

## 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

(SOT-89)



**NJM78L00UA**

(EMP8)



**NJM78L00EA**  
(5V, 9V, 12V Version Only)

### ■ FEATURES

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

SOT-89, EMP8

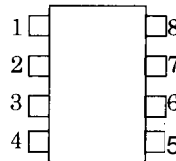
### ■ PIN CONFIGURATION



**NJM78L00UA**

PIN CONFIGURATION

1. OUT
2. GND
3. IN



**NJM78L00EA**

PIN CONFIGURATION

1. OUT
2. GND
3. GND
4. NC
5. NC
6. GND
7. GND
8. IN

### ■ EQUIVALENT CIRCUIT



# NJM78L00

## ■ ABSOLUTE MAXIMUM RATINGS

(T<sub>a</sub>=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Input Voltage	V <sub>IN</sub>	(78L02A to 78L09A) 30	V
		(78L12A to 78L15A) 35	
		(78L18A to 78L24A) 40	
Power Dissipation	P <sub>D</sub>	(EMP8) 350 (SOT-89) 300	mW
Operating Temperature Range	T <sub>opr</sub>	-40 to +85	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +150	°C

## ■ ELECTRICAL CHARACTERISTICS(C<sub>IN</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>J</sub>=25°C)

Measurement is to be conducted is pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78L02UA						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =40mA	2.47	2.6	2.73	V
Line Regulation 1	ΔV <sub>O</sub> -V <sub>IN1</sub>	V <sub>IN</sub> =4.75V to 20V, I <sub>O</sub> =40mA	-	-	125	mV
Line Regulation 2	ΔV <sub>O</sub> -V <sub>IN2</sub>	V <sub>IN</sub> =5V to 20V, I <sub>O</sub> =40mA	-	-	100	mV
Load Regulation 1	ΔV <sub>O</sub> -I <sub>O1</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =1 to 40mA	-	-	25	mV
Load Regulation 2	ΔV <sub>O</sub> -I <sub>O2</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =1 to 100mA	-	-	50	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =0mA	-	2.0	6	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =9V, I <sub>O</sub> =1mA	-	0.2	-	mV/°C
Ripple Rejection	RR	6V < V <sub>IN</sub> < 16V, I <sub>O</sub> =40mA, e <sub>in</sub> =1V <sub>P-P</sub> , f=120Hz	43	73	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =9V, BW=10Hz to 100kHz, I <sub>O</sub> =40mA	-	35	-	μV
NJM78L03UA						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =40mA	2.85	3.0	3.15	V
Line Regulation 1	ΔV <sub>O</sub> -V <sub>IN1</sub>	V <sub>IN</sub> =5V to 20V, I <sub>O</sub> =40mA	-	-	125	mV
Line Regulation 2	ΔV <sub>O</sub> -V <sub>IN2</sub>	V <sub>IN</sub> =6V to 20V, I <sub>O</sub> =40mA	-	-	100	mV
Load Regulation 1	ΔV <sub>O</sub> -I <sub>O1</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =1 to 40mA	-	-	25	mV
Load Regulation 2	ΔV <sub>O</sub> -I <sub>O2</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =1 to 100mA	-	-	50	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =9V, I <sub>O</sub> =0mA	-	2.0	6	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =9V, I <sub>O</sub> =1mA	-	0.2	-	mV/°C
Ripple Rejection	RR	6V < V <sub>IN</sub> < 16V, I <sub>O</sub> =40mA, e <sub>in</sub> =1V <sub>P-P</sub> , f=120Hz	43	72	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =9V, BW=10Hz to 100kHz, I <sub>O</sub> =40mA	-	40	-	μV
NJM78L05UA/EA						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =10V, I <sub>O</sub> =40mA	4.75	5.0	5.25	V
Line Regulation 1	ΔV <sub>O</sub> -V <sub>IN1</sub>	V <sub>IN</sub> =7V to 20V, I <sub>O</sub> =40mA	-	-	200	mV
Line Regulation 2	ΔV <sub>O</sub> -V <sub>IN2</sub>	V <sub>IN</sub> =8V to 20V, I <sub>O</sub> =40mA	-	-	150	mV
Load Regulation 1	ΔV <sub>O</sub> -I <sub>O1</sub>	V <sub>IN</sub> =10V, I <sub>O</sub> =1 to 40mA	-	-	30	mV
Load Regulation 2	ΔV <sub>O</sub> -I <sub>O2</sub>	V <sub>IN</sub> =10V, I <sub>O</sub> =1 to 100mA	-	-	60	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =10V, I <sub>O</sub> =0mA	-	2.0	6	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =10V, I <sub>O</sub> =1mA	-	0.4	-	mV/°C
Ripple Rejection	RR	8V < V <sub>IN</sub> < 18V, I <sub>O</sub> =40mA, e <sub>in</sub> =1V <sub>P-P</sub> , f=120Hz	40	69	-	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =10V, BW=10Hz to 100kHz, I <sub>O</sub> =40mA	-	70	-	μV

■ **ELECTRICAL CHARACTERISTICS**( $C_{IN}=0.33\mu F$ ,  $C_O=0.1\mu F$ ,  $T_j=25^\circ C$ )

Measurement is to be conducted is pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM78L06UA</b>						
Output Voltage	$V_O$	$V_{IN}=12V, I_O=40mA$	5.7	6.0	6.3	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=8.5V$ to $20V, I_O=40mA$	-	-	200	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=9V$ to $20V, I_O=40mA$	-	-	150	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=12V, I_O=1$ to $40mA$	-	-	40	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=12V, I_O=1$ to $100mA$	-	-	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/°C
Ripple Rejection	RR	$9V < V_{IN} < 20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	40	67	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=12V, BW=10Hz$ to $100kHz, I_O=40mA$	-	80	-	$\mu V$
<b>NJM78L07UA</b>						
Output Voltage	$V_O$	$V_{IN}=13V, I_O=40mA$	6.65	7.0	7.35	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=9.5V$ to $22V, I_O=40mA$	-	-	210	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=10V$ to $22V, I_O=40mA$	-	-	160	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=13V, I_O=1$ to $40mA$	-	-	45	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=13V, I_O=1$ to $100mA$	-	-	90	mV
Quiescent Current	$I_Q$	$V_{IN}=13V, I_O=0mA$	-	2.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=13V, I_O=1mA$	-	0.55	-	mV/°C
Ripple Rejection	RR	$10V < V_{IN} < 20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	39	66	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=13V, BW=10Hz$ to $100kHz, I_O=40mA$	-	100	-	$\mu V$
<b>NJM78L08UA</b>						
Output Voltage	$V_O$	$V_{IN}=14V, I_O=40mA$	7.6	8.0	8.4	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=10.5V$ to $23V, I_O=40mA$	-	-	225	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=11V$ to $23V, I_O=40mA$	-	-	175	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=14V, I_O=1$ to $40mA$	-	-	50	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=14V, I_O=1$ to $100mA$	-	-	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/°C
Ripple Rejection	RR	$11V < V_{IN} < 20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	39	66	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=14V, BW=10Hz$ to $100kHz, I_O=40mA$	-	115	-	$\mu V$

# NJM78L00

## ■ ELECTRICAL CHARACTERISTICS ( $C_{IN}=0.33\mu F$ , $C_O=0.1\mu F$ , $T_J=25^\circ C$ )

Measurement is to be conducted is pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM78L09UA/EA</b>						
Output Voltage	$V_O$	$V_{IN}=15V$ , $I_O=40mA$	8.55	9.0	9.45	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=11.5V$ to $23V$ , $I_O=40mA$	-	-	250	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=12V$ to $23V$ , $I_O=40mA$	-	-	200	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=15V$ , $I_O=1$ to $40mA$	-	-	50	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=15V$ , $I_O=1$ to $100mA$	-	-	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/ $^\circ C$
Ripple Rejection	RR	$12V < V_{IN} < 21V$ , $I_O=40mA$ , $e_{in}=1V_{P-P}$ , $f=120Hz$	38	65	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=15V$ , $BW=10Hz$ to $100kHz$ , $I_O=40mA$	-	125	-	$\mu V$
<b>NJM78L10UA</b>						
Output Voltage	$V_O$	$V_{IN}=16V$ , $I_O=40mA$	9.5	10.0	10.5	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=13V$ to $25V$ , $I_O=40mA$	-	-	250	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=14V$ to $25V$ , $I_O=40mA$	-	-	200	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=16V$ , $I_O=1$ to $40mA$	-	-	50	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=16V$ , $I_O=1$ to $100mA$	-	-	100	mV
Quiescent Current	$I_Q$	$V_{IN}=16V$ , $I_O=0mA$	-	2.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=16V$ , $I_O=1mA$	-	0.7	-	mV/ $^\circ C$
Ripple Rejection	RR	$13V < V_{IN} < 22V$ , $I_O=40mA$ , $e_{in}=1V_{P-P}$ , $f=120Hz$	37	64	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=16V$ , $BW=10Hz$ to $100kHz$ , $I_O=40mA$	-	135	-	$\mu V$
<b>NJM78L12UA/EA</b>						
Output Voltage	$V_O$	$V_{IN}=19V$ , $I_O=40mA$	11.4	12.0	12.6	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=14.5V$ to $27V$ , $I_O=40mA$	-	-	250	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=16V$ to $27V$ , $I_O=40mA$	-	-	200	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=19V$ , $I_O=1$ to $40mA$	-	-	50	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=19V$ , $I_O=1$ to $100mA$	-	-	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/ $^\circ C$
Ripple Rejection	RR	$15V < V_{IN} < 25V$ , $I_O=40mA$ , $e_{in}=1V_{P-P}$ , $f=120Hz$	37	62	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=19V$ , $BW=10Hz$ to $100kHz$ , $I_O=40mA$	-	160	-	$\mu V$
<b>NJM78L15UA</b>						
Output Voltage	$V_O$	$V_{IN}=23V$ , $I_O=40mA$	14.3	15.0	15.7	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=17.5V$ to $30V$ , $I_O=40mA$	-	-	300	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=20V$ to $30V$ , $I_O=40mA$	-	-	250	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=23V$ , $I_O=1$ to $40mA$	-	-	75	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=23V$ , $I_O=1$ to $100mA$	-	-	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/ $^\circ C$
Ripple Rejection	RR	$18.5V < V_{IN} < 28.5V$ , $I_O=40mA$ , $e_{in}=1V_{P-P}$ , $f=120Hz$	34	60	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=23V$ , $BW=10Hz$ to $100kHz$ , $I_O=40mA$	-	190	-	$\mu V$

■ **ELECTRICAL CHARACTERISTICS**( $C_{IN}=0.33\mu F$ ,  $C_O=0.1\mu F$ ,  $T_J=25^\circ C$ )

Measurement is to be conducted is pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM78L18UA</b>						
Output Voltage	$V_O$	$V_{IN}=27V, I_O=40mA$	17.1	18.0	18.9	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=22V$ to $33V, I_O=40mA$	-	-	320	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=22V$ to $33V, I_O=40mA$	-	-	270	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=27V, I_O=1$ to $40mA$	-	-	80	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=27V, I_O=1$ to $100mA$	-	-	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/°C
Ripple Rejection	RR	$23V < V_{IN} < 33V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	33	59	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=27V, BW=10Hz$ to $100kHz, I_O=40mA$	-	230	-	$\mu V$
<b>NJM78L20UA</b>						
Output Voltage	$V_O$	$V_{IN}=29V, I_O=40mA$	19.0	20.0	21.0	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=23V$ to $34V, I_O=40mA$	-	-	330	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=24V$ to $34V, I_O=40mA$	-	-	280	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=29V, I_O=1$ to $40mA$	-	-	90	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=29V, I_O=1$ to $100mA$	-	-	180	mV
Quiescent Current	$I_Q$	$V_{IN}=29V, I_O=0mA$	-	2.3	7	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=29V, I_O=1mA$	-	1.2	-	mV/°C
Ripple Rejection	RR	$24V < V_{IN} < 34V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	32	58	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=29V, BW=10Hz$ to $100kHz, I_O=40mA$	-	250	-	$\mu V$
<b>NJM78L24UA</b>						
Output Voltage	$V_O$	$V_{IN}=33V, I_O=40mA$	22.8	24	25.2	V
Line Regulation 1	$\Delta V_O-V_{IN1}$	$V_{IN}=27V$ to $38V, I_O=40mA$	-	-	350	mV
Line Regulation 2	$\Delta V_O-V_{IN2}$	$V_{IN}=28V$ to $38V, I_O=40mA$	-	-	300	mV
Load Regulation 1	$\Delta V_O-I_O1$	$V_{IN}=33V, I_O=1$ to $40mA$	-	-	100	mV
Load Regulation 2	$\Delta V_O-I_O2$	$V_{IN}=33V, I_O=1$ to $100mA$	-	-	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/°C
Ripple Rejection	RR	$27.5V < V_{IN} < 37.5V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz$	32	57	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=33V, BW=10Hz$ to $100kHz, I_O=40mA$	-	280	-	$\mu V$

■ **SOT-89 MARK**



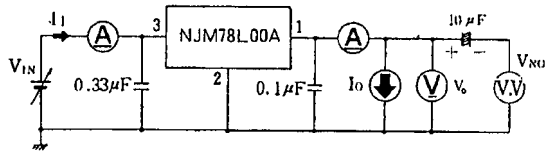
- (1) 8 : Positive Output
  - (2)  $V_O$  Rank
  - (3) The end of A.D.
  - (4) Production Mouth
- Oct. ...X  
Nov. ...Y  
Dec. ...Z

NJM78L02UA	8	A
NJM78L03UA	8	B
NJM78L05UA	8	C
NJM78L06UA	8	E
NJM78L07UA	8	F
NJM78L08UA	8	G
NJM78L09UA	8	H
NJM78L10UA	8	J
NJM78L12UA	8	K
NJM78L15UA	8	L
NJM78L18UA	8	M
NJM78L20UA	8	N
NJM78L24UA	8	P

# NJM78L00

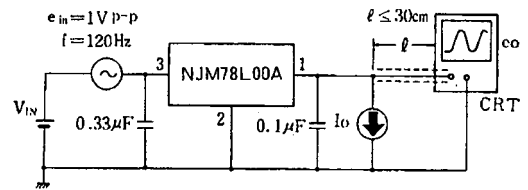
## ■ TEST CIRCUIT

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



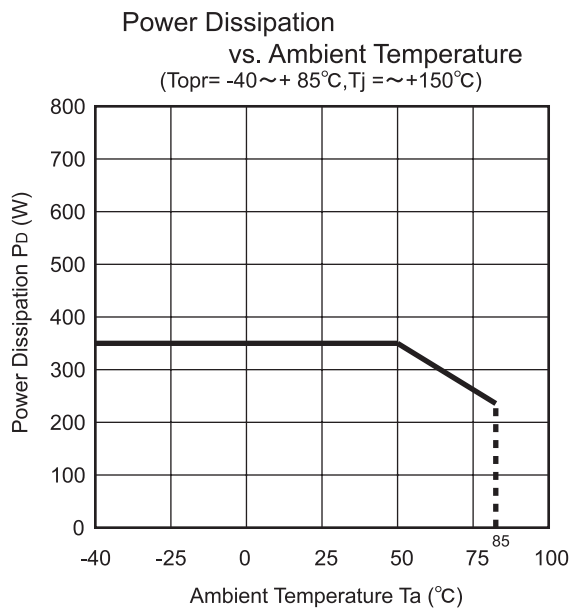
○ Measurement is to be conducted in pulse testing.  
 ○  $I_Q = I_I - I_O$

2. Ripple Rejection



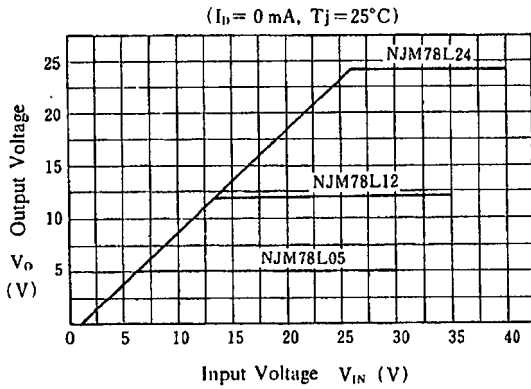
$$RR = 20 \log_{10} \left( \frac{e_{in}}{e_o} \right) \text{ (dB)}$$

## ■ POWER DISSIPATION VS. AMBIENT TEMPERATURE

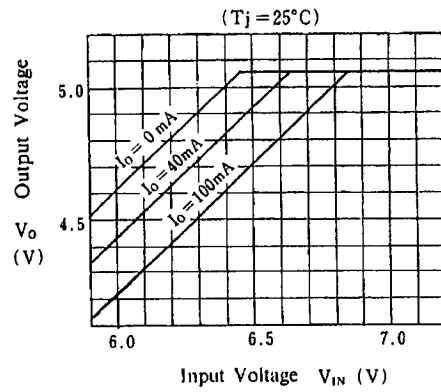


## ■ TYPICAL CHARACTERISTICS

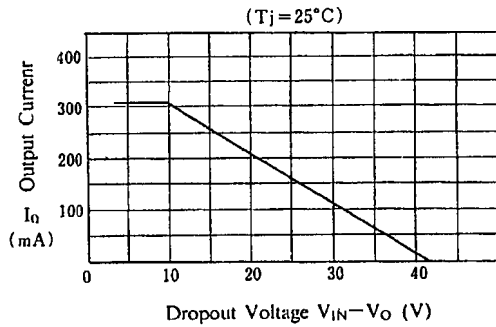
**NJM78L05 / L12 / L24**  
**Output Characteristics**



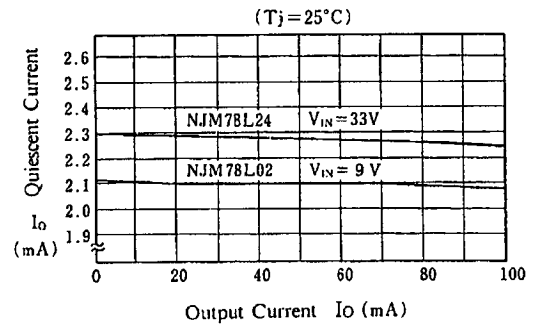
**NJM78L05 Dropout Characteristics**



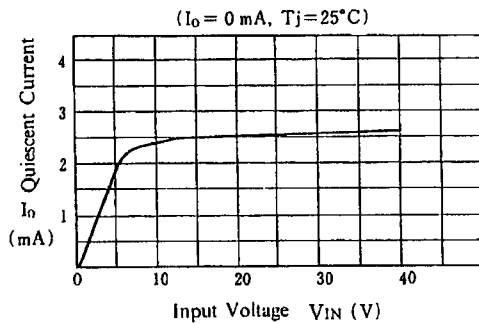
**NJM78L00 Series Short Circuit**  
**Output Current**



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



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

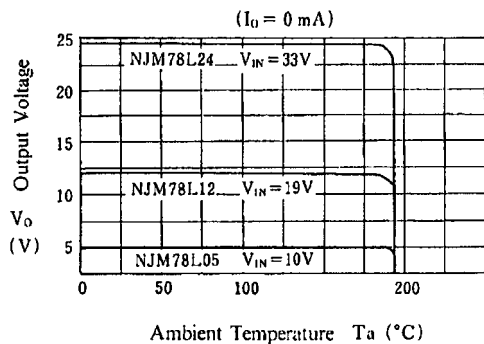


# NJM78L00

## ■ TYPICAL CHARACTERISTICS

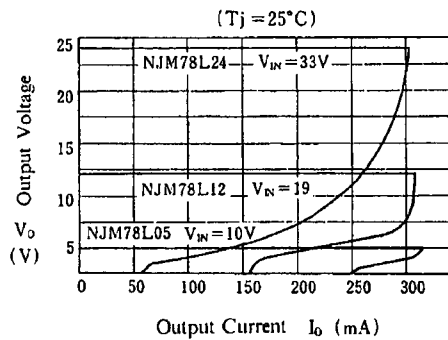
### NJM78L05 / L12 / L24

#### Thermal Shutdown Characteristics

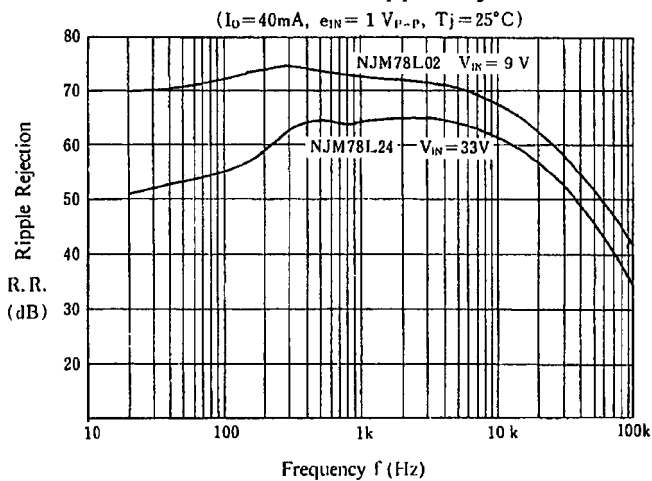


### NJM78L05 / L12 / L24

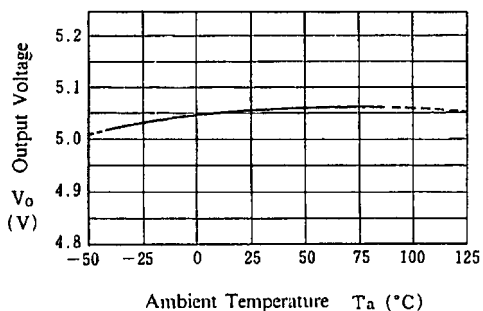
#### Load Characteristics



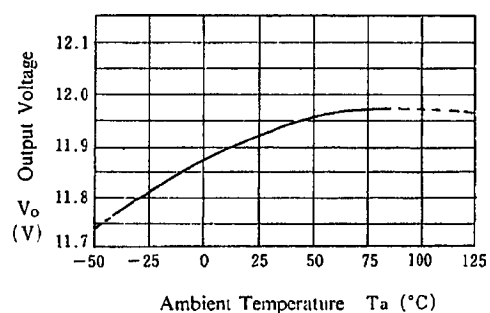
### NJM78L02 / L24 Ripple Rejection



### NJM78L05 Output Voltage vs. Temperature



### NJM78L12 Output Voltage vs. Temperature



#### [CAUTION]

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