NJM78L00

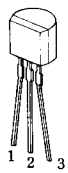
The NJM78L00 series of 3-Terminal Positive Voltage Regulators is constructed using the New JRC Planar epitaxial process. These regulators employ internal current-limiting and thermal-shutdown, making them essentially indestructible. If adequate heat sinking is provided, they can deliver up to 100mA output 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.

■ Absolute Maximum Ratings (Ta=25°C)

Input Voltage	V_{IN} (78L02A~78L09A)	30V
"	V_{IN} (78L12A~78L15A)	35V
"	V_{IN} (78L18A~78L24A)	40V
Output Current	I_O	100mA
Power Dissipation	P_D TO-92 (SOT-89)	500mW (350mW)
Operating Temperature Range	T_{OPR}	−30~+75°C
Storage Temperature Range	T_{STG}	−40~+125°C

■ Package Outline

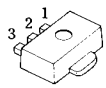
(TO-92)



NJM78LXXA

1. OUT
2. GND
3. IN

(SOT-89)



NJM78LXXUA

1. OUT
2. GND
3. IN

4

■ Electrical Characteristics (T_j=25°C, C_{IN}=0.33μF, C_O=0.1μF)

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=40mA	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	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=9V, I_O=1mA	—	−1	—	mV/°C
Ripple Rejections	RR	6V<V_{IN}<16V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	43	51	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=9V, I_O=40mA	—	30	—	μV
NJM78L05A						
Output Voltage	V_O	V_{IN}=10V, I_O=40mA	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	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=10V, I_O=1mA	—	−1	—	mV/°C
Ripple Rejections	RR	8V<V_{IN}<18V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	40	49	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=10V, I_O=40mA	—	40	—	μV

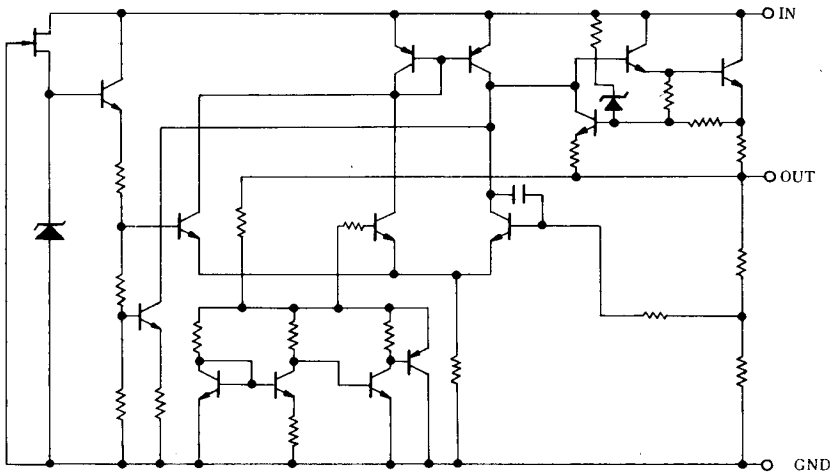
■ **Electrical Characteristics** (C_{IN}=0.33μF, C_O=0.1μF, T_j=25°C) Measurement is to be conducted in pulse testing.

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	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=12V, I_O=1mA	—	−1	—	mV/°C
Ripple Rejections	RR	9V<V_{IN}<20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	40	46	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=12V, I_O=40mA	—	120	—	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	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=14V, I_O=1mA	—	−1	—	mV/°C
Ripple Rejections	RR	11V<V_{IN}<20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	39	45	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=14V, I_O=40mA	—	120	—	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	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=15V, I_O=1mA	—	−1	—	mV/°C
Ripple Rejections	RR	12V<V_{IN}<21V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	38	44	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=15V, I_O=40mA	—	180	—	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	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=19V, I_O=1mA	—	−1.5	—	mV/°C
Ripple Rejections	RR	15V<V_{IN}<25V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	37	42	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=19V, I_O=40mA	—	240	—	μV

■ **Electrical Characteristics** (T_j=25°C, C_{IN}=0.33μF, C_O=0.1μF) Measurement is to be conducted in pulse testing.

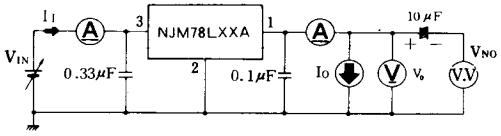
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
NJM78L15A						
Output Voltage	V_O	V_{IN}=23V, I_O=40mA	14.3	15	15.7	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=17.5~30V, I_O=40mA	—	—	300	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=20~30V, I_O=40mA	—	—	250	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=23V, I_O=1~40mA	—	—	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	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=23V, I_O=1mA	—	−1.5	—	mV/°C
Ripple Rejections	RR	18.5V<V_{IN}<28.5V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	34	39	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=23V, I_O=40mA	—	250	—	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	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=27V, I_O=1mA	—	−2	—	mV/°C
Ripple Rejections	RR	23V<V_{IN}<33V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	33	38	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=27V, I_O=40mA	—	310	—	μV
NJM78L20A						
Output Voltage	V_O	V_{IN}=29V, I_O=40mA	19.0	20	21.0	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	—	—	7	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=29V, I_O=1mA	—	−2	—	mV/°C
Ripple Rejections	RR	24V<V_{IN}<34V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	32	37	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=29V, I_O=40mA	—	340	—	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	—	—	7	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=33V, I_O=1mA	—	−2	—	mV/°C
Ripple Rejections	RR	27.5V<V_{IN}<37.5V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	32	37	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=33V, I_O=40mA	—	420	—	μV

■ Equivalent Circuit



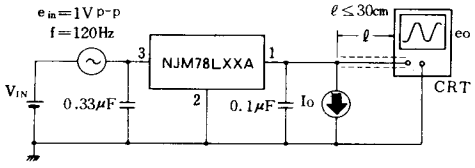
■ Test Circuit

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



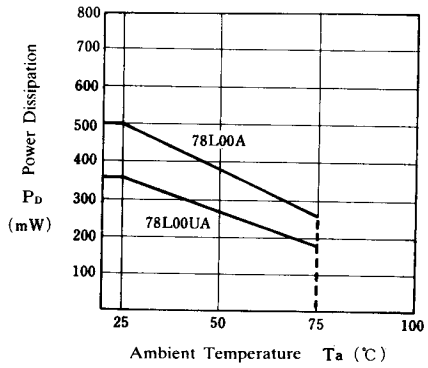
○ Measurement is to be conducted in pulse testing.
○ $I_Q = I_I - I_O$

2. Ripple Rejection

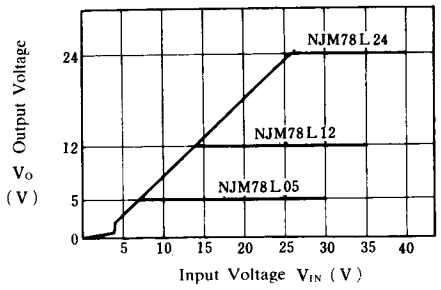


$$RR = 20\,\ell o_{G\ 10}\left(\frac{e_{in}}{e_o}\right) \quad (dB)$$

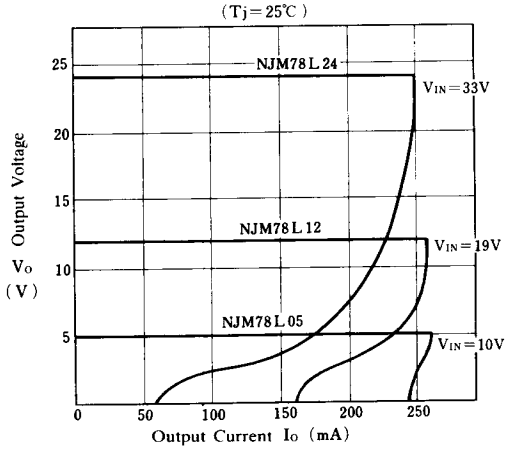
■ Ambient Temperature vs. Power Dissipation



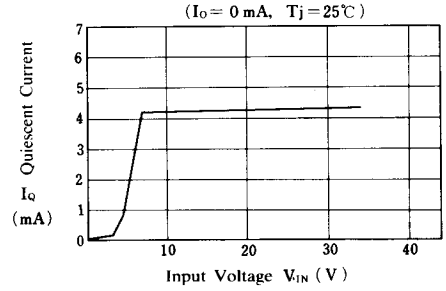
NJM78L05/L12/L24
Output Characteristics
(Io = 0 mA, Tj = 25℃)



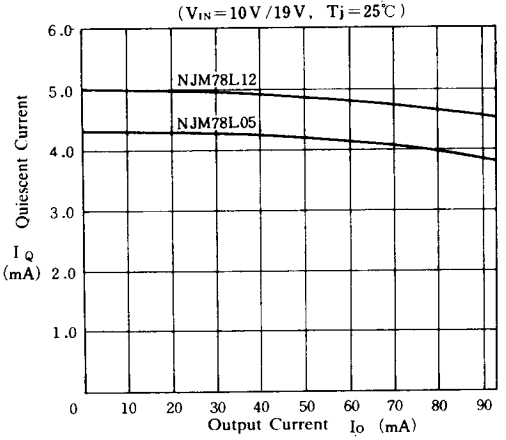
NJM78L05/L12/L24
Load Characteristics
(Tj = 25℃)



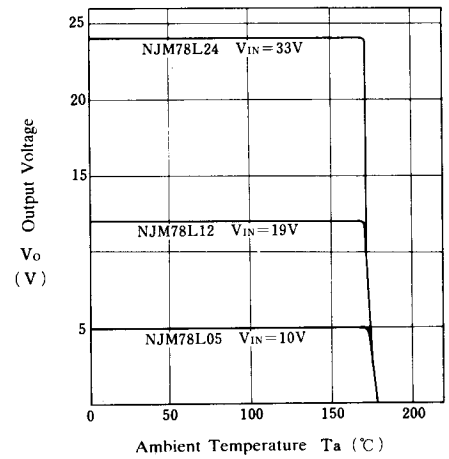
NJM78L05 Quiescent Voltage
vs.
Input Voltage
(Io = 0 mA, Tj = 25℃)



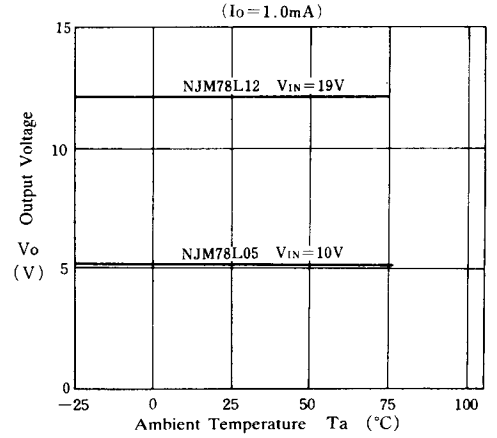
NJM78L05/L12 Quiescent Currrent
vs. Output Current
(VIN = 10 V / 19 V, Tj = 25℃)



NJM78L05/L12/L24
Thermal Shutdown Characteristics
(VIN = 10 V / 19 V / 33 V, Io = 0 mA)

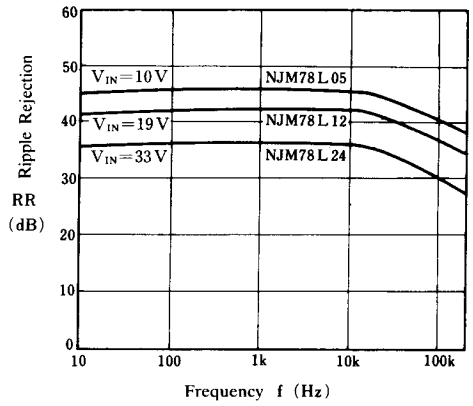


NJM78L05/L12 Output Voltage
vs. Ambient Temperature
(Io = 1.0mA)



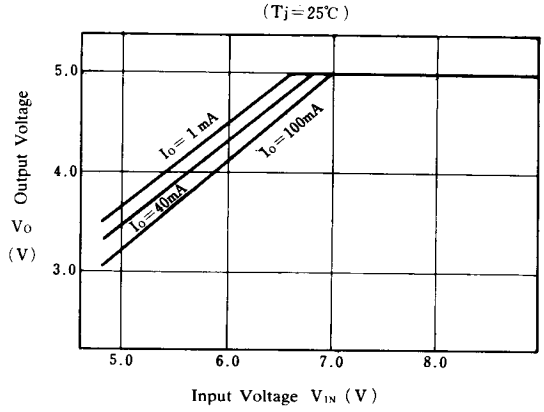
NJM78L05/L12/L24 Ripple Rejection

(I_O=40mA, Tj=25℃)



NJM78L05 Dropout Characteristics

(Tj=25℃)



NJM78L00 Series Short Circuit Output Current

(Tj=25℃)