

# TC9244P

## LSI FOR REMOTE CONTROL RECEIVING

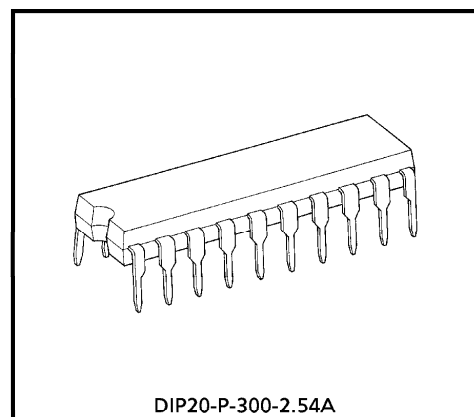
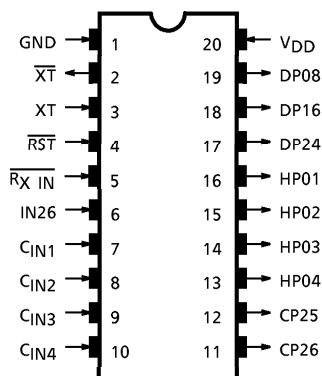
The TC9244P is an LSI for infrared Remote Control receiving. It is used for remote control of devices such as audio system, TVs, VTRs, CD players.

Remote control systems are easily constructed using TC9244P in combination with transmitting LSIs TC9243P and TC9243F.

### FEATURES

- Basic function : 9
  - Hold pulse function : 7
  - Cyclic pulse function : 2
- 3 functions out of 7 hold pulse functions are shift key outputs and can be output in parallel with other outputs corresponding to double-pushed signals sent from sending side.
- 1 function out of 2 cyclic pulse functions can be control outputs using an external key in addition to control by remote control signal.
- 8bit system codes are detected. System codes permitting signal receiving can be set up to 4 bits. Interference with other equipment can be thus prevented.

### PIN CONNECTION (TOP VIEW)

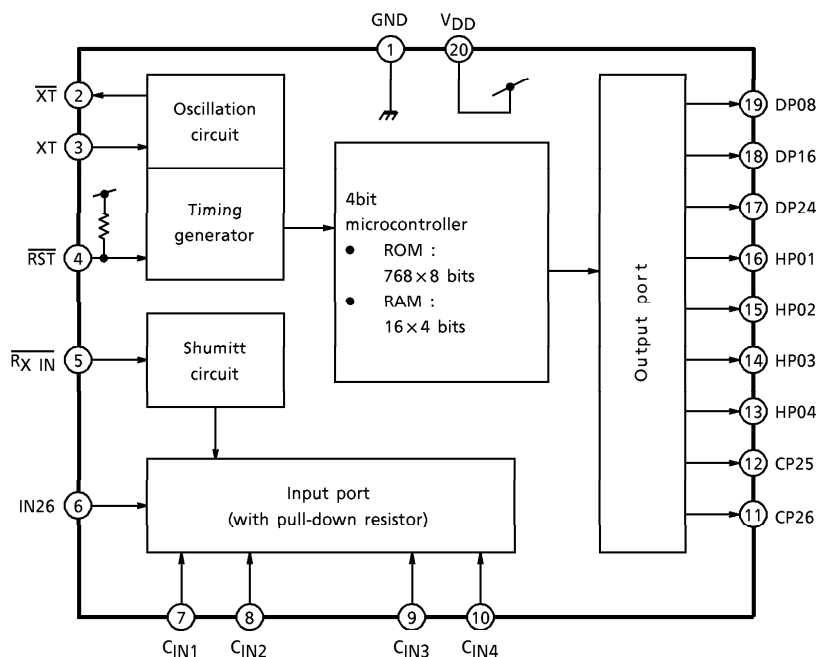


Weight : 1.4g (Typ.)

980910EBA2

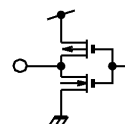
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**BLOCK DIAGRAM**



**PIN FUNCTION**

| PIN No.        | SYMBOL                    | PIN NAME                    | FUNCTION AND OPERATION  |               |
|----------------|---------------------------|-----------------------------|---|---------------|
| 1              | GND                       | Power supply terminal       | Applies power supply voltage. ( $V_{DD} = 5.0V$ , Typ.)   |               |
| 20             | $V_{DD}$                  |                             |   |               |
| 2              | $\overline{XT}$           | Oscillator terminal         | Ceramic oscillator output and input amplifier circuit and feedback resistor are built in.                 |               |
| 3              | XT                        |                             |   |               |
| 4              | $\overline{RST}$          | Reset input                 | When set to "L" level, initializes internal states. pull-up resistor are built in.                        |               |
| 5              | $\overline{RX IN}$        | Remote control signal input | Input remote control signal whose sub-carrier signal is removed.  |               |
| 6              | IN26                      | Cyclic input                | Inverts corresponding output (CP26) each time "H" level is input. Pull-down resistors are built in.       |               |
| 7~10           | $C_{IN1} \sim C_{IN4}$    | Code input                  | Inputs system code which enables receiving. Pull-down resistors are built in.                             |               |
| 11, 12         | CP26, CP25                | Cyclic output               | Inverted by corresponding remote control signal and key input. "L" level when power is turned on. (reset) | OUTPUT FORMAT |
| 13~16<br>17~19 | HP04~HP01<br>DP24, 16, 08 | Hold output                 |   |               |
|                |                           |                             |   |               |



**OPERATIONS**

1. Setting receive-enable system code

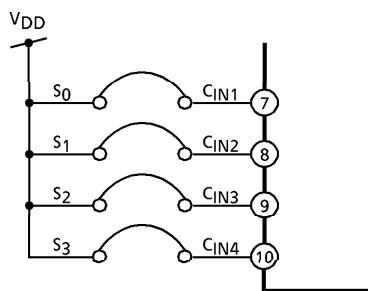
Transmitting LSIs TC9243P and TC9243F support an 8bit system code transmitting format to prevent interference with other machines.

This code makes each machine unique and thus prevents interference.

With TC9244P, the lower 4 bits of the 8bit system code used to enable receive can be set.

The upper 4 bits are fixed to "1000". (Setting value range : "80"~"8F" HEX.)

Once this receive-enabling system code is set, a match between the system code of the remote control input signal and the set system code enables reception of the subsequent key data code.



To set the receive-enabling system code, connect pins C1N1~4 to VDD using jumpers. The jumpers correspond to system code bits 0~3 (S0~S3). Connecting the pins to VDD using jumpers sets the corresponding bits to 1.

2. Receive signal check

The transmitting LSIs TC9243P and TC9243F support transmission of a check code in one-shot waveforms in order to prevent malfunctioning due to data read errors.

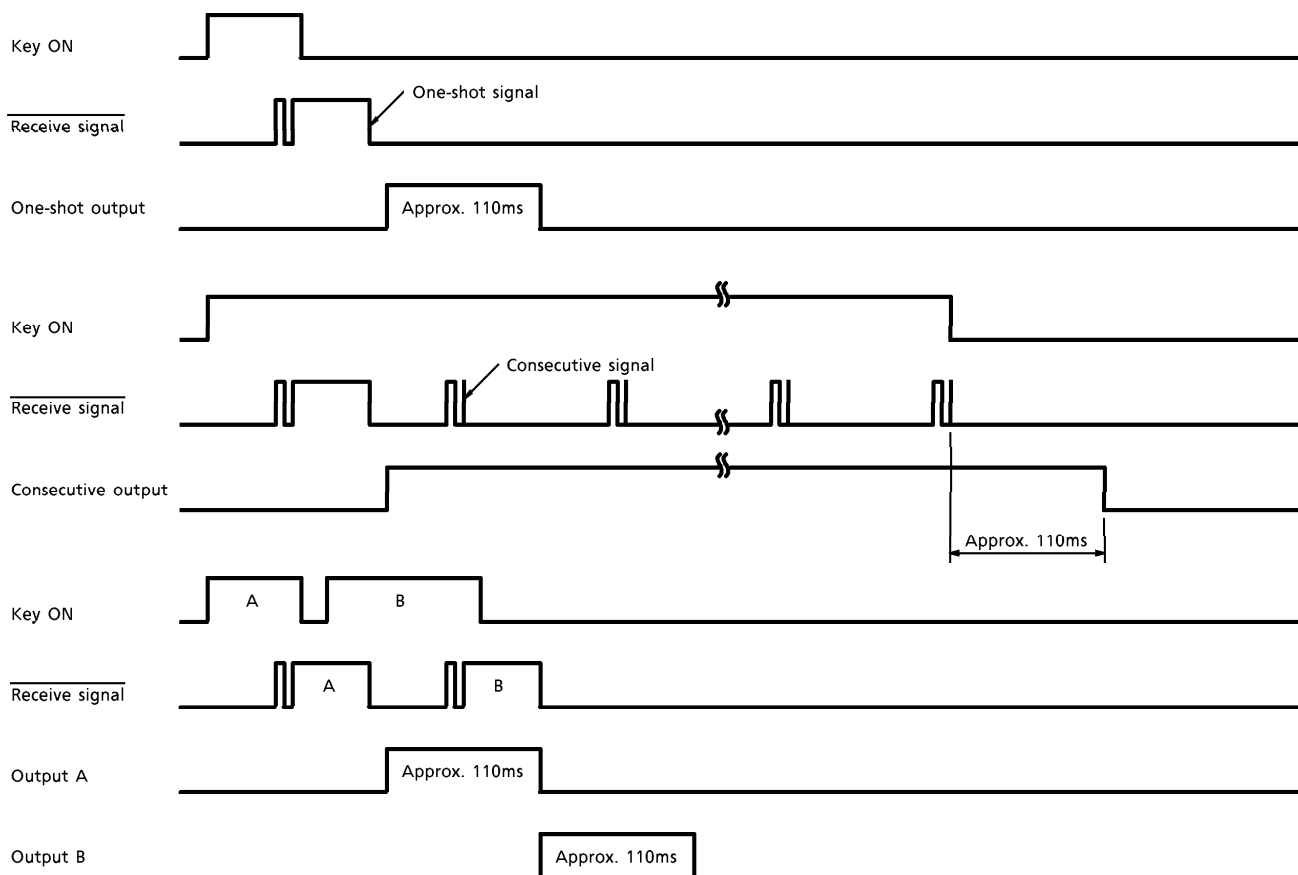
As the check code, the same system code is sent again ; after the key data code, the inverted key data code is sent.

|              |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                |                  |                  |                  |                  |                  |                  |                  |                  |
|--------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Leader pulse | System code    |                |                |                |                |                |                |                | System code    |                |                |                |                |                |                |                | Key data code  |                |                |                |                |                |                |                | Key data code    |                  |                  |                  |                  |                  |                  |                  |
|              | S <sub>0</sub> | S <sub>1</sub> | S <sub>2</sub> | S <sub>3</sub> | S <sub>4</sub> | S <sub>5</sub> | S <sub>6</sub> | S <sub>7</sub> | S <sub>0</sub> | S <sub>1</sub> | S <sub>2</sub> | S <sub>3</sub> | S <sub>4</sub> | S <sub>5</sub> | S <sub>6</sub> | S <sub>7</sub> | D <sub>0</sub> | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | D <sub>5</sub> | D <sub>6</sub> | D <sub>7</sub> | $\overline{D_0}$ | $\overline{D_1}$ | $\overline{D_2}$ | $\overline{D_3}$ | $\overline{D_4}$ | $\overline{D_5}$ | $\overline{D_6}$ | $\overline{D_7}$ |

TC9244P decodes all data. The code is sent twice. TC9244P determines that the data are valid only when codes in both transmissions match.

### 3. HP, DP and CP output pulses

#### 3-1. HP01~HP04, DP08, DP16, DP24 (Hold pulse)



When the initial one-shot system code and the receive signal are checked and the data are valid, the hold pulse is switched to "H" level.

If the receive signal is only a one-shot signal, the output switches to "L" level after approximately 110ms.

If the key is held down after the one-shot signal is output and signals are input consecutively, the output stays at "H" level.

When the key is released and the consecutive signal input stops, key release is determined after 110ms elapses after the last consecutive signal input.

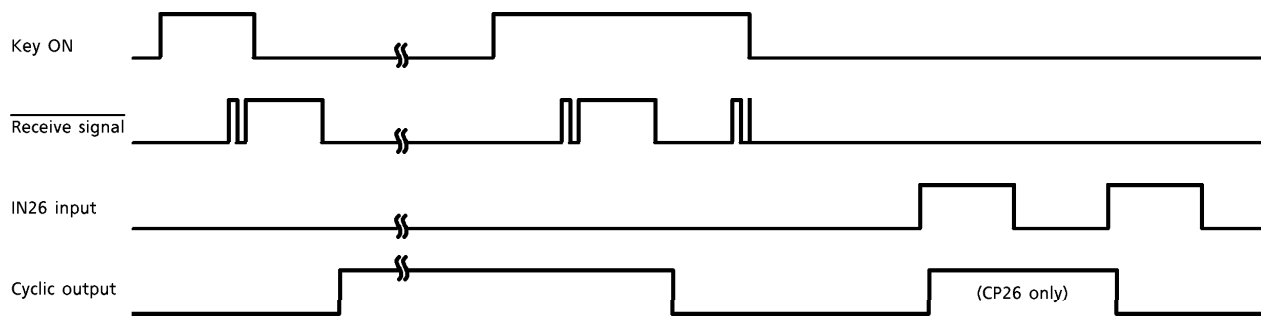
The output is switched to "L" level.

DP08, DP16, DP24 are used for outputting shift pulses.

These are set to "H" level in parallel to other output in response to a signal indicating that two keys are pressed simultaneously sent by the transmitter.

This type of output is optimal for tape deck RECORD-PLAY, RECORD-PAUSE and RECORD-REVERSE output.

3-2. CP25 and CP26 (Cyclic pulses)



Cyclic pulses are inverted each time a one-shot signal is received.  
 Setting pin IN26 to "H" level also inverts CP26.  
 Unless output is stabilized within 4ms, cyclic pulse is not valid.  
 Thus, an external component used to prevent chatter is not required.  
 Cyclic pulse output is optimal for turning power on/off and for muting.

4. Code assignment (Key numbers : TC9243P and TC9243F send key numbers)

| KEY NUMBER | KEY DATA CODE |     |     |     |     |     |     |     | OUTPUT | FUNCTION       |
|------------|---------------|-----|-----|-----|-----|-----|-----|-----|--------|----------------|
|            | D0            | D1  | D2  | D3  | D4  | D5  | D6  | D7  |        |                |
| K01        | 1             | 0   | 0   | 0   | 0   | (*) | (*) | (*) | HP01   | Hold           |
| K02        | 0             | 1   | 0   | 0   | 0   | (*) | (*) | (*) | HP02   |                |
| K03        | 1             | 1   | 0   | 0   | 0   | (*) | (*) | (*) | HP03   |                |
| K04        | 0             | 0   | 1   | 0   | 0   | (*) | (*) | (*) | HP04   |                |
| K08        | (*)           | (*) | (*) | (*) | (*) | 1   | 0   | 0   | DP08   | Hold and Shift |
| K16        | (*)           | (*) | (*) | (*) | (*) | 1   | 1   | 0   | DP16   |                |
| K24        | (*)           | (*) | (*) | (*) | (*) | 1   | 0   | 1   | DP32   |                |
| K25        | 1             | 0   | 0   | 1   | 1   | (*) | (*) | (*) | CP25   | Cyclic         |
| K26        | 0             | 1   | 0   | 1   | 1   | (*) | (*) | (*) | CP26   |                |

(\*) Don't care (Corresponding output changes regardless of data)

## MAXIMUM RATING (Ta = 25°C)

| CHARACTERISTIC        | SYMBOL           | RATING                          | UNIT |
|-----------------------|------------------|---------------------------------|------|
| Supply Voltage        | V <sub>DD</sub>  | -0.3~6.0                        | V    |
| Input Voltage         | V <sub>IN</sub>  | GND - 0.3~V <sub>DD</sub> + 0.3 | V    |
| Power Dissipation     | P <sub>D</sub>   | 350                             | mW   |
| Operating Temperature | T <sub>opr</sub> | -40~85                          | °C   |
| Storage Temperature   | T <sub>stg</sub> | -65~150                         | °C   |

## ELECTRICAL CHARACTERISTICS

Recommended operating conditions (Unless otherwise specified, V<sub>DD</sub> = 5.0V, Ta = 25°C)

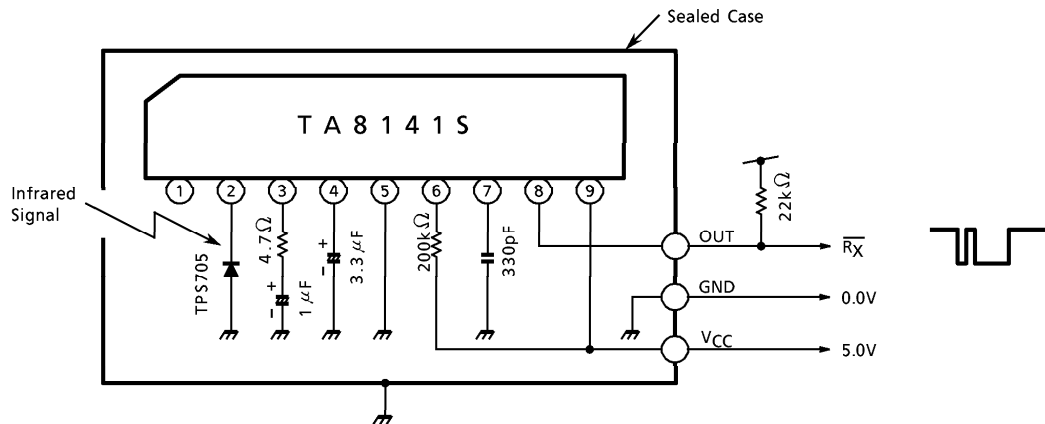
| CHARACTERISTIC           | SYMBOL           | TEST CIR-CUIT    | TEST CONDITION                                  | MIN.                  | TYP. | MAX.                  | UNIT |
|--------------------------|------------------|------------------|---|-----------------------|------|-----------------------|------|
| Operating Supply Voltage | V <sub>DD</sub>  | —                | Ta = -40~85°C                                   | 4.5                   | —    | 5.5                   | V    |
| Oscillation Frequency    | f <sub>osc</sub> | —                | —   | 400                   | —    | 800                   | kHz  |
| Input Voltage            | "H" Level        | V <sub>IH1</sub> | (Except $\overline{RST}$ , $\overline{RX IN}$ ) | V <sub>DD</sub> × 0.7 | —    | V <sub>DD</sub>       | V    |
|                          | "H" Level        | V <sub>IH2</sub> | ( $\overline{RST}$ , $\overline{RX IN}$ )       | V <sub>DD</sub> × 0.8 | —    | V <sub>DD</sub>       | V    |
|                          | "L" Level        | V <sub>IL1</sub> | (Except $\overline{RST}$ , $\overline{RX IN}$ ) | 0                     | —    | V <sub>DD</sub> × 0.3 | V    |
|                          | "L" Level        | V <sub>IL2</sub> | ( $\overline{RST}$ , $\overline{RX IN}$ )       | 0                     | —    | V <sub>DD</sub> × 0.2 | V    |

DC Characteristics (Unless otherwise specified, V<sub>DD</sub> = 5.0V, Ta = 25°C)

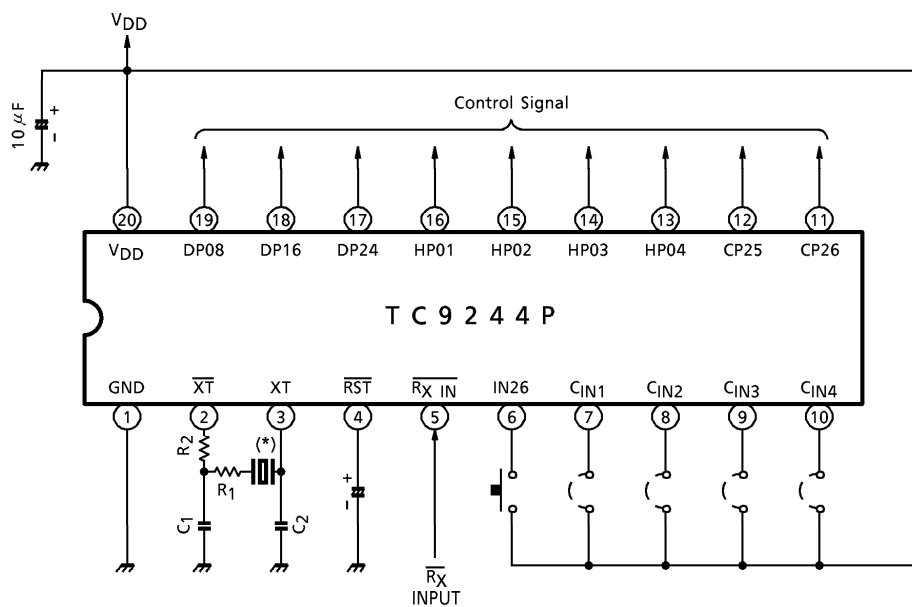
| CHARACTERISTIC           | SYMBOL          | TEST CIR-CUIT   | TEST CONDITION                          | MIN. | TYP. | MAX. | UNIT |
|--------------------------|-----------------|-----------------|---|------|------|------|------|
| Operating Supply Current | I <sub>DD</sub> | —               | f <sub>osc</sub> = 455kHz               | —    | 1.0  | 3.0  | mA   |
| Pull-down Resistor       | R <sub>D</sub>  | —               | (IN26, C <sub>IN</sub> )                | 100  | 200  | 400  | kΩ   |
| Pull-up Resistor         | R <sub>U</sub>  | —               | ( $\overline{RST}$ )                    | 25   | 50   | 100  | kΩ   |
| Output Current           | "H" Level       | I <sub>OH</sub> | (CP, HP, DP) V <sub>OH</sub> = 4V       | -1.0 | -4.0 | —    | mA   |
|                          | "L" Level       | I <sub>OL</sub> | (CP, HP, DP) V <sub>OL</sub> = 1V       | 1.0  | 8.0  | —    | mA   |
| Input Leak Current       | I <sub>LI</sub> | —               | V <sub>IN</sub> = V <sub>DD</sub> , GND | -1.0 | —    | 1.0  | μA   |

APPLICATION CIRCUIT

1. Receiver circuit



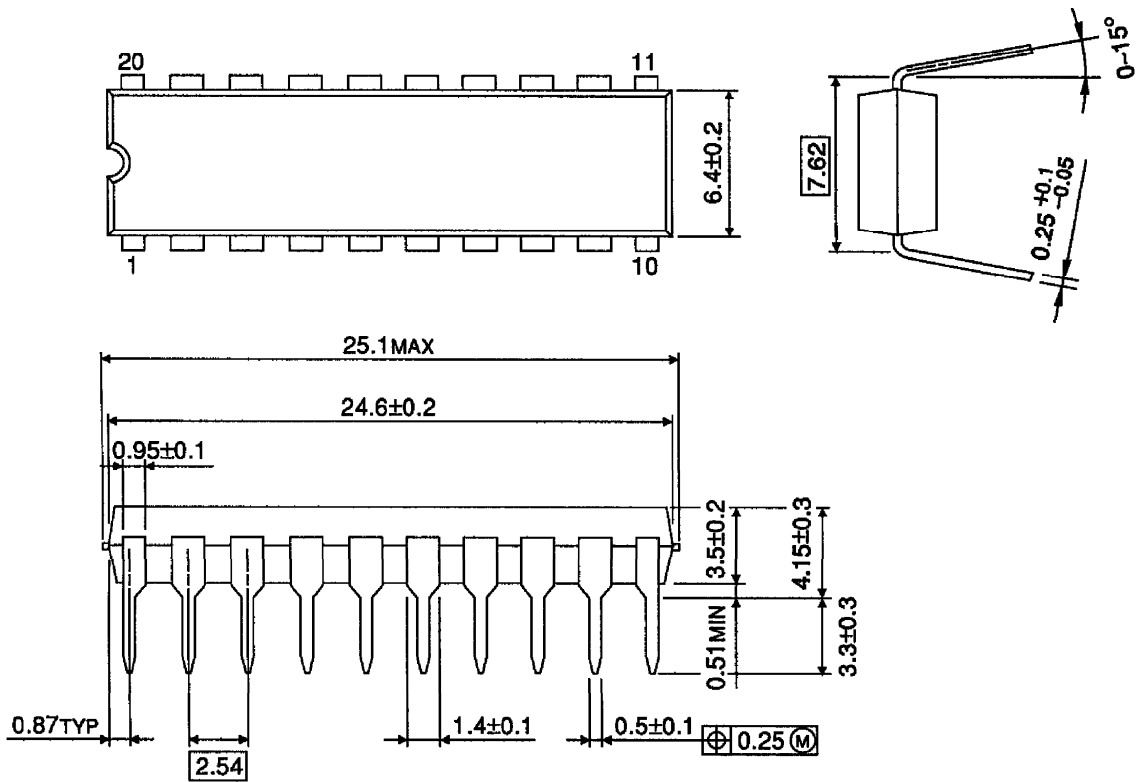
2. TC9244P circuit



- (\*) Ceramic oscillator  
 CSB455E (Murata Seisakusyo)  $C_1 = C_2 = 100\text{pF}$ ,  $R_2 = \text{unnecessary}$   
 In case of influenced by oscillation noise, add resistor  $R_1$  to  $10\text{k}\Omega$  MAX.  
 FCR455K3 (TDK)  $C_1 = C_2 = 220\text{pF}$ ,  $R_2 = 4.7\text{k}\Omega$ ,  $R_1 = \text{unnecessary}$   
 In case of influenced by oscillation noise, add resistor  $R_2$  to large ( $>4.7\text{k}\Omega$ ).  
 or equivalent

**OUTLINE DRAWING**  
DIP20-P-300-2.54A

Unit : mm



Weight : 1.4g (Typ.)