

D.C. MOTOR SPEED CONTROLLING IC

DESCRIPTION

The CS-175 is a monolithic integrated circuit motor speed control. It is designed to provide maximum flexibility to the user at low cost. Requirements for adjustment and external components in multiple speed applications have been further reduced by giving the user accurate pin programmable speed ratios.

While many other applications are possible, the CS-175 is intended primarily for use with A.C. tachometer signals. The CS-175 is capable of providing a level of stability such that errors are dominated by terms created by the finite loop bandwidth made necessary to ensure stability with the dynamics of the specific motor and load.

The CS-175 is housed in a 14L plastic Dual-in Line Package.

APPLICATION INFORMATION

The regulator, Pin 1, is nominally 2.0V, with a low temperature coefficient. It can be used externally as a reference if the current leaving or entering is restricted to less than 100 μ A. If large capacitive loads are tied from Pin 1 to ground, instability may result. This can be eliminated by inserting a small value resistor (200 Ω) between Pin 1 and the load.

The one-shot reference, Pin 2, is normally connected to Pin 14, the internal one-shot reference divider. It can, however, be used with an external resistor network or potentiometer if desired.

The delay option can be disabled by connecting Pin 4 directly to Pin 1.

The output current can be increased by connecting a resistor from Pin 1 to Pin 6. The output current is then:

$$I_{10} \text{ max} = 700 \mu\text{A} + \frac{1.2\text{V}}{R} \quad \text{where } R \geq 270\Omega$$

While reverse polarity protection has been included to prevent damage during temporary battery reversals at up to 9V, the capacitor on Pin 11 may be damaged if it is polarized.

The current limit input, Pin 9, can be used to prevent external power transistor and/or motor burnout. R limit is connected from Pin 7 to Pin 9.

$$I \text{ Limit} \approx \frac{.73\text{V}}{R \text{ Limit}}$$

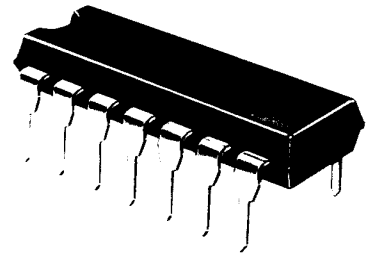
A rolloff, capacitor of .01 μ F may be required from Pin 10 to ground, depending upon the type of external power transistor used. An epi-base or single diffused output device will very often provide satisfactory output amplifier compensation, but the added capacitor will ensure stability in all cases.

Due to the inescapable non-linear time varying nature of the typical motor speed control and the load, the integrator capacitor value can be found most directly by experimentation. If the system can be thoroughly characterized (moment of inertia of both motor and load, compliance of load, torque of load including speed dependence, and torque and RPM characteristics of the motor), and analytical approach may be possible. However, even if the user is familiar with non-linear controls, such an effort probably cannot be justified.

This difficulty is not peculiar to the 175, but is essentially present with all ordinary motor speed controls. The trial value of the capacitor should be initially between 1 μ F and 10 μ F, with larger values used at low Vcc's and with large motors.

The tachometer detector input, Pin 12, may require a capacitor to Pin 1 to reduce the noise caused by coupling from the motor windings to the tachometer windings. It may be possible to eliminate this capacitor when the motor and tach are well isolated.

Pin 13, the speed programming pin, should be connected to Pin 1, opened, or grounded to obtain slow, medium and fast respectively.

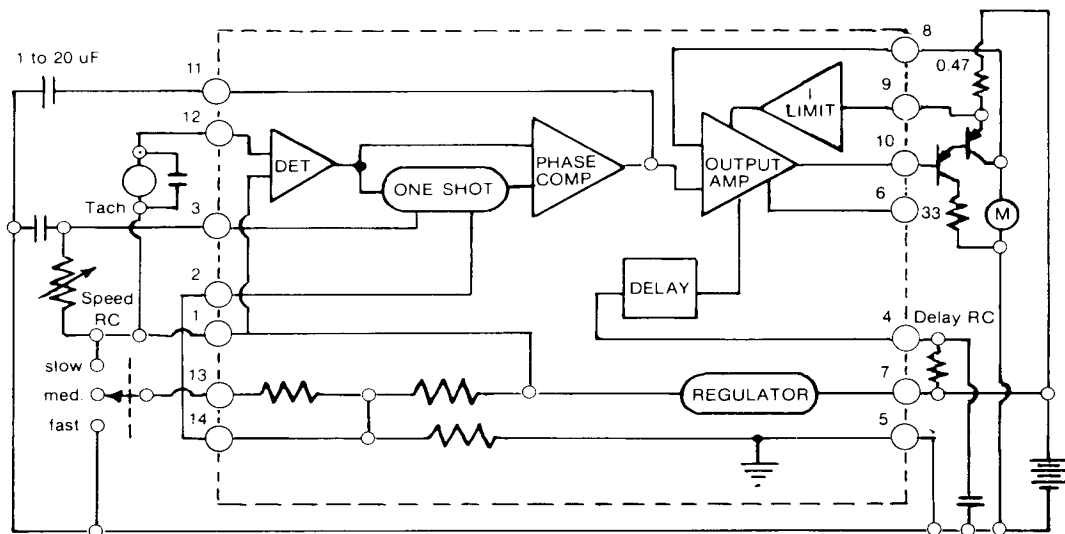


FEATURES

- Pin programmable speed ratios
- Accurate speed control of $\pm 0.5\%$ max up to 1.5:1 speed ratio
- Built-in delay option
- Internal 2V reference available at pin 1 with up to 100 μ A sink/source capability

ABSOLUTE MAXIMUM RATINGS

Power Supply Voltage, V7 (reverse polarity protected)	-9V to +12V
Tachometer Input, V12	-5V to +9V
Storage Temperature, Ts	-40°C to +150°C
Operating Temperature, TA	-20°C to +85°C
Current Programming Current, I _p	5mA
Regulator Current, I _r	5mA



BLOCK DIAGRAM

ELECTRICAL CHARACTERISTICS $V_{CC} = 6V$, $T_A = 25^\circ C$ (Unless Otherwise Specified)

PARAMETER	Symbol	Min.	Typ.	Max.	Units
Tachometer Input Threshold	$V_{12}-V_1$	+1	+18	+36	mV
Bias Current, Tach. Input	I_{12}		+2		μA
Tachometer Input Impedance	R_{in}		50		K ohms
One Shot Time Fast - Speed x 2.0 Medium - Speed x 1.333 Slow - Speed x 1.0			.56 .84 1.12		RC RC RC
Speed Ratio Tolerance 1.333:1 1.5:1 2:1			± 2 ± 2 ± 2	± 5 ± 5 ± 1.0	% % %
One Shot Resistor	R	10	30	80	K ohms
Current Limit Threshold	V_T-V_g		.73		V
Output Current	I_{10}	500	700	1100	μA
Delay Time		.8	.96	1.1	(RC) Delay
Bias Current, Delay Input	I_4		2		μA
Supply Operating Range	V_T	3.5	6.0	9.0	V
Speed Error Due To I.C. (effective speed reference error)	0 to +70°C -20 to +85°C 3.5 to 9.0V 4.0 to 9.0V		± 1 ± 2 ± 15 ± 05		% % % %
Regulator Voltage	V_1	1.8	2.0	2.2	V
Supply Current	I_T		7.0	12.0	ma

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