

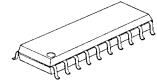
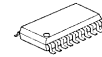


## 2-CHANNEL ELECTRONIC VOLUME WITH INPUT SELECTOR

### GENERAL DESCRIPTION

NJW1156 is a two channel electronic volume with 5 input selector. It's suitable for Input signal trimmer of audio equipments such as DVD / HDD recorder and VCR. These functions are controlled by I<sup>2</sup>C Bus.

### PACKAGE OUTLINE



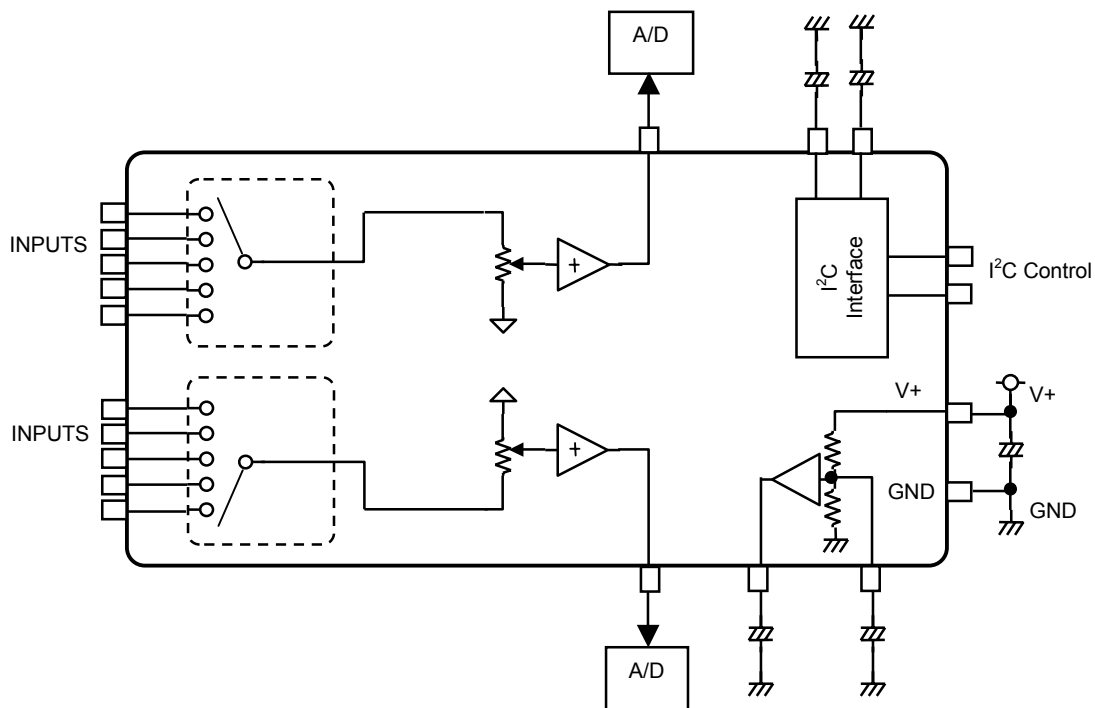
NJW1156V

NJW1156M

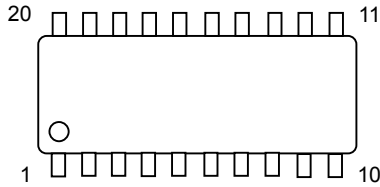
### FEATURES

- Operating Voltage 8 to 13V
- I<sup>2</sup>C Bus control
- 5 Input Selector
- Volume 0 to -39.5dB/0.5dBstep, MUTE
- Bi-CMOS Technology
- Package Outline SSOP20, DMP20

### BLOCK DIAGRAM



## ■ PIN FUNCTION



No.	SYMBOL	FUNCTION
1	GND	Ground
2	R1IN	R channel Input 1
3	R2 IN	R channel Input 2
4	R3IN	R channel Input 3
5	R4IN	R channel Input 4
6	R5IN	R channel Input 5
7	ROUT	R channel Output
8	VSSOUT	Internal VSS Noise Rejection Capacitor Terminal
9	SCL	I <sup>2</sup> C Clock Input
10	SDA	I <sup>2</sup> C Data Input
11	VDDOUT	Internal VDD Noise Rejection Capacitor Terminal
12	VREFOUT	Reference Voltage Output
13	V+	Power Supply
14	VREFIN	Reference Voltage Noise Rejection Capacitor Terminal
15	LOUT	L channel Output
16	L5IN	L channel Input 5
17	L4IN	L channel Input 4
18	L3IN	L channel Input 3
19	L2IN	L channel Input 2
20	L1IN	L channel Input 1

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

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	V+	15	V
Power Dissipation	P <sub>D</sub>	375	mW
Operating Temperature Range	Topr	-20 to +75	°C
Storage Temperature Range	Tstg	-40 to +125	°C

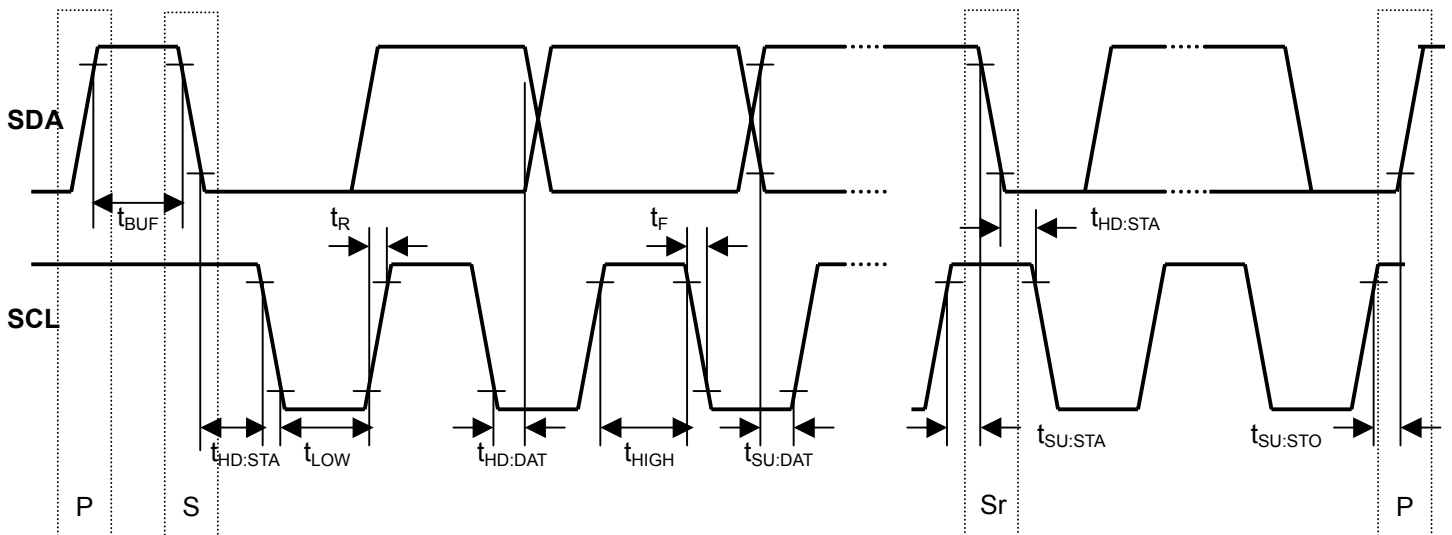
## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C, V<sup>+</sup>=+12V)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>◆ Power Supply</b>						
Operating Voltage	V+	-	8	12	13	V
Reference Voltage	V <sub>ref</sub>	-	5.5	6	6.5	V
Supply Current	I <sub>CC</sub>	No signal	-	4.5	6.8	mA
<b>◆ Input/Output Characteristics</b>						
Maximum Output Voltage	V <sub>OM</sub>	f=1kHz, THD=1% Volume=0dB	3.0	4.0	-	V <sub>rms</sub>
Voltage Gain 1	G <sub>V1</sub>	V <sub>IN</sub> =1V <sub>rms</sub> , f=1kHz Volume=0dB	-0.5	0	0.5	dB
Voltage Gain 2	G <sub>V2</sub>	V <sub>IN</sub> =1V <sub>rms</sub> , f=1kHz Volume=-20dB	-21	-20	-19	dB
Voltage Gain 3	G <sub>V3</sub>	V <sub>IN</sub> =1V <sub>rms</sub> , f=1kHz Volume=-39.5dB	-42.0	-39.5	-37.0	dB
Voltage Gain Error	ΔG <sub>V</sub>	V <sub>IN</sub> =1V <sub>rms</sub> , f=1kHz Volume=-20dB, Ach - Bch	-0.5	0	0.5	dB
Mute Level	Mute	f=1kHz, V <sub>IN</sub> =1V <sub>rms</sub> Volume=Mute, A-weight	-	-100	-	dB
Output Noise	V <sub>NO</sub>	Volume=0dB, Rg=0, A-weight	-	-110 (3.2μ)	-100 (10μ)	dBV (V <sub>rms</sub> )
Total Harmonic Distortion	THD	f=1kHz, V <sub>o</sub> =1V <sub>rms</sub> , Volume=0dB BW : 400Hz - 30kHz	-	0.0015	0.05	%
Channel Separation	CS	f=1kHz, V <sub>o</sub> =1V <sub>rms</sub> , Volume=0dB Rg=0Ω, A-weight	-	-100	-90	dB

■ I<sup>2</sup>C BUS BLOCK CHARACTERISTICS (SDA,SCL)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
High Level Input Voltage	V <sub>IH</sub>	2.5	-	5.0	V
Low Level Input Voltage	V <sub>IL</sub>	0	-	1.5	V
High Level Input Current	I <sub>IH</sub>	-	-	10	μA
Low Level Input Current	I <sub>IL</sub>	-	-	10	μA
Low Level Output Voltage (3mA at SDA pin)	V <sub>OL</sub>	0	-	0.4	V
Maximum Output Current	I <sub>OL</sub>	-3.0	-	-	mA
Maximum Clock Frequency	f <sub>SCL</sub>	-	-	100	kHz
Data Change Minimum Waiting Time	t <sub>BUF</sub>	4.7	-	-	μs
Data Transfer Start Minimum Waiting Time	t <sub>HD:STA</sub>	4.0	-	-	μs
Low Level Clock Pulse Width	t <sub>LOW</sub>	4.7	-	-	μs
High Level Clock Pulse Width	t <sub>HIGH</sub>	4.0	-	-	μs
Minimum Start Preparation Waiting Time	t <sub>SU:STA</sub>	4.7	-	-	μs
Minimum Data Hold Time	t <sub>HD:DAT</sub>	5.0	-	-	μs
Minimum Data Preparation Time	t <sub>SU:DAT</sub>	250	-	-	ns
Rise Time	t <sub>R</sub>	-	-	1.0	μs
Fall Time	t <sub>F</sub>	-	-	300	ns
Minimum Stop Preparation Waiting Time	t <sub>SU:STO</sub>	4.0	-	-	μs

I<sup>2</sup>C BUS Load Condition: Pull up resistance 4kΩ (Connected to +5V)  
Load capacitance 200pF (Connected to GND)



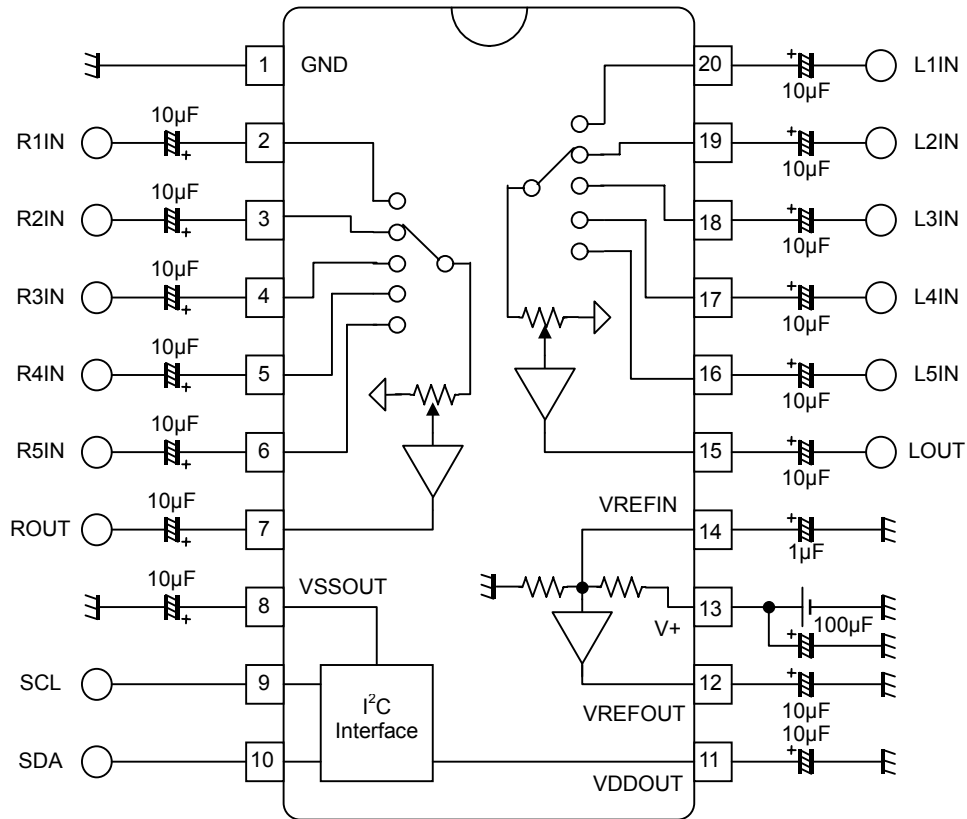
■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	TERMINAL DC VOLTAGE
2 3 4 5 6 16 17 18 19 20	R1IN R2IN R3IN R4IN R5IN L5IN L4IN L3IN L2IN L1IN	R channel Input 1 R channel Input 2 R channel Input 3 R channel Input 4 R channel Input 5 L channel Input 5 L channel Input 4 L channel Input 3 L channel Input 2 L channel Input 1		$V^+/2$
7 15	ROUT LOUT	Rch Output Lch Output		$V^+/2$
8 11	VSS_OUT VDD_OUT	Internal VSS Noise Rejection Capacitor Terminal Internal VDD Noise Rejection Capacitor Terminal		$VSS\_OUT = V_{ref} - 2.5V$  $VDD\_OUT = V_{ref} + 2.5V$
9	SCL	I <sup>2</sup> C Clock Input		-

■ TERMINAL DESCRIPTION

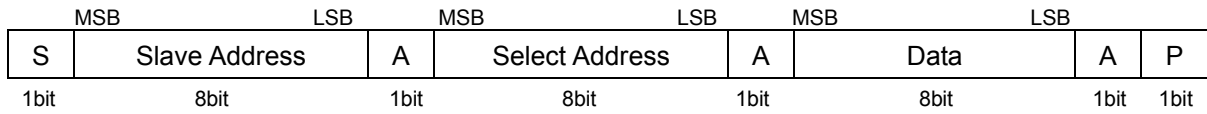
PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	TERMINAL DC VOLTAGE
10	SDA	I <sup>2</sup> C Data Input		-
12	VREFOUT	Reference Voltage Output		V <sup>+</sup> /2
13	V+	Power Supply		V <sup>+</sup>
14	VREFIN	Reference Voltage Noise Rejection Capacitor Terminal		V <sup>+</sup> /2

## APPLICATION CIRCUIT



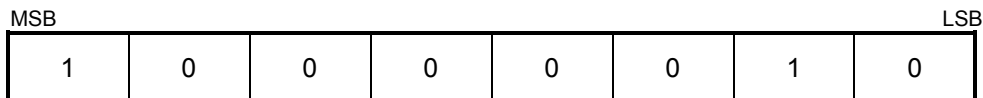
■ DEFINITION OF I<sup>2</sup>C REGISTER

◆ I<sup>2</sup>C BUS FORMAT



S: Starting Term  
 A: Acknowledge Bit  
 P: Ending Term

◆ SLAVE ADDRESS



◆ CONTROL REGISTER TABLE

The select address sets each function (Volume, Selector).  
 The auto increment function cycles the select address as follows.  
 00H→01H→02H→00H

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
00H	Don't Care	VOLa						
01H	Don't Care	VOLb						
02H	Don't Care	TEST	OFF	Don't Care		Selector		

◆ CONTROL REGISTER DEFAULT VALUE

Control register default value is all "0".

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
00H	0	0	0	0	0	0	0	0
01H	0	0	0	0	0	0	0	0
02H	0	0	0	0	0	0	0	0

■ CONTROL COMMAND TABLE

a) Master Volume

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
00H	Don't Care	VOLa						
01H	Don't Care	VOLb						

•VOLa / VOLb : Ach and Bch volume level setting from 0dB to -39.5dB with 0.5dB step.

Gain (dB)	VOLa / VOLb						
	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	0	0	0	0
-0.5	0	0	0	0	0	0	1
-1	0	0	0	0	0	1	0
-1.5	0	0	0	0	0	1	1
-2	0	0	0	0	1	0	0
-2.5	0	0	0	0	1	0	1
-3	0	0	0	0	1	1	0
-3.5	0	0	0	0	1	1	1
-4	0	0	0	1	0	0	0
-4.5	0	0	0	1	0	0	1
-5	0	0	0	1	0	1	0
-5.5	0	0	0	1	0	1	1
-6	0	0	0	1	1	0	0
-6.5	0	0	0	1	1	0	1
-7	0	0	0	1	1	1	0
-7.5	0	0	0	1	1	1	1
-8	0	0	1	0	0	0	0
-8.5	0	0	1	0	0	0	1
-9	0	0	1	0	0	1	0
-9.5	0	0	1	0	0	1	1
-10	0	0	1	0	1	0	0
-10.5	0	0	1	0	1	0	1
-11	0	0	1	0	1	1	0
-11.5	0	0	1	0	1	1	1
-12	0	0	1	1	0	0	0
-12.5	0	0	1	1	0	0	1
-13	0	0	1	1	0	1	0
-13.5	0	0	1	1	0	1	1
-14	0	0	1	1	1	0	0
-14.5	0	0	1	1	1	0	1
-15	0	0	1	1	1	1	0
-15.5	0	0	1	1	1	1	1
-16	0	1	0	0	0	0	0
-16.5	0	1	0	0	0	0	1
-17	0	1	0	0	0	1	0
-17.5	0	1	0	0	0	1	1
-18	0	1	0	0	1	0	0
-18.5	0	1	0	0	1	0	1
-19	0	1	0	0	1	1	0
-19.5	0	1	0	0	1	1	1
-20	0	1	0	1	0	0	0
...	...	...	...	...	...	...	...
-39.5	1	0	0	1	1	1	1
Mute	1	1	1	1	1	1	1



**b)Input Selector**

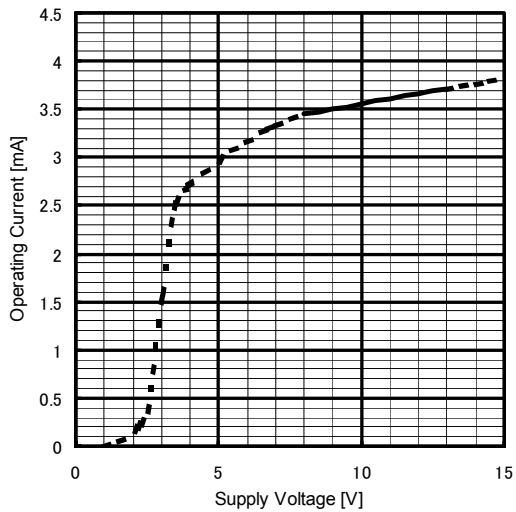
Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
01H	Don't Care	TEST	OFF	Don't Care		Selector		

•Selector : Input signal selecting

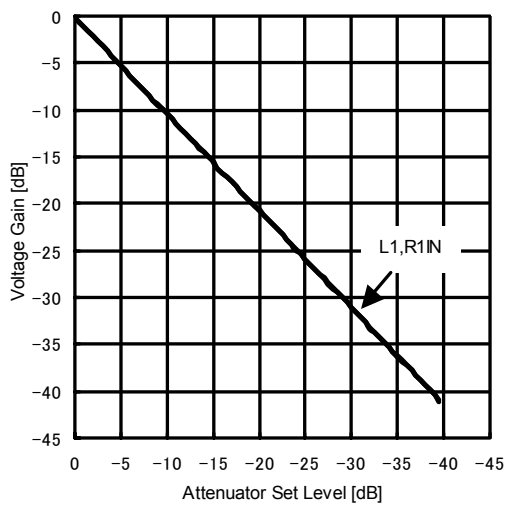
Input	Selector		
	D2	D1	D0
L1IN / R1IN	0	0	0
L2IN / R2IN	0	0	1
L3IN / R3IN	0	1	0
L4IN / R4IN	0	1	1
L5IN / R5IN	1	0	0

## TYPICAL CHARACTERISTICS

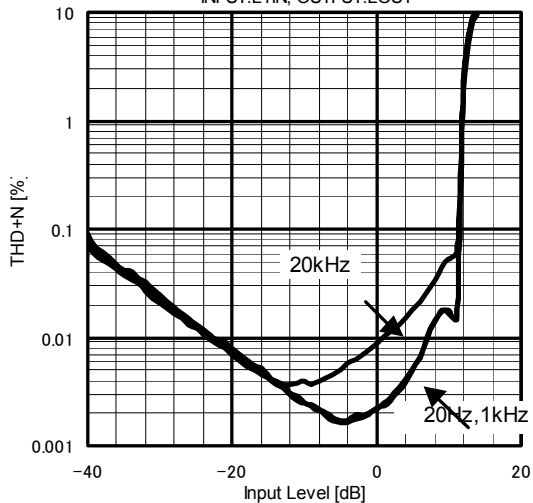
Operating Current vs. Supply Voltage  
Ta=25°C



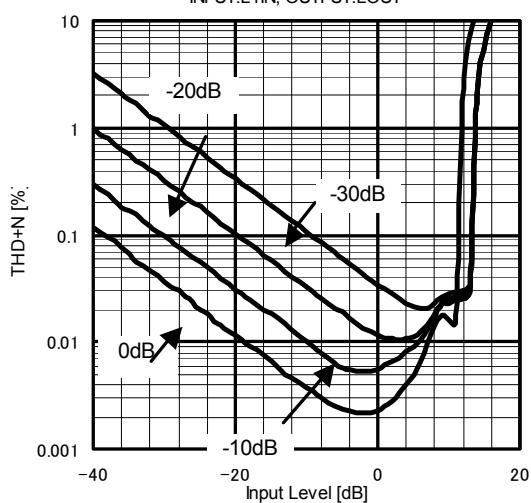
Voltage Gain vs. Attenuator Set Level  
Ta=25°C



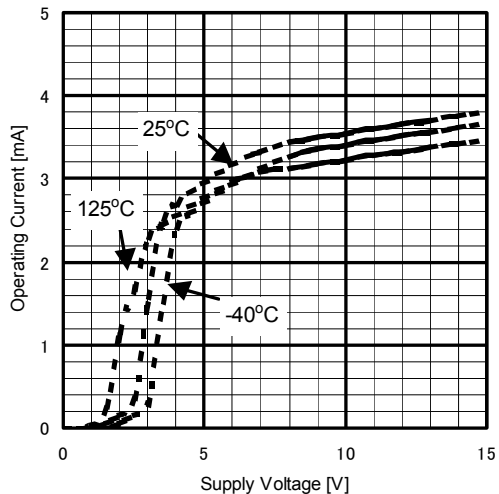
THD+N vs. Input Level  
V+=12V, VOL=0dB, BW=10Hz-80kHz  
INPUT:L1IN, OUTPUT:L.OUT



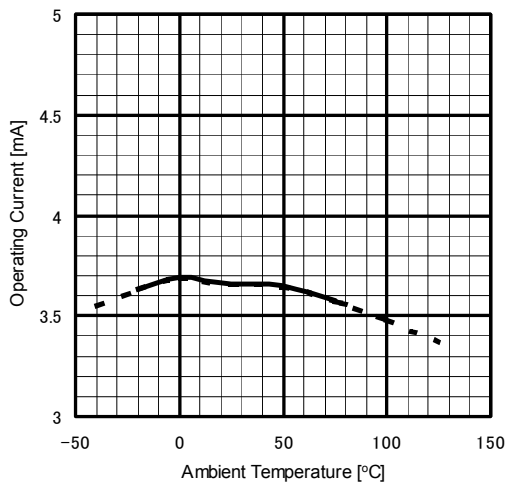
THD+N vs. Input Level  
V+=12V, f=1kHz, BW=10Hz-80kHz  
INPUT:L1IN, OUTPUT:L.OUT



Operating Current vs. Supply Voltage

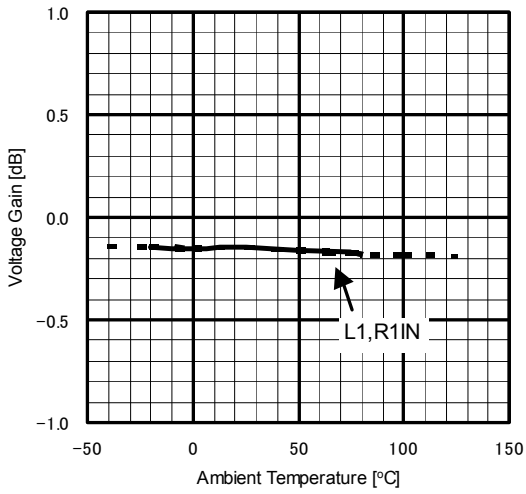


Operating Current vs. Ambient Temperature  
V+=12V

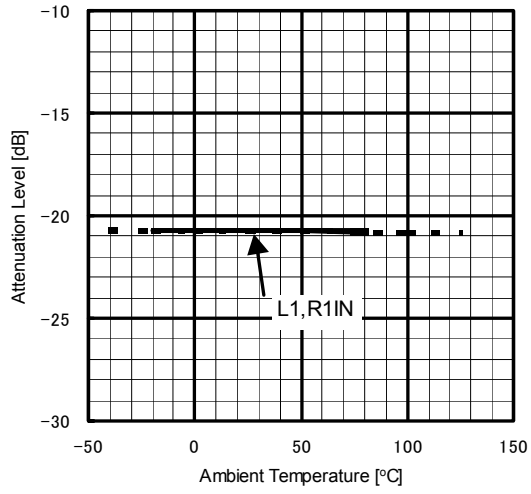


■ TYPICAL CHARACTERISTICS

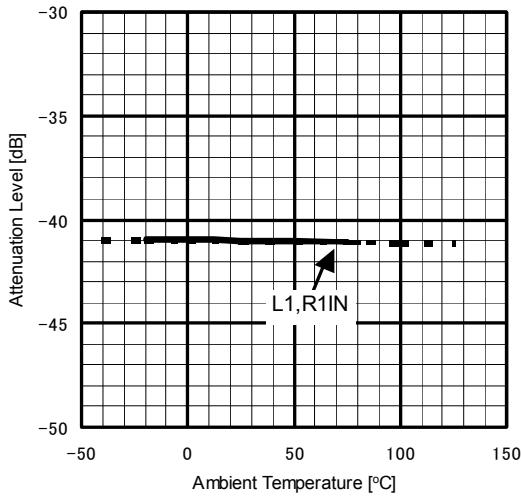
Voltage Gain vs. Ambient Temperature  
 $V^+=12V, V_{in}=1V, f=1kHz, Vol=0dB$



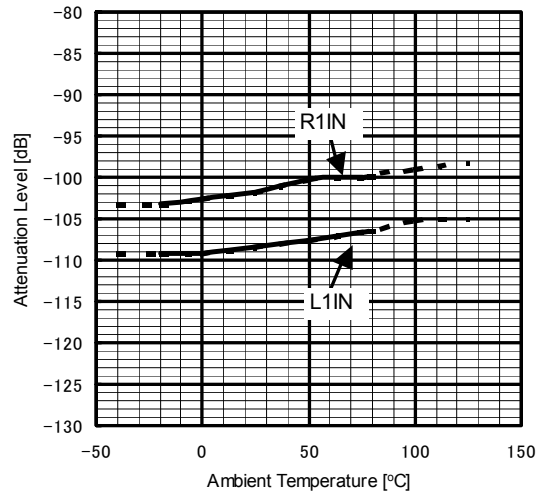
Attenuation Level vs. Ambient Temperature  
 $V^+=12V, V_{in}=1V, f=1kHz, Vol=-20dB$



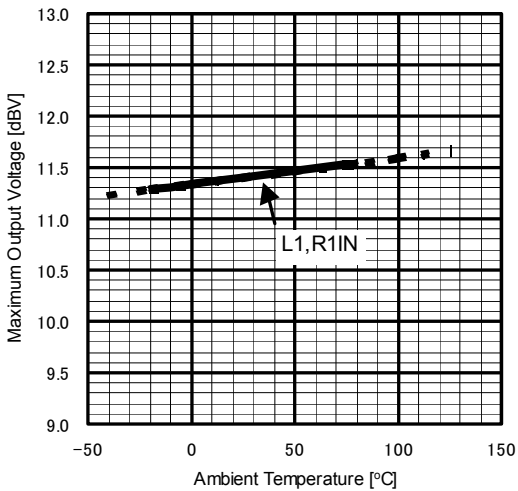
Attenuation Level vs. Ambient Temperature  
 $V^+=12V, V_{in}=1V, f=1kHz, Vol=-39.5dB$



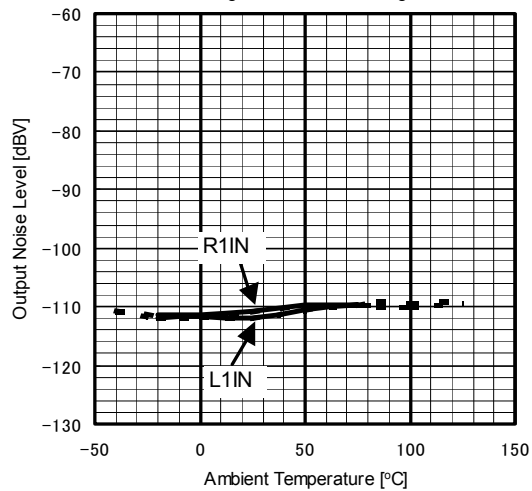
Attenuation Level vs. Ambient Temperature  
 $V^+=12V, V_{in}=1V, f=1kHz, Vol=Mute$



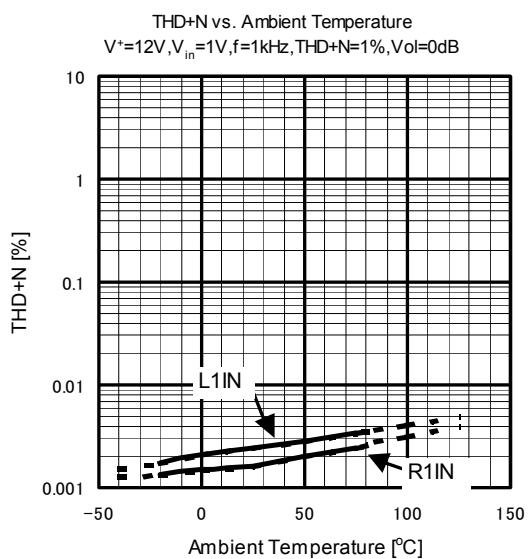
Maximum Output Voltage vs. Ambient Temperature  
 $V^+=12V, f=1kHz, THD+N=1%, Vol=0dB$



Output Noise Level vs. Ambient Temperature  
 $V^+=12V, R_g=0\Omega, Vol=0dB, A-w eight$



## ■ TYPICAL CHARACTERISTICS



**NOTE**

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