

# AN79Lxx/AN79LxxM Series

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

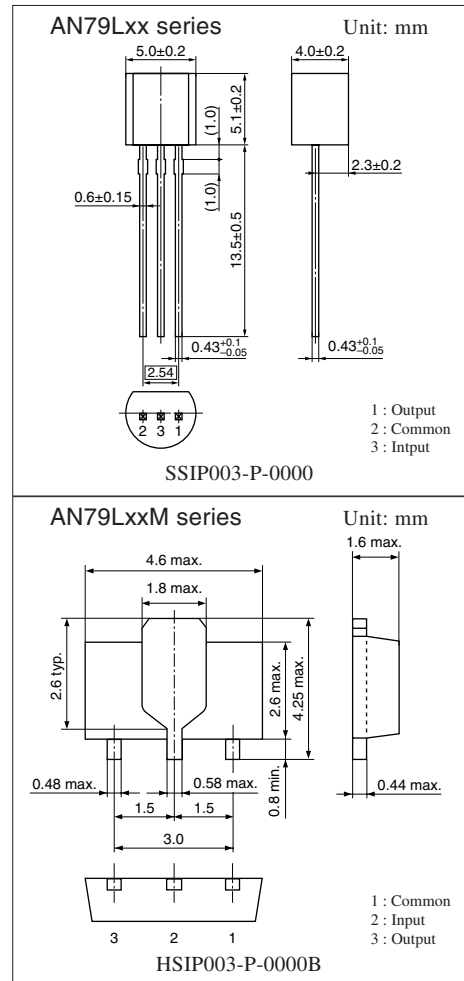
### ■ Overview

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

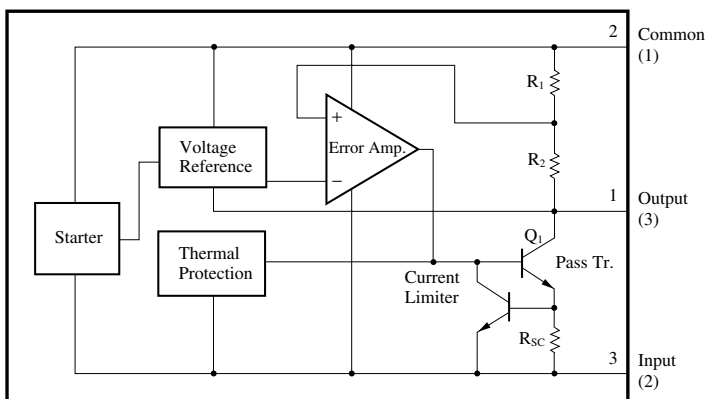
Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 12 types of output voltage are available:  $-4V$ ,  $-5V$ ,  $-6V$ ,  $-7V$ ,  $-8V$ ,  $-9V$ ,  $-10V$ ,  $-12V$ ,  $-15V$ ,  $-18V$ ,  $-20V$  and  $-24V$ . They can be used widely in power 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 <sup>*1</sup>	V
			-40 <sup>*2</sup>	V
Power dissipation		$P_D$	650 <sup>*3</sup>	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/M, AN79L08/M, AN79L09/M, AN79L10/M, AN79L12/M, AN79L15/M, AN79L18

\*2 AN79L20, AN79L24

\*3 Follow the derating curve. When  $T_j$  exceeds  $150^\circ\text{C}$ , 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 1cm<sup>2</sup> 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 $-19\text{V}$ , $I_O = 1$ to $70\text{mA}$	-3.8	—	-4.2	V
Line regulation	$REG_{IN}$	$V_I = -6$ to $-20\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	80	mV
		$V_I = -7$ to $-17\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	40	mV
Load regulation	$REG_L$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	10	60	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	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 $-19\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{no}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	38	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -7$ to $-17\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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  $125^\circ\text{C}$

### ■ 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 $-20\text{V}$ , $I_O = 1$ to $70\text{mA}$	–4.75	—	–5.25	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -7$ to $-21\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	100	mV
		$V_I = -8$ to $-18\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	50	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	11	60	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	5	30	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -8$ to $-20\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	40	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -8$ to $-18\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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  $125^\circ\text{C}$  (AN79L05) and  $T_j = 0$  to  $100^\circ\text{C}$  (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 $-21\text{V}$ , $I_O = 1$ to $70\text{mA}$	–5.7	—	–6.3	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -8$ to $-22\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	120	mV
		$V_I = -9$ to $-19\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	60	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	12	60	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	5.5	30	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -9$ to $-21\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	44	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -9$ to $-19\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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  $125^\circ\text{C}$

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

• AN79L07, AN79L07M (–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 $-22\text{V}$ , $I_O = 1$ to $70\text{mA}$	–6.65	—	–7.35	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -9$ to $-23\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	140	mV
		$V_I = -10$ to $-20\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	70	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	13	70	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	6	40	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -10$ to $-22\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	48	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -10$ to $-20\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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  $125^\circ\text{C}$  (AN79L07) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L07M)

• 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 $-23\text{V}$ , $I_O = 1$ to $70\text{mA}$	–7.6	—	–8.4	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -10$ to $-24\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	160	mV
		$V_I = -11$ to $-21\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	80	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	15	80	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	7	40	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -11$ to $-23\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	52	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -11$ to $-21\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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 $125^\circ\text{C}$	—	–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 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  $125^\circ\text{C}$  (AN79L08) and  $T_j = 0$  to  $100^\circ\text{C}$  (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 $-24\text{V}$ , $I_O = 1$ to $70\text{mA}$	–8.55	—	–9.45	V
Line regulation	REG <sub>IN</sub>	$V_I = -11$ to $-25\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	160	mV
		$V_I = -12$ to $-22\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	80	mV
Load regulation	REG <sub>L</sub>	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	16	90	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	8	50	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -12$ to $-24\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	58	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -12$ to $-22\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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 $125^\circ\text{C}$	—	–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 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  $125^\circ\text{C}$  (AN79L09) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L09M)

#### • AN79L10, AN79L10M (–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 $-25\text{V}$ , $I_O = 1$ to $70\text{mA}$	–9.5	—	–10.5	V
Line regulation	REG <sub>IN</sub>	$V_I = -12$ to $-26\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	160	mV
		$V_I = -13$ to $-23\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	80	mV
Load regulation	REG <sub>L</sub>	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	17	100	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	9	50	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -13$ to $-25\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	65	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -13$ to $-23\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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  $125^\circ\text{C}$  (AN79L10) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L10M)

### ■ 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 $-27\text{V}$ , $I_O = 1$ to $70\text{mA}$	-11.4	—	-12.6	V
Line regulation	REG <sub>IN</sub>	$V_I = -14.5$ to $-30\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	200	mV
		$V_I = -15$ to $-25\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	100	mV
Load regulation	REG <sub>L</sub>	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	20	100	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	10	50	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -15$ to $-27\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	75	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -15$ to $-25\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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	—	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  $125^\circ\text{C}$  (AN79L12) and  $T_j = 0$  to  $100^\circ\text{C}$  (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 $-28\text{V}$ , $I_O = 1$ to $70\text{mA}$	-14.25	—	-15.75	V
Line regulation	REG <sub>IN</sub>	$V_I = -17.5$ to $-33\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	200	mV
		$V_I = -18$ to $-28\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	100	mV
Load regulation	REG <sub>L</sub>	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	25	130	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	12	60	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -18$ to $-30\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	90	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -18$ to $-28\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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	—	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  $125^\circ\text{C}$  (AN79L15) and  $T_j = 0$  to  $100^\circ\text{C}$  (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 $-33\text{V}$ , $I_O = 1$ to $70\text{mA}$	-17.1	—	-18.9	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -21$ to $-33\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	200	mV
		$V_I = -21$ to $-32\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	100	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	30	160	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	15	80	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -21$ to $-33\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	110	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -22$ to $-32\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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  $125^\circ\text{C}$

#### • 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 $-35\text{V}$ , $I_O = 1$ to $70\text{mA}$	-19	—	-21	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -23$ to $-35\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	200	mV
		$V_I = -24$ to $-34\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	100	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	35	180	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	17	90	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -23$ to $-35\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	135	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -24$ to $-34\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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  $125^\circ\text{C}$

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

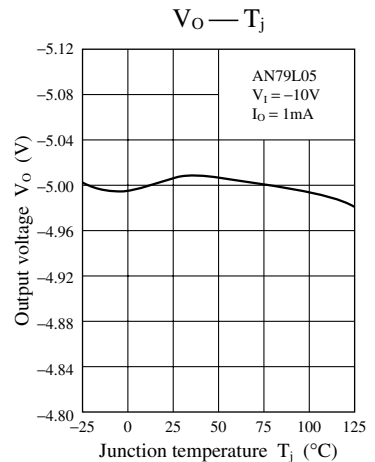
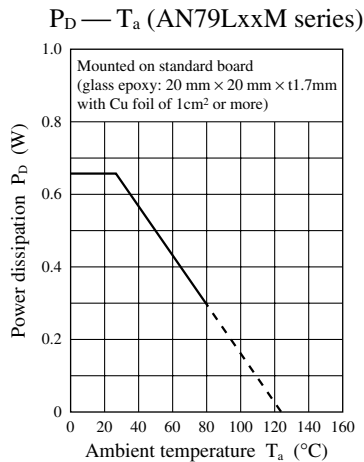
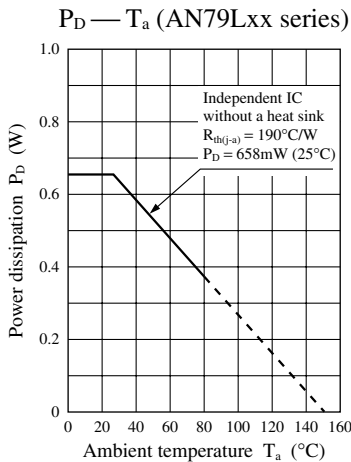
• AN79L24 (-24V type)

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 $-38\text{V}$ , $I_O = 1$ to $70\text{mA}$	-22.8	—	-25.2	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -27$ to $-38\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	200	mV
		$V_I = -27$ to $-37\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	100	mV
Load regulation	$\text{REG}_L$	$I_O = 1$ to $100\text{mA}$ , $T_j = 25^\circ\text{C}$	—	40	200	mV
		$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	20	100	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3	5	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = -27$ to $-38\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 1$ to $40\text{mA}$ , $T_j = 25^\circ\text{C}$	—	—	0.1	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$ , $T_a = 25^\circ\text{C}$	—	170	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = -28$ to $-38\text{V}$ , $f = 120\text{Hz}$ , $T_a = 25^\circ\text{C}$	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	—	$\text{mV}/^\circ\text{C}$

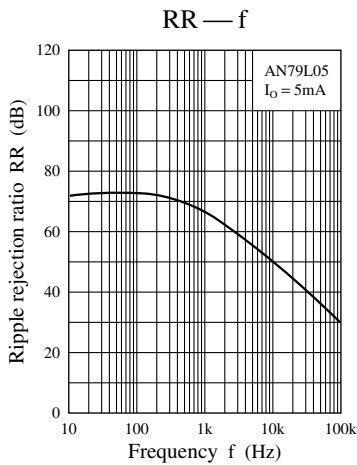
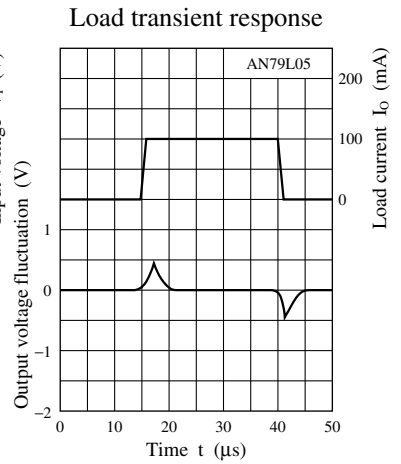
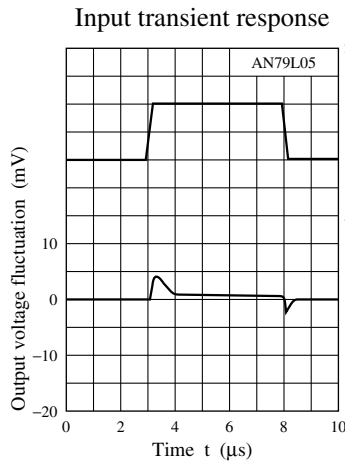
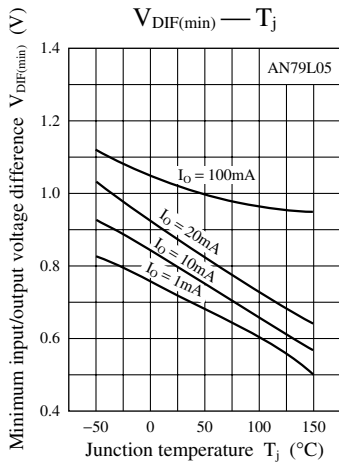
Note 1) The specified condition  $T_j = 25^\circ\text{C}$  means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.

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  $125^\circ\text{C}$

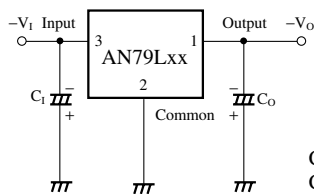
■ Main Characteristics



■ 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

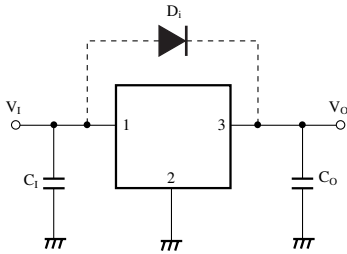


Figure 1

C<sub>I</sub>: 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<sub>O</sub>: 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<sub>I</sub>: Normally unnecessary. But add it in the case that there is a residual voltage at the output capacitor C<sub>O</sub> 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.

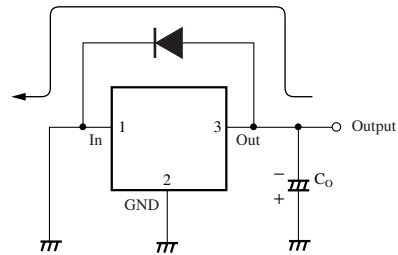
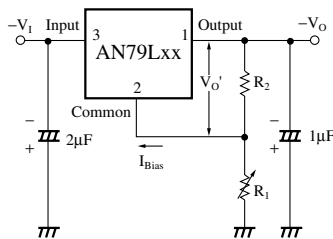


Figure 2

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

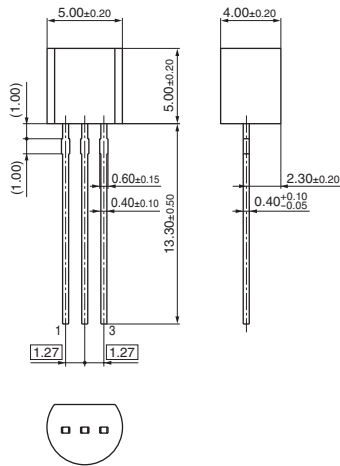


$$|V_O| = V_O' \left( 1 + \frac{R_1}{R_2} \right) + I_Q R_1$$

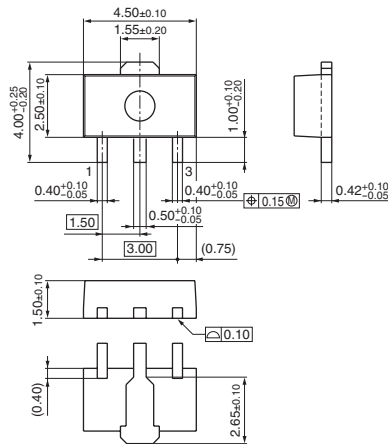
(Note) V<sub>O</sub> varies due to sample to sample variation of I<sub>Bias</sub> .  
Never fail to adjust individually with R<sub>1</sub> .

■ New Package Dimensions (Unit: mm)

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



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



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