

## 1.0 A Output Current, Dual Power Operational Amplifiers

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
- Pb-Free Packages are Available\*

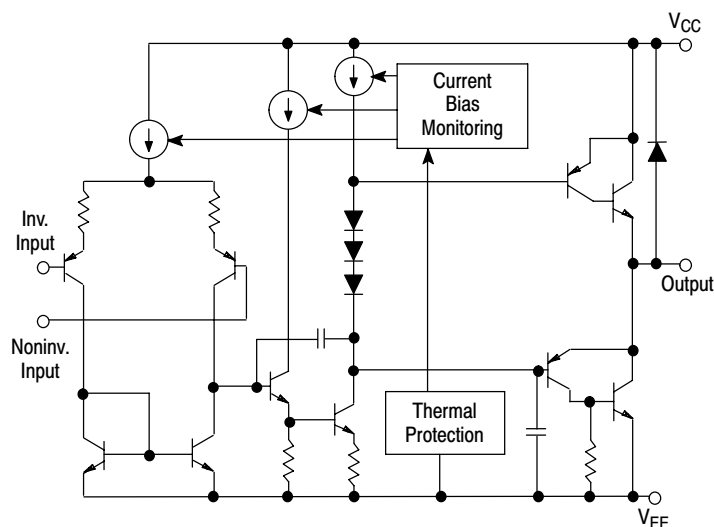
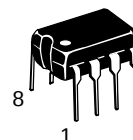


Figure 1. Representative Block Diagram

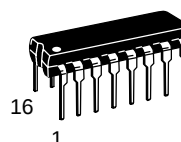


**ON Semiconductor®**

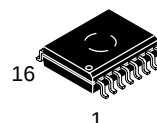
<http://onsemi.com>



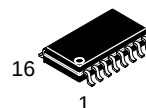
PDIP-8  
DP1 SUFFIX  
CASE 626



PDIP-16  
DP2 SUFFIX  
CASE 648



SOIC-16W  
DW SUFFIX  
CASE 751G



SOEIAJ-16  
DM2 SUFFIX  
CASE 966

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 6 of this data sheet.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

# TCA0372, TCA0372B

## MAXIMUM RATINGS

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| 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<br>Case 626<br>Case 648<br>Case 751G  | $R_{\theta JA}$ | 137<br>72<br>80 | °C/W |
| Thermal Resistance, Junction-to-Case<br>Case 626<br>Case 648<br>Case 751G | $R_{\theta JC}$ | 23<br>10<br>12  | °C/W |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, 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

上海“TCA0372-D”供应商

**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 $T_{high}$                                                                                                                                                                                                                                                                               | $V_{IO}$                 | –                                                            | 1.0       | 15     | 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                                                 | 14.2<br>– | –<br>– | 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                                                 | 22.7<br>– | –<br>– | 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 $T_{high}$                                                                                                                                                                                                                                                                                                | $I_D$                    | –                                                            | 5.0       | 10     | mA                           |
|                                                                                                                                                                                                                                                                                                                                                                                   |                          | –                                                            | 8.0       | 10     |                              |
|                                                                                                                                                                                                                                                                                                                                                                                   |                          | –                                                            | –         | 14     |                              |
|                                                                                                                                                                                                                                                                                                                                                                                   |                          | –                                                            | –         | 14     |                              |

**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       | –      | $\text{nV}/\sqrt{\text{Hz}}$ |
| 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.

# TCA0372, TCA0372B

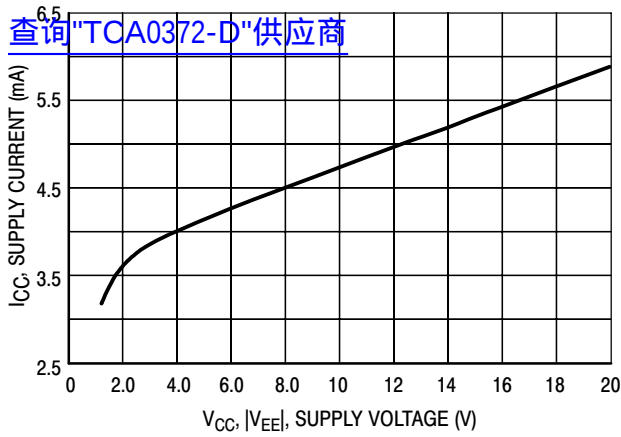


Figure 2. Supply Current versus Supply Voltage with No Load

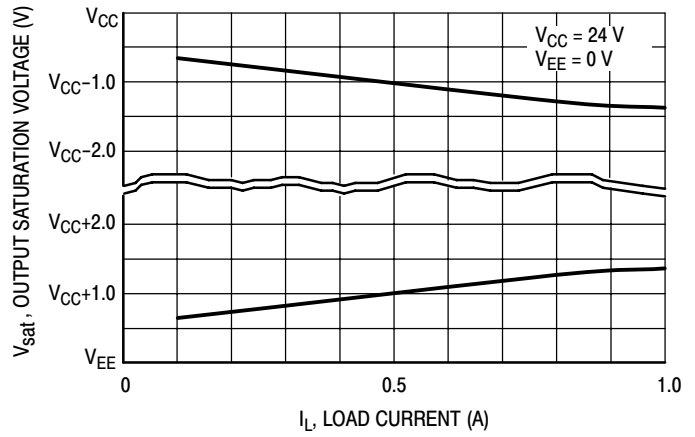


Figure 3. Output Saturation Voltage versus Load Current

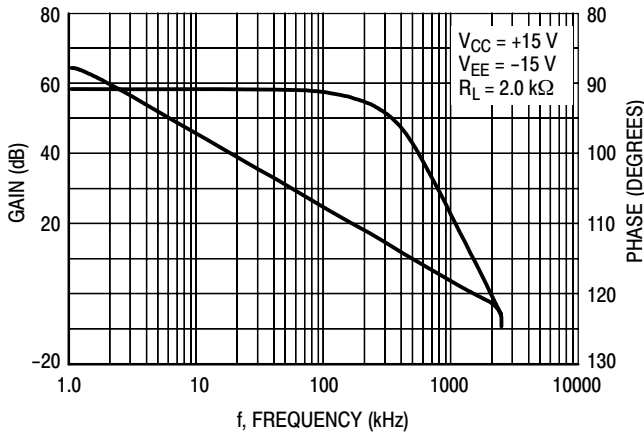


Figure 4. Voltage Gain and Phase versus Frequency

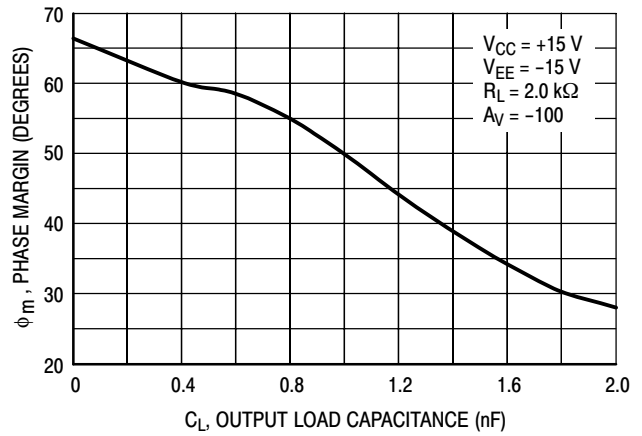


Figure 5. Phase Margin versus Output Load Capacitance

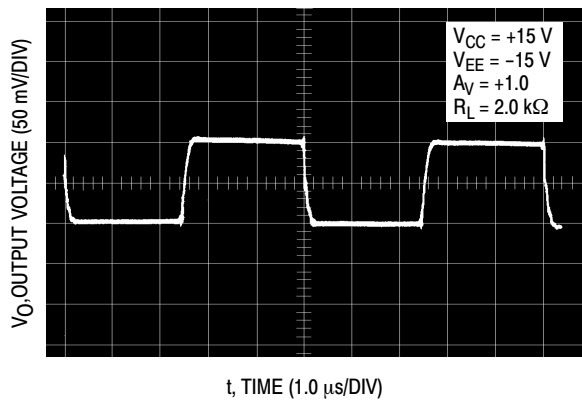


Figure 6. Small Signal Transient Response

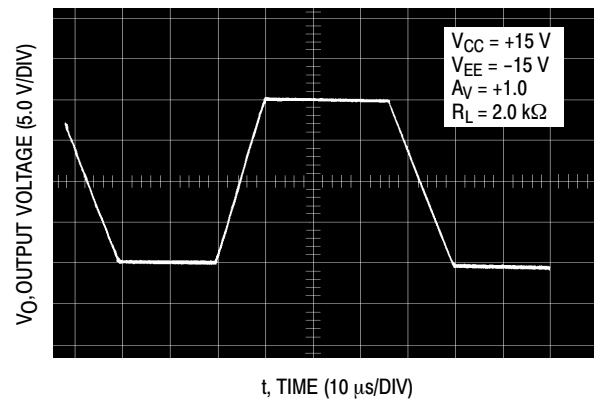


Figure 7. Large Signal Transient Response

## TCA0372, TCA0372B

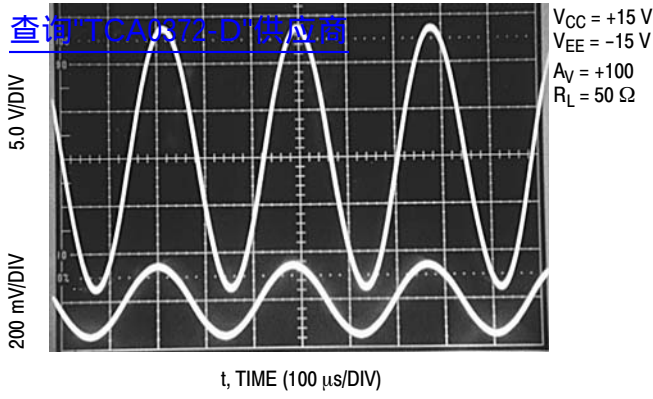


Figure 8. Sine Wave Response

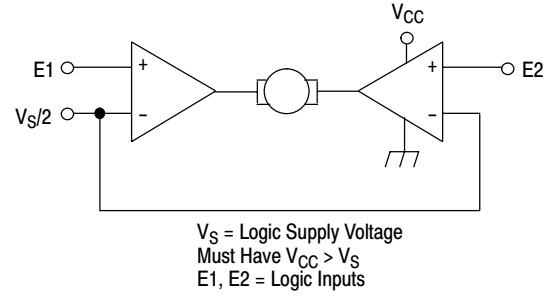
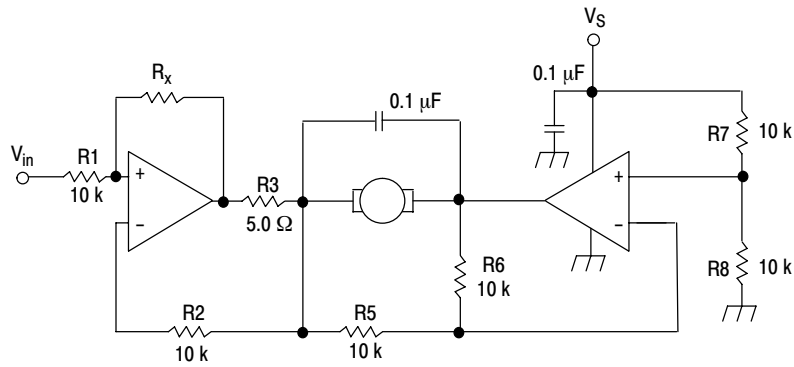


Figure 9. Bidirectional DC Motor Control with Microprocessor-Compatible Inputs



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:  $V_M = 2(V_1 - \frac{V_S}{2}) + |R_0| \cdot I_M$

where,  $|R_0| = \frac{2R_3 \cdot R_1}{R_x}$  and  $I_M$  is the motor current.

Figure 10. Bidirectional Speed Control of DC Motors

# TCA0372, TCA0372B

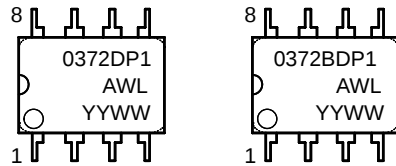
## ORDERING INFORMATION

| Device        | Package                | Shipping <sup>†</sup> |
|---------------|------------------------|-----------------------|
| TCA0372DW     | SOIC-16W               | 47 Units / Rail       |
| TCA0372DWG    | SOIC-16W<br>(Pb-Free)  | 47 Units / Rail       |
| TCA0372DWR2   | SOIC-16W               | 1000 Tape & Reel      |
| TCA0372DWR2G  | SOIC-16W<br>(Pb-Free)  | 1000 Tape & Reel      |
| TCA0372BDWR2  | SOIC-16W               | 1000 Tape & Reel      |
| TCA0372BDWR2G | SOIC-16W<br>(Pb-Free)  | 1000 Tape & Reel      |
| TCA0372DP1    | PDIP-8                 | 50 Units / Rail       |
| TCA0372DP1G   | PDIP-8<br>(Pb-Free)    | 50 Units / Rail       |
| TCA0372BDP1   | PDIP-8                 | 50 Units / Rail       |
| TCA0372BDP1G  | PDIP-8<br>(Pb-Free)    | 50 Units / Rail       |
| TCA0372DP2    | PDIP-16                | 25 Units / Rail       |
| TCA0372DP2G   | PDIP-16<br>(Pb-Free)   | 25 Units / Rail       |
| TCA0372DM2EL  | SOEIAJ-16              | 2500 Tape & Reel      |
| TCA0372DM2ELG | SOEIAJ-16<br>(Pb-Free) | 2500 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.

## MARKING DIAGRAMS

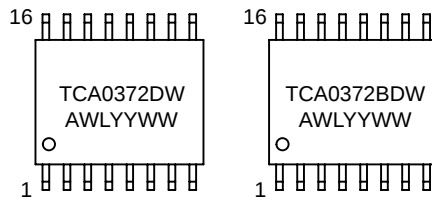
**PDIP-8  
DP1 SUFFIX  
CASE 626**



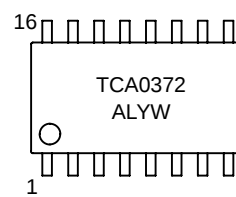
**PDIP-16  
DP2 SUFFIX  
CASE 648**



**SOIC-16W  
DW SUFFIX  
CASE 751G**



**SOEIAJ-16  
DM2 SUFFIX  
CASE 966**

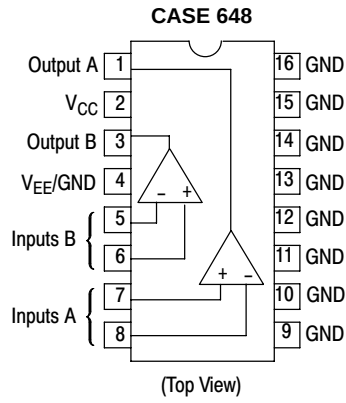


A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week

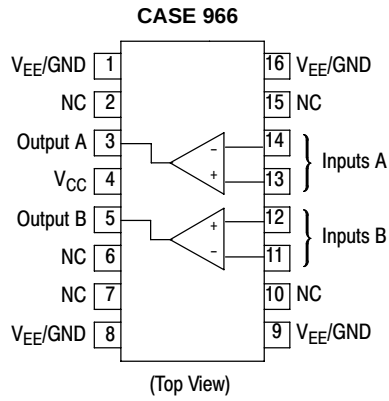
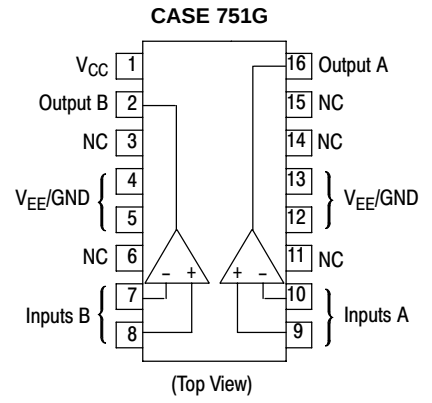
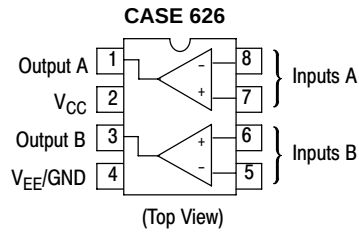
# TCA0372, TCA0372B

## PIN CONNECTIONS

[查询"TCA0372-D"供应商](#)



\*Pins 4 and 9 to 16 are internally connected.

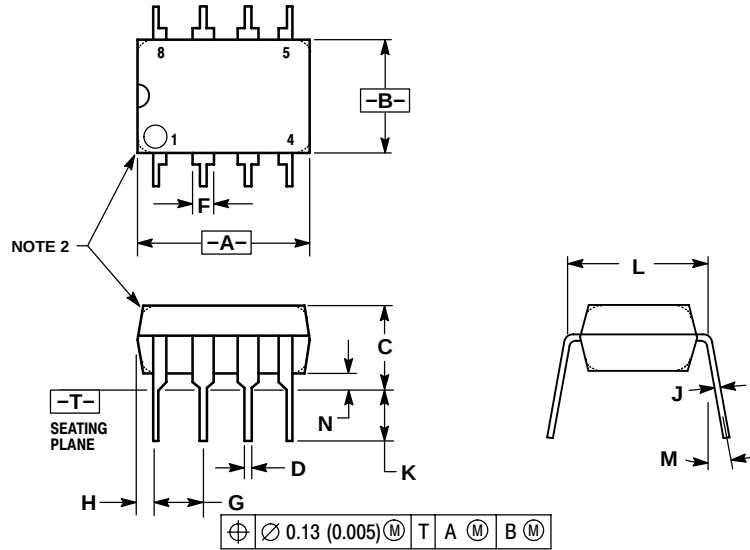


# TCA0372, TCA0372B

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## PACKAGE DIMENSIONS

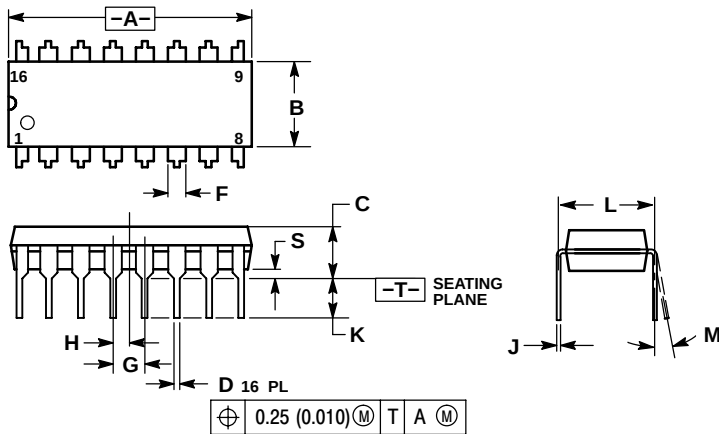
PDIP-8  
DP1 SUFFIX  
CASE 626-05  
ISSUE L



- NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
  2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
  3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

| 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   | 3.94        | 4.45  | 0.155     | 0.175 |
| D   | 0.38        | 0.51  | 0.015     | 0.020 |
| F   | 1.02        | 1.78  | 0.040     | 0.070 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| H   | 0.76        | 1.27  | 0.030     | 0.050 |
| J   | 0.20        | 0.30  | 0.008     | 0.012 |
| K   | 2.92        | 3.43  | 0.115     | 0.135 |
| L   | 7.62 BSC    |       | 0.300 BSC |       |
| M   | ---         | 10°   | ---       | 10°   |
| N   | 0.76        | 1.01  | 0.030     | 0.040 |

PDIP-16  
DP2 SUFFIX  
CASE 648-08  
ISSUE T



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
  5. ROUNDED CORNERS OPTIONAL.

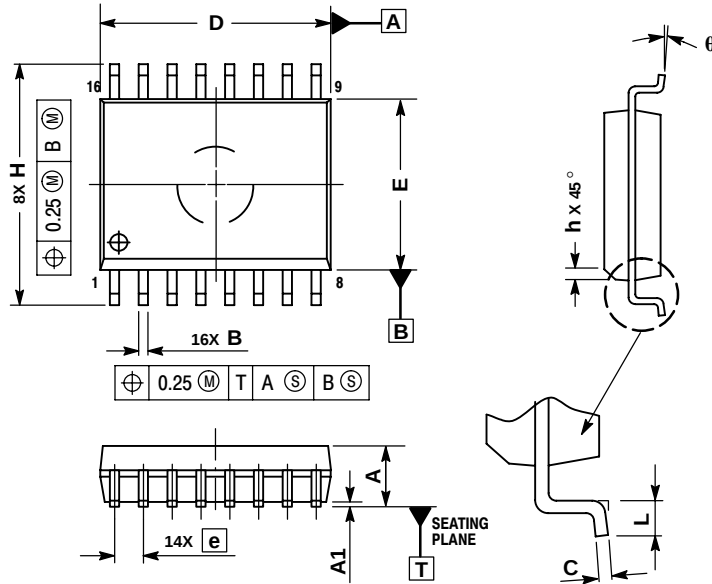
| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| D   | 0.015     | 0.021 | 0.39        | 0.53  |
| F   | 0.040     | 0.70  | 1.02        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.050 BSC |       | 1.27 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.130 | 2.80        | 3.30  |
| L   | 0.295     | 0.305 | 7.50        | 7.74  |
| M   | 0°        | 10°   | 0°          | 10°   |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

# TCA0372, TCA0372B

[查询"TCA0372-D"供应商](#)

## PACKAGE DIMENSIONS

SOIC-16W  
DW SUFFIX  
CASE 751G-03  
ISSUE B

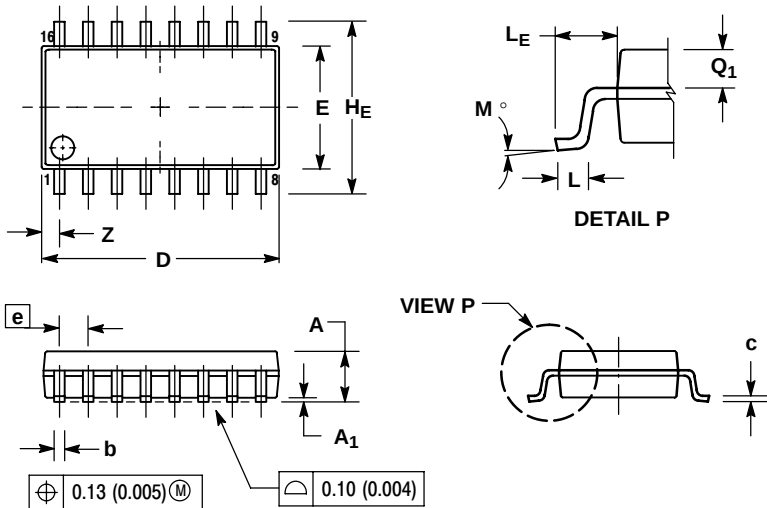


### NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| 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     | 0.25        | 0.75  |
| L     | 0.50        | 0.90  |
| theta | 0°          | 7°    |

SOEIAJ-16  
DM2 SUFFIX  
CASE 966-01  
ISSUE O



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | ---         | 2.05  | ---       | 0.081 |
| A1  | 0.05        | 0.20  | 0.002     | 0.008 |
| b   | 0.35        | 0.50  | 0.014     | 0.020 |
| c   | 0.18        | 0.27  | 0.007     | 0.011 |
| D   | 9.90        | 10.50 | 0.390     | 0.413 |
| E   | 5.10        | 5.45  | 0.201     | 0.215 |
| e   | 1.27 BSC    |       | 0.050 BSC |       |
| HE  | 7.40        | 8.20  | 0.291     | 0.323 |
| L   | 0.50        | 0.85  | 0.020     | 0.033 |
| LE  | 1.10        | 1.50  | 0.043     | 0.059 |
| M   | 0°          | 10°   | 0°        | 10°   |
| Q1  | 0.70        | 0.90  | 0.028     | 0.035 |
| Z   | ---         | 0.78  | ---       | 0.031 |

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