Low Dropout Voltage Regulator

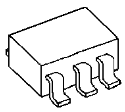
■ GENERAL DESCRIPTION

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

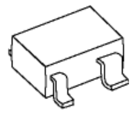
Advanced bipolar technology achieves low noise, high ripple rejection, high accuracy and low quiescent current.

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

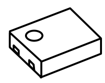
■ PACKAGE OUTLINE



NJM2878F3



NJM2878F4

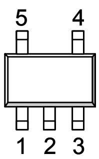


NJM2878KF1

■ FEATURES

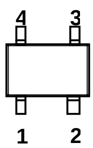
- High Ripple Rejection 75dB typ. (f=1kHz Vo=3V version)
- Output Noise Voltage Vno=45µVrms typ.
- Output capacitor with 0.47µF ceramic capacitor(Vo≥2.7V Version)
- Output Current Io(max.)=150mA
- High Precision Output Vo ±1.0%
- Low Dropout Voltage 0.10V typ. (Io=60mA)
- ON/OFF Control (Active High)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

■ PIN CONFIGURATION



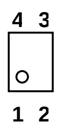
1. CONTROL
2. GND
3. NC
4. V_{OUT}
5. V_{IN}

NJM2878F3



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

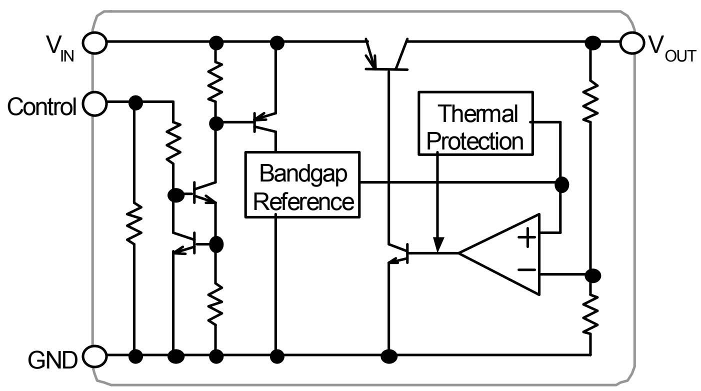
NJM2878F4



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

NJM2878KF1

■ EQUIVALENT CIRCUIT



■ 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)	mW
		ESON4	150(*2)	
			800(*3)	
Operating Temperature	Topr	–40 ~ +85		°C
Storage Temperature	Tstg	–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 ~ +9V (In case of Vo<2.1V version)

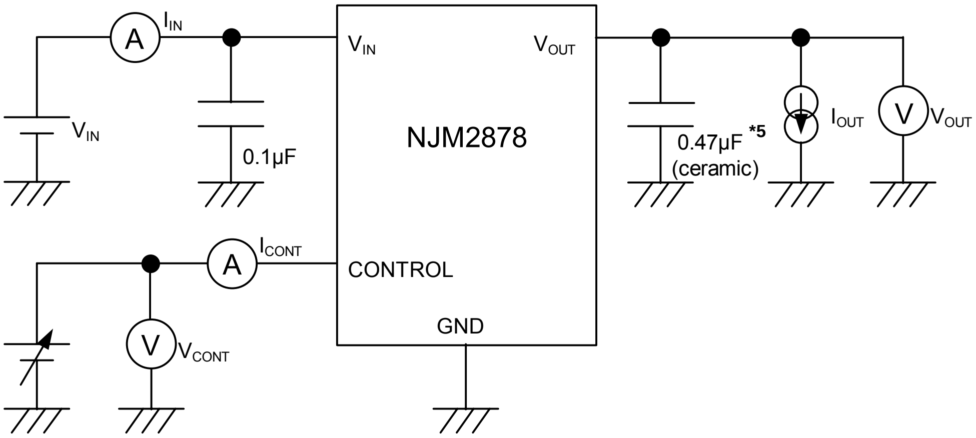
■ ELECTRICAL CHARACTERISTICS

(V_{IN}=Vo+1V, C_{IN}=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	Vo	Io=30mA	-1.0%	–	+1.0%	V
Quiescent Current	I_Q	Io=0mA, except Icont	–	140	195	µA
Quiescent Current at Control OFF	$I_{Q(OFF)}$	V_{CONT}=0V	–	–	100	nA
Output Current	Io	Vo - 0.3V	150	200	–	mA
Line Regulation	$\Delta Vo/\Delta V_{IN}$	V_{IN}=Vo+1V ~ Vo+6V(Vo≤3V), V_{IN}=Vo+1V ~ 9V(Vo>3V), Io=30mA	–	–	0.10	%/V
Load Regulation	ΔVo/ΔIo	Io=0 ~ 100mA	–	–	0.016	%/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_{NO1}	f=10Hz~80kHz, Io=10mA, Vo=3V Version	–	45	–	µVrms
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.

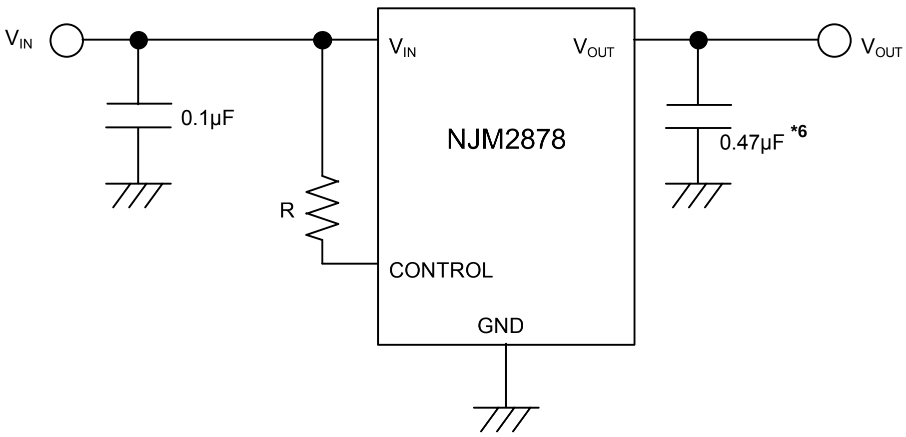
■ TEST CIRCUIT



*5 : 1.8V<Vo≤2.6V version: Co=1.0µF(Ceramic)
Vo≤1.8V version: Co=2.2µF(Ceramic)

■ TYPICAL APPLICATION

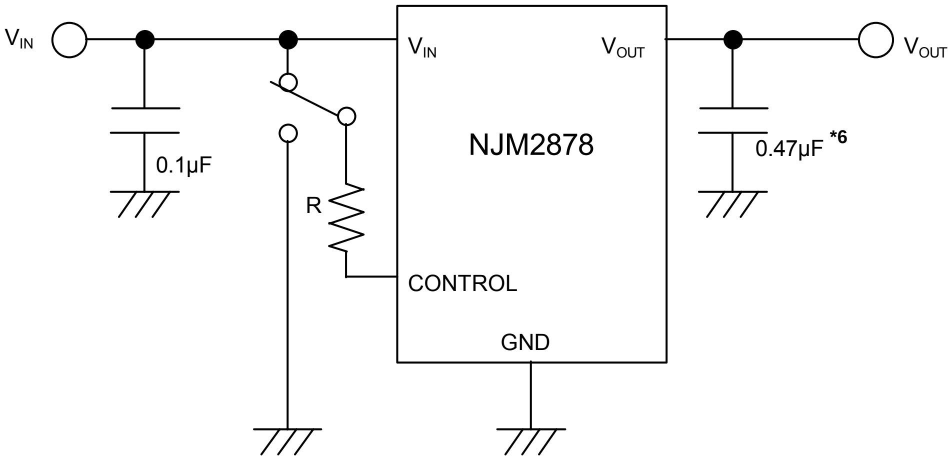
① In the case where ON/OFF Control is not required:



*6 : 1.8V<Vo≤2.6V version: Co=1.0µF
Vo≤1.8V version: Co=2.2µF

Connect control terminal to V_{IN} terminal

② In use of ON/OFF CONTROL:



*6 : 1.8V<Vo≤2.6V version: Co=1.0µF
Vo≤1.8V version: Co=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.

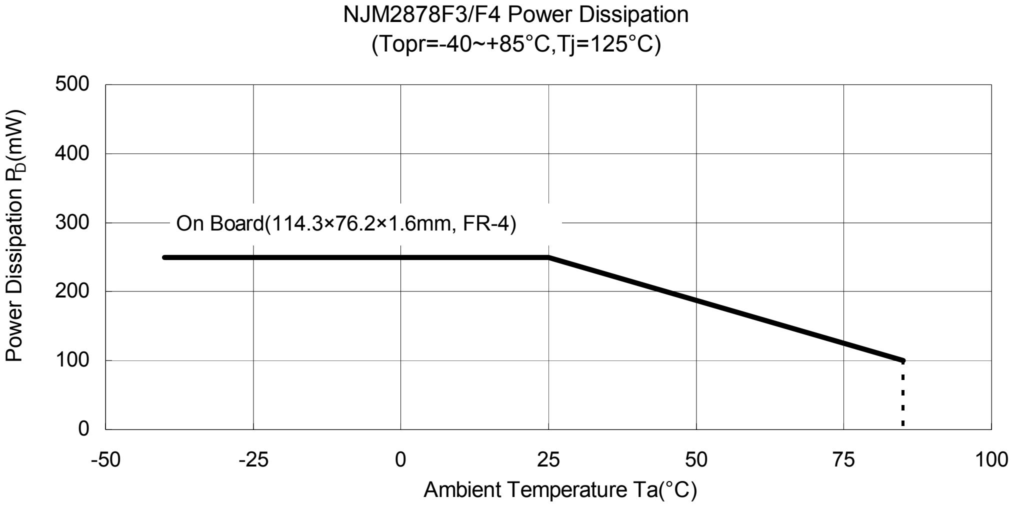
*In the case of using a resistance "R" between V_{IN} and control.

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.

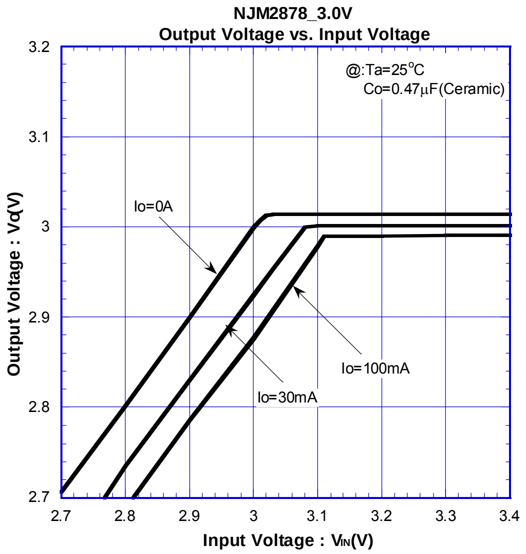
*Output Capacitance Co

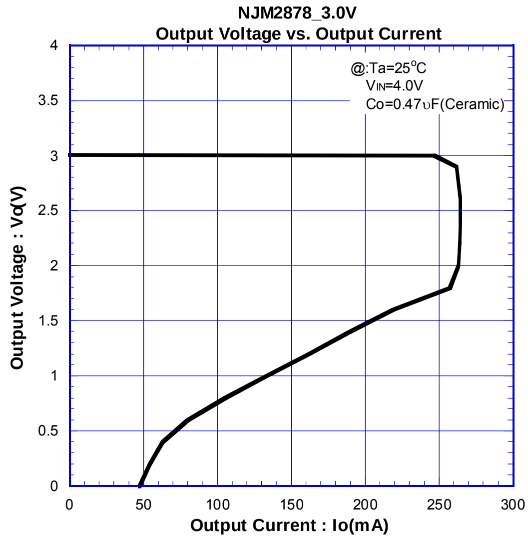
Output capacitor (Co) will be required for a phase compensation of the internal error amplifier.
The capacitance and the equivalent series resistance (ESR) influence to stable operation of the regulator.
This product is designed to work with a low ESR capacitor (Co). However use of recommended capacitance or larger value is effective 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 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 Co. Thus, check the recommended capacitance for each output voltage rank.
Use of a larger Co reduces output noise and ripple output, and also improves output transient response against rapid load change.

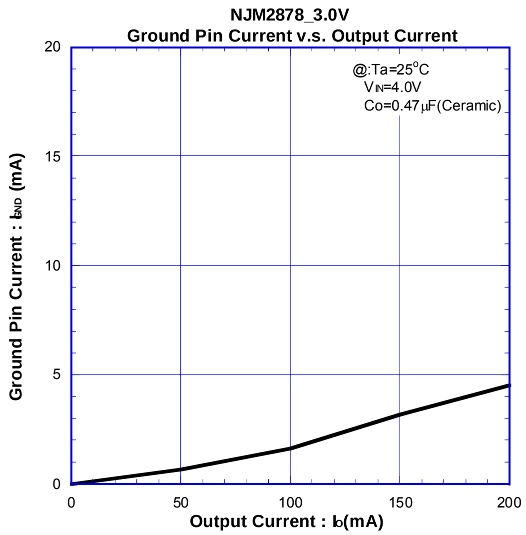
■ POWER DISSIPATION vs. AMBIENT TEMPERATURE (SC-88A/SC82AB)

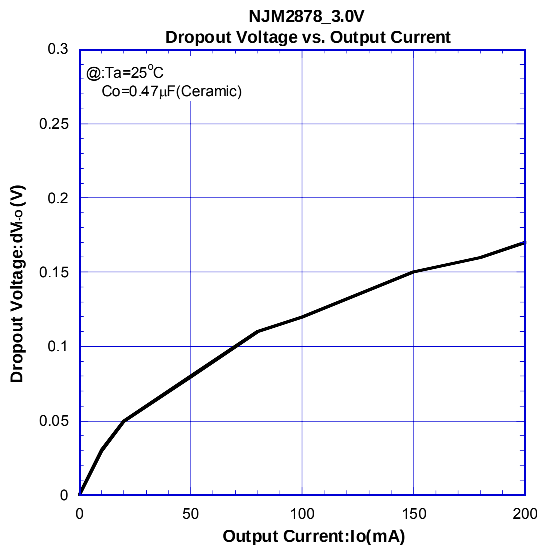


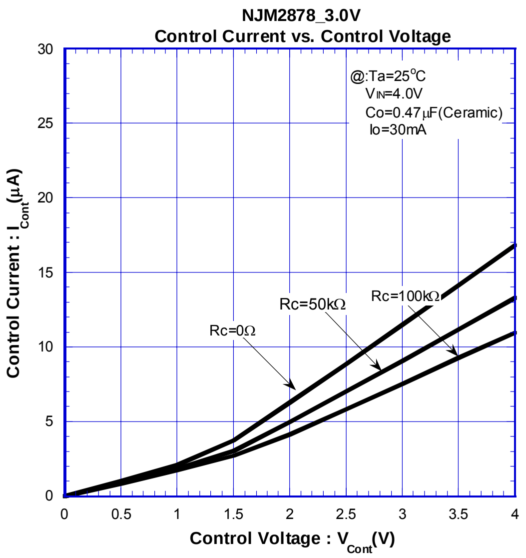
■ TYPICAL CHARACTERISTICS

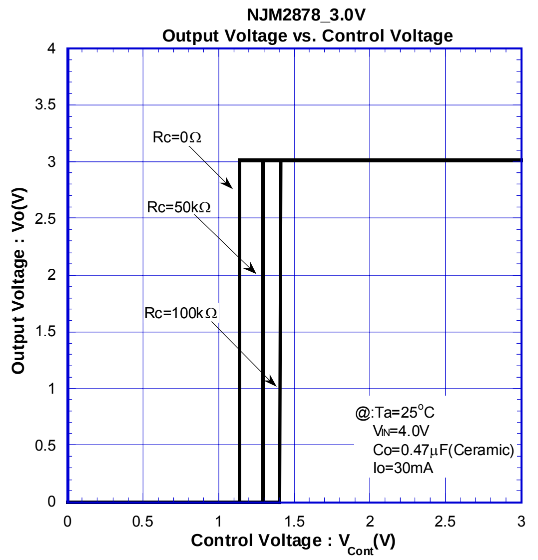




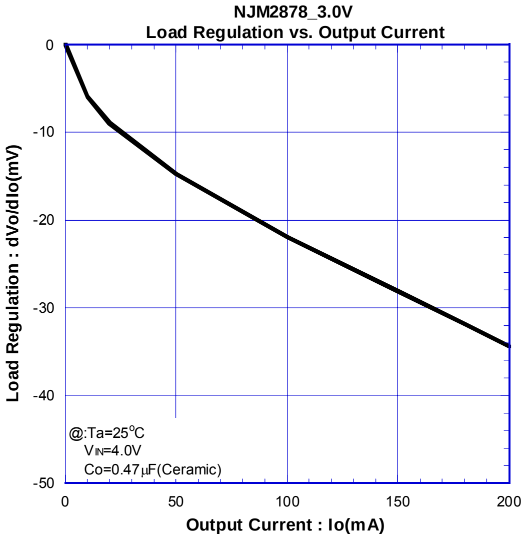


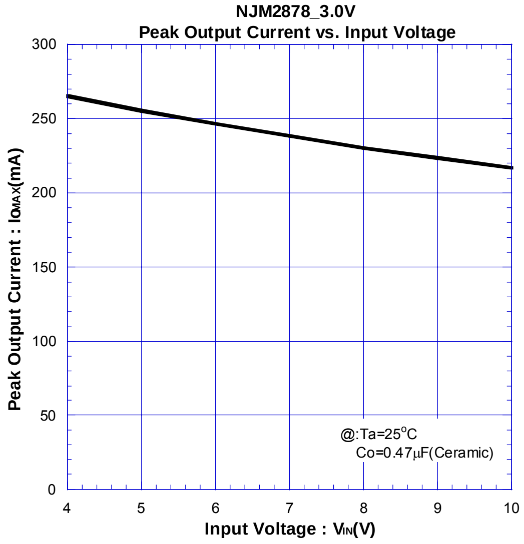


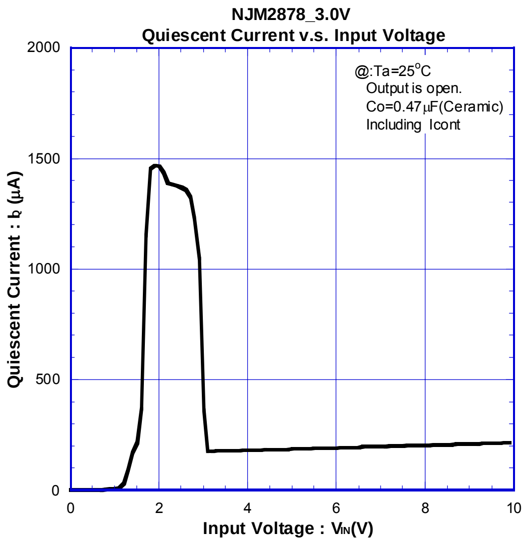


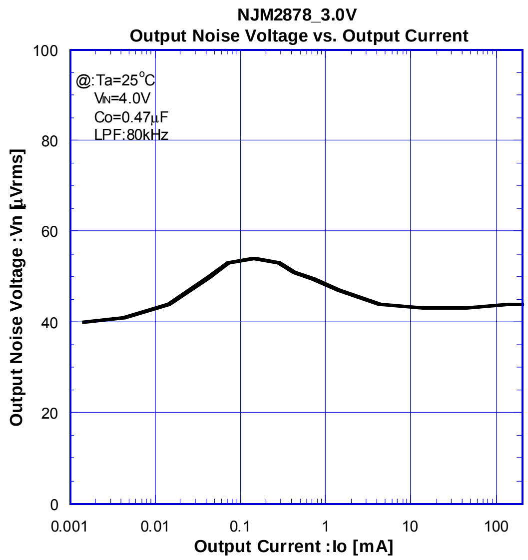


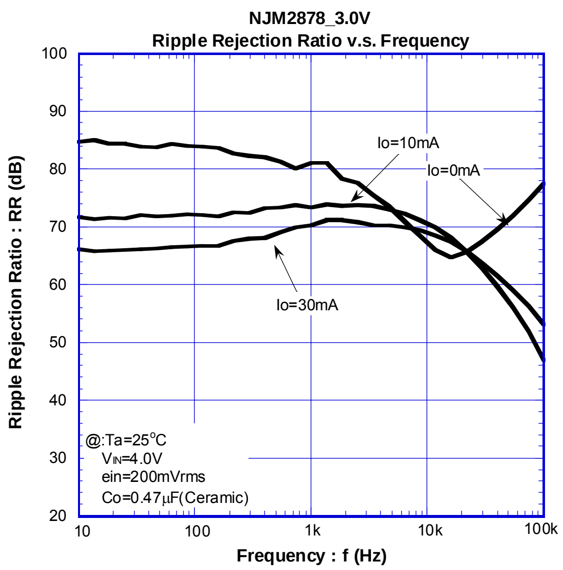
■ TYPICAL CHARACTERISTICS

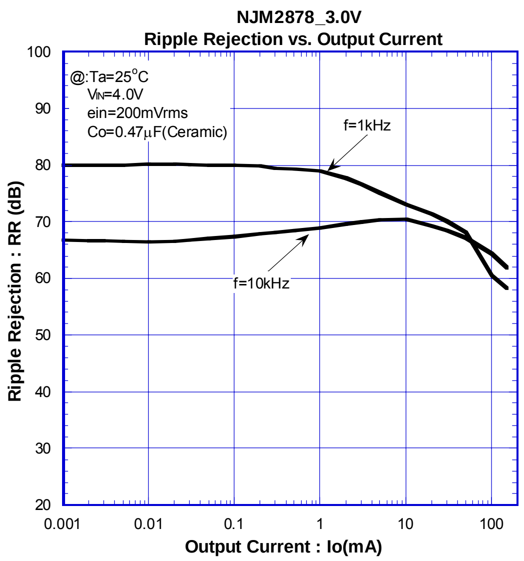




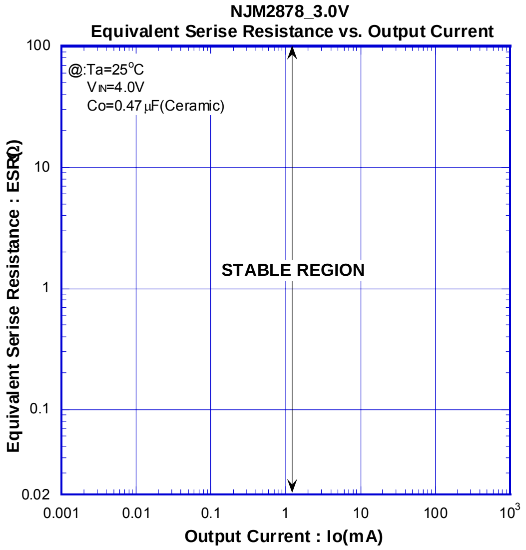


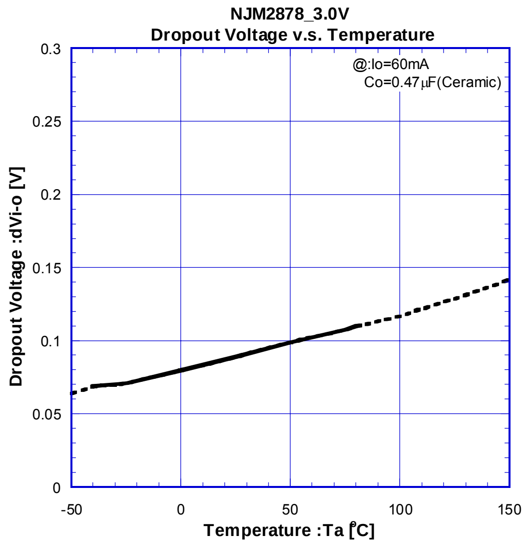


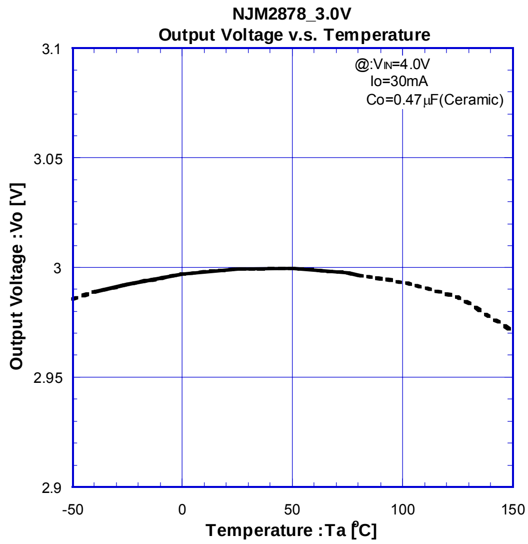


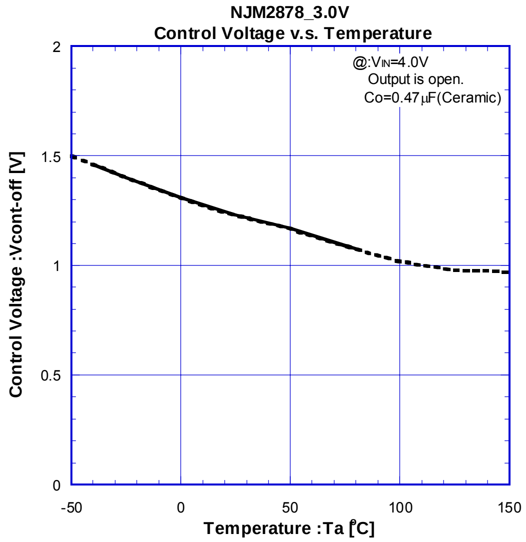


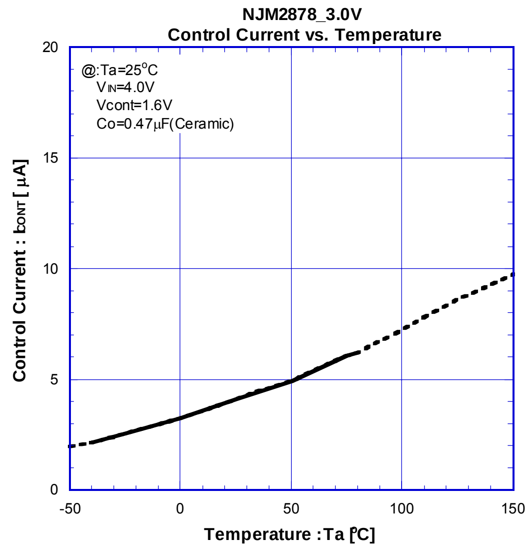
■ TYPICAL CHARACTERISTICS





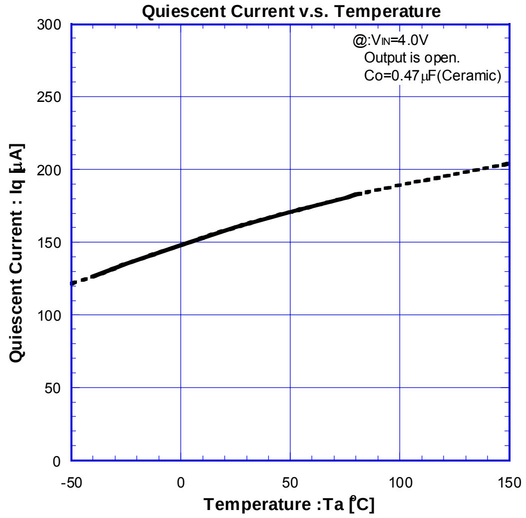




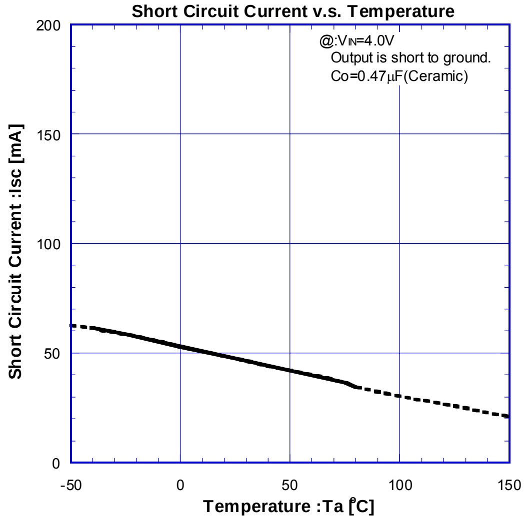


■ TYPICAL CHARACTERISTICS

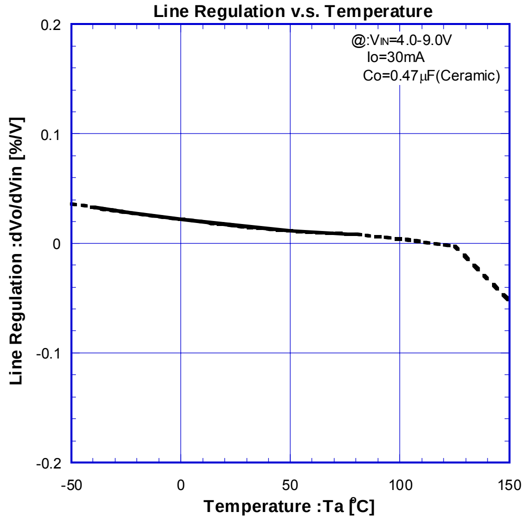
NJM2878_3.0V
Quiescent Current v.s. Temperature



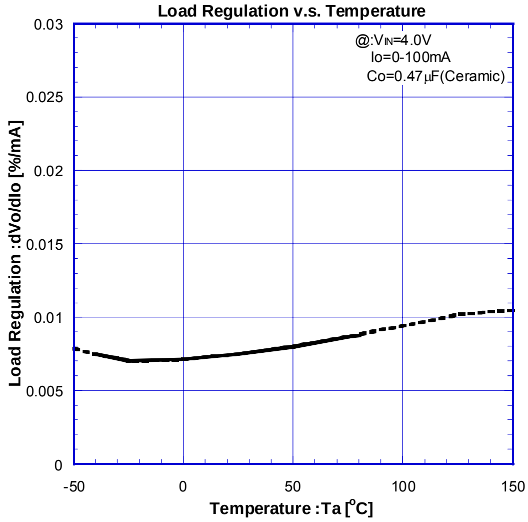
NJM2878_3.0V
Short Circuit Current v.s. Temperature



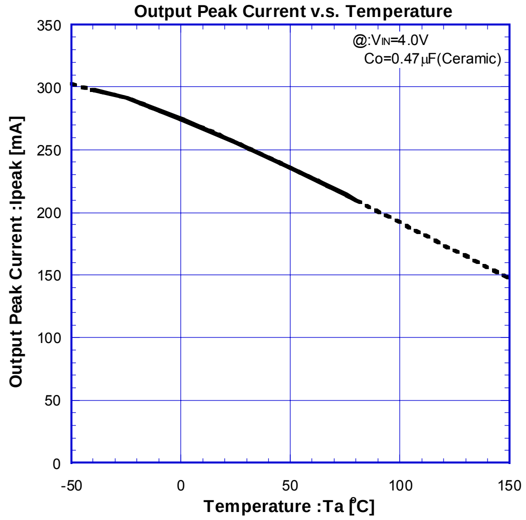
NJM2878_3.0V
Line Regulation v.s. Temperature



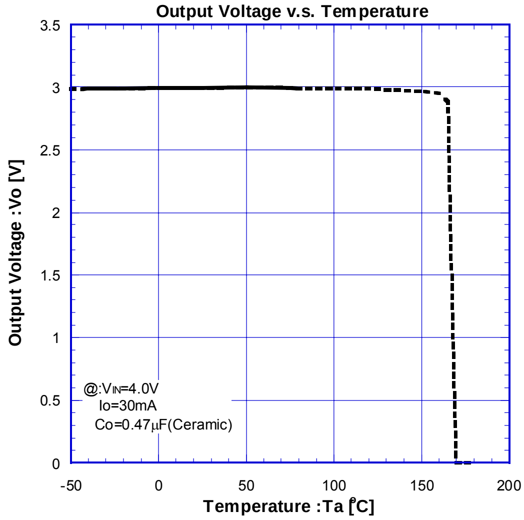
NJM2878_3.0V
Load Regulation v.s. Temperature



NJM2878_3.0V
Output Peak Current v.s. Temperature



NJM2878_3.0V
Output Voltage v.s. Temperature



■ TYPICAL CHARACTERISTICS