N *National Semiconductor*

74LCX245
Low-Voltage Bidirectional Transceiver
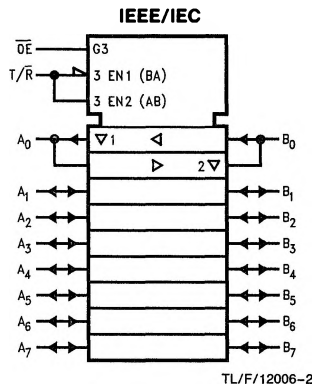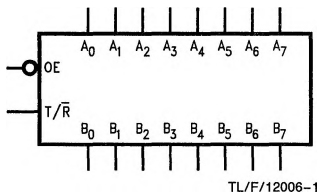# with 5V Tolerant Inputs and Outputs

General Description

The LCX245 contains eight non-inverting bidirectional buffers with TRI-STATE® outputs and is intended for bus oriented applications. The device is designed for low voltage (3.3V) V_{CC} applications with capability of interfacing to a 5V signal environment. The T/$\overline{R}$ input determines the direction of data flow through the device. The $\overline{OE}$ input disables both the A and B ports by placing them in a high impedance state.

The LCX245 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.
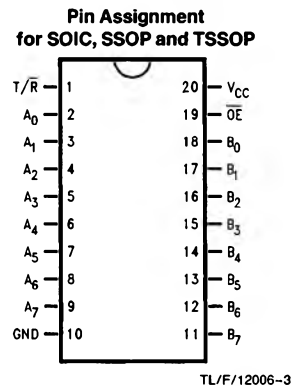
Features

- 5V tolerant inputs and outputs
- 7.0 ns t_{PD} max, 10 μA I_{CCQ} max
- Power down high impedance inputs and outputs
- 2.0V–3.6V V_{CC} supply operation
- ±24 mA output drive
- Implements patented Quiet Series™ noise/EMI reduction circuitry
- Functionally compatible with the 74 series 245
- Latch-up performance exceeds 500 mA
- ESD performance:
  Human body model > 2000V
  Machine model > 200V

Logic Symbols

TL/F/12006–1

IEEE/IEC

TL/F/12006–2

Connection Diagram

Pin Assignment
for SOIC, SSOP and TSSOP

TL/F/12006–3

Pin Names	Description
$\overline{OE}$	Output Enable Input
T/$\overline{R}$	Transmit/Receive Input
A_0–A_7	Side A Inputs or TRI-STATE Outputs
B_0–B_7	Side B Inputs or TRI-STATE Outputs

	SOIC JEDEC	SOIC EIAJ	SSOP Type II	TSSOP JEDEC
Order Number	74LCX245WM 74LCX245WMX	74LCX245SJ 74LCX245SJX	74LCX245MSA 74LCX245MSAX	74LCX245MTC 74LCX245MTCX
See NS Package Number	M20B	M20D	MSA20	MTC20

Truth Table

Inputs		Outputs
$\overline{OE}$	T/$\overline{R}$	
L	L	Bus $B_0 - B_7$ Data to Bus $A_0 - A_7$
L	H	Bus $A_0 - A_7$ Data to Bus $B_0 - B_7$
H	X	HIGH Z State on $A_0 - A_7$, $B_0 - B_7$

H = High Voltage Level
L = Low Voltage Level
X = Immaterial
Z = High Impedance

Logic Diagram
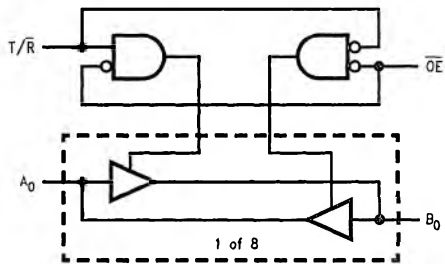
TL/F/12006–4

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Symbol	Parameter	Value	Conditions	Units
V_{CC}	Supply Voltage	-0.5 to $+7.0$		V
V_I	DC Input Voltage	-0.5 to $+7.0$		V
V_O	DC Output Voltage	-0.5 to $+7.0$	Output in TRI-STATE	V
		-0.5 to $V_{CC} + 0.5$	Output in High or Low State (Note 2)	V
I_{IK}	DC Input Diode Current	-50	$V_I <$ GND	mA
I_{OK}	DC Output Diode Current	-50 $+50$	$V_O <$ GND $V_O > V_{CC}$	mA
I_O	DC Output Source/Sink Current	±50		mA
I_{CC}	DC Supply Current per Supply Pin	±100		mA
I_{GND}	DC Ground Current per Ground Pin	±100		mA
T_{STG}	Storage Temperature	-65 to $+150$		°C

Note 1: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: I_O Absolute Maximum Rating must be observed.

Recommended Operating Conditions

Symbol	Parameter		Min	Max	Units
V_{CC}	Supply Voltage	Operating Data Retention	2.0 1.5	3.6 3.6	V
V_I	Input Voltage		0	5.5	V
V_O	Output Voltage	HIGH or LOW State TRI-STATE	0 0	V_{CC} 5.5	V
I_{OH}/I_{OL}	Output Current	$V_{CC} = 3.0V - 3.6V$ $V_{CC} = 2.7V$		±24 ±12	mA
T_A	Free-Air Operating Temperature		-40	85	°C
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8V–2.0V$, $V_{CC} = 3.0V$		0	10	ns/V

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = -40°C$ to $+85°C$ Min	Max	Units
V_{IH}	HIGH Level Input Voltage		2.7–3.6	2.0		V
V_{IL}	LOW Level Input Voltage		2.7–3.6		0.8	V
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100\ \mu A$	2.7–3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -12$ mA	2.7	2.2		V
		$I_{OH} = -18$ mA	3.0	2.4		V
		$I_{OH} = -24$ mA	3.0	2.2		V
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100\ \mu A$	2.7–3.6		0.2	V
		$I_{OL} = 12$ mA	2.7		0.4	V
		$I_{OL} = 16$ mA	3.0		0.4	V
		$I_{OL} = 24$ mA	3.0		0.55	V
I_I	Input Leakage Current	$0 \le V_I \le 5.5V$	2.7–3.6		±5.0	μA
I_{OZ}	TRI-STATE I/O Leakage	$0 \le V_O \le 5.5V$ $V_I = V_{IH}$ or V_{IL}	2.7–3.6		±5.0	μA
I_{OFF}	Power-Off Leakage Current	V_I or $V_O = 5.5V$	0		100	μA
I_{CC}	Quiescent Supply Current	$V_I = V_{CC}$ or GND	2.7–3.6		10	μA
		$3.6V \le V_I, V_O \le 5.5V$	2.7–3.6		±10	μA
ΔI_{CC}	Increase in I_{CC} per Input	$V_{IH} = V_{CC} - 0.6V$	2.7–3.6		500	μA

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40°C$ to $+85°C$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		Min	Max	Min	Max	
t_{PHL}	Propagation Delay	1.5	7.0	1.5	8.0	
t_{PLH}	A_n to B_n or B_n to A_n	1.5	7.0	1.5	8.0	ns
t_{PZL}	Output Enable Time	1.5	8.5	1.5	9.5	
t_{PZH}		1.5	8.5	1.5	9.5	ns
t_{PLZ}	Output Disable Time	1.5	7.5	1.5	8.5	
t_{PHZ}		1.5	7.5	1.5	8.5	ns
t_{OSHL},	Output to Output Skew		1.0			
t_{OSLH}	(Note 1)		1.0			ns

Note 1: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}).
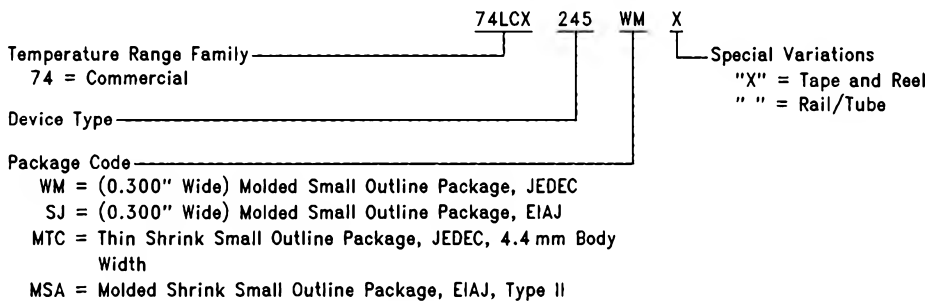
Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25°C$ Typical	Units
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	$C_L = 50\,pF$, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	0.8	V
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	$C_L = 50\,pF$, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	0.8	V

Capacitance

Symbol	Parameter	Conditions	Typical	Units
C_{IN}	Input Capacitance	$V_{CC} = $ Open, $V_I = 0V$ or V_{CC}	7	pF
$C_{I/O}$	Input/Output Capacitance	$V_{CC} = 3.3V$, $V_I = 0V$ or V_{CC}	8	pF
C_{PD}	Power Dissipation Capacitance	$V_{CC} = 3.3V$, $V_I = 0V$ or V_{CC}, $F = 10\,MHz$	25	pF

74LCX245 Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

74LCX 245 WM X

Temperature Range Family —
  74 = Commercial

Device Type —

Package Code —
  WM = (0.300" Wide) Molded Small Outline Package, JEDEC
  SJ = (0.300" Wide) Molded Small Outline Package, EIAJ
  MTC = Thin Shrink Small Outline Package, JEDEC, 4.4 mm Body
        Width
  MSA = Molded Shrink Small Outline Package, EIAJ, Type II

Special Variations
  "X" = Tape and Reel
  " " = Rail/Tube

TL/F/12006-5