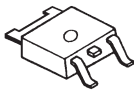
LOW DROPOUT VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

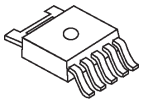
The NJM2845/46 is low dropout voltage regulator. Advanced Bipolar technology achieves low noise, high ripple rejection and low quiescent current.

NJM2845 is 3 terminal type and NJM2846 is ON/OFF control built in type. These product can be selected according to the applications.

■ PACKAGE OUTLINE



NJM2845DL1

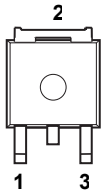


NJM2846DL3

■ FEATURES

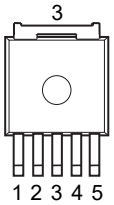
- High Ripple Rejection 75dB typ. (f=1kHz,3V Version)
- Output Noise Voltage Vno=45μVrms typ. (Vo=3V Version)
- Output capacitor with 2.2μF ceramic capacitor (Vo≥2.6V)
- Output Current Io(max.)=800mA
- High Precision Output Vo ±1.0%
- Low Dropout Voltage 0.18V typ. (Io=500mA)
- ON/OFF Control (NJM2846)
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline TO-252-3 (NJM2845DL1), TO-252-5 (NJM2846DL3)

■ PIN CONFIGURATION



1.V_{IN}
2.GND
3.V_{OUT}

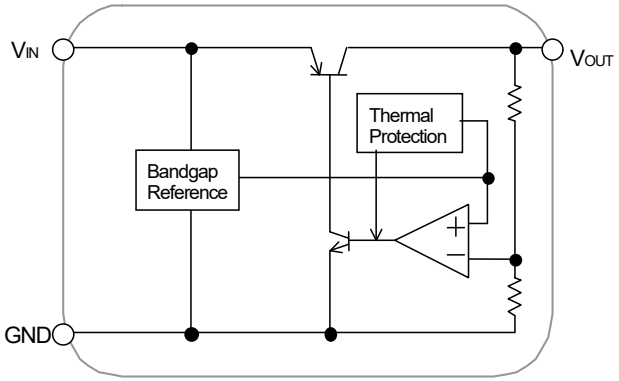
NJM2845DL1



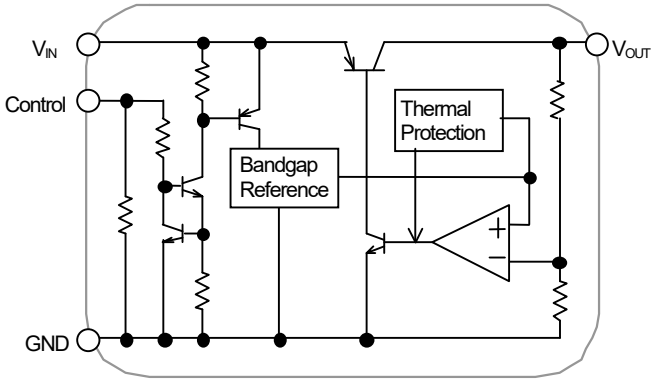
1.CONTROL
2.V_{IN}
3.GND
4.Vo
5.NC

NJM2846DL3

■ EQUIVALENT CIRCUIT



NJM2845DL1



NJM2846DL3

■ OUTPUT VOLTAGE

Device Name	V_{OUT}
NJM284*DL*-15	1.5V
NJM284*DL*-18	1.8V
NJM284*DL-*02	2.0V
NJM284*DL*-22	2.2V
NJM284*DL*-23	2.3V
NJM284*DL*-25	2.5V
NJM284*DL*-03	3.0V
NJM284*DL*-33	3.3V
NJM284*DL*-04	4.0V
NJM284*DL*-05	5.0V

Output voltage options available : 1.5 ~ 5.0V (0.1V step)

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	+14	V
Control Voltage	V_{CONT}	+14(*1)	V
Power Dissipation	P_D	10(Tc≤25°C) 1.0(Ta≤25°C)	W
Operating Temperature	Topr	-40 ~ +85	°C
Storage Temperature	Tstg	-40 ~ +150	°C

(*1): When input voltage is less than +14V, the absolute maximum control voltage is equal to the input voltage.

■ Operating voltage

V_{IN}=+2.5V(In case of Vo<2.3V) ~ +(Vo+9V)

■ NJM2845

■ ELECTRICAL CHARACTERISTICS

(V_{IN}=Vo+1V, C_{IN}=0.33µF ,Co=2.2µF(1.7V<Vo≤2.6V:Co=4.7µF, Vo≤1.7V: Co=10µF), Ta=25°C)

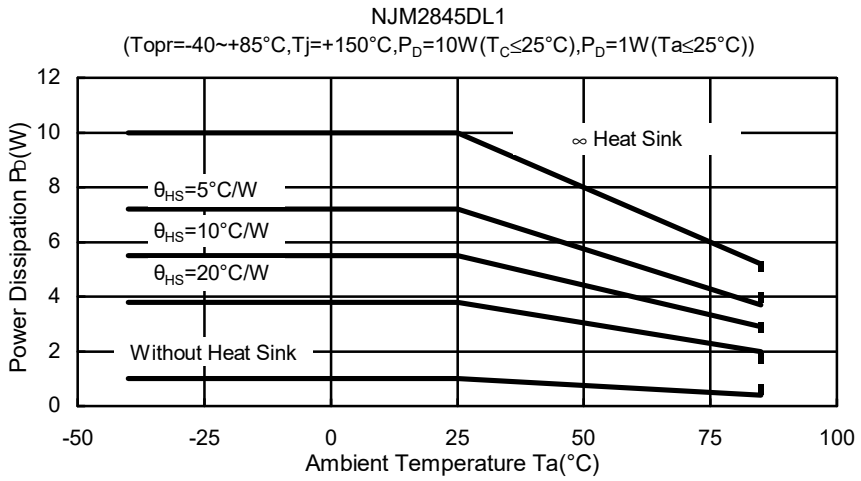
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	Vo	Io=30mA	-1.0%	-	+1.0%	V
Quiescent Current	I_Q	Io=0mA	-	400	600	µA
Output Current	Io	Vo - 0.3V	800	1050	-	mA
Line Regulation	$\Delta Vo/\Delta V_{IN}$	V_{IN}=Vo+1V ~ Vo+6V, Io=30mA	-	-	0.10	%/V
Load Regulation	$\Delta Vo/\Delta Io$	Io=0 ~ 800mA	-	-	0.004	%/mA
Dropout Voltage(*2)	ΔV_{I-O}	Io=500mA	-	0.18	0.28	V
Ripple Rejection	RR	ein=200mVrms, f=1kHz, Io=10mA, 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, Vo=3V Version	-	45	-	µVrms

(*2): The output voltage excludes under 2.3V.

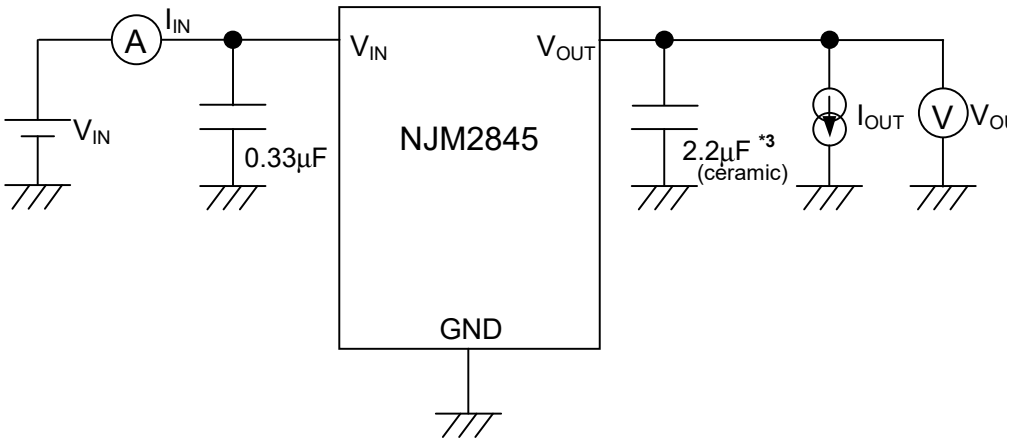
The above specification is a common specification for all output voltages.

Therefore, it may be different from the individual specification for a specific output voltage.

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

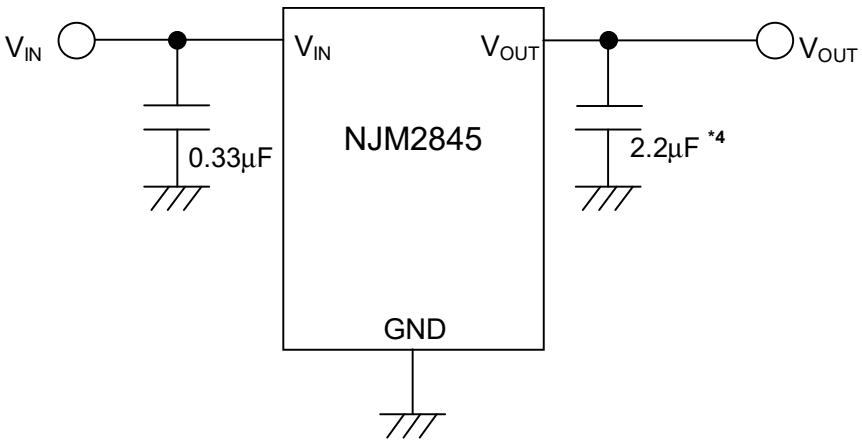


■ TEST CIRCUIT



*3 1.7V<Vo≤2.6V version: Co=4.7µF, Vo≤1.7V: Co=10µF(ceramic)

■ TYPICAL APPLICATION



*4 1.7V<Vo≤2.6V version: Co=4.7µF, Vo≤1.7V: Co=10µF

■ NJM2846

■ ELECTRICAL CHARACTERISTICS

(V_{IN}=Vo+1V, C_{IN}=0.33µF, Co=2.2µF(1.7V<Vo≤2.6V version: Co=4.7µF, Vo≤1.7V: Co=10µF), Ta=25°C)

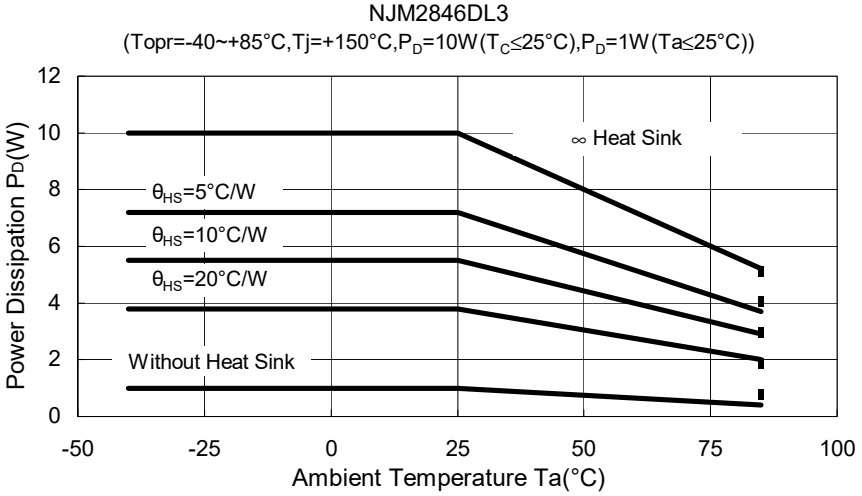
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	Vo	Io=30mA	-1.0%	-	+1.0%	V
Quiescent Current	I_Q	Io=0mA	-	400	600	µA
Quiescent Current at Control OFF	$I_{Q\,(OFF)}$	V_{CONT}=0V	-	-	100	nA
Line Regulation	Io	Vo - 0.3V	800	1050	-	mA
Line Regulation	$\Delta Vo/\Delta V_{IN}$	V_{IN}=Vo+1V ~ Vo+6V, Io=30mA	-	-	0.10	%/V
Load Regulation	$\Delta Vo/\Delta Io$	Io=0 ~ 800mA	-	-	0.004	%/mA
Dropout Voltage(*5)	ΔV_{I-O}	Io=500mA	-	0.18	0.28	V
Ripple Rejection	RR	ein=200mVrms, f=1kHz, Io=10mA, 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, Vo=3V Version	-	45	-	µVrms
Control Current	I_{CONT}	V_{CONT}=1.6V, Io=0mA	-	3	12	µA
Control Voltage for ON-state	$V_{CONT(ON)}$		1.6	-	-	V
Control Voltage for OFF-state	$V_{CONT(OFF)}$		-	-	0.6	V

(*5): The output voltage excludes under 2.3V.

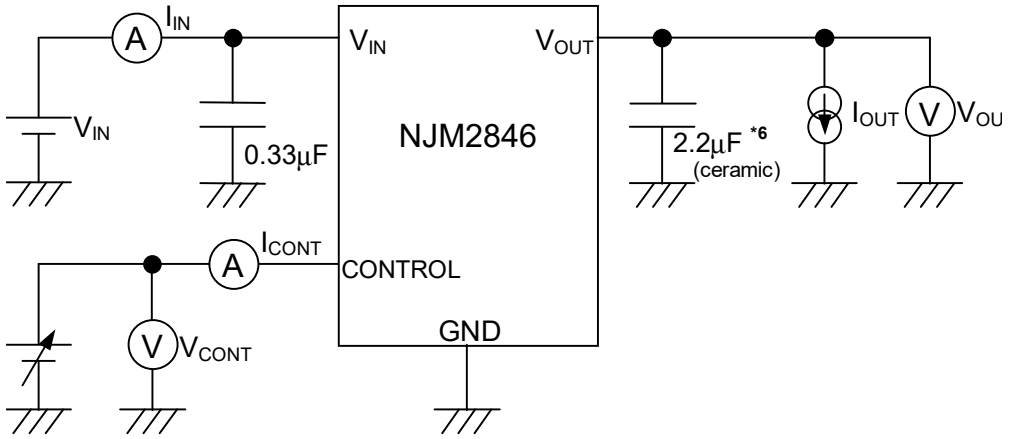
The above specification is a common specification for all output voltages.

Therefore, it may be different from the individual specification for a specific output voltage.

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



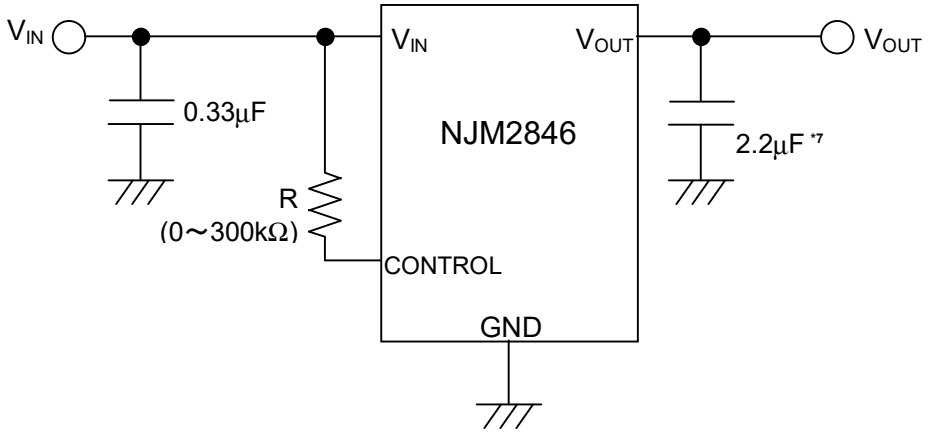
■ TEST CIRCUIT



*6 1.7V<Vo≤2.6V version: Co=4.7µF, Vo≤1.7V: Co=10µF

■ TYPICAL APPLICATIONS

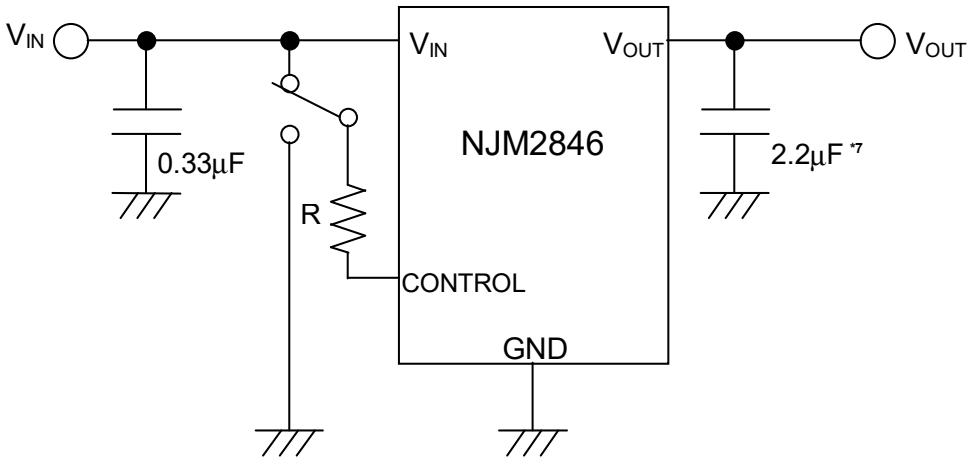
① In the case where ON/OFF Control is not required:



*7 1.7V<Vo≤2.6V version: Co=4.7µF, Vo≤1.7V: Co=10µF

Connect control terminal to V_{IN} terminal

② In use of ON/OFF CONTROL:



*7 1.7V<Vo≤2.6V version: Co=4.7µF, Vo≤1.7V: Co=10µF

State of control terminal:

- "H"→ output is enabled.
- "L" or "open" → output is disabled.

∗In the case of using a resistance "R" between V_{IN} and control.

The current flow into the control terminal while the IC is ON state (I_{CONT}) can be reduced when a pull up resistance "R" is inserted between V_{IN} and the control terminal.

The minimum control voltage for ON state ($V_{CONT\,(ON)}$) is increased due to the voltage drop caused by I_{CONT} and the resistance "R". The I_{CONT} is temperature dependence as shown in the "Control Current vs. Temperature" characteristics. Therefore, the resistance "R" should be carefully selected to ensure the control voltage exceeds the $V_{CONT\,(ON)}$ over the required temperature range.

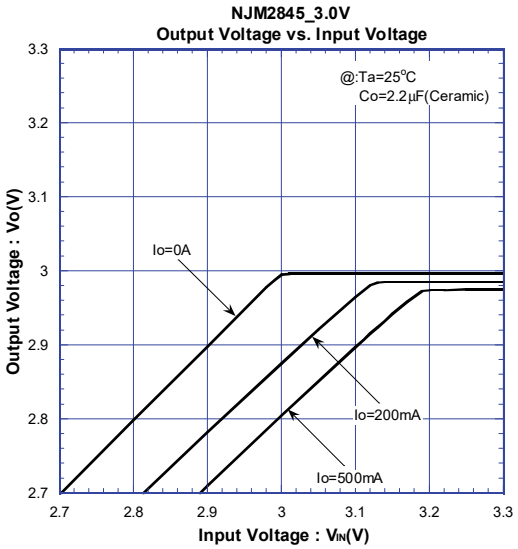
∗Input Capacitance C_{IN}

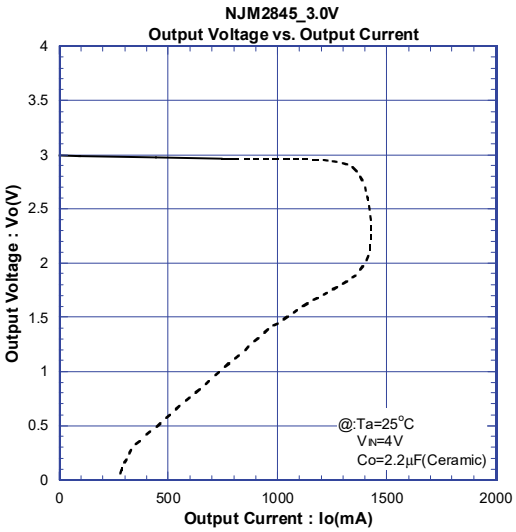
Input capacitance C_{IN} is required to prevent oscillation and reduce power supply ripple for applications with high power supply impedance or a long power supply line.
Use the C_{IN} value of 0.33μF greater to avoid the problem.
C_{IN} should connect between GND and V_{IN} as short as possible.

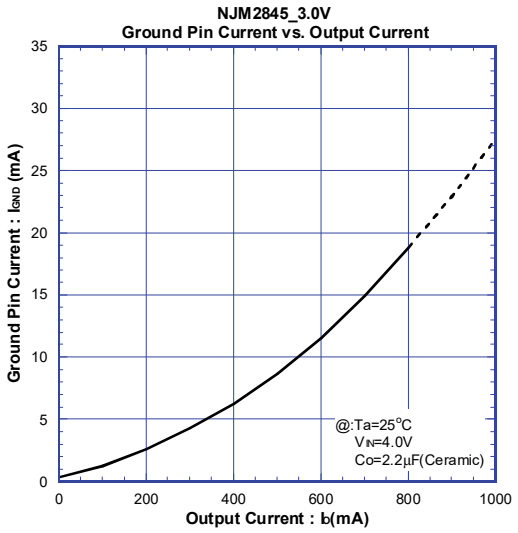
∗Output Capacitance C_O

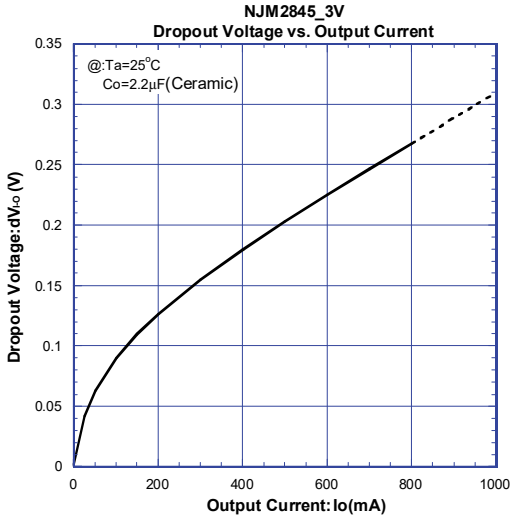
Output capacitor (Co) is required for a phase compensation of the internal error amplifier. The capacitance and the equivalent series resistance (ESR) influences stability of the regulator.
This product is designed to work with a low ESR capacitor for the Co; however, use of recommended capacitance or greater value is essential for stable operation.
Use of a smaller Co may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.
Therefore, use Co with the recommended capacitance or greater value and connect between Vo terminal and GND terminal with minimal wiring. The recommended capacitance depends on the output voltage. Low voltage regulator requires greater value of the Co. Thus, check the recommended capacitance for each output voltage.
Use of a greater Co reduces output noise and ripple output, and also improves transient response of the output voltage against rapid load change.

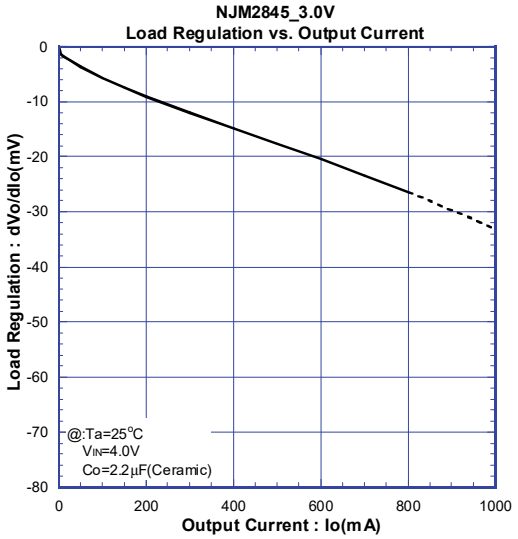
■ TYPICAL CHARACTERISTICS (NJM2845)

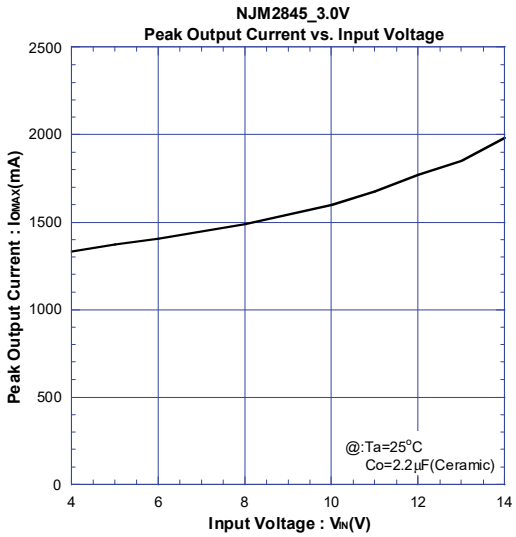




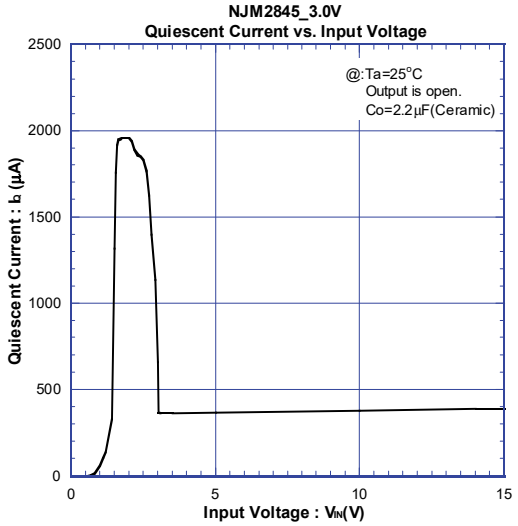


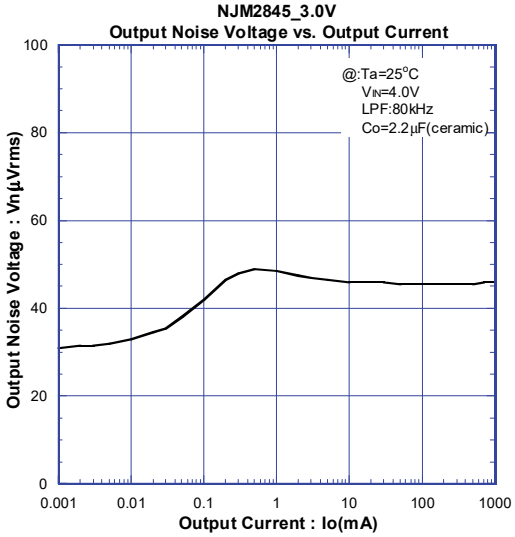


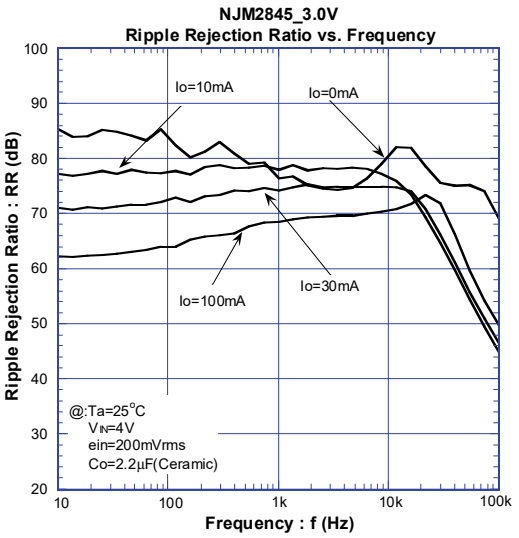


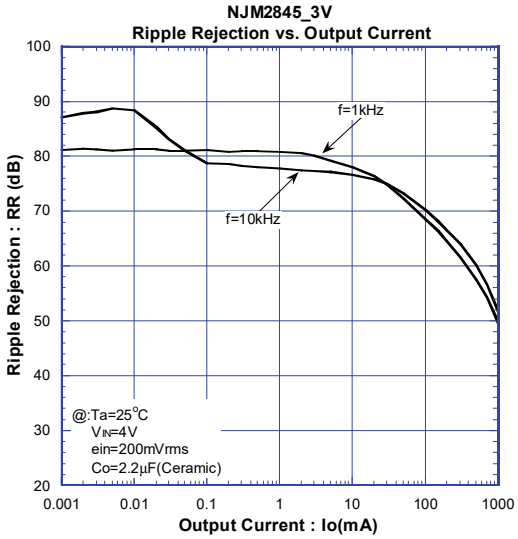


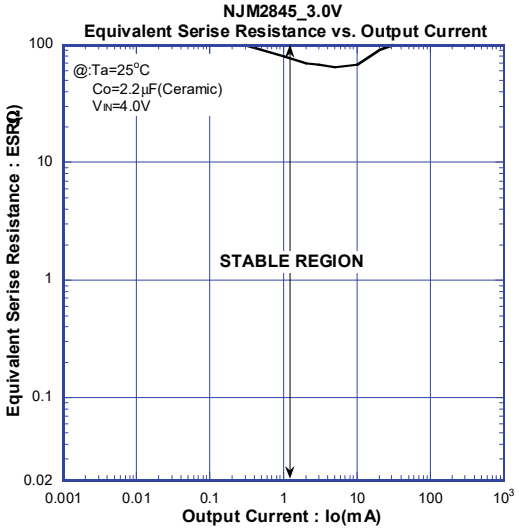
■ TYPICAL CHARACTERISTICS (NJM2845)





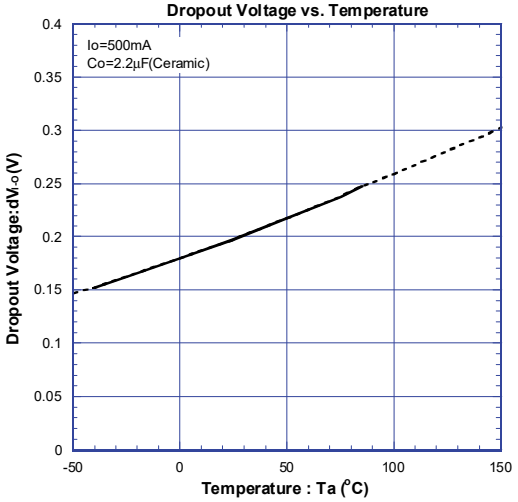




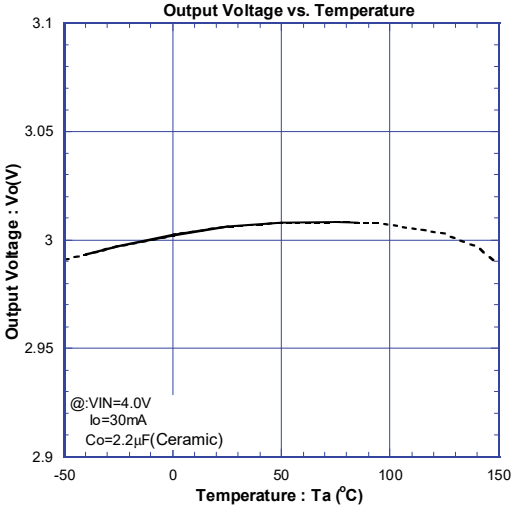


■ TYPICAL CHARACTERISTICS (NJM2845)

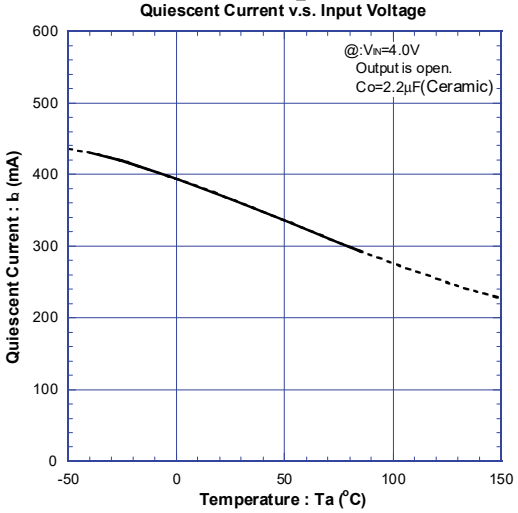
NJM2845_3.0V
Dropout Voltage vs. Temperature



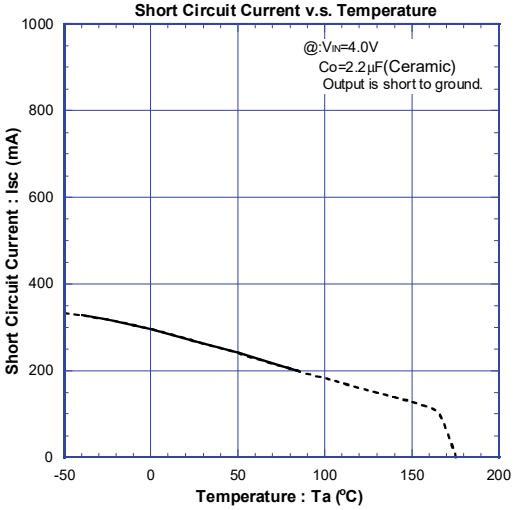
NJM2845_3.0V
Output Voltage vs. Temperature



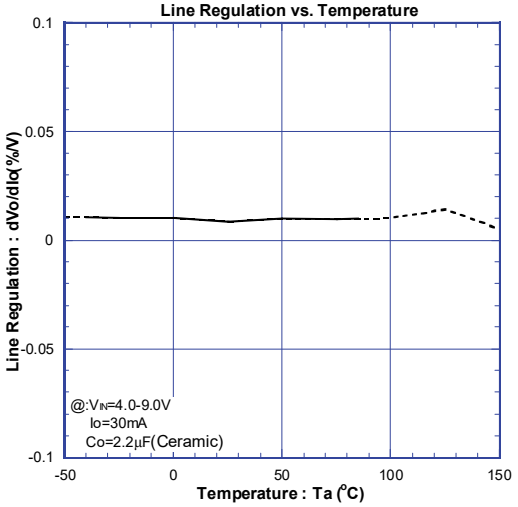
NJM2845_3.0V
Quiescent Current v.s. Input Voltage



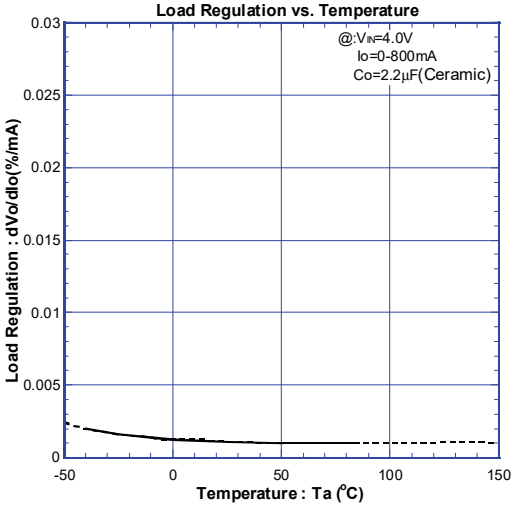
NJM2845_3.0V
Short Circuit Current v.s. Temperature



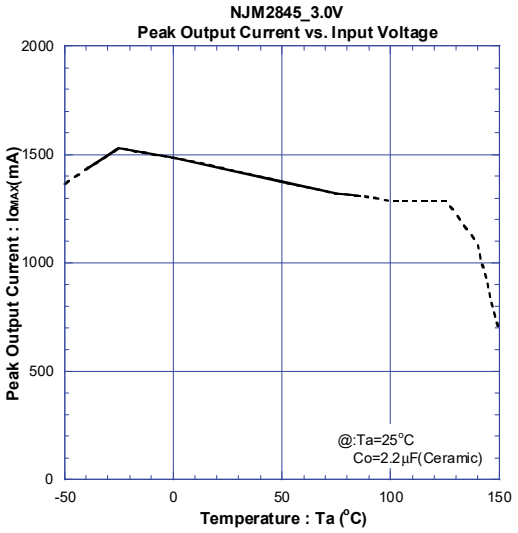
NJM2845_3.0V
Line Regulation vs. Temperature

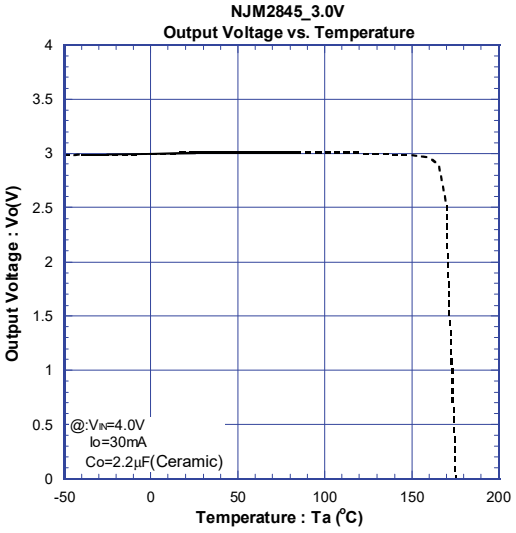


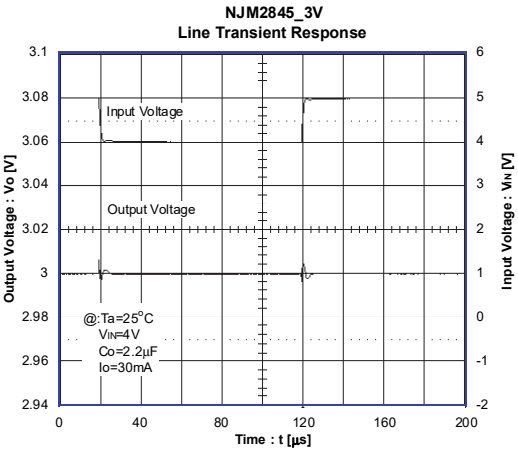
NJM2845_3.0V
Load Regulation vs. Temperature

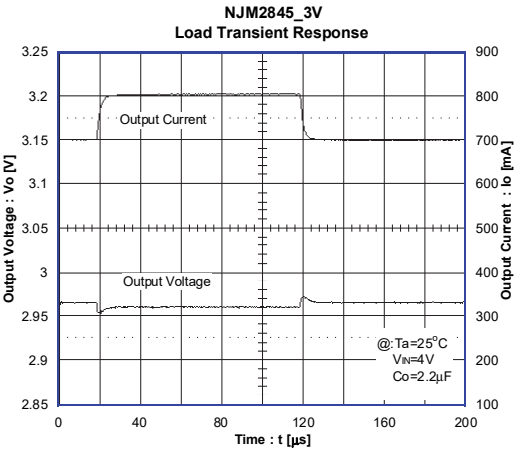


■ TYPICAL CHARACTERISTICS (NJM2845)

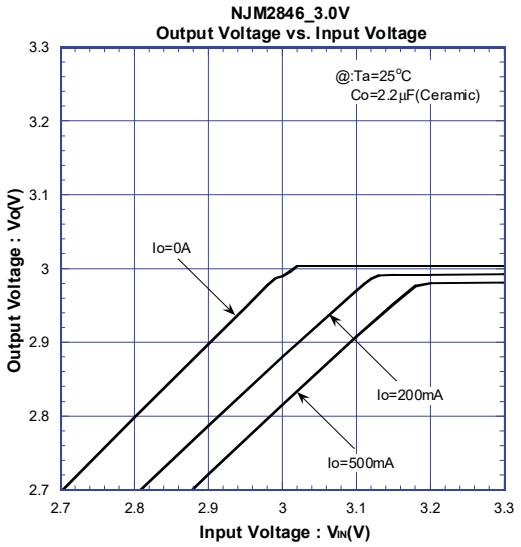


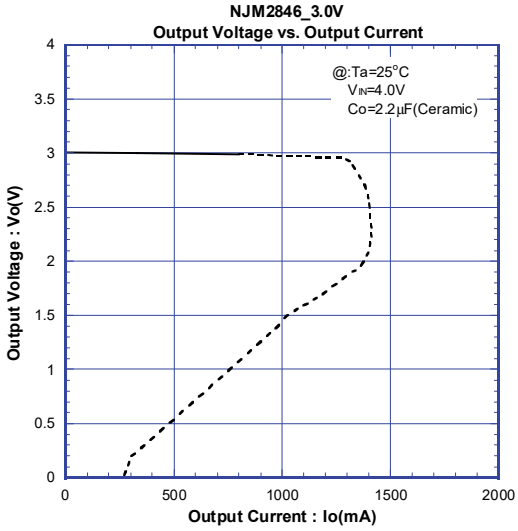


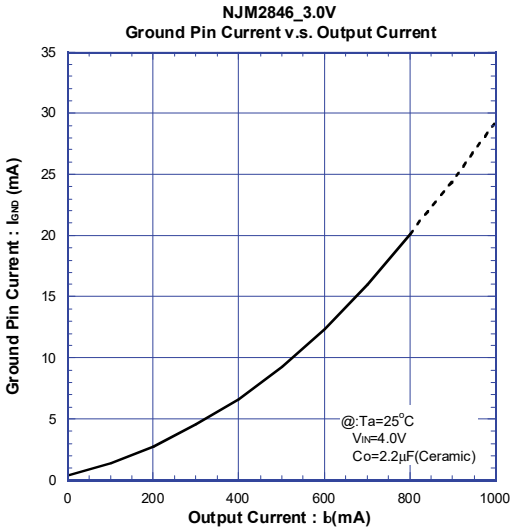


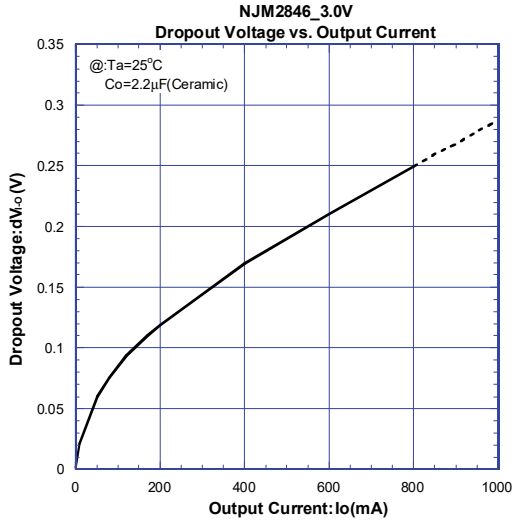


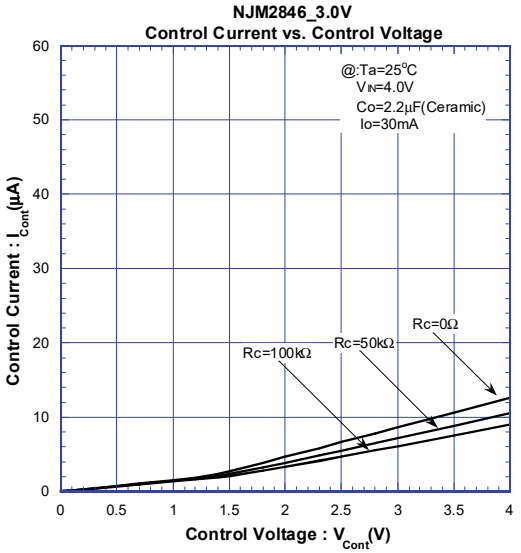
■ TYPICAL CHARACTERISTICS (NJM2846)

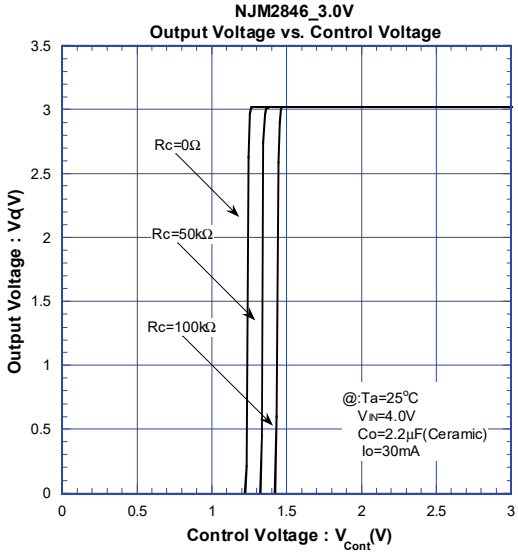






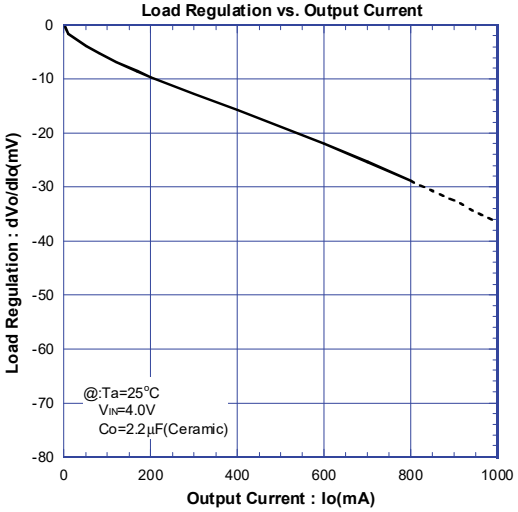




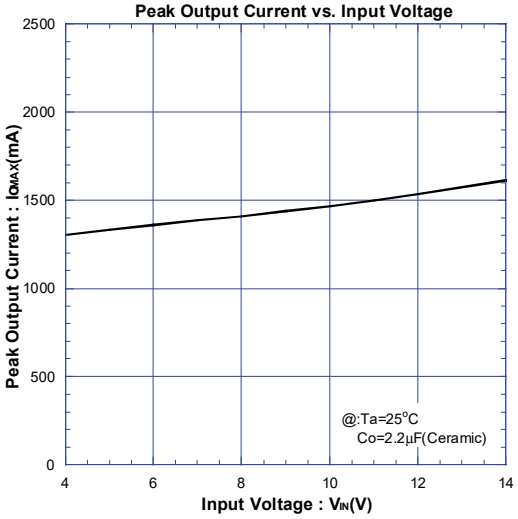


■ TYPICAL CHARACTERISTICS (NJM2846)

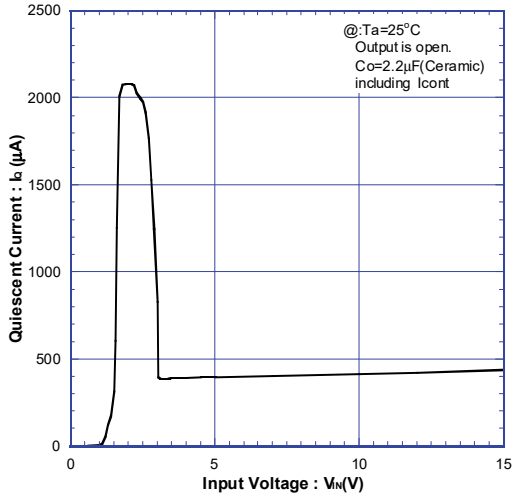
NJM2846_3.0V
Load Regulation vs. Output Current



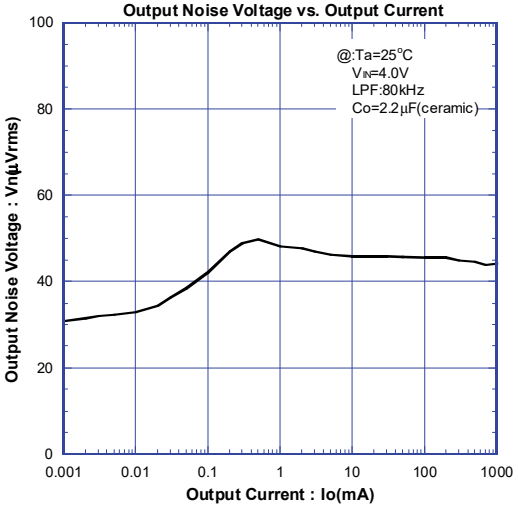
NJM2846_3.0V
Peak Output Current vs. Input Voltage



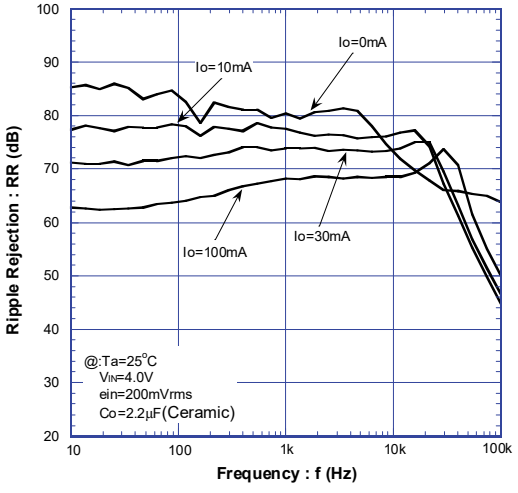
NJM2846_3.0V
Quiescent Current v.s. Input Voltage



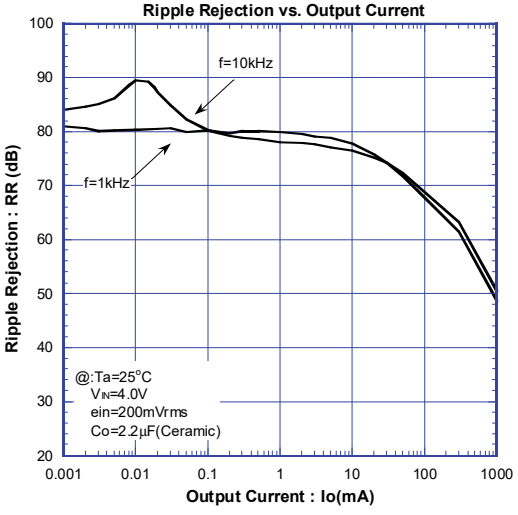
NJM2846_3.0V
Output Noise Voltage vs. Output Current



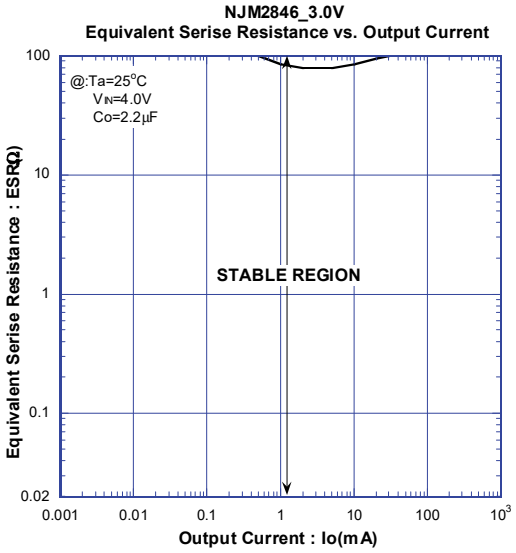
NJM2846_3.0V
Ripple Rejection Ratio v.s. Frequency

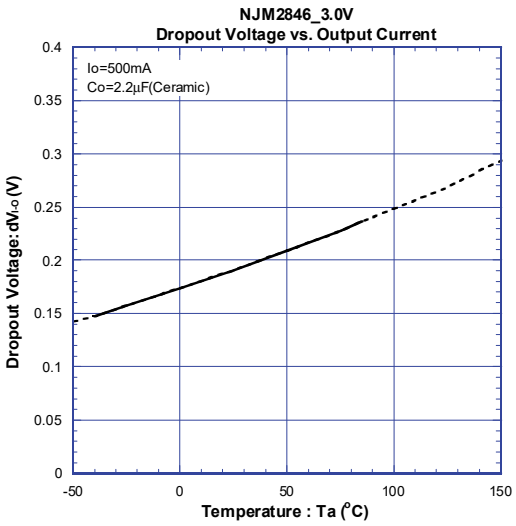


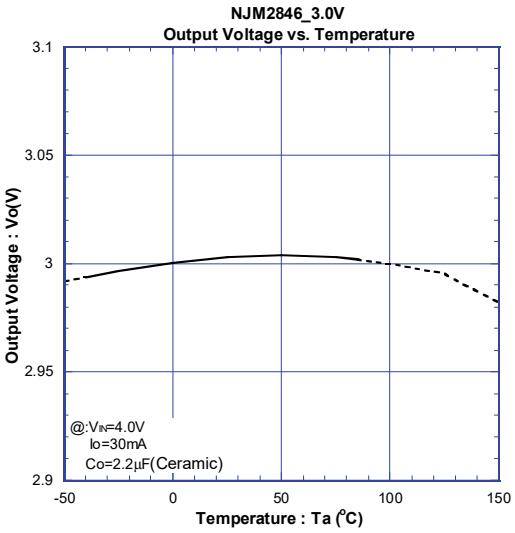
NJM2846_3.0V
Ripple Rejection vs. Output Current

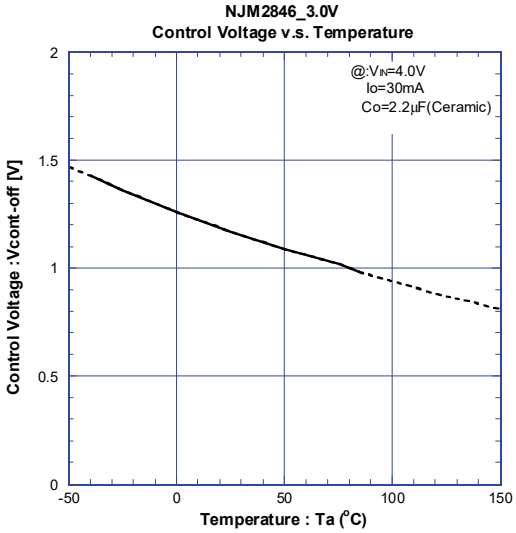


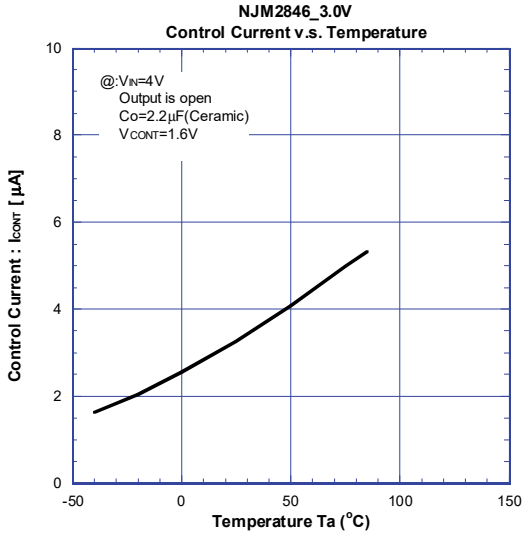
■ TYPICAL CHARACTERISTICS (NJM2846)





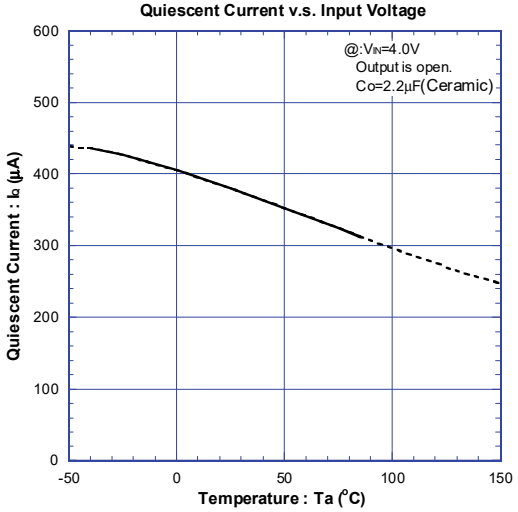




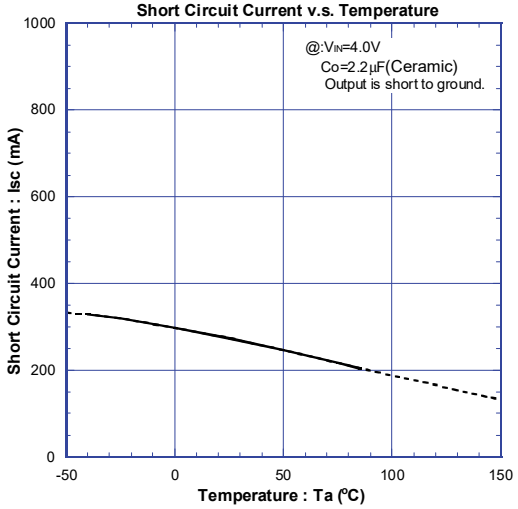


■ TYPICAL CHARACTERISTICS (NJM2846)

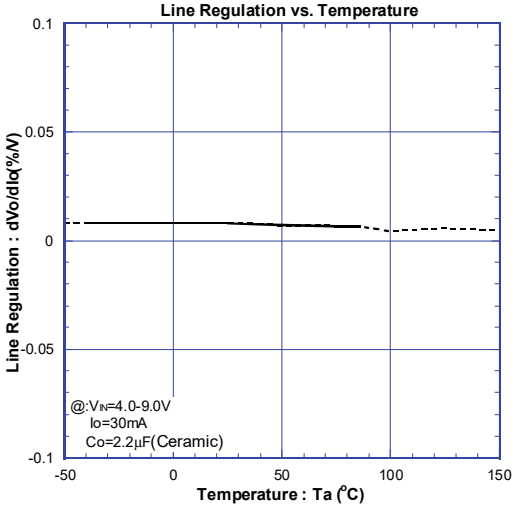
NJM2846_3.0V
Quiescent Current v.s. Input Voltage



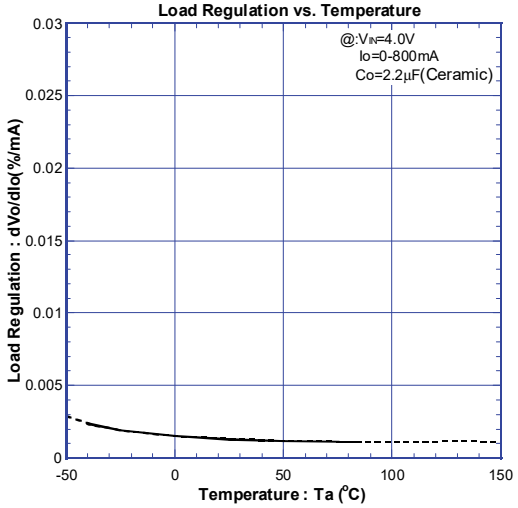
NJM2846_3.0V
Short Circuit Current v.s. Temperature



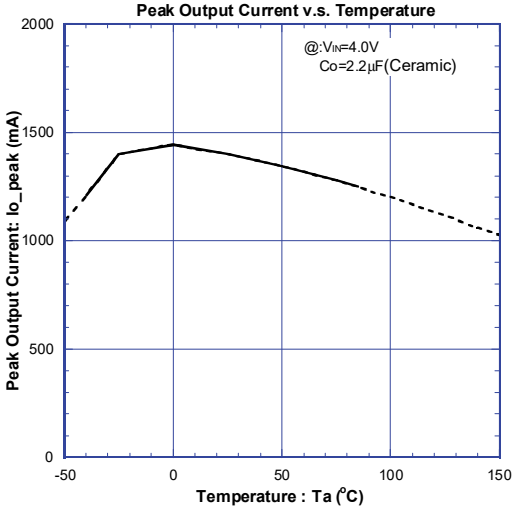
NJM2846_3.0V
Line Regulation vs. Temperature



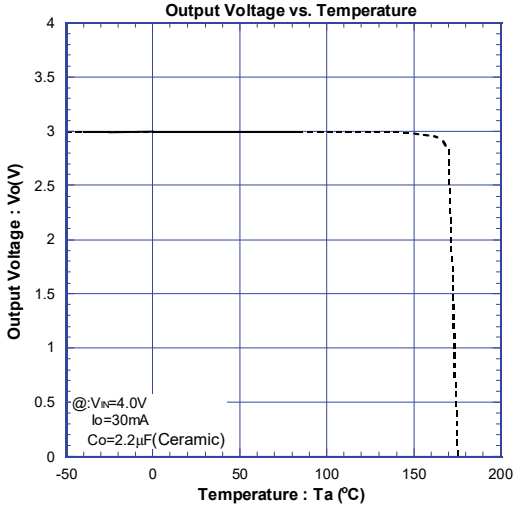
NJM2846_3.0V
Load Regulation vs. Temperature



NJM2846_3.0V
Peak Output Current v.s. Temperature

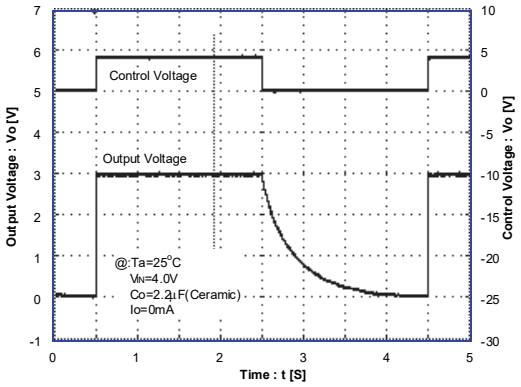


NJM2846_3.0V
Output Voltage vs. Temperature

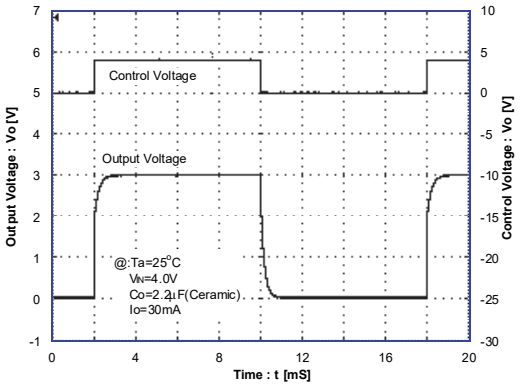


■ TYPICAL CHARACTERISTICS (NJM2846)

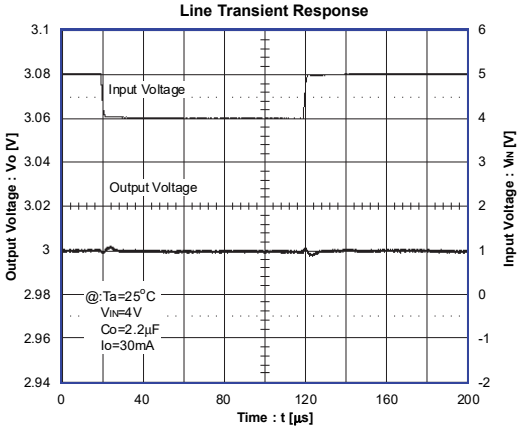
NJM2846_3.0V
ON/OFF Transient Response without Load



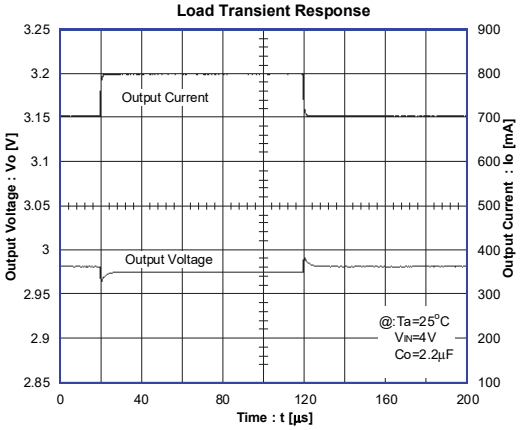
NJM2846_3.0V
ON/OFF Transient Response with Load



NJM2846_3V
Line Transient Response



NJM2846_3V
Load Transient Response



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