

# Operational Amplifiers, Dual Power, 1.0 A Output Current

## TCA0372, TCA0372B, NCV0372B

The TCA0372 is a monolithic circuit intended for use as a power operational amplifier in a wide range of applications, including servo amplifiers and power supplies. No deadband crossover distortion provides better performance for driving coils.

### Features

- Output Current to 1.0 A
- Slew Rate of 1.3 V/ $\mu$ s
- Wide Bandwidth of 1.1 MHz
- Internal Thermal Shutdown
- Single or Split Supply Operation
- Excellent Gain and Phase Margins
- Common Mode Input Includes Ground
- Zero Deadband Crossover Distortion
- NCV devices are AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

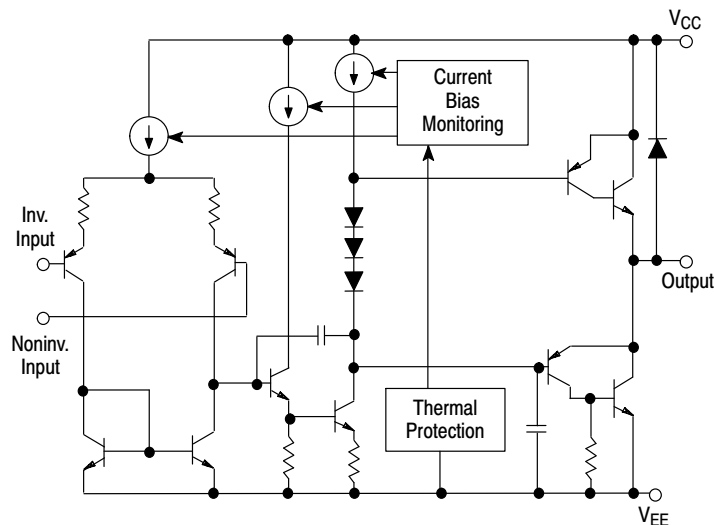
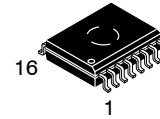
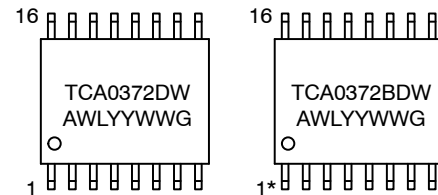


Figure 1. Representative Block Diagram



SOIC-16W  
DW SUFFIX  
CASE 751G

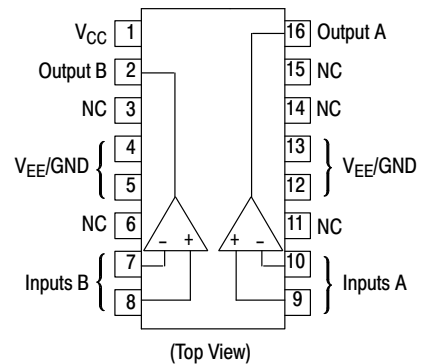
### MARKING DIAGRAMS



\*Also applies to NCV0372BDWR2G.

A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

**MAXIMUM RATINGS**

| Rating                                      | Symbol          | Value       | Unit |
|---------------------------------------------|-----------------|-------------|------|
| Supply Voltage (from $V_{CC}$ to $V_{EE}$ ) | $V_S$           | 40          | V    |
| Input Differential Voltage Range            | $V_{IDR}$       | Note 1      | V    |
| Input Voltage Range                         | $V_{IR}$        | Note 1      | V    |
| Junction Temperature (Note 2)               | $T_J$           | +150        | °C   |
| Operating Temperature Range                 | $T_A$           | –40 to +125 | °C   |
| Storage Temperature Range                   | $T_{stg}$       | –55 to +150 | °C   |
| DC Output Current                           | $I_O$           | 1.0         | A    |
| Peak Output Current (Nonrepetitive)         | $I_{(max)}$     | 1.5         | A    |
| Thermal Resistance, Junction-to-Air         | $R_{\theta JA}$ | 80          | °C/W |
| Thermal Resistance, Junction-to-Case        | $R_{\theta JC}$ | 12          | °C/W |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Either or both input voltages should not exceed the magnitude of  $V_{CC}$  or  $V_{EE}$ .

2. Power dissipation must be considered to ensure maximum junction temperature ( $T_J$ ) is not exceeded.



# TCA0372, TCA0372B, NCV0372B

## DC ELECTRICAL CHARACTERISTICS ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ , $R_L$ connected to ground, $T_A = -40^\circ$ to $+125^\circ\text{C}$ .)

| Characteristics                                                                                                                                                                                                                                                                                                                                                                   | Symbol                   | Min                                                          | Typ                     | Max                      | Unit                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------|-------------------------|--------------------------|------------------------------|
| Input Offset Voltage ( $V_{CM} = 0$ )<br>$T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$                                                                                                                                                                                                                                                                               | $V_{IO}$                 | –<br>–                                                       | 1.0<br>–                | 15<br>20                 | mV                           |
| Average Temperature Coefficient of Offset Voltage                                                                                                                                                                                                                                                                                                                                 | $\Delta V_{IO}/\Delta T$ | –                                                            | 20                      | –                        | $\mu\text{V}/^\circ\text{C}$ |
| Input Bias Current ( $V_{CM} = 0$ )                                                                                                                                                                                                                                                                                                                                               | $I_{IB}$                 | –                                                            | 100                     | 500                      | nA                           |
| Input Offset Current ( $V_{CM} = 0$ )                                                                                                                                                                                                                                                                                                                                             | $I_{IO}$                 | –                                                            | 10                      | 50                       | nA                           |
| Large Signal Voltage Gain<br>$V_O = \pm 10\text{ V}$ , $R_L = 2.0\text{ k}$                                                                                                                                                                                                                                                                                                       | $A_{VOL}$                | 30                                                           | 100                     | –                        | V/mV                         |
| Output Voltage Swing ( $I_L = 100\text{ mA}$ )<br>$T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$<br>$T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$                                                                                                                                                                                                        | $V_{OH}$<br>$V_{OL}$     | 14.0<br>13.9<br>–<br>–                                       | 14.2<br>–<br>–14.2<br>– | –<br>–<br>–14.0<br>–13.9 | V                            |
| Output Voltage Swing ( $I_L = 1.0\text{ A}$ )<br>$V_{CC} = +24\text{ V}$ , $V_{EE} = 0\text{ V}$ , $T_A = +25^\circ\text{C}$<br>$V_{CC} = +24\text{ V}$ , $V_{EE} = 0\text{ V}$ , $T_A = T_{low}$ to $T_{high}$<br>$V_{CC} = +24\text{ V}$ , $V_{EE} = 0\text{ V}$ , $T_A = +25^\circ\text{C}$<br>$V_{CC} = +24\text{ V}$ , $V_{EE} = 0\text{ V}$ , $T_A = T_{low}$ to $T_{high}$ | $V_{OH}$<br>$V_{OL}$     | 22.5<br>22.5<br>–<br>–                                       | 22.7<br>–<br>1.3<br>–   | –<br>–<br>1.5<br>1.6     | V                            |
| Input Common Mode Voltage Range<br>$T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$                                                                                                                                                                                                                                                                                     | $V_{ICR}$                | $V_{EE}$ to $(V_{CC} - 1.0)$<br>$V_{EE}$ to $(V_{CC} - 1.3)$ |                         |                          | V                            |
| Common Mode Rejection Ratio ( $R_S = 10\text{ k}$ )                                                                                                                                                                                                                                                                                                                               | CMRR                     | 70                                                           | 90                      | –                        | dB                           |
| Power Supply Rejection Ratio ( $R_S = 100\ \Omega$ )                                                                                                                                                                                                                                                                                                                              | PSRR                     | 70                                                           | 90                      | –                        | dB                           |
| Power Supply Current<br>$T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$                                                                                                                                                                                                                                                                                                | $I_D$                    | –<br>–<br>–<br>–                                             | 5.0<br>8.0<br>–<br>–    | 10<br>10<br>14<br>14     | mA                           |
|                                                                                                                                                                                                                                                                                                                                                                                   |                          | TCA0372<br>TCA0372B/NCV0372B<br>TCA0372<br>TCA0372B/NCV0372B |                         |                          |                              |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## AC ELECTRICAL CHARACTERISTICS ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ , $R_L$ connected to ground, $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

| Characteristics                                                                                                                                             | Symbol   | Min        | Typ      | Max    | Unit                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|----------|--------|------------------------|
| Slew Rate ( $V_{in} = -10\text{ V}$ to $+10\text{ V}$ , $R_L = 2.0\text{ k}$ , $C_L = 100\text{ pF}$ )<br>$A_V = -1.0$ , $T_A = T_{low}$ to $T_{high}$      | SR       | 1.0        | 1.4      | –      | V/ $\mu\text{s}$       |
| Gain Bandwidth Product ( $f = 100\text{ kHz}$ , $C_L = 100\text{ pF}$ , $R_L = 2.0\text{ k}$ )<br>$T_A = 25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$ | GBW      | 0.9<br>0.7 | 1.4<br>– | –<br>– | MHz                    |
| Phase Margin $T_J = T_{low}$ to $T_{high}$<br>$R_L = 2.0\text{ k}$ , $C_L = 100\text{ pF}$                                                                  | $\phi_m$ | –          | 65       | –      | Degrees                |
| Gain Margin<br>$R_L = 2.0\text{ k}$ , $C_L = 100\text{ pF}$                                                                                                 | $A_m$    | –          | 15       | –      | dB                     |
| Equivalent Input Noise Voltage<br>$R_S = 100\ \Omega$ , $f = 1.0$ to $100\text{ kHz}$                                                                       | $e_n$    | –          | 22       | –      | nV/ $\sqrt{\text{Hz}}$ |
| Total Harmonic Distortion<br>$A_V = -1.0$ , $R_L = 50\ \Omega$ , $V_O = 0.5\text{ VRMS}$ , $f = 1.0\text{ kHz}$                                             | THD      | –          | 0.02     | –      | %                      |

NOTE: In case  $V_{EE}$  is disconnected before  $V_{CC}$ , a diode between  $V_{EE}$  and Ground is recommended to avoid damaging the device.



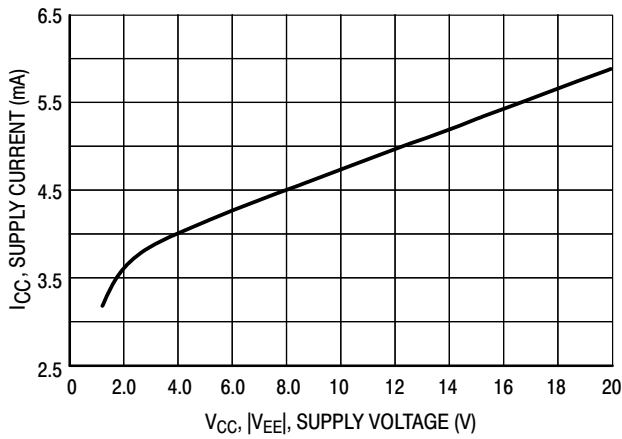


Figure 2. Supply Current versus Supply Voltage with No Load

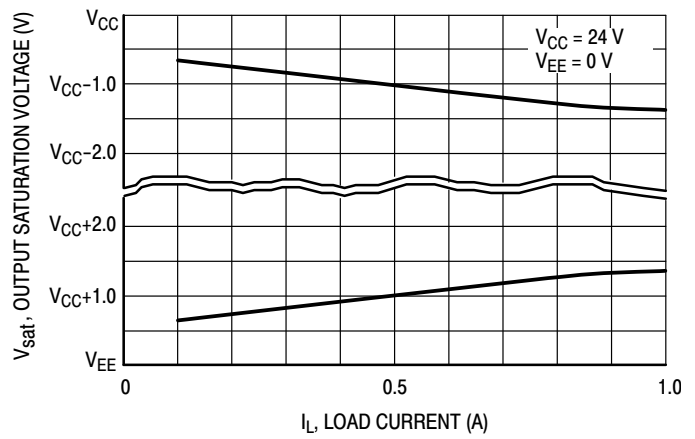


Figure 3. Output Saturation Voltage versus Load Current

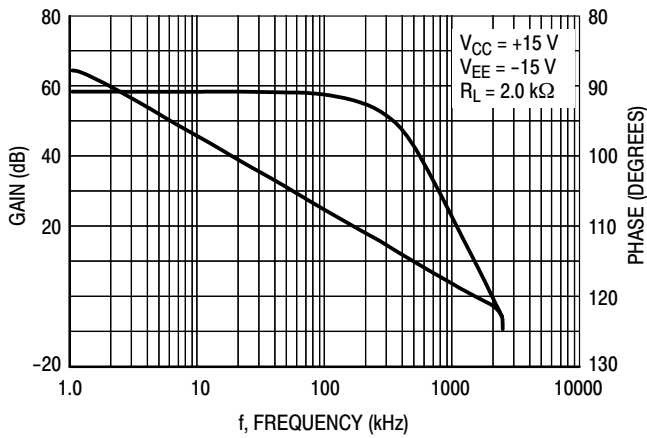


Figure 4. Voltage Gain and Phase versus Frequency

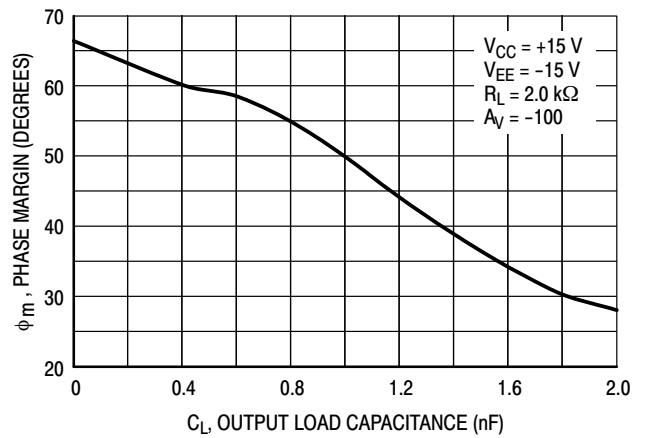


Figure 5. Phase Margin versus Output Load Capacitance

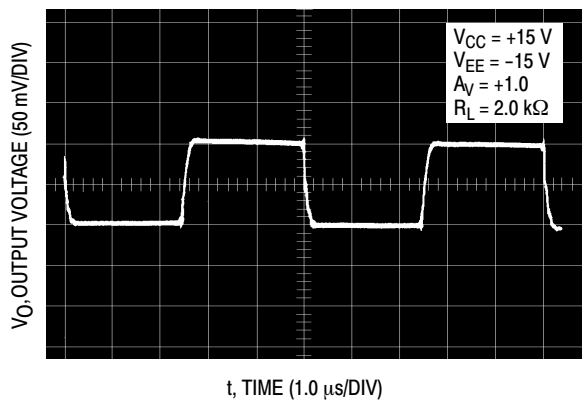


Figure 6. Small Signal Transient Response

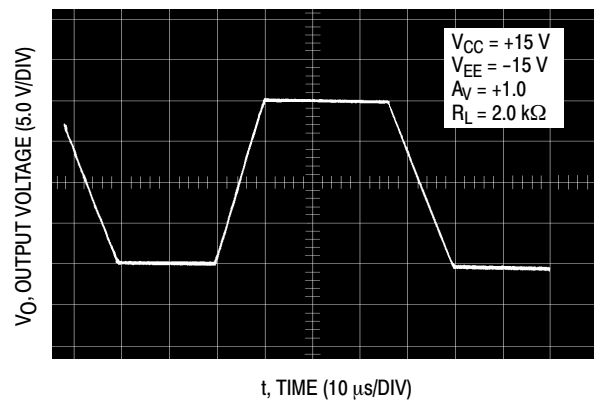


Figure 7. Large Signal Transient Response

# TCA0372, TCA0372B, NCV0372B

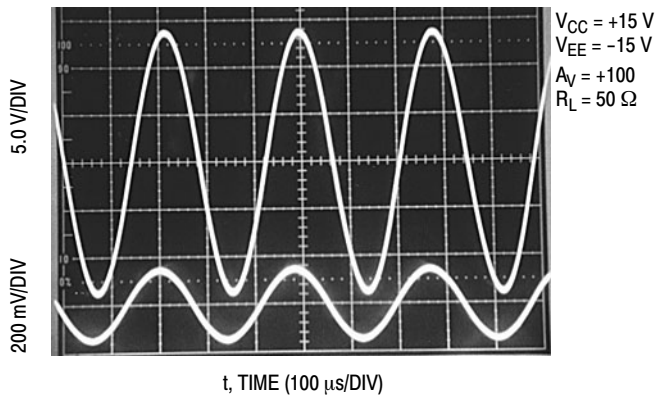


Figure 8. Sine Wave Response

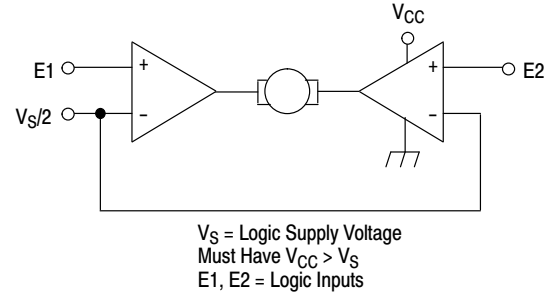
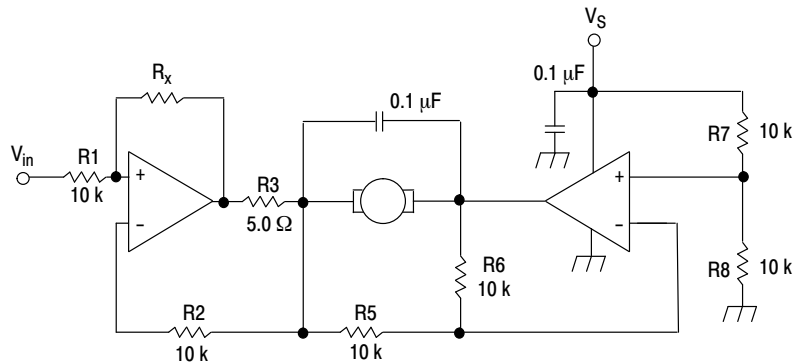


Figure 9. Bidirectional DC Motor Control with Microprocessor-Compatible Inputs



For circuit stability, ensure that  $R_x > \frac{2R_3 \cdot R_1}{R_M}$  where,  $R_M$  = internal resistance of motor.  
 The voltage available at the terminals of the motor is:  $V_M = 2(V_1 - \frac{V_S}{2}) + |R_O| \cdot I_M$   
 where,  $|R_O| = \frac{2R_3 \cdot R_1}{R_x}$  and  $I_M$  is the motor current.

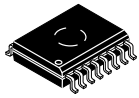
Figure 10. Bidirectional Speed Control of DC Motors

## ORDERING INFORMATION

| Device         | Package               | Shipping <sup>†</sup> |
|----------------|-----------------------|-----------------------|
| TCA0372DWR2G   | SOIC-16W<br>(Pb-Free) | 1000 / Tape & Reel    |
| TCA0372BDWR2G  | SOIC-16W<br>(Pb-Free) | 1000 / Tape & Reel    |
| NCV0372BDWR2G* | SOIC-16W<br>(Pb-Free) | 1000 / Tape & Reel    |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

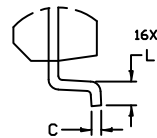
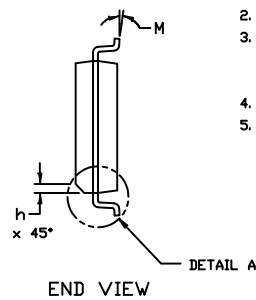
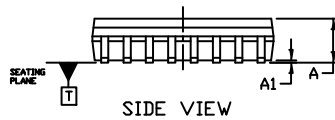
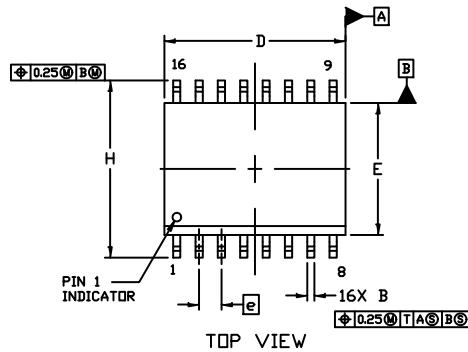
\*AEC-Q100 Qualified and PPAP Capable



1  
SCALE 1:1

SOIC-16 WB  
CASE 751G  
ISSUE E

DATE 08 OCT 2021



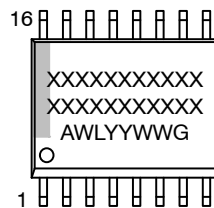
DETAIL A  
2X SCALE

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION.  
ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION OR FLASH TO BE 0.15 PER SIDE.

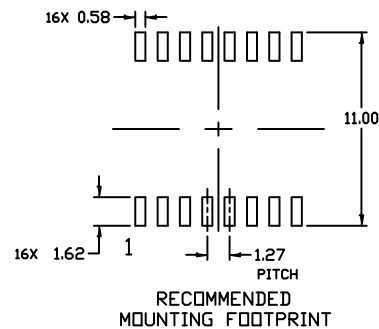
| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | MIN.        | MAX.  |
| A   | 2.35        | 2.65  |
| A1  | 0.10        | 0.25  |
| B   | 0.35        | 0.49  |
| C   | 0.23        | 0.32  |
| D   | 10.15       | 10.45 |
| E   | 7.40        | 7.60  |
| e   | 1.27        | BSC   |
| H   | 10.05       | 10.55 |
| h   | 0.53        | REF   |
| L   | 0.50        | 0.90  |
| M   | 0°          | 7°    |

GENERIC  
MARKING DIAGRAM\*



XXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.



|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | SOIC-16 WB  | PAGE 1 OF 1                                                                                                                                                                         |

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