

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/ μ 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

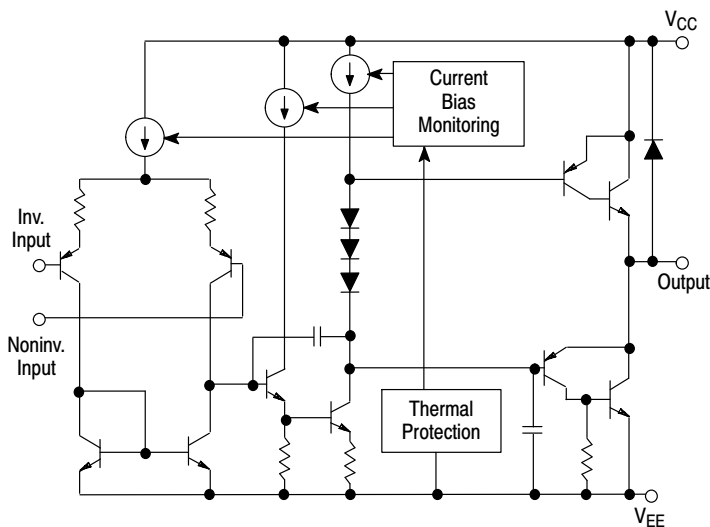
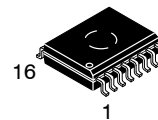


Figure 1. Representative Block Diagram



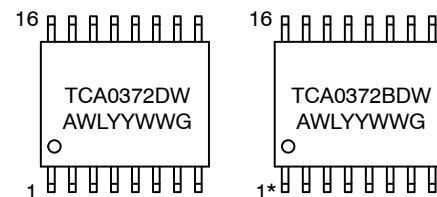
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SOIC-16W
DW SUFFIX
CASE 751G

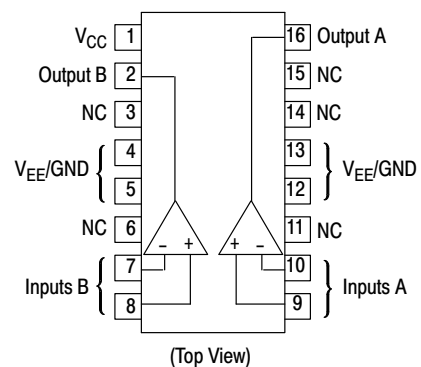
MARKING DIAGRAMS



*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 in the package dimensions section on page 5 of this data sheet.

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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 ($V_{CM} = 0$) $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to T_{high}	V_{IO}	– –	1.0 –	15 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 $V_O = \pm 10\text{ V}$, $R_L = 2.0\text{ k}$	A_{VOL}	30	100	–	V/mV
Output Voltage Swing ($I_L = 100\text{ mA}$) $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to T_{high}	V_{OH} V_{OL}	14.0 13.9 – –	14.2 – –14.2 –	– – –14.0 –13.9	V
Output Voltage Swing ($I_L = 1.0\text{ A}$) $V_{CC} = +24\text{ V}$, $V_{EE} = 0\text{ V}$, $T_A = +25^\circ\text{C}$ $V_{CC} = +24\text{ V}$, $V_{EE} = 0\text{ V}$, $T_A = T_{low}$ to T_{high} $V_{CC} = +24\text{ V}$, $V_{EE} = 0\text{ V}$, $T_A = +25^\circ\text{C}$ $V_{CC} = +24\text{ V}$, $V_{EE} = 0\text{ V}$, $T_A = T_{low}$ to T_{high}	V_{OH} V_{OL}	22.5 22.5 – –	22.7 – 1.3 –	– – 1.5 1.6	V
Input Common Mode Voltage Range $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to T_{high}	V_{ICR}	V_{EE} to $(V_{CC} - 1.0)$ 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 ($R_S = 100\text{ }\Omega$)	PSRR	70	90	–	dB
Power Supply Current $T_A = +25^\circ\text{C}$ TCA0372 TCA0372B/NCV0372B $T_A = T_{low}$ to T_{high} TCA0372 TCA0372B/NCV0372B	I_D	– – – –	5.0 8.0 – –	10 10 14 14	mA

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 $+10\text{ V}$, $R_L = 2.0\text{ k}$, $C_L = 100\text{ pF}$) $A_V = -1.0$, $T_A = T_{low}$ to T_{high}	SR	1.0	1.4	–	V/ μs
Gain Bandwidth Product ($f = 100\text{ kHz}$, $C_L = 100\text{ pF}$, $R_L = 2.0\text{ k}$) $T_A = 25^\circ\text{C}$ $T_A = T_{low}$ to T_{high}	GBW	0.9 0.7	1.4 –	– –	MHz
Phase Margin $T_J = T_{low}$ to T_{high} $R_L = 2.0\text{ k}$, $C_L = 100\text{ pF}$	ϕ_m	–	65	–	Degrees
Gain Margin $R_L = 2.0\text{ k}$, $C_L = 100\text{ pF}$	A_m	–	15	–	dB
Equivalent Input Noise Voltage $R_S = 100\text{ }\Omega$, $f = 1.0$ to 100 kHz	e_n	–	22	–	$\text{nV}/\sqrt{\text{Hz}}$
Total Harmonic Distortion $A_V = -1.0$, $R_L = 50\text{ }\Omega$, $V_O = 0.5\text{ VRMS}$, $f = 1.0\text{ kHz}$	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.

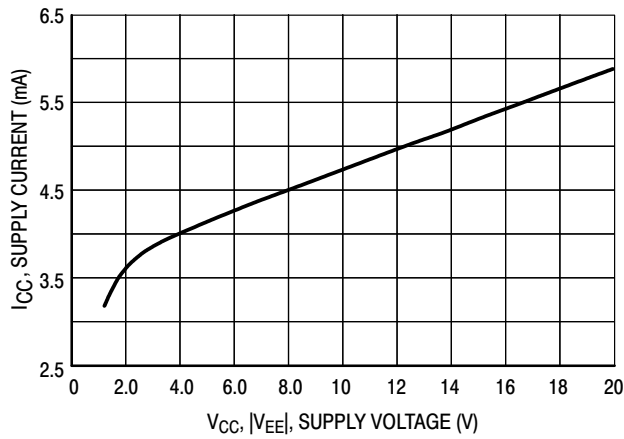


Figure 2. Supply Current versus Supply Voltage with No Load

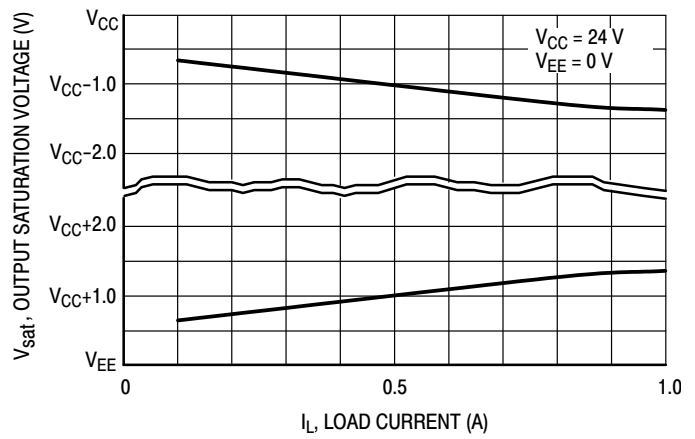


Figure 3. Output Saturation Voltage versus Load Current

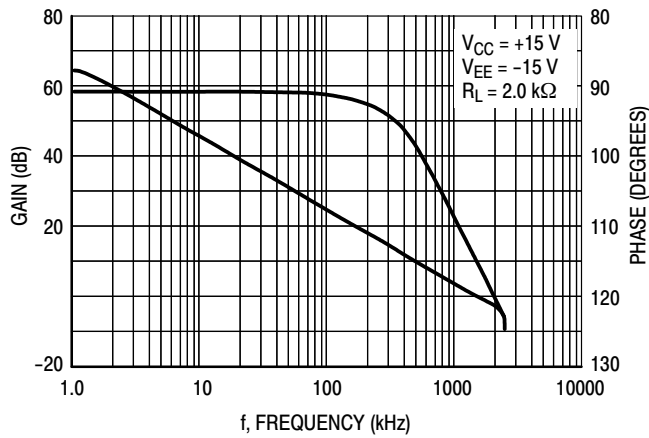


Figure 4. Voltage Gain and Phase versus Frequency

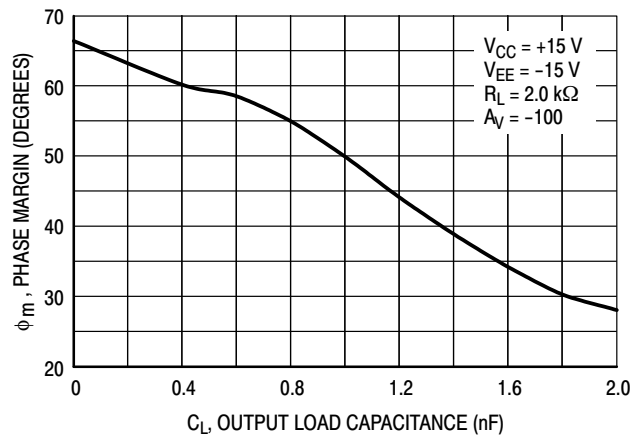


Figure 5. Phase Margin versus Output Load Capacitance

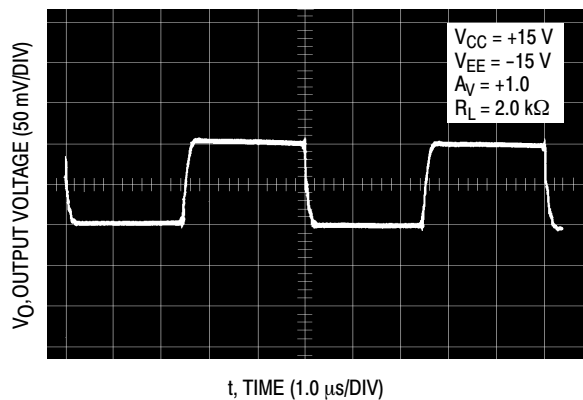


Figure 6. Small Signal Transient Response

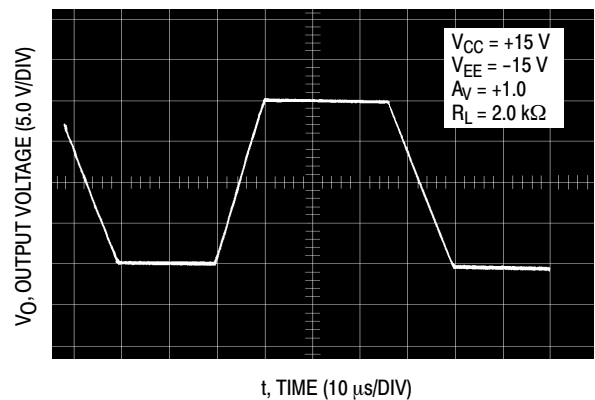


Figure 7. Large Signal Transient Response

TCA0372, TCA0372B, NCV0372B

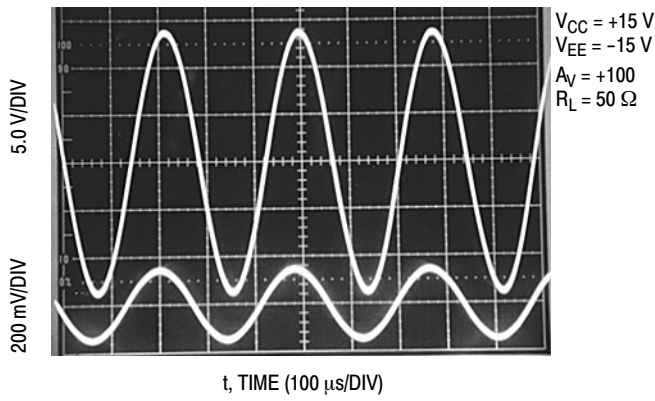


Figure 8. Sine Wave Response

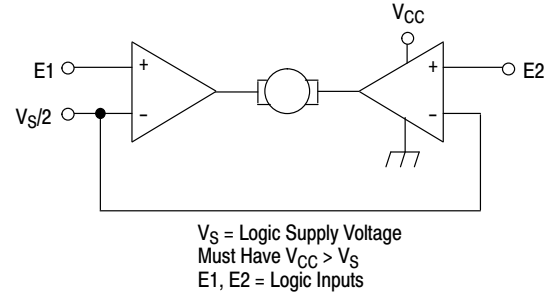
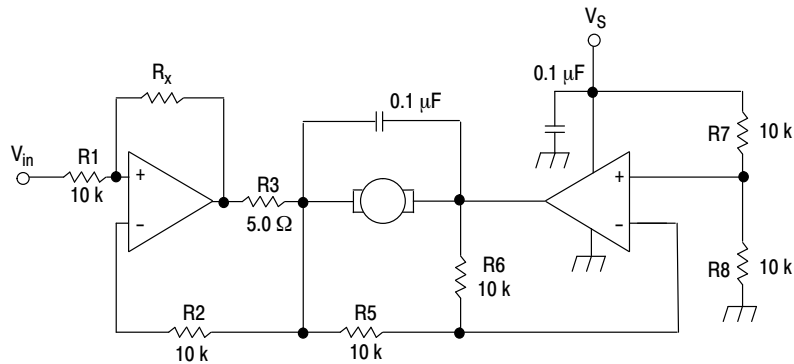


Figure 9. Bidirectional DC Motor Control with Microprocessor-Compatible Inputs



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

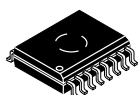
ORDERING INFORMATION

Device	Package	Shipping [†]
TCA0372DWR2G	SOIC-16W (Pb-Free)	1000 / Tape & Reel
TCA0372BDWR2G	SOIC-16W (Pb-Free)	1000 / Tape & Reel
NCV0372BDWR2G*	SOIC-16W (Pb-Free)	1000 / Tape & Reel

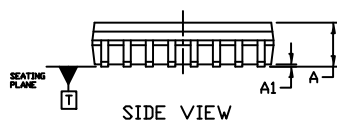
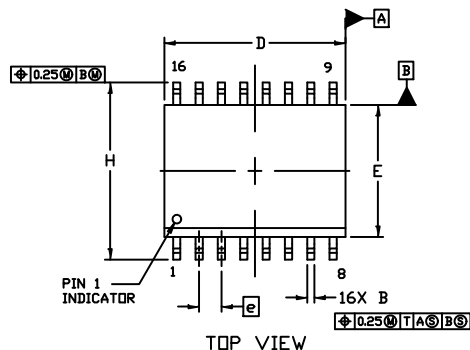
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*AEC-Q100 Qualified and PPAP Capable

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



1
SCALE 1:1



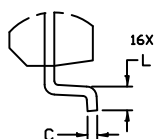
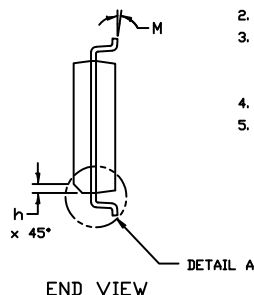
SOIC-16 WB
CASE 751G
ISSUE E

DATE 08 OCT 2021

NOTES:

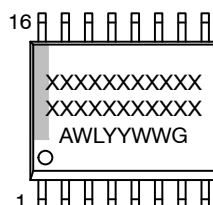
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION.
ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM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



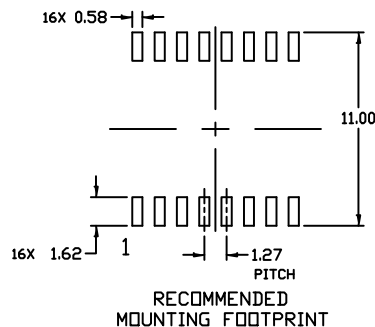
DETAIL A
2X SCALE

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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