



STK405-070

2ch AF Power Amplifier (Split Power Supply) (40W + 40W min, THD = 10%)

Overview

The STK405-070, 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 $6\Omega/3\Omega$ output drive.

Features

- Class B amplifiers
- Output load impedance $R_L=6\Omega$ support
- EIAJ-output compatible ($f=1\text{kHz}$, $\text{THD}=10\%$)
- 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 $V_G=26\text{dB}$ for easy gain distribution within the set
- Member of 10W/ch to 80W/ch pin-compatible series

Series Organization

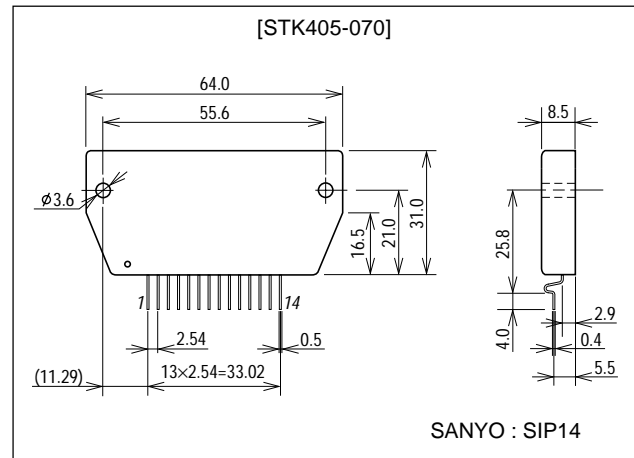
The following devices form a series with differing output capacity. Some of the following devices are under development. Contact your Sanyo sales representative if you require more detailed information.

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

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Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$		± 39.0	V
Thermal resistance	θ_{j-c}	Per power transistor	3.4	$^\circ\text{C/W}$
Junction temperature	T_j		150	$^\circ\text{C}$
Operating temperature	T_c		125	$^\circ\text{C}$
Storage temperature	T_{stg}		-30 to +125	$^\circ\text{C}$
Available time for load short-circuit	t_s	$V_{CC}=\pm 25\text{V}$, $R_L=6\Omega$, $f=50\text{Hz}$, $P_O=40\text{W}$	1	s

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

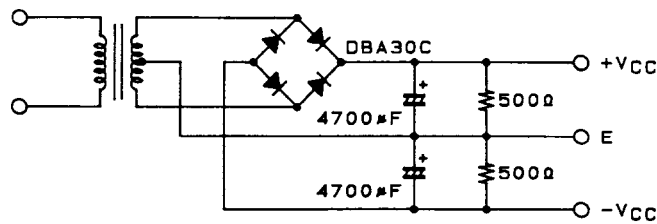
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	I_{CCO}	$V_{CC}=\pm 32.0\text{V}$, no load		13	20	mA
Output power	P_O	$V_{CC}=\pm 25.0\text{V}$, $f=1\text{kHz}$, $\text{THD}=10.0\%$	40			W
Total harmonic distortion	THD	$V_{CC}=\pm 25.0\text{V}$, $f=1\text{kHz}$, $P_O=5.0\text{W}$		0.04	0.1	%
Frequency response	f_L, f_H	$V_{CC}=\pm 25.0\text{V}$, $P_O=1.0\text{W}$, $+0_{-3}\text{ dB}$		20 to 50k		Hz
Input impedance	r_i	$V_{CC}=\pm 25.0\text{V}$, $f=1\text{kHz}$, $P_O=1.0\text{W}$		55		$\text{k}\Omega$
Output noise voltage	V_{NO}	$V_{CC}=\pm 32.0\text{V}$, $R_g=10\text{k}\Omega$			1.2	mVrms
Neutral voltage	V_N	$V_{CC}=\pm 32.0\text{V}$	-100	0	+100	mV

Note.

All tests are measured using a constant-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.

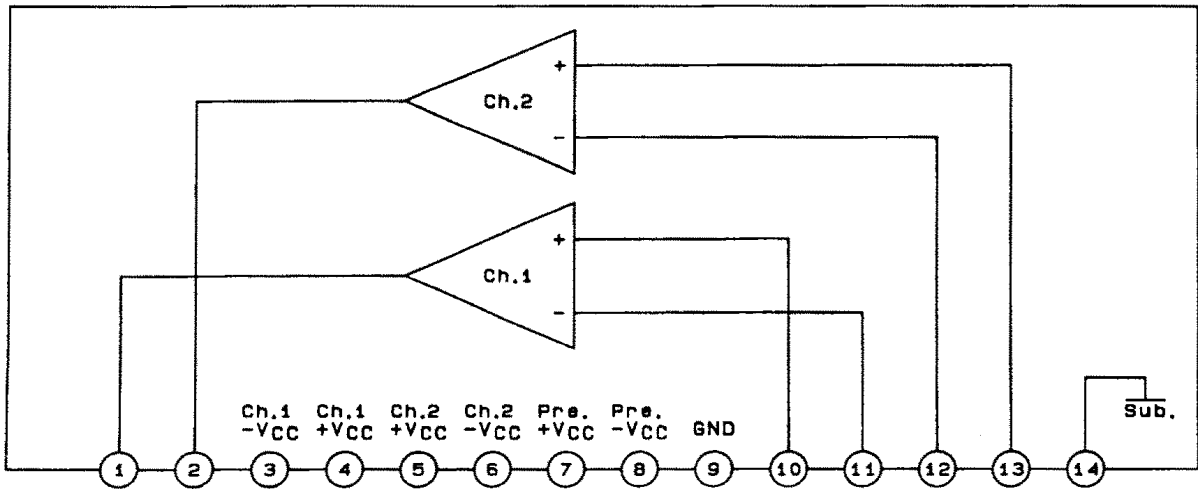
Specified Transformer Supply (RP-25 or Equivalent)



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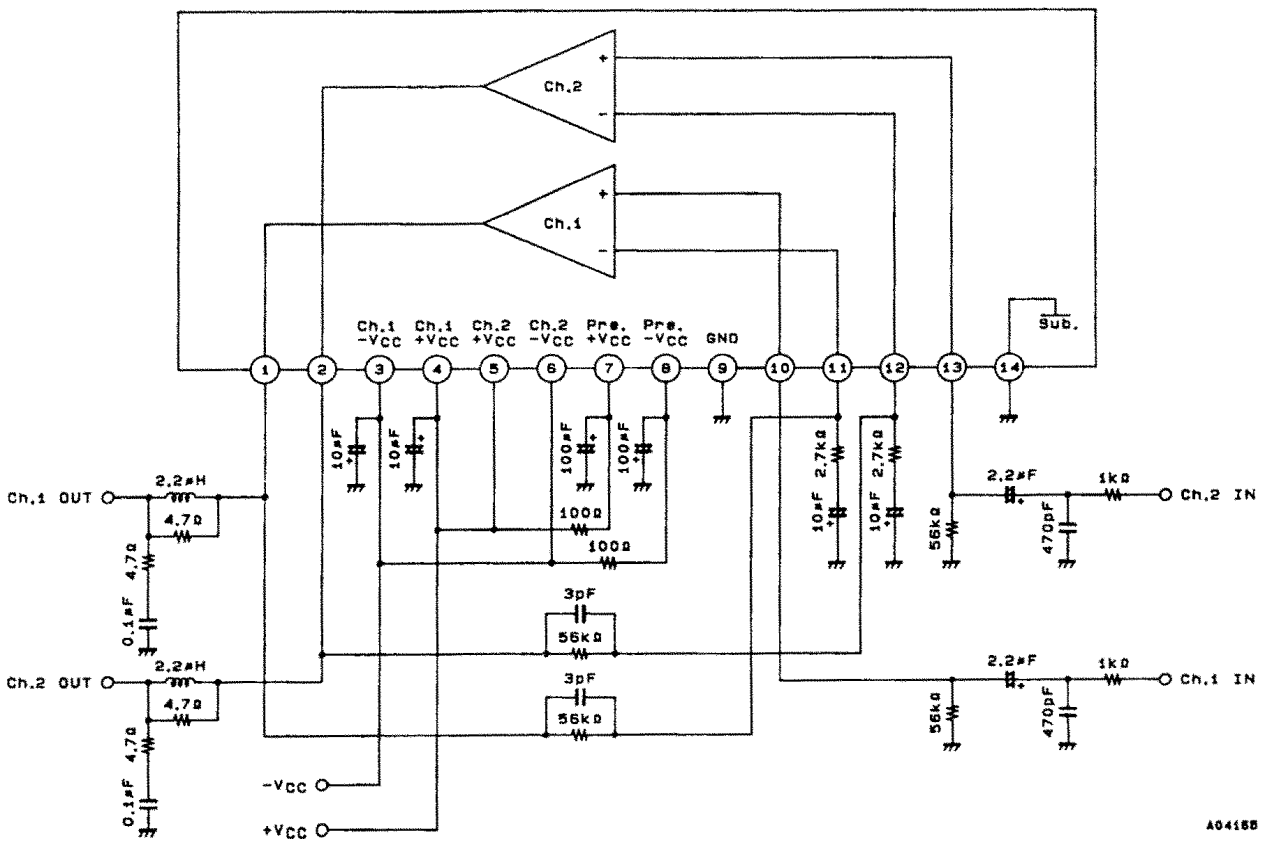
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Block Diagram



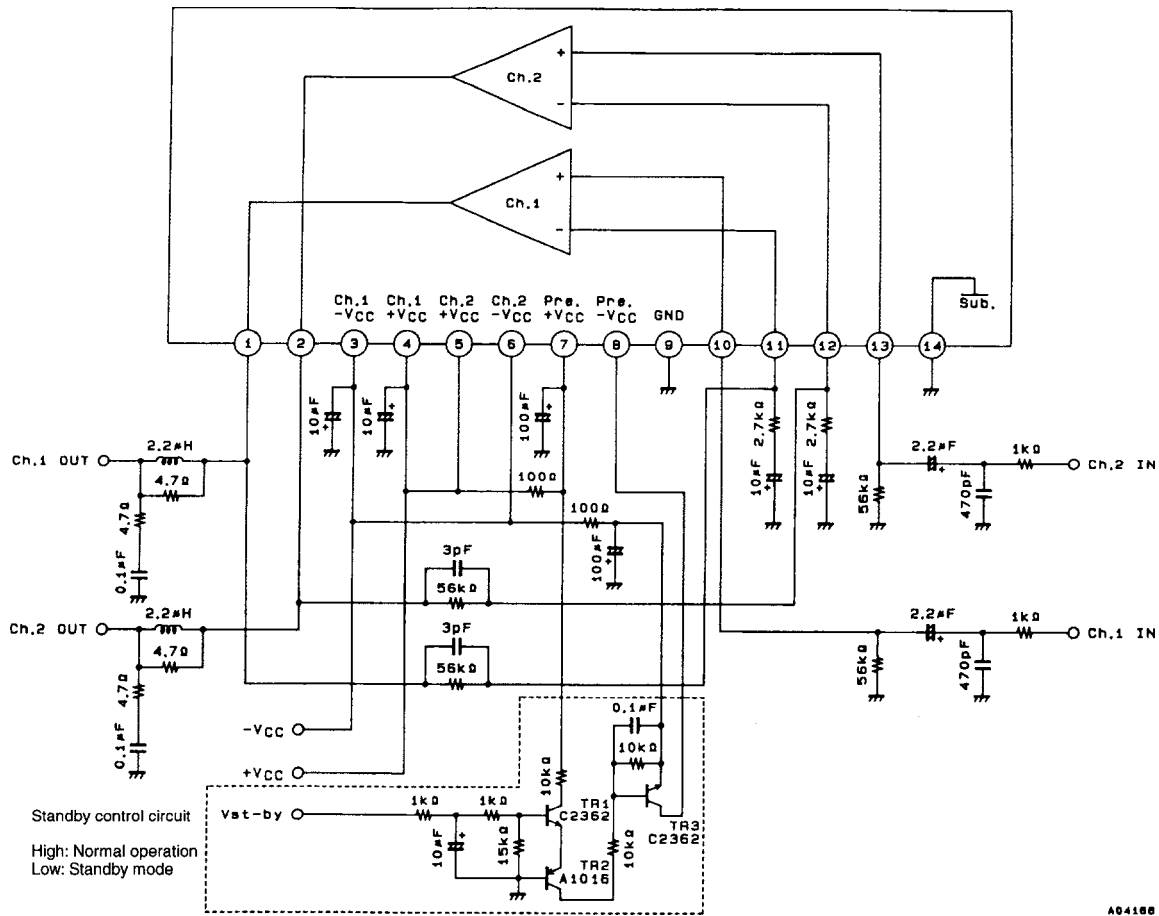
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Test Circuit



A04185

Sample Application Circuit (Standby Mode Supported)



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Heatsink Design Considerations

The heatsink thermal resistance, θ_{c-a} , required to dissipate the STK405-070 device total power dissipation, P_d , is determined as follows :

Condition 1: IC substrate temperature not to exceed 125°C
 $P_d \times \theta_{c-a} + T_a < 125^\circ\text{C}$ (1)

Where T_a is the guaranteed maximum ambient temperature.

Condition 2: Power transistor junction temperature, T_j , not to exceed 150°C
 $P_d \times \theta_{c-a} + P_d / N \times \theta_{j-c} + T_a < 150^\circ\text{C}$ (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.

$\theta_{c-a} < (125 - T_a) / P_d$ (1)
 $\theta_{c-a} < (150 - T_a) / P_d - \theta_{j-c} / N$ (2)

The heatsink required must have a thermal resistance that simultaneously satisfied 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 STK405-070 $V_{CC} = \pm 25.0\text{V}$ and $R_L = 6\Omega$, for a continuous sine wave signal, is a maximum of 42W, as shown in the $P_d - P_O$ characteristics 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,

$P_d = 29\text{W}$ [for 1/10 P_O max = 4W]

The STK405-070 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 :

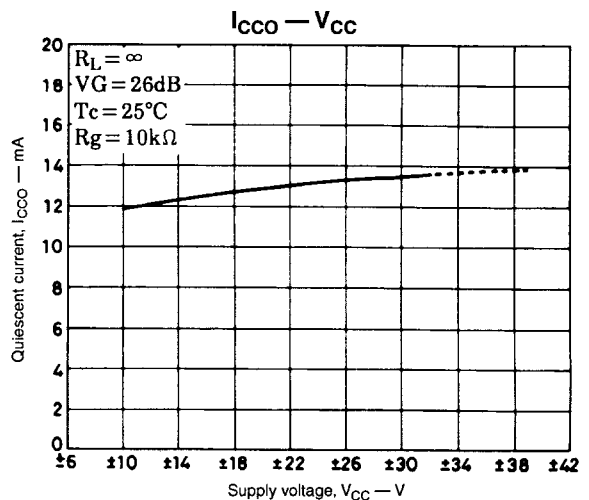
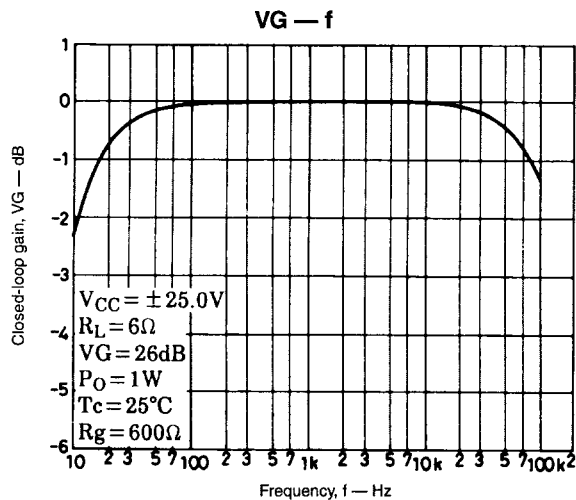
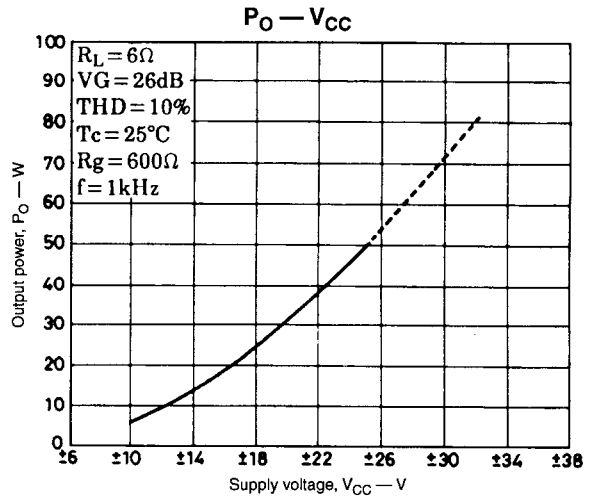
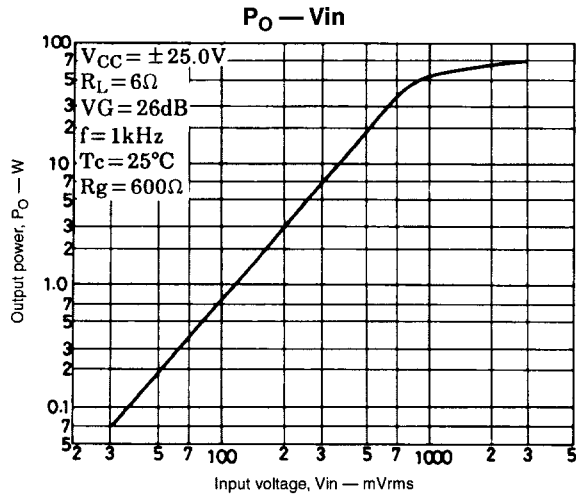
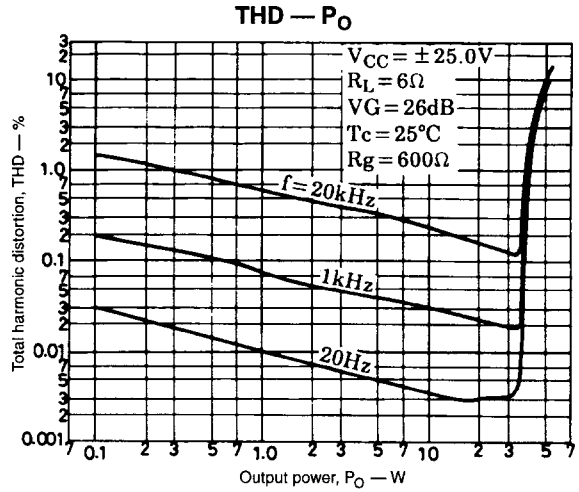
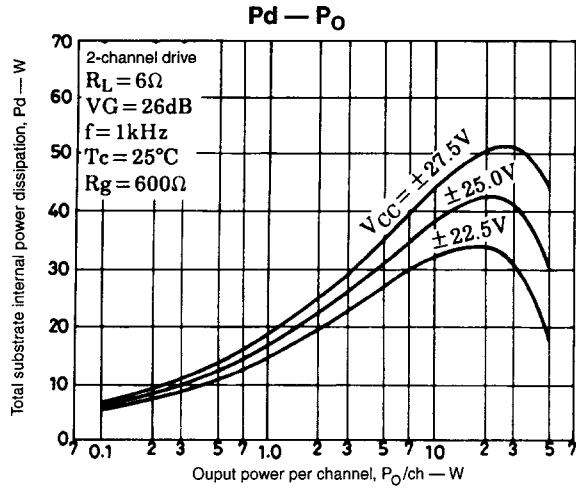
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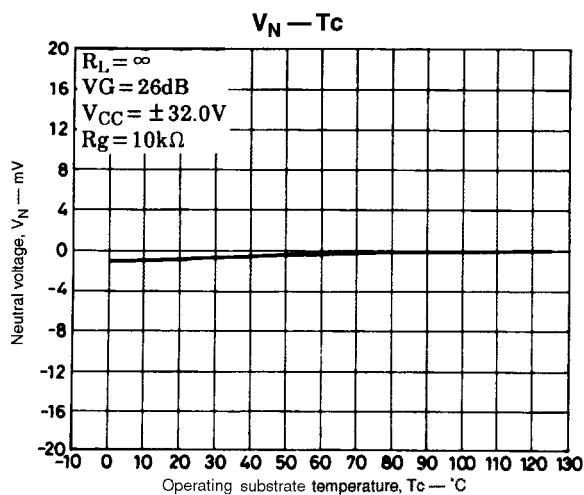
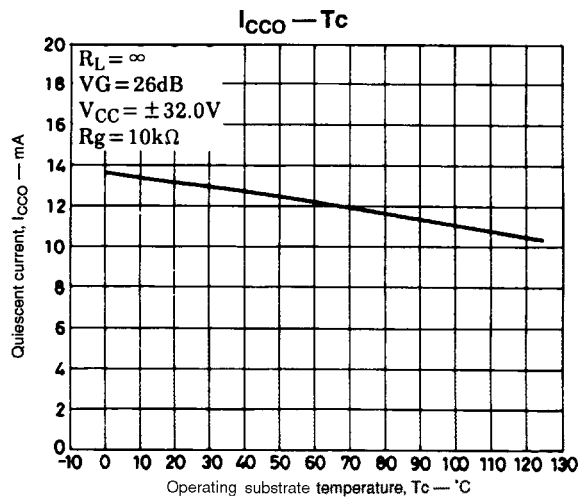
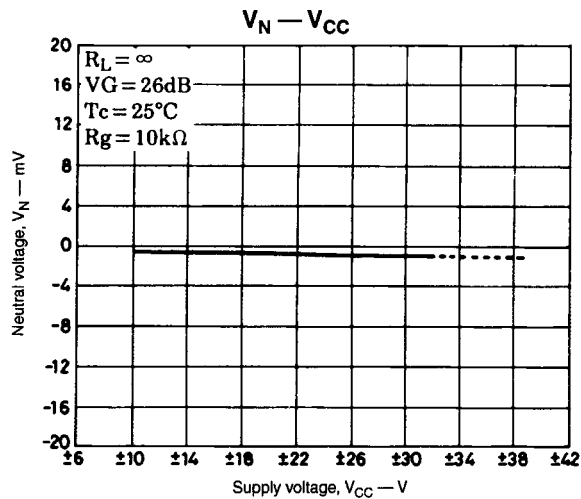
From expression (1) : $\theta_{c-a} < (125-50)/29 < 2.58$

From expression (2) : $\theta_{c-a} < (150-50)/29-3.4/4 < 2.59$

Therefore, to satisfy both expressions, the required heatsink must have a thermal resistance less than $2.58^{\circ}\text{C}/\text{W}$.

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





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