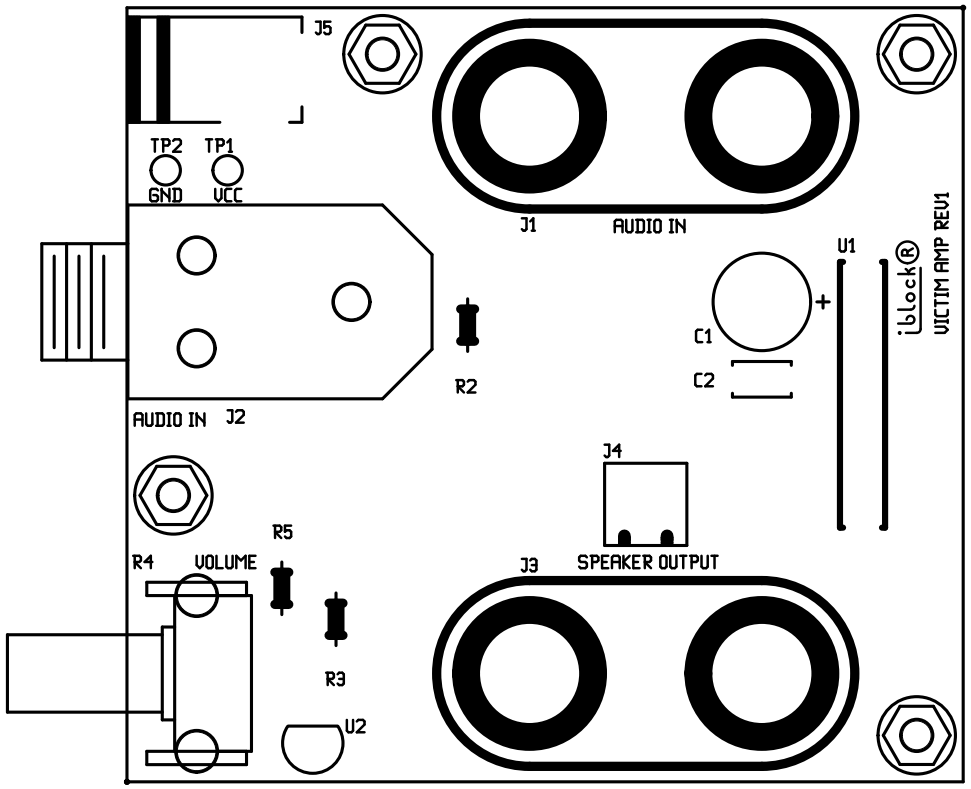


VICTIM-AMP Description

The VICTIM-AMP is a amplifier kit that is designed to provent a low-cost device for testing audio circuits.

Features

- TDA7056A 5W Amplifier
- Inputs – 1/4" Phone Jack, banana jacks (optional)
- Outputs– terminal block, banana jacks (optional)
- Volume control
- DC input jack (2.1mm barrel)

1 Assembling the VICTIM-AMP

Semiconductors are electrostatic-sensitive devices. Proper ESD handling precautions need to be taken to avoid damage.

The Bill of Materials (BOM) and Component List are in section 4. For full page assembly drawings see Figure 1 (top) and **??** (bottom).

1.1 Passive Components

- C1

  C1 is a polarized parts. The long lead is the positive. The short lead is the negative. Make sure that the **positive** *lead is inserted into positive hole in the PCB*

- C2.
- R2, R3, R5

1.2 Electromechanical Components

- J2
- J4
- J5
- R4

1.2.1 Optional Banana Jacks

The VICTIM-AMP PCB contains positions for a banana jack input and output. `J1` and `J3` can be populated with Pomona 2269 insulated double banana jacks.

1.3 IC Installation and Test

1.3.1 U1 (TDA7056A)

Remove the TDA7056A from the antistatic foam and insert it into the socket aligning pin one with the pin one marking on the PCB..

1.3.2 U2 (TLV431)

Install the TLV431 with the flat side of the packaging aligned with the flat side of the silkscreen marking.

2 IO Connectors

J1 Audio Input (double banana jack) (optional)

J2 Audio Input (1/4" phone jack)

J3 Amplifier Output (double banana jack) (optional)

J4 Amplifier Output screw terminal

J5 Input power jack.

3 Electrical Hints

The maximum output power of the VICTIM-AMP is 5W for 8Ω loads and 3W for 16Ω loads. The output power is also limited by the operating temperature of the amplifier IC. The maximum output power is calculated using the thermal resistance and maximum juction tmperature specications in the TDA7056B datasheet.

The thermal resistance ($R_{\theta JA}$) of the TDA7056B in ambient free air is 55°C/W. The maximum junction temperature (T_{jmax}) is 150°C. In room temperature free air the maximum power dissipation of the TDA7056B is –

$$P_{max} = \frac{T_{jmax} - T_{ambient}}{R_{\theta JA}} = \frac{150°\text{C} - 25°\text{C}}{55°\text{C/W}} = 2.25\text{W}$$

The amount of power dissipated for various power supply voltages and loads is shown in Figure 10 – Total worst case power dissipation versus supply voltage. Reasonable power supply voltage limits would be 8V for 8Ω loads and 11V for 16Ω loads. If the ambient temperature around the amplifier is higher than 25°C then these values need to be decreased. The minimum power supply voltage is 4.5V.

References

NXP. (1997, August). TDA7056B 5W mono BTL audio amplifier with DC volume control. (Retrieved June 20, 2011, from http://www.nxp.com)

4 Assembly Documentation and Schematics

Table 1: Bill of Materials

Kit: VICTIM-AMP-KIT

Qty	Reference	Part Number	Description
1	C1	CAPPR__Nichicon_UPW1E221MPD1TA	capacitor, Nichicon UPW1E221MPD1TA
1	C2	CAPR-0U47-25V-X7R-200M	capacitor, cereamic, 0.47uF
1	J2	CON__Switchraft_RN112APC	jack, phone, 1/4 inch
1	J4	CON_TB-2x1-3MM5	connector, terminal block, 2x1, 3.5mm centers
1	J5	CON__CUI-PJ-202AH	power jack, 2.1mm
1	R2	Xicon_270-4.7K-RC	
2	R3, R5	RES-1K00-0W125-1T00	resistor, 1K, 1/8W, 1%
1	R4	POT_RA-5K00-0W10-20T	potentiometer, RA, 5K, 1/10W, 3/4 turn
2	TP1, TP2	TP	testpoint
1	U1	IC__Philips_TDA7056A	IC, Amplifier, Audio TDA7056A
1	U2	IC_REF__TLV431B	IC, TLV431B, 1.24V, 0.5%, TO-92
1		iblock_VICTIM-AMP-PCB	

Table 2: Component List

Kit: VICTIM-AMP-KIT

Reference	Part Number	Description
C1	CAPPR__Nichicon_UPW1E221MPD1TA	capacitor, Nichicon UPW1E221MPD1TA
C2	CAPR-0U47-25V-X7R-200M	capacitor, cereamic, 0.47uF
J2	CON__Switchraft_RN112APC	jack, phone, 1/4 inch
J4	CON_TB-2x1-3MM5	connector, terminal block, 2x1, 3.5mm centers
J5	CON__CUI-PJ-202AH	power jack, 2.1mm
R2	Xicon_270-4.7K-RC	
R3	RES-1K00-0W125-1T00	resistor, 1K, 1/8W, 1%
R5	RES-1K00-0W125-1T00	resistor, 1K, 1/8W, 1%
R4	POT_RA-5K00-0W10-20T	potentiometer, RA, 5K, 1/10W, 3/4 turn
TP1	TP	testpoint
TP2	TP	testpoint
U1	IC__Philips_TDA7056A	IC, Amplifier, Audio TDA7056A
U2	IC_REF__TLV431B	IC, TLV431B, 1.24V, 0.5%, TO-92
	iblock_VICTIM-AMP-PCB	

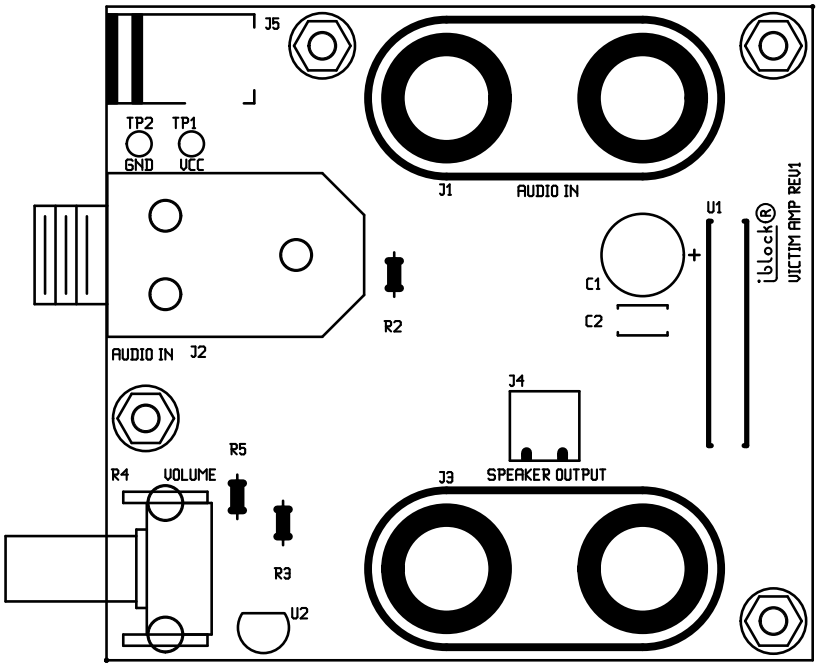


Figure 1: VICTIM-AMP Top Side Assembly Drawing (Rev 1)

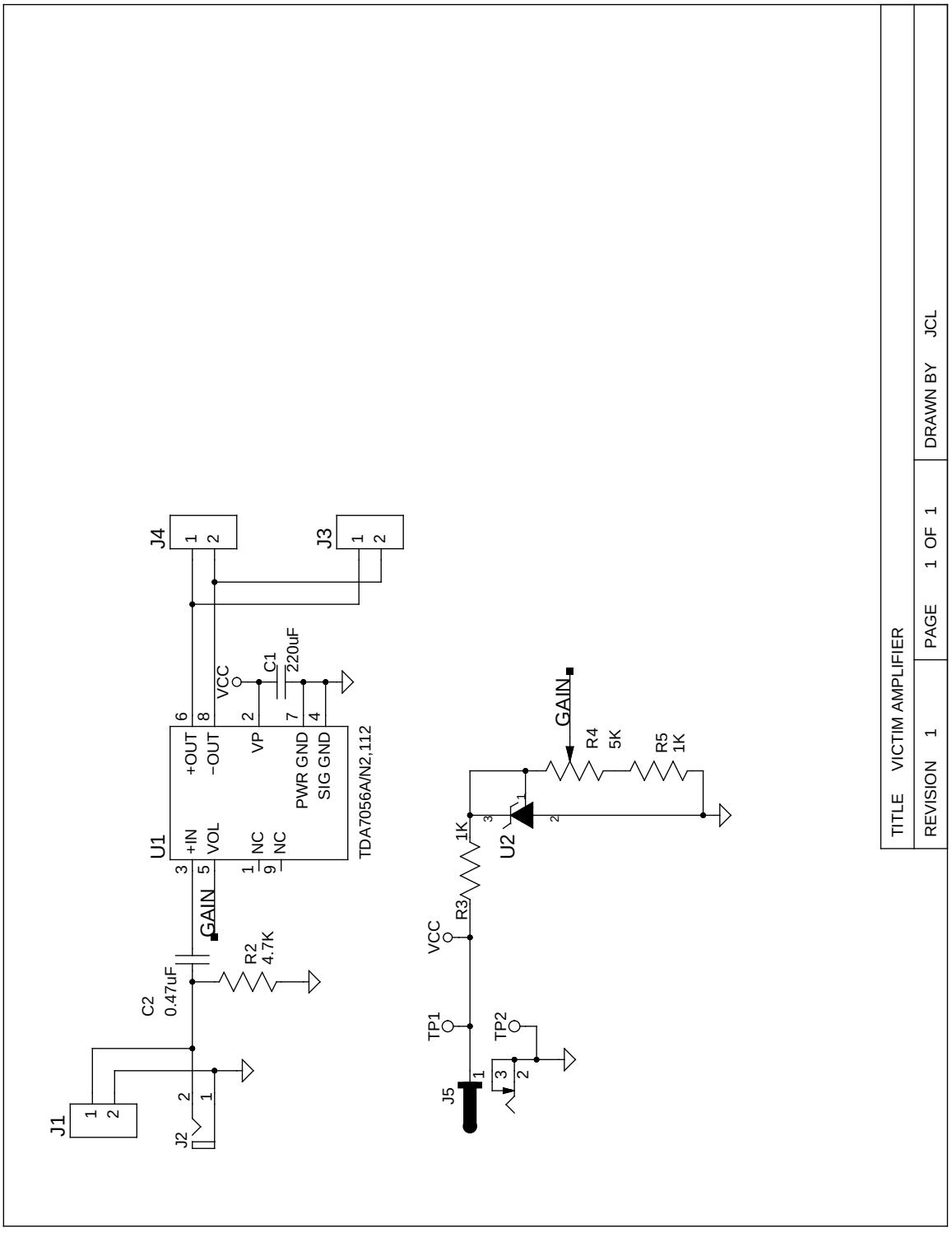


Figure 2: VICTIM-AMP (Rev 1)

PRELIMINARY

INTEGRATED CIRCUITS

DATA SHEET

TDA7056B
5 W mono BTL audio amplifier with DC volume control

Product specification
Supersedes data of 1996 May 28

1997 Aug 15

PRELIMINARY

5 W mono BTL audio amplifier with DC volume control

TDA7056B

FEATURES

- DC volume control
- Few external components
- Mute mode
- Thermal protection
- Short-circuit proof
- No switch-on and switch-off clicks
- Good overall stability
- Low power consumption
- Low HF radiation
- ESD protected on all pins.

GENERAL DESCRIPTION

The TDA7056B is a mono Bridge-Tied Load (BTL) output amplifier with DC volume control.
It is designed for use in TV and monitors, but is also suitable for battery-fed portable recorders and radios.
The device is contained in a 9-pin medium power package.

A Missing Current Limiter (MCL) is built in. The MCL circuit is activated when the difference in current between the output terminal of each amplifier exceeds 100 mA (300 mA typ.). This level of 100 mA allows for headphone applications (single-ended).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage		4.5	–	18	V
P_O	output power	V_P = 12 V				
		R_L = 16 Ω	3	3.5	–	W
		R_L = 8 Ω	5	5.5	–	W
$G_{v(max)}$	maximum total voltage gain		39.5	40.5	41.5	dB
ϕ	gain control		68	73.5	–	dB
$I_{q(tot)}$	total quiescent current	V_P = 12 V; R_L = ∞	–	9.2	13	mA
THD	total harmonic distortion	P_O = 0.5 W	–	0.3	1	%

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA7056B	SIL9MPF	plastic single in-line medium power package with fin; 9 leads	SOT110-1

BLOCK DIAGRAM

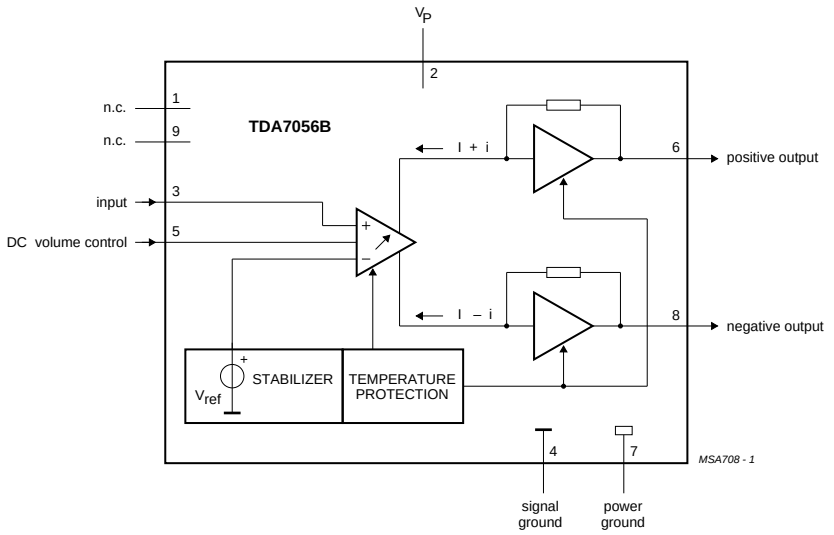


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
n.c.	1	not connected
V_P	2	positive supply voltage
V_I	3	voltage input
GND1	4	signal ground
VC	5	DC volume control
OUT+	6	positive output
GND2	7	power ground
OUT−	8	negative output
n.c.	9	not connected

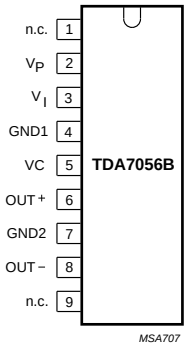


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

The TDA7056B is a mono BTL output amplifier with DC volume control, designed for use in TV and monitor but is also suitable for battery-fed portable recorders and radios.

In conventional DC volume circuits the control or input stage is AC coupled to the output stage via external capacitors to keep the offset voltage low. In the TDA7056B the DC volume control stage is integrated into the input stage so that no coupling capacitors are required. With this configuration, a low offset voltage is still maintained and the minimum supply voltage remains low.

The BTL principle offers the following advantages:

- Lower peak value of the supply current
- The frequency of the ripple on the supply voltage is twice the signal frequency.

Consequently, a reduced power supply with smaller capacitors can be used which results in cost reductions. For portable applications there is a trend to decrease the supply voltage, resulting in a reduction of output power at conventional output stages. Using the BTL principle increases the output power.

The maximum gain of the amplifier is fixed at 40.5 dB. The DC volume control stage has a logarithmic control characteristic. Therefore, the total gain can be controlled from 40.5 dB to −33 dB. If the DC volume control voltage falls below 0.4 V, the device will switch to the mute mode.

The amplifier is short-circuit proof to ground, V_P and across the load. Also a thermal protection circuit is implemented. If the crystal temperature rises above +150 °C the gain will be reduced, thereby reducing the output power. Special attention is given to switch-on and switch-off clicks, low HF radiation and a good overall stability.

Power dissipation

Assume V_P = 12 V; R_L = 16 Ω.
The maximum sine wave dissipation is = 1.8 W.

The $R_{th\ vj\text{-}a}$ of the package is 55 K/W.
Therefore $T_{amb\ (max)} = 150 - 55 \times 1.8 = 51$ °C.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_P	supply voltage		–	18	V
$V_{3,5}$	input voltage pins 3 and 5		–	5	V
I_{ORM}	repetitive peak output current		–	1.25	A
I_{OSM}	non-repetitive peak output current		–	1.5	A
P_{tot}	total power dissipation	$T_{case} < 60$ °C	–	9	W
T_{amb}	operating ambient temperature		−40	+85	°C
T_{stg}	storage temperature		−55	+150	°C
T_{vj}	virtual junction temperature		–	+150	°C
T_{sc}	short-circuit time		–	1	h

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air	55	K/W
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	10	K/W

CHARACTERISTICS

V_P = 12 V; V_{DC} = 1.4 V; f = 1 kHz; R_L = 16 Ω; T_{amb} = 25 °C; unless otherwise specified (see Fig.13).

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_P	positive supply voltage		4.5	–	18	V
$I_{q(tot)}$	total quiescent current	note 1; $R_L = \infty$	–	9.2	13	mA
Maximum gain (V_5 = 1.4 V)						
P_O	output power	THD = 10%; R_L = 16 Ω	3	3.5	–	W
		THD = 10%; R_L = 8 Ω	5	5.5	–	W
THD	total harmonic distortion	P_O = 0.5 W	–	0.3	1	%
$G_{v(max)}$	maximum total voltage gain		39.5	40.5	41.5	dB
V_I	input signal handling (RMS value)	$G_{v(max)}$ = 0 dB; THD < 1%	1.0	–	–	V
V_{no}	noise output voltage (RMS value)	note 2; f = 500 kHz	–	210	–	μV
B	bandwidth	at –1 dB	–	0.02 to 300	–	kHz
SVRR	supply voltage ripple rejection	note 3	34	38	–	dB
$\lvert\Delta V_O\rvert$	DC output offset voltage	$\lvert V_8 - v_6\rvert$	–	0	200	mV
Z_I	input impedance (pin 3)		15	20	25	kΩ
Mute position						
V_O	output voltage in mute position	note 4; $V_5 \leq 0.4$ V; V_I = 1.0 V	–	35	45	μV
DC volume control; note 5						
ϕ	gain control		68	73.5	–	dB
I_5	control current	V_5 = 0 V	–20	–25	–30	μA

Notes

1. With a load connected to the outputs the quiescent current will increase, the maximum value of this increase being equal to the DC output offset voltage divided by R_L.
2. The noise output voltage (RMS value) at f = 500 kHz is measured with R_S = 0 Ω and B = 5 kHz.
3. The ripple rejection is measured with R_S = 0 Ω and f = 100 Hz to 10 kHz. The ripple voltage V_R of 200 mV (RMS value) is applied to the positive supply rail.
4. The noise output voltage (RMS value) is measured with R_S = 5 kΩ unweighted.
5. The DC volume control can be configured in several ways. Two possible circuits are shown in Figs 14 and 15. The circuits at the volume control pin will influence the switch-on and switch-off behaviour and the maximum voltage gain.

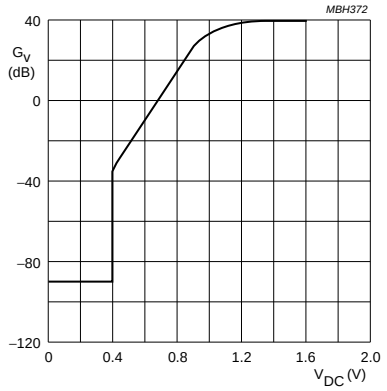
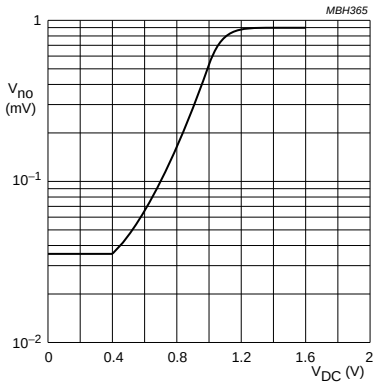


Fig.3 Gain control as a function of DC volume control.



Measured with R_S = 5 kΩ unweighted.
Frequency range is 22 Hz to 22 kHz.

Fig.4 Noise output voltage as a function of DC volume control.

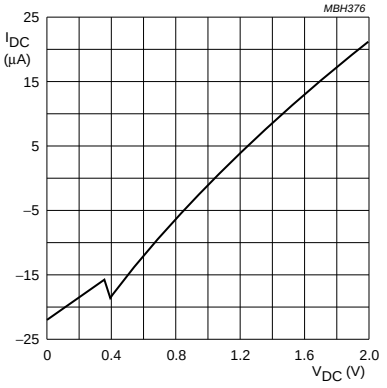
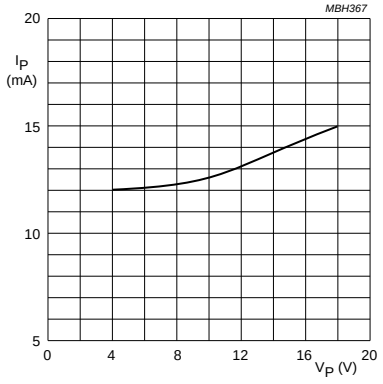
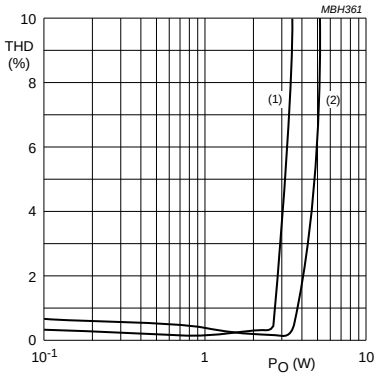


Fig.5 Control current as a function of DC volume control.



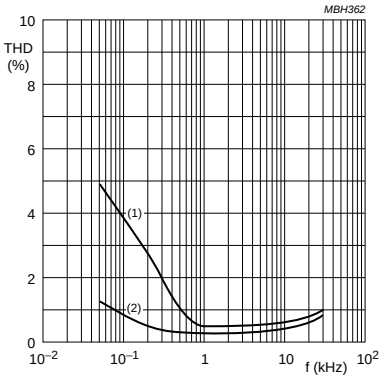
Measured with $R_L = \infty$.

Fig.6 Quiescent current versus supply voltage.



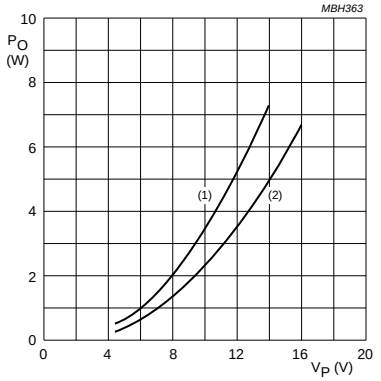
(1) R_L 16 Ω.
(2) R_L = 8 Ω.

Fig.7 Total harmonic distortion versus output power.



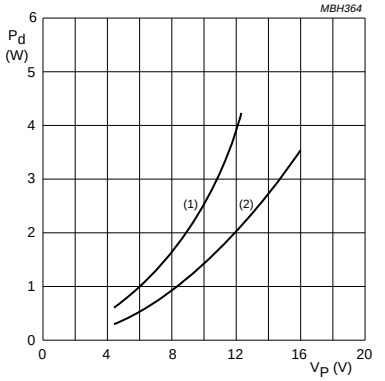
P_O = 0.1 W.
(1) $G_{v(max)}$ = 40 dB.
(2) $G_{v(max)}$ = 30 dB.

Fig.8 Total harmonic distortion versus frequency.



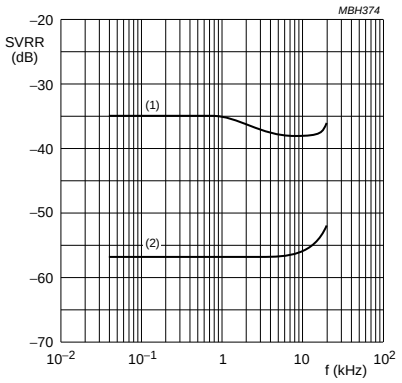
Measured at a THD of 10%. The maximum output power is limited by the maximum power dissipation and the maximum available output current.
(1) R_L = 8 Ω.
(2) R_L = 16 Ω.

Fig.9 Output power versus supply voltage.



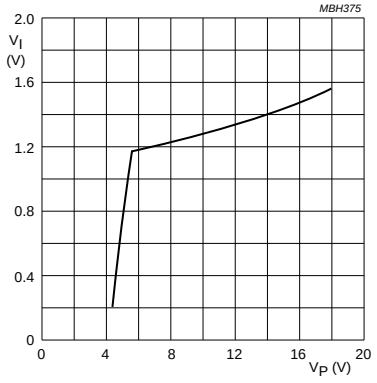
(1) R_L = 8 Ω.
(2) R_L = 16 Ω.

Fig.10 Total worst case power dissipation versus supply voltage.



Measured with V_R = 0.2 V.
(1) V_{DC} = 1.4 V.
(2) V_{DC} = 0.4 V.

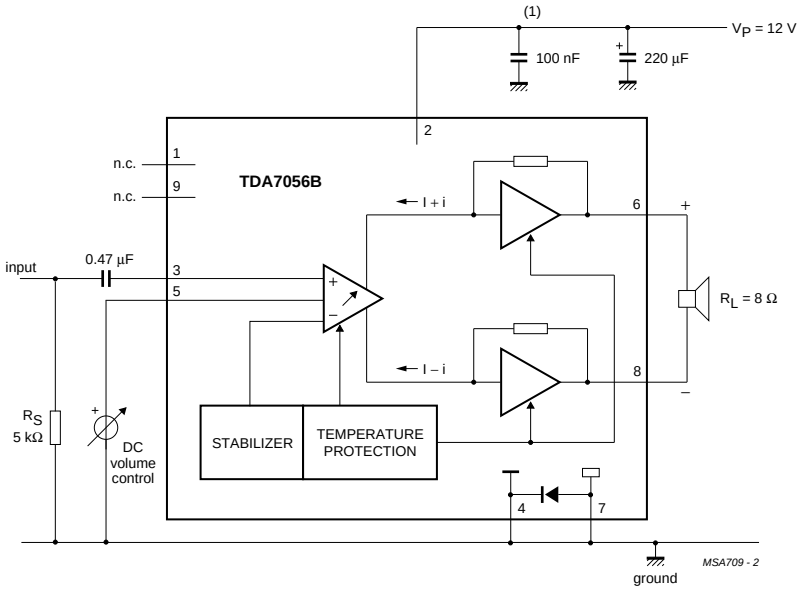
Fig.11 Supply voltage ripple rejection versus frequency.



Measured at a THD of 1% and a voltage gain of 0 dB.

Fig.12 Input signal handling.

TEST AND APPLICATION INFORMATION



To avoid instabilities and too high distortion, the input- and power ground must be separated as long as possible and connected together as close as possible to the IC.

(1) This capacitor can be omitted if the 220 µF electrolytic capacitor is connected close to pin 2.

Fig.13 Test and application diagram.

For single-end application the output peak current may not exceed 100 mA; at higher output currents the short circuit protection (MLC) will be activated.

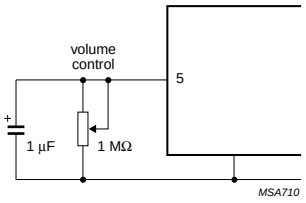


Fig.14 Application with potentiometer as volume control; maximum gain = 34 dB.

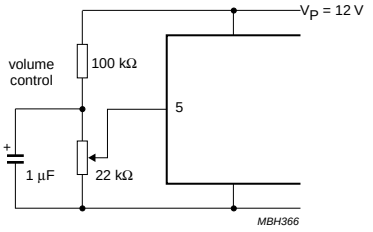
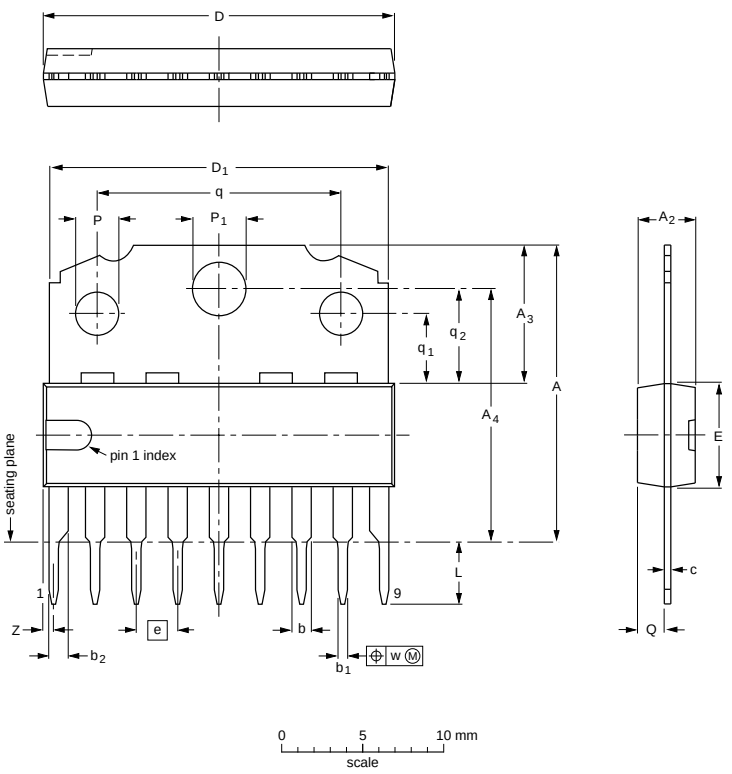


Fig.15 Application with potentiometer as volume control; maximum gain = 40 dB.

PACKAGE OUTLINE

SIL9MPF: plastic single in-line medium power package with fin; 9 leads **SOT110-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_2 max.	A_3	A_4	b	b_1	b_2	c	$D^{(1)}$	D_1	$E^{(1)}$	e	L	P	P_1	Q	q	q_1	q_2	w	$Z^{(1)}$ max.
mm	18.5 17.8	3.7	8.7 8.0	15.8 15.4	1.40 1.14	0.67 0.50	1.40 1.14	0.48 0.38	21.8 21.4	21.4 20.7	6.48 6.20	2.54	3.9 3.4	2.75 2.50	3.4 3.2	1.75 1.55	15.1 14.9	4.4 4.2	5.9 5.7	0.25	1

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT110-1						~~95-02-25~~ 03-03-12

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

PRELIMINARY

DATA SHEET STATUS

DOCUMENT STATUS[1]	PRODUCT STATUS[2]	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

Notes

1. Please consult the most recently issued document before initiating or completing a design.
2. The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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PRELIMINARY

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provides High Performance Mixed Signal and Standard Product solutions that leverage its leading RF, Analog, Power Management, Interface, Security and Digital Processing expertise

Customer notification

This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content, except for package outline drawings which were updated to the latest version.

Contact information

For additional information please visit: **http://www.nxp.com**
For sales offices addresses send e-mail to: **salesaddresses@nxp.com**

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