

# AN78M00/AN78M00F Series

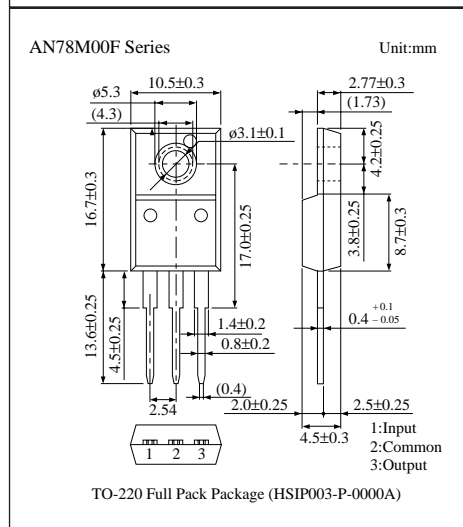
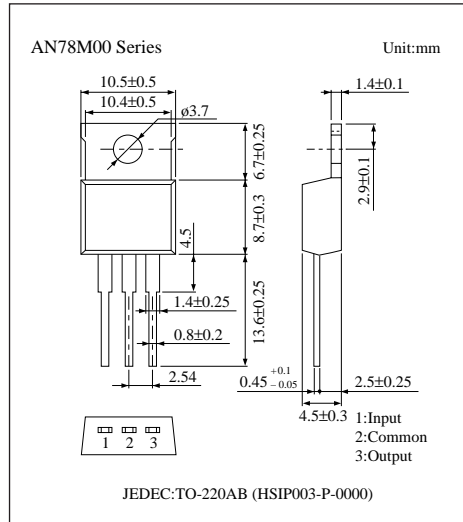
## 3-pin Positive Output Voltage Regulators (500mA Type)

### ■ Overview

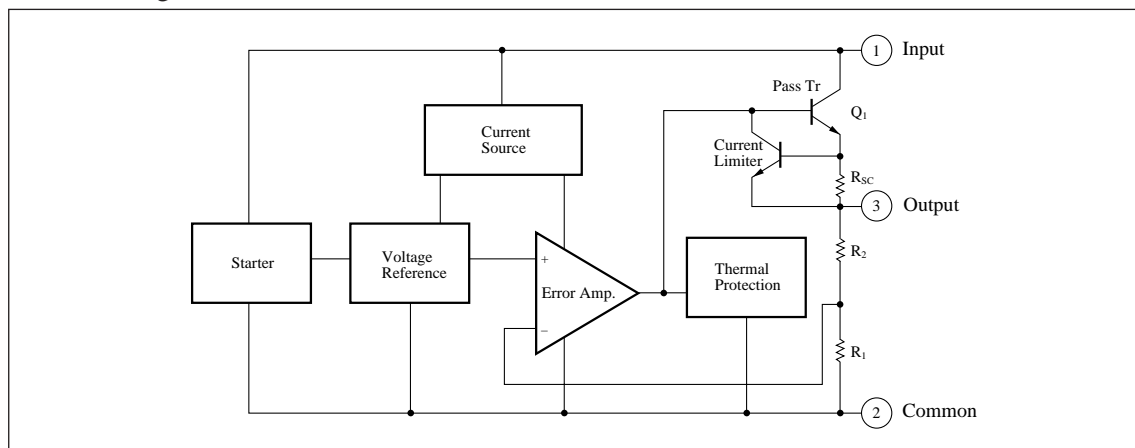
The AN78M00 and the AN78M00F series are 3-pin fixed positive output voltage regulators. Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 11 types of fixed output voltage are available; 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V and 24V. They can be used widely in power circuits with current capacitance up to 500mA.

### ■ Features

- No external components
- Output voltage: 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V
- Short-circuit current limiting built-in
- Thermal overload protection built-in
- Output transistor safe area compensation



### ■ Block Diagram



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

Parameter		Symbol	Rating	Unit
Input voltage		V <sub>I</sub>	35 * <sup>1</sup>	V
			40 * <sup>2</sup>	V
Power dissipation	AN7800 Series	P <sub>D</sub>	15 * <sup>3</sup>	W
	AN7800F Series		10.25 * <sup>3</sup>	
Operating ambient temperature		T <sub>opr</sub>	-20 to +80	°C
Storage temperature		T <sub>stg</sub>	-55 to +150	°C

\*<sup>1</sup> AN78M05/F, AN78M06/F, AN78M07/F, AN78M08/F, AN78M09/F, AN78M10/F, AN78M12/F, AN78M15/F, AN78M18/F

\*<sup>2</sup> AN78M20/F, AN78M24/F

\*<sup>3</sup> Follow the derating curve. When T<sub>j</sub> exceeds 150°C, the internal circuit cuts off the output.

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

• AN78M05/78M05F (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> =5 to 350mA, T <sub>j</sub> =25°C, P <sub>D</sub> ≤*	4.75	—	5.25	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =7.5 to 25V, T <sub>j</sub> =25°C	—	3	100	mV
		V <sub>I</sub> =8 to 25V, T <sub>j</sub> =25°C	—	1	50	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =5 to 500mA, T <sub>j</sub> =25°C	—	20	100	mV
		I <sub>O</sub> =5 to 200mA, T <sub>j</sub> =25°C	—	10	50	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	4	6	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =8 to 25V, T <sub>j</sub> =25°C	—	—	0.8	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C	—	—	0.5	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> =100mA, f=120Hz	62	—	—	dB
Minimum input/output voltage difference	V <sub>DIF (min.)</sub>	I <sub>O</sub> =500mA, T <sub>j</sub> =25°C	—	2	—	V
Output short circuit current	I <sub>O (Short)</sub>	V <sub>I</sub> =35V, T <sub>j</sub> =25°C	—	300	—	mA
Peak output current	I <sub>O (Peak)</sub>	T <sub>j</sub> =25°C	—	700	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.5	—	mV/°C

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

Note 2) When not specified, V<sub>I</sub>=10V, I<sub>O</sub>=350mA, C<sub>I</sub>=0.33μF and C<sub>O</sub>=0.1μF.

\* AN78M00 Series:15W, AN78M00F Series:10.25W

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

### • AN78M06/78M06F (6V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	5.75	6	6.25	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =8.5 to 21V, I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C, P <sub>D</sub> ≤*	5.7	—	6.3	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =8.5 to 25V, T <sub>j</sub> =25°C	—	5	100	mV
		V <sub>I</sub> =9 to 25V, T <sub>j</sub> =25°C	—	1.5	50	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =5 to 500mA, T <sub>j</sub> =25°C	—	20	120	mV
		I <sub>O</sub> =5 to 200mA, T <sub>j</sub> =25°C	—	10	60	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	4	6	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =9 to 25V, T <sub>j</sub> =25°C	—	—	0.8	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C	—	—	0.5	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	45	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =9 to 19V, I <sub>O</sub> =100mA, f=120Hz	59	—	—	dB
Minimum input/output voltage difference	V <sub>DIF (min.)</sub>	I <sub>O</sub> =500mA, T <sub>j</sub> =25°C	—	2	—	V
Output short circuit current	I <sub>O (Short)</sub>	V <sub>I</sub> =35V, T <sub>j</sub> =25°C	—	300	—	mA
Peak output current	I <sub>O (Peak)</sub>	T <sub>j</sub> =25°C	—	700	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.5	—	mV/°C

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

Note 2) When not specified, V<sub>I</sub>=11V, I<sub>O</sub>=350mA, C<sub>I</sub>=0.33μF and C<sub>O</sub>=0.1μF.

\* AN78M00 Series:15W, AN78M00F Series:10.25W

### • AN78M07/78M07F (7V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	6.7	7	7.3	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =9.5 to 22V, I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C, P <sub>D</sub> ≤*	6.65	—	7.35	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =9.5 to 25V, T <sub>j</sub> =25°C	—	6	100	mV
		V <sub>I</sub> =10 to 25V, T <sub>j</sub> =25°C	—	2	50	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =5 to 500mA, T <sub>j</sub> =25°C	—	20	140	mV
		I <sub>O</sub> =5 to 200mA, T <sub>j</sub> =25°C	—	10	70	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	4	6	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =10 to 25V, T <sub>j</sub> =25°C	—	—	0.8	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C	—	—	0.5	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	48	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =10 to 20V, I <sub>O</sub> =100mA, f=120Hz	57	—	—	dB
Minimum input/output voltage difference	V <sub>DIF (min.)</sub>	I <sub>O</sub> =500mA, T <sub>j</sub> =25°C	—	2	—	V
Output short circuit current	I <sub>O (Short)</sub>	V <sub>I</sub> =35V, T <sub>j</sub> =25°C	—	300	—	mA
Peak output current	I <sub>O (Peak)</sub>	T <sub>j</sub> =25°C	—	700	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.5	—	mV/°C

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

Note 2) When not specified, V<sub>I</sub>=12V, I<sub>O</sub>=350mA, C<sub>I</sub>=0.33μF and C<sub>O</sub>=0.1μF.

\* AN78M00 Series:15W, AN78M00F Series:10.25W

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

### • AN78M08/78M08F (8V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	7.7	8	8.3	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =10.5 to 23V, I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C, P <sub>D</sub> ≤*	7.6	—	8.4	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =10.5 to 25V, T <sub>j</sub> =25°C	—	6	100	mV
		V <sub>I</sub> =11 to 25V, T <sub>j</sub> =25°C	—	2	50	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =5 to 500mA, T <sub>j</sub> =25°C	—	25	160	mV
		I <sub>O</sub> =5 to 200mA, T <sub>j</sub> =25°C	—	10	80	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	4.1	6	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =10.5 to 25V, T <sub>j</sub> =25°C	—	—	0.8	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C	—	—	0.5	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	52	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =11.5 to 21.5V, I <sub>O</sub> =100mA, f=120Hz	56	—	—	dB
Minimum input/output voltage difference	V <sub>DIF (min.)</sub>	I <sub>O</sub> =500mA, T <sub>j</sub> =25°C	—	2	—	V
Output short circuit current	I <sub>O (Short)</sub>	V <sub>I</sub> =35V, T <sub>j</sub> =25°C	—	300	—	mA
Peak output current	I <sub>O (Peak)</sub>	T <sub>j</sub> =25°C	—	700	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.5	—	mV/°C

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

Note 2) When not specified, V<sub>I</sub>=14V, I<sub>O</sub>=350mA, C<sub>I</sub>=0.33μF and C<sub>O</sub>=0.1μF.

\* AN78M00 Series:15W, AN78M00F Series:10.25W

### • AN78M09/78M09F (9V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	V <sub>O</sub>	T <sub>j</sub> =25°C	8.65	9	9.35	V
Output voltage tolerance	V <sub>O</sub>	V <sub>I</sub> =11.5 to 24V, I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C, P <sub>D</sub> ≤*	8.55	—	9.45	V
Line regulation	REG <sub>IN</sub>	V <sub>I</sub> =11.5 to 25V, T <sub>j</sub> =25°C	—	7	100	mV
		V <sub>I</sub> =12 to 25V, T <sub>j</sub> =25°C	—	2	50	mV
Load regulation	REG <sub>L</sub>	I <sub>O</sub> =5 to 500mA, T <sub>j</sub> =25°C	—	25	180	mV
		I <sub>O</sub> =5 to 200mA, T <sub>j</sub> =25°C	—	10	90	mV
Bias current	I <sub>bias</sub>	T <sub>j</sub> =25°C	—	4.1	6	mA
Input bias current fluctuation	ΔI <sub>bias (IN)</sub>	V <sub>I</sub> =12 to 25V, T <sub>j</sub> =25°C	—	—	0.8	mA
Load bias current fluctuation	ΔI <sub>bias (L)</sub>	I <sub>O</sub> =5 to 350mA, T <sub>j</sub> =25°C	—	—	0.5	mA
Output noise voltage	V <sub>no</sub>	f=10Hz to 100kHz	—	60	—	μV
Ripple rejection ratio	RR	V <sub>I</sub> =12 to 22V, I <sub>O</sub> =100mA, f=120Hz	56	—	—	dB
Minimum input/output voltage difference	V <sub>DIF (min.)</sub>	I <sub>O</sub> =500mA, T <sub>j</sub> =25°C	—	2	—	V
Output short circuit current	I <sub>O (Short)</sub>	V <sub>I</sub> =35V, T <sub>j</sub> =25°C	—	300	—	mA
Peak output current	I <sub>O (Peak)</sub>	T <sub>j</sub> =25°C	—	700	—	mA
Output voltage temperature coefficient	ΔV <sub>O</sub> /Ta	I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C	—	-0.5	—	mV/°C

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

Note 2) When not specified, V<sub>I</sub>=15V, I<sub>O</sub>=350mA, C<sub>I</sub>=0.33μF and C<sub>O</sub>=0.1μF.

\* AN78M00 Series:15W, AN78M00F Series:10.25W

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

### • AN78M10/78M10F (10V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	9.6	10	10.4	V
Output voltage tolerance	$V_O$	$V_i=12.5$ to $25\text{V}$ , $I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$ , $P_D \leq *$	9.5	—	10.5	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_i=12.5$ to $30\text{V}$ , $T_j=25^\circ\text{C}$	—	7	100	mV
		$V_i=13$ to $25\text{V}$ , $T_j=25^\circ\text{C}$	—	2	50	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O=5$ to $500\text{mA}$ , $T_j=25^\circ\text{C}$	—	25	200	mV
		$I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$	—	10	100	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	4.1	6	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_i=13$ to $25\text{V}$ , $T_j=25^\circ\text{C}$	—	—	0.8	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	65	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_i=13$ to $23\text{V}$ , $I_O=100\text{mA}$ , $f=120\text{Hz}$	56	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF (min.)}}$	$I_O=500\text{mA}$ , $T_j=25^\circ\text{C}$	—	2	—	V
Output short circuit current	$I_{\text{O (Short)}}$	$V_i=35\text{V}$ , $T_j=25^\circ\text{C}$	—	300	—	mA
Peak output current	$I_{\text{O (Peak)}}$	$T_j=25^\circ\text{C}$	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-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 with the test time so short (within 10ms) that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

Note 2) When not specified,  $V_i=16\text{V}$ ,  $I_O=350\text{mA}$ ,  $C_i=0.33\mu\text{F}$  and  $C_O=0.1\mu\text{F}$ .

\* AN78M00 Series: 15W, AN78M00F Series: 10.25W

### • AN78M12/78M12F (12V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	11.5	12	12.5	V
Output voltage tolerance	$V_O$	$V_i=14.5$ to $27\text{V}$ , $I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$ , $P_D \leq *$	11.4	—	12.6	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_i=14.5$ to $30\text{V}$ , $T_j=25^\circ\text{C}$	—	8	100	mV
		$V_i=16$ to $30\text{V}$ , $T_j=25^\circ\text{C}$	—	2	50	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O=5$ to $500\text{mA}$ , $T_j=25^\circ\text{C}$	—	25	240	mV
		$I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$	—	10	120	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	4.3	6	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_i=14.5$ to $30\text{V}$ , $T_j=25^\circ\text{C}$	—	—	0.8	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	75	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_i=15$ to $25\text{V}$ , $I_O=100\text{mA}$ , $f=120\text{Hz}$	55	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF (min.)}}$	$I_O=500\text{mA}$ , $T_j=25^\circ\text{C}$	—	2	—	V
Output short circuit current	$I_{\text{O (Short)}}$	$V_i=35\text{V}$ , $T_j=25^\circ\text{C}$	—	300	—	mA
Peak output current	$I_{\text{O (Peak)}}$	$T_j=25^\circ\text{C}$	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-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 with the test time so short (within 10ms) that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

Note 2) When not specified,  $V_i=19\text{V}$ ,  $I_O=350\text{mA}$ ,  $C_i=0.33\mu\text{F}$  and  $C_O=0.1\mu\text{F}$ .

\* AN78M00 Series: 15W, AN78M00F Series: 10.25W

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

### • AN78M15/78M15F (15V Type)

Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	14.4	15	15.6	V
Output voltage tolerance	$V_O$	$V_I=17.5$ to $30\text{V}$ , $I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$ , $P_D \leq^*$	14.25	—	15.75	V
Line regulation	REG <sub>IN</sub>	$V_I=17.5$ to $30\text{V}$ , $T_j=25^\circ\text{C}$	—	10	100	mV
		$V_I=20$ to $30\text{V}$ , $T_j=25^\circ\text{C}$	—	3	50	mV
Load regulation	REG <sub>L</sub>	$I_O=5$ to $500\text{mA}$ , $T_j=25^\circ\text{C}$	—	25	300	mV
		$I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$	—	10	150	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	4.3	6	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_I=17.5$ to $30\text{V}$ , $T_j=25^\circ\text{C}$	—	—	0.8	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	90	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=18.5$ to $28.5\text{V}$ , $I_O=100\text{mA}$ , $f=120\text{Hz}$	54	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF (min.)}}$	$I_O=500\text{mA}$ , $T_j=25^\circ\text{C}$	—	2	—	V
Output short circuit current	$I_{O(\text{Short})}$	$V_I=35\text{V}$ , $T_j=25^\circ\text{C}$	—	300	—	mA
Peak output current	$I_{O(\text{Peak})}$	$T_j=25^\circ\text{C}$	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-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 with the test time so short (within 10ms) that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

Note 2) When not specified,  $V_I=23\text{V}$ ,  $I_O=350\text{mA}$ ,  $C_I=0.33\mu\text{F}$  and  $C_O=0.1\mu\text{F}$ .

\* AN78M00 Series:15W, AN78M00F Series:10.25W

### • AN78M18/78M18F (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	$V_O$	$V_I=21$ to $33\text{V}$ , $I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$ , $P_D \leq^*$	17.1	—	18.9	V
Line regulation	REG <sub>IN</sub>	$V_I=21$ to $33\text{V}$ , $T_j=25^\circ\text{C}$	—	10	100	mV
		$V_I=22$ to $33\text{V}$ , $T_j=25^\circ\text{C}$	—	5	50	mV
Load regulation	REG <sub>L</sub>	$I_O=5$ to $500\text{mA}$ , $T_j=25^\circ\text{C}$	—	30	360	mV
		$I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$	—	10	180	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	4.4	6	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_I=21$ to $33\text{V}$ , $T_j=25^\circ\text{C}$	—	—	0.8	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	100	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=22$ to $32\text{V}$ , $I_O=100\text{mA}$ , $f=120\text{Hz}$	53	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF (min.)}}$	$I_O=500\text{mA}$ , $T_j=25^\circ\text{C}$	—	2	—	V
Output short circuit current	$I_{O(\text{Short})}$	$V_I=35\text{V}$ , $T_j=25^\circ\text{C}$	—	300	—	mA
Peak output current	$I_{O(\text{Peak})}$	$T_j=25^\circ\text{C}$	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-1.0	—	$\text{mV}/^\circ\text{C}$

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

Note 2) When not specified,  $V_I=27\text{V}$ ,  $I_O=350\text{mA}$ ,  $C_I=0.33\mu\text{F}$  and  $C_O=0.1\mu\text{F}$ .

\* AN78M00 Series:15W, AN78M00F Series:10.25W

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

### • AN78M20/78M20F (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	$V_O$	$V_I=23$ to $35\text{V}$ , $I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$ , $P_D \leq *$	19	—	21	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I=23$ to $35\text{V}$ , $T_j=25^\circ\text{C}$	—	10	100	mV
		$V_I=24$ to $35\text{V}$ , $T_j=25^\circ\text{C}$	—	5	50	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O=5$ to $500\text{mA}$ , $T_j=25^\circ\text{C}$	—	30	400	mV
		$I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$	—	10	200	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	4.4	6	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_I=23$ to $35\text{V}$ , $T_j=25^\circ\text{C}$	—	—	0.8	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	110	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=24$ to $34\text{V}$ , $I_O=100\text{mA}$ , $f=120\text{Hz}$	53	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF (min.)}}$	$I_O=500\text{mA}$ , $T_j=25^\circ\text{C}$	—	2	—	V
Output short circuit current	$I_{\text{O (Short)}}$	$V_I=35\text{V}$ , $T_j=25^\circ\text{C}$	—	300	—	mA
Peak output current	$I_{\text{O (Peak)}}$	$T_j=25^\circ\text{C}$	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-1.0	—	$\text{mV}/^\circ\text{C}$

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

Note 2) When not specified,  $V_I=29\text{V}$ ,  $I_O=350\text{mA}$ ,  $C_I=0.33\mu\text{F}$  and  $C_O=0.1\mu\text{F}$ .

\* AN78M00 Series:15W, AN78M00F Series:10.25W

### • AN78M24/78M24F (24V Type)

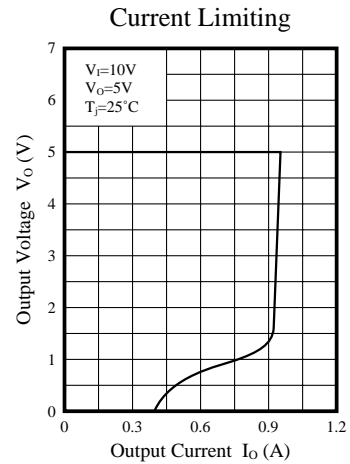
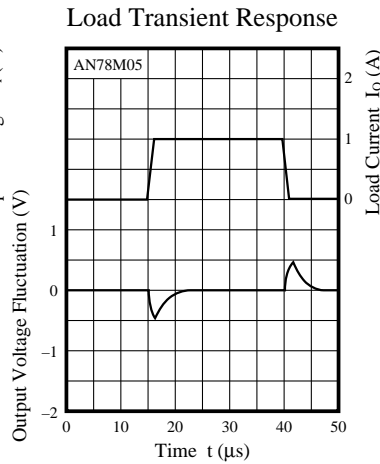
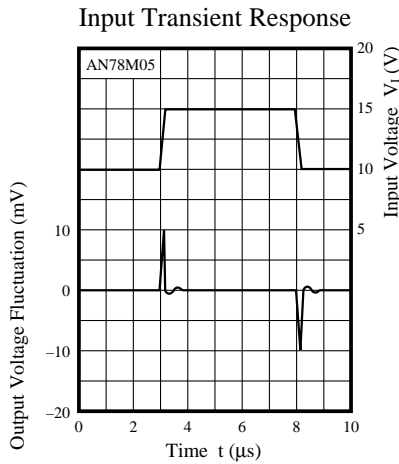
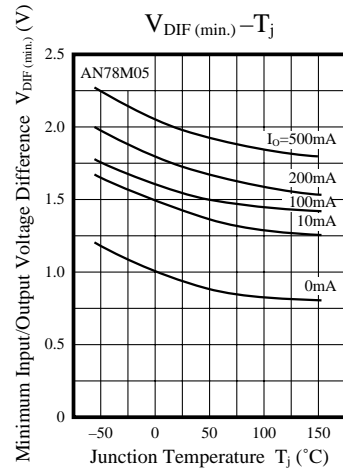
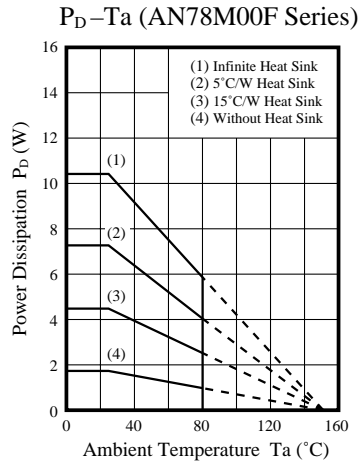
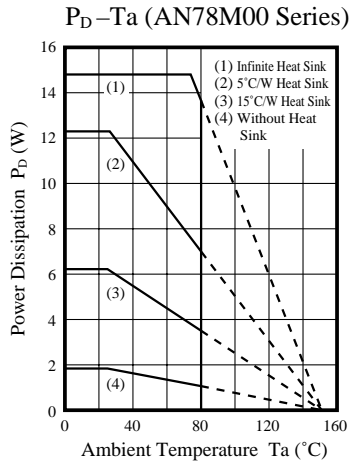
Parameter	Symbol	Condition	min	typ	max	Unit
Output voltage	$V_O$	$T_j=25^\circ\text{C}$	23	24	25	V
Output voltage tolerance	$V_O$	$V_I=27$ to $38\text{V}$ , $I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$ , $P_D \leq *$	22.8	—	25.2	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I=27$ to $38\text{V}$ , $T_j=25^\circ\text{C}$	—	10	100	mV
		$V_I=28$ to $38\text{V}$ , $T_j=25^\circ\text{C}$	—	5	50	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O=5$ to $500\text{mA}$ , $T_j=25^\circ\text{C}$	—	30	480	mV
		$I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$	—	10	240	mV
Bias current	$I_{\text{bias}}$	$T_j=25^\circ\text{C}$	—	4.5	6	mA
Input bias current fluctuation	$\Delta I_{\text{bias (IN)}}$	$V_I=27$ to $38\text{V}$ , $T_j=25^\circ\text{C}$	—	—	0.8	mA
Load bias current fluctuation	$\Delta I_{\text{bias (L)}}$	$I_O=5$ to $350\text{mA}$ , $T_j=25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f=10\text{Hz}$ to $100\text{kHz}$	—	170	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I=28$ to $38\text{V}$ , $I_O=100\text{mA}$ , $f=120\text{Hz}$	50	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF (min.)}}$	$I_O=500\text{mA}$ , $T_j=25^\circ\text{C}$	—	2	—	V
Output short circuit current	$I_{\text{O (Short)}}$	$V_I=35\text{V}$ , $T_j=25^\circ\text{C}$	—	300	—	mA
Peak output current	$I_{\text{O (Peak)}}$	$T_j=25^\circ\text{C}$	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$	—	-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 with the test time so short (within 10ms) that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

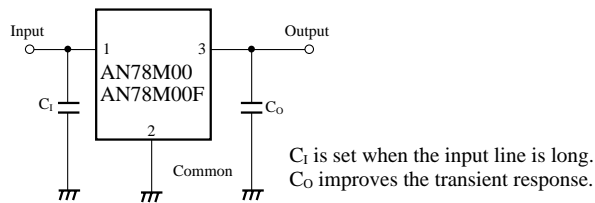
Note 2) When not specified,  $V_I=33\text{V}$ ,  $I_O=350\text{mA}$ ,  $C_I=0.33\mu\text{F}$  and  $C_O=0.1\mu\text{F}$ .

\* AN78M00 Series:15W, AN78M00F Series:10.25W

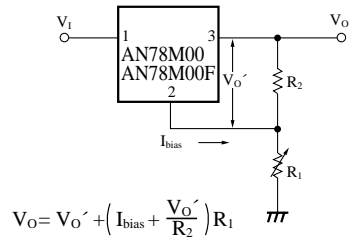
## ■ Characteristic Curve



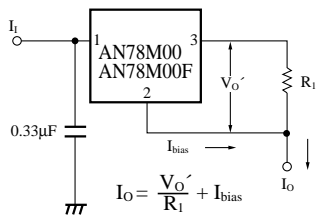
## ■ Basic Regulator Circuit



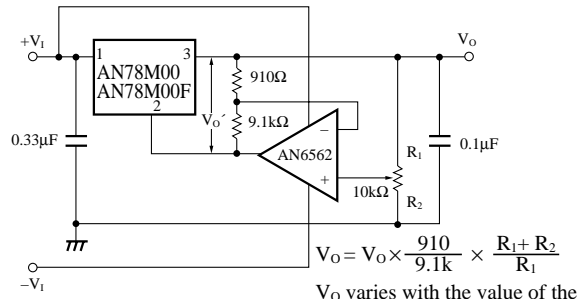
■ Application Circuit



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

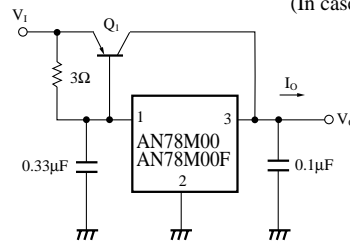


$$I_O = \frac{V_{O'}}{R_1} + I_{\text{bias}}$$



$$V_O = V_{O'} \times \frac{910}{9.1k} \times \frac{R_1 + R_2}{R_1}$$

$V_O$  varies with the value of the input voltage  $V_1$ .  
(In case of  $R_1 + R_2 = 10k\Omega$ )





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