TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74LCX245F, TC74LCX245FW, TC74LCX245FT

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

The TC74LCX245 is a high parformance 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.

TC74LCX245F

SOP20-P-300-1.27

TC74LCX245FW

SOL20-P-300-1.27

TC74LCX245FT
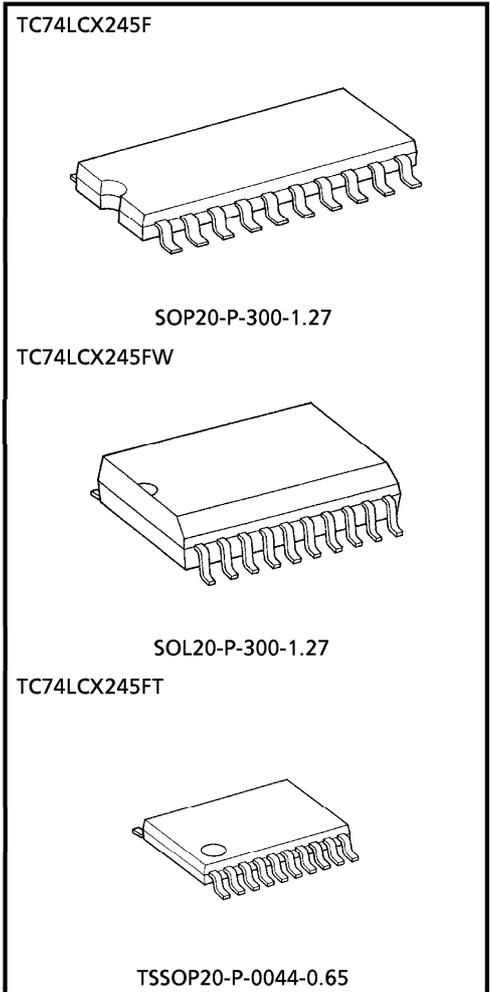
TSSOP20-P-0044-0.65

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.)

2001-05-17

TOSHIBA

TC74LCX245F/FW/FT

PIN ASSIGNMENT

(TOP VIEW)
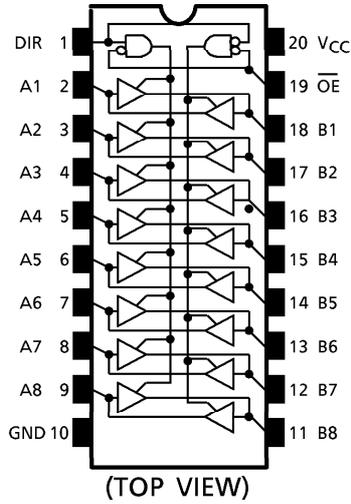
IEC LOGIC SYMBOL
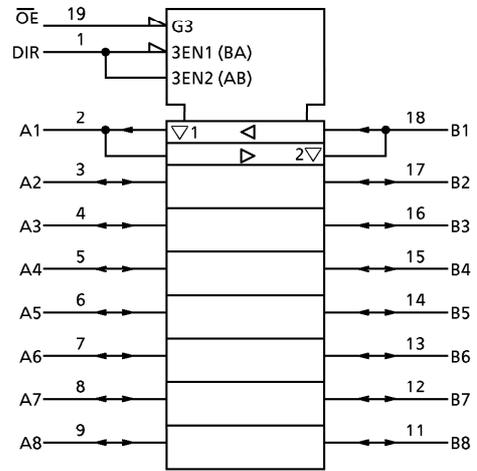
TRUTH TABLE

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}	$-0.5 \sim 7.0$	V
DC Input Voltage (DIR, $\overline{OE}$)	V_{IN}	$-0.5 \sim 7.0$	V
DC Bus I/O Voltage	$V_{I/O}$	$-0.5 \sim 7.0$ (Note 1)	V
		$-0.5 \sim V_{CC}+0.5$ (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}	$-65 \sim 150$	°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		°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) $V_{CC} = 3.0~3.6V$
(Note 8) $V_{CC} = 2.7~3.0V$
(Note 9) $V_{IN} = 0.8~2.0V$, $V_{CC} = 3.0V$

ELECTRICAL CHARACTERISTICS

DC characteristics (Ta = −40~85°C)

PARAMETER		SYMBOL	TEST CONDITION		V_{CC} (V)	MIN.	MAX.	UNIT
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}	$V_{IN} = 0~5.5V$		2.7~3.6	—	±5.0	μA
3-State Output Off-State Current		I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0~5.5V$		2.7~3.6	—	±5.0	μA
Power Off Leakage Cuurent		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
			$V_{IN}/V_{OUT} = 3.6~5.5V$		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

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AC characteristic (Ta = $-40\sim85°C$)

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 $t_r = t_f = 2.5ns$, $C_L = 50pF$, $R_L = 500\Omega$)

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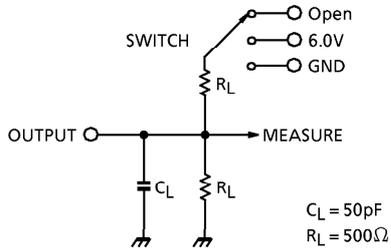
PARAMETER	SWITCH
t_{pLH}, t_{pHL}	Open
t_{pLZ}, t_{pZL}	6.0V
t_{pHZ}, t_{pZH}	GND

$C_L = 50pF$
$R_L = 500\Omega$

AC WAVEFORM

Fig.2 t_{pLH}, t_{pHL}
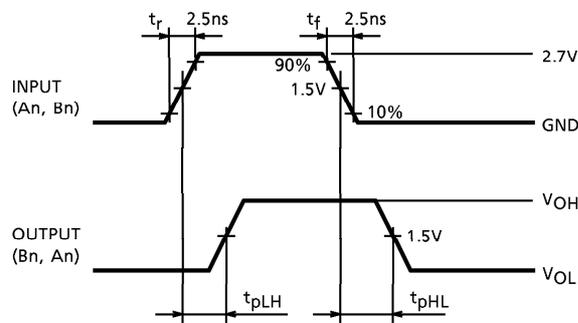
Fig.3 t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}
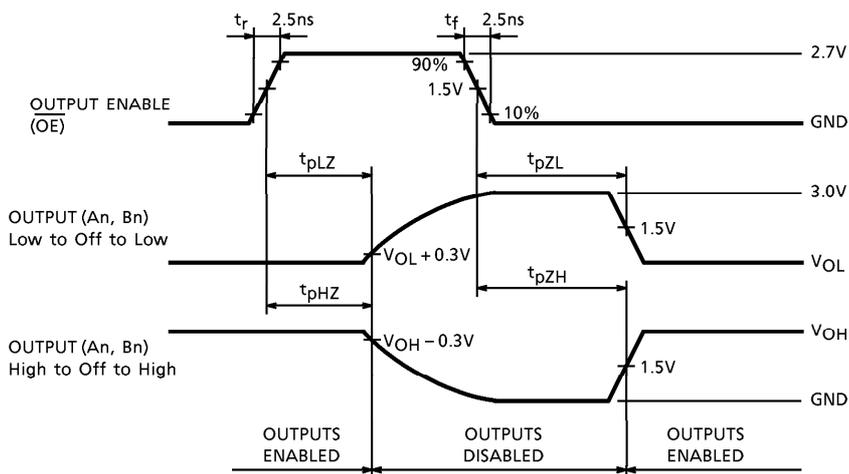
PACKAGE DIMENSIONS
SOP20-P-300-1.27   Unit : mm
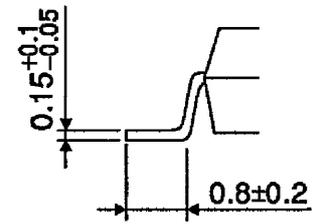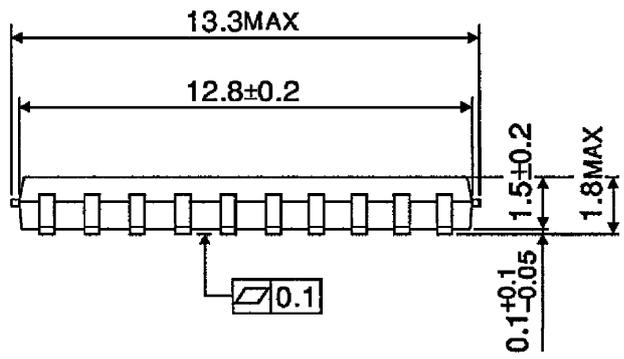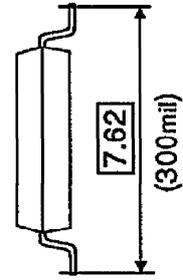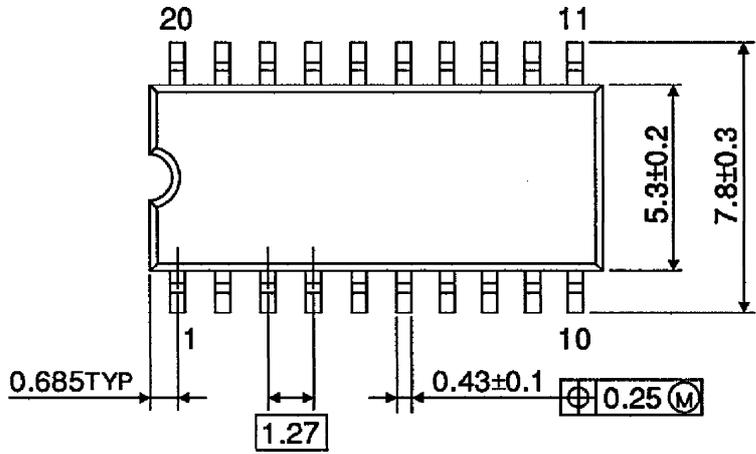
Weight : 0.22g (Typ.)

PACKAGE DIMENSIONS

SOL20-P-300-1.27

Unit : mm

(Note) This package is not available in Japan.
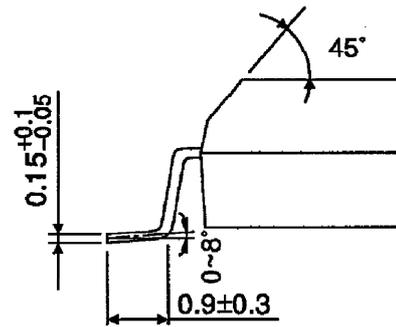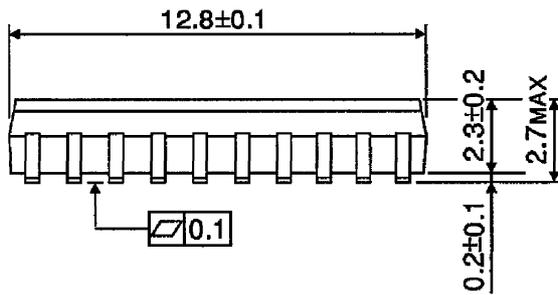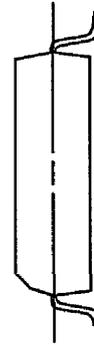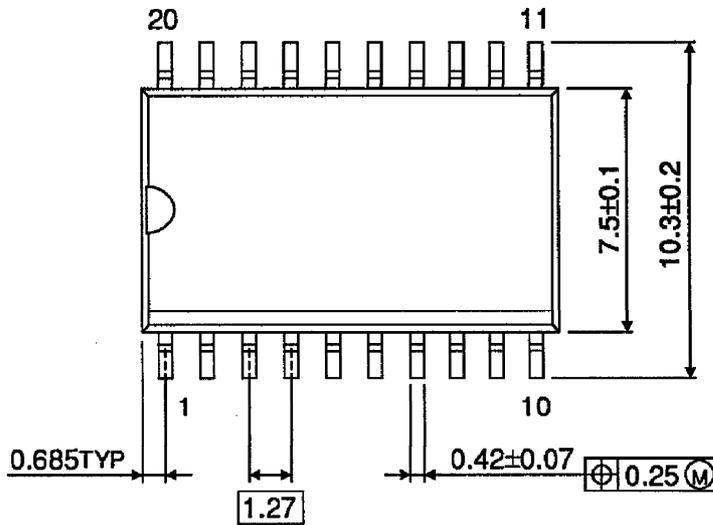
Weight : 0.46g (Typ.)

PACKAGE DIMENSIONS
TSSOP20-P-0044-0.65

Unit : mm
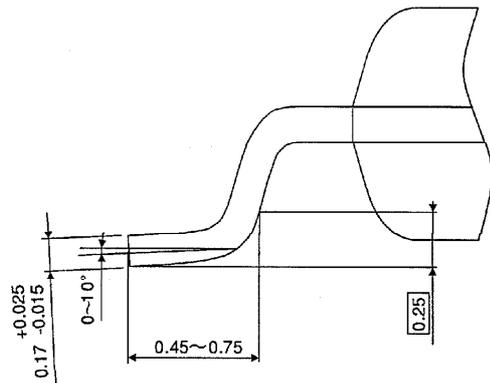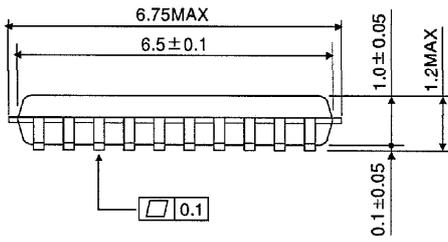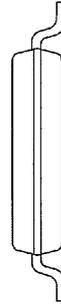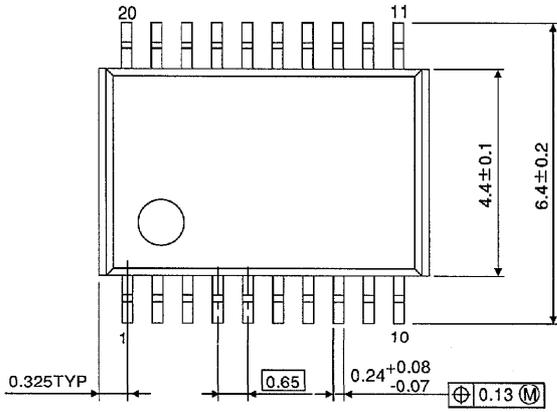
Weight : 0.08g (Typ.)

RESTRICTIONS ON PRODUCT USE