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# 74HC165D

Nexperia

Counter Shift Registers 8-BIT S/PI-SO SHIFT REGISTER

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# 74HC165; 74HCT165

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

Rev. 4 — 28 December 2015

Product data sheet

### 1. General description

The 74HC165; 74HCT165 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 of  $V_{CC}$ .

### 2. Features and benefits

- Asynchronous 8-bit parallel load
- Synchronous serial input
- Complies with JEDEC standard no. 7A
- Input levels:
  - ◆ For 74HC165: CMOS level
  - ◆ For 74HCT165: TTL level
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

### 3. Applications

- Parallel-to-serial data conversion

### 4. Ordering information

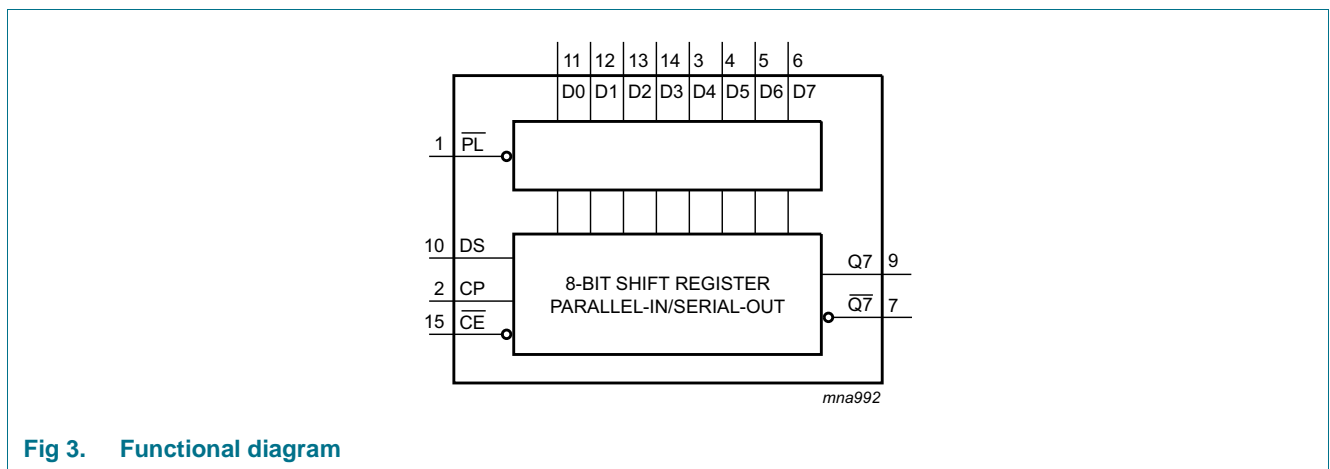
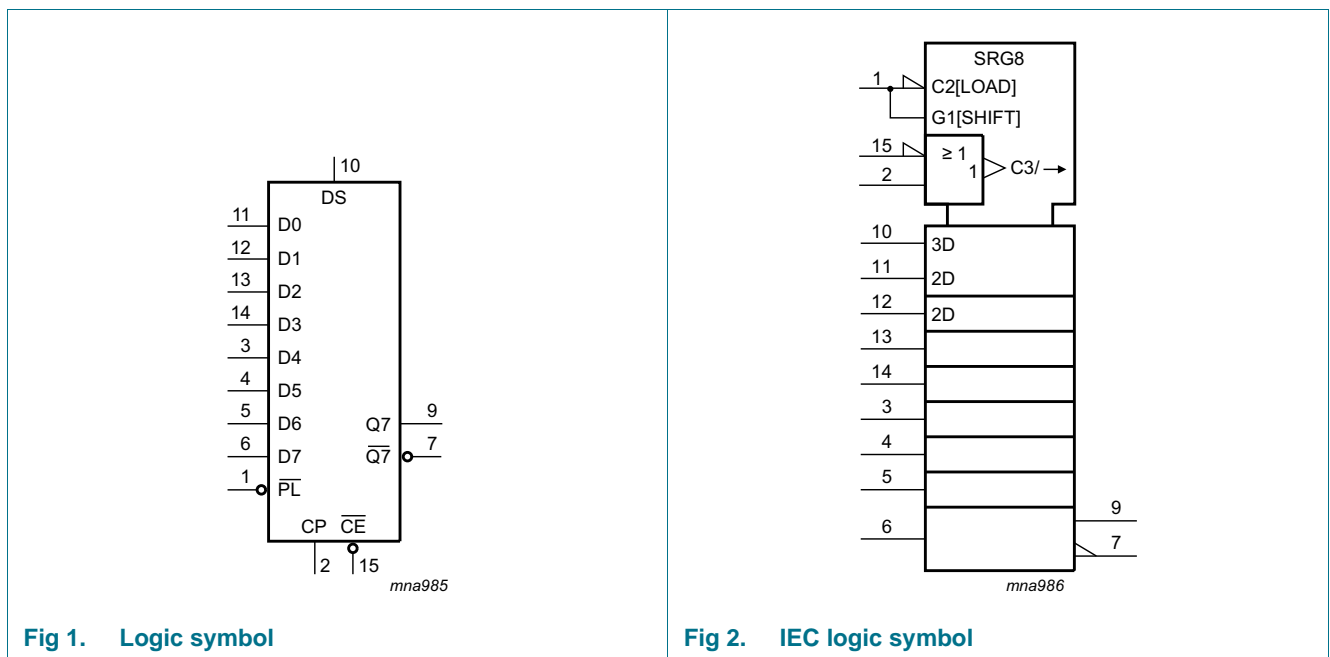
Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC165D	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT165D				
74HC165DB	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT165DB				

**Table 1. Ordering information ...continued**

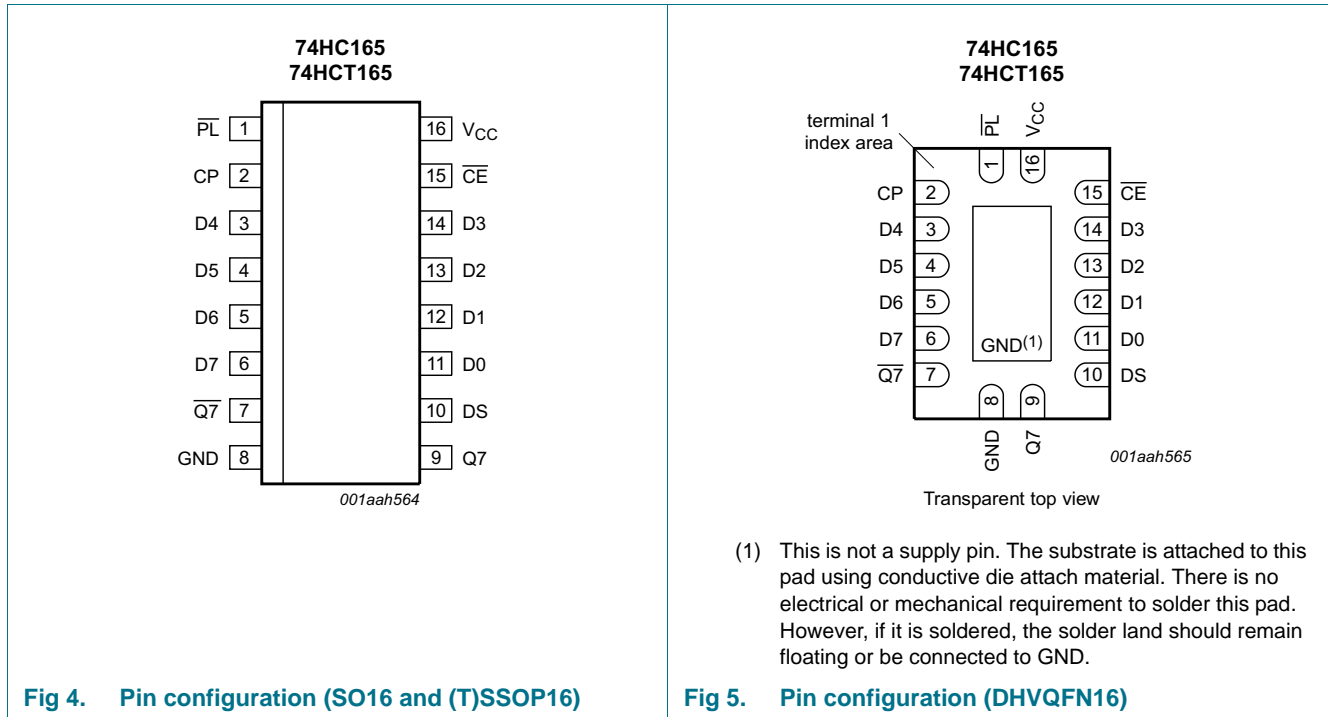
Type number	Package			Version
	Temperature range	Name	Description	
74HC165PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT165PW				
74HC165BQ	-40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1
74HCT165BQ				

## 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{PL}$	1	asynchronous parallel load input (active LOW)
CP	2	clock input (LOW-to-HIGH edge-triggered)
$\overline{Q7}$	7	complementary output from the last stage
GND	8	ground (0 V)
Q7	9	serial output from the last stage
DS	10	serial data input
D0 to D7	11, 12, 13, 14, 3, 4, 5, 6	parallel data inputs (also referred to as Dn)
$\overline{CE}$	15	clock enable input (active LOW)
V <sub>CC</sub>	16	positive supply voltage

## 7. Functional description

Table 3. Function table<sup>[1]</sup>

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

- [1] 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.

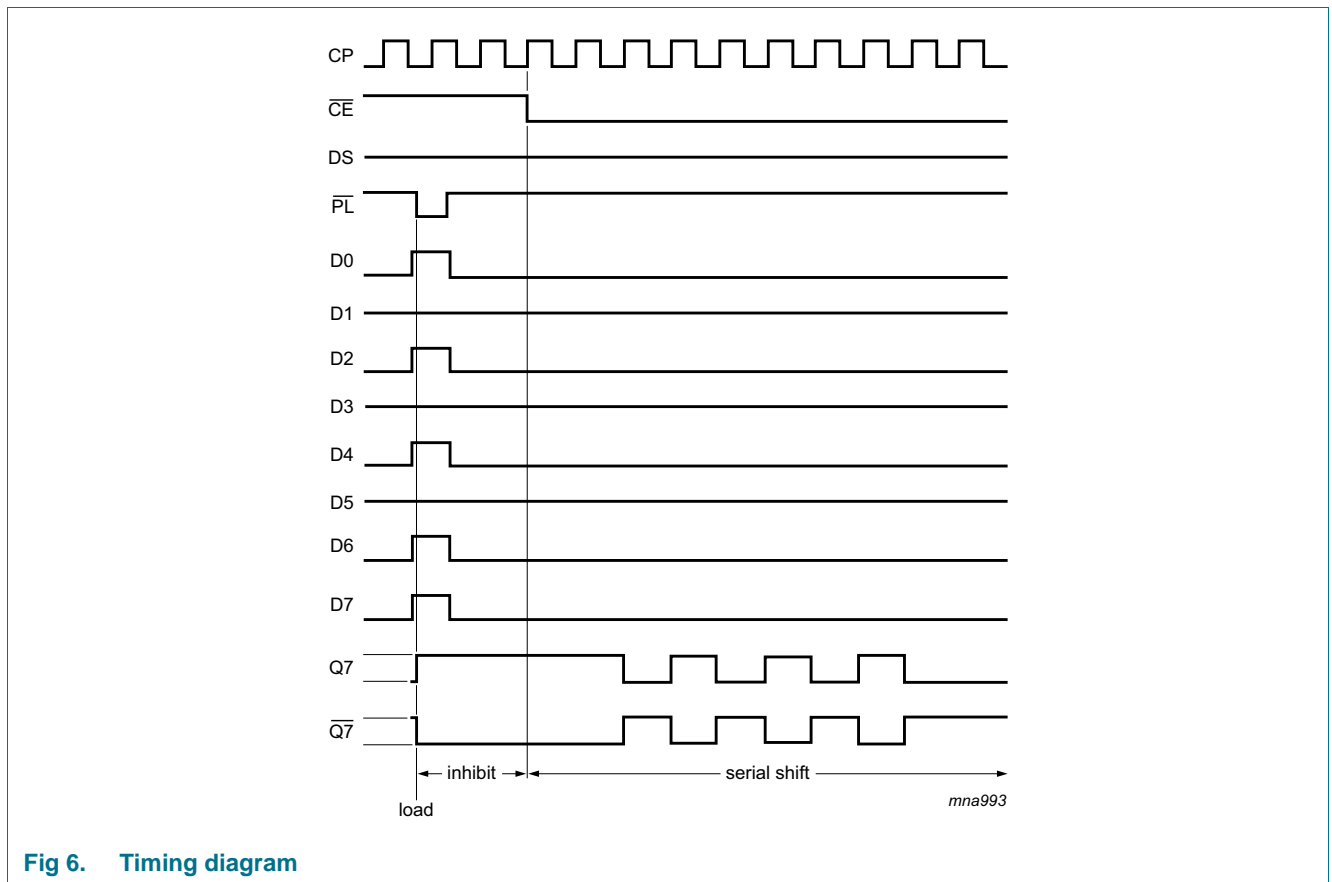


Fig 6. Timing diagram

## 8. Limiting values

**Table 4. 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	+7	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1]	-	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]	-	$\pm 20$	mA
$I_O$	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	$\pm 25$	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	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$			
		SO16 package [2]	-	500	mW
		(T)SSOP16 package [3]	-	500	mW
		DHVQFN16 package [4]	-	500	mW

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

[2]  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

[3]  $P_{tot}$  derates linearly with 5.5 mW/K above 60 °C.

[4]  $P_{tot}$  derates linearly with 4.5 mW/K above 60 °C.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC165			74HCT165			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	-	+125	-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	-	-	-	ns/V

## 10. Static characteristics

**Table 6. Static characteristics**

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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC165</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1	-	±1	μA
		I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	8.0	-	80	-
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF
<b>74HCT165</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
I <sub>I</sub>	input leakage current	I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
		V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1	-	±1	μA

**Table 6.** Static characteristics ...continued

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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0$ V	-	-	8.0	-	80	-	160	$\mu$ A
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = V_{CC} - 2.1$ V; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5$ V to 5.5 V								
		Dn and DS inputs	-	35	126	-	157.5	-	171.5	$\mu$ A
		CP $\overline{CE}$ , and $\overline{PL}$ inputs	-	65	234	-	292.5	-	318.5	$\mu$ A
$C_I$	input capacitance		-	3.5	-	-	-	-	-	pF

## 11. Dynamic characteristics

**Table 7.** Dynamic characteristicsGND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 12](#)

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC165</b>										
$t_{pd}$	propagation delay	CP or $\overline{CE}$ to Q7, $\overline{Q7}$ ; see <a href="#">Figure 7</a> <sup>[1]</sup>								
		$V_{CC} = 2.0$ V	-	52	165	-	205	-	250	ns
		$V_{CC} = 4.5$ V	-	19	33	-	41	-	50	ns
		$V_{CC} = 6.0$ V	-	15	28	-	35	-	43	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	16	-	-	-	-	-	ns
		$\overline{PL}$ to Q7, $\overline{Q7}$ ; see <a href="#">Figure 8</a>								
		$V_{CC} = 2.0$ V	-	50	165	-	205	-	250	ns
		$V_{CC} = 4.5$ V	-	18	33	-	41	-	50	ns
		$V_{CC} = 6.0$ V	-	14	28	-	35	-	43	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	15	-	-	-	-	-	ns
		D7 to Q7, $\overline{Q7}$ ; see <a href="#">Figure 9</a>								
		$V_{CC} = 2.0$ V	-	36	120	-	150	-	180	ns
		$V_{CC} = 4.5$ V	-	13	24	-	30	-	36	ns
$V_{CC} = 6.0$ V	-	10	20	-	26	-	31	ns		
$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	11	-	-	-	-	-	ns		
$t_t$	transition time	Q7, $\overline{Q7}$ output; see <a href="#">Figure 7</a> <sup>[2]</sup>								
		$V_{CC} = 2.0$ V	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0$ V	-	6	13	-	16	-	19	ns



**Table 7. Dynamic characteristics ...continued**GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 12](#)

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$t_w$	pulse width	CP input HIGH or LOW; see <a href="#">Figure 7</a>								
		$V_{CC} = 2.0$ V	80	17	-	100	-	120	-	ns
		$V_{CC} = 4.5$ V	16	6	-	20	-	24	-	ns
		$V_{CC} = 6.0$ V	14	5	-	17	-	20	-	ns
		$\overline{PL}$ input LOW; see <a href="#">Figure 8</a>								
		$V_{CC} = 2.0$ V	80	14	-	100	-	120	-	ns
		$V_{CC} = 4.5$ V	16	5	-	20	-	24	-	ns
	$V_{CC} = 6.0$ V	14	4	-	17	-	20	-	ns	
$t_{rec}$	recovery time	$\overline{PL}$ to CP, $\overline{CE}$ ; see <a href="#">Figure 8</a>								
		$V_{CC} = 2.0$ V	100	22	-	125	-	150	-	ns
		$V_{CC} = 4.5$ V	20	8	-	25	-	30	-	ns
		$V_{CC} = 6.0$ V	17	6	-	21	-	26	-	ns
$t_{su}$	set-up time	DS to CP, $\overline{CE}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 2.0$ V	80	11	-	100	-	120	-	ns
		$V_{CC} = 4.5$ V	16	4	-	20	-	24	-	ns
		$V_{CC} = 6.0$ V	14	3	-	17	-	20	-	ns
		$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 2.0$ V	80	17	-	100	-	120	-	ns
		$V_{CC} = 4.5$ V	16	6	-	20	-	24	-	ns
		$V_{CC} = 6.0$ V	14	5	-	17	-	20	-	ns
		Dn to $\overline{PL}$ ; see <a href="#">Figure 11</a>								
		$V_{CC} = 2.0$ V	80	22	-	100	-	120	-	ns
		$V_{CC} = 4.5$ V	16	8	-	20	-	24	-	ns
		$V_{CC} = 6.0$ V	14	6	-	17	-	20	-	ns
$t_h$	hold time	DS to CP, $\overline{CE}$ and Dn to $\overline{PL}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 2.0$ V	5	6	-	5	-	5	-	ns
		$V_{CC} = 4.5$ V	5	2	-	5	-	5	-	ns
		$V_{CC} = 6.0$ V	5	2	-	5	-	5	-	ns
		$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 2.0$ V	5	-17	-	5	-	5	-	ns
		$V_{CC} = 4.5$ V	5	-6	-	5	-	5	-	ns
$V_{CC} = 6.0$ V	5	-5	-	5	-	5	-	ns		

**Table 7. Dynamic characteristics ...continued**GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 12](#)

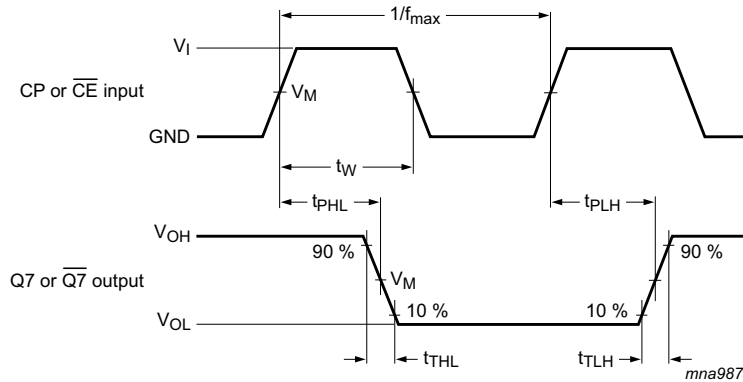
Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$f_{\max}$	maximum frequency	CP input; see <a href="#">Figure 7</a>								
		$V_{CC} = 2.0$ V	6	17	-	5	-	4	-	MHz
		$V_{CC} = 4.5$ V	30	51	-	24	-	20	-	MHz
		$V_{CC} = 6.0$ V	35	61	-	28	-	24	-	MHz
$C_{PD}$	power dissipation capacitance	$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	56	-	-	-	-	-	MHz
		per package; $V_1 = \text{GND to } V_{CC}$ <a href="#">[3]</a>	-	35	-	-	-	-	-	pF
<b>74HCT165</b>										
$t_{pd}$	propagation delay	$\overline{CE}$ , CP to Q7, $\overline{Q7}$ ; see <a href="#">Figure 7</a> <a href="#">[1]</a>								
		$V_{CC} = 4.5$ V	-	17	34	-	43	-	51	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	14	-	-	-	-	-	ns
		$\overline{PL}$ to Q7, $\overline{Q7}$ ; see <a href="#">Figure 8</a>								
		$V_{CC} = 4.5$ V	-	20	40	-	50	-	60	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	17	-	-	-	-	-	ns
		D7 to Q7, $\overline{Q7}$ ; see <a href="#">Figure 9</a>								
		$V_{CC} = 4.5$ V	-	14	28	-	35	-	42	ns
$t_t$	transition time	Q7, $\overline{Q7}$ output; see <a href="#">Figure 7</a> <a href="#">[2]</a>								
		$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns
$t_{wv}$	pulse width	CP input; see <a href="#">Figure 7</a>								
		$V_{CC} = 4.5$ V	16	6	-	20	-	24	-	ns
		$\overline{PL}$ input; see <a href="#">Figure 8</a>								
$t_{rec}$	recovery time	$\overline{PL}$ to CP, $\overline{CE}$ ; see <a href="#">Figure 8</a>								
		$V_{CC} = 4.5$ V	20	8	-	25	-	30	-	ns
$t_{su}$	set-up time	DS to CP, $\overline{CE}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 4.5$ V	20	2	-	25	-	30	-	ns
		$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 4.5$ V	20	7	-	25	-	30	-	ns
		Dn to $\overline{PL}$ ; see <a href="#">Figure 11</a>								
$t_h$	hold time	$V_{CC} = 4.5$ V	20	10	-	25	-	30	-	ns
		DS to CP, $\overline{CE}$ and Dn to $\overline{PL}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 4.5$ V	7	-1	-	9	-	11	-	ns
$t_h$	hold time	$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see <a href="#">Figure 10</a>								
		$V_{CC} = 4.5$ V	0	-7	-	0	-	0	-	ns

**Table 7. Dynamic characteristics ...continued**  
 GND (ground = 0 V);  $C_L = 50 \text{ pF}$  unless otherwise specified; for test circuit, see [Figure 12](#)

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$f_{\text{max}}$	maximum frequency	CP input; see <a href="#">Figure 7</a>								
		$V_{\text{CC}} = 4.5 \text{ V}$	26	44	-	21	-	17	-	MHz
		$V_{\text{CC}} = 5.0 \text{ V}; C_L = 15 \text{ pF}$	-	48	-	-	-	-	-	MHz
$C_{\text{PD}}$	power dissipation capacitance	per package; $V_I = \text{GND to } V_{\text{CC}} - 1.5 \text{ V}$ [3]	-	35	-	-	-	-	-	pF

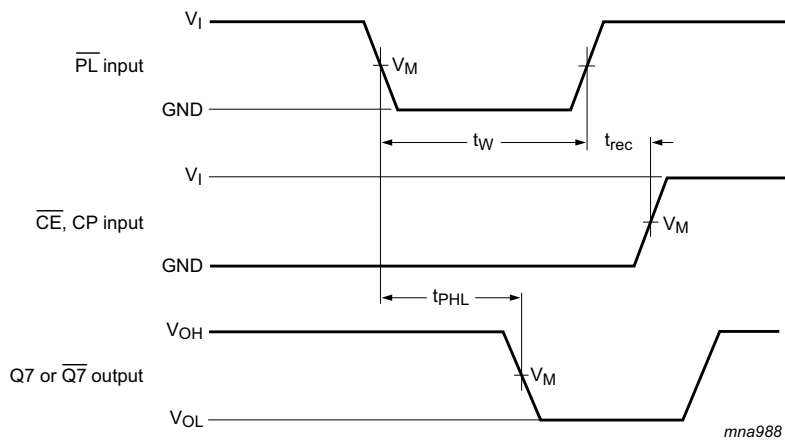
- [1]  $t_{\text{pd}}$  is the same as  $t_{\text{PHL}}$  and  $t_{\text{PLH}}$ .
- [2]  $t_t$  is the same as  $t_{\text{THL}}$  and  $t_{\text{TLH}}$ .
- [3]  $C_{\text{PD}}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).  
 $P_D = C_{\text{PD}} \times V_{\text{CC}}^2 \times f_i + \Sigma (C_L \times V_{\text{CC}}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  
 $f_o$  = output frequency in MHz;  
 $\Sigma (C_L \times V_{\text{CC}}^2 \times f_o)$  = sum of outputs;  
 $C_L$  = output load capacitance in pF;  
 $V_{\text{CC}}$  = supply voltage in V.

## 12. Waveforms



Measurement points are given in [Table 8](#).  
 $V_{\text{OL}}$  and  $V_{\text{OH}}$  are typical voltage output levels that occur with the output load.

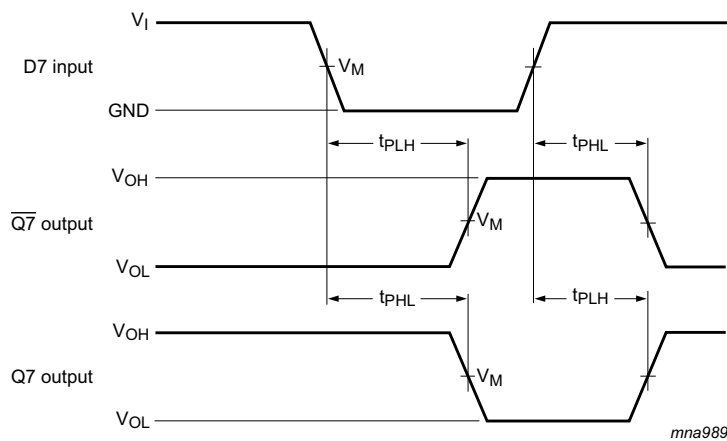
**Fig 7. The clock (CP) or clock enable (CE) to output (Q7 or Q7) propagation delays, the clock pulse width, the maximum clock frequency and the output transition times**



Measurement points are given in [Table 8](#).

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

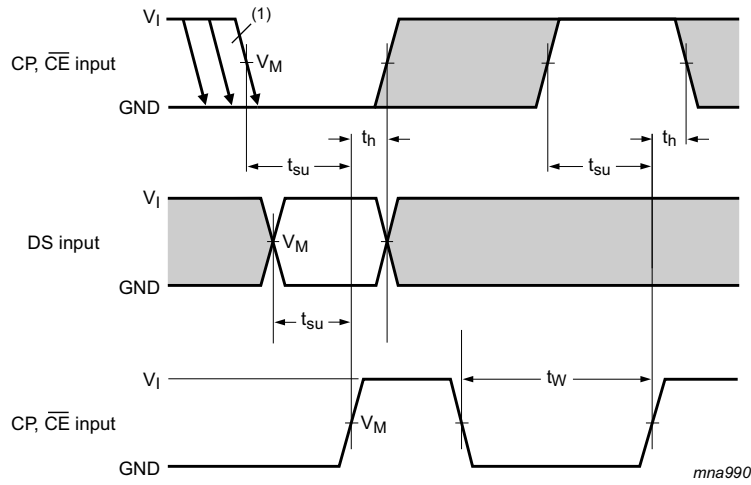
**Fig 8.** The parallel load ( $\overline{\text{PL}}$ ) pulse width, the parallel load to output (Q7 or  $\overline{\text{Q7}}$ ) propagation delays, the parallel load to clock (CP) and clock enable (CE) recovery time



Measurement points are given in [Table 8](#).

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

**Fig 9.** The data input (D7) to output (Q7 or  $\overline{\text{Q7}}$ ) propagation delays when  $\overline{\text{PL}}$  is LOW

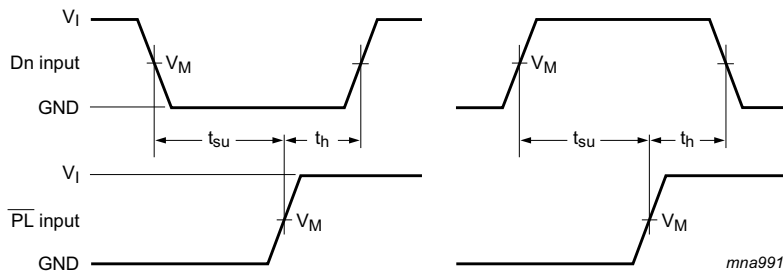


The shaded areas indicate when the input is permitted to change for predictable output performance. Measurement points are given in [Table 8](#).

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

(1)  $\overline{CE}$  may change only from HIGH-to-LOW while CP is LOW, see [Section 1](#).

**Fig 10.** The set-up and hold times from the serial data input (DS) to the clock (CP) and clock enable ( $\overline{CE}$ ) inputs, from the clock enable input (CE) to the clock input (CP) and from the clock input (CP) to the clock enable input (CE)



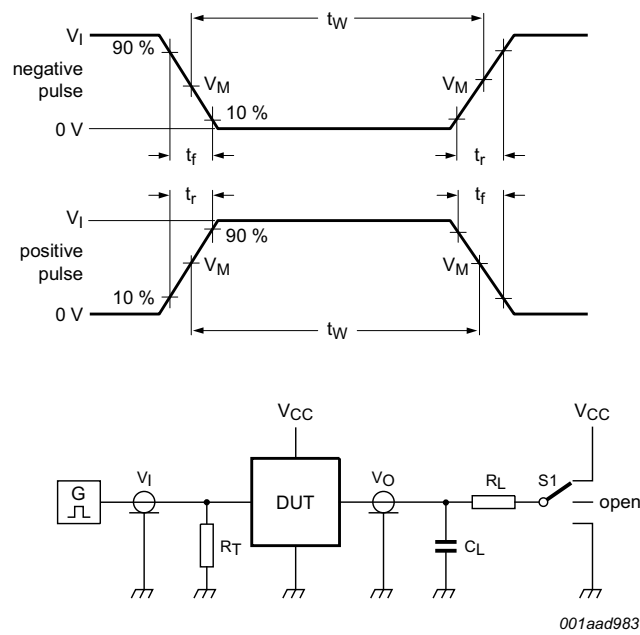
Measurement points are given in [Table 8](#).

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

**Fig 11.** The set-up and hold times from the data inputs (Dn) to the parallel load input ( $\overline{PL}$ )

**Table 8.** Measurement points

Type	Input		Output
	$V_I$	$V_M$	$V_M$
74HC165	$V_{CC}$	$0.5V_{CC}$	$0.5V_{CC}$
74HCT165	3 V	1.3 V	1.3 V



001aad983

Test data is given in [Table 9](#).

Definitions for test circuit:

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_L$  = Load resistance.

S1 = Test selection switch

**Fig 12. Test circuit for measuring switching times**

**Table 9. Test data**

Type	Input		Load		S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$
74HC165	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open
74HCT165	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open

## 13. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

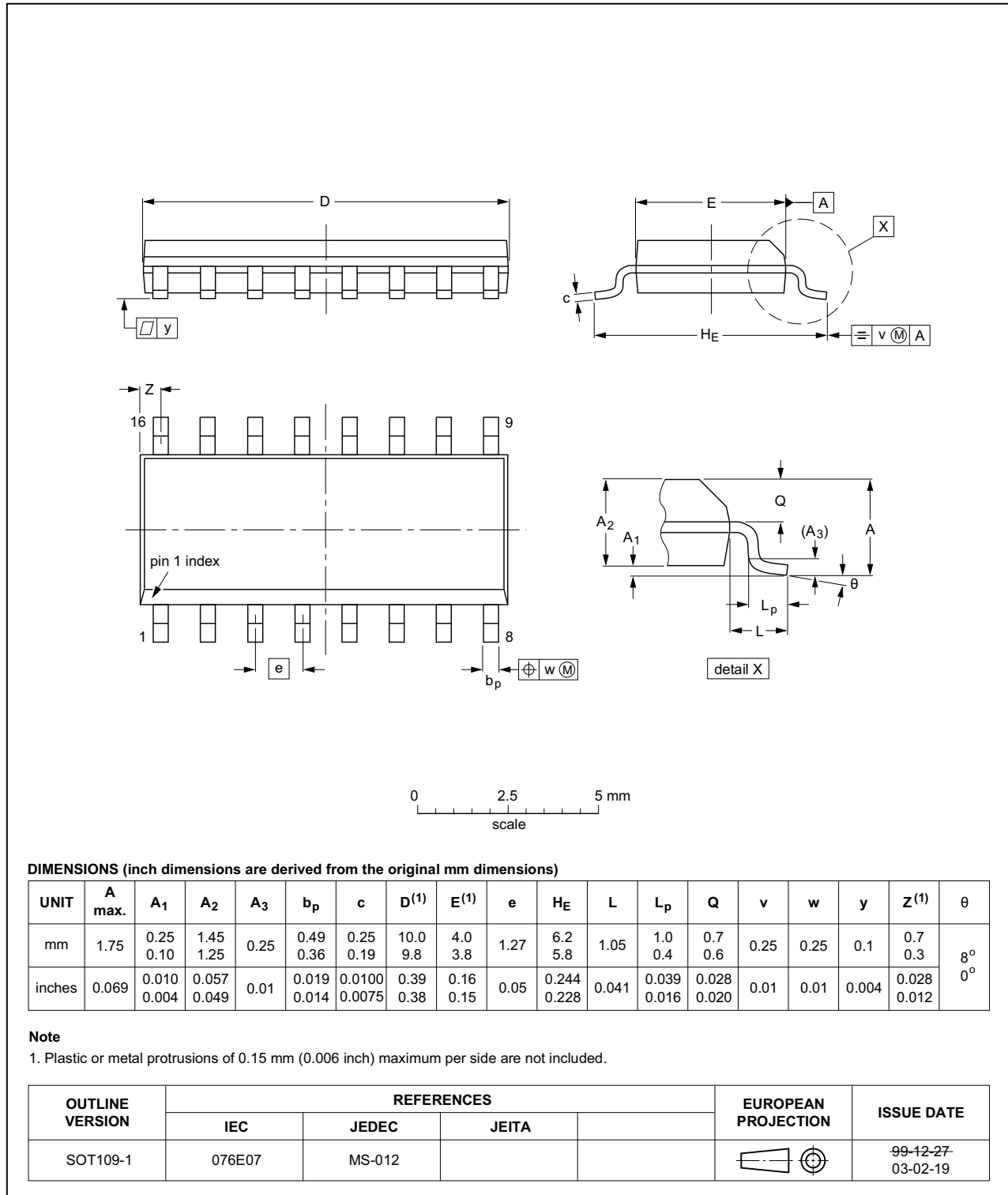


Fig 13. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

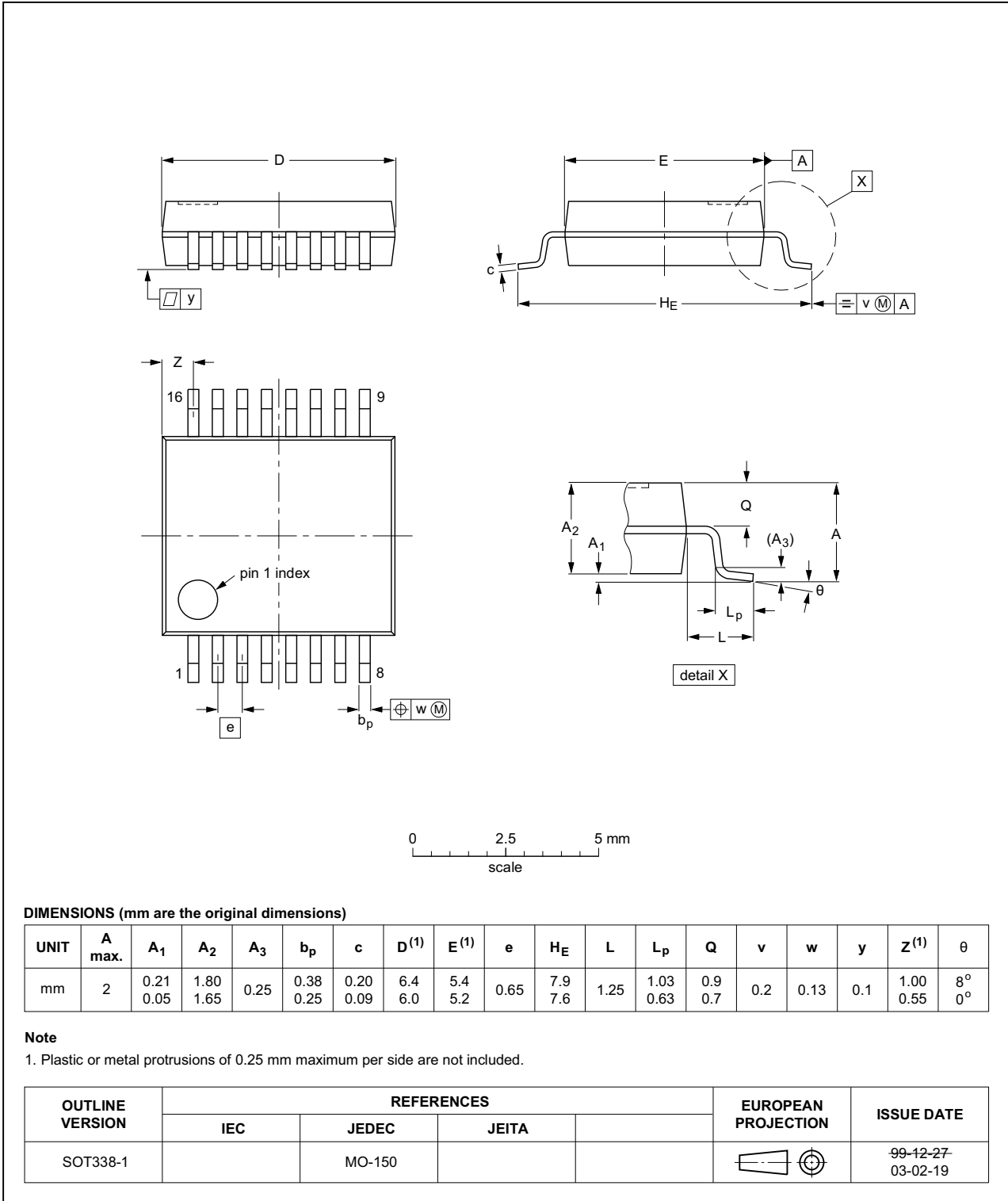


Fig 14. Package outline SOT338-1 (SSOP16)



TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

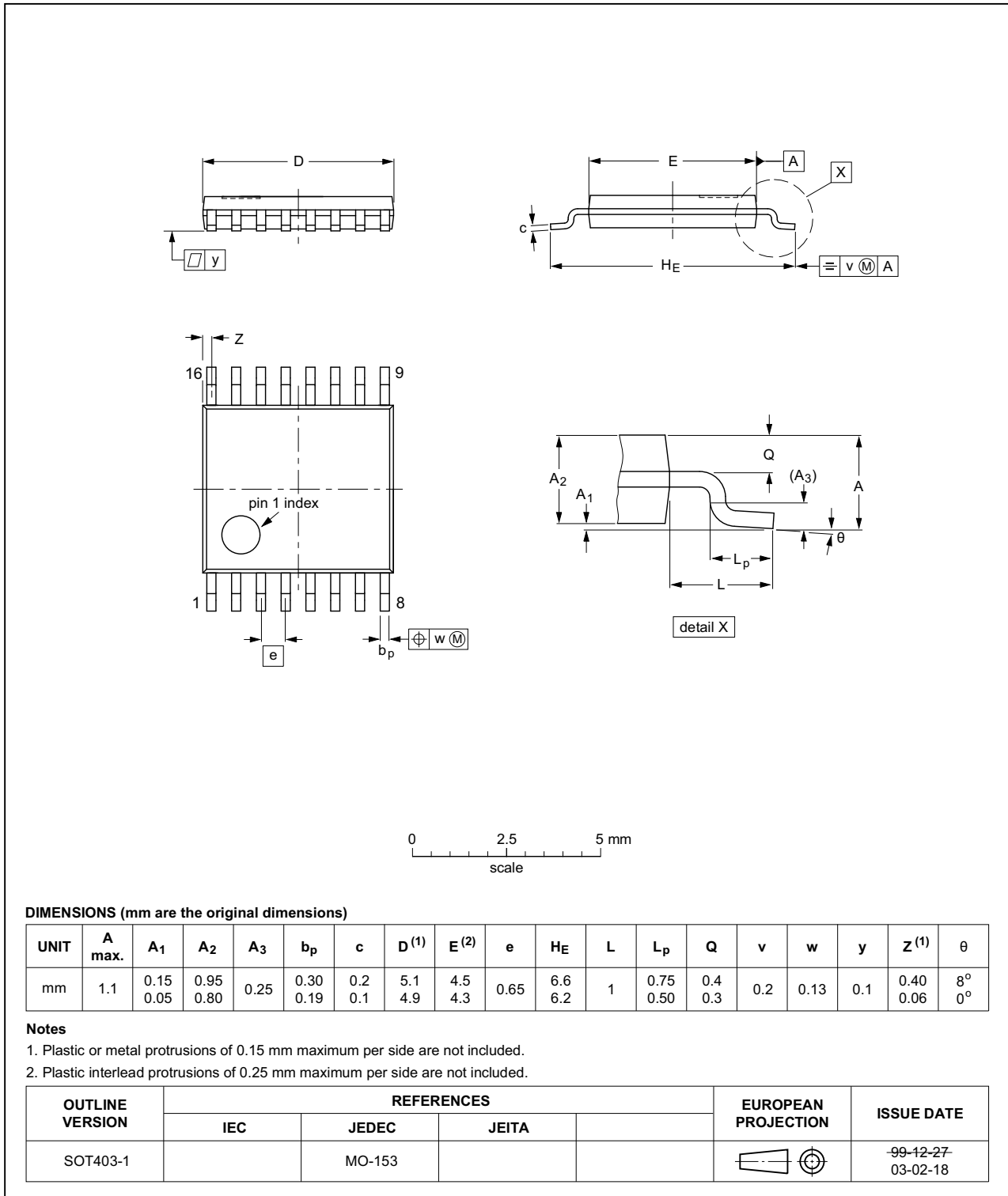


Fig 15. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

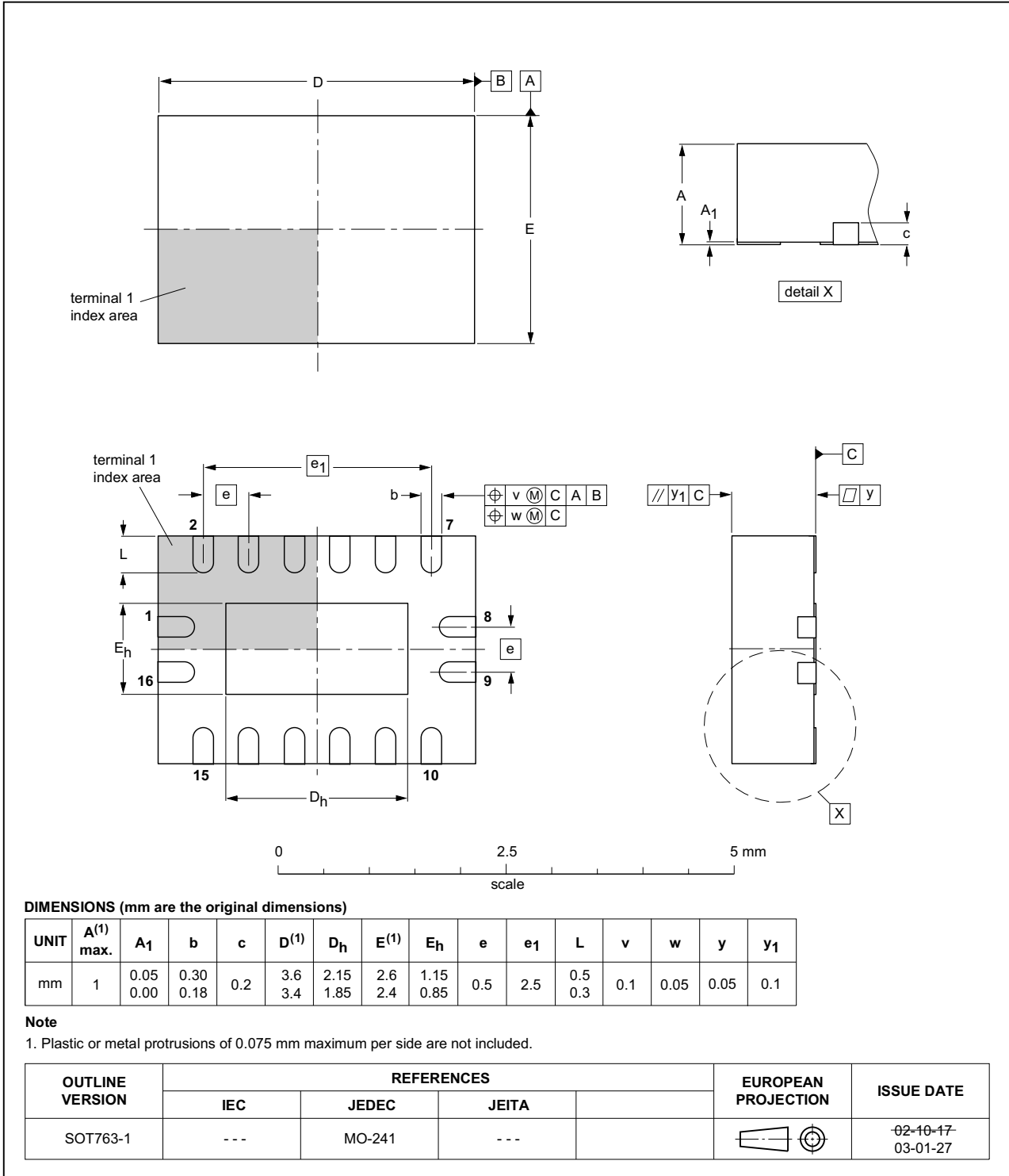


Fig 16. Package outline SOT763-1 (DHVQFN16)

## 14. Abbreviations

Table 10. Abbreviations

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

## 15. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT165 v.4	20151228	Product data sheet	-	74HC_HCT165 v.3
Modifications:	<ul style="list-style-type: none"> <li>Type numbers 74HC165N and 74HCT165N (SOT38-4) removed.</li> </ul>			
74HC_HCT165 v.3	20080314	Product data sheet	-	74HC_HCT165_CNV v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Package SOT763-1 (DHVQFN16) added to <a href="#">Section 4 “Ordering information”</a> and <a href="#">Section 13 “Package outline”</a>.</li> <li>Family data added, see <a href="#">Section 10 “Static characteristics”</a></li> </ul>			
74HC_HCT165_CNV v.2	December 1990	Product specification	-	-

## 16. Legal information

### 16.1 Data sheet status

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

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

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

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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