4-bit dual supply translating transceiver with configurable voltage translation; 3-state

General Description

The ET74AVCH4T245 is an 4-bit, dual supply transceiver that enables bidirectional level translation. It features two 4-bit input-output ports (nAn and nBn), a direction control input (DIR), an output enable input ($\overline{OE}$) and dual supply pins ($V_{CC(A)}$ and $V_{CC(B)}$). Both $V_{CC(A)}$ and $V_{CC(B)}$ can be supplied at any voltage between 0.8V and 3.6V making the device suitable for translating between any of the low voltage nodes (0.8V, 1.2V, 1.8V and 3.3V). Pins nAn, OE and DIR are referenced to $V_{CC(A)}$ and pins nBn are referenced to $V_{CC(B)}$. A HIGH on DIR allows transmission from nAn to nBn and a LOW on DIR allows transmission from nBn to nAn. The output enable input ($\overline{OE}$) can be used to disable the outputs so the buses are effectively isolated.

The device is fully specified for partial power-down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing any damaging backflow current through the device when it is powered down. In suspend mode when either $V_{CC(A)}$ or $V_{CC(B)}$ are at GND level, both An and Bn outputs are in the high-impedance OFF-state. The bus-hold circuitry on the powered-up side always stays active.

The ET74AVCH4T245 has active bus hold circuitry which is provided to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

Features

- Wide Supply Voltage Range:

  $V_{CC(A)}$: 0.8V to 3.6V

  $V_{CC(B)}$: 0.8V to 3.6V
- Fully Configurable Dual-Rail Design
- Maximum Data Rates:

  200Mbit/s (≥ 1.8V to 3.3V translation)

  200Mbit/s (≥ 1.2V to 3.3V translation)

  200Mbit/s (≥ 1.2V to 2.5V translation)

  200Mbit/s (≥ 1.2V to 1.8V translation)

  150Mbit/s (≥ 0.8V to 1.5V translation)
- Bus Hold on Data Inputs
- I_{OFF} Circuitry Provides Partial Power-down Mode Operation
- ESD protection exceeds JESD22
  - 4000 V Human-Body Model (A114-A)
  - 1500 V Charged-Device Model (C101)
- Latch-up performance exceeds 100mA per JESD78, Class II

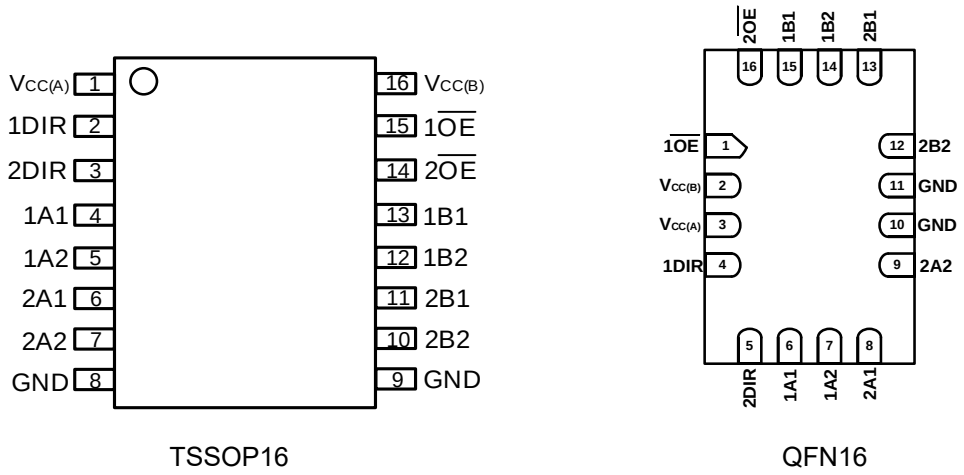
Applications

- Personal Electronic
- Industrial Equipment
- Enterprise Infrastructure
- Telecom Equipment

Ordering Information

Part No.	Package	MSL
ET74AVCH4T245V	TSSOP16(6.4mm×5mm)	3
ET74AVCH4T245Y	QFN16(1.8mm×2.6mm)	1

Pin Configuration



TSSOP16 QFN16

Fig 1. Top View

Pin Function

Pin			I/O	Description
Pin Name	TSSOP16	QFN16		
V_{CCA}	1	3	–	A port supply voltage.
V_{CCB}	16	2	–	B port supply voltage.
1DIR,2DIR	2,3	4,5	I	Direction-control signal. Referenced to V_{CCA}.
$2\overline{OE}$,$1\overline{OE}$	14,15	16,1	I	3-state output-mode enables. Pull OE high to place all outputs in 3-state mode. Referenced to V_{CCA}.
1A1~2A2	4~7	6~9	I/O	Input/output 1A1~2A2.Referenced to V_{CCA}
2B2~1B1	10~13	12~15	I/O	Input/output 2B2~1B1.Referenced to V_{CCB}
GND	8,9	10,11	–	Ground

Functional Diagram

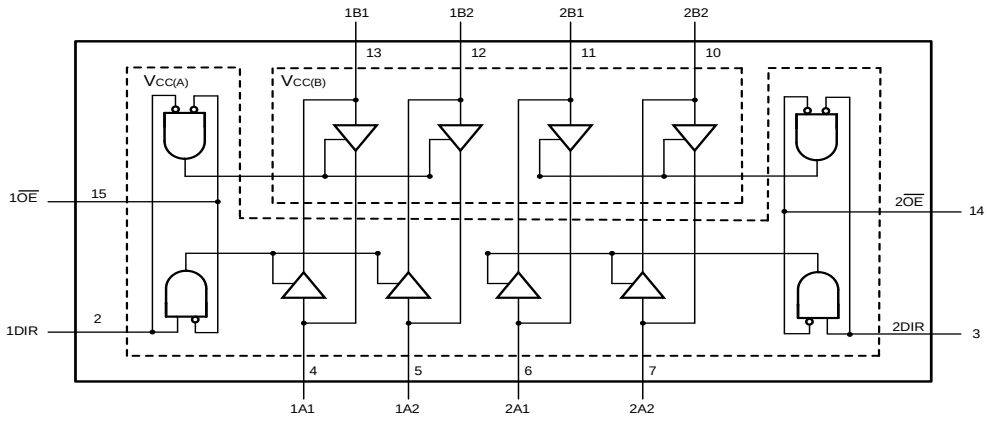


Fig 2. Logic Symbol

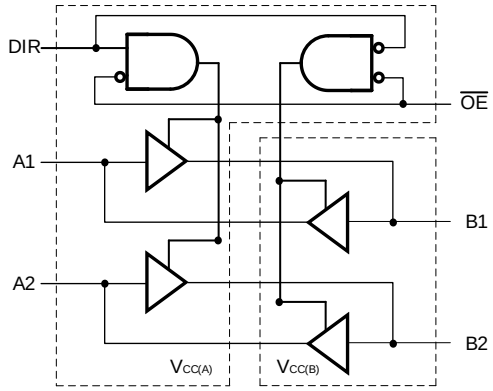


Fig 3. Logic Diagram

Functional Description

Table 1. Function table[1]

Supply voltage	Input		Input/Output	
$V_{CC(A)}$, $V_{CC(B)}$	n$\overline{OE}$ [2]	nDIR[2]	nAn[2]	nBn[2]
0.8V to 3.6V	L	L	nAn = nBn	input
0.8V to 3.6V	L	H	input	nBn = nAn
0.8V to 3.6V	H	X	Hi-Z	Hi-Z
GND[3]	X	X	Hi-Z	Hi-Z

Note1: H = High Voltage Level; L = Low Voltage Level; X = Don't Care; Z = High-impedance OFF-state.

Note2: The nAn, DIR and $\overline{OE}$ input circuit is referenced to $V_{CC(A)}$; The Bn input circuit is referenced to $V_{CC(B)}$.

Note3: If at least one of $V_{CC(A)}$ or $V_{CC(B)}$ is at GND level, the device goes into suspend mode.

Absolute Maximum Ratings

Symbol	Parameter	Conditions	Rating	Unit
$V_{CC(A)}$	Supply Voltage A		-0.5~+4.6	V
$V_{CC(B)}$	Supply Voltage B		-0.5~+4.6	V
I_{IK}	Input Clamping Current	V_I < 0 V	-50	mA
V_I	Input Voltage[4]		-0.5~+4.6	V
I_{OK}	Output Clamping Current	V_O < 0 V	-50	mA
V_O	Output Voltage	Active Mode[5]	-0.5~V_{CCO}+0.5	V
		Suspend or 3-state Mode	-0.5~+4.6	V
I_O	Output Current	V_O = 0 V to V_{CC}	±50	mA
I_{CC}	Supply Current	Per $V_{CC(A)}$ or $V_{CC(B)}$ pin	+100	mA
I_{GND}	Ground Current	Per GND pin	-100	mA
T_{STG}	Storage Temperature		-65 to +150	°C
P_D	Power Dissipation	T_A = 25°C	500	mW
T_J	Operating Junction Range		-40 to +150	°C
V_{ESD}	Human Body Mode[6]		±4000	V
	Charged Device Mode[7]		±1500	V
I_{LU}	Latch-up Current[8]		±100	mA

Note4: I/O absolute maximum rating must be observed.

Note5: V_{CCO} is the supply voltage associated with the output port.

Note6: HBM tested per AEC-Q100-002(EIA/JESD22-A114);

Note7: CDM tested per AEC-Q100-011(EIA/JESD22-C101);

Note8: Latch up Current Maximum Rating tested per AEC-Q100-004(EIA/JESD78E);

Recommended Operating Conditions

Symbol	Parameter	Conditions	Rating	Unit
$V_{CC(A)}$	Supply Voltage A		0.8~3.6	V
$V_{CC(B)}$	Supply Voltage B		0.8~3.6	V
V_I	Input Voltage		0~3.6	V
V_O	Output Voltage	Active Mode	0~V_{CCO}	V
		Suspend or 3-state Mode	0~3.6	V
T_A	Operating Ambient Temperature		-40 to +125	°C
t_r,t_f	Input Rise and Fall Time	V_{CCI} = 0.8 V to 3.6 V [9]	5	ns/V

Note9: V_{CCI} is the supply voltage associated with the input port.

Electrical Characteristics

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

V_{CCI} is the supply voltage associated with the data input port; V_{CCO} is the supply voltage associated with the output port.

Symbol	Parameter	Conditions	T_A = +25°C			Unit
			Min	Typ	Max	
V_{OH}	High-Level Output Voltage	V_I = V_{IH} or V_{IL}; I_O = -1.5 mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 0.8 V		0.69		V
V_{OL}	Low-Level Output Voltage	V_I = V_{IH} or V_{IL}; I_O = 1.5 mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 0.8 V		0.07		V
I_I	Input Leakage Current	DIR, $\overline{OE}$ Input; V_I = 0 V or 3.6 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 0.8 V to 3.6 V		±0.025	±0.25	μA
I_{BHL}(10)	Bus hold LOW current	A or B port; V_I=0.42 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.2 V		26		μA
I_{BHH}(10)	Bus hold HIGH current	A or B port; V_I=0.78 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.2 V		-24		μA
I_{BHLO}(10) (11)	Bus hold LOW overdrive current	$V_{CC(A)}$ = $V_{CC(B)}$ = 1.2 V		27		μA
I_{BHHO}(10) (11)	Bus hold HIGH overdrive current	$V_{CC(A)}$ = $V_{CC(B)}$ = 1.2 V		-26		μA
I_{OZ}	Off-State Output Current	A or B port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.6 V		±0.5	±2.5	μA
		Suspend Mode A port; V_O = 0 V or V_{CCO};		±0.5	±2.5	μA
		Suspend Mode B port; V_O = 0 V or V_{CCO};		±0.5	±2.5	μA
I_{OFF}	Power-Off Leakage Current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ =0 V; $V_{CC(B)}$ = 0.8 V to 3.6V		±0.1	±1	μA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ =0 V; $V_{CC(A)}$ = 0.8 V to 3.6 V		±0.1	±1	μA
C_I	Input Capacitance	DIR, $\overline{OE}$ Input; V_I = 0 V or 3.3 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.3 V		4		pF
$C_{I/O}$	Input/Output Capacitance	A and B port; V_O = 3.3 V or 0 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.3 V		6.5		pF

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	−40°C ≤ T_A ≤ +85°C		−40°C ≤ T_A ≤ +125°C		Unit
			Min	Max	Min	Max	
V_{IH}	High−Level Input Voltage	Data Input					
		V_{CCI} = 0.8V	0.7V_{CCI}		0.7V_{CCI}		V
		V_{CCI} = 1.1V to 1.95V	0.65V_{CCI}		0.65V_{CCI}		V
		V_{CCI} = 2.3V to 2.70V	1.6		1.6		V
		V_{CCI} = 3.0V to 3.60V	2.0		2.0		V
		DIR, $\overline{OE}$ Input					
		$V_{CC(A)}$ = 0.8V	0.7$V_{CC(A)}$		0.7$V_{CC(A)}$		V
		V_{CCI} = 1.1V to 1.95V	0.65$V_{CC(A)}$		0.65$V_{CC(A)}$		V
		V_{CCI} = 2.3V to 2.70V	1.6		1.6		V
		V_{CCI} = 3.0V to 3.60V	2.0		2.0		V
V_{IL}	Low−Level Input Voltage	Data Input					
		V_{CCI} = 0.8V		0.3V_{CCI}		0.3V_{CCI}	V
		V_{CCI} = 1.1V to 1.95V		0.35V_{CCI}		0.35V_{CCI}	V
		V_{CCI} = 2.3V to 2.70V		0.7		0.7	V
		V_{CCI} = 3.0V to 3.60V		0.8		0.8	V
		DIR, $\overline{OE}$ Input					
		$V_{CC(A)}$ = 0.8V		0.3$V_{CC(A)}$		0.3$V_{CC(A)}$	V
		V_{CCI} = 1.1V to 1.95V		0.35$V_{CC(A)}$		0.35$V_{CC(A)}$	V
		V_{CCI} = 2.3V to 2.70V		0.7		0.7	V
		V_{CCI} = 3.0V to 3.60V		0.8		0.8	V
V_{OH}	High-Level Output Voltage	V_I = V_{IH} or V_{IL}					
		I_O = -100μA; $V_{CC(A)}$ = $V_{CC(B)}$ = 0.8V to 3.6V	V_{CCO} - 0.1		V_{CCO} - 0.1		V
		I_O = -3mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.2V	0.85		0.85		V
		I_O = -6mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.4V	1.05		1.05		V
		I_O = -8mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.65V	1.2		1.2		V
		I_O = -9mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 2.3V	1.75		1.75		V
		I_O = -12mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.0V	2.3		2.3		V
V_{OL}	Low-Level Output Voltage	V_I = V_{IH} or V_{IL}					
		I_O = 100μA; $V_{CC(A)}$ = $V_{CC(B)}$ = 0.8V to 3.6 V		0.10		0.10	V
		I_O = 3mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.2 V		0.25		0.25	V
		I_O = 6mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.4 V		0.35		0.35	V
		I_O = 8mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.65 V		0.45		0.45	V
		I_O = 9mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 2.3 V		0.55		0.55	V
		I_O = 12mA; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.0 V		0.70		0.70	V

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	−40°C ≤ T_A ≤+85°C		−40°C≤ T_A≤+125°C		Unit
			Min	Max	Min	Max	
I_I	Input Leakage Current	DIR, $\overline{OE}$ Input; V_I = 0 V or 3.6 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 0.8 V to 3.6 V		±1		±5	μA
I_{BHL}[10]	Bus hold LOW current	A or B port					
		V_I = 0.49 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.4 V	15		15		μA
		V_I = 0.58 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.65 V	25		25		μA
		V_I = 0.70 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 2.3 V	45		45		μA
		V_I = 0.80 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.3 V	100		90		μA
I_{BHH}[10]	Bus hold HIGH current	A or B port					
		V_I = 0.91 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.4 V	-15		-15		μA
		V_I = 1.07 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.65 V	-25		-25		μA
		V_I = 1.60 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 2.3 V	-45		-45		μA
		V_I = 2.00 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.3 V	-100		-100		μA
I_{BHLO}[10] [11]	Bus hold LOW overdrive current	A or B port					
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.4 V	125		125		μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.65 V	200		200		μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 2.3V	300		300		μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 3.3 V	500		500		μA
I_{BHHO}[10] [11]	Bus hold HIGH overdrive current	A or B port					
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.4 V	-125		-125		μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.65 V	-200		-200		μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 2.3V	-300		-300		μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 3.3 V	-500		-500		μA
I_{OZ}	Off-State Output Current	A or B port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.6 V		±5		±30	μA
		Suspend Mode A port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V		±5		±30	μA
		Suspend Mode B port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V		±5		±30	μA
I_{OFF}	Power-Off Leakage Current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ =0 V; $V_{CC(B)}$ = 0.8 V to 3.6V		±5		±30	μA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ =0 V; $V_{CC(A)}$ = 0.8 V to 3.6 V		±5		±30	μA

Note10: '+/-' represents the direction of the current.

Note11: I_{BHL}, I_{BHH} means the bus hold current; I_{BHLO}, I_{BHHO} means the minimum overdrive current to flip the level.

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	−40°C ≤ T_A ≤ +85°C		−40°C≤ T_A≤ +125°C		Unit
			Min	Max	Min	Max	
I_{CC}	Supply Current	A port; V_I = 0 V or V_{CCI}; I_O = 0 A					
		$V_{CC(A)}$ = 0.8 to 3.6 V; $V_{CC(B)}$ = 0.8 to 3.6 V		20		70	μA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0.0 V		20		70	μA
		$V_{CC(A)}$ = 0.0 V; $V_{CC(B)}$ = 3.6 V	-2		-12		μA
		B port; V_I = 0 V or V_{CCI}; I_O = 0 A					
		$V_{CC(A)}$ = 0.8 to 3.6 V; $V_{CC(B)}$ = 0.8 to 3.6 V		20		70	μA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0.0 V		20		70	μA
		$V_{CC(A)}$ = 0.0 V; $V_{CC(B)}$ = 3.6 V	-2		-12		μA
		A plus B port ($I_{CC(A)}$ + $I_{CC(B)}$); I_O = 0 A; V_I = 0 V or V_{CCI}; $V_{CC(A)}$ = 0.8 V to 3.6 V; $V_{CC(B)}$ = 0.8 V to 3.6 V		16		65	μA

Table 2. Typical Total Supply Current, T_A = 25 °C ($I_{CC(A)}$ + $I_{CC(B)}$)

$V_{CC(A)}$	$V_{CC(B)}$						Unit
	0 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
0 V	0	0.1	0.1	0.1	0.1	0.1	μA
1.2 V	0.1	0.1	0.1	0.1	0.2	1.0	μA
1.5 V	0.1	0.1	0.1	0.1	0.4	0.6	μA
1.8 V	0.1	0.1	0.1	0.1	0.1	0.3	μA
2.5 V	0.1	0.2	0.3	0.1	0.1	0.1	μA
3.3 V	0.1	0.8	0.5	0.9	0.1	0.1	μA

Dynamic Characteristics

Typical switching characteristics at $V_{CC(A)}$ = 0.8V and T_A = 25°C (unless otherwise noted)

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig.7; for wave forms see Fig.5 and Fig.6.

t_{pd} is the same as t_{PLH} and t_{PHL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}; t_{en} is the same as t_{PZL} and t_{PZH}.

Symbol	Parameter	Conditions	$V_{CC(B)}$				Unit
			0.8 V	1.2 V	1.8 V	3.3 V	
t_{pd}	Propagation Delay	nAn to nBn	21.2	11.0	10.1	10.3	ns
		nBn to nAn	19.9	16.6	15.5	14.6	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	25.5	25.5	25.5	25.5	ns
		$\overline{OE}$ to nBn	29.0	18.6	14.9	14.4	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	34.6	34.6	34.6	34.6	ns
		$\overline{OE}$ to nBn	35.8	19.4	15.4	15.1	ns

Typical switching characteristics at $V_{CC(B)}$ = 0.8V and T_A = 25°C (unless otherwise noted)

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig.7; for wave forms see Fig.5 and Fig.6.

t_{pd} is the same as t_{PLH} and t_{PHL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}; t_{en} is the same as t_{PZL} and t_{PZH}.

Symbol	Parameter	Conditions	$V_{CC(A)}$				Unit
			0.8 V	1.2 V	1.8 V	3.3 V	
t_{pd}	Propagation Delay	nAn to nBn	21.2	15.8	14.6	13.6	ns
		nBn to nAn	19.9	11.5	9.1	9.9	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	25.5	14.0	9.7	7.4	ns
		$\overline{OE}$ to nBn	29.0	28.0	26.4	25.4	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	34.6	13.8	7.8	4.9	ns
		$\overline{OE}$ to nBn	35.8	30.9	29.4	28.7	ns

Dynamic Characteristics(Continued)

Voltages are referenced to GND (ground = 0 V), T_A = 25°C.

Symbol	Parameter	Conditions	$V_{CC(A)} = V_{CC(B)}$						Unit
			0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
C_{PD} (12) (13)	Power Dissipation Capacitance	A port: (direction nAn to nBn); output enabled	0.34	0.25	0.30	0.37	0.76	1.48	pF
		A port: (direction nAn to nBn); output disabled	0.34	0.26	0.28	0.35	0.71	1.33	pF
		A port: (direction nBn to nAn); output enabled	7.02	9.09	10.51	11.80	14.13	16.43	pF
		A port: (direction nBn to nAn); output disabled	0.76	0.76	0.77	0.79	0.83	0.89	pF
		B port: (direction nAn to nBn); output enabled	6.63	9.09	10.51	11.80	14.13	16.43	pF
		B port: (direction nAn to nBn); output disabled	0.75	0.76	0.77	0.79	0.83	0.89	pF
		B port: (direction nBn to nAn); output enabled	0.35	0.25	0.30	0.37	0.76	1.48	pF
		B port: (direction nBn to nAn); output disabled	0.35	0.26	0.28	0.35	0.71	1.33	pF

Note12: 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.

Note13: f_i = 10 MHz; V_I = GND to V_{CC}; $t_r = t_f$ = 1 ns; C_L = 0 pF; R_L = ∞ Ω.

Dynamic Characteristics(Continued)

Voltages are referenced to GND (ground = 0 V), T_A = -40°C ~ +85°C.

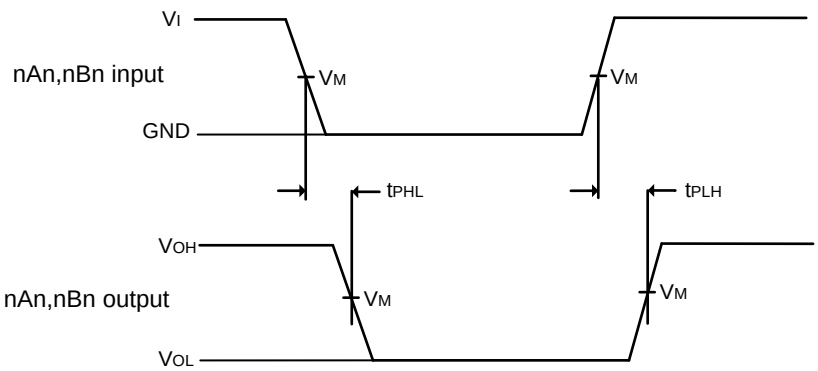
Symbol	Parameter	Conditions	$V_{CC(B)}$						Unit
			1.2V ± 0.1V		1.8V ± 0.15V		3.3V ± 0.3V		
			Min	Max	Min	Max	Min	Max	
$V_{CC(A)}$= 1.1V to 1.3V									
t_{pd}	Propagation Delay	nAn to nBn	0.5	12.0	0.5	8.8	0.5	7.5	ns
		nBn to nAn	0.5	12.0	0.5	11.3	0.5	10.5	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	0.5	17.1	0.5	17.1	0.5	17.1	ns
		$\overline{OE}$ to nBn	0.5	17.9	0.5	13.6	0.5	11.4	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	1.1	18.0	1.1	18.0	1.1	18.0	ns
		$\overline{OE}$ to nBn	1.1	20.0	1.1	15.0	1.0	8.0	ns
$V_{CC(A)}$= 1.65V to 1.95V									
t_{pd}	Propagation Delay	nAn to nBn	0.5	11.3	0.5	7.5	0.5	6.5	ns
		nBn to nAn	0.5	10.0	0.5	7.5	0.5	7.1	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	0.5	12.7	0.5	12.7	0.5	12.7	ns
		$\overline{OE}$ to nBn	0.5	15.0	0.5	11.2	0.5	9.1	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	1.0	13.0	1.0	13.0	1.0	13.0	ns
		$\overline{OE}$ to nBn	1.1	17.4	1.0	12.0	0.5	10.5	ns
$V_{CC(A)}$= 3.0V to 3.6V									
t_{pd}	Propagation Delay	nAn to nBn	0.5	9.8	0.5	7.1	0.5	5.0	ns
		nBn to nAn	0.5	7.8	0.5	6.5	0.5	5.0	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	0.5	8.5	0.5	8.5	0.5	8.5	ns
		$\overline{OE}$ to nBn	0.5	14.5	0.5	9.6	0.5	8.2	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	0.5	6.8	0.5	6.8	0.5	6.8	ns
		$\overline{OE}$ to nBn	1.1	16.0	0.5	10.0	0.5	7.0	ns

Dynamic Characteristics(Continued)

Voltages are referenced to GND (ground = 0 V), T_A = -40°C ~ +125°C.

Symbol	Parameter	Conditions	$V_{CC(B)}$						Unit
			1.2V ± 0.1V		1.8V±0.15V		3.3V ± 0.3V		
			Min	Max	Min	Max	Min	Max	
$V_{CC(A)}$= 1.1V to 1.3V									
t_{pd}	Propagation Delay	nAn to nBn	0.5	12.5	0.5	9.3	0.5	8.0	ns
		nBn to nAn	0.5	12.5	0.5	11.8	0.5	11.0	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	0.5	17.6	0.5	17.6	0.5	17.6	ns
		$\overline{OE}$ to nBn	0.5	18.4	0.5	14.1	0.5	11.9	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	1.1	18.5	1.1	18.5	1.1	18.5	ns
		$\overline{OE}$ to nBn	1.1	20.5	1.1	15.5	1.0	8.5	ns
$V_{CC(A)}$= 1.65V to 1.95V									
t_{pd}	Propagation Delay	nAn to nBn	0.5	11.8	0.5	8.0	0.5	7.0	ns
		nBn to nAn	0.5	10.5	0.5	8.0	0.5	7.6	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	0.5	13.2	0.5	13.2	0.5	13.2	ns
		$\overline{OE}$ to nBn	0.5	15.5	0.5	11.7	0.5	9.6	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	1.0	13.5	1.0	13.5	1.0	13.5	ns
		$\overline{OE}$ to nBn	1.1	17.9	1.0	12.5	0.5	11.0	ns
$V_{CC(A)}$= 3.0V to 3.6V									
t_{pd}	Propagation Delay	nAn to nBn	0.5	10.3	0.5	7.6	0.5	5.5	ns
		nBn to nAn	0.5	8.3	0.5	7.0	0.5	5.5	ns
t_{dis}	Disable Time	$\overline{OE}$ to nAn	0.5	9.0	0.5	9.0	0.5	9.0	ns
		$\overline{OE}$ to nBn	0.5	15.0	0.5	10.4	0.5	8.7	ns
t_{en}	Enable Time	$\overline{OE}$ to nAn	0.5	7.3	0.5	7.3	0.5	7.3	ns
		$\overline{OE}$ to nBn	1.1	16.5	0.5	10.5	0.5	7.5	ns

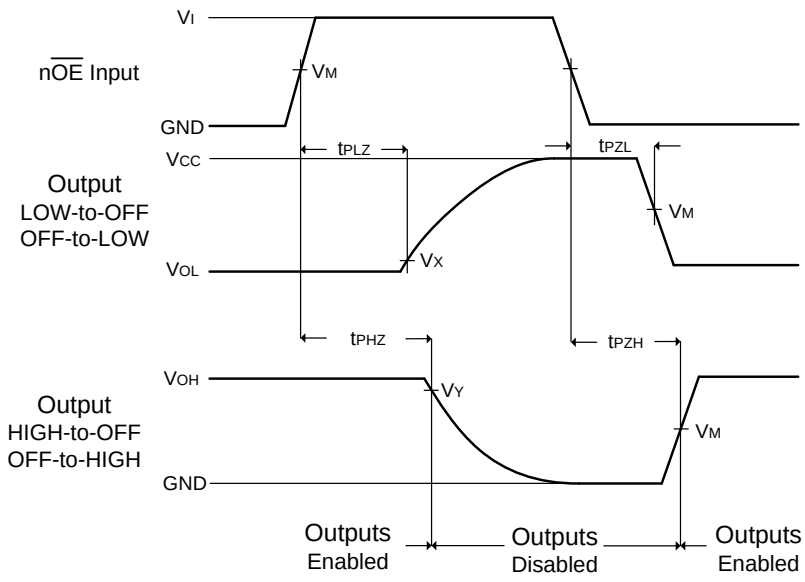
Test Circuit



Measurement points are given in Table 2.

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

Fig.5 The data input (nAn, nBn) to output (nBn, nAn) propagation delay times



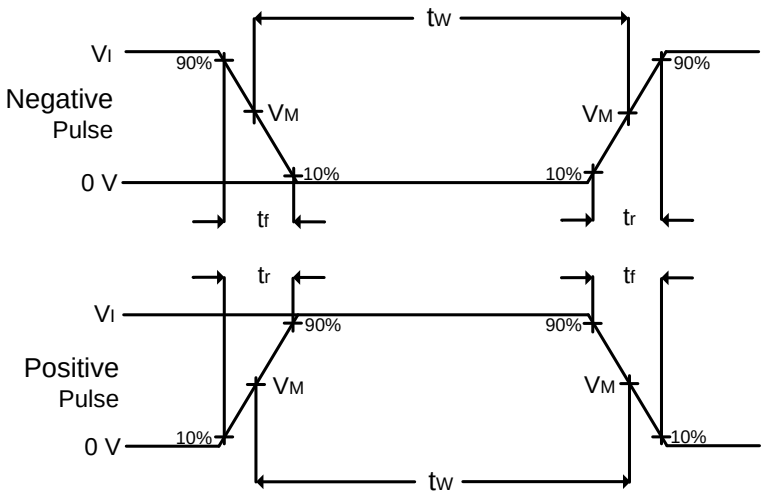
Measurement points are given in Table 2.

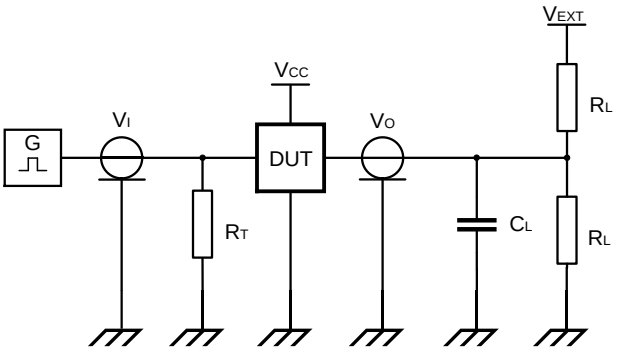
V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig.6 Enable and disable times

Table 2. Measurement Points

Supply Voltage	Input	Output		
$V_{CC(A)}$, $V_{CC(B)}$	V_M	V_M	V_X	V_Y
1.2V to 1.6V	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.1V	V_{OH} - 0.1V
1.65V to 2.7V	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.15V	V_{OH} - 0.15V
3.0V to 3.6V	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.3V	V_{OH} - 0.3V





Measurement points are given in Table 3.

Definitions 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.7 Test circuit for measuring switching times

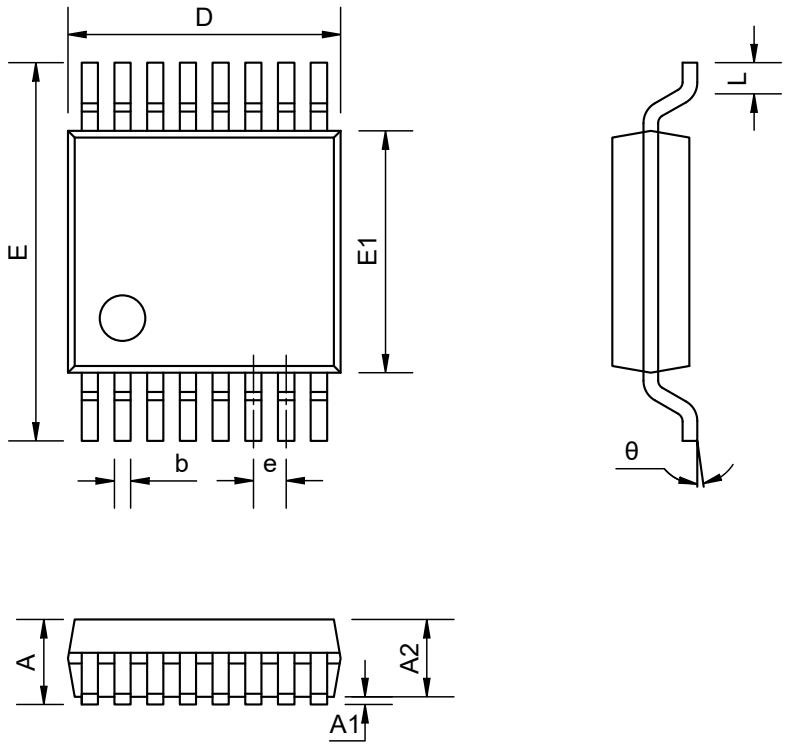
Table 3.Test Data

Supply Voltage	**Input**		**Load**		**V_{EXT}**		
$V_{CC(A)}$, $V_{CC(B)}$	**V_I**	**$\Delta t/\Delta V$[14]**	**C_L**	**R_L**	**t_{PLH} , t_{PHL}**	**t_{PZH} , t_{PHZ}**	**t_{PZL} , t_{PLZ}**
0.8 V to 1.6 V	V_{CCI}	≤ 1.0 ns/V	15 pF	2 kΩ	Open	GND	2 × V_{CCO}
1.65 V to 2.7 V	V_{CCI}	≤ 1.0 ns/V	15 pF	2 kΩ	Open	GND	2 × V_{CCO}
3.0 V to 3.6 V	V_{CCI}	≤ 1.0 ns/V	15 pF	2 kΩ	Open	GND	2 × V_{CCO}

Note14: dV/dt ≥ 1.0 V/ns

Package Dimension

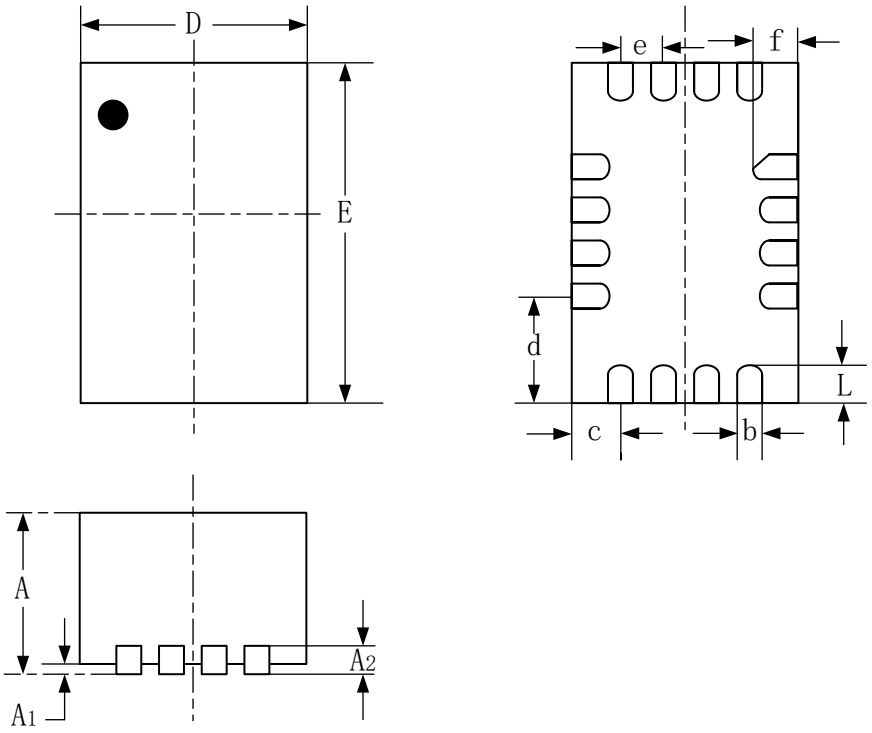
TSSOP16



Dimensions Table (Units: mm)

Symbol	Min	Non	Max
A	--	--	1.10
A1	0.05	--	0.15
A2	0.80	--	1.00
b	0.19	--	0.30
D	4.90	5.00	5.10
E	6.25	6.40	6.55
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.50	0.60	0.70
θ	1°	--	7°

QFN16



Dimensions Table (Units: mm)

SYMBOL	MIN	NOM	MAX
A	0.5	0.55	0.6
A_1	0	-	0.05
A_2	-	0.15	-
D	1.75	1.80	1.85
E	2.55	2.60	2.65
L	0.30	0.40	0.50
b	0.15	0.20	0.25
c	-	0.30	-
d	-	0.70	-
e	0.40BSC		
f	-	0.50	-

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2024-10-29	Preliminary Version	Yuyifan	Lichenxuan	Liujy
1.0	2025-03-20	Official Version	Wanganran	Yangxiaoxu	Liujy