

## LOW DROPOUT VOLTAGE REGULATOR WITH ON/OFF CONTROL

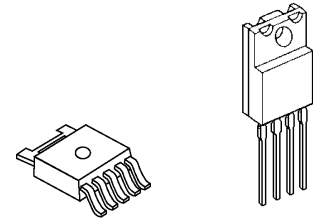
### ■ GENERAL DESCRIPTION

The NJM2386/88 is a general purpose low dropout voltage regulators with ON/OFF control.

The output current is up to 1.0A and dropout voltage is 0.2V typical at 500mA load.

It features high maximum input voltage of 35V for a wide application range including TV, home appliances and power modules.

### ■ PACKAGE OUTLINE



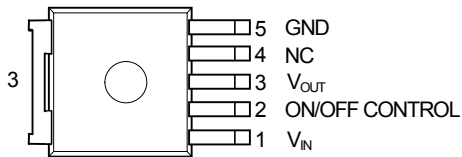
NJM2386DL3

NJM2388F

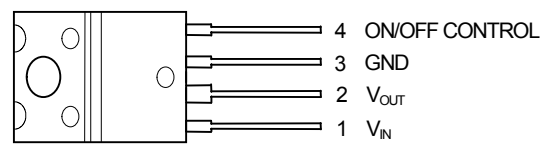
### ■ FEATURES

- High Maximum Input Voltage Up to 35V
- Low Dropout Voltage 0.2V typ. at  $I_o=0.5A$
- Output Current  $I_o(max.)=1.0A$
- ON/OFF Control (Active High)
- Internal Short Circuit Current Limit
- Internal Overvoltage Protection
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline TO-252-5(NJM2386), TO-220F-4(NJM2388)

### ■ PIN CONFIGURATION

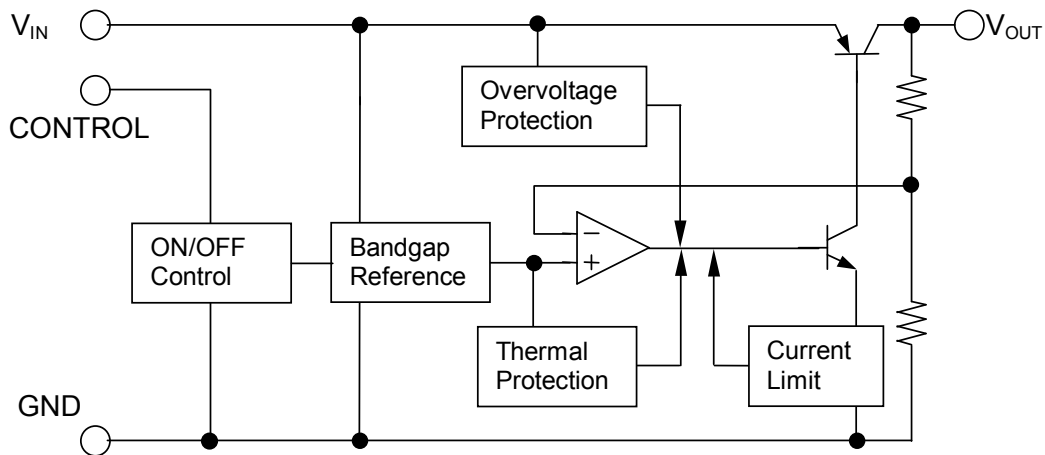


NJM2386DL3



NJM2388F

### ■ BLOCK DIAGRAM



# NJM2386/88

## ■ OUTPUT VOLTAGE RANK LIST

NJM2386DL3

NJM2388F

| Device Name   | V <sub>OUT</sub> | Device Name | V <sub>OUT</sub> |
|---------------|------------------|-------------|------------------|
| NJM2386DL3-33 | 3.3V             | NJM2388F33  | 3.3V             |
| NJM2386DL3-05 | 5.0V             | NJM2388F05  | 5.0V             |
| NJM2386DL3-63 | 6.3V             | NJM2388F63  | 6.3V             |
| NJM2386DL3-08 | 8.0V             | NJM2388F08  | 8.0V             |
| NJM2386DL3-09 | 9.0V             | NJM2388F84  | 8.4V             |
| NJM2386DL3-12 | 12.0V            | NJM2388F09  | 9.0V             |
|               |                  | NJM2388F10  | 10.0V            |
|               |                  | NJM2388F12  | 12.0V            |

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

| PARAMETER                            | SYMBOL            | RATINGS    |                     | UNIT |
|--------------------------------------|-------------------|------------|---------------------|------|
| Input Voltage                        | V <sub>IN</sub>   | +35        |                     | V    |
| Control Voltage                      | V <sub>CONT</sub> | +35(*1)    |                     | V    |
| Power Dissipation                    | P <sub>D</sub>    | NJM2386    | 1190(*2) / 3125(*3) | mW   |
|                                      |                   | NJM2388    | 18(Tc<50°C)         | W    |
| Operating Junction Temperature Range | T <sub>j</sub>    | -40 ~ +150 |                     | °C   |
| Operating Temperature Range          | T <sub>opr</sub>  | -40 ~ +85  |                     | °C   |
| Storage Temperature Range            | T <sub>stg</sub>  | -50 ~ +150 |                     | °C   |

(\*1): When input voltage is less than +35V, the absolute maximum control voltage is equal to the input voltage.

(\*2): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard size, 2Layers, Cu area 100mm<sup>2</sup>)

(\*3): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard, 4Layers)

(For 4Layers: Applying 74.2 × 74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

■ ELECTRICAL CHARACTERISTICS ( $V_{IN}=V_O+1V$ ,  $I_o=0.5A$ ,  $C_{IN}=0.33\mu F$ ,  $C_o=22\mu F$ ,  $T_a=25^\circ C$ )

Measurement is to be conducted is pulse testing.

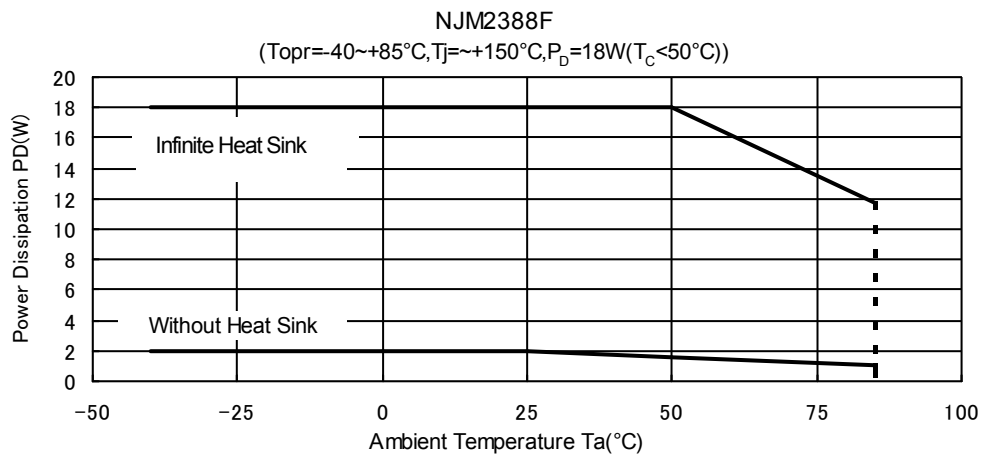
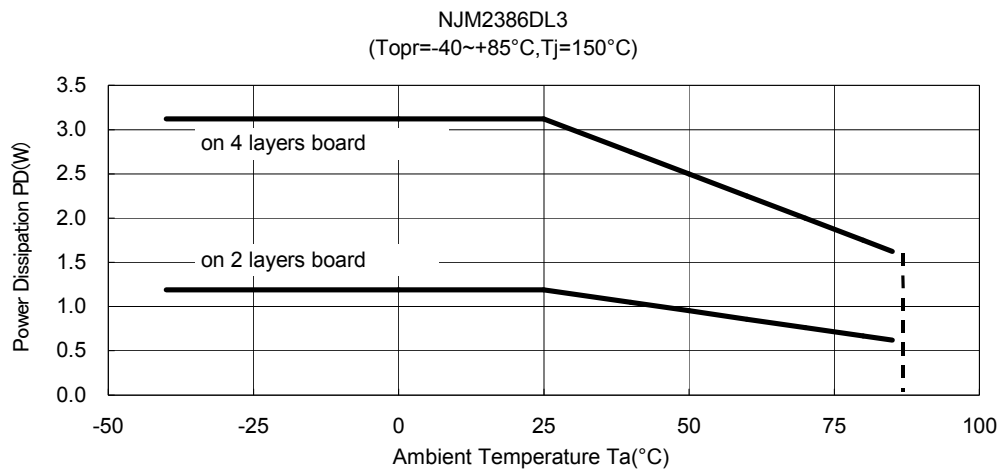
| PARAMETER   | SYMBOL                     | CONDITIONS                        | MIN.   | TYP.       | MAX. | UNIT    |    |
|---|----------------------------|-----------------------------------|--|------------|------|---------|----|
| Output Voltage                                    | $V_o$                      | $V_{IN}=V_O+1V$                   | -2%  | -          | +2%  | V       |    |
| Line Regulation                                   | $\Delta V_o/\Delta V_{IN}$ | $V_{IN}=V_O+1V \sim V_O+17V$      | -  | 0.04       | 0.16 | %/V     |    |
| Load Regulation                                   | $\Delta V_o/\Delta I_o$    | $V_{IN}=V_O+2V, I_o=0A \sim 1.0A$ | -  | 0.2        | 1.4  | %/A     |    |
| Average Temperature Coefficient of Output Voltage | $\Delta V_o/\Delta T$      | $T_j=0 \sim +125^\circ C$         | -  | $\pm 0.02$ | -    | %/°C    |    |
| Quiescent Current                                 | $I_Q$                      | $I_o=0A$                          | -  | -          | 5    | mA      |    |
| Quiescent Current at Control OFF(*4)              | $I_{Q(OFF)}$               | $V_{CONT}=0V$                     | -  | -          | 500  | $\mu A$ |    |
| Dropout Voltage                                   | $\Delta V_{LO}$            | $I_o=0.5A$                        | -  | 0.2        | 0.5  | V       |    |
| Ripple Rejection                                  | NJM238**33                 | RR                                | $V_{IN}=V_O+2V,$<br>$e_{in}=0.5V_{rms}, f=120Hz$ | 54         | 67   | -       | dB |
|   | NJM238**05                 |                                   |  | 54         | 67   | -       |    |
|   | NJM238**63                 |                                   |  | 54         | 67   | -       |    |
|   | NJM238**08                 |                                   |  | 52         | 65   | -       |    |
|   | NJM238**84                 |                                   |  | 52         | 65   | -       |    |
|   | NJM238**09                 |                                   |  | 52         | 65   | -       |    |
|   | NJM238**10                 |                                   |  | 50         | 63   | -       |    |
|   | NJM238**12                 |                                   |  | 50         | 63   | -       |    |
| ON Control Voltage                                | $V_{CONT(ON)}$             |                                   | 2.0(*5)  | -          | -    | V       |    |
| OFF Control Voltage                               | $V_{CONT(OFF)}$            |                                   | -  | -          | 0.4  | V       |    |
| ON Control Current                                | $I_{CONT(ON)}$             | $V_C=2.7V$                        | -  | -          | 20   | $\mu A$ |    |
| OFF Control Current                               | $I_{CONT(OFF)}$            | $V_C=0.4V$                        | -  | -          | -20  | $\mu A$ |    |

(\*4) This electrical characteristics is applied to NJM2388.

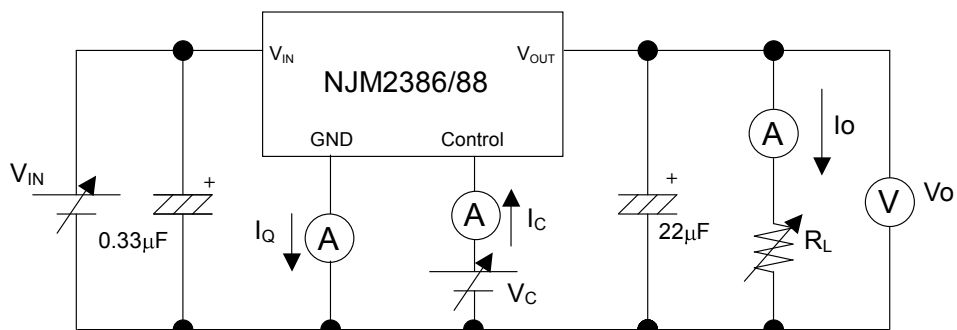
(\*5): When ON/OFF CONTROL Terminal is open, Output Voltage is ON.

# NJM2386/88

## POWER DISSIPATION vs. AMBIENT TEMPERATURE

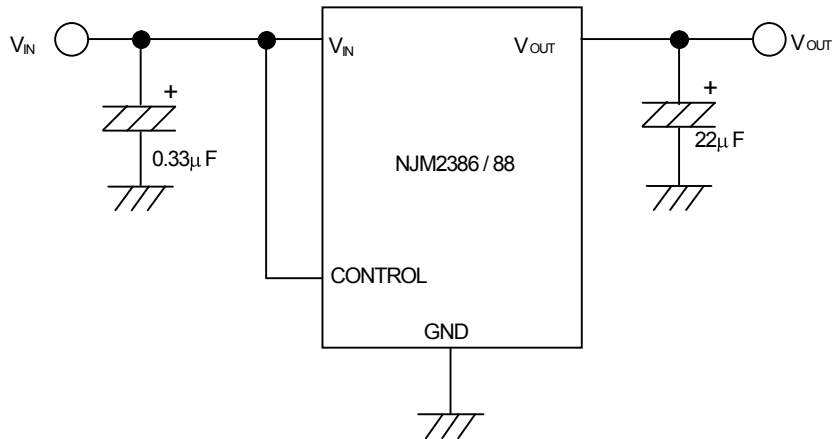


## TEST CIRCUIT



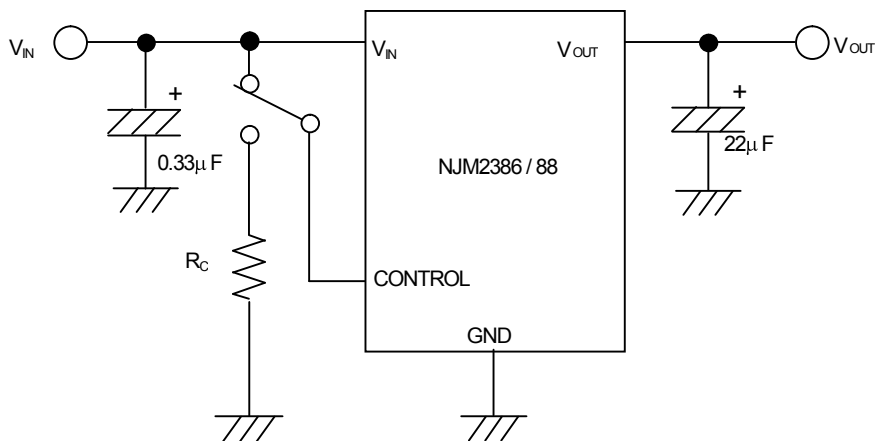
## ■ TYPICAL APPLICATION

① In the case where ON/OFF Control is not required:



Connect control pin to  $V_{IN}$  pin or open.

② In use of ON/OFF CONTROL:



State of control pin:

- “H” or “open” → output is enabled.
- “L” → output is disabled.

## \*Input Capacitor $C_{IN}$

Input Capacitor  $C_{IN}$  is required to prevent oscillation and reduce power supply ripple for applications when high power supply impedance or a long power supply line.

Therefore, use the recommended  $C_{IN}$  value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between GND and  $V_{IN}$  as shortest path as possible to avoid the problem.

## \*Output Capacitor $C_O$

Output capacitor ( $C_O$ ) will be required for a phase compensation of the internal error amplifier.

The capacitance and the equivalent series resistance (ESR) influence to stable operation of the regulator.

Use of a smaller  $C_O$  may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.

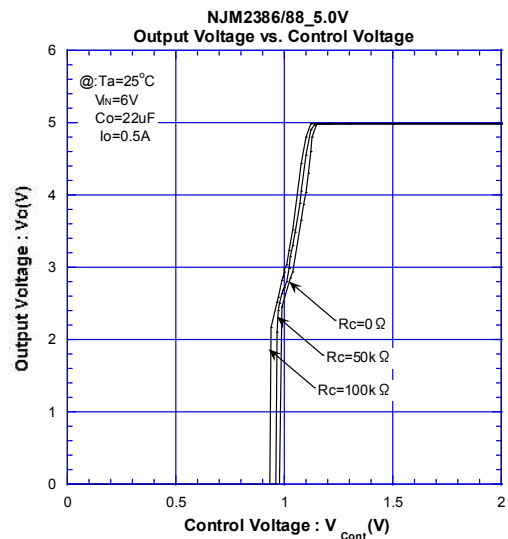
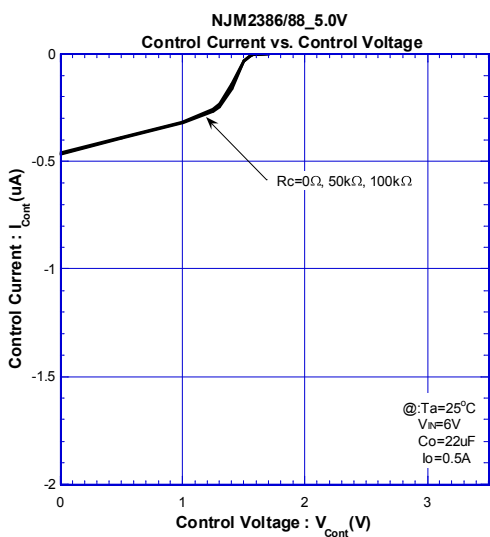
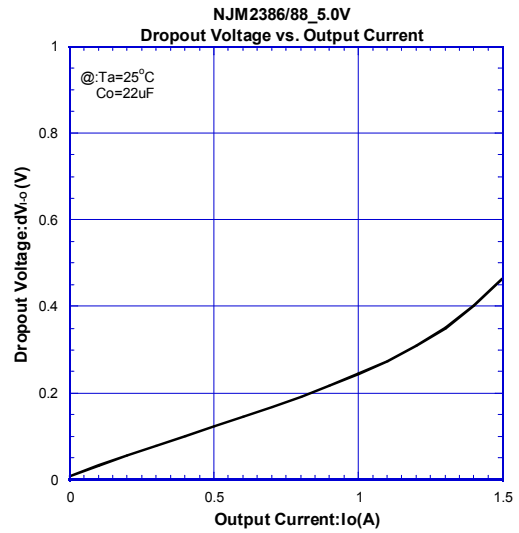
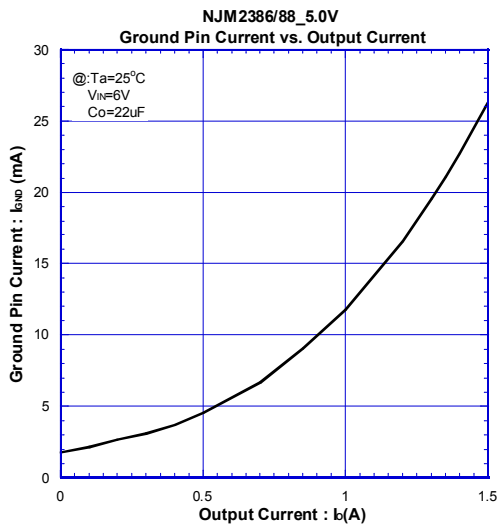
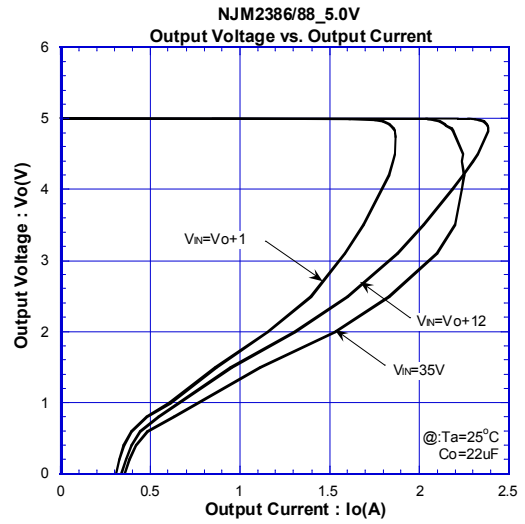
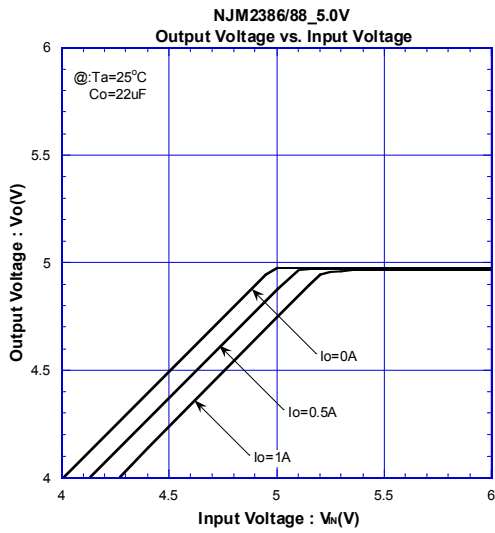
On the other hand, Use of a larger  $C_O$  reduces output noise and ripple output, and also improves output transient response when rapid load change.

Therefore, use the recommended  $C_O$  value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between GND and  $V_{OUT}$  as shortest path as possible for stable operation

The recommended capacitance depends on the output voltage rank. Especially, low voltage regulator requires larger  $C_O$  value.

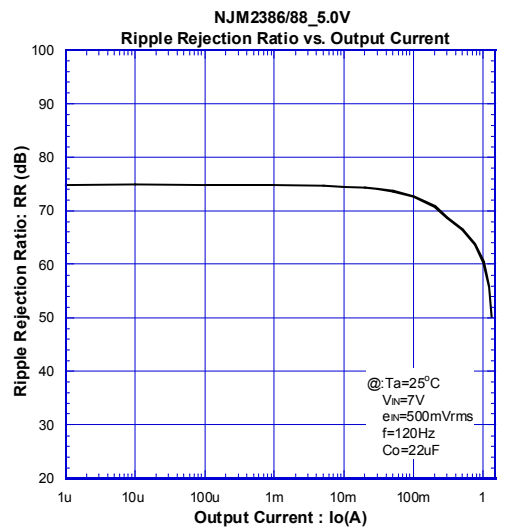
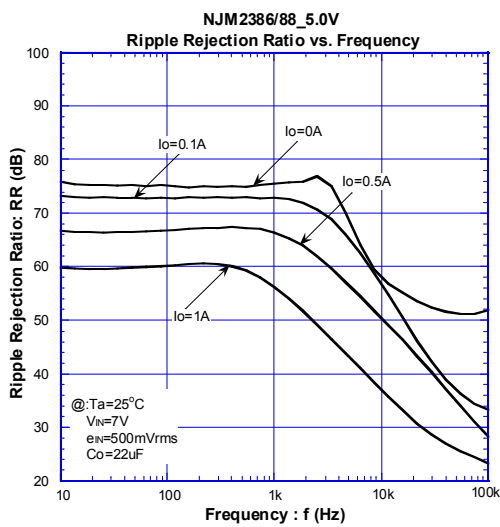
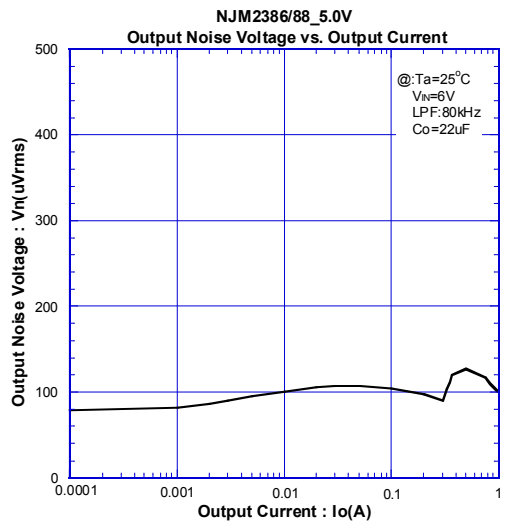
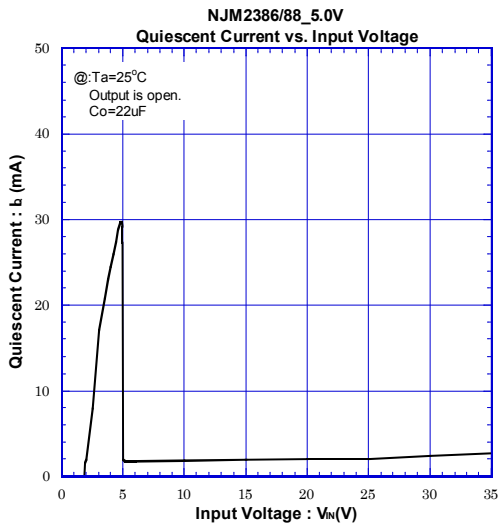
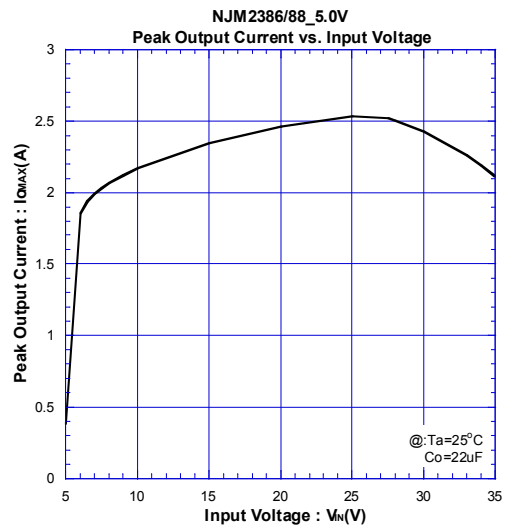
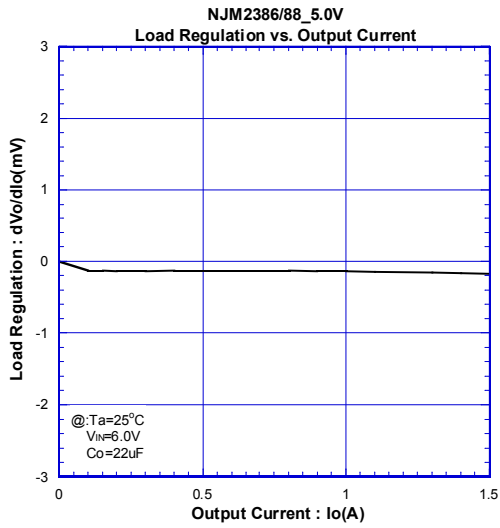
In addition, Please choose an appropriate capacitor in considering varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, and so on) when selecting  $C_O$ .

## TYPICAL CHARACTERISTICS



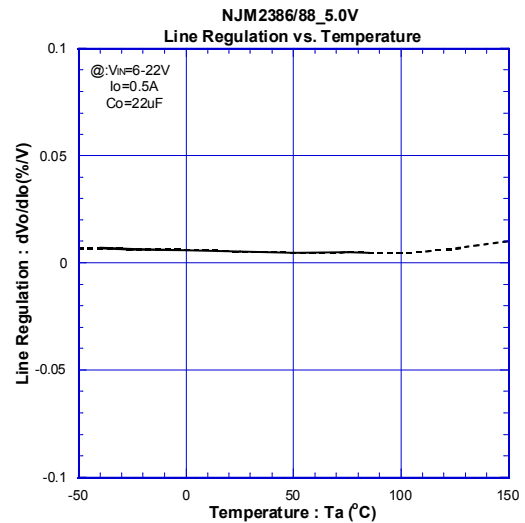
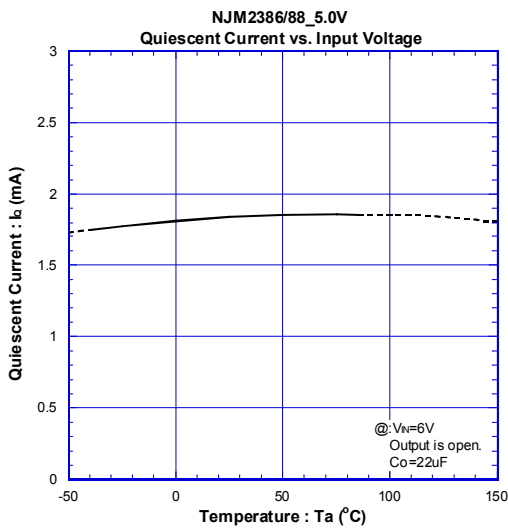
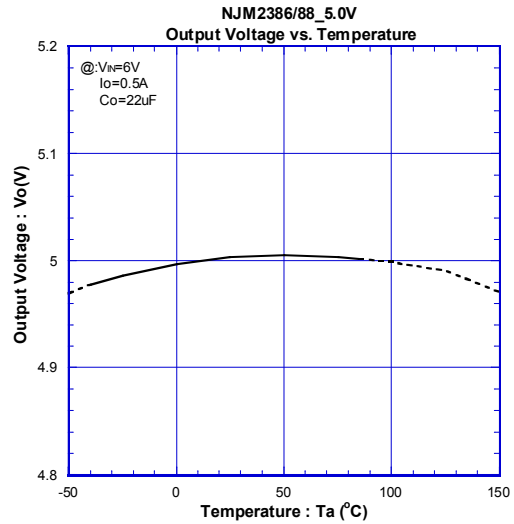
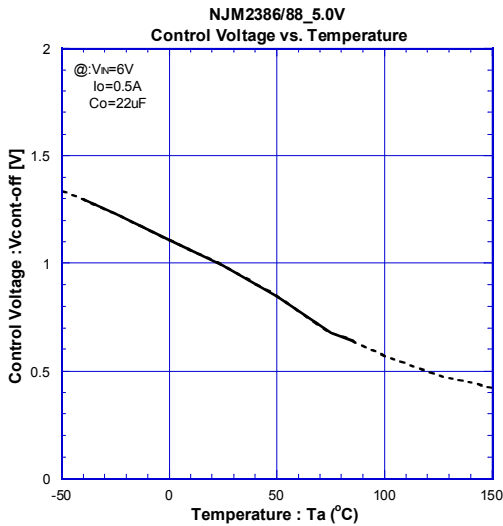
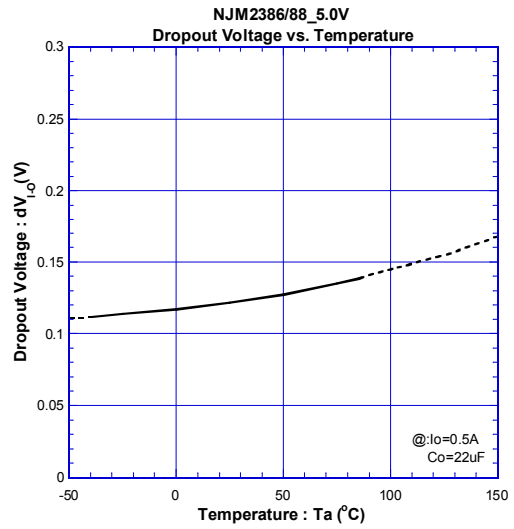
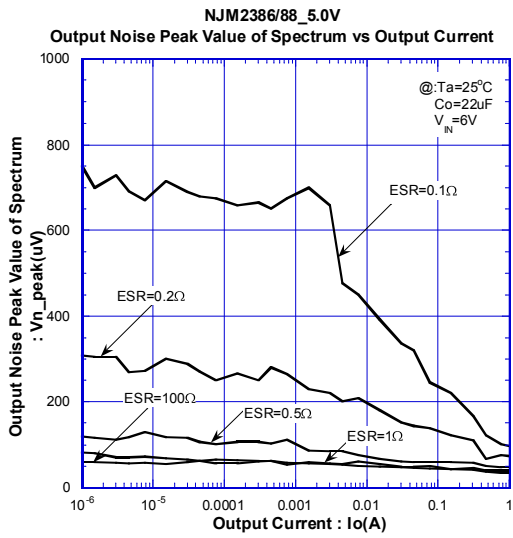
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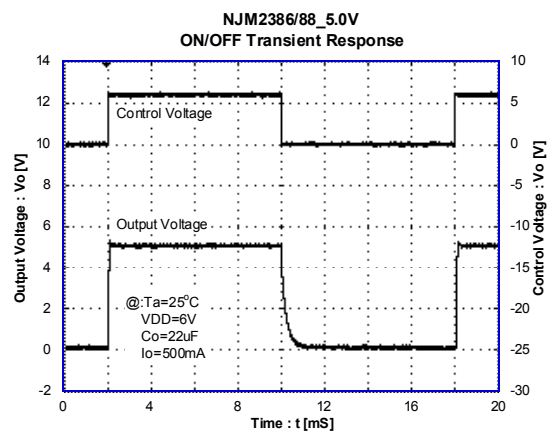
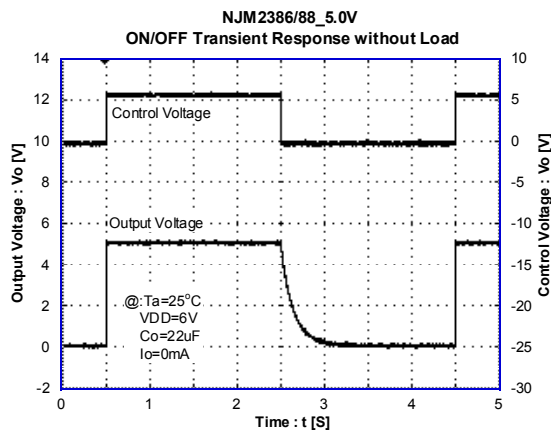
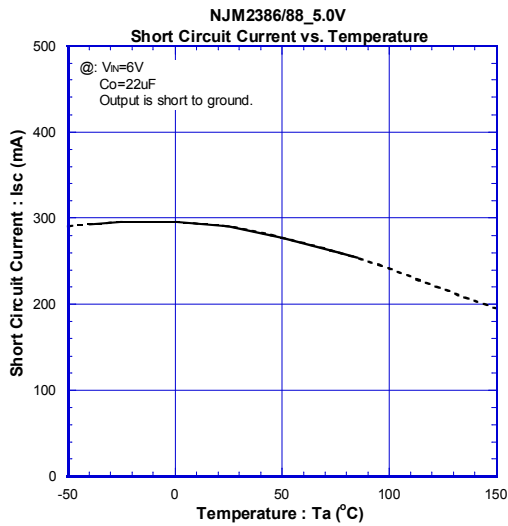
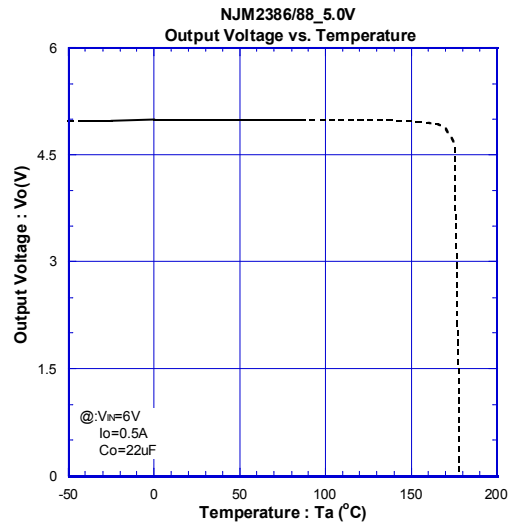
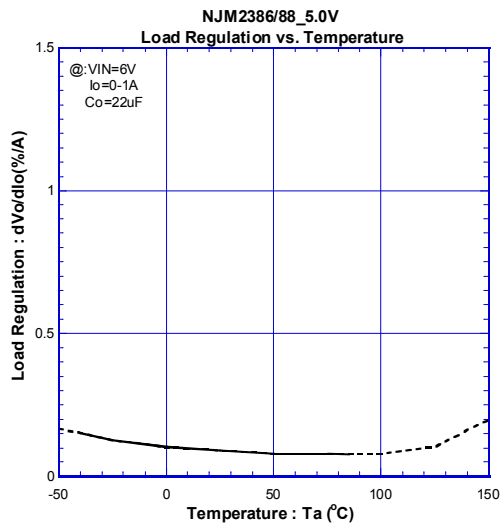


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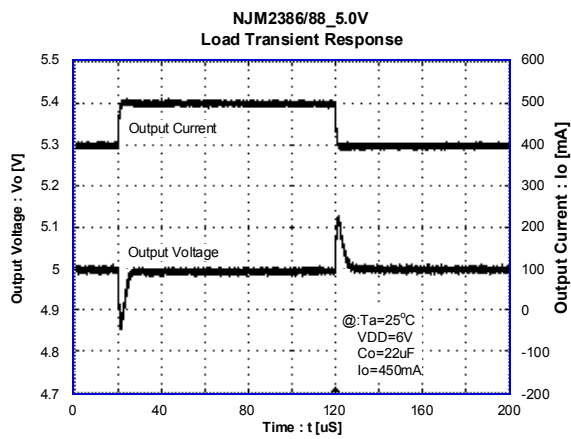
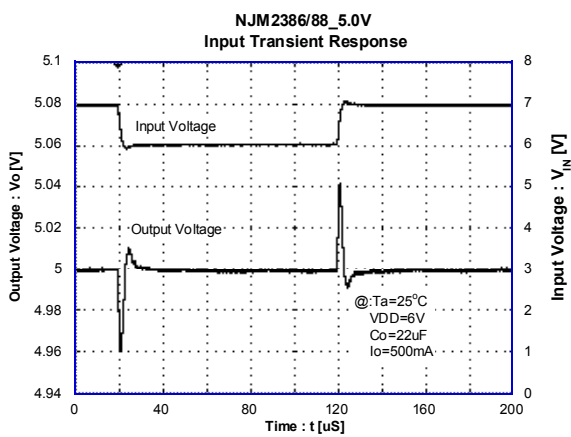


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## TYPICAL CHARACTERISTICS



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