

TC74LCX245F, TC74LCX245FW, TC74LCX245FT

LOW VOLTAGE OCTAL BUS TRANSCEIVER WITH 5V TOLERANT INPUTS AND OUTPUTS

The TC74LCX245 is a high performance CMOS OCTAL BUS TRANSCEIVER. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

The device is designed for low-voltage (3.3V) V_{CC} applications, but it could be used to interface to 5V 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.

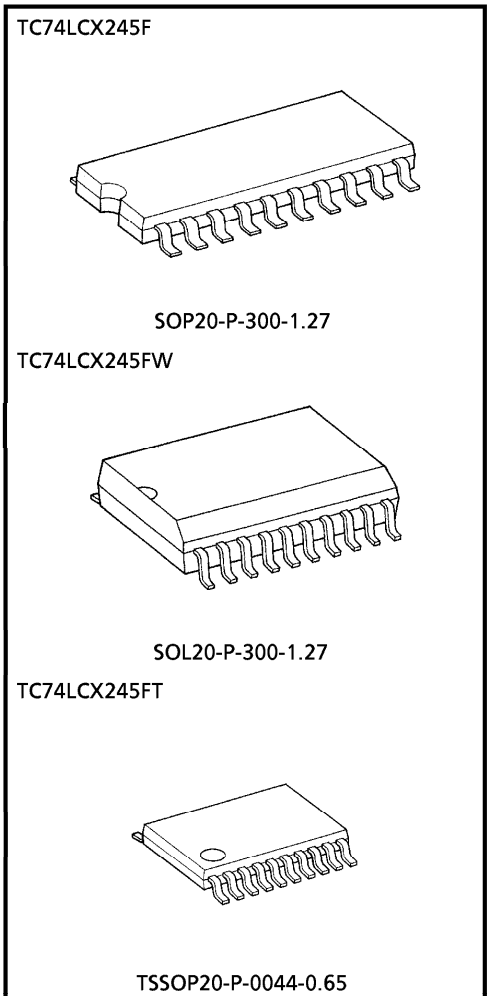
All inputs are equipped with protection circuits against static discharge.

FEATURES

- Low voltage operation : $V_{CC} = 2.0 \sim 3.6V$
- High speed operation : $t_{pd} = 7.0ns$ (Max.)
($V_{CC} = 3.0 \sim 3.6V$)
- Output current : $|I_{OH}| / I_{OL} = 24mA$ (Min.)
($V_{CC} = 3.0V$)
- Latch-up performance : $\pm 500mA$
- Available in JEDEC SOP, JEITA SOP and TSSOP
- Bidirectional interface between 5V and 3.3V signals.
- Power down protection is 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 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.

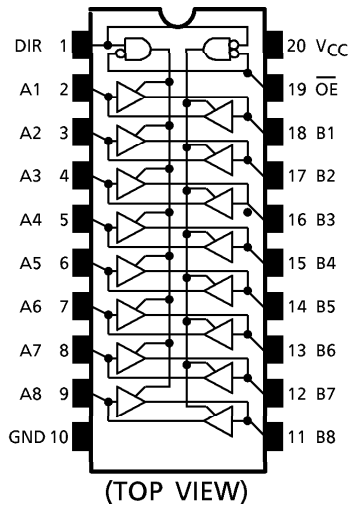
(Note) The JEDEC SOP (FW) is not available in Japan.



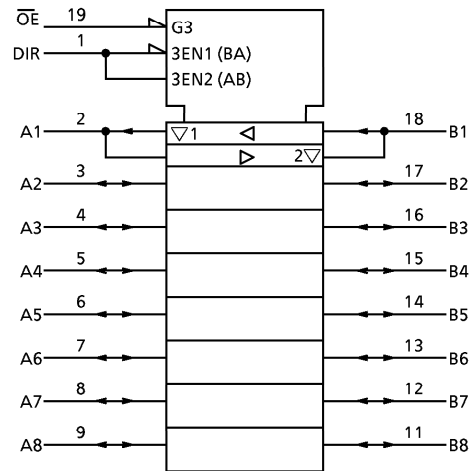
Weight

SOP20-P-300-1.27	: 0.22g (Typ.)
SOL20-P-300-1.27	: 0.46g (Typ.)
TSSOP20-P-0044-0.65	: 0.08g (Typ.)

PIN ASSIGNMENT



IEC LOGIC SYMBOL



TRUTH TABLE

INPUTS		OUTPUTS	FUNCTION	
\overline{OE}	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

MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage Range	V_{CC}	-0.5~7.0	V
DC Input Voltage (DIR, \overline{OE})	V_{IN}	-0.5~7.0	V
DC Bus I/O Voltage	$V_{I/O}$	-0.5~7.0 (Note 1)	V
		-0.5~ $V_{CC} + 0.5$ (Note 2)	
Input Diode Current	I_{IK}	-50	mA
Output Diode Current	I_{OK}	±50 (Note 3)	mA
DC Output Current	I_{OUT}	±50	mA
Power Dissipation	P_D	180	mW
DC V_{CC} /Ground Current	I_{CC}/I_{GND}	±100	mA
Storage Temperature	T_{stg}	-65~150	°C

(Note 1) Output in Off-State
 (Note 2) High or Low State. I_{OUT} absolute maximum rating must be observed.
 (Note 3) $V_{OUT} < GND, V_{OUT} > V_{CC}$

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	2.0~3.6	V
		1.5~3.6 (Note 4)	
Input Voltage (DIR, \overline{OE})	V_{IN}	0~5.5	V
Bus I/O Voltage	$V_{I/O}$	0~5.5 (Note 5)	V
		0~ V_{CC} (Note 6)	
Output Current	I_{OH}/I_{OL}	± 24 (Note 7)	mA
		± 12 (Note 8)	
Operating Temperature	T_{opr}	-40~85	$^{\circ}C$
Input Rise And Fall Time	dt/dv	0~10 (Note 9)	ns/V

(Note 4) Data Retention Only

(Note 5) Output in Off-State

(Note 6) High or Low State

(Note 7) $V_{CC} = 3.0\sim 3.6V$ (Note 8) $V_{CC} = 2.7\sim 3.0V$ (Note 9) $V_{IN} = 0.8\sim 2.0V$, $V_{CC} = 3.0V$

ELECTRICAL CHARACTERISTICS

DC characteristics ($T_a = -40\sim 85^{\circ}C$)

PARAMETER		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT	
				V_{CC} (V)				
Input Voltage	"H" Level	V_{IH}		2.7~3.6	2.0	—	V	
	"L" Level	V_{IL}		2.7~3.6	—	0.8		
Output Voltage	"H" Level	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -100\mu A$	2.7~3.6	$V_{CC} - 0.2$	—	V
				$I_{OH} = -12mA$	2.7	2.2	—	
				$I_{OH} = -18mA$	3.0	2.4	—	
				$I_{OH} = -24mA$	3.0	2.2	—	
	"L" Level	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100\mu A$	2.7~3.6	—	0.2	
				$I_{OL} = 12mA$	2.7	—	0.4	
				$I_{OL} = 16mA$	3.0	—	0.4	
				$I_{OL} = 24mA$	3.0	—	0.55	
Input Leakage Current	I_{IN}		$V_{IN} = 0\sim 5.5V$	2.7~3.6	—	± 5.0	μA	
3-State Output Off-State Current	I_{OZ}		$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0\sim 5.5V$	2.7~3.6	—	± 5.0	μA	
Power Off Leakage Current	I_{OFF}		$V_{IN} / V_{OUT} = 5.5V$	0	—	10.0	μA	
Quiescent Supply Current	I_{CC}		$V_{IN} = V_{CC}$ or GND	2.7~3.6	—	10.0	μA	
			$V_{IN} / V_{OUT} = 3.6\sim 5.5V$	2.7~3.6	—	± 10.0		
Increase In I_{CC} Per Input	ΔI_{CC}		$V_{IH} = V_{CC} - 0.6V$	2.7~3.6	—	500	μA	

AC characteristic (Ta = -40~85°C)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	MIN.	MAX.	UNIT
Propagation Delay Time	t _{pLH}	(Fig.1, 2)	2.7	—	8.0	ns
	t _{pHL}		3.3 ± 0.3	1.5	7.0	
Output Enable Time	t _{pZL}	(Fig.1, 3)	2.7	—	9.5	ns
	t _{pZH}		3.3 ± 0.3	1.5	8.5	
Output Disable Time	t _{pLZ}	(Fig.1, 3)	2.7	—	8.5	ns
	t _{pHZ}		3.3 ± 0.3	1.5	7.5	
Output To Output Skew	t _{osLH}	(Note 10)	2.7	—	—	ns
	t _{osHL}		3.3 ± 0.3	—	1.0	

(Note 10) Parameter guaranteed by design.
 (t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)

DYNAMIC SWITCHING CHARACTERISTICS (Ta = 25°C, Input t_r = t_f = 2.5ns, C_L = 50pF, R_L = 500Ω)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	TYP.	UNIT
Quiet Output Maximum Dynamic V _{OL}	V _{OLP}	V _{IH} = 3.3V, V _{IL} = 0V	3.3	0.8	V
Quiet Output Minimum Dynamic V _{OL}	V _{OLV}	V _{IH} = 3.3V, V _{IL} = 0V	3.3	0.8	V

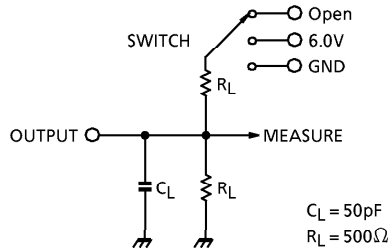
CAPACITIVE CHARACTERISTICS (Ta = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	TYP.	UNIT
Input Capacitance	C _{IN}	DIR, \overline{OE}	3.3	7	pF
Bus Input Capacitance	C _{I/O}	An, Bn	3.3	8	pF
Power Dissipation Capacitance	C _{PD}	f _{IN} = 10MHz (Note 11)	3.3	25	pF

(Note 11) 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 :
 $I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8$ (per bit)

TEST CIRCUIT

Fig.1



PARAMETER	SWITCH
t_{pLH}, t_{pHL}	Open
t_{pLZ}, t_{pZL}	6.0V
t_{pHZ}, t_{pZH}	GND

AC WAVEFORM

Fig.2 t_{pLH}, t_{pHL}

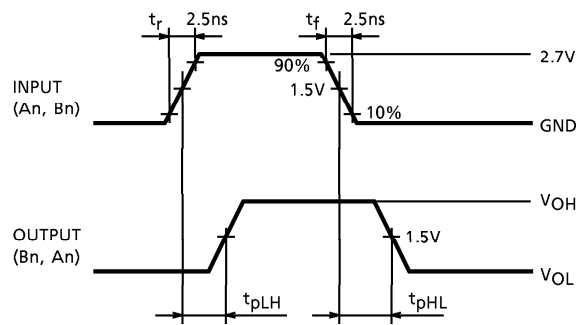
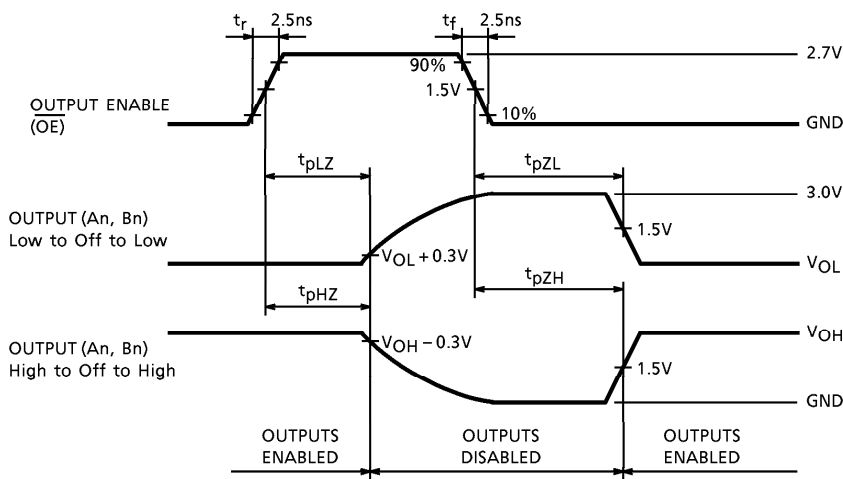
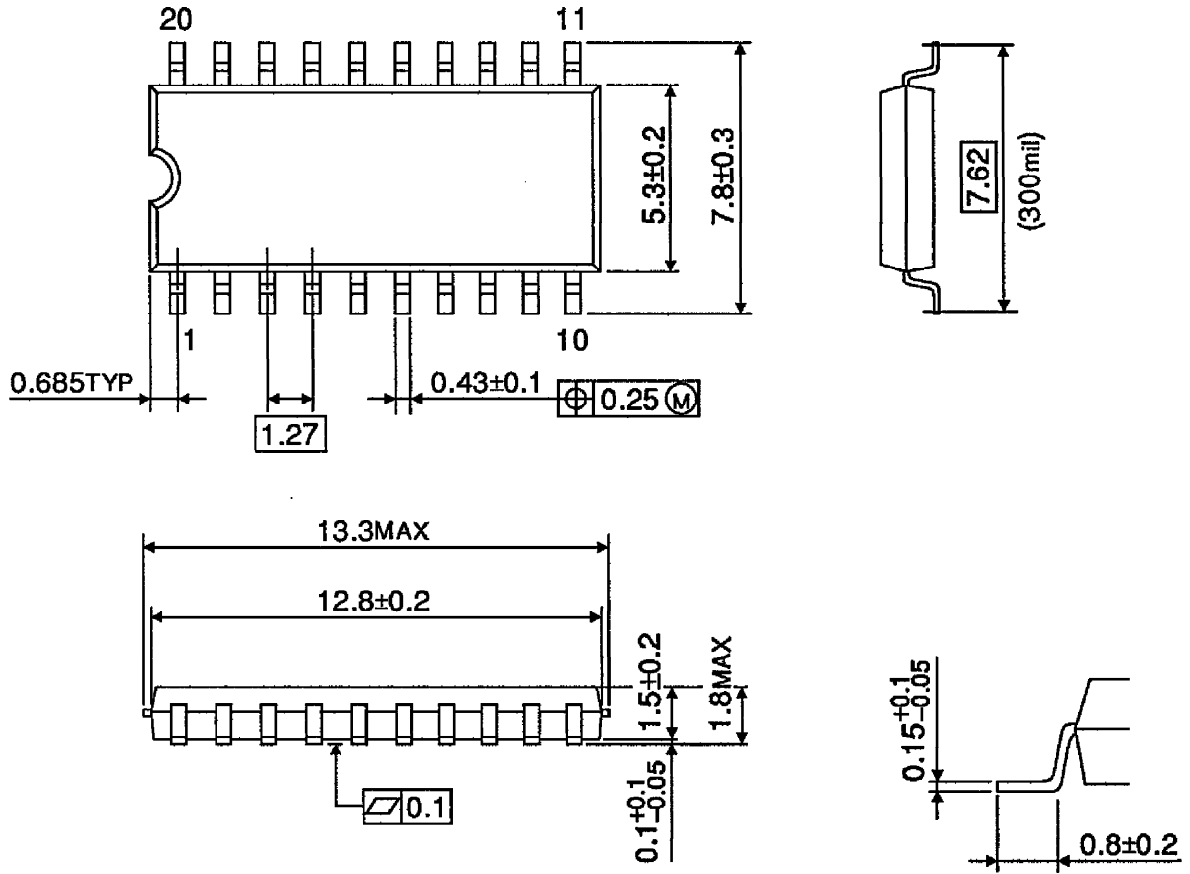


Fig.3 $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$



PACKAGE DIMENSIONS
SOP20-P-300-1.27

Unit : mm

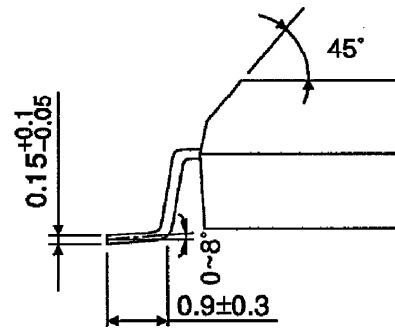
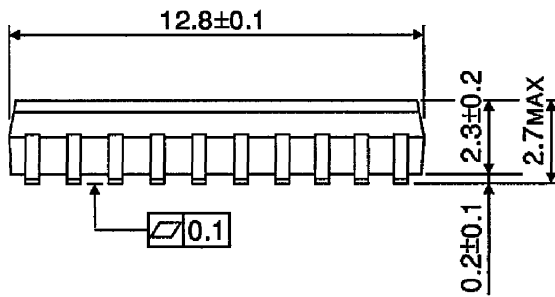
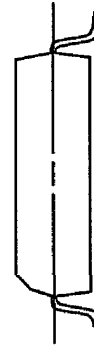
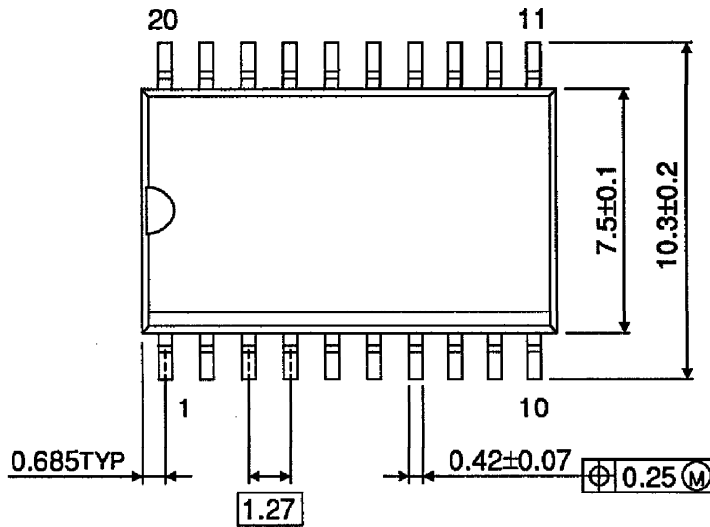


Weight : 0.22g (Typ.)

PACKAGE DIMENSIONS
SOL20-P-300-1.27

Unit : mm

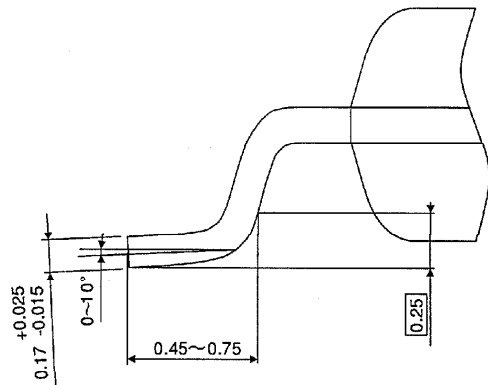
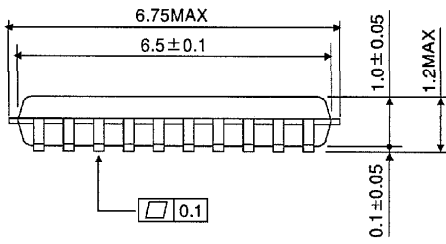
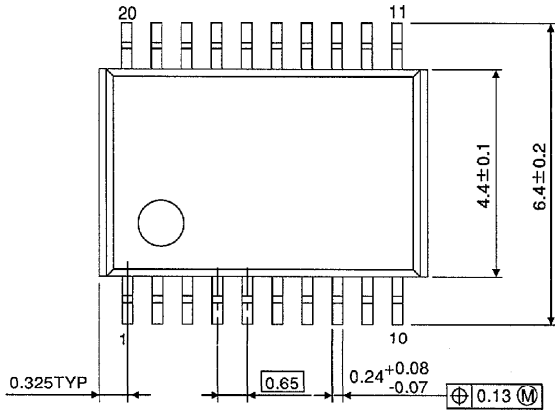
(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)

PACKAGE DIMENSIONS
TSSOP20-P-0044-0.65

Unit : mm



Weight : 0.08g (Typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.