

## AN79Lxx/AN79LxxM Series

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

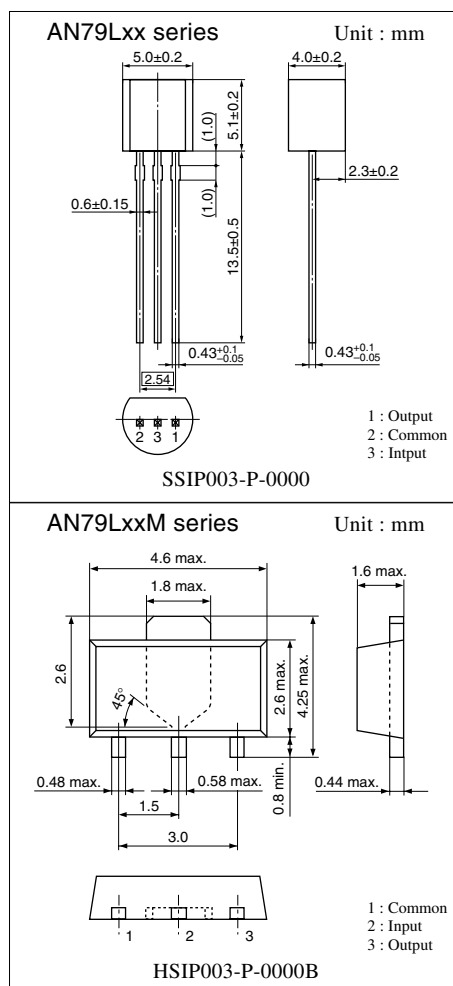
## ■ Overview

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

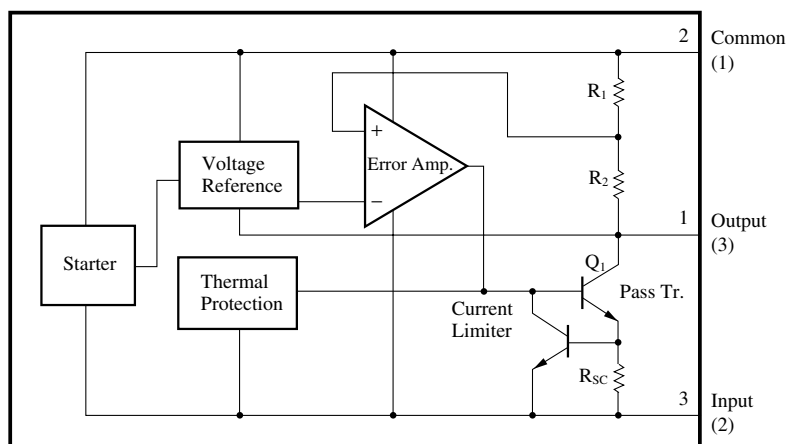
Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 12 types of output voltage are available:  $-4\text{V}$ ,  $-5\text{V}$ ,  $-6\text{V}$ ,  $-7\text{V}$ ,  $-8\text{V}$ ,  $-9\text{V}$ ,  $-10\text{V}$ ,  $-12\text{V}$ ,  $-15\text{V}$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

## ■ 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.

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

Parameter		Symbol	Rating	Unit
Input voltage		V <sub>I</sub>	−35 <sup>*1</sup>	V
			−40 <sup>*2</sup>	V
Power dissipation		P <sub>D</sub>	650 <sup>*3</sup>	mW
Operating ambient temperature		T <sub>opr</sub>	−20 to +80	°C
Storage temperature	AN79Lxx series	T <sub>stg</sub>	−55 to +150	°C
	AN79LxxM series		−55 to +125	

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

\*2 AN79L20/M, AN79L24/M

\*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:  $20\text{mm} \times 20\text{mm} \times 1.7\text{mm}$  with Cu foil of  $1\text{cm}^2$  or more).

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

#### • AN79L04, AN79L04M ( $-4\text{V}$ 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	$\text{REG}_{IN}$	$V_i = -6$ 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	$\text{REG}_L$	$I_O = 1$ 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,  $V_i = -9\text{V}$ ,  $I_O = 40\text{mA}$ ,  $C_1 = 2\mu\text{F}$ ,  $C_O = 1\mu\text{F}$ ,  $T_j = 0$  to  $125^\circ\text{C}$  (AN79L04) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L04M)

■ 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	$\text{REG}_L$	$I_O = 1$ 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, AN79L06M (–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	$\text{REG}_L$	$I_O = 1$ 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  $125^\circ\text{C}$  (AN79L06) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L06M)

# ■ 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	$\text{REG}_L$	$I_O = 1$ 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	$\text{REG}_L$	$I_O = 1$ 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	$\text{REG}_{\text{IN}}$	$V_I = -11$ 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	$\text{REG}_L$	$I_O = 1$ 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	$\text{REG}_{\text{IN}}$	$V_I = -12$ 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	$\text{REG}_L$	$I_O = 1$ 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	$\text{REG}_{\text{IN}}$	$V_I = -14.5$ 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	$\text{REG}_L$	$I_O = 1$ 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	—	$\text{mV}/^\circ\text{C}$

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  $125^\circ\text{C}$  (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	$\text{REG}_{\text{IN}}$	$V_I = -17.5$ 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	$\text{REG}_L$	$I_O = 1$ 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	—	$\text{mV}/^\circ\text{C}$

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  $125^\circ\text{C}$  (AN79L15) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L15M)

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

• AN79L18, AN79L18M (–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	$\text{REG}_L$	$I_O = 1$ 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  $125^\circ\text{C}$  (AN79L18) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L18M)

• AN79L20, AN79L20M (–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	$\text{REG}_L$	$I_O = 1$ 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  $125^\circ\text{C}$  (AN79L20) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L20M)

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

## • AN79L24, AN79L24M (–24V type)

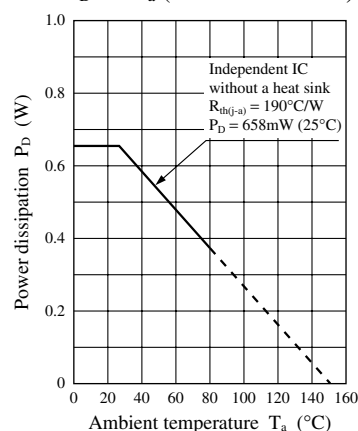
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	$V_O$	$T_j = 25^\circ\text{C}$	–23	–24	–25	V
Output voltage tolerance	$V_O$	$V_I = -27$ to $-38\text{V}$ , $I_O = 1$ to $70\text{mA}$	–22.8	—	–25.2	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = -27$ to $-38\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	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.

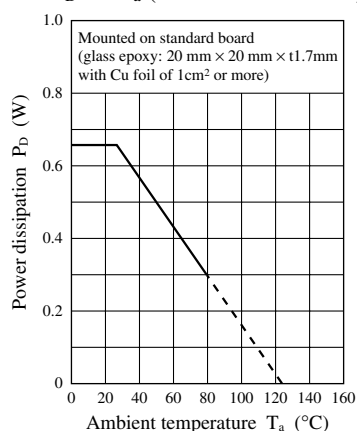
Note 2) Unless otherwise specified,  $V_I = -33\text{V}$ ,  $I_O = 40\text{mA}$ ,  $C_I = 2\mu\text{F}$ ,  $C_O = 1\mu\text{F}$ ,  $T_j = 0$  to  $125^\circ\text{C}$  (AN79L24) and  $T_j = 0$  to  $100^\circ\text{C}$  (AN79L24M)

# ■ Main Characteristics

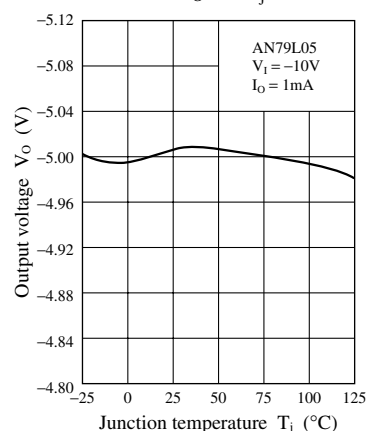
$P_D$  —  $T_a$  (AN79Lxx series)



$P_D$  —  $T_a$  (AN79LxxM series)

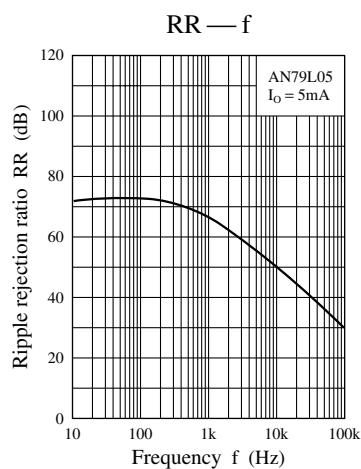
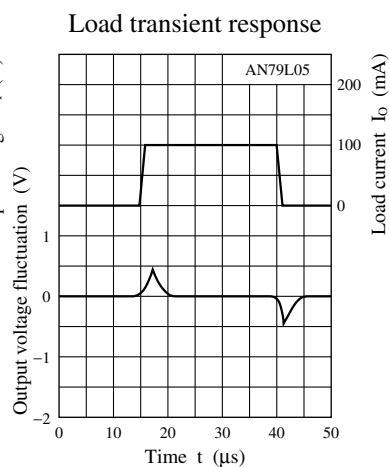
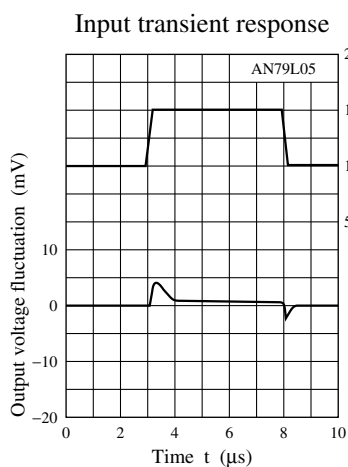
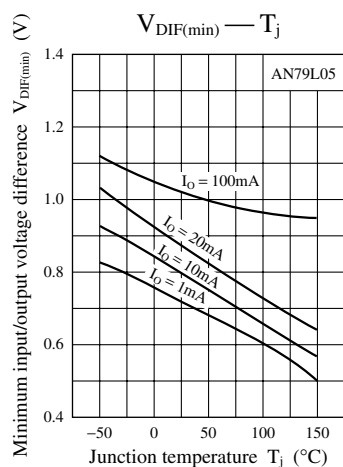


$V_O$  —  $T_j$

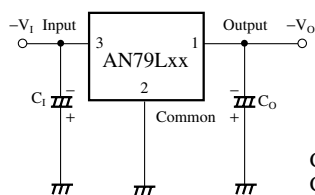




## ■ Main Characteristics (continued)



## ■ 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

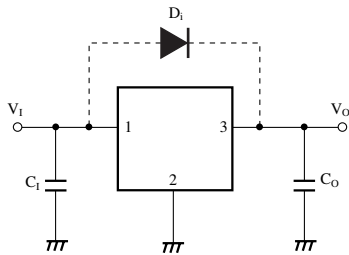


Figure 1

$C_I$ : When a wiring from a smoothing circuit to a three-pin regulator is long, it is likely to oscillate at output. A capacitor of  $0.1\mu\text{F}$  to  $0.47\mu\text{F}$  should be connected near an input pin.

$C_O$ : Deadly needed to prevent from oscillation ( $0.33\mu\text{F}$  to  $1.0\mu\text{F}$ ). 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  $10\mu\text{F}$  to  $100\mu\text{F}$  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  $C_O$  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.

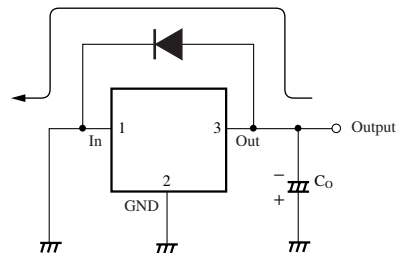
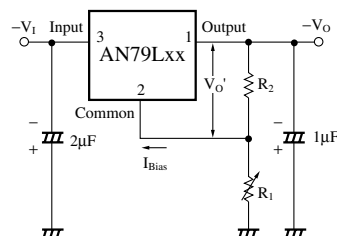


Figure 2

#### 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  $R_1$ .

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