M51556P

1.5V KEY CONTROLLER FOR HEADPHONE STEREO

DESCRIPTION

The M51556P is an IC designed to control the record, playback, fast forward, rewind, and stop functions of headphone stereo with a touch switch, it also provides auto stop and reverse functions and is enclosed in a 36-pin flat package.

FEATURES

- Built-in logic circuit to reduce package size
- Full logic control
- Auto stop, auto reverse, and battery check functions

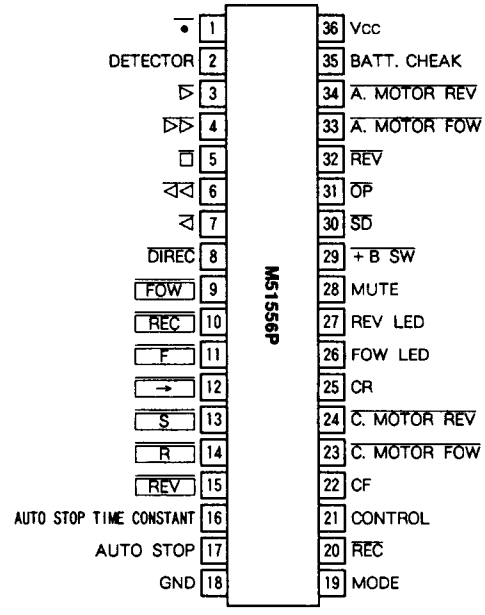
APPLICATION

1.5V Headphone stereo

RECOMMENDED OPERATING CONDITIONS

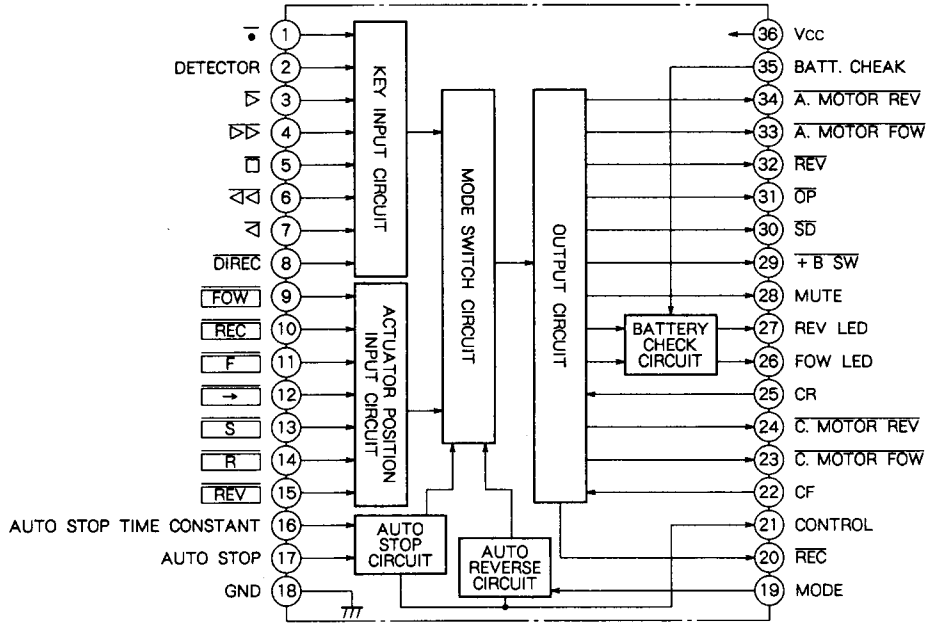
Supply voltage range ..... 1.0~1.8V
Rated supply voltage 1.5V

PIN CONNECTION (TOP VIEW)



Outline 36P2R

BLOCK DIAGRAM



FUNCTIONS

- Mode switching circuit, key input circuit
  - REC mode : record ($\overline{\bullet}$, pin①)
  - Record lock : erase protection detection (Detector, pin②)
  - FOW mode : forward playback ($\overline{\triangleright}$, pin③)
  - FF mode : fast forward ($\overline{\triangleright\triangleright}$, pin④)
  - STOP mode : stop ($\overline{\square}$, pin⑤)
  - REW mode : rewind ($\overline{\triangleleft\triangleleft}$, pin⑥)
  - REV mode : reverse playback ($\overline{\triangleleft}$, pin⑦)
  - DIRECTION : playback direction reversal ($\overline{\text{Direc}}$, pin⑧)

- Output circuit
  - REC control (pin㉑)
  - Capstan motor break time constant (pin㉒, ㉕)
  - Capstan motor direction control (pin㉓, ㉔)
  - Tape direction indicator LED control (pin㉖, ㉗)
  - Amplifier mute control (pin㉘)
  - Amplifier bias control (pin㉙)
  - Capstan motor control (pin㉚)
  - Actuator motor control (pin㉛)
  - REV control (pin㉜)
  - Actuator motor direction control (pin㉝, ㉞)
- Control circuit power (pin㉛)
  - Auto stop circuit auto reverse circuit power
- Battery check circuit (pin㉟)
- Actuator position input circuit (pin⑨to⑮)
- Auto stop circuit (pin⑯, ⑰)
- Auto reverse circuit (pin⑲)
  - Switch between 3 modes ($\circlearrowleft$, $\supset$, $\rightleftarrows$)

Main Electrical Characteristics (Ta = 25℃, Vcc = 1.5V)

Current STOP mode 0.5μA (typ.)

FOW mode 4.7mA (typ.)

Typical output characteristics (open collector)

V_{CE} = 150mV (max)

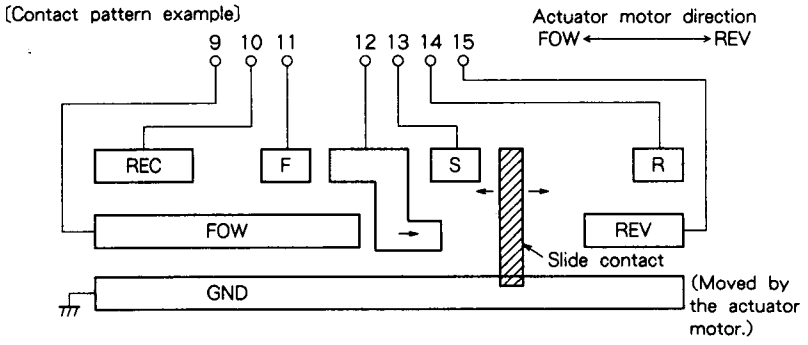
Ic = 100μA : pin㉑, ㉕, ㉗, ㉘

Ic = 200μA : pin㉓, ㉔, ㉙to㉞

ABSOLUTE MAXIMUM RATINGS (Ta = 25℃, unless otherrwise noted)

Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage		3.5	V
P_d	Power dissipation		660	mW
K_θ	Thermal derating		6.6	mW/℃
T_{opr}	Operating temperature		− 20～+ 60	℃
T_{stg}	Storage temperature		− 40～+ 125	℃

PIN DESCRIPTION

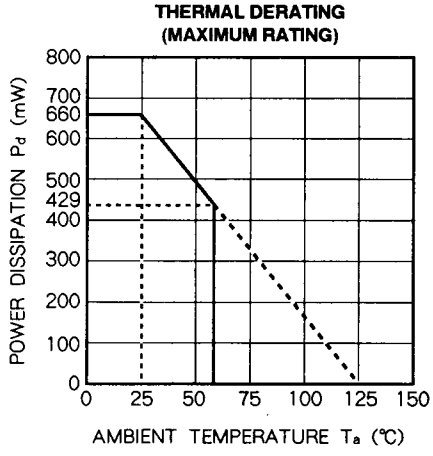
No.	Name	Function
①	$\overline{\bullet}$	REC mode selection input. Valid only when pin② is "H" and pin③ is "L".("L" : active)
②	Detector	REC lock detection input. ("L" : active)
③	$\overline{\triangleright}$	FOW (playback) mode selection input. ("L" : active)
④	$\overline{\triangleright\triangleright}$	FF mode selection input. ("L" : active)
⑤	$\overline{\square}$	STOP mode selection input. ("L" : active)
⑥	$\overline{\triangleleft\triangleleft}$	REW mode selection input. ("L" : active)
⑦	$\overline{\triangleleft}$	REV (playback) mode selection input. ("L" : active)
⑧	$\overline{\text{Direc}}$	Playback mode direction reversal input. Changes to FOW mode if the previous mode is not playback. ("L" : active)
⑨	$\overline{\text{FOW}}$	Input pin connected to the contact which moves with the actuator motor. ("L" : active) pin⑨, ⑮ : Output circuit status setting input pin⑩, ⑪, ⑬, ⑭ : Actuator motor stop position detection input pin⑫ : Actuator motor direction setting input (Contact pattern example) 
⑩	$\overline{\text{REC}}$	
⑪	$\overline{\text{F}}$	
⑫	$\overline{\rightarrow}$	
⑬	$\overline{\text{S}}$	
⑭	$\overline{\text{R}}$	
⑮	$\overline{\text{REV}}$	
⑯	AUTO STOP time constant	Pin to connect the capacitor for setting the STOP detection wait time of the AUTO STOP circuit. (The tape is assumed to be stopped when the pin voltage is "H".)
⑰	AUTO STOP	Tape rotation signal input pin. ("M" : Pin⑯ becomes OPEN and rotation stops."H"or "L" : Pin⑯becomes "L" and the tape is rotating. "M" is assumed when pin⑰ is OPEN.)
⑱	GND	Ground
⑲	MODE	Auto reverse mode setting input pin. (Set to "H" ⟲, "M" ⇄ , "L" ⟳("M" is assumed when pin⑲ is OPEN)
⑳	$\overline{\text{REC}}$	Record circuit control signal output pin. Recording amplifier and AC bias circuit control output that becomes "L" during REC.
㉑	Control	Auto stop circuit, auto reverse circuit power pin.
㉒	CF (Capacitor Foward)	Connection pin for capstan motor forward break output signal capacitor. Sets the pulse width of the break output signal when the motor is stopping from forward movement.
㉓	$\overline{\text{C. MOTOR FOW}}$ (Capstan Motor)	Capstan motor direction control output pin. Pin㉓ is "L" when the tape direction is forward and pin㉔ is "L" when it is reverse.
㉔	$\overline{\text{C. MOTOR REV}}$ (Capstan Motor)	
㉕	CR (Capacitor Reverse)	Connection pin for capstan motor reverse break output signal capacitor. Sets the pulse width of the break output signal when the motor is stopping from reverse movement.
㉖	FOW LED	Capstan motor reverse display LED control output pin. Pin㉖ is "H" when the tape direction is forward and pin㉗ is "H" when it is reverse.
㉗	REV LED	
㉘	MUTE	Amplifier mute control output. Output is "H" during FF and REW operation (amplifier operation not required)
㉙	$\overline{\text{+B SW}}$	Amplifier bias control output. Output is "L" during FOW, REV, and REC operation (amplifier operation required)

PIN DESCRIPTION (cont.)

No.	Name	Function
㉚	$\overline{SD}$ (Control drive)	Capstan motor drive output. Becomes "L" when the capstan motor is rotating. This is used to control pin㉑.
㉛	$\overline{OP}$ (Operation)	Actuator motor drive output. Becomes "L" when the actuator motor is rotating. This is used to control pin㉑.
㉜	$\overline{REV}$	REV mode control output. Becomes "L" during REV operation. This is used to switch the head direction. (it can switch amplifiers)
㉝	$\overline{A.\ MOTOR\ FOW}$ (Actuator Motor Foward)	Actuator motor direction control output. Pin㉝ is "L" during forward movement and pin㉞ is "L" during reverse movement.
㉞	$\overline{A.\ MOTOR\ REV}$ (Actuator Motor Reverse)	
㉟	BATT. CHECK	Battery check input. Pins㉘ and ㉗ both become "L" when the voltage of pin㉟ drops.
㊱	Vcc	Power supply (rated power voltage : 1.5V)

Note 1. Input pins①~⑮ must be watched closely for error due to noise.

TYPICAL CHARACTERISTICS



OPERATING DESCRIPTION

1. Output pin status during each mode

Output \ Mode	STOP	FOW	REV	FF	REW	REC
$\overline{REC}$ ⑳	H	H	H	H	H	L
$\overline{C.\ MOTOR\ FOW}$ ㉓	H	L	H	L	H	L
$\overline{C.\ MOTOR\ REV}$ ㉔	H	H	L	H	L	H
FOW LED ㉖	L	H	L	H	L	H
REV LED ㉗	L	L	H	L	H	L
MUTE ㉘	L	L	L	H	H	L
+ B SW ㉙	H	L	L	H	H	L
$\overline{REC}$ ㉚	H	H	L	H	H	H

Note 2. The status is different from the above table during transition when switching between modes.

2. $\overline{SD}$ (pin㉚), $\overline{OP}$ (pin㉛)

$\overline{SD}$ (capstan motor drive control (pin㉚)) and $\overline{OP}$ (actuator motor drive control (pin㉛)) become "L" when the respective motor is rotating. They are used to control the motor operation related circuits.

$$\overline{SD} = (\overline{C.\ MOTOR\ FOW}) \cdot (\overline{C.\ MOTOR\ REV})$$

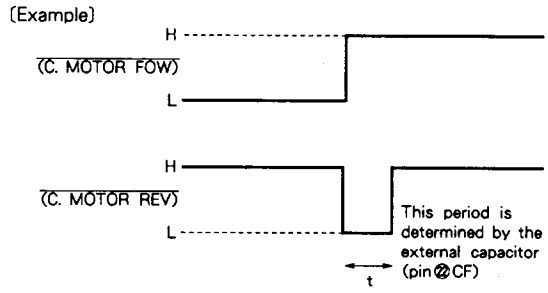
$$\overline{OP} = (\overline{A.\ MOTOR\ FOW}) \cdot (\overline{A.\ MOTOR\ REV})$$

3. Control (pin㉑)

Control (pin㉑) is a power supply pin for the auto stop circuit and auto reverse circuit. Power is applied when $\overline{SD}$ or $\overline{OP}$ is "L" and the auto stop/reverse circuit is driven when the mode is not STOP (both $\overline{SD}$ and $\overline{OP}$ are "H").

4. Capstan motor break output signal

CF (pin㉒) and CR (pin㉘) are time constant pins for the capstan motor break. The operation is shown below.



If the capstan motor stops after forward movement, the pulse width of the break output signal is determined by the external capacitor CF (pin㉒). If it stops after reverse movement, it is determined by the external capacitor CR (pin㉘)

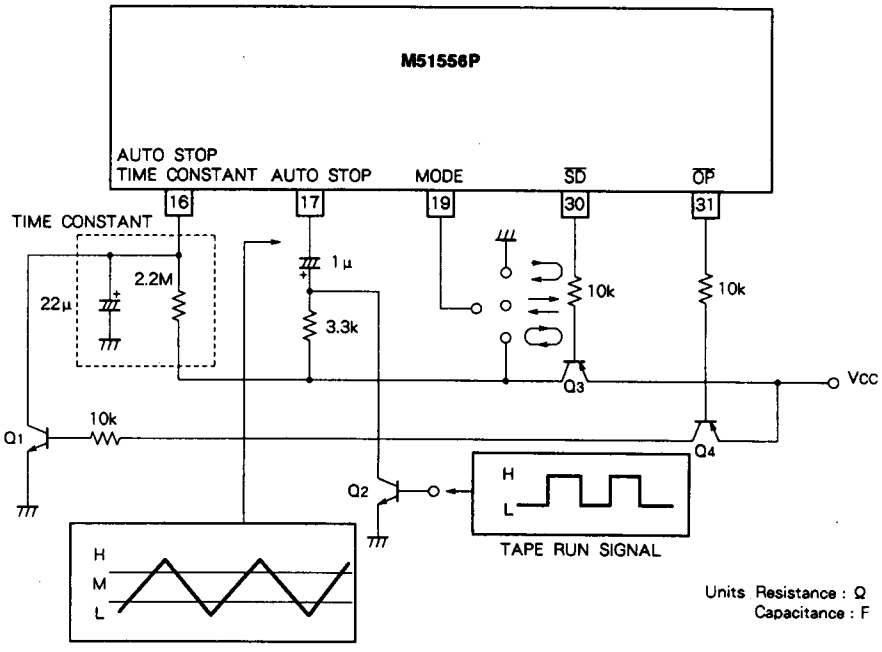
The pulse width is approximately 40ms (typ.) when the capacitance of the application circuit is 0.018μF (Vcc = 1.5V).

$$t = (\text{external capacitor}) \times K_1 \times Io(Vcc/K_2)$$

$$K_1 = 3M\Omega,\ K_2 = 0.7$$

5. Auto stop/auto reverse circuit

The following diagram shows only the auto stop/auto reverse circuit.



Note 3. Pins⑰ and ⑱ are "M" when open

(1) Description of tape run state detection function

(a) When tape is movin

When the tape is running, pin⑰ changes between "H" and "L" because a signal which switches Q_2 ON/OFF is input (see figure above). Pin⑯ becomes "L" when pin⑰ is "H" or "L" and the auto stop circuit determines that the tape is running.

(b) When tape is moving

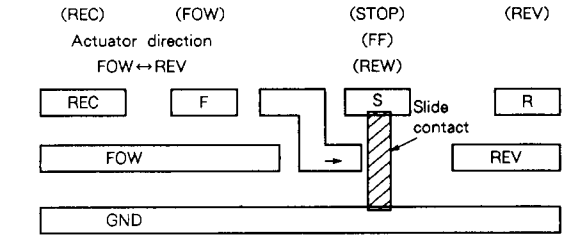
When signal to switch Q_2 on and off is not input, pin⑰ becomes "M" and the voltage of pin⑯ rises due to the external time constant. When this voltage exceeds the threshold level, the auto stop circuit detects a tape stop condition. Q_1 disables the detection of tape stop condition if the tape stops temporarily while switching modes (OP becomes "L").

(2) Auto stop/auto reverse mode description

(Operation when tape is stopped)

In FOW or REV mode, auto reverse mode is entered according to the input status of pin⑲ ("H", "M", or "L") as shown in the figure above. In all other modes (FF, FRW, REC), the STOP mode is entered.

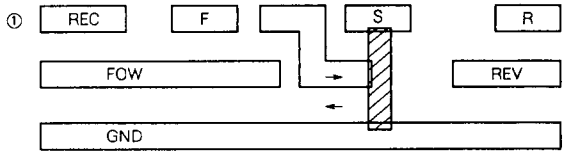
6. Actuator motor operation



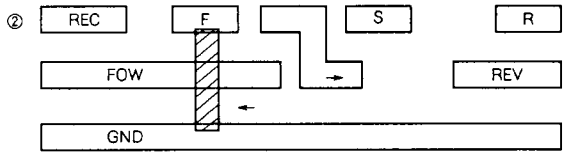
In addition to driving the mechanism (such as moving the pinch roller), the actuator motor also moves the slide contact.

Normally, the slide contact is at the position (REC, F, S, R) shown at left in each mode.

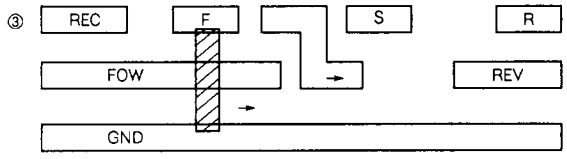
STOP to FOW to REV is used as an example.



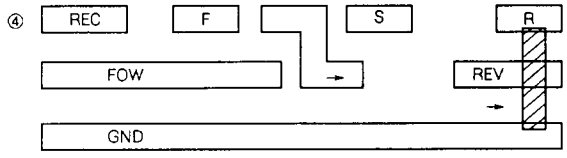
In the STOP state, the slide contact is at the S position. When pin③ is momentarily made "L", the actuator motor turns and the slide contact starts to move forward.



When the slide contact comes to the F position, the actuator motor stops and the mode becomes FOW.



When pin⑦ is momentarily made "L", the actuator motor turns and the slide contact starts to move in the reverse direction.

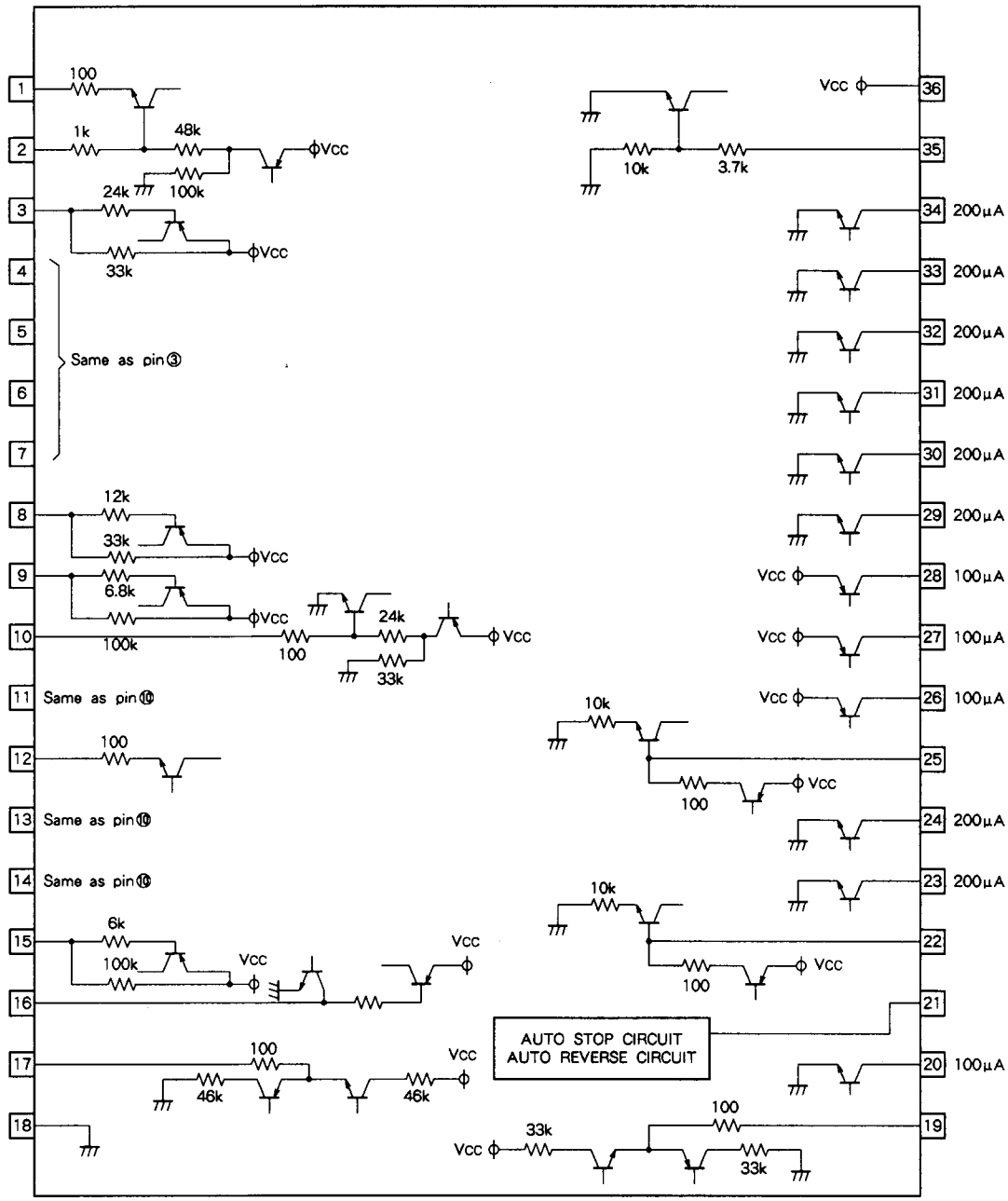


When the slide contact comes to the R position, the actuator motor stops and the mode becomes REV.

7. Battery check circuit

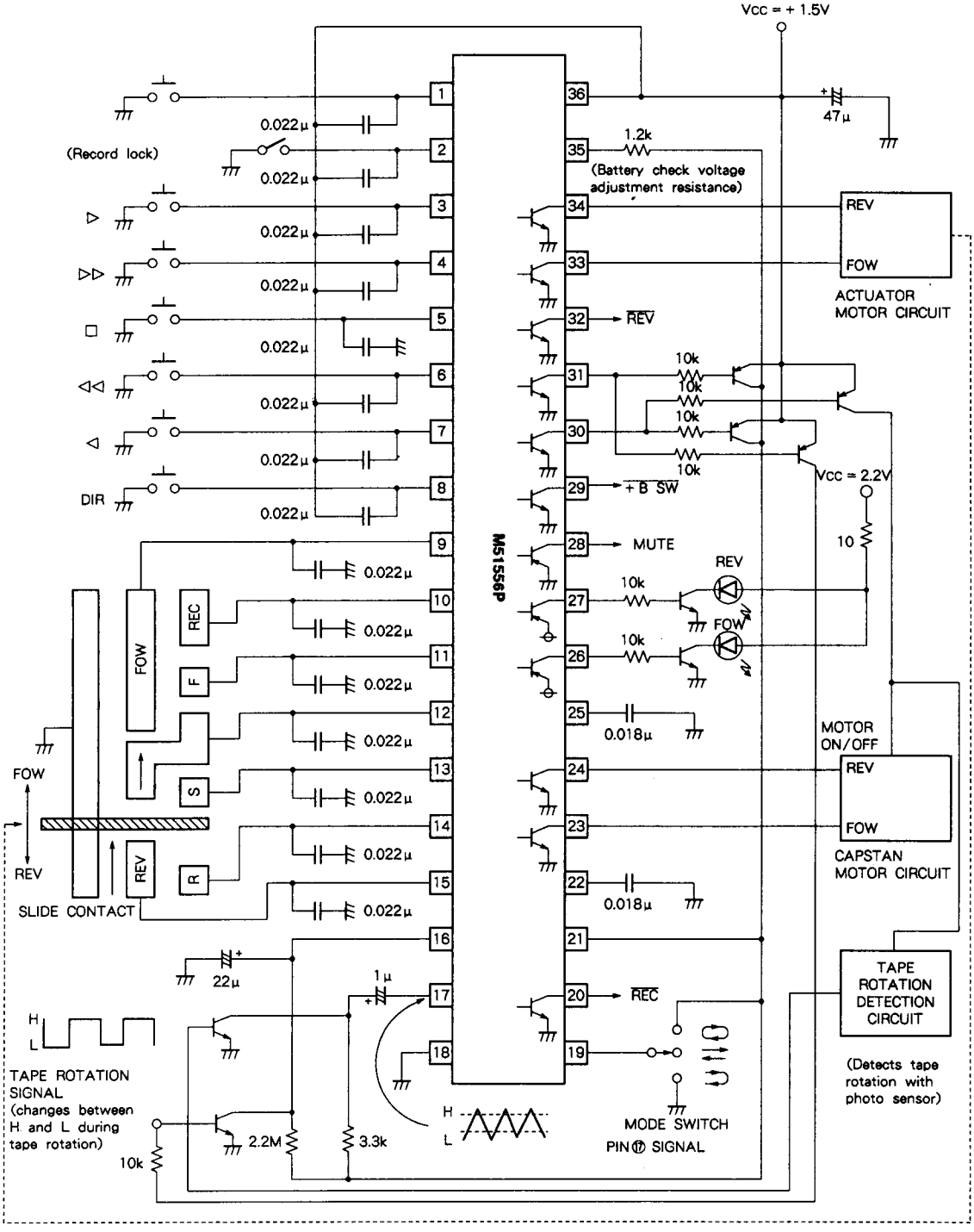
When the voltage at BATT. CHECK (pin㉕ becomes under 1.0V (typ.), the FOW LED pin㉖ and REV LED pin㉗ become "L".

INPUT/OUTPUT CIRCUIT



Notes ● The values in the figure are typical values.
● The currents beside pins ㉘, ㉙, ㉚, ㉕~㉗ are collector currents when the output transistor is "ON", V_{CE} = 150mVmax (V_{CC} = 1.5V).

APPLICATION EXAMPLE



Units Resistance : Ω
Capacitance : F

Note 5. The capacitors connected to pins① to ④ and ⑥ to ⑮ are for noise prevention and the capacitor connected to pin⑤ is for power on reset.