

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.

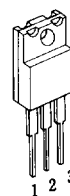
■ FEATURES

- 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

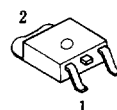
(TO-220F)



NJM78M00FA

1. IN
2. GND
3. OUT

(TO-252)

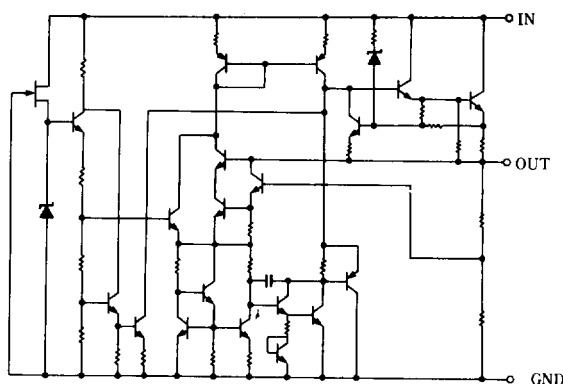


NJM78M00LA

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
	Operating Junction Temperature	T_{opr}	-30 ~ +75	
Power Dissipation	P_D	TO220F	7.5 ($T_c \leq 75^\circ\text{C}$)	W
		TO252	1.0 ($T_a = 25^\circ\text{C}$)	
			7.5 ($T_c \leq 56^\circ\text{C}$)	

■ 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	$V_{IN} = 10\text{V}$, $I_O = 350\text{mA}$	4.8	5.0	5.2	V
Line Regulation	$\Delta V_O / V_{IN}$	$V_{IN} = 7 \sim 25\text{V}$, $I_O = 200\text{mA}$	—	3	50	mV
Load Regulation	$\Delta V_O / I_O$	$V_{IN} = 10\text{V}$, $I_O = 5 \sim 500\text{mA}$	—	5	50	mV
Quiescent Current	I_Q	$V_{IN} = 10\text{V}$, $I_O = 0\text{mA}$	—	4	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O / \Delta T$	$V_{IN} = 10\text{V}$, $I_O = 5\text{mA}$	—	-1	—	mV/°C
Ripple Rejection	RR	$V_{IN} = 10\text{V}$, $I_O = 350\text{mA}$, $e_{in} = 1\text{V}_{P-P}$, $f = 120\text{Hz}$	60	80	—	dB
Output Noise Voltage	V_{NO}	$V_{IN} = 10\text{V}$, $BW = 10\text{Hz} \sim 100\text{kHz}$, $I_O = 350\text{mA}$	—	60	—	μV



■ ELECTRICAL CHARACTERISTICS ¹(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
NJM78M06A						
Output Voltage	V _O	V _{IN} =11V, I _O =350mA	5.75	6.0	6.25	V
Line Regulation	ΔV _O -V _{IN}	V _{IN} =8~25V, I _O =200mA	—	5	60	mV
Load Regulation	ΔV _O -I _O	V _{IN} =11V, I _O =5~500mA	—	5	60	mV
Quiescent Current	I _Q	V _{IN} =11V, I _O =0mA	—	4	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =11V, I _O =5mA	—	-1	—	mV/°C
Ripple Rejection	RR	V _{IN} =11V, I _O =350mA, e _{in} =1V _{P-P} , f=120Hz	59	75	—	dB
Output Noise Voltage	V _{NO}	V _{IN} =11V, BW=10Hz~100kHz, I _O =350mA	—	70	—	μV
NJM78M08A						
Output Voltage	V _O	V _{IN} =14V, I _O =350mA	7.7	8.0	8.3	V
Line Regulation	ΔV _O -V _{IN}	V _{IN} =10.5~25V, I _O =200mA	—	6	60	mV
Load Regulation	ΔV _O -I _O	V _{IN} =14V, I _O =5~500mA	—	8	80	mV
Quiescent Current	I _Q	V _{IN} =14V, I _O =0mA	—	4	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =14V, I _O =5mA	—	-1	—	mV/°C
Ripple Rejection	RR	V _{IN} =14V, I _O =350mA, e _{in} =1V _{P-P} , f=120Hz	56	75	—	dB
Output Noise Voltage	V _{NO}	V _{IN} =14V, BW=10Hz~100kHz, I _O =350mA	—	80	—	μV
NJM78M09A						
Output Voltage	V _O	V _{IN} =15V, I _O =350mA	8.65	9.0	9.35	V
Line Regulation	ΔV _O -V _{IN}	V _{IN} =11.5~25V, I _O =200mA	—	6	60	mV
Load Regulation	ΔV _O -I _O	V _{IN} =15V, I _O =5~500mA	—	8	90	mV
Quiescent Current	I _Q	V _{IN} =15V, I _O =0mA	—	4.1	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =15V, I _O =5mA	—	-1	—	mV/°C
Ripple Rejection	RR	V _{IN} =15V, I _O =350mA, e _{in} =1V _{P-P} , f=120Hz	56	70	—	dB
Output Noise Voltage	V _{NO}	V _{IN} =15V, BW=10Hz~100kHz, I _O =350mA	—	90	—	μV
NJM78M12A						
Output Voltage	V _O	V _{IN} =19V, I _O =350mA	11.5	12.0	12.5	V
Line Regulation	ΔV _O -V _{IN}	V _{IN} =14.5~30V, I _O =200mA	—	8	60	mV
Load Regulation	ΔV _O -I _O	V _{IN} =19V, I _O =5~500mA	—	8	120	mV
Quiescent Current	I _Q	V _{IN} =19V, I _O =0mA	—	4.1	6	mA
Average Temperature Coefficient of Output Voltage	ΔV _O /ΔT	V _{IN} =19V, I _O =5mA	—	-1	—	mV/°C
Ripple Rejection	RR	V _{IN} =19V, I _O =350mA, e _{in} =1V _{P-P} , f=120Hz	55	70	—	dB
Output Noise Voltage	V _{NO}	V _{IN} =19V, BW=10Hz~100kHz, I _O =350mA	—	100	—	μV



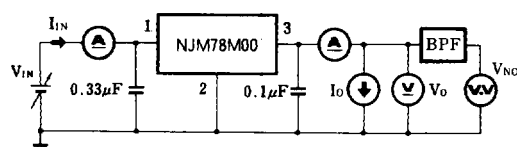
■ ELECTRICAL CHARACTERISTICS ($C_{IN}=0.33\ \mu\text{F}$, $C_O=0.1\ \mu\text{F}$, $T_J=25^\circ\text{C}$) Measurement is to be conducted in pulse testing.

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	$\Delta V_O - V_{IN}$	$V_{IN}=17.5\sim 30\text{V}$, $I_O=200\text{mA}$	—	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	—	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	$\Delta V_O - V_{IN}$	$V_{IN}=21\sim 33\text{V}$, $I_O=200\text{mA}$	—	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	—	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	$\Delta V_O - V_{IN}$	$V_{IN}=23\sim 35\text{V}$, $I_O=200\text{mA}$	—	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	—	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	$\Delta V_O - V_{IN}$	$V_{IN}=27\sim 38\text{V}$, $I_O=200\text{mA}$	—	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	—	μV



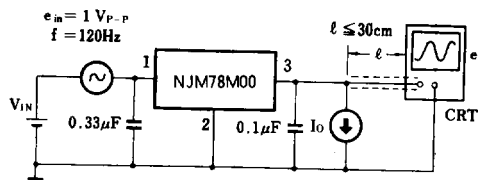
■ TEST CIRCUIT

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

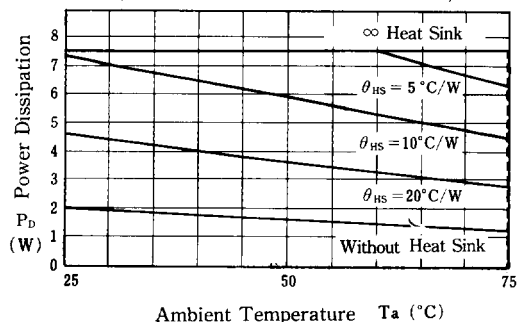


$$RR = 20 \log_{10} \left(\frac{e_{in}}{e_o} \right) \text{ [dB]}$$

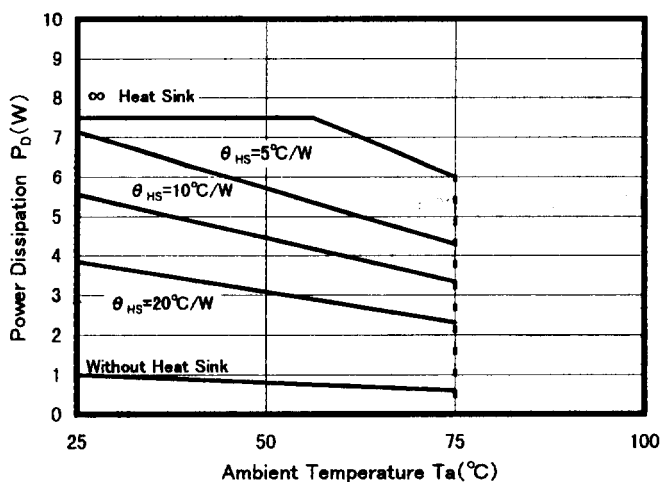
■ POWER DISSIPATION VS. AMBIENT TEMPERATURE

NJM78M00FA

(θ_{HS} = Heat Sink Thermal Resistance)



NJM78M00DLA



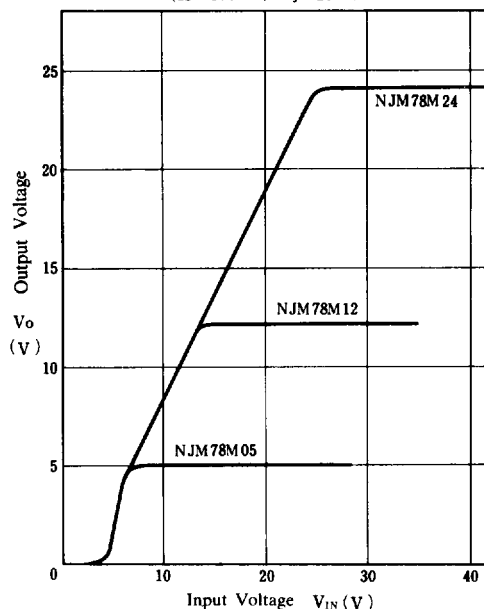
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■ TYPICAL CHARACTERISTICS

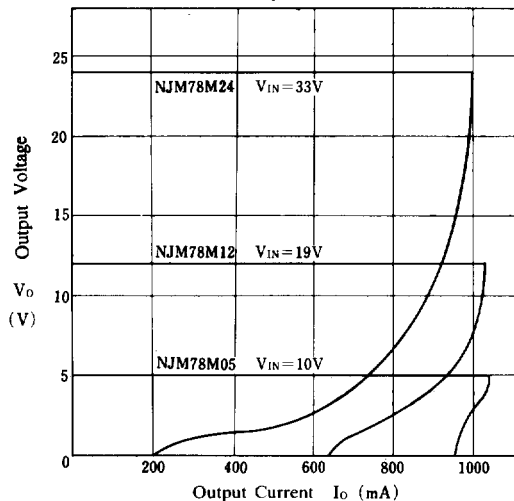
NJM78M05/M12/M24 Output Characteristics

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



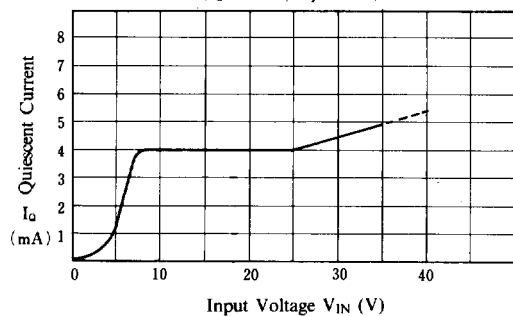
NJM78M05/M12/M24 Load Characteristics

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

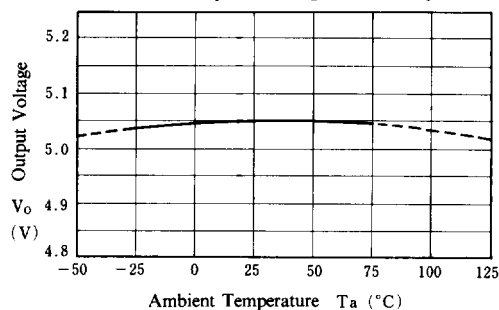


NJM78M05 Quiescent Current vs. Input Voltage

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



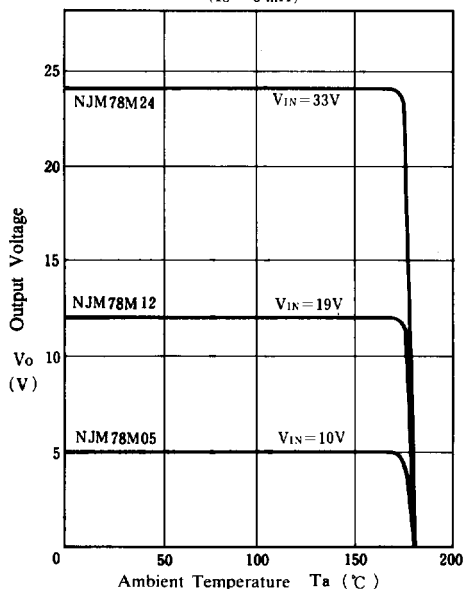
NJM78M05 Output Voltage vs. Temperature



NJM78M05/M12/M24

Thermal Shutdown Characteristics

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

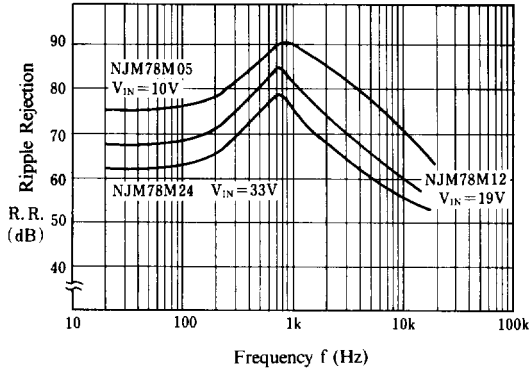




■ TYPICAL CHARACTERISTICS

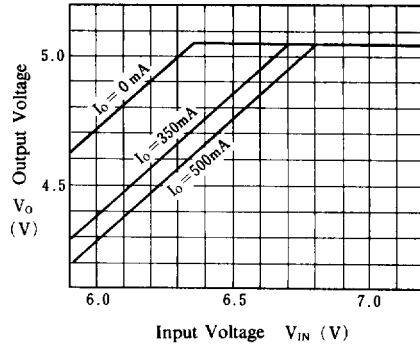
NJM78M05/12/24 Ripple Rejection

($I_o = 350\text{mA}$, $e_{in} = 1\text{V}_{P-P}$, $T_j = 25^\circ\text{C}$)



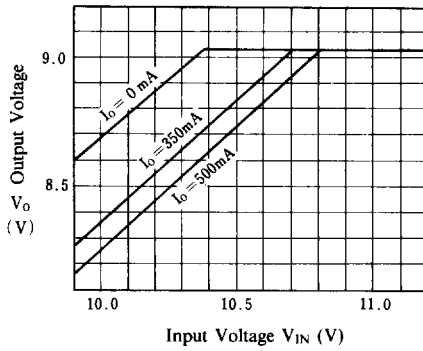
NJM78M05 Dropout Characteristics

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



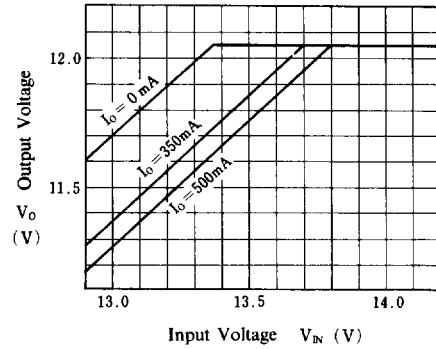
NJM78M09 Dropout Characteristics

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



NJM78M12 Dropout Characteristics

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



NJM78M00 Series Short Circuit Output Current

($T_j = 25^\circ\text{C}$, ∞ heat sink)

