

## 74LCX07

### Low Voltage Hex Buffer with Open Drain Outputs

#### General Description

The LCX07 contains six buffers. The inputs tolerate voltages up to 7V allowing the interface of 5V systems to 3V systems.

The outputs of the LCX07 are open drain and can be connected to other open drain outputs to implement active HIGH wire AND or active LOW wire OR functions.

The 74LCX07 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

#### Features

- 5V tolerant inputs
- 2.3V to 5.5V  $V_{CC}$  specifications provided
- 2.9 ns  $t_{PD}$  max ( $V_{CC} = 3.3V$ ), 10  $\mu A$   $I_{CC}$  max
- Power down high impedance inputs and outputs
- +24 mA output drive ( $V_{CC} = 3.0V$ )
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds JEDEC 78 conditions
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V
- Leadless Pb-Free DQFN package

#### Ordering Code:

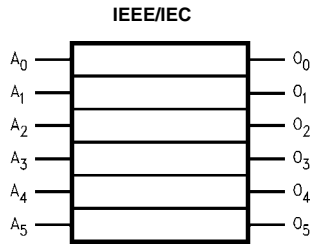
Order Number	Package Number	Package Description
74LCX07M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LCX07MX_NL (Note 1)	M14A	Pb-Free 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LCX07SJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LCX07BQX (Note 2)	MLP014A	Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
74LCX07MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74LCX07MTCX_NL (Note 1)	MTC14	Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

**Note 1:** "\_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

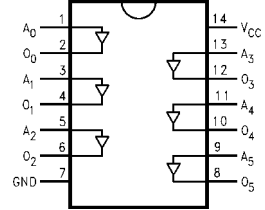
**Note 2:** DQFN package available in Tape and Reel only.

**Logic Symbol**



**Connection Diagrams**

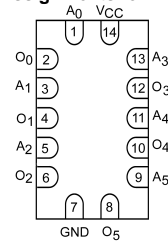
Pin Assignments for SOIC, SOP, and TSSOP



**Pin Descriptions**

Pin Names	Description
$A_n$	Inputs
$O_n$	Outputs

Pad Assignments for DQFN



(Top Through View)

Absolute Maximum Ratings (Note 3)				
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 HIGH or LOW State (Note 4)	V
$I_{IK}$	DC Input Diode Current	-50	$V_I < \text{GND}$	mA
$I_{OK}$	DC Output Diode Current	-50 +50	$V_O < \text{GND}$ $V_O > V_{CC}$	mA
$I_O$	DC Output Current	$\pm 50$		mA
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 100$		mA
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 100$		mA
$T_{STG}$	Storage Temperature	-65 to +150		$^{\circ}\text{C}$

Recommended Operating Conditions (Note 5)				
Symbol	Parameter	Min	Max	Units
$V_{CC}$	Supply Voltage			
		Operating	2.0	5.5
		Data Retention	1.5	5.5
$V_I$	Input Voltage	0	5.5	V
$V_O$	Output Voltage	0	5.5	V
$I_{OL}$	Output Current			
		$V_{CC} = 4.5 - 5.5\text{V}$	+32	mA
		$V_{CC} = 3.0\text{V} - 3.6\text{V}$	+24	
		$V_{CC} = 2.7\text{V} - 3.0\text{V}$	+12	
		$V_{CC} = 2.3\text{V} - 2.7\text{V}$	+8	
$T_A$	Free-Air Operating Temperature	-40	85	$^{\circ}\text{C}$
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8\text{V} - 2.0\text{V}$ , $V_{CC} = 3.0\text{V}$	0	10	ns/V

**Note 3:** 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 tables are not guaranteed at the Absolute Maximum Ratings. The Recommended Operating Conditions table will define the conditions for actual device operation.

**Note 4:**  $I_O$  Absolute Maximum Rating must be observed.

**Note 5:** Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		Units	
				Min	Max		
$V_{IH}$	HIGH Level Input Voltage		2.3 - 2.7	1.7		V	
			2.7 - 3.6	2.0			
			4.5 - 5.5	$0.7 \times V_{CC}$			
$V_{IL}$	LOW Level Input Voltage		2.3 - 2.7		0.7	V	
			2.7 - 3.6		0.8		
			4.5 - 5.5		$0.3 \times V_{CC}$		
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu\text{A}$	2.3 - 5.5		0.2	V	
			$I_{OL} = 8 \text{ mA}$	2.3			0.6
			$I_{OL} = 12 \text{ mA}$	2.7			0.4
			$I_{OL} = 16 \text{ mA}$	3.0			0.4
			$I_{OL} = 24 \text{ mA}$	3.0			0.55
			$I_{OL} = 32 \text{ mA}$	4.5			0.55
$I_I$	Input Leakage Current	$0 \leq V_I \leq 5.5\text{V}$	2.3 - 5.5		$\pm 5.0$	$\mu\text{A}$	
$I_{OFF}$	Power-Off Leakage Current	$V_I$ or $V_O = 5.5\text{V}$	0		10	$\mu\text{A}$	
$I_{CC}$	Quiescent Supply Current	$V_I = V_{CC}$ or GND	2.3 - 5.5		10	$\mu\text{A}$	
			3.6V $\leq V_I \leq 5.5\text{V}$	2.3 - 5.5			$\pm 10$
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6\text{V}$	2.3 - 3.6		500	$\mu\text{A}$	
			4.5 - 5.5		1	mA	
$I_{OHZ}$	Off State Current	$V_O = 5.5$	2 - 5.5		10	$\mu\text{A}$	

## AC Electrical Characteristics

Symbol	Parameter	$T_A = -40^\circ\text{C to } +85^\circ\text{C}, R_L = 500\Omega$								Units
		$V_{CC} = 5.0V \pm 0.5V$		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		$V_{CC} = 2.5V \pm 0.2V$		
		$C_L = 50\text{ pF}$		$C_L = 50\text{ pF}$		$C_L = 50\text{ pF}$		$C_L = 30\text{ pF}$		
		Min	Max	Min	Max	Min	Max	Min	Max	
$t_{PZL}$	Propagation Delay Time	0.5	3.0	0.8	3.7	1.0	4.4	0.8	3.8	ns
$t_{PLZ}$		0.5	3.0	0.8	3.7	1.0	4.4	0.8	3.8	

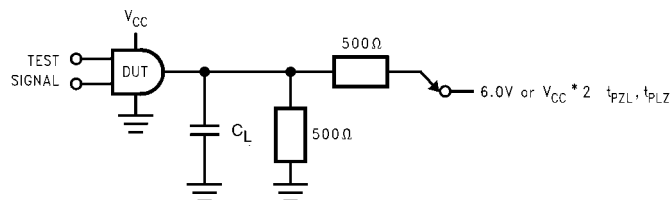
## Dynamic Switching Characteristics

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$	Units
				Typical	
$V_{OLP}$	Quiet Output Dynamic Peak $V_{OL}$	$C_L = 50\text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$ $C_L = 30\text{ pF}, V_{IH} = 2.5V, V_{IL} = 0V$	3.3 2.5	0.9 0.7	V
$V_{OLV}$	Quiet Output Dynamic Valley $V_{OL}$	$C_L = 50\text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$ $C_L = 30\text{ pF}, V_{IH} = 2.5V, V_{IL} = 0V$	3.3 2.5	-0.8 -0.6	V

## Capacitance

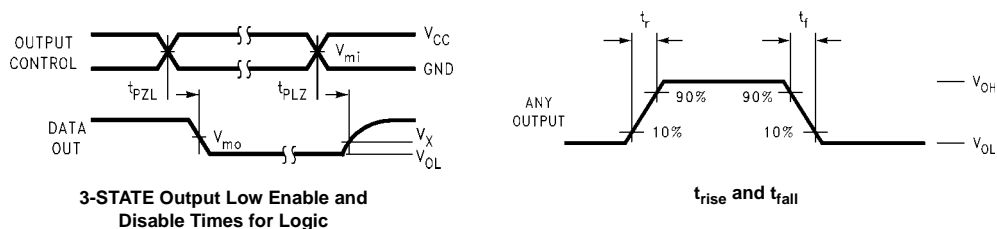
Symbol	Parameter	Conditions	Typical	Units
$C_{IN}$	Input Capacitance	$V_{CC} = \text{Open}, V_I = 0V \text{ or } V_{CC}$	7	pF
$C_{OUT}$	Output Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}$	8	pF
$C_{PD}$	Power Dissipation Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}, f = 10\text{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

## AC Loading and Waveforms



**FIGURE 1. AC Test Circuit**  
( $C_L$  includes probe and jig capacitance)

Test	Switch
$t_{PZL}$ , $t_{PLZ}$	$V_{CC} \times 2$ at $V_{CC} = 5.0 \pm 0.5V$
	6V at $V_{CC} = 3.3 \pm 0.3V$
	$V_{CC} \times 2$ at $V_{CC} = 2.5 \pm 0.2V$



**FIGURE 2. Waveforms**  
(Input Pulse Characteristics;  $f = 1MHz$ ,  $t_r = t_f = 3ns$ )

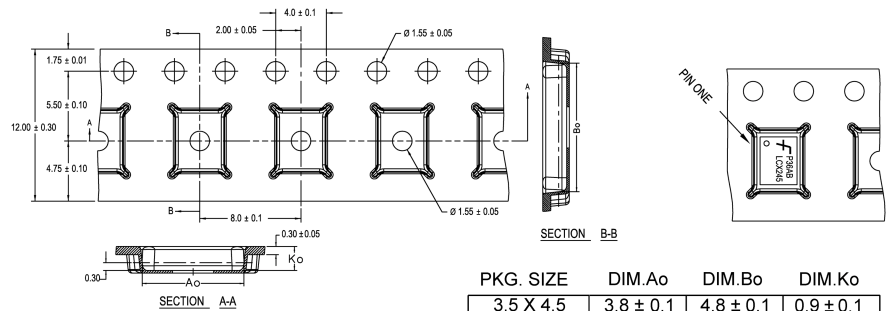
Symbol	$V_{CC}$			
	$5.0V \pm 0.5V$	$3.3V \pm 0.3V$	2.7V	$2.5V \pm 0.2V$
$V_{mi}$	$V_{CC}/2$	1.5V	1.5V	$V_{CC}/2$
$V_{mo}$	$V_{CC}/2$	1.5V	1.5V	$V_{CC}/2$
$V_x$	$V_{OL} + 0.3V$	$V_{OL} + 0.3V$	$V_{OL} + 0.3V$	$V_{OL} + 0.15V$
$V_y$	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$	$V_{OH} - 0.15V$

## Tape and Reel Specification

Tape Format for DQFN

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
BQX	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	2500/3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

**TAPE DIMENSIONS** inches (millimeters)



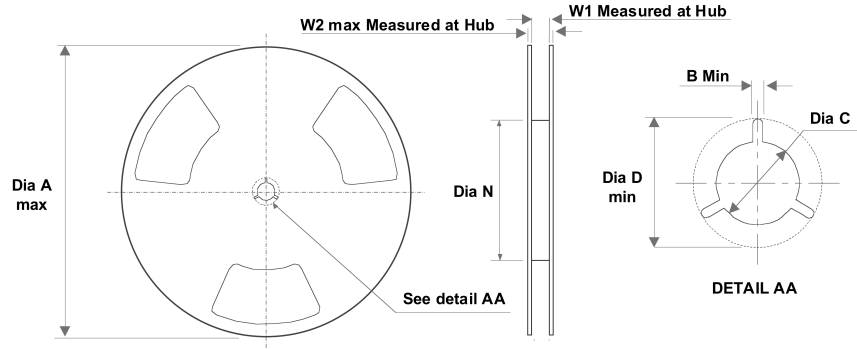
PKG. SIZE	DIM.Ao	DIM.Bo	DIM.Ko
3.5 X 4.5	3.8 ± 0.1	4.8 ± 0.1	0.9 ± 0.1
3.0 X 3.0	3.3 ± 0.1	3.3 ± 0.1	0.9 ± 0.1
2.5 X 4.5	2.8 ± 0.1	4.8 ± 0.1	0.9 ± 0.1
2.5 X 3.5	2.8 ± 0.1	3.8 ± 0.1	0.9 ± 0.1
2.5 X 3.0	2.8 ± 0.1	3.3 ± 0.1	0.9 ± 0.1
2.5 X 2.5	2.8 ± 0.1	2.8 ± 0.1	0.9 ± 0.1

DIMENSIONS ARE IN MILLIMETERS

NOTES: unless otherwise specified

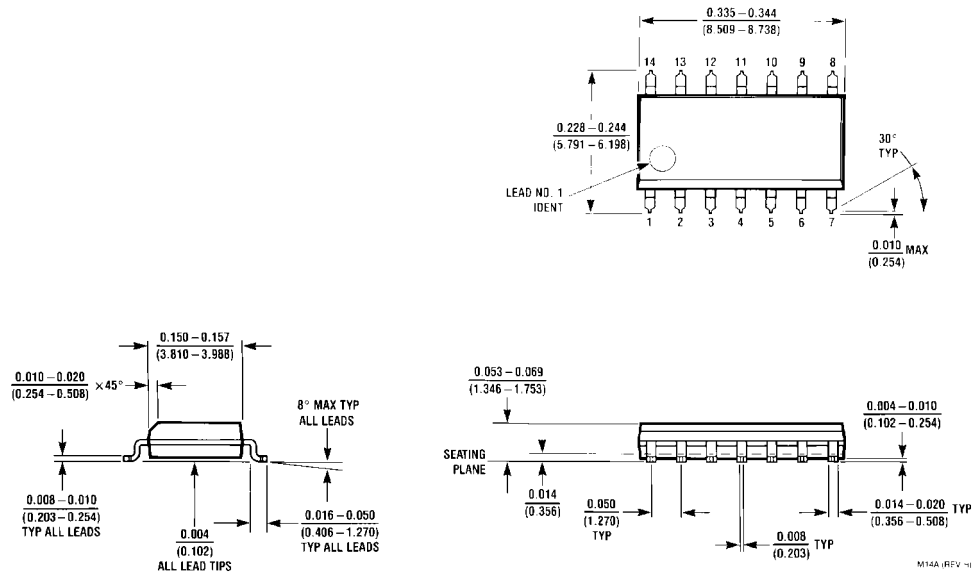
1. Cumulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is ±0.002[0.05] for these dimensions on all 12mm tapes.
5. Ao and Bo measured on a plane 0.120[0.30] above the bottom of the pocket.
6. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Dimension in inches rounded.

**REEL DIMENSIONS** inches (millimeters)



Tape Size	A	B	C	D	N	W1	W2
12 mm	13.0 (330)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	7.008 (178)	0.488 (12.4)	0.724 (18.4)

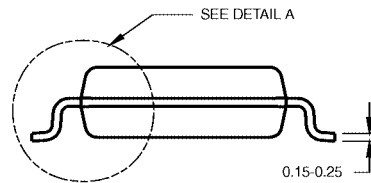
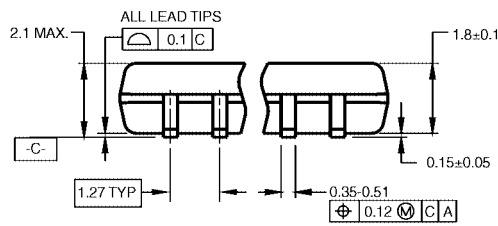
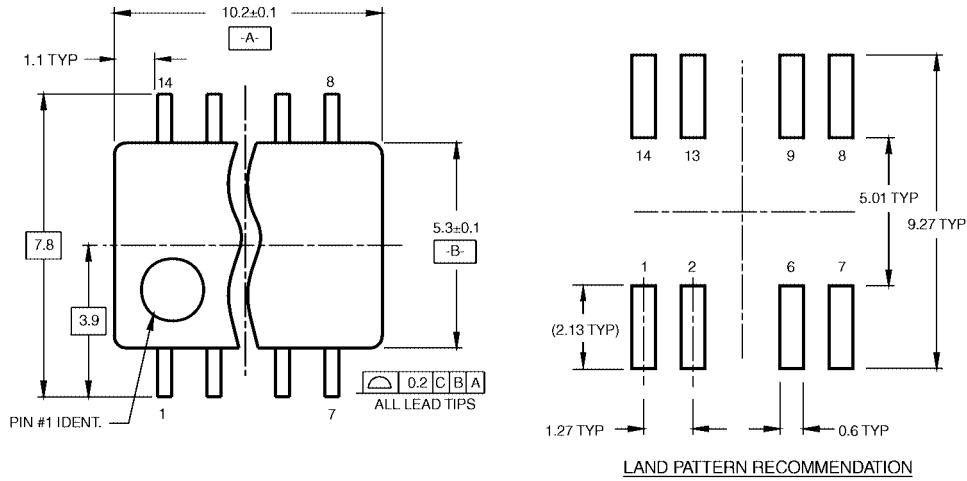
**Physical Dimensions** inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow  
Package Number M14A**

M14A (REV. 1)

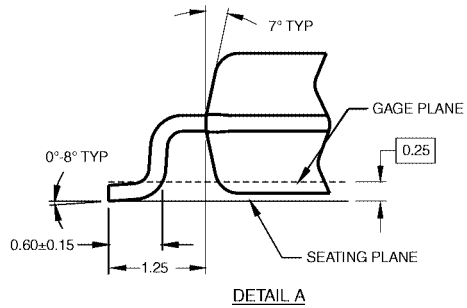
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

- NOTES:  
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.  
 B. DIMENSIONS ARE IN MILLIMETERS.  
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1

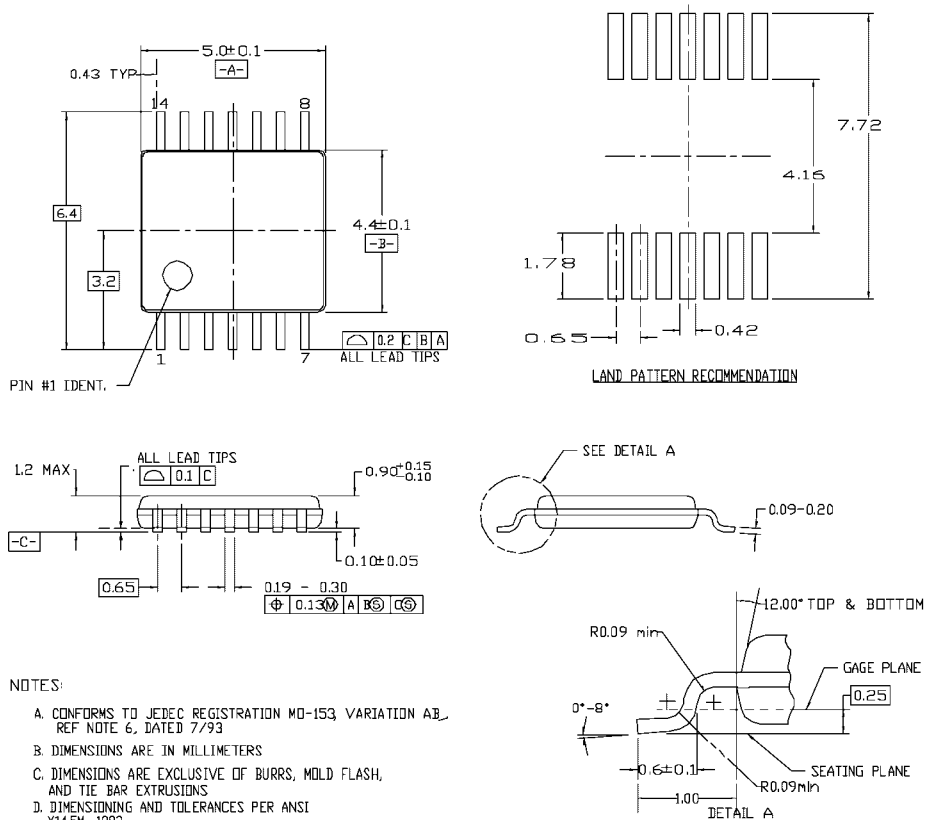


**Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
 Package Number M14D**





**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



- NOTES:
- A. CONFORMS TO JEDEC REGISTRATION MO-153 VARIATION AB, REF NOTE 6, DATED 7/93
  - B. DIMENSIONS ARE IN MILLIMETERS
  - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
  - D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

MTC14revD

**14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC14**

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