

## Low Dropout Voltage Regulator

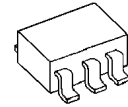
### ■ GENERAL DESCRIPTION

The NJM2878 is a 150mA output low dropout voltage regulator with ON/OFF control.

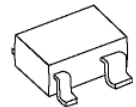
Advanced bipolar technology achieves low noise, high ripple rejection, high accuracy and low quiescent current.

Small packaging (SC-88A/SC82AB) and very small packaging (ESON4), 0.47 $\mu$ F small decoupling capacitor and built-in noise bypass capacitor make the NJM2878 suitable for space conscious applications.

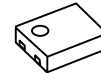
### ■ PACKAGE OUTLINE



NJM2878F3



NJM2878F4

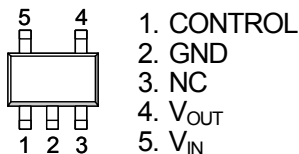


NJM2878KF1

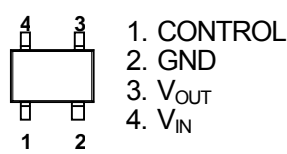
### ■ FEATURES

- High Ripple Rejection      75dB typ. (f=1kHz Vo=3V version)
- Output Noise Voltage      Vno=45 $\mu$ Vrms typ.
- Output capacitor with 0.47 $\mu$ F ceramic capacitor(Vo $\geq$ 2.7V Version)
- Output Current              Io(max.)=150mA
- High Precision Output      Vo  $\pm$ 1.0%
- Low Dropout Voltage      0.10V typ. (Io=60mA)
- ON/OFF Control              (Active High)
- Internal Thermal Overload Protection
- Internal Over Current Protection
- Bipolar Technology
- Package Outline              SC88A(NJM2878F3) / SC82AB(NJM2878F4) / ESON4-F1(NJM2878KF1)

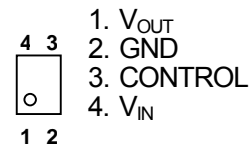
### ■ PIN CONFIGURATION



NJM2878F3

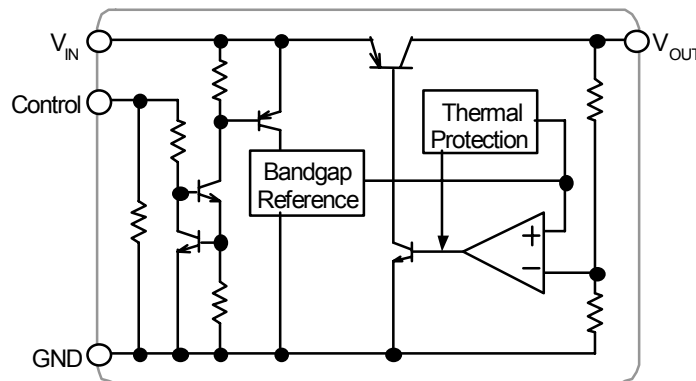


NJM2878F4



NJM2878KF1

### ■ EQUIVALENT CIRCUIT



# NJM2878

## ■ OUTPUT VOLTAGE RANK LIST

The WHITE column shows applicable Voltage Rank(s)

Device Name	V <sub>out</sub>	Device Name	V <sub>out</sub>
NJM2878F3/F4-15	1.5V	NJM2878F3/F4-35	3.5V
NJM2878F3/F4-16	1.6V	NJM2878F3/F4-36	3.6V
NJM2878F3/F4-17	1.7V	NJM2878F3/F4-37	3.7V
NJM2878F3/F4-18	1.8V	NJM2878F3/F4-38	3.8V
NJM2878F3/F4-19	1.9V	NJM2878F3/F4-39	3.9V
NJM2878F3/F4-02	2.0V	NJM2878F3/F4-04	4.0V
NJM2878F3/F4-21	2.1V	NJM2878F3/F4-41	4.1V
NJM2878F3/F4-22	2.2V	NJM2878F3-42	4.2V
NJM2878F3/F4-23	2.3V	NJM2878F3-43	4.3V
NJM2878F3/F4-24	2.4V	NJM2878F3/F4-44	4.4V
NJM2878F3/F4-25	2.5V	NJM2878F3/F4-45	4.5V
NJM2878F3/F4-26	2.6V	NJM2878F3/F4-46	4.6V
NJM2878F3/F4-27	2.7V	NJM2878F3/F4-47	4.7V
NJM2878F3/F4-28	2.8V	NJM2878F3/F4-48	4.8V
NJM2878F3/F4-29	2.9V	NJM2878F3/F4-49	4.9V
NJM2878F3/F4-03	3.0V	NJM2878F3/F4-05	5.0V
NJM2878F3/F4-31	3.1V		
NJM2878F3/F4-32	3.2V		
NJM2878F3/F4-33	3.3V		
NJM2878F3/F4-34	3.4V		

The WHITE column shows applicable Voltage Rank(s)

Device Name	V <sub>out</sub>	Device Name	V <sub>out</sub>
NJM2878KF1-15	1.5V	NJM2878KF1-35	3.5V
NJM2878KF1-16	1.6V	NJM2878KF1-36	3.6V
NJM2878KF1-17	1.7V	NJM2878KF1-37	3.7V
NJM2878KF1-18	1.8V	NJM2878KF1-38	3.8V
NJM2878KF1-19	1.9V	NJM2878KF1-39	3.9V
NJM2878KF1-02	2.0V	NJM2878KF1-04	4.0V
NJM2878KF1-21	2.1V	NJM2878KF1-41	4.1V
NJM2878KF1-22	2.2V	NJM2878KF1-42	4.2V
NJM2878KF1-23	2.3V	NJM2878KF1-43	4.3V
NJM2878KF1-24	2.4V	NJM2878KF1-44	4.4V
NJM2878KF1-25	2.5V	NJM2878KF1-45	4.5V
NJM2878KF1-26	2.6V	NJM2878KF1-46	4.6V
NJM2878KF1-27	2.7V	NJM2878KF1-47	4.7V
NJM2878KF1-28	2.8V	NJM2878KF1-48	4.8V
NJM2878KF1-29	2.9V	NJM2878KF1-49	4.9V
NJM2878KF1-03	3.0V	NJM2878KF1-05	5.0V
NJM2878KF1-31	3.1V		
NJM2878KF1-32	3.2V		
NJM2878KF1-33	3.3V		
NJM2878KF1-34	3.4V		

## ■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V <sub>IN</sub>	+10	V
Control Voltage	V <sub>CONT</sub>	+10	V
Power Dissipation	P <sub>D</sub>	SC88A/SC82AB	250(*1)
		ESON4	150(*2)
			800(*3)
Operating Temperature	T <sub>opr</sub>	-40 ~ +85	°C
Storage Temperature	T <sub>stg</sub>	-40 ~ +125	°C

(\*1): Mounted on glass epoxy board based on EIA/JEDEC. (114.3 × 76.2 × 1.6mm: 2Layers FR-4)

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

(\*3): 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)

## ■ Operating voltage

V<sub>IN</sub>=+2.3 ~ +9V (In case of Vo<2.1V version)

## ■ ELECTRICAL CHARACTERISTICS

(V<sub>IN</sub>=Vo+1V, C<sub>IN</sub>=0.1μF, Co=0.47μF: Vo≥2.7V (Co=1.0μF : 1.8V<Vo≤2.6V, Co=2.2μF : Vo≤1.8V), Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V <sub>o</sub>	I <sub>o</sub> =30mA	-1.0%	-	+1.0%	V
Quiescent Current	I <sub>Q</sub>	I <sub>o</sub> =0mA, except I <sub>cont</sub>	-	140	195	μA
Quiescent Current at Control OFF	I <sub>Q(OFF)</sub>	V <sub>CONT</sub> =0V	-	-	100	nA
Output Current	I <sub>o</sub>	V <sub>o</sub> - 0.3V	150	200	-	mA
Line Regulation	ΔV <sub>o</sub> /ΔV <sub>IN</sub>	V <sub>IN</sub> =Vo+1V ~ Vo+6V(V <sub>o</sub> ≤3V), V <sub>IN</sub> =Vo+1V ~ 9V(V <sub>o</sub> >3V), I <sub>o</sub> =30mA	-	-	0.10	%/V
Load Regulation	ΔV <sub>o</sub> /ΔI <sub>o</sub>	I <sub>o</sub> =0 ~ 100mA	-	-	0.016	%/mA
Dropout Voltage (*4)	ΔV <sub>L-O</sub>	I <sub>o</sub> =60mA	-	0.10	0.18	V
Ripple Rejection	RR	e <sub>in</sub> =200mVrms, f=1kHz, I <sub>o</sub> =10mA, Vo=3V version	-	75	-	dB
Average Temperature Coefficient of Output Voltage	ΔV <sub>o</sub> /ΔTa	Ta=0 ~ +85°C, I <sub>o</sub> =10mA	-	± 50	-	ppm/°C
Output Noise Voltage	V <sub>NO1</sub>	f=10Hz~80kHz, I <sub>o</sub> =10mA, Vo=3V Version	-	45	-	μVrms
Control Current	I <sub>CONT</sub>	V <sub>CONT</sub> =1.6V	-	3	12	μA
Control Voltage for ON-state	V <sub>CONT(ON)</sub>		1.6	-	-	V
Control Voltage for OFF-state	V <sub>CONT(OFF)</sub>		-	-	0.6	V
Input Voltage	V <sub>IN</sub>		-	-	9	V

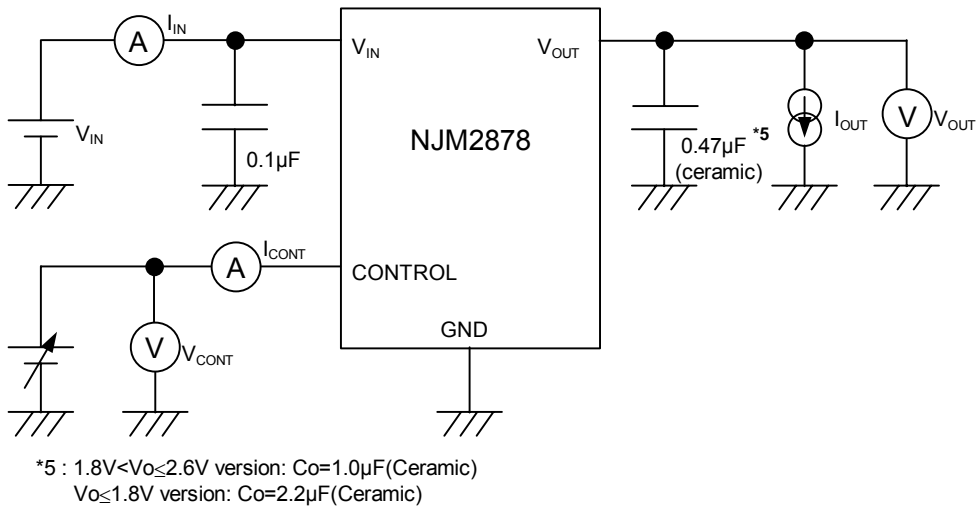
(\*4): The output voltage excludes under 2.1V.

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.

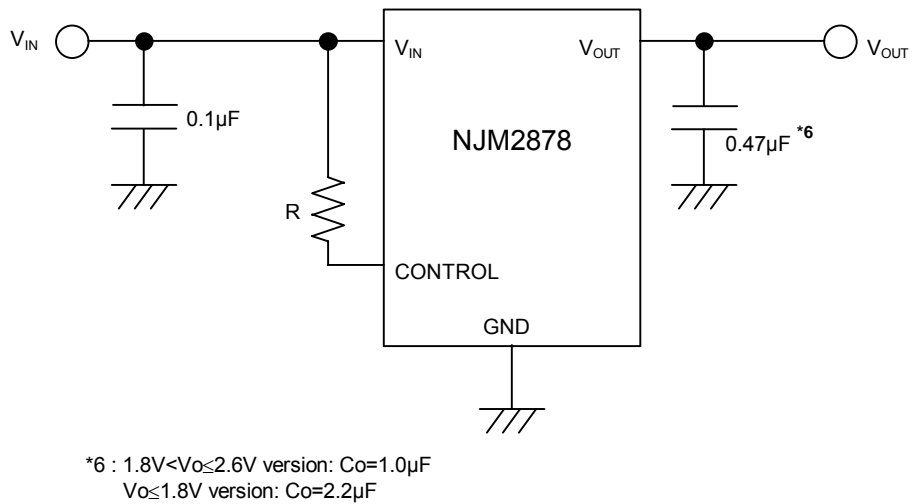
# NJM2878

## TEST CIRCUIT



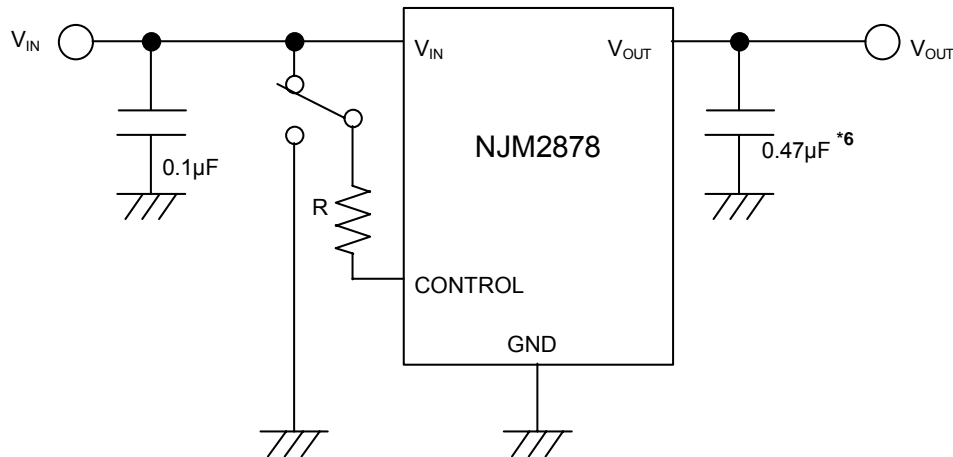
## TYPICAL APPLICATION

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



Connect control terminal to  $V_{IN}$  terminal

## ② In use of ON/OFF CONTROL:



\*6 : 1.8V <  $V_O$  ≤ 2.6V version:  $C_O = 1.0\mu\text{F}$   
 $V_O \leq 1.8\text{V}$  version:  $C_O = 2.2\mu\text{F}$

State of control terminal:

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

### \*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.

You should use the  $C_{IN}$  value of  $0.1\mu\text{F}$  larger to avoid the problem.

$C_{IN}$  should connect between GND and  $V_{IN}$  as **shortest path** as possible.

### \*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.

### \*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.

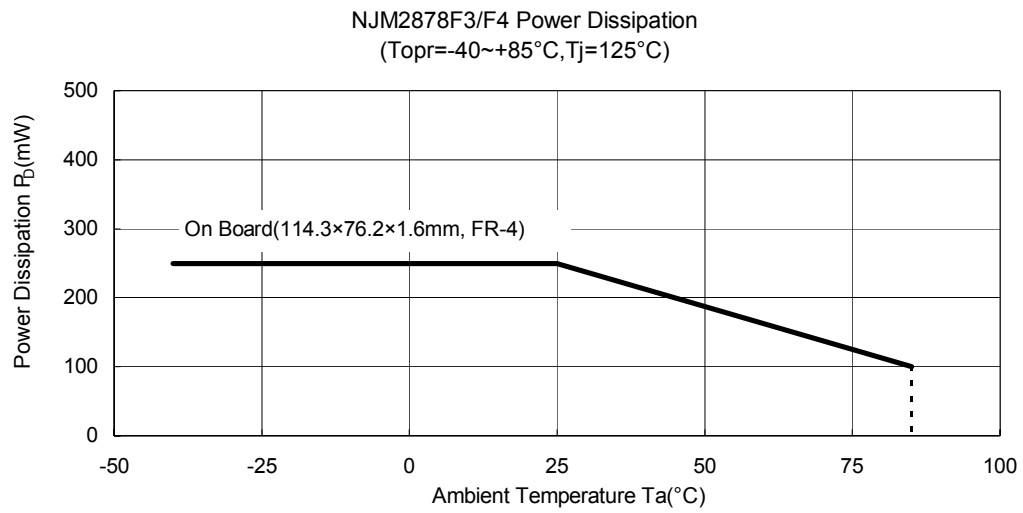
Use of a smaller  $C_O$  may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.

Therefore use  $C_O$  with the recommended capacitance or **larger** value and connect between  $V_O$  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.

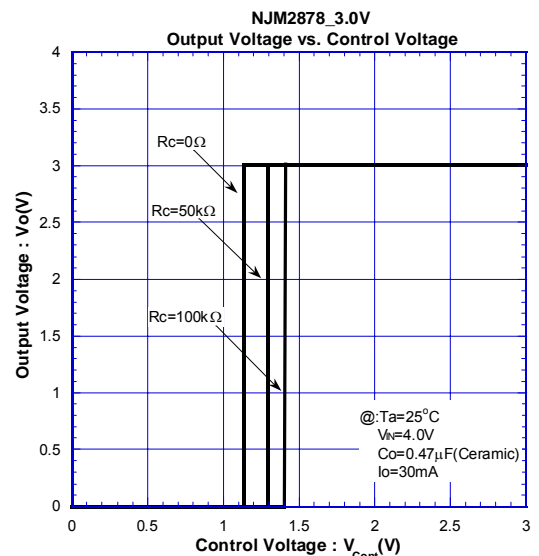
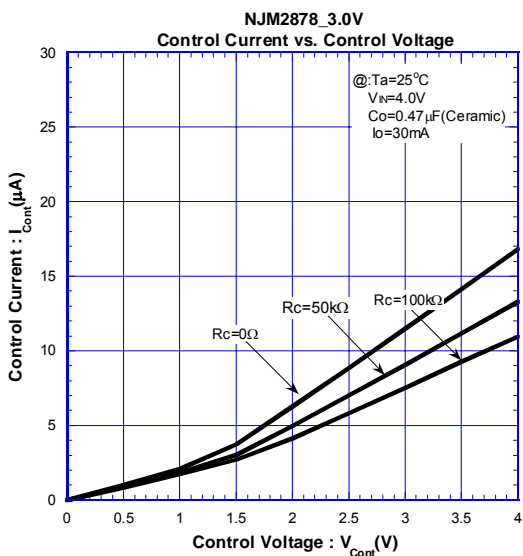
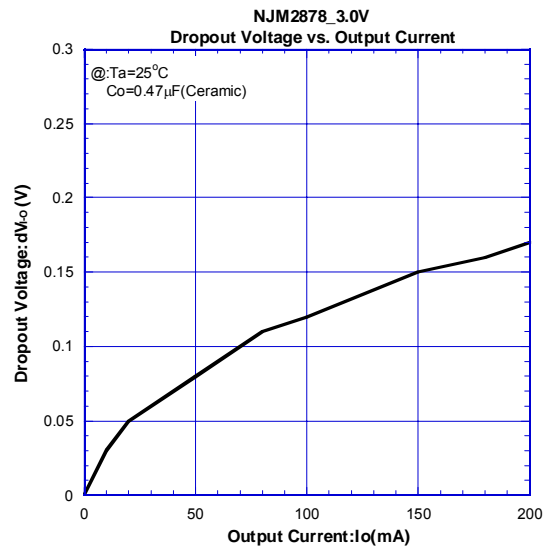
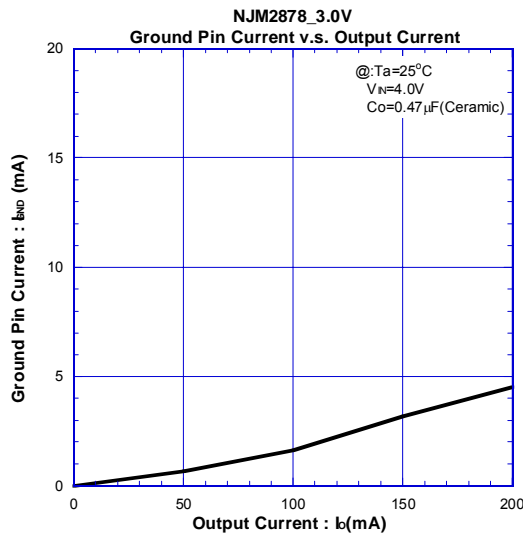
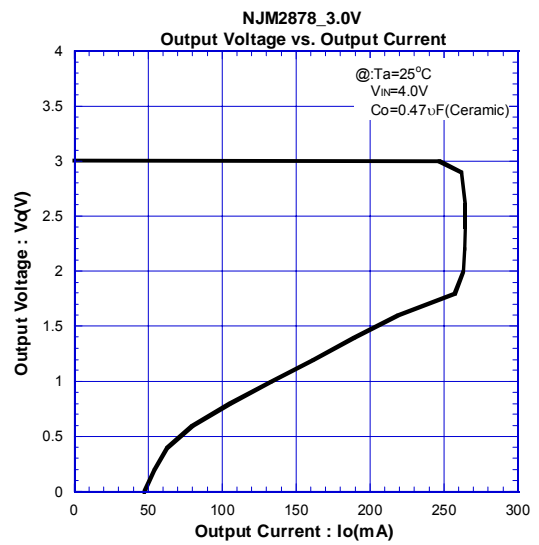
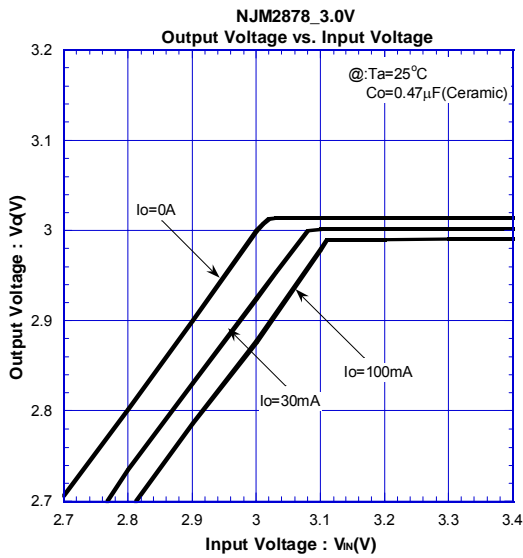
Use of a larger  $C_O$  reduces output noise and ripple output, and also improves output transient response against rapid load change.

# NJM2878

## ■ POWER DISSIPATION vs. AMBIENT TEMPERATURE (SC-88A/SC82AB)

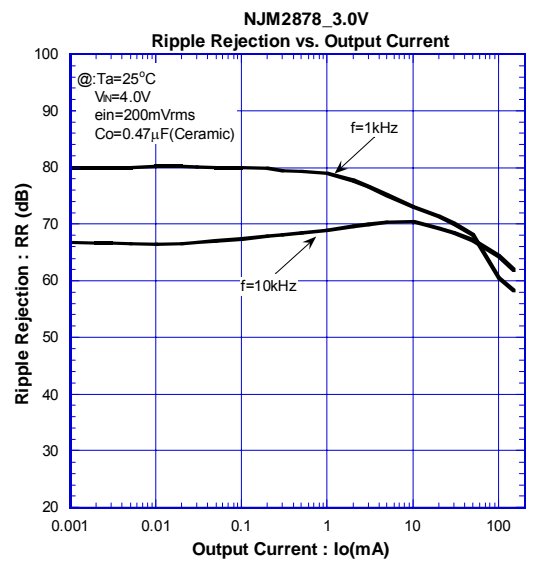
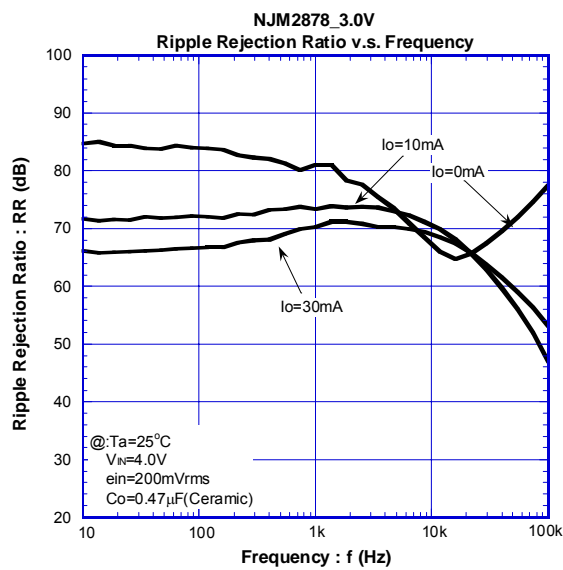
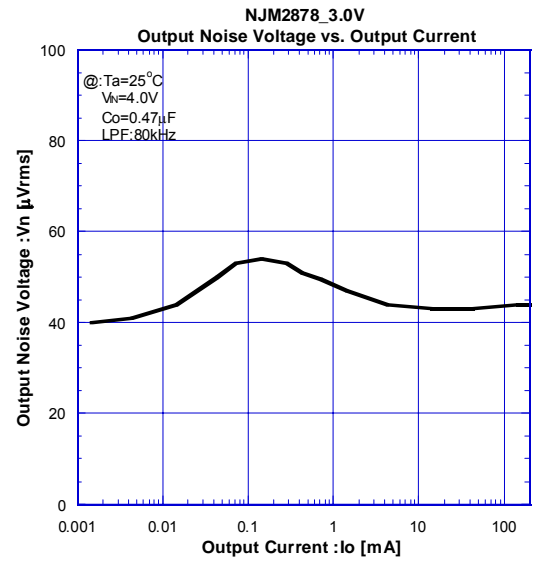
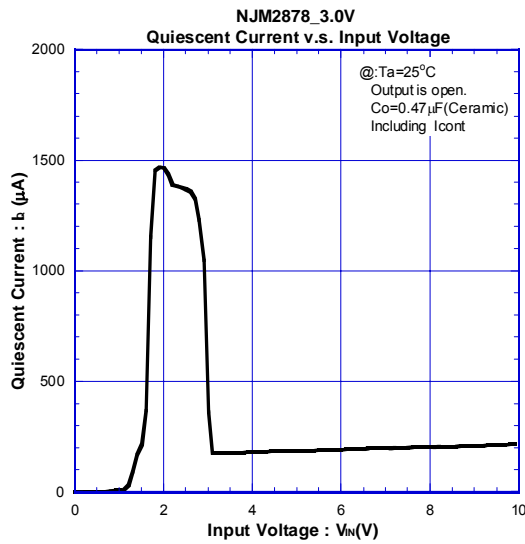
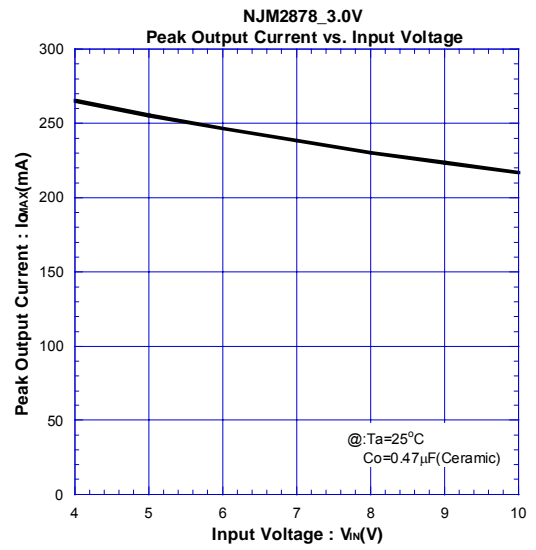
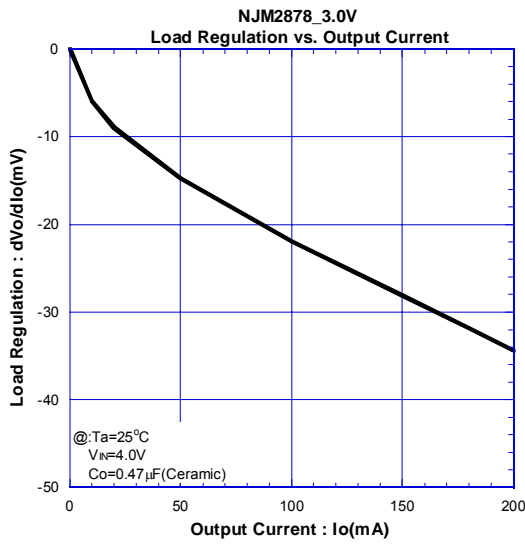


## TYPICAL CHARACTERISTICS



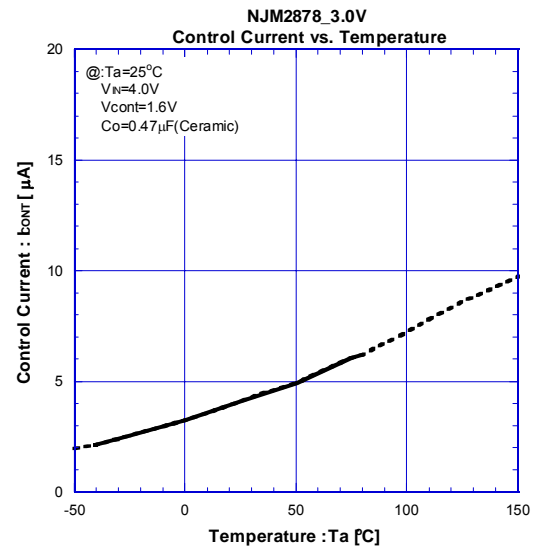
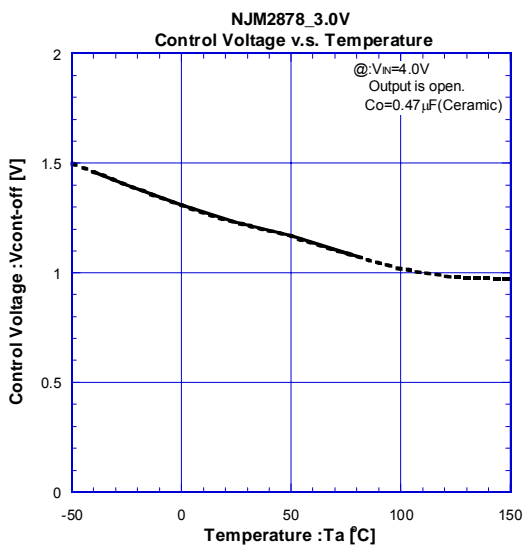
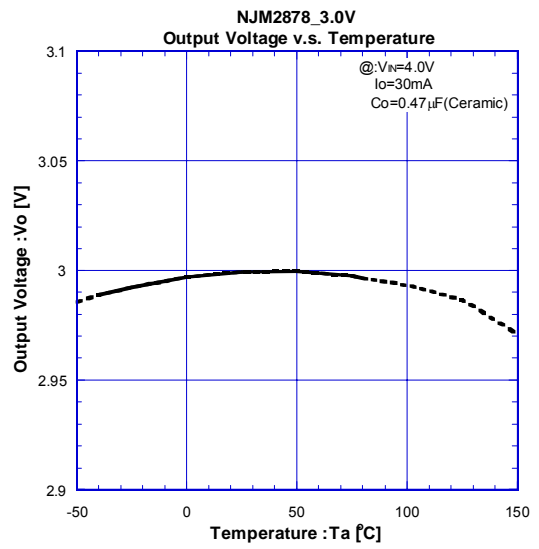
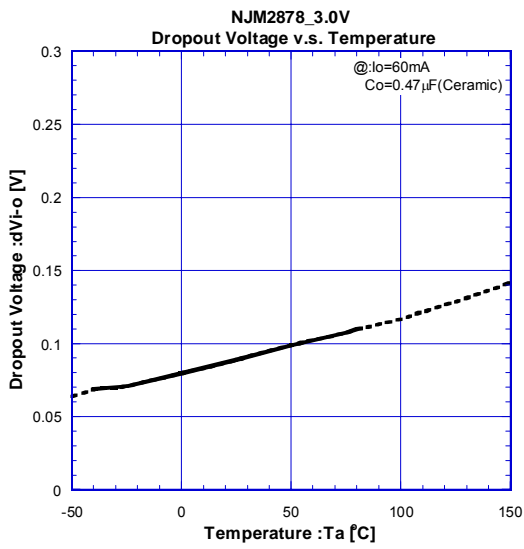
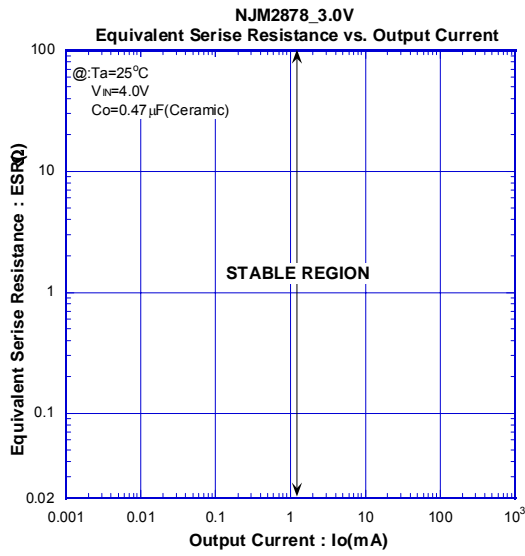
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## ■ TYPICAL CHARACTERISTICS

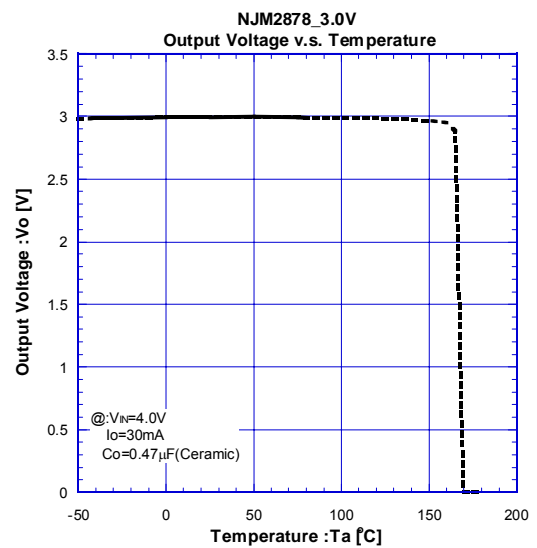
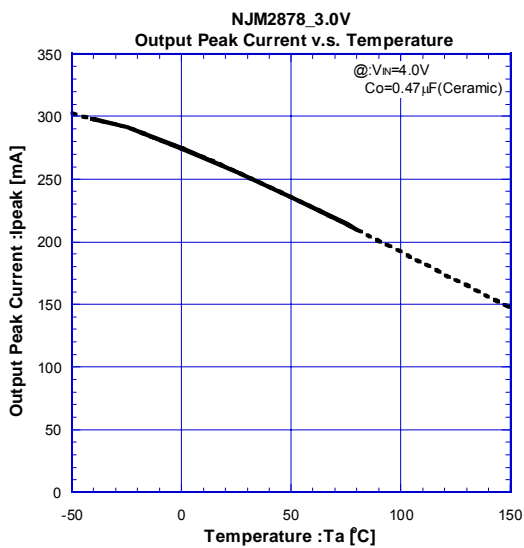
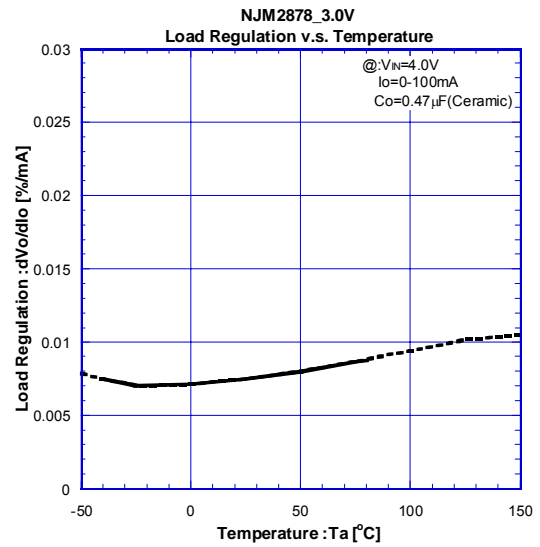
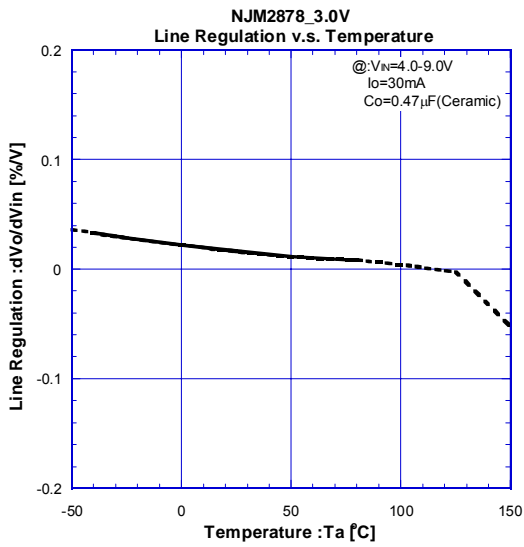
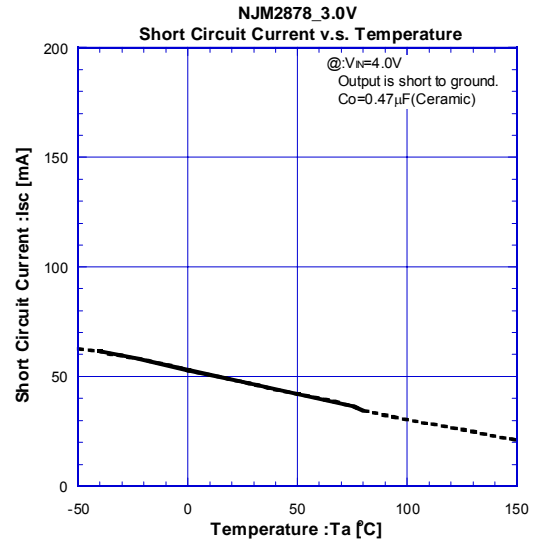
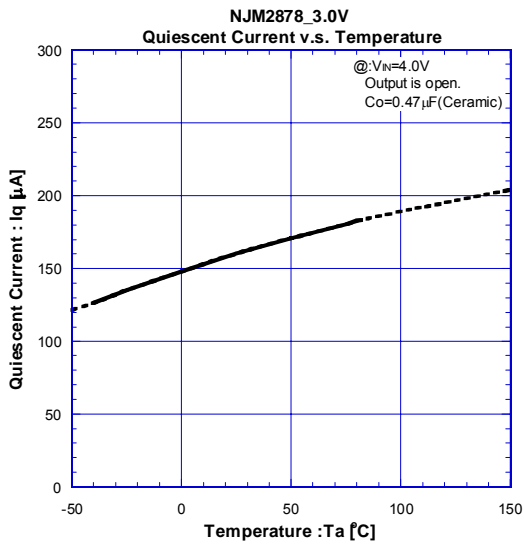




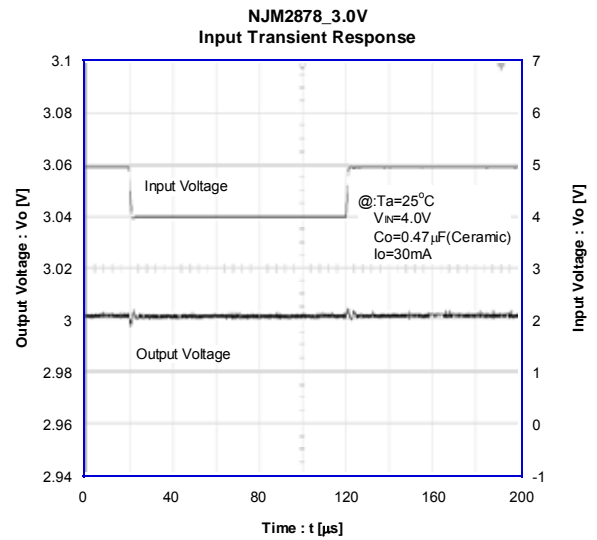
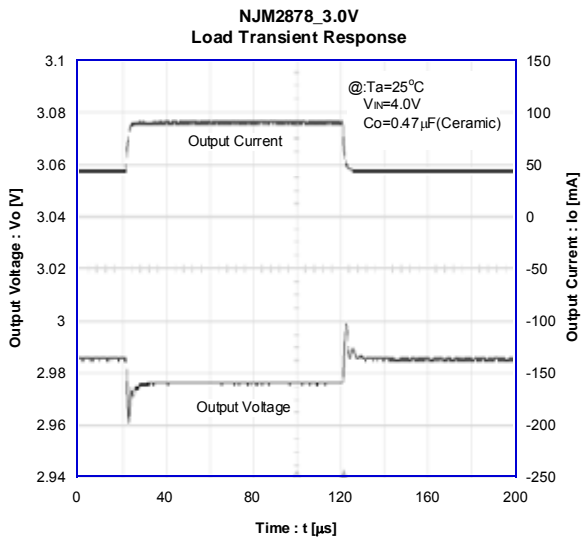
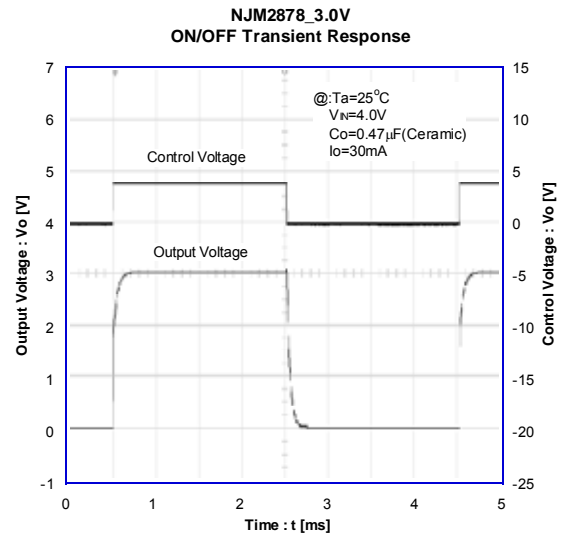
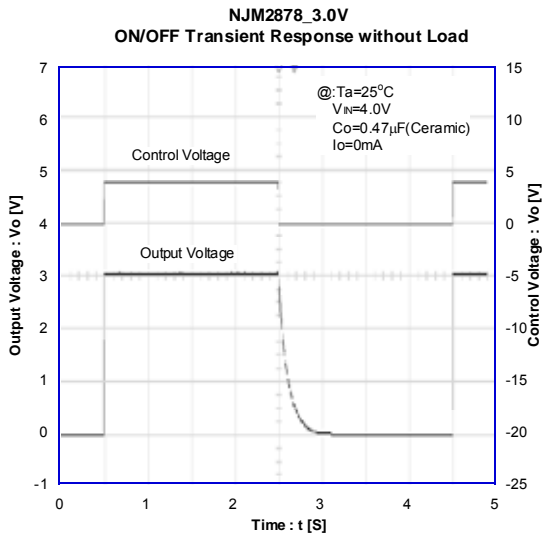
■ TYPICAL CHARACTERISTICS



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