

Data sheet	
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# TDA1551Q

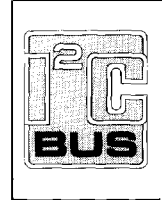
## 2 x 22 W BTL car radio power amplifier with diagnostic facility

### FEATURES

- Requires very few external components
- Flexible in use – quad, single ended or stereo BTL
- I<sup>2</sup>C-bus control
- Dynamic distortion detector
- Thermal protection
- Output status information
- Power supply dip detection
- High output power
- MUTE/sleep mode by writing to I<sup>2</sup>C-bus
- Stand-by mode
- Fixed gain
- Good ripple rejection
- Load dump protection
- AC/DC short circuit safe to ground and V<sub>P</sub>
- Reverse polarity safe
- Low offset voltage at output
- Capable of handling high energy at outputs (V<sub>P</sub> = 0 V)
- Electrostatic discharge protection
- No switch-ON/switch-OFF plop
- Flexible leads
- Low thermal resistance
- Identical inputs (inverting and non-inverting).

### DESCRIPTION

The TDA1551Q is an integrated class-B output amplifier encased in a 17-lead single-in-line plastic power package. The device contains 4 x 11 W single-ended (SE) or 2 x 22 W BTL amplifiers and is intended for use in car radio applications.



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V <sub>P</sub>	supply voltage range	operating	6	14.4	18	V
V <sub>P</sub>	supply voltage	non-operating	-	-	30	V
I <sub>P</sub>	total quiescent current		-	80	160	mA
<b>Quad single-ended application</b>						
P <sub>o</sub>	output power	R <sub>L</sub> = 4 Ω; THD = 10 %	-	6	-	W
		R <sub>L</sub> = 2 Ω; THD = 10 %	-	11	-	W
V <sub>no</sub>	output voltage noise	R <sub>S</sub> = 0 Ω	-	50	-	μV
<b>Stereo BTL application</b>						
P <sub>o</sub>	output power	R <sub>L</sub> = 4 Ω; THD = 10 %	-	22	-	W
V <sub>no</sub>	output voltage noise	R <sub>S</sub> = 0 Ω	-	70	-	μV
ΔV <sub>o</sub>	DC output offset voltage		-	-	100	mV

### ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA1551Q	17	SIL bent to DIL	plastic	SOT243R

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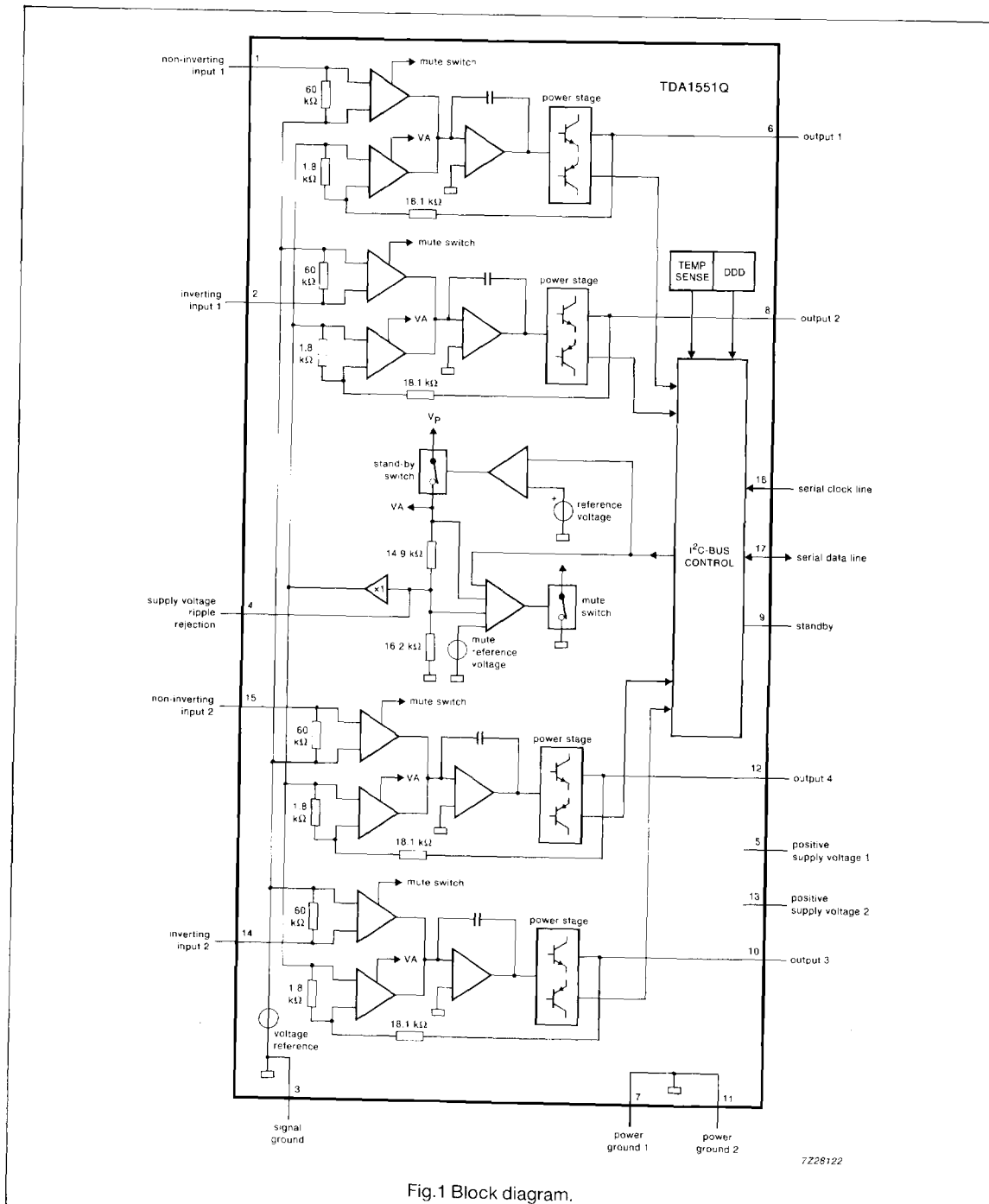


Fig.1 Block diagram.

## 2 x 22 W BTL car radio power amplifier with diagnostic facility

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### DC CHARACTERISTICS

$V_P = 14.4\text{ V}$ ;  $T_{\text{amb}} = 25^\circ\text{C}$ ; measurements in accordance with Fig.6 unless otherwise stated.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Supply</b>						
$V_P$	supply voltage	note 1	6	14.4	18	V
$I_P$	quiescent current		-	80	160	mA
$V_O$	DC output voltage	note 2	-	6.9	-	V
$ \Delta V_O $	DC output offset voltage		-	-	100	mV
<b>MUTE/sleep/standby</b>						
$V_O$	output signal in MUTE position	$V_{I(\text{max})} = 1\text{ V}$ ; $f = 20\text{ Hz to }10\text{ kHz}$	-	-	2	mV
$I_P$	DC current in sleep condition	$V_9 > 3\text{ V}$	-	0.6	1	mA
$I_P$	DC current in standby condition	$V_9 < 2\text{ V}$	-	-	0.1	mA
$ \Delta V_O $	DC output offset voltage		-	-	100	mV

### AC CHARACTERISTICS

$V_P = 14.4\text{ V}$ ;  $T_{\text{amb}} = 25^\circ\text{C}$ ;  $f = 1\text{ kHz}$ ;  $R_L = 4\ \Omega$ ; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Stereo BTL application (Fig.7)</b>						
$P_O$	output power	THD = 0.5% THD = 10%	15 20	17 22	- -	W W
$P_O$	output power	$V_P = 13.2\text{ V}$ THD = 0.5% THD = 10%	- -	12 17	- -	W W
THD	total harmonic distortion	$P_O = 1\text{ W}$	-	0.05	-	%
B	power bandwidth	THD = 0.5%; $P_O = -1\text{ dB}$ with respect to 15 W	-	20 - 15000	-	Hz
$f_{\text{LOW}}$	low frequency roll-off	at -3 dB; note 3	-	25	-	Hz
$f_{\text{HIGH}}$	high frequency roll-off	at -1 dB	20	-	-	kHz
$G_V$	closed loop voltage gain		25	26	27	dB
$V_{\text{PRR}}$	supply voltage ripple rejection	ON; note 4 MUTE; note 4 standby; note 4	48 48 80	- - -	- - -	dB dB dB
$ Z_i $	input impedance		25	30	38	k $\Omega$
$V_{\text{no}}$	noise output voltage	ON; $R_S = 0$ ; note 5 ON; $R_S = 10\text{ k}\Omega$ ; note 5 MUTE; notes 5 and 6	- - -	70 100 60	- 200 -	$\mu\text{V}$ $\mu\text{V}$ $\mu\text{V}$
$\alpha$	channel separation	$R_S = 10\text{ k}\Omega$	40	-	-	dB
$ \Delta G_V $	channel unbalance		-	-	1	dB
	dynamic distortion detector switch level		-	3.5	-	%

## 2 x 22 W BTL car radio power amplifier with diagnostic facility

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### FUNCTIONAL DESCRIPTION

The TDA1551Q contains four identical amplifiers with differential input stages (two inverting and two non-inverting) which can be used in SE or BTL applications. The gain of each amplifier is fixed at 20 dB for SE and 26 dB for BTL. The device also contains an I<sup>2</sup>C-bus facility which operates in the read or write mode.

In the **write** mode the device can be switched to either the sleep condition (low sleep current of 0.6 mA typ.), the MUTE condition or the ON condition.

In the **read** mode an 8-bit status word is available. Data bits D0 to D3 contain status information of each of the 4 outputs. If the device is switched to the ON or MUTE condition and there is a short-circuit at one or more outputs, the power transistors will be outside their safe operating area consequently one or more bits of D0 to D3 will be HIGH. Bits D0 to D3 are LOW when in the normal safe operating area. Bit D4 is normally LOW, if one or more channels reaches the clipping level D4 will go HIGH. Bit D5 is normally LOW, if the crystal temperature reaches 150 °C D5 will go HIGH. After a power-on reset bit 7 will go HIGH and a dip in the power supply will be noticed. Bit 7 will go LOW after the I<sup>2</sup>C-bus is read. When pin 9 is LOW the device will switch OFF and the supply current will be reduced to 0.1 mA (max.).

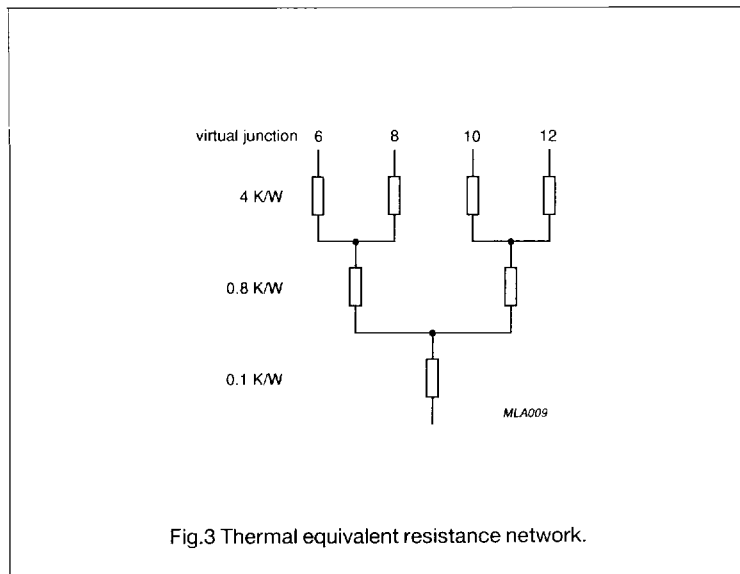
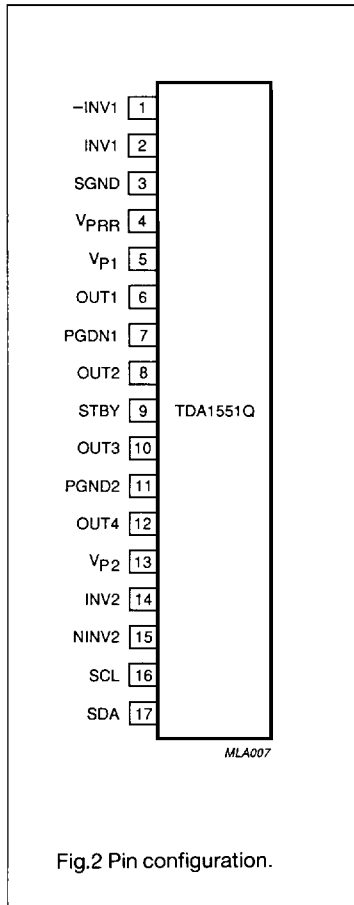


Fig.3 Thermal equivalent resistance network.

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#### PIN CONFIGURATION



#### PINNING

SYMBOL	PIN	DESCRIPTION
-INV1	1	non-inverting input 1
INV1	2	inverting input 1
GND	3	signal ground
VPRR	4	supply voltage ripple rejection
V <sub>p1</sub>	5	positive supply voltage 1
OUT1	6	output 1
GND1	7	power ground 1
OUT2	8	output 2
SB	9	standby
OUT3	10	output 3
GND2	11	power ground 2
OUT4	12	output 4
V <sub>p2</sub>	13	positive supply voltage 2
INV2	14	inverting input 2
-INV2	15	non-inverting input 2
SCL	16	serial clock line
SDA	17	serial data line

#### LIMITING VALUES

In accordance with the Absolute Maximum System (IEC134)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
<b>Supply voltage</b>				
V <sub>p</sub>	operating voltage	-	18	V
V <sub>p</sub>	non-operating voltage	-	30	V
	load dump protect	-	45	V
IOSM	non-repetitive peak output current	-	6	A
IORM	repetitive peak output current	-	4	A
T <sub>stg</sub>	storage temperature range	-55	150	°C
T <sub>c</sub>	crystal temperature	-	150	°C
V <sub>Psc</sub>	AC/DC short-circuit safe voltage	-	18	V
	energy handling capability at outputs (V <sub>p</sub> = 0)	-	200	mJ
V <sub>Pr</sub>	reverse polarity	-	6	V
P <sub>tot</sub>	total power dissipation	-	60	W

#### THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
R <sub>th j-c</sub>	from junction to case (Fig.3)	1.5 K/W
R <sub>th j-a</sub>	from junction to ambient in free air	40 K/W

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### AC CHARACTERISTICS (continued)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Quad single-ended application (Fig.6)</b>						
P <sub>O</sub>	output power	THD = 0.5%; note 7	4	5	-	W
		THD = 10%; note 7	5.5	6	-	W
P <sub>O</sub>	output power	R <sub>L</sub> = 2 Ω	7.5	8.5	-	W
		THD = 0.5%; note 7 THD = 10%; note 7	10	11	-	W
THD	total harmonic distortion	P <sub>O</sub> = 1 W	-	0.05	-	%
f <sub>LOW</sub>	low frequency roll-off	at -3 dB; note 3	-	25	-	Hz
f <sub>HIGH</sub>	high frequency roll-off	at -1 dB	20	-	-	kHz
G <sub>v</sub>	closed loop voltage gain		19	20	21	dB
V <sub>PRR</sub>	supply voltage ripple rejection	ON; note 4	48	-	-	dB
		MUTE; note 4	48	-	-	dB
		stand-by; note 4	80	-	-	dB
Z <sub>i</sub>	input impedance		50	60	75	kΩ
V <sub>no</sub>	noise output voltage	ON; R <sub>S</sub> = 0; note 5	-	50	-	μV
		ON; R <sub>S</sub> = 10 kΩ; note 5	-	70	100	μV
		MUTE; notes 5 and 6	-	60	-	μV
α	channel separation	R <sub>S</sub> = 10 kΩ	40	-	-	dB
ΔG <sub>v</sub>	channel unbalance		-	-	1	dB
	dynamic distortion detector switch level		-	3.5	-	%
<b>I<sup>2</sup>C-bus (see I<sup>2</sup>C-bus protocol)</b>						
V <sub>IH</sub>	input voltage HIGH		3	-	5.5	V
V <sub>IL</sub>	input voltage LOW		- 0.3	-	1.5	V
I <sub>IH</sub>	input current HIGH	V = 5.5 V	-10	-	10	μA
I <sub>IL</sub>	input current LOW	V = GND	-10	-	10	μA
V <sub>OL</sub>	output voltage LOW	I <sub>L</sub> = 3 mA	-	-	0.4	V
<b>Power-on reset (increasing supply voltage)</b>						
V <sub>P</sub>	start of reset		0.5	-	-	V
	end of reset		-	-	5	V
<b>Standby (pin 9)</b>						
V <sub>9</sub>	input voltage HIGH		3	-	V <sub>P</sub>	V
	input voltage LOW		-	-	2	V

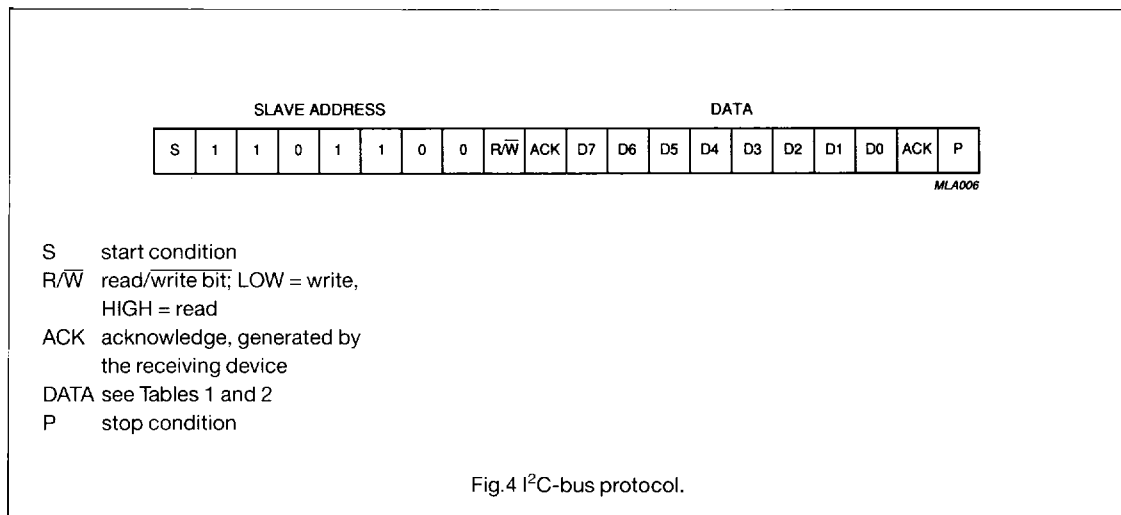
### Notes to the characteristics

1. The circuit is DC adjusted at V<sub>P</sub> = 6 V and AC operating at V<sub>P</sub> = 8 to 18 V.
2. At 18 V < V<sub>P</sub> < 30 V the DC output voltage < V<sub>P</sub>/2.
3. Frequency response externally fixed.
4. Ripple rejection measured at the output with a source impedance of 0 Ω and at a frequency of 100 Hz to 10 kHz (amplitude = 2 V(p-p)).
5. Noise voltage measured in a bandwidth of 20 Hz to 20 kHz.
6. Noise output voltage independent of R<sub>S</sub> (V<sub>i</sub> = 0 V).
7. Output power is measured directly at the output pins of the IC.

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## I<sup>2</sup>C-bus protocol



**Table 1:** WRITE definition (R/W = LOW)

MSB		DATA						LSB		Function
D7	D6	D5	D4	D3	D2	D1	D0			
0	0	0	0	0	0	0	0		SLEEP condition	
0	0	0	0	0	0	0	1		MUTE condition	
0	0	0	0	0	0	1	0		not allowed (1)	
0	0	0	0	0	0	1	1		ON condition (2)	

Bit D0 switches from SLEEP to the ON condition

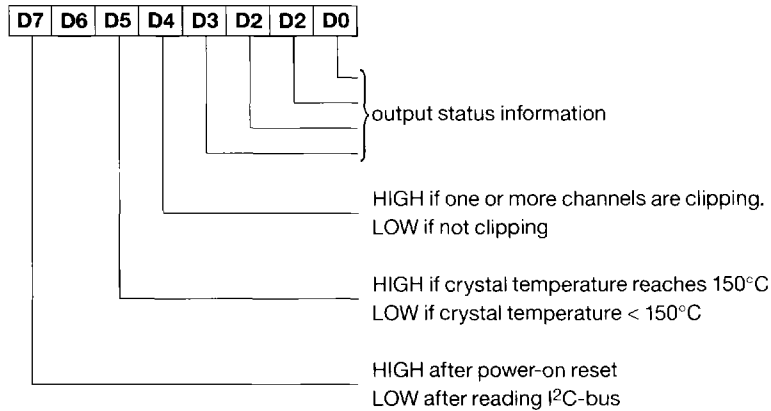
Bit D1 switches the MUTE condition

- (1) For test purposes only; I<sup>2</sup>C-bus is in the ON condition, amplifier is in the stand-by condition.
- (2) To get into the ON condition without switch-on plops, the device should be switched from the SLEEP condition to the MUTE condition and then, after a period of 150 ms, to the ON condition.

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**Table 2:** READ definition (R/ $\overline{W}$  = HIGH)



If the device is sinewave driven bit D4 will be HIGH if the THD in one or more channels exceeds 3.5%.

**Table 3:** Fault conditions

DATA		MSB		FUNCTION
D3	D2	D1	D0	
0	0	0	0	all output power transistors in the normal safe operating condition
-	-	-	1	fault condition pin 6
-	-	1	-	fault condition pin 8
-	1	-	-	fault condition pin 10
1	-	-	-	fault condition pin 12

If more outputs are in a fault condition (e.g. short-circuit) then more bits, D3 to D0, will be HIGH.



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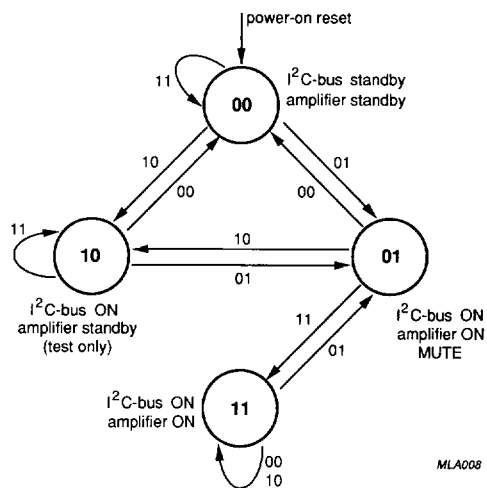
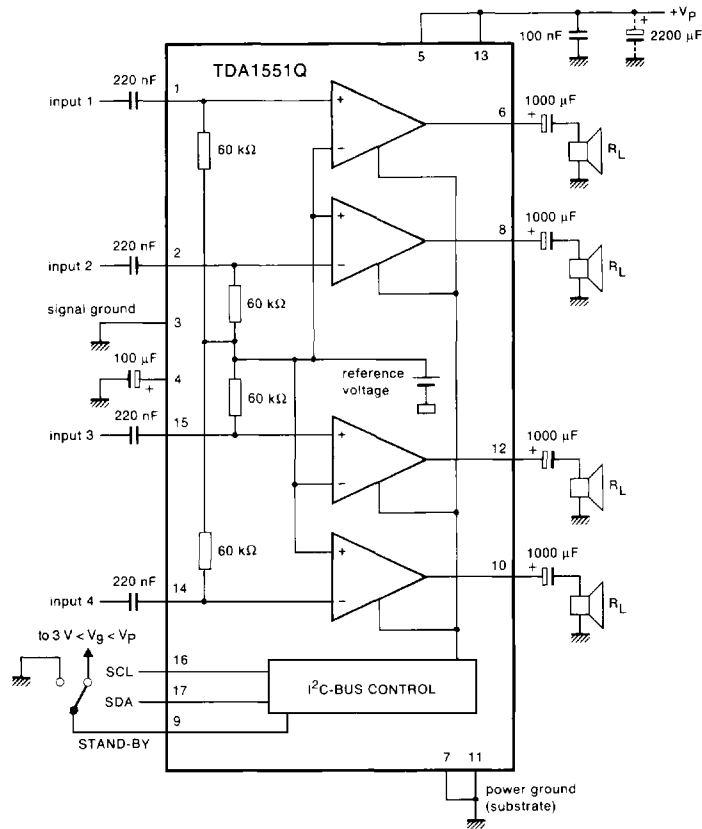


Fig.5 State diagram.

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7Z28121

Fig.6 Test circuit quad single-ended.

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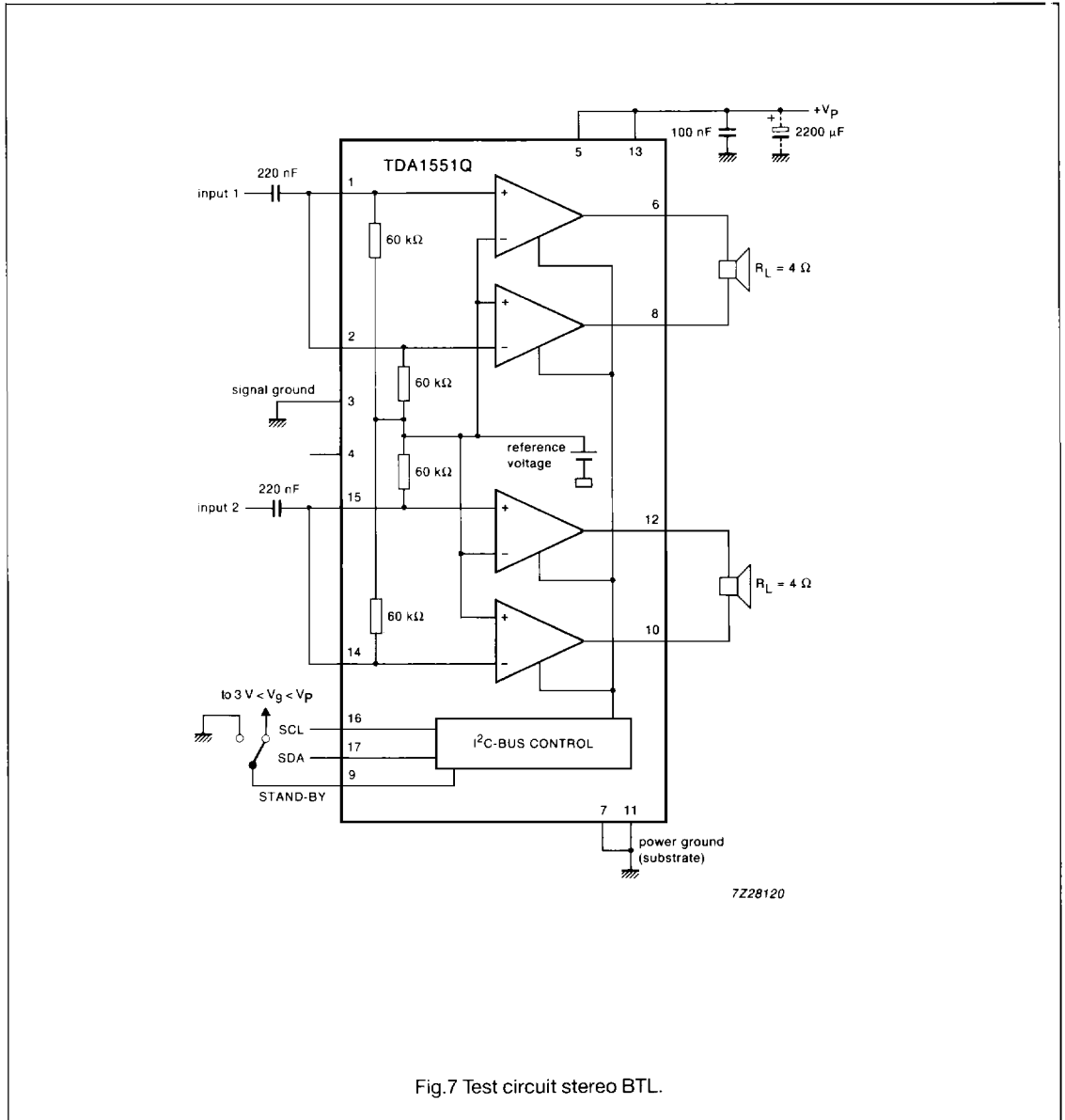


Fig.7 Test circuit stereo BTL.

**2 × 22 W BTL car radio power amplifier with  
diagnostic facility**

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**QUALITY SPECIFICATION**

**Electrostatic handling.**

SYMBOL	PINS	MIN.	MAX.	UNIT
<b>Human body model; <math>R_s = 1500 \Omega</math>; <math>C = 100 \text{ pF}</math></b>				
$V_{es}$	1, 2, 14, 15, 16, and 17	-1.5	+1.5	kV
	other	-2	+2	kV
<b>Machine model; <math>R_s = 0 \Omega</math>; <math>C = 200 \text{ pF}</math></b>				
$V_{es}$	1, 2, 14, 15, 16, and 17	-100	+100	V
	other	-200	+200	V