

## Low Noise Low Supply Voltage Dual Operational Amplifier with Full Swing Input and Output

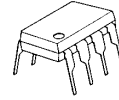
### ■ GENERAL DESCRIPTION

NJM2737 is a single supply dual operational amplifier with full swing input and output, operates from 1.8V.

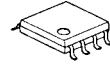
Noise characteristic is designed low as conventional low noise operational amplifiers, such as NJM5532 and NJM4580.

It is suitable for PC audio, portable audio and other low voltage single supplied audio applications.

### ■ PACKAGE OUTLINE



NJM2737D



NJM2737M



NJM2737V

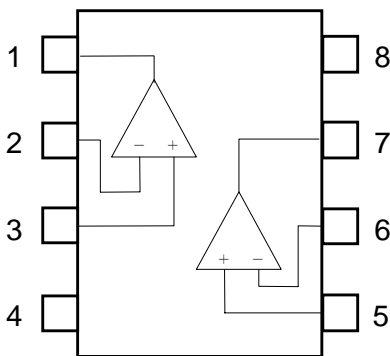


NJM2737RB1

### ■ FEATURES

- Operating Voltage 1.8 to 6.0V
- Low Input Voltage Noise 5nV/√Hz typ.
- Gain Band Width product 3.5MHz typ.
- Slew Rate 0.7V/μs typ.
- Offset Voltage 5mV max
- Input Full-Swing  $V_{ICM} = 0$  to 5.0V at  $V^+ = 5V$
- Output Full-Swing  $V_{OH} \geq 4.9V / V_{OL} \leq 0.15V$  at  $V^+ = 5V, R_L = 20k\Omega$
- Load Drivability  $V_{OH} \geq 4.75V / V_{OL} \leq 0.25V$  at  $V^+ = 5V, R_L = 2k\Omega$
- Bipolar Technology
- Package Outline DIP8, DMP8, SSOP8, TVSP8

### ■ PIN CONFIGURATION



### PIN CONFIGURATION

- 1. OUTPUT1
- 2. -INPUT1
- 3. +INPUT1
- 4.  $V^-$
- 5. +INPUT2
- 6. -INPUT2
- 7. OUTPUT2
- 8.  $V^+$

# NJM2737

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)			
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	7.0	V
Differential Input Voltage	V <sub>ID</sub>	±1.0	V
Input Common Mode Voltage Range	V <sub>ICM</sub>	0 to 7.0	V
Power Dissipation	P <sub>D</sub>	500(DIP8) 300(DMP8) 250(SSOP8) 320(TVSP8)	mW
Operating Temperature Range	Topr	-40 to +85	°C
Storage Temperature Range	Tstg	-40 to +125	°C

(Note1)

If the supply voltage (V<sup>+</sup>) is less than 7V, the input voltage must not over the V<sup>+</sup> level through 7V is limit specified.

## ■ RECOMMENDED OPERATING CONDITION

(Ta=25°C)			
PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V <sup>+</sup>	1.8 to 6.0	V

## ■ ELECTRICAL CHARACTERISTICS

### ● DC CHARACTERISTICS

(V <sup>+</sup> =5V, Ta=25°C)						
PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Current	I <sub>CC</sub>	No Signal	-	1200	1600	μA
Input Offset Voltage	V <sub>IO</sub>		-	1	5	mV
Input Bias Current	I <sub>B</sub>		-	200	800	nA
Input Offset Current	I <sub>IO</sub>		-	5	100	nA
Voltage Gain	A <sub>V</sub>	R <sub>L</sub> =2kΩ	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 2.5V ≤ V <sub>CM</sub> ≤ 5.0V, CMR-: 0 ≤ V <sub>CM</sub> ≤ 2.5V (Note2)	55	70	-	dB
Supply Voltage Rejection Ratio	SVR	V <sup>+</sup> /GND = ±2.0 to ±3.0V	70	85	-	dB
Maximum Output Voltage 1	V <sub>OH1</sub>	R <sub>L</sub> =20kΩ	4.9	4.95	-	V
	V <sub>OL1</sub>	R <sub>L</sub> =20kΩ	-	0.05	0.1	
Maximum Output Voltage 2	V <sub>OH2</sub>	R <sub>L</sub> =2kΩ	4.75	4.85	-	V
	V <sub>OL2</sub>	R <sub>L</sub> =2kΩ	-	0.15	0.25	
Input Common Mode Voltage Range	V <sub>ICM</sub>	CMR > 55dB	0	-	5	V

(Note2) CMR is represented by either CMR+ or CMR- which has lower value.

CMR+ is measured with 2.5V ≤ V<sub>CM</sub> ≤ 5V and CMR- is measured with 0V ≤ V<sub>CM</sub> ≤ 2.5V .

### ● AC CHARACTERISTICS

(V <sup>+</sup> =5V, Ta=25°C)						
PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Unity Gain Bandwidth	f <sub>T</sub>	R <sub>L</sub> =2kΩ	-	3.5	-	MHz
Phase Margin	Φ <sub>M</sub>	R <sub>L</sub> =2kΩ	-	70	-	Deg
Equivalent Input Noise Voltage	V <sub>N</sub>	f=1kHz	-	5	-	nV/ √Hz

● TRANSIENT CHARACTERISTICS

(V<sup>+</sup>=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Slew Rate	SR	R <sub>L</sub> =2kΩ	-	0.7	-	V/μs

● DC CHARACTERISTICS

(V<sup>+</sup>=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Current	I <sub>CC</sub>	No Signal	-	1000	1500	μA
Input Offset Voltage	V <sub>IO</sub>		-	1	5	mV
Input Bias Current	I <sub>B</sub>		-	200	800	nA
Input Offset Current	I <sub>IO</sub>		-	5	100	nA
Voltage Gain	A <sub>V</sub>	R <sub>L</sub> =2kΩ	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 1.5V ≤ V <sub>CM</sub> ≤ 3.0V, CMR-: 0 ≤ V <sub>CM</sub> ≤ 1.5V(Note3)	48	63	-	dB
Supply Voltage Rejection Ratio	SVR	V <sup>+</sup> /GND = ±1.2 to ±2.0V	68	83	-	dB
Maximum Output Voltage 1	V <sub>OH1</sub>	R <sub>L</sub> =20kΩ	2.9	2.95	-	V
	V <sub>OL1</sub>	R <sub>L</sub> =20kΩ	-	0.05	0.1	
Maximum Output Voltage 2	V <sub>OH2</sub>	R <sub>L</sub> =2kΩ	2.75	2.85	-	V
	V <sub>OL2</sub>	R <sub>L</sub> =2kΩ	-	0.15	0.25	
Input Common Mode Voltage Range	V <sub>ICM</sub>	CMR > 48dB	0	-	3	V

(Note3) CMR is represented by either CMR+ or CMR- which has lower value.

CMR+ is measured with 1.5V ≤ V<sub>CM</sub> ≤ 3V and CMR- is measured with 0V ≤ V<sub>CM</sub> ≤ 1.5V .

● AC CHARACTERISTICS

(V<sup>+</sup>=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Unity Gain Bandwidth	f <sub>T</sub>	R <sub>L</sub> =2kΩ	-	3	-	MHz
Phase Margin	Φ <sub>M</sub>	R <sub>L</sub> =2kΩ	-	70	-	Deg
Equivalent Input Noise Voltage	V <sub>N</sub>	f=1kHz	-	5	-	nV/ √Hz

● TRANSIENT CHARACTERISTICS

(V<sup>+</sup>=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Slew Rate	SR	R <sub>L</sub> =2kΩ	-	0.7	-	V/μs

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## ● DC CHARACTERISTICS

(V<sup>+</sup>=1.8V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Current	I <sub>CC</sub>	No Signal	-	1000	1500	μA
Input Offset Voltage	V <sub>IO</sub>		-	1	5	mV
Input Bias Current	I <sub>B</sub>		-	200	800	nA
Input Offset Current	I <sub>IO</sub>		-	5	100	nA
Voltage Gain	A <sub>V</sub>	R <sub>L</sub> =2kΩ	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 0.9V ≤ V <sub>CM</sub> ≤ 1.8V, CMR-: 0 ≤ V <sub>CM</sub> ≤ 0.9V (Note4)	40	55	-	dB
Supply Voltage Rejection Ratio	SVR	V <sup>+</sup> /GND = ±0.9 to ±1.2V	65	80	-	dB
Maximum Output Voltage 1	V <sub>OH1</sub>	R <sub>L</sub> =20kΩ	1.7	1.75	-	V
	V <sub>OL1</sub>	R <sub>L</sub> =20kΩ	-	0.1	0.15	
Maximum Output Voltage 2	V <sub>OH2</sub>	R <sub>L</sub> =2kΩ	1.6	1.65	-	V
	V <sub>OL2</sub>	R <sub>L</sub> =2kΩ	-	0.15	0.25	
Input Common Mode Voltage Range	V <sub>ICM</sub>	CMR > 40dB	0	-	1.8	V

(Note4) CMR is represented by either CMR+ or CMR- which has lower value.

CMR+ is measured with 0.9V ≤ V<sub>CM</sub> ≤ 1.8V and CMR- is measured with 0V ≤ V<sub>CM</sub> ≤ 0.9V .

## ● AC CHARACTERISTICS

(V<sup>+</sup>=1.8V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Unity Gain Bandwidth	f <sub>T</sub>	R <sub>L</sub> =2kΩ	-	3	-	MHz
Phase Margin	Φ <sub>M</sub>	R <sub>L</sub> =2kΩ	-	70	-	Deg
Equivalent Input Noise Voltage	V <sub>N</sub>	f=1kHz	-	5	-	nV/ √Hz

## ● TRANSIENT CHARACTERISTICS

(V<sup>+</sup>=1.8V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Slew Rate	SR	R <sub>L</sub> =2kΩ	-	0.6	-	V/μs

## ■ TERMINAL CHARACTERISTICS

No.	Symbol	Equivalent Circuit	Typ.DC Voltage(V)	Function
3,5	+INPUT			non-inverting input
2,6	-INPUT			inverting input
1,7	VOUT			output

## ■ MEMO

**[CAUTION]**

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