

AN79Lxx/AN79LxxM Series

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

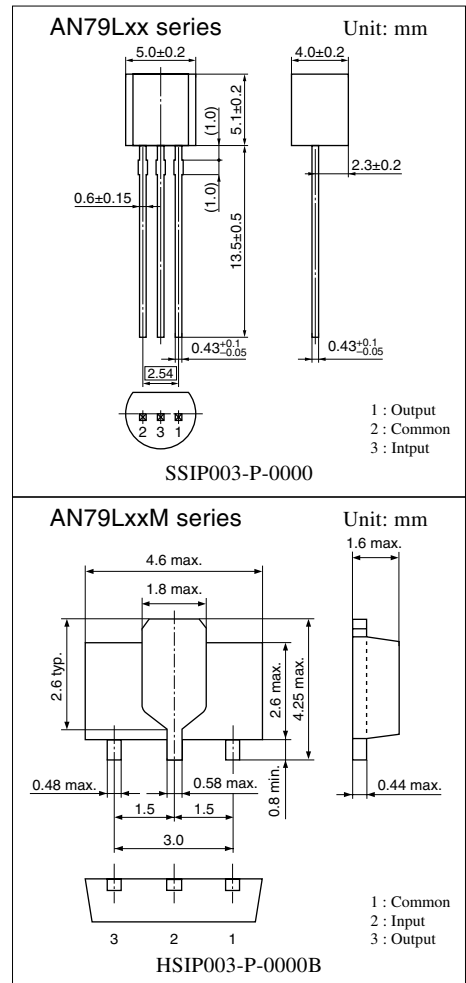
■ Overview

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

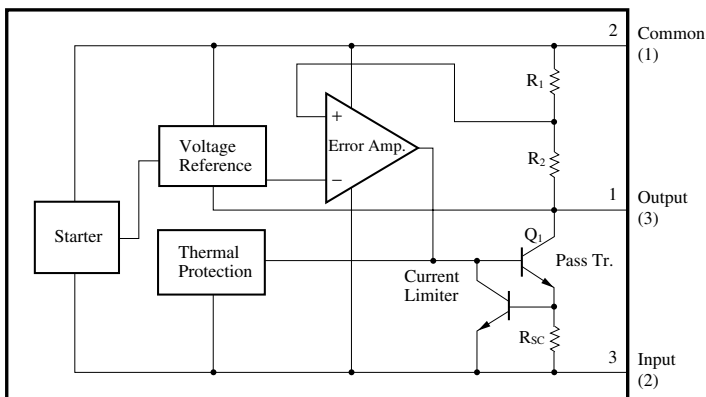
Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 12 types of output voltage are available: $-4V$, $-5V$, $-6V$, $-7V$, $-8V$, $-9V$, $-10V$, $-12V$, $-15V$, $-18V$, $-20V$ and $-24V$. They can be used widely in power circuits with current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

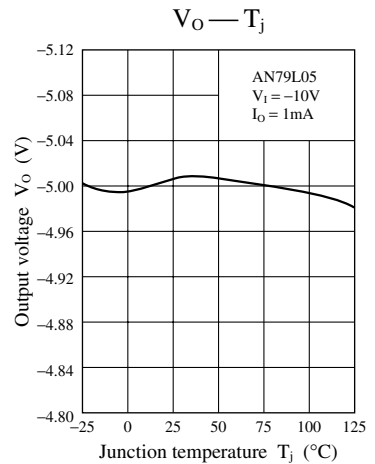
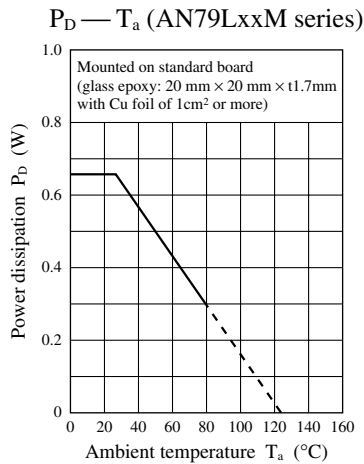
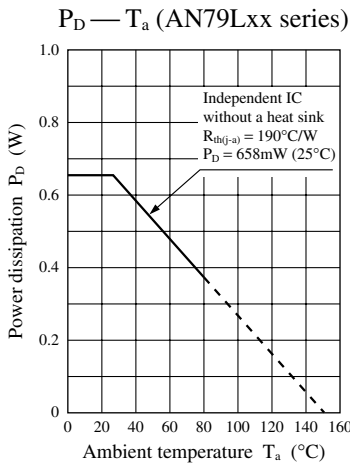
• AN79L24 (-24V type)

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	—	$\text{mV}/^\circ\text{C}$

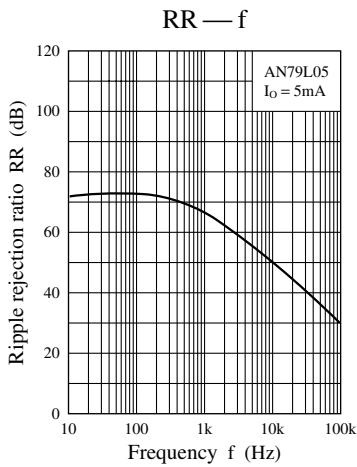
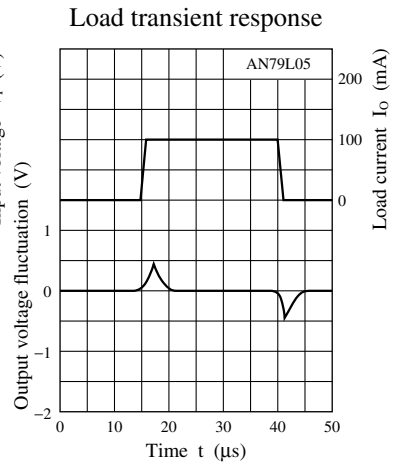
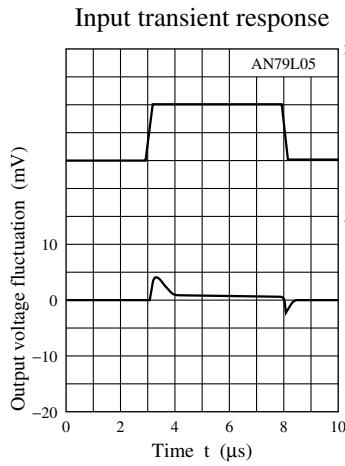
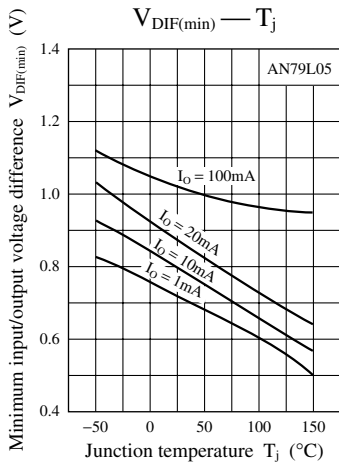
Note 1) The specified condition $T_j = 25^\circ\text{C}$ means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.

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

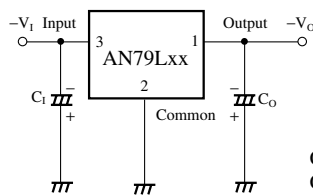
■ Main Characteristics



■ Main Characteristics (continued)



■ Basic Regulator Circuit



Connect C_i of 2μF when the input line is long.
 C_o improves the transient response. 1μF

■ Usage Notes

1. Cautions for a basic circuit

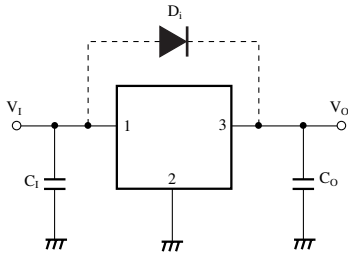


Figure 1

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.

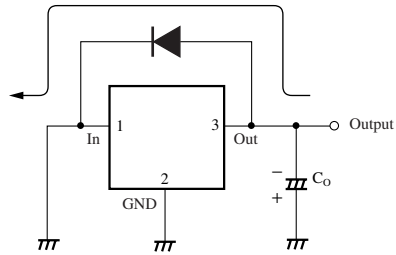
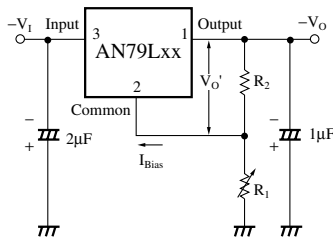


Figure 2

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 .

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