74LV165

8-bit parallel-in/serial-out shift register

Rev. 10 — 31 January 2024 Product data sheet

1. General description

The 74LV165 is an 8-bit serial or parallel-in/serial-out shift register. The device features a serial data input (DS), eight parallel data inputs (D0 to D7) and two complementary serial outputs (Q7 and $\overline{Q7}$). When the parallel load input ($\overline{PL}$) is LOW the data from D0 to D7 is loaded into the shift register asynchronously. When $\overline{PL}$ is HIGH data enters the register serially at DS. When the clock enable input ($\overline{CE}$) is LOW data is shifted on the LOW-to-HIGH transitions of the CP input. A HIGH on $\overline{CE}$ will disable the CP input. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess V_{CC}.

2. Features and benefits

- Wide supply voltage range from 1.0 V to 5.5 V
- CMOS low power dissipation
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Optimized for low voltage applications: 1.0 V to 3.6 V
- Synchronous parallel-to-serial applications
- Synchronous serial input for easy expansion
- Complies with JEDEC standards:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8C (2.7 V to 3.6 V)
  - JESD36 (4.5 V to 5.5 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LV165D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74LV165PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

4. Functional diagram

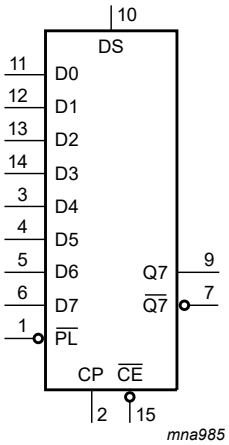


Fig. 1. Logic symbol

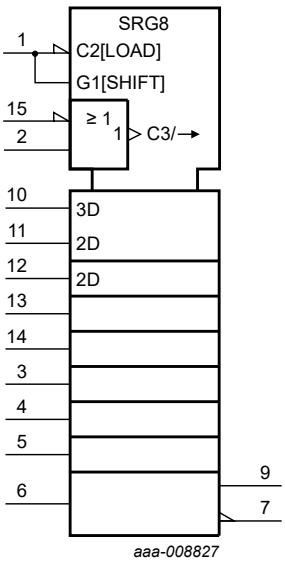


Fig. 2. IEC logic symbol

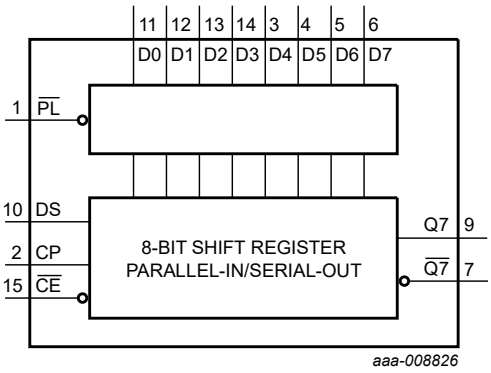


Fig. 3. Functional diagram

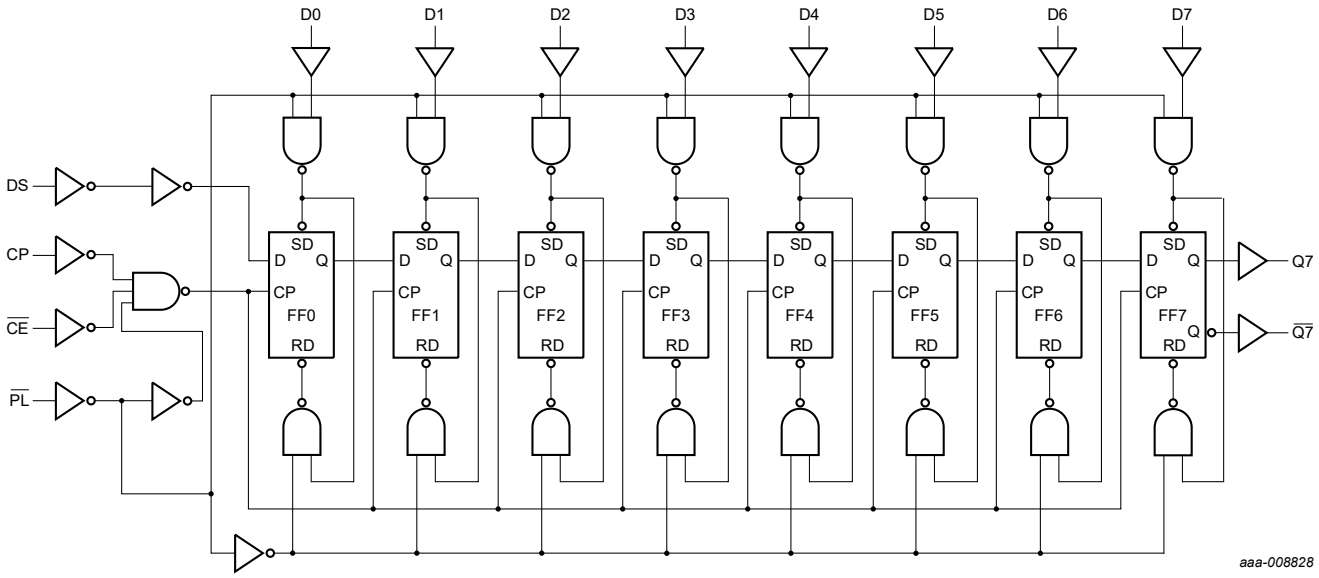


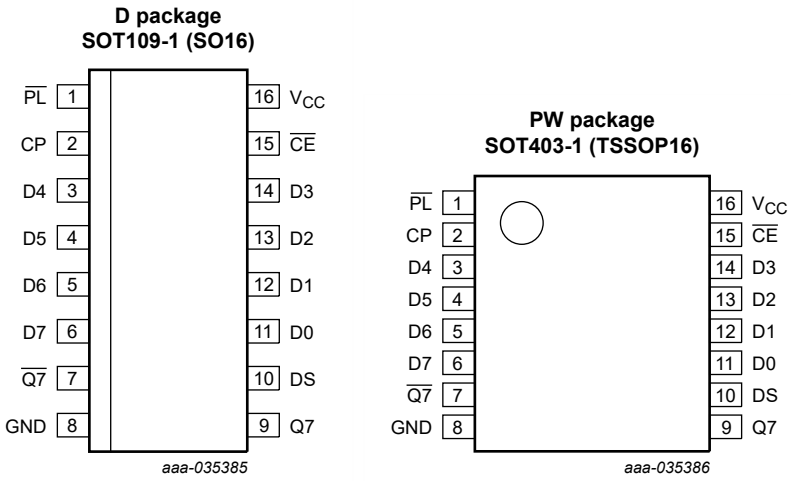
Fig. 4. Logic diagram

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{PL}$	1	parallel enable input (active LOW)
CP	2	clock input (LOW-to-HIGH edge-triggered)
$\overline{Q7}$	7	complementary serial output from the last stage
GND	8	ground (0 V)
Q7	9	serial output from the last stage
DS	10	serial data input
D0, D1, D2, D3, D4, D5, D6, D7	11, 12, 13, 14, 3, 4, 5, 6	parallel data inputs
$\overline{CE}$	15	clock enable input (active LOW)
V_{CC}	16	positive supply voltage

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

6. Functional description

Table 3. Function table

H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;
L = LOW voltage level; l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;
q = state of the referenced output one set-up time prior to the LOW-to-HIGH clock transition;
X = don't care; ↑ = LOW-to-HIGH clock transition.

Operating modes	Inputs					Qn registers		Output	
	$\overline{PL}$	$\overline{CE}$	CP	DS	D0 to D7	Q0	Q1 to Q6	Q7	$\overline{Q7}$
parallel load	L	X	X	X	L	L	L to L	L	H
	L	X	X	X	H	H	H to H	H	L
serial shift	H	L	↑	l	X	L	q0 to q5	q6	$\overline{q6}$
	H	L	↑	h	X	H	q0 to q5	q6	$\overline{q6}$
hold "do nothing"	H	H	X	X	X	q0	q1 to q6	q7	q7

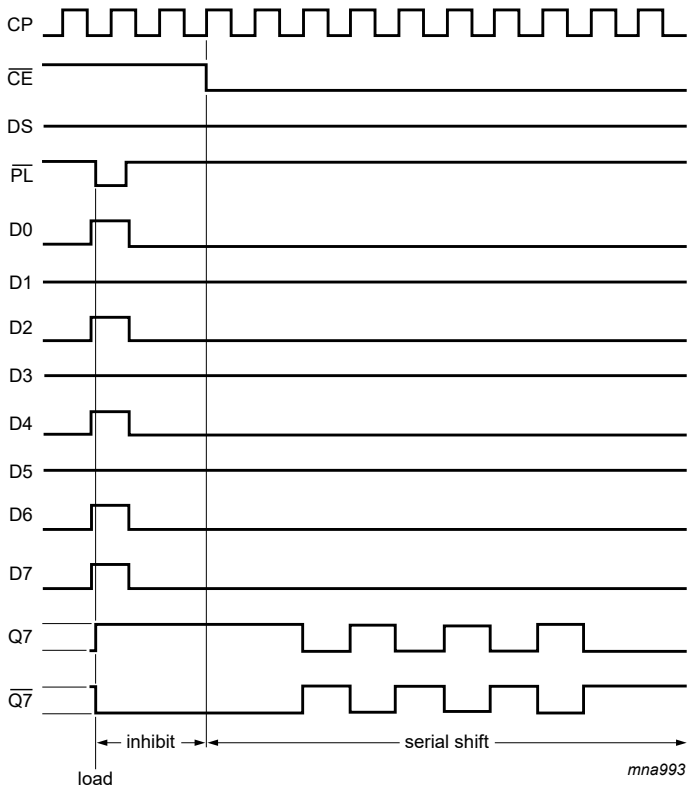


Fig. 5. Timing diagram

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V). [1]

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	+7	V
I_{IK}	input clamping current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	20	mA
V_I	input voltage		-0.5	+7	V
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$	-	±50	mA
I_O	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5$ V	-	±25	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]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For SOT109-1 (SO16) package: P_{tot} derates linearly with 12.4 mW/K above 110 °C.
For SOT403-1 (TSSOP16) package: P_{tot} derates linearly with 8.5 mW/K above 91 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.0	3.3	5.5	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V_{CC} = 1.0 V to 2.0 V	0	-	500	ns/V
		V_{CC} = 2.0 V to 2.7 V	0	-	200	ns/V
		V_{CC} = 2.7 V to 3.6 V	0	-	100	ns/V
		V_{CC} = 3.6 V to 5.5 V	0	-	50	ns/V

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	V_{CC} = 1.2 V	0.9	-	-	0.9	-	V
		V_{CC} = 2.3 V to 2.7 V	1.4	-	-	1.4	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
		V_{CC} = 4.5 V to 5.5 V	0.7 × V_{CC}	-	-	0.7 × V_{CC}	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 1.2 V	-	-	0.3	-	0.3	V
		V_{CC} = 2.3 V to 2.7 V	-	-	0.6	-	0.6	V
		V_{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V_{CC} = 4.5 V to 5.5 V	-	-	0.3 × V_{CC}	-	0.3 × V_{CC}	
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}; I_O = -100 µA						
		V_{CC} = 1.2 V	-	1.2		-		
		V_{CC} = 2.0 V	1.8	2.0	-	1.8	-	V
		V_{CC} = 2.7 V	2.5	2.7	-	2.5	-	V
		V_{CC} = 3.0 V	2.8	3.0	-	2.8	-	V
		V_{CC} = 4.5 V	4.3	4.5	-	4.3	-	V
		standard outputs: V_I = V_{IH} or V_{IL}						
		V_{CC} = 3.0 V; I_O = -6 mA	2.40	2.82	-	2.20	-	V
		V_{CC} = 4.5 V; I_O = -12 mA	3.60	4.20	-	3.50	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}; I_O = 100 µA						
		V_{CC} = 1.2 V	-	0	-	-	-	
		V_{CC} = 2.0 V	-	0	0.2	1.8	0.2	V
		V_{CC} = 2.7 V	-	0	0.2	2.5	0.2	V
		V_{CC} = 3.0 V	-	0	0.2	2.8	0.2	V
		V_{CC} = 4.5 V	-	0	0.2	4.3	0.2	V
		standard outputs: V_I = V_{IH} or V_{IL}						
		V_{CC} = 3.0 V; I_O = 6 mA	-	0.25	0.40	-	0.50	V
		V_{CC} = 4.5 V; I_O = 12 mA	-	0.35	0.55	-	0.65	V
I_I	input leakage current	V_I = V_{CC} or GND; V_{CC} = 5.5 V	-	-	±1	-	±1	µA
I_{CC}	supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	20	-	160	µA
ΔI_{CC}	additional supply current	V_I = V_{CC} – 0.6 V; V_{CC} = 2.7 V to 3.6 V	-	-	500	-	850	µA
C_I	input capacitance		-	3.5	-	-	-	pF

[1] Typical values are measured at T_{amb} = 25 °C.

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND (ground = 0 V); for test circuit, see Fig. 11.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	$\overline{CE}$, CP to Q7, $\overline{Q7}$; see Fig. 6 and Fig. 7 [2]						
		V_{CC} = 1.2 V	-	115	-	-	-	ns
		V_{CC} = 2.0 V	-	38	61	-	76	ns
		V_{CC} = 2.7 V	-	27	43	-	54	ns
		V_{CC} = 3.0 V to 3.6 V [3]	-	22	36	-	45	ns
		V_{CC} = 3.3 V; C_L = 15 pF	-	18	-	-	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	-	15	24	-	30	ns
		$\overline{PL}$ to Q7, $\overline{Q7}$; see Fig. 7						
		V_{CC} = 1.2 V	-	110	-	-	-	ns
		V_{CC} = 2.0 V	-	35	56	-	70	ns
		V_{CC} = 2.7 V	-	24	39	-	49	ns
		V_{CC} = 3.0 V to 3.6 V [3]	-	20	33	-	41	ns
		V_{CC} = 3.3 V; C_L = 15 pF	-	18	-	-	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	-	14	22	-	27	ns
		D7 to Q7, $\overline{Q7}$; see Fig. 8						
		V_{CC} = 1.2 V	-	90	-	-	-	ns
		V_{CC} = 2.0 V	-	28	45	-	56	ns
		V_{CC} = 2.7 V	-	20	32	-	40	ns
		V_{CC} = 3.0 V to 3.6 V [3]	-	17	27	-	33	ns
		V_{CC} = 3.3 V; C_L = 15 pF	-	14	-	-	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	-	11	18	-	22	ns
t_W	pulse width	CP input HIGH to LOW; see Fig. 6						
		V_{CC} = 2.0 V	34	10	-	41	-	ns
		V_{CC} = 2.7 V	25	8	-	30	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	20	7	-	24	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	15	5	-	18	-	ns
		$\overline{PL}$ input LOW; see Fig. 7						
		V_{CC} = 2.0 V	34	10	-	41	-	ns
		V_{CC} = 2.7 V	25	8	-	30	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	20	7	-	24	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	15	5	-	18	-	ns
t_{rec}	recovery time	$\overline{PL}$ to CP, $\overline{CE}$; see Fig. 7						
		V_{CC} = 1.2 V	-	40	-	-	-	ns
		V_{CC} = 2.0 V	24	15	-	30	-	ns
		V_{CC} = 2.7 V	18	11	-	23	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	17	10	-	21	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	12	7	-	15	-	ns

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t_{su}	set-up time	DS to CP, $\overline{CE}$; see Fig. 9						
		V_{CC} = 1.2 V	-	-8	-	-	-	ns
		V_{CC} = 2.0 V	22	-2	-	26	-	ns
		V_{CC} = 2.7 V	16	-1	-	19	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	13	-1	-	15	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	9	0	-	10	-	ns
		$\overline{CE}$ to CP, CP to $\overline{CE}$; see Fig. 9						
		V_{CC} = 1.2 V	-	20	-	-	-	ns
		V_{CC} = 2.0 V	22	7	-	26	-	ns
		V_{CC} = 2.7 V	16	5	-	19	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	13	4	-	15	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	9	3	-	10	-	ns
		Dn to $\overline{PL}$; see Fig. 10						
		V_{CC} = 1.2 V	-	25	-	-	-	ns
		V_{CC} = 2.0 V	22	8	-	26	-	ns
		V_{CC} = 2.7 V	16	6	-	19	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	13	5	-	15	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	9	4	-	10	-	ns
t_h	hold time	DS to CP, $\overline{CE}$; Dn to $\overline{PL}$; see Fig. 9 and Fig. 10						
		V_{CC} = 1.2 V	-	20	-	-	-	ns
		V_{CC} = 2.0 V	22	7	-	26	-	ns
		V_{CC} = 2.7 V	16	5	-	19	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	13	4	-	15	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	9	3	-	10	-	ns
		$\overline{CE}$ to CP, CP to $\overline{CE}$; see Fig. 9						
		V_{CC} = 1.2 V	-	-30	-	-	-	ns
		V_{CC} = 2.0 V	5	-8	-	5	-	ns
		V_{CC} = 2.7 V	5	-6	-	5	-	ns
		V_{CC} = 3.0 V to 3.6 V [3]	5	-5	-	5	-	ns
		V_{CC} = 4.5 V to 5.5 V [4]	5	-4	-	5	-	ns
f_{max}	maximum frequency	see Fig. 6						
		V_{CC} = 2.0 V	14	40	-	12	-	MHz
		V_{CC} = 2.7 V	19	60	-	16	-	MHz
		V_{CC} = 3.0 V to 3.6 V [3]	24	65	-	20	-	MHz
		V_{CC} = 3.3 V; C_L = 15 pF	-	78	-	-	-	MHz
		V_{CC} = 4.5 V to 5.5 V [4]	36	75	-	30	-	MHz

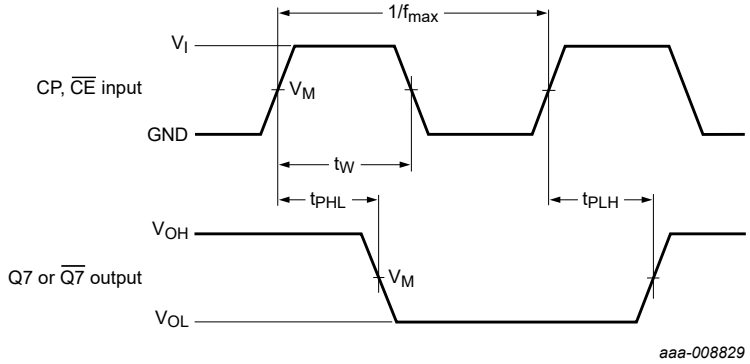
All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC}; V_{CC} = 3.3 V [5]	-	35	-	-	-	pF

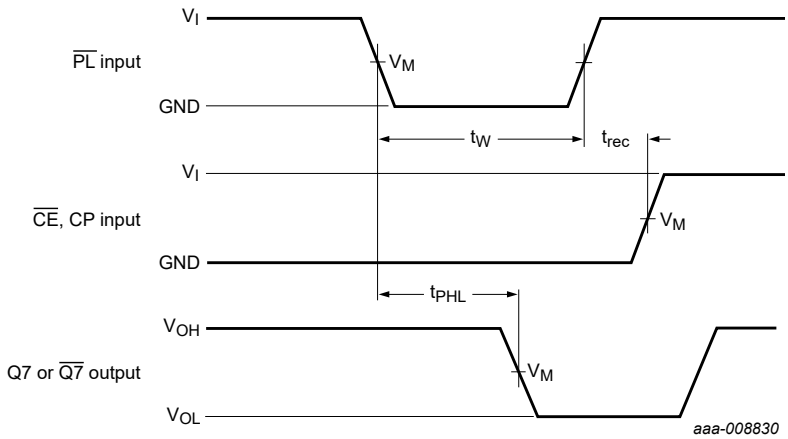
[1] Typical values are measured at T_{amb} = 25 °C.
[2] t_{pd} is the same as t_{PHL} and t_{PLH}.
[3] Typical values are measured at V_{CC} = 3.3 V.
[4] Typical values are measured at V_{CC} = 5.0 V.
[5] C_{PD} is used to determine the dynamic power dissipation $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ (P_D in µW), where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
$\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in V.

10.1. Waveforms and test circuit



Measurement points are given in Table 8.
The changing to output assumes that internal Q6 is opposite state from Q7.

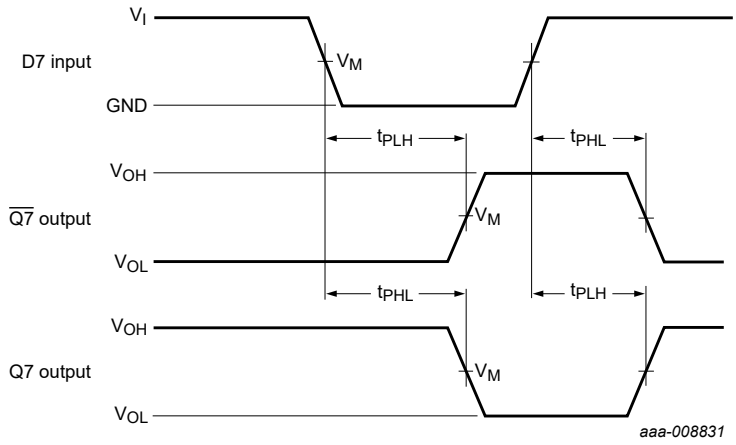
Fig. 6. Clock pulse (CP) and clock enable ($\overline{CE}$) to output (Q7 or $\overline{Q7}$) propagation delays, clock pulse width and maximum clock frequency



Measurement points are given in Table 8.
The changing to output assumes that internal Q6 is opposite state from Q7.

Fig. 7. Parallel load ($\overline{PL}$) pulse width, parallel load to output (Q7 or $\overline{Q7}$) propagation delays, parallel load to clock (CP) and clock enable ($\overline{CE}$) recovery time

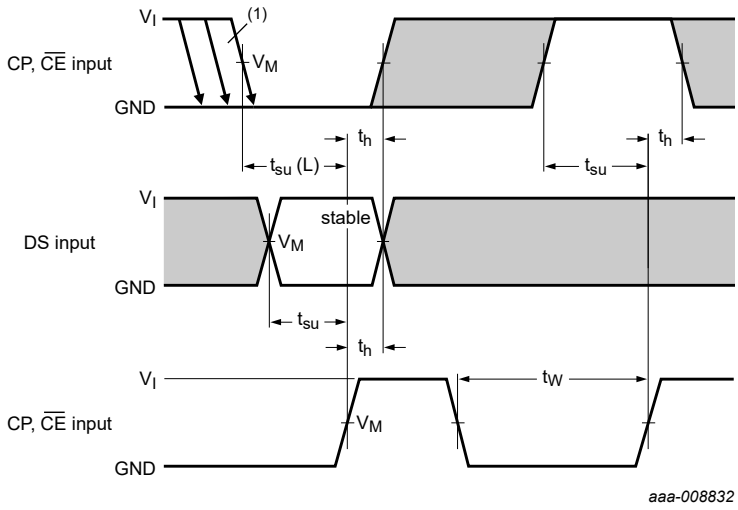
All information provided in this document is subject to legal disclaimers.
© Nexperia B.V. 2024. All rights reserved



Measurement points are given in Table 8.

The changing to output assumes that internal Q6 is opposite state from Q7.

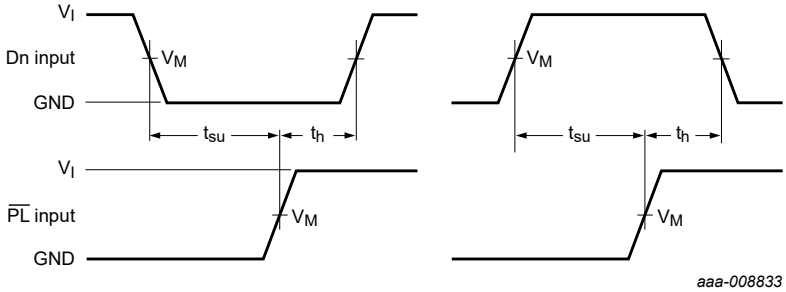
Fig. 8. Data input (Dn) to output (Q7 or $\overline{Q7}$) propagation delays when $\overline{PL}$ is LOW



Measurement points are given in Table 8.

(1) CE may change only from HIGH-to-LOW while CP is LOW. The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig. 9. Set-up and hold times



Measurement points are given in Table 8.

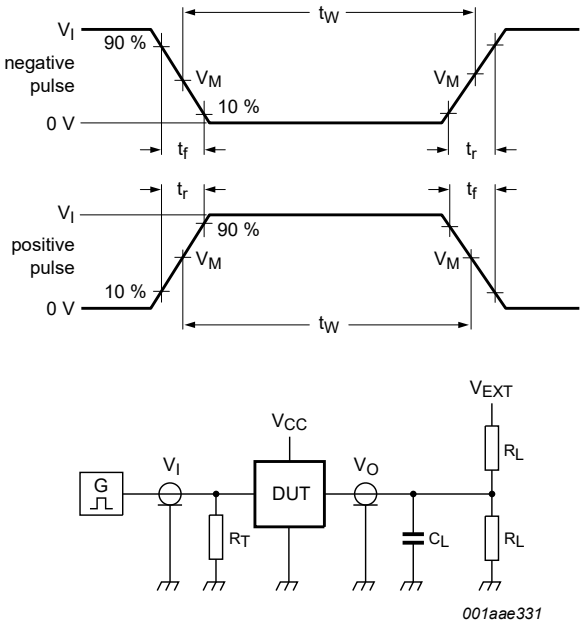
Fig. 10. Set-up and hold times from the data inputs (Dn) to the parallel load input ($\overline{PL}$)

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

Table 8. Measurement points

Supply voltage	Input	Output
V_{CC}	V_M	V_M
< 2.7 V	0.5 × V_{CC}	0.5 × V_{CC}
2.7 V to 3.6 V	1.5 V	1.5 V
≥ 4.5 V	0.5 × V_{CC}	0.5 × V_{CC}



Test data is given in Table 9.

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 output impedance Z_o of the pulse generator;

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

Fig. 11. Test circuit for measuring switching times

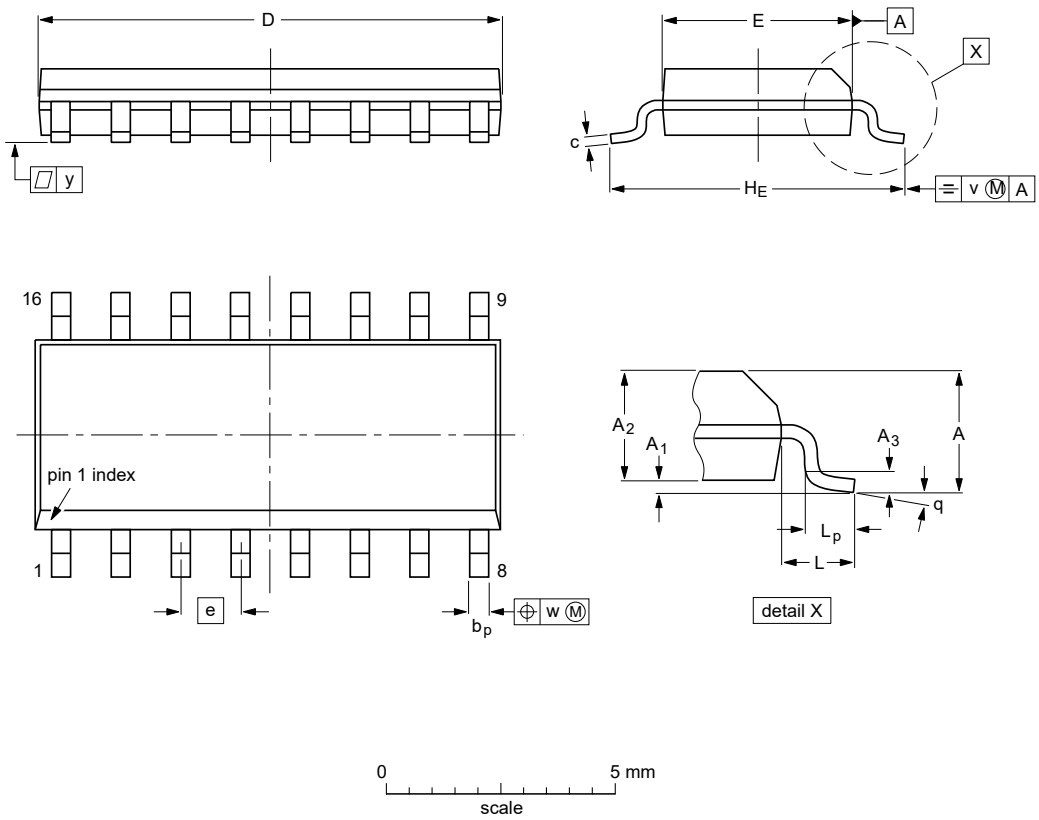
Table 9. Test data

Supply voltage	Input		Load		V_{EXT}
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}
< 2.7 V	V_{CC}	2.5 ns	50 pF	1 kΩ	open
2.7 V to 3.6 V	2.7 V	2.5 ns	50 pF, 15 pF	1 kΩ	open
≥ 4.5 V	V_{CC}	2.5 ns	50 pF	1 kΩ	open

All information provided in this document is subject to legal disclaimers.
© Nexperia B.V. 2024. All rights reserved

11. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm **SOT109-1**



Dimensions (inch dimensions are derived from the original mm dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	v	w	y	θ
mm	max	1.75	0.25			0.51	0.25	10.0	4.0		6.2		1.27				8°
	nom				0.25					1.27		1.05		0.2	0.25	0.1	
	min		0.10	1.25		0.31	0.10	9.8	3.8		5.8		0.4				0°
inches	max	0.069	0.010			0.020	0.010	0.394	0.16		0.244		0.05				8°
	nom				0.01					0.05		0.041		0.008	0.01	0.004	
	min		0.004	0.049		0.012	0.004	0.386	0.15		0.228		0.016				0°

Note
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

sot109-1_po

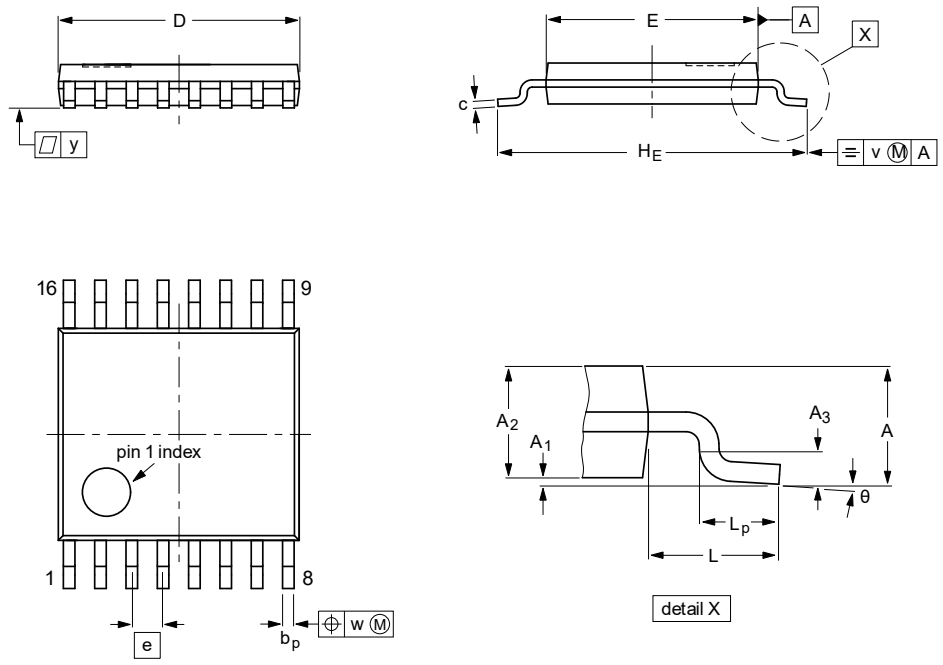
Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT109-1		MS-012				~~03-02-19~~ 23-10-27

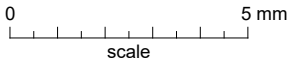
Fig. 12. Package outline SOT109-1 (SO16)

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm **SOT403-1**





Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	v	w	y	θ
mm	max	1.20	0.15	1.05		0.30	0.2	5.1	4.5		6.6		0.75				8°
	nom				0.25					0.65		1		0.2	0.1	0.1	
	min		0.05	0.80		0.19	0.09	4.9	4.3		6.2		0.45				0°

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

sot403-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT403-1		MO-153				~~03-02-18~~ 23-10-27

Fig. 13. Package outline SOT403-1 (TSSOP16)

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV165 v.10	20240131	Product data sheet	-	74LV165 v.9
Modifications:	• Section 2: ESD specification updated according to the latest JEDEC standard. • Fig. 12, Fig. 13: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153			
74LV165 v.9	20220905	Product data sheet	-	74LV165 v.8
Modifications:	• Section 8: Maximum value for T_{amb} ambient temperature corrected to +125 °C.			
74LV165 v.8	20210921	Product data sheet	-	74LV165 v.7
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. • Section 1 and Section 2 updated. • Section 7: Derating values for P_{tot} total power dissipation updated. • Type number 74LV165DB (SOT338-1/SSOP16) removed.			
74LV165 v.7	20160309	Product data sheet	-	74LV165 v.6
Modifications:	• Type number 74HC165N (SOT38-4) removed.			
74LV165 v.6	20140219	Product data sheet	-	74LV165 v.5
Modifications:	• Typo corrected in Table 2			
74LV165 v.5	20130909	Product data sheet	-	74LV165 v.4
Modifications:	• Typo corrected in the header of Table 6			
74LV165 v.4	20130830	Product data sheet	-	74LV165_CNV_3
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Family data added, see Table 6			
74LV165_CNV_3	December 1998	Product specification	-	-

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

14. 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".
[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 https://www.nexperia.com.

Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2024. All rights reserved

Contents

1. General description....1
2. Features and benefits....1
3. Ordering information....1
4. Functional diagram....2
5. Pinning information....3
5.1. Pinning....3
5.2. Pin description....3
6. Functional description....4
7. Limiting values....5
8. Recommended operating conditions....5
9. Static characteristics....6
10. Dynamic characteristics....7
10.1. Waveforms and test circuit....9
11. Package outline....12
12. Abbreviations....14
13. Revision history....14
14. Legal information....15

© Nexperia B.V. 2024. All rights reserved

For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com
Date of release: 31 January 2024