# LOW DROPOUT VOLTAGE REGULATOR

## ■ GENERAL DESCRIPTION

The NJM2835 is a 500mA output low dropout voltage regulator.

Advanced Bipolar technology achieves low noise, high ripple rejection and high supply voltage.

2.1V to 15.5V output voltage range, 2.2μF small decoupling capacitor, built-in noise bypass capacitor make the NJM2835 suitable for various applications.

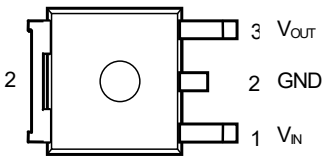
## ■ PACKAGE OUTLINE

NJM2835DL1

## ■ FEATURES

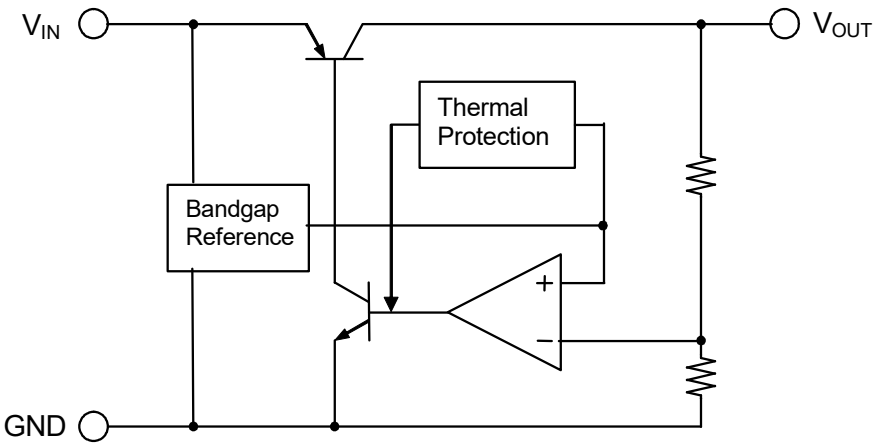
- Output voltage options available 2.1 ~ 15.5V
- High Ripple Rejection 75dB typ. (f=1kHz,Vo=3V Version)
- Output Noise Voltage Vno=45μVrms typ.
- Output capacitor with 2.2μF ceramic capacitor (Vo≥5.1V)
- Output Current Io(max.)=500mA
- High Precision Output Vo±1.0%
- Low Dropout Voltage 0.18V typ. (Io=300mA)
- Internal Thermal Overload Protection
- Internal Over Current Protection
- Bipolar Technology
- Package Outline TO-252-3

## ■ PIN CONFIGURATION




NJM2835DL1

## ■ BLOCK DIAGRAM



■ OUTPUT VOLTAGE RANK LIST

The WHITE column shows applicable Voltage Rank(s)

| Device Name | Vout | Device Name | Vout | Device Name | Vout |
|---|---|---|---|---|---|
| NJM2835DL1-21 | 2.1V | NJM2835DL1-36 | 3.6V | NJM2835DL1-08 | 8.0V |
| NJM2835DL1-22 | 2.2V | NJM2835DL1-37 | 3.7V | NJM2835DL1-85 | 8.5V |
| NJM2835DL1-23 | 2.3V | NJM2835DL1-38 | 3.8V | NJM2835DL1-09 | 9.0V |
| NJM2835DL1-24 | 2.4V | NJM2835DL1-39 | 3.9V | NJM2835DL1-10 | 10.0V |
| NJM2835DL1-25 | 2.5V | NJM2835DL1-04 | 4.0V | NJM2835DL1-12 | 12.0V |
| NJM2835DL1-26 | 2.6V | NJM2835DL1-41 | 4.1V | NJM2835DL1-15 | 15.0V |
| NJM2835DL1-27 | 2.7V | NJM2835DL1-42 | 4.2V | | |
| NJM2835DL1-28 | 2.8V | NJM2835DL1-43 | 4.3V | | |
| NJM2835DL1-29 | 2.9V | NJM2835DL1-44 | 4.4V | | |
| NJM2835DL1-03 | 3.0V | NJM2835DL1-45 | 4.5V | | |
| NJM2835DL1-31 | 3.1V | NJM2835DL1-46 | 4.6V | | |
| NJM2835DL1-32 | 3.2V | NJM2835DL1-47 | 4.7V | | |
| NJM2835DL1-33 | 3.3V | NJM2835DL1-48 | 4.8V | | |
| NJM2835DL1-34 | 3.4V | NJM2835DL1-49 | 4.9V | | |
| NJM2835DL1-35 | 3.5V | NJM2835DL1-05 | 5.0V | | |

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | +20 | V |
| Power Dissipation | $P_D$ | 1190(*1)<br>3125(*2) | mW |
| Operating Temperature | Topr | -40 ~ +85 | °C |
| Storage Temperature | Tstg | -40 ~ +150 | °C |

(*1): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard size, 2Layers, Cu area 100mm$^2$)

(*2): 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

$V_{IN=}$ Vo+1V, $C_{IN}$=0.33μF, Co=2.2μF (2.9V<Vo≤5V:Co=4.7μF,Vo≤2.9V:Co=10μF),Ta=25°C

| PARAMETER | SYMBOL | TEST CONDITION | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Output Voltage | Vo | Io=30mA | | -1.0% | - | +1.0% | V |
| Quiescent Current | $I_Q$ | Io=0mA | Vo≤5V Version | - | 200 | 300 | μA |
| | | | 5V<Vo≤10V Version | - | 215 | 315 | μA |
| | | | 10V<Vo≤15V Version | - | 230 | 330 | μA |
| Output Current | Io | Vo-0.3V | | 500 | 650 | - | mA |
| Line Regulation | $\Delta Vo/\Delta V_{IN}$ | $V_{IN}$=Vo+1V ~ Vo+6V(Vo≤12V),<br>$V_{IN}$=Vo+1V ~ 18V(Vo>12V),<br>Io=30mA | | - | - | 0.10 | %/V |
| Load Regulation | $\Delta Vo/\Delta Io$ | Io=0 ~ 500mA | | - | - | 0.007 | %/mA |
| Dropout Voltage(*3) | $\Delta V_{I-O}$ | Io=300mA | | - | 0.18 | 0.28 | V |
| Ripple Rejection | RR | ein=200mVrms,f=1kHz,Io=10mA<br>Vo=3V Version | | - | 75 | - | dB |
| Average Temperature Coefficient of Output Voltage | $\Delta Vo/\Delta Ta$ | Ta=0 ~ 85°C, Io=10mA | | - | ±50 | - | ppm/°C |
| Output Noise Voltage | $V_{NO}$ | f=10Hz ~ 80kHz, Io=10mA,<br>Vo=3V Version | | - | 45 | - | μVrms |
| Input Voltage | $V_{IN}$ | | | - | - | 18 | V |

(*3): The above specification is a common specification for all output voltages.
Therefore, it may be different from the individual specification for a specific output voltage.

■ THERMAL CHARACTERISTICS

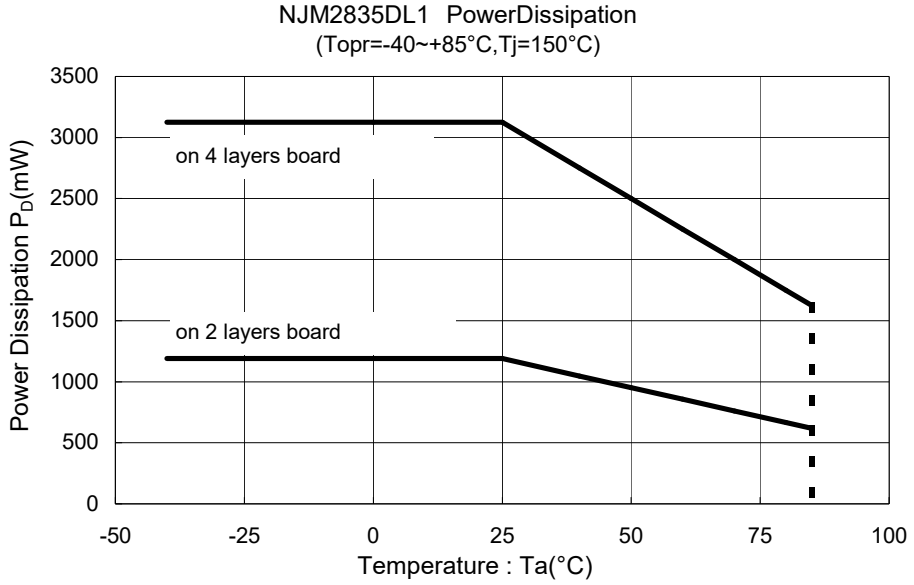
| PARAMETER | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Junction-to-Ambient thermal resistance | θja | 105 (*4)<br>40 (*5) | °C/W |
| Junction-to-Top of package characterization parameter | ψjt | 17 (*4)<br>12 (*5) | °C/W |

(*4): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard size, 2Layers, Cu area 100mm$^2$)

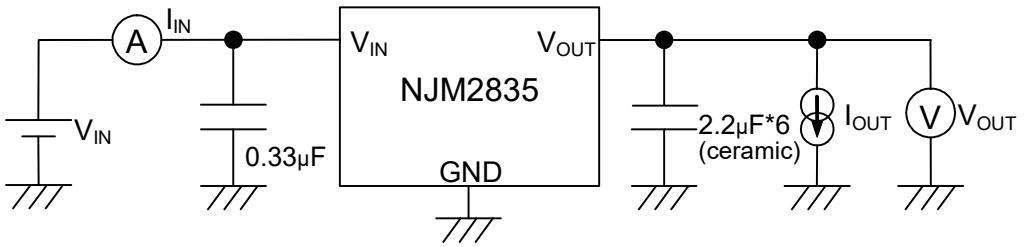
(*5): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard, 4Layers)

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

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



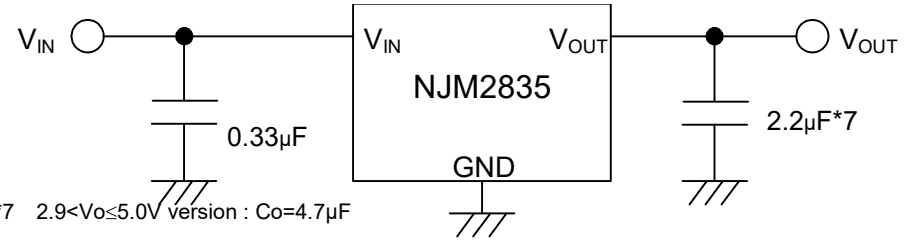
■ TEST CIRCUIT




*6 2.9<Vo≤5.0V version : Co=4.7μF(ceramic)

Vo≤2.9V version : Co=10μF(ceramic)

■ TYPICAL APPLICATION




*7 2.9<Vo≤5.0V version : Co=4.7μF

Vo≤2.9V version : Co=10μF

*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 $C_O$

The 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 an output noise or an oscillation of the regulator due to lack of the phase compensation.

On the other hand, use of a larger $C_O$ reduces an output noise and a ripple output, and also improves an output transient response when load rapidly changes.

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, a low voltage regulator requires larger $C_O$ value.

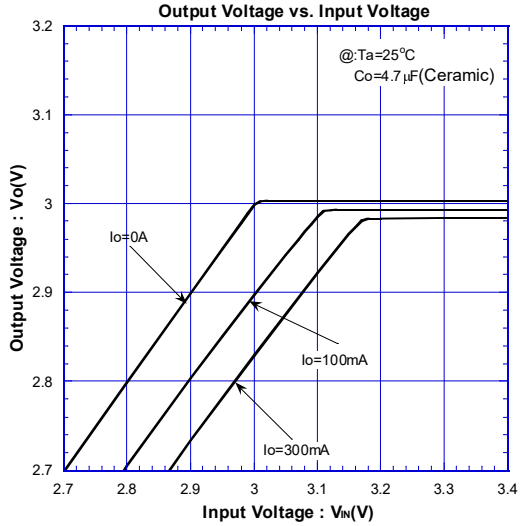
In addition, you should consider varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, a DC bias characteristic and so on) and unevenness peculiar to a capacitor supplier enough.

When selecting $C_O$, recommend that have withstand voltage margin against an output voltage and superior temperature characteristic.

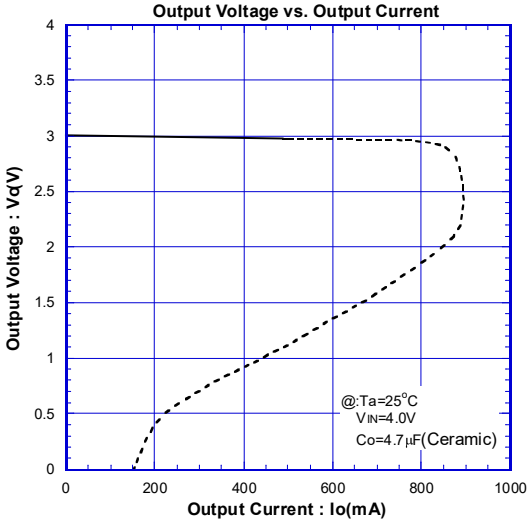
## ■ TYPICAL CHARACTERISTICS

### ●DC CHARACTERISTICS (3V Version)

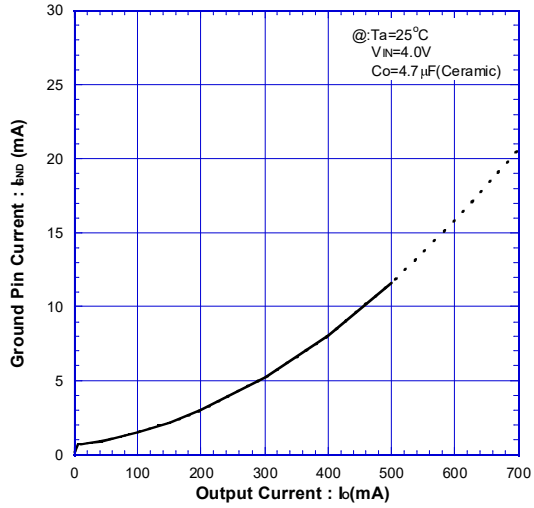
NJM2835_3.0V
Output Voltage vs. Input Voltage



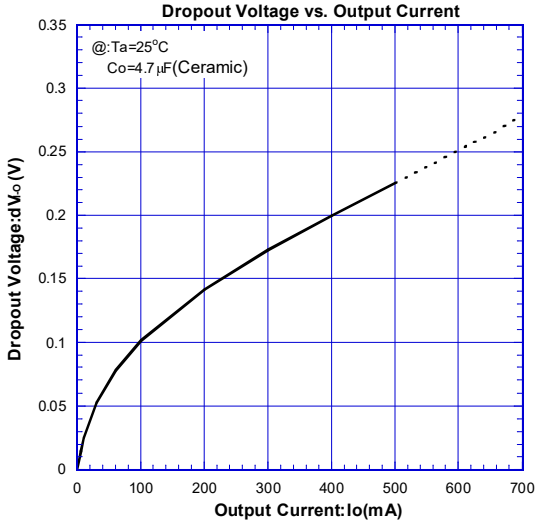

NJM2835_3.0V
Output Voltage vs. Output Current



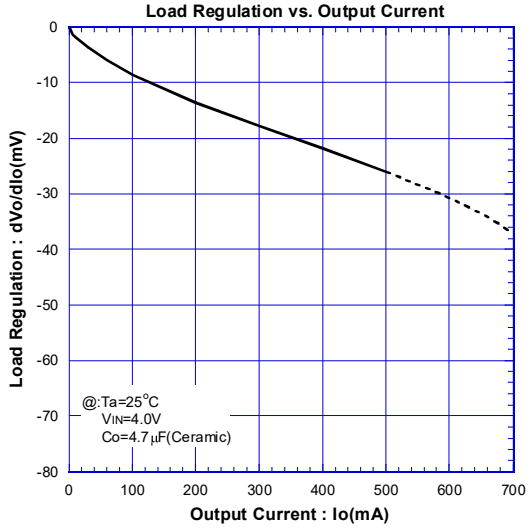

NJM2835_3.0V
Ground Pin Current v.s. Output Current



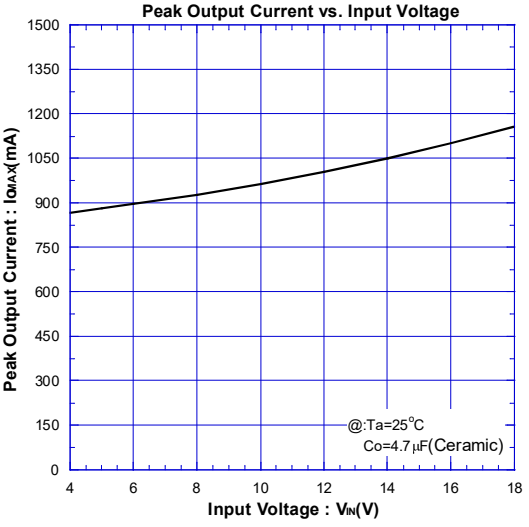

NJM2835_3.0V
Dropout Voltage vs. Output Current




NJM2835_3.0V
Load Regulation vs. Output Current

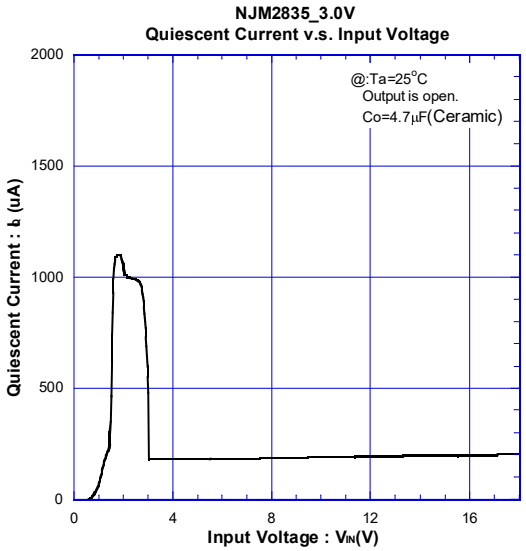



NJM2835_3.0V
Peak Output Current vs. Input Voltage

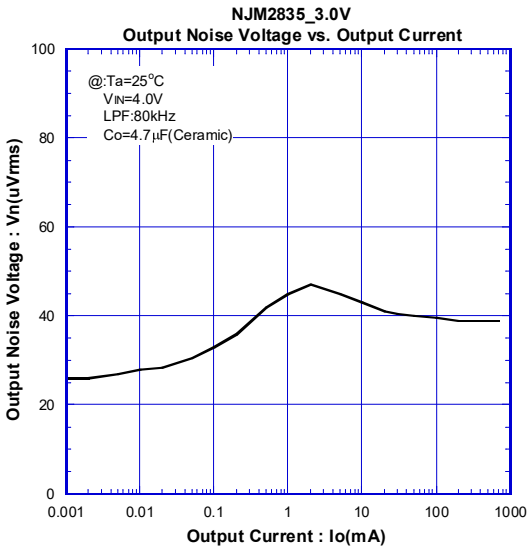


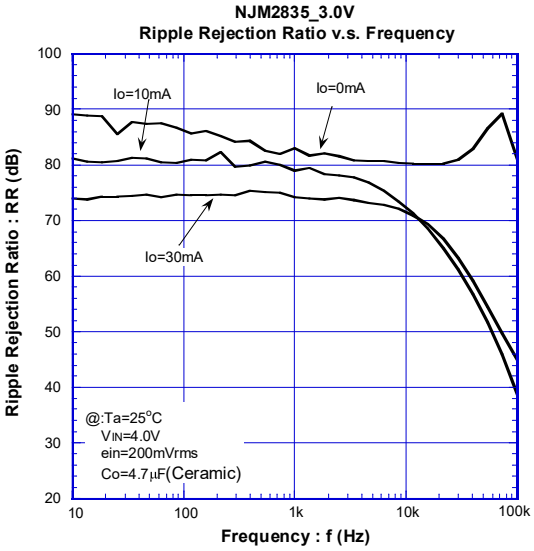
## ■ TYPICAL CHARACTERISTICS

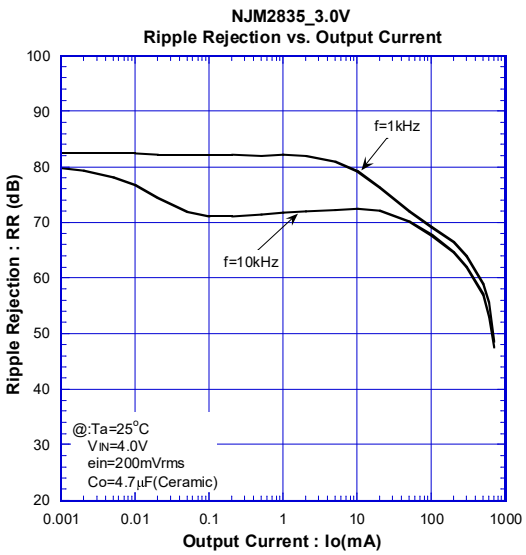
### ●DC CHARACTERISTICS (3V Version)

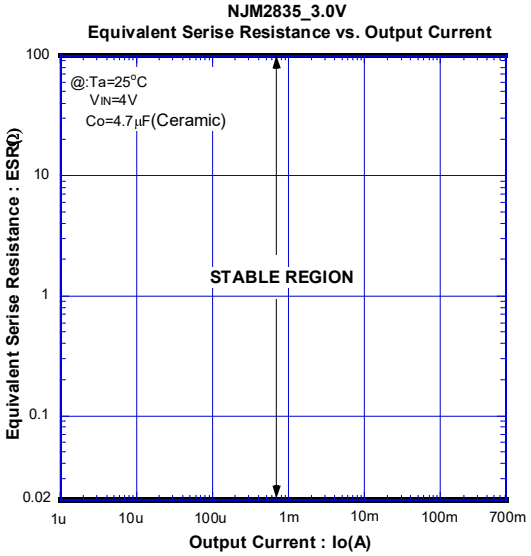



### ●AC CHARACTERISTICS (3V Version)



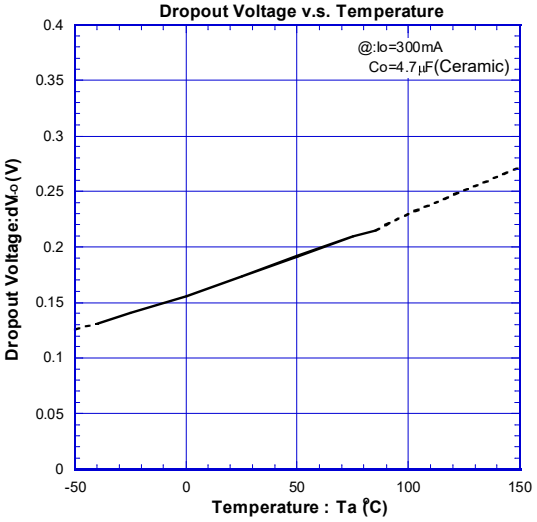

NJM2835_3.0V
Ripple Rejection vs. Output Current
Ripple Rejection : RR (dB)
Output Current : Io(mA)
f=1kHz
f=10kHz
@:Ta=25°C
VIN=4.0V
ein=200mVrms
Co=4.7µF(Ceramic)
100
90
80
70
60
50
40
30
20
0.001
0.01
0.1
1
10
100
1000


NJM2835_3.0V
Equivalent Serise Resistance vs. Output Current
Equivalent Serise Resistance : ESR(Ω)
Output Current : Io(A)
@:Ta=25°C
VIN=4V
Co=4.7µF(Ceramic)
STABLE REGION
100
10
1
0.1
0.02
1u
10u
100u
1m
10m
100m
700m

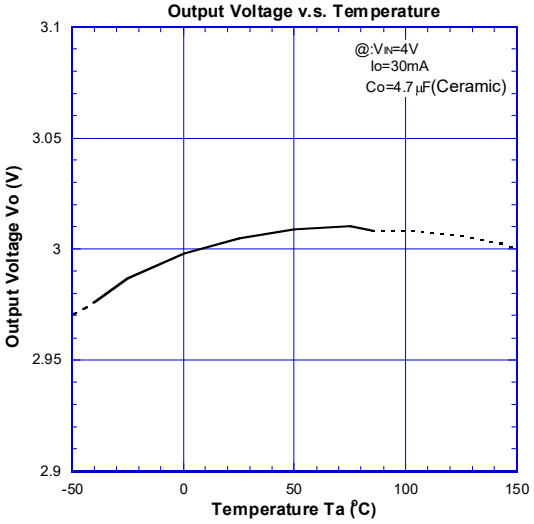
## ■ TYPICAL CHARACTERISTICS

### ●TEMPERATURE CHARACTERISTICS (3V Version)

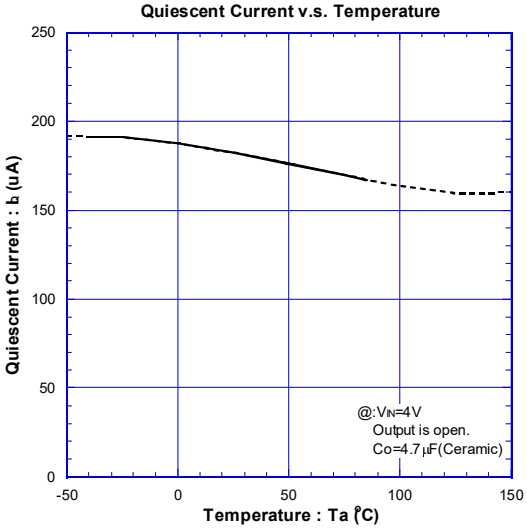
NJM2835_3.0V
Dropout Voltage v.s. Temperature



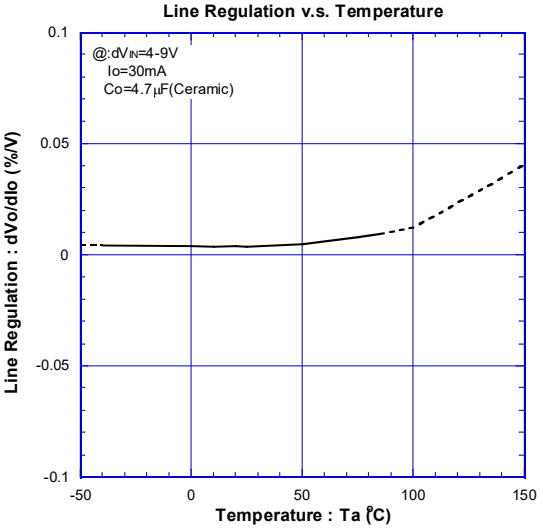

NJM2835_3.0V
Output Voltage v.s. Temperature



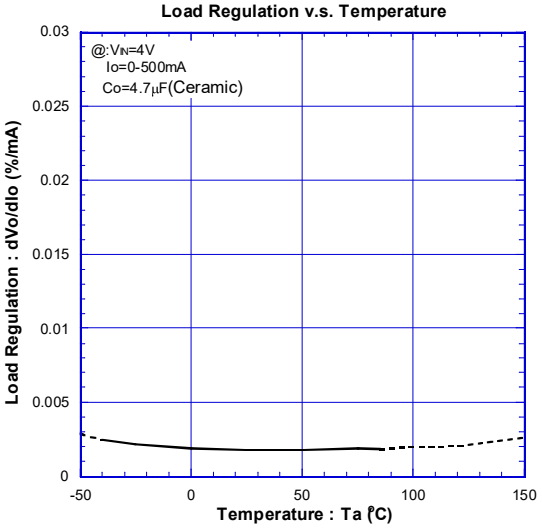

NJM2835_3.0V
Quiescent Current v.s. Temperature



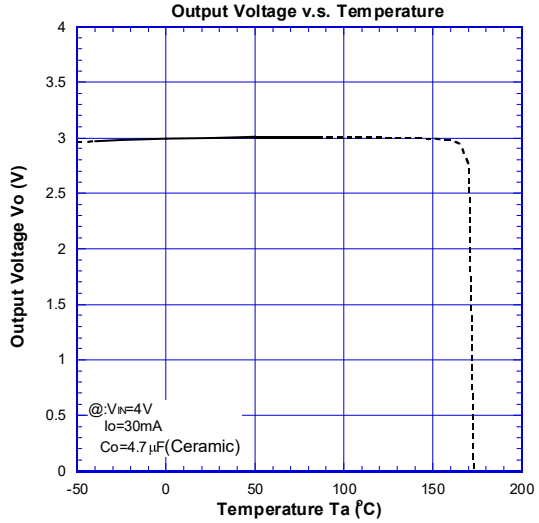

NJM2835_3.0V
Line Regulation v.s. Temperature




NJM2835_3.0V
Load Regulation v.s. Temperature

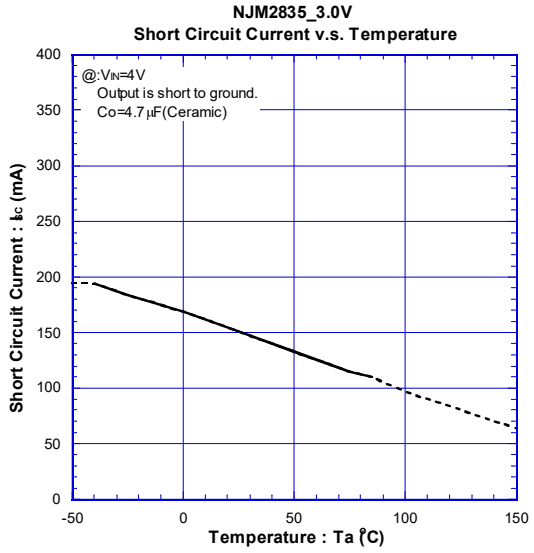



NJM2835_3.0V
Output Voltage v.s. Temperature



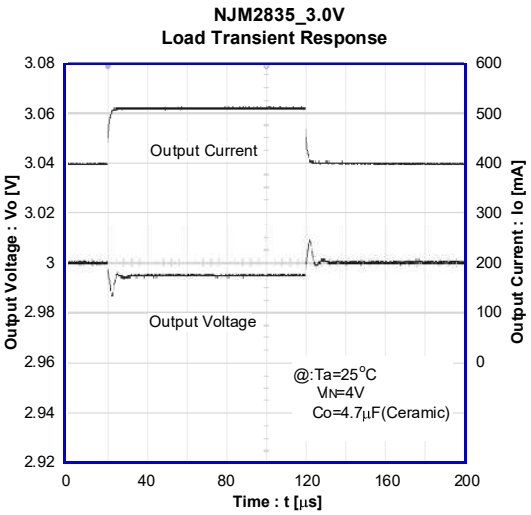
## ■ TYPICAL CHARACTERISTICS

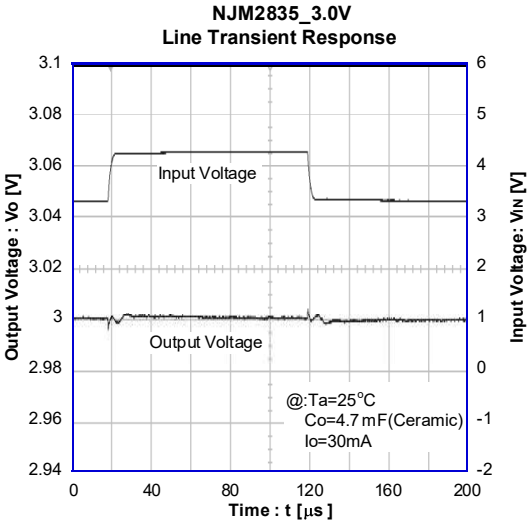
### ●TEMPERATURE CHARACTERISTICS (3V Version)




## ■ TYPICAL CHARACTERISTICS

### ●TRANSIENT RESPONSE (3V Version)

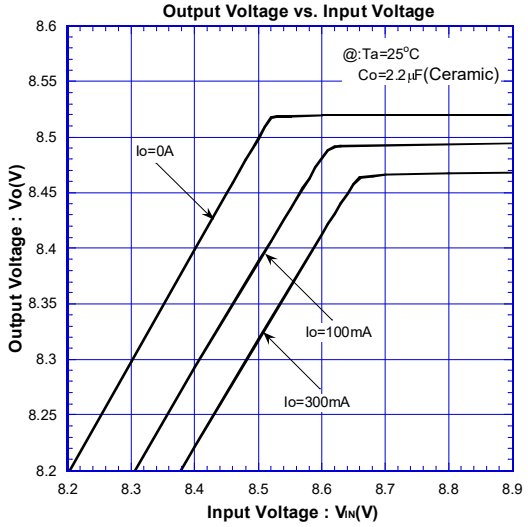


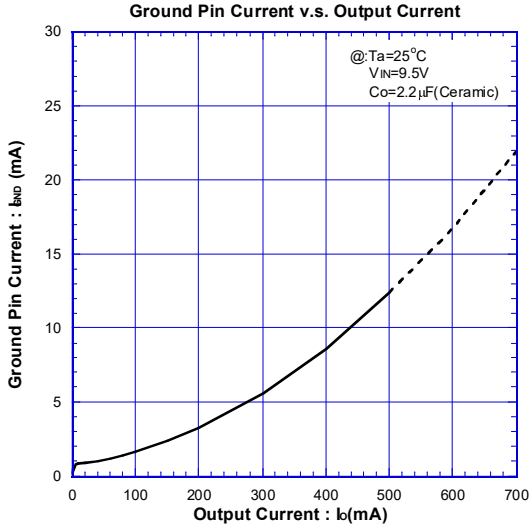
## ■ TYPICAL CHARACTERISTICS

### ●DC CHARACTERISTICS (8.5V Version)

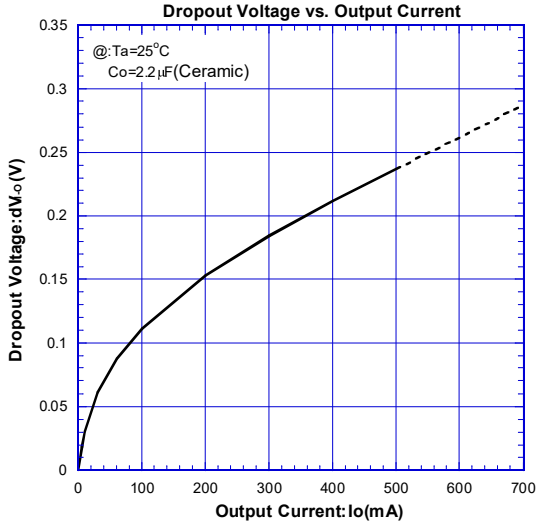
NJM2835_8.5V
Output Voltage vs. Input Voltage



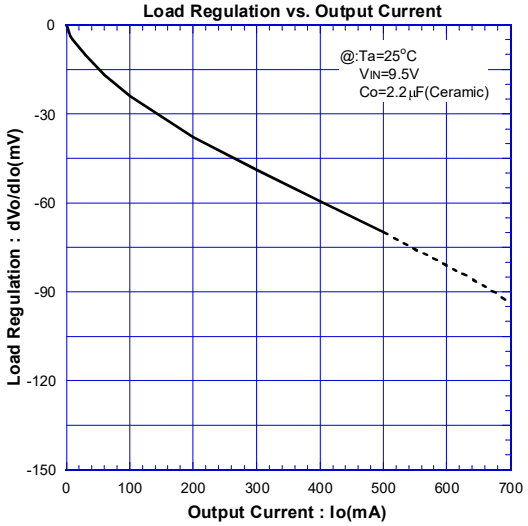

NJM2835_8.5V
Ground Pin Current v.s. Output Current



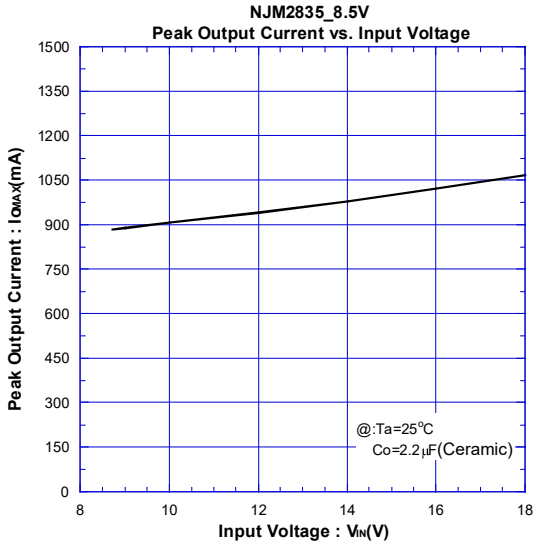

NJM2835_8.5V
Dropout Voltage vs. Output Current



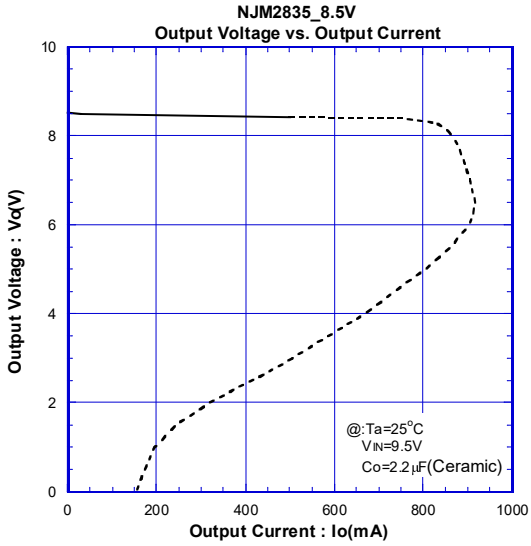

NJM2830_8.5V
Load Regulation vs. Output Current




NJM2835_8.5V
Peak Output Current vs. Input Voltage

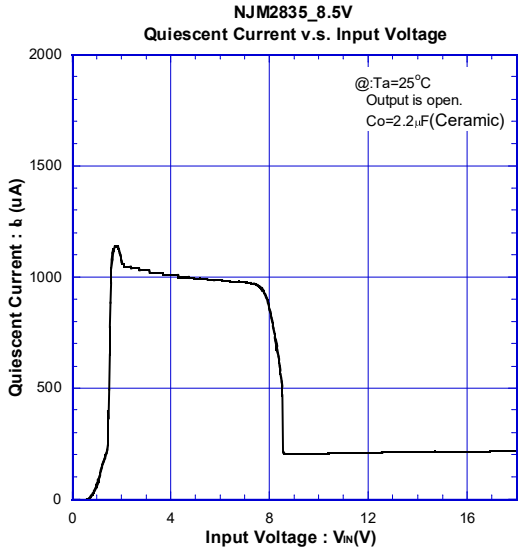



NJM2835_8.5V
Output Voltage vs. Output Current

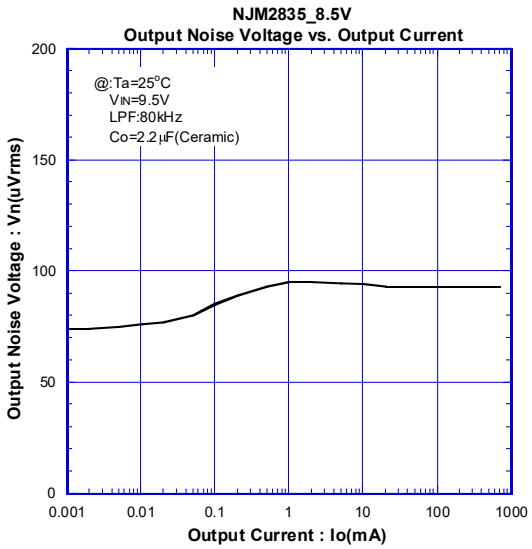


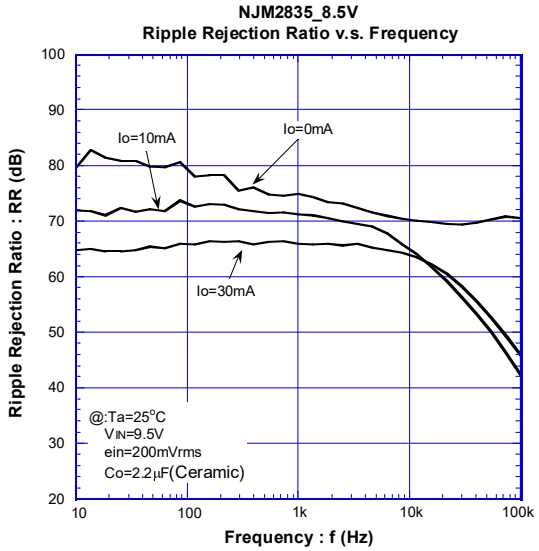
## ■ TYPICAL CHARACTERISTICS

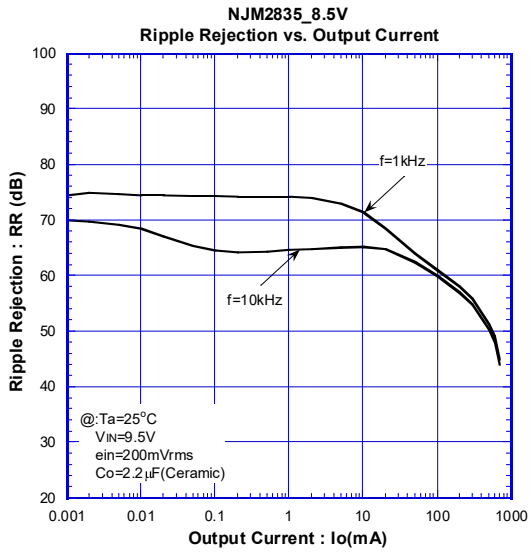
### ●DC CHARACTERISTICS (8.5V Version)

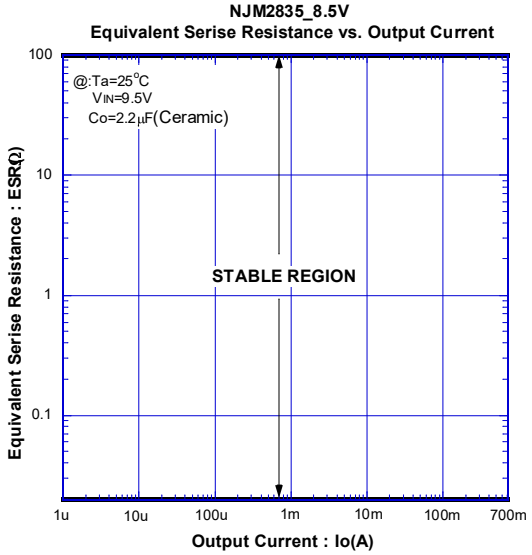



### ●AC CHARACTERISTICS (8.5V Version)



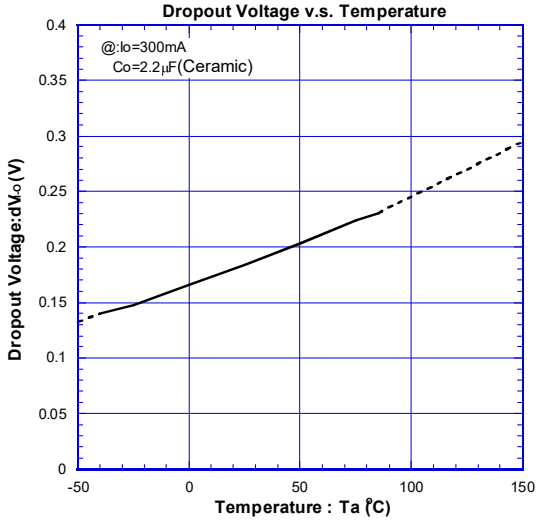



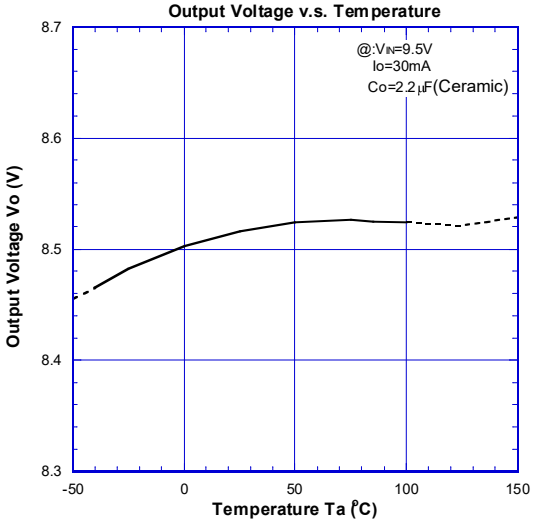
## ■ TYPICAL CHARACTERISTICS

### ●TEMPERATURE CHARACTERISTICS (8.5V Version)

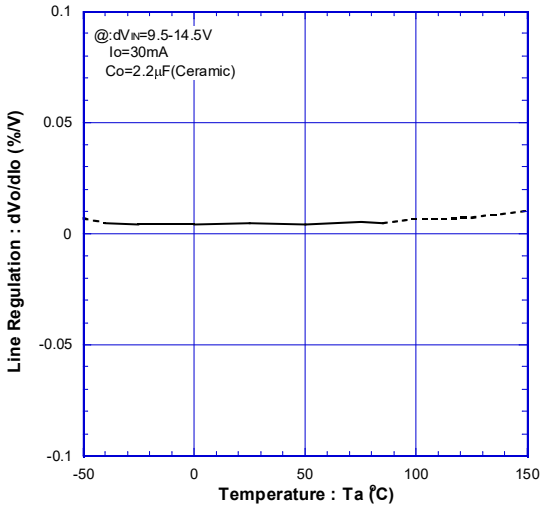
NJM2835_8.5V
Dropout Voltage v.s. Temperature



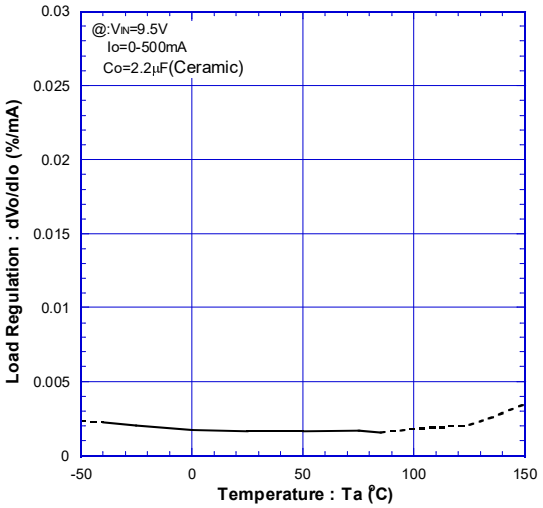

NJM2835_8.5V
Output Voltage v.s. Temperature



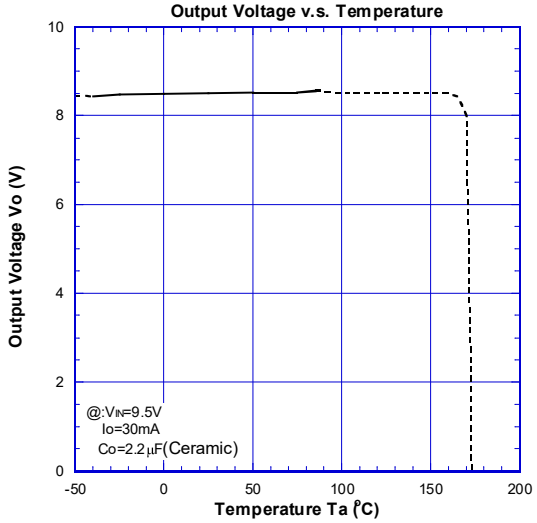

NJM2835_8.5V
Line Regulation v.s. Temperature



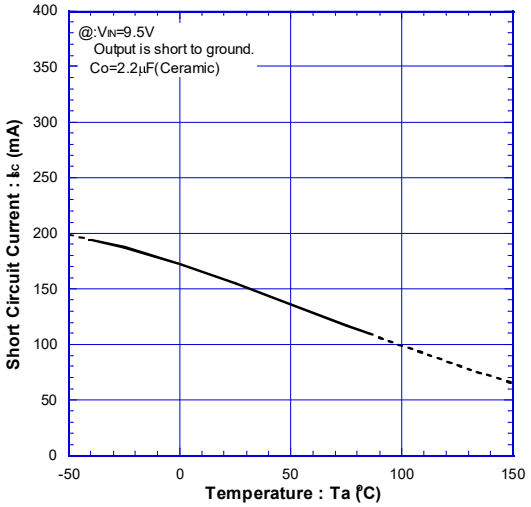

NJM2835_8.5V
Load Regulation v.s. Temperature




NJM2835_8.5V
Output Voltage v.s. Temperature

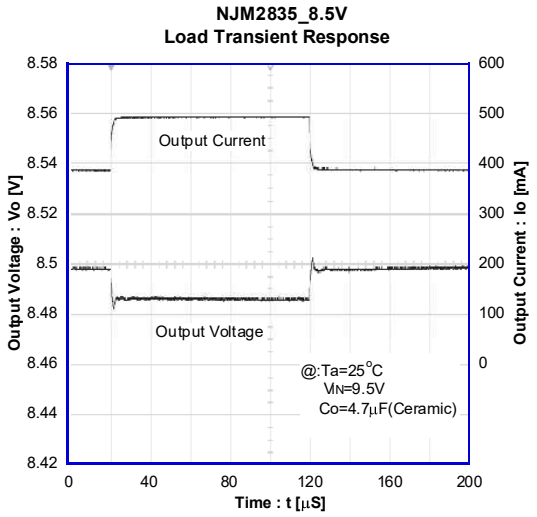


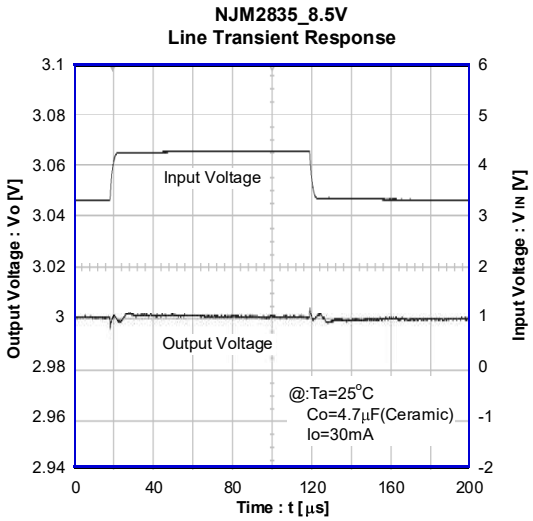

NJM2830_8.5V
Short Circuit Current v.s. Temperature



## ■ TYPICAL CHARACTERISTICS

### ●TRANSIENT RESPONSE (8.5V Version)

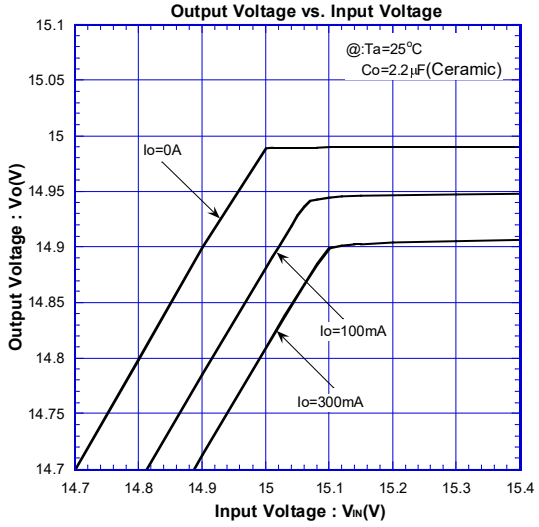


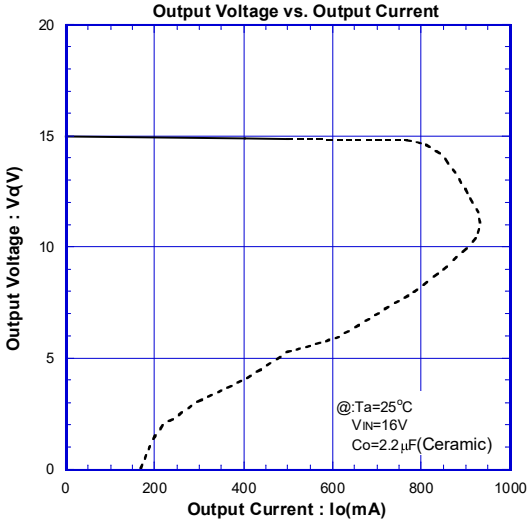
## ■ TYPICAL CHARACTERISTICS

### ●DC CHARACTERISTICS (15V Version)

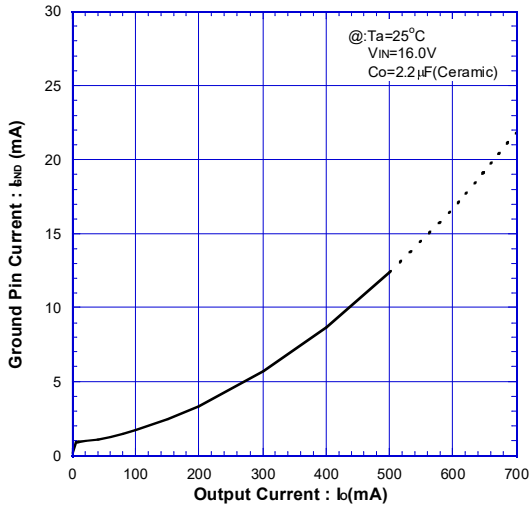
NJM2835_15V
Output Voltage vs. Input Voltage



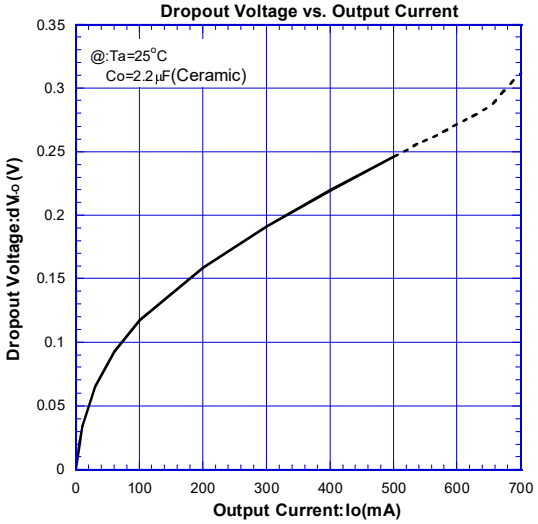

NJM2835_15V
Output Voltage vs. Output Current



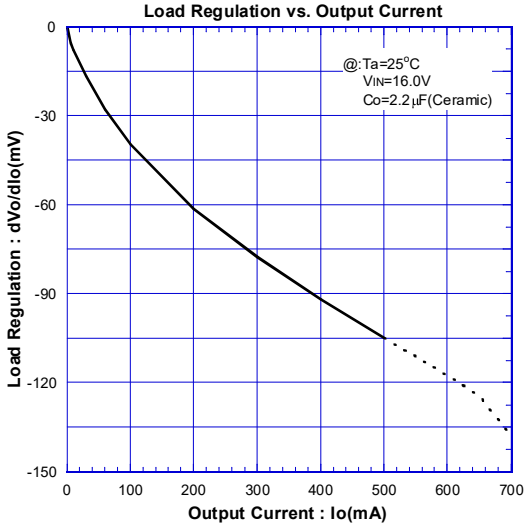

NJM2835_15V
Ground Pin Current v.s. Output Current



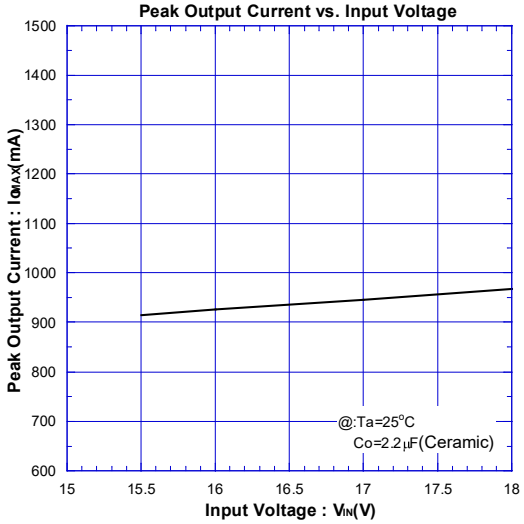

NJM2835_15V
Dropout Voltage vs. Output Current




NJM2835_15V
Load Regulation vs. Output Current

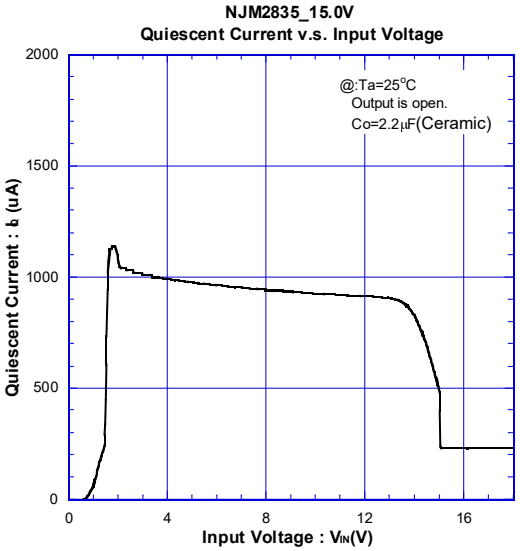



NJM2835_15V
Peak Output Current vs. Input Voltage

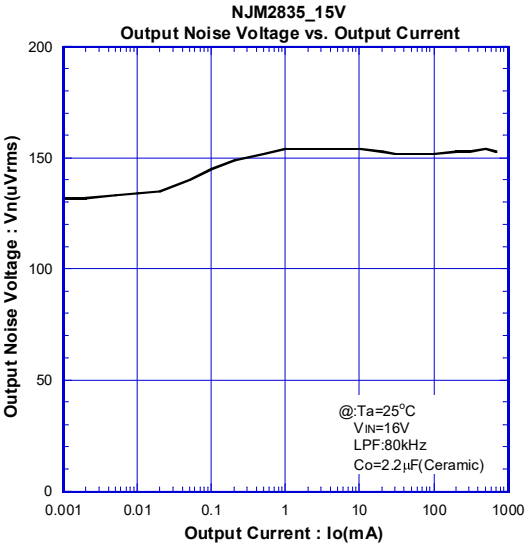


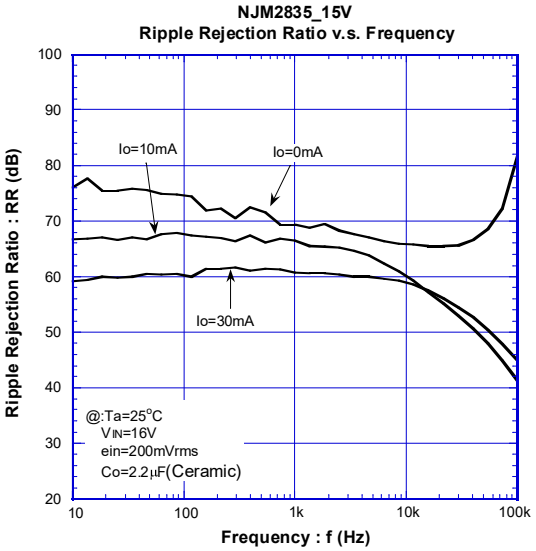
## ■ TYPICAL CHARACTERISTICS

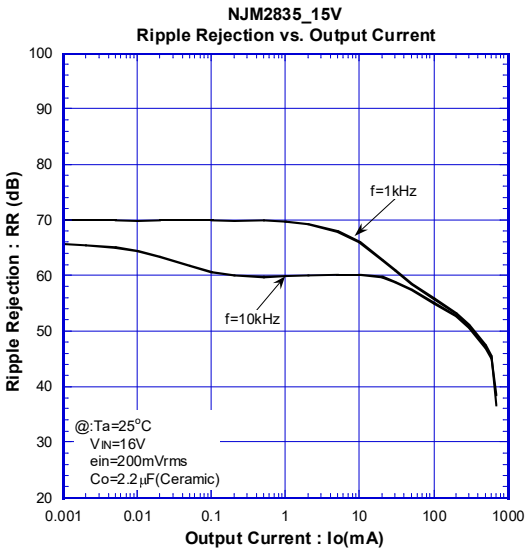
### ●DC CHARACTERISTICS (15V Version)

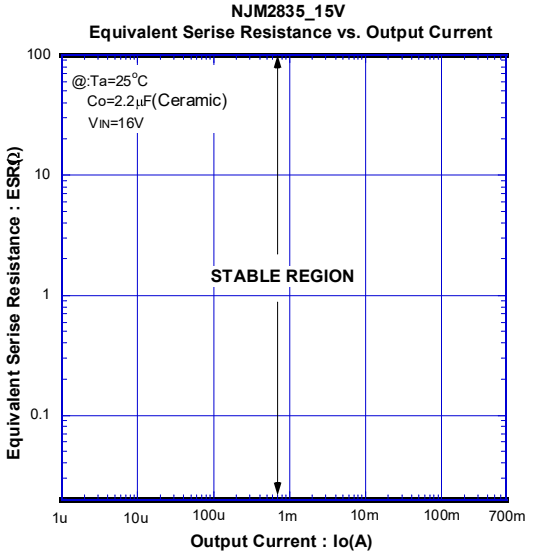



### ●AC CHARACTERISTICS (15V Version)



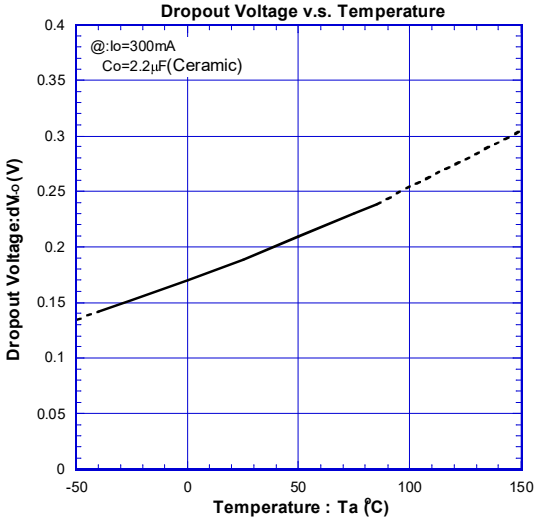



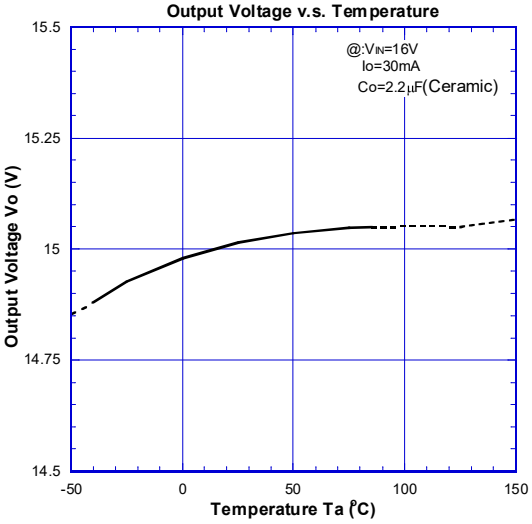
## ■ TYPICAL CHARACTERISTICS

### ●TEMPERATURE CHARACTERISTICS (15V Version)

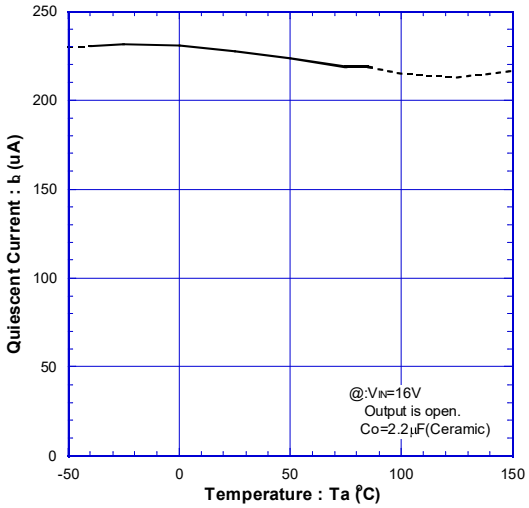
NJM2835_15V
Dropout Voltage v.s. Temperature



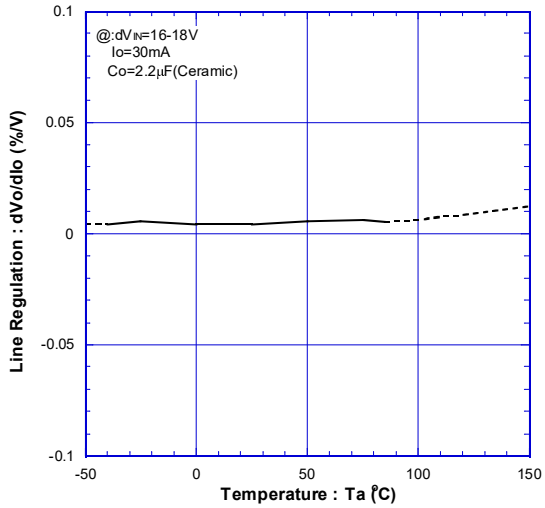

NJM2835_15V
Output Voltage v.s. Temperature



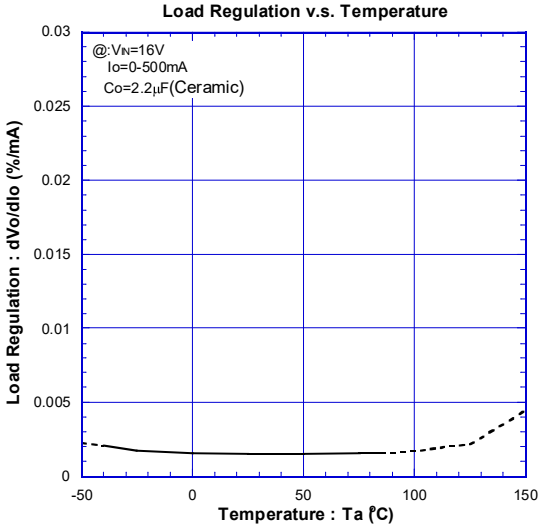

NJM2835_15V
Quiescent Current v.s. Temperature



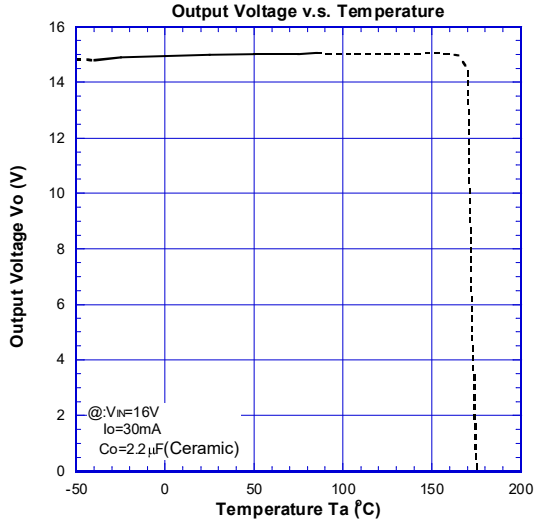

NJM2835_15V
Line Regulation v.s. Temperature




NJM2835_15V
Load Regulation v.s. Temperature

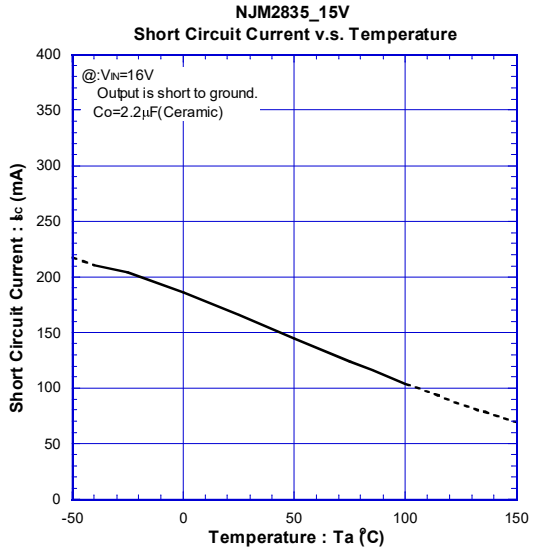



NJM2835_15V
Output Voltage v.s. Temperature



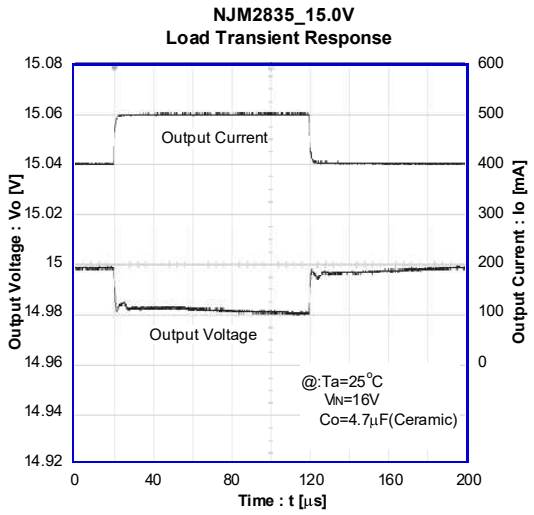
## ■ TYPICAL CHARACTERISTICS

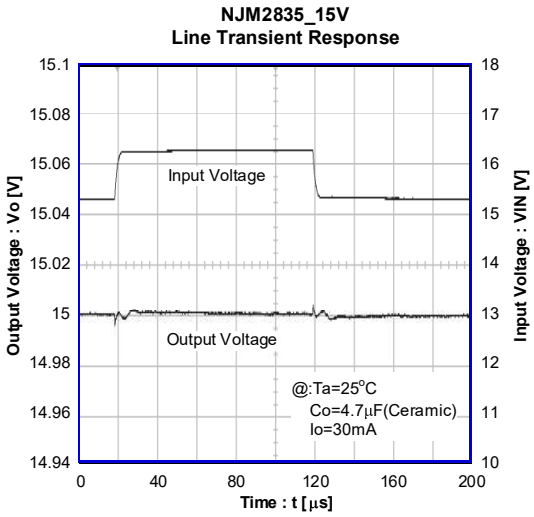
### ●TEMPERATURE CHARACTERISTICS (15V Version)




## ■ TYPICAL CHARACTERISTICS

### ●TRANSIENT RESPONSE (15V Version)




[CAUTION]
The specifications on this databook are only
given for information , without any guarantee
as regards either mistakes or omissions. The
application circuits in this databook are
described only to show representative