

SANYO Semiconductors DATA SHEET

STK433-030-E — 2-channel class AB audio power IC, 30W+30W

Overview

The STK433-030-E is a hybrid IC designed to be used in 30W × 30W (2-channel) class AB audio power amplifiers.

Applications

• Audio power amplifiers.

Features

- Pin-to-pin compatible outputs ranging from 30W to 60W.
- Can be used to replace the STK433-100 series (80W to 150W/2ch) and STK433-200/-300 series (3-channel) due to its pin compatibility.
- Miniature package (47.0mm × 25.6mm × 9.0mm)
- Output load impedance: $R_L = 6\Omega$ to 4Ω supported
- Allowable load shorted time: 0.3 second
- Allows the use of predesigned applications for standby and mute circuits.

Series Models

	STK433-030-E	STK433-040-E	STK433-060-E	STK433-070-E				
Output 1 (10%/1kHz)	30W×2 channels	40W×2 channels	50W×2 channels	60W×2 channels				
Output 2 (0.4%/20Hz to 20kHz)	20W×2 channels	25W×2 channels	35W×2 channels	40W×2 channels				
Max. rated V_{CC} (quiescent)	±34V	±38V	±46V	±50V				
Max. rated V _{CC} (6 Ω)	±32V	±36V	±40V	±44V				
Max. rated V _{CC} (4 Ω)	±26V	±30V	±33V	±37V				
Recommended operating V _{CC} (6 Ω)	±21V	±24V	±27V	±29V				
Dimensions (excluding pin height)	47.0mm×25.6mm×9.0mm							

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Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum quiescent supply voltage 0	V _{CC} max (0)	When no signal	±34	V
Maximum supply voltage 1	V _{CC} max (1)	$R_{L} \ge 6\Omega$	±32	V
Maximum supply voltage 2	V _{CC} max (2)	$R_L=4\Omega$	±26	V
Minimum operating supply voltage	V _{CC} min		±10	V
Pin 13 input voltage	VST max		-0.3 to +5.5	V
Thermal resistance	өј-с	Per power transistor	4.2	°C/W
Junction temperature	Tj max	Both the Tj max and Tc max conditions must be met.	150	°C
IC substrate operating temperature	Tc max		125	°C
Storage temperature	Tstg		-30 to +125	°C
Allowable load shorted time *4	ts	V _{CC} =±21V, R _L =6Ω, f=50Hz, P _O =20W, 1-channel active	0.3	S

Operating Characteristics at Tc=25°C, R_L =6 Ω , R_g =600 Ω , VG=30dB, non-inductive load R_L , unless otherwise

	1			o	**			D (1			
				Condition	is *2			Ratings			
Parameter	Symbol	bol V _{CC} f P _O THD (V) (Hz) (W) (%)			min	typ	max	unit			
Output power *1	P _O (1)	±21	20 to 20k		0.4		18	20			
	P _O (2)	±21	1k		10			30		W	
	P _O (3)	±18	1k		1	$R_L=4\Omega$		20			
Total harmonic distortion *1	THD (1)	±21	20 to 20k	5.0					0.4	0/	
	THD (2)	±21	1k	5.0				0.02		%	
Frequency characteristics *1	fL, fH	±21		1.0		+0 -3dB		20 to 50k		Hz	
Input impedance	ri	±21	1k	1.0				55		kΩ	
Output noise voltage *3	V _{NO}	±26				Rg=2.2kΩ			1.0	mVrms	
Quiescent current	ICCO	±26				No loading	20	45	70	mA	
Standby current	ICST	±26							1	mA	
Output neutral voltage	VN	±26					-70	0	+70	mV	
Pin 13 voltage when standby ON	VST ON	±21				Standby			0.6	V	
Pin 13 voltage when standby OFF	VST OFF	±21				Operating	2.5			V	

specified

[Remarks]

*1: For 1-channel operation

*2: Unless otherwise specified, use a constant-voltage power supply to supply power when inspections are carried out.

*3: The output noise voltage values shown are peak values read with a VTVM. However, an AC stabilized (50Hz)

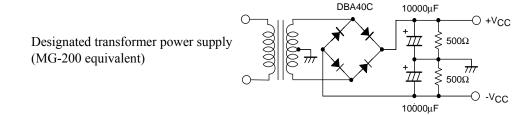
power supply should be used to minimize the influence of AC primary side flicker noise on the reading.

*4: Use the transformer power supply circuit shown in the figure below for allowable load shorted time measurement.

*5: Please connect –Pre V_{CC} pin (#1 pin) with the stable minimum voltage and connect so that current does not flow in by reverse bias.

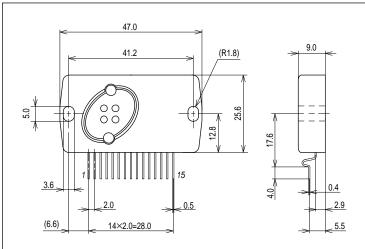
* Thermal design must be implemented based on the conditions under which the customer's end products are expected to operate on the market.

* A thermoplastic adhesive is used to adhere the case.

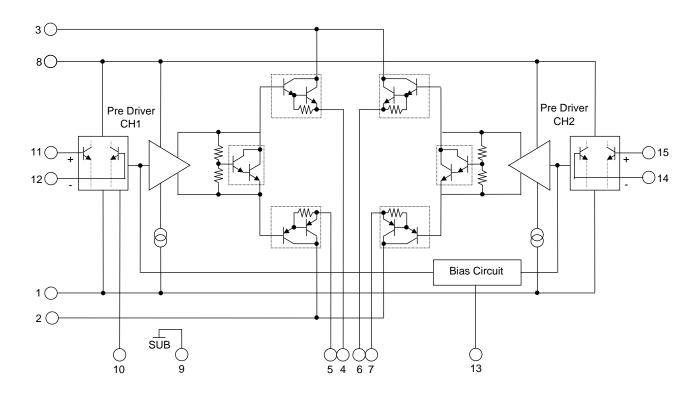


Package Dimensions

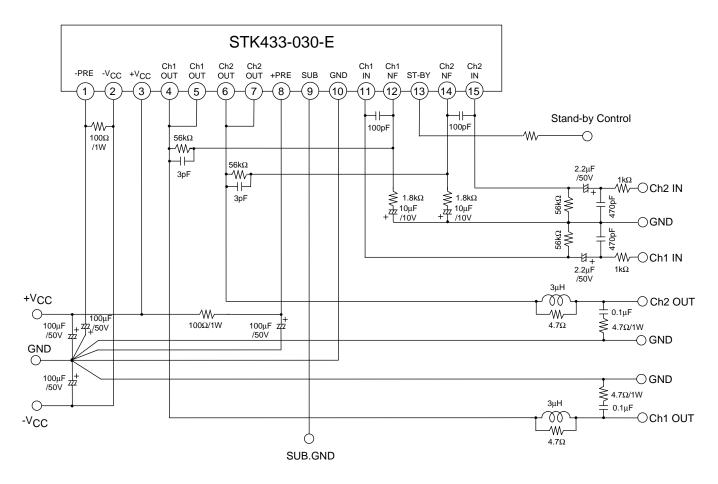
unit:mm (typ)



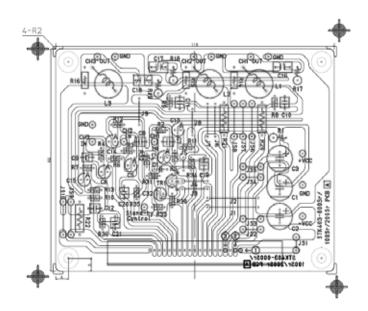
Internal Equivalent Circuit



Application Circuit Example



Sample PCB Trace Pattern



STK433-000/-200/STK403-100Sr PCB PARTS LIST

PCB Name: STK403-000Sr/100Sr/200Sr PCBA

				Component					
Leastion No. (*	2)	PARTS	RATING	STK433-030/-040	STK433-060/-070				
Location No. (*	3)	PARIS	RATING	STK433-230/-240	STK433-260/-270				
					STK403-090 to130				
Hybrid IC#1 Pin Position		-	-	C	D				
R01		ERG1SJ101	100Ω, 1W	ena	enable				
R02, R03 (R4)		RN16S102FK	1kΩ, 1/6W	ena	ıble				
R05, R06, R08, R09 (R7,	R10)	RN16S563FK	56kΩ, 1/6W	ena	ıble				
R11, R12 (R13)		RN16S182FK	1.8kΩ, 1/6W	ena	ible				
R14, R15 (R16)		RN14S4R7FK	4.7Ω, 1/4W	ena	ıble				
R17, R18 (R19)		ERX1SJ4R7	4.7Ω, 1W	ena	ble				
R20, R21 (R22)		ERX2SJR22	0.22Ω, 2W	short	enable				
C01, C02, C03		100MV100HC	100μF, 100V	ena	ble				
C04, C05 (C06)		50MV2R2HC	2.2μF, 50V	enabl	e (*1)				
C07, C08 (C09)		DD104-63B471K50	470pF, 50V	ena	ble				
C10, C11 (C12)		DD104-63CJ030C50	3pF, 50V	enabl	e (*2)				
C13, C14 (C15)		10MV10HC	10μF, 10V	enabl	e (*1)				
C16, C17 (C18)		ECQ-V1H104JZ	0.1µF, 50V	ena	ble				
C19, C20 (C21)		DD104-63B***K50	***pF, 50V	100)pF				
R34, R35 (R36)		RN16S302FK	3kΩ, 1/6W	Sh	ort				
L01, L02 (L3)		-	ЗμН	ena	ıble				
Stand-By Control Circuit	Tr1	2SC2274 (Reference)	VCE≥50V, IC≥10mA	ena	ble				
	D1	GMB01 (Reference)	B01 (Reference) Di						
	R30	RN16S512FK	5.1kΩ, 1/6W	STK433-	*00series				
		RN16S103FK	13kΩ, 1/6W	STK403-100series					
R31		RN16S333FK	RN16S333FK 33kΩ, 1/6W						
	R32	RN16S102FK	1kΩ, 1/6W	ena	ble				
	R33	RN16S202FK	2kΩ, 1/6W	ena	ble				
	C32	10MV33HC	33µF, 10V	enable					
J1, J2, J3, J4, J5, J6, J8, J9		-	-	ena	ble				
J7, JS2, JS3, JS4, JS5, JS	67 JS8, JS9	-	-		-				
JS6, JS10		-	-	ena	ble				
JS1		-	-	ena	ible				

(*1) Capacitor mark "A" side is "-" (negative).

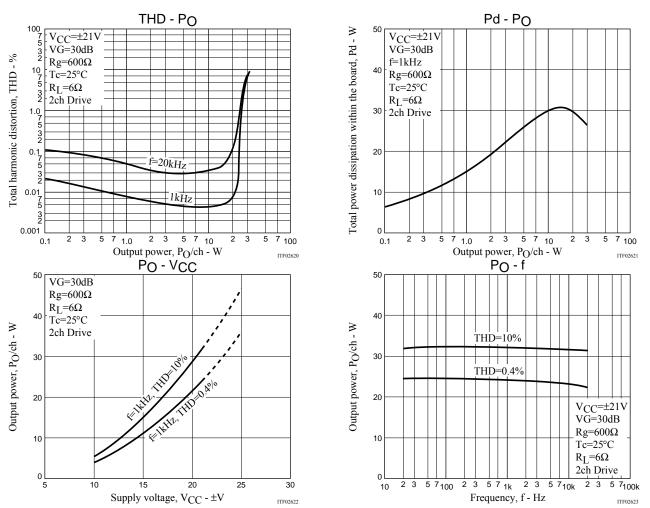
(*2) STK433-200Sr (3ch) is 8pF use.

(*3) Location No.() parts is STK433-200Sr (3ch) only use.

Pin Assignments

[STK433-000/-100/-200Sr & STK415/416-100Sr Pin Layout]

2-channel class-ABIII<	[S1K433-000/-100/-200Sr &	. <u>51</u> r	X 41	3/41	10-1	002	SI P.	шL	ayo	uu														
STK433-00-E 40WJEITA STK433-00-E 40WJEITA STK433-00-E 60WJEITA P V <th< td=""><td>2 shannel slage AD</td><td></td><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td></td><td></td><td></td><td></td></th<>	2 shannel slage AD					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				
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STK433-060-E 50WJEITA STK433-070-E 60WJEITA STK433-070-E 60WJEITA STK433-070-E 60WJEITA STK433-070-E 60WJEITA STK433-000-E 80WJEITA STK433-000-E 80WJEITA STK433-000-E 80WJEITA STK433-000-E 80WJEITA STK433-000-E 80WJEITA STK433-00-E 80WJEITA STK433-00-E 80WJEITA STK433-00-E 100WJEITA STK433-00-E 100WJEITA STK433-00-E 100WJEITA STK433-00-E 100WJEITA STK433-200-E 100WJEITA STK43-200-E 100WJEITA STK44-100-E 100WJEITA <t< td=""><td>STK433-030-E 30W/JEITA</td><td></td><td></td><td></td><td></td><td>-</td><td>-</td><td>+</td><td>0</td><td>0</td><td>0</td><td>0</td><td>+</td><td></td><td></td><td>Ι</td><td>Ν</td><td>S</td><td>Ν</td><td>Ι</td><td></td><td></td><td></td><td></td></t<>	STK433-030-E 30W/JEITA					-	-	+	0	0	0	0	+			Ι	Ν	S	Ν	Ι				
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STK433-090-E 80W/JEITA STK433-090-E 80W/JEITA STK433-100-E 100W/JEITA STK433-200-E 100W/JEITA STK435-300-E 100W/JEITA	STK433-060-E 50W/JEITA					R	С	С	Т	т	Т	Т	R	U	Ν	/	/	А	/	/				
STK433-090-E 80WJEITA STK433-100-E 100WJEITA STK433-200-E 100WJEITA STK43-200-E 100WJEITA STK44-10-E 100-E 100WJEITA STK44-10-E 100-E	STK433-070-E 60W/JEITA					Е	С	С	/	/	/	/	Е	в	D	С	С	Ν	С	С				
STK433-100-E 100W/JEITA STK433-120-E 120W/JEITA STK433-120-E 120W/JEITA STK433-120-E 120W/JEITA STK433-120-E 120W/JEITA STK433-230-E 30W/JEITA STK433-240-E 40W/JEITA STK435-340-E 40W/JEITA									С	С	С	С		•		н	н	D	н	н				
STK433-120-E 120W/JEITA Image: Strammetry image: Stramme	STK433-090-E 80W/JEITA								н	н	н	н		G		1	1		2	2				
STK433-130-E 150W/JEITA Image: Marking and Marki	STK433-100-E 100W/JEITA								1	1	2	2		Ν				В						
3-channel class-AB - 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 STK433-230A-E 30W/JEITA S STK433-240A-E 40W/JEITA - + + + 0 0 0 + S G N F F N N F U N F N N F U N F N N F U N F N N F U N F N N F U N F N N F U N F N <td>STK433-120-E 120W/JEITA</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>+</td> <td>-</td> <td>+</td> <td>-</td> <td></td> <td>D</td> <td></td> <td></td> <td></td> <td>Υ</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	STK433-120-E 120W/JEITA								+	-	+	-		D				Υ						
3-channel class-AB S-trianuel class-ki/2 voltavianuel	STK433-130-E 150W/JEITA																							
STK433-230A-E 30W/JEITA S	3-channel class-AB					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
STK433-240A-E 40W/JEITA STK433-260A-E 50W/JEITA STK433-270-E 60W/JEITA STK433-300-E 100W/JEITA STK433-300-E 100W/JEITA STK433-300-E 100W/JEITA STK433-300-E 100W/JEITA STK433-300-E 100W/JEITA STK435-300-E 100W/JEITA STK436-300-E 100W/JEITA <										3-	chan	nel c	lass	AB/2	.00m	m								
STK433-260A E 50W/JEITA STK433-260A E 50W/JEITA STK433-270-E 60W/JEITA STK433-290-E 80W/JEITA STK435-290-E 80W/JEITA STK435-190-E 80W/JEITA ST S S N I </td <td>STK433-230A-E 30W/JEITA</td> <td></td> <td></td> <td></td> <td></td> <td> - </td> <td>-</td> <td>+</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>+</td> <td></td> <td></td> <td>Ι</td> <td>Ν</td> <td>S</td> <td>Ν</td> <td>Т</td> <td></td> <td>Ν</td> <td>0</td> <td>0</td>	STK433-230A-E 30W/JEITA					-	-	+	0	0	0	0	+			Ι	Ν	S	Ν	Т		Ν	0	0
STK433-270-E 60W/JEITA SK433-290-E 80W/JEITA SK433-290-E 80W/JEITA SK433-300-E 100W/JEITA SK415-100-E 100W/JEITA SK S <td>STK433-240A-E 40W/JEITA</td> <td></td> <td></td> <td></td> <td></td> <td>Р</td> <td>V</td> <td>V</td> <td>U</td> <td>U</td> <td>U</td> <td>U</td> <td>Ρ</td> <td>S</td> <td>G</td> <td>Ν</td> <td>F</td> <td>Т</td> <td>F</td> <td>Ν</td> <td>Ν</td> <td>F</td> <td>U</td> <td>U</td>	STK433-240A-E 40W/JEITA					Р	V	V	U	U	U	U	Ρ	S	G	Ν	F	Т	F	Ν	Ν	F	U	U
STK433-290-E 80W/JEITA STK433-300-E 100W/JEITA STK435-300-E 100W/JEITA <td>STK433-260A-E 50W/JEITA</td> <td></td> <td></td> <td></td> <td></td> <td>R</td> <td>С</td> <td>С</td> <td>Т</td> <td>Т</td> <td>Т</td> <td>Т</td> <td>R</td> <td>U</td> <td>Ν</td> <td>/</td> <td>/</td> <td>А</td> <td>/</td> <td>/</td> <td>/</td> <td>/</td> <td>Т</td> <td>Т</td>	STK433-260A-E 50W/JEITA					R	С	С	Т	Т	Т	Т	R	U	Ν	/	/	А	/	/	/	/	Т	Т
STK433-300-E 100W/JEITA STK433-300-E 100W/JEITA STK433-300-E 120W/JEITA STK433-300-E 120W/JEITA STK433-300-E 120W/JEITA STK433-300-E 120W/JEITA STK433-300-E 150W/JEITA STK433-300-E 150W/JEITA STK415-010-E 00W/JEITA STK416-010-E 00W/JEITA	STK433-270-E 60W/JEITA					Е	С	С	/	/	/	/	Е	В	D	С	С	Ν	С	С	С	С	/	/
STK433-320-E 120W/JEITA T <td>STK433-290-E 80W/JEITA</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>С</td> <td>С</td> <td>С</td> <td>С</td> <td></td> <td>•</td> <td></td> <td>Н</td> <td>н</td> <td>D</td> <td>н</td> <td>н</td> <td>н</td> <td>н</td> <td>С</td> <td>С</td>	STK433-290-E 80W/JEITA								С	С	С	С		•		Н	н	D	н	н	н	н	С	С
STK433-330-E 150W/JEITA I <td>STK433-300-E 100W/JEITA</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>н</td> <td>н</td> <td>Н</td> <td>н</td> <td></td> <td>G</td> <td></td> <td>1</td> <td>1</td> <td></td> <td>2</td> <td>2</td> <td>3</td> <td>3</td> <td>н</td> <td>н</td>	STK433-300-E 100W/JEITA								н	н	Н	н		G		1	1		2	2	3	3	н	н
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	STK433-320-E 120W/JEITA								1	1	2	2		Ν				В					3	3
2-channel class-H - - - + 0 0 0 + - - - + 0 0 0 + - 1 N S N 1 STK415-090-E 80W/JEITA + - + - + + 0 0 0 + - 1 N S N 1 S N 1 S N 1 S N 1 S N 1 S N 1 S N 1 S N 1 S N 1 S N 1 S N 1 S N N S N N S N N S N N S N N S S S S S S S S S S S N N S N N N S N N S N N S N N S S N N S <td>STK433-330-E 150W/JEITA</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>+</td> <td>-</td> <td>+</td> <td>-</td> <td></td> <td>D</td> <td></td> <td></td> <td></td> <td>Y</td> <td></td> <td></td> <td></td> <td></td> <td>+</td> <td>-</td>	STK433-330-E 150W/JEITA								+	-	+	-		D				Y					+	-
STK415-090-E 80W/JEITA + - + - - + O O O O V </td <td>2 abannal alass H</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> <td>11</td> <td>12</td> <td>13</td> <td>14</td> <td>15</td> <td>16</td> <td>17</td> <td>18</td> <td>19</td> <td></td> <td></td> <td></td> <td></td>	2 abannal alass H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19				
STK415-100-E 90W/JEITA V V O O P V V U U U U U U U V V V V V V V V U U U U U U U U U V <	2-channel class-									2	char	nnel d	class	H/2.	00mi	m								
STK415-120-E 120W/JEITA L F F R H H T T T R U N / A / / //	STK415-090-E 80W/JEITA	+	-	+	-	-	-	+	0	0	0	0	+			Ι	Ν	S	Ν	Ι				
STK415-130-E 150W/JEITA I F	STK415-100-E 90W/JEITA	V	V	0	0	Ρ	V	V	U	U	U	U	Ρ	s	G	Ν	F	Т	F	Ν				
STK415-140-E 180W/JEITA I S S S S E E E E E E I H H H G I 1 I 2 2 2 I H	STK415-120-E 120W/JEITA	L	L	F	F	R	н	н	Т	т	Т	Т	R	U	Ν	/	/	А	/	/				
And Antipersonal Antiperso	STK415-130-E 150W/JEITA			F	F	Е			/	/	/	/	Е	в	D	С	С	Ν	С	С				
And Antipersonal Antiperso	STK415-140-E 180W/JEITA			S	s				С	С	С	С		•		Н	н	D	н	н				
Image: Normal Classe H I				Е	Е				н	н	н	н		G		1	1		2	2				
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3-channel class-H STK416-090-E 80W/JEITA STK416-100-E 90W/JEITA + - + - + - + - + O O O O + I N S N I I N N F U U STK416-100-E 90W/JEITA + - + - - + O O O + - I N S N I I N O O O STK416-120-E 120W/JEITA L L F F R H H T T T R U N /									+	-	+	-		D				Y						
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STK416-130-E 150W/JEITA F F F E / / / / E B D C C N C C C / <td>STK416-100-E 90W/JEITA</td> <td>V</td> <td>V</td> <td>0</td> <td>0</td> <td>Р</td> <td>V</td> <td>V</td> <td>U</td> <td>U</td> <td>U</td> <td>U</td> <td>Ρ</td> <td>s</td> <td>G</td> <td>Ν</td> <td>F</td> <td>Т</td> <td>F</td> <td>Ν</td> <td>Ν</td> <td>F</td> <td>U</td> <td>U</td>	STK416-100-E 90W/JEITA	V	V	0	0	Р	V	V	U	U	U	U	Ρ	s	G	Ν	F	Т	F	Ν	Ν	F	U	U
S S S C C C C H H H H H C C E E H H H H H H H H H H H C C T T T I <td>STK416-120-E 120W/JEITA</td> <td>L</td> <td>L</td> <td>F</td> <td>F</td> <td>R</td> <td>н</td> <td>н</td> <td>Т</td> <td>Т</td> <td>Т</td> <td>Т</td> <td>R</td> <td>U</td> <td>Ν</td> <td>/</td> <td>/</td> <td>А</td> <td>/</td> <td>/</td> <td>/</td> <td>/</td> <td>Т</td> <td>Т</td>	STK416-120-E 120W/JEITA	L	L	F	F	R	н	н	Т	Т	Т	Т	R	U	Ν	/	/	А	/	/	/	/	Т	Т
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Evaluation Board Characteristics

[Thermal Design Example for STK433-030-E ($R_L = 6\Omega$)]

The thermal resistance, θ c-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.

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

Ta: Guaranteed ambient temperature for the end product

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

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

N: Number of power transistors

 $\boldsymbol{\theta}j\text{-}\boldsymbol{c}\text{:}$ 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 θ c-a.

 $\theta c-a < (125 - Ta)/Pd$ (1)' $\theta c-a < (150 - Ta)/Pd - \theta j-c/N$ (2)'

 $u = a > (150 - 1a)/1 u = 0 - 0/1 u \dots (2)$

Values that satisfy these two inequalities at the same time represent the required heat sink thermal resistance. When the following specifications have been stipulated, the required heat sink thermal resistance can be determined from formulas (1)' and (2)'.

•	Supply	voltage	V	CC

RL	 Load resistance
R]	 Load resistance

• Guaranteed ambient temperature Ta

[Example]

When the IC supply voltage, V_{CC}, is $\pm 21V$ and R_L is 6 Ω , the total power dissipation, Pd, within the hybrid IC, will be a maximum of 31W at 1kHz for a continuous sine wave signal according to the Pd-P_O 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 ≈ 24.0 W (when 1/8PO max. = 3.75W, PO max. = 30W).

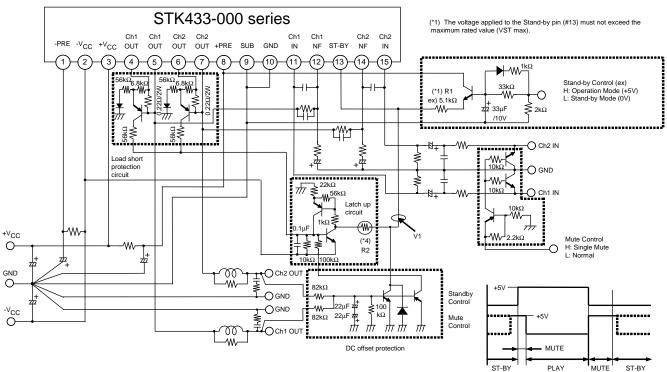
The number of power transistors in audio amplifier block of these hybrid ICs, N, is 4, and the thermal resistance per transistor, θ j-c, is 4.2°C/W. Therefore, the required heat sink thermal resistance for a guranteed ambient temperature, Ta, of 50°C will be as follows.

From formula (1)'	θ c-a < (125 - 50)/24.0
	< 3.13
From formula (2)'	θ c-a < (150 - 50)/24.0 - 4.2/4
	< 3.12

Therefore, the value of 3.12° C/W, which satisfies both of these formulae, is the required thermal resistance of the heat sink.

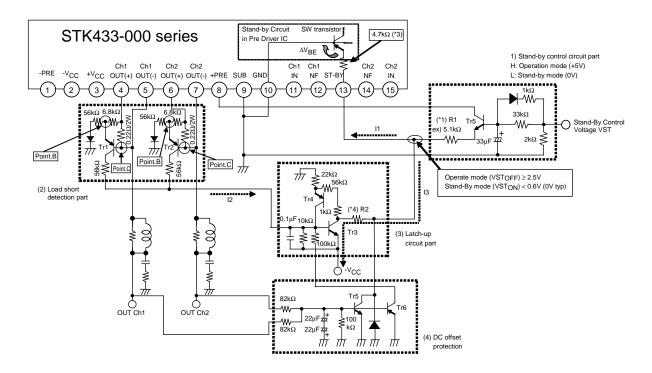
Note that this thermal design example assumes the use of a constant-voltage power supply, and is therefore not a verified design for any particular user's end product.

STK433-000 Series Standby Control, Mute Control, Load-short Protection & DC offset Protection application



(*1) R1 is changed depending on the power-supply voltage (-VCC). Please set resistance (R1) to become "V1 = 0V" by the following calculation types

STK433-000 Series Application Explanation



The protection circuit application for the STK433-000sr consists of the following blocks (blocks (1) to (4)).

- (1) Standby control circuit block
- (2) Load short-circuit detection block
- (3) Latch-up circuit block
- (4) DC voltage protection block

1) Standby control circuit block

Concerning pin 13 reference voltage VST

<1> Operation mode

The switching transistor of the predriver IC turns on when the pin 13 reference voltage, VST, becomes greater than or equal to 2.5V, placing the amplifier into the operation mode.

Example: When VST (min.) = 2.5V

I1 is approximately equal to 0.40mA since VST = $(*2) \times IST + 0.6V \rightarrow 2.5V = 4.7k\Omega \times IST + 0.6V$.

<2> Standby mode

The switching transistor of the predriver IC turns off when the pin 13 reference voltage, VST, becomes lower than or equal to 0.6V (typ. 0V), placing the amplifier into the standby mode.

Example: When VST = 0.6V

It is approximately equal to 0mA since VST = $(*2) \times IST + 0.6V \rightarrow 0.6V = 4.7k\Omega \times IST + 0.6V$. (*1) Limiting resistor

Determine the value of R1 so that the voltage VST applied to the standby pin (pin 13) falls within the rating (+2.5V to 5.5V (typ. 3.0V)).

- (*2) The standby control voltage must be supplied from the host including microcontrollers.
- (*3) A 4.7k Ω limiting resistor is also incorporated inside the hybrid IC (at pin 13).

2) Load short-circuit detection block

Since the voltage between point B and point C is less than 0.6V in normal operation mode ($V_{BE} < 0.6V$) and TR1 (or TR2) is not activated, the load short-circuit detection block does not operate.

When a load short-circuit occurs, however, the voltage between point B and point C becomes larger than 0.6V, causing TR1 (or TR2) to turn on ($V_{BE} > 0.6V$), and current I2 to flows.

3) Latch-up circuit block

TR3 is activated when I2 is supplied to the latch-up circuit.

When TR3 turns on and current I3 starts flowing, VST goes down to 0V (standby mode), protecting the power amplifier.

Since TR3 and TR4 configure a thyristor, once TR3 is activated, the IC is held in the standby mode.

To release the standby mode and reactivate the power amplifier, it is necessary to set the standby control voltage (*2) temporarily low (0V). Subsequently, when the standby control is returned to high, the power amplifier will become active again.

(*4) The I3 value varies depending on the supply voltage. Determine the value of R2 using the formula below, so that I1 is equal to or less than I3.

 $I1 \le I3 = V_{CC}/R2$

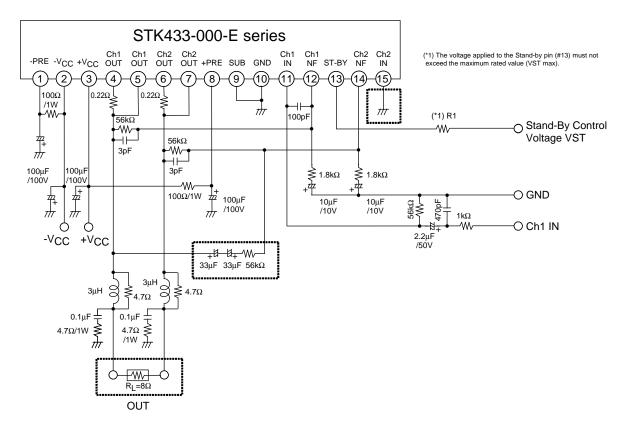
4) DC offset protection block

The DC offset protection circuit is activated when $\pm 0.5V$ (typ) voltage is applied to either "OUT CH1" or "OUT CH2," and the hybrid IC is shut down (standby mode).

To release the IC from the standby mode and reactivate the power amplifier, it is necessary to set the standby control voltage temporarily low (0V).

Subsequently, when the standby control is returned to high (+5V, for example), the power amplifier will become active again.

The protection level must be set using the $82k\Omega$ resistor. Furthermore, the time constant must be determined using $22\mu//22\mu$ capacitors to prevent the amplifier from malfunctioning due to the audio signal.



STK433-000 Series BTL Application

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