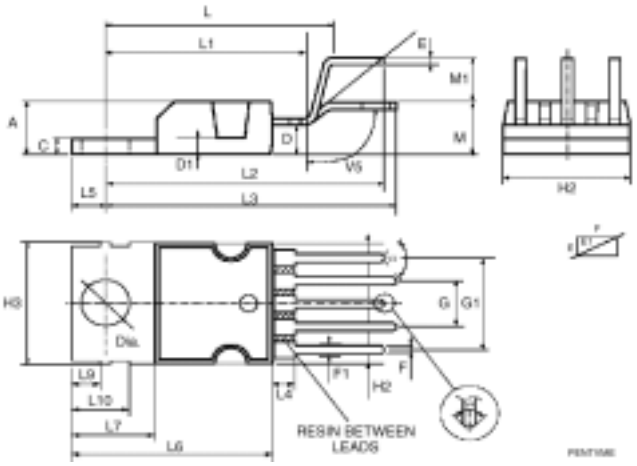
10W CAR RADIO AUDIO AMPLIFIER TDA2003

GENERAL DESCRIPTION

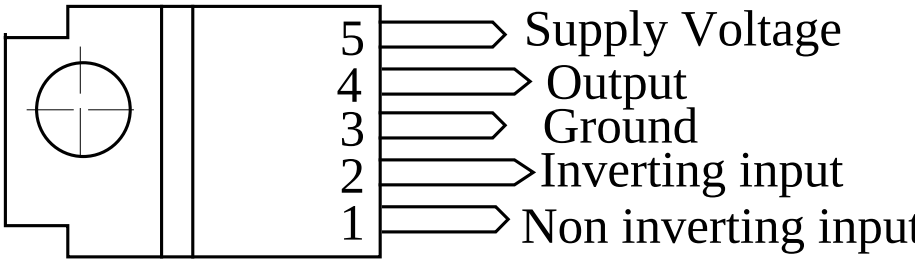
The TDA2003 is suitable for use as audio amplifier in cassette tape player.The device provides a high output current capacity (up to 3.5A) very low harmonic and crossover distortion. Completely safe operation is guaranteed due to protection against DC and AC short circuit between all pins and ground,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



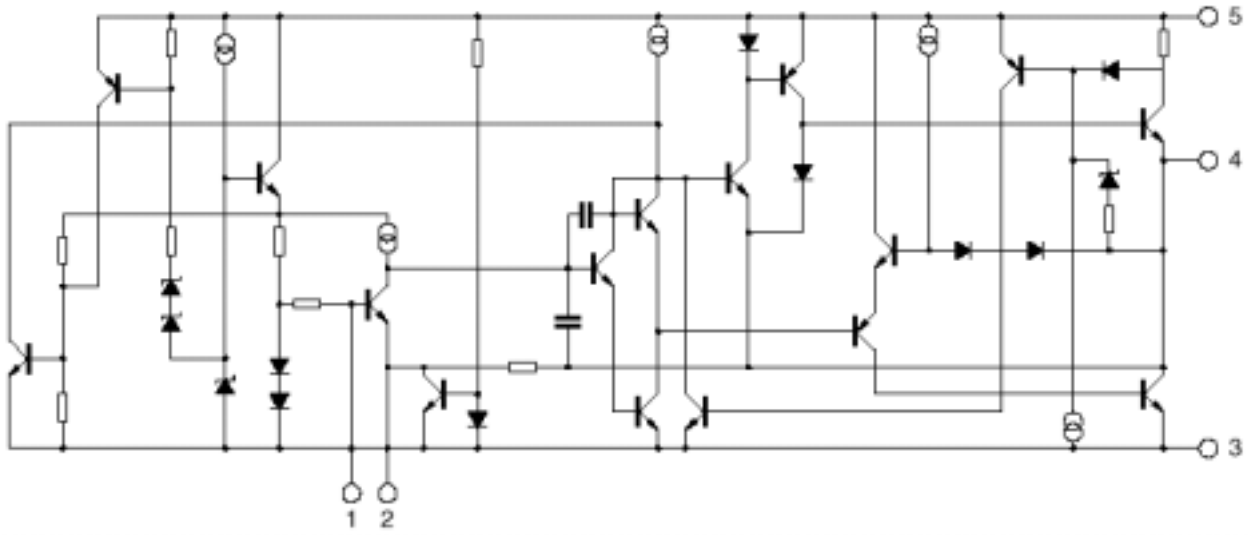
ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

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

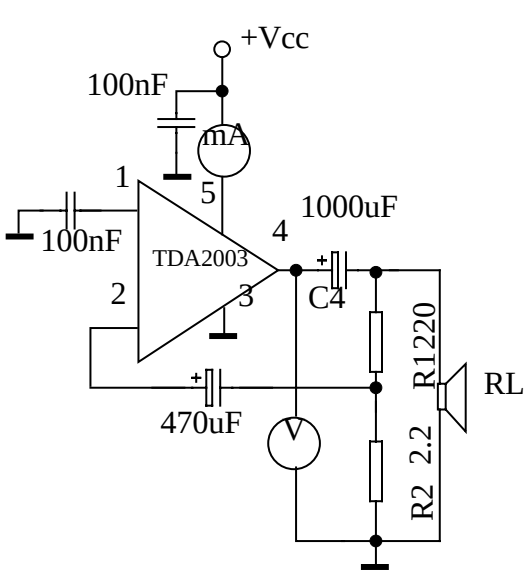
PIN CONNECTION



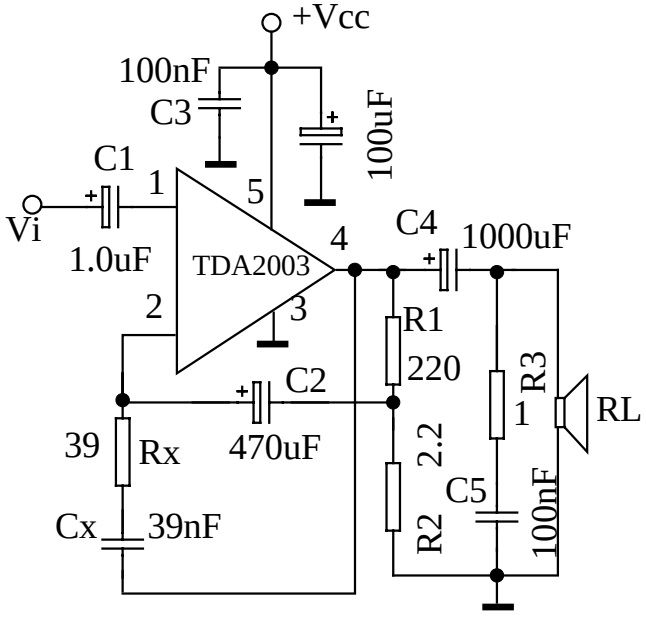
SCHEMATIC DIAGRAM



TEST CIRCUIT



DC Test Circuit



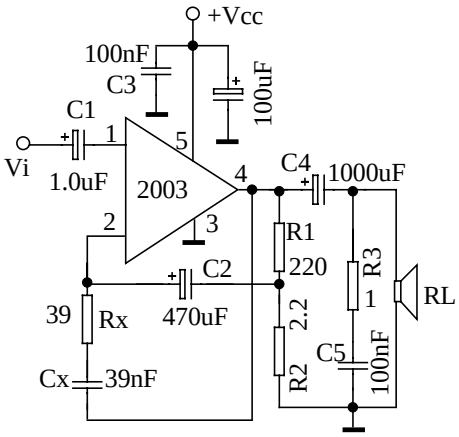
Rx=20*R2 Cx=1/(2πB*R1)

AC Test Circuit

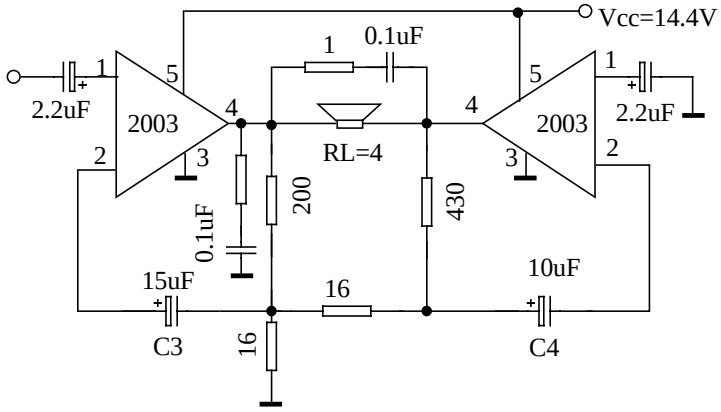
ELECTRICAL CHARACTERISTICS (Refer to the test circuit ,Vcc=±16V,Ta=25°C)

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

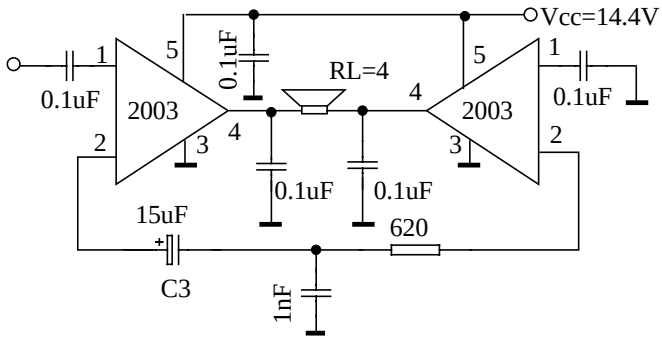


Typical application circuit



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.

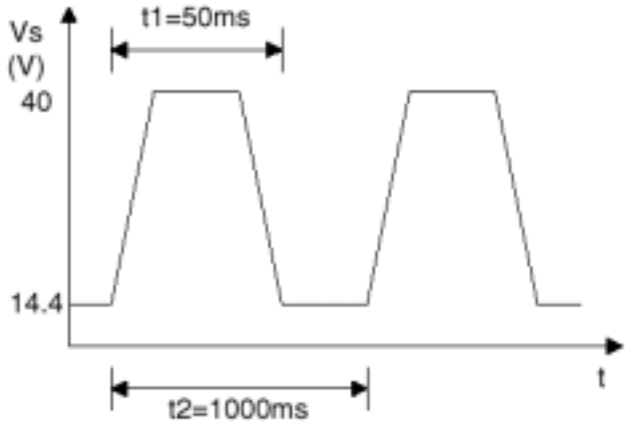


Figure 1

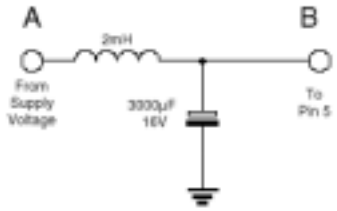


Figure 2

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.

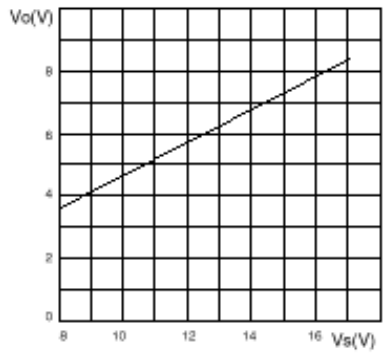
Component	Recommended Value	Purpose	Smaller than recommended Value	Large than recommended Value
R1	(Gv-1)*R2	Gain setting		Increase of gain
R2	2.2Ω	Gain and SVR setting	Decrease of SVR	
R3	1Ω	Frequency stability	Danger of Oscillation at high frequency with inductive loads.	
Rx	=20*R2	Upper frequency 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)

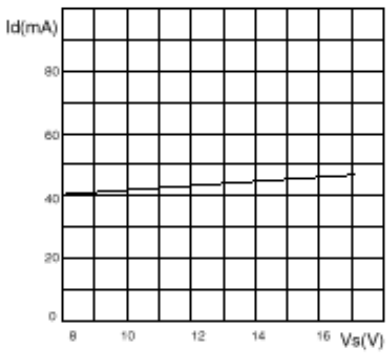
Component	Recommended Value	Purpose	Large than recommended Value	Large than recommended Value
C5	0.1µF	Frequency stability		Danger of Oscillation at high frequencies with inductive loads
Cx	≈1/(2π*B*R1)	Upper frequency cut off	Small bandwidth	Large bandwidth

CHARACTERISTICS CURVES

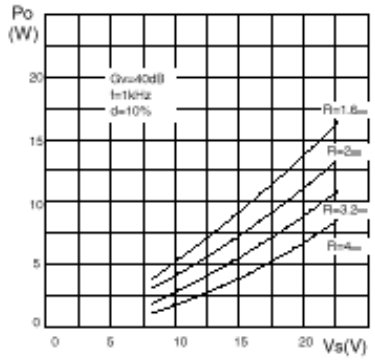
Quiescent Output Voltage Vs. Supply Voltage



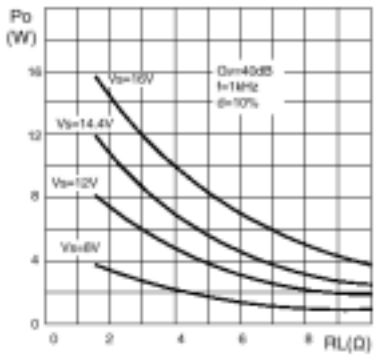
Quiescent drain current Vs. Supply voltage



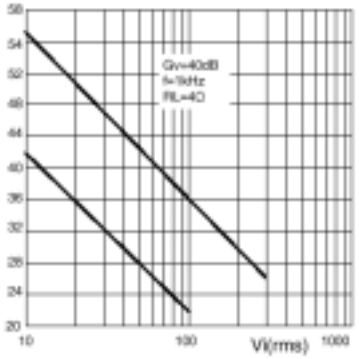
Output power Vs. Supply Voltage



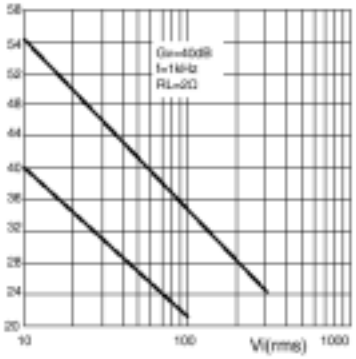
Output Power Vs. Load resistance



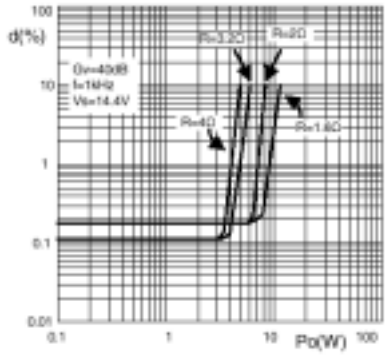
Gain Vs. Input sensitivity



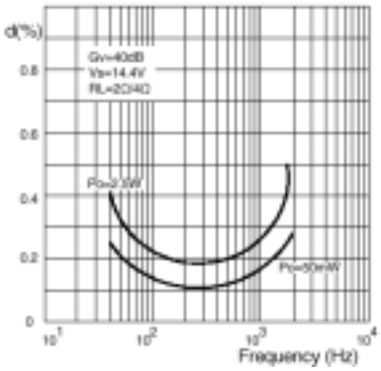
Gain Vs. Input Sensitivity



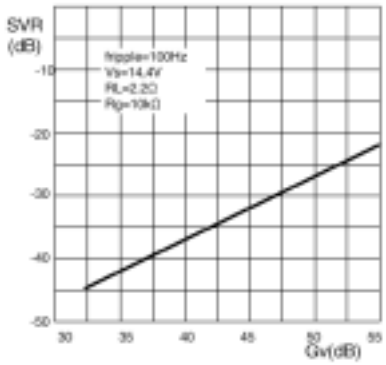
Distortion Vs. Output power



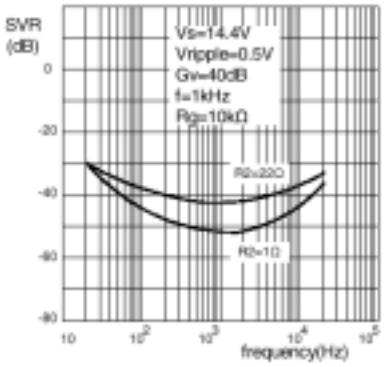
Distortion Vs. Frequency



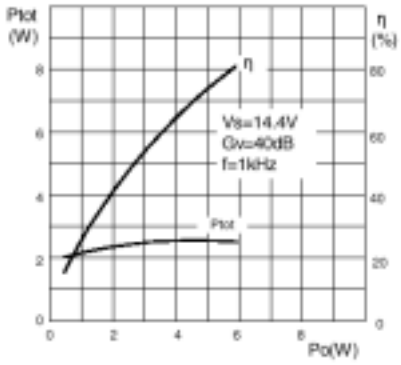
Supply voltage rejection Vs. voltage gain



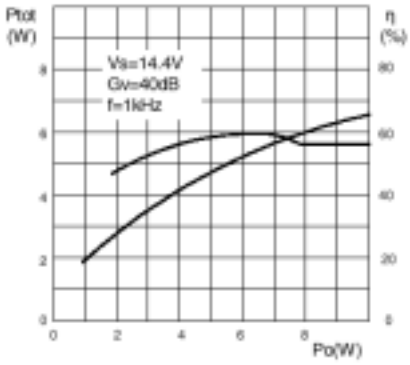
Supply voltage rejection Vs. frequency



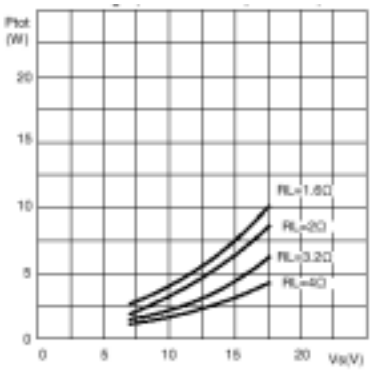
Power Dissipation and efficiency Vs. Output Power (Rl=4Ω)



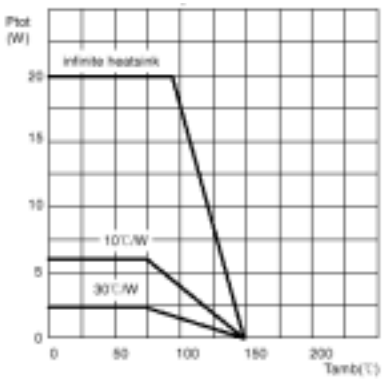
Power Dissipation and efficiency Vs. Output Power (Rl=2Ω)



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