74AUP1G74

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

Rev. 13 — 23 January 2023 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 µA (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			
	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
74AUP1G74GF	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm	SOT1089
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
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

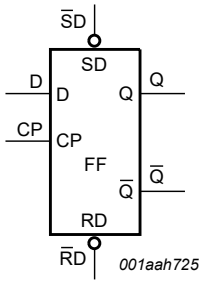


Fig. 1. Logic symbol

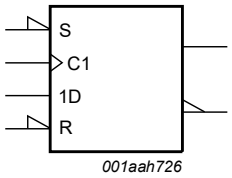


Fig. 2. IEC logic symbol

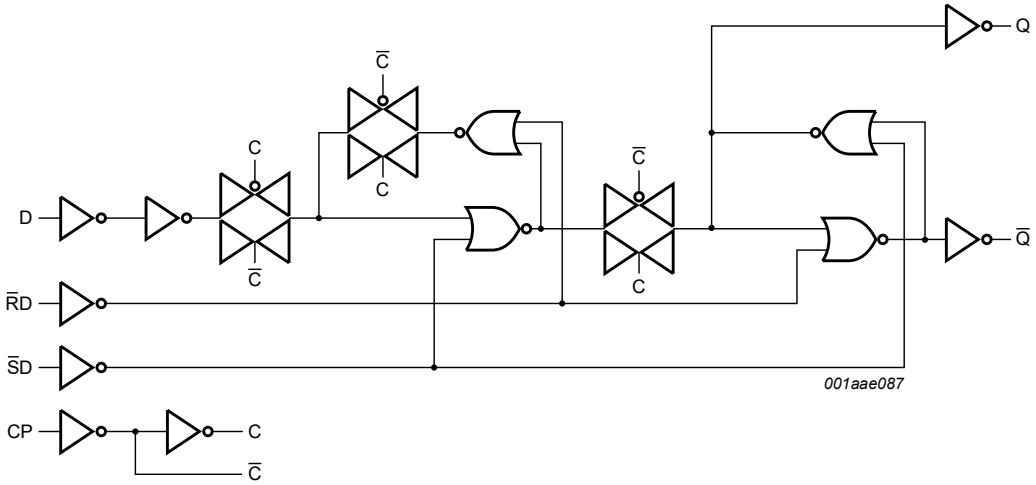


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

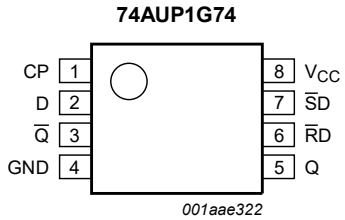
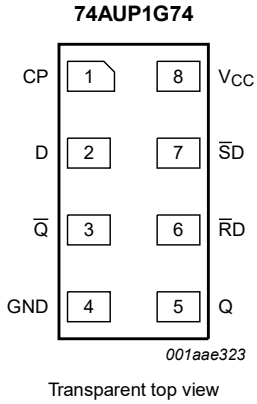
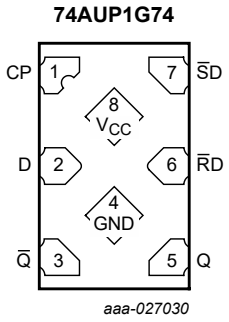


Fig. 4. Pin configuration SOT765-1 (VSSOP8)



Transparent top view

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



Transparent top view

Fig. 6. Pin configuration SOT1233-2 (X2SON8)

6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
CP	1	clock input
D	2	data input
$\overline{Q}$	3	complement output
GND	4	ground (0 V)
Q	5	true output
$\overline{RD}$	6	asynchronous reset input (active LOW)
$\overline{SD}$	7	asynchronous set input (active LOW)
V_{CC}	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	
$\overline{SD}$	$\overline{RD}$	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. Function table for synchronous operation

H = HIGH voltage level; L = LOW voltage level; ↑ = LOW-to-HIGH CP transition;
$\overline{Q}_{n+1}$, Q_{n+1} = state after the next LOW-to-HIGH CP transition.

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

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				
		SOT765-1 (VSSOP8)	[2]	-	250	mW
		SOT833-1 (XSON8)	[3]	-	250	mW
		SOT1089 (XSON8)	[4]	-	250	mW
		SOT1116 (XSON8)	[5]	-	250	mW
		SOT1203 (XSON8)	[6]	-	250	mW
		SOT1233-2 (X2SON8)	[7]	-	300	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 °C.
[3] For SOT833-1 (XSON8) package: P_{tot} derates linearly with 3.1 mW/K above 68 °C.
[4] For SOT1089 (XSON8) package: P_{tot} derates linearly with 4.0 mW/K above 88 °C.
[5] For SOT1116 (XSON8) package: P_{tot} derates linearly with 4.2 mW/K above 90 °C.
[6] For SOT1203 (XSON8) package: P_{tot} derates linearly with 3.6 mW/K above 81 °C.
[7] For SOT1233-2 (X2SON8) package: P_{tot} derates linearly with 7.7 mW/K above 118 °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
Δt/ΔV	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 × 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
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	-	-	0.31	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

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	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 × 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	0.7 × 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
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

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
		I_O = -4.0 mA; V_{CC} = 3.0 V	2.30	-	-	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_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 Fig. 9.

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, $\overline{Q}$; see Fig. 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	3.8	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
		$\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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	3.7	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
		$\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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	11.5	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. 7.								
		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

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, $\overline{Q}$; see Fig. 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	4.6	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
		$\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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	4.4	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
		$\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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	4.4	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. 7.								
		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

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, $\overline{Q}$; see Fig. 7. [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
		$\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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	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
		$\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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	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. 7.								
		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

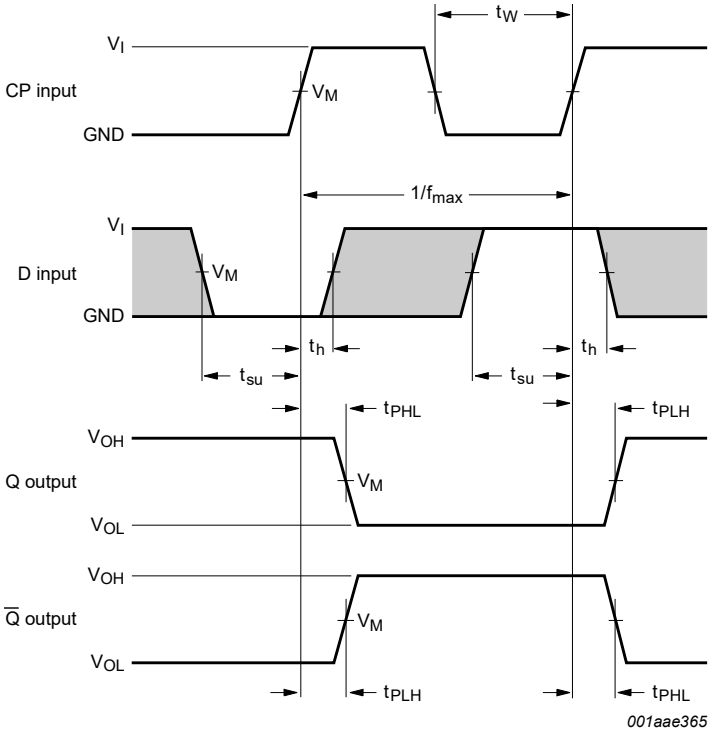
Symbol	Parameter	Conditions	T_{amb} = 25 °C			T_{amb} = -40 °C to +85 °C		T_{amb} = -40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
C_L = 30 pF										
t_{pd}	propagation delay	CP to Q, $\overline{Q}$; see Fig. 7. [2]								
		V_{CC} = 0.8 V	-	42.7	-	-	-	-	-	ns
		V_{CC} = 1.1 V to 1.3 V	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	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
		$\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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	6.6	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
		$\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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	6.5	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. 7.								
		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

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. 7.								
		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. 7.								
		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. 7.								
		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	$\overline{RD}$; see Fig. 8								
		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
		$\overline{SD}$; see Fig. 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	-	-0.4	-	-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

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. 7.								
		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. 8.								
		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).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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

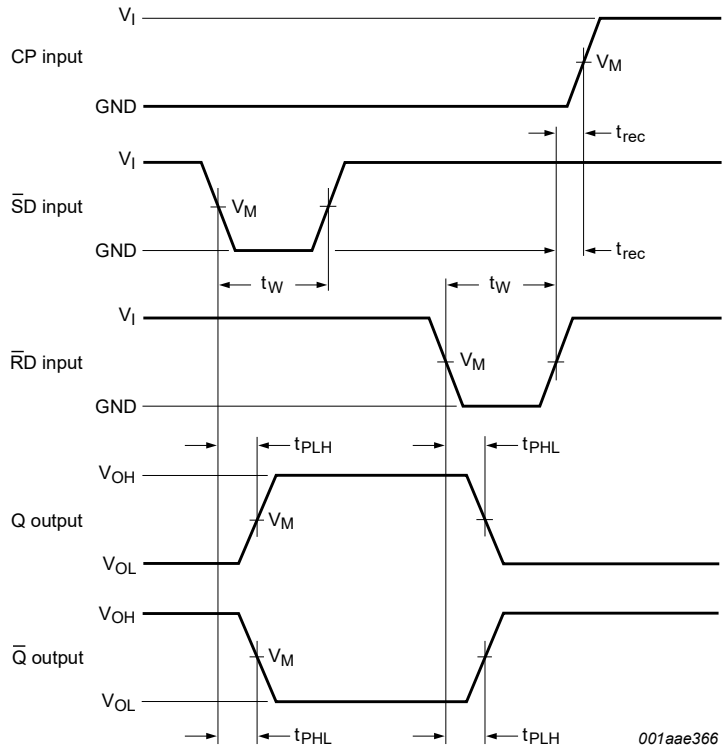


Measurement points are given in Table 10.

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.

Fig. 7. The clock input (CP) to output (Q, $\overline{Q}$) 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



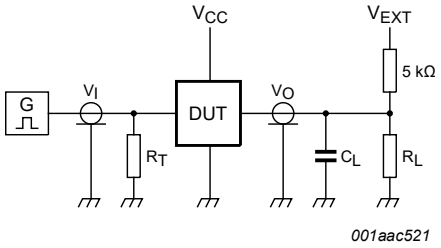
Measurement points are given in Table 10.

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

Fig. 8. The set input ($\overline{SD}$) and reset input ($\overline{RD}$) to output (Q, $\overline{Q}$) propagation delays, the set input ($\overline{SD}$) and reset input ($\overline{RD}$) pulse widths and the reset input ($\overline{RD}$) 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 × V_{CC}	0.5 × V_{CC}	V_{CC}	≤ 3.0 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 Zo of the pulse generator;

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

Fig. 9. Test circuit for measuring switching times

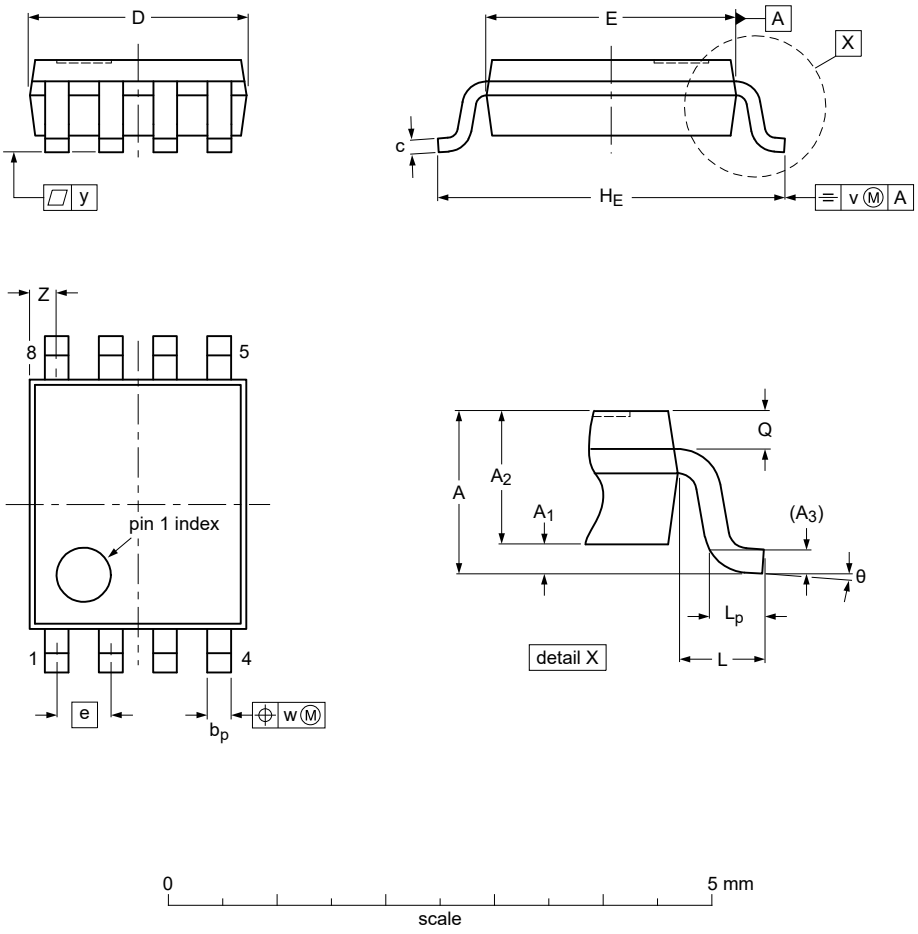
Table 11. Test data

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 × 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.

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
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		
min		0.00	0.60		0.17	0.08	1.9	2.2		3.0		0.15	0.19				0.1	0°

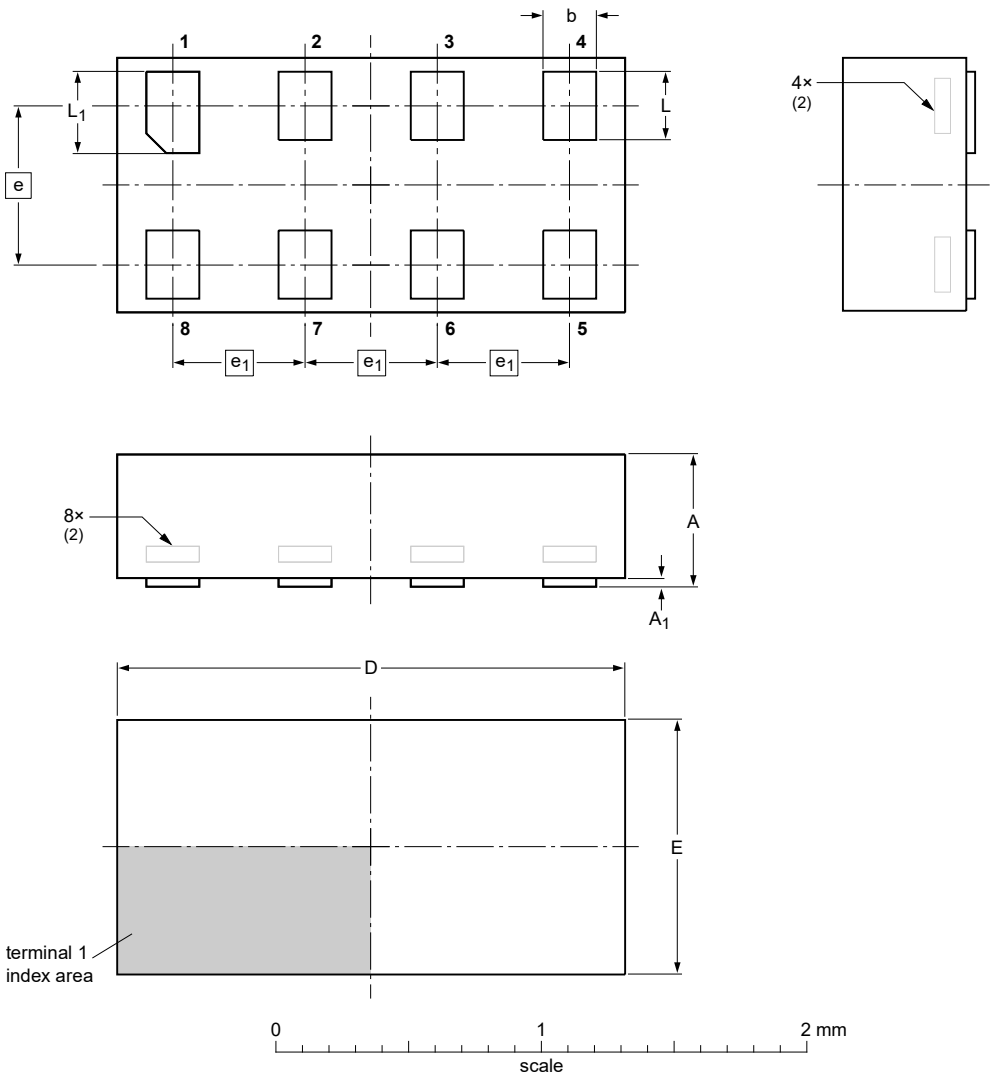
Note
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

sot765-1_po

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

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	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

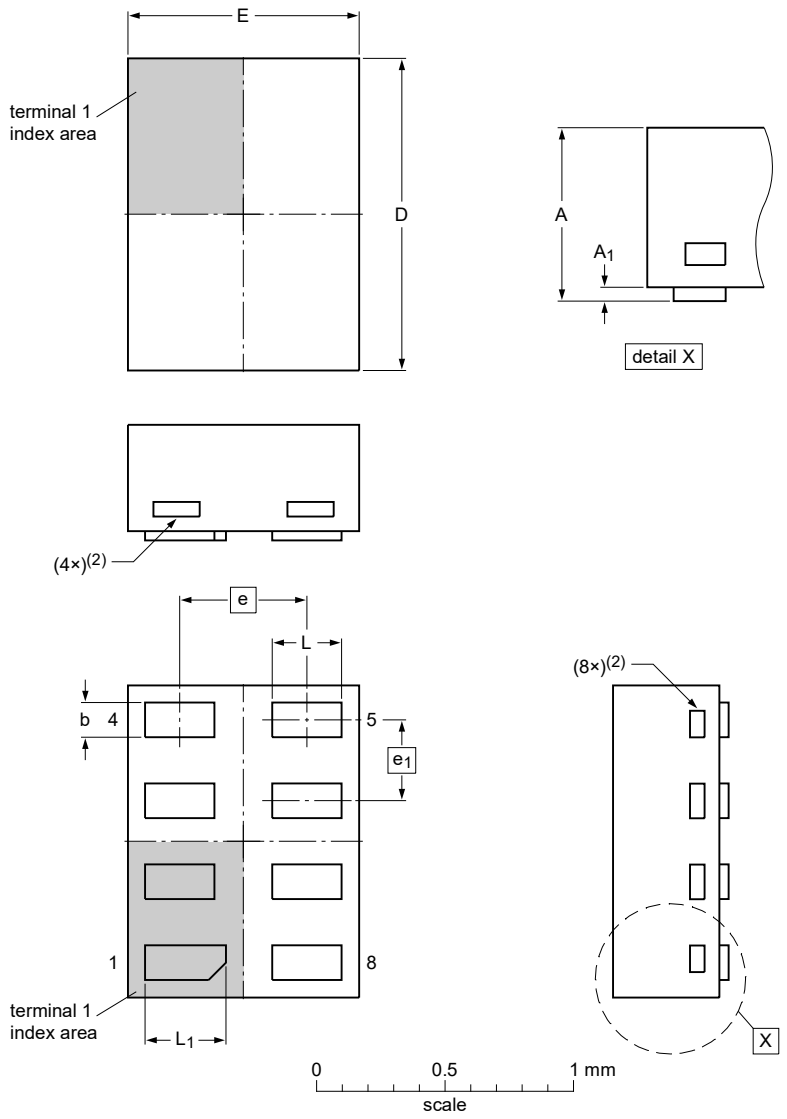
Notes

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

Fig. 11. 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**



Dimensions

Unit		$A^{(1)}$	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.5	0.04	0.20	1.40	1.05			0.35	0.40
	nom			0.15	1.35	1.00	0.55	0.35	0.30	0.35
	min			0.12	1.30	0.95			0.27	0.32

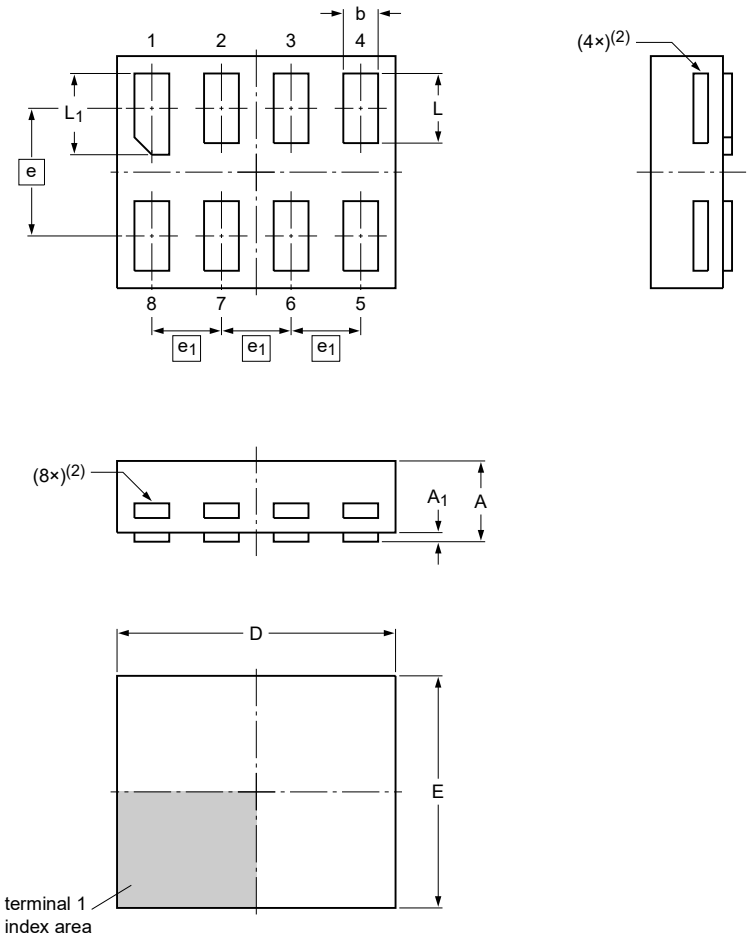
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1089_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1089		MO-252				~~10-04-09~~ 10-04-12

Fig. 12. Package outline SOT1089 (XSON8)

XSON8: extremely thin small outline package; no leads;
8 terminals; body 1.2 x 1.0 x 0.35 mm **SOT1116**



Dimensions

Unit		A(1)	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.35	0.04	0.20	1.25	1.05			0.35	0.40
	nom			0.15	1.20	1.00	0.55	0.3	0.30	0.35
	min			0.12	1.15	0.95			0.27	0.32

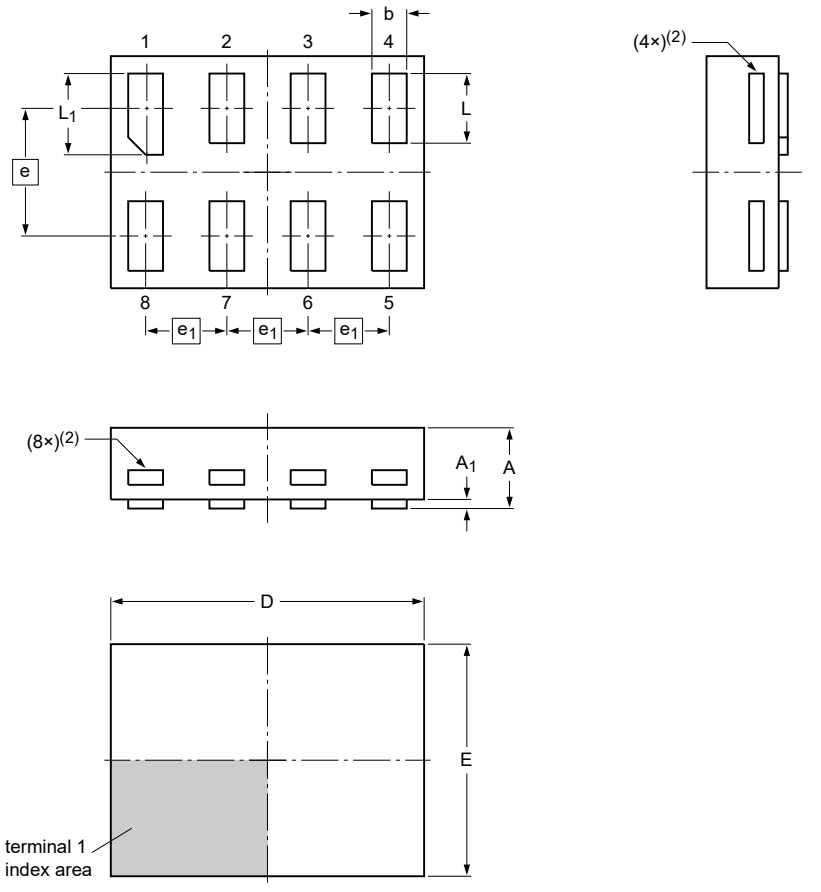
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1116_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1116						~~10-04-02~~ 10-04-07

Fig. 13. 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
	nom			0.15	1.35	1.00	0.55	0.35	0.30	0.35
	min			0.12	1.30	0.95			0.27	0.32

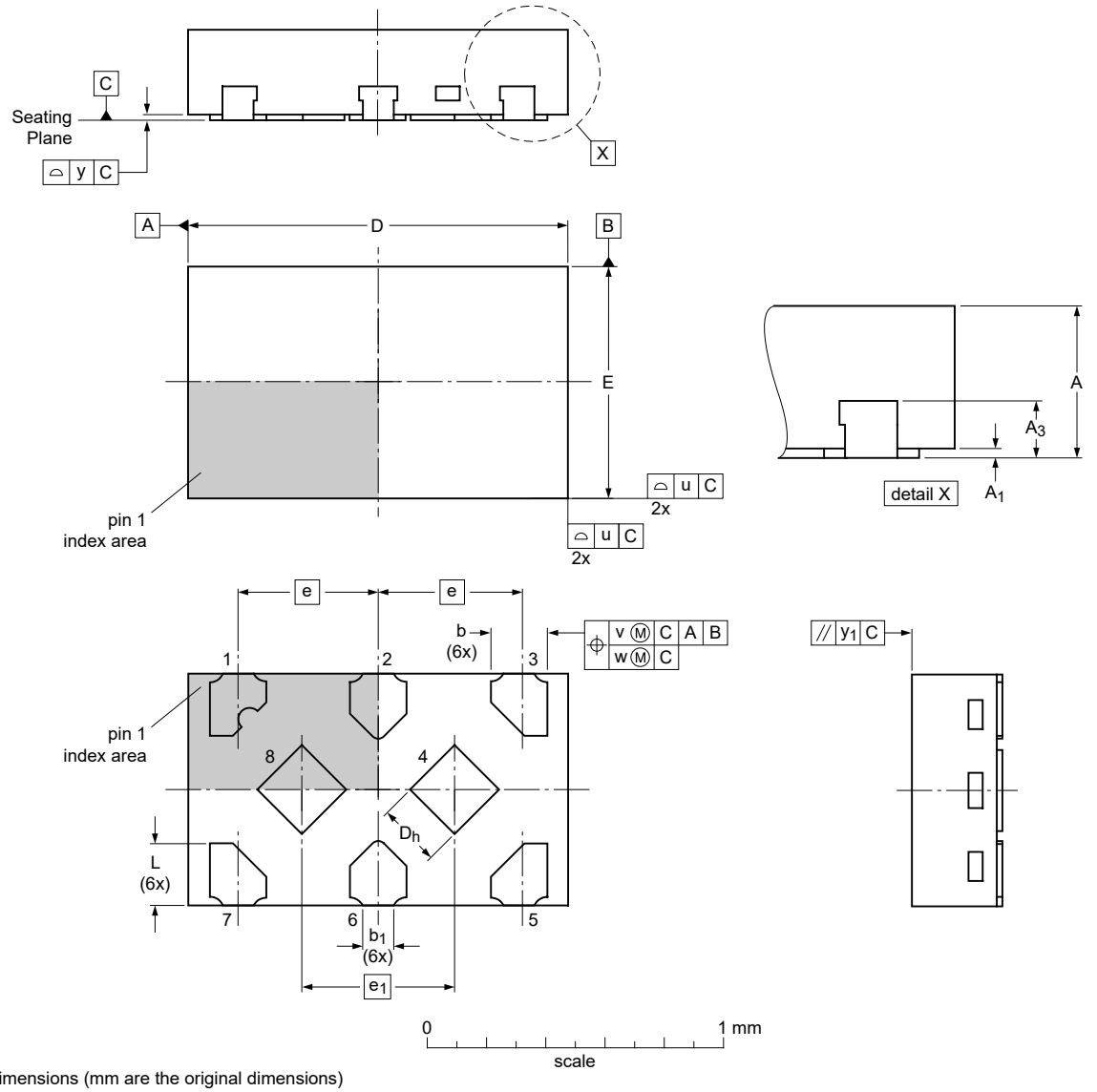
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1203_po

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

Fig. 14. Package outline SOT1203 (XSON8)

X2SON8: plastic thermal enhanced extremely thin small outline package; no leads; 8 terminals; body 1.35 x 0.8 x 0.32 mm **SOT1233-2**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_3	b	b_1	D	D_h	E	e	e_1	L	u	v	w	y	y_1
mm	max	0.35	0.04	0.10 (Typ.)	0.25	0.11 (ref)	1.35	0.27	0.80	0.50	0.54	0.27	0.05	0.10	0.05	0.05	0.05
	nom	0.32	0.02		0.20			0.22				0.22					
	min	0.30	0.00		0.15			0.17				0.17					

sot1233-2_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1233-2		---				19-11-12

Fig. 15. 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.13	20230123	Product data sheet	-	74AUP1G74 v.12
Modifications:	• Type number 74AUP1G74GM (SOT902-2/XQFN8) removed.			
74AUP1G74 v.12	20220620	Product data sheet	-	74AUP1G74 v.11
Modifications:	• 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:	• 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. 6 and Fig. 15 (drawings SOT1233/X2SON8) updated • Type number 74AUP1G74GD removed.			
74AUP1G74 v.10	20161028	Product data sheet	-	74AUP1G74 v.9
Modifications:	• Added type number 74AUP1G74GX (SOT1233/X2SON8)			
74AUP1G74 v.9	20140106	Product data sheet	-	74AUP1G74 v.8
Modifications:	• Conditions for f_{max} corrected (errata).			
74AUP1G74 v.8	20130123	Product data sheet	-	74AUP1G74 v.7
Modifications:	• 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

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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