

BIPOLAR ANALOG INTEGRATED CIRCUITS

μ PC7800A SERIES

THREE TERMINAL POSITIVE VOLTAGE REGULATORS

DESCRIPTION

μ PC7800A series are monolithic three terminal positive regulators which employ internally current limiting, thermal shut down, output transistor safe operating area protection make them essentially indestructible.

They are improved for ripple rejection ratio, line regulation, load regulation and quiescent current, as comparison of conventional μ PC7800 series.

FEATURES

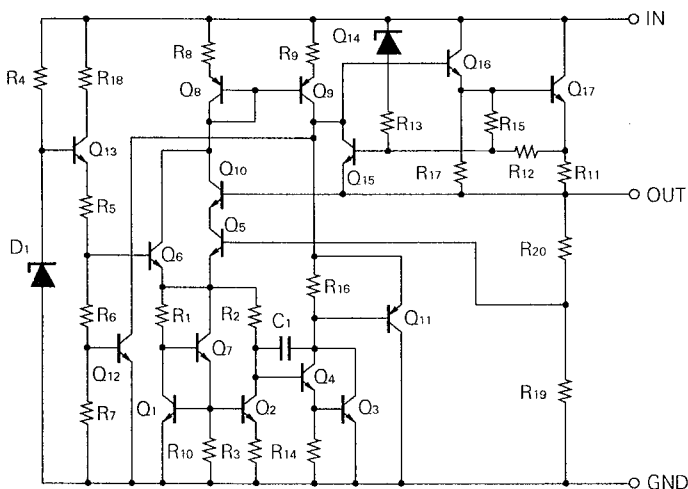
- Wide operation temperature range.
- High ripple rejection ratio.
- Good regulation (line, load).
- Low quiescent current.
- Built-in protection circuits.
(over current protection, SOA protection and thermal shut down)

ORDER INFORMATION

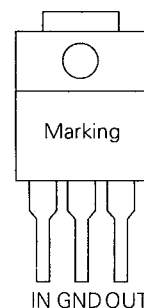
TYPE NUMBER	OUTPUT VOLTAGE	PACKAGE	QUALITY GRADE
μ PC7805AHF	5 V	MP-45G (ISOLATED TO-220)	Standard
μ PC7808AHF	8 V		
μ PC7893AHF	9.3 V		
μ PC7812AHF	12 V		
μ PC7815AHF	15 V		
μ PC7818AHF	18 V		
μ PC7824AHF	24 V		

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

EQUIVALENT CIRCUIT



CONNECTION DIAGRAM



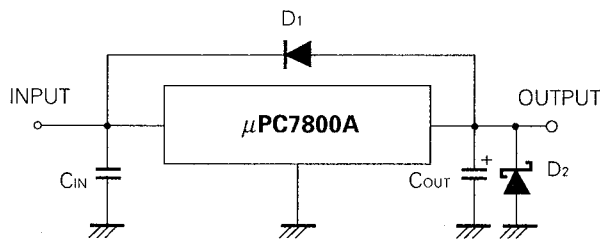
ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Voltage	V _{IN}	35/40 (Note1)	V
Internal Power Dissipation	P _T	15 (Note2)	W
Operating Ambient Temperature Range	T _{opt}	- 30 to + 85	°C
Operating Junction Temperature Range	T _{opt(j)}	- 30 to + 150	°C
Storage Temperature Range	T _{stg}	- 55 to + 150	°C
Thermal Resistance (junction to case)	R _{th(j-c)}	5	°C/W
Thermal Resistance (junction to ambient)	R _{th(j-a)}	65	°C/W

(Note1) μPC7805A, 08A, 93A, 12A, 15A, 18A : 35 V, μPC7824A : 40 V

(Note2) Internally limited

TYPICAL CONNECTION



C₁: Required if regulator is located an appreciable distance from power supply filter.

C₂: More than 0.1 μF

D₁: Needed for V_{IN} < V_o

D₂: Needed for V_o < GND

RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL		MIN.	TYP.	MAX.	UNIT
Input Voltage	V _{IN}	μPC7805AHF	7	10	25	V
		μPC7808AHF	10.5	14	25	
		μPC7893AHF	12	15	24.5	
		μPC7812AHF	14.5	19	30	
		μPC7815AHF	17.5	23	30	
		μPC7818AHF	21	27	33	
		μPC7824AHF	27	33	38	
Output Current	I _o	All	0.005	0.5	1	A
Operating Junction Temperature Range	T _{opt(j)}	All	- 30		+ 125	°C

ELECTRICAL CHARACTERISTICS μPC7805A

($V_{IN} = 10\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	4.8	5.0	5.2	V
		$7\text{ V} \leq V_{IN} \leq 20\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$	4.75		5.25	
		$-30\text{ °C} \leq T_j \leq +125\text{ °C}$	4.75		5.25	
Line Regulation	REG _{IN}	$T_j = 25\text{ °C}$, $7\text{ V} \leq V_{IN} \leq 25\text{ V}$		7	30	mV
		$T_j = 25\text{ °C}$, $8\text{ V} \leq V_{IN} \leq 12\text{ V}$		2	15	
Load Regulation	REG _L	$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		4	30	mV
		$T_j = 25\text{ °C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$		2	10	
Quiescent Current	I _{BIAS}	$T_j = 25\text{ °C}$		2.8	4.3	mA
Quiescent Current Change	ΔI_{BIAS}	$7\text{ V} \leq V_{IN} \leq 25\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1.0\text{ A}$			0.5	
Output Noize Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		40	200	μV _{r.m.s.}
Ripple Rejection	R•R	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $8\text{ V} \leq V_{IN} \leq 18\text{ V}$	70	76		dB
Dropout Voltage	V _{DIF}	$T_j = 25\text{ °C}$, $I_o = 1.0\text{ A}$		1.8		V
Short Circuit Current	I _{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 25\text{ V}$		1.6		A
Peak Output Current	I _{Opeak}	$T_j = 25\text{ °C}$, $V_{IN} = 10\text{ V}$	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_o/\Delta T$	$I_o = 5\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$		-0.4		mV/°C

ELECTRICAL CHARACTERISTICS μPC7808A

($V_{IN} = 14\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	7.7	8.0	8.3	V
		$10.5\text{ V} \leq V_{IN} \leq 23\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$	7.6		8.4	
		$-30\text{ °C} \leq T_j \leq +125\text{ °C}$	7.6		8.4	
Line Regulation	REG _{IN}	$T_j = 25\text{ °C}$, $10.5\text{ V} \leq V_{IN} \leq 25\text{ V}$		8	35	mV
		$T_j = 25\text{ °C}$, $11\text{ V} \leq V_{IN} \leq 17\text{ V}$		3	25	
Load Regulation	REG _L	$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		12	90	mV
		$T_j = 25\text{ °C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$		4	20	
Quiescent Current	I _{BIAS}	$T_j = 25\text{ °C}$		3	4.4	mA
Quiescent Current Change	ΔI_{BIAS}	$10.5\text{ V} \leq V_{IN} \leq 25\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1.0\text{ A}$			0.5	
Output Noize Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		50	250	μV _{r.m.s.}
Ripple Rejection	R•R	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $11.5\text{ V} \leq V_{IN} \leq 21.5\text{ V}$	66	72		dB
Dropout Voltage	V _{DIF}	$T_j = 25\text{ °C}$, $I_o = 1.0\text{ A}$		1.8		V
Short Circuit Current	I _{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 25\text{ V}$		1.6		A
Peak Output Current	I _{Opeak}	$T_j = 25\text{ °C}$, $V_{IN} = 14\text{ V}$	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_o/\Delta T$	$I_o = 5\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$		-0.6		mV/°C

ELECTRICAL CHARACTERISTICS μPC7812A
 (V_{IN} = 19 V, I_o = 500 mA, 0 °C ≤ T_j ≤ + 125 °C)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V _o	T _j = 25 °C	11.5	12.0	12.5	V
		14.5 V ≤ V _{IN} ≤ 27 V, 5 mA ≤ I _o ≤ 1 A, P _r ≤ 15 W	11.4		12.6	
		- 30 °C ≤ T _j ≤ + 125 °C	11.4		12.6	
Line Regulation	REG _{IN}	T _j = 25 °C, 14.5 V ≤ V _{IN} ≤ 30 V		10	45	mV
		T _j = 25 °C, 16 V ≤ V _{IN} ≤ 22 V		4	30	
Load Regulation	REG _L	T _j = 25 °C, 5 mA ≤ I _o ≤ 1.5 A		17	130	mV
		T _j = 25 °C, 250 mA ≤ I _o ≤ 750 mA		6	30	
Quiescent Current	I _{BIAS}	T _j = 25 °C		3.1	4.6	mA
Quiescent Current Change	ΔI _{BIAS}	14.5 V ≤ V _{IN} ≤ 30 V			1.0	mA
		5 mA ≤ I _o ≤ 1.0 A			0.5	
Output Noize Voltage	V _n	T _j = 25 °C, 10 Hz ≤ f ≤ 100 kHz		70	300	μV _{r.m.s.}
Ripple Rejection	R•R	T _j = 25 °C, f = 120 Hz, 15 V ≤ V _{IN} ≤ 25 V	62	68		dB
Dropout Voltage	V _{DIF}	T _j = 25 °C, I _o = 1.0 A		1.8		V
Short Circuit Current	I _o short	T _j = 25 °C, V _{IN} = 30 V		1.3		A
Peak Output Current	I _o peak	T _j = 25 °C, V _{IN} = 19 V	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	ΔV _o /ΔT	I _o = 5 mA, 0 °C ≤ T _j ≤ + 125 °C		- 0.8		mV/°C

ELECTRICAL CHARACTERISTICS μPC7815A
 (V_{IN} = 23 V, I_o = 500 mA, 0 °C ≤ T_j ≤ + 125 °C)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V _o	T _j = 25 °C	14.4	15.0	15.6	V
		17.5 V ≤ V _{IN} ≤ 30 V, 5 mA ≤ I _o ≤ 1 A, P _r ≤ 15 W	14.25		15.75	
		- 30 °C ≤ T _j ≤ + 125 °C	14.25		15.75	
Line Regulation	REG _{IN}	T _j = 25 °C, 17.5 V ≤ V _{IN} ≤ 30 V		10	45	mV
		T _j = 25 °C, 20 V ≤ V _{IN} ≤ 26 V		5	35	
Load Regulation	REG _L	T _j = 25 °C, 5 mA ≤ I _o ≤ 1.5 A		25	190	mV
		T _j = 25 °C, 250 mA ≤ I _o ≤ 750 mA		8	40	
Quiescent Current	I _{BIAS}	T _j = 25 °C		3.3	4.8	mA
Quiescent Current Change	ΔI _{BIAS}	17.5 V ≤ V _{IN} ≤ 30 V			1.0	mA
		5 mA ≤ I _o ≤ 1.0 A			0.5	
Output Noize Voltage	V _n	T _j = 25 °C, 10 Hz ≤ f ≤ 100 kHz		85	400	μV _{r.m.s.}
Ripple Rejection	R•R	T _j = 25 °C, f = 120 Hz, 18.5 V ≤ V _{IN} ≤ 28.5 V	60	66		dB
Dropout Voltage	V _{DIF}	T _j = 25 °C, I _o = 1.0 A		1.8		V
Short Circuit Current	I _o short	T _j = 25 °C, V _{IN} = 30 V		1.3		A
Peak Output Current	I _o peak	T _j = 25 °C, V _{IN} = 23 V	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	ΔV _o /ΔT	I _o = 5 mA, 0 °C ≤ T _j ≤ + 125 °C		- 1.1		mV/°C

ELECTRICAL CHARACTERISTICS μPC7818A

($V_{IN} = 27\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	17.3	18.0	18.7	V
		$21\text{ V} \leq V_{IN} \leq 33\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$	17.1		18.9	
		$-30\text{ °C} \leq T_j \leq +125\text{ °C}$	17.1		18.9	
Line Regulation	REG_{IN}	$T_j = 25\text{ °C}$, $21\text{ V} \leq V_{IN} \leq 33\text{ V}$		12	60	mV
		$T_j = 25\text{ °C}$, $24\text{ V} \leq V_{IN} \leq 30\text{ V}$		6	45	
Load Regulation	REG_L	$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		32	110	mV
		$T_j = 25\text{ °C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$		10	40	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.4	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$21\text{ V} \leq V_{IN} \leq 33\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1.0\text{ A}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		95	450	$\mu V_{r.m.s.}$
Ripple Rejection	$R \cdot R$	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $22\text{ V} \leq V_{IN} \leq 32\text{ V}$	59	65		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$, $I_o = 1.0\text{ A}$		1.8		V
Short Circuit Current	I_{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 33\text{ V}$		1.2		A
Peak Output Current	I_{Opeak}	$T_j = 25\text{ °C}$, $V_{IN} = 27\text{ V}$	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$		-1.3		mV/°C

ELECTRICAL CHARACTERISTICS μPC7824A

($V_{IN} = 33\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

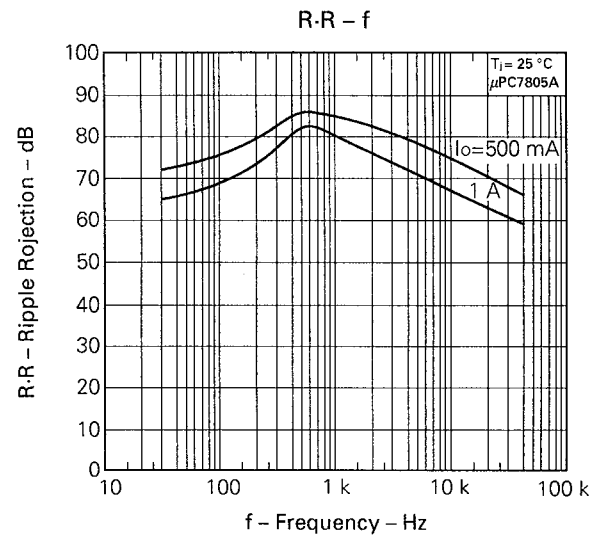
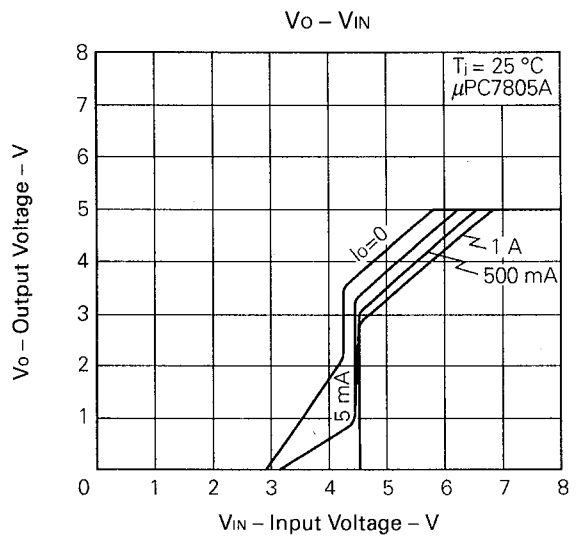
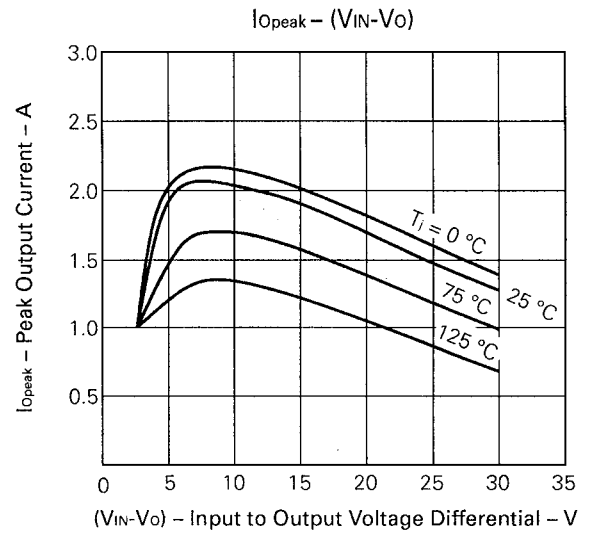
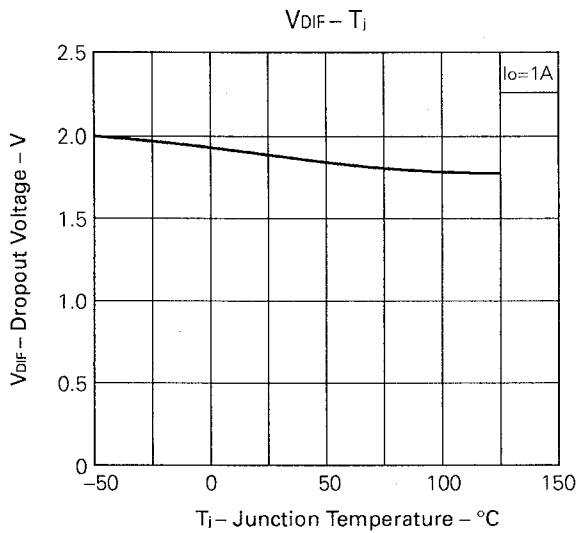
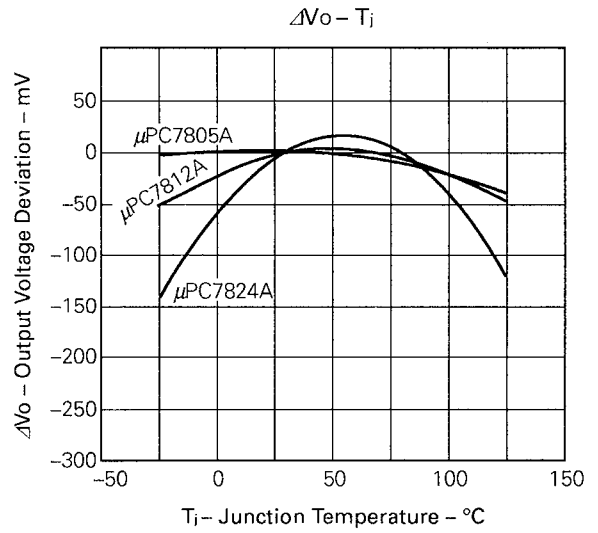
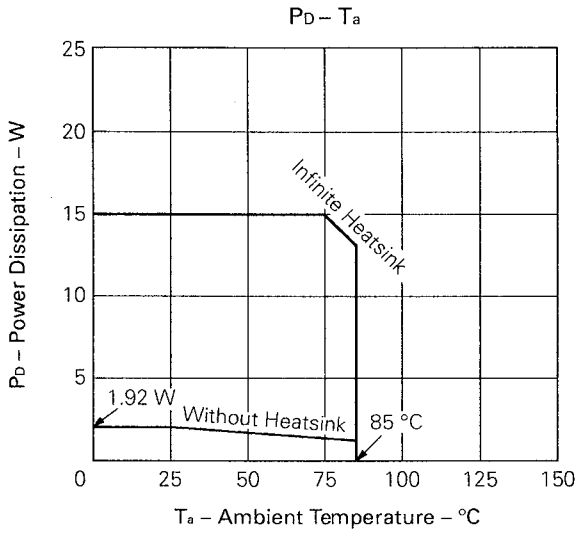
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	23.0	24.0	25.0	V
		$27\text{ V} \leq V_{IN} \leq 38\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$	22.8		25.2	
		$-30\text{ °C} \leq T_j \leq +125\text{ °C}$	22.8		25.2	
Line Regulation	REG_{IN}	$T_j = 25\text{ °C}$, $27\text{ V} \leq V_{IN} \leq 38\text{ V}$		15	80	mV
		$T_j = 25\text{ °C}$, $30\text{ V} \leq V_{IN} \leq 36\text{ V}$		8	50	
Load Regulation	REG_L	$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		44	150	mV
		$T_j = 25\text{ °C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$		14	50	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.6	5.3	mA
Quiescent Current Change	ΔI_{BIAS}	$27\text{ V} \leq V_{IN} \leq 38\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1.0\text{ A}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		120	500	$\mu V_{r.m.s.}$
Ripple Rejection	$R \cdot R$	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $28\text{ V} \leq V_{IN} \leq 38\text{ V}$	55	62		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$, $I_o = 1.0\text{ A}$		2.0		V
Short Circuit Current	I_{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 38\text{ V}$		1.0		A
Peak Output Current	I_{Opeak}	$T_j = 25\text{ °C}$, $V_{IN} = 33\text{ V}$	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$		-1.7		mV/°C

ELECTRICAL CHARACTERISTICS μPC7893A

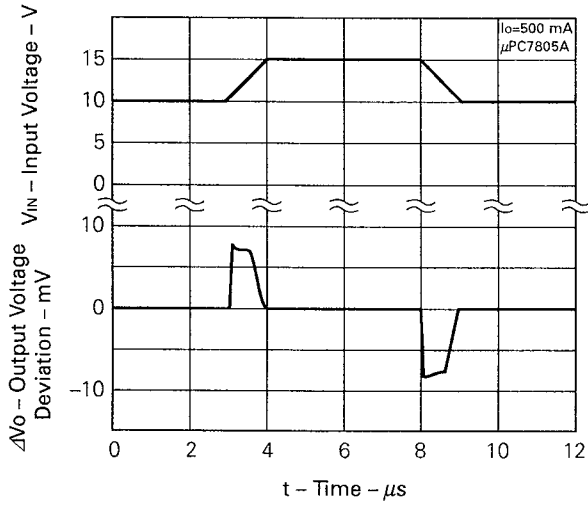
($V_{IN} = 15\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	9.0	9.3	9.5	V
		$12\text{ V} \leq V_{IN} \leq 24.5\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_r \leq 15\text{ W}$	8.9		9.7	
		$-30\text{ °C} \leq T_j \leq +125\text{ °C}$	8.9		9.7	
Line Regulation	REG_{IN}	$T_j = 25\text{ °C}$, $12\text{ V} \leq V_{IN} \leq 26.5\text{ V}$		9	40	mV
		$T_j = 25\text{ °C}$, $12.5\text{ V} \leq V_{IN} \leq 18.5\text{ V}$		4	30	
Load Regulation	REG_L	$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		15	110	mV
		$T_j = 25\text{ °C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$		5	25	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.1	4.5	mA
Quiescent Current Change	ΔI_{BIAS}	$12\text{ V} \leq V_{IN} \leq 26.5\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1.0\text{ A}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		55	230	μV _{r.m.s.}
Ripple Rejection	$R \cdot R$	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $12.5\text{ V} \leq V_{IN} \leq 22.5\text{ V}$	64	70		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$, $I_o = 1.0\text{ A}$		1.8		V
Short Circuit Current	I_{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 26.5\text{ V}$		1.5		A
Peak Output Current	I_{Opeak}	$T_j = 25\text{ °C}$, $V_{IN} = 15\text{ V}$	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$		-0.7		mV/°C

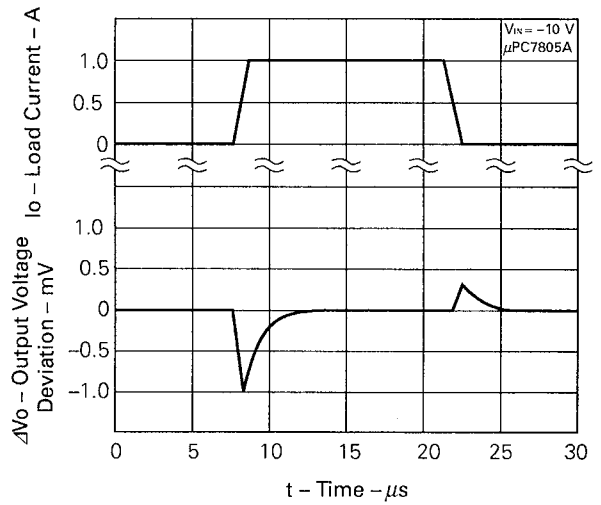
TYPICAL CHARACTERISTICS (T_a = 25 °C)



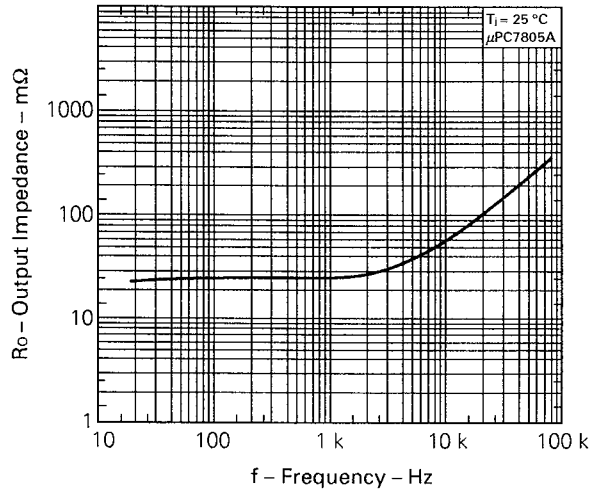
LINE TRANSIENT RESPONSE



LOAD TRANSIENT RESPONSE

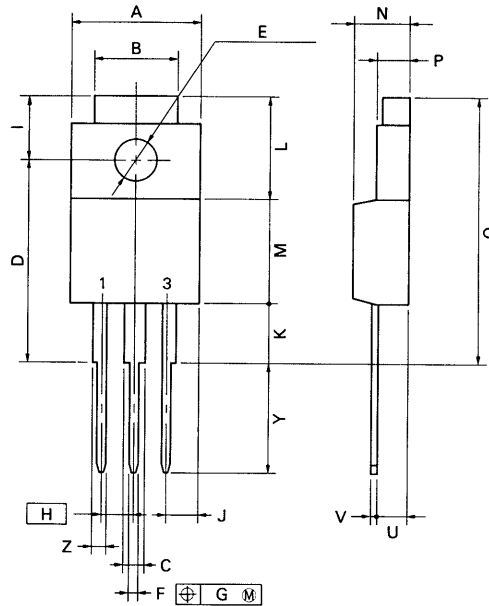


$R_o - f$



PACKAGE DIMENSIONS

3PIN PLASTIC SIP (MP-45G)



P3HF-254B-1

NOTE

Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	10.4 MAX.	0.410 MAX.
B	7.0	0.276
C	1.2 MIN.	0.047 MIN.
D	17.0 ^{±0.3}	0.669 ^{+0.013} _{-0.012}
E	φ3.3 ^{±0.2}	φ0.130 ^{±0.008}
F	0.75 ^{±0.10}	0.030 ^{+0.004} _{-0.005}
G	0.25	0.010
H	2.54 (T.P.)	0.100 (T.P.)
I	5.0 ^{±0.3}	0.197 ^{±0.012}
J	2.66 MAX.	0.105 MAX.
K	4.8 MIN.	0.188 MIN.
L	8.5	0.335
M	8.5	0.335
N	4.5 ^{±0.2}	0.177 ^{±0.008}
P	2.8 ^{±0.2}	0.110 ^{+0.009} _{-0.008}
Q	22.4 MAX.	0.882 MAX.
U	2.4 ^{±0.5}	0.094 ^{+0.021} _{-0.020}
V	0.65 ^{±0.10}	0.026 ^{+0.004} _{-0.005}
Y	8.9 ^{±0.7}	0.350 ^{±0.028}
Z	1.0 MIN.	0.039 MIN.

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.
 Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

TYPES OF THROUGH HOLE MOUNT DEVICE

μPC7800AHF Series

Soldering process	Soldering conditions	Symbol
Wave soldering	Solder temperature : 260 °C or below. Flow time : 10 seconds or below.	

[MEMO]

[MEMO]

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

The devices listed in this document are not suitable for use in aerospace equipment, submarine cables, nuclear reactor control systems and life support systems. If customers intend to use NEC devices for above applications or they intend to use "Standard" quality grade NEC devices for applications not intended by NEC, please contact our sales people in advance.

Application examples recommended by NEC Corporation.

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tools, Industrial robots, Audio and Visual equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.