DATA SHEET
MARCH 2003

No. 00003
Rev. 1-03

REPLACEMENT
of **LM393**

MIK393

LOW POWER LOW OFFSET VOLTAGE DUAL COMPARATORS

GENERAL DESCRIPTION

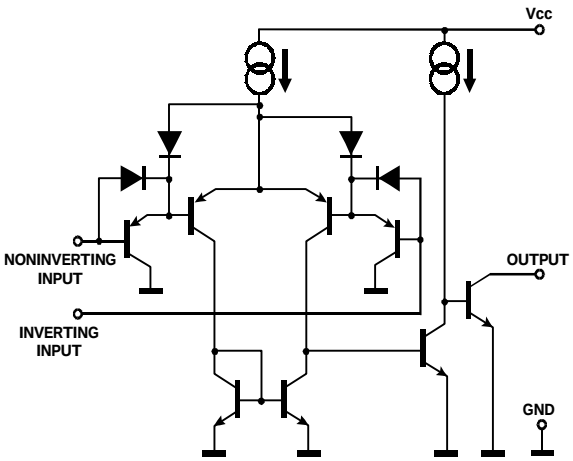
The MIK393 consists of two independent precision voltage comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates. The MIK393 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the MIK393 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

FEATURES

- Wide supply voltage range 2.0V to 32V.
- Low supply current drain independent of supply voltage.
- Low input biasing current: 25 nA typ.
- Low input offset current: 5 nA typ.
- Low input offset voltage: 2 mV typ.
- Input common-mode voltage range includes GND.
- Differential input voltage range equal to the power supply voltage.
- Low output saturation voltage.
- Output voltage compatible with TTL, MOS and CMOS logic.

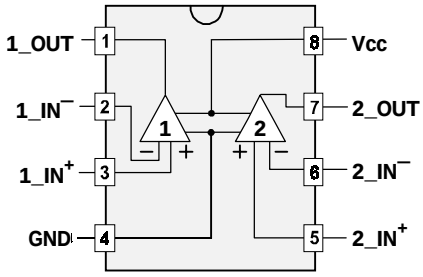
SCHEMATIC DIAGRAM (½ MIK393)



SOP-8  **MIK393M**

DIP-8  **MIK393N**

PIN CONNECTIONS
(top view)



ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	VALUE	UNIT
Vcc	SUPPLY VOLTAGE	36	V
V_{IDR}	DIFFERENTIAL INPUT VOLTAGE	36	V
V_{IN}	INPUT VOLTAGE	-0,3 ÷ +36	V
I_O	INPUT CURRENT	20	mA
POWER DISSIPATION (Note 1)			
	Molded DIP	780	mW
	Small Outline Package	510	mW
I_{OS}	OUTPUT SHORT-CIRCUIT TO GROUND	Continuous	
T_A	OPERATING TEMPERATURE RANGE	0 to +70	°C
Tstg	STORAGE TEMPERATURE RANGE	-65 to +150	°C

NOTE 1: For operating at high temperatures, the MIK393 must be derated based on a 125°C maximum junction temperature and a thermal resistance of 170°C/W which applies for the device soldered in a printed circuit board, operating in a still air ambient. The low bias dissipation and the "ON-OFF" characteristic of the outputs keeps the chip dissipation very small ($P_D \leq 100$ mW), provided the output transistors are allowed to saturate.

SWITCHING CHARACTERISTICS V_{CC}=5V; T_A=25°C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Response time	**R_L** connected to 5V through 5.1 kΩ; **C_L**=15pF* (See Note1)	100-mV input step with 5-mV overdrive		1.3		µs
		TTL-level input step		0.3		

* **C_L** includes probe and jig capacitance.

NOTE 1: The response time specified is the interval between the input step function and the instant when the output crosses 1.4V.

ELECTRICAL CHARACTERISTICS

electrical characteristics at specified free-air temperature, Vcc = 5 V (unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS*			MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	**Vcc** = 5V to 30V; V_{IC} = V_{ICR} min; **Vo**= 1.4		25 °C		2.0	5.0	mV
				Full range			9.0	
I_{IO}	Input offset current	**Vo** = 1.4V		25 °C		5.0	50.0	nA
				Full range			150.0	
I_{IB}	Input bias current	**Vo** = 1.4V		25 °C		-25.0	-250.0	nA
				Full range			-400.0	
V_{ICR}	Common-mode input voltage range**			25 °C	0 to Vcc -1.5			V
				Full range	0 to Vcc -2.0			
A_{VD}	Large-signal differential voltage amplification	**Vcc** = 15 V; **Vo**=1.4V to 11.4 V; R_L ≥ 15 kΩ to V_{CC}		25 °C	50.0	200.0		V/mV
I_{OH}	High-level output current	V_{OH}= 5 V; V_{ID}= 1V		25 °C		0.1	50.0	nA
		V_{OH}= 30V; V_{ID}= 1V		Full range			1.0	µA
V_{OL}	Low-level output voltage	I_{OL} = 4 mA; V_{ID}= -1V		25 °C		150.0	400.0	mV
				Full range			700.0	
I_{OL}	Low-level output current	V_{OL}= 1.5V; V_{ID}= -1V		25 °C	6.0			mA
I_{CC}	Supply current	R_L = ∞	V_{CC} = 5V	25 °C		0.8	1.0	mA
			V_{CC} = 30V	Full range			2.5	

* Full range (MIN to MAX), for the MIK393 is 0°C to 70°C. All characteristics are measured with zero common-mode input voltage unless otherwise specified.

** The voltage at either input or common-mode should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is VCC -1.5V, but either or both inputs can go to 30V without damage.

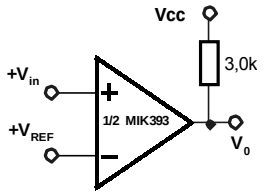
TYPICAL APPLICATIONS (Vcc = 5 V)

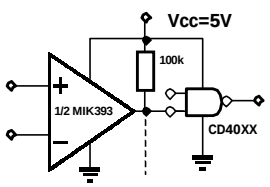
These dual comparators feature high gain, wide bandwidth characteristics. This gives the device oscillation tendencies if the outputs are capacitively coupled to the inputs via stray capacitance. This oscillation manifests itself during output transitions (V_{OL} to V_{OH}). To alleviate this situation, input resistors <10 kΩ should be used.

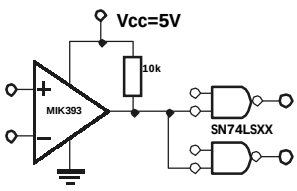
The addition of positive feedback (<10 mV) is also recommended. It is good design practice to ground all unused pins.

Differential input voltages may be larger than supply voltage without damaging the comparator's inputs. Voltages more negative than –0.3 V should not be used.

BASIC COMPARATOR	DRIVING CMOS	DRIVING TTL

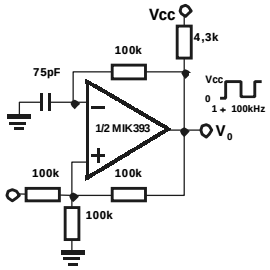






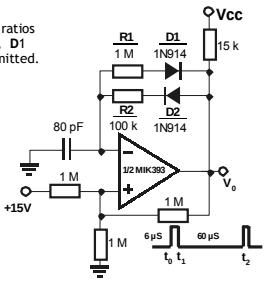
TYPICAL APPLICATIONS Vcc = 5 V (CONTINUED)

SQUARE-WAVE OSCILLATOR

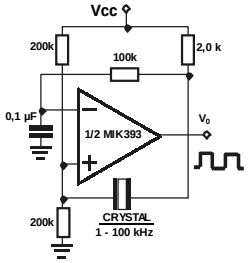


PULSE GENERATOR

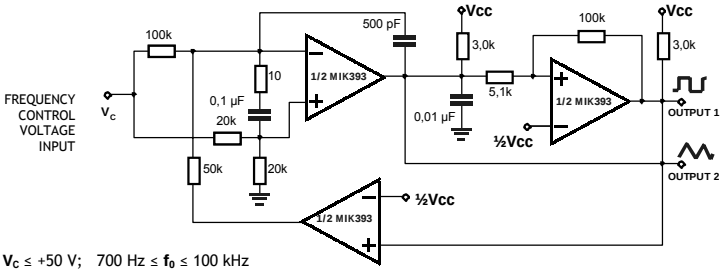
NOTE:
For large ratios of **R1**/**R2**, **D1** can be omitted.



CRYSTAL CONTROLLED OSCILLATOR

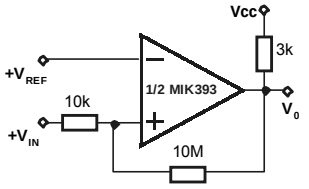


TWO-DECADE HIGH FREQUENCY VCO

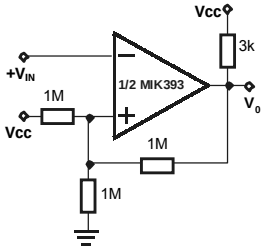


+250 mV ≤ V_C ≤ +50 V; 700 Hz ≤ f_0 ≤ 100 kHz

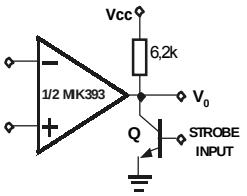
NON-INVERTING COMPARATOR WITH HYSTERESIS



INVERTING COMPARATOR WITH HYSTERESIS

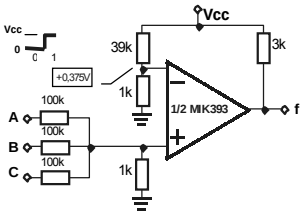


OUTPUT STROBING

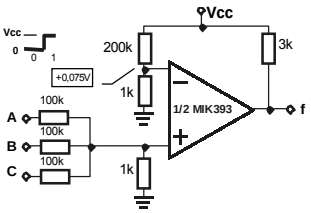


Q or **Logic Gate** without Pull-Up resistor

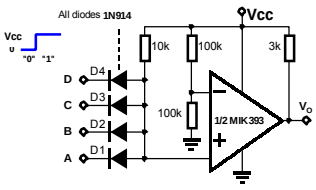
AND GATE



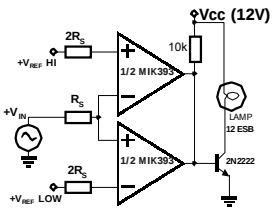
OR GATE



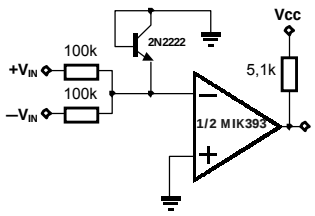
LARGE FAN-IN AND GATE



LIMIT COMPARATOR

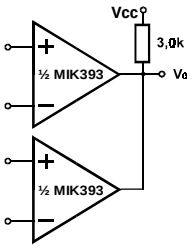


COMPARING INPUT VOLTAGES OF OPPOSITE POLARITY

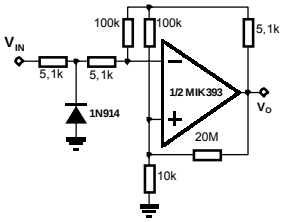


TYPICAL APPLICATIONS Vcc = 5 V (CONTINUED)

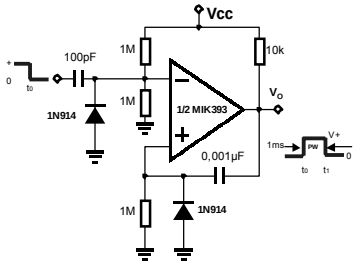
ORing THE OUTPUTS



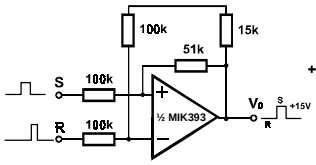
ZERO CROSSING DETECTOR (SINGLE POWER SUPPLY)



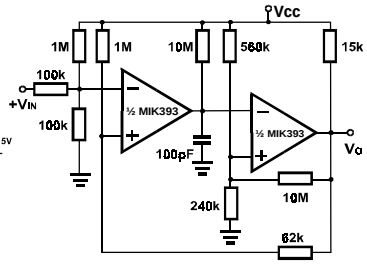
ONE-SHOT MULTIVIBRATOR



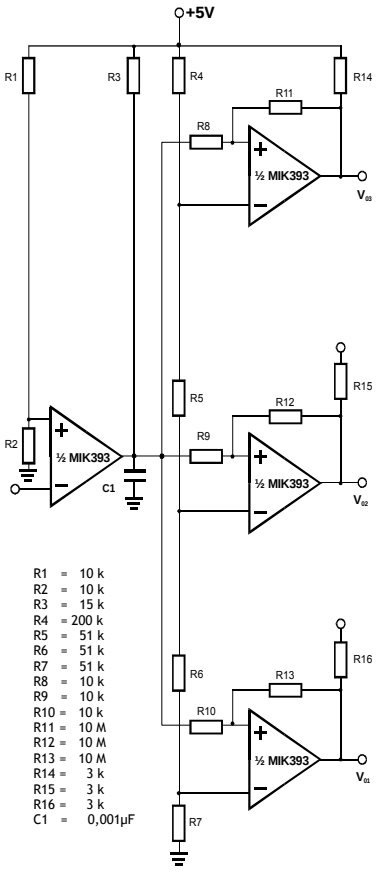
BI-STABLE MULTIVIBRATOR



ONE-SHOT MULTIVIBRATOR WITH INPUT LOCK OUT

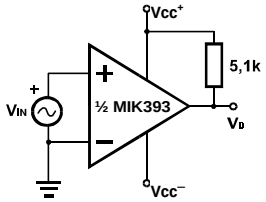


TIME DELAY GENERATOR

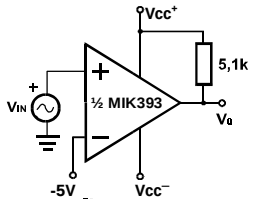


R1 = 10 k
R2 = 10 k
R3 = 15 k
R4 = 200 k
R5 = 51 k
R6 = 51 k
R7 = 51 k
R8 = 10 k
R9 = 10 k
R10 = 10 k
R11 = 10 M
R12 = 10 M
R13 = 10 M
R14 = 3 k
R15 = 3 k
R16 = 3 k
C1 = 0,001µF

ZERO CROSSING DETECTOR

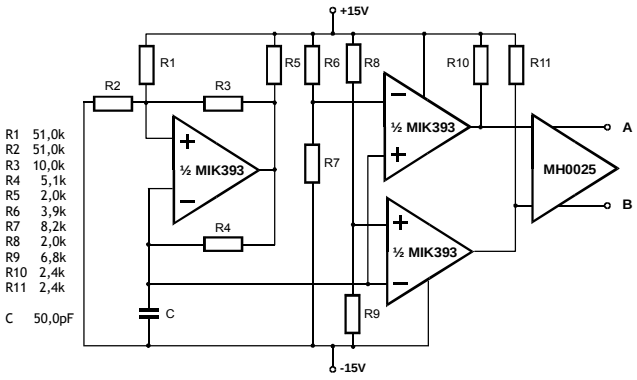


COMPARATOR WITH A NEGATIVE REFERENCE



SPLIT-SUPPLY APPLICATIONS

MOS CLOCK DRIVER

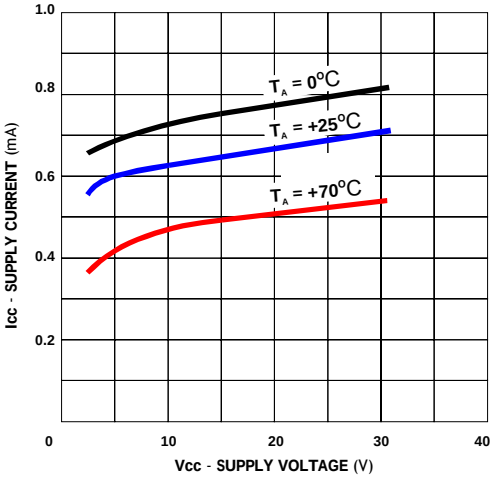


R1 51,0k
R2 51,0k
R3 10,0k
R4 5,1k
R5 2,0k
R6 3,9k
R7 8,2k
R8 2,0k
R9 6,8k
R10 2,4k
R11 2,4k

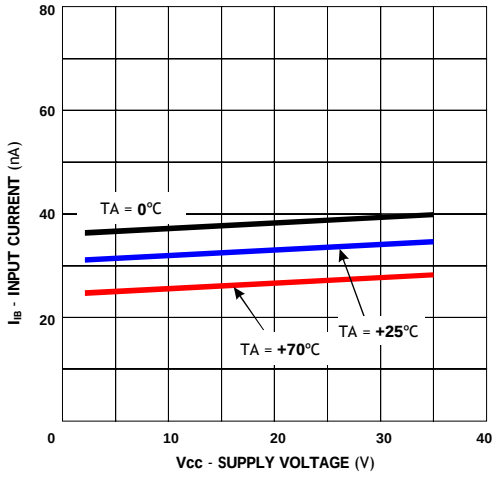
C 50,0pF

TYPICAL PERFORMANCE CHARACTERISTICS

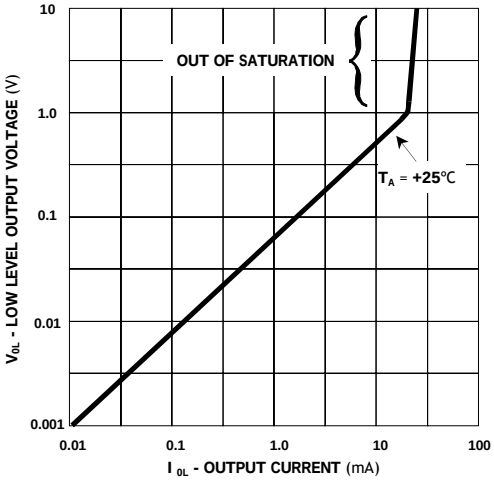
SUPPLY CURRENT



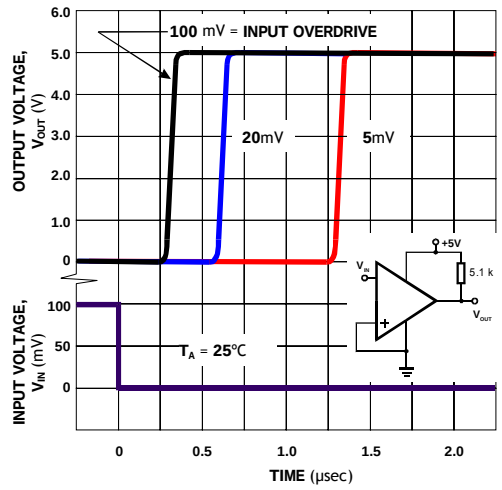
INPUT CURRENT



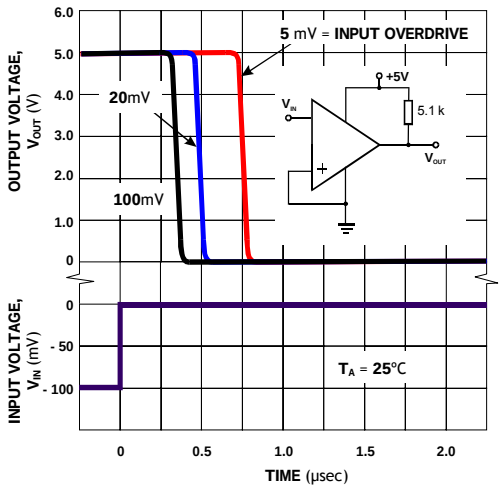
LOW LEVEL OUTPUT VOLTAGE



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION

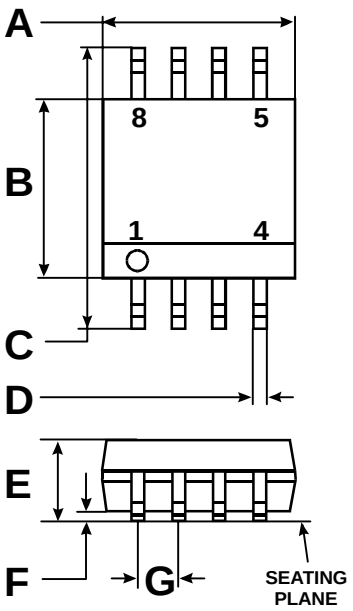


RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - NEGATIVE TRANSITION

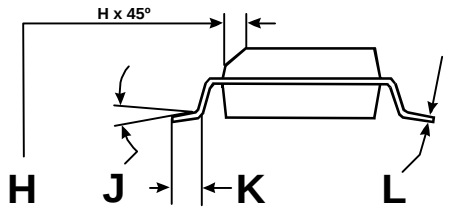


PHYSICAL DIMENSIONS AND MARKING DIAGRAMS

SOP-8
PACKAGE

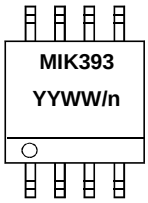


DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	4.80	5.00	0.189	0.197
B	5.80	6.20	0.228	0.244
C	5.80	6.20	0.228	0.244
D	0.33	0.51	0.013	0.020
E	1.35	1.75	0.053	0.069
F	0.10	0.25	0.004	0.010
G	1.27 BSC		0.050 BSC	
H	0.25	0.50	0.010	0.020
J	0°	8°	0°	8°
K	0.40	1.27	0.016	0.050
L	0.19	0.25	0.007	0.010

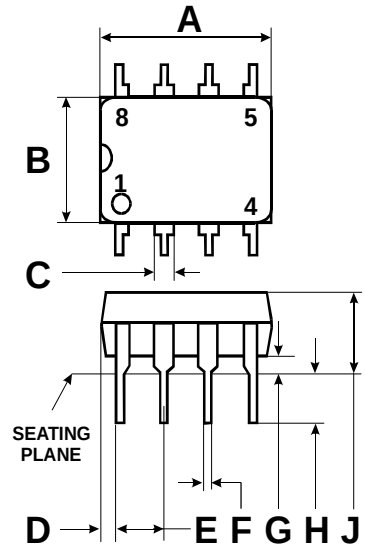


SOP-8
MARKING DIAGRAM

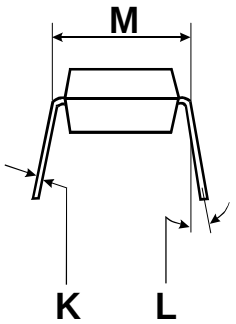
ABBREVIATION	ABBREVIATION EXPANSION
YY	Year
WW	Work Week
n	Assembly Location



DIP-8
PACKAGE



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	9,40	10,16	0,370	0,400
B	6.10	6.60	0.240	0.260
C	1,02	1,78	0,040	0,070
D	0,76	1,27	0,030	0,050
E	2,54 BSC		0,100 BSC	
F	0,38	0,51	0,015	0,020
G	0,76	1,01	0,030	0,040
H	2,92	3,43	0,115	0,135
J	3.94	4,45	0,155	0,175
K	0,20	0,30	0,008	0,012
L	—	10°	—	10°
M	7,62 BSC		0,300 BSC	



DIP-8
MARKING DIAGRAM

ABBREVIATION	ABBREVIATION EXPANSION
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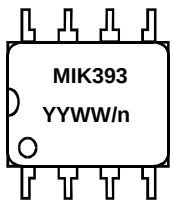

ORDERING INFORMATION

DEVICE	PACKAGE	SHIPPING
MIK393**M**	SOP-8	98 Units / Rail
		2500 Units / Reel
MIK393**N**	DIP-8	50 Units / Rail

NOTE: The form of packing is stipulated in the contract.

MIKRON JSC Head Office

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