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June 2015

# HMHA281, HMHA2801 Series 4-Pin Half-Pitch Mini-Flat Phototransistor Optocouplers

## Features

- Compact 4-pin Package
  - 2.4 mm Maximum Standoff Height
  - Half-pitch Leads for Optimum Board Space Savings
- Current Transfer Ratio:
  - HMHA281: 50% to 600%
  - HMHA2801: 80% to 600%
  - HMHA2801A: 80% to 160%
  - HMHA2801B: 130% to 260%
  - HMHA2801C: 200% to 400%
- Safety and Regulatory Approvals:
  - UL1577, 3,750 VAC<sub>RMS</sub> for 1 Minute
  - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

## Applications

- Digital Logic Inputs
- Microprocessor Inputs
- Power Supply Monitor
- Twisted Pair Line Receiver
- Telephone Line Receiver

## Description

The HMHA281 and HMHA2801 series devices consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a compact 4-pin mini-flat package. The lead pitch is 1.27 mm.

## Schematic

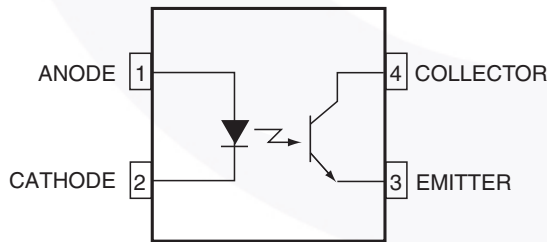


Figure 1. Schematic

## Package Outline

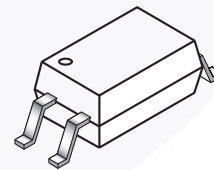


Figure 2. Package Outlines

## Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–III
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	904	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1060	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	565	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	4000	V <sub>peak</sub>
	External Creepage	≥ 5	mm
	External Clearance	≥ 5	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	150	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	200	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	300	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

### Note:

1. Safety limit values – maximum values allowed in the event of a failure.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Value	Units
<b>TOTAL PACKAGE</b>			
$T_{STG}$	Storage Temperature	-55 to +125	°C
$T_{OPR}$	Operating Temperature	-55 to +100	°C
$T_J$	Junction Temperature	-40 to +125	°C
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	210	mW
	Derate Above $25^\circ\text{C}$	2.1	mW/°C
<b>EMITTER</b>			
$I_F$ (avg)	Continuous Forward Current	50	mA
$I_F$ (pk)	Peak Forward Current (1 $\mu\text{s}$ pulse, 300 pps)	1	A
$V_R$	Reverse Input Voltage	6	V
$P_D$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	60	mW
	Derate Above $25^\circ\text{C}$	0.6	mW/°C
<b>DETECTOR</b>			
$I_C$	Continuous Collector Current	50	mA
$V_{CEO}$	Collector-Emitter Voltage	80	V
$V_{ECO}$	Emitter-Collector Voltage	7	V
$P_D$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate Above $25^\circ\text{C}$	1.5	mW/°C

## Electrical Characteristics

$T_A = 25^\circ\text{C}$

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
<b>INDIVIDUAL COMPONENT CHARACTERISTICS</b>							
<b>Emitter</b>							
$V_F$	Forward Voltage	$I_F = 10\text{ mA}$	All	1.0		1.3	V
$I_R$	Reverse Current	$V_R = 5\text{ V}$	All			5	$\mu\text{A}$
<b>Detector</b>							
$BV_{CEO}$	Breakdown Voltage Collector to Emitter	$I_C = 0.5\text{ mA}, I_F = 0$	All	80			V
$BV_{ECO}$	Emitter to Collector	$I_E = 100\text{ }\mu\text{A}, I_F = 0$	All	7			
$I_{CEO}$	Collector Dark Current	$V_{CE} = 80\text{ V}, I_F = 0$	All			100	nA
$C_{CE}$	Capacitance	$V_{CE} = 0\text{ V}, f = 1\text{ MHz}$	All		10		pF
<b>TRANSFER CHARACTERISTICS</b>							
CTR	DC Current Transfer Ratio	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$	HMHA281	50		600	%
			HMHA2801	80		600	
			HMHA2801A	80		160	
			HMHA2801B	130		260	
			HMHA2801C	200		400	
$V_{CE(SAT)}$	Saturation Voltage	$I_F = 8\text{ mA}, I_C = 2.4\text{ mA}$	HMHA281			0.4	V
		$I_F = 10\text{ mA}, I_C = 2\text{ mA}$	HMHA2801, HMHA2801A, HMHA2801B, HMHA2801C			0.3	
$t_r$	Rise Time (Non-Saturated)	$I_C = 2\text{ mA}, V_{CE} = 5\text{ V},$ $R_L = 100\text{ }\Omega$	All		3		$\mu\text{s}$
$t_f$	Fall Time (Non-Saturated)	$I_C = 2\text{ mA}, V_{CE} = 5\text{ V},$ $R_L = 100\text{ }\Omega$	All		3		
<b>ISOLATION CHARACTERISTICS</b>							
$V_{ISO}$	Steady State Isolation Voltage	1 Minute	All	3750			$V_{AC_{RMS}}$

Typical Performance Characteristics

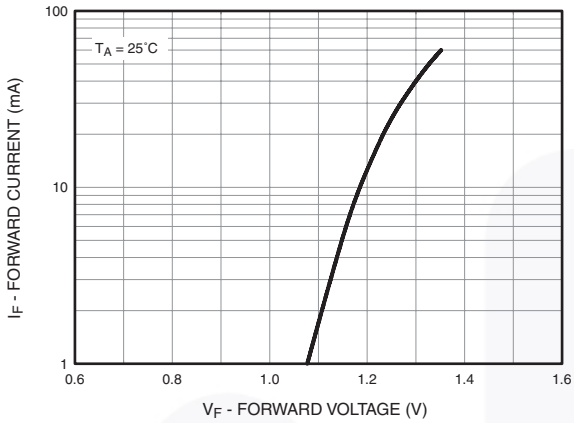


Figure 3. Forward Current vs. Forward Voltage

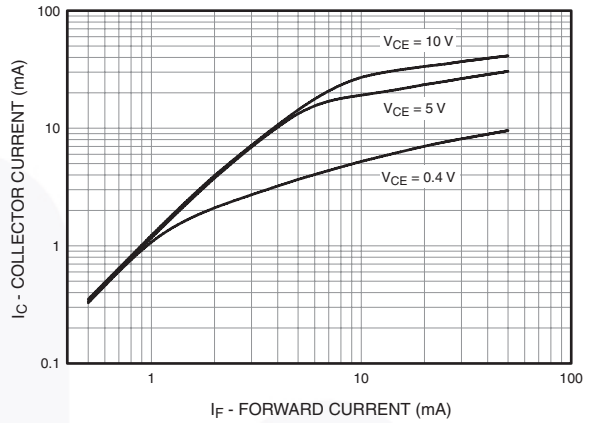


Figure 4. Collector Current vs. Forward Current

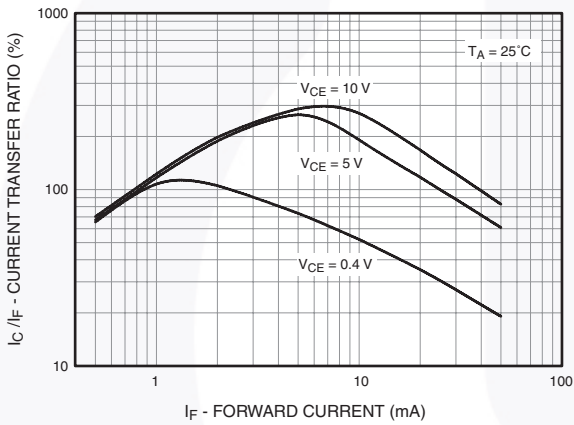


Figure 5. Current Transfer Ratio vs. Forward Current

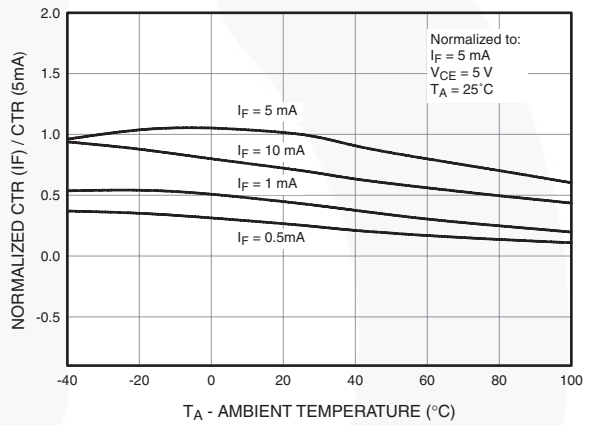


Figure 6. Normalized CTR vs. Temperature

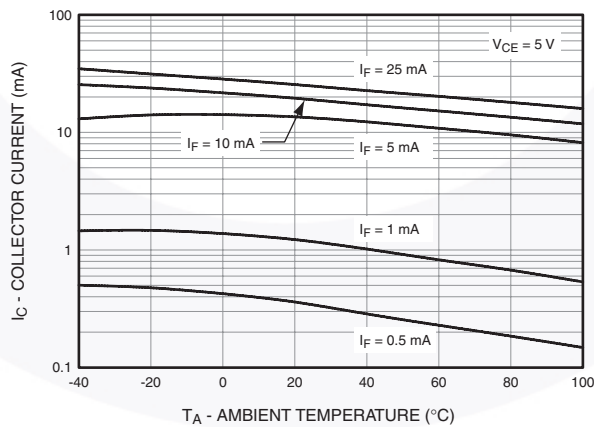


Figure 7. Collector Current vs. Temperature

Typical Performance Characteristics (Continued)

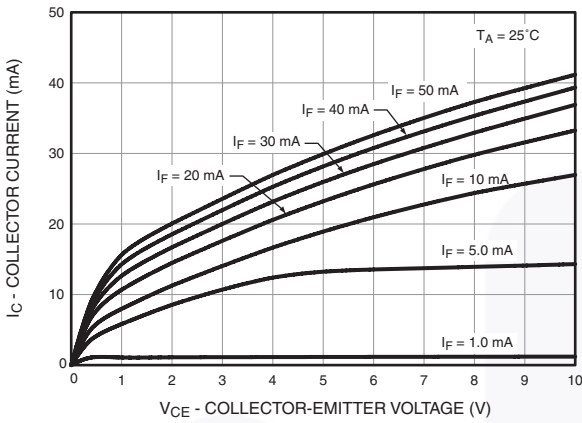


Figure 8. Collector Current vs. Collector-Emitter Voltage

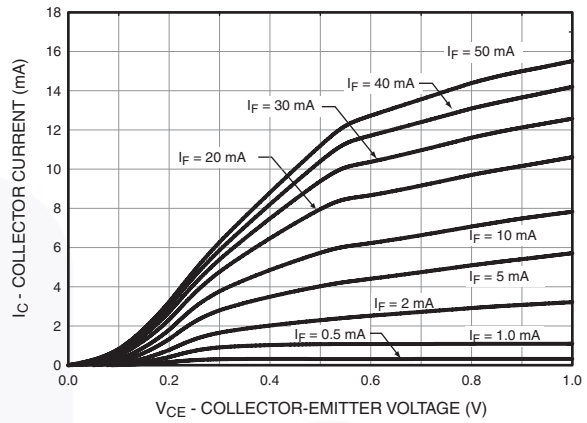


Figure 9. Collector Current vs. Collector-Emitter Voltage

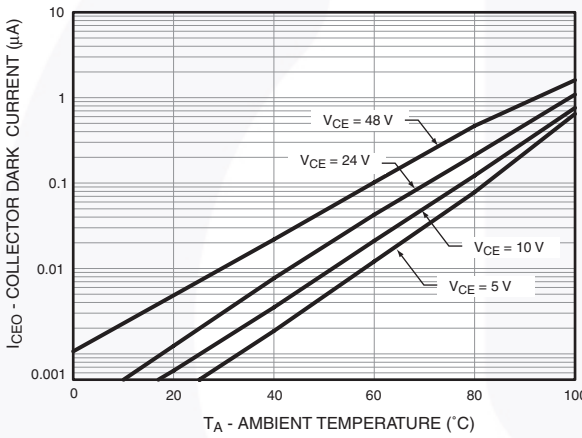


Figure 10. Collector Dark Current vs. Temperature

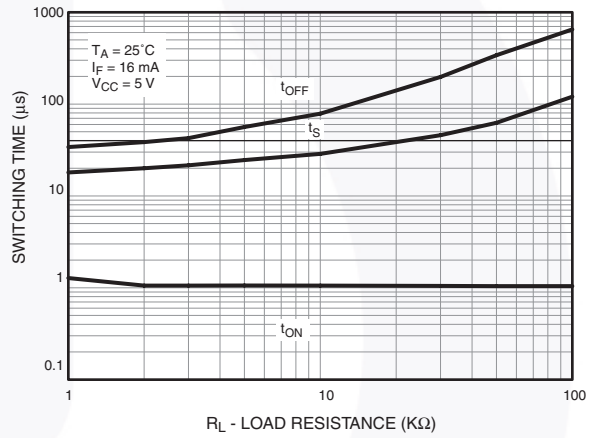


Figure 11. Switching Time vs. Load Resistance

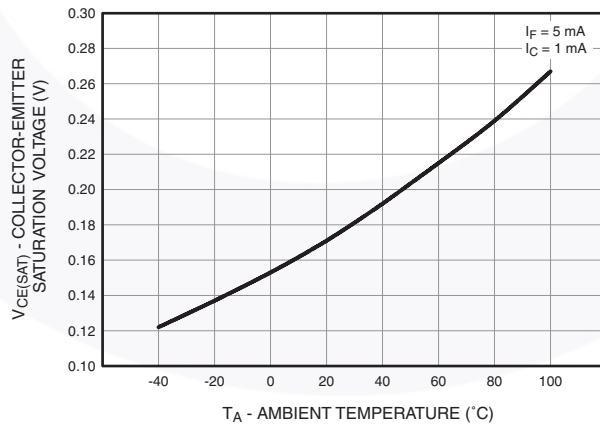


Figure 12. Collector-Emitter Saturation Voltage vs. Temperature

### Reflow Profile

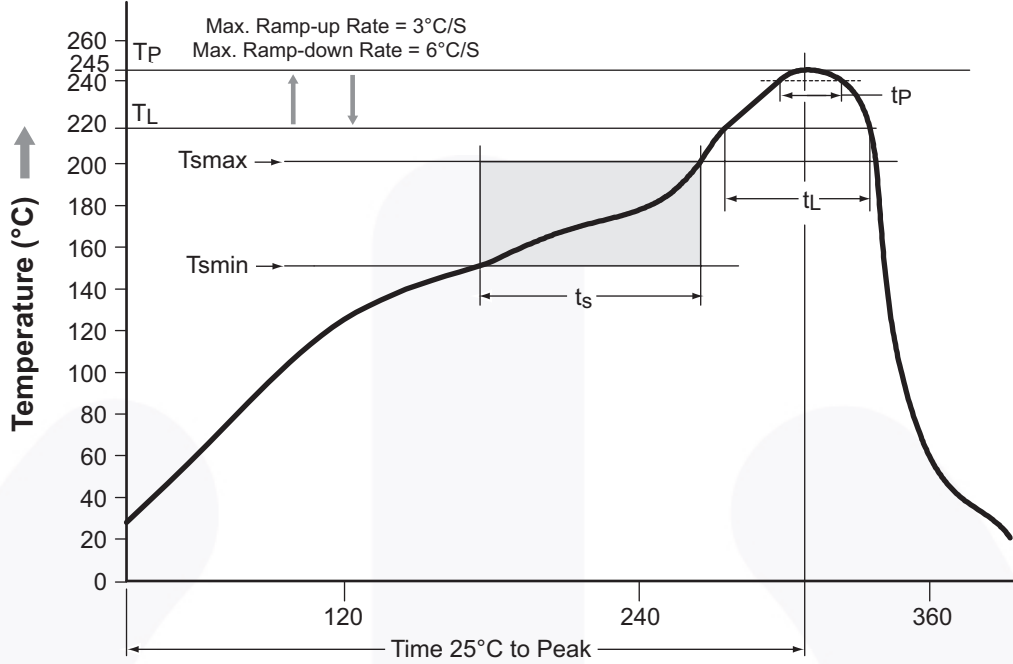


Figure 13. Reflow Profile

Profile Feature	Pb-Free Assembly Profile
Temperature Minimum (T <sub>smin</sub> )	150°C
Temperature Maximum (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60–120 seconds
Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second maximum
Liquidous Temperature (T <sub>L</sub> )	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60–150 seconds
Peak Body Package Temperature	245°C +0°C / -5°C
Time (t <sub>P</sub> ) within 5°C of 245°C	30 seconds
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum



## Ordering Information

Part Number	Package	Packing Method
HMHA2801	Half Pitch Mini-Flat 4-Pin	Tube (100 units)
HMHA2801R2	Half Pitch Mini-Flat 4-Pin	Tape and Reel (2500 Units)
HMHA2801V	Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
HMHA2801R2V	Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (2500 Units)

**Note:**

2. The product orderable part number system listed in this table also applies to the HMHA281, HMHA2801A, HMHA2801B, and HMHA2801C products.

## Marking Information

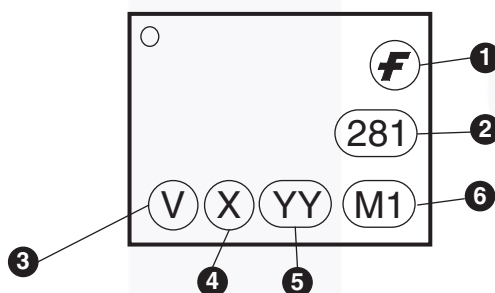
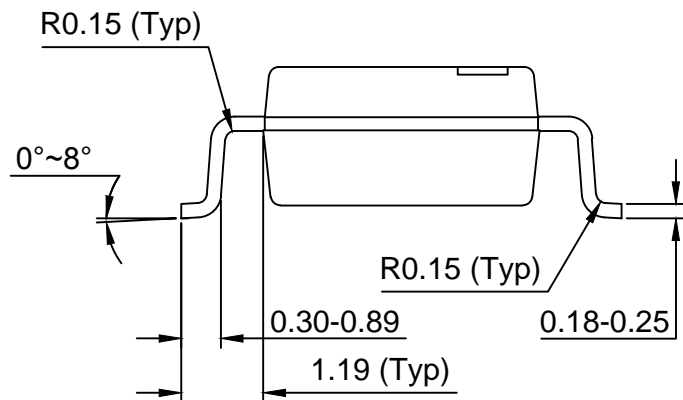
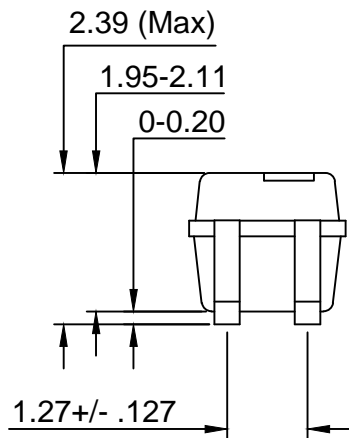
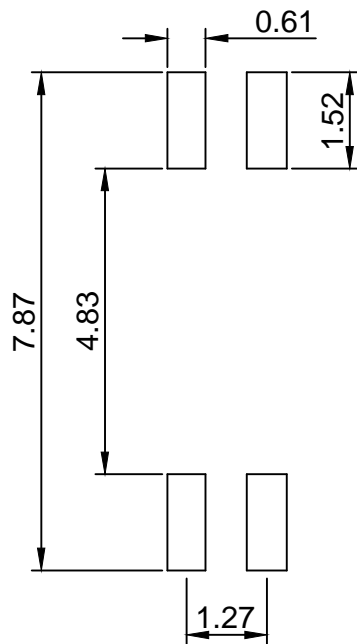
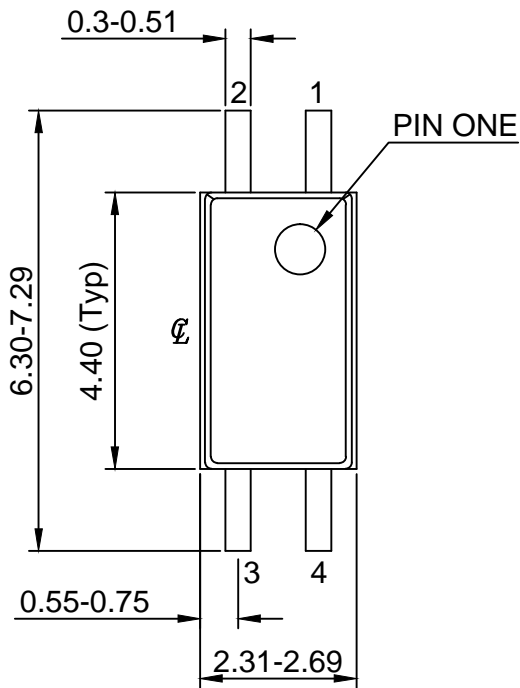


Figure 14. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., “5”
5	Digit Work Week, Ranging from “01” to “53”
6	Assembly Package Code



NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE
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