# AN79Lxx/AN79LxxM Series

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

### ■ Overview

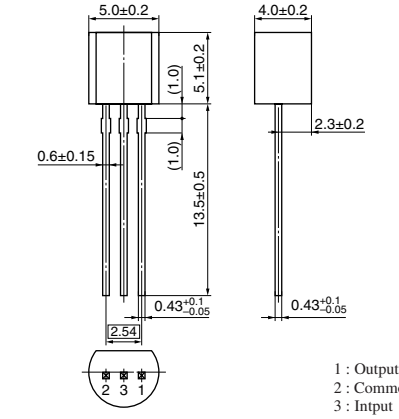
The AN79Lxx series and the AN79LxxM series are 3-pin, fixed negative output type monolithic voltage regulators.

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

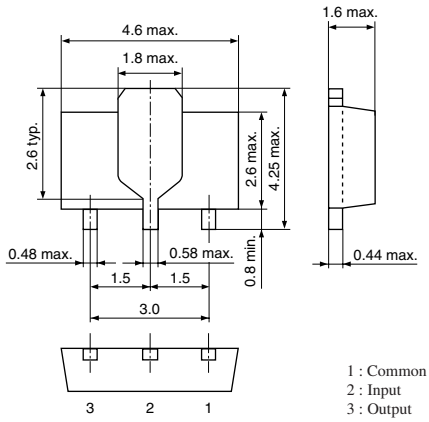
- No external components
- Output voltage: –4V, –5V, –6V, –7V, –8V, –9V,–10V, –12V, –15V, –18V, –20V, –24V
- Built-in overcurrent limit circuit
- Built-in thermal overload protection circuit

AN79Lxx series Unit: mm




SSIP003-P-0000

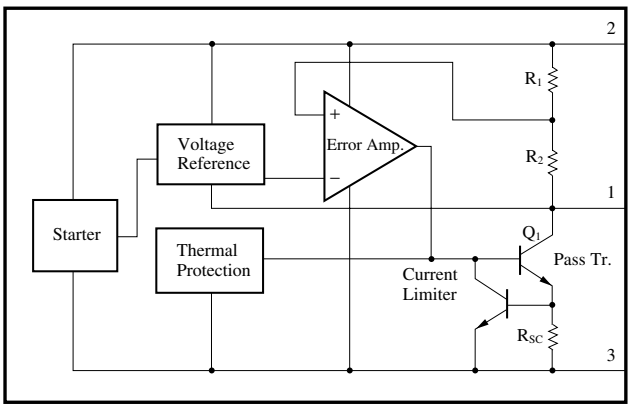
AN79LxxM series Unit: mm




HSIP003-P-0000B

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.

### ■ Block Diagram (AN79Lxx series)




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

## ■ Absolute Maximum Ratings at $T_a$ = 25°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 | °C |
| Storage temperature | AN79Lxx series | $T_{stg}$ | −55 to +150 | °C |
| | AN79LxxM series | | −55 to +125 | |

*1 AN79L04, AN79L05/M, AN79L06, AN79L07/M, AN79L08/M, AN79L09/M, AN79L10/M, 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: 20mm × 20mm × t1.7mm with Cu foil of 1cm² or more).

## ■ Electrical Characteristics at $T_a$ = 25°C

• AN79L04 (−4V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = −9V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C

## ■ Electrical Characteristics at $T_a$ = 25°C (continued)

• AN79L05, AN79L05M (–5V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –10V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 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°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°C | — | — | 120 | mV |
| | | $V_I$ = –9 to –19V, $T_j$ = 25°C | — | — | 60 | mV |
| Load regulation | $REG_L$ | $I_O$ = 1 to 100mA, $T_j$ = 25°C | — | 12 | 60 | mV |
| | | $I_O$ = 1 to 40mA, $T_j$ = 25°C | — | 5.5 | 30 | mV |
| Bias current | $I_{Bias}$ | $T_j$ = 25°C | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{Bias(IN)}$ | $V_I$ = –9 to –21V, $T_j$ = 25°C | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{Bias(L)}$ | $I_O$ = 1 to 40mA, $T_j$ = 25°C | — | — | 0.1 | mA |
| Output noise voltage | $V_{no}$ | f = 10Hz to 100kHz, $T_a$ = 25°C | — | 44 | — | μV |
| Ripple rejection ratio | RR | $V_I$ = –9 to –19V, f = 120Hz, $T_a$ = 25°C | 55 | — | — | dB |
| Minimum input/output voltage difference | $V_{DIF(min)}$ | $T_j$ = 25°C | — | 0.8 | — | V |
| Output short-circuit current | $I_{O(Short)}$ | $V_I$ = –35V, $T_j$ = 25°C | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O$ = 5mA | — | – 0.4 | — | mV/°C |

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –11V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C

## ■ Electrical Characteristics at $T_a$ = 25°C (continued)

• AN79L07, AN79L07M (–7V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –12V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C (AN79L07) and $T_j$ = 0 to 100°C (AN79L07M)

• AN79L08, AN79L08M (–8V type)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output voltage | $V_O$ | $T_j$ = 25°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°C | — | — | 160 | mV |
| | | $V_I$ = –11 to –21V, $T_j$ = 25°C | — | — | 80 | mV |
| Load regulation | $REG_L$ | $I_O$ = 1 to 100mA, $T_j$ = 25°C | — | 15 | 80 | mV |
| | | $I_O$ = 1 to 40mA, $T_j$ = 25°C | — | 7 | 40 | mV |
| Bias current | $I_{Bias}$ | $T_j$ = 25°C | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{Bias(IN)}$ | $V_I$ = –11 to –23V, $T_j$ = 25°C | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{Bias(L)}$ | $I_O$ = 1 to 40mA, $T_j$ = 25°C | — | — | 0.1 | mA |
| Output noise voltage | $V_{no}$ | f = 10Hz to 100kHz, $T_a$ = 25°C | — | 52 | — | μV |
| Ripple rejection ratio | RR | $V_I$ = –11 to –21V, f = 120Hz, $T_a$ = 25°C | 54 | — | — | dB |
| Minimum input/output voltage difference | $V_{DIF(min)}$ | $T_j$ = 25°C | — | 0.8 | — | V |
| Output short-circuit current | $I_{O(Short)}$ | $V_I$ = –35V, $T_j$ = 25°C | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O$ = 5mA, $T_j$ = 0 to 125°C | — | – 0.6 | — | mV/°C |

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –14V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C (AN79L08) and $T_j$ = 0 to 100°C (AN79L08M)

## ■ Electrical Characteristics at $T_a$ = 25°C (continued)

• AN79L09, AN79L09M (–9V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –15V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C (AN79L09) and $T_j$ = 0 to 100°C (AN79L09M)

• AN79L10, AN79L10M (–10V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –16V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C (AN79L10) and $T_j$ = 0 to 100°C (AN79L10M)

## ■ Electrical Characteristics at $T_a$ = 25°C (continued)

• AN79L12, AN79L12M (–12V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –19V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 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°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°C | — | — | 200 | mV |
| | | $V_I$ = –18 to –28V, $T_j$ = 25°C | — | — | 100 | mV |
| Load regulation | $REG_L$ | $I_O$ = 1 to 100mA, $T_j$ = 25°C | — | 25 | 130 | mV |
| | | $I_O$ = 1 to 40mA, $T_j$ = 25°C | — | 12 | 60 | mV |
| Bias current | $I_{Bias}$ | $T_j$ = 25°C | — | 3 | 5 | mA |
| Bias current fluctuation to input | $\Delta I_{Bias(IN)}$ | $V_I$ = –18 to –30V, $T_j$ = 25°C | — | — | 0.5 | mA |
| Bias current fluctuation to load | $\Delta I_{Bias(L)}$ | $I_O$ = 1 to 40mA, $T_j$ = 25°C | — | — | 0.1 | mA |
| Output noise voltage | $V_{no}$ | f = 10Hz to 100kHz, $T_a$ = 25°C | — | 90 | — | μV |
| Ripple rejection ratio | RR | $V_I$ = –18 to –28V, f = 120Hz, $T_a$ = 25°C | 51 | — | — | dB |
| Minimum input/output voltage difference | $V_{DIF(min)}$ | $T_j$ = 25°C | — | 0.8 | — | V |
| Output short-circuit current | $I_{O(Short)}$ | $V_I$ = –35V, $T_j$ = 25°C | — | 200 | — | mA |
| Output voltage temperature coefficient | $\Delta V_O/T_a$ | $I_O$ = 5mA | — | – 0.9 | — | mV/°C |

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –23V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C (AN79L15) and $T_j$ = 0 to 100°C (AN79L15M)

■ Electrical Characteristics at $T_a$ = 25°C (continued)

• AN79L18 (–18V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –27V, $I_O$ = 40mA, $C_I$ = 2µF, $C_O$ = 1µF, $T_j$ = 0 to 125°C

• AN79L20 (–20V type)

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

Note 1) The specified condition $T_j$ = 25°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, $V_I$ = –29V, $I_O$ = 40mA, $C_I$ = 2µF, $C_O$ = 1µF, $T_j$ = 0 to 125°C

## ■ Electrical Characteristics at $T_a$ = 25°C (continued)

• AN79L24 (–24V type)

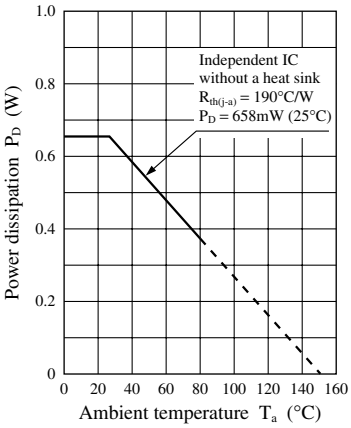
| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output voltage | $V_O$ | $T_j$ = 25°C | –23 | –24 | –25 | V |
| Output voltage tolerance | $V_O$ | $V_I$ = –27 to –38V, $I_O$ = 1 to 70mA | –22.8 | — | –25.2 | V |
| Line regulation | $REG_{IN}$ | $V_I$ = –27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

Note 1) The specified condition $T_j$ = 25°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.

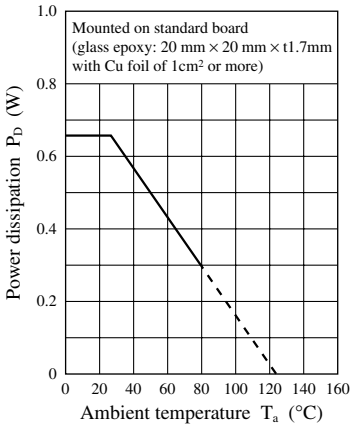
Note 2) Unless otherwise specified, $V_I$ = –33V, $I_O$ = 40mA, $C_I$ = 2μF, $C_O$ = 1μF, $T_j$ = 0 to 125°C

## ■ Main Characteristics

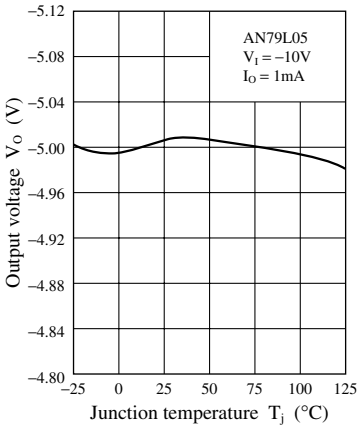
$P_D$ — $T_a$ (AN79Lxx series)




$P_D$ — $T_a$ (AN79LxxM series)

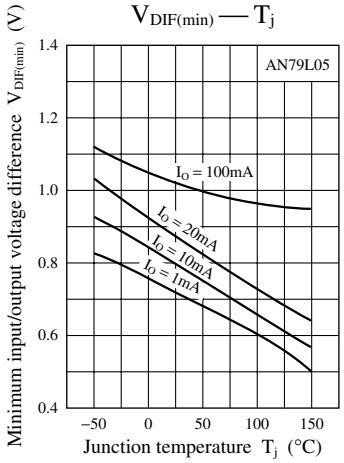



$V_O$ — $T_j$

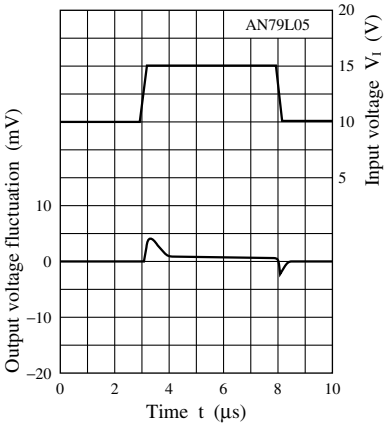


## ■ Main Characteristics (continued)

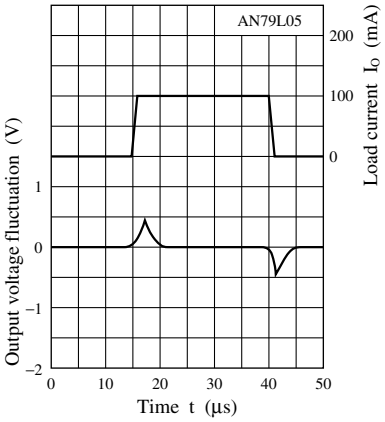
$V_{DIF(min)}$ — $T_j$



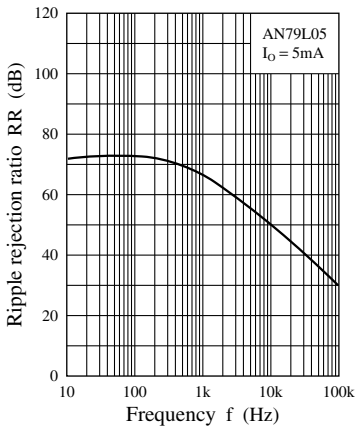

Input transient response



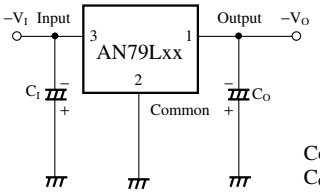

Load transient response




RR — f




## ■ Basic Regulator Circuit




Connect $C_I$ of 2µF when the input line is long.
$C_O$ improves the transient response. 1µF

## ■ Usage Notes

### 1. Cautions for a basic circuit

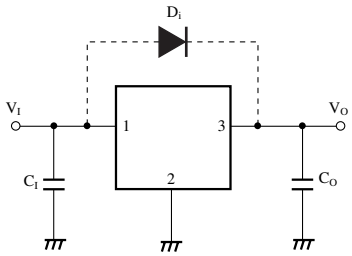



Figure 1

$C_I$: 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.

$D_i$: 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-circuitted 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.

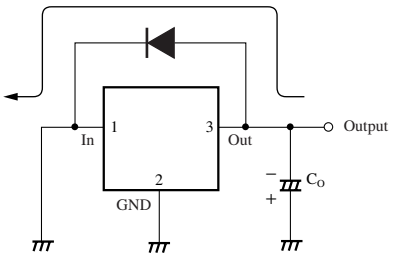
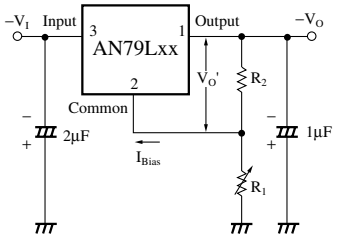



Figure 2

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

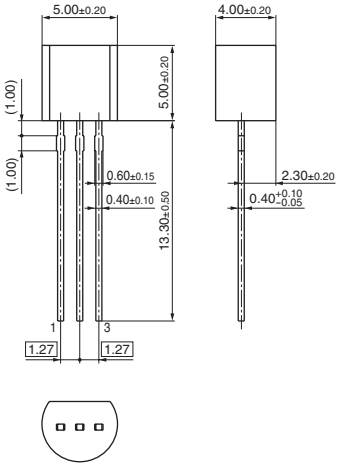



$$|V_O| = V_O'\left(1 + \frac{R_1}{R_2}\right) + I_Q R_1$$

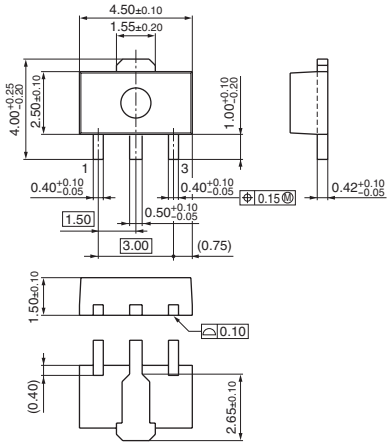
Note) $V_O$ varies due to sample to sample variation of $I_{Bias}$ .
Never fail to adjust individually with $R_1$ .

■ New Package Dimensions (Unit: mm)

• SSIP003-P-0000S (Lead-free package)




• HSIP003-P-0000Q (Lead-free package)



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