NCS2372

1.0 A Output Current, Dual Power Operational Amplifiers

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/μs
- 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

## ON Semiconductor®

http://onsemi.com

MARKING DIAGRAM

SOIC−16W
DW SUFFIX
CASE 751G

NCS2372DW
AWLYYWWG

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

PIN CONNECTIONS

SOIC−16W

V_CC [1]	[16] Output A
Output B [2]	[15] NC
NC [3]	[14] NC
V_EE/GND { [4] [5] }	[13] [12] } V_EE/GND
NC [6]	[11] NC
Inputs B { [7] [8] }	[10] [9] } Inputs A

(Top View)
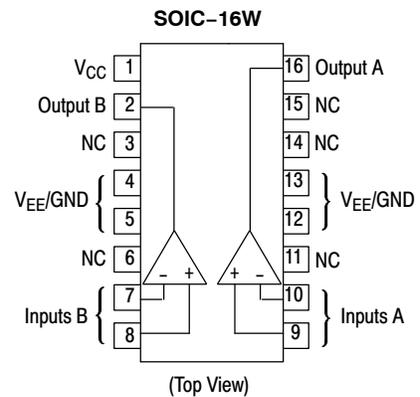
ORDERING INFORMATION

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.

Figure 1. Representative Block Diagram

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 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.

DC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = −15 V, R_L connected to ground, T_A = −40° to +125°C.)

Characteristics	Symbol	Min	Typ	Max	Unit

Input Offset Voltage (V_{CM} = 0)
  T_A = +25°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	–	µV/°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 = ±10 V, R_L = 2.0 k	A_{VOL}	30	100	–	V/mV

Output Voltage Swing (I_L = 100 mA)
  T_A = +25°C
  T_A = T_{low} to T_{high}
  T_A = +25°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 A)
  V_{CC} = +24 V, V_{EE} = 0 V, T_A = +25°C
  V_{CC} = +24 V, V_{EE} = 0 V, T_A = T_{low} to T_{high}
  V_{CC} = +24 V, V_{EE} = 0 V, T_A = +25°C
  V_{CC} = +24 V, V_{EE} = 0 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°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 k)	CMRR	70	90	–	dB
Power Supply Rejection Ratio (R_S = 100 Ω)	PSRR	70	90	–	dB

Power Supply Current
  T_A = +25°C
  T_A = T_{low} to T_{high}
	I_D	
		–
		–
			
			8.0
			–
				
				10
				14
					mA

AC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = −15 V, R_L connected to ground, T_A = +25°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Slew Rate (V_{in} = −10 V to +10 V, R_L = 2.0 k, C_L = 100 pF) A_V = −1.0, T_A = T_{low} to T_{high}	SR	1.0	1.4	–	V/µs

Gain Bandwidth Product (f = 100 kHz, C_L = 100 pF, R_L = 2.0 k)
  T_A = 25°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 k, C_L = 100 pF	ϕ_m	–	65	–	Degrees
Gain Margin R_L = 2.0 k, C_L = 100 pF	A_m	–	15	–	dB
Equivalent Input Noise Voltage R_S = 100 Ω, f = 1.0 to 100 kHz	e_n	–	22	–	nV/$\sqrt{Hz}$
Total Harmonic Distortion A_V = −1.0, R_L = 50 Ω, V_O = 0.5 VRMS, f = 1.0 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.
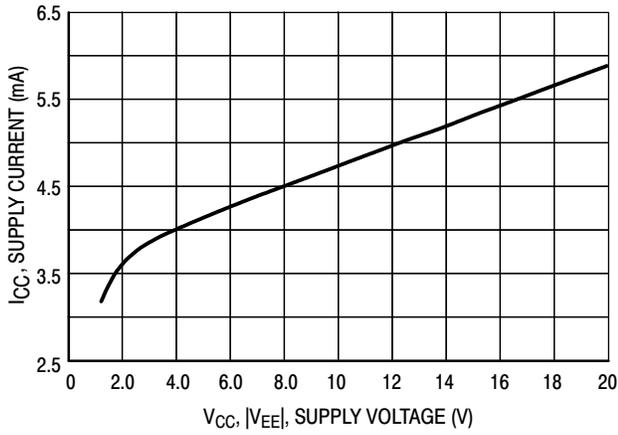
Figure 2. Supply Current versus Supply Voltage with No Load
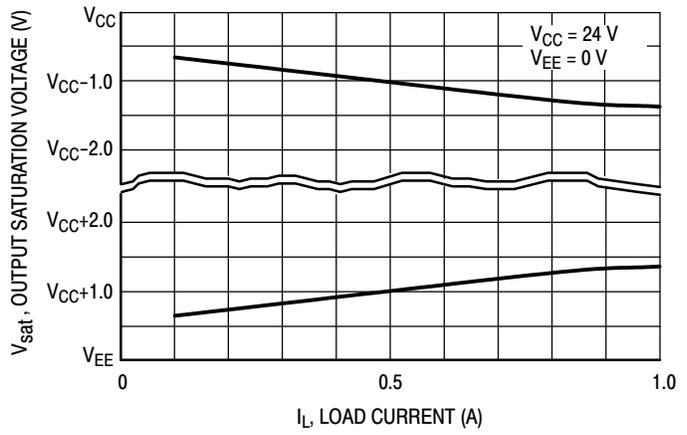

Figure 3. Output Saturation Voltage versus Load Current
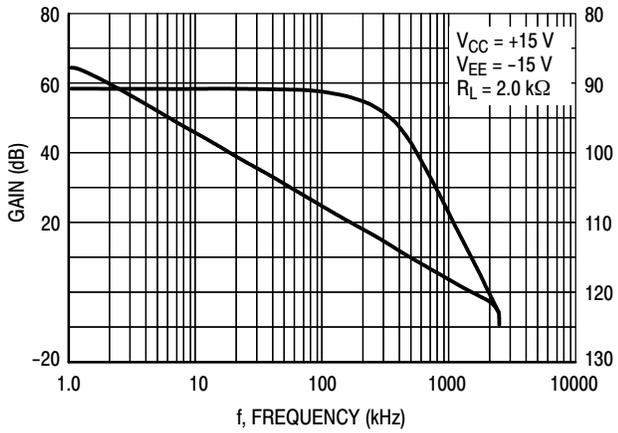
Figure 4. Voltage Gain and Phase versus Frequency
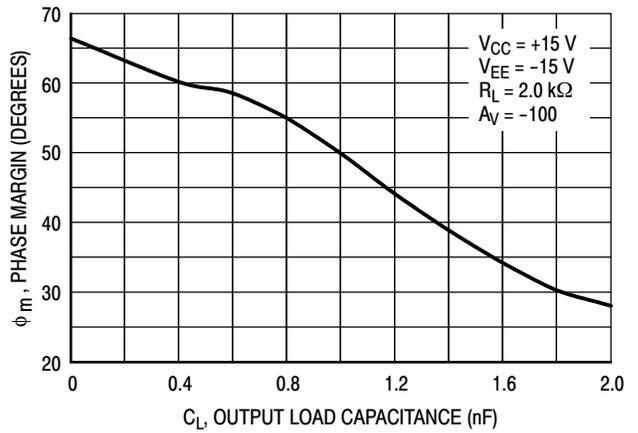
Figure 5. Phase Margin versus Output Load Capacitance
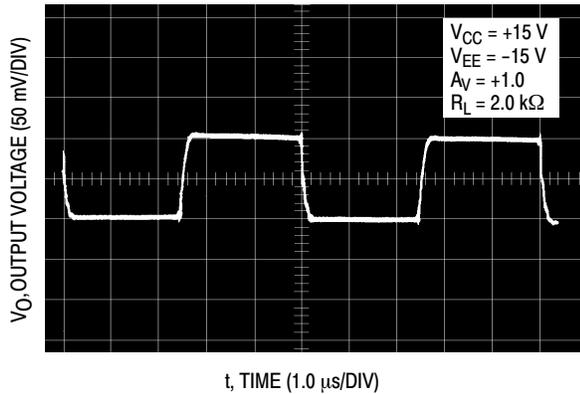
Figure 6. Small Signal Transient Response
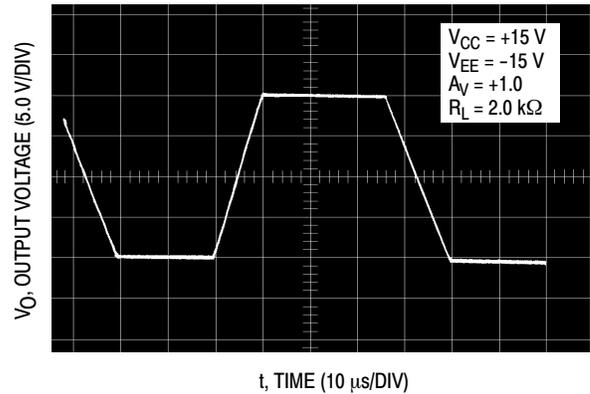
Figure 7. Large Signal Transient Response

V_{CC} = +15 V
V_{EE} = −15 V
A_V = +100
R_L = 50 Ω

t, TIME (100 μs/DIV)
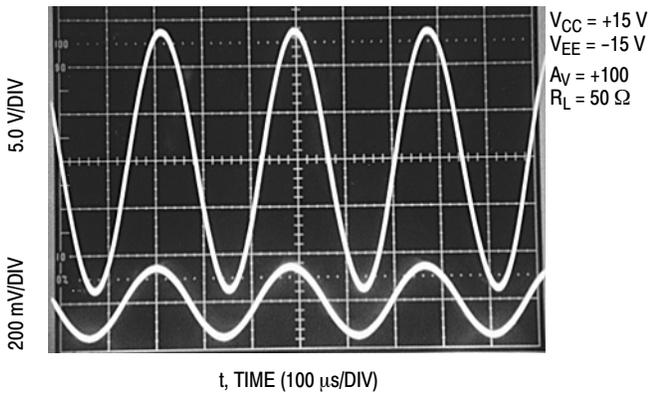
Figure 8. Sine Wave Response

V_S = Logic Supply Voltage
Must Have V_{CC} > V_S
E1, E2 = Logic Inputs
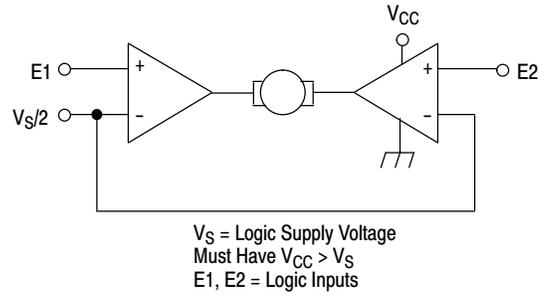
Figure 9. Bidirectional DC Motor Control with Microprocessor−Compatible Inputs
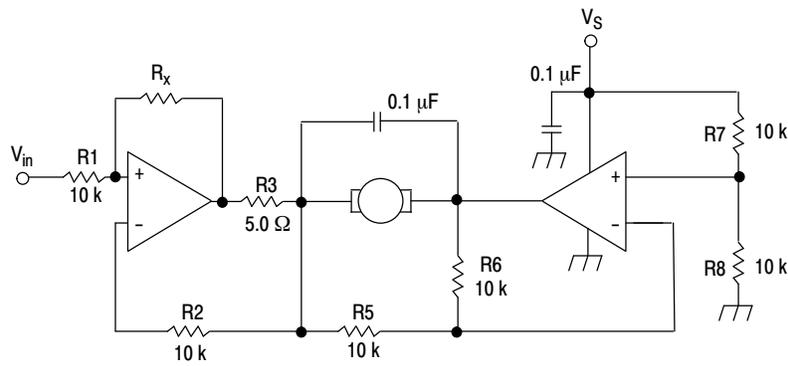
For circuit stability, ensure that $R_x > \dfrac{2R3 \cdot R1}{R_M}$ where, R_M = internal resistance of motor.

The voltage available at the terminals of the motor is: $V_M = 2\left(V_1 - \dfrac{V_S}{2}\right) + |R_o| \cdot I_M$

where, $|R_o| = \dfrac{2R3 \cdot R1}{R_x}$ and I_M is the motor current.

Figure 10. Bidirectional Speed Control of DC Motors

PACKAGE DIMENSIONS

SOIC−16W
DW SUFFIX
CASE 751G−03
ISSUE C
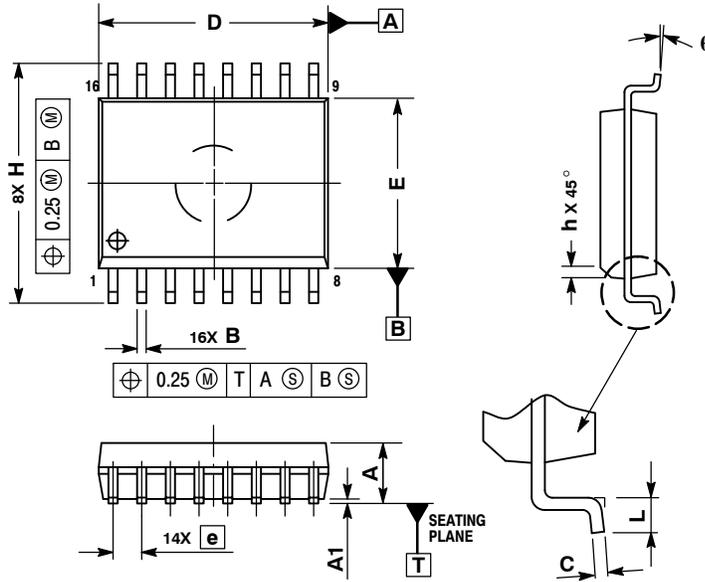
NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INLCUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 TOTAL IN 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
θ	0 °	7 °

PUBLICATION ORDERING INFORMATION