

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

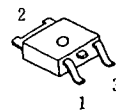
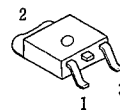
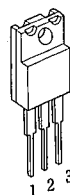
TO-220F, TO-252

■ PACKAGE OUTLINE

(TO-220F)

(TO-252)

(TO-252)



NJM78M00FA

NJM78M00DLA

NJM78M00DL1A

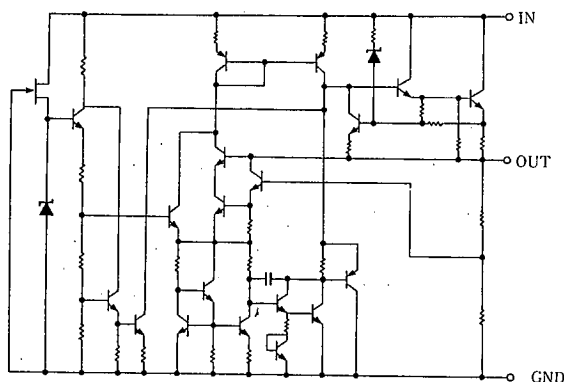
1. IN
2. GND
3. OUT

1. IN
2. GND
3. OUT

1. IN
2. GND
3. OUT

(note) The radiation fin is connected pin2.

■ EQUIVALENT CIRCUIT



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS		UNIT
Input Voltage	V _{IN}	78M05~78M09	35	V
		78M12~78M15	35	
		78M18~78M24	40	
Storage Temperature Range	T _{stg}	-40 ~ +150		°C
Operating Temperature Range	Operating Junction Temperature	T _j	-30 ~ +150	°C
		T _{opr}	-40 ~ +85	
Power Dissipation	P _D	TO220F	7.5 (T _c ≤75°C)	W
		TO252	1.0 (Ta=25°C)	
			7.5 (T _c ≤56°C)	

■ THERMAL CHARACTERISTICS

Thermal Resistance	Junction-to-Ambient Temperature	θ _{ja}	TO220F	TO252	°C/W
			60	125	
	Junction-to-Case	θ _{jc}	7	12.5	

■ ELECTRICAL CHARACTERISTICS (C_{IN}=0.33 μF, C_O=0.1 μF, T_J=25°C) Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78M05A						
Output Voltage	V _O	V _{IN} =10V, I _O =350mA	4.8	5.0	5.2	V
Line Regulation	ΔV _O -V _{IN}	V _{IN} =7~25V, I _O =200mA	—	3	50	mV
Load Regulation	ΔV _O -I _O	V _{IN} =10V, I _O =5~500mA	—	5	50	mV
Quiescent Current	I _Q	V _{IN} =10V, I _O =0mA	—	4	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =10V, I _O =5mA	—	-1	—	mV/°C
Ripple Rejection	RR	V _{IN} =10V, I _O =350mA, e _{in} =1V _{P-P} , f=120Hz	60	80	—	dB
Output Noise Voltage	V _{NO}	V _{IN} =10V, BW=10Hz~100kHz, I _O =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
NJM78M06A						
Output Voltage	V_O	$V_{IN}=11\text{V}$, $I_O=350\text{mA}$	5.75	6.0	6.25	V
Line Regulation	ΔV_O-V_{IN}	$V_{IN}=8\sim 25\text{V}$, $I_O=200\text{mA}$	—	5	60	mV
Load Regulation	ΔV_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/°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	—	μV
NJM78M08A						
Output Voltage	V_O	$V_{IN}=14\text{V}$, $I_O=350\text{mA}$	7.7	8.0	8.3	V
Line Regulation	ΔV_O-V_{IN}	$V_{IN}=10.5\sim 25\text{V}$, $I_O=200\text{mA}$	—	6	60	mV
Load Regulation	ΔV_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/°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	—	μV
NJM78M09A						
Output Voltage	V_O	$V_{IN}=15\text{V}$, $I_O=350\text{mA}$	8.65	9.0	9.35	V
Line Regulation	ΔV_O-V_{IN}	$V_{IN}=11.5\sim 25\text{V}$, $I_O=200\text{mA}$	—	6	60	mV
Load Regulation	ΔV_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/°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	—	μV
NJM78M12A						
Output Voltage	V_O	$V_{IN}=19\text{V}$, $I_O=350\text{mA}$	11.5	12.0	12.5	V
Line Regulation	ΔV_O-V_{IN}	$V_{IN}=14.5\sim 30\text{V}$, $I_O=200\text{mA}$	—	8	60	mV
Load Regulation	ΔV_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/°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	—	μV

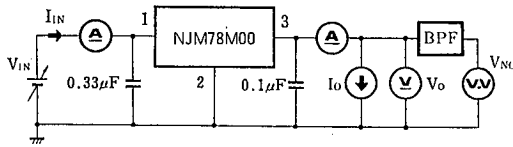
■ **ELECTRICAL CHARACTERISTICS** ($C_{IN}=0.33\ \mu\text{F}$, $C_O=0.1\ \mu\text{F}$, $T_j=25^\circ\text{C}$) Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78M15A						
Output Voltage	V_O	$V_{IN}=23\text{V}$, $I_O=350\text{mA}$	14.4	15.0	15.6	V
Line Regulation	$\Delta V_O \cdot V_{IN}$	$V_{IN}=17.5\sim 30\text{V}$, $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O \cdot I_O$	$V_{IN}=23\text{V}$, $I_O=5\sim 500\text{mA}$	—	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	—	μV
NJM78M18A						
Output Voltage	V_O	$V_{IN}=27\text{V}$, $I_O=350\text{mA}$	17.3	18.0	18.7	V
Line Regulation	$\Delta V_O \cdot V_{IN}$	$V_{IN}=21\sim 33\text{V}$, $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O \cdot I_O$	$V_{IN}=27\text{V}$, $I_O=5\sim 500\text{mA}$	—	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	—	μV
NJM78M20A						
Output Voltage	V_O	$V_{IN}=29\text{V}$, $I_O=350\text{mA}$	19.2	20.0	20.8	V
Line Regulation	$\Delta V_O \cdot V_{IN}$	$V_{IN}=23\sim 35\text{V}$, $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O \cdot I_O$	$V_{IN}=29\text{V}$, $I_O=5\sim 500\text{mA}$	—	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	—	μV
NJM78M24A						
Output Voltage	V_O	$V_{IN}=33\text{V}$, $I_O=350\text{mA}$	23.0	24.0	25.0	V
Line Regulation	$\Delta V_O \cdot V_{IN}$	$V_{IN}=27\sim 38\text{V}$, $I_O=200\text{mA}$	—	10	60	mV
Load Regulation	$\Delta V_O \cdot I_O$	$V_{IN}=33\text{V}$, $I_O=5\sim 500\text{mA}$	—	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	—	μV

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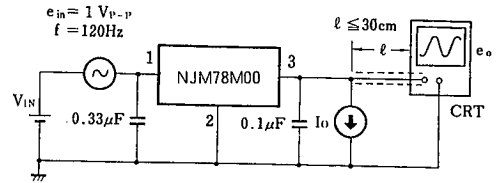
■ TEST CIRCUIT

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



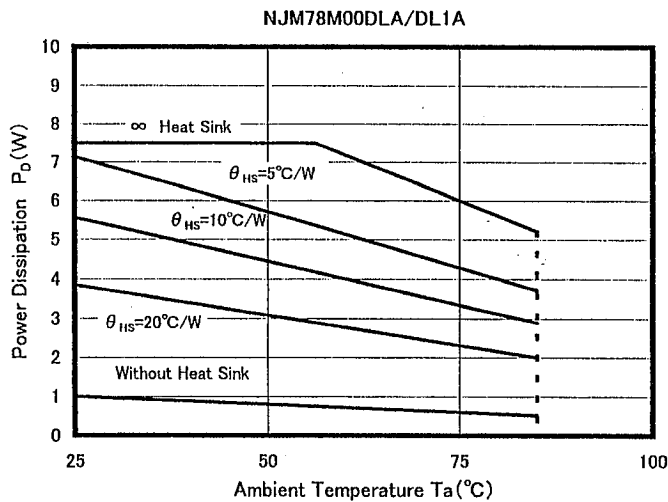
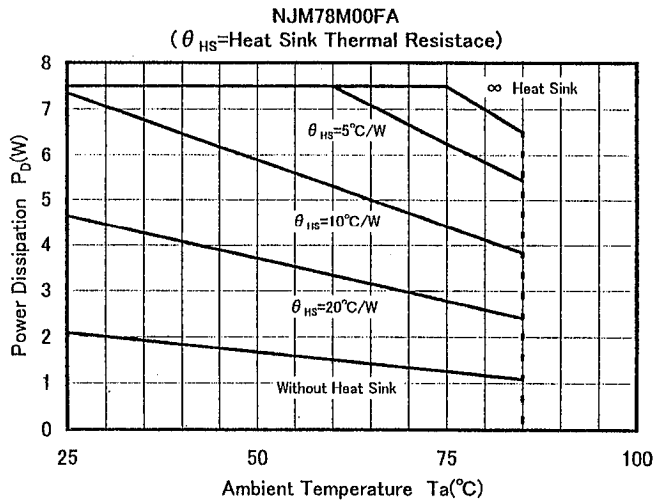
- Measurement is to be conducted
- $I_0 = I_{IN} - I_0$ in pulse testing

2. Ripple Rejection



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

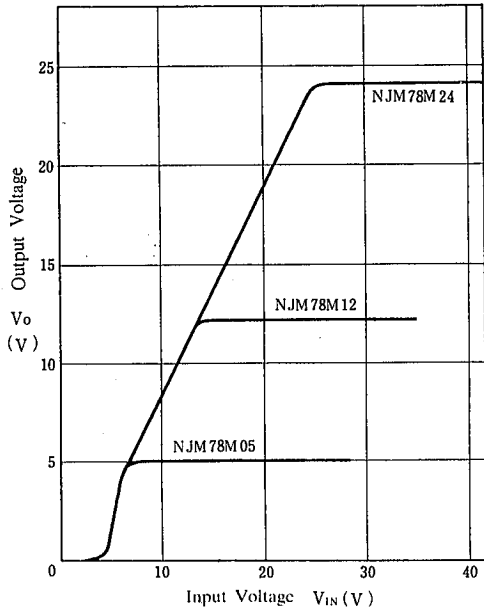
■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



■ TYPICAL CHARACTERISTICS

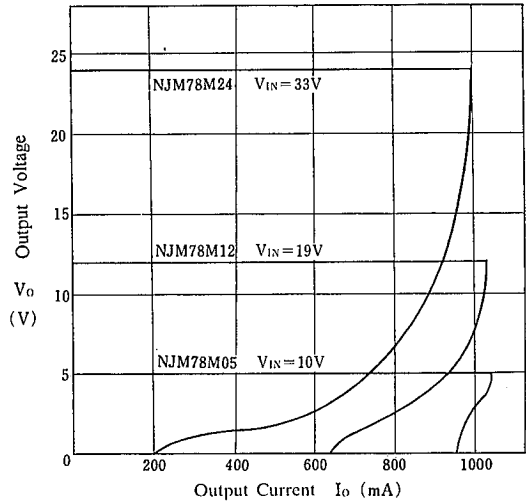
NJM78M05/M12/M24 Output Characteristics

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



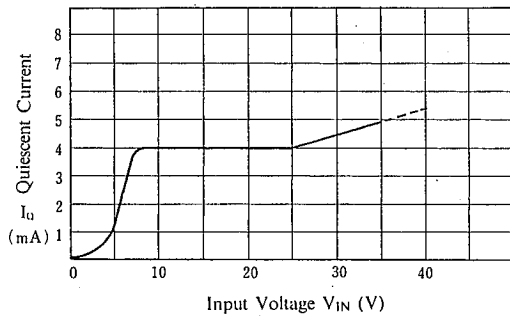
NJM78M05/M12/M24 Load Characteristics

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



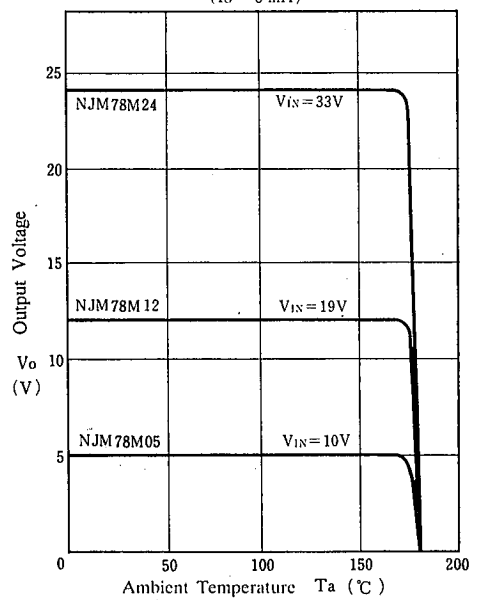
NJM78M05 Quiescent Current vs. Input Voltage

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

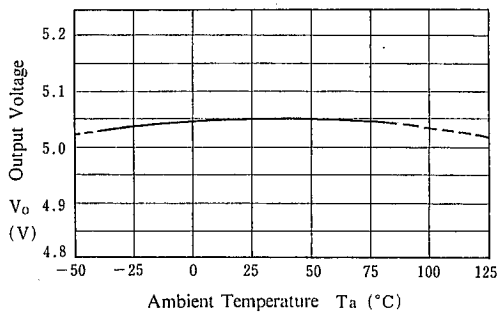


NJM78M05/M12/M24 Thermal Shutdown Characteristics

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



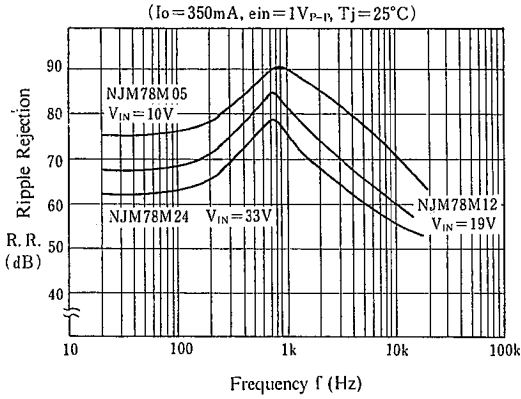
NJM78M05 Output Voltage vs. Temperature



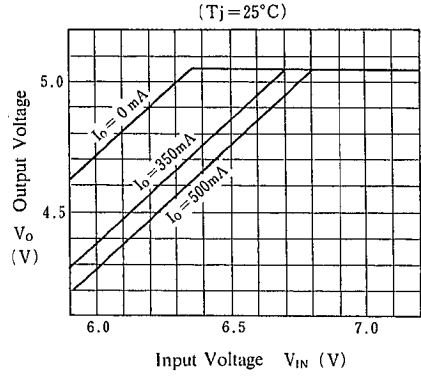
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■ TYPICAL CHARACTERISTICS

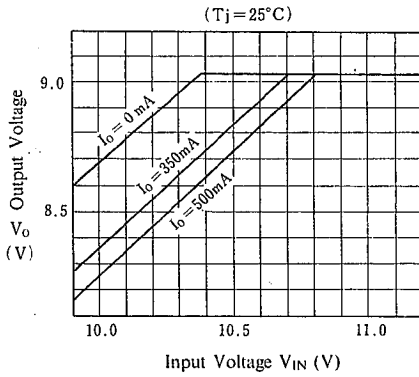
NJM78M05/12/24 Ripple Rejection



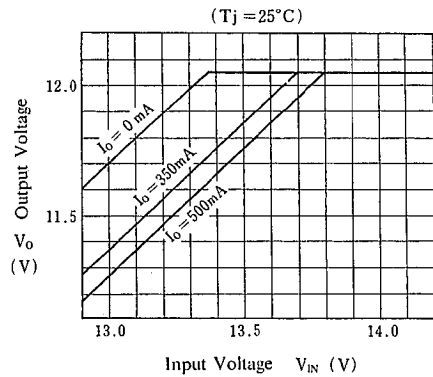
NJM78M05 Dropout Characteristics



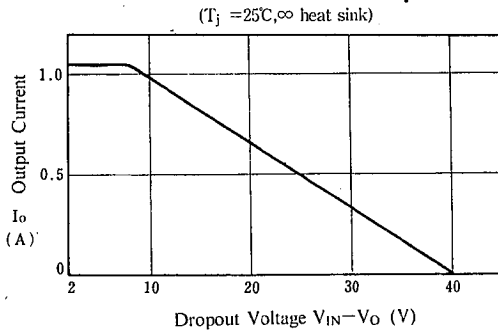
NJM78M09 Dropout Characteristics



NJM78M12 Dropout Characteristics



NJM78M00 Series Short Circuit Output Current



MEMO

[CAUTION]

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