File Number **681**

HC2500

T-79-23

Multi-Purpose, Low-Distortion 7-Ampere Operational Amplifier

Linear Amplifier for Applications in Industrial and Commercial Equipment

Features:

- *Bandwidth: 30 kHz at 60 W*
- *High power output: up to 100 W(rms)*
- *Adjustable idling current*

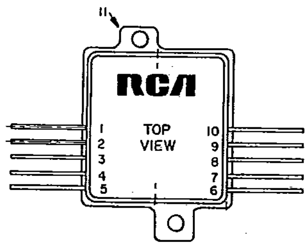
RCA type HC2500• is a complete solid-state hybrid amplifier in a compact hermetic package. It employs a quasi-complementary-symmetry output circuit.

The HC2500 is a low-distortion, 100-watt linear amplifier. The output section can be externally biased class AB for low inter-modulation and total harmonic distortion. Terminals are available for external frequency compensation, external short-circuit protection, and inverting and non-inverting inputs.

The HC2500 is recommended for the following applications; servo amplifiers (ac, dc, PWM), deflection amplifiers, power operational amplifiers, voltage regulators, driven inverters, hi-fi amplifiers, PA systems, and solenoid drivers.

•Derived from RCA Dev. No. TA8651A.

TERMINAL DESIGNATIONS



MAXIMUM RATINGS, *Absolute-Maximum Values:*

SUPPLY VOLTAGE:		
Between leads 1 and 10	75	V
OUTPUT CURRENT (Peak)	7	A
TOTAL DISSIPATION:		
Per output device	See Figs. 4 & 5	
TEMPERATURE RANGE:		
Storage	−55 to +125°C	
Output junction	−55 to +150°C	
LEAD TEMPERATURE (During Soldering):		
At distance ≥ 1/8 in. (3.17 mm) from case for 10 s max.	235°C	

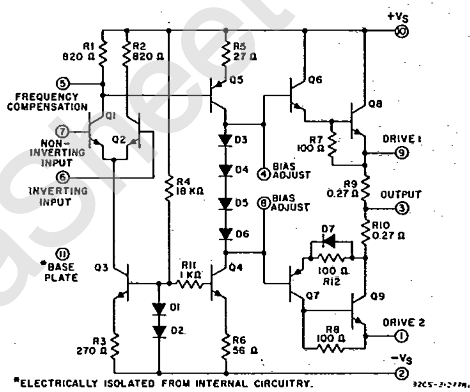


Fig. 1 — Schematic diagram of type HC2500 operational amplifier.

COMPARISON CHART

TYPE	IM DIST. @ 50 mW	OUTPUT PROTECTION NETWORK	OPERATING MODE	FREQUENCY COMPENSATION	COMMUTATING DIODES
HC2500	0.06%	NO	CLASS AB	CAPACITOR ON SIGNAL TERMINALS	NO
HC2000H	5.8%	YES	CLASS B	LC FILTER ON OUTPUT	YES

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ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C and Supply Voltage (V_S) = ±37.5 V*

CHARACTERISTIC	SYMBOL	REFERENCE FIG. NO.	TEST CONDITIONS: SPECIAL NOTES	TEST CONDITIONS: FREQ. (f)–kHz	TEST CONDITIONS: OUTPUT POWER (P_O)–W	TEST CONDITIONS: LOAD RESIST. (R_L)–Ω	LIMITS: MIN.	LIMITS: TYP.	LIMITS: MAX.	UNITS
Offset Voltage	V_{offset}	3	Measured Pin 3 to Gnd	–	–	4	–	–	±250	mV
Quiescent Current	I_o	3	Idling Current < 1 mA	–	–	Open	–	–	±30	mA
Output Voltage Swing	V_{OUT}		Peak dc voltage	0	200	4	28	–	–	V
Closed-Loop Bandwidth	f_H	3		–	1	4	43	–	–	kHz
Total Harmonic Distortion	THD	15		1	60	4	–	0.3	0.5	%
Closed-Loop Voltage Gain	A_{CL}	3		1	1	4	31	32	–	
Thermal Resistance	$R_{\theta JC}$	5		–	–	–	–	–	2	°C/W

ELECTRICAL CHARACTERISTICS
Typical Values (for Design Guidance), *At Case Temperature (T_C) = 25°C and Supply Voltage (V_S) = ±37.5*

CHARACTERISTIC	SYMBOL	REFERENCE FIG. NO.	SPECIAL NOTES	FREQ. (f)–kHz	OUTPUT POWER (P_O)–W	LOAD RESIST. (R_L)–Ω	MIN.	TYP.	MAX.	UNITS
Open-Loop Voltage Gain	A_{OL}	8, 19	Idling current = 50 mA	1	25	4	–	70	–	dB
Input Offset Voltage	V_{IO}	20		–	0	Open	–	±10	–	mV
Input Offset Current	I_{IO}	20		–	0	Open	–	7	–	μA
Input Bias Current	I_{IB}	20		–	0	Open	–	20	–	μA
Common-Mode Input Impedance	R_{CM}	22		0.005	0	Open	–	1	–	MΩ
Common-Mode Input-Voltage Range	V_{ICR}			0.5	100	4	–	32	–	V
Common-Mode-Rejection Ratio	CMRR			0.005	0	Open	–	50	–	dB
Supply-Voltage Ripple-Rejection Ratio	V_{RR}			0.06	0	4	–	30	–	dB
Intermodulation Distortion	IMD	14	Idling current = 50 mA	–	0.05	4	–	0.06	–	%
Slew Rate	SR	18	A_{CL} = 2, C_c = 100 pF	0.5 Square Wave	–	4	–	4.3	–	V/μs
Idling-Current Drift	ΔI_I	17	25°C to 100°C	–	–	4	–	1	–	mA/°C

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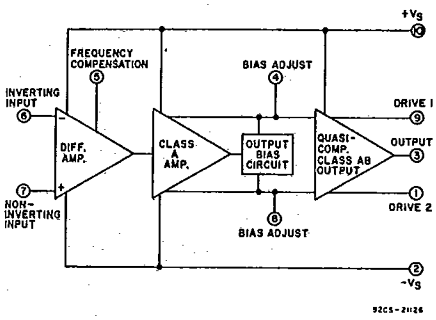

Fig. 2 – Block diagram of HC2500 100-watt class AB amplifier.

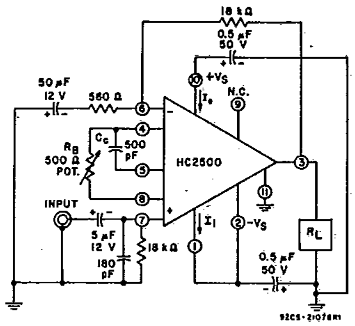

Fig. 3 – Typical test circuit with split supply for measuring A_{CL}, I_i, I_o, V_{offset}, f_H, THD, and IMD.

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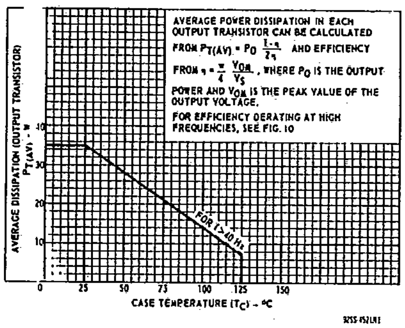

Fig. 4 – Dissipation (average) derating curve for each output transistor (for symmetrical waveforms with f >40 Hz).

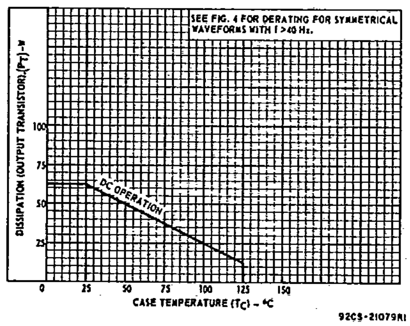

Fig. 5 – Dissipation derating curve for each output transistor.

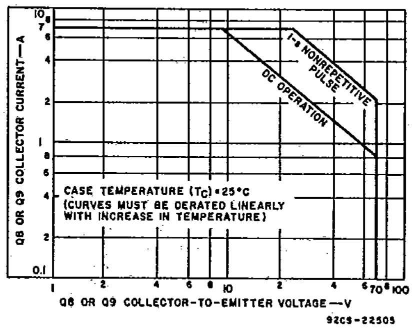

Fig. 6 – Maximum operating area for HC2500.

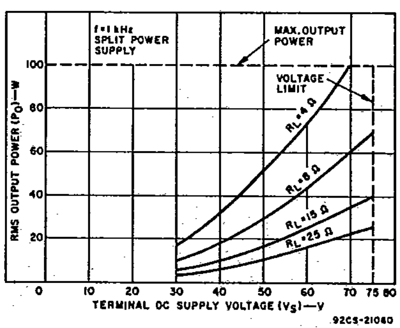

Fig. 7 – Output power as a function of supply voltage, with various values of load resistance, for symmetrical sine-wave operation.

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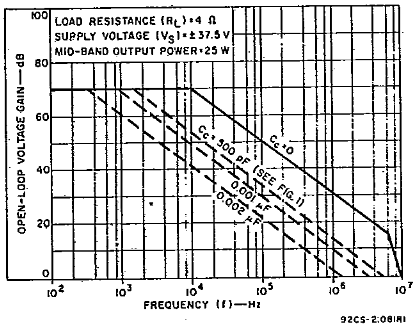

Fig. 8 — Typical open-loop voltage gain vs. frequency.

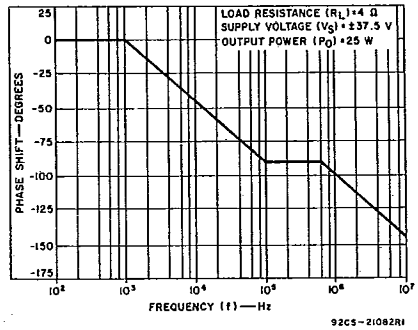

Fig. 9 — Typical open-loop phase shift vs. frequency.

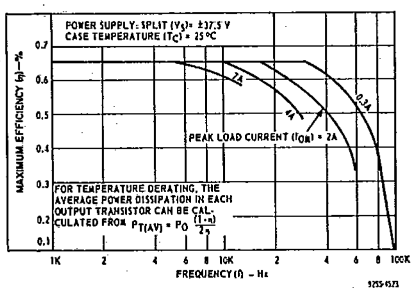

Fig. 10 — Maximum efficiency vs. frequency for several values of peak load current.

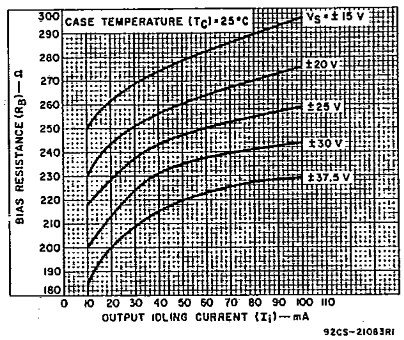

Fig. 11 — Bias resistor (R_B in Fig. 3) value vs. output idling current (I_I).

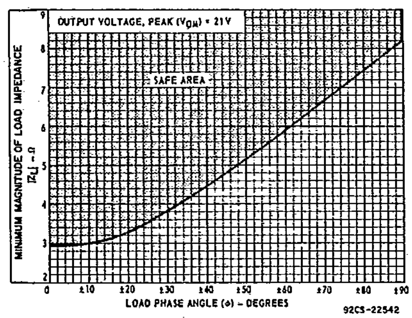

Fig. 12 — Minimum load impedance vs. load phase angle and safe area of operation.

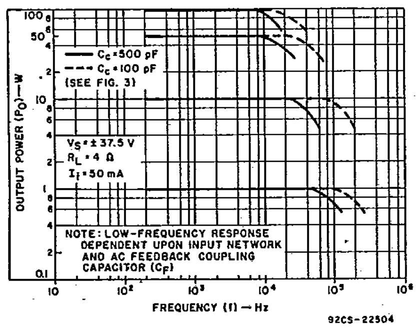

Fig. 13 — Output power vs. frequency.

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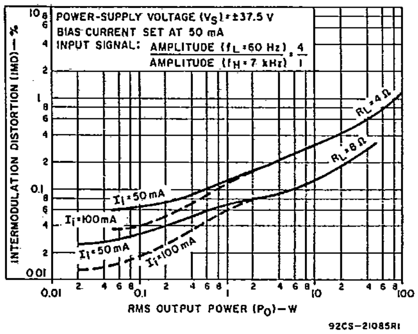

Fig. 14 – Typical intermodulation distortion vs. rms output power.

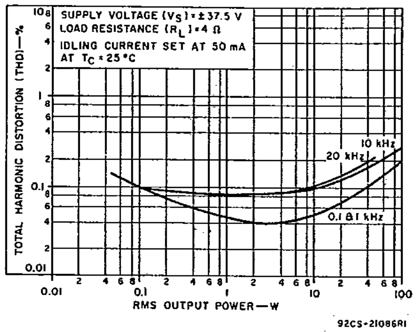

Fig. 15 – Typical total harmonic distortion vs. rms output power.

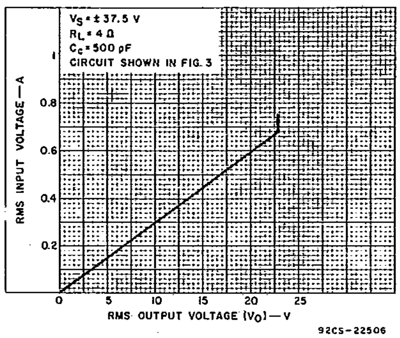

Fig. 16 – Input sensitivity.

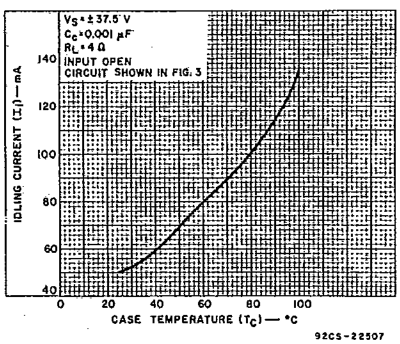

Fig. 17 – Typical idling-current dirft.

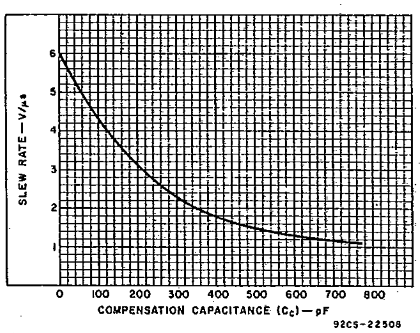

Fig. 18 – Typical slew rate vs. value of compensation capacitor, C_c (test circuit shown in Fig. 21).

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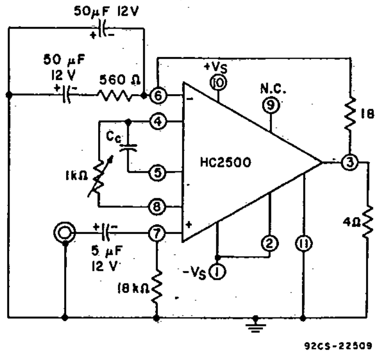
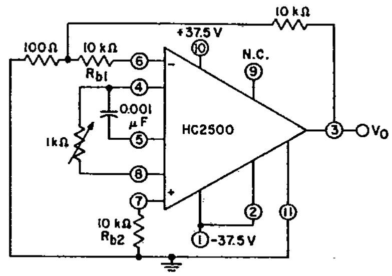


Fig. 19 – Test circuit for open-loop gain and phase response.



$V_{IO} = -\frac{V_O}{100}$ with R_{b1} and R_{b2} shorted

$I_{IO} = -\frac{V_O}{100\,R_{b2}}$

$I_{Ib} = \frac{\pm V_O}{100\,R_{b2}}$ with R_{b1} shorted

Fig. 20 – Test circuit for input offset voltage and current test.

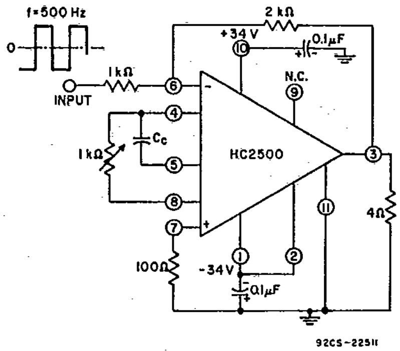
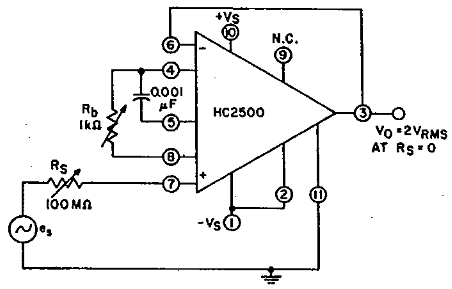


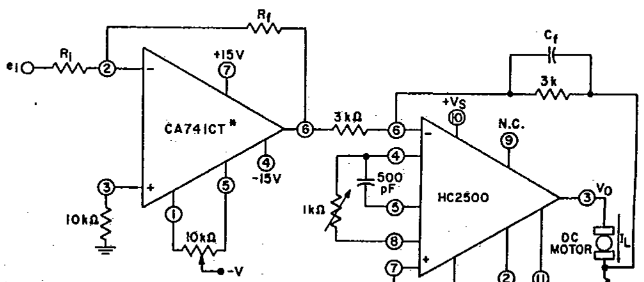
Fig. 21 – Circuit used to test slew rate.



R_{CM} = 9 R_S with series resistance (R_S) increased from zero until output voltage (V_O) is reduced by 10%.

Fig. 22 – Test circuit for measuring common-mode input resistance.

TYPICAL APPLICATION CIRCUITS



$|I_L| = |e_I| \frac{R_f}{R_I R_S}$

C_f should be chosen to limit $L(dI_L/dt)$ during rapid transitions of the input waveform without limiting required output performance.
R_S should be chosen as high as possible without limiting required output performance.
*See Data Bulletin File 531.

Fig. 23 – Current-feedback motor-control circuit.

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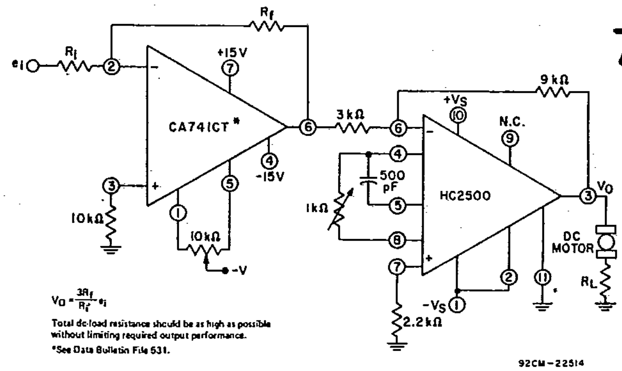

Fig. 24 — Voltage-feedback motor-control circuit.

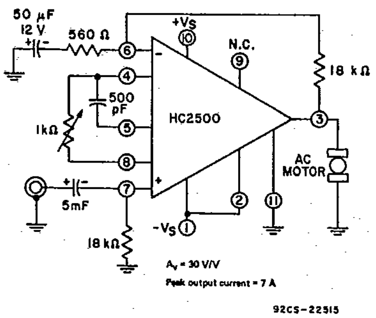

Fig. 25 — AC motor control.

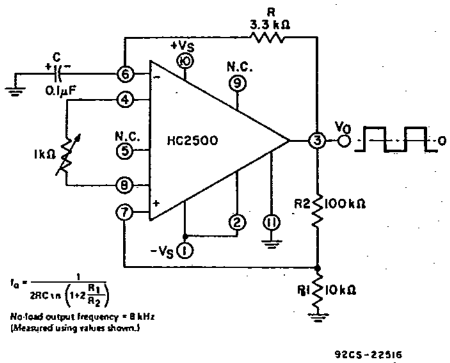

Fig. 26 — High-power astable multivibrator.

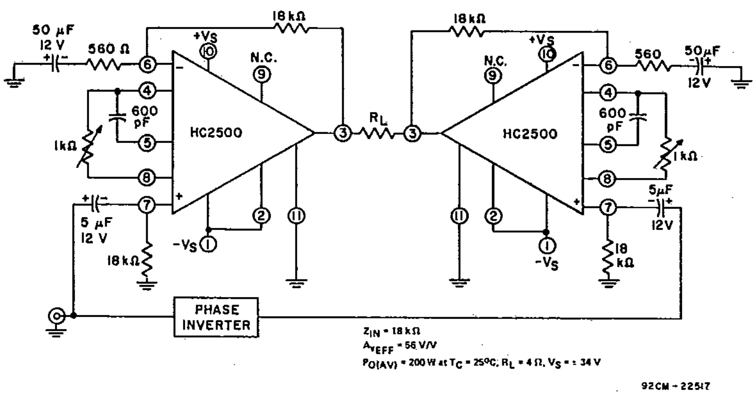

Fig. 27 — Bridge circuit for loads greater than 100 watts.

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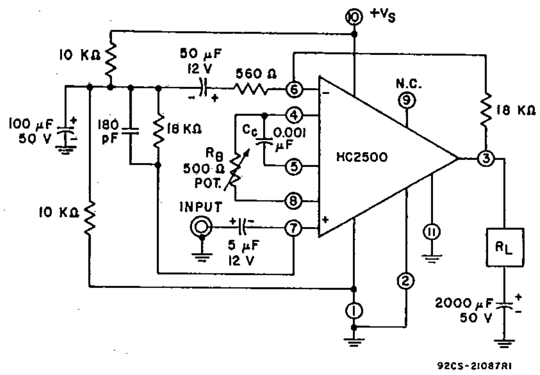

V_S	54 V
P_{out}	60 W
Idling Current (R_B = 168 Ω	50 mA
THD	0.15%
IMD @ 50 mW	0.06%
V_{offset} Pin 3 To Gnd.	+ 100 mV
Efficiency	64%
R_L	4 ohms

Fig. 28 – Typical circuit connections for operation of HC2500 with single-ended supply, and performance data.