74HC257; 74HCT257

Quad 2-input multiplexer; 3-state

Product data sheet

1. General description

The 74HC257; 74HCT257 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL).

The 74HC257; 74HCT257 has four identical 2-input multiplexers with 3-state outputs, which select 4 bits of data from two sources and are controlled by a common data select input (S).

The data inputs from source 0 (1I0 to 4I0) are selected when input S is LOW and the data inputs from source 1 (1I1 to 4I1) are selected when S is HIGH. Data appears at the outputs (1Y to 4Y) in true (non-inverting) form from the selected inputs.

The 74HC257; 74HCT257 is the logic implementation of a 4-pole, 2-position switch, where the position of the switch is determined by the logic levels applied to S. The outputs are forced to a high-impedance OFF-state when $\overline{OE}$ is HIGH.

The logic equations for the outputs are:

$$1\bar{Y} = \overline{OE} \times (1I1 \times S + 1I0 \times \bar{S})$$

$$2\bar{Y} = \overline{OE} \times (2I1 \times S + 2I0 \times \bar{S})$$

$$3\bar{Y} = \overline{OE} \times (3I1 \times S + 3I0 \times \bar{S})$$

$$4\bar{Y} = \overline{OE} \times (4I1 \times S + 4I0 \times \bar{S})$$

The 74HC257; 74HCT257 is identical to the 74HC258 but has non-inverting (true) outputs.

2. Features

- Non-inverting data path
- 3-state outputs interface directly with system bus
- Complies with JEDEC standard no. 7A
- ESD protection:
  - HBM EIA/JESD22-A114-C exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from –40 °C to +85 °C and from –40 °C to +125 °C

PHILIPS

3. Quick reference data

Table 1: Quick reference data

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
74HC257							
t_{PHL}, t_{PLH}	propagation delay nI0, nI1 to nY	C_L = 15 pF; V_{CC} = 5 V		-	11	-	ns
	propagation delay S to nY	C_L = 15 pF; V_{CC} = 5 V		-	14	-	ns
C_i	input capacitance			-	3.5	-	pF
C_{PD}	power dissipation capacitance (per multiplexer)	V_I = GND to V_{CC}	[1]	-	45	-	pF
74HCT257							
t_{PHL}, t_{PLH}	propagation delay nI0, nI1 to nY	C_L = 15 pF; V_{CC} = 5 V		-	13	-	ns
	propagation delay S to nY	C_L = 15 pF; V_{CC} = 5 V		-	17	-	ns
C_i	input capacitance			-	3.5	-	pF
C_{PD}	power dissipation capacitance (per multiplexer)	V_I = GND to V_{CC} – 1.5 V	[1]	-	45	-	pF

[1] 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.

4. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC257N	–40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil); long body	SOT38-1
74HC257D	–40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC257DB	–40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HC257PW	–40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT257N	–40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil); long body	SOT38-1

Table 2: Ordering information *…continued*

Type number	Package			
	Temperature range	Name	Description	Version
74HCT257D	–40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT257DB	–40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT257PW	–40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

5. Functional diagram

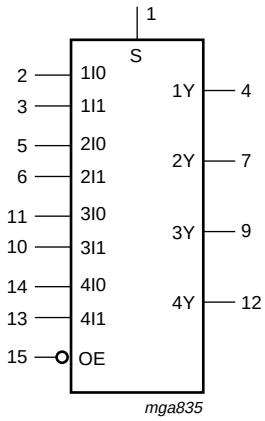


Fig 1. Logic symbol

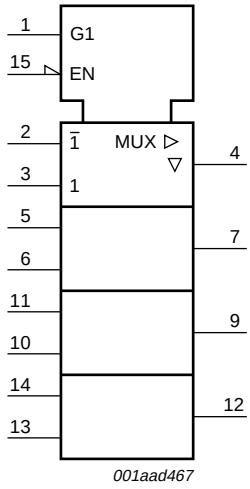


Fig 2. IEC logic symbol

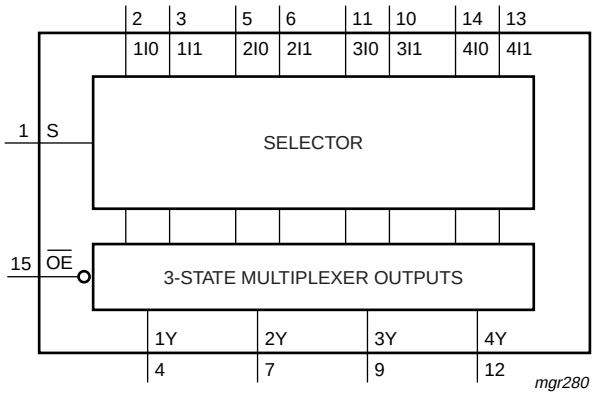


Fig 3. Functional diagram

8. Limiting values

Table 5: 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	$V_I < –0.5$ V or $V_I > V_{CC} + 0.5$ V		-	±20	mA
I_{OK}	output clamping current	$V_O < –0.5$ V or $V_O > V_{CC} + 0.5$ V		-	±20	mA
I_O	output current	$V_O = –0.5$ V to $V_{CC} + 0.5$ V		-	±35	mA
I_{CC}	quiescent supply current			-	+70	mA
I_{GND}	ground current			-	–70	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation					
	DIP16 package		[1]	-	750	mW
	SO16 package		[2]	-	500	mW
	SSOP16 package		[3]	-	500	mW
	TSSOP16 package		[3]	-	500	mW

[1] For DIP16 packages: above 70 °C, P_{tot} derates linearly with 12 mW/K.

[2] For SO16 packages: above 70 °C, P_{tot} derates linearly with 8 mW/K.

[3] For SSOP16 and TSSOP16 packages: above 60 °C, P_{tot} derates linearly with 5.5 mW/K.

9. Recommended operating conditions

Table 6: Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Type 74HC257						
V_{CC}	supply voltage		2.0	5.0	6.0	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
t_r, t_f	input rise and fall times	$V_{CC} = 2.0$ V	-	-	1000	ns
		$V_{CC} = 4.5$ V	-	6.0	500	ns
		$V_{CC} = 6.0$ V	-	-	400	ns
T_{amb}	ambient temperature		–40	-	+125	°C
Type 74HCT257						
V_{CC}	supply voltage		4.5	5.0	5.5	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
t_r, t_f	input rise and fall times	$V_{CC} = 4.5$ V	-	6.0	500	ns
T_{amb}	ambient temperature		–40	-	+125	°C

Table 7: Static characteristics type 74HC257 *…continued*

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OL}	LOW-state output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_O = 20 µA; V_{CC} = 2.0 V	-	-	0.1	V
		I_O = 20 µA; V_{CC} = 4.5 V	-	-	0.1	V
		I_O = 20 µA; V_{CC} = 6.0 V	-	-	0.1	V
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	-	0.33	V
		I_O = 7.8 mA; V_{CC} = 6.0 V	-	-	0.33	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 6.0 V	-	-	±1.0	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; $V_O = V_{CC}$ or GND; V_{CC} = 6.0 V	-	-	±5.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 6.0 V	-	-	80	µA
T_{amb} = −40 °C to +125 °C						
V_{IH}	HIGH-state input voltage	V_{CC} = 2.0 V	1.5	-	-	V
		V_{CC} = 4.5 V	3.15	-	-	V
		V_{CC} = 6.0 V	4.2	-	-	V
V_{IL}	LOW-state input voltage	V_{CC} = 2.0 V	-	-	0.5	V
		V_{CC} = 4.5 V	-	-	1.35	V
		V_{CC} = 6.0 V	-	-	1.8	V
V_{OH}	HIGH-state output voltage	$V_I = V_{IH}$ or V_{IL}		-		
		I_O = −20 µA; V_{CC} = 2.0 V	1.9	-	-	V
		I_O = −20 µA; V_{CC} = 4.5 V	4.4	-	-	V
		I_O = −20 µA; V_{CC} = 6.0 V	5.9	-	-	V
		I_O = −6.0 mA; V_{CC} = 4.5 V	3.7	-	-	V
		I_O = −7.8 mA; V_{CC} = 6.0 V	5.2	-	-	V
V_{OL}	LOW-state output voltage	$V_I = V_{IH}$ or V_{IL}		-		
		I_O = 20 µA; V_{CC} = 2.0 V	-	-	0.1	V
		I_O = 20 µA; V_{CC} = 4.5 V	-	-	0.1	V
		I_O = 20 µA; V_{CC} = 6.0 V	-	-	0.1	V
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	-	0.4	V
		I_O = 7.8 mA; V_{CC} = 6.0 V	-	-	0.4	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 6.0 V	-	-	±1.0	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; $V_O = V_{CC}$ or GND; V_{CC} = 6.0 V	-	-	±10.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 6.0 V	-	-	160	µA

Table 8: Static characteristics type 74HCT257

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-state input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	1.6	-	V
V_{IL}	LOW-state input voltage	V_{CC} = 4.5 V to 5.5 V	-	1.2	0.8	V
V_{OH}	HIGH-state output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = −20 µA	4.4	4.5	-	V
		I_O = −6 mA	3.98	4.32	-	V

Table 8: Static characteristics type 74HCT257 *…continued*

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OL}	LOW-state output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = 20 µA	-	0	0.1	V
		I_O = 6.0 mA	-	0.15	0.26	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	±0.1	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 5.5 V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; I_O = 0 A	-	-	±0.5	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	8.0	µA
ΔI_{CC}	additional quiescent 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; I_O = 0 A				
	nI0 input		-	40	144	µA
	nI1 input		-	40	144	µA
	$\overline{OE}$ input		-	135	486	µA
	S input		-	70	252	µA
C_i	input capacitance		-	3.5	-	pF
T_{amb} = –40 °C to +85 °C						
V_{IH}	HIGH-state input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-state input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-state output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = –20 µA	4.4	-	-	V
		I_O = –6 mA	3.84	-	-	V
V_{OL}	LOW-state output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = 20 µA	-	-	0.1	V
		I_O = 6.0 mA	-	-	0.33	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	±1.0	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 5.5 V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; I_O = 0 A	-	-	±5.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	80	µA
ΔI_{CC}	additional quiescent 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; I_O = 0 A				
	nI0 input		-	-	180	µA
	nI1 input		-	-	180	µA
	$\overline{OE}$ input		-	-	608	µA
	S input		-	-	315	µA
T_{amb} = –40 °C to +125 °C						
V_{IH}	HIGH-state input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-state input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-state output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = –20 µA	4.4	-	-	V
		I_O = –6 mA	3.7	-	-	V

Table 8: Static characteristics type 74HCT257 *…continued*

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OL}	LOW-state output voltage	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 4.5 V				
		I_O = 20 μA	-	-	0.1	V
		I_O = 6.0 mA	-	-	0.4	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	±1.0	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; V_{CC} = 5.5 V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; I_O = 0 A	-	-	±10	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	160	μA
ΔI_{CC}	additional quiescent 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; I_O = 0 A				
	nI0 input		-	-	196	μA
	nI1 input		-	-	196	μA
	$\overline{OE}$ input		-	-	662	μA
	S input		-	-	343	μA

11. Dynamic characteristics

Table 9: Dynamic characteristics type 74HC257

Voltages are referenced to GND (ground = 0 V); C_L = 50 pF, unless otherwise specified.
For test circuit see Figure 8.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
t_{PHL}, t_{PLH}	propagation delay nI0 to nY or nI1 to nY	see Figure 6				
		V_{CC} = 2.0 V	-	36	110	ns
		V_{CC} = 4.5 V	-	13	22	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	11	-	ns
		V_{CC} = 6.0 V	-	10	19	ns
	propagation delay S to nY	see Figure 6				
		V_{CC} = 2.0 V	-	47	150	ns
		V_{CC} = 4.5 V	-	17	30	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	14	-	ns
		V_{CC} = 6.0 V	-	14	26	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to nY	see Figure 7				
		V_{CC} = 2.0 V	-	33	150	ns
		V_{CC} = 4.5 V	-	12	30	ns
		V_{CC} = 6.0 V	-	10	26	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to nY	see Figure 7				
		V_{CC} = 2.0 V	-	41	150	ns
		V_{CC} = 4.5 V	-	15	30	ns
		V_{CC} = 6.0 V	-	12	26	ns

Table 9: Dynamic characteristics type 74HC257 *…continued*

Voltages are referenced to GND (ground = 0 V); C_L = 50 pF, unless otherwise specified. For test circuit see Figure 8.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to nY	see Figure 7				
		V_{CC} = 2.0 V	-	-	225	ns
		V_{CC} = 4.5 V	-	-	45	ns
		V_{CC} = 6.0 V	-	-	38	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to nY	see Figure 7				
		V_{CC} = 2.0 V	-	-	225	ns
		V_{CC} = 4.5 V	-	-	45	ns
		V_{CC} = 6.0 V	-	-	38	ns
t_{THL}, t_{TLH}	output transition time	see Figure 6				
		V_{CC} = 2.0 V	-	-	90	ns
		V_{CC} = 4.5 V	-	-	18	ns
		V_{CC} = 6.0 V	-	-	15	ns

[1] 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.

Table 10: Dynamic characteristics type 74HCT257

Voltages are referenced to GND (ground = 0 V); C_L = 50 pF, unless otherwise specified. For test circuit see Figure 8.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
t_{PHL}, t_{PLH}	propagation delay nI0 to nY or nI1 to nY	see Figure 6				
		V_{CC} = 4.5 V	-	16	30	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	13	-	ns
	propagation delay S to nY	see Figure 6				
		V_{CC} = 4.5 V	-	20	35	ns
		V_{CC} = 5.0 V; C_L = 15 pF	-	17	-	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to nY	V_{CC} = 4.5 V; see Figure 7	-	15	30	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to nY	V_{CC} = 4.5 V; see Figure 7	-	16	30	ns
t_{THL}, t_{TLH}	output transition time	V_{CC} = 4.5 V; see Figure 6	-	5	12	ns
T_{amb} = −40 °C to +85 °C						
t_{PHL}, t_{PLH}	propagation delay nI0 to nY or nI1 to nY	V_{CC} = 4.5 V; see Figure 6	-	-	38	ns
	propagation delay S to nY	V_{CC} = 4.5 V; see Figure 6	-	-	44	ns

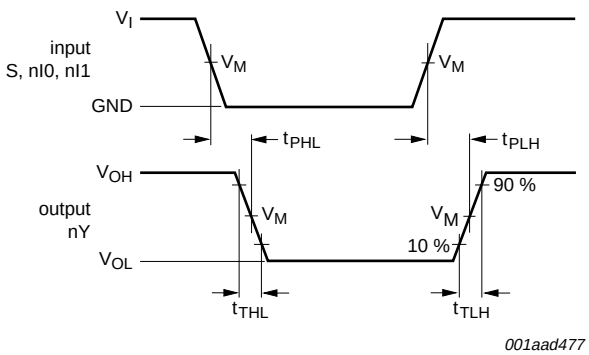
Table 10: Dynamic characteristics type 74HCT257 *…continued*

Voltages are referenced to GND (ground = 0 V); C_L = 50 pF, unless otherwise specified. For test circuit see Figure 8.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to nY	V_{CC} = 4.5 V; see Figure 7		-	-	38	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to nY	V_{CC} = 4.5 V; see Figure 7		-	-	38	ns
t_{THL}, t_{TLH}	output transition time	V_{CC} = 4.5 V; see Figure 6		-	-	15	ns
T_{amb} = −40 °C to +125 °C							
t_{PHL}, t_{PLH}	propagation delay nI0 to nY or nI1 to nY	V_{CC} = 4.5 V; see Figure 6		-	-	45	ns
	propagation delay S to nY	V_{CC} = 4.5 V; see Figure 6		-	-	53	ns
t_{PZH}, t_{PZL}	3-state output enable time $\overline{OE}$ to nY	V_{CC} = 4.5 V; see Figure 7		-	-	45	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $\overline{OE}$ to nY	V_{CC} = 4.5 V; see Figure 7		-	-	45	ns
t_{THL}, t_{TLH}	output transition time	V_{CC} = 4.5 V; see Figure 6		-	-	18	ns
C_{PD}	power dissipation capacitance (per multiplexer)	V_I = GND to V_{CC}	[1]	-	45	-	pF

[1] 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.

12. Waveforms



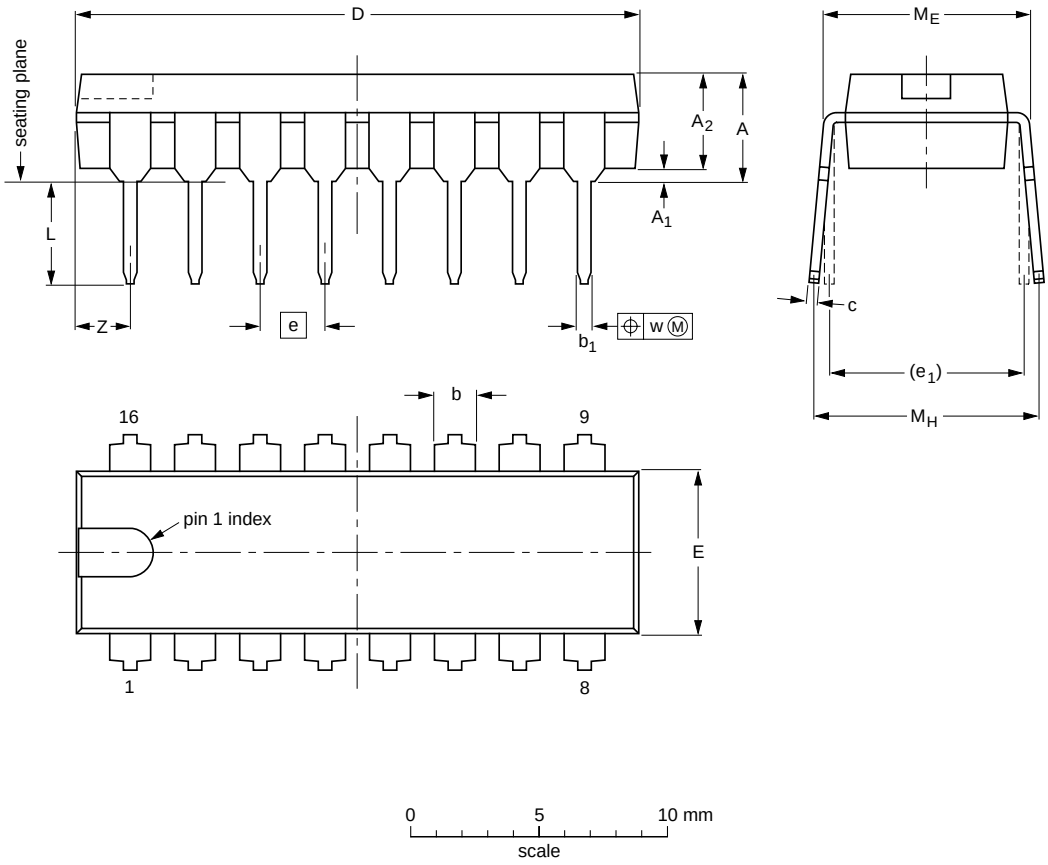
Measurement points are given in Table 11.

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

Fig 6. Propagation delays input (S, nI0, nI1) to output (nY) and output (nY) transition times

13. Package outline

DIP16: plastic dual in-line package; 16 leads (300 mil); long body **SOT38-1**



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

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.7	0.51	3.7	1.40 1.14	0.53 0.38	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	2.2
inches	0.19	0.02	0.15	0.055 0.045	0.021 0.015	0.013 0.009	0.86 0.84	0.26 0.24	0.1	0.3	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	
	IEC	JEDEC	JEITA			
SOT38-1	050G09	MO-001	SC-503-16			

Fig 9. Package outline SOT38-1 (DIP16)