

# HCPL2631 DUAL-CHANNEL OPTOCOUPLER/OPTOISOLATOR

SOOS017 D3114, APRIL 1988

- Gallium Arsenide Phosphide LED Optically Coupled to an Integrated Circuit Detector
- Compatible with TTL and LSTTL Inputs
- Low Input Current Required for On-State Output . . . 5 mA Max
- High-Voltage Electrical Insulation . . . 3000 V DC Min
- High-Speed Switching . . . 75 ns Max
- Directly Interchangeable with Hewlett Packard HCPL2631
- UL Recognized . . . File Number E65085
- Internal Shield for High Common-Mode Rejection

## description

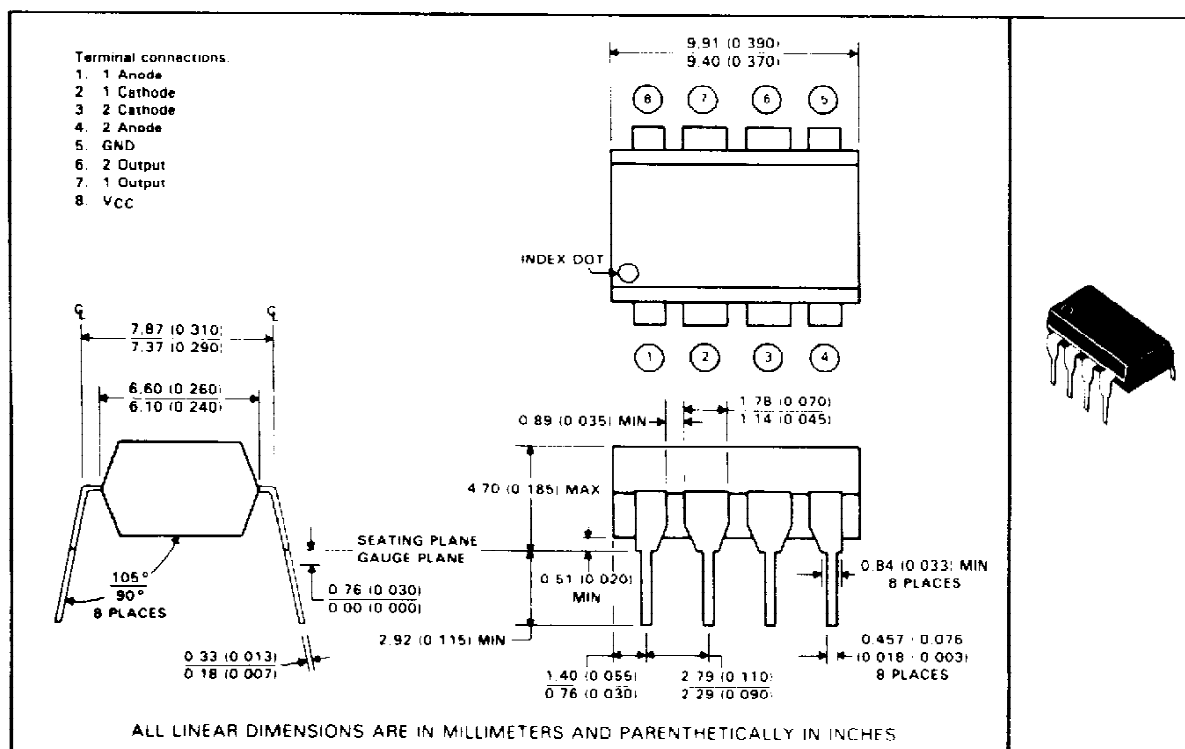
The HCPL2631 is a dual optocoupler designed for use in high-speed digital interfacing applications that require high-voltage isolation between the input and output. Applications include line receivers, microprocessors or computer interface, and other control systems.

Each channel of the HCPL2631 optocoupler consists of a GaAsP light-emitting diode and an integrated light detector composed of a photodiode, a high-gain amplifier, and a Schottky-clamped open-collector output transistor. An input diode forward current of 5 mA will switch the output transistor low, providing an on-state drive current of 13 mA (eight 1.6-mA TTL loads).

The device is mounted in a standard 8-pin dual-in-line plastic package. The internal shield provides a guaranteed common-mode transient immunity of 1000 V/μs minimum.

The HCPL2631 is characterized for operation over the temperature range of 0°C to 70°C.

## mechanical data



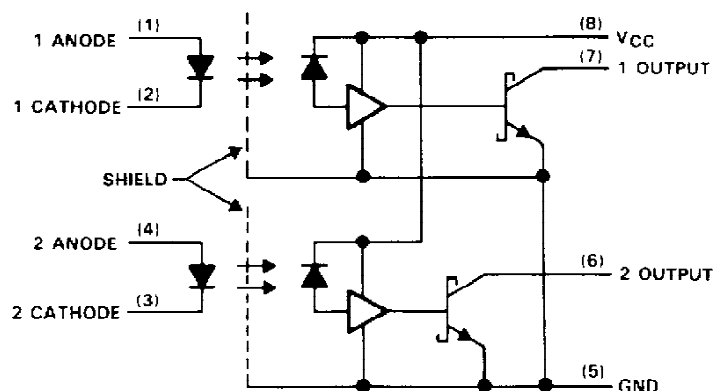
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# **HCPL2631** **DUAL-CHANNEL OPTOCOUPLER/OPTOISOLATOR**

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                                                  |                                                |
|------------------------------------------------------------------|------------------------------------------------|
| Supply voltage, $V_{CC}$                                         | 7 V                                            |
| Reverse input voltage                                            | 5 V                                            |
| Output voltage                                                   | 7 V                                            |
| Peak forward input current, each channel ( $\leq 1$ ms duration) | 30 mA                                          |
| Average forward input current, each channel                      | 15 mA                                          |
| Output current, each channel                                     | 16 mA                                          |
| Output power dissipation                                         | 85 mW                                          |
| Storage temperature range                                        | $-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ |
| Operating free-air temperature range                             | $0^{\circ}\text{C}$ to $70^{\circ}\text{C}$    |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds     | $260^{\circ}\text{C}$                          |

recommended operating conditions

|                                                       | MIN | NOM | MAX | UNIT               |
|-------------------------------------------------------|-----|-----|-----|--------------------|
| $V_{CC}$ Output supply voltage (see Note 1)           | 4.5 | 5   | 5.5 | V                  |
| $I_{F(on)}$ Input forward current to turn output on   | 6.3 |     | 15  | mA                 |
| $I_{F(off)}$ Input forward current to turn output off | 0   |     | 250 | $\mu\text{A}$      |
| $I_{OL}$ Low-level (on-state) output current          |     |     | 13  | mA                 |
| $T_A$ Operating free-air temperature                  | 0   |     | 70  | $^{\circ}\text{C}$ |

NOTE 1: All voltage values are with respect to GND (pin 5).

# HCPL2631

## DUAL-CHANNEL OPTOCOUPLER/OPTOISOLATOR

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER        | TEST CONDITIONS                            | MIN                                                                            | TYP <sup>†</sup> | MAX  | UNIT  |
|------------------|--------------------------------------------|--------------------------------------------------------------------------------|------------------|------|-------|
| V <sub>F</sub>   | Input forward voltage                      | I <sub>F</sub> = 10 mA, T <sub>A</sub> = 25°C                                  | 1.6              | 1.75 | V     |
| α <sub>VF</sub>  | Temperature coefficient of forward voltage | I <sub>F</sub> = 10 mA                                                         | -1.8             |      | mV/°C |
| V <sub>BR</sub>  | Input reverse breakdown voltage            | I <sub>R</sub> = 10 μA, T <sub>A</sub> = 25°C                                  | 5                |      | V     |
| V <sub>OL</sub>  | Low-level output voltage                   | V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 5 mA, I <sub>OL</sub> = 13 mA        | 0.23             | 0.6  | V     |
| I <sub>OH</sub>  | High-level output current                  | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 5.5 V, I <sub>F</sub> = 250 μA       |                  | 250  | μA    |
| I <sub>CCH</sub> | Supply current, high-level output          | V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 0                                    | 20               | 30   | mA    |
| I <sub>CCL</sub> | Supply current, low-level output           | V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 10 mA                                | 26               | 38   | mA    |
| I <sub>II</sub>  | Input-input insulation leakage current     | V <sub>II</sub> = 500 V, t = 5 s, T <sub>A</sub> = 25°C, RH = 45%, See Note 2  | 0.005            |      | μA    |
| I <sub>IO</sub>  | Input-output insulation leakage current    | V <sub>IO</sub> = 3000 V, t = 5 s, T <sub>A</sub> = 25°C, RH = 45%, See Note 1 |                  | 1    | μA    |
| r <sub>II</sub>  | Input-input resistance                     | V <sub>II</sub> = 500 V, T <sub>A</sub> = 25°C, See Note 2                     | 10 <sup>11</sup> |      | Ω     |
| r <sub>IO</sub>  | Input-output resistance                    | V <sub>IO</sub> = 500 V, T <sub>A</sub> = 25°C, See Note 1                     | 10 <sup>12</sup> |      | Ω     |
| C <sub>I</sub>   | Input capacitance                          | V <sub>F</sub> = 0, f = 1 MHz                                                  | 60               |      | pF    |
| C <sub>II</sub>  | Input-input capacitance                    | V <sub>F</sub> = 0, f = 1 MHz                                                  | 0.25             |      | pF    |
| C <sub>IO</sub>  | Input-output capacitance                   | f = 1 MHz, T <sub>A</sub> = 25°C, See Note 1                                   | 0.6              |      | pF    |

<sup>†</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

NOTES: 1. These parameters are measured between pins 1, 2, 3, and 4 shorted together and pins 5, 6, 7, and 8 shorted together.

2. These parameters are measured between pins 1 and 2 shorted together and pins 3 and 4 shorted together.

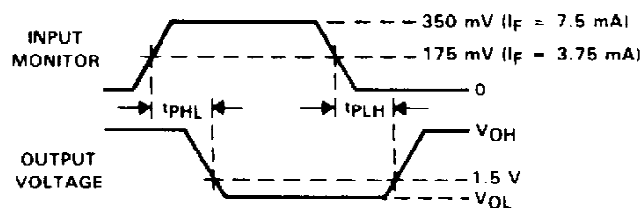
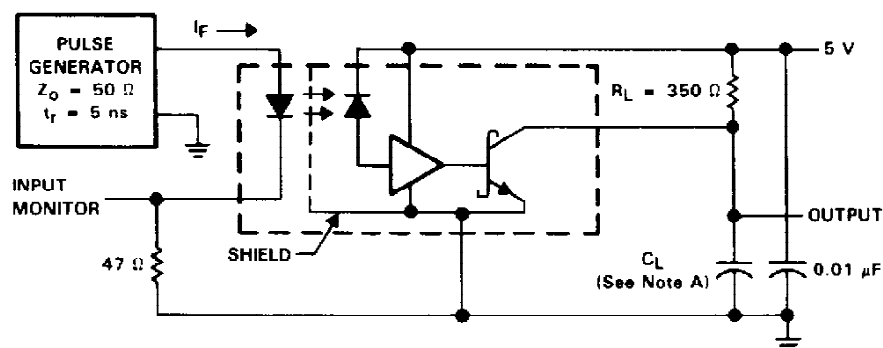
switching characteristics at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

| PARAMETER                | TEST CONDITIONS                                                  | MIN                                                                                              | TYP   | MAX     | UNIT |
|--------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------|---------|------|
| t <sub>PLH</sub>         | Propagation delay time, low-to-high-level output, from LED input | I <sub>F</sub> = 7.5 mA, R <sub>L</sub> = 350 Ω, C <sub>L</sub> = 15 pF, See Figure 1            | 42    | 75      | ns   |
| t <sub>PHL</sub>         | Propagation delay time, high-to-low level output, from LED input | I <sub>F</sub> = 7.5 mA, R <sub>L</sub> = 350 Ω, C <sub>L</sub> = 15 pF, See Figure 1            | 42    | 75      | ns   |
| t <sub>r</sub>           | Rise time                                                        | I <sub>F</sub> = 7.5 mA, R <sub>L</sub> = 350 Ω, C <sub>L</sub> = 15 pF                          | 20    |         | ns   |
| t <sub>f</sub>           | Fall time                                                        | I <sub>F</sub> = 7.5 mA, R <sub>L</sub> = 350 Ω, C <sub>L</sub> = 15 pF                          | 30    |         | ns   |
| $\frac{dV_{CM}}{dt}$ (H) | Common-mode input transient immunity, high-level output          | ΔV <sub>CM</sub> = 50 V, I <sub>F</sub> = 0, R <sub>L</sub> = 350 Ω, See Note 3 and Figure 2     | 1000  | 10 000  | V/μs |
| $\frac{dV_{CM}}{dt}$ (L) | Common-mode input transient immunity, low-level output           | ΔV <sub>CM</sub> = -50 V, I <sub>F</sub> = 5 mA, R <sub>L</sub> = 350 Ω, See Note 3 and Figure 2 | -1000 | -10 000 | V/μs |

NOTE 3: Common-mode input transient immunity, high-level output, is the maximum rate of rise of the common-mode input voltage that does not cause the output voltage to drop below 2 V. Common-mode input transient immunity, low-level output, is the maximum rate of fall of the common-mode input voltage that does not cause the output voltage to rise above 0.8 V.

# **HCPL2631** **DUAL-CHANNEL OPTOCOUPLER/OPTOISOLATOR**

## **PARAMETER MEASUREMENT INFORMATION** **(EACH CHANNEL)**

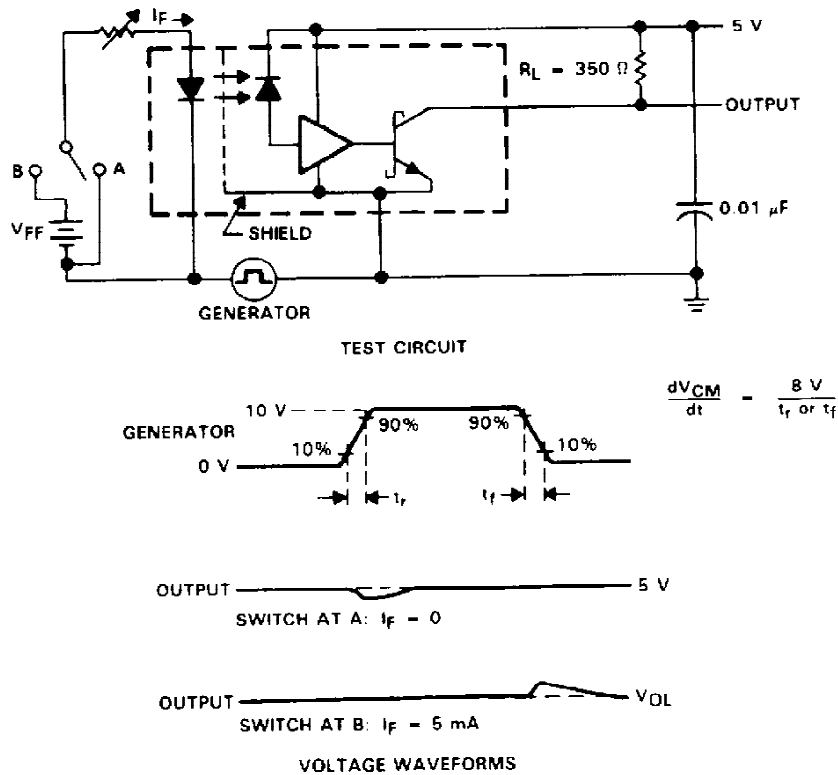


NOTE A:  $C_L$  is approximately 15 pF, which includes probe and stray wiring capacitances

**FIGURE 1.  $t_{PLH}$  AND  $t_{PHL}$  FROM LED INPUT TEST CIRCUIT AND WAVEFORMS**

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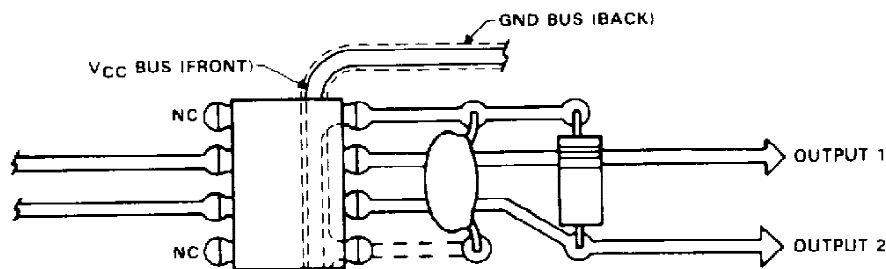
## **PARAMETER MEASUREMENT INFORMATION** **(EACH CHANNEL)**



**FIGURE 2. TRANSIENT IMMUNITY TEST CIRCUIT AND WAVEFORMS**

## **TYPICAL APPLICATION INFORMATION**

A ceramic capacitor (0.01  $\mu\text{F}$  to 0.1  $\mu\text{F}$ ) should be connected between pins 8 and 5 to stabilize the high-gain amplifier. The total lead length between the capacitor and the optocoupler should not exceed 20 mm (0.8 inches). Failure to provide a bypass capacitor may result in impaired switching characteristics.



**HCPL2631**  
**DUAL-CHANNEL OPTOCOUPLER/OPTOISOLATOR**

**TYPICAL CHARACTERISTICS**

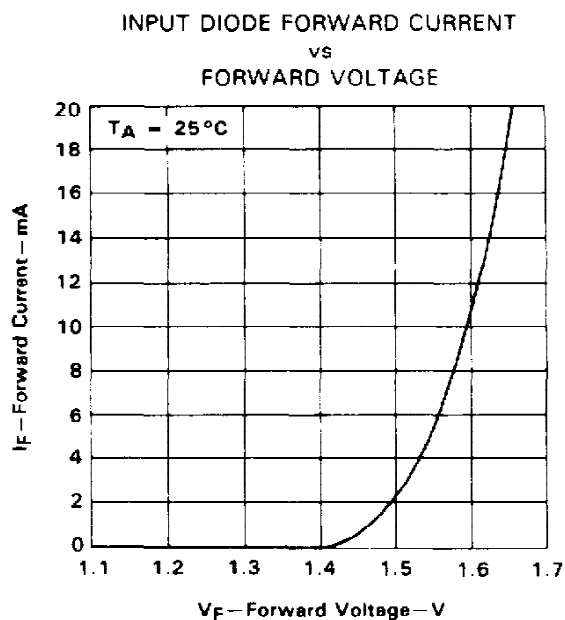


FIGURE 4

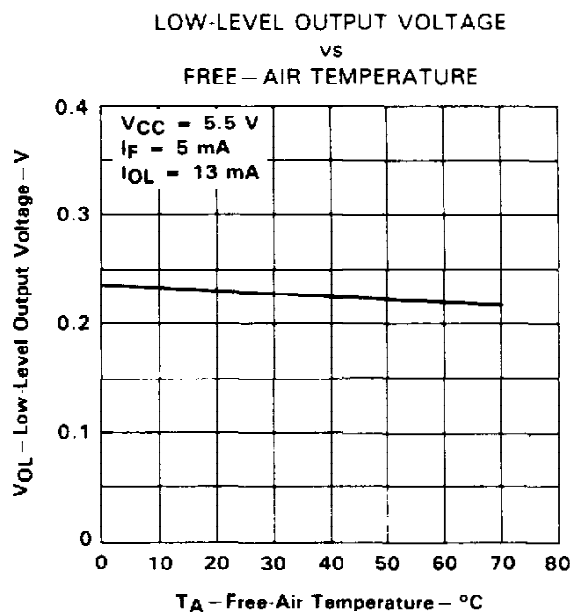


FIGURE 5

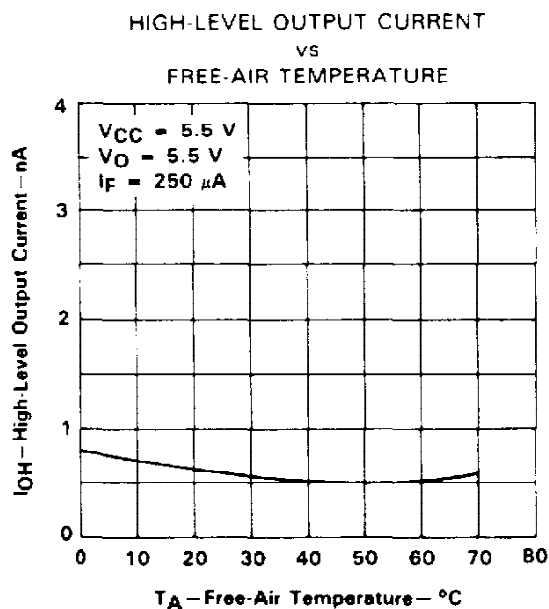


FIGURE 6

**HCPL2631**  
**DUAL-CHANNEL OPTOCOUPLER/OPTOISOLATOR**

**TYPICAL CHARACTERISTICS**

PROPAGATION DELAY TIME FROM LED INPUT  
VS  
PULSE FORWARD CURRENT

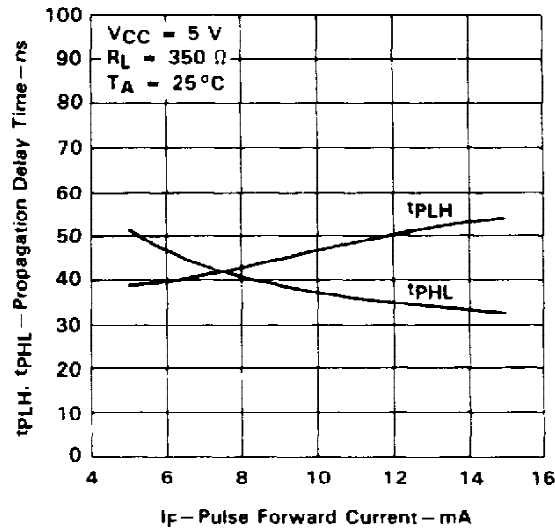


FIGURE 7

PROPAGATION DELAY TIME FROM LED INPUT  
VS  
LOAD RESISTANCE

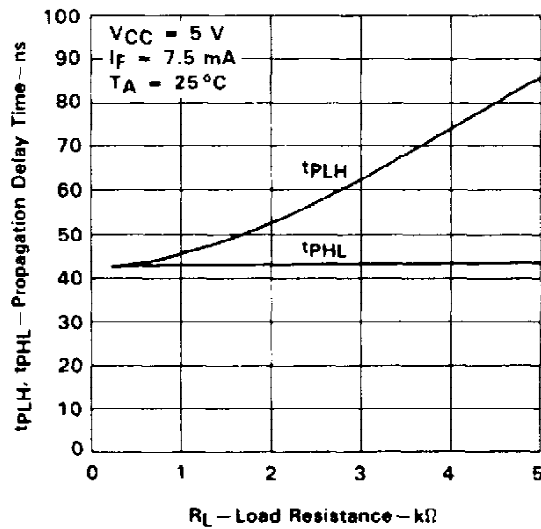


FIGURE 8

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## PACKAGING INFORMATION

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| HCPL2631         | OBSOLETE              | PDIP         | N               | 8    |             | TBD                     | Call TI          | Call TI                      |

<sup>(1)</sup> The marketing status values are defined as follows:

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<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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