

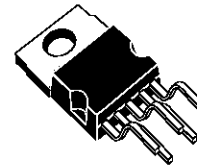
32W Hi-Fi AUDIO POWER AMPLIFIER

- HIGH OUTPUT POWER
(50W MUSIC POWER IEC 268.3 RULES)
- HIGH OPERATING SUPPLY VOLTAGE (50V)
- SINGLE OR SPLIT SUPPLY OPERATIONS
- VERY LOW DISTORTION
- SHORT CIRCUIT PROTECTION (OUT TO GND)
- THERMAL SHUTDOWN

DESCRIPTION

The TDA 2050 is a monolithic integrated circuit in Pentawatt package, intended for use as an audio class AB audio amplifier. Thanks to its high power capability the TDA2050 is able to provide up to 35W true rms power into 4 ohm load @ THD = 10%, $V_S = \pm 18V$, $f = 1KHz$ and up to 32W into 8ohm load @ THD = 10%, $V_S = \pm 22V$, $f = 1KHz$.

Moreover, the TDA 2050 delivers typically 50W music power into 4 ohm load over 1 sec at $V_S = 22.5V$, $f = 1KHz$.

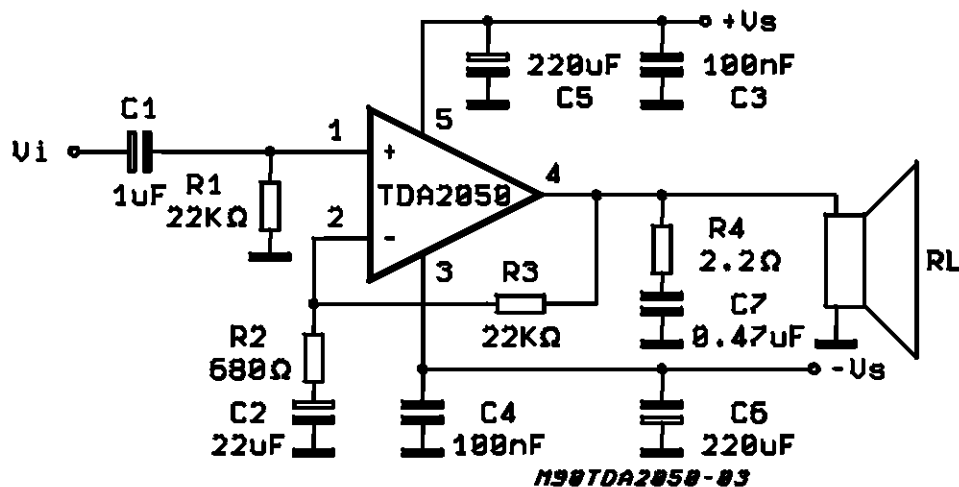


Pentawatt

ORDERING NUMBERS: TDA2050V
TDA2050H

The high power and very low harmonic and cross-over distortion (THD = 0.05% typ, @ $V_S = \pm 22V$, $P_o = 0.1$ to 15W, $R_L = 8ohm$, $f = 100Hz$ to 15KHz) make the device most suitable for both HiFi and high class TV sets.

TEST AND APPLICATION CIRCUIT

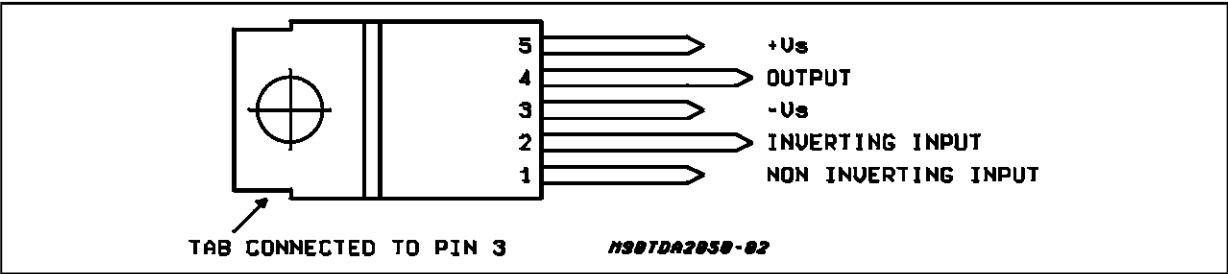


TDA2050

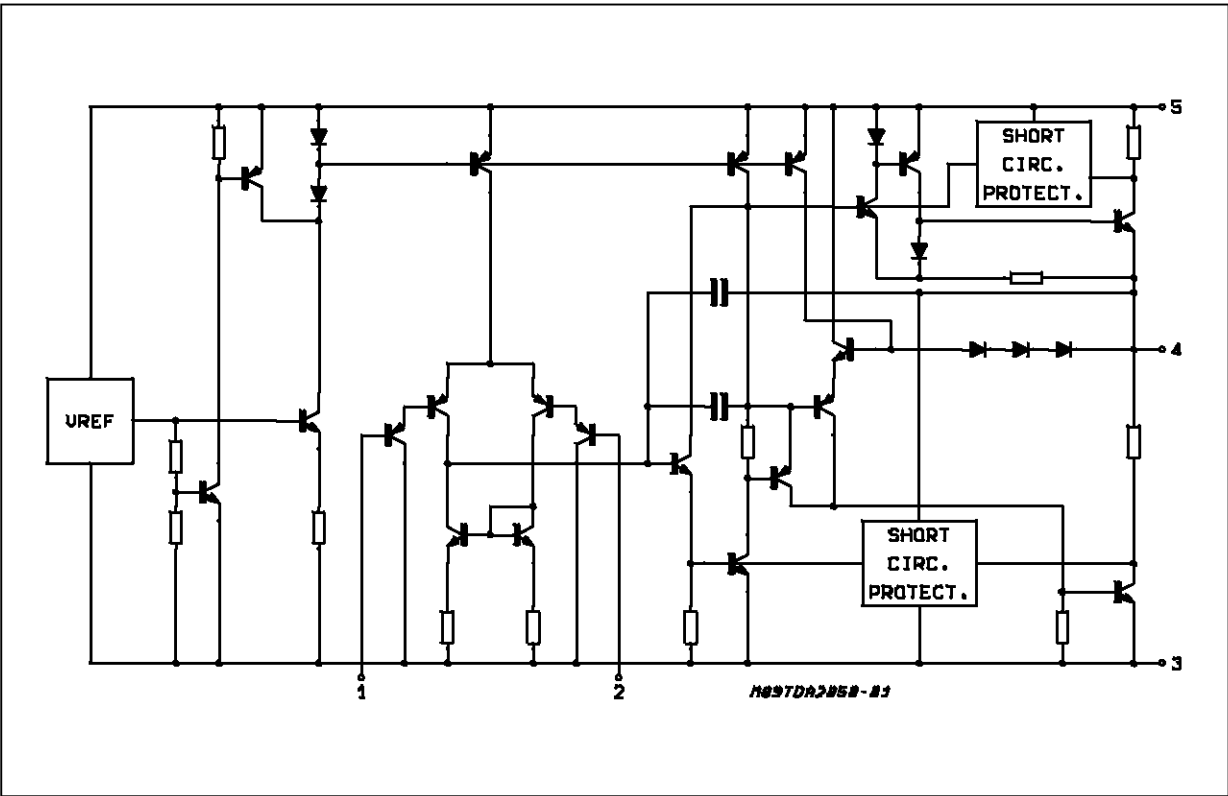
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	± 25	V
V_i	Input Voltage	V_S	
V_i	Differential Input Voltage	± 15	V
I_O	Output Peak Current (internally limited)	5	A
P_{tot}	Power Dissipation $T_{CASE} = 75^{\circ}C$	25	W
T_{stg}, T_j	Storage and Junction Temperature	-40 to 150	$^{\circ}C$

PIN CONNECTION (Top view)



SCHEMATIC DIAGRAM



THERMAL DATA

Symbol	Description	Value	Unit
$R_{th\ j-case}$	Thermal Resistance junction-case	Max 3	$^{\circ}C/W$

ELECTRICAL CHARACTERISTICS (Refer to the Test Circuit, $V_S = \pm 18V$, $T_{amb} = 25^\circ C$, $f = 1\text{ kHz}$; unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_S	Supply Voltage Range		± 4.5		± 25	V
I_d	Quiescent Drain Current	$V_S = \pm 4.5V$ $V_S = \pm 25V$		30 55	50 90	mA mA
I_b	Input Bias Current	$V_S = \pm 22V$		0.1	0.5	μA
V_{OS}	Input Offset Voltage	$V_S = \pm 22V$			± 15	mV
I_{OS}	Input Offset Current	$V_S = \pm 22V$			± 200	nA
P_O	RMS Output Power	$d = 0.5\%$ $R_L = 4\Omega$ $R_L = 8\Omega$ $V_S = \pm 22V$ $R_L = 8\Omega$	24 22	28 18 25		W W W
		$d = 10\%$ $R_L = 4\Omega$ $R_L = 8\Omega$ $V_S = \pm 22V$ $R_L = 8\Omega$		35 22 32		W W W
		Music Power IEC268.3 RULES		50		W
		$d = 10\%$; $T = 1s$ $V_S = \pm 22.5V$; $R_L = 4\Omega$				
d	Total Harmonic Distortion	$R_L = 4\Omega$ $f = 1\text{ kHz}$, $P_O = 0.1$ to $24W$ $f = 100\text{ Hz}$ to 10 kHz , $P_O = 0.1$ to $18W$		0.03	0.5 0.5	% %
		$V_S = \pm 22V$ $R_L = 8\Omega$ $f = 1\text{ kHz}$, $P_O = 0.1$ to $20W$ $f = 100\text{ Hz}$ to 10 kHz , $P_O = 0.1$ to $15W$		0.02	0.5	% %
SR	Slew Rate		5	8		V/ μs
G_V	Open Loop Voltage Gain			80		dB
G_V	Closed Loop Voltage Gain		30	30.5	31	dB
BW	Power Bandwidth (-3dB)	$R_L = 4\Omega$ $V_i = 200\text{ mV}$	20 to 80,000			Hz
e_N	Total Input Noise	curve A		4		μV
		B = 22Hz to 22kHz		5	10	μV
R_i	Input Resistance (pin 1)		500			k Ω
SVR	Supply Voltage Rejection	$R_S = 22\text{ k}\Omega$; $f = 100\text{ Hz}$; $V_{ripple} = 0.5V_{rms}$		45		dB
η	Efficiency	$P_O = 28W$; $R_L = 4\Omega$		65		%
		$P_O = 25W$; $R_L = 8\Omega$; $V_S = \pm 22V$		67		%
T_{sd-j}	Thermal Shut-down Junction Temperature			150		$^\circ C$

Figure 1: Split Supply Typical Application Circuit

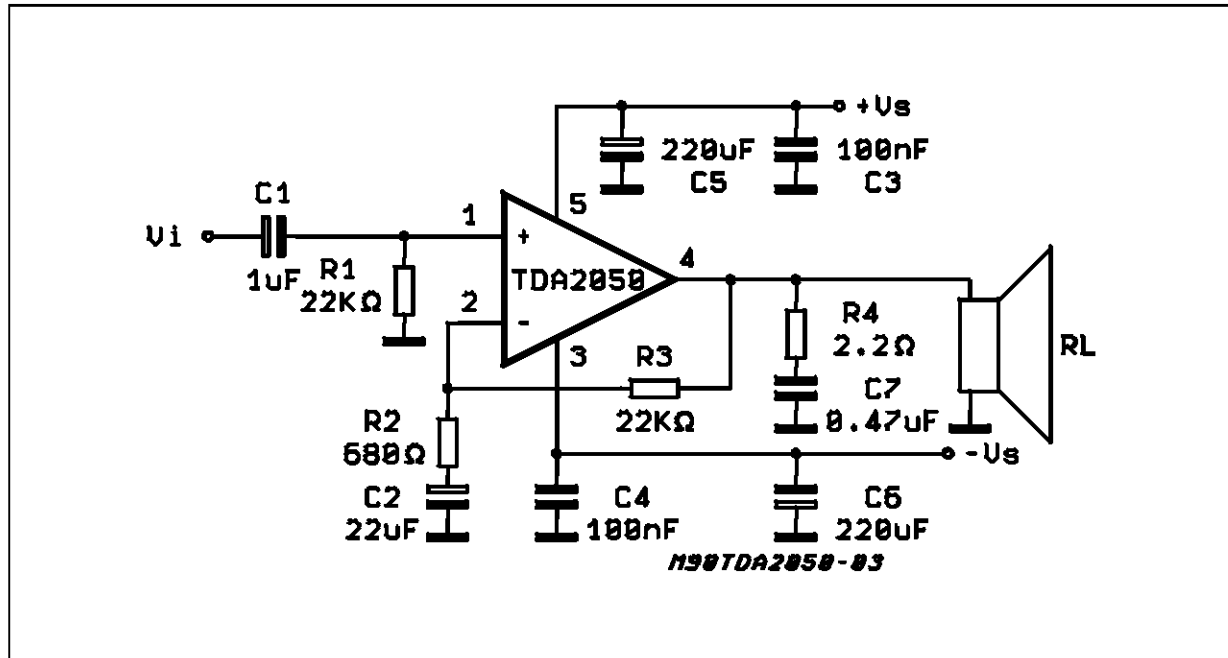
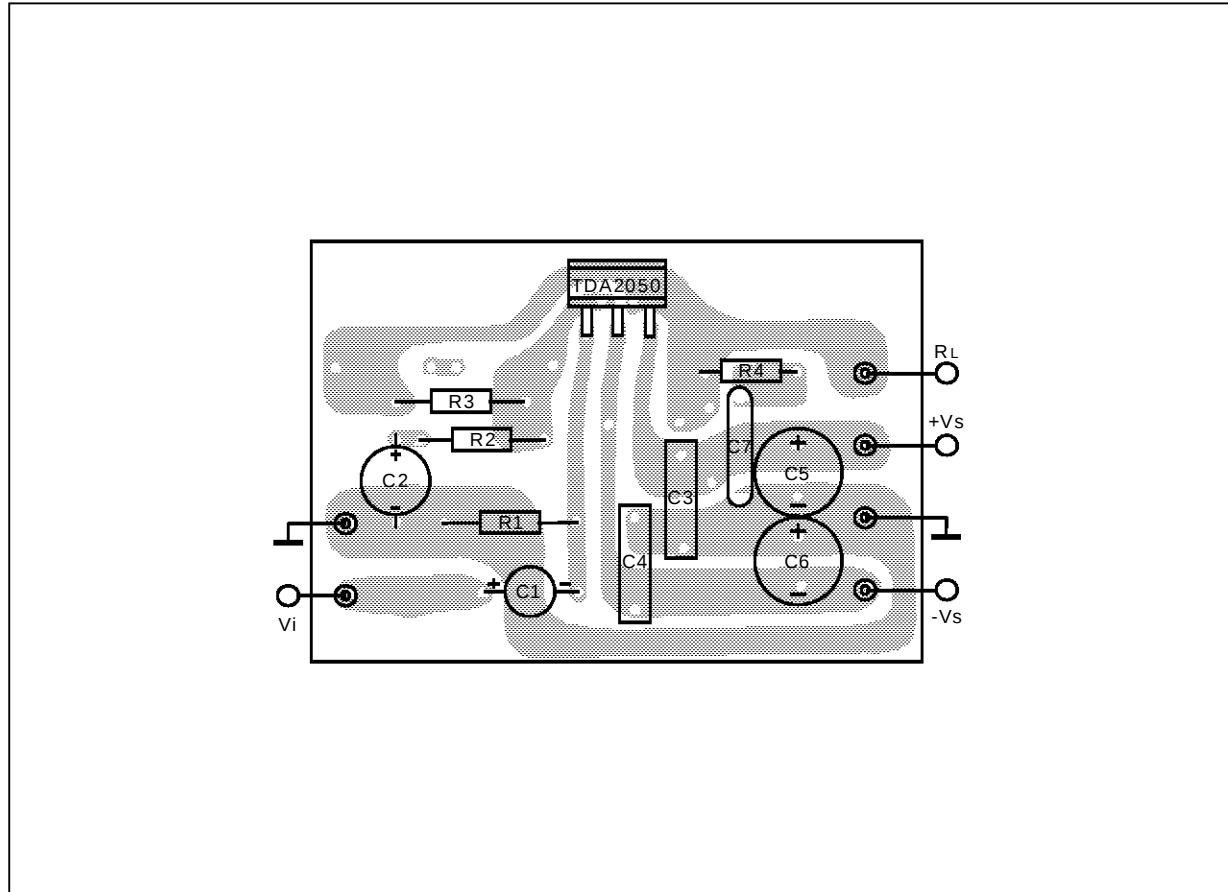


Figure 2: P.C. Board and Components Layout of the Circuit of Fig. 1 (1:1)



SPLIT SUPPLY APPLICATION SUGGESTIONS

The recommended values of the external components are those shown on the application circuit

of fig. 2. Different values can be used. The following table can help the designer.

Component	Recommended Value	Purpose	Larger than Recommended Value	Smaller than Recommended Value
R1	22k Ω	Input Impedance	Increase of Input Impedance	Decrease of Input Impedance
R2	680 Ω	Feedback Resistor	Decrease of Gain (*)	Increase of Gain
R3	22k Ω		Increase of Gain	Decrease of Gain (*)
R4	2.2 Ω	Frequency Stability	Danger of Oscillations	
C1	1 μ F	Input Decoupling DC		Higher Low-frequency cut-off
C2	22 μ F	Inverting Input DC Decoupling	Increase of Switch ON/OFF Noise	Higher Low-frequency cut-off
C3 C4	100nF	Supply Voltage Bypass		Danger of Oscillations
C5 C6	220 μ F	Supply Voltage Bypass		Danger of Oscillations
C7	0.47 μ F	Frequency Stability		Danger of Oscillations

(*) The gain must be higher than 24dB

PRINTED CIRCUIT BOARD

The layout shown in fig. 2 should be adopted by the designers. If different layouts are used, the

ground points of input 1 and input 2 must be well decoupled from the ground return of the output in which a high current flows.

Figure 3: Single Supply Typical Application Circuit

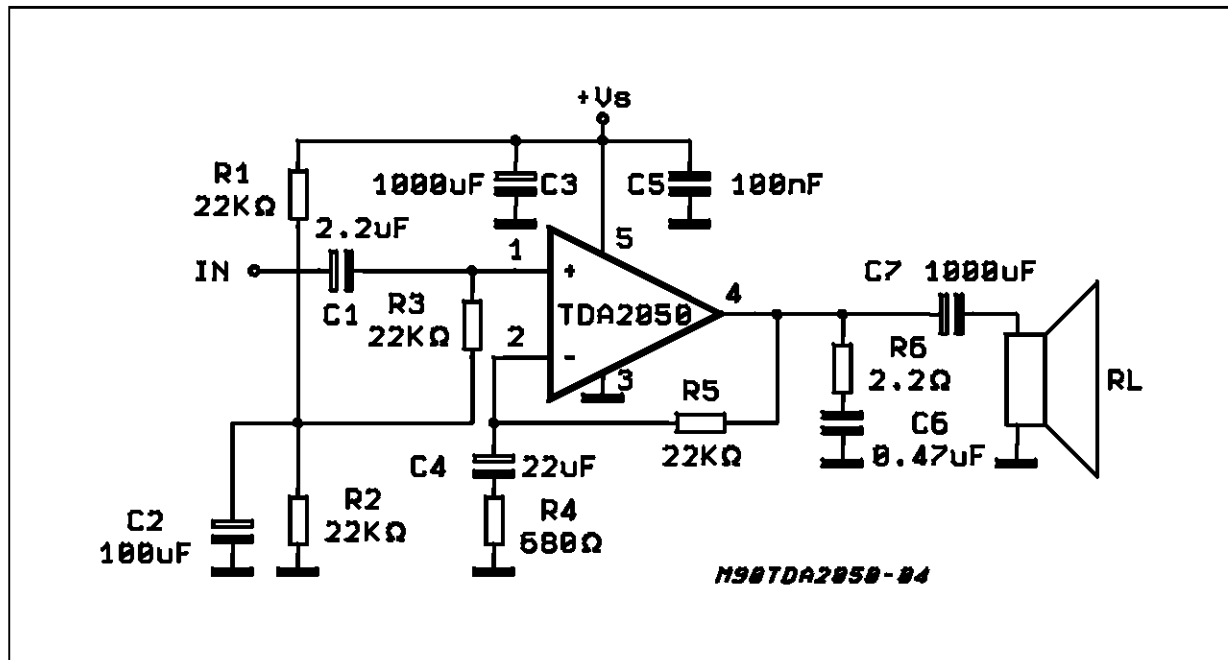
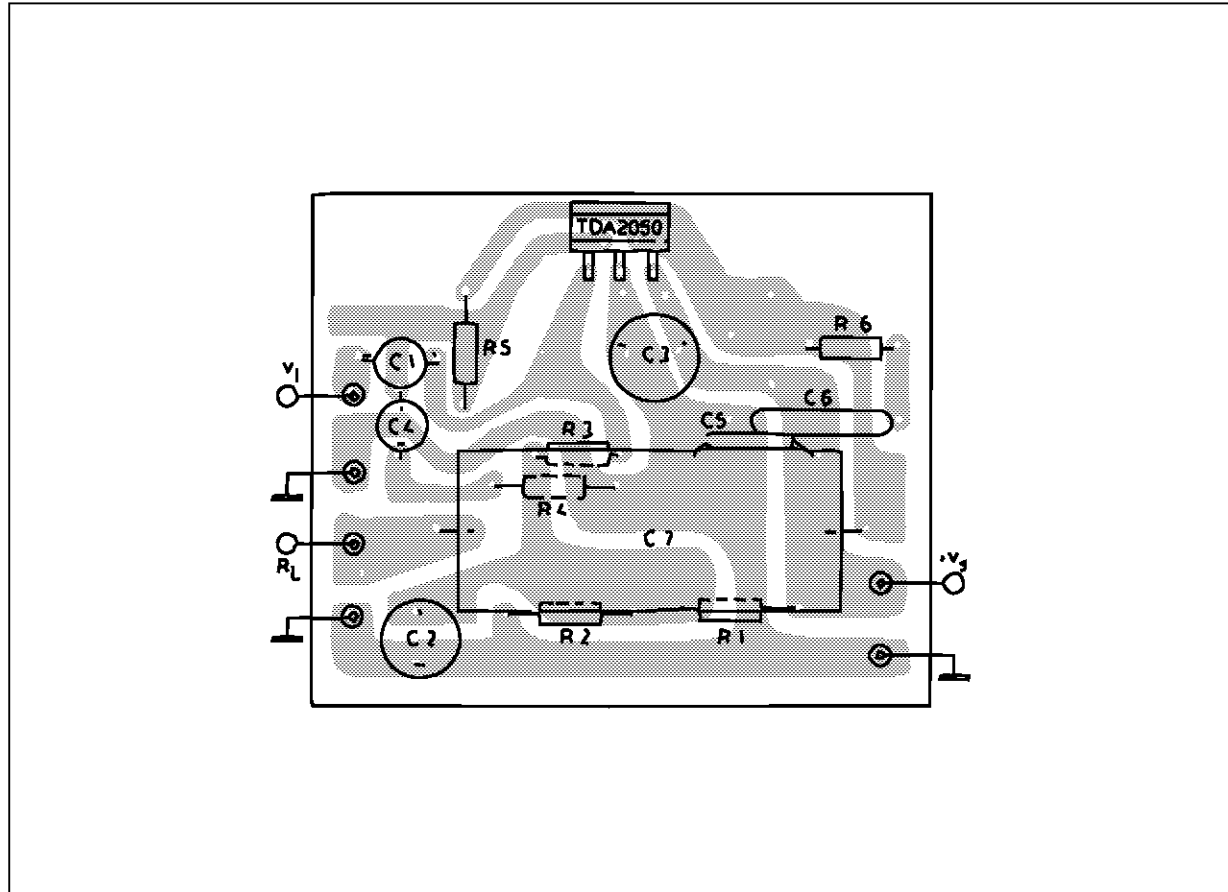


Figure 4: P.C. Board and Components Layout of the Circuit of Fig. 3 (1:1)



SINGLE SUPPLY APPLICATION SUGGESTIONS

The recommended values of the external components are those shown on the application circuit

of fig. 3. Different values can be used. The following table can help the designer.

Component	Recommended Value	Purpose	Larger than Recommended Value	Smaller than Recommended Value
R1, R2, R3	22k Ω	Biasing Resistor		
R4	22k Ω	Feedback Resistors	Increase of Gain	Decrease of Gain (*)
R5	680 Ω		Decrease of Gain (*)	Increase of Gain
R6	2.2 Ω	Frequency Stability	Danger of Oscillations	
C1	2.2 μ F	Input Decoupling DC		Higher Low-frequency cut-off
C2	100 μ F	Supply Voltage Rejection	Worse Turn-off Transient Worse Turn-on Delay	
C3	1000 μ F	Supply Voltage Bypass		Danger of Oscillations Worse of Turn-off Transient
C4	22 μ F	Inverting Input DC Decoupling	Increase of Switching ON/OFF	Higher Low-frequency cut-off
C5	100nF	Supply Voltage Bypass		Danger of Oscillations
C6	0.47 μ F	Frequency Stability		Danger of Oscillations
C7	1000 μ F	Output DC Decoupling		Higher Low-frequency cut-off

(*) The gain must be higher than 24dB

NOTE

If the supply voltage is lower than 40V and the load is 8ohm (or more) a lower value of C2 can

be used (i.e. 22 μ F).

C7 can be larger than 1000 μ F only if the supply voltage does not exceed 40V.

TYPICAL CHARACTERISTICS (Split Supply Test Circuit unless otherwise specified)

Figure 5: Output Power vs. Supply Voltage

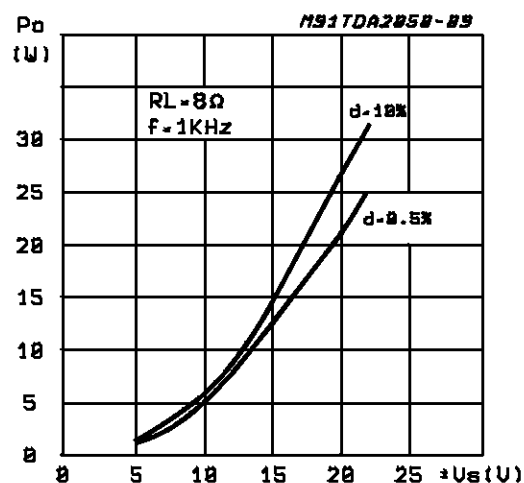


Figure 6: Distortion vs. Output Power

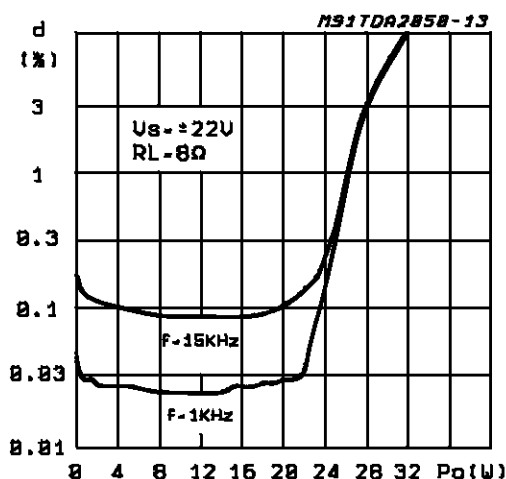


Figure 7: Output Power vs. Supply Voltage

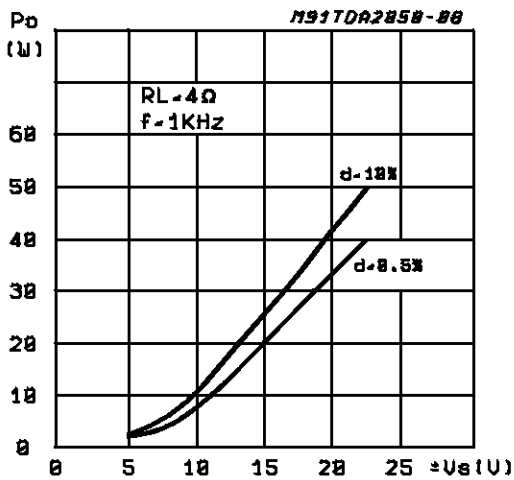


Figure 8: Distortion vs. Output Power

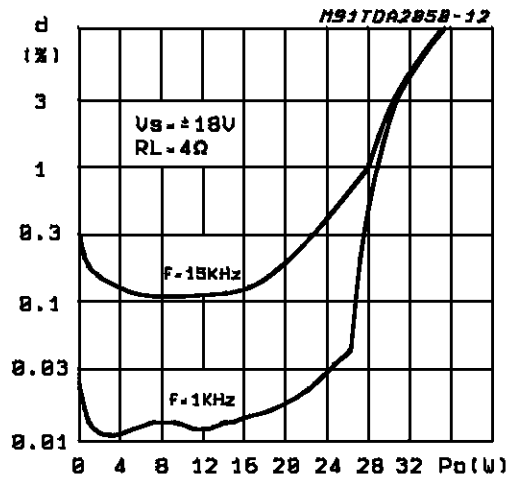


Figure 9: Distortion vs. Frequency

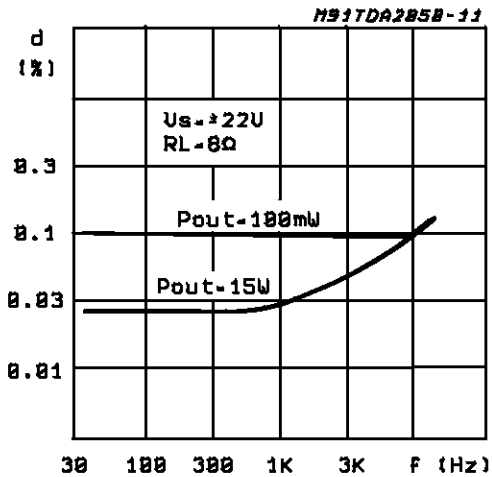


Figure 10: Distortion vs. Frequency

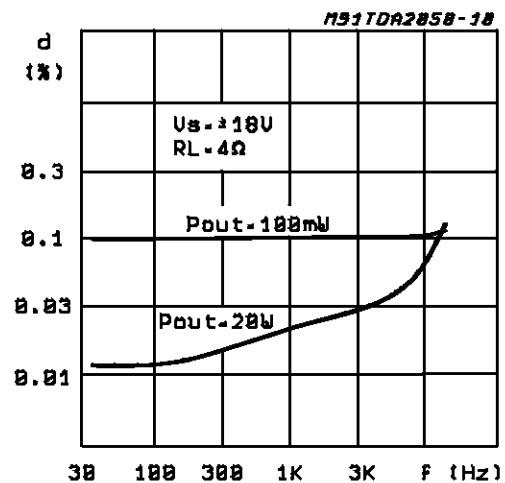


Figure 11: Quiescent Current vs. Supply Voltage

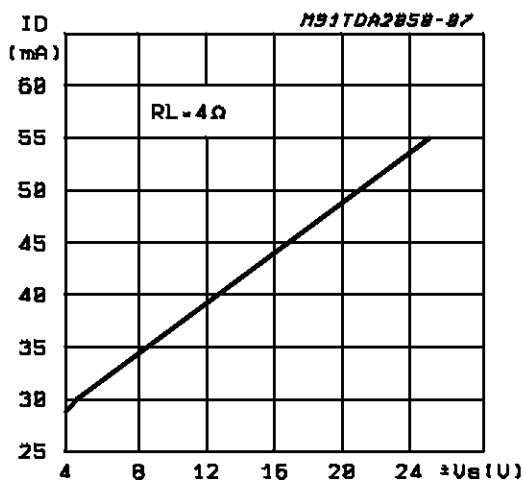


Figure 12: Supply Voltage Rejection vs. Frequency

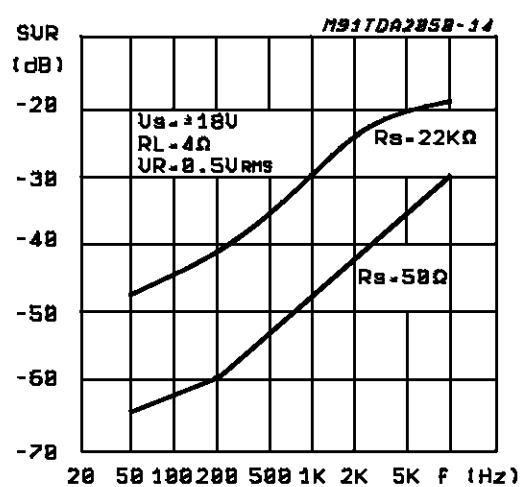


Figure 13: Supply Voltage Rejection vs. Frequency (Single supply) for Different values of C2 (circuit of fig. 3)

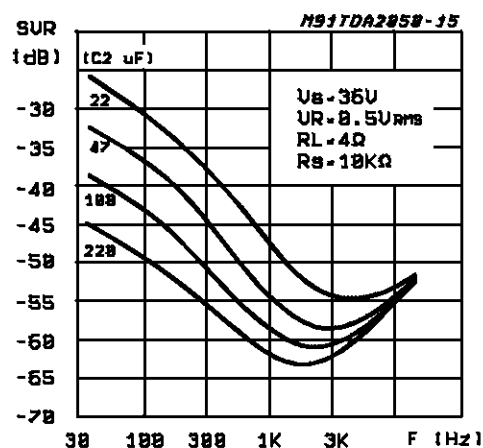


Figure 14: Supply Voltage Rejection vs. Frequency (Single supply) for Different values of C2 (circuit of fig. 3)

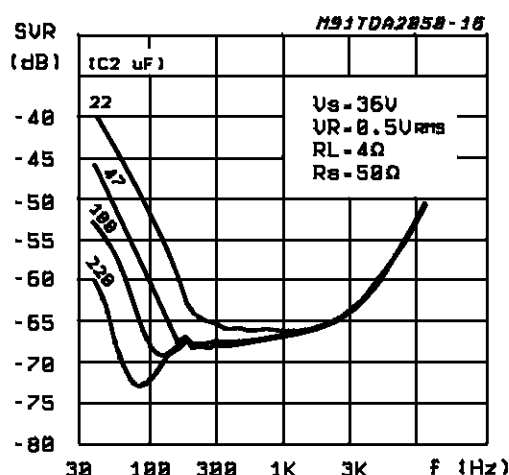


Figure 15: Total Power Dissipation and Efficiency vs. Output Power

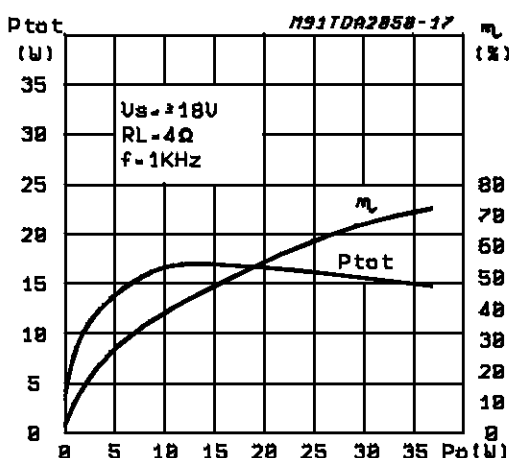
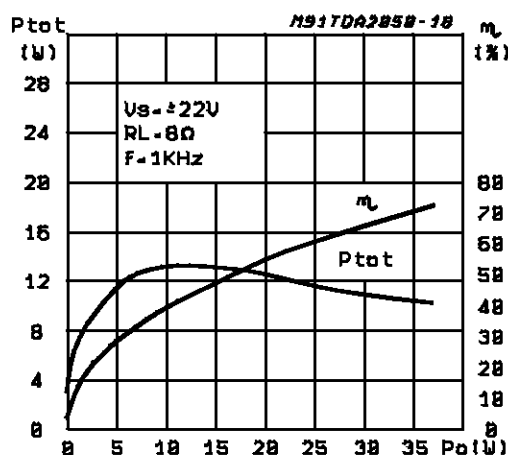


Figure 16: Total Power Dissipation and Efficiency vs. Output Power



SHORT CIRCUIT PROTECTION

The TDA 2050 has an original circuit which limits the current of the output transistors. The maximum output current is a function of the collector emitter voltage; hence the output transistors work within their safe operating area. This function can therefore be considered as being peak power limiting rather than simple current limiting.

It reduces the possibility that the device gets damaged during an accidental short circuit from AC output to ground.

THERMAL SHUTDOWN

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

- 1) An overload on the output (even if it is permanent), or an above limit ambient temperature can be easily tolerated since the T_j cannot be higher than 150°C.
- 2) The heatsink can have a smaller factor of safety compared with that of a conventional circuit. There is no possibility of device damage due to high junction temperature. If for any reason, the junction temperature increases up to 150°C, the thermal shutdown simply reduces the power dissipation and the current consumption.

The maximum allowable power dissipation depends upon the thermal resistance junction-ambi-

A circuit for generating the test signal is given in fig. 19.

The load network consists of a 40 μF capacitor, in series with a 1 ohm resistor. The capacitor limits the current due to the 20 Hz signal to a low value, whereas for the short pulses the effective load impedance is of the order of 1 ohm, and a high output current is produced.

Using this signal and load network the measurement may be made without causing excessive dissipation in the amplifier. The dissipation in the 1 ohm resistor is much lower than a rated output

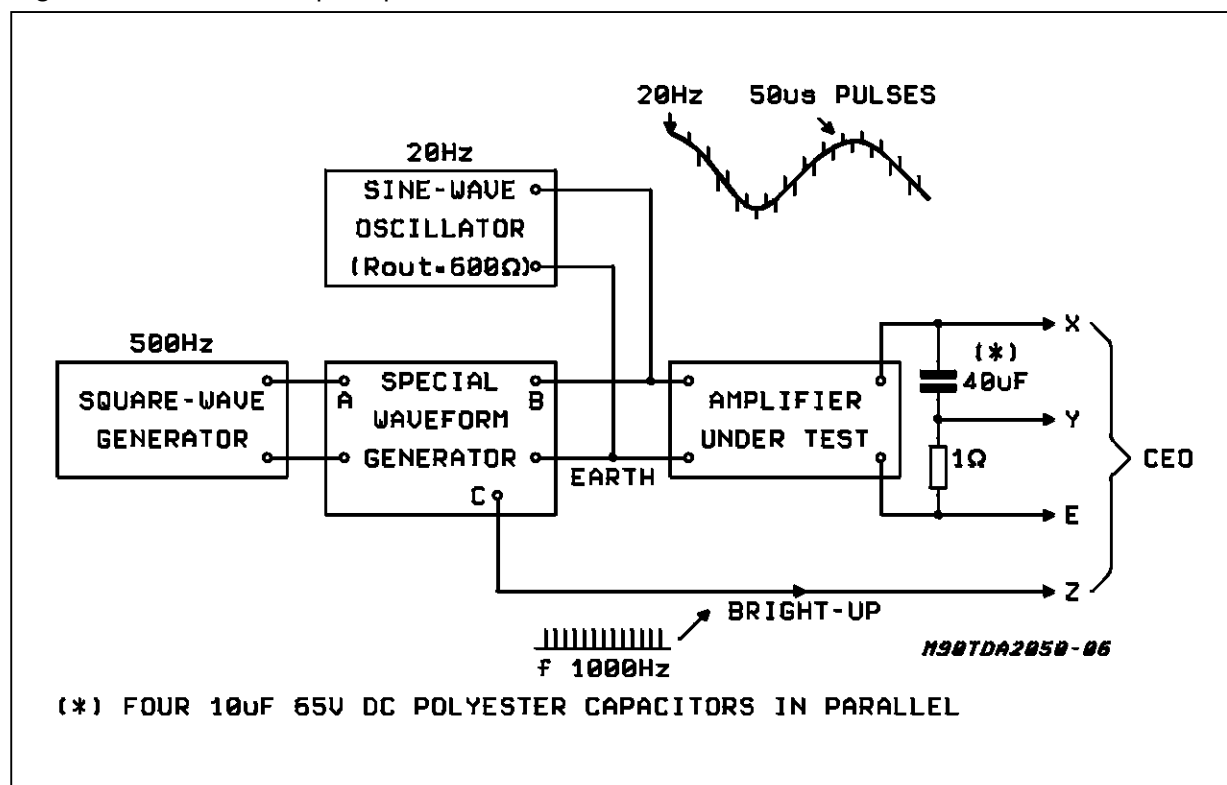
power of the amplifier, because the duty-cycle of the high output current is low.

By feeding the amplifier output voltage to the X-plates of an oscilloscope, and the voltage across the 1 ohm resistor (representing the output current) to the Y=plates, it is possible to read on the display the value of the maximum instantaneous output power.

The result of this test applied at the TDA 2050 is:

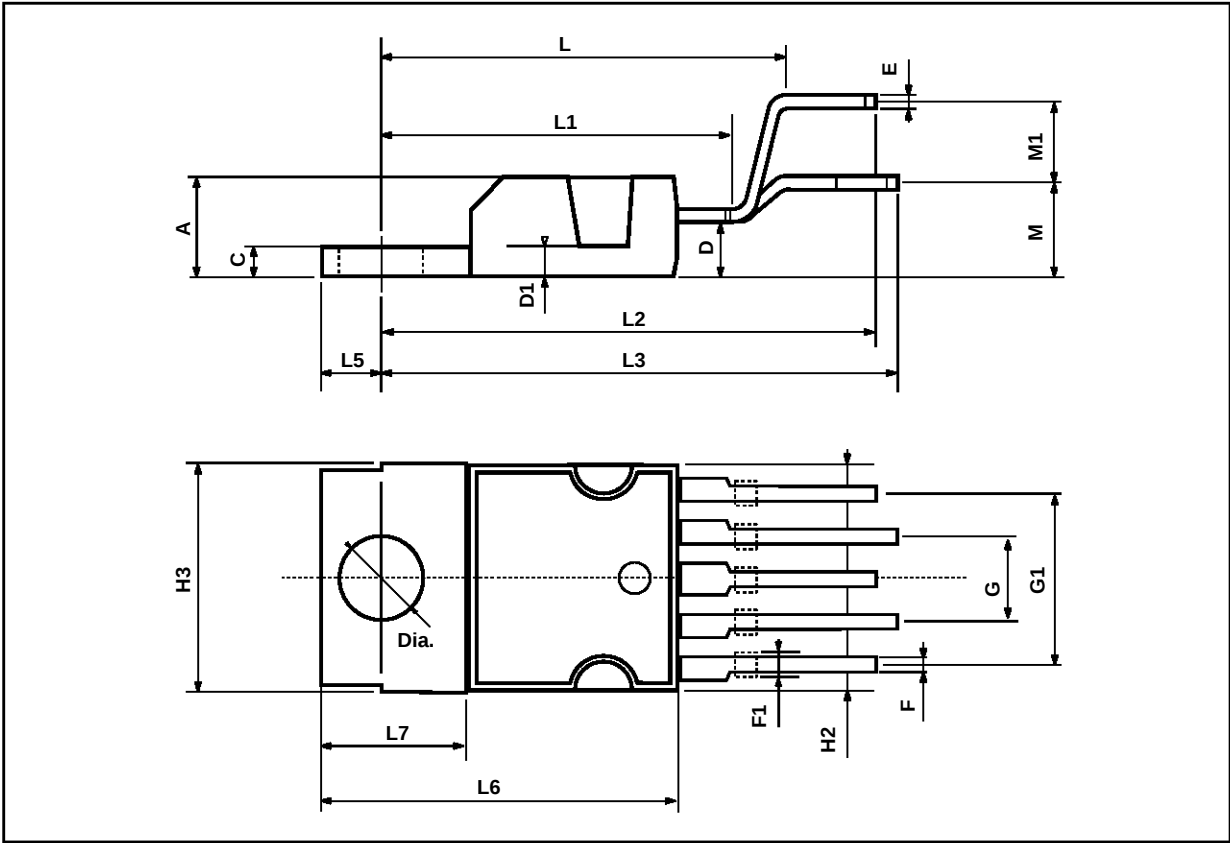
PEAK POWER = 100W typ

Figure 19: Test circuit for peak power measurement



PENTAWATT PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.8		1.05	0.031		0.041
F1	1		1.4	0.039		0.055
G		3.4		0.126	0.134	0.142
G1		6.8		0.260	0.268	0.276
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L		17.85			0.703	
L1		15.75			0.620	
L2		21.4			0.843	
L3		22.5			0.886	
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
M		4.5			0.177	
M1		4			0.157	
Dia	3.65		3.85	0.144		0.152



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