

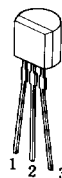
## 3-TERMINAL POSITIVE VOLTAGE REGULATOR

### ■ 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)



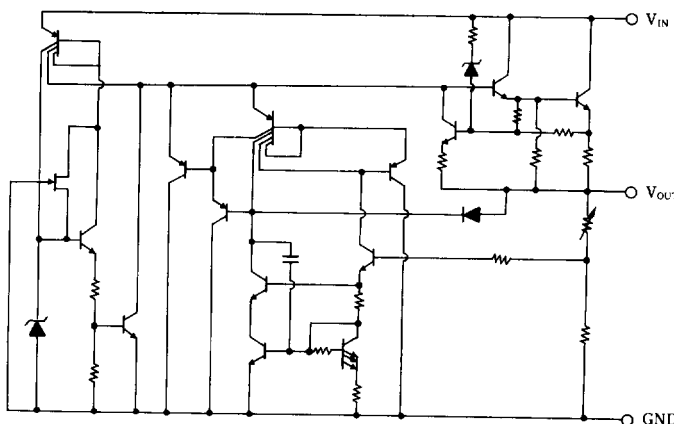
NJM78L00UA

- 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
<b>NJM78L02A</b>						
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	—	$\mu V$
<b>NJM78L05A</b>						
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	—	$\mu V$



■ 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
<b>NJM78L06A</b>						
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	—	$\mu\text{V}$
<b>NJM78L08A</b>						
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	—	$\mu\text{V}$
<b>NJM78L09A</b>						
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	—	$\mu\text{V}$
<b>NJM78L12A</b>						
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	—	$\mu\text{V}$

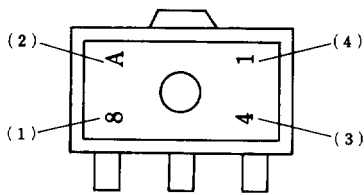


## ■ ELECTRICAL CHARACTERISTICS (C<sub>IN</sub>=0.33 μF, C<sub>O</sub>=0.1 μF, T<sub>J</sub>=25°C) Measurement is to be conducted in pulse testing.

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



■ SOT- 89 MARK



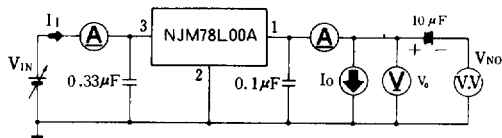
(1)8: Positive Output  
(2)Vo Rank  
(3)The end of A.D.  
(4)Production Month  
Oct. ...X  
Nov....Y  
Dec. ...Z

	(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



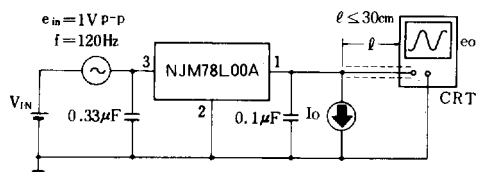
## ■ TEST CIRCUIT

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



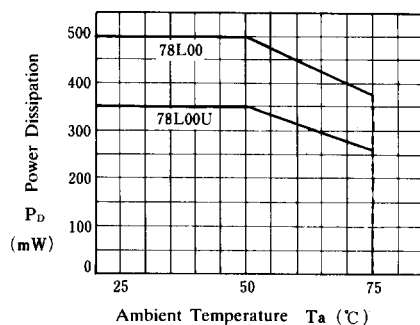
○ Measurement is to be conducted in pulse testing.

○  $I_Q = I_1 - I_O$



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

## ■ AMBIENT TEMPERATURE VS. POWER DISSIPATION

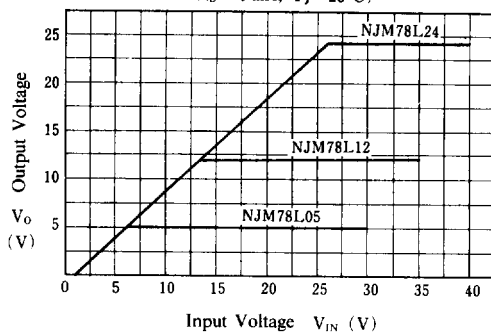




## ■ TYPICAL CHARACTERISTICS

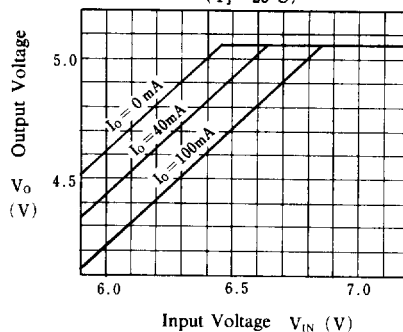
**NJM78L05/L12/L24**  
**Output Characteristics**

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



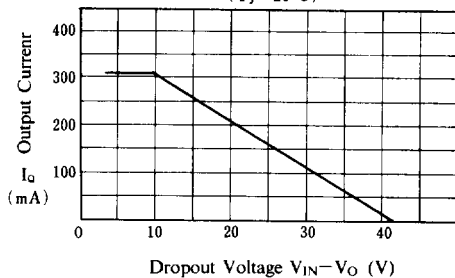
**NJM78L05 Dropout Characteristics**

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



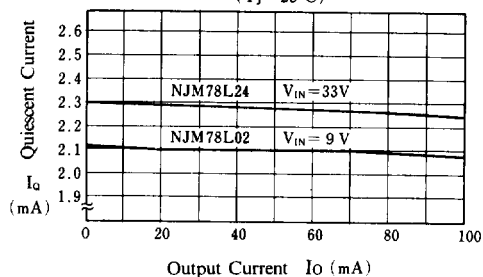
**NJM78L00 Series Short Circuit**  
**Output Current**

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



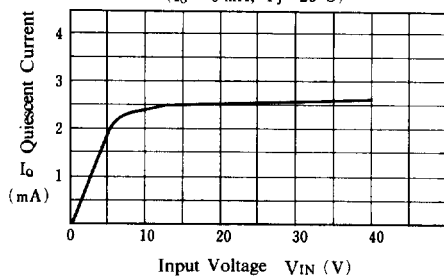
**NJM78L02/L24 Quiescent Current**  
**vs. Output Current**

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



**NJM78L05 Quiescent Current**  
**vs. Input Voltage**

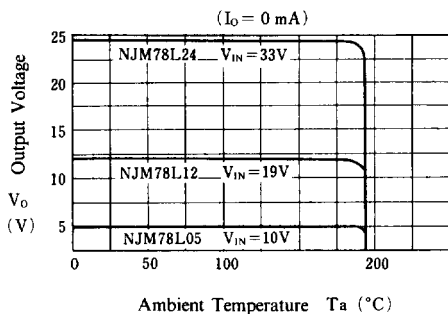
( $I_O = 0$  mA,  $T_j = 25^\circ\text{C}$ )



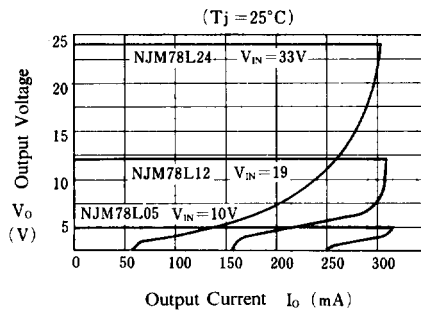


## TYPICAL CHARACTERISTICS

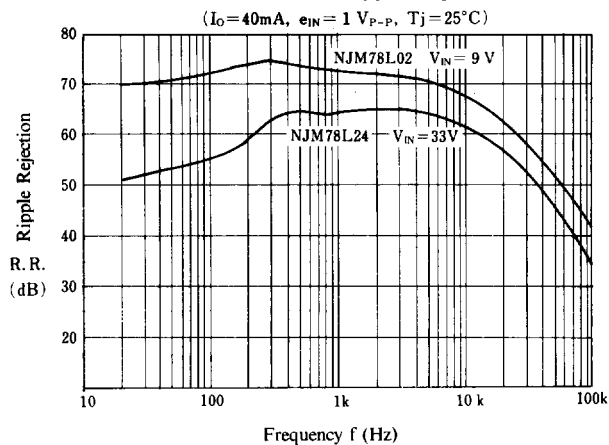
**NJM78L05/L12/L24**  
**Thermal Shutdown Characteristics**



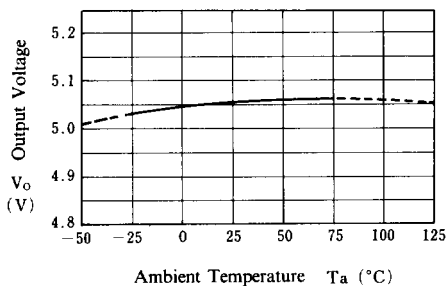
**NJM78L05/L12/L24**  
**Load Characteristics**



**NJM78L02/L24 Ripple Rejection**



**NJM78L05 Output Voltage**  
**vs. Temperature**



**NJM78L12 Output Voltage**  
**vs. Temperature**

