



MIX205

16W 单通道防破音F类功放

描述

MIX2051是一款高效率、无输出滤波器的单声道6W带防破音功能F类音频功率放大器。

MIX2051的差分输入架构和极高的PSRR有效地提高了MIX2051对RF噪声的抑制能力。防破音功能解决了不同音源输出幅度不一致的问题，同时带来不失真的完美音乐享受。无需滤波器的PWM调制结构及增益内置方式减少了外部元件、PCB面积和系统成本，并简化了设计。高达90%的效率，快速启动时间和纤小的封装尺寸使得MIX2051成为蓝牙音箱和其他便携式音频产品的最佳选择。

MIX2051具有关断功能，极大的延长系统的待机时间。过热保护功能增强系统的可靠性。POP声抑制功能改善了系统的听觉感受，同时简化系统调试。

MIX2051提供ESOP8封装

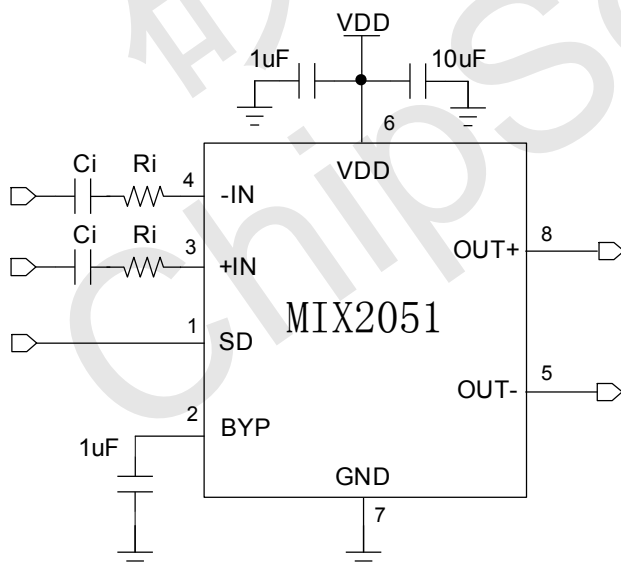
特性

- D类输出功率：
 - 6W (5.5V, $R_L = 2\ \Omega$, THD+N=10%)
 - 3.9W (5.5V, $R_L = 4\ \Omega$, THD+N=10%)
- AB类输出功率：
 - 5.3W (5.5V, $R_L = 2\ \Omega$, THD+N=10%)
 - 3.5W (5.5V, $R_L = 4\ \Omega$, THD+N=10%)
- 工作电压：2.8V to 5.5V
- 低失真和低噪声
- 两种防破音模式可选
- 防破音功能可关闭
- 开机POP声抑制功能
- 关机电流小于1 μ A
- 过热保护功能

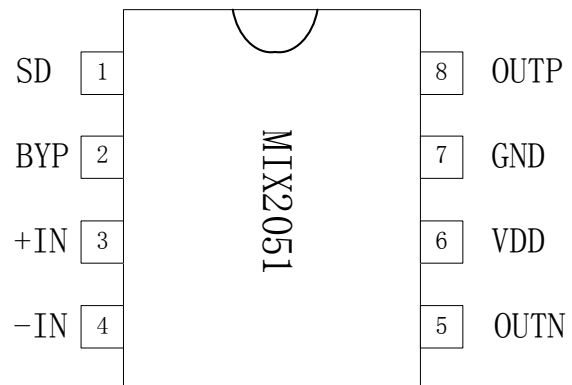
应用

- 蓝牙音箱 / 插卡音响
- 背包音箱 / 对箱

典型应用电路图



引脚排列

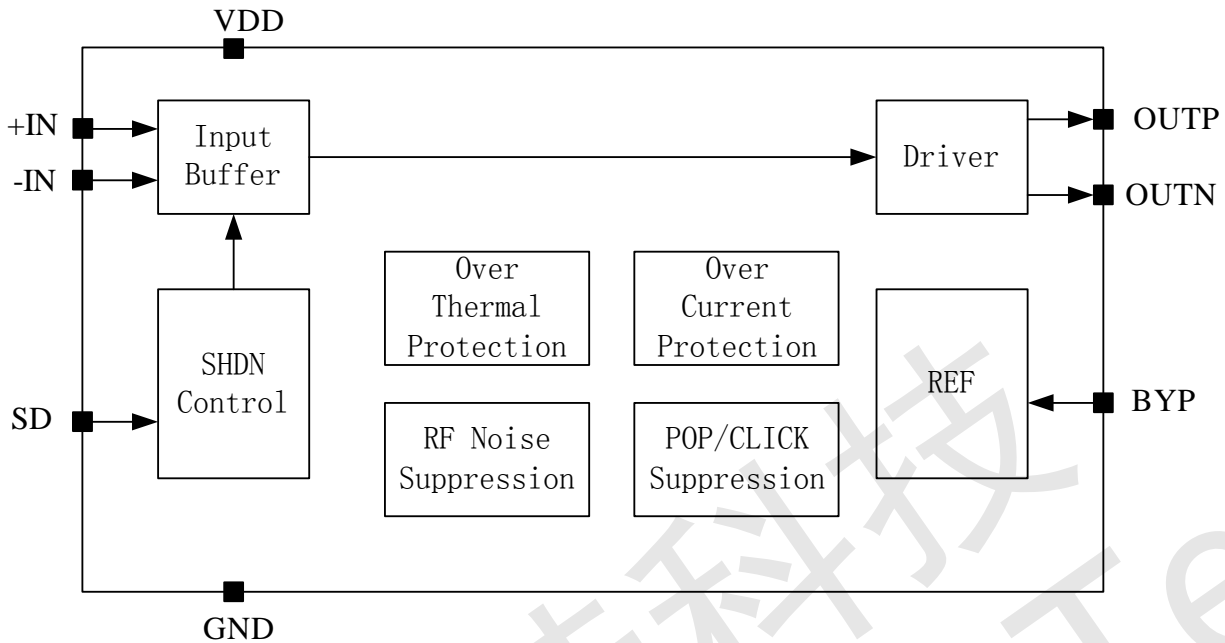




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功能框图



管脚描述

| 管脚 | 符号 | I/O | 描述 |
|----|------|-----|--|
| 1 | SD | I | 系统关断控制（高电平工作，低电平关机） 同时具有一线脉冲防破音功能控制 |
| 2 | BYP | I | 旁路 |
| 3 | +IN | I | 音频正输入端 |
| 4 | -IN | I | 音频负输入端 |
| 5 | OUTN | O | 音频负输出端 |
| 6 | VDD | | 电源 |
| 7 | GND | | 地 |
| 8 | OUTP | O | 音频正输出端 |



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订货信息

| 料号 | 封装 | 表面印字 | 包装 |
|--------------|-------|--------------------|----------|
| MIX2051-Reel | ESOP8 | MIX2051 XXXXXXX | 2500 颗/卷 |
| MIX2051-Tube | ESOP8 | MIX2051 XXXXXXX | 100 颗/管 |

绝对最大额定值

| | | |
|------------------|------|--------------------------------|
| V _{DD} | 供电电压 | -0.3V to 6.0V |
| V _I | 输入电压 | -0.3V to V _{DD} +0.3V |
| T _A | 工作温度 | -40°C to 85°C |
| T _J | 结温 | -40°C to 125°C |
| T _{STG} | 储存温度 | -65°C to 150°C |
| T _{SLD} | 焊接温度 | 300°C, 5sec |

推荐额定值

| | | | MIN | MAX | UNIT |
|-----------------|-------------|----------|-----|-----|------|
| V _{DD} | 供电电压 | VDD | 2.8 | 5.5 | V |
| V _{IH} | SD, ENB 高电平 | VDD=5.0V | 1.6 | | V |
| V _{IL} | SD, ENB 低电平 | VDD=5.0V | | 0.8 | V |

热阻参数

| Parameter | Symbol | Package | MAX | UNIT |
|-------------------------|---------------|---------|-----|------|
| 热阻(Junction to Ambient) | θ_{JA} | ESOP8 | 90 | °C/W |
| 热阻(Junction to Case) | θ_{JC} | ESOP8 | 11 | °C/W |



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D Mode Electrical Characteristics

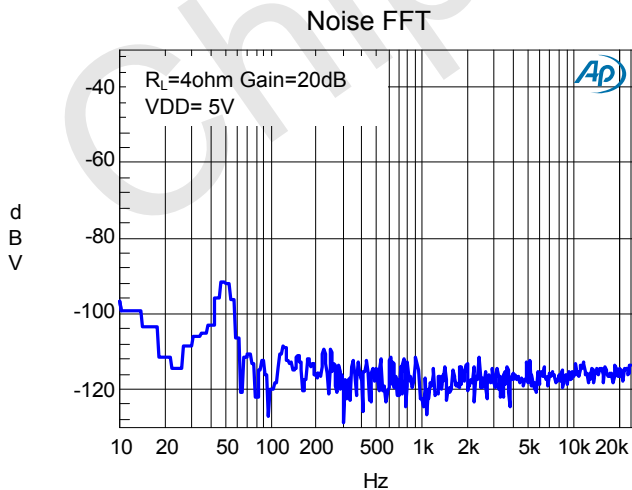
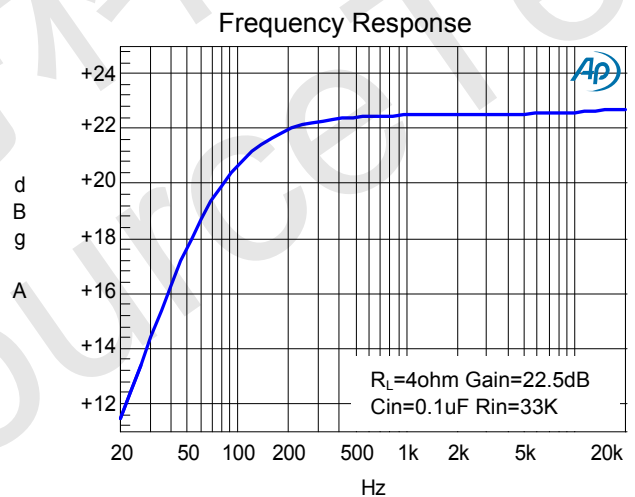
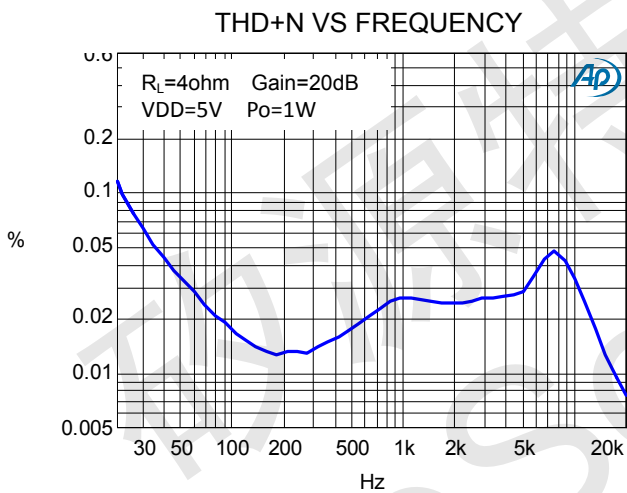
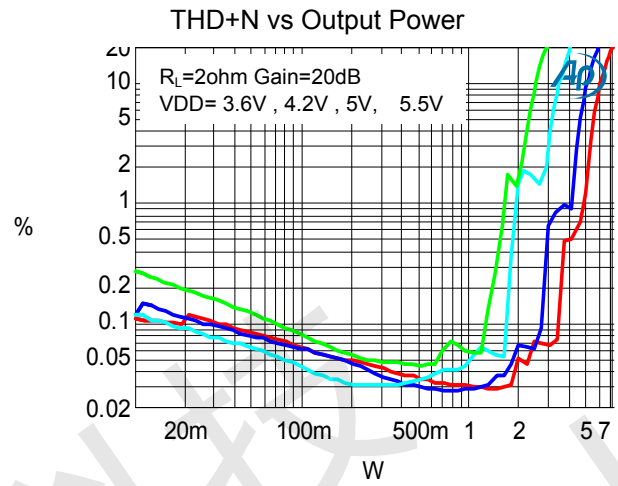
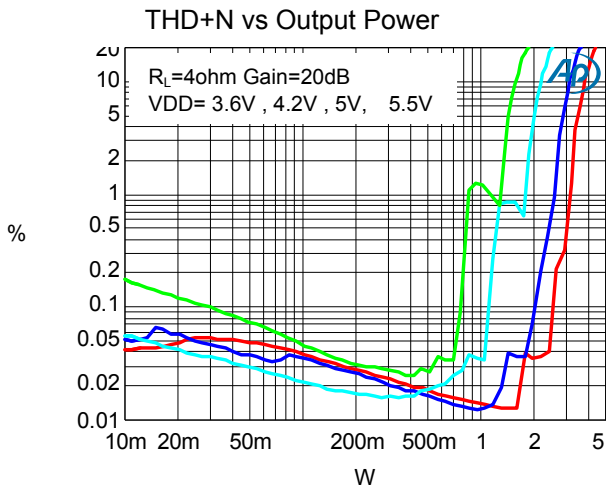
(VDD =5V, Gain=20dB, RL =4Ω, T =25°C, unless otherwise noted.)

| Symbol | Parameter | Test Conditions | MIN | TYP | MAX | UNIT |
|-----------------|--------------------------------------|---|--|-----|-----|------|
| V _{IN} | Supply Voltage | | 2.8 | - | 5.5 | V |
| P _O | Output Power | THD+N=10%,f=1KHZ,R _L =2 Ω | V _{DD} =5.0V | 5.1 | | W |
| | | | V _{DD} =3.6V | 2.5 | | |
| | | THD+N=10%,f=1KHZ,R _L =4 Ω | V _{DD} =5.0V | 3.1 | | W |
| | | | V _{DD} =3.6V | 1.6 | | |
| | | THD+N=1%,f=1KHZ,R _L =2 Ω | V _{DD} =5.0V | 4.1 | | W |
| | | | V _{DD} =3.6V | 1.7 | | |
| | | THD+N=1%,f=1KHZ,R _L =4 Ω | V _{DD} =5.0V | 2.6 | | W |
| | | | V _{DD} =3.6V | 1.3 | | |
| THD+N | Total Harmonic Distortion Plus Noise | f=1KHz | V _{DD} =5.0V, P _O =4W, R _L =2 Ω | 0.2 | | % |
| | | | V _{DD} =3.6V, P _O =2W, R _L =2 Ω | 1 | | |
| | | f=1KHz | V _{DD} =5.0V, P _O =2W, R _L =4 Ω | 0.1 | | % |
| | | | V _{DD} =3.6V, P _O =1W, R _L =4 Ω | 0.1 | | |
| G _v | Gain | R _i = 33K | | 23 | | dB |
| PSRR | Power Supply Ripple Rejection | V _{DD} =4.2V±200mVp-p | f=1KHz | 60 | | dB |
| SNR | Signal-to-Noise Ratio | V _{DD} =5.0V, V _{o rms} =1V, G _v =20dB | f=1KHz | 85 | | dB |
| V _n | Output Noise | V _{DD} =5.0V, Input floating with C _{IN} =0.1μF | A-weighting | 100 | | μV |
| | | | No A-weighting | 150 | | |
| Dyn | Dynamic Range | V _{DD} =5.0V, THD=1% | f=1KHz | 90 | | dB |
| η | Efficiency | V _{DD} =5.0V, R _L =2 Ω, P _O =5W | f=1KHz | 83 | | % |
| | | V _{DD} =5.0V, R _L =4 Ω, P _O =2.8W | | 90 | | |
| I _Q | Quiescent Current | V _{DD} =5.0V | No Load | 10 | | mA |
| | | V _{DD} =3.6V | | 5 | | |
| I _{SD} | Shutdown Current | V _{DD} =3V to 5V | V _{SD} =0V | | 1 | μA |
| V _{OS} | Offset Voltage | V _{IN} =0V, V _{DD} =5V | | 10 | | mV |
| Fosc | Oscillator Frequency | | | 360 | | khz |
| T _{st} | Setup Time | Bypass capacitor =1uF | | 300 | | mS |
| OTP | — | No Load, Junction Temperature | V _{DD} =5.0V | 180 | | °C |
| OTH | — | | | 40 | | |



D Mode Typical Operating Characteristics

(VDD =5V, Gain=20dB, $R_L = 4\Omega$, T =25°C, unless otherwise noted.)





F Mode Electrical Characteristics

(VDD =5V, Gain=20dB, RL =4Ω, T =25°C, unless otherwise noted.)

| Symbol | Parameter | Test Conditions | MIN | TYP | MAX | UNIT |
|-----------------|--------------------------------------|--|-----------------------|--|-----|------|
| V _{IN} | Supply Voltage | | 2.8 | - | 5.5 | V |
| P _O | Output Power | THD+N=10%,f=1KHZ,RL=2 Ω | V _{DD} =5.0V | 4.5 | | W |
| | | | V _{DD} =3.6V | 1.8 | | |
| | | THD+N=10%,f=1KHZ,RL=4 Ω | V _{DD} =5.0V | 2.9 | | W |
| | | | V _{DD} =3.6V | 1.2 | | |
| | | THD+N=1%,f=1KHZ,RL=2 Ω | V _{DD} =5.0V | 3.4 | | W |
| | | | V _{DD} =3.6V | 1.4 | | |
| | | THD+N=1%,f=1KHZ,RL=4 Ω | V _{DD} =5.0V | 2.3 | | W |
| | | | V _{DD} =3.6V | 0.9 | | |
| THD+N | Total Harmonic Distortion Plus Noise | V _{DD} =5.0V, P _O =3W, RL=2 Ω | f=1KHz | 1 | | % |
| | | | | V _{DD} =3.6V, P _O =1.5W, RL=2 Ω | 2 | |
| | | V _{DD} =5.0V, P _O =1.5W, RL=4 Ω | f=1KHz | 0.1 | | % |
| | | | | V _{DD} =3.6V, P _O =0.75W, RL=4 Ω | 0.2 | |
| G _v | Gain | R _i = 33K | | 23 | | dB |
| PSRR | Power Supply Ripple Rejection | VDD=4.2V±200mVp-p | f=1KHz | 60 | | dB |
| SNR | Signal-to-Noise Ratio | VDD=5.0V, Vo rms=1V, Gv=20dB | f=1KHz | 85 | | dB |
| V _n | Output Noise | V _{DD} =5.0V,Input floating with C _{IN} =0.1μF | A-weighting | 100 | | μV |
| | | | No A-weighting | 150 | | |
| Dyn | Dynamic Range | V _{DD} =5.0V,THD=1% | f=1KHz | 90 | | dB |
| I _Q | Quiescent Current | V _{DD} =5.0V | No Load | 20 | | mA |
| | | V _{DD} =3.6V | | 12 | | |
| I _{SD} | Shutdown Current | V _{DD} =3V to 5V | V _{SD} =0V | | 1 | μA |
| V _{OS} | Offset Voltage | V _{IN} =0V, V _{DD} =5V | | 10 | | mV |
| T _{st} | Setup Time | Bypass capacitor =1uF | | 300 | | mS |
| OTP | — | No Load, Junction Temperature | V _{DD} =5.0V | 180 | | °C |
| OTH | — | | | 40 | | |



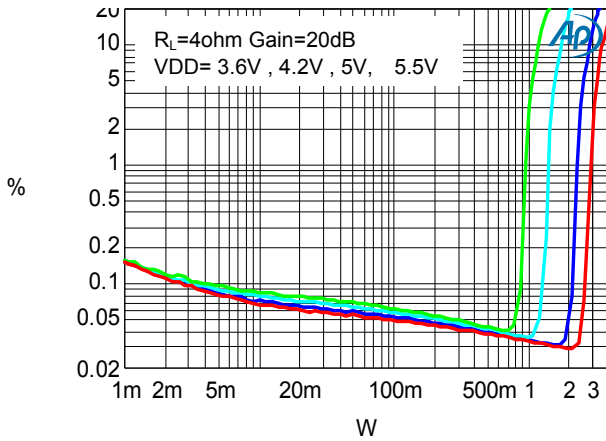
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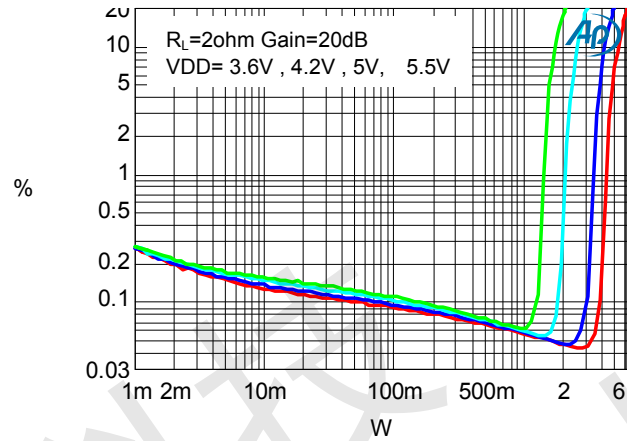
AB Mode Typical Operating Characteristics

(VDD =5V, Gain=20dB, $R_L = 4\Omega$, T =25°C, unless otherwise noted.)

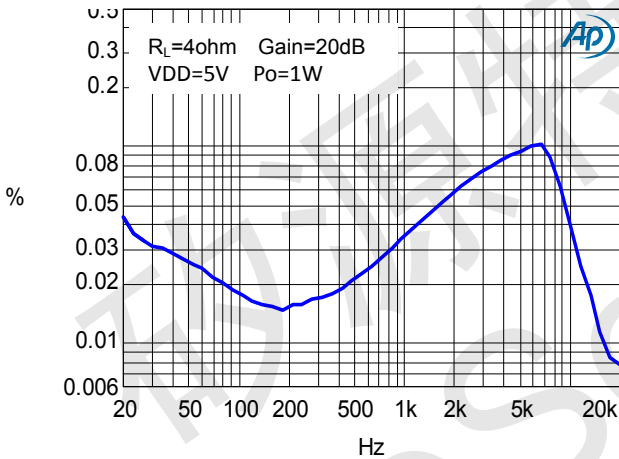
THD+N vs Output Power



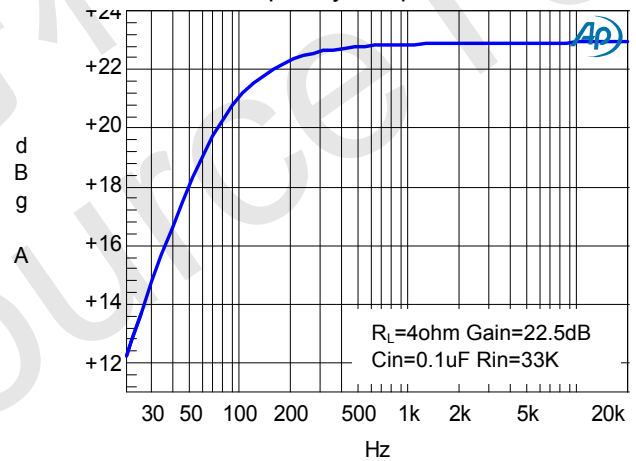
THD+N vs Output Power



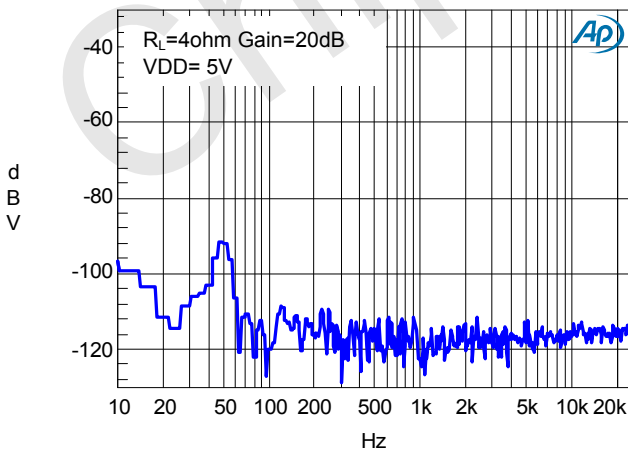
THD+N VS FREQUENCY



Frequency Response



Noise FFT





应用信息

输入电阻(Ri)

MIX2051的增益由音量调节控制的输入电阻(RI)和反馈电阻(RF)控制。有如下的增益计算公式:

$$A_v = 2 \times \frac{R_f}{R_e} \left(\frac{V}{V} \right)$$

其中, R_e 为芯片外部的可调节输入电阻; 反馈电阻 R_f 为225K(反馈电阻为内部固定, 不可外部调节)。例如, 外部输入电阻为33K, 则放大倍数为:

$$A_v = 2 \times 225 / (33) = 13.6 \text{ 倍} = 23\text{dB}$$

输入电容 (Ci)

输入电容与输入电阻构成一个高通滤波器, 其截止频率可由下式得出:

$$f_c = \frac{1}{(2\pi R_i C_i)}$$

C_i 的值不仅会影响到电路的低频响应, 而且也会影响到电路启动和关断时所产生的POP声, 输入电容越大, 则到达其稳定工作点所需的电荷越多, 在同等条件下, 小的输入电容所产生的POP声比较小。

SD管脚控制

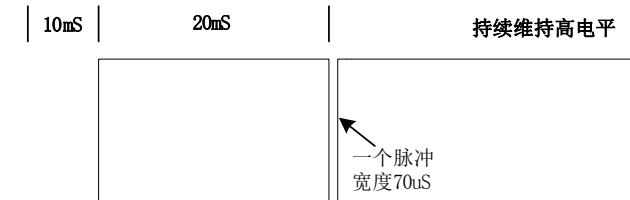
SD管脚是功放的使能管脚。SD管脚为高电平时, 功放正常工作, SD管脚为低电平时, 功放关断。芯片有三个工作状态, 分别是D类防破音模式1, D类防破音模式2, D类防破音关闭。如果SD管脚直接拉高, 不输入一线脉冲信号, MIX2051默认进入到D类防破音模式1。如果SD管脚输入一线脉冲信号, 则MIX2051进入到相对应的工作模式。

D类防破音模式1的输出音量比D类防破音模式2要大一些, 但是失真同时也大一些。追求较低失真同时要求防破音功能, 可以选择D类防破音模式2。如果追求较大的声音, 则选择D类防破音模式1。

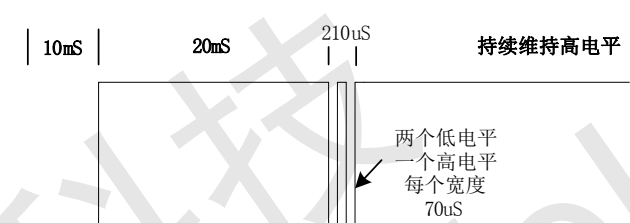
如果不需要防破音功能, 则选择D类防破音关闭的工作模式。

一线脉冲控制方式如下:

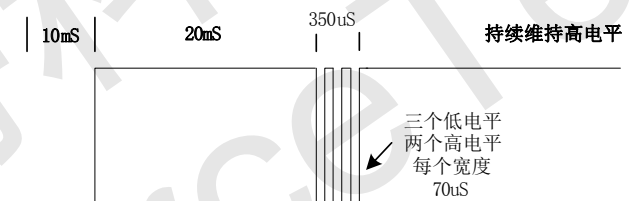
1.切换到D类防破音模式1的波形



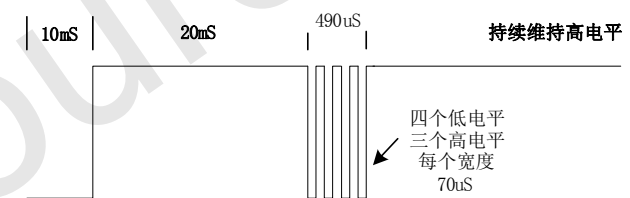
2.切换到D类防破音模式2的波形



3.切换到D类防破音关闭的波形



4.切换到AB类防破音关闭的波形



偏置电容C_{BYP}

偏置电容是很关键的电容, 它与几个重要性能相关, 当电路启动时, 偏置电容决定了放大器的开启速度, 偏置电容同时会影响到电路的噪声, 电源抑制比以及开关机的POP声。

为避免启动时的POP声, 偏置电压的上升速度应该比输入偏置电压的上升速度慢。

过温保护

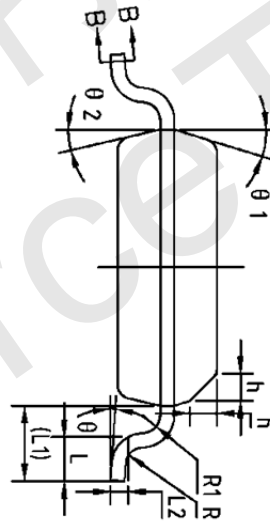
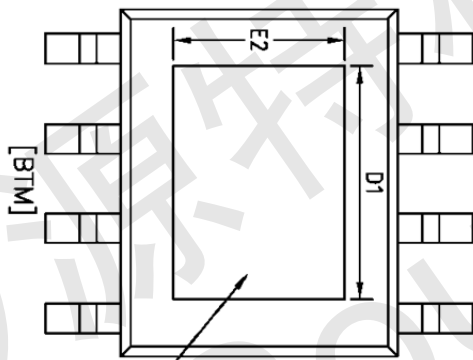
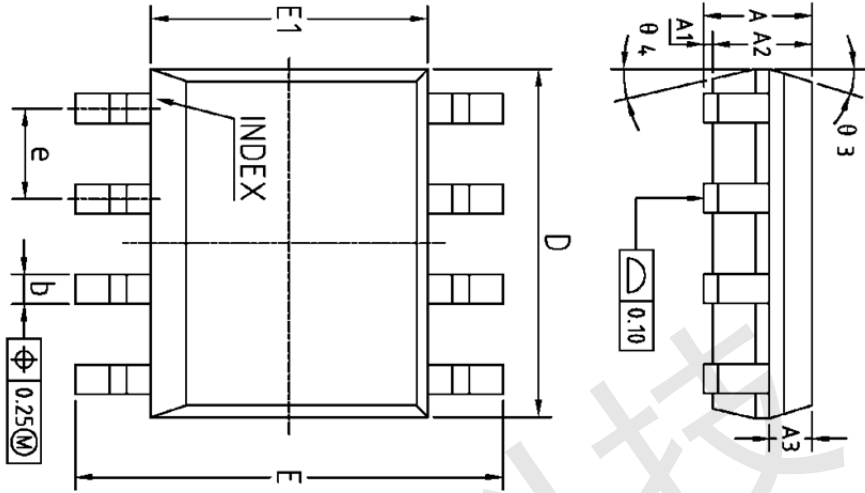
MIX2051带有过温保护电路以防止内部温度超过 180°C 时器件损坏。在不同器件之间, 这个值有25°C的差异。当内部电路超过设置的保护温度时, 器件进入关断状态, 输出被截止。当温度下降 30°C后, 器件重新正常工作。



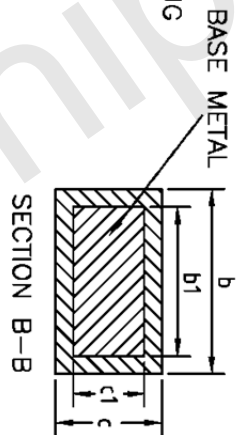
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封装图 (ESOP8)



NOTES:
 ALL DIMENSIONS REFER TO JEDEC STANDARD MS-012 AA
 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---------|------|---------|------|
| A | 1.35 | 1.35 | 1.75 |
| A1 | 0 | 0.10 | 0.15 |
| A2 | 1.25 | 1.40 | 1.65 |
| A3 | 0.50 | 0.60 | 0.70 |
| b | 0.38 | - | 0.51 |
| b1 | 0.37 | 0.42 | 0.47 |
| c | 0.17 | - | 0.25 |
| c1 | 0.17 | 0.20 | 0.23 |
| D | 4.80 | 4.90 | 5.00 |
| D1 | 3.10 | 3.30 | 3.50 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| E2 | 2.20 | 2.40 | 2.60 |
| e | - | 1.27BSC | - |
| L | 0.45 | 0.60 | 0.80 |
| L1 | - | 1.04REF | - |
| L2 | - | 0.25BSC | - |
| R | 0.07 | - | - |
| R1 | 0.07 | - | - |
| h | 0.30 | 0.40 | 0.50 |
| theta | 0° | - | 8° |
| theta 1 | 15° | 17° | 19° |
| theta 2 | 11° | 13° | 15° |
| theta 3 | 15° | 17° | 19° |
| theta 4 | 11° | 13° | 15° |