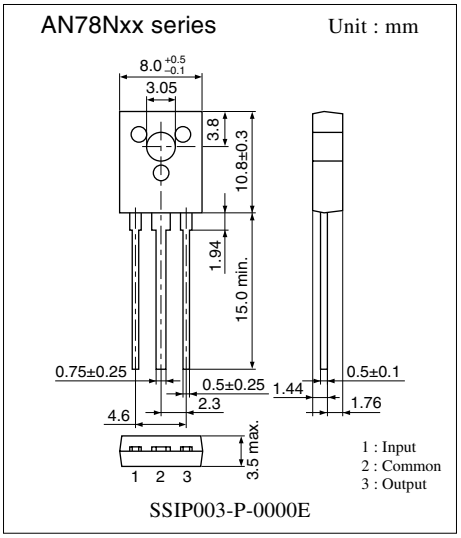
AN78Nxx Series

3-pin positive output voltage regulator (300 mA type)

■ Overview

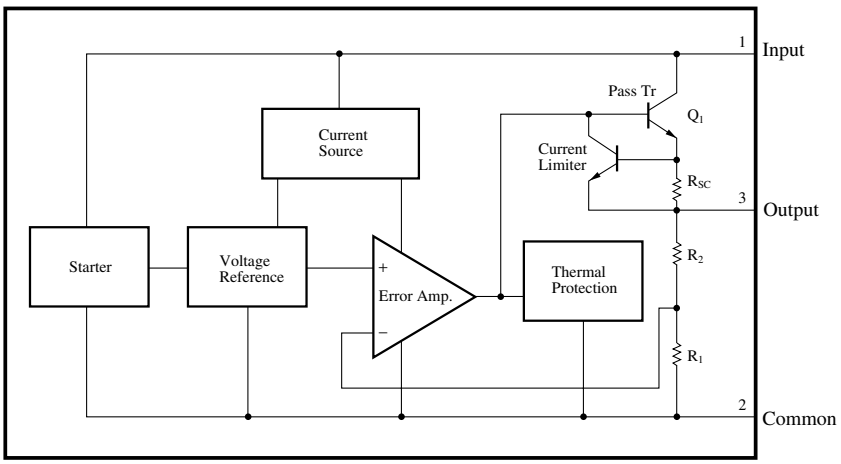
The AN78Nxx series is a 3-pin, fixed positive output type monolithic voltage regulator. Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 12 types of fixed output voltage are available: 4V, 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V and 24V. They can be used widely in power circuits with current capacity of up to 300mA.



■ Features

- No external components
- Output voltage: 4V, 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V
- Built-in overcurrent limit circuit
- Built-in thermal overload protection circuit
- Built-in ASO (area of safe operation) protection circuit

■ Block Diagram



■ Absolute Maximum Ratings at T_a = 25°C

Parameter	Symbol	Rating	Unit
Input voltage	V_I	35 *1	V
		40 *2	V
Power dissipation	P_D	8 *3	W
Operating ambient temperature	T_{opr}	−20 to +80	°C
Storage temperature	T_{stg}	−55 to +150	°C

*1 AN78N04, AN78N05, AN78N06, AN78N07, AN78N08, AN78N09, AN78N10, AN78N12, AN78N15, AN78N18
*2 AN78N20, AN78N24
*3 Follow the derating curve. When T_j exceeds 150°C, the internal circuit cuts off the output.

■ Electrical Characteristics at T_a = 25°C

• AN78N04 (4V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	3.84	4	4.16	V
Output voltage tolerance	V_O	V_I = 6.5 to 20V, I_O = 5 to 200mA	3.8	—	4.2	V
Line regulation	REG_{IN}	V_I = 6.5 to 25V, T_j = 25°C	—	9	40	mV
		V_I = 7 to 20V, T_j = 25°C	—	4	20	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	20	80	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	40	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 6.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	38	—	μV
Ripple rejection ratio	RR	V_I = 7 to 17V, I_O = 50mA, f = 120Hz	62	72	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	− 0.3	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 9V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

• AN78N05 (5V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	4.8	5	5.2	V
Output voltage tolerance	V_O	V_I = 7.5 to 20V, I_O = 5 to 200mA	4.75	—	5.25	V
Line regulation	REG_{IN}	V_I = 7.5 to 25V, T_j = 25°C	—	10	50	mV
		V_I = 8 to 20V, T_j = 25°C	—	5	25	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	20	100	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	50	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 7.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	40	—	μV
Ripple rejection ratio	RR	V_I = 8 to 18V, I_O = 50mA, f = 120Hz	62	72	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.3	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 10V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

• AN78N06 (6V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	5.75	6	6.25	V
Output voltage tolerance	V_O	V_I = 8.5 to 20V, I_O = 5 to 200mA	5.7	—	6.3	V
Line regulation	REG_{IN}	V_I = 8.5 to 25V, T_j = 25°C	—	11	60	mV
		V_I = 9 to 20V, T_j = 25°C	—	6	30	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	20	120	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	60	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 8.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	45	—	μV
Ripple rejection ratio	RR	V_I = 9 to 19V, I_O = 50mA, f = 120Hz	59	70	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.4	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 11V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

• AN78N07 (7V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	6.7	7	7.3	V
Output voltage tolerance	V_O	V_I = 9.5 to 20V, I_O = 5 to 200mA	6.65	—	7.35	V
Line regulation	REG_{IN}	V_I = 9.5 to 25V, T_j = 25°C	—	12	70	mV
		V_I = 10 to 20V, T_j = 25°C	—	7	35	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	20	140	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	70	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 9.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	50	—	μV
Ripple rejection ratio	RR	V_I = 10 to 20V, I_O = 50mA, f = 120Hz	57	69	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.4	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 12V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

• AN78N08 (8V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	7.7	8	8.3	V
Output voltage tolerance	V_O	V_I = 10.5 to 23V, I_O = 5 to 200mA	7.6	—	8.4	V
Line regulation	REG_{IN}	V_I = 10.5 to 25V, T_j = 25°C	—	13	80	mV
		V_I = 12 to 23V, T_j = 25°C	—	8	40	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	25	160	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	80	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 10.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	55	—	μV
Ripple rejection ratio	RR	V_I = 11 to 21V, I_O = 50mA, f = 120Hz	56	69	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.4	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 14V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

• AN78N09 (9V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	8.65	9	9.35	V
Output voltage tolerance	V_O	V_I = 11.5 to 24V, I_O = 5 to 200mA	8.55	—	9.45	V
Line regulation	REG_{IN}	V_I = 11.5 to 25V, T_j = 25°C	—	14	90	mV
		V_I = 13 to 24V, T_j = 25°C	—	9	45	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	25	180	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	90	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 11.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	60	—	μV
Ripple rejection ratio	RR	V_I = 12 to 22V, I_O = 50mA, f = 120Hz	56	68	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 15V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

• AN78N10 (10V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	9.6	10	10.4	V
Output voltage tolerance	V_O	V_I = 12.5 to 25V, I_O = 5 to 200mA	9.5	—	10.5	V
Line regulation	REG_{IN}	V_I = 12.5 to 30V, T_j = 25°C	—	15	100	mV
		V_I = 13 to 25V, T_j = 25°C	—	10	50	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	25	200	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	100	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 12.5 to 30V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	70	—	μV
Ripple rejection ratio	RR	V_I = 13 to 23V, I_O = 50mA, f = 120Hz	56	68	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 16V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

• AN78N12 (12V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	11.5	12	12.5	V
Output voltage tolerance	V_O	V_I = 14.5 to 27V, I_O = 5 to 200mA	11.4	—	12.6	V
Line regulation	REG_{IN}	V_I = 14.5 to 30V, T_j = 25°C	—	15	100	mV
		V_I = 16 to 27V, T_j = 25°C	—	10	50	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	25	240	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	120	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 14.5 to 30V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	80	—	μV
Ripple rejection ratio	RR	V_I = 15 to 25V, I_O = 50mA, f = 120Hz	55	67	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	− 0.6	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 19V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

• AN78N15 (15V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	14.4	15	15.6	V
Output voltage tolerance	V_O	V_I = 17.5 to 30V, I_O = 5 to 200mA	14.25	—	15.75	V
Line regulation	REG_{IN}	V_I = 17.5 to 30V, T_j = 25°C	—	16	100	mV
		V_I = 20 to 30V, T_j = 25°C	—	11	50	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	25	300	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	150	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 17.5 to 30V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	80	—	μV
Ripple rejection ratio	RR	V_I = 18.5 to 28.5V, I_O = 50mA, f = 120Hz	54	66	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	− 0.8	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 23V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

• AN78N18 (18V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	17.3	18	18.7	V
Output voltage tolerance	V_O	V_I = 21 to 33V, I_O = 5 to 200mA	17.1	—	18.9	V
Line regulation	REG_{IN}	V_I = 21 to 33V, T_j = 25°C	—	18	100	mV
		V_I = 22 to 33V, T_j = 25°C	—	13	50	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	30	360	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	180	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 21 to 33V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	90	—	μV
Ripple rejection ratio	RR	V_I = 22 to 32V, I_O = 50mA, f = 120Hz	53	65	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	−1.0	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 27V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

• AN78N20 (20V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	19.2	20	20.8	V
Output voltage tolerance	V_O	V_I = 23 to 35V, I_O = 5 to 200mA	19.0	—	21	V
Line regulation	REG_{IN}	V_I = 23 to 35V, T_j = 25°C	—	19	100	mV
		V_I = 24 to 35V, T_j = 25°C	—	14	50	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	30	400	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	200	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 23 to 35V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	100	—	μV
Ripple rejection ratio	RR	V_I = 24 to 34V, I_O = 50mA, f = 120Hz	52	64	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	−1.2	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 29V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

• AN78N24 (24V type)

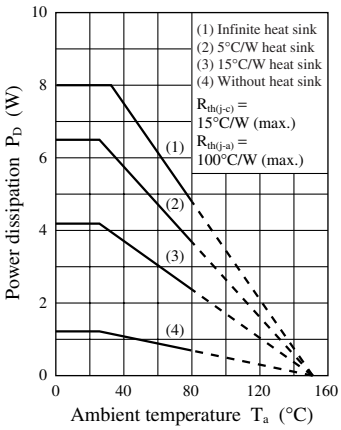
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	23	24	25	V
Output voltage tolerance	V_O	V_I = 27 to 38V, I_O = 5 to 200mA	22.8	—	25.2	V
Line regulation	REG_{IN}	V_I = 27 to 38V, T_j = 25°C	—	20	100	mV
		V_I = 28 to 38V, T_j = 25°C	—	15	50	mV
Load regulation	REG_L	I_O = 1 to 300mA, T_j = 25°C	—	30	480	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	240	mV
Bias current	I_{Bias}	T_j = 25°C	—	2.8	5	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 27 to 38V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 1 to 300mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	110	—	μV
Ripple rejection ratio	RR	V_I = 28 to 38V, I_O = 50mA, f = 120Hz	50	63	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 300mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	500	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	−1.5	—	mV/°C

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.

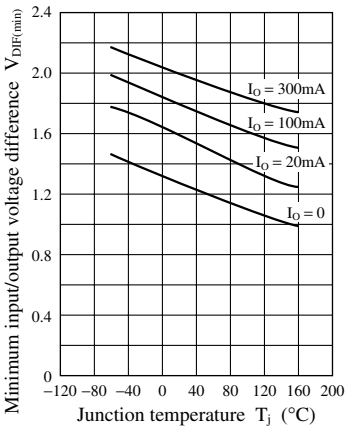
Note 2) Unless otherwise specified, V_I = 33V, I_O = 100mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Main Characteristics

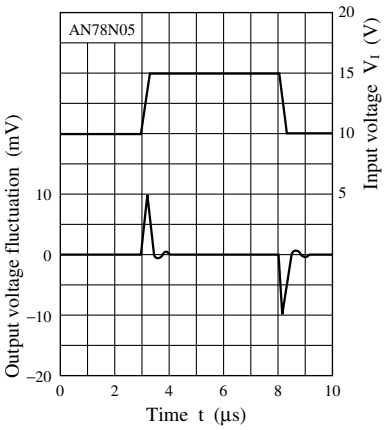
P_D — T_a (AN78Mxx series)



$V_{DIF(min)}$ — T_j

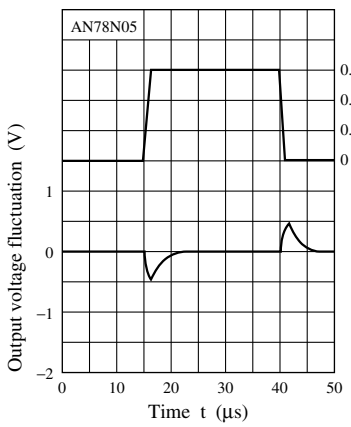


Input transient response

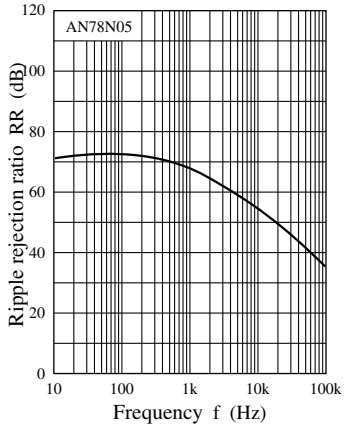


■ Main Characteristics (continued)

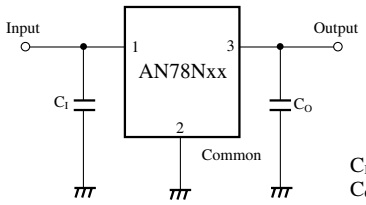
Load transient response



RR — f



■ Basic Regulator Circuit



C_I is necessary when the input line is long.
C_O improves the transient response.

■ Usage Notes

1. Cautions for a basic circuit

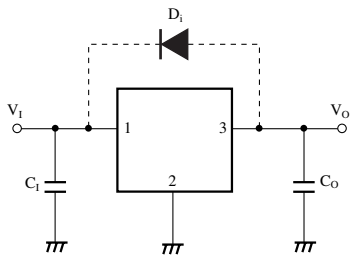


Figure 1

C_I: When a wiring from a smoothing circuit to a three-pin regulator is long, it is likely to oscillate at output. A capacitor of 0.1μF to 0.47μF should be connected near an input pin.

C_O: When any sudden change of load current is likely to occur, connect an electrolytic capacitor of 10μF to 100μF to improve a transitional response of output voltage.

D_i: Normally unnecessary. But add it in the case that there is a residual voltage at the output capacitor Co even after switching off the supply power because a current is likely to flow into an output pin of the IC and damage the IC.

■ Usage Notes (continued)

2. Other caution items

1) Short-circuit between the input pin and GND pin

If the input pin is short-circuitted to GND or is cut off when a large capacitance capacitor has been connected to the IC's load, a voltage of a capacitor connected to an output pin is applied between input/output of the IC and this likely results in damage of the IC. It is necessary, therefore, to connect a diode, as shown in figure 2, to counter the reverse bias between input/output pins.

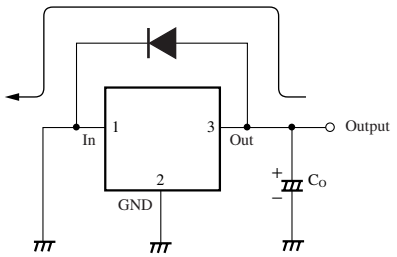
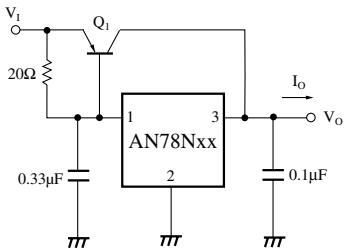


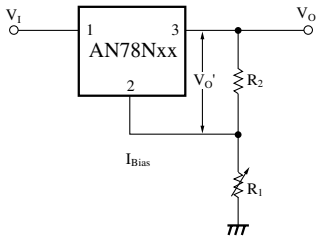
Figure 2

2) Floating of GND pin

If a GND pin is made floating in an operating mode, an unstabilized input voltage is outputted. In this case, a thermal protection circuit inside the IC does not normally operate. In this state, if the load is short-circuited or overloaded, it is likely to damage the IC.

■ Application Circuit Examples





$$|V_O| = V_O' + \left(I_{Bias} + \frac{V_O'}{R_2}\right) R_1$$

Note) V_O varies due to sample to sample variation of I_{Bias} .
Never fail to adjust individually with R_1 .