

74AUP1G74

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

Rev. 12 — 20 June 2022

Product data sheet

1. General description

The 74AUP1G74 is a single positive edge triggered D-type flip-flop with individual data (D), clock (CP), set (\overline{SD}) and reset (\overline{RD}) inputs, and complementary Q and \overline{Q} outputs. Data at the D-input that meets the set-up and hold time requirements on the LOW-to-HIGH clock transition will be stored in the flip-flop and appear at the Q output.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device ensures 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 potentially 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
- CMOS low power dissipation
- High noise immunity
- Overvoltage tolerant inputs to 3.6 V
- Low static power consumption; $I_{CC} = 0.9 \mu\text{A}$ (maximum)
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Low noise overshoot and undershoot < 10 % of V_{CC}
- I_{OFF} circuitry provides partial Power-down mode operation
- 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)
 - JESD8C (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F Class 3A exceeds 5 kV
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101E exceeds 1 kV
- 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
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 × 0.32 mm	SOT1233-2

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

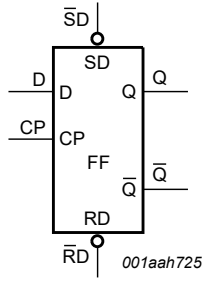


Fig. 1. Logic symbol

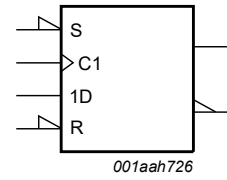


Fig. 2. IEC logic symbol

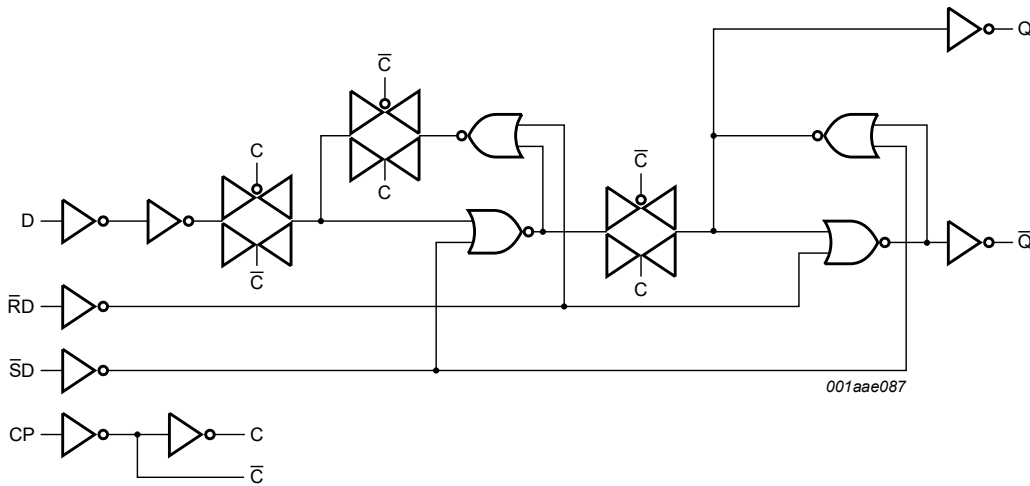


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

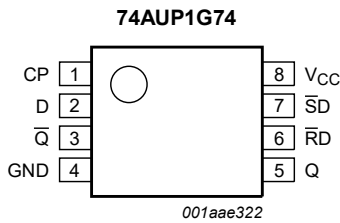


Fig. 4. Pin configuration SOT765-1 (VSSOP8)

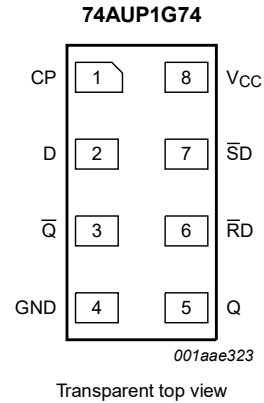


Fig. 5. Pin configuration SOT833-1, SOT1089, SOT1116 and SOT1203 (XSON8)

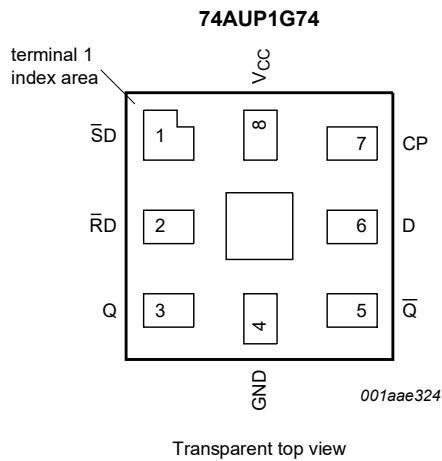


Fig. 6. Pin configuration SOT902-2 (XQFN8)

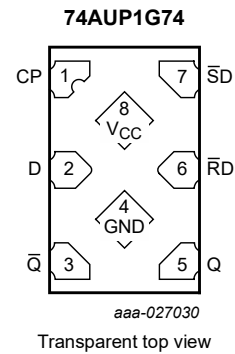


Fig. 7. Pin configuration SOT1233-2 (X2SON8)

6.2. Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT765-1, SOT833-1, SOT1089, SOT1116, SOT1203 and SOT1233-2	SOT902-2	
CP	1	7	clock input
D	2	6	data input
\bar{Q}	3	5	complement output
GND	4	4	ground (0 V)
Q	5	3	true output
$\bar{R}D$	6	2	asynchronous reset input (active LOW)
$\bar{S}D$	7	1	asynchronous set input (active LOW)
V _{CC}	8	8	supply voltage

7. Functional description

Table 4. Function table for asynchronous operation

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

Input				Output	
SD	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. Function table for synchronous operation

H = HIGH voltage level; L = LOW voltage level; \uparrow = LOW-to-HIGH CP transition;

\bar{Q}_{n+1} , Q_{n+1} = state after the next LOW-to-HIGH CP transition.

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

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]	+4.6	V
V_O	output voltage	Active mode and Power-down mode	[1]	+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	$^{\circ}$ C
P_{tot}	total power dissipation	$T_{amb} = -40$ $^{\circ}$ C to +125 $^{\circ}$ C SOT765-1 (VSSOP8) [2] SOT833-1 (XSON8) [3] SOT1089 (XSON8) [4] SOT902-2 (XQFN8) [5] SOT1116 (XSON8) [6] SOT1203 (XSON8) [7] SOT1233-2 (X2SON8) [8]	-	250	mW

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

[2] For SOT765-1 (VSSOP8) package: P_{tot} derates linearly with 4.9 mW/K above 99 $^{\circ}$ C.

[3] For SOT833-1 (XSON8) package: P_{tot} derates linearly with 3.1 mW/K above 68 $^{\circ}$ C.

[4] For SOT1089 (XSON8) package: P_{tot} derates linearly with 4.0 mW/K above 88 $^{\circ}$ C.

[5] For SOT902-2 (XQFN8) packages: P_{tot} derates linearly with 4.1 mW/K above 89 $^{\circ}$ C.

[6] For SOT1116 (XSON8) package: P_{tot} derates linearly with 4.2 mW/K above 90 $^{\circ}$ C.

[7] For SOT1203 (XSON8) package: P_{tot} derates linearly with 3.6 mW/K above 81 $^{\circ}$ C.

[8] For SOT1233-2 (X2SON8) package: P_{tot} derates linearly with 7.7 mW/K above 118 $^{\circ}$ C.

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
$T_{amb} = 25$ °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}				
		$I_O = -20$ μ A; $V_{CC} = 0.8$ V to 3.6 V	$V_{CC} - 0.1$	-	-	V
		$I_O = -1.1$ mA; $V_{CC} = 1.1$ V	$0.75 \times V_{CC}$	-	-	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
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 20$ μ A; $V_{CC} = 0.8$ 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	$V_I = \text{GND}$ to 3.6 V; $V_{CC} = 0$ V to 3.6 V	-	-	± 0.1	μ A
I_{OFF}	power-off leakage current	V_I or $V_O = 0$ V to 3.6 V; $V_{CC} = 0$ V	-	-	± 0.2	μ A

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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	μ A
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	μ A
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	μ A
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}				
		$I_O = -20$ μ A; $V_{CC} = 0.8$ 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
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 20$ μ A; $V_{CC} = 0.8$ 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	-	-	0.37	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	μ A
I_{OFF}	power-off leakage current	V_I or $V_O = 0$ V to 3.6 V; $V_{CC} = 0$ V	-	-	± 0.5	μ A
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	μ A
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	μ A
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	μ A

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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
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 _I	input leakage current	V _I = GND to 3.6 V; V _{CC} = 0 V to 3.6 V	-	-	±0.75	μA
		V _I or V _O = 0 V to 3.6 V; V _{CC} = 0 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 Fig. 10.

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
C_L = 5 pF										
t _{pd}	propagation delay	CP to Q, \bar{Q} ; see Fig. 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	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	3.8	1.4	4.4	1.4	4.7	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	2.2	3.1	1.2	3.4	1.2	3.7	ns
		$\bar{S}D$ to Q, \bar{Q} ; see Fig. 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	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	3.7	1.7	4.0	1.7	4.2	ns
		V _{CC} = 3.0 V to 3.6 V	1.8	2.5	3.2	1.5	3.6	1.5	3.8	ns
		$\bar{R}D$ to Q, \bar{Q} ; see Fig. 9. [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	11.5	ns
		V _{CC} = 1.4 V to 1.6 V	2.3	3.9	6.3	2.2	6.8	2.2	7.3	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	4.1	1.7	4.3	ns		
V _{CC} = 3.0 V to 3.6 V	1.8	2.4	3.3	1.5	3.6	1.5	3.8	ns		
f _{max}	maximum frequency	CP; see Fig. 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

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

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
C_L = 10 pF										
t _{pd}	propagation delay	CP to Q, \bar{Q} ; see Fig. 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	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	4.6	1.8	5.3	1.8	5.6	ns
		V _{CC} = 3.0 V to 3.6 V	1.8	2.8	3.8	1.6	4.1	1.6	4.4	ns
		SD to Q, \bar{Q} ; see Fig. 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	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	4.4	2.0	4.8	2.0	5.2	ns
		V _{CC} = 3.0 V to 3.6 V	2.2	3.0	3.9	1.9	4.2	1.9	4.4	ns
		$\bar{R}D$ to Q, \bar{Q} ; see Fig. 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	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	4.4	2.0	4.9	2.0	5.2	ns		
V _{CC} = 3.0 V to 3.6 V	2.0	2.9	4.0	1.9	4.3	1.9	4.5	ns		
f _{max}	maximum frequency	CP; see Fig. 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

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

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
C_L = 15 pF										
t _{pd}	propagation delay	CP to Q, \bar{Q} ; see Fig. 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	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	5.2	2.2	5.8	2.2	6.2	ns
		V _{CC} = 3.0 V to 3.6 V	2.2	3.2	4.4	2.0	4.9	2.0	5.2	ns
		SD to Q, \bar{Q} ; see Fig. 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	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	5.1	2.2	5.5	2.2	5.8	ns
		V _{CC} = 3.0 V to 3.6 V	2.5	3.5	4.6	2.4	5.0	2.4	5.2	ns
		$\bar{R}\bar{D}$ to Q, \bar{Q} ; see Fig. 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	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	5.0	2.4	5.5	2.4	5.8	ns		
V _{CC} = 3.0 V to 3.6 V	2.4	3.4	4.6	2.3	5.0	2.3	5.2	ns		
f _{max}	maximum frequency	CP; see Fig. 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

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

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
C_L = 30 pF										
t _{pd}	propagation delay	CP to Q, \bar{Q} ; see Fig. 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	ns
		V _{CC} = 1.4 V to 1.6 V	3.7	7.2	12.0	3.7	13.3	3.7	14.0	ns
		V _{CC} = 1.65 V to 1.95 V	3.5	5.8	9.2	3.4	10.4	3.4	11.0	ns
		V _{CC} = 2.3 V to 2.7 V	3.3	4.7	6.6	3.0	7.3	3.0	7.8	ns
		V _{CC} = 3.0 V to 3.6 V	3.0	4.3	5.8	2.8	6.8	2.8	7.3	ns
		SD to Q, \bar{Q} ; see Fig. 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	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	6.6	3.2	7.2	3.2	7.6	ns
		V _{CC} = 3.0 V to 3.6 V	3.4	4.6	6.0	3.1	6.8	3.1	7.1	ns
		$\bar{R}D$ to Q, \bar{Q} ; see Fig. 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	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	6.5	3.2	7.1	3.2	7.6	ns		
V _{CC} = 3.0 V to 3.6 V	3.3	4.4	6.1	3.1	7.1	3.1	7.5	ns		
f _{max}	maximum frequency	CP; see Fig. 8.								
		V _{CC} = 0.8 V	-	28	-	-	-	-	MHz	
		V _{CC} = 1.1 V to 1.3 V	-	145	-	70	-	70	-	MHz
		V _{CC} = 1.4 V to 1.6 V	-	185	-	120	-	110	-	MHz
		V _{CC} = 1.65 V to 1.95 V	-	270	-	150	-	120	-	MHz
		V _{CC} = 2.3 V to 2.7 V	-	290	-	190	-	170	-	MHz
		V _{CC} = 3.0 V to 3.6 V	-	315	-	200	-	190	-	MHz

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

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

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

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
t _w	pulse width	CP HIGH or LOW; see Fig. 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
		\overline{SD} or \overline{RD} LOW; see Fig. 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 μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

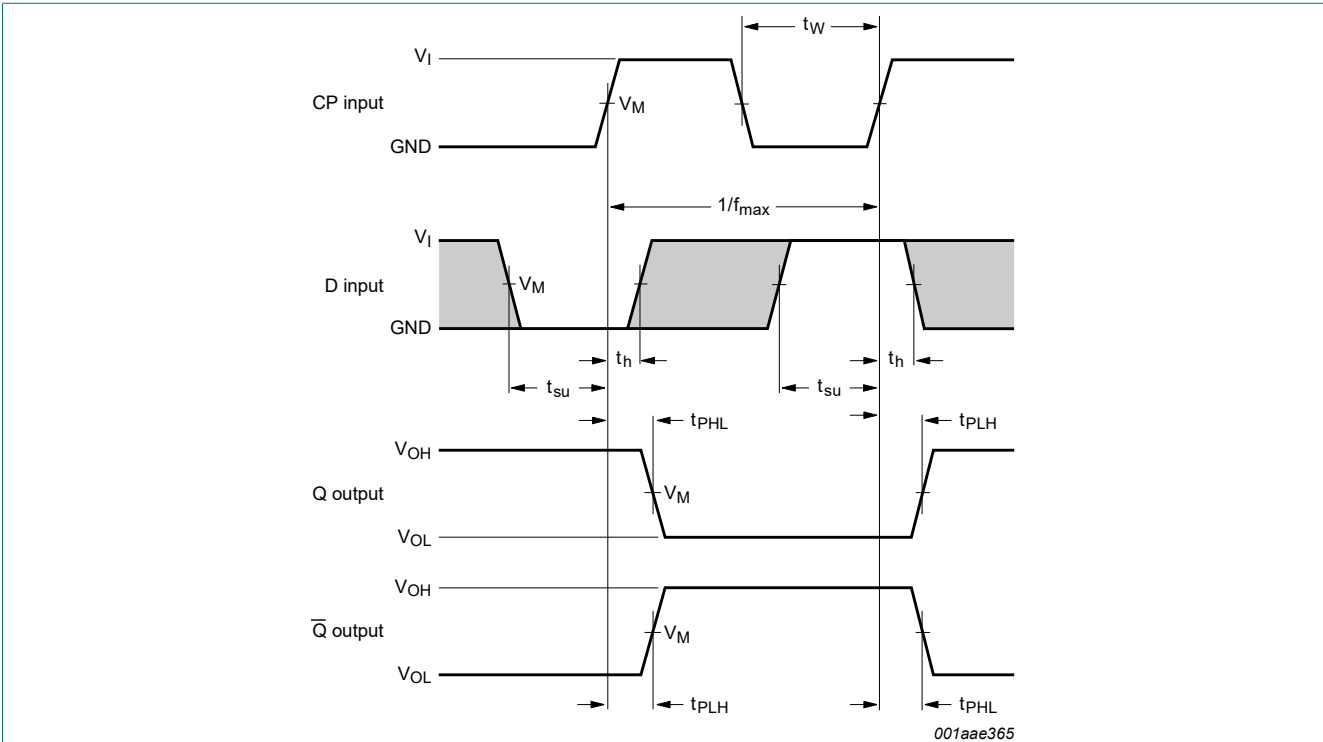
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

Σ(C_L × V_{CC}² × f_o) = sum of outputs.

11.1. Waveforms and test circuit



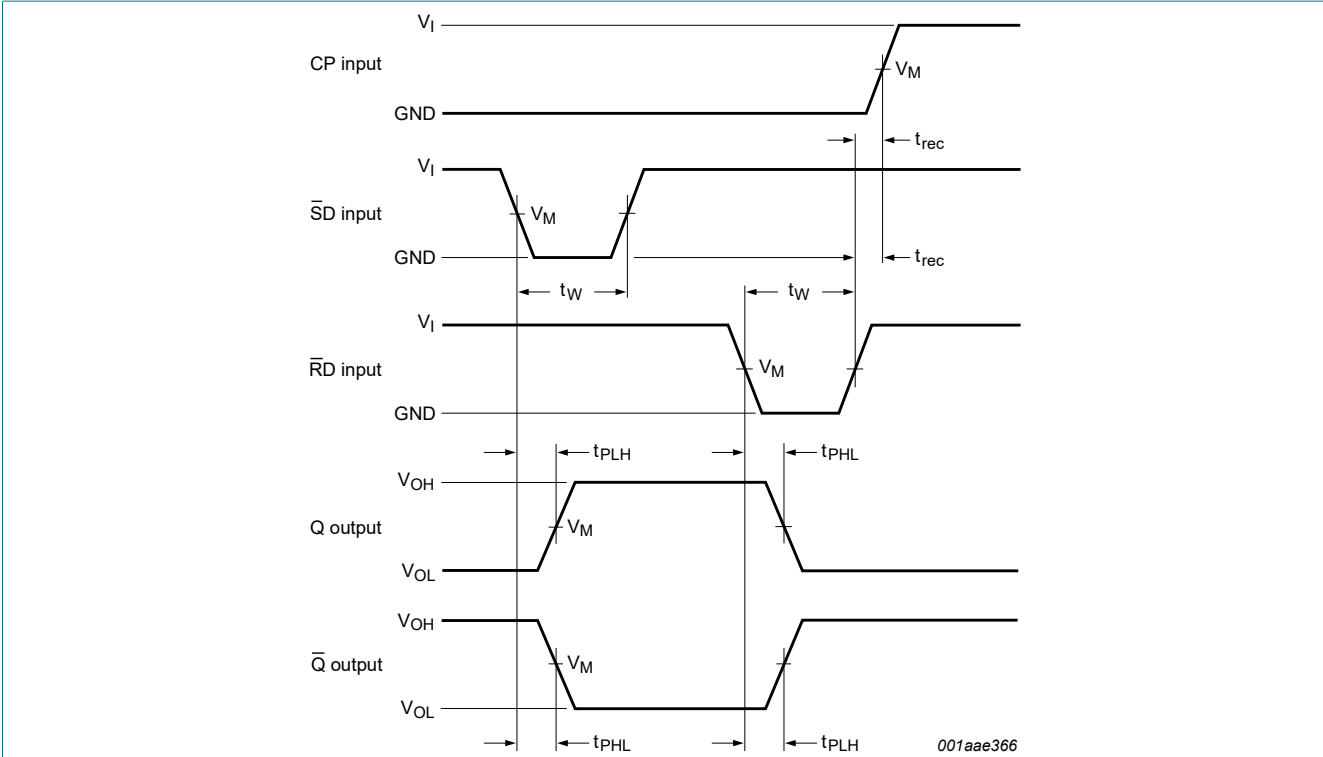
Measurement points are given in [Table 10](#).

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.

Fig. 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

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



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

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

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

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

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

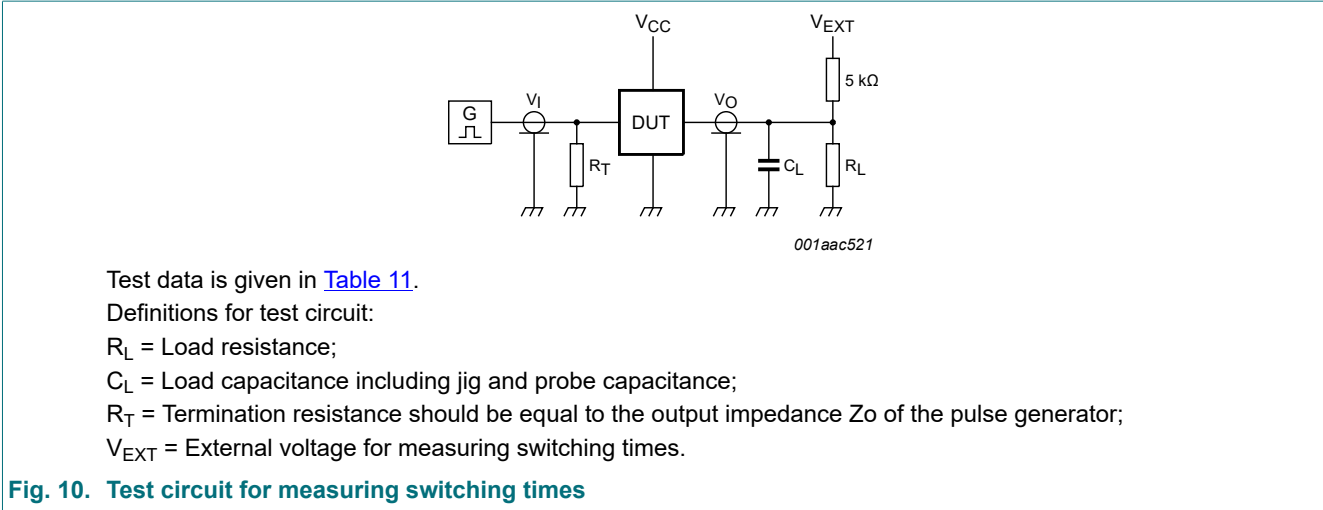


Fig. 10. Test circuit for measuring switching times

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

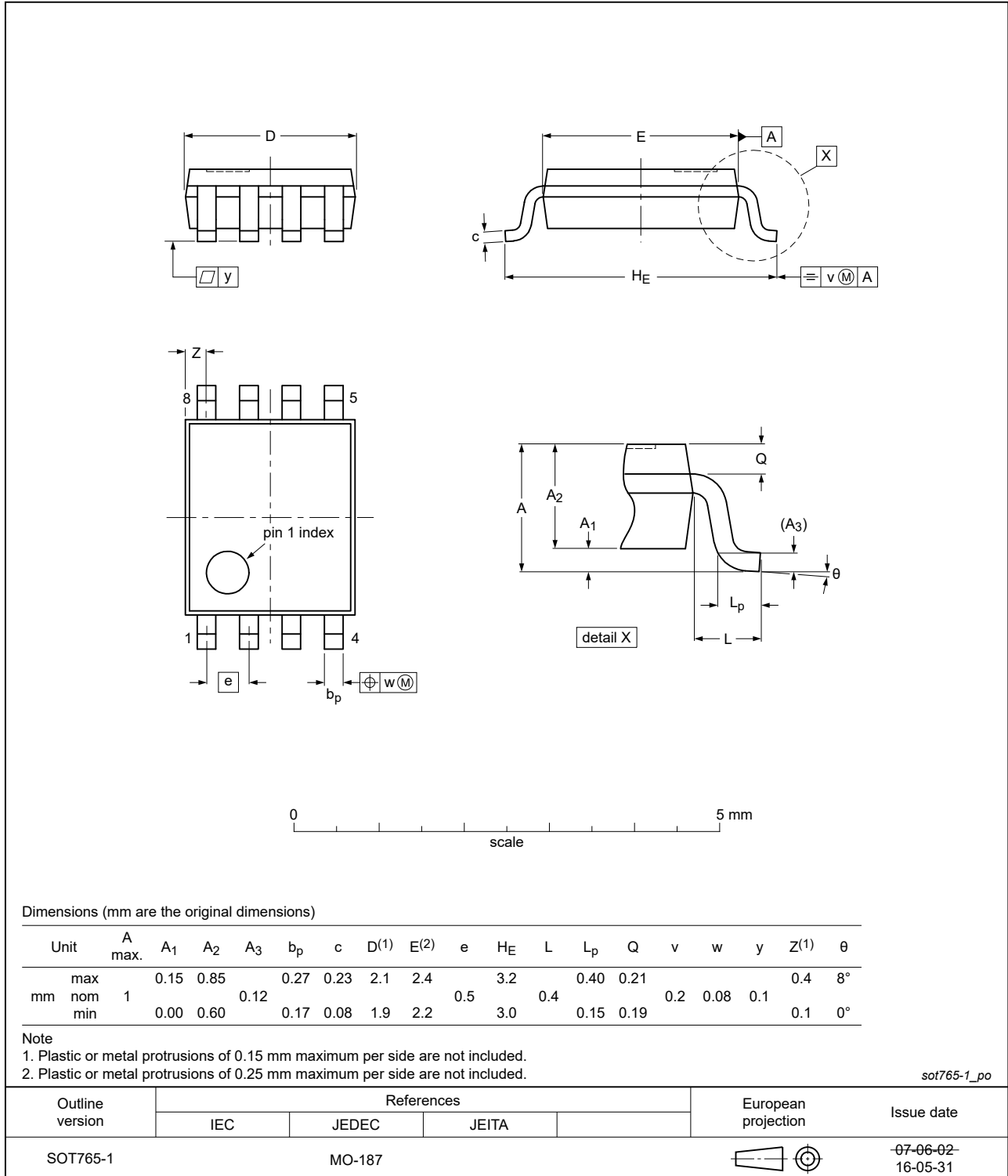


Fig. 11. Package outline SOT765-1 (VSSOP8)

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

SOT833-1

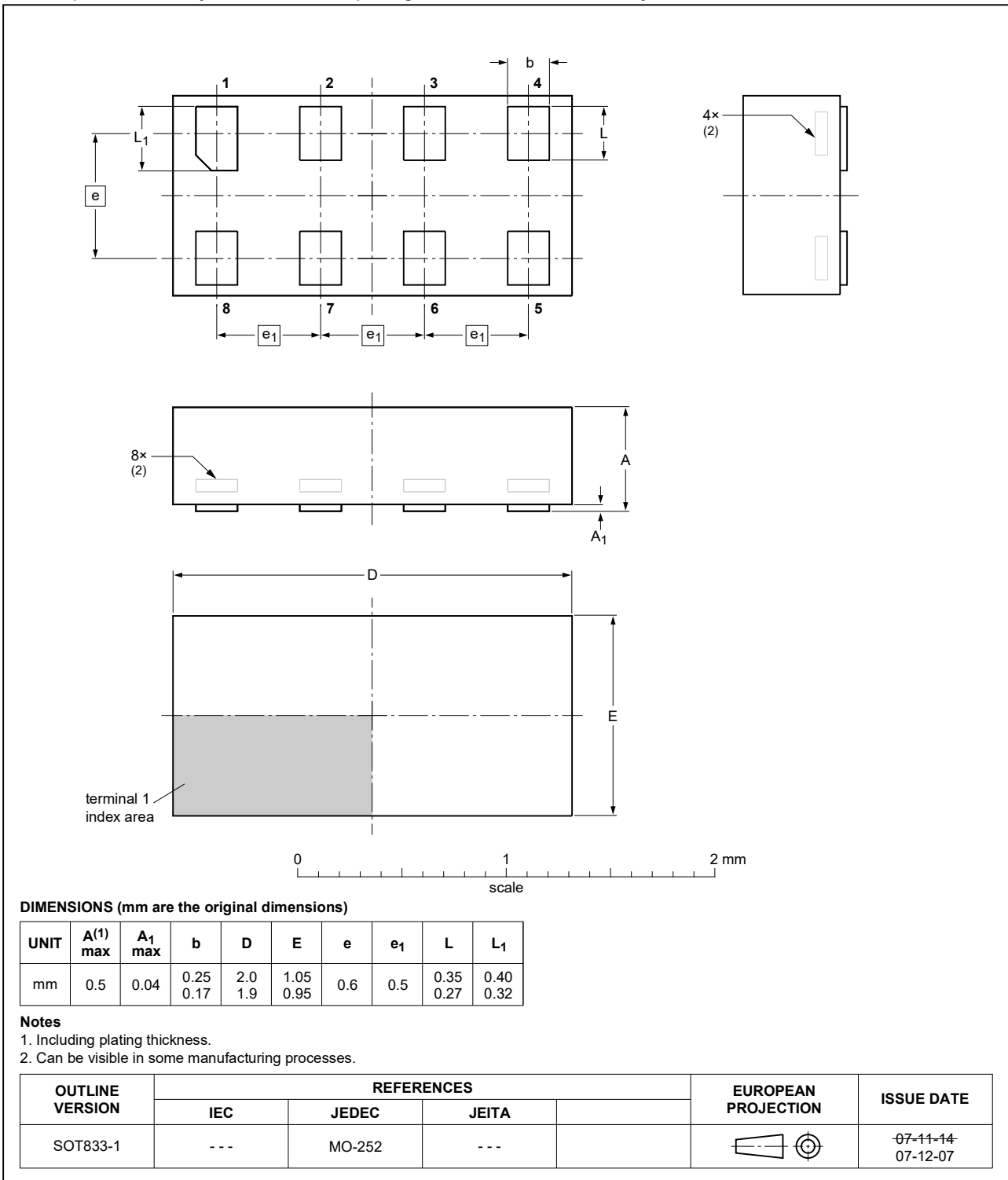


Fig. 12. Package outline SOT833-1 (XSON8)

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

SOT1089

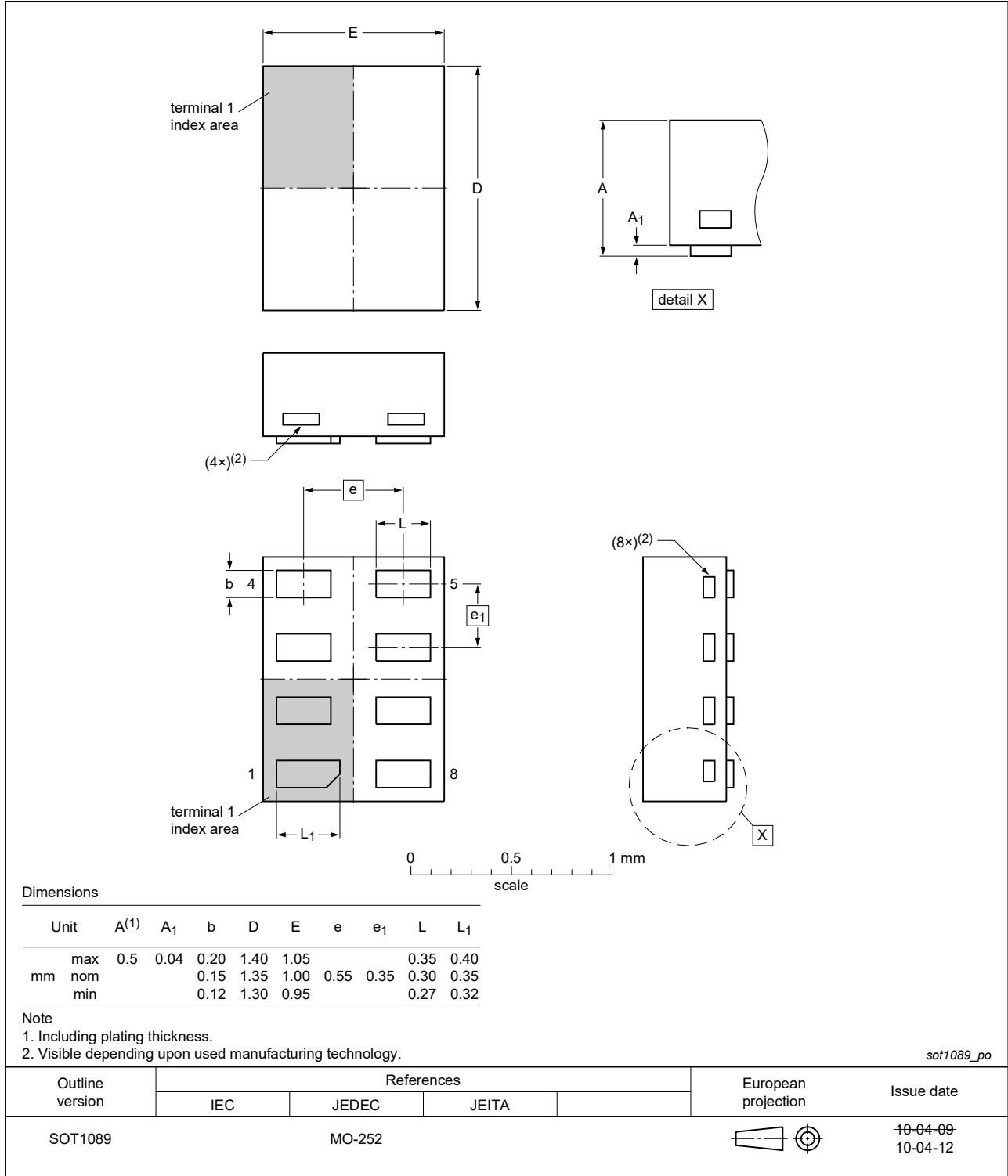


Fig. 13. Package outline SOT1089 (XSON8)

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

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

SOT902-2

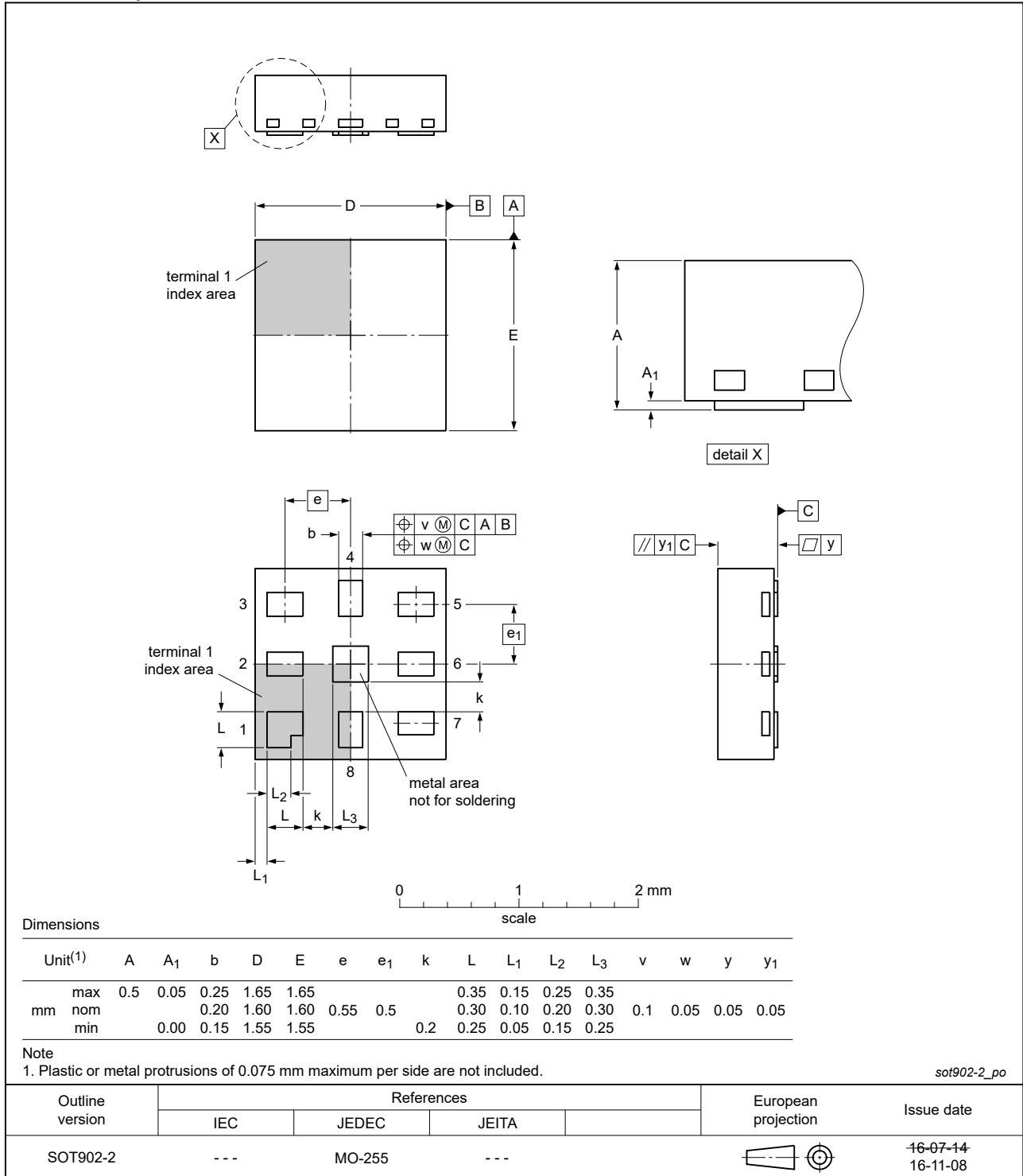


Fig. 14. Package outline SOT902-2 (XQFN8)

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

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

SOT1116

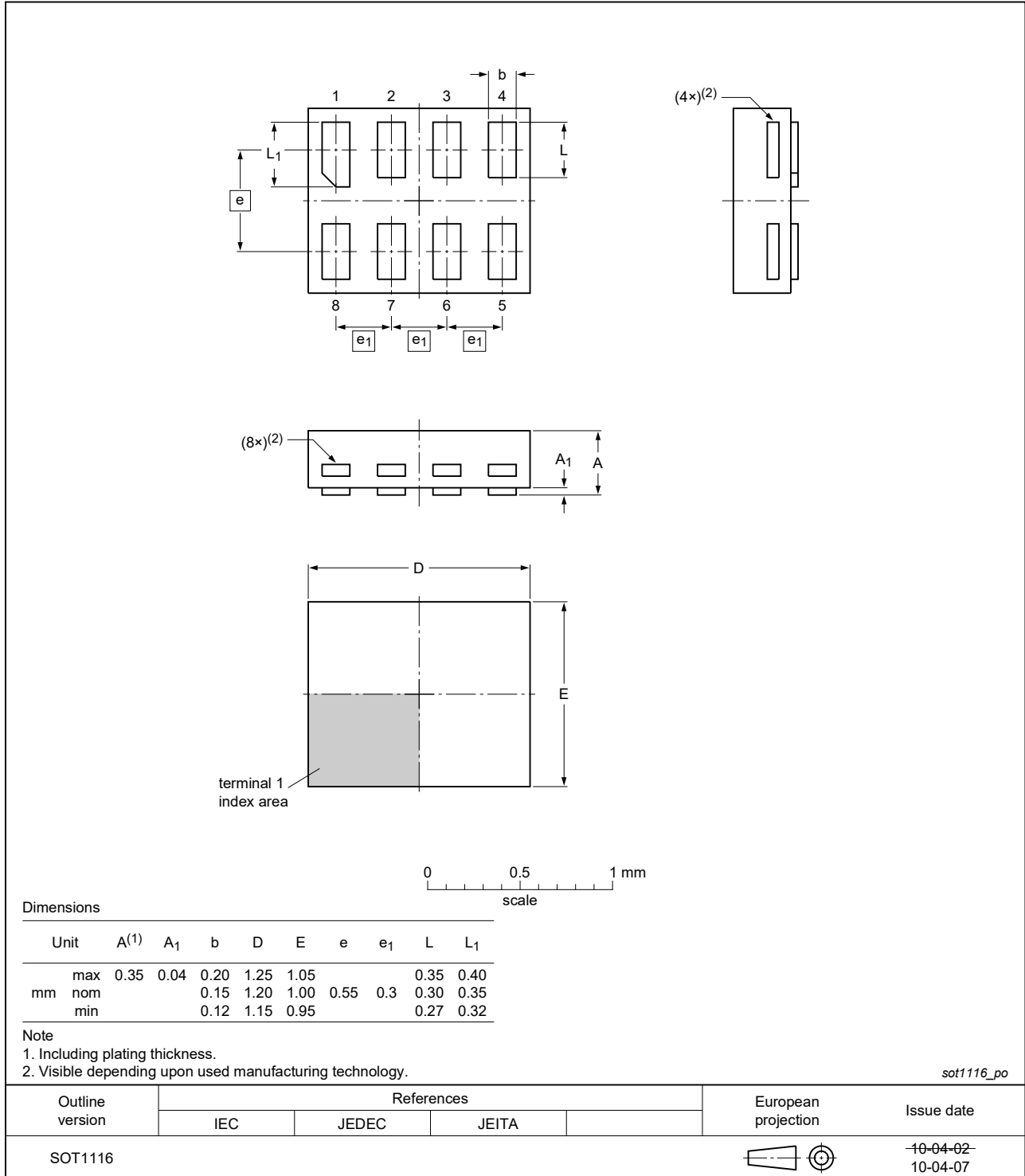


Fig. 15. Package outline SOT1116 (XSON8)

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

SOT1203

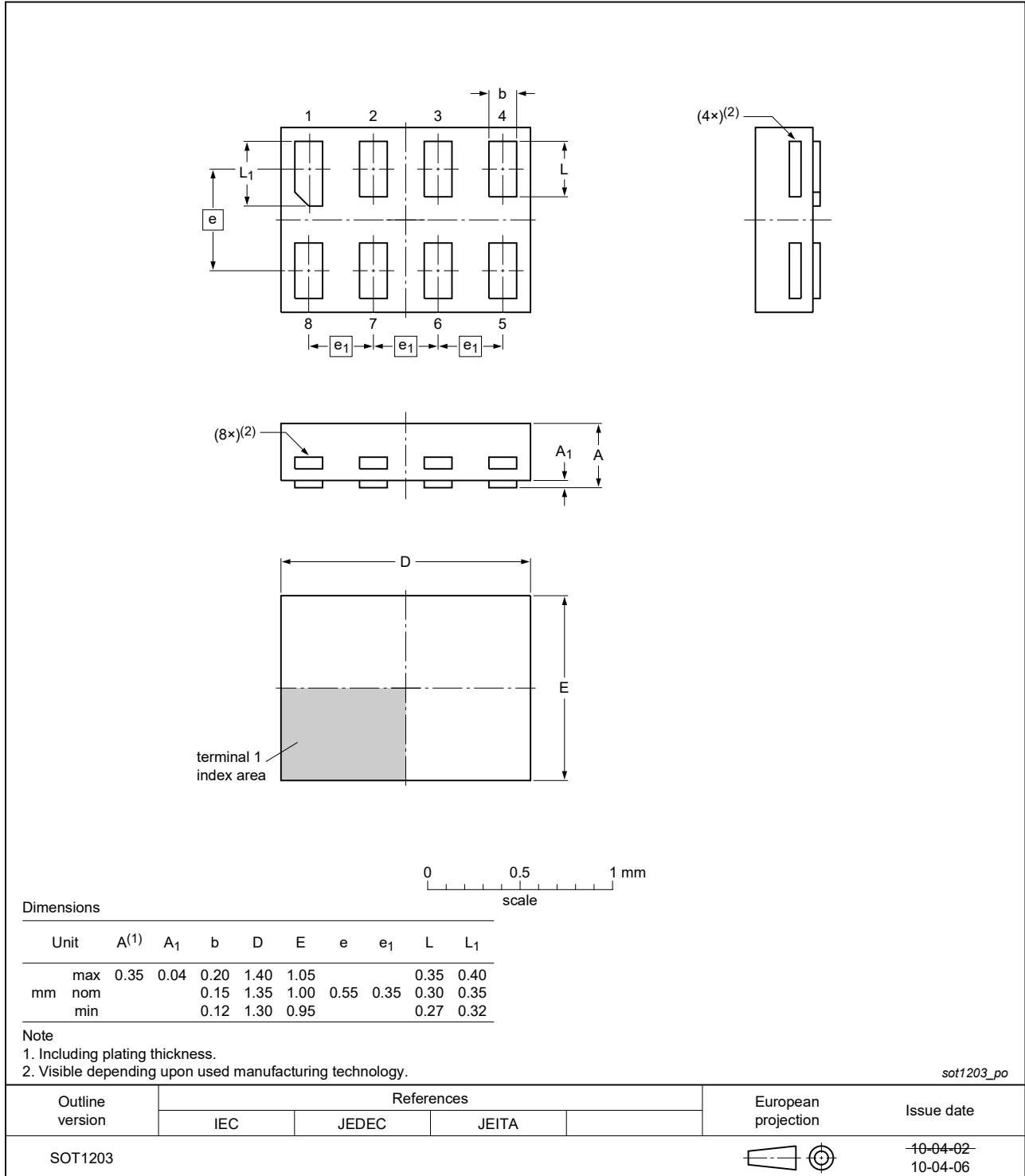


Fig. 16. Package outline SOT1203 (XSON8)

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

X2SON8: plastic thermal enhanced extremely thin small outline package; no leads; 8 terminals; body 1.35 x 0.8 x 0.32 mm

SOT1233-2

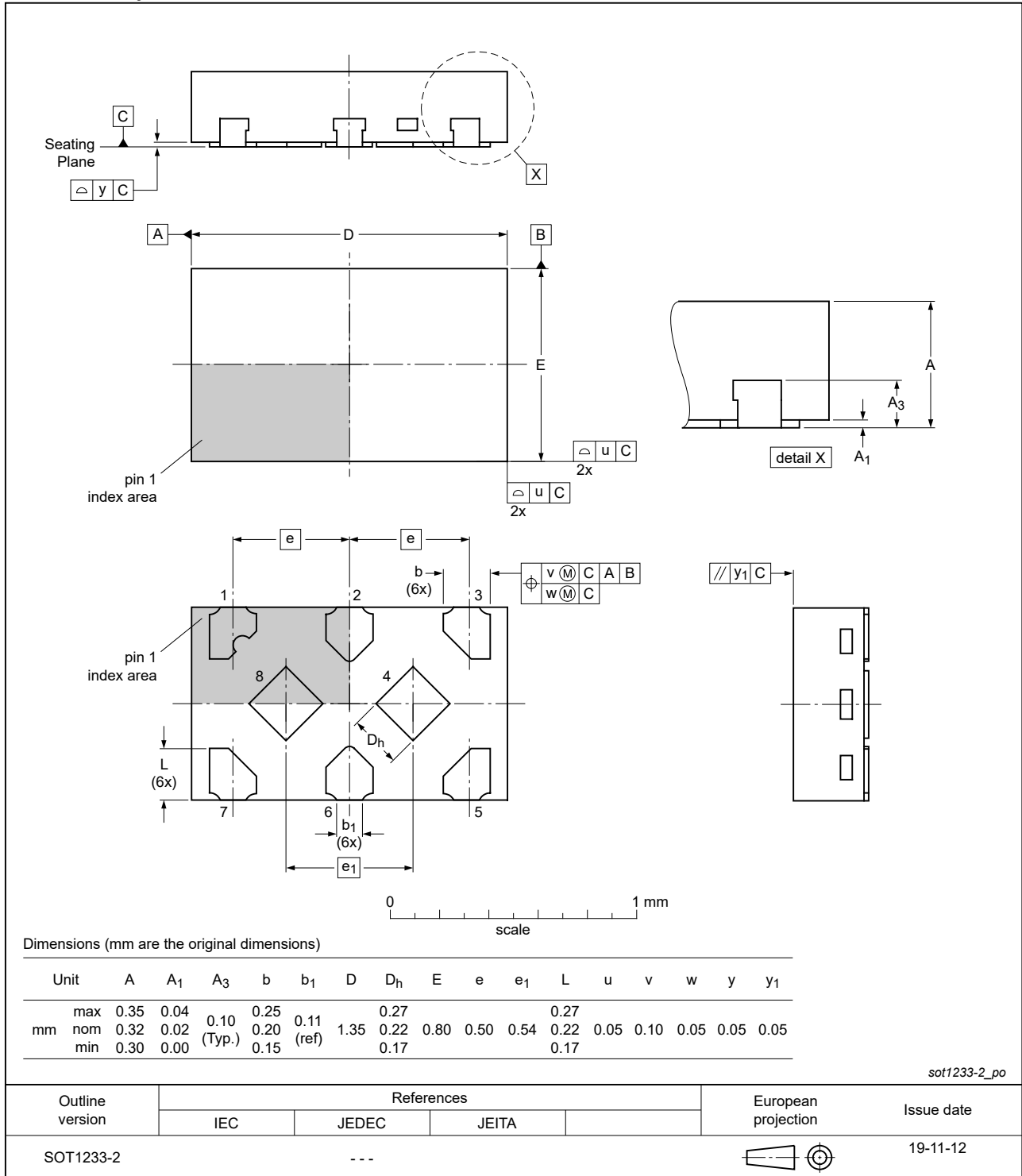


Fig. 17. Package outline SOT1233-2 (X2SON8)

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.12	20220620	Product data sheet	-	74AUP1G74 v.11
Modifications:	<ul style="list-style-type: none"> SOT1233 (X2SON8) package changed to SOT1233-2 (X2SON8) package. Section 1 and Section 2 updated. Table 6: Derating values for P_{tot} total power dissipation have been updated. 			
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. Fig. 7 and Fig. 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

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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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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.....	4
7. Functional description	5
8. Limiting values	5
9. Recommended operating conditions	6
10. Static characteristics	6
11. Dynamic characteristics	9
11.1. Waveforms and test circuit.....	15
12. Package outline	18
13. Abbreviations	25
14. Revision history	25
15. Legal information	26

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Date of release: 20 June 2022