

AN78xx/AN78xxF Series

3-pin positive output voltage regulator (1 A type)

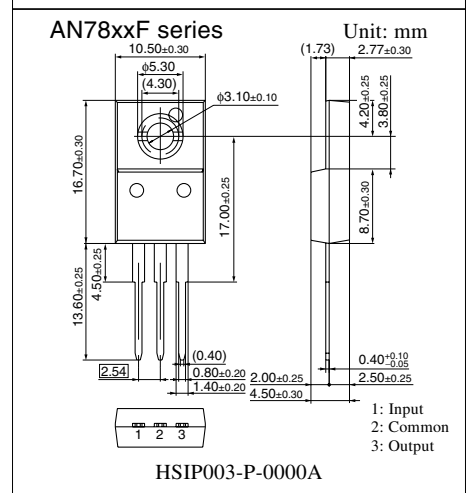
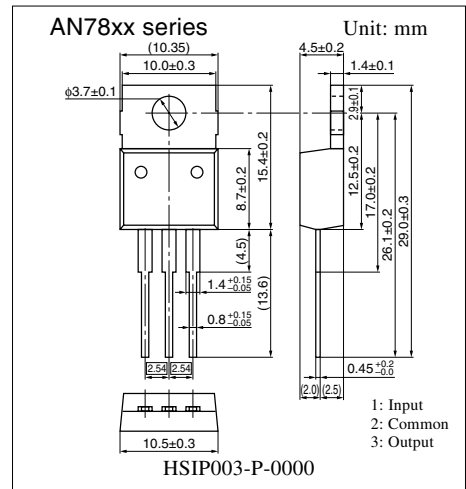
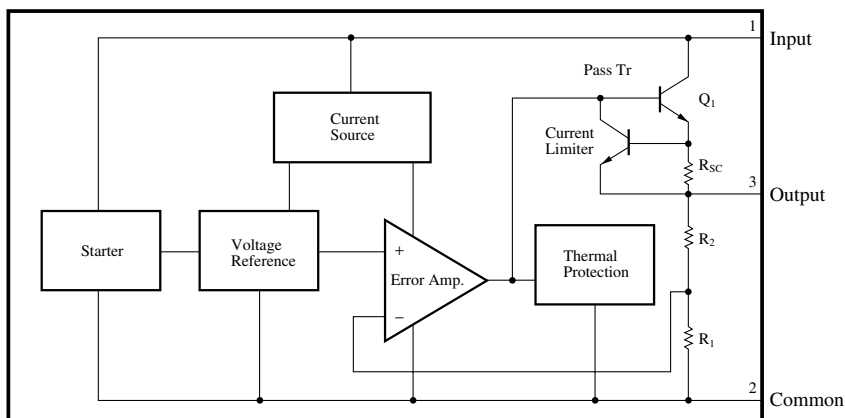
■ Overview

The AN78xx series and the AN78xxF series are 3-pin, fixed positive output type monolithic voltage regulators. Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 11 types of fixed output voltage are available; 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 1A.

■ Features

- No external components
- Output voltage: 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 $T_a = 25^\circ\text{C}$

Parameter		Symbol	Rating	Unit
Input voltage		V_I	35 ^{*1}	V
			40 ^{*2}	V
Power dissipation	AN78xx series	P_D	15 ^{*3}	W
	AN78xxF series		10.25 ^{*3}	
Operating ambient temperature		T_{opr}	-30 to +80	$^\circ\text{C}$
Storage temperature		T_{stg}	-55 to +150	$^\circ\text{C}$

*1 AN7805/F, AN7806/F, AN7807/F, AN7808/F, AN7809/F, AN7810/F, AN7812/F, AN7815/F, AN7818/F

*2 AN7820/F, AN7824/F

*3 Follow the derating curve. When T_j exceeds 150°C , the internal circuit cuts off the output.

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

• AN7805, AN7805F (5V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	4.8	5	5.2	V
Output voltage tolerance	V_O	$V_I = 8$ to 20V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	4.75	—	5.25	V
Line regulation	REG_{IN}	$V_I = 7.5$ to 25V , $T_j = 25^\circ\text{C}$	—	3	100	mV
		$V_I = 8$ to 12V , $T_j = 25^\circ\text{C}$	—	1	50	mV
Load regulation	REG_L	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	15	100	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	5	50	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	$V_I = 7.5$ to 25V , $T_j = 25^\circ\text{C}$	—	—	1.3	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	40	—	μV
Ripple rejection ratio	RR	$V_I = 8$ to 18V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	62	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	17	—	$\text{m}\Omega$
Output short-circuit current	$I_{O(short)}$	$V_I = 25\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{O(Peak)}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-0.3	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 10\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

• AN7806, 7806F (6V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	5.75	6	6.25	V
Output voltage tolerance	V_O	$V_I = 9$ to 21V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	5.7	—	6.3	V
Line regulation	REG_{IN}	$V_I = 8.5$ to 25V , $T_j = 25^\circ\text{C}$	—	5	120	mV
		$V_I = 9$ to 13V , $T_j = 25^\circ\text{C}$	—	1.5	60	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	14	120	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	60	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 8.5$ to 25V , $T_j = 25^\circ\text{C}$	—	—	1.3	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	40	—	μV
Ripple rejection ratio	RR	$V_I = 9$ to 19V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	59	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	17	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 25\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-0.4	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 11\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

• AN7807, 7807F (7V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	6.7	7	7.3	V
Output voltage tolerance	V_O	$V_I = 10$ to 22V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	6.6	—	7.4	V
Line regulation	REG_{IN}	$V_I = 9.5$ to 25V , $T_j = 25^\circ\text{C}$	—	5	140	mV
		$V_I = 10$ to 15V , $T_j = 25^\circ\text{C}$	—	1.5	70	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	14	140	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	70	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 9.5$ to 25V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	46	—	μV
Ripple rejection ratio	RR	$V_I = 10$ to 20V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	57	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 25\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-0.5	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 12\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

• AN7808, 7808F (8V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	7.7	8	8.3	V
Output voltage tolerance	V_O	$V_I = 11$ to 23V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	7.6	—	8.4	V
Line regulation	REG_{IN}	$V_I = 10.5$ to 25V , $T_j = 25^\circ\text{C}$	—	6	160	mV
		$V_I = 11$ to 17V , $T_j = 25^\circ\text{C}$	—	2	80	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	160	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	80	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 10.5$ to 25V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	52	—	μV
Ripple rejection ratio	RR	$V_I = 11.5$ to 21.5V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	56	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 25\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-0.5	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 14\text{V}$, $I_O = 500\text{mA}$, $C_I = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

• AN7809, 7809F (9V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	8.65	9	9.35	V
Output voltage tolerance	V_O	$V_I = 12$ to 24V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	8.55	—	9.45	V
Line regulation	REG_{IN}	$V_I = 11.5$ to 26V , $T_j = 25^\circ\text{C}$	—	7	180	mV
		$V_I = 12$ to 18V , $T_j = 25^\circ\text{C}$	—	2	90	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	180	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	90	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 11.5$ to 26V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	57	—	μV
Ripple rejection ratio	RR	$V_I = 12$ to 22V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	56	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 26\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-0.5	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 15\text{V}$, $I_O = 500\text{mA}$, $C_I = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

• AN7810, 7810F (10V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	9.6	10	10.4	V
Output voltage tolerance	V_O	$V_I = 13$ to 25V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	9.5	—	10.5	V
Line regulation	REG_{IN}	$V_I = 12.5$ to 27V , $T_j = 25^\circ\text{C}$	—	8	200	mV
		$V_I = 13$ to 19V , $T_j = 25^\circ\text{C}$	—	2.5	100	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	200	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	100	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 12.5$ to 27V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	63	—	μV
Ripple rejection ratio	RR	$V_I = 13$ to 23V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	56	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 27\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-0.6	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 16\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

• AN7812, 7812F (12V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	11.5	12	12.5	V
Output voltage tolerance	V_O	$V_I = 15$ to 27V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	11.4	—	12.6	V
Line regulation	REG_{IN}	$V_I = 14.5$ to 30V , $T_j = 25^\circ\text{C}$	—	10	240	mV
		$V_I = 16$ to 22V , $T_j = 25^\circ\text{C}$	—	3	120	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	240	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	120	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	4	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 14.5$ to 30V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	75	—	μV
Ripple rejection ratio	RR	$V_I = 15$ to 25V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	55	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	18	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 30\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-0.8	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 19\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

• AN7815, 7815F (15V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	14.4	15	15.6	V
Output voltage tolerance	V_O	$V_I = 18$ to 30V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	14.25	—	15.75	V
Line regulation	REG_{IN}	$V_I = 17.5$ to 30V , $T_j = 25^\circ\text{C}$	—	11	300	mV
		$V_I = 20$ to 26V , $T_j = 25^\circ\text{C}$	—	3	150	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	300	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	150	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	4	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 17.5$ to 30V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	90	—	μV
Ripple rejection ratio	RR	$V_I = 18.5$ to 28.5V , $f = 120\text{Hz}$	54	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	19	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 30\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-1	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 23\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

• AN7818, 7818F (18V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	17.3	18	18.7	V
Output voltage tolerance	V_O	$V_I = 21$ to 33V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	17.1	—	18.9	V
Line regulation	REG_{IN}	$V_I = 21$ to 33V , $T_j = 25^\circ\text{C}$	—	14	360	mV
		$V_I = 24$ to 30V , $T_j = 25^\circ\text{C}$	—	4	180	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	360	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	180	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	4.1	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 21$ to 33V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	110	—	μV
Ripple rejection ratio	RR	$V_I = 22$ to 32V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	53	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 35\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-1.1	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 27\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

• AN7820, 7820F (20V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	19.2	20	20.8	V
Output voltage tolerance	V_O	$V_I = 24$ to 35V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	19	—	21	V
Line regulation	REG_{IN}	$V_I = 23$ to 35V , $T_j = 25^\circ\text{C}$	—	15	400	mV
		$V_I = 26$ to 32V , $T_j = 25^\circ\text{C}$	—	5	200	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	400	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	200	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	4.1	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 23$ to 35V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	110	—	μV
Ripple rejection ratio	RR	$V_I = 24$ to 34V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	53	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	22	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 35\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-1.2	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 29\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

• AN7824, 7824F (24V type)

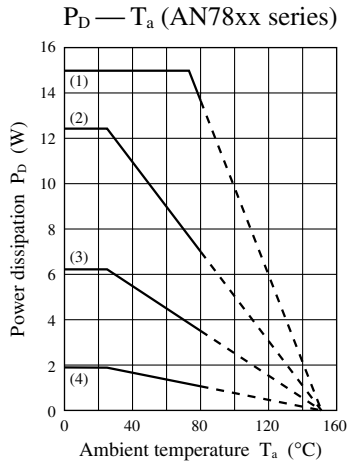
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25^\circ\text{C}$	23	24	25	V
Output voltage tolerance	V_O	$V_I = 28$ to 38V , $I_O = 5\text{mA}$ to 1A , $T_j = 0$ to 125°C , $P_D \leq *$	22.8	—	25.2	V
Line regulation	REG_{IN}	$V_I = 27$ to 38V , $T_j = 25^\circ\text{C}$	—	18	480	mV
		$V_I = 30$ to 36V , $T_j = 25^\circ\text{C}$	—	6	240	mV
Load regulation	REG_{L}	$I_O = 5\text{mA}$ to 1.5A , $T_j = 25^\circ\text{C}$	—	12	480	mV
		$I_O = 250$ to 750mA , $T_j = 25^\circ\text{C}$	—	4	240	mV
Bias current	I_{Bias}	$T_j = 25^\circ\text{C}$	—	4.1	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 27$ to 38V , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to 1A , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	V_{no}	$f = 10\text{Hz}$ to 100kHz	—	170	—	μV
Ripple rejection ratio	RR	$V_I = 28$ to 38V , $I_O = 100\text{mA}$, $f = 120\text{Hz}$	50	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$, $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	Z_O	$f = 1\text{kHz}$	—	28	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 38\text{V}$, $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$, $T_j = 0$ to 125°C	—	-1.4	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition $T_j = 25^\circ\text{C}$ 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, $V_I = 33\text{V}$, $I_O = 500\text{mA}$, $C_1 = 0.33\mu\text{F}$ and $C_O = 0.1\mu\text{F}$.

* AN78xx series: 15W, AN78xxF series: 10.25W

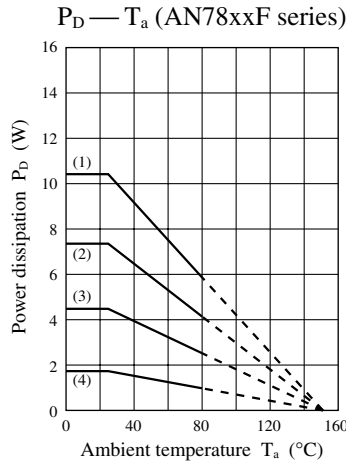
■ Main Characteristic Curve



Thermal resistance value:
 $R_{th(j-c)} = 5^\circ\text{C/W}$ (max.)
 $R_{th(j-a)} = 65^\circ\text{C/W}$ (max.)

Installation condition to heat sink
 Tightening torque 6kg-cm
 Heat radiation compound used

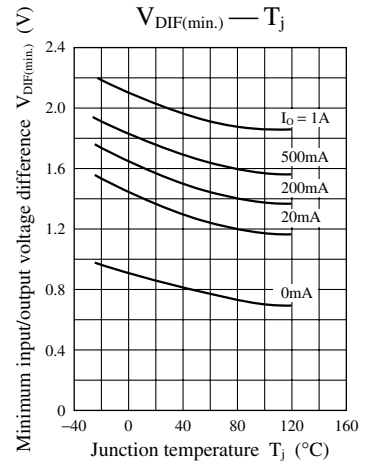
- (1) Infinite heat sink: 15.0W
- (2) 5°C/W heat sink: 12.5W
- (3) 15°C/W heat sink: 6.3W
- (4) Without heat sink: 1.923W



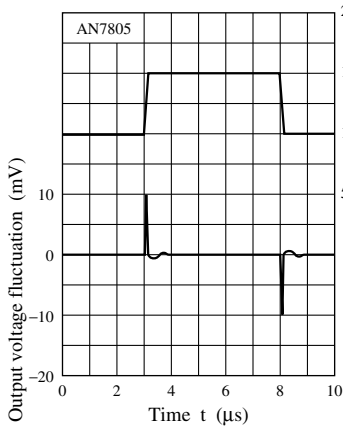
Thermal resistance value:
 $R_{th(j-c)} = 12.2^\circ\text{C/W}$ (max.)
 $R_{th(j-a)} = 65^\circ\text{C/W}$ (max.)

Installation condition to heat sink
 Tightening torque 6kg-cm
 Heat radiation compound used

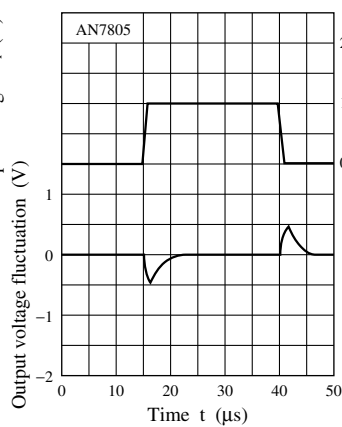
- (1) Infinite heat sink: 10.25W
- (2) 5°C/W heat sink: 7.3W
- (3) 15°C/W heat sink: 4.5W
- (4) Without heat sink: 1.923W



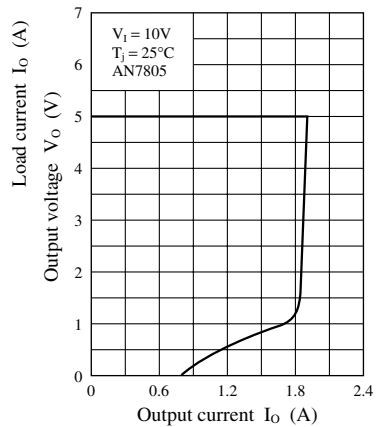
Input transient response



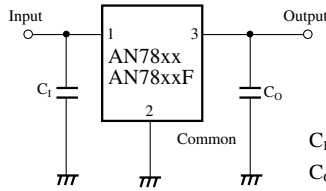
Load transient response



Current limiting characteristic



■ Basic Regulator Circuit



C_1 : C_1 is necessary when the input line is long.
 C_0 : C_0 improves the transient response.

■ Usage Notes

1. Cautions for a basic circuit

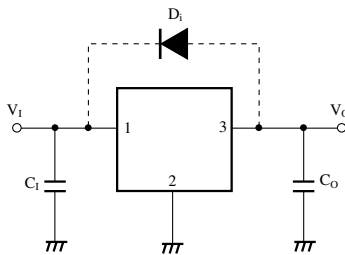


Figure 1

- C_1 : When a wiring from a smoothing circuit to a three-pin regulator is long, it is likely to oscillate in output. A capacitor of $0.1\mu\text{F}$ to $0.47\mu\text{F}$ should be connected near an input pin.
- C_0 : When any sudden change of load current is likely to occur, connect an electrolytic capacitor of $10\mu\text{F}$ to $100\mu\text{F}$ to improve a transitional response of output voltage.
- D_1 : Normally unnecessary. But add it in the case that there is a residual voltage at the output capacitor C_0 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.

2. Other caution items

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

If the input pin is short-circuited 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.

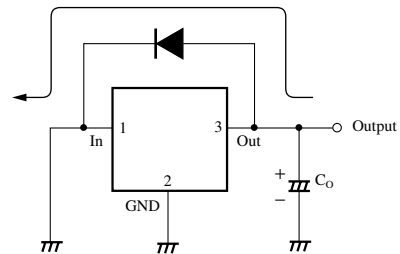


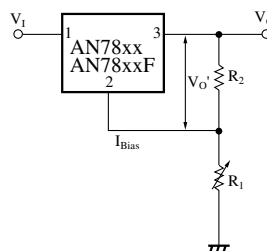
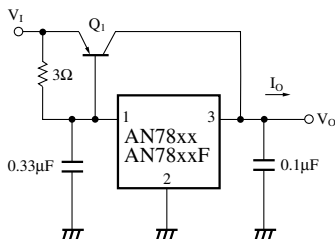
Figure 2

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

1. Current bootstrap circuit 2. Adjustable output regulator



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

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

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