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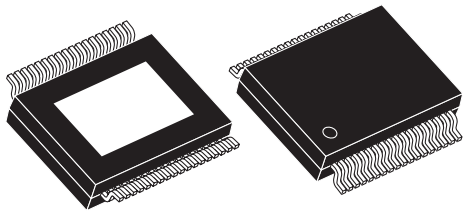
# TDA7491P

## 2 x 10-watt dual BTL class-D audio amplifier

## Features

- 10 W + 10 W continuous output power: $R_L$ = 6 Ω, THD = 10% at $V_{CC}$ = 11 V
- 9.5 W + 9.5 W continuous output power: $R_L$ = 8 Ω, THD = 10% at $V_{CC}$ = 12 V
- Wide range single supply operation (5 V - 18 V)
- High efficiency (η = 90%)
- Four selectable, fixed gain settings of nominally 20 dB, 26 dB, 30 dB and 32 dB
- Differential inputs minimize common-mode noise
- Filterless operation
- No ‘pop’ at turn-on/off
- Standby and mute features
- Short-circuit protection
- Thermal overload protection
- Externally synchronizable



**PowerSSO-36 with exposed pad down**

## Description

The TDA7491P is a dual BTL class-D audio amplifier with single power supply designed for LCD TVs and monitors.

Thanks to the high efficiency and exposed-pad-down (EPD) package no separate heatsink is required.

Furthermore, the filterless operation allows a reduction in the external component count.

The TDA7491P is pin-to-pin compatible with the TDA7491LP and TDA7491HV.

**Table 1. Device summary**

| Order code | Operating temperature | Package | Packaging |
|---|---|---|---|
| TDA7491P | -40 to 85 °C | PowerSSO-36 EPD | Tube |
| TDA7491P13TR | -40 to 85 °C | PowerSSO-36 EPD | Tape and reel |

# Contents

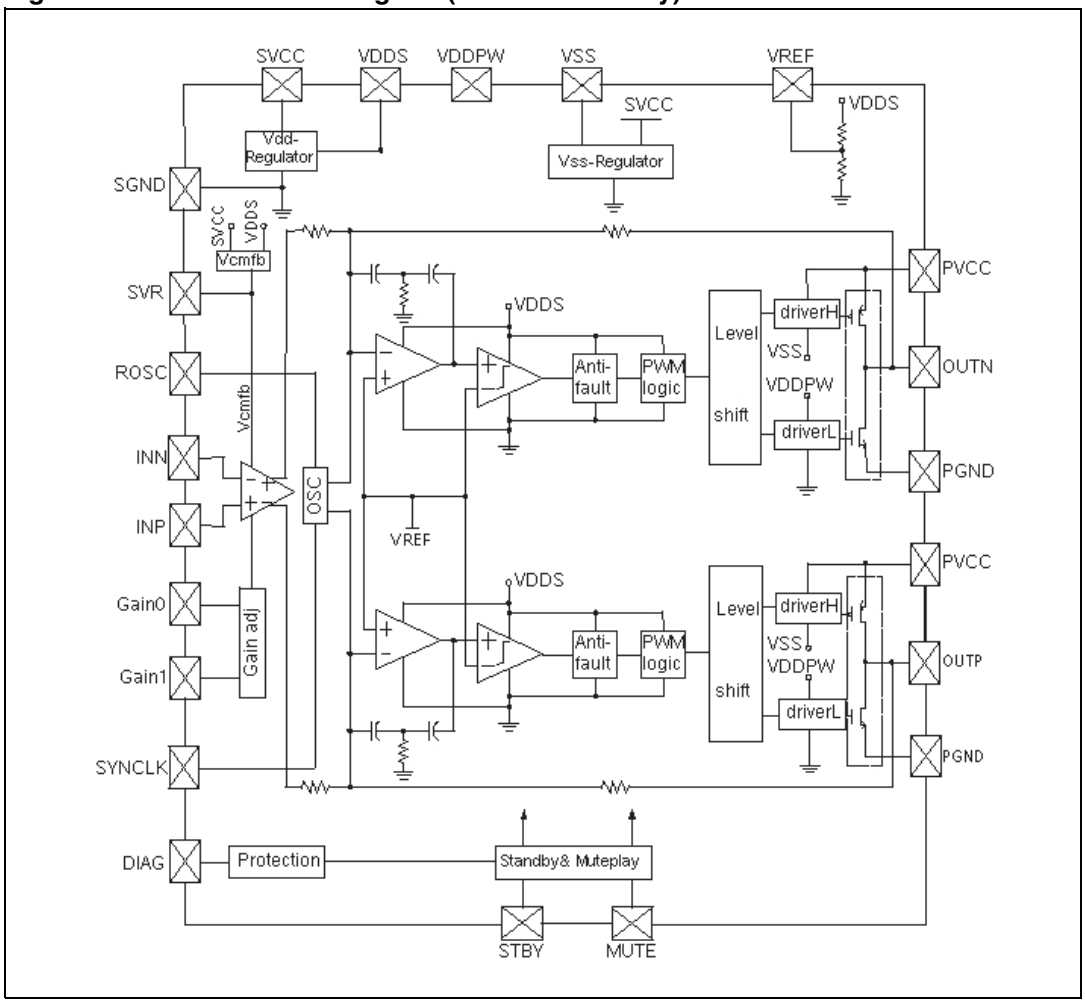
# List of tables

# List of figures

# 1 Device block diagram

*Figure 1* shows the block diagram of one of the two identical channels of the TDA7491P.

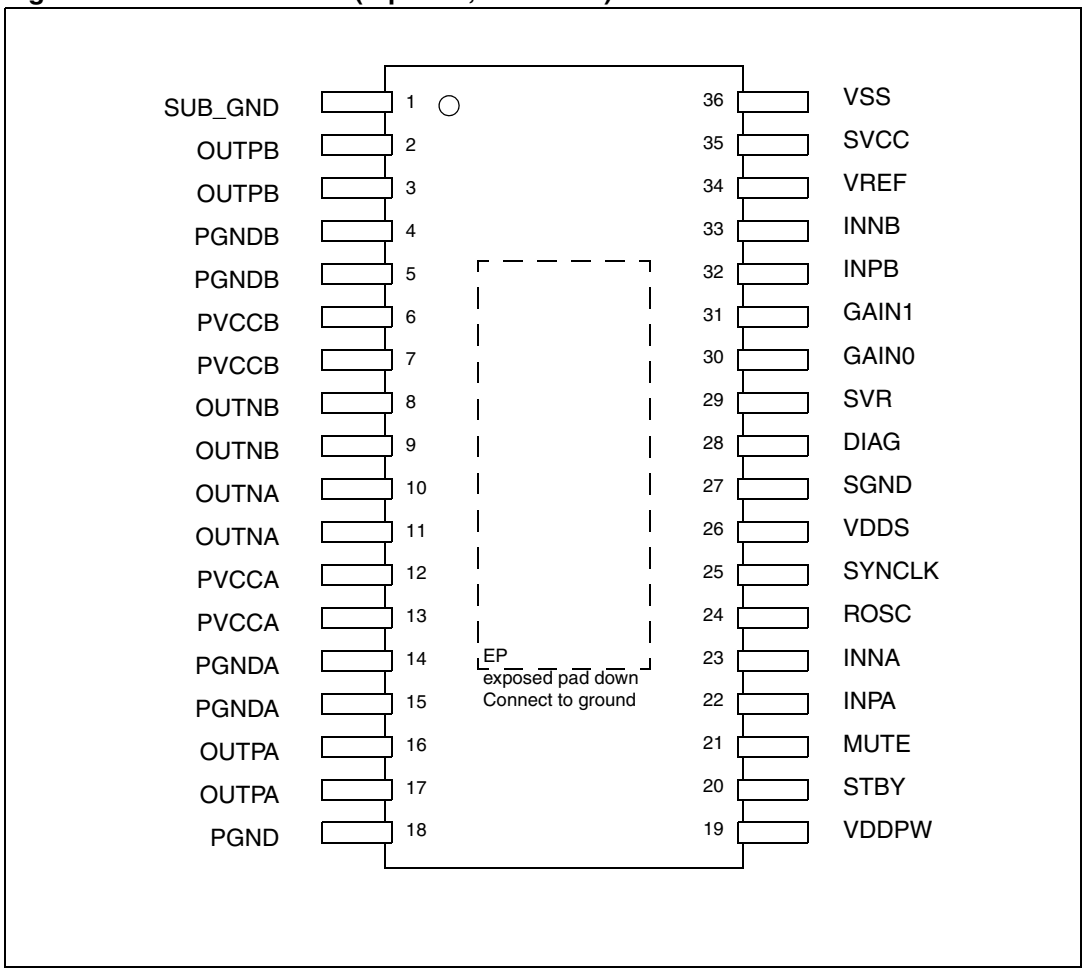
**Figure 1. Internal block diagram (one channel only)**



# 2 Pin description

## 2.1 Pin out

**Figure 2. Pin connection (top view, PCB view)**



## 2.2 Pin list

**Table 2. Pin description list**

| Number | Name | Type | Description |
|---|---|---|---|
| 1 | SUB_GND | POWER | Connect to the frame |
| 2,3 | OUTPB | OUT | Positive PWM output for right channel |
| 4,5 | PGNDB | POWER | Power stage ground for right channel |
| 6,7 | PVCCB | POWER | Power supply for right channel |
| 8,9 | OUTNB | OUT | Negative PWM output for right channel |
| 10,11 | OUTNA | OUT | Negative PWM output for left channel |
| 12,13 | PVCCA | POWER | Power supply for left channel |
| 14,15 | PGNDA | POWER | Power stage ground for left channel |
| 16,17 | OUTPA | OUT | Positive PWM output for left channel |
| 18 | PGND | POWER | Power stage ground |
| 19 | VDDPW | OUT | 3.3-V (nominal) regulator output referred to ground for power stage |
| 20 | STBY | INPUT | Standby mode control |
| 21 | MUTE | INPUT | Mute mode control |
| 22 | INPA | INPUT | Positive differential input of left channel |
| 23 | INNA | INPUT | Negative differential input of left channel |
| 24 | ROSC | OUT | Master oscillator frequency-setting pin |
| 25 | SYNCLCK | IN/OUT | Clock in/out for external oscillator |
| 26 | VDDS | OUT | 3.3-V (nominal) regulator output referred to ground for signal blocks |
| 27 | SGND | POWER | Signal ground |
| 28 | DIAG | OUT | Open-drain diagnostic output |
| 29 | SVR | OUT | Supply voltage rejection |
| 30 | GAIN0 | INPUT | Gain setting input 1 |
| 31 | GAIN1 | INPUT | Gain setting input 2 |
| 32 | INPB | INPUT | Positive differential input of right channel |
| 33 | INNB | INPUT | Negative differential input of right channel |
| 34 | VREF | OUT | Half VDDS (nominal) referred to ground |
| 35 | SVCC | POWER | Signal power supply |
| 36 | VSS | OUT | 3.3-V (nominal) regulator output referred to power supply |
| - | EP | - | Exposed pad for ground-plane heatsink, to be connected to GND |

# 3 Electrical specifications

## 3.1 Absolute maximum ratings

**Table 3. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | DC supply voltage | 20 | V |
| $V_I$ | Voltage limits for input pins STBY, MUTE, INNA, INPA, INNB, INPB, GAIN0, GAIN1 | -0.3 to 3.6 | V |
| $T_{op}$ | Operating temperature | -40 to 85 | °C |
| $T_j$ | Operating junction temperature | -40 to 150 | °C |
| $T_{stg}$ | Storage temperature | -40 to 150 | °C |

## 3.2 Thermal data

Refer also to *Section 5.9: Heatsink requirements on page 37*.

**Table 4. Thermal data**

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $R_{th\ j\text{-}case}$ | Thermal resistance, junction to case | - | 2 | 3 | °C/W |
| $R_{th\ j\text{-}amb}$ | Thermal resistance, junction to ambient | - | 24 | - | |

## 3.3 Electrical specifications

Unless otherwise stated, the results in *Table 5* below are given for the conditions: $V_{CC}$ = 11 V, $R_L$ (load) = 6 Ω, $R_{OSC}$ = R3 = 39 kΩ, C8 = 100 nF, f = 1 kHz, $G_V$ = 20 dB, and $T_{amb}$ = 25 °C.

**Table 5. Electrical specifications**

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | - | 5 | - | 18 | V |
| $I_q$ | Total quiescent current | Without LC filter | - | 26 | 35 | mA |
| $I_{qSTBY}$ | Quiescent current in standby | - | - | - | 10 | µA |
| $V_{OS}$ | Output offset voltage | Play mode | -100 | - | 100 | mV |
| | | Mute mode | -60 | - | 60 | mV |
| $I_{OCP}$ | Overcurrent protection threshold | $R_L$ = 0 Ω | 3 | - | - | A |
| $T_j$ | Junction temperature at thermal shutdown | - | - | 150 | - | °C |
| $R_i$ | Input resistance | Differential input | 54 | 68 | - | kΩ |
| $V_{UVP}$ | Undervoltage protection threshold | - | - | - | 4.5 | V |
| $R_{dsON}$ | Power transistor on resistance | High side | - | 0.2 | - | Ω |
| | | Low side | - | 0.2 | - | |
| $P_o$ | Output power | THD = 10% | - | 10 | - | W |
| | | THD = 1% | - | 8.0 | - | |
| $P_o$ | Output power | $R_L$ = 8 Ω, THD = 10%, $V_{CC}$ = 12 V | - | 9.5 | - | W |
| | | $R_L$ = 8 Ω, THD = 1%, $V_{CC}$ = 12 V | - | 7.2 | - | |
| $P_D$ | Dissipated power | $P_o$ = 10 W + 10 W, THD = 10% | - | 2.0 | - | W |
| η | Efficiency | $P_o$ = 10 W + 10 W, $R_L$ = 8 Ω, THD = 10%, $V_{CC}$ = 12 V | - | 90 | - | % |
| THD | Total harmonic distortion | $P_o$ = 1 W | - | 0.1 | - | % |
| $G_V$ | Closed loop gain | GAIN0 = L, GAIN1 = L | 18 | 20 | 22 | dB |
| | | GAIN0 = L, GAIN1 = H | 24 | 26 | 28 | |
| | | GAIN0 = H, GAIN1 = L | 28 | 30 | 32 | |
| | | GAIN0 = H, GAIN1 = H | 30 | 32 | 34 | |
| $\Delta G_V$ | Gain matching | - | -1 | - | 1 | dB |
| CT | Crosstalk | f = 1 kHz, $P_o$ = 1 W | - | 70 | - | dB |
| eN | Total input noise | A Curve, $G_V$ = 20 dB | - | 15 | - | µV |
| | | f = 22 Hz to 22 kHz | - | 20 | - | |

**Table 5. Electrical specifications (continued)**

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| SVRR | Supply voltage rejection ratio | fr = 100 Hz, Vr = 1 Vpp, $C_{SVR}$ = 10 µF | - | 50 | - | dB |
| $T_r$, $T_f$ | Rise and fall times | - | - | 40 | - | ns |
| $f_{SW}$ | Switching frequency | Internal oscillator, master mode | 290 | 320 | 350 | kHz |
| $f_{SWR}$ | Switching frequency range | (1) | 250 | - | 400 | kHz |
| $V_{inH}$ | Digital input high (H) | - | 2.3 | - | - | V |
| $V_{inL}$ | Digital input low (L) | | - | - | 0.8 | |
| $A_{MUTE}$ | Mute attenuation | $V_{MUTE}$ = low, $V_{STBY}$ = high | - | 80 | - | dB |
| Function mode | Standby, mute and play modes | $V_{STBY}$ < 0.5 V $V_{MUTE}$ = X | Standby | | | - |
| | | $V_{STBY}$ > 2.9 V $V_{MUTE}$ < 0.8 V | Mute | | | - |
| | | $V_{STBY}$ > 2.9 V $V_{MUTE}$ > 2.9 V | Play | | | - |

1. Refer to *Section 5.5: Internal and external clocks on page 32*.

# 4 Characterization curves

The following characterization curves were made using the TDA7491P demo board. The LC filter for the 4-Ω load uses components of 15 µH and 470 nF, whilst that for the 6-Ω load uses 22 µH and 220 nF and that for the 8-Ω load uses 33 µH and 220 nF.

## 4.1 With 4-Ω load at $V_{CC}$ = 10 V

**Figure 3. Output power vs. supply voltage**

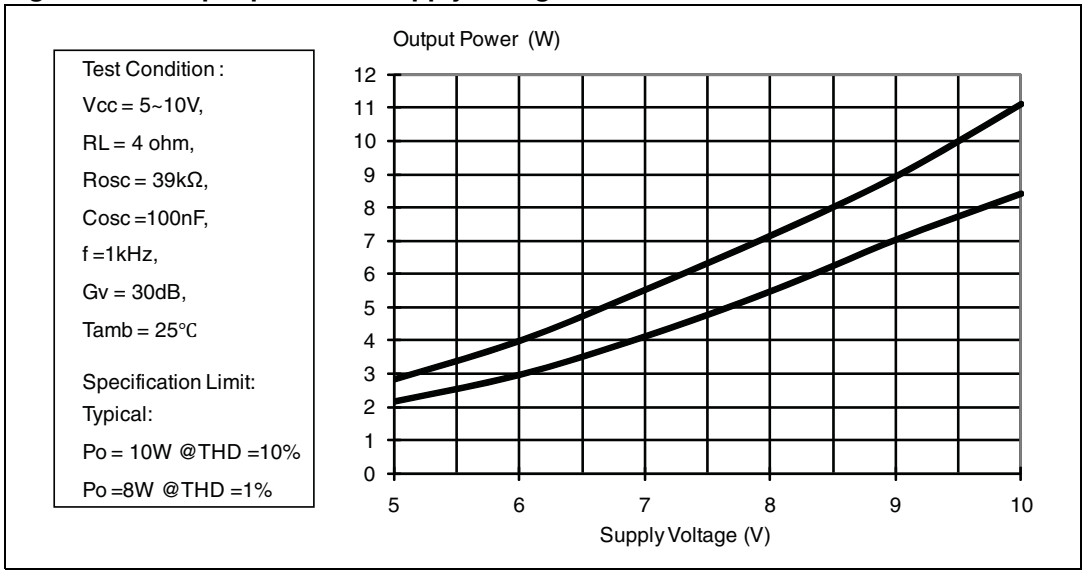



**Figure 4. THD vs. output power (1 kHz)**

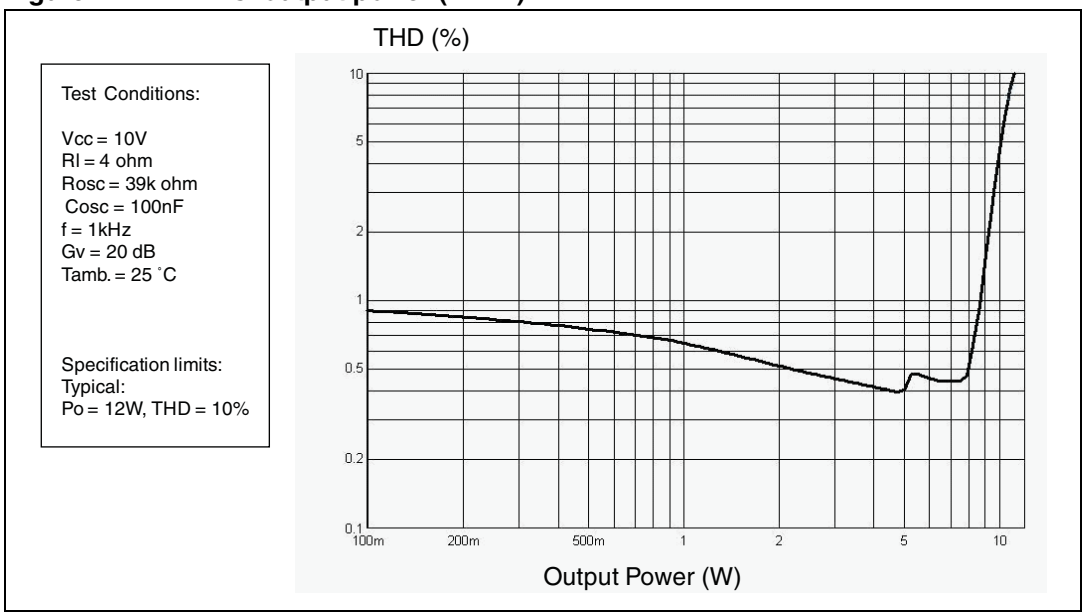


**Figure 5. THD vs. output power (100 Hz)**

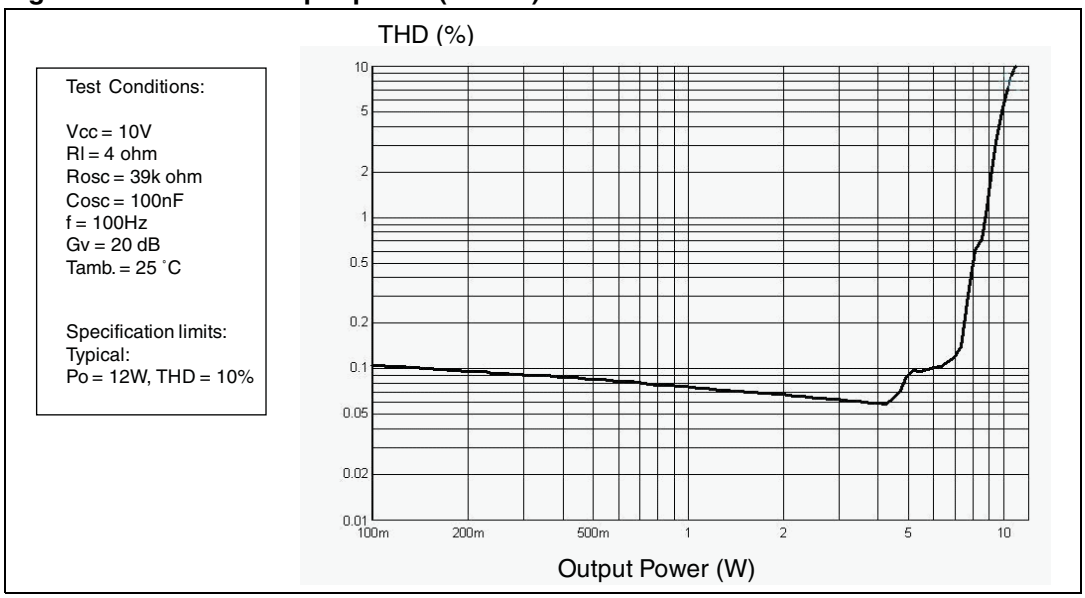



**Figure 6. THD vs. output power (15 kHz)**

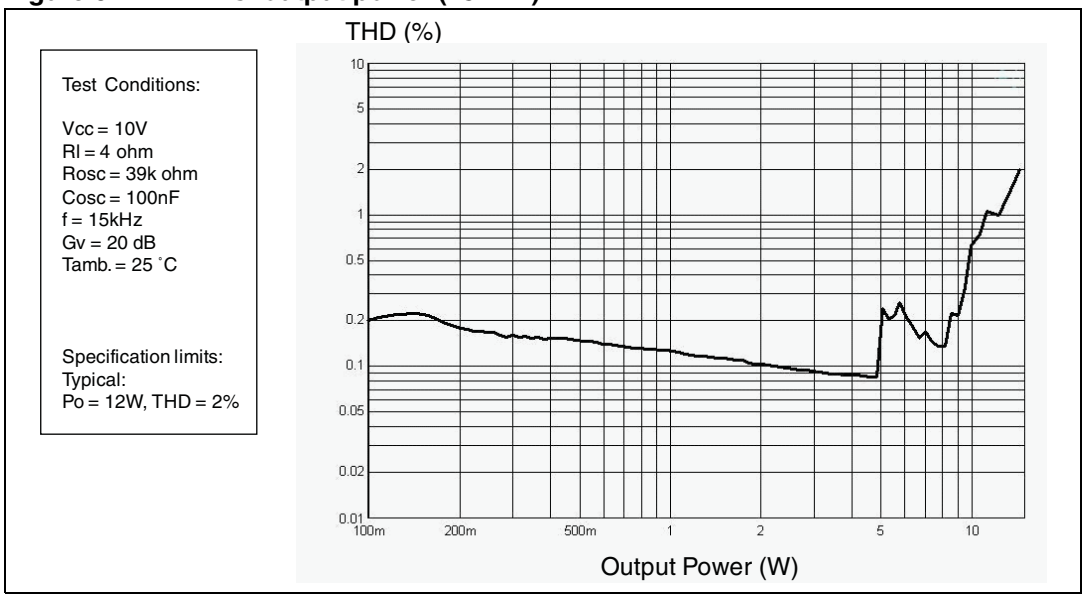


**Figure 7. THD vs. frequency**

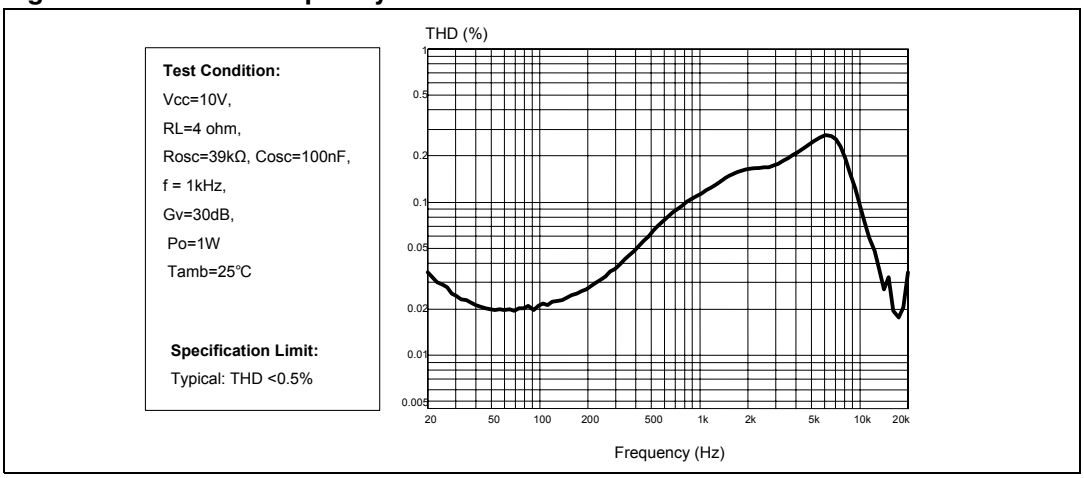



**Figure 8. Frequency response**

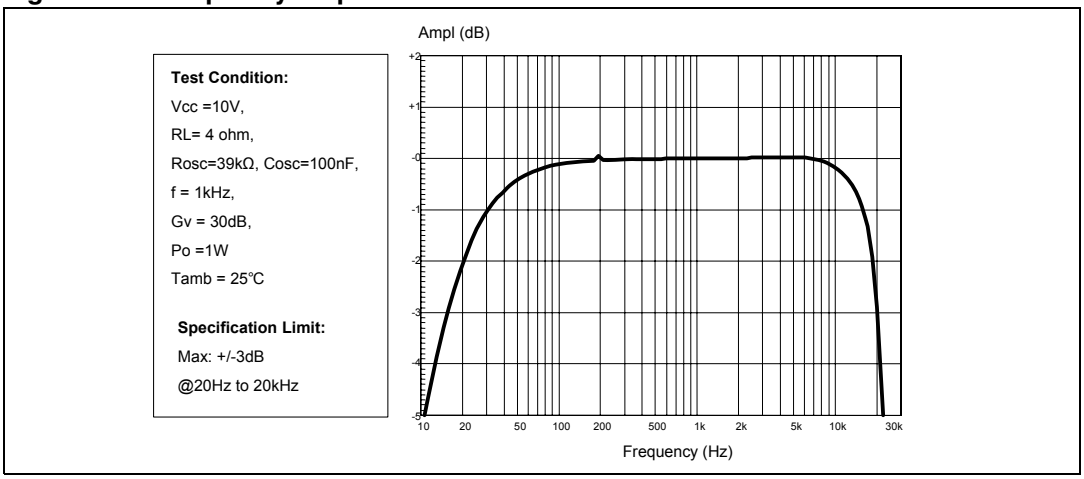



**Figure 9. Crosstalk vs. frequency**

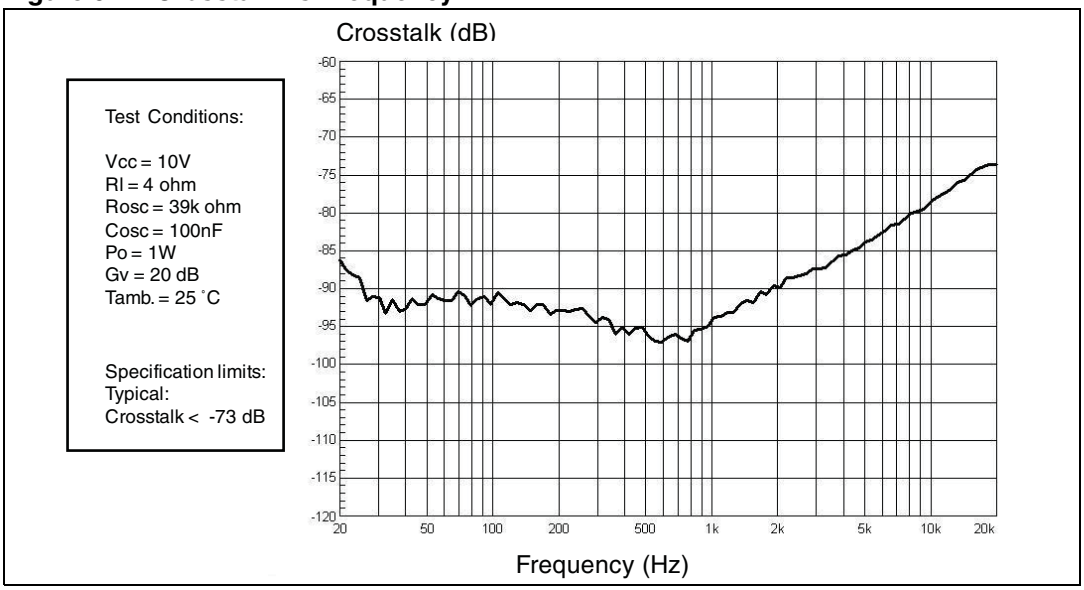


**Figure 10. FFT (0 dB)**

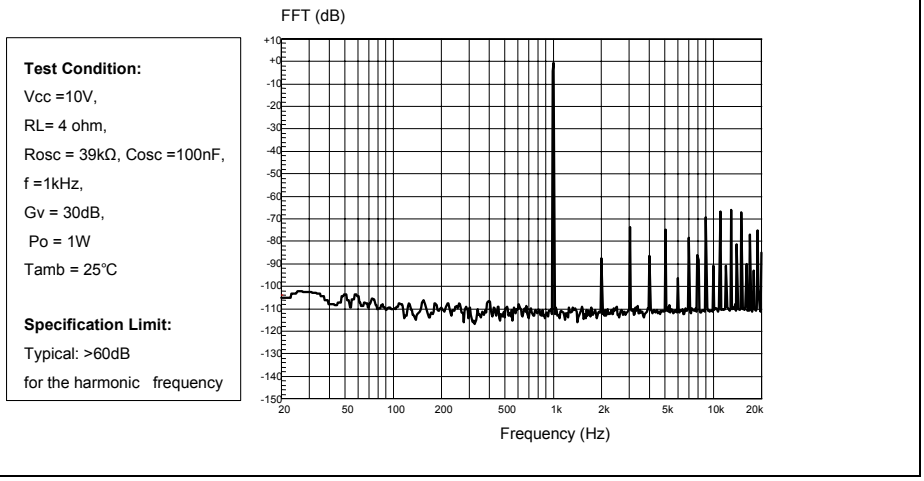



**Figure 11. FFT (-60 dB)**

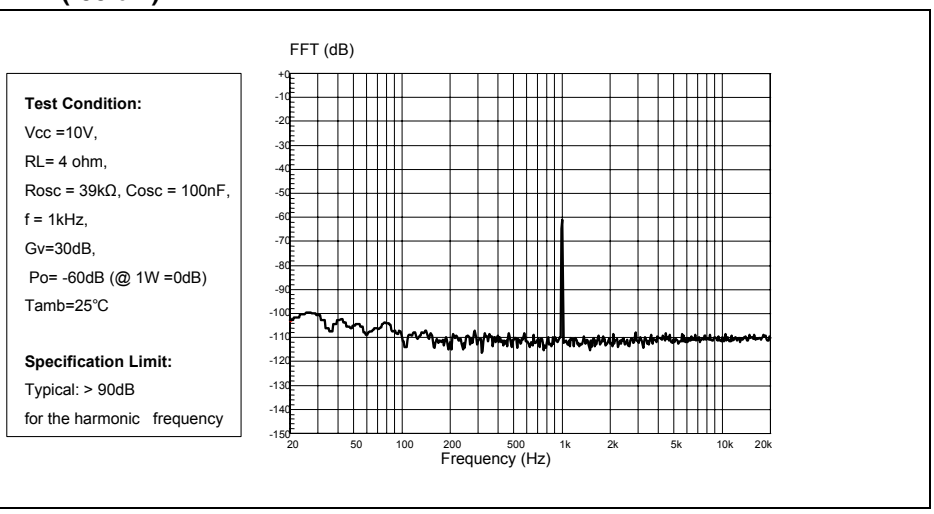



**Figure 12. Power supply rejection ratio vs. frequency**

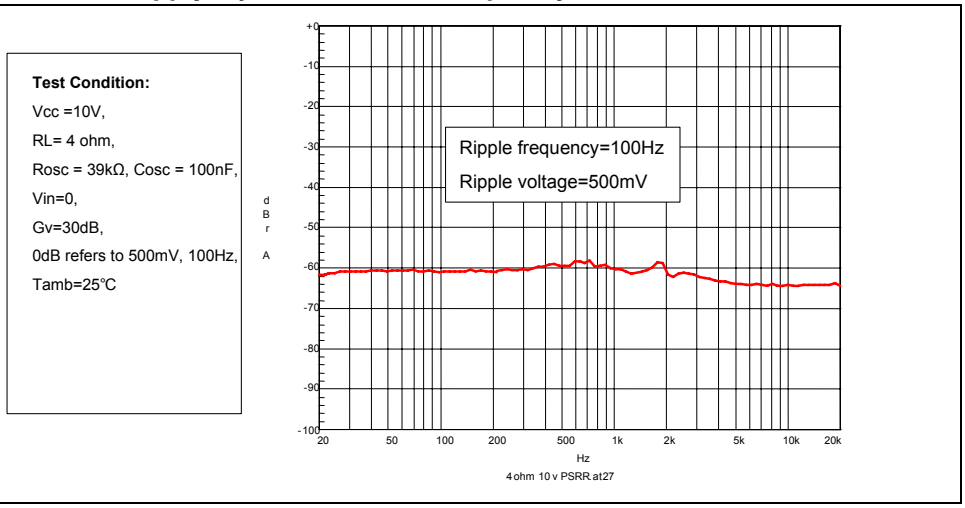


**Figure 13. Power dissipation and efficiency vs. output power**

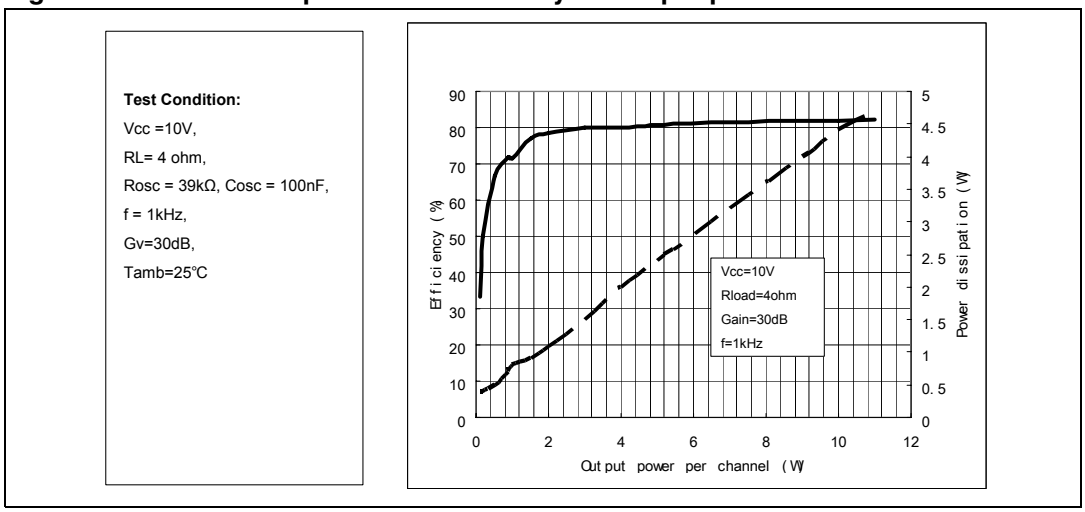



**Figure 14. Attenuation vs. voltage on pin MUTE**

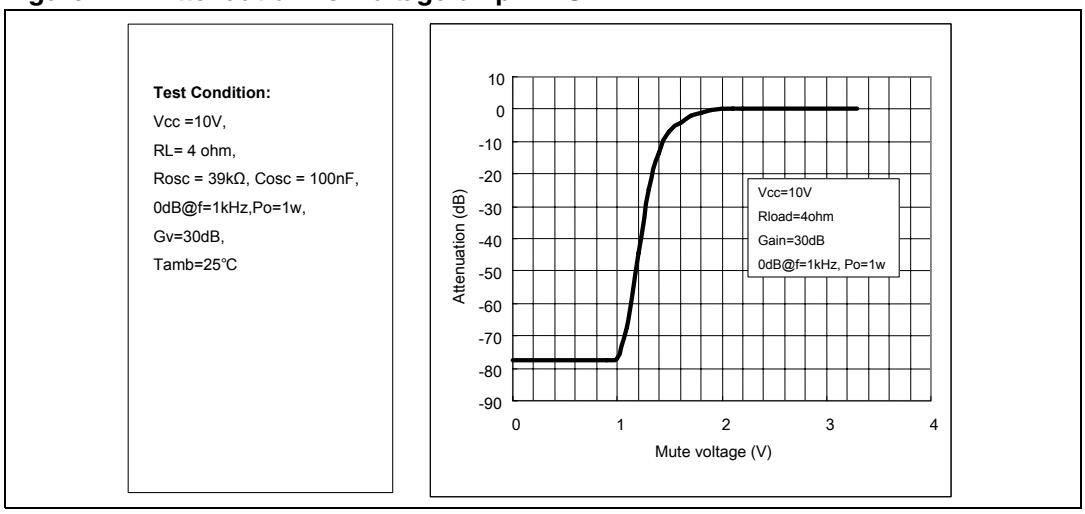



**Figure 15. Current consumption vs. voltage on pin STBY**

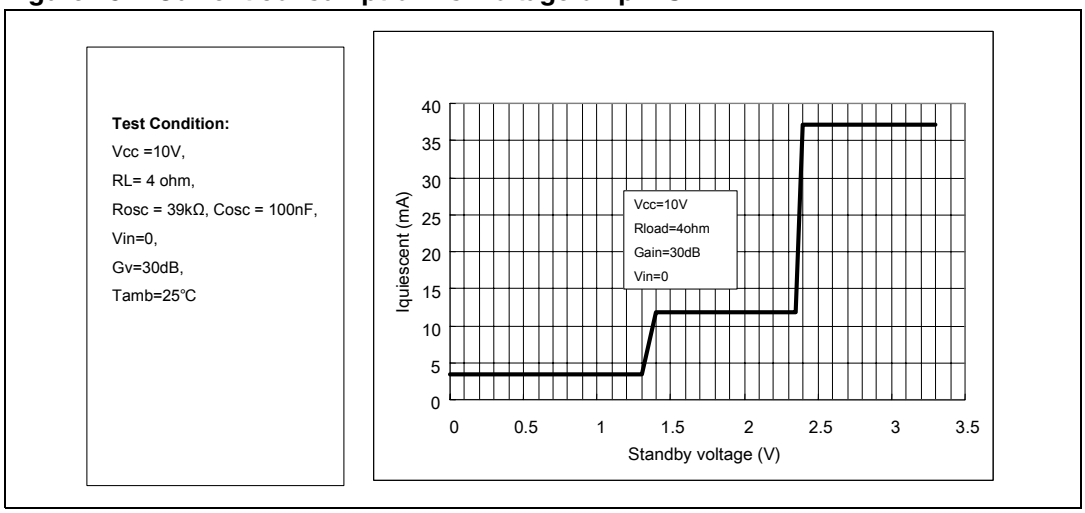
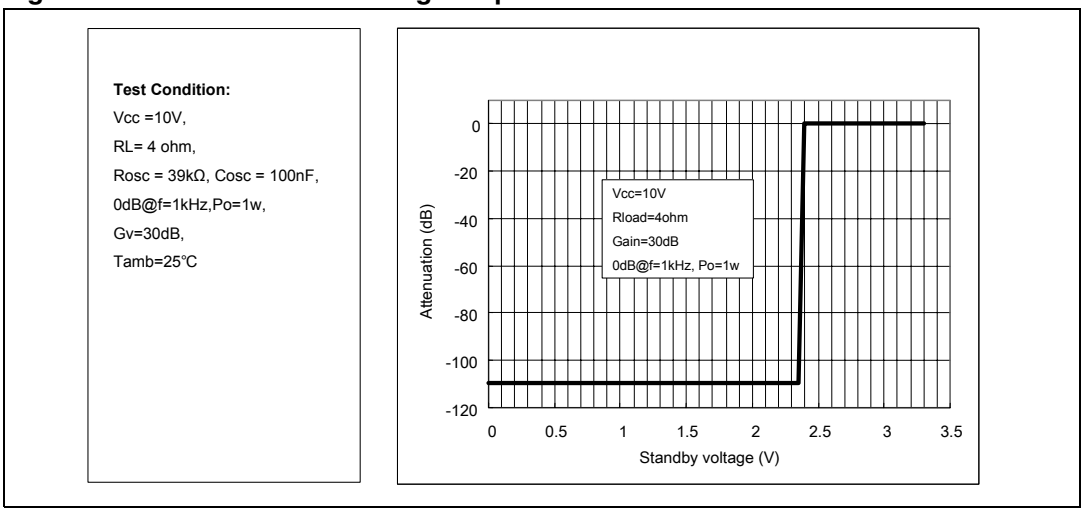


**Figure 16. Attenuation vs. voltage on pin STBY**




## 4.2 With 6-Ω load at $V_{CC}$ = 11 V

**Figure 17. Output power vs. supply voltage**

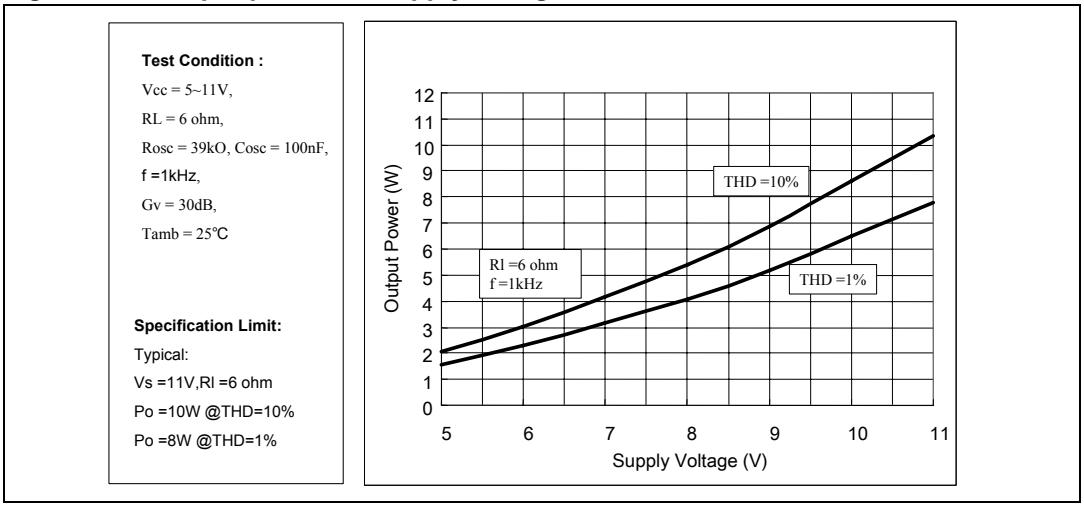


**Figure 18. THD vs. output power (1 kHz)**

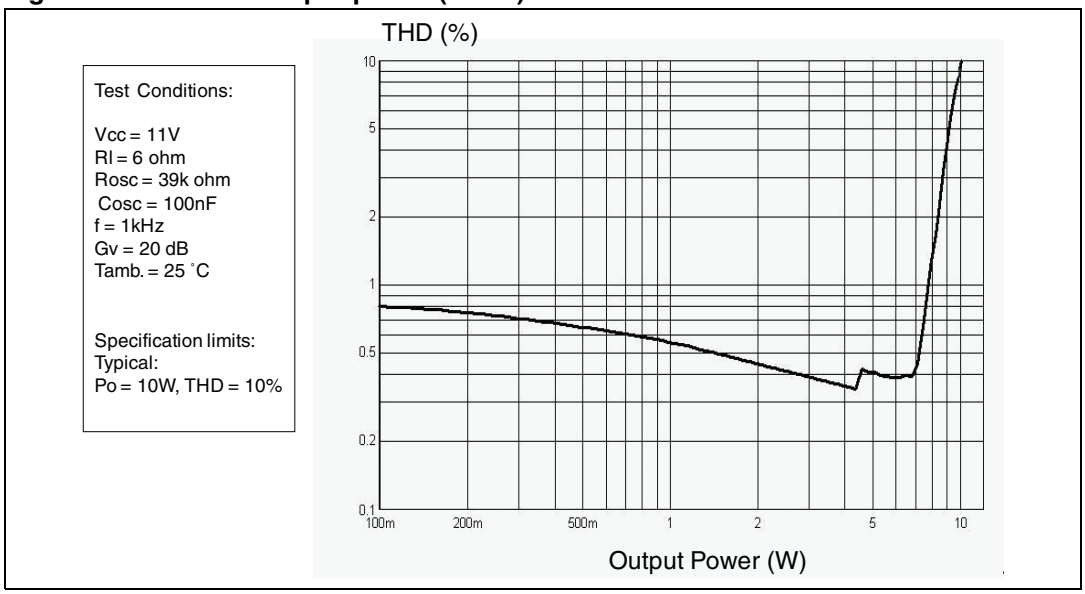



**Figure 19. THD vs. output power (100 Hz)**

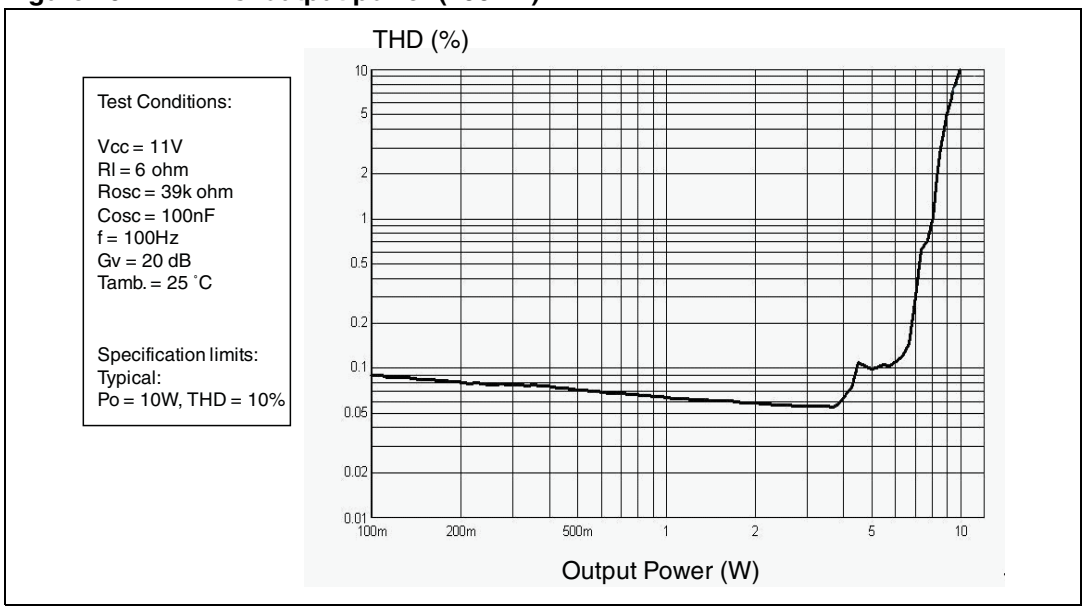


**Figure 20. THD vs. output power (15 kHz)**

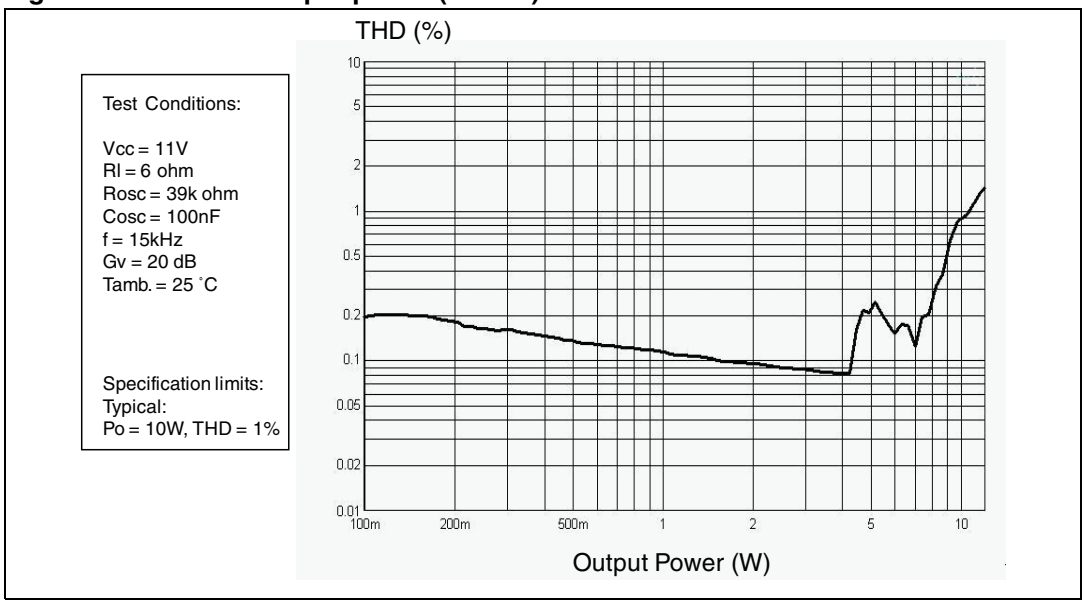



**Figure 21. THD vs. frequency**

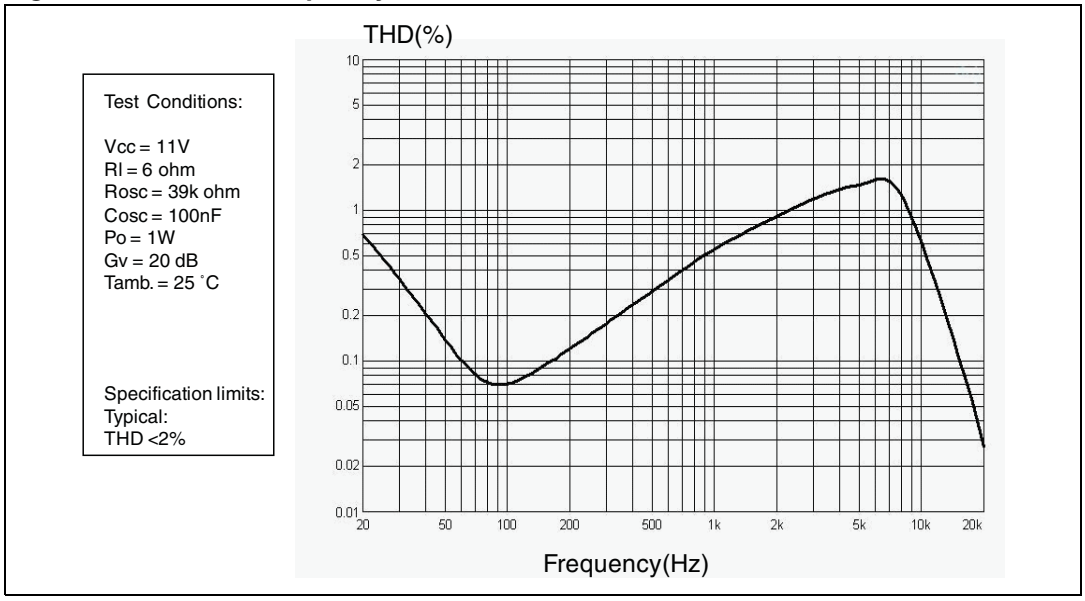


**Figure 22. Frequency response**

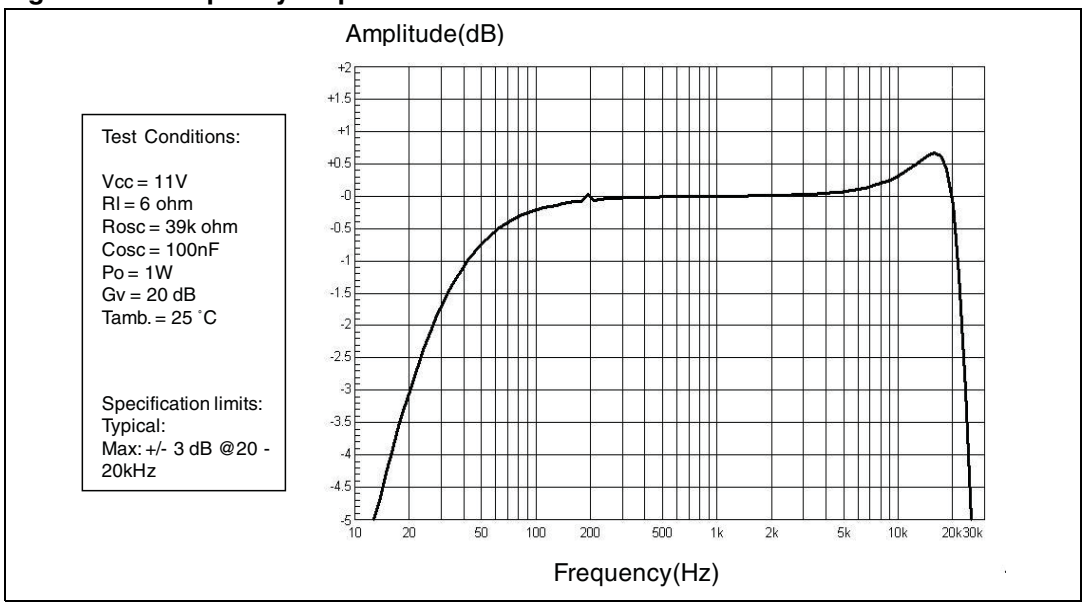



**Figure 23. Crosstalk vs. frequency**

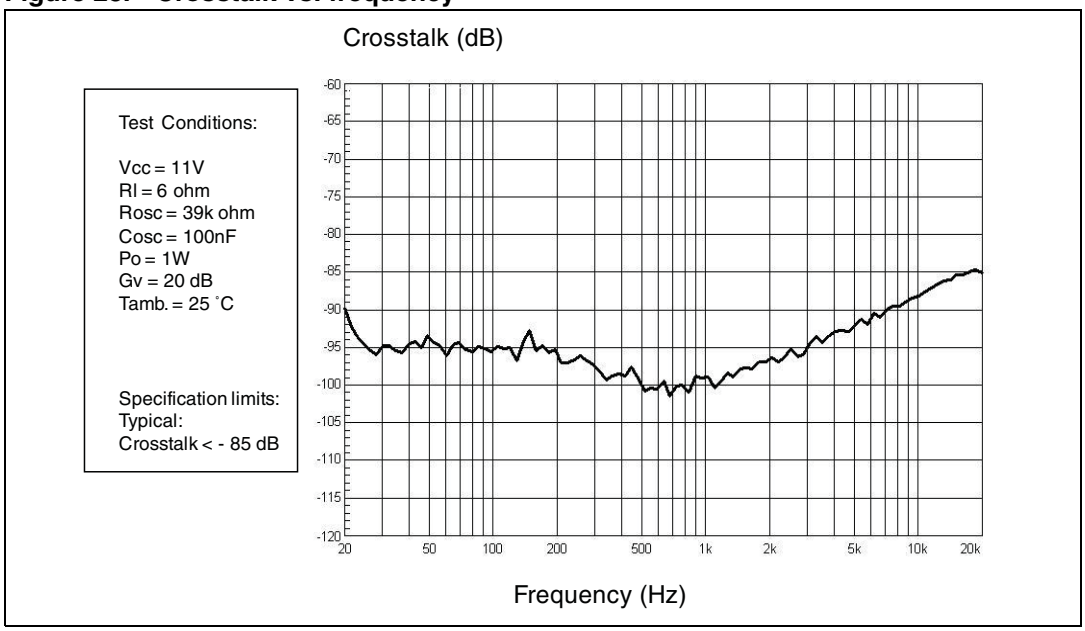


**Figure 24. FFT (0 dB)**

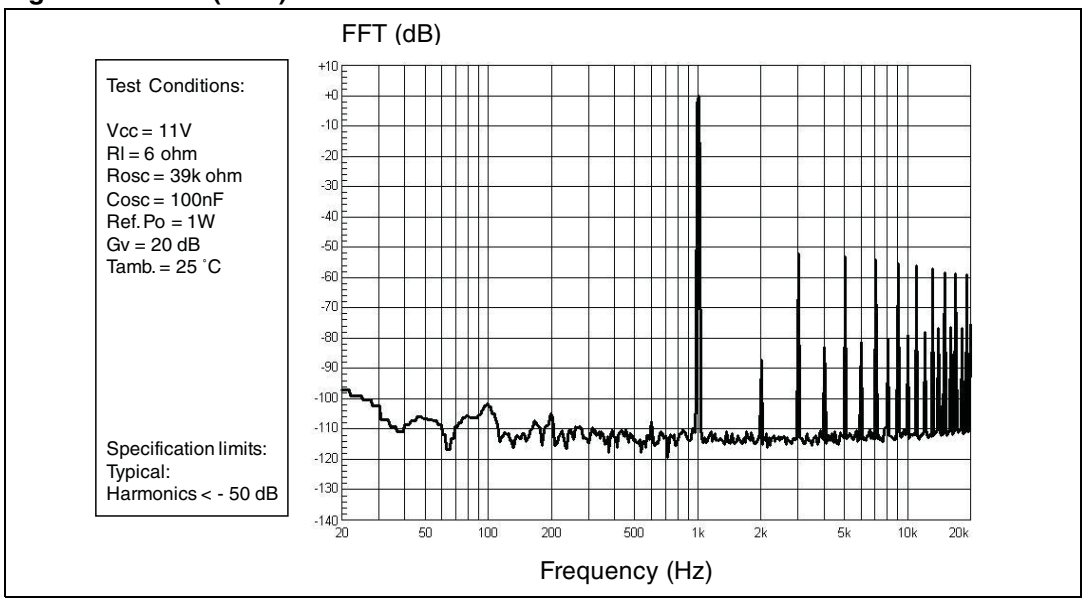



**Figure 25. FFT (-60 dB)**

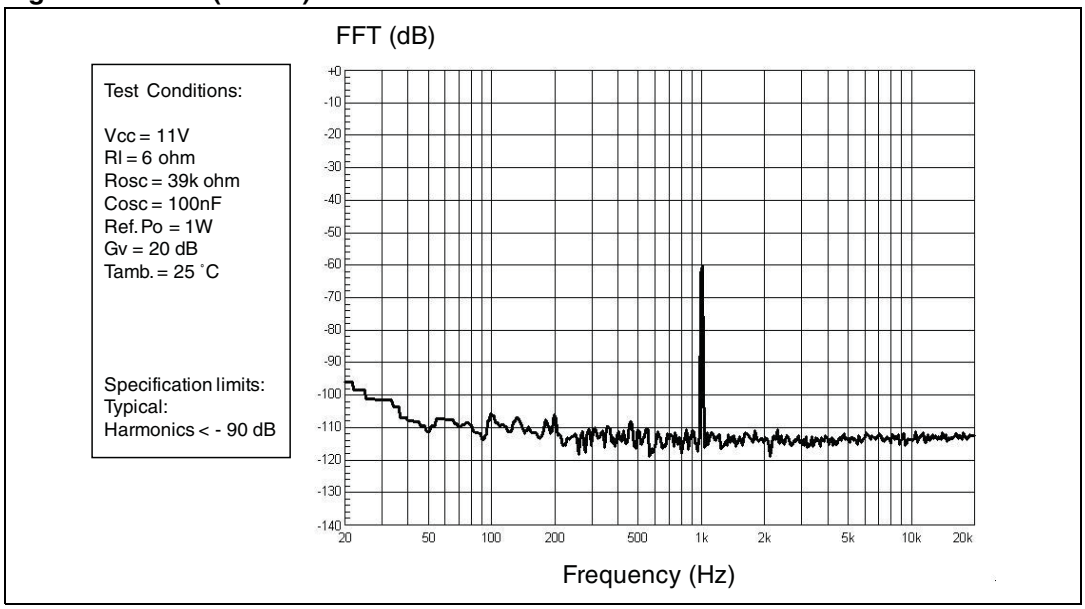


**Figure 26. Power supply rejection ratio vs. frequency**

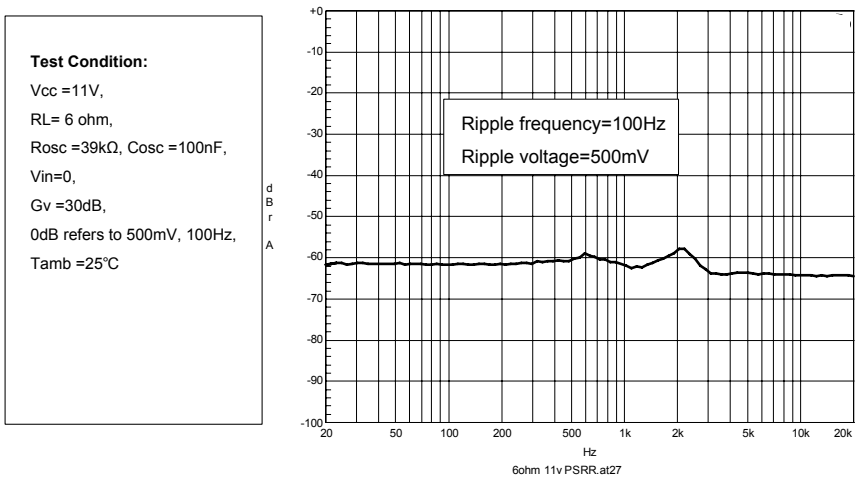
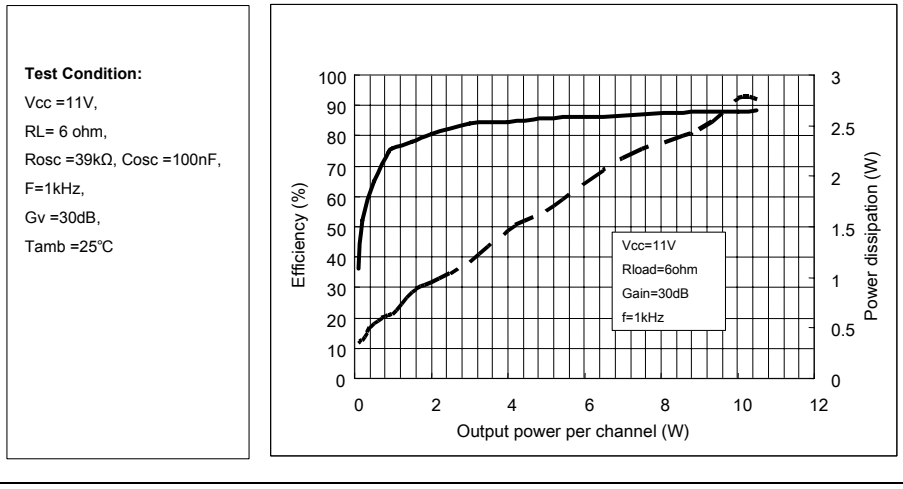



**Figure 27. Power dissipation and efficiency vs. output power**



## 4.3 With 8-Ω load at $V_{CC}$ = 12 V

**Figure 28. Output power vs. supply voltage**

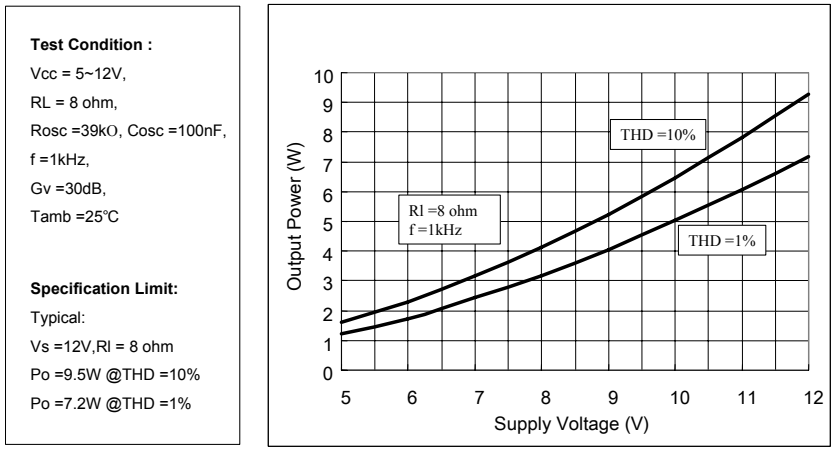



**Figure 29. THD vs. output power (1 kHz)**

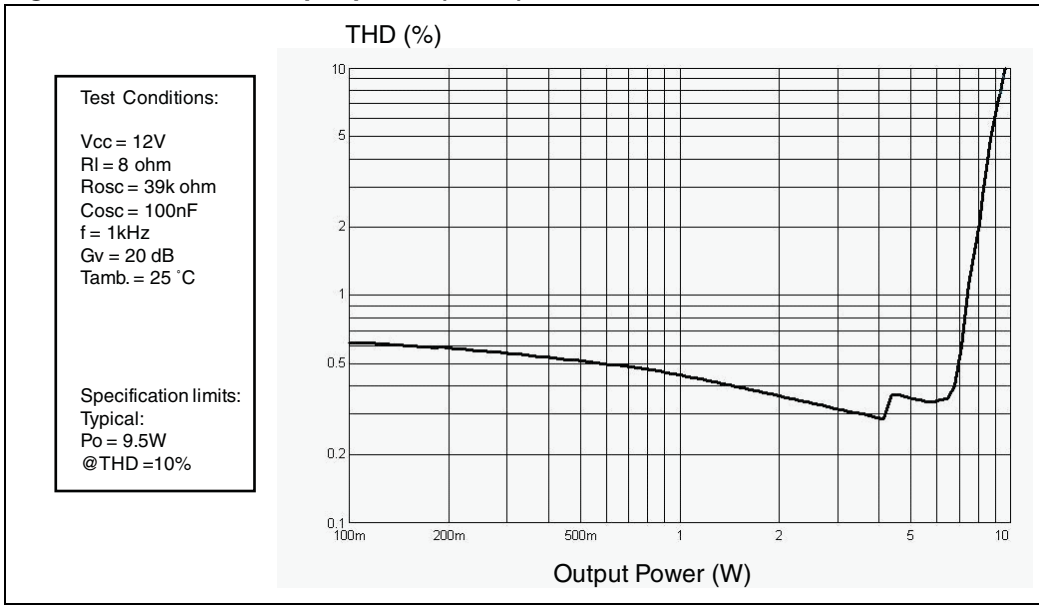


**Figure 30. THD vs. output power (100 Hz)**

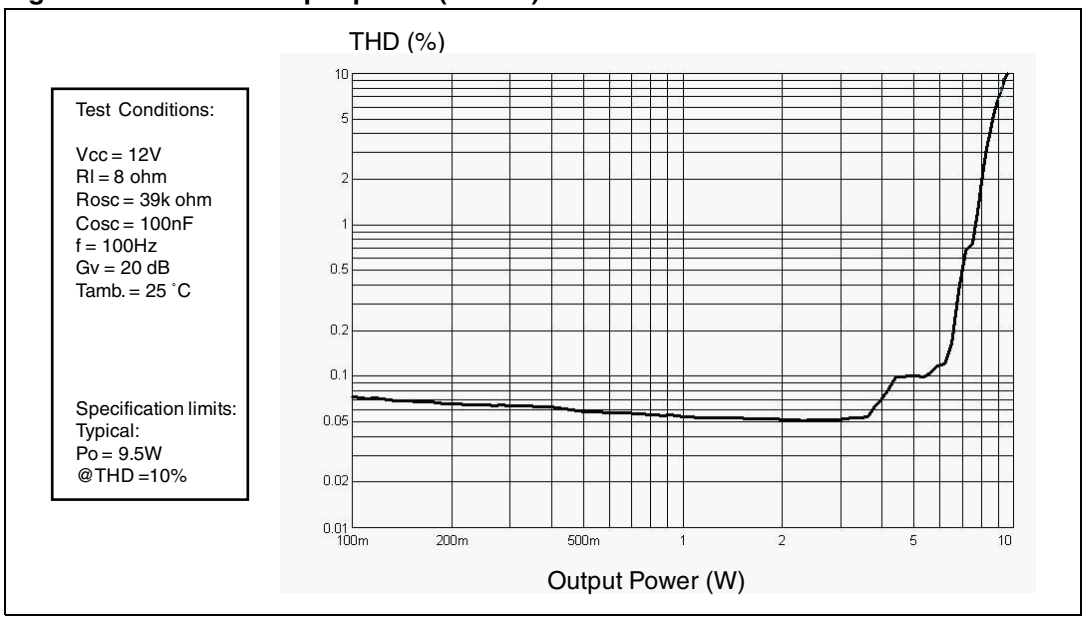



**Figure 31. THD vs. output power (15 kHz)**