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

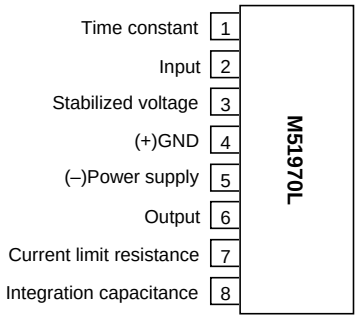
APPLICATION

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

RECOMMENDED OPERATING CONDITIONS

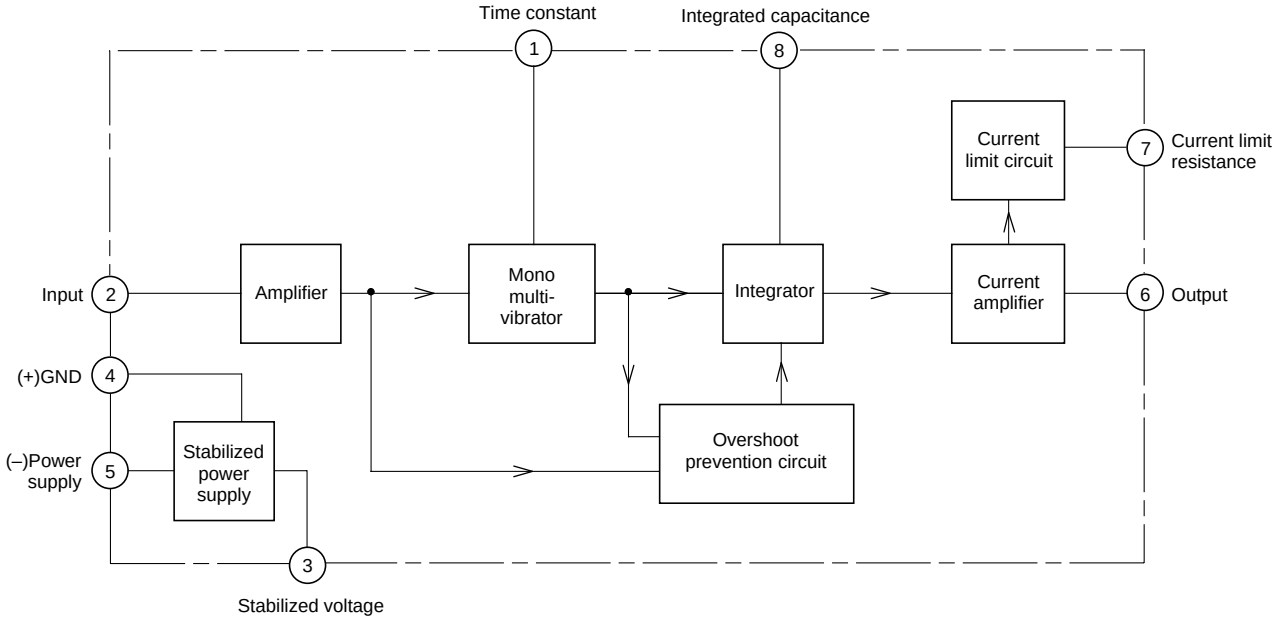
Supply voltage range ..... 2.5 – 18V
Rated supply voltage 9V

PIN CONFIGURATION (TOP VIEW)



Outline 8P5

BLOCK DIAGRAM



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

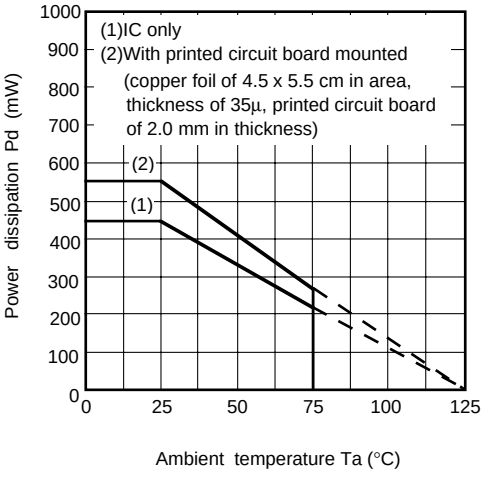
Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage		18	V
$I_{⑥}$	Sink current into ⑥ pin		40	mA
$I_{③}$	Source current from ③ pin		-3	mA
P_{dF}	Power dissipation	With printed circuit board mounted (copper foil of 4.5 x 5.5 cm in area, thickness of 35μ, printed circuit board of 2.0 mm in thickness)	550	mW
$K_{\theta F}$	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.	
V_{CC}	Supply voltage range	Ta = -20 – +75˚C	2.5	–	18	V
I_{CC}	Circuit current	Except for output drive current	3	4.5	8	mA
V_S	Stabilized output voltage		1.8	2.0	2.2	V
$V_{TH②}$	Input threshold voltage		-50	0	50	mV
R_{IN}	Input impedance		4.2	7.9	12	kΩ
$I_{SC⑥}$	Output limit current	R_{SC} = 27Ω	20	27	35	mA
Tτ	One-shot pulse width	Rτ = 75kΩ, Cτ = 22,000pF	375	395	415	μs
Reg-V_{CC}	Motor speed stability for Vcc	V_{CC} = 4 – 15V		±0.1		%
Reg-L	Motor speed stability for load			±0.1		%
TC_N	Motor speed stability for temperature	Ta = -20 – +75˚C		±10		ppm/˚C

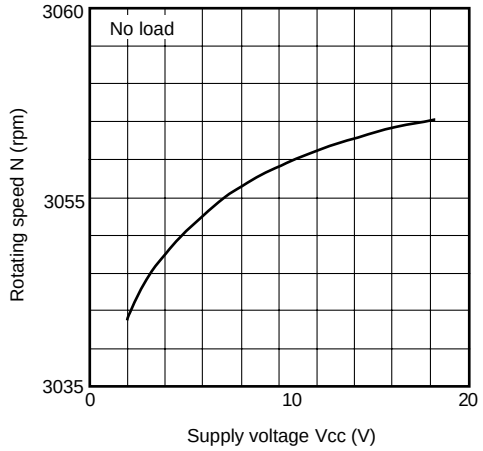
TYPICAL CHARACTERISTICS (Ta=25°C unless otherwise noted)

Thermal derating (Maximum rating)

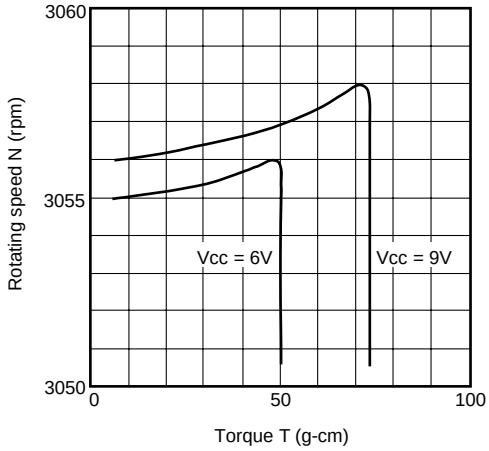


The data on the next page was measured with the following constants in the “Application Circuit Example” given below.
R_1=100kΩ, R_2=30kΩ, C_{F1}=1μF, C_{F2}=4.7μF, R_F=4.7kΩ, Rτ=75kΩ, Cτ=22,000pF, R_{SC}=56Ω, number of tacho-generator poles; 10 poles. Motor speed - ambient temperature characteristics is measured with Rτ and Cτ put out of the temperature test chamber.

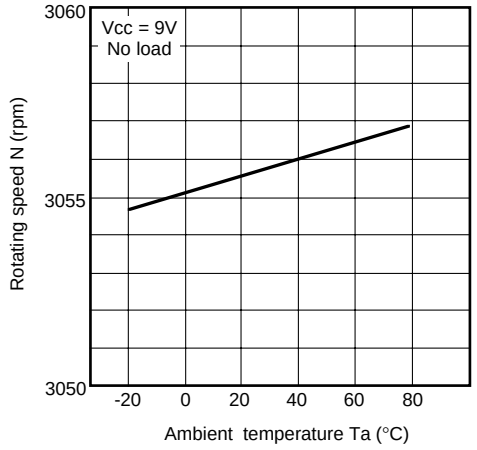
Rotating speed–Supply voltage characteristics



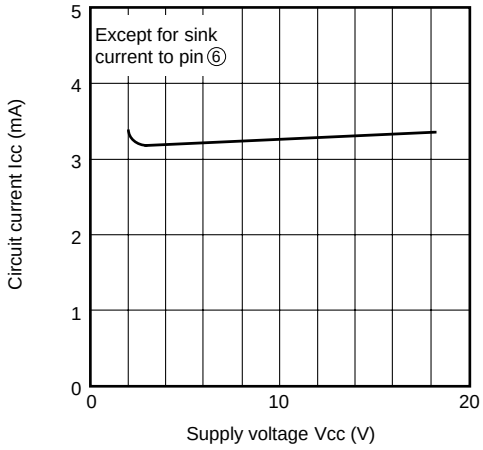
Rotating speed–Motor torque characteristics



Rotating speed–Ambient temperature characteristics

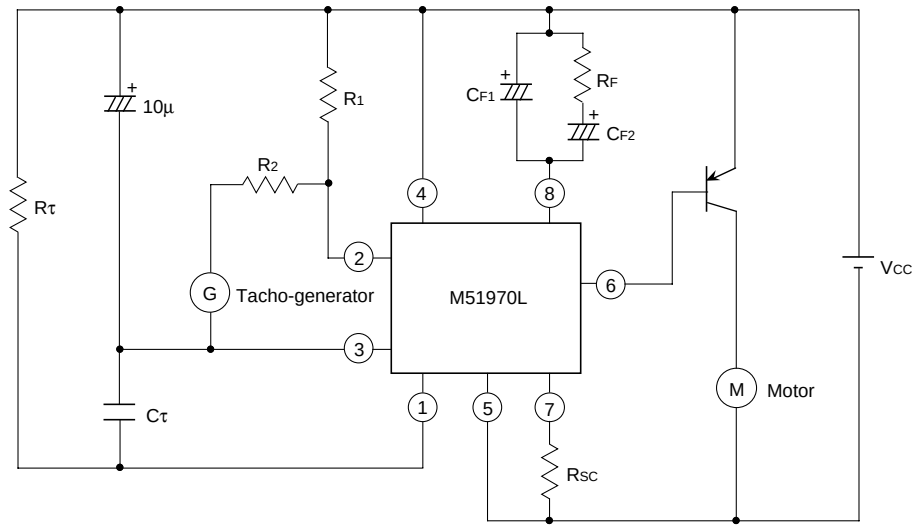


Circuit current–Supply voltage characteristics



APPLICATION CIRCUIT EXAMPLE

Motor rotating speed control circuit

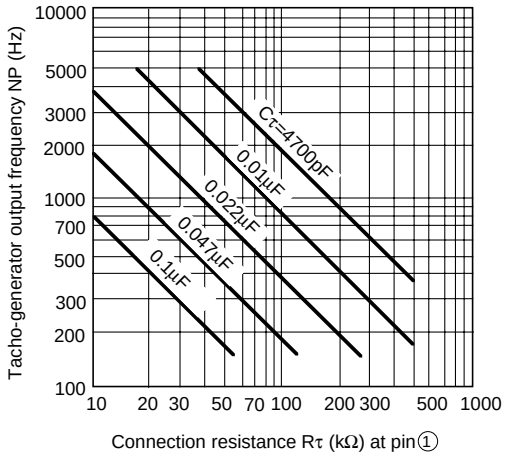


(Note 1) How to determine Rτ and Cτ

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 Rτ in the range of 10kΩ to 500kΩ, select the constant according to the required rotating speed.

$$NP \fallingdotseq \frac{1}{1.17R\tau\, C\tau}$$

Tacho-generator output frequency–
Connection resistance characteristics of pin①

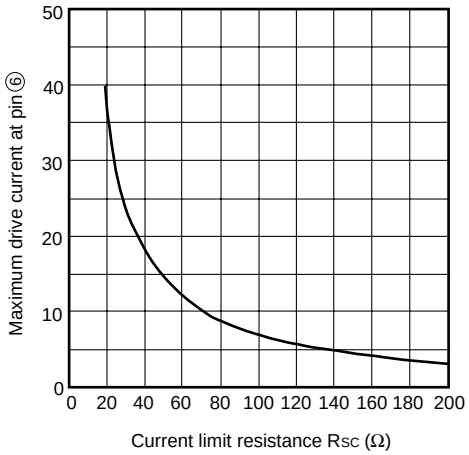


(Note 2) How to determine RSC

According to the relation with maximum current ISC flowing to pin⑥, the following relational expression is generally established. Set ISC 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.

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

Maximum drive current at pin⑥–
current limit resistance characteristics



(Note 3) How to determine CF1, CF2 RF

Select CF1 and CF2 RF according to the inertia of motor and required rising characteristics.