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New Japan Radio Co.,Ltd.

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## 3-TERMINAL NEGATIVE VOLTAGE REGULATOR

### ■ GENERAL DESCRIPTION

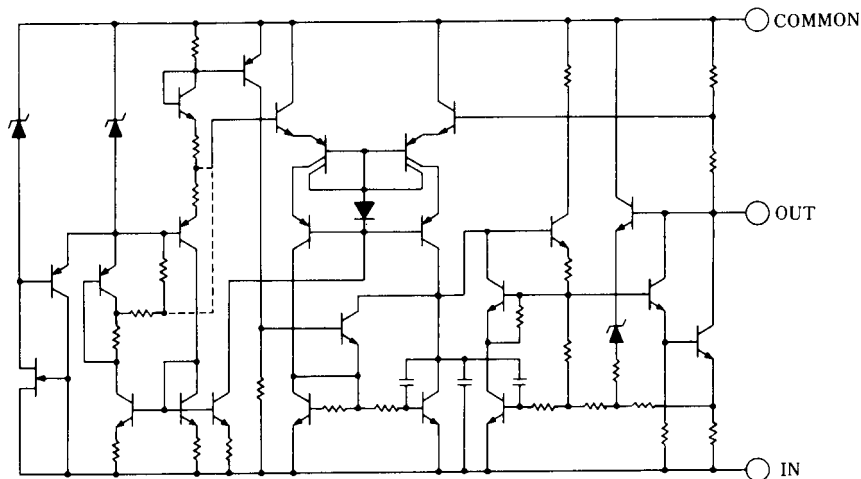
The NJM7900 series of Monolithic 3-Terminal Negative Voltage Regulators are constructed using the New JRC Planar epitaxial process. These negative regulators are intended as complements to the popular NJM7800 series of positive voltage regulators, and they are available in the same voltage options from  $-5$  to  $-24$ V.

The NJM7900 series employ internal current limiting, safe area protection, and thermal shutdown, making the virtually indestructible.

### ■ FEATURES

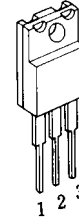
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Excellent Ripple Rejection
- Guarantee'd 1.5A Output Current
- Output Capacitor recommended electrolytic capacitor
- Package Outline TO-220F
- Bipolar Technology

### ■ EQUIVALENT CIRCUIT



### ■ PACKAGE OUTLINE

(TO-220F)



1. COMMON
2. IN
3. OUT

### NJM7900FA

(note) The radiation fin is connected to Pin 2.

# NJM7900

## ■ ABSOLUTE MAXIMUM RATINGS

( $T_a=25^\circ\text{C}$ )

PARAMETER	SYMBOL	MAXIMUM RATINGS		UNIT
Input Voltage	$V_{IN}$	7905 to 7909 7912 to 7915 7918 to 7924	-35 -35 -40	V
Power Dissipation	$P_D$	16( $T_C \leq 70^\circ\text{C}$ )		W
Operating Junction Temperature	$T_j$	-40 to +150		$^\circ\text{C}$
Operating Temperature Range	$T_{opr}$	-40 to +85		$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-40 to +150		$^\circ\text{C}$

## ■ ELECTRICAL CHARACTERISTICS ( $T_j=25^\circ\text{C}$ , $C_{IN}=2.2\mu\text{F}$ , $C_O=1.0\mu\text{F}$ )

Measurement is to be conducted in pulse testing

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM7905FA</b>						
Output Voltage	$V_O$	$V_{IN}=-10\text{V}$ , $I_O=0.5\text{A}$	-4.8	-5.0	-5.2	V
Line Regulation	$\Delta V_O - V_{IN}$	$V_{IN}=-7$ to $-25\text{V}$ , $I_O=0.5\text{A}$	-	5	50	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-10\text{V}$ , $I_O=0.005$ to $1.5\text{A}$	-	50	80	mV
Quiescent Current	$I_Q$	$V_{IN}=-10\text{V}$ , $I_O=0\text{mA}$	-	2.2	5.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=-10\text{V}$ , $I_O=5\text{mA}$	-	-0.4	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=-10\text{V}$ , $I_O=0.5\text{A}$ , $e_{in}=2V_{P-P}$ , $f=120\text{Hz}$	54	60	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=-10\text{V}$ , $I_O=0.5\text{A}$ , $BW=10\text{Hz}$ to $100\text{kHz}$ ,	-	100	-	$\mu\text{V}$
<b>NJM7906FA</b>						
Output Voltage	$V_O$	$V_{IN}=-11\text{V}$ , $I_O=0.5\text{A}$	-5.75	-6.0	-6.25	V
Line Regulation	$\Delta V_O - V_{IN}$	$V_{IN}=-8$ to $-25\text{V}$ , $I_O=0.5\text{A}$	-	5	60	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-11\text{V}$ , $I_O=0.005$ to $1.5\text{A}$	-	50	90	mV
Quiescent Current	$I_Q$	$V_{IN}=-11\text{V}$ , $I_O=0\text{mA}$	-	2.2	5.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=-11\text{V}$ , $I_O=5\text{mA}$	-	-0.5	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=-11\text{V}$ , $I_O=0.5\text{A}$ , $e_{in}=2V_{P-P}$ , $f=120\text{Hz}$	54	60	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=-11\text{V}$ , $I_O=0.5\text{A}$ , $BW=10\text{Hz}$ to $100\text{kHz}$ ,	-	110	-	$\mu\text{V}$

## ■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, C<sub>IN</sub>=2.2μF, C<sub>O</sub>=1.0μF)

Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM7908FA</b>						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =-14V, I <sub>O</sub> =0.5A	-7.7	-8.0	-8.3	V
Line Regulation	ΔV <sub>O</sub> - V <sub>IN</sub>	V <sub>IN</sub> =-10.5 to -25V, I <sub>O</sub> =1.5A	-	8	80	mV
Load Regulation	ΔV <sub>O</sub> - I <sub>O</sub>	V <sub>IN</sub> =-14V, I <sub>O</sub> =0.005 to 0.5A	-	60	110	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =-14V, I <sub>O</sub> =0mA	-	2.2	5.0	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =-14V, I <sub>O</sub> =5mA	-	-0.7	-	mV/°C
Ripple Rejection	RR	V <sub>IN</sub> =-14V, I <sub>O</sub> =0.5A, e <sub>in</sub> =2V <sub>P-P</sub> , f=120Hz	54	60	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =-14V, I <sub>O</sub> =0.5A, BW=10Hz to 100kHz,	-	130	-	μV
<b>NJM7909FA</b>						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =-15V, I <sub>O</sub> =0.5A	-8.65	-9.0	-9.35	V
Line Regulation	ΔV <sub>O</sub> - V <sub>IN</sub>	V <sub>IN</sub> =-11.5 to -25V, I <sub>O</sub> =0.5A	-	8	90	mV
Load Regulation	ΔV <sub>O</sub> - I <sub>O</sub>	V <sub>IN</sub> =-15V, I <sub>O</sub> =0.005 to 1.5A	-	60	120	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =-15V, I <sub>O</sub> =0mA	-	2.2	5.0	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =-15V, I <sub>O</sub> =5mA	-	-0.8	-	mV/°C
Ripple Rejection	RR	V <sub>IN</sub> =-15V, I <sub>O</sub> =0.5A, e <sub>in</sub> =2V <sub>P-P</sub> , f=120Hz	54	59	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =-15V, I <sub>O</sub> =0.5A, BW=10Hz to 100kHz,	-	150	-	μV
<b>NJM7912FA</b>						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =-19V, I <sub>O</sub> =0.5A	-11.5	-12.0	-12.5	V
Line Regulation	ΔV <sub>O</sub> - V <sub>IN</sub>	V <sub>IN</sub> =-14.5 to -30V, I <sub>O</sub> =0.5A	-	3	120	mV
Load Regulation	ΔV <sub>O</sub> - I <sub>O</sub>	V <sub>IN</sub> =-19V, I <sub>O</sub> =0.005 to 1.5A	-	60	150	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =-19V, I <sub>O</sub> =0mA	-	2.7	6.0	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =-19V, I <sub>O</sub> =5mA	-	-0.4	-	mV/°C
Ripple Rejection	RR	V <sub>IN</sub> =-19V, I <sub>O</sub> =0.5A, e <sub>in</sub> =2V <sub>P-P</sub> , f=120Hz	54	68	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =-19V, I <sub>O</sub> =0.5A, BW=10Hz to 100kHz,	-	150	-	μV
<b>NJM7915FA</b>						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =-23V, I <sub>O</sub> =0.5A	-14.4	-15.0	-15.6	V
Line Regulation	ΔV <sub>O</sub> - V <sub>IN</sub>	V <sub>IN</sub> =-17.5 to -30V, I <sub>O</sub> =0.5A	-	3	150	mV
Load Regulation	ΔV <sub>O</sub> - I <sub>O</sub>	V <sub>IN</sub> =-23V, I <sub>O</sub> =0.005 to 1.5A	-	60	180	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =-23V, I <sub>O</sub> =0mA	-	2.7	6.0	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =-23V, I <sub>O</sub> =5mA	-	-0.5	-	mV/°C
Ripple Rejection	RR	V <sub>IN</sub> =-23V, I <sub>O</sub> =0.5A, e <sub>in</sub> =2V <sub>P-P</sub> , f=120Hz	54	67	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =-23V, I <sub>O</sub> =0.5A, BW=10Hz to 100kHz,	-	170	-	μV

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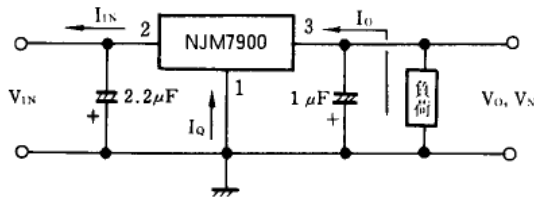
## ■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, C<sub>IN</sub>=2.2μF, C<sub>O</sub>=1.0μF)

Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM7918FA</b>						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =-27V, I <sub>O</sub> =0.5A	-17.3	-18.0	-18.7	V
Line Regulation	ΔV <sub>O</sub> - V <sub>IN</sub>	V <sub>IN</sub> =-21 to -33V, I <sub>O</sub> =0.5A	-	4	180	mV
Load Regulation	ΔV <sub>O</sub> - I <sub>O</sub>	V <sub>IN</sub> =-27V, I <sub>O</sub> =0.005 to 1.5A	-	60	210	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =-27V, I <sub>O</sub> =0mA	-	2.7	6.0	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =-27V, I <sub>O</sub> =5mA	-	-0.6	-	mV/°C
Ripple Rejection	RR	V <sub>IN</sub> =-27V, I <sub>O</sub> =0.5A, e <sub>in</sub> =2V <sub>P,P</sub> , f=120Hz	54	66	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =-27V, I <sub>O</sub> =0.5A, BW=10Hz to 100kHz,	-	200	-	μV
<b>NJM7924FA</b>						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =-33V, I <sub>O</sub> =0.5A	-23.0	-24.0	-25.0	V
Line Regulation	ΔV <sub>O</sub> - V <sub>IN</sub>	V <sub>IN</sub> =-27 to -38V, I <sub>O</sub> =0.5A	-	5	240	mV
Load Regulation	ΔV <sub>O</sub> - I <sub>O</sub>	V <sub>IN</sub> =-33V, I <sub>O</sub> =0.005 to 1.5A	-	60	270	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =-33V, I <sub>O</sub> =0mA	-	2.7	6.0	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =-33V, I <sub>O</sub> =5mA	-	-0.8	-	mV/°C
Ripple Rejection	RR	V <sub>IN</sub> =-33V, I <sub>O</sub> =0.5A, e <sub>in</sub> =2V <sub>P,P</sub> , f=120Hz	54	64	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =-33V, I <sub>O</sub> =0.5A, BW=10Hz to 100kHz,	-	300	-	μV

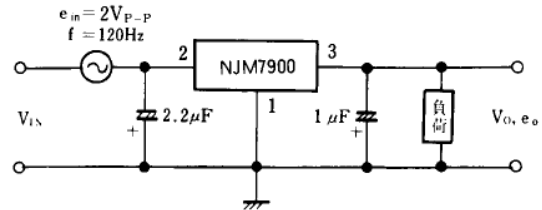
## ■ TEST CIRCUIT

1. Output Voltage, Line Regulation, Load Regulation, Quiescent Current, Average Temperature Coefficient of Output Voltage, Output Noise Voltage



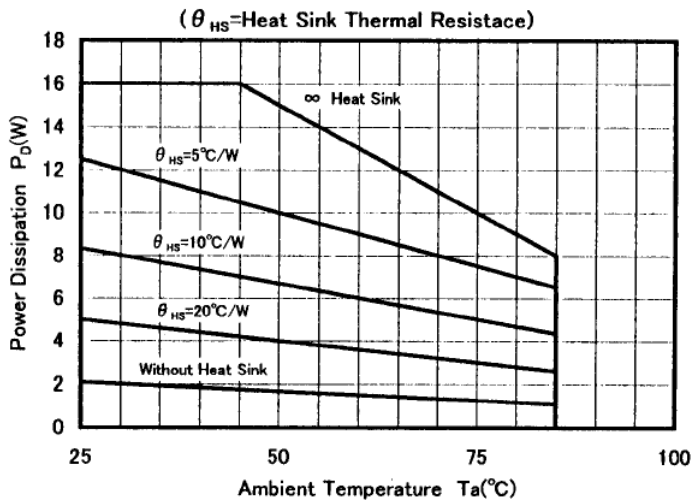
$$I_Q = I_{IN} - I_O$$

2. Ripple Rejection



$$RR = 20 \log_{10} \left( \frac{e_{in}}{e_o} \right) \text{ [dB]}$$

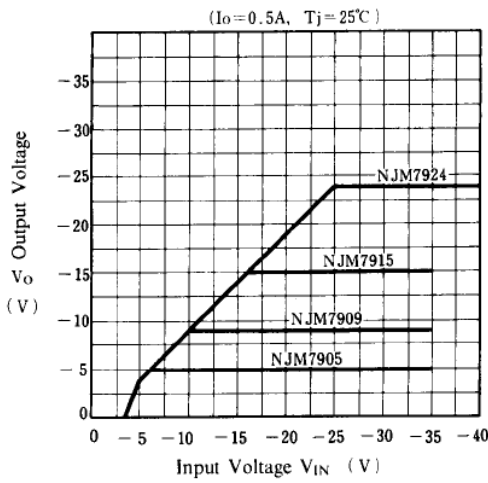
## ■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



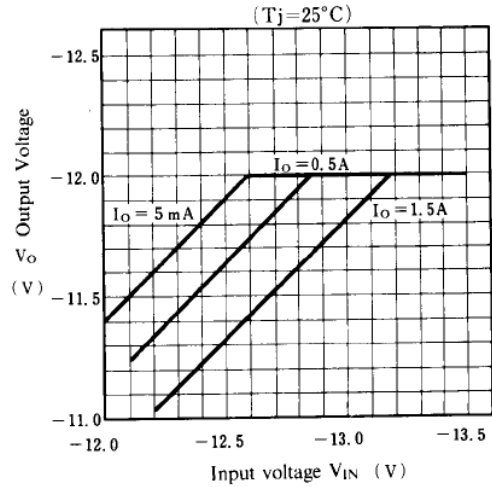
# NJM7900

## ■ TYPICAL CHARACTERISTICS

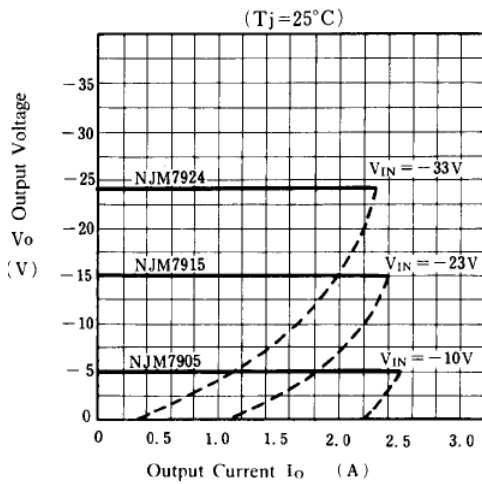
**NJM7900 Output Characteristics**



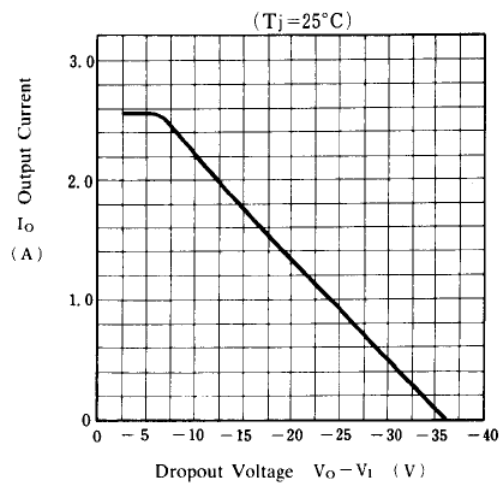
**NJM7912 Output Voltage vs. Low Input Voltage**



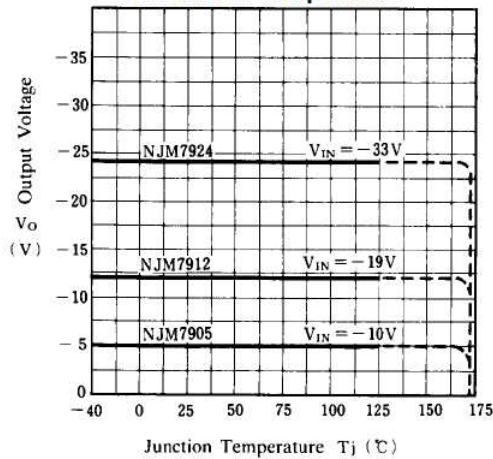
**NJM7905/15/24 Load Characteristics**



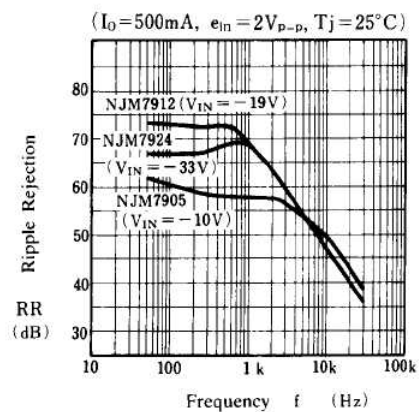
**NJM7900 Series Short Circuit Output Current**



**NJM7905/12/24 Output Voltage vs. Junction Temperature**

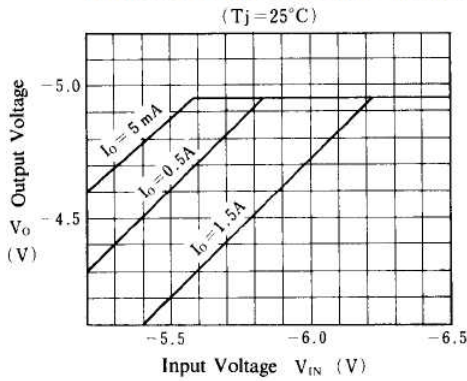


**NJM7905/15/24 Ripple Rejection vs. Frequency**

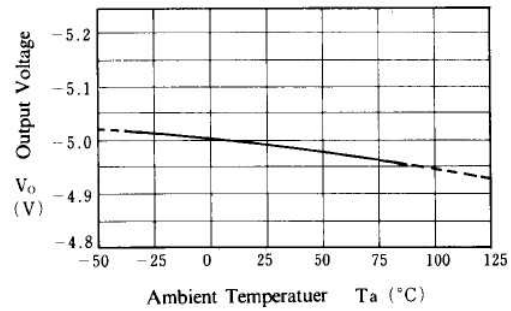


## ■ TYPICAL CHARACTERISTICS

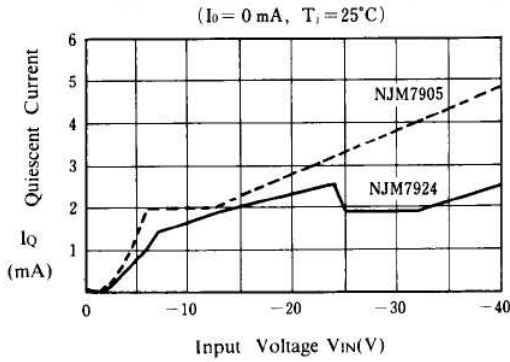
### NJM7905 Dropout Characteristics



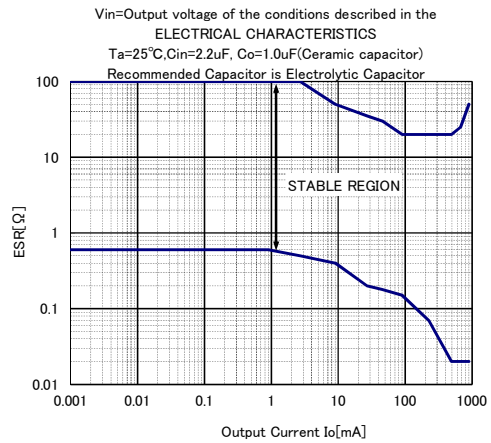
### NJM7905 Output Voltage vs. Temperature



### Quiescent Current vs. Input Voltage



### NJM7900 Equivalent Series Resistor Vs. Output Current





#### [CAUTION]

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