

**HEADPHONE™**  
**SRS Headphone 3D SURROUND PROCESSOR**

■ GENERAL DESCRIPTION

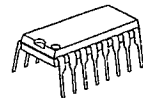
The NJM2190 is a headphone surround processor based on SRS technology. It provides a realistic and spacious listening experience through standard headphones.

The features of low operating voltage, low output noise, and low operating current are very suitable for portable audio applications.

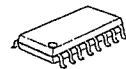
■ FEATURES

- Operating Voltage (1.8 to 6.0V)
- Low Operating Current (1.3mA typ. at SRS mode)
- Low Output Noise (12.0μVrms typ. at SRS mode)
- WIDTH Control
- Bipolar Technology
- Package Outline DIP16, DMP16, SSOP16

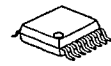
■ PACKAGE OUTLINE



NJM2190D

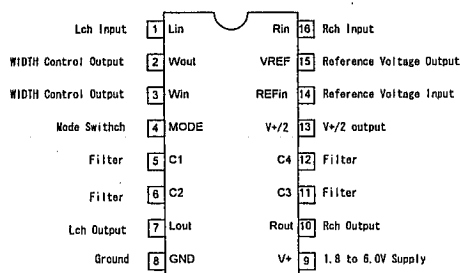


NJM2190M

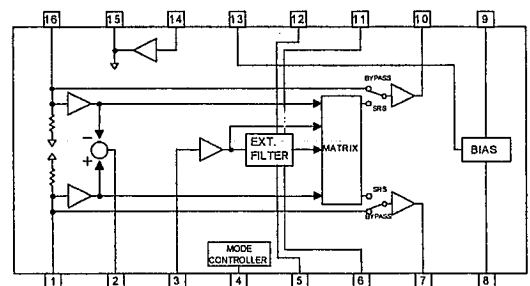


NJM2190V

■ PIN CONFIGURATION



■ BLOCK DIAGRAM



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## ■ ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	7	V
Power Dissipation	P <sub>D</sub>	(DIP16) 500 (DMP16) 300 (SSOP16) 300	mW
Operating Temperature Range	T <sub>OPR</sub>	-20 to +75	°C
Storage Temperature Range	T <sub>STG</sub>	-40 to +125	°C

## ■ ELECTRICAL CHARACTERISTICS (V<sup>+</sup>=3V, V<sub>IN</sub>=-26dBV (50mVrms), Ta=25°C, unless otherwise specified.)

PARAMETER	SYMBOL		CONDITION					MIN	TYP	MAX	UNIT
			INPUT		OUTPUT	MODE	WIDTH VR <sup>(*)</sup>				
			L	R							
Operating Voltage	V <sup>+</sup>		-	-	-	-	-	1.8	3.0	6.0	V
Operating Current	I <sub>CC</sub>	No Signal	0	0	-	BYPASS	-	-	0.7	1.0	mA
			0	0	-	SRS	MIN	-	1.3	1.8	
			0	0	-	SRS	MAX	-	1.3	1.8	
Reference Voltage	V <sub>REF</sub>	V <sup>+</sup> /2	-	-	-	-	-	1.3	1.5	1.7	V
Maximum Input Voltage	V <sub>IM</sub>	f=1kHz THD=1%	V <sub>IN</sub>	0	L	BYPASS	-	-	0.1 (1012)	-	dBV (mVrms)
			0	V <sub>IN</sub>	R						
		f=100Hz THD=1%	V <sub>IN</sub>	0	L	SRS	MIN	-	-11.8 (257)	-	
			0	V <sub>IN</sub>	R						
		f=100Hz THD=1%	V <sub>IN</sub>	0	L	SRS	MAX	-	-15.8 (162)	-	
			0	V <sub>IN</sub>	R						
		V <sup>+</sup> =1.8V f=1kHz THD=1%	V <sub>IN</sub>	0	L	BYPASS	-	-6.7 (462)	-4.7 (582)	-	
			0	V <sub>IN</sub>	R						
		V <sup>+</sup> =1.8V f=100Hz THD=1%	V <sub>IN</sub>	0	L	SRS	MIN	-	-16.7 (146)	-	
			0	V <sub>IN</sub>	R						
		V <sup>+</sup> =1.8V f=100Hz THD=1%	V <sub>IN</sub>	0	L	SRS	MAX	-22.5 (75)	-20.5 (94)	-	
			0	V <sub>IN</sub>	R						

■ ELECTRICAL CHARACTERISTICS ( $V^+=3V, V_{IN}=-26dBV(50mV_{rms}), T_a=25^\circ C$ , unless otherwise specified.)

PARAMETER	SYMBOL		CONDITION					MIN	TYP	MAX	UNIT
			INPUT		OUTPUT	MODE	WIDTH VR <sup>(*)</sup>				
			L	R							
Maximum Input Voltage (*2)	$V_{IM}$	$V^+=1.8V$ $f=1kHz$ THD=1%	$V_{IN}$	$V_{IN}$	L	SRS	MIN	-	-16.7 (146)	-	dBV ( $\mu V_{rms}$ )
					R						
			$V_{IN}$	$V_{IN}$	L	SRS	MAX	-	-16.7 (146)	-	
					R						
$V_{IN}$	$-V_{IN}$	L	SRS	MIN	-	-22.9 (72)	-				
		R									
$V_{IN}$	$-V_{IN}$	L	SRS	MAX	-28.5 (38)	-26.5 (47)	-				
		R									
Output Noise	$V_{NO}$	$R_g=0\Omega$ A-Weighted	0	0	L	BYPASS	-	-	-110 (3.0)	-104 (6.0)	dBV ( $\mu V_{rms}$ )
					R						
			0	0	L	SRS	MIN	-	-98 (12.0)	-	
					R						
			0	0	L	SRS	MAX	-	-98 (12.0)	-92 (24.0)	
					R						
Total Harmonic Distortion	THD	$V^+=1.8V$ $f=1kHz$	$V_{IN}$	0	L	BYPASS	-	-	0.02	-	%
					R						
			$V_{IN}$	0	L	SRS	MIN	-	0.10	-	
					R						
			$V_{IN}$	0	L	SRS	MAX	-	0.25	0.5	
					R						
$V_{IN}$	$V_{IN}$	L	SRS	MIN	-	0.0	-				
		R									
BYPASS Gain	$G_{VBYP}$	$f=1kHz$	$V_{IN}$	0	L	BYPASS	-	-1.0	0.0	1.0	dB
					R						
L + R Gain	$G_{L+R}$	$f=1kHz$	$V_{IN}$	$V_{IN}$	L	SRS	MIN	-	0.0	-	dB
					R						
			$V_{IN}$	$V_{IN}$	L	SRS	MAX	-1.0	0.0	1.0	
					R						

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■ ELECTRICAL CHARACTERISTICS ( $V^+=3V$ ,  $V_{IN}=-26dBV$  (50mVrms),  $T_a=25^\circ C$ , unless otherwise specified.)

PARAMETER	SYMBOL		CONDITION					MIN	TYP	MAX	UNIT			
			INPUT		OUTPUT	MODE	WIDTH VR <sup>(*)</sup>							
			L	R										
L-R Gain (*)2	G <sub>L-R</sub>	f=100Hz	V <sub>IN</sub>	-V <sub>IN</sub>	L	SRS	MIN	3.7	5.7	7.7	dB			
					R									
			V <sub>IN</sub>	-V <sub>IN</sub>	L	SRS	MAX					19.3	21.3	23.3
					R									
Channel Separation	CS	f=1kHz	0	V <sub>IN</sub>	L	BYPASS	-	60.0	80.0	-	dB			
			V <sub>IN</sub>	0	R									
MODE Select Control Voltage	V <sub>IH</sub>	High Level	-	-	-	-	-	1.3	-	V <sup>+</sup>	V			
	V <sub>IL</sub>	Low Level	-	-	-	-	-	0.0	-	0.5				

(\*1) Refer to application circuit 1.

(\*2) The word '-V<sub>IN</sub>' signifies opposite phase of 'V<sub>IN</sub>'.

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■ MODE Switch

	MODE
BYPASS MODE	L
SRS MODE	H

■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
1 16	Lin Rin	Audio Input		$V^+/2$
2	Wout	WIDTH Control Output		$V^+/2$
3	Win	WIDTH Control Input		$V^+/2$
4	MODE	Mode Switch		-

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## ■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
5	C1	Capacitor Terminal 1 for Filter		$V^+/2$
6	C2	Capacitor Terminal 2 for Filter		$V^+/2$
7 10	Lout Rout	Audio Output		$V^+/2$
8	GND	Ground		0V

■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
9	V <sup>+</sup>	Power Supply		V <sup>+</sup>
11	C3	Capacitor Terminal 3 for Filter		V <sup>+</sup> /2
12	C4	Capacitor Terminal 4 for Filter		V <sup>+</sup> /2
13	V <sup>+</sup> /2	V <sup>+</sup> /2 Output		V <sup>+</sup> /2

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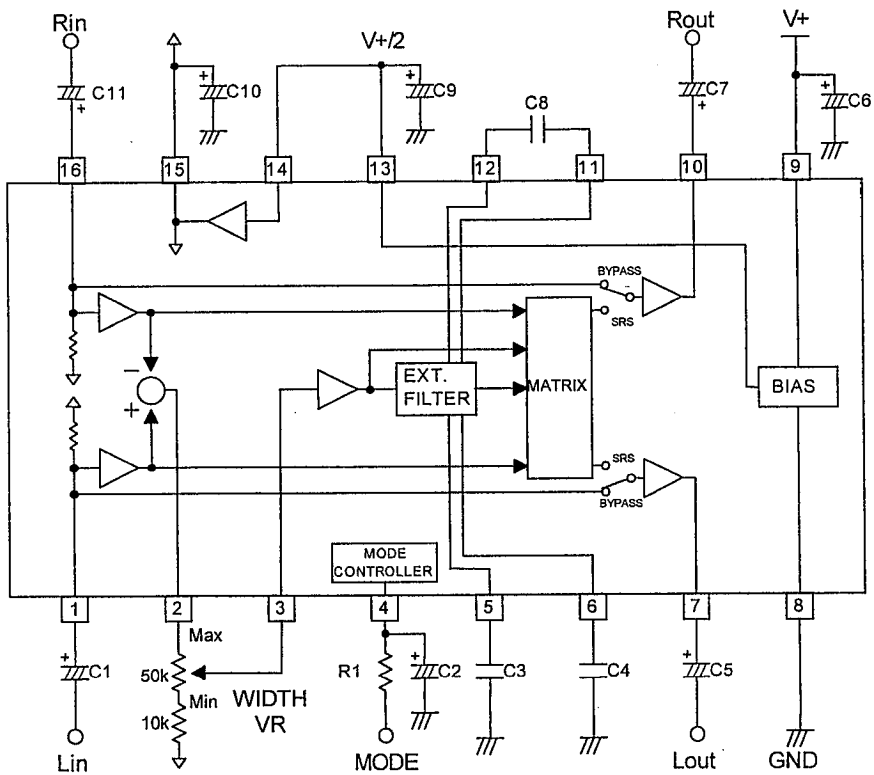
## ■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
14	REFin	Reference Voltage Input		$V^+/2$
15	VREF	Reference Voltage Output		$V^+/2$

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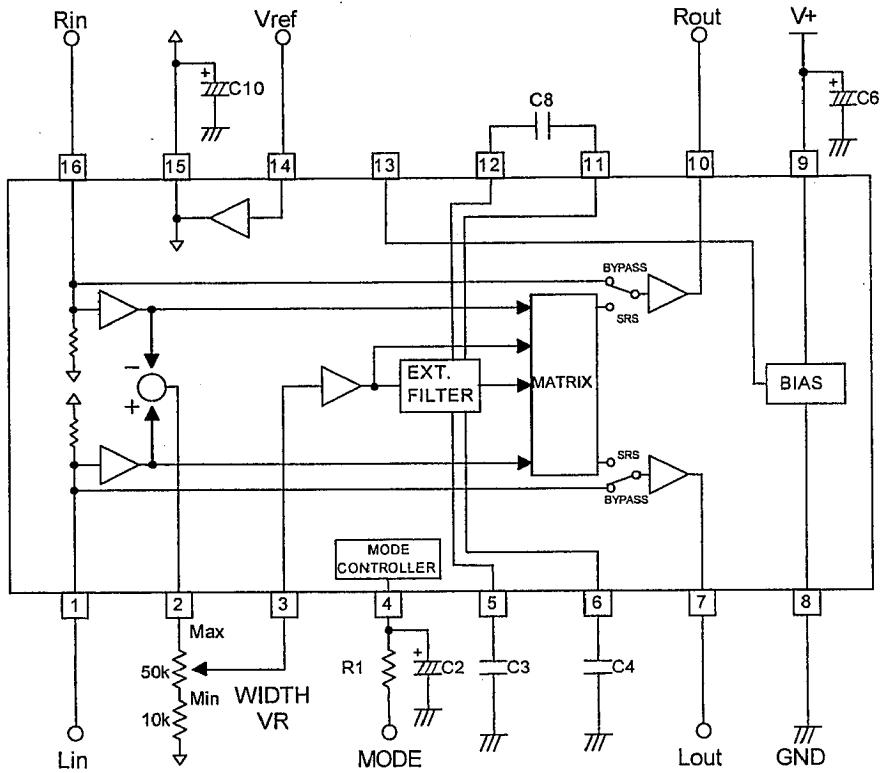
APPLICATION CIRCUIT 1



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Parts No.	Value	Tolerance	Parts No.	Value	Tolerance
R1	22k $\Omega$	$\pm 5\%$	C6	22 to 100 $\mu$ F	-
C1	10 $\mu$ F	-	C7	10 $\mu$ F	-
C2	10 $\mu$ F	-	C8	4.7nF	$\pm 5\%$
C3	3.3nF	$\pm 5\%$	C9	1 to 10 $\mu$ F	-
C4	0.1 $\mu$ F	$\pm 5\%$	C10	10 to 7 $\mu$ F	-
C5	10 $\mu$ F	-	C11	10 $\mu$ F	-

## APPLICATION CIRCUIT 2 (Without using internal V+/2.)

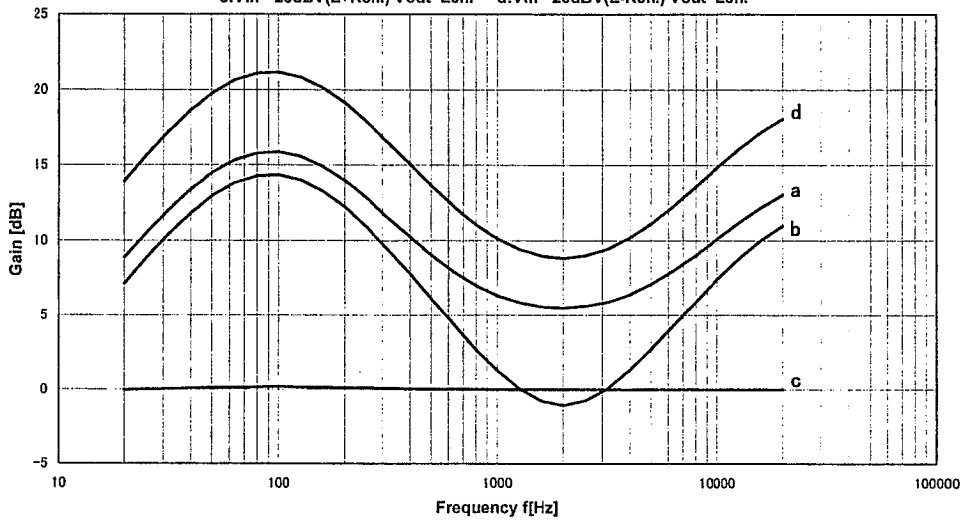


Parts No.	Value	Tolerance	Parts No.	Value	Tolerance
R1	22k $\Omega$	$\pm 5\%$	C6	22 to 100 $\mu F$	-
C2	10 $\mu F$	-	C8	4.7nF	$\pm 5\%$
C3	3.3nF	$\pm 5\%$	C10	10 to 47 $\mu F$	-
C4	0.1 $\mu F$	$\pm 5\%$			

■ TYPICAL CHARACTERISTICS

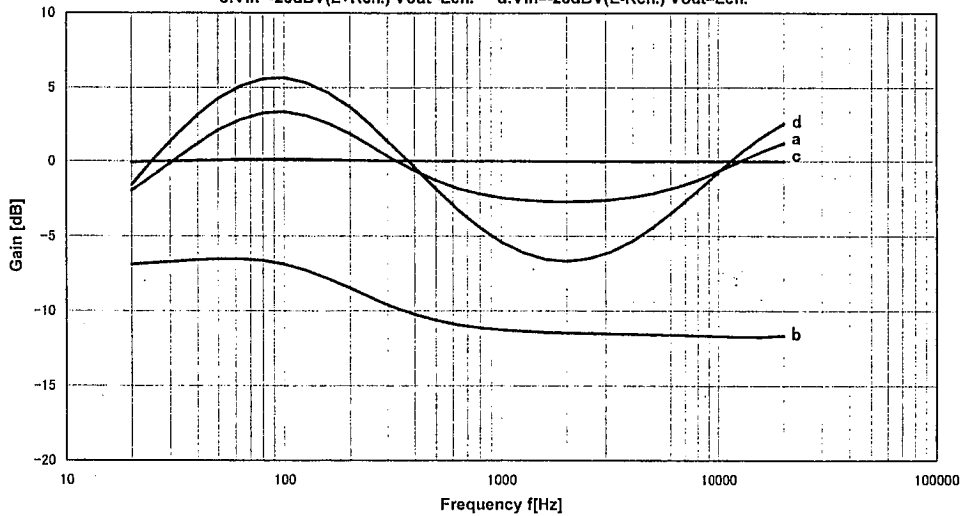
GAIN STRUCTURE (WIDTH VR:MAX)

Conditions : SRS MODE , WIDTH VR=MAX , V+=3V  
 a:Vin=-26dBV(Lch.) Vout=Lch. b:Vin=-26dBV(Rch.) Vout=Lch.  
 c:Vin=-26dBV(L+Rch.) Vout=Lch. d:Vin=-26dBV(L-Rch.) Vout=Lch.



GAIN STRUCTURE (WIDTH VR:MIN)

Conditions : SRS MODE , WIDTH VR=MIN , V+=3V  
 a:Vin=-26dBV(Lch.) Vout=Lch. b:Vin=-26dBV(Rch.) Vout=Lch.  
 c:Vin=-26dBV(L+Rch.) Vout=Lch. d:Vin=-26dBV(L-Rch.) Vout=Lch.

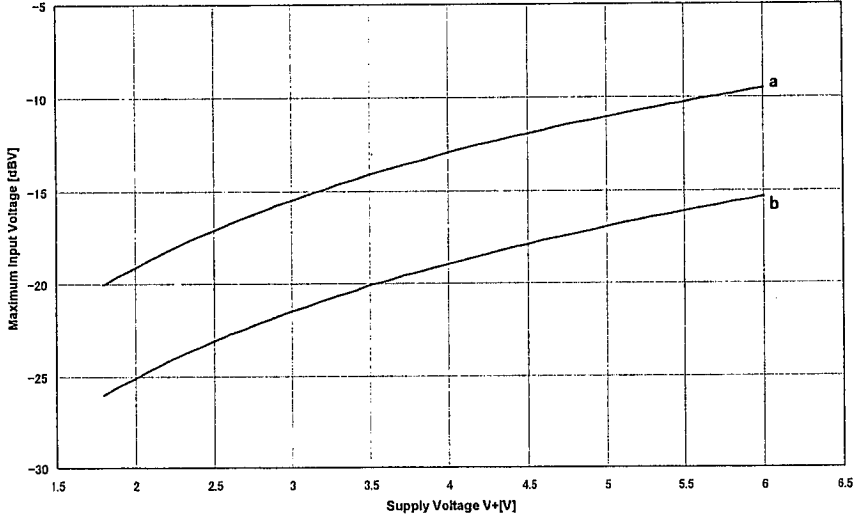


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## TYPICAL CHARACTERISTICS

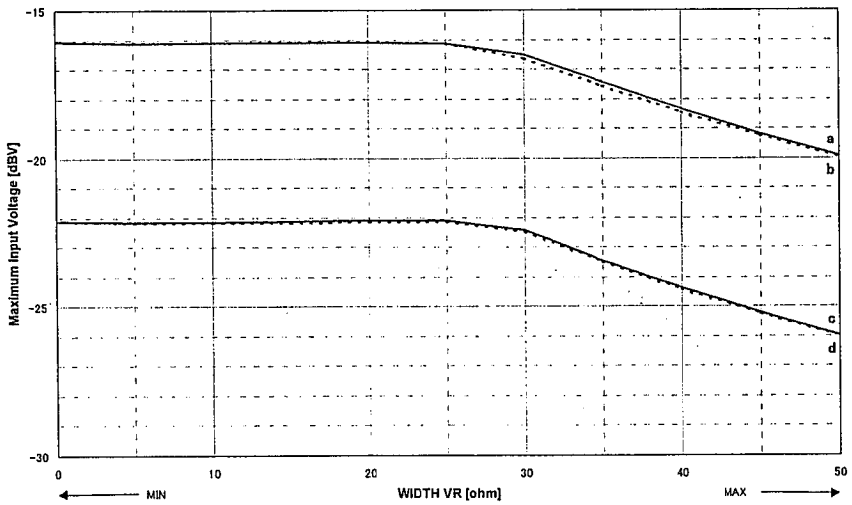
### Maximum Input Voltage vs. Supply Voltage

Maximum Input Voltage vs. Supply Voltage  
 conditions : SRS MODE, WIDTH VR=MAX, f=100Hz  
 a. Vin=Lch. Vout=Lch.(at THD=1%)  
 b. Vin=L-Rch. Vout=Lch.(at THD=1%)



### Maximum Input Voltage vs. WIDTH VR

Conditions : SRS MODE, V+=1.8V, f=100Hz  
 a: Vin=Lch. Vout=Lch.(at THD=1%) b: Vin=Lch. Vout=Rch.(at THD=1%)  
 c: Vin=L-Rch. Vout=Lch.(at THD=1%) d: Vin=L-Rch. Vout=Rch.(at THD=1%)



## MEMO

[CAUTION]

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