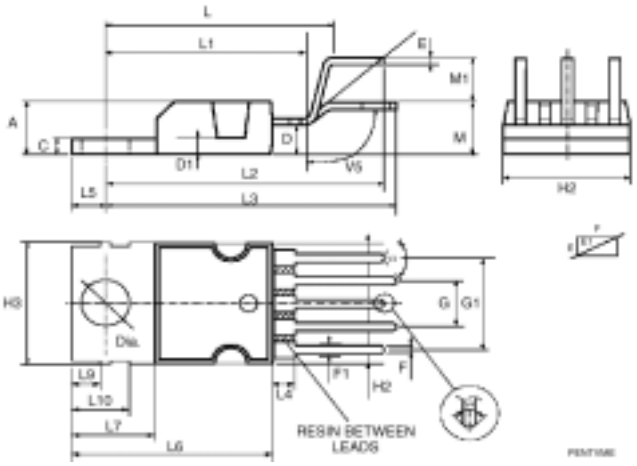
# 10W CAR RADIO AUDIO AMPLIFIER TDA2003

## GENERAL DESCRIPTION

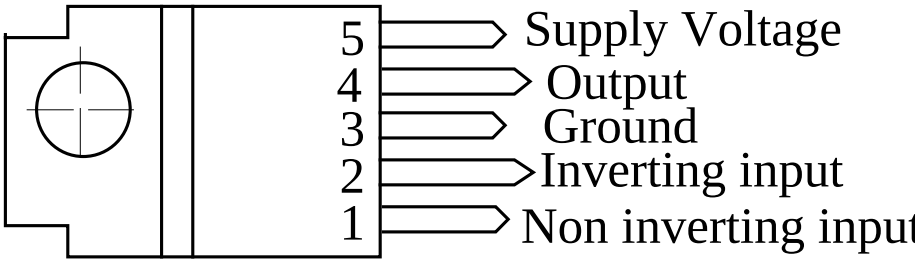
The TDA2003 is suitable for use as audio amplifier in cassette tape player.The device provides a high output current capacity (up to 3.5A) very low harmonic and crossover distortion. Completely safe operation is guaranteed due to protection against DC and AC short circuit between all pins and ground, thermal over-range, load dump voltage surge up to 40V and fortuitous open ground.



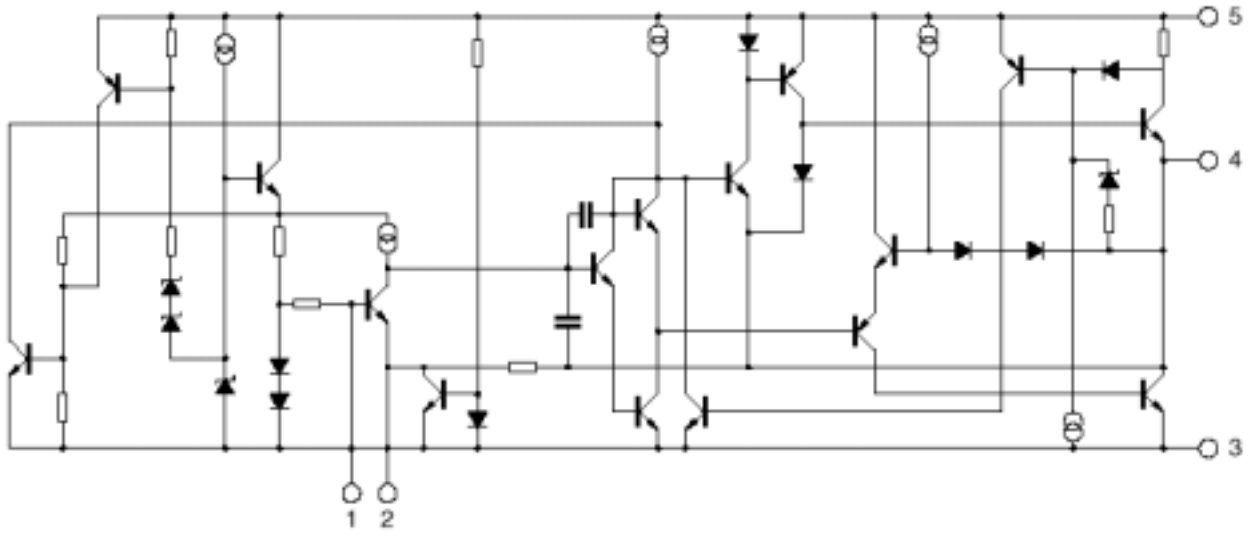

## ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| CHARACTERISTICS | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| Peak Supply Voltage | Vs | 40 | V |
| DC Supply Voltage | Vs | 28 | V |
| Operating Supply Voltage | Vs | 18 | V |
| Output peak current (repetitive) | Io | 3.5 | A |
| Output peak current (non repetitive) | Io | 4.5 | A |
| Power Dissipation at Tcase=90°C | Ptot | 20 | W |
| Storage Temperature | Tstg | -40~+150 | °C |
| Junction Temperature | Tj | -40~+150 | °C |

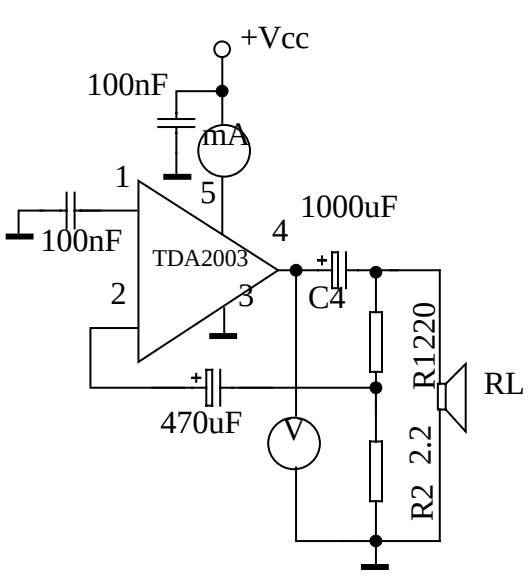
## PIN CONNECTION



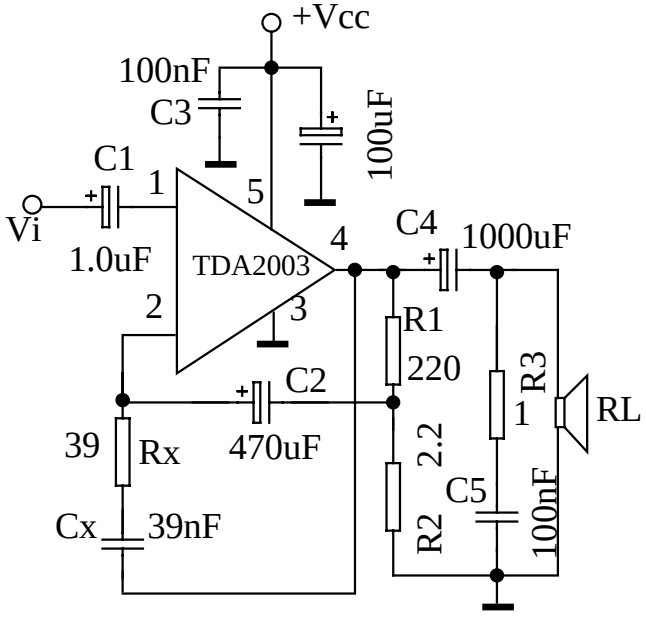
## SCHEMATIC DIAGRAM




## TEST CIRCUIT




DC Test Circuit



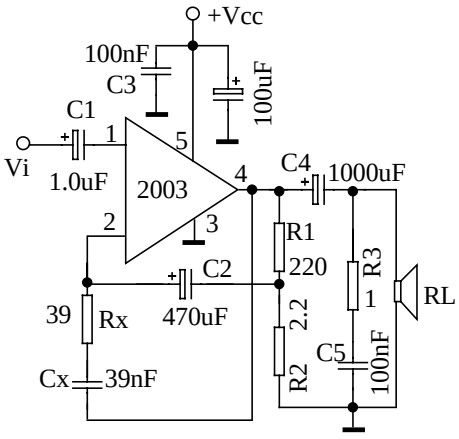

Rx=20*R2 Cx=1/(2πB*R1)

AC Test Circuit

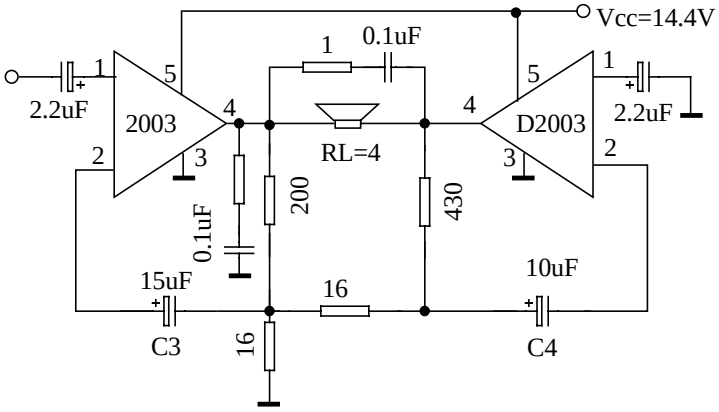
**ELECTRICAL CHARACTERISTICS (**Refer to the test circuit ,Vcc=±16V,Ta=25°C)

| Characteristics | Symbol | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| DC Characteristics | | | | | | | |
| Supply Voltage | Vcc | | | 8 | | 18 | V |
| Quiescent Output Voltage | Vo | | | 6.1 | 6.9 | 7.7 | V |
| Quiescent Drain Current | Id | | | | 40 | 55 | mA |
| AC Characteristics | | | | | | | |
| Output Power | Po | THD=10%, f=1kHz | $R_L$=8Ω | 5.5 | 6 | | W |
| | | | $R_L$=2Ω | 9 | 10 | | |
| | | | $R_L$=3.2Ω | | 7.5 | | |
| | | | $R_L$=1.6Ω | | 12 | | |
| Input Sensitivity | Vi | f=1kHz | Po=0.5W, $R_L$=4Ω | | 14 | | mV |
| | | | Po=6W, $R_L$=4Ω | | 55 | | |
| | | | Po=0.5W, $R_L$=2Ω | | 10 | | |
| | | | Po=10W, $R_L$=2Ω | | 50 | | |
| Input Saturation Voltage | Vi(rms) | | | | 300 | | mV |
| Frequency response(-3dB) | B | Po=1W, $R_L$=4Ω | | 40 | | 15000 | Hz |
| Distortion | THD | f=1kHz | Po=0.05W to 4.5W, $R_L$=4Ω | | 0.15 | | % |
| | | | Po=0.05W to 7.5W, $R_L$=2Ω | | 0.15 | | |
| Input Resistance (pin 1) | Ri | Open Loop f=1kHz | | 70 | 150 | | kΩ |
| Input Noise Current | $e_N$ | | | | 60 | 200 | pA |
| Input Noise Voltage | $I_N$ | | | | 1 | 5 | μV |
| Open Loop Voltage Gain | Gvo | f=1kHz | | | 80 | | dB |
| | | f=10kHz | | | 60 | | |
| Closed Loop Voltage Gain | Gvc | f=1kHz, $R_L$=2Ω | | 39.3 | 40 | 40.3 | dB |
| Efficiency | η | f=1kHz | Po=6W, $R_L$=4Ω | | 69 | | % |
| | | | Po=10W, $R_L$=2Ω | | 65 | | |
| Supply Voltage Rejection | SVR | Vripple=0.5V,f=100Hz, Rg=10kΩ, $R_L$=4Ω | | 30 | 36 | | dB |

## APPLICATION CIRCUIT

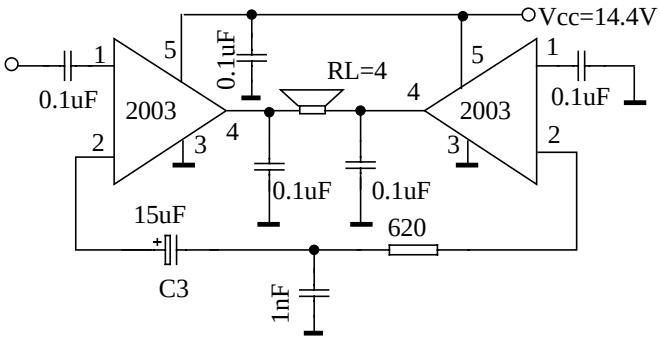



Typical application circuit




20W Bridge configuration application

The Value of the capacitors C3 and C4 are different to optimize the SVR (Typ. 40dB)




Low cost bridge configuration application circuit (Po=18W)

## BUILT-IN PROTECTION SYSTEMS

Load dump voltage surge

The TDA2003 has a circuit which enables it to withstand a voltage pulse train, on pin 5, of the type shown in Fig. 2. If the supply voltage peaks to more than 40V, then an LC filter must be inserted between the supply and pin 5, in order to assure that the pulses at pin 5 will be head within the limits shown in Fig.1.

A suggested LC network is shown in Fig.2.With this network, a train of pulses with amplitude up to 120V and width of 2ms can be applied at point A. This type of protection is ON when the supply voltage (pulsed or DC) exceeds 18V.For this reason the maximum operating supply voltage is 18V.

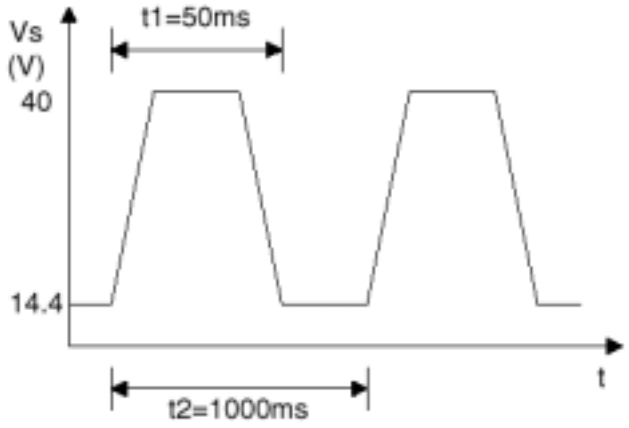



Figure 1

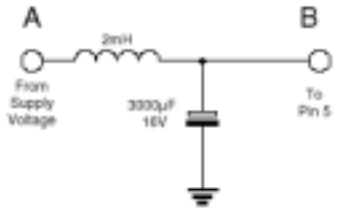



Figure 2

### Short Circuit (AC and DC Conditions )

The TDA2003 can withstand a permanent short-circuit on the output for a supply voltage up to 16V.

### Polarity inversion

High current (up to 5A) can be handled by the device with no damage for a longer period than the blow-out time of a quick 1A fuse(normally connected in series with the supply).
The feature is added to avoid destruction if, during fitting to the car, a mistake on connection of the supply is made.

### Open ground

When the radio is in the ON condition and the ground is accidentally opened, a standard audio amplifier will be damaged. On the TDA2003 protection diodes are included to avoid any damage.

### Inductive load

A protection diode is provide between pin 4 and pin 5(see the internal schematic diagram) to allow use of the TDA2003 with inductive loads. In particular, the TDA2003 can drive a coupling transformer for audio modulation.

### DC voltage

The maximum operating DC voltage on the TDA2003 is 18V.

However the device can withstand a DC voltage up to 28V with no damage. This could occur during winter if two batteries were series connected to crank the engine.

### Thermal shut-down

The presence of a thermal limiting circuit offers the following advantages:

(1).an overload on the output (even if it is permanent),or an excessive ambient temperature can be easily withstood.

(2).the heat-sink can have a smaller factor compared with that of a conventional circuit.

There is no device damage in case of excessive junction temperature: all that happens is that Po( and there Ptot) and Id are reduced.

## APPLICATION SUGGESTION

The recommended values of the components are those shown on application circuit of Typical application circuit. Different values can be used .the following table can help the designer.

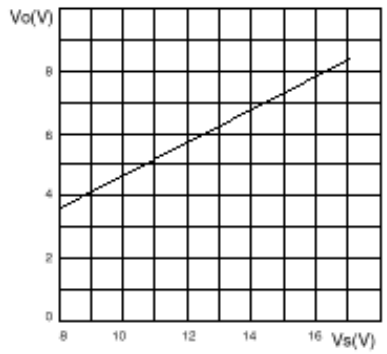
| Component | Recommended Value | Purpose | Smaller than recommended Value | Large than recommended Value |
|---|---|---|---|---|
| R1 | (Gv-1)*R2 | Gain setting | | Increase of gain |
| R2 | 2.2Ω | Gain and SVR setting | Decrease of SVR | |
| R3 | 1Ω | Frequency stability | Danger of Oscillation at high frequency with inductive loads. | |
| Rx | =20*R2 | Upper frequency cut off | Poor high frequencies attenuation | Danger of oscillation |
| C1 | 2.2μF | Input DC decoupling | | Noise at switch-on switch-off |
| C2 | 470μF | Ripple rejection | | Decrease of SVR |
| C3 | 0.1μF | Supply voltage by pass | | Danger of oscillation |
| C4 | 1000μF | Supply voltage by pass | | Higher low frequency cut off |

(Continue)

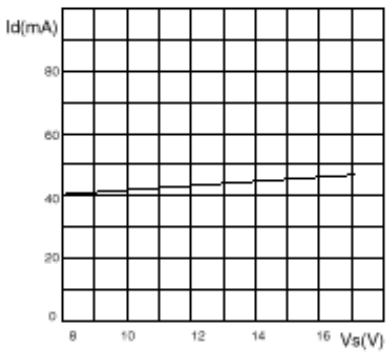
| Component | Recommended Value | Purpose | Large than recommended Value | Large than recommended Value |
|---|---|---|---|---|
| C5 | 0.1µF | Frequency stability | | Danger of Oscillation at high frequencies with inductive loads |
| Cx | ≈1/(2π*B*R1) | Upper frequency cut off | Small bandwidth | Large bandwidth |

## CHARACTERISTICS CURVES

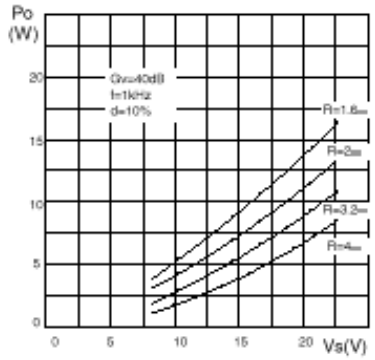
Quiescent Output Voltage Vs. Supply Voltage



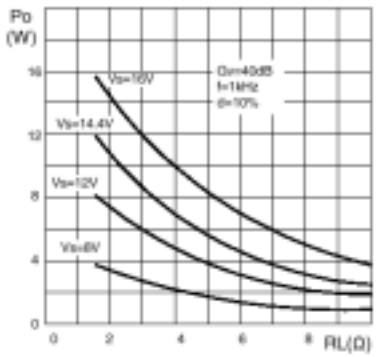

Quiescent drain current Vs. Supply voltage



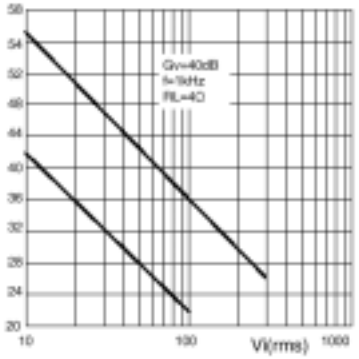

Output power Vs. Supply Voltage



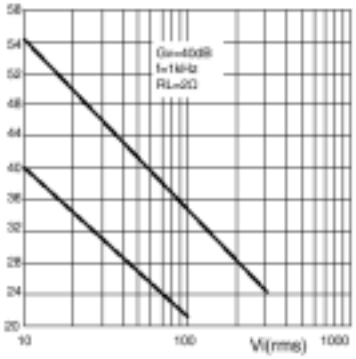

Output Power Vs. Load resistance



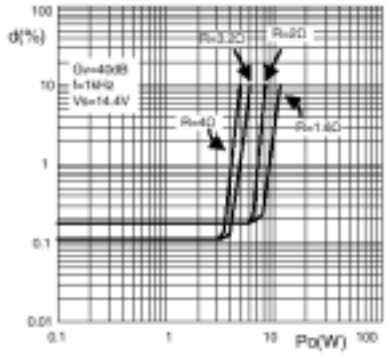

Gain Vs. Input sensitivity



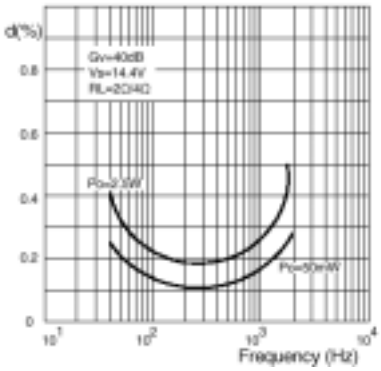

Gain Vs. Input Sensitivity



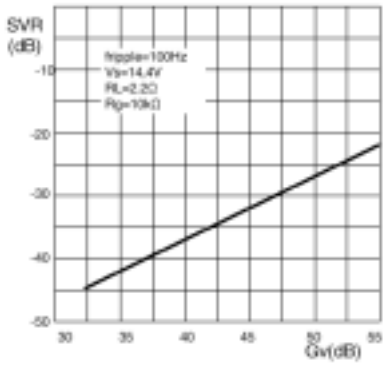
Distortion Vs. Output power



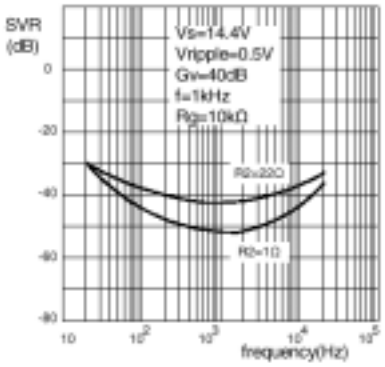

Distortion Vs. Frequency



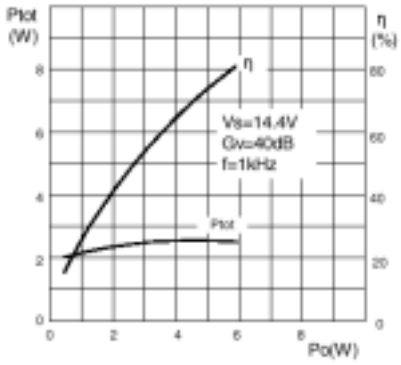

Supply voltage rejection Vs. voltage gain



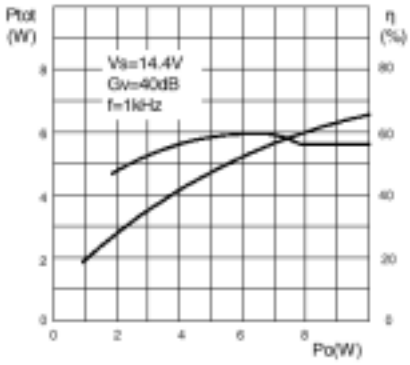

Supply voltage rejection Vs. frequency



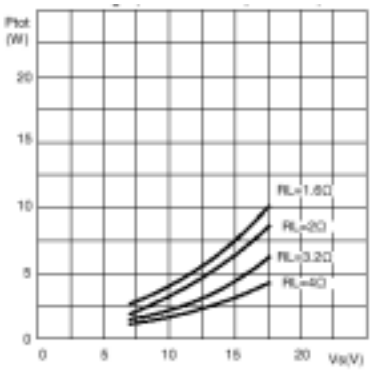

Power Dissipation and efficiency Vs. Output Power (Rl=4Ω)



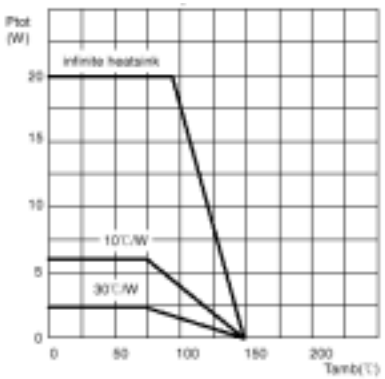

Power Dissipation and efficiency Vs. Output Power (Rl=2Ω)




Maximum power dissipation and supply voltage (sine wave operation)




Maximum allowable dissipation and ambient temperature




Typical values of capacitor (Cx) for different values of frequency response