M51781FP

SPEED CONTROL AND DRIVER FOR 2-PHASE BRUSHLESS MOTOR

DESCRIPTION

The M51781FP is a semiconductor integrated circuit developed for use in controlling 2-phase DC brushless motor. Both control and driver systems are contained in a single chip. It employs hall elements for position detection and consists of an FG amplifier, F-V converter, sample and hold circuit, constituting a complete circuit of F-serve motor driver system in a single chip.

FEATURES

- Includes both control system and driver system in a single chip
- Drives all waves of 2-phase motors
- High output current
- Including FG amplifier, hysteresis comparator, F-V converter, sample and hold circuit
- Gain adjustment of control amplifier of the final stage of servo system possible
- Internal reference voltage generator
- Built-in output current limiter circuit
- Including forward/reverse direction control pins
- Start/stop control pins provided

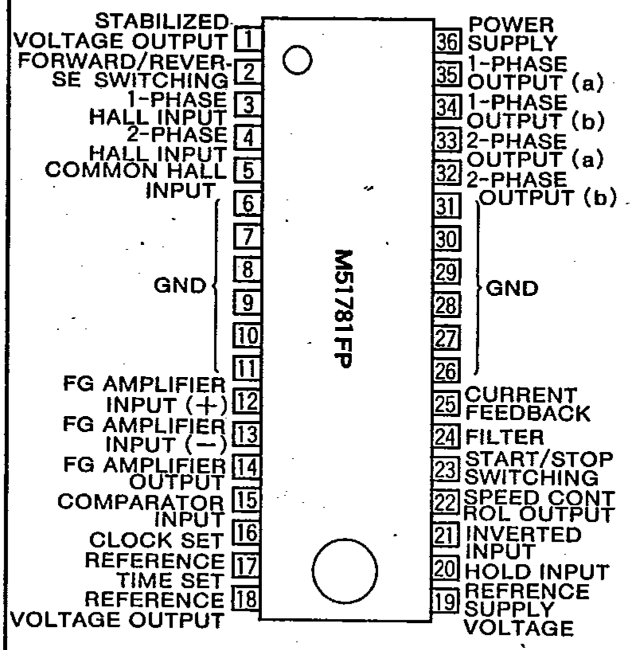
APPLICATION

FDD, etc.

RECOMMENDED OPERATING CONDITIONS

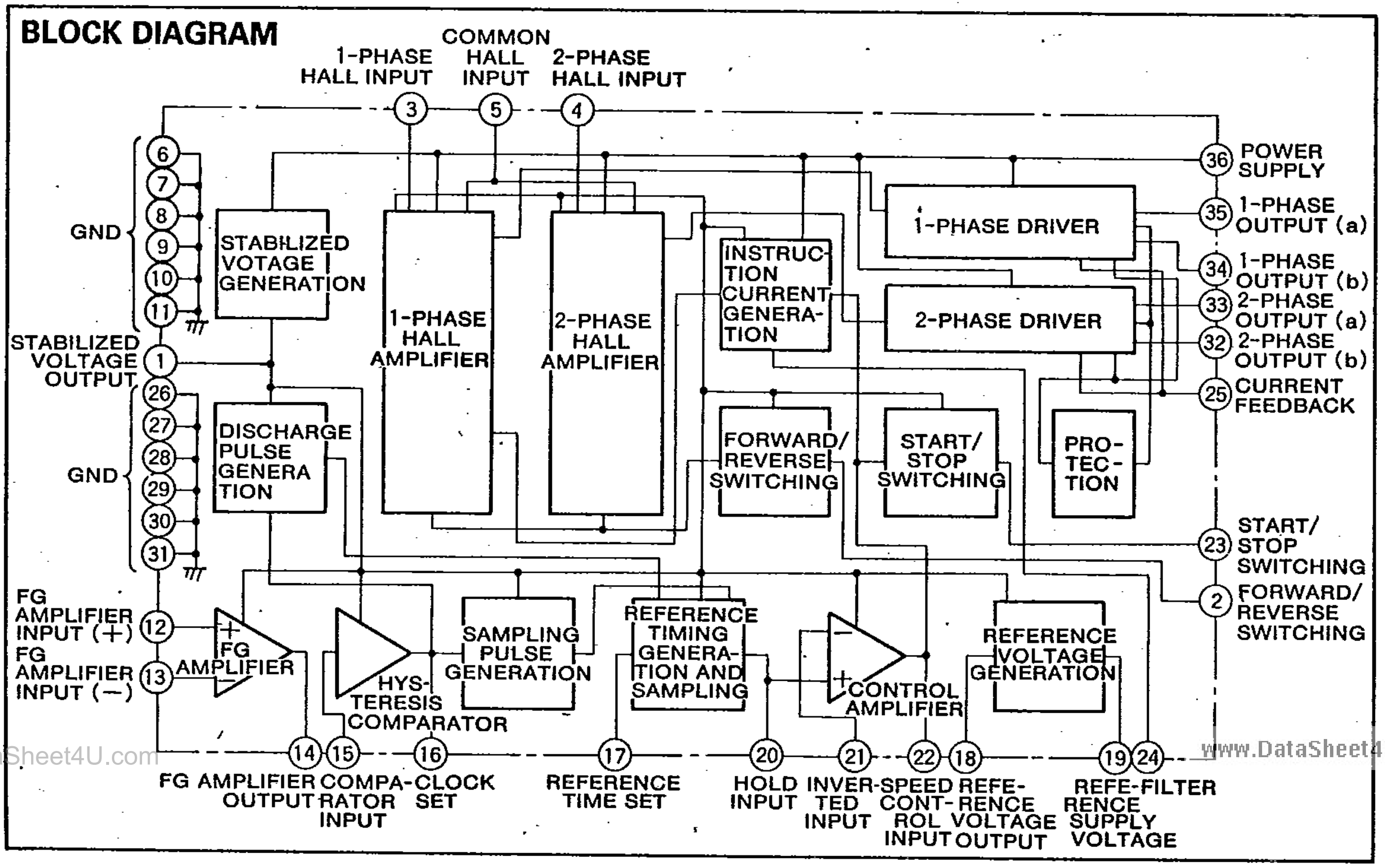
Supply voltage range .... 7.2V~18V
Rated supply voltage 12V

PIN CONFIGURATION (TOP VIEW)



36-pin molded plastic FLAT (A type)

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (T_a=25℃, unless otherwise noted)

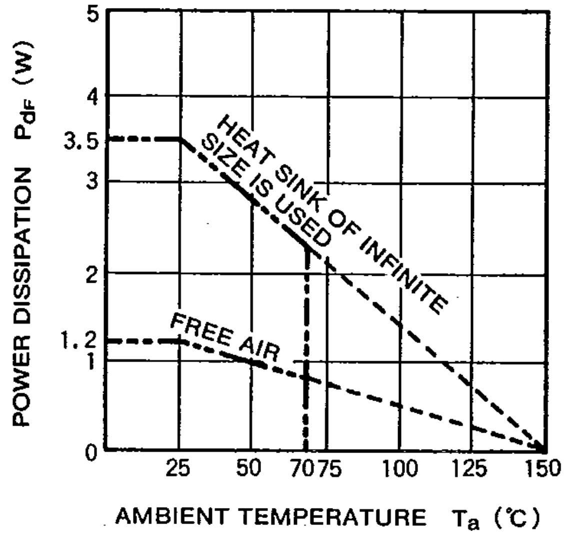
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		18	V
I_{Lmax}	Charge current		1.2	A/PHASE
I_L	Output current		0.4	A/PHASE
I_{stb}	Pin ① output current		20	mA
I_{OL}⑯	Pin ⑯ source current	When discharge of time constant capacitor is finished	10	mA
I_{OL}⑰	Pin ⑰ source current	When discharge of time constant capacitor is finished	10	mA
V_H	Applied voltages between pins ③—⑤ and pins ④—⑤		5	V_{P-P}
V⑳-㉑	Applied current between pin ⑳ and pin ㉑		±0.7	V
$V_{H(C)}$	Hall input common phase voltage	Between pins ③—⑤ and pins ④—⑤	1~V_{stb}−1	V
P_{dF}	Power dissipation	Heat sink of infinite size is used	3.5	W
T_{opr}	Operating temperature		−20~+70	℃
T_{stg}	Storage temperature		−40~+125	℃

ELECTRICAL CHARACTERISTICS (T_a=25℃, V_{CC}=12V, unless otherwise noted)

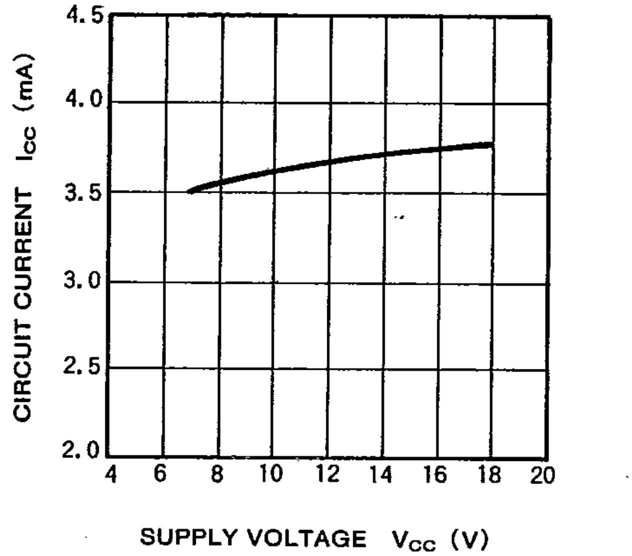
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$I_{CC(1)}$	Circuit current (1)		2.2	3.5	5.5	mA
$I_{CC(2)}$	Circuit current (2)	V_{CC}=18V	2.4	3.9	6.6	mA
$V_{stb(1)}$	Stabilized output voltage (1)		5.4	5.8	6.2	V
$V_{stb(2)}$	Stabilized output voltage (2)	270Ω between V_{stb} and GND	5.2	5.8	6.2	V
V_{ref}	Output voltage of reference voltage		2.72	2.90	3.02	V
I⑫	Pin ⑫ input current	V_{CC}=V_{stb}=5.8V, V⑫=0V		0.5	3.0	μA
I⑬	Pin ⑬ input current	V_{CC}=V_{stb}=5.8V, V⑬=0V		30	180	nA
V_{OL}⑯	Pin ⑯ low level voltage	V_{CC}=V_{stb}=5.8V, 10kΩ between V_{stb} and pin ⑯		80	120	mV
V_{OL}⑰	Pin ⑰ low level voltage	V_{CC}=V_{stb}=5.8V, 10kΩ between V_{stb} and pin ⑰		50	90	mV
$V_{TH(1)}$	Clock threshold voltage (1)	V_{CC}=V_{stb}=5.8V	1.83	1.95	2.05	V
$V_{TH(2)}$	Clock threshold voltage (2)	V_{CC}=V_{stb}=5.8V	2.75	2.90	3.05	V
$V_{TH(3)}$	Clock threshold voltage (3)	V_{CC}=V_{stb}=5.8V	3.12	3.28	3.44	V
$V_{TH(4)}$	Clock threshold voltage (4)	V_{CC}=V_{stb}=5.8V	4.10	4.32	4.54	V
V_{OL}㉒	Pin ㉒ low level voltage	V_{CC}=V_{stb}=5.8V, 5.1kΩ between V_{stb} and pin ㉒		0.75	1.00	V
V_{offset}⑰-⑳	Offset voltage between pin ⑰ and pin ⑳	V_{CC}=V_{stb}=5.8V			±10	mV
V_{offset}⑳-㉑	Offset voltage between pin ⑳ and pin ㉑	V_{CC}=V_{stb}=5.8V			±10	mV
$I_{Ba(max)}$	Maximum bias current of a output	Measured at pin ㉕	9	13		mA
$I_{Bb(max)}$	Maximum bias current of b output	Measured at pin ㉕	9	13		mA
$KI_{B(max)}$	Maximum current bias ratio	Calculated by $I_{Ba(max)}/I_{Bb(max)}$	0.9	1.0	1.1	A/A
$V_{sat(U)}$	Output saturation voltage (upper)	I_O=0.8A, applicable to pins ㉜~㉟		1.5	2.2	V
$V_{sat(D)}$	Output saturation voltage (lower)	I_O=0.8A, applicable to pins ㉜~㉟		1.0	1.5	V

TYPICAL CHARACTERISTICS

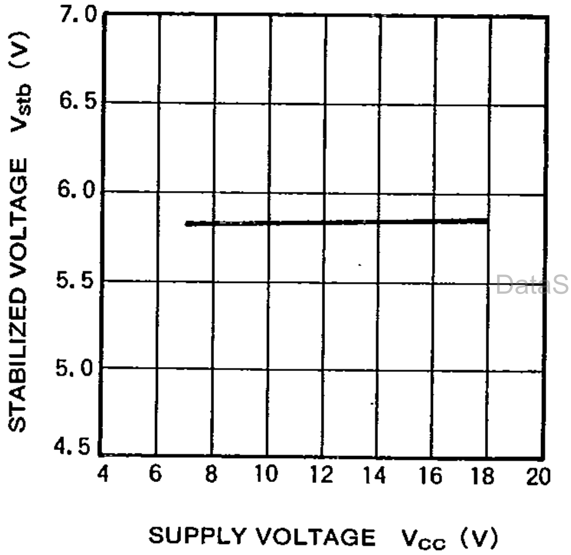
THERMAL DERATING (MAXIMUM RATING)



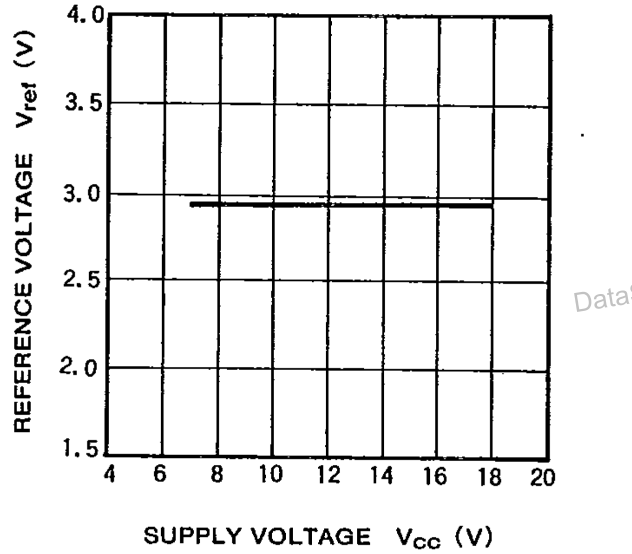
CIRCUIT CURRENT VS. SUPPLY VOLTAGE



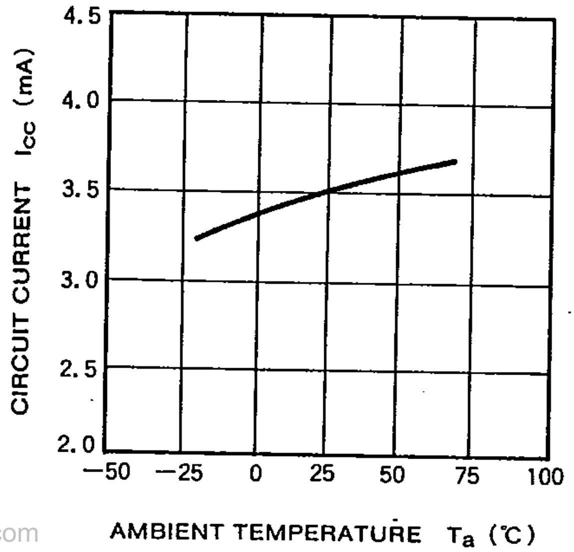
STABILIZED VOLTAGE VS. SUPPLY VOLTAGE



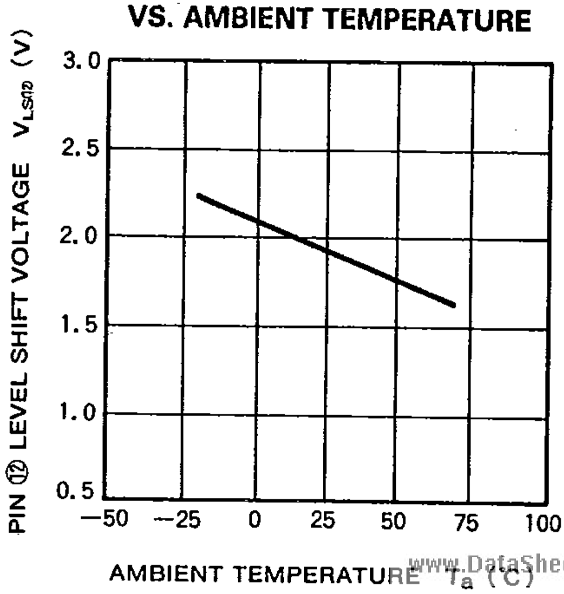
REFERENCE VOLTAGE VS. SUPPLY VOLTAGE



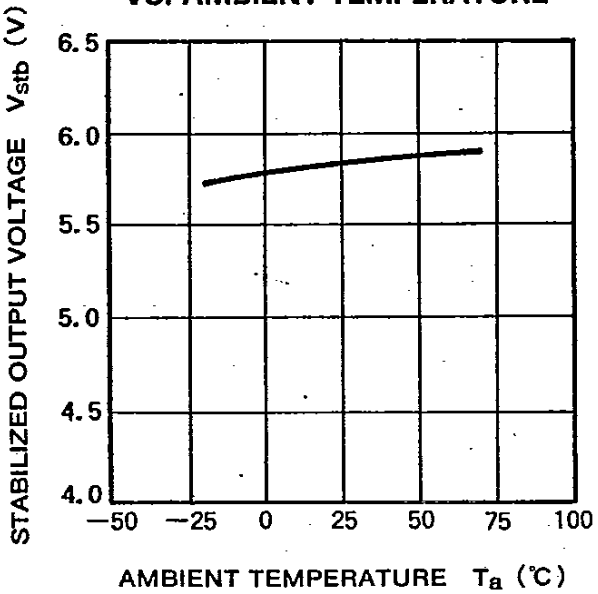
CIRCUIT CURRENT VS. AMBIENT TEMPERATURE



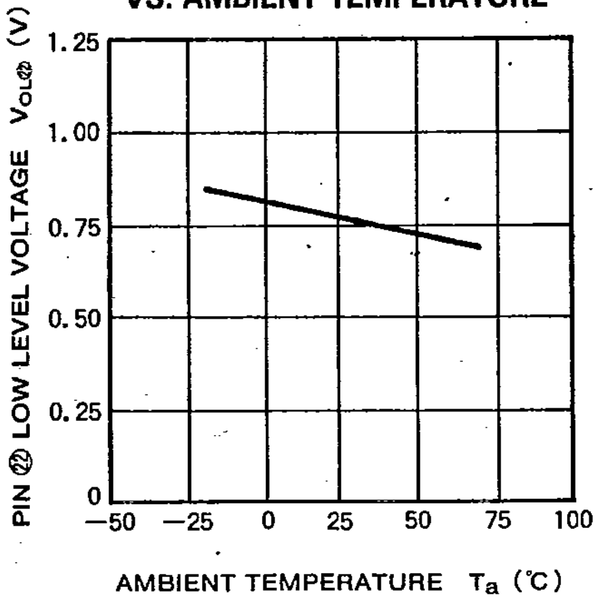
PIN ⑫ LEVEL SHIFT VOLTAGE VS. AMBIENT TEMPERATURE



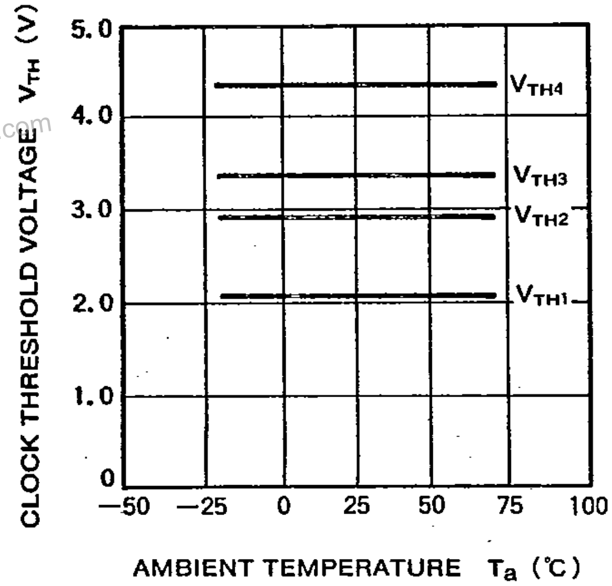
STABILIZED OUTPUT VOLTAGE VS. AMBIENT TEMPERATURE



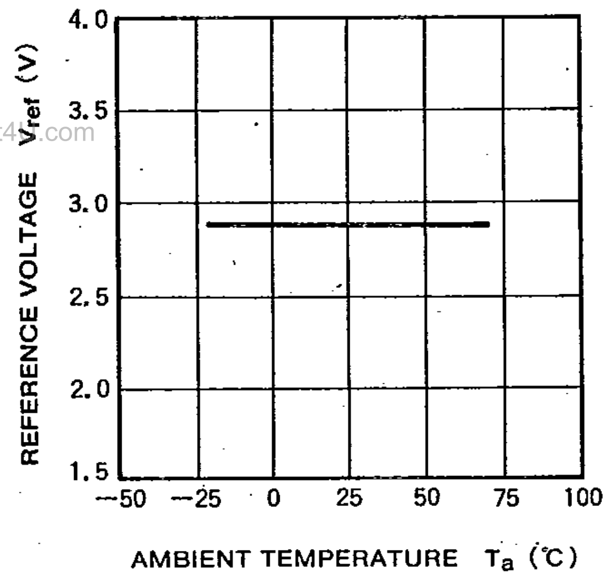
PIN ㉒ LOW LEVEL VOLTAGE VS. AMBIENT TEMPERATURE



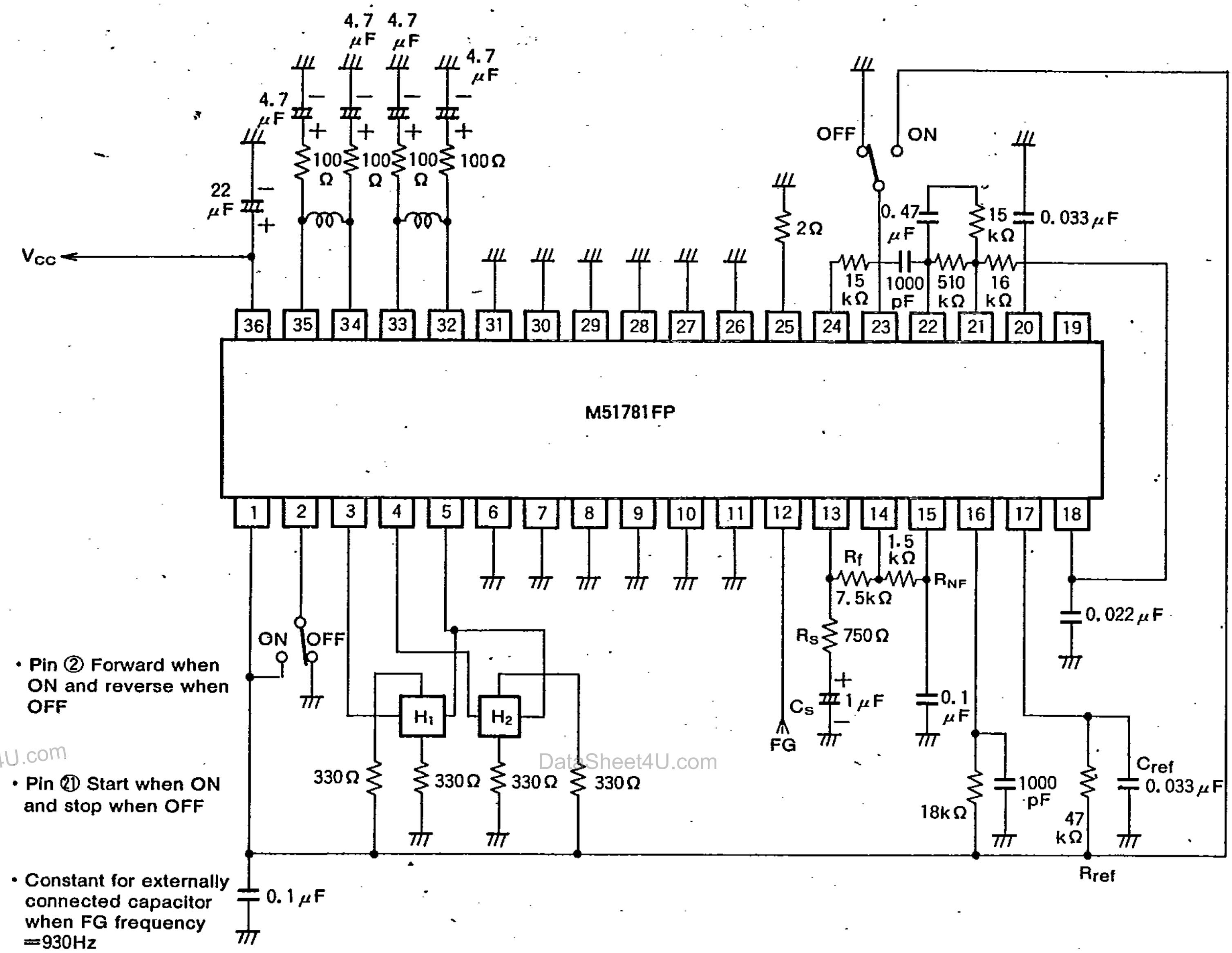
CLOCK THRESHOLD VOLTAGE VS. AMBIENT TEMPERATURE



REFERENCE VOLTAGE VS. AMBIENT TEMPERATURE



APPLICATION EXAMPLE



Note 1. The signal amplitude for the input tacho generator should be $1mV_{P-P}$ or more.

First stage amplifier gain ~

$$\frac{1+\omega_G{}^2C_S{}^2(R_S+R_f)^2}{1+\omega_G{}^2C_S{}^2R_S{}^2}$$

where ω_G: input tacho generator angle frequency

C_S must be chosen 4.7 μF or less. The disireable range of R_S is obtained in the following.

$$\frac{2}{\omega_G} \geqq C_S \cdot R_S \geqq \frac{1}{\omega_G}$$

Note 2. R_{NF} and C_{NF} are resistor and capacitor for noise filtering. If the time constant is too large, the input signal is weakened. R_{NF} and C_{NF} should be chosen as follows;

$$R_{NF} \cdot C_{NF} \leqq \frac{1}{\omega_G}$$

Note 3. R_{ref} and C_{ref} are resistor and capacitor for setting speed of motor. R_{ref} and C_{ref} should be chosen as follows;

$$R_{ref} \cdot C_{ref} = \frac{1}{0.693 \cdot f_G}$$

where f_G: input tacho generator frequency