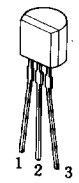
3-TERMINAL POSITIVE VOLTAGE REGULATOR

■ 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

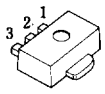
(TO-92)



NJM78L00A

1 . OUT
2 . GND
3 . IN

(SOT-89)



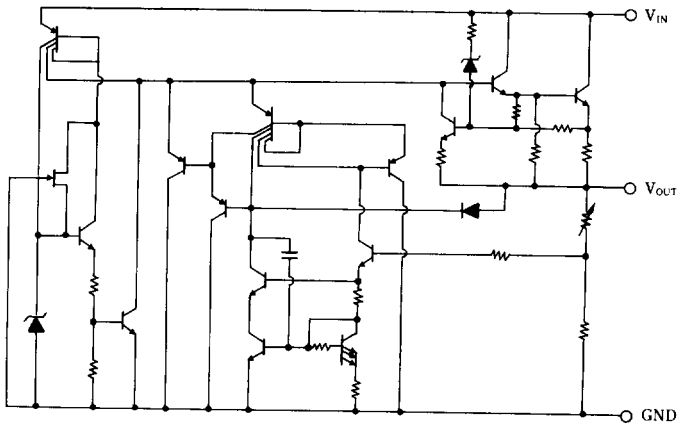
NJM78L00UA

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



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■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

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	℃
Storage Temperature Range	T_{stg}	−40~+125	℃

■ ELECTRICAL CHARACTERISTICS

(C_{IN}=0.33 μf, Co=0.1 μf. T_j=25℃) 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	ΔV_O-V_{IN1}	V_{IN}=4.75~20V, I_O=40mA	—	—	125	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=5~20V, I_O=40mA	—	—	100	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=9V, I_O=1~40mA	—	—	25	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=9V, I_O=1~100mA	—	—	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/℃
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~100kHz, V_{IN}=9V, I_O=40mA	—	35	—	μV
NJM78L05A						
Output Voltage	V_O	V_{IN}=10V, I_O=40mV	4.75	5	5.25	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=7~20V, I_O=40mA	—	—	200	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=8~20V, I_O=40mA	—	—	150	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=10V, I_O=1~40mA	—	—	30	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=10V, I_O=1~100mA	—	—	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/℃
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~100kHz, V_{IN}=10V, I_O=40mA	—	70	—	μV

■ ELECTRICAL CHARACTERISTICS (C_{IN}=0.33 μf, C_O=0.1 μf. Tj=25℃) Measurement is to be conducted in pulse testing.

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

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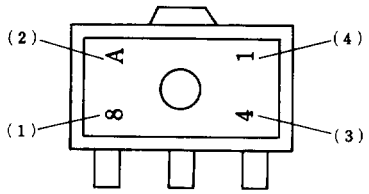
■ ELECTRICAL CHARACTERISTICS (C_{IN}=0.33 μF, Co=0.1 μF. Tj=25℃) Measurement is to be conducted in pulse testing.

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	$\Delta V_O/\Delta T$	V_{IN}=23V, I_O=1mA	—	1.0	—	mV/℃
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	$\Delta V_O/\Delta T$	V_{IN}=27V, I_O=1mA	—	1.1	—	mV/℃
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	$\Delta V_O/\Delta T$	V_{IN}=29V, I_O=1mA	—	1.2	—	mV/℃
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	$\Delta V_O/\Delta T$	V_{IN}=33V, I_O=1mA	—	1.4	—	mV/℃
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**

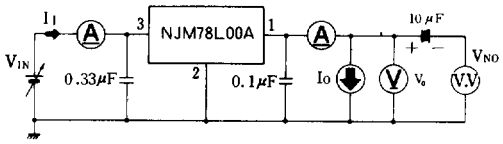


(1)8: Positive Output
(2)Vo Rank
(3)The end of A.D.
(4)Production Month
Oct. ···X
Nov.···Y
Dec. ···Z

	(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

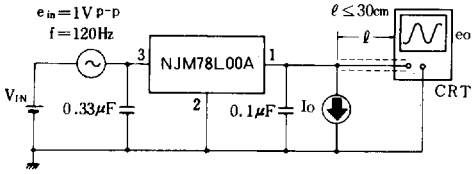
■ TEST CIRCUIT

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



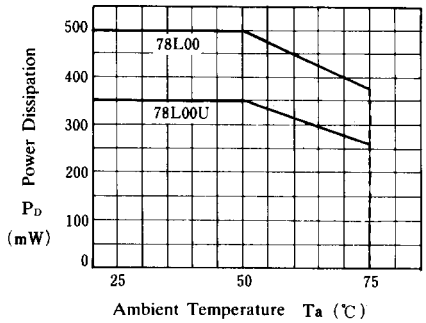
○ Measurement is to be conducted in pulse testing.
○ $I_Q = I_I - I_O$

2. Ripple Rejection



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

■ AMBIENT TEMPERATURE VS. POWER DISSIPATION



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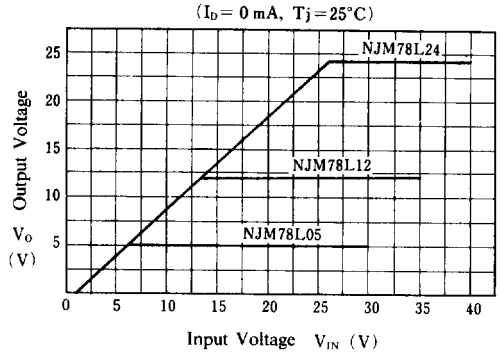
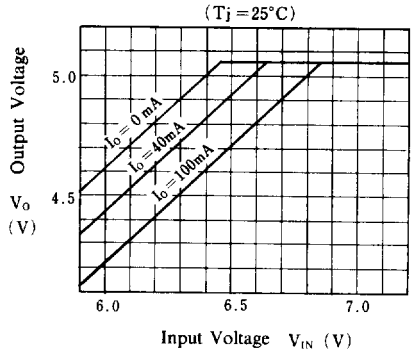
■ TYPICAL CHARACTERISTICS

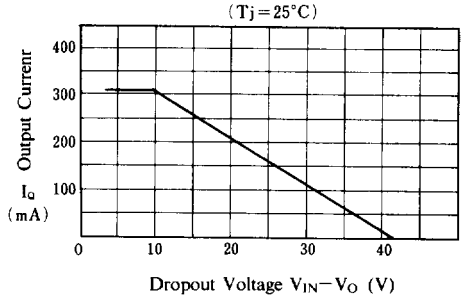
NJM78L05/L12/L24
Output Characteristics



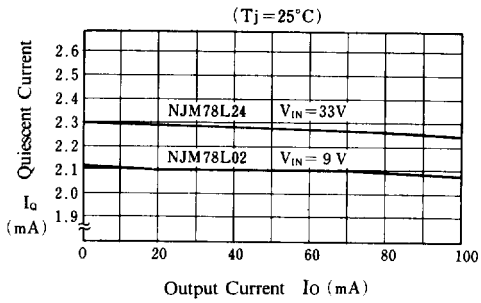
NJM78L05 Dropout Characteristics



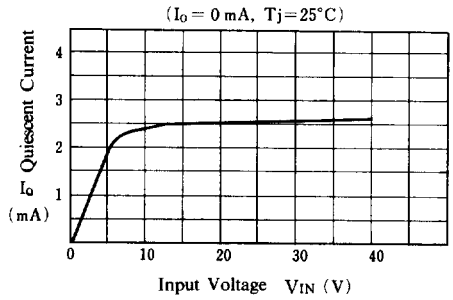
NJM78L00 Series Short Circuit
Output Current



NJM78L02/L24 Quiescent Current
vs. Output Current



NJM78L05 Quiescent Current
vs. Input Voltage



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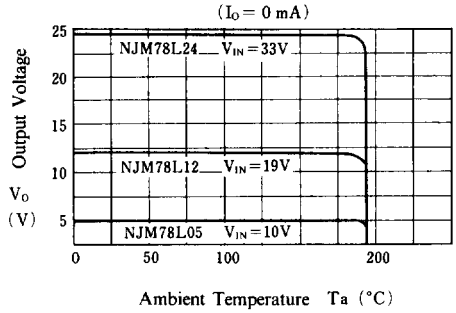
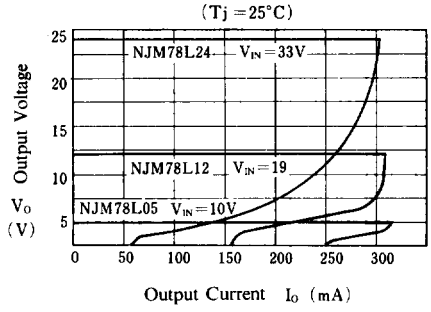
■ TYPICAL CHARACTERISTICS

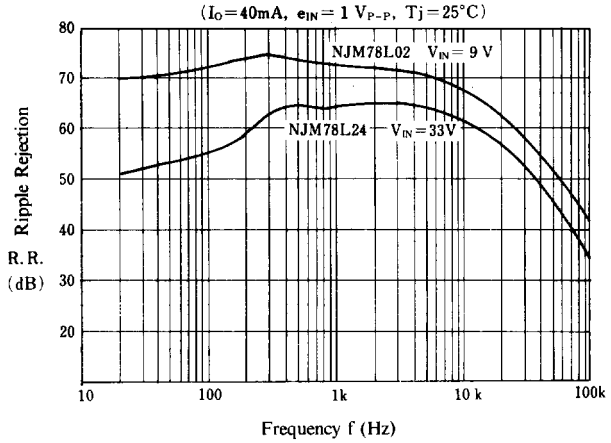
NJM78L05/L12/L24
Thermal Shutdown Characteristics



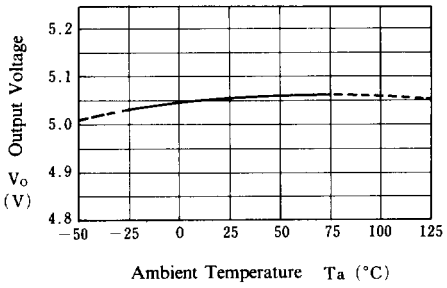
NJM78L05/L12/L24
Load Characteristics



NJM78L02/L24 Ripple Rejection



NJM78L05 Output Voltage vs. Temperature



NJM78L12 Output Voltage vs. Temperature