

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

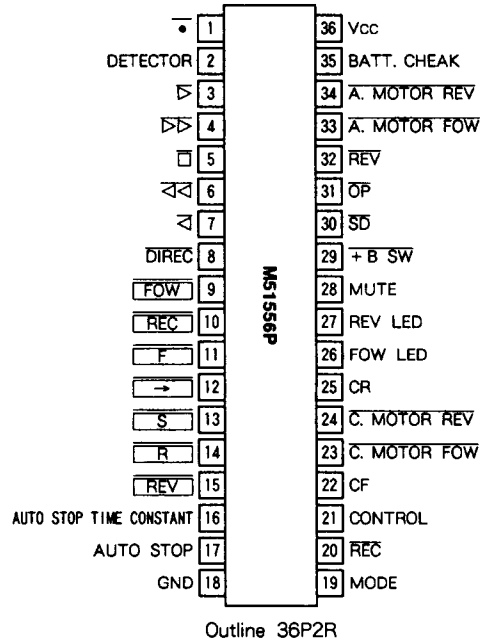
APPLICATION

1.5V Headphone stereo

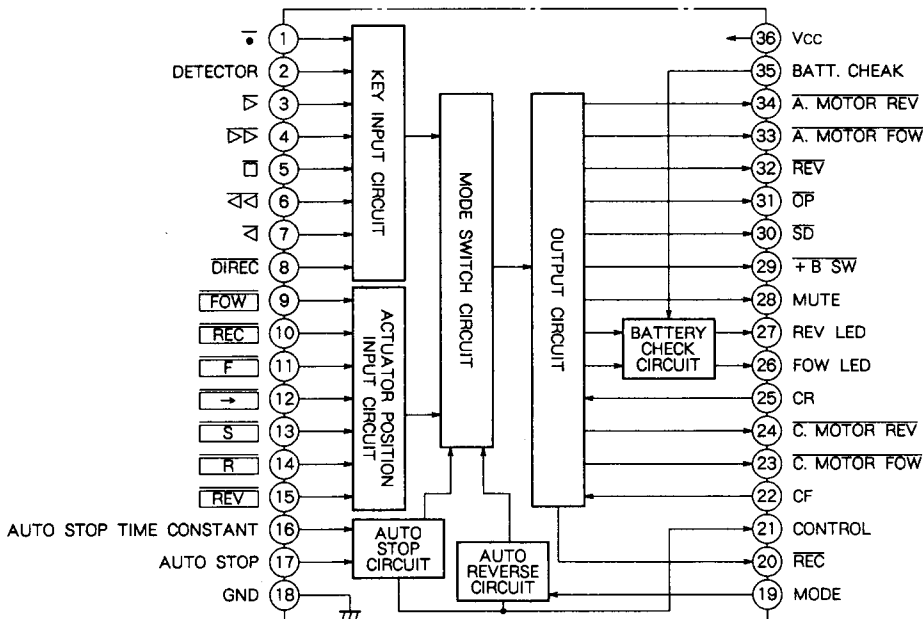
RECOMMENDED OPERATING CONDITIONS

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

PIN CONNECTION (TOP VIEW)



BLOCK DIAGRAM



1.5V KEY CONTROLLER FOR HEADPHONE STEREO

FUNCTIONS

- Mode switching circuit, key input circuit
 - REC mode : record (◀, pin①)
 - Record lock : erase protection detection (Detector, pin②)
 - FOW mode : forward playback (▶, pin③)
 - FF mode : fast forward (▶▶, pin④)
 - STOP mode : stop (□, pin⑤)
 - REW mode : rewind (◀◀, pin⑥)
 - REV mode : reverse playback (◀, pin⑦)
 - DIRECTION : playback direction reversal (Direc, pin⑧)
- Output circuit
 - REC control (pin②)
 - Capstan motor break time constant (pin②, ⑤)
 - Capstan motor direction control (pin③, ④)
 - Tape direction indicator LED control (pin③, ⑦)
 - Amplifier mute control (pin③)
 - Amplifier bias control (pin③)
 - Capstan motor control (pin③)

- Actuator motor control (pin⑩)
- REV control (pin⑫)
- Actuator motor direction control (pin⑬, ⑭)
- Control circuit power (pin⑪)
 - Auto stop circuit auto reverse circuit power
- Battery check circuit (pin⑤)
- Actuator position input circuit (pin⑨ to ⑮)
- Auto stop circuit (pin⑮, ⑰)
- Auto reverse circuit (pin⑱)
- Switch between 3 modes (↺, ↻, ↻↻)

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

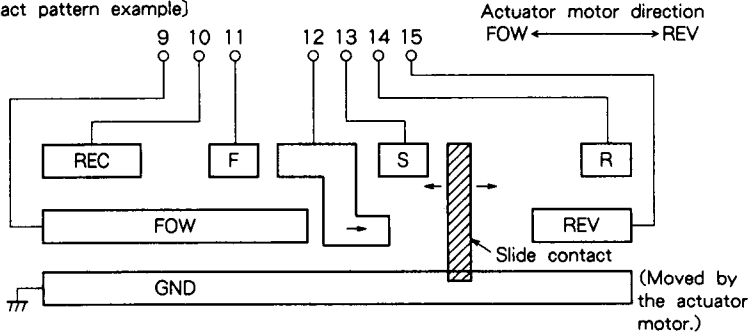
- Current STOP mode 0.5μA (typ.)
- FOW mode 4.7mA (typ.)
- Typical output characteristics (open collector)
 - VCE = 150mV (max)
 - Ic = 100μA : pin②, ⑤, ⑦, ⑮
 - Ic = 200μA : pin③, ④, ⑬ to ⑰

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

Symbol	Parameter	Conditions	Limits	Unit
Vcc	Supply voltage		3.5	V
Pa	Power dissipation		660	mW
Kθ	Thermal derating		6.6	mW/°C
Topr	Operating temperature		- 20 ~ + 60	°C
Tstg	Storage temperature		- 40 ~ + 125	°C

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PIN DESCRIPTION

No.	Name	Function
①	•	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	▷	FOW (playback) mode selection input. ("L" : active)
④	▷▷	FF mode selection input. ("L" : active)
⑤	□	STOP mode selection input. ("L" : active)
⑥	◁◁	REW mode selection input. ("L" : active)
⑦	◁	REV (playback) mode selection input. ("L" : active)
⑧	Direc	Playback mode direction reversal input. Changes to FOW mode if the previous mode is not playback. ("L" : active)
⑨	FOW	<p>Input pin connected to the contact which moves with the actuator motor. ("L" : active)</p> <p>pin⑨, ⑮ : Output circuit status setting input pin⑩, ⑪, ⑬, ⑭ : Actuator motor stop position detection input pin⑫ : Actuator motor direction setting input</p> <p>(Contact pattern example)</p>  <p>Actuator motor direction FOW ← → REV</p> <p>Slide contact (Moved by the actuator motor.)</p>
⑩	REC	
⑪	F	
⑫	→	
⑬	S	
⑭	R	
⑮	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" : Pin⑮ becomes OPEN and rotation stops. "H" or "L" : Pin⑮ becomes "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	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	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	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	+ B SW	Amplifier bias control output. Output is "L" during FOW, REV, and REC operation (amplifier operation required)

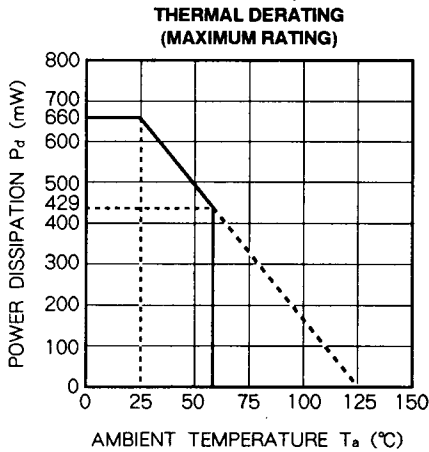
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PIN DESCRIPTION (cont.)

No.	Name	Function
②	SD (Control drive)	Capstan motor drive output. Becomes "L" when the capstan motor is rotating. This is used to control pin②.
③	OP (Operation)	Actuator motor drive output. Becomes "L" when the actuator motor is rotating. This is used to control pin②.
④	REV	REV mode control output. Becomes "L" during REV operation. This is used to switch the head direction. (it can switch amplifiers)
⑤	A. MOTOR FOW (Actuator Motor Forward)	Actuator motor direction control output. Pin⑤ is "L" during forward movement and pin⑥ is "L" during reverse movement.
⑥	A. MOTOR REV (Actuator Motor Reverse)	
⑦	BATT. CHECK	Battery check input. Pins⑤ and ⑦ both become "L" when the voltage of pin⑤ drops.
⑧	Vcc	Power supply (rated power voltage : 1.5V)

Note 1. Input pins①~⑧ 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
REC ②	H	H	H	H	H	L
C. MOTOR FOW ③	H	L	H	L	H	L
C. MOTOR REV ④	H	H	L	H	L	H
FOW LED ⑤	L	H	L	H	L	H
REV LED ⑥	L	L	H	L	H	L
MUTE ⑦	L	L	L	H	H	L
+ B SW ⑧	H	L	L	H	H	L
REC ⑨	H	H	L	H	H	H

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

2. SD (pin②), OP (pin③)

SD (capstan motor drive control (pin②)) and OP (actuator motor drive control (pin③)) become "L" when the respective motor is rotating. They are used to control the motor

operation related circuits.

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

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

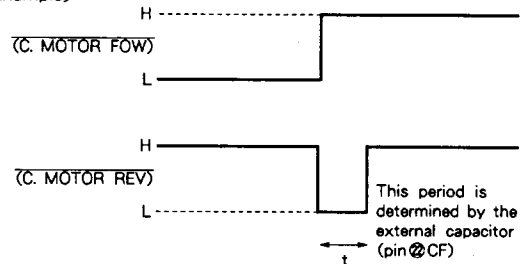
3. Control (pin②)

Control (pin②) is a power supply pin for the auto stop circuit and auto reverse circuit. Power is applied when SD or OP is "L" and the auto stop/reverse circuit is driven when the mode is not STOP (both SD and OP are "H").

4. Capstan motor break output signal

CF (pin②) and CR (pin⑤) are time constant pins for the capstan motor break. The operation is shown below.

[Example]



If the capstan motor stops after forward movement, the pulse width of the break output signal is determined by the external capacitor CF (pin②). If it stops after reverse movement, it is determined by the external capacitor CR (pin⑤)

The pulse width is approximately 40ms (typ.) when the capacitance of the application circuit is 0.018μF ($V_{cc} = 1.5V$).

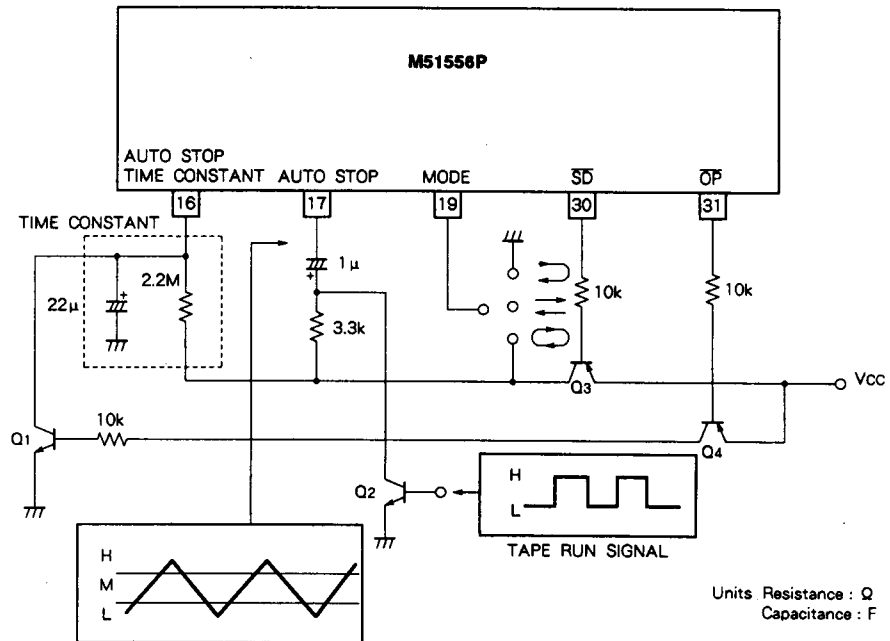
$$t = (\text{external capacitor}) \times K_1 \times I_0(V_{cc}/K_2)$$

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

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5. Auto stop/auto reverse circuit

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



Note 3. Pins ⑬ and ⑭ are "M" when open

(1) Description of tape run state detection function

(a) When tape is moving

When the tape is running, pin ⑬ changes between "H" and "L" because a signal which switches Q2 ON/OFF is input (see figure above). Pin ⑭ becomes "L" when pin ⑬ is "H" or "L" and the auto stop circuit determines that the tape is running.

(b) When tape is moving

When signal to switch Q2 on and off is not input, pin ⑬ becomes "M" and the voltage of pin ⑭ rises due to the external time constant. When this voltage exceeds the threshold level, the auto stop circuit detects a tape stop condition. Q1 disables the detection of tape stop condition if the tape stops temporarily while switching modes (OP becomes "L").

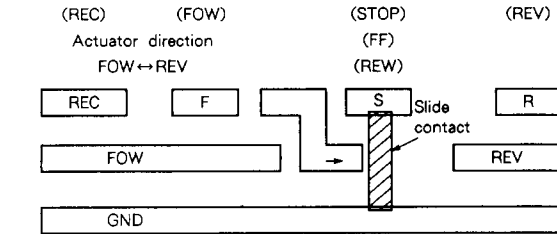
(2) Auto stop/auto reverse mode description

(Operation when tape is stopped)

In FOW or REV mode, auto reverse mode is entered according to the input status of pin ⑬ ("H", "M", or "L") as shown in the figure above. In all other modes (FF, FRW, REC), the STOP mode is entered.

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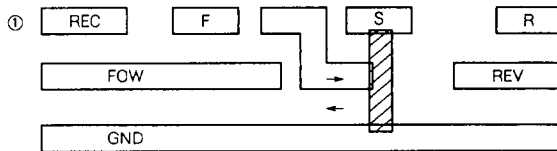
6. Actuator motor operation



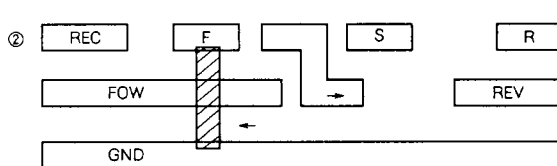
In addition to driving the mechanism (such as moving the pinch roller), the actuator motor also moves the slide contact.

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

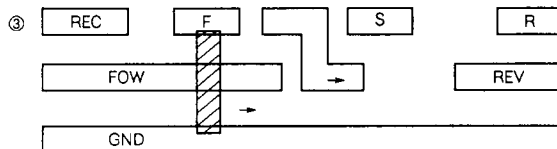
STOP to FOW to REV is used as an example.



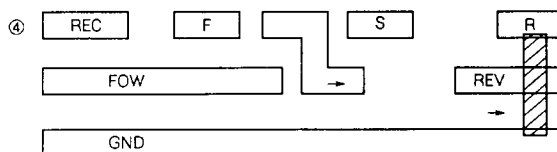
In the STOP state, the slide contact is at the S position. When pin ③ is momentarily made "L", the actuator motor turns and the slide contact starts to move forward.



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



When pin ⑦ is momentarily made "L", the actuator motor turns and the slide contact starts to move in the reverse direction.



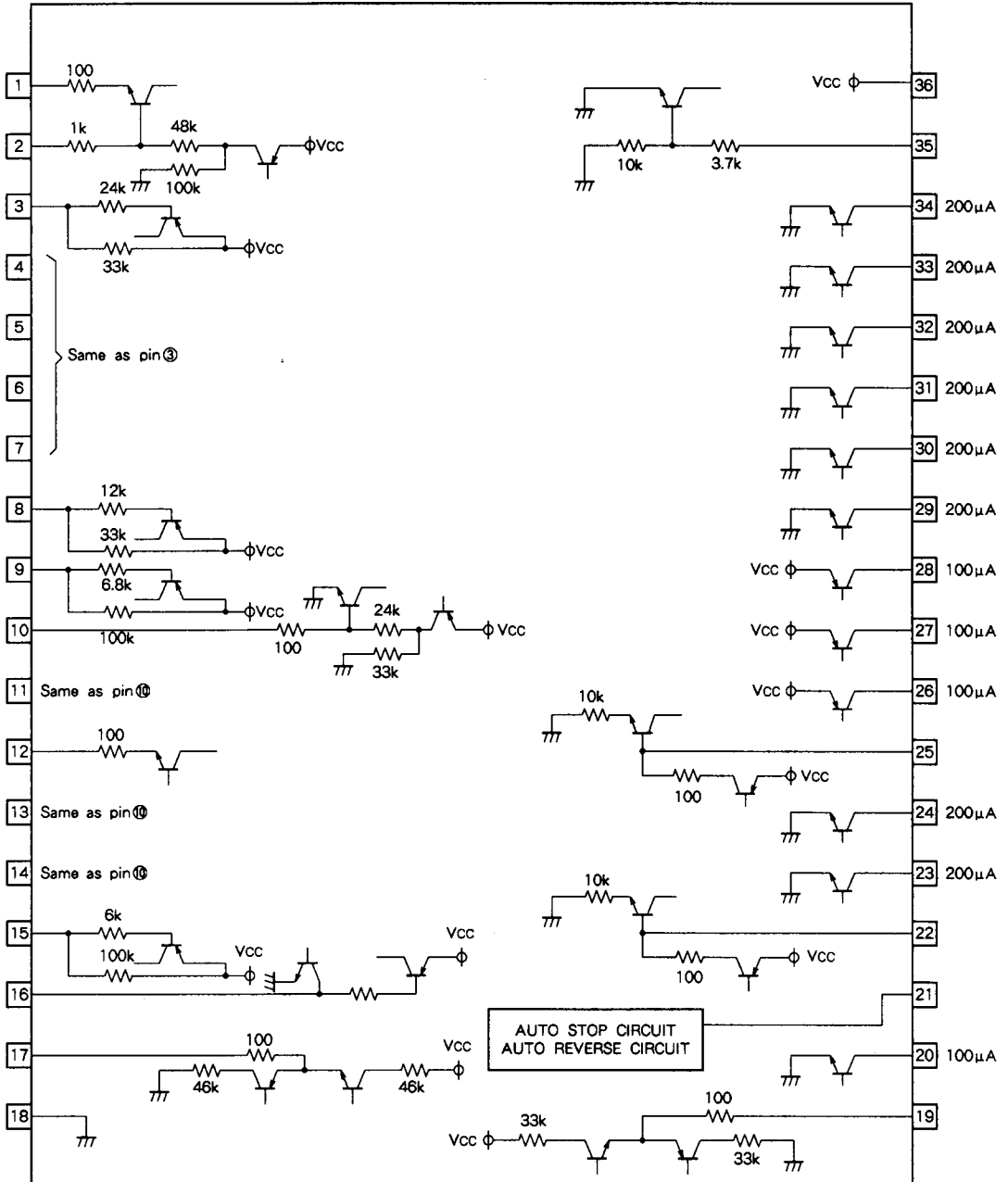
When the slide contact comes to the R position, the actuator motor stops and the mode becomes REV.

7. Battery check circuit

When the voltage at BATT. CHECK (pin ⑤) becomes under 1.0V (typ.), the FOW LED pin ⑥ and REV LED pin ⑦ become "L".

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INPUT/OUTPUT CIRCUIT



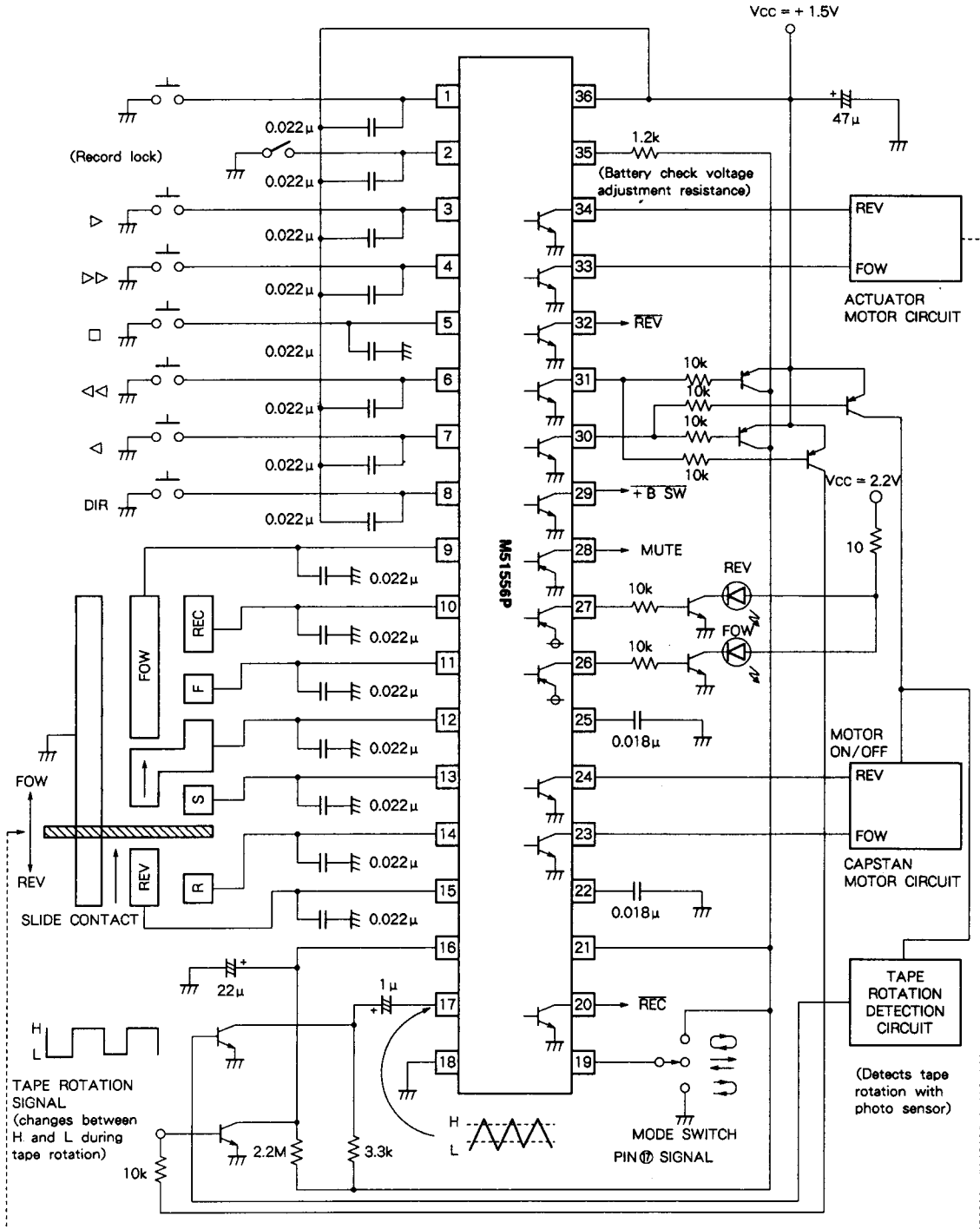
Unit Resistance : Ω

Notes ● The values in the figure are typical values.

● The currents beside pins 28, 29, 30, 31, 32, 33, 34 are collector currents when the output transistor is "ON", VCE = 150mVmax (VCC = 1.5V).

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APPLICATION EXAMPLE



Units Resistance : Ω
Capacitance : F

Note 5. The capacitors connected to pins ① to ④ and ⑥ to ⑯ are for noise prevention and the capacitor connected to pin ⑤ is for power on reset.