

## *Stereo Headphone Driver, 0dB / 6dB Gain*

### *Low Voltage, Internal Mute Function*

### *No Popping Noise When Power On / Off*

#### FEATURES

- Low supply voltage 2.7 to 5.5V
- Internal mute function
- No popping noise
- Fixed gain of 6 dB for MS6544  
Fixed gain of 0 dB for MS6541
- High SNR , Slew rate
- Low distortion
- Excellent power supply ripple rejection
- Low power consumption
- Large output voltage swing

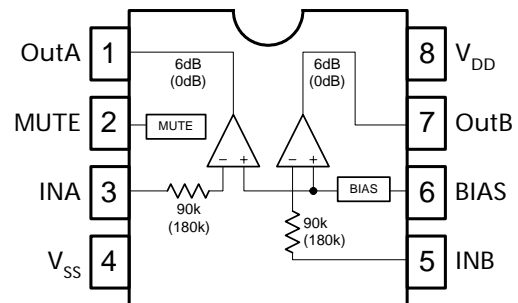
#### APPLICATIONS

- MP3, PDA
- Portable Digital Audio.
- CD-ROM, DVD-ROM, CD-RW, DVD-RW
- Cross-reference :  
6dB: BH3544F, NJM2169  
0dB: BH3541F, NJM2168

#### DESCRIPTION

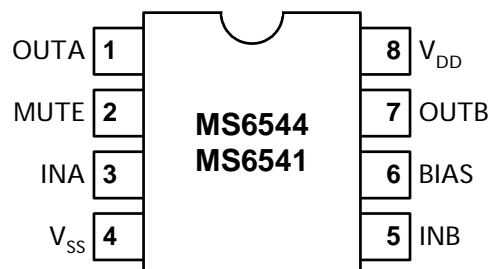
The MS6544 is an integrated class AB stereo headphone driver contained in an SO8 package. The MS6544 has fixed gain of 6dB and the MS6541 has fixed gain of 0dB. The mute function to prevent popping sounds when the power is turned on and off. It has good performance at low voltage operation, the MS6544/41 ideally suited for use in portable digital audio equipment.

#### BLOCK DIAGRAM



#### PIN CONFIGURATION

Symbol	Pin	Description
OutA	1	Output A
Mute	2	Mute control (Low: mute on, High: mute off)
INA	3	Input A
V <sub>SS</sub>	4	Negative supply
INB	5	Input B
BIAS	6	Bias (connect CAP)
OutB	7	Output B
V <sub>DD</sub>	8	Positive supply



### ORDERING INFORMATION

Package	Part number	Packaging Marking	Transport Media
8-Pin SOP	MS6544TR	MS6544	2.5k Units Tape and Reel
8-Pin SOP	MS6544U	MS6544	100 Units Tube
8-Pin SOP (lead free)	MS6544GTR	MS6544G	2.5k Units Tape and Reel
8-Pin SOP (lead free)	MS6544GU	MS6544G	100 Units Tube
8-Pin SOP	MS6541TR	MS6541	2.5k Units Tape and Reel
8-Pin SOP	MS6541U	MS6541	100 Units Tube
8-Pin SOP (lead free)	MS6541GTR	MS6541G	2.5k Units Tape and Reel
8-Pin SOP (lead free)	MS6541GU	MS6541G	100 Units Tube

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
V <sub>DD</sub>	Supply Voltage	6	V
V <sub>ESD</sub>	Electrostatic Handling	-4500 to 4500	V
T <sub>STG</sub>	Storage Temperature Range	-65 to 150	°C
T <sub>A</sub>	Operating Ambient Temperature Range	-40 to 85	°C
T <sub>J</sub>	Maximum Junction Temperature	150	°C
T <sub>S</sub>	Soldering Temperature, 10 seconds	260	°C
R <sub>THJA</sub>	Thermal Resistance from Junction to Ambient in Free Air SOP8	210	°C/W

### OPERATING RATINGS

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>DD</sub>	Supply Voltage	2.7	-	5.5	V

### 5V ELECTRICAL CHARACTERISTICS

( $T_a=25^\circ\text{C}$ ,  $V_{DD}=5\text{V}$ ,  $V_{SS}=0\text{V}$ ,  $V_o=2\text{V}_{pp}$ ,  $f=1\text{kHz}$ ,  $A_v=1$ ,  $R_L=32\Omega$ ; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>DC Characteristics</b>							
I <sub>Q</sub>	Quiescent current	V <sub>o</sub> =0V <sub>pp</sub> 2 channels	Mute On	-	1.5	1.6	mA
			Mute Off	3.7	3.9	4.1	mA
V <sub>TM</sub>	Mute control voltage	Mute on	0	-	1	V	
		Mute off	3	-	V <sub>DD</sub>	V	
G <sub>VC</sub>	Voltage Gain	MS6544 : 6dB	5	6	7	dB	
		MS6541 : 0dB	-1	0	1	dB	
PSRR	Power supply rejection ratio	V <sub>ripple</sub> = -20dBV, 100Hz	57	60	-	dB	
CS	Channel separation	V <sub>o</sub> =0dBV	100	117	-	dB	
ATT	Mute attenuation	V <sub>o</sub> =0dBV	100	115	-	dB	
<b>AC Characteristics</b>							
S/N	Signal-to-noise	V <sub>o</sub> =4V <sub>pp</sub>	95	99	-	dB	
THD+N	Total harmonic distortion plus noise	V <sub>o</sub> =2V <sub>pp</sub>	-	-64	-62	dB	
SR	Slew rate	Unity gain inverting	-	5	-	V/ $\mu\text{s}$	
P <sub>o</sub>	Maximum output power	(THD+N)/S<0.1%, 2 ch	130	140	-	mW	
V <sub>o</sub>	Maximum output voltage swing	(THD+N)/S<0.1%	4.1	4.2	-	V <sub>pp</sub>	

### 3.3V ELECTRICAL CHARACTERISTICS

( $T_a=25^\circ\text{C}$ ,  $V_{DD}=3.3\text{V}$ ,  $V_{SS}=0\text{V}$ ,  $V_o=2\text{V}_{pp}$ ,  $f=1\text{kHz}$ ,  $A_v=1$ ,  $R_L=32\Omega$ ; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>DC Characteristics</b>							
I <sub>Q</sub>	Quiescent current	V <sub>o</sub> =0V <sub>pp</sub> 2 channels	Mute On	-	1.3	1.4	mA
			Mute Off	-	3.3	3.5	mA
V <sub>TM</sub>	Mute control voltage	Mute on	0	-	1	V	
		Mute off	2.5	-	V <sub>DD</sub>	V	
PSRR	Power supply rejection ratio	V <sub>ripple</sub> = -20dBV, 100Hz	57	60	-	dB	
CS	Channel separation	V <sub>o</sub> =0dBV	100	115	-	dB	
ATT	Mute attenuation	V <sub>o</sub> =0dBV	100	115	-	dB	
<b>AC Characteristics</b>							
S/N	Signal-to-noise	V <sub>o</sub> =2.6V <sub>pp</sub>	93	97	-	dB	
THD+N	Total harmonic distortion plus noise	V <sub>o</sub> =2V <sub>pp</sub>	-	-64	-62	dB	
P <sub>o</sub>	Maximum output power	(THD+N)/S<0.1%, 2 ch	49	52	-	mW	
V <sub>o</sub>	Maximum output voltage swing	(THD+N)/S<0.1%	2.5	2.6	-	V <sub>pp</sub>	

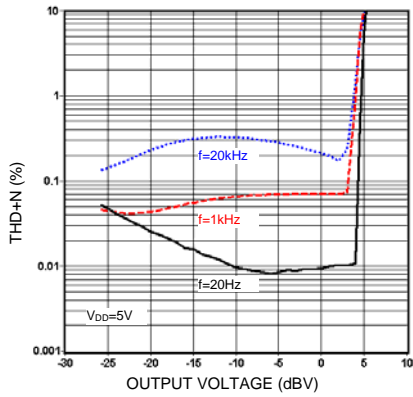
### 2.7V ELECTRICAL CHARACTERISTICS

( $T_a=25^\circ\text{C}$ ,  $V_{DD}=2.7\text{V}$ ,  $V_{SS}=0\text{V}$ ,  $V_o=2V_{pp}$ ,  $f=1\text{kHz}$ ,  $A_v=1$ ,  $R_L=32\Omega$ ; unless otherwise specified)

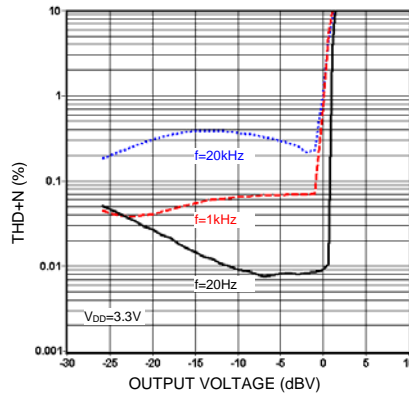
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>DC Characteristics</b>							
I <sub>Q</sub>	Quiescent current	V <sub>o</sub> =0V <sub>pp</sub> 2 channels	Mute On	-	1.2	1.3	mA
			Mute Off	-	3.0	3.2	mA
V <sub>TM</sub>	Mute control voltage	Mute on	0	-	1	V	
		Mute off	2.5	-	V <sub>DD</sub>	V	
PSRR	Power supply rejection ratio	V <sub>ripple</sub> = -20dBV, 100Hz	57	60	-	dB	
CS	Channel separation	V <sub>o</sub> =-3dBV	100	112	-	dB	
ATT	Mute attenuation	V <sub>o</sub> =-3dBV	100	115	-	dB	
<b>AC Characteristics</b>							
S/N	Signal-to-noise	V <sub>o</sub> =2V <sub>pp</sub>	92	96	-	dB	
THD+N	Total harmonic distortion plus noise	V <sub>o</sub> =2V <sub>pp</sub>	-	-64	-62	dB	
P <sub>o</sub>	Maximum output power	(THD+N/S)<0.1%, 2 ch	28	31	-	mW	
V <sub>o</sub>	Maximum output voltage swing	(THD+N)/S<0.1%	1.9	2	-	V <sub>pp</sub>	

## TYPICAL PERFORMANCE CHARACTERISTICS

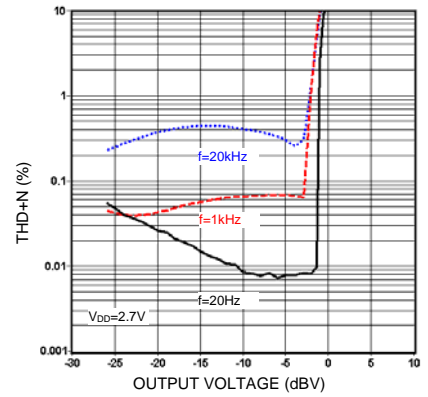
( $T_a=25^\circ\text{C}$ ,  $R_L=32\Omega$ ; unless otherwise specified)



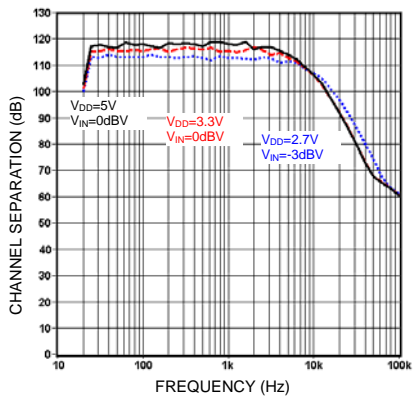
**THD+N vs. output voltage**



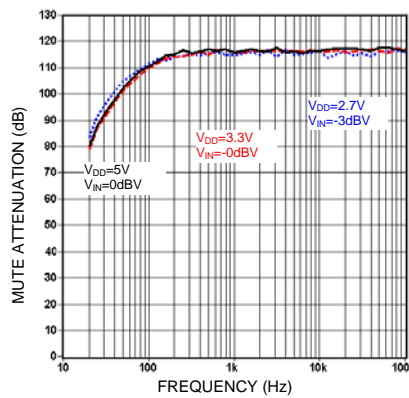
**THD+N vs. output voltage**



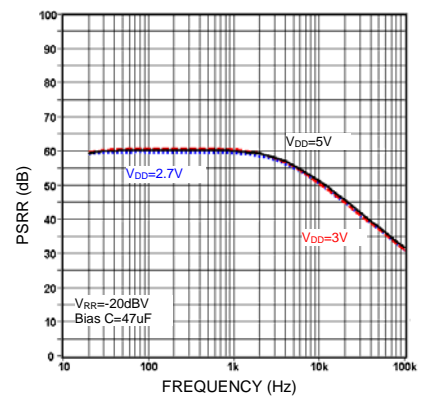
**THD+N vs. output voltage**



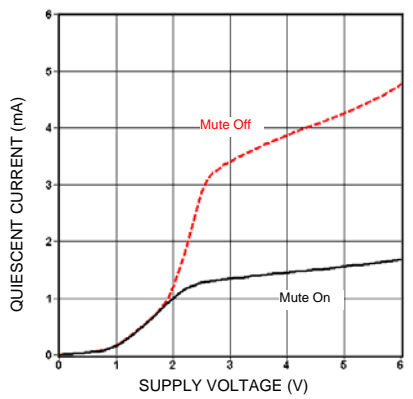
**Channel separation vs. frequency**



**Mute Attenuation vs. frequency**



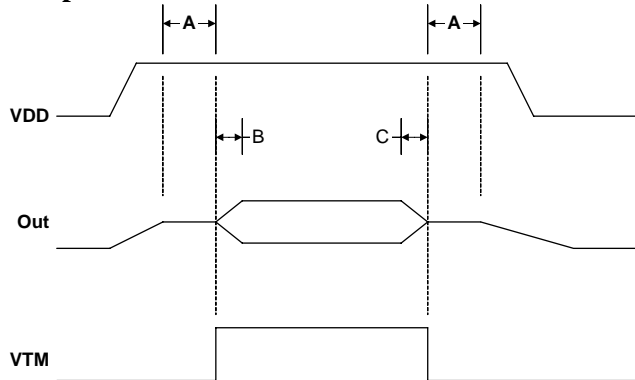
**PSRR vs. frequency**



**Quiescent current vs. supply voltage**

## MUTE FUNCTION

### Mute operation



A: Mute period

Set Mute = Low to prevent the popping noise when power is turned on and off.

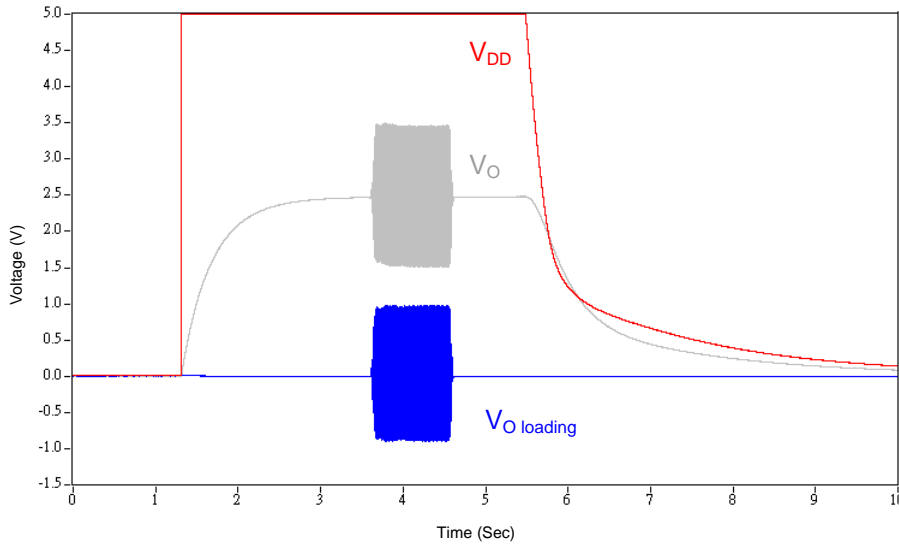
B: Mute release time

The time constant is decided by R and C of pin 2.

C: Mute start time

The time constant like Mute release time.

### Mute function to prevent the popping noise



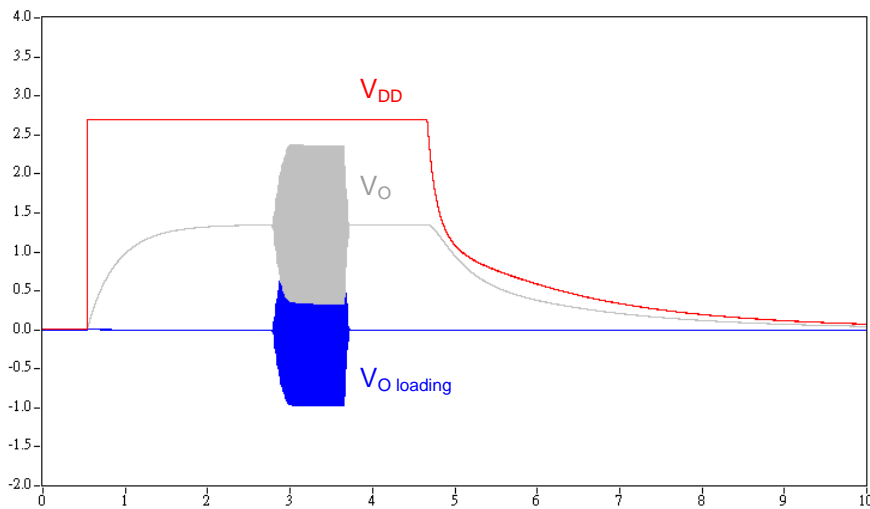
Conditions :

$V_{DD} = 5V$ ,  $V_o = 2V_{pp}$

Process :

Mute On,  $V_{DD}$  On, Mute Off

Mute On,  $V_{DD}$  Off



Conditions :

$V_{DD} = 2.7V$ ,  $V_o = 2V_{pp}$

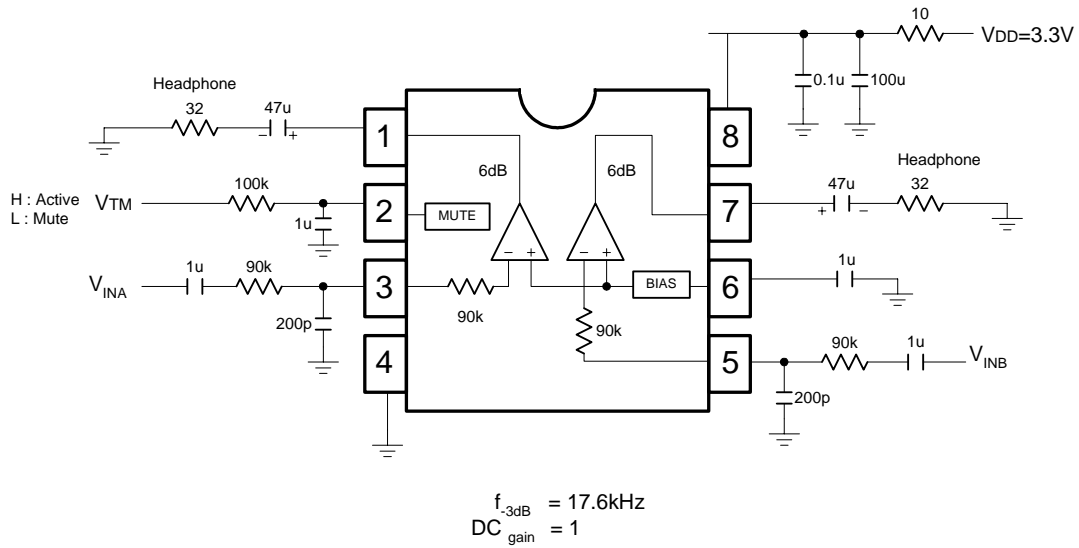
Process :

Mute On,  $V_{DD}$  On, Mute Off

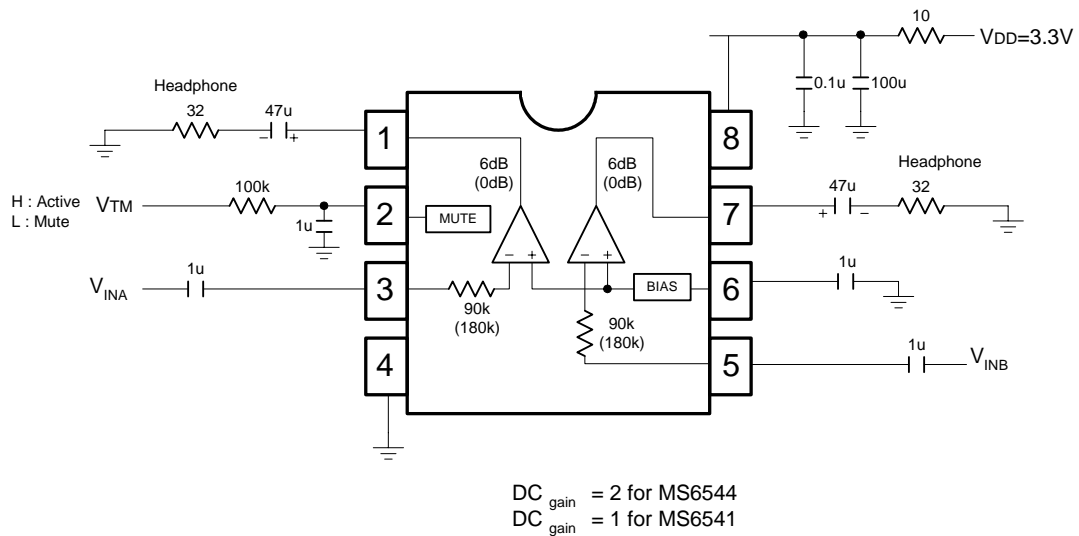
Mute On,  $V_{DD}$  Off

## APPLICATION INFORMATION

### Low voltage application

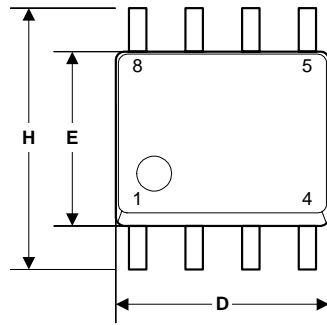


**Fig.1 The 1st order low pass filter for MP3 solution with MS6544.**

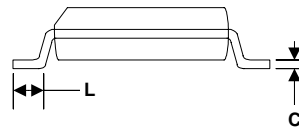
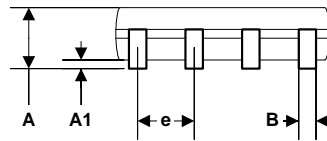


**Fig.2 The MP3 solution .**

## EXTERNAL DIMENSIONS



Symbol	Dimension in mm		Dimension in inch	
	Min	Max	Min	Max
A	1.35	1.75	0.0532	0.0688
A1	0.10	0.25	0.0040	0.0098
B	0.33	0.51	0.013	0.020
C	0.19	0.25	0.0075	0.0098
D	4.80	5.00	0.1890	0.1968
H	5.80	6.20	0.2284	0.2440
E	3.80	4.00	0.1497	0.1574
e	1.27 BSC		0.050 BSC	
L	0.40	1.27	0.016	0.050



SOP8

## TAPE AND REEL (Unit : mm)

