



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

## STK404-120N-E — Thick-Film Hybrid IC 1ch class-AB Audio Power IC 120W

### Overview

The STK404-120N-E is a 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).

### Application

- Audio Power use

### Features

- Pin-to-pin compatible outputs ranging from 60W to 180W
- Miniature package
- Output load impedance:  $R_L = 6\Omega$  recommended.
- Allowable load shorted time: 0.3 second
- Allows the use of predesigned applications for standby, mute, and the load short protection circuit.

### Selection Guide

	STK404-070N-E	STK404-120N-E	STK404-140N-E
Output1 (10%/1kHz)	60W × 1ch	120W × 1ch	180W × 1ch
Output2 (1%/20Hz to 20kHz)	40W × 1ch	80W × 1ch	120W × 1ch
Maximum rating $V_{CC}$ max (no sig.)	±46V	±65V	±78V
Maximum rating $V_{CC}$ (6Ω)	±39V	±59V	±73V
Recommended operating $V_{CC}$ (6Ω)	±30V	±41V	±51V
Package size	44.0mm×25.6mm×8.5mm	46.6mm×25.5mm×8.5mm	59.2mm×25.5mm×8.5mm

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment. The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for new introduction or other application different from current conditions on the usage of automotive device, communication device, office equipment, industrial equipment etc. , please consult with us about usage condition (temperature, operation time etc.) prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

**SANYO Semiconductor Co., Ltd.**

<http://semicon.sanyo.com/en/network>

# STK404-120N-E

## Specifications

**Absolute Maximum Ratings** at  $T_a = 25^\circ\text{C}$ ,  $T_c = 25^\circ\text{C}$  unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage 1	$V_{CC\ max1}$	Non- signal	$\pm 65$	V
Power supply voltage 2	$V_{CC\ max2}$	Signal, $R_L = 6\Omega$	$\pm 59$	V
Thermal detector maximum voltage	$V_p$	1-4pin	16	V
Thermal detector maximum current	$I_p$	1-4pin	30	mA
Thermal resistance	$\theta_{j-c}$	Per one power transistor	1.7	$^\circ\text{C}/\text{W}$
Junction temperature	$T_{j\ max}$		150	$^\circ\text{C}$
Operating substrate temperature	$T_c\ max$		125	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-30 to +125	$^\circ\text{C}$
Allowable time for load short-circuit *4	$t_s$	$V_{CC} = \pm 41\text{V}$ , $R_L = 6\Omega$ , $f = 50\text{Hz}$ $P_O = 80\text{W}$	0.3	s

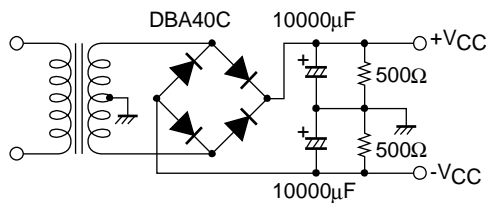
**Operating Characteristics** at  $T_c = 25^\circ\text{C}$ ,  $R_L = 6\Omega$  (Non-inductive load),  $R_g = 600\Omega$ ,  $V_G = 30\text{dB}$

Parameter	Symbol	Conditions				Ratings			Unit	
		$V_{CC}$ [V]	f [Hz]	$P_O$ [W]	THD [%]	min	typ	max		
Output power	$P_{O\ 1}$	$\pm 41$	20 to 20k		1.0	80			W	
	$P_{O\ 2}$	$\pm 41$	1k		10		120			
Frequency characteristics	$f_L, f_H$	$\pm 41$		1.0		+0 -3dB	20 to 20k		Hz	
Input impedance	$r_i$	$\pm 41$	1k	1.0			55		$k\Omega$	
Output noise voltage *3	$V_{NO}$	$\pm 49$				$R_g = 10k\Omega$	1.2		mVrms	
Output neutral voltage	$V_N$	$\pm 49$					-100	0	+100	mV
Quiescent current	$I_{CCO}$	$\pm 49$				No load		60	mA	
Thermal detector resistance *2	$R_p$	$T_p = 25^\circ\text{C}$ , 1-4pin						470		$\Omega$
Thermal detector operate temperature *2	$T_p$	$R_p = 4.7k\Omega$ , 1-4pin						135		$^\circ\text{C}$

[Note]

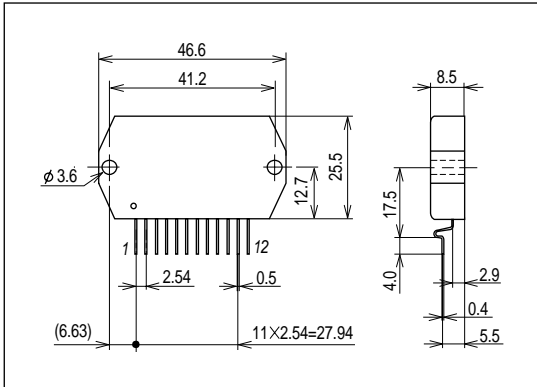
- \*1. All tests are measured using a constant-voltage supply unless otherwise specified.
- \*2. Thermal Detector temperature ( $+135^\circ\text{C} \pm 5^\circ\text{C}$ ) indicates the value at unusual operation, therefore, does not indicate the guaranteed value at usual operation.  
Thermal Detector is PRF18series (AS characteristic) manufactured by MURATA.
- \*3. The output noise voltage is peak value of an average-reading meter with a rms value scale (VTVM).  
A regulated AC supply (50Hz) should be used to eliminate the effects of AC primary line flicker noise.
- \*4. Allowable time for load short-circuit and output noise voltage are measured using the specified transformer power supply. About the load short circuit, it is designed assuming protecting by cut-off within 0.3 second.
- \*5. Weight of 1 HIC : 12.6g Outer carton dimensions (W×L×H) : 420mm×233mm×277mm

(Equivalent to MG-250)



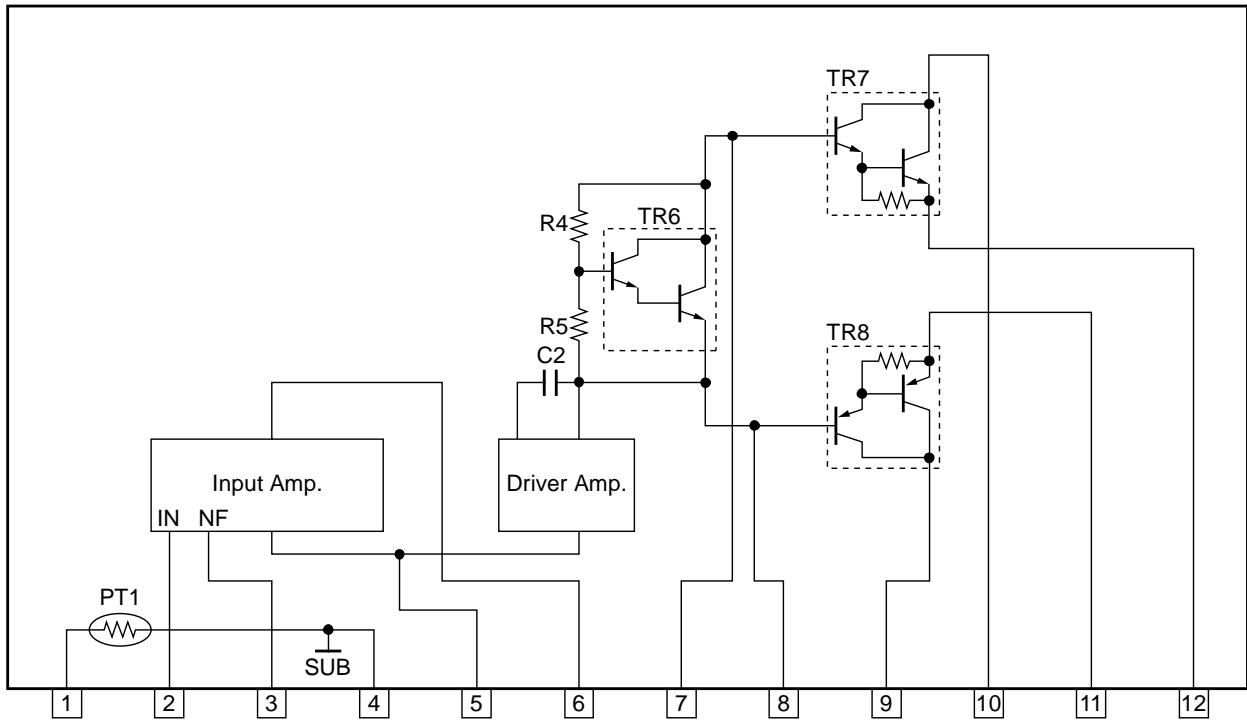
**Package Dimensions**

unit : mm (typ)



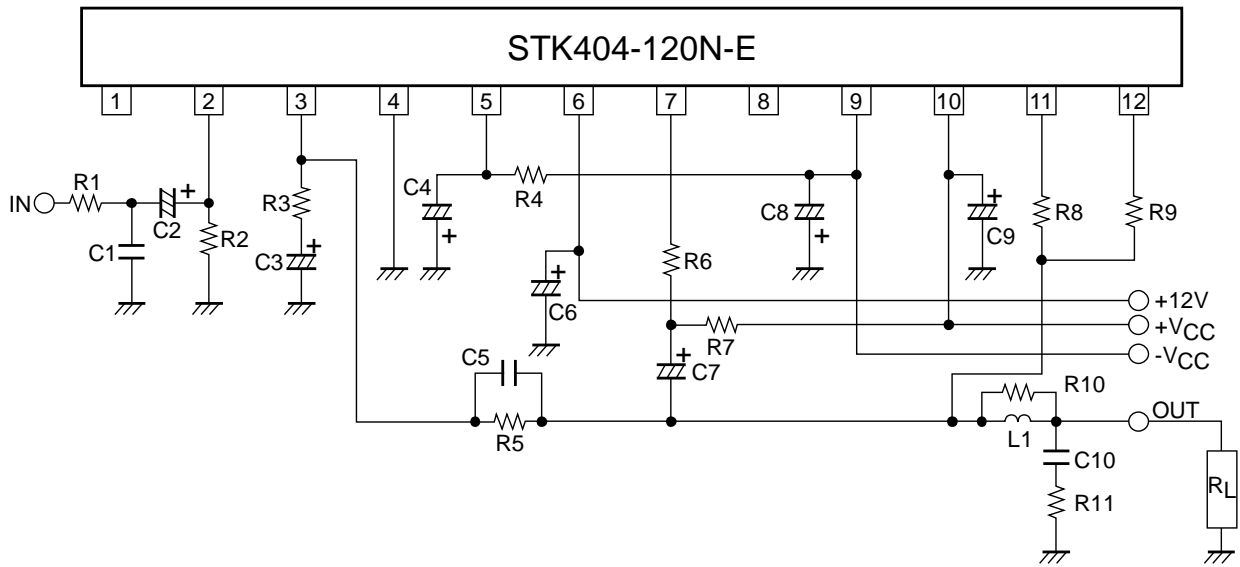
RoHS directive pass

**Equivalent Circuit**



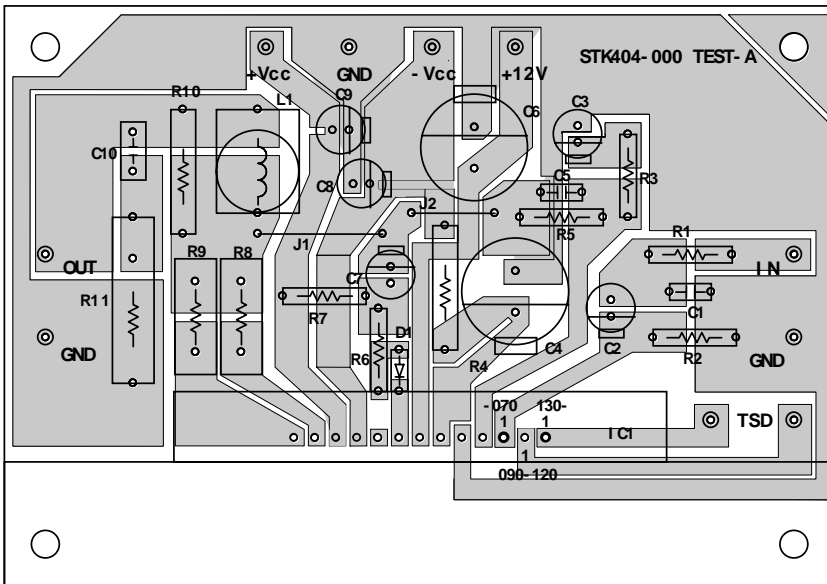
# STK404-120N-E

## Test Circuit



## PCB Layout Example

Top view



## STK404-120N-E

### PCB Parts List

Type (IC1)	STK404-070N-E	STK404-120N-E	STK404-140N-E
Position of (1)pin	Third from the right end	Second from the right end	The right end
Location			
R1	1k $\Omega$	←	←
R2	56k $\Omega$	←	←
R3	1.8k $\Omega$	←	←
R4	100 $\Omega$ /1W	←	←
R5	56k $\Omega$	←	←
R6	10k $\Omega$ /1W	4.7k $\Omega$ /1W	5.1k $\Omega$ /1W
R7	10k $\Omega$ /1W	4.7k $\Omega$ /1W	5.1k $\Omega$ /1W
R8	0.22 $\Omega$ /5W	←	←
R9	-	0.22 $\Omega$ /5W	←
R10	4.7 $\Omega$ /1W	←	←
R11	4.7 $\Omega$ /1W	←	←
C1	470pF	←	←
C2	2.2 $\mu$ F/50V	←	←
C3	10 $\mu$ F/50V	←	←
C4	100 $\mu$ F/100V	←	←
C5	5pF	←	←
C6	100 $\mu$ F/50V	←	←
C7	47 $\mu$ F/100V	←	←
C8	10 $\mu$ F/100V	←	←
C9	10 $\mu$ F/100V	←	←
C10	0.1 $\mu$ F	←	←
D1	200V/0.5A	←	←
L1	2.2 $\mu$ H	←	←
J1	15mm	←	←
J2	10mm	←	←

# STK404-120N-E

[STK404-000Nsr Pin Layout]

		1	2	3	4	5	6	7	8	9	10
(Size) 44.0mm×25.6mm×8.5mm		1ch classAB/2.54mm									
STK404-070N 60W/JEITA		I	N	S	-	+	+	-	-	+	O
		N	F	U	P	P	p	p	V	V	U
		/	/	B	R	R	o	o	C	C	T
		C	C		E	E	w	w	C	C	/
		H	H				e	e			C
		1	1				r	r			H
							T	T			1
							R	R			

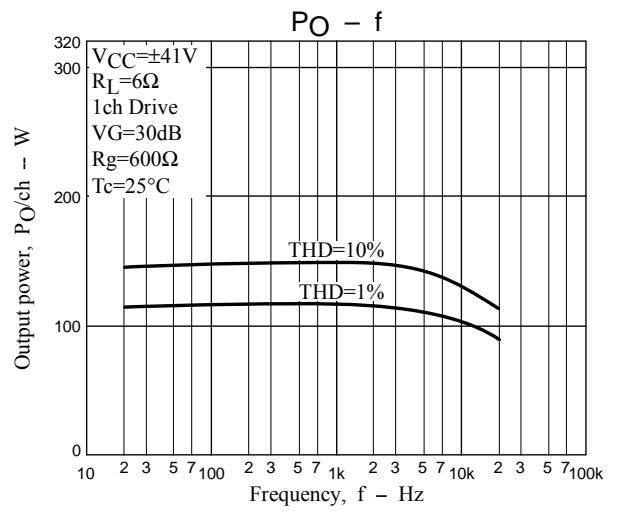
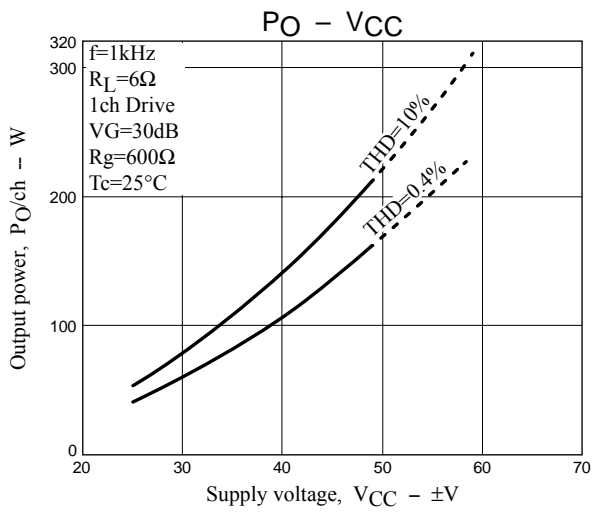
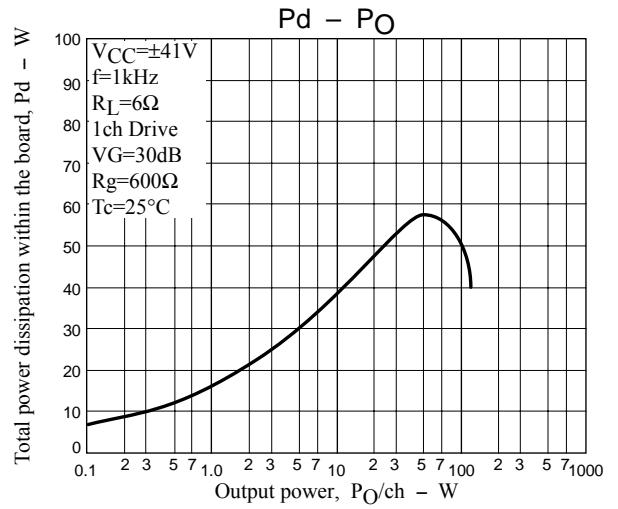
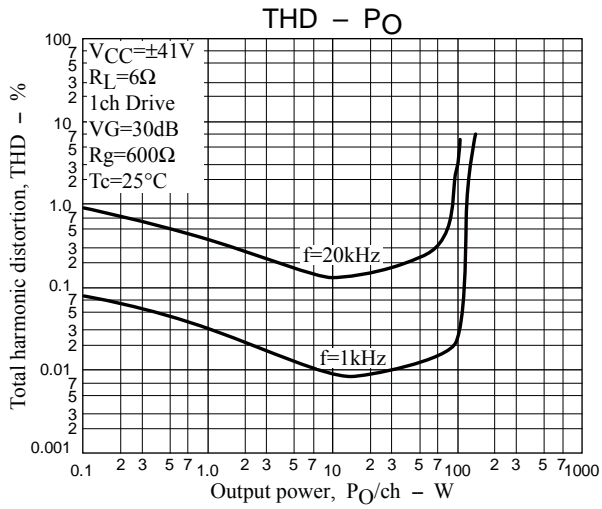
  

		1	2	3	4	5	6	7	8	9	10	11	12
(Size) 46.6mm×25.5mm×8.5mm		1ch classAB/2.54mm											
STK404-120N 120W/JEITA		T	I	N	S	-	+	+	-	-	+	O	O
		H	N	F	U	P	P	p	p	V	V	U	U
		/	/	B	R	R	R	o	o	C	C	T	T
		C	C		E	E	E	w	w	C	C	/	/
		H	H					e	e			C	C
		1	1					r	r			H	H
								T	T			1	1
								R	R			-	+

		1	2	3	4	5	6	7	8	9	10	11	12	13
(Size) 59.2mm×25.5mm×8.5mm		1ch classAB/2.54mm												
STK404-140N 180W/JEITA		T	I	N	S	-	+	+	-	-	+	O	O	
		H	N	F	U	P	P	p	p	V	V	U	U	
		/	/	B	R	R	R	o	o	C	C	T	T	
		C	C		E	E	E	w	w	C	C	/	/	
		H	H					e	e			C	C	
		1	1					r	r			H	H	
								T	T			1	1	
								R	R			-	+	

Characteristic of Evaluation Board



A Thermal Design Tip For STK404-120N-E Amplifier

[Thermal Design Conditions]

The thermal resistance ( $\theta_{c-a}$ ) of the heat-sink which manages the heat dissipation inside the Hybrid IC will be determined as follow:

(Condition 1) The case temperature ( $T_c$ ) of the Hybrid IC should not exceed 125°C
Pd x theta\_c-a + Ta < 125°C (1)

Where Ta : the ambient temperature for the system

(Condition 2) The junction temperature of each power transistor should not exceed 150°C
Pd x theta\_c-a + Pd/N x theta\_j-c + Ta < 150°C (2)

Where N : the number of transistors (two for 1 channel , ten for channel)

theta\_j-c : the thermal resistance of each transistor (see specification)

Note that the power consumption of each power transistor is assumed to be equal to the total power dissipation (Pd) divided by the number of transistors (N).

From the formula (1) and (2), we will obtain:

theta\_c-a < (125 - Ta)/Pd (1)'

theta\_c-a < (150 - Ta)/Pd - theta\_j-c/N (2)'

The value which satisfies above formula (1)' and (2)' will be the thermal resistance for a desired heat-sink.

Note that all of the component except power transistors employed in the Hybrid IC comply with above conditions.

[Example of Thermal Design]

Generally, the power consumption of actual music signals are being estimated by the continuous signal of 1/8 P\_O max. (Note that the value of 1/8 P\_O max may be varied from the country to country.)

(Sample of STK404-120N-E ; 80W x 1ch)

If V\_CC is +/-41V, and R\_L is 6 Ohm, then the total power dissipation (Pd) of inside Hybrid IC is as follow;

Pd = 37.5W (at 10W output power, 1/8 of P\_O max)

There are four (2) transistors in Audio Section of this Hybrid IC, and thermal resistance (theta\_j-c) of each transistor is 1.7°C/W. If the ambient temperature (Ta) is guaranteed for 50°C, then the thermal resistance (theta\_c-a) of a desired heat-sink should be;

From (1)' theta\_c-a < (125 - 50)/37.5 < 2.00

From (2)' theta\_c-a < (150 - 50)/37.5 - 1.7/2 < 1.82

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 1.82°C/W.

[Note]

Above are reference only. The samples are operated with a constant power supply. Please verify the conditions when your system is actually implemented.



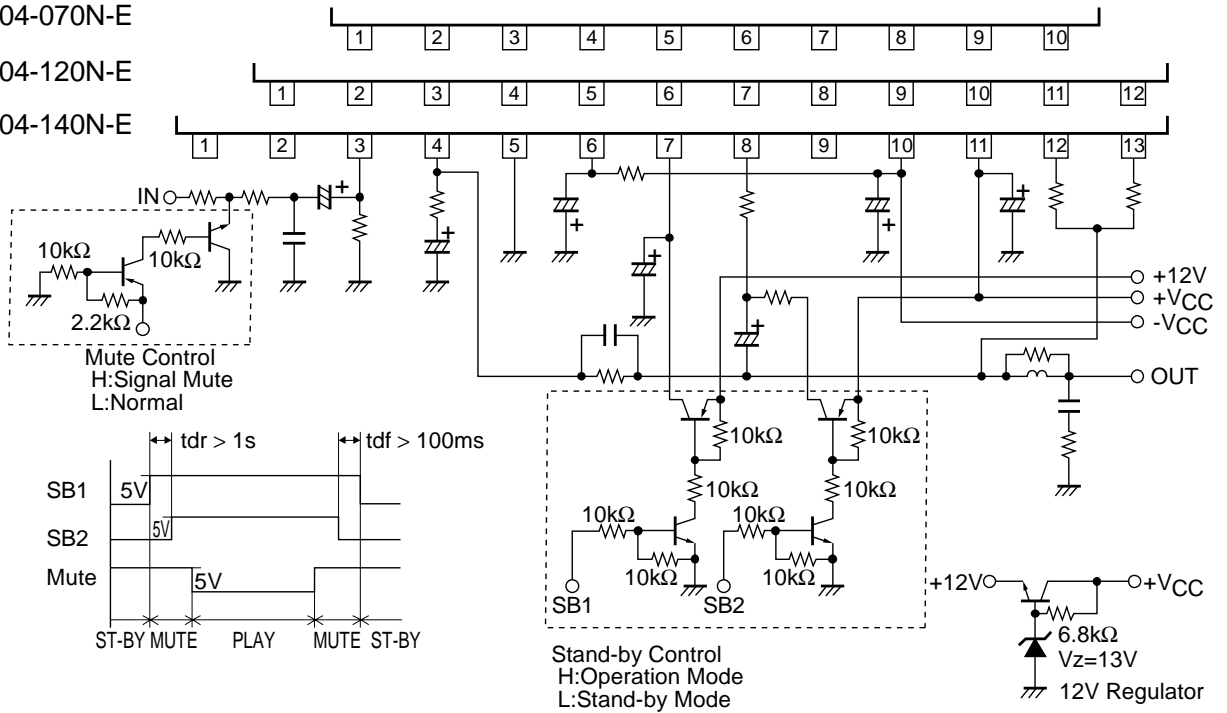
# STK404-120N-E

## STK404-000N-Eseries Stand-by control & Mute control Application

STK404-070N-E

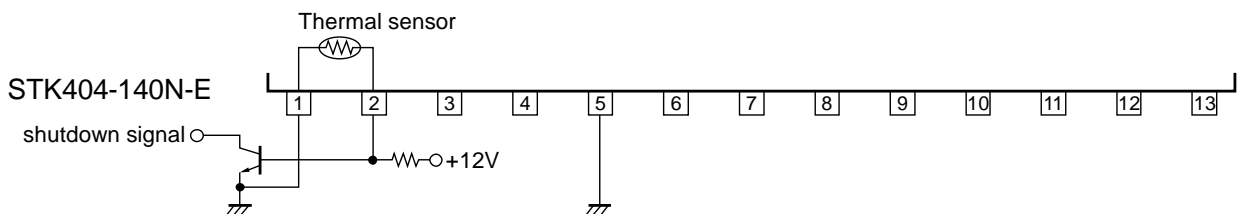
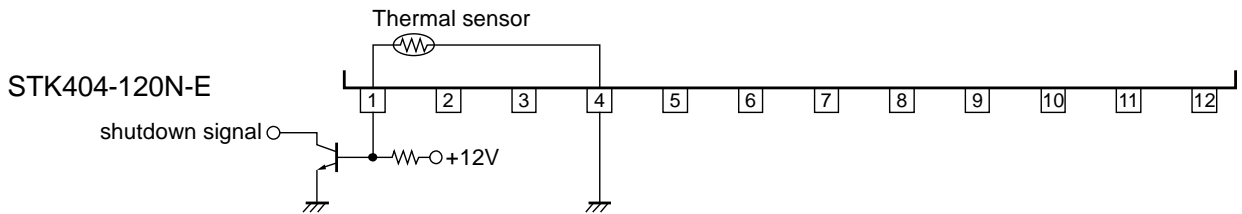
STK404-120N-E

STK404-140N-E

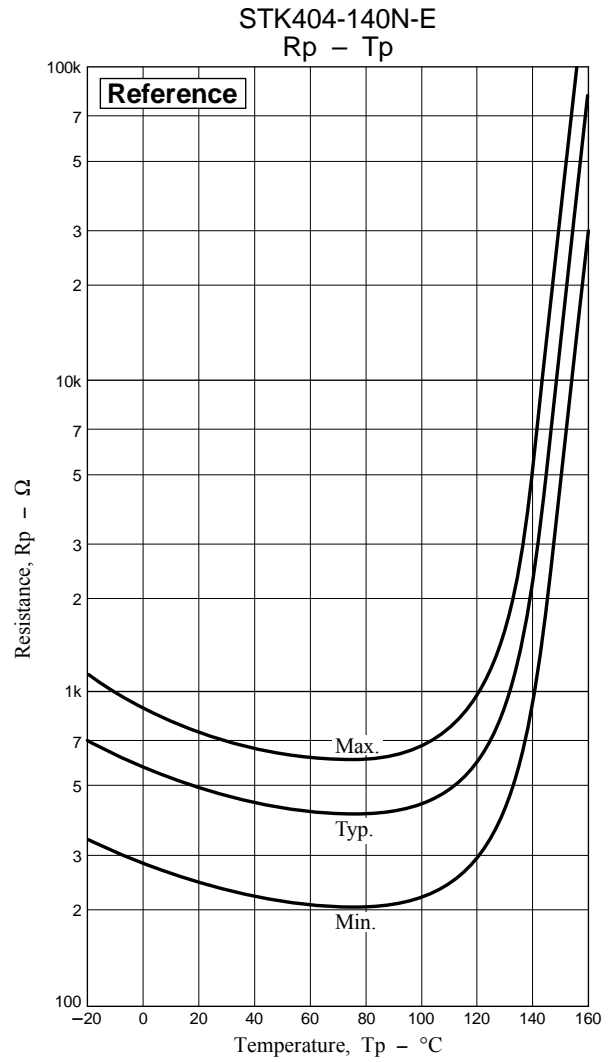
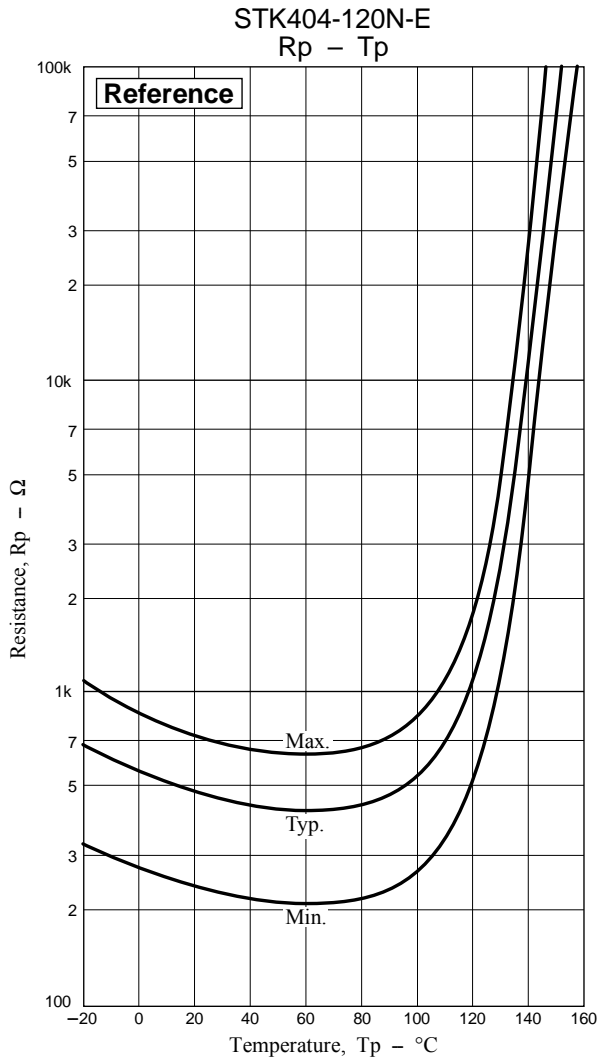


## STK404-000N-Esr Thermal shut down Application

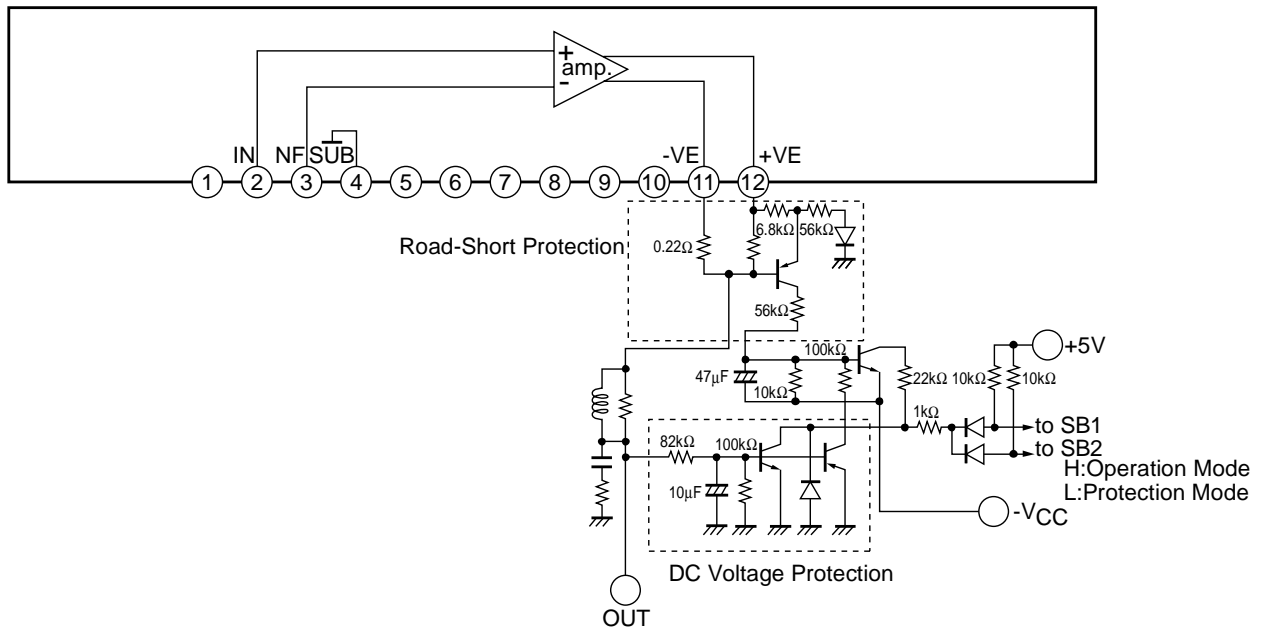
STK404-070N-E No thermal sensor



Thermal Sensor Characteristic



STK404-120N-E Road-Short & DC Voltage Protection Application



- SANYO Semiconductor Co.,Ltd. assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein.
- Regarding monolithic semiconductors, if you should intend to use this IC continuously under high temperature, high current, high voltage, or drastic temperature change, even if it is used within the range of absolute maximum ratings or operating conditions, there is a possibility of decrease reliability. Please contact us for a confirmation.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of August, 2012. Specifications and information herein are subject to change without notice.