Matched quad high-performance low-voltage operational amplifier

NE/SA5234

DESCRIPTION

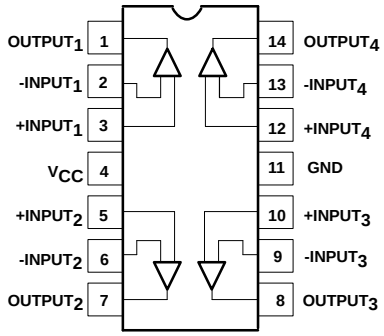
The NE/SA5234 is a matched, low voltage, high performance quad operational amplifier. Among its unique input and output characteristics is the capability for both input and output rail-to-rail operation, particularly critical in low voltage applications. The output swings to less than 50mV of both rails across the entire power supply range. The NE/SA5234 is capable of delivering 5.5V peak-to-peak across a 600Ω load and will typically draw only 700μA per amplifier. The bandwidth is 2.5MHz and the 1% settling time is 1.4μs.

FEATURES

- Wide common-mode input voltage range: 250mV beyond both rails
- Output swing within 50mV of both rails
- Functionality to 1.8V typical
- Low current consumption: 700μA per amplifier
- ±15mA output current capability
- Unity gain bandwidth: 2.5MHz
- Slew rate: 0.8V/μs
- Low noise: 25nV/√Hz
- Electrostatic discharge protection
- Short-circuit protection
- Output inversion prevention

PIN CONFIGURATION

N, and D PACKAGES



APPLICATIONS

- Automotive electronics
- Signal conditioning and sensing amplification
- Portable instrumentation
  - Test and measurement
  - Medical monitors and diagnostics
  - Remote meters
- Audio equipment
- Security systems
- Communications
  - Pagers
  - Cellular telephone
  - LAN
  - 5V Datacom bus
- Error amplifier in motor drives
- Transducer buffer amplifier

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
14-Pin Plastic Small Outline (SO) package	0 to +70°C	NE5234D	0175D
14-Pin Plastic Dual In-Line Package (DIP)	0 to +70°C	NE5234N	0405B
14-Pin Plastic Small Outline (SO) package	-40 to +85°C	SA5234D	0175D
14-Pin Plastic Dual In-Line Package (DIP)	-40 to +85°C	SA5234N	0405B

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNITS
V_{CC}	Single supply voltage	7	V
V_{ESD}	ESD protection voltage at any pin[5] human body model robot model	 2000 200	 V V
V_S	Dual supply voltage	$\pm$3.5	V
V_{DP}	Voltage at any device pin[1]	$V_S \pm 0.5$	V
I_{DP}	Current into any device pin[1]	$\pm$ 50	mA
V_{IN}	Differential input voltage[2]	0.5	V
V_{CM}	Common-mode input voltage (positive)	V_{CC} + 0.5	V
V_{CM}	Common-mode input voltage (negative)	V_{EE} - 0.5	V
P_D	Power dissipation[3]	500	mW
T_J	Operating junction temperature[3]	+150	°C
V_{SC}	Supply voltage allowing indefinite output short circuit to either rail[3,4]	7	V
T_{STG}	Storage temperature range	-65 to +150	°C
T_{SOLD}	Lead soldering temperature (10sec max)	+300	°C
θ_{JA}	Thermal impedance 14 pin Plastic DIP 14 pin Plastic SO	 80 115	 °C/W °C/W

NOTES:
1. Each pin is protected by ESD diodes. The voltage at any pin is limited by the ESD diodes.
2. The differential input of each amplifier is limited by two internal diodes, connected in parallel and opposite to each other. For more differential input range, use differential resistors in series with the input pins.
3. The maximum operating junction temperature is +150°C. At elevated temperatures, devices must be derated according to the package thermal resistance and device mounting conditions. Derates above +25°C: F package at 6.7mW/°C; N package at 9.5mW/°C; D package at 6.25mW/°C.
4. Simultaneous short circuits of two or more amplifiers to the positive or negative rail can exceed the power dissipation ratings and cause eventual destruction of the device.
5. Guaranteed by design.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	RATING	UNITS
V_{CC}	Single supply voltage	+2 to +5.5	V
V_S	Dual supply voltage	$\pm$1 to $\pm$2.75	V
V_{CM}	Common-mode input voltage (positive)	V_{CC} + 0.25	V
V_{CM}	Common-mode input voltage (negative)	V_{EE} - 0.25	V
T_A	Temperature NE SA	 0 to +70 -40 to +85	 °C °C

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 2 to 5.5V, V_{EE} = 0V, T_A = 25°C; $V_{EE} < V_{CM} < V_{CC}$; unless otherwise stated.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNITS
			NE5234			SA5234			
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current	V_{CC} = 5.5V		2.8	4.0		2.8	4.0	mA
		V_{CC} = 5.5V over full temperature range		3.0	4.6		3.2	4.8	
V_{OS}	Offset voltage			±0.2	±4		±0.2	±4	mV
		Over full temperature range		±0.4	±5		±0.6	±5	
$\Delta V_{OS}/\Delta T$	Offset voltage drift with temperature			4			4		µV/°C
ΔV_{OS}	Offset voltage difference between any amplifiers in the same package at the same common mode level[1]			0.4	3		0.4	3	mV
		Over full temperature range		0.8	4		1.2	4	
I_{OS}	Offset current			±3	±20		±3	±30	nA
		Over full temperature range		±4	±30		±6	±60	
$\Delta I_{OS}/\Delta T$	Offset current drift with temperature			0.02	±.3		0.03	±.3	nA/°C
I_B	Input bias current[1]	$V_{EE} < V_{CM} < V_{EE}$ +0.5V	-200	-90		-200	-90		nA
		Over full temperature range	-225	-100		-250	-150		
		V_{EE} +1V < V_{CM} < V_{CC}		25	70		25	75	
		Over full temperature range		35	100		35	120	
$\Delta I_B/\Delta T$	Input bias current drift with temperature			0.5			0.5		nA/°C
ΔI_B	Input bias current difference between any amplifier in the same package at the same common mode level.	$V_{EE} < V_{CM} < V_{EE}$ +0.5V		10	30		10	30	nA
		Over full temperature range		25	50		50	70	
		V_{EE} +1V < V_{CM} < V_{CC}		5	20		5	20	
		Over full temperature range		15	30		25	50	
V_{CM}	Common-mode input range	$V_{OS} \leq$ 6mV	V_{EE}-0.25		V_{CC}+0.25	V_{EE}-0.25		V_{CC}+0.25	V
		$V_{OS} \leq$ 6mV over full temperature range	V_{EE}-0.1		V_{CC}+0.1	V_{EE}-0.1		V_{CC}+0.1	
CMRR	Common-mode rejection ratio, small signal	$V_{EE} < V_{CM} < V_{EE}$+0.5V, V_{EE}+1V < V_{CM} < V_{CC}		100		90	100		dB
		Over full temperature range		100		80	90		
	Common-mode rejection ratio, large signal	$V_{EE} < V_{CM} < V_{CC}$		90			100		
		Over full temperature range		80			90		
PSRR	Power supply rejection ratio	$V_{EE} < V_{CM} < V_{CC}$	80	100		80	100		dB
		Over full temperature range	80	90		80	90		

DC ELECTRICAL CHARACTERISTICS (continued)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNITS
			NE5234			SA5234			
			MIN	TYP	MAX	MIN	TYP	MAX	
I_L	Peak load current, sink and source		10	12		10	12		mA
		Over full temperature range	5	8		5	8		
A_{VOL}	Open-loop voltage gain		90	110		90	110		dB
		Over full temperature range		90			90		
V_{OUT}	Output voltage swing	I_{PEAK} = 0.1mA	V_{EE}+0.05		V_{CC}-0.05	V_{EE}+0.1		V_{CC}-0.1	V
		I_{PEAK} = 10mA	V_{EE}+0.25		V_{CC}-0.25	V_{EE}+0.25		V_{CC}-0.25	
		I_{PEAK} = 5mA over full temp range	V_{EE}+0.2		V_{CC}-0.2	V_{EE}+0.2		V_{CC}-0.2	
	Output voltage swing for V_{CC} = 2.75V, V_{EE} = -2.75V	R_L = 2kΩ	V_{EE}+0.2		V_{CC}-0.2	V_{EE}+0.2		V_{CC}-0.2	V
		R_L = 600Ω,	V_{EE}+0.25		V_{CC}-0.25	V_{EE}+0.25		V_{CC}-0.25	

NOTES:
1. These parameters are measured for $V_{EE} < V_{CM} < V_{EE}$+.5V and for V_{EE}+1V < $V_{CM} < V_{CC}$. By design these parameters are intermediate for common mode ranges between the measured regions.

AC ELECTRICAL CHARACTERISTICS

T_A = +25°C; V_{CC} = 2 to 5.5V; R_L = 10k; C_L = 100pF; unless otherwise stated.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNITS
			NE5234			SA/SE5234			
			MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate	Over full temperature range	0.5	0.8		0.5	0.8		V/µs
BW	Unity gain bandwidth: -3dB	Over full temperature range	2	2.5	4.0	2	2.5	4.0	MHz
θ_M	Phase Margin	C_L = 50pF		55			55		deg
t_S	1% settling time	A_V = 1, 1V step		1.4			1.4		µs
V_N	Input referred voltage noise	A_V = 1, R_S = 0Ω, at 1kHz		25			25		nV/Hz 1/2
THD	Total harmonic distortion	10kHz, $1V_{P-P}$, A_V = 1		0.1			0.1		%

OUTPUT INVERSION PREVENTION

