

BIPOLAR ANALOG INTEGRATED CIRCUIT
 μ PC78N00 SERIES

THREE TERMINAL POSITIVE VOLTAGE REGULATOR

DESCRIPTION

μ PC78N00 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 intended as fixed voltage regulators in a wide range of application including local on card regulation for elimination of distribution problems associated wide single point regulation.

FEATURES

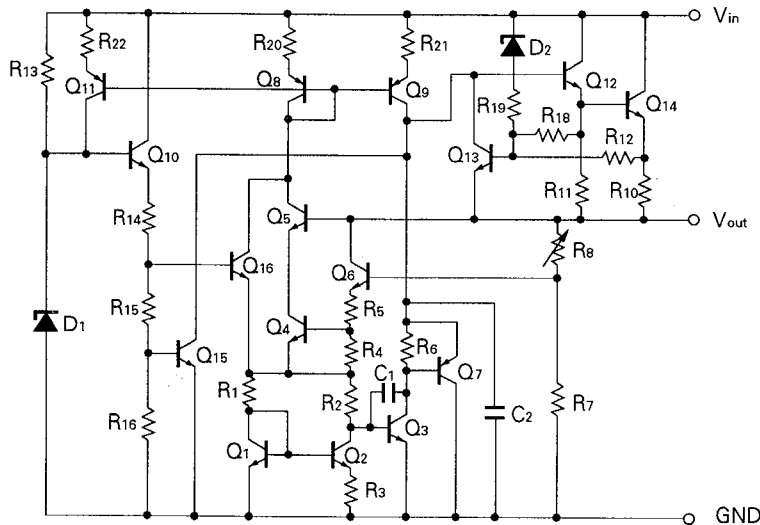
- Output current in excess of 300 mA.
- Built-in some protection circuits.
 (over current protection, SOA protection and thermal shut down)
- Small package, TO-126

ORDER INFORMATION

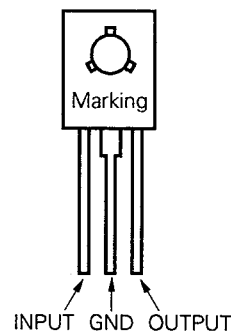
Type Number	Output Voltage	Package	Quality Grade
μ PC78N05H	5 V	TO-126	Standard
μ PC78N08H	8 V		
μ PC78N10H	10 V		
μ PC78N12H	12 V		
μ PC78N15H	15 V		
μ PC78N18H	18 V		
μ PC78N24H	24 V		

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



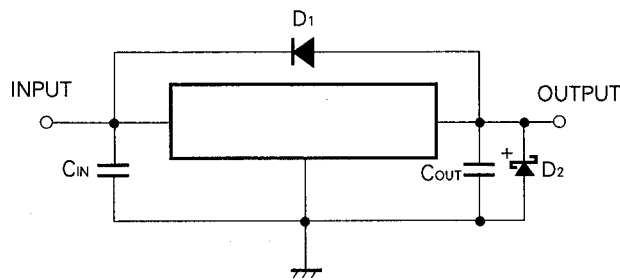
ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Voltage	V _{IN}	35/40 (Note1)	V
Internal Power Dissipation	P _T	12.5 (Note2)	W
Operating Ambient Temperature Range	T _{opt}	-20 to +85	°C
Operating Junction Temperature Range	T _{opt (j)}	-20 to +150	°C
Storage Temperature Range	T _{stg}	-55 to +150	°C
Thermal Resistance (junction to case)	R _{th (j-c)}	10	°C/W
Thermal Resistance (junction to ambient)	R _{th (j-a)}	110	°C/W

(Note 1) μ PC78N05, 08, 10, 12, 15, 18 : 35 V, μ PC78N24 : 40 V

(Note 2) Internally limited

TYPICAL CONNECTION



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

C2: More than 0.1 μ F

D1: Needed for V_{IN} < V_o

D2: Needed for V_o < GND

RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	TYPE NUMBER	MIN.	TYP.	MAX.	UNIT
Input Voltage	V _{IN}	μ PC78N05H	7	10	25	V
		μ PC78N08H	10.5	14	25	
		μ PC78N10H	12.5	17	30	
		μ PC78N12H	14.5	19	30	
		μ PC78N15H	17.5	23	30	
		μ PC78N18H	21	27	33	
		μ PC78N24H	27	33	38	
Output Current	I _o	All	0		300	mA
Operating Temperature Range	T _{opt}	All	-20		+85	°C
Operating Junction Temperature Range	T _{opt (j)}	All	-20		+125	°C

ELECTRICAL CHARACTERISTICS μ PC78N05

($V_{IN} = 10\text{ V}$, $I_o = 200\text{ mA}$, $0\text{ }^\circ\text{C} \leq T_j \leq +125\text{ }^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ }^\circ\text{C}$	4.8	5.0	5.2	V
		$7\text{ V} \leq V_{IN} \leq 20\text{ V}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$	4.75		5.25	
Line Regulation	REG_{IN}	$T_j = 25\text{ }^\circ\text{C}$, $7\text{ V} \leq V_{IN} \leq 25\text{ V}$		15	50	mV
		$T_j = 25\text{ }^\circ\text{C}$, $8\text{ V} \leq V_{IN} \leq 20\text{ V}$		10	25	
Load Regulation	REG_L	$T_j = 25\text{ }^\circ\text{C}$, $1\text{ mA} \leq I_o \leq 300\text{ mA}$		6	100	mV
		$T_j = 25\text{ }^\circ\text{C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$		4	50	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ }^\circ\text{C}$		3.5	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$7\text{ V} \leq V_{IN} \leq 25\text{ V}$			0.8	mA
		$1\text{ mA} \leq I_o \leq 300\text{ mA}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ }^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		50	120	$\mu\text{V}_{r.m.s.}$
Ripple Rejection	$R \cdot R$	$T_j = 25\text{ }^\circ\text{C}$, $f = 120\text{ Hz}$, $8\text{ V} \leq V_{IN} \leq 18\text{ V}$	62	70		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ }^\circ\text{C}$		1.7		V
Short Circuit Current	I_{oshort}	$T_j = 25\text{ }^\circ\text{C}$, $V_{IN} = 25\text{ V}$		170		mA
Peak Output Current	I_{opeak}	$T_j = 25\text{ }^\circ\text{C}$	360	500	640	mA
Temperature coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$		0.1		mV/ $^\circ\text{C}$

ELECTRICAL CHARACTERISTICS μ PC78N08

($V_{IN} = 14\text{ V}$, $I_o = 200\text{ mA}$, $0\text{ }^\circ\text{C} \leq T_j \leq +125\text{ }^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ }^\circ\text{C}$	7.7	8.0	8.3	V
		$10.5\text{ V} \leq V_{IN} \leq 23\text{ V}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$	7.6		8.4	
Line Regulation	REG_{IN}	$T_j = 25\text{ }^\circ\text{C}$, $10.5\text{ V} \leq V_{IN} \leq 25\text{ V}$		18	80	mV
		$T_j = 25\text{ }^\circ\text{C}$, $12\text{ V} \leq V_{IN} \leq 23\text{ V}$		13	40	
Load Regulation	REG_L	$T_j = 25\text{ }^\circ\text{C}$, $1\text{ mA} \leq I_o \leq 300\text{ mA}$		8	160	mV
		$T_j = 25\text{ }^\circ\text{C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$		6	80	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ }^\circ\text{C}$		3.5	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$10.5\text{ V} \leq V_{IN} \leq 25\text{ V}$			0.8	mA
		$1\text{ mA} \leq I_o \leq 300\text{ mA}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ }^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		65	190	$\mu\text{V}_{r.m.s.}$
Ripple Rejection	$R \cdot R$	$T_j = 25\text{ }^\circ\text{C}$, $f = 120\text{ Hz}$, $11\text{ V} \leq V_{IN} \leq 21\text{ V}$	56	68		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ }^\circ\text{C}$		1.7		V
Short Circuit Current	I_{oshort}	$T_j = 25\text{ }^\circ\text{C}$, $V_{IN} = 25\text{ V}$		170		mA
Peak Output Current	I_{opeak}	$T_j = 25\text{ }^\circ\text{C}$	360	490	640	mA
Temperature coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$		0.2		mV/ $^\circ\text{C}$

ELECTRICAL CHARACTERISTICS μPC78N10

($V_{IN} = 17\text{ V}$, $I_o = 200\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	9.6	10	10.4	V
		$12.5\text{ V} \leq V_{IN} \leq 25\text{ V}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$	9.5		10.5	
Line Regulation	REG_{IN}	$T_j = 25\text{ °C}$, $12.5\text{ V} \leq V_{IN} \leq 30\text{ V}$		25	100	mV
		$T_j = 25\text{ °C}$, $13\text{ V} \leq V_{IN} \leq 25\text{ V}$		17	50	
Load Regulation	REG_L	$T_j = 25\text{ °C}$, $1\text{ mA} \leq I_o \leq 300\text{ mA}$		12	200	mV
		$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$		8	100	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.6	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$13\text{ V} \leq V_{IN} \leq 30\text{ V}$			0.8	mA
		$1\text{ mA} \leq I_o \leq 300\text{ mA}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		80	230	$\mu\text{V}_{r.m.s.}$
Ripple Rejection	$R \cdot R$	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $13\text{ V} \leq V_{IN} \leq 23\text{ V}$	56	66		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$		1.7		V
Short Circuit Current	I_{short}	$T_j = 25\text{ °C}$, $V_{IN} = 30\text{ V}$		100		mA
Peak Output Current	I_{peak}	$T_j = 25\text{ °C}$	360	480	640	mA
Temperature coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$		0.2		$\text{mV}/\text{°C}$

ELECTRICAL CHARACTERISTICS μPC78N12

($V_{IN} = 19\text{ V}$, $I_o = 200\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	11.5	12	12.5	V
		$14.5\text{ V} \leq V_{IN} \leq 27\text{ V}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$	11.4		12.6	
Line Regulation	REG_{IN}	$T_j = 25\text{ °C}$, $14.5\text{ V} \leq V_{IN} \leq 30\text{ V}$		30	100	mV
		$T_j = 25\text{ °C}$, $16\text{ V} \leq V_{IN} \leq 27\text{ V}$		20	50	
Load Regulation	REG_L	$T_j = 25\text{ °C}$, $1\text{ mA} \leq I_o \leq 300\text{ mA}$		18	240	mV
		$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$		12	120	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.6	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$14.5\text{ V} \leq V_{IN} \leq 30\text{ V}$			0.8	mA
		$1\text{ mA} \leq I_o \leq 300\text{ mA}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		90	280	$\mu\text{V}_{r.m.s.}$
Ripple Rejection	$R \cdot R$	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $15\text{ V} \leq V_{IN} \leq 25\text{ V}$	55	64		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$		1.7		V
Short Circuit Current	I_{short}	$T_j = 25\text{ °C}$, $V_{IN} = 30\text{ V}$		100		mA
Peak Output Current	I_{peak}	$T_j = 25\text{ °C}$	360	480	640	mA
Temperature coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$		0.3		$\text{mV}/\text{°C}$

ELECTRICAL CHARACTERISTICS μPC78N15

($V_{IN} = 23\text{ V}$, $I_o = 200\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$, $C_{IN} = 0.33\text{ μF}$, $C_{OUT} = 0.1\text{ μF}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	14.4	15	15.6	V
		$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$	14.25		15.75	
Line Regulation	REG _{IN}	$T_j = 25\text{ °C}$, $17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$		32	100	mV
		$T_j = 25\text{ °C}$, $20\text{ V} \leq V_{IN} \leq 30\text{ V}$		25	50	
Load Regulation	REG _L	$T_j = 25\text{ °C}$, $1\text{ mA} \leq I_o \leq 300\text{ mA}$		25	300	mV
		$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$		16	150	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.7	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$			0.8	mA
		$1\text{ mA} \leq I_o \leq 300\text{ mA}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		100	350	μV _{r.m.s.}
Ripple Rejection	R · R	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $18.5\text{ V} \leq V_{IN} \leq 28.5\text{ V}$	54	62		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$		1.7		V
Short Circuit Current	I_{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 30\text{ V}$		100		mA
Peak Output Current	I_{Opeak}	$T_j = 25\text{ °C}$	360	470	640	mA
Temperature coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$		0.5		mV/°C

ELECTRICAL CHARACTERISTICS μPC78N18

($V_{IN} = 27\text{ V}$, $I_o = 200\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$, $C_{IN} = 0.33\text{ μF}$, $C_{OUT} = 0.1\text{ μF}$)

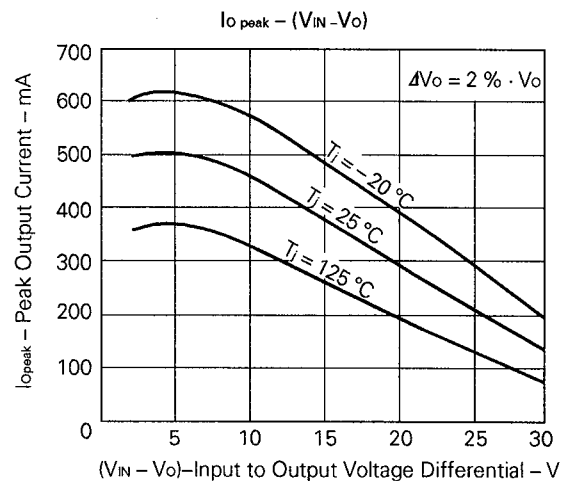
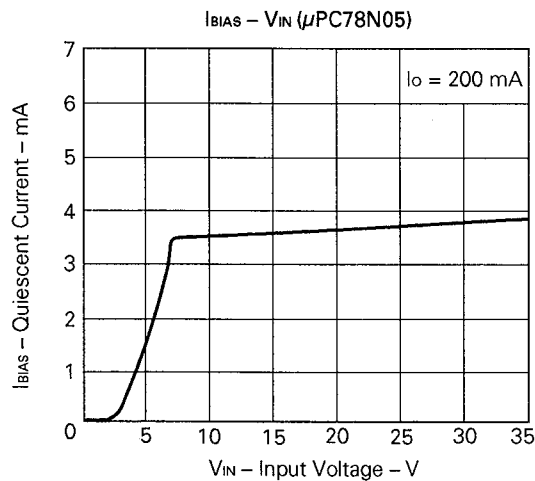
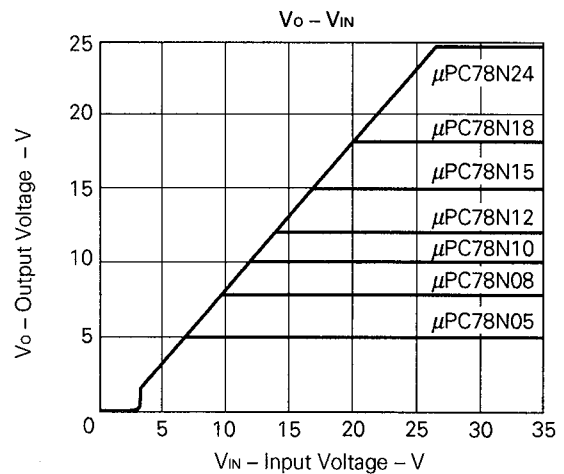
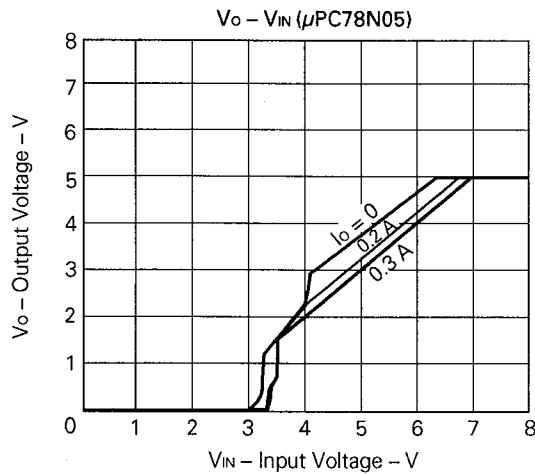
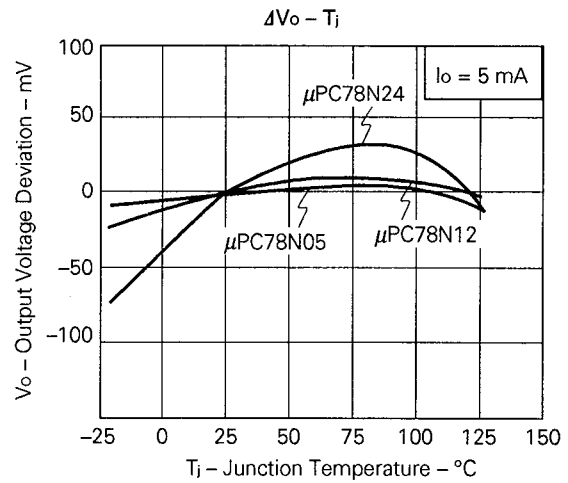
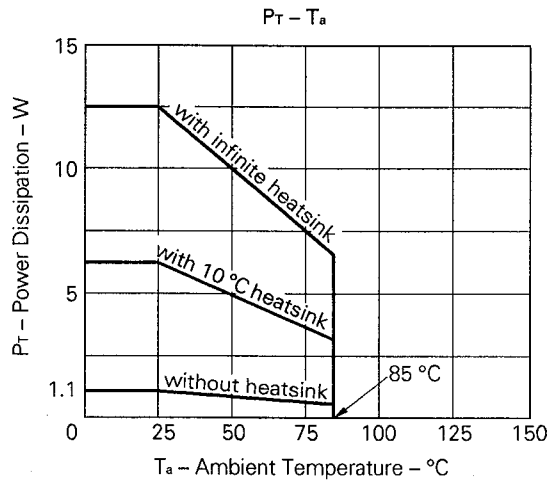
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	17.3	18	18.7	V
		$21\text{ V} \leq V_{IN} \leq 33\text{ V}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$	17.1		18.9	
Line Regulation	REG _{IN}	$T_j = 25\text{ °C}$, $21\text{ V} \leq V_{IN} \leq 33\text{ V}$		32	100	mV
		$T_j = 25\text{ °C}$, $22\text{ V} \leq V_{IN} \leq 33\text{ V}$		25	50	
Load Regulation	REG _L	$T_j = 25\text{ °C}$, $1\text{ mA} \leq I_o \leq 300\text{ mA}$		30	360	mV
		$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$		20	180	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.7	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$21\text{ V} \leq V_{IN} \leq 33\text{ V}$			0.8	mA
		$1\text{ mA} \leq I_o \leq 300\text{ mA}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		115	420	μV _{r.m.s.}
Ripple Rejection	R · R	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $22\text{ V} \leq V_{IN} \leq 32\text{ V}$	53	60		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$		1.7		V
Short Circuit Current	I_{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 33\text{ V}$		60		mA
Peak Output Current	I_{Opeak}	$T_j = 25\text{ °C}$	360	460	640	mA
Temperature coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$		0.5		mV/°C

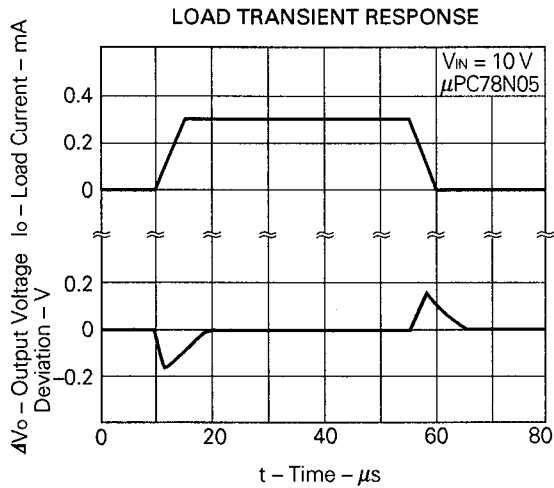
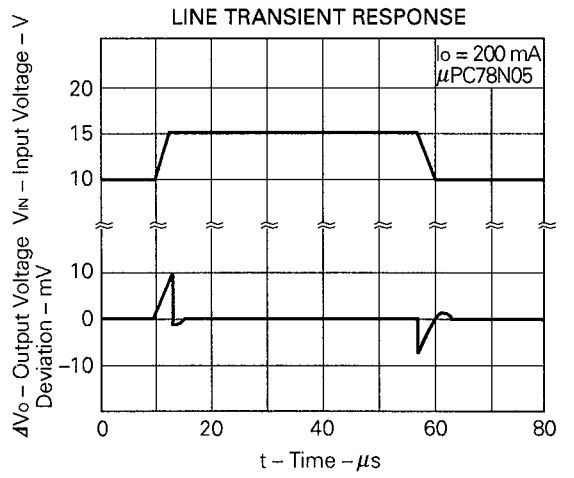
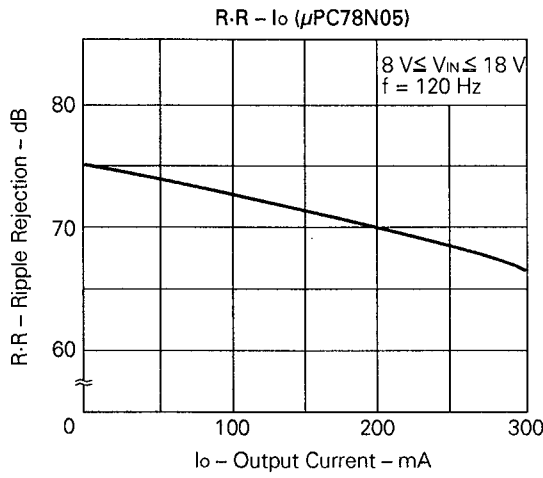
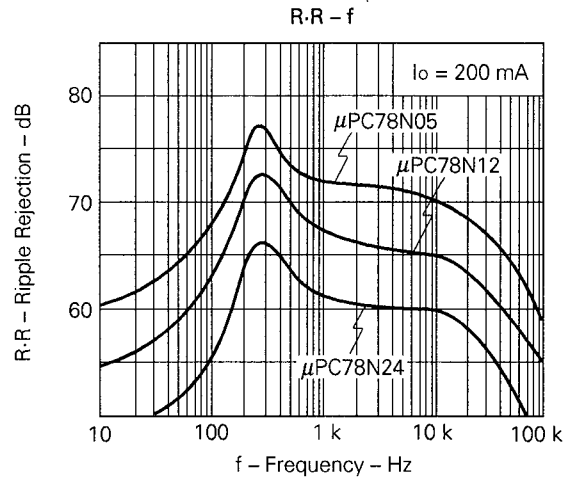
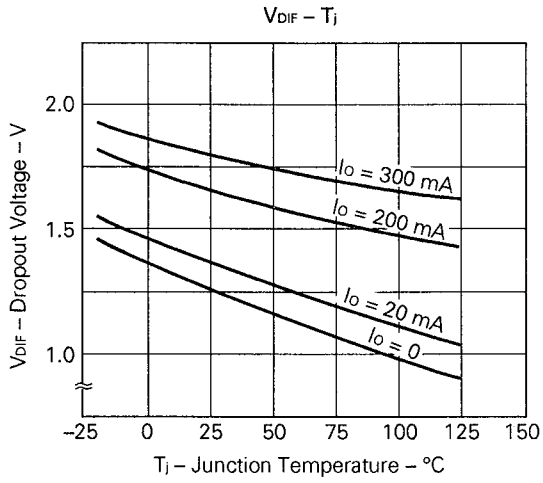
ELECTRICAL CHARACTERISTICS μPC78N24

($V_{IN} = 33\text{ V}$, $I_o = 200\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_o	$T_j = 25\text{ °C}$	23	24	25	V
		$27\text{ V} \leq V_{IN} \leq 38\text{ V}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$	22.8		25.2	
Line Regulation	REG _{IN}	$T_j = 25\text{ °C}$, $27\text{ V} \leq V_{IN} \leq 38\text{ V}$		40	100	mV
		$T_j = 25\text{ °C}$, $28\text{ V} \leq V_{IN} \leq 38\text{ V}$		30	50	
Load Regulation	REG _L	$T_j = 25\text{ °C}$, $1\text{ mA} \leq I_o \leq 300\text{ mA}$		35	480	mV
		$T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$		23	240	
Quiescent Current	I_{BIAS}	$T_j = 25\text{ °C}$		3.7	5.0	mA
Quiescent Current Change	ΔI_{BIAS}	$27\text{ V} \leq V_{IN} \leq 38\text{ V}$			0.8	mA
		$1\text{ mA} \leq I_o \leq 300\text{ mA}$			0.5	
Output Noise Voltage	V_n	$T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		135	560	μV _{r.m.s.}
Ripple Rejection	R · R	$T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $28\text{ V} \leq V_{IN} \leq 38\text{ V}$	50	57		dB
Dropout Voltage	V_{DIF}	$T_j = 25\text{ °C}$		1.7		V
Short Circuit Current	I_{Oshort}	$T_j = 25\text{ °C}$, $V_{IN} = 38\text{ V}$		5		mA
Peak Output Current	I_{Opeak}	$T_j = 25\text{ °C}$	360	460	640	mA
Temperature coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$		0.7		mV/°C

TYPICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

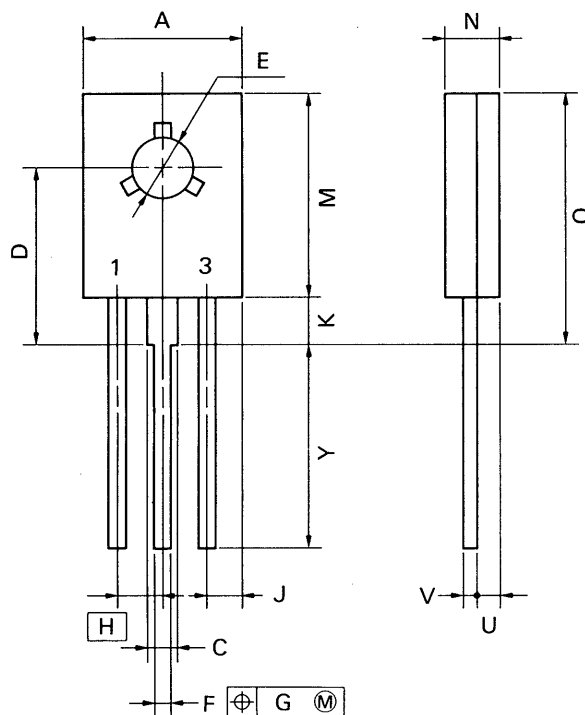




PACKAGE DIMENSIONS (Unit: mm)

μPC78N00H Series

3 PIN PLASTIC SIP (TO-126)



P3HP-230B

NOTE

Each lead centerline is located within 0.23 mm (0.009 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	8.5 MAX.	0.335 MAX.
C	1.1 MIN.	0.043 MIN.
D	9.7 ^{±0.3}	0.382 ^{±0.012}
E	φ3.2 ^{±0.1}	φ0.126 ^{±0.004}
F	0.80 ^{±0.1}	0.031 ^{±0.005}
G	0.23	0.009
H	2.3	0.091
J	1.95 MAX.	0.077 MAX.
K	2.3 MIN.	0.09 MIN.
M	11.5 MAX.	0.453 MAX.
N	2.7 ^{±0.2}	0.106 ^{±0.008}
Q	14.5 MAX.	0.571 MAX.
U	1.7 MAX.	0.067 MAX.
V	0.55 ^{±0.1}	0.022 ^{±0.005}
Y	13.5 ^{±0.7}	0.531 ^{±0.028}

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>

[μPC78N00H Series]

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

Reference

Application note name	No.
Quality control of NEC semiconductor devices	TEI-1202
Quality control guide of semiconductors devices	MEI-1202
Assembly manual of semiconductors devices	IEI-1207
NEC semiconductor device reliability/quality control system	IEI-1212

[MEMO]

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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.