TDK SEMICONDUCTOR CORP.

# AVPro™ 5000A
# Quad Audio and Dual Video Drivers

**Advanced Information**

November 2000

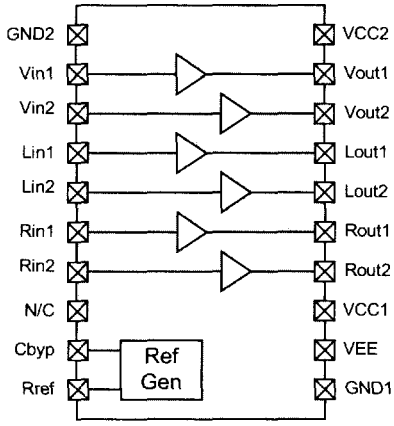
## DESCRIPTION

The AVPro 5000A device is an audio/video driver IC that supports two video inputs and four audio inputs. Each video path has a gain of 2 with output buffer designed to drive a 150 ohm load. Each audio path has two independent drivers that are capable of providing nominal outputs of 2 Vrms into 600 Ohm loads and upt to 3.2 Vrms into 10k Ohm loads. The gain of each audio driver is individually set using a pair of external resistors. In addition, the audio drivers use +/- 5volt power supplies so that the output is centered around ground. This allows direct coupling of the 5000A audio outputs to the associated load. Typical applications for the 5000A include DVD players, VCRs, and digital receivers for satellite, cable, and terrestrial television.

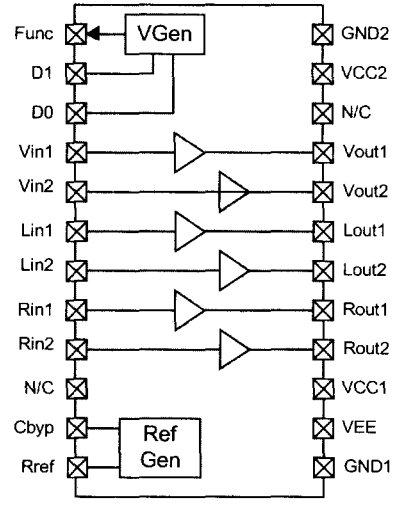
## FEATURES

- Video section
  - Direct coupled video inputs
  - 150 ohm output drivers
- Audio section
  - better than 90 dB SNR+distortion
  - direct coupled outputs
- +5V and -5V power supplies
- 20-lead SOIC package (AVPro5000A-1CL)
- 24-lead SOIC package (AVPro5000A-2CL)
  - Includes function control I/O pins

## BLOCK DIAGRAM




5000A-1CL




5000A-2CL

### VIDEO DESCRIPTION

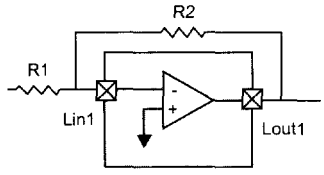
The 5000A video section provides inputs for two video signals, which are DC coupled into the device. To maintain low distortion operation in the linear range of the video amplifier, the input signal should be a minimum of 200 mV above ground.

The output amplifiers are designed to provide a gain of two (2) so that a 150 ohm load can be driven. In a typical application, an external 75 ohm resistor is placed in series with the output to provide a nominal 75 ohm output impedance to the system.

### AUDIO DESCRIPTION

The 5000A audio section provides inputs for four audio signals, typically left and right channels of a stereo audio source. In many applications, the audio inputs are generated by an external DAC.

Each audio amplifier if configured as an inverting amplifier. The gain of each path is set by the ratio of two external resistors, as shown in the diagram below.




**Audio Gain set by external resistors.**
**Av = R2/R1**

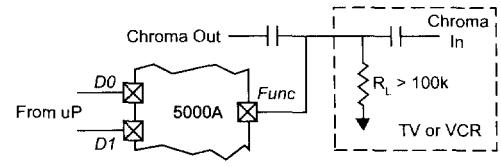
Each audio amplifier can output a signal of 2 Vrms while achieving the parametric specs indicated. The amplifiers can drive over 3 Vrms before significant distortion occurs. The audio buffers use +5V and -5V power supplies, which allow the DC level of the output to be 0 Vdc. For most applications, this allows the outputs of the 5000A to be direct coupled to the load, eliminating external AC coupling capacitors. A resistor in series with the load is suggested to provide over-current protection.

### FUNCTION CONTROL

In some video systems, the video source can set the aspect ratio of a TV or VCR by applying a DC voltage to the Chroma signal. The 24-pin SOIC configuration of the 5000A provides an output voltage pin that can be used for this purpose. The output pin, labeled *Func*, is controlled by two digital input pins *D0* and *D1*. The DC voltage on the *Func* pin is set as follows:

| D1 | D0 | Func Voltage | Function |
|---|---|---|---|
| 0 | 0 | 0.0 to 0.4V | Normal |
| 0 | 1 | 1.4 to 2.4V | Letterbox |
| 1 | 0 | 3.5 to 5.0V | Squeezed |
| 1 | 1 | Hi-impedance | Not Applicable |

The diagram below shows the typical circuit used to implement the aspect switching function:




**Function Control Application**

### REFERENCE GENERATOR

The 5000A generates internal reference currents based on an external 10.0k ohm, 1% resistor connected between the *RRef* pin and analog ground. The reference generator also uses a 0.01 uF capacitor connected between the *Cbyp* pin and analog ground for filtering purposes.

### POWER SUPPLY CONSIDERATIONS

The –5V power supply is also used as the bias voltage for the P-type substrate of the 5000A. As such, the –5V power supply must turn-on at the same rate or before the +5V power supply to avoid turning on substrate diodes. For the best results, the +5V power supply ramp-up should be delayed approximately 2 msec relative to the –5V ramp-up. If the proper power-up sequence cannot be guaranteed, then and external reverse biased Schottky kode should be placed between –5V and ground to prevent latch-up.

**PIN DESCRIPTIONS** (Pins marked N/C should be left unconnected during normal use)

| NAME | TYPE | DESCRIPTION |
|---|---|---|
| **I/O Pins:** | | |
| Func | O | Function Output: This pin provides one of three output voltages that signal a TV or VCR in order to set the proper aspect ratio. |
| D0, D1 | I | Digital inputs: These pins select the output voltage on the *Func* pin. |
| Lin1 | I | Left audio input 1: This pin accepts an audio signal that can be either direct coupled or AC-coupled. This pin is typically connected to the left channel of a stereo audio source. |
| Lin2 | I | Left audio input 2: This pin accepts an audio signal that can be either direct coupled or AC-coupled. This pin is typically connected to the left channel of a stereo audio source. |
| Rin1 | I | Right audio input 1: This pin accepts an audio signal that can be either direct coupled or AC-coupled. This pin is typically connected to the right channel of a stereo audio source. |
| Rin2 | I | Right audio input 2: This pin accepts an audio signal that can be either direct coupled or AC-coupled. This pin is typically connected to the right channel of a stereo audio source. |
| Vin1 | I | Video input 1: This pin accepts a direct-coupled video signal. |
| Vin2 | I | Video input 1: This pin accepts a direct-coupled video signal. |
| Lout1 | O | Left audio 1 output: This pin is the output for the *Lin1* input channel. |
| Lout2 | O | Left audio 2 output: This pin is the output for the *Lin2* input channel. |
| Rout1 | O | Right audio 1 output: This pin is the output for the *Rin1* input channel. |
| Rout2 | O | Right audio 2 output: This pin is the output for the *Rin2* input channel. |
| Vout1 | O | Video 1 output: This pin is the buffered output of the *Vin1* input pin with a gain of 2. For a typical 75 ohm load, an external 75 ohms should be added in series with the load. |
| Vout2 | O | Video 2 output: This pin is the buffered output of the *Vin2* input pin with a gain of 2. For a typical 75 ohm load, an external 75 ohms should be added in series with the load. |
| **Power Pins:** | | |
| VCCn | - | +5 VDC power supply pins. VCC1 is the audio supply, VCC2 is the video supply. |
| VEE | - | -5 VDC power supply pins. |
| GNDn | - | Ground pins. GND1 is the audio supply, GND2 is the video supply. |
| Rref | - | Bias point of internal current generator. Add resistor 10.0k to ground. |
| Cbyp | - | Filter pin for the internal voltage reference. Add capacitor 0.01 uF to ground. |

## ELECTRICAL SPECIFICATIONS

### ABSOLUTE MAXIMUM RATINGS

Operation beyond the maximum ratings may damage the device

| PARAMETER | RATING | UNIT |
|---|---|---|
| Storage temperature | -55 to 150 | °C |
| Junction operating temperature | +150 | °C |
| Positive supply voltages | -0.3 < VCC < 6 | V |
| Negative supply voltages | -6 < VEE < -+0.3 | V |
| Voltage applied at Digital Inputs | -0.3V to VCC+0.3 | V |
| | | |
| | -0.3 to VCC + 0.3 | V |
| | VEE –0.3 to VCC + 0.3 | V |

**TARGET SPECIFICATIONS**: Unless otherwise specified: 0° < Ta < 70 °C; power supplies VCC = +5.0 V ±5%, VEE = -5.0 V ±5%.

### OPERATING CHARACTERISTICS

| PARAMETER | CONDITION | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| Power supply current | Video loads = 150 ohm<br>VCC1 and VCC2 = 5.0V<br>VEE1 = -5.0V<br>Video loads = 75 ohm<br>VCC1 and VCC2 = 5.25V<br>VEE1 = -5.25V | | <br>52<br>5 | <br><br><br>90<br>10 | <br>mA<br>mA<br><br>mA<br>mA |
| *Func* output voltage | D0 = 0, D1 = 0; $R_L$ > 100k ohm<br>D0 = 1, D1 = 0; $R_L$ > 100k ohm<br>D0 = 0, D1 = 1; $R_L$ > 100k ohm | 0.0<br>1.4<br>3.5 | | 0.4<br>2.4<br>5.0 | V<br>V<br>V |
| *Func* output impedance | D0 = 0, D1 = 0<br>D0 = 1, D1 = 0<br>D0 = 0, D1 = 1 | 7.0 | | 13.0 | kΩ |
| PSRR | $f_{in}$ = 100 Hz, 0.3 Vpp on VCC/ VEE | 40 | | | dB |

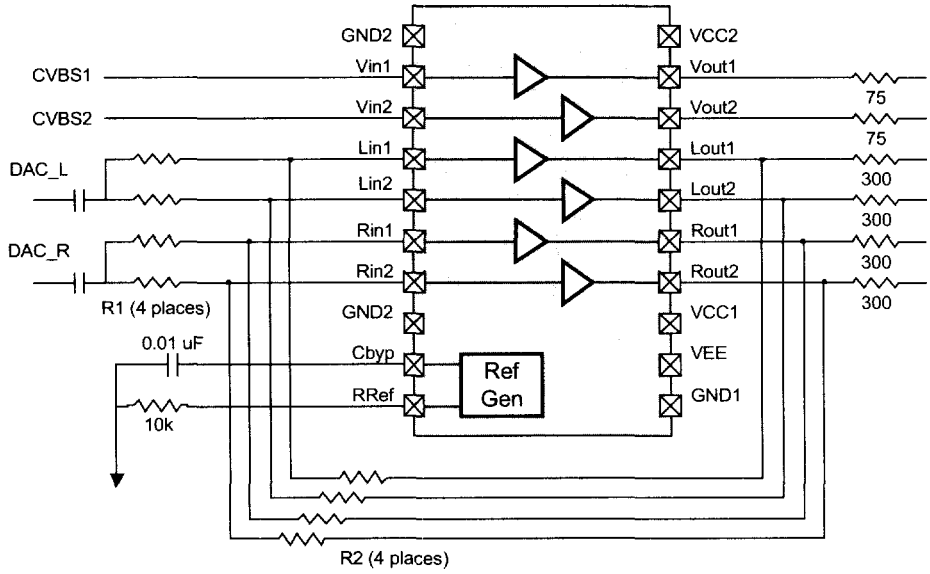
**Video Characteristics** - Unless otherwise noted, typical output loading on all video outputs is 150 Ω. All video outputs are capable of withstanding a sustained 75 ohm load to ground without damage.

| PARAMETER | CONDITION | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| Input impedance | All video inputs | 100 | | | kΩ |
| Input dynamic range | $f_{in}$ = 100 kHz, THD < 1.0% at 0.3V DC floor level | | 1.5 | | Vpp |
| Gain | 1.0 Vpp input, $f_{in}$ = 100 kHz | 1.90 | 2.00 | 2.10 | V/V |
| Input DC floor level | Ground to sync tip, Freq. = 100kHz Vpk=1.0V, THD < 1% | 0.2 | | 1.25 | V |
| Signal to noise ratio | 1 Vpp input | 70 | | | dB |
| Cross talk | $f_{in}$ = 3.58 MHz, 1 Vpp | 55 | | | dB |
| Differential phase | Video Inputs | -0.5 | | 0.5 | Deg. |
| Differential gain | Video Inputs | -0.5 | | 0.5 | % |
| | | | | | |

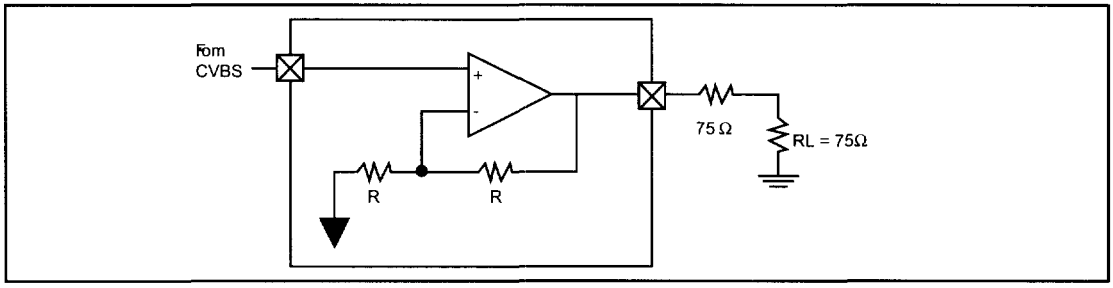
**Audio Characteristics** - Unless otherwise noted, all audio parameters are specified at a load condition of 10 kΩ. All audio outputs will withstand a sustained short to ground without damage.

| Parameter | Condition | Min | Nom | Max | UNIT |
|---|---|---|---|---|---|
| Input impedance | | 100 | | | kΩ |
| Gain | $f_{in}$ = 1.0 kHz, 0.5 Vrms; 2*R1 = R2 (1% resistors)[1] | 1.95 | 2.0 | 2.05 | V/V |
| Frequency response | 0.5 Vrms input, Flat within ± 0.3 dB | 20 | | | kHz |
| | Measured -3 dB point | 100 | | | kHz |
| Dynamic range | $f_{in}$ = 1.0 kHz; 2.0 Vrms | 90 | 100 | | dB |
| Signal to Noise ratio | $f_{in}$ = 1.0 kHz, 2.0 Vrms, A-weighting | 90 | 100 | | dB |
| Distortion (THD) | $f_{in}$ = 1.0 kHz, 0.5 Vrms | | | 0.01 | % |
| | $f_{in}$ = 1.0 kHz, 2 Vrms | | | TBD | % |
| | | | | | |
| Output DC Offset | Input to Output | -20 | | 20 | mV |
| Output phase matching | $f_{in}$ = 1.0 kHz, 0.5 Vrms | | 0.5 | | Deg. |
| Channel separation | $f_{in}$ = 1.0 kHz, 0.5 Vrms | 90 | | | dB |

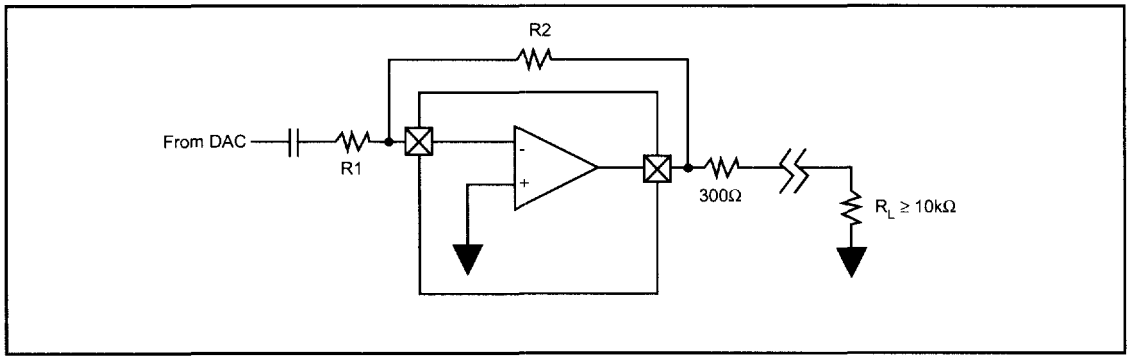
Note 1: The gain tolerance is specified for the amplifier only and does not include tolerance of the external resistors




**AVPro 5000A-1CL: Typical Application Diagram**

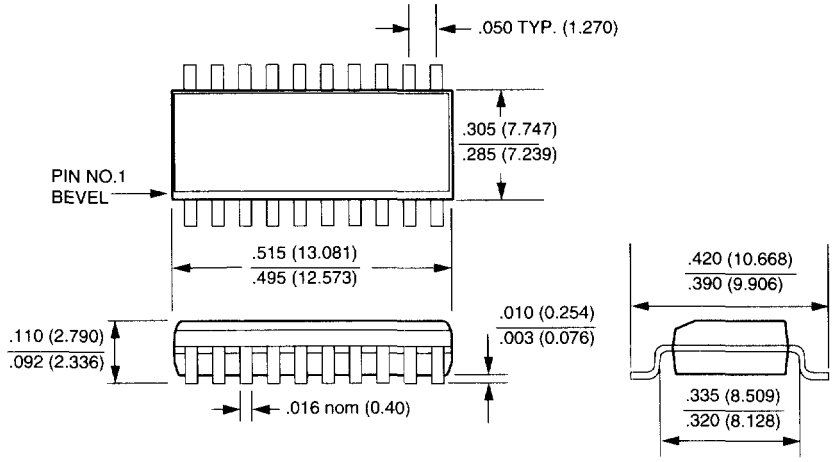



**Video Output Circuit**

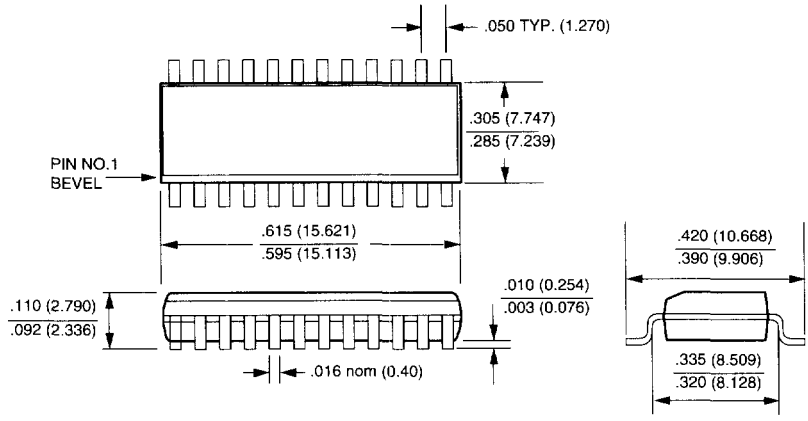



**Audio Output Circuit**

## MECHANICAL SPECIFICATIONS



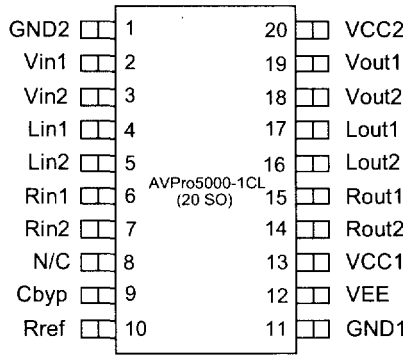

**20-PIN Small Outline Package (SOL)**



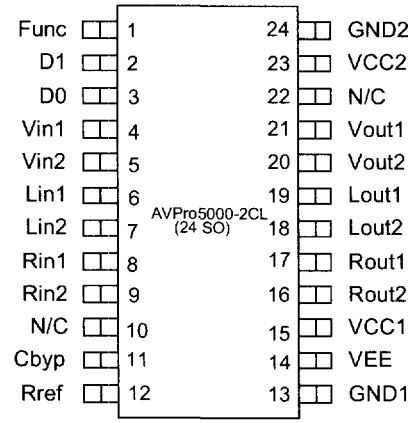

**24-PIN Small Outline Package (SOL)**

## PACKAGE PIN DESIGNATIONS

(Top View)




**20-Pin SOL**
**AVPro 5000A-1CL**




**24-Pin SOL**
**AVPro 5000A-2CL**

## ORDERING INFORMATION

| PART DESCRIPTION | ORDER NUMBER | PACKAGING MARK |
|---|---|---|
| AVPro 5000A | | |
| 20-Pin Small Outline | AVPro 5000A-1CL | AVPro 5000A-1CL |
| 24-Pin Small Outline | AVPro 5000A-2CL | AVPro 5000A-2CL |

**Advanced Information:** The Advanced Information data sheet is to be approved for Beta Site and advanced customer information purposes only. It is not intended to replace the electrical specification for the specific device it represents. This document will be updated and converted into a Final (Preliminary Data Sheet) upon completion of Design Engineering Validation. Design Engineering should review this documentation for its accuracy to the definition and the design goals for the product it represents.



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011/18/00- rev. B