

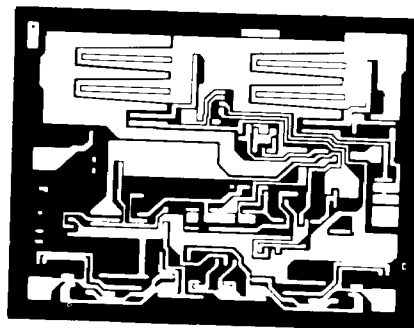


a Penn Central unit

ULN-3784B 4-WATT AUDIO POWER AMPLIFIER

FEATURES

- Low External Parts Count
- Wide Supply-Voltage Range (To 32 V)
- Single Power Supply
- 34 dB Internally Fixed Gain
- High Input Impedance
- Bandwidth Limited
- A-C Short-Circuit Protection
- Thermal Overload Protection
- Directly Replaces LM384N



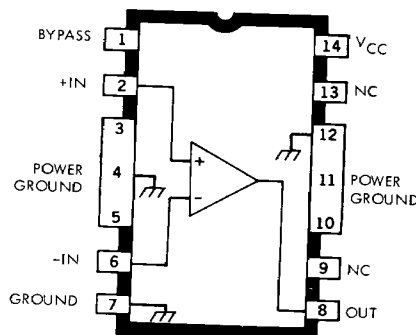
A MINIMUM of external components is needed to obtain high-quality audio from the Type ULN-3784B integrated circuit in communications, automotive, and consumer applications.

The audio power amplifier is supplied in a 14-pin dual in-line plastic package with heat-sink contact tabs. The lead configuration enables attachment of an inexpensive heat sink for increased power dissipation capability, and use of a standard integrated circuit socket or printed wiring board layout.

With a 24 V supply, Type ULN-3784B delivers a minimum of 4 W of audio into an 8Ω load. Output power with a 28 V supply is typically 4.8 W of low-distortion audio into a 16Ω load.

Type ULN-3784B is pin-compatible with, and significantly improves upon, several older designs. Its higher supply-voltage rating allows it to replace

the LM380N, LM384N, and Sprague Types ULN-2280B and ULN-2281B with a wider margin of protection against supply transients. Internal bandwidth limiting provides a significant immunity to r-f not found in many other integrated amplifiers.



Dwg. No. A-11,681

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{CC}	32 V
Peak Output Current, I_{OUT}	1.2 A
Package Power Dissipation, P_D	See Graph
Operating Temperature Range, T_A	-20°C to +85°C
Storage Temperature Range, T_S	-65°C to +150°C

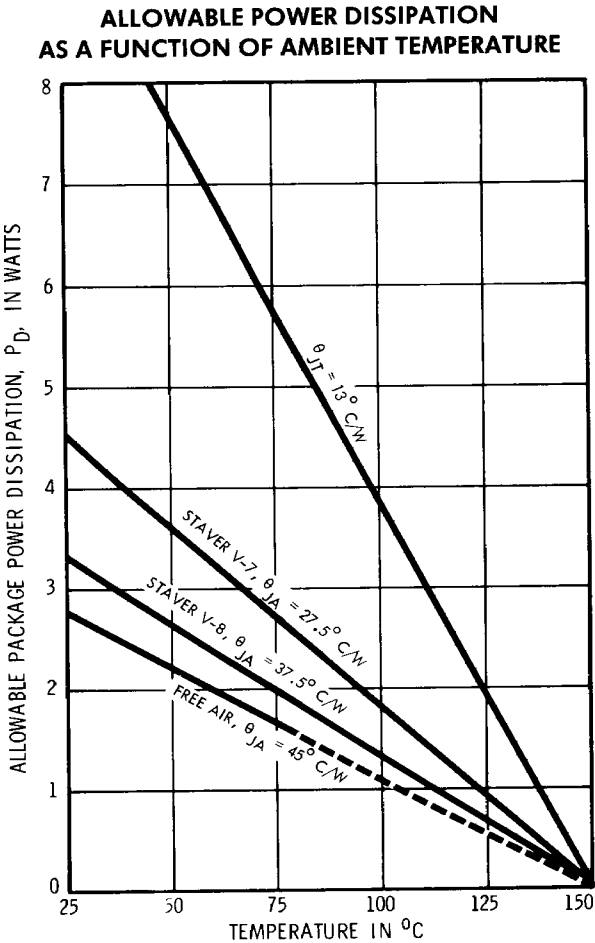
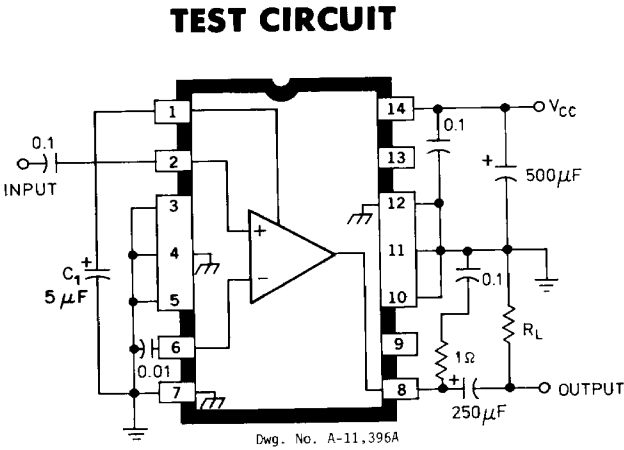
SEMICONDUCTOR DIVISION
SPRAGUE ELECTRIC COMPANY

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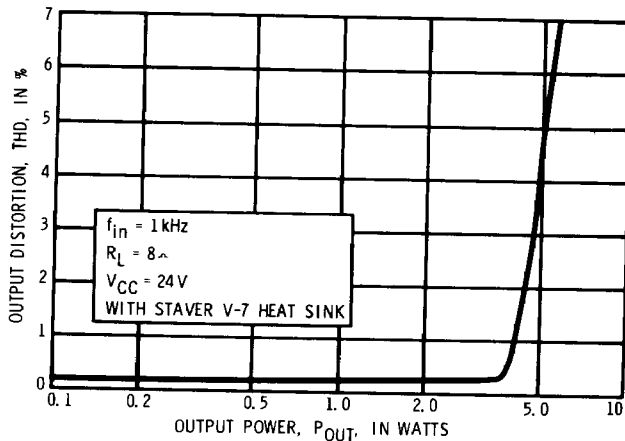
ELECTRICAL CHARACTERISTICS at $T_A = +25^{\circ}\text{C}$, $V_{CC} = 24\text{ V}$, $R_L = 8\Omega$, $f_{in} = 1\text{ kHz}$
(unless otherwise noted)

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Supply Voltage Range	V_{CC}		9.0	24	28	V
Quiescent Supply Current	I_{CC}	$V_{in} = 0\text{ V}$	—	20	—	mA
Quiescent Output Voltage	V_{OQ}	$V_{in} = 0\text{ V}$, See Note 1	—	12	—	V
Voltage Gain	A_v	$P_{out} = 0\text{ W}$	31	34	37	dB
Total Harmonic Distortion	THD	$P_{out} = 50\text{ mW}$, $R_L = 8\Omega$, $V_{CC} = 24\text{ V}$	—	0.2	—	%
		$P_{out} = 50\text{ mW}$, $R_L = 16\Omega$, $V_{CC} = 28\text{ V}$	—	<0.2	—	%
		$P_{out} = 4\text{ W}$, $R_L = 8\Omega$, $V_{CC} = 24\text{ V}$	—	<0.3	5.0	%
Audio Output Power	P_{out}	$R_L = 8\Omega$, $V_{CC} = 24\text{ V}$, THD = 5%	4.0	5.0	—	W
		$R_L = 16\Omega$, $V_{CC} = 28\text{ V}$, THD = 5%	4.0	4.8	—	W
Input Impedance	Z_{in}	Each Input	140	170	—	k Ω
Power Supply Rejection	PSRR	$P_{out} = 0\text{ W}$, $f = 120\text{ Hz}$	—	30	—	dB
Equiv. Input Noise Voltage		$f = 20\text{ Hz to } 20\text{ kHz}$	—	60	—	μV_{rms}
Bandwidth (−3 dB)	BW	$P_{out} = 1\text{ W}$, See Note 2	—	100	—	kHz

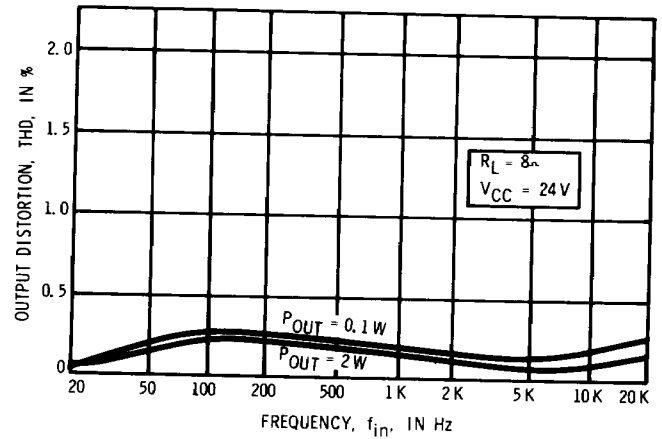
NOTES: 1. The quiescent output voltage typically equals ½ the supply voltage.
2. Unity gain typically occurs between 10 MHz and 100 MHz.



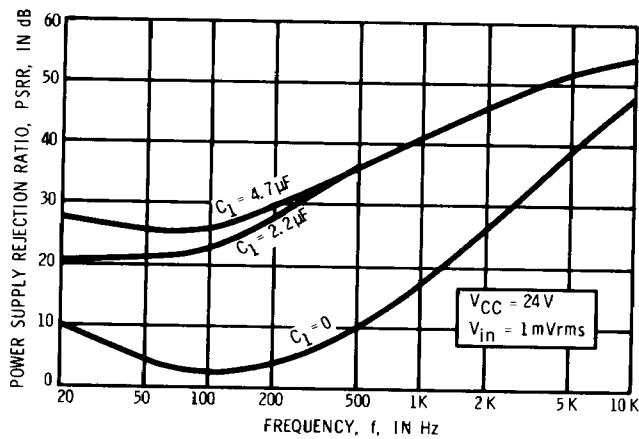
TYPICAL CHARACTERISTICS

DISTORTION AS A FUNCTION
OF OUTPUT POWER

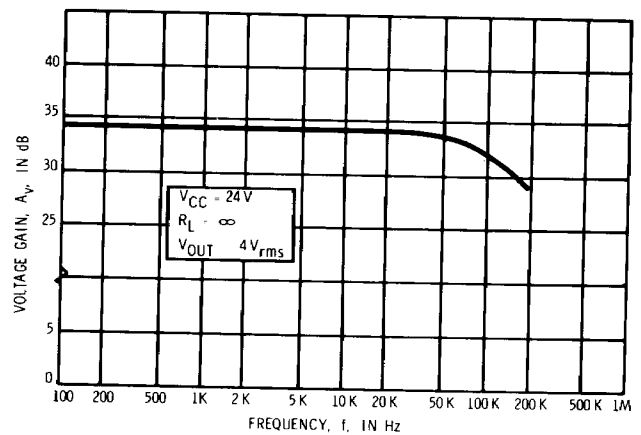
Dwg. No. A-11,683A

DISTORTION AS A FUNCTION
OF FREQUENCY

Dwg. No. A-11,685

PSRR AS A FUNCTION
OF FREQUENCY

Dwg. No. A-11,684

VOLTAGE GAIN AS A FUNCTION
OF FREQUENCY

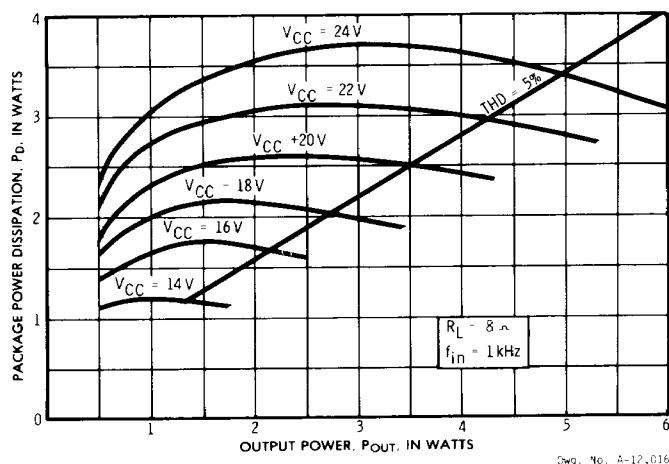
Dwg. No. A-11,400A

THERMAL FACTORS AND ULN-3784B OPERATION

Thermal factors must be considered in achieving reliable operation of Type ULN-3784B. Guidelines given here provide the circuit-design engineer with information on maintaining IC junction temperature below safe limits.

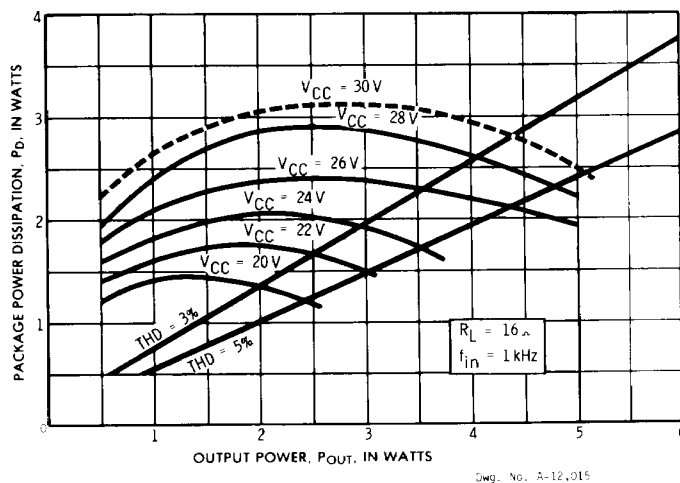
The graphs below show package power dissipation as a function of output power over a wide range of supply voltage with a load resistance of 8Ω or 16Ω . Lines indicating 3% distortion and 5% distortion are shown as guides to trade-offs between supply voltages, package power dissipation, and upper-limit distortion. As the power supply voltage increases for any output power requirement, distortion decreases and package power dissipation increases.

Package power dissipation figures must be taken from the highest point on the supply voltage curve. Note that although supply voltage is normally specified at the rated audio-output power, it will usually increase for reduced audio-output levels.



**POWER DISSIPATION AS A FUNCTION
OF OUTPUT POWER (8Ω LOAD)**

**POWER DISSIPATION AS A FUNCTION
OF OUTPUT POWER (16Ω LOAD)**



CIRCUIT DESIGN

If design values of audio output power, distortion, and maximum ambient temperature have been selected, optimal speaker impedance, supply voltage, as well as heat-sink requirements can be determined from the curves below and on the previous page.

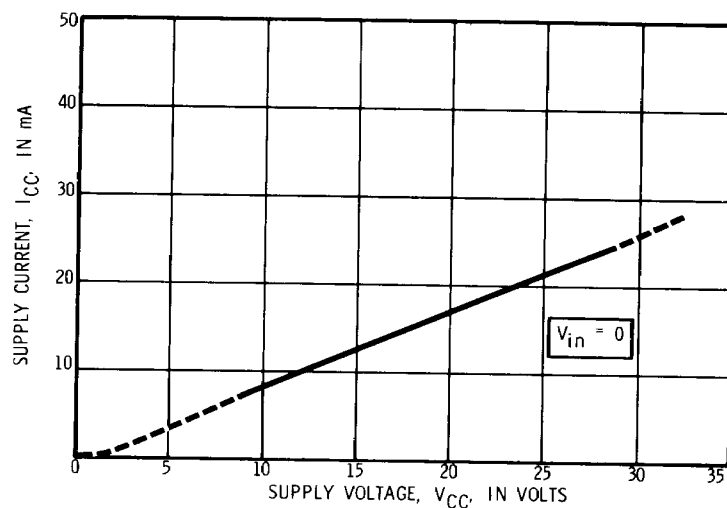
For an output of 4.5 W at 5% distortion and a maximum ambient temperature of +50°C:

R_L	8 Ω	16 Ω	Specified
V_{CC}	22.5 V	26.5 V	From Graph
$P_{D(max)}$	3.2 W	2.6 W	From Graph (determines heat sink)
P_D	3.1 W	2.2 W	From Graph at V_{CC} and P_{OUT}
$P_D + P_{OUT}$	7.6 W	6.7 W	Calculated
I_{CC}	338 mA	253 mA	Calculated (determines supply current)

The Allowable Package Power Dissipation graph shows that the Staver V-7 heat sink is required for the 8 Ω , 22.5 V design, while the smaller Staver V-8 heat sink is just adequate for the 16 Ω , 26.5 V design.

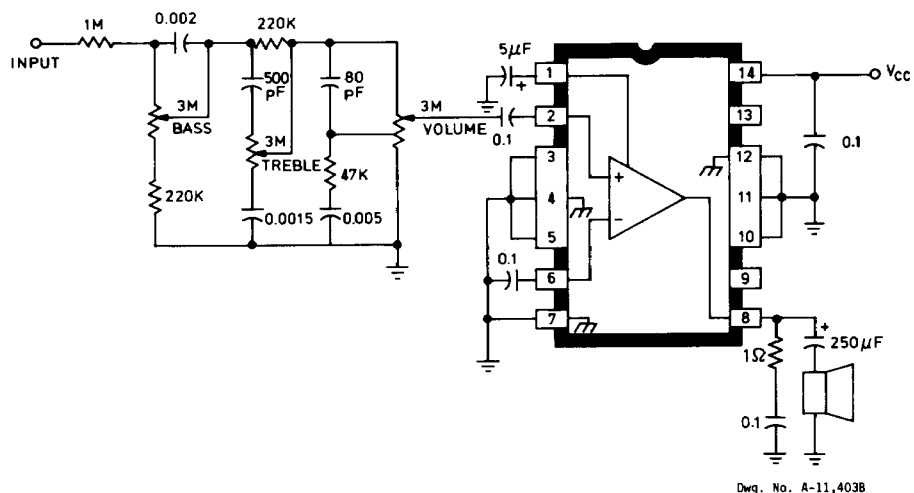
The preceding appears to indicate that the best choice is an output impedance of 16 Ω with its higher efficiency and smaller heat sink requirements. If lower distortion is required, the higher impedance load with the higher supply voltage becomes even better. However, if an unregulated supply is used, the designer may prefer the 8 Ω load, since the absolute maximum supply voltage rating is 32 V.

QUIESCENT SUPPLY CURRENT
AS A FUNCTION OF SUPPLY VOLTAGE

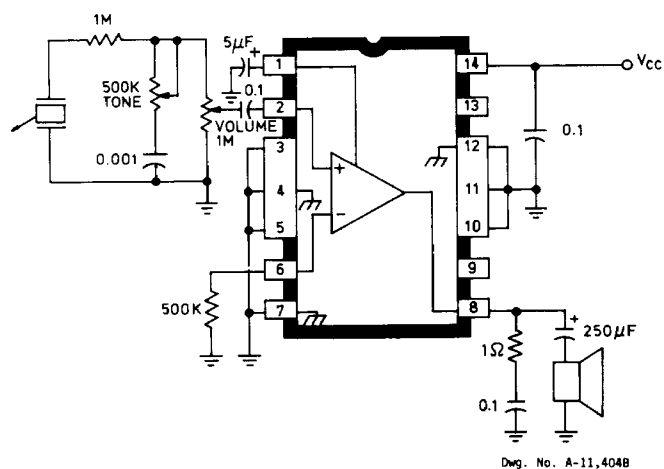


Dwg. No. A-11,682

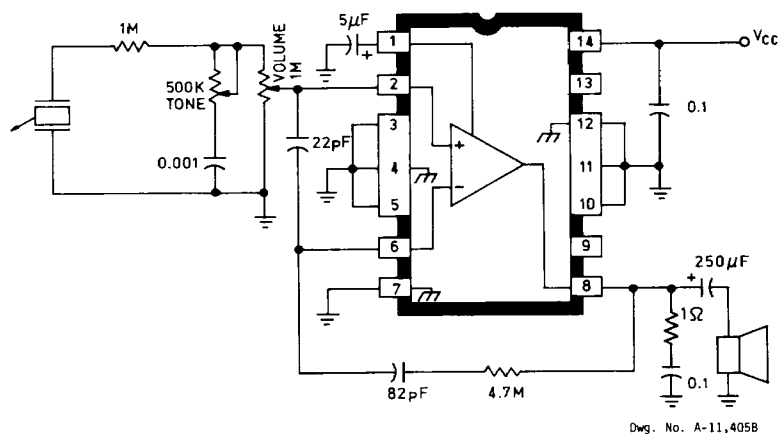
TYPICAL APPLICATIONS



**AMPLIFIER
WITH TONE CONTROLS**

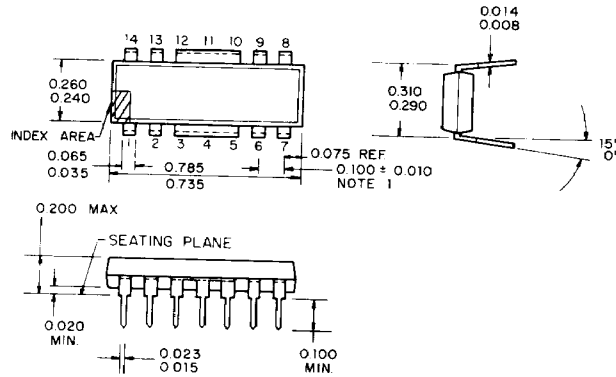


**LOW-COST
PHONOGRAPH**



**AMPLIFIER
WITH BASS-BOOST NETWORK**

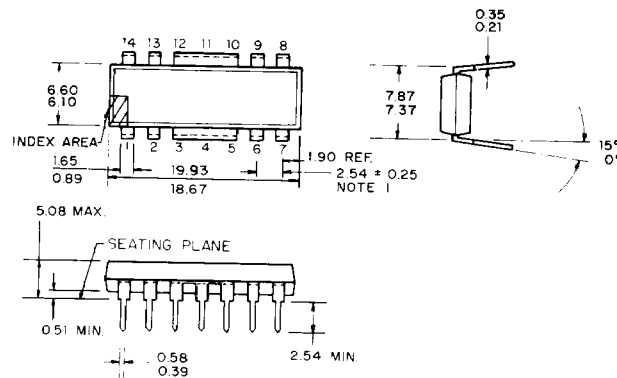
DIMENSIONS IN INCHES



DWG. NO. A-9843C 1N

DIMENSIONS IN MILLIMETRES

Based on 1" = 25.4 mm



DWG. NO. A-9843C 1M

NOTES:

1. Lead spacing tolerance is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Leads missing from their designated positions shall also be counted when numbering leads.
4. Terminal lead standoffs may be omitted and replaced by body standoffs.
5. Lead gauge plane is 0.030" (0.76 mm) max. below seating plane.



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a Penn Central unit

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602/831-6762

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In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

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