

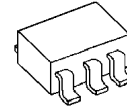
## LOW DROPOUT VOLTAGE REGULATOR

### ■ GENERAL DESCRIPTION

The NJM2870 is low dropout voltage regulator designed for cellular phone application.

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

### ■ PACKAGE OUTLINE

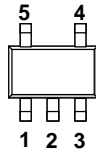


NJM2870F

### ■ FEATURES

- High Ripple Rejection       $56\text{dB} \leq \text{RR} \text{ (DC} < f < 60\text{kHz)}$   
66dB typ. (f=100Hz)  
60dB typ. (f=1kHz)
- Output Noise Voltage       $V_{\text{no}}=30\mu\text{V typ. (Cp}=0.01\mu\text{F)}$
- Output Current               $I_{\text{o(max)}}=150\text{mA}$
- High Precision Output       $V_{\text{o}}\pm 2\%$
- Low Dropout Voltage       $\Delta V_{\text{I-O}}=0.12\text{V typ. (I}_\text{o}=60\text{mA, V}_\text{o}\geq 1.8\text{V)}$
- Input Voltage range      +2~+14V ( $V_{\text{o}}=1.5\text{V Version}$ )
- ON/OFF Control              (Active High)
- Output capacitor with 4.7uF ceramic capacitor
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline              SOT-23-5

### ■ PIN CONFIGURATION

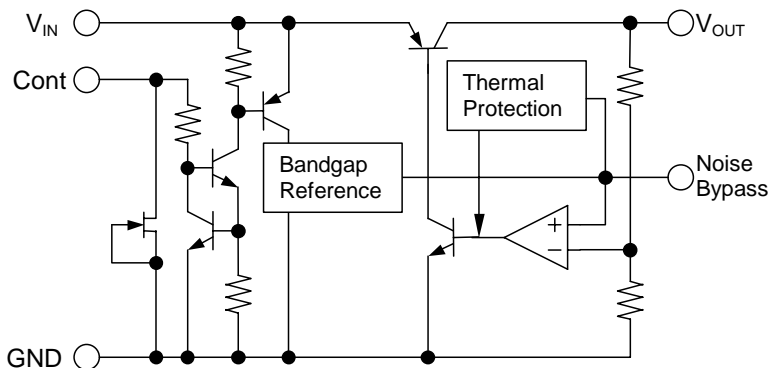


NJM2870F

#### PIN FUNCTION

1. CONTROL (Active High)
2. GND
3. NOISE BYPASS
4.  $V_{\text{OUT}}$
5.  $V_{\text{IN}}$

### ■ EQUIVALENT CIRCUIT



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

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V <sub>IN</sub>	+14	V
Control Voltage	V <sub>CONT</sub>	+14(*1)	V
Power Dissipation	P <sub>D</sub>	SOT-23-5	350(*2)
			200(*3)
Operating Temperature	Topr	-40 ~ +85	°C
Storage Temperature	Tstg	-40 ~ +125	°C

(\*1) When input voltage is less than +14V, 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.

**■ ELECTRICAL CHARACTERISTICS (V<sub>IN</sub>=V<sub>o</sub>+1V, C<sub>IN</sub>=0.1μF, C<sub>o</sub>=4.7μF, C<sub>p</sub>=0.01μF, Ta=25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V <sub>o</sub>	I <sub>o</sub> =30mA	-2%	-	+2%	V
Quiescent Current	I <sub>Q</sub>	I <sub>o</sub> =0mA, expect I <sub>cont</sub>	-	200	300	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> =V <sub>o</sub> +1V ~ V <sub>o</sub> +6V, I <sub>o</sub> =30mA	-	-	0.10	%/V
Load Regulation	ΔV <sub>o</sub> /ΔI <sub>o</sub>	I <sub>o</sub> =0 ~ 100mA	-	-	0.03	%/mA
Dropout Voltage	ΔV <sub>I-O</sub>	I <sub>o</sub> =60mA	-	0.12	0.2	V
Ripple Rejection	RR	e <sub>in</sub> =200mVrms, f=1kHz, I <sub>o</sub> =10mA V <sub>IN</sub> =V <sub>o</sub> +2V, V <sub>o</sub> =3V Version	-	60	-	dB
Average Temperature Coefficient of Output Voltage	ΔV <sub>o</sub> /ΔT <sub>a</sub>	T <sub>a</sub> =0~85°C, I <sub>o</sub> =10mA, V <sub>o</sub> =3V Version	-	0.2	-	mV/°C
Output Noise Voltage	V <sub>NO</sub>	f=10Hz~80kHz, I <sub>o</sub> =10mA, V <sub>o</sub> =3V Version	-	30	-	μVrms
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

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.

**■ ELECTRICAL CHARACTERISTICS**

(V<sub>o</sub>=1.5V Version, V<sub>IN</sub>=2.4V, C<sub>IN</sub>=0.1μF, C<sub>o</sub>=4.7μF, C<sub>p</sub>=0.01μF, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V <sub>o</sub>	I <sub>o</sub> =30mA	-2%	-	+2%	V
Quiescent Current	I <sub>Q</sub>	I <sub>o</sub> =0mA, expect I <sub>cont</sub>	-	200	300	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> =V <sub>o</sub> +1V ~ V <sub>o</sub> +6V, I <sub>o</sub> =30mA	-	-	0.10	%/V
Load Regulation	ΔV <sub>o</sub> /ΔI <sub>o</sub>	I <sub>o</sub> =0 ~ 100mA	-	-	0.03	%/mA
Ripple Rejection	RR	e <sub>in</sub> =200mVrms, f=1kHz, I <sub>o</sub> =10mA V <sub>IN</sub> =V <sub>o</sub> +2V	-	64	-	dB
Average Temperature Coefficient of Output Voltage	ΔV <sub>o</sub> /ΔT <sub>a</sub>	T <sub>a</sub> =0~85°C, I <sub>o</sub> =10mA	-	0.13	-	mV/°C
Output Noise Voltage	V <sub>NO</sub>	f=10Hz~80kHz, I <sub>o</sub> =10mA,	-	15	-	μVrms
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

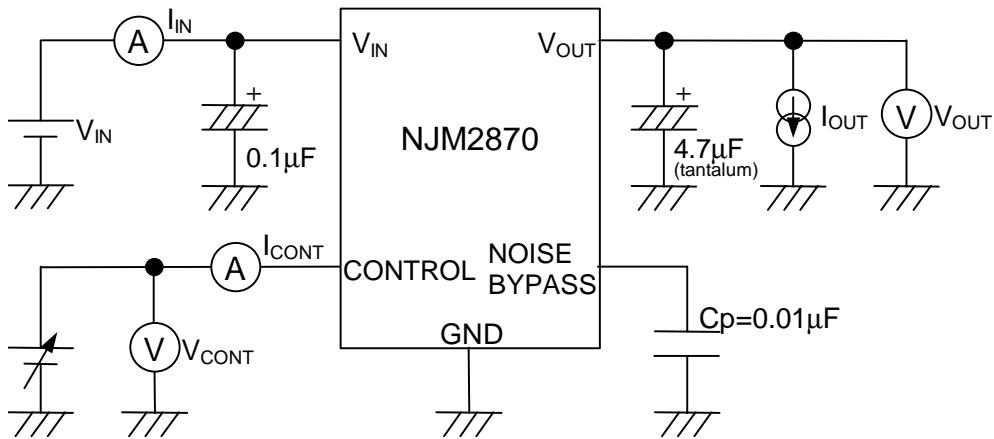
## ■ OUTPUT VOLTAGE RANK LIST

Device Name	V <sub>OUT</sub>
NJM2870F15	1.5V
NJM2870F18	1.8V
NJM2870F19	1.9V
NJM2870F02	2.0V
NJM2870F21	2.1V
NJM2870F23	2.3V
NJM2870F24	2.4V
NJM2870F25	2.5V
NJM2870F26	2.6V

Device Name	V <sub>OUT</sub>
NJM2870F27	2.7V
NJM2870F28	2.8V
NJM2870F285	2.85V
NJM2870F29	2.9V
NJM2870F03	3.0V
NJM2870F31	3.1V
NJM2870F32	3.2V
NJM2870F33	3.3V
NJM2870F34	3.4V

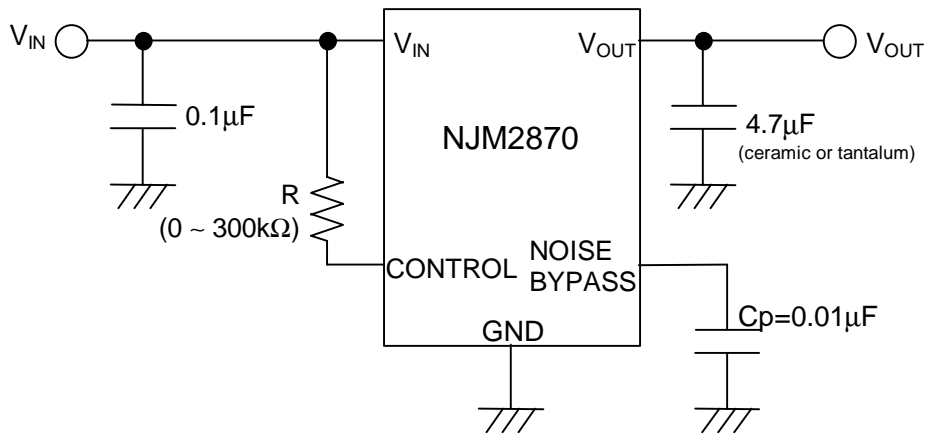
Device Name	V <sub>OUT</sub>
NJM2870F35	3.5V
NJM2870F36	3.6V
NJM2870F38	3.8V
NJM2870F04	4.0V
NJM2870F45	4.5V
NJM2870F46	4.6V
NJM2870F47	4.7V
NJM2870F48	4.8V
NJM2870F05	5.0V

## ■ TEST CIRCUIT



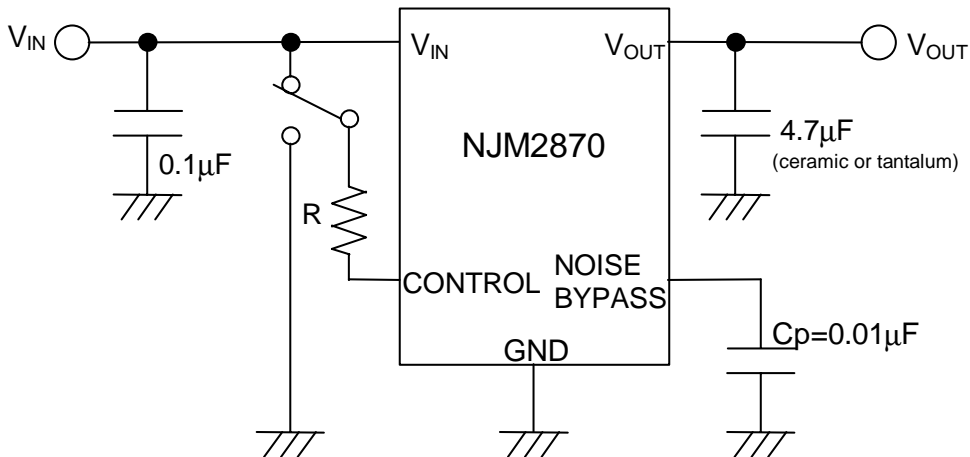
## ■ TYPICAL APPLICATION

① In case that ON/OFF Control is not required:



Connect control terminal to  $V_{IN}$  terminal

② In use of ON/OFF CONTROL:



State of control terminal:

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

### \*Noise bypass Capacitance $C_p$

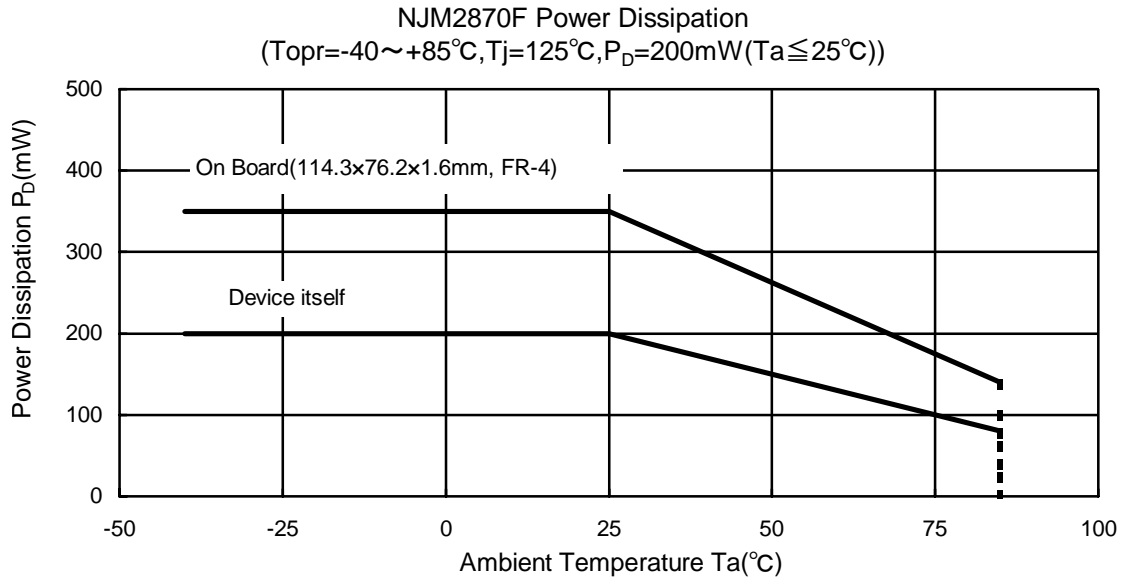
Noise bypass capacitance  $C_p$  reduces noise generated by band-gap reference circuit. Noise level and ripple rejection will be improved when larger  $C_p$  is used. Use of smaller  $C_p$  value may cause oscillation. Use the  $C_p$  value of  $0.01\mu\text{F}$  greater to avoid the problem.

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

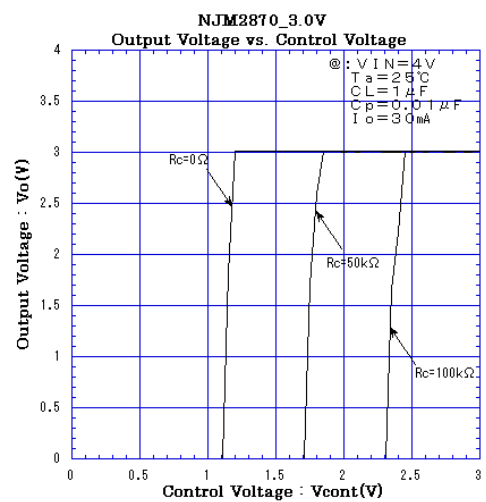
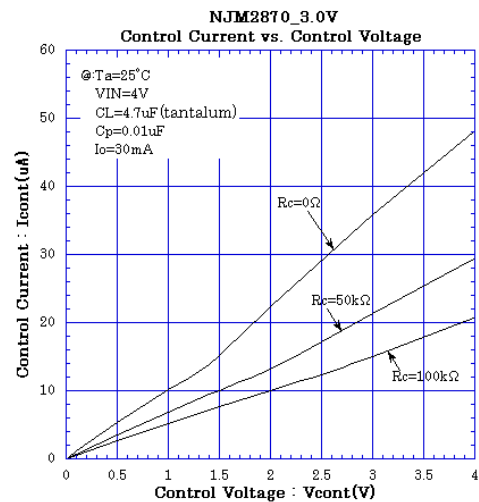
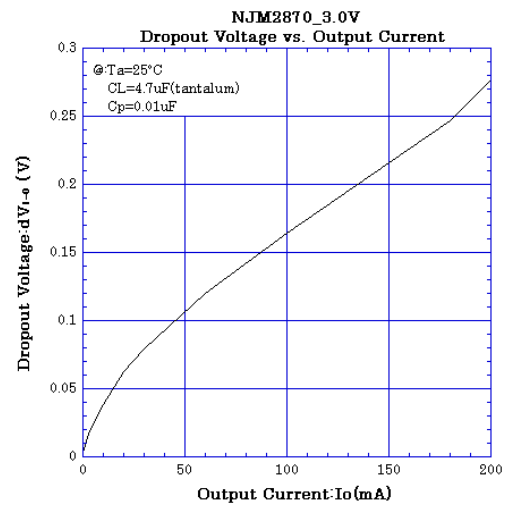
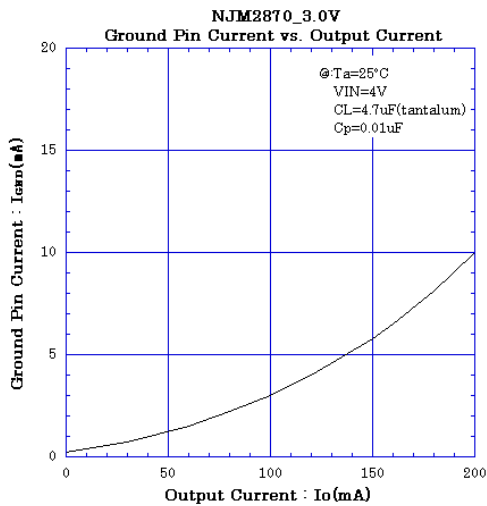
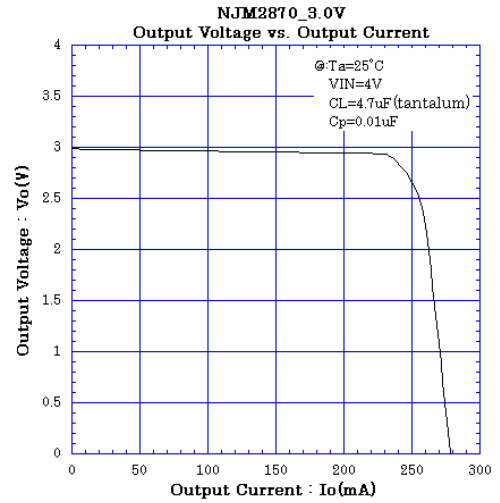
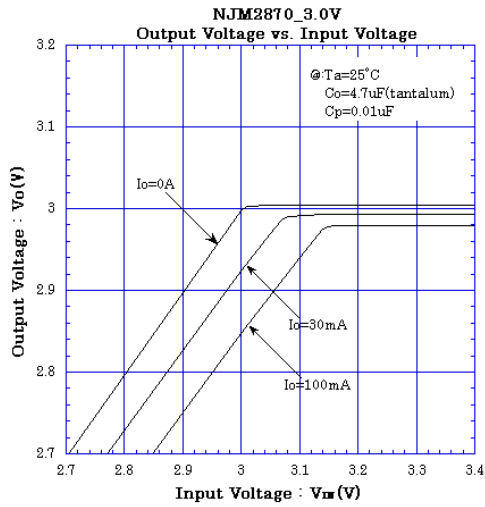
The current flow into the control terminal while the IC is ON state ( $I_{CONT}$ ) can be reduced when a pull up resistance "R" is inserted between  $V_{IN}$  and the control terminal.

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.

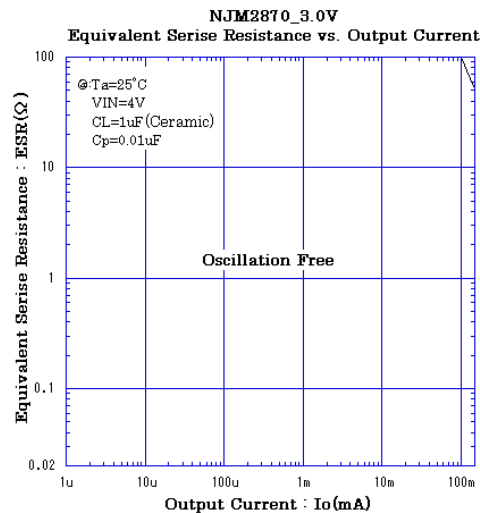
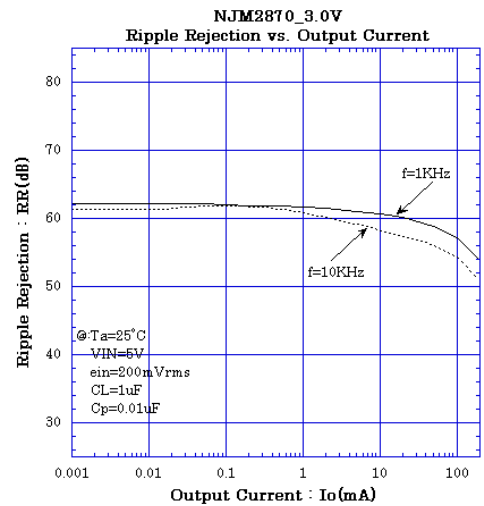
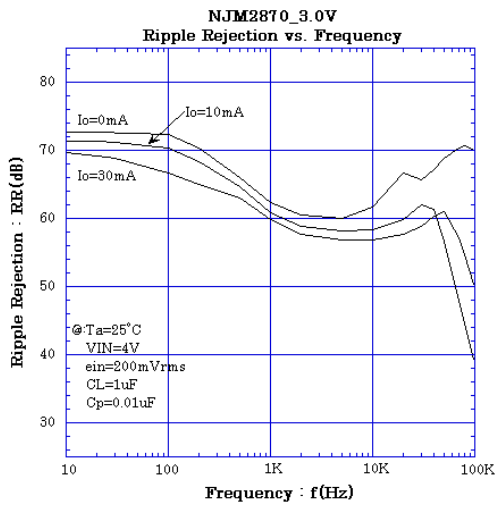
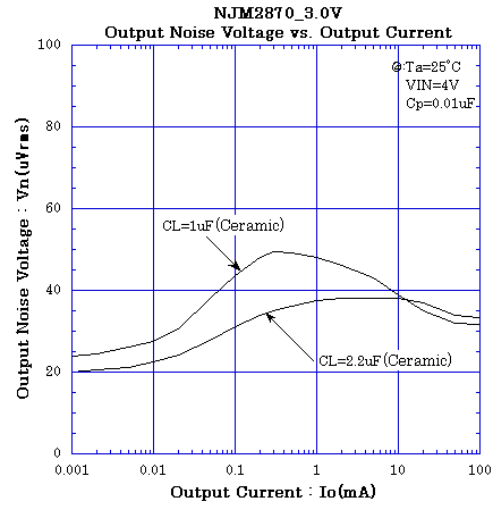
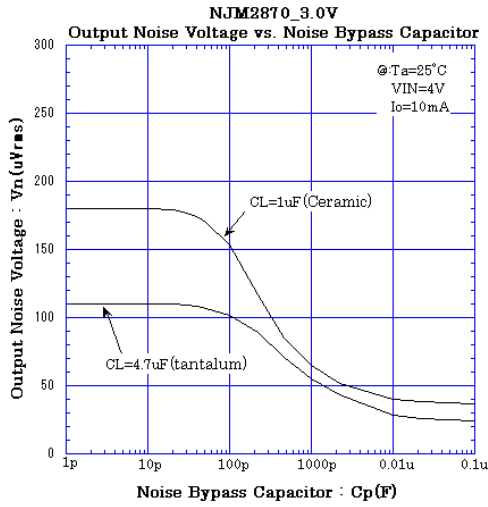
## POWER DISSIPATION vs. AMBIENT TEMPERATURE



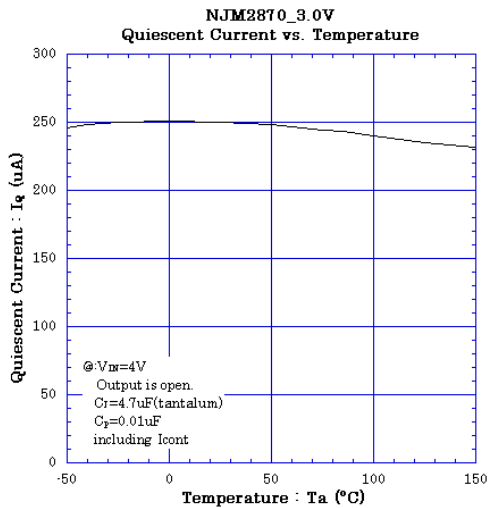
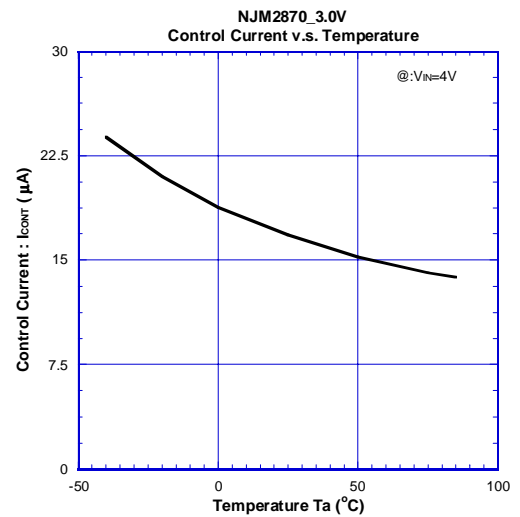
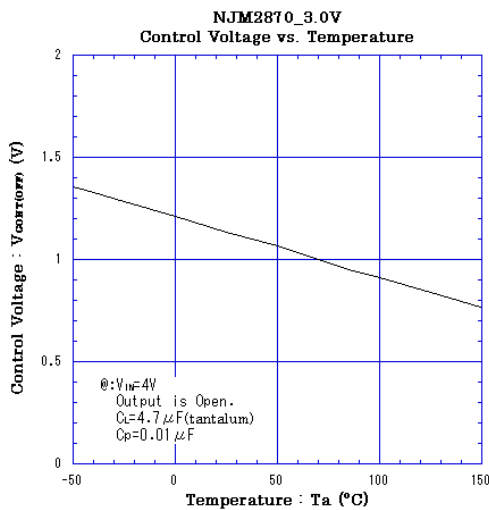
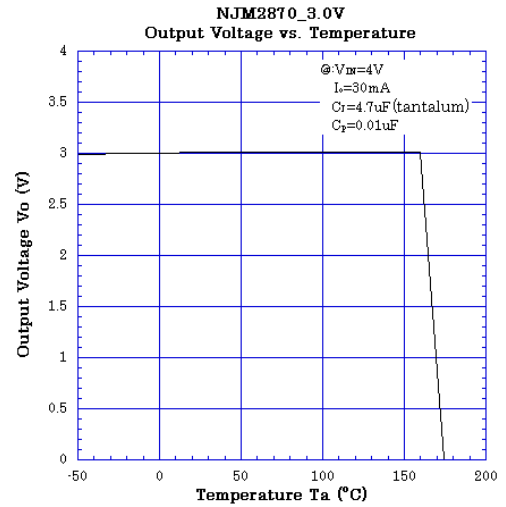
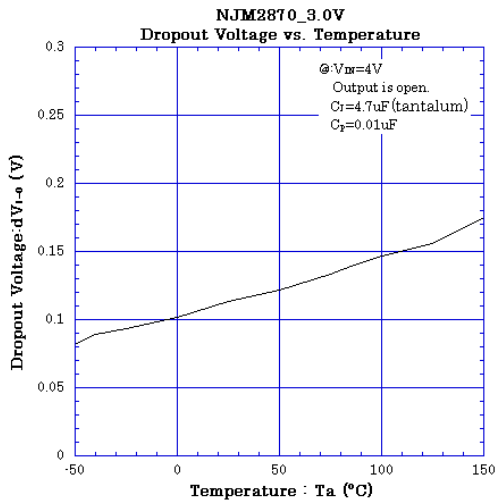
## ■ TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS





**[CAUTION]**

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