

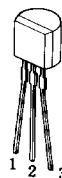
3-TERMINAL POSITIVE VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

The NJM78L00 series of 3-Terminal Positive Voltage Regulators is constructed using the New JRC Planar epitaxial process. These regulators employ internal current-limiting and thermal-shutdown, making them essentially indestructible. If adequate heat sinking is provided, they can deliver up to 100mA output current. They are intended as fixed voltage regulators in a wide range of applications including local or on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power pass elements to make high-current voltage regulators. The NJM78L00 series used as a Zener diode/resistor combination replacement, offers an effective output impedance improvement of typically two orders of magnitude, along with lower quiescent current and lower noise.

■ PACKAGE OUTLINE

(TO-92)



NJM78L00A

1. OUT
2. GND
3. IN

(SOT-89)



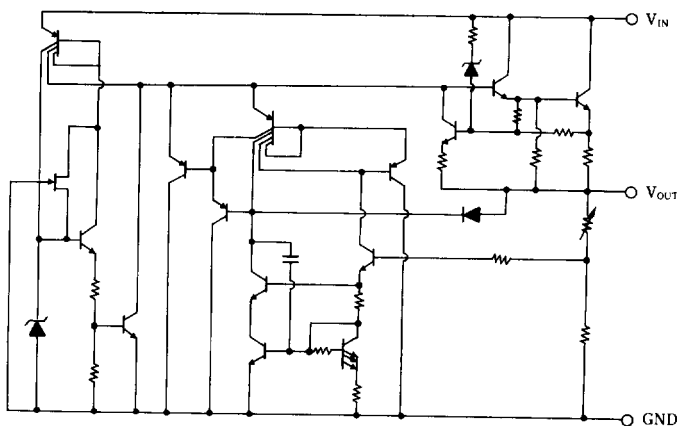
NJM78L00UA

1. OUT
2. GND
3. IN

■ FEATURES

- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Excellent Ripple Rejection
- Guarantee'd 100mA Output Current
- Package Outline TO-92, SOT-89
- Bipolar Technology

■ EQUIVALENT CIRCUIT





■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	(78L02A~78L09A)30	V
		(78L12A~78L15A)35	V
		(78L18A~78L24A)40	V
Output Current	I_O	100	mA
Power Dissipation	P_D	(TO92) 500	mW
		(SOT89) 350	mW
Operating Temperature Range	T_{opr}	-30~+75	°C
Storage Temperature Range	T_{stg}	-40~+125	°C

■ ELECTRICAL CHARACTERISTICS

($C_{IN}=0.33\mu f$, $C_O=0.1\mu f$, $T_J=25^\circ C$)

Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78L02A						
Output Voltage	V_O	$V_{IN}=9V$, $I_O=400mA$	2.47	2.6	2.73	V
Line Regulation 1	$\Delta V_O/V_{IN1}$	$V_{IN}=4.75\sim 20V$, $I_O=40mA$	—	—	125	mV
Line Regulation 2	$\Delta V_O/V_{IN2}$	$V_{IN}=5\sim 20V$, $I_O=40mA$	—	—	100	mV
Load Regulation 1	$\Delta V_O/I_{O1}$	$V_{IN}=9V$, $I_O=1\sim 40mA$	—	—	25	mV
Load Regulation 2	$\Delta V_O/I_{O2}$	$V_{IN}=9V$, $I_O=1\sim 100mA$	—	—	50	mV
Quiescent Current	I_Q	$V_{IN}=9V$, $I_O=0mA$	—	2.0	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=9V$, $I_O=1mA$	—	0.2	—	mV/°C
Ripple Rejections	RR	$6V<V_{IN}<16V$, $I_O=40mA$, $e_{in}=1V_{P-P}$, $f=120Hz$	43	73	—	dB
Output Noise Voltage	V_{NO}	$BW=10Hz\sim 100kHz$, $V_{IN}=9V$, $I_O=40mA$	—	35	—	μV
NJM78L05A						
Output Voltage	V_O	$V_{IN}=10V$, $I_O=40mA$	4.75	5	5.25	V
Line Regulation 1	$\Delta V_O/V_{IN1}$	$V_{IN}=7\sim 20V$, $I_O=40mA$	—	—	200	mV
Line Regulation 2	$\Delta V_O/V_{IN2}$	$V_{IN}=8\sim 20V$, $I_O=40mA$	—	—	150	mV
Load Regulation 1	$\Delta V_O/I_{O1}$	$V_{IN}=10V$, $I_O=1\sim 40mA$	—	—	30	mV
Load Regulation 2	$\Delta V_O/I_{O2}$	$V_{IN}=10V$, $I_O=1\sim 100mA$	—	—	60	mV
Quiescent Current	I_Q	$V_{IN}=10V$, $I_O=0mA$	—	2.0	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=10V$, $I_O=1mA$	—	0.4	—	mV/°C
Ripple Rejections	RR	$8V<V_{IN}<18V$, $I_O=40mA$, $e_{in}=1V_{P-P}$, $f=120Hz$	40	69	—	dB
Output Noise Voltage	V_{NO}	$BW=10Hz\sim 100kHz$, $V_{IN}=10V$, $I_O=40mA$	—	70	—	μV



■ ELECTRICAL CHARACTERISTICS ($C_{IN}=0.33\ \mu\text{f}$, $C_O=0.1\ \mu\text{f}$, $T_J=25^\circ\text{C}$) Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78L06A						
Output Voltage	V_O	$V_{IN}=12\text{V}$, $I_O=40\text{mA}$	5.7	6	6.3	V
Line Regulation 1	$\Delta V_O \cdot V_{IN1}$	$V_{IN}=8.5\sim 20\text{V}$, $I_O=40\text{mA}$	—	—	200	mV
Line Regulation 2	$\Delta V_O \cdot V_{IN2}$	$V_{IN}=9\sim 20\text{V}$, $I_O=40\text{mA}$	—	—	150	mV
Load Regulation 1	$\Delta V_O \cdot I_{O1}$	$V_{IN}=12\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	40	mV
Load Regulation 2	$\Delta V_O \cdot I_{O2}$	$V_{IN}=12\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	80	mV
Quiescent Current	I_Q	$V_{IN}=12\text{V}$, $I_O=0\text{mA}$	—	2.0	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O / \Delta T$	$V_{IN}=12\text{V}$, $I_O=1\text{mA}$	—	0.5	—	mV/ $^\circ\text{C}$
Ripple Rejections	RR	$9\text{V} < V_{IN} < 20\text{V}$, $I_O=40\text{mA}$, $e_{in}=1\text{V}_{P-P}$, $f=120\text{Hz}$	40	67	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=12\text{V}$, $I_O=40\text{mA}$	—	80	—	μV
NJM78L08A						
Output Voltage	V_O	$V_{IN}=14\text{V}$, $I_O=40\text{mA}$	7.6	8	8.4	V
Line Regulation 1	$\Delta V_O \cdot V_{IN1}$	$V_{IN}=10.5\sim 23\text{V}$, $I_O=40\text{mA}$	—	—	225	mV
Line Regulation 2	$\Delta V_O \cdot V_{IN2}$	$V_{IN}=11\sim 23\text{V}$, $I_O=40\text{mA}$	—	—	175	mV
Load Regulation 1	$\Delta V_O \cdot I_{O1}$	$V_{IN}=14\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	50	mV
Load Regulation 2	$\Delta V_O \cdot I_{O2}$	$V_{IN}=14\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	100	mV
Quiescent Current	I_Q	$V_{IN}=14\text{V}$, $I_O=0\text{mA}$	—	2.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O / \Delta T$	$V_{IN}=14\text{V}$, $I_O=1\text{mA}$	—	0.6	—	mV/ $^\circ\text{C}$
Ripple Rejections	RR	$11\text{V} < V_{IN} < 20\text{V}$, $I_O=40\text{mA}$, $e_{in}=1\text{V}_{P-P}$, $f=120\text{Hz}$	39	66	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=14\text{V}$, $I_O=40\text{mA}$	—	115	—	μV
NJM78L09A						
Output Voltage	V_O	$V_{IN}=15\text{V}$, $I_O=40\text{mA}$	8.55	9	9.45	V
Line Regulation 1	$\Delta V_O \cdot V_{IN1}$	$V_{IN}=11.5\sim 23\text{V}$, $I_O=40\text{mA}$	—	—	250	mV
Line Regulation 2	$\Delta V_O \cdot V_{IN2}$	$V_{IN}=12\sim 23\text{V}$, $I_O=40\text{mA}$	—	—	200	mV
Load Regulation 1	$\Delta V_O \cdot I_{O1}$	$V_{IN}=15\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	50	mV
Load Regulation 2	$\Delta V_O \cdot I_{O2}$	$V_{IN}=15\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	100	mV
Quiescent Current	I_Q	$V_{IN}=15\text{V}$, $I_O=0\text{mA}$	—	2.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O / \Delta T$	$V_{IN}=15\text{V}$, $I_O=1\text{mA}$	—	0.65	—	mV/ $^\circ\text{C}$
Ripple Rejections	RR	$12\text{V} < V_{IN} < 21\text{V}$, $I_O=40\text{mA}$, $e_{in}=1\text{V}_{P-P}$, $f=120\text{Hz}$	38	65	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=15\text{V}$, $I_O=40\text{mA}$	—	125	—	μV
NJM78L12A						
Output Voltage	V_O	$V_{IN}=19\text{V}$, $I_O=40\text{mA}$	11.4	12	12.6	V
Line Regulation 1	$\Delta V_O \cdot V_{IN1}$	$V_{IN}=14.5\sim 27\text{V}$, $I_O=40\text{mA}$	—	—	250	mV
Line Regulation 2	$\Delta V_O \cdot V_{IN2}$	$V_{IN}=16\sim 27\text{V}$, $I_O=40\text{mA}$	—	—	200	mV
Load Regulation 1	$\Delta V_O \cdot I_{O1}$	$V_{IN}=19\text{V}$, $I_O=1\sim 40\text{mA}$	—	—	50	mV
Load Regulation 2	$\Delta V_O \cdot I_{O2}$	$V_{IN}=19\text{V}$, $I_O=1\sim 100\text{mA}$	—	—	100	mV
Quiescent Current	I_Q	$V_{IN}=19\text{V}$, $I_O=0\text{mA}$	—	2.1	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O / \Delta T$	$V_{IN}=19\text{V}$, $I_O=1\text{mA}$	—	0.9	—	mV/ $^\circ\text{C}$
Ripple Rejections	RR	$15\text{V} < V_{IN} < 25\text{V}$, $I_O=40\text{mA}$, $e_{in}=1\text{V}_{P-P}$, $f=120\text{Hz}$	37	62	—	dB
Output Noise Voltage	V_{NO}	$BW=10\text{Hz}\sim 100\text{kHz}$, $V_{IN}=19\text{V}$, $I_O=40\text{mA}$	—	160	—	μV

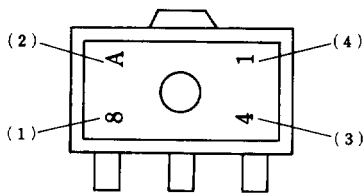


■ ELECTRICAL CHARACTERISTICS (C_{IN}=0.33 μF, C_O=0.1 μF, T_J=25°C) Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78L15A						
Output Voltage	V _O	V _{IN} =23V, I _O =40mA	14.3	15	15.7	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =17.5~30V, I _O =40mA	—	—	300	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =20~30V, I _O =40mA	—	—	250	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =23V, I _O =1~40mA	—	—	75	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =23V, I _O =1~100mA	—	—	150	mV
Quiescent Current	I _Q	V _{IN} =23V, I _O =0mA	—	2.2	6.5	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =23V, I _O =1mA	—	1.0	—	mV/°C
Ripple Rejections	RR	18.5V<V _{IN} <28.5V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	34	60	—	dB
Output Noise Voltage	V _{NO}	BW=10Hz~100kHz, V _{IN} =23V, I _O =40mA	—	190	—	μV
NJM78L18A						
Output Voltage	V _O	V _{IN} =27V, I _O =40mA	17.1	18	18.9	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =22~33V, I _O =40mA	—	—	320	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =23~33V, I _O =40mA	—	—	270	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =27V, I _O =1~40mA	—	—	80	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =27V, I _O =1~100mA	—	—	160	mV
Quiescent Current	I _Q	V _{IN} =27V, I _O =0mA	—	2.2	6.5	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =27V, I _O =1mA	—	1.1	—	mV/°C
Ripple Rejections	RR	23V<V _{IN} <33V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	33	59	—	dB
Output Noise Voltage	V _{NO}	BW=10Hz~100kHz, V _{IN} =27V, I _O =40mA	—	230	—	μV
NJM78L20A						
Output Voltage	V _O	V _{IN} =29V, I _O =40mA	19.0	20	21	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =23~34V, I _O =40mA	—	—	330	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =24~34V, I _O =40mA	—	—	280	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =29V, I _O =1~40mA	—	—	90	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =29V, I _O =1~100mA	—	—	180	mV
Quiescent Current	I _Q	V _{IN} =29V, I _O =1mA	—	2.3	7	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =29V, I _O =1mA	—	1.2	—	mV/°C
Ripple Rejections	RR	24V<V _{IN} <34V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	32	58	—	dB
Output Noise Voltage	V _{NO}	BW=10Hz~100kHz, V _{IN} =29V, I _O =40mA	—	250	—	μV
NJM78L24A						
Output Voltage	V _O	V _{IN} =33V, I _O =40mA	22.8	24	25.2	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =27~38V, I _O =40mA	—	—	350	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =28~38V, I _O =40mA	—	—	300	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =33V, I _O =1~40mA	—	—	100	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =33V, I _O =1~100mA	—	—	200	mV
Quiescent Current	I _Q	V _{IN} =33V, I _O =0mA	—	2.3	7	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =33V, I _O =1mA	—	1.4	—	mV/°C
Ripple Rejections	RR	27.5V<V _{IN} <37.5V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	32	57	—	dB
Output Noise Voltage	V _{NO}	BW=10Hz~100kHz, V _{IN} =33V, I _O =40mA	—	280	—	μV



■ SOT- 89 MARK



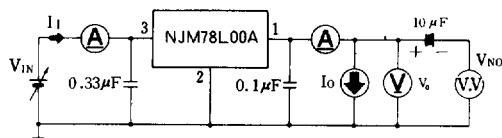
(1)8: Positive Output
(2)Vo Rank
(3)The end of A.D.
(4)Production Month
Oct. ...X
Nov....Y
Dec. ...Z

	(1)	(2)
NJM78L02UA	8	A
NJM78L05UA	8	C
NJM78L06UA	8	E
NJM78L08UA	8	G
NJM78L09UA	8	H
NJM78L12UA	8	K
NJM78L15UA	8	L
NJM78L18UA	8	M
NJM78L20UA	8	N
NJM78L24UA	8	P



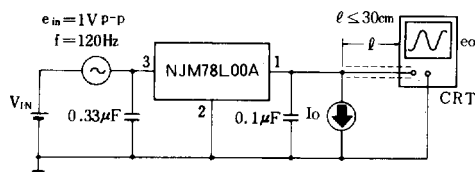
■ TEST CIRCUIT

1. Output Voltage, Line Regulation, Load Regulation, Quiescent Current, Average Temperature Coefficient of Output Voltage, Output Noise Voltage, Peak Output/Short-Circuit Current
2. Ripple Rejection



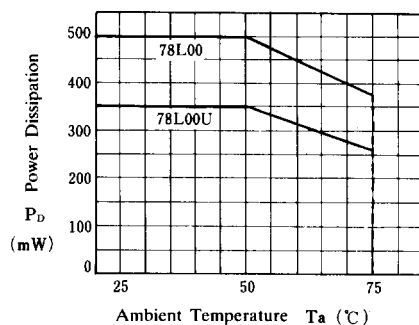
○ Measurement is to be conducted in pulse testing.

○ $I_Q = I_1 - I_O$



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

■ AMBIENT TEMPERATURE VS. POWER DISSIPATION

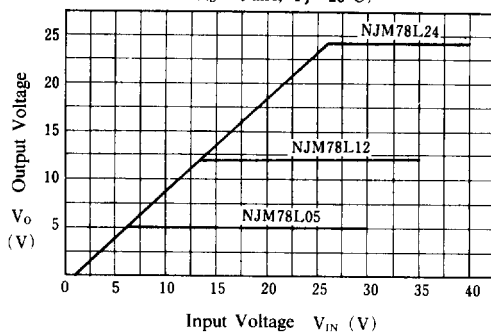




■ TYPICAL CHARACTERISTICS

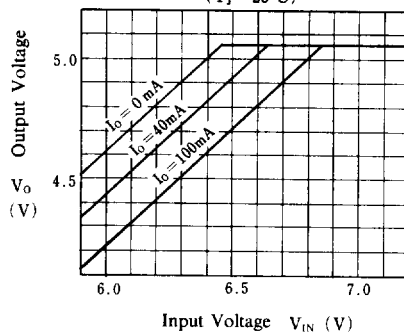
NJM78L05/L12/L24
Output Characteristics

($I_O = 0$ mA, $T_j = 25^\circ\text{C}$)



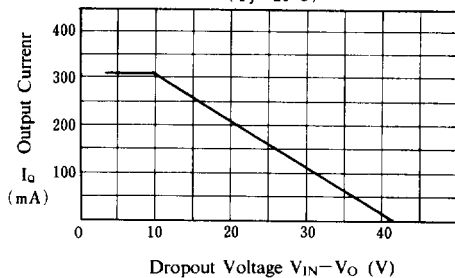
NJM78L05 Dropout Characteristics

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



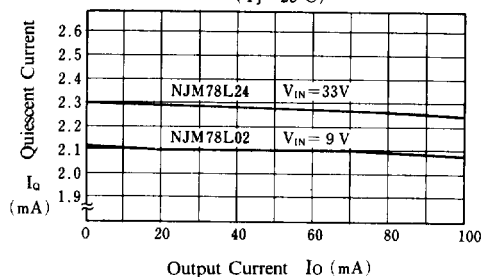
NJM78L00 Series Short Circuit
Output Current

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



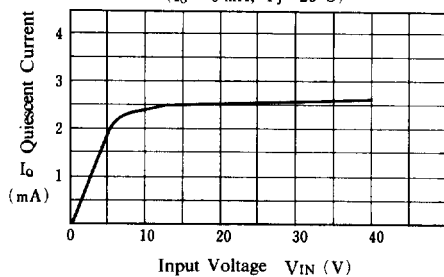
NJM78L02/L24 Quiescent Current
vs. Output Current

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



NJM78L05 Quiescent Current
vs. Input Voltage

($I_O = 0$ mA, $T_j = 25^\circ\text{C}$)





TYPICAL CHARACTERISTICS

