Ordering number : EN*A1686

Preliminary

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=6Ω 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	

Specifications

Absolute Maximum Ratings at Ta = 25°C (excluding rated temperature items), Tc=25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage 1	V_{CC} max1	Non-signal	±55	V
Power supply voltage 2	V_{CC} max2	Signal, R_L=6Ω	±51	V
Thermal detector maximum voltage	Vp	1-4pin	16	V
Thermal detector maximum current	Ip	1-4pin	30	mA
Thermal resistance	θj-c	Per power transistor	1.7	°C/W
Junction temperature	Tj max	Should satisfy Tj max and Tc max	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}=±35V, R_L=6Ω, f=50Hz, P_O=60W	0.3	s

Electrical Characteristics at Tc=25°C, R_L=6Ω, Rg=600Ω, VG=30dB, 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	ri	±35	1k	1.0				55		kΩ
Output noise voltage *3	V_{NO}	±42				Rg=10kΩ		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	Rp	Tp=25°C, 1-4pin						470		Ω
Thermal detector operate temperrature	Tp	Rp=4.7kΩ, 1-4pin						145		°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°C±5°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.

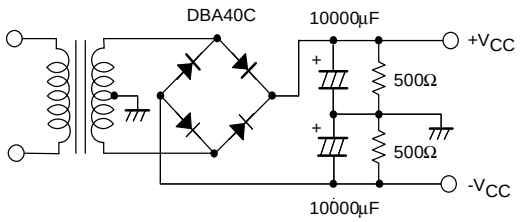
*3. The output noise voltage values shown are peak values read with a VTVM. However, an AC stabilized (50Hz) power supply should be used to minimize the influence of AC primary side flicker noise on the reading.

*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.

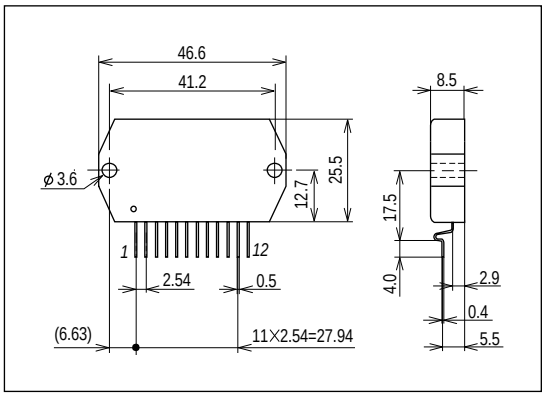
*6 Weight of 1 HIC: 12.6g
Outer carton dimensions (W×L×H): 420mm×233mm×277mm

Designated transformer power supply (MG-250 equivalent)

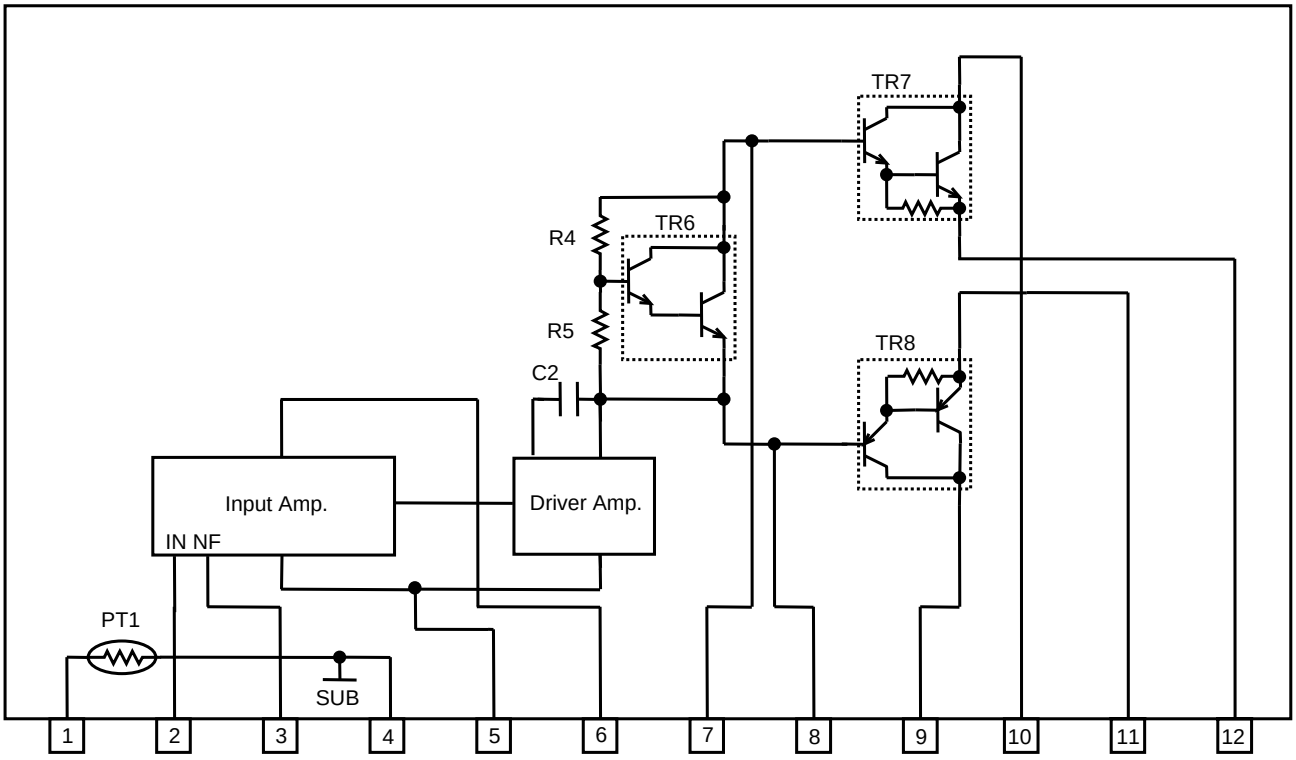


Package Dimensions

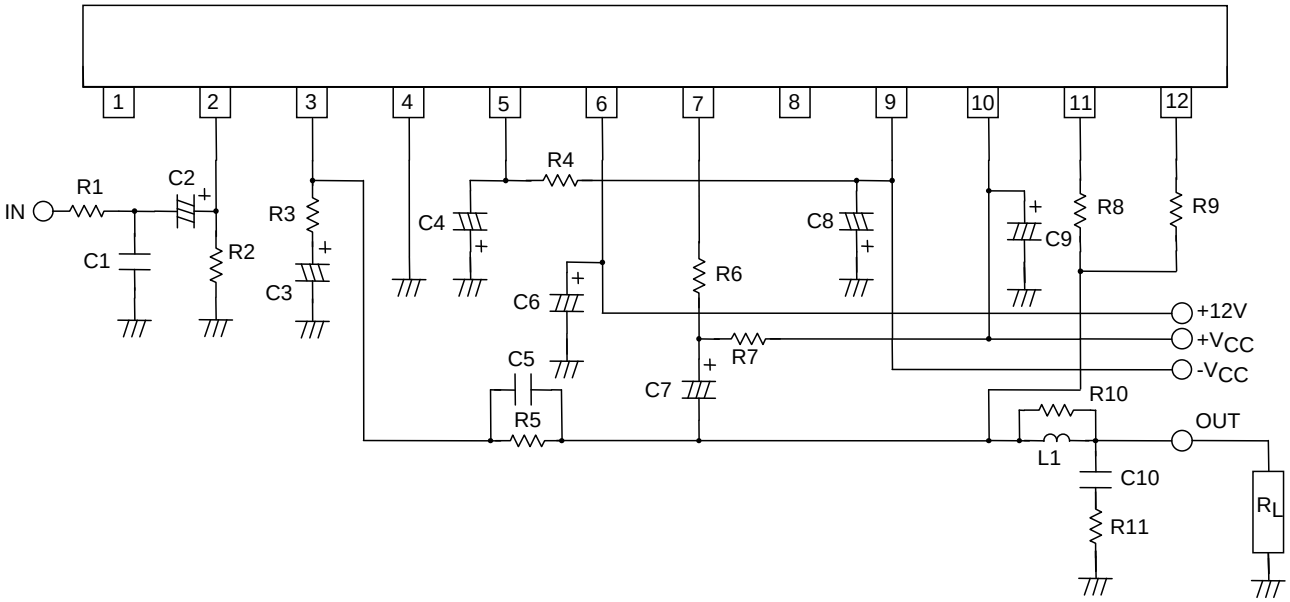
unit:mm (typ)



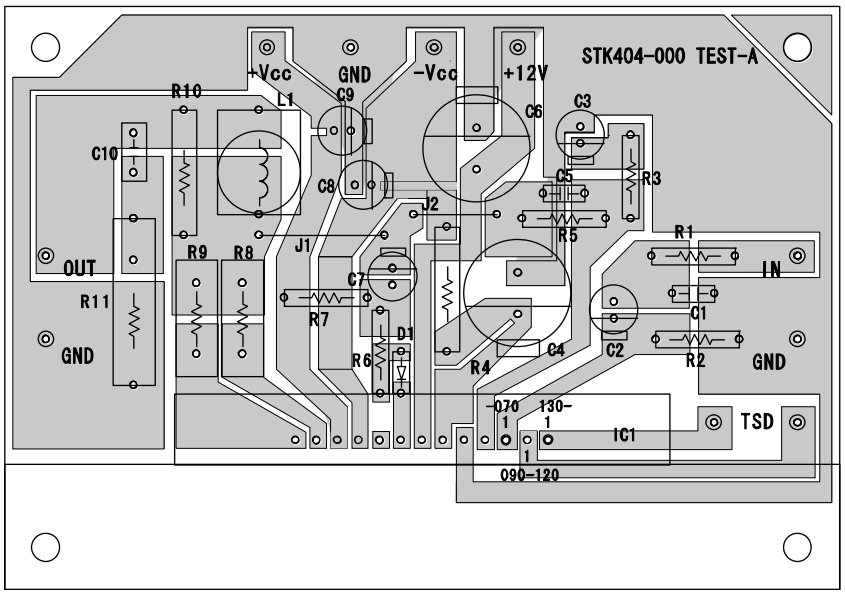
Equivalent Circuit



Application Circuit



PCB Layout Example



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.

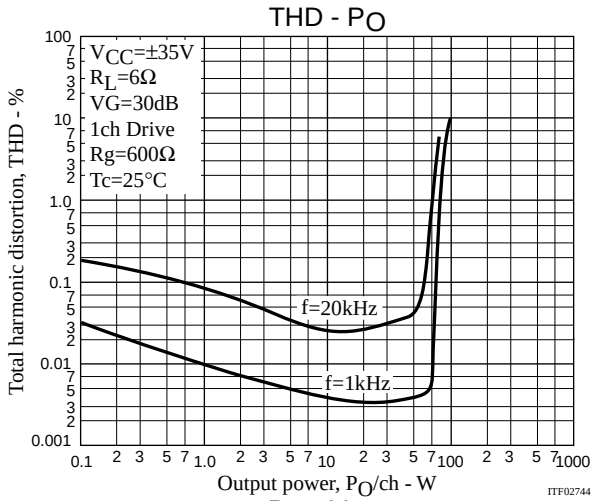
*2 ←: Same as left

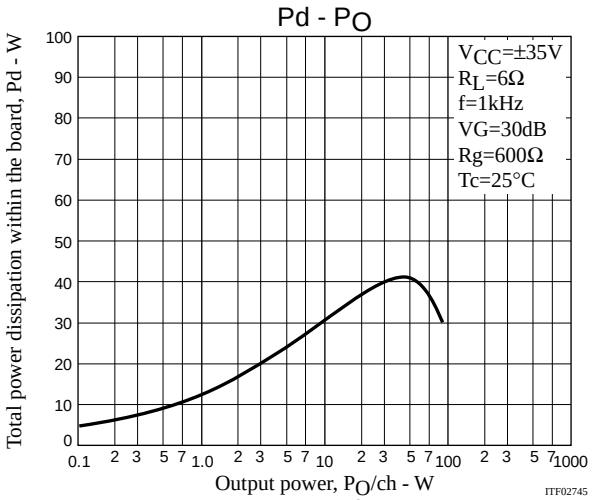
Pin Layout

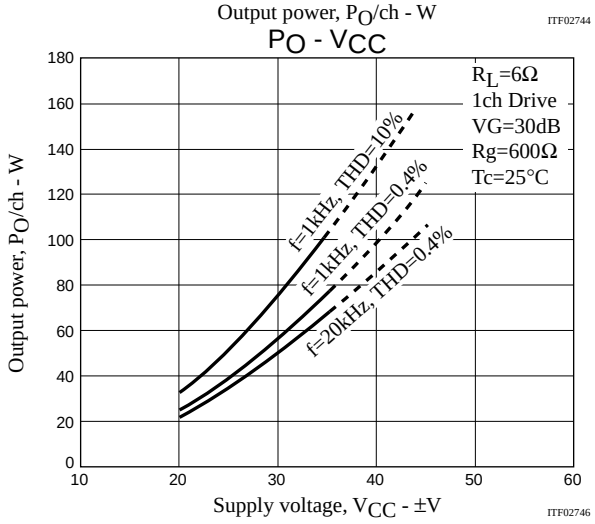
[STK404-100SC sr Pin Layout]

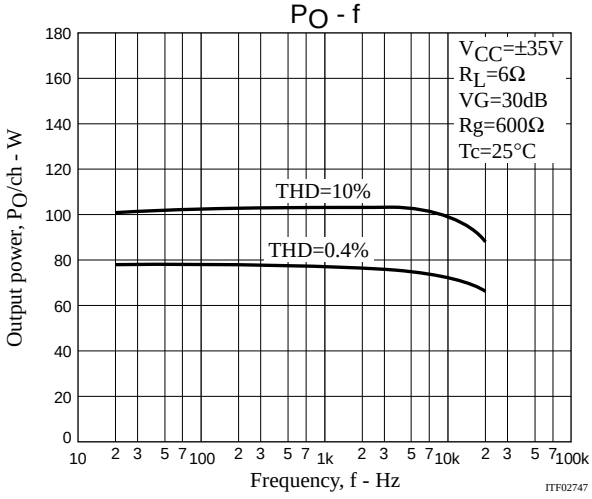
1ch class-AB		1	2	3	4	5	6	7	8	9	10	11	12
		1ch classAB/2.54mm											
STK404-100SC-E 90W/JEITA STK404-120SC-E 120W/JEITA		PT+	IN/CH1	NF/CH1	SUB•PT-	-PRE	+12V	+VBOOT	NC	-VCC	+VCC	OUT/CH1-	OUT/CH1+
	1	2	3	4	5	6	7	8	9	10	11	12	13
	1ch classAB/2.54mm												
STK404-130SC-E 150W/JEITA STK404-140SC-E 180W/JEITA	PT-	PT+	IN/CH1	NF/CH1	SUB•PT-	-PRE	+12V	+VBOOT	NC	-VCC	+VCC	OUT/CH1-	OUT/CH1+

Characteristic of Evaluation Board









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

The thermal resistance, θc-a, of the heat sink for total power dissipation, Pd, within the hybrid IC is determined as follows.

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

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

Ta: Guaranteed ambient temperature for the end product

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

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

N: Number of power transistors

θj-c: Thermal resistance per power transistor

However, the power dissipation, Pd, 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 θc-a.

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

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

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 Ta

[Example]

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

For the music signals normally handled by audio amplifiers, a value of $1/8P_O$ max is generally used for Pd 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:

Pd = 28W (when $1/8P_O$ max = 7.5W).

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

From formula (1)' $\theta c\text{-}a < (125 - 50)/28$

< 2.67

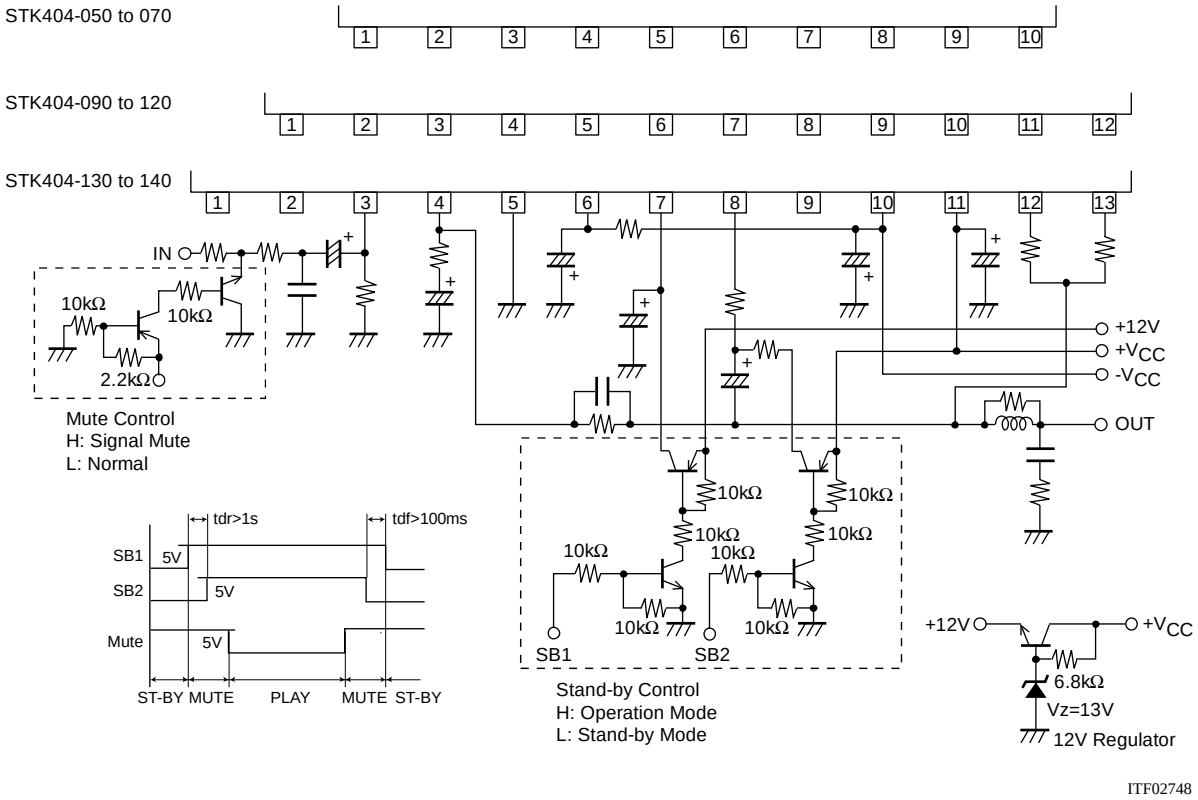
From formula (2)' $\theta c\text{-}a < (150 - 50)/28 - 1.7/2$

< 2.72

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



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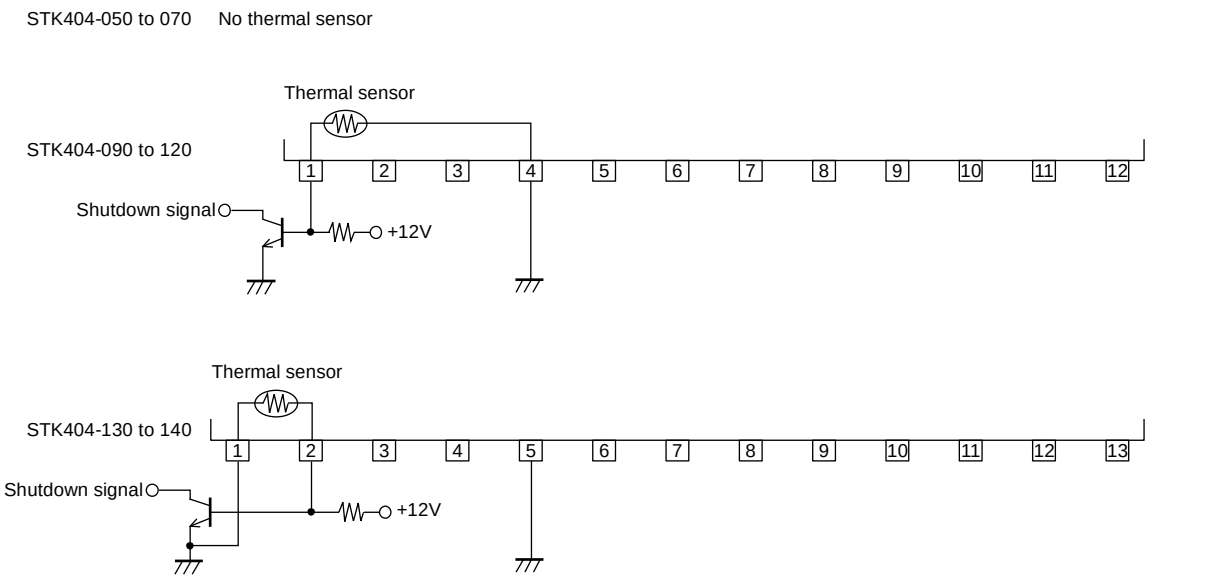
STK404-000s Thermal Shut Down Application



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