

3-TERMINAL NEGATIVE VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

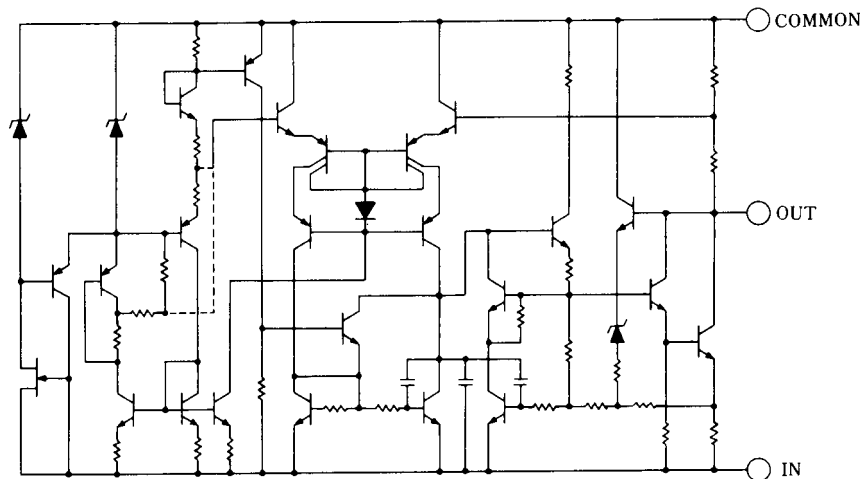
The NJM7900 series of Monolithic 3-Terminal Negative Voltage Regulators are constructed using the New JRC Planar epitaxial process. These negative regulators are intended as complements to the popular NJM7800 series of positive voltage regulators, and they are available in the same voltage options from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

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

■ FEATURES

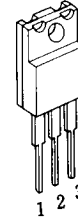
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Excellent Ripple Rejection
- Guarantee'd 1.5A Output Current
- Output Capacitor recommended electrolytic capacitor
- Package Outline TO-220F
- Bipolar Technology

■ 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		$^\circ\text{C}$

■ THERMAL CHARACTERISTICS

Thermal Resistance	Junction-to-Ambient Temperature	θ_{ja}	60	$^\circ\text{C/W}$
	Junction-to-case	θ_{jc}	5	

■ 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
NJM7905FA						
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 -25V , $I_O=0.5\text{A}$	-	5	50	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-10\text{V}$, $I_O=0.005$ to 1.5A	-	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 100kHz ,	-	100	-	μV
NJM7906FA						
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 -25V , $I_O=0.5\text{A}$	-	5	60	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-11\text{V}$, $I_O=0.005$ to 1.5A	-	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 100kHz ,	-	110	-	μV

■ **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
NJM7908FA						
Output Voltage	V_O	$V_{IN}=-14\text{V}$, $I_O=0.5\text{A}$	-7.7	-8.0	-8.3	V
Line Regulation	$\Delta V_O - V_{IN}$	$V_{IN}=-10.5$ to -25V , $I_O=1.5\text{A}$	-	8	80	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-14\text{V}$, $I_O=0.005$ to 0.5A	-	60	110	mV
Quiescent Current	I_Q	$V_{IN}=-14\text{V}$, $I_O=0\text{mA}$	-	2.2	5.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=-14\text{V}$, $I_O=5\text{mA}$	-	-0.7	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=-14\text{V}$, $I_O=0.5\text{A}$, $e_{in}=2V_{P-P}$, $f=120\text{Hz}$	54	60	-	dB
Output Noise Voltage	V_{NO}	$V_{IN}=-14\text{V}$, $I_O=0.5\text{A}$, $BW=10\text{Hz}$ to 100kHz ,	-	130	-	μV
NJM7909FA						
Output Voltage	V_O	$V_{IN}=-15\text{V}$, $I_O=0.5\text{A}$	-8.65	-9.0	-9.35	V
Line Regulation	$\Delta V_O - V_{IN}$	$V_{IN}=-11.5$ to -25V , $I_O=0.5\text{A}$	-	8	90	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-15\text{V}$, $I_O=0.005$ to 1.5A	-	60	120	mV
Quiescent Current	I_Q	$V_{IN}=-15\text{V}$, $I_O=0\text{mA}$	-	2.2	5.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=-15\text{V}$, $I_O=5\text{mA}$	-	-0.8	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=-15\text{V}$, $I_O=0.5\text{A}$, $e_{in}=2V_{P-P}$, $f=120\text{Hz}$	54	59	-	dB
Output Noise Voltage	V_{NO}	$V_{IN}=-15\text{V}$, $I_O=0.5\text{A}$, $BW=10\text{Hz}$ to 100kHz ,	-	150	-	μV
NJM7912FA						
Output Voltage	V_O	$V_{IN}=-19\text{V}$, $I_O=0.5\text{A}$	-11.5	-12.0	-12.5	V
Line Regulation	$\Delta V_O - V_{IN}$	$V_{IN}=-14.5$ to -30V , $I_O=0.5\text{A}$	-	3	120	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-19\text{V}$, $I_O=0.005$ to 1.5A	-	60	150	mV
Quiescent Current	I_Q	$V_{IN}=-19\text{V}$, $I_O=0\text{mA}$	-	2.7	6.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=-19\text{V}$, $I_O=5\text{mA}$	-	-0.4	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=-19\text{V}$, $I_O=0.5\text{A}$, $e_{in}=2V_{P-P}$, $f=120\text{Hz}$	54	68	-	dB
Output Noise Voltage	V_{NO}	$V_{IN}=-19\text{V}$, $I_O=0.5\text{A}$, $BW=10\text{Hz}$ to 100kHz ,	-	150	-	μV
NJM7915FA						
Output Voltage	V_O	$V_{IN}=-23\text{V}$, $I_O=0.5\text{A}$	-14.4	-15.0	-15.6	V
Line Regulation	$\Delta V_O - V_{IN}$	$V_{IN}=-17.5$ to -30V , $I_O=0.5\text{A}$	-	3	150	mV
Load Regulation	$\Delta V_O - I_O$	$V_{IN}=-23\text{V}$, $I_O=0.005$ to 1.5A	-	60	180	mV
Quiescent Current	I_Q	$V_{IN}=-23\text{V}$, $I_O=0\text{mA}$	-	2.7	6.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=-23\text{V}$, $I_O=5\text{mA}$	-	-0.5	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=-23\text{V}$, $I_O=0.5\text{A}$, $e_{in}=2V_{P-P}$, $f=120\text{Hz}$	54	67	-	dB
Output Noise Voltage	V_{NO}	$V_{IN}=-23\text{V}$, $I_O=0.5\text{A}$, $BW=10\text{Hz}$ to 100kHz ,	-	170	-	μV

NJM7900

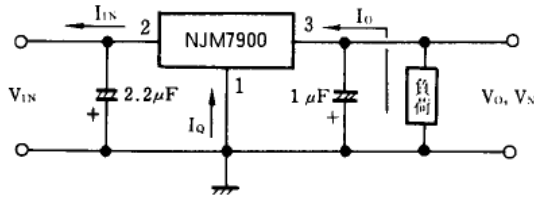
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, C_{IN}=2.2μF, C_O=1.0μF)

Measurement is to be conducted in pulse testing.

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

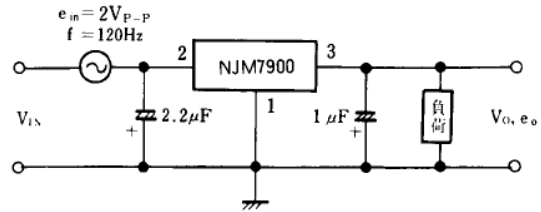
■ TEST CIRCUIT

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



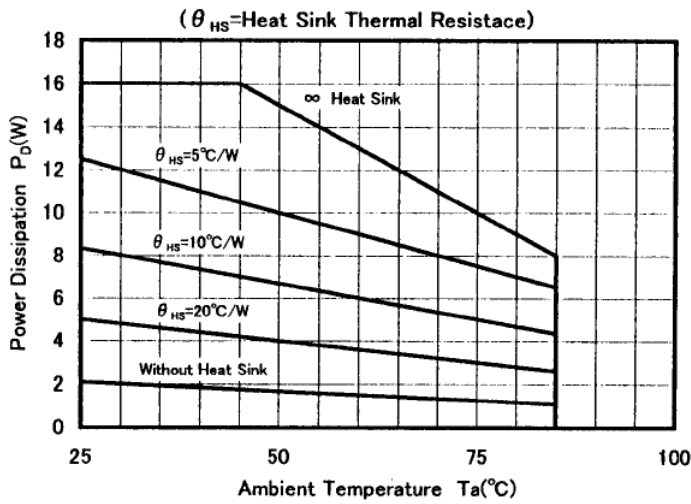
$$I_Q = I_{IN} - I_O$$

2. Ripple Rejection



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

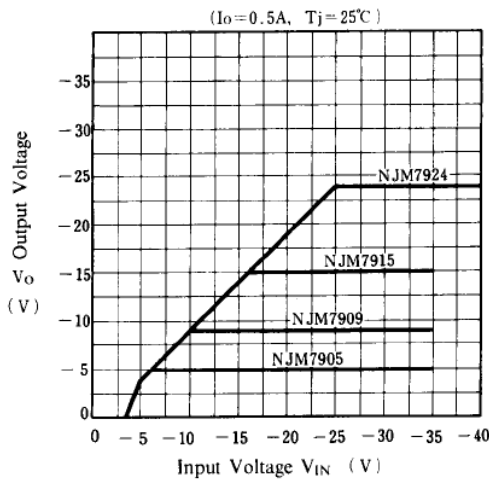
■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



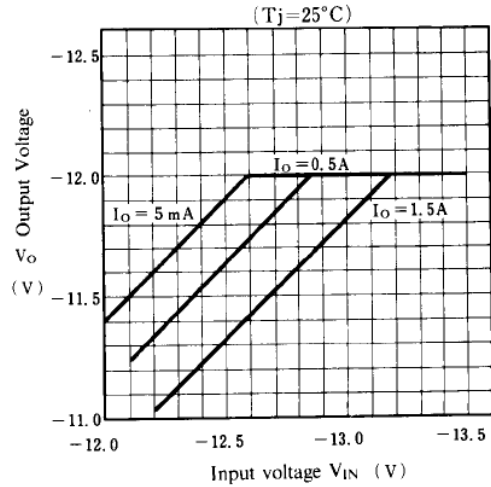
NJM7900

■ TYPICAL CHARACTERISTICS

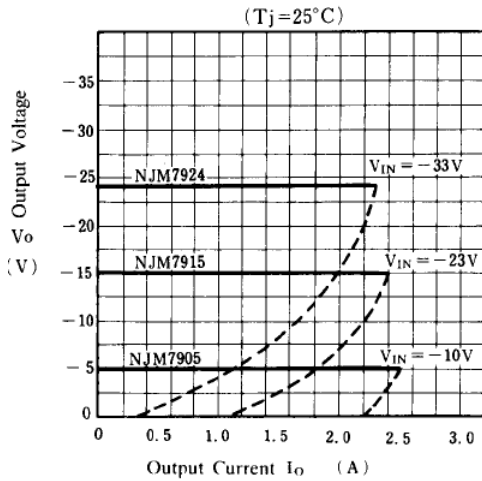
NJM7900 Output Characteristics



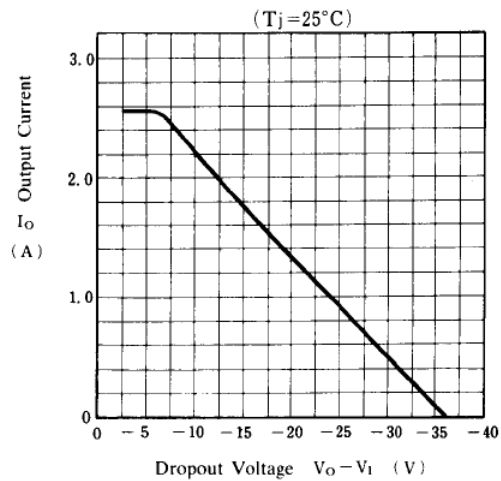
NJM7912 Output Voltage vs. Low Input Voltage



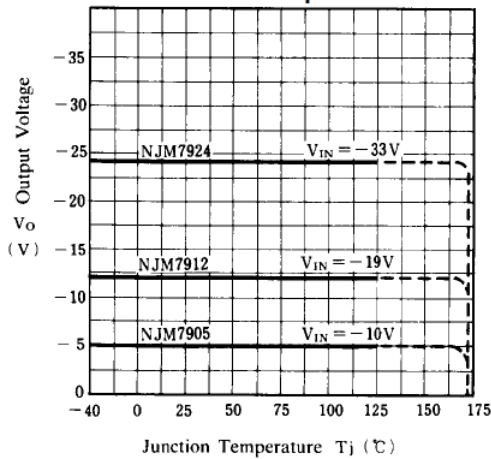
NJM7905/15/24 Load Characteristics



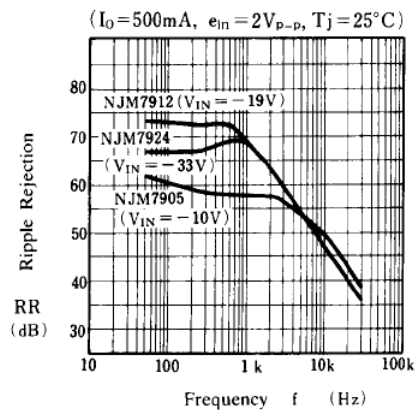
NJM7900 Series Short Circuit Output Current



NJM7905/12/24 Output Voltage vs. Junction Temperature

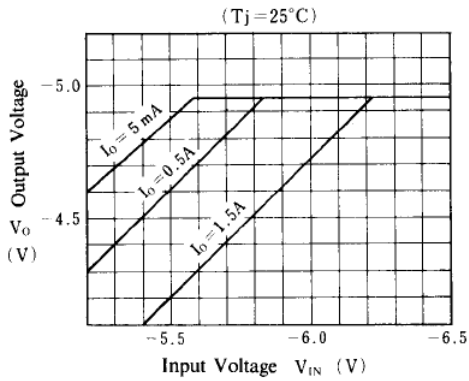


NJM7905/15/24 Ripple Rejection vs. Frequency

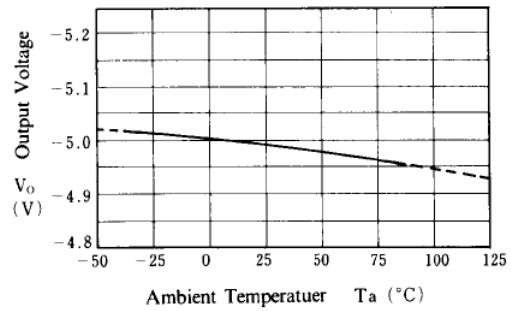


■ TYPICAL CHARACTERISTICS

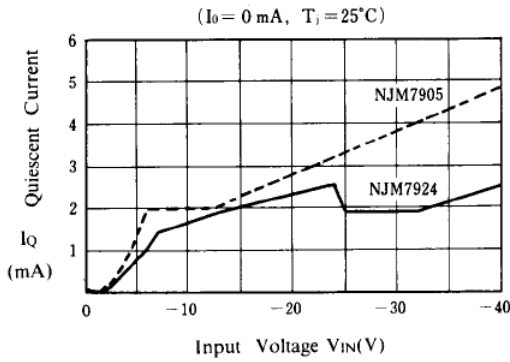
NJM7905 Dropout Characteristics



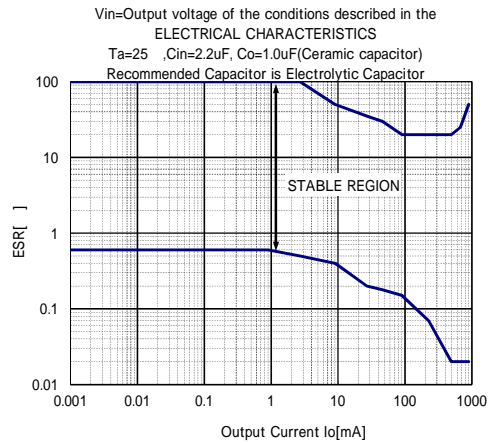
NJM7905 Output Voltage vs. Temperature



Quiescent Current vs. Input Voltage



NJM7900 Equivalent Series Resistor Vs. Output Current



[CAUTION]

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