3-TERMINAL POSITIVE VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

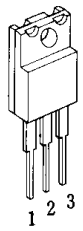
The NJM7800 series of monolithic 3-Terminal Positive Voltage Regulators is constructed using the New JRC Planar epitaxial process. These regulators employ internal current-limiting, thermal-shutdown and safe-area compensation making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. They are intended as fixed voltage regulators in a wide range of applications including local (on card) regulation for elimination of 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

- Operating Voltage
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Excellent Ripple Rejection
- Guarantee'd 1.5A Output Current
- Package Outline TO-220F, TO-252
- Bipolar Technology

■ PACKAGE OUTLINE

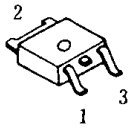
(TO-220F)



NJM7800FA

1. IN
2. GND
3. OUT

(TO-252)

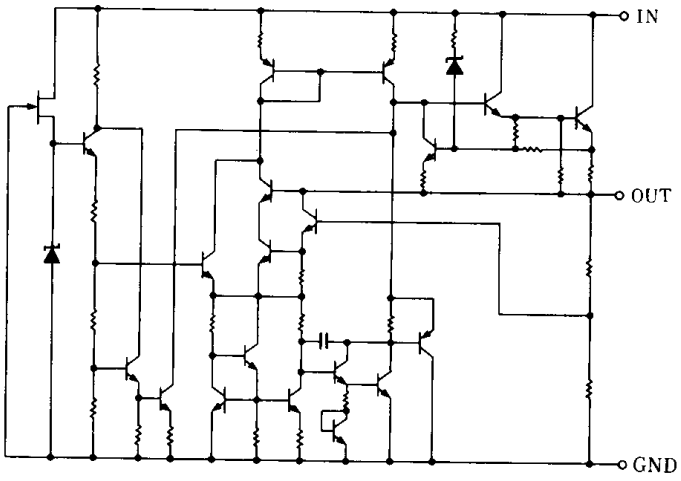


NJM7800DL1A

1. IN
2. GND
3. OUT

(note) The radiation fin is connected pin2.

■ EQUIVALENT CIRCUIT



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

PARAMETER	SYMBOL	MAXIMUM RATINGS		UNIT
Input Voltage	V_{IN}	7805～7809	35	V
		7812～7815	35	
		7818～7824	40	
Storge Temperature Range	T_{stg}	−40 ～ +150		℃
Operating Temperature Range	Operating Junction Temperature	Tj	−30～+150	℃
	Operating Junction Temperature	Topr	−40～+85	
Power Dissipation	P_D	TO220F	16 (Tc≤70℃)	W
		TO252	10 (Tc=25℃)	
			1 (Ta≤25℃)	

3

■ THERMAL CHARACTERISTICS

			TO220F	TO252	
Thermal Resistance	Junction-to-Ambient Temperature	θ ja	60	125	℃/W
	Junction-to-Case	θ jc	5	12.5	

■ ELECTRICAL CHARACTERISTICS

(C_1=0.33 μF, C_0=0.1 μF, T_j=25℃) Measurement is to be conducted in pulse testing.

PARAMETER	SYMBOL	TEST CONDITIONS	F TYP.			DL1 TYP.			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
NJM7805 FA/DL1A									
Output Voltage	V_O	V_{IN}=10V, I_O=0.5A	4.8	5.0	5.2	4.8	5.0	5.2	V
Quiescent Current	I_Q	V_{IN}=10V, I_O=0mA	−	4.2	6.0	−	4.2	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=10V, I_O=0.005～1.5A	−	15	50	−	15	100	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=7～25V, I_O=0.5A	−	3	50	−	3	100	mV
Ripple Rejection	RR	V_{IN}=10V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	68	78	−	68	78	−	dB
Output Noise Voltage	V_{NO}	V_{IN}=10V, BW=10Hz～100kHz, I_O=0.5A	−	45	−	−	45	−	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=10V, I_O 5mA	−	−0.5	−	−	−0.5	−	mV/℃

■ ELECTRICAL CHARACTERISTICS (C_I=0.33 μF, C_O=0.1 μF, T_j=25℃) Measurement is to be conducted in pulse testing.

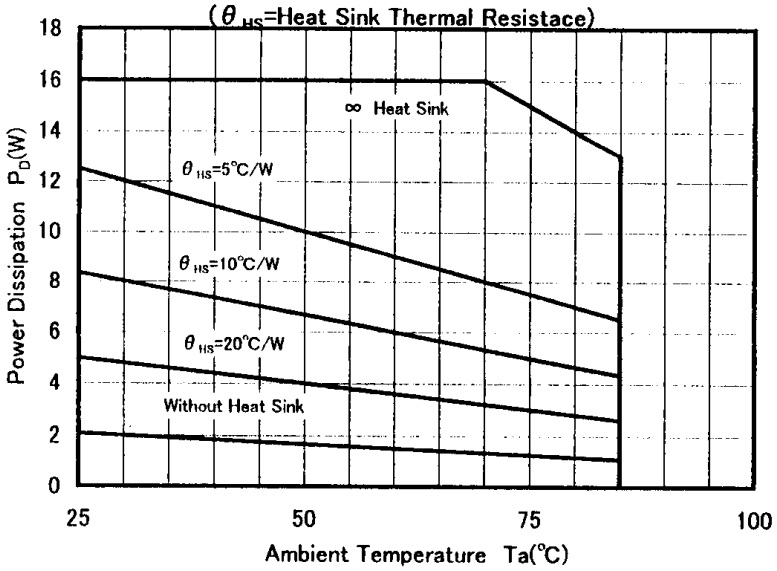
PARAMETER	SYMBOL	TEST CONDITIONS	F TYP.			DL1 TYP.			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
NJM7806 FA/DL1									
Output Voltage	V_O	V_{IN}=11V, I_O=0.5A	5.75	6.0	6.25	5.75	6.0	6.25	V
Quiescent Current	I_Q	V_{IN}=11V, I_O=0mA	—	4.3	6.0	—	4.3	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=11V, I_O=0.005～1.5A	—	15	60	—	15	120	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=8～25V, I_O=0.5A	—	5	60	—	5	120	mV
Ripple Rejection	RR	V_{IN}=11V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	65	75	—	65	75	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=11V, BW=10Hz～100kHz, I_O=0.5A	—	45	—	—	45	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=11V, I_O 5mA	—	−0.6	—	—	−0.6	—	mV/℃
NJM7808 FA/DL1									
Output Voltage	V_O	V_{IN}=14V, I_O=0.5A	7.7	8.0	8.3	7.7	8.0	8.3	V
Quiescent Current	I_Q	V_{IN}=14V, I_O=0mA	—	4.3	6.0	—	4.3	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=14V, I_O=0.005～1.5A	—	15	80	—	15	160	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=10.5～25V, I_O=0.5A	—	6	80	—	6	160	mV
Ripple Rejection	RR	V_{IN}=14V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	62	72	—	62	72	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=14V, BW=10Hz～100kHz, I_O=0.5A	—	55	—	—	55	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=14V, I_O 5mA	—	−0.8	—	—	−0.8	—	mV/℃
NJM7809 FA/DL1									
Output Voltage	V_O	V_{IN}=15V, I_O=0.5A	8.65	9.0	9.35	8.65	9.0	9.35	V
Quiescent Current	I_Q	V_{IN}=15V, I_O=0mA	—	4.3	6.0	—	4.3	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=15V, I_O=0.005～1.5A	—	15	90	—	15	180	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=11.5～25V, I_O=0.5A	—	7	90	—	7	180	mV
Ripple Rejection	RR	V_{IN}=15V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	62	72	—	62	72	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=15V, BW=10Hz～100kHz, I_O=0.5A	—	60	—	—	60	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=15V, I_O 5mA	—	−0.9	—	—	−0.9	—	mV/℃
NJM7812 FA/DL1									
Output Voltage	V_O	V_{IN}=19V, I_O=0.5A	11.5	12.0	12.5	11.5	12.0	12.5	V
Quiescent Current	I_Q	V_{IN}=19V, I_O=0mA	—	4.3	6.0	—	4.3	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=19V, I_O=0.005～1.5A	—	25	120	—	25	240	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=14.5～30V, I_O=0.5A	—	10	120	—	10	240	mV
Ripple Rejection	RR	V_{IN}=19V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	61	71	—	61	71	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=19V, BW=10Hz～100kHz, I_O=0.5A	—	75	—	—	75	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=19V, I_O 5mA	—	−1.2	—	—	−1.2	—	mV/℃

■ ELECTRICAL CHARACTERISTICS (C_I=0.33 μF, C_O=0.1 μF, T_j=25℃) Measurement is to be conducted in pulse testing.

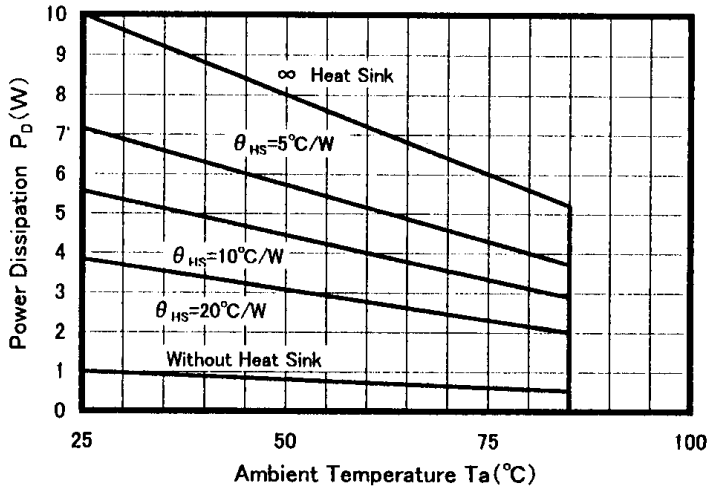
PARAMETER	SYMBOL	TEST CONDITIONS	F TYP.			DL1 TYP.			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
NJM7815 FA/DL1									
Output Voltage	V_O	V_{IN}=23V, I_O=0.5A	14.4	15.0	15.6	14.4	15.0	15.6	V
Quiescent Current	I_Q	V_{IN}=23V, I_O=0mA	—	4.4	6.0	—	4.4	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=23V, I_O=0.005～1.5A	—	35	150	—	35	300	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=17.5～30V, I_O=0.5A	—	11	150	—	11	300	mV
Ripple Rejection	RR	V_{IN}=23V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	60	70	—	60	70	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=23V, BW=10Hz～100kHz, I_O=0.5A	—	90	—	—	90	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=23V, I_O 5mA	—	−1.5	—	—	−1.5	—	mV/℃
NJM7818 FA/DL1									
Output Voltage	V_O	V_{IN}=27V, I_O=0.5A	17.3	18.0	18.7	17.3	18.0	18.7	V
Quiescent Current	I_Q	V_{IN}=27V, I_O=0mA	—	4.5	6.0	—	4.5	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=27V, I_O=0.005～1.5A	—	55	180	—	55	360	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=21～33V, I_O=0.5A	—	15	180	—	15	360	mV
Ripple Rejection	RR	V_{IN}=27V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	59	69	—	59	69	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=27V, BW=10Hz～100kHz, I_O=0.5A	—	100	—	—	100	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=27V, I_O 5mA	—	−1.8	—	—	−1.8	—	mV/℃
NJM7820 FA/DL1									
Output Voltage	V_O	V_{IN}=29V, I_O=0.5A	19.2	20.0	20.8	19.2	20.0	20.8	V
Quiescent Current	I_Q	V_{IN}=29V, I_O=0mA	—	4.5	6.0	—	4.5	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=29V, I_O=0.005～1.5A	—	61	200	—	61	400	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=23～35V, I_O=0.5A	—	16	200	—	16	400	mV
Ripple Rejection	RR	V_{IN}=29V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	58	68	—	58	68	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=29V, BW=10Hz～100kHz, I_O=0.5A	—	120	—	—	120	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=29V, I_O 5mA	—	−2.0	—	—	−2.0	—	mV/℃
NJM7824 FA/DL1									
Output Voltage	V_O	V_{IN}=33V, I_O=0.5A	23.0	24.0	25.0	23.0	24.0	25.0	V
Quiescent Current	I_Q	V_{IN}=33V, I_O=0mA	—	4.6	6.0	—	4.6	6.0	mA
Load Regulation	$\triangle V_O$-I_O	V_{IN}=33V, I_O=0.005～1.5A	—	65	240	—	65	480	mV
Line Regulation	$\triangle V_O$-V_{IN}	V_{IN}=27～38V, I_O=0.5A	—	18	240	—	18	480	mV
Ripple Rejection	RR	V_{IN}=33V, I_O=0.5A, e_{in}=2$V_{P\text{-}P}$, f=120Hz	56	66	—	56	66	—	dB
Output Noise Voltage	V_{NO}	V_{IN}=33V, BW=10Hz～100kHz, I_O=0.5A	—	120	—	—	120	—	μV
Average Temperature Cofficient of Output Voltage	$\triangle V_O/\triangle T$	V_{IN}=33V, I_O 5mA	—	−2.4	—	—	−2.4	—	mV/℃

■ POWER DISSIPATION VS. AMBIENT TEMPERATURE

NJM7800FA

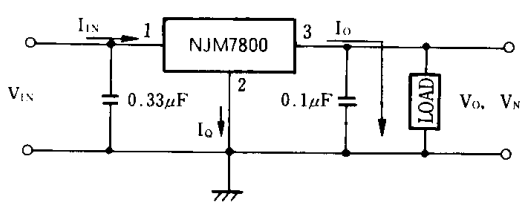


NJM7800DL1A



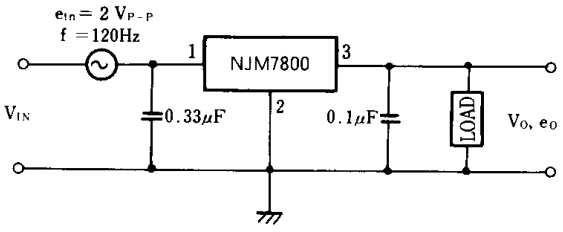
■ TEST CIRCUIT

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



$I_Q = I_{IN} - I_O$

2. Ripple Rejection

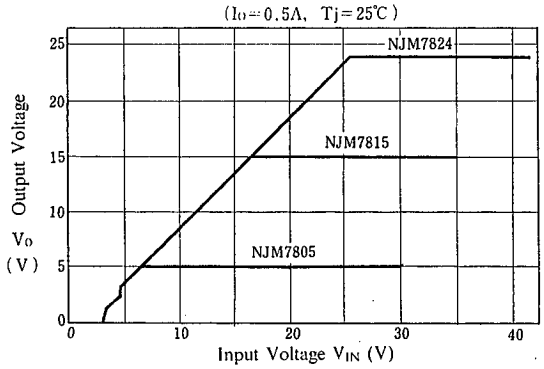


$RR = 20\log_{10}\left(\frac{e_{in}}{e_o}\right)$ [dB]

■ TYPICAL CHARACTERISTICS

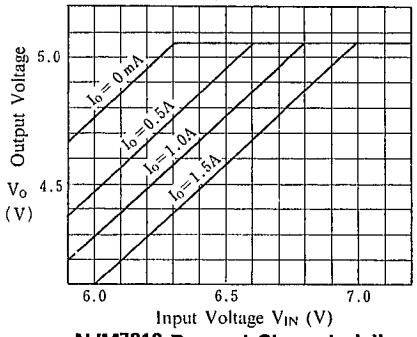
NJM7805/15/24 Output Characteristics

(I_O=0.5A, Tj=25°C)



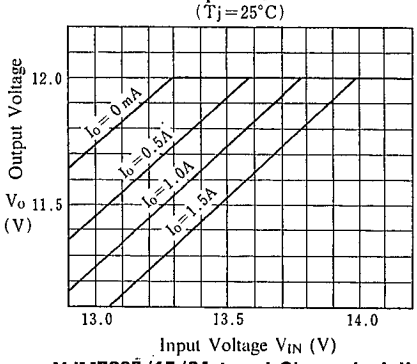
NJM7805 Dropout Characteristics

(Tj=25°C)



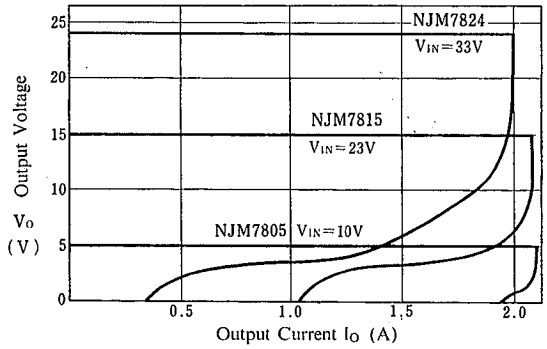
NJM7812 Dropout Characteristics

(Tj=25°C)



NJM7805/15/24 Load Characteristics

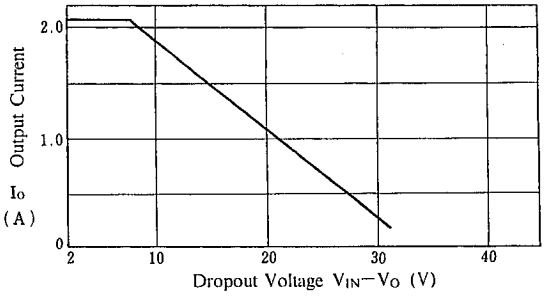
(Tj=25°C)



■ TYPICAL CHARACTERISTICS

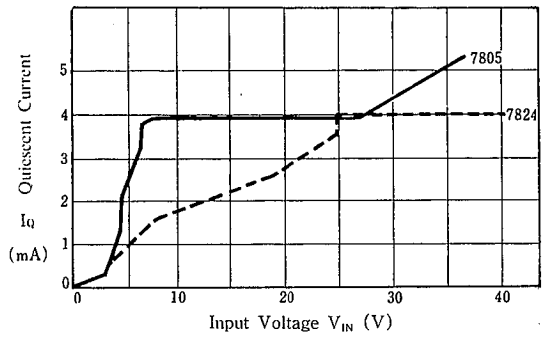
NJM7800 Series Short Circuit Output Current

(T_j =25℃, ∞ Heat Sink)

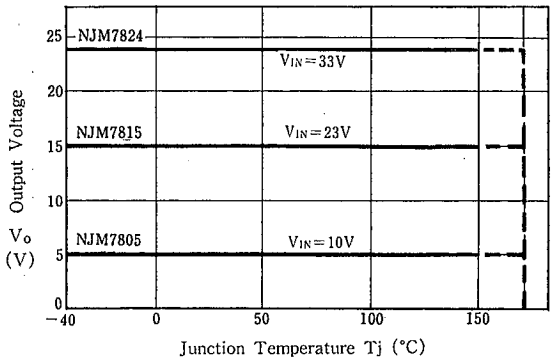


NJM7805/24 Quiescent Current vs. Input Voltage

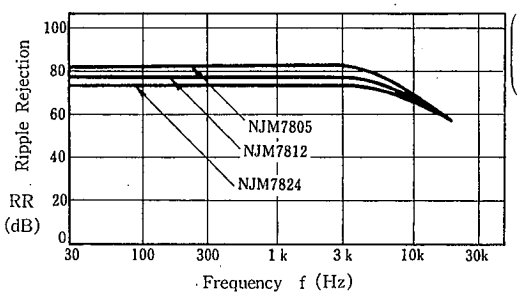
(Tj=25℃)



NJM7805/15/24 Output Voltage vs. Junction Temperature



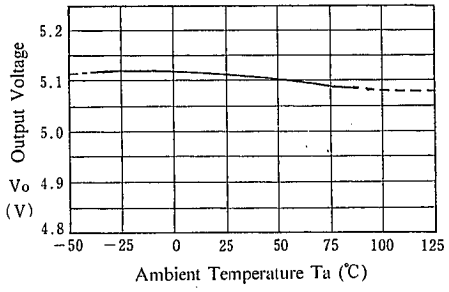
NJM7805/12/24 Ripple Rejection vs. Frequency



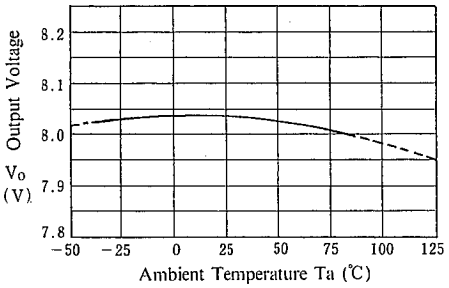
VIN=10V (05) ein= 2 VP-P
19V (12)
33V (24)
Tj=25℃

■ TYPICAL CHARACTERISTICS

NJM7805 Output Voltage vs. Temperature



NJM7808 Output Voltage vs. Temperature



MEMO