

AN79Lxx/AN79LxxM Series

3-pin negative output voltage regulator (100 mA type)

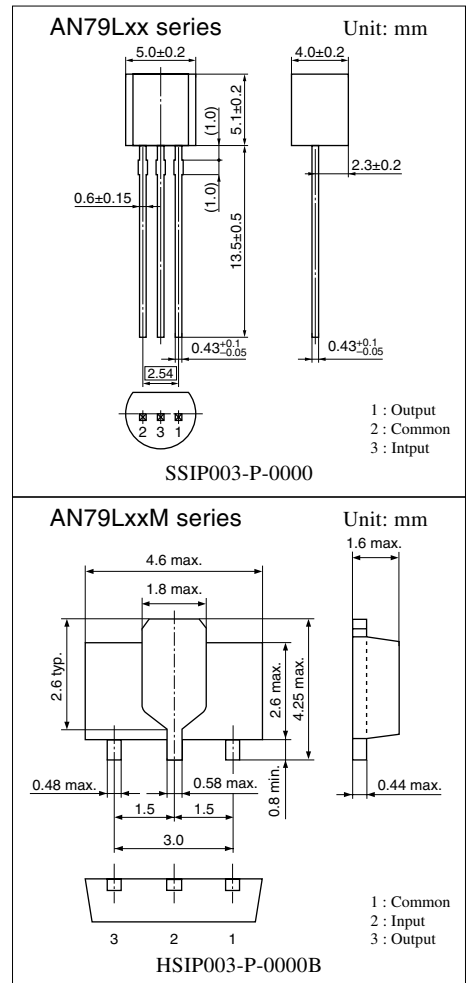
■ Overview

The AN79Lxx series and the AN79LxxM series are 3-pin, fixed negative output type monolithic voltage regulators.

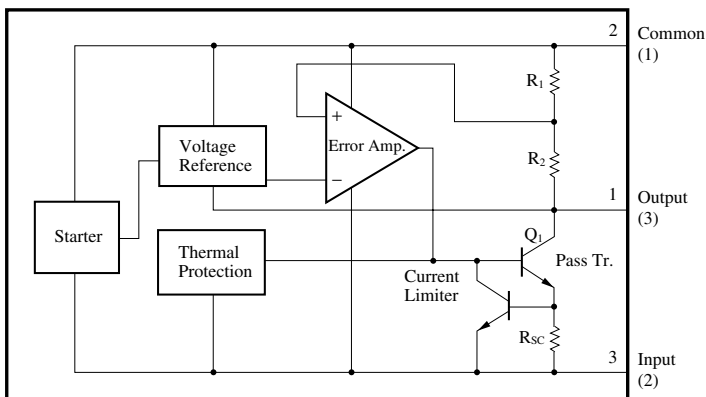
Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 12 types of output voltage are available: $-4V$, $-5V$, $-6V$, $-7V$, $-8V$, $-9V$, $-10V$, $-12V$, $-15V$, $-18V$, $-20V$ and $-24V$. They can be used widely in power circuits with current capacity of up to 100mA.

■ Features

- No external components
- Output voltage: $-4V$, $-5V$, $-6V$, $-7V$, $-8V$, $-9V$, $-10V$, $-12V$, $-15V$, $-18V$, $-20V$, $-24V$
- Built-in overcurrent limit circuit
- Built-in thermal overload protection circuit



■ Block Diagram (AN79Lxx series)



Note) The number in () shows the pin number for the AN79LxxM series.

Note) The packages (SSIP003-P-0000 and HSIP003-P-0000B) of this product will be changed to lead-free type (SSIP003-P-0000S and HSIP003-P-0000Q). See the new package dimensions section later of this datasheet.

■ Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

| Parameter | | Symbol | Rating | Unit |
|-------------------------------|-----------------|-----------|-----------------|------------------|
| Input voltage | | V_I | -35 *1 | V |
| | | | -40 *2 | V |
| Power dissipation | | P_D | 650 *3 | mW |
| Operating ambient temperature | | T_{opr} | -20 to $+80$ | $^\circ\text{C}$ |
| Storage temperature | AN79Lxx series | T_{stg} | -55 to $+150$ | $^\circ\text{C}$ |
| | AN79LxxM series | | -55 to $+125$ | |

*1 AN79L04, AN79L05/M, AN79L06, AN79L07, AN79L08/M, AN79L09/M, AN79L10, AN79L12/M, AN79L15/M, AN79L18

*2 AN79L20, AN79L24

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

AN79LxxM series is mounted on a standard board (glass epoxy: $20\text{mm} \times 20\text{mm} \times 1.7\text{mm}$ with Cu foil of 1cm^2 or more).

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

• AN79L04 (−4V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|-----------------------|---|---------|--------|---------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | -3.84 | -4 | -4.16 | V |
| Output voltage tolerance | V_O | $V_I = -7$ to -19V , $I_O = 1$ to 70mA | -3.8 | — | -4.2 | V |
| Line regulation | REG_{IN} | $V_I = -6$ to -20V , $T_j = 25^\circ\text{C}$ | — | — | 80 | mV |
| | | $V_I = -7$ to -17V , $T_j = 25^\circ\text{C}$ | — | — | 40 | mV |
| Load regulation | REG_L | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 10 | 60 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 4.5 | 30 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{Bias(IN)}$ | $V_I = -7$ to -19V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{Bias(L)}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 38 | — | μV |
| Ripple rejection ratio | RR | $V_I = -7$ to -17V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 55 | — | — | dB |
| Minimum input/output voltage difference | $V_{DIF(min)}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{O(Short)}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | -0.4 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -9\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C

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

• AN79L05, AN79L05M (–5V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|---|-------|------|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | –4.8 | –5 | –5.2 | V |
| Output voltage tolerance | V_O | $V_I = -8$ to -20V , $I_O = 1$ to 70mA | –4.75 | — | –5.25 | V |
| Line regulation | REG_{IN} | $V_I = -7$ to -21V , $T_j = 25^\circ\text{C}$ | — | — | 100 | mV |
| | | $V_I = -8$ to -18V , $T_j = 25^\circ\text{C}$ | — | — | 50 | mV |
| Load regulation | REG_{L} | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 11 | 60 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 5 | 30 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -8$ to -20V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 40 | — | μV |
| Ripple rejection ratio | RR | $V_I = -8$ to -18V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 55 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | –0.4 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -10\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C (AN79L05) and $T_j = 0$ to 100°C (AN79L05M)

• AN79L06 (–6V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|---|-------|------|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | –5.76 | –6 | –6.24 | V |
| Output voltage tolerance | V_O | $V_I = -9$ to -21V , $I_O = 1$ to 70mA | –5.7 | — | –6.3 | V |
| Line regulation | REG_{IN} | $V_I = -8$ to -22V , $T_j = 25^\circ\text{C}$ | — | — | 120 | mV |
| | | $V_I = -9$ to -19V , $T_j = 25^\circ\text{C}$ | — | — | 60 | mV |
| Load regulation | REG_{L} | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 12 | 60 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 5.5 | 30 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -9$ to -21V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 44 | — | μV |
| Ripple rejection ratio | RR | $V_I = -9$ to -19V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 55 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | –0.4 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -11\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C

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

• AN79L07 (-7V type)

| Parameter | Symbol | Conditions | 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 | $V_I = -10$ to -22V , $I_O = 1$ to 70mA | -6.65 | — | -7.35 | V |
| Line regulation | REG _{IN} | $V_I = -9$ to -23V , $T_j = 25^\circ\text{C}$ | — | — | 140 | mV |
| | | $V_I = -10$ to -20V , $T_j = 25^\circ\text{C}$ | — | — | 70 | mV |
| Load regulation | REG _L | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 13 | 70 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 6 | 40 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -10$ to -22V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 48 | — | μV |
| Ripple rejection ratio | RR | $V_I = -10$ to -20V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 54 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | -0.5 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -12\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C

• AN79L08, AN79L08M (-8V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|-------|------|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | -7.68 | -8 | -8.32 | V |
| Output voltage tolerance | V_O | $V_I = -11$ to -23V , $I_O = 1$ to 70mA | -7.6 | — | -8.4 | V |
| Line regulation | REG _{IN} | $V_I = -10$ to -24V , $T_j = 25^\circ\text{C}$ | — | — | 160 | mV |
| | | $V_I = -11$ to -21V , $T_j = 25^\circ\text{C}$ | — | — | 80 | 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} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -11$ to -23V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 52 | — | μV |
| Ripple rejection ratio | RR | $V_I = -11$ to -21V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 54 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$, $T_j = 0$ to 125°C | — | -0.6 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -14\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C (AN79L08) and $T_j = 0$ to 100°C (AN79L08M)

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

• AN79L09, AN79L09M (–9V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|-------|------|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | –8.64 | –9 | –9.36 | V |
| Output voltage tolerance | V_O | $V_I = -12$ to -24V , $I_O = 1$ to 70mA | –8.55 | — | –9.45 | V |
| Line regulation | REG_{IN} | $V_I = -11$ to -25V , $T_j = 25^\circ\text{C}$ | — | — | 160 | mV |
| | | $V_I = -12$ to -22V , $T_j = 25^\circ\text{C}$ | — | — | 80 | mV |
| Load regulation | REG_{L} | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 16 | 90 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 8 | 50 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -12$ to -24V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 58 | — | μV |
| Ripple rejection ratio | RR | $V_I = -12$ to -22V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 53 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$, $T_j = 0$ to 125°C | — | –0.6 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -15\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C (AN79L09) and $T_j = 0$ to 100°C (AN79L09M)

• AN79L10 (–10V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|------|------|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | –9.6 | –10 | –10.4 | V |
| Output voltage tolerance | V_O | $V_I = -13$ to -25V , $I_O = 1$ to 70mA | –9.5 | — | –10.5 | V |
| Line regulation | REG_{IN} | $V_I = -12$ to -26V , $T_j = 25^\circ\text{C}$ | — | — | 160 | mV |
| | | $V_I = -13$ to -23V , $T_j = 25^\circ\text{C}$ | — | — | 80 | mV |
| Load regulation | REG_{L} | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 17 | 100 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 9 | 50 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -13$ to -25V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 65 | — | μV |
| Ripple rejection ratio | RR | $V_I = -13$ to -23V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 53 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | –0.7 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -16\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C

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

• AN79L12, AN79L12M (–12V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|-------|------|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | -11.5 | -12 | -12.5 | V |
| Output voltage tolerance | V_O | $V_I = -15$ to -27V , $I_O = 1$ to 70mA | -11.4 | — | -12.6 | V |
| Line regulation | REG_{IN} | $V_I = -14.5$ to -30V , $T_j = 25^\circ\text{C}$ | — | — | 200 | mV |
| | | $V_I = -15$ to -25V , $T_j = 25^\circ\text{C}$ | — | — | 100 | mV |
| Load regulation | REG_L | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 20 | 100 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 10 | 50 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -15$ to -27V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 75 | — | μV |
| Ripple rejection ratio | RR | $V_I = -15$ to -25V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 52 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | -0.8 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -19\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C (AN79L12) and $T_j = 0$ to 100°C (AN79L12M)

• AN79L15, AN79L15M (–15V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|--------|------|--------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | -14.4 | -15 | -15.6 | V |
| Output voltage tolerance | V_O | $V_I = -18$ to -28V , $I_O = 1$ to 70mA | -14.25 | — | -15.75 | V |
| Line regulation | REG_{IN} | $V_I = -17.5$ to -33V , $T_j = 25^\circ\text{C}$ | — | — | 200 | mV |
| | | $V_I = -18$ to -28V , $T_j = 25^\circ\text{C}$ | — | — | 100 | mV |
| Load regulation | REG_L | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 25 | 130 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 12 | 60 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -18$ to -30V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 90 | — | μV |
| Ripple rejection ratio | RR | $V_I = -18$ to -28V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 51 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | -0.9 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -23\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C (AN79L15) and $T_j = 0$ to 100°C (AN79L15M)

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

• AN79L18 (-18V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|-------|-----|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | -17.3 | -18 | -18.7 | V |
| Output voltage tolerance | V_O | $V_I = -21$ to -33V , $I_O = 1$ to 70mA | -17.1 | — | -18.9 | V |
| Line regulation | REG_{IN} | $V_I = -21$ to -33V , $T_j = 25^\circ\text{C}$ | — | — | 200 | mV |
| | | $V_I = -21$ to -32V , $T_j = 25^\circ\text{C}$ | — | — | 100 | mV |
| Load regulation | REG_{L} | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 30 | 160 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 15 | 80 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -21$ to -33V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 110 | — | μV |
| Ripple rejection ratio | RR | $V_I = -22$ to -32V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 50 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | -1 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -27\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C

• AN79L20 (-20V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|-------|-----|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | -19.2 | -20 | -20.8 | V |
| Output voltage tolerance | V_O | $V_I = -23$ to -35V , $I_O = 1$ to 70mA | -19 | — | -21 | V |
| Line regulation | REG_{IN} | $V_I = -23$ to -35V , $T_j = 25^\circ\text{C}$ | — | — | 200 | mV |
| | | $V_I = -24$ to -34V , $T_j = 25^\circ\text{C}$ | — | — | 100 | mV |
| Load regulation | REG_{L} | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 35 | 180 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 17 | 90 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -23$ to -35V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 135 | — | μV |
| Ripple rejection ratio | RR | $V_I = -24$ to -34V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 49 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | -1 | — | $\text{mV}/^\circ\text{C}$ |

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

Note 2) Unless otherwise specified, $V_I = -29\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C

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

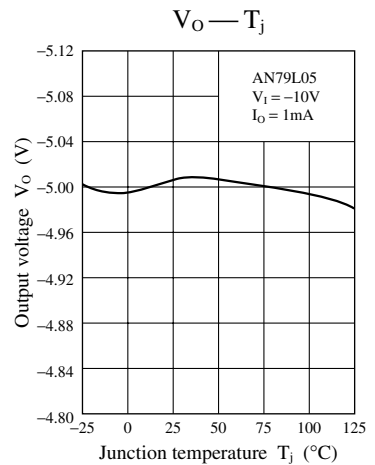
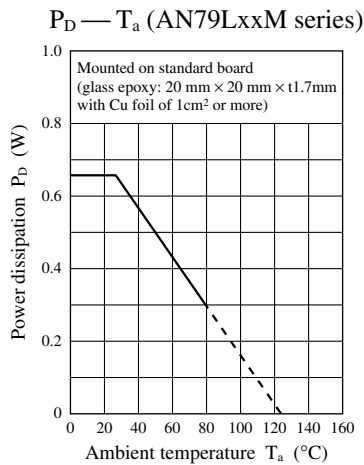
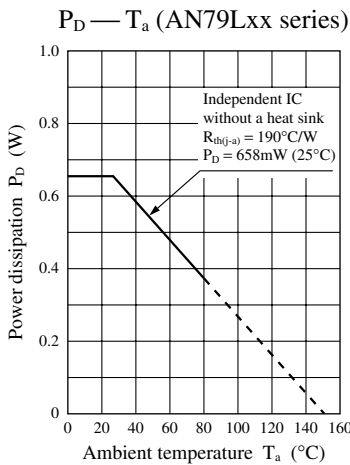
• AN79L24 (-24V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|-------|-----|-------|----------------------------|
| Output voltage | V_O | $T_j = 25^\circ\text{C}$ | -23 | -24 | -25 | V |
| Output voltage tolerance | V_O | $V_I = -27$ to -38V , $I_O = 1$ to 70mA | -22.8 | — | -25.2 | V |
| Line regulation | REG_{IN} | $V_I = -27$ to -38V , $T_j = 25^\circ\text{C}$ | — | — | 200 | mV |
| | | $V_I = -27$ to -37V , $T_j = 25^\circ\text{C}$ | — | — | 100 | mV |
| Load regulation | REG_L | $I_O = 1$ to 100mA , $T_j = 25^\circ\text{C}$ | — | 40 | 200 | mV |
| | | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | 20 | 100 | mV |
| Bias current | I_{Bias} | $T_j = 25^\circ\text{C}$ | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{\text{Bias(IN)}}$ | $V_I = -27$ to -38V , $T_j = 25^\circ\text{C}$ | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{\text{Bias(L)}}$ | $I_O = 1$ to 40mA , $T_j = 25^\circ\text{C}$ | — | — | 0.1 | mA |
| Output noise voltage | V_{no} | $f = 10\text{Hz}$ to 100kHz , $T_a = 25^\circ\text{C}$ | — | 170 | — | μV |
| Ripple rejection ratio | RR | $V_I = -28$ to -38V , $f = 120\text{Hz}$, $T_a = 25^\circ\text{C}$ | 49 | — | — | dB |
| Minimum input/output voltage difference | $V_{\text{DIF(min)}}$ | $T_j = 25^\circ\text{C}$ | — | 0.8 | — | V |
| Output short-circuit current | $I_{\text{O(Short)}}$ | $V_I = -35\text{V}$, $T_j = 25^\circ\text{C}$ | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O = 5\text{mA}$ | — | -1 | — | $\text{mV}/^\circ\text{C}$ |

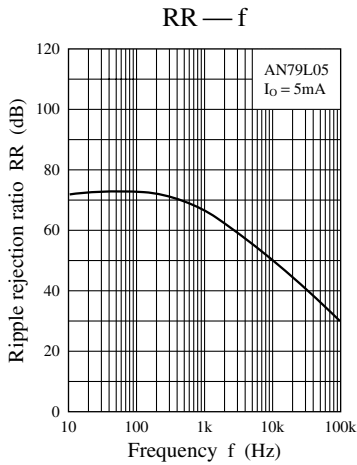
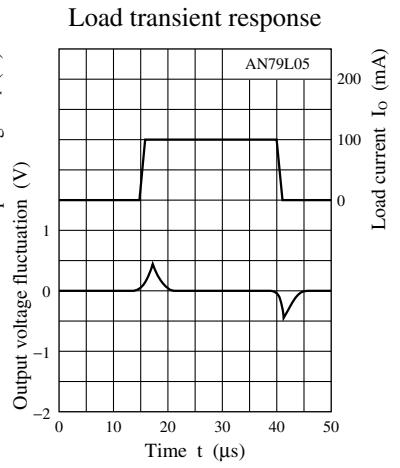
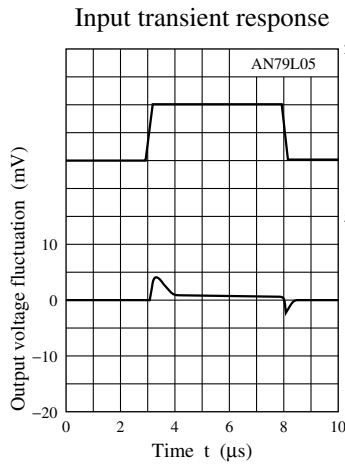
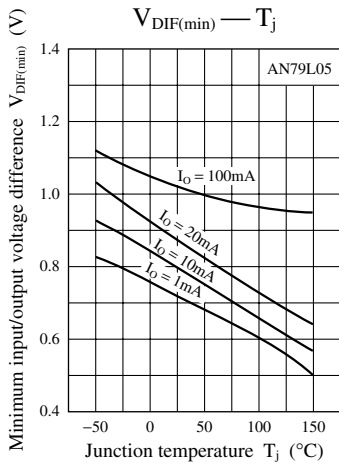
Note 1) The specified condition $T_j = 25^\circ\text{C}$ means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.

Note 2) Unless otherwise specified, $V_I = -33\text{V}$, $I_O = 40\text{mA}$, $C_I = 2\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_j = 0$ to 125°C

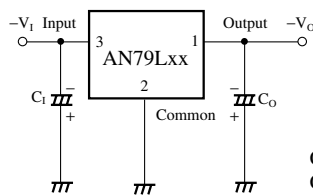
■ Main Characteristics



■ Main Characteristics (continued)



■ Basic Regulator Circuit



Connect C_i of $2\mu F$ when the input line is long.
 C_o improves the transient response. $1\mu F$

■ Usage Notes

1. Cautions for a basic circuit

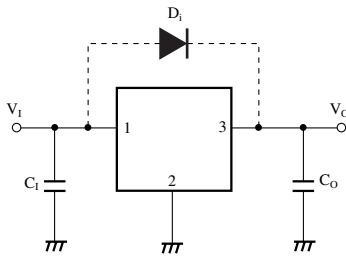


Figure 1

C₁: When a wiring from a smoothing circuit to a three-pin regulator is long, it is likely to oscillate at output. A capacitor of 0.1μF to 0.47μF should be connected near an input pin.

C_O: Deadly needed to prevent from oscillation (0.33μF to 1.0μF). It is recommended to use a capacitor of a small internal impedance (ex. tantalum capacitor) when using it under a low temperature.

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

D₁: Normally unnecessary. But add it in the case that there is a residual voltage at the output capacitor Co even after switching off the supply power because a current is likely to flow into an output pin of the IC and damage the IC.

2. Other caution items

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

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

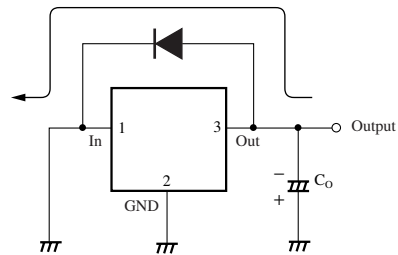
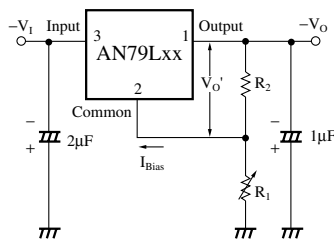


Figure 2

2) Floating of GND pin

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

■ Application Circuit Example

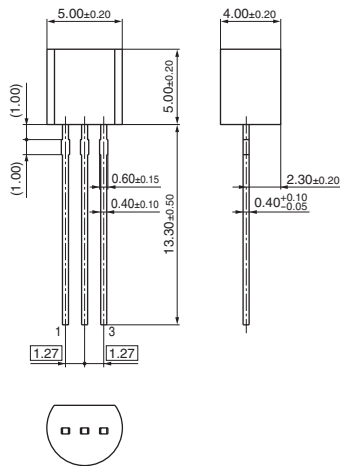


$$|V_o| = V_o' \left(1 + \frac{R_1}{R_2} \right) + I_Q R_1$$

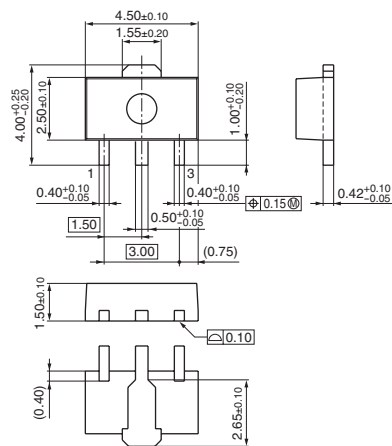
Note) V_O varies due to sample to sample variation of I_{Bias} .
Never fail to adjust individually with R₁ .

■ New Package Dimensions (Unit: mm)

- SSIP003-P-0000S (Lead-free package)



- HSIP003-P-0000Q (Lead-free package)



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