LOW DROPOUT VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

The NJM2831 is a 100mA output low dropout voltage regulator with ON/OFF control.

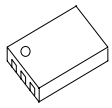
Advanced Bipolar technology achieves low noise, high ripple rejection and low quiescent current.

2.1V to 15.5V output voltage range, 1μF small decoupling capacitor, built-in noise bypass capacitor make the NJM2831 suitable for various applications.

■ PACKAGE OUTLINE



NJM2831F

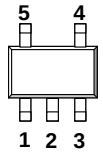


NJM2831KG1

■ FEATURES

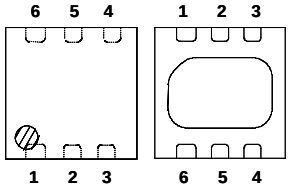
- Output voltage options available 2.1 ~ 15.5V (0.1V step)
- High Ripple Rejection 75dB typ. (f=1kHz Vo=3V Version)
- Output Noise Voltage Vno=45μVrms typ.
- Output capacitor with 1.0μF ceramic capacitor (Vo≥5.1V)
- Output Current Io(max.)=100mA
- High Precision Output Vo±1.0%
- Low Dropout Voltage 0.10V typ. (Io=60mA)
- ON/OFF Control (Active High)
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline SOT-23-5, ESON6-G1

■ PIN CONFIGURATION



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

NJM2831F

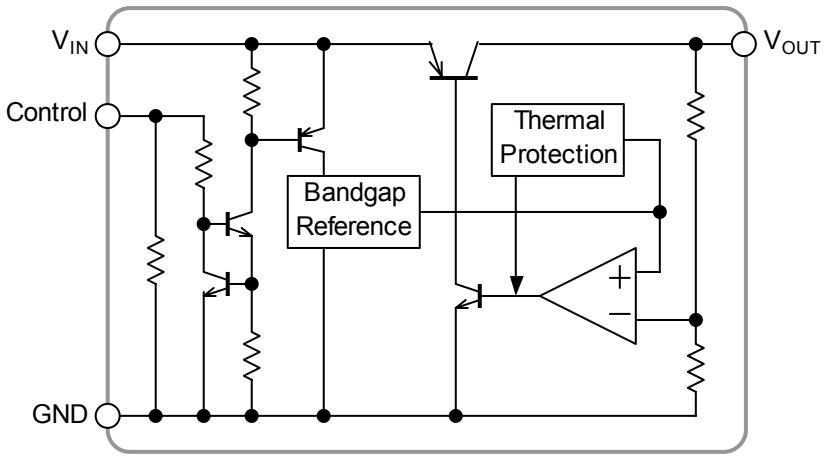


Exposed Pad
(connected to GND)

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

NJM2831KG1

■ EQUIVALENT CIRCUIT



■ OUTPUT VOLTAGE

The WHITE column shows applicable Voltage Rank(s)

Device Name	Vout	Device Name	Vout	Device Name	Vout
NJM2831F-21	2.1V	NJM2831F-41	4.1V	NJM2831F-116	11.6V
NJM2831F-22	2.2V	NJM2831F-42	4.2V	NJM2831F-12	12.0V
NJM2831F-23	2.3V	NJM2831F-43	4.3V	NJM2831F-125	12.5V
NJM2831F-24	2.4V	NJM2831F-44	4.4V	NJM2831F-13	13.0V
NJM2831F-25	2.5V	NJM2831F-45	4.5V	NJM2831F-135	13.5V
NJM2831F-26	2.6V	NJM2831F-46	4.6V	NJM2831F-15	15.0V
NJM2831F-27	2.7V	NJM2831F-47	4.7V	NJM2831F-155	15.5V
NJM2831F-28	2.8V	NJM2831F-48	4.8V		
NJM2831F-29	2.9V	NJM2831F-49	4.9V		
NJM2831F-03	3.0V	NJM2831F-05	5.0V		
NJM2831F-31	3.1V	NJM2831F-53	5.3V		
NJM2831F-32	3.2V	NJM2831F-06	6.0V		
NJM2831F-33	3.3V	NJM2831F-64	6.4V		
NJM2831F-34	3.4V	NJM2831F-07	7.0V		
NJM2831F-35	3.5V	NJM2831F-08	8.0V		
NJM2831F-36	3.6V	NJM2831F-82	8.2V		
NJM2831F-37	3.7V	NJM2831F-85	8.5V		
NJM2831F-38	3.8V	NJM2831F-09	9.0V		
NJM2831F-39	3.9V	NJM2831F-92	9.2V		
NJM2831F-04	4.0V	NJM2831F-10	10.0V		

ESON Type Available Voltage Rank(s)

Device Name	Vout	Device Name	Vout	Device Name	Vout
NJM2831KG1-33	3.3V	NJM2831KG1-52	5.2V		

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS		UNIT
Input Voltage	V_{IN}	+20		V
Control Voltage	V_{CONT}	+20(*1)		V
Power Dissipation	P_D	SOT-23-5	500(*2)	mW
			250(*3)	
		ESON6	420(*4)	
			1135(*5)	
Operating Temperature	Topr	-40~+85		°C
Storage Temperature	Tstg	-40~+150		°C

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

(*2): Mounted on glass epoxy board based on EIA/JEDEC. (114.3x76.2x1.6mm: 2Layers)

(*3): Device itself.

(*4): Mounted on glass epoxy board based on EIA/JEDEC STANDARD.
(101.5×114.5×1.6mm: 2Layers FR-4, copper area 100mm^2)

(*5): Mounted on glass epoxy board based on EIA/JEDEC STANDARD. (101.5 × 114.5 × 1.6mm: 4Layers FR-4, Internal foil area size: 99.5 × 99.5mm, Applying a thermal via hole to a board based on JEDEC standard JESD51-5)

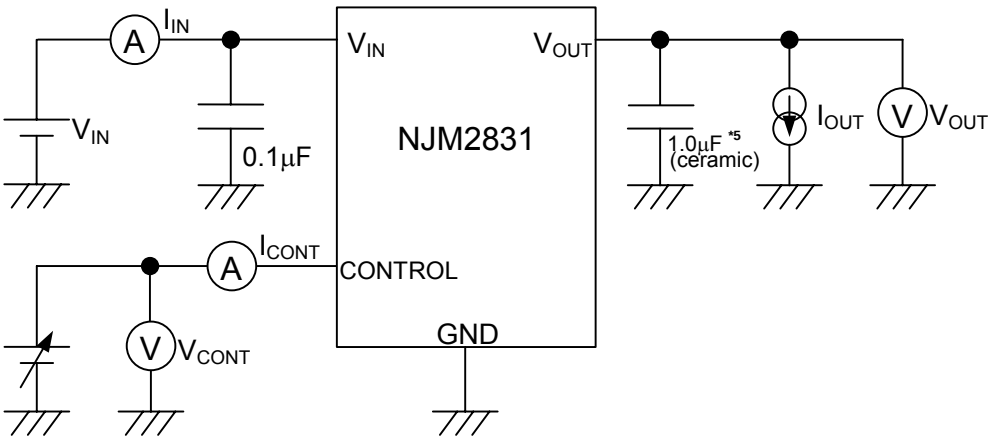
■ ELECTRICAL CHARACTERISTICS

(V_{IN}= Vo+1V, C_{IN}=0.1μF, Co=1.0μF (2.8V<Vo≤5.4V:Co=2.2μF, Vo≤2.8V: Co=4.7μF),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, except Icont	Vo≤5V Version	–	120	180	μA
			5V<Vo≤10V Version	–	135	195	μA
			10V<Vo≤15V Version	–	150	210	μA
Quiescent Current at Control OFF	$I_{Q(OFF)}$	V_{CONT}=0V		–	–	100	nA
Output Current	Io	Vo-0.3V		100	130	–	mA
Line Regulation	$\Delta Vo/\Delta V_{IN}$	V_{IN}=Vo+1V ~ Vo+6V(Vo≤12V Version) V_{IN}=Vo+1V ~ 18V(Vo>12V Version), Io=30mA		–	–	0.10	%/V
Load Regulation	ΔVo/ΔIo	Io=0 ~ 60mA		–	–	0.03	%/mA
Dropout Voltage(*4)	ΔV_{I-O}	Io=60mA		–	0.10	0.18	V
Ripple Rejection	RR	ein=200mVrms,f=1kHz,Io=10mA, Vo=3V Version		–	75	–	dB
Average Temperature Coefficient of Output Voltage	ΔVo/ΔTa	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	Icont	V_{CONT}=1.6V			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
Input Voltage	V_{IN}			–	–	18	V

(*4): 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.

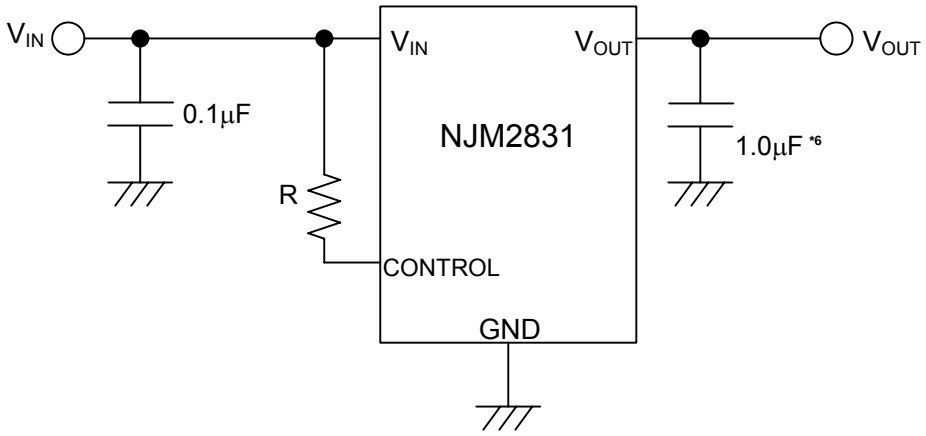
■ TEST CIRCUIT



*5 2.8V<Vo≤5.4V version: Co=2.2μF(ceramic)
Vo≤2.8V version: Co=4.7μF(ceramic)

■ TYPICAL APPLICATIONS

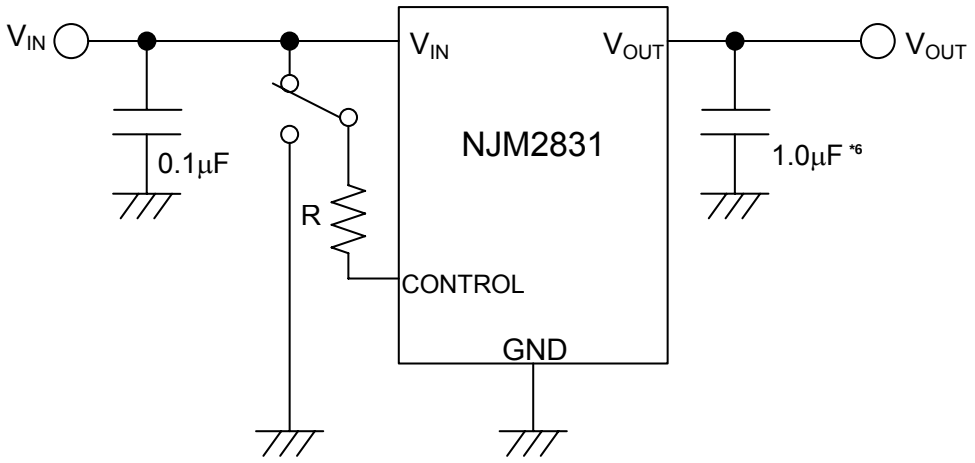
① In the case where ON/OFF Control is not required:



*6 2.8V<Vo≤5.4V version: Co=2.2μF
Vo≤2.8V version: Co=4.7μF

Connect control terminal to V_{IN} terminal

② In use of ON/OFF CONTROL:



*6 2.8V<Vo≤5.4V version: Co=2.2μF
Vo≤2.8V version: Co=4.7μF

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 0.1μF greater to avoid the problem.

C_{IN} should connect between GND and V_{IN} as short as possible.

∗Output Capacitance 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.

This product is designed to work with a low ESR capacitor (C_O). However use of recommended capacitance or larger value is effective for stable operation.

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

Therefore use C_O with the recommended capacitance or larger value and connect between Vo terminal and GND terminal with shortest path. The recommended capacitance depends on the output voltage rank. Low voltage regulator requires larger value C_O. Thus, check the recommended capacitance for each output voltage rank.

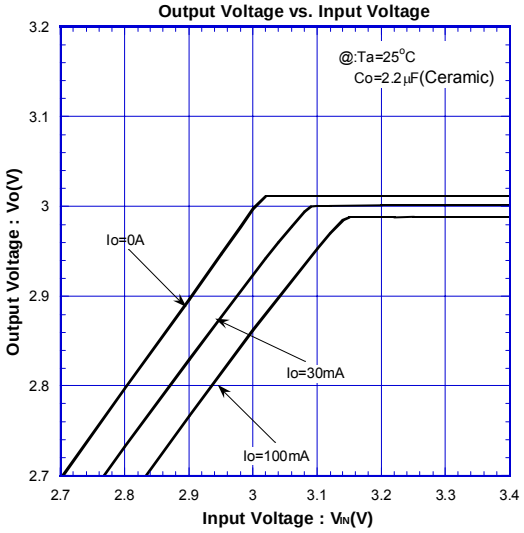
In addition, You should consider varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, a DC bias characteristic and so on) and unevenness peculiar to a capacitor supplier enough .We recommend that withstand voltage margin against output voltage and superior in a temperature characteristic, when selecting Output capacitor.

Uses of a larger C_O reduces output noise and ripple output, and also improves output transient response against rapid load change.

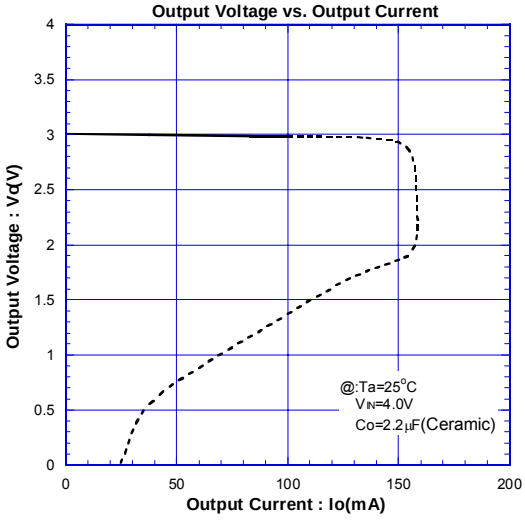
■ TYPICAL CHARACTERISTICS

●DC CHARACTERISTICS (3V Version)

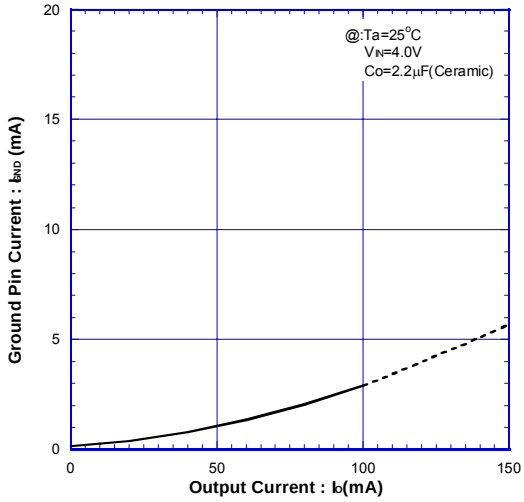
NJM2831_3.0V
Output Voltage vs. Input Voltage



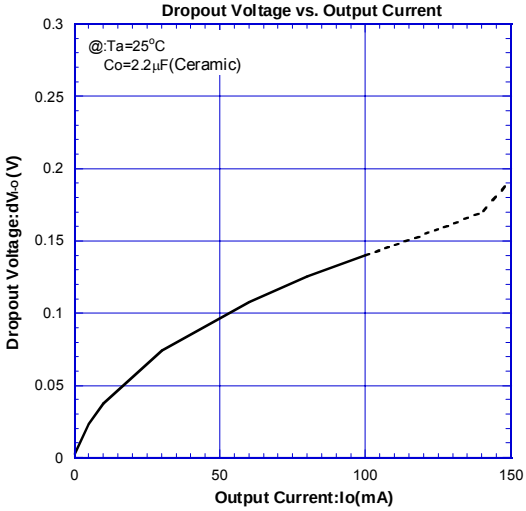
NJM2831_3.0V
Output Voltage vs. Output Current



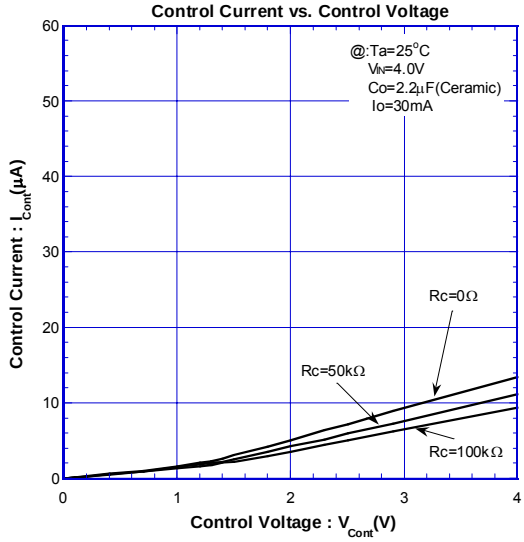
NJM2831_3.0V
Ground Pin Current v.s. Output Current



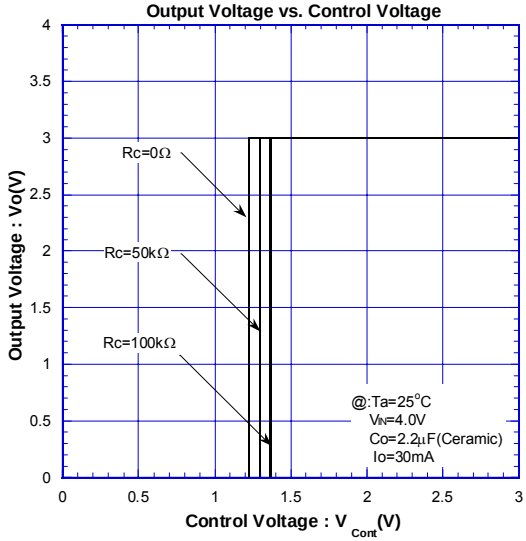
NJM2831_3.0V
Dropout Voltage vs. Output Current



NJM2831_3.0V
Control Current vs. Control Voltage

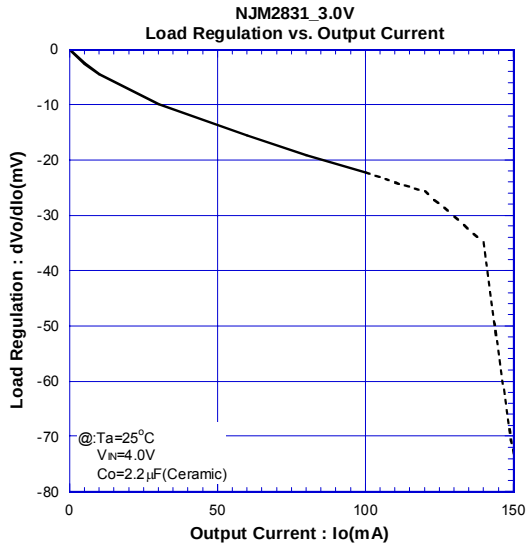


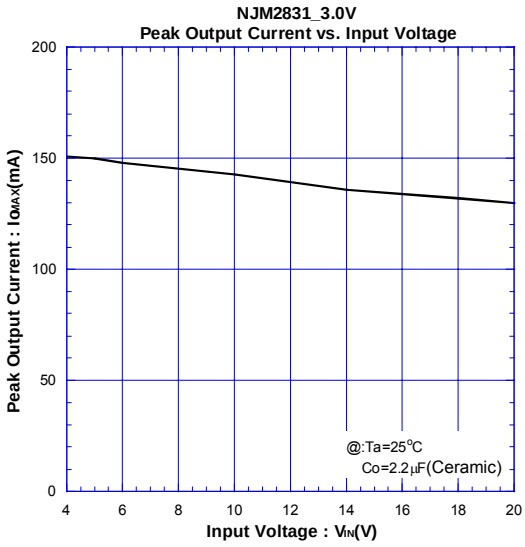
NJM2831_3.0V
Output Voltage vs. Control Voltage

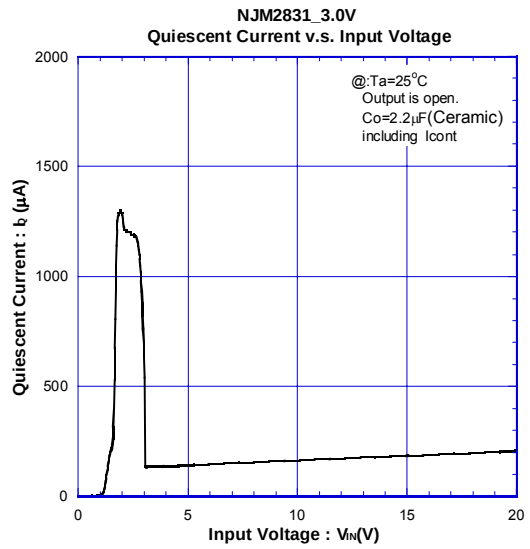


■ TYPICAL CHARACTERISTICS

●DC CHARACTERISTICS (3V Version)



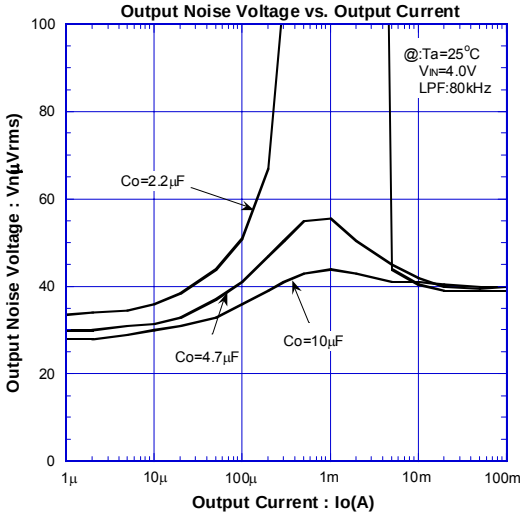




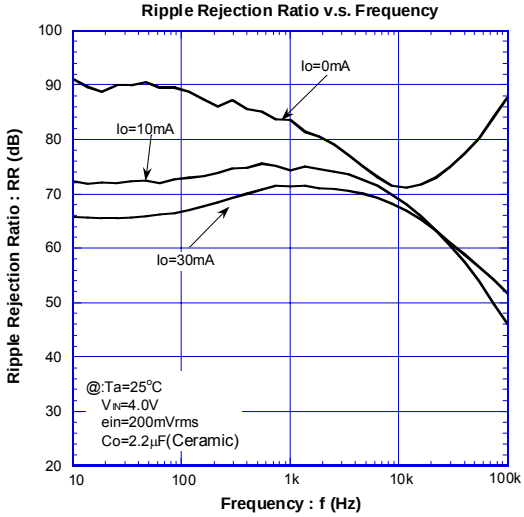
■ TYPICAL CHARACTERISTICS

●AC CHARACTERISTICS (3V Version)

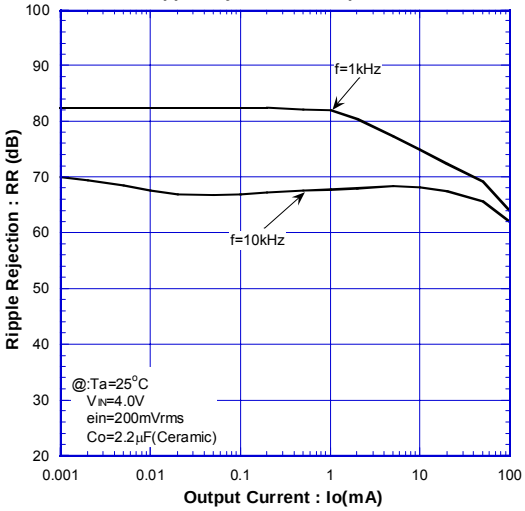
NJM2831_3.0V
Output Noise Voltage vs. Output Current



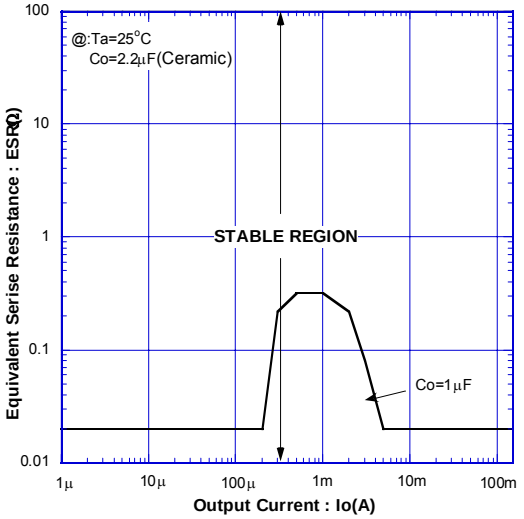
NJM2831_3.0V
Ripple Rejection Ratio v.s. Frequency



NJM2831_3.0V
Ripple Rejection vs. Output Current



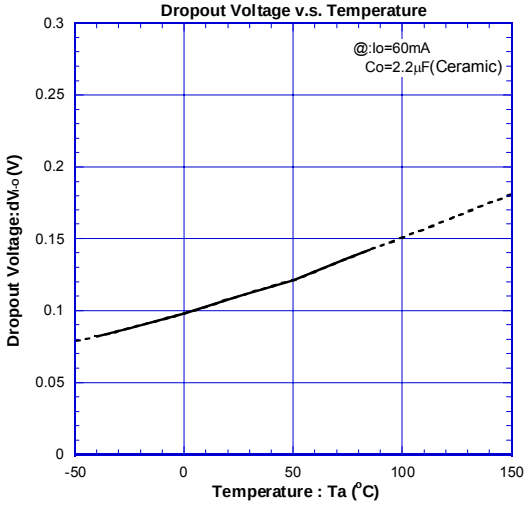
NJM2831_3.0V
Equivalent Serise Resistance vs. Output Current



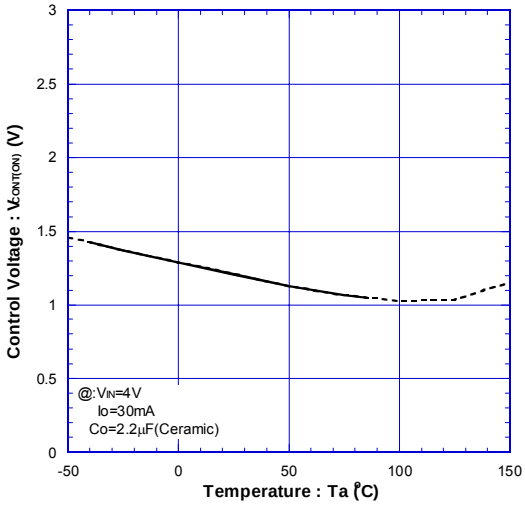
■ TYPICAL CHARACTERISTICS

●TEMPERATURE CHARACTERISTICS (3V Version)

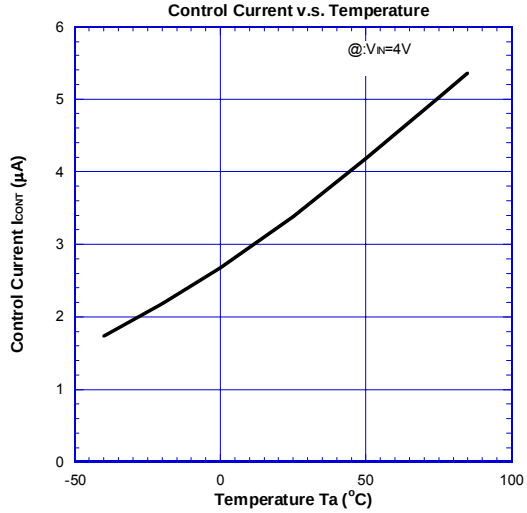
NJM2831_3.0V
Dropout Voltage v.s. Temperature



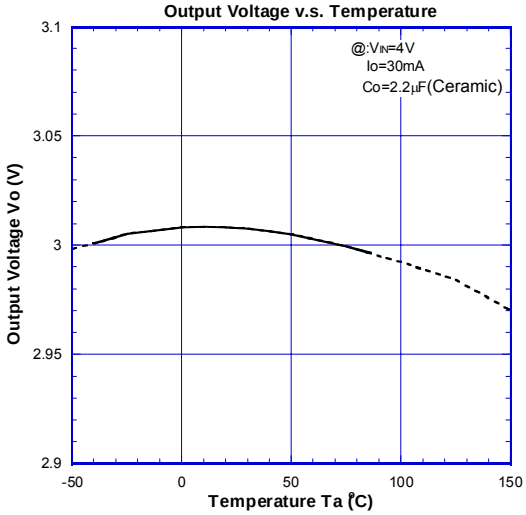
NJM2831_3.0V
Control Voltage v.s. Temperature



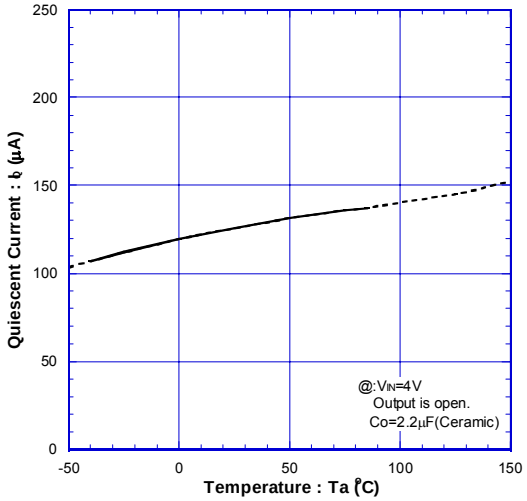
NJM2831_3.0V
Control Current v.s. Temperature



NJM2831_3.0V
Output Voltage v.s. Temperature



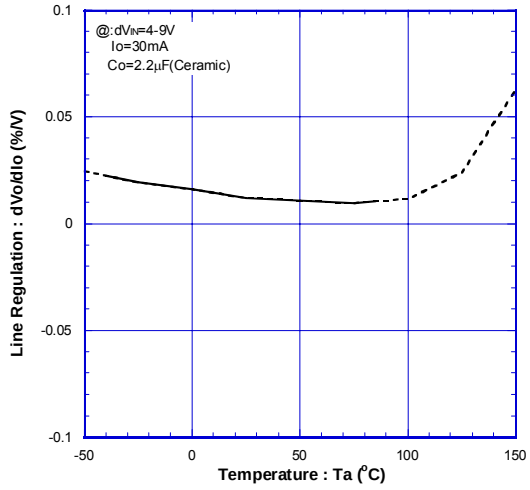
NJM2831_3.0V
Quiescent Current v.s. Temperature



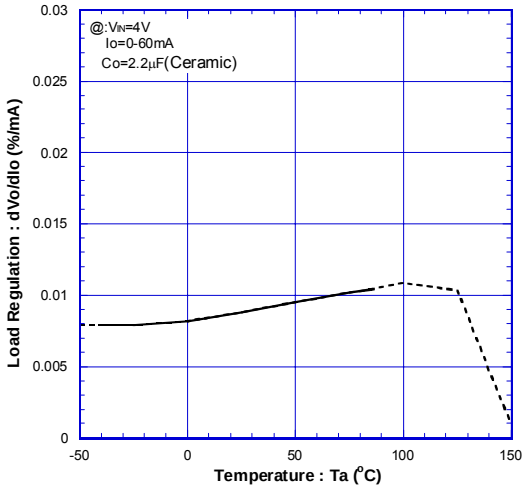
■ TYPICAL CHARACTERISTICS

●TEMPERATURE CHARACTERISTICS (3V Version)

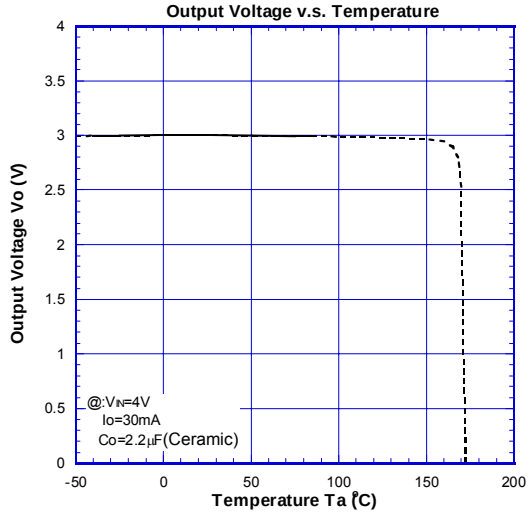
NJM2831_3.0V
Line Regulation v.s. Temperature



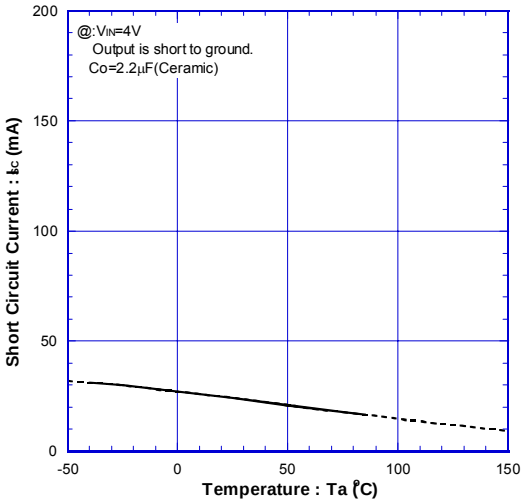
NJM2831_3.0V
Load Regulation v.s. Temperature



NJM2831_3.0V
Output Voltage v.s. Temperature

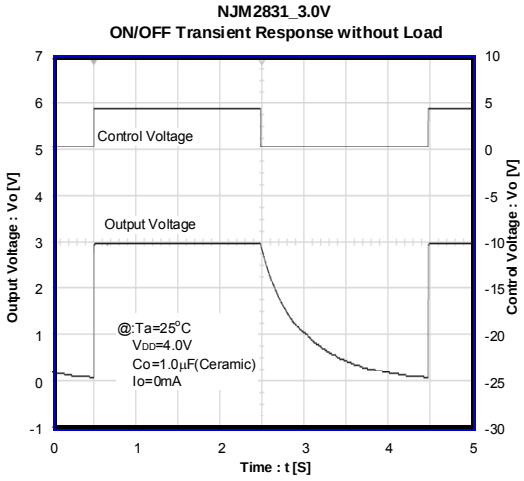


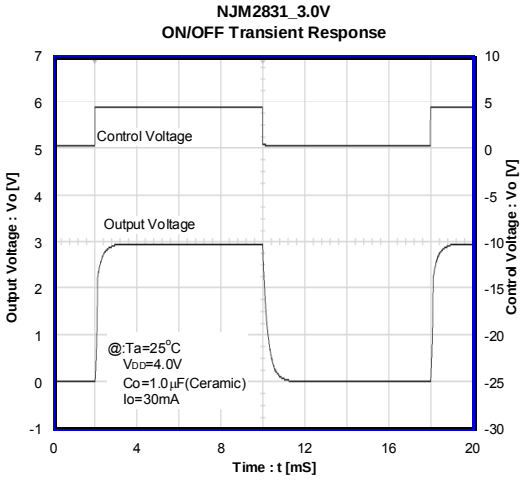
NJM2831_3.0V
Short Circuit Current v.s. Temperature

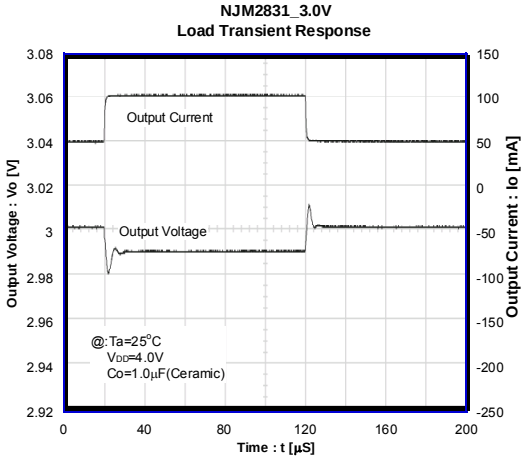


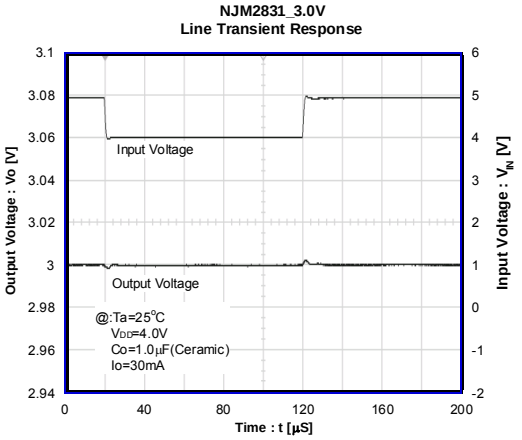
■ TYPICAL CHARACTERISTICS

●TRANSIENT RESPONSE (3V Version)



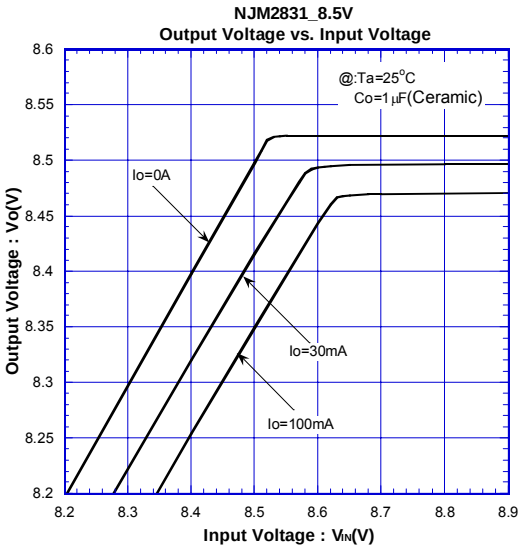


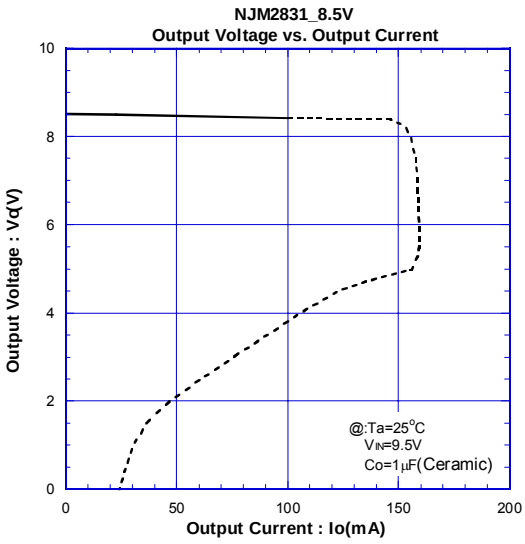


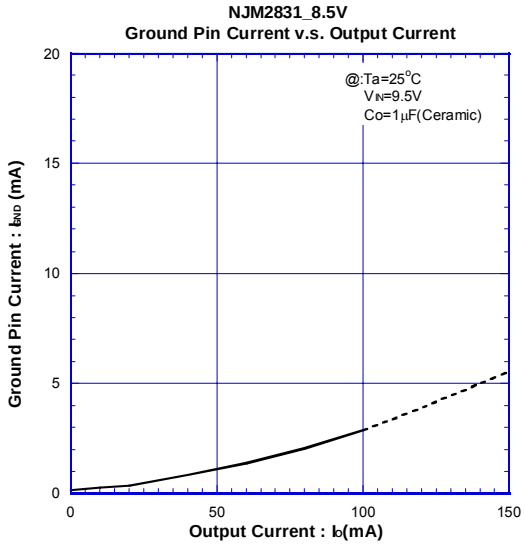


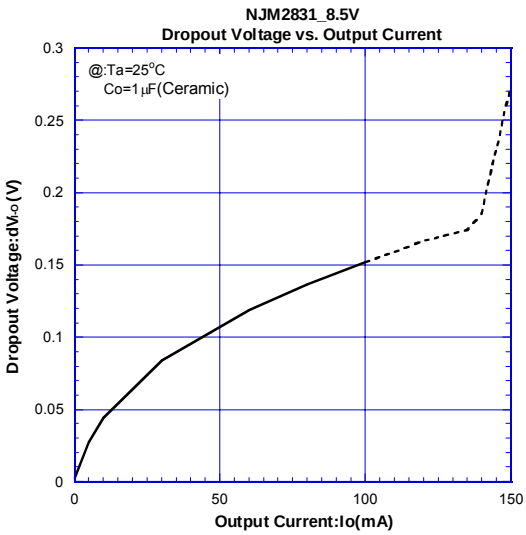
■ TYPICAL CHARACTERISTICS

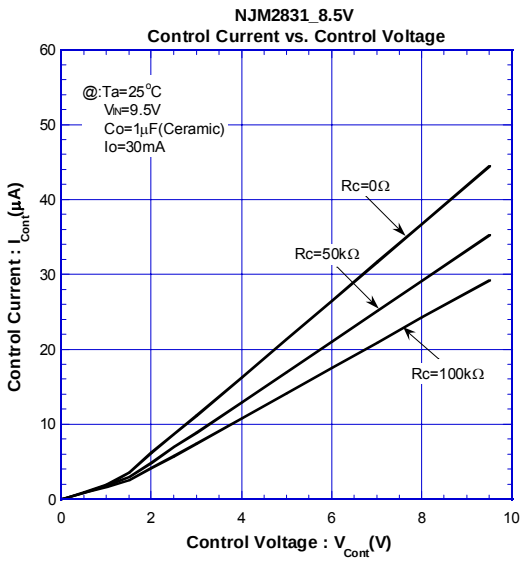
●DC CHARACTERISTICS (8.5V Version)

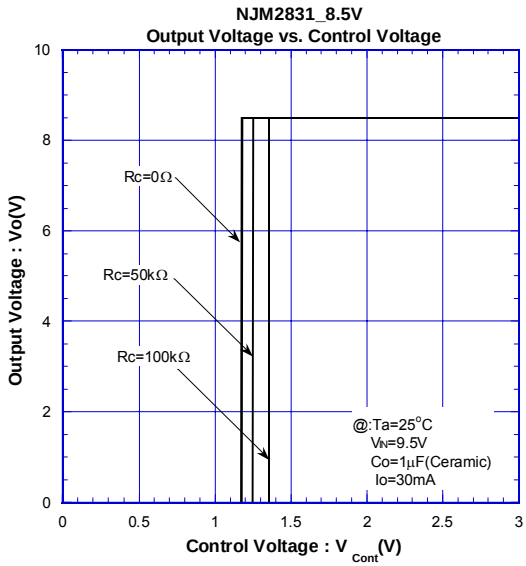






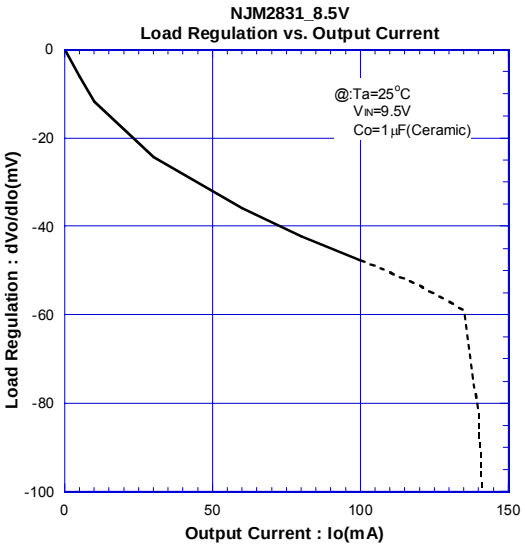


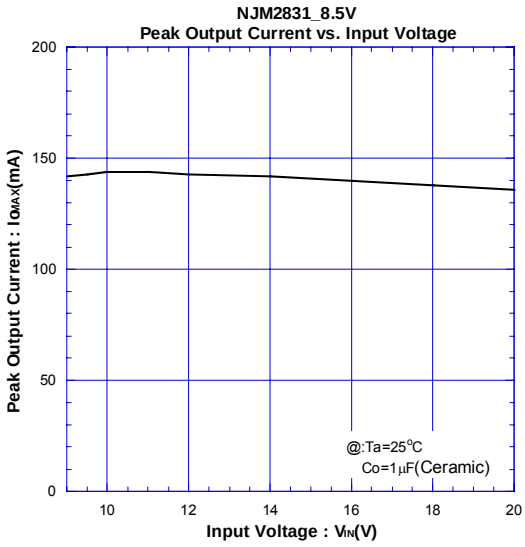


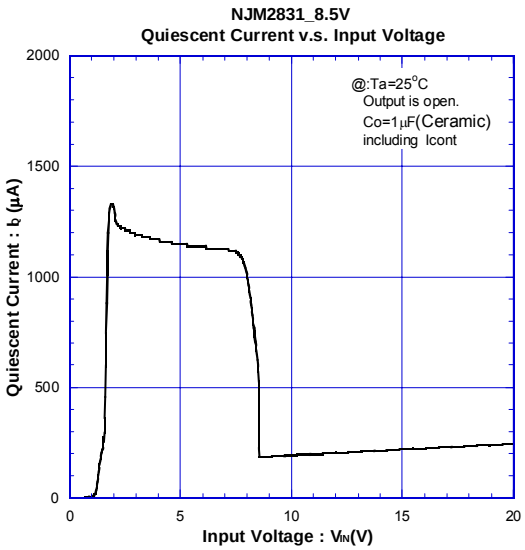


■ TYPICAL CHARACTERISTICS

●DC CHARACTERISTICS (8.5V Version)

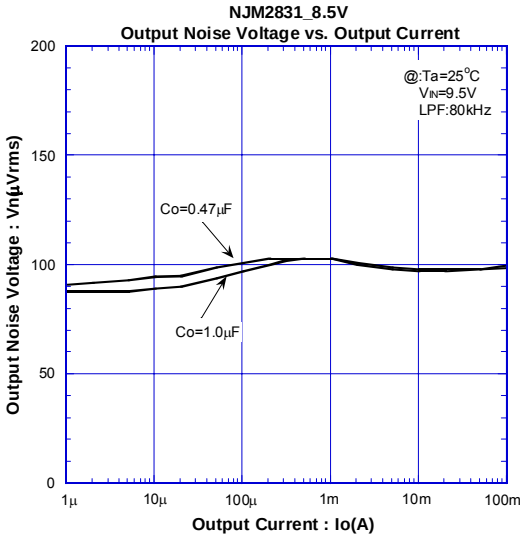


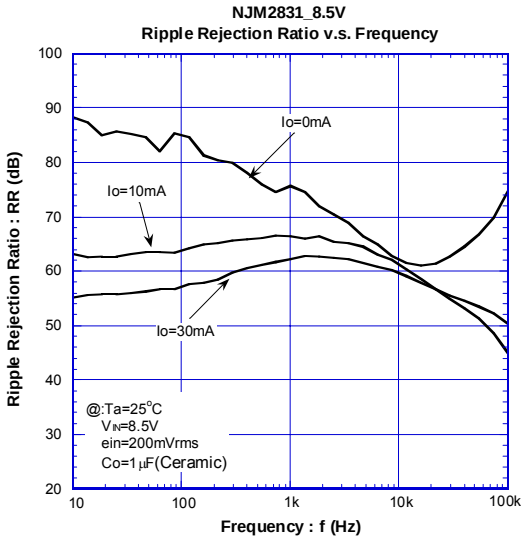


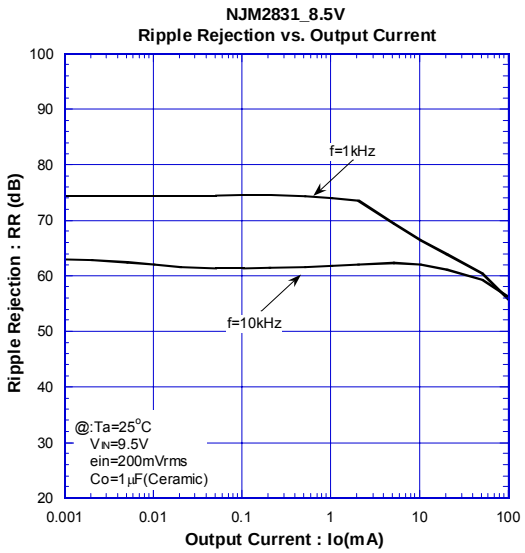


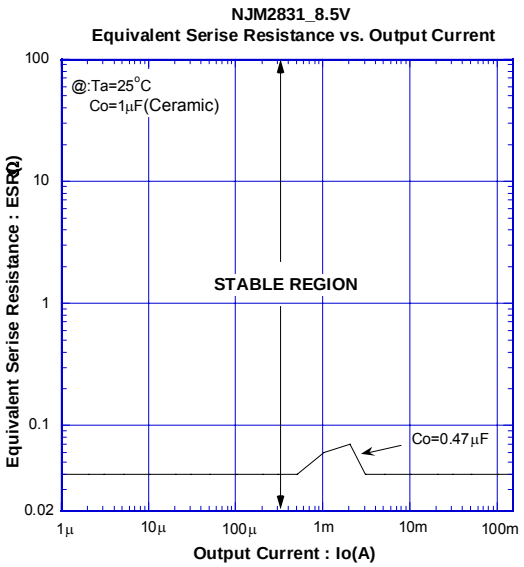
■ TYPICAL CHARACTERISTICS

●AC CHARACTERISTICS (8.5V Version)





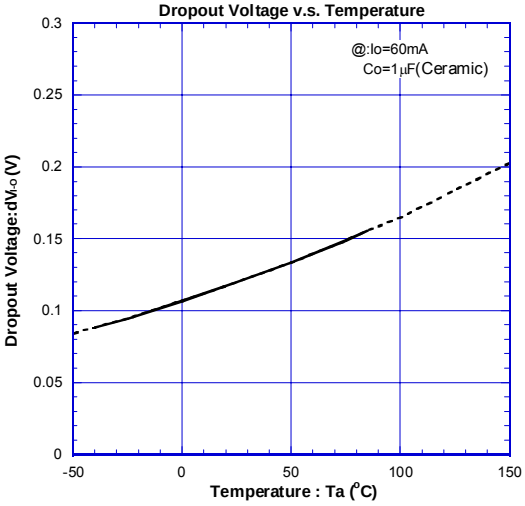




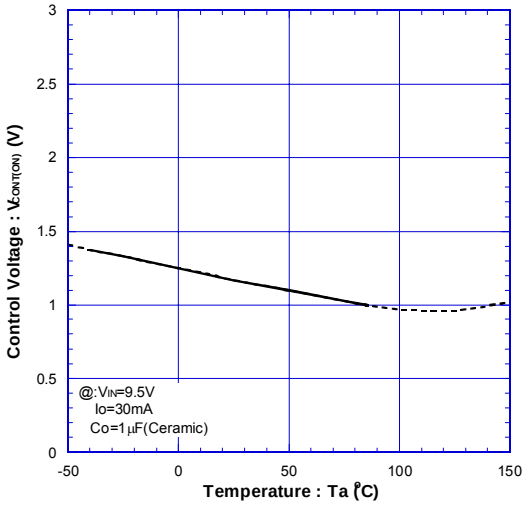
■ TYPICAL CHARACTERISTICS

●TEMPERATURE CHARACTERISTICS (8.5V Version)

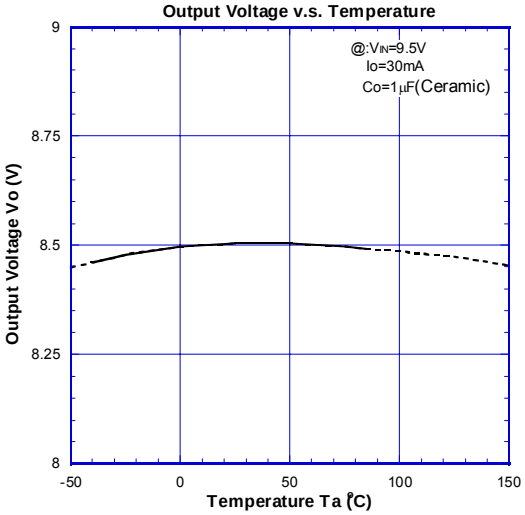
NJM2831_8.5V
Dropout Voltage v.s. Temperature



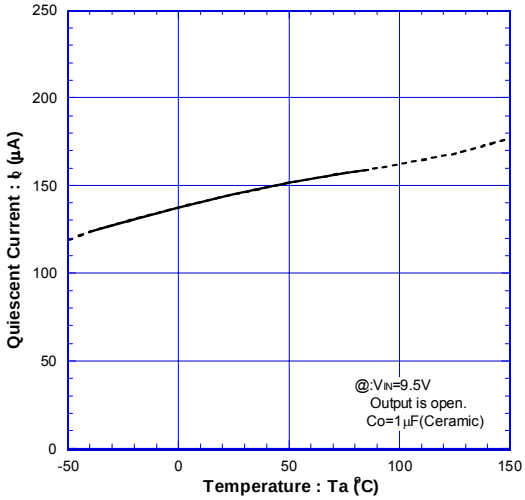
NJM2831_8.5V
Control Voltage v.s. Temperature



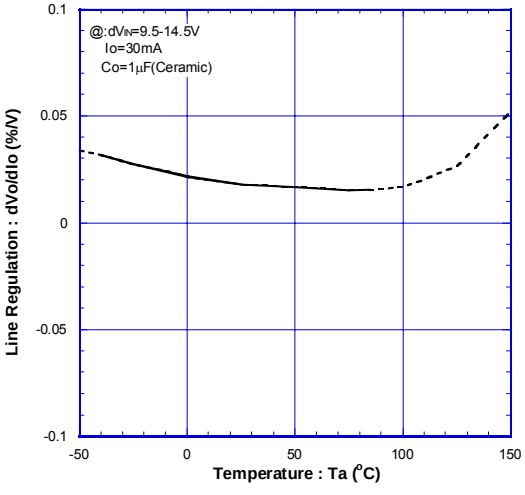
NJM2831_8.5V
Output Voltage v.s. Temperature



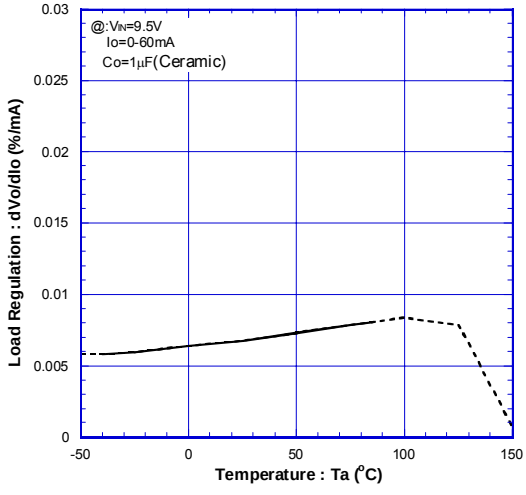
NJM2831_8.5V
Quiescent Current v.s. Temperature



NJM2831_8.5V
Line Regulation v.s. Temperature

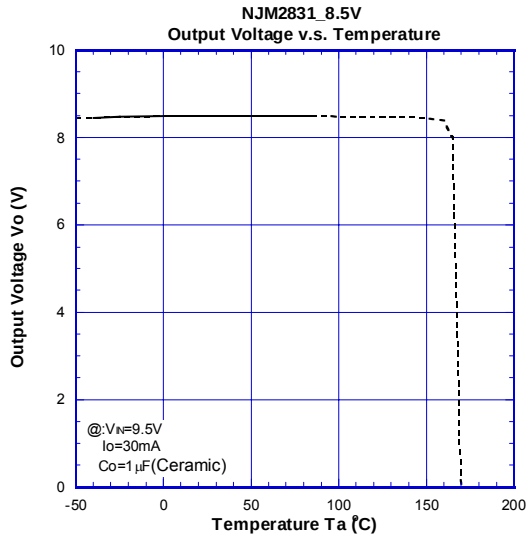


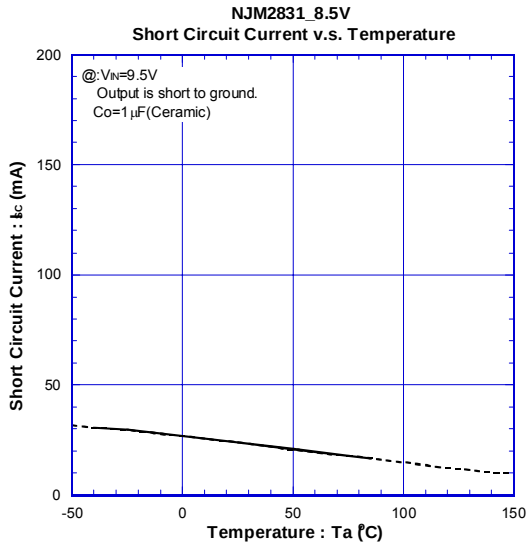
NJM2831_8.5V
Load Regulation v.s. Temperature



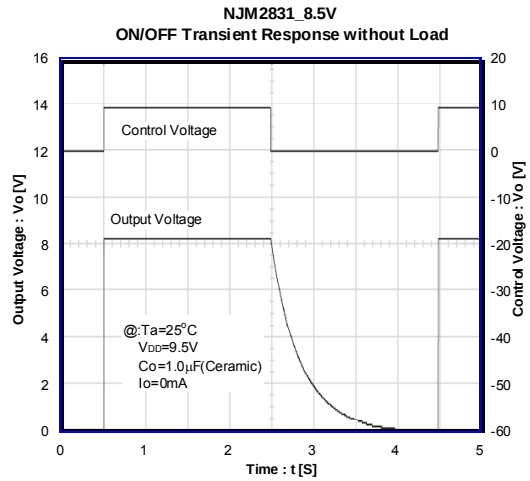
■ TYPICAL CHARACTERISTICS

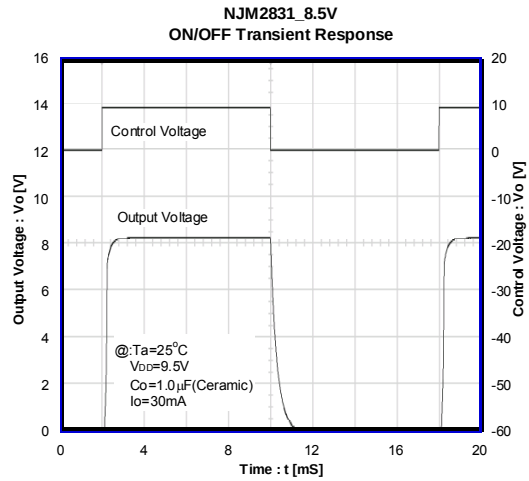
●TEMPERATURE CHARACTERISTICS (8.5V Version)

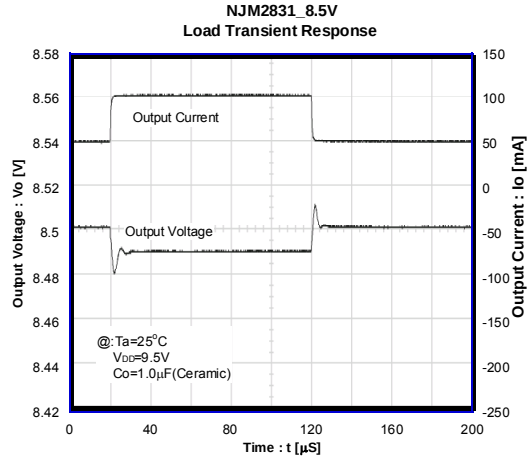


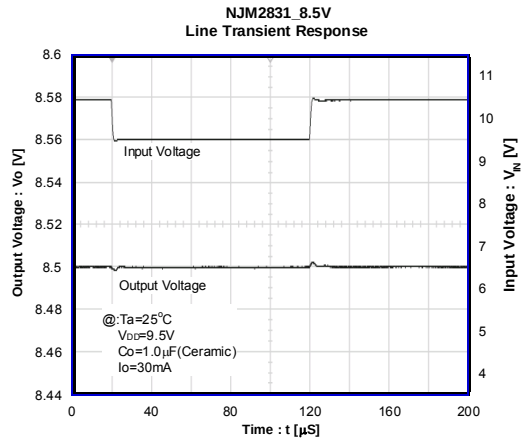


●TRANSIENT RESPONSE (8.5V Version)





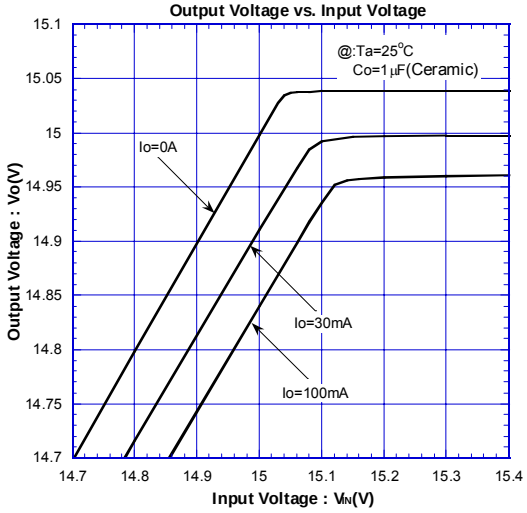




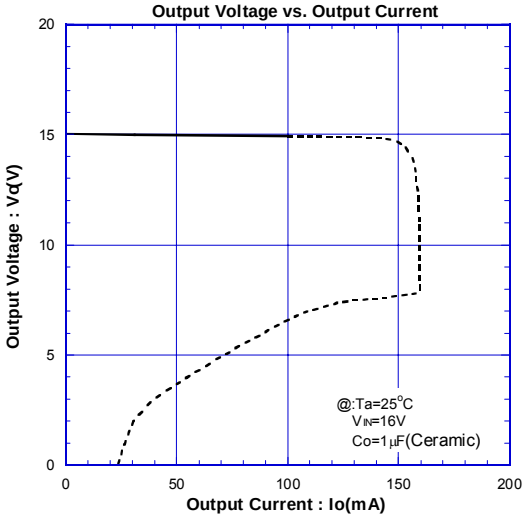
■ TYPICAL CHARACTERISTICS

●DC CHARACTERISTICS (15V Version)

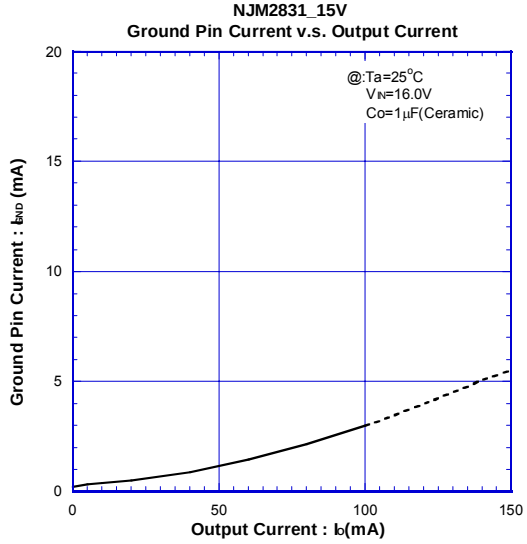
NJM2831_15V
Output Voltage vs. Input Voltage



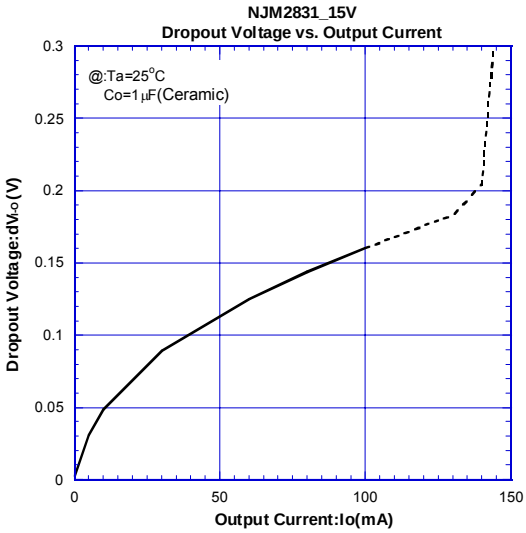
NJM2831_15V
Output Voltage vs. Output Current



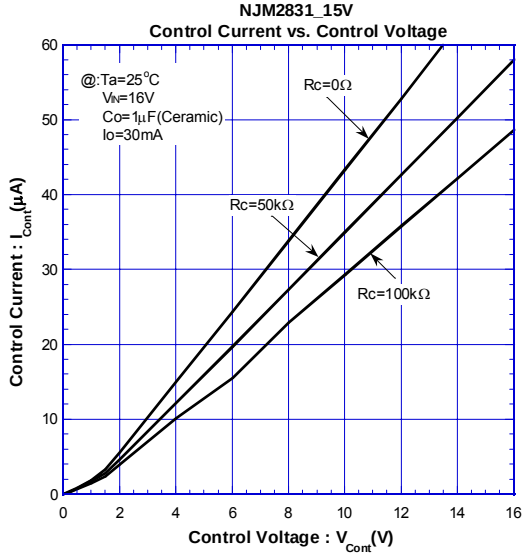
NJM2831_15V
Ground Pin Current v.s. Output Current



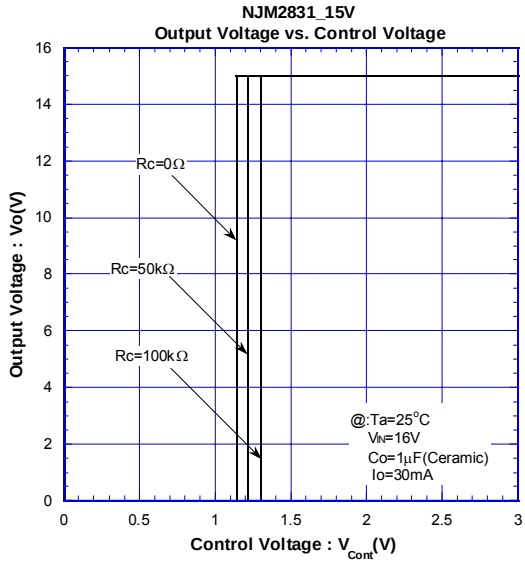
NJM2831_15V
Dropout Voltage vs. Output Current



NJM2831_15V
Control Current vs. Control Voltage

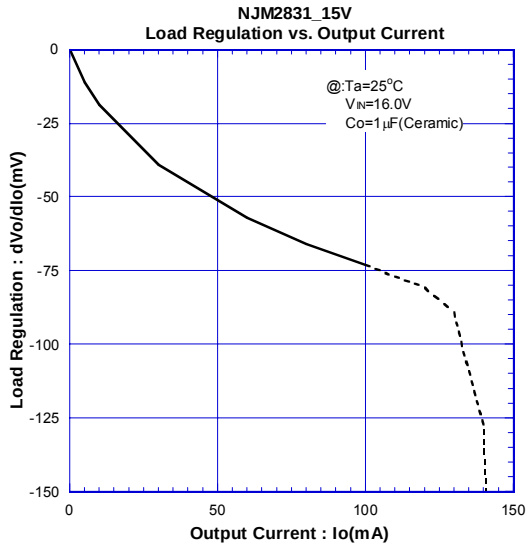


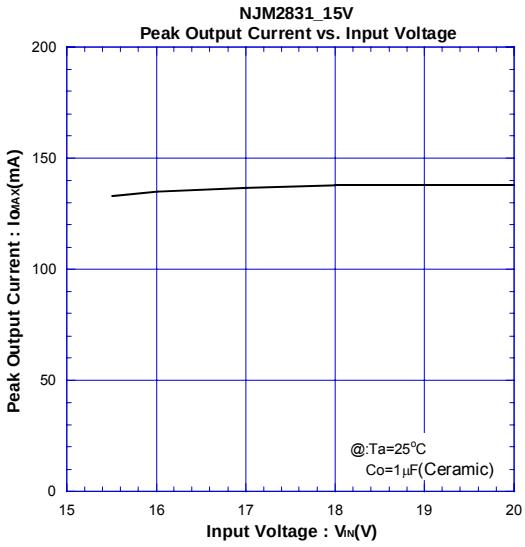
NJM2831_15V
Output Voltage vs. Control Voltage

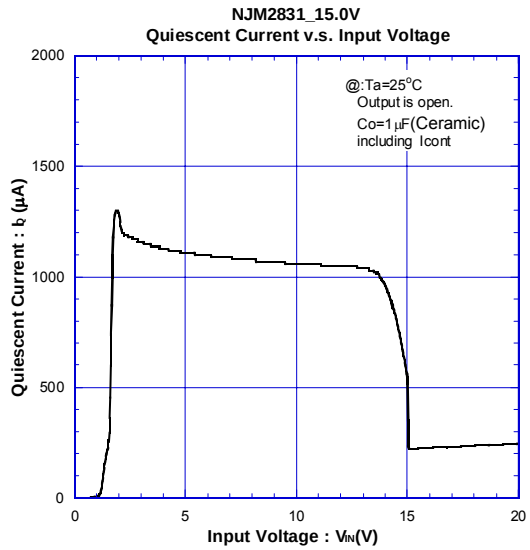


■ TYPICAL CHARACTERISTICS

●DC CHARACTERISTICS (15V Version)



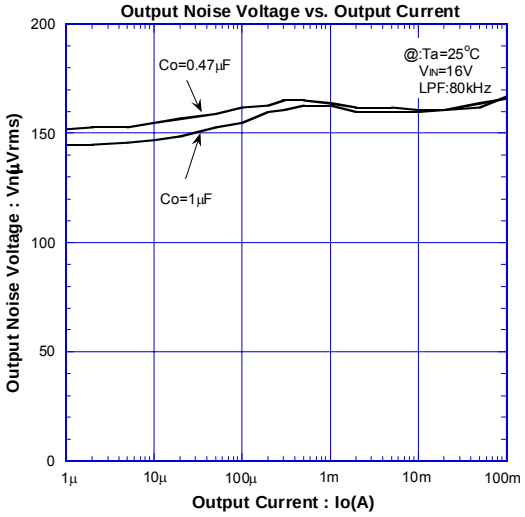




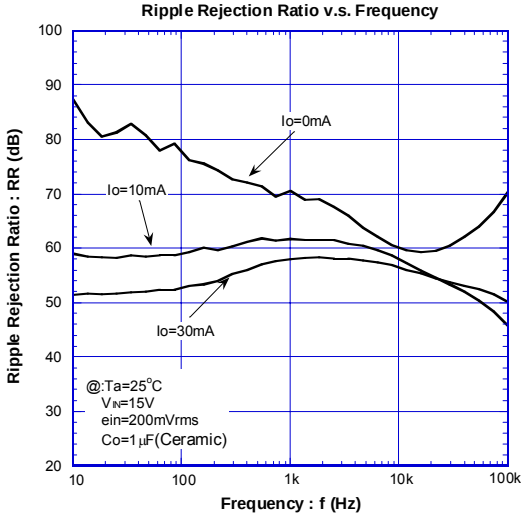
■ TYPICAL CHARACTERISTICS

●AC CHARACTERISTICS (15V Version)

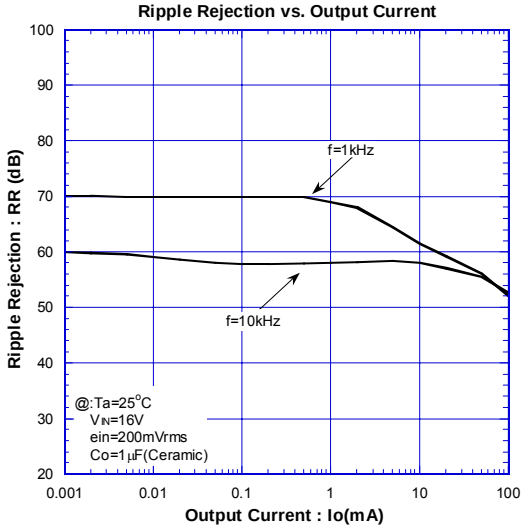
NJM2831_15V
Output Noise Voltage vs. Output Current



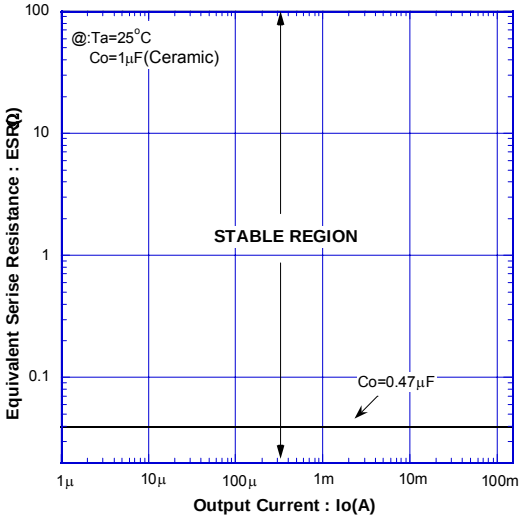
NJM2831_15V
Ripple Rejection Ratio v.s. Frequency



NJM2831_15V
Ripple Rejection vs. Output Current



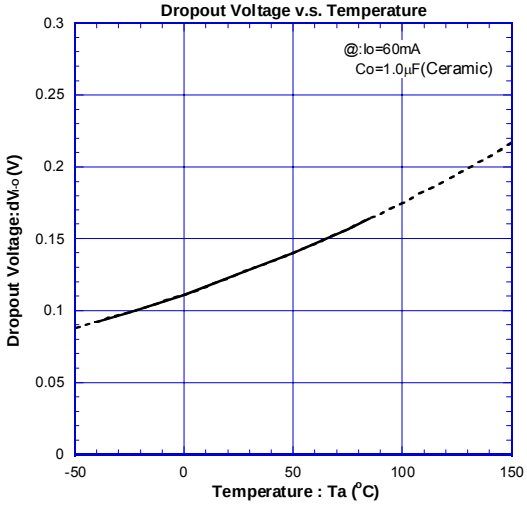
NJM2831_15V
Equivalent Serise Resistance vs. Output Current



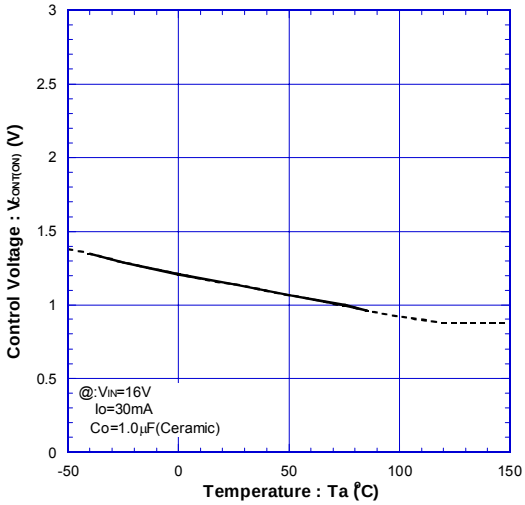
■ TYPICAL CHARACTERISTICS

●TEMPERATURE CHARACTERISTICS (15V Version)

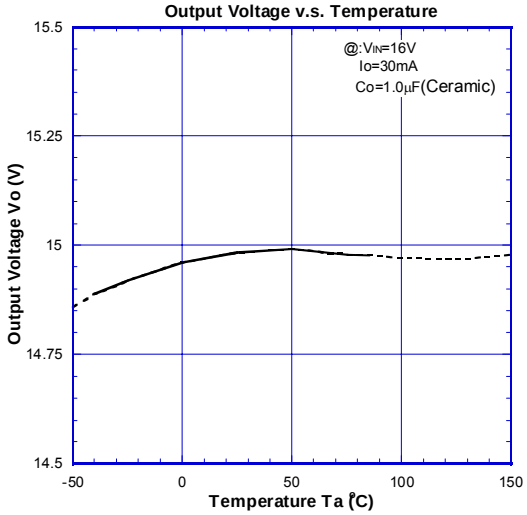
NJM2831_15V
Dropout Voltage v.s. Temperature



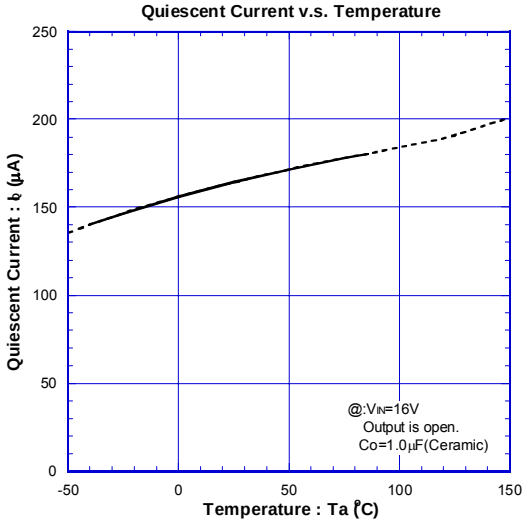
NJM2831_15V
Control Voltage v.s. Temperature



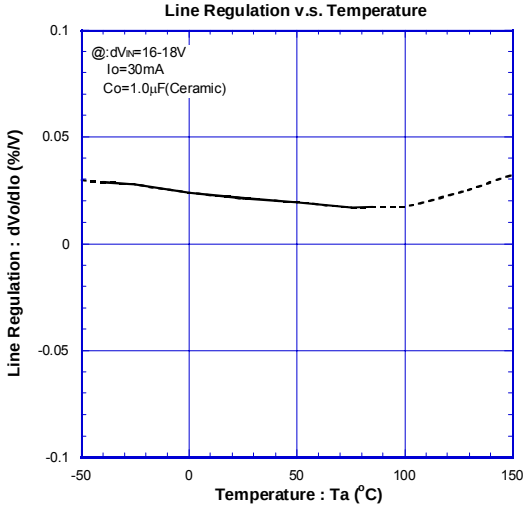
NJM2831_15V
Output Voltage v.s. Temperature



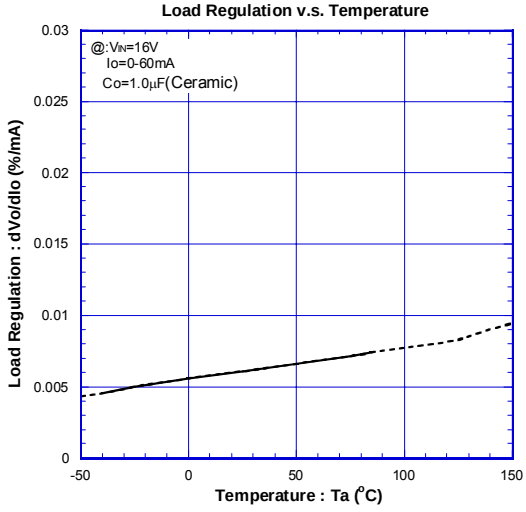
NJM2831_15V
Quiescent Current v.s. Temperature



NJM2831_15V
Line Regulation v.s. Temperature

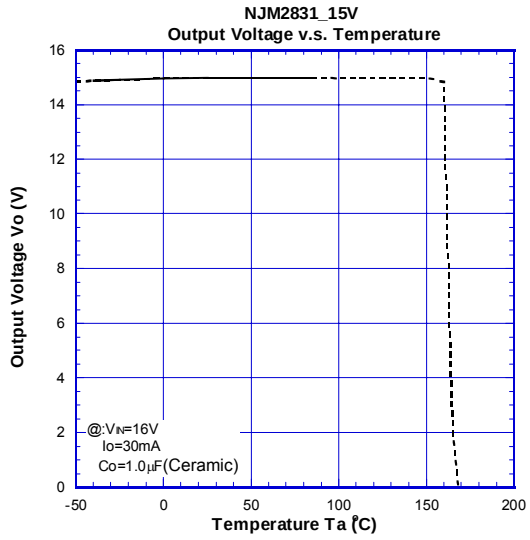


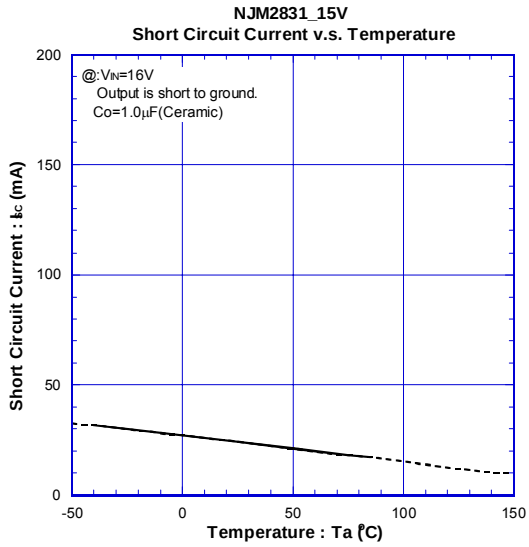
NJM2831_15V
Load Regulation v.s. Temperature



■ TYPICAL CHARACTERISTICS

●TEMPERATURE CHARACTERISTICS (15V Version)





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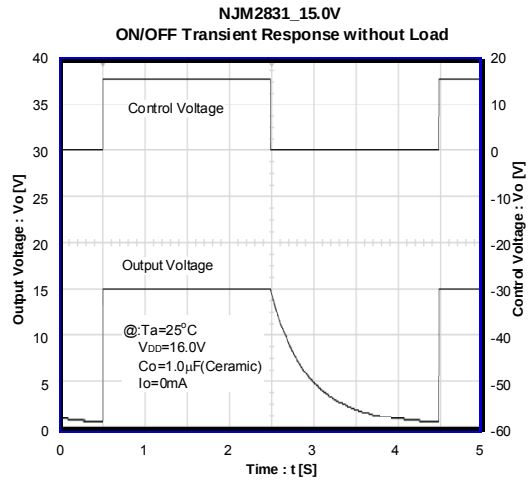

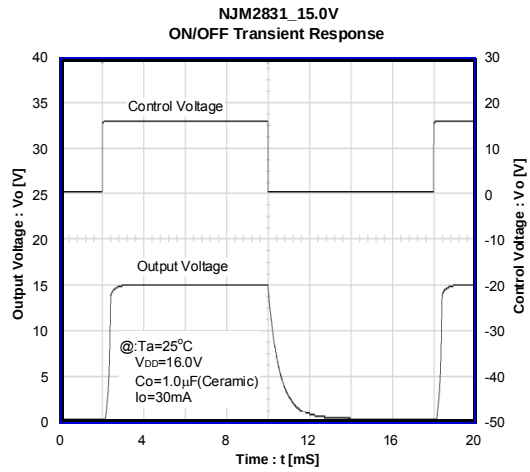

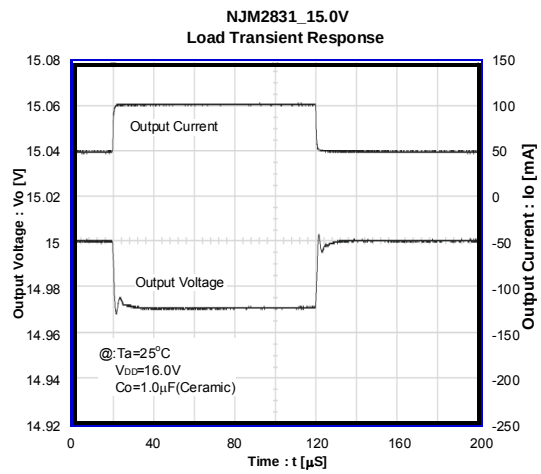

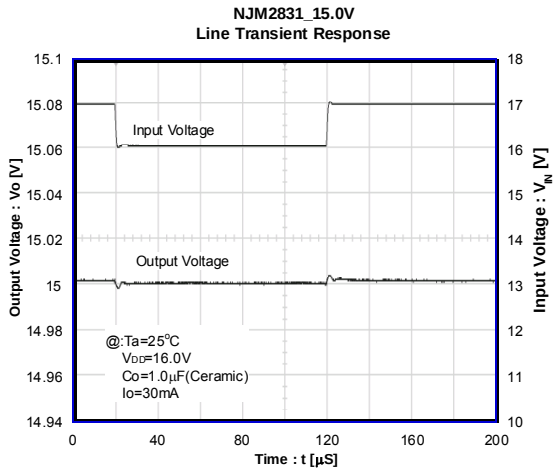

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