TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74LVXC3245FS

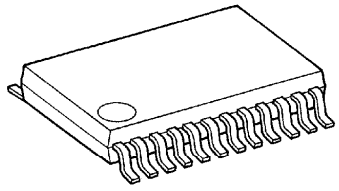
OCTAL DUAL SUPPLY CONFIGURABLE VOLTAGE INTERFACE BUS TRANSCEIVER

The TC74LVXC3245 is a dual supply, advanced high speed CMOS OCTAL CONFIGURABLE VOLTAGE INTERFACE BUS TRANSCEIVER fabricated with silicon gate CMOS technology.

Designed for use as an interface between a 3.3V bus and a 3.3V - 5V bus in mixed 3.3V / 5V 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 ($\overline{G}$) can be used to disable the device so that the buses are effectively isolated. The A-port interfaces with the 3V bus, the B-port with the 3.3V - 5V bus. This device will allow the V_{CCB} voltage source pin and I / O pins on the B port to float when $\overline{G}$ is "H".

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



SSOP24-P-300-0.65A

Weight : 0.14g (Typ.)

FEATURES

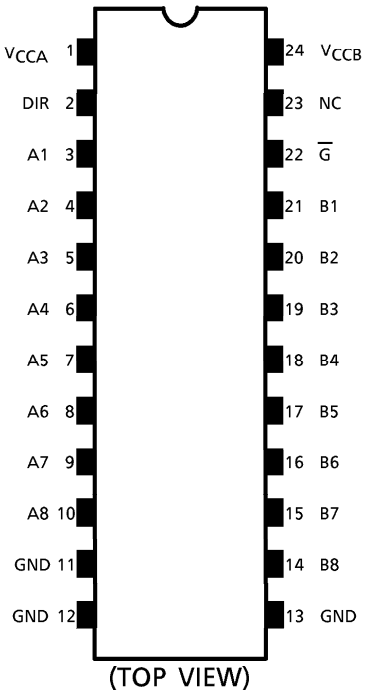
- Bidirectional interface between 3.3V and 5V buses
- High speed : t_{pd} = 8.5ns (Max.) (V_{CCA} = 3.3V / V_{CCB} = 5.0V)
- Low power dissipation : I_{CC} = 8μA (Max.) (Ta = 25°C)
- Symmetrical output impedance : I_{OUTA} = ± 24mA (Min.) I_{OUTB} = ± 24mA (Min.) (V_{CCA} = V_{CCB} = 3.0V)
- Low noise : V_{OLP} = 1.5V (Max.)
- Flexible V_{CCB} operating range
- Allows B port and V_{CCB} to float simultaneously when $\overline{G}$ is "H".
- 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.

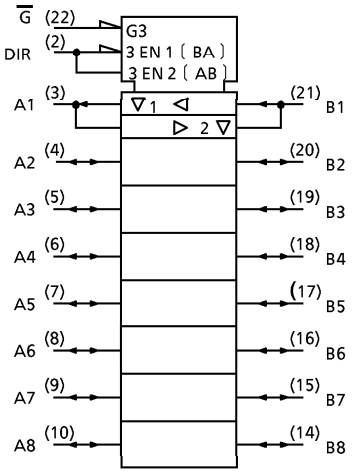
All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

PIN ASSIGNMENT



(TOP VIEW)

IEC LOGIC SYMBOL



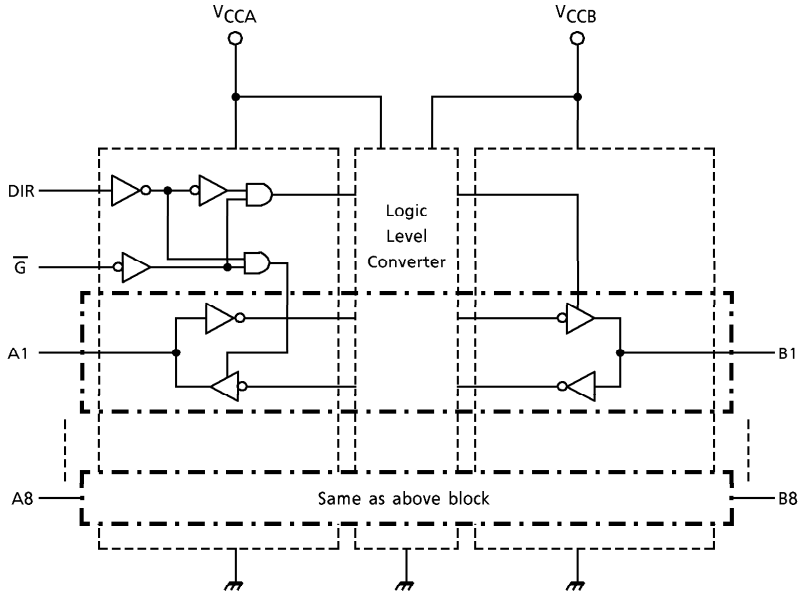
TRUTH TABLE

INPUTS		OUTPUTS	FUNCTION	
$\overline{G}$	DIR		A-BUS	B-BUS
L	L	A = B	OUTPUT	INPUT
L	H	B = A	INPUT	OUTPUT
H	X	Z	High Impedance	

X : Don't Care

Z : High Impedance

BLOCK DIAGRAM



MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage Range (Note 1)	V_{CCA}	−0.5~7.0	V
	V_{CCB}	−0.5~7.0	
DC Input Voltage ($\overline{G}$, DIR)	V_{IN}	−0.5~V_{CCA} + 0.5	V
DC Bus I/O Voltage	$V_{I/OA}$	−0.5~V_{CCA} + 0.5	V
	$V_{I/OB}$	−0.5~V_{CCB} + 0.5	
Input Diode Current	I_{IK}	±20	mA
Output Diode Current	I_{OK}	±50	mA
DC Output Current	I_{OUTA}	±50	mA
	I_{OUTB}	±50	
DC V_{CC}/Ground Current	I_{CCA}	±200	mA
	I_{CCB}	±200	
Power Dissipation	P_D	180	mW
Storage Temperature	T_{stg}	−65~150	°C

(Note 1) Don't supply a voltage to V_{CCB} terminal when V_{CCA} is in the off-state.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{CCA}	2.7~3.6	V
	V_{CCB}	3.0~5.5	
Input Voltage ($\overline{G}$, DIR)	V_{IN}	0~V_{CCA}	V
Bus I/O Voltage	$V_{I/OA}$	0~V_{CCA}	V
	$V_{I/OB}$	0~V_{CCB}	
Operating Temperature	T_{opr}	−40~85	°C
Input Rise And Fall Time	dt/dv	0~8 (V_{CCA} = 2.7~3.6V)	ns/V
		0~8 (V_{CCB} = 3.0~5.5V)	

ELECTRICAL CHARACTERISTICS

DC characteristics

PARAMETER	SYM-BOL	TEST CONDITION		V_{CCA} (V)	V_{CCB} (V)	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	Ta = −40~85°C MIN.	Ta = −40~85°C MAX.	UNIT
High Level Input Voltage	V_{IHA}	DIR, $\overline{G}$, An		2.7	3.0	2.0	—	—	2.0	—	V
				3.0	3.6	2.0	—	—	2.0	—	
				3.6	5.5	2.0	—	—	2.0	—	
	V_{IHB}	Bn		2.7	3.0	2.0	—	—	2.0	—	
				3.0	3.6	2.0	—	—	2.0	—	
				3.6	5.5	3.85	—	—	3.85	—	
Low Level Input Voltage	V_{ILA}	DIR, $\overline{G}$, An		2.7	3.0	—	—	0.8	—	0.8	V
				3.0	3.6	—	—	0.8	—	0.8	
				3.6	5.5	—	—	0.8	—	0.8	
	V_{ILB}	Bn		2.7	3.0	—	—	0.8	—	0.8	
				3.0	3.6	—	—	0.8	—	0.8	
				3.6	5.5	—	—	1.65	—	1.65	
High Level Output Voltage	V_{OHA}	V_{INA} = V_{IHA} or V_{ILA} V_{INB} = V_{IHB} or V_{ILB}	I_{OH} = −100μA	3.0	3.0	2.9	3.0	—	2.9	—	V
			I_{OH} = −12mA	3.0	3.0	2.56	—	—	2.46	—	
			I_{OH} = −24mA	3.0	3.0	2.35	—	—	2.25	—	
			I_{OH} = −12mA	2.7	3.0	2.3	—	—	2.2	—	
			I_{OH} = −24mA	2.7	4.5	2.1	—	—	2.0	—	
	V_{OHB}	V_{INA} = V_{IHA} or V_{ILA}	I_{OH} = −100μA	3.0	3.0	2.9	3.0	—	2.9	—	
			I_{OH} = −12mA	3.0	3.0	2.56	—	—	2.46	—	
			I_{OH} = −24mA	3.0	3.0	2.35	—	—	2.25	—	
			I_{OH} = −24mA	3.0	4.5	3.86	—	—	3.76	—	
Low Level Output Voltage	V_{OLA}	V_{INA} = V_{IHA} or V_{ILA} V_{INB} = V_{IHB} or V_{ILB}	I_{OL} = 100μA	3.0	3.0	—	0.0	0.1	—	0.1	V
			I_{OL} = 24mA	3.0	3.0	—	—	0.36	—	0.44	
			I_{OL} = 12mA	2.7	3.0	—	—	0.36	—	0.44	
			I_{OL} = 24mA	2.7	4.5	—	—	0.42	—	0.5	
	V_{OLB}	V_{INA} = V_{IHA} or V_{ILA}	I_{OL} = 100μA	3.0	3.0	—	0.0	0.1	—	0.1	
			I_{OL} = 24mA	3.0	3.0	—	—	0.36	—	0.44	
			I_{OL} = 24mA	3.0	4.5	—	—	0.36	—	0.44	
3-State Output Off-State Current	I_{OZA}	V_{IN} = V_{IH} or V_{IL} $V_{I/OA}$ = V_{CCA} or GND		3.6	3.6	—	—	±0.5	—	±5.0	μA
				3.6	5.5	—	—	±0.5	—	±5.0	
	I_{OZB}	V_{IN} = V_{IH} or V_{IL} $V_{I/OB}$ = V_{CCB} or GND		3.6	3.6	—	—	±0.5	—	±5.0	
				3.6	5.5	—	—	±0.5	—	±5.0	
Input Leakage Current	I_{IN}	V_{IN} (DIR, $\overline{G}$) = V_{CCA} or GND		3.6	3.6	—	—	±0.1	—	±1.0	μA
				3.6	5.5	—	—	±0.1	—	±1.0	

DC characteristics (Continued)

PARAMETER	SYM-BOL	TEST CONDITION	V_{CCA} (V)	V_{CCB} (V)	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	Ta = −40~85°C MIN.	Ta = −40~85°C MAX.	UNIT
Quiescent Supply Current	I_{CCA1}	$V_{INA} = V_{CCA}$ or GND V_{INB} = Open, $\overline{G} = V_{CCA}$ DIR = V_{CCA}, V_{CCB} = Open	3.6	Open	—	—	5.0	—	50.0	μA
	I_{CCA2}	$V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND	3.6 3.6	3.6 5.5	— —	— —	5.0 5.0	—	50.0 50.0	
	I_{CCB}	$V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND	3.6 3.6	3.6 5.5	— —	— —	5.0 8.0	—	50.0 80.0	
	I_{CCT}	$V_{INA} = V_{CCA} - 0.6V$ $V_{INB} = V_{CCB} - 0.6V$ PER INPUT	3.6	3.6	—	—	0.35	—	0.50	mA

AC characteristics (Input $t_r = t_f = 3ns$, $C_L = 50pF$, $R_L = 500\Omega$)

PARAMETER	SYM-BOL	TEST CONDITION	V_{CCA} (V)	V_{CCB} (V)	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	Ta = −40~85°C MIN.	Ta = −40~85°C MAX.	UNIT
Propagation Delay Time (An⇒Bn)	t_{pLH}	Input : An Output : Bn (DIR = "H")	2.7~3.6	4.5~5.5	—	5.7	8.0	1.0	8.5	ns
	t_{pHL}		2.7~3.6	3.0~3.6	—	6.2	8.5	1.0	9.0	
3-State Output Enable Time ($\overline{G}$⇒Bn)	t_{pZL}		2.7~3.6	4.5~5.5	—	6.5	9.5	1.0	10.0	ns
	t_{pZH}		2.7~3.6	3.0~3.6	—	7.4	10.5	1.0	11.5	
3-State Output Disable Time ($\overline{G}$⇒Bn)	t_{pLZ}		2.7~3.6	4.5~5.5	—	7.3	9.5	1.0	10.0	ns
	t_{pHZ}		2.7~3.6	3.0~3.6	—	6.6	9.5	1.0	10.0	
Propagation Delay Time (Bn⇒An)	t_{pLH}	Input : Bn Output : An (DIR = "L")	2.7~3.6	4.5~5.5	—	4.6	7.5	1.0	8.0	ns
	t_{pHL}		2.7~3.6	3.0~3.6	—	5.2	7.5	1.0	8.0	
3-State Output Enable Time ($\overline{G}$⇒An)	t_{pZL}		2.7~3.6	4.5~5.5	—	7.0	10.5	1.0	11.5	ns
	t_{pZH}		2.7~3.6	3.0~3.6	—	7.0	10.5	1.0	11.5	
3-State Output Disable Time ($\overline{G}$⇒An)	t_{pLZ}		2.7~3.6	4.5~5.5	—	6.1	9.5	1.0	10.0	ns
	t_{pHZ}		2.7~3.6	3.0~3.6	—	6.0	9.5	1.0	10.0	
Output To Output Skew	t_{osLH}	(Note 2)	2.7~3.6	4.5~5.5	—	1.0	1.5	—	1.5	ns
	t_{osHL}		2.7~3.6	3.0~3.6	—	1.0	1.5	—	1.5	
Input Capacitance	C_{INA}	DIR, $\overline{G}$	3.3 ± 0.3	5.0 ± 0.5	—	5	10	—	10	pF
Bus Input Capacitance	$C_{I/O}$	An, Bn	3.3 ± 0.3	5.0 ± 0.5	—	8	—	—	—	pF
Power Dissipation Capacitance (Note 3)	C_{PDA}	A⇒B (DIR = "H")	3.3 ± 0.3	5.0 ± 0.5	—	4	—	—	—	pF
		B⇒A (DIR = "L")	3.3 ± 0.3	5.0 ± 0.5	—	38	—	—	—	
	C_{PDB}	A⇒B (DIR = "H")	3.3 ± 0.3	5.0 ± 0.5	—	88	—	—	—	
		B⇒A (DIR = "L")	3.3 ± 0.3	5.0 ± 0.5	—	7	—	—	—	

(Note 2) Parameter guaranteed by design.
($t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$)

(Note 3) C_{PD} 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 :

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

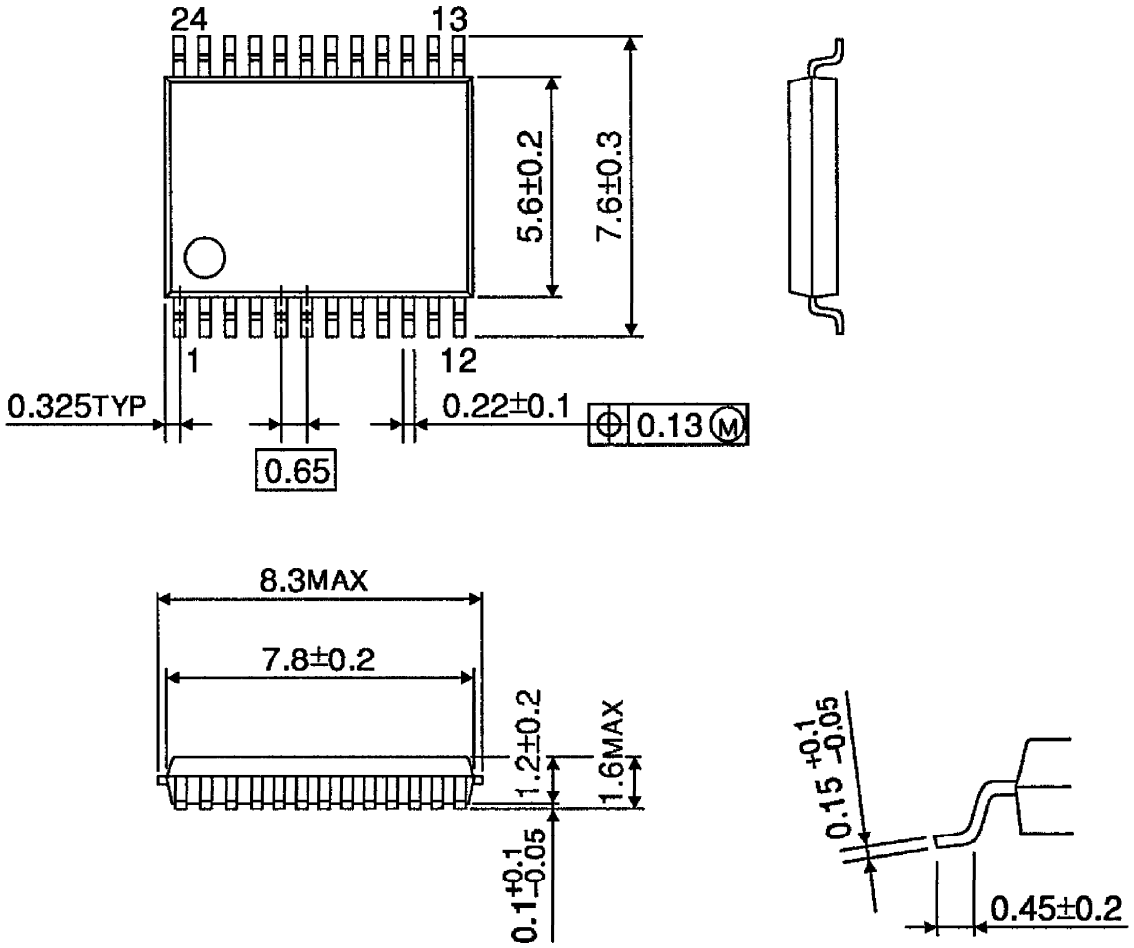
Noise characteristics (Ta = 25°C, Input $t_r = t_f = 3ns$, $C_L = 50pF$, $R_L = 500\Omega$)

PARAMETER	SYMBOL	TEST CONDITION	V_{CCA} (V)	V_{CCB} (V)	TYP.	LIMIT	UNIT
Quiet Output Maximum Dynamic V_{OL} (A)	V_{OLPA}	Input : Bn Output : An (DIR = "L")	3.3	3.3	—	0.9	V
			3.3	5.0	—	0.9	
Quiet Output Mimimum Dynamic V_{OL} (A)	V_{OLVA}		3.3	3.3	—	−0.9	V
			3.3	5.0	—	−0.9	
Quiet Output Maximum Dynamic V_{OL} (B)	V_{OLPB}	Input : An Output : Bn (DIR = "H")	3.3	3.3	—	0.8	V
			3.3	5.0	—	1.5	
Quiet Output Mimimum Dynamic V_{OL} (B)	V_{OLVB}		3.3	3.3	—	−0.8	V
			3.3	5.0	—	−1.2	
Minimum High Level Dynamic Input Voltage V_{IH} (A)	V_{IHDA}	Input : An	3.3	3.3	—	2.0	V
			3.3	5.0	—	2.0	
Maximum Low Level Dynamic Input Voltage V_{IL} (A)	V_{ILDA}	Input : An	3.3	3.3	—	0.8	V
			3.3	5.0	—	0.8	
Minimum High Level Dynamic Input Voltage V_{IH} (B)	V_{IHDB}	Input : Bn	3.3	3.3	2.0	—	V
			3.3	5.0	3.5	—	
Maximum Low Level Dynamic Input Voltage V_{IL} (B)	V_{ILDB}	Input : Bn	3.3	3.3	0.8	—	V
			3.3	5.0	1.5	—	

OUTLINE DRAWING

SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14g (Typ.)