

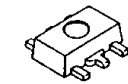
## LOW DROPOUT VOLTAGE REGULATOR WITH ON/OFF CONTROL

### ■ GENERAL DESCRIPTION

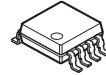
The NJM2370 is a low dropout positive voltage regulator with ON/OFF control. It has a low quiescent current, output current of 150mA and low dropout voltage of 0.1V (at  $I_O=30mA$ ). Further it can be added an external noise bypass capacitor. It can be improve the characteristics of output noise and ripple rejection by changing the capacitance value.

The NJM2370 is available in a small 5-lead SOT-89 package and thin 8-lead MSOP (VSP) and MSOP (TVSP) packages. These performances make it well-suited for battery-powered portable devices such as a mobile phone, PHS and movie camera.

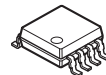
### ■ PACKAGE OUTLINE



NJM2370U1  
(SOT89-5)



NJM2370R  
(MSOP8 (VSP8))



NJM2370RB1  
(MSOP8 (TVSP8))

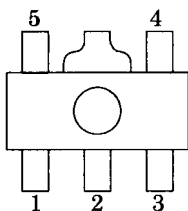
### ■ FEATURES

- Output Current (150mA min. ( $V_O=0.3V$ ))
- Low Dropout Voltage (0.1V typ. ( $I_O=30mA$ ))
- External Capacitor for Noise Bypass
- ON / OFF Control Function
- Over Current Limit
- Thermal Shutdown
- Bipolar Technology
- Package Outline

SOT-89-5, MSOP8 (VSP8)\*, MSOP8 (TVSP8)\*\*

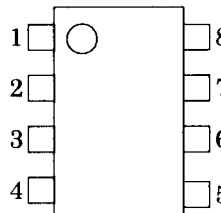
\*MEET JEDEC MO-187-DA, \*\*MEET JEDEC MO-187-DA/THIN TYPE

### ■ PIN CONFIGURATION



NJM2370U1

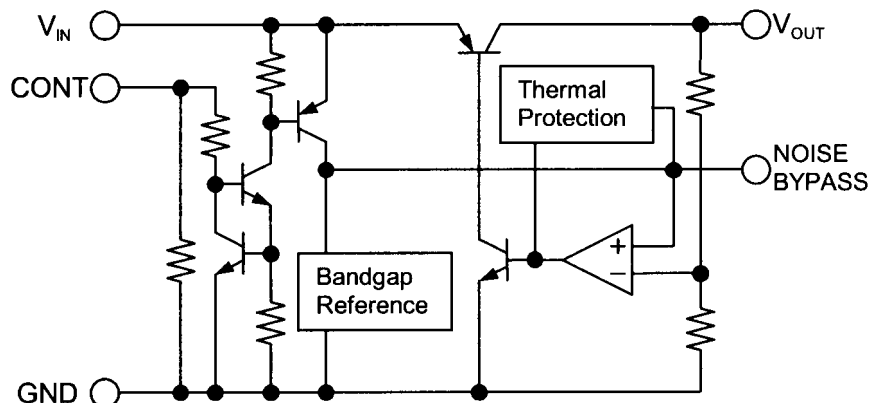
- PIN FUNCTION**
1. CONTROL
  2. GND
  3. NOISE BYPASS
  4.  $V_{OUT}$
  5.  $V_{IN}$



NJM2370R/RB1

- PIN FUNCTION**
1. CONTROL
  2. GND
  3. NC
  4. NOISE BYPASS
  5.  $V_{OUT}$
  6. NC
  7. NC
  8.  $V_{IN}$

### ■ EQUIVALENT CIRCUIT



# NJM2370

## ■ ABSOLUTE MAXIMUM RATINGS

( $T_a=25^\circ\text{C}$ )

| PARAMETER                   | SYMBOL     | RATINGS  | UNIT             |
|-----------------------------|------------|--|------------------|
| Input Voltage               | $V_{IN}$   | 20   | V                |
| Control Voltage             | $V_{CONT}$ | 20 (note 1)                                    | V                |
| Power Dissipation           | $P_D$      | (SOT-89) 350<br>MSOP8 (VSP8), MSOP8(TVSP8) 320 | mW               |
| Operating Temperature Range | $T_{opr}$  | -40 to +85                                     | $^\circ\text{C}$ |
| Storage Temperature Range   | $T_{stg}$  | -40 to +125                                    | $^\circ\text{C}$ |

(note 1) When input voltage is less than +20V, the absolute maximum control voltage is equal to the input voltage.

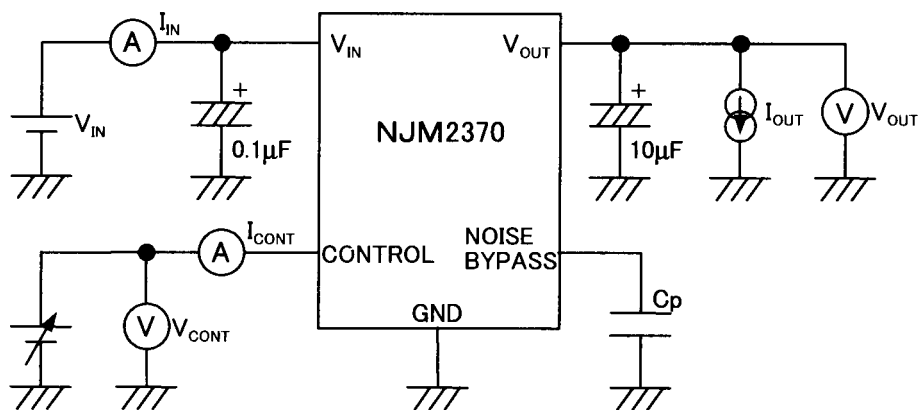
## ■ ELECTRICAL CHARACTERISTICS

( $T_a=25^\circ\text{C}$ )

| PARAMETER   | SYMBOL                       | CONDITIONS   | MIN. | TYP. | MAX. | UNIT                         |
|---|------------------------------|--|------|------|------|------------------------------|
| Output Voltage                                    | $V_O$                        | $V_{IN}=V_O+1\text{V}$ , $I_O=30\text{mA}$   | -3%  | -    | +3%  | V                            |
| Quiescent Current 1                               | $I_{Q1}$                     | $I_O=0\text{mA}$ , expect $I_{CONT}$   | -    | 180  | -    | $\mu\text{A}$                |
| Quiescent Current 2                               | $I_{Q2}$                     | CONTROL-GND short  | -    | -    | 100  | nA                           |
| Output Current                                    | $I_O$                        | ( $V_O-0.3\text{V}$ )  | 150  | 180  | -    | mA                           |
| Line Regulation                                   | $\Delta V_O / \Delta V_{IN}$ | $V_{IN}=(V_O+1\text{V})$ to ( $V_O+6\text{V}$ )<br>$V_O=2\text{V}$ to $14\text{V}$             | -    | -    | 0.12 | % / V                        |
|   |                              | $V_{IN}=(V_O+1\text{V})$ to ( $V_O+5\text{V}$ )<br>$V_O=15\text{V}$                            | -    | -    | 0.12 | % / V                        |
| Load Regulation                                   | $\Delta V_O / \Delta I_O$    | $I_O=0$ to $60\text{mA}$   | -    | -    | 0.03 | % / mA                       |
| Dropout Voltage                                   | $\Delta V_{I_O}$             | $I_O=30\text{mA}$  | -    | 0.1  | 0.3  | V                            |
| Ripple Rejection                                  | R-R                          | $f=400\text{Hz}$ , $e_{in}=100\text{mV}_{P-P}$<br>$V_{IN}=V_O+1.5\text{V}$ , $I_O=10\text{mA}$ | -    | 60   | -    | dB                           |
| Average Temperature Coefficient of Output Voltage | $\Delta V_O / \Delta T_a$    | $T_a=-20$ to $75^\circ\text{C}$ , $I_O=10\text{mA}$<br>$V_{IN}=V_O+1.5\text{V}$                | -    | 0.2  | -    | $\text{mV} / ^\circ\text{C}$ |
| Output Noise Voltage                              | $V_{NO}$                     | $10\text{Hz} < f < 80\text{kHz}$ , $I_O=10\text{mA}$ , $V_O=3\text{V}$                         | -    | 30   | -    | $\mu\text{V}_{rms}$          |

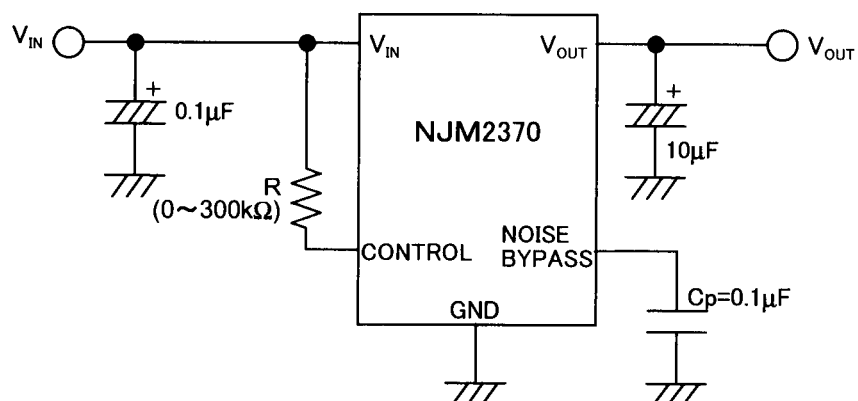
(note 2) Please confirm the specification separately because some parameters depend on output voltage.

## ■ TEST CIRCUIT



## ■ TYPICAL APPLICATION

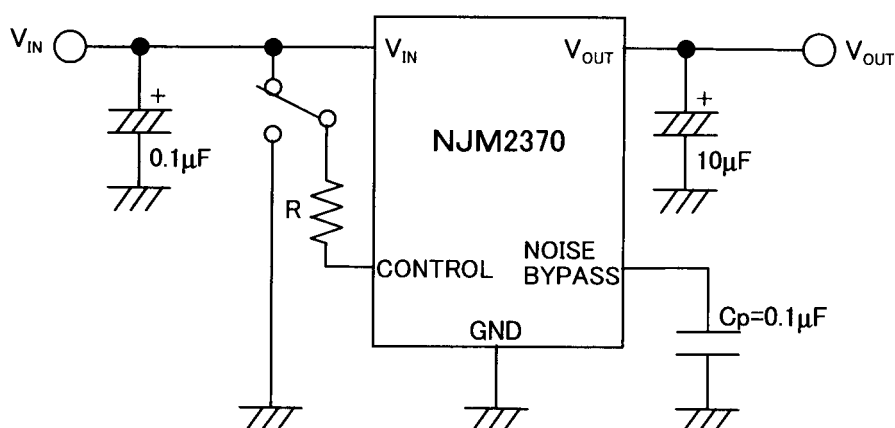
### (1) In Nonuse of ON / OFF Control



Connect control terminal (1Pin) to  $V_{IN}$  terminal (5Pin)

When a resistance "R" is connected, the quiescent current decreases, but minimum operating voltage increases. Please refer to a figure of Output Voltage vs. Control Voltage.

### (2) In Use of ON / OFF CONTROL



When the control terminal is "H", it is ON.

When the control terminal is "L" or "open", it is OFF.

#### \*Noise bypass Capacitance $C_p$

Noise bypass capacitance  $C_p$  reduces noise generated by band-gap reference circuit.

Noise level and ripple rejection will be improved when larger  $C_p$  is used. Please refer to the typical characteristics to determine the value.

Use of smaller  $C_p$  value may induce oscillation.

Please make sure to use  $C_p$  value of greater than 0.1µF to avoid the problem.

# NJM2370

## ■ OUTPUT VOLTAGE RANK LIST

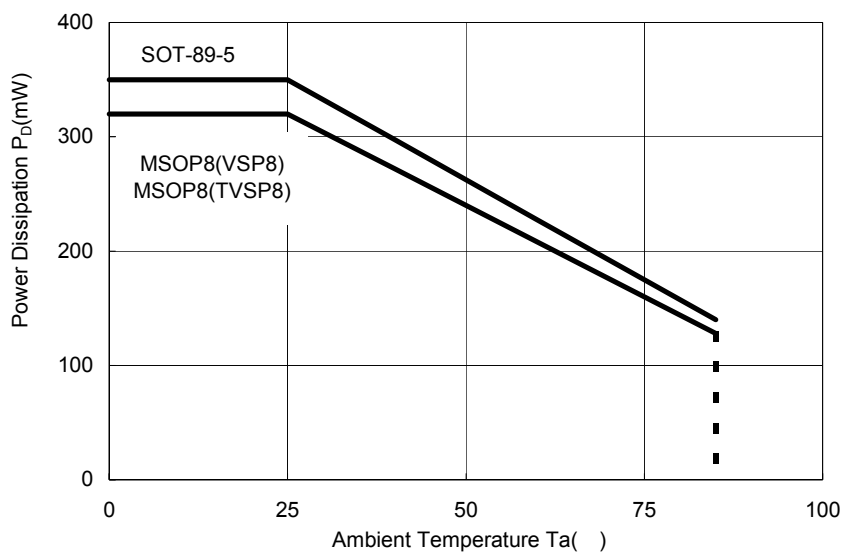
| Past Number        | Output Voltage |      | Past Number        | Output Voltage |      | Past Number        | Output Voltage |      |
|--------------------|----------------|------|--------------------|----------------|------|--------------------|----------------|------|
| NJM2370U1/R/RB1-02 | 2.0V           |      | NJM2370U1/R/RB1-31 | 3.1V           |      | NJM2370U1/R/RB1-08 | 8.0V           | (*1) |
| NJM2370U1/R/RB1-21 | 2.1V           | (*1) | NJM2370U1/R/RB1-32 | 3.2V           | (*1) | NJM2370U1/R/RB1-85 | 8.5V           |      |
| NJM2370U1/R/RB1-22 | 2.2V           | (*1) | NJM2370U1/R/RB1-33 | 3.3V           |      | NJM2370U1/R/RB1-09 | 9.0V           |      |
| NJM2370U1/R/RB1-23 | 2.3V           | (*1) | NJM2370U1/R/RB1-35 | 3.5V           |      | NJM2370U1/R/RB1-10 | 10.0V          |      |
| NJM2370U1/R/RB1-24 | 2.4V           | (*1) | NJM2370U1/R/RB1-36 | 3.6V           | (*1) | NJM2370U1/R/RB1-12 | 12.0V          |      |
| NJM2370U1/R/RB1-25 | 2.5V           |      | NJM2370U1/R/RB1-37 | 3.7V           | (*1) | NJM2370U1/R/RB1-13 | 13.0V          | (*2) |
| NJM2370U1/R/RB1-26 | 2.6V           | (*1) | NJM2370U1/R/RB1-38 | 3.8V           | (*1) | NJM2370U1/R/RB1-D3 | 13.5V          |      |
| NJM2370U1/R/RB1-27 | 2.7V           |      | NJM2370U1/R/RB1-39 | 3.9V           | (*1) | NJM2370U1/R/RB1-15 | 15.0V          |      |
| NJM2370U1/R/RB1-28 | 2.8V           | (*1) | NJM2370U1/R/RB1-04 | 4.0V           |      | NJM2370U1/R/RB1-F5 | 15.5V          |      |
| NJM2370U1/R/RB1-29 | 2.9V           | (*1) | NJM2370U1/R/RB1-05 | 5.0V           |      |                    |                |      |
| NJM2370U1/R/RB1-03 | 3.0V           |      | NJM2370U1/R/RB1-06 | 6.0V           |      |                    |                |      |

(\*1) : MSOP8(VSP8), MSOP8(TVSP8) ONLY

(\*2) : SOT-89-5 (5pin) ONLY

## ■ POWER DISSIPATION VS. AMBIENT TEMPERATURE

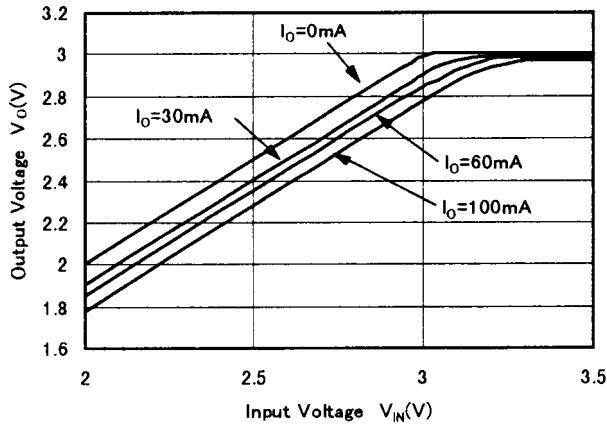
NJM2370 Power Dissipation  
( $T_{opr} = -40 \sim +85$ ,  $T_j = 125$ )



## ■ TYPICAL CHARACTERISTICS

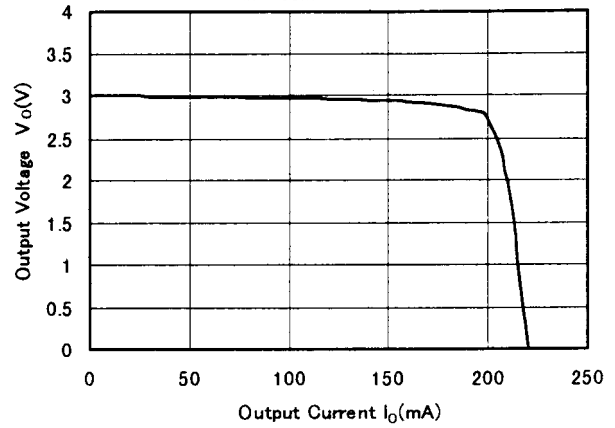
### NJM2370 3V Version Dropout Voltage

( $V_{IN}=V_{CONT}$ ,  $T_a=25^\circ\text{C}$ )



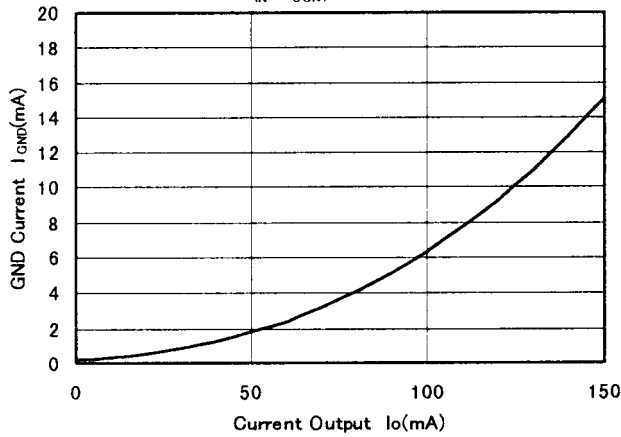
### NJM2370 3V Version Load Regulation

( $V_{IN}=V_{CONT}=4\text{V}$ ,  $T_a=25^\circ\text{C}$ )



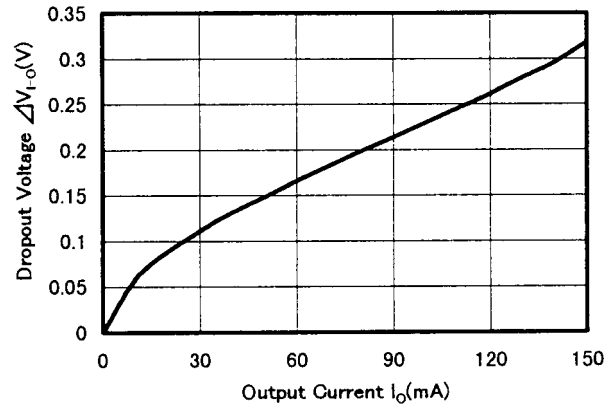
### NJM2370 3V Version GND Current vs. Output Current

( $V_{IN}=V_{CONT}=4\text{V}$ ,  $T_a=25^\circ\text{C}$ )



### NJM2370 3V Version Dropout Voltage

( $T_a=25^\circ\text{C}$ )

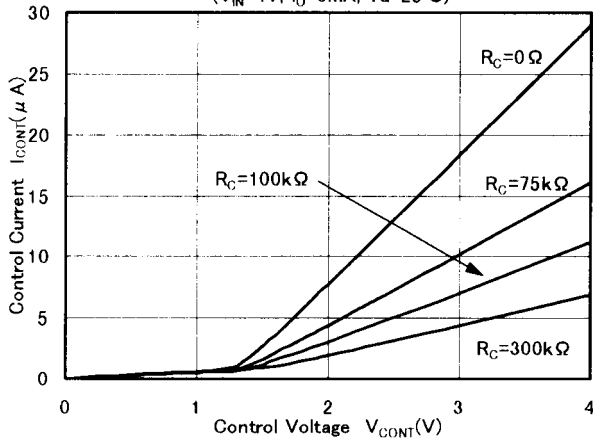


# NJM2370

## ■ TYPICAL CHARACTERISTICS

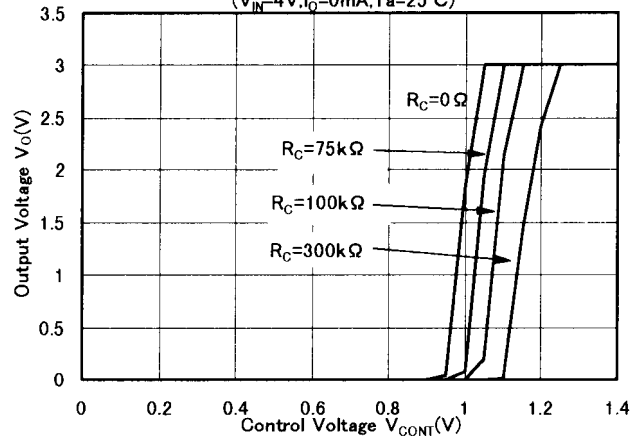
**NJM2370 3V Version Control Current vs. Control Voltage**

( $V_{IN}=4V, I_O=0mA, T_a=25^\circ C$ )



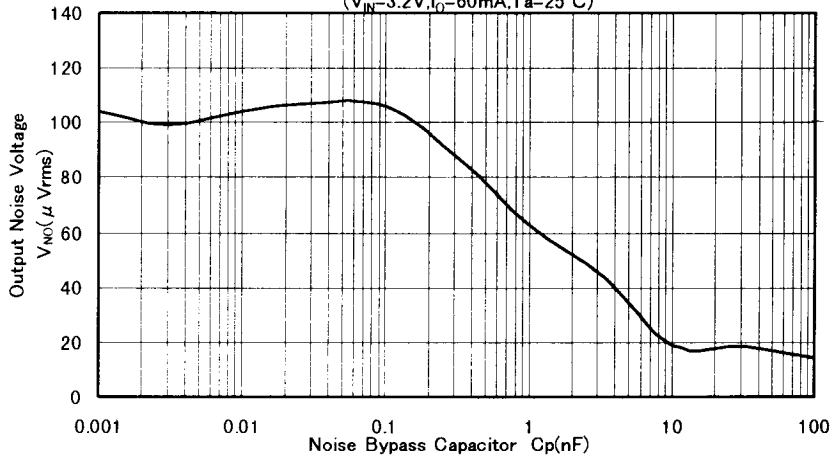
**NJM2370 3V Version Output Voltage vs. Control Voltage**

( $V_{IN}=4V, I_O=0mA, T_a=25^\circ C$ )



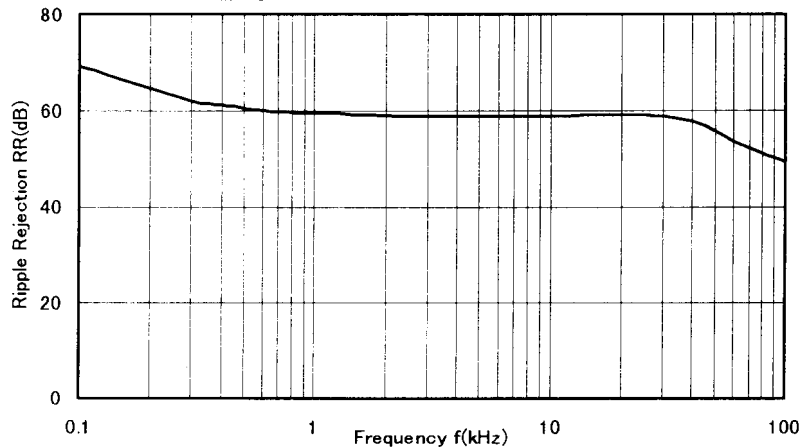
**NJM2370 3V Version Output Noise Voltage vs. Noise Bypass Capacitor**

( $V_{IN}=3.2V, I_O=60mA, T_a=25^\circ C$ )



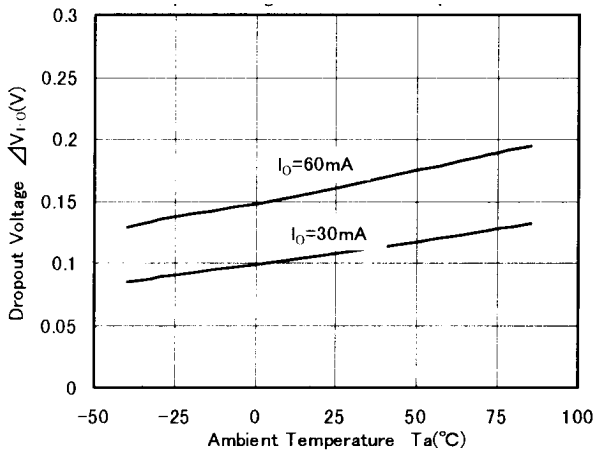
**NJM2370 3V Version Ripple Rejection vs. Frequency**

( $V_{IN}=V_O+1.5V, e_{in}=100mV_{rms}, I_O=10mA, T_a=25^\circ C$ )



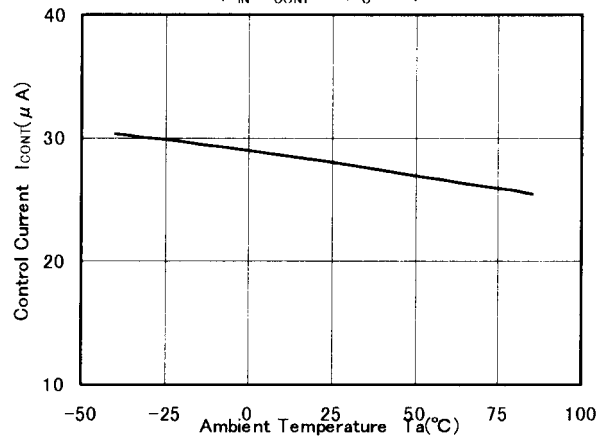
## ■ TYPICAL CHARACTERISTICS

### Dropout Voltage vs. Ambient Temperature



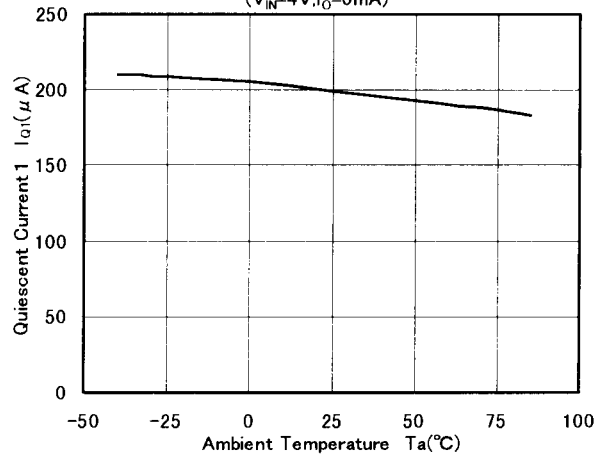
### NJM2370 3V Version Control Current vs. Ambient Temperature

( $V_{IN} = V_{CONT} = 4\text{V}, R_C = 0\Omega$ )



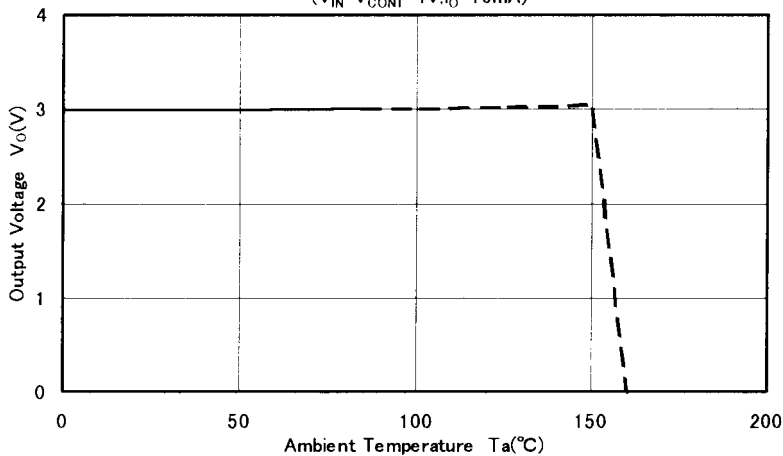
### NJM2370 3V Version Quiescent Current 1 vs. Ambient Temperature

( $V_{IN} = 4\text{V}, I_0 = 0\text{mA}$ )



### Thermal Shutdown

( $V_{IN} = V_{CONT} = 4\text{V}, I_0 = 10\text{mA}$ )



**[CAUTION]**

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