{Q} ; see Figure 9. [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
		V _{CC} = 1.4 V to 1.6 V	3.6	6.6	10.9	3.7	12.0	3.7	12.6
		V _{CC} = 1.65 V to 1.95 V	3.5	5.5	8.5	3.5	9.5	3.5	10.1
		V _{CC} = 2.3 V to 2.7 V	3.5	4.7	6.5	3.2	7.1	3.2	7.6
		V _{CC} = 3.0 V to 3.6 V	3.3	4.4	6.1	3.1	7.1	3.1	7.5
f _{max}	maximum frequency	CP; see Figure 8.							
		V _{CC} = 0.8 V	-	28	-	-	-	-	MHz
		V _{CC} = 1.1 V to 1.3 V	-	145	-	70	-	70	-
		V _{CC} = 1.4 V to 1.6 V	-	185	-	120	-	110	-
		V _{CC} = 1.65 V to 1.95 V	-	270	-	150	-	120	-
		V _{CC} = 2.3 V to 2.7 V	-	290	-	190	-	170	-
		V _{CC} = 3.0 V to 3.6 V	-	315	-	200	-	190	-

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Min	
C _L = 5 pF, 10 pF, 15 pF and 30 pF									
t _{su}	set-up time	D to CP HIGH; see Figure 8 .							
		V _{CC} = 0.8 V	-	3.4	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	-	0.6	-	1.2	-	1.2	-
		V _{CC} = 1.4 V to 1.6 V	-	0.3	-	0.6	-	0.6	-
		V _{CC} = 1.65 V to 1.95 V	-	0.4	-	0.5	-	0.5	-
		V _{CC} = 2.3 V to 2.7 V	-	0.2	-	0.4	-	0.4	-
		V _{CC} = 3.0 V to 3.6 V	-	0.3	-	0.4	-	0.4	-
		D to CP LOW; see Figure 8 .							
		V _{CC} = 0.8 V	-	3.0	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	-	0.5	-	1.2	-	1.2	-
		V _{CC} = 1.4 V to 1.6 V	-	0.3	-	0.7	-	0.7	-
		V _{CC} = 1.65 V to 1.95 V	-	0.4	-	0.7	-	0.7	-
		V _{CC} = 2.3 V to 2.7 V	-	0.5	-	0.7	-	0.7	-
		V _{CC} = 3.0 V to 3.6 V	-	0.6	-	0.8	-	0.8	-
t _h	hold time	D to CP; see Figure 8 .							
		V _{CC} = 0.8 V	-	-1.9	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	-	-0.3	-	0.5	-	0.5	-
		V _{CC} = 1.4 V to 1.6 V	-	-0.2	-	0.2	-	0.2	-
		V _{CC} = 1.65 V to 1.95 V	-	-0.2	-	0.1	-	0.1	-
		V _{CC} = 2.3 V to 2.7 V	-	-0.2	-	0.1	-	0.1	-
		V _{CC} = 3.0 V to 3.6 V	-	-0.2	-	0.1	-	0.1	-
t _{rec}	recovery time	RD; see Figure 9							
		V _{CC} = 1.1 V to 1.3 V	-	-0.5	-	-0.9	-	-0.9	-
		V _{CC} = 1.4 V to 1.6 V	-	-0.2	-	-0.6	-	-0.6	-
		V _{CC} = 1.65 V to 1.95 V	-	-0.2	-	-0.4	-	-0.4	-
		V _{CC} = 2.3 V to 2.7 V	-	-0.1	-	-0.1	-	-0.1	-
		V _{CC} = 3.0 V to 3.6 V	-	-0.1	-	-0.1	-	-0.1	-
		SD; see Figure 9							
		V _{CC} = 1.1 V to 1.3 V	-	-0.5	-	-0.3	-	-0.3	-
		V _{CC} = 1.4 V to 1.6 V	-	-0.4	-	-0.1	-	-0.1	-
		V _{CC} = 1.65 V to 1.95 V	-	-0.3	-	0	-	0	-
		V _{CC} = 2.3 V to 2.7 V	-	-0.2	-	0.1	-	0.1	-
		V _{CC} = 3.0 V to 3.6 V	-	-0.1	-	0.1	-	0.1	-

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ ^[1]	Max	Min	Max (85 °C)	Min	
t _W	pulse width	CP HIGH or LOW; see Figure 8 .							
		V _{CC} = 1.1 V to 1.3 V	-	2.1	-	2.7	-	2.7	- 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	-	0.9	-	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	-	0.6	-	1.9	-	1.9	- ns
		SD or RD LOW; see Figure 9 .							
		V _{CC} = 1.1 V to 1.3 V	-	4.2	-	11.3	-	11.5	- ns
		V _{CC} = 1.4 V to 1.6 V	-	2.3	-	6.2	-	6.4	- ns
		V _{CC} = 1.65 V to 1.95 V	-	1.8	-	4.8	-	5.0	- ns
		V _{CC} = 2.3 V to 2.7 V	-	1.2	-	3.3	-	3.5	- ns
		V _{CC} = 3.0 V to 3.6 V	-	1.1	-	2.6	-	2.8	- ns
C _{PD}	power dissipation capacitance	f _i = 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 μ W).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f_i = input frequency in MHz;

f_o = output frequency in MHz;

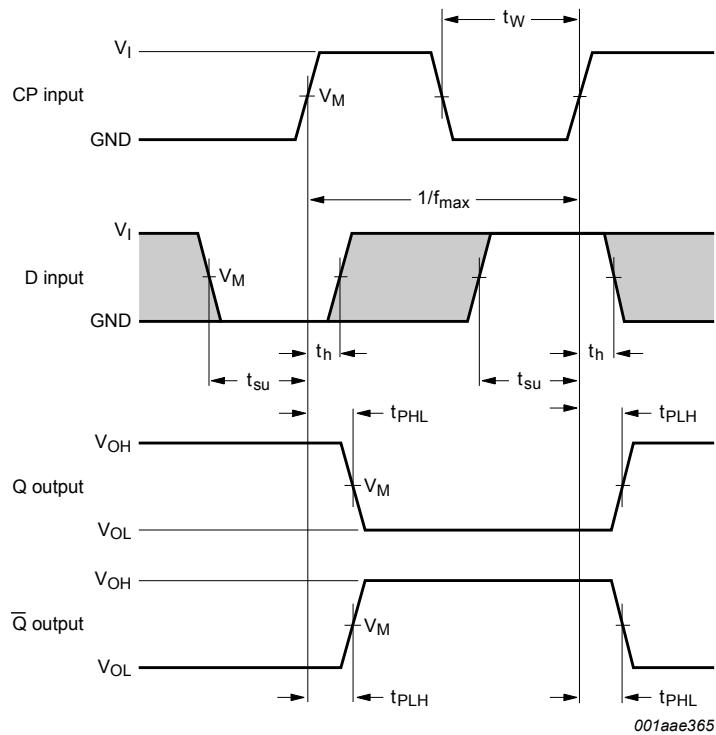
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11.1 Waveforms and test circuit

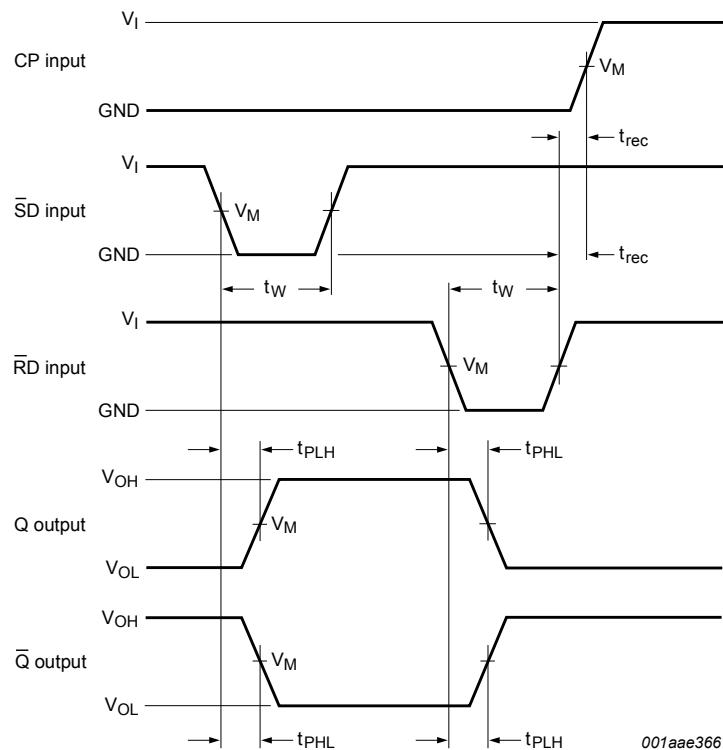


Measurement points are given in [Table 10](#).

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.

Figure 8. The clock input (CP) to output (Q, \bar{Q}) 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



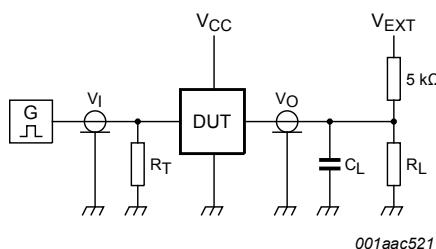
Measurement points are given in [Table 10](#).

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

Figure 9. The set input (SD) and reset input (RD) to output (Q, Q̄) propagation delays, the set input (SD) and reset input (RD) pulse widths and the reset input (RD) to clock input (CP) recovery time

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}	$\leq 3.0 \text{ ns}$



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_0 of the pulse generator.

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

Figure 10. Test circuit for measuring 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	$2 \times V_{CC}$

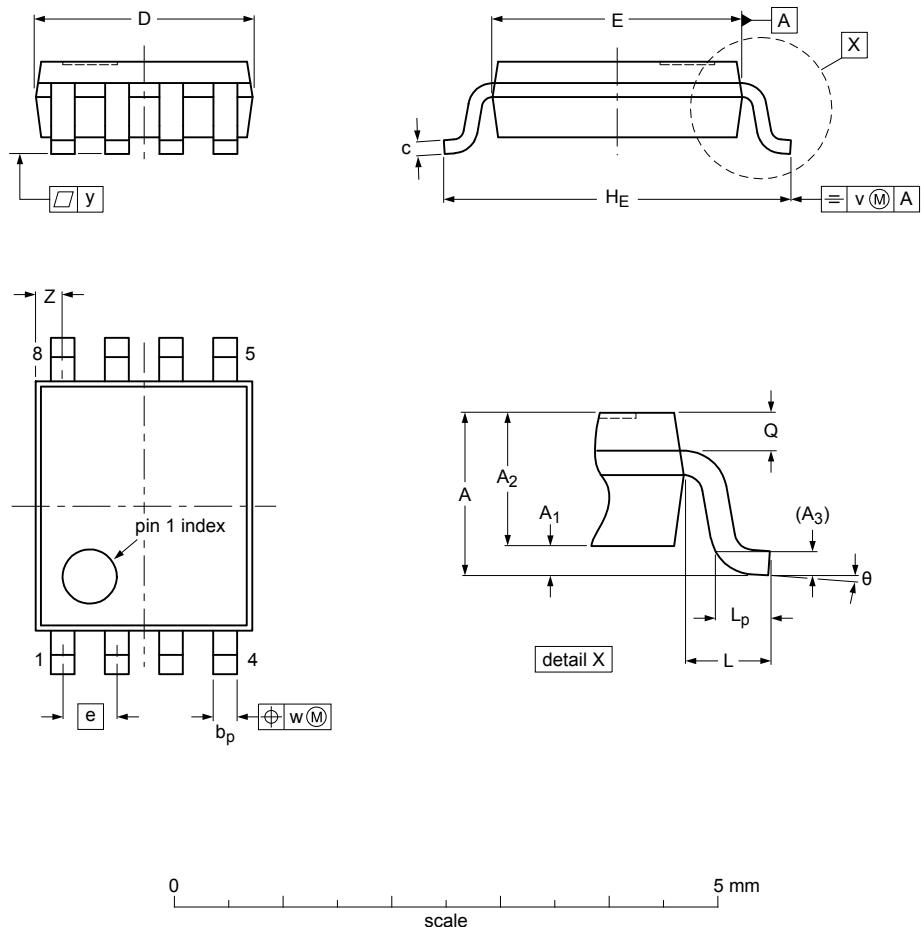
[1] For measuring enable and disable times $R_L = 5 \text{ k}\Omega$

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

12 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	max	0.15	0.85		0.27	0.23	2.1	2.4		3.2		0.40	0.21			0.4	8°	
mm	nom	1			0.12				0.5		0.4		0.2	0.08	0.1			
mm	min	0.00	0.60		0.17	0.08	1.9	2.2		3.0		0.15	0.19			0.1	0°	

Note

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.

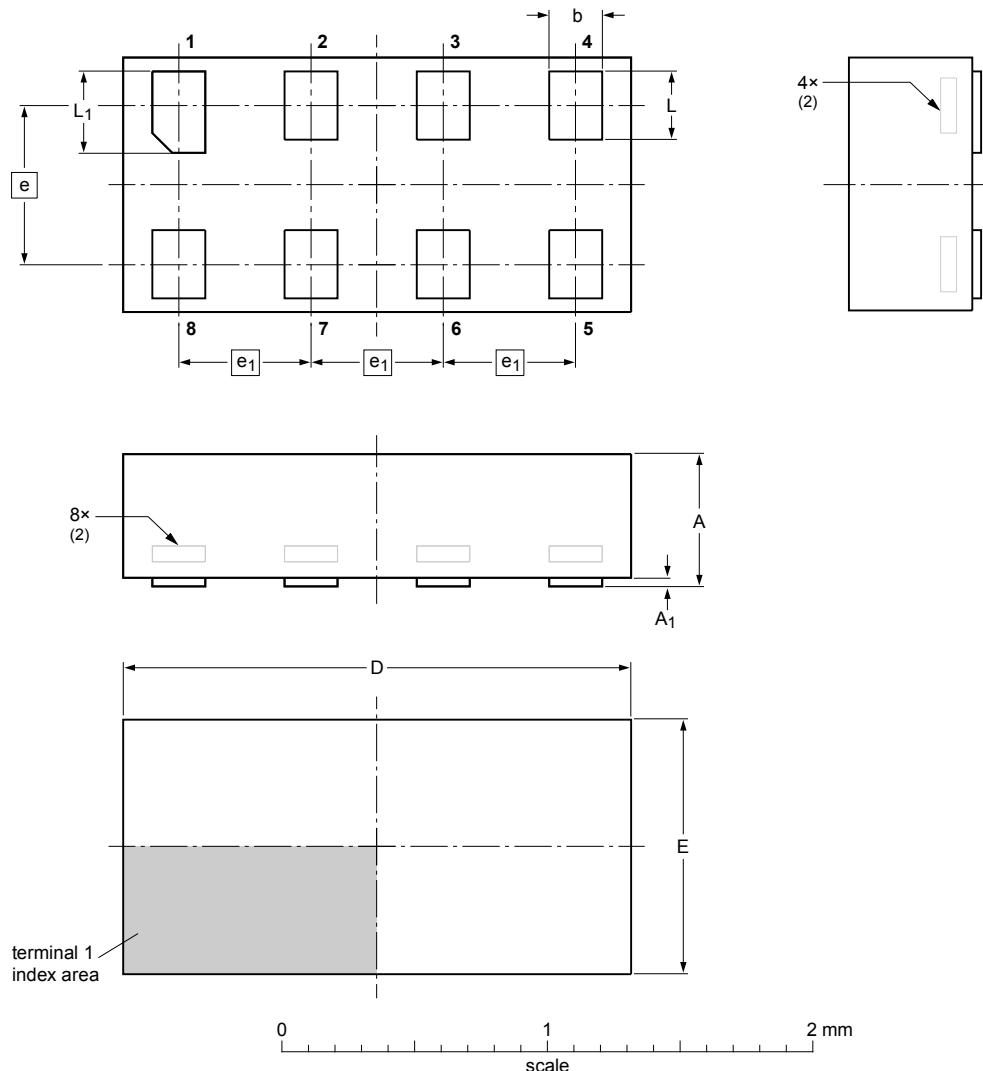
sot765-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT765-1		MO-187				-07-06-02 16-05-31

Figure 11. Package outline SOT765-1 (VSSOP8)

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

SOT833-1



DIMENSIONS (mm are the original dimensions)

UNIT	A ⁽¹⁾ max	A ₁ max	b	D	E	e	e ₁	L	L ₁
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	---			07-11-14 07-12-07

Figure 12. Package outline SOT833-1 (XSON8)

XSON8: extremely thin small outline package; no leads;
8 terminals; body $1.35 \times 1 \times 0.5$ mm

SOT1089

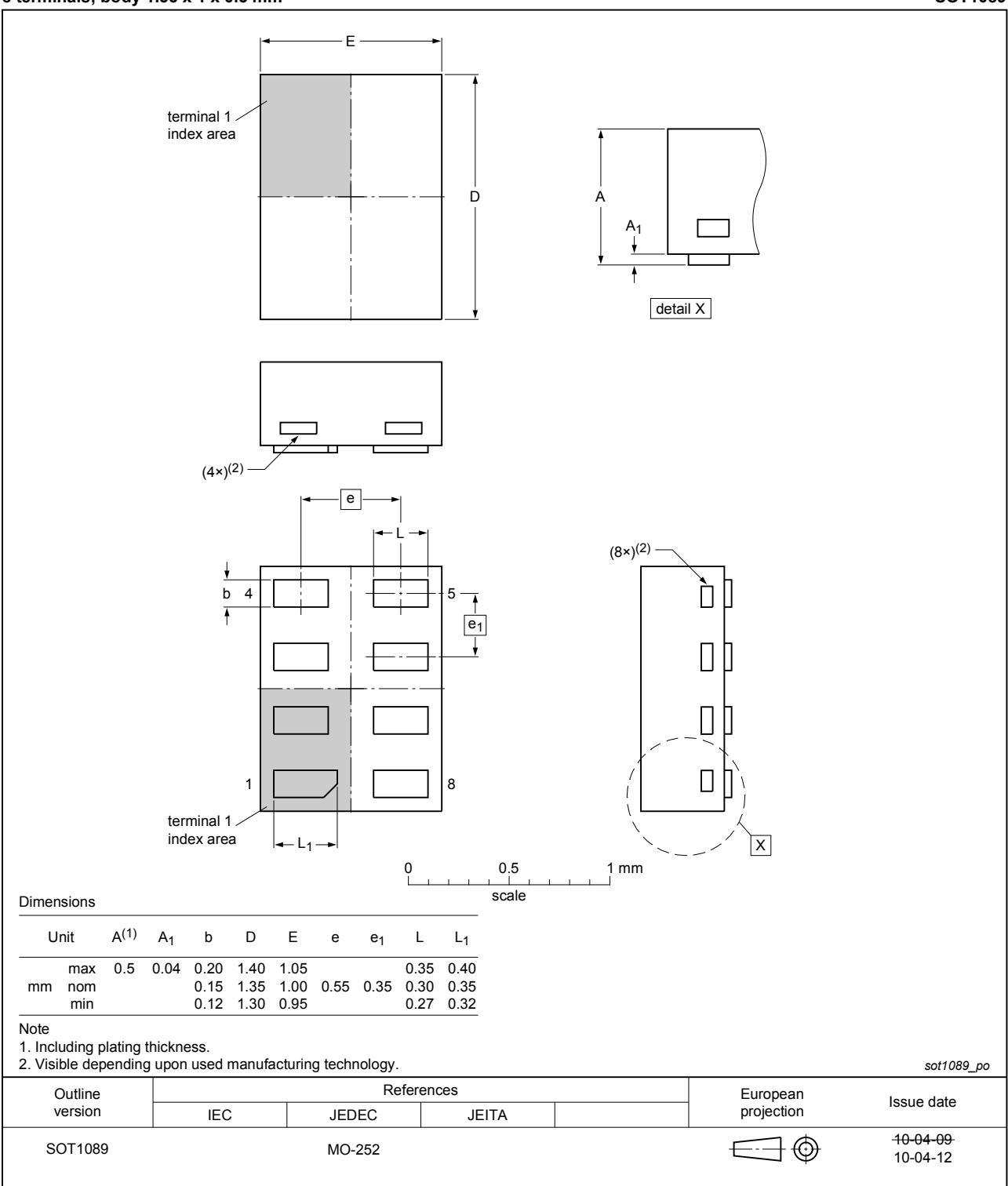
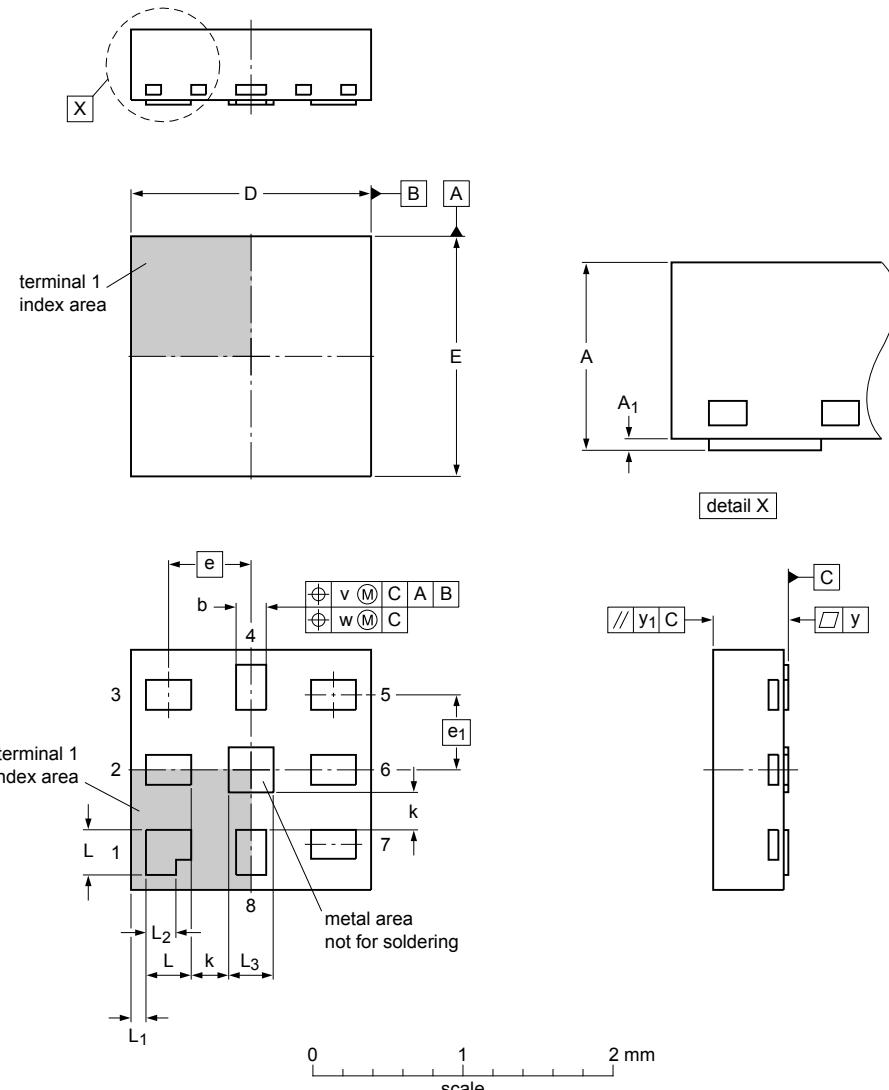


Figure 13. Package outline SOT1089 (XSON8)

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

SOT902-2



Dimensions

Unit ⁽¹⁾	A	A ₁	b	D	E	e	e ₁	k	L	L ₁	L ₂	L ₃	v	w	y	y ₁	
max	0.5	0.05	0.25	1.65	1.65				0.35	0.15	0.25	0.35					
mm	nom			0.20	1.60	1.60	0.55	0.5	0.30	0.10	0.20	0.30	0.1	0.05	0.05	0.05	
min				0.00	0.15	1.55	1.55		0.2	0.25	0.05	0.15	0.25				

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot902-2_po

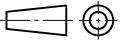
Outline version	References			European projection	Issue date
	IEC	JEDEC	JEITA		
SOT902-2	---	MO-255	---		16-07-14 16-11-08

Figure 14. Package outline SOT902-2 (XQFN8)

XSON8: extremely thin small outline package; no leads;
8 terminals; body 1.2 x 1.0 x 0.35 mm

SOT1116

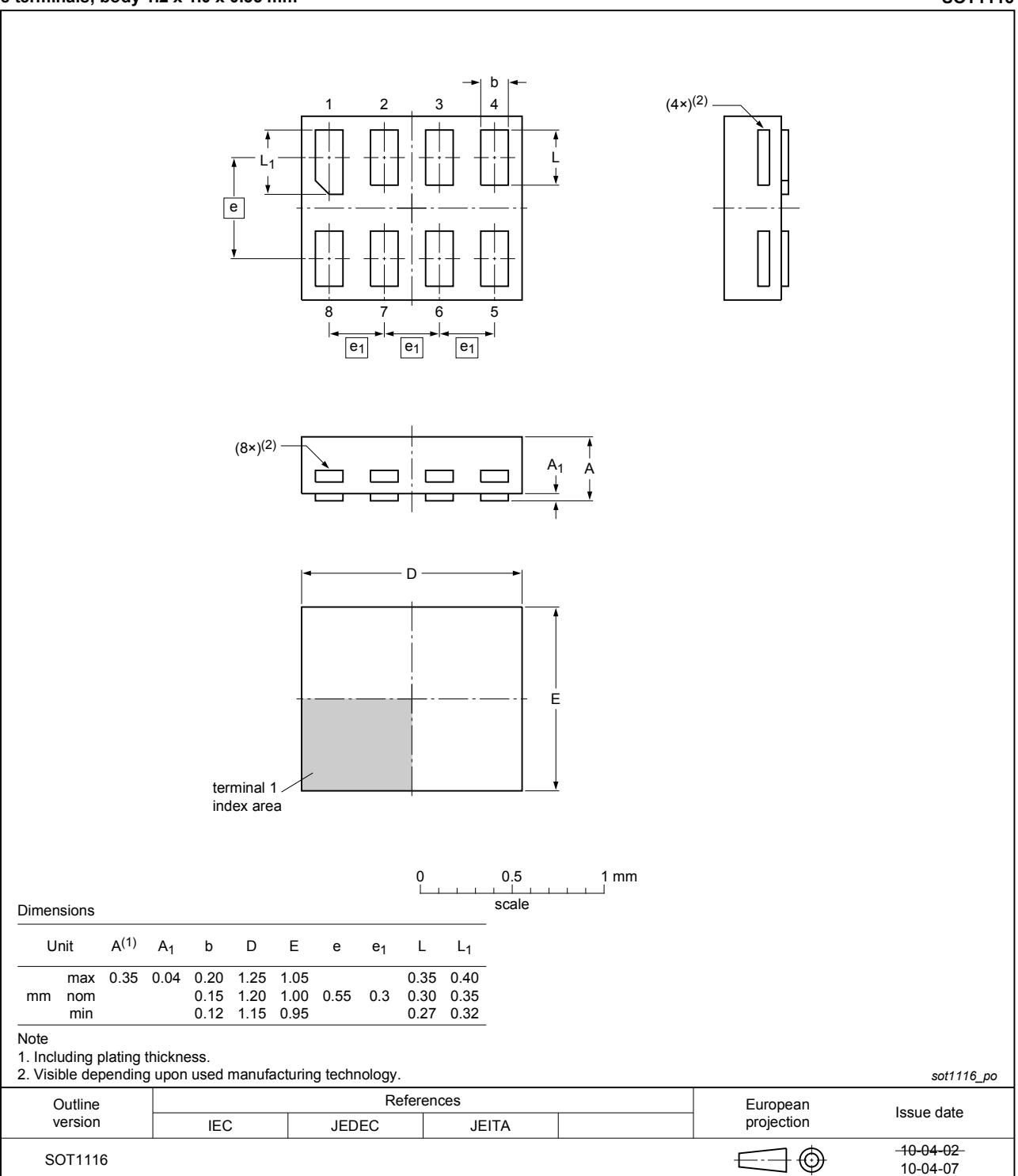
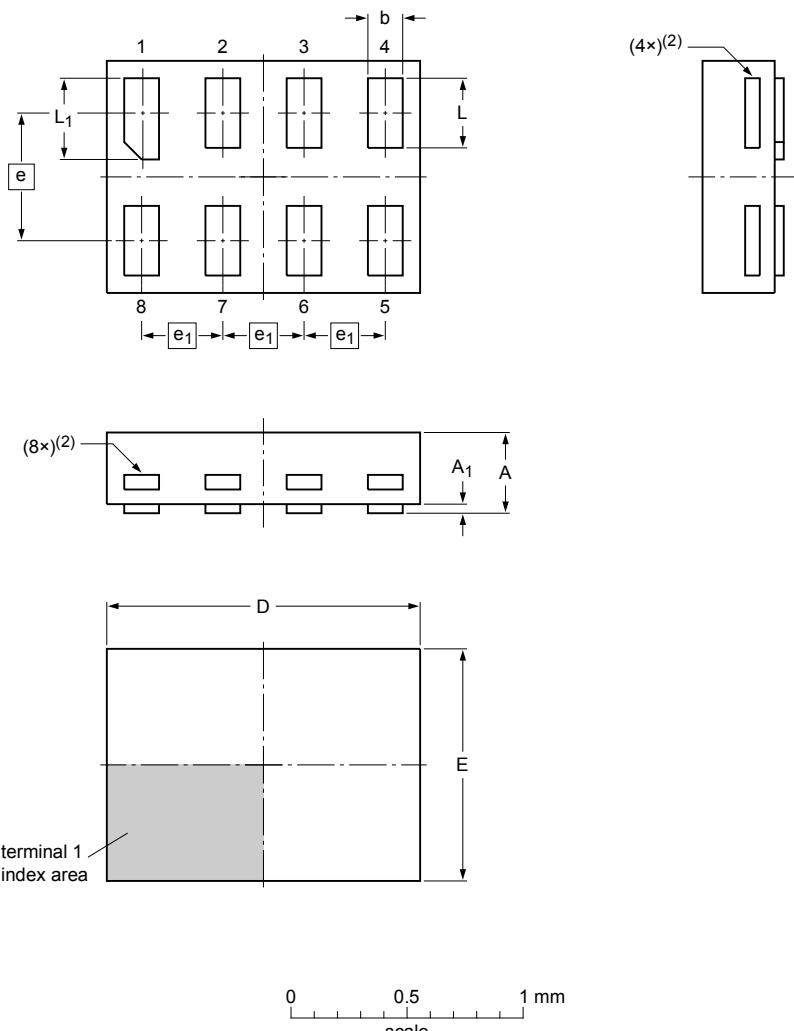


Figure 15. Package outline SOT1116 (XSON8)

XSON8: extremely thin small outline package; no leads;
8 terminals; body 1.35 x 1.0 x 0.35 mm

SOT1203



Dimensions

Unit	A ⁽¹⁾	A ₁	b	D	E	e	e ₁	L	L ₁
mm	max	0.35	0.04	0.20	1.40	1.05		0.35	0.40
mm	nom			0.15	1.35	1.00	0.55	0.35	0.35
mm	min			0.12	1.30	0.95		0.27	0.32

Note

1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1203_po

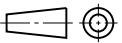
Outline version	References			European projection	Issue date
	IEC	JEDEC	JEITA		
SOT1203					10-04-02- 10-04-06

Figure 16. Package outline SOT1203 (XSON8)

X2SON8: plastic thermal enhanced extremely thin small outline package; no leads;
8 terminals; body 1.35 x 0.8 x 0.35 mm

SOT1233

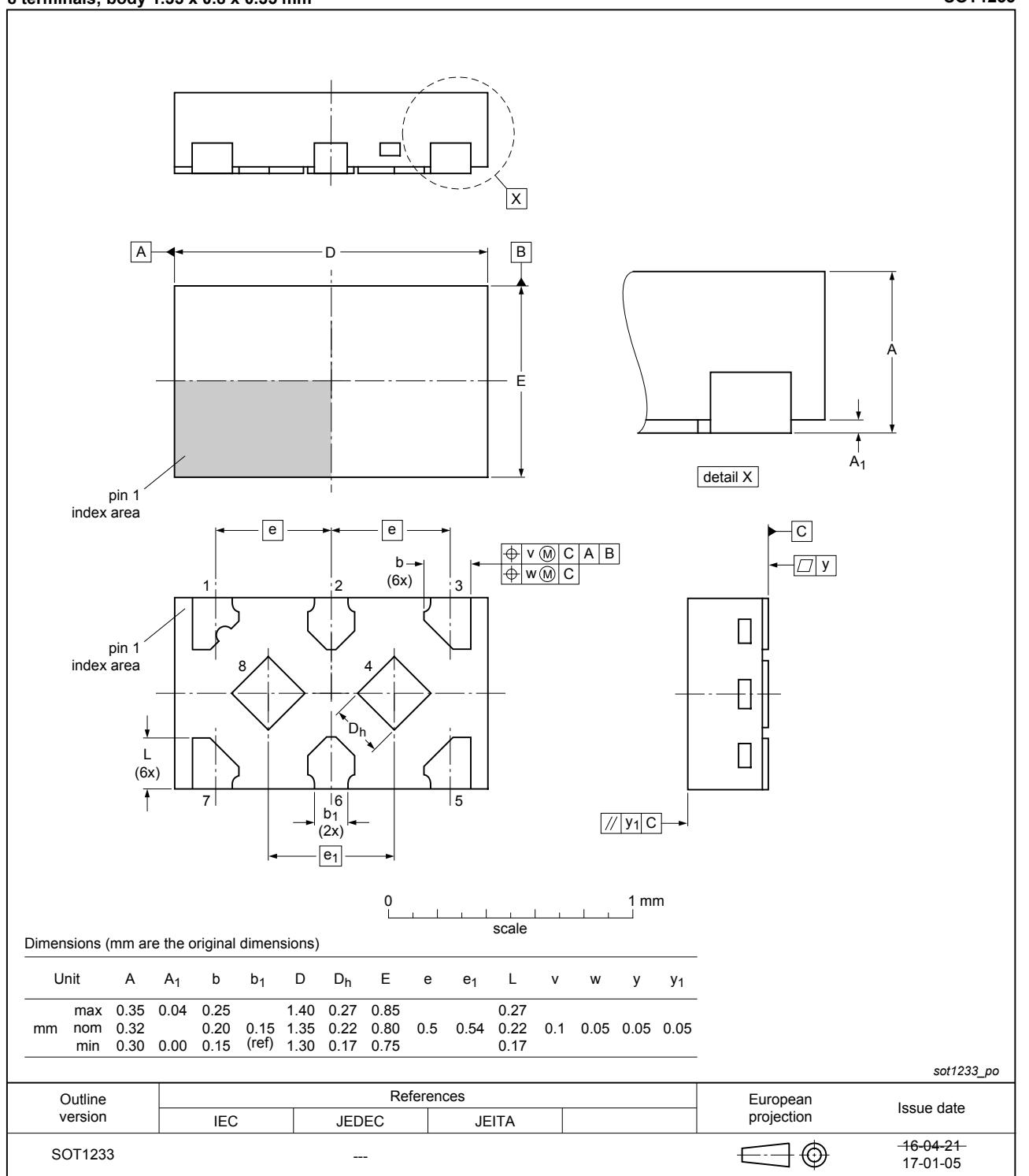


Figure 17. Package outline SOT1233 (X2SON8)

13 Abbreviations

Table 12. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

14 Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AUP1G74 v.11	20170703	Product data sheet	-	74AUP1G74 v.10
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Figure 7 and Figure 17 (drawings SOT1233/X2SON8) updated Type number 74AUP1G74GD removed. 			
74AUP1G74 v.10	20161028	Product data sheet	-	74AUP1G74 v.9
Modifications:	<ul style="list-style-type: none"> Added type number 74AUP1G74GX (SOT1233/X2SON8) 			
74AUP1G74 v.9	20140106	Product data sheet	-	74AUP1G74 v.8
Modifications:	<ul style="list-style-type: none"> Conditions for f_{max} corrected (errata). 			
74AUP1G74 v.8	20130123	Product data sheet	-	74AUP1G74 v.7
Modifications:	<ul style="list-style-type: none"> For type number 74AUP1G74GD XSON8U has changed to XSON8. 			
74AUP1G74 v.7	20120522	Product data sheet	-	74AUP1G74 v.6
74AUP1G74 v.6	20111128	Product data sheet	-	74AUP1G74 v.5
74AUP1G74 v.5	20100726	Product data sheet	-	74AUP1G74 v.4
74AUP1G74 v.4	20080603	Product data sheet	-	74AUP1G74 v.3
74AUP1G74 v.3	20080207	Product data sheet	-	74AUP1G74 v.2
74AUP1G74 v.2	20070515	Product data sheet	-	74AUP1G74 v.1
74AUP1G74 v.1	20060825	Product data sheet	-	-

15 Legal information

15.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[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.nexperia.com>.

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

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Contents

1	General description	1
2	Features and benefits	1
3	Ordering information	2
4	Marking	2
5	Functional diagram	3
6	Pinning information	4
6.1	Pinning	4
6.2	Pin description	5
7	Functional description	5
8	Limiting values	6
9	Recommended operating conditions	6
10	Static characteristics	7
11	Dynamic characteristics	10
11.1	Waveforms and test circuit	16
12	Package outline	19
13	Abbreviations	26
14	Revision history	26
15	Legal information	27

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