NEC

BIPOLAR ANALOG INTEGRATED CIRCUITS
μPC7800A SERIES

THREE TERMINAL POSITIVE VOLTAGE REGULATORS

DESCRIPTION

μPC7800A 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 μPC7800 series.

FEATURES

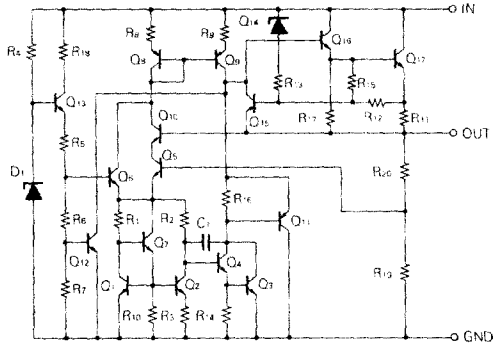
- Wide operation temperature range.
- High ripple rejection ratio.
- Good regulation (line, load).
- Low quiescent current.
- Built-in protection circuits.
  (over current protection, SOA protection and thermal shut down)

ORDER INFORMATION

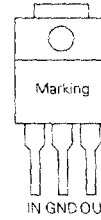
TYPE NUMBER	OUTPUT VOLTAGE	PACKAGE	QUALITY GRADE
μPC7805AHF	5 V	MP-45G(ISOLATED TO-220)	Standard
μPC7808AHF	8 V		
μPC7893AHF	9.3 V		
μPC7812AHF	12 V		
μPC7815AHF	15 V		
μPC7818AHF	18 V		
μPC7824AHF	24 V		

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



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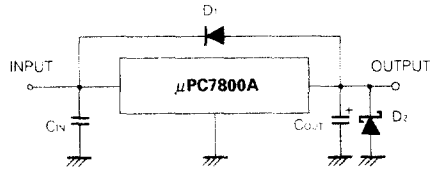
ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

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



C_1 : Required if regulator is located an appreciable distance from power supply filter.

C_2 : More than 0.1 μF

D_1 : Needed for $V_{IN} < V_O$

D_2 : 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 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	4.8	5.0	5.2	V
		7 V ≦ V_{IN} ≦ 20 V, 5 mA ≦ I_O ≦ 1 A, P_T ≦ 15 W	4.75		5.25	
		− 30 °C ≦ T_j ≦ + 125 °C	4.75		5.25	
Line Regulation	REG_{IN}	T_j = 25 °C, 7 V ≦ V_{IN} ≦ 25 V		7	30	mV
		T_j = 25 °C, 8 V ≦ V_{IN} ≦ 12 V		2	15	
Load Regulation	REG_L	T_j = 25 °C, 5 mA ≦ I_O ≦ 1.5 A		4	30	mV
		T_j = 25 °C, 250 mA ≦ I_O ≦ 750 mA		2	10	
Quiescent Current	I_{BIAS}	T_j = 25 °C		2.8	4.3	mA
Quiescent Current Change	ΔI_{BIAS}	7 V ≦ V_{IN} ≦ 25 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		40	200	$\mu V_{r.m.s.}$
Ripple Rejection	R•R	T_j = 25 °C, f = 120 Hz, 8 V ≦ V_{IN} ≦ 18 V	70	76		dB
Dropout Voltage	V_{DIF}	T_j = 25 °C, I_O = 1.0 A		1.8		V
Short Circuit Current	I_{Oshort}	T_j = 25 °C, V_{IN} = 25 V		1.6		A
Peak Output Current	I_{Opeak}	T_j = 25 °C, V_{IN} = 10 V	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 5 mA, 0 °C ≦ T_j ≦ + 125 °C		− 0.4		mV/°C

ELECTRICAL CHARACTERISTICS μPC7808A
(V_{IN} = 14 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	7.7	8.0	8.3	V
		10.5 V ≦ V_{IN} ≦ 23 V, 5 mA ≦ I_O ≦ 1 A, P_T ≦ 15 W	7.6		8.4	
		− 30 °C ≦ T_j ≦ + 125 °C	7.6		8.4	
Line Regulation	REG_{IN}	T_j = 25 °C, 10.5 V ≦ V_{IN} ≦ 25 V		8	35	mV
		T_j = 25 °C, 11 V ≦ V_{IN} ≦ 17 V		3	25	
Load Regulation	REG_L	T_j = 25 °C, 5 mA ≦ I_O ≦ 1.5 A		12	90	mV
		T_j = 25 °C, 250 mA ≦ I_O ≦ 750 mA		4	20	
Quiescent Current	I_{BIAS}	T_j = 25 °C		3	4.4	mA
Quiescent Current Change	ΔI_{BIAS}	10.5 V ≦ V_{IN} ≦ 25 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		50	250	$\mu V_{r.m.s.}$
Ripple Rejection	R•R	T_j = 25 °C, f = 120 Hz, 11.5 V ≦ V_{IN} ≦ 21.5 V	66	72		dB
Dropout Voltage	V_{DIF}	T_j = 25 °C, I_O = 1.0 A		1.8		V
Short Circuit Current	I_{Oshort}	T_j = 25 °C, V_{IN} = 25 V		1.6		A
Peak Output Current	I_{Opeak}	T_j = 25 °C, V_{IN} = 14 V	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 5 mA, 0 °C ≦ T_j ≦ + 125 °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_T ≦ 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	$\mu V_{r.m.s.}$
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_{Oshort}	T_j = 25 °C, V_{IN} = 30 V		1.3		A
Peak Output Current	I_{Opeak}	T_j = 25 °C, V_{IN} = 19 V	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	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_T ≦ 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	$\mu V_{r.m.s.}$
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_{Oshort}	T_j = 25 °C, V_{IN} = 30 V		1.3		A
Peak Output Current	I_{Opeak}	T_j = 25 °C, V_{IN} = 23 V	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 5 mA, 0 °C ≦ T_j ≦ + 125 °C		− 1.1		mV/°C

ELECTRICAL CHARACTERISTICS μPC7818A
(V_{IN} = 27 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	17.3	18.0	18.7	V
		21 V ≦ V_{IN} ≦ 33 V, 5 mA ≦ I_O ≦ 1 A, P_T ≦ 15 W	17.1		18.9	
		− 30 °C ≦ T_j ≦ + 125 °C	17.1		18.9	
Line Regulation	REG_{IN}	T_j = 25 °C, 21 V ≦ V_{IN} ≦ 33 V		12	60	mV
		T_j = 25 °C, 24 V ≦ V_{IN} ≦ 30 V		6	45	
Load Regulation	REG_L	T_j = 25 °C, 5 mA ≦ I_O ≦ 1.5 A		32	110	mV
		T_j = 25 °C, 250 mA ≦ I_O ≦ 750 mA		10	40	
Quiescent Current	I_{BIAS}	T_j = 25 °C		3.4	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	21 V ≦ V_{IN} ≦ 33 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		95	450	$\mu V_{r.m.s.}$
Ripple Rejection	R•R	T_j = 25 °C, f = 120 Hz, 22 V ≦ V_{IN} ≦ 32 V	59	65		dB
Dropout Voltage	V_{DIF}	T_j = 25 °C, I_O = 1.0 A		1.8		V
Short Circuit Current	I_{Oshort}	T_j = 25 °C, V_{IN} = 33 V		1.2		A
Peak Output Current	I_{Opeak}	T_j = 25 °C, V_{IN} = 27 V	1.7	2.2	2.8	A
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	I_O = 5 mA, 0 °C ≦ T_j ≦ + 125 °C		− 1.3		mV/°C

ELECTRICAL CHARACTERISTICS μPC7824A
(V_{IN} = 33 V, I_O = 500 mA, 0 °C ≦ T_j ≦ + 125 °C)

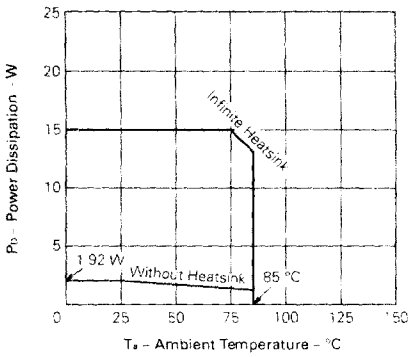
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	T_j = 25 °C	23.0	24.0	25.0	V
		27 V ≦ V_{IN} ≦ 38 V, 5 mA ≦ I_O ≦ 1 A, P_T ≦ 15 W	22.8		25.2	
		− 30 °C ≦ T_j ≦ + 125 °C	22.8		25.2	
Line Regulation	REG_{IN}	T_j = 25 °C, 27 V ≦ V_{IN} ≦ 38 V		15	80	mV
		T_j = 25 °C, 30 V ≦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

ELECTRICAL CHARACTERISTICS μPC7893A
(V_{IN} = 15 V, I_O = 500 mA, 0 °C ≦ T_j ≦ + 125 °C)

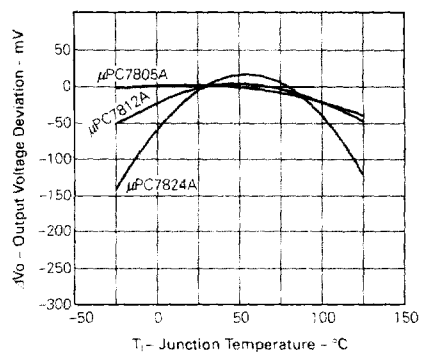
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	T_j = 25 °C	9.0	9.3	9.5	V
		12 V ≦ V_{IN} ≦ 24.5 V, 5 mA ≦ I_O ≦ 1 A, P_T ≦ 15 W	8.9		9.7	
		− 30 °C ≦ T_j ≦ + 125 °C	8.9		9.7	
Line Regulation	REG_{IN}	T_j = 25 °C, 12 V ≦ V_{IN} ≦ 26.5 V		9	40	mV
		T_j = 25 °C, 12.5 V ≦ V_{IN}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

TYPICAL CHARACTERISTICS (T_a = 25 °C)

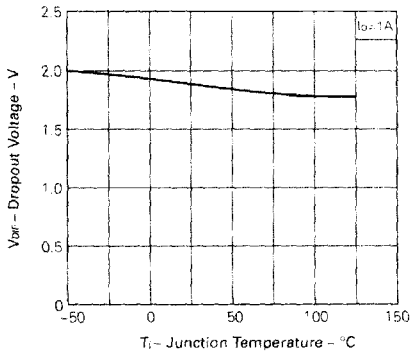
P_D – T_a



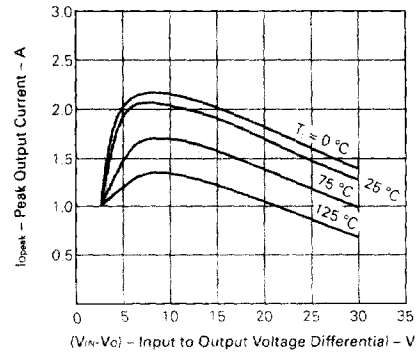
ΔV_O – T_j



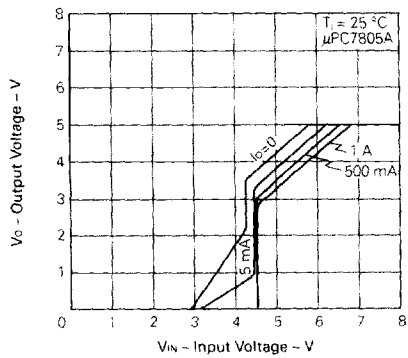
V_{DIF} – T_j



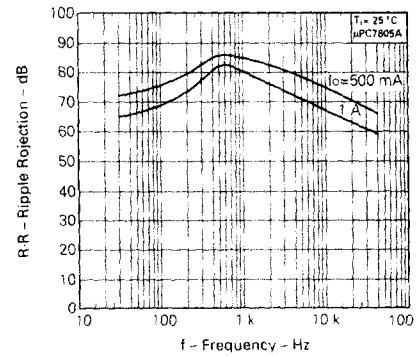
I_{Opeak} – (V_{IN}-V_O)



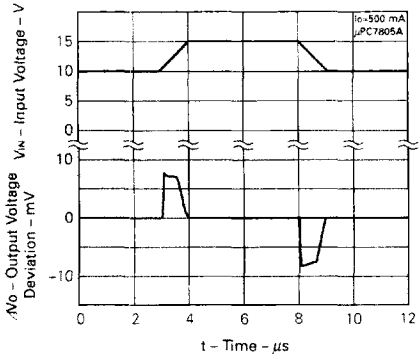
V_O – V_{IN}



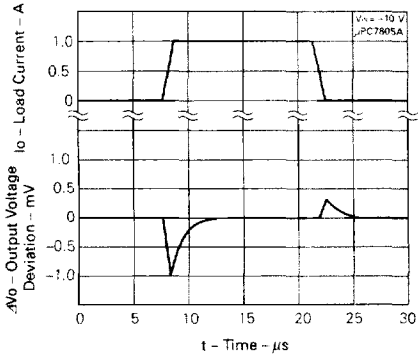
R·R – f



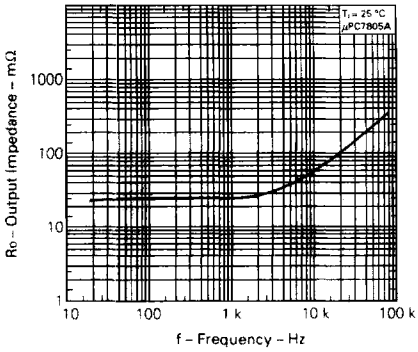
LINE TRANSIENT RESPONSE



LOAD TRANSIENT RESPONSE

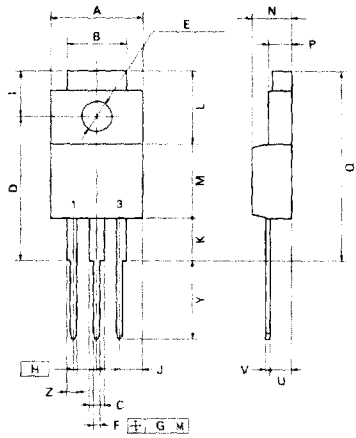


Ro – f



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	$17.0^{+0.3}$	$0.669^{+0.012}_{-0.013}$
E	$\phi 3.3^{\pm 0.2}$	$\phi 0.130^{\pm 0.008}$
F	$0.75^{\pm 0.10}$	$0.030^{+0.004}_{-0.005}$
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	$4.5^{\pm 0.2}$	$0.177^{\pm 0.008}$
P	$2.8^{\pm 0.2}$	$0.110^{+0.008}_{-0.009}$
Q	22.4 MAX.	0.882 MAX.
U	$2.4^{+0.5}$	$0.094^{+0.020}_{-0.021}$
V	$0.65^{\pm 0.10}$	$0.026^{+0.004}_{-0.005}$
Y	$8.9^{\pm 0.7}$	$0.350^{\pm 0.028}$
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.	