

LM4562

LM4562 Dual High Performance, High Fidelity Audio Operational Amplifier



Literature Number: SNAS326I

勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)



LM4562

January 26, 2010

LM4562 Dual High Performance, High Fidelity Audio Operational Amplifier

Dual High Performance, High Fidelity Audio Operational Amplifier

General Description

The LM4562 is part of the ultra-low distortion, low noise, high slew rate operational amplifier series optimized and fully specified for high performance, high fidelity applications. Combining advanced leading-edge process technology with state-of-the-art circuit design, the LM4562 audio operational amplifiers deliver superior audio signal amplification for outstanding audio performance. The LM4562 combines extremely low voltage noise density ($2.7\text{nV}/\sqrt{\text{Hz}}$) with vanishingly low THD+N (0.00003%) to easily satisfy the most demanding audio applications. To ensure that the most challenging loads are driven without compromise, the LM4562 has a high slew rate of $\pm 20\text{V}/\mu\text{s}$ and an output current capability of $\pm 26\text{mA}$. Further, dynamic range is maximized by an output stage that drives $2\text{k}\Omega$ loads to within 1V of either power supply voltage and to within 1.4V when driving 600Ω loads. The LM4562's outstanding CMRR (120dB), PSRR (120dB), and V_{OS} (0.1mV) give the amplifier excellent operational amplifier DC performance.

The LM4562 has a wide supply range of $\pm 2.5\text{V}$ to $\pm 17\text{V}$. Over this supply range the LM4562's input circuitry maintains excellent common-mode and power supply rejection, as well as maintaining its low input bias current. The LM4562 is unity gain stable. This Audio Operational Amplifier achieves outstanding AC performance while driving complex loads with values as high as 100pF .

The LM4562 is available in 8-lead narrow body SOIC, 8-lead Plastic DIP, and 8-lead Metal Can TO-99. Demonstration boards are available for each package.

Key Specifications

- Power Supply Voltage Range $\pm 2.5\text{V}$ to $\pm 17\text{V}$
- THD+N ($A_V = 1$, $V_{\text{OUT}} = 3\text{V}_{\text{RMS}}$, $f_{\text{IN}} = 1\text{kHz}$)

$R_L = 2\text{k}\Omega$	0.00003% (typ)
$R_L = 600\Omega$	0.00003% (typ)
Input Noise Density	$2.7\text{nV}/\sqrt{\text{Hz}}$ (typ)
Slew Rate	$\pm 20\text{V}/\mu\text{s}$ (typ)
Gain Bandwidth Product	55MHz (typ)
Open Loop Gain ($R_L = 600\Omega$)	140dB (typ)
Input Bias Current	10nA (typ)
Input Offset Voltage	0.1mV (typ)
DC Gain Linearity Error	0.000009%

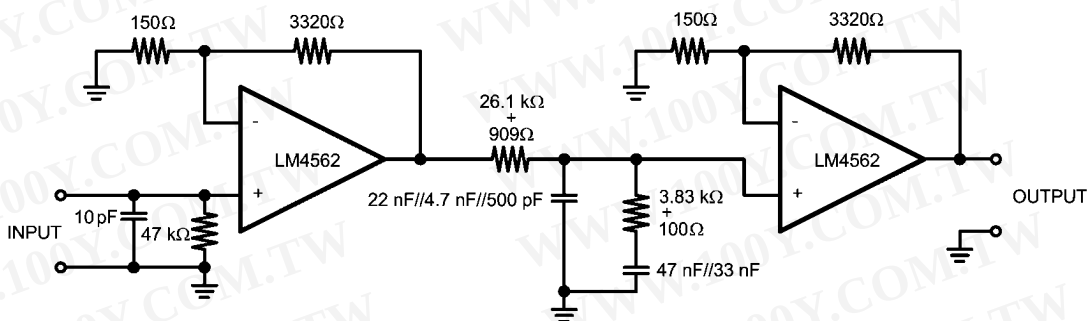
Features

- Easily drives 600Ω loads
- Optimized for superior audio signal fidelity
- Output short circuit protection
- PSRR and CMRR exceed 120dB (typ)
- SOIC, DIP, TO-99 metal can packages

Applications

- Ultra high quality audio amplification
- High fidelity preamplifiers
- High fidelity multimedia
- State of the art phono pre amps
- High performance professional audio
- High fidelity equalization and crossover networks
- High performance line drivers
- High performance line receivers
- High fidelity active filters

Typical Application



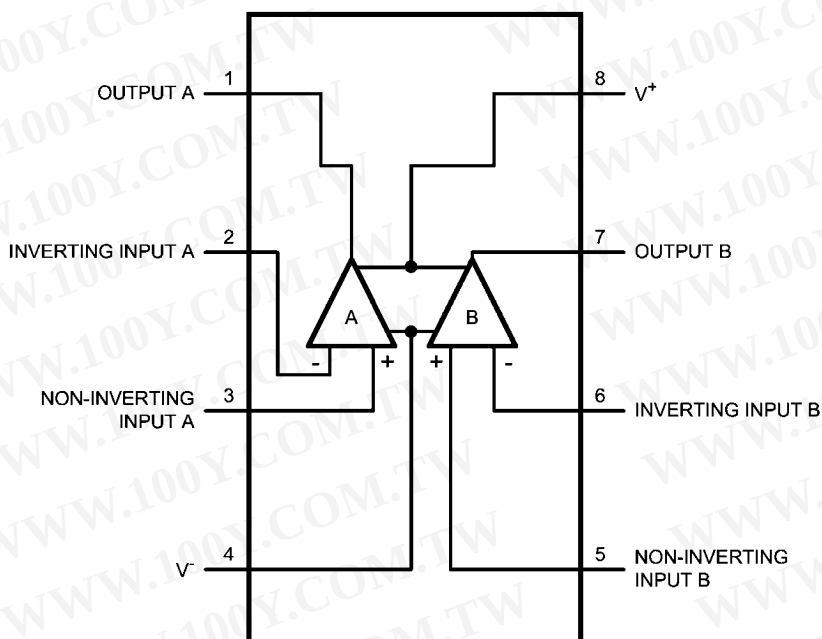
Note: 1% metal film resistors, 5% polypropylene capacitors

Passively Equalized RIAA Phono Preamplifier

201572k5

Connection Diagrams

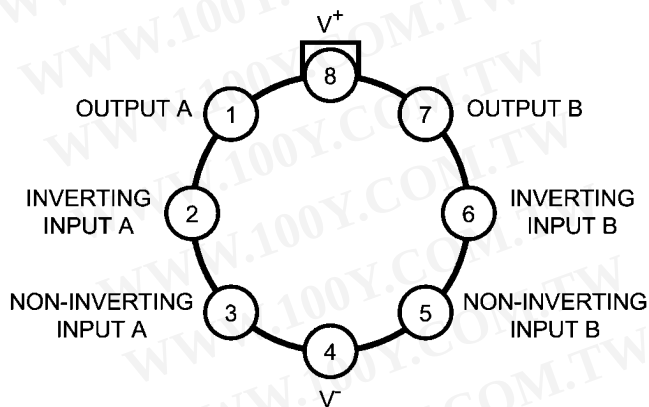
Dual-In-Line Package



Order Number LM4562MA
See NS Package Number — M08A
Order Number LM4562NA
See NS Package Number — N08E

20157255

Metal Can



Order Number LM4562HA
See NS Package Number — H08C

20157213

勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Absolute Maximum Ratings (Note 1, Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Power Supply Voltage ($V_S = V^+ - V^-$)	36V
Storage Temperature	-65°C to 150°C
Input Voltage (V^-) - 0.7V to (V^+) + 0.7V	
Output Short Circuit (Note 3)	Continuous
Power Dissipation	Internally Limited
ESD Susceptibility (Note 4)	2000V

ESD Susceptibility (Note 5)

Pins 1, 4, 7 and 8	200V
Pins 2, 3, 5 and 6	100V
Junction Temperature	150°C
Thermal Resistance	
θ_{JA} (SO)	145°C/W
θ_{JA} (NA)	102°C/W
θ_{JA} (HA)	150°C/W
θ_{JC} (HA)	35°C/W
Temperature Range	
$T_{MIN} \leq T_A \leq T_{MAX}$	-40°C $\leq T_A \leq$ 85°C
Supply Voltage Range	$\pm 2.5V \leq V_S \leq \pm 17V$

Electrical Characteristics for the LM4562 (Note 1, Note 2) The specifications apply for $V_S = \pm 15V$, $R_L = 2k\Omega$, $f_{IN} = 1kHz$, $T_A = 25^\circ C$, unless otherwise specified.

Symbol	Parameter	Conditions	LM4562		Units (Limits)
			Typical	Limit	
			(Note 6)	(Note 7)	
THD+N	Total Harmonic Distortion + Noise	$A_V = 1$, $V_{OUT} = 3V_{rms}$ $R_L = 2k\Omega$ $R_L = 600\Omega$	0.00003 0.00003	0.00009	% (max)
IMD	Intermodulation Distortion	$A_V = 1$, $V_{OUT} = 3V_{RMS}$ Two-tone, 60Hz & 7kHz 4:1	0.00005		%
GBWP	Gain Bandwidth Product		55	45	MHz (min)
SR	Slew Rate		± 20	± 15	V/ μs (min)
FPBW	Full Power Bandwidth	$V_{OUT} = 1V_{P-P}$, -3dB referenced to output magnitude at $f = 1kHz$	10		MHz
t_s	Settling time	$A_V = -1$, 10V step, $C_L = 100pF$ 0.1% error range	1.2		μs
e_n	Equivalent Input Noise Voltage	$f_{BW} = 20Hz$ to 20kHz	0.34	0.65	μV_{RMS} (max)
	Equivalent Input Noise Density	$f = 1kHz$ $f = 10Hz$	2.7 6.4	4.7	nV/ $\sqrt{Hz}$ (max)
i_n	Current Noise Density	$f = 1kHz$ $f = 10Hz$	1.6 3.1		pA/ $\sqrt{Hz}$
V_{OS}	Offset Voltage		± 0.1	± 0.7	mV (max)
$\Delta V_{OS}/\Delta Temp$	Average Input Offset Voltage Drift vs Temperature	-40°C $\leq T_A \leq$ 85°C	0.2		$\mu V/^\circ C$
PSRR	Average Input Offset Voltage Shift vs Power Supply Voltage	$\Delta V_S = 20V$ (Note 8)	120	110	dB (min)
ISO_{CH-CH}	Channel-to-Channel Isolation	$f_{IN} = 1kHz$ $f_{IN} = 20kHz$	118 112		dB
I_B	Input Bias Current	$V_{CM} = 0V$	10	72	nA (max)
$\Delta I_{OS}/\Delta Temp$	Input Bias Current Drift vs Temperature	-40°C $\leq T_A \leq$ 85°C	0.1		nA/ $^\circ C$
I_{OS}	Input Offset Current	$V_{CM} = 0V$	11	65	nA (max)
V_{IN-CM}	Common-Mode Input Voltage Range		+14.1 -13.9	(V^+) - 2.0 (V^-) + 2.0	V (min)
CMRR	Common-Mode Rejection	-10V $< V_{cm} <$ 10V	120	110	dB (min)
Z_{IN}	Differential Input Impedance		30		k Ω
	Common Mode Input Impedance	-10V $< V_{cm} <$ 10V	1000		M Ω

Symbol	Parameter	Conditions	LM4562		Units (Limits)
			Typical	Limit	
			(Note 6)	(Note 7)	
A_{VOL}	Open Loop Voltage Gain	$-10V < V_{out} < 10V, R_L = 600\Omega$	140	125	dB (min)
		$-10V < V_{out} < 10V, R_L = 2k\Omega$	140		
		$-10V < V_{out} < 10V, R_L = 10k\Omega$	140		
V_{OUTMAX}	Maximum Output Voltage Swing	$R_L = 600\Omega$	± 13.6	± 12.5	V (min)
		$R_L = 2k\Omega$	± 14.0		
		$R_L = 10k\Omega$	± 14.1		
I_{OUT}	Output Current	$R_L = 600\Omega, V_S = \pm 17V$	± 26	± 23	mA (min)
I_{OUT-CC}	Instantaneous Short Circuit Current		+53 -42		mA
R_{OUT}	Output Impedance	$f_{IN} = 10kHz$ Closed-Loop Open-Loop	0.01 13		Ω
C_{LOAD}	Capacitive Load Drive Overshoot	100pF	16		%
I_S	Total Quiescent Current	$I_{OUT} = 0mA$	10	12	mA (max)

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur.

Note 2: Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Note 3: Amplifier output connected to GND, any number of amplifiers within a package.

Note 4: Human body model, 100pF discharged through a 1.5k Ω resistor.

Note 5: Machine Model ESD test is covered by specification EIAJ IC-121-1981. A 200pF cap is charged to the specified voltage and then discharged directly into the IC with no external series resistor (resistance of discharge path must be under 50 Ω).

Note 6: Typical specifications are specified at +25°C and represent the most likely parametric norm.

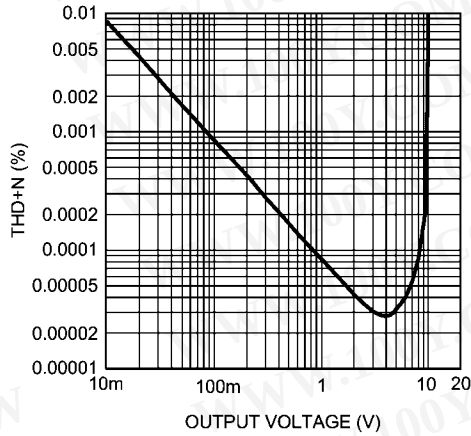
Note 7: Tested limits are guaranteed to National's AOQL (Average Outgoing Quality Level).

Note 8: PSRR is measured as follows: V_{OS} is measured at two supply voltages, $\pm 5V$ and $\pm 15V$. $PSRR = |20\log(\Delta V_{OS}/\Delta V_S)|$.

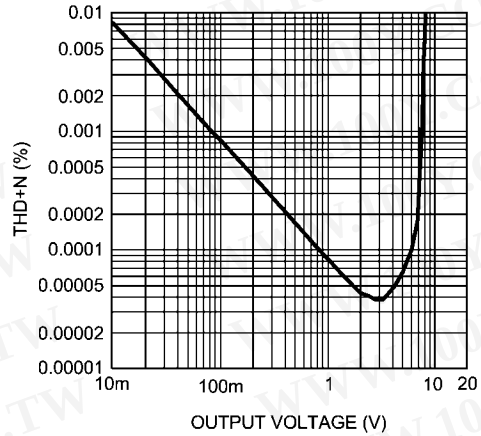
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Typical Performance Characteristics

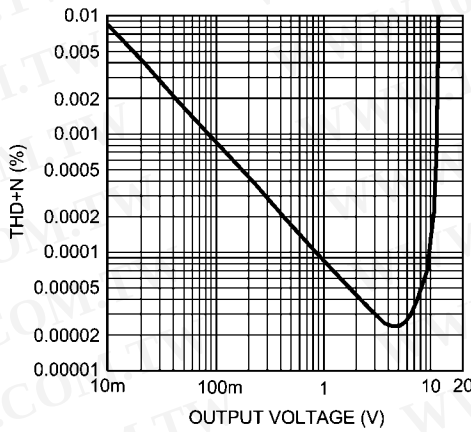
THD+N vs Output Voltage
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 2k\Omega$



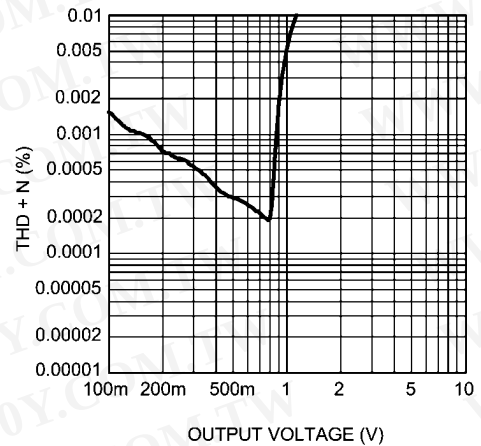
THD+N vs Output Voltage
 $V_{CC} = 12V$, $V_{EE} = -12V$
 $R_L = 2k\Omega$



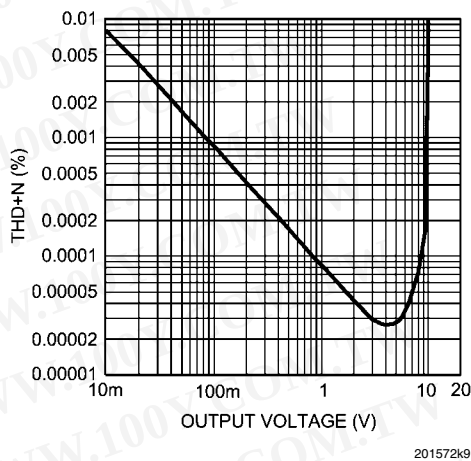
THD+N vs Output Voltage
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 2k\Omega$



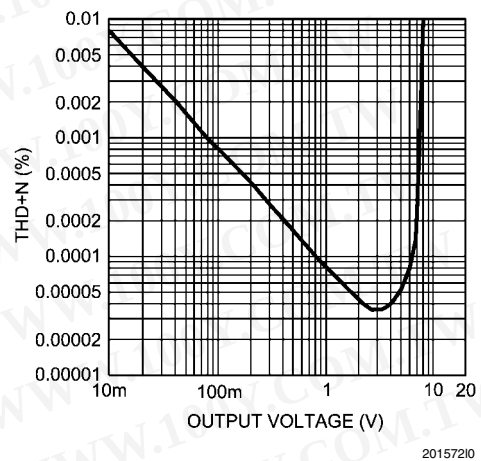
THD+N vs Output Voltage
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 2k\Omega$



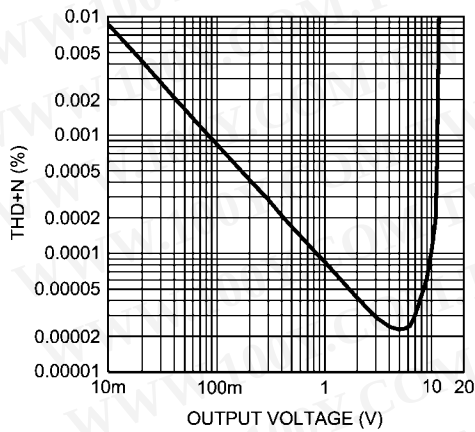
THD+N vs Output Voltage
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 600\Omega$



THD+N vs Output Voltage
 $V_{CC} = 12V$, $V_{EE} = -12V$
 $R_L = 600\Omega$

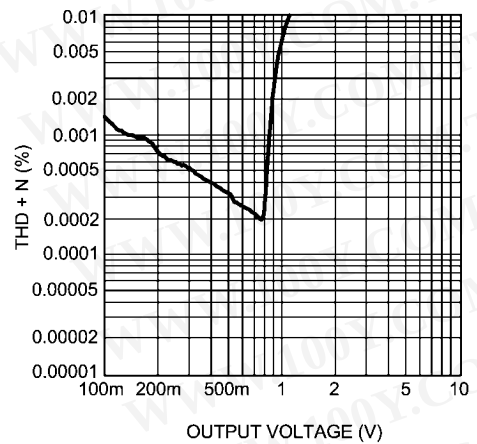


THD+N vs Output Voltage
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 600\Omega$



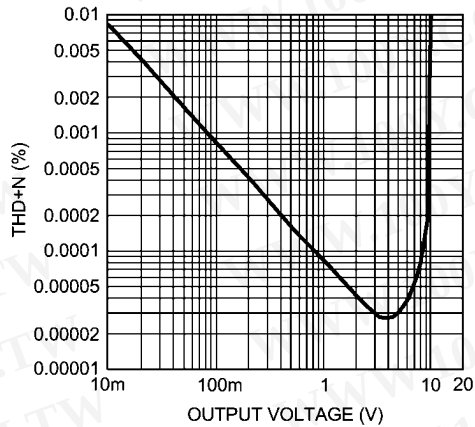
20157211

THD+N vs Output Voltage
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 600\Omega$



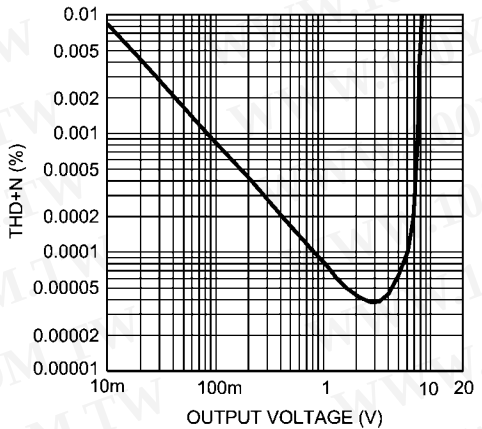
20157216

THD+N vs Output Voltage
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 10k\Omega$



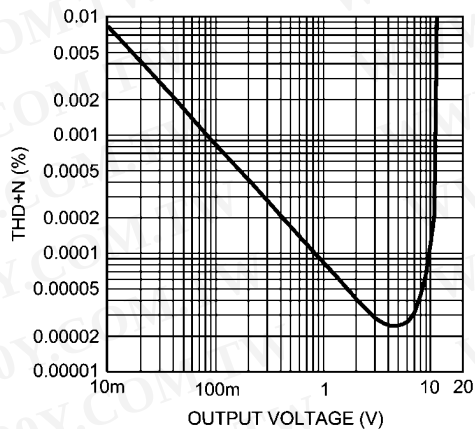
20157212

THD+N vs Output Voltage
 $V_{CC} = 12V$, $V_{EE} = -12V$
 $R_L = 10k\Omega$



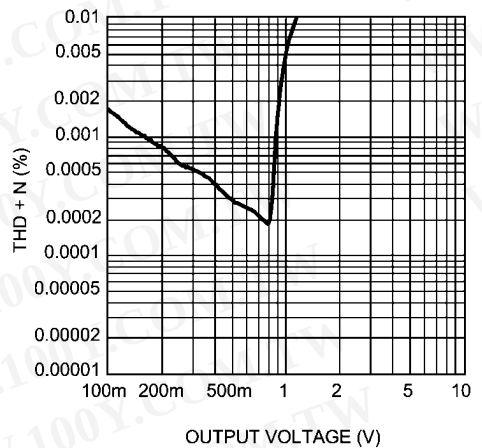
20157213

THD+N vs Output Voltage
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 10k\Omega$

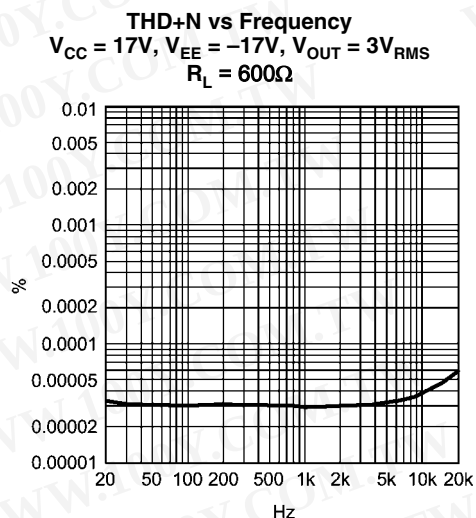
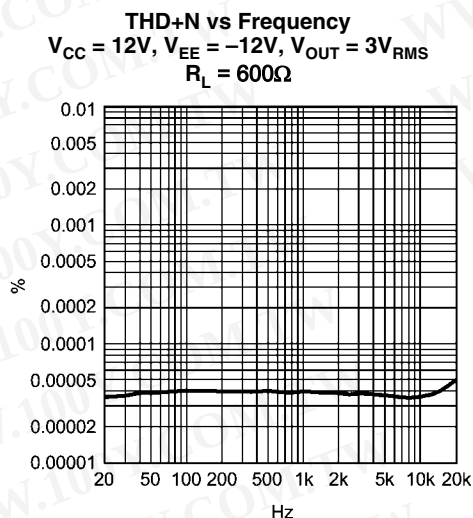
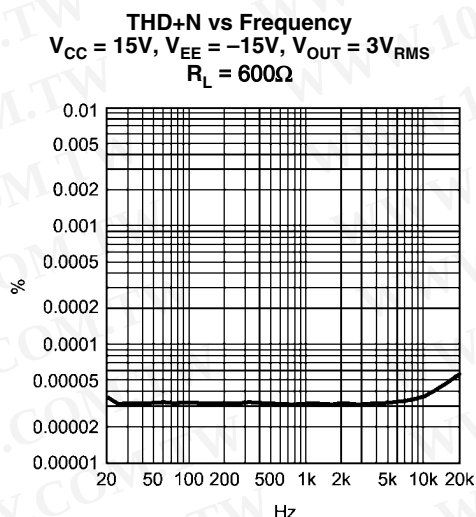
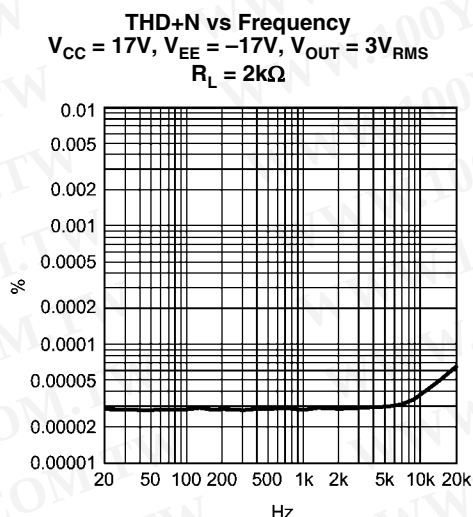
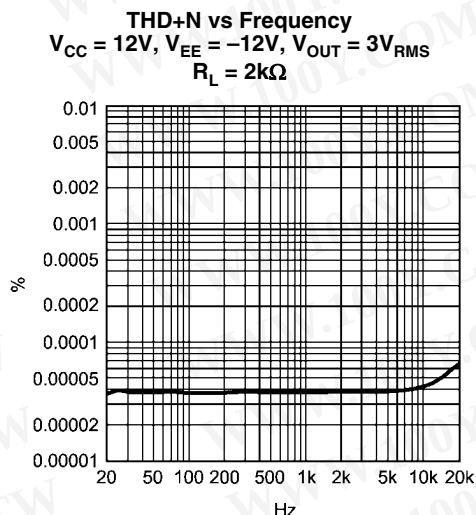
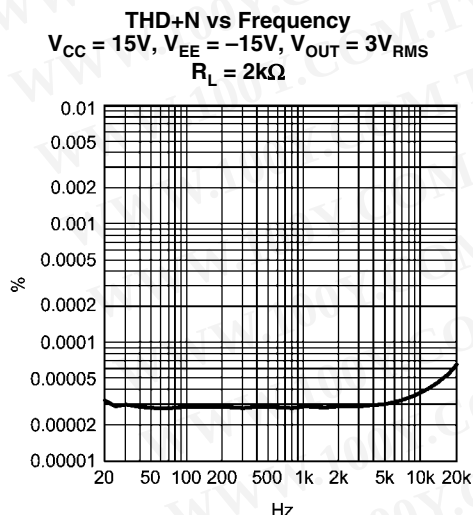


20157214

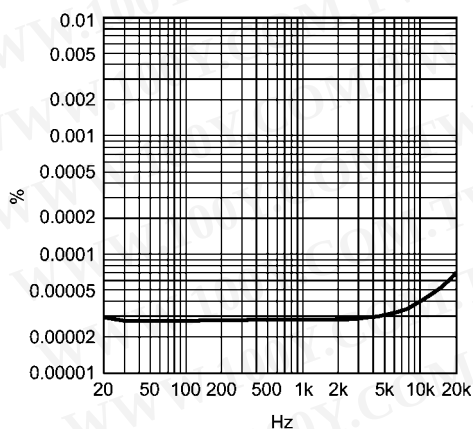
THD+N vs Output Voltage
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 10k\Omega$



20157215

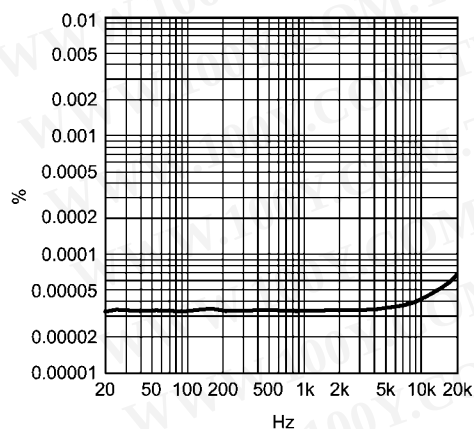


THD+N vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$, $V_{OUT} = 3V_{RMS}$
 $R_L = 10k\Omega$



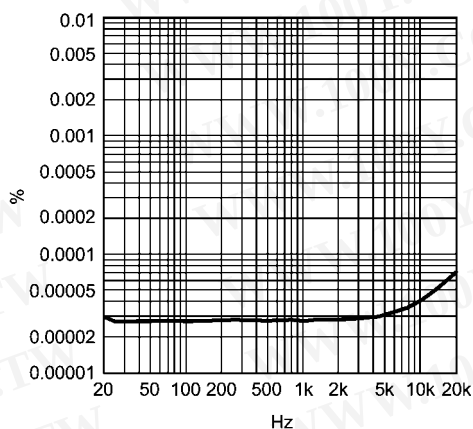
20157267

THD+N vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$, $V_{OUT} = 3V_{RMS}$
 $R_L = 10k\Omega$



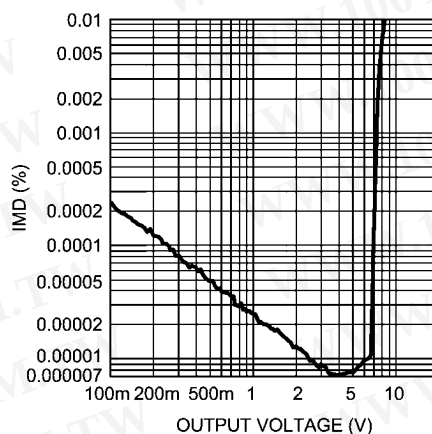
20157266

THD+N vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$, $V_{OUT} = 3V_{RMS}$
 $R_L = 10k\Omega$



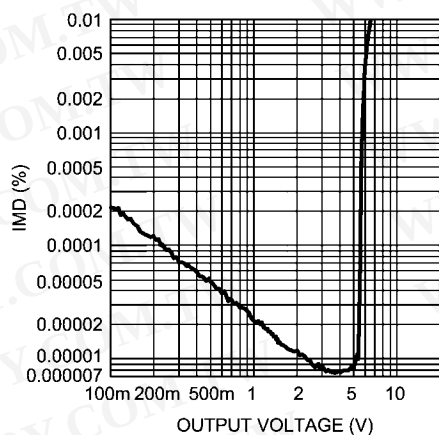
20157268

IMD vs Output Voltage
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 2k\Omega$



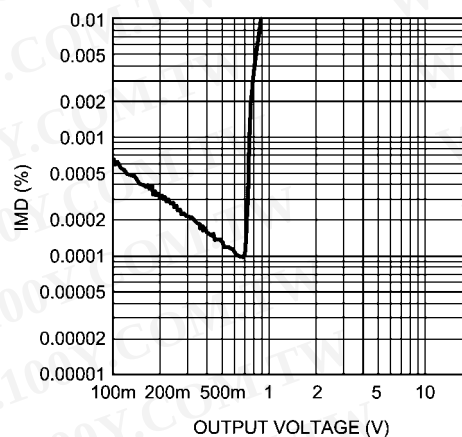
20157266

IMD vs Output Voltage
 $V_{CC} = 12V$, $V_{EE} = -12V$
 $R_L = 2k\Omega$

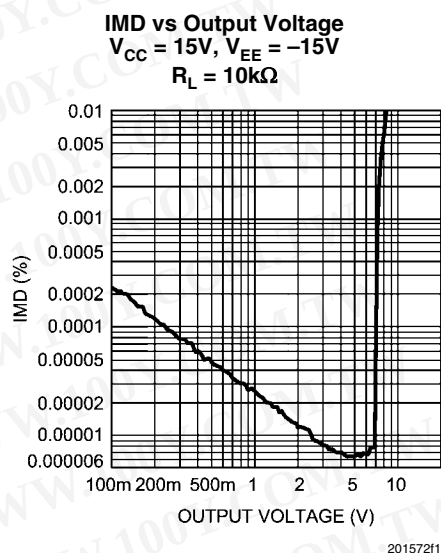
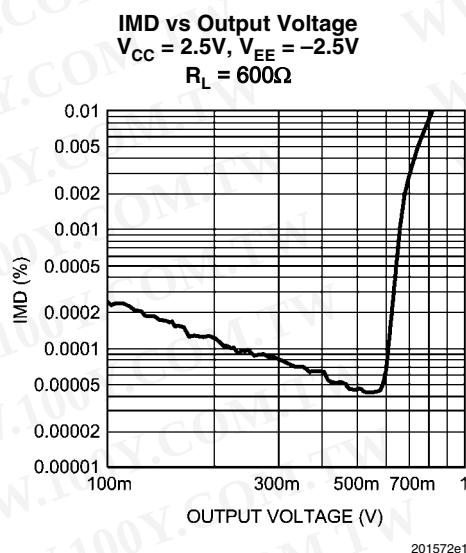
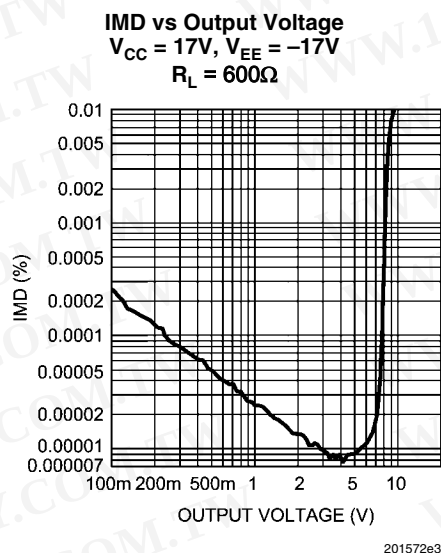
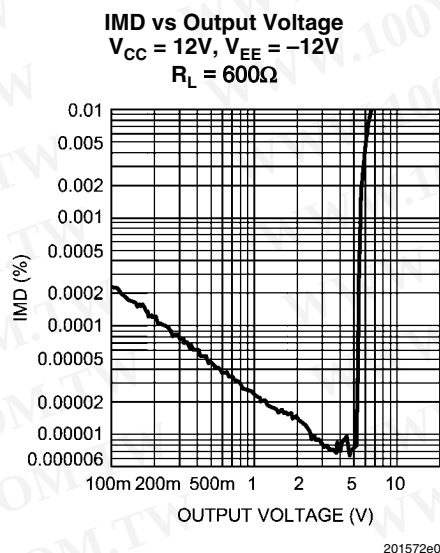
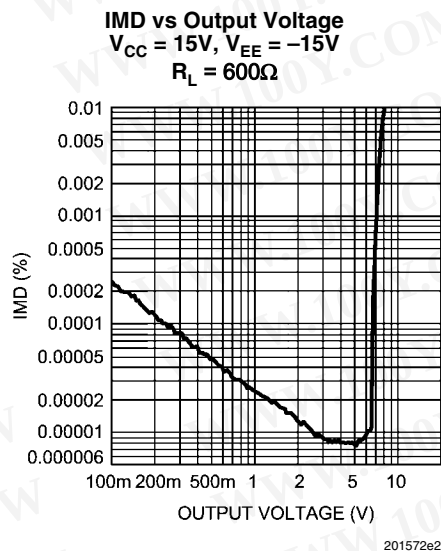
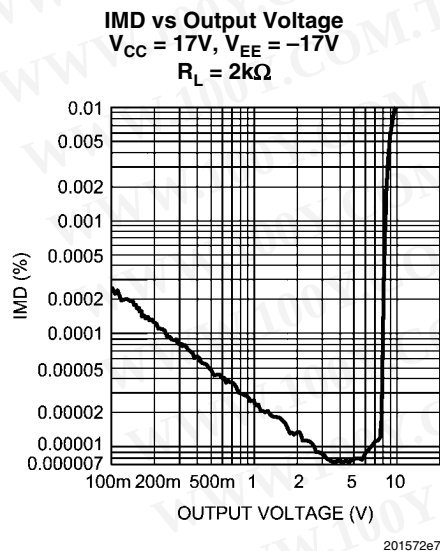


20157265

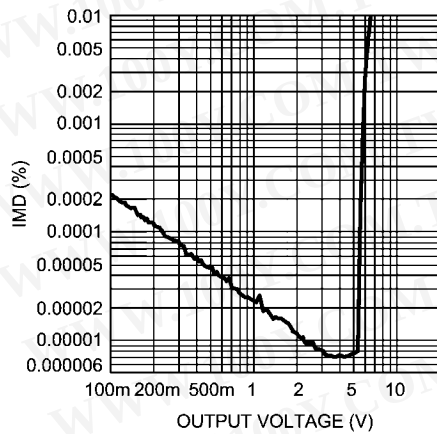
IMD vs Output Voltage
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 2k\Omega$



20157264

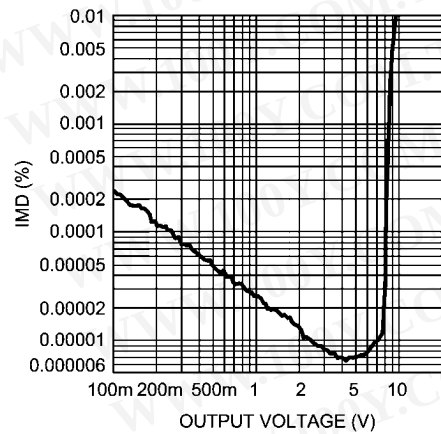


IMD vs Output Voltage
 $V_{CC} = 12V$, $V_{EE} = -12V$
 $R_L = 10k\Omega$



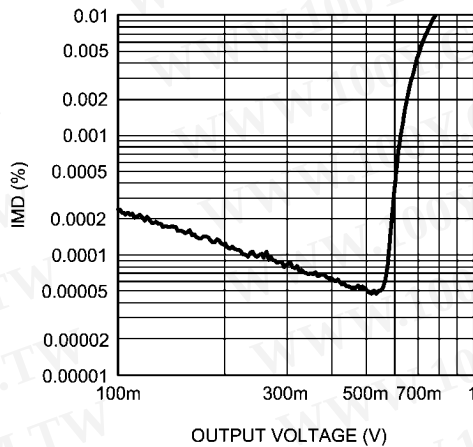
201572f0

IMD vs Output Voltage
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 10k\Omega$



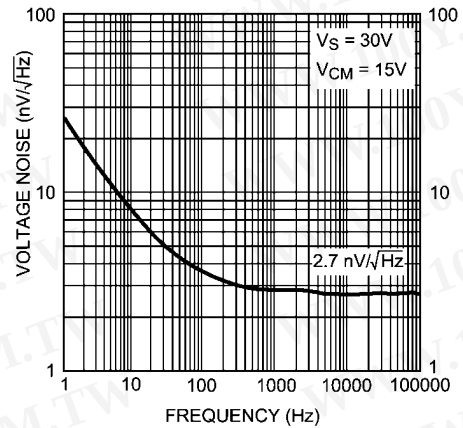
201572f2

IMD vs Output Voltage
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 10k\Omega$



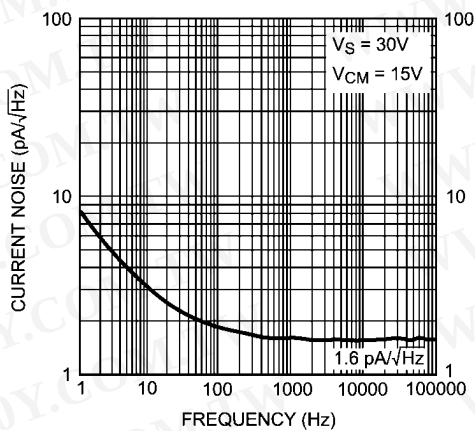
201572f6

Voltage Noise Density vs Frequency



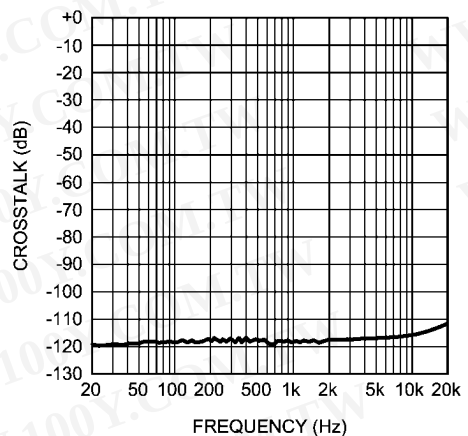
201572h6

Current Noise Density vs Frequency



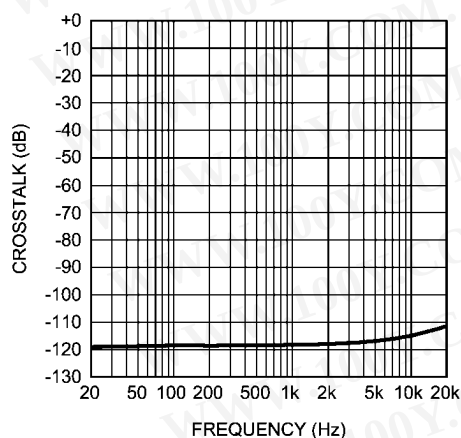
201572h7

Crosstalk vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 2k\Omega$



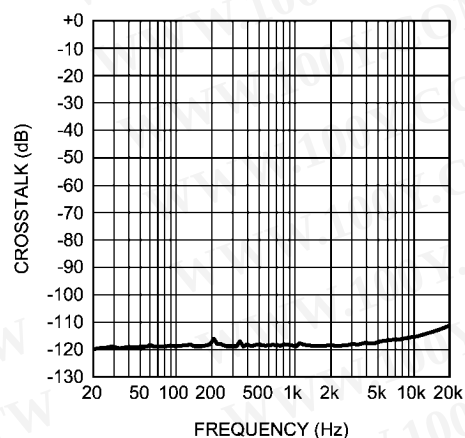
201572c8

Crosstalk vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 2k\Omega$



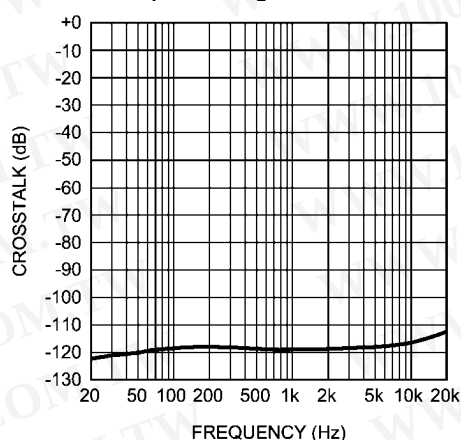
201572c9

Crosstalk vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 2k\Omega$



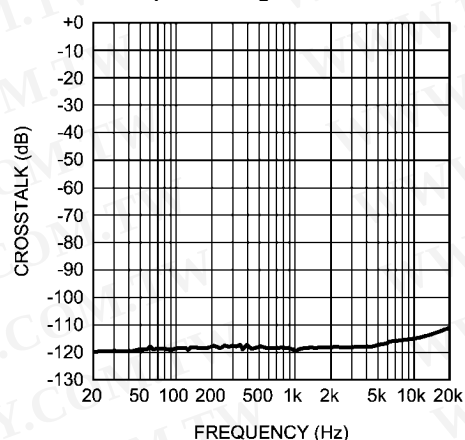
201572c6

Crosstalk vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 2k\Omega$



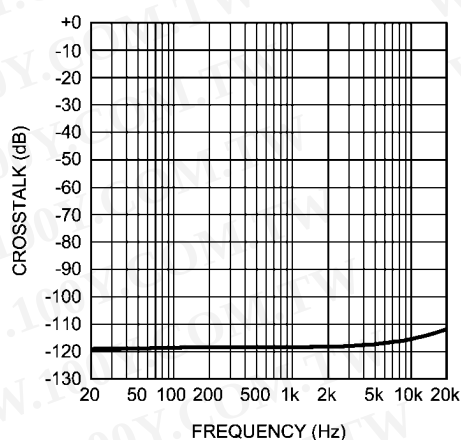
201572c7

Crosstalk vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 2k\Omega$



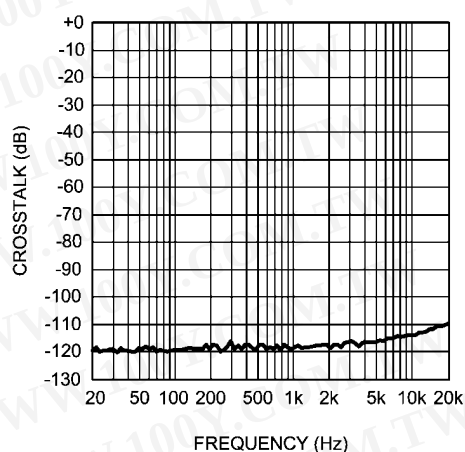
201572d0

Crosstalk vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 2k\Omega$



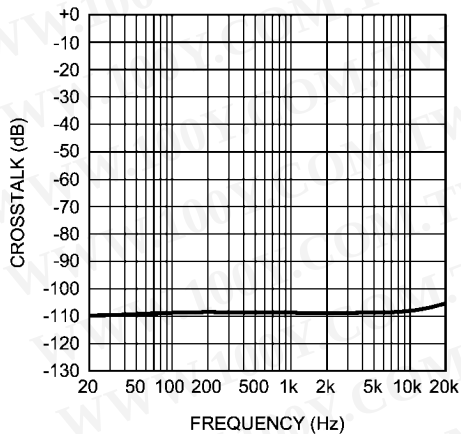
201572d1

Crosstalk vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$, $V_{OUT} = 1V_{RMS}$
 $A_V = 0dB$, $R_L = 2k\Omega$



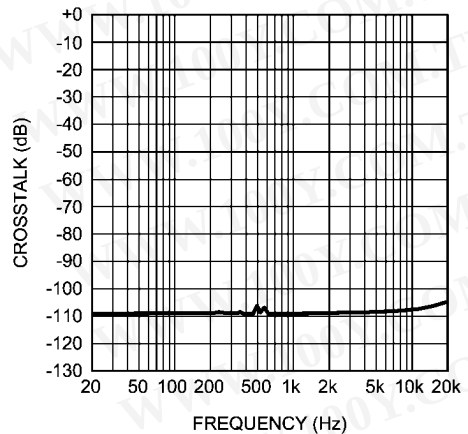
201572n8

Crosstalk vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 600\Omega$



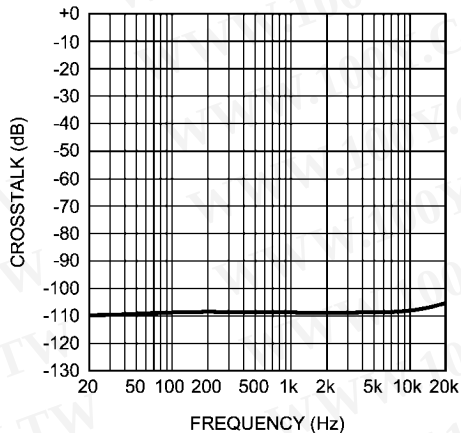
201572d6

Crosstalk vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 600\Omega$



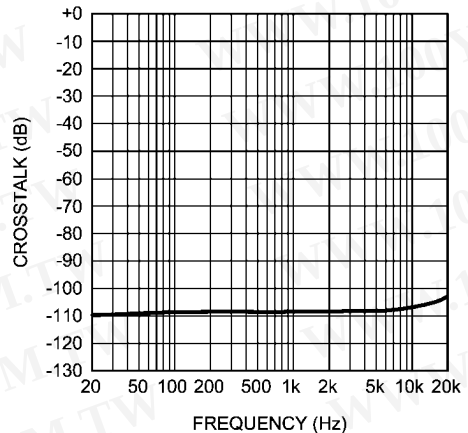
201572d7

Crosstalk vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 600\Omega$



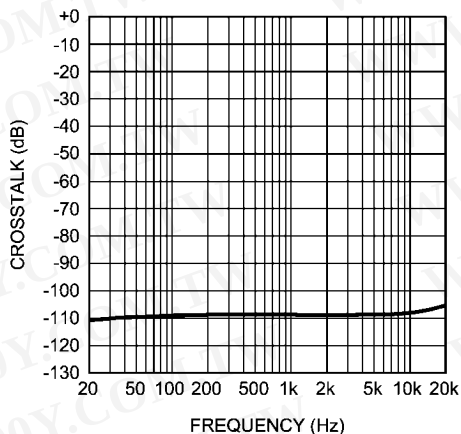
201572d4

Crosstalk vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 600\Omega$



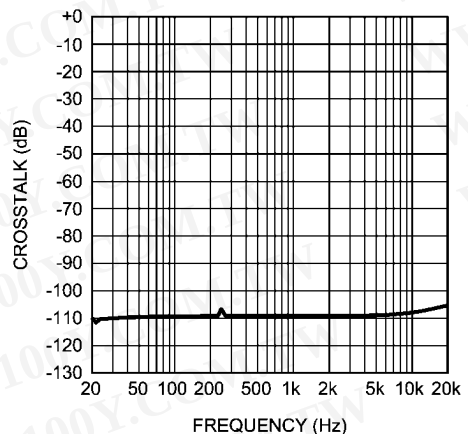
201572d5

Crosstalk vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 600\Omega$



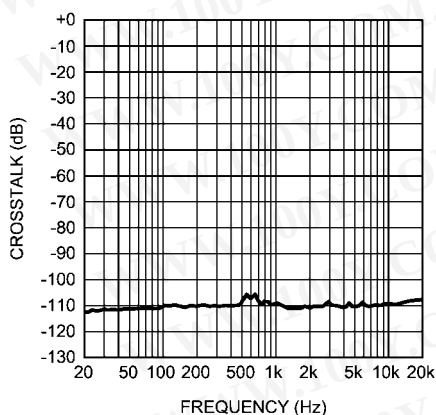
201572d8

Crosstalk vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 600\Omega$



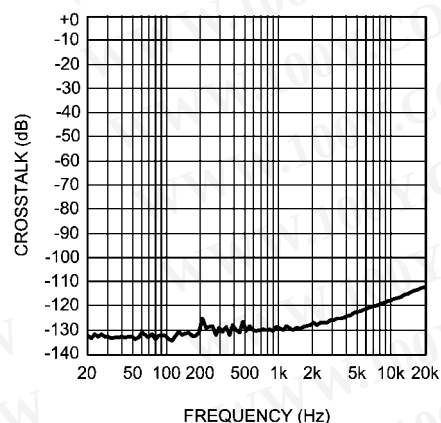
201572d9

Crosstalk vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$, $V_{OUT} = 1V_{RMS}$
 $A_V = 0dB$, $R_L = 600\Omega$



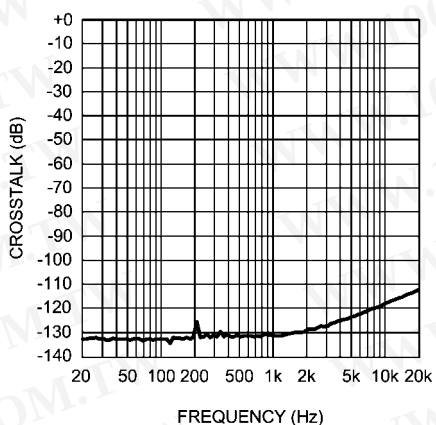
201572d2

Crosstalk vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 10k\Omega$



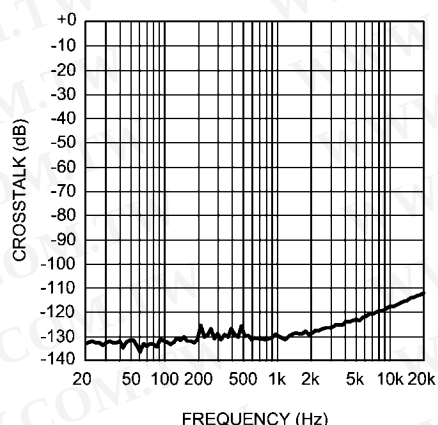
201572o0

Crosstalk vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 10k\Omega$



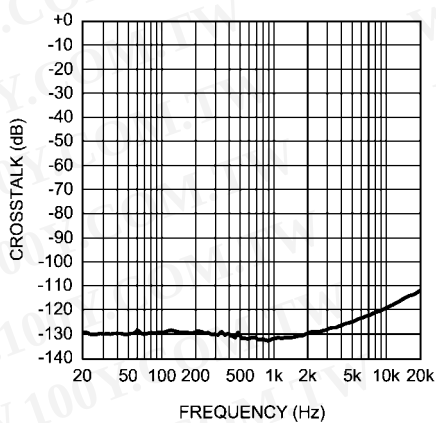
201572n7

Crosstalk vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 10k\Omega$



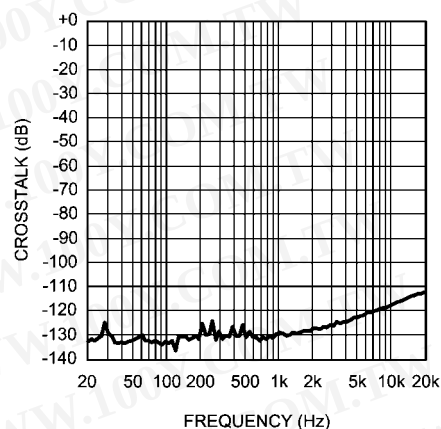
201572n9

Crosstalk vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 10k\Omega$



201572n6

Crosstalk vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$, $V_{OUT} = 3V_{RMS}$
 $A_V = 0dB$, $R_L = 10k\Omega$

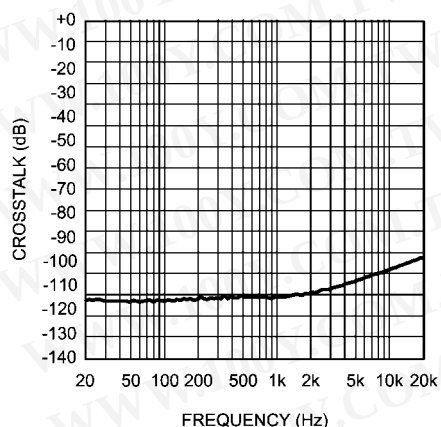


201572n5

勝特力材料 86-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787

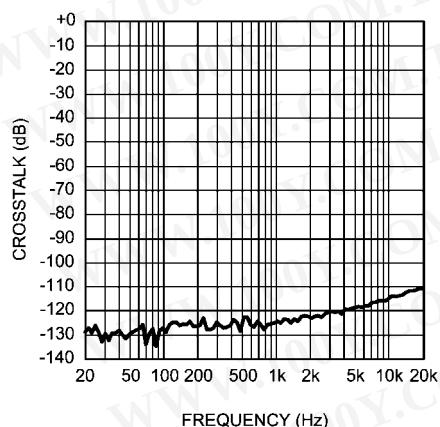
[Http://www.100y.com.tw](http://www.100y.com.tw)

Crosstalk vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$, $V_{OUT} = 10V_{RMS}$
 $A_V = 0dB$, $R_L = 10k\Omega$



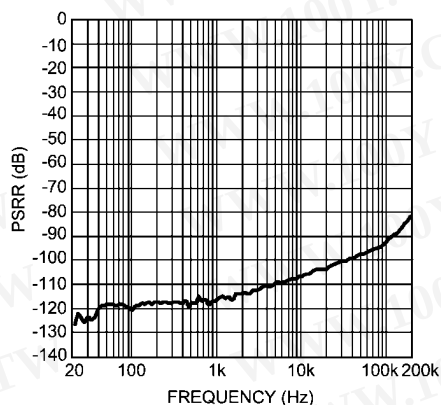
201572n3

Crosstalk vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$, $V_{OUT} = 1V_{RMS}$
 $A_V = 0dB$, $R_L = 10k\Omega$



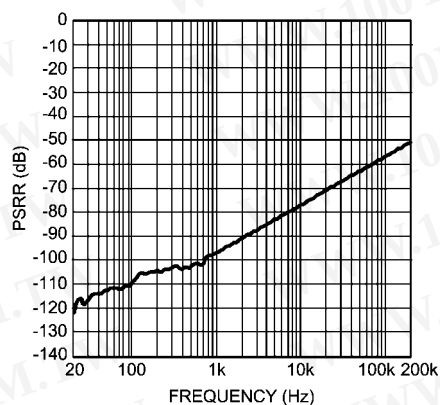
201572n4

PSRR+ vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 10k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



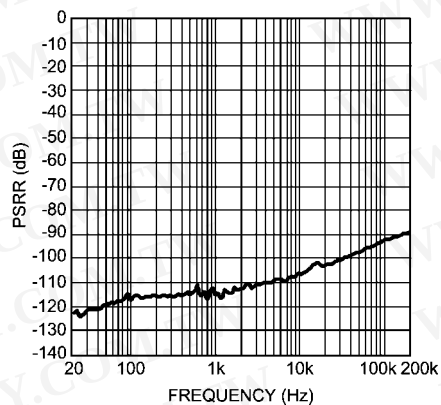
201572p1

PSRR- vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 10k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



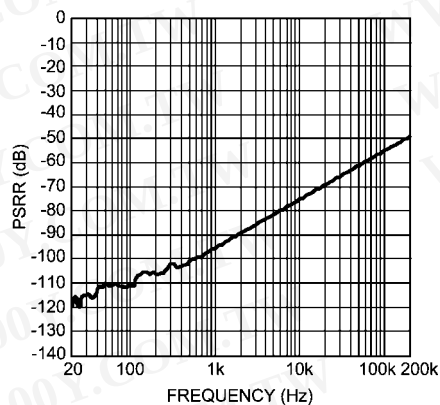
201572p4

PSRR+ vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 2k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



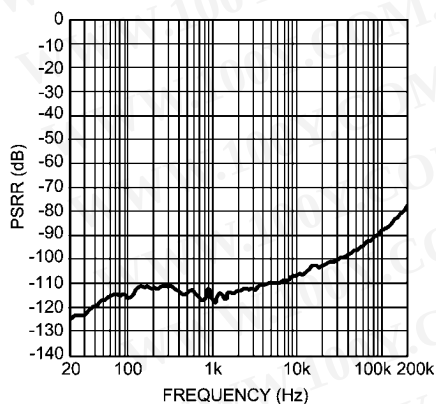
201572p2

PSRR- vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 2k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



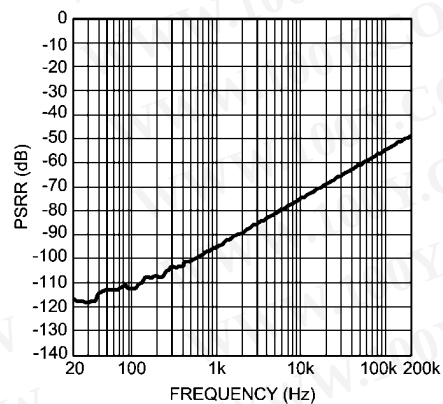
201572p5

PSRR+ vs Frequency
 $V_{CC} = 15V, V_{EE} = -15V$
 $R_L = 600\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



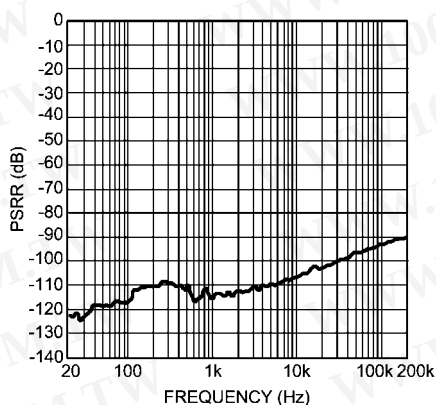
201572p0

PSRR- vs Frequency
 $V_{CC} = 15V, V_{EE} = -15V$
 $R_L = 600\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



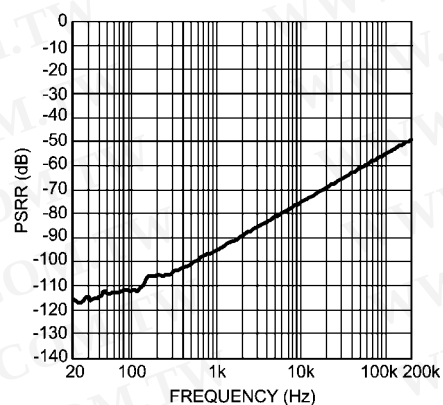
201572p3

PSRR+ vs Frequency
 $V_{CC} = 12V, V_{EE} = -12V$
 $R_L = 10k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



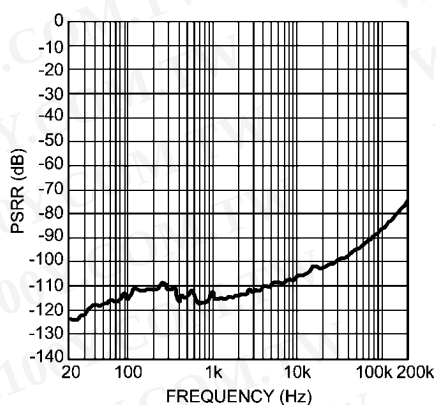
201572p7

PSRR- vs Frequency
 $V_{CC} = 12V, V_{EE} = -12V$
 $R_L = 10k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



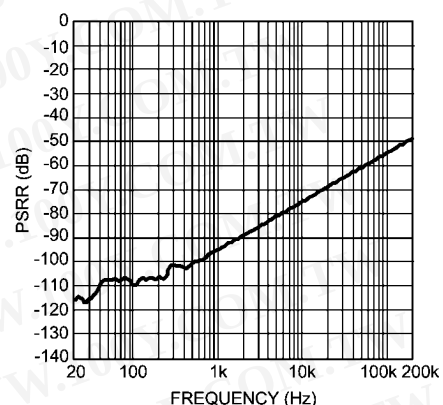
201572q0

PSRR+ vs Frequency
 $V_{CC} = 12V, V_{EE} = -12V$
 $R_L = 2k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



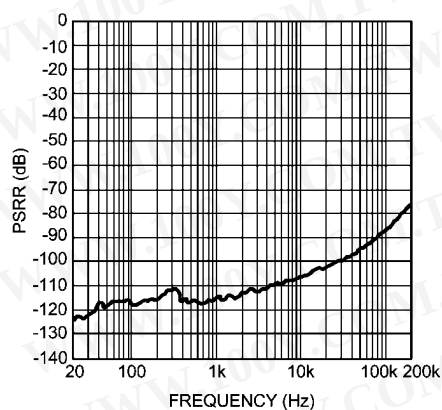
201572p8

PSRR- vs Frequency
 $V_{CC} = 12V, V_{EE} = -12V$
 $R_L = 2k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



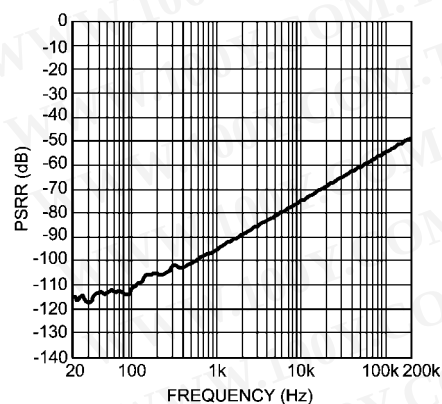
201572q1

PSRR+ vs Frequency
 $V_{CC} = 12V, V_{EE} = -12V$
 $R_L = 600\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



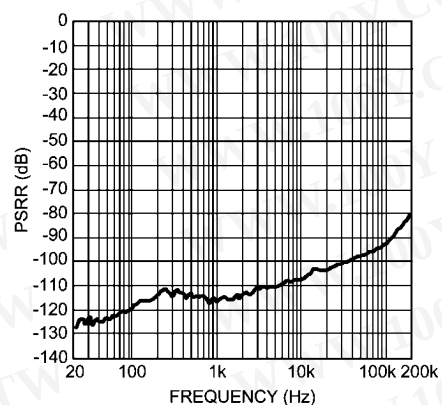
201572p6

PSRR- vs Frequency
 $V_{CC} = 12V, V_{EE} = -12V$
 $R_L = 600\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



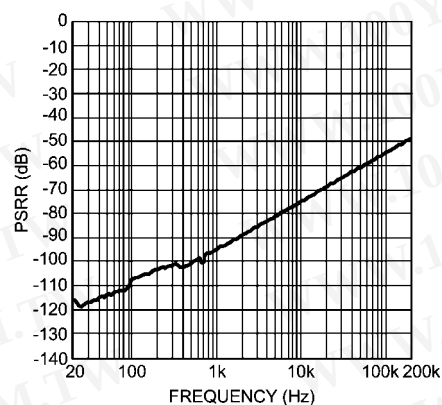
201572p9

PSRR+ vs Frequency
 $V_{CC} = 17V, V_{EE} = -17V$
 $R_L = 10k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



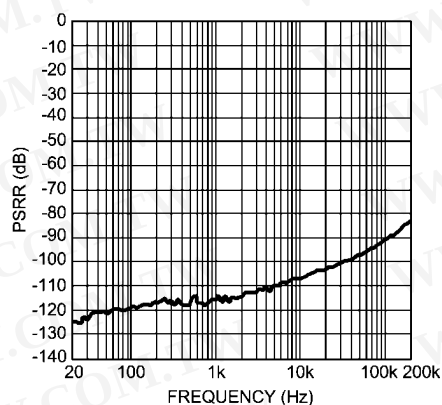
201572q9

PSRR- vs Frequency
 $V_{CC} = 17V, V_{EE} = -17V$
 $R_L = 10k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



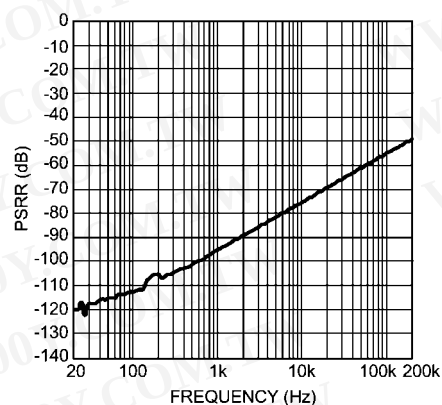
201572r2

PSRR+ vs Frequency
 $V_{CC} = 17V, V_{EE} = -17V$
 $R_L = 2k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



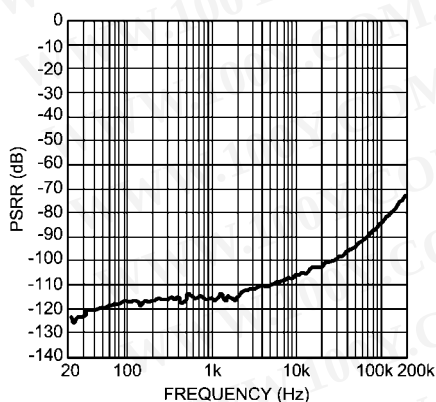
201572r0

PSRR- vs Frequency
 $V_{CC} = 17V, V_{EE} = -17V$
 $R_L = 2k\Omega, f = 200kHz, V_{RIPPLE} = 200mV_{pp}$



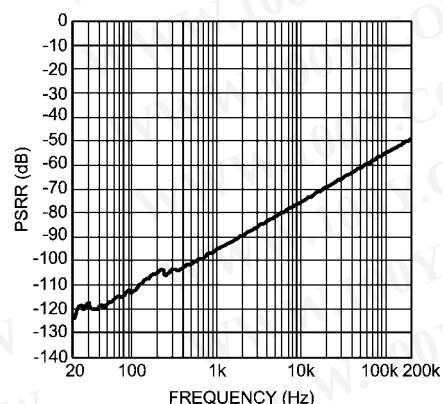
201572r3

PSRR+ vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 600\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



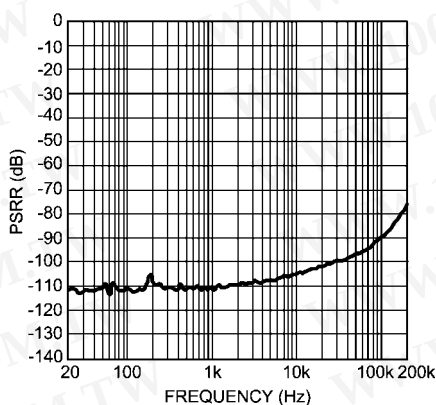
201572q8

PSRR- vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 600\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



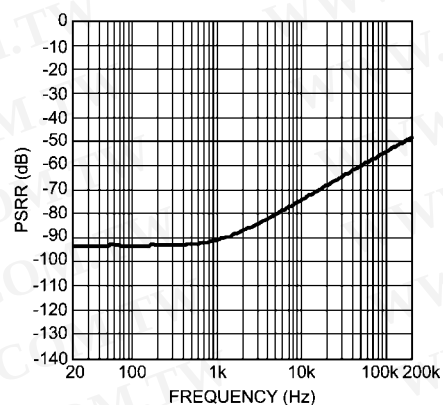
201572r1

PSRR+ vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 10k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



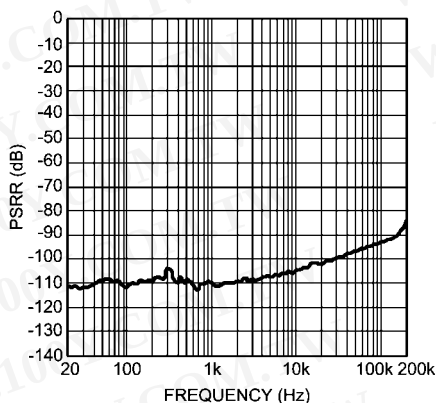
201572q3

PSRR- vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 10k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



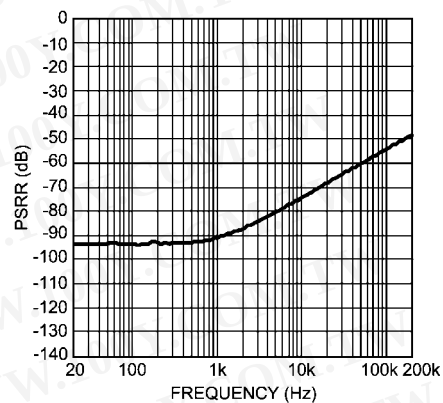
201572q6

PSRR+ vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 2k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



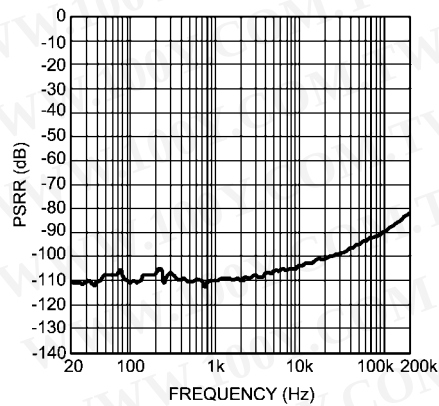
201572q4

PSRR- vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 2k\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



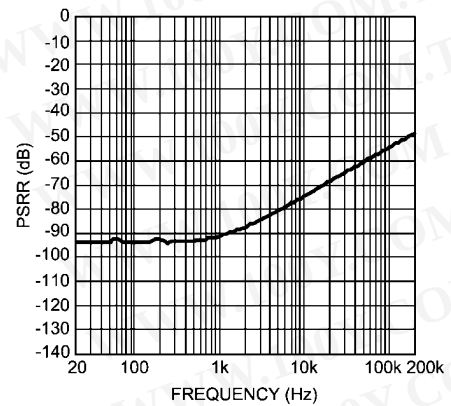
201572q7

PSRR+ vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 600\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



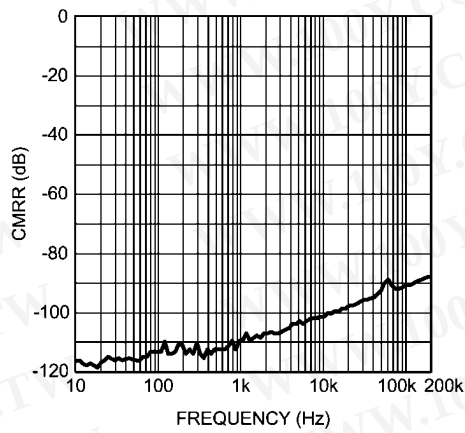
201572q2

PSRR- vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 600\Omega$, $f = 200kHz$, $V_{RIPPLE} = 200mV_{pp}$



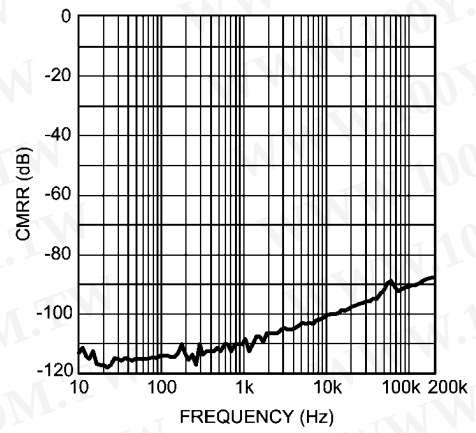
201572q5

CMRR vs Frequency
 $V_{CC} = 15V$, $V_{EE} = -15V$
 $R_L = 2k\Omega$



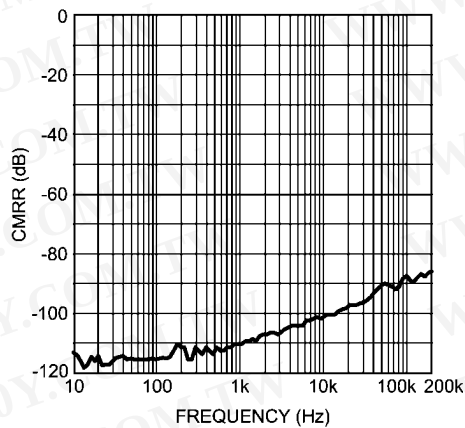
201572g0

CMRR vs Frequency
 $V_{CC} = 12V$, $V_{EE} = -12V$
 $R_L = 2k\Omega$



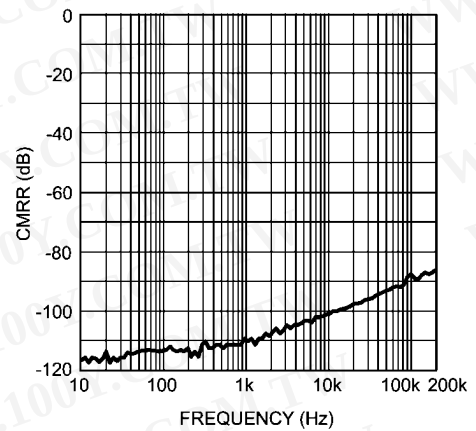
201572f7

CMRR vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 2k\Omega$

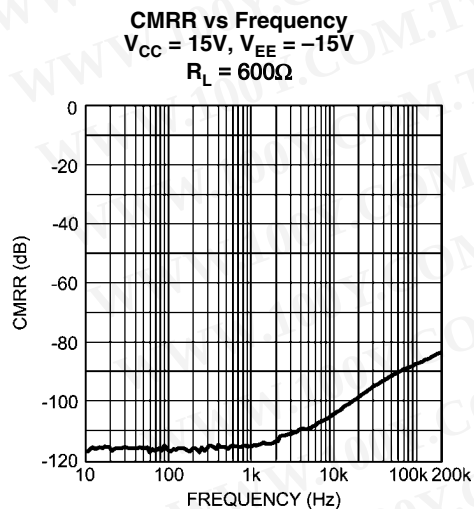


201572g3

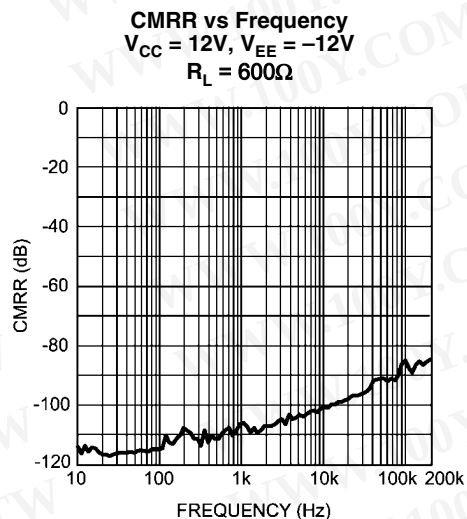
CMRR vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 2k\Omega$



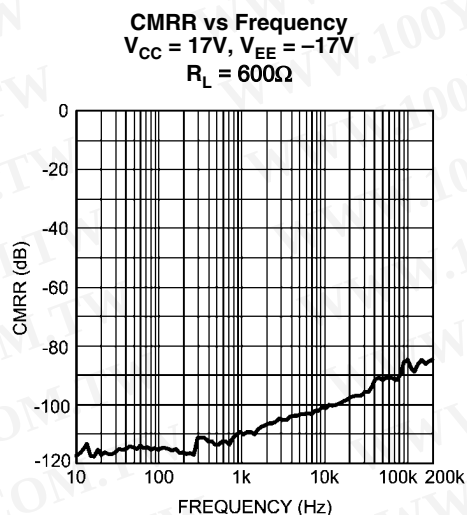
201572f4



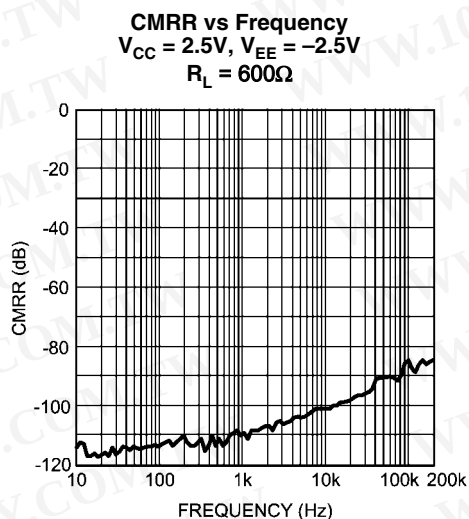
201572o9



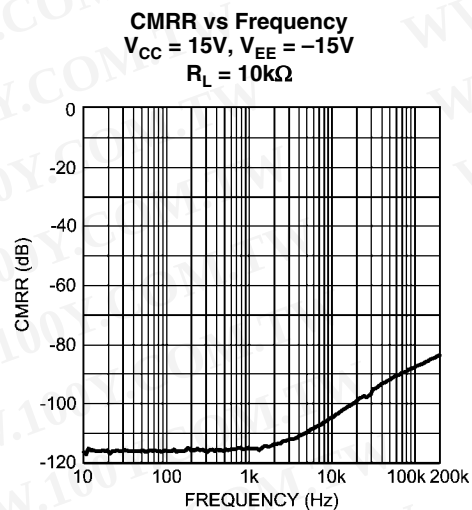
201572f9



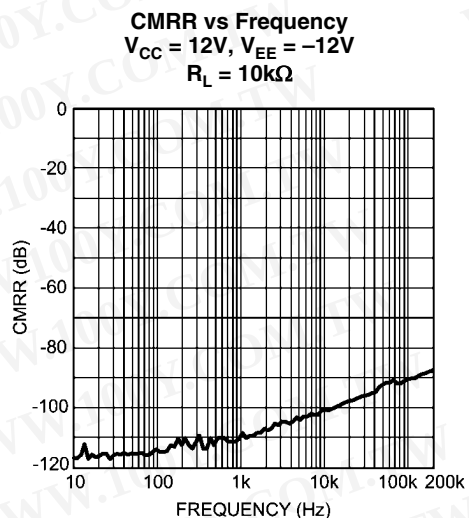
201572g5



201572f6



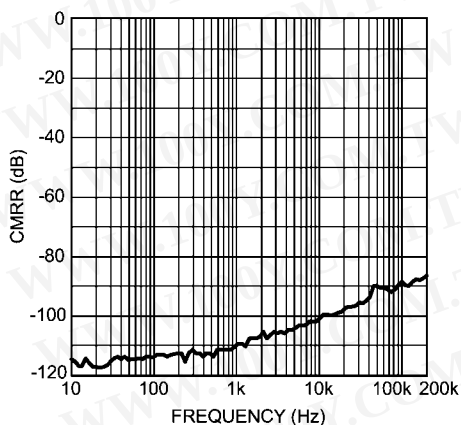
201572o8



201572f8

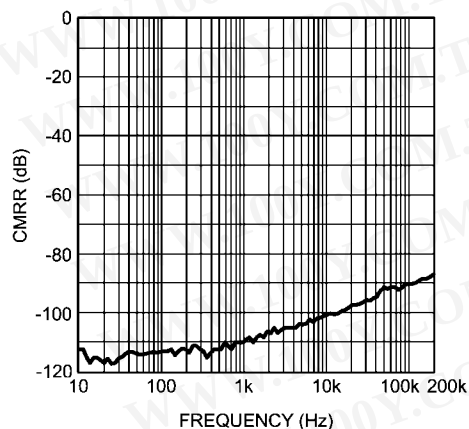
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

CMRR vs Frequency
 $V_{CC} = 17V$, $V_{EE} = -17V$
 $R_L = 10k\Omega$



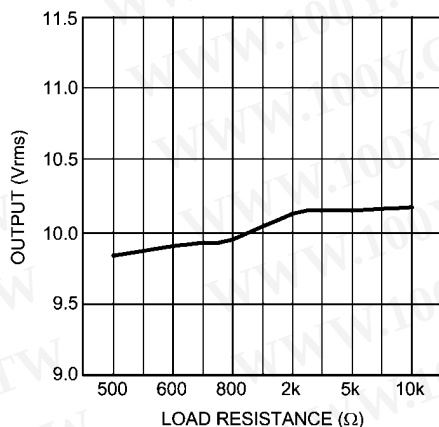
201572g4

CMRR vs Frequency
 $V_{CC} = 2.5V$, $V_{EE} = -2.5V$
 $R_L = 10k\Omega$



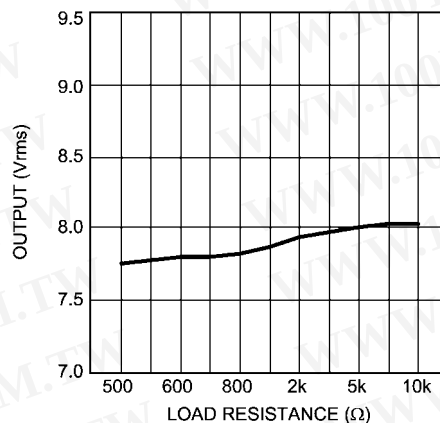
201572f5

Output Voltage vs Load Resistance
 $V_{DD} = 15V$, $V_{EE} = -15V$
 $THD+N = 1\%$



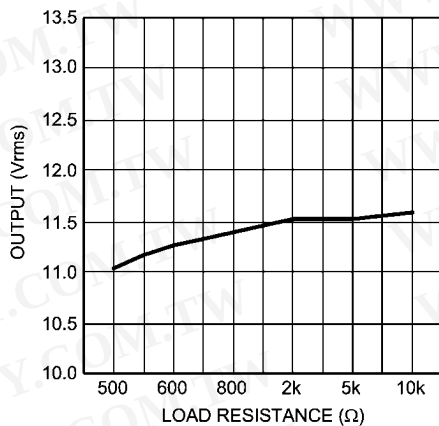
201572h1

Output Voltage vs Load Resistance
 $V_{DD} = 12V$, $V_{EE} = -12V$
 $THD+N = 1\%$



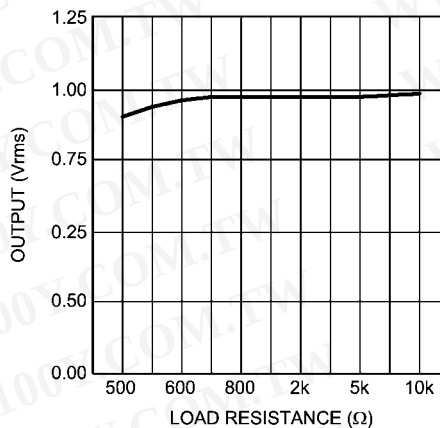
201572h0

Output Voltage vs Load Resistance
 $V_{DD} = 17V$, $V_{EE} = -17V$
 $THD+N = 1\%$

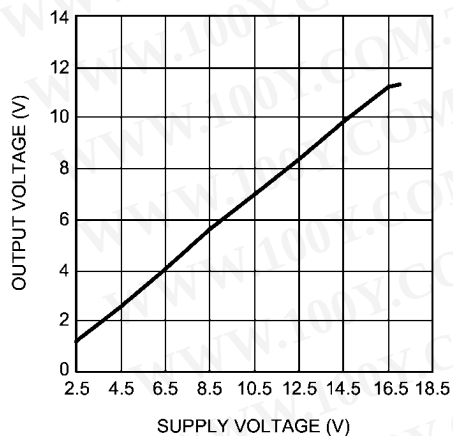


201572h2

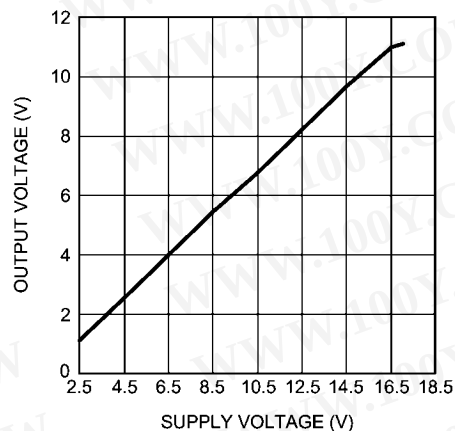
Output Voltage vs Load Resistance
 $V_{DD} = 2.5V$, $V_{EE} = -2.5V$
 $THD+N = 1\%$



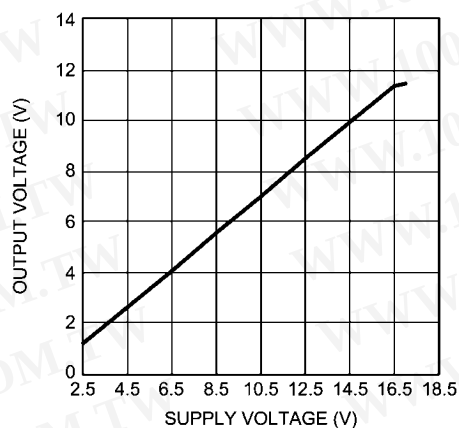
201572g9

Output Voltage vs Supply Voltage $R_L = 2k\Omega$, THD+N = 1%

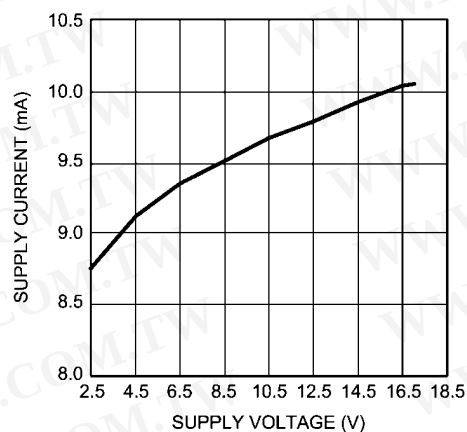
201572j9

Output Voltage vs Supply Voltage $R_L = 600\Omega$, THD+N = 1%

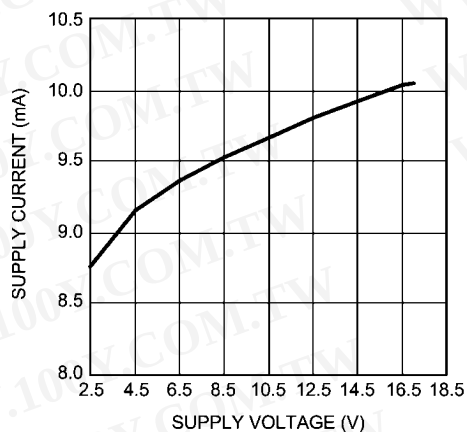
201572j8

Output Voltage vs Supply Voltage $R_L = 10k\Omega$, THD+N = 1%

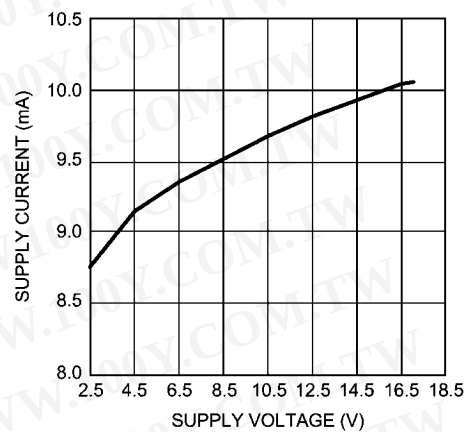
201572k0

Supply Current vs Supply Voltage $R_L = 2k\Omega$ 

201572j6

Supply Current vs Supply Voltage $R_L = 600\Omega$ 

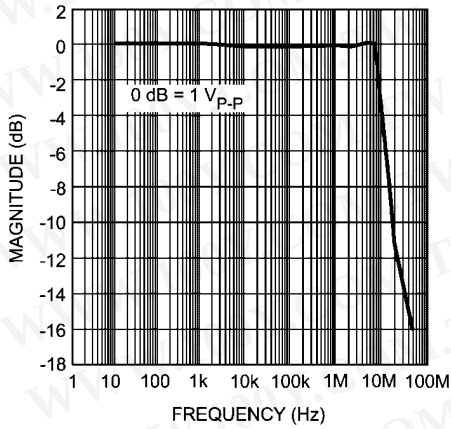
201572j5

Supply Current vs Supply Voltage $R_L = 10k\Omega$ 

201572j7

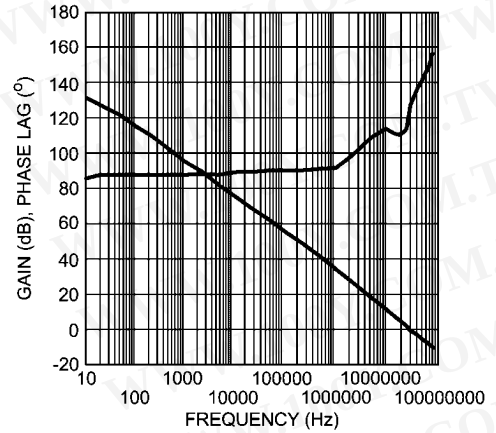
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Full Power Bandwidth vs Frequency

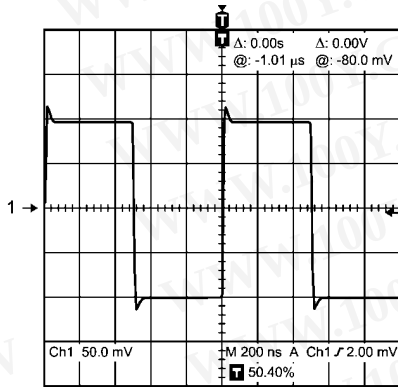


201572j0

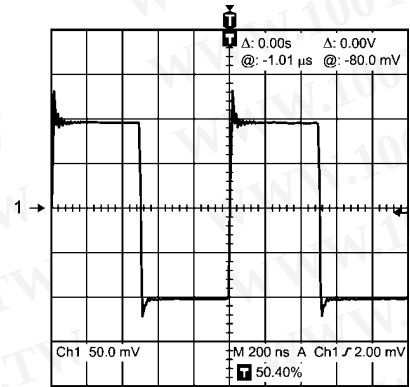
Gain Phase vs Frequency



201572j1

Small-Signal Transient Response
 $A_V = 1$, $C_L = 10\text{pF}$ 

201572i7

Small-Signal Transient Response
 $A_V = 1$, $C_L = 100\text{pF}$ 

201572i8

勝 特 力 材 料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Application Information

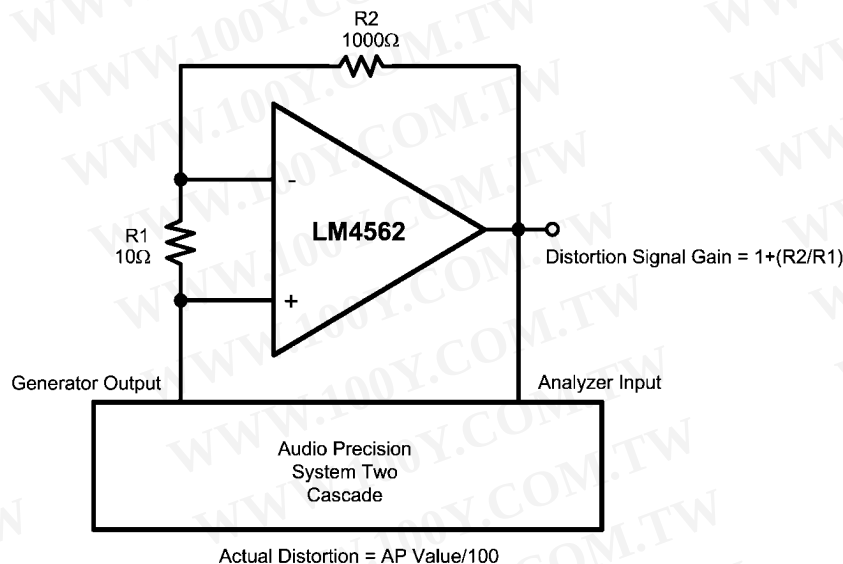
DISTORTION MEASUREMENTS

The vanishingly low residual distortion produced by LM4562 is below the capabilities of all commercially available equipment. This makes distortion measurements just slightly more difficult than simply connecting a distortion meter to the amplifier's inputs and outputs. The solution, however, is quite simple: an additional resistor. Adding this resistor extends the resolution of the distortion measurement equipment.

The LM4562's low residual distortion is an input referred internal error. As shown in Figure 1, adding the 10Ω resistor connected between the amplifier's inverting and non-inverting inputs changes the amplifier's noise gain. The result is that

the error signal (distortion) is amplified by a factor of 101. Although the amplifier's closed-loop gain is unaltered, the feedback available to correct distortion errors is reduced by 101, which means that measurement resolution increases by 101. To ensure minimum effects on distortion measurements, keep the value of R1 low as shown in Figure 1.

This technique is verified by duplicating the measurements with high closed loop gain and/or making the measurements at high frequencies. Doing so produces distortion components that are within the measurement equipment's capabilities. This datasheet's THD+N and IMD values were generated using the above described circuit connected to an Audio Precision System Two Cascade.



201572k4

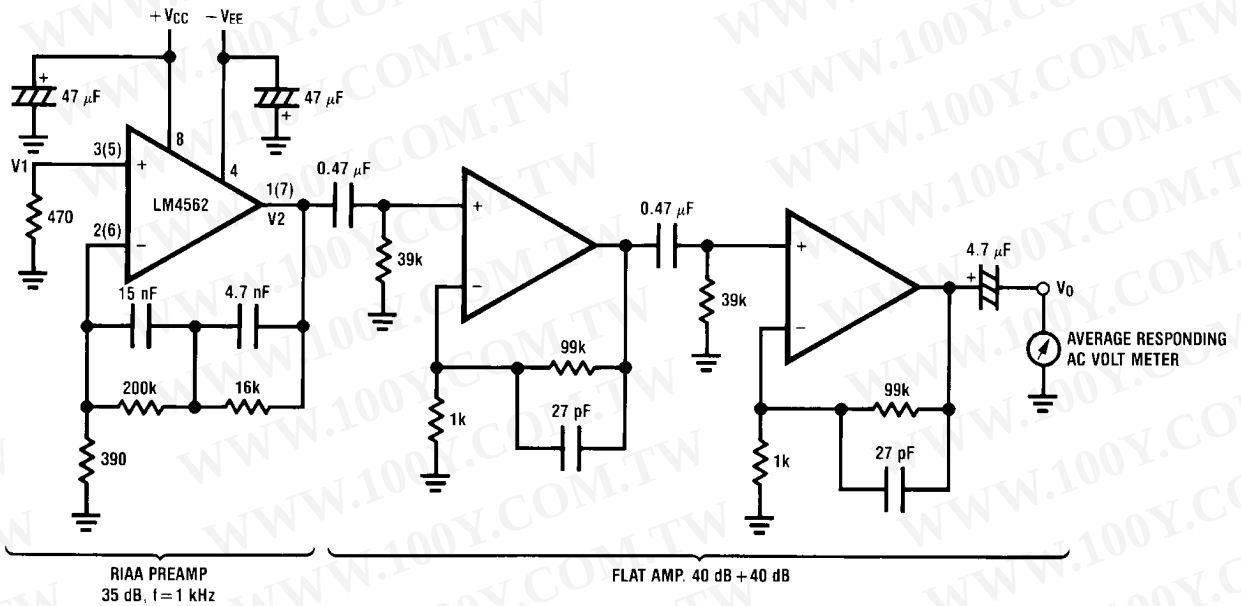
FIGURE 1. THD+N and IMD Distortion Test Circuit

勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

The LM4562 is a high speed op amp with excellent phase margin and stability. Capacitive loads up to 100pF will cause little change in the phase characteristics of the amplifiers and are therefore allowable.

Capacitive loads greater than 100pF must be isolated from the output. The most straightforward way to do this is to put

a resistor in series with the output. This resistor will also prevent excess power dissipation if the output is accidentally shorted.

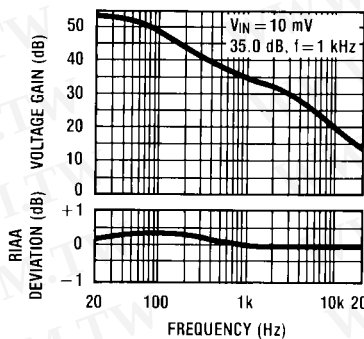


Complete shielding is required to prevent induced pick up from external sources. Always check with oscilloscope for power line noise.

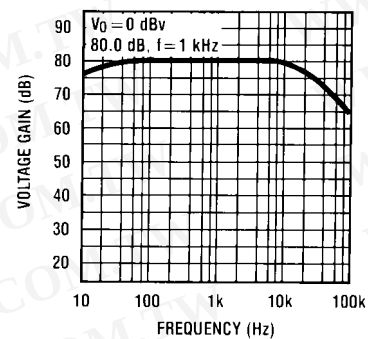
20157227

Noise Measurement Circuit
Total Gain: 115 dB @ $f = 1$ kHz
Input Referred Noise Voltage: $e_n = V_0/560,000$ (V)

RIAA Preamp Voltage Gain, RIAA Deviation vs Frequency



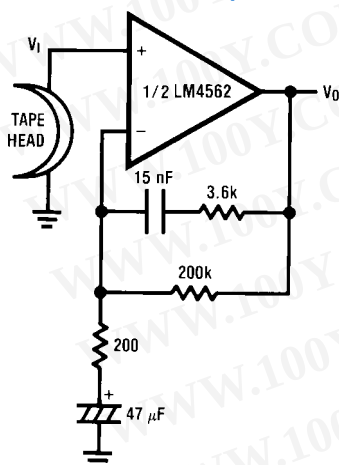
Flat Amp Voltage Gain vs Frequency



勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

TYPICAL APPLICATIONS

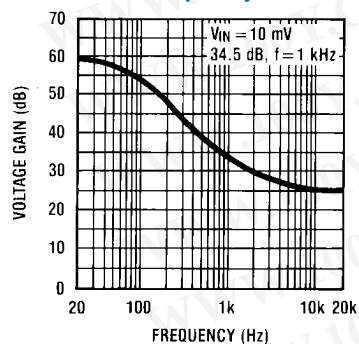
NAB Preamp



20157230

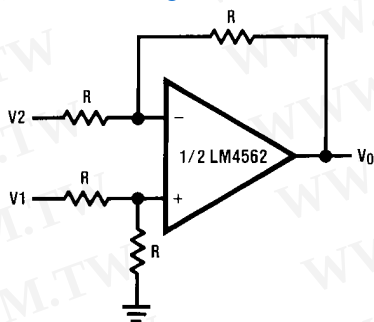
$A_v = 34.5$
 $F = 1 \text{ kHz}$
 $E_n = 0.38 \mu\text{V}$
 A Weighted

NAB Preamp Voltage Gain vs Frequency



20157231

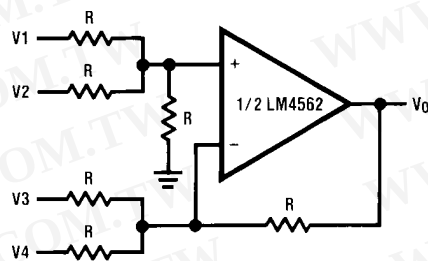
Balanced to Single Ended Converter



20157232

$$V_O = V_1 - V_2$$

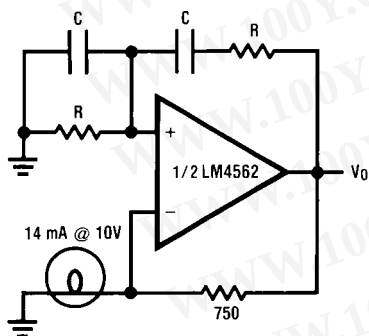
Adder/Subtractor



20157233

$$V_O = V_1 + V_2 - V_3 - V_4$$

Sine Wave Oscillator

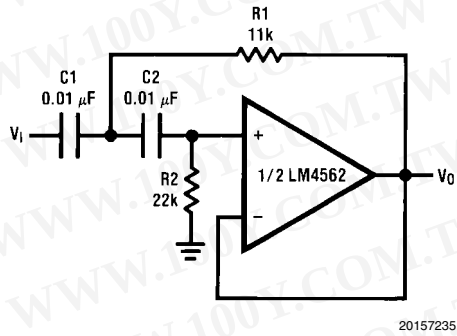


20157234

$$f_o = \frac{1}{2\pi RC}$$

勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Second Order High Pass Filter (Butterworth)



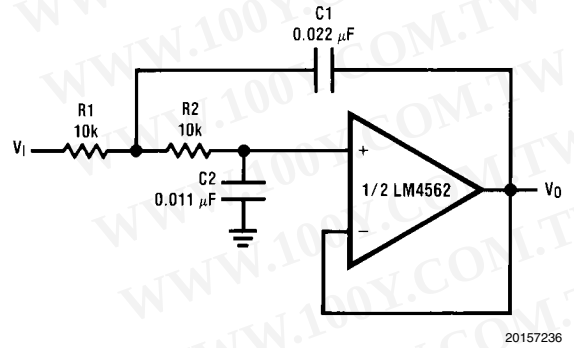
if $C_1 = C_2 = C$

$$R_1 = \frac{\sqrt{2}}{2\omega_0 C}$$

$$R_2 = 2 \cdot R_1$$

Illustration is $f_0 = 1 \text{ kHz}$

Second Order Low Pass Filter (Butterworth)



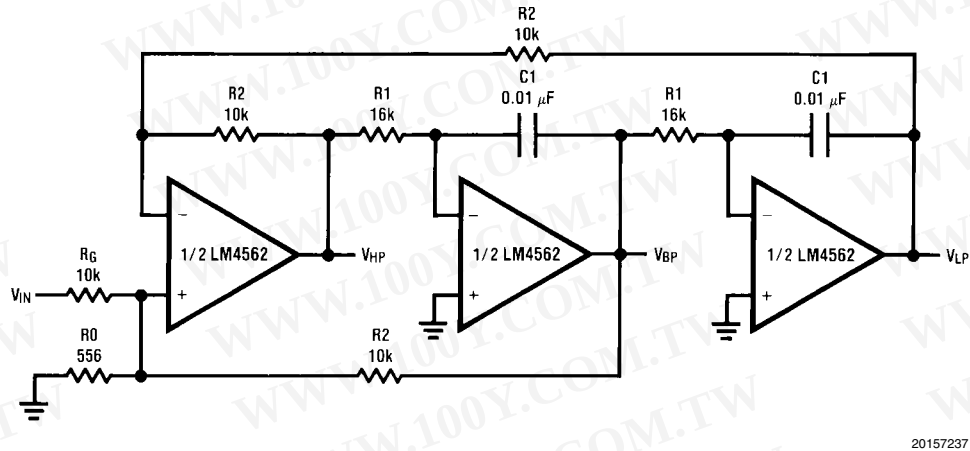
if $R_1 = R_2 = R$

$$C_1 = \frac{\sqrt{2}}{\omega_0 R}$$

$$C_2 = \frac{C_1}{2}$$

Illustration is $f_0 = 1 \text{ kHz}$

State Variable Filter

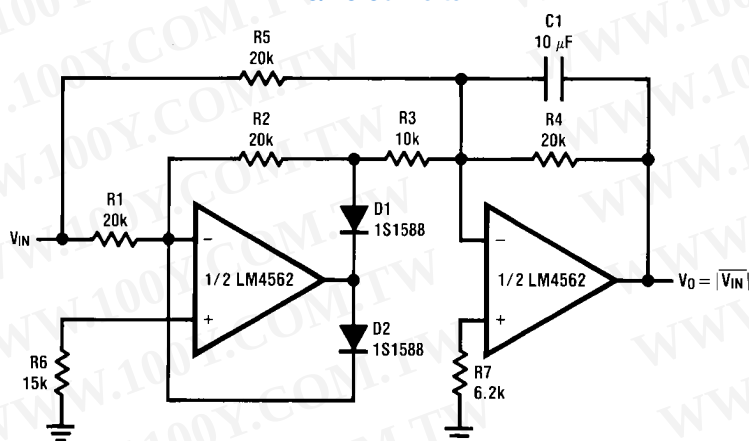


$$f_0 = \frac{1}{2\pi C_1 R_1}, Q = \frac{1}{2} \left(1 + \frac{R_2}{R_0} + \frac{R_2}{R_G} \right), A_{BP} = Q A_{LP} = Q A_{LH} = \frac{R_2}{R_G}$$

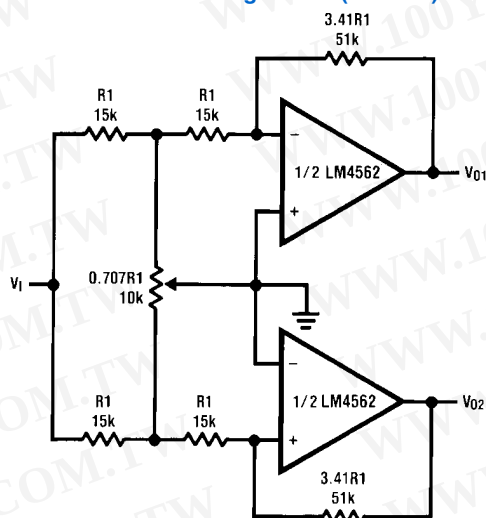
Illustration is $f_0 = 1 \text{ kHz}$, $Q = 10$, $A_{BP} = 1$

勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

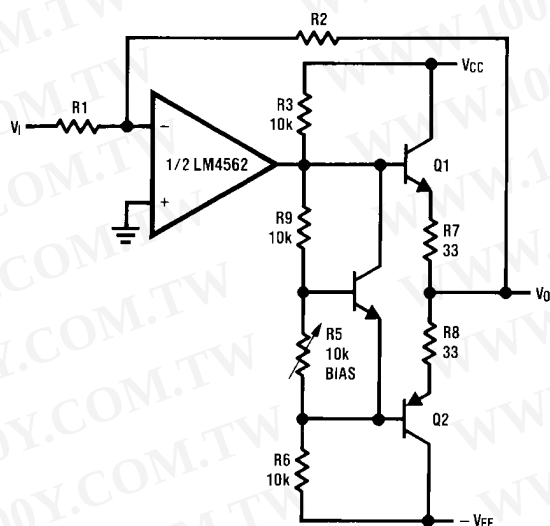
AC/DC Converter



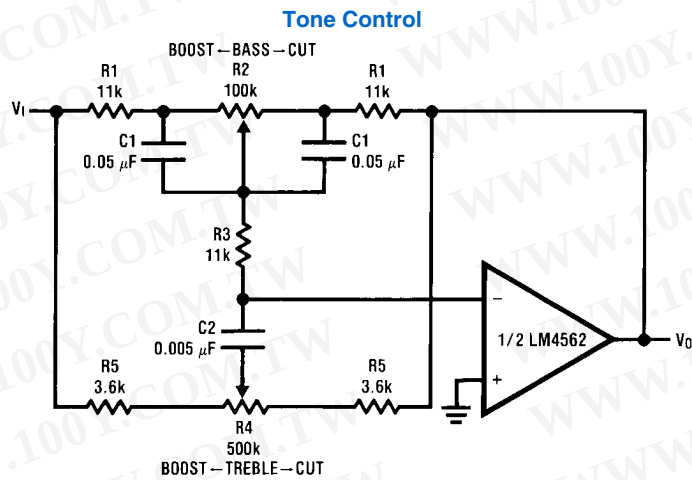
2 Channel Panning Circuit (Pan Pot)



Line Driver



勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)



$$f_L \approx \frac{1}{2\pi R_2 C_1}, f_{LB} \approx \frac{1}{2\pi R_1 C_1}$$

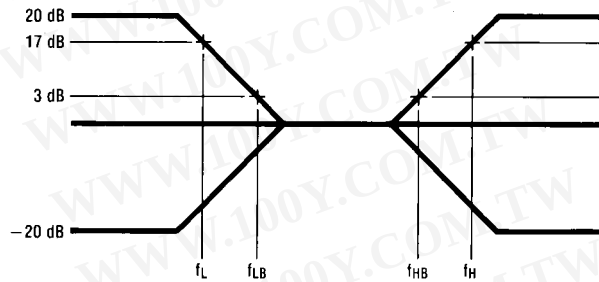
$$f_H \approx \frac{1}{2\pi R_5 C_2}, f_{HB} \approx \frac{1}{2\pi (R_1 + R_5 + 2R_3) C_2}$$

Note: The equations started above are simplifications, providing guidance of general -3dB point values, when the potentiometers are at their null position.

Illustration is:

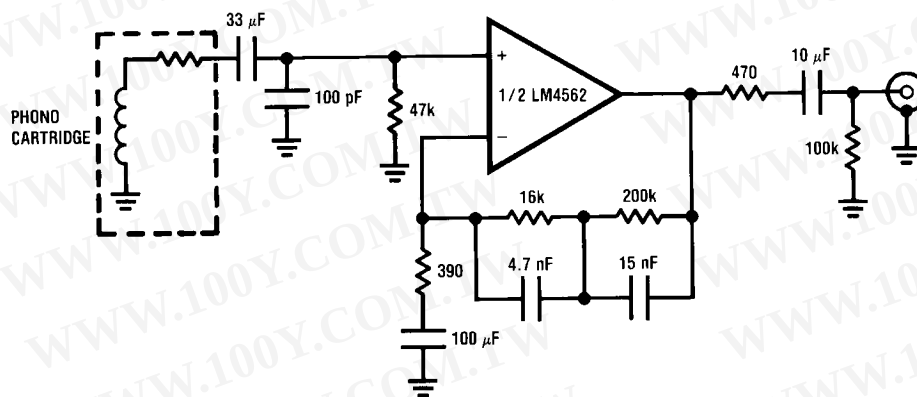
$$f_L \approx 32 \text{ Hz}, f_{LB} \approx 320 \text{ Hz}$$

$$f_H \approx 11 \text{ kHz}, f_{HB} \approx 1.1 \text{ kHz}$$



勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

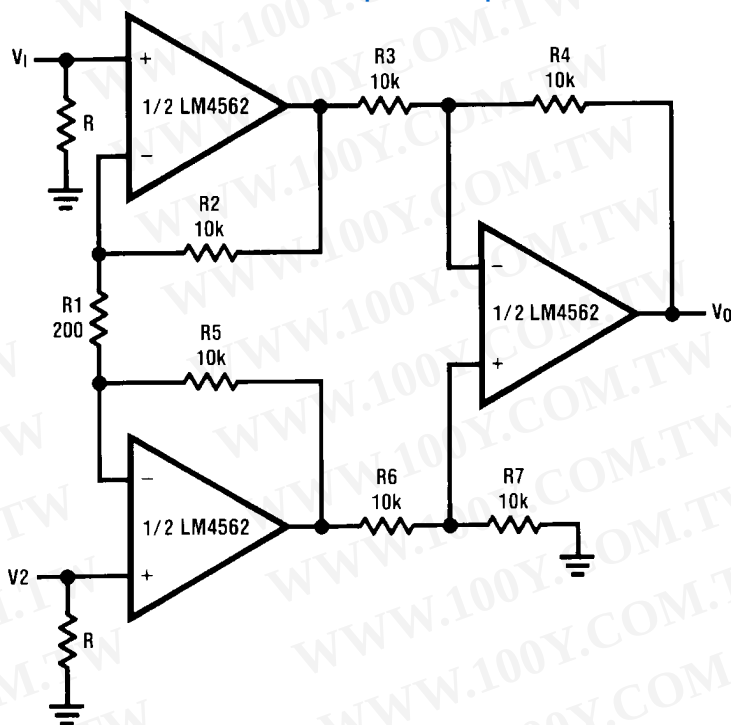
RIAA Preamp



20157203

$A_v = 35 \text{ dB}$
 $E_n = 0.33 \mu\text{V}$
 $S/N = 90 \text{ dB}$
 $f = 1 \text{ kHz}$
 $A \text{ Weighted}$
 $A \text{ Weighted, } V_{IN} = 10 \text{ mV}$
 $@f = 1 \text{ kHz}$

Balanced Input Mic Amp



20157243

If $R_2 = R_5, R_3 = R_6, R_4 = R_7$

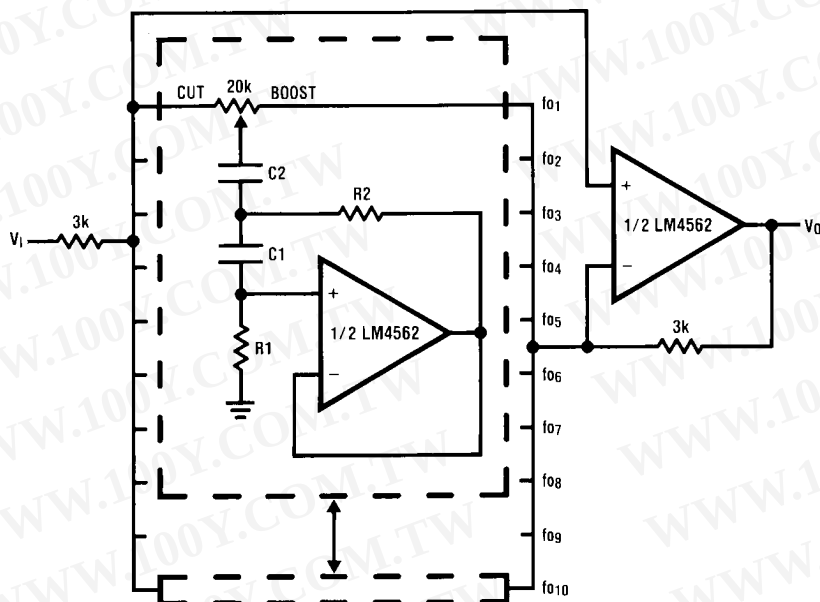
$$V_0 = \left(1 + \frac{2R_2}{R_1}\right) \frac{R_4}{R_3} (V_2 - V_1)$$

Illustration is:

$$V_0 = 101(V_2 - V_1)$$

勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

10 Band Graphic Equalizer



20157244

fo (Hz)	C ₁	C ₂	R ₁	R ₂
32	0.12μF	4.7μF	75kΩ	500Ω
64	0.056μF	3.3μF	68kΩ	510Ω
125	0.033μF	1.5μF	62kΩ	510Ω
250	0.015μF	0.82μF	68kΩ	470Ω
500	8200pF	0.39μF	62kΩ	470Ω
1k	3900pF	0.22μF	68kΩ	470Ω
2k	2000pF	0.1μF	68kΩ	470Ω
4k	1100pF	0.056μF	62kΩ	470Ω
8k	510pF	0.022μF	68kΩ	510Ω
16k	330pF	0.012μF	51kΩ	510Ω

Note 9: At volume of change = ± 12 dB

Q = 1.7

Reference: "AUDIO/RADIO HANDBOOK", National Semiconductor, 1980, Page 2-61

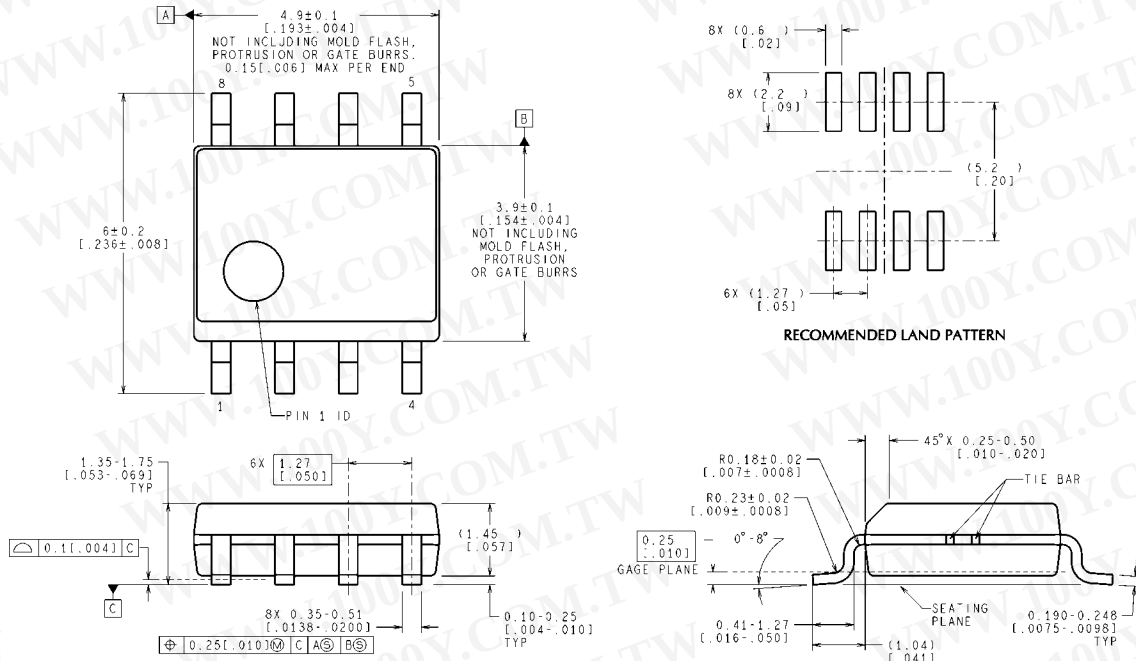
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Revision History

Rev	Date	Description
1.0	08/16/06	Initial release.
1.1	08/22/06	Updated the Instantaneous Short Circuit Current specification.
1.2	09/12/06	Updated the three $\pm 15V$ CMRR Typical Performance Curves.
1.3	09/26/06	Updated interstage filter capacitor values on page 1 Typical Application schematic.
1.4	05/03/07	Added the "general note" under the EC table.
1.5	10/17/07	Replaced all the PSRR curves.
1.6	01/26/10	Edited the equations on page 28 (under Tone Control).

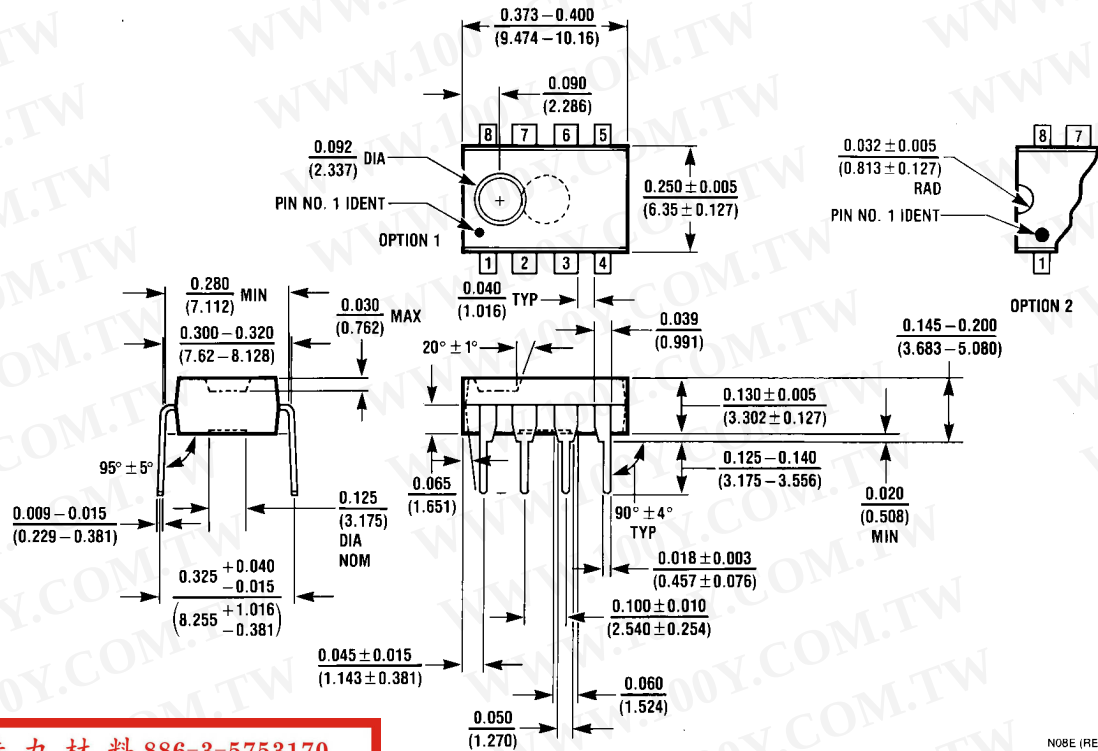
勝 特 力 材 料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Physical Dimensions inches (millimeters) unless otherwise noted



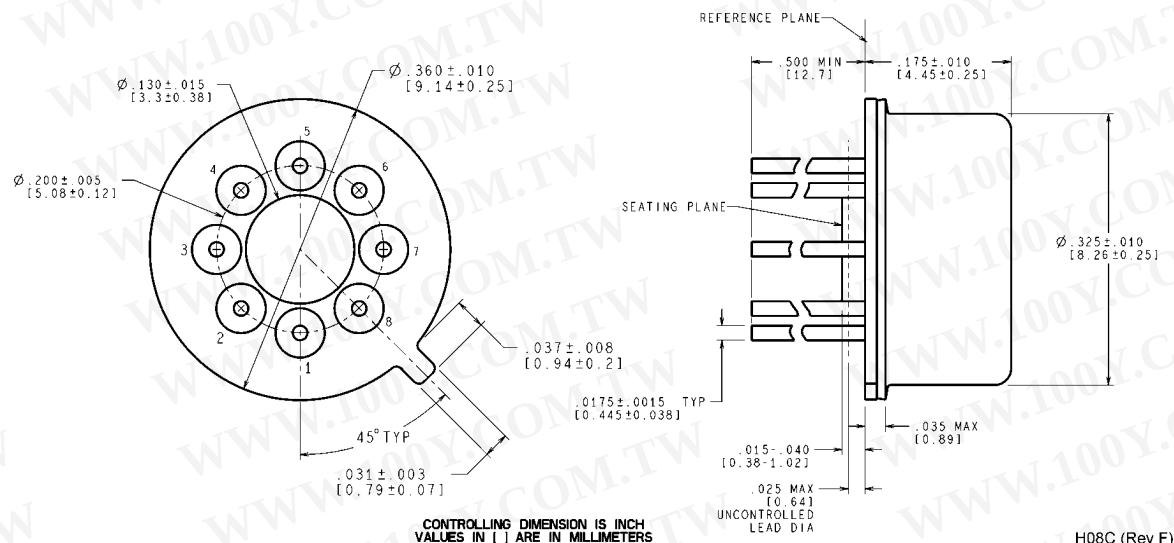
Narrow SOIC Package
Order Number LM4562MA
NS Package Number M08A

M08A (Rev M)



N08E (REV F)

勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)



CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE IN MILLIMETERS

TO-99 Metal Can Package
Order Number LM4562HA
NS Package Number H08C

H08C (Rev F)

勝 特 力 材 料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Notes

勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

For more National Semiconductor product information and proven design tools, visit the following Web sites at:
www.national.com

Products		Design Support	
Amplifiers	www.national.com/amplifiers	WEBENCH® Tools	www.national.com/webench
Audio	www.national.com/audio	App Notes	www.national.com/appnotes
Clock and Timing	www.national.com/timing	Reference Designs	www.national.com/refdesigns
Data Converters	www.national.com/adac	Samples	www.national.com/samples
Interface	www.national.com/interface	Eval Boards	www.national.com/evalboards
LVDS	www.national.com/lvds	Packaging	www.national.com/packaging
Power Management	www.national.com/power	Green Compliance	www.national.com/quality/green
Switching Regulators	www.national.com/switchers	Distributors	www.national.com/contacts
LDOs	www.national.com/ldo	Quality and Reliability	www.national.com/quality
LED Lighting	www.national.com/led	Feedback/Support	www.national.com/feedback
Voltage References	www.national.com/vref	Design Made Easy	www.national.com/easy
PowerWise® Solutions	www.national.com/powerwise	Applications & Markets	www.national.com/solutions
Serial Digital Interface (SDI)	www.national.com/sdi	Mil/Aero	www.national.com/milaero
Temperature Sensors	www.national.com/tempsensors	SolarMagic™	www.national.com/solarmagic
PLL/VCO	www.national.com/wireless	PowerWise® Design University	www.national.com/training

THE CONTENTS OF THIS DOCUMENT ARE PROVIDED IN CONNECTION WITH NATIONAL SEMICONDUCTOR CORPORATION ("NATIONAL") PRODUCTS. NATIONAL MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS PUBLICATION AND RESERVES THE RIGHT TO MAKE CHANGES TO SPECIFICATIONS AND PRODUCT DESCRIPTIONS AT ANY TIME WITHOUT NOTICE. NO LICENSE, WHETHER EXPRESS, IMPLIED, ARISING BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT.

TESTING AND OTHER QUALITY CONTROLS ARE USED TO THE EXTENT NATIONAL DEEMS NECESSARY TO SUPPORT NATIONAL'S PRODUCT WARRANTY. EXCEPT WHERE MANDATED BY GOVERNMENT REQUIREMENTS, TESTING OF ALL PARAMETERS OF EACH PRODUCT IS NOT NECESSARILY PERFORMED. NATIONAL ASSUMES NO LIABILITY FOR APPLICATIONS ASSISTANCE OR BUYER PRODUCT DESIGN. BUYERS ARE RESPONSIBLE FOR THEIR PRODUCTS AND APPLICATIONS USING NATIONAL COMPONENTS. PRIOR TO USING OR DISTRIBUTING ANY PRODUCTS THAT INCLUDE NATIONAL COMPONENTS, BUYERS SHOULD PROVIDE ADEQUATE DESIGN, TESTING AND OPERATING SAFEGUARDS.

EXCEPT AS PROVIDED IN NATIONAL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, NATIONAL ASSUMES NO LIABILITY WHATSOEVER, AND NATIONAL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE SALE AND/OR USE OF NATIONAL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

National Semiconductor and the National Semiconductor logo are registered trademarks of National Semiconductor Corporation. All other brand or product names may be trademarks or registered trademarks of their respective holders.

Copyright© 2010 National Semiconductor Corporation

For the most current product information visit us at www.national.com



**National Semiconductor
Americas Technical
Support Center**
Email: support@nsc.com
Tel: 1-800-272-9959

**National Semiconductor Europe
Technical Support Center**
Email: europe.support@nsc.com

**National Semiconductor Asia
Pacific Technical Support Center**
Email: ap.support@nsc.com

**National Semiconductor Japan
Technical Support Center**
Email: jpn.feedback@nsc.com

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Transportation and Automotive	www.ti.com/automotive
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated