

# AN78xx/AN78xxF Series

## 3-pin positive output voltage regulator (1 A type)

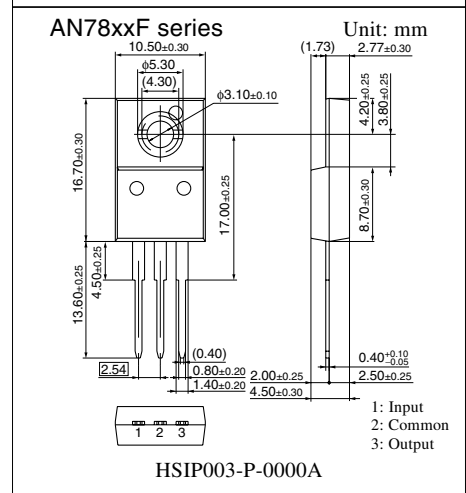
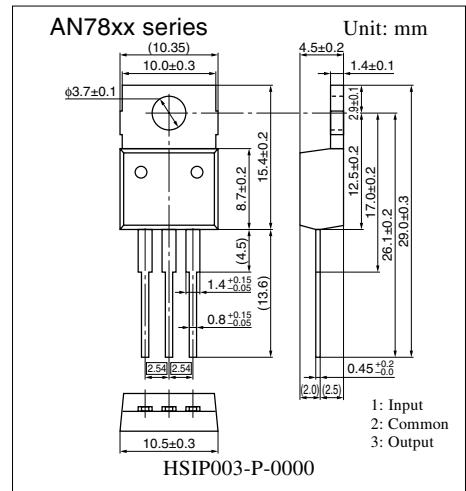
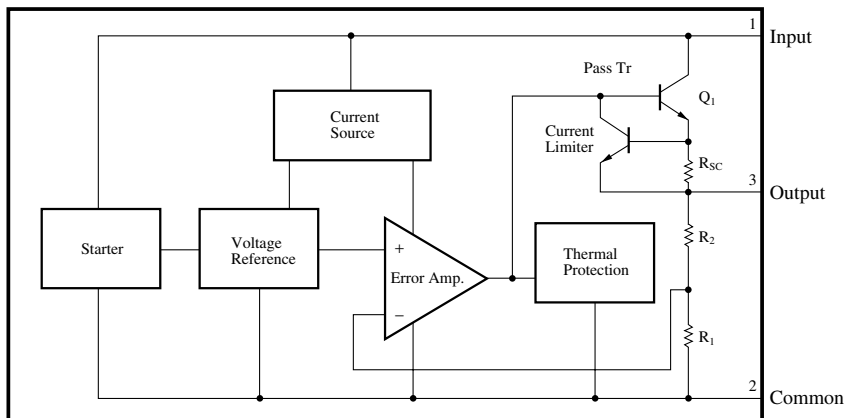
### ■ Overview

The AN78xx series and the AN78xxF series are 3-pin, fixed positive output type monolithic voltage regulators. Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. 11 types of fixed output voltage are available; 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 1A.

### ■ Features

- No external components
- Output voltage: 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V
- Built-in overcurrent limit circuit
- Built-in thermal overload protection circuit
- Built-in ASO (area of safe operation) protection circuit

### ■ Block Diagram



### ■ 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	AN78xx series	$P_D$	15 <sup>*3</sup>	W
	AN78xxF series		10.25 <sup>*3</sup>	
Operating ambient temperature		$T_{opr}$	-30 to +80	$^\circ\text{C}$
Storage temperature		$T_{stg}$	-55 to +150	$^\circ\text{C}$

\*1 AN7805/F, AN7806/F, AN7807/F, AN7808/F, AN7809/F, AN7810/F, AN7812/F, AN7815/F, AN7818/F

\*2 AN7820/F, AN7824/F

\*3 Follow the derating curve. When  $T_j$  exceeds  $150^\circ\text{C}$ , the internal circuit cuts off the output.

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

#### • AN7805, AN7805F (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 $20\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	4.75	—	5.25	V
Line regulation	$\text{REG}_{IN}$	$V_I = 7.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	3	100	mV
		$V_I = 8$ to $12\text{V}$ , $T_j = 25^\circ\text{C}$	—	1	50	mV
Load regulation	$\text{REG}_L$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	15	100	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	5	50	mV
Bias current	$I_{Bias}$	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	$V_I = 7.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1.3	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{no}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	40	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 8$ to $18\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	62	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	17	—	$\text{m}\Omega$
Output short-circuit current	$I_{O(short)}$	$V_I = 25\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{O(Peak)}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-0.3	—	$\text{mV}/^\circ\text{C}$

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,  $V_I = 10\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

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

#### • AN7806, 7806F (6V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	$V_O$	$T_j = 25^\circ\text{C}$	5.75	6	6.25	V
Output voltage tolerance	$V_O$	$V_I = 9$ to $21\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	5.7	—	6.3	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 8.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	5	120	mV
		$V_I = 9$ to $13\text{V}$ , $T_j = 25^\circ\text{C}$	—	1.5	60	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	14	120	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	60	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 8.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1.3	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	40	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 9$ to $19\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	59	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	17	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 25\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-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,  $V_I = 11\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

#### • AN7807, 7807F (7V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	$V_O$	$T_j = 25^\circ\text{C}$	6.7	7	7.3	V
Output voltage tolerance	$V_O$	$V_I = 10$ to $22\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	6.6	—	7.4	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 9.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	5	140	mV
		$V_I = 10$ to $15\text{V}$ , $T_j = 25^\circ\text{C}$	—	1.5	70	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	14	140	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	70	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 9.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	46	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 10$ to $20\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	57	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 25\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-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,  $V_I = 12\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

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

#### • AN7808, 7808F (8V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	$V_O$	$T_j = 25^\circ\text{C}$	7.7	8	8.3	V
Output voltage tolerance	$V_O$	$V_I = 11$ to $23\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	7.6	—	8.4	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 10.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	6	160	mV
		$V_I = 11$ to $17\text{V}$ , $T_j = 25^\circ\text{C}$	—	2	80	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	160	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	80	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 10.5$ to $25\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	52	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 11.5$ to $21.5\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	56	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 25\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-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,  $V_I = 14\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_I = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

#### • AN7809, 7809F (9V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	$V_O$	$T_j = 25^\circ\text{C}$	8.65	9	9.35	V
Output voltage tolerance	$V_O$	$V_I = 12$ to $24\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	8.55	—	9.45	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 11.5$ to $26\text{V}$ , $T_j = 25^\circ\text{C}$	—	7	180	mV
		$V_I = 12$ to $18\text{V}$ , $T_j = 25^\circ\text{C}$	—	2	90	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	180	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	90	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 11.5$ to $26\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	57	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 12$ to $22\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	56	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 26\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-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,  $V_I = 15\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_I = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

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

#### • AN7810, 7810F (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 $25\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	9.5	—	10.5	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 12.5$ to $27\text{V}$ , $T_j = 25^\circ\text{C}$	—	8	200	mV
		$V_I = 13$ to $19\text{V}$ , $T_j = 25^\circ\text{C}$	—	2.5	100	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	200	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	100	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 12.5$ to $27\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	63	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 13$ to $23\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	56	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 27\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
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,  $V_I = 16\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

#### • AN7812, 7812F (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 $27\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	11.4	—	12.6	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 14.5$ to $30\text{V}$ , $T_j = 25^\circ\text{C}$	—	10	240	mV
		$V_I = 16$ to $22\text{V}$ , $T_j = 25^\circ\text{C}$	—	3	120	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	240	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	120	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	4	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 14.5$ to $30\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	75	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 15$ to $25\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	55	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	18	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 30\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-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,  $V_I = 19\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

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

#### • AN7815, 7815F (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	$V_O$	$V_I = 18 \text{ to } 30\text{V}$ , $I_O = 5\text{mA to } 1\text{A}$ , $T_j = 0 \text{ to } 125^\circ\text{C}$ , $P_D \leq *$	14.25	—	15.75	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 17.5 \text{ to } 30\text{V}$ , $T_j = 25^\circ\text{C}$	—	11	300	mV
		$V_I = 20 \text{ to } 26\text{V}$ , $T_j = 25^\circ\text{C}$	—	3	150	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA to } 1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	300	mV
		$I_O = 250 \text{ to } 750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	150	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	4	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 17.5 \text{ to } 30\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA to } 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz to } 100\text{kHz}$	—	90	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 18.5 \text{ to } 28.5\text{V}$ , $f = 120\text{Hz}$	54	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	19	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 30\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0 \text{ to } 125^\circ\text{C}$	—	-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,  $V_I = 23\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

#### • AN7818, 7818F (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	$V_O$	$V_I = 21 \text{ to } 33\text{V}$ , $I_O = 5\text{mA to } 1\text{A}$ , $T_j = 0 \text{ to } 125^\circ\text{C}$ , $P_D \leq *$	17.1	—	18.9	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 21 \text{ to } 33\text{V}$ , $T_j = 25^\circ\text{C}$	—	14	360	mV
		$V_I = 24 \text{ to } 30\text{V}$ , $T_j = 25^\circ\text{C}$	—	4	180	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA to } 1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	360	mV
		$I_O = 250 \text{ to } 750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	180	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	4.1	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 21 \text{ to } 33\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA to } 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz to } 100\text{kHz}$	—	110	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 22 \text{ to } 32\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	53	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	16	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 35\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0 \text{ to } 125^\circ\text{C}$	—	-1.1	—	$\text{mV}/^\circ\text{C}$

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,  $V_I = 27\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

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

#### • AN7820, 7820F (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	$V_O$	$V_I = 24$ to $35\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	19	—	21	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 23$ to $35\text{V}$ , $T_j = 25^\circ\text{C}$	—	15	400	mV
		$V_I = 26$ to $32\text{V}$ , $T_j = 25^\circ\text{C}$	—	5	200	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	400	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	200	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	4.1	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 23$ to $35\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	110	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 24$ to $34\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	53	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	22	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 35\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-1.2	—	$\text{mV}/^\circ\text{C}$

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,  $V_I = 29\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

#### • AN7824, 7824F (24V type)

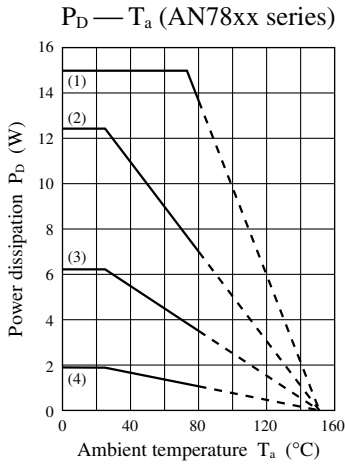
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	$V_O$	$T_j = 25^\circ\text{C}$	23	24	25	V
Output voltage tolerance	$V_O$	$V_I = 28$ to $38\text{V}$ , $I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 0$ to $125^\circ\text{C}$ , $P_D \leq *$	22.8	—	25.2	V
Line regulation	$\text{REG}_{\text{IN}}$	$V_I = 27$ to $38\text{V}$ , $T_j = 25^\circ\text{C}$	—	18	480	mV
		$V_I = 30$ to $36\text{V}$ , $T_j = 25^\circ\text{C}$	—	6	240	mV
Load regulation	$\text{REG}_{\text{L}}$	$I_O = 5\text{mA}$ to $1.5\text{A}$ , $T_j = 25^\circ\text{C}$	—	12	480	mV
		$I_O = 250$ to $750\text{mA}$ , $T_j = 25^\circ\text{C}$	—	4	240	mV
Bias current	$I_{\text{Bias}}$	$T_j = 25^\circ\text{C}$	—	4.1	8	mA
Bias current fluctuation to input	$\Delta I_{\text{Bias(IN)}}$	$V_I = 27$ to $38\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{\text{Bias(L)}}$	$I_O = 5\text{mA}$ to $1\text{A}$ , $T_j = 25^\circ\text{C}$	—	—	0.5	mA
Output noise voltage	$V_{\text{no}}$	$f = 10\text{Hz}$ to $100\text{kHz}$	—	170	—	$\mu\text{V}$
Ripple rejection ratio	RR	$V_I = 28$ to $38\text{V}$ , $I_O = 100\text{mA}$ , $f = 120\text{Hz}$	50	—	—	dB
Minimum input/output voltage difference	$V_{\text{DIF(min)}}$	$I_O = 1\text{A}$ , $T_j = 25^\circ\text{C}$	—	2	—	V
Output impedance	$Z_O$	$f = 1\text{kHz}$	—	28	—	$\text{m}\Omega$
Output short-circuit current	$I_{\text{O(Short)}}$	$V_I = 38\text{V}$ , $T_j = 25^\circ\text{C}$	—	700	—	mA
Peak output current	$I_{\text{O(Peak)}}$	$T_j = 25^\circ\text{C}$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5\text{mA}$ , $T_j = 0$ to $125^\circ\text{C}$	—	-1.4	—	$\text{mV}/^\circ\text{C}$

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,  $V_I = 33\text{V}$ ,  $I_O = 500\text{mA}$ ,  $C_1 = 0.33\mu\text{F}$  and  $C_O = 0.1\mu\text{F}$ .

\* AN78xx series: 15W, AN78xxF series: 10.25W

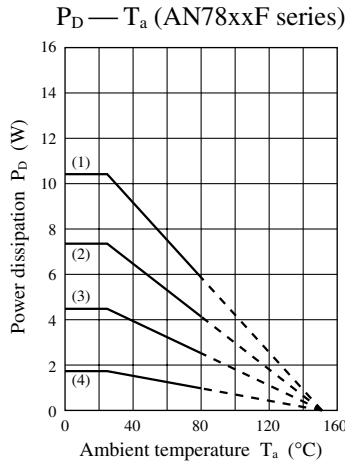
■ Main Characteristic Curve



Thermal resistance value:  
 $R_{th(j-c)} = 5^\circ\text{C/W}$  (max.)  
 $R_{th(j-a)} = 65^\circ\text{C/W}$  (max.)

Installation condition to heat sink  
 Tightening torque 6kg-cm  
 Heat radiation compound used

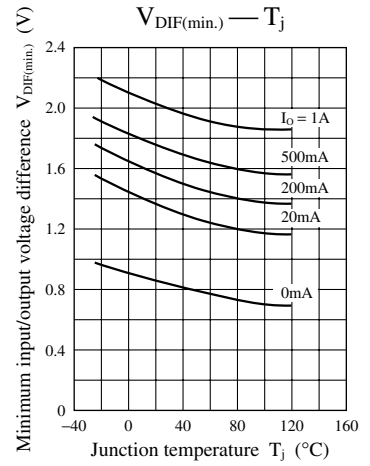
- (1) Infinite heat sink: 15.0W
- (2) 5°C/W heat sink: 12.5W
- (3) 15°C/W heat sink: 6.3W
- (4) Without heat sink: 1.923W



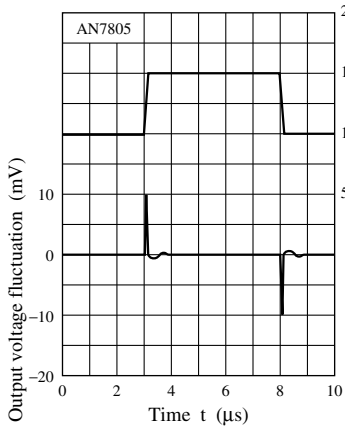
Thermal resistance value:  
 $R_{th(j-c)} = 12.2^\circ\text{C/W}$  (max.)  
 $R_{th(j-a)} = 65^\circ\text{C/W}$  (max.)

Installation condition to heat sink  
 Tightening torque 6kg-cm  
 Heat radiation compound used

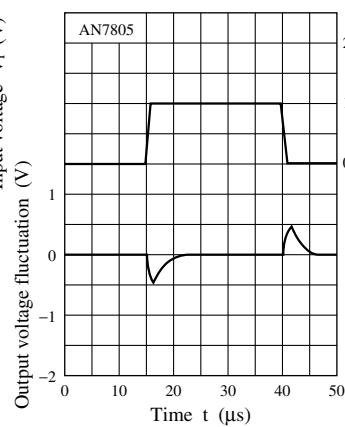
- (1) Infinite heat sink: 10.25W
- (2) 5°C/W heat sink: 7.3W
- (3) 15°C/W heat sink: 4.5W
- (4) Without heat sink: 1.923W



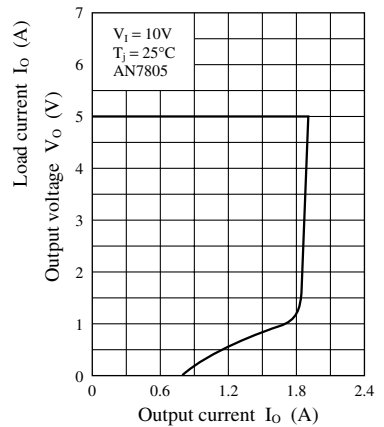
Input transient response



Load transient response

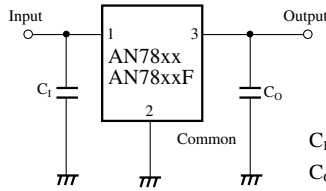


Current limiting characteristic





■ Basic Regulator Circuit



C<sub>1</sub>: C<sub>1</sub> is necessary when the input line is long.  
 C<sub>O</sub>: C<sub>O</sub> improves the transient response.

■ Usage Notes

1. Cautions for a basic circuit

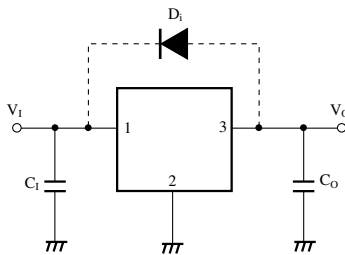


Figure 1

- C<sub>1</sub>: When a wiring from a smoothing circuit to a three-pin regulator is long, it is likely to oscillate in output. A capacitor of 0.1μF to 0.47μF should be connected near an input pin.
- C<sub>O</sub>: 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 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.

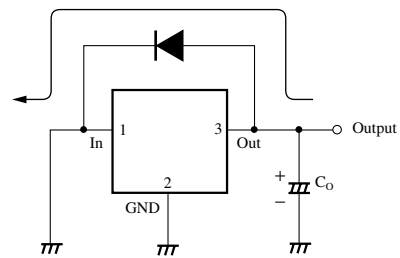


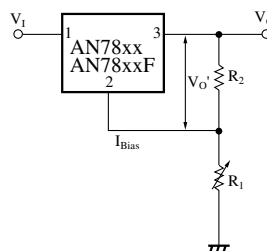
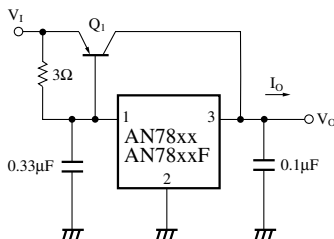
Figure 2

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 Examples

1. Current bootstrap circuit      2. Adjustable output regulator



$$V_O = V_O' + \left( I_{Bias} + \frac{V_O'}{R_2} \right) R_1$$

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>.

## 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.