

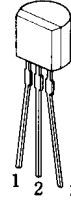
3-TERMINAL POSITIVE VOLTAGE REGULATOR

■ 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

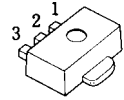
(TO-92)



NJM78L00A

- 1.OUT
- 2.GND
- 3.IN

(SOT-89)



NJM78L00UA

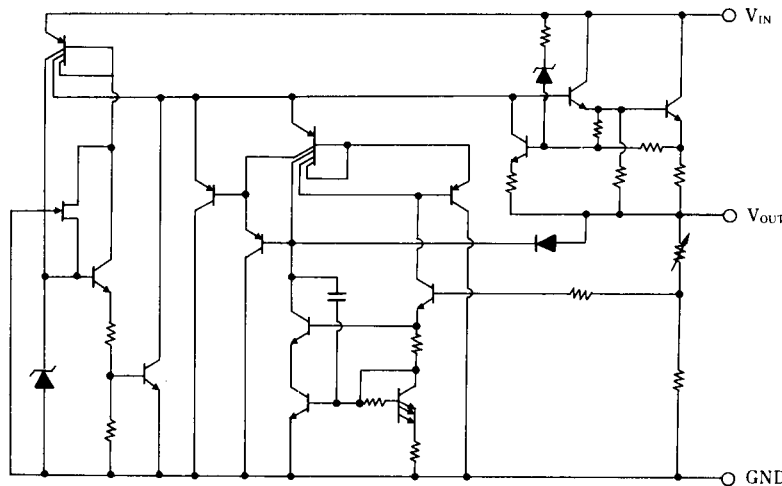
- 1.OUT
- 2.GND
- 3.IN

■ FEATURES

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

TO-92, SOT-89

■ EQUIVALENT CIRCUIT



NJM78L00

■ ABSOLUTE MAXIMUM RATINGS

(T_a=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Input Voltage	V _{IN}	(78L02A to 78L09A) 30	V
		(78L12A to 78L15A) 35	
		(78L18A to 78L24A) 40	
Power Dissipation	P _D	(TO-92) 500	mW
		(EMP8) 350	
		(SOT-89) 300	
Operating Temperature Range	T _{opr}	-40 to +85	°C
Storage Temperature Range	T _{stg}	-40 to +150	°C

■ ELECTRICAL CHARACTERISTICS(C_{IN}=0.33μF, C_O=0.1μF, T_J=25°C)

Measurement is to be conducted is 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} =4.75V to 20V, I _O =40mA	-	-	125	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =5V to 20V, I _O =40mA	-	-	100	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =9V, I _O =1 to 40mA	-	-	25	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =9V, I _O =1 to 100mA	-	-	50	mV
Quiescent Current	I _Q	V _{IN} =9V, I _O =0mA	-	2.0	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =9V, I _O =1mA	-	0.2	-	mV/°C
Ripple Rejection	RR	6V < V _{IN} < 16V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	43	73	-	dB
Output Noise Voltage	V _{NO}	V _{IN} =9V, BW=10Hz to 100kHz, I _O =40mA	-	35	-	μV
NJM78L03A(*1)						
Output Voltage	V _O	V _{IN} =9V, I _O =40mA	2.85	3.0	3.15	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =5V to 20V, I _O =40mA	-	-	125	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =6V to 20V, I _O =40mA	-	-	100	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =9V, I _O =1 to 40mA	-	-	25	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =9V, I _O =1 to 100mA	-	-	50	mV
Quiescent Current	I _Q	V _{IN} =9V, I _O =0mA	-	2.0	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =9V, I _O =1mA	-	0.2	-	mV/°C
Ripple Rejection	RR	6V < V _{IN} < 16V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	43	72	-	dB
Output Noise Voltage	V _{NO}	V _{IN} =9V, BW=10Hz to 100kHz, I _O =40mA	-	40	-	μV
NJM78L05A(*3)						
Output Voltage	V _O	V _{IN} =10V, I _O =40mA	4.75	5.0	5.25	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =7V to 20V, I _O =40mA	-	-	200	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =8V to 20V, I _O =40mA	-	-	150	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =10V, I _O =1 to 40mA	-	-	30	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =10V, I _O =1 to 100mA	-	-	60	mV
Quiescent Current	I _Q	V _{IN} =10V, I _O =0mA	-	2.0	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =10V, I _O =1mA	-	0.4	-	mV/°C
Ripple Rejection	RR	8V < V _{IN} < 18V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	40	69	-	dB
Output Noise Voltage	V _{NO}	V _{IN} =10V, BW=10Hz to 100kHz, I _O =40mA	-	70	-	μV

(*1) : SOT-89 package only.

(*2) : TO-92 package only.

(*3) : SOT-89, TO-92, EMP8

■ ELECTRICAL CHARACTERISTICS (C_{IN}=0.33μF, C_O=0.1μF, T_J=25°C)

Measurement is to be conducted is pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78L06A						
Output Voltage	V _O	V _{IN} =12V, I _O =40mA	5.7	6.0	6.3	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =8.5V to 20V, I _O =40mA	-	-	200	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =9V to 20V, I _O =40mA	-	-	150	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =12V, I _O =1 to 40mA	-	-	40	mV
Load Regulation 2	ΔV _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	ΔV _O /ΔT	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	-	μV
NJM78L62A(*2)						
Output Voltage	V _O	V _{IN} =12.2V, I _O =40mA	5.89	6.2	6.51	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =8.7V to 20.2V, I _O =40mA	-	-	200	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =9.2V to 20.2V, I _O =40mA	-	-	150	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =12.2V, I _O =1 to 40mA	-	-	40	mV
Load Regulation 2	ΔV _O -I _{O2}	V _{IN} =12.2V, I _O =1 to 100mA	-	-	85	mV
Quiescent Current	I _Q	V _{IN} =12.2V, I _O =0mA	-	2.0	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =12.2V, I _O =1mA	-	0.5	-	mV/°C
Ripple Rejection	RR	9.2V < V _{IN} < 20.2V, I _O =40mA, e _{in} =1V _{P-P} , f=120Hz	40	67	-	dB
Output Noise Voltage	V _{NO}	V _{IN} =12.2V, BW=10Hz to 100kHz, I _O =40mA	-	85	-	μV
NJM78L07A						
Output Voltage	V _O	V _{IN} =13V, I _O =40mA	6.65	7.0	7.35	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =9.5V to 22V, I _O =40mA	-	-	210	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =10V to 22V, I _O =40mA	-	-	160	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =13V, I _O =1 to 40mA	-	-	45	mV
Load Regulation 2	ΔV _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	ΔV _O /ΔT	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	-	μV
NJM78L08A						
Output Voltage	V _O	V _{IN} =14V, I _O =40mA	7.6	8.0	8.4	V
Line Regulation 1	ΔV _O -V _{IN1}	V _{IN} =10.5V to 23V, I _O =40mA	-	-	225	mV
Line Regulation 2	ΔV _O -V _{IN2}	V _{IN} =11V to 23V, I _O =40mA	-	-	175	mV
Load Regulation 1	ΔV _O -I _{O1}	V _{IN} =14V, I _O =1 to 40mA	-	-	50	mV
Load Regulation 2	ΔV _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	ΔV _O /ΔT	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	-	μV

(*1) : SOT-89 package only.

(*2) : TO-92 package only.

(*3) : SOT-89, TO-92, EMP8

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
NJM78L09A(*3)						
Output Voltage	V_O	$V_{IN}=15V$, $I_O=40mA$	8.55	9.0	9.45	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=11.5V$ to $23V$, $I_O=40mA$	-	-	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=12V$ to $23V$, $I_O=40mA$	-	-	200	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=15V$, $I_O=1$ to $40mA$	-	-	50	mV
Load Regulation 2	ΔV_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	-	μV
NJM78L10A						
Output Voltage	V_O	$V_{IN}=16V$, $I_O=40mA$	9.5	10.0	10.5	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=13V$ to $25V$, $I_O=40mA$	-	-	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=14V$ to $25V$, $I_O=40mA$	-	-	200	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=16V$, $I_O=1$ to $40mA$	-	-	50	mV
Load Regulation 2	ΔV_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	-	μV
NJM78L12A(*3)						
Output Voltage	V_O	$V_{IN}=19V$, $I_O=40mA$	11.4	12.0	12.6	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=14.5V$ to $27V$, $I_O=40mA$	-	-	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=16V$ to $27V$, $I_O=40mA$	-	-	200	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=19V$, $I_O=1$ to $40mA$	-	-	50	mV
Load Regulation 2	ΔV_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	-	μV
NJM78L15A						
Output Voltage	V_O	$V_{IN}=23V$, $I_O=40mA$	14.3	15.0	15.7	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=17.5V$ to $30V$, $I_O=40mA$	-	-	300	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=20V$ to $30V$, $I_O=40mA$	-	-	250	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=23V$, $I_O=1$ to $40mA$	-	-	75	mV
Load Regulation 2	ΔV_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	-	μV

(*1) : SOT-89 package only.

(*2) : TO-92 package only.

(*3) : SOT-89, TO-92, EMP8

■ **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.

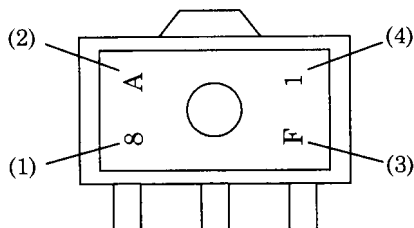
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78L18A						
Output Voltage	V_O	$V_{IN}=27V, I_O=40mA$	17.1	18.0	18.9	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=22V$ to $33V, I_O=40mA$	-	-	320	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=22V$ to $33V, I_O=40mA$	-	-	270	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=27V, I_O=1$ to $40mA$	-	-	80	mV
Load Regulation 2	ΔV_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	-	μV
NJM78L20A						
Output Voltage	V_O	$V_{IN}=29V, I_O=40mA$	19.0	20.0	21.0	V
Line Regulation 1	ΔV_O-V_{IN1}	$V_{IN}=23V$ to $34V, I_O=40mA$	-	-	330	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=24V$ to $34V, I_O=40mA$	-	-	280	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=29V, I_O=1$ to $40mA$	-	-	90	mV
Load Regulation 2	ΔV_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	-	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}	$V_{IN}=27V$ to $38V, I_O=40mA$	-	-	350	mV
Line Regulation 2	ΔV_O-V_{IN2}	$V_{IN}=28V$ to $38V, I_O=40mA$	-	-	300	mV
Load Regulation 1	ΔV_O-I_{O1}	$V_{IN}=33V, I_O=1$ to $40mA$	-	-	100	mV
Load Regulation 2	ΔV_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	-	μV

(*1) : SOT-89 package only.

(*2) : TO-92 package only.

(*3) : SOT-89, TO-92, EMP8

■ **SOT-89 MARK**



(1) 8 : Positive Output

(2) V_O Rank

(3) The end of A.D.

(4) Production Mouth

Oct. ...X

Nov. ...Y

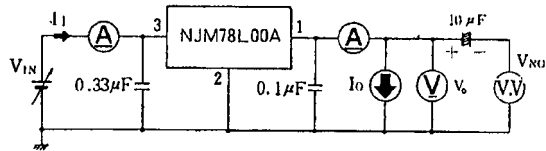
Dec. ...Z

NJM78L02A	8	A
NJM78L03A	8	B
NJM78L05A	8	C
NJM78L06A	8	E
NJM78L62A	8	Z
NJM78L07A	8	F
NJM78L08A	8	G
NJM78L09A	8	H
NJM78L10A	8	J
NJM78L12A	8	K
NJM78L15A	8	L
NJM78L18A	8	M
NJM78L20A	8	N
NJM78L24A	8	P

NJM78L00

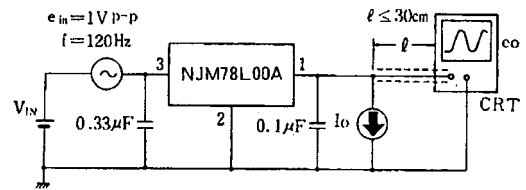
■ TEST CIRCUIT

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



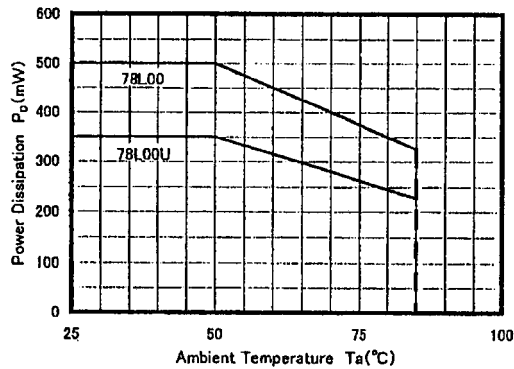
○ Measurement is to be conducted in pulse testing.
 ○ $I_Q = I_1 - I_O$

2. Ripple Rejection



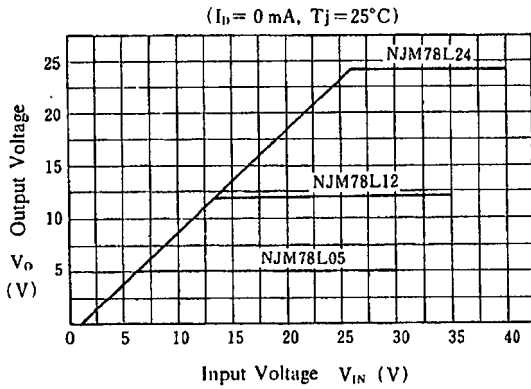
$$RR = 20 \log_{10} \left(\frac{e_{in}}{e_o} \right) \text{ (dB)}$$

■ AMBIENT TEMPERATURE VS. POWER DISSIPATION

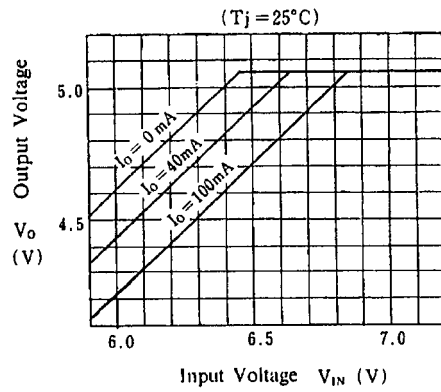


■ TYPICAL CHARACTERISTICS

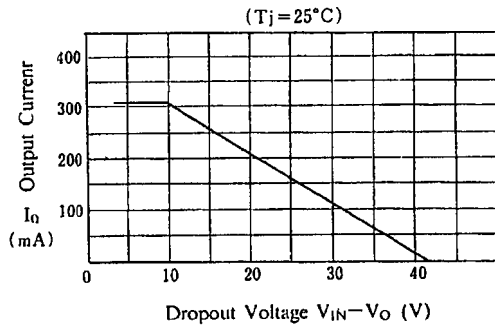
NJM78L05 / L12 / L24
Output Characteristics



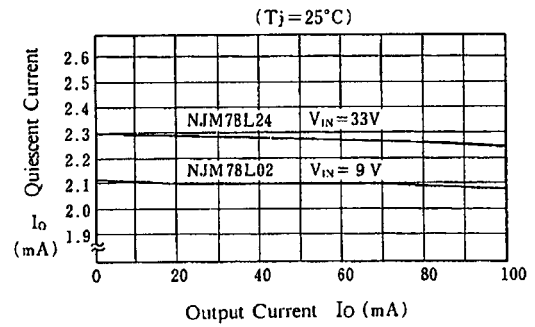
NJM78L05 Dropout Characteristics



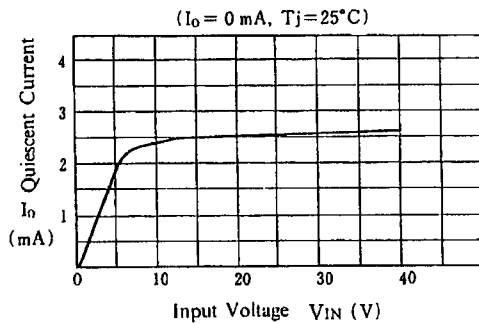
NJM78L00 Series Short Circuit
Output Current



NJM78L02 / L24 Quiescent Current
vs. Output Current



NJM78L05 Quiescent Current
vs. Input Voltage

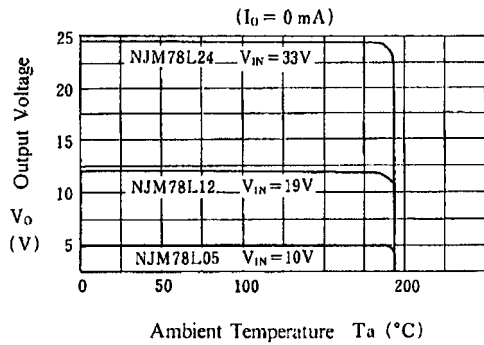


NJM78L00

■ TYPICAL CHARACTERISTICS

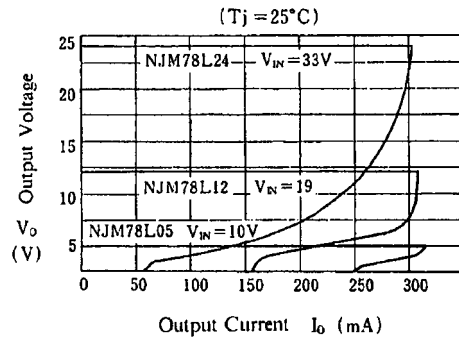
NJM78L05 / L12 / L24

Thermal Shutdown Characteristics

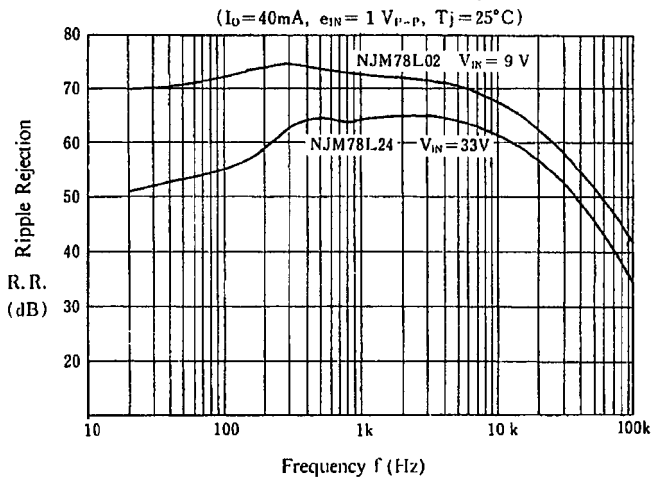


NJM78L05 / L12 / L24

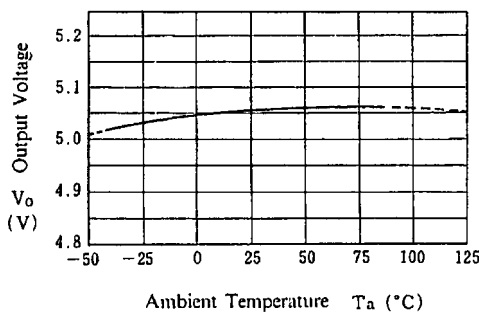
Load Characteristics



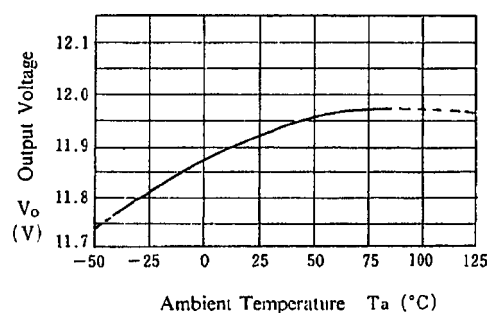
NJM78L02 / L24 Ripple Rejection



NJM78L05 Output Voltage vs. Temperature



NJM78L12 Output Voltage vs. Temperature



[CAUTION]

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