Octal Bus Transceiver; 3-state

1. Description

The 74HC/HCT245 is an 8-bit transceiver with 3-state outputs. The device features an output enable ($\overline{OE}$) and send/receive (DIR) for direction control. A HIGH on $\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

2. Features

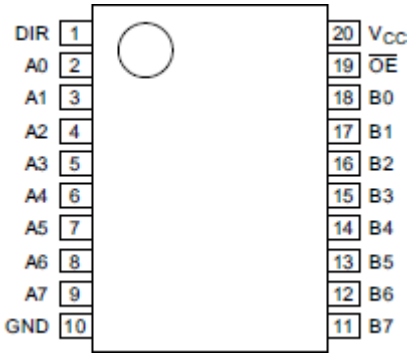
- Input levels:
  - For 74HC245: CMOS level
  - For 74HCT245: TTL level
- Octal bidirectional bus interface
- Non-inverting 3-state outputs
- Specified from -40˚C to +105˚C
- Packaging information:
  DIP20/SOIC20/TSSOP20

3. Ordering Information

Type Number	Package Type	Packing	Notes
74HC245N	DIP-20	Tube	
74HCT245N	DIP-20	Tube	
74HC245D	SOIC-20	Tape & Reel	
74HCT245D	SOIC-20	Tape & Reel	
74HC245PW	TSSOP-20	Tape & Reel	
74HCT245PW	TSSOP-20	Tape & Reel	

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

4. Pinning



Pin Description

Pin No.	Pin Name	Description
1	DIR	direction control
2	A0	data input/output
3	A1	data input/output
4	A2	data input/output
5	A3	data input/output
6	A4	data input/output
7	A5	data input/output
8	A6	data input/output
9	A7	data input/output
10	GND	ground (0V)
11	B7	data input/output
12	B6	data input/output
13	B5	data input/output
14	B4	data input/output
15	B3	data input/output
16	B2	data input/output
17	B1	data input/output
18	B0	data input/output
19	$\overline{OE}$	output enable input (active LOW)
20	V_{CC}	supply voltage

Function Table

Input		Output	
$\overline{OE}$	DIR	An	Bn
L	L	A=B	input
L	H	input	B=A
H	X	Z	Z

Note: H=HIGH voltage level; L=LOW voltage level; X=don't care; Z=high-impedance OFF-state.

5. Block Diagram

Block Diagram

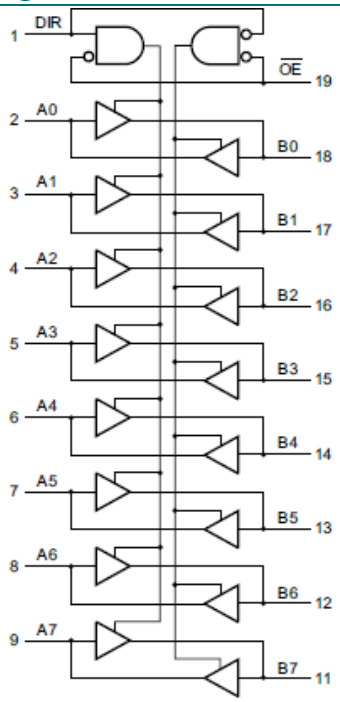


Fig. 1. Logic symbol

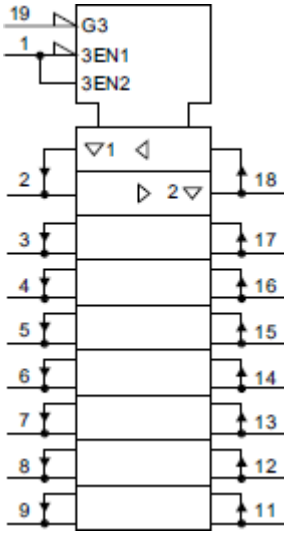


Fig. 2. IEC logic symbol

6. Electrical Parameter

Absolute Maximum Ratings

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V_{CC}	-		-0.5	+7.0	V
input clamping current	I_{IK}	$V_I < -0.5V$ or $V_I > V_{CC}+0.5V$		-	±20	mA
output clamping current	I_{OK}	$V_O < -0.5V$ or $V_O > V_{CC}+0.5V$		-	±20	mA
output current	I_O	$-0.5V < V_O < V_{CC}+0.5V$		-	±35	mA
supply current	I_{CC}	-		-	70	mA
ground current	I_{GND}	-		-70	-	mA
storage temperature	T_{stg}	-		-65	+150	˚C
total power dissipation	P_{tot}	-		-	500	mW
Soldering temperature	T_L	10s	DIP	245		˚C
			SOIC	250		˚C

Note:

1 For DIP20 packages: above 70˚C the value of P_{tot} derates linearly with 12mW/K.

2 For SOIC20 packages: above 70˚C the value of P_{tot} derates linearly with 8mW/K.

3 For TSSOP20 packages: above 60˚C the value of P_{tot} derates linearly with 5.5mW/K.

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
74HC245						
supply voltage	V_{CC}	-	2.0	5.0	6.0	V
input voltage	V_I	-	0	-	V_{CC}	V
output voltage	V_O	-	0	-	V_{CC}	V
input transition rise and fall rate	$\Delta t/\Delta V$	V_{CC}=2.0V	-	-	625	ns/V
		V_{CC}=4.5V	-	1.67	139	ns/V
		V_{CC}=6.0V	-	-	83	ns/V
ambient temperature	T_{amb}	-	-40	-	+105	℃
74HCT245						
supply voltage	V_{CC}	-	4.5	5.0	5.5	V
input voltage	V_I	-	0	-	V_{CC}	V
output voltage	V_O	-	0	-	V_{CC}	V
input transition rise and fall rate	$\Delta t/\Delta V$	V_{CC}=4.5V	-	1.67	139	ns/V
ambient temperature	T_{amb}	-	-40	-	+105	℃

7. Electrical Characteristics

DC Characteristics 1

(T_{amb}=25℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
74HC245							
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	1.2	-	V
		V_{CC}=4.5V		3.15	2.4	-	V
		V_{CC}=6.0V		4.2	3.2	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	0.8	0.5	V
		V_{CC}=4.5V		-	2.1	1.35	V
		V_{CC}=6.0V		-	2.8	1.8	V
HIGH-level output voltage	V_{OH}	V_I = V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	2.0	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	4.5	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	6.0	-	V
			I_O=-6.0mA; V_{CC}=4.5V	3.98	4.32	-	V
			I_O=-7.8mA; V_{CC}=6.0V	5.48	5.81	-	V
LOW-level output voltage	V_{OL}	V_I = V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	0	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	0	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	0	0.1	V
			I_O=6.0mA; V_{CC}=4.5V	-	0.15	0.26	V
			I_O=7.8mA; V_{CC}=6.0V	-	0.16	0.26	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±0.1	uA
OFF-state output current	I_{OZ}	V_I=V_{IH} or V_{IL}; V_{CC}=6.0V; V_O=V_{CC} or GND		-	-	±0.5	uA

supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V	-	-	8.0	uA
input capacitance	C_I	-	-	3.5	-	pF
input/output capacitance	$C_{I/O}$	-	-	10	-	pF
74HCT245						
HIGH-level input voltage	V_{IH}	V_{CC}=4.5V to 5.5V	2.0	1.6	-	V
LOW-level input voltage	V_{IL}	V_{CC}=4.5V to 5.5V	-	1.2	0.8	V
HIGH-level output voltage	V_{OH}	V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=-20uA	4.4	4.5	-	V
		V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=-6.0mA	3.98	4.32	-	V
LOW-level output voltage	V_{OL}	V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=20uA	-	0	0.1	V
		V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=6.0mA	-	0.15	0.26	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=5.5V	-	-	±0.1	uA
OFF-state output current	I_{OZ}	V_I=V_{IH} or V_{IL}; V_{CC}=5.5V; V_O=V_{CC} or GND	-	-	±0.5	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=5.5V	-	-	8.0	uA
additional supply current	ΔI_{CC}	per input pin; V_I=V_{CC}-2.1V; other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V; I_O=0A; An or Bn inputs	-	40	144	uA
		per input pin; V_I=V_{CC}-2.1V; other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V; I_O=0A; $\overline{OE}$ input	-	150	540	uA
		per input pin; V_I=V_{CC}-2.1V; other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V; I_O=0A; DIR input	-	90	324	uA
input capacitance	C_I	-	-	3.5	-	pF
input/output capacitance	$C_{I/O}$	-	-	10	-	pF

DC Characteristics 2

(T_{amb}=-40℃ to +85℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
74HC245						
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V	1.5	-	-	V
		V_{CC}=4.5V	3.15	-	-	V
		V_{CC}=6.0V	4.2	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V	-	-	0.5	V
		V_{CC}=4.5V	-	-	1.35	V
		V_{CC}=6.0V	-	-	1.8	V
HIGH-level output voltage	V_{OH}	V_I = V_{IH} or V_{IL}; I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
		V_I = V_{IH} or V_{IL}; I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
		V_I = V_{IH} or V_{IL}; I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
		V_I = V_{IH} or V_{IL}; I_O=-6.0mA; V_{CC}=4.5V	3.84	-	-	V
		V_I = V_{IH} or V_{IL}; I_O=-7.8mA; V_{CC}=6.0V	5.34	-	-	V
LOW-level output voltage	V_{OL}	V_I = V_{IH} or V_{IL}; I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
		V_I = V_{IH} or V_{IL}; I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
		V_I = V_{IH} or V_{IL}; I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
		V_I = V_{IH} or V_{IL}; I_O=6.0mA; V_{CC}=4.5V	-	-	0.33	V
		V_I = V_{IH} or V_{IL}; I_O=7.8mA; V_{CC}=6.0V	-	-	0.33	V

input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±1.0	uA
OFF-state output current	I_{OZ}	V_I=V_{IH} or V_{IL}; V_{CC}=6.0V; V_O=V_{CC} or GND		-	-	±5.0	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	80	uA
74HCT245							
HIGH-level input voltage	V_{IH}	V_{CC}=4.5V to 5.5V		2.0	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=4.5V to 5.5V		-	-	0.8	V
HIGH-level output voltage	V_{OH}	V_I = V_{IH} or V_{IL}; V_{CC}=4.5V	I_O=-20uA	4.4	-	-	V
			I_O=-6.0mA	3.84	-	-	V
LOW-level output voltage	V_{OL}	V_I = V_{IH} or V_{IL}; V_{CC}=4.5V	I_O=20uA	-	-	0.1	V
			I_O=6.0mA	-	-	0.33	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=5.5V		-	-	±1.0	uA
OFF-state output current	I_{OZ}	V_I=V_{IH} or V_{IL}; V_{CC}=5.5V; V_O=V_{CC} or GND		-	-	±5.0	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=5.5V		-	-	80	uA
additional supply current	ΔI_{CC}	per input pin; V_I=V_{CC}-2.1V; other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V; I_O=0A or GND; V_{CC}=4.5V to 5.5V; I_O=0A	An or Bn inputs	-	-	180	uA
			$\overline{OE}$ input	-	-	675	uA
			DIR input	-	-	405	uA

DC Characteristics 3

(T_{amb}=-40°C to +105°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
74HC245							
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
HIGH-level output voltage	V_{OH}	V_I = V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
			I_O=-6.0mA; V_{CC}=4.5V	3.7	-	-	V
			I_O=-7.8mA; V_{CC}=6.0V	5.2	-	-	V
LOW-level output voltage	V_{OL}	V_I = V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
			I_O=6.0mA; V_{CC}=4.5V	-	-	0.4	V
			I_O=7.8mA; V_{CC}=6.0V	-	-	0.4	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±1.0	uA
OFF-state output current	I_{OZ}	V_I=V_{IH} or V_{IL}; V_{CC}=6.0V; V_O=V_{CC} or GND		-	-	±10	uA

supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V	-	-	160	uA
74HCT245						
HIGH-level input voltage	V_{IH}	V_{CC}=4.5V to 5.5V	2.0	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=4.5V to 5.5V	-	-	0.8	V
HIGH-level output voltage	V_{OH}	V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=-20uA	4.4	-	-	V
		V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=-6.0mA	3.7	-	-	V
LOW-level output voltage	V_{OL}	V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=20uA	-	-	0.1	V
		V_I = V_{IH} or V_{IL}; V_{CC}=4.5V; I_O=6.0mA	-	-	0.4	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=5.5V	-	-	±1.0	uA
OFF-state output current	I_{OZ}	V_I=V_{IH} or V_{IL}; V_{CC}=5.5V; V_O=V_{CC} or GND	-	-	±10	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=5.5V	-	-	160	uA
additional supply current	ΔI_{CC}	per input pin; V_I=V_{CC}-2.1V; other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V; I_O=0A; An or Bn inputs	-	-	196	uA
		$\overline{OE}$ input	-	-	735	uA
		DIR input	-	-	441	uA

AC Characteristics 1

(T_{amb}=25°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
74HC245							
An to Bn or Bn to An propagation delay	t_{pd}	see Figure 4	V_{CC}=2.0V	-	25	90	ns
			V_{CC}=4.5V	-	9	18	ns
			V_{CC}=5.0V; C_L=15pF	-	7	-	ns
			V_{CC}=6.0V	-	7	15	ns
$\overline{OE}$ to An or Bn enable time	t_{en}	see Figure 5	V_{CC}=2.0V	-	30	150	ns
			V_{CC}=4.5V	-	11	30	ns
			V_{CC}=6.0V	-	9	26	ns
$\overline{OE}$ to An or Bn disable time	t_{dis}	see Figure 5	V_{CC}=2.0V	-	41	150	ns
			V_{CC}=4.5V	-	15	30	ns
			V_{CC}=6.0V	-	12	26	ns
transition time	t_t	see Figure 4	V_{CC}=2.0V	-	14	60	ns
			V_{CC}=4.5V	-	5	12	ns
			V_{CC}=6.0V	-	4	10	ns
power dissipation capacitance	C_{PD}	per buffer; V_I=GND to V_{CC}		-	30	-	pF
74HCT245							
An to Bn or Bn to An propagation delay	t_{pd}	see Figure 4	V_{CC}=4.5V	-	12	22	ns
			V_{CC}=5.0V; C_L=15pF	-	10	-	ns
$\overline{OE}$ to An or Bn enable time	t_{en}	V_{CC}=4.5V; see Figure 5		-	16	30	ns
$\overline{OE}$ to An or Bn disable time	t_{dis}	V_{CC}=4.5V; see Figure 5		-	16	30	ns
transition time	t_t	V_{CC}=4.5V; see Figure 4		-	5	12	ns
power dissipation capacitance	C_{PD}	per buffer; V_I=GND to V_{CC}-1.5V		-	30	-	pF

Note:

1 t_{pd} is the same as t_{PLH} and t_{PHL}.

2 t_{en} is the same as t_{PZL} and t_{PZH}.

3 t_{dis} is the same as t_{PLZ} and t_{PHZ}.

4 t_t is the same as t_{THL} and t_{TLH}.

5 C_{PD} is used to determine the dynamic power dissipation (P_D in uW). $P_D=C_{PD}\times V_{CC}^2\times f_i\times N+\sum(C_L\times V_{CC}^2\times f_o)$ 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;

$\sum(C_L\times V_{CC}^2\times f_o)$=sum of outputs.

AC Characteristics 2

(T_{amb}=-40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
74HC245							
An to Bn or Bn to An propagation delay	t_{pd}	see Figure 4	V_{CC}=2.0V	-	-	115	ns
			V_{CC}=4.5V	-	-	23	ns
			V_{CC}=6.0V	-	-	20	ns
$\overline{OE}$ to An or Bn enable time	t_{en}	see Figure 5	V_{CC}=2.0V	-	-	190	ns
			V_{CC}=4.5V	-	-	38	ns
			V_{CC}=6.0V	-	-	33	ns
$\overline{OE}$ to An or Bn disable time	t_{dis}	see Figure 5	V_{CC}=2.0V	-	-	190	ns
			V_{CC}=4.5V	-	-	38	ns
			V_{CC}=6.0V	-	-	33	ns
transition time	t_t	see Figure 4	V_{CC}=2.0V	-	-	75	ns
			V_{CC}=4.5V	-	-	15	ns
			V_{CC}=6.0V	-	-	13	ns
74HCT245							
An to Bn or Bn to An propagation delay	t_{pd}	see Figure 4	V_{CC}=4.5V	-	-	28	ns
$\overline{OE}$ to An or Bn enable time	t_{en}	V_{CC}=4.5V; see Figure 5		-	-	38	ns
$\overline{OE}$ to An or Bn disable time	t_{dis}	V_{CC}=4.5V; see Figure 5		-	-	38	ns
transition time	t_t	V_{CC}=4.5V; see Figure 4		-	-	15	ns

Note:

1 t_{pd} is the same as t_{PLH} and t_{PHL}.

2 t_{en} is the same as t_{PZL} and t_{PZH}.

3 t_{dis} is the same as t_{PLZ} and t_{PHZ}.

4 t_t is the same as t_{THL} and t_{TLH}.

AC Characteristics 3

(T_{amb}=-40℃ to +105℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
74HC245							
An to Bn or Bn to An propagation delay	t_{pd}	see Figure 4	V_{CC}=2.0V	-	-	135	ns
			V_{CC}=4.5V	-	-	27	ns
			V_{CC}=6.0V	-	-	23	ns
$\overline{OE}$ to An or Bn enable time	t_{en}	see Figure 5	V_{CC}=2.0V	-	-	225	ns
			V_{CC}=4.5V	-	-	45	ns
			V_{CC}=6.0V	-	-	38	ns
$\overline{OE}$ to An or Bn disable time	t_{dis}	see Figure 5	V_{CC}=2.0V	-	-	225	ns
			V_{CC}=4.5V	-	-	45	ns
			V_{CC}=6.0V	-	-	38	ns
transition time	t_t	see Figure 4	V_{CC}=2.0V	-	-	90	ns
			V_{CC}=4.5V	-	-	18	ns
			V_{CC}=6.0V	-	-	15	ns
74HCT245							
An to Bn or Bn to An propagation delay	t_{pd}	see Figure 4	V_{CC}=4.5V	-	-	33	ns
$\overline{OE}$ to An or Bn enable time	t_{en}	V_{CC}=4.5V; see Figure 5		-	-	45	ns
$\overline{OE}$ to An or Bn disable time	t_{dis}	V_{CC}=4.5V; see Figure 5		-	-	45	ns
transition time	t_t	V_{CC}=4.5V; see Figure 4		-	-	18	ns

Note:

1 t_{pd} is the same as t_{PLH} and t_{PHL}.

2 t_{en} is the same as t_{PZL} and t_{PZH}.

3 t_{dis} is the same as t_{PLZ} and t_{PHZ}.

4 t_t is the same as t_{THL} and t_{TLH}.

8. Testing Circuit

AC Testing Circuit

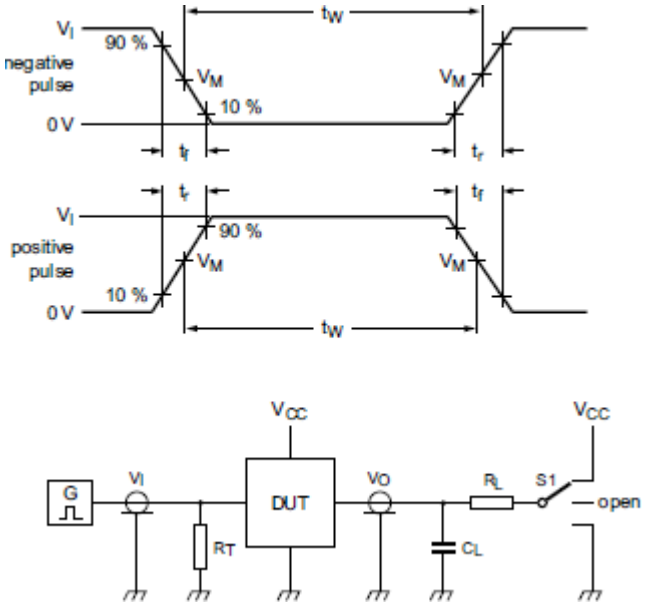


Fig. 3. Test circuit for measuring switching times

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

Z_o of the pulse generator.

S1=Test selection switch.

AC Testing Waveforms

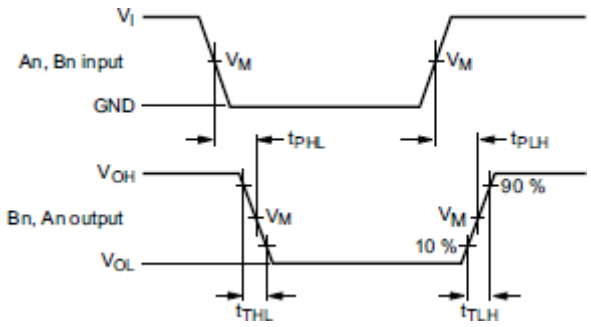


Fig. 4. Input (An, Bn) to output (Bn, An) propagation delays and output transition times

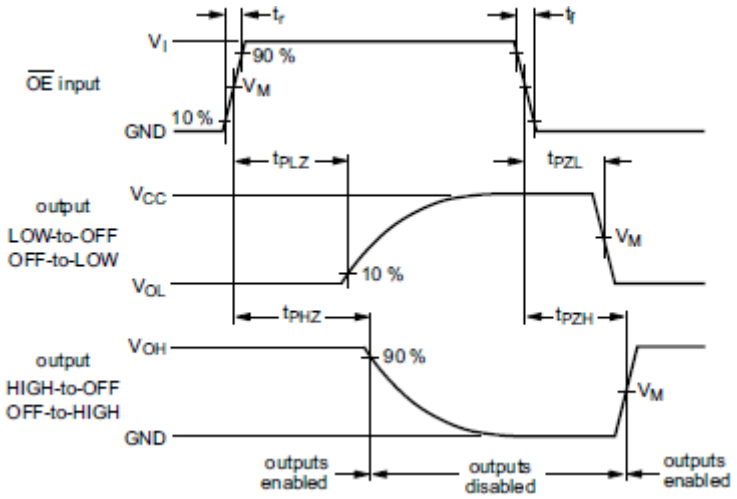


Fig. 5. 3-state enable and disable times

Measurement Points

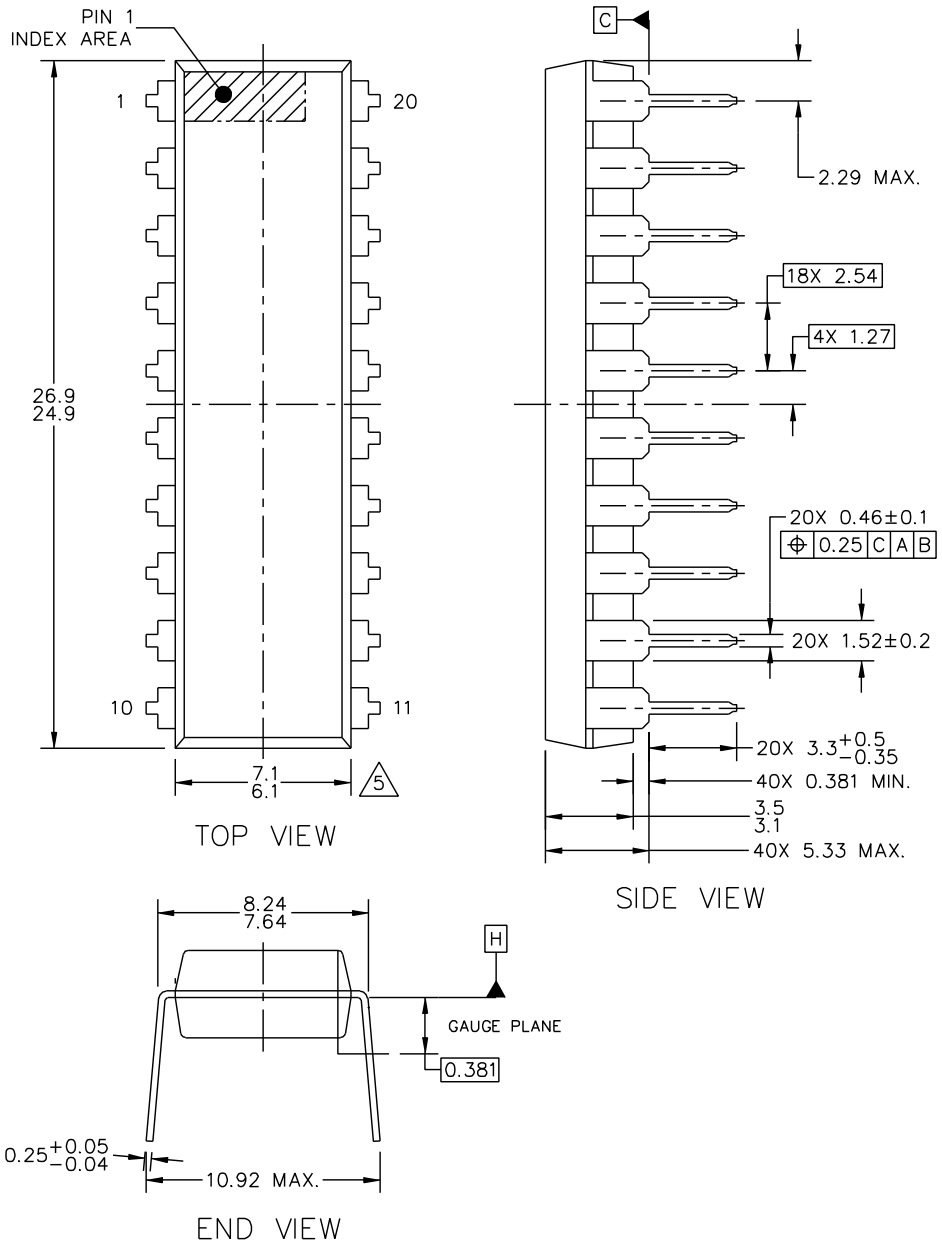
Type	Input	Output
	V_M	V_M
74HC245	$0.5\times V_{CC}$	$0.5\times V_{CC}$
74HCT245	1.3V	1.3V

Test Data

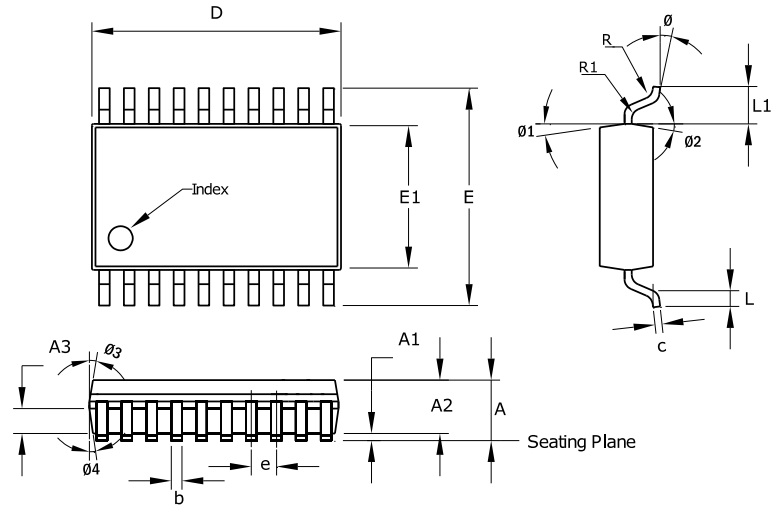
Type	Input		Load		S1 position		
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74HC245	V_{CC}	6ns	15pF, 50pF	1kΩ	open	GND	V_{CC}
74HCT245	3V	6ns	15pF, 50pF	1kΩ	open	GND	V_{CC}

9. Package Outlines

DIP-20

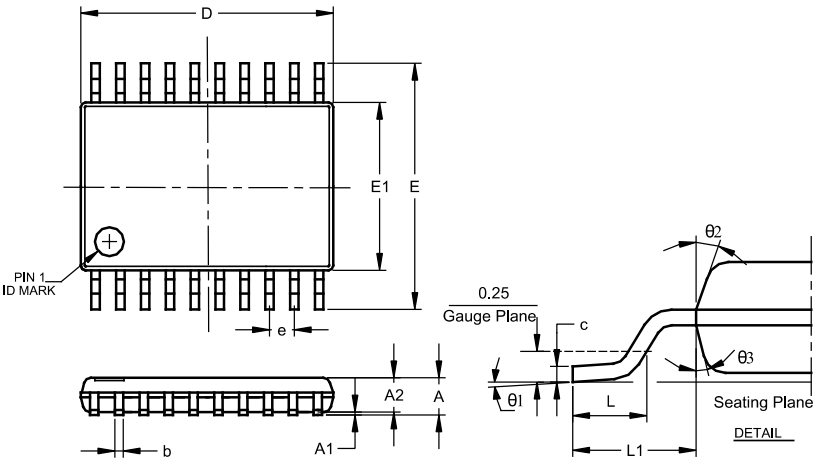


SOIC-20



SOIC-20			
Dim	Min	Max	Typ
A	2.35	2.65	2.52
A1	0.10	0.30	0.20
A2	2.05	2.55	2.35
A3	0.90	1.10	1.00
b	0.35	0.49	-
c	0.23	0.32	-
D	12.60	12.80	12.70
E	10.00	10.60	10.20
E1	7.40	7.60	7.50
e	1.27 BSC		
L	0.50	1.27	0.80
L1	1.35 REF		
R/R1	0.07	-	-
θ	0°	8°	-
θ1	10°	14°	12°
θ2	6°	10°	8°
θ3	9°	14°	11.5°
θ4	6°	10°	8°
All Dimensions in mm			

TSSOP-20



TSSOP-20			
Dim	Min	Max	Typ
A	-	1.20	-
A1	0.05	0.15	-
A2	0.80	1.05	-
b	0.19	0.30	-
c	0.09	0.20	-
D	6.40	6.60	6.50
E	6.20	6.60	6.40
E1	4.30	4.50	4.40
e	0.65 BSC		
L	0.45	0.75	0.60
L1	1.0 REF		
θ1	0°	8°	-
θ2	10°	14°	12°
θ3	10°	14°	12°
All Dimensions in mm			

10. Disclaimers

Limited warranty and liability

Information in this document is believed to be accurate and reliable. However, Fulihao 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. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application.

Suitability for use

Fulihao products are designed for specific applications and should not be used for any purpose (including, without limitation, automotive, aerospace, medical, life-saving applications, or any other application which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property) not expressly set forth in applicable Fulihao product documentation.

Right to make changes

Fulihao 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. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. Fulihao takes no responsibility for the content in this document if provided by an information source outside of Fulihao. This document supersedes and replaces all information supplied prior to the publication hereof.