

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.

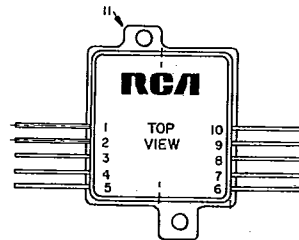
The HC2500 is recommended for the following applications; servo amplifiers (ac, dc, PWM), deflection amplifiers, power operational amplifiers, voltage regulators, driven inverters, hi-fi amplifiers, PA systems, and solenoid drivers.

*Derived from RCA Dev. No. TA8651A.

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 $\geq 1/8$ in. (3.17 mm) from case for 10 s max. 235°C

TERMINAL DESIGNATIONS



92CS-40377

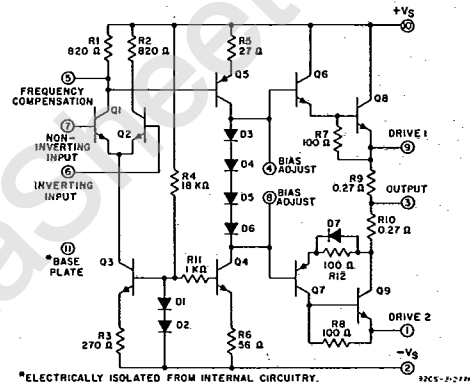


Fig. 1 - Schematic diagram of type HC2500 operational amplifier.

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	REFER- ENCE FIG. NO.	TEST CONDITIONS				LIMITS			UNITS
			SPECIAL NOTES	FREQ. (f)-kHz	OUTPUT POWER (P_O)-W	LOAD RESIST. (R_L)-Ω	MIN.	TYP.	MAX.	
Offset Voltage	V_{offset}	3	Measured Pin 3 to Gnd	-	-	4	-	-	±250	mV
Quiescent Current	I_o	3	Idling Cur- rent < 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

Open-Loop Voltage Gain	A_{OL}	8, 19	Idling cur- rent = 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 cur- rent = 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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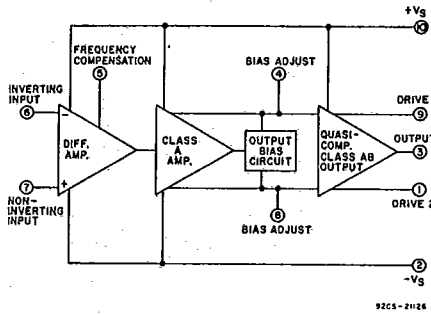


Fig. 2 - Block diagram of HC2500 100-watt class AB amplifier.

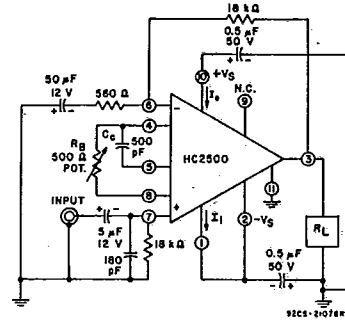


Fig. 3 - Typical test circuit with split supply for measuring A_{CL} , I_q , V_{offset} , f_H , THD, and IMD.

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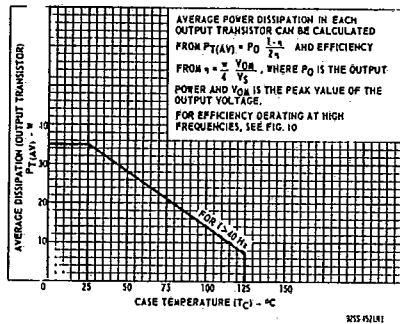


Fig. 4 - Dissipation (average) derating curve for each output transistor (for symmetrical waveforms with $f > 40$ Hz).

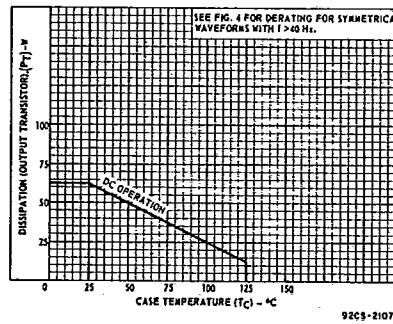


Fig. 5 - Dissipation derating curve for each output transistor.

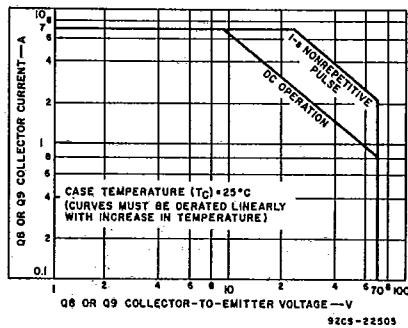


Fig. 6 - Maximum operating area for HC2500.

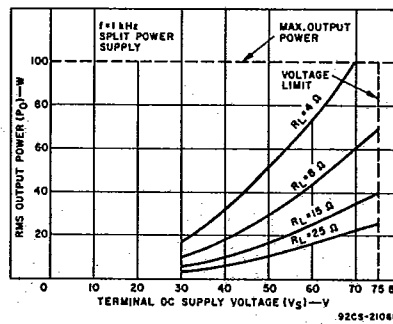


Fig. 7 - Output power as a function of supply voltage, with various values of load resistance, for symmetrical sine-wave operation.

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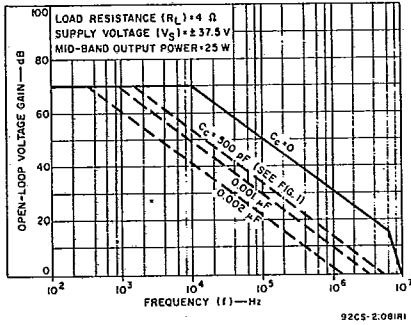


Fig. 8 - Typical open-loop voltage gain vs. frequency.

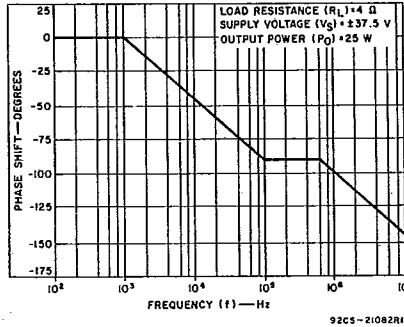


Fig. 9 - Typical open-loop phase shift vs. frequency.

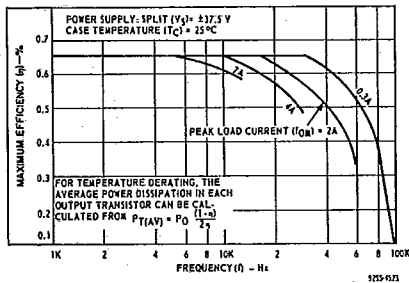


Fig. 10 - Maximum efficiency vs. frequency for several values of peak load current.

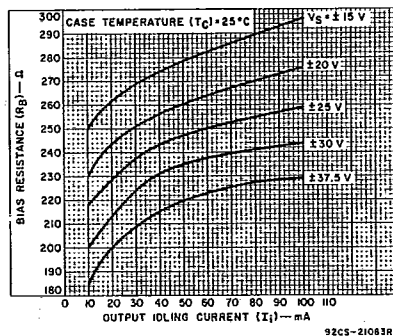


Fig. 11 - Bias resistor (R_B in Fig. 3) value vs. output idling current (I_i).

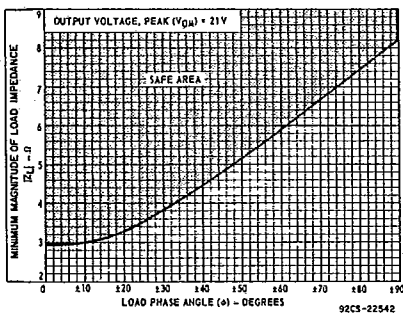


Fig. 12 - Minimum load impedance vs. load phase angle and safe area of operation.

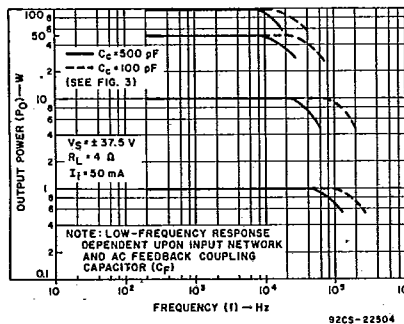


Fig. 13 - Output power vs. frequency.

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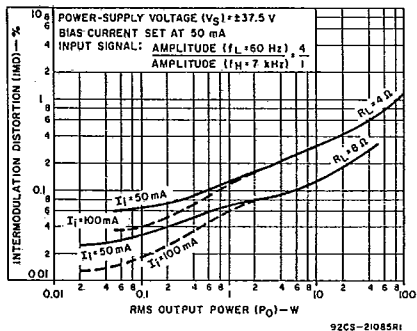


Fig. 14 — Typical intermodulation distortion vs. rms output power.

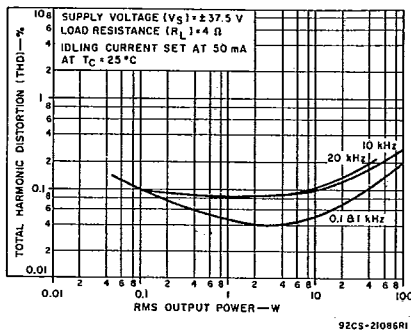


Fig. 15 — Typical total harmonic distortion vs. rms output power.

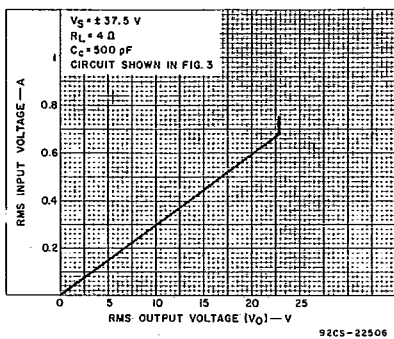


Fig. 16 — Input sensitivity.

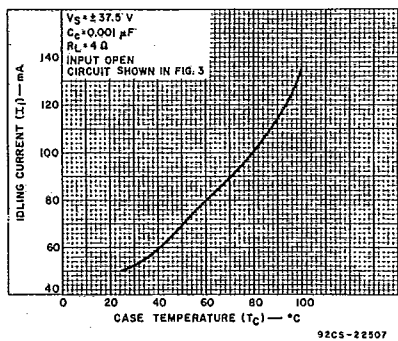


Fig. 17 — Typical idling-current drift.

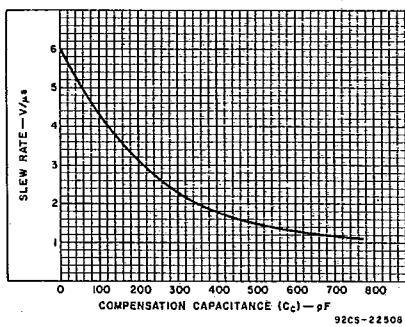
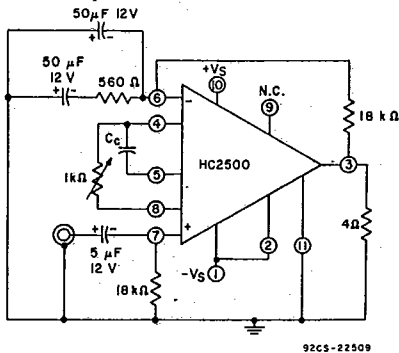


Fig. 18 — Typical slew rate vs. value of compensation capacitor, C_C (test circuit shown in Fig. 21).



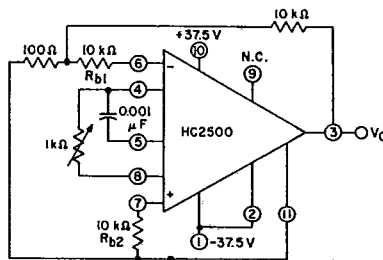
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Fig. 19 - Test circuit for open-loop gain and phase response.



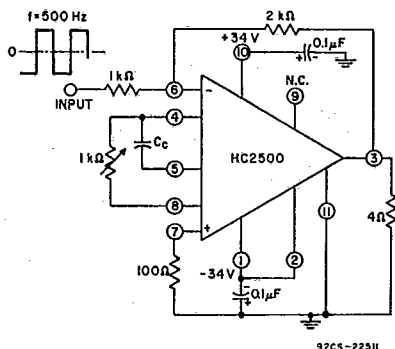
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Fig. 20 - Test circuit for input offset voltage and current test.

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

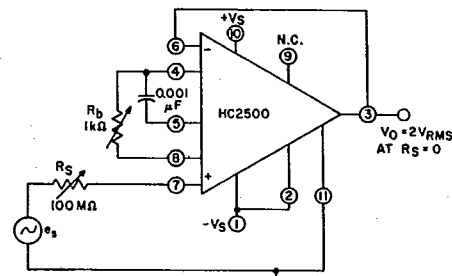
$$I_{IO} = -\frac{V_O}{100 R_{b2}}$$

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



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Fig. 21 - Circuit used to test slew rate.

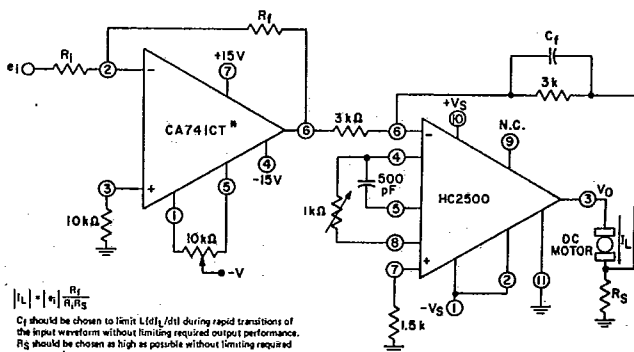


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$R_{CM} = 9 R_S$ with series resistance (R_S) increased from zero until output voltage (V_O) is reduced by 10%.

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

TYPICAL APPLICATION CIRCUITS



92CM-22513

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

$|G| = \left| \frac{R_f}{R_i} \right|$
 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.

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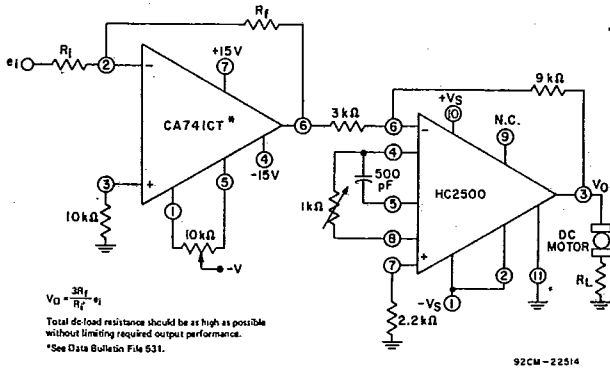


Fig. 24 - Voltage-feedback motor-control circuit.

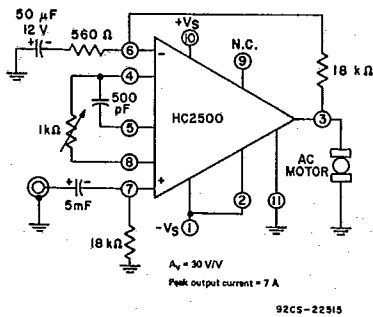


Fig. 25 - AC motor control.

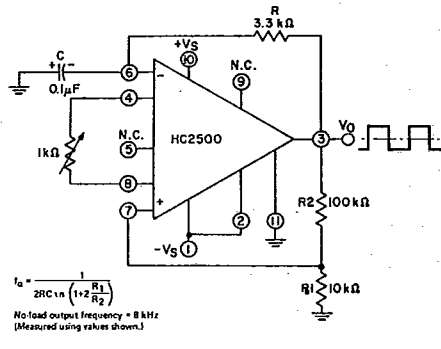


Fig. 26 - High-power astable multivibrator.

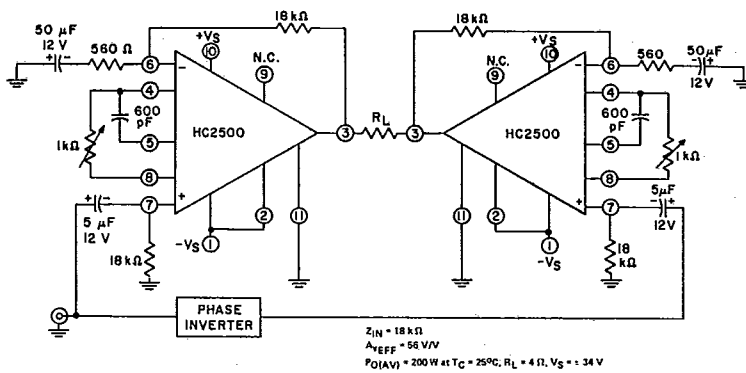
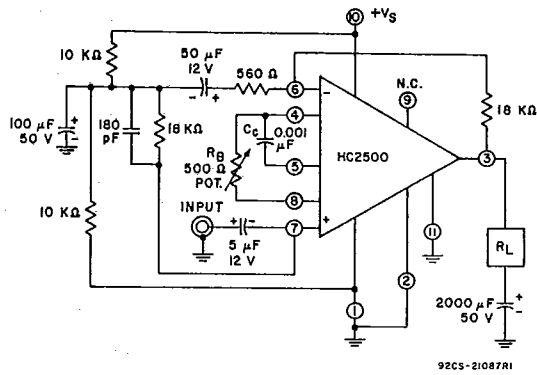


Fig. 27 - Bridge circuit for loads greater than 100 watts.



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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%
Pin 3 V _{offset} 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.