

### 3-TERMINAL POSITIVE VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

The NJM78M00 series of 3-Terminal Positive Voltage Regulators is constructed using the New JRC Planar epitaxial process. These regulators employ internal current-limiting, thermal-shutdown and safe-area compensation making them essentially indestructible. If adequate heat sinking is provided, they can deliver in excess of 500mA output current. They are intended as fixed voltage regulation 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 to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents.

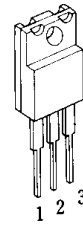
■ FEATURES

- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Excellent Ripple Rejection
- Guarantee'd 500mA Output Current
- Package Outline
- Bipolar Technology

TO-220F, TO-252

■ PACKAGE OUTLINE

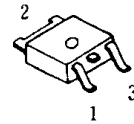
(TO-220F)



NJM78M00FA

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

(TO-252)



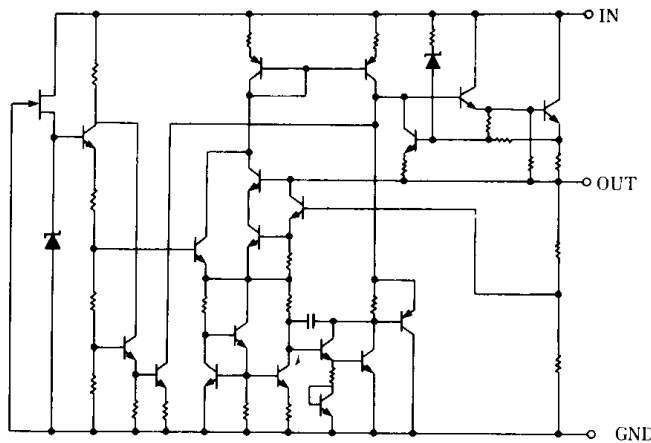
NJM78M00DL1A

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

(note) The radiation fin is connected pin2.

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■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS		UNIT	
Input Voltage	V <sub>IN</sub>	78M05 ~ 78M09	35	V	
		78M12 ~ 78M15	35		
		78M18 ~ 78M24	40		
Storage Temperature Range	T <sub>stg</sub>	-40 ~ +150		°C	
Operating Temperature Range	Operating Junction Temperature		T <sub>j</sub>	-30 ~ +150	°C
	Operating Junction Temperature		T <sub>opr</sub>	-40 ~ +85	
Power Dissipation	P <sub>D</sub>	TO220F	7.5 (T <sub>c</sub> ≤ 75°C)	W	
		TO252	1.0 (T <sub>a</sub> = 25°C)		
			7.5 (T <sub>c</sub> ≤ 56°C)		

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## ■ THERMAL CHARACTERISTICS

Thermal Resistance	Junction-to-Ambient Temperature	θ <sub>ja</sub>	TO220F	TO252	°C/W
			Junction-to-Case		
			60	125	
			7	12.5	

## ■ 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>NJM78M05 FA/DL1A</b>						
Output Voltage	V <sub>O</sub>	V <sub>IN</sub> =10V, I <sub>O</sub> =350mA	4.8	5.0	5.2	V
Line Regulation	ΔV <sub>O</sub> -V <sub>IN</sub>	V <sub>IN</sub> =7~25V, I <sub>O</sub> =200mA	—	3	50	mV
Load Regulation	ΔV <sub>O</sub> -I <sub>O</sub>	V <sub>IN</sub> =10V, I <sub>O</sub> =5~500mA	—	5	50	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =10V, I <sub>O</sub> =0mA	—	4	6	mA
Average Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	V <sub>IN</sub> =10V, I <sub>O</sub> =5mA	—	-1	—	mV/°C
Ripple Rejection	RR	V <sub>IN</sub> =10V, I <sub>O</sub> =350mA, e <sub>in</sub> =1V <sub>P-P</sub> , f=120Hz	60	80	—	dB
Output Noise Voltage	V <sub>NO</sub>	V <sub>IN</sub> =10V, BW=10Hz~100kHz, I <sub>O</sub> =350mA	—	60	—	μV

■ **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>NJM78M06 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=11\text{V}$ , $I_O=350\text{mA}$	5.75	6.0	6.25	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=8\sim 25\text{V}$ , $I_O=200\text{mA}$	—	5	60	mV
Load Regulation	$\Delta V_O-I_O$	$V_{IN}=11\text{V}$ , $I_O=5\sim 500\text{mA}$	—	5	60	mV
Quiescent Current	$I_Q$	$V_{IN}=11\text{V}$ , $I_O=0\text{mA}$	—	4	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=11\text{V}$ , $I_O=5\text{mA}$	—	-1	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=11\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	59	75	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=11\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	70	—	$\mu\text{V}$
<b>NJM78M08 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=14\text{V}$ , $I_O=350\text{mA}$	7.7	8.0	8.3	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=10.5\sim 25\text{V}$ , $I_O=200\text{mA}$	—	6	60	mV
Load Regulation	$\Delta V_O-I_O$	$V_{IN}=14\text{V}$ , $I_O=5\sim 500\text{mA}$	—	8	80	mV
Quiescent Current	$I_Q$	$V_{IN}=14\text{V}$ , $I_O=0\text{mA}$	—	4	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=14\text{V}$ , $I_O=5\text{mA}$	—	-1	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=14\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	56	75	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=14\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	80	—	$\mu\text{V}$
<b>NJM78M09 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=15\text{V}$ , $I_O=350\text{mA}$	8.65	9.0	9.35	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=11.5\sim 25\text{V}$ , $I_O=200\text{mA}$	—	6	60	mV
Load Regulation	$\Delta V_O-I_O$	$V_{IN}=15\text{V}$ , $I_O=5\sim 500\text{mA}$	—	8	90	mV
Quiescent Current	$I_Q$	$V_{IN}=15\text{V}$ , $I_O=0\text{mA}$	—	4.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=15\text{V}$ , $I_O=5\text{mA}$	—	-1	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=15\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	56	70	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=15\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	90	—	$\mu\text{V}$
<b>NJM78M12 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=19\text{V}$ , $I_O=350\text{mA}$	11.5	12.0	12.5	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=14.5\sim 30\text{V}$ , $I_O=200\text{mA}$	—	8	60	mV
Load Regulation	$\Delta V_O-I_O$	$V_{IN}=19\text{V}$ , $I_O=5\sim 500\text{mA}$	—	8	120	mV
Quiescent Current	$I_Q$	$V_{IN}=19\text{V}$ , $I_O=0\text{mA}$	—	4.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=19\text{V}$ , $I_O=5\text{mA}$	—	-1	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=19\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	55	70	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=19\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	100	—	$\mu\text{V}$

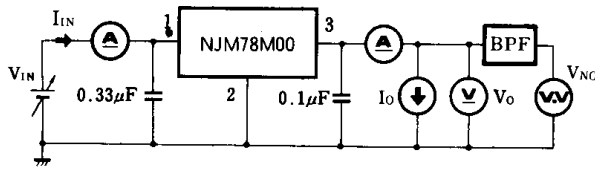
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■ **ELECTRICAL CHARACTERISTICS** ( $C_{IN}=0.33\ \mu\text{F}$ ,  $C_O=0.1\ \mu\text{F}$ ,  $T_j=25^\circ\text{C}$ ) Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM78M15 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=23\text{V}$ , $I_O=350\text{mA}$	14.4	15.0	15.6	V
Line Regulation	$\Delta V_O/V_{IN}$	$V_{IN}=17.5\sim 30\text{V}$ , $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O/I_O$	$V_{IN}=23\text{V}$ , $I_O=5\sim 500\text{mA}$	—	10	150	mV
Quiescent Current	$I_Q$	$V_{IN}=23\text{V}$ , $I_O=0\text{mA}$	—	4.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=25\text{V}$ , $I_O=5\text{mA}$	—	-1	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=23\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	54	70	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=23\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	120	—	$\mu\text{V}$
<b>NJM78M18 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=27\text{V}$ , $I_O=350\text{mA}$	17.3	18.0	18.7	V
Line Regulation	$\Delta V_O/V_{IN}$	$V_{IN}=21\sim 33\text{V}$ , $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O/I_O$	$V_{IN}=27\text{V}$ , $I_O=5\sim 500\text{mA}$	—	15	180	mV
Quiescent Current	$I_Q$	$V_{IN}=27\text{V}$ , $I_O=0\text{mA}$	—	4.2	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=27\text{V}$ , $I_O=5\text{mA}$	—	-1.1	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=27\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	53	65	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=27\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	140	—	$\mu\text{V}$
<b>NJM78M20 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=29\text{V}$ , $I_O=350\text{mA}$	19.2	20.0	20.8	V
Line Regulation	$\Delta V_O/V_{IN}$	$V_{IN}=23\sim 35\text{V}$ , $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O/I_O$	$V_{IN}=29\text{V}$ , $I_O=5\sim 500\text{mA}$	—	20	200	mV
Quiescent Current	$I_Q$	$V_{IN}=29\text{V}$ , $I_O=0\text{mA}$	—	4	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=29\text{V}$ , $I_O=5\text{mA}$	—	-1.1	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=29\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	53	65	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=29\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	150	—	$\mu\text{V}$
<b>NJM78M24 FA/DL1</b>						
Output Voltage	$V_O$	$V_{IN}=33\text{V}$ , $I_O=350\text{mA}$	23.0	24.0	25.0	V
Line Regulation	$\Delta V_O/V_{IN}$	$V_{IN}=27\sim 38\text{V}$ , $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O/I_O$	$V_{IN}=33\text{V}$ , $I_O=5\sim 500\text{mA}$	—	20	240	mV
Quiescent Current	$I_Q$	$V_{IN}=33\text{V}$ , $I_O=0\text{mA}$	—	4.2	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=33\text{V}$ , $I_O=5\text{mA}$	—	-1.2	—	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=33\text{V}$ , $I_O=350\text{mA}$ , $e_{in}=1\text{V}_{P-P}$ , $f=120\text{Hz}$	50	60	—	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=33\text{V}$ , $BW=10\text{Hz}\sim 100\text{kHz}$ , $I_O=350\text{mA}$	—	160	—	$\mu\text{V}$

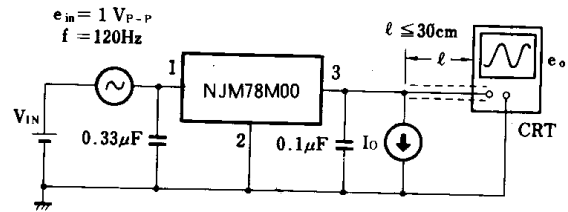
## ■ TEST CIRCUIT

1. Output Voltage, Line Regulation, Load Regulation, Quiescent Current, Average Temperature Coefficient of Output Voltage, Output Noise Voltage.



- Measurement is to be conducted
- $I_Q = I_{IN} - I_O$  in pulse testing

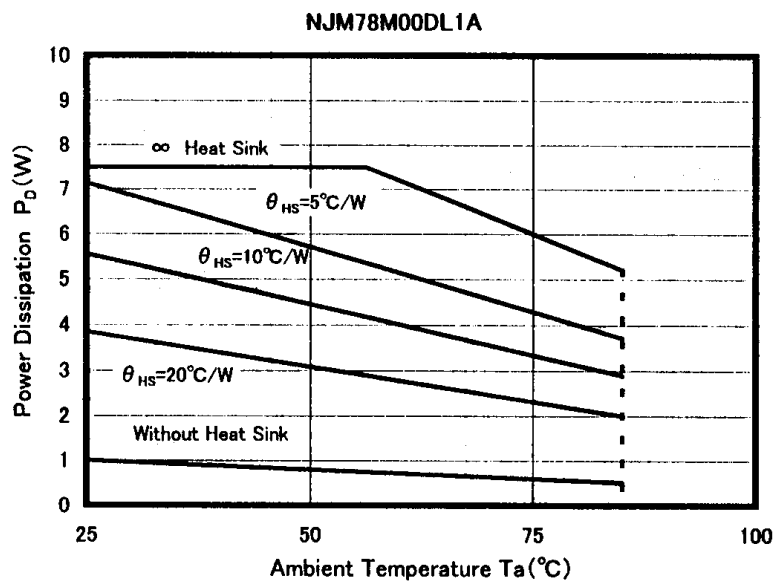
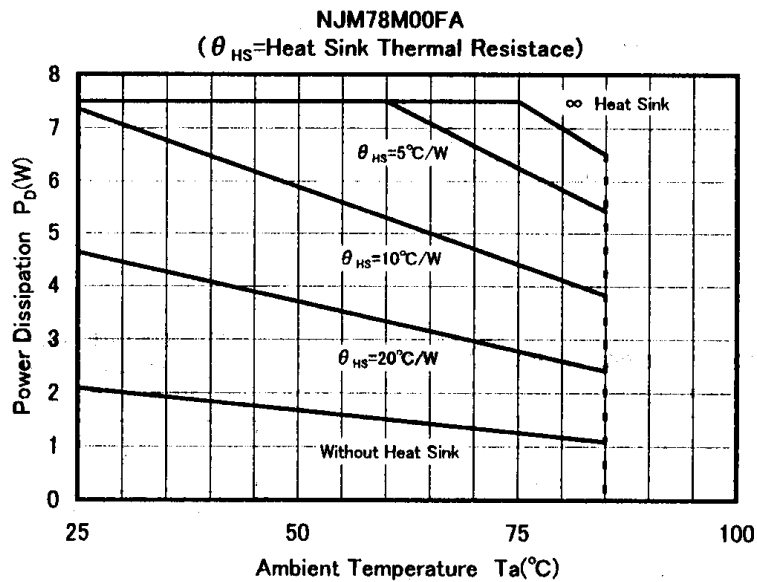
2. Ripple Rejection



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

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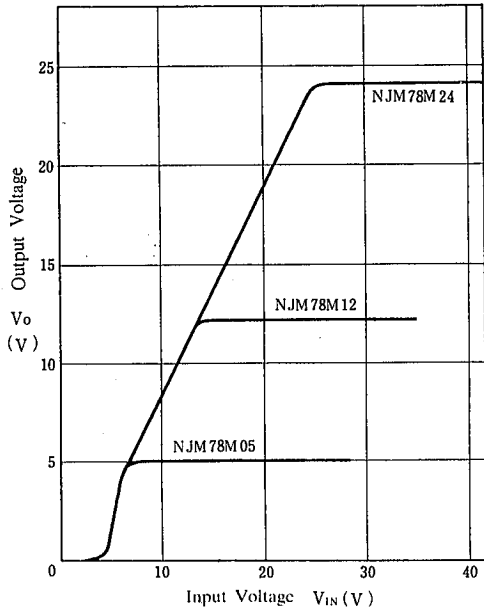
## ■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



## ■ TYPICAL CHARACTERISTICS

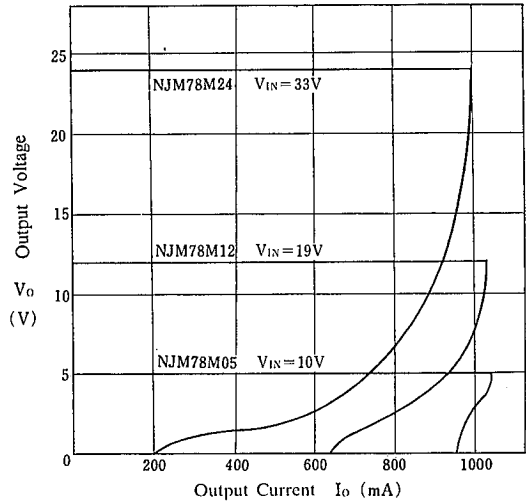
### NJM78M05/M12/M24 Output Characteristics

( $I_o = 350\text{mA}$ ,  $T_j = 25^\circ\text{C}$ )



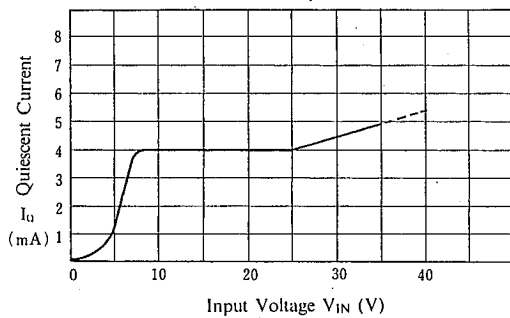
### NJM78M05/M12/M24 Load Characteristics

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



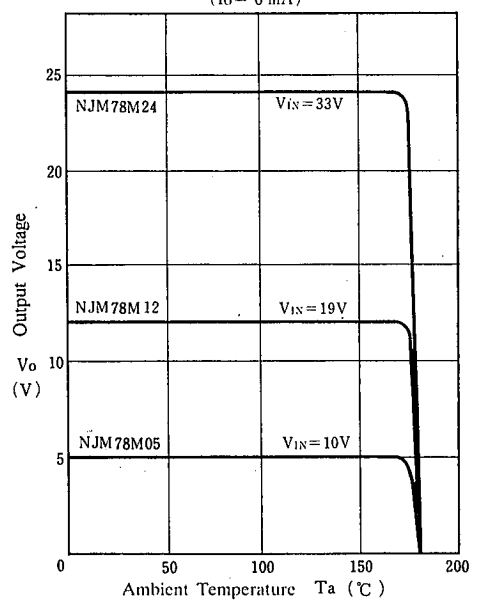
### NJM78M05 Quiescent Current vs. Input Voltage

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

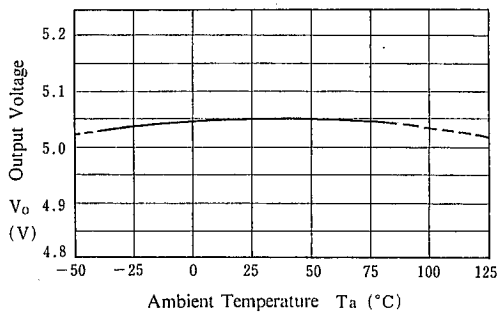


### NJM78M05/M12/M24 Thermal Shutdown Characteristics

( $I_o = 0\text{mA}$ )



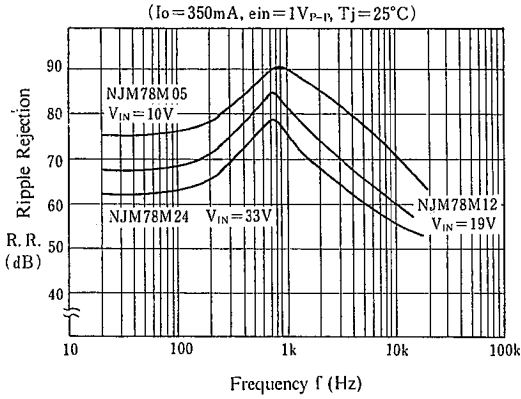
### NJM78M05 Output Voltage vs. Temperature



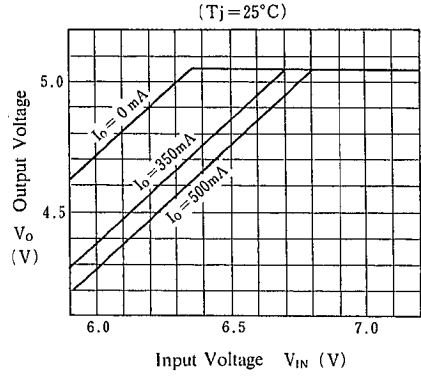
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## ■ TYPICAL CHARACTERISTICS

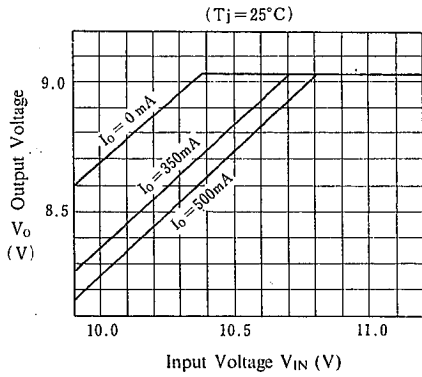
### NJM78M05/12/24 Ripple Rejection



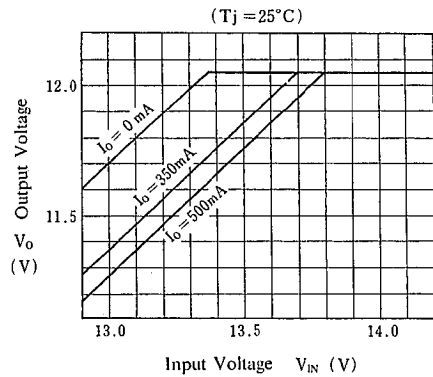
### NJM78M05 Dropout Characteristics



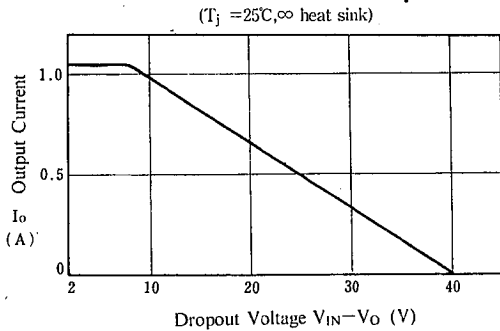
### NJM78M09 Dropout Characteristics



### NJM78M12 Dropout Characteristics



### NJM78M00 Series Short Circuit Output Current



## MEMO

[CAUTION]

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