Ordering number : ENN7374

Thick-Film Hybrid IC

STK403-430

Six-Channel Class AB Audio Power Amplifier IC
20 W × 6 Channels

Overview

The STK403-400 series products are audio power amplifier hybrid ICs that consist of optimally-designed discrete component power amplifier circuits that have been miniaturized using SANYO's unique insulated metal substrate technology (IMST). The adoption of a newly-developed low thermal resistance substrate allows this product to integrate six power amplifier channels in a single compact package. The adoption of a standby circuit in this device allows it to reduce impulse noise significantly as compared to earlier Sanyo products, in particular, the STK402-*00 series products.

Features

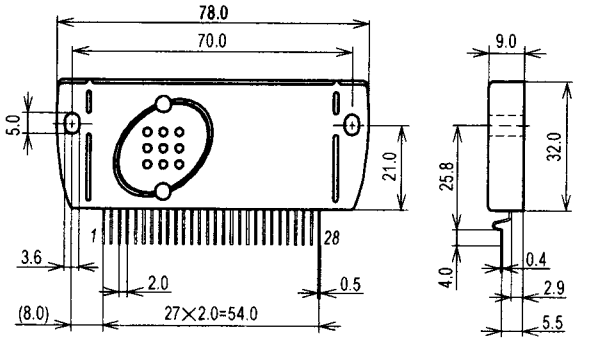
- Series of pin compatible power amplifiers ranging from 30 W/ch to 45 W/ch (10%/1 kHz) devices. The same printed circuit board can be used depending on the output power grade.
- Miniature packages
  — 78.0 mm × 32.0 mm × 9.0 mm *
  *: Not including the pins.
- Output load impedance: R_L = 6 Ω
- Allowable load shorted time: 0.3 seconds
- Supports the use of standby and muting circuits.

Package Dimensions

unit: mm

4202-SIP28

[STK403-430]



SANYO: SIP28

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SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

Series Organization

These products are organized as a series based on their output capacity.

Item	Type No.		
	STK403-430	STK403-440	STK403-450
Output 1 (10%/1 kHz)	30 W × 6 ch	40 W × 6 ch	45 W × 6 ch
Output 2 (0.6%/20 Hz to 20 kHz)	20 W × 6 ch	25 W × 6 ch	30 W × 6 ch
Maximum supply voltage (No signal)	±36 V	±38 V	±40 V
Maximum supply voltage (6 Ω)	±34 V	±36 V	±38 V
Recommended supply voltage (6 Ω)	±23 V	±26 V	±28 V
Package	78.0 mm × 32.0 mm × 9.0 mm		

Specifications

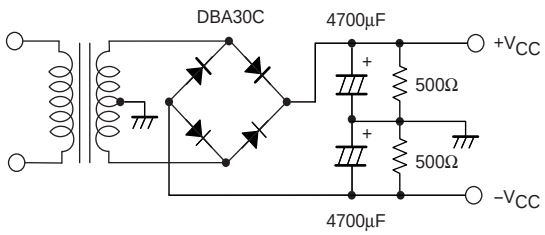
Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage (No signal)	V_{CC} max(0)		±36	V
Maximum supply voltage	V_{CC} max(1)	$R_L \geq 6\ \Omega$	±34	V
Minimum operating supply voltage	V_{CC} min		±10	V
Maximum operation flow-in current (pin 23)	$I_{ST\ OFF}$ max		1.2	mA
Thermal resistance	θj-c	Per power transistor	3.6	°C/W
Junction temperature	Tj max	Both the Tj max and the Tc max conditions must be met.	150	°C
Operating IC substrate temperature	Tc max		125	°C
Storage temperature	Tstg		–30 to +125	°C
Allowable load shorted time *4	ts	V_{CC} = ±23.0 V, R_L = 6 Ω, f = 50 Hz, P_O = 20 W, 1ch drive	0.3	s

Operating Characteristics at Tc = 25°C, R_L = 6 Ω (noninductive load), Rg = 600 Ω, VG = 30 dB

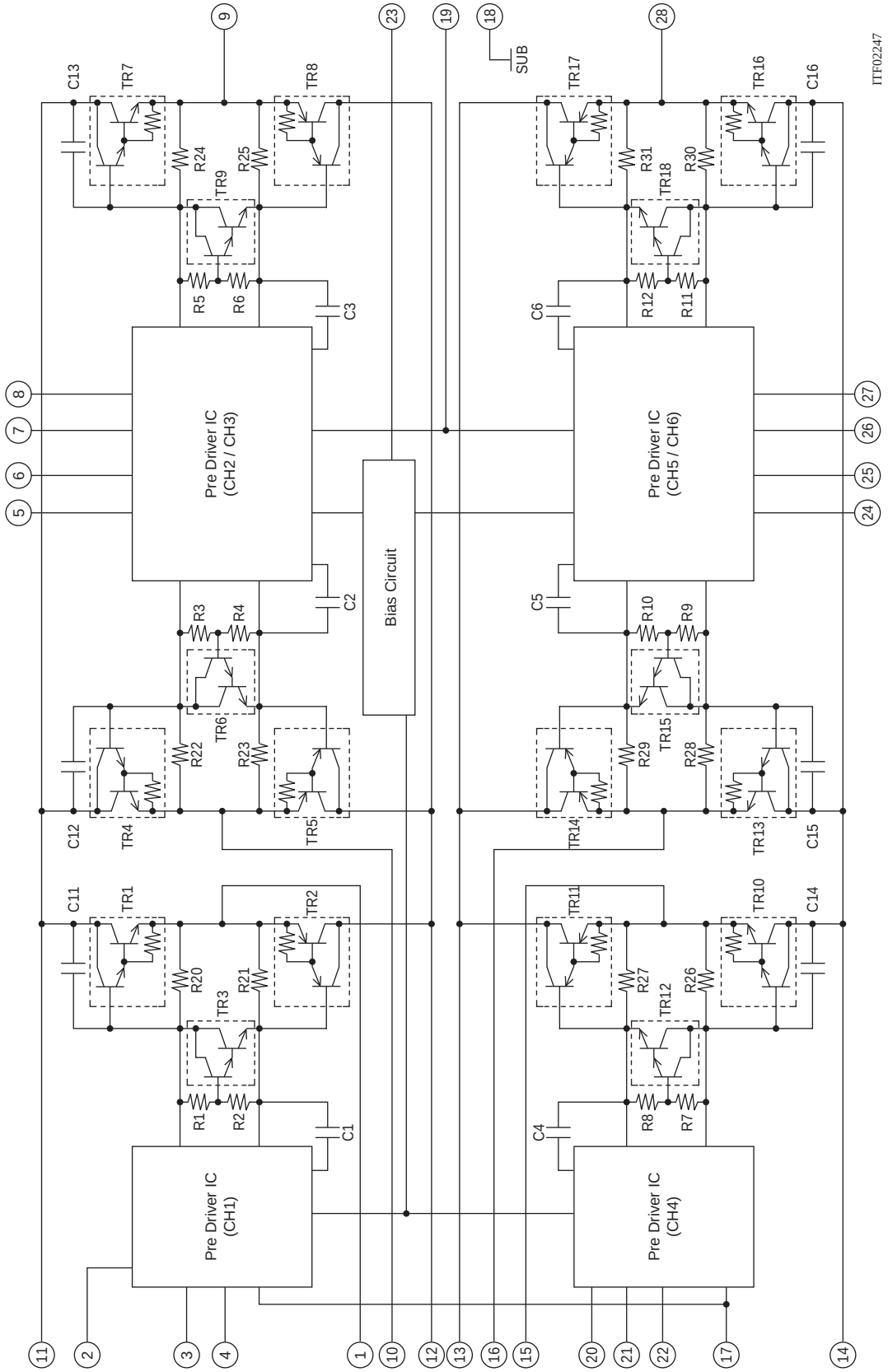
Parameter	Symbol	Conditions*1					Ratings			Unit
		V_{CC} (V)	f (Hz)	P_O (W)	THD (%)		min	typ	max	
Output power *1	P_O (1)	±23.0	20 to 20 k		0.6		18	20		W
	P_O (2)	±23.0	1 k		10			30		
Total harmonic distortion *1	THD (1)	±23.0	20 to 20 k	5.0		VG = 30 dB			0.6	%
	THD (2)	±23.0	1 k	5.0		VG = 30 dB		0.03		
Frequency characteristics	f_L, f_H	±23.0		1.0		+0 –3 dB	20 to 50 k			Hz
Input impedance	ri	±23.0	1 k	1.0				55		kΩ
Output noise voltage *2	V_{NO}	±28.0				Rg = 2.2 kΩ			1.0	mVrms
Quiescent current	I_{CCO}	±28.0				No loading	60	110	180	mA
Neutral voltage	V_N	±28.0					–70	0	+70	mV
Current flowing into pin 23 in standby mode *6	$I_{ST\ ON}$	±23.0				V_{23} = 5 V, current Limiting resistance: 6.2 kΩ			0	mA
Current flowing into pin 23 in operating mode *6	$I_{ST\ OFF}$	±23.0					0.4		1.2	mA

Notes: 1. 1ch drive
2. Unless otherwise noted, use a constant-voltage supply for the power supply used during inspection.
3. Use the transformer power supply circuit shown in the figure below for allowable load shorted time measurement and output noise voltage measurement.
4. The output noise voltage values shown are peak values read with a VTVM. However, an AC stabilized (50 Hz) power supply should be used to minimize the influence of AC primary side flicker noise on the reading.
5. Design applications so that the minus pre-V_{CC} line (pin 17) is the lowest potential applied to the IC at all times.
6. A limiting resistor that assures that the maximum operating current flowing into the standby pin (pin 23) does not exceed the maximum rating must be included in application circuits. This IC operates when a voltage higher than V_{BE} (about 0.6 V) is applied to the standby pin.

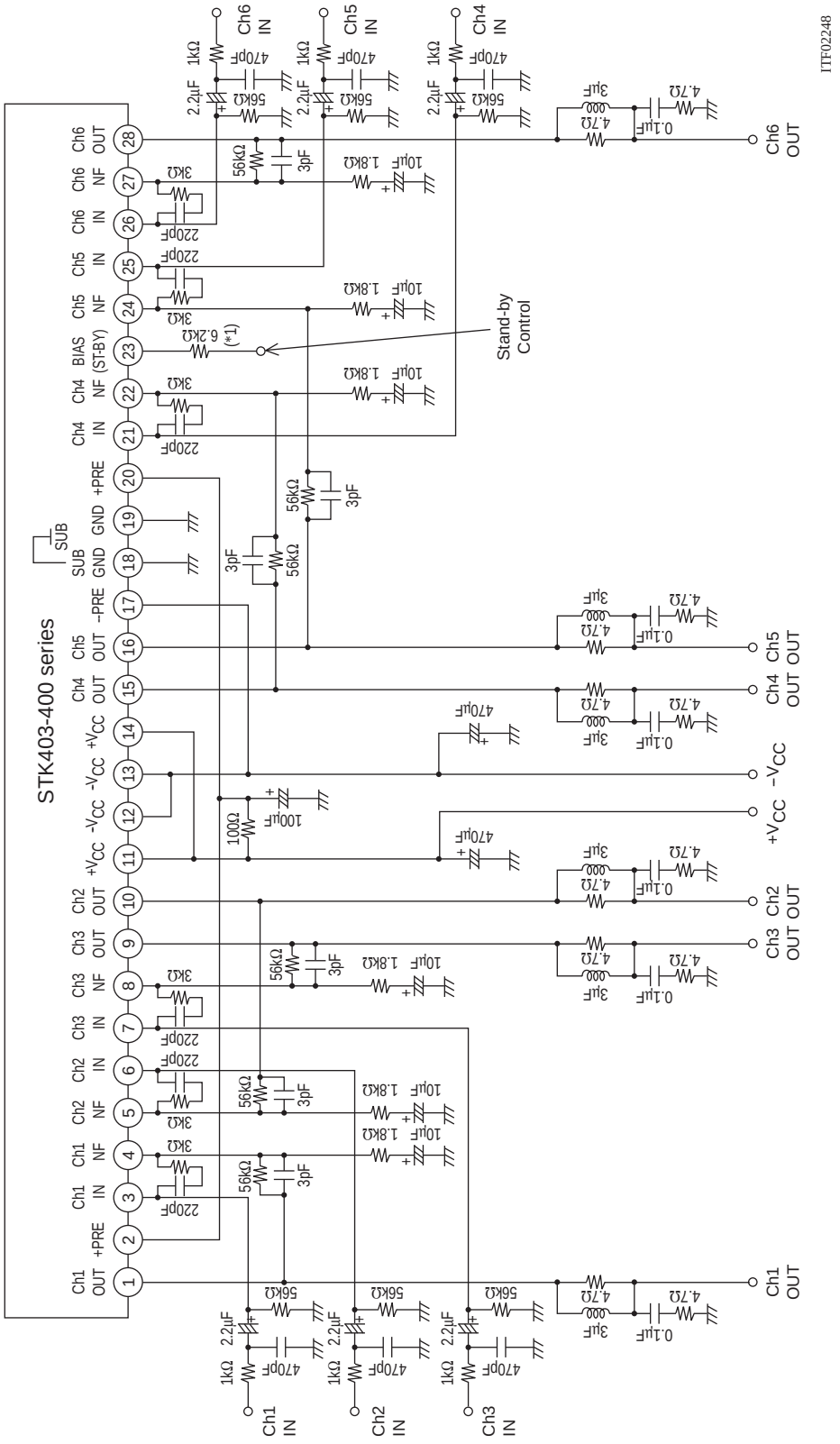


Designated Transformer Power Supply (RP-25 equivalent)

Internal Equivalent Circuit



Sample Application Circuit



*1. Use a value for the limiting resistor that assures that the maximum operating current flowing into the standby pin (pin 23) does not exceed the maximum rating.

Thermal Design Example

The heat sink thermal resistance, θc-a, required to handle the total power dissipated within this hybrid IC is determined as follows.

Condition 1: The IC substrate temperature Tc must not exceed 125°C.

$Pd \times \theta c - a + Ta < 125°C$ ... (1)

Ta: Guaranteed ambient temperature for the end product.

Condition 2: The junction temperature of each individual transistor must not exceed 150°C.

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

N: Number of power transistors

θj-c: Thermal resistance per power transistor

We take the power dissipation in the power transistors to be Pd evenly distributed across those N power transistors.

If we solve for θc-a in equations (1) and (2), we get the following inequalities.

$\theta c - a < (125 - Ta)/Pd$ ... (1)'

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

Values that satisfy both these inequalities at the same time are the required heat sink thermal resistance values.

Determining the following specifications allows us to determine the required heat sink thermal resistance from inequalities (1)' and (2)'.

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

Example:

Assume that the IC supply voltage, V_{CC}, is ±23 V, R_L is 6 Ω, and that the signal is a continuous sine wave. In this case, from the Pd – P_O characteristics, the maximum power will be 103 W for a signal with a frequency of 1 kHz.

For actual music signals, it is usual to use a Pd of 1/8 of $P_O$max, which is the power estimated for continuous signals in this manner. (Note that depending on the particular safety standard used, a value somewhat different from the value of 1/8 used here may be used.)

That is:

Pd = 65 W (when 1/8 $P_O$max is 2.5 W)

The number, N, of power transistors in the hybrid IC's audio amplifier block is 12. Since the thermal resistance, θc-a, per transistor is 3.6°C/W, the required heat sink thermal resistance, θc-a, for a guaranteed ambient temperature of 50°C will be as follows.

From inequality (1)': $\theta c - a < (125 - 50)/65$

< 1.15

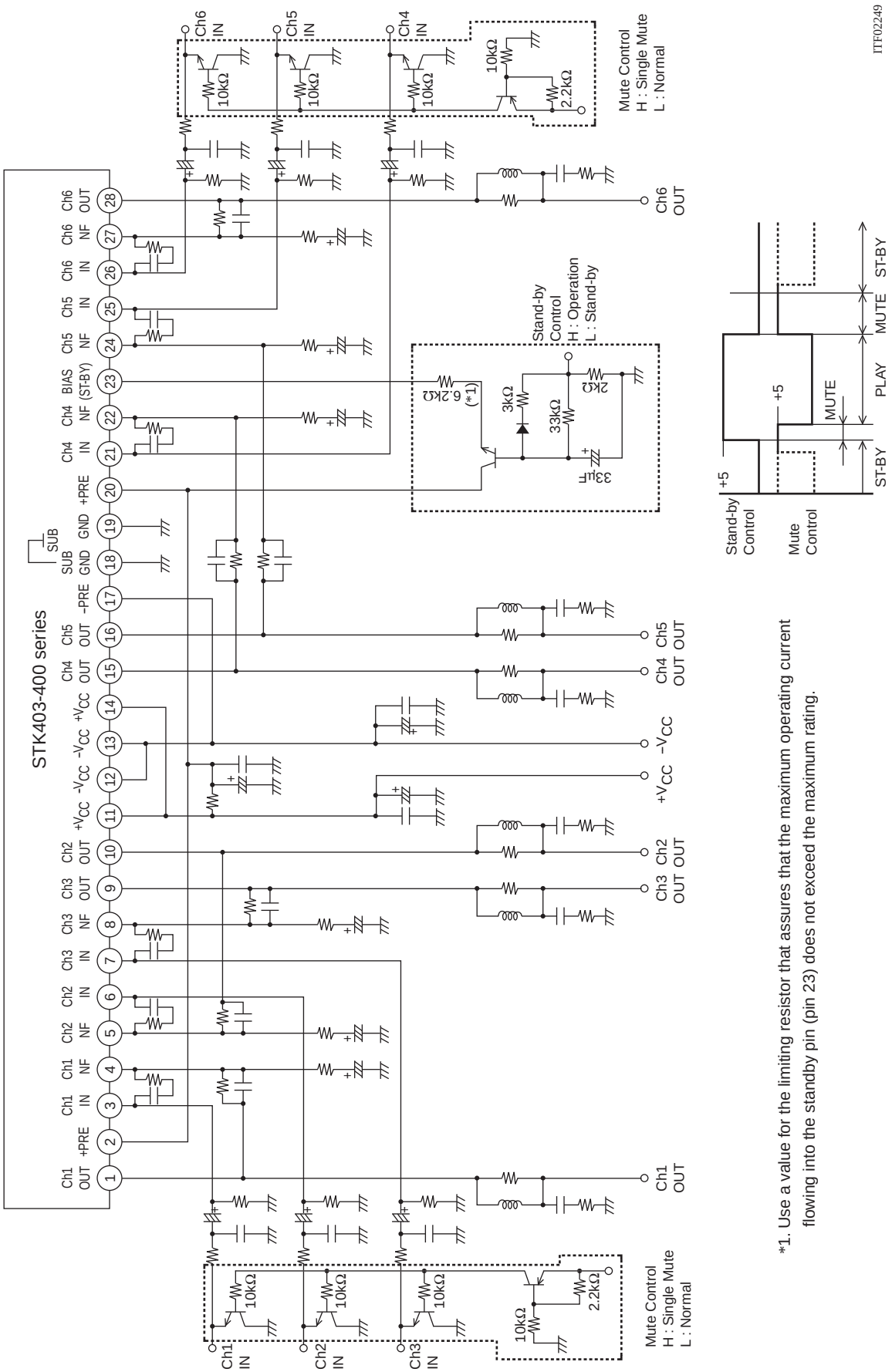
From inequality (2)': $\theta c - a < (150 - 50)/65 - 3.6/12$

< 1.23

Therefore, the thermal resistance that satisfies both these expressions at the same time is 1.15°C/W.

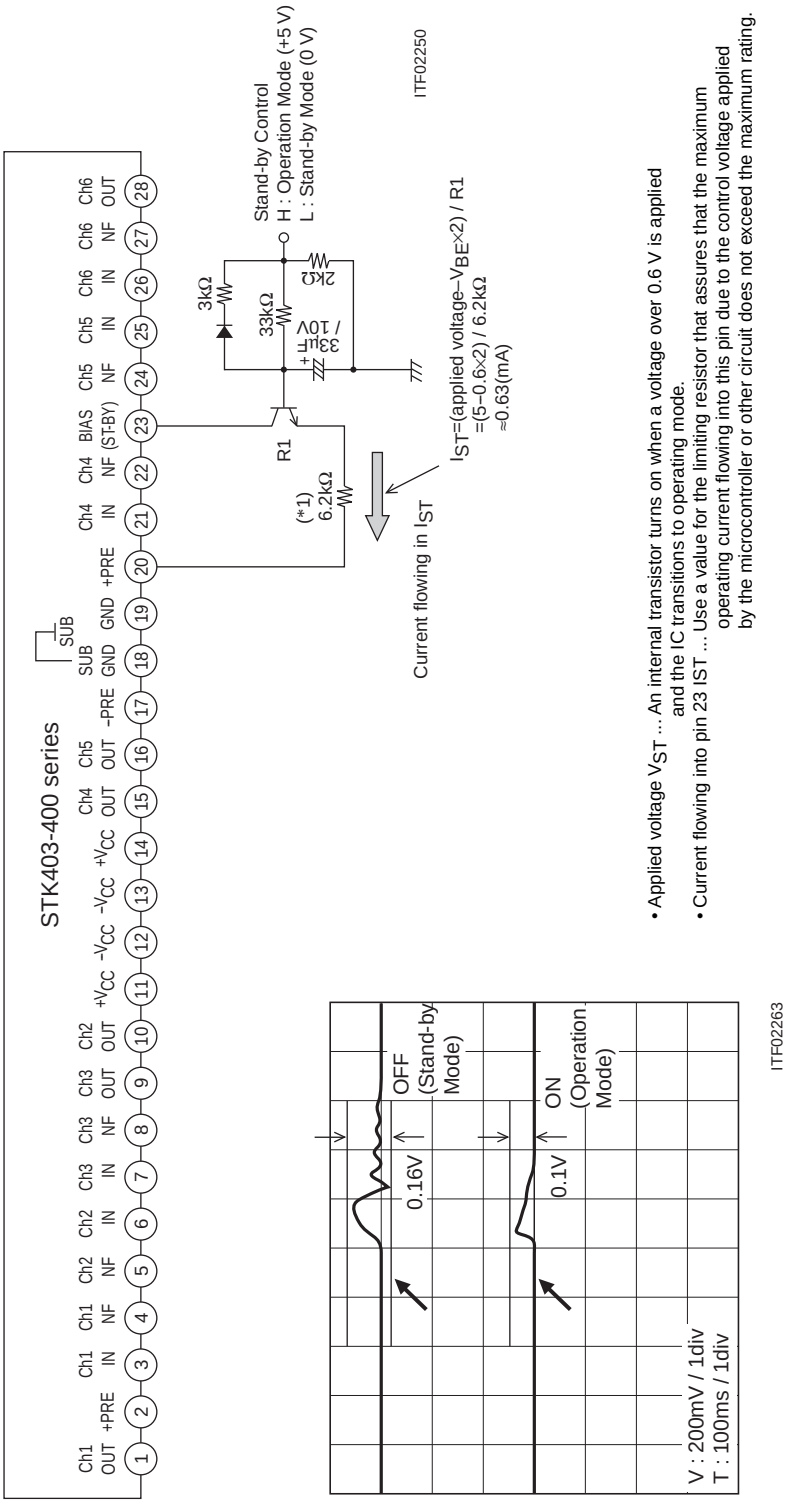
Note that this thermal design example assumes the use of a constant-voltage power supply, and is only provided as an example for reference purposes. Thermal designs must be tested in an actual end product.

Stand-by & Mute Sample Application Circuit

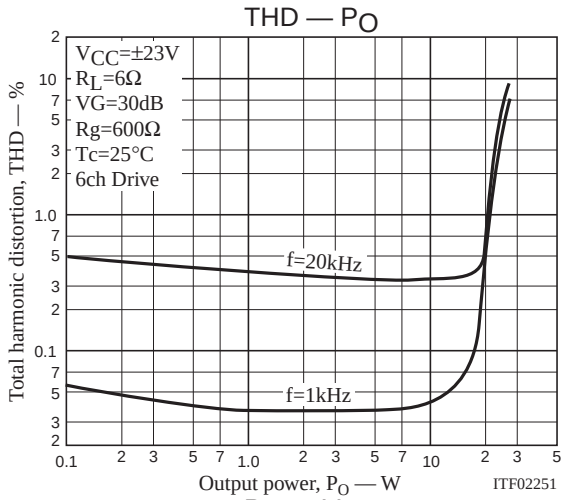


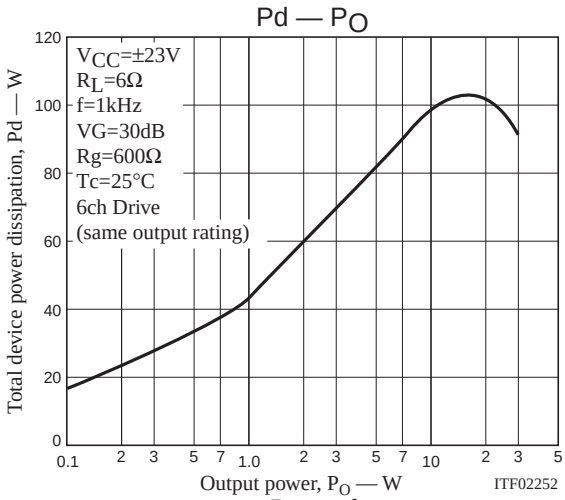
*1. Use a value for the limiting resistor that assures that the maximum operating current flowing into the standby pin (pin 23) does not exceed the maximum rating.

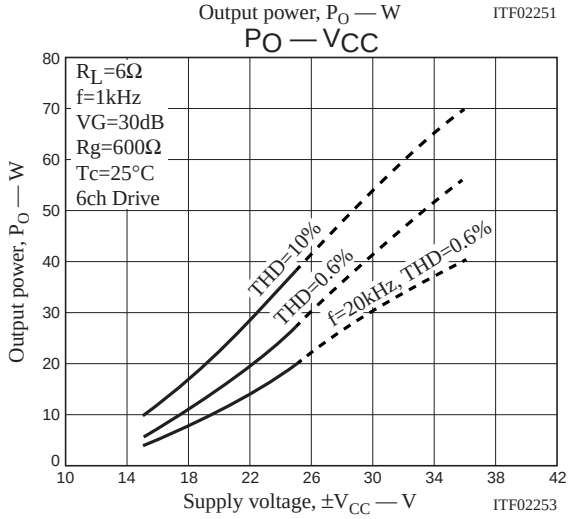
Standby Mode Control

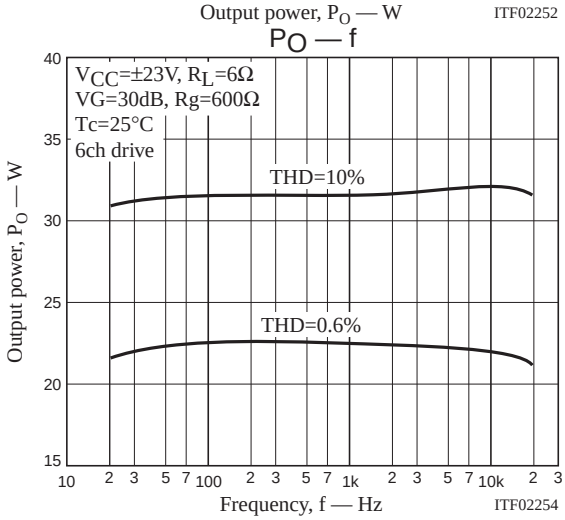


- Impulse noise that occurs at power on and power off can be reduced significantly by using a standby circuit.
- End product design is made easier by using a limiting resistor *1 to match the control voltage provided by the microcontroller or other control circuit.
- Standby control can be applied by controlling the current (I_{ST}) flowing into the standby pin (pin 23).









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