

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.

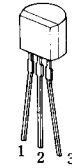
■ Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

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}	$-30 \sim +75^\circ\text{C}$
Storage Temperature Range	T_{STR}	$-40 \sim +125^\circ\text{C}$

■ Package Outline

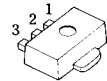
(TO-92)

(SOT-89)



NJM78LXXA

1. OUT
2. GND
3. IN



NJM78LXXUA

1. OUT
2. GND
3. IN

■ Electrical Characteristics ($T_J = 25^\circ\text{C}$, $C_{IN} = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$)

Measurement is to be conducted in pulse testing.

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
NJM78L02A						
Output Voltage	V_O	$V_{IN} = 9\text{V}$, $I_O = 40\text{mA}$	2.47	2.6	2.73	V
Line Regulation 1	$\Delta V_O / V_{IN1}$	$V_{IN} = 4.75 \sim 20\text{V}$, $I_O = 40\text{mA}$	—	—	125	mV
Line Regulation 2	$\Delta V_O / V_{IN2}$	$V_{IN} = 5 \sim 20\text{V}$, $I_O = 40\text{mA}$	—	—	100	mV
Load Regulation 1	$\Delta V_O / I_{O1}$	$V_{IN} = 9\text{V}$, $I_O = 1 \sim 40\text{mA}$	—	—	25	mV
Load Regulation 2	$\Delta V_O / I_{O2}$	$V_{IN} = 9\text{V}$, $I_O = 1 \sim 100\text{mA}$	—	—	50	mV
Quiescent Current	I_Q	$V_{IN} = 9\text{V}$, $I_O = 0\text{mA}$	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O / \Delta T$	$V_{IN} = 9\text{V}$, $I_O = 1\text{mA}$	—	-1	—	mV/ $^\circ\text{C}$
Ripple Rejections	RR	$6\text{V} < V_{IN} < 16\text{V}$, $I_O = 40\text{mA}$, $e_{IN} = 1\text{V}_{P-P}$, $f = 120\text{Hz}$	43	51	—	dB
Output Noise Voltage	V_{NO}	$BW = 10\text{Hz} \sim 100\text{kHz}$, $V_{IN} = 9\text{V}$, $I_O = 40\text{mA}$	—	30	—	μV
NJM78L05A						
Output Voltage	V_O	$V_{IN} = 10\text{V}$, $I_O = 40\text{mA}$	4.75	5	5.25	V
Line Regulation 1	$\Delta V_O / V_{IN1}$	$V_{IN} = 7 \sim 20\text{V}$, $I_O = 40\text{mA}$	—	—	200	mV
Line Regulation 2	$\Delta V_O / V_{IN2}$	$V_{IN} = 8 \sim 20\text{V}$, $I_O = 40\text{mA}$	—	—	150	mV
Load Regulation 1	$\Delta V_O / I_{O1}$	$V_{IN} = 10\text{V}$, $I_O = 1 \sim 40\text{mA}$	—	—	30	mV
Load Regulation 2	$\Delta V_O / I_{O2}$	$V_{IN} = 10\text{V}$, $I_O = 1 \sim 100\text{mA}$	—	—	60	mV
Quiescent Current	I_Q	$V_{IN} = 10\text{V}$, $I_O = 0\text{mA}$	—	—	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O / \Delta T$	$V_{IN} = 10\text{V}$, $I_O = 1\text{mA}$	—	-1	—	mV/ $^\circ\text{C}$
Ripple Rejections	RR	$8\text{V} < V_{IN} < 18\text{V}$, $I_O = 40\text{mA}$, $e_{IN} = 1\text{V}_{P-P}$, $f = 120\text{Hz}$	40	49	—	dB
Output Noise Voltage	V_{NO}	$BW = 10\text{Hz} \sim 100\text{kHz}$, $V_{IN} = 10\text{V}$, $I_O = 40\text{mA}$	—	40	—	μV

■ **Electrical Characteristics** ($C_{IN}=0.33\mu F$, $C_O=0.1\mu F$, $T_I=25^\circ C$)

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}	$V_{IN}=8.5\sim 20V$, $I_O=40mA$	—	—	200	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=9\sim 20V$, $I_O=40mA$	—	—	150	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=12V$, $I_O=1\sim 40mA$	—	—	40	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=12V$, $I_O=1\sim 100mA$	—	—	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/ $^\circ C$
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}	$BW=10Hz\sim 100kHz$, $V_{IN}=12V$, $I_O=40mA$	—	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}	$V_{IN}=10.5\sim 23V$, $I_O=40mA$	—	—	225	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=11\sim 23V$, $I_O=40mA$	—	—	175	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=14V$, $I_O=1\sim 40mA$	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=14V$, $I_O=1\sim 100mA$	—	—	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/ $^\circ C$
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}	$BW=10Hz\sim 100kHz$, $V_{IN}=14V$, $I_O=40mA$	—	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}	$V_{IN}=11.5\sim 23V$, $I_O=40mA$	—	—	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=12\sim 23V$, $I_O=40mA$	—	—	200	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=15V$, $I_O=1\sim 40mA$	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=15V$, $I_O=1\sim 100mA$	—	—	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/ $^\circ C$
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}	$BW=10Hz\sim 100kHz$, $V_{IN}=15V$, $I_O=40mA$	—	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}	$V_{IN}=14.5\sim 27V$, $I_O=40mA$	—	—	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=16\sim 27V$, $I_O=40mA$	—	—	200	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=19V$, $I_O=1\sim 40mA$	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	$V_{IN}=19V$, $I_O=1\sim 100mA$	—	—	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/ $^\circ C$
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}	$BW=10Hz\sim 100kHz$, $V_{IN}=19V$, $I_O=40mA$	—	240	—	μV

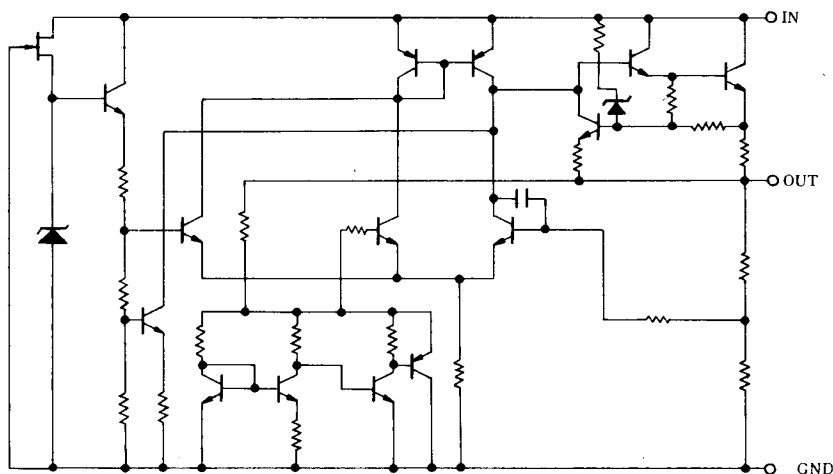
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■ Electrical Characteristics (T_i=25°C, C_{IN}=0.33μF, C_O=0.1μF)

Measurement is to be conducted in pulse testing.

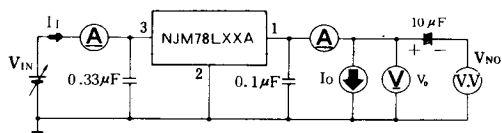
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
NJM78L15A						
Output Voltage	V _O	V _{IN} =23V, I _O =40mA	14.3	15	15.7	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =17.5~30V, I _O =40mA	—	—	300	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =20~30V, I _O =40mA	—	—	250	mV
Load Regulation 1	ΔV _O -I _{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 _O	V _{IN} =23V, I _O =0mA	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	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 _O	V _{IN} =27V, I _O =0mA	—	—	6.5	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	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 _O	V _{IN} =29V, I _O =1mA	—	—	7	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	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 _O	V _{IN} =33V, I _O =0mA	—	—	7	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	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

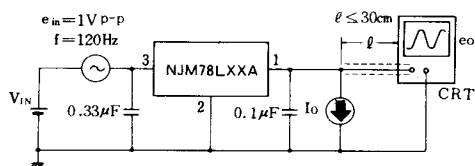


■ Test Circuit

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

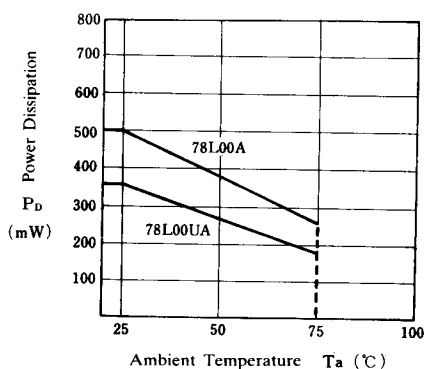


- Measurement is to be conducted in pulse testing.
- $I_Q = I_I - I_O$

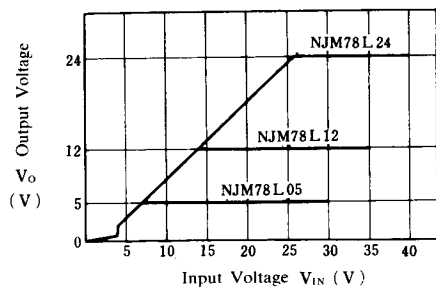


$$RR = 20 \log_{10} \left(\frac{e_{in}}{e_o} \right) \text{ (dB)}$$

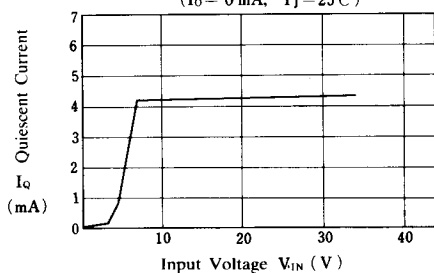
■ Ambient Temperature vs. Power Dissipation



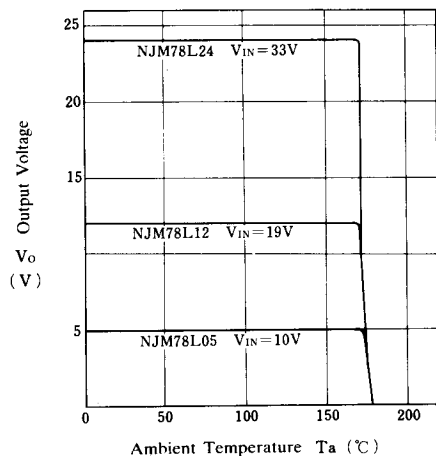
**NJM78L05/L12/L24
Output Characteristics**
($I_o = 0\text{ mA}$, $T_j = 25^\circ\text{C}$)



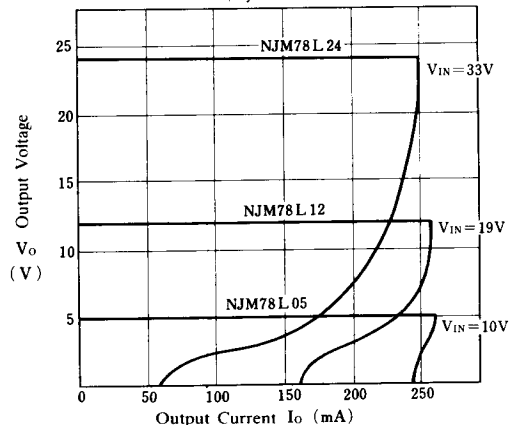
**NJM78L05 Quiescent Voltage
vs.
Input Voltage**
($I_o = 0\text{ mA}$, $T_j = 25^\circ\text{C}$)



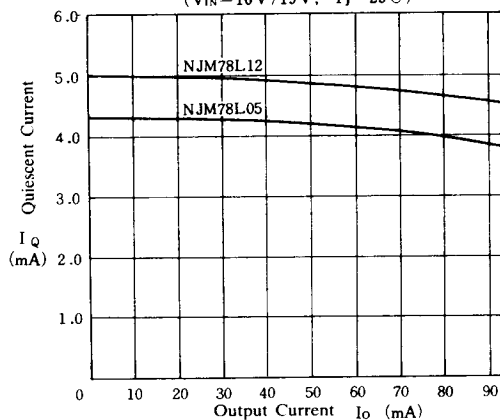
**NJM78L05/L12/L24
Thermal Shutdown Characteristics**
($V_{IN} = 10\text{V}/19\text{V}/33\text{V}$, $I_o = 0\text{ mA}$)



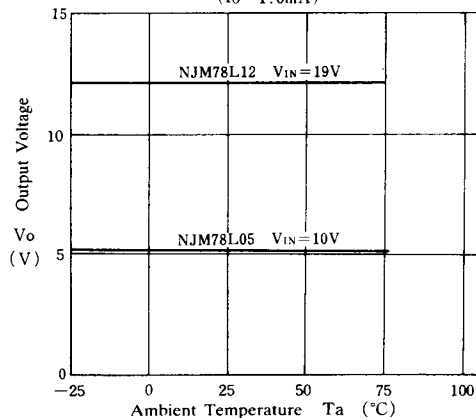
**NJM78L05/L12/L24
Load Characteristics**
($T_j = 25^\circ\text{C}$)



**NJM78L05/L12 Quiescent Current
vs. Output Current**
($V_{IN} = 10\text{V}/19\text{V}$, $T_j = 25^\circ\text{C}$)

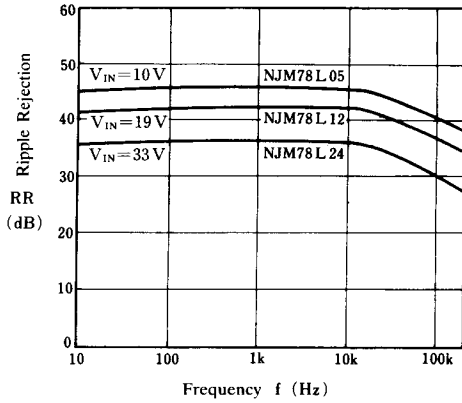


**NJM78L05/L12 Output Voltage
vs. Ambient Temperature**
($I_o = 1.0\text{ mA}$)



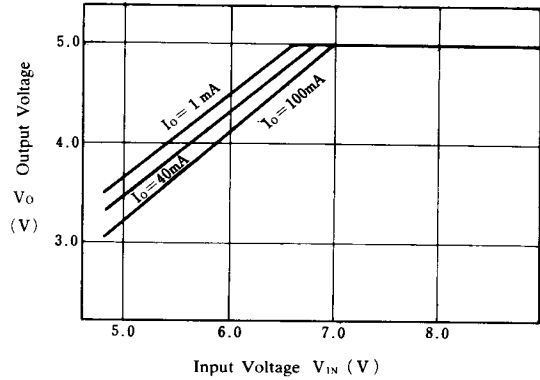
NJM78L05/L12/L24 Ripple Rejection

($I_O = 40\text{mA}$, $T_j = 25^\circ\text{C}$)



NJM78L05 Dropout Characteristics

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



NJM78L00 Series Short Circuit Output Current

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

