

Low Dropout Voltage Regulator

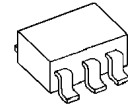
■ GENERAL DESCRIPTION

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

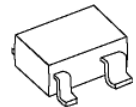
Advanced bipolar technology achieves low noise, high ripple rejection, high accuracy and low quiescent current.

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

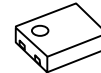
■ PACKAGE OUTLINE



NJM2878F3



NJM2878F4

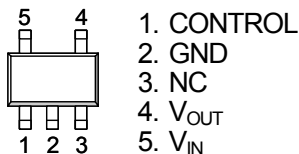


NJM2878KF1

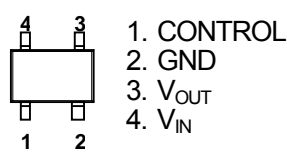
■ FEATURES

- High Ripple Rejection 75dB typ. (f=1kHz Vo=3V version)
- Output Noise Voltage Vno=45 μ Vrms typ.
- Output capacitor with 0.47 μ 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)

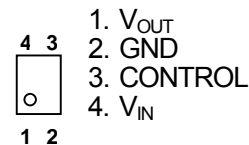
■ PIN CONFIGURATION



NJM2878F3

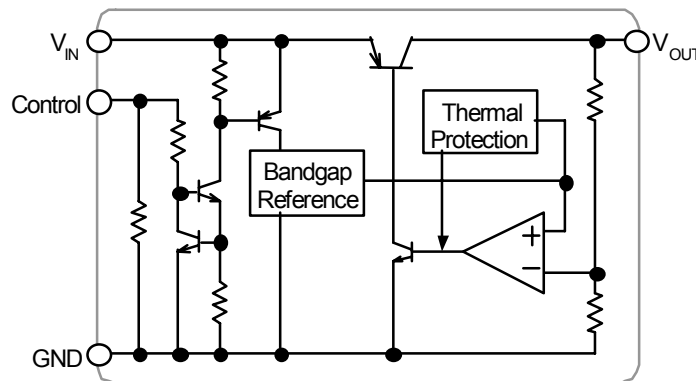


NJM2878F4



NJM2878KF1

■ EQUIVALENT CIRCUIT



NJM2878

■ OUTPUT VOLTAGE RANK LIST

The WHITE column shows applicable Voltage Rank(s)

Device Name	V _{out}	Device Name	V _{out}
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 _{out}	Device Name	V _{out}
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_{IN}	+10	V
Control Voltage	V_{CONT}	+10	V
Power Dissipation	P_D	SC88A/SC82AB	250(*1)
		ESON4	150(*2)
			800(*3)
Operating Temperature	T_{opr}	-40 ~ +85	°C
Storage Temperature	T_{stg}	-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

$V_{IN}=+2.3 \sim +9V$ (In case of $V_o < 2.1V$ version)

■ ELECTRICAL CHARACTERISTICS

($V_{IN}=V_o+1V$, $C_{IN}=0.1\mu F$, $C_o=0.47\mu F$: $V_o \geq 2.7V$ ($C_o=1.0\mu F$: $1.8V < V_o \leq 2.6V$, $C_o=2.2\mu F$: $V_o \leq 1.8V$), $T_a=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$I_o=30mA$	-1.0%	-	+1.0%	V
Quiescent Current	I_Q	$I_o=0mA$, except I_{cont}	-	140	195	μA
Quiescent Current at Control OFF	$I_{Q(OFF)}$	$V_{CONT}=0V$	-	-	100	nA
Output Current	I_o	$V_o - 0.3V$	150	200	-	mA
Line Regulation	$\Delta V_o / \Delta V_{IN}$	$V_{IN}=V_o+1V \sim V_o+6V (V_o \leq 3V)$, $V_{IN}=V_o+1V \sim 9V (V_o > 3V)$, $I_o=30mA$	-	-	0.10	%/V
Load Regulation	$\Delta V_o / \Delta I_o$	$I_o=0 \sim 100mA$	-	-	0.016	%/mA
Dropout Voltage (*4)	ΔV_{L-O}	$I_o=60mA$	-	0.10	0.18	V
Ripple Rejection	RR	$e_{in}=200mV_{rms}$, $f=1kHz$, $I_o=10mA$, $V_o=3V$ version	-	75	-	dB
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T_a$	$T_a=0 \sim +85^\circ C$, $I_o=10mA$	-	± 50	-	ppm/°C
Output Noise Voltage	V_{NO1}	$f=10Hz \sim 80kHz$, $I_o=10mA$, $V_o=3V$ Version	-	45	-	μV_{rms}
Control Current	I_{CONT}	$V_{CONT}=1.6V$	-	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}		-	-	9	V

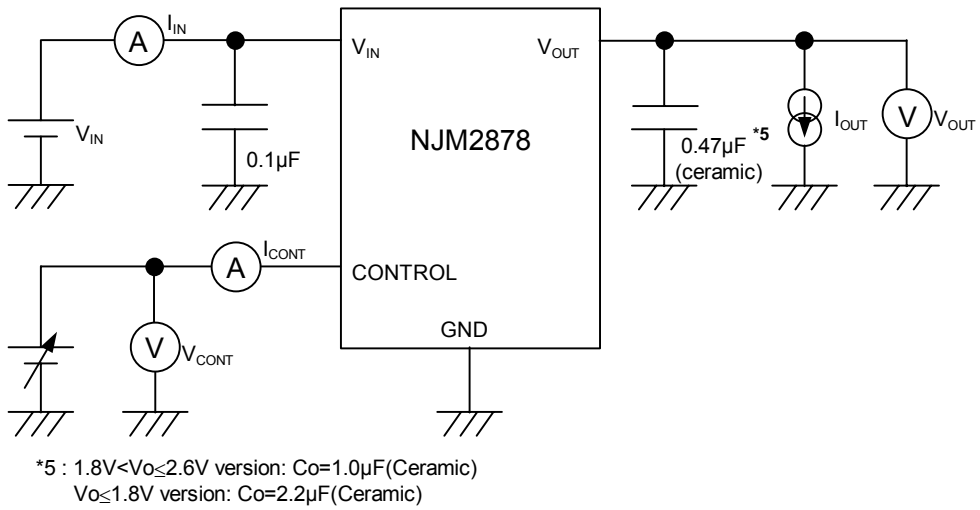
(*4): The output voltage excludes under 2.1V.

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.

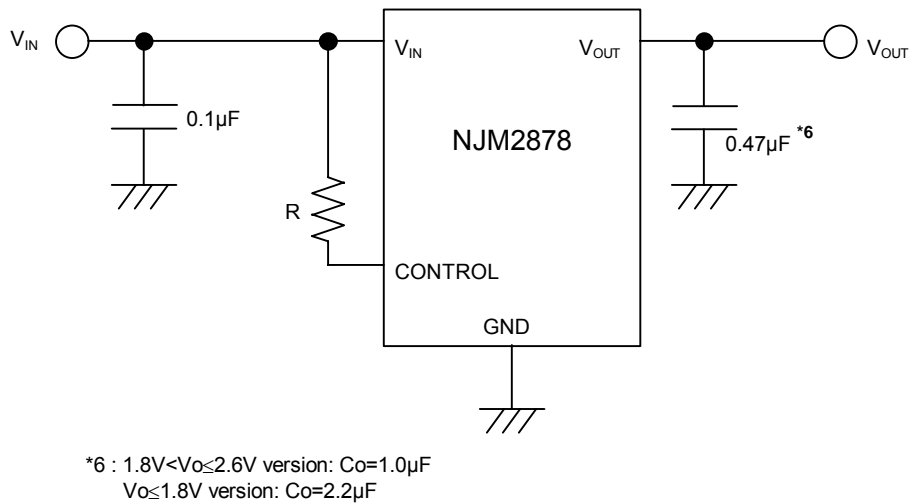
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TEST CIRCUIT



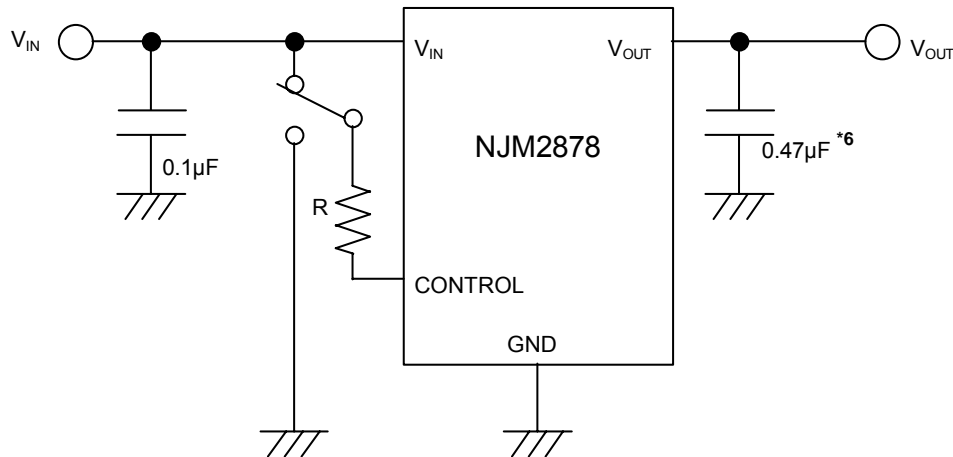
TYPICAL APPLICATION

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 = 1.0µF
 V_O ≤ 1.8V version: C_O = 2.2µF

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 0.1µF 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.

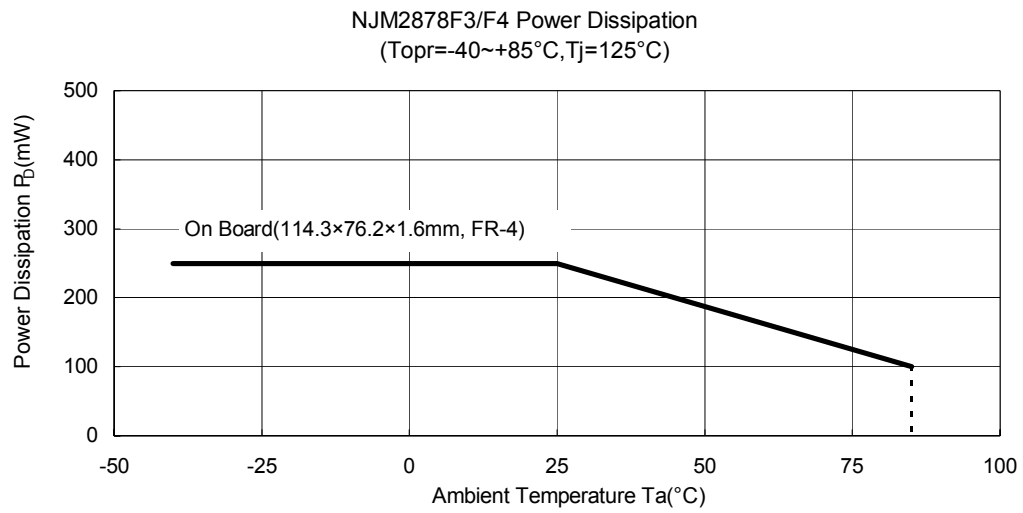
Use of a smaller C_O may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.

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.

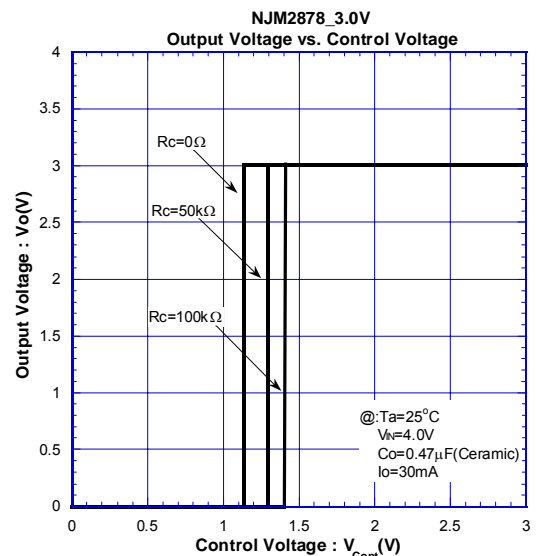
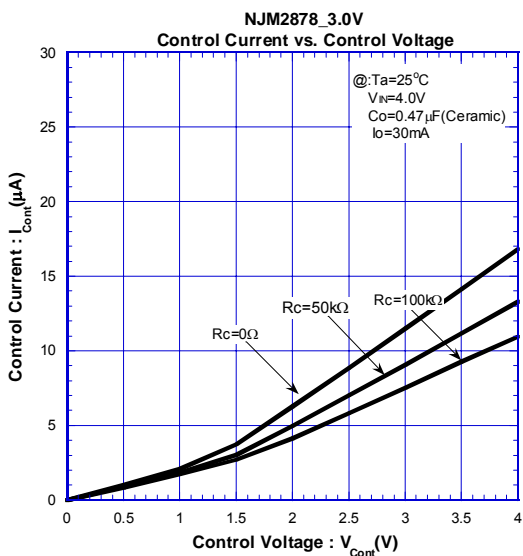
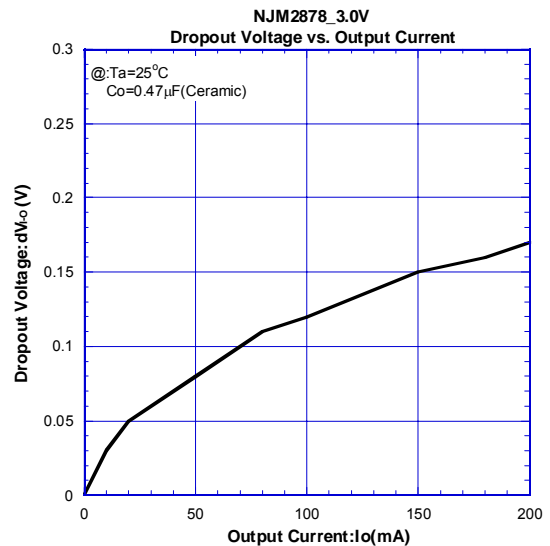
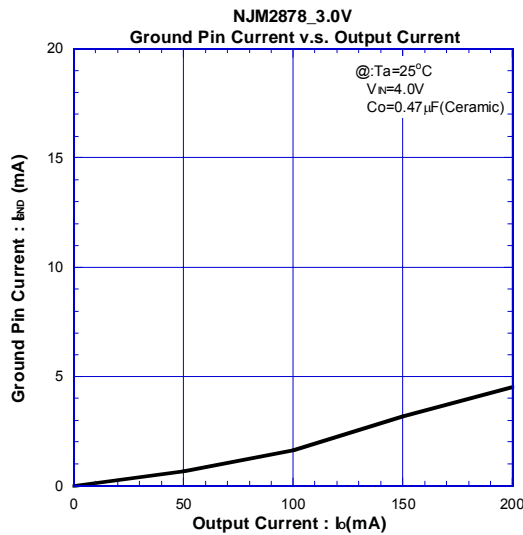
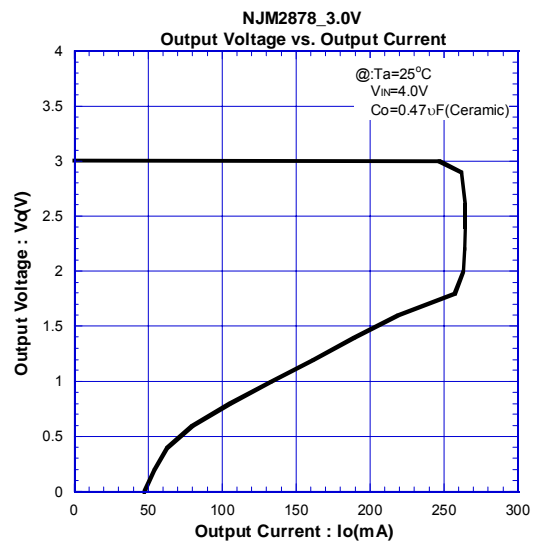
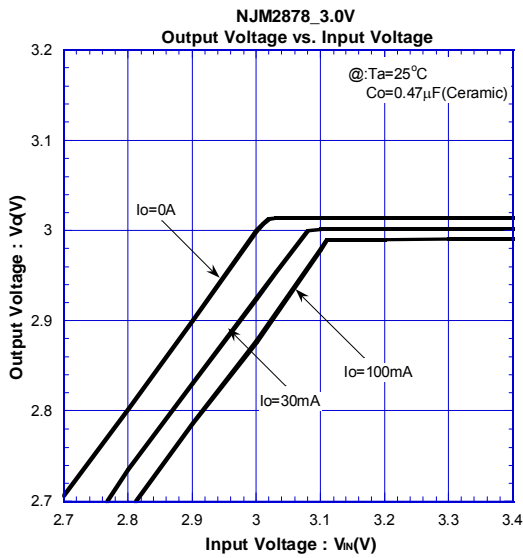
Use of a larger C_O reduces output noise and ripple output, and also improves output transient response against rapid load change.

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

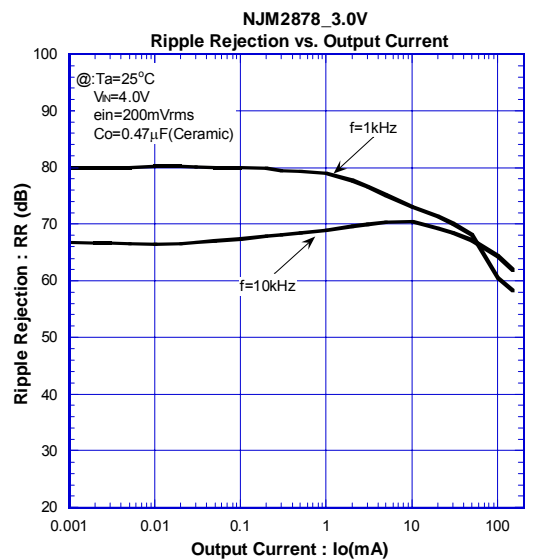
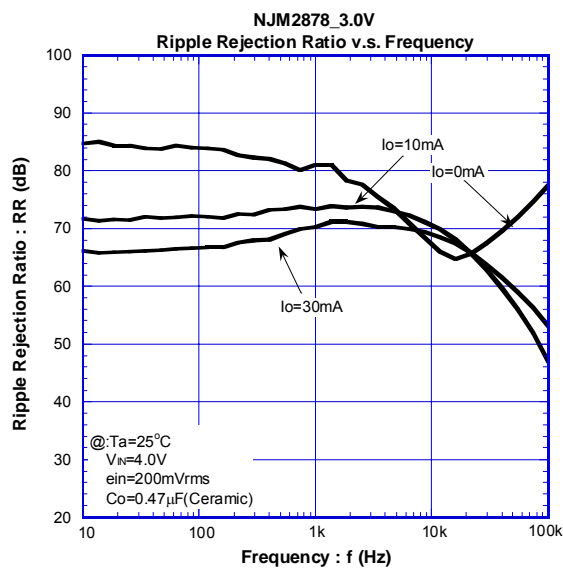
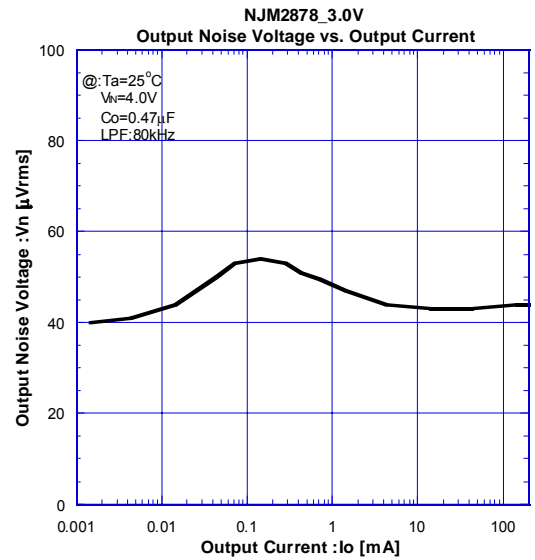
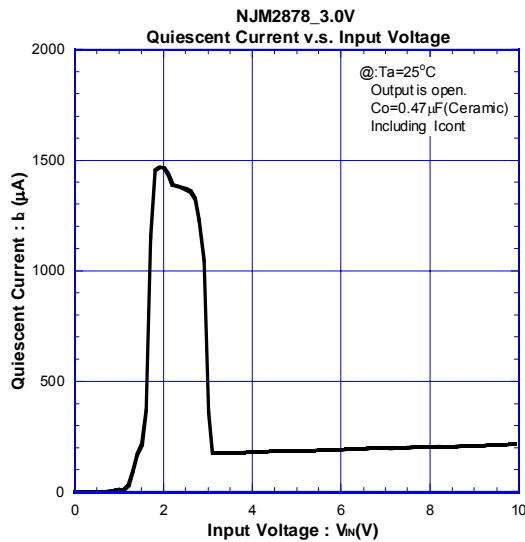
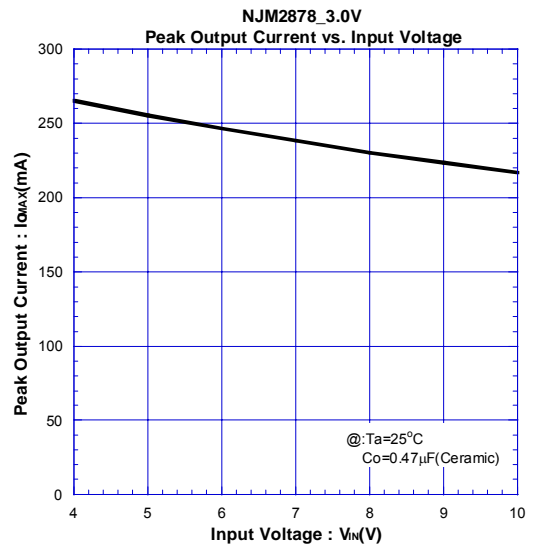
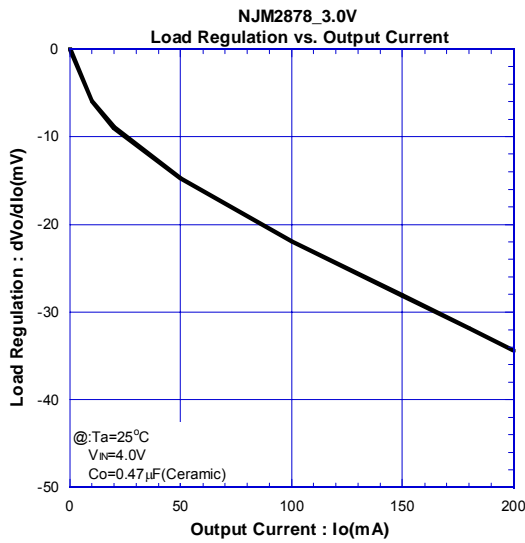


TYPICAL CHARACTERISTICS

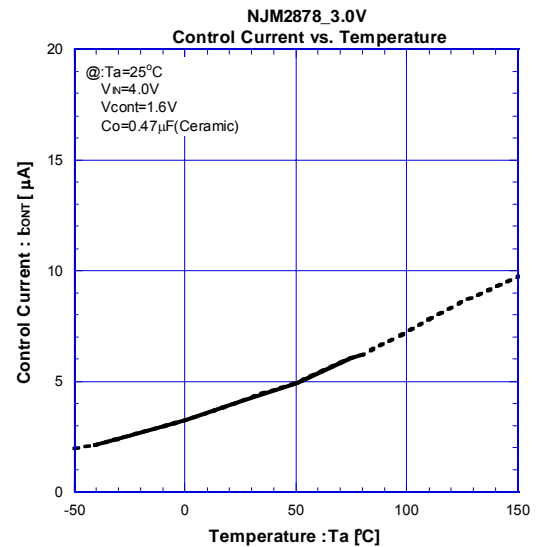
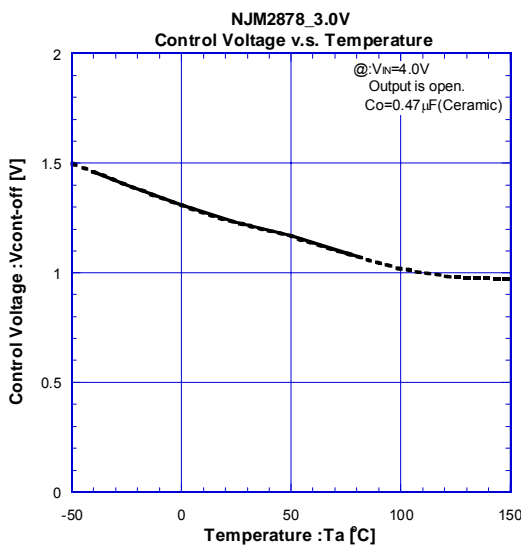
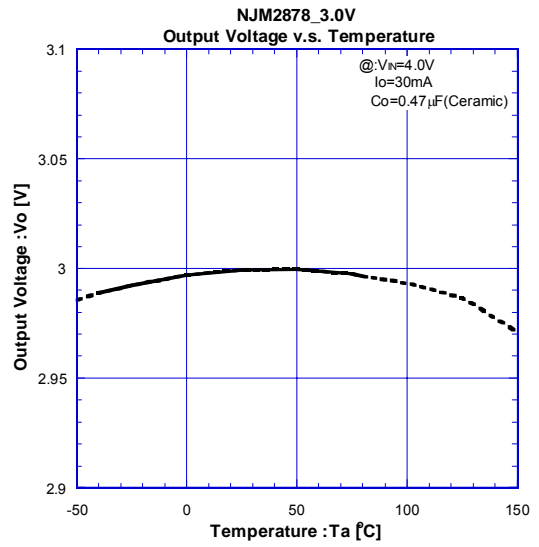
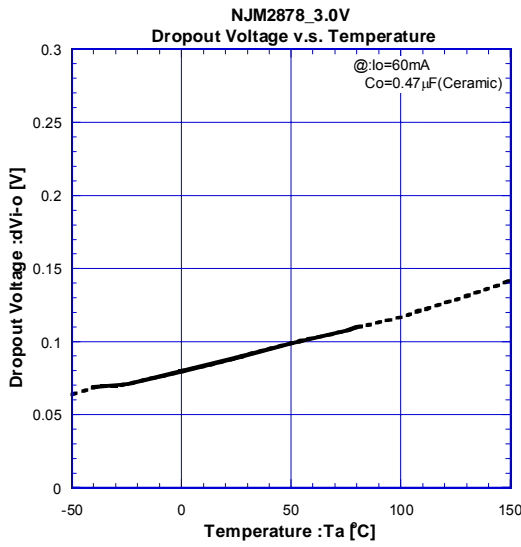
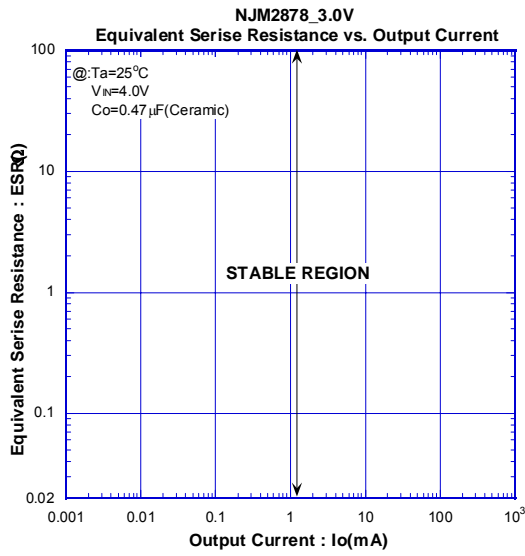


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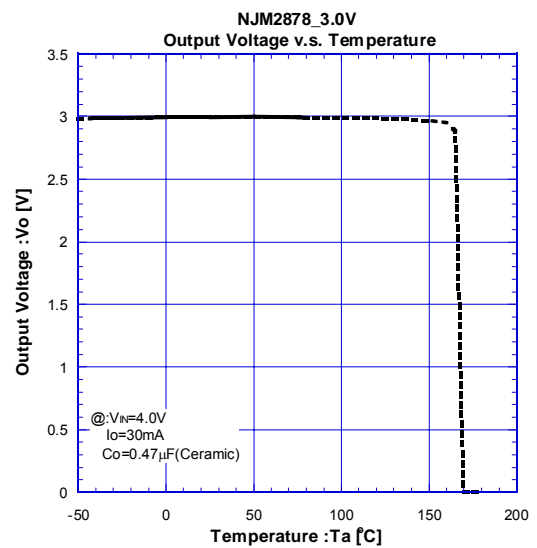
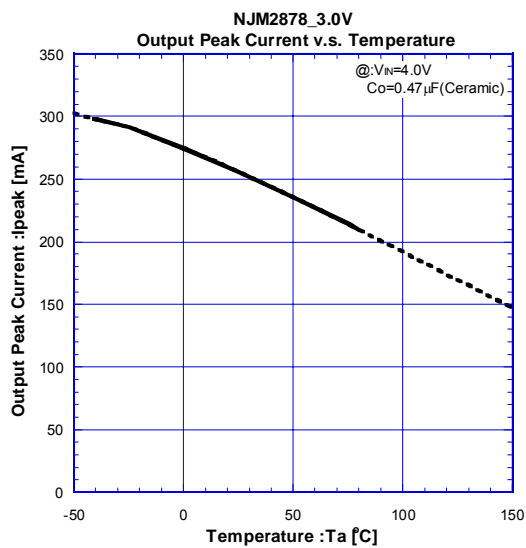
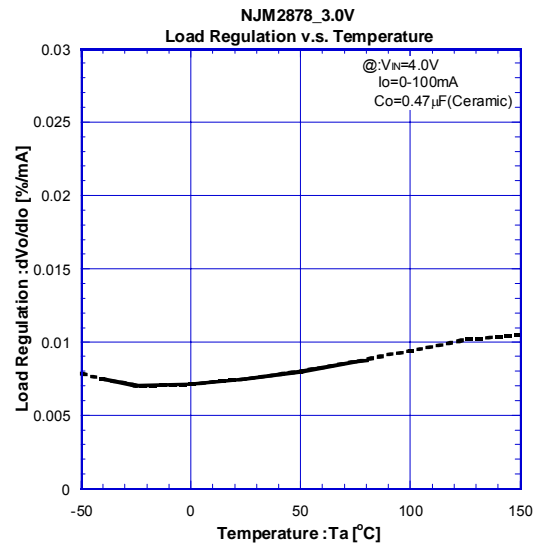
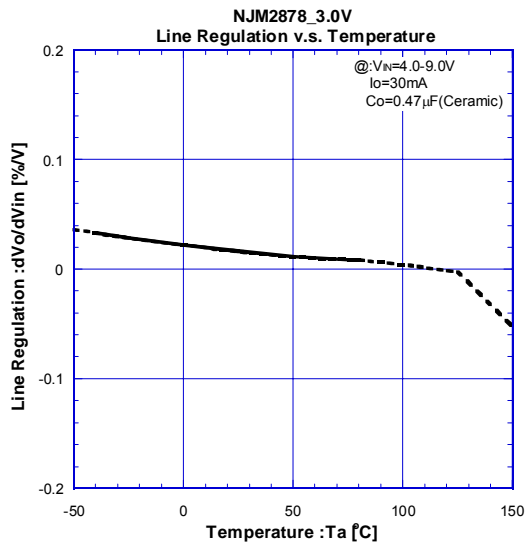
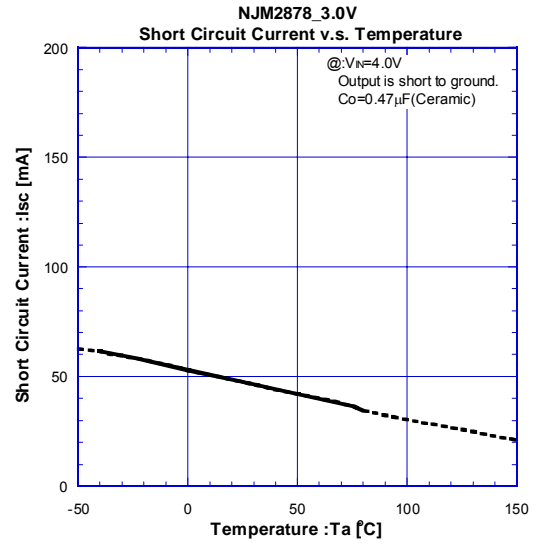
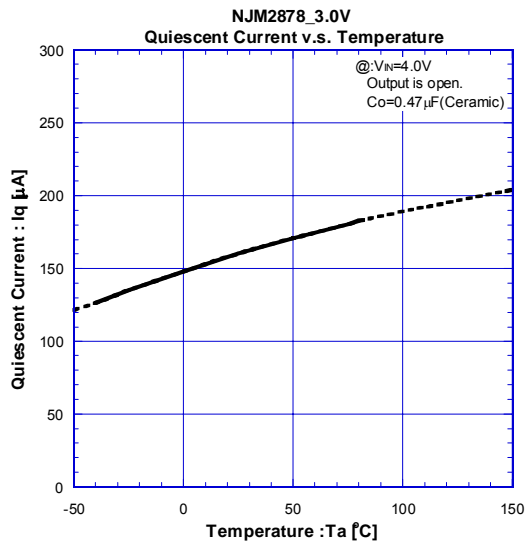
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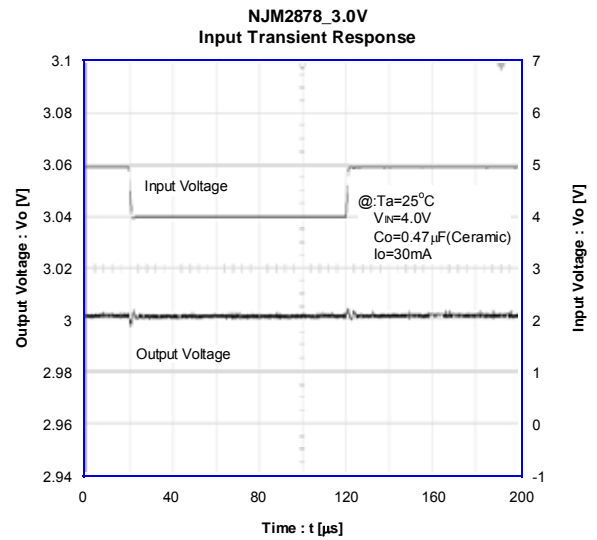
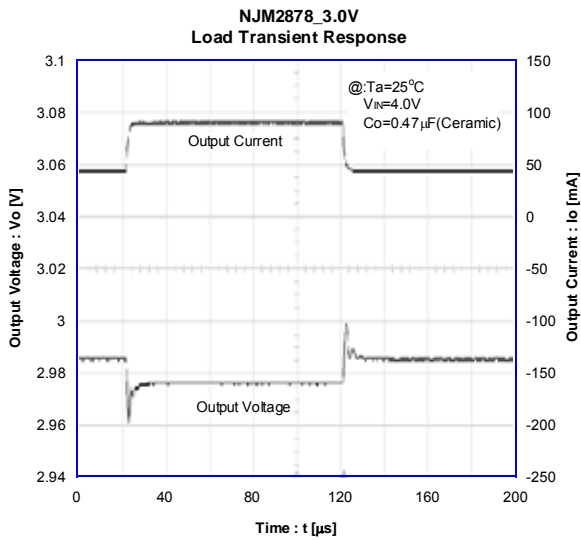
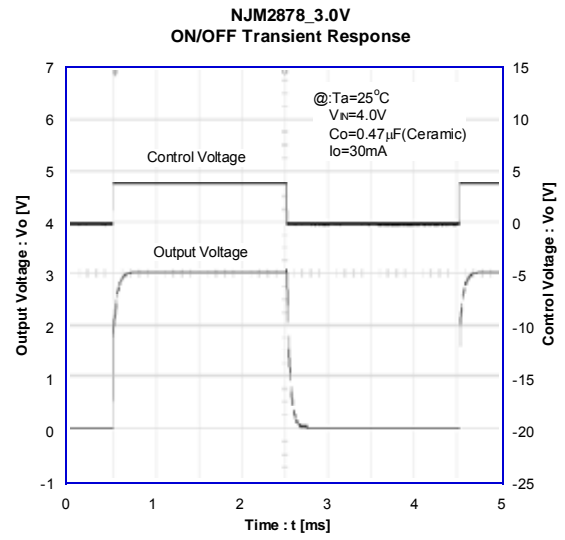
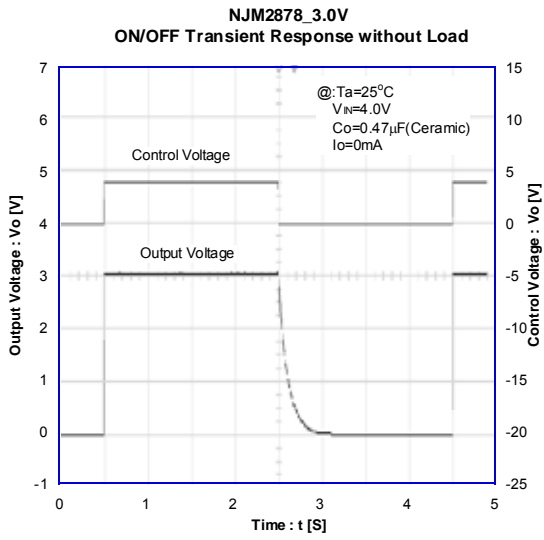
■ TYPICAL CHARACTERISTICS



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