TENTATIVE

# SPECIFICATION

SPECIFICATIONS No.
Date: 2005.02.09
LAST SPECIFICATIONS No.
Date

Product Name STK428-610-E

**Case Outline** : 28pins -See attached outline drawing

**Functions** : 70W 2-chnnel Class D Audio Power Amplifier

**Application** : Audio Equipments

**Features** :

- Hybrid IC adopting Sanyo original technology IMST® -Insulated Metal Substrate Technology
- Pin-compatible series

**Absolute Maximum Ratings** at Ta=25°C (*1)

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum Power Supply Voltage | VD/VS max | Include spike voltage | +/-50 | V |
| Driver Maximum Power Supply Voltage | VDR max | | VS+15 | |
| Analog Maximum Power Supply Voltage | VDD/VSS max | | +/-7.5 | V |
| Signal Input Voltage | IN1-,IN2+ | | +/-6 | V |
| Thermal resistance | θ j-c | Per power transistor | 12.0 | °C/W |
| Junction temperature | Tj max | Both the Tj max and Tc max conditions must be met. | 150 | °C |
| IC substrate operationg temperature | Tc max | | 105 | °C |
| Storage temperature | Tstg | | -30 to +125 | °C |

**Recommended Operating Conditions** at Ta=25°C (*1)

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Power Supply Voltage 1 | VD/VS 1 | RL=8Ω | +/-37 to +/-45 | V |
| Power Supply Voltage 2 | VD/VS 2 | RL=4Ω | +/-28 to +/-34 | V |
| Driver Supply Voltage | VDR | | VS+9 to VS+11 | |
| Analog Supply Voltage | VDD/VSS | Normal Operating | +/-4.5 to +/-5.5 | V |

**Electrical Characteristics**

at Ta=25°C, VDD/VSS=+5/-5V, VDR=VS+10V, RL=8Ω (noninductive load), Rg=600Ω, VG=24dB

| Parameter | Symbol | Conditions | | | | | Ratings | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | VD/VS [V] *2 | f [Hz] | Po [W] | THD [%] | | Min. | Typ. | Max. | |
| Output power*3,4 | Po 1 | +41/-41 | 20 to 20k | | 0.8 | RL=8Ω | 70 | | | W |
| | Po 2 | +31/-31 | 1k | | 10 | RL=4Ω | | 100 | | W |
| Power Stage Efficiency | η | +41/-41 | 1k | 70 | | 2ch drive | | 87 | | % |
| Frequency characteristics | fL, fH | +41/-41 | | 1 | | +0/-3dB | | 20 to 20k | | Hz |
| Input impedance | ri | +41/-41 | 1k | 1 | | | | 4.7 | | kΩ |
| Output noise voltage*3 | VNO | +41/-41 | | | | Rg=0Ω A-weighted | | 1.0 | | mVrms |
| Quiescent current | IVDO | +41/-41 | | | | No load | | | 50 | mA |
| Neutral voltage | VN | +41/-41 | | | | | -100 | 0 | +100 | mV |

**Specifications and information herein are subject to change without notice**

[Note]

*1 The maximum rating cannot be exceeded at the moment, either. When the maximum rating is exceeded, H-IC may damege

*2 Use a constant-voltage supply for the power supply used during inspection.

*3 Use Audio Analyzer with Pre-LPF for removing switching element, and use 20kHz LPF.
High output power over the ratings may go to the protection mode.

*4 RC-Zobel is designed for music load. Long continuous high output at high frequency above 10kHz may go to the protection mode.

*5 Channel 1 is inverting and channel 2 is non-inverting.

*6 This product is based on ICE power® technologies developed by Bang & Olufsen ICE power.

RoHS DIRECTIVE PASS (5-XXXX)

## Interface and Protection

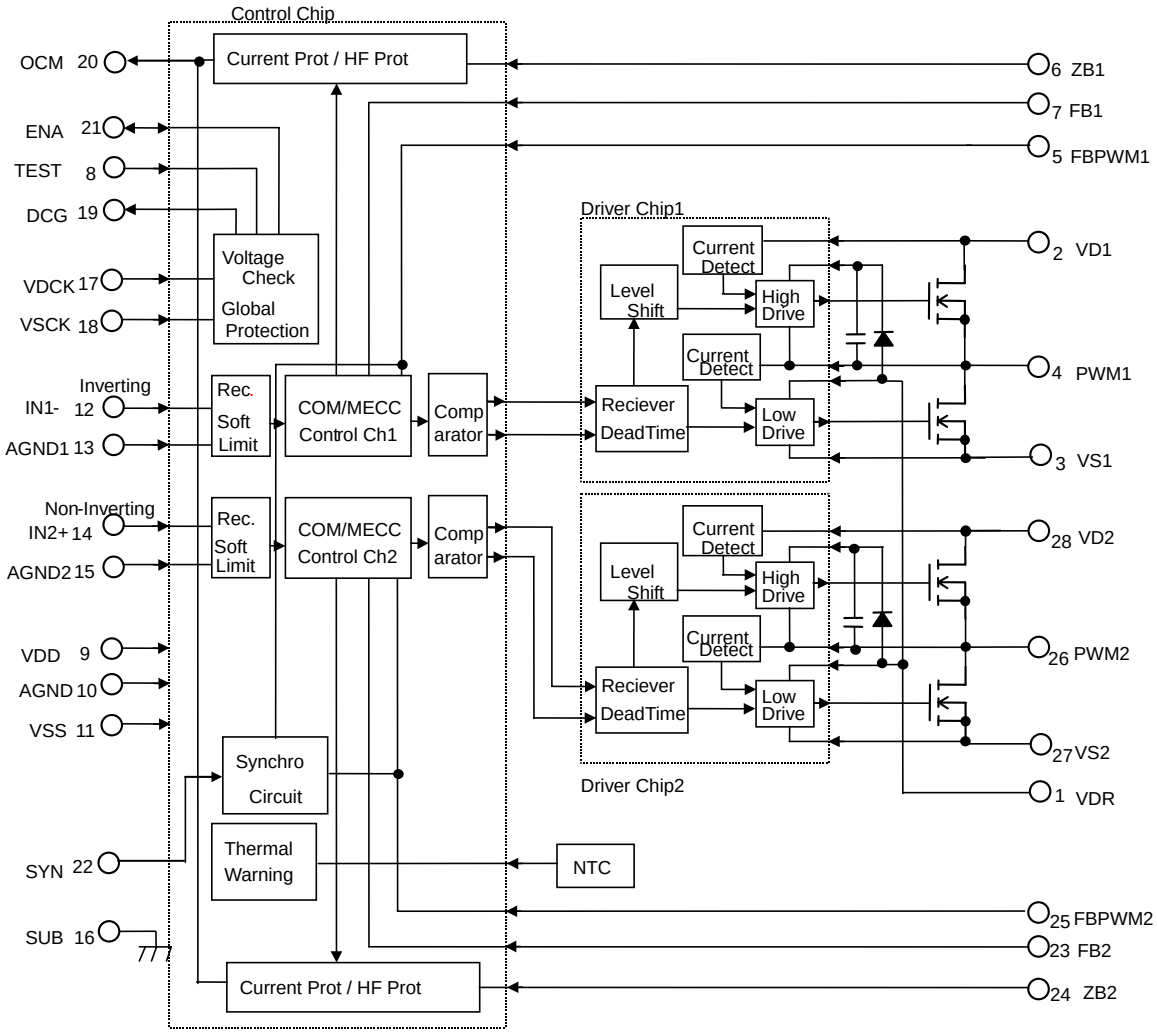
TC=25°C, VD/VS=+41/-41V, VDD/VSS=+5/-5V, VDR=VS+10V, RL=8 Ω (Non-inductive Load), f=1kHz, Rg=600 Ω, VG=24dB

| Item | Symbol | I/O | Conditions | | | | | Ratings | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | VD/VS (V) | f (Hz) | Po (W) | THD (%) | | min | typ | max | |
| Over voltage detect VDCK | VD ck | I | | | | | | | 1.82 | 2.22 | V |
| Over voltage detect VSCK | VS ck | I | | | | | | -2.22 | -1.82 | | V |
| Enable Input High | ENA-I-H | I | | | | | | | 2.7 | 3.5 | V |
| Enable Input Low | ENA-I-L | I | | | | | | 1.4 | 2.0 | | V |
| Enable Output High | ENA-O-H | O | | | | | 10kΩ pull-up | | VDD | | V |
| Enable Output Low | ENA-O-L | O | | | | | 0.5mA | | | 2.0 | V |
| Over Current Protection level | OCP | O | | 1k | | 10 | | 11 | | | A |
| Over Current Monitor Output High | OCM-H | O | | | | | 10kΩ pull-up | | VDD | | V |
| Over Current Monitor Output Low | OCM-L | O | | | | | 0.5mA | | | 2.0 | V |
| Thermal monitor High → Low | OCM-L *1,2 (THM-L) | O | | | | | | 105 | 130 | | °C |
| Discharge Output High | DCG-H | O | | | | | | | 1.0 | | V |
| Discharge Output Low | DCG-L | O | | | | | | | | -4.5 | V |

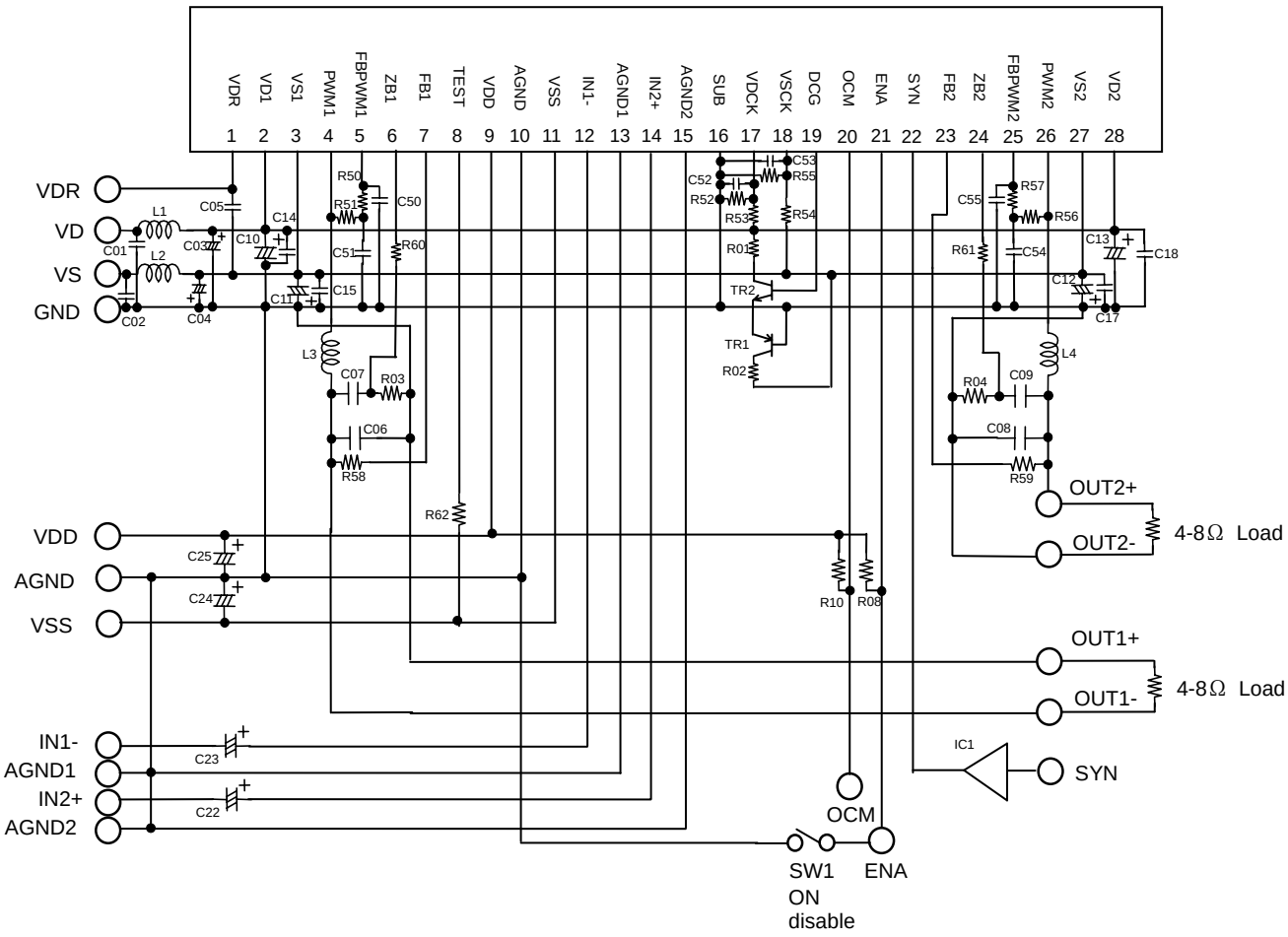
*1 Thermal detection temperature indicates the value at unusual operation, therefore, does not indicate the guaranteed value at usual operation

*2 OCM(Over Current Monitor) is shared THM terminal by common collectors.

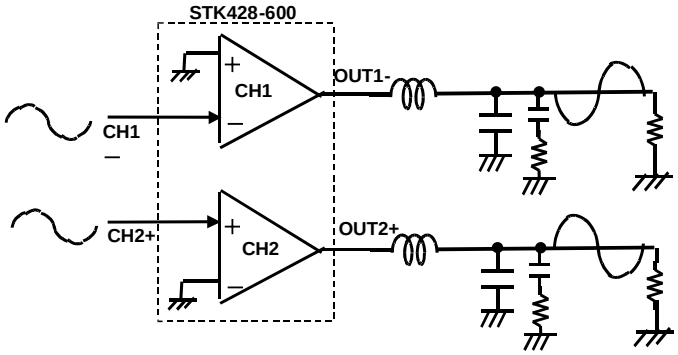
## Equivalent Block Diagram

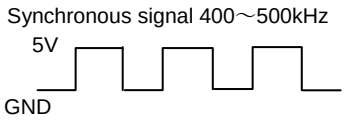


## Test Circuit



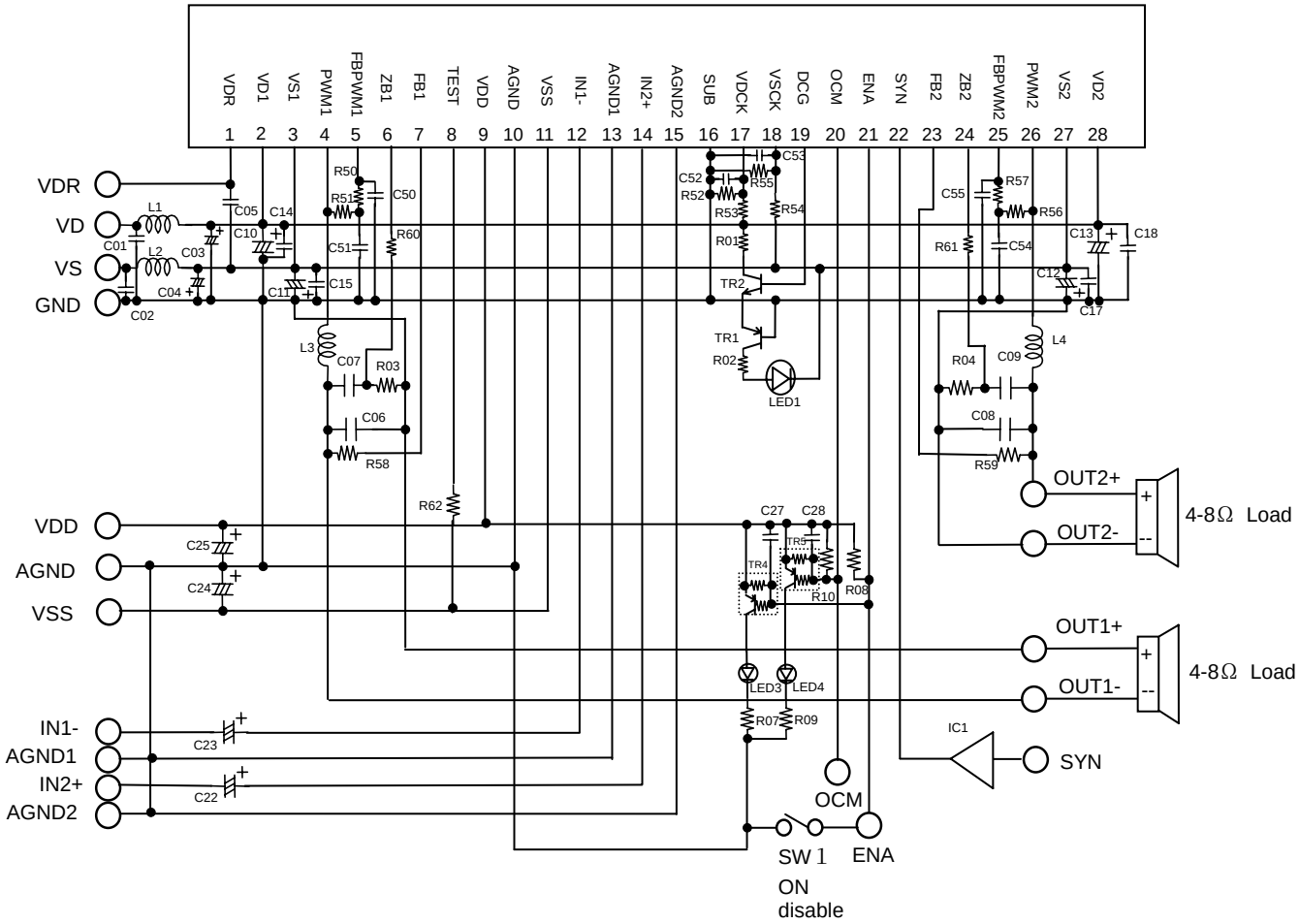

**Notice1: Channel 1 is inverting and Channel 2 is non inverting.**



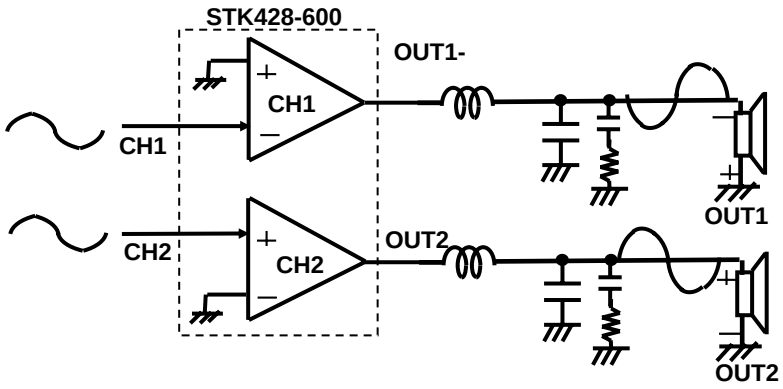




Un-synchronous：L:420kHz,H:500kHz typ.

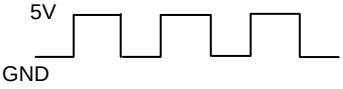
## Sample Application Circuit




**Notice1: Channel 1 is inverting and Channel 2 is non inverting.**




Synchronous signal 400～500kHz




Un-synchronous：L:420kHz,H:500kHz typ.

## Application Circuit Parts List

| Rocation | Name | Ratings |
|---|---|---|
| C01, C02, C05 | Film Capacitor | 0.1uF / 100V |
| C03, C04, C10, C11, C12, C13 | Electrolytic condenser | 1000uF / 63V |
| C06, C08 | Film Capacitor | 0.47uF / 100V |
| C07, C09 | Film Capacitor | 0.39uF / 100V |
| C14, C15, C17, C18 | Ceramic Capacitor | 0.1uF / 100V |
| C22, C23 | Electrolytic condenser | 22uF / 50V |
| C24, C25 | Electrolytic condenser | 47uF / 63V |
| C27, C28 | Ceramic Capacitor | 220pF / 100V |
| C50, C55 | open | open |
| C51, C54 | Ceramic Capacitor | 330pF / 100V |
| C52, C53 | Ceramic Capacitor | 2200pF / 100V |
| R01, R02 | Resistor | 1.2kΩ / 2W |
| R03, R04 | Resistor | 4.7Ω/ 2 W |
| R07, R09 | Resistor | 10kΩ / 1/4W |
| R08, R10, R62 | Resistor | 10kΩ / 1/4W |
| R50, R57 | Resistor | 4.7kΩ / 1/4W |
| R51, R56 | Resistor | 12kΩ / 1/4W |
| R52, 55 | Resistor | 3.3kΩ / 1/6W |
| R53, R54 | Resistor | 62kΩ / 1/4W |
| R58, R59 | Resistor | 18kΩ / 1/4W |
| R60, R61 | Resistor | 15kΩ / 1/4W |
| L1, L2 | Inductor | 2.1uH |
| L3, L4 | Troidal Coil | 20uH |
| LED1,3,4 | LED | 5V |
| IC1 | Buffer | 74AC244 |
| TR1 | Transistor | 2SA984 |
| TR2 | Transistor | 2SC2274 |
| TR3, TR4, TR5 | Transistor | 2SA1345 |
| SW1 | Switch | B-12AP |
| J1 | Connector | 2mm / 28pin |
| J3 | Connector | 5.08mm / 4pin |

## Pin configuration

| PIN | SYMBOL | DESCRIPTION |
|---|---|---|
| 1 | VDR | Positive supply for driver chip with respect to VS1,2; (VS1,2+10V). |
| 2 | VD1 | Positive supply for power stage of channel 1. |
| 3 | VS1 | Negative supply for power stage of channel 1. |
| 4 | PWM1 | PWM output of channel 1. |
| 5 | FBPWM1 | Feedback for inner loop of channel 1. |
| 6 | ZB1 | For estimating the power dissipation in the zobel resister, this input is sensing the zobel voltage via a resistive network of channel 1. |
| 7 | FB1 | Feedback for global loop of channel 1. |
| 8 | TEST | Test terminal connect to VSS. |
| 9 | VDD | Positive power supply for control chip (+5V). |
| 10 | AGND | Analog ground for control chip power supply. |
| 11 | VSS | Negative power supply for control chip (-5V). |
| 12 | IN1- | High impedance audio input for channel 1. **This input is inverting.** |
| 13 | AGND1 | Input reference for channel 1. This is true non-inverting low impedance (2kohm) input for avoiding ground loop noise. |
| 14 | IN2+ | High impedance audio input for channel 2**. This input is non-inverting.** |
| 15 | AGND2 | Input reference for channel 2. This is true inverting low impedance (1kohm) input for avoiding ground loop noise. |
| 16 | SUB | Substrate of IMST. |
| 17 | VDCK | This high impedance input for monitoring positive power stage. This monitoring controls the soft clipping circuit and the over voltage shutdown. |
| 18 | VSCK | This high impedance input for monitoring negative power stage. This monitoring controls the soft clipping circuit and the over voltage shutdown. |
| 19 | DCG | This high impedance output generates a current in case of over voltage condition on the power stage voltage (VD/VS). This current is designed to turn-on a set of discharge transistors. |
| 20 | OCM | Error signal of open collector output “L” for three conditions.<br>1. Over current limitation.<br>2. For monitoring the state of control and average voltage across the zobel resistor in case of of-limit conditions.<br>3. Over temperature warning. By connecting to the ENA pin, thermal shutdown is set. |
| 21 | ENA | Bi-direction input/output. The input “H” enables to start switching and the input “L” disables. Input is including hysteresis for glitch free enable of the system. When the protection circuit detects the over voltage condition, the open collector output turns on. |
| 22 | SYN | The switching frequency can be synchronized with frequency of this pin signal to avoid the influence for AM radio tuner. Normal condition is “L”. |
| 23 | FB2 | Feedback for global loop of channel 2 |
| 24 | ZB2 | For estimating the power dissipation in the zobel resister, this input is sensing the zobel voltage via a resistive network of channel 2. |
| 25 | FBPWM2 | Feedback for inner loop of channel 2 |
| 26 | PWM2 | PWM output of channel 2 |
| 27 | VS2 | Negative supply for power stage of channel 2 |
| 28 | VD2 | Positive supply for power stage of channel 2 |

**Package dimension**