

Ordering number: EN 5178

Thick Film Hybrid IC

| | | |
|--------------|----------|---|
| SANYO | No. 5178 | STK405-050 |
| | | 2ch AF Power Amplifier (Split Power Supply) 30W + 30W min, THD = 10% |

Overview

The STK405-050, 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 $R_L = 6\Omega$ support
- EIAJ-output compatible ($f = 1\text{kHz}$, 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

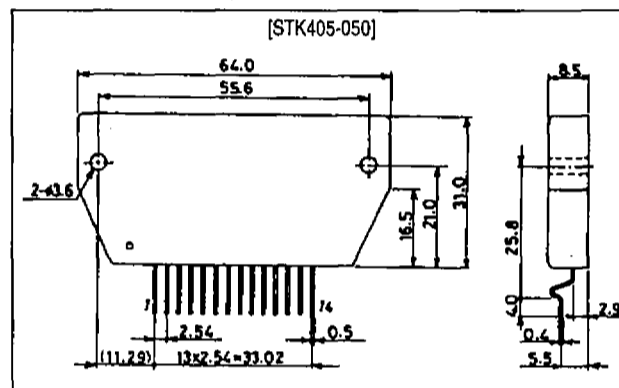
The following devices form a series with differing output capacity. Some of the following devices are under development. Contact your Sanyo sales representative if you require more detailed information.

| Type No. | Output power | Supply voltage [V] | |
|------------|--------------|---------------------|----------|
| | | $V_{CC\text{ max}}$ | 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

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O1295HA (ID) No. 5178-1/6

Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|---------------------------------------|----------------------|---|------------------------|--------------------|
| Maximum supply voltage | $V_{CC \text{ max}}$ | | ± 34.5 | V |
| Thermal resistance | θ_{j-c} | Per power transistor | 3.4 | $^\circ\text{C/W}$ |
| Junction temperature | T_j | | 150 | $^\circ\text{C}$ |
| Operating substrate temperature | T_c | | 125 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | $-30 \text{ to } +125$ | $^\circ\text{C}$ |
| Available time for load short-circuit | t_s | $V_{CC} = \pm 22\text{V}, R_L = 6\Omega, f = 50\text{Hz}, P_O = 30\text{W}$ | 1 | s |

Operating Characteristics at $T_a = 25^\circ\text{C}$, $R_L = 6\Omega$ (noninductive load), $R_g = 600\Omega$, $V_G = 26\text{dB}$

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---------------------------|------------|---|------|-----------|------|------------------|
| Quiescent current | I_{CCO} | $V_{CC} = \pm 28.0\text{V}$, no load | - | 13 | 20 | mA |
| Output power | P_O | $V_{CC} = \pm 22.0\text{V}$, $f = 1\text{kHz}$, THD = 10.0% | 30 | - | - | W |
| Total harmonic distortion | THD | $V_{CC} = \pm 22.0\text{V}$, $f = 1\text{kHz}$, $P_O = 5.0\text{W}$ | - | 0.04 | 0.1 | % |
| Frequency response | f_L, f_H | $V_{CC} = \pm 22.0\text{V}$, $P_O = 1.0\text{W}$, $\pm 3\text{dB}$ | - | 20 to 50k | - | Hz |
| Input impedance | r_i | $V_{CC} = \pm 22.0\text{V}$, $f = 1\text{kHz}$, $P_O = 1.0\text{W}$ | - | 55 | - | $\text{k}\Omega$ |
| Output noise voltage | V_{NO} | $V_{CC} = \pm 28.0\text{V}$, $R_g = 10\text{k}\Omega$ | - | - | 1.2 | mVrms |
| Neutral voltage | V_N | $V_{CC} = \pm 28.0\text{V}$ | -100 | 0 | +100 | mV |

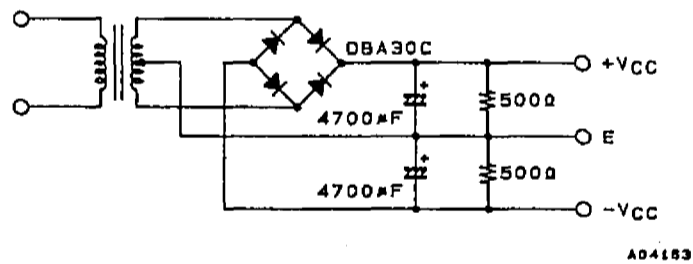
Notes.

All tests are measured using a regulated voltage supply unless otherwise specified.

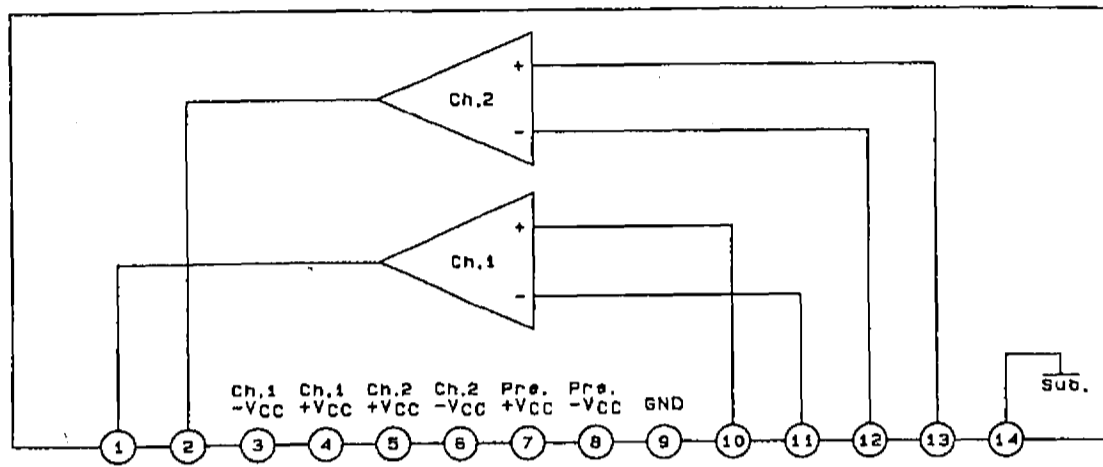
Available time for load short-circuit and output noise voltage are measured using the transformer supply specified below.

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 (RP-25 or Equivalent)

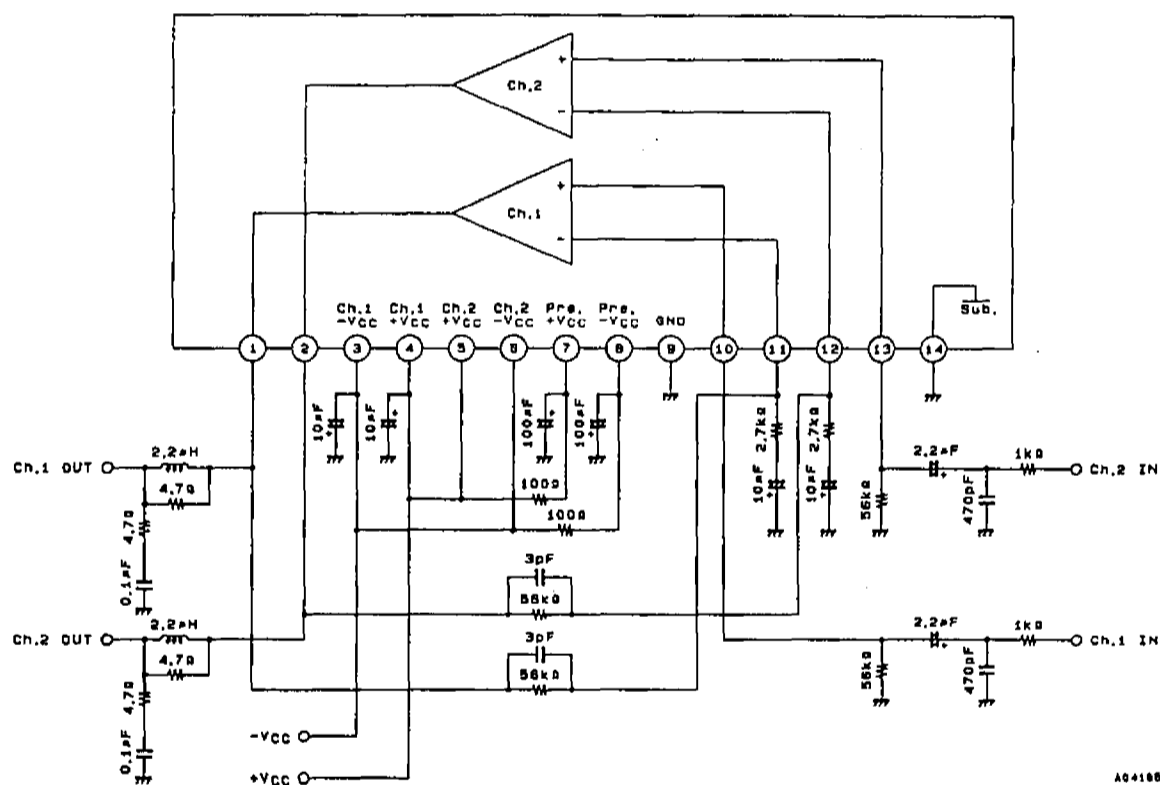


Block Diagram



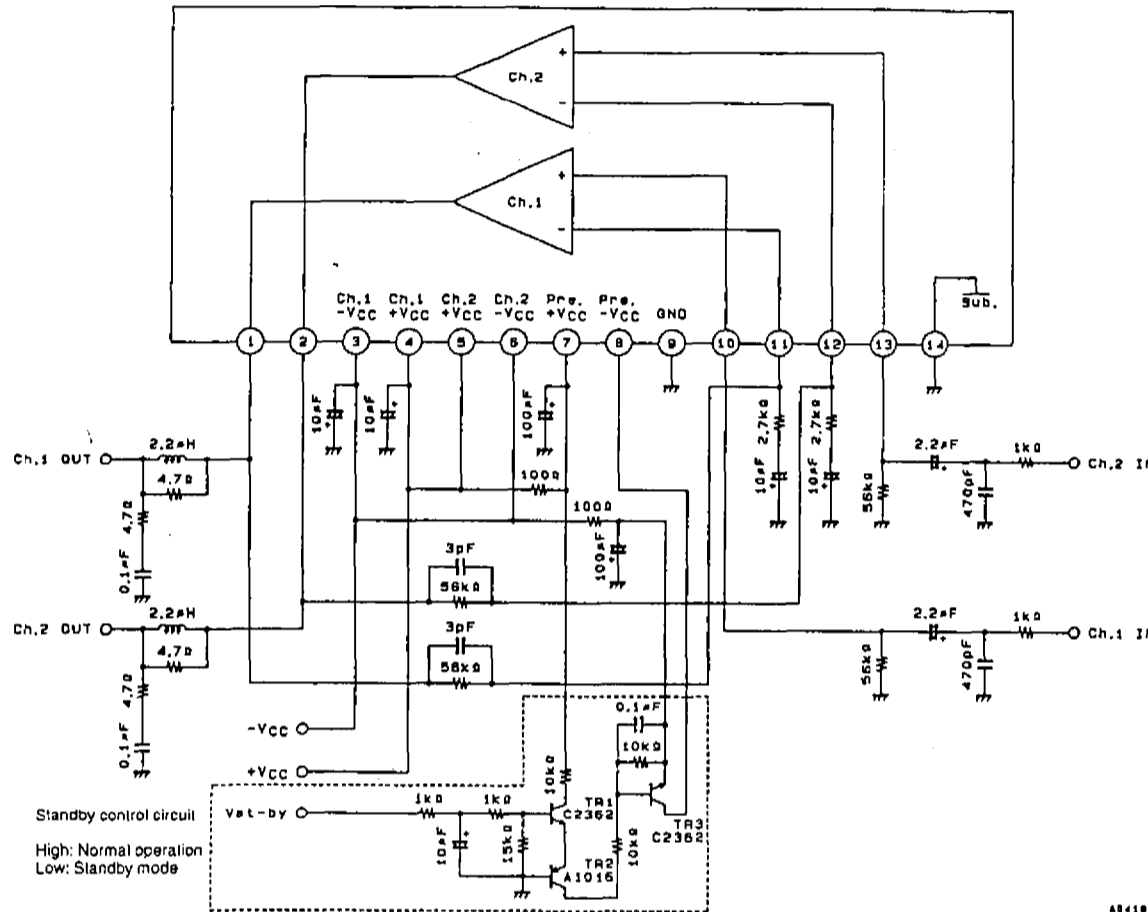
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Test Circuit



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Sample Application Circuit (Standby Mode Supported)



Heatsink Design Considerations

The heatsink thermal resistance, θ_{c-a} , required to dissipate the STK405-050 device total power dissipation, P_d , is determined as follows:

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

$$P_d \times \theta_{c-a} + T_a < 125^\circ\text{C} \dots (1)$$

where T_a is the guaranteed maximum ambient temperature.

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

$$P_d \times \theta_{c-a} + P_d/N \times \theta_{j-c} + T_a < 150^\circ\text{C} \dots (2)$$

where N is the number of power transistors and θ_{j-c} is the power transistor thermal resistance per transistor. Note that the power dissipated per transistor is the total, P_d , divided evenly among the N power transistors.

Expressions (1) and (2) can be rewritten making θ_{c-a} the subject.

$$\theta_{c-a} < (125 - T_a)/P_d \dots (1)'$$

$$\theta_{c-a} < (150 - T_a)/P_d - \theta_{j-c}/N \dots (2)'$$

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: T_a

The total device power dissipation when STK405-050 $V_{CC} = \pm 22.0\text{V}$ and $R_L = 6\Omega$, for a continuous sine wave signal, is a maximum of 33.5W, as shown in the P_d — P_O characteristic graph.

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

$$P_d = 23\text{W (for } 1/10 P_O \text{ max} = 3\text{W)}$$

The STK405-050 has 4 power transistors, and the thermal resistance per transistor, θ_{j-c} , is 3.4°C/W. If the guaranteed maximum ambient temperature, T_a , is 50°C, then the required heatsink thermal resistance, θ_{c-a} , is:

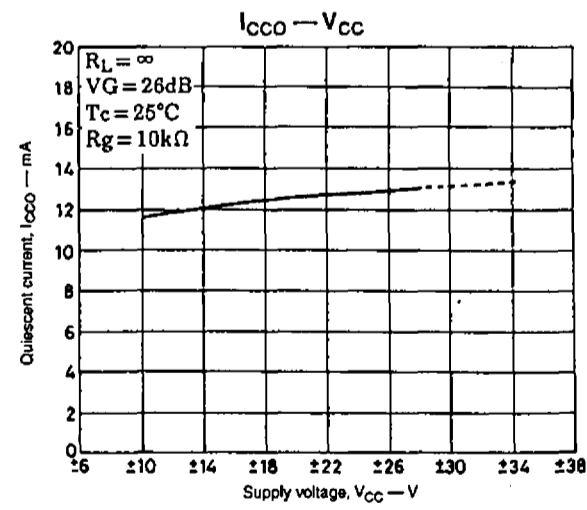
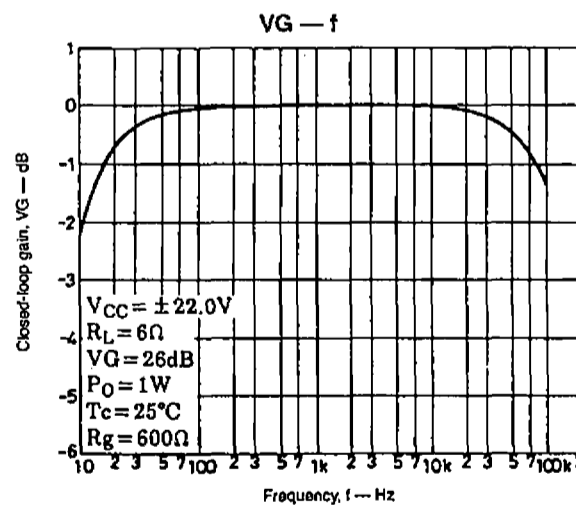
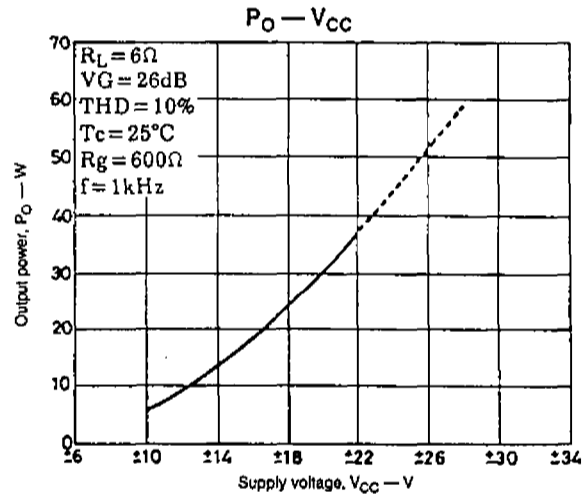
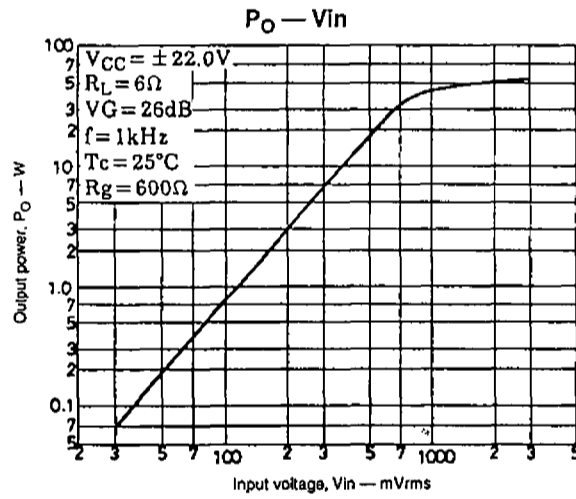
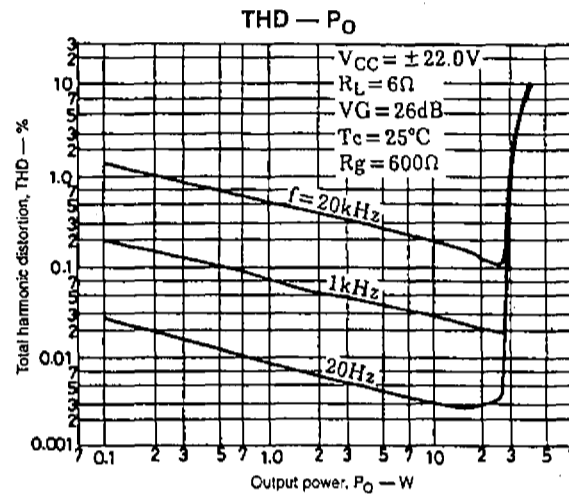
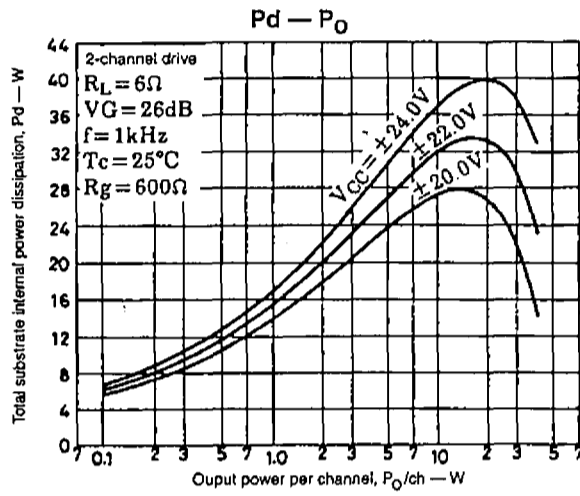
STK405-050

From expression (1): $\theta_{c-a} < (125 - 50)/23$
 < 3.26

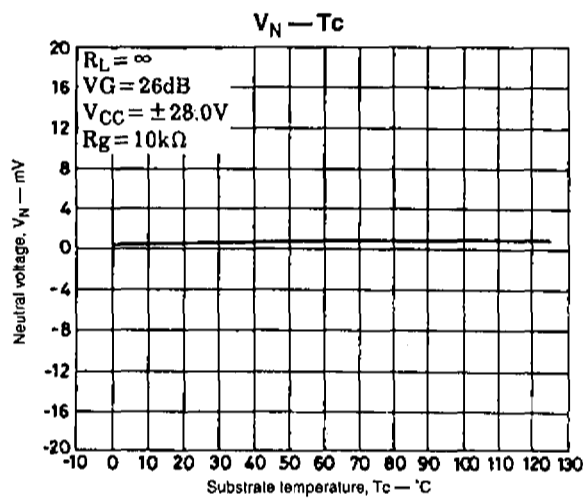
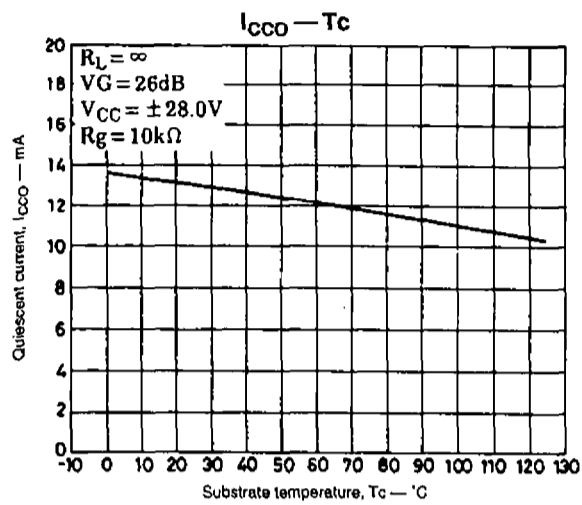
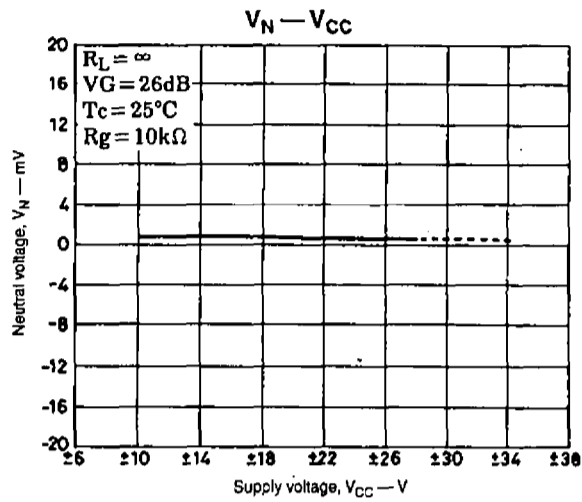
From expression (2): $\theta_{c-a} < (150 - 50)/23 - 3.4/4$
 < 3.49

Therefore, to satisfy both expressions, the required heat-sink must have a thermal resistance less than 3.26°C/W.

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



STK405-050



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