

# M51970L

## MOTOR SPEED CONTROL

### DESCRIPTION

The M51970L is a semiconductor integrated circuit designed to control the motor rotating speed. Connection of the rotating speed detector (F-G detector) to the input keeps the motor rotating speed constant with high precision. Connection of an appropriate power transistor to the output controls a wide range of DC motors.

### FEATURES

- Wide range of supply voltage ..... 2.5 – 18V (-20 – +75°C)
- Variation coefficient of supply voltage ..... ±0.1% standard (4 – 15V)
- Load variation coefficient ..... ±0.1% standard
- Temperature coefficient of rotating speed ..... ±10 ppm/°C (standard) (-20 – +75°C)
- The built-in over-shoot prevention circuit keeps the over-shoot low.
- DC drive system with minimum RFI

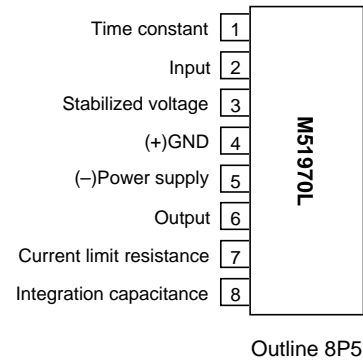
### APPLICATION

Motor rotating control in the player, tape recorder, etc.

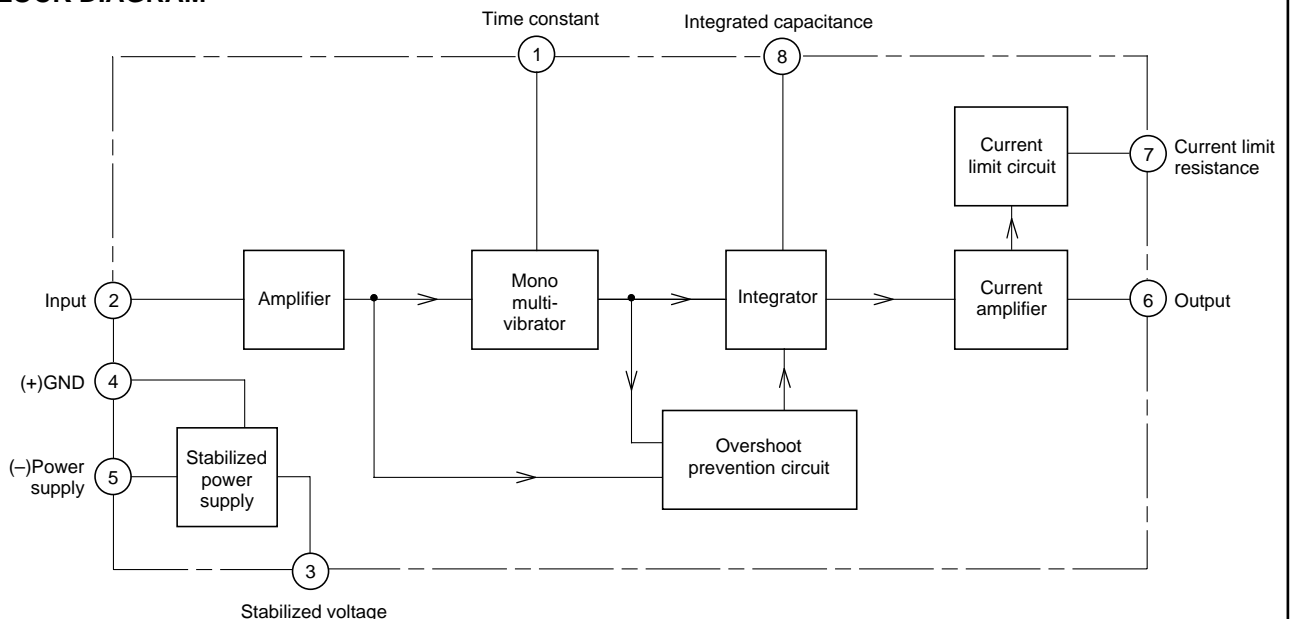
### RECOMMENDED OPERATING CONDITIONS

Supply voltage range ..... 2.5 – 18V  
 Rated supply voltage ..... 9V

### PIN CONFIGURATION (TOP VIEW)



### BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS** (Ta=25°C unless otherwise noted)

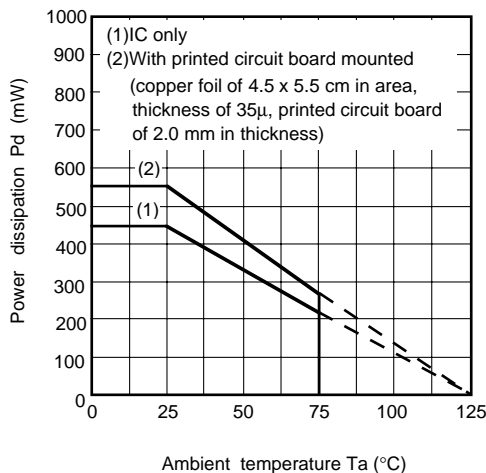
Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage		18	V
I⑥	Sink current into ⑥ pin		40	mA
I③	Source current from ③ pin		-3	mA
PdF	Power dissipation	With printed circuit board mounted (copper foil of 4.5 x 5.5 cm in area, thickness of 35μ, printed circuit board of 2.0 mm in thickness)	550	mW
KθF	Thermal derating		5.5	mW / °C
Topr	Operating temperature		-20 – +75	°C
Tstg	Storage temperature		-40 – +125	°C

**ELECTRICAL CHARACTERISTICS** (Ta=25°C, Vcc=9V unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
Vcc	Supply voltage range	Ta = -20 – +75°C	2.5	–	18	V
Icc	Circuit current	Except for output drive current	3	4.5	8	mA
Vs	Stabilized output voltage		1.8	2.0	2.2	V
VTH②	Input threshold voltage		-50	0	50	mV
RIN	Input impedance		4.2	7.9	12	kΩ
ISC⑥	Output limit current	Rsc = 27Ω	20	27	35	mA
Tτ	One-shot pulse width	Rτ = 75kΩ, Cτ = 22,000pF	375	395	415	μs
Reg-vcc	Motor speed stability for Vcc	Vcc = 4 – 15V		±0.1		%
Reg-L	Motor speed stability for load			±0.1		%
TCN	Motor speed stability for temperature	Ta = -20 – +75°C		±10		ppm/°C

**TYPICAL CHARACTERISTICS** (Ta=25°C unless otherwise noted)

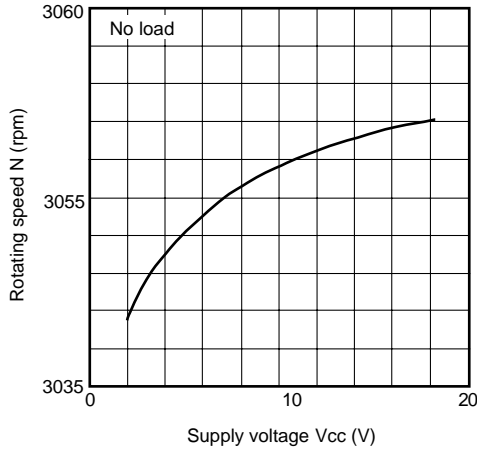
Thermal derating (Maximum rating)



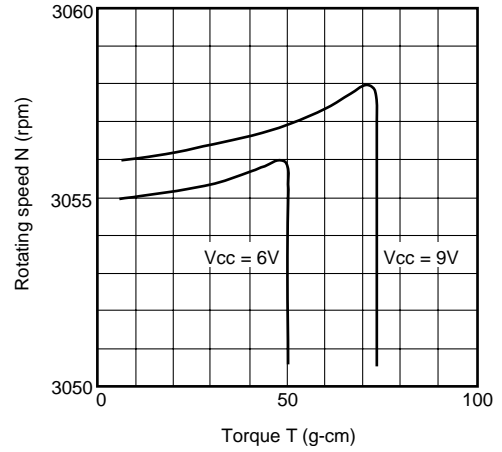
The data on the next page was measured with the following constants in the "Application Circuit Example" given below.

R1=100kΩ, R2=30kΩ, CF1=1μF, CF2=4.7μF, RF=4.7kΩ, Rτ=75kΩ, Cτ=22,000pF, Rsc=56Ω, number of tachogenerator poles; 10 poles. Motor speed - ambient temperature characteristics is measured with Rτ and Cτ put out of the temperature test chamber.

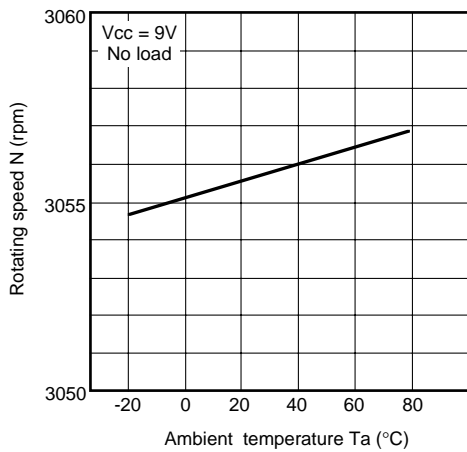
Rotating speed–Supply voltage characteristics



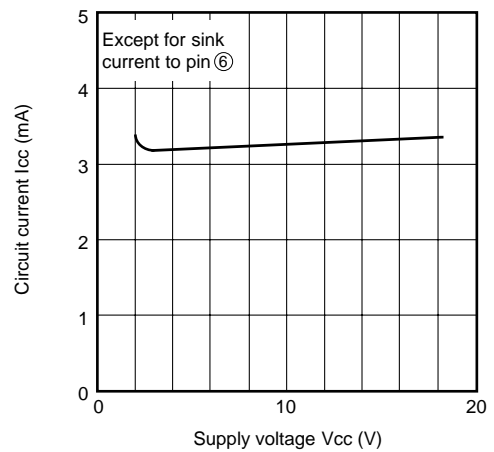
Rotating speed–Motor torque characteristics



Rotating speed–Ambient temperature characteristics

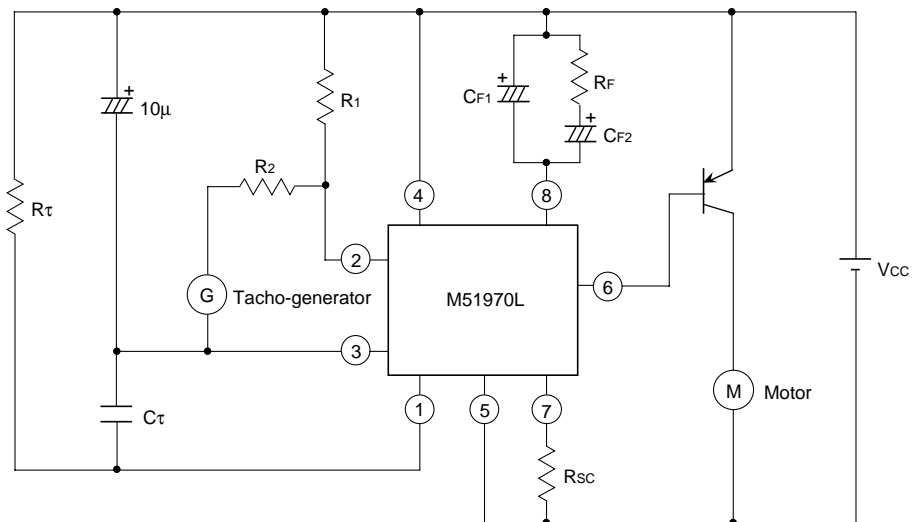


Circuit current–Supply voltage characteristics



**APPLICATION CIRCUIT EXAMPLE**

Motor rotating speed control circuit

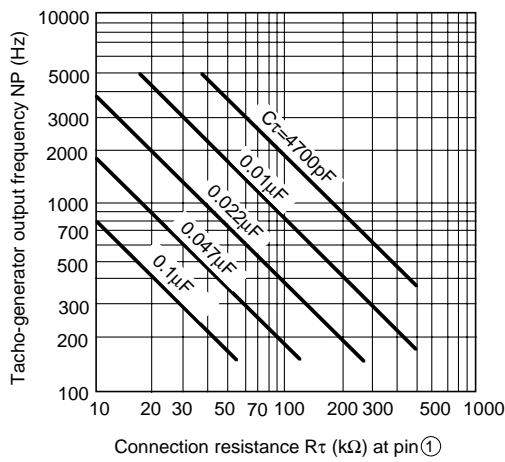


(Note 1) How to determine  $R\tau$  and  $C\tau$

This constant determines the motor rotating speed. If the motor rotating speed and the number of poles in the tacho-generator are assumed to be  $N$  and  $P$ , respectively, the following relational expression is generally established. Putting  $R\tau$  in the range of  $10k\Omega$  to  $500k\Omega$ , select the constant according to the required rotating speed.

$$NP \approx \frac{1}{1.17R\tau C\tau}$$

Tacho-generator output frequency—  
Connection resistance characteristics of pin①

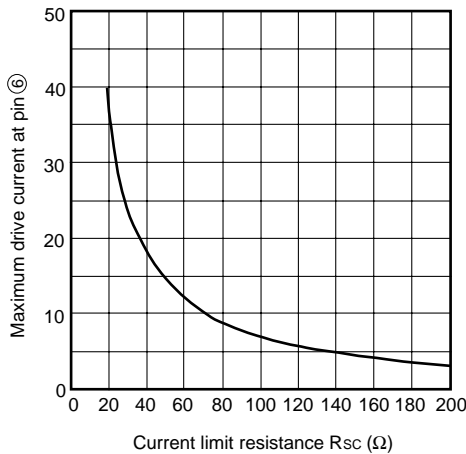


(Note 2) How to determine  $R_{SC}$

According to the relation with maximum current  $I_{SC}$  flowing to pin⑥, the following relational expression is generally established. Set  $I_{SC}$  in such a way that the value cannot exceed the maximum rated value of the power dissipation of the M51970L when the supply voltage and temperature arrive at their maximum values.

$$I_{SC} \approx \frac{0.7(V)}{R_{SC}}$$

Maximum drive current at pin⑥—  
current limit resistance characteristics



(Note 3) How to determine  $CF_1$ ,  $CF_2$   $R_F$

Select  $CF_1$  and  $CF_2$   $R_F$  according to the inertia of motor and required rising characteristics.