

# SANYO Semiconductors DATA SHEET

## STK433-000N-E series

Thick-Film Hybrid IC

# 2-4ch class-AB Audio Power IC from 40W to 150W

#### Overview

The STK433-000N-E series is a hybrid IC designed to be used in from 40W to 150W x 2,3,4ch class AB audio power amplifiers.

## **Application**

• Audio Power amplifiers

#### **Features**

- Pin-to-pin compatible outputs ranging from 40W to 150W.
- Miniature package.
- Output load impedance: RL=6Ω recommended.
- Allowable load shorted time: 0.3 second
- Allows the use of predesigned applications for standby and mute circuit.

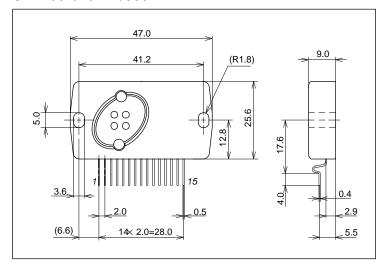
#### Series model

	STK433-040N-E	STK433-060N-E	STK433-130N-E
Output1 (10%/1kHz)	40W × 2ch	50W × 2ch	150W × 2ch
Output2 (0.4%/20Hz to 20kHz)	25W × 2ch	35W × 2ch	100W × 2ch
Max. rating V <sub>CC</sub> (quiescent)	±38V	±46V	±71.5V
Max. rating V <sub>CC</sub> (6Ω)	±36V	±40V	±63V
Recommended operating V <sub>CC</sub> (6Ω)	±24V	±27V	±44V
Dimensions (excluding pin height)	47.0mm×25.0	6mm×9.0mm	67.0mm×25.6mm×9.0mm

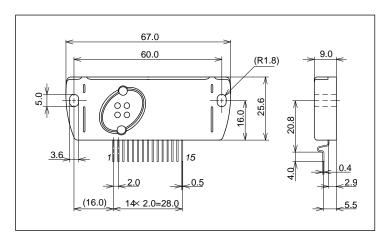
	STK433-330N-E	STK433-840N-E	STK433-890N-E
Output1 (10%/1kHz)	150W × 3ch	40W × 4ch	80W × 4ch
Output2 (0.4%/20Hz to 20kHz)	100W × 3ch	25W × 4ch	50W × 4ch
Max. rating V <sub>CC</sub> (quiescent)	±71.5V	±38V	±54V
Max. rating $V_{CC}$ (6 $\Omega$ )	±63V	±36V	±47V
Recommended operating $V_{CC}$ (6 $\Omega$ )	±44V	±25V	±34V
Dimensions (excluding pin height)	64.0mm×36.6mm×9.0mm	64.0mm×31.1mm×9.0mm	78.0mm×44.1mm×9.0mm

## Package Dimensions (unit : mm typ) RoHS DIRECTIVE PASS

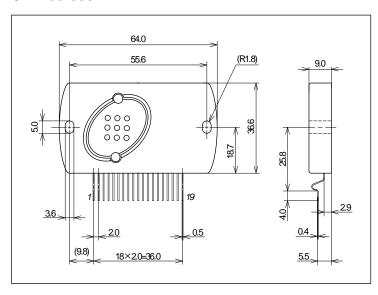
## STK433-040N-E/060N-E



## STK433-130N-E

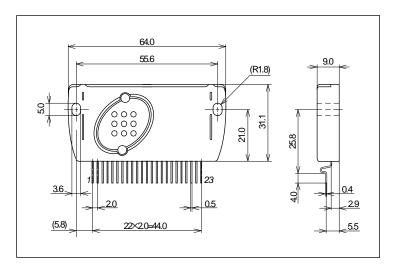


## STK433-330N-E



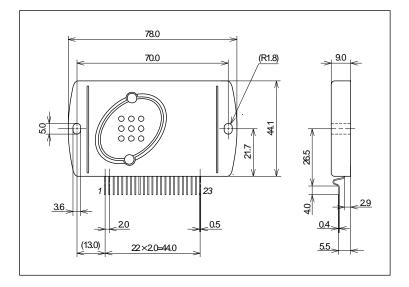
## Package Dimensions (unit : mm typ) RoHS DIRECTIVE PASS

STK433-840N-E



## Package Dimensions (unit : mm typ) RoHS DIRECTIVE PASS

STK433-890N-E



## **Pin Layout**

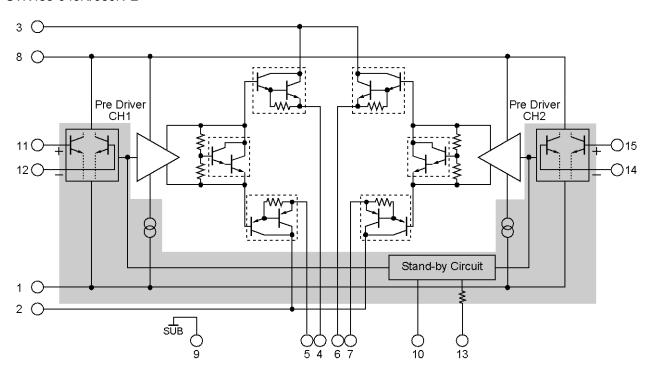
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STK433-040N 40W/JEITA	-	-	+	0	0	0	0	+			I	N	S	N	I				
STK433-060N 50W/JEITA	Р	٧	٧	U	U	U	U	Р	S	G	N	F	Т	F	N				
	R	С	С	Т	Т	Т	Т	R	U	N	/	/	Α	/	/				
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(Size) 67.0mm×25.6mm×9.0mm				C H	С	С	С				H 1	H 1	D I	H 2	H 2				
STK433-130N 150W/JEITA				1	1	2	2				ļ '	ļ '	В	_	_				
				+	-	+	-						Υ						
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(Size) 64.0mm×36.6mm×9.0mm							l	3cl	n clas	sAB/	2.00n	nm	l		l		l	l	
STK433-330N 150W/JEITA	-	-	+	0	0	0	0	+			ı	N	S	N	ı	ı	N	0	0
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	R	С	С	Т	Т	Т	Т	R	U	N	/	/	Α	/	/	/	/	Т	Т
	E	С	С	/	/	/	/	Е	В	D	С	С	N	С	С	С	С	/	/
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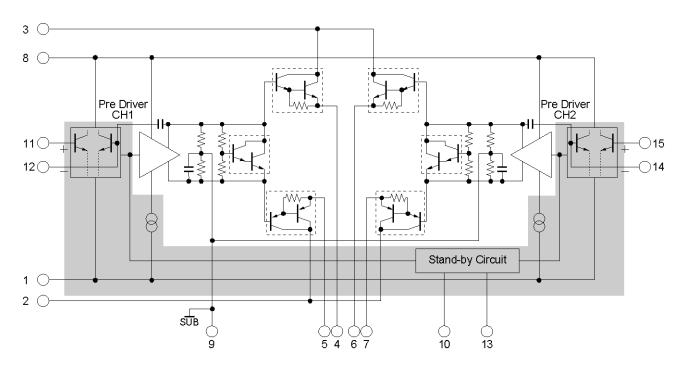
[STK433-000N/-100N/-800Nsr Pin Layout]

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15								
(Size) 47.0mm×25.6mm×9.0mm						2c	h clas	ssAB/	2.00r	nm													
STK433-040N 40W/JEITA	-	-	+	0	0	0	0	+			Ι	Ν	S	N	ı								
STK433-060N 50W/JEITA	Р	٧	٧	U	U	U	U	Р	S	G	N	F	Т	F	N								
	R	С	С	Т	Т	Т	Т	R	U	N	/	/	Α	/	/								
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(Size) 67.0mm×25.6mm×9.0mm				С	С	С	C H				H 1	H 1	D	H 2	H 2								
STK433-130N 150W/JEITA				1	1	2	2						В										
	_			+	-	+	-						Υ										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
(Size) 64.0mm×31.1mm×9.0mm								•		4cl	n clas	sAB/	2.00n	nm				•					
STK433-840N 40W/JEITA	-	-	+	0	0	0	0	+			I	Ν	S	N	I	N	1	I	N	0	0	0	0
	Р	٧	٧	U	U	U	U	Р	S	G	N	F	Т	F	N	F	N	Ν	F	U	U	U	U
	R	С	С	Т	Т	Т	Т	R	U	N	/	/	Α	/	/	/	/	/	/	Т	Т	Т	Т
	E	С	С	/	/	/	/	Е	В	D	С	С	N	С	С	С	С	С	С	/	/	/	/
(Size) 78.0mm×44.1mm×9.0mm				C	C	С	C				Н	Н	D	Н	Н	Н	Н	Н	Н	C	С	С	С
,	4			Н	Н	Н	Н				1	1		2	2	3	3	4	4	Н	Н	Н	Н
STK433-890N 80W/JEITA	1			1	1	2	2						В							3	3	4	4
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## **Equivalent Circuit** STK433-040N/060N-E

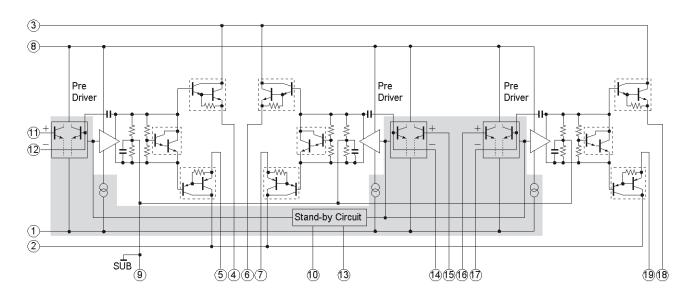


## STK433-130N-E

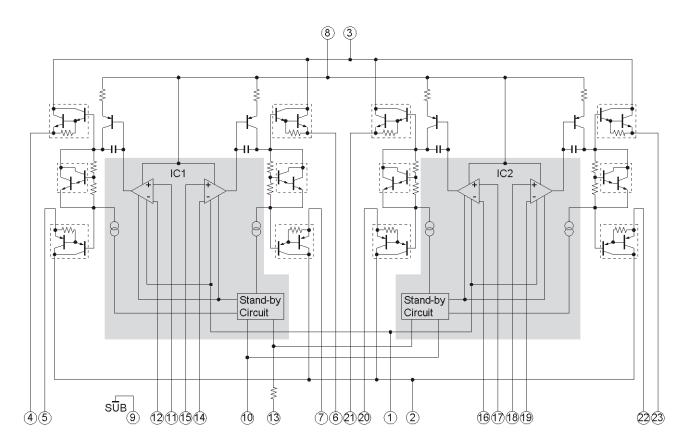


## **Equivalent Circuit**

## STK433-330N-E



### STK433-840N-E/890N-E



#### STK433-040N-E

## **Specifications**

## Absolute maximum ratings at Ta=25°C, Tc=25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Maximum Power Supply Voltage	Vcc max(0)	Non- signal	±38	V
Maximum Power Supply Voltage	Vcc max(1)	Signal, RL≥6Ω	±36	V
Maximum Power Supply Voltage	Vcc max(2)	Signal, RL=4Ω	±30	V
Minimum Operation Supply Voltage	Vcc min		±10	V
#13 Operating Voltage *5	VST OFF max	#13 voltage	-0.3 to +5.5	V
Thermal Resistance	Өј-с	Per one power transistor	4.2	°C/W
Junction Temperature	Tj max	Should satisfy Tj max and Tc max	150	°C
Operating Substrate Temperature	Tc max	Should Salisty 1) max and 10 max	125	°C
Storage Temperature	Tstg		-30 to +125	°C
Allowable Time for Load Short-circuit *4	ts	Vcc=±24V, RL=6Ω, f=50Hz Po=25W, 1ch drive	0.3	s

Operating Characteristics at Tc=25°C, RL= $6\Omega$  (Non-inductive Load), Rg= $600\Omega$ , VG=30dB

			C	Condition	s *2					
Parameter	Symbol	Vcc [V]	f [Hz]	Po [W]	THD [%]		min	typ	max	Unit
	Po 1	±24	20 to20k		0.4		23	25		
Output Power *1	Po 2	±24	1k		10			40		W
	Po 3	±20	1k		1	RL=4Ω		25		
THD *1	THD 1	±24	20 to20k	F 0		VG=30dB			0.4	%
I I I	THD 2	±24	1k	5.0		VG=300B		0.02		70
Frequency Characteristics *1	fL, fH	±24		1.0		+0 -3dB		20 to 50k		Hz
Input Impedance	ri	±24	1k	1.0				55		kΩ
Output Noise Voltage *3	VNO	±29				Rg=2.2kΩ			1.0	mVrms
Quiescent Current	Icco	±29				No load	15	30	70	mA
Quiescent Current at Stand-by	ICST	±29							1.0	mA
Output Neutral Voltage	VN	±29					-70	0	+70	mV
#13 Stand-By ON Threshold *5	VST ON	±24				Stand-by		0	0.6	V
#13 Stand-By OFF Threshold *5	VST OFF	±24				Operation	2.5	3.0	5.5	V

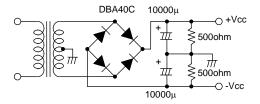
#### Note

- \*1. 1 channel Operation.
- \*2. All tests are measured using a constant-voltage supply unless otherwise specified
- \*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.
- \*5. Please connect PreVcc pin (#1 pin) with the stable minimum voltage. and connect so that current does not flow in by reverse bias.
- \*6. In case of heat sink design, we request customer to design in the condition to have assumed market.
- \* The case of this Hybrid-IC is using thermosetting silicon adhesive(TSE322SX).
- \* Weight of HIC: (typ) 12.0 g

Outer carton dimensions (WxLxH): 452mmx325mmx192mm

Specified Transformer Power Supply (Equivalent to MG-200)



#### STK433-060N-E

## **Specifications**

## Absolute maximum ratings at Ta=25°C, Tc=25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Maximum Power Supply Voltage	Vcc max(0)	Non- signal	±46	V
Maximum Power Supply Voltage	Vcc max(1)	Signal, RL≥6Ω	±40	V
Maximum Power Supply Voltage	Vcc max(2)	Signal, RL=4Ω	±33	V
Minimum Operation Supply Voltage	Vcc min		±10	V
#13 Operating Voltage *5	VST OFF max	#13 voltage	-0.3 to +5.5	V
Thermal Resistance	Өј-с	Per one power transistor	3.5	°C/W
Junction Temperature	Tj max	Should satisfy Tj max and Tc max	150	°C
Operating Substrate Temperature	Tc max	Should satisfy 1) max and 10 max	125	°C
Storage Temperature	Tstg		-30 to +125	°C
Allowable Time for Load Short-circuit *4	ts	Vcc=±27V, RL=6Ω, f=50Hz Po=35W, 1ch drive	0.3	S

## Operating Characteristics at Tc=25°C, RL=6Ω(Non-inductive Load), Rg=600Ω, VG=30dB

			C	Condition	s *2			Ratings		
Parameter	Symbol	Vcc [V]	f [Hz]	Po [W]	THD [%]		min	typ	max	Unit
	Po 1	±27	20 to20k		0.4		33	35		
Output Power *1	Po 2	±27	1k		10			50		W
	Po 3	±22	1k		1	RL=4Ω		35		
THD *1	THD 1	±27	20 to20k	<b>5</b> 0		)/C 204D			0.4	0/
THD *1	THD 2	±27	1k	5.0		VG=30dB		0.02		%
Frequency Characteristics *1	fL, fH	±27		1.0		+0 -3dB		20 to 50k		Hz
Input Impedance	ri	±27	1k	1.0				55		kΩ
Output Noise Voltage *3	VNO	±33				Rg=2.2kΩ			1.0	mVrms
Quiescent Current	Icco	±33				No load	15	30	70	mA
Quiescent Current at Stand-by	ICST	±33				VST=0v			1.0	mA
Output Neutral Voltage	VN	±33					-70	0	+70	mV
#13 Stand-By ON Threshold *5	VST ON	±27				Stand-by		0	0.6	V
#13 Stand-By OFF Threshold *5	VST OFF	±27				Operation	2.5	3.0	5.5	V

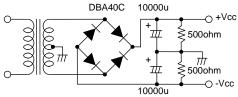
#### Note

- \*1. 1 channel Operation.
- \*2. All tests are measured using a constant-voltage supply unless otherwise specified
- \*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.
- \*5. The impression voltage of '#13(Stand-By) pin' must not exceed the maximum rating. Power amplifier operate by impressing voltage +2.5 to +5.5v to '#13(Stand-By) pin'.
- \* Please connect PreVcc pin (#1 pin) with the stable minimum voltage. and connect so that current does not flow in by reverse bias.
- \* In case of heat sink design, we request customer to design in the condition to have assumed market.
- \* The case of this Hybrid-IC is using thermosetting silicon adhesive(TSE322SX).
- \* Weight of HIC: (typ) 12.0 g

Outer carton dimensions (WxLxH) : 452mmx325mmx192mm

Specified Transformer Power Supply (Equivalent to MG-200)



#### STK433-130N-E

## **Specifications**

### **Absolute maximum ratings** at Ta=25°C, Tc=25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Maximum Power Supply Voltage	Vcc max(0)	Non- signal	±71.5	V
Maximum Power Supply Voltage	Vcc max(1)	Signal, RL≥6Ω	±63	V
Maximum Operation Supply Voltage	Vcc min		±10	V
#13 Operating Voltage *5	VST OFF max		-0.3 to +5.5	V
Thermal Resistance	Өј-с	Per one power transistor	1.6	°C/W
Junction Temperature	Tj max	Should satisfy Tj max and Tc max	150	ů
Operating Substrate Temperature	Tc max	Should satisfy 1) max and 10 max	125	°C
Storage Temperature	Tstg		-30 to +125	°C
Allowable Time for Load Short-circuit *4	ts	$Vcc=\pm44V$ ,RL= $6\Omega$ ,f= $50$ Hz Po= $100W$ ,1ch drive	0.3	S

**Operating Characteristics** at Tc=25°C, RL=6Ω(Non-inductive Load), Rg=600Ω, VG=30dB

				Conditio		0 2000), 11	<u> </u>			
Parameter	Symbol	Vcc [V]	f [Hz]	Po [W]	THD [W]		min	typ	max	Unit
Output Power *1	Po 1	±44	20 to20k		0.4		96	100		W
Output Power *1	Po 2	±44	1k		10			150		VV
THD *1	THD 1	±44	20 to20k	5.0		VG=30dB			0.4	- %
ו שחו	THD 2	±44	1k	5.0		VG=300B		0.01		70
Frequency Characteristics *1	fL, fH	±44		1.0		+0 -3dB		20 to 50k		Hz
Input Impedance	ri	±44	1k	1.0				55		kΩ
Output Noise Voltage *3	VNO	±53				Rg=2.2kΩ			1.0	mVrms
Quiescent Current	Icco	±53				No load	40	80	100	mA
Output Neutral Voltage	VN	±53					-70	0	+70	mV
#13 Stand-By ON Threshold *5	VST ON	±44				Stand-by		0	0.6	V
#13 Stand-By OFF Threshold *5	VST OFF	±44				Operation	2.5	3.0	5.5	V

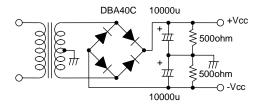
#### Note

- \*1.1channel Operation.
- \*2.All tests are measured using a constant-voltage supply unless otherwise specified
- \*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.
- \*5. The impression voltage of '#13(Stand-By) pin' must not exceed the maximum rating. Power amplifier operate by impressing voltage +2.5 to +5.5v to '#13(Stand-By) pin'.
- \* Please connect PreVcc pin (#1 pin)with the stable minimum voltage. and connect so that current does not flow in by reverse bias.
- \* In case of heat sink design, we request customer to design in the condition to have assumed market.
- \* The case of this Hybrid-IC is using thermosetting silicon adhesive(TSE322SX).
- \* Weight of HIC: (typ)18.4 g

Outer carton dimensions (WxLxH): 429mmx245mmx275mm

Specified Transformer Power Supply (Equivalent to MG-250)



#### STK433-330N-E

## **Specifications**

## **Absolute maximum ratings** at Ta=25°C, Tc=25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Maximum Power Supply Voltage	Vcc max(0)	Non- signal	±71.5	V
Maximum Power Supply Voltage	Vcc max(1)	Signal, RL≥6Ω	±63	V
Maximum Operation Supply Voltage	Vcc min		±10	V
#13 Operating Voltage *5	VST OFF max		-0.3 to +5.5	V
Thermal Resistance	Өј-с	Per one power transistor	1.6	°C/W
Junction Temperature	Tj max	Should satisfy Tj max and Tc max	150	ô
Operating Substrate Temperature	Tc max	Should Salisty 1) max and 10 max	125	°C
Storage Temperature	Tstg		-30 to +125	°C
Allowable Time for Load Short-circuit *4	ts	Vcc= $\pm$ 44V,RL= $6\Omega$ ,f= $50$ Hz Po= $100$ W,1ch drive	0.3	s

Operating Characteristics at Tc=25°C, RL=6Ω(Non-inductive Load), Rg=600Ω, VG=30dB

		Conditions				Ratings				
Parameter	Symbol	Vcc [V]	f [Hz]	Po [W]	THD [W]		min	typ	max	Unit
Output Power *1	Po 1	±44	20 to20k		0.4		96	100		W
Output Power *1	Po 2	±44	1k		10			150		
TIID +4	THD 1	±44	20 to20k	F 0		VG=30dB		0.4	%	
THD *1	THD 2	±44	1k	5.0				0.01		70
Frequency Characteristics *1	fL, fH	±44		1.0		+0 -3dB	20 to 50k		Hz	
Input Impedance	ri	±44	1k	1.0				55		kΩ
Output Noise Voltage *3	VNO	±53				Rg=2.2kΩ			1.0	mVrms
Quiescent Current	Icco	±53				No load	60	120	160	mA
Output Neutral Voltage	VN	±53					-70	0	+70	mV
#13 Stand-By ON Threshold *5	VST ON	±44				Stand-by		0	0.6	V
#13 Stand-By OFF Threshold *5	VST OFF	±44				Operation	2.5	3.0	5.5	V

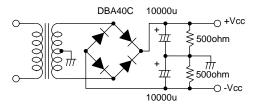
#### Note

- \*1.1channel Operation.
- \*2.All tests are measured using a constant-voltage supply unless otherwise specified
- \*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.
- \*5. The impression voltage of '#13(Stand-By)pin' must not exceed the maximum rating. Power amplifier operate by impressing voltage +2.5 to +5.5v to '#13(Stand-By)pin'.
- \* Please connect PreVcc pin (#1 pin)with the stable minimum voltage. and connect so that current does not flow in by reverse bias.
- \* In case of heat sink design, we request customer to design in the condition to have assumed market.
- \* The case of this Hybrid-IC is using thermosetting silicon adhesive(TSE322SX).
- \* Weight of HIC: (typ)24.5g

Outer carton dimensions (WxLxH): 452mmx325mmx192mm

Specified Transformer Power Supply (Equivalent to MG-250)



## STK433-840N-E Specifications

## Absolute maximum ratings at Ta=25°C, Tc=25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
	Vcc max(0)	No signal	±38	V
Maximum supply voltage	Vcc max(1)	Signal, RL≥6Ω	±36	V
	Vcc max(2)	Signal, RL=4Ω	±30	V
Minimum supply voltage	Vcc min		±10	V
#13pin Operating Voltage *5	VST OFF max	#13pin voltage	-0.3 to +5.5	٧
Thermal resistance	Өј-с	Per power transistor	4.2	°C/W
Junction temperature	Tj max	Both the Tj max and Tc max	150	°C
Operating Substrate Temperature			125	°C
Storage temperature	Tstg		-30 to +125	°C
Allowable load shorted time *4	ts	Vcc=±25V,RL=6Ω,f=50Hz Po=25W,1ch Drive	0.3	S

### **Operating Characteristics** at Tc=25°C, RL=6Ω(Non-inductive Load), Rg=600Ω, VG=30dB

<u> </u>			Co	onditions	s *2		Ratings			
Parameter	Symbol	Vcc [V]	f [Hz]	Po [W]	THD [%]		min	typ	max	Unit
Output power *1	Po 1	±25	20 to 20k		0.6		23	25		
Output power *1	Po 2	±25	1k		10			40		W
TUD *4	THD 1	±25	20 to 20k	<b>5</b> 0		VC 204D		0.6	0.6	0/
THD *1	*1 THD 2 ±25 1k		1k	5.0 VG=30dB			0.02		%	
Frequency characteristics *1	fL, fH	±25		1.0		+0 -3dB	20 to 50k		Hz	
Input impedance	Ri	±25	1k	1.0				55		kΩ
Output noise voltage *3	VNO	±30				Rg=2.2 kΩ			1.0	mVrms
Quiescent current	Icco	±30				No load	30	60	140	mA
Quiescent Current at Stand-by	ICST	±30				VST=0v			1.0	mA
Neutral voltage	VN	±30					-70	0	+70	mV
#13 Stand-By ON Threshold *5	VST ON	±25				Stand-by		0	0.6	٧
#13 Stand-By OFF Threshold *5	VST OFF	±25				Operation	2.5	3.0	5.5	V

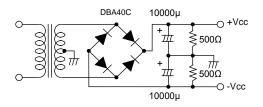
#### [Note]

- \*1. 1channel Operation.
- \*2. All tests are measured using a constant-voltage supply unless otherwise specified
- \*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.
- \*5. The impression voltage of '#13(Stand-By)pin' must not exceed the maximum rating. Power amplifier operate by impressing voltage +2.5 to +5.5V to '#13(Stand-By) pin'.
- \* Please connect PreVcc pin (#1 pin) with the stable minimum voltage and connect so that current does not flow in by reverse bias.
- \* In case of heat sink design, we request customer to design in the condition to have assumed market.
- \* The case of this Hybrid-IC is using thermosetting silicon adhesive(TSE322SX).
- \* Weight of 1 HIC: (typ) 20.6 g

Outer carton dimensions (WxLxH): 502mmx247mmx282mm

#### Specified Transformer Power Supply

(Equivalent to MG-200)



#### STK433-890N-E

## **Specifications**

## **Absolute maximum ratings** at Ta=25°C, Tc=25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
	Vcc max(0)	No signal	±54	V
Maximum supply voltage	Vcc max(1)	Signal, RL≥6Ω	±47	V
	Vcc max(2)	Signal, RL=4Ω	±40	V
Minimum supply voltage	Vcc min		±10	V
#13pin Operating Voltage *5	VST OFF max	#13pin voltage	-0.3 to +5.5	V
Thermal resistance	Өј-с	Per power transistor	2.1	°C/W
Junction temperature	Tj max	Both the Tj max and Tc max	150	°C
Operating Substrate Temperature	The state of the s		125	°C
Storage temperature	Tstg		-30 to +125	°C
Allowable load shorted time *4	ts	Vcc=±34V,RL=6Ω,f=50Hz Po=50W,1ch Drive	0.3	s

### **Operating Characteristics** at Tc=25°C, RL=6Ω(Non-inductive Load), Rg=600Ω, VG=30dB

			Co	ondition	s *2	•		Ratings		
Parameter	Symbol	Vcc [V]	f [Hz]	Po [W]	THD [%]		min	typ	max	Unit
Output power *1	Po 1	±34	20 to 20k		0.6		47	50		W
Output power *1	Po 2	±34	1k		10			80		
THD *1	THD 1	±34	20 to 20k	- 0		VC 204B			0.6	- %
THD *1	THD 2	±34	1k	5.0		VG=30dB	0.02		70	
Frequency characteristics *1	fL, fH	±34		1.0		+0 -3dB	20 to 50k		Hz	
Input impedance	ri	±34	1k	1.0				55		kΩ
Output noise voltage *3	VNO	±40				Rg=2.2 kΩ			1.0	mVrms
Quiescent current	Icco	±40				No load	90	150	210	mA
Quiescent Current at Stand-by	ICST	±40				VST=0v			1.0	mA
Neutral voltage	VN	±40					-70	0	+70	mV
#13 Stand-By ON Threshold *5	VST ON	±34				Stand-by		0	0.6	V
#13 Stand-By OFF Threshold *5	VST OFF	±34				Operation	2.5	3.0	5.5	V

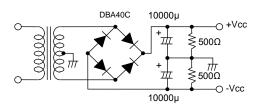
## [Note]

- \*1. 1channel Operation.
- \*2. All tests are measured using a constant-voltage supply unless otherwise specified
- \*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.
- \*5. The impression voltage of '#13(Stand-By)pin' must not exceed the maximum rating. Power amplifier operate by impressing voltage +2.5 to +5.5V to '#13(Stand-By) pin'.
- \* Please connect: PreVcc pin (#1 pin)with the stable minimum voltage and connect so that current does not flow in by reverse bias.
- \* In case of heat sink design, we request customer to design in the condition to have assumed market.
- \* The case of this Hybrid-IC is using thermosetting silicon adhesive(TSE322SX).
- \* Weight of 1 HIC: (typ) 37.0 g

Outer carton dimensions (WxLxH): 452mmx325mmx192mm

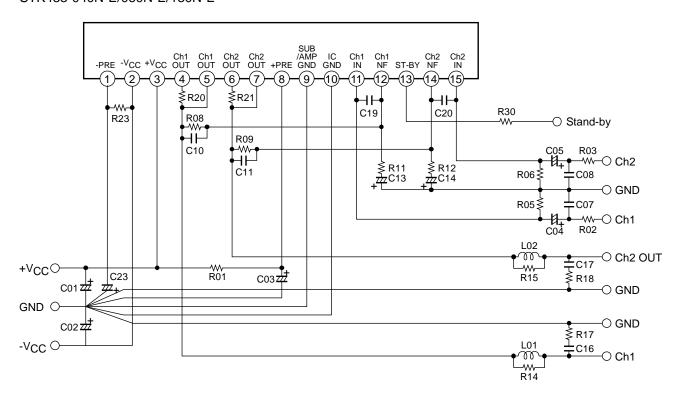
#### Specified Transformer Power Supply

(Equivalent to MG-200)

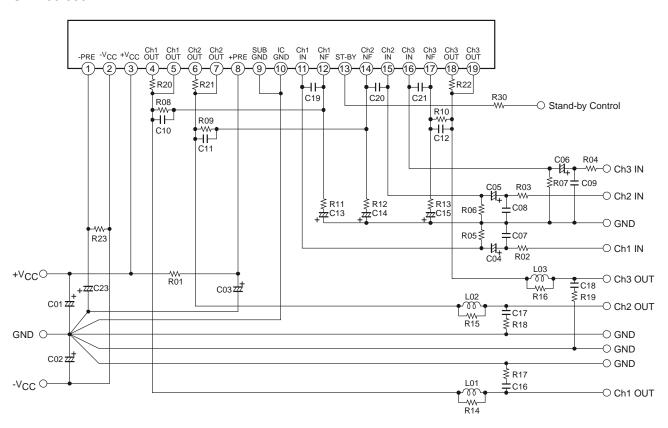


## **Application Circuit**

STK433-040N-E/060N-E/130N-E

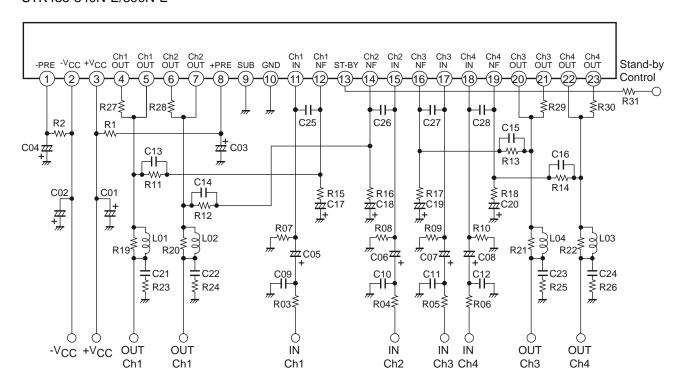


#### STK433-330N-E



## **Application Circuit**

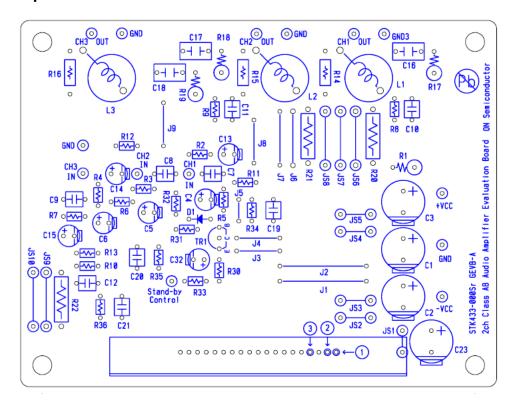
STK433-840N-E/890N-E

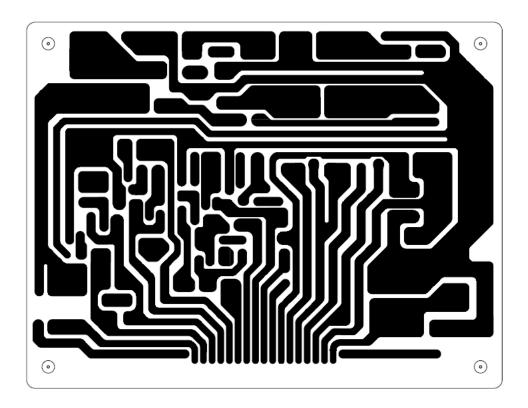


## **PCB** Layout example

STK433-040N-E/060N-E/130N-E/330N-E

## Top view





## STK433-040N-E/060N-E/130N-E/330N-E PCB PARTS LIST

PCB Name: STK433 - 000Sr GEVB - A

Locati	on No.						
	doesn't mount f () .	RATING	Component STK/33-				
				STK433-			
Hybrid IC#1 Pin Positi	on	-	040N-E	060N-E	130N-E/ 330N-E		
R01		100Ω, 1W	0				
R02, R03, (R04)		1kΩ, 1/6W	0				
R05, R06, (R07), R08	, R09, (R10)	56KΩ, 1/6W		0			
R11, R12, (R13)		1.8KΩ, 1/6W		0			
R14, R15, (R16)		4.7Ω, 1/4W		0			
R17, R18, (R19)		4.7Ω, 1W	0				
R20, R21, (R22)		0.22Ω, 2W	0	0	-		
		0.22Ω, 5W	-	-	0		
C01, C02, C03, C23		100μF, 100V	0				
C04, C05, (C06)		2.2μF, 50V	0				
C07, C08, (C09)		470pF, 50V	0				
C10, C11, (C12)		3pF, 50V	0				
C13, C14, (C15)		10μF, 16V	0				
C16, C17, (C18)		0.1μF, 50V		0			
C19, C20, (C21)		***pF, 50V	100pF	56pF	N.C.		
R34, R35, (R36)		Jumper		Short	•		
L01, L02, (L03)		3μΗ		0			
	Tr1	VCE ≥ 75V, IC ≥ 1mA		0			
	D1	Di		0			
Stand-By	R30 (*2)	2.7kΩ, 1/6W		○ (*2)			
Control R31		33kΩ, 1/6W	0				
Circuit	R32	1kΩ, 1/6W		0			
	R33	2kΩ, 1/6W		0			
	C32	33μF, 10V		0			
J1, J2, J3, J4, J5, J6, J8, J9		Jumper	0				
J7, JS2, JS3, JS4, JS JS8, JS9	5, JS7	-	-				
JS6, JS10		Jumper		0			
JS1 (R23)		100Ω, 1W		0			

<sup>(\*1)</sup> STK433-040N-E/060N-E/130N-E (2ch Amp) doesn't mount parts of (

<sup>(\*2)</sup> Recommended standby circuit is used.

## **Recommended external components**

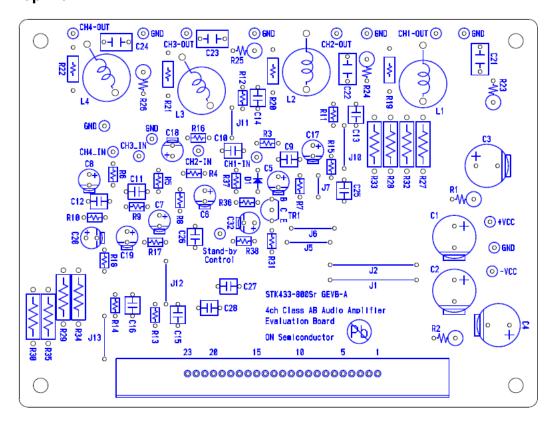
## STK433-040N-E/060N-E/130N-E/330N-E

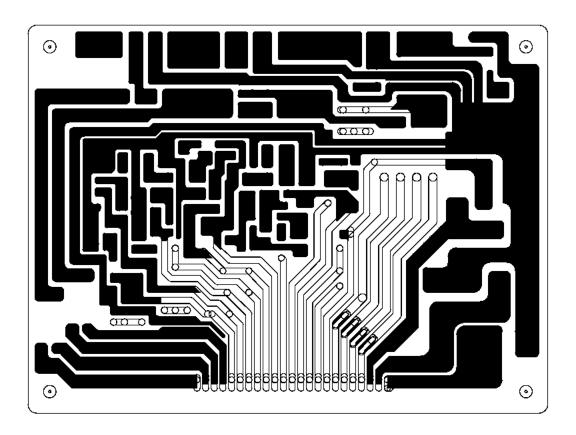
Parts	Recommended	Circuit purpose	Above	Below
Location	value	Circuit purpose	Recommended value	Recommended value
R01, R23	100Ω/1W	Resistance for Ripple filter. (Fuse resistance is recommended.	Short-through current	Short-through current
		Ripple filter is constituted with C03, C23.)	may decrease at	may increase at high
			high frequency.	frequency.
R02, R03, R04	1kΩ	Resistance for input filters.	-	-
R05, R06, R07	56kΩ	Input impedance is determined.	Output neutral voltage(	VN) shift.
			(It is referred that R05=	R08, R06=R09)
R08, R09, R10	56kΩ	Voltage Gain (VG) is determined with R11, R12, R13	-	-
R11, R12, R13	1.8kΩ	Voltage Gain (VG) is determined with R8, R9, R10	It may oscillate.	With especially no
		(As for VG, it is desirable to set up by R11, R12, R13)	(Vg < 30dB)	problem
R14, R15, R16	4.7Ω	Resistance for oscillation prevention.	-	-
R17, R18, R19	4.7Ω/1W	Resistance for oscillation prevention.	-	-
R20, R21, R22	0.22Ω/2W	This resistance is used as detection resistance of the protection		
	(040N-E,060N-E)	circuit application.	Decrease of	It may cause thermal
	0.22Ω/5W		Maximum output	runaway
	(130N-E,330N-E)		Power	
R30	Note *5	Select Restriction resistance, for the impression voltage of '#17	(Stand-By) pin' must no	t exceed the maximum
		rating.	T	
C01, C02	100μF/50V	Capacitor for oscillation prevention.		
		Locate near the HIC as much as possible.	_	-
		Power supply impedance is lowered and stable operation of		
		the IC is carried out. (Electrolytic capacitor is recommended.)		
C03, C23	100μF/50V	Decoupling capacitor	The change in the Ripple ingredient mixed	
		The Ripple ingredient mixed in an input side Is removed from a	an input side from a por	wer supply line
001 005 000	0.0 5/50//	power supply line. (Ripple filter is constituted with R01, R23.)		
C04, C05, C06	2.2μF/50V	Input coupling capacitor.(for DC current prevention.)		•
C07, C08, C09	470pF	Input filter capacitor		
		A high frequency noise is reduced with the filter constituted by		-
040 044 040	0.5	R02, R03, R04	11.	
C10, C11, C12	3pF	Capacitor for oscillation prevention.	It may oscillate.	Г_: : : : : : : : : : : : : : : : : : :
C13, C14, C15	10μF/10V	Negative feedback capacitor.	The voltage gain (VG)	The voltage gain (VG)
		The cutoff frequency of a low cycle changes.	of low frequency is	of low frequency
		$(fL = 1/(2\pi \cdot C13 \cdot R11))$	extended. However,	decreases.
			the pop noise at the	
			time of a power	
			supply injection also becomes large.	
C16, C17, C18	0.1μF	Capacitor for oscillation prevention.	It may oscillate.	
C10, C17, C18	100pF (040N-E)			
019, 020, 021	56pF (060N-E)	Capacitor for oscillation prevention.	It may oscillate.	
	N.C. (130N-E)			
	330N-E)			
L01, L02, L03	330N-E) 3μH	Coil for oscillation prevention.	With especially	It may oscillate.
_5., _52, _55	Opti i		Jop Johan y	

## **PCB** Layout example

STK433-840N-E/890N-E

## Top view





## STK433-800NSr PCB PARTS LIST

PCB Name: STK433-800Sr GEVB - A

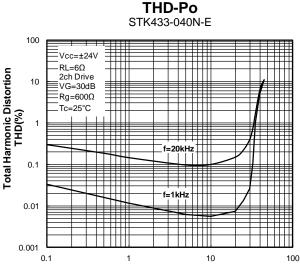
1	ation No.	RATING	Component
LOCA	alion No.	RATING	STK433-840N-E/890N-E
Hybrid IC#1 Pin Pos	sition	-	1
R01, R02		100Ω, 1W	0
R03, R04, R05, R06	3	1kΩ, 1/6W	0
R07, R08, R09, R10	), R11, R12, R13, R14	56KΩ, 1/6W	0
R15, R16, R17, R18	3	1.8KΩ, 1/6W	0
R19, R20, R21, R22	2	4.7Ω, 1/4W	0
R23, R24, R25, R26	3	4.7Ω, 1W	0
R27, R28, R29, R30	)	0.22Ω, 5W	0
R32, R33, R34, R35		Jumper	Short
C01, C02, C03, C04		100μF, 100V	0
C05, C06, C07, C08	3	2.2μF, 50V	0
C09, C10, C11, C12	2	470pF, 50V	0
C13, C14, C15, C16		5pF, 50V	0
C17, C18, C19, C20	)	10μF, 16V	0
C21, C22, C23, C24	ļ	0.1μF, 50V	0
C25, C26, C27, C28	3	100pF, 50V	0
L01, L02, L03, L04		3μΗ	0
	Tr1	VCE ≥ 50V, IC ≥ 10mA	0
	D1	Di	0
Stand-By	R31	1.3kΩ, 1/6W	0
Control	R36	33kΩ, 1/6W	0
Circuit	R37	1kΩ, 1/6W	0
	R38	2kΩ, 1/6W	0
	C32	33μF, 10V	0
J1,J2,J5,J6,J7,J10,	J11,J12,J13	Jumper	0
		-	
		-	
		-	

## **Recommended external components**

## STK433-840N-E/890N-E

J111133 0 101	L D/07011 D			
Parts	Recommended	Circuit purpose	Above	Below
Location	value	Circuit purpose	Recommended value	Recommended value
R01, R02	100Ω/1W	Resistance for Ripple filters. (Fuse resistance is recommended.	Short-through current	Short-through current
		Ripple filter is constituted with C03, C04.)	may decrease at	may increase at high
			high frequency.	frequency.
R03,R04,R05,	1kΩ	Resistance for input filters.		
R06			-	-
R07,R08,R09,	56kΩ	Input impedance is determined.	Output neutral voltage	(VN) shift.
R10			(It is referred that R07=	R11, R08=R12,
			R09=R13, R10=R14)	
R11,R12,R13,	56kΩ	Voltage Gain (VG) is determined with R15, R16, R17, R18		
R14			-	-
R15,R16,R17,	1.8kΩ	Voltage Gain (VG) is determined with R11, R12, R13, and R14.	It may oscillate.	With especially no
R18		(As for VG, it is desirable to set up by R15, R16, R17, and R18.)	(Vg < 30dB)	problem
R19,R20,R21,	4.7Ω	Resistance for oscillation prevention.		
R22			-	-
R23,R24,R25,	4.7Ω/1W	Resistance for oscillation prevention.		
R26			-	-
R27,R28,R29,	0.22Ω	Output emitter resistor (Metal-plate Resistor is recommended.)	Decrease of	It may cause thermal
R30	±10%, 5W		Maximum output	runaway
			Power	·
R31	Note *4	Select Restriction resistance, for the impression voltage of #13	(Stand-By) pin' must no	t exceed the maximum
		rating.		
C01, C02	100μF/100V	Capacitor for oscillation prevention.		
	•	Locate near the HIC as much as possible.		
		Power supply impedance is lowered and stable operation of	-	-
		the IC is carried out. (Electrolytic capacitor is recommended.)		
C03,C04	100μF/100V	Decoupling capacitor	The change in the Ripp	le ingredient mixed in
		The Ripple ingredient mixed in an input side Is removed from a	an input side from a por	wer supply line
		power supply line. (Ripple filter is constituted with R01, R02.)		
C05,C06,C07,	2.2μF/50V	Input coupling capacitor. (For DC current prevention.)		
C08			,	-
C09,C10,C11,	470pF	Input filter capacitor		
C12		A high frequency noise is reduced with the filter constituted by		-
		R03, R04, R05, R06.		
C13,C14,C15,	5pF	Capacitor for oscillation prevention.	It may oscillate.	
C16				
C17,C18,C19,	10μF/10V	Negative feedback capacitor.	The voltage gain (VG)	The voltage gain (VG)
C20		The cutoff frequency of a low cycle changes.	of low frequency is	of low frequency
		$(fL = 1/(2\pi \cdot C17 \cdot R15))$	extended. However,	decreases.
			the pop noise at the	
			time of a power	
			supply injection also	
			becomes large.	
C21,C22,C23,	0.1μF	Capacitor for oscillation prevention.	It may oscillate.	
C24	·	<u> </u>	,	
C25,C26,C27,	100pF	Capacitor for oscillation prevention.	It may oscillate.	
C28	•	<u> </u>	,	
L01,L02,L03,	3μΗ	Coil for oscillation prevention.	With especially	It may oscillate.
	Ομιι			

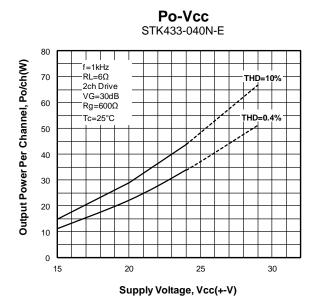
STK433-040N-E

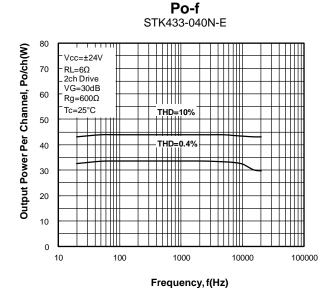


Pd-Po STK433-040N-E 80 Total Device Power Dissipation, Pd(W) Vcc=±24V 70 f=1kHz RL=6Ω 2ch Drive 60 VG=30dB Rg=600Ω 50 Tc=25°C 40 30 20 0 0.1 10 100

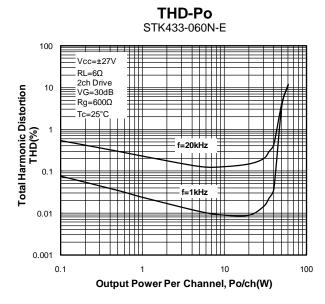
Output Power Per Channel, Po/ch(W)

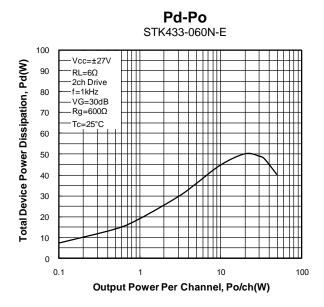
Output Power Per Channel, Po/ch(W)

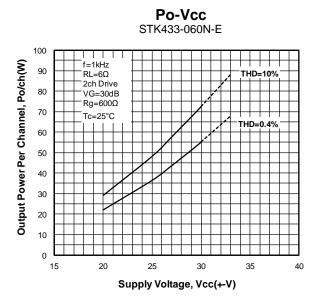


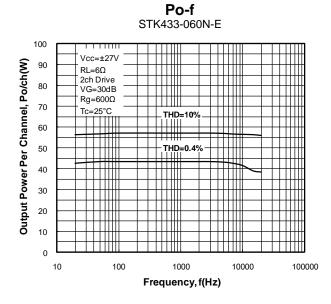


STK433-060N-E

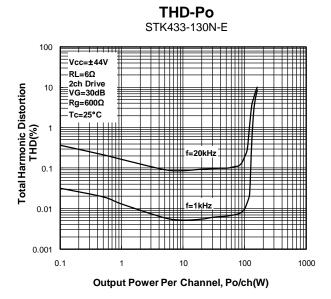


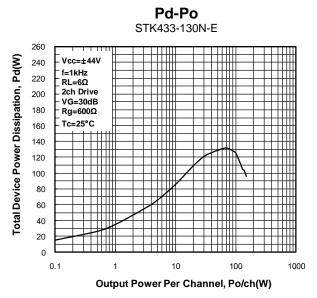


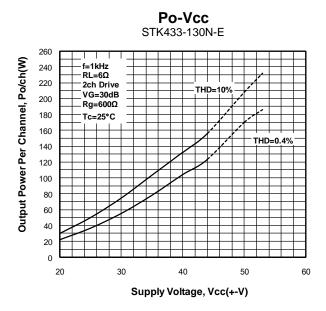


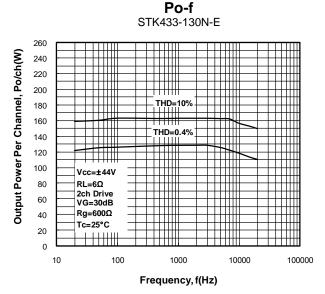


STK433-130N-E

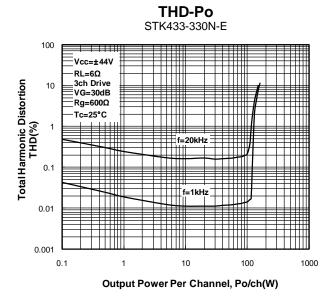


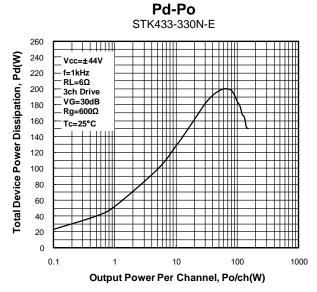


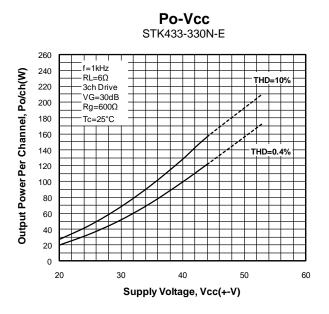


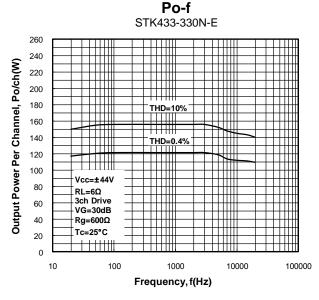


STK433-330N-E

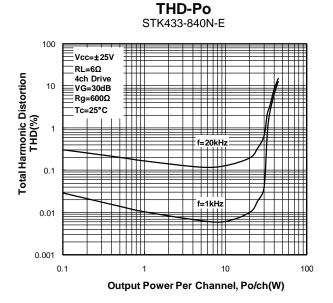


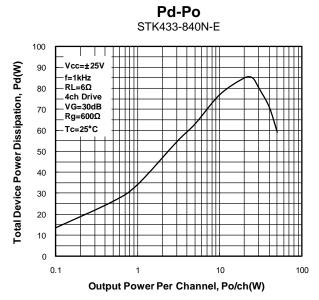


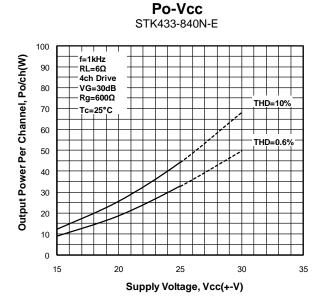


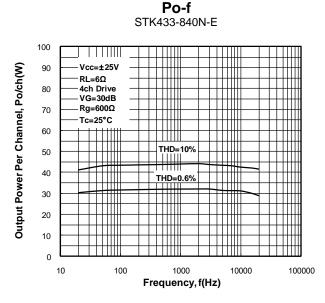


STK433-840N-E

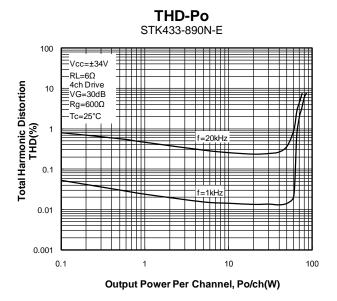


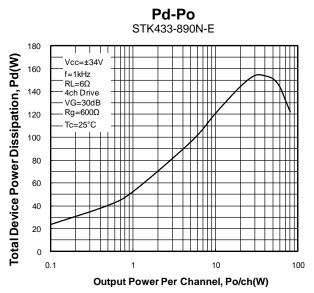


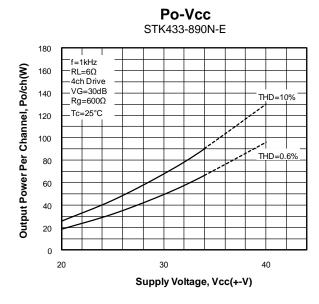


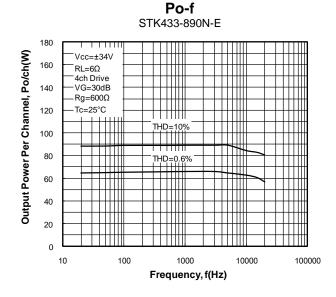


STK433-890N-E









## A Thermal Design Tip For STK433-040N-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 (Tc) of the Hybrid IC should not exceed 125°C

$$Pd \times \theta c-a + Ta < 125^{\circ}C \qquad (1)$$

Where Ta: the ambient temperature for the system

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

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

Where N : the number of transistors (two for 1 channel , ten for channel)  $% \label{eq:channel} % \left( \frac{1}{N} \right) = \frac{1}{N} \left( \frac{1}{N} \right) \left($ 

θj-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:

$$\begin{array}{l} \theta c\text{-}a < (125-Ta)/Pd \cdots \\ \theta c\text{-}a < (150-Ta)/Pd - \theta j\text{-}c/N \end{array} \tag{1}$$

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 STK433-040N-E;  $25W\times2ch$ )

If  $V_{CC}$  is  $\pm 24V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation (Pd) of inside Hybrid IC is as follow;

$$Pd = 26W$$
 (at 3.13W output power, 1/8 of  $P_O$  max)

There are four (4) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta$ j-c) of each transistor is 4.2°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;

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 2.79°C/W.

#### [Note]

## A Thermal Design Tip For STK433-060N-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 (Tc) of the Hybrid IC should not exceed 125°C

$$Pd \times \theta c-a + Ta < 125^{\circ}C$$
 .....(1)

Where Ta: the ambient temperature for the system

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

$$Pd \times \theta c \text{-} a + Pd/N \times \theta j \text{-} c + Ta < 150^{\circ}C \cdots (2)$$

Where N : the number of transistors (two for 1 channel , ten for channel)  $% \left( 1\right) =\left( 1\right) \left( 1\right$ 

 $\theta j\text{-}c$  : 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:

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 STK433-060N-E;  $35W\times2ch$ )

If  $V_{CC}$  is  $\pm 27V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation (Pd) of inside Hybrid IC is as follow;

$$Pd = 33W$$
 (at 4.375W output power, 1/8 of  $P_O$  max)

There are four (4) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta$ j-c) of each transistor is 3.5°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;

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 2.16°C/W.

#### [Note]

## A Thermal Design Tip For STK433-130N-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 (Tc) of the Hybrid IC should not exceed 125°C

$$Pd \times \theta c-a + Ta < 125^{\circ}C \cdots (1)$$

Where Ta: the ambient temperature for the system

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

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

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

θj-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:

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 STK433-130N-E;  $100W\times2ch$ )

If  $V_{CC}$  is  $\pm 44V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation (Pd) of inside Hybrid IC is as follow;

$$Pd = 91W$$
 (at 12.5W output power, 1/8 of  $PO$  max)

There are four (4) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta$ j-c) of each transistor is 1.6°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)' 
$$\theta c-a < (125 - 50)/91$$
  
 $< 0.82$   
From (2)'  $\theta c-a < (150 - 50)/91 - 1.6/4$   
 $< 0.70$ 

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 0.70°C/W.

#### [Note]

## A Thermal Design Tip For STK433-330N-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 (Tc) of the Hybrid IC should not exceed 125°C

$$Pd \times \theta c-a + Ta < 125^{\circ}C \qquad (1)$$

Where Ta: the ambient temperature for the system

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

$$Pd \times \theta c - a + Pd/N \times \theta j - c + Ta < 150^{\circ}C$$
 (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:

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 STK433-330N-E;  $100W\times3ch$ )

If  $V_{CC}$  is  $\pm 44V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation (Pd) of inside Hybrid IC is as follow;

$$Pd = 139W$$
 (at 12.5W output power, 1/8 of  $P_O$  max)

There are six (6) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta$ j-c) of each transistor is 1.6°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 <  $(125 - 50)/139$   
<  $0.54$   
From (2)'  $\theta c$ -a <  $(150 - 50)/139 - 1.6/6$   
<  $0.45$ 

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 0.45°C/W.

#### [Note]

## A Thermal Design Tip For STK433-840N-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 (Tc) of the Hybrid IC should not exceed 125°C

$$Pd \times \theta c-a + Ta < 125^{\circ}C \qquad (1)$$

Where Ta: the ambient temperature for the system

(Condition 2) The junction temperature of each power transistor should not exceed  $150^{\circ}$ C

$$Pd \times \theta c - a + Pd/N \times \theta j - c + Ta < 150^{\circ}C$$
 (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:

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 PO max. (Note that the value of 1/8 PO max may be varied from the country to country.) (Sample of STK433-840N-E;  $25W\times4ch$ )

If  $V_{CC}$  is  $\pm 25V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation (Pd) of inside Hybrid IC is as follow;

$$Pd = 55.0W$$
 (at 3.125W output power, 1/8 of PO max)

There are eight (8) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta$ j-c) of each transistor is 4.2°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)/55.0  
< 1.36  
From (2)'  $\theta c$ -a < (150 – 50)/55.0 – 4.2/8  
< 1.29

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 1.29°C/W.

#### [Note]

## A Thermal Design Tip For STK433-890N-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 (Tc) of the Hybrid IC should not exceed 125°C

$$Pd \times \theta c-a + Ta < 125^{\circ}C$$
 .....(1)

Where Ta: the ambient temperature for the system

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

$$Pd \times \theta c \text{-} a + Pd/N \times \theta j \text{-} c + Ta < 150^{\circ}C \cdots (2)$$

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:

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 PO max. (Note that the value of 1/8 PO max may be varied from the country to country.) (Sample of STK433-890N-E;  $50W\times4ch$ )

If  $V_{CC}$  is  $\pm 34V$ , and  $R_L$  is  $6\Omega$ , then the total power dissipation (Pd) of inside Hybrid IC is as follow;

$$Pd = 99.0W$$
 (at 6.25W output power, 1/8 of  $P_O$  max)

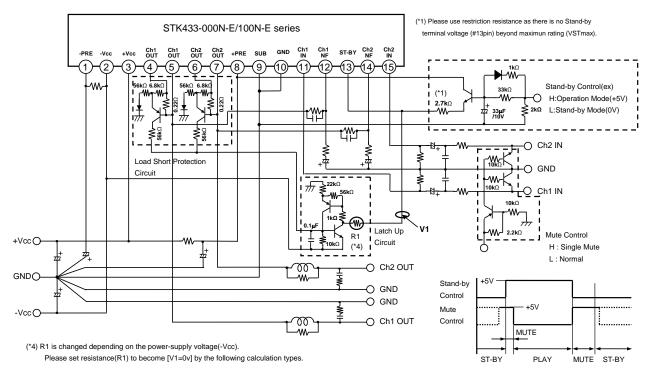
There are eight (8) transistors in Audio Section of this Hybrid IC, and thermal resistance ( $\theta$ j-c) of each transistor is 2.1°C/W. If the ambient temperature (Ta) is guaranteed for 50°C, then the thermal resistance ( $\theta$ c-a) of a desired heat-sink should be;

From (1)' 
$$\theta c\text{-a} < (125 - 50)/99.0$$
  
 $< 0.76$   
From (2)'  $\theta c\text{-a} < (150 - 50)/99.0 - 2.1/8$   
 $< 0.75$ 

Therefore, in order to satisfy both (1)' and (2)', the thermal resistance of a desired Heat-sink will be 0.75°C/W.

#### [Note]

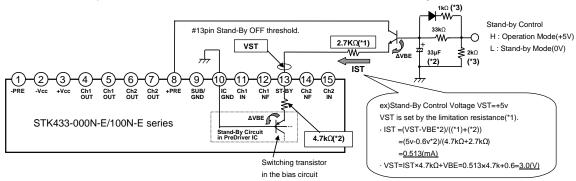
## STK433-000N-E/100N-E series Stand-by Control & Mute Control & Load-Short Protection Application



## [STK433-000N-E/100N-E series Stand-By Control Example] [Feature]

- The pop noise which occurs to the time of power supply on/off can be improved substantially by recommendation Stand-By Control Application.
- Stand-By Control can be done by additionally adjusting the limitation resistance to the voltage such as micom, the set design is easy.

(Reference circuit) STK433-000N-E/100N-E series test circuit To Stand-By Control added +5V.



[Operation explanation] #13pin Stand-By Control Voltage VST

(1) Operation Mode

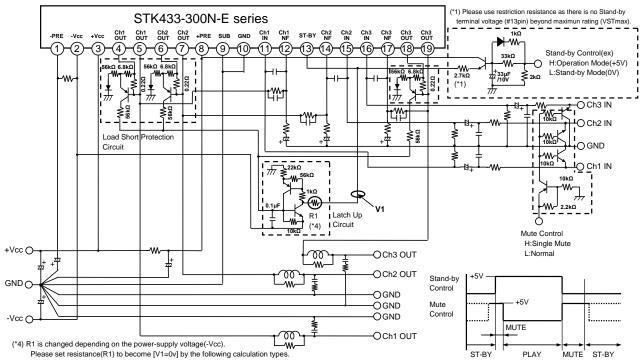
The switching transistor in the bias circuit turns on and places the amplifier into the operating mode, when 13pin (VST) voltage added above 2.5V (typ 3.0V).

#### (2) Stand-By Mode

When 13pin (VST) voltage is stopped (= 0V), the switching transistor in the bias circuit turn off, placing the amplifier into the standby mode.

- (\*1) The current limiting resistor must be used to ensure that stand-by pin (13pin) voltage does not exceed its maximum rated value VST max.
- (\*2) The pop noise level when the power is turned on can be reduced by setting the time constant with a capacitor in operating mode.
- (\*3) Determines the time constant at which the capacitor (\*2) is discharged in stand-by mode.

## STK433-300 series Stand-by Control & Mute Control & Load-Short Protection Application

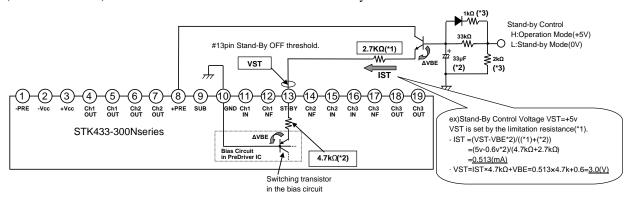


#### [STK433-300N-E series Stand-By Control Example]

[Feature]

- The pop noise which occurs to the time of power supply on/off can be improved substantially by recommendation Stand-By Control Application.
- Stand-By Control can be done by additionally adjusting the limitation resistance to the voltage such as micom, the set design is easy.

(Reference circuit) STK433-300N-E series test circuit To Stand-By Control added +5V.



[Operation explanation] #13pin Stand-By Control Voltage VST

(1) Operation Mode

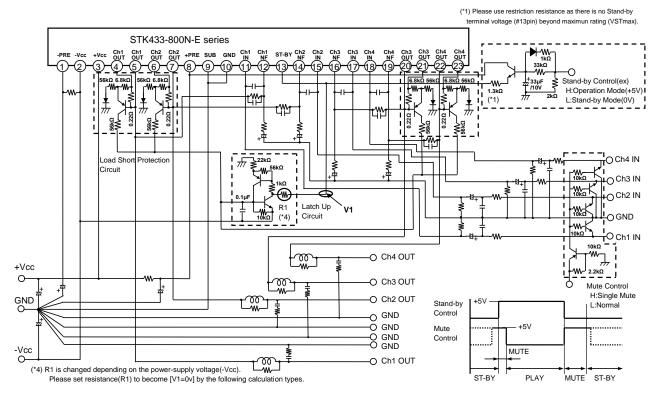
The switching transistor in the bias circuit turns on and places the amplifier into the operating mode, when 13pin (VST) voltage added above 2.5V (typ 3.0V).

### (2) Stand-By Mode

When 13pin (VST) voltage is stopped (= 0V), the switching transistor in the bias circuit turn off, placing the amplifier into the standby mode.

- (\*1) The current limiting resistor must be used to ensure that stand-by pin (13pin) voltage does not exceed its maximum rated value VST max.
- (\*2) The pop noise level when the power is turned on can be reduced by setting the time constant with a capacitor in operating mode.
- (\*3) Determines the time constant at which the capacitor (\*2) is discharged in stand-by mode.

## STK433-800 series Stand-by Control & Mute Control & Load-Short Protection Application

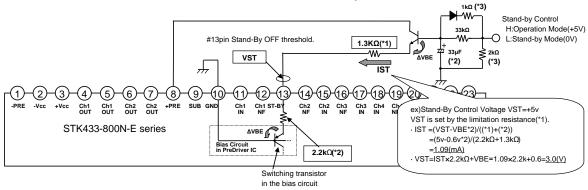


#### [STK433-800N-E series Stand-By Control Example]

[Feature]

- The pop noise which occurs to the time of power supply on/off can be improved substantially by recommendation Stand-By Control Application.
- Stand-By Control can be done by additionally adjusting the limitation resistance to the voltage such as micom, the set design is easy.

(Reference circuit) STK433-800N-E series test circuit To Stand-By Control added +5V.



#### [Operation explanation] #13pin Stand-By Control Voltage VST

(1) Operation Mode

The switching transistor in the bias circuit turns on and places the amplifier into the operating mode, when 13pin (VST) voltage added above 2.5V (typ 3.0V).

(2) Stand-By Mode

When 13pin (VST) voltage is stopped (= 0V), the switching transistor in the bias circuit turn off, placing the amplifier into the standby mode.

- (\*1) The current limiting resistor must be used to ensure that stand-by pin (13pin) voltage does not exceed its maximum rated value VST max.
- (\*2) The pop noise level when the power is turned on can be reduced by setting the time constant with a capacitor in operating mode.
- (\*3) Determines the time constant at which the capacitor (\*2) is discharged in stand-by mode.

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