

# AN78L00/AN78L00M Series

## 3-pin Positive Output Voltage Regulator (100mA Type)

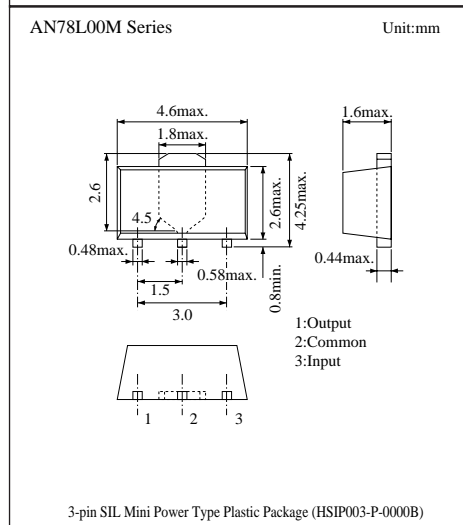
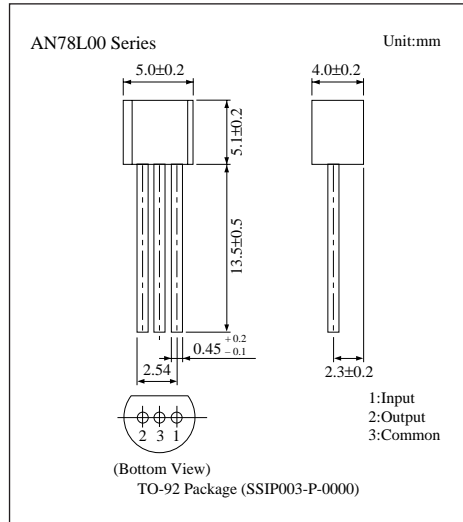
### ■ Overview

The AN78L00 series is 3-pin fixed positive output type monolithic voltage regulators.

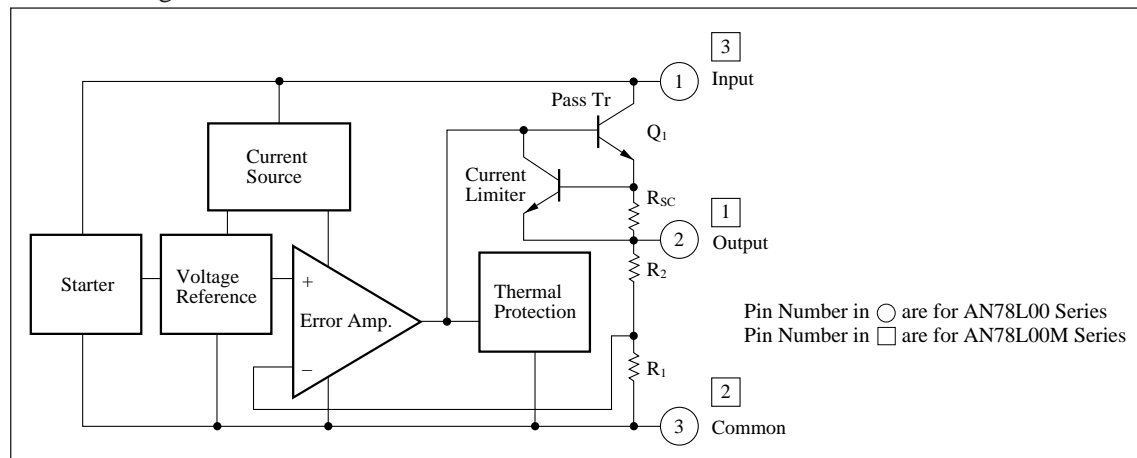
A Stabilized fixed output voltage is obtained from an unstable DC input voltage without using any external parts. Eleven types of fixed output voltage are available from 4V through 10V, 12V, 15V, 18V, 20V, and 24V. They can be used widely as power circuits with a current capacitance of up to 100mA.

### ■ Features

- No external components
- Output voltage: 4V, 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V
- Internal short-circuit current limiting
- Internal thermal overload protection



### ■ Block Diagram



## ■ Absolute Maximum Ratings (Ta=25°C)

Parameter		Symbol	Rating	Unit
Input voltage		V <sub>I</sub>	35 *1	V
			40 *2	V
Power dissipation		P <sub>D</sub>	650 *3	mW
Operating ambient temperature		T <sub>opr</sub>	-30 to +80	°C
Storage temperature	AN78L00 Series	T <sub>stg</sub>	-55 to +150	°C
	AN78L00M Series		-55 to +125	

\*1 AN78L04/M, AN78L05/M, AN78L06/M, AN78L07/M, AN78L08/M, AN78L09/M, AN78L10/M, AN78L12/M, AN78L15/M

\*2 AN78L18/M, AN78L20/M, AN78L24/M

\*3 Follow the derating curve. When T<sub>j</sub> exceeds 150°C, the internal circuit shuts off the output.  
Mounting onto the PCB (20 × 20 × 1.7mm glass epoxy copper foil 1cm<sup>2</sup> or more), for AN78L00M Series.

## ■ Electrical Characteristics (Ta=25°C)

• AN78L04/AN78L04M (4V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	3.84	4	4.16	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =6.5 to 19V, I <sub>O</sub> =1 to 70mA	3.8	—	4.2	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =6.5 to 19V, T <sub>j</sub> =25°C	—	50	145	mV
		V <sub>I</sub> =7 to 19V, T <sub>j</sub> =25°C	—	40	95	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =1 to 100mA, T <sub>j</sub> =25°C	—	10	55	mV
		I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	4.5	30	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	2	3	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =7 to 19V, T <sub>j</sub> =25°C	—	—	1	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	—	0.1	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	40	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =7 to 17V, I <sub>O</sub> =40mA, f=120Hz	48	58	—	dB
Minimum I/O voltage difference	V <sub>DIF (min.)</sub>	T <sub>j</sub> =25°C	—	1.7	—	V
Output short-circuit current	I <sub>O (Short)</sub>	T <sub>j</sub> =25°C, V <sub>I</sub> =35V	—	140	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.6	—	mV/°C

Note 1) The specified condition T<sub>j</sub>=25°C means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified, V<sub>I</sub>=9V, I<sub>O</sub>=40mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C (AN78L04) and T<sub>j</sub>=0 to 100°C (AN78L04M).

## ■ Electrical Characteristics (Ta=25°C)

### • AN78L05/AN78L05M (5V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	4.8	5	5.2	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =7.5 to 20V, I <sub>O</sub> =1 to 70mA	4.75	—	5.25	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =7.5 to 20V, T <sub>j</sub> =25°C	—	55	150	mV
		V <sub>I</sub> =8 to 20V, T <sub>j</sub> =25°C	—	45	100	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =1 to 100mA, T <sub>j</sub> =25°C	—	11	60	mV
		I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	5	30	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	2	3	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =8 to 20V, T <sub>j</sub> =25°C	—	—	1	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	—	0.1	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	40	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =8 to 18V, I <sub>O</sub> =40mA, f=120Hz	47	57	—	dB
Minimum I/O voltage difference	V <sub>DIF (min.)</sub>	T <sub>j</sub> =25°C	—	1.7	—	V
Output short-circuit current	I <sub>O (Short)</sub>	T <sub>j</sub> =25°C, V <sub>I</sub> =35V	—	140	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.65	—	mV/°C

Note 1) The specified condition T<sub>j</sub>=25°C means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified, V<sub>I</sub>=10V, I<sub>O</sub>=40mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C (AN78L05) and T<sub>j</sub>=0 to 100°C (AN78L05M).

### • AN78L06/AN78L06M (6V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	5.76	6	6.24	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =8.5 to 21V, I <sub>O</sub> =1 to 70mA	5.7	—	6.3	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =8.5 to 21V, T <sub>j</sub> =25°C	—	60	155	mV
		V <sub>I</sub> =9 to 21V, T <sub>j</sub> =25°C	—	50	105	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =1 to 100mA, T <sub>j</sub> =25°C	—	12	65	mV
		I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	5.5	35	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	2	3	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =9 to 21V, T <sub>j</sub> =25°C	—	—	1	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	—	0.1	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	50	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =9 to 19V, I <sub>O</sub> =40mA, f=120Hz	46	56	—	dB
Minimum I/O voltage difference	V <sub>DIF (min.)</sub>	T <sub>j</sub> =25°C	—	1.7	—	V
Output short-circuit current	I <sub>O (Short)</sub>	T <sub>j</sub> =25°C, V <sub>I</sub> =35V	—	140	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.7	—	mV/°C

Note 1) The specified condition T<sub>j</sub>=25°C means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified, V<sub>I</sub>=11V, I<sub>O</sub>=40mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C (AN78L06) and T<sub>j</sub>=0 to 100°C (AN78L06M).

## ■ Electrical Characteristics (Ta=25°C)

### • AN78L07/AN78L07M (7V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	6.72	7	7.28	V
Output voltage tolerance	$V_O$	$V_I=9.5$ to 22V, $I_O=1$ to 70mA	6.65	—	7.35	V
Line regulation	$REG_{IN}$	$V_I=9.5$ to 22V, $T_j=25^\circ\text{C}$	—	70	165	mV
		$V_I=10$ to 22V, $T_j=25^\circ\text{C}$	—	60	115	mV
Load regulation	$REG_L$	$I_O=1$ to 100mA, $T_j=25^\circ\text{C}$	—	13	75	mV
		$I_O=1$ to 40mA, $T_j=25^\circ\text{C}$	—	6	35	mV
Bias current	$I_{bias}$	$T_j=25^\circ\text{C}$	—	2	3	mA
Input bias current fluctuation	$\Delta I_{bias(IN)}$	$V_I=10$ to 22V, $T_j=25^\circ\text{C}$	—	—	1	mA
Load bias current fluctuation	$\Delta I_{bias(L)}$	$I_O=1$ to 40mA, $T_j=25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{no}$	$f=10\text{Hz}$ to 100kHz	—	50	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=10$ to 20V, $I_O=40\text{mA}$ , $f=120\text{Hz}$	45	55	—	dB
Minimum I/O voltage difference	$V_{DIF(min)}$	$T_j=25^\circ\text{C}$	—	1.7	—	V
Output short-circuit current	$I_{O(Short)}$	$T_j=25^\circ\text{C}$ , $V_I=35\text{V}$	—	140	—	mA
Output voltage temperature coefficient	$\Delta V_O/Ta$	$I_O=5\text{mA}$ , $T_j=0$ to 125°C	—	-0.75	—	mV/°C

Note 1) The specified condition  $T_j=25^\circ\text{C}$  means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified,  $V_I=12\text{V}$ ,  $I_O=40\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to 125°C (AN78L07) and  $T_j=0$  to 100°C (AN78L07M).

### • AN78L08/AN78L08M (8V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	7.7	8	8.3	V
Output voltage tolerance	$V_O$	$V_I=10.5$ to 23V, $I_O=1$ to 70mA	7.6	—	8.4	V
Line regulation	$REG_{IN}$	$V_I=10.5$ to 23V, $T_j=25^\circ\text{C}$	—	80	175	mV
		$V_I=11$ to 23V, $T_j=25^\circ\text{C}$	—	70	125	mV
Load regulation	$REG_L$	$I_O=1$ to 100mA, $T_j=25^\circ\text{C}$	—	15	80	mV
		$I_O=1$ to 40mA, $T_j=25^\circ\text{C}$	—	7	40	mV
Bias current	$I_{bias}$	$T_j=25^\circ\text{C}$	—	2	3	mA
Input bias current fluctuation	$\Delta I_{bias(IN)}$	$V_I=11$ to 23V, $T_j=25^\circ\text{C}$	—	—	1	mA
Load bias current fluctuation	$\Delta I_{bias(L)}$	$I_O=1$ to 40mA, $T_j=25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{no}$	$f=10\text{Hz}$ to 100kHz	—	60	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=11$ to 21V, $I_O=40\text{mA}$ , $f=120\text{Hz}$	44	54	—	dB
Minimum I/O voltage difference	$V_{DIF(min)}$	$T_j=25^\circ\text{C}$	—	1.7	—	V
Output short-circuit current	$I_{O(Short)}$	$T_j=25^\circ\text{C}$ , $V_I=35\text{V}$	—	140	—	mA
Output voltage temperature coefficient	$\Delta V_O/Ta$	$I_O=5\text{mA}$ , $T_j=0$ to 125°C	—	-0.8	—	mV/°C

Note 1) The specified condition  $T_j=25^\circ\text{C}$  means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified,  $V_I=14\text{V}$ ,  $I_O=40\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to 125°C (AN78L08) and  $T_j=0$  to 100°C (AN78L08M).

## ■ Electrical Characteristics (Ta=25°C)

### • AN78L09/AN78L09M (9V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	8.64	9	9.35	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =11.5 to 24V, I <sub>O</sub> =1 to 70mA	8.55	—	9.45	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =11.5 to 24V, T <sub>j</sub> =25°C	—	90	190	mV
		V <sub>I</sub> =12 to 24V, T <sub>j</sub> =25°C	—	80	140	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =1 to 100mA, T <sub>j</sub> =25°C	—	16	85	mV
		I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	8	45	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	2	3	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =12 to 24V, T <sub>j</sub> =25°C	—	—	1	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	—	0.1	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	65	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =12 to 22V, I <sub>O</sub> =40mA, f=120Hz	43	53	—	dB
Minimum I/O voltage difference	V <sub>DIF (min.)</sub>	T <sub>j</sub> =25°C	—	1.7	—	V
Output short-circuit current	I <sub>O (Short)</sub>	T <sub>j</sub> =25°C, V <sub>I</sub> =35V	—	140	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.85	—	mV/°C

Note 1) The specified condition T<sub>j</sub>=25°C means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified, V<sub>I</sub>=15V, I<sub>O</sub>=40mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C (AN78L09) and T<sub>j</sub>=0 to 100°C (AN78L09M).

### • AN78L10/AN78L10M (10V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	9.6	10	10.4	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =12.5 to 25V, I <sub>O</sub> =1 to 70mA	9.5	—	10.5	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =12.5 to 25V, T <sub>j</sub> =25°C	—	100	210	mV
		V <sub>I</sub> =13 to 25V, T <sub>j</sub> =25°C	—	90	160	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =1 to 100mA, T <sub>j</sub> =25°C	—	17	90	mV
		I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	9	45	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	2	3	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =13 to 25V, T <sub>j</sub> =25°C	—	—	1	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	—	0.1	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	70	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =13 to 23V, I <sub>O</sub> =40mA, f=120Hz	42	52	—	dB
Minimum I/O voltage difference	V <sub>DIF (min.)</sub>	T <sub>j</sub> =25°C	—	1.7	—	V
Output short-circuit current	I <sub>O (Short)</sub>	T <sub>j</sub> =25°C, V <sub>I</sub> =35V	—	140	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.9	—	mV/°C

Note 1) The specified condition T<sub>j</sub>=25°C means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified, V<sub>I</sub>=16V, I<sub>O</sub>=40mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C (AN78L10) and T<sub>j</sub>=0 to 100°C (AN78L10M).

■ Electrical Characteristics (Ta=25°C)

• AN78L12/AN78L12M (12V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	11.5	12	12.5	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =14.5 to 27V, I <sub>O</sub> =1 to 70mA	11.4	—	12.6	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =14.5 to 27V, T <sub>j</sub> =25°C	—	120	250	mV
		V <sub>I</sub> =15 to 27V, T <sub>j</sub> =25°C	—	100	200	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =1 to 100mA, T <sub>j</sub> =25°C	—	20	100	mV
		I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	10	50	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	2	3.5	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =15 to 27V, T <sub>j</sub> =25°C	—	—	1	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	—	0.1	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	80	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =15 to 25V, I <sub>O</sub> =40mA, f=120Hz	40	50	—	dB
Minimum I/O voltage difference	V <sub>DIF (min.)</sub>	T <sub>j</sub> =25°C	—	1.7	—	V
Output short-circuit current	I <sub>O (Short)</sub>	T <sub>j</sub> =25°C, V <sub>I</sub> =35V	—	140	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-1	—	mV/°C

Note 1) The specified condition T<sub>j</sub>=25°C means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified, V<sub>I</sub>=19V, I<sub>O</sub>=40mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C (AN78L12) and T<sub>j</sub>=0 to 100°C (AN78L12M).

• AN78L15/AN78L15M (15V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	14.4	15	15.6	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =17.5 to 30V, I <sub>O</sub> =1 to 70mA	14.25	—	15.75	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =17.5 to 30V, T <sub>j</sub> =25°C	—	130	300	mV
		V <sub>I</sub> =18 to 30V, T <sub>j</sub> =25°C	—	110	250	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =1 to 100mA, T <sub>j</sub> =25°C	—	25	150	mV
		I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	12	75	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	2	3.5	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =18 to 30V, T <sub>j</sub> =25°C	—	—	1	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =1 to 40mA, T <sub>j</sub> =25°C	—	—	0.1	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	90	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =18 to 28V, I <sub>O</sub> =40mA, f=120Hz	38	48	—	dB
Minimum I/O voltage difference	V <sub>DIF (min.)</sub>	T <sub>j</sub> =25°C	—	1.7	—	V
Output short-circuit current	I <sub>O (Short)</sub>	T <sub>j</sub> =25°C, V <sub>I</sub> =35V	—	140	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-1.3	—	mV/°C

Note 1) The specified condition T<sub>j</sub>=25°C means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified, V<sub>I</sub>=23V, I<sub>O</sub>=40mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C (AN78L15) and T<sub>j</sub>=0 to 100°C (AN78L15M).

## ■ Electrical Characteristics (Ta=25°C)

### • AN78L18/AN78L18M (18V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	17.3	18	18.7	V
Output voltage tolerance	$V_O$	$V_I=20.5$ to $33\text{V}$ , $I_O=1$ to $70\text{mA}$	17.1	—	18.9	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I=20.5$ to $33\text{V}$ , $T_j=25^\circ\text{C}$	—	45	300	mV
		$V_I=21$ to $33\text{V}$ , $T_j=25^\circ\text{C}$	—	35	250	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O=1$ to $100\text{mA}$ , $T_j=25^\circ\text{C}$	—	30	170	mV
		$I_O=1$ to $40\text{mA}$ , $T_j=25^\circ\text{C}$	—	15	85	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	2	3.5	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_I=21$ to $33\text{V}$ , $T_j=25^\circ\text{C}$	—	—	1	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=1$ to $40\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	150	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=21$ to $31\text{V}$ , $I_O=40\text{mA}$ , $f=120\text{Hz}$	36	46	—	dB
Minimum I/O voltage difference	$V_{\text{DIF (min.)}}$	$T_j=25^\circ\text{C}$	—	1.7	—	V
Output short-circuit current	$I_{\text{O (Short)}}$	$T_j=25^\circ\text{C}$ , $V_I=35\text{V}$	—	140	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-1.5	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition  $T_j=25^\circ\text{C}$  means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified,  $V_I=27\text{V}$ ,  $I_O=40\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$  (AN78L18) and  $T_j=0$  to  $100^\circ\text{C}$  (AN78L18M).

### • AN78L20/AN78L20M (20V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	19.2	20	20.8	V
Output voltage tolerance	$V_O$	$V_I=22.5$ to $35\text{V}$ , $I_O=1$ to $70\text{mA}$	19	—	21	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I=22.5$ to $35\text{V}$ , $T_j=25^\circ\text{C}$	—	50	300	mV
		$V_I=23$ to $35\text{V}$ , $T_j=25^\circ\text{C}$	—	40	250	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O=1$ to $100\text{mA}$ , $T_j=25^\circ\text{C}$	—	35	180	mV
		$I_O=1$ to $40\text{mA}$ , $T_j=25^\circ\text{C}$	—	17	90	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	2	3.5	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_I=23$ to $35\text{V}$ , $T_j=25^\circ\text{C}$	—	—	1	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=1$ to $40\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	170	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=23$ to $33\text{V}$ , $I_O=40\text{mA}$ , $f=120\text{Hz}$	34	44	—	dB
Minimum I/O voltage difference	$V_{\text{DIF (min.)}}$	$T_j=25^\circ\text{C}$	—	1.7	—	V
Output short-circuit current	$I_{\text{O (Short)}}$	$T_j=25^\circ\text{C}$ , $V_I=35\text{V}$	—	140	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-1.7	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition  $T_j=25^\circ\text{C}$  means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified,  $V_I=29\text{V}$ ,  $I_O=40\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$  (AN78L20) and  $T_j=0$  to  $100^\circ\text{C}$  (AN78L20M).

## ■ Electrical Characteristics (Ta=25°C)

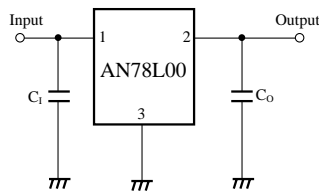
• AN78L24/AN78L24M (24V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	23	24	25	V
Output voltage tolerance	$V_O$	$V_I=26.5$ to $39\text{V}$ , $I_O=1$ to $70\text{mA}$	22.8	—	25.2	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I=26.5$ to $39\text{V}$ , $T_j=25^\circ\text{C}$	—	60	300	mV
		$V_I=27$ to $39\text{V}$ , $T_j=25^\circ\text{C}$	—	50	250	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O=1$ to $100\text{mA}$ , $T_j=25^\circ\text{C}$	—	40	200	mV
		$I_O=1$ to $40\text{mA}$ , $T_j=25^\circ\text{C}$	—	20	100	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	2	3.5	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_I=27$ to $39\text{V}$ , $T_j=25^\circ\text{C}$	—	—	1	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=1$ to $40\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	200	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=27$ to $37\text{V}$ , $I_O=40\text{mA}$ , $f=120\text{Hz}$	34	44	—	dB
Minimum I/O voltage difference	$V_{\text{DIF (min.)}}$	$T_j=25^\circ\text{C}$	—	1.7	—	V
Output short-circuit current	$I_{\text{O (Short)}}$	$T_j=25^\circ\text{C}$ , $V_I=35\text{V}$	—	140	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-2	—	$\text{mV}/^\circ\text{C}$

Note 1) The specified condition  $T_j=25^\circ\text{C}$  means that the test should be conducted with each test time reduced (within 10ms) so that the drift in characteristic value due to a temperature rise at chip junction can be ignored.

Note 2) Unless otherwise specified,  $V_I=33\text{V}$ ,  $I_O=40\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$  (AN78L24) and  $T_j=0$  to  $100^\circ\text{C}$  (AN78L24M).

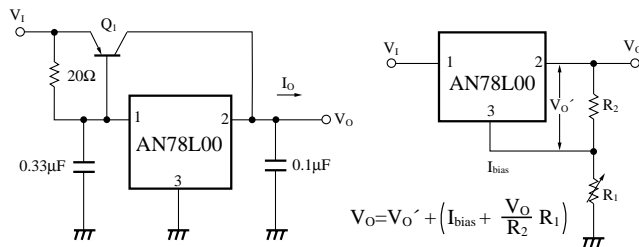
## ■ Basic Regulator Circuit



$C_1$  : Required when the input line is long

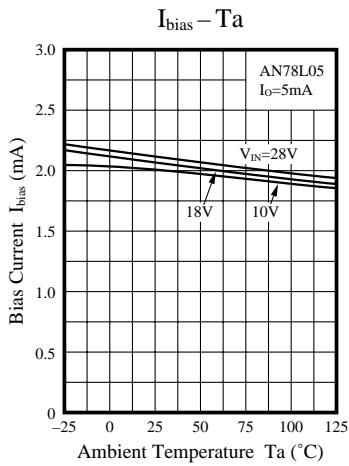
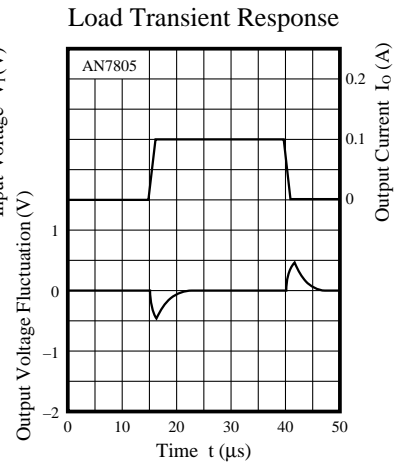
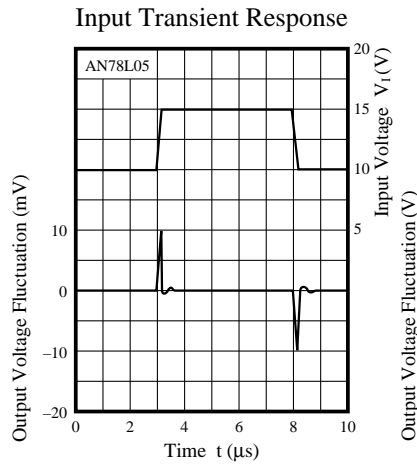
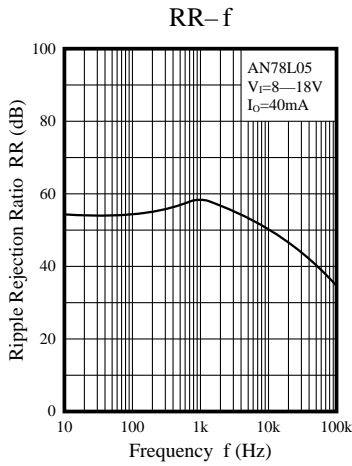
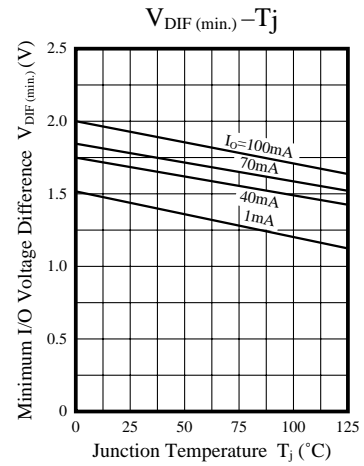
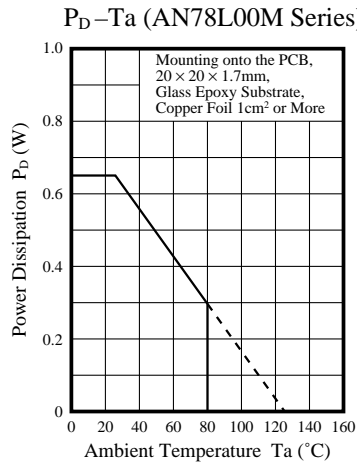
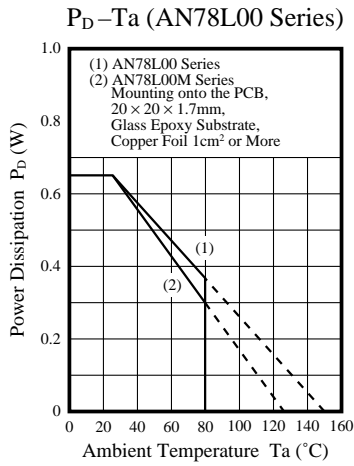
$C_0$  : Improves the transient response

## ■ Application Circuit



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

## ■ Characteristic Curve





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