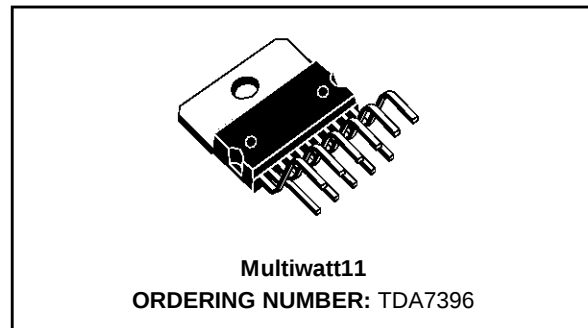


45W BRIDGE CAR RADIO AMPLIFIER WITH DIAGNOSTIC FACILITY

- HIGH POWER CAPABILITY:
 - 60W/2Ω EIAJ
 - 45W/2Ω @ $V_s = 14.4V$, $f = 1KHz$, $d = 10\%$
- DIFFERENTIAL INPUTS (EITHER SINGLE ENDED OR DIFFERENTIAL INPUT SIGNALS ARE ACCEPTED)
- MINIMUM EXTERNAL COMPONENT COUNT:
 - NO BOOTSTRAP CAPACITORS
 - NO BOUCHEROT CELLS
 - INTERNALLY FIXED GAIN (26dB)
 - NO SVR CAPACITOR
- ST-BY FUNCTION (CMOS COMPATIBLE)
- AUTOMATIC MUTE DURING TURN-ON/OFF
- AUTOMUTE AT MINIMUM SUPPLY VOLTAGE DETECTION
- SYNCHRONIZING PIN FOR SIMULTANEOUS TURN-ON IN MULTI-DEVICE APPLICATIONS
- NO AUDIBLE POP DURING MUTE AND ST-BY OPERATIONS

Diagnostic Facilities:

- CLIPPING DETECTOR
- SHORT CIRCUIT

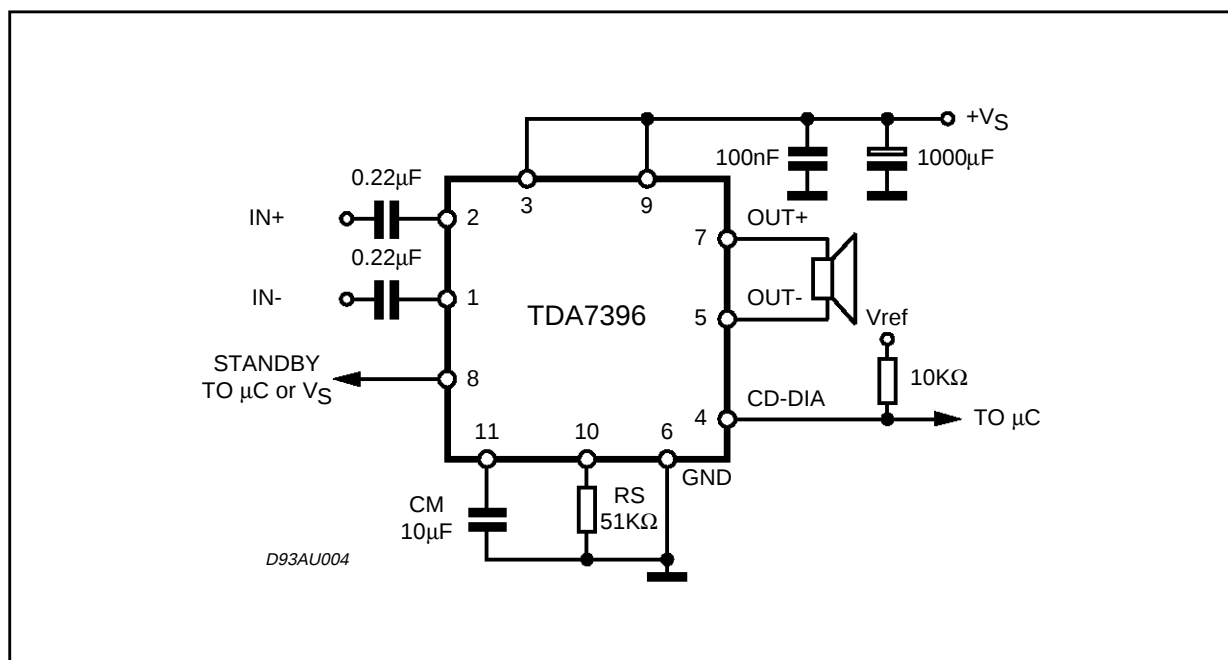


- OPEN LOAD
- THERMAL SHUTDOWN

PROTECTIONS:

- SHORT CIRCUIT (TO GND, TO V_S , ACROSS THE LOAD)
- VERY INDUCTIVE LOADS
- CHIP OVER-TEMPERATURE
- LOAD DUMP
- OPEN GND
- ESD

Figure 1: Test And Application Circuit



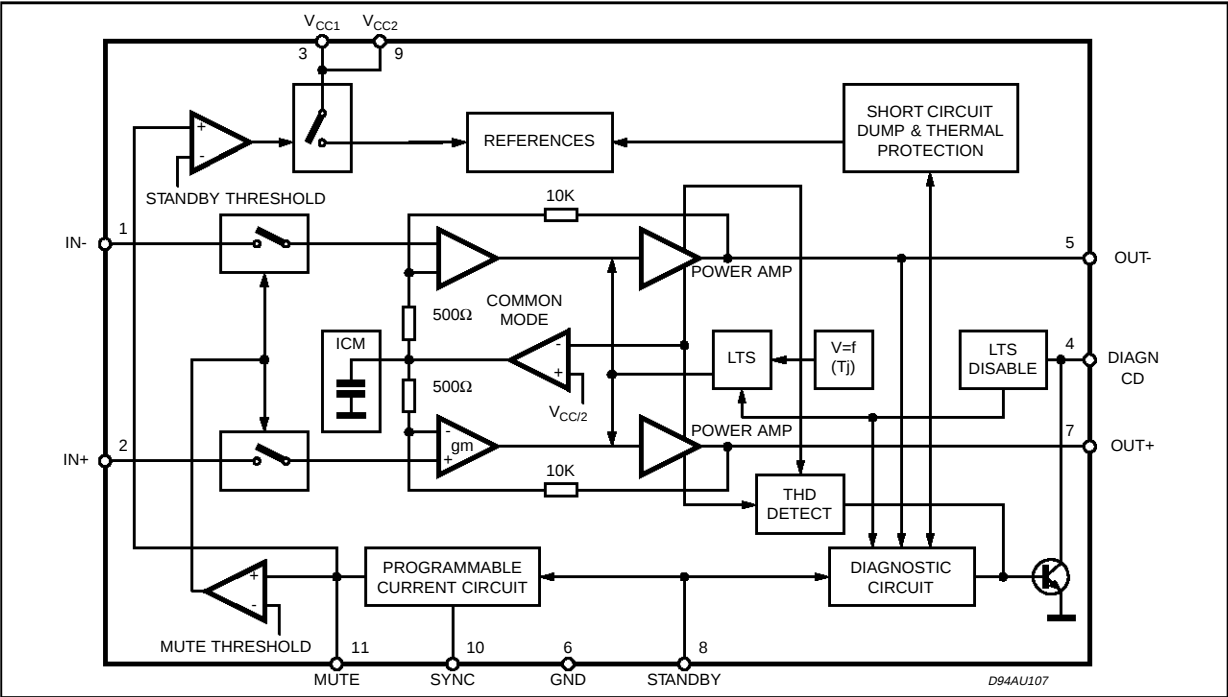
TDA7396

DESCRIPTION

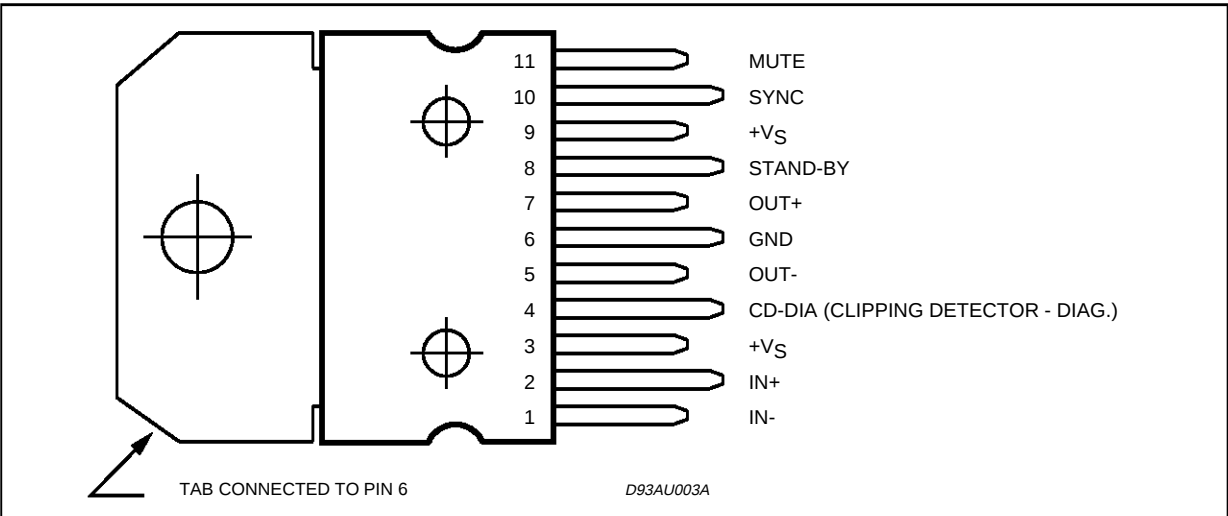
The TDA7396 is a BRIDGE class AB audio power amplifier especially intended for car radio High Power applications.
The 2Ω power capability together with the possibility to operate either in DIFFERENTIAL INPUT MODE or SINGLE ENDED INPUT MODE makes it suitable for boosters and high end car radio ap-

plications.
The exclusive fully complementary output stage and the internally fixed gain configuration drop the external component count.
The on board clipping detector allows easy implementation of gain compression systems.
The diagnostics facility allows to detect any mistakes during car radio set assembly and wiring in the car.

Figure 2: Block Diagram



PIN CONNECTION (Top view)



THERMAL DATA

Symbol	Description	Value	Unit
R _{th j-case}	Thermal Resistance Junction-case	Max 1.5	°C/W

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	DC Supply Voltage	28	V
V_{OP}	Operating Supply Voltage	18	V
V_{PEAK}	Peak Supply Voltage (t = 50ms)	50	V
I_O	Output Peak Current repetitive (f > 10Hz)	6	A
	Output Peak Current non repetitive	7	A
P_{tot}	Power Dissipation ($T_{CASE} = 85^\circ\text{C}$)	43	W
T_{stg}, T_j	Storage and Junction-Case	-40 to 150	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($V_S = 14.4\text{V}$; $R_L = 2\Omega$, $f = 1\text{KHz}$, $T_{amb} = 25^\circ\text{C}$, unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_S	Supply Voltage Range		8		18	V
I_q	Total Quiescent Current			100		mA
V_{OS}	Output Offset Voltage				150	mV
I_{SB}	ST-BY Current	$V_{ST-BY} = 1.5\text{V}$			100	μA
I_{SBin}	ST-BY Input Bias Current	$V_{ST-BY} = 5\text{V}$			10	μA
V_{SBon}	ST-BY On Threshold Voltage				1.5	V
V_{SBoff}	ST-BY Off threshold Voltage		3.5			V
ATT_{ST-BY}	ST-BY Attenuation			90		dB
R_{EXT}/R_S	Mute Resistor Ratio for External Mute Control	(see Application Circuit of fig. 4)	0.63		0.69	V
$I_{M in}$	Mute Input Bias Current	$V_{MUTE} = 5\text{V}$			10	μA
A_M	Mute Attenuation			90		dB
P_O	RMS Output Power	d = 10% d = 1% d = 10%; $R_L = 4\Omega$		45 35 27		W W W
	EIAJ Output Power	$V_S = 13.7\text{V}$		60		W
d	Distortion	$P_O = 0.1$ to 20W $P_O = 0.1$ to 15W ; $R_L = 4\Omega$		0.06 0.03		% %
G_V	Voltage Gain		25	26	27	dB
f_H	High Frequency rolloff	$P_O = 1\text{W}$; -3dB	75			KHz
R_{IN}	Input Impedance	Differential		60		$\text{K}\Omega$
		Single Ended		55		$\text{K}\Omega$
E_{IN}	Input Noise Voltage	$R_g = 0\Omega$; f = 22Hz to 22KHz		4		mV
CMRR	Input Common Mode Rejection	f = 1KHz; $V_{IN} = 1\text{Vrms}$		70		dB
SVR	Supply Voltage Rejection	$R_g = 0\Omega$; $V_r = 1\text{Vrms}$		60		dB
CDL	Clipping Detection Level			0.5		%
T_{sd}	Absolute Thermal Shutdown Junction Temperature			160		$^\circ\text{C}$

Figure 3: Application Circuit with External Mute Control



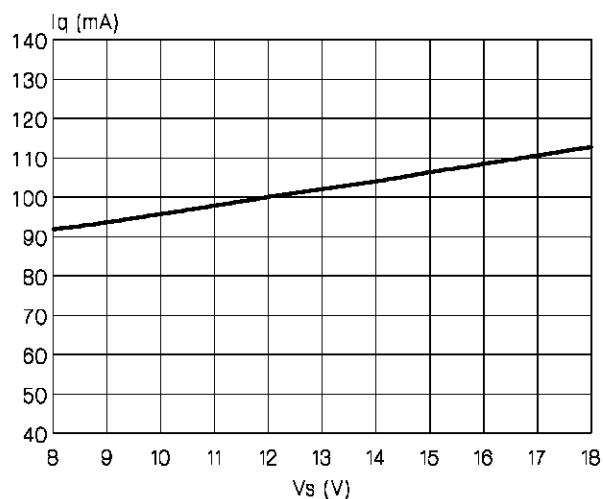
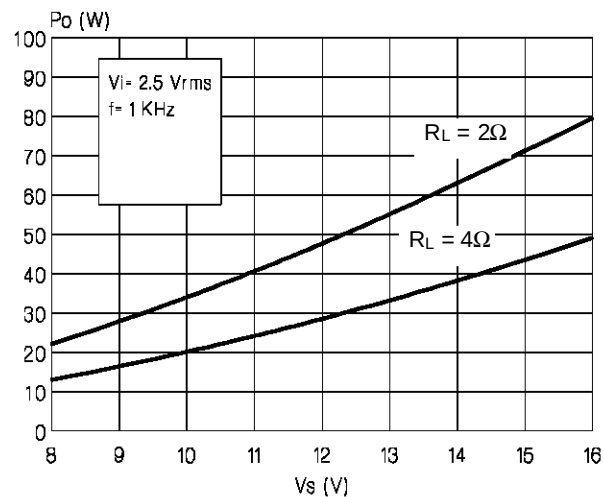
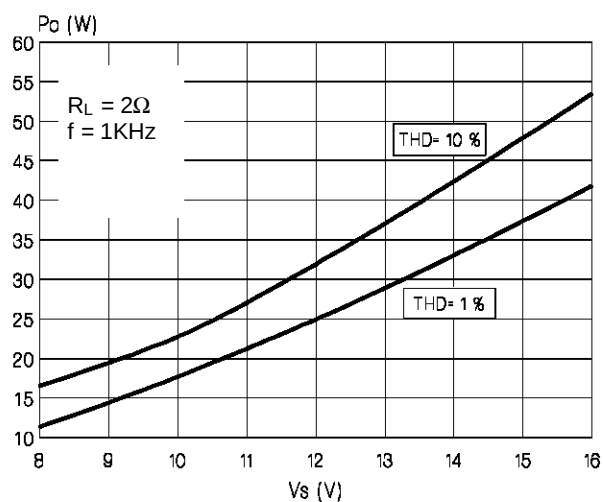
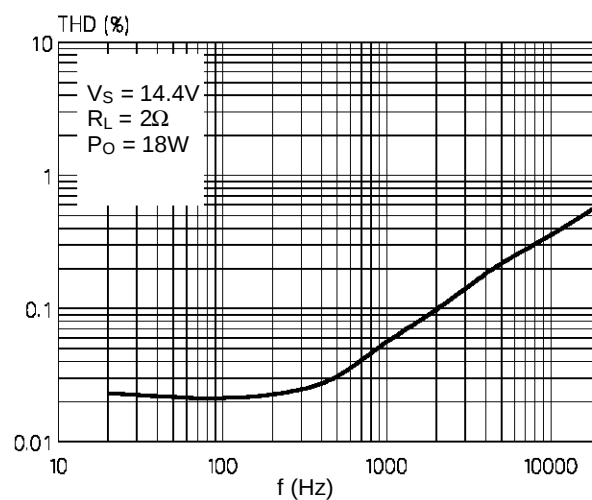
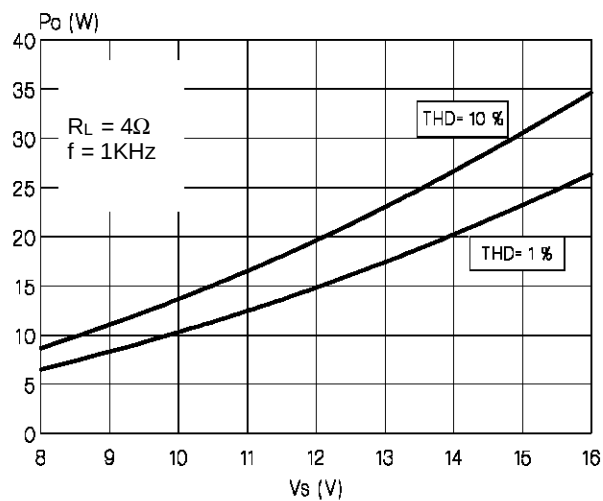
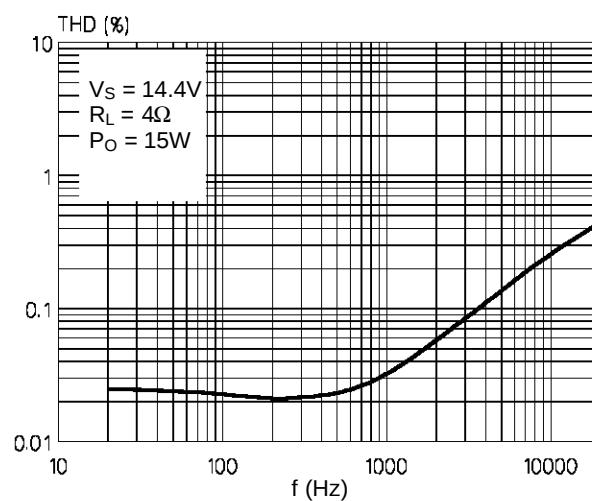
Figure 4: Quiescent Current vs Supply Voltage**Figure 5:** EIAJ power vs Supply Voltage**Figure 6:** Output Power vs Supply Voltage ($R_L = 2\Omega$)**Figure 7:** Distortion vs Frequency ($R_L = 2\Omega$)**Figure 8:** Output Power vs Supply Voltage ($R_L = 4\Omega$)**Figure 9:** Distortion vs Frequency ($R_L = 4\Omega$)

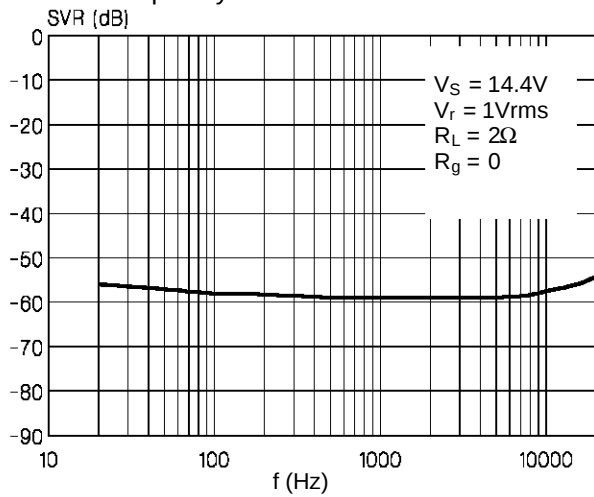
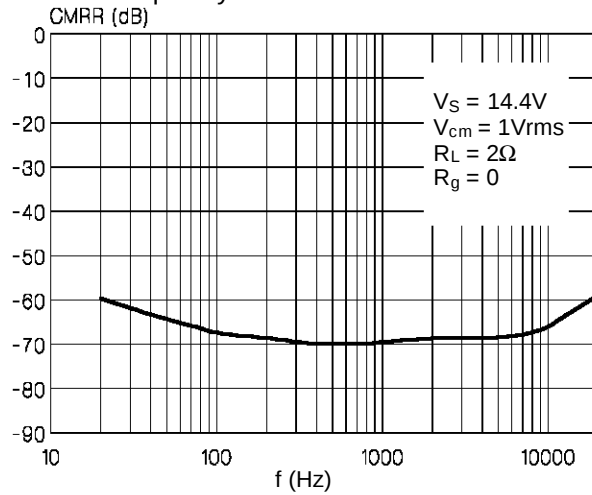
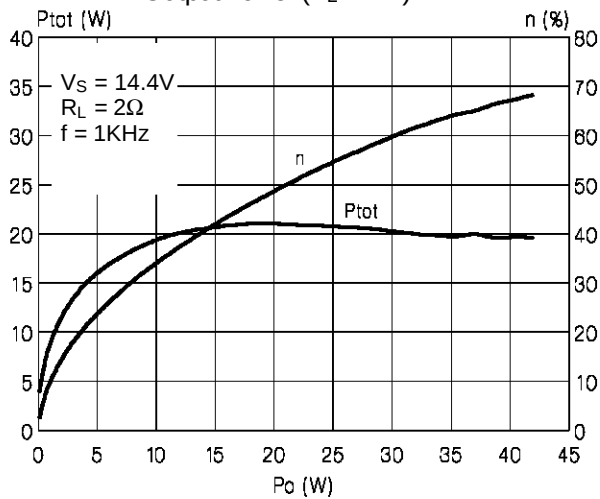
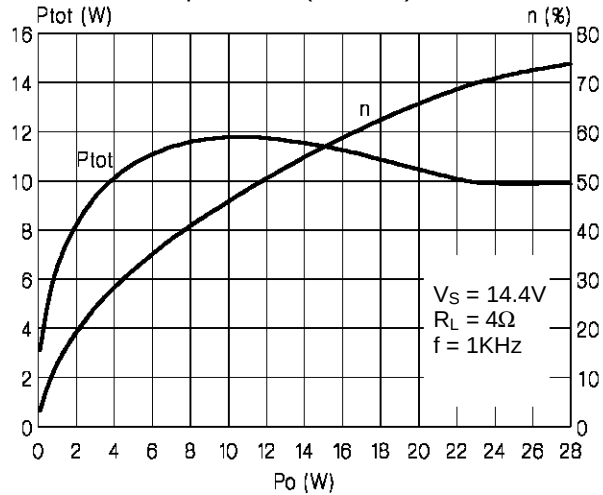
Figure 10: Supply Voltage Rejection vs Frequency**Figure 11:** Common Mode Rejection vs. Frequency**Figure 12:** Total Power Dissipation & Efficiency vs. Output Power ($R_L = 2\Omega$)**Figure 13:** Total Power Dissipation & Efficiency vs. Output Power ($R_L = 4\Omega$)

Figure 14: Application Circuit

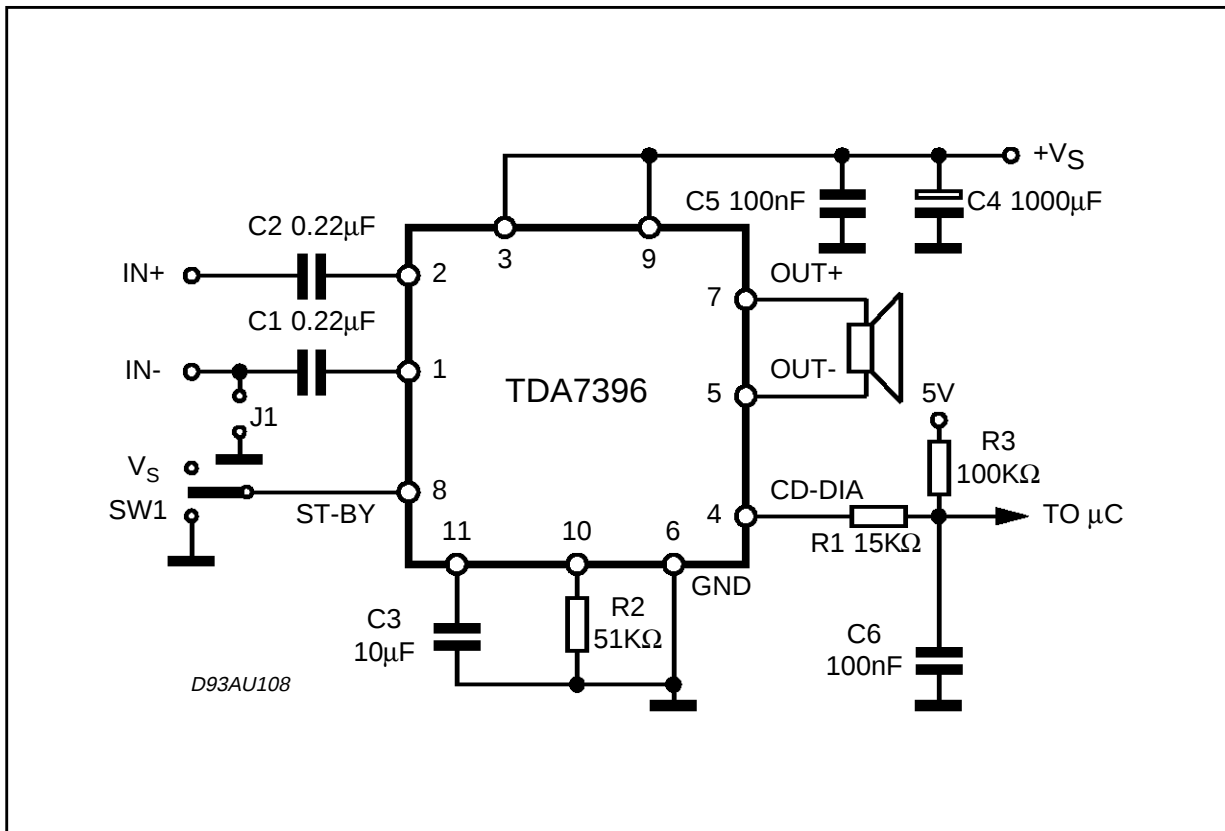
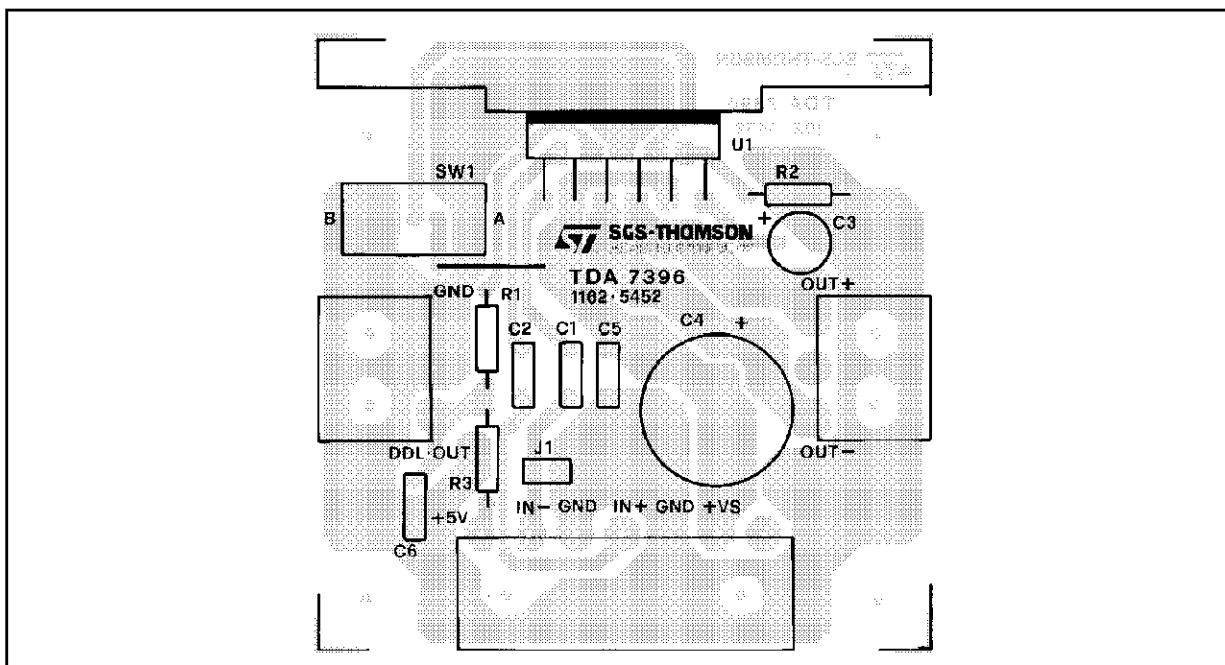


Figure 15: P.C. Board and Component Layout (1:1 scale)



CLIPPING DETECTION & DIAGNOSTICS

(see fig. 16)

An active pull-down circuit is provided to signal out the occurrence of any of the conditions described later. In order to use this function, the CD-DIA pin (#4) has to be resistively connected to a positive voltage reference (between 5V and V_s).

A) Clipping Detection

Current is sunk whenever the output clipping distortion level reaches a fixed 0.5% threshold; this function allows gain compression facility when the amplifier is overdriven.

B) Output Fault Diagnostics

Current is sunk as soon as one of the following output faults is recognized:

- short-circuit to GND
- short-circuit to V_s
- short-circuit across the load (after turn-on)
- open load (before turn-on)

The diagnostics signal remains steadily on until the fault is removed.

All the output fault conditions (listed above) can be distinguished from the clipping detection (A) because of their different time duration.

THERMAL WARNING (see fig. 17)

Thermal protection has been implemented in accordance to a new principle involving different steps:

- 1) Thermal foldback (**Linear Thermal Shutdown**)
- 2) Shutdown with soft restart (**Absolute Thermal Shutdown**)

As long as the junction temperature remains below the preset threshold (140°C) the IC delivers the full power. Once the threshold has been reached, a thermal foldback starts limiting the output signal level; the output power is then reduced, thus decreasing also the temperature without output signal interruption (LTS). Supposing the thermal foldback does not reduce the junction temperature to a safe level, a complete shutdown will occur at 160°C (ATS).

Soft restart avoids large voltage disturbance across the loudspeaker, due to the presence of high input signals when the IC comes out of thermal shutdown.

Current is sunk from the CD-DIA pin (#4) when the thermal protection is acting. The voltage at pin #4 bounces back and forth (depending on the amplifier input signal magnitude) during the linear thermal intervention (LTS) and stays low (sinking current) after the amplifier has been eventually shut-down (Absolute Thermal Shutdown).

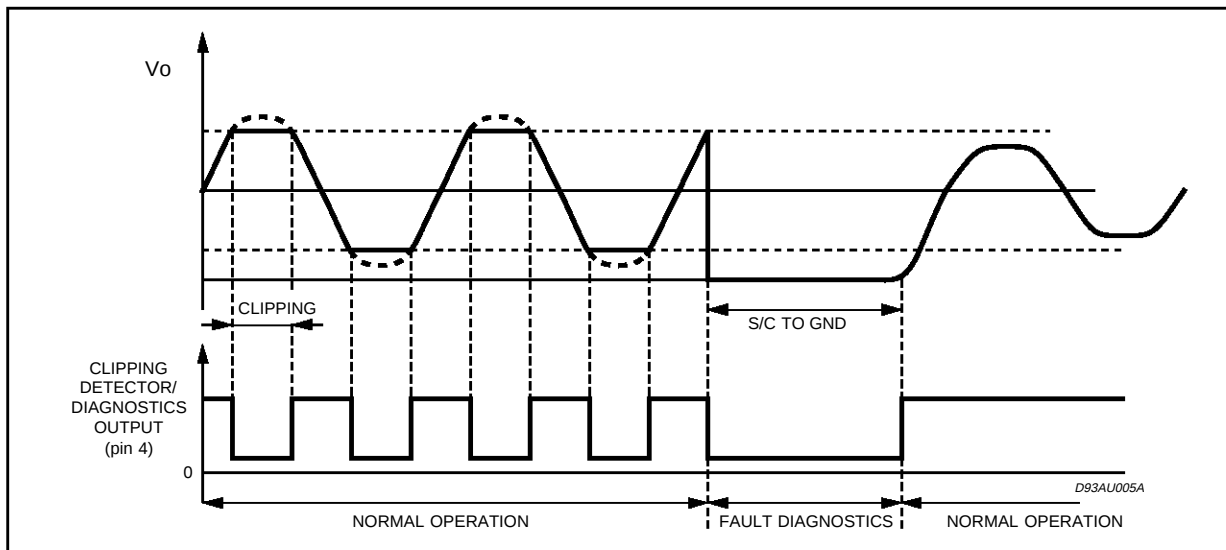
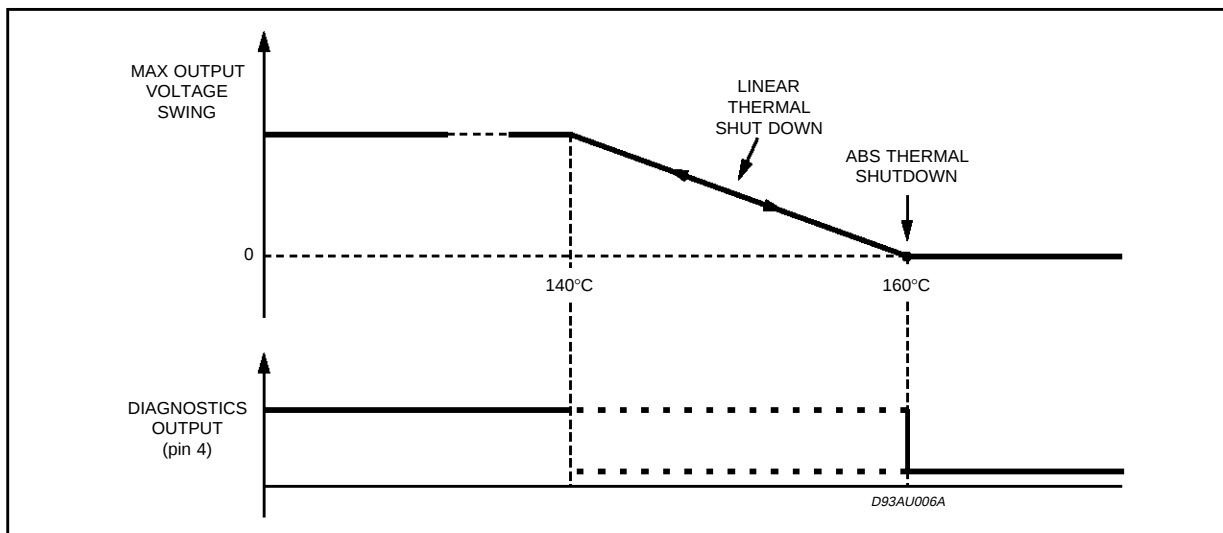
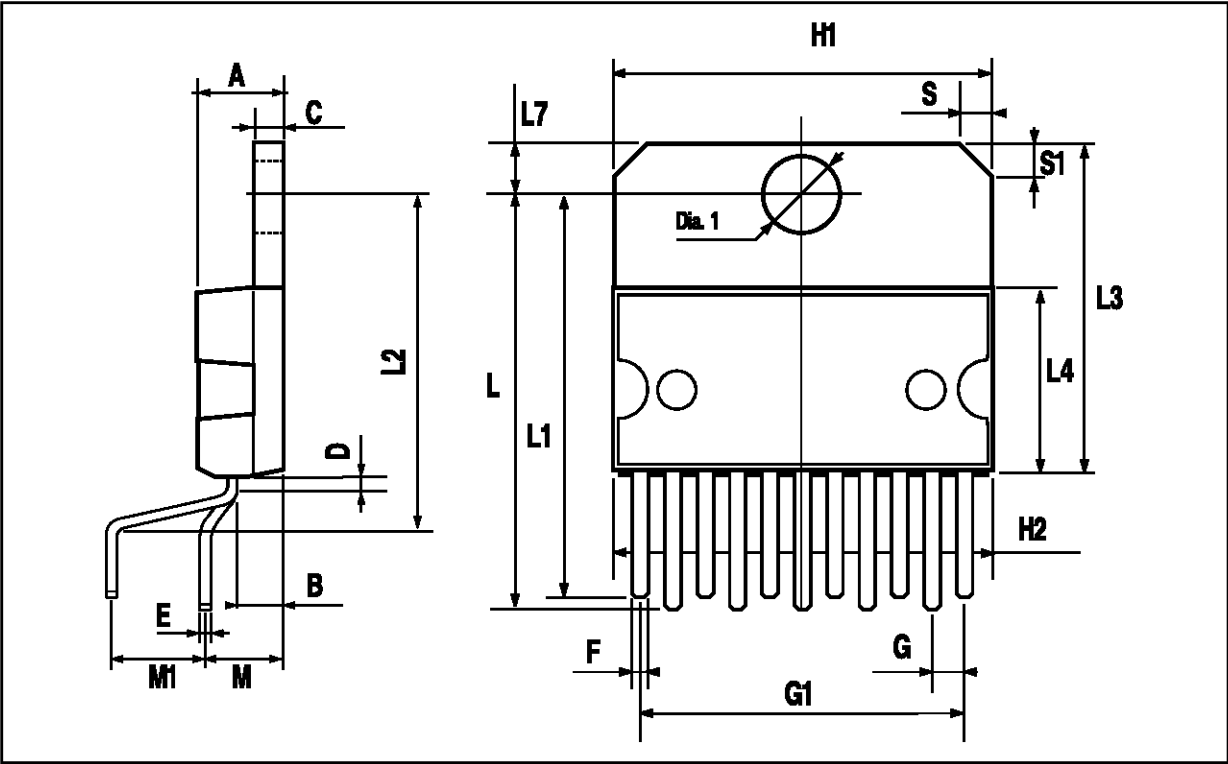
Figure 16: Clipping Detection & Diagnostics Waveforms

Figure 17: Thermal Protection & Diagnostic Waveforms

MULTIWATT11 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.88		0.95	0.035		0.037
G	1.57	1.7	1.83	0.062	0.067	0.072
G1	16.87	17	17.13	0.664	0.669	0.674
H1	19.6			0.772		
H2			20.2			0.795
L	21.5		22.3	0.846		0.878
L1	21.4		22.2	0.843		0.874
L2	17.4		18.1	0.685		0.713
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
M	4.1	4.3	4.5	0.161	0.169	0.177
M1	4.88	5.08	5.3	0.192	0.200	0.209
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152



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