

# NCS2372

## Operational Amplifier, 1.0 A, Dual

The NCS2372 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
- These Devices are Pb-Free and are RoHS Compliant

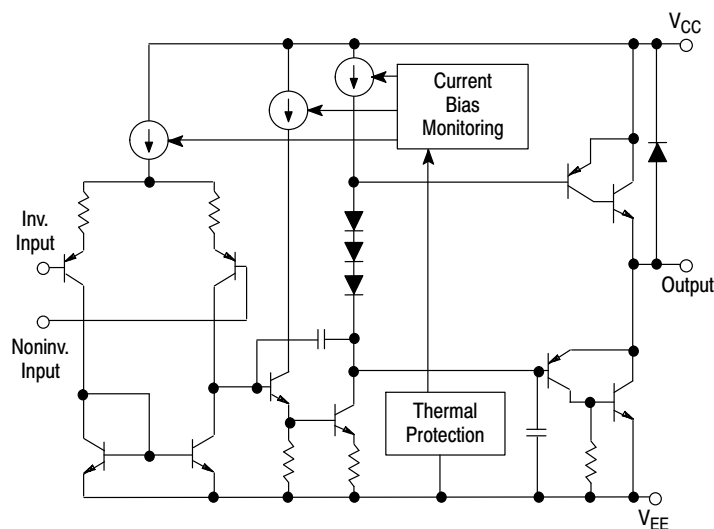


Figure 1. Representative Block Diagram



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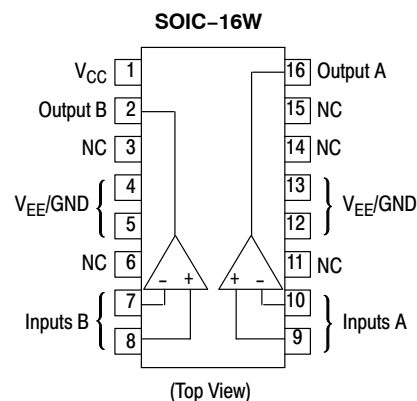
<http://onsemi.com>

### MARKING DIAGRAM



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

### PIN CONNECTIONS



### ORDERING INFORMATION

Device	Package	Shipping†
NCS2372DWR2G	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 Specification Brochure, BRD8011/D.

**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) > 1 ms Duration < 1 ms Duration (Note 3)	$I_{(max)}$	1.5 2.0	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 Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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.
3. When driving inductive loads, negative flyback voltage/current excursions may need to be constrained with Schottky diodes to protect the output drivers.

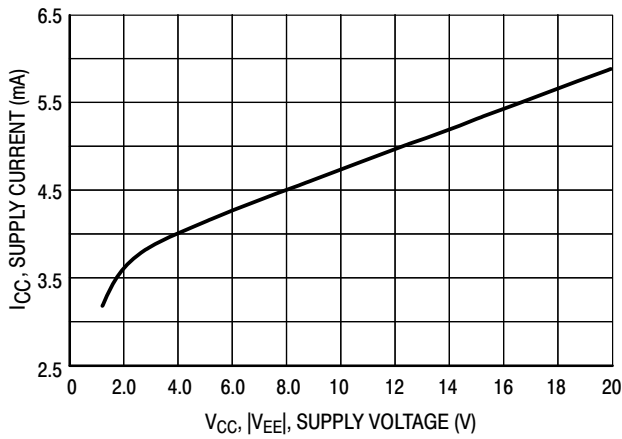
**DC ELECTRICAL CHARACTERISTICS** ( $V_{CC} = +15\text{ V}$ ,  $V_{EE} = -15\text{ V}$ ,  $R_L$  connected to ground,  $T_A = -40^\circ$  to  $+125^\circ\text{C}$ .)

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 ( $R_S = 100\ \Omega$ )	PSRR	70	90	–	dB
Power Supply Current $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$	$I_D$	– –	8.0 –	10 14	mA

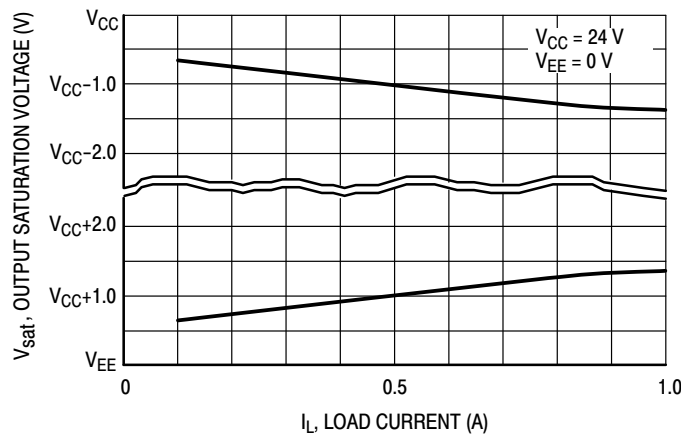
**AC ELECTRICAL CHARACTERISTICS** ( $V_{CC} = +15\text{ V}$ ,  $V_{EE} = -15\text{ V}$ ,  $R_L$  connected to ground,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

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/ $\mu\text{s}$
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 $T_{high}$ $R_L = 2.0\text{ k}$ , $C_L = 100\text{ pF}$	$\phi_m$	–	65	–	Degrees
Gain Margin $R_L = 2.0\text{ k}$ , $C_L = 100\text{ pF}$	$A_m$	–	15	–	dB
Equivalent Input Noise Voltage $R_S = 100\ \Omega$ , $f = 1.0$ to $100\text{ kHz}$	$e_n$	–	22	–	$\text{nV}/\sqrt{\text{Hz}}$
Total Harmonic Distortion $A_V = -1.0$ , $R_L = 50\ \Omega$ , $V_O = 0.5\text{ VRMS}$ , $f = 1.0\text{ kHz}$	THD	–	0.02	–	%

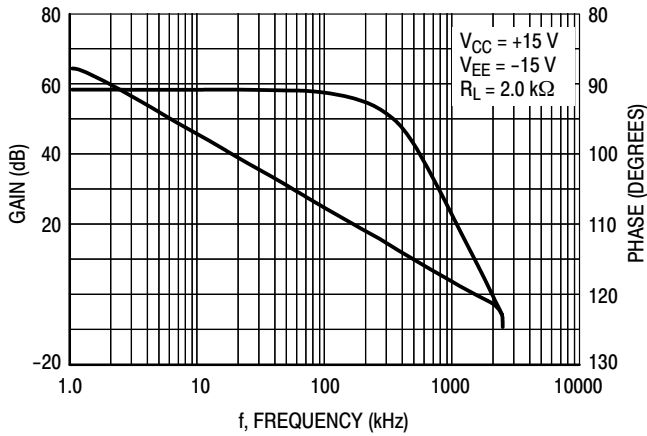
NOTE: In case  $V_{EE}$  is disconnected before  $V_{CC}$ , a diode between  $V_{EE}$  and Ground is recommended to avoid damaging the device.



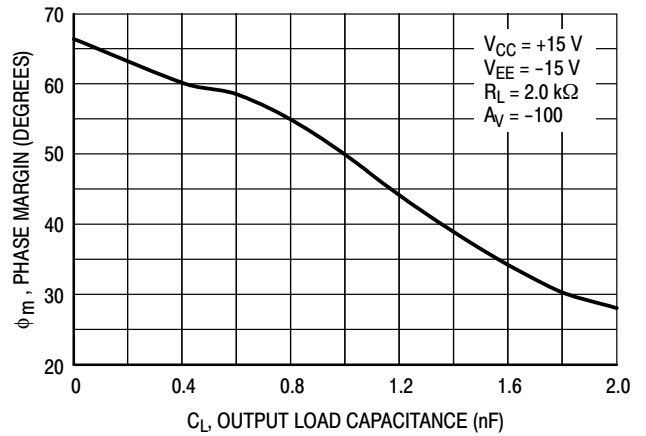
**Figure 2. Supply Current versus Supply Voltage with No Load**



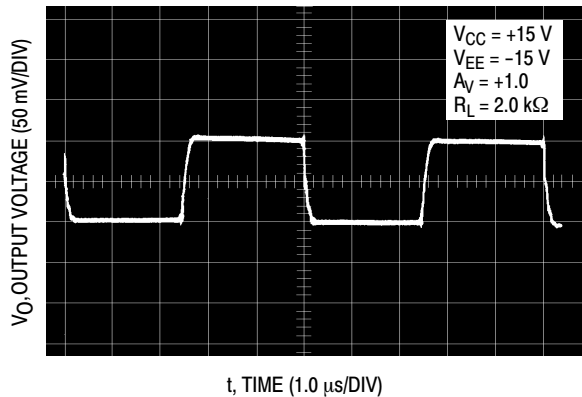
**Figure 3. Output Saturation Voltage versus Load Current**



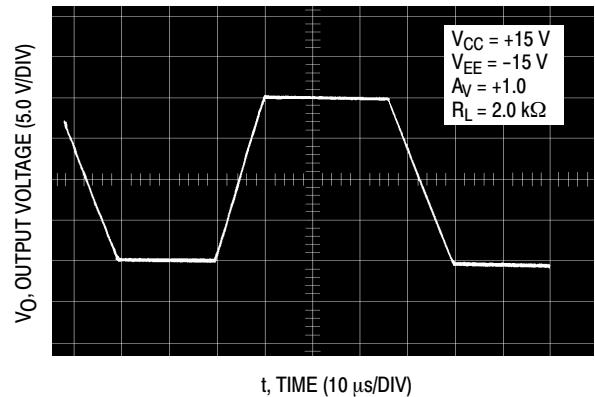
**Figure 4. Voltage Gain and Phase versus Frequency**



**Figure 5. Phase Margin versus Output Load Capacitance**



**Figure 6. Small Signal Transient Response**



**Figure 7. Large Signal Transient Response**

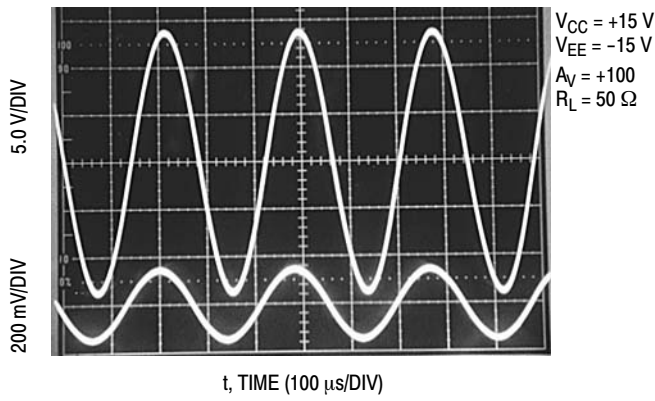


Figure 8. Sine Wave Response

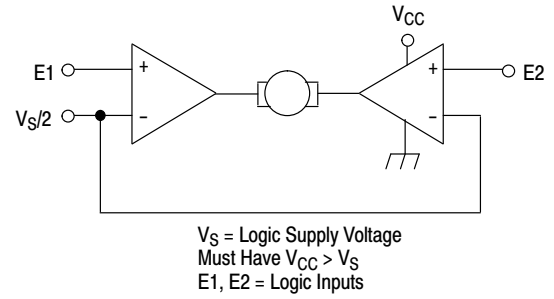
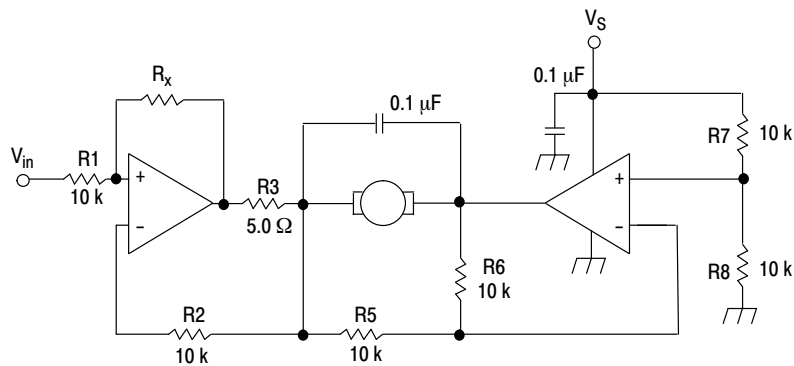


Figure 9. Bidirectional DC Motor Control with Microprocessor-Compatible Inputs

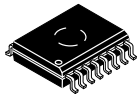


For circuit stability, ensure that  $R_x > \frac{2R_3 \cdot R_1}{R_M}$  where,  $R_M$  = internal resistance of motor.

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.

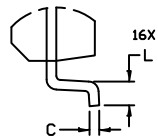
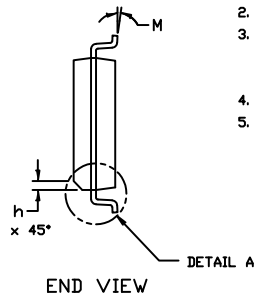
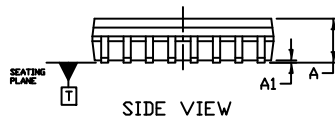
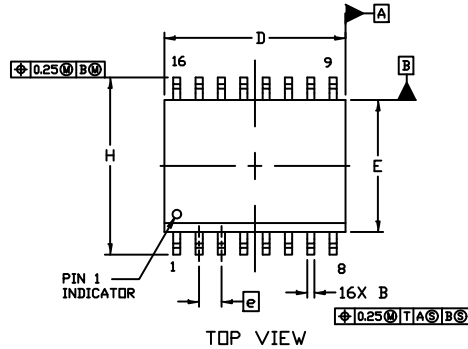
Figure 10. Bidirectional Speed Control of DC Motors



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SCALE 1:1

SOIC-16 WB  
CASE 751G  
ISSUE E

DATE 08 OCT 2021

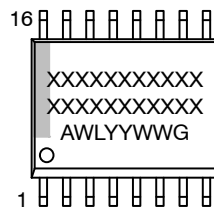


NOTES:

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.

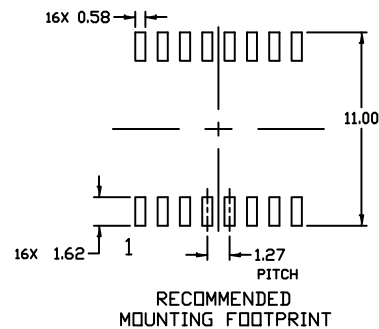
DIM	MILLIMETERS	
	MIN.	MAX.
A	2.35	2.65
A1	0.10	0.25
B	0.35	0.49
C	0.23	0.32
D	10.15	10.45
E	7.40	7.60
e	1.27	BSC
H	10.05	10.55
h	0.53	REF
L	0.50	0.90
M	0°	7°

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

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