

TOSHIBA Bipolar linear Integrated Circuit Silicon Monolithic

# TA8214K

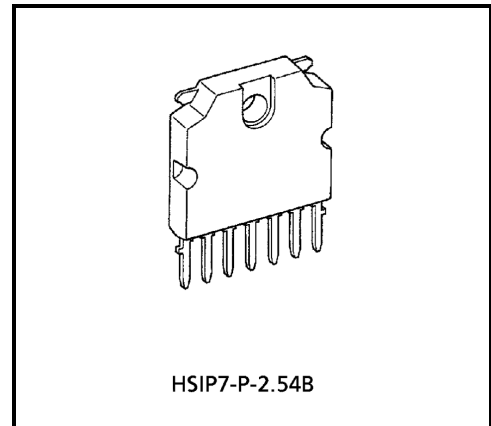
## Multi Output Voltage Regulator (8.3V output)

The TA8214K is voltage regulator IC, designed for car audio use, has built-in 4 outputs. (fixed 1 output and changed 3 outputs.) The input-output differential voltage : VDIF is very small. (VDIF = 0.3V (typ.))

Because each outputs consist of PNP transistor. In addition, protection of over voltage, output short and thermal shut down are involved.

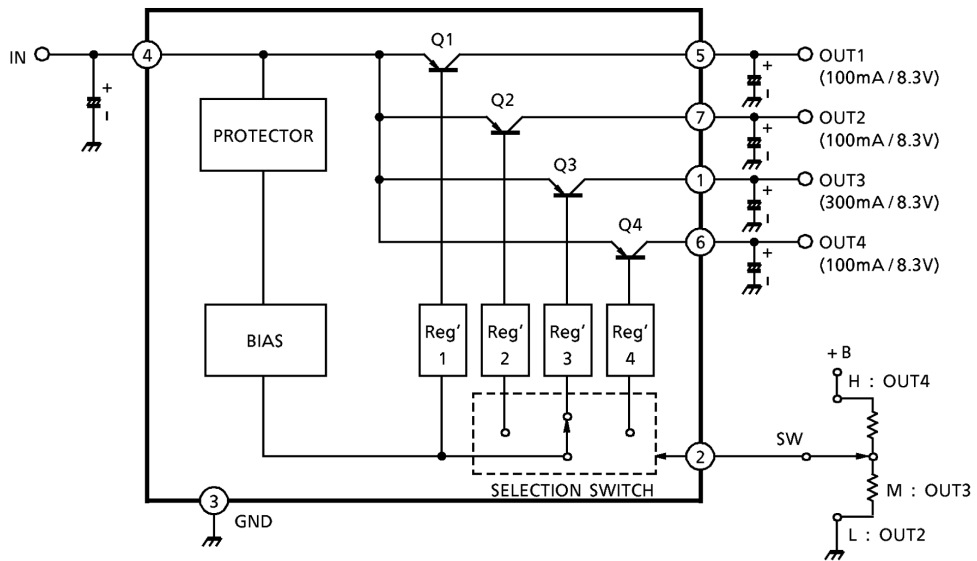
### Features

- 4 channel outputs
  - OUT1 : 8.3V (typ.) / 100mA (max.) .... fixed output
  - OUT2 : 8.3V (typ.) / 100mA (max.)
  - OUT3 : 8.3V (typ.) / 300mA (max.) switchable output
  - OUT4 : 8.3V (typ.) / 100mA (max.)
- Very small input-output differential voltage  
VDIF = 0.3V (typ.)
- Built-in various protection circuits  
Over voltage, Output short, Thermal shut down
- Input operating voltage  
VIN (opr) = 9.3~18V



Weight: 2.19g (typ.)

## Block Diagram



## Caution For Use And Method Of Application

### (1) IC protective diode in $V_{IN} < V_{OUT}$ mode : D

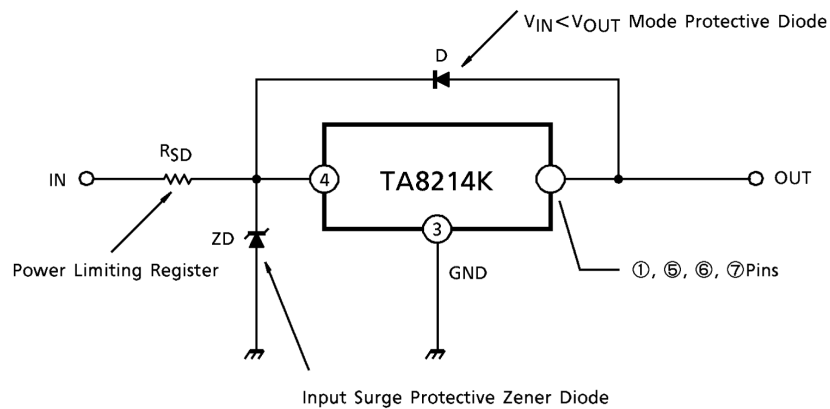
When surge voltage is applied to the input / output terminals of IC or  $V_{OUT}$  becomes larger than  $V_{IN}$  ( $V_{IN} < V_{OUT}$ ) at the time of power on / off, insert a high speed switching diode : D.

### (2) Power limiting register : RSD

If  $V_{IN}$  is too high, insert a power limiting register : RSD to reduce power dissipation of IC.

### (3) Input surge protective zener diode : ZD

Though an over voltage protective circuit (for positive surge) is built in, if excessive surge is input, insert a surge protective zener diode : ZD.



(Fig.1)

### (4) Design of heat sink

Thermal resistance :  $\theta_{j-T}$  of the package of this IC can be obtained from (Fig.2) according to the following expression :

$$\theta_{j-T} = \frac{150^{\circ}\text{C} - 75^{\circ}\text{C}}{15\text{W}} = 5^{\circ}\text{C} / \text{W}$$

(terminal from the junction to the TAB) ... expression (1)

Thermal resistance :  $\theta_{HS}$  of the heat sink attached to this IC is decided by the following expression :

$$\theta_{HS} = \frac{T_j \text{ MAX} - T_a}{P_D \text{ MAX}} - \theta_{j-T} \dots \text{expression (2)}$$

Where,  $P_D \text{ MAX}$  expresses maximum power dissipation in this IC.

$$P_D \text{ MAX} = (V_{IN} \text{ (max)} - V_{OUT} \text{ (MIN)}) \times (I_1, I_6, I_7 + I_5 + I_B \text{ (MAX)}) \dots \text{expression (3)}$$

For instance, if this IC is used under the conditions of  $V_{IN} \text{ (MAX)} = 16V$ ,  $I_1 = 300mA$ ,  $I_5 = 100mA$  and  $T_a = \text{up to } 85^\circ C$  from expression (3),

$P_D \text{ MAX} = (16V - 8V) \times (300mA + 100mA + 35mA) = 3.48W$  substituting  $P_D \text{ max} = 3.48W$  into expression (2), above,  $\theta_{HS}$  is obtained as follows :

$$\theta_{HS} = \frac{150^\circ C - 85^\circ C}{3.48W} - 5^\circ C / W = 13.7^\circ C / W$$

Accordingly, a heat sink having  $\theta_{HS} = 13.7^\circ C / W$  becomes necessary and referring to (Fig.3), it can be set to be an aluminum plate 2mm in thickness and about  $270cm^2$  in area.

However, when a heat sink is actually mounted to IC, the contact resistance is generated on its contacting surface and heat generated on its contacting surface and heat conduction becomes worse.

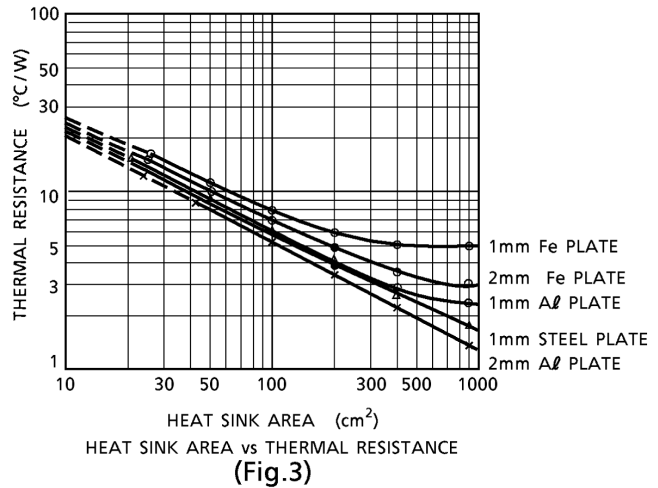
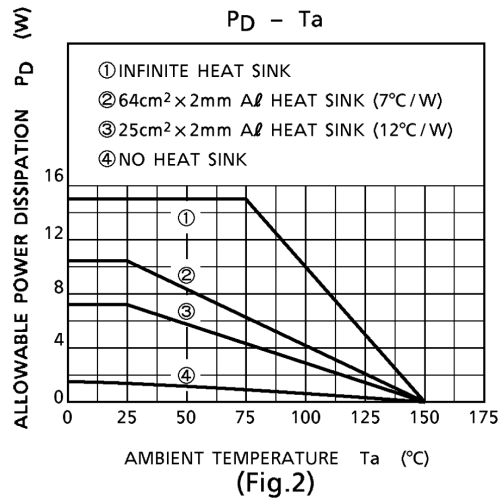
Therefore, a heat sink shall be designed with a sufficient margin of heat sink given.

Further, the TAB shall be grounded or kept open when the IC is used.

(5) Output capacitor for preventing the oscillation.

Type and capacity of a capacitor to be used between the output and GND shall be decided after thoroughly examining print pattern, route of connection, at high / low temperature, etc.

In particular, if inductor component is connected to the output, it is necessary to make the capacity larger than the recommended value.



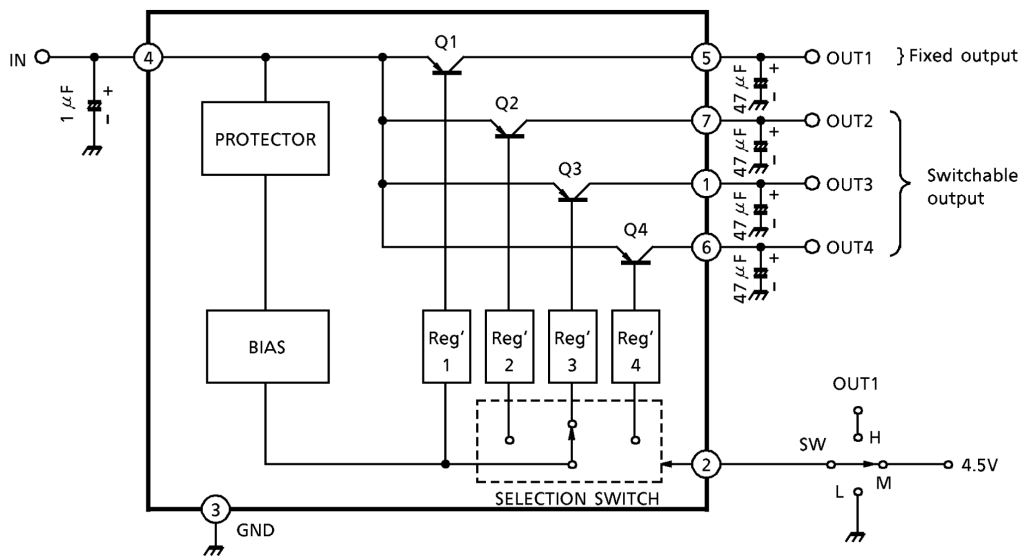
## Maximum Ratings (Ta = 25°C)

| Characteristic            | Symbol                  | Rating  | Unit |
|---------------------------|-------------------------|---------|------|
| Peak input voltage (0.2s) | V <sub>IN (surge)</sub> | 50      | V    |
| DC input voltage          | V <sub>IN (DC)</sub>    | 25      | V    |
| Operating input voltage   | V <sub>IN (opr)</sub>   | 18      | V    |
| Power dissipation         | P <sub>D</sub>          | 15      | W    |
| Operating temperature     | T <sub>opr</sub>        | -30~85  | °C   |
| Storage temperature       | T <sub>stg</sub>        | -55~150 | °C   |

## Electrical Characteristics (unless otherwise specified, V<sub>IN</sub> = 13.2V, Ta = 25°C)

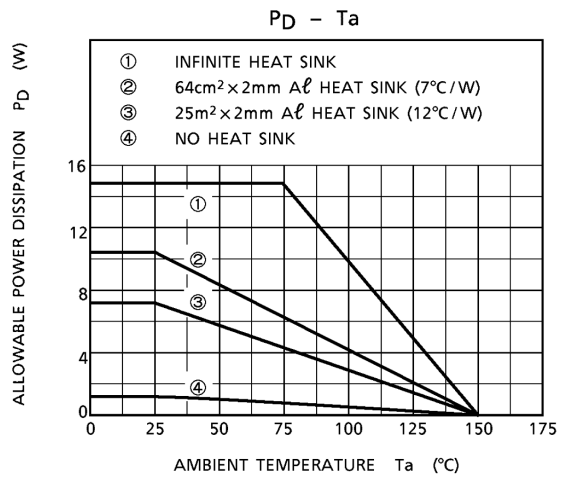
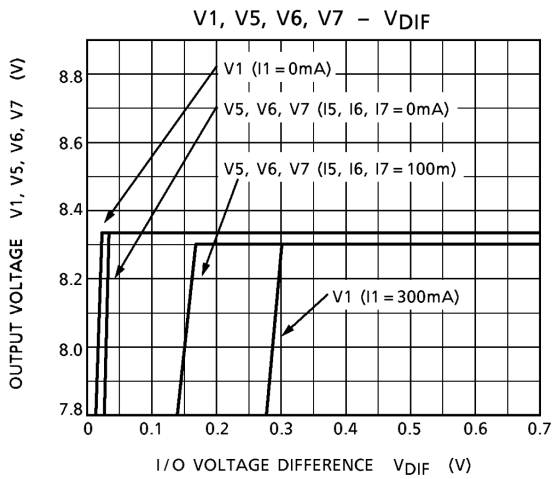
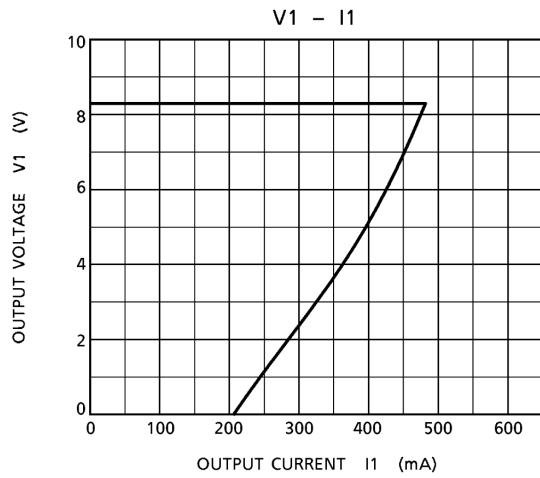
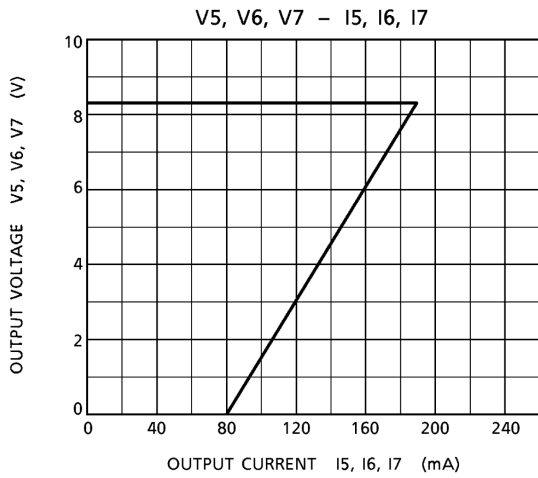
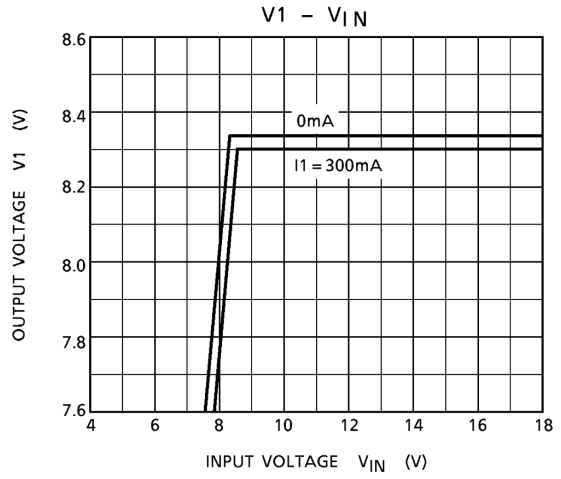
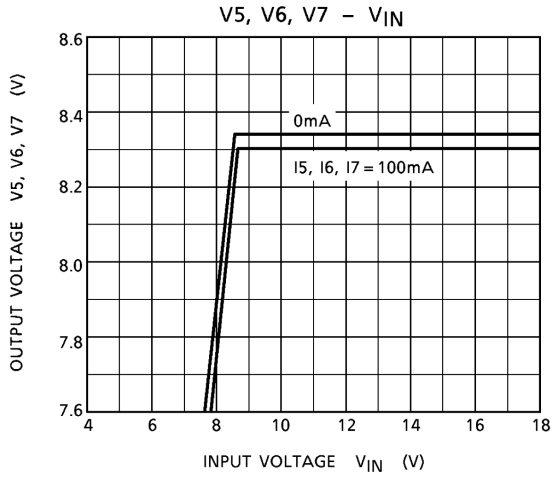
| Characteristic                         |                | Symbol                   | Test Circuit | Test Condition   | Min.              | Typ. | Max. | Unit            |   |
|--|----------------|--------------------------|--------------|--|-------------------|------|------|-----------------|---|
| Output voltage                         | Out1           | V5                       | —            | I5 = 100mA   | 8.0               | 8.3  | 8.6  | V               |   |
|  | Out2           | V7                       | —            | I7 = 100mA   | 8.0               | 8.3  | 8.6  |                 |   |
|  | Out3           | V1                       | —            | I1 = 300mA   | 8.0               | 8.3  | 8.6  |                 |   |
|  | Out4           | V6                       | —            | I6 = 100mA   | 8.0               | 8.3  | 8.6  |                 |   |
| Bias current                           |                | I <sub>B</sub>           | —            | I5, 7, 1, 6 = 0  | —                 | 12   | 35   | mA              |   |
| Input variation                        |                | ΔV <sub>o1</sub>         | —            | V <sub>IN</sub> = 9.3~18V<br>I5, 7, 6 = 100mA, I1 = 300mA  | —                 | —    | ±50  | mV              |   |
| Load variation                         |                | ΔV <sub>o2</sub>         | —            | I5, 7, 6 = 0~100mA<br>I1 = 0~300mA   | —                 | —    | ±50  | mV              |   |
| Input-output voltage difference        |                | V <sub>DIF</sub>         | —            | I5, 7, 6 = 100mA, I1 = 300mA   | —                 | 0.3  | 0.6  | V               |   |
| Ripple rejection ratio                 |                | R.R.                     | —            | f = 100Hz,<br>V <sub>ripple</sub> = 0.775V <sub>rms</sub> (0dBm)<br>I5, 7, 6 = 100mA, I1 = 300mA | 50                | 65   | —    | dB              |   |
| Max. output current                    | Out 1, 2, 4    | I <sub>MAX 5, 7, 6</sub> | —            | —  | 100               | —    | —    | mA              |   |
|  | Out3           | I <sub>MAX 1</sub>       | —            | —  | 300               | —    | —    |                 |   |
| Output voltage temperature coefficient |                | TC <sub>VO</sub>         | —            | I5, 7, 6 = 100mA, I1 = 300mA   | —                 | +1   | —    | mV / deg        |   |
| Control terminal input resistance      |                | R <sub>CONT</sub>        | —            | —  | 6                 | 10   | —    | kΩ              |   |
| Control voltage                        | V <sub>H</sub> | —                        | —            | V6 (out4) : On   | Ta = -30<br>~80°C | 7.0  | —    | V <sub>IN</sub> | V |
|  | V <sub>M</sub> | —                        | —            | V1 (out3) : On   |                   | 2.8  | —    | 5.5             |   |
|  | V <sub>L</sub> | —                        | —            | V7 (out2) : On   |                   | 0    | —    | 1.2             |   |

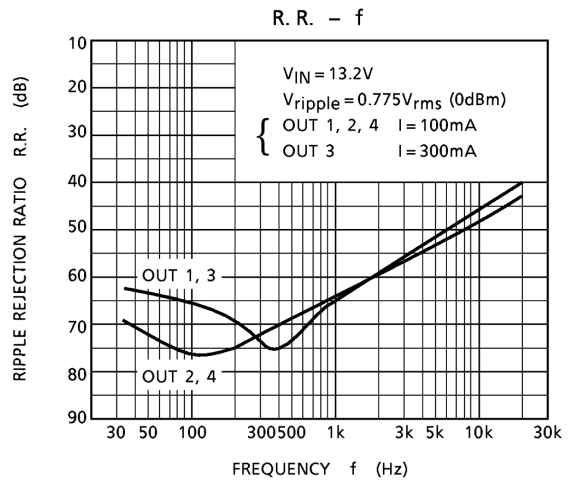
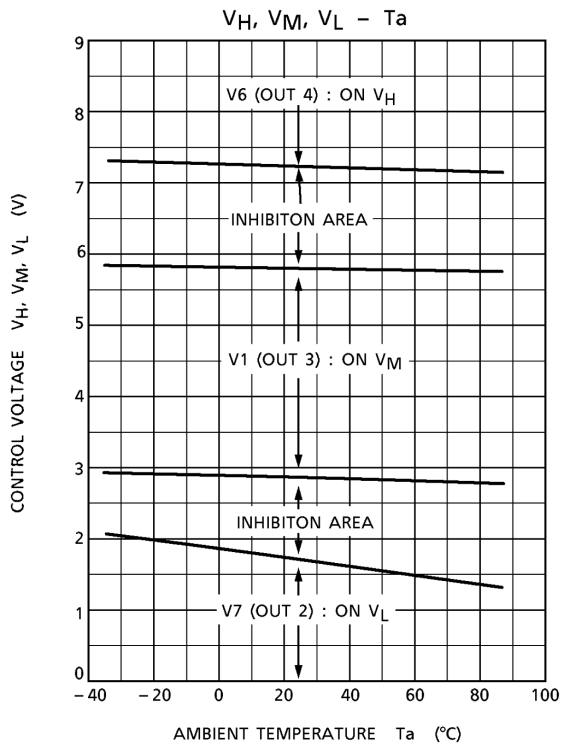
**Test Circuit**



(Note 1) Heat sink must be used with its fin grounded or in "open" status.

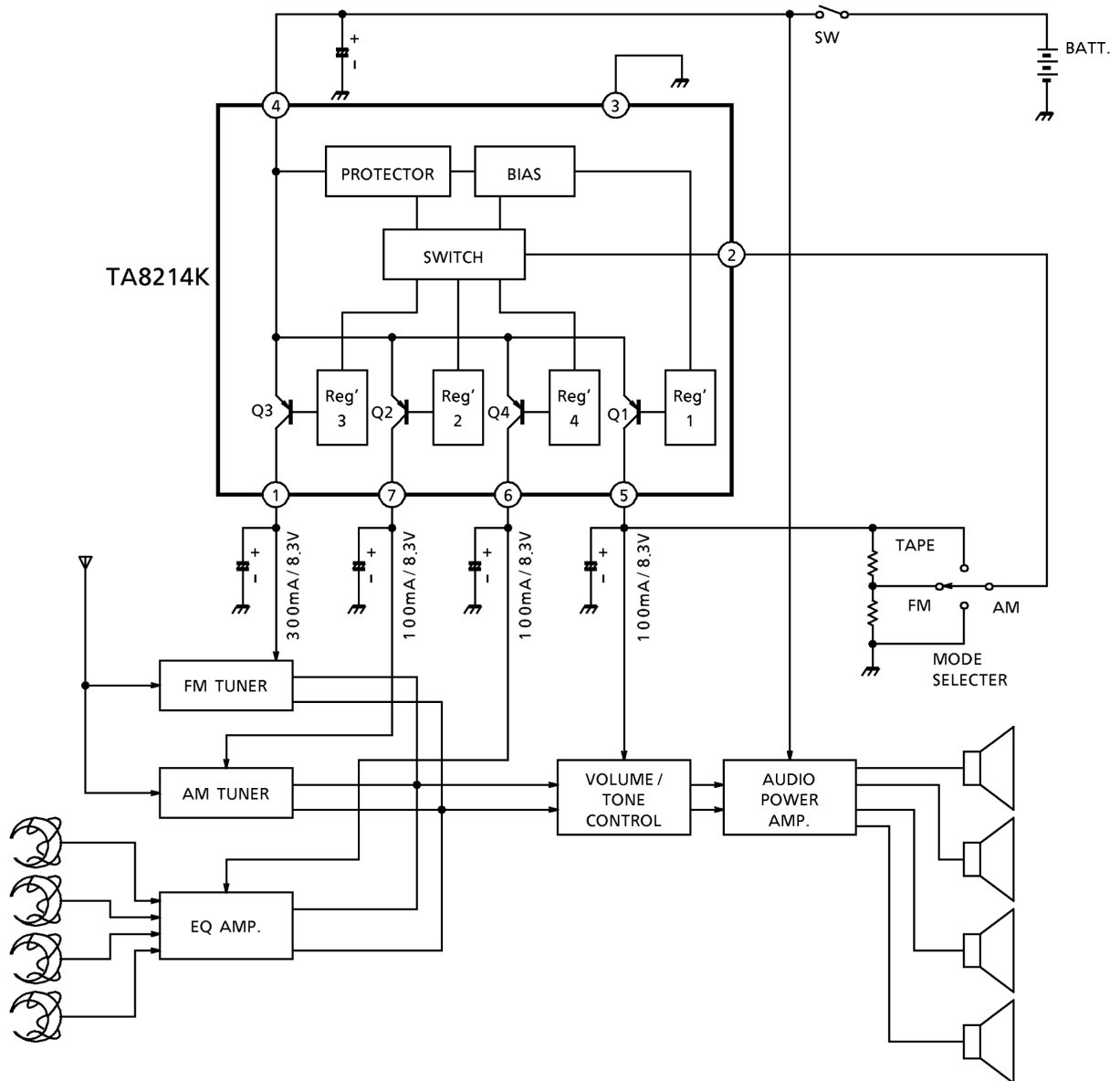
(Note 2) When inductor element is connected to output, increase the capacity value of oscillation stop capacitor between output and GND.







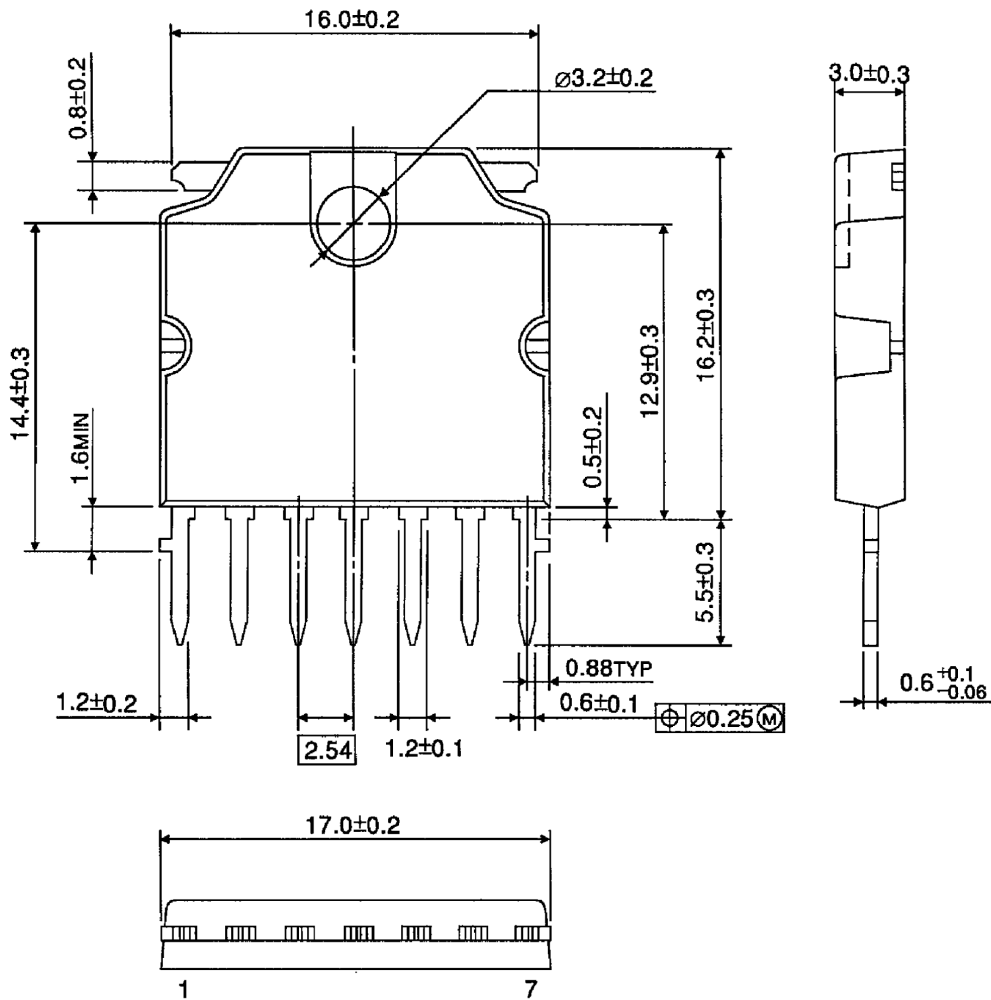
## Application Circuit



**Package Dimensions**

HSIP7-P-2.54B

Unit : mm



Weight : 2.19g (typ.)

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