TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74LCX245F, TC74LCX245FT, TC74LCX245FK

Low-Voltage Octal Bus Transceiver with 5-V Tolerant Inputs and Outputs

The TC74LCX245 is a high-performance CMOS octal bus transceiver. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

The device is designed for low-voltage (3.3 V) VCC applications, but it could be used to interface to 5-V supply environment for both inputs and outputs.

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 busses are effectively isolated.

All inputs are equipped with protection circuits against static discharge.

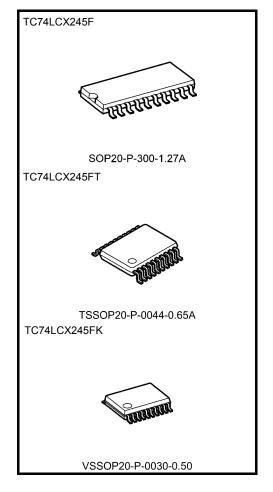
Features (Note)

- Low-voltage operation: VCC = 1.65 to 3.6 V
- High-speed operation: $t_{pd} = 7.0 \text{ ns (max) (V}_{CC} = 3.0 \text{ to } 3.6 \text{ V})$
- Ouput current: $|I_{OH}|/I_{OL} = 24 \text{ mA (min) (V}_{CC} = 3.0 \text{ V)}$
- Latch-up performance: $> \pm 500 \text{ mA}$
- Available in JEITA SOP, TSSOP and VSSOP (US)
- Bidirectional interface between 5.0 V and 3.3 V signals
- · Power-down protection provided on all inputs and outputs
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 245 type

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

All floating (high impedance) bus pins must have their

input levels fixed by means of pull-up or pull-down resistors.

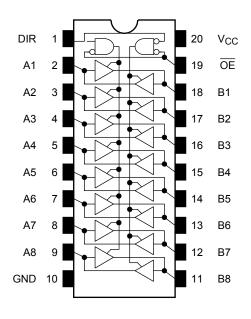


Weight

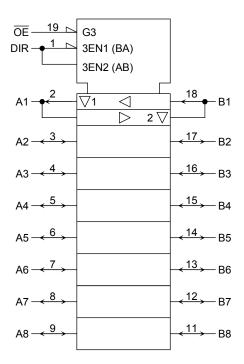
SOP20-P-300-1.27A : 0.22g (typ.) TSSOP20-P-0044-0.65A : 0.08 g (typ.) VSSOP20-P-0030-0.50 : 0.03 g (typ.)

Note: The Electrical Characteristics of V_{CC} =1.8±0.15V is only applicable for products which manufactured from January 2009 onward.

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

Inputs		Outputs	Function		
ŌĒ	DIR	Outputs	A-Bus	B-Bus	
L	L	A = B	Output	Input	
L	Н	B=A	Input	Output	
Н	Х	Z	Z		

X: Don't care

Z: High impedance



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V _{CC}	–0.5 to 7.0	V
DC input voltage (DIR, $\overline{\text{OE}}$)	V _{IN}	-0.5 to 7.0	V
		-0.5 to 7.0 (Note 2)	
DC bus I/O voltage	V _{I/O}	-0.5 to V _{CC} + 0.5 (Note 3)	V
Input diode current	l _{IK}	-50	mA
Output diode current	lok	±50 (Note 4)	mA
DC output current	lout	±50	mA
Power dissipation	PD	180	mW
DC V _{CC} /ground current	I _{CC} /I _{GND}	±100	mA
Storage temperature	T _{stg}	–65 to 150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: Output in OFF state

Note 3: High or low state. IOUT absolute maximum rating must be observed.

Note 4: $V_{OUT} < GND, V_{OUT} > V_{CC}$

Operating Ranges (Note 1)

Characteristics	Symbol	Rating	Unit	
Power supply voltage	Voc	1.65 to 3.6	V	
Fower supply voltage	V _{CC}	1.5 to 3.6 (Note 2)	V	
Input voltage (DIR, $\overline{\sf OE}$)	V _{IN}	0 to 5.5	V	
Bus I/O voltage	Vivo	0 to 5.5 (Note 3)	V	
Bus 1/O Vollage	V _{I/O}	0 to V _{CC} (Note 4)		
Output current	IOH/IOI	±24 (Note 5)	mA	
Output current	IOH/IOL	±12 (Note 6)	ША	
Operating temperature	T _{opr}	-40 to 85	°C	
Input rise and fall time	dt/dv	0 to 10 (Note 7)	ns/V	

Note 1: The operating ranges are required to ensure the normal operation of the device. Unused inputs and bus inputs must be tied to either V_{CC} or GND. Please connect both bus inputs and the bus outputs with V_{CC} or GND when the I/O of the bus terminal changes by the function. In this case, please note that the output is not short-circuited.

Note 2: Data retention only

Note 3: Output in OFF state

Note 4: High or low state

Note 5: $V_{CC} = 3.0 \text{ to } 3.6 \text{ V}$

Note 6: $V_{CC} = 2.7 \text{ to } 3.0 \text{ V}$

Note 7: $V_{IN} = 0.8$ to 2.0 V, $V_{CC} = 3.0$ V



Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Characteristics		Symbol	Test Condition V _{CC} (V)			Min	Max	Unit
		Cymbol			V _{CC} (V)	IVIIII	IVIAX	Offic
					1.65 to 2.3	V _{CC} × 0.9	_	
	H-level	V _{IH}	_	_		1.7	_	
Input voltage					2.7 to 3.6	2.0	_	٧
input voltage					1.65 to 2.3	_	V _{CC} × 0.1	
	L-level	VIL	_		2.3 to 2.7	_	0.7	
					2.7 to 3.6	_	0.8	
				$I_{OH} = -100 \mu A$	1.65 to 3.6	V _{CC} -0.2	_	
				I _{OH} = -4 mA	1.65	1.05	_	
	II level		\ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	I _{OH} = -8 mA	2.3	1.7	_	. V
	H-level	VoH	$V_{IN} = V_{IH}$ or V_{IL}	I _{OH} = -12 mA	2.7	2.2	_	
				$I_{OH} = -18 \text{ mA}$	3.0	2.4	_	
Output voltage				I _{OH} = -24 mA	3.0	2.2	_	
Output voltage			V _{IN} = V _{IH} or V _{IL}	$I_{OL} = 100 \mu A$	1.65 to 3.6	_	0.2	
				I _{OL} = 4 mA	1.65	_	0.45	
	Lieusi	.,		I _{OL} = 8 mA	2.3	_	0.7	
	L-level	V _{OL}		$I_{OL} = 12 \text{ mA}$	2.7	_	0.4	
				I _{OL} = 16 mA	3.0		0.4	
				I _{OL} = 24 mA	3.0	_	0.55	
Input leakage current	Input leakage current		V _{IN} = 0 to 5.5 V		1.65 to 3.6	_	±5.0	μА
3-state output OFF state current		loz	V _{IN} = V _{IH} or V _{IL} V _{OUT} = 0 to 5.5 V		1.65 to 3.6	_	±5.0	μА
Power-off leakage current		l _{OFF}	V _{IN} /V _{OUT} = 5.5 V		0	_	10.0	μА
Quiggaant gupply gurrent		Icc	V _{IN} = V _{CC} or GND		1.65 to 3.6	_	10.0	
Quiescent supply cult	Quiescent supply current		V _{IN} /V _{OUT} = 3.6 to 5.5 V		1.65 to 3.6	_	±10.0	μΑ
Increase in I _{CC} per inp	out	Δlcc	$V_{IH} = V_{CC} - 0.6 V$		2.7 to 3.6	_	500	



AC Characteristics ($Ta = -40 \text{ to } 85^{\circ}\text{C}$)

Characteristics	Symbol Test Condition			Min	Max	Unit
Characteristics	Syllibol	rest Condition	V _{CC} (V)	IVIIII	IVIAX	Offic
			1.8 ± 0.15	_	25.0	ns
Propagation delay time	t _{pLH}	Figure 1, Figure 2	2.5 ± 0.2		9.0	
Propagation delay time	t _{pHL}	ir igure 1, r igure 2	2.7		8.0	
			3.3 ± 0.3	1.5	7.0	
				_	34.0	
Output anable time	t _{pZL} t _{pZH}	Figure 1, Figure 3	2.5 ± 0.2	_	17.0	ns
Output enable time			2.7	_	9.5	
			3.3 ± 0.3	1.5	8.5	
	t _{pLZ}	Figure 1, Figure 3	1.8 ± 0.15	_	32.0	
Output disable time			2.5 ± 0.2	_	16.0	20
Output disable time			2.7	_	8.5	ns
			3.3 ± 0.3	1.5	7.5	
Output to output allow	t _{osLH}		2.7	_	_	no
Output to output skew	t _{osHL}	(Note)	3.3 ± 0.3	_	1.0	ns

Note: Parameter guaranteed by design.

 $(t_{\text{OSLH}} = |t_{\text{pLHm}} - t_{\text{pLHn}}|, \ t_{\text{OSHL}} = |t_{\text{pHLm}} - t_{\text{pHLn}}|)$



Dynamic Switching Characteristics (Ta = 25°C, input: $t_r = t_f = 2.5$ ns, $C_L = 50$ pF, $R_L = 500$ Ω)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Тур.	Unit
Quiet output maximum dynamic V _{OL}	V _{OLP}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	$V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$	3.3	0.8	V

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Тур.	Unit
Input capacitance	C _{IN}	DIR, OE	3.3	7	pF
Bus input capacitance	C _{I/O}	An, Bn	3.3	8	pF
Power dissipation capacitance	C _{PD}	f _{IN} = 10 MHz (Not	3.3	25	pF

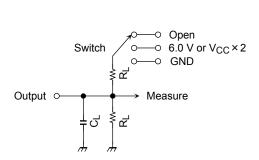
Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

Average operating current can be obtained by the equation:

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



AC Test Circuit



Parameter	Switch				
t _{pLH} , t _{pHL}	Open				
	6.0 V	$@V_{CC}=3.3\pm0.3V$			
t., = t.=.		@V _{CC} =2.7V			
t _{pLZ} , t _{pZL}	V _{CC} ×2	@V _{CC} =2.5±0.2V			
		$@V_{CC}=1.8\pm0.15V$			
t _{pHZ} , t _{pZH}		GND			

Figure 1

AC Waveform

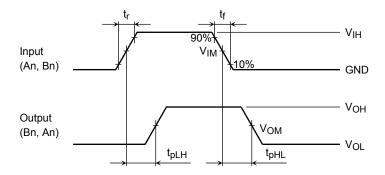


Figure 2 t_{pLH} , t_{pHL}

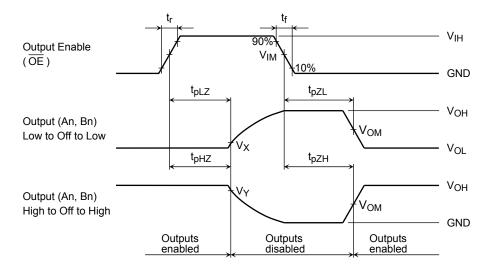


Figure 3 t_{pLZ} , t_{pHZ} , t_{pZL} , t_{pZH}

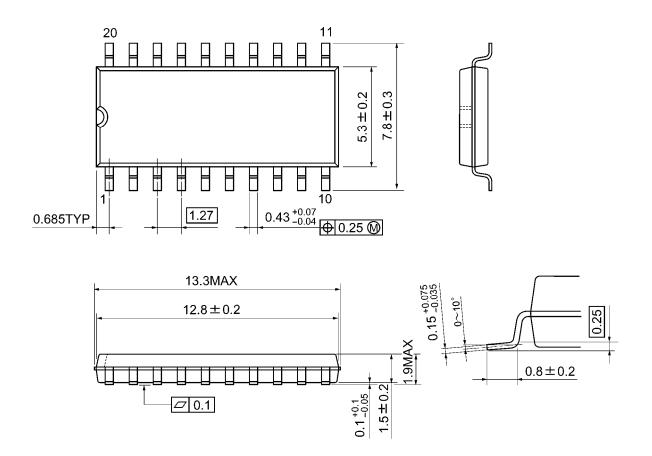
		V _{CC}				
	Symbol	$3.3\pm0.3~\textrm{V}$	2.5 ± 0.2 V	1.8 ± 0.15 V		
		2.7V	2.5 ± 0.2 V	1.6 ± 0.15 V		
Input	V _{IH}	2.7V	V _{CC}	V _{CC}		
	V _{IM}	1.5V	V _{CC} /2	V _{CC} /2		
	t _r , t _f	2.5ns	2.0ns	2.0ns		
Output	V _{OM}	1.5V	V _{OH} /2	V _{OH} /2		
	V _X	V _{OL} +0.3V	V _{OL} +0.15V	V _{OL} +0.15V		
	VY	V _{OH} -0.3V	V _{OL} -0.15V	V _{OL} -0.15V		
Load	C_L	50pF	30pF	30pF		
	RL	500Ω	500Ω	1kΩ		

8



Package Dimensions

SOP20-P-300-1.27A Unit: mm

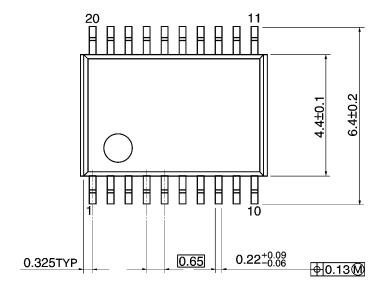


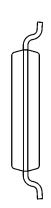
Weight: 0.22 g (typ.)

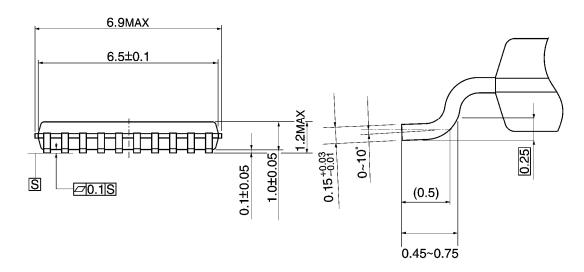
Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm





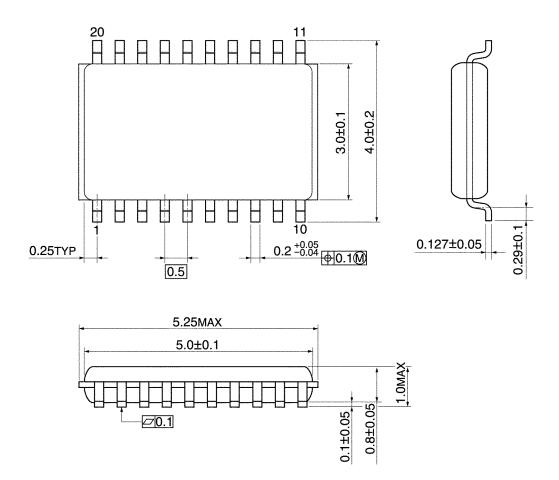


Weight: 0.08 g (typ.)



Package Dimensions

VSSOP20-P-0030-0.50 Unit: mm



Weight: 0.03 g (typ.)

RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively "TOSHIBA"), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively "Product") without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.
- PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE
 EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH
 MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT
 ("UNINTENDED USE"). Except for specific applications as expressly stated in this document, Unintended Use includes, without
 limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for
 automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions,
 safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. IF YOU USE
 PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT. For details, please contact your
 TOSHIBA sales representative.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any
 applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE
 FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY
 WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR
 LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND
 LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO
 SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS
 FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without
 limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile
 technology products (mass destruction weapons). Product and related software and technology may be controlled under the
 applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the
 U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited
 except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
 Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES
 OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.

12

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Toshiba:

TC74LCX245FK

ПОСТАВКА ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001 Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

Данный компонент на территории Российской Федерации Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru_6 moschip.ru_4 moschip.ru_9