Ordering number: EN 5173

Thick Film Hybrid IC

No. 5173

SANYO

# STK405-120

## 2ch AF Power Amplifier (Split Power Supply) 80W + 80W min, THD = 10%

## Overview

The STK405-120, a member of the STK405-000 series, is a low-cost, 2-channel audio power amplifier hybrid IC that is ideal for a wide range of stereo sets. It has dedicated 6Ω output drive, in contrast with the STK401-000 series which supports 6Ω/3Ω output drive.

## Features

- Class B amplifiers
- Output load impedance $R_L$ = 6Ω support
- EIAJ-output compatible (f = 1kHz, THD = 10%)
- Low supply switching shock noise
- Pin assignment grouped into individual blocks of inputs, outputs and supply lines to minimize the adverse effects of pattern layout on operating characteristics
- External bootstrap circuit not necessary
- Standby operation possible using external circuit
- Voltage gain VG = 26dB for easy gain distribution within the set
- Member of 10W/ch to 80W/ch pin-compatible series

## Series Organization

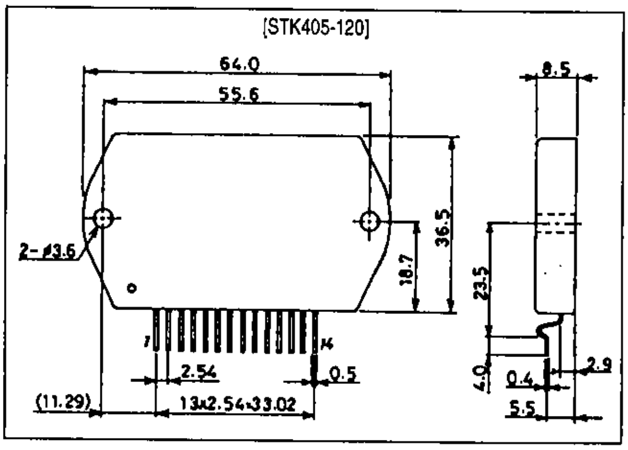
The following devices form a series with differing output capacity. Some of the following devices are under development. Contact your Sanyo sales representative if you require more detailed information.

| Type No. | Output power | Supply voltage [V] | |
|---|---|---|---|
| | | $V_{CC}$ max | $V_{CC}$ |
| STK405-010 | 10W + 10W | ±26.0 | ±14.0 |
| STK405-030 | 20W + 20W | ±30.5 | ±18.5 |
| STK405-050 | 30W + 30W | ±34.5 | ±22.0 |
| STK405-070 | 40W + 40W | ±39.0 | ±25.0 |
| STK405-090 | 50W + 50W | ±42.0 | ±26.5 |
| STK405-100 | 60W + 60W | ±45.0 | ±29.0 |
| STK405-110 | 70W + 70W | ±50.0 | ±31.0 |
| STK405-120 | 80W + 80W | ±52.5 | ±33.0 |

## Package Dimensions

unit: mm

**4162**



# Specifications

## Maximum Ratings at Ta = 25°C

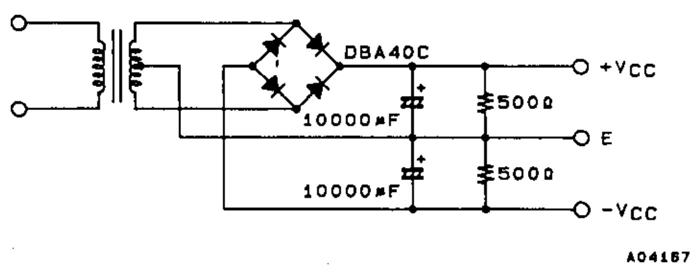
| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum supply voltage | $V_{CC}$ max | | ±52.5 | V |
| Thermal resistance | θj-c | Per power transistor | 1.8 | °C/W |
| Junction temperature | Tj | | 150 | °C |
| Operating substrate temperature | Tc | | 125 | °C |
| Storage temperature | Tstg | | –30 to +125 | °C |
| Available time for load short-circuit | $t_s$ | $V_{CC}$ = ±33.0V, $R_L$ = 6Ω, f = 50Hz, $P_O$ = 80W | 1 | s |

## Operating Characteristics at Ta = 25°C, $R_L$ = 6Ω (noninductive load), Rg = 600Ω, VG = 26dB

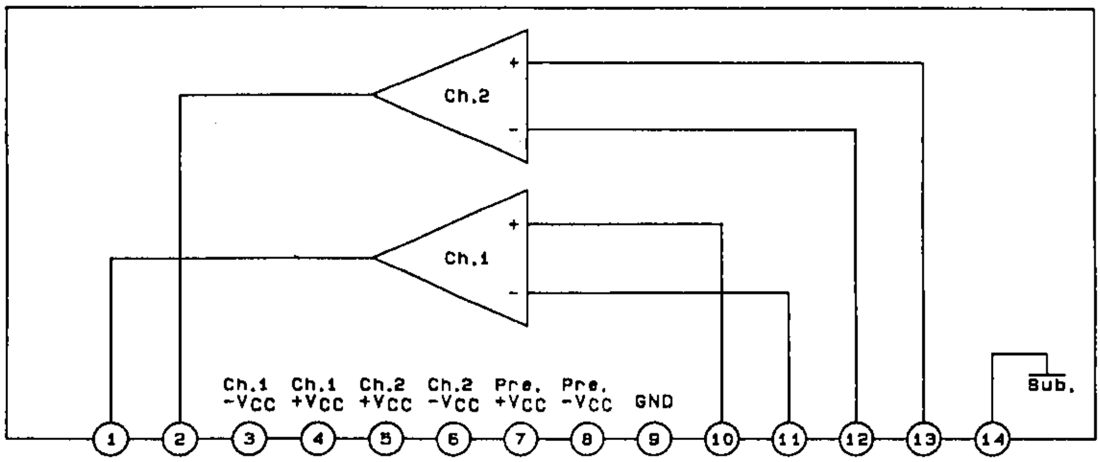
| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Quiescent current | $I_{CCO}$ | $V_{CC}$ = ±42.0V, no load | – | 13 | 20 | mA |
| Output power | $P_O$ | $V_{CC}$ = ±33.0V, f = 1kHz, THD = 10.0% | 80 | – | – | W |
| Total harmonic distortion | THD | $V_{CC}$ = ±33.0V, f = 1kHz, $P_O$ = 5.0W | – | 0.04 | 0.1 | % |
| Frequency response | $f_L$, $f_H$ | $V_{CC}$ = ±33.0V, $P_O$ = 1.0W, $^{+0}_{-3}$dB | – | 20 to 50k | – | Hz |
| Input impedance | $r_i$ | $V_{CC}$ = ±33.0V, f = 1kHz, $P_O$ = 1.0W | – | 55 | – | kΩ |
| Output noise voltage | $V_{NO}$ | $V_{CC}$ = ±42.0V, Rg = 10kΩ | – | – | 1.2 | mVrms |
| Neutral voltage | $V_N$ | $V_{CC}$ = ±42.0V | –100 | 0 | +100 | mV |

Notes.
All tests are measured using a regulated voltage supply unless otherwise specified.
Available time for load short-circuit and output noise voltage are measured using the transformer supply specified below.
The output noise voltage is the peak value of an average-reading meter with an rms value scale (VTVM). A regulated AC supply (50Hz) should be used to eliminate the effects of AC primary line flicker noise.

## Specified Transformer Supply (MG-200 or Equivalent)



## Block Diagram

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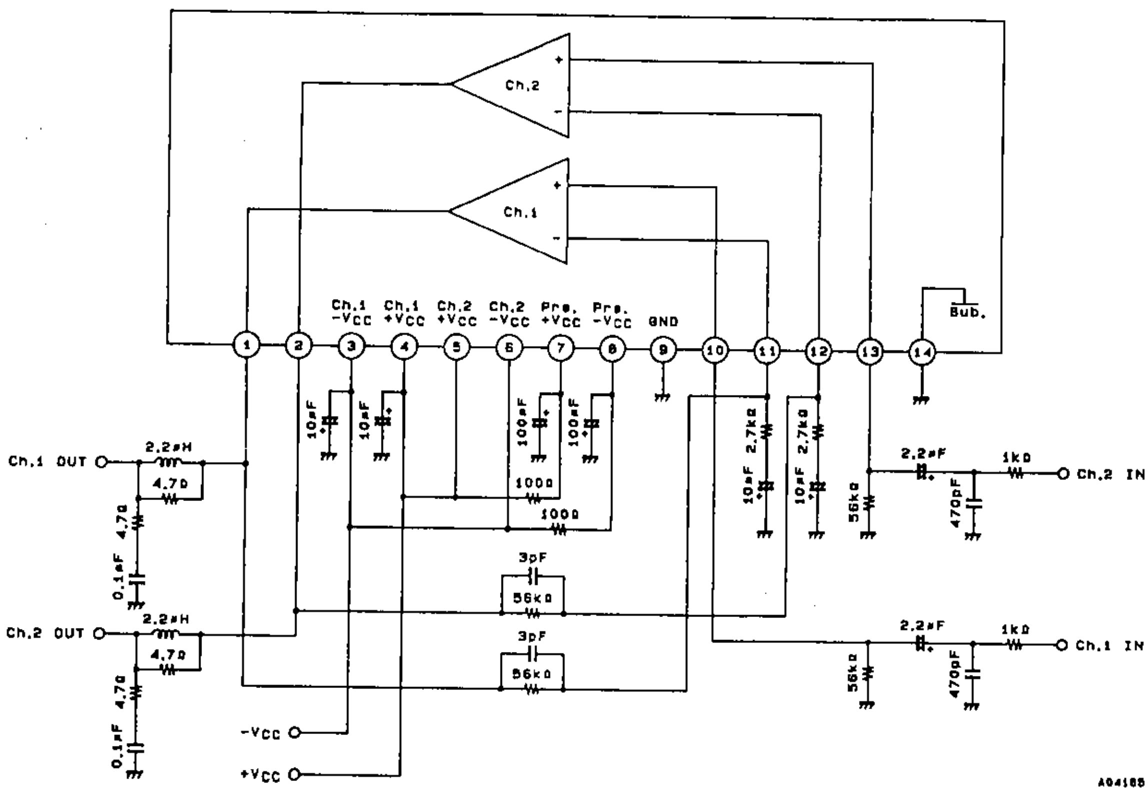
## Test Circuit

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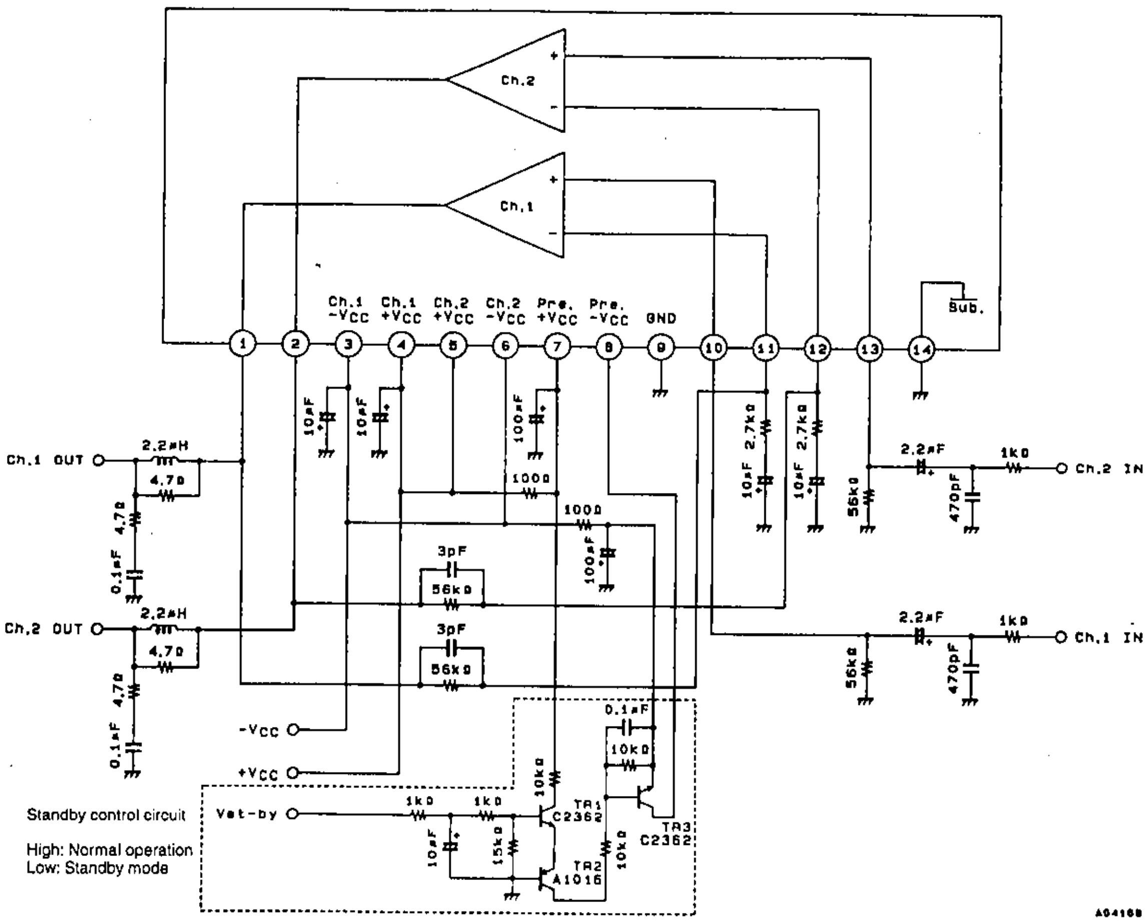
## Sample Application Circuit (Standby Mode Supported)




## Heatsink Design Considerations

The heatsink thermal resistance, θc-a, required to dissipate the STK405-120 device total power dissipation, Pd, is determined as follows:

Condition 1: IC substrate temperature not to exceed 125°C.

$$Pd \times \theta c\text{-}a + Ta < 125°C \quad (1)$$

where Ta is the guaranteed maximum ambient temperature.

Condition 2: Power transistor junction temperature, Tj, not to exceed 150°C.

$$Pd \times \theta c\text{-}a + Pd/N \times \theta j\text{-}c + Ta < 150°C \quad (2)$$

where N is the number of power transistors and θj-c is the power transistor thermal resistance per transistor. Note that the power dissipated per transistor is the total, Pd, divided evenly among the N power transistors.

Expressions (1) and (2) can be rewritten making θc-a the subject.

$$\theta c\text{-}a < (125 - Ta)/Pd \quad (1)'$$

$$\theta c\text{-}a < (150 - Ta)/Pd - \theta j\text{-}c/N \quad (2)'$$

The heatsink required must have a thermal resistance that simultaneously satisfies both expressions.

The heatsink thermal resistance can be determined from (1)′ and (2)′ once the following parameters have been defined.

- Supply voltage: $V_{CC}$
- Load resistance: $R_L$
- Guaranteed maximum ambient temperature: Ta

The total device power dissipation when STK405-120 $V_{CC}$ = ±33.0V and $R_L$ = 6Ω, for a continuous sine wave signal, is a maximum of 74W, as shown in the Pd—$P_O$ characteristic graph.

When estimating the power dissipation for an actual audio signal input, the rule of thumb is to select Pd corresponding to 1/10 $P_O$ max (within safe limits) for a continuous sine wave input. For example,

Pd = 53W (for 1/10 $P_O$ max = 8W)

The STK405-120 has 4 power transistors, and the thermal resistance per transistor, θj-c, is 1.8°C/W. If the guaranteed maximum ambient temperature, Ta, is 50°C, then the required heatsink thermal resistance, θc-a, is:

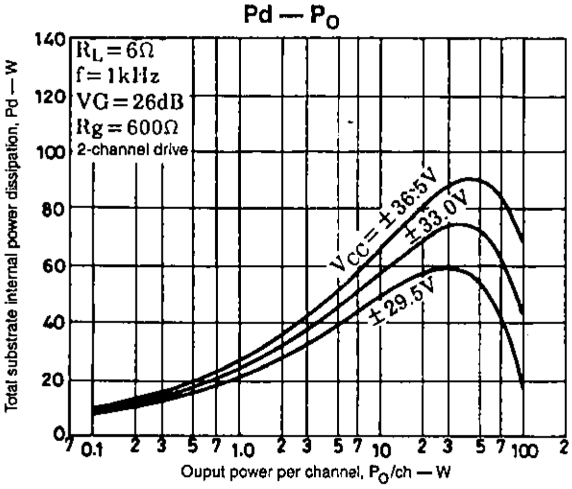
From expression (1)′: θc-a < (125 – 50)/53
< 1.41

From expression (2)′: θc-a < (150 – 50)/53 – 1.8/4
< 1.43

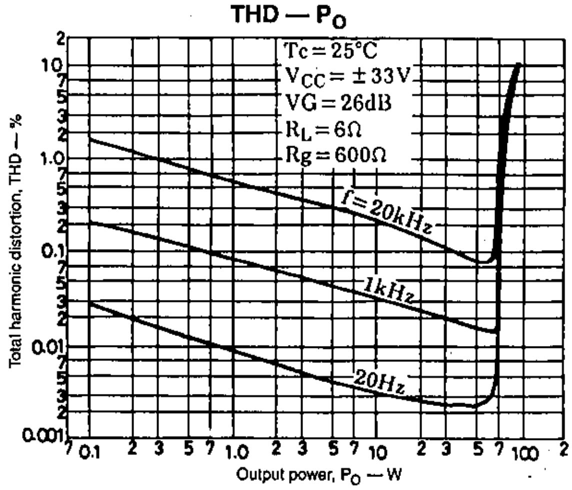
Therefore, to satisfy both expressions, the required heatsink must have a thermal resistance less than 1.41°C/W.

This heatsink design example is based on a constant-voltage supply, and should be verified within your specific set environment.

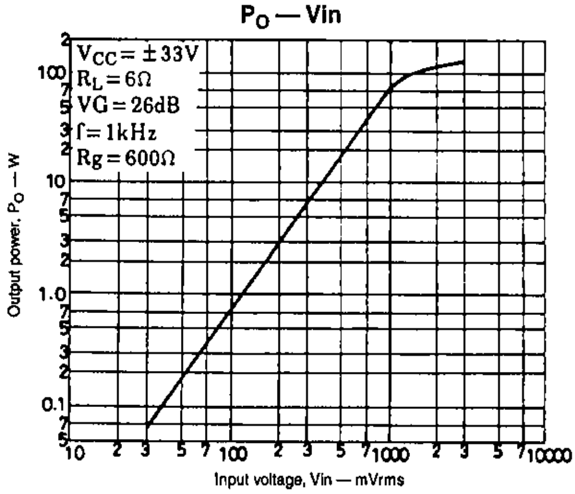
Pd — $P_O$



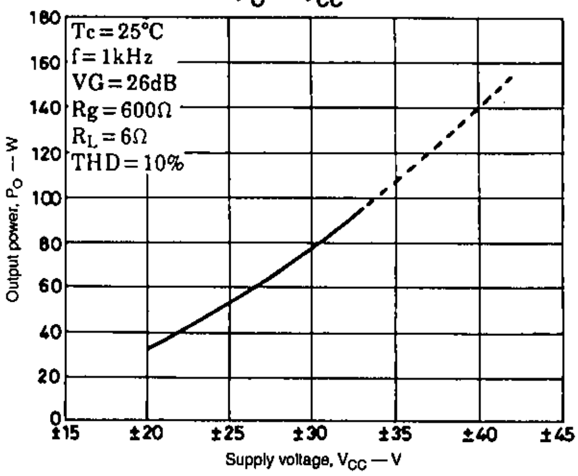

THD — $P_O$



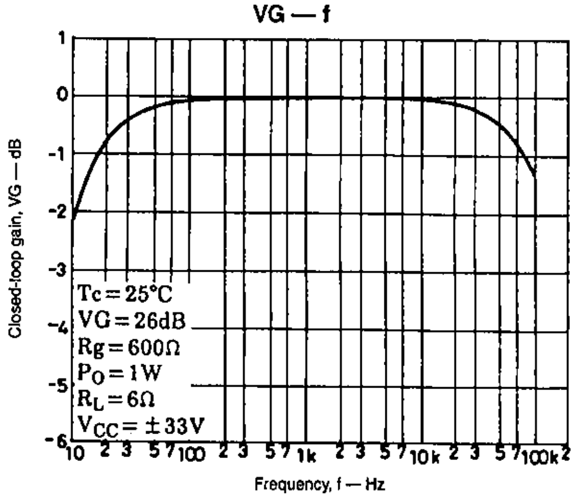

$P_O$ — Vin



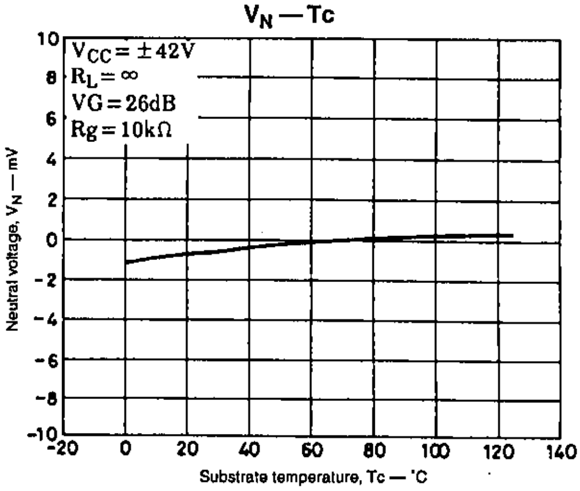

$P_O$ — $V_{CC}$

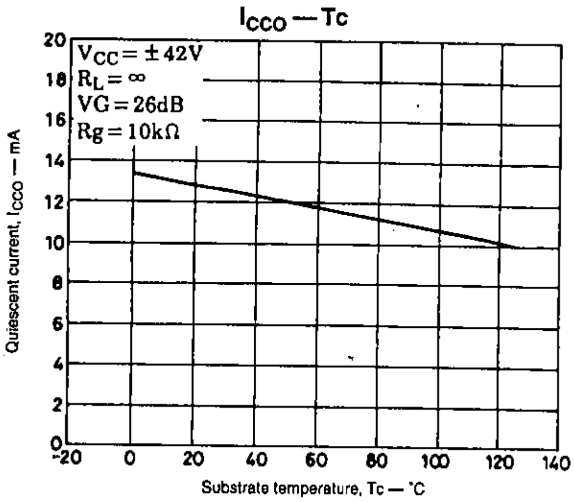



VG — f

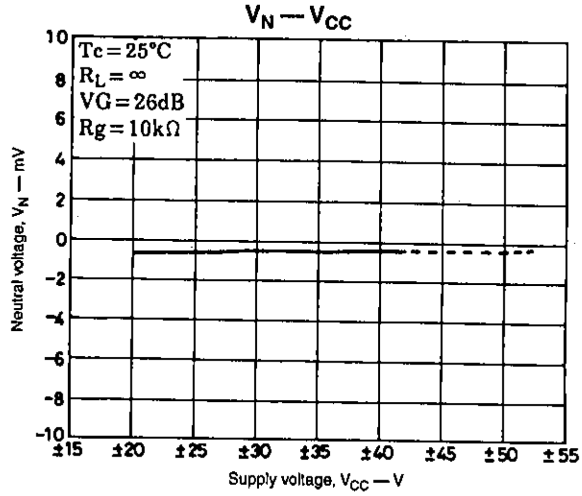



$V_N$ — Tc

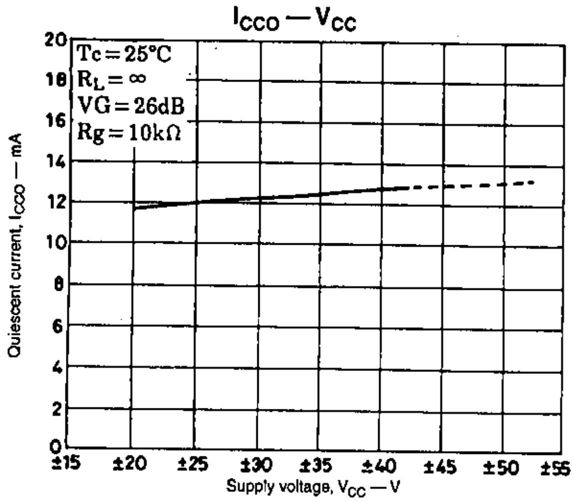




$I_{CCO}$ — Tc
$V_{CC}$ = ±42V
$R_L$ = ∞
VG = 26dB
Rg = 10kΩ
Quiescent current, $I_{CCO}$ — mA
Substrate temperature, Tc — °C

$V_N$ — $V_{CC}$
Tc = 25°C
$R_L$ = ∞
VG = 26dB
Rg = 10kΩ
Neutral voltage, $V_N$ — mV
Supply voltage, $V_{CC}$ — V

$I_{CCO}$ — $V_{CC}$
Tc = 25°C
$R_L$ = ∞
VG = 26dB
Rg = 10kΩ
Quiescent current, $I_{CCO}$ — mA
Supply voltage, $V_{CC}$ — V