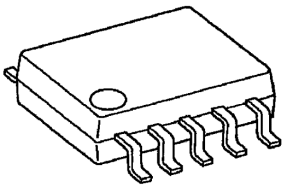
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

# TA2015FNG

Ripple Filter (1.5V USE)

The TA2015FNG is a ripple filter IC, which is developed for low voltage operation (1.5V).
It is especially suitable for supplying voltage for headphone stereo etc.



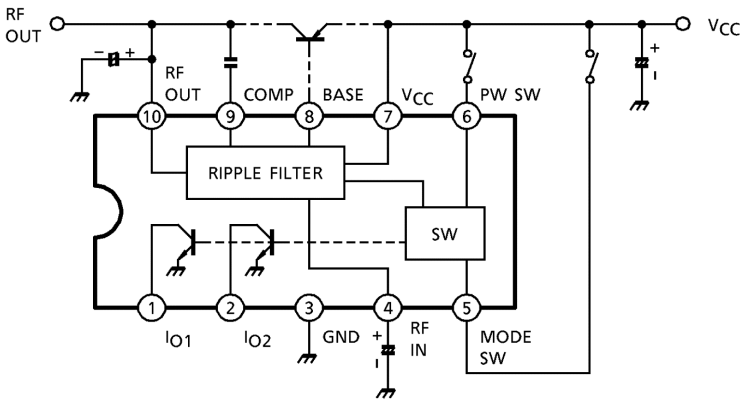
SSOP10-P-0.65

Weight: 0.04g (typ.)

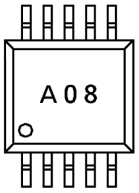
## Features

- Built−in a power switch
- Excellent ripple rejection ratio: RR = 43dB (typ.)
- Ripple filter output voltage can be controlled by external resistor.
- Output voltage is limited to $V_{RF}$ = 1.5V (typ.)
- Built−in two constant current sources.
- Excellent low voltage operation.
- Low quiescent supply current ($V_{CC}$ = 1.2V, Ta = 25°C)
  $I_{CC}$ = 0.7mA (typ.)
- Operating supply voltage range. (Ta = 25°C)
  $V_{CC\ (opr)}$ = 0.9~2.2V

## Block Diagram

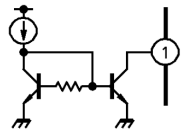
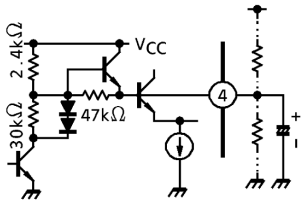
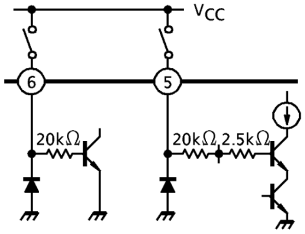
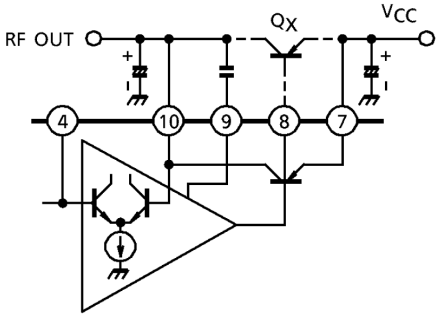



## Marking



## Terminal Explanation

Terminal Voltage: Typical Terminal Voltage with Test Circuit
($V_{CC}$ = 1.2V, Ta = 25°C, non load)

| Terminal No. | Terminal Name | Function | Internal Circuit | Terminal Voltage (V) |
|---|---|---|---|---|
| 1 | $I_{O1}$ | Output of constant current source 1<br>Operating condition<br>PW SW : H<br>MODE SW : L |  | — |
| 2 | $I_{O2}$ | Output of constant current source 2<br>Synchronized to PW SW | | — |
| 3 | GND | — | — | 0 |
| 4 | RF in | Ripple filter terminal<br>Ripple filter output voltage can be controlled by external resistor.<br>(See application note) |  | 1.14 |
| 5 | Mode SW | Mode switch<br>$V_{CC}$ : $I_{O2}$, RF OUT on<br>GND / OPEN : $I_{O1}$, $I_{O2}$ on |  | — |
| 6 | PW SW | Power switch<br>$V_{CC}$ : Power on<br>GND / OPEN : Power off | | — |
| 7 | $V_{CC}$ | — | — | 1.2 |
| 8 | Base | Base biasing terminal for ripple filter transistor.<br>Output current capacity is 1.2mA with only built–in PNP transistor.<br>This capacity can be increased with an external transistor $Q_X$. |  | 0.5 |
| 9 | Comp | Phase compensation terminal for a ripple filter circuit | | 0.5 |
| 10 | RF out | Ripple filter output | | 1.14 |

## Application Note

1. Operation mode of constant current source
   Operation mode is decided by switch condition shown in table.1. Output of constant current source 1 can be used as a reset circuit by changing start up timing of PW SW, MODE SW.
2. Ripple filter output
   It is necessary to connect an external pull−down resistor with PW SW (pin(6)) and MODE SW (pin(5)) in case that ripple filter circuit doesn't operate normally due to external noise etc.
3. Adjustment of ripple filter output voltage
   Internal circuit of pin(4) is shown in Fig.1. Ripple filter output voltage is decided by internal resistor $R_1$, $R_2$ and $Q_3$, and limited by $D_{1\sim2}$ and $Q_3$ to $V_{RF}$ = 1.5V (typ.)
   Ripple filter output voltage can be controlled by method below.

| PW SW \ Mode SW | H | L |
|---|---|---|
| H | $I_{O2}$ RF OUT | $I_{O1}$ $I_{O2}$ |
| L | — | — |

Table.1 Operation mode

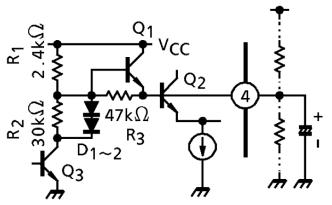



Fig.1 Internal circuit of pin④

(1) Method to rise the ripple filter output voltage
External resistor should be connected between $V_{CC}$ and RF IN terminal (pin(4)). In this case, output current capacity of ripple filter circuit is down. Because at ripple filter output stage, collector−emitter voltage of PNP transistor will small, and drive capacity of transistor is down.

(2) Method to drop the ripple filter output voltage
External resistor should be connected between GND and RF IN terminal (pin(4)).
Current flows through external resistor and internal resistor $R_1$, $R_3$ (2.4kΩ, 47kΩ).
In case that output voltage dropped too much, ripple rejection ratio and other characteristics will be worse, because constant current source of differential amplifier is saturated especially at low voltage.

## Maximum Ratings (Ta = 25°C)

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 4.5 | V |
| Constant current source output voltage | $V_S$ | 4.5 | |
| Constant current source output current | $I_S$ | 10 | mA |
| Ripple filter output current (built−in transistor) | $I_{RF}$ | 20 | |
| Power dissipation | $P_D$ (Note) | 300 | mW |
| Operating temperature | $T_{opr}$ | −25~75 | °C |
| Storage temperature | $T_{stg}$ | −55~150 | |

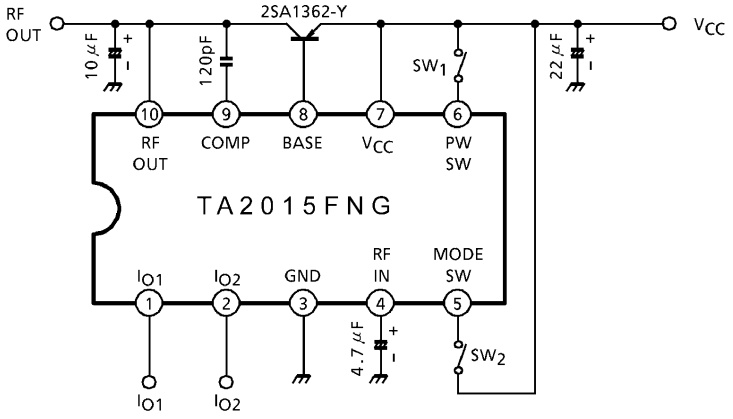
(Note) Derated above Ta = 25°C in the proportion of 2.4mW / °C.

## Electrical Characteristics

(unless otherwise specified, $V_{CC}$ = 1.2V, Ta = 25°C, $SW_1$: ON, $SW_2$: ON)

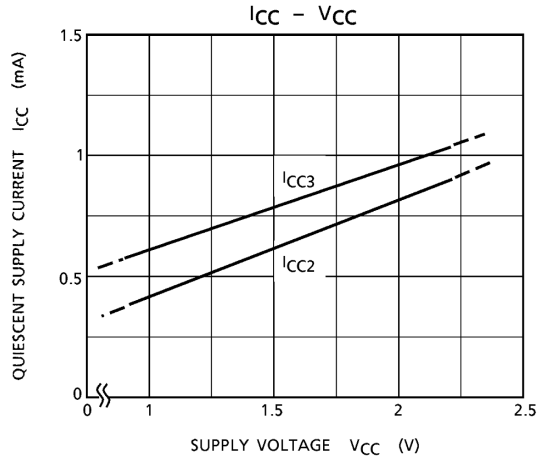
| Characteristic | Symbol | Test Cir−cuit | Test Condition | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Quiescent supply current | $I_{CC1}$ | — | PW off, $SW_1$: OPEN $SW_2$: OPEN | | — | 0.1 | 5 | μA |
| | $I_{CC2}$ | — | $SW_2$: Open, $I_{O1} = I_{O2} = 0$ | | — | 0.5 | 0.8 | mA |
| | $I_{CC3}$ | — | $I_{RF} = I_{O2} = 0$ | | — | 0.7 | 1.0 | |
| Ripple filter output voltage | $V_{RF}$ | — | $V_{CC}$ = 1V, $I_{RF}$ = 0 | | 0.91 | 0.94 | — | V |
| Ripple rejection ratio | RR | — | $V_r$ = −32dBV $f_r$ = 100Hz, $I_{RF}$ = 30mA | | 36 | 43 | — | dB |
| Constant current source output current | $I_{O1}$ | — | $SW_2$: OPEN | | 50 | — | — | μA |
| | $I_{O2}$ | — | — | | 50 | — | — | |
| Power switch on current | $I_6$ | — | $V_{CC}$ = 0.9V | $V_{10} \geq 0.6V$ | 5 | — | — | μA |
| Power switch off voltage | $V_6$ | — | | $V_{10} \leq 0.3V$ | 0 | — | 0.3 | V |
| Mode switch on current | $I_5$ | — | | $V_{10} \geq 0.6V$ | 5 | — | — | μA |
| Mode switch off voltage | $V_5$ | — | | $V_{10} \leq 0.3V$ | 0 | — | 0.3 | V |

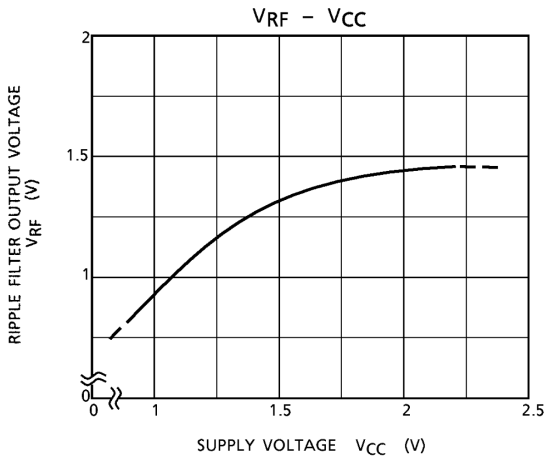
## Test Circuit

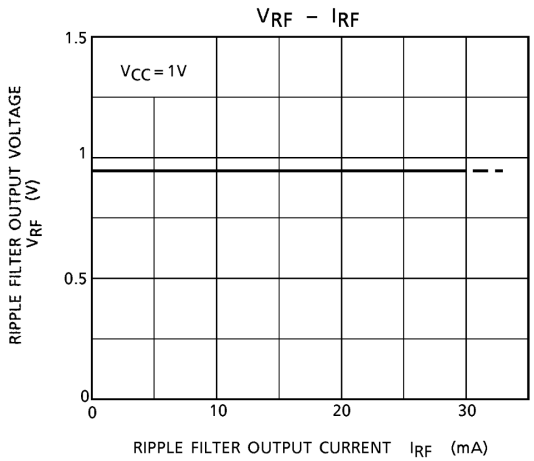


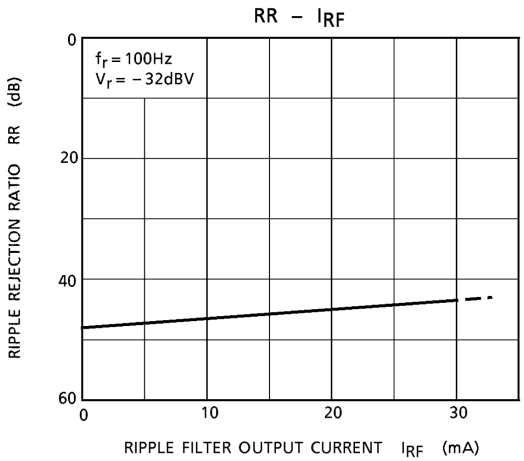
## Characteristic Curves

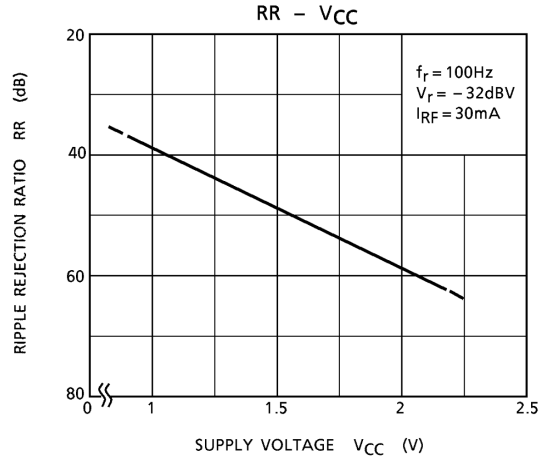
(unless otherwise specified, $V_{CC}$ = 1.2V, $I_{RF}$ = 0, $I_{O1}$ = $I_{O2}$ = 0, Ta = 25°C)

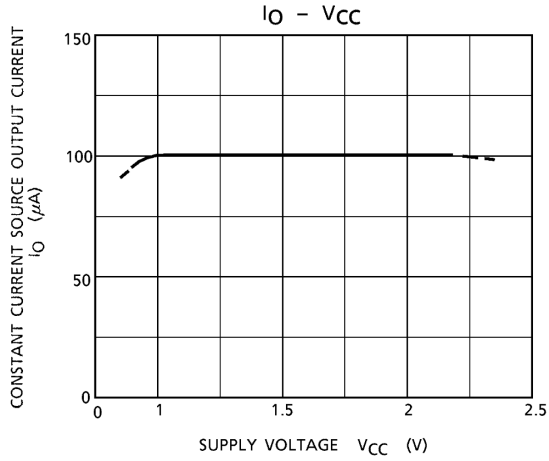


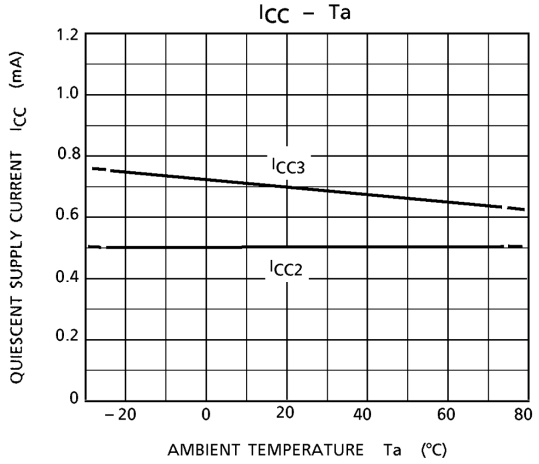



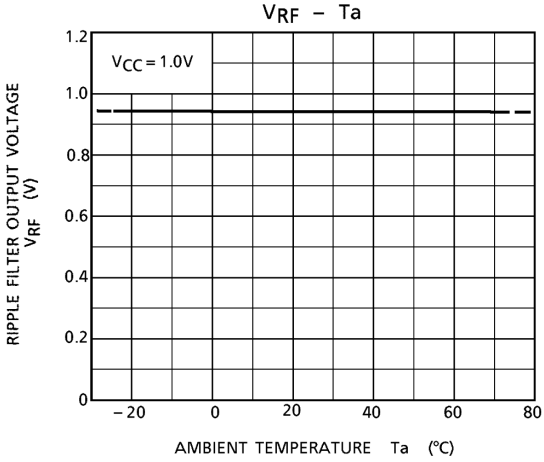



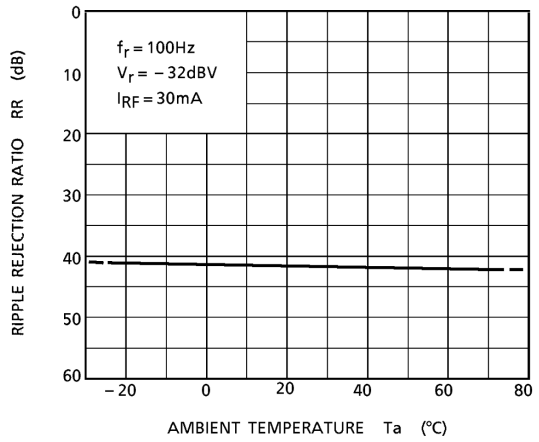
$I_{CC}$ – Ta



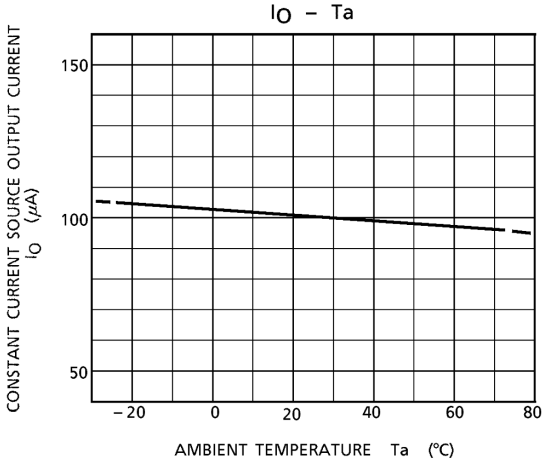

$V_{RF}$ – Ta




RR – Ta

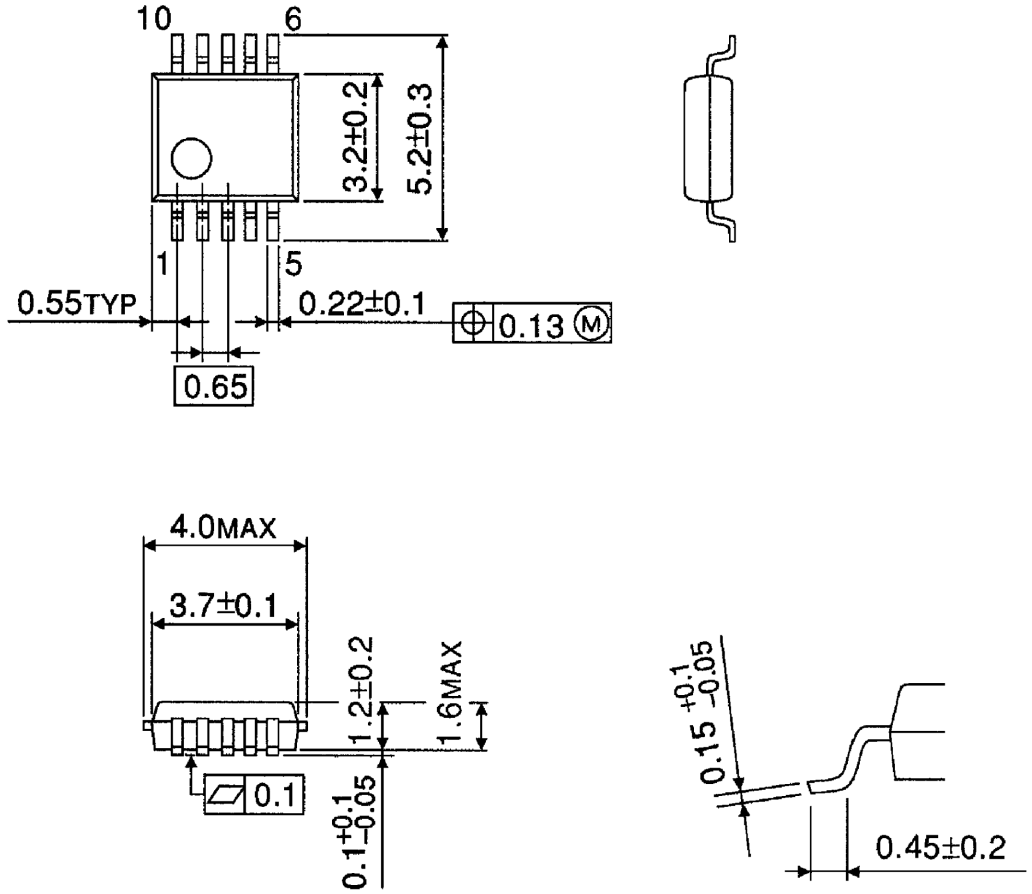



$I_O$ – Ta



## Package Dimensions

SSOP10-P-0.65 Unit : mm




Weight: 0.04g (typ.)

About solderability, following conditions were confirmed

- Solderability

  (1) Use of Sn-63Pb solder Bath
  - solder bath temperature = 230°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

  (2) Use of Sn-3.0Ag-0.5Cu solder Bath
  - solder bath temperature = 245°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

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