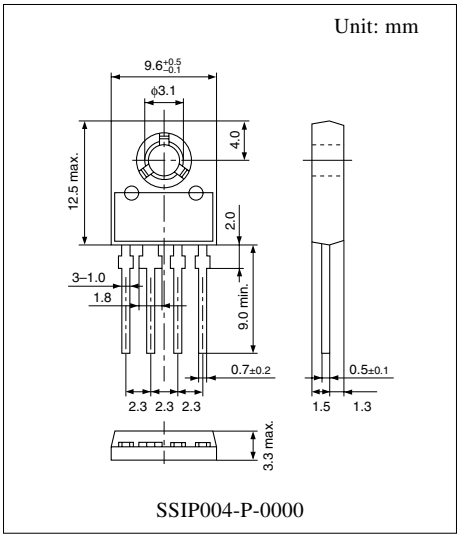
AN78xxR/AN78MxxR Series

4-pin positive output voltage regulator with reset pin (1 A/500 mA type)

■ Overview

The AN78xxR series and the AN78MxxR series are the fixed positive output type monolithic voltage regulators with reset pin. Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. Three types of output voltage, 5V, 9V and 12V, are available for the AN78xxR series, and four types, 5V, 8V, 9V and 12V, are available for the AN78MxxR series. They can be used in power circuits with current capacity of 1A/500mA. On/off of output voltage can be controlled by the reset pin.

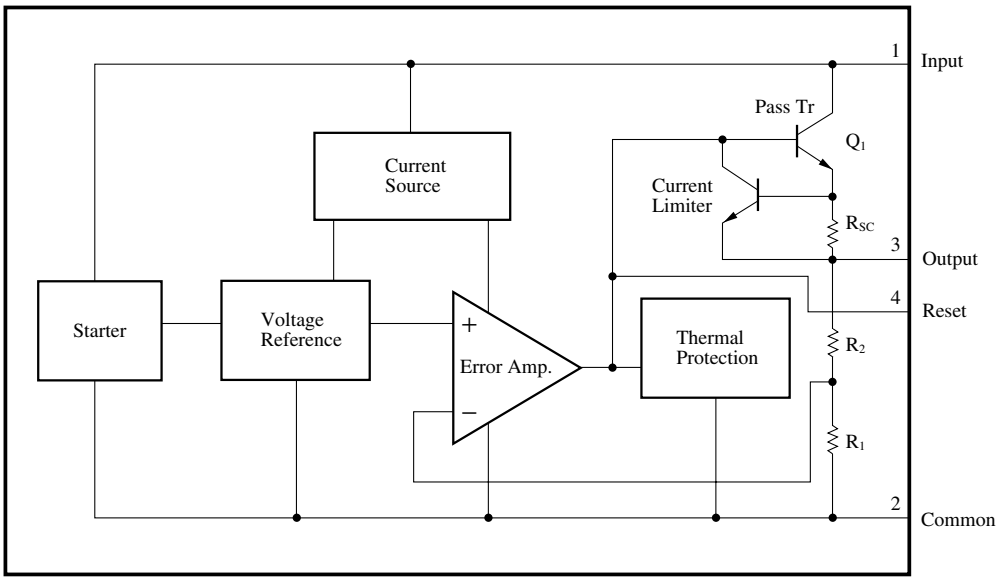


SSIP004-P-0000

■ Features

- No external components
- Maximum output current: 1A (AN78xxR)
  500mA (AN78MxxR)
- Output voltage: 5V, 9V, 12V (AN78xxR)
  5V, 8V, 9V, 12V (AN78MxxR)
- Built-in overcurrent limit circuit
- Built-in thermal overload protection circuit
- Built-in ASO (area of safe operation) protection circuit
- On/off of output voltage can be controlled by reset pin

■ Block Diagram



■ Absolute Maximum Ratings at T_a = 25°C

Parameter	Symbol	Rating	Unit
Input voltage	V_I	35	V
Power dissipation	P_D	10 *	W
Operating ambient temperature	T_{opr}	−20 to +80	°C
Storage temperature	T_{stg}	−55 to +150	°C

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

■ Electrical Characteristics at T_a = 25°C

[1] AN78xxR series

• AN7805R (1A, 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 = 5mA to 1A, T_j = 0 to 125°C, $P_D \leq$ 15W	4.75	—	5.25	V
Line regulation	REG_{IN}	V_I = 7.5 to 25V, T_j = 25°C	—	3	100	mV
		V_I = 8 to 12V, T_j = 25°C	—	1	50	mV
Load regulation	REG_L	I_O = 5mA to 1.5A, T_j = 25°C	—	15	100	mV
		I_O = 250 to 750mA, T_j = 25°C	—	5	50	mV
Bias current	I_{Bias}	T_j = 25°C	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 7.5 to 25V, T_j = 25°C	—	—	1.3	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5mA to 1A, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	40	—	μV
Ripple rejection ratio	RR	V_I = 8 to 18V, I_O = 100mA, f = 120Hz	62	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 1A, T_j = 25°C	—	2	—	V
Output impedance	Z_O	f = 1kHz	—	17	—	mΩ
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	700	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	− 0.3	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

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 = 500mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

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

• AN7809R (1A, 9V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	8.65	9	9.35	V
Output voltage tolerance	V_O	V_I = 12 to 24V, I_O = 5mA to 1A, T_j = 0 to 125°C, $P_D \leq$ 15W	8.55	—	9.45	V
Line regulation	REG_{IN}	V_I = 11.5 to 26V, T_j = 25°C	—	7	180	mV
		V_I = 12 to 18V, T_j = 25°C	—	2	90	mV
Load regulation	REG_L	I_O = 5mA to 1.5A, T_j = 25°C	—	12	180	mV
		I_O = 250 to 750mA, T_j = 25°C	—	4	90	mV
Bias current	I_{Bias}	T_j = 25°C	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 11.5 to 26V, T_j = 25°C	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5mA to 1A, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	57	—	μV
Ripple rejection ratio	RR	V_I = 12 to 22V, I_O = 100mA, f = 120Hz	56	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 1A, T_j = 25°C	—	2	—	V
Output impedance	Z_O	f = 1kHz	—	16	—	mΩ
Output short-circuit current	$I_{O(Short)}$	V_I = 26V, T_j = 25°C	—	700	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

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 = 500mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

• AN7812R (1A, 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 = 5mA to 1A, T_j = 0 to 125°C, $P_D \leq$ 15W	11.4	—	12.6	V
Line regulation	REG_{IN}	V_I = 14.5 to 30V, T_j = 25°C	—	10	240	mV
		V_I = 16 to 22V, T_j = 25°C	—	3	120	mV
Load regulation	REG_L	I_O = 5mA to 1.5A, T_j = 25°C	—	12	240	mV
		I_O = 250 to 750mA, T_j = 25°C	—	4	120	mV
Bias current	I_{Bias}	T_j = 25°C	—	4	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 14.5 to 30V, T_j = 25°C	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5mA to 1A, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	75	—	μV
Ripple rejection ratio	RR	V_I = 15 to 25V, I_O = 100mA, f = 120Hz	55	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 1A, T_j = 25°C	—	2	—	V
Output impedance	Z_O	f = 1kHz	—	18	—	mΩ
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	700	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.8	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

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 = 500mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

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

[2] AN78MxxR series

• AN78M05R (500mA, 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 = 7.5 to 20V, I_O = 5 to 350mA, T_j = 0 to 125°C, $P_D \leq$ 15W	4.75	—	5.25	V
Line regulation	REG_{IN}	V_I = 7.5 to 25V, T_j = 25°C	—	3	100	mV
		V_I = 8 to 25V, T_j = 25°C	—	1	50	mV
Load regulation	REG_L	I_O = 5 to 500mA, T_j = 25°C	—	20	100	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	50	mV
Bias current	I_{Bias}	T_j = 25°C	—	4.6	6	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 8 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5 to 350mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	40	—	µV
Ripple rejection ratio	RR	V_I = 8 to 18V, I_O = 100mA, f = 120Hz	62	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 500mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

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 = 350mA, C_I = 0.33µF, C_O = 0.1µF and T_j = 0 to 125°C

• AN78M08R (500mA, 8V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	7.7	8	8.3	V
Output voltage tolerance	V_O	V_I = 10.5 to 23V, I_O = 5 to 350mA, T_j = 0 to 125°C, $P_D \leq$ 15W	7.6	—	8.4	V
Line regulation	REG_{IN}	V_I = 10.5 to 25V, T_j = 25°C	—	6	100	mV
		V_I = 11 to 25V, T_j = 25°C	—	2	50	mV
Load regulation	REG_L	I_O = 5 to 500mA, T_j = 25°C	—	25	160	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	80	mV
Bias current	I_{Bias}	T_j = 25°C	—	4.1	6	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 10.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5 to 350mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	52	—	µV
Ripple rejection ratio	RR	V_I = 11.5 to 21.5V, I_O = 100mA, f = 120Hz	56	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 500mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	0.7	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

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 = 350mA, C_I = 0.33µF, C_O = 0.1µF and T_j = 0 to 125°C

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

• AN78M09R (500mA, 9V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	8.65	9	9.35	V
Output voltage tolerance	V_O	V_I = 11.5 to 24V, I_O = 5 to 350mA, T_j = 0 to 125°C, $P_D \leq$ 15W	8.55	—	9.45	V
Line regulation	REG_{IN}	V_I = 11.5 to 25V, T_j = 25°C	—	7	100	mV
		V_I = 12 to 25V, T_j = 25°C	—	2	50	mV
Load regulation	REG_L	I_O = 5 to 500mA, T_j = 25°C	—	25	180	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	90	mV
Bias current	I_{Bias}	T_j = 25°C	—	4.1	6.0	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 12 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5 to 350mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	60	—	µV
Ripple rejection ratio	RR	V_I = 12 to 22V, I_O = 100mA, f = 120Hz	56	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 500mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	0.7	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

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 = 350mA, C_I = 0.33µF, C_O = 0.1µF and T_j = 0 to 125°C

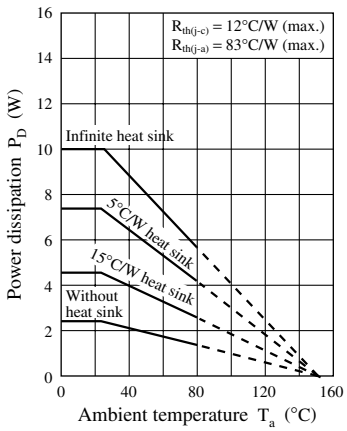
• AN78M12R (500mA, 12V type)

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 = 14.5 to 27V, I_O = 5 to 350mA, T_j = 0 to 125°C, $P_D \leq$ 15W	11.4	—	12.6	V
Line regulation	REG_{IN}	V_I = 14.5 to 30V, T_j = 25°C	—	8	100	mV
		V_I = 16 to 30V, T_j = 25°C	—	2	50	mV
Load regulation	REG_L	I_O = 5 to 500mA, T_j = 25°C	—	25	240	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	120	mV
Bias current	I_{Bias}	T_j = 25°C	—	4.3	6	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 14.5 to 30V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5 to 350mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	75	—	µV
Ripple rejection ratio	RR	V_I = 15 to 25V, I_O = 100mA, f = 120Hz	55	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 500mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C, V_I = 35V	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

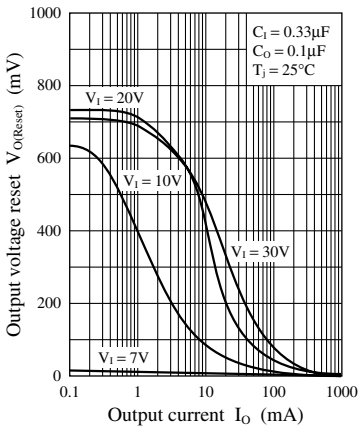
Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 19V, I_O = 350mA, C_I = 0.33µF, C_O = 0.1µF and T_j = 0 to 125°C

■ Main Characteristics

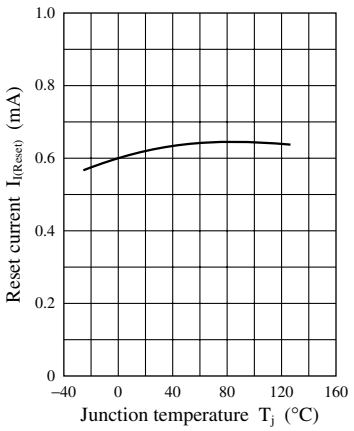
P_D — T_a



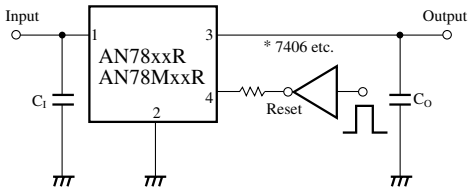
$V_{O(Reset)}$ — I_O



$I_{I(Reset)}$ — T_j



■ Basic Regulator Circuit



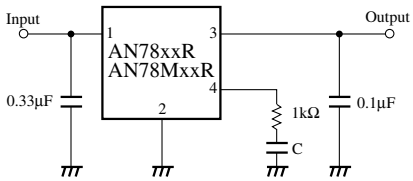
* For TTL, an open collector type inverter, buffer, gate etc. can be used.

Beware of the breakdown of TTL, as the reset pin bears voltage higher than the output voltage V_O by 1 to 2V.

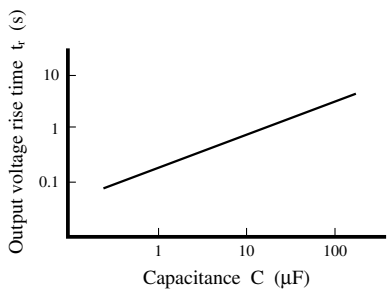
C_I is necessary when the input line is long.
C_O improves the transient response.

■ Application Circuit Example

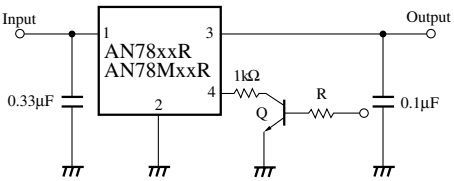
1. Soft start circuit

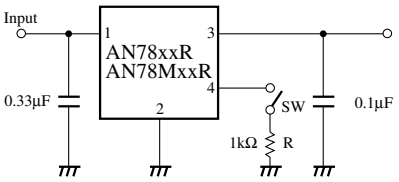


* Control of output voltage rise time



2. Several output reset circuits





Request for your special attention and precautions in using the technical information and semiconductors described in this material

(1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technologies described in this material and controlled under the "Foreign Exchange and Foreign Trade Law" is to be exported or taken out of Japan.

(2) The technical information described in this material is limited to showing representative characteristics and applied circuit examples of the products. It does not constitute the warranting of industrial property, the granting of relative rights, or the granting of any license.

(3) The products described in this material are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).
Consult our sales staff in advance for information on the following applications:
- Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
- Any applications other than the standard applications intended.

(4) The products and product specifications described in this material are subject to change without notice for reasons of modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.

(5) When designing your equipment, comply with the guaranteed values, in particular those of maximum rating, the range of operating power supply voltage and heat radiation characteristics. Otherwise, we will not be liable for any defect which may arise later in your equipment.
Even when the products are used within the guaranteed values, redundant design is recommended, so that such equipment may not violate relevant laws or regulations because of the function of our products.

(6) When using products for which dry packing is required, observe the conditions (including shelf life and after-unpacking standby time) agreed upon when specification sheets are individually exchanged.

(7) No part of this material may be reprinted or reproduced by any means without written permission from our company.

Please read the following notes before using the datasheets

A. These materials are intended as a reference to assist customers with the selection of Panasonic semiconductor products best suited to their applications.
Due to modification or other reasons, any information contained in this material, such as available product types, technical data, and so on, is subject to change without notice.
Customers are advised to contact our semiconductor sales office and obtain the latest information before starting precise technical research and/or purchasing activities.

B. Panasonic is endeavoring to continually improve the quality and reliability of these materials but there is always the possibility that further rectifications will be required in the future. Therefore, Panasonic will not assume any liability for any damages arising from any errors etc. that may appear in this material.

C. These materials are solely intended for a customer's individual use.
Therefore, without the prior written approval of Panasonic, any other use such as reproducing, selling, or distributing this material to a third party, via the Internet or in any other way, is prohibited.

2001 MAR