

-tone CONTROL DIGITALLY CONTROLLED AUDIO PROCESSOR

1 FEATURES

- INPUT MULTIPLEXER
 - 4 STEREO INPUTS
 - SELECTABLE INPUT GAIN FOR OPTIMAL ADAPTATION TO DIFFERENT SOURCES
- ONE STEREO OUTPUT
- TREBLE AND BASS CONTROL IN 2.0dB STEPS
- VOLUME CONTROL IN 1.0dB STEPS
- TWO SPEAKER ATTENUATORS:
 - TWO INDEPENDENT SPEAKER CONTROL IN 1.0dB STEPS FOR BALANCE FACILITY
 - INDEPENDENT MUTE FUNCTION
- ALL FUNCTION ARE PROGRAMMABLE VIA SERIAL BUS

2 DESCRIPTION

The TDA7440D is a volume tone (bass and treble) balance (Left/Right) processor for quality audio applications in Hi-Fi systems.

Figure 1. Package

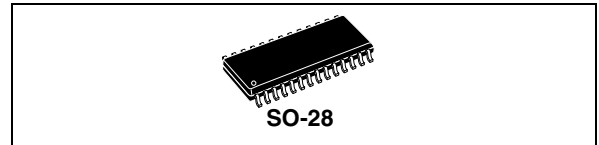


Table 1. Order Codes

| Order code | Package |
|---------------|-------------|
| TDA7440D | SO-28 |
| TDA7440D013TR | Tape & Reel |

Selectable input gain is provided. Control of all the functions is accomplished by serial bus.

The AC signal setting is obtained by resistor networks and switches combined with operational amplifiers.

Thanks to the used BIPOLAR/CMOS Technology, Low Distortion, Low Noise and DC stepping are obtained

Figure 2. Block Diagram

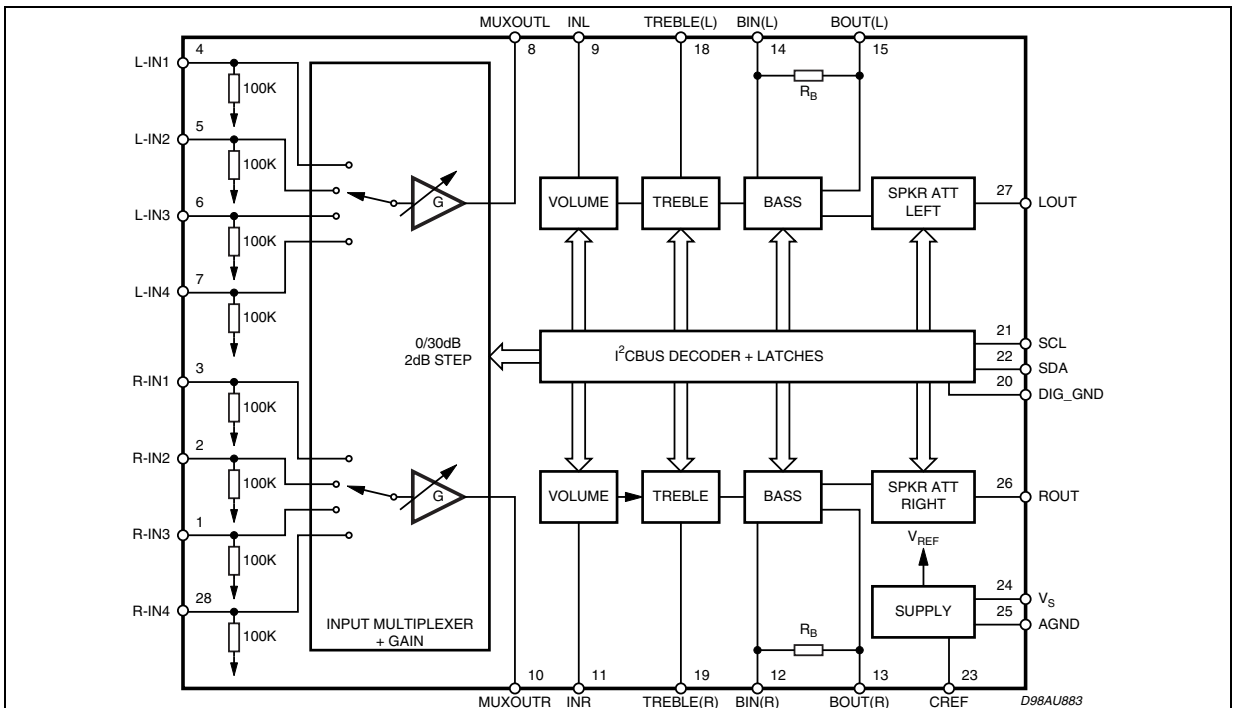


Figure 3. Pin Connection (Top view)

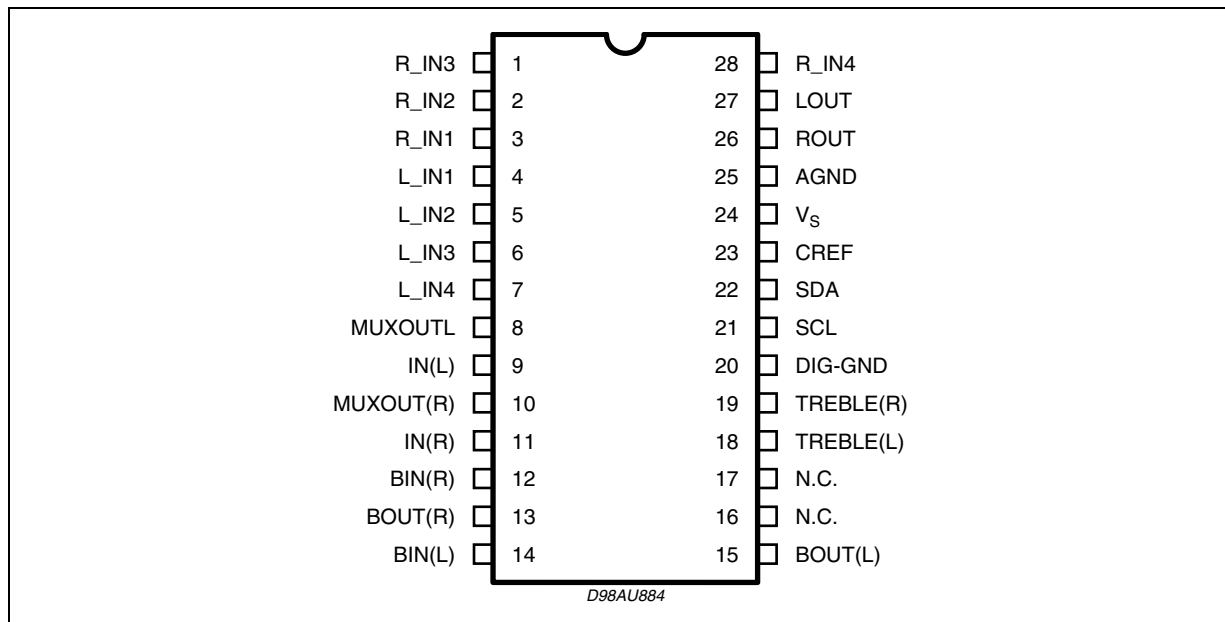


Table 2. Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|-----------|-------------------------------|------------|------|
| V_S | Operating Supply Voltage | 10.5 | V |
| T_{amb} | Operating Ambient Temperature | 0 to 70 | °C |
| T_{stg} | Storage Temperature Range | -55 to 150 | °C |

Table 3. Thermal Data

| Symbol | Parameter | Value | Unit |
|-----------------|----------------------------------|-------|------|
| $R_{th\ j-pin}$ | Thermal Resistance Junction-pins | 85 | °C/W |

Table 4. Quick Reference Data

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|----------|---|------|------|------|------------------|
| V_S | Supply Voltage | 6 | 9 | 10.2 | V |
| V_{CL} | Max. input signal handling | 2 | | | V _{rms} |
| THD | Total Harmonic Distortion $V = 1V_{rms}$ $f = 1KHz$ | 0.01 | 0.1 | % | |
| S/N | Signal to Noise Ratio $V_{out} = 1V_{rms}$ (mode = OFF) | | 106 | | dB |
| S_C | Channel Separation $f = 1KHz$ | | 90 | | dB |
| | Input Gain in (2dB step) | 0 | | 30 | dB |
| | Volume Control (1dB step) | -47 | | 0 | dB |
| | Treble Control (2dB step) | -14 | | +14 | dB |
| | Bass Control (2dB step) | -14 | | +14 | dB |
| | Balance Control 1dB step | -79 | | 0 | dB |
| | Mute Attenuation | | 100 | | dB |

Table 5. Electrical Characteristics

Refer to the test circuit $T_{amb} = 25^{\circ}\text{C}$, $V_S = 9\text{V}$, $R_L = 10\text{K}\Omega$, $R_G = 600\Omega$, all controls flat ($G = 0\text{dB}$), unless otherwise specified.

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|----------------------------|------------------------------|---|-------|----------|-------|------------------|
| SUPPLY | | | | | | |
| V_S | Supply Voltage | | 6 | 9 | 10.2 | V |
| I_S | Supply Current | | 4 | 7 | 10 | mA |
| SVR | Ripple Rejection | | 60 | 90 | | dB |
| INPUT STAGE | | | | | | |
| R_{IN} | Input Resistance | | 70 | 100 | 130 | $\text{K}\Omega$ |
| V_{CL} | Clipping Level | THD = 0.3% | 2 | 2.5 | | V_{rms} |
| S_{IN} | Input Separation | The selected input is grounded through a 2.2μ capacitor | 80 | 100 | | dB |
| G_{inmin} | Minimum Input Gain | | -1 | 0 | 1 | dB |
| G_{inman} | Maximum Input Gain | | 29 | 30 | 31 | dB |
| G_{step} | Step Resolution | | 1.5 | 2 | 2.5 | dB |
| VOLUME CONTROL | | | | | | |
| R_i | Input Resistance | | 20 | 33 | 50 | $\text{K}\Omega$ |
| C_{RANGE} | Control Range | | 45 | 47 | 49 | dB |
| A_{VMAX} | Max. Attenuation | | 45 | 47 | 49 | dB |
| A_{STEP} | Step Resolution | | 0.5 | 1 | 1.5 | dB |
| E_A | Attenuation Set Error | $A_V = 0$ to -24dB | -1.0 | 0 | 1.0 | dB |
| | | $A_V = -24$ to -47dB | -1.5 | 0 | 1.5 | dB |
| E_T | Tracking Error | $A_V = 0$ to -24dB | | 0 | 1 | dB |
| | | $A_V = -24$ to -47dB | | 0 | 2 | dB |
| V_{DC} | DC Step | adjacent attenuation steps from 0dB to A_V max | | 0 0.5 | 3 | mV mV |
| A_{mute} | Mute Attenuation | | 80 | 100 | | dB |
| BASS CONTROL (1) | | | | | | |
| G_b | Control Range | Max. Boost/cut | +12.0 | +14.0 | +16.0 | dB |
| B_{STEP} | Step Resolution | | 1 | 2 | 3 | dB |
| R_B | Internal Feedback Resistance | | 33 | 44 | 55 | $\text{K}\Omega$ |
| TREBLE CONTROL (1) | | | | | | |
| G_t | Control Range | Max. Boost/cut | +13.0 | +14.0 | +15.0 | dB |
| T_{STEP} | Step Resolution | | 1 | 2 | 3 | dB |
| SPEAKER ATTENUATORS | | | | | | |
| C_{RANGE} | Control Range | | 70 | 76 | 82 | dB |
| S_{STEP} | Step Resolution | | 0.5 | 1 | 1.5 | dB |
| E_A | Attenuation Set Error | $A_V = 0$ to -20dB | -1.5 | 0 | 1.5 | dB |
| | | $A_V = -20$ to -56dB | -2 | 0 | 2 | dB |
| V_{DC} | DC Step | adjacent attenuation steps | | 0 | 3 | mV |
| A_{mute} | Mute Attenuation | | 80 | 100 | | dB |

NOTE1:

1) The device is functionally good at $V_S = 5\text{V}$. a step down, on V_S , to 4V does't reset the device.

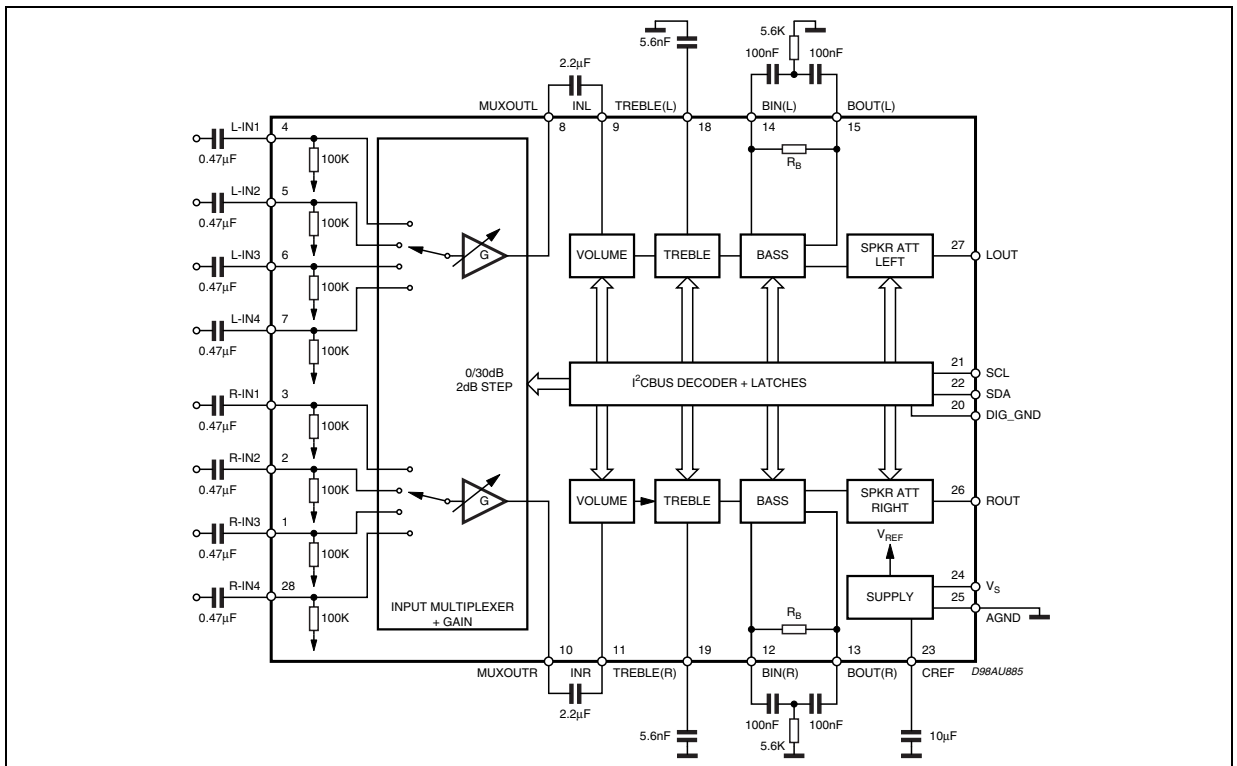
2) BASS and TREBLE response: The center frequency and the response quality can be chosen by the external circuitry.

Table 5. Electrical Characteristics (continued)

Refer to the test circuit $T_{amb} = 25^{\circ}\text{C}$, $V_S = 9\text{V}$, $R_L = 10\text{K}\Omega$, $R_G = 600\Omega$, all controls flat ($G = 0\text{dB}$), unless otherwise specified.

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|----------------------|--------------------------------|--|------|------|------|---------------|
| AUDIO OUTPUTS | | | | | | |
| V_{CLIP} | Clipping Level | $d = 0.3\%$ | 2.1 | 2.6 | | Vrms |
| R_L | Output Load Resistance | | 2 | | | K Ω |
| R_O | Output Impedance | | 10 | 30 | 50 | Ω |
| V_{DC} | DC Voltage Level | | 3.5 | 3.8 | 4.1 | V |
| GENERAL | | | | | | |
| E_{NO} | Output Noise | All gains = 0dB; BW = 20Hz to 20KHz flat | | 5 | 15 | μV |
| E_t | Total Tracking Error | $A_V = 0$ to -24dB $A_V = -24$ to -47dB | | 0 | 1 | dB |
| S/N | Signal to Noise Ratio | All gains 0dB; $V_O = 1\text{Vrms}$ | 95 | 106 | | dB |
| S_C | Channel Separation Left/Right | | 80 | 100 | | dB |
| d | Distortion | $A_V = 0$; $V_I = 1\text{Vrms}$ | | 0.01 | 0.08 | % |
| BUS INPUT | | | | | | |
| V_{IL} | Input Low Voltage | | | | 1 | V |
| V_{IH} | Input High Voltage | | 3 | | | V |
| I_{IN} | Input Current | $V_{IN} = 0.4\text{V}$ | -5 | 0 | 5 | μA |
| V_O | Output Voltage SDA Acknowledge | $I_O = 1.6\text{mA}$ | | 0.4 | 0.8 | V |

Figure 4. Test Circuit



3 APPLICATION SUGGESTIONS

The first and the last stages are volume control blocks. The control range is 0 to -47dB (mute) for the first one, 0 to -79dB (mute) for the last one. Both of them have 1dB step resolution. The very high resolution allows the implementation of systems free from any noisy acoustical effect.

The TDA7440D audioprocessor provides 3 bands tones control.

3.1 Bass Stage

Several filter types can be implemented, connecting external components to the Bass IN and OUT pins.

The fig.5 refers to basic T Type Bandpass Filter starting from the filter component values (R1 internal and R2,C1,C2 external) the centre frequency Fc, the gain Av at max. boost and the filter Q factor are computed as follows:

$$F_C = \frac{1}{2 \cdot \pi \cdot \sqrt{R1 \cdot R2 \cdot C1 \cdot C2}}$$

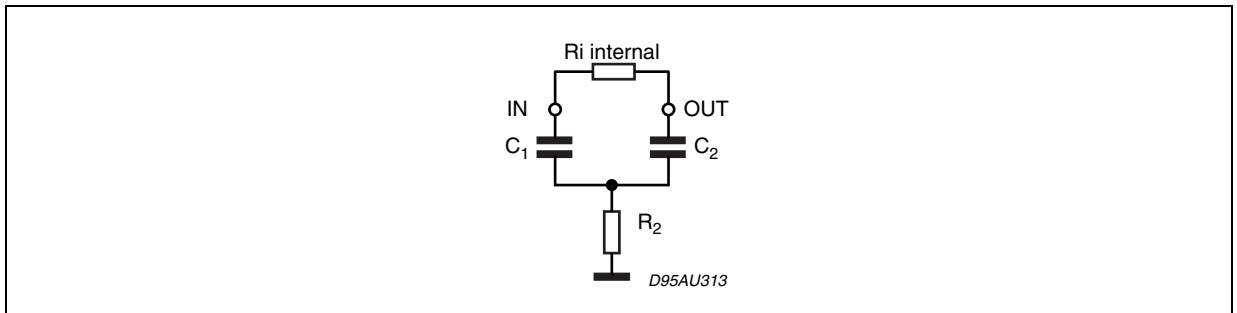
$$A_V = \frac{R2 \cdot C2 + R2 \cdot C1 + R_i \cdot C1}{R2 \cdot C1 + R2 \cdot C2}$$

$$Q = \frac{\sqrt{R1 \cdot R2 \cdot C1 \cdot C2}}{R2 \cdot C1 + R2 \cdot C2}$$

Viceversa, once Fc, Av, and Ri internal value are fixed, the external components values will be:

$$C1 = \frac{A_V - 1}{2 \cdot \pi \cdot F_C \cdot R_i \cdot Q} \quad C2 = \frac{Q^2 \cdot C1}{A_V - 1 - Q^2} \quad R2 = \frac{A_V - 1 - Q^2}{2 \cdot \pi \cdot C1 \cdot F_C \cdot (A_V - 1) \cdot Q}$$

Figure 5.



Treble Stage

The treble stage is a high pass filter whose time constant is fixed by an internal resistor (25KΩ typical) and an external capacitor connected between treble pins and ground.

Typical responses are reported in Figg. 14 to 17.

CREF

The suggested 10mF reference capacitor (CREF) value can be reduced to 4.7mF if the application requires faster power ON.

Figure 6. THD vs. frequency

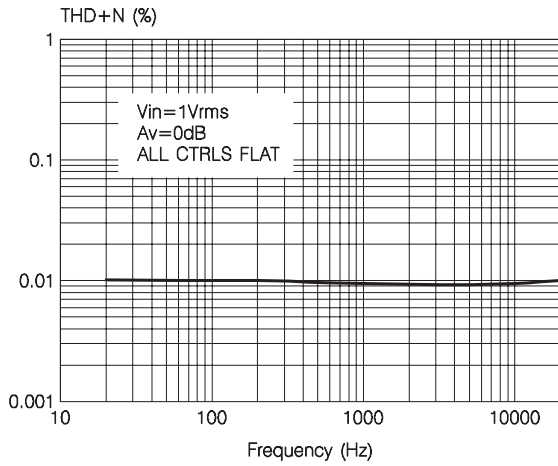


Figure 9. Bass response

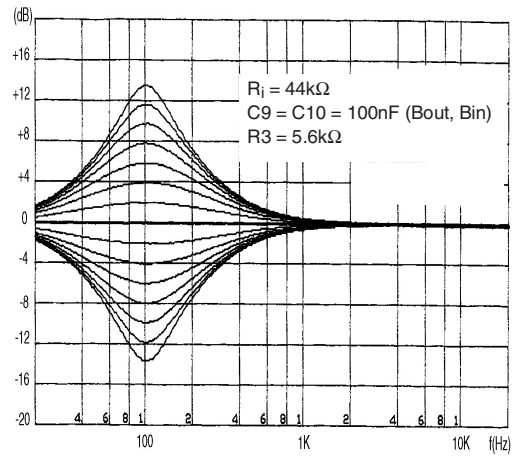


Figure 7. THD vs. R_{LOAD}

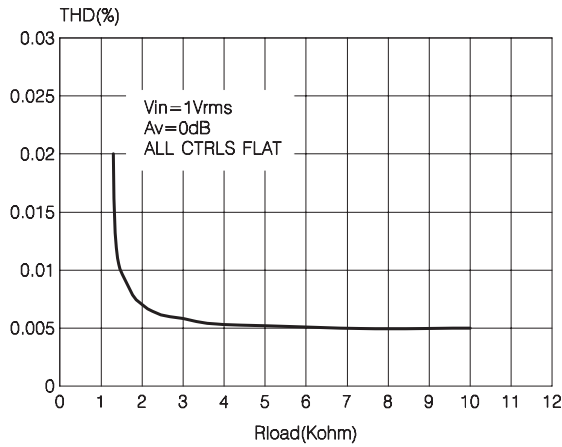


Figure 10. Treble response

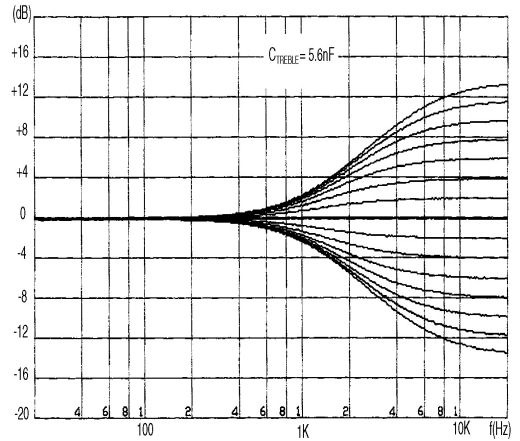
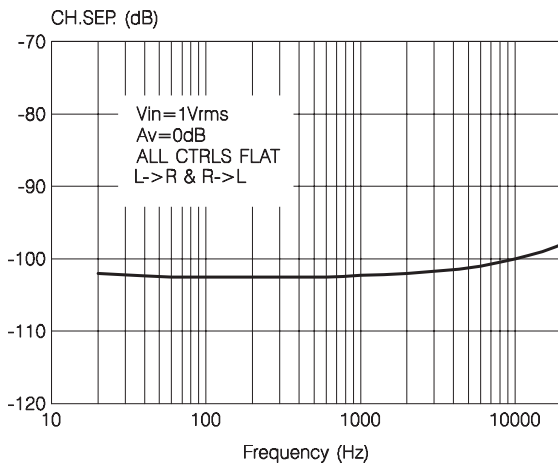


Figure 8. Channel separation vs. frequency



4 I²C BUS INTERFACE

Data transmission from microprocessor to the TDA7440D and vice versa takes place through the 2 wires I²C BUS interface, consisting of the two lines SDA and SCL (pull-up resistors to positive supply voltage must be connected).

4.1 Data Validity

As shown in fig. 11, the data on the SDA line must be stable during the high period of the clock. The HIGH and LOW state of the data line can only change when the clock signal on the SCL line is LOW.

4.2 Start and Stop Conditions

As shown in fig. 12 a start condition is a HIGH to LOW transition of the SDA line while SCL is HIGH. The stop condition is a LOW to HIGH transition of the SDA line while SCL is HIGH.

4.3 Byte Format

Every byte transferred on the SDA line must contain 8 bits. Each byte must be followed by an acknowledge bit. The MSB is transferred first.

4.4 Acknowledge

The master (μ P) puts a restive HIGH level on the SDA line during the acknowledge clock pulse (see fig. 13). The peripheral (audio processor) that acknowledges has to pull-down (LOW) the SDA line during this clock pulse.

The audio processor which has been addressed has to generate an acknowledge after the reception of each byte, otherwise the SDA line remains at the HIGH level during the ninth clock pulse time. In this case the master transmitter can generate the STOP information in order to abort the transfer.

4.5 Transmission without Acknowledge

Avoiding to detect the acknowledge of the audio processor, the μ P can use a simpler transmission: simply it waits one clock without checking the slave acknowledging, and sends the new data.

This approach of course is less protected from misworking.

Figure 11. Data Validity on the I²CBUS

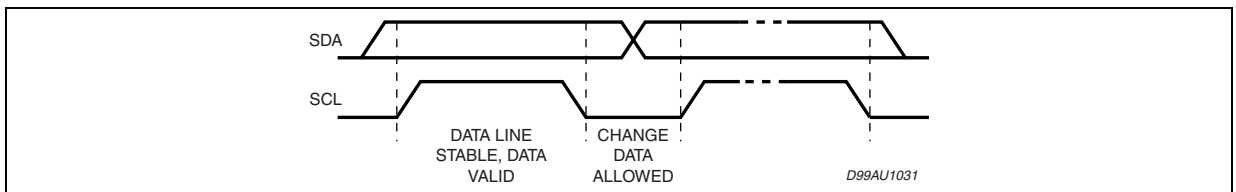


Figure 12. Timing Diagram of I²CBUS

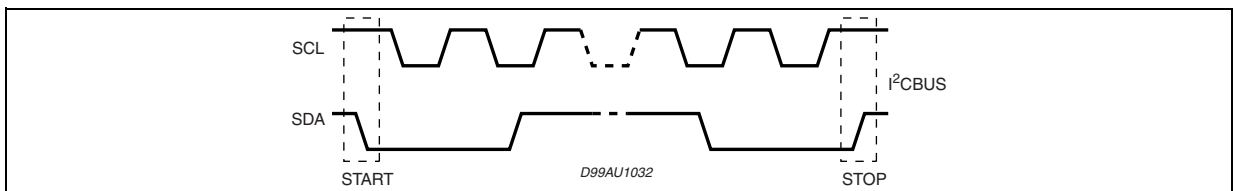
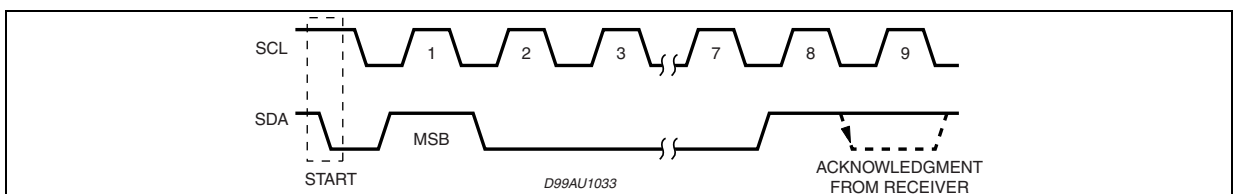


Figure 13. Acknowledge on the I²CBUS

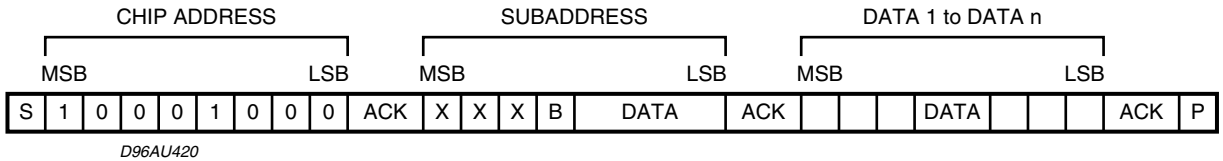


5 SOFTWARE SPECIFICATION

Interface Protocol

The interface protocol comprises:

- A start condition (S)
- A chip address byte, containing the TDA7440D
- A subaddress bytes
- A sequence of data (N byte + acknowledge)
- A stop condition (P)



ACK = Acknowledge

S = Start

P = Stop

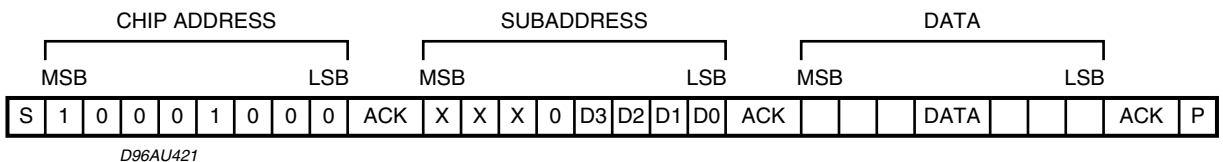
A = Address

B = Auto Increment

5.1 EXAMPLES

5.1.1 No Incremental Bus

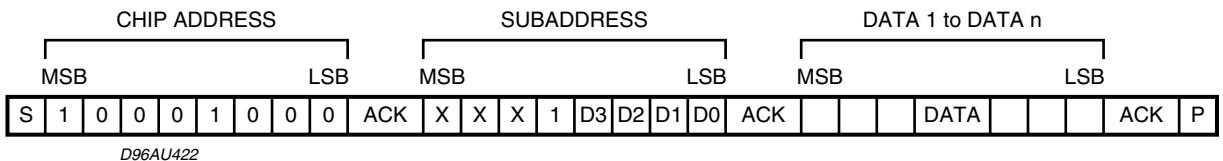
The TDA7440D receives a start condition, the correct chip address, a subaddress with the B = 0 (no incremental bus), N-datas (all these data concern the subaddress selected), a stop condition.



5.1.2 Incremental Bus

The TDA7440D receive a start conditions, the correct chip address, a subaddress with the B = 1 (incremental bus): now it is in a loop condition with an autoincrease of the subaddress whereas SUBADDRESS from "XXX1000" to "XXX1111" of DATA are ignored.

The DATA 1 concern the subaddress sent, and the DATA 2 concerns the subaddress sent plus one sent in the loop etc, and at the end it receivers the stop condition.



5.2 POWER ON RESET CONDITION

Table 6.

| | |
|-----------------|------|
| INPUT SELECTION | IN2 |
| INPUT GAIN | 28dB |
| VOLUME | MUTE |
| BASS | 0dB |
| TREBLE | 2dB |
| SPEAKER | MUTE |

5.3 DATA BYTES

Address = 88 HEX (ADDR:OPEN).

Table 7. FUNCTION SELECTION: First byte (subaddress)

| MSB | | | | | | | LSB | SUBADDRESS |
|-----|----|----|----|----|----|----|-----|-----------------------|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
| X | X | X | B | 0 | 0 | 0 | 0 | INPUT SELECT |
| X | X | X | B | 0 | 0 | 0 | 1 | INPUT GAIN |
| X | X | X | B | 0 | 0 | 1 | 0 | VOLUME |
| X | X | X | B | 0 | 0 | 1 | 1 | BASS |
| X | X | X | B | 0 | 1 | 0 | 0 | NOT USED |
| X | X | X | B | 0 | 1 | 0 | 1 | TREBLE |
| X | X | X | B | 0 | 1 | 1 | 0 | SPEAKER ATTENUATE "R" |
| X | X | X | B | 0 | 1 | 1 | 1 | SPEAKER ATTENUATE "L" |

B = 1: INCREMENTAL BUS ACTIVE

B = 0: NO INCREMENTAL BUS

X = DON'T CARE

In Incremental Bus Mode, the "not used" function must be addressed in any case. For example to refresh "Volume = 0dB" and Speaker_R = -40dB", the following bytes must be sent:

Table 8.

| | |
|----------------|----------|
| SUBADDRESS | XXX10010 |
| VOLUME DATA | X0000000 |
| BUS DATA | XXXX1111 |
| NOT USED DATA | XXXX1111 |
| TREBLE DATA | XXXX1111 |
| SPEAKER_R DATA | X0000010 |

Table 9. INPUT SELECTION

| MSB | | | | | | | LSB | INPUT MULTIPLEXER |
|-----|----|----|----|----|----|----|-----|-------------------|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
| X | X | X | X | X | X | 0 | 0 | IN4 |
| X | X | X | X | X | X | 0 | 1 | IN3 |
| X | X | X | X | X | X | 1 | 0 | IN2 |
| X | X | X | X | X | X | 1 | 1 | IN1 |

5.3 DATA BYTES (continued)

Table 10. INPUT GAIN SELECTION

| MSB | | | | | | | LSB | INPUT GAIN |
|-----|----|----|----|----|----|----|-----|------------|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | 2dB STEPS |
| | | | | 0 | 0 | 0 | 0 | 0dB |
| | | | | 0 | 0 | 0 | 1 | 2dB |
| | | | | 0 | 0 | 1 | 0 | 4dB |
| | | | | 0 | 0 | 1 | 1 | 6dB |
| | | | | 0 | 1 | 0 | 0 | 8dB |
| | | | | 0 | 1 | 0 | 1 | 10dB |
| | | | | 0 | 1 | 1 | 0 | 12dB |
| | | | | 0 | 1 | 1 | 1 | 14dB |
| | | | | 1 | 0 | 0 | 0 | 16dB |
| | | | | 1 | 0 | 0 | 1 | 18dB |
| | | | | 1 | 0 | 1 | 0 | 20dB |
| | | | | 1 | 0 | 1 | 1 | 22dB |
| | | | | 1 | 1 | 0 | 0 | 24dB |
| | | | | 1 | 1 | 0 | 1 | 26dB |
| | | | | 1 | 1 | 1 | 0 | 28dB |
| | | | | 1 | 1 | 1 | 1 | 30dB |

GAIN = 0 to 30dB

Table 11. VOLUME SELECTION

| MSB | | | | | | | LSB | VOLUME |
|-----|----|----|----|----|----|----|-----|-----------|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | 1dB STEPS |
| | | | | | 0 | 0 | 0 | 0dB |
| | | | | | 0 | 0 | 1 | -1dB |
| | | | | | 0 | 1 | 0 | -2dB |
| | | | | | 0 | 1 | 1 | -3dB |
| | | | | | 1 | 0 | 0 | -4dB |
| | | | | | 1 | 0 | 1 | -5dB |
| | | | | | 1 | 1 | 0 | -6dB |
| | | | | | 1 | 1 | 1 | -7dB |
| | 0 | 0 | 0 | 0 | | | | 0dB |
| | 0 | 0 | 0 | 1 | | | | -8dB |
| | 0 | 0 | 1 | 0 | | | | -16dB |
| | 0 | 0 | 1 | 1 | | | | -24dB |
| | 0 | 1 | 0 | 0 | | | | -32dB |
| | 0 | 1 | 0 | 1 | | | | -40dB |
| | X | 1 | 1 | 1 | X | X | X | MUTE |

VOLUME = 0 to 47dB/MUTE

5.3 DATA BYTES (continued)

Table 12. BASS SELECTION

| MSB | | | | | | | LSB | BASS |
|-----|----|----|----|----|----|----|-----|-----------|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | 2dB STEPS |
| | | | | 0 | 0 | 0 | 0 | -14dB |
| | | | | 0 | 0 | 0 | 1 | -12dB |
| | | | | 0 | 0 | 1 | 0 | -10dB |
| | | | | 0 | 0 | 1 | 1 | -8dB |
| | | | | 0 | 1 | 0 | 0 | -6dB |
| | | | | 0 | 1 | 0 | 1 | -4dB |
| | | | | 0 | 1 | 1 | 0 | -2dB |
| | | | | 0 | 1 | 1 | 1 | 0dB |
| | | | | 1 | 1 | 1 | 1 | 0dB |
| | | | | 1 | 1 | 1 | 0 | 2dB |
| | | | | 1 | 1 | 0 | 1 | 4dB |
| | | | | 1 | 1 | 0 | 0 | 6dB |
| | | | | 1 | 0 | 1 | 1 | 8dB |
| | | | | 1 | 0 | 1 | 0 | 10dB |
| | | | | 1 | 0 | 0 | 1 | 12dB |
| | | | | 1 | 0 | 0 | 0 | 14dB |

Table 13. TREBLE SELECTION

| MSB | | | | | | | LSB | TREBLE |
|-----|----|----|----|----|----|----|-----|-----------|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | 2dB STEPS |
| | | | | 0 | 0 | 0 | 0 | -14dB |
| | | | | 0 | 0 | 0 | 1 | -12dB |
| | | | | 0 | 0 | 1 | 0 | -10dB |
| | | | | 0 | 0 | 1 | 1 | -8dB |
| | | | | 0 | 1 | 0 | 0 | -6dB |
| | | | | 0 | 1 | 0 | 1 | -4dB |
| | | | | 0 | 1 | 1 | 0 | -2dB |
| | | | | 0 | 1 | 1 | 1 | 0dB |
| | | | | 1 | 1 | 1 | 1 | 0dB |
| | | | | 1 | 1 | 1 | 0 | 2dB |
| | | | | 1 | 1 | 0 | 1 | 4dB |
| | | | | 1 | 1 | 0 | 0 | 6dB |
| | | | | 1 | 0 | 1 | 1 | 8dB |
| | | | | 1 | 0 | 1 | 0 | 10dB |
| | | | | 1 | 0 | 0 | 1 | 12dB |
| | | | | 1 | 0 | 0 | 0 | 14dB |

5.3 DATA BYTES (continued)

Table 14. SPEAKER ATTENUATE SELECTION

| MSB | | | | | | | LSB | SPEAKER ATTENUATION |
|-----|----|----|----|----|----|----|-----|---------------------|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | 1dB |
| | | | | | 0 | 0 | 0 | 0dB |
| | | | | | 0 | 0 | 1 | -1dB |
| | | | | | 0 | 1 | 0 | -2dB |
| | | | | | 0 | 1 | 1 | -3dB |
| | | | | | 1 | 0 | 0 | -4dB |
| | | | | | 1 | 0 | 1 | -5dB |
| | | | | | 1 | 1 | 0 | -6dB |
| | | | | | 1 | 1 | 1 | -7dB |
| | | | | | | | | |
| | | | | | | | | |
| | 0 | 0 | 0 | 0 | | | | 0dB |
| | 0 | 0 | 0 | 1 | | | | -8dB |
| | 0 | 0 | 1 | 0 | | | | -16dB |
| | 0 | 0 | 1 | 1 | | | | -24dB |
| | 0 | 1 | 0 | 0 | | | | -32dB |
| | 0 | 1 | 0 | 1 | | | | -40dB |
| | 0 | 1 | 1 | 0 | | | | -48dB |
| | 0 | 1 | 1 | 1 | | | | -56dB |
| | 1 | 0 | 0 | 0 | | | | -64dB |
| | 1 | 0 | 0 | 1 | | | | -72dB |
| | 1 | 1 | 1 | 1 | X | X | X | MUTE |

Figure 14. PINS: 23

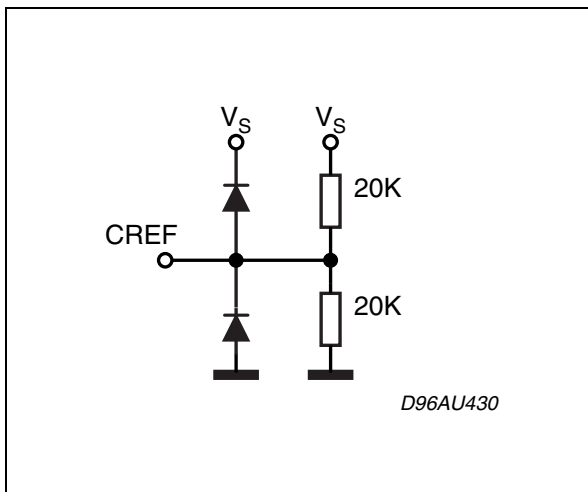


Figure 17. PINS: 8, 10

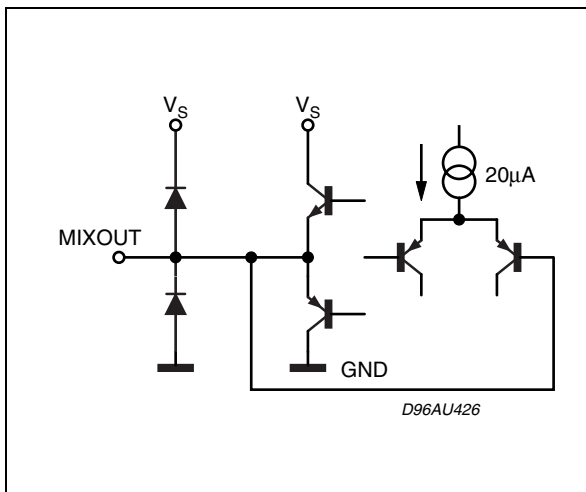


Figure 15. PINS: 26, 27

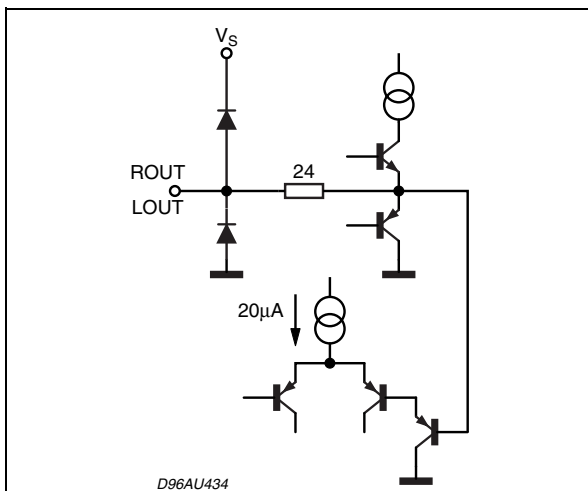


Figure 18. PINS: 19, 11

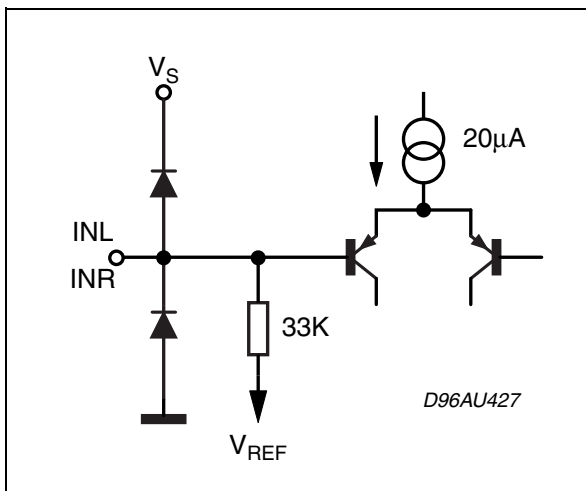


Figure 16. PINS: 1, 2, 3, 4, 5, 6, 7, 28

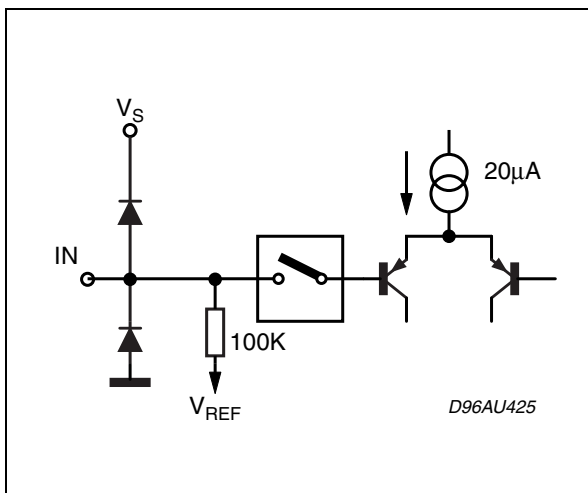


Figure 19. PINS: 12, 14

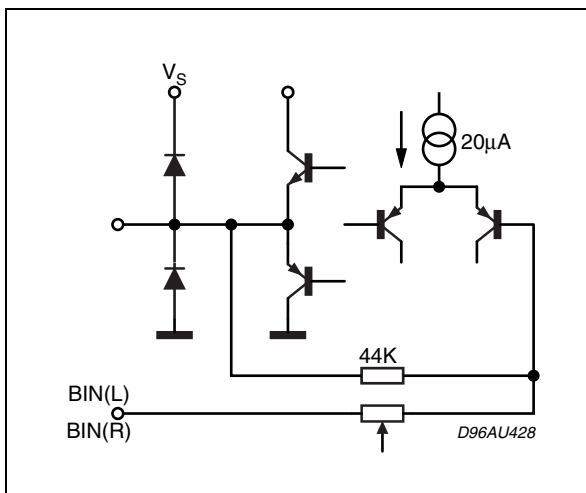


Figure 20. PINS: 13, 15

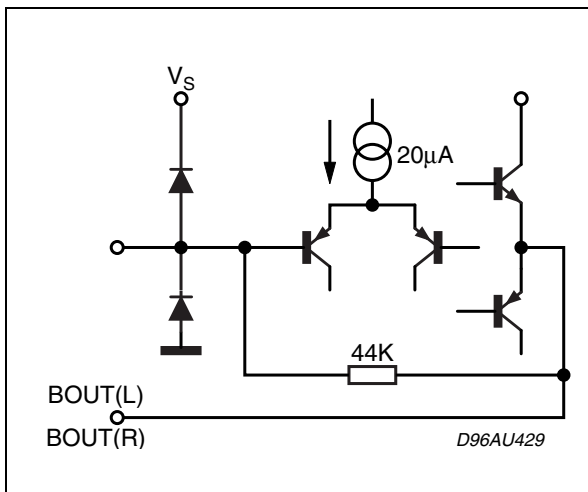


Figure 22. PIN: 20

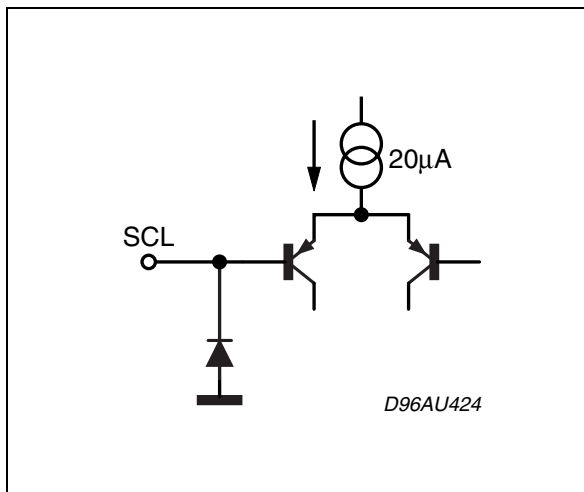


Figure 21. PINS: 18, 19

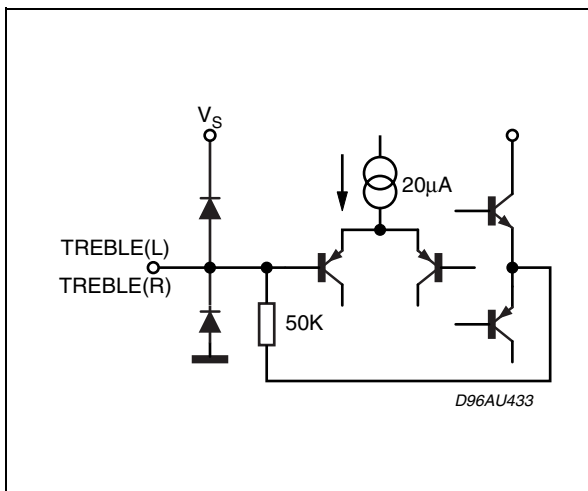
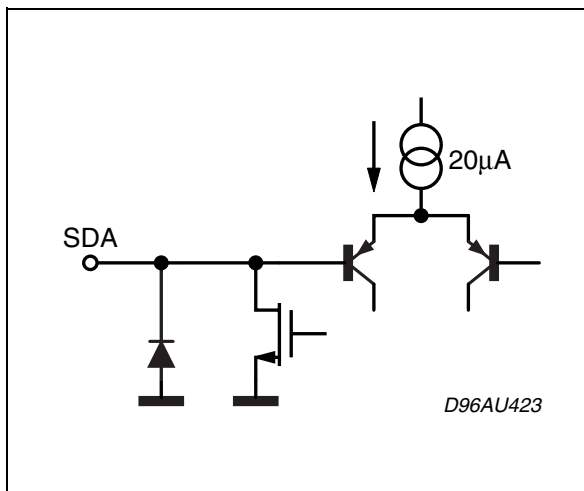


Figure 23. PIN 21



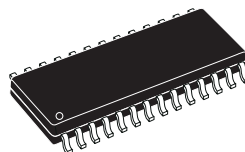
6 PACKAGE MECHANICAL DATA

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

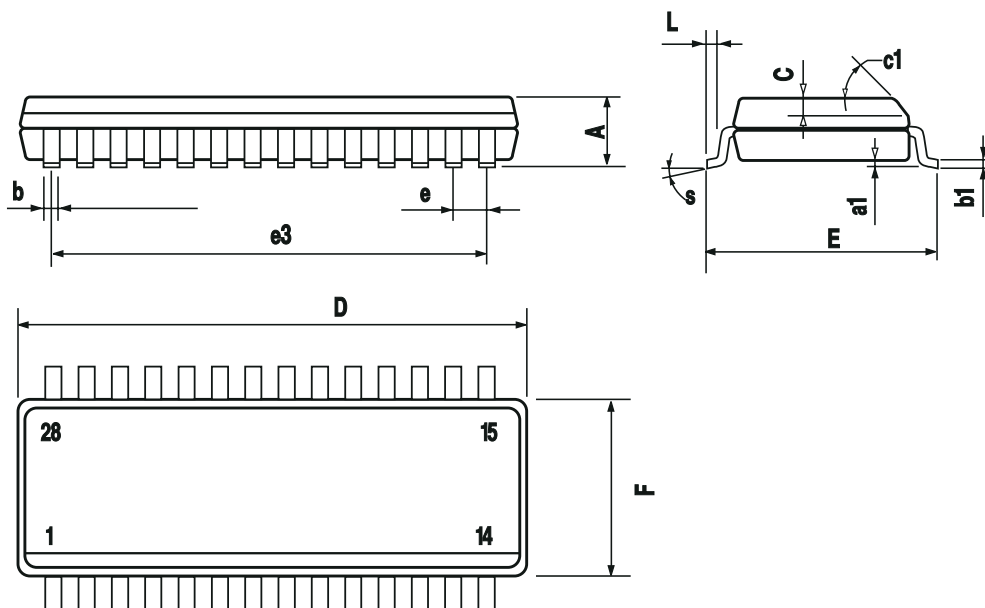
Figure 24. SO-28 Mechanical Data & Package Dimensions

| DIM. | mm | | | inch | | |
|------|------------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 2.65 | | | 0.104 |
| a1 | 0.1 | | 0.3 | 0.004 | | 0.012 |
| b | 0.35 | | 0.49 | 0.014 | | 0.019 |
| b1 | 0.23 | | 0.32 | 0.009 | | 0.013 |
| C | | 0.5 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D | 17.7 | | 18.1 | 0.697 | | 0.713 |
| E | 10 | | 10.65 | 0.394 | | 0.419 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 16.51 | | | 0.65 | |
| F | 7.4 | | 7.6 | 0.291 | | 0.299 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| S | 8° (max.) | | | | | |

OUTLINE AND MECHANICAL DATA



SO-28



7 REVISION HISTORY

Table 15. Revision History

| Date | Revision | Description of Changes |
|--------------|----------|---|
| January 2004 | 2 | First Issue |
| June 2004 | 3 | Modified the style-sheet in compliance with the last revision of the "Corporate Technical Publications Design Guide". |
| 30-Apr-2010 | 4 | Updated title and added environmental compliance statement for package |

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