

MC33171, MC33172, MC33174, NCV33172

Single Supply 3.0 V to 44 V, Low Power Operational Amplifiers

Quality bipolar fabrication with innovative design concepts are employed for the MC33171/72/74 series of monolithic operational amplifiers. These devices operate at 180 μ A per amplifier and offer 1.8 MHz of gain bandwidth product and 2.1 V/ μ s slew rate without the use of JFET device technology. Although this series can be operated from split supplies, it is particularly suited for single supply operation, since the common mode input voltage includes ground potential (V_{EE}). With a Darlington input stage, these devices exhibit high input resistance, low input offset voltage and high gain. The all NPN output stage, characterized by no deadband crossover distortion and large output voltage swing, provides high capacitance drive capability, excellent phase and gain margins, low open loop high frequency output impedance and symmetrical source/sink AC frequency response.

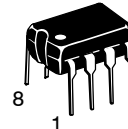
The MC33171/72/74 are specified over the industrial/automotive temperature ranges. The complete series of single, dual and quad operational amplifiers are available in plastic as well as the surface mount packages.

Features

- Low Supply Current: 180 μ A (Per Amplifier)
- Wide Supply Operating Range: 3.0 V to 44 V or ± 1.5 V to ± 22 V
- Wide Input Common Mode Range, Including Ground (V_{EE})
- Wide Bandwidth: 1.8 MHz
- High Slew Rate: 2.1 V/ μ s
- Low Input Offset Voltage: 2.0 mV
- Large Output Voltage Swing: -14.2 V to $+14.2$ V (with ± 15 V Supplies)
- Large Capacitance Drive Capability: 0 pF to 500 pF
- Low Total Harmonic Distortion: 0.03%
- Excellent Phase Margin: 60°
- Excellent Gain Margin: 15 dB
- Output Short Circuit Protection
- ESD Diodes Provide Input Protection for Dual and Quad
- Pb-Free Packages are Available
- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes



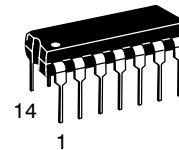
ON Semiconductor®



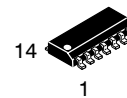
PDIP-8
P SUFFIX
CASE 626



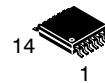
SO-8
D, VD SUFFIX
CASE 751



PDIP-14
P, VP SUFFIX
CASE 646



SO-14
D, VD SUFFIX
CASE 751A



TSSOP-14
DTB SUFFIX
CASE 948G

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 9 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 10 of this data sheet.

MC33171, MC33172, MC33174, NCV33172

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}/V_{EE}	± 22	V
Input Differential Voltage Range	V_{IDR}	(Note 1)	V
Input Voltage Range	V_{IR}	(Note 1)	V
Output Short Circuit Duration (Note 2)	t_{SC}	Indefinite	sec
Operating Ambient Temperature Range	T_A	(Note 3)	$^{\circ}\text{C}$
Operating Junction Temperature	T_J	+150	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	-65 to +150	$^{\circ}\text{C}$

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.

DC 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
Input Offset Voltage ($V_{CM} = 0\text{ V}$) $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{ V}$, $V_{EE} = 0\text{ V}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = T_{low}$ to T_{high} (Note 3)	V_{IO}	-	2.0 2.5 -	4.5 5.0 6.5	mV
Average Temperature Coefficient of Offset Voltage	$\Delta V_{IO}/\Delta T$	-	10	-	$\mu\text{V}/^{\circ}\text{C}$
Input Bias Current ($V_{CM} = 0\text{ V}$) $T_A = +25^{\circ}\text{C}$ $T_A = T_{low}$ to T_{high} (Note 3)	I_{IB}	-	20	100 200	nA
Input Offset Current ($V_{CM} = 0\text{ V}$) $T_A = +25^{\circ}\text{C}$ $T_A = T_{low}$ to T_{high} (Note 3)	I_{IO}	-	5.0	20 40	nA
Large Signal Voltage Gain ($V_O = \pm 10\text{ V}$, $R_L = 10\text{ k}$) $T_A = +25^{\circ}\text{C}$ $T_A = T_{low}$ to T_{high} (Note 3)	A_{VOL}	50 25	500 -	- -	V/mV
Output Voltage Swing $V_{CC} = +5.0\text{ V}$, $V_{EE} = 0\text{ V}$, $R_L = 10\text{ k}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $R_L = 10\text{ k}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $R_L = 10\text{ k}$, $T_A = T_{low}$ to T_{high} (Note 3) $V_{CC} = +5.0\text{ V}$, $V_{EE} = 0\text{ V}$, $R_L = 10\text{ k}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $R_L = 10\text{ k}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $R_L = 10\text{ k}$, $T_A = T_{low}$ to T_{high} (Note 3)	V_{OH} V_{OL}	3.5 13.6 13.3	4.3 14.2 -	- - - 0.15 -13.6 -13.3	V
Output Short Circuit ($T_A = +25^{\circ}\text{C}$) Input Overdrive = 1.0 V, Output to Ground Source Sink	I_{SC}	3.0 15	5.0 27	- -	mA
Input Common Mode Voltage Range $T_A = +25^{\circ}\text{C}$ $T_A = T_{low}$ to T_{high} (Note 3)	V_{ICR}	V_{EE} to $(V_{CC} - 1.8)$ V_{EE} to $(V_{CC} - 2.2)$			V
Common Mode Rejection Ratio ($R_S \leq 10\text{ k}$), $T_A = +25^{\circ}\text{C}$	CMRR	80	90	-	dB
Power Supply Rejection Ratio ($R_S = 100\ \Omega$), $T_A = +25^{\circ}\text{C}$	PSRR	80	100	-	dB
Power Supply Current (Per Amplifier) $V_{CC} = +5.0\text{ V}$, $V_{EE} = 0\text{ V}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = +25^{\circ}\text{C}$ $V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = T_{low}$ to T_{high} (Note 3)	I_D	-	180 220 -	250 250 300	μA

1. Either or both input voltages must 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. MC3317x $T_{low} = -40^{\circ}\text{C}$ $T_{high} = +85^{\circ}\text{C}$
MC3317xV, NCV33172 $T_{low} = -40^{\circ}\text{C}$ $T_{high} = +125^{\circ}\text{C}$

MC33171, MC33172, MC33174, NCV33172

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 ($V_{in} = -10\text{ V to } +10\text{ V}$, $R_L = 10\text{ k}$, $C_L = 100\text{ pF}$) $A_V +1$ $A_V -1$	SR	1.6 -	2.1 2.1	- -	$\text{V}/\mu\text{s}$
Gain Bandwidth Product ($f = 100\text{ kHz}$)	GBW	1.4	1.8	-	MHz
Power Bandwidth $A_V = +1.0$, $R_L = 10\text{ k}$, $V_O = 20\text{ V}_{pp}$, THD = 5%	BWp	-	35	-	kHz
Phase Margin $R_L = 10\text{ k}$ $R_L = 10\text{ k}$, $C_L = 100\text{ pF}$	ϕ_m	- -	60 45	- -	Deg
Gain Margin $R_L = 10\text{ k}$ $R_L = 10\text{ k}$, $C_L = 100\text{ pF}$	A_m	- -	15 5.0	- -	dB
Equivalent Input Noise Voltage $R_S = 100\ \Omega$, $f = 1.0\text{ kHz}$	e_n	-	32	-	$\text{nV}/\sqrt{\text{Hz}}$
Equivalent Input Noise Current ($f = 1.0\text{ kHz}$)	I_n	-	0.2	-	$\text{pA}/\sqrt{\text{Hz}}$
Differential Input Resistance $V_{cm} = 0\text{ V}$	R_{in}	-	300	-	$\text{M}\Omega$
Input Capacitance	C_{in}	-	0.8	-	pF
Total Harmonic Distortion $A_V = +10$, $R_L = 10\text{ k}$, $2.0\text{ V}_{pp} \leq V_O \leq 20\text{ V}_{pp}$, $f = 10\text{ kHz}$	THD	-	0.03	-	%
Channel Separation ($f = 10\text{ kHz}$)	CS	-	120	-	dB
Open Loop Output Impedance ($f = 1.0\text{ MHz}$)	z_o	-	100	-	Ω

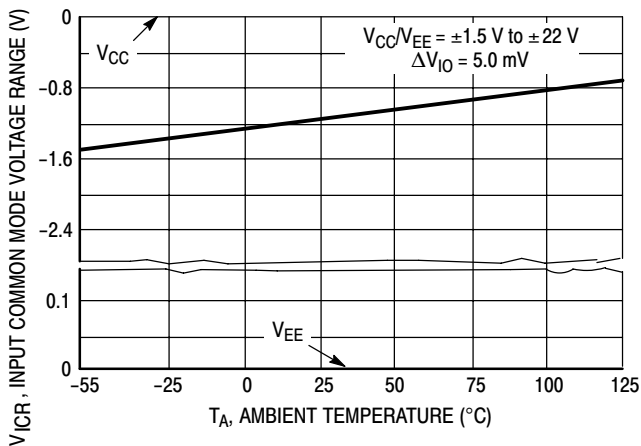


Figure 2. Input Common Mode Voltage Range versus Temperature

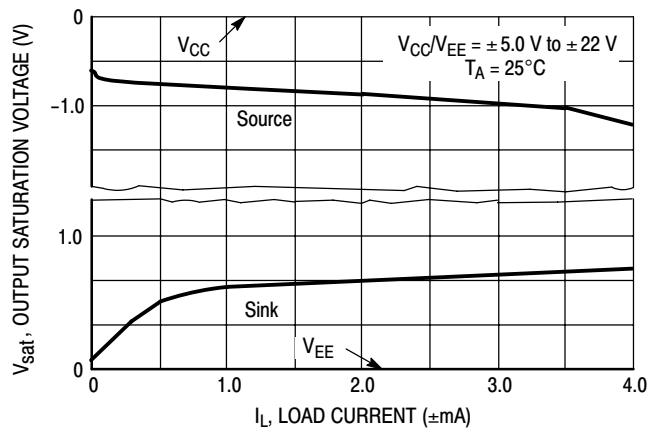


Figure 3. Split Supply Output Saturation versus Load Current

MC33171, MC33172, MC33174, NCV33172

ORDERING INFORMATION

Op Amp Function	Device	Operating Temperature Range	Package	Shipping [†]
Single	MC33171D	$T_A = -40^\circ \text{ to } +85^\circ \text{C}$	SO-8	98 Units/Rail
	MC33171DG		SO-8 (Pb-Free)	
	MC33171DR2		SO-8	2500 / Tape & Reel
	MC33171DR2G		SO-8 (Pb-Free)	
	MC33171P		Plastic DIP	50 Units/Rail
	MC33171PG		Plastic DIP (Pb-Free)	
Dual	MC33172D	$T_A = -40^\circ \text{ to } +85^\circ \text{C}$	SO-8	98 Units/Rail
	MC33172DG		SO-8 (Pb-Free)	
	MC33172DR2		SO-8	2500 / Tape & Reel
	MC33172DR2G		SO-8 (Pb-Free)	
	MC33172P		Plastic DIP	50 Units/Rail
	MC33172PG		Plastic DIP (Pb-Free)	
	MC33172VD	$T_A = -40^\circ \text{ to } +125^\circ \text{C}$	SO-8	98 Units/Rail
	MC33172VDG		SO-8 (Pb-Free)	
	MC33172VDR2		SO-8	2500 / Tape & Reel
	MC33172VDR2G		SO-8 (Pb-Free)	
	NCV33172DR2**		SO-8	2500 / Tape & Reel
Quad	MC33174D	$T_A = -40^\circ \text{ to } +85^\circ \text{C}$	SO-14	55 Units/Rail
	MC33174DG		SO-14 (Pb-Free)	
	MC33174DR2		SO-14	2500 / Tape & Reel
	MC33174DR2G		SO-14 (Pb-Free)	
	MC33174DTB		TSSOP-14*	96 Units/Rail
	MC33174DTBG		TSSOP-14*	
	MC33174DTBR2	TSSOP-14*	2500 / Tape & Reel	
	MC33174DTBR2G	TSSOP-14*		
	MC33174P	Plastic DIP	25 Units/Rail	
	MC33174PG	Plastic DIP (Pb-Free)		
	MC33174VDR2	$T_A = -40^\circ \text{ to } +125^\circ \text{C}$	SO-14	2500 / Tape & Reel
	MC33174VDR2G		SO-14 (Pb-Free)	
	MC33174VP		Plastic DIP	25 Units/Rail
	MC33174VPG		Plastic DIP (Pb-Free)	

[†]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.

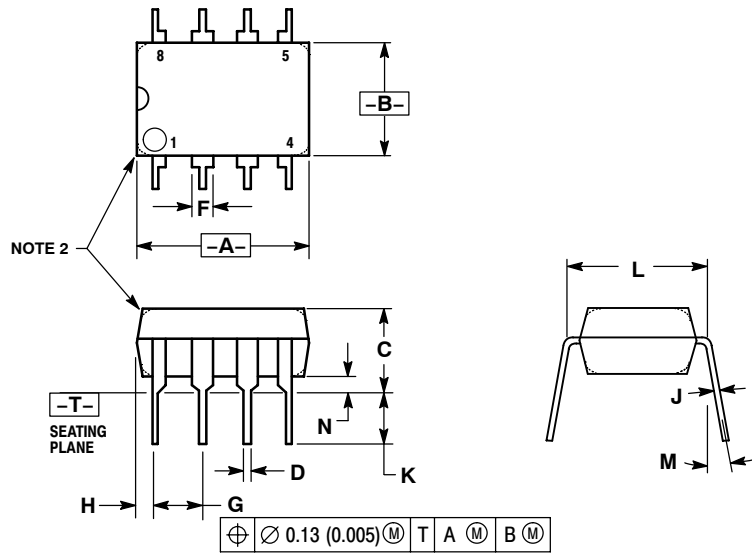
*This package is inherently Pb-Free.

**NCV prefix for automotive and other applications requiring site and control changes.

MC33171, MC33172, MC33174, NCV33172

PACKAGE DIMENSIONS

PDIP-8
P 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