FAIRCHILD SEMICONDUCTOR™

September 1983
Revised February 1999

# MM74HC245A
# Octal 3-STATE Transceiver

## General Description

The MM74HC245A 3-STATE bidirectional buffer utilizes advanced silicon-gate CMOS technology, and is intended for two-way asynchronous communication between data buses. It has high drive current outputs which enable high speed operation even when driving large bus capacitances. This circuit possesses the low power consumption and high noise immunity usually associated with CMOS circuitry, yet has speeds comparable to low power Schottky TTL circuits.

This device has an active LOW enable input $\overline{G}$ and a direction control input, DIR. When DIR is HIGH, data flows from the A inputs to the B outputs. When DIR is LOW, data flows from the B inputs to the A outputs. The MM74HC245A transfers true data from one bus to the other.

This device can drive up to 15 LS-TTL Loads, and does not have Schmitt trigger inputs. All inputs are protected from damage due to static discharge by diodes to $V_{CC}$ and ground.

## Features

- Typical propagation delay: 13 ns
- Wide power supply range: 2–6V
- Low quiescent current: 80 μA maximum (74 HC)
- 3-STATE outputs for connection to bus oriented systems
- High output drive: 6 mA (minimum)
- Same as the 645

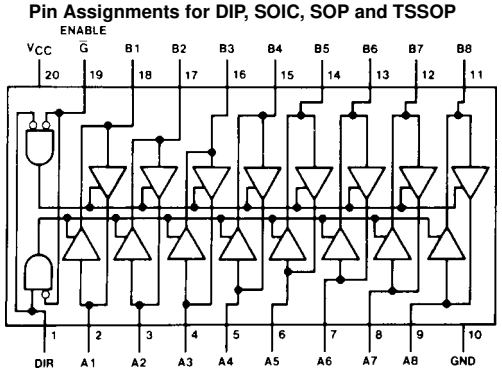
## Ordering Code:

| Order Number | Package Number | Package Description |
|---|---|---|
| MM74HC245AWM | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| MM74HC245ASJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HC245AMTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HC245AN | N20A | 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

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

## Connection Diagram

**Pin Assignments for DIP, SOIC, SOP and TSSOP**




**Top View**

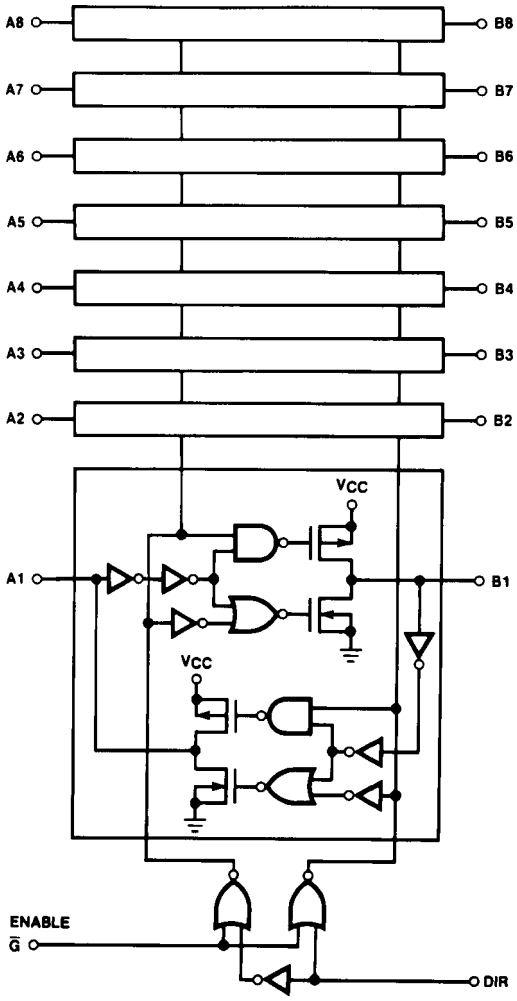
## Truth Table

| Control Inputs | | Operation |
|---|---|---|
| $\overline{G}$ | DIR | |
| L | L | B data to A bus |
| L | H | A data to B bus |
| H | X | Isolation |

H = HIGH Level
L = LOW Level
X = Irrelevant

## Logic Diagram



## Absolute Maximum Ratings (Note 1)

(Note 2)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | −0.5 to +7.0V |
| DC Input Voltage DIR and $\overline{G}$ pins ($V_{IN}$) | −1.5 to $V_{CC}$ +1.5V |
| DC Input/Output Voltage ($V_{IN}$, $V_{OUT}$) | −0.5 to $V_{CC}$ +0.5V |
| Clamp Diode Current ($I_{CD}$) | ±20 mA |
| DC Output Current, per pin ($I_{OUT}$) | ±35 mA |
| DC $V_{CC}$ or GND Current, per pin ($I_{CC}$) | ±70 mA |
| Storage Temperature Range ($T_{STG}$) | −65°C to +150°C |
| Power Dissipation ($P_D$) | |
| (Note 3) | 600 mW |
| S.O. Package only | 500 mW |
| Lead Temperature ($T_L$) | |
| (Soldering 10 seconds) | 260°C |

## Recommended Operating Conditions

| | Min | Max | Units |
|---|---|---|---|
| Supply Voltage ($V_{CC}$) | 2 | 6 | V |
| DC Input or Output Voltage | | | |
| ($V_{IN}$, $V_{OUT}$) | 0 | $V_{CC}$ | V |
| Operating Temperature Range ($T_A$) | −40 | +85 | °C |
| Input Rise/Fall Times | | | |
| ($t_r$, $t_f$) $V_{CC}$ = 2.0V | | 1000 | ns |
| $V_{CC}$ = 4.5V | | 500 | ns |
| $V_{CC}$ = 6.0V | | 400 | ns |

**Note 1:** Maximum Ratings are those values beyond which damage to the device may occur.

**Note 2:** Unless otherwise specified all voltages are referenced to ground.

**Note 3:** Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C.

## DC Electrical Characteristics (Note 4)

| Symbol | Parameter | Conditions | $V_{CC}$ | $T_A$ = 25°C | $T_A$ = −40 to 85°C | $T_A$ = −55 to 125°C | Units |
|---|---|---|---|---|---|---|---|
| | | | | Typ | Guaranteed Limits | | |
| $V_{IH}$ | Minimum HIGH Level Input Voltage | | 2.0V | | 1.5 | 1.5 | 1.5 | V |
| | | | 4.5V | | 3.15 | 3.15 | 3.15 | V |
| | | | 6.0V | | 4.2 | 4.2 | 4.2 | V |
| $V_{IL}$ | Maximum LOW Level Input Voltage | | 2.0V | | 0.5 | 0.5 | 0.5 | V |
| | | | 4.5V | | 1.35 | 1.35 | 1.35 | V |
| | | | 6.0V | | 1.8 | 1.8 | 1.8 | V |
| $V_{OH}$ | Minimum HIGH Level Output Voltage | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | | | | | | |
| | | $\|I_{OUT}\| \le 20$ μA | 2.0V | 2.0 | 1.9 | 1.9 | 1.9 | V |
| | | | 4.5V | 4.5 | 4.4 | 4.4 | 4.4 | V |
| | | | 6.0V | 6.0 | 5.9 | 5.9 | 5.9 | V |
| | | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | | | | | | |
| | | $\|I_{OUT}\| \le 6.0$ mA | 4.5V | 4.2 | 3.98 | 3.84 | 3.7 | V |
| | | $\|I_{OUT}\| \le 7.8$ mA | 6.0V | 5.7 | 5.48 | 5.34 | 5.2 | V |
| $V_{OL}$ | Maximum LOW Level Output Voltage | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | | | | | | |
| | | $\|I_{OUT}\| \le 20$ μA | 2.0V | 0 | 0.1 | 0.1 | 0.1 | V |
| | | | 4.5V | 0 | 0.1 | 0.1 | 0.1 | V |
| | | | 6.0V | 0 | 0.1 | 0.1 | 0.1 | V |
| | | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | | | | | | |
| | | $\|I_{OUT}\| \le 6.0$ mA | 4.5V | 0.2 | 0.26 | 0.33 | 0.4 | V |
| | | $\|I_{OUT}\| \le 7.8$ mA | 6.0V | 0.2 | 0.26 | 0.33 | 0.4 | V |
| $I_{IN}$ | Input Leakage Current ($\overline{G}$ and DIR) | $V_{IN}$ = $V_{CC}$ to GND | 6.0V | | ±0.1 | ±1.0 | ±1.0 | μA |
| $I_{OZ}$ | Maximum 3-STATE Output Leakage Current | $V_{OUT}$ = $V_{CC}$ or GND<br>Enable $\overline{G}$ = $V_{IH}$ | 6.0V | | ±0.5 | ±5.0 | ±10 | μA |
| $I_{CC}$ | Maximum Quiescent Supply Current | $V_{IN}$ = $V_{CC}$ or GND<br>$I_{OUT}$ = 0 μA | 6.0V | | 8.0 | 80 | 160 | μA |

**Note 4:** For a power supply of 5V ±10% the worst case output voltages ($V_{OH}$, and $V_{OL}$) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case $V_{IH}$ and $V_{IL}$ occur at $V_{CC}$ = 5.5V and 4.5V respectively. (The $V_{IH}$ value at 5.5V is 3.85V.) The worst case leakage current ($I_{IN}$, $I_{CC}$, and $I_{OZ}$) occur for CMOS at the higher voltage and so the 6.0V values should be used.

## AC Electrical Characteristics

$V_{CC}$ = 5V, $T_A$ = 25°C, $t_r = t_f$ = 6ns

| Symbol | Parameter | Conditions | Typ | Guaranteed Limit | Units |
|---|---|---|---|---|---|
| $t_{PHL}$, $t_{PLH}$ | Maximum Propagation Delay | $C_L$ = 45 pF | 12 | 17 | ns |
| $t_{PZH}$, $t_{PZL}$ | Maximum Output Enable Time | $R_L$ = 1 kΩ<br>$C_L$ = 45 pF | 24 | 35 | ns |
| $t_{PHZ}$, $t_{PLZ}$ | Maximum Output Disable Time | $R_L$ = 1 kΩ<br>$C_L$ = 5 pF | 18 | 25 | ns |

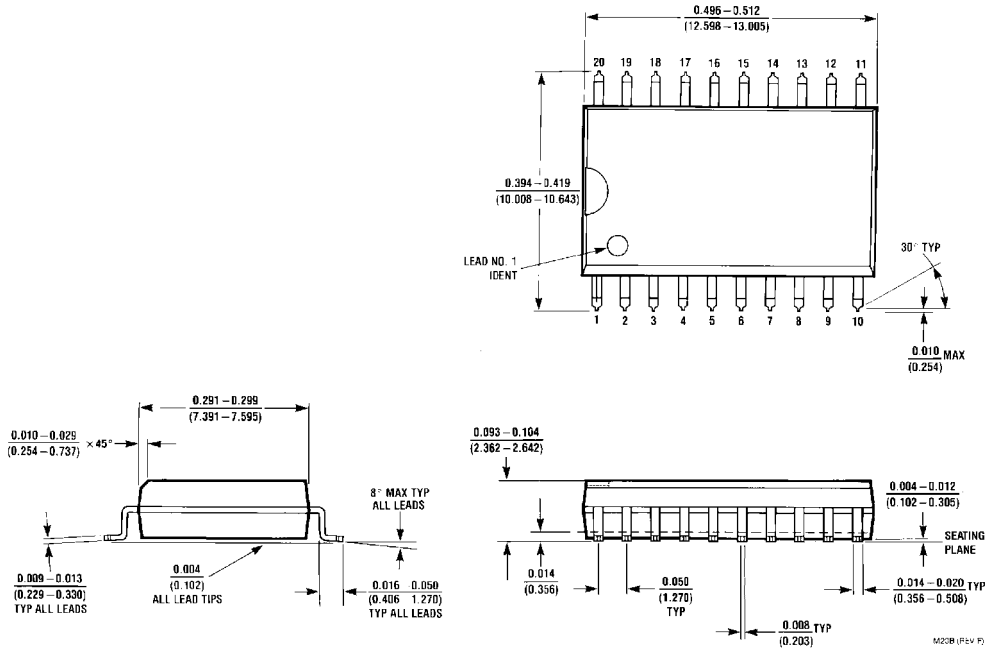
## AC Electrical Characteristics

$V_{CC}$ = 2.0V to 6.0V, $C_L$ = 50 pF, $t_r = t_f$ = 6ns (unless otherwise specified)

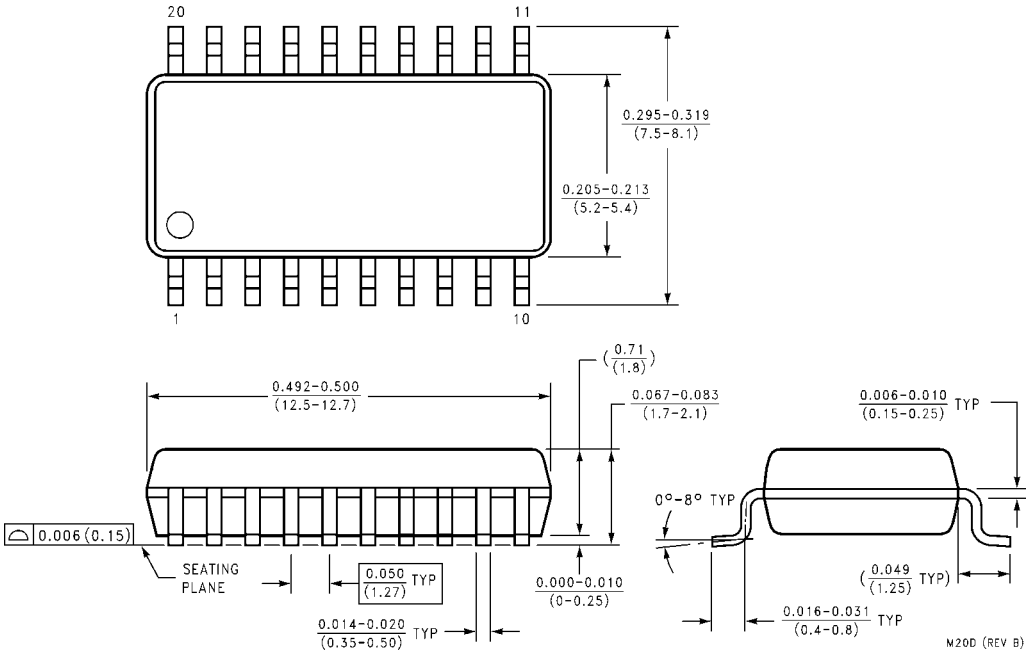
| Symbol | Parameter | Conditions | $V_{CC}$ | $T_A$ = 25°C | $T_A$ = −40 to 85°C | $T_A$ = −55 to 125°C | | Units |
|---|---|---|---|---|---|---|---|---|
| | | | | Typ | Guaranteed Limits | | | |
| $t_{PHL}$, | Maximum Propagation | $C_L$ = 50 pF | 2.0V | 31 | 90 | 113 | 135 | ns |
| $t_{PLH}$ | Delay | $C_L$ = 150 pF | 2.0V | 41 | 96 | 116 | 128 | ns |
| | | $C_L$ = 50 pF | 4.5V | 13 | 18 | 23 | 27 | ns |
| | | $C_L$ = 150 pF | 4.5V | 17 | 22 | 28 | 33 | ns |
| | | $C_L$ = 50 pF | 6.0V | 11 | 15 | 19 | 23 | ns |
| | | $C_L$ = 150 pF | 6.0V | 14 | 19 | 23 | 28 | ns |
| $t_{PZH}$, | Maximum Output Enable | $R_L$ = 1 kΩ | | | | | | |
| $t_{PZL}$ | Time | $C_L$ = 50 pF | 2.0V | 71 | 190 | 240 | 285 | ns |
| | | $C_L$ = 150 pF | 2.0V | 81 | 240 | 300 | 360 | ns |
| | | $C_L$ = 50 pF | 4.5V | 26 | 38 | 48 | 57 | ns |
| | | $C_L$ = 150 pF | 4.5V | 31 | 48 | 60 | 72 | ns |
| | | $C_L$ = 50 pF | 6.0V | 21 | 32 | 41 | 48 | ns |
| | | $C_L$ = 150 pF | 6.0V | 25 | 41 | 51 | 61 | ns |
| $t_{PHZ}$, | Maximum Output Disable | $R_L$ = 1 kΩ | 2.0V | 39 | 135 | 169 | 203 | ns |
| $t_{PLZ}$ | Time | $C_L$ = 50 pF | 4.5V | 20 | 27 | 34 | 41 | ns |
| | | | 6.0V | 18 | 23 | 29 | 34 | ns |
| $t_{TLH}$, $t_{THL}$ | Output Rise and Fall Time | $C_L$=50 pF | 2.0V | 20 | 60 | 75 | 90 | ns |
| | | | 4.5V | 6 | 12 | 15 | 18 | ns |
| | | | 6.0V | 5 | 10 | 13 | 15 | ns |
| $C_{PD}$ | Power Dissipation | G = $V_{IL}$ | | 50 | | | | pF |
| | Capacitance (Note 5) | $\overline{G}$ = $V_{IH}$ | | 5 | | | | pF |
| $C_{IN}$ | Maximum Input Capacitance | | | 5 | 10 | 10 | 10 | pF |
| $C_{IN/OUT}$ | Maximum Input/Output Capacitance, A or B | | | 15 | 20 | 20 | 20 | pF |

**Note 5:** $C_{PD}$ determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

## Physical Dimensions inches (millimeters) unless otherwise noted

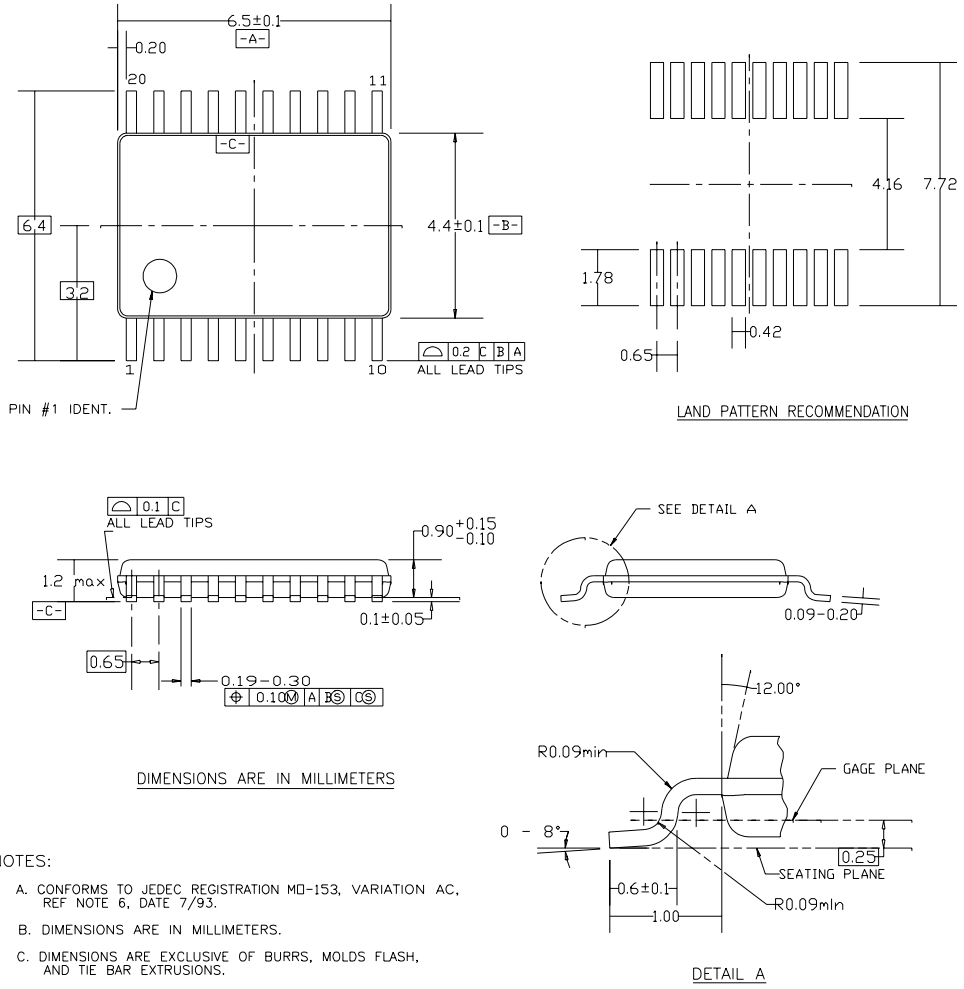



**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide**
**Package Number M20B**




**20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**
**Package Number M20D**

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




DIMENSIONS ARE IN MILLIMETERS

NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.

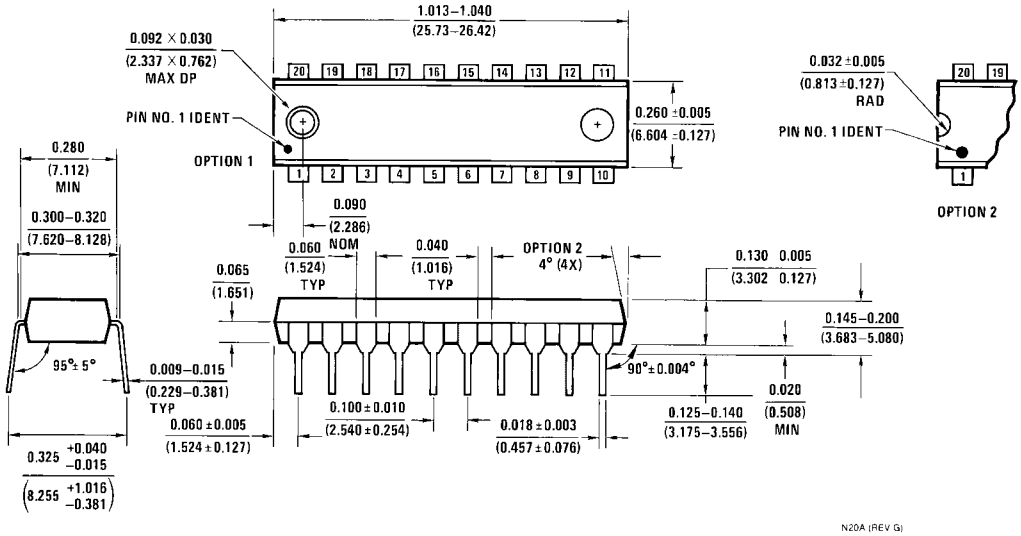
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

**20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide**
**Package Number MTC20**

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




**20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide**
**Package Number N20A**

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