

# AN78N00 Series

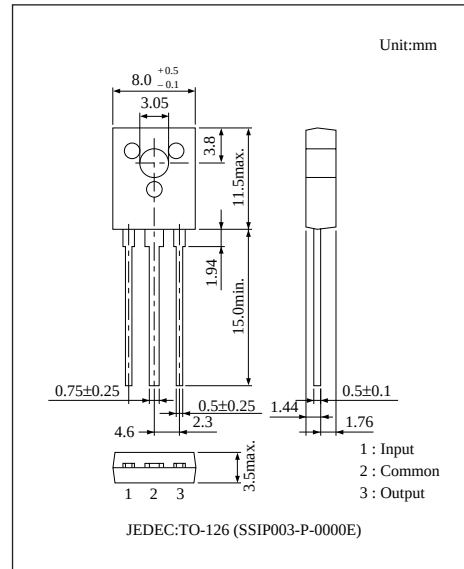
## 3-pin Positive Output Voltage Regulator (300mA Type)

### ■ Overview

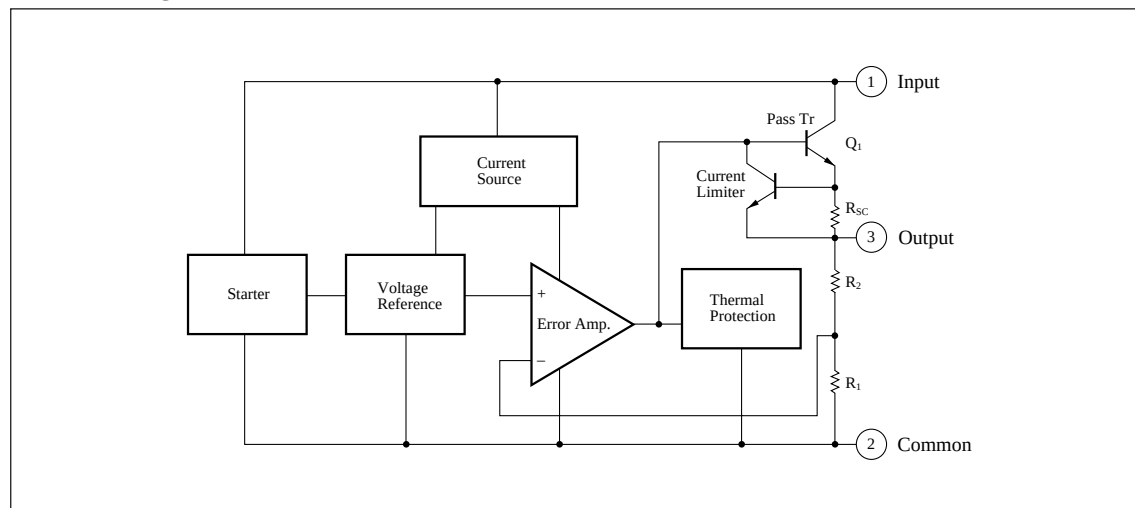
The AN78N00 series is 3-pin fixed positive output voltage regulators. Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 12 types of fixed output voltage are available ; 4V, 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V and 24V. They can be used widely in power circuits with current capacitance up to 300mA.

### ■ Features

- No external components
- Output voltage : 4V, 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             | P <sub>D</sub>   | 8 * <sup>3</sup>  | W    |
| Operating ambient temperature | T <sub>opr</sub> | −20 to +80        | °C   |
| Storage temperature           | T <sub>stg</sub> | −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<sub>j</sub> exceeds 150°C, the internal circuit cuts off the output.

■ Electrical Characteristics (Ta=25°C)

• AN78N04 (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 20V, I <sub>O</sub> =5 to 200mA  | 3.8  | —    | 4.2  | V     |
| Line regulation                         | REG <sub>IN</sub>       | V <sub>I</sub> =6.5 to 25V, T <sub>j</sub> =25°C        | —    | 9    | 40   | mV    |
|                                         |                         | V <sub>I</sub> =7 to 20V, T <sub>j</sub> =25°C          | —    | 4    | 20   | mV    |
| Load regulation                         | REG <sub>L</sub>        | I <sub>O</sub> =1 to 300mA, T <sub>j</sub> =25°C        | —    | 20   | 80   | mV    |
|                                         |                         | I <sub>O</sub> =5 to 200mA, T <sub>j</sub> =25°C        | —    | 10   | 40   | mV    |
| Bias current                            | I <sub>bias</sub>       | T <sub>j</sub> =25°C                                    | —    | 2.8  | 5    | mA    |
| Input bias current fluctuation          | ΔI <sub>bias (IN)</sub> | V <sub>I</sub> =6.5 to 25V, T <sub>j</sub> =25°C        | —    | —    | 0.8  | mA    |
| Load bias current fluctuation           | ΔI <sub>bias (L)</sub>  | I <sub>O</sub> =1 to 300mA, T <sub>j</sub> =25°C        | —    | —    | 0.5  | mA    |
| Output noise voltage                    | V <sub>no</sub>         | f=10Hz to 100kHz                                        | —    | 38   | —    | μV    |
| Ripple rejection ratio                  | RR                      | V <sub>I</sub> =7 to 17V, I <sub>O</sub> =50mA, f=120Hz | 62   | 72   | —    | dB    |
| Minimum input/output voltage difference | V <sub>DIF (min.)</sub> | I <sub>O</sub> =300mA, 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                                    | —    | 500  | —    | mA    |
| Output voltage temperature coefficient  | ΔV <sub>O</sub> /Ta     | I <sub>O</sub> =5mA, T <sub>j</sub> =0 to 125°C         | —    | −0.3 | —    | 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>=9V, I<sub>O</sub>=100mA, C<sub>I</sub>=0.33μF, C<sub>O</sub>=0.1μF, T<sub>j</sub>=0 to 125°C

■ Electrical Characteristics (Ta=25°C)

• AN78N05 (5V Type)

| Parameter                               | Symbol                        | Condition                                                      | min  | typ   | max  | Unit                       |
|-----------------------------------------|-------------------------------|----------------------------------------------------------------|------|-------|------|----------------------------|
| Output voltage                          | $V_O$                         | $T_j=25^\circ\text{C}$                                         | 4.8  | 5     | 5.2  | V                          |
| Output voltage tolerance                | $V_O$                         | $V_I=7.5$ to $20\text{V}$ , $I_O=5$ to $200\text{mA}$          | 4.75 | —     | 5.25 | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=7.5$ to $25\text{V}$ , $T_j=25^\circ\text{C}$             | —    | 10    | 50   | mV                         |
|                                         |                               | $V_I=8$ to $20\text{V}$ , $T_j=25^\circ\text{C}$               | —    | 5     | 25   | mV                         |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$             | —    | 20    | 100  | mV                         |
|                                         |                               | $I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$             | —    | 10    | 50   | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                         | —    | 2.8   | 5    | mA                         |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=7.5$ to $25\text{V}$ , $T_j=25^\circ\text{C}$             | —    | —     | 0.8  | mA                         |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$             | —    | —     | 0.5  | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to $100\text{kHz}$                             | —    | 40    | —    | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=8$ to $18\text{V}$ , $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 62   | 72    | —    | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$                    | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                         | —    | 500   | —    | mA                         |
| Output voltage temperature coefficient  | $\Delta V_O/T_a$              | $I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$              | —    | − 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 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,  $V_I=10\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

• AN78N06 (6V Type)

| Parameter                               | Symbol                        | Condition                                                      | min  | typ   | max  | Unit                       |
|-----------------------------------------|-------------------------------|----------------------------------------------------------------|------|-------|------|----------------------------|
| Output voltage                          | $V_O$                         | $T_j=25^\circ\text{C}$                                         | 5.75 | 6     | 6.25 | V                          |
| Output voltage tolerance                | $V_O$                         | $V_I=8.5$ to $20\text{V}$ , $I_O=5$ to $200\text{mA}$          | 5.7  | —     | 6.3  | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=8.5$ to $25\text{V}$ , $T_j=25^\circ\text{C}$             | —    | 11    | 60   | mV                         |
|                                         |                               | $V_I=9$ to $20\text{V}$ , $T_j=25^\circ\text{C}$               | —    | 6     | 30   | mV                         |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$             | —    | 20    | 120  | mV                         |
|                                         |                               | $I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$             | —    | 10    | 60   | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                         | —    | 2.8   | 5    | mA                         |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=8.5$ to $25\text{V}$ , $T_j=25^\circ\text{C}$             | —    | —     | 0.8  | mA                         |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$             | —    | —     | 0.5  | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to $100\text{kHz}$                             | —    | 45    | —    | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=9$ to $19\text{V}$ , $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 59   | 70    | —    | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$                    | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                         | —    | 500   | —    | mA                         |
| Output voltage temperature coefficient  | $\Delta V_O/T_a$              | $I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$              | —    | − 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 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,  $V_I=11\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

■ Electrical Characteristics (Ta=25°C)

• AN78N07(7V Type)

| Parameter                               | Symbol                        | Condition                                             | min  | typ  | max  | Unit                       |
|-----------------------------------------|-------------------------------|-------------------------------------------------------|------|------|------|----------------------------|
| Output voltage                          | $V_O$                         | $T_j=25^\circ\text{C}$                                | 6.7  | 7    | 7.3  | V                          |
| Output voltage tolerance                | $V_O$                         | $V_I=9.5$ to 20V, $I_O=5$ to 200mA                    | 6.65 | —    | 7.35 | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=9.5$ to 25V, $T_j=25^\circ\text{C}$              | —    | 12   | 70   | mV                         |
|                                         |                               | $V_I=10$ to 20V, $T_j=25^\circ\text{C}$               | —    | 7    | 35   | mV                         |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —    | 20   | 140  | mV                         |
|                                         |                               | $I_O=5$ to 200mA, $T_j=25^\circ\text{C}$              | —    | 10   | 70   | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                | —    | 2.8  | 5    | mA                         |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=9.5$ to 25V, $T_j=25^\circ\text{C}$              | —    | —    | 0.8  | mA                         |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —    | —    | 0.5  | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to 100kHz                             | —    | 50   | —    | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=10$ to 20V, $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 57   | 69   | —    | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$           | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                | —    | 500  | —    | mA                         |
| Output voltage temperature coefficient  | $\Delta V_O/T_a$              | $I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$     | —    | -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 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,  $V_I=12\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

• AN78N08 (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, $I_O=5$ to 200mA                   | 7.6 | —    | 8.4 | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=10.5$ to 25V, $T_j=25^\circ\text{C}$             | —   | 13   | 80  | mV                         |
|                                         |                               | $V_I=12$ to 23V, $T_j=25^\circ\text{C}$               | —   | 8    | 40  | mV                         |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —   | 25   | 160 | mV                         |
|                                         |                               | $I_O=5$ to 200mA, $T_j=25^\circ\text{C}$              | —   | 10   | 80  | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                | —   | 2.8  | 5   | mA                         |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=10.5$ to 25V, $T_j=25^\circ\text{C}$             | —   | —    | 0.8 | mA                         |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —   | —    | 0.5 | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to 100kHz                             | —   | 55   | —   | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=11$ to 21V, $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 56  | 69   | —   | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$           | —   | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                | —   | 500  | —   | mA                         |
| Output voltage temperature coefficient  | $\Delta V_O/T_a$              | $I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$     | —   | -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 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,  $V_I=14\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

■ Electrical Characteristics (Ta=25°C)

• AN78N09 (9V Type)

| Parameter                               | Symbol                        | Condition                                                       | min  | typ   | max  | Unit                         |
|-----------------------------------------|-------------------------------|-----------------------------------------------------------------|------|-------|------|------------------------------|
| Output voltage                          | $V_O$                         | $T_J=25^{\circ}\text{C}$                                        | 8.65 | 9     | 9.35 | V                            |
| Output voltage tolerance                | $V_O$                         | $V_I=11.5$ to $24\text{V}$ , $I_O=5$ to $200\text{mA}$          | 8.55 | —     | 9.45 | V                            |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=11.5$ to $25\text{V}$ , $T_J=25^{\circ}\text{C}$           | —    | 14    | 90   | mV                           |
|                                         |                               | $V_I=13$ to $24\text{V}$ , $T_J=25^{\circ}\text{C}$             | —    | 9     | 45   | mV                           |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to $300\text{mA}$ , $T_J=25^{\circ}\text{C}$            | —    | 25    | 180  | mV                           |
|                                         |                               | $I_O=5$ to $200\text{mA}$ , $T_J=25^{\circ}\text{C}$            | —    | 10    | 90   | mV                           |
| Bias current                            | $I_{\text{bias}}$             | $T_J=25^{\circ}\text{C}$                                        | —    | 2.8   | 5    | mA                           |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=11.5$ to $25\text{V}$ , $T_J=25^{\circ}\text{C}$           | —    | —     | 0.8  | mA                           |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to $300\text{mA}$ , $T_J=25^{\circ}\text{C}$            | —    | —     | 0.5  | mA                           |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to $100\text{kHz}$                              | —    | 60    | —    | $\mu\text{V}$                |
| Ripple rejection ratio                  | RR                            | $V_I=12$ to $22\text{V}$ , $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 56   | 68    | —    | dB                           |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_J=25^{\circ}\text{C}$                   | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_J=25^{\circ}\text{C}$                                        | —    | 500   | —    | 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,  $V_I=15\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_J=0$  to  $125^{\circ}\text{C}$

• AN78N10 (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 $200\text{mA}$          | 9.5 | —     | 10.5 | V                            |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=12.5$ to $30\text{V}$ , $T_J=25^{\circ}\text{C}$           | —   | 15    | 100  | mV                           |
|                                         |                               | $V_I=13$ to $25\text{V}$ , $T_J=25^{\circ}\text{C}$             | —   | 10    | 50   | mV                           |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to $300\text{mA}$ , $T_J=25^{\circ}\text{C}$            | —   | 25    | 200  | mV                           |
|                                         |                               | $I_O=5$ to $200\text{mA}$ , $T_J=25^{\circ}\text{C}$            | —   | 10    | 100  | mV                           |
| Bias current                            | $I_{\text{bias}}$             | $T_J=25^{\circ}\text{C}$                                        | —   | 2.8   | 5    | mA                           |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=12.5$ to $30\text{V}$ , $T_J=25^{\circ}\text{C}$           | —   | —     | 0.8  | mA                           |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to $300\text{mA}$ , $T_J=25^{\circ}\text{C}$            | —   | —     | 0.5  | mA                           |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to $100\text{kHz}$                              | —   | 70    | —    | $\mu\text{V}$                |
| Ripple rejection ratio                  | RR                            | $V_I=13$ to $23\text{V}$ , $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 56  | 68    | —    | dB                           |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_J=25^{\circ}\text{C}$                   | —   | 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                     | $I_{\text{O (Peak)}}$         | $T_J=25^{\circ}\text{C}$                                        | —   | 500   | —    | 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,  $V_I=16\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_J=0$  to  $125^{\circ}\text{C}$

■ Electrical Characteristics (Ta=25°C)

• AN78N12 (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 $200\text{mA}$          | 11.4 | —     | 12.6 | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=14.5$ to $30\text{V}$ , $T_j=25^\circ\text{C}$             | —    | 15    | 100  | mV                         |
|                                         |                               | $V_I=16$ to $27\text{V}$ , $T_j=25^\circ\text{C}$               | —    | 10    | 50   | mV                         |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$              | —    | 25    | 240  | mV                         |
|                                         |                               | $I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$              | —    | 10    | 120  | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                          | —    | 2.8   | 5    | 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           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$              | —    | —     | 0.5  | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to $100\text{kHz}$                              | —    | 80    | —    | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=15$ to $25\text{V}$ , $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 55   | 67    | —    | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$                     | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                          | —    | 500   | —    | mA                         |
| Output voltage temperature coefficient  | $\Delta V_O/T_a$              | $I_O=5\text{mA}$ , $T_j=0$ to $125^\circ\text{C}$               | —    | − 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 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,  $V_I=19\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

• AN78N15 (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 $20\text{V}$ , $I_O=5$ to $200\text{mA}$              | 14.25 | —     | 15.75 | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=17.5$ to $25\text{V}$ , $T_j=25^\circ\text{C}$                 | —     | 16    | 100   | mV                         |
|                                         |                               | $V_I=20$ to $30\text{V}$ , $T_j=25^\circ\text{C}$                   | —     | 11    | 50    | mV                         |
| Load regulation                         | $\text{REG}_L$                | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$                  | —     | 25    | 300   | mV                         |
|                                         |                               | $I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$                  | —     | 10    | 150   | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                              | —     | 2.8   | 5     | 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           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$                  | —     | —     | 0.5   | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to $100\text{kHz}$                                  | —     | 80    | —     | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=18.5$ to $28.5\text{V}$ , $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 54    | 66    | —     | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$                         | —     | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                              | —     | 500   | —     | 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,  $V_I=23\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

■ Electrical Characteristics (Ta=25°C)

• AN78N18 (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 33V, $I_O=5$ to 200mA                     | 17.1 | —    | 18.9 | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=21$ to 33V, $T_j=25^\circ\text{C}$               | —    | 18   | 100  | mV                         |
|                                         |                               | $V_I=22$ to 33V, $T_j=25^\circ\text{C}$               | —    | 13   | 50   | mV                         |
| Load regulation                         | $\text{REG}_{\text{L}}$       | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —    | 30   | 360  | mV                         |
|                                         |                               | $I_O=5$ to 200mA, $T_j=25^\circ\text{C}$              | —    | 10   | 180  | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                | —    | 2.8  | 5    | mA                         |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=21$ to 33V, $T_j=25^\circ\text{C}$               | —    | —    | 0.8  | mA                         |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —    | —    | 0.5  | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to 100kHz                             | —    | 90   | —    | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=22$ to 32V, $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 53   | 65   | —    | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$           | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                | —    | 500  | —    | 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,  $V_I=27\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

• AN78N20 (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 35V, $I_O=5$ to 200mA                     | 19.0 | —    | 21   | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=23$ to 35V, $T_j=25^\circ\text{C}$               | —    | 19   | 100  | mV                         |
|                                         |                               | $V_I=24$ to 35V, $T_j=25^\circ\text{C}$               | —    | 14   | 50   | mV                         |
| Load regulation                         | $\text{REG}_{\text{L}}$       | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —    | 30   | 400  | mV                         |
|                                         |                               | $I_O=5$ to 200mA, $T_j=25^\circ\text{C}$              | —    | 10   | 200  | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                | —    | 2.8  | 5    | mA                         |
| Input bias current fluctuation          | $\Delta I_{\text{bias (IN)}}$ | $V_I=23$ to 35V, $T_j=25^\circ\text{C}$               | —    | —    | 0.8  | mA                         |
| Load bias current fluctuation           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to 300mA, $T_j=25^\circ\text{C}$              | —    | —    | 0.5  | mA                         |
| Output noise voltage                    | $V_{\text{no}}$               | $f=10\text{Hz}$ to 100kHz                             | —    | 100  | —    | $\mu\text{V}$              |
| Ripple rejection ratio                  | RR                            | $V_I=24$ to 34V, $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 52   | 64   | —    | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$           | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                | —    | 500  | —    | 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,  $V_I=29\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

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

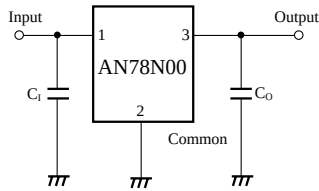
• AN78N24 (24V Type)

| 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 $200\text{mA}$            | 22.8 | —    | 25.2 | V                          |
| Line regulation                         | $\text{REG}_{\text{IN}}$      | $V_I=27$ to $38\text{V}$ , $T_j=25^\circ\text{C}$               | —    | 20   | 100  | mV                         |
|                                         |                               | $V_I=28$ to $38\text{V}$ , $T_j=25^\circ\text{C}$               | —    | 15   | 50   | mV                         |
| Load regulation                         | $\text{REG}_{\text{L}}$       | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$              | —    | 30   | 480  | mV                         |
|                                         |                               | $I_O=5$ to $200\text{mA}$ , $T_j=25^\circ\text{C}$              | —    | 10   | 240  | mV                         |
| Bias current                            | $I_{\text{bias}}$             | $T_j=25^\circ\text{C}$                                          | —    | 2.8  | 5    | 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           | $\Delta I_{\text{bias (L)}}$  | $I_O=1$ to $300\text{mA}$ , $T_j=25^\circ\text{C}$              | —    | —    | 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                            | $V_I=28$ to $38\text{V}$ , $I_O=50\text{mA}$ , $f=120\text{Hz}$ | 50   | 63   | —    | dB                         |
| Minimum input/output voltage difference | $V_{\text{DIF (min.)}}$       | $I_O=300\text{mA}$ , $T_j=25^\circ\text{C}$                     | —    | 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                     | $I_{\text{O (Peak)}}$         | $T_j=25^\circ\text{C}$                                          | —    | 500  | —    | 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 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.

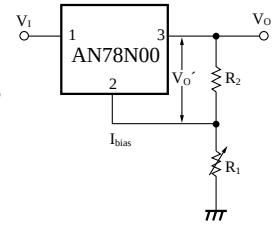
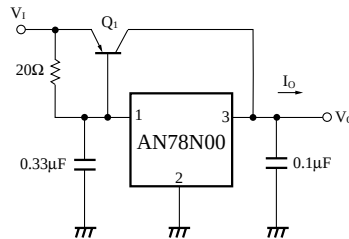
Note 2) When not specified,  $V_I=33\text{V}$ ,  $I_O=100\text{mA}$ ,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_j=0$  to  $125^\circ\text{C}$

## ■ Basic Regulator Circuit



$C_I$  : is set when the input line is long.  
 $C_O$  : improves the transient response.

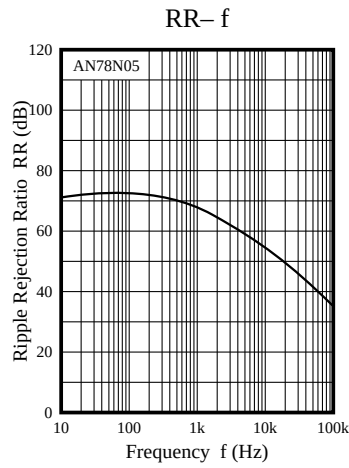
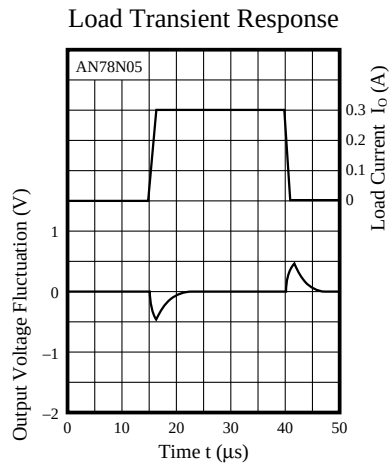
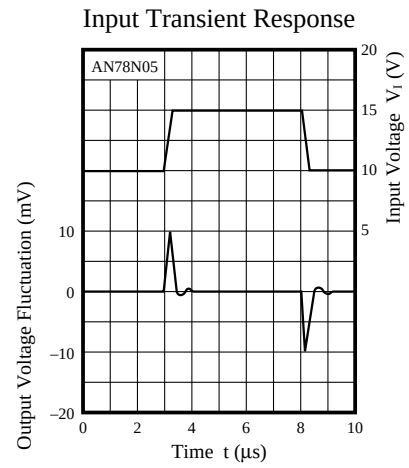
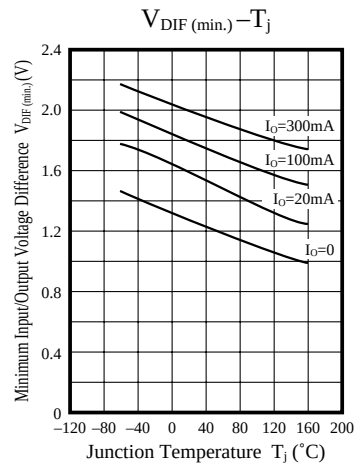
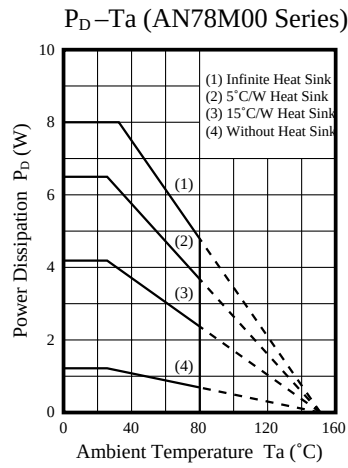
## ■ Application Circuit



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



## ■ Characteristic Curve



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