


SANYO Semiconductors

DATA SHEET

Thick-Film Hybrid IC

STK404-100SC-E — 1-channel class AB audio power IC, 90W

Overview

The STK404-100SC-E series is hybrid IC for the audio power amplifier that mounts discrete components as the audio power amplifier circuit in small space using the original Insulated Metal Substrate Technology IMST. The compact package has been achieved by adopting the low thermal resistance substrate (our conventional model kind ratio).

Applications

- Audio power amplifiers.

Features

- Pin-to-pin compatible outputs ranging from 90W to 180W
- Miniature package (46.6mm×25.5mm×8.5mm, 59.2mm×25.5mm×8.5mm)
- Output load impedance $R_L=6\Omega$ supported.
- Allowable load shorted time: 0.3s
- Allows the use of predesigned applications for standby, mute, and the load short protection circuit.

Series Models

	STK404-100SC-E	STK404-120SC-E	STK404-130SC-E	STK404-140SC-E
Output 1 (10%/1kHz)	90W×1ch	120W×1ch	150W×1ch	180W×1ch
Output 2 (0.4%/20Hz to 20kHz)	60W×1ch	80W×1ch	100W×1ch	120W×1ch
Maximum rated V_{CC} max(no sig.)	±55V	±65V	±70V	±78V
Maximum rated V_{CC} (6Ω)	±51V	±59V	±64V	±73V
Recommended operating V_{CC} (6Ω)	±35V	±41V	±45V	±51V
Dimensions (excluding pin height)	46.6mm×25.5mm×8.5mm		59.2mm×25.5mm×8.5mm	

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Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$ (excluding rated temperature items), $T_c = 25^\circ\text{C}$ unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage 1	$V_{CC \text{ max1}}$	Non-signal	± 55	V
Power supply voltage 2	$V_{CC \text{ max2}}$	Signal, $R_L = 6\Omega$	± 51	V
Thermal detector maximum voltage	V_p	1-4pin	16	V
Thermal detector maximum current	I_p	1-4pin	30	mA
Thermal resistance	θ_{j-c}	Per power transistor	1.7	$^\circ\text{C/W}$
Junction temperature	$T_j \text{ max}$	Should satisfy $T_j \text{ max}$ and $T_c \text{ max}$	150	$^\circ\text{C}$
Operating IC substrate temperature	$T_c \text{ max}$		125	$^\circ\text{C}$
Storage temperature	T_{stg}		-30 to +125	$^\circ\text{C}$
Allowable load shorted time *4	t_s	$V_{CC} = \pm 35\text{V}$, $R_L = 6\Omega$, $f = 50\text{Hz}$, $P_O = 60\text{W}$	0.3	s

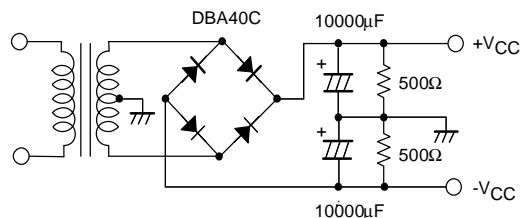
Electrical Characteristics at $T_c = 25^\circ\text{C}$, $R_L = 6\Omega$, $R_g = 600\Omega$, $V_G = 30\text{dB}$, non-inductive load R_L , unless otherwise specified

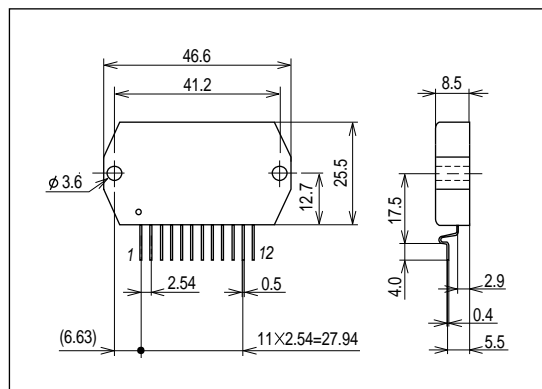
Parameter	Symbol	Conditions *2					Ratings			unit
		V_{CC} (V)	f (Hz)	P_O (W)	THD (%)		min	typ	max	
Output power *1	$P_O (1)$	± 35	20 to 20k		0.4		60			W
	$P_O (2)$	± 35	1k		10			90		
Frequency characteristics *1	f_L, f_H	± 35		1.0		+0 -3dB	20 to 20k			Hz
Input impedance	r_i	± 35	1k	1.0				55		k Ω
Output noise voltage *3	V_{NO}	± 42				$R_g = 10\text{k}\Omega$		1.2		mVrms
Output neutral voltage	V_N	± 42					-100	0	+100	mV
Quiescent current	I_{CCO}	± 42				No load			50	mA
Thermal detector resistance	R_p	$T_p = 25^\circ\text{C}$, 1-4pin						470		Ω
Thermal detector operate temperature	T_p	$R_p = 4.7\text{k}\Omega$, 1-4pin						145		$^\circ\text{C}$

[Remarks]

- *1. Unless otherwise specified, use a constant-voltage power supply to supply power when inspections are carried out.
- *2. Thermal Detector temperature ($+145^\circ\text{C} \pm 5^\circ\text{C}$) indicates the value at unusual operation, therefore, does not indicate the guaranteed value at usual operation.
Thermal Detector is PRF21series (AS characteristic) manufactured by MURATA.
- *3. The output noise voltage values shown are peak values read with a VTVM. However, an AC stabilized (50Hz) power supply should be used to minimize the influence of AC primary side flicker noise on the reading.
- *4. Use the designated transformer power supply circuit shown in the figure below for the measurement of allowable load shorted time and output noise voltage.
- *5. Thermal design must be implemented based on the conditions under which the customer's end products are expected to operate on the market.
- *6 Weight of 1 HIC: 12.6g
Outer carton dimensions (W×L×H): 420mm×233mm×277mm

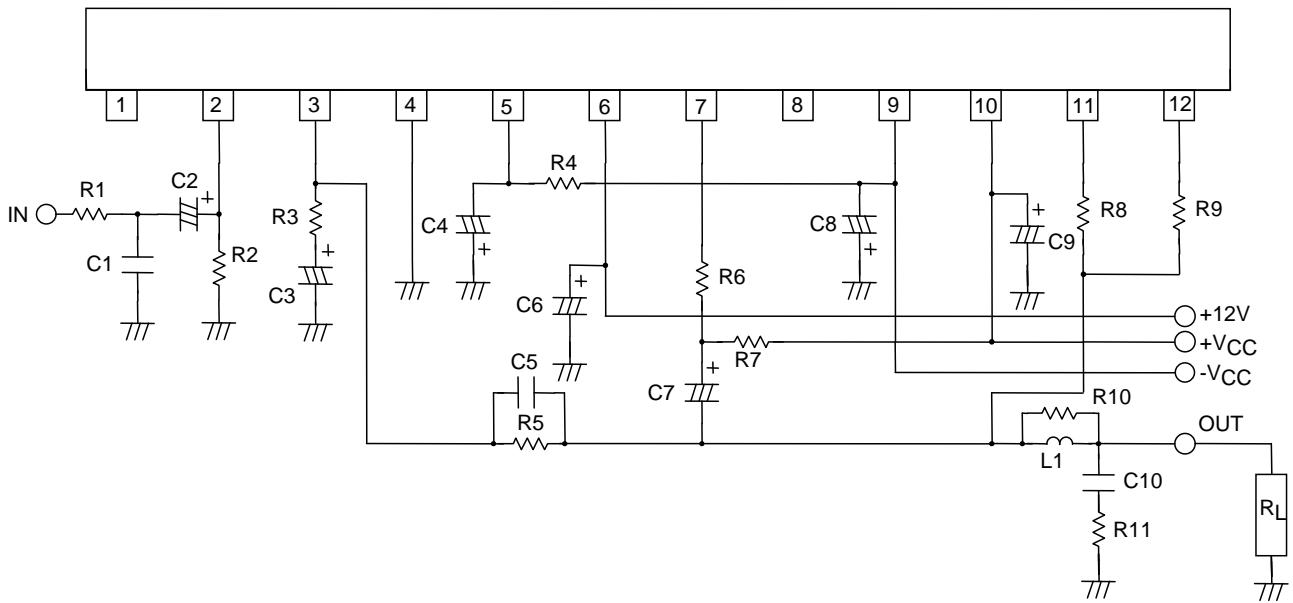
Designated transformer power supply
(MG-250 equivalent)



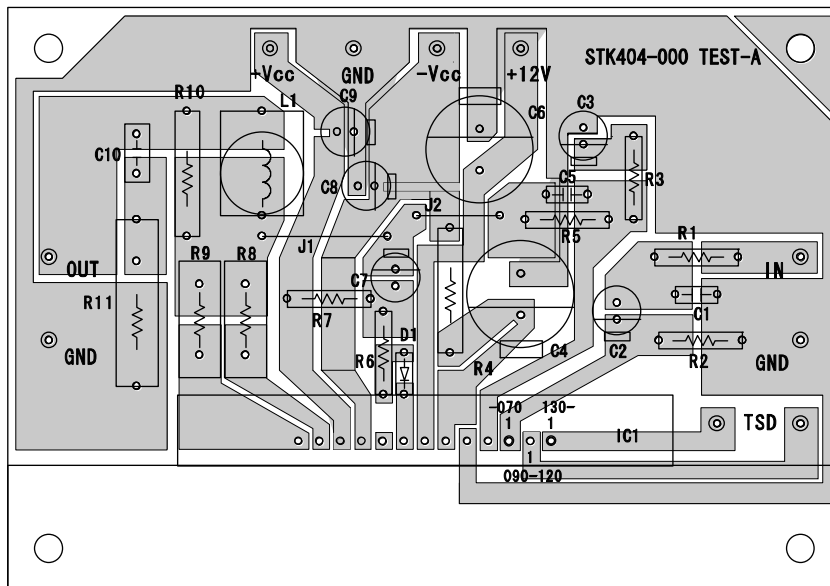


The schematic diagram illustrates a 200W audio amplifier circuit. It begins with an input stage labeled 'Input Amp. IN NF' connected to a 'SUB' input. The output of the input stage is connected to the 'Driver Amp.' stage. The driver stage's output is connected to the base of transistor TR6. Transistor TR6 is part of a push-pull output stage, with its emitter connected to a common ground. The collector of TR6 is connected to the base of transistor TR7. Transistor TR7 is also part of a push-pull output stage, with its emitter connected to a common ground. The collector of TR7 is connected to the base of transistor TR8. Transistor TR8 is also part of a push-pull output stage, with its emitter connected to a common ground. The collector of TR8 is connected to the positive output terminal. The circuit includes several resistors: R4 and R5 are connected between the collector of TR6 and the base of TR7; R6 and R7 are connected between the collector of TR7 and the base of TR8; R8 and R9 are connected between the collector of TR8 and the positive output terminal. A capacitor C2 is connected between the base of TR6 and the common ground. A potentiometer PT1 is connected between the positive output terminal and the common ground. The circuit is powered by a 200V AC source connected to the positive output terminal and the common ground.

Application Circuit



PCB Layout Example



STK404-100SC-E

PCB Parts List

Type(IC1) *1	STK404-100	STK404-120	STK404-130	STK404-140
Position of ①pin	Second from the right end	Second from the right end	The right end	The right end
Location				
R1	1kΩ	←*2	←	←
R2	56kΩ	←	←	←
R3	1.8kΩ	←	←	←
R4	100Ω/1W	←	←	←
R5	56kΩ	←	←	←
R6	4.7kΩ/1W	4.7kΩ/1W	5.1kΩ/1W	8.2kΩ/1W
R7	4.7kΩ/1W	4.7kΩ/1W	5.1kΩ/1W	8.2kΩ/1W
R8	0.22Ω/5W	←	←	←
R9	0.22Ω/5W	←	←	←
R10	4.7Ω/1W	←	←	←
R11	4.7Ω/1W	←	←	←
C1	470pF	←	←	←
C2	2.2μF/50V	←	←	←
C3	10μF/50V	←	←	←
C4	100μF/100V	←	←	←
C5	3pF	←	←	←
C6	100μF/50V	←	←	←
C7	47μF/100V	←	←	←
C8	10μF/100V	←	←	←
C9	10μF/100V	←	←	←
C10	0.1μF	←	←	←
D1	short	←	←	←
L1	2.2μH	←	←	←
J1	15mm	←	←	←
J2	10mm	←	←	←

*1 There is a model from which the sign (S, C, SC etc) is added to the end of the product name.

If it is a product of this output, Parts List is same.

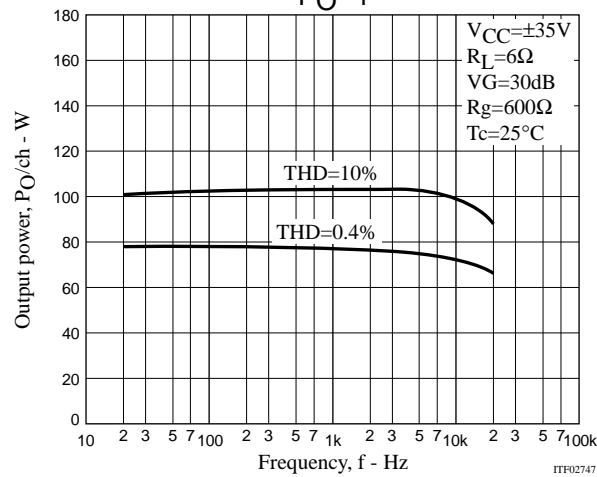
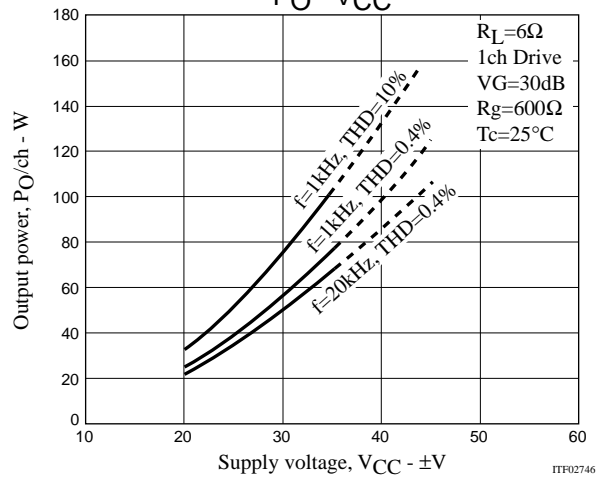
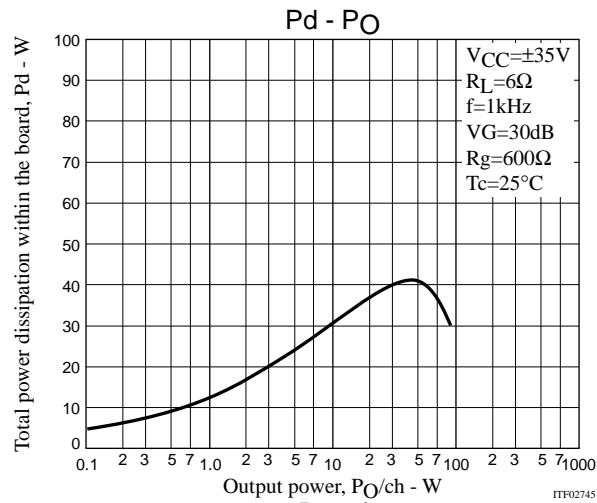
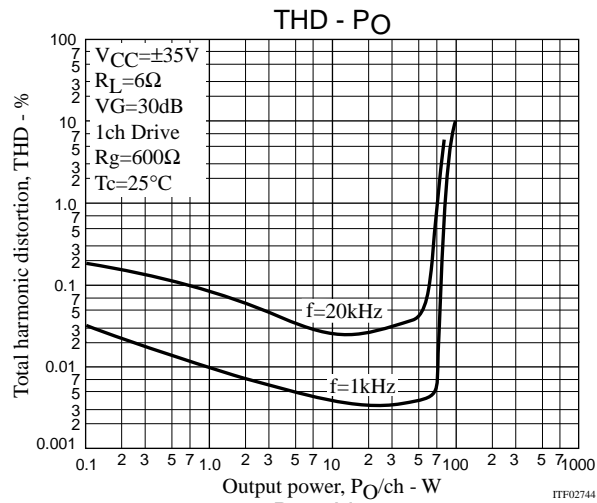
*2 ←: Same as left

Pin Layout

[STK404-100SC sr Pin Layout]

1ch class-AB		1	2	3	4	5	6	7	8	9	10	11	12
		1ch classAB/2.54mm											
STK404-100SC-E 90W/JEITA STK404-120SC-E 120W/JEITA		P T +	I N / C H 1	N F / C H 1	S U B • P T -	- P R E	+ 1 2 V	+ V B O O T	N C	- V C C	+ V C C	O U T / C H 1 -	O U T / C H 1 +
	1	2	3	4	5	6	7	8	9	10	11	12	13
		1ch classAB/2.54mm											
STK404-130SC-E 150W/JEITA STK404-140SC-E 180W/JEITA	P T -	P T +	I N / C H 1	N F / C H 1	S U B • P T -	- P R E	+ 1 2 V	+ V B O O T	N C	- V C C	+ V C C	O U T / C H 1 -	O U T / C H 1 +

Characteristic of Evaluation Board



[Thermal Design Example for STK404-100SC-E]

The thermal resistance, θ_{c-a} , of the heat sink for total power dissipation, P_d , within the hybrid IC is determined as follows.

Condition 1: The hybrid IC substrate temperature, T_c , must not exceed 125°C.

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

T_a : Guaranteed ambient temperature for the end product

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

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

N : Number of power transistors

θ_{j-c} : Thermal resistance per power transistor

However, the power dissipation, P_d , for the power transistors shall be allocated equally among the number of power transistors.

The following inequalities result from solving equations (1) and (2) for θ_{c-a} .

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

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

Values that satisfy these two inequalities at the same time represent the required heat sink thermal resistance.

When the following specifications have been stipulated, the required heat sink thermal resistance can be determined from formulas (1)' and (2)'.

- | | |
|----------------------------------|----------|
| • Supply voltage | V_{CC} |
| • Load resistance | R_L |
| • Guaranteed ambient temperature | T_a |

[Example]

When the IC supply voltage, $V_{CC}=\pm 35\text{V}$ and R_L is 6Ω, the total power dissipation, P_d , within the hybrid IC, will be a maximum of 42W at 1kHz for a continuous sine wave signal according to the P_d - P_o characteristics.

For the music signals normally handled by audio amplifiers, a value of 1/8 $P_{O\text{ max}}$ is generally used for P_d as an estimate of the power dissipation based on the type of continuous signal. (Note that the factor used may differ depending on the safety standard used.)

This is:

$$P_d = 28\text{W} \qquad \text{(when } 1/8P_{O\text{ max}} = 7.5\text{W).}$$

The number of power transistors in audio amplifier block of these hybrid ICs, N , is 2, and the thermal resistance per transistor, θ_{j-c} , is 1.7°C/W. Therefore, the required heat sink thermal resistance for a guaranteed ambient temperature, T_a , of 50°C will be as follows.

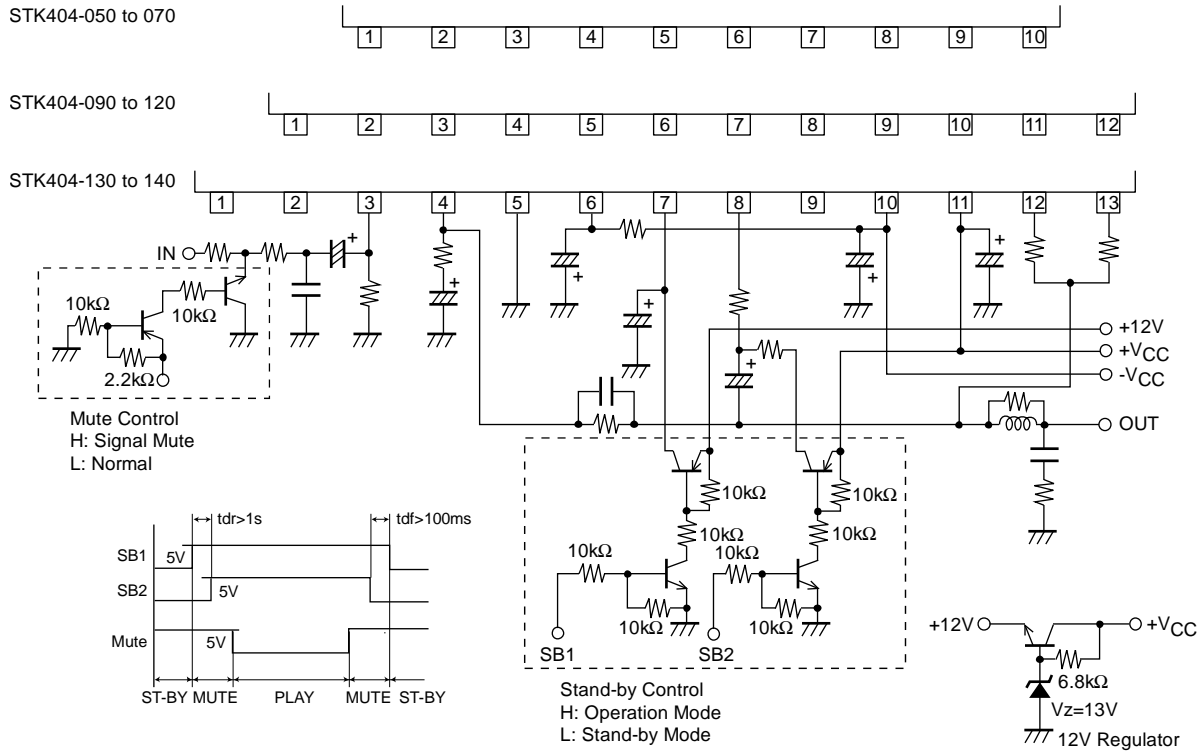
$$\begin{array}{ll} \text{From formula (1)'} & \theta_{c-a} < (125 - 50)/28 \\ & < 2.67 \end{array}$$

$$\begin{array}{ll} \text{From formula (2)'} & \theta_{c-a} < (150 - 50)/28 - 1.7/2 \\ & < 2.72 \end{array}$$

Therefore, the value of 2.67°C/W, which satisfies both of these formulae, is the required thermal resistance of the heat sink.

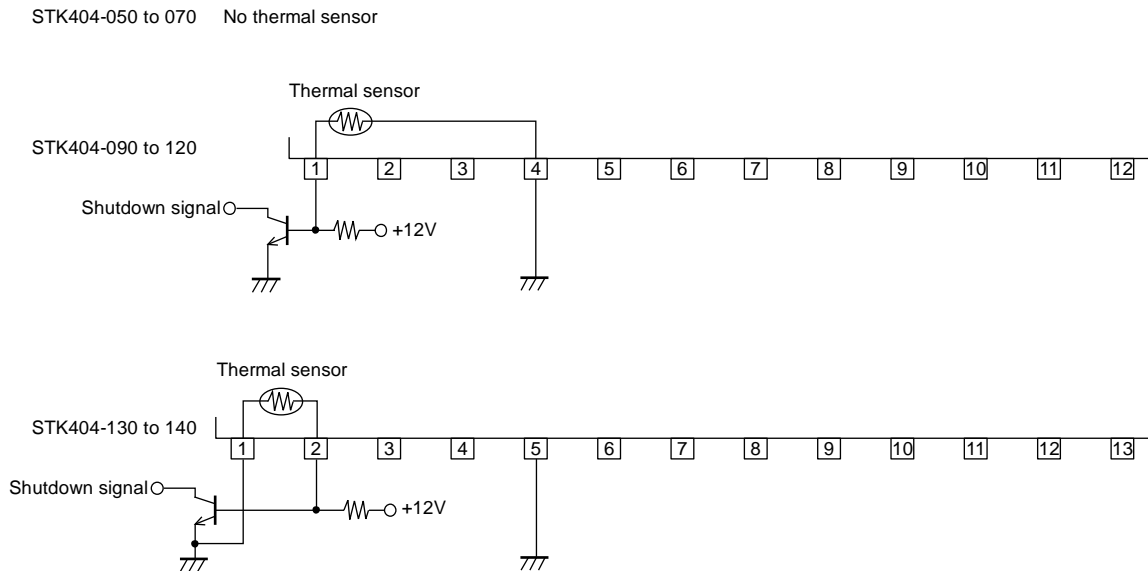
Note that this thermal design example assumes the use of a constant-voltage power supply, and is therefore not a verified design for any particular user's end product.

STK404-000s Stand-by Control & Mute Control Application



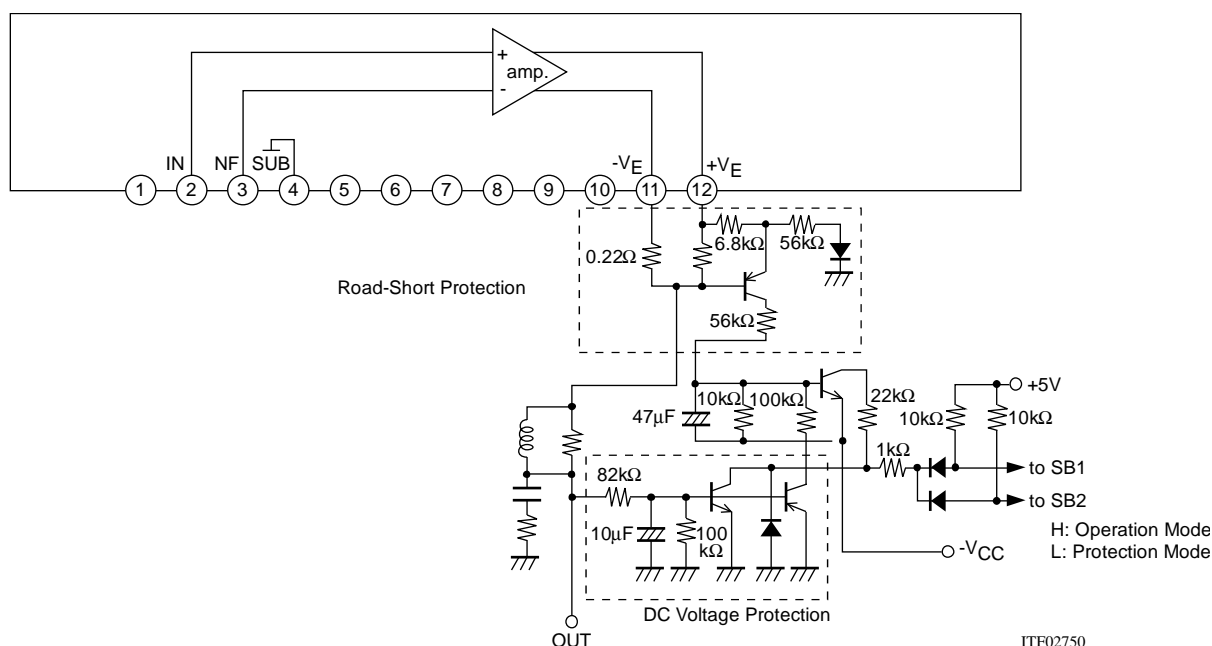
ITF02748

STK404-000s Thermal Shut Down Application



ITF02749

STK404-090, 100, 120 Road-Short & DC Voltage Protect Application



ITF02750

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