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TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

## T C 7 4 L V X 4 2 4 5 F S

### OCTAL DUAL SUPPLY BUS TRANSCEIVER

The TC74LVX4245 is a dual supply, advanced high speed CMOS OCTAL BUS TRANSCEIVER fabricated with silicon gate CMOS technology.

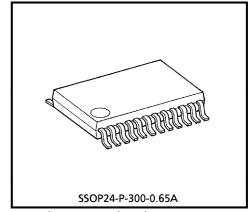
Designed for use as an interface between a 5V bus and a 3.3V bus in mixed 5V/3.3V supply systems' it achieves high speed operation while maintaining the CMOS low power dissipation.

It is intended for 2 way asynchronous communication between data busses. The direction of data transmission is determined by the level of the DIR input.

The enable input  $(\overline{OE})$  can be used to disable the device so that the buses are effectively isolated.

The A-port interfaces with the 5V bus, the B-port with the 3.3V bus.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.



Weight: 0.14g (Typ.)

### FEATURES

- Bidirectional interface between 5V and 3V buses
- High speed • Low power dissipation • Symmetrical output impedance • Low noise • Low noise • High speed •  $t_{pd} = 6.0ns (Typ.) (V_{CCB} = 3.3V)$ •  $t_{CC} = 8\mu A (Max.) (Ta = 25^{\circ}C)$ •  $t_{OUTA} = \pm 24mA (Min.) (V_{CCA} = 4.5V / V_{CCB} = 3.0V)$ • Low noise •  $t_{OLP} = 1.5V (Max.)$
- Available in SSOP package

#### **APPLICATION NOTES**

Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.

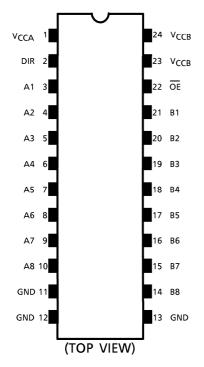
All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

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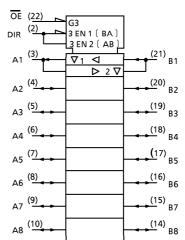
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**IEC LOGIC SYMBOL** 



#### TRUTH TABLE

INPUTS		OUTPUTS	FUNCTION			
G	DIR	OUIPUIS	A-BUS	B-BUS		
L	L	A = B	OUTPUT	INPUT		
L	Н	B = A	= A INPUT			
Н	Х	Z	High Impedance			

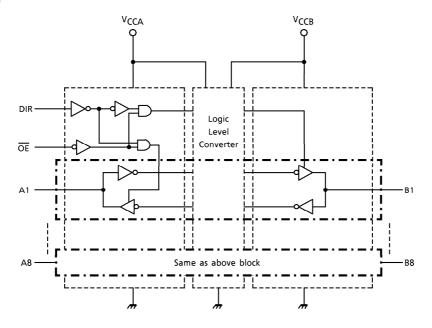
X : Don't Care

Z : High Impedance

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#### **BLOCK DIAGRAM**



#### MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage Range*	V <sub>CCA</sub>	-0.5~7.0	v
Supply Voltage Range	V <sub>CCB</sub>	-0.5~V <sub>CCA</sub>	v
DC Input Voltage (OE,DIR)	VIN	-0.5~V <sub>CCA</sub> +0.5	V
DC Bus L/O Voltago	VI/OA	-0.5~V <sub>CCA</sub> +0.5	v
DC Bus I/O Voltage	VI/OB	$-0.5 \sim V_{CCB} + 0.5$	v
Input Diode Current	ЧК	- 20	mA
Output Diode Current	Іок	± 50	mA
DC Output Current	ΙΟυτα	± 50	mA
DC Output Current	ΙΟυτβ	± 50	
DC Ver (Ground Current	ICCA	± 200	mA
DC V <sub>CC</sub> /Ground Current	Іссв	± 100	IIIA
Power Dissipation	PD	180	mW
Storage Temperature	T <sub>stg</sub>	- 65~150	°C

\*:  $V_{CCA}\!>\!V_{CCB_{,}}$  Don't use under the condition that  $V_{CCB}$  is 0V.

### **RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	RATING	UNIT	
Supply Voltage	V <sub>CCA</sub>	4.5~5.5	v	
Supply Voltage	VCCB	2.7~3.6		
Input Voltage (OE,DIR)	VIN	0~V <sub>CCA</sub>	V	
Bus I/O Voltage	VI/OA	0~V <sub>CCA</sub>	v	
Bus 170 Voltage	VI/OB	0~V <sub>CCB</sub>	Ň	
Operating Temperature	T <sub>opr</sub>	- 40~85	°C	
Input Rise And Fall Time	dt/dv	0~8 (V <sub>CCA</sub> = 4.5~5.5V)	ns/V	
		$0 \sim 8 (V_{CCB} = 2.7 \sim 3.6V)$	1137 V	

### ELECTRICAL CHARACTERISTICS

DC characteristics (V<sub>CCA</sub>)  $V_{CCB} = 2.7 \sim 3.6V$ 

		SYM-	TEST CON		Vçça	٦	a = 25°	С	Ta = -4	40∼85°C	UNIT
		BOL			(V)	MIN.	TYP.	MAX.	MIN.	MAX.	
"H" Level Input Voltage "L" Level		VIHA	DIR, G, An		4.5 ~ 5.5	2.0	_	_	2.0	_	v
		VILA	DIR, G, An		4.5 ~ 5.5	_	_	0.8	_	0.8	v
Output Voltage	Voua	V <sub>INA</sub> = V <sub>IHA</sub> or V <sub>ILA</sub>	<sup>I</sup> OH = – 100µА	4.5	4.4	4.5	_	4.4	_		
	II Level	∙она	V <sub>INB</sub> = V <sub>IHB</sub> or V <sub>ILB</sub>	<sup>I</sup> OH = - 24mA	4.5	3.86	_	_	3.76	_	v
	″L" Level	Vola	V <sub>INA</sub> = V <sub>IHA</sub> or V <sub>ILA</sub> V <sub>INB</sub> = V <sub>IHB</sub> or V <sub>ILB</sub>	l <sub>OL</sub> = 100μΑ	4.5		0.0	0.1	_	0.1	
				<sup>I</sup> OL = 24mA	4.5	_	_	0.36	_	0.44	
3-State Output Off-State Current		loza	V <sub>INA</sub> = V <sub>IHA</sub> or V <sub>INB</sub> = V <sub>IHB</sub> or V <sub>I</sub> / OA = V <sub>CCA</sub>	VILB	5.5		_	±0.5	_	± 5.0	μΑ
Input Leak Current	kage	IINA	$V_{IN}$ (DIR, $\overline{G}$ ) = $V_{CCA}$ or GND		5.5		_	±0.1	—	± 1.0	μΑ
Quiescent Supply Current		ICCA	V <sub>INA</sub> = V <sub>CCA</sub> or GND V <sub>INB</sub> = V <sub>CCB</sub> or GND		5.5	_	_	8.0	_	80.0	μΑ
		Ісста	PER INPUT : V OTHER INPUT		5.5			2.3	_	2.5	mA

PARAMETER		SYM-	TEST CON		VCCB	Г	ā = 25°	C	Ta = -4	₩0~85°C	UNIT
		BOL	-		(Ŭ) -	MIN.	TYP.	MAX.	MIN.	MAX.	
Input "H" Lev		VIHB	Bn		2.7	2.0		—	2.0	—	
		VIHB	ы		3.6	2.2		—	2.2		v
Voltage	"L" Level	VILB	Bn		2.7	_	—	0.8	—	0.8	
		VILB	ы		3.6	_		0.8	—	0.8	
"H" L Output				<sup>I</sup> OH = – 100µА	3.0	2.9	3.0	_	2.9	_	
	"H" Level	V <sub>ОНВ</sub>	V <sub>INA</sub> = V <sub>IHA</sub> or V <sub>ILA</sub>	<sup>I</sup> OH = -8mA	2.7	2.26	_	_	2.20	_	
				<sup>I</sup> OH = – 12mA	3.0	2.48		_	2.40	_	v
Voltage	"L" Level	VOLB	B VINA = VIHA or VILA	l <sub>OL</sub> = 100μΑ	3.0		0.0	0.1	_	0.1	
				I <sub>OL</sub> = 8mA	2.7			0.31	_	0.40	
				I <sub>OL</sub> = 12mA	3.0	l		0.31	_	0.40	
3-State Output Off-State Current		IOZB	$V_{INA} = V_{IHA}$ or $V_{ILA}$ $V_{I / OB} = V_{CCB}$ or GND		3.6			±0.5	_	± 5.0	μΑ
Quiescent Supply Current		ІССВ	$V_{INA} = V_{CCA} \text{ or } GND$ $V_{INB} = V_{CCB} \text{ or } GND$ PER INPUT : $V_{INB} = 3.0V$ OTHER INPUT : $V_{CCB}$ or GND		3.6	_		5.0	_	50.0	μΑ
		Ісств			3.6			0.35		0.50	mA

DC characteristics (V<sub>CCB</sub>)  $V_{CCA} = 4.5 \sim 5.5 V$ 

PARAMETER	SYMBOL	TEST			a = 25°0)	2	Ta = −40~85°C		UNIT
		CONDITION	V <sub>CCB</sub> (V)	MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay	t <sub>pLH</sub>		2.7	—	7.1	9.5	1.0	10.5	ns
Time (An⇒Bn)	t <sub>pHL</sub>	lanut An	3.3±0.3	_	6.5	8.6	1.0	9.5	
3-State Output Enable	t <sub>pZL</sub>	Input : An	2.7		9.5	12.5	1.0	13.8	
Time (Ḡ⇒Bn)	t <sub>pZH</sub>	Output:Bn (DIR = "H")	3.3±0.3	_	8.6	11.4	1.0	12.5	ns
3-State Output Disable	t <sub>pLZ</sub>		2.7	—	5.3	9.1	1.0	10.0	ns
Time (Ḡ⇒Bn)	t <sub>pHZ</sub>		3.3±0.3	—	5.3	9.1	1.0	10.0	
Propagation Delay	t <sub>pLH</sub>		2.7	_	7.0	9.5	1.0	10.5	-
Time (Bn⇒An)	t <sub>pHL</sub>		3.3±0.3		6.4	8.6	1.0	9.5	ns
3-State Output Enable	t <sub>pZL</sub>	Input : Bn Output : An (DIR = "L")	2.7		8.5	11.6	1.0	12.7	
Time (Ḡ⇒An)	t <sub>pZH</sub>		3.3±0.3		7.7	10.5	1.0	11.5	ns
3-State Output Disable	t <sub>pLZ</sub>		2.7	_	5.1	6.8	1.0	7.5	
Time (Ḡ⇒An)	t <sub>pHZ</sub>		3.3±0.3	_	5.1	6.8	1.0	7.5	ns
Output To Output	t <sub>osLH</sub>	(Note 1)	2.7	_	—	1.5	_	1.5	nc
Skew	t <sub>osHL</sub>	(Note I)	3.3 ± 0.3	_	—	1.5	—	1.5	ns
Input Capacitance	CINA	DIR, G	3.3±0.3		5	10	—	10	рF
Bus Input Capacitance	C <sub>I/O</sub>	An, Bn	3.3±0.3	_	13	—	—	_	рF
Devere Dissingstice		A⇒B (DIR = "H")	3.3±0.3		17	_	_		
Power Dissipation	CPDA	B⇒A (DIR = "L")	3.3±0.3		25	—	—	—	
Capacitance (Note 2)	6	A⇒B (DIR = "H")	3.3±0.3		4	—	—	—	рF
	CPDB	B⇒A (DIR = "L")	3.3±0.3	—	4		—	—	

AC characteristics (Input t\_r = t\_f = 3ns, C\_L = 50pF, R\_L = 500 \Omega, V\_{CCA} = 5.0 \pm 0.5 V)

(Note 1) Parameter guaranteed by design.

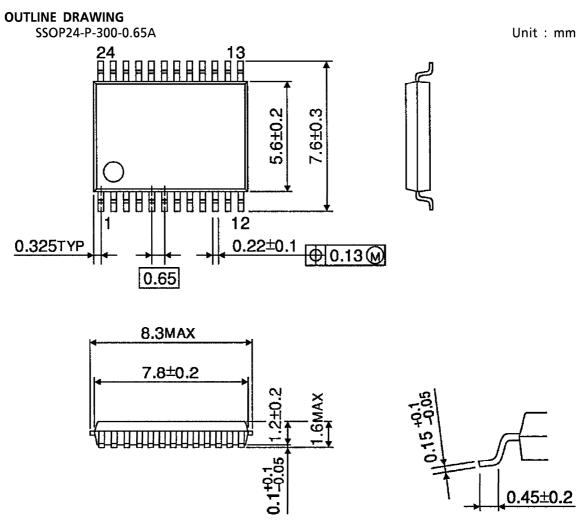
 $(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$ 

(Note 2) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.
 Average operating current can be obtained by the equation :

 $I_{CC (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8 \text{ (per bit)}$ 

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CCA</sub> (V)	V <sub>CCB</sub> (V)	TYP.	LIMIT	UNIT
Quiet Output Maximum Dynamic V <sub>OL</sub> (A)	VOLPA	Input : Bn Output : An	5.0	3.3	1.0	1.5	V
Quiet Output Mimimum Dynamic V <sub>OL</sub> (A)	VOLVA	(DIR = "L")	5.0	3.3	- 0.6	- 1.2	V
Quiet Output Maximum Dynamic V <sub>OL</sub> (B)	VOLPB	Input : An Output : Bn	5.0	3.3	0.8	1.2	V
Quiet Output Mimimum Dynamic V <sub>OL</sub> (B)	VOLVB	(DIR = "H")	5.0	3.3	- 0.5	- 0.8	V
Minimum High Level Dynamic Input Voltage	VIHDA	Input : An	5.0	3.3	_	2.0	V
Maximum Low Level Dynamic Input Voltage	VILDA	Input : An	5.0	3.3	_	0.8	V
Minimum High Level Dynamic Input Voltage	VIHDB	Input : Bn	5.0	3.3	_	2.0	v
Maximum Low Level Dynamic Input Voltage	V <sub>ILDB</sub>	Input : Bn	5.0	3.3		0.8	v

Noise characteristics (Ta = 25°C, Input  $t_r = t_f = 3ns$ , CL = 50pF, RL = 500 $\Omega$ )



Weight : 0.14g (Typ.)