Passive Matrix TruSurround™ 3D Audio Processor

■GENERAL DESCRIPTION

The **NJM2188** is a Passive Matrix TruSurround™ 3D audio processor. It regenerates the full surround sound field directly from any kinds of surround encoded stereo input (Lt/Rt) signals.

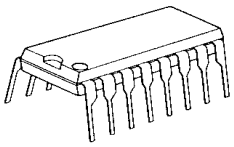
After the internal passive matrix circuit decodes Lt/Rt signal into 4 channel signals, the TruSurround virtualizer encodes them into 2 channel surround signals again.

Accordingly any pre-processors decoding into 4 channel signals are not required.

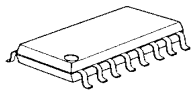
The **NJM2188** also includes the SRS 3D-STEREO, and regenerates a 3D sound field from normal L/R input.

The **NJM2188** is suitable for TV, mini component, CD radio cassette, multimedia speaker system ,and others.

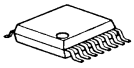
■PACKAGE



NJM2188D



NJM2188M



NJM2188V

■FEATURES

●Operating Voltage	(4.7 to 13V)
●Maximum Input Voltage	(1.5Vrms typ. at $V^+ \geq 11V$)
●Low Output Noise	(32μVrms typ. at TRU mode)
●SRS 3D-STEREO FUNCTION	(Two-grade Switch for 3D Effect)
●BYPASS FUNCTION	(THROUGH)
●Bipolar Technology	
●Package Outline	DIP16, DMP16, SSOP16

For further information, please contact:
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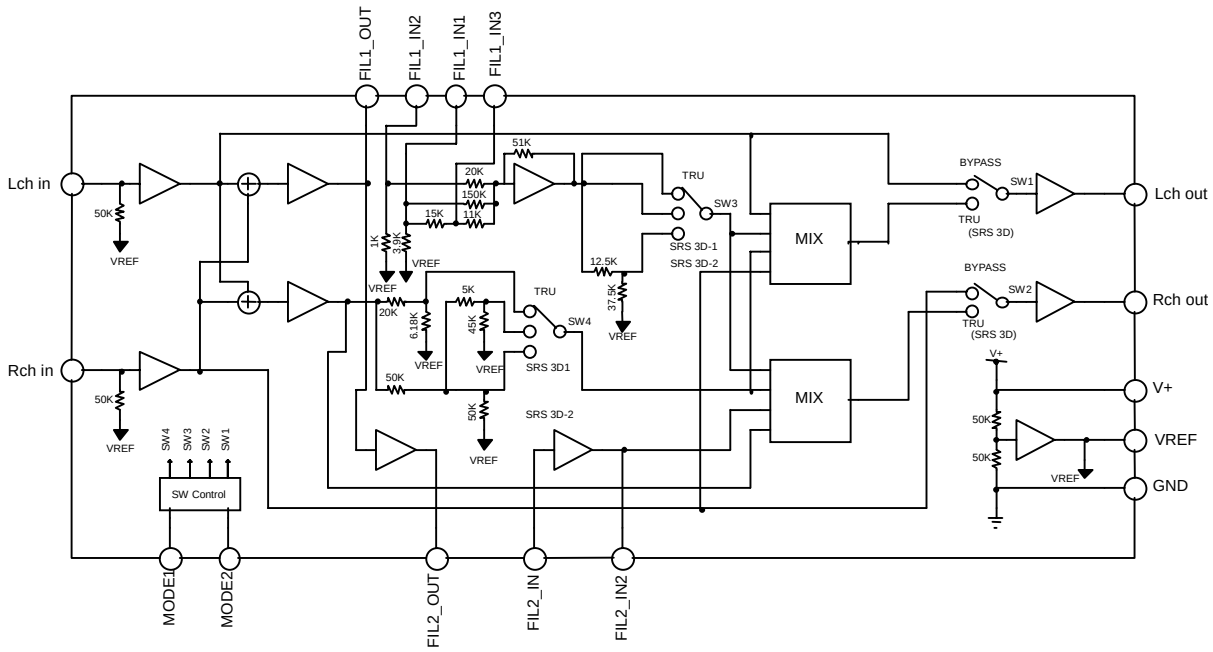
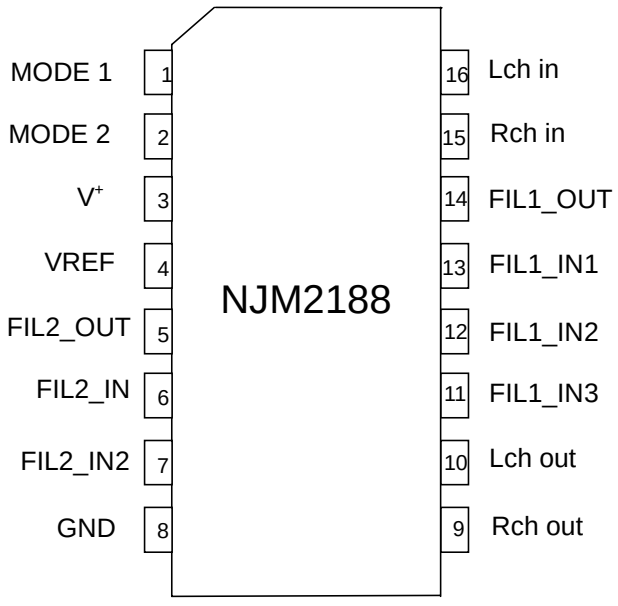
2909 Daimler Street. Santa Ana, CA 92705 USA
Tel:949-442-1070 Fax:949-852-1099
http://www.srslabs.com

■BLOCK DIAGRAM



■PIN CONFIGRATION



No.	Symbol	Function
1	MODE1	Mode Switch
2	MODE2	Mode Switch
3	V^+	Supply Voltage 4.5V to 13V
4	V_{REF}	$V^+/2$ output
5	FIL2_OUT	Filter2 output
6	FIL2_IN	Filter2 input
7	FIL2_IN2	Filter2 input2
8	GND	Ground
9	$R_{ch\ OUT}$	Rch output
10	$L_{ch\ OUT}$	Lch output
11	FIL1_IN3	Filter1 input3
12	FIL1_IN2	Filter1 input2
13	FIL1_IN1	Filter1 input1
14	FIL1_OUT	Filter1 output
15	$R_{ch\ IN}$	Rch input
16	$L_{ch\ IN}$	Lch input

■ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+	15	V
Power Dissipation	P_D	(DIP16) 500 (DMP16) 300 (SSOP16) 300	mW
Operating Temperature Range	T_{opr}	-40 to +85	°C
Storage Temperature Range	T_{stg}	-40 to +125	°C

■ELECTRICAL CHARACTERISTICS (V^+=12V,Ta=25°C)

PARAMETER	SYMBOL	CONDITION	IN L	IN R	OUT	MODE	MIN	TYP	MAX	UNIT
Operating Voltage	V^+		-	-	-	-	4.7	12.0	13.0	V
Supply Current	I_{cc}	No Signal	0	0	-	BYPASS	-	9.0	13.5	mA
			0	0	-	TRU				
			0	0	-	SRS 3D-1				
Reference Voltage	V_{REF}	V^+/2	-	-	-	-	5.5	6.0	6.5	V
Maximum Input Voltage	V_{INMAX}	f=1kHz THD=3%	V_{IN}	0	L	BYPASS	11.0 (3.55)	12.0 (3.98)	-	dBV (Vrms)
			0	V_{IN}	R					
		f=125Hz THD=3%	V_{IN}	0	L	TRU	4.5 (1.67)	6.5 (2.11)	-	
			V_{IN}	0	R		7.3 (2.32)	9.3 (2.92)	-	
			V_{IN}	V_{IN}	L		3.9 (1.57)	5.9 (1.97)	-	
		f=125Hz THD=3%	V_{IN}	0	L	SRS3D-1	7.5 (2.37)	9.5 (3.0)	-	
			V_{IN}	0	R		7.3 (2.32)	9.3 (2.92)	-	
			V_{IN}	V_{IN}	L		4.0 (1.58)	6.0 (2.0)	-	
		f=125Hz THD=3%	V_{IN}	0	L	SRS3D-2	7.5 (2.37)	9.5 (3.0)	-	
			V_{IN}	0	R		7.5 (2.37)	9.5 (3.0)	-	
			V_{IN}	V_{IN}	L		4.5 (1.68)	6.5 (2.11)	-	

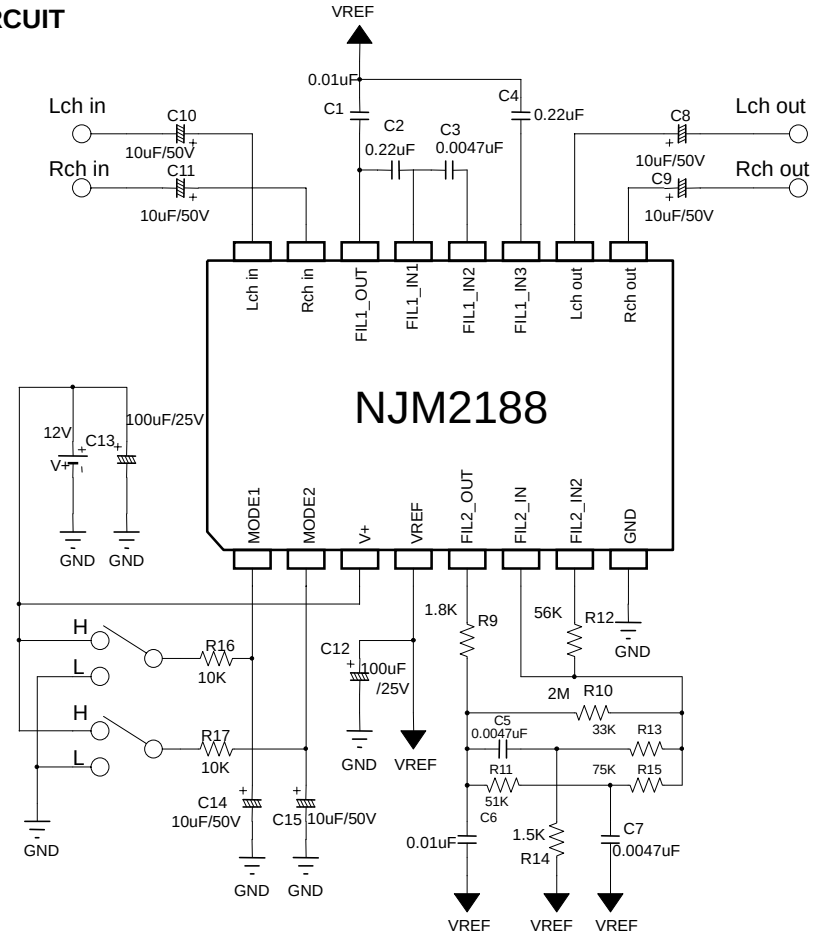
■ELECTRICAL CHARACTERISTICS (V^+=12V,Ta=25°C)

PARAMETER	SYMBOL	CONDITION	IN L	IN R	OUT	MODE	MIN	TYP	MAX	UNIT
Output Noise	V_{NOISE}	A-Weighting Rg=0Ω	0	0	L	BYPASS	-	-110 (3.16)	-100 (10.0)	dBV (μVrms)
			0	0	R					
			0	0	L	TRU	-	-90 (31.6)	-84 (63.1)	
			0	0	R					
			0	0	L	SRS3D-1	-	-90 (31.6)	-84 (63.1)	
			0	0	R					
Total Harmonic Distortion	THD	f=1kHz V_{IN}=-10dB	V_{IN}	0	L	BYPASS	-	0.01	-	%
			0	V_{IN}	R		-	0.01	-	
			V_{IN}	0	L	TRU	-	0.10	-	
			V_{IN}	0	R		-	0.20	-	
			V_{IN}	0	L	SRS3D-1	-	0.10	-	
			V_{IN}	0	R		-	0.20	-	
Bypass Gain	$G_{Bypass2}$	f=1kz	V_{IN}	0	L	BYPASS	-1.0	0.0	1.0	dB
			0	V_{IN}	R		-1.0	0.0	1.0	
Passive Gain	$G_{Lt/Rt-L}$	f=1kHz	V_{IN}	0	L	TRU	0.2	2.2	4.2	dB
	$G_{Lt/Rt-R}$	f=1kHz	V_{IN}	0	R		-14.0	-12.0	-10.0	
SRS 3D Gain	G_{SRS3D}	f=1kHz	V_{IN}	0	L	SRS3D-1	-4.8	-2.8	-0.8	dB
			V_{IN}	0	R		-15.1	-13.1	-11.1	
			0	V_{IN}	L		-15.1	-13.1	-11.1	
		f=1kHz	V_{IN}	0	L	SRS3D-2	-5.8	-3.8	-1.8	dB
			V_{IN}	0	R		-21.1	-19.1	-17.1	
			0	V_{IN}	L		-21.1	-19.1	-17.1	
MODE Select Control Voltage	V_{MODE}	V_{IN}=High Level	-	-	-	-	2.0	-	V^+	V
		V_{IN}=Low Level	-	-	-	-	0.0	-	0.7	

■MODE SELECT SWITCH

MODE	MODE1	MODE2	NOTE
BYPASS	L	L	INPUT THROUGH MODE
TRU	L	H	Passive Matrix TruSurround
SRS 3D-1	H	L	SRS 3D STEREO MODE Space 100% Center 90%
SRS 3D-2	H	H	SRS 3D STEREO MODE Space 90% Center 70%

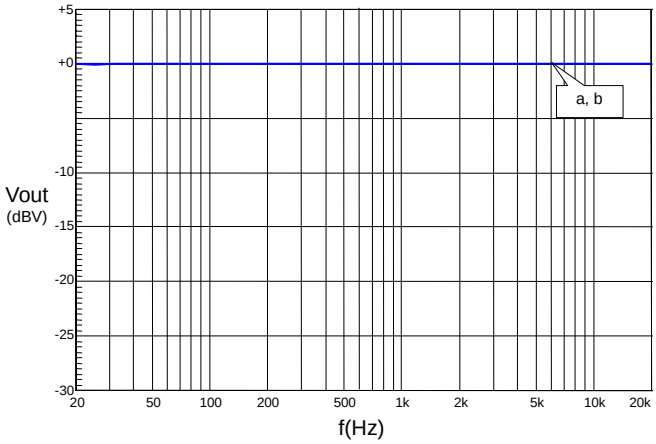
■APPLICATION CIRCUIT



PARTS NO.	VALUE	Tolerance	PARTS NO.	VALUE	Tolerance
C1,C6	0.01µF	±5%	R12	56k	±5%
C2,C4	0.22µF	±5%	R13	33k	±5%
C3,C5,C7	0.0047µF	±5%	R14	1.5k	±5%
C8,C9,C10,C11	10µF		R15	75k	±5%
C14,C15	10µF		R16,R17	10k	±5%
C12,C13	100µF				
R9	1.8k	±5%			
R10	2M	±5%			
R11	51k	±5%			

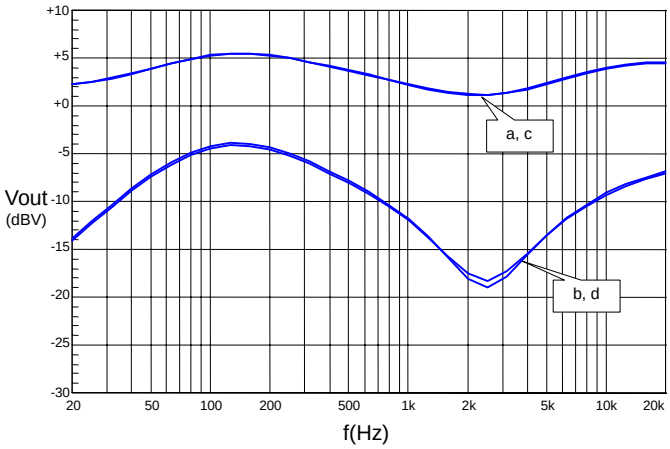
■TYPICAL CHARACTERISTICS

FREQUENCY RESPONSE
BYPASS MODE



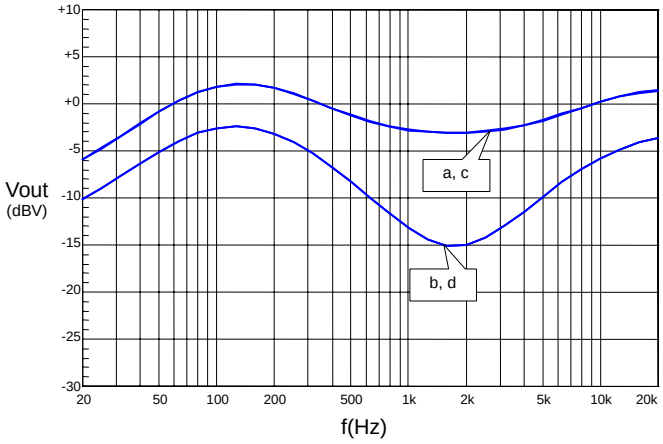
a: Vin = 0dBV Lch ⇒ Vout = Lch
b: Vin = 0dBV Rch ⇒ Vout = Rch
V^+=12V, 0dB V = 1Vrms

FREQUENCY RESPONSE
TRU(Lt/Rt) MODE



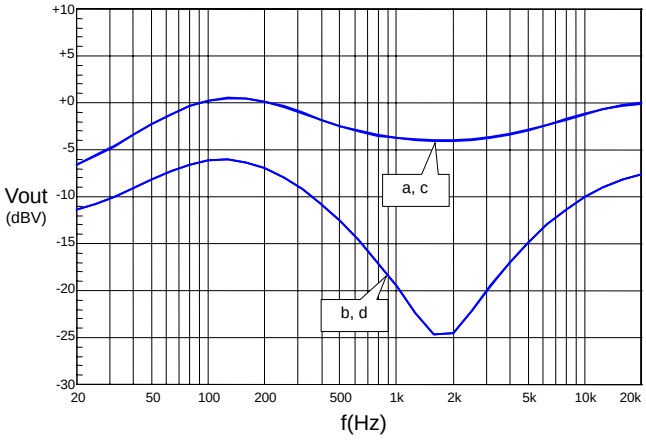
a: Vin = 0dBV Lch ⇒ Vout = Lch
b: Vin = 0dBV Lch ⇒ Vout = Rch
c: Vin = 0dBV Rch ⇒ Vout = Rch
d: Vin = 0dBV Rch ⇒ Vout = Lch
V^+=12V, 0dBV = 1Vrms

FREQUENCY RESPONSE
SRS 3D-1 MODE



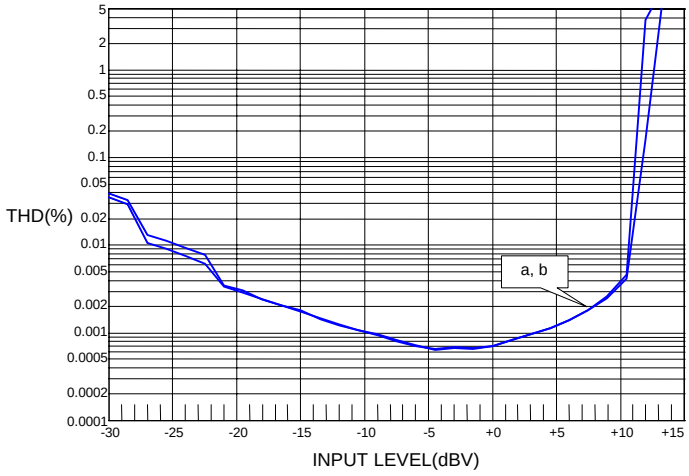
a: Vin = 0dBV Lch ⇒ Vout = Lch
b: Vin = 0dBV Lch ⇒ Vout = Rch
c: Vin = 0dBV Rch ⇒ Vout = Rch
d: Vin = 0dBV Rch ⇒ Vout = Lch
V^+=12V, 0dBV = 1Vrms

FREQUENCY RESPONSE
SRS 3D-2 MODE



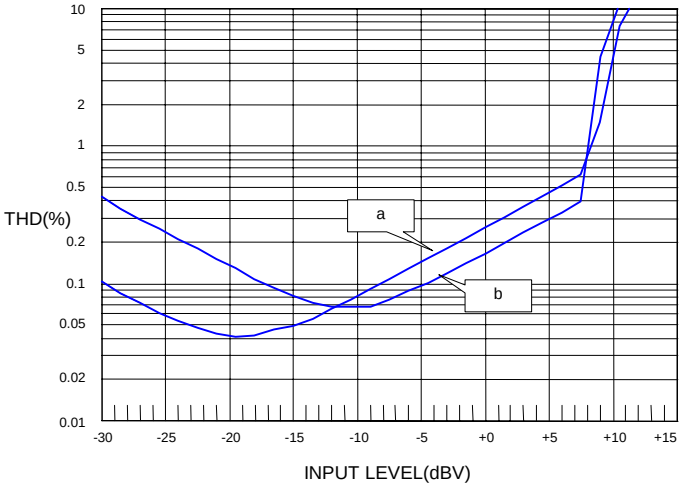
a: Vin = 0dBV Lch ⇒ Vout = Lch
b: Vin = 0dBV Lch ⇒ Vout = Rch
c: Vin = 0dBV Rch ⇒ Vout = Rch
d: Vin = 0dBV Rch ⇒ Vout = Lch
V^+=12V, 0dBV = 1Vrms

TOTAL HARMONIC DISTORTION vs. INPUT VOLTAGE
BYPASS MODE



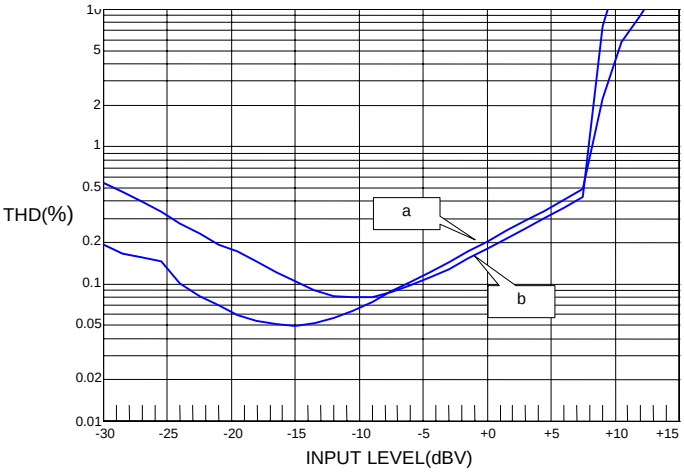
a: Vin = 1kHz Lch ⇒ Vout = Lch
b: Vin = 1kHz Lch ⇒ Vout = Rch
V^+=12V

TOTAL HARMONIC DISTORTION vs. INPUT VOLTAGE
TRU MODE



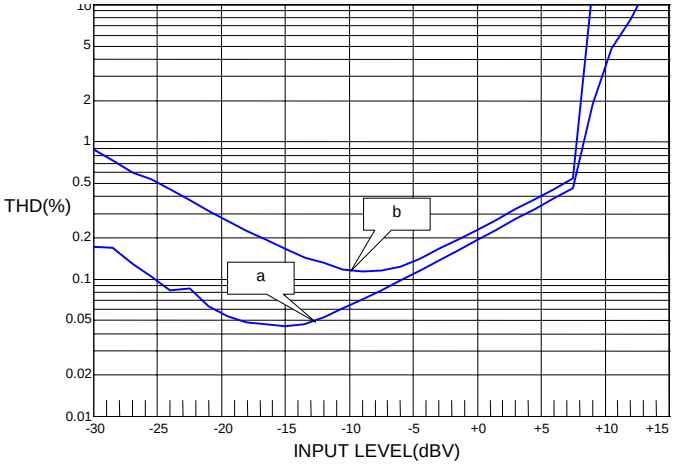
a: Vin = 1kHz Lch ⇒ Vout = Lch
b: Vin = 1kHz Lch ⇒ Vout = Rch
V^+=12V

TOTAL HARMONIC DISTORTION vs. INPUT VOLTAGE
SRS 3D-1 MODE



a: Vin = 1kHz Lch ⇒ Vout = Lch
b: Vin = 1kHz Lch ⇒ Vout = Rch
V^+=12V

TOTAL HARMONIC DISTORTION vs. INPUT VOLTAGE
SRS 3D-2 MODE



a: Vin = 1kHz Lch ⇒ Vout = Lch
b: Vin = 1kHz Lch ⇒ Vout = Rch
V^+=12V