

## HSMx-C130

### Surface Mount ChipLEDs

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#### Description

The Broadcom<sup>®</sup> HSMx-C130 ChipLED is a surface-mount LED that comes in an industrial standard 1.6 mm × 0.8 mm footprint. It offers industry leading performance by using efficient and high brightness AlInGaP material. Its small form factor and low profile enable flexible board or custom design, and the LED can be closely mounted, thus offering a cost effective solution.

This LED has a wide viewing angle. Coupled with high performance and a small package size, these features make this device an ideal candidate for applications that require uniform light distribution, high brightness and less board space.

This device is ideal for use in applications, such as industrial equipment, consumer electronics, gaming, home appliances, and black and white goods markets.

These chip-type LEDs utilize Aluminum Indium Gallium Phosphide (AlInGaP) material technology. The AlInGaP material has a very high luminous efficiency, capable of producing high light output over a wide range of drive currents.

Four different colors are available: amber, red, green, and orange. All parts are intensity binned and color binned (except for red color). They come in 8-mm conductive tape on a 7-in. diameter reel with 4000 units per reel, which make them compatible for automatic placement.

#### Features

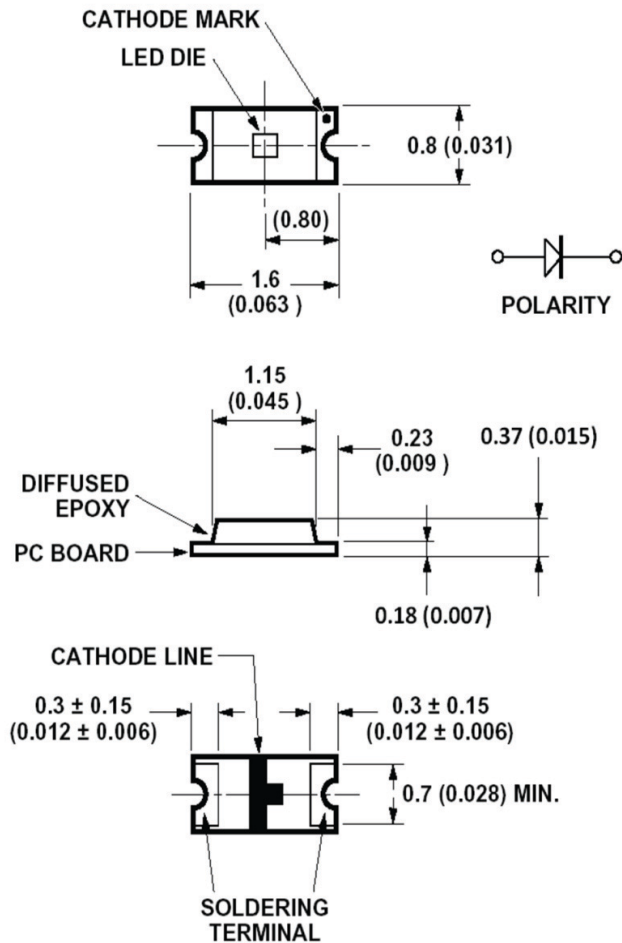
- High brightness AlInGaP material
- Small size with low profile
- 0603 industry standard footprint with 0.37 mm height
- Diffused optics
- Operating range of -40°C to 85°C
- Available in four colors
- Compatible with IR soldering
- Available in 8-mm conductive tape on 7-in. diameter reel
- Reel sealed in zip-locked moisture barrier bags

#### Applications

- Membrane switch indicator
- LCD backlighting
- Push button backlighting
- Front panel indicator
- Symbol backlighting
- Keypad backlighting

**CAUTION!** HSMx-C130 LEDs are Class 1A ESD sensitive per JESD22-A114C.01 standard. Please observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.

## Package Dimensions



### NOTE:

1. All dimensions are in millimeters (inches).
2. Tolerance is  $\pm 0.1$  mm ( $\pm 0.004$  in.) unless otherwise specified.

## Device Selection Guide

Part Number	Color	Die Technology	Parts per Reel	Package Description
HSMA-C130	Amber	AllnGaP	4000	Untinted, Diffused
HSMC-C130	Red	AllnGaP	4000	Untinted, Diffused
HSME-C130	Yellow Green	AllnGaP	4000	Untinted, Diffused
HSML-C130	Orange	AllnGaP	4000	Untinted, Diffused

## Absolute Maximum Ratings at $T_A = 25^\circ\text{C}$

Parameter	AllnGaP	Units
DC Forward Current <sup>a</sup>	20	mA
Power Dissipation	48	mW
Reverse Voltage ( $I_R = 100 \mu\text{A}$ )	5	V
LED Junction Temperature	95	$^\circ\text{C}$
Operating Temperature Range	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	
Storage Temperature Range	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	
Soldering Temperature	See reflow soldering profile (Figure 5 and 6)	

a. Derate linearly as shown in Figure 4.

## Electrical Characteristics at $T_A = 25^\circ\text{C}$

Part Number	Forward Voltage $V_F$ (Volts) @ $I_F = 20 \text{ mA}$		Reverse Breakdown $V_R$ (Volts) @ $I_R = 100 \mu\text{A}$ <sup>a</sup>	Thermal Resistance $R\theta_{JP}$ ( $^\circ\text{C}/\text{W}$ ) Typical
	Typ.	Max.	Min.	
HSMA-C130	2.05	2.40	5	500
HSMC-C130	1.94	2.40	5	500
HSME-C130	1.94	2.40	5	500
HSML-C130	1.94	2.40	5	500

a. Indicate product final test condition only, Long-term reverse bias is not recommended.

## Optical Characteristics at $T_A = 25^\circ\text{C}$

Part Number	Luminous Intensity $I_V$ <sup>a</sup> (mcd) @ 20 mA		Peak Wavelength $\lambda_{\text{peak}}$ (nm) Typical	Color, Dominant Wavelength $\lambda_d$ <sup>b</sup> (nm) Typical	Viewing Angle $2\theta_{1/2}$ <sup>c</sup> (Degrees) Typical
	Min.	Typ.			
HSMA-C130	28.5	87.0	591	589	110
HSMC-C130	28.5	131.0	635	626	110
HSME-C130	18.0	54.0	575	573	110
HSML-C130	28.5	139.0	612	606	110

a. The luminous intensity  $I_V$  is measured at the peak of the spatial radiation pattern which may not be aligned with the mechanical axis of the LED package.

b. The dominant wavelength,  $\lambda_d$  is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.

c.  $\theta_{1/2}$  is the off-axis angle where the luminous intensity is  $1/2$  the peak intensity.

## Light Intensity (IV) Bin Limits

Bin ID	Intensity (mcd)	
	Minimum	Maximum
M	18.00	28.50
N	28.50	45.00
P	45.00	71.50
Q	71.50	112.50
R	112.50	180.00
S	180.0	285.0
T	285.0	450.0
U	450.0	715.0
V	715.0	1125.0
W	1125.0	1800.0
X	1800.0	2850.0
Y	2850.0	4500.0

Tolerance :  $\pm 15\%$

**NOTE:** Bin categories are established for classification of products. Products may not be available in all categories. Please contact your Broadcom representative for information on current available bins.

## Forward Voltage Limits

Bin ID	Forward Voltage (V)	
	Minimum	Maximum
1	1.60	1.80
2	1.80	2.00
3	2.00	2.20
4	2.20	2.40

## AllnGaP Amber Color Bin Limits

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
A	582.0	584.5
B	584.5	587.0
C	587.0	589.5
D	589.5	592.0
E	592.0	594.5
F	594.5	597.0

Tolerance :  $\pm 1$  nm

## AllnGaP Red Color Bin Limits

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
—	620.0	635.0

Tolerance :  $\pm 1$  nm

## AllnGaP Yellow Green Color Bin Limits

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
A	561.5	564.5
B	564.5	567.5
C	567.5	570.5
D	570.5	573.5
E	573.5	576.5

Tolerance :  $\pm 1$  nm

## AllnGaP Orange Color Bin Limits

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
A	597.0	600.0
B	600.0	603.0
C	603.0	606.0
D	606.0	609.0
E	609.0	612.0
F	612.0	615.0

Tolerance :  $\pm 1$  nm

**NOTE:** Bin categories are established for classification of products. Products may not be available in all categories. Please contact your Broadcom representative for information on current available bins.

Figure 1: Luminous Intensity vs. Forward Current

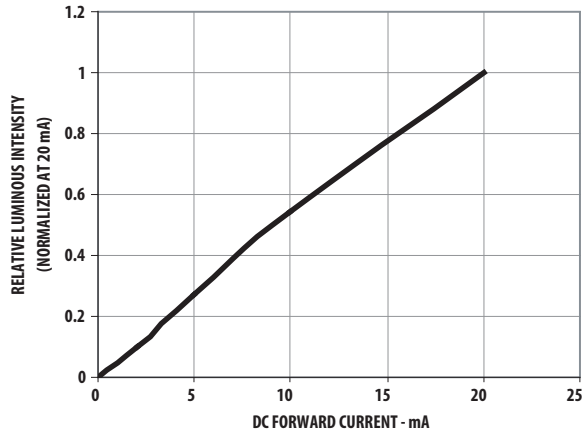


Figure 2: Forward Current vs. Forward Voltage

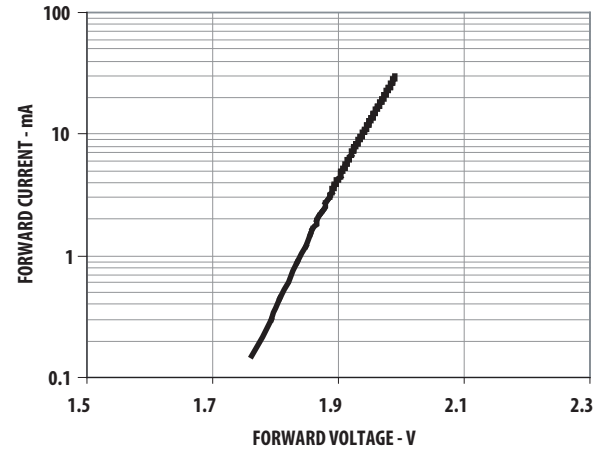


Figure 3: Relative Intensity vs. Peak Wavelength

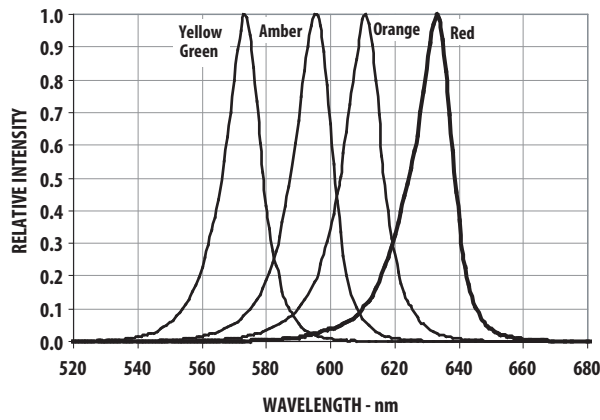


Figure 4: Maximum DC Forward Current vs. Ambient Temperature

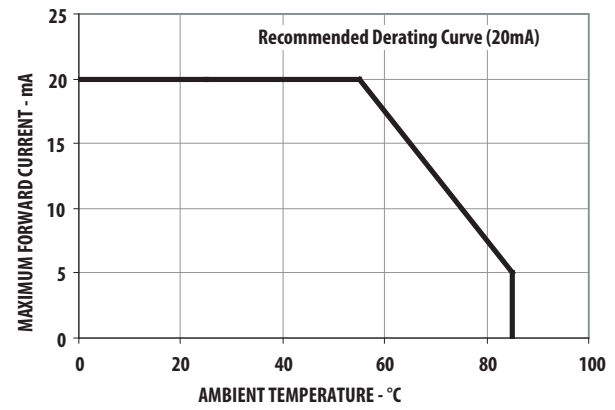


Figure 5: Radiation Pattern

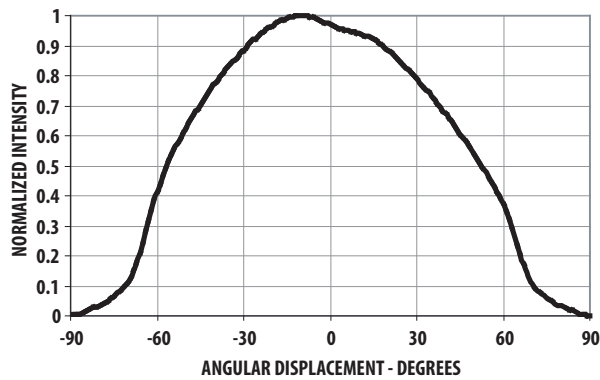
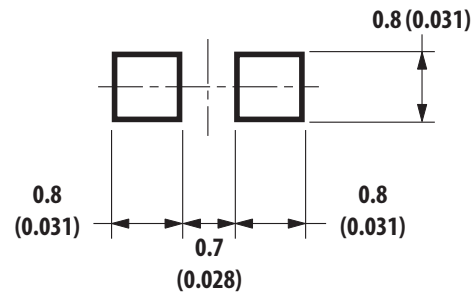


Figure 6: Recommended Soldering Land Pattern



**NOTE:**

1. All dimensions are in millimeters (inches).
2. Tolerance is  $\pm 0.1$  mm ( $\pm 0.004$  in.) unless otherwise specified.

Figure 7: Reeling Orientation

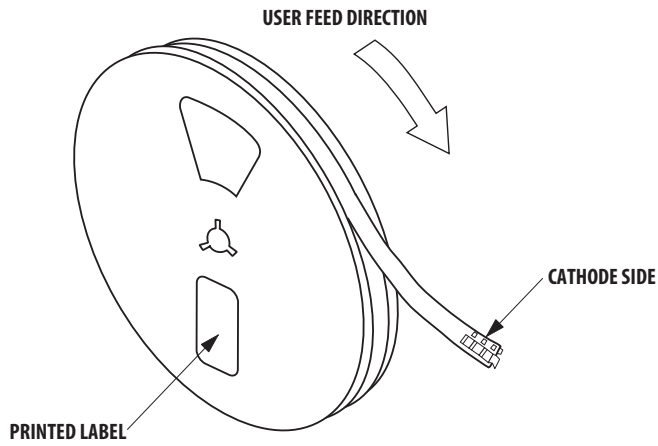


Figure 8: Reel Dimensions

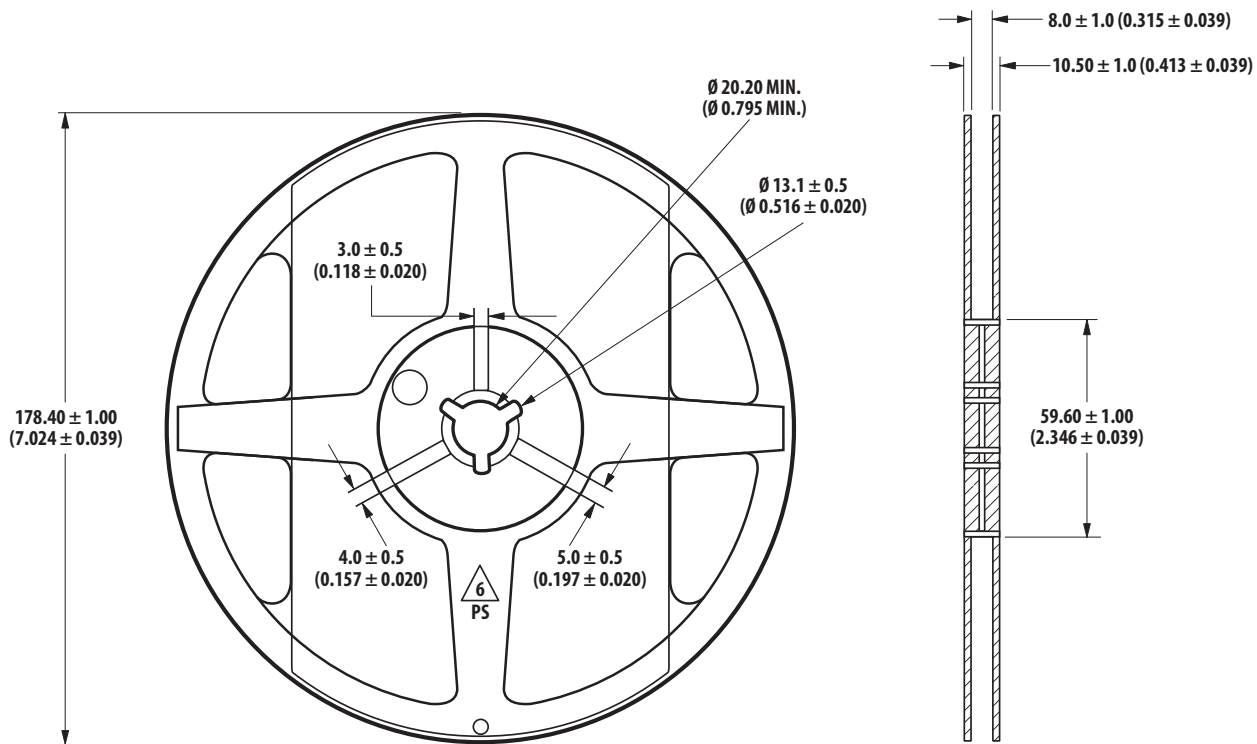


Figure 9: Tape Dimensions

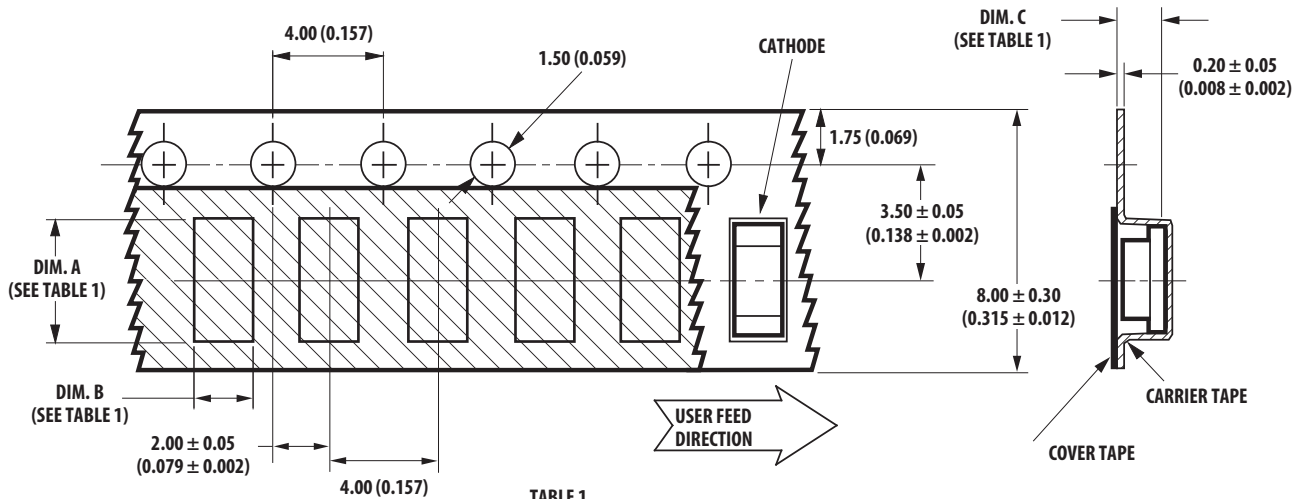


TABLE 1

PART NUMBER	DIM. A ± 0.10 (± 0.004)	DIM. B ± 0.10 (± 0.004)	DIM. C ± 0.10 (± 0.004)
HSMx-C130	1.75 (0.069)	0.90 (0.035)	0.60 (0.024)

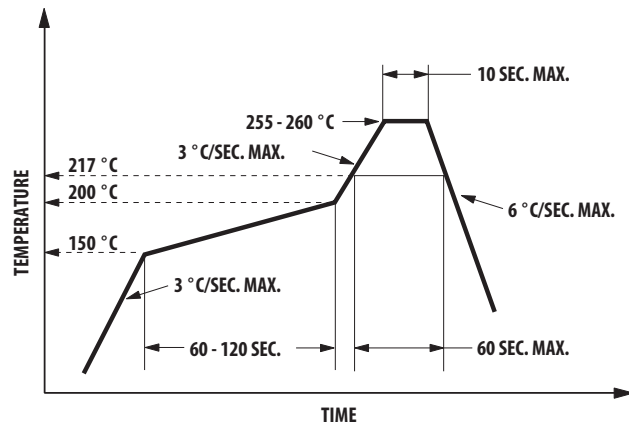
DIMENSIONS IN MILLIMETERS (INCHES)

## Precautionary Notes

### Soldering

- Do not perform reflow soldering more than twice. Observe necessary precautions for handling moisture-sensitive devices as stated in the following section.
- Do not apply any pressure or force on the LED during reflow and after reflow when the LED is still hot.
- Use reflow soldering to solder the LED. Use hand soldering only for rework if unavoidable, but it must be strictly controlled to following conditions:
  - Soldering iron tip temperature = 310°C max.
  - Soldering duration = 2s max.
  - Number of cycles = 1 only
  - Power of soldering iron = 50W max.
- Do not touch the LED package body with the soldering iron except for the soldering terminals, because it may cause damage to the LED.
- Confirm beforehand whether the functionality and performance of the LED is affected by soldering with hand soldering.

Figure 10: Recommended Lead-Free Reflow Soldering Profile



## Handling of Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 2a rating per JEDEC J-STD-020. Refer to Broadcom Application Note AN5305, *Handling of Moisture Sensitive Surface Mount Devices* for additional details and a review of proper handling procedures.

- Before use:
  - An unopened moisture barrier bag (MBB) can be stored at < 40°C/90% RH for 12 months. If the actual indicator card (HIC) indicates that baking is not required, it is safe to reflow the LEDs per the original MSL rating.
  - Do not open the MBB prior to assembly (for example, for IQC). If unavoidable, MBB must be properly resealed with fresh desiccant and HIC. The exposed duration must be taken in as floor life.
- Control after opening the MBB:
  - Read the HIC immediately upon opening of MBB.
  - Keep the LEDs at <30°/60% RH at all times, and complete all high temperature-related processes, including soldering, curing or rework within 672 hours.
- Control for unfinished reel:
 

Store unused LEDs in a sealed MBB with desiccant or a desiccator at <5% RH.
- Control of assembled boards:
 

If the PCB soldered with the LEDs is to be subjected to other high-temperature processes, store the PCB in a sealed MBB with desiccant or desiccator at <5% RH to ensure that all LEDs have not exceeded their floor life of 672 hours.
- Baking is required if:
  - The HIC indicator indicates a change in color for 10% and 5%, as stated on the HIC.
  - The LEDs are exposed to conditions of >30°C/60% RH at any time.
  - The LED's floor life exceeded 672 hours.

The recommended baking condition is: 60°C ± 5°C for 20 hours.

Baking can only be done once.

## Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperature as stated in the data sheet. Constant current driving is recommended to ensure consistent performance.
- Circuit design must cater to the whole range of forward voltage ( $V_F$ ) of the LEDs to ensure the intended drive current can always be achieved.
- The LED exhibits slightly different characteristics at different drive currents, which may result in a larger variation of performance (meaning: intensity, wavelength, and forward voltage). Set the application current as close as possible to the test current to minimize these variations.
- If the LED is intended to be used along with an LED of another color to achieve color mixing, Broadcom does not guarantee the consistency of the resultant color. Contact your Broadcom sales representative for such applications.
- The LED is not intended for reverse bias. Use other appropriate components for such purposes. When driving the LED in matrix form, ensure that the reverse bias voltage does not exceed the allowable limit of the LED.
- Avoid rapid change in ambient temperature, especially in high-humidity environments, because they cause condensation on the LED.
- If the LED is intended to be used in harsh or outdoor environments, protect the LED against damages caused by rain water, water, dust, oil, corrosive gases, external mechanical stresses, and so on.

## Eye Safety Precautions

LEDs may pose optical hazards when in operation. Do not look directly at operating LEDs because it might be harmful to the eyes. For safety reasons, use appropriate shielding or personal protective equipment



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