



## Test Procedure for the STK404-070NGEVB Evaluation Board

### [Supply Voltage]

+Vcc/-Vcc : Power Supply for audio power amplifiers

+PRE (+12V) : Power Supply for +PRE

### [Operation Guide]

1. Installation of the heat sink  
Please refer to a thermal design tip for the amplifier.
2. Load Connection:  
Connect the  $R_L=6\Omega$  (Non-inductive load)
3. Power Supply Connection:  
Connect the +Vcc/-Vcc/+12V (Output off : 0V)
5. Input Connection:  
Connect the Oscillator (Sine wave / Output resistance  $600\Omega$ )  
The gain of the evaluation board is set in 30dB.
6. Power Supply:  
At first, supply DC voltage to +12V.  
Next, supply DC voltage to +Vcc and -Vcc.
7. Input: ON

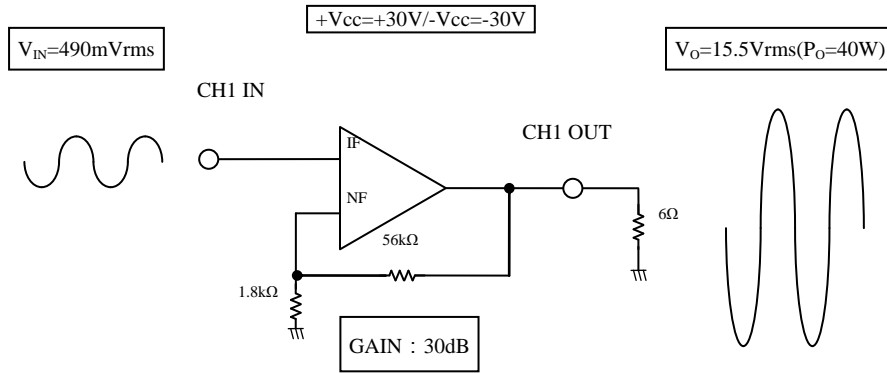


[Required Equipment]

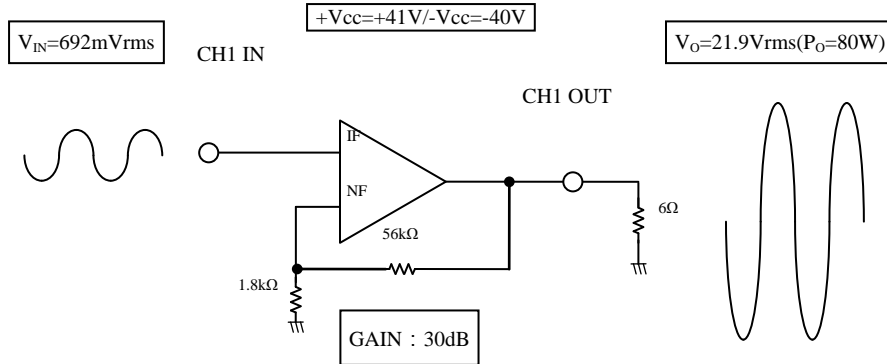
Equipment	Efficiency		
Evaluation Board	STK404-070NGEVB	STK404-120NGEVB	STK404-140NGEVB
Power supply +Vcc	60V-3A	80V-5A	100V-6A
Power supply -Vcc	60V-3A	80V-5A	100V-6A
Power supply Stand-By Control	15V-1A		
Load	6Ω(Non-inductive load )		
Measurement	Audio analyzer (Panasonic VP-7723B)		

Characteristics confirmation

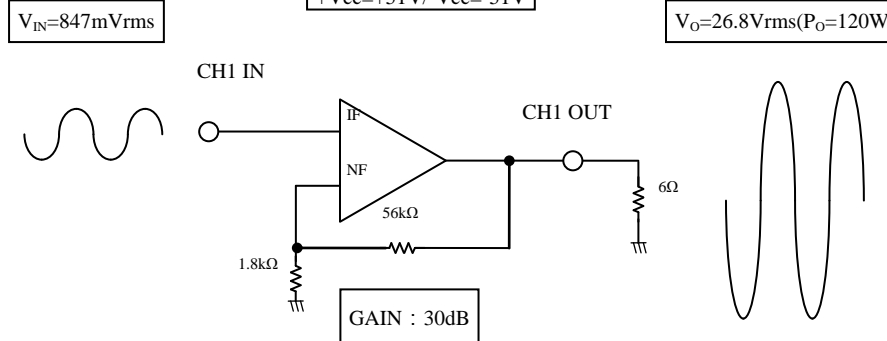
STK404-070NGEVB



STK404-120NGEVB

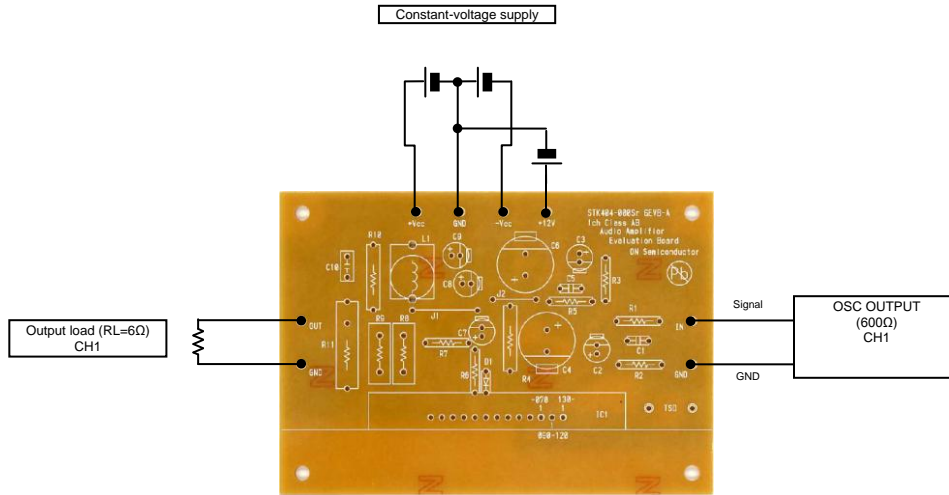


STK404-140NGEVB

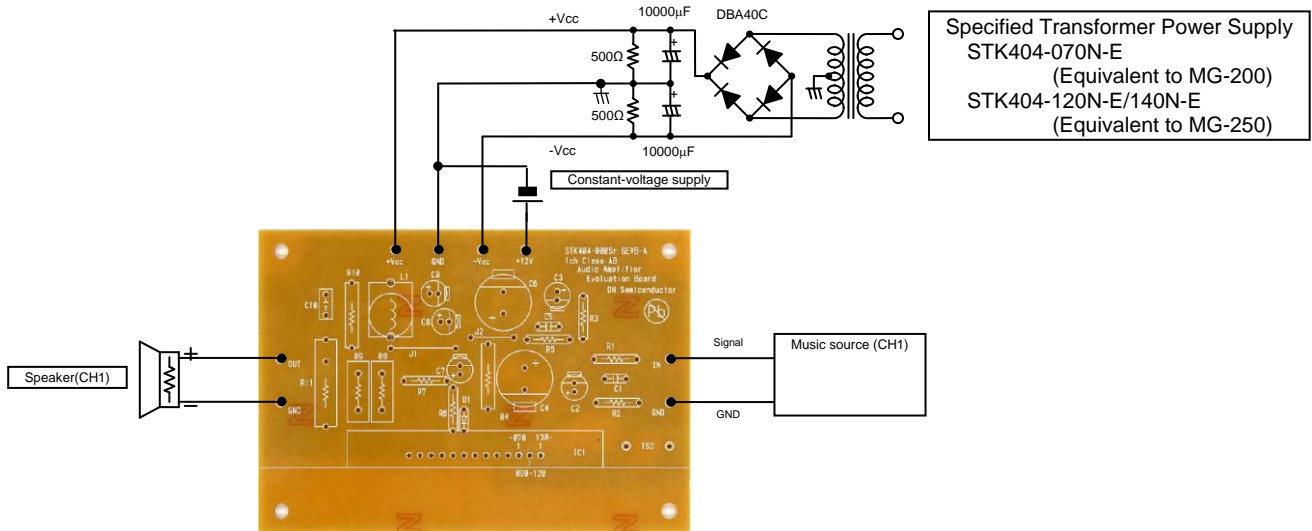




Characteristics confirmation



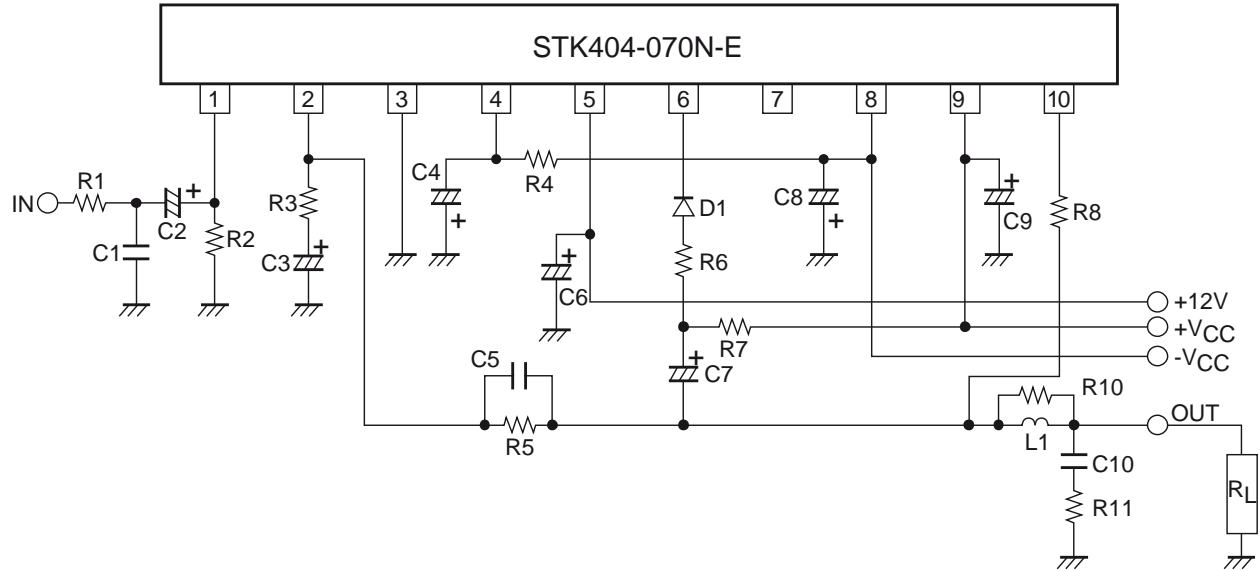
Sound quality confirmation, load short-circuit test, noise examination





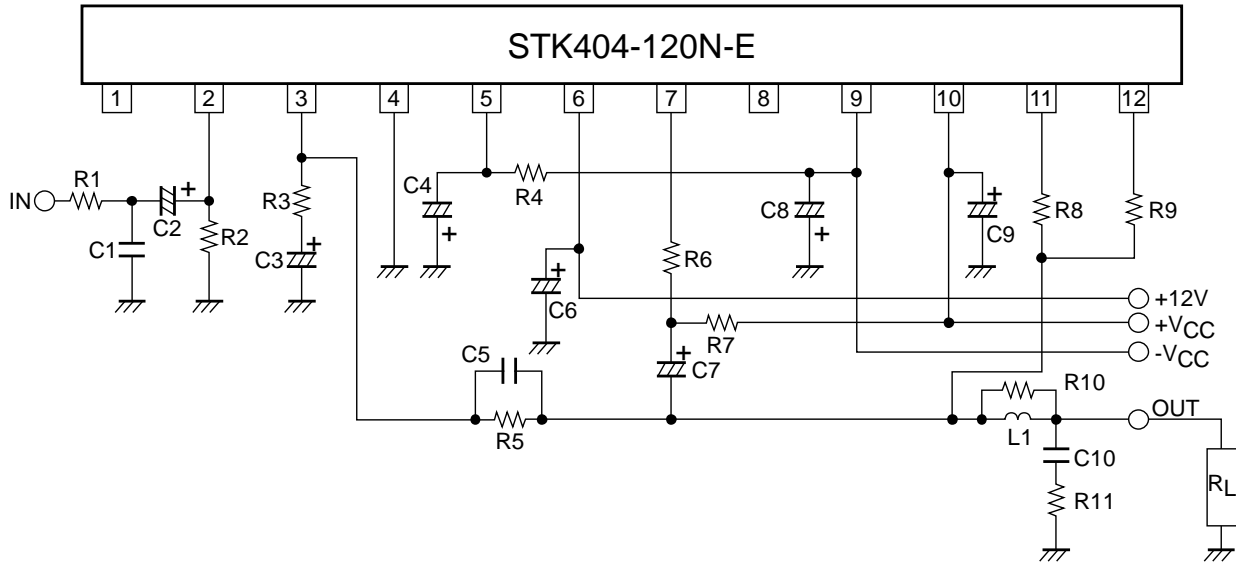
**Test Circuit**

STK404-070N-E



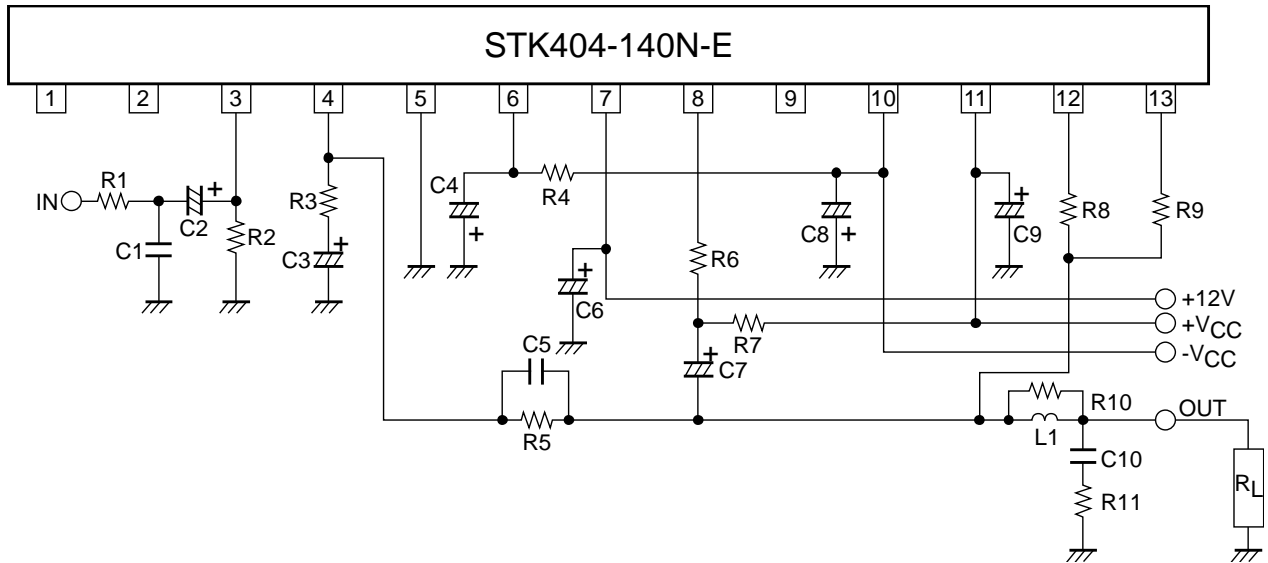
**Test Circuit**

STK404-120N-E





### Test Circuit STK404-140N-E

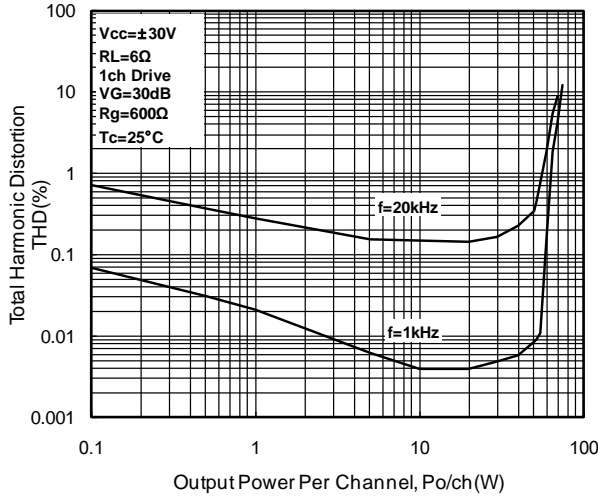




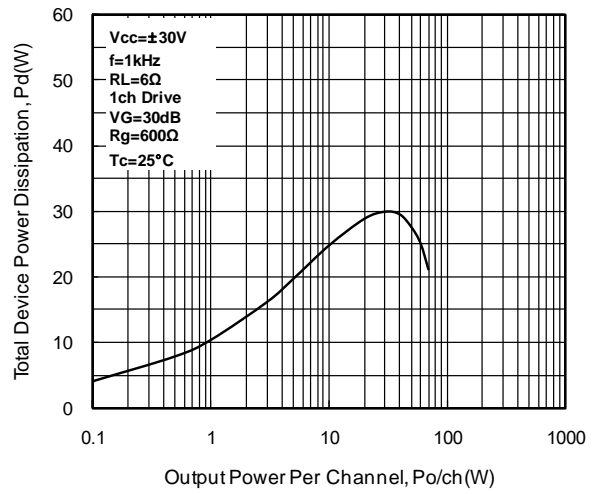
## Characteristic of Evaluation Board

STK404-070N-E

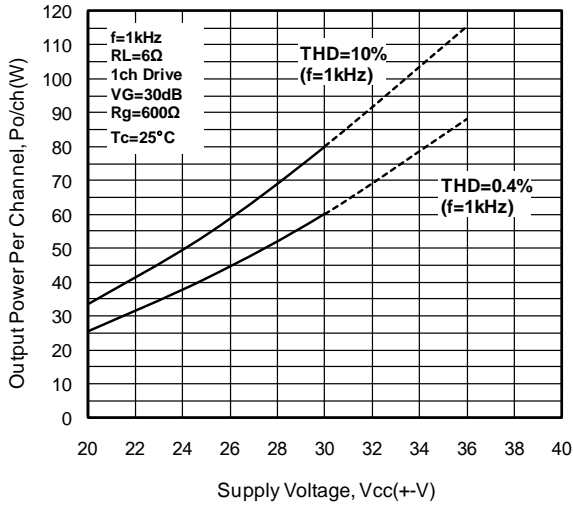
**THD-Po**  
STK404-070N-E



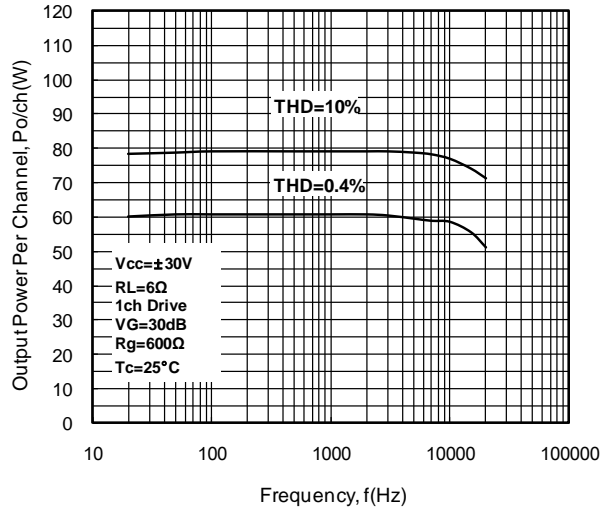
**Pd-Po**  
STK404-070N-E



**Po-Vcc**  
STK404-070N-E



**Po-f**  
STK404-070N-E

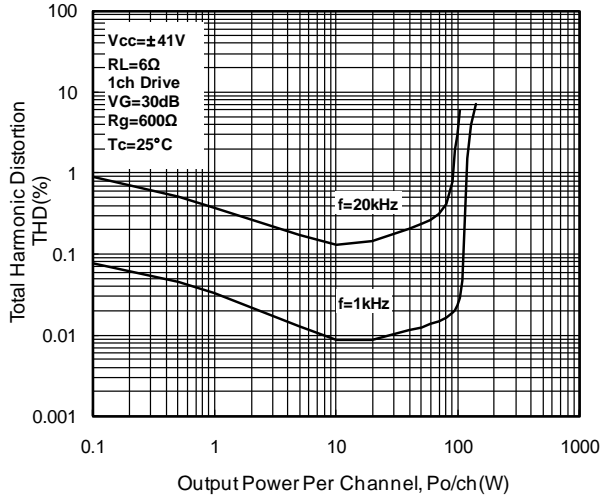




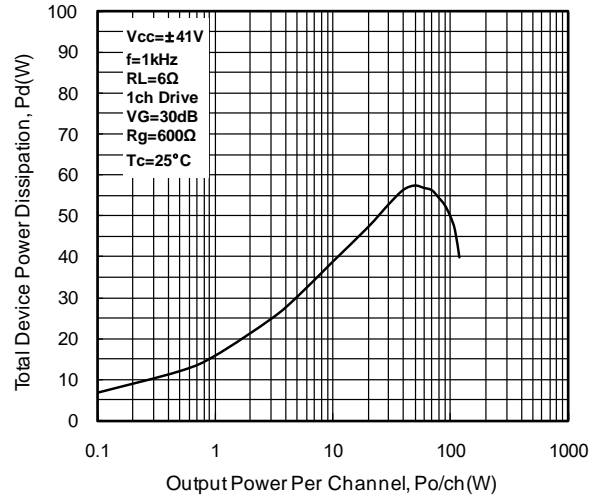
# Characteristic of Evaluation Board

STK404-120N-E

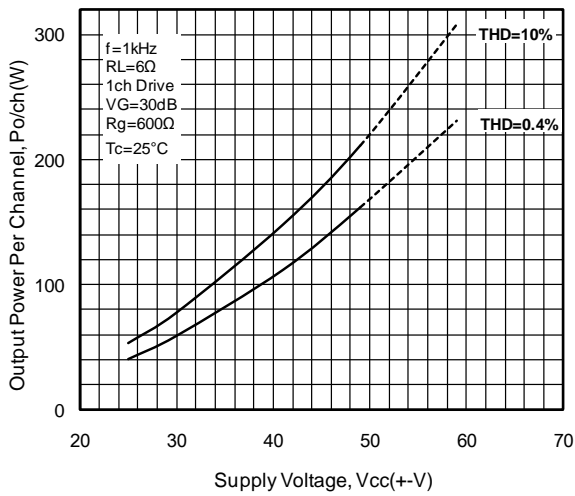
**THD-Po**  
STK404-120N-E



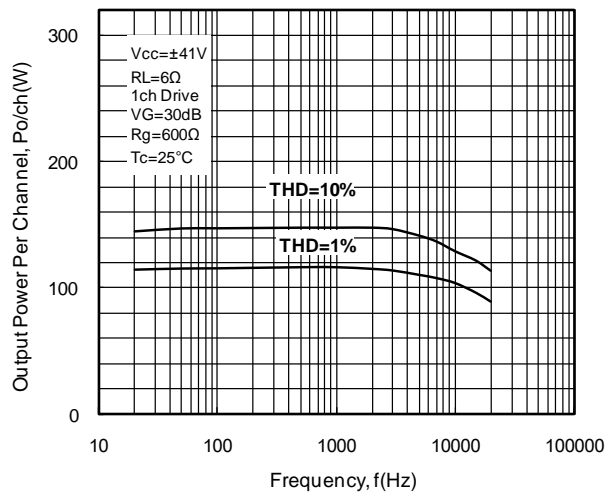
**Pd-Po**  
STK404-120N-E



**Po-Vcc**  
STK404-120N-E



**Po-f**  
STK404-120N-E

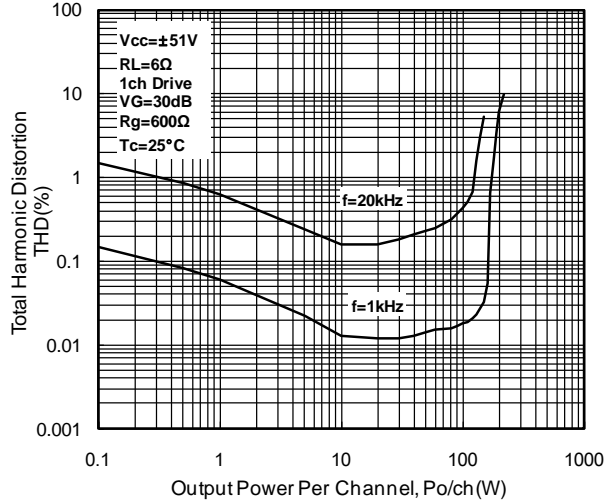




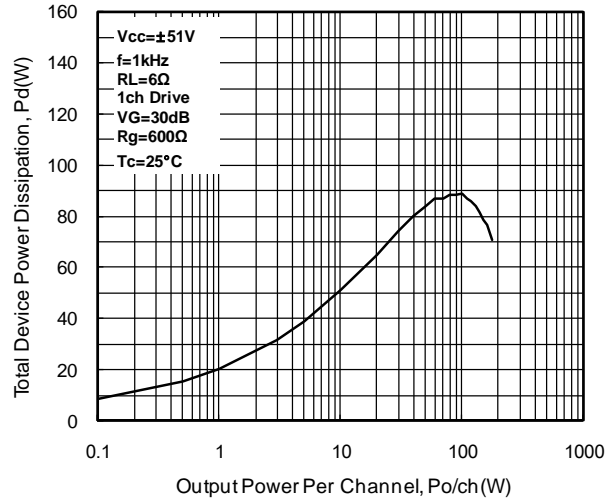
# Characteristic of Evaluation Board

STK404-140N-E

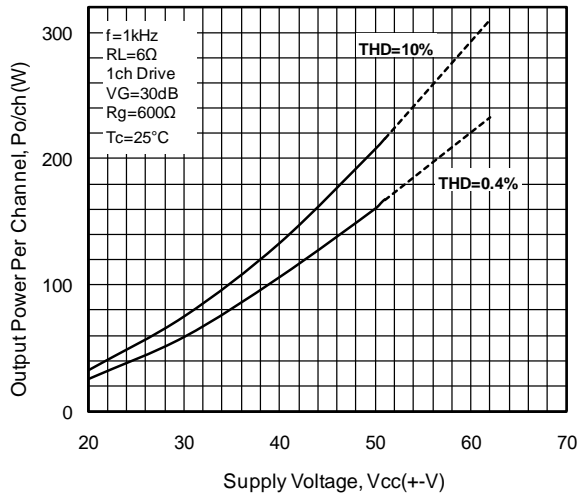
**THD-Po**  
STK404-140N-E



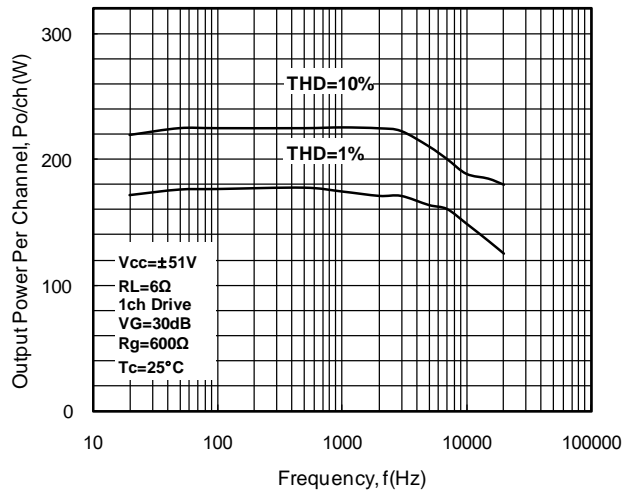
**Pd-Po**  
STK404-140N-E



**Po-Vcc**  
STK404-140N-E



**Po-f**  
STK404-140N-E







## A Thermal Design Tip For STK404-070N-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

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

Where  $T_a$  : the ambient temperature for the system

(Condition 2) The junction temperature of each power transistor should not exceed 150°C

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

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 ( $P_d$ ) divided by the number of transistors (N).

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

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

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

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 STK404-070N-E ; 40W×1ch)

If  $V_{CC}$  is ±30V, and  $R_L$  is 6Ω, then the total power dissipation ( $P_d$ ) of inside Hybrid IC is as follow;

$$P_d = 19.6\text{W (at 5W output power, 1/8 of } P_O \text{ max)}$$

There are two (2) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta_{j-c}$ ) of each transistor is 3.0°C/W. If the ambient temperature ( $T_a$ ) is guaranteed for 50°C, then the thermal resistance ( $\theta_{c-a}$ ) of a desired heat-sink should be;

$$\begin{aligned} \text{From (1)'} \quad \theta_{c-a} &< (125 - 50)/19.6 \\ &< 3.83 \end{aligned}$$

$$\begin{aligned} \text{From (2)'} \quad \theta_{c-a} &< (150 - 50)/19.6 - 3.0/2 \\ &< 3.60 \end{aligned}$$

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 3.60°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.



## 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

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

Where  $T_a$  : the ambient temperature for the system

(Condition 2) The junction temperature of each power transistor should not exceed 150°C

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

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 ( $P_d$ ) divided by the number of transistors ( $N$ ).

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

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

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

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×1ch)

If  $V_{CC}$  is  $\pm 41V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation ( $P_d$ ) of inside Hybrid IC is as follow;

$$P_d = 37.5W \text{ (at } 10W \text{ output power, } 1/8 \text{ of } P_{O\ max})$$

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 ( $T_a$ ) is guaranteed for 50°C, then the thermal resistance ( $\theta_{c-a}$ ) of a desired heat-sink should be;

$$\begin{aligned} \text{From (1)'} \quad \theta_{c-a} &< (125 - 50)/37.5 \\ &< 2.00 \end{aligned}$$

$$\begin{aligned} \text{From (2)'} \quad \theta_{c-a} &< (150 - 50)/37.5 - 1.7/2 \\ &< 1.82 \end{aligned}$$

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.



## A Thermal Design Tip For STK404-140N-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

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

Where  $T_a$  : the ambient temperature for the system

(Condition 2) The junction temperature of each power transistor should not exceed 150°C

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

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 ( $P_d$ ) divided by the number of transistors (N).

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

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

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

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 STK404-140N-E ; 120W×1ch)

If  $V_{CC}$  is  $\pm 51V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation ( $P_d$ ) of inside Hybrid IC is as follow;

$$P_d = 57.2W \text{ (at 15W output power, 1/8 of } P_O \text{ max)}$$

There are four (2) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta_{j-c}$ ) of each transistor is 1.1°C/W. If the ambient temperature ( $T_a$ ) is guaranteed for 50°C, then the thermal resistance ( $\theta_{c-a}$ ) of a desired heat-sink should be;

$$\begin{aligned} \text{From (1)'} \quad \theta_{c-a} &< (125 - 50)/57.2 \\ &< 1.31 \end{aligned}$$

$$\begin{aligned} \text{From (2)'} \quad \theta_{c-a} &< (150 - 50)/57.2 - 1.1/2 \\ &< 1.19 \end{aligned}$$

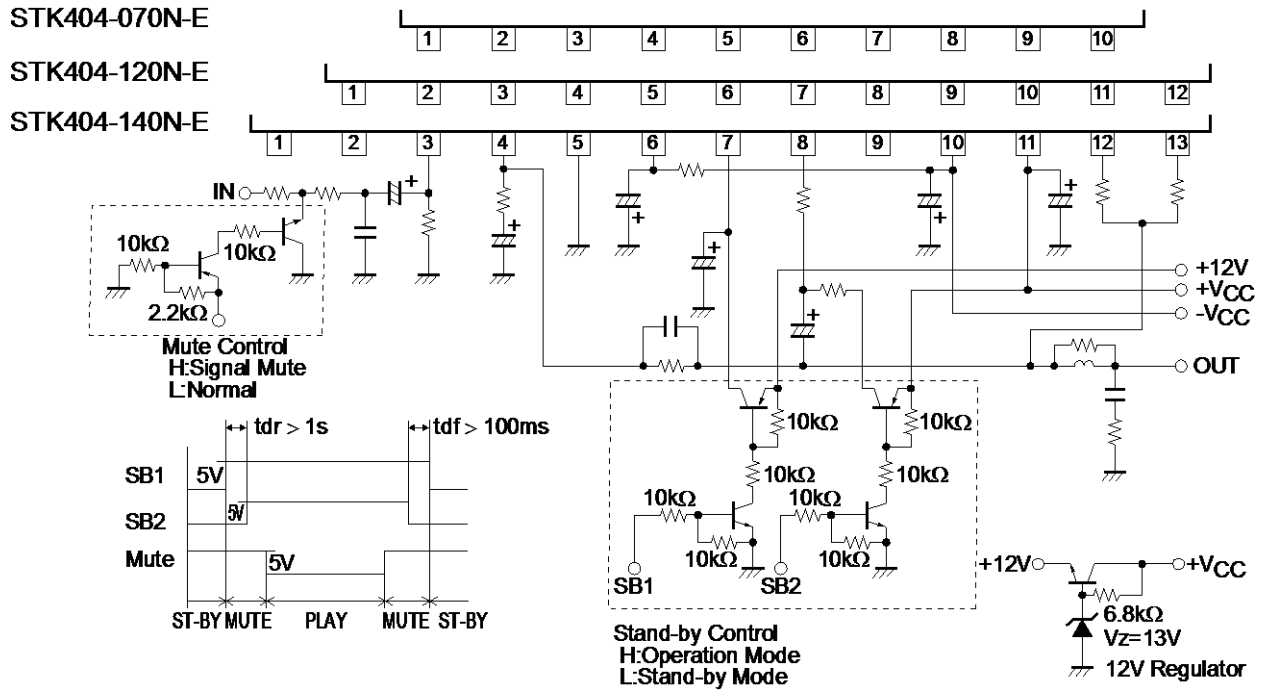
Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 1.19°C/W.

### [Note]

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

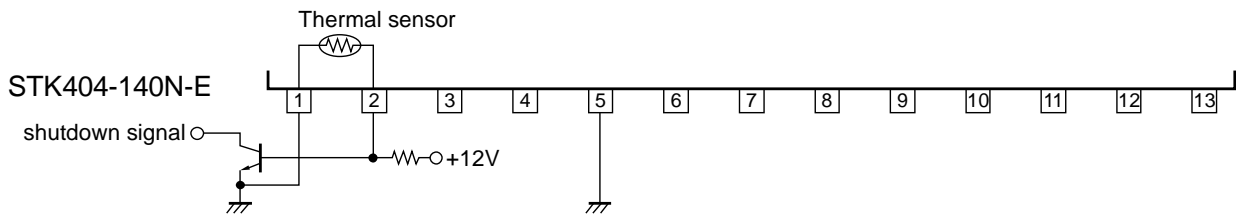
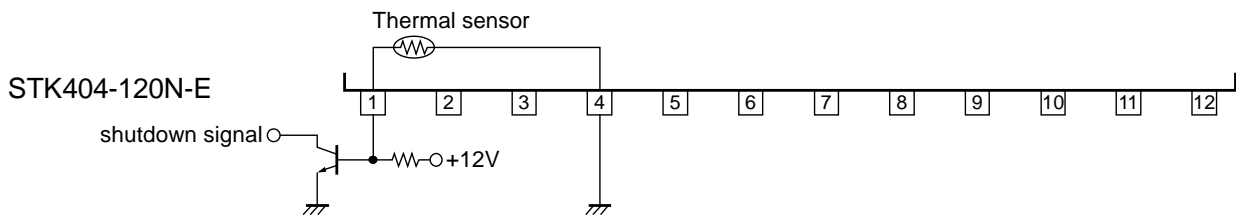


## STK404-000N-Ese Stand-by control & Mute control Application



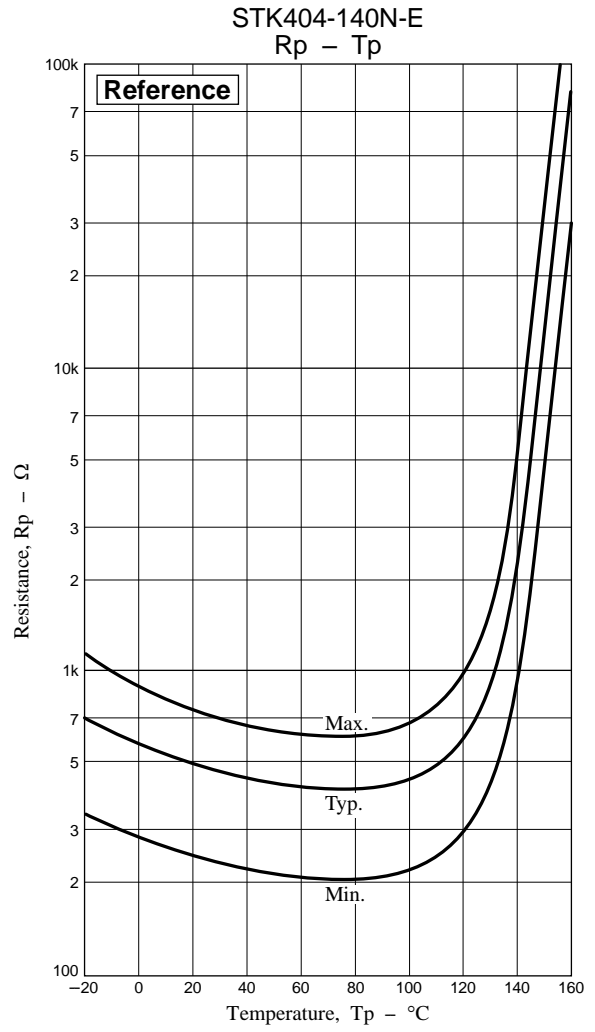
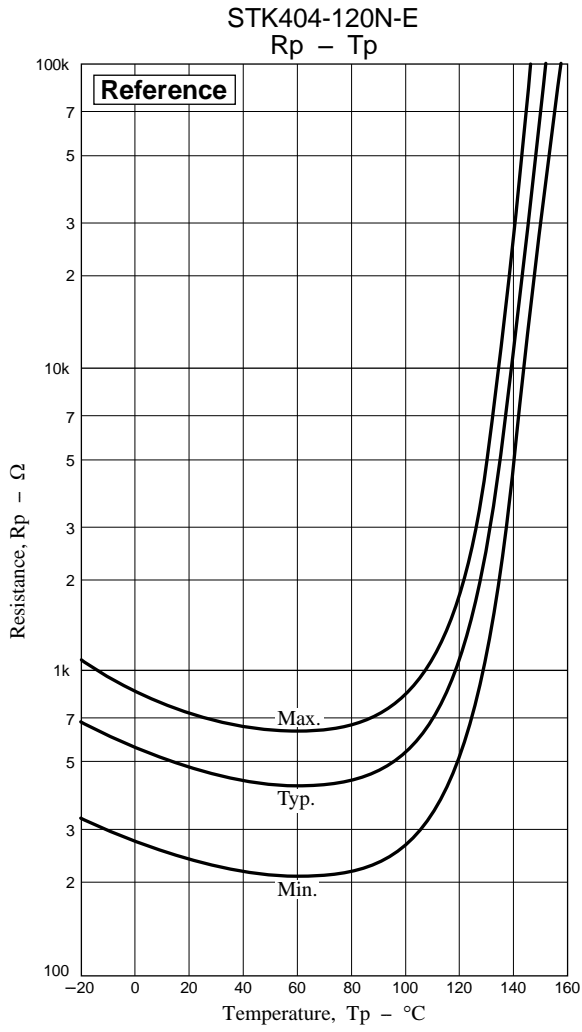
## STK404-000N-Esr Thermal shut down Application

STK404-070N-E No thermal sensor



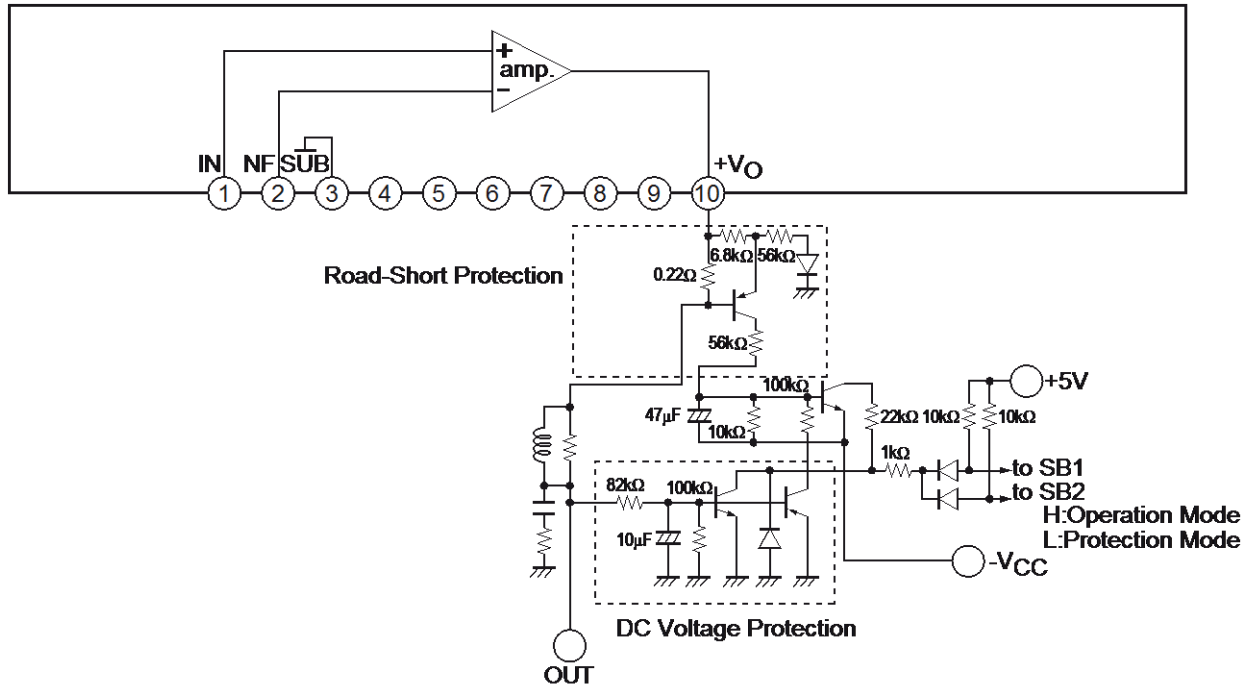


### Thermal Sensor Characteristic

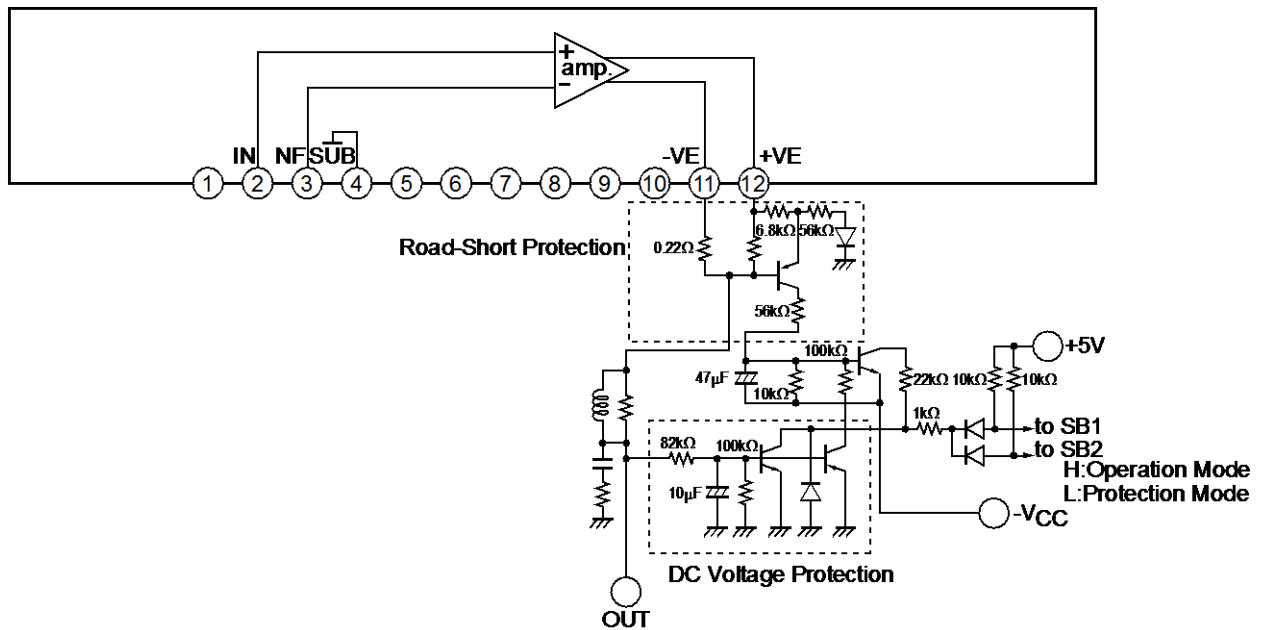




### STK404-070N-E Road-Short & DC Voltage Protection Application



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





### STK404-140N-E Road-Short & DC Voltage Protection Application

