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LA4628

Monolithic Linear IC

20W 2-Channel BTL Power Amplifier for General Audio

Overview

The LA4628 is a 2-channel general-purpose BTL audio power amplifier provided in a miniature package. It was designed for the best possible audio quality and features an extended low band roll-off frequency provided by a newly-developed NF circuit that does not require an external capacitor. Furthermore, crosstalk, which can cause muddiness in the audio output, has been significantly reduced by both circuit and wiring pattern improvements. Thus this amplifier can provide powerful lows and clear highs.

Note that this device is pin compatible with the 13.5W×2-channel LA4625, and allows end products differentiated by their power rating to share the same printed circuit board.

Features

- Total output : 20W+20W (at $V_{CC} = 13.5V$, $R_L = 4\Omega$, THD = 10%)
- High-fidelity design ($f_L < 10Hz$, $f_H = 130kHz$)
- Extremely low impulse noise levels
- An arbitrary amplifier startup time can be set up with external components.
- Full complement of built-in protection circuits (includes circuits that protect against shorting to V_{CC} , shorting to ground, load shorting, overvoltages and excessive temperatures)

Specifications

Maximum Ratings at $T_a = 25^\circ C$

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|--------------|-------------------------------------|-------------|------------|
| Maximum supply voltage | V_{CC} max | No signal | 24 | V |
| Maximum output current | I_O peak | Per channel | 4 | A |
| Allowable power dissipation | P_d max | With an arbitrarily large heat sink | 32.5 | W |
| Operating temperature | T_{opr} | | -20 to +85 | $^\circ C$ |
| Storage temperature | T_{stg} | | -40 to +150 | $^\circ C$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Operating Conditions at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|--|-------------|------------|---------|----------|
| Recommended supply voltage | V_{CC} | | 13.5 | V |
| Recommended load resistance range | R_L op | | 4 to 8 | Ω |
| Allowable operating supply voltage range | V_{CC} op | | 9 to 20 | V |

Note : With V_{CC} , R_L , and the output level in ranges such that the P_d max for the heat sink used is not exceeded.

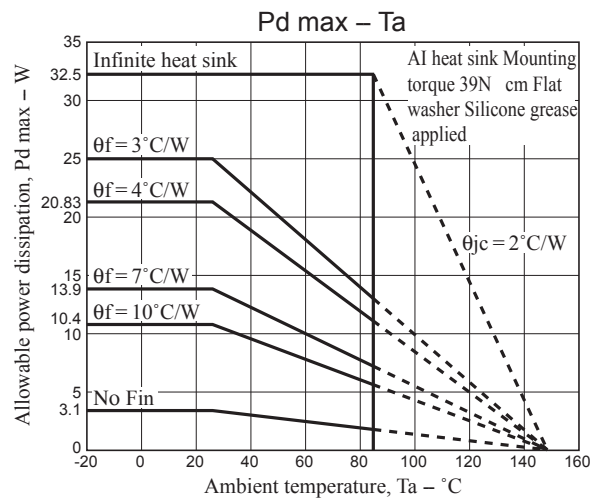
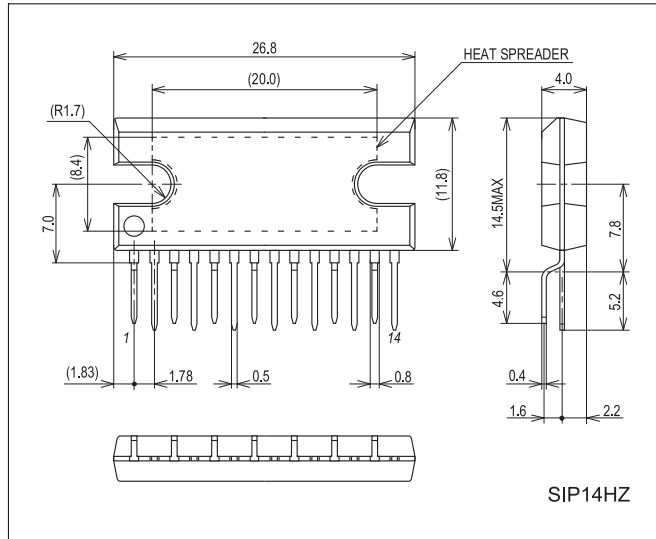
Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 13.5\text{V}$, $R_L = 4\Omega$, $f = 1\text{kHz}$, $R_g = 600\Omega$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|-----------------------------|--------------|---|---------|------|----------|------------------|
| | | | min | typ | max | |
| Quiescent current | I_{CCO} | With $R_g = 0$ and R_L open. | 70 | 130 | 250 | mA |
| Standby mode current drain | I_{st} | Standby mode (amplifier off), with no power supply capacitor. | | 10 | 60 | μA |
| Voltage gain | V_G | $V_O = 0\text{dBm}$ | 38 | 40 | 42 | dB |
| Total harmonic distortion | THD | $P_O = 1\text{W}$, Filter = FLAT | | 0.06 | 0.2 | % |
| Output power | P_{O1} | $V_{CC} = 13.5\text{V}$, THD = 10%, $R_L = 4\Omega$ | 16 | 20 | | W |
| | P_{O2} | $V_{CC} = 16.5\text{V}$, THD = 10%, $R_L = 4\Omega$ | | 30 | | W |
| Output offset voltage | V_N offset | $R_g = 0$ | -300 | | +300 | mV |
| Output noise voltage | V_{NO} | $R_g = 0$, BPF = 20Hz to 20kHz | | 0.1 | 0.5 | mV |
| Ripple rejection ratio | SVRR | $R_g = 0$, $V_R = 0\text{dBm}$, $f_R = 100\text{Hz}$ | 40 | 50 | | dB |
| Channel separation | CHsep | $R_g = 10\text{k}\Omega$, $V_O = 0\text{dBm}$ | 50 | 60 | | dB |
| Input resistance | R_i | | 21 | 30 | 39 | $\text{K}\Omega$ |
| Standby pin applied voltage | V_{ST} | Amplifier on (applied through an external $10\text{k}\Omega$ resistor) | 2.5 | | V_{CC} | V |

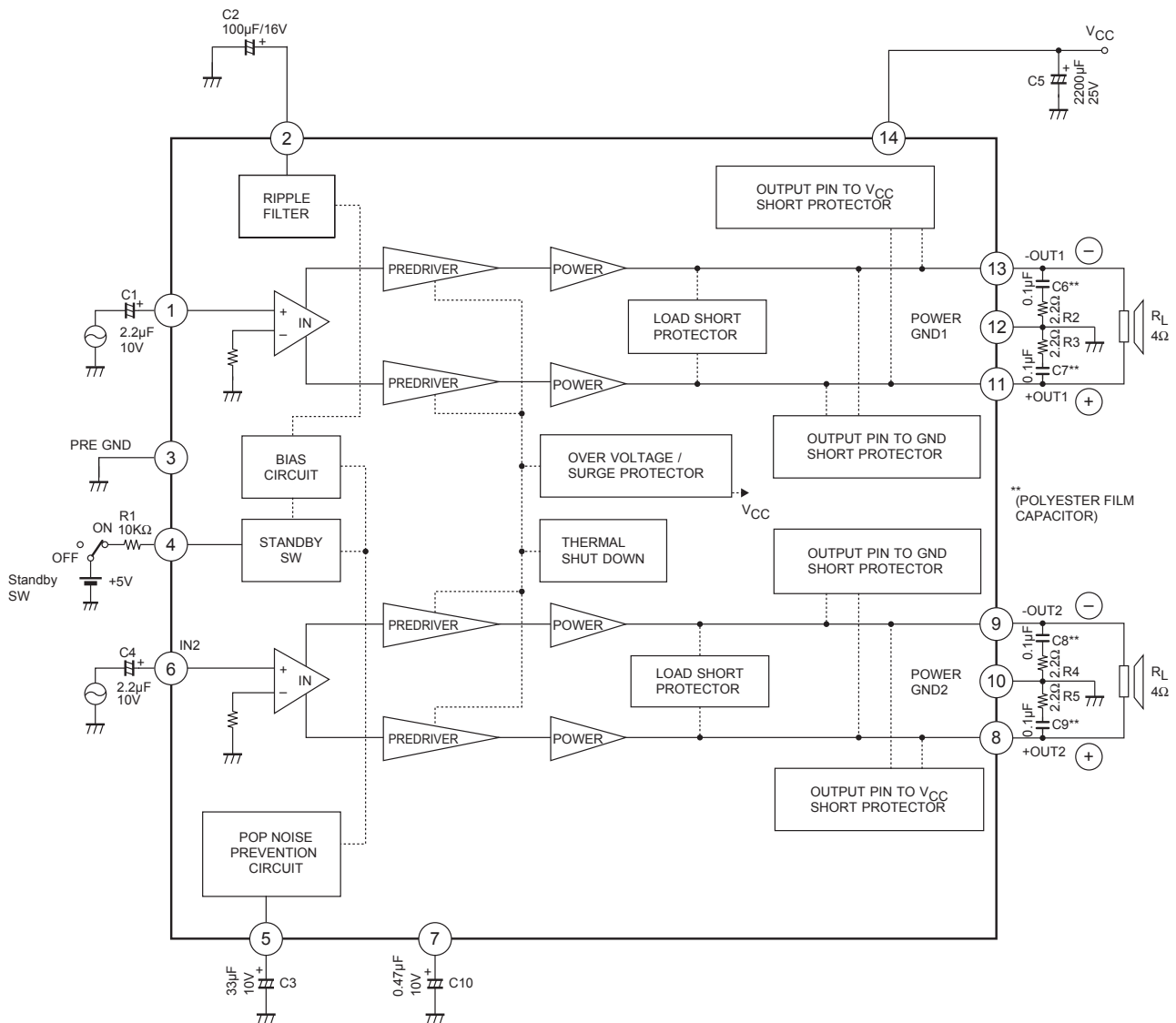
Package Dimensions

unit : mm (typ)

3113B



Block Diagram



C3
Sets the amplifier starting time
(Approximately 0.6 seconds when 33 μ F)

C10
Impulse noise reduction
(Note : The device's ability to withstand shorting to V_{CC} or shorting to ground when V_{CC} is around 16V may be reduced as the value of this capacitor is increased. We recommend 0.47 μ F.)

Pin Voltages

$V_{CC} = 13.5V$, with 5V applied to STBY through a 10k Ω resistor, $R_L = 4\Omega$, $R_g = 0$

| Pin No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------------|-------|-------|---------|-------|---------|-------|-------|
| Pin name | IN1 | DC | PRE-GND | STBY | ON TIME | IN2 | POP |
| Pin voltage | 1.55V | 6.63V | 0V | 3.21V | 2.32V | 1.55V | 2.07V |

| Pin No. | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-------------|-------|-------|---------|-------|---------|-------|----------|
| Pin name | +OUT2 | -OUT2 | PWR-GND | +OUT1 | PWR-GND | -OUT1 | V_{CC} |
| Pin voltage | 6.6V | 6.5V | 0V | 6.5V | 0V | 6.6V | 13.5V |

External Components

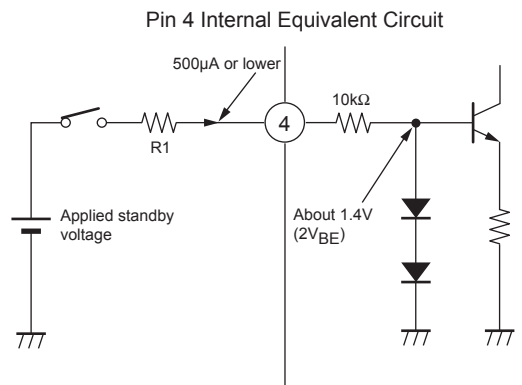
- C1 and C4 : Input capacitors. A value of 2.2 μF is recommended. Determine the polarity based on the DC potential of the circuit connected directly to the LA4628 front end. Note that the low band response can be adjusted by varying f_L with the capacitors C1 and C4.
- C2 : Decoupling capacitor (ripple filter)
- C3 : Sets the amplifier starting time, which will be approximately 0.6 seconds for a value of 33 μF . The starting time is proportional to the value of this capacitor, and can be set to any desired value.
- C5 : Power-supply capacitor
- C6, C7, C8, and C9 : Oscillation prevention capacitors. Use polyester film capacitors (Mylar capacitors) with excellent characteristics. (Note that the series resistors R2, R3, R4, and R5 are used in conjunction with these capacitors to achieve stable amplifier operation.) A value of 0.1 μF is recommended.
- C10 : Impulse noise reduction capacitor. A value of 0.47 μF is recommended. Caution is required when selecting the value for this capacitor, since increasing its value influences the operation of the circuits that protect against shorting the amplifier output pins to V_{CC} or to ground when higher V_{CC} voltages (approximately 16V or higher) are used.
- R1 : Standby switch current limiting resistor. A value of 10k Ω is recommended when a voltage in the range 2.5 to 13.5V will be applied as the standby switching voltage. Note that this resistor is not optional : it must be included.

IC Internal Characteristics and Notes

1. Standby function

- Pin 4 is the standby switch. A voltage of 2.5V or higher must be applied through an external resistor to turn the amplifier on.
- If a voltage of over 13.5V will be applied as the standby mode switching voltage, use the following formula to determine the value of R1 so that the current entering at pin 4 remains under 500 μA .

$$R1 = \frac{\langle \text{applied voltage} \rangle - 1.4}{500\mu A} - 10k\Omega$$



2. Muting function

- Pin 5 connects the capacitor that determines the starting time to prevent impulse noise. It can also be used to mute the amplifier output by shorting pin 5 to ground. When this function is used, the recovery time depends on C3.

3. Impulse noise improvements

- While the LA4628 achieves a low level of impulse noise, if even further reductions in impulse noise at power on/off (and when switching into or out of standby mode) a 0.47 μ F capacitor may be inserted between pin 7 and the PRE GND pin (pin 3). (Pin 7 is the output amplifier bias pin. Since the ability to withstand shorting the output pins to V_{CC} or ground is reduced for supply voltages over 16V if the pin 7 capacitance is large, we recommend a value of 0.47 μ F or lower for this capacitor.)

4. Protection circuits

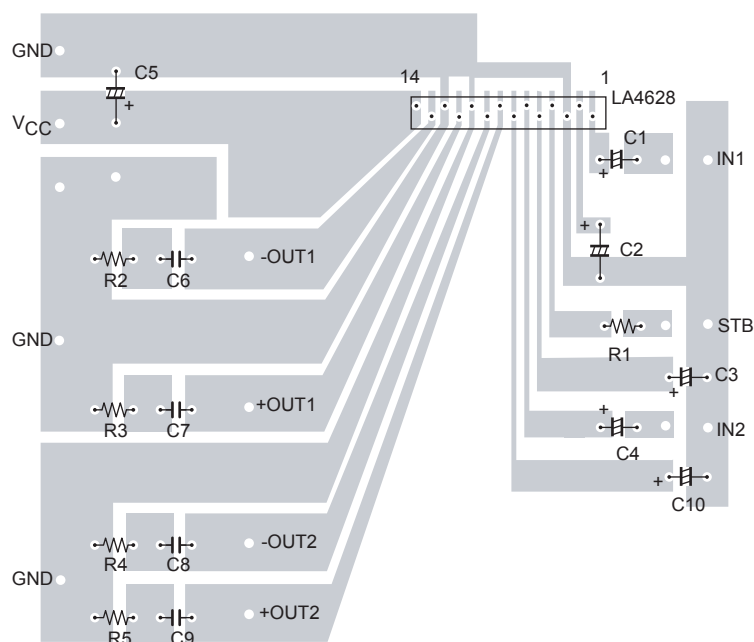
- Due to the system structure of the protection circuit for shorts to V_{CC} or ground, if there is a DC resistance between the amplifier output pins and ground, the protection circuit may operate when power is first applied and the amplifier may fail to turn on. The basic design approach we recommend is not to adopt any designs in which there is a DC resistance between the amplifier outputs and ground.
- The LA4628 includes a built-in thermal protection circuit to prevent the IC from being damaged or destroyed if abnormally high temperatures occur. This thermal protection circuit gradually reduces the output if the IC junction temperature (T_j) reaches the range 170 to 180°C due to inadequate heat sinking or other problem. If the temperature falls, the amplifier will restart automatically.
- The LA4628 also includes other protection circuits. Use of these circuits also requires care during end product design and testing.

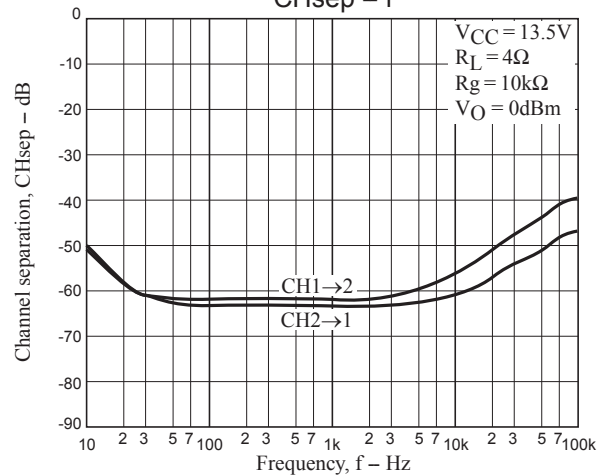
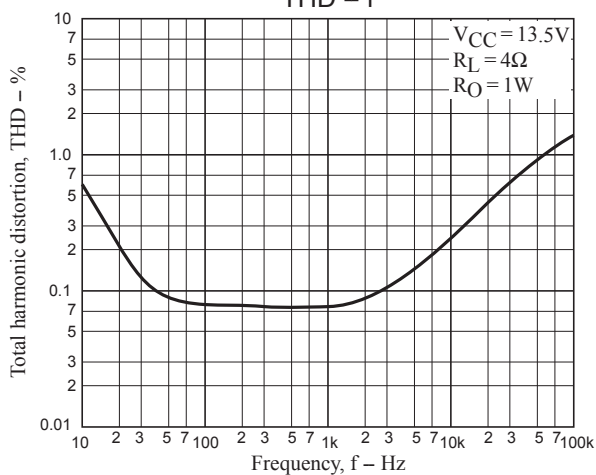
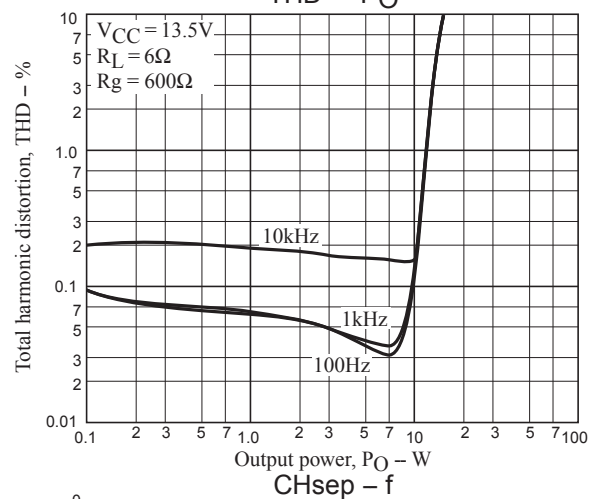
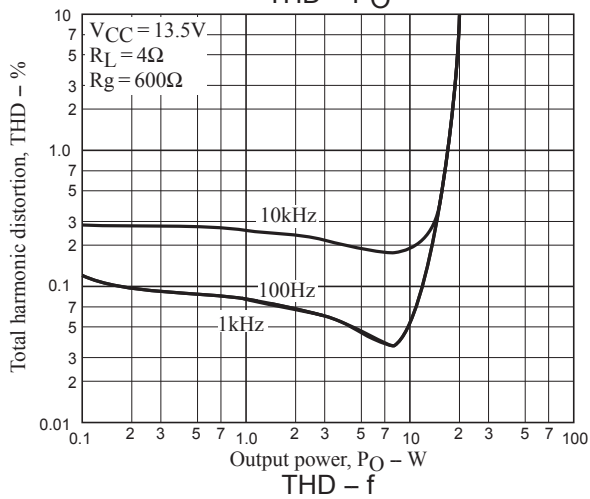
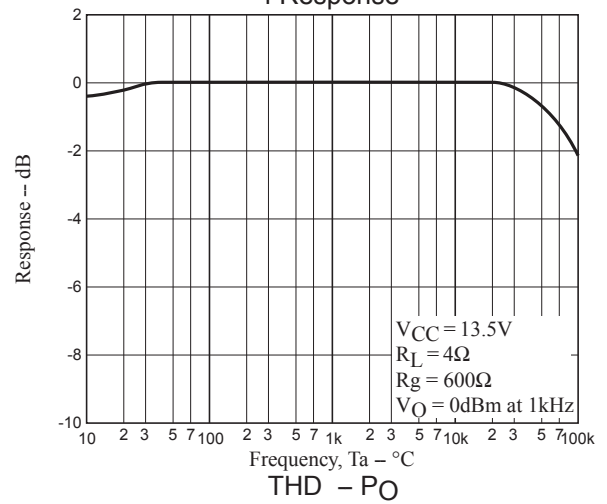
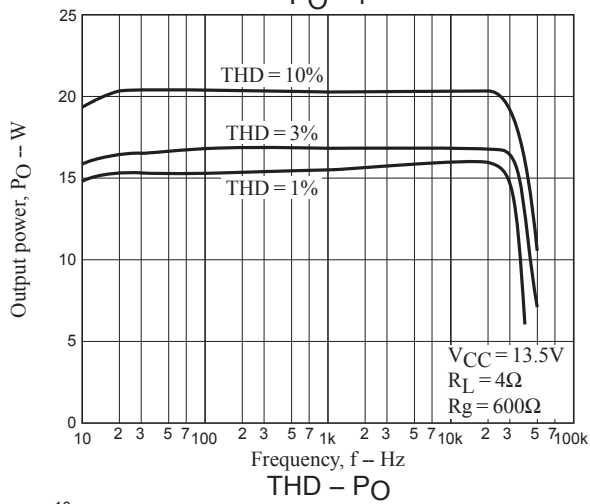
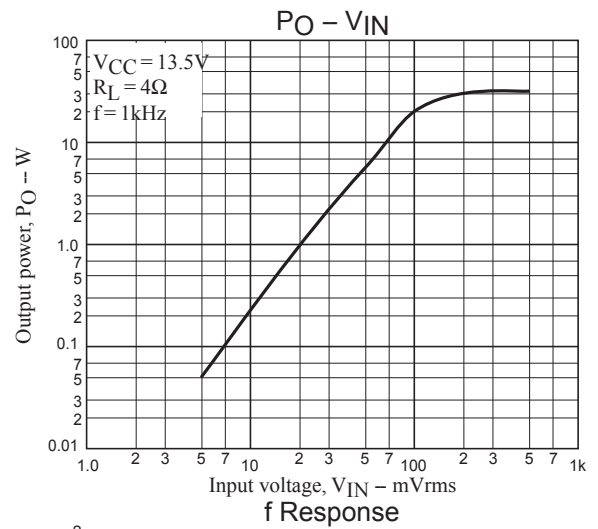
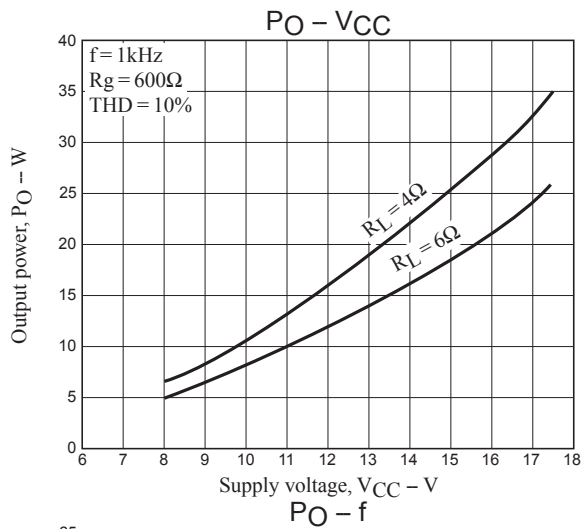
5. Other notes

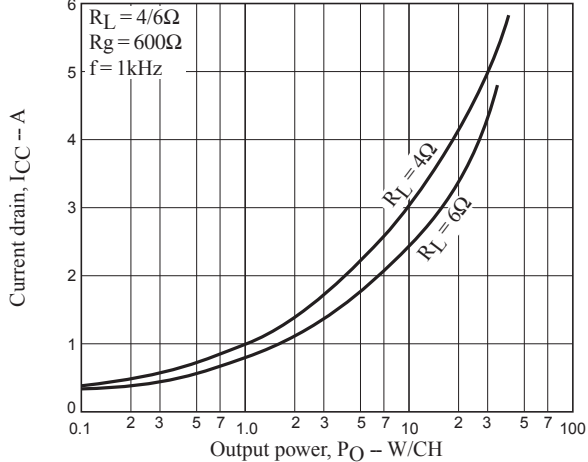
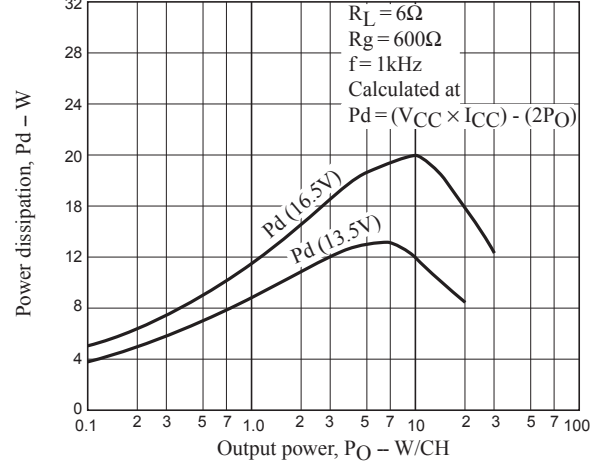
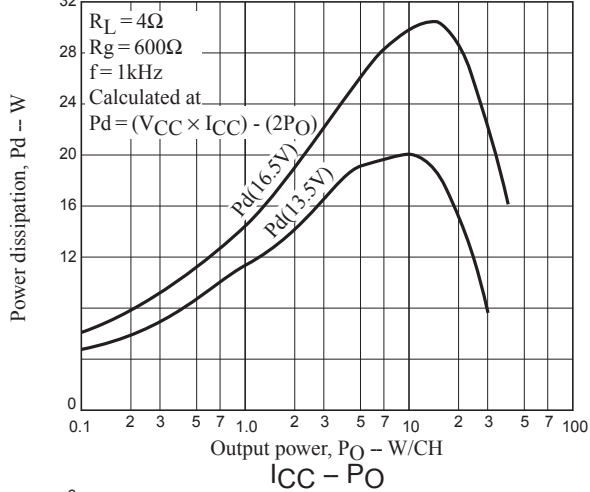
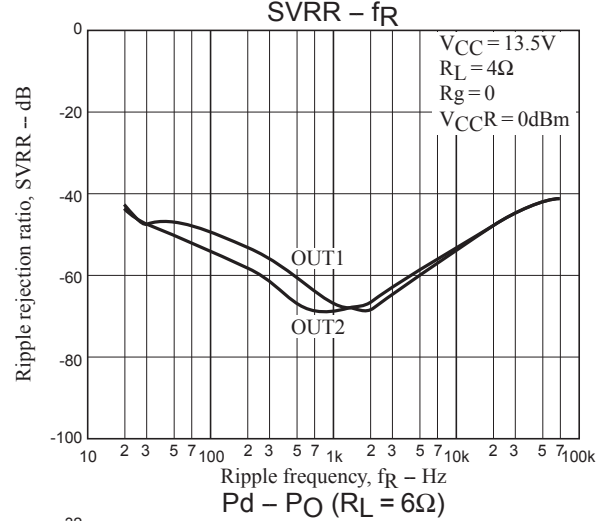
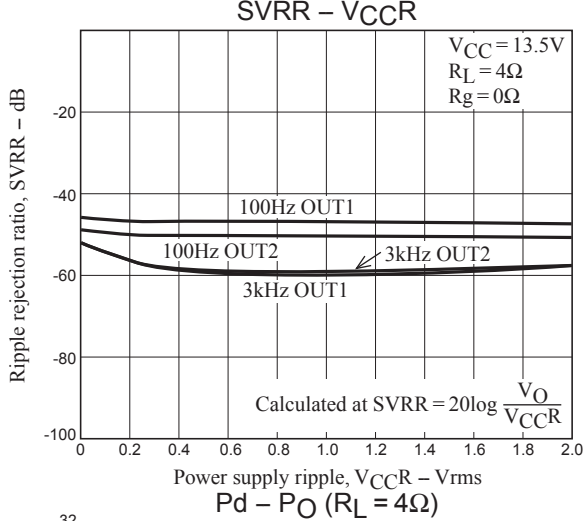
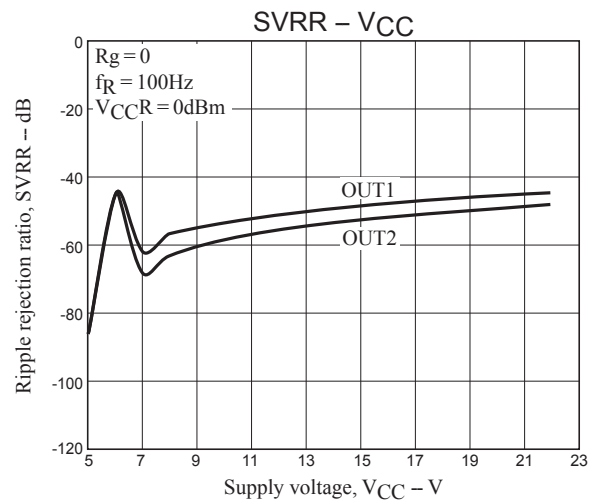
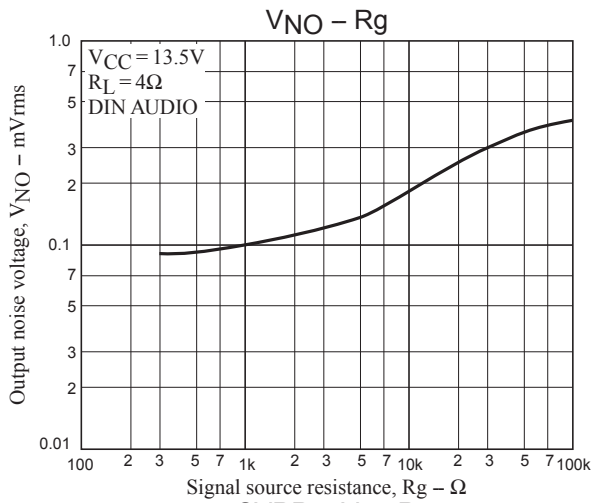
- The LA4628 is a BTL power amplifier. When testing this device, the ground systems for the test equipment connected to IC inputs, and that for the test equipment connected to IC outputs, must be isolated. Do not use a common ground.

Printed Circuit Pattern

(copper foil side)







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